MYANMAR WANBAO MINING COPPER LTD
LETPADAUNG COPPER PROJECT





ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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MYANMAR WANBAO MINING COPPER LTD (MWMCL)

LETPADAUNG COPPER PROJECT

ENVIRONMENTAL AND

SOCIAL IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

Executive Summary

The Letpadaung Copper Project (the Project) is located on the largest of four (4) copper deposits in the Salingyi Township area of the Sagaing Region. It is owned by Myanmar Wanbao Mining Copper Limited (MWMCL), Union of Myanmar Economic Holdings Limited (MEHL) and Mining Enterprise 1 (ME-1) and operated by MWMCL. This Environmental and Social Impact Assessment (ESIA) has been prepared to address the effect this project will have within and beyond the Project area and is consistent with a Terms of Reference provided to the Republic of the Union of Myanmar in April 2013.

Under the Production Sharing Contract and its Amendments between the Contract parties, the Government is responsible for all consultation with the community and MEHL is responsible for all elements associated with land acquisition, compensation and resettlement. MWMCL is responsible for the design, operation and closure of the project, as well as completion of this ESIA.

The ESIA has been prepared using the International Finance Corporation's (IFC) standards as a good practice guide to the achievement of sound environmental, social and health outcomes from the Project's implementation.

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The document has been developed based on a design approved by MWMCL in November 2012. The project in its broader context consists of:

- An open cut mine from which copper ore and mine waste are extracted;
- A network of crushers which break the ore down to a size suitable for leaching;
- A series of three (3) heap leach pads (HLPs) which will be progressively increased in height, as the optimum leaching period is reached, to a full height of 84 metres (m);
- A solvent extraction and electro-winning plant (SX/EW plant) which is used to extract the copper from the solution from the HLPs and then plate the copper onto electrodes for sale and export.

The estimated mine life is 30 years.

A total of 92,500 tonnes of ore will be mined and placed onto the HLPs daily. This is expected to produce 100,000 tonnes of copper per annum (100ktpa). The stripping ratio in the mine is almost 1:0.99 so it is expect the mining process will also produce almost 30Mtpa of waste rock. This waste rock will be dumped in three (3) areas around the mine during the first 19 years of mine life then placed as backfill into the mined out pit after that time. The waste rock dumps (WRDs) will range in height from 85 m to 150 m in height.

The network of crushers is based around a system of in-pit semi-mobile crushers which is transferred to a mobile stacker for placement onto the HLPs.

The project has an estimated mineral resource of approximately 1 billion tonnes with a strip ratio of 0.99, resulting in approximately 1 billion tonnes of waste being generated over the proposed 30 year mine life. Three heap leach pads (HLPs) situated to the south of the crusher complex are proposed for the life of the operation, as shown in Figure 2.1. HLP1 and HLP2 will be utilised initially with HLP3 proposed to be commissioned after 14 years of operation.

The heap leach pad will be constructed with a textured HDPE liner installed over a prepared subgrade. The upper 300 mm of the subgrade will be composed of a compacted clay low-permeability zone with about 5 mm of sand between the top of the clay and the base of the liner to provide an acceptable level of slope stability. The liner will be overlain by 300 mm of cushion material that should be sandy in nature to assure a high interface friction between the liner and cushion. Collection pipes will be installed on top of the cushion layer and arranged in herring bone fashion. The collection pipes will be encased with a sandy gravel layer with a thickness of about 700 mm.

Crushed ore will be spread by conveyor and stacked in cells, the stacked slopes of the heap leach pads are designed with an outer slope of about 37 degrees. Each raise will have a height of about 6 m and every 12 m the subsequent raise will be offset inward 4.5 m, which will create benches on the outer slope thus reducing the global inclination of the heap leach to about 31 degrees. The ultimate height of the heap leach is about 84 m.

The copper is extracted from the ore on the HLPs through a leach process involving the application of a sulfuric acid solution to the surface of heaped ore material which is then allowed to percolate through the ore before being collected in the base of the HLP and diverted to the pregnant liquor solution pond (PLS) for transfer to the SX/EW Plant. In its movement through the ore, the acid dissolves the copper metal in the ore to form a copper laden solution, called the pregnant liquor. This solution is the primary feed for the winning of copper for the production of copper cathode.

After extraction of the copper, the solution is recovered and recycled through the HLPs again to extract further copper for metal production.

A risk assessment was undertaken to determine the potential significant impacts of the Project on the environment within and around the Project site. The assessment was based on the intensity, duration, extent and probability of the impact occurring to determine the unmitigated risk. Based on the availability of management options, the cost of implementation of those options and preparedness to change current practices in this area of work, the mitigated (residual) risk for each impact was determined.

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The risks ranged from very low to extreme in the calibration of the methodology.

The following risks were classified as high, very high or extreme unmitigated risks and those in bold text could not be mitigated to a risk of medium or below:

- Construction
  - Contamination of rivers and watercourses;
    - Sediment loads due to erosion of exposed surfaces.
  - Exceedence of health screening guidelines for ground level concentrations of dust;
    - Movement of vehicles and machinery and entrainment from exposed surfaces,
    - **Blasting on site during construction.**
  - Disturbance of noise receptors during the day;
    - Blasting.
  - Disturbance of cultural sites;
    - Site clearance and excavations.
  - Disturbance of view scape;
    - Development of processing plant and other infrastructure,
    - Development of topsoil stockpiles,
    - Construction infrastructure.
  - Resettlement of members of the community;
    - **Persons living within the mining area and the blast exclusion zone are to be relocated to allow for mining to continue.**
  - Reduced access to land for agriculture and traditional livelihood;
    - **Local residents and previous land owners to be excluded from project area.**
  - Increased safety risk to road users;
    - **Construction traffic to and from site,**
    - **Increased traffic due to increased population.**
  - Increase in the spread of communicable disease;

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        - Influx of persons into the area (work-seekers and service providers),
        - Increased population density,
        - Greater transient workforce.
    - Change in traditional values and norms;
        - **Greater exposure to transient populations and new technologies.**
- Operations
    - Change in landform and landscape character;
        - **Excavation of open pit,**
        - **Development of dams, HLPs and waste rock dumps.**
    - Soil contamination;
        - **Acid rock drainage (ARD) and metal leaching associated with waste rock dumps,**
        - ARD and metal leaching associated with HLPs.
    - Lowering of groundwater table reducing groundwater supply;
        - Decrease of groundwater level elevation due to pit dewatering.
    - Contamination of groundwater resources;
        - **Seepage from the HLP or waste rock dumps.**
    - Loss of catchment yield;
        - Containment of storm water run-off,
        - Change in creek hydrology.
    - Contamination of rivers and watercourses;
        - Dirty water run-off from plant area, pit, waste rock and HLP area,
    - Exceedence of health screening guidelines for ground level concentrations of dust;
        - Movement of vehicles and machinery and entrainment from exposed surfaces,
        - **Blasting on site for mining,**
        - Wind blown dust from exposed surfaces.

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- Exceedence of health screening guidelines for ground level concentrations of sulphuric acid;
    - Acid mist from HLPs.
- Disturbance of noise receptors during the day;
    - Blasting.
- Disturbance of noise receptors at night;
    - Movement of vehicles, machinery and mechanical operation of plant components (e.g. crushers).
- Disturbance to receptors due to blast vibrations;
    - Blasting associated with open pit mining.
- Increased pressure on ecological services;
    - **Increased collection of fuel wood associated with influx of people,**
    - **Bio-ethnology** (loss of traditionally used plants and medicinal resources due to site access restrictions).
- Vegetation clearance and loss of plant productivity;
    - **Influx of persons into the area (work-seekers and service providers) requiring fuel and land.**
- Disturbance of view scape;
    - **Development of pit,**
    - **Development of waste dumps,**
    - **HLP development.**
- Increased safety risk to road users;
    - Operations traffic to and from site,
    - Increased traffic due to increased population.
- Increase in the spread of communicable disease (including HIV/AIDS);
    - Influx of persons into the area (transport operators and service providers).

- Closure
    - Soil contamination;

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  - **Long term ARD and metal leaching associated with waste rock dumps,**
  - **Long term ARD and metal leaching associated with HLPs.**
- Contamination of groundwater resources;
  - **Seepage from HLPs or waste rock dumps.**
- Contamination of rivers and watercourses;
  - **Dirty water run-off from waste rock dumps and HLPs,**
  - Slope failure of HLP / waste rock dump resulting in exposure of PAF leached ore / mine waste to surface water runoff.
- Disturbance of view scape;
  - Establishment of permanent pit lake,
  - Establishment of permanent waste rock dumps,
  - Establishment of permanent HLP heaps.
- Loss of jobs;
  - **Direct loss of jobs at mine after operations cease,**
  - **Indirect loss of jobs in surrounding area from industries linked to mine and mine employees.**
- Loss of land for agriculture and traditional livelihood;
- Rehabilitated WRDs and HLPs unsuitable for grazing or cultivation of crops due to potential for damage to cover system.

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The biophysical environment of the Project area has been studied on several occasions since 1996 when the feasibility of the Sabetaung and Kyisintaung deposits and the Letpadaung deposit were being considered as separate operations. During that time the physical environment in the area has remained almost static in its environmental condition whereas quite marked changes have occurred in the biological environment.

The climate in the area is a summer monsoons with a positive water balance (rainfall – evaporation) only experienced in September and October. The monsoons are carried into the area by winds from the south. The area experiences two other seasons, a cool-dry and a hot-dry, which are dominated by high temperatures, little or no rainfall and northerly winds. The rainfall in the area is about 725 mm with about 2000 mm of evaporation being experienced annually. Winds in the area generally do not exceed 10 m/s and average about 3.5 m/s.

Groundwater in the area is dominated by the Kangon aquifer and the groundwater levels are as shallow as 1.8 m from the surface. The groundwater from this aquifer can be avoided with minor changes to the latter stages of the pit design (after Year 20). But its presence may limit the capacity of water storage ponds and its shallow depth in some areas increases the risk of contamination from surface spillages. Groundwater seepage into the open pit is estimated to be 26 l/s based on investigations undertaken around the pit perimeter.

Surface water is dominated by flows from the Chindwin River when it floods. However, in normal circumstances the Project area is a net, although small, generator of runoff. Studies completed have identified a need to divert flows through the site from the west to maintain community supply to the south of the project area. These flows are estimated to be in the order of 25 m^3/s. Conservation of water supply to the communities downstream of the project is a **moderate** environmental and social risk to the project.

The site will use up to 39,656 m^3/day which will be provide entirely from the Chindwin River during the dry season. Small quantities of water will be available from mine pit water. During the wet season water will be collected on site and stored for use during the dry season.

The soils in the Project area range from rock scree, on the hill slopes, to fine grained soils, on the floodplains of the Chindwin River. The finer grained soils are found in areas which are most suitable for crop production due to their moisture retention and ease of cultivation and the lower slopes of the hills are more suitable for grazing. The upper scree slopes cannot be heavily grazed or cropped due to the high percentage of large stones and the high potential for soil erosion on the slopes.

The ore body itself is made up of a leached overburden cap overlying a hard rock which contains the copper to be won from mining. The leach cap and ore body contain materials that are geochemically reactive when exposed to air and water. The reactivity of the rock generated sulfuric acid in over 70% of samples taken and the balance of the rock samples leached metals under kinetic leach test conditions. These properties make management of ore handling and waste rock dumping critical issues in the environmental management of the operation and the geochemistry of the ore body presents an **extreme** environmental risk to the project.

Vegetation within the project area can be broken down into three (3) classes – the naturally vegetated hills, the cultivated and pastured plains and areas of degraded land (normally thorn bush growing on eroded subsoils). The vegetated hills can be further broken down into four (4) main types of vegetation:

- Low heath in the broad saddle between the hills;
- Low shrubland on the lower slopes where drainage is received from higher slopes;

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- Tall shrubland in steeply sided and cooler valleys; and
- Stunted woodland on the hill crests.

Some species growing in the area are used for provision of firewood, traditional medicines and foods and fodder for livestock. Supplementation of areas to foster growth of these areas in areas surrounding the project is being considered by government agencies and MWMCL to offset loss of access to these resources.

A review of historical reports suggests that the loss of natural resources and species in the Project area has occurred over an extended period. A number of timber plantations present at the time of the 1997 Feasibility Study are no longer present and the size of the timber resource (in m^3/ha) and height of the forests are at least 50% less when recent baseline studies were conducted.

The studies did not identify any flora species listed as rare or endangered on international registers.

In addition, studies of the fauna of the Project area suggests that species present only represent a small proportion of the species known from the Monywa district. The studies did not identify any fauna species listed on international registers of rare or endangered fauna, although Eld's Deer (*Panolia eldii*) is known to use the Letpadaung Hills and its foothills as feeding habitat. This species is considered as 'significant' by Myanmar wildlife conservation authorities and the local community. Special local reservation areas are being considered for this species.

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At a community level, the loss of natural resources is considered a **high** risk to the community and the Project as it threatens continuation of local culture and may hamper security of the site if people seek to continue to access the site to collect traditional materials.

The need to acquire land to accommodate the Project and relocate people living within the Project site has an **extreme** level of risk associated with it, both for the Project and the communities involved. The communities involved draw their livelihood from agrarian based activities – production of subsistence and cash crops and grazing of animals. The loss of the ability to practice these activities takes away the ability to sustain this livelihood for project-affected-peoples (PAP). This not only include people living on the land, but also people who own land but live outside the areas being acquired for the Project and those people who provide labour to assist in the agrarian based activities and draw an income from them.

MWMCL has offered a minimum of one job per person on the Project for every household that was relocated as a consequence of the project. This offering increases as the size of the affected land involved increases (to a maximum of three jobs). To take up this opportunity most of the PAP within these households will require training and on-the-job skills development to

meet that opportunity to the fullest extent. Given the level of literacy within the community – greater than 50% of people do not have an education and many of those with an education did not go beyond Year 3 at school – the complexity of work, and subsequently the income that each household could expect to earn, will be quite low and possibly result in income per capita still being below the World Bank recognized poverty line. At present, the salary MWMCL provide to unskilled laborers is USD120/month, which is much higher than local mean salary level and that of civil servants in Myanmar government. That salary can be improved will skills development through on-the-job education and training.

In addition, within the communities involved, there are people who draw a living from the land who could not fulfill a role in another industry – the old, the youth, woman who split their home duties with work in the fields and men whose life long experience has been farming using hand tools and animals who actually fear working with machines. Opportunities need to be provided for these people to work directly or indirectly on the Project. The development of cottage industries – sewing, plant propagation, revegetation, for example – need to be considered.

For people who have received compensation, assistance needs to be provided in management and investment of the funds resulting from the compensation. Case studies on other projects suggest this income is quickly dispersed in many cases leaving the PAP in poverty with no means of sustaining themselves or their families. Successful resettlement requires management of the release of funds and education in their management.

A Resettlement Action Plan (RAP) needs to be developed by MEHL (the nominated agent for land acquisition) and endorsed by the Government to ensure the assistance required for the successful resettlement and compensation of the PAP. The RAP should consider short-, medium- and long-term requirements for this success and include a documented grievance mechanism that is developed in consultation with the community and communicated through all the affected communities.

MWMCL has developed a Community and Social Development Plan to make provision for the needs of the community in its strengthening and capacity building. This Plan needs to be supported by all the Project partners and be complemented by Government programs at all levels to maximize its effectiveness. Actions associated with this Plan are already being implemented with some benefits, particularly associated with health issues being evidenced.

In-migration is a **high** risk, particularly during the construction phase of the Project, which requires considerable management. In-migration brings with it issues of disease introduction, increased levels of disposable income, cultural change, vice and crime. MWMCL has put in place policies to assist with management of some of these issues. However, the implementation will require co-operation from local government, local service providers and individuals to

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minimize its effect. As a result, consultation with the community is required to highlight these issues and opportunities for reporting of such issues needs to be provided through two-way conversations with the Project managers. Within the site and the staff working on the Project, management can take actions to raise the awareness of staff and control activities to limit the vectors for disease introduction and promote codes of behavior.

The introduction of the economic activity will increase the overall flow of money within the community. This is a **high** risk in both a positive and negative sense depending on the issues involved. This will result in increased demand for goods and services, which has the potential to increase their costs within the community. Monitoring of this effect will be undertaken to ensure an economy does not develop where individuals with a substantial income develop an economy which cannot involve people not engaged in the Project due to the differences in income level. Increased income is also likely to see access to services like mobile phones become highly utilized, particularly among younger persons. With that access, other challenges for the community will arise, including knowledge of the global community, lifestyle opportunities, some of which challenge traditional norms, and entrepreneurship.

Planning for the cessation of mining after the 30-year life of the Project needs to be progressively developed as the certainty of the operation develops. Closure planning also needs to accommodate the early cessation of mining as a result of mineral economics or increased production throughput. Closure planning should engage the community to identify its expectation and also accommodate their desire for use of the Project site after mining. After the works associated with closure are completed, a period of monitoring will be required to demonstrate the long-term sustainability of the closed site and the community affected by the closure.

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The loss of livelihood is an **extreme** risk to be considered in the development of the detailed closure plan. Unless alternative industry or another mine was to commence operation which can use the skills gained, it is highly unlikely the direct and indirect employees of the Project would find alternative local employment. If these employees were members of families that had lost land at the commencement of the project, any opportunity to return to a subsistence or cash crop lifestyle will have been foregone.

The cumulative impacts of this Project are closely linked to the nearby S&K mine, other large mining projects in the region (should they develop) and in Myanmar as a whole, development projects undertaken by the Government and aid organizations and cultural changes in the community. The cumulative impacts of the two mines can be managed as there is common ownership between the two Projects. They include environmental issues like dust, noise and vibration as well as activities like land acquisition, community development, education and training, health initiatives and transport management. A significant cumulative impact will occur

when the S&K mine finishes operation in about 15 years into the future. In the face of no alternative work, these staff will increase competition for work at Letpadaung, particularly as many of them will have significant levels of experience in the mining industry. The impact of other mining projects are likely to involve movement of trained national staff between projects which leads to movement of local knowledge, culture and skills, as well as demands for services like transport and mining support.

A series of management plans has been developed to address all risks identified, including moderate and lower risks, with the view of reducing the risk to the lowest level possible. In some instances, such as the geochemical and resettlement risks, the degree or extent of impact makes it difficult to reduce the risk significantly and these risks remain high or extreme. Other risks have limits to the level of control over those risks that is held by MWMCL and the reduction of those risks requires intervention by local, regional or national government to reduce them to the fullest extent possible. The management plans should be fully developed to a system that can be incorporated into an Environmental and Social Management System.

MWMCL will prepare an Environmental and Social Management System at the commencement of construction with a view to having that system functional, compliant with and certified to ISO 14001, the international standard for Environmental Management Systems, within three (3) years of commencement of Project operation. The system will detail all activities required to manage environmental and social issues to the extent possible by MWMCL and include policies, objectives, the legal framework, management criteria, control procedures, training packages, roles and responsibilities, monitoring and reporting and audit and review practices adopted in relation to the Project.

MWMCL will report their performance to relevant government agencies in relation to specific issues on a quarterly basis. A detailed annual report which will include details and analysis of all environmental management on the site will be provided to the Ministry of Environmental Conservation and Forests and the Ministry of Mines on an annual basis. In addition, MWMCL will produce a project Sustainability Report consistent with the elements described in the Global Reporting Initiative for the Project. All reports produced on a quarterly or annual basis will be provided to the public via the Project website. Reports will also be made to the project affected villages on a quarterly basis, at a minimum, describing progress with the project and its community development as well as describing what is planned for the next quarter of the year. Community reports should also describe any complaints or grievances received and how they were resolved. Where items are still outstanding, MWMCL will report on progress being made with them.

The Project can be undertaken with some effects in the Project area which will not have a long term impact on the environment when compared to the benefit the community and the nation

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may derive from the Project. However, achievement of this result will require strict adherence to management plans described in this document, recognition that the extreme and high risks exist and continuous, timely and diligent attention to that management.

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Myanmar Wanbao Mining Copper Limited (MWMCL or Project Proponent) is developing the Letpadaung Copper Project (the Project) located in the south of Sagaing Region, Myanmar. The Project site is approximately 4.5 km to the south west of Monywa, the largest township of the Region as shown in Figure 1.1.1.

The Letpadaung deposit, on which the Project is based, is the largest of four deposits (Sabetaung, Sabetaung South, Kyisintaung and Letpadaung) in terms of resource in the Monywa area and accounts for 75 % of the resource from all four deposits.

This Environmental and Social Impact Assessment (ESIA) is based on the development of an open-pit copper mining operation at the Letpadaung deposit to support an ore processing capacity of 92,000 tonnes per day (tpd).

The Project will comprise the following major facilities and activities:

- The construction and operation of open-pit mining operations and related infrastructure;
- The construction and operation of crushing and heap leaching facilities, with an average throughput of 92,000 tpd, which may be expanded in the future;
- The construction and operation of a solvent extraction and electrowinning (SX/EW) plant to produce 100,000 tonnes per annum (tpa) of cathode copper;
- The construction and operation of waste rock dumps (WRD);
- The construction and operation of a water abstraction and supply system between the Chindwin River and the Project site; and
- The construction and operation of a power supply system incorporating a 230 kV step-down sub-station, 35 kV sub-station and other various sub-stations.

A workforce total of 2,000 persons will be required for the construction phase of the Project and about 2,500 persons during the operational phase. It is planned that 90 % of the workforce will be sourced from Myanmar with a preference for engagement from within the Salingyi Township area if numbers and skills permit. About 10 % of the workforce will be Chinese nationals or other expatriate staff to provide the high level management of the Project and technical expertise unavailable in the country.

In line with its Health, Safety and Environmental Policy (HSEP), MWMCL is committed to assessing in full the potential economic, environmental, health, safety and social impacts of its operations, and is committed to avoiding, minimising or mitigating negative impacts and enhancing positive impacts wherever possible.

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MWMCL expects to meet applicable requirements of Myanmar legislation for natural resource operations, project development and environmental and social impact assessment. Additionally, the Project has been designed to meet current international good practice. This ESIA sets out how the Project will seek to implement international good industry practices including the applicable requirements of the International Finance Corporation (IFC) Performance Standards for Social and Environmental Sustainability (2006).

This draft ESIA will be disclosed to Project stakeholders and the public and will be updated as needed in response to their comments. The ESIA will be used as a reference by international financial institutions seeking to finance the development of the Letpadaung Project in accordance with their environmental and social policies, IFC performance standards, and the Equator Principles for commercial banks.

1.2 PROJECT LOCATION AND SETTING

The Letpadaung Copper Project is located in the south of Sagaing Region, Myanmar. The project is approximately 4.5 km to the south west of Monywa, a regional town located 110 km west of Mandalay, the economic centre of central Myanmar, and 722 km north of Yangon. Travel to Monywa from the project site can be undertaken by road or by river transport. From Monywa, ongoing travel and transport can be undertaken by road, rail and air. The Project site is located around the geographic location 22 º04' N, 95º05' E (716100mE, 2443100mN, Zone 46Q) and occupies an area of 32.73 km².

The location of these major facilities is shown in Figure 1.2.1.

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1.3 SITE AND PROJECT HISTORY

Copper mining and smelting started in the Monywa copper district several centuries ago. The British discovered the mineral wealth of the Salingyi Township in the 1930's and the Myanmar Geological Department visited and investigated the site in the 1950's together with a Yugoslavian geological team. This visit resulted in the implementation of an exploration programme. Myanmar Geological Bureau (MGB) and relevant institutions of the United Nations (UN), Japan and Yugoslavia then carried out a series of exploration programmes to follow up on the findings of the initial programme.

Mining Enterprise No 1 (ME-1) of Myanmar and BorInstitute of Yugoslavia signed an agreement in 1978 to jointly develop the Sabetaung and Kyisintaung deposits and a processing plant with a capacity of 8,000 tpd was built in 1984. Production was difficult to maintain and the operation stopped soon afterwards due to low recovery and poor economic benefits.

ME-1 signed a Feasibility Study agreement with Ivanhoe Myanmar Holdings Limited in 1994 to jointly develop the Sabetaung and Kyisintaung deposits. A 1 tpd copper pilot plant was built in 1995 and detailed exploration started. Myanmar Ivanhoe Copper Corporation Limited (MICCL) was formed in 1996. Mining only took place at Sabetaung and Sabetaung South whilst the Kyisintaung and Letpadaung deposits remained untouched. The MICCL operation had a design capacity of 25,000 tpa cathode copper. The plant was put into production in 1998 and the capacity was expanded to 39 kilotonnes per annum (kt/a) in 2004. The mine essentially ceased operating between April 2008 and August 2010, with only sporadic production continuing. Some production was resumed in September 2010 and has increased in scale since that time. It is currently producing about 11,000 tpa of copper cathode.

Wanbao Mining Ltd organised an expert group to visit the Monywa copper mines and investigate the resources and production there in July 2007. The expert group recommended purchase of the Project following the visit.

Wanbao Mining Ltd then organised another expert group to visit the site in December 2008. A review of data relating to previous exploration programmes, feasibility study reports and mine production conditions, and additional testing confirmed the presence of a primary ore body.

Wanbao Mining Ltd reached a draft co-operative development agreement with the Myanmar Government in March 2010 preliminarily acquiring the mining right of the Letpadaung deposit. The formal co-operative development agreement was signed on 3 June 2010. At present MWMCL is in the process of preparing to develop the Letpadaung deposit.

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In May 2010 MWMCL selected China Nerin Engineering Co. Ltd. (NERIN) to complete the Feasibility Study, Basic Design and Detail Design for the Project. NERIN completed the Feasibility Study Report for the Myanmar Monywa Letpadaung Copper Project (100 kt/a cathode Cu) in September 2010 and completed the Project Application Report in October 2010. The Basic Design was submitted for review in February 2011 and was approved by MWMCL in May 2011.

A site locality plan showing the relative location of these operations is shown at Figure 1.2.1.

1.4 PROJECT OWNERSHIP

Wanbao Mining Ltd. (Wanbao Mining) was established on 16 March 2005 and is a subsidiary of China North Industries Corporation. Wanbao Mining is a professional mining company approved by the Chinese Government with a registered capital of

RMB 1,3 million. The headquarters is in Beijing and overseas subsidiaries are established to run overseas projects.

Myanmar Wanbao Mining Copper Ltd. (MWMCL) is registered in Myanmar and wholly owned by Hong Kong Wanbao Mining Copper Ltd. which itself is a wholly owned subsidiary of Wanbao Mining Ltd. With a registered capital of USD 10 million, MWMCL is the operational entity to develop the Letpadaung Copper Mine Project.

The Myanmar partner in the Project contributes the mining rights while Wanbao is responsible for Project investment development and management. Both parties will share Project benefits based on the Production Sharing Contract for Letpadaung Copper Mine. The large scale mineral production permit for Letpadaung is currently held by Myanmar Economics Holding Limited (MEHL).

1.5 PRODUCTION SHARING AGREEMENT

The key terms of the Production Sharing Agreement between MWMCL and MEHL are as follows:

- MEHL are responsible for the requisition of land required for the development and operation of the mine and associated infrastructure.
- MEHL are responsible for the removal of former landholders, occupants, or squatters still residing in the land take area.
- Any delay in the completion of the project construction due to the above is not the fault of MWMCL and would constitute grounds for an extension of the contract period.

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The responsibility for land requisition rests with the Myanmar Government, represented by MEHL. Wanbao, as the Project Operator, is active in the communities near the Project Area, especially in those affected by land take, and has made broad efforts to establish rapport and improve relations with local communities with a view to winning their support for the mine development.

1.6 EXISTING OPERATIONS AND FACILITIES

Letpadaung is a greenfield mining project and therefore requires extensive investment in plant and infrastructure in addition to development of an open pit and processing facilities. Existing infrastructure is limited to:

- Accommodation camps including laydown areas and workshops located at the foot of the hills northwest of the proposed pit and in the south of the site;
- A small starter pit on the eastern side of Letpadaung Hill;
- Site access roads, along the western and northern boundaries of the future pit,

- A haul road accessing the starter pit from adjacent to the main camp area in the north western corner of the Project area; and
- A haul road access from the Chindwin River and the S&K mine operations

The site layout is shown in Figure 1.4.1.

1.7 DOCUMENT STRUCTURE

This ESIA has been prepared to provide an integrated social and environmental assessment of the Letpadaung Project across all social and environmental media and all phases of the Project. The ESIA draws on a range of project component specific environmental assessments previously prepared for Myanmar approval purposes and a baseline environmental and social investigations undertaken by MWMCL to assist in understanding existing environmental conditions associated with the Project.

The ESIA is structured in twelve sections as follows:

- Section 1 describes the project location, its history, the existing operations and facilities as well as describing the document structure.
- Section 2 describes the administrative setting including government and public administration structures in the project area, applicable legislation, rules and guidelines, good practice guidelines and applicable standards adopted in design.
- Section 3 describes the historic studies in the area including: the 1996 and 1997 feasibility studies; environmental studies undertaken in 2004; and the basic design and associated studies undertaken as part of the project development.
- Section 4 provides a detailed description of the environmental aspects of the Project including atmospheric, surface water, groundwater, geology, geochemistry, seismicity, soils, flora and fauna and the social environment.
- Section 5 presents a project description including a description of the ore body, the construction tasks, site water management, waste management and staff engagement and accommodation.
- Section 6 presents a description of the community consultation methodology, records of meetings held, issues raised and responses by MWMCL.
- Section 7 presents a description of the impacts on the natural environment including a description of the assessment methodology.
- Section 8 describes the Environmental Management Plans for the Project.
- Section 9 describes the Social Management Plans for the Project.
- Section 10 describes the Environmental and Social Monitoring Plans covering the frequency of monitoring for specific management elements as well as the proposed reporting schedules for internal and external review.
- Section 11 presents a list of commitments by MWMCL arising from the ESIA.

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- Section 12 presents a conclusion and a series of recommendations arising from the ESIA.

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2. ADMINISTRATIVE SETTING

2.1 GOVERNMENT AND PUBLIC ADMINISTRATION STRUCTURES IN THE PROJECT AREA

Myanmar is divided into 21 administrative subdivisions, which include: states (7), regions (7), self-administered zones (5), a union territory, and a self-administered division. The Regions were called Divisions prior to August 2010 and five of them are named after their capital city. The Regions can be described as ethnically predominantly Burman (Bamar), while the States, the Zones and the Division are ethnic minority-dominant. States and Divisions are divided into Districts. These Districts consist of Townships that include towns, wards and village-tracts. Village-tracts are groups of adjacent villages. The Project is located in the south of Sagaing Region 93 km west-northwest of the region's capital city of Sagaing. The immediate Project area is located within the Salingyi Township, 4.7 km southwest of the town of Monywa.[1]

Sagaing Region (formerly Sagaing Division) is an administrative region of Myanmar and is located in the north-western part of the country between latitude 21° 30' North and longitude 94° 97' East. It is bordered by India's Nagaland and Manipur States to the north, Kachin State, Shan State, and Mandalay Region to the east, Mandalay Region and Magway Region to the south, with the Ayeyarwady River forming a greater part of its eastern and also southern boundary, and Chin State and India to the west. The Region has an area of 93,527 km². The population in 2012 was 6,600,000. The urban population was 1,230,000 and rural population was 5,360,000. Sagaing (city) is the capital of the Sagaing Region.

Sagaing Region consists of eight (8) districts divided into 34 townships with 198 wards and villages. The major towns and cities are Sagaing, Monywa, Shwebo, Katha, Kale, Tamu, Mawlaik and Hkamti. The districts are Sagaing, Shwebo, Monywa, Katha, Kale (Kalemyo), Tamu, Mawlaik and Hkamti. The townships include Monywa, Salingyi and Yinmabin (Yin Mar Bin) which are all within or nearby the Project area.[2]

The Project area has affected people in seven (7) villages - tracts and 29 villages (four of which have been resettled).

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[1] As described in http://en.wikipedia.org/wiki/Administrative_divisions_of_Burma as cited on 16 September 2013
[2] As cited in http://en.wikipedia.org/wiki/Sagaing_Region on 16 September 2013

2.2 APPLICABLE LEGISLATION, RULES AND GUIDELINES

2.2.1 Legal and Other Requirements

This section reviews the administrative and legal structures set up to protect the environment, as well as ongoing activities by the government and civil society organisations based inside and outside Myanmar that are intended to promote sustainable development and environmental protection.

The Draft Environmental Impact Assessment Rules, which are yet to be enforced states that every project proponent is required to carry out an Environmental Impact Assessment in respect of a proposed project and shall prepare an Environmental Impact Assessment Report detailing every stage of the assessment and its conclusion in a format and timeframe as may be prescribed by the Ministry of Environmental Conservation and Forestry. The project proponent shall prepare an Environmental Management and Monitoring Plan in a format prescribed by the Ministry of Environmental Conservation and Forestry and shall submit it with the Environmental Impact Assessment Report.

2.2.2 Legal Requirements

Legal and approval requirements applicable to the Project related to the environment will be identified by MWMCL.

To meet environmental, legal and other requirements, MWMCL shall:

- Ensure that legal and other obligations are incorporated in the designs, procedures and project controls;
- Communicate legal and other requirements to personnel and contractors accountable for compliance;
- Ensure all relevant legal and other requirements and associated documentation (e.g. licenses, permits, approval applications) are readily available on site to MWMCL personnel, contractors, subcontractors and consultants; and
- Conduct a compliance audit at least annually and ensure there is a process in place to monitor on-going compliance with all legal and other requirements. Where work or construction activities are less than 12-months in duration at least one compliance audit will occur.

2.2.3 National Legislation

The following Myanmar Acts and Rules apply to the Letpadaung Copper Project:

- The Land Acquisition Mines Act (1885);
- The Water Power Act (1927);
- The Forest Law (1992);

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- Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law (1994);
- The Protection and Preservation of Cultural Heritage Regions Law (1998);
- The Explosives Act (1887);
- The Explosive Substance Act (1908);
- Myanmar Insurance Law (1993);
- The Factories Act (1951);
- Workmen's Compensation Act (1923);
- Union of Myanmar Public Health Law (1972);
- The Natural Drug Law (1992);
- The Traditional Drug Law (1996);
- The National Food Law (1997);
- Prevention and Control of Communicable Diseases Law (1995);
- Mines Law (1994) and accompanying Mining Rules:
  - Environment Conservation Law (2012)
  - Foreign Investment Law (2012)
- Foreign Investment Rules (2013) by the Ministry of National Planning and Economic Development:
  - Notification No. 1/2013 by Myanmar Investment Commission
  - Environment Conservation Law (2012)
- Guideline to Overview of Labour Laws in Myanmar published by the Ministry of Labour 2004.

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2.3 THE ENVIRONMENTAL CONSERVATION LAW 2012 (ECL)

2.3.1 Objectives

The ECL, the landmark law specifically dedicated to address environmental conservation, was enacted:

a) to implement the national environmental policy;
b) to lay down basic principles and provide guidance to systematically integrate environmental conservation matters with the sustainable development works;
c) to build a healthy and clean environment and to conserve natural and cultural heritage for the benefit of current and future generations;
d) to restore the deteriorating and disappearing ecosystem to the fullest extent possible;

e) to enable to manage and implement for the decrease and loss of natural resources and for enabling the benefits of sustainable use;
f) to enable promotion of public awareness and cooperation in the matters of environmental conservation;
g) to enable promotion of international, regional, and bilateral cooperation in the matters of environmental conservation; and
h) To co-operate with the government departments and organisations, international organisations, non-governmental organisations and private individuals on environmental conservation matters.

2.3.2 Current Position

Though the ECL paves the way for the use of EIA and/or SIA in evaluation of issuing a prior permission for prescribed businesses, the prior permission scheme itself is discretionary and there is currently no basis in the law for the Ministry to determine whether or not to issue a permit, and whether to impose environmental compliance conditions on the user. Also, some of the Ministry of Environmental Conservation and Forestry's (MOECAF) broad powers granted under the law require the approval of the Union Government and the Environmental Conservation Council (ECC) but without the clear power and basis of the approval.

There are no regulatory guidelines and rules specified to enable the ECL to be operable in practice: such as setting the environmental quality standards, emission standards, and classes of hazardous waste and substances. In addition, there is a need to cover the non-point sources of pollution that is not discussed in the ECL.

The ECL provides for integration with sectoral policies and co-ordination amongst the Ministries and departments. It is expected that the Environmental Conservation Rules (ECR) of the ECL which is underway would provide regulatory guidelines to implement the ECL.

The maximum monetary fine imposable under the law is only Kyats 2,000,000 or about USD 2,300.

2.3.3 Obligations of Business Owners and Occupiers

The polluter at source has obligations to clean, discharge, dispose, or keep pollutants in accordance with the prescribed standards.

The owner or occupier of business activities, materials or places that are the source of the pollution must install or use an on-site facility or controlling equipment to monitor, control, manage, reduce or eliminate environmental pollution. If this is not possible, it

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must be arranged to dispose the wastes in accordance with environmentally sound methods.

The individuals or organisations conducting activities in the industrial zones, or special economic zones or the businesses appointed by the Government ministries have responsibilities to contribute either in cash or in kind and carry out the management of pollutants and environmental conservations, including the treatment of wastes collectively; must give the fees for the usage and expenses incurred in connection with management of environmental conservation by the relevant industrial zones, special economic zones and business organisations; and must comply with the environmental conservation directives published by the relevant industrial zone, special economic zone or the business organisations.

2.3.4 Insurances

The person who has obtained the necessary prior permission to carry out the business concerned must obtain the environmental accident insurance in accordance with the existing laws. Section 77 of the FIL states that "All economic organisation formed under a permit shall affect insurance with any authorised local insurance enterprise in respect of the following types of insurance:

a) machinery insurance;
b) fire insurance;
c) marine insurance;
d) physical injury insurance;
e) natural disaster insurance; and
f) life insurance.

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Section 78 provides that in addition, an economic organisation shall acquire other types of insurance prescribed by any existing law based on the category of economic activity.

2.3.5 Prohibitions, Offences and Penalties

No one is allowed to operate a business, worksite, factory, or workshop without the prior permission from the Ministry. The violation of this prohibition constitutes an offence punishable by imprisonment with a term not exceeding 3 years, fines with an amount not smaller than Kyats 100,000 and not greater than Kyats 1,000,000, or both.

No one shall violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under the ECL. The violation of this prohibition constitutes an offence punishable by imprisonment with a term not exceeding 1 year, a monetary fine, or both.

No one shall, without permission of the MOECAF, import, export, produce, store, carry or trade any material which can have an adverse impact on the environment. Any violation of this prohibition will attract a prison term of minimum 3 years and maximum 5 years, a monetary fine of minimum Kyats 100,000 and maximum Kyats 2,000,000, or both.

2.4 FOREIGN INVESTMENT LAW 2012 (FIL)

The Basic Principals of the FIL state that the investment shall be allowed based upon principles including “protection and conservation of the environment”.

The duties of the investor requires the business to be carried out in a manner that does not cause environmental pollution or damage in accord with existing laws in respect of investment business.

2.5 FOREIGN INVESTMENT LAW 2012 (FIL)

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2.5.1 Notification No 1 of 2013

The list of Economic Activities under Prohibition includes the installation of a factory that utilises imported wastes, specifically:

- Manufacturing of hazardous material which are not in compliance with the environmental and conservation Law, Rules and Procedures promulgated from time to time;
- Activities which may emit hazardous chemicals, minerals, rays, noise, particles etc., and may cause earth/water/air pollution which affect public health; and
- Exploitation of minerals including gold in the revering and water way.

The list of Economic Activities Permitted with Specific Conditions at No (3) in Notification 1 includes economic activities which require Environmental Impact Assessment. These include exploration and production of minerals, manufacturing of iron, steel and minerals and operation in cultural heritage, archaeological and prominent geographical symbolical sites, amongst others, all require the assessment of Environmental Impact and Social Impact or Environmental Impact without Social Impact to be carried out for the initial study of the environment, prior to the granting of approval to proceed.

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Clause 37 of the Rules of the FIL states “In order to scrutinize accepted proposals sector by sector, a Proposal Review Group, composed of high ranking officers from the following departments (including the Environmental Conservation Department), is to be formed to perform preliminary scrutiny”.

Section 47 states that the Commission shall scrutinize investment proposals, including the remarks from the Ministry of Environmental Protection and Forestry on the proposed mitigation measures to reduce the social and environmental impacts of the project.

Notification No 1/2013 of MIC dated 29th January, 2013 includes in the List of Economic Activities requiring Environmental Impact Assessments, the exploration and production of minerals depending upon the scale of business activity, to avoid environmental and social impacts, or to minimise environmental and social impacts. It will be allowed only after the EIA is concluded.

2.6 MINES LAW (1994) (MML) AND ASSOCIATED MINES RULES

The Mines Law (1994) aims to protect the environment from mining operations that may be detrimental to environmental conservation.Section (3) of the Mine Law states the following objectives:

- To carry out for the development of conservation, utilisation and research works of mineral resources; and
- To protect the environmental conservation works that may have detrimental effects due to mining operations.

Under the section referring to the duties of the holder of Permit, it is stated that the holder of permit shall comply with the rules prescribed under this Law in respect of the following matters:

- Making provisions for safety and the prevention of accidents in a mine and their implementation;
- Making and implementation of plans relating to the welfare, health, sanitation and discipline of personnel and workers in a mine;
- Making provisions for the environmental conservation works that may have detrimental effects due to the mining operation;
- Reporting of accidents, loss of life and bodily injury received due to such accidents in the mine; and
- Submission forinspection bythe Chief Inspector and his inspectors.

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Rules 69 to 73 govern the rights of utilisation of land and water for mineral production. They include the provision that puts the burden of responsibility of land and water pollution onto the mineral permit holder. It is his responsibility not to pollute.

The holder of a mineral exploration permit or a mineral production permit must backfill or otherwise make safe bore holes, excavations, surface of land damaged during the course of underground mining operations to the satisfaction of the Ministry or the Department. The holder must also establish forest plantations or pay compensation to the Ministry of Forestry (now MOECAF), if trees were cut and cleared for mineral exploration or mineral production within a forest land or in a land area covered with forests.

In disposing of liquids, wastes, tailings and fumes which have resulted from mineral production, the holder of a mineral production permit must undertake laboratory tests as may be necessary for the prevention of pollution of water, air and land in the environment and for the safety of living beings. If toxic materials are found in the waste products, which are harmful to living beings, degradation shall be made by chemical means and systematic disposal shall be made only when it is assured that there is no danger.

The holder of a permit for mineral production within an area under the Ministry's administrative control or which does not lie within the Mineral Reserve Area or Gemstone Tract, shall carry out such production only after co-ordinating and receiving agreement from the individual or organisation having the right of cultivation, right of possession, right of use and occupancy, beneficial enjoyment, right of succession or transfer of the said land.

If the holder of a mineral production permit requires the use of public water for mineral production he shall first and foremost inform the Department of such requirement in accordance with the prescribed manner.

If the Department, after scrutinising the requirement submitted under Section 16 finds that the use of public water is necessary for the holder of a mineral production permit, it shall co-ordinate with the relevant government department(s) and organisation(s) to obtain permission to use water in accordance with the existing law.

Chapter XXI of the Myanmar Mining Rules (MMR) describes "making provisions to prevent detrimental effects due to mining operations on the environmental conservation works". The requirements include:

- Backfilling or making safe bore holes, excavations or surface of the land damaged during the course of underground mining; and

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- Undertaking laboratory tests, as necessary, to prevent pollution of water, air and land.

2.7 NATIONAL COMMISSION FOR ENVIRONMENTAL AFFAIRS (CURRENTLY ENVIRONMENTAL CONSERVATION COMMITTEE)

Environmental protection in Myanmar previously came under the authority of the National Commission for Environmental Affairs (NCEA), formed in 1990. Until 2005, the Minister of Foreign Affairs was the chair of NCEA. In 2005, however, the NCEA was transferred under the Ministry of Forestry (MoF), and the Minister of Forestry assumed the role of the NCEA chairperson.

The stated objectives of the now Ministry of Environmental Conservation and Forestry were to set environmental standards, create environmental policies for using natural resources, issue rules and regulations to control pollution, and to create short- and long-term environmental policies which balance environmental needs and development requirements.

The Ministry of Environmental Conservation and Forestry has drafted the Environmental Impact Assessment Rules, which are pending approval by the government, to complement the ECL 2012.

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2.8 ENVIRONMENTAL AND SOCIAL POLICIES

A national environmental policy was drafted in 1994. The National Environment Policy is as follows:

"To establish sound environment policies, utilisation of water, land, forests, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation, the Government of the Union of Myanmar hereby adopts the following policy: The wealth of the nation is its people, its cultural heritage, its environment and its natural resources."

The objective of Myanmar's environmental policy is to achieve harmony and balance between its people, its cultural heritage, its environment and its natural resources through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has the sovereign right to utilise its natural resources in accordance with its environmental policies; but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations. It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations.

The development of the environmental policy was followed by the drafting of 'Myanmar Agenda 21' in 1997, which follows a UN framework for a multi-pronged approach to sustainable development. The Myanmar Agenda 21 recognises the need for Environmental Impact Assessments. Myanmar, in its Agenda 21, calls for integrated management of natural resources and provides a blueprint for achieving sustainable development.

The ECL provides more institutional space to regulate environmental quality and conduct EIA's and SIA's for infrastructure and investment projects funded by the government and private sector.

2.9 MYANMAR INVESTMENT COMMISSION (MIC)

The MIC issued a Notification on 30 June 1994 on the Protection of Environment stating that:

1. The Myanmar Investment Commission, at its meeting 8/94 held on 17 June 1994 has resolved that all projects established with the permission of the Commission shall be responsible for the preservation of the environment at and around the area of the project site. The enterprises are entirely responsible that they shall be able to control pollution or air, water and land, and other environmental degradation, and that they keep the project site environmentally friendly.
2. Consequently, it is hereby notified that the treatment plant, industrial waste water treatment plant and other pollution control procedures should be promptly implemented and comply with the sanitary and hygienic rules and regulations set by the relevant authorities.
3. In the future proposals that are to be submitted to the Commission, either under the Union of Myanmar Foreign Investment Law or the Myanmar Citizens Investment Law, shall incorporate the provision in their contracts that they will undertake proper sewage and industrial wastewater treatment systems and other environmental control systems. The system used shall be in accordance with the rules and regulations specified by the respective development committees and local authorities.

2.10 IMPACT ASSESSMENTS IN MYANMAR

One of the most important internationally-accepted environmental protection methods is to conduct an environmental and social impact assessment (ESIA) prior to implementing development projects. An ESIA identifies, predicts, evaluates, and mitigates the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. The ESIA is supposed to

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provide appropriate opportunities to inform and involve stakeholders in a project. In the absence of formal regulations and guidelines in Myanmar regarding the scope and content for ESIA, the International Association for Impact Assessment has guidelines on the objectives and principles of an ESIA which should be used to inform this ESIA process.

A social impact assessment (SIA) is a tool used to help understand the potential impacts that a proposed project may have on a community. Social impact assessment should cover:

> *all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs, and generally cope as members of society' and 'cultural impacts involve changes to the norms, values, and beliefs of individuals that guide and rationalise their cognition of themselves and their societies* (Burge and Vanclay, 1996).

Hence, the SIA enables the project proponent and government to determine effective strategies to help mitigate the negative impacts, and maximise positive impacts, of a project.

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2.11 NATIONAL SUSTAINABLE DEVELOPMENT STRATEGY

The National Sustainable Development Strategy (NSDS) is part of a broader programme of the UN Sustainable Development Commission set up after the World Summit on Sustainable Development in 2002. Every country, including Myanmar, that signed Agenda 21 at the Earth Summit in Rio de Janeiro in 1992, agreed to develop an NSDS by 2010 in line with the Millennium Development Goals (MDGs). UNEP provided funding for Myanmar to develop an NSDS. The main aim of the process was to develop an NSDS in line with international standards by meeting the MDGs and ensure that environmental and social impacts are mitigated when implementing development projects. The NCEA took a lead in developing the strategy in consultation with the government and a small number of NGOs. Myanmar's NSDS was published in August 2009.

The three goals described in Myanmar's NSDS are sustainable management of natural resources, integrated economic development and sustainable social development. Specific strategies are outlined under each goal. For example, the goal for Sustainable Management of Natural Resources suggests strategies for forest resource management, sustainable energy production and consumption, biodiversity

conservation, sustainable freshwater resources management, sustainable management of land resources, sustainable management for mineral resources utilisation, and so on.

The NSDS was officially accepted by the Ministry of Planning. In theory, it is a guiding document for government ministries, departments and local authorities, UN organisations, and international and local NGOs. Implementation of the strategy will be assisted by adoption of the ECL and its accompanying regulations and guidelines and the development of sectoral-specific regulations that seek to enhance environmental protection and efficiency of resource use.

The United Nations Environment Program (UNEP) (BEWG, 2011) has stated that there are opportunities to review and further develop the strategy in the future.

2.12 INTERNATIONAL COMMITMENTS

Myanmar has signed a number international treaties related to the environment which may have implications for the Project. These include:

- Plant Protection Agreement for the Asia and Pacific Region; Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer;
- London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;
- United Nations Framework Convention on Climate Change (UNFCCC); United Nations Convention to Combat Desertification;
- International Civil Aviation Organisation: ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. I, II, Aircraft Noise;
- Vienna Convention for the Protection of Ozone Layer;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- Convention Concerning the Protection of the World Cultural and Natural Heritage;
- Convention on Biological Diversity (CBD); International Tropical Timber Agreement (ITTA);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- ASEAN Agreement on the Conservation of Nature and Natural Resources; Catagena Protocol on Biosafety;
- Kyoto Protocol to the United Nations Framework Convention on Climate Change;

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- Ramsar Convention on Wetlands; and
- Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer.

2.12.1 United Nations Declaration on the Rights of Indigenous Peoples

Myanmar was one of 144 states that endorsed the United Nations Declaration on the Rights of Indigenous Peoples in September 2007. Article 32 discusses indigenous peoples' right to free and prior informed consent (FPIC):

"States shall consult and co-operate in good faith with the Indigenous Peoples concerned through their own representative institutions in order to obtain Free and Prior Informed Consent prior to approval of any project affecting their land or territories".

Article 10 discusses forcible relocation of indigenous people, and the need for FPIC and Article 26 about land rights are also relevant articles for indigenous peoples in relation to this project. It is good practice to ensure that relocation takes place following the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return if that is possible following mining.

The Resettlement Action Plan (RAP) should conform to all relevant international environmental and social conventions ratified by Myanmar.

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2.13 ENVIRONMENTAL CONSERVATION DEPARTMENT (ECD)

Environmental Conservation Department (ECD) was established on 11 October, 2012.

The Objectives of ECD are as follows:

1. To implement the National Environment policy.
2. To develop short, medium and long term strategy, policy and planning for the integration of environmental consideration into the sustainable development process.
3. To manage natural resources conservation and sustainable utilisation.
4. To manage the pollution control on water, air and land for environmental sustainability.
5. To cooperate with government organization, civil societies, private and international organizations for the environmental affairs.

2.14 GOOD PRACTICE GUIDELINES

Where no appropriate Myanmar standards are available, standards or guidelines based on International Finance Corporation (IFC) guidelines or other international best practice will be applied to the Project and existing environmental conditions.

The following list of IFC policies, procedures, standards and guidelines is applicable to this Project:

- Policy on Environmental and Social Sustainability (2012);
- IFC Sustainability Framework (2012);
- IFC Performance Standards on Environmental and Social Sustainability (2012);
- Guidance Notes (#1 – 9) on IFC Performance Standards on Environmental and Social Sustainability (2012);
- IFC Environmental Health and Safety General Guidelines, April 30, 2007;
- IFC Environmental Health and Safety Guidelines – Mining, December 10, 2007;
- IFC Operational Policy:
  - OP 4.01 Environmental Assessment, January 1999
  - OP 4.02 Environmental Action Plans, February 2000
  - OP 4.04 Natural Habitats, June 2001
  - OP4.07 Water Resources Management, February 2000
  - OP 4.09 Pest Management, December 1998
  - OP 4.10 Indigenous People, July 2005
  - OP 4.11 Physical Cultural Resources, July 2006
  - OP 4.12 Involuntary Resettlement, December 2001
  - OP 4.20 Gender and Development, March 2003
  - OP 4.36 Forests, November 2002
  - OP 4.37 Safety of Dams, October 2001
  - BP 4.01 Environmental Assessment, January 1999
  - BP 4.02 Environmental Action Plans, February 2000
  - BP 4.04 Natural Habitats, June 2001
  - BP 4.10 Indigenous Peoples, July 2005
  - BP 4.11 Physical Cultural Resources, June 2006
  - BP 4.12 Involuntary Resettlement, December 2001
  - BP 4.20 Gender Development, March 2003
  - BP 4.36 Forests, November 2002
  - BP 4.37 Safety of Dams, October 2001
- Handbook for Preparing a Resettlement Action Plan, 2002;
- A Handbook for Addressing Project-induced In-migration;

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- Investing in People – Sustaining Communities Through Improved Business Practice;
- Good Practice Note – Public Infrastructure and Mining, 2010;
- Good Practice Note – Community Development Agreements, 2010;
- Introduction to Health Impact Assessment, 2009;
- Workers Accommodation – Processes and Standards, 2009;
- Strategic Community Investment, June 2010;
- Good Practice Note – Addressing the Social Dimensions of Private Sector Projects, December 2003; and
- Good Practice Note – HIV/AIDS in the Workplace, December 2002.

2.15 APPLICABLE STANDARDS ADOPTED IN DESIGN

The Basic Design document prepared by Nerin describes a number of Chinese guidelines that have been used in the detailed design of the Project. These are described in summary below.

- CECS 102-2002 - Technical Specification for Steel Structure of Light-Weight Buildings with Gabled Frames. The code is formulated to improve the development of light-weight building steel structures with gabled frames and improve design, manufacturing and installation to introduce state-of-the-art technology and make the structures economically feasible, safe and usable, and ensure sound engineering quality.
- CECS 138:2002 - Specification for Structural Design of Reinforced Concrete Water Tank of Water Supply and Sewerage Engineering. The standard describes the construction of concrete water tanks so that they are technically logical, economical, safe, and high quality.
- CECS 200:2006 -Technical Code for Fire Safety of Steel Structure in Buildings. The code aims to prevent and reduce the number of fire-related accidents to protect the safety of humans and assets by adopting economical and logical fire-prevention structural steel design. The code is suitable for new construction expansion or re-design projects.
- CECS24 - Technical Code for Application of Fire Resistant Coating for Steel Structure in Buildings. The code aims to implement fire protection measurements on structures by using fire-resistive coating to protect steel structures and to increase the resistance to heating using a logical, safe, and technically advanced approach.
- GB 50050-2007- Industrial Circulated Cooling Water Treatment Rule. The code aims to implement national water resources saving and environment protection

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policies, promote the cyclic utilization of industrial cooling water and sewage reclamation, effectively control and reduce harm caused by re-circulated cooling water, guarantee the recuperation efficiency and service life of implements, decrease water pollution and enable the industrial cycle cooling water treatment to be state-of-art, economical and practical, secure and stable.

- GB 50058-92 - Code for Design of Electric Installations within Explosion and Fire Hazard Atmospheres. The code provides guidelines for installation of electrical work in explosive and fire hazard atmospheres to ensure the safety of humans and assets by adopting logical, economical and safe approaches.
- GB 50201- 94 - Standard for Flood Control. This code is suitable for urban and rural development, mining sites development, power houses, telecommunication infrastructures, places for tourism or of cultural heritage. The code provides guidelines for flash-flooding, rapid snowmelt floods, and rain and rain-induced floods.
- GB 5749-85 - Sanitary Standard for Drinking Water. A standard designed to provide clean and sanitised water for the end users to ensure the safety and health of consumers.
- GB/T14848 - 93: Quality Standard for Groundwater. This standard specifies the classification of groundwater quality, groundwater quality monitoring, evaluation methods and groundwater quality protection. The standard applies to general groundwater, mineral water and brine water.
- GB/T16453.1~16453.6-2008: The Standard on Comprehensive Water and Soil Conservation Treatment.
- GB/T19001－2000－ISO9001:2000. ISO certification for a quality management system.
- GB/T24001－2004－ISO14001:2004. EMS Environmental Management System certification.
- GB/T28001－2001. Occupational Health and Safety Assessment System certification.
- GB13271 - 2001: Emission Standard of Air Pollutants for Coal-Burning Oil-Burning Gas-Fired Boiler. This Standard specifies the permissible effluent concentration of flue dust, SO_2 and nitrogen.
- GB15618 - 1995 - Environmental Quality Standard for Soils. This Standard specifies to the investigations required to assess soils contamination.

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- GB16297 – 1996 - Integrated Emission Standard of Air Pollutants. This standard specifies the emission standards of 33 air pollutants and presents various requirements for the implementation of the Standard.
- GB18597-2001 - Standard for Pollution Control on Hazardous Waste Storage. This Standard implements the People's Republic of China law on the Prevention and Control of Environmental Pollution by Solid Wastes, preventing environmental pollution caused by the storage of hazardous wastes and enhancing the supervision and regulation of the storage of hazardous wastes. This Standard stipulates the general requirements for storage of hazardous wastes, including the siting, design, operation, protection and monitoring of storage facilities of hazardous wastes.
- GB18598 - 2001 - Standard for Pollution Control on the Security Landfill Site for Hazardous Wastes. This Standard specifies the environmental protection requirements for hazardous waste landfill sites during their construction and operation, including entrance conditions, site selection, design, construction, operation, and closing and monitoring of the landfill site.
- GB18599-2001 - Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes. This standard specifies the requirements of environmental protection for the storage and disposal site for general industrial solid wastes during the construction and operation phases, including landfill entrance conditions, selection, design, construction, operation, closing and monitoring of the landfill site.
- GB3095 - 1996 - Ambient Air Quality Standard. This Standard specifies the control of air quality including zones delineation, standards, contaminant concentrations, and sampling and methods of analysis.
- GB3096 - 2008 - Environmental Quality Standard for Noise. This Standard specifies environmental noise limits.
- GB3838-2002 - Environmental Quality Standard for Surface Water. This Standard specifies the water quality values, evaluation of water quality and analysis method of water quality. The Standard is applicable to rivers, lakes, canals, channels, reservoirs and other surface water areas with utilisable functions within the People’s Republic of China.
- GB4387-1994 - Safety Regulation for Transportation in Plants of Industrial Enterprises. This Standard specifies the safety regulations relating to transportation on internal and external mine roads and on cargo handling.

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- GB50011-2010 - Code for Seismic Design of Buildings. This Standard specifies the engineering and building standards for earthquake prevention and disaster reduction.
- GB50013-2006 - Outdoor Water Supply Design Rule. This Standard is formulated to make water supply engineering design conform to national principles, policies, laws and regulations.
- GB50014 - 2006 - Code for Design of Outdoor Wastewater Engineering. This Standard specifies development standards for the design of wastewater engineering in China in order to conform with national laws and specifications, meet the requirements to control the water pollution, improve and protect the environment and improvie the health of people and ensuring their safety.
- GB50015 - 2003 - Water Supply and Drainage Rules for Buildings. This standard is designed to ensure the quality of building water supply and drainage design.
- GB50016-2006 - Code of Design on Building Fire Protection and Prevention. This standard is formulated with a view to preventing and reducing building fire hazards and safeguarding people's life and property.
- GB50040 - 96: Code for Dynamic Machine Foundation Design.
- GB50069 - 2002 - Structural Design Code for Special Structures of Water Supply and Waste Water Engineering. This Standard specifies the national technical and economic policies pertaining to the structural design for water supply and drainage structures.
- GB50151-92 to 02 - Design Codes on Expansion Foam Fire Extinguishing Systems.
- GB50191- 93 - Design Code for Anti - Seismic of Special Structures. This specification has been formulated to lessen the damage to structures caused by earthquakes, to avoid casualties, and to reduce economic losses.
- GB50229-2006 - Fire-Proof Rules for Thermal Power Plant and Substation Design. This Standard is formulated to ensure fire safety in thermal power plant and substation design.
- GB50330 - 2002 - Technical Code for Building Slope Engineering. This Standard is applicable to the design and construction of slopes.
- GB50343 - 2004 - Technical Code for Protection against Lightning of Building Electronic Information System. This standard is formulated with a view to prevent and reduce the damage caused by lightning on electronic information systems and protecting the safety of life and property.

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- GB50370 - 2005 - Gas Fire Extinguish System Design Rule. This standard aims to reduce fire hazards by implementing a systematic fire extinguishing design rule.
- GB50421 - 2007 - Code for Waste Dump Design of Non-ferrous Metal Mines. This standard is designed to standardise the technical requirements for waste dump design of nonferrous metal mines. It implements national technical and economic policies, as well as meeting the requirement tosafely stockpiling mine overburden and protecting the environment.
- GB50433 - 2008 - Technical Code on Soil and Water Conservation of Development and Construction Projects. This standard is formulated with a view to standardise the technical requirements for soil and water conservation of development and construction projects. The standard emphasizes the need to reduce negative impacts on ecosystems, as well as prevent soil and water erosion.
- GB50630 - 2010 - Code for Design on Fire Prevention of Nonferrous Metal Engineering.
- GB5085.1 5085.7 - 2007 - Identification Standard for Hazardous Wastes. This standard is formulated for the prevention of environmental pollution caused by hazardous wastes, strengthen the management of hazardous waste, protect the environment and protect human health.
- GB5085.1 - 2007 - Identification Standards for Hazardous Wastes - Identification for Corrosivity.
- GB5085.3 - 2007 - Identification Standards for Hazardous Wastes - Identification for Extraction Toxicity.
- GB5749 - 2006 - Domestic Water Sanitation Standard. This national standard specifies the sanitary requirements for drinking water quality, drinking water source quality, central water supply organization, secondary water supply and health- and safety-related products, together with the water quality monitoring methods and water examination methods. This national standard is applicable to all kinds of central drinking water supply and non-central drinking water supply in both urban and rural regions.
- GB6722-2003 - Blasting Safety Rule. This standard specifies the safety technical requirements and supervisory work requirements of a blasting operation, explosive workings and storage, transportation, processing, inspection and disposal of blasting supplies.
- GB8978 - 1996 - Sewage Discharge Standard: This standard is formulated to carry out: The Environmental Protection Law of the People's Republic of China;

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Law of the People's Republic of China on Prevention and Control of Water Pollution; and Marine Environment Protection Law of the People's Republic of China in order to control water pollution, protect the surface water such as rivers, lakes, canals, channels, reservoirs and oceans as well as groundwater, protect human health, maintain the ecological balance, and promote the development of the national economy and urban and rural construction.

- GBJ22 - 87 - Specifications for the Design of Factory and Mine Roads. This standard is formulated to ensure the quality of factory, mine and road designs and ensure that they meet national policies and guidelines.
- JGJ94 - 2008: Technical Code for Building Pile Foundations. The code was established to enable pile foundation engineering and construction to comply with national technical economy policies, and to be safe, workable, state-of-art technology, economically feasible, quality assured and environmentally friendly.
- YSJ019 - 1992 - Code for Design of Non - ferrous Metal Mining.

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3. HISTORIC STUDIES IN THE AREA

The following three sections summarise existing reports prepared on the Project which have considered the Project's environmental impact. The information presented in the following sections is extracted from these reports that were prepared between 1997 and 2011. The information is assumed correct at the time of the original reports but may now be out of date.

3.1 1996 S&K ENVIRONMENTAL IMPACT ASSESSMENT[3]

This study was undertaken to describe the existing conditions in and around the S&K project operations. It also highlighted existing environmental effects that were evident from the operations that had been conducted to date and the impact they were having on key environmental areas, such as the Yamar Stream and the Chindwin River.

The description of the existing biophysical and social conditions in the area are relevant to this report (and others following) as they enable an assessment of changes that have been occurring in the Project area over the last 15 - 20 years and highlight some significant existing effects of copper mining in the area which are not only a consequence of the Letpadaung Project but are conditions that have existed in the area for three decades or more.

This assessment indicates that social conditions in the area for populations not involved in mining have not changed much. However, there has been migration into the area and increased pressure on biodiversity. Many features of the natural resources described in the S&K report are no longer present today.

3.1.1 Soils

The S&K report indicated that local soils in areas undisturbed by the mining activities tended to be mildly alkaline, non-saline but low in organic and nutrient content. Supplementation of organic matter, nitrates potassium and phosphorus is required to improve plant growth in the soils.

3.1.2 Climate

AATA described the climate at the site as semi-tropical with monthly average maximum temperatures ranging from 30.9°C in January to 42.5°C in April. Minimal temperatures in the same months range from 10.5°C to 19.4°C respectively.

[3] AATA, 1996; Environmental Assessment – Monywa Copper Project, Volume 1;In Feasibility Study Sabetaung – Kyisintaung Copper Project, Monywa, Union of Myanmar – Volume 5 Appendices , prepared for Ivanhoe Myanmar Holdings Ltd by Mincorp Engineers and Constructors; AATA International Inc., Fort Collins, Colorado USA; March 1996

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Rainfall in the area indicated an annual average rainfall of 751 mm with the wettest months being August to October with more than 50% of the annual rainfall received during that time.

Evaporation records suggest a mean annual evaporation of 1,971 mm with monthly evaporation exceeding rainfall in all months except August to October.

The mean maximum wind speed was observed to be 3.66 m/s with speeds to 9.71 m/s. Winds were predominantly from the south in the monsoon period and from the north in the dry season.

Relative humidity (RH) ranged from a low of 30% in April to 86% in August with periods of 100% RH, consistent with temperature and rainfall patterns.

3.1.3 Air Quality

TSP levels were within WHO ambient air quality guidelines, although higher levels were observed near crushing and conveying facilities. Overall observations of all gaseous emissions indicated the Monywa airshed was clean.

3.1.4 Hydrology

The principal streams in the area were the Chindwin River and the Yamar Stream. Most of the mining site laid adjacent to the Chindwin River floodplain (over 12 km wide). The Chindwin catchment area was 106,000 km^2 and the Yamar Stream catchment area was 2,046 km^2. In the project area the 100-year flood level of the Chindwin was 74.6 m and the 10-year flood level was 74.4 m. The flow rate of the Chindwin ranged from the lowest flow rate of 600 m^3/sec to the highest rate of 24,850 m^3/s, in full flood conditions.

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3.1.5 Water Quality

The water quality of the Chindwin River was neutral to slightly alkaline with moderate alkalinity, hardness and conductivity. Almost all parameters tested exceeded US EPA water quality criteria both above and below Yamar Stream.

Seasonal variations in water quality were evident with increases in TSS but decreases in TDS, conductivity, hardness and alkalinity.

Some metal parameters (Cr, Cu and Fe) rose with increased flow rates.

3.1.6 Hydrogeology

Both the Kangon Formation and a bedrock aquifer were observed in the area. Samples taken from both aquifers exhibited low quality standards which exceeded US EPA drinking water standards, except from two wells used for drinking water, although some

standards for these wells were also of a poor standard suggesting treatment of the water is required for it to be acceptable for human consumption.

3.1.7 Vegetation

The project area was located in the Dry Belt bioregion of Myanmar. The bioregion was characterised by four (4) forest types:

- The Savannah Forest;
- Than-Dahat Forest (Tectonia hamiltoniana - Terminalia oliveri Forest);
- Sha-Dahat (Acacia - Tectonia hamiltoniana Association) Forest; and
- Sha (Acacia) Thorn Scrub.

Undisturbed land was almost impossible to find in the area due to population pressure and demand for forest resources. The S&K report identified trees up to nine (9) metres in height. Much of the area was considered by the Forest Department as being non-forested due to the prevalence of thorny acacia scrub. Their vegetation classifications were:

- Mixed deciduous forests classified as Dry Upper Mixed Forest; and
- Dry forests classified as Than-Dahat Forests and Thorn Forests.

These forest types were most frequently observed in the Monywa project area.

3.1.8 Wildlife

Habitat conditions in the project area were reported as being poor. Habitat limitations resulted from human population density, loss of original vegetation cover, hunting and other forms of human disturbance.

Wildlife density in the area was assessed to be very low in comparison to the lists of wildlife types developed for the Central Myanmar region.

3.1.9 Socio-Economic Conditions

The S&K operation supported about 7,500 people through direct or indirect employment in a Township (Salingyi) with a population of about 130,000 (in 1996).

The income levels provided by mining companies to locally engaged employees were (and continue to be) the highest available in the project area. Many farmers in the area earned less than $1/day which was the internationally recognised definition of extreme poverty (The World Bank).

Life expectancy within the population is low, aggravated by the lack of trained medical personnel in the area.

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Most people in the project area were engaged in farming, with only 2,720 people reported as being employed in industrial pursuits. The key crops produced were wheat, sorghum, green gram, sesame and chickpeas.

Most available water in the area was left untreated from the Chindwin River. Any reticulated water would then only supply about 100 litres per person per day (or about 50% of the requirements specified by the United Nations). Mine water for S&K was sourced from the Chindwin River and used 25 ML/day. No wastewater treatment systems were used in the area for the treatment of sewage.

Electricity was not accessible to all residents. The major fuel source was wood (hence the degradation of the woody vegetation).

Essential services, such as police, fire brigade, medical care, schools and roads were available in limited capacity. Activity was underway at the time of the S&K report to increase the supply of communal services through developmental works.

3.1.10 Summary

This report highlighted the existence of an issue with ARD management in 1996 and the need to rationalise the tailings management on the operation. It also described the influence of the operation on the Yamar Stream. Whilst the report and its findings do not apply directly to the Letpadaung Project, it does highlight some of the broader regional issues and also some of the social and environmental issues likely to require management on the Project.

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3.2 1997 FEASIBILITY STUDY

This report[4] was a feasibility study focussing on the key aspects of the Letpadaung Project, in which Section 17 of the report presented an assessment of the environmental and social impacts of the Project. As there was an absence of Myanmar environmental guidelines, the assessment was based on Australian guidelines, and they were considered to be sufficiently specific without being overly prescriptive and hence appropriate for the country context.

[4] Muir Environmental, 1997; Environmental and Social Assessment and Management Programme Volume 1 - Report Final Draft , Letpadaung Copper Project, Myanmar for Ivanhoe Myanmar Holdings; Report No ME96-056-001; 17 February 1997; In Volume 8, Appendix 10, Feasibility Study Letpadaung Copper project, Monywa, Union of Myanmar commissioned by Ivanhoe Myanmar Holdings; Presented to No1 Mining Enterprise, Ministry of Mines, Government of the Union of Myanmar; Minproc Engineers Limited ACN 008 992 694; March 1997

3.2.1 Physical Environment

The average yearly precipitation and evaporation were 780 mm and 1,876 mm respectively, with a dry season occurring from November to February. There was some anecdotal evidence to suggest the climate was drying, possibly the result of local deforestation and/ or global climate change. The average daily maximum temperature was 37°C.

The wider area's topography comprised typically flat plains with a small number of steep sided and prominent hills present across the landscape. The Letpadaung mine site was located within one of these prominent hills, Letpadaung hill.

In terms of rainfall, central Myanmar was considered temperate; however the vegetation was floristically tropical and similar to that of its neighbouring countries.

The flora on Letpadaung Hill was notably uniform and strongly influenced by human exploitation. The hill crests comprised stunted woodland, the more steeply sloping hill sides and cooler valleys contained tall scrubland and low heath and low scrubland was present toward the base of the hills. The plains were used predominantly for agriculture and contained little natural vegetation with the exception of hedgerows along field boundaries.

Due to the human population, there was limited habitat for fauna in the area and the diversity and density of this fauna was limited. The diversity of bird, reptile and amphibian species was found to be low with bird species being those of agricultural significance (either feeding off the agricultural crops or the insects and pests associated with the crops). Equally few mammalian species were found with only the Dhole (*Cuon alphinus*) being considered vulnerable in the threatened and endangered species list.

The Chindwin River was the main river in the area and was located approximately 2.8 km to the northeast and flows southward. Surface water samples of the river taken a few kilometres upstream recorded the water to be slightly alkaline and of a good quality (better than United States Environmental Protection Agency and Western Australia Environmental Protection Authority water quality criteria).

At the time of writing the report, copper effluent was being discharged into the rivers from the adjacent Sabetaung and Kyisintaung (S&K) mine site. There was no evidence that this effluent was adversely affecting the river systems and this was probably due to the high level of dilution. However, it was recommended that all future discharges received pre-treatment.

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A total of 55 species of fish were reported within the Chindwin River and that this fishery was just maintaining itself at sustainable levels. High parasite loads were found in the fish, indicating physiological stress and degradation of the river ecosystem. The high level of parasites were found in fish caught both from the local area but also further upstream, suggesting environmental degradation was affecting a wide area of the river basin.

Groundwater samples that were tested were found to be of low overall quality with high total dissolved solids. There were high levels of trace metals (As, Cr, Cu, Fe and Mn), all of which were higher than drinking water quality.

3.2.2 Social and Economic Environment

Social and economic research that was undertaken for the S&K mine site is germane for the Letpadaung Project. Key information is presented below. .

Myanmar is a culturally diverse nation with approximately 30 % of the population belonging to numerous ethnic minority groups. The majority of the people within the Letpadaung area are from the main cultural group, the Burmans who comprise approximately 70% of the population of Myanmar. The dominant religion is Theravada Buddhism and there are two monasteries very close to the Letpadaung mine. One of these monasteries (Taunguar Monastery) and a stupa will need to be moved to allow development of the Letpadaung mine. No other culturally or archaeologically significant sites will be affected by the mining development with the exception of some WWII lookout points which may have some historic significance.

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The local economy is primarily agrarian. Trade and services are the next most significant sectors. The key regional industries are cotton mills, lathe shops, saw mills, noodle plants and cooking oil mills.

The existing S&K mine directly employs approximately 0.5 % of the area's workforce, with more being indirectly employed. One of the negative impacts of the S&K mine is that a cottage industry of backyard smelters has developed that process mine tailings. This has led to health risks for the workers, pollution of the watercourses and an increased demand for fuel wood.

The Letpadaung mine will require the removal of four villages. There is an absence of any discussion on this human impact or the amount of people that will be affected. The only information provided is that it is assumed that the land will be obtained through compulsory purchase and those affected compensated in accordance with Myanmar practice. The mine and associated infrastructure will also lead to a loss of land used for agriculture and for obtaining firewood. Some of this land is more productive and the

area to the south of Letpadaung appears least productive due to its readily drained stony soils. This less productive area is proposed to be used for the waste dumps and heap leach pads. The impact on the local food supply from the loss of agricultural land is not expected to be significant as there appears sufficient production elsewhere in the region to meet demand.

3.2.3 Environmental Impacts

The Letpadaung hill is the only feature in an otherwise flat landscape and the project will be clearly visible from the surrounding villages. The perception gained was that the local people viewed the economic benefits of the scheme as far outweighing the impact it will have on the landscape. Similarly, the operation of the Letpadaung mine will lead to an increase in noise levels in the area, but it is said that people living close to the S&K mine have learnt to accept and live with the noise.

Dust arising from the operations will be controlled as far as possible but there will be some increase when measured against current farming operations. Fibrous tests that have been undertaken on soils found no asbestos form materials to be present.

Rocks exposed by the mining operations contain a high level of sulphur (mean concentration of 1.7 %) and have the propensity to generate acid rock drainage (ARD). This occurs when the sulphur bearing minerals oxidise on exposure to the air and produce acidic by products and liberate trace minerals. This solution can be extremely damaging if discharged to the environment.

To minimise the impacts of ARD it was proposed that surface water infiltration should be minimised and all subsurface water and pit water be collected and either redirected through the heap leach circuit or process plant or sent to evaporation ponds. The heap leach pads were proposed to be provided with double liner systems and leak detection systems and the process plant provided with segregated drainage systems to ensure accidental release was not discharged.

The mine operations will require a supply of process water and the pit will depress the groundwater table locally. Both impacts were considered insignificant as water demand from the Chindwin River is small in comparison to its dry season flow and few local water supply wells are thought to be within the zone of influence of any dewatering.

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3.3 2000 DEVELOPMENT PLAN[5]

3.3.1 Climate

This study adjusted the annual average rainfall to 786 mm/yr and the annual pan evaporation to 1,876 mm/yr through adjustment of the historic rainfall events to exclude outlier records from the recordings taken at Monywa and 15 years of data reported in a 1996 report associated with the report at footnote 24. This report identified the following trends:

- Strongly defined wet and dry seasons;
- The wet season occurring within the months April to November;
- The majority of precipitation as intense, short duration (less than five (50 day) storm events during the wet season;
- Mean maximum monthly average temperatures ranging from 27.7°C (December) to 38.7°C (April);
- Mean minimum monthly temperatures ranging from 13.2°C (January) to 25.9°C (July); and
- Rainfall records from 1913 for which a complete record has not been available to date.

3.3.2 Soils and Geology

The report found clay alluvium to 7.5 m overlying a sand alluvium with the water table encountered at 9.5 m in the proposed ponds area.

The interpretation of the soil geology revealed:

- Residual pyroclastic rock soils occur on the surface and at shallow depth near the hills;
- Erosion of the hills has produced clayey, silty, sandy, gravel, cobbles and boulders, which have spread by gravity in scree slopes away from the hills. This forms the obviously steeper areas with about 30% cobbles and boulders on the surface to over a depth of two (2) metres depth;
- It is likely the soils become finer with distance from the hills, although this is not obvious;
- At the abrupt change of slope and about 50 m beyond, the surface soil rapidly reduces in gravel cobble content;
- The flat slopes plain was almost entirely highly plastic clays (probably deposited by the Chindwin River from upstream origins) but drainage outwashes from the

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[5] Knight Piésold, 2000; Development Plan - Leach Pads, Waste Dumps and Water Management for Letpadaung Copper Project Ref 846/1; Ivanhoe Mines Ltd; April 2000

steeper slopes carry sand hundreds of metres out into sandy shallow creeks. These paleo-channels occur throughout the area and to depth and through the clay horizon;

- The clay horizon is dark brown, almost black, slightly moist, highly desiccated (open cracks) to about 1.8 m. Indicator tests show this clay is highly active and effective precautions against swell are required;
- Thereafter, the clay horizon becomes rapidly brown, moist and intact. The clay contained no sand horizon to 7.5 m when excavated;
- In the ponds area, the water table was at 9.5 m. This could be linked to the river or the topographic recharge from upslope, in which case it could rise dramatically after rain.

The valley has been intensively farmed and ploughed to 0.2 m, even in rocky areas, and planted with millet and beans.

3.3.3 Water Balance

Extreme storm water events of 14 to 30 days duration are the most critical for the facility, but the pond sizes (as designed in 1997) will contain all 1 in 100 year events. Shorter duration events can result in peak discharges in pipes and channels. These peak events have been considered in the design of those components.

Even in a wet year, the facility will have a shortfall of water that will require make-up water with a peak requirement of 32,500 m^3/day.

3.3.4 Waste Dump Design

Based on the sampling and testing done to date it has been inferred that up to 70% of the volume of waste may comprise potentially acid forming (PAF) material. The weathered leach cap is expected to have little or no acid generating potential and can be placed to cap the acid forming waste or other non (PAF) uses. More detailed studies into the PAF material and the potential neutralisation of the waste will be required at the final design stage.

Several factors were taken into consideration in selecting a suitable location for waste dumps including:

- Waste dumps to be in close proximity to the pit;
- Avoiding placing waste below the Chindwin River flood limit (74.6 m AMSL);
- Limit the extent of the waste so as not to extend over roads or project boundaries;
- Avoid blocking off the Chindwin River Paleo-channel in the north-east;
- Avoid areas delineated as potential ore reserves; and

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- Work around the heap leach operation.

The approaches to control of ARD should be defined at final design stage after further testing of the waste has been conducted.

3.4 2004 ENVIRONMENTAL STUDY[6]

Much of what is presented in the 1997 feasibility report is again presented in this 2004 Environmental Preliminary Impacts Assessment. The following text presents only the additional or revised information and omits information already presented in the section above.

In the absence of defined environmental requirements, this report was based on advisory services provided to the government by the United Nations Economic and Advisory Commission for Asia and the Pacific (UNECAP).

The report similarly concludes that the area has low biodiversity but identifies the presence of numerous venomous snakes and two further vulnerable species: the Hooded Treppie bird and Eld's deer. It states that the presence of these vulnerable species may require further work.

The report highlights the negative impact migrant mine workers can have on the locality but concludes that this has not been a significant issue with the existing S&K mine as the project currently employs a predominantly local workforce.

Information is provided on the positive impacts of selected S&K healthcare services being made available to the wider population.

The report concludes that the key potential environmental impacts are air and noise pollution, hydrocarbons spillages, acid rock drainage and increased road traffic. It concludes that all of these can be adequately mitigated when considered against the benefits that the project can offer.

3.5 2011 BASIC DESIGN STUDY[7]

As with the previous section, this section identifies only the additional or revised information presented in this Basic Design Specification but omits information that has already been presented in the above two sections. The report was primarily based on Chinese environmental standards.

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[6] MICCL, (2004);72E-58 Environmental Preliminary Impacts Assessment for Letpadaung Project Area; Myanmar Ivanhoe Copper Company Ltd.' 13 July 2004

[7] NERIN (2011); Myanmar Monywa Letpadaung Copper Project Basic Design (100kt/a Cathode Copper) Volume 1 Specification for Myanmar Wanbao Mining Copper Ltd; China Nerin Engineering Co. Ltd., June 2011

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The report primarily provides quantitative information on the consumption, emission and waste generation of resources, their acceptable range and monitoring and control measures.

Emissions include the generation of dust from transport, mine blasting and ore processing (including conveying and crushing), the emission of sulphuric acid mist from smelting, emissions from a diesel fired boiler and noise emissions. Dust emissions were seen to be primarily controlled through the use of water spraying and/or dust extraction equipment. Noise emissions were seen to be primarily controlled through silencing, acoustic barriers, sound insulation, vibration reduction and regular maintenance. All emissions were said to meet the relevant standards.

Waste generation covers the treatment and disposal of waste water and mine waste solids. All waste water would either be sent to the water conditioning ponds which would feed back to the heap leaching process. Domestic wastewater would be treated prior to discharge to the water conditioning ponds.

Solid waste, comprising waste rock clay mixing slag, would be disposed of according to the requirements of Category I general industrial solid and heap leaching. Slag would be stacked in the heap leaching pad and will meet the requirements for the disposal of Category II general industrial solid.

To further reduce environmental impacts, focus was given to 'cleaner production' which included using the most efficient mine fleet, reducing transportation distances, decreasing the ore loss ratio, using cleaner light diesel oil in the boiler to reduce sulphur dioxide and dust emissions and recycling wastewater back into the production system.

Environmental protection and monitoring would comprise a staff of six and information was provided on the proposed categories and frequency of monitoring. This monitoring focussed on the source of pollutants but not the risk or impact of their dispersal. No mention was given to containment leakage monitoring or the monitoring of the environment beyond the mine.

A short chapter was provided on soil erosion and the proposals for erosion and sediment control. The proposals followed the requirements of Chinese standards and comprised a combination of minimising vegetation clearance, re-vegetating, storing topsoil for reuse, providing erosion and flood protection and providing sediment traps

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within drainage channels. Rehabilitation of the site will follow a concpet mine closure[8] plan that has been developed by MWMCL in consultation with Knight Piesold.

3.6 HISTORICAL FIELD SURVEYS

3.6.1 Flora and Fauna

3.6.1.1 Flora

A baseline flora study undertaken by the Botany Department of Yangon University in 2003 identified 80 species of flora in the vicinity of the Project. Shrubs, which comprised 39 of the species identified, are the most predominant vegetation community in this area and the trees greater than 5-10 cm diameter are used as a source of wood by local villagers. The second largest community is trees of which 19 species were identified. The remaining groups differentially encompass 13 species of herbs, 6 species of grass, 2 species of bamboo and one Acacia species. Most of the plants found in this area are xerophytes which are totally adapted to the arid conditions of the project area.

A total of 134 species representing 107 genera and 49 families were listed in the Letpadaung Taung area during the fieldwork associated with the 1997 field studies. The tree layer in the study area is dominated by *Azadirachta indica* A. Juss. (with the highest incident vegetation index (IVI) of 91.93%), the second most dominant species is *Dalbergia paniculata* Roxb. (IVI = 38.29%), and *Atalantia monophylla* A. DC. (IVI= 37.87%) is third. The number of species greater than 10% IVI value was seven species. Those species could be considered as ecological indicator species of the Letpadaung Taung area.

The distribution of scrub and tree species by frequency class in the study area showed that a high percentage of the total number of species was in the lower frequency classes, A and B, whilst a low percentage only was observed for the higher frequency class C, D, and E. This indicates that the forest in the study area is floristically heterogeneous. The value of diversity indices and evenness indices for scrubs and tree species were very low in the study area.

Stem density of ≥10cm was 1,247 m^2/ha and basal area was 3.17 m^2/ha in the study area. Among the 15 sample plot studies, 27 tree species were recorded, and 10 species with only one (1) individual were found and these were considered as unique species. The 3 most abundant species in terms of basal area occupied 71.45% of the

[8] Knight Piesold Report, Conceptual Closure Plan, PE701-00022/20 Rev A, September, 2013.

total area, of which *Azadirachta indica* A. Juss. was the most dominant species in the study area with 37.08%, followed by *Dalbergia paniculata* Roxb. 22.04%, and *Atalantia monophylla* A. DC. with 12.32% of the total basal area. The plant species that were listed and recorded in the recent study were checked against the International Union for the Conservation of Nature (IUCN) Red List of threatened species but are not found on the IUCN Red List.

3.6.1.2 Fauna

A number of fauna surveys were undertaken in the mid-1990's (Muir, 1997) when the proposal to mine Letpadaung was mooted by MICCL. The results of those fauna surveys are described below.

Birds of the Letpadaung Project Area

A total of 18 bird species were recorded during the studies in the 1990s (Table 3.1) (Muir, 1997). The recorded species belong to 11 Families of the Order Passeriformes.

The broad saddles between the hills are inhabited by 7 bird species of 6 Families; 16 bird species were recorded on the lower slopes, 11 species in the steeply sided valley of Letpadaung hill, and 4 species at the hill crest.

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Table 3.1: Bird species of the Letpadaung Copper Mine project area

Sr. No.	Family	Scientific name	Common name	Location
1	Ploceidae	Passer montanus	Tree sparrow	I,II
2		Streptopelia chinensis	Spotted dove	I,II,III,IV
3	Pycnonotidae	Pycnonotus cafer	Red vented bulbul	II,III
4		P. blanfordi	Streak eared bulbul	I,II,III
5	Coraciidae	Coracias benghalensis	Indian roller	II
6	Meropidae	Merops orientalis	Green bee-eater	I,II,III
7	Timaliidae	Turdoides gularis	White throated babblers	II
8		Lanius collurioides	Burmese shrike	II,III
9		Accipiter badius	Shikra	III,IV
10	Sturnidae	Acridotheres tristis	Common mynah	II,III
11		Sturnus burmanicus	Vinous breasted starling	II
12	Upupidae	Upupa epops	Hoopoe	II
13		Coracias benghalensis	Indian roller	II,III
14	Turnicidae	Turnix tanki	Yellow-legged buttonquail	II
15	Sylviidae	Orthotomus sutorius	Common tailorbird	I,II,III,IV
16		Orthotomus cuculatus	Mountain tailor bird	I,II,III,IV
17	Falconidae	Francolinus pintadeanus	Chinese francolin	I,III,
18	Turdidae	Saxicola caprata	Pied bush chat	II,III

Note: I = the broad saddle between the hills
II = the lower slopes
III = the steeply-sided valleys
IV = the hill crests

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Mammals of the Project Area

The Myanmar hare *Lepus peguensis* was recorded during the survey period and were observed on the flatlands. They have a large movement range between the shrublands and cultivated areas at the base of Letpadaung Hill. According to the interview survey, Eld's deer (Shwethamin) *Cervus eldi thamin* was listed as a frequent visitor to the project area.

Reptilian and Amphibian Species

A total of three reptile species and one amphibian species were recorded during the survey period (Table 3.2). The most common species among them was observed as garden fence lizard *Calotes versicolar*.

Table 3.2: Reptile and amphibian species recorded during the survey period

Sr. No.	Species	Common name	Family	Taxonomic group
1	Calotes versicolor	Garden Fence Lizard	Agamidae	Reptile
2	Mabuya multifasciata	Many-lined Sun Skink	Scincidae	Reptile
3	Ptyas korros	Rat Snake	Colubridae	Reptile
4	Bufo melanostatus	Common Toad	Bufonidae	Amphibian

Butterfly and Odonate Species

Twelve butterfly species were recorded during the survey period (Table 3.3) (Muir, 1997). The most common species among them were *Eurema andersoni* and *Cethosia cyane* species. Most of the butterfly species and higher population size were observed in the lower slope habitat.

Three odonate species, namely *Tholymis tillarga*, *Orthetrum sabina*, and *Macrodiplax cora*, were recorded. Damsal fly species were not observed in the project area during the survey period.

Table 3.3: Butterfly species recorded during the survey period

Sr. No.	Family	Species	Habitat
1	Papilionidae	*Papilio demoleus mylayanus*	I,II,III
2	Papilionidae	*P. castor*	II,III
3	Papilionidae	*P. memnon*	I,II
4	Papilionidae	*C. clydia*	II,III
5	Peridae	*Hebomoia glaucippe*	III,IV
7	Peridae	*Eurema andersoni*	I,II,III,IV
7	Peridae	*Eurema andersoni*	I,II,III,IV
8	Peridae	*Hyarotis adrastus*	I,II,III
9	Peridae	*Pareronia valeria lutescens*	II
10	Peridae	*Catopsilia pomona*	I,II,III,IV
11	Nymphalidae	*Cethosia cyane*	I,II,III
12	Nymphalidae	*Junonia hierta*	I,II,III

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4. ENVIRONMENT

4.1 ATMOSPHERIC ENVIRONMENT

4.1.1 Climate

Myanmar experiences a tropical monsoon climate in which there are three distinct seasons:

- A cool-dry season occurs from October to February;
- A hot-dry season occurs from March to May; and
- A hot wet season occurs from June to September.

The mean monthly temperatures presented in Table 4.1 show that temperatures range between a minimum 21.9ºC in January and a maximum of 31ºC in May.

The mean annual rainfall is 773.8 mm which has ranged between a minimum of 411 mm in 1982 and a maximum 1,370 mm in 1973. Mean monthly rainfall (Table 4.2) range from a minimum of 1.9 mm in January and a maximum of 166.4 mm in September.

Pan evaporation shown in Table 4.3 reflects the annual temperature distribution ranging between 121.3 mm in January to 172.7 mm in August. Pan evaporation exceeds precipitation in all months.

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Table 4.1: Mean monthly temperatures in the project area (1981 to 2012)

Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	21.9	24.0	28.1	30.9	31.0	30.6	30.5	29.9	29.3	28.0	25.1	22.2
SD	1.9	2.3	2.3	1.4	1.4	1.1	1.2	1.0	0.7	0.7	1.1	1.9
Median	21.9	23.6	28.0	30.9	31.0	30.5	30.8	29.8	29.3	28.1	25.3	22.0

Table 4.2: Mean monthly precipitation in the project area (1961 to 2013)

Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave. # of Rain Days	0	0	1	4	9	9	8	10	11	10	3	1
Mean	1.9	3.3	4.6	25.9	101.5	99.9	67.1	121.3	166.4	141.7	32.7	6.4
SD	5.9	14.8	13.7	22.3	69.5	79.4	42.5	80.4	89.1	94.9	44.4	16.9
Median	0.0	0.0	1.0	20.5	94.4	71.5	59.0	103.0	149.5	135.5	12.2	0.0

Table 4.3: Mean monthly pan evaporation in the project area (2000 to 2006)

Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	121.3	149.3	209.5	227.8	216.6	203.1	172.2	172.7	160.2	144.6	124.7	116.5
SD	0.9	12.7	14.4	21.1	23.4	35.9	12.0	26.9	26.9	27.3	16.6	12.0
Median	120.9	151.1	212.9	235.5	209.2	186.9	174.1	172.5	149.7	147.8	129.9	111.8

The prevailing winds during March to October are south-westerly and south-easterly, and during November to February they are northerly. The average wind velocity (2010 to 2012) ranged between 1.0 and 3.2 m/s and the maximum recorded wind velocity was 9.2 m/s.

Details on the derivation of the base climatology can be found in Appendix A – Surface Water Management.

4.1.2 Air Quality (including dust)

Dust is a significant contributor to respiratory infections in communities located near infrastructure works and impacts the life quality of residents. Visual observations conducted at the Letpadaung site suggest that the level of suspended particles in the air is very high as there is an obvious smoke haze early in the morning. Also the end of the dry season saw significant areas of soil laid bare of any vegetation cover after crops had been harvested and straw and fodder depleted by collection or grazing. Land was also laid fallow in preparation for the oncoming planting season. This resulted in observable dust in the atmosphere being generated from the ground surface.

Existing mining operations in the region also contribute to dust being generated. Dust plumes were observed to disperse over surrounding areas after blasting of the open pit mines had taken place.

The general observations were supported by dust monitoring undertaken by Environment Myanmar Cooperative Company Limited (EMC) that took place in the dry and wet seasons in 2013. The results obtained are included in Table 4.4 and Table 4.5.

Table 4.4: Mean ambient air pollutant concentration – dry season

Air Pollutants	Concentrations ($\mu g/m^3$)		WHO guidelines ($\mu g/m^3$) (24 hour average unless specified)
Station	Station 1	Station 2	
PM_{10}	82	82	50
$PM_{2.5}$	58	78	25
SO_2	0.3	0.3	20
NO_2	42	41	200 (1 hour average)
CO	0.4	0.3	NA

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Further field sampling around the Project area and beyond was undertaken in the wet season over an extended sampling station network. As expected, these results indicated significantly lower levels of dust.

The air quality data obtained for the wet season are provided in Table 4.5.

Table 4.5: Mean ambient air pollutant concentration – wet season

Parameter ($\mu g/m^3$)	WHO guidelines ($\mu g/m^3$) (24 hour average unless specified)	Station							
		1	2	3	4	5	6	7	8
$PM_{2.5}$	25	6	1.71	2.35	5.63	8.77	2.56	5.21	2.58
PM_{10}	50	8.31	2.67	4.19	10.96	17.71	4.69	10.81	4.35
SO_2	20	2.5	2.4	2.5	2.4	2.5	2.5	2.5	2.5
NO_2	200 (1 hour average)	26.04	24.12	34.75	29.25	22.0	19.7	9.45	13.2
CO	NA	0.33	0.33	0.4	0.4	0.4	0.4	0.4	0.4

The results of the field sampling provided the basis for modelling of potential dust generation at the site and enable both the nuisance and respiratory irritants to be predicted for areas around the site. Based on the results of the modelling, exceedences of health and nuisance levels will be established and a control program developed.

Field monitoring of air quality is being undertaken by MWMCL to develop a fuller background database prior to commencement of the project. This will enable the effect of construction and operations to be observed and managed.

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4.1.3 Climate Change

Whilst the 1997 Feasibility Study (Muir, 1997) indicated that there was anecdotal evidence to suggest the climate is drying, possibly the result of local deforestation and/or global climate change, the available climatic data do not support this.

There is no statistically significant wetting/drying trend observable in the Monywa city annual precipitation data (1961 to 2013). Similarly there is no statistically significant heating/cooling in the temperature data (1981 to 2012).

The Monywa city pan evaporation data (2000 to 2013) show a step reduction in the evaporation rate from about 2000 mm (2000 to 2006) to 1,400 mm (2007 to 2012), but having reviewed global lake evaporation data it was considered the lower values over the latter period are the consequence of a change in the method/quality of data collection and not climate change per se.

4.2 SURFACE WATER

The Chindwin River lies approximately 2.8 km northeast of the Letpadaung deposit, with a maximum flow rate of 24,850 m^3/s and an average flow rate of 3,860 m^3/s. The river depth ranges from 1.5 to 10.25 m with an average depth over the year of 5 m. The 20-year flood water level is RL 75.1 m and a 100-year flood water level is RL75.65 m.[9] A water supply from this source could meet the mine requirements.

Water quality in the Chindwin River changes over the course of the year. Table 4.6 presents a series of water quality indicators monitored during various months over the year 2000.

Table 4.6: Water quality monitoring data – Chindwin River (NERIN, 2011)

Month	Temp. (°C)	Total Dissolved Solids (mg/l)	Total Suspended Solids (mg/l)	Total Hardness (mg/l)	Dissolved Oxygen (mg/l)	C_aCO_3 (mg/l)	Sulphate (mg/l)	Ca (mg/l)	Mg (mg/l)
Feb	22.6	146.7	70	90	3.8	107.4	9.2	18.5	10.7
May	34.5	186	11.9	93	-	113	4.8	18.5	11.3
Jun	29	399	1,438	-	4.2	51.6	6.0	21	-
Aug	30.6	98	404	58	3.5	43	2.0	11.6	7
Nov	28.4	79	528	43	3.3	57	10	10.3	4.2
Dec	21	117	190	85	4.6	90	2.4	19.1	9

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The table indicates that the indices are generally stable (except salinity and turbidity which increases in the rainy season) and meet the surface water standard of Class IV water (NERIN, 2011), and as such can be used for common industrial purposes. The current water supply for the existing town and mine/mill is taken directly from the Chindwin River. The issue of increased salinity and turbidity in the rainy season may need to be further addressed for future operations. For example process water may need to be sourced from an infiltration gallery or bore field located in the alluvium of the Yamar or Chindwin Rivers.

4.2.1 Water Catchments

An analysis of water catchments was undertaken to determine the local dependence on water flow from within the Project area or through the Project area. The outputs of this analysis are included at Appendix A – Surface Water Management.

[9] Coffey Partners International Pty Ltd (1997). Letpadaung Copper Project Feasibility Study - Water Management and Environmental Monitoring. Report No. G7024/4-A; February 1997

The analysis identified that runoff, from the Letpadaung hills and through the catchment from the west, supports supply of water to the south of the Project area and to the north-west and north of the Project area. No data was available regarding the volume of water or quality of the water entering these areas.

Currently these catchments provide runoff to three major community dams inside, and beyond the southern boundary, of the site. Catchments draining to the north and north-west provide run-off to a number of small dams which local communities use to supplement dry season water requirements.

Water catchments draining to the east of the site are intercepted by a regional irrigation drain. A detailed analysis of the impact of changes to drainage to the east was not undertaken due to the influence of the drain on catchments between the site and the Chindwin River.

A plan showing the catchments delineated within and around the Project area is shown at Figure 4.2.1.

4.2.2 Baseline Surface Water Quality

For discussion purposes the baseline water chemistry data are compared with the following international and national water quality guidelines:

- WHO Drinking Water Guidelines, (2011)[10].
- The International Finance Corporation (IFC), Environmental Guidelines, (2007)[11].
- The IFC Health and Safety Guidelines, (2004)[12].
- The People's Republic of China Surface Water Quality Standards, (2002)[13]; and
- The People's Republic of China Groundwater Quality Standards (1993)[14].

Using several guidelines allows a comparison with a broader range of parameters. These guidelines are used for a preliminary assessment of water quality only. It is not implied the Project will be required to meet these guideline levels or that these reference levels should be used as the regulatory framework. More detailed assessment of the impact of any discharge from the Project will be required in later

[10] World Health Organisation, 2011; Guidelines for Drinking-Water Quality, 4th Edition; WHO Press, Geneva.
[11] IFC, 2007; Environmental, Health and Safety (EHS) Guidelines, International Finance Corporation, World Bank Group, Washington DC, April 30 2007
[12] Now replaced by reference at Footnote 31
[13] GB3838-2002; Environmental Quality Standard for Surface Water; Ministry of Environmental Protection, The Peoples Republic of China, Bejing
[14] GB/T14848-1993; Quality Standard for Groundwater; Ministry of Environmental Protection, The Peoples Republic of China, Bejing

design stages to assess the impact on receiving environments, where different water quality requirements may be applicable.

The Chindwin River water quality is reported to be fresh, slightly alkaline and soft. Coffey (1997) summarises the Chindwin River quality as:

- Total dissolved solids (TDS) values of 49 mg/L to 123 mg/L (very fresh); and
- pH values between 7.3 and 8.0 (slightly alkaline).

NFMKSDI (2011)[15] summarises the Chindwin River quality as:

- HCO3-Na-Mg dominated;
- A salinity of 500 mg/L (fresh);
- A total hardness of around 160 mg/L (soft);
- A total alkalinity of 300 mg/L (low alkalinity/acid neutralizing capacity); and
- A pH value of around 8 (slightly alkaline).

Surface water sample locations are described as follows:

- LSW-1 North Moe Gyo Byin Drain;
- LSW-2 Yoe Chaung Bridge;
- LSW-3 Kyauk Phyu Dine Dam;
- LSW-4 Kyauk Phyu Dine Drain;
- LSW-5 Ye Dwet Yoe Drain;
- LSW-6 Zi Daw Pond;
- LSW-7 Sede Pond;
- LSW-8 Toe Drain; and
- LSW-9 Tada Gyauk (Shwehlay Village).

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The baseline surface water quality results are summarised as follows:

- All samples are pH basic with pH values ranging between 8.2 and 9;
- Dissolved oxygen concentrations range between 12.4 and 99.8 mg/L;
- Seven of the nine samples contain copper above the detection level (0.01 mg/L) but below the adopted guideline value (0.3 mg/L). Four of these have values of 0.01 mg/L and it is possible that the 'less than sign' (<) has been omitted in which case only three of the nine samples contain copper above the (0.01 mg/L) detection level;

[15] Non Ferrous Metal-Kunming Survey and Design (Institute) Co (NFMKSDIC), 2011 Hydrogeology, Engineering Geology and Mineral Supplements Survey Report of Monywa Letpadaung Copper Mine, Sagaing Division, Burma; Prepared for Myanmar Wanbao Mining Copper Limited; April 2011

- Two of the nine samples contain iron above the detection level (0.01 mg/L) but well below the adopted guideline value (1.0 mg/L); and
- The lead concentration is quoted as being “nil’ for each sample. The detection level is not provided.

The surface water samples were only analysed for three metals: copper, iron and lead. The analysis suite has been expanded to a suite which includes the IFC Environmental Guidelines (IFC, 2007) as a minimum. First results of this expanded sampling will be available prior to commencement of works in the Project area.

Baseline surface water samples will also be required in the Chindwin River to allow a comparison of river water quality prior to mining. On-going surface water sampling will be required upstream and downstream of any proposed mine water discharge point.

4.3 GROUNDWATER

The aim of this section is to describe the baseline or pre-mining groundwater conditions relating to the Project.

4.3.1 Previous Studies

Previous groundwater related studies are listed as follows:

- WESTEC (October 1994). Hydrological and Geotechnical Scoping Study, Monywa Copper Project. Westec Project No. 94166. Report No. 1063;
- HTL (1996) (in Coffey, 1997). Letpadaung Water Supply and Management Hydrology, Geohydrology and Water Quality Pre-Feasibility. Mincorp Engineers and Constructors for Ivanhoe Myanmar Holdings Ltd;
- Coffey Partners International Pty Ltd (October 1996). Letpadaung Water Management and Environmental Monitoring Study – Phase 1. Report No. G7024/1-Y;
- Coffey Partners International Pty Ltd (February 1997d). Letpadaung Copper Project Feasibility Study - Water Management and Environmental Monitoring. Report No. G7024/4-A;
- Knight Piésold (April 2000). Development Plan Leach Pads, Waste Dumps, and Water Management. KP Ref 846/1;
- Soe Soe Aung (March 2005) Water Management Strategy for Letpadaung; and
- MWMCL (April 2011) Hydrogeology, Engineering Geology and Mineral Supplements Survey Report of Monywa Letpadaung Copper Mine, Sagaing Division, Burma.

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In addition baseline water chemistry data and groundwater level data from monitor bores installed around the periphery of the heap leach pads have been reviewed. The results of this monitoring are provided at Appendix B – Groundwater Monitoring Data.

4.3.1.1 Regional Groundwater

The Project is- flanked by a mountainous region to the west and an alluvial plain and the Chindwin River to the east. There are large volumes of groundwater held within the Quaternary alluvial deposits of the Chindwin River and in the underlying fractured rock aquifer. The Quaternary aquifer includes eluvial (slope) deposits at the piedmont and slope edge and the alluvial aquifer of the alluvial plain. The fractured rock aquifer is likely to be more highly developed in the upper weathered zone, and is expected to become less permeable and store less water at depth. Aquifer properties may also be enhanced along fault zones within the bedrock aquifer.

4.3.1.2 Mine Site Groundwater

The main aquifers within the mining area include the Quaternary alluvium aquifer overlying an andesite – dacite fractured rock aquifer summarised as follows:

- The Quaternary aquifer can be subdivided into two aquifers: Quaternary eluvial deposits (IA) forming a poor aquifer, and Quaternary alluvial deposits (IB) that form the primary aquifer of the area.
    - The Quaternary eluvial slope deposits (IA) forms a primary porosity aquifer of limited thickness and extent. The lithology of this aquifer mainly comprises silty clay to gravel breccia and gravelly soil, with a thickness of 0.8 m to 22.6 m (average of 6.6 m). This aquifer is mainly distributed around the isolated peaks in the river valley and stretches to between 100m and 800 m (300 m on average) from the piedmont of Letpadaung. This aquifer is highly permeable, ring infiltration tests indicating permeability coefficients of 0.1 m/d to 7.5 m/d with an average of 3.4 m/d (i.e. high permeability).
    - The Quaternary alluvial (IB) deposits form a primary aquifer that is in hydraulic contact with the Chindwin River. This aquifer comprises river alluvium of medium – fine sand, sand gravel and clay. The upper part is clay, with a thickness of 4 to 6 m; the lower part is a medium to fine sand, sand gravel and cobble gravel, with a thickness of 12.1 to 50.1 m (25.7 m on average). It has high permeability and aquifer storage properties. The permeability ranges between 18.4 m/d and 43.6 m/d, with an average of 23.6 m/d (i.e. very high permeability). On the alluvial plain the depth to groundwater in the dry season ranges between 0.65 m to 19.12 m, with an

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average of 4.86 m. Based on the current pit design the main eastern ramp will intersect the high permeability (IB) alluvium that will result in significant groundwater inflows.

- The andesite – dacite rock bedrock forms a fractured rock (or secondary porosity aquifer) with the lithology mainly comprising dacite-andesite, andesite porphyry, ignimbrite and rhyolite. The thickness is estimated to be about 600 to 650 m. This aquifer is widely distributed in the Letpadaung mining area, and will form the main wall of the proposed Letpadaung pit. Based on the weathering degree, permeability and water yield properties, this aquifer is divided into an intensely weathered fissure weak aquifer (IIA), and a moderately weathered fissure weak aquifer (IIB).
    - The intensely weathered fissure weak aquifer (IIA) is mostly covered by Quaternary slope eluvium. The thickness ranges between 25.43 m and 138.05 m, with an average thickness of 66.78 m. The recorded permeability coefficient ranges between 2.9×10^{-4} m/d and 6.7×10^{-2} m/d, with an average of 1.60×10^{-2} m/d (i.e. low permeability).
    - The recorded thickness of the moderately weathered fissure weak aquifer (IIB) ranges between 17.7 m to 620.4 m, with an average of 251.51 m. The recorded permeability value is between 2.8×10^{-4} m/d and 2.4×10^{-3} m/d, with an average of 1.80×10^{-3} m/d (i.e. low permeability).

4.3.2 Groundwater Levels

Groundwater level data are given in MWMCL (2011)[16]. The monitor bore depths and status are summarised in Appendix B. These data together with baseline monitoring data from monitor bores installed around the heap leach pads have been combined to generate groundwater level contours shown on Figure 4.3.1. The groundwater contours shown in Figure 4.3.1 indicate a groundwater flow direction from the mountainous region in the west to the alluvial plain and the Chindwin River to the east. The groundwater contours indicate that groundwater is providing base flow to the Chindwin River.

4.3.3 Hydraulic Connection of the Aquifers

At Letpadaung, the Quaternary eluvium (slope deposits) form a thin aquifer overlying the bedrock, receiving rainfall recharge. The groundwater of this aquifer has a direct hydraulic connection with the groundwater of the underlying intensely weathered

[16] MWMCL, 2011; Hydrogeology, Engineering Geology and Mineral Supplements Survey Report of Monywa Letpadaung Copper Mine, Sagaing Division, Burma; April, 2011

andesite – dacite rock mass fissure weak (IIA) aquifer. On the alluvial plain, a significantly thicker sequence of the Quaternary alluvium aquifer overlies the intensely weathered andesite – dacite rock mass fissure weak (IIA) aquifer that in turn has direct hydraulic connection with the underlying moderately weathered fissure weak (IIB) aquifer.

4.3.4 Groundwater Recharge and Discharge

The two main sources of groundwater recharge in the mining area are direct rainfall, recharge and seasonal river leakage both from the main river channel and from over bank flood events. The groundwater flow direction reflects the general topography and moves from the higher altitude areas west to east, to the lower lying alluvial plain. Groundwater discharge from the area is likely to be via evaporation, and via base flow to the Chindwin River. Pit dewatering will be an additional groundwater discharge mechanism once the Letpadaung pit is excavated below the piezometric surface. As the pit deepens, a cone of depression will develop in the piezometric surface that may impact other groundwater users.

4.3.5 Hydrogeological Characteristics of Faults

Faults that intersect the Letpadaung deposit include the Chindwin Fault, the Monastery Fault and cross connecting faults f1 to f4. These faults are mainly compressional fractures, and are consequently expected to have low hydraulic permeability and storage properties, due to their compressional nature and narrowness.

4.3.6 Pit Dewatering

4.3.6.1 Groundwater Inflows

Groundwater inflow and incident rainfall predictions based on preliminary modelling undertaken by Coffey (1997) and MWMCL (2011) are summarised below.

Coffey (1997) predict groundwater inflows with two different permeability values:

- With an average permeability of 0.01 m/d inflows are predicted to increase from 12 L/s after 5 years to 39 L/s after 25 years; and
- With an average permeability of 0.1 m/d this would increase to 115 L/s to 385 L/s.

MWMCL (2011) predicted groundwater inflows at two pit stages:

- First Pit (-150 m) groundwater inflows of 26 L/s; and
- Final Pit (-350 m) groundwater inflows of 116 L/s with 37.4 L/s coming from the andesite-dacite and 78.8 L/s (two thirds) of the inflow coming from a 430 m stretch of Quaternary sediments at the eastern edge of the pit.

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4.3.6.2 Storm Inflows

Coffey (1997) predicted a 10 year annual return interval (ARI) 24-hr storm inflow of 3,850 L/s for the 25 year pit.

NFMKSDI (2011) predicted:

- An average year incident rainfall of 357 L/s; and
- A 20 year ARI storm of 3,428 L/s for the -375 m pit.

This ESIA places greater reliance on the later NFMKSDI (2011) study as it is based on the greatest depth of information resulting from a drilling and testing field campaign. Groundwater inflows are therefore predicted to be between 26 and 116 L/s. A significant proportion of this will be later in the mine development when the main eastern pit ramp intersects the alluvial plain. If the pit was re-shaped to avoid cutting the alluvium this would reduce to 37.4 L/s. Inflow from the alluvium should be intercepted as it enters the pit prior to the water being affected by ARD deeper within the pit.

The above inflow estimates are preliminary based on limited field data and analytical equations based on simplifying assumptions. A numerical groundwater model could be used to improve the inflow predictions and would also model the drawdown cone as it develops with time. Modelling to assess the post-mining pit lake/water recovery levels has also not been undertaken.

4.3.7 Potential Impact of Surface Water on Pit Dewatering

The main surface water features of Letpadaung Project are the Chindwin River and an associated floodway. The Chindwin River is 2.8 km north east of the Project. The river has a catchment area of 106,000 km^2; a channel width of about 800 m and a depth of about 1.5 m to 10.25 m (5 m on average). For the period 1964 to 1987 the river had a mean annual flow of 3,860 m^3/s and a peak recorded flow of 19,503 m^3/sec. The average base flow in the dry months was 800 m^3/sec and the lowest recorded monthly average flow was 571 m^3/sec (Coffey 1997).

A significant floodway of the Chindwin River passes close the eastern side of the Letpadaung Project (Figure 4.2.1). Previous flood level estimates and measurements are summarised as follows.

- Coffey (1997) estimated a 1:100 year flood level of RL74.62 m that would encroach to within about 200m of the planned Letpadaung open pit. A maximum recorded level of RL74.04 m recorded at the Nyauangbigyi Police Station was noted to be close to the predicted value.

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- Two flood events occurred in 1995 that resulted in water lapping at the base of the Letpadaung hill which is at about RL76 m (Coffey 1997d).
- Knight Piésold (2000) assumed a Chindwin River flood level of RL78 m based on Coffey's (1997d) reported levels.
- NFMKSDI (2011) noted a maximum flood level of RL74.81 m for the period 1999 to 2010 and a 1:100 year maximum water level of RL75.65 m was estimated.
- The maximum recorded flood level is therefore RL74.81 m and the maximum predicted level was 78 mRL.

In summary, the elevation of the 100-year return flood of the Chindwin River is RL75.65 m, and that of the 20 year return flood is RL75.1 m. The elevation of the topography around the eastern boundary of the final open pit is about RL72 m, and the open pit could therefore be affected by flooding of the Chindwin River. Accordingly, it will be necessary to construct flood prevention measures in this area. Groundwater inflows through the alluvium on the eastern side of the pit, and to a lesser extent through the fractured rock aquifer, will also increase when the Chindwin River is in flood.

4.3.8 Baseline Groundwater Quality

MWMCL (2011) summarised the pre-mining surface water and groundwater quality as follows:

- Surface Water: (Chindwin River): Water chemistry type: HCO3-Na-Mg; salinity: about 500 mg/L; total hardness: about 160 mg/L; total alkalinity: 300 mg/L; pH: about 8.
- Quaternary Aquifer: Water chemistry type: $HCO_3 \cdot SO_4 \cdot Cl$—Ca·Mg·Na; salinity: 390 to 2,350 mg/L; total hardness: 150 to 940 mg/L; total alkalinity: 590 to 780 mg/L; pH: 7.2 to 7.4.
- Andesite-Dacite Rock Fissure Weak Aquifer: Water chemistry type HCO3·SO4·Cl- Ca·Na·Mg; salinity: 960 to 1,878 mg/L; total hardness: 340 to 421 mg/L; total alkalinity: 20 to 144 mg/L; pH: 3.30 to 8.30. Trace metals (As, Cr, Cu, Fe and Mn) occur at higher than guideline values.

Groundwater in the alluvium is shown by Coffey (1997d) to contain brackish to saline (2,600 to 2,700 mg/L TDS), pH neutral, NaCl dominated water near to the mine site and is said to contain fresher water close to the Chindwin River and in association with the floodway. A sharp increase in salinity after pumping at bore LWB01 located at the foot of Letpadaung hill is consistent with a fresh water layer or lens over saline water with the freshwater lens being depleted by pumping. Saline water is also noted as having been pumped from mineral drilling supply bores within the Letpadaung deposit.

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During mine dewatering the water quality may also be affected by acid rock drainage (ARD) resulting in low pH and high dissolved metals (Fe and Cu) concentrations in what is likely to be a brackish to saline water. Water quality from the existing Sabetaung is shown by Coffey (1997) to be low pH water of moderately high salinity and high copper concentrations.

The Letpadaung open pit mine water may therefore be of three different types:

- Alluvium Aquifer: Saline (7,000 to 8,000 mg/L TDS), pH neutral, Na-Cl dominated water.
- Volcanics Aquifer: Saline to hyper saline (4,500 to 20,000 mg/L TDS), pH neutral, Na-Cl dominated water from fractured rock aquifers prior to oxidation.
- In-Pit Acid Rock Drainage (ARD): Saline (4,000 mg/L) water in the pit resulting in low pH (pH ~3.2) and high dissolved metals (Fe and Cu) concentrations.

4.3.9 Baseline Groundwater Quality Beneath the Heap Leach Pads

Groundwater levels recorded on 19th December 2011 (beginning of the dry season) beneath Heap Leach Pads 1 and 2 vary between 0.8 and 16.5 metres below ground level (mbgl) with an average depth of 7.2 mbgl. The contoured groundwater levels (Figure 4.3.1) indicate a general movement down from the Letpadaung hill towards the Chindwin River to the east.

Baseline surface water/groundwater chemistry for December 2011 (end of wet season) and February 2013 (end of dry season) collected from surface water sampling points and from monitor bores around the proposed Heap Leach Pads 1 and 2 are included in Appendix B. The baseline surface water quality results are summarised as follows:

- The groundwater samples are neutral to slightly basic ranging between pH 6.9 and 8.7 with an average value of 7.8;
- Total dissolved solids (TDS) concentrations range between fresh to saline, 1,016 mg/L to 19,386 mg/L TDS with an average value of 4,368 mg/L TDS; and
- TDS, hardness, sulphate, lead and manganese values occur above the guideline values.

4.3.10 Recommended Baseline Groundwater Sampling Programme

Additional water sampling is required to establish baseline groundwater quality at additional locations (generally along the down hydraulic gradient the eastern margin of the project) and to determine seasonal variations in baseline water chemistry prior to the commencement of operations at Letpadaung. A database should be established with samples collected via documented procedures with the results assessed and reported on a quarterly basis. A groundwater monitoring network should be

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established that could include existing test/monitor bores, existing village wells and possibly nested piezometers or installed in the alluvium and in the weathered bedrock and bedrock strata close to the pit.

The monitor bores should be sampled on a quarterly basis for one year following which the data should be reviewed and formally reported on. The IFC (2007) Environmental, Health and Safety Guidelines for Mining recommended an analysis suite as follows: Total Suspended Solids (TDS); pH; COD mg/L; BOD mg/L; Oil and Grease mg/L; Arsenic mg/L; Cadmium mg/L; Chromium (VI) mg/L; Copper mg/L; Cyanide; Cyanide Free; Cyanide WAD; Iron (total); Lead; Mercury; Nickel; Phenols; Zinc; Temperature.

4.4 GEOLOGY[17]

The Letpadaung Copper Project is located in the Monywa Copper District in Central Myanmar. The Monywa Copper District is located along the north-south trending Inner Volcanic Arc, which within the Central Burma Tectonic Belt and lies between the Eastern Highlands Belt to the east and the Western Ranges Belt to the west.

In general, Letpadaung is overlain by a Holocene alluvial deposit which comprises sand, high plasticity clay, and gravel that is underlain by rocks of Pleistocene Kangon Formation. The Kangon formation is composed of muds and poorly consolidated sands and gravels, which extend about 40 m in depth. The Kangon formation is underlain by the Pliocene to Miocene Magyigon formation which consists of thinly bedded sandstone, siltstone, mudstone, and various pyroclastic units.

The pyroclastic units include:

- Post-mineral andesite porphyry composed of 75 percent plagioclase phenocrysts, 5 – 10 percent euhedral biotite, and minor alkali feldspar with quartz and rarely magnetite.
- Phreatomagmatic breccia zones (diatreme) that consists of angular to rounded fragments of andesite porphyry in a rock flour or fine grained andesite porphyry matrix.
- Andesite porphyry composed of 10 – 30 percent plagioclase feldspar, minor quartz, and rarely alkali feldspar in a pale green to grey aphanitic groundmass.

[17] Mitchell. A.H.G.. Win Myint, Kyi Lynn, Yint Thein Htay, Maw oo, and Thein Zaw (2008) The Monywas Copper Deposits, Myanmar: Chalccite-covellite Veins and Breccia Dykes in Late Miocene Epithermal System. Proceedings of the International Symposia on Geoscience Resources and Environments of Asian Terranes (GREST 2008), 4th IGCP 516, and 5th APSEG: Nov 24-26 2008, Bangkok, Thailand

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The Magyigon formation extends about 800 m deep and is underlain by Oligocene Damapala formation, which consists of sandstones that are well-sorted, sub-rounded to rounded and are commonly cemented by clay and carbonates. The Damapala formation extends approximately 300 m deep.

The Letpadaung copper deposit is one of four major copper deposits within the Monywa Copper District which also includes the Kyisintaung, Sabetaung, and Sabetaung South copper deposits. Letpadaung crops out as a cluster of fault bounded hills rising above a generally flat plane. Elevations range from 75 m to 120 m at the base of the hills to 330 m at their summits. Please refer to Figure 1.2.1 for the relative location of the Sabetayng and Kyisintayng (S&K) Mine.

Letpadaung is classified as an Acid-Sulphate or High Sulfidation mineral deposit. These deposits which are formed where reactive, strongly acidic magmatic fluids and gases forcefully migrate vertically and laterally via structures and permeable rocks. The reactive fluids and gases undergo extensive mixing and reaction within wall rocks. Characteristics of the Letpadaung deposits are:

- A zoned alteration sequence that consists of a central residual silica core, surrounded by zones of silica and alunite, then advanced argillic alteration, and finally propylitic/chloritic alteration;
- Wall rock alteration consisting of silica + alunite ± pyrophyllite ± kaolinite ± pyrite; and
- An association with calc-alkalilne volcanism.

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The residual silica zone is characterised by the complete leaching and removal of all mineral constituents except quartz. The surrounding silica and alunite is characterised by the pervasive silica replacement of the andesite host rock groundmass and the complete alunitisation of the plagioclase feldspar. The transition between the silica-alunite zone and the zone of advanced argillic alteration is quite sharp. The advanced argillic zone is characterised by hornblende, biotite, and feldspar phenocrysts extensively replaced by kaolinite, alunite, sericite, pyrophyllite, diaspora, and minor pyrite. The zone of chloritic alteration is characterised by weak to strong chloritisation of biotite and hornblende, moderate seritisation of the plagioclase feldspars, and ubiquitous secondary cubic pyrite.

Episodic hydrothermal brecciation is a geologic feature related to mineralization at Letpadaung. Hydrothermal breccia occurs within northwest and northeast trending lozenge shaped breccia dikes that pinch and swell in all directions. The breccia dikes can occur in isolated lenses or in en echelon swarms.

Copper mineralisation is dominated by hypogene chalcocite/digenite, covellite, and supergene chalcocite. The mineralisation is by a 10 to 200 m thick strongly weathered, oxidized leached cap. The leached cap contains no economic copper mineralisation with the exception of a few resistant pods. Below the cap is a zone of intense acid leaching, alunitisation, silicification, and episodic hydrothermal brecciation. Pyrite is ubiquitous and occurs as coarsely crystalline masses in veins, in breccia matrix, vugs and disseminated in groundmass of the host rock.

Andesite porphyry is the most common rock type in the Letpadaung hills and is the most common host rock for copper mineralization in the Monywa Copper District. The andesite has phenocrysts composed of 10 – 30 percent plagioclase feldspar and minor quartz and rare alkali feldspar in aphanitic groundmass.

Pyroclastic rocks are the second most abundant rock type in the Letpadaung hills. Pyroclastic rocks include sub aerial tuff and ejecta, diatreme-related breccias and explosion debris. Volcanclastic siltstones and sandstones overlie small areas within the volcanic section.

In general, Letpadaung is overlain by a Holocene alluvial deposit which comprises sand, high plasticity clay, and gravel that is underlain by rocks of Pleistocene Kangon Formation.

The Kangon formation is composed of muds and poorly consolidated sands and gravels, which extend about 40 m in depth. The Kangon formation is underlain by the Pliocene to Miocene Magyigon formation which consists of thinly bedded sandstone, siltstone, mudstone, and various pyroclastic units.

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4.5 RESOURCE OVERVIEW

The deposit contains a currently identified resource of almost 4.5 million tonnes (Mt) of contained copper in the measured and Indicated categories and another 1.4 Mt of contained copper in the Inferred category. Further deposits are expected to be identified along the mineralisation trend, and the known deposits have also not been closed off at depth (i.e. a lower depth to the deposit has not yet been identified). The resource identified within the Letpadaung Licence Area is described in Table 4.7 below.

The Letpadaung deposit is a concealed deposit beneath two mountains and their valley. The deposit is gold-ingot-shaped with a flat top, trending north-west and approximately 2,200 m long and 1,400 m wide and the occurrence is basically horizontal. The ore body has an average thickness of about 140 m, and an average copper grade of 0.37 %.

Table 4.7: Summary of resources calculated in the design

Resource Category	Ore Quantity (kt)	Copper Grade (%)	Metal Quantity (t)
Measured	611,068	0.43	2,621,301
Indicated	528,952	0.35	1,866,164
Inferred	448,142	0.31	1,394,405
Total	1,588,162,000	0.37	5,881,870

4.6 GEOCHEMISTRY

Knight Piésold has conducted an initial geochemical assessment, with samples of waste rock selected and sent to an accredited laboratory for analysis.

One hundred and fifty samples of waste rock were selected for this study, collected from boreholes distributed across the pit and from a depth range commensurate to that of the proposed pit. The samples were sent to an accredited laboratory in Perth for geochemical testing. Testing of the samples was conducted in accordance with internationally accepted methods for assessment acid rock drainage potential and metal leaching potential. The test work included analysis of the mineralogical content, sulfur contents and sulfur forms, acid neutralising capacity and net acid generation to determine the potential for acid rock drainage from the waste rock, and multi-element analysis and distilled water extract to assess the risk of metal leaching from the waste.

The waste rock, although not all sulphur, was present as reactive sulfide minerals capable of generating acid. However, the portion of the sulfur that was present as reactive sulfide minerals was still very high, averaging over 2%, which equates to an average maximum potential acidity of approximately 60 kg of sulfuric acid which can be produced per tonne of waste.

The acid neutralising capacity of the waste was generally very low with the exception of discreet zones within the deposit which were shown to have some carbonate mineralisation, providing additional acid neutralising capacity.

Overall approximately 71% of the samples were found to be potentially acid forming with only 29% of the samples found to be non-acid forming. There was no relationship between the lithology of the samples and the acid formation potential. However, there was a clear trend of decreasing amounts of non-acid generating material with depth, and below 250 m depth essentially all samples were potentially acid forming.

The multi-element analysis indicated the majority of the waste rock to be highly enriched, and the distilled water extract testing indicated that some of these metals are

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readily soluble, especially under acidic conditions, although not dependent on the potential acid forming capacity of the waste rock to liberated the metal content.

The combination of potential acid forming capacity and the solubility of metals within the waste rock suggests these properties represent a significant environmental risk once the waste rock is exposed to the environment unless managed carefully.

4.7 SEISMICITY

4.7.1 Regional Tectonics

The convergence of the Indo-Australian and Eurasian plates has caused the orogenic uplift which has formed the Himalaya Mountains. The northward under-thrusting of the Indo-Australian plate beneath Eurasian plate generates numerous earthquakes and consequently makes this area one of the most seismically hazardous regions on Earth. The surface expression of this plate boundary is marked by the foothills of the north-south trending Sulaiman Range in the west, the Indo-Burmese Arc in the east and the east-west trending Himalaya Front in the north of India.

As the Indo-Australian plate moves north, it also rotates in a counter-clockwise direction along the eastern edge. As a result of this movement and rotation, the convergence along the plate's eastern boundary (the Burma-Andaman-Malay region) with Eurasia was at an oblique angle. The transform forces along this subduction zone started the clockwise bending of the Sunda arc in the late Oligocene (ca. 32 Ma). These forces caused further faulting and the Burma and Sunda microplates began to "break off" from the larger Eurasian plate.

After a further series of transform faulting, and the continuing subduction of the India Plate beneath the Burma plate, back-arc spreading caused the formation of the marginal basin and seafloor spreading centre that has formed the Andaman Sea, a process well-underway by the mid-Pliocene (3-4 Ma).

4.7.2 Tectonic Background of Myanmar

Myanmar is located on or near the convergent plate boundary between the north-eastern corner of the Indo-Australian plate and the Eurasian plate. Plate tectonics is a highly theoretic field, and the locations of plate boundaries in Myanmar are only approximately located and the locations vary between expert seismic geologists. Rather than present conflicting theories of plate tectonics in Myanmar, the following are based on information presented by Win Swe, former President of Myanmar Geosciences Society (MGS).

Myanmar is composed of two microplates or blocks, the western block is the Burma plate and to the east is the Shan-Thai block. The Burma plate includes the Western

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Ranges and extends into the Bay of Bengal, where the India portion of the Indo-Australian plate subducts beneath the Burma plate. These two blocks separated in the Miocene, 23.03 to 5.332 Ma (million years ago). The composition of two blocks is believed to be of Gowndana origin (Gowndana was a large land mass in the southern hemisphere between 510 – 430 Ma). These blocks are separated by the Sagaing fault, which is a transform fault with right lateral movement in Myanmar and is comparable to the San Andrea fault. The Sagaing fault trends in the north-south direction, and extends to the Andaman Sea, where a south-westward trending oceanic rift (sea-floor spreading) formed the sea and is an extension of the south-east trending Sumatra Fault System.

There are four major physio-tectonic regions in Myanmar, the Eastern Highlands Province is located east of the Sagaing fault on the Shan-Thai block, the Central Myanmar Belt located west of the Sagaing fault is a relatively flat area that has had some instances of quaternary volcanism, the Western Ranges a accretionary wedge lying above the subducting oceanic crust, and the Rakhine Coastal Belt, which may be considered as part of the Western Range, but comprises rocks of the Oligocene epoch (Tertiary period between Eocene and Miocene) and younger mollasse strata. Mollasse are sedimentary deposits that contain materials of marine and continental origins.

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4.7.3 Seismicity in Myanmar

The Sagaing Fault is a major strike-slip fault which is located in the central part of Myanmar and potentially within 100 km of the Letpadaung Project. Other major faults in Myanmar comprise the Kabaw and Dauki faults, and shallow earthquakes within this region are predominantly associated with these faults. Deep earthquakes (200km) have also been known to occur in this region, these are thought to be due to the subduction of the eastwards dipping, Indo-Australian plate, though whether subduction is currently active is debated.

Historical records of earthquakes in Myanmar date back to 1429 in Innwa when an earthquake tumbled enclosure walls intended as fire-stops. Of the historical records 15 earthquakes have been recorded in Innwa since 1429 and 11 other records recorded in Bago (Ref. 3). Between 1927 and 1956, six magnitude(M)7.0+ earthquakes occurred near the right-lateral Sagaing Fault, resulting in severe damage in Myanmar including the generation of landslides, liquefaction and the loss of 610 lives. The records also show that at least fifteen M7.0 earthquakes have occurred in Myanmar in the past 100 years.

A search of the USGS database earthquake lists 406 earthquakes that have been recorded between 1973 and 2013, within 200 km of the Letpadaung site including one

M7.0 and M6.8, and 44 events at magnitudes between M5.0 and M5.9. The most recent earthquake was a M4.7 event that occurred on the 20th July 2013, about 70 km south-west from Letpadaung. The closest earthquakes in proximity of the site were a M4.0 event that occurred approximately 3.6 km from the site and a M4.1 that was approximately 9.1 km of the site.

4.7.4 Seismicity of Letpadaung

A preliminary seismic hazard assessment has been performed for the Letpadaung Copper Project. Existing seismic and tectonic information and historical data, including earthquake catalogues and technical publications have been collected and reviewed. Preliminary seismic ground motion parameters for the project area have also been determined.

The computer program EZ-FRISK (Risk Engineering, Inc., 2011) was used to develop a seismic hazard model for Letpadaung. The seismic hazard analysis module available with EZ-FRISK includes a database provided by Risk Engineering Inc. of faults and areal seismic sources pertinent to the study area.

Seismic sources defined in the hazard model include Sagaing Fault, which is the closest fault located approximately 96 km east of Letpadaung. The Sagaing Fault is an active strike-slip fault that separates the Burma plate extending west of the Sagaing Fault to the Bay of Bengal and the Shan-Thai block that contains the Eastern Highlands Belt extending east. Other faults and areal seismic sources defined in the EZ-FRISK seismic source zone and within 500 km of Letpadaung are listed in Table 4.8.

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Table 4.8: EZ-FRISK seismic sources zones

Source	Deterministic distance (km)	Fault Magnitude	Mechanism	Site Lies to
Sagaing SE	95.88	7.6	Strike-Slip	West
Kabaw SE	105.57	7.75	Strike-Slip	East
Arakan Trench Arakan Trench	325.66 331.2	7.25 7.5	Reverse Strike-Slip	North North-East
Myanmar Margin	372.98	6.75	Strike-Slip	North-West
Mae Saraing	393.28	6.8	Strike-Slip	North-West
Mae Chan	495.73	7.3	Strike-Slip	North-West

For shallow crustal earthquakes a set of five ground motion attenuation models, known as the Next Generation Attenuation (NGA) relations were used (Earthquake Spectra, 2008). These include the ground motion relationships of Abrahamson and Silva, Boore

and Atkinson, Campbell and Bozorgnia, Chiou and Youngs. These ground motion attenuation relationships are applicable to shallow crustal earthquakes in western North American and similar tectonic regions of the world. The reported peak ground accelerations for shallow crustal earthquakes are average values calculated using the four attenuation relationships (equal weighting). Appropriate NGA attenuation relationships for normal faulting have been used in the probabilistic and deterministic analyses.

Table 4.9 lists the annual return periods for several events, probability of exceedance depending on anticipated mine life, and peak ground accelerations for the Letpadaung Copper Project based on the NGA relations.

Table 4.9: Summary of probabilistic hazard analysis

Return Period (Years)	Probability of Exceedance (%)				Median Peak Ground Acceleration (PGA)
	Design Life = 10 years	Design Life = 15 years	Design Life = 20 years	Design Life = 25 years	
50	18	26	33	39	0.027
100	10	14	18	22	0.043
200	4.9	7	10	12	0.059
500	1.98	3.0	4	5	0.083
1000	1.0	1.5	2	2	0.101
2500	0.40	0.60	1	1	0.124
5000	0.20	0.30	0	0	0.145
10000	0.10	0.15	0.2	0	0.170
20000	0.05	0.07	0.1	0.1	0.199

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4.8 SOILS

Surficial deposits in the low-lying areas of Letpadaung consisting of alluvial sands and gravels, and are underlain by residual soils. The residual soils comprise residual silica that results from the weathering and leaching of the andesite porphyry of all minerals, silica-alunite that is characterised by the silica replacement of the andesite host rock and the complete alunitisation of plagioclase feldspar, advanced argillic soils that results from alteration of the hornblende, biotite, and feldspar phenocrysts to clay minerals such as kaolinite.

Test pits excavated on the Letpadaung site identified highly plastic clays, silts, sands, gravels, cobbles and boulders of varying proportions extending to the depths explored. Most of the surficial deposits in low-lying areas have been disturbed and reworked by the historic agricultural use of the lands for generations.

The description of soils in the area included here is taken from Muir (1997). The soils are described in two (2) parts – Letpadaung Hills and the plains surrounding the Letpadaung Hills. These descriptions were confirmed by review of two geotechnical reports undertaken at the site by Knight Piésold (2000) and SWNFKDIC (2011, 2012)[18]-[19]

A soil distribution map is shown at Figure 4.8.1.

4.8.1 Letpadaung Hills

All soils examined in the area comprised deeply weathered profiles, with only minor bedrock being encountered, mainly along the hill crests. Soil sections observed indicated a general soil profile comprising:

- A few centimetres of humus at the surface;
- A deep gradational profile of pink to red-loamy clays with increasing boulder content with depth;
- An underlay of moderately dense weathered rock; and
- Water seepage at the soil rock interface.

Soil surfaces tend to be rough and rocky due to the abundance of large particles (greater than 75 mm in size) in the surface soils. This results in limited evidence of soil erosion and suggests run-off in the area tends to be a sheet flow rather than concentrated in gullies.

Soils on the hills exhibited:

- Uniform structure laterally;
- Good moisture retention characteristics;
- Slow drying when exposed to heat from the sun;
- Low to moderate permeability; and
- High dispersion.

It is expected that the combination of slope and permeability would encourage run-off rather than percolation into the soil. It is also expected that the dispersive nature of the soil would lead to a turbid run-off containing fine soil particles.

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[18] SWNFDIC, 2011: Detailed Geotechnical and Hydrogeology Investigation Report for Leach Pads, Storm and Sedimentation Ponds at Letpadaung Copper Mine (100kt/year Cathodic Copper): Southwest Non-ferrous Kunming Design Institute Co. Ltd, August 2011.

[19] SWNFKDIC, 2012: Detailed Geotechnical and Hydrogeology Investigation Report for Waste Rock Dumps and Waste Water Reservoir Dams at Letpadaung Copper Mine (100kt/year Cathodic Copper)" by Southwest Non-ferrous Kunming Design Institute Co. Ltd: February 2012.

Muir (1997) estimated that 10 cm of soil had been lost from the surface of the hills through historic disturbances of fire and firewood collection.

4.8.2 Plains Around The Letpadaung Hills

The soils around the Letpadaung Hills grade from sandy materials close to the hills to fine grained soils near creeks and the Yamar Stream and Chindwin Rivers. Sections of the plains are subject to periodic inundation which influences the consistency of gradation and soil productivity. These soils are frequently loamy and silty in nature. The heavy clays are most often found within 1 km of the Yamar Stream and Chindwin River and represent the best soils for paddy fields.

The undisturbed soils on the plains are near-neutral to slightly alkaline, non-saline and very low in organic matter (based on Muir (1997) results). They are also nutrient and zinc deficient but contain normal levels of copper and manganese.

4.9 FLORA AND FAUNA

4.9.1 Flora

Environment Myanmar Cooperative Company Limited (EMC) was appointed by Myanmar Wanbao Mining Copper Limited (MWMCL) to undertake a baseline survey of the flora and vegetation associations in the project area of the Letpadaung Copper Project The work was undertaken in the period from February 2013 to August 2013 to enable the evaluation of the floristics in the three seasons experienced in the Project area (See Appendix C – Baseline Studies – Flora).

On each occasion the surveys consisted of a series of point quadrats, line transects and wandering transects. Casual observations along roadsides and from tracks were also made in travelling around the study area to ensure all vegetation patterns in the study area were identified. The location of the point quadrats and line transects are shown in Figure 4.9.1.

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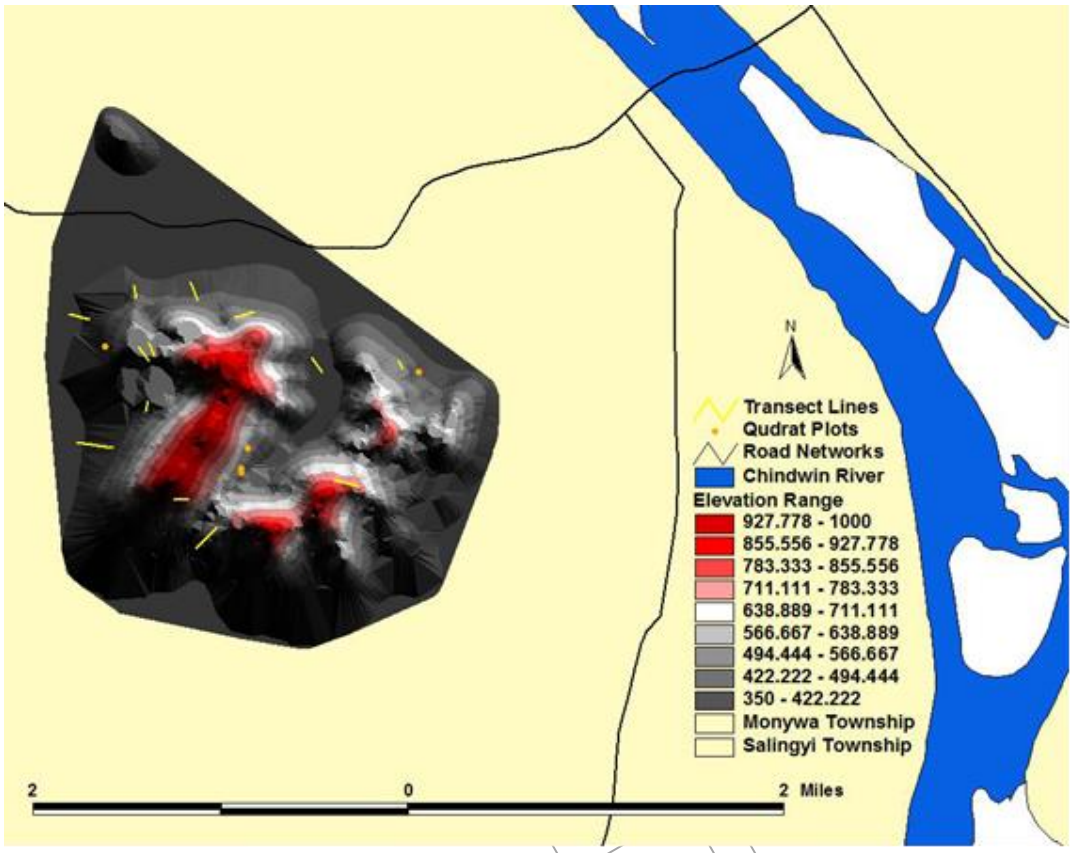


Figure 4.9.1: Location of line transects and point quadrats around Letpadaung Hill.

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4.9.1.1 Flora Cool-Dry Season

A total of 90 species representing 71 genera and 38 families were listed in the Letpadaung taung area in the cool-dry season. The tree layer in the study area is dominated by *Azadirachta indica* with the highest IVI of 114.81%, the second most dominant species is an *Acacia sp*. (IVI = 35.43%) and *Dalbergia paniculata* (IVI= 32.45%) is third. The number of species greater than 10% IVI value was seven species. Those species could be considered as an ecological indicator species of the Letpadaung taung area.

Scrub and tree species distribution by frequency classes in study area showed that a high percentage of the total number of species was in lower frequency classes, A and B, while only a low percentage was observed only in higher frequency class C and D. This indicates that the forest of study area is floristically heterogeneous. The value of diversity indices and evenness indices for scrubs and tree species was very low in study area.

Stem density of ≥10cm was 1,630 stems m^2/ha and basal area was 3.74 m^2/ha in the study area. Among the 10 sample plots studies, 16 tree species were recorded and

nine (9) species were found. These cannot be considered to be unique species. The three (3) most abundance species in terms of basal area occupied 82.01% of the total, of which *Azadirachta indica* was the most dominant species in the study area with 45.03%, followed by an *Acacia sp.* with 25.50%, and *Dahlbergia paniculata* with 11.48% of the total basal area.. The plant species that are listed and recorded in the recent study were checked with the IUCN Red List of threatened species, but none were found in the IUCN Red List.

4.9.1.2 Flora Hot-Dry Season

A total of 71 species representing 60 genera and 33 families were listed in the Letpadaung taung area in the hot-dry season. The tree layer in the study area is dominated by *Azadirachta indica* with the highest IVI of 54.47%, the second most dominant species is *Dalbergia paniculata* (IVI = 53.41%) and *Tectonia hamiltoniana* (IVI= 34.65%) is third. The number of species greater than 10% IVI value was eight species. Those species could be considered as an ecological indicator species of the Letpadaung taung area.

Herb species distribution by frequency classes in study area showed that a high percentage of the total number of species was in the lower frequency classes, A and B, while a low percentage was observed in the higher frequency class C only. This indicates that the herb species of the study area is floristically heterogeneous. The value of diversity indices and evenness indices for herb and tree species was very low in study area.

Stem density of ≥10cm was 1,311 stems m^2/ha and basal area was 6.22 m^2/ha in the study area. Among the 4 sample plots studies, 14 tree species were recorded. Four (4) species were found only one individual and these were considered to be unique species. The three (3) most abundance species in terms of basal area occupied 63.70% of the total area, of which *Prosopis juliflora* was the most dominant species in the study area with 23.25%, followed by *Azadirachta indica* with (20.79%), and Dalbergia paniculata (19.66% of the total basal area). The plant species that are listed and recorded in the recent study were checked with the IUCN Red List of threatened species, but none were found in the IUCN Red List.

4.9.1.3 Flora Wet Season

A total of 117 species representing 94 genera and 44 families were listed in the Letpadaung taung area in the wet season. The tree layer in the study area is dominated by *Azadirachta indica* with the highest IVI of 66.83%, the second most dominant species is *Dalbergia paniculata* (IVI = 44.22%) and *Prosopis juliflora* (IVI= 31.60%) is third. The number of species greater than 10% IVI value was ten species.

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Those species could be considered as an ecological indicator species of the Letpadaung taung area.

Herb species distribution by frequency classes in study area showed that a high percentage of the total number of species was in the lowest frequency classes, A, and while a low percentage was observed only in the higher frequency class C, D, and E. This indicates that the herb species of the study area is floristically heterogeneous. The value of diversity indices and evenness indices for herb and tree species was very low in study area.

Stem density of ≥10cm was 1,633 m^2/ha and basal area was 6.76 m^2/ha in the study area. Among the 4 sample plots studies, 16 tree species were recorded, 4 species were found and only one individual, and these were considered to be unique species. The 3 most abundance species in terms of basal area occupied 64.65% of the total, of which *Azadirachta indica* was the most dominant species in the study area with 23.74%, followed by *Prosopis juliflora* (22.45%), and *Dalbergia paniculata* (18.45% of the total basal area). The plant species that are listed and recorded in the recent study were checked with the IUCN Red List of threatened species, but none were found in the IUCN Red List.

4.9.1.4 Flora Seasonal Variability

The highest number of unique species was recorded in the Wet Season with 117 species identified, as shown in Table 4.10. The least was recorded during the Hot-Dry season with only 71 species identified. This shows the seasonal variability of the flora of the Letpadaung hills, with species possibly lying dormant during the dryer seasons and then taking advantage of the wet season.

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Table 4.10: Number of unique species, genera and families recorded

Season	Number of Species	Number of Genera	Number of Families
Cool-Dry Season	90	71	38
Hot-Dry Season	71	60	37
Wet Season	117	94	44

4.9.2 Vegetation

The Letpadaung hills themselves have a modified, semi-natural vegetation. Remnants of natural woodland occur on nearby Nachitaung Hill. Remnant natural vegetation also exists on the surrounding plains, which are mostly cultivated with agricultural crops farmed by the local people. Than (*Tectonia hamiltoniana*), Dahat (*Terminalia olivieri*), and Sha (*Acacia catechu*) are dominant species in the project area. A bamboo species

Dendrocalamus strictus, and two shrub species, *Limonia acidissima* and *Harrisonia benettii*, also exist in the project area. Natural vegetation of the flatlands is almost entirely cleared.

A map of the existing vegetation at Letpadaung is provided below at Figure 4.9.2.

In the past, there was a proposal to set aside the Letpadaung Hills as a "protected forest" for the purpose of protecting the area for its value as a firewood supply. Earlier mining proposals have recognised the need for a firewood supply for the surrounding communities given the coincidence of areas where vegetation suitable for firewood and the mineral resources exist within the Salingyi Township.

The modified vegetation of the Letpadaung hills is structurally heath to shrub land and is further divisible into:

- Low heath in the broad saddle between the hills;
- Low shrub land on the lower slopes;
- Tall shrub land in more steeply-sided and cooler valleys; and
- Stunted woodland on the hill crests.

4.9.3 Fauna

Environment Myanmar Cooperative Company Limited (EMC) was appointed by MWMCL to undertake a baseline survey of fauna in the project area. The work was undertaken in February, May and June 2013 to enable the evaluation of the fauna in the three seasons experienced in the Project area. A report on the survey is provided in Appendix D – Baseline Studies – Fauna.

The surveys focused on avifauna, reptiles, amphibians, mammals, butterflies and odonates.

A total of 20 unique species of avifauna were recorded during the surveys, with some species being observed in all of the seasons whilst others were only observed during one or two of the three seasons as shown in Table 4.11.

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Table 4.11: Avifauna observed during the Fauna surveys

No.	Scientific name	Common name	Family	IUCN Red List Status	Cool Dry	Hot Dry	Wet
1	*Accipiter badius*	Shikra	Timaliidae	NL	✔	✔	✔
2	*Acridotheres tristis*	Common Myna	Sturnidae	NL	✔	✔	✔
3	*Coracias benghalensis*	Indian Roller	Coraciidae	NL	✔	✔	✔
4	*Elanus caeruleus*	Black-shoulder Kite	Accipitridae	NL	✔	✔	
5	*Francolinus pintadeanus*	Chinese Francolin	Falconidae	NL	✔	✔	✔
6	*Lanius collurioides*	Burmese Shrike	Timaliidae	NL	✔		
7	*Merops orientalis*	Green Bee-eater	Meropidae	NL	✔	✔	✔
8	*Mirafra microptera*	Burmese Bushlark	Alaudidae	Endemic			✔
9	*Motacilla alba*	White Wagtail	Motacillidae	NL	✔	✔	✔
10	*Orthotomus cuculatus*	Mountain Tailorbird	Sylviidae	NL	✔	✔	✔
11	*Orthotomus sutorius*	Common Tailorbird	Sylviidae	NL	✔	✔	✔
12	*Passer montanus*	Tree Sparrow	Ploceidae	NL	✔	✔	✔
13	*Pycnonotus blanfordi*	Streak-eared Bulbul	Pycnonotidae	NL			✔
14	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	NL	✔	✔	✔
15	*Saxicola caprata*	Pied Bush Chat	Turdidae	NL	✔	✔	✔
16	*Streptopelia chinensis*	Spotted Dove	Ploceidae	NL	✔	✔	✔
17	*Sturnus burmanicus*	Vinous-breasted Starling	Sturnidae	NL	✔	✔	✔
18	*Turdoides gularis*	White-throated Babbler	Timaliidae	NL	✔	✔	✔
19	*Turnix tanki*	Yellow-legged Buttonquail	Turnicidae	NL	✔	✔	✔
20	*Upupa epops*	Hoopoe	Upupidae	NL	✔	✔	✔

NL = Not Listed

A total of 13 species of reptiles and amphibians were recorded during the surveys, with a number of species only being observed during the wet season. The survey included actual first hand observations of individuals as well as anecdotal observations by people.

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Table 4.12: Reptiles and Amphibians recorded in the Fauna surveys

No.	Scientific name	Common name	Family	IUCN Red List Status	Cool Dry	Hot Dry	Wet
1	*Bufo melanostatus*	Common Toad	Bufonidae	Lc	✔	✔	
2	*Bungarus fasciatus*	Banded Krait	Elapidae	Lc			✔
3	*Calotes emma*	Tree Lizard	Agamidae	Lc			✔
4	*Calotes versicolor*	Garden Fence Lizard	Agamidae	Lc	✔	✔	✔
5	*Daboia russellii siamensis*	Russell's Viper	Viperidae	Lc			✔
6	*Duttaphrynus melanostictus*	Common Toad	Bufonidae	Lc			✔
7	*Eutropis carinatus*	Common Sun Skink	Scincidae	Lc			✔
8	*Fejervarya l. limnocharis*	Paddy Frog	Dicroglossidae	Lc			✔
9	*Holobatrachus tigerinus*	Indian Bull Frog	Dicroglossidae	Lc			✔
10	*Kaloula pulchra*	Painted Bull Frog	Microhylidae	Lc			✔
11	*Mabuya multifasciata*	Many-lined Sun Skink	Scincidae	Lc	✔	✔	
12	*Polypedates leucomystax*	Common Tree Frog	Rhacophoridae	Lc			✔
13	*Ptyas korros*	Rat Snake	Colubridae	Lc	✔	✔	✔

Lc = Least Concern

A total of six (6) species of mammals were recorded in the Fauna surveys. Individuals were either recorded from direct observation, from the analysis of scat, observation of tracks or from anecdotal evidence provided by the local people. Myanmar Hares and Common Palm Civets were recorded in all seasons whilst all of the other species were recorded in one of the three seasons only.

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Table 4.13: Mammal species recorded during the Fauna surveys

No.	Scientific name	Common name	Family	IUCN Status	Cool Dry	Hot Dry	Wet
1	*Callosciurus pygerythrus*	Grey Squirrel	Sciuridae	Lc			✔
2	*Cervus eldi thamin*	Eld's Deer	Cervidae	Endemic / Endangered	✔		
3	*Lepus peguensis*	Myanmar Hare	Leporidae	NL	✔	✔	✔
4	*Muntiacus muntjak*	Barking Deer	Cervidae	NL	✔		
5	*Niviventer fulvscens*	White-belleyed Rat	Muridae	Lc			✔
6	*Paradoxurus hermaphroditus*	Common Palm Civet	Viverridae	NL	✔	✔	✔

NL = Not Listed

Lc = Least Concern

A total of 15 species of Butterfly were recorded during the fauna surveys. Individuals were caught using hand nets with some being photographed and released while others were preserved for use in identification. The largest numbers of species were recorded during the wet season.

Table 4.14: Butterfly species recorded in the Fauna surveys

No.	Species	Family	IUCN Status	Wet	Cool Dry	Hot Dry
1	*Papilio polytes romulus*	Papilionidae	Common	✔		
2	*Papilio demolius*	Papilionidae	Common	✔		
3	*Graphium agamemnon*	Papilionidae	Common		✔	✔
4	*Catopsilia pomona*	Pieridae	Common	✔	✔	✔
5	*Eurema hecabe*	Pieridae	Very Common	✔		
6	*Ixias pyrene verna*	Pieridae	Uncommon	✔		
7	*Ixias marianne*	Pieridae	Very Common		✔	✔
8	*Appias libythea*	Pieridae	Very Common	✔	✔	✔
9	*Danaus limniace*	Danaidae	Uncommon	✔	✔	✔
10	*Danaus chrysippus*	Danaidae	Common	✔	✔	✔
11	*Danaus genutia*	Danaidae	Uncommon	✔		
12	*Junonia hierta*	Nymphalidae	Common	✔		
13	*Junonia almana*	Nymphalidae	Uncommon	✔		
14	*Junonia atlites*	Nymphalidae	Common	✔		
15	*Mycalesis perseidoes*	Satyridae	Common		✔	✔

A total of five (5) Odonate (Dragon Fly) species were recorded during the surveys. The same five species were recorded in the cool-dry, hot-dry and wet seasons. The species are listed in Table 4.15.

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Table 4.15: Odonate species recorded during the fauna survey

No.	Species	Common name	Family	IUCN Status
1	*Tholymis tillarga*	Evening Skimmer	Libellulidae	Common
2	*Orthetrum sabina*	Green Skimmer	Libellulidae	Common
3	*Macrodiplax cora*	Common Glider	Libellulidae	Common
4	*Tramea basilaris*	Glider	Libellulidae	Common
5	*Ictinogomphus pertinax*	Common Flangetail	Gomphidae	Common

4.9.4 Habitat

Muir (1997) found that conditions around Letpadaung provided poor habitat for wildlife, and wildlife diversity and density can be expected to be low. The factors limiting habitat include human population density, conversion of vegetative cover to cropping and firewood collecting. These factors would only have increased the pressure on habitat over time and it is likely that the habitat has continued to degrade.

4.9.5 Aquatic Ecology

The aquatic fauna in the major water ways surrounding the Letpadaung Project site were surveyed during each of the three seasons. A total of seven (7) survey locations were selected. The survey locations consist of locations on the Chindwin River that are upstream, downstream and adjacent to the Letpadaung project site. Additionally upstream and downstream sections of the Yamar Creek were also selected as survey locations as shown in Figure 4.9.3. A copy of the survey findings is included at Appendix E – Baseline Studies – Aquatic Ecology.

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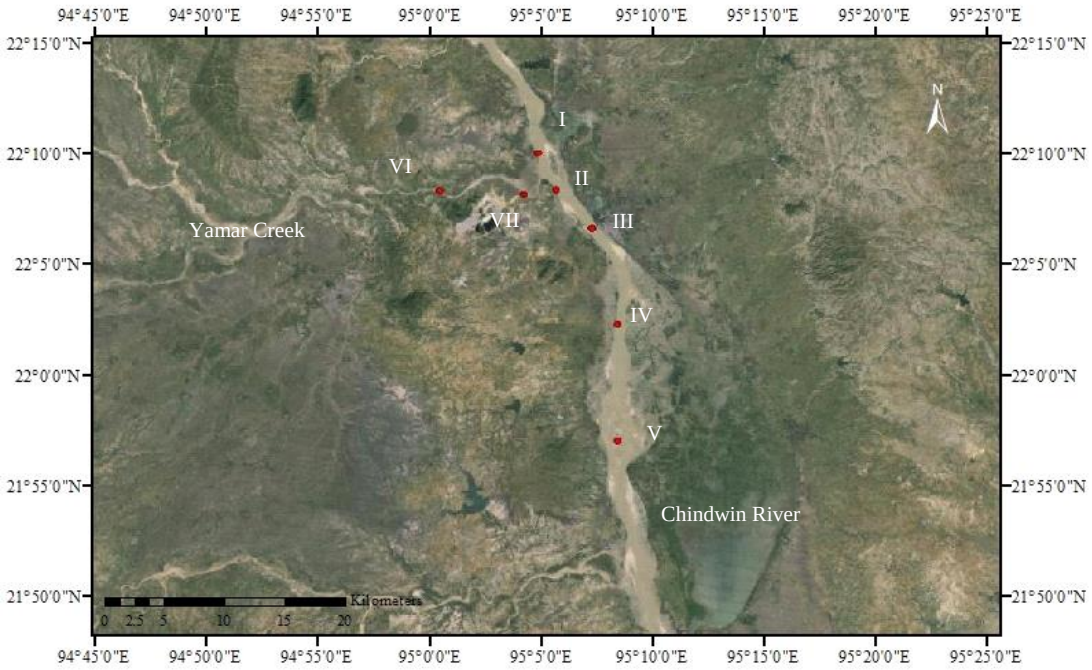


Figure 4.9.3: Survey locations for the Aquatic Fauna survey

The aquatic fauna survey included sampling: fish, zooplankton, phytoplankton, and benthos species.

A total of 21 species of fish were recorded during each of the surveys as shown in Table 4.16, with no species missing from the surveys completed in each season. During the Cool-Dry season, the population of fish was predominated by *Glossogobius giuris* and *Labeo sp*. During both the Hot-Dry season and the Wet season the fish population was predominated by *Glossogobius giuris* and *Chanda ranga*.

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Table 4.16: Fish species recorded during all three seasons

No.	Scientific name	Local name	Family	IUCN RedList Status
1	*Puntius chola*	Ngakhonema	Cyprinidae	NL
2	*Chela sardinella*	Yinbaungzar		NL
3	*Cirrhina mrigala*	Ngagyinbyu		NL
4	*Labeo calbasu*	Nganet pyah		NL
5	*Labeo angra*	Ngalu		NL
6	*Labeo rohita*	Ngagyin		NL
7	*Labeo boga*	Ngalu		NL
8	*Esomus altus*	Ngamautort		NL
9	*Rhinomugil corsula*	Ngazinlone	Mugilidae	NL
10	*Lepidocephalus thermalis*	Ngathaledoe	Cobitidae	NL
11	*Mastacembelus armatus*	Ngamwedoegyar	Mastacembelidae	NL
12	*Mastacembelus zebranus*	Ngamwedoebaygyar		NL
13	*Chanda ranga*	Ngazinzat	Channidae	NL
14	*Glossogobius giuris*	Kathaboe	Gobiidae	NL
15	*Mystus aor*	Nga-gyaung	Siluridae	NL
16	*Ompok bimaculatus*	Nganuthan		NL
17	*Silonia silondia*	Ngamyin	Schilbeidae	NL
18	*Mystus cavasius*	Ngazinyaingbyu	Bagridae	NL
19	*Notopterus notopterus*	Ngaphe	Notopteridae	NL
20	*Gudusia variegata*	Ngalabi	Clupeidae	NL
21	*Channa orientalis*	Ngayantgaungdoe	Channidae	NL

NL = Not Listed

A total of 15 zooplankton species were recorded from the Chindwin River and Yamar Creek during the surveys in cool dry, hot dry and wet seasons (Table 4.17). No significant seasonal variation in the population of zooplankton was found, however some species were not recorded at some of the sampling locations.

Table 4.17: Species composition of Zooplankton in the Chindwin River and Yamar Creek

No.	Species	Phylum	Station (Cool Dry Season)	Station (Hot Dry Season)	Station (Wet Season)
1	*Astramoeba radiosa*	Protozoa	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
2	*Spirostomum minus*	Protozoa	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
3	*Monostyla lunaris*	Rotifer	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
4	*Monostyla bulla*	Rotifer	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
5	*Brachionus diversicornis*	Rotifer	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
6	*Brachionus havanaensis*	Rotifer	I,II,III,IV,V,VI	I,II,III,IV,V,VI	I,II,III,IV,V,VI
7	*Lecane ungulata*	Rotifer	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
8	*Daphnia sp*	Arthropoda	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
9	*Daphnia pulex*	Arthropoda	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII

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No.	Species	Phylum	Station (Cool Dry Season)	Station (Hot Dry Season)	Station (Wet Season)
10	*Bosminopsis sp*	Arthropoda	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
11	*Chydorus sp*	Arthropoda	I,II,III,IV,V,VI	I,II,III,IV,V,VI	I,II,III,IV,V,VI
12	*Cyclops vicinus*	Arthropoda	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
13	*Stenocypris malcolmsoni*	Arthropoda	I,II,III,IV,V,VI	I,II,III,IV,V,VI	I,II,III,IV,V,VI
14	*Eucypris virens*	Arthropoda	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
15	*Entacythere donaldsonensis*	Arthropoda	I,II,III,IV,V,VI	I,II,III,IV,V,VI	I,II,III,IV,V,VI

A total of 21 phytoplankton species were recorded from the Chindwin River and Yamar Creek during the surveys in cool dry, hot dry and wet seasons as shown in Table 4.18. No significant seasonal variation in the population of phytoplankton was found, however some species were not recorded at some of the sampling locations.

Table 4.18: Species Composition of Phytoplankton in the Chindwin River and Yamar Creek

No.	Species	Class	Station (Cool Dry Season)	Station (Hot Dry Season)	Station (Wet Season)
1	*Synedra affinis*	Chrysophyta	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
2	*Dinobryon divergens*	Chrysophyta	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
3	*Diatoma elongaum*	Bacillariophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
4	*Campsopogan caeruleus*	Rhodophyceae	I,II,III,IV,V,VI	I,II,III,IV,V,VI	I,II,III,IV,V,VI
5	*Staurastrum leptopus*	Chlorophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
6	*Mougeotia nummuloides*	Chlorophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
7	*Spirogyra protecta*	Chlorophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
8	*Spirogyra microspora*	Chlorophyceae	III,,VI,VII	III,,VI,VII	III,,VI,VII
9	*Spirogyra cylindrospora*	Chlorophyceae	III,,VI,VII	III,,VI,VII	III,,VI,VII
10	*Spiroyra prolifica*	Chlorophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
11	*Spirogyra azygospora*	Chlorophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
12	*Oscillatoria laete-virens*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
13	*Oscillatoria subbrevis*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
14	*Lyngbya martensiana*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
15	*Lyngbya truncicola*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
16	*Lyngbya contorta*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
17	*Phormidium ambiguum*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
18	*Planktothrix raciborskii*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
19	*Treubaria crassispina*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
20	*Synedra acus var. angustissima*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII
21	*Synedra acus var. radians*	Cyanophyceae	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII	I,II,III,IV,V,VI,VII

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Five benthos species; *Crocothemis servilia*, *Orthetrum glaucaum*, *Rhyothemis Phyllis*, *Tramea basilaris*, and *Ictinogomphus rapax* were recorded in Chindwin River; all of them are nymphs of dragonfly species. Six benthos species; *Crocothemis servilia*, *Orthetrum glaucaum*, *Rhyothemis Phyllis*, *Tramea basilaris*, *Macrodiplax cora* and *Ictinogomphus rapax* were found in Yamar Creek. Similarly to the survey of the Chindwin River, all of the aforementioned species recorded were dragonfly nymphs.

For all surveyed groups, the results showed that there was no significant difference in species diversity between the upstream and downstream sampling locations. This indicates that in relation to environmental conditions the upstream and downstream sites have relatively similar quality of aquatic habitat.

4.10 SOCIAL ENVIRONMENT

This Section describes the baseline social environment of the local and regional communities surrounding the Letpadaung Copper Mine Project. The baseline was developed from information ascertained from both primary and secondary sources. Due to the lack of official data at the village level, some of the information presented concern the socio-economic and cultural environment reported in secondary sources for Salingyi Township, the administrative unit governing the village-tracts located near the Project site, and Monywa District, the next administrative level up from the township level. Information sourced from interviews, consultations with the villages (See Section 6) and site observations and sampling was extensively used to understand the existing community environment, as well as identifying potential impacts and suggesting the mitigation strategies and measures presented in Section 7.

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Absent from the social baseline is a thorough consideration of the social and economic implications of land acquisition on the affected communities. Four (4) villages have already been moved to two (2) new sites located south and south-east of the Project site boundary under the auspices of the Regional authorities and MEHL. Households in an additional 26 villages are in the process of relinquishing their land for the Project activities. A short summary is presented in Section 4.10.4 along with recommendations for moving forward.

Monasteries previously located in the villages have also been relocated to the new sites and a new monastery was constructed outside the new villages (the New Taungyar Monastery Area). More information is required to verify the process undertaken to physically unearth and transfer these cultural resources to the new village locations. This issue is addressed in Section 7.11.1.

Finally, land take will also affect villagers who had previously collected wood and herbs from the Project Area for fuel and medicine. The impacts of the access restrictions to natural resources on the families dependent on these resources require further investigation and possible mitigation. This issue is addressed in Section 4.10.6.

Socio-economic impacts occur throughout the life cycle of the mine, but they are most keenly felt by local residents in the period leading up to construction. Land acquisition and resettlement pose the greatest social challenges to communities and project sponsors. The process of land take occurs prior to construction and can involve the physical and/or economic displacement of entire communities away from their traditional sources of livelihood, from long standing social and family networks and from their places of worship, schools, medical facilities, and markets.

Because of the multiple stresses and livelihood implications resulting from resettlement, the management of resettlement, particularly in its early stages, is a critical factor determining the extent to which adverse impacts are avoided or minimised in both the short and long term. The unintended consequences of a poorly planned or implemented resettlement can be far reaching and result in project delays throughout the life of the mine. The resettlement process undertaken for the Letpadaung Copper Mine Project has been fraught with difficulties and has already resulted in the stoppage of work and scheduling delays.

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4.10.1 Methodology

Data was sourced from a number of resources to define and understand the existing social environment documented in this section. From these baseline data, an assessment of the potential impacts, both positive and negative, has been made.

Baseline data sources include:

- Official statistics of Salingyi Township, Monywa District, and Sagaing Region collected from April – December 2012.
- Historical studies prepared for the S&K development, including the 1996 S&K Environmental Assessment and 1997 Feasibility Study conducted by Minproc Engineers, Ltd.
- MEHL.
- Existing MEHL, MWMCL and MYMCL documentation, policies and programs.
- Websites of development agencies and NGOs working in Myanmar.
- Press articles from *Salingyi Township Gazeteer*.
- Community feedback from interviews and consultations.

- Baseline Study - Cultural Heritage Assessment for the Letpadaung Copper Mine Project prepared by MEHL (2013).
- Baseline Study – Social Impact for the Letpadaung Copper Mine Project and analysis of data collected (2013).
- Draft Resettlement Action Plan for the Letpadaung Copper Mine Project prepared by MWMCL (2013).
- Site observations and testing for noise levels, vibrations, and visual amenities.
- EMC Survey of Traffic Conditions.

An important data source was the baseline survey of the socio-economic conditions in the Project area conducted by EMC in May and June 2013. The findings of this baseline study are provided in Appendix F and the survey data sheets are included in Appendix G. The data possess a number of methodological limitations which may affect the integrity of the sample, however the effect of these sampling biases appears to be sufficiently small. While it is assumed that the data are representative of the existing community environment at the Letpadaung Copper Mine, any findings used to direct interventions toward specific villages require confirmation. See Table 4.19 for the population and number of households of the villages included in the social baseline and of the sample.

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Table 4.19: Characteristics of the surrounding villages[20] near Letpadaung and the sample

Village Tract	Village Name	Population	# of Households (HH)	# HH in Sample (n)	% of HH
Moegyobyin	North Moegyobyin	638	121	34	28.1
	South Moegyobyin	700	140	48	34.3
	Wardan	634	120	39	32.5
	North Paungga	1200	238	64	26.9
	Central Paungga	628	125	41	32.8
	South Paungga	450	86	27	31.4
Dondaw	Dondaw	1600	315	44	14.0
	Ywartha	384	71	60	84.5
Shwe Pan Khaing	Shwe Pan Khaing	843	166	55	33.1
	Telpinkan	433	82	40	48.8
	Thedawayi	368	73	21	28.8
Taungpalu	Taungpalu	867	163	37	22.7
	Kyawywa	650	131	34	26.0
Phaunggada	South Phaunggada	964	187	44	23.5
	Kyaukpyudaing	547	114	51	44.7
	Zidaw/Sede	530	101	20	19.8
Letpadaung	Shwehlay	265	56	41	73.2
Ywarshay	Ywarshay	1450	275	88	32.0
	Palaung	956	145	84	57.9
	Wetme (new)	350	65	13	20.0
	Kandaw	582	110	25	22.7
Ton	Ledi	562	111	18	16.2
Nyaungbingyi	Nyaungbingyi	1549	291	68	23.4
	Yonebinyoe	728	130	49	37.7
	Mingalargone	187	32	13	40.6
Shwebo	Palaing	439	87	30	34.5
Total		18,504	3,535	1,090	-

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Unfortunately there has been a lack of complete data concerning the resettlement carried out to date. MWMCL prepared a draft Resettlement Action Plan (RAP) in outline form which is in need of clarification, updating, analysis and planning. A thorough investigation of the resettlement process to date and any outstanding activities, including corrective measures and mitigation plans, is urgently needed.

[20] The villages of Gondaw and HtanDawGyi were excluded from the analysis as they had too few observations. Wetme is also known as Wet Hmay.

4.10.2 National Demographic and Economic Features

The estimated population of Myanmar in 2004/2005 was 54.3 million, of which 49.7% was male and 50.3% was female (UNDP Country Assessment Report). Myanmar shares borders with Bangladesh and India to the north-west, the People's Republic of China to the northeast, the Lao People's Democratic Republic to the east, and Thailand to the southeast.

In Myanmar, there are 135 recognised ethnic groups residing in seven (7) states and seven (7) divisions. The major ethnic groups are Bamar, Shan, Kayin, Rakhine, Mon, Chin, Kachin and Kayah. The majority of the Myanmar nationals are Bamar and they comprise approximately 70% of the population. The second largest majority are the Shan comprising about 9% of population and the third largest majority are Kayin comprising about 6% of the population.

In view of the topography and natural resources, Myanmar is dependent on agriculture for its economic base. Agriculture is the leading sector in Myanmar's economy, providing about 60% of GDP, 66% of employment, and over 60% in export profits. GDP increased by 7.3% per annum between 1997 and 2003. During that time, mining only contributed 0.5% of GDP.

4.10.3 The Regional and Local Environment of the Project Area

The site of the Letpadaung Copper Mine Project lies within the jurisdiction of the Salingyi Township of Monywa District. Monywa is approximately 7 km north-east of the Project site. Salingyi is approximately 13 km south of the site. Neighbouring townships to Salingyi are Yinmabin Township to the north, Monywa and Chaung-U Townships to the east, Yesagyo and Myaing Townships (both in Magway Division) to the south and Yinmabin and Pale Townships to the west. Average temperatures in Salingyi Township range from 6 ºC to 38 ºC. Average annual rainfall ranges from 25 cm to 76 cm.

Within 5 km of the S&K and Letpadaung Project sites, 26 villages account for a population of approximately 25,000 people. Mine Town is the largest community with appropriately 3,100 people and is continuing to grow (MICCL, 2003). The four (4) villages of Dondaw, Nyaungbingyi, North Paungga, and Ywarshay are the second largest set of villages with populations hovering around 1,500 people. These larger villages provide services to the smaller villages in the area.

Mine Town and eight (8) villages, namely, South, North and Central Paungga, South, North and Central Moegyobyin, Kyawywa, and Taungpalu, are located within eight (8) kilometres of the Letpadaung Project site as shown at Figure 4.10.1. A profile of Mine Town and the villages is, as follows:

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Mine Town

Mine Town has a total population of 3,100 people and its infrastructure is significantly more advanced than the villages situated near the mine. Housing includes 145 separate houses, 256 semi-detached houses and a 60-person male dormitory for semi-contract workers. The bulk of the workforce of MYTCL comes from Mine Town, as well as some of the nearby rural communities.

The existing facilities in Mine Town include a high school, a hospital, a recreation centre, a fire station with two (2) fire engines and ten (10) fire brigade personnel, a police station, a number of small stores, and a telecommunications centre. Electricity is supplied to residences and facilities in Mine Town from the Nyaungbingyi Power Station. Treated water is provided in the form of running water to all buildings in Mine Town from Pump Station No 3.

South Paungga Village

This village is located three (3) kilometres from the Project site. It has a population of 450 persons occupying 86 houses. The majority of inhabitants are farmers and they principally grow wheat, peas and beans, sesame, and a small amount of paddy. A main water source for the village is Paungga Dam, which was recently renovated by MWMCL, and irrigates 300 acres of farmed land.

Aside from crop cultivation, the villagers have established sheep and goat farms for trade as well as breeding a few pigs and cows for domestic consumption. Approximately four (4) villagers work at MYTCL, three (3) are contract labourers and one (1) is a permanent employee.

Central Paungga Village

This village is 3.25 km from the project site and has 628 residents and 125 houses. It is one of the few villages in the area with a library and a monastery. The village does not have a primary school and school-going children in the village attend the primary school in North Paungga village.

Due to Central Paungga's close proximity to the Phaungga Dam, paddy farming is more utilised in Central Paungga Village than in North and South Paungga. A scattered toddy plantation exists around Central Phaunga up to the periphery of Phaunga Dam, which is located ½ mile to the west of Central Paungga. These toddy palms are a source of feedstock for animals and the leaves are used as covering materials for houses. The number of MYTCL recruits from this village includes two (2) permanent employees and 60 contract labourers.

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North Paungga Village

This village is located four (4) kilometres from the Project site with a population of 1,200 inhabitants occupying 238 houses. The traditional economy is the same as that of South and Central Paungga villages. Sesame and a variety of peas and beans are staple crops for most villagers, while some farmers adopt paddy cultivation from water drawn from Phaunga Dam.

In addition, a number of village women consistently trade items of groceries and vegetables to Mine Town. It has a primary school and two (2) monasteries. Approximately eight (8) permanent staff and about 50 contract employees work for MYTCL.

South Moegyobyin Village

South Moegyobyin is approximately five (5) kilometres south-west of the Project. It has a resident population of 700 occupying 140 houses. The major crops are sesame, maize, peas and beans, and wheat. Paddy cannot be grown due to the scarcity of water in this area. This village has a primary school, a Sub Health Centre and a midwife.

A small dam of approximately 35 ha is located near the village, providing the sole source of water for the purpose of drinking, irrigation and domestic uses. The dam dries up during the dry season, which results in a shortage of available water, not only in this village but also in the adjoining villages of North and Central Moegyobyin.

The south-west part of the village is of archaeological importance. Cultural resources dating back to the antediluvian period were unearthed by the Department of Archaeology at sites just 0.5 km south-west of South Moegyobyin village (MICCL, 2004). Also located in this area is an ancient graveyard dating back to the Pyu civilisation.

North Moegyobyin Village

North Moegyobyin has 638 people living in 121 houses. The village is located approximately five (5) kilometres from the Project site. A primary school operates in the village and the economy and living standards are similar to those of the nearby villages. The number of MYTCL workers originating from the village is 15 contract labourers, which appears to be a higher figure than the number of MYTCL workers coming from Central and South Moegyobyin.

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Central Moegyobyin Village

Similar to the North and South villages, the local population in Central Moegyobin village relies heavily on the cultivation of crops. It has a population of 511 and 90 houses situated five (5) kilometres away from the Project site. There is no primary school in Central Moegyobin village and school-going children attend school in South Moegyobyin village.

Kyawywa Village

Kyawywa village is situated adjacent to the Yin Mar Bin Road, 1.5 km from the Project site. The total population is 650 people living in 131 houses. The farmers predominantly grow wheat, peas and beans, garlic, onion, maize and sesame. There is no paddy cultivation in Kyawywa as the majority of the farm plots are located on moorland and the saline content in the groundwater is too high. The high saline content prohibits the groundwater from being a source of drinking water. The residents of Kyawywa get their drinking water from a fresh water well located in the direction of Aungchansi approximately 0.5 km away.

Since Kyawywa village is situated quite close to Nyaungbingyi village and Monywa Town, a number of villagers are self-employed tradesmen doing odd jobs. Eight (8) people are civil servants and six (6) are MICCL and MYTCL permanent employees. The village has a primary school, a monastery and two (2) stupas.

Taungpalu Village

Taungpalu has a population of 867 dwellers and a total of 163 houses. The community infrastructure appears to be better equipped than that found in the nearby villages. Taungpalu village lies next to the Yin Mar Bin Road and just two (2) kilometres away from the Letpadaung site. It has a primary school, a Rural Health Centre and two (2) monasteries. Approximately 14 people from Taungpalu work for MYTCL while the majority cultivate crops.

4.10.4 Land Acquisition and its Effects

A total of 2,746 ha of land take from 30 villages is required for the Letpadaung Copper Mine Project. The four (4) villages of Zidaw, Sede, Kandaw and Wetme, comprising 2,000 inhabitants/220 households, were physically relocated to two (2) sites located south and south-east of the Project lease boundary in 2012. The resettlement was organised by was organised by MEHL and the Regional Government in a process that started in October 2010. Broad community support for resettlement collapsed however in Fall 2013 following NGO agitation demanding better compensation terms for the affected households. The old villages of Sede, Zidaw, Wetme and Kandaw still exist

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and populated by the remaining households refusing to move to the new villages. Other households owning land in the Project lease area refuse to relinquish their plots and accept compensation. These dissenting households represent 44% of the households eligible to receive compensation. Currently within the Project lease area early works activities are being carried out alongside working farms with farmers and livestock present.

Two (2) rounds of compensation have been paid to the relocated households in 2011 and 2012, with a third round of back compensation paid in September 2013. Auxiliary compensation was also paid to households affected by the drilling works which took place prior to relocation. Compensation rates were roughly three (3) times higher than the official Government rates.

From the information obtained about the resettlement process underway, the following activities are urgently required to support the affected households and communities displaced by the Project:

- A retrospective Resettlement Action Plan (RAP) based on the current RAP should be prepared in accordance with IFC Performance Standard 5 on Land Acquisition and Involuntary Resettlement ;
- Ethnic minority groups and households residing in the Project area should be identified and researched to determine whether they qualify as “indigenous peoples” under IFC Performance Standard 7 on Indigenous Peoples or as a vulnerable group requiring specialised livelihood assistance.
- Livelihood restoration measures need careful examination to ensure that comprehensive and adequate coverage is provided to all relocated households. Livelihood restoration should take into account the needs and capabilities of household members. MWMCL has committed employment to eligible households affected by land take. It is not clear whether an employment placement will be sufficient to meet the subsistence needs of larger families. Specific livelihood restoration measures remain to be identified for the households who are ineligible to work for MWMCL and/or are fully reliant on farming and unable to cope with industrial employment; and
- Resettlement assistance may be required by the affected households in the interim period between relocation and the commencement of employment with MWMCL. Villagers report in the social baseline survey interviews that their ability to feed their families is an immediate concern. The most advisable form of assistance is land clearance and the provision of seeds and other inputs for planting and rice for immediate consumption.

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4.10.5 Cultural Heritage

The cultural heritage assessment (CHA) identified a single site as being significant. The site which comprises a Buddhist stupa and associated buildings is regarded as having some historical, religious and cultural importance to the local community. The stupa, as well as being a monument to Buddha, is a shrine to the famous holy monk Ledi Sayadaw. The stupa and attached Thein and Gandaguri buildings is found on the Letpadaung hillslope at the following location: 22° 04' 36.77" latitude; and 95° 05' 36.29" longitude.

4.10.5.1 Historical Background

Maung Tet Khaung, who would later become known as the monk Ledi Sayadaw, was born in 1846 at Saipyin village in Depayin Township. At the age of 15 he started as a samanera novice and took the novice name of Shin Nyanadaza.

According to the historical records Ledi Sayadaw sojourned during Buddhist lent at a hut situated on the hillslopes of Letpadaung Hill for a period of around eight months in the year 1903[21]. In the records the precise location of the hut was not specified but it is surmised to have been in the valley not far from the Kyaw Ywar and Taung Palu villages. The basis of this assertion is that the records indicate that Ledi Sayadaw used to visit to these villages to accept food offerings from local villagers from these communities.

Ledi Sayadaw wrote a thesis over this period, whilst residing in his hut on the Letpadaung hillslopes[22]. In his thesis he mentioned the general location of the hut but did not include any specific geographic reference points. Furthermore no mention is made in the text of the Tawya Valley Stupa, the Thein and Gandagudi buildings, nor the Tawya Kyaung monestary. Considering that Ledi Sayadaw mentions many of his other construction activities in his thesis some have interpreted this to suggest that he may not have been involved in construction of the stupa, monastery, or other associated buildings in their current location. The historical connection between the original temporary monastery (established by Ledi Sayada) and the current stupa site is regarded by some local monks in the areas as contentious[23]

However, in the interview survey, a village elder namely U Pike of Aung Chan Si village reportedly explained that Ledi Sayadaw used to practice meditation in the hut located in the valley of Letpadaung hill as well as in a cave in the Kyaukgyi hill.

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[21] Biography of Ledi Sayadaw.
[22] Kammahttana Depan Thesis.
[23] Recorded converstaions with monks U Kay Lar Tha, U Wa Tha Wa, and U Tha Thana (Abbot of Yesaygyo Way Lu Won monastery.

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In summary there is insufficient evidence to confirm the current stupa location as being the original location of the Ledi Sayadaw hut or monastery and so this issue remains contentious.

4.10.5.2 Impacted Cultural Heritage Buildings

The construction and restoration history of the Tawya Valley stupa and associated buildings was provided by U Dhamasara who once resided there. According to his account the Tawya Valley stupa was built during the period of Myanmar kings and the upper portion was destroyed with only the lower portion remaining. In 1964 the stupa was renovated by the locals and over time it has received regular repair and restoration work. According to the stone carved records (on site) the latest repairs were carried out in 2004 by U Ye Aung and Daw Nyunt Nyunt Yi. Dhammasara claims that the stupa Buddha image is an ancient relic that was crafted during the Konboung dynasty (1752 – 1885).



Plate 1: Tawya Valley a stupa and attached buildings)

The stone carved stupa records indicate that the Gandagudi building, situated in the compound, was donated by the community in 1982. The present day Thein building was recently constructed in 2009 by the Howpar villagers.



Plate 2: Buddha image in the Thein building

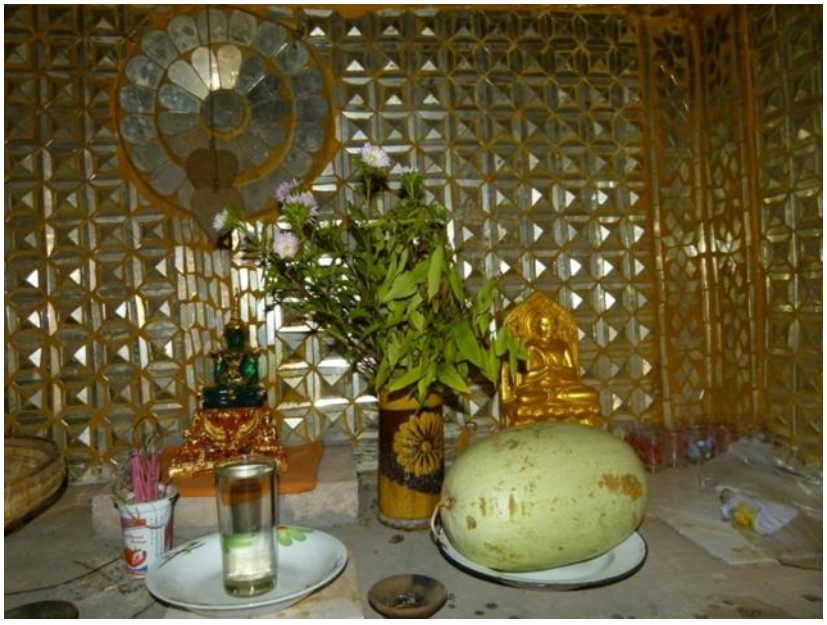


Plate 3: Buddha image in the Gandagudi building

As previously noted there have been several modifications and renovations made to the original stupa over the years including construction of a brick wall. Two boundary pillars in the consecrated area of the stupa are evident. The newest of the pillars is in good condition and quite ornate and the other pillar is ancient, unadorned and in poor condition. The ancient boundary pillar may have been erected in the period that Ledi Sayadaw was in the area but this cannot be confirmed.



Plate 4: Boundary pillars



Plate 5: Thein building plaque

4.10.5.3 Other Structures

There are four (4) other small stupas in the vicinity of Letpadaung hill referred to as the Shwemyintin, Anumyudatpaungkatkyaw, Shwezarli, and Kha stupas. However they are not recognized as having any significant religious, cultural or historical importance by the local community.

4.10.6 Reduced Access to Land and Trees

Local residents and previous land owners will no longer be able to use the land within the site boundary for farming and wood and herb collection important for sustenance and heating. The lower availability of resources requires residents to travel longer distances in search of suitable land, fuel supplies and medicinal plants. The scarcity of

supply may also become a source of conflict among residents and communities. Sustainable use of available land is also required.

A Community Natural Resource Management Plan should be prepared to identify the ways in which residents are impacted by the land access restrictions imposed by the Project and to develop appropriate mitigation measures. Such access restriction plans or frameworks tend to be participatory, involving discussions and negotiations amongst villagers on the use of land and forests in the community, to arrive at a community resource use agreement. The Community Natural Resource Plan would regulate residents' use of neighbouring land and forests as a conservation measure. The Community Natural Resource Plan would also include activities to offset the poverty impacts resulting from the land access restrictions.

In the short term, MWMCL may want to provide alternative fuel sources to those households who are highly dependent on firewood for their sustenance. In the long term, MWMCL and the Regional Government should work toward developing the non-farming sector in Sagaing Region to diversity the income base of residents. This can be achieved through skills training, exposure to other industries, provision of vocational courses in marketing, and long-term investments in education (see Section 4.10.13).

4.10.7 Demographics

Salingyi Township has a population of approximately 190,000 people.[24] The population grew at a rate of 2% per annum since 1995 primarily as a result of in-migration. Approximately 4,000 new identity cards were issued in the Township in 2012, 2.5 times the number issued in 2011. Fertility is slightly above replacement level in Myanmar and in Salingyi Township. The birth rate was 13.10 (per 1000) in Salingyi Township and 17.3 (per 1000) in Myanmar in 2012. Infant mortality is low relative to other Southeast Asian countries with the same economic level; in 2012, it was 6.10 (per 1,000) in Salingyi Township. The maternal mortality rate was also low in the Township, at 2.8 (per 1,000) in 2012.

The majority of the residents in Monywa District, Mine Town and the neighbouring villages are Bamar. A small fraction of the population in the Sagaing Region comprises Chin, Shan and Kayin ethnic groups. Most of the villagers living near the Letpadaung Copper Mine are Bamar and the predominant religion and traditional practices is based

[24] The population was estimated to be 130,000 in 1995 and had an annual growth rate of 2%. Minproc Engineers Ltd. 1996 Feasibility Study –Sabetaung Kyisintaung Copper Project. Ivanhoe Myanmar Holdings Ltd

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on Theravada Buddhism. A meditation centre exists in the vicinity of the Project and one (1) historical stupa is situated within the site boundary.

Salingyi Township is predominately rural with 92% of the population living in a rural area. The Township comprises three (3) urban quarters, 39 village-tracts and 152 villages. The majority of the population (176,000 people or 21,550 households) live in the villages.

Households in the surveyed villages report an average of 5.6 persons which exceeds the national rural average of 4.67.[25] Households typically consist of two (2) parents, one or two (1-2) grandparents, and two or three (2-3) children. Some households have just two (2) adult members while others have as many as 14 members.

The dependency ratio, which is the ratio of dependents to the working age population, is 77% in the villages near the Project site compared to a much lower figure of 44% for the country in 2012[26]. The higher dependency ratio in the Project area suggests that family structure effects may play a greater role in the economic welfare of households in the surveyed villages than in the country as a whole. In general, compared to the national average, households in the surveyed villages have a relatively larger number of young dependents to support.

Table 4.20 presents the dependency ratios for the surveyed villages. Households with more dependents than breadwinners have dependency ratios above 0. The villages with a high proportion of such households are: *Thedawayi, Shwehlay*, and *Ledi*. *Ywartha* and *South Phaunggada* have the lowest dependency ratios.

Another indicator of household welfare is the percentage of households with small children (aged 6 and under) as the presence of young children limit the number of household members available for wage work and may keep older siblings needed for child-minding activities from attending school. Forty percent (40%) of households in the villages have small children. Five (5) villages (*South Moegyobyin, South Paungga, Telpinkan, Ywarshay, Kandaw*) have a high proportion of young families, while four (4)

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[25] "Household Income and Expenditure Survey." Central Statistical Organisation. Ministry of National Planning and Economic Development. Retrieved 17 July 2011. Cited from Wikipedia on 7 November 2013.

[26] The World Bank defines dependents as children under 15 years and adults over 64 years, and reports a dependency ratio of 44% for Myanmar in 2012 (http://data.worldbank.org/indicator/SP.POP.DPND. sighted 8 October 2013). **Error! Reference ource not found.** presents the dependency ratio for households by village using a broader definition than that employed by the World Bank. Here dependents are defined as children under 18 years and adults over 60 years. Respondents were asked to report the ages of household members using the broad categories of 0-7, 8-17, 18-59, and 60+, hence the deviation from the World Bank definition.

(*Wardan, Ywartha, South Phaunggada and Mingalargone*) have less than a quarter of households with small children.

Table 4.20: Dependency ratios and the percent of households with small children by village

Village Tract	Village Name	Dependency Ratio (%)	Percent of households with small children
Moegyobyin	North Moegyobyin	79	35.2
	South Moegyobyin	60	56.3
	Wardan	88	23.0
	North Paungga	77	28.1
	Central Paungga	58	29.3
	South Paungga	82	59.3
Dondaw	Dondaw	79	45.5
	Ywartha	41	23.3
Shwe Pan Khaing	Shwe Pan Khaing	75	40.0
	Telpinkan	91	52.5
	Thedawayi	102	42.9
Taungpalu	Taungpalu	72	37.8
	Kyawywa	70	44.1
Paunggada	Phaunggada (South)	53	22.7
	Kyaukpyudaing	72	35.3
	Zidaw/Sede	92	45.0
Letpadaung	Shwehlay	116	43.9
Ywarshay	Ywarshay	65	54.5
	Palaung	88	44.0
	Wetme (new)	67	30.8
	Kandaw	95	52.0
Ton	Ledi	103	50.0
Nyaungbingyi	Nyaungbingyi	65	44.0
	Yonebinyoe	60	32.7
	Mingalargone	94	23.0
Shwebo	Palaing	98	46.7
Average		76	40.2

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4.10.8 Main Economic Sectors

Crop production and agricultural trade play an important role in the Salingyi Township and Regional economies (see Table 4.21). The staple crops are peas and beans, corn, oil crops (sesame, sunflower, peas, and groundnut), vegetables and millet. Drought resistant crops, such as the oil crops, grow well in the region which is plagued by irregular rainfall. Cotton and red chili are grown in small quantities.

Table 4.21: Agricultural production in Salingyi Township in 2013

Crop	Number of Hectares (ha) Cultivated
Millet, corn, vegetables and non-edible (e.g. toddy, banana, betel leaves)	19,217
Various types of pea	13,398
Oil crops	13,010
Castor oil plant	7,796
Rice paddy	1,795
Cotton	1,704
Spices (red chili)	209
Total	57,129

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In the 2012-13 year, 57,127 ha of cultivable land was utilised in the Salingyi Township (Table 4.22). Over 89 % of that land was used for dry land crop production (farming), about 5.5% was used as paddy, and the rest was used for seasonal farming on riverbanks or gardens. The Salingyi area is a net importer of rice as local rice production can only meet 49% of demand. In contrast, the area produces nearly 5 times the local requirement of vegetable oils and exports about 5,000 tonnes annually.

Table 4.22: Land Use in Salingyi Township, 2012-2013

Land Use	Number of Hectares (ha)
Agricultural land	**45,023**
Farm land	40,295
Paddy field	2,507
Seasonal farm land on the river bank	2,206
Garden	16
Shifting cultivation	0
Reserved forest and protected area	**5,520**
Barren land	**17,501**

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After agriculture, manufacturing is the second most important economic sector in Monywa District and in Salingyi Township. Mills and home industry, to a small extent, produce textiles, cotton products, rice noodles, wood and wood products. No manufacturing takes place in Salingyi Township, which does not have a dedicated industrial area.

As expected from the Township data, communities near the Project primarily depend on farming and husbandry (43%) and seasonal farm work (26%) for their livelihood (Figure 4.10.2). Nine-percent (9%) of household's main source of income comes from selling goods and produce. Two-percent (2%) of households have members who work for the Government. Six-percent (6%) of respondents report they have no income sources and are unemployed. The remaining 19% are those households reporting multiple income sources from trade, farming and/or seasonal wage work.

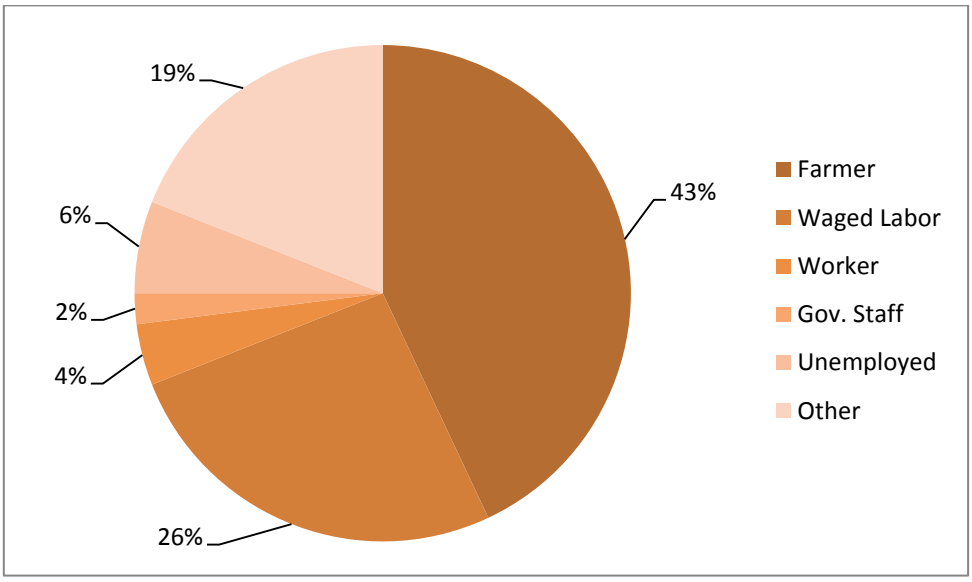


Figure 4.10.2: Livelihood sources among interviewed households.

4.10.9 Public Finance

MWMCL estimates that the Myanmar Government will receive annual revenue from the Letpadaung Copper Mine Project totalling USD 100 million.[27] The revenue will enable the Government to modernise the existing infrastructure in the Country and to build the capacity of the public sector. During the three (3) year construction period, the Project will purchase an estimated USD 70 million worth of construction materials, equipment, labour, and transportation services from local suppliers. During operations, the Project is expected to require USD181 million worth of local goods and services annually. The economic benefit of the Project to the local economy and to the country is therefore anticipated to be large. It is hoped that the Project will stimulate the other economic sectors and increase employment opportunities in all industries.

From 2011 through October 2013, MWMCL spent USD 1.18 million toward 116 community development activities in the nearby villages. The contract volume for the projects still under construction is USD 908,084. These investments include the construction of electricity and water supply facilities to local monasteries; construction of wells and a water purification system; other infrastructural improvements, such as road and bridge upgrading, construction of dams and canals to facilitate irrigation; financing of the mobile health clinic, and various donations toward cultural and education activities throughout the Country and toward earthquake emergency relief in Sagaing Region. Particularly noteworthy is MWMCL's financing of the electricity supply

[27] Report to the Special Commission on Social and Economic Benefits. MWMCL (2013).

facility (USD 37,000) and water supply facility (USD 24,692) in Myaypyinthar monastery. MWMCL spent Ks 72 million (USD 74,076) in road construction and USD 177,000 to repair the Yamar Stream river bank.

An amount of USD 1 million has been preliminarily allocated for FY2014 for community development activities. Salingyi Township generates revenue from various departmental sources. The Township receives most of its departmental revenue from income tax. In 2012, the Internal Revenue Service collected a total of Ks 1,828 (USD 1.88), over double the amount collected in 2011. Most of this revenue came from income tax (55%) and commercial tax (26%). The second highest revenue source came from tender tax collected by the Township Development Committee of the Ministry of Border Affairs. The tender tax collected in 2012 totaled Ks 1067 (USD 1.10), a sharp increase over that collected in 2011, which was just Ks 295 (US 30 cents). The Township's General Administration Department brought in Ks 99.77 (US 10 cents) in 2012, an increase of 38% from 2011, of which two-thirds (2/3's) came from liquor and one-third (1/3's) from land tax. Revenue from the Township's postal and telecommunication services remained stable at Ks 84.2 and Ks 81.3 in 2012 and 2011 respectively (US 9 cents). Finally, the Forestry Department contributed relatively little to the Township's budget, totaling Ks 15.94 in 2012, but it was one-third (1/3) more than had been forecasted.

In the 2012-13 financial year, Salingyi Township generated Ks 79,808 (USD 821) in net gross product and services, significally less than the amount forecasted in the preceding year (just 54%). Gross product revenues constituted most of this revenue (Ks 60,206 in 2012). Trade contributed Ks 14,588 (24%) and services contributed Ks 5014 (8.3%) in 2012.

4.10.10 Communication Facilities

Salingyi Township has two (2) main post offices and one (1) small post office. It also has a telegraph office and a telephone exchange. A GSM tower was constructed in 2012.

4.10.11 Fire Services

The Township has a total of nine (9) fire engines housed in various facilities, i.e. Sulphuric Acid Plant, MEHL, No. 6 Textile Mill, Letpadaung Copper Mine, and in Salingyi Quarter #2 and Kan Kone village. In addition to the firemen who work for the Government, there is a large volunteer fire brigade operating in the quarters and the villages totalling 45 platoons and 1,585 crews. The Government takes active fire prevention measures in the form of daily test runs, training, public education and the

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removal of combustibles from the villages in the summer time. Streets are also maintained to ensure passage of the fire engines.

4.10.12 Electrical Power Substations and Transmission Lines

S&K Copper Mine has two (2) electrical power substations, each with a capacity of 10MVA and transmission cable 6.4 km long. No.6 Textile Mill also has an electrical power substation with 10MVA capacity and 16.1 km of cable. The Sulphuric Acid Plant has a substation of much smaller capacity, 1.5MVA, and 5.6 km of cable. The Nyaungbingyi River water electrical pump has a capacity of 7.5 MVA and 4.8 km of cable.

4.10.13 Education

Formal primary education in Sagaing Region faces problems related to universal access, equity, quality, internal and external efficiency and lack of schools. In recent years, substantial improvements have been made in the access to primary education and to its internal efficiency in Salingyi Township. Nevertheless a large proportion of children do not enrol in the first grade and of those who do attend school, a considerable number drop out before reaching the fifth grade (Y5) with generally an insufficient level of education to stay literate. In Salingyi Township, girls are less likely than boys to enrol in school at the age of 5 years.

Statistics indicate that school attendance in Salingyi Township is generally limited to primary education. Just 25% of school-aged children (aged 5 to 17) attend school. Fifty-eight percent (58%) attend primary school (Y1 – Y5), 31% attend middle school (Y6 – Y9) and 11% attend high school (Y10 – Y11). In 2011-12, a total of 92 students matriculated to attend university. Overall, the ratio of teachers to students is 1:24.

Within the Salingyi Township, there are ten (10) high schools, 18 middle schools and 76 primary schools (with an additional 11 functioning as extensions and one (1) functioning as an informal school).

In contrast to the formal educational system, Buddhist monasteries have been the traditional sites for informal primary level and life-long learning in the Region as most villages in the Township have a monastery. Monastic education has been restricted to educating boys and men. Informal education in the region is hampered by a weak infrastructure and delivery system and minimal financial support from the Government.

The findings from the village surveys are broadly aligned with the educational statistics reported for the Township. The majority of respondents (72%) have had primary schooling only, including attendance at a monastic school. Just 10% of respondents

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attended middle school and 11% attended high school. Five-percent (5%) attended university. Two-percent (2%) of respondents had no schooling and are illiterate.

Net enrolment rates[28] (NER) for primary and secondary school enrolment are presented in Table 4.23. The NER for the surveyed villages is roughly 20 percentage points lower than for the Region as a whole. The lowest NERs are in the 50% range; they are: *Thedawayi, Shwehlay, Yonebinyoe, and Mingalargone* villages. *Thedawayi* and *Shwehlay* are villages characterised by high dependency ratios and large families. In contrast, some of the villages characterised by low NERs also have low concentrations of small children (*Wardan, North Paungga, Yonebinyoe* and *Mingalargone*). A locational map of the primary and secondary school sites may show a lack of schools near these villages. This should be explored as these villages, with the exception of *Yonebinyoe*, are relatively better-off than other villages in the vicinity.

The main reason for children not attending school is the cost, in the form of direct costs and opportunity costs. When asked what the main reason for their child's (children's) non-school attendance, respondents report that they need their children's labour at home (42%) or they cannot afford to pay for the school fees, school uniform and shoes, and textbooks (54%). Less than 6% of respondents cite poor health, disability or school distance as the main reason for their child's non-school attendance.

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[28] The net enrolment rate (NER) in primary education (the ratio of primary school-aged children who are enrolled in primary school to the total population of primary school-aged children) in the Project region, Sagaing Region is 94.1%. There is little difference in boys' and girls' NER. IHCL 2009-2010. Integrated household living conditions survey in Myanmar: MDG Data Report. Ministry of National Planning and Economic Development. Cited in the Baseline Study – Social Impact report, Letpadaung Copper Mine Project, 2013.

Table 4.23: Net enrolment rates by village

Village Tract	Village Name	NER	Percent of households with children
Moegyobyin	North	97	74
	South	83	68
	Wardan	66	77
	North Paungga	61	91
	Central Paungga	92	77
	South Paungga	76	90
Dondaw	Dondaw	94	64
	Ywartha	94	67
Shwe Pan Khaing	Shwe Pan Khaing	62	83
	Telpinkan	80	79
	Thedawayi	50	93
Taungpalu	Taungpalu	80	68
	Kyawywa	62	91
Phaunggada	Phaunggada	92	91
	Kyaukpyudaing	84	80
	Zidaw/Sede	84	77
Letpadaung	Shwehlay	59	62
Ywarshay	Ywarshay	85	80
	Palaung	68	84
	Wetme (new)	94	50
	Kandaw	60	73
Ton	Ledi	68	87
Nyaungbingyi	Nyaungbingyi	61	69
	Yonebinyoe	55	78
	Mingalargone	50	64
Shwebo	Palaing	61	91
Average		**74**	**77**
Sagaing Region		**94**	

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Low educational attainment in the villages points to the need for MWMCL to commit to improving the access to education and its quality in its CSR Programme. This should be in the form of a concerted education programme tailored to the schooling needs of

the Township and in collaboration with Local and Regional government. Improving educational access in the *village-tract of Nyaungbingyi* is warranted.

4.10.14 Health

The Salingyi Township Health Department has the responsibility of providing comprehensive health care services in the area of health promotion, disease prevention, treatment and rehabilitation.

In 2012-13, the Township had two (2) government-run hospitals with a total capacity of 41 beds, 26 rural health care centres and six (6) clinics. The hospitals were located in Salingyi town and Kyadet. In total, 5,522 people were treated as in-patients or outpatients at the two (2) hospitals in 2012-13 and an additional 12,026 patients were treated by the 26 health care centres. One of the rural health clinics in Salingyi town delivered services for maternal and child health. None of the hospitals had a dedicated room for childbirth.

In 2012-13, the Township employed 81 medical staff and was seeking to fill 38 positions. The Township has only five credentialed (5) doctors, 12 nurses and four (4) health assistants. Consequently, the ratio of medical personnel to population is extremely low.

The main diseases in Salingyi Township are malaria, diarrhoea-related illnesses, tuberculosis, dysentery and hepatitis. In 2012, there were 366 reported cases of malaria, 847 cases of diarrhoea-related illnesses, 199 cases of tuberculosis resulting in eight (8) deaths, 315 cases of dysentery and 30 cases of hepatitis.

In addition to these public medical facilities, Mine Town has one (1) private hospital and one (1) private clinic. The Mine Town hospital provides medical care to the mine workers and to the communities located near the S&K mine and the Letpadaung Copper Mine. The hospital has 16 beds, an ultrasound facility, x-ray facility and a dental clinic. Four (4) medical doctors, one (1) dentist and six (6) nurses work at the hospital. Data show sharp annual declines in the number of in-patients and out-patients treated starting in 2008. The reason for the lower utilisation among residents is unknown as the mobile clinic began operation in 2012. The Mine Hospital nevertheless was, and continues to be, an important medical provider to the local communities.

Two doctors (2) employed by MWMCL administer to the health care needs of 40 villages near the Project area in a mobile clinic. Every month they travel to these villages on a regular basis and treat patients from their mobile vans which are specifically equipped for this purpose. Figure 4.11.9 shows the presentation of the most common diseases presented by the villagers from January to August 2013. It

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includes all of the villages in the social baseline survey with the exception of Mingalargone and Palaing (n=24), and an additional 16 villages,[29]a total of 40 villages.

Viral infections and hypertension are the most commonly presented conditions, followed by arthritis, gastric infections and skin complaints. Respiratory infections, eye and teeth problems, symptoms of vitamin deficiency and female reproductive conditions are presented less often. The total number of presentations is 10,298, averaging roughly 1,287 per month across the 24 surveyed villages.

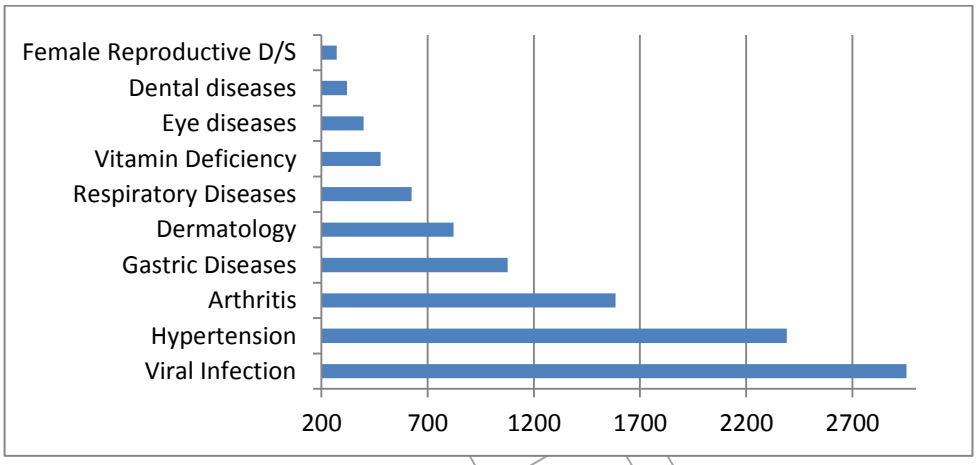


Figure 4.11.9: Common diseases presented in the mobile van visits to the villages

Assuming that there are no repeat visits to the mobile van for the same condition, it is possible to construct a proxy measure for the prevalence of diseases[30] in the villages where population data are available. Seven (7) villages stand out for having much higher presentations (per person) across all the disease categories. They are: *Ywartha, Wardan, Telpinkan, Shwe Pan Khaing, Shwehlay, North Paungga, and North Moegyobyin* (Appendix H – Table 1). *Dondaw, Thedawayi, Palaung, and Taungpalu* also report relatively high presentations of viral infections, hypertension and arthritis. Interestingly, most of these villages are located within the same village tract (*Moegyobyin, Dondaw, and Shwe Pan Khaing*).

Figure 4.11.10 shows the disease prevalence of the three (3) most common diseases presented in the villages (viral infection, hypertension and arthritis). Eighty-three percent (83%) of villagers in *Ywartha* presented viral infections to the mobile van doctors from January to August 2013. This appears to be an exceptional case as the

[29] They are Aungchansi, Aye Kone, Gondaw, Htan Taw (Ywarshay and YPY), Kangon, Kyae Sar Kya, Central Moe Gyo Pyin, Mya Yeik, Ngar Tae Su, Phaunggada (Central and North), Thar Yar Kone, Ton, and Yaekyipin.

[30] The prevalence of a disease is the proportion of the population that is affected by the disease at a specific time (http://celiacdisease.about.com/od/celiacdiseaseglossary/g/Prevalence.htm sighted 9 October 2013).

next set of villages with relatively high presentations of viral infections presented ½ that proportion, *Wardan* (42%), *Telpinkan* (32%) and *Dondaw* (31%). Still, prevalence estimates are notably high. Hypertension, thought to be the result of a poor diet, reached a high of 28% prevalence in *Telpinkan*, 26% in *Thedawayi* and 20% in *North Paungga*. *Ywartha* presented the highest prevalence of arthritis (25%), followed by *Telpinkan* (16%) and *North Paungga* (15%).

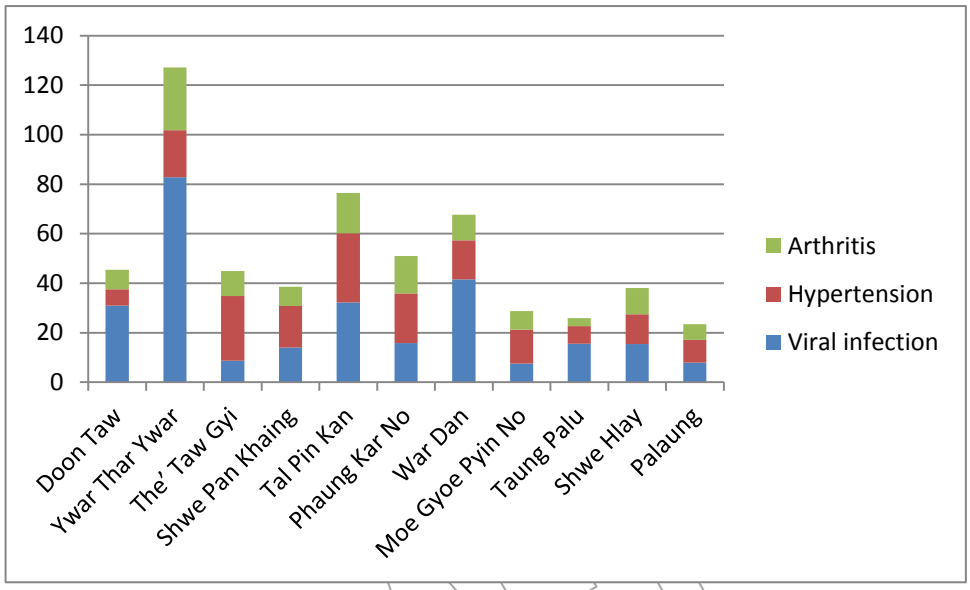


Figure 4.11.10: Disease prevalence in select villages near the Project Area, Jan - Aug 2013

During the next phase of the Project, a Community Health, Safety and Security Plan will be prepared which will address the common ailments identified in the community (refer to Section 9.6 for a summary of the SMP). It will also address the facilities available in the community and the pressure additional population generated by the Project will place on those resources. The plan should make concrete proposals regarding how shortcomings in the current facilities will be addressed by MWMCL. MWMCL has committed to progressively improving the health infrastructure in the villages surrounding the Project in the operational phase (refer to Section 11).

Potential health impacts arising from the Project's industrial activities require management. These have been identified elsewhere in this Report. They include: an increase in accidents and injuries resulting from increased road and river traffic, work place injuries and death, residents' and employees' exposure to hazardous chemicals leading to illness and/or death, an increase in respiratory illnesses associated with lengthy exposure to dust, headaches from exposure to strong light from work carried out at night and noise from blasting and heavy machinery.

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Additionally the changes to the landscape, ground water, and surface water may increase the number of disease-carrying organisms. The presence of standing pools of water in the operations phase will attract mosquitos and potentially spread malaria and bilharzia. If left untreated, unclean water can cause invasive skin infections and life-threatening diarrhoea.

The health impacts to workers and communities associated with the Project's industrial works have been addressed in the mitigation measures presented in Section 7. A summary of the water and sanitation infrastructure in the villages and associated recommendations for MWMCL is discussed below.

4.10.15 Electric power

Some of the villages are connected to the electricity network, while others, e.g. South, Central and North Moegyobyin have no access to electricity. However low income prohibits many of the communities supplied with electricity from using it. The villages with access to electricity are: Zidaw/Sede, Kandaw/Wetme, Taungpalu and Kyawywa. Those villages with likely access to electricity are: Palaing, Ywatha and Dondaw. It is assumed that the other villages located near the Project area are not connected to the electricity network.

4.10.16 Water Supply

Household water and drinking water is mainly sourced from the rain-fed weirs and shallow wells. Tube-wells are used to a smaller extent. Some villages like North, Central and South Paungga and North, Central and South Moegyobin depend on water that is captured in the Phaungga weir and in sub-earthen ponds near the villages. There are three (3) weirs located south of the Project site that collect water in the rainy season. Communities use the weirs for crop irrigation, drinking and bathing.

Approximately 11% of households have their own shallow wells, which they use for drinking and bathing in the rainy season. These wells are dry in the summer. Some shallow wells, such as those in Taungpalu, are not used due to local concerns that the water is contaminated with mineral deposits. Consequently, these villagers fetch water from nearby tube-wells, which stay full in the dry season.

The status of the water supply in the villages is not precisely known and more information is needed on the type of infrastructure and its utilisation is needed for all the communities near the Project. The villages whose respondents in the social baseline survey cited the most need for water improvements are*: North Paungga, Mingalargone, Kyawywa, and North Moegyobyin*. The other villages where

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approximately 15 to 20% of respondents mentioned water as a village need are: *Kandaw, Taungpalu, South Paugga, Telpinkan and Dondaw.*

4.10.17 Solid waste and waste water system

From a public health perspective, local communities are in need of improved sanitation facilities, e.g. fly-proof toilet systems. Through the provision of the mobile clinic, MWMCL is becoming more knowledgeable about the health status of the communities with a view to upgrade water and sewage systems that differentially impact on residents' health. Continuous health monitoring and efforts to increase public awareness in general hygiene alongside efforts to improve the quality of water and sanitation in the villages will be included in the Community Health, Safety and Security Plan. A related concern is the local propensity to scavenge from solid waste sites, which have both health and safety implications for the waste collectors. The Project waste site will be fenced off and signed to deter the waste collectors from entering it. In addition, the hazards of sorting through rubbish stored at designated dumping sites will be a topic in the Community Health, Safety and Security Plan and public awareness campaigns.

4.10.18 Social Problems Associated with Community Exposure to New Populations

Crime is low in Salingyi Township and generally confined to minor offenses, involving police actions, theft, and disorderly behaviour. From 2007 to 2012, there were six (6) murder convictions and eight (8) rape convictions[31]. There was no gang behaviour, kidnappings, robberies or prostitution prosecuted in the past five (5) years.

Compared to cities, villages situated near the Letpadaung Copper Mine are relatively pristine displaying a strong adherence to traditional values and behaviours associated with Theravada Buddhism. The population is relatively homogeneous, with little or no conflict present apart from the recent tensions associated with resettlement.

The presence of the Project in the Township is expected to have a number of impacts, positive and negative, upon the local communities. The source of the impacts is the exposure of the population to new people, new ideas, and more money. The villages in the Township are likely to undergo social and economic transformations in response to communities' exposure to attitudes and behaviours characteristic of modern urban societies and aided by regular wages earned at the Letpadaung Copper Mine.

Historically, large mining projects have attracted prostitutes due to the large concentration of single male employees who are hired from outside the area (Laite,

[31] Salingyi Township statistics.

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2009). Associated with prostitution is the spread of sexually transmitted infections (STI) and HIV/AIDs. The risk of becoming infected with HIV/AIDs or an STI is exacerbated by the presence of large numbers of workers, especially in the construction phase of the project.

Additionally, the communities' exposure to transient populations and new technologies, as they become more accessible from the presence of money, is likely to bring about changes in societal norms and values from traditional approaches to modern approaches. This may produce rifts between the older generation and the younger generation, and between men and women, who may adopt a different set of expectations and values from one another in response to new opportunities arising from employment and/or skills enhancement and almost certainly in response to large amounts of cash available as a result of wages and the lump sum compensation payments.

The changing composition of the villages brought about by the presence of new people may result disrupt existing social structures and create tension and conflict. New arrivals to the villages may not respect the traditional leaders and challenge their authority. Changes in the village social structure may have adverse economic and psychological impacts on the residents who do not support the new regime. It could also disturb the rapport created between the local communities and MWMCL.

The relocation and amalgamation of the four (4) villages into Zidaw/Sede and Kandaw/Wetme is likely to bring about the retirement of two (2) of the four 4) village leaders and a new set of societal hierarchies reflecting the size and composition of the amalgamated villages. It is inevitable that uncertainties arising from amalgamation and its associated effects on leadership structures and patterns of social interaction will produce a certain amount of tension in Zidaw/Sede and Kandaw/Wetme. It is expected that as the residents in the two (2) villages acclimate to their new surroundings and begin employment with MWMCL, any community tension induced by resettlement will attenuate.

4.10.19 Mitigation Measures

A compilation of measures are recommended to offset the social impacts arising from the communities' greater exposure to ideas, people and money.

- As part of the Community Health, Safety and Security Plan, the control of the spread of HIV/AIDS and STIs should be addressed in the training of employees, as well as the risks associated with the use of prostitutes. The concept of "safe sex" should be introduced as part of the employee induction package as well as

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in any controls the company may wish to place on staff accessing these services should they become available in the community;

- MWMCL, in collaboration with Government, will conduct an integrated community awareness plan;
- MWMCL will implement an In-Migration Management Plan which shall complement and/or include the following measures:
  - MWMCL will support the village elders in their efforts to control settlement of new arrivals. As noted earlier, the elders have the capacity to restrict opportunistic migration into the area through the use of their powers to refuse settlement and new builds;
  - Additionally, MWMCL has the capacity to control the in-migration of persons seeking employment in the Project area through its preferential employment of local people if their skill set matches that required by MWMCL or its contractors. Application of this requirement by contractors and sub-contractors can be enforced through contract specifications regarding employees;
  - MWMCL can further control long-term migration by only offering single accommodation to those employees who live outside Salingyi Township or Sagaing Region. Whilst this has some limitations with respect to gender balance in the area, it has the advantage of impeding moving whole families into the area and placing a load on public infrastructure and land available for housing. Accommodation camps will strictly enforce a code of conduct.
  - Given mining projects of this nature generally result in job creation ratios of 3 or 4 persons in indirect employment to those in direct employment, it is not unreasonable to expect that 8,000 indirect employment opportunities will be generated as a result of this Project. MWMCL has little opportunity to manage the filling of these positions directly. The development of indirect employment opportunities requires considerable land use planning to enable appropriate location of light industries and additional housing around the Project area. MWMCL can catalyse this process in the definition of local procurement and support service requirements early in the Project life; and
- In response to the potential for changing leadership structures occurring in the villages, MWMCL will liaison with the village elders who have the broad support of their respective communities. Resettlement-induced impacts on traditional leadership structures will be addressed in the RAP. Whilst MWMCL cannot

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influence the evolution of societal norms, it can support families in transitioning to a more modern lifestyle through economic-based incentives to raise the standard of living (e.g. employment, skills training and re-training, quality improvements to education) and Company-sponsored public awareness efforts.

4.10.20 Housing Quality and Living Space

Interviewed households residing near the Project area live in detached houses differentiated by the building material and the presence of a roof. Table 4.24 ranks the types of housing present in the villages in order of their quality, with brick houses being the best or most desirable houses and toddy palm houses being the worst or least desirable houses. There is a fairly even distribution of houses in the villages, except for brick houses and one-storey wooden house, which are less common. Fifty-six percent (56%) of the houses are made from plant materials (toddy palm or bamboo), the majority of which do not have a roof.

Table 4.24: Types of housing in the surveyed villages[32]

Type of house	Number	Percent
Brick walls and zinc roof	37	3.7
Two-storey wooden house with zinc roof	211	21.3
One-storey wooden house with zinc roof	94	9.5
Bamboo sheet house with zinc roof	179	18.0
Bamboo sheet house	174	17.5
Toddy palm house	297	29.9
Total	992	100

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Houses in the *Ton*[33] and *Dondaw Village-Tracts* have a concentration of houses made with plant materials. Eighty-six (86%) of houses in Ton and 71% in Dondaw are bamboo sheet houses and toddy palm houses. These houses are the least desirable because they provide inadequate shelter against rain and hot weather.

[32] The villages which were relocated at the time of the baseline survey are excluded from this analysis. They are: Kandaw, Wetme and Zidaw/Sede.
[33] The data refer to *Ledi*, the only village represented in the *Ton* Village Tract in the survey.

Table 4.25: A comparison of housing quality in the Village Tracts

Village Tract	Houses with zinc roofs		Houses without zinc roof	
	number	%	number	%
Moegyobyin	113	45.7	134	54.3
Dondaw	31	29.5	74	70.5
Shwe Pan Khaing	55	53.9	47	46.1
Taungpalu	34	58.6	24	41.4
Paunggada	58	76.3	18	23.7
Letpadaung	21	55.3	17	44.7
Ywarshay	69	48.3	74	51.7
Ton	2	14.3	12	85.7
Nyaungbingyi	65	52.4	59	47.6
Shwebo	17	58.6	12	41.4

Note: Chi-square is 51.65 at .05 significance, n=992.

Overcrowding is common in Asia and South-east Asia. Average per capita living space is reputedly 269 m^2 in China, 281 m^2 in South Korea, and 395 m^2 in Japan.[34] Among the villages in the social survey, average per capita living space is estimated to be 251 m^2, roughly eight (8) m^2 less than the average for China.

From Table 4.26, two (2) conclusions can be drawn. First, several villages stand out as having particularly overcrowded housing (less than 200 m^2 per capita). They are: *Dondaw, Shwe Pan Khaing and Taungpalu*.

Second, the distribution of living space per capita is narrow in many of the villages. This means that even the more spacious households are cramped. The villages characterised by a generally low level of per capita living space are: *South Paungga, Dondaw, Shwe Pan Khaing, Telpinkan, Thedawayi, Taungpalu, Kyawywa and Ledi.*

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[34](http://heartsofthegods.blogspot.com.au/2006/11/giant-american-houses-another-symptom.html sighted 7 October 2013).

Table 4.26: Per capita living space estimates by village (in m^2)

Village Tract	Village Name	Mean (in $m^{2)}$	Standard Error	Minimum (n)	Maximum (n)	N
Moegyobyin	North Moegyobyin	285.4	27.9	125.0	800.0	34
	South Moegyobyin	272.65	17.8	125.0	600.0	45
	Wardan	269.5	21.9	100.0	800.0	39
	North Paungga	245.1	14.5	100.0	600.0	63
	Central Paungga	273.8	28.4	111.1	1000	41
	South Paungga	217.6	20.3	76.9	500.0	27
Dondaw	Dondaw	196.5	16.4	83.3	600.0	44
	Ywartha	232.9	19.3	90.9	1200.0	60
Shwe Pan Khaing	Shwe Pan Khaing	195.7	12.7	83.3	450.0	55
	Telpinkan	234.1	11.0	125.0	360.0	40
	Thedawayi	228.0	29.8	71.4	600.0	21
Taungpalu	Taungpalu	197.7	18.6	90.9	500.0	37
	Kyawywa	203.2	16.1	76.9	500.0	33
Phaunggada	Phaunggada (South)	254.9	20.3	90.9	800.0	44
	Kyaukpyudaing	310.9	21.1	111.1	900.0	51
Letpadaung	Shwehlay	335.4	31.2	111.1	900.0	41
Ywarshay	Ywarshay	270.5	17.7	66.7	1200.0	88
	Palaung	236.2	18.3	83.3	900.0	84
Ton	Ledi	231.8	23.4	76.92	500.0	33
Nyaungbingyi	Nyaungbingyi	269.9	15.2	90.9	600.0	68
	Yonebinyoe	260.1	27.4	83.3	1000.0	49
	Mingalargone	304.3	44.3	142.9	600.0	13
Shwebo	Palaing	223.6	29.3	83.3	900.0	30
All villages		251.1		66.7	1200.0	932

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4.10.21 New Villages Constructed for the Relocated Villagers

A total of 441 houses made with wood and iron sheet roofs were constructed in the new villages of Zidaw/Sede and Kandaw/Wetme. MWMCL also built a monastery, pagoda, market, clinic, school, fire station and library to facilitate community development. Residents of Zidaw/Sede and Kandaw/Wetme mentioned in the community consultations that they were not satisfied with the quality of house construction, citing the poor quality wood used. They also mentioned water improvements, most notably, a drainage system as community priorities. MWMCL budgeted Ks 4.9 million (USD 50,360) for house renovations, including the installation of ammeters for electricity, a water supply system, etc. to address residents' housing and infrastructure concerns.

4.10.22 Living Standards

The standard of living is very low in Salingyi Township. The average income is less than USD500/annum (or 500,000 kyats), which is on par with the World Bank definition of extreme poverty.[35] According to the *Salingyi Township Gazetteer*[36], poverty has increased in recent years as a result of low farm yields affected by drought, irregular rainfall, disease, and pest interference. All of these factors combine to bring about low agricultural productivity, especially to crops requiring long growing periods. There has been a shift toward the harvesting of oil crops and other cash crops which take less time to grow, but quick and early ripening varieties require more intensive labour which limits the productive capacity of smaller households. In the past five (5) years, pests have become more invasive as a result of climatic changes and the arrival of new cash crops. Farmers in Salingyi Township attempt to control pests but are often unsuccessful as there is a lack of awareness of pesticide usage, often resulting in its misuse, and chemical fertilizers are expensive.

According to the *Salingyi Township Gazetteer*, environmental shocks have threatened the livelihoods of farmers in the Region with many operating at or near subsistence levels. The most vulnerable farm families are those who do not have relatives from whom they can borrow money or in-kind assistance or whose relatives are in equally dire circumstances.

The Government has implemented the Rural Credit Scheme which allows farmers to borrow money at concessional interest rates, however it is claimed that the amount of credit given is too low and farmers cannot cover their production costs and repay the loan. Farmers with small land holdings are less able to benefit from the Rural Credit Scheme as the amount of credit is given in proportion to the number of acres utilised. Low access to formal credit has given rise to tenure insecurity, as farmers are forced to transfer their land use rights when they borrow money from money lenders. In many instances, they have no means to repay the loan and consequently lose their land.

Reported income in the surveyed villages suggests that the standard of living is lower in the communities near the Project area than in the Township as a whole. The average household earns between Ks 50,000 to 100,000 each month, between USD

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[35] The World Bank defines extreme poverty as persons consuming less than 1.25 USD per day (http://data.worldbank.org/topic/poverty sighted 9 October 2013).
[36] The information from the Gazetteer came from 2012-13, but the precise date of publication is unknown as only an English translation of the article (or cummulation of articles) was available.

52 to 103[37]. Roughly 30% of households report an average monthly income somewhere between USD 10 and 52, or between 33 cents and USD1.70 per day. As this money is spread across an average of six (6) household members, these households can be considered to be extremely poor by the World Bank definition of USD 1.25 per person per day.

Table 4.27: Reported household income among surveyed households

	Number	Percent
10,000 to 49,999 kyats	290	29.3
50,000 to 99,999 kyats	479	48.3
100,000 to 149,999 kyats	155	15.6
150,000 kyats and over	67	6.8

Monthly per capita income is very low in the Project area, ranging from 2,308 kyats (2.38 USD) to 75,000 (77.40 USD). The mean per capita monthly income is 14,914 kyats (15.40 USD) and the median is 12,500 kyats (12.90 USD). These results indicate that individuals living in the villages near the Project area live on less than 50 cents a day on average. An overwhelming 96% of respondents live in extreme poverty, on less than 1.25 USD a day.

When an entire population is deemed poor by an absolute poverty measure, a relative poverty measure is commonly used to distinguish the poor from the non-poor in a community. In this analysis, households reporting a monthly per capita income of less than Ks 6,819 (USD 7.03) are considered to be poor (those housholds with incomes in the bottom income quartile). These 166 households (16.8 %) represent the poorest households in the surveyed villages.

North Moegyobyin, Yonebinyoe and Dondaw have a concentration of the poorest households representing between 30 to 34 % of all households in their respective villages (Table 4.28). Twenty-eight percent (28%) of households are extremely poor in *Kyawywa*. Villages with zero or few households in the bottom income quartile are the four (4) that had been relocated *(Zidaw/Sede, Kandaw, Wetme*) and *Wardan* and *Kyaukpyudaing*

[37] http://www.xe.com/currencyconverter/convert/?Amount=150000&From=MMK&To=USD. 9 October 2013. The market exchange rate is Ks 969 to 1 USD.

Table 4.28: Villages with the poorest households

Village Tract	Village Name	Number of the poorest households	Percent	Total N
Moegyobyin	North Moegyobyin	10	30.3	33
	South Moegyobyin	9	20.9	45
	Wardan	1	2.6	39
	North Paungga	4	9.8	63
	Central Paungga	8	24.2	41
	South Paungga	2	8.3	27
Dondaw	Dondaw	13	29.5	44
	Ywartha	9	16.1	60
Shwe Pan Khaing	Shwe Pan Khaing	10	19.6	55
	Telpinkan	35	14.0	40
	Thedawayi	5	23.8	21
Taungpalu	Taungpalu	4	12.1	37
	Kyawywa	7	28.0	33
Paunggada	Phaunggada (South)	4	9.8	44
	Kyaukpyudaing	1	2.2	51
	Zidaw/Sede	0	0.0	19
Letpadaung	Shwehlay	8	20.5	41
Ywarshay	Ywarshay	8	10.0	88
	Palaung	10	12.7	84
	Kandaw	0	0.0	24
	Wetme	0	0.0	12
Ton	Ledi	3	20.0	33
Nyaungbingyi	Nyaungbingyi	13	22.4	68
	Yonebinyoe	15	34.9	49
	Mingalargone	0	0.0	13
Shwebo	Palaing	7	25.0	30

Note: Chi-square is 74.1 at .05 level of significance, n=1071.

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4.10.23 Project Impacts on Living Standards

The Project is expected to increase living standards in the Sagaing Region through revenue and employment generation and investments in the community and social infrastructure at the village level. Whilst many of these benefits will have a direct impact on communities, especially on the households with members working at MWMCL and those communities in receipt of new water supply and sanitation systems, electricity, and served by the mobile health clinic, many of the benefits to communities may not reach the poorest and most vulnerable families without targeted assistance. It is recommended that MWMCL identify the poorest families in the community catchment

area with a view to providing them with in-kind and other assistance in times of crisis. The social baseline has alerted MWMCL and its stakeholders to the fact that the villages are extremely poor by international standards and live precariously on the margins of subsistence. It is likely that many Project-affected families will go hungry unless provided with targeted food security measures, such as in-kind resettlement assistance in the period prior to employment at MWMCL.

To improve living standards in the Project communities, access to low-interest microcredit and other financial instruments, such as pooled risk credit arrangements are needed. Low interest credit should be supplemented by capacity building projects to assist farmers in crop diversification, pesticide management and advanced farming techniques to increase productivity. Residents also require new skills to enable them to move away from farm-based employment towards other economic sectors where the income-earning opportunities are greater. They also require life-long skills to help them become more self-sufficient and less vulnerable to economic downturns and environmental shocks.

4.10.24 Multi-dimensional Poverty

The socio-economic baseline results presented in this Section indicate that some of the villages and village-tracts near the Project Area are poor across multiple dimensions. Households in a subset of the surveyed villages experience one or more combinations of poverty, including low income, lack of modern sanitation facilities, inadequate water supply or electricity supply, inadequate housing conditions, etc.

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It is often the case that a household's attributes, the educational status of its main wage earners, its sources of livelihood, its family structure, can influence the type of poverty the household experiences. Families with high numbers of young children, for instance, may have difficulty feeding themselves because child care responsibilities restrict the number of members available for wage work. Poverty, caused and/or exacerbated by the presence of young children in the household, prohibits older school-aged siblings from attending school as they are needed for wage work or child care, farm work and other household duties.

Among the 24 villages represented in the baseline, *Dondaw* stands out as having the highest number of poverty dimensions factors relative to the other villages in the study (Table 4.29)[38]. Dondaw is poor across four (4) dimensions: compared to the other

[38] As the majority of villages do not appear to have electricity, while an important requirement in modern daily life, its absence in a village does not differentiate the households in that village from other households in other villages.

communities, its residents are impoverished, face severe water supply constraints, and live in crowded conditions in houses that do not provide shelter against the elements.

After Dondaw, the next set of villages that can be classified as poor across three (3) dimensions when compared to the other villages in the study is: *North Moegyobin, Kwawya, South Paungga, Telpinkan and Thedawayi.* They are poor in the following ways:

- North Moegyobin residents have no direct assess to water and they are impoverished and often in ill health;
- Like Dondaw, residents of Kwawya are poor, live in crowded housing and have an inadequate supply of water;
- South Paungga residents lack available water, live in crowded housing, and have a large presence of young families;
- Telpinkan village is characterised by a concentration of young families, cramped housing conditions and poor health (and possibly, nutrition) status; and
- Thedawayi village has a high dependency burden, low school attendance and crowded housing conditions.

Finally, the following seven (7) villages have two (2) dimensions of poverty compared to the other villages the study. They are: *Ledi, Mingalargone, North Paungga, South Moegyobyin, Shwe Pan Khaing, Shwehlay and Yonebinyoe.*

- Ledi residents have too few breadwinners relative to dependents and live in cramped conditions;
- Mingalargone residents has inadequate water provision and the lowest school enrolment amongst all the villages;
- North Paungga residents lack adequate water provision and have low health status;
- South Moegyobyin has a preponderance of young families and low access to water;
- Similar to Telpinkan, which is located in the same village-tract, Shwe Pan Khaing residents have poor health/nutritional status and live in crowded conditions;
- Similar to Thedawayi village, which is located in the same village-tract, Shwehlay village has a high dependency burden and low school attendance; and

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- Yonebinyoe residents are (income) poor and like Mingalargone, roughly ½ of its school-aged children do not attend school.

Table 4.29: Dimensions of poverty in the surrounding villages.

	High dependency ratio	Young families	Low school attendance	Poor health	Lack of water	Crowded housing	Low income	Houses with inadequate shelter
Dondaw					x	x	x	x
Kyawywa					x	x	x	
Ledi	x					x		
Mingalargon			x		x			
N Moegyobin				x	x		x	
N Paungga				x	x			
S Moegyobin		x			x			
S Paungga		x			x	x		
Shwe Pan Khaing				x		x		
Shwehlay	x		x					
Taungpalu					x	x		
Telpinkan		x		x		x		
Thedawayi	x		x			x		
Yonebinyoe			x				x	

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From the analysis, one may conclude that the standard of living broadly defined is the lowest in the *village-tracts of Dondaw, Moegyobyin and Shwe Pan Khaing.* These village-tracts have a relatively higher incidence of poor and extremely poor households, are poorly equipped with basic infrastructure, and have a concentration of houses that do not provide adequate shelter and are severely overcrowded. It is possible that these factors contribute to the high number of disease presentations (relative to population) in these village-tracts.

Also of concern is the *village-tract of Nyaungbingyi,* which has the lowest net primary school enrolment rates in the surveyed villages near the Project site. One-half of school-aged children only attend school in Mingalargone and Yonebinyoe.

4.10.25 The Poorest Villages

Households can be characterised by the depth of poverty they experience. The villages found in the social baseline as having the most severe poverty outcomes are summarised below.[39]

39 Dependency ratios are the highest in Shwehlay, Ledi and Thedawayi villages. The working members of these families are apt to experience significant stress in providing for all of its members. While the standard of living is by no means high in these villages, high dependency ratios have not appeared to impact on these households' poverty status. Similarly, South Paugga has a relatively high percentage of families with young children (59%, which does not seem to have any poverty impacts.

- The poorest households, as measured by reported income, are located in North *Moegyobyin village, Yonebinyoe village and Dondaw village.* These households are possibly living below subsistence; and
- Households in *Dondaw* village have the worst housing conditions. Lack of adequate shelter and overcrowding may contribute to the exceptionally low health status among village residents.

The information presented in this Section and in the preceding Section can be used to target a portion of the Project-sponsored community investments as part of its Corporate and Social Responsibility Programme. As mentioned in Section 4.10.3, a thorough examination of the critically poor households is required and can be included in a poverty profile that is based on more rigorous data collection.

4.10.26 Social Impacts from Closure

The closure of the Letpadaung Copper Mine will likely have adverse employment and environmental impacts on local communities. It is difficult to anticipate all of the social impacts to occur in 30 years' time and unfortunately most of the mitigation measures proposed today to manage mine closure impacts are inadequate. The closure of a mine invariably results in the loss of jobs to workers and to local suppliers of goods and support services. Upon closure, towns where the mine was the largest employer or the only employer empty overnight as residents leave in search of better opportunities. The remaining residents are left to cope on their own with little or no access to local services, e.g. jobs, stores, schools, libraries, etc.

Given the often devastating impacts on households and communities occurring at mine closure, it is recommended that the Letpadaung Copper Mine develop an exit strategy in conjunction with the Mine Closure Plan early on, in the operational phase. The exit strategy should endeavour to raise the development of Salingyi Township and villages to a level of self-sufficiency, whereby the transition from mine to non-mine work is facilitated amongst former Mine employees and residents who wish to remain in the local vicinity, and whereby the transfer of Mine employees to other mines still operating in the area is supported. In this way, the villages in the Township would continue to function well after the Letpadaung Copper Mine closes.

Training programmes and other capacity-building programmes sponsored by MWMCL and the Government during the 30 years of Mine operation should be developed in conjunction with the Mine Closure Plan. MWMCL's responsibility for maintaining the community and social infrastructure in the villages needs to be gradually phased out in the operations phase and turned over to the communities and Local Government. This

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will help ensure that the investments will be sustained long after the Letpadaung Mine closes. Finally, efforts to develop the governance capacity of local government are required in the operational phase to facilitate and maximise the potential for business development and job creation, and to provide government with the tools to effectively govern after mine decommissioning.

In the mine closure planning process, it may be the case that some of the land areas used for the Project will require specific attention. There is the possibility that the rehabilitated WRD and HLPs will be unsuitable for grazing and other uses by the local community as a result of damage the capping system by people and livestock. A recommendation made from the social baseline study was to revegetate the water shed areas, such as *Khamauk-taung, Kyadwin-taung, Hninsi-taung and Phowuntaung* among others and turn them into protected areas.

In development of the Mine Closure Plan, the local community shall be consulted to agree to a suitable end land use for the landforms situated within the current site. The Mine Closure Plan will take into account these community agreements and a cost provision will be made for implementing the end land use rehabilitations.

4.10.27 Noise

Ten (10) noise stations were sampled during the dry and wet seasons of 2013, whose locations are shown at Figure 4.10.3. Noise equivalent values have been determined per period (daytime and night-time). Consequently, during the dry season, noise levels for the daytime period varied between 41.3 and 46.6 dB(A), while they varied between 41.5 and 46.3 dB(A) for the night-time period. It is important to point out that, except for the value determined for Station 3 during the night-time period, the remaining recorded values do not exceed international noise standards established by the IFC (2007).

On the other hand, values exceeding IFC standards were recorded during the wet season. These values range from 59.9 to 85.5 dB (A) during the daytime period, and from 66.7 to 74.6 dB(A) during the night-time period. These results are likely the result of rain incident on roofs and surrounding structures as well as the increased activity within the villages associated with the planting of crops and collection of seasonal plant materials.

The criterion considered for assessing the results obtained at sampling stations close to vehicle traffic and built-up areas was the one established by the OECD (Organisation for Economic Cooperation and Development). This standard considers a value below 65 dB(A) to be an acceptable noise level for the daytime period, and a value below 55 dB(A) to be acceptable for the night-time period.

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Furthermore, the samplings also provided measurement results for meteorological parameters, which are shown in Table 4.30.

Table 4.30: Meteorological conditions during noise quality sampling

Season (2013)	Station	Parameters			
		Temperature ºC	Relative humidity (%)	Wind speed (m/s)	Wind direction
Dry	1	29-31	41-63	2.5-3.3	167 (S)
	2	29-31	40-64	2.6-3.5	178 (S)
	3	26-42	41-63	2.5-3.4	158 (S)
	4	25-42	41-63	2.4-3.8	169 (S)
	5	26-45	41-60	2.8-3.9	175 (S)
	6	23-40	40-61	2.3-3.5	164 (S)
	7	23-38	40-65	2.3-3.5	165 (S)
	8	23-37	40-68	2.3-3.5	172 (S)
	9	23-41	40-66	2.5-3.6	164 (S)
	10	24-41	41-67	2.6-3.8	172 (S)
Wet	1	29.9-30.4	36-93	0.5-3.3	177 (S)
	2	30.4-31.1	40-91	0.6-3.5	174 (S)
	3	34.8-41.7	41-83	0.5-3.4	168 (S)
	4	34.8-41.9	41-83	0.4-3.8	175 (S)
	5	34.8-42.4	41-90	0.8-3.9	176 (S)
	6	35.8-44.6	40-81	0.3-3.5	168 (S)
	7	37.6-39.4	40-85	0.3-3.5	167 (S)
	8	35.3-37.8	40-90	0.3-3.5	173 (S)
	9	35.1-36.9	40-96	0.5-3.6	166 (S)
	10	37.4-41	41-87	0.6-3.8	177 (S)

Source: Data provided by EMC

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From a community health perspective, noise associated with mining operations (as with other noise sources) is known to disturb areas around the source of noise generation. It is particularly significant where noise disturbance is associated with schools, hospitals, places of worship and nearby households. Noise disturbance is most intrusive at night when people are sleeping and background noise levels are low.

A common standard is that any increase in noise levels which is 3dB(A) above the existing background level is likely to disturb people at the receptor point whilst the background noise level varies dependent on the time of day that it occurs. Typically noise levels in town areas are likely to be 60-65 dB(A) during the day and 45-50 dB(A) during the night. In rural settings the levels may be 5-10 dB(A) less depending on season.

There is no current background noise data available to determine how significant the noise generated by the mining, crushing, stacking and processing is likely to be and

what management actions will be necessary to make it acceptable. In the next phase of the project, background noise levels will be determined by field sampling and modelling will be conducted to determine the areas where noise disturbance levels will exceed accepted levels based on a range of global guidelines.

A noise management plan will then be incorporated into the ESIA if required.

4.10.28 Vibration

The background vibration levels at Letpadaung were recorded for dry season and wet season comparison as shown in Table 4.31 and Table 4.32. The locations selected were ten villages located around the boundary of the Letpadaung site.

Table 4.31: Vibration levels recorded during the Hot-Dry Seasons

Vibration (mm/s)	Mean	MAX	MIN
Station 1	0.371	1.4	0
Station 2	0.510	3	0.1
Station 3	1.383	4.8	0.4
Station 4	0.298	0.8	0.1
Station 5	0.229	1.2	0.1
Station 6	0.958	4.5	0.2
Station 7	0.360	1.5	0
Station 8	0.329	1.4	0.1
Station 9	0.279	1.3	0.1
Station 10	0.233	1.1	0.1

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Table 4.32: Vibration levels recorded during the Wet Season

Vibration (mm/s)	Mean	MAX	MIN
Station 1	0.360	1.5	0
Station 2	0.515	3	0.1
Station 3	1.410	5.9	0.4
Station 4	0.294	0.7	0.1
Station 5	0.225	1.2	0.1
Station 6	0.990	4.5	0.2
Station 7	0.373	1.5	0
Station 8	0.338	1.5	0.1
Station 9	0.271	1.2	0.1
Station 10	0.223	1.2	0.1

The mean vibration levels recorded are all below a recommended peak particle velocity (PPV) of 5 mm/sec. However, three maximum PPV readings approached that value and one reading exceeded the recommended maximum value. These values were recorded over the period of a blast being completed at the Kysintaung Mine at the S&K operation.

Values exceeding a PPV of 2 mm/sec are known to elicit a response from humans sensitive to vibration and it is likely that persons in the vicinity of Letpadaung would respond to the peak readings observed here.

4.10.29 Mitigation of Potentially Adverse Noise and Vibration Impacts

Proposed mitigation measures to protect sensitive receptors from noise and vibration include:

- Schedule waste dumping away from sensitive receptors during night-time operations;
- Limit the extent of other noisy activities, as far as possible, during night-time operations;
- Monitoring of noise levels near sensitive receptors;
- Install acoustic barriers to reduce noise in sensitive areas;
- Management of blasting (timing/magnitude); and
- Notification of receptors regarding blast times.

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4.10.30 Visual Amenity

Letpadaung Hill is a series of hills on the flood plain of the Chindwin River that rise about 300 m above the surrounding lowlands. The hills provide a viewscape from them which covers the surrounding villages and town including across the River to Monywa some 4 km to the east. From the hills many stupa are visible on the surrounding hills and activities on the plains below can be observed.

On the plains the hills are a prominent landmark and a feature within the overall landscape. Their rise above the plain provides a relief from the constrained viewscape created by the flatness of the plain. The vegetation and slopes on the hill also provide a visual diversity that is not generally accommodated by other local visual opportunities due to their scale and diversity of steepness amongst the slopes.

The valley running through the hills is not typical of the surrounding hills and, as a consequence, these hills provide a visually unique experience in this area.

Any adverse impacts to the visual amenity will be mitigated by the following activities:

- Construction area and mine site to be kept tidy;
- Clearing of vegetation around the site will be minimised;
- Revegetation of disturbed areas will be carried out progressively and as soon as practicable; and
- Landscape planting strategy will be adopted to identify appropriate revegetation to act as a visual barrier.

4.10.31 Traffic and Transport

The current level of heavy vehicles using the local road network appears quite low. It is envisaged that during construction and operation up to 20 heavy vehicle movements may occur on a daily basis to carry loads from barge landings on the Yamar Stream during the wet season and the Chindwin River at Pakokku during the dry seasons.

It is also proposed that convoys of vehicles will bring supplies of explosives to site from China at least twice yearly.

EMC has undertaken a survey of the traffic at the key intersections expected to be impacted from the Letpadaung Copper project for Myanmar Wanbao Mining Copper Limited. The survey was undertaken in three campaigns over the period from September 2012 until late June 2013 to enable the influence of season to be established with respect to traffic volumes and traffic types.

The survey was undertaken at 11 fixed locations and included recording not only the total traffic volume, but divided the traffic into 5 types: Heavy Truck, Light Truck, Passenger Bus, Passenger Car or Motorcycle. The results are shown in Table 4.33.

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Table 4.33: Survey data

Sr. No.	Survey Location Name	Season		
		Cool-Dry (Oct-Feb)	Hot-dry (Mar-May)	Wet (Jun-Sep)
1	Mine haul road intersection	2035	3925	1587
2	Road intersection1 (Salingyi)	323	343	277
3	Road intersection2 (Salingyi)	359	396	354
4	Road intersection (Kyadet)	936	1036	502
5	Road intersection (Lingadaw)	961	826	716
6	Road intersection (Yesago)	2583	2583	2301
7	Fuel landing point (Pakokku)	3098	2164	4979
8	Highway intersection (fuel landing point)	8958	8509	3961
9	Highway intersection (Pakokku Bridge)	6952	6328	6334
10	Let Pan Chay Paw (Pakokku)	2641	2832	1922
11	Barge landing site on Chindwin River	1917	2339	1053

The potential for adverse traffic-related impacts is high in the construction and operational phases of the Project. SMPs have been developed for the management of road traffic and river traffic (Section 9.7.1 and Section 9.7.2).

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5. PROJECT DESCRIPTION

This section describes the various aspects of construction and operation of the Letpadaung copper mining project. A simplified flowchart of the mining and processing sequence is shown at Figure 5.0.1. The construction phase will focus on the development of the facilities to enable mining and processing to be carried out successfully.

5.1 DESCRIPTION OF THE ORE BODY

The Letpadaung deposit is a concealed deposit beneath two hills and their valley. The deposit is gold-ingot-shaped and essentially horizontal with a flat top, trending north-west and approximately 2,200 m long and 1,400 m wide. The average thickness of the orebody is about 140 m and the average copper grade is 0.37 %.

There is a 10-200 m thick leaching zone between the ore body and the surface. Under the leaching zone is a layer of secondary enrichment zone at the thickness of several metres to dozens of metres which is the high grade ore section and concentrated in the valley between two hill tops. Beneath the secondary enrichment zone is a mixed belt composed of primary and secondary sulphide, silicate and sulphate minerals. Further downward is a primary zone consisting of andesite porphyry and dacite porphyry. There is no clear boundary between each pair of zones.

Due to secondary leaching of the deposit, part of the secondary ores under the leaching cap contains mud. Categorisation is made based on clay content:

- High clay ores (clay content >15%) account for three (3) %;
- Medium clay ores (clay content between 10% and 15%) account for four (4) %; and
- Low clay ores (clay content 0%-10%) account for 93%.

Generally speaking, clay content is not high and far lower than that of the Sabetaung deposit.

5.2 CONSTRUCTION

Construction works for Letpadaung will be split into five (5) sections to phase the works accordingly. Works are to run partially concurrently and generally split to construct and install specific infrastructure for ore production and mine operation. The works are in addition to the works undertaken by the Mining Contractor in stripping of the Letpadaung Pit and removal of waste rock overburden to the designated waste rock dump areas.

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Table 5.1: Construction phases

Outline Tasks	Duration
<u>Mine Infrastructure</u> • 33 kV and 10 kV substations • Semi Portable Crusher • Conveyors • Intermediate Ore Stack • Fresher Water Supply • Associated Infrastructure including, - Office buildings - Warehouses - Fuelling Station - Road Works	466 days
<u>Heap Leach Pads and Infrastructure</u> • Heap Leach Pad #1 (HLP1)Blocks 1 – 10 • Heap Leach Pad #2 (HLP2) Blocks 1 – 10 • Solution Pond for HLP1 and channel for blocks 1 – 10 • Solution Pond for HLP2 and channel for blocks 1 – 10 • Raffinate Pond • Pregnant leach Solution Pond • Flood Storage Pond • Heap Leach Pad 33 kV Substation • Associated Road Works	691 days
<u>Plant Site and Infrastructure</u> • SX – EW Plant • Solvent oil Warehouse • Sulphuric Acid Storage • Diesel Generator • Cooling Tower • Air Compression Station • Boiler House • Metallurgical Office and Laboratory • Associated Piping and power supply • Crushing Plant	420 days
<u>Power Supply</u> • 230 KV Step-sown substation • 230 kV overhead power lines • 33 kV and 10 kV Substations • 33 kV and 10 kV overhead power lines	228 days
<u>Wastewater Treatment</u> • Wastewater treatment pond North • Wastewater treatment pond South	300 days

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Construction works are due to commence in October 2013 with the completion of each section phased to allow for mine operations to commence in early 2015. Construction works are estimated to be complete in Quarter 4 2015.

5.3 CONSTRUCTION TASKS

As described in Section 5.2, the construction works will be split into 5 sections to phase and construct the works accordingly. These works will be undertaken partly concurrently by separate contractors in order to construct key infrastructure required to ensure the mine in operational by Quarter 4 2015. An overview of the key construction zones is provided in Figure 5.3.1 and described in further detail in the following sections.

5.3.1 Mine Infrastructure

These works are primarily associated with the initial infrastructure required for the ore processing works including power supply, portable crushers, conveyors, water supply, office facilities and road works.

5.3.1.1 Mine Site

The construction works for the mine site are intended to commence in October 2013 with an estimated duration of 435 days.

The major works included are the excavation and earthworks associated with the semi-portable crushing station and foundations as well as the crushing equipment itself, foundations and structural works for primary belt conveyor systems. Also included is the construction of structural pads only for the 33 kV substations and 10 kV distribution room.

5.3.1.2 Belt Conveyor System for Heap Leach Pads

These works include all civil, structural, mechanical and electrical works involved in five number belt conveyors servicing the heap leach pads (HLPs). The works for each conveyor will be undertaken concurrently, commencing in early 2014 with an estimated duration of 235 days.

5.3.1.3 Stacking Conveyor Systems for Heap Leach Pads

The works comprise the civil, structural, mechanical and electrical works for installing the mobile stacking conveyors and portable belt conveyors for both HLPs #1 and #2. The works for HLP1 are planned to commence in Quarter 2 2014 approximately 10 weeks before HLP2, with a total construction duration for the two systems of approximately 191 days.

5.3.1.4 Auxiliary Facilities

Also included within the mine infrastructure works are numerous auxiliary works associated with the ore processing. These include civil, structural and installation works for maintenance facilities, the fuelling station, metals warehouse and a diesel generator. Also included is the fresh water supply system as well as the construction

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and surfacing of the main access road from the western site boundary to the ore processing site. Construction works associated with these auxiliary facilities are expected to commence in October 2013 with a duration of 350 days.

Construction equipment involved in these activities would vary depending on the tasks involved. However, the civil works equipment would include a fleet of at least 4 medium sized excavators (greater than 24T), 2 large bulldozers, numerous earthmoving trucks as well as graders, rollers and water carts for levelling and compacting. Some cranage will also be required for the structural elements.

Details of the construction personnel and materials are provided in Sections 5.4 and 5.7 respectively.

The mine infrastructure works are expected to be completed in Quarter 4 2014 which includes the commissioning of the whole system.

5.3.2 Heap Leach Pads and Infrastructure

These works incorporate the construction of the eastern blocks of HLP1 and HLP2 as well as the solution pond and associated channel for the constructed HLP blocks. Also included is the construction of the roads associated with the HLPs, raffinate pond, pregnant solution pond and flood pond for HLP1 and HLP2 as well as the civil works for the 33 kV substation associated with these works.

5.3.2.1 HLP1 and HLP2

The construction of the numerous aspects of the eastern blocks (Blocks 1 to 10) of HLP1 and HLP2 will involve bulk earthworks and detailed construction of various earthworks layers to creating a suitable heap leach pad, as well as the associated works for the channels and solution ponds for each pad. The works, following the recovery and storage of vegetation, topsoil and sub-soil, can be summarised as follows:

- Bulk earthworks (cut and fill) to engineer the existing ground to provide the required pad with surface slopes to enable gravity flow of leachate from the HLPs to the solution channels;
- Import, placement and compaction of a low permeability clay layer above the pad to reduce the potential for fluid ingress to the natural environment;
- Bulk earthworks for the solution ponds, foundation preparation and placement of low permeability clay layer;
- Installation of a synthetic smooth geomembrane (HDPE) above the clay layer for heap leach pads and pond;

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- Import and placement of a fine grained soil (sand) protective layer over the membrane on the pads;
- Placement of an underdrainage network of pipes, enveloped in gravel together with a drainage layer of selected gravel over the heap leach pad protective layer;
- Placement of mine rock over the underdrainage layer;
- Installation of W-drains solution channels for constructed heap leach pad blocks; and
- Fencing of ponds.

The works will be phased with works associated with each of the construction stages described above undertaken in the following order:

1. HLP1 Blocks 1 and 2
2. HLP2 Blocks 1 and 2
3. HLP1 Blocks 3, 4 and 5.
4. HLP1 Blocks 6 to 10, and, HLP2 Blocks 3, 4 and 5
5. HLP2 Blocks 6 to 10.

The works to the solution ponds and solution channels will be undertaken in conjunction with the works to the pads as indicated above.

Works to the first area will commence in October 2013 with a total duration for the whole works of approximately 686 days.

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5.3.2.2 Road Construction

This work involves the construction of the access roads both to and around HLP1 and HLP2. The works involve the vegetation and growth medium recovery along the road alignments and the construction of the road pavement and associated surface seal.

Works will commence for the roads in October 2013 with a total duration of 350 days. The works will be phased so that the road pavement is complete in Quarter 2 2014 to allow for construction access prior to the completion of the sealing works in Quarter 4 2014.

5.3.2.3 Raffinate and Pregnant Leach Solution Pond

The works for the raffinate pond and pregnant leach solution (PLS) pond involve similar works to that of solution ponds described with the heap leach pads above. The works, following the recovery of vegetation and growth medium, can be summarised as follows:

- Bulk excavation works and embankment construction to form the pond shapes;

- Trenching and installation of groundwater drainage system to collect and discharge groundwater flows below the ponds;
- Import, placement and compaction of a low permeability clay layer to reduce the potential for fluid ingress to the natural environment;
- Installation of a two layer synthetic smooth geomembrane (HDPE) above the clay layer for both ponds;
- Installation of monitoring equipment and piping etc.; and
- Fencing of the ponds.

The construction of each pond should require a duration of approximately 140 days with works commencing in early 2014.

5.3.2.4 Heap leach Storm Water Pond

The construction of the heap leach storm water pond will be undertaken in sections to provide adequate storage as the works progress. The works involved, following the recovery and storage of vegetation and growth medium, are summarised below:

- Bulk excavation works and embankment construction to form the pond shape;
- Trenching and installation of groundwater drainage system to collect and discharge groundwater flows below the pond;
- Import, placement and compaction of a low permeability clay layer to reduce the potential for fluid ingress to the natural environment;
- Installation of a synthetic smooth geomembrane (HDPE) above the clay layer; and
- Installation of monitor wells and fencing.

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Construction works will commence in early 2014 with the pond split into four (4) sections. The works will be phased so that the first section is completed in Quarter 3 2014 with the final section completed in Quarter 3 2015.

5.3.2.5 Auxiliary Facilities

Also included within the HLP and infrastructure works is the construction of structural pads only for the 33 kV substations associated with the HLP area. These works will commence in October 2013 and are due for completion in March 2014.

The majority of the tasks required for the construction of the HLPs and associated infrastructure require similar equipment. As the majority of these tasks will be completed in parallel it will require a larger fleet of equipment. As this is also the largest area of works it is envisaged that a fleet of at least 8 medium to large sized excavators, 8 large bulldozers, up to 50 earthmoving trucks as well as graders, rollers and water carts for levelling and compacting.

Details of the construction personnel and materials are provided in Sections 5.4 and 5.7 respectively.

The HLP and infrastructure works are expected to be completed in Quarter 3 2015.

5.3.3 Plant Site and Infrastructure

Works in this section include the construction and install of the solvent extraction and electrowinning (SX-EW) plant as well as the associated infrastructure and auxiliary features. Also included in these works are the civil works for the step-down Substation and the construction and install of the crushing plant.

5.3.3.1 SX-EW Plant

The construction works for SX-EW plant are intended to commence in October 2013 with an estimated duration of 420 days.

The major works included are the excavation and earthworks to provide the construction pad. Works also include the construction of the foundation structures and the install of all structural equipment as well as the construction of cranes to facilitate the work.

5.3.3.2 Auxiliary Facilities

These works include the civil, structural and mechanical works associated with the support facilities for the SX-EW Plant. Included are the works for the following facilities:

- Solvent oil and sulphuric acid storage;
- Diesel generator station;
- Cooling tower ;
- Air compressor station;
- Fire station;
- 33 kV substation and 10 kV distribution room;
- Boiler Room;
- Metallurgical laboratory and offices; and
- Associated pipe networks and power supply.

Works to construct and install the above facilities are expected to commence in November 2013 with a construction duration of approximately 1 year.

5.3.3.3 Step-down Substation

Construction of the 230 kV step-down substation includes the civil works for the structural pads for all aspects of the substation as well as the construction of the structural elements such as the switch room building, control room and guard house. Also included is the works for water and electricity supply to the substation.

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These works are due to commence in October 2013 with a duration of approximately 170 days.

5.3.3.4 Crushing Plant

Works include the civil, structural and mechanical works to install the main crushing plant. This installation includes detailed civil works including foundations for all structural components as well as the formation of underground works for the belt conveyor. Also included is the installation and test of all the crusher components.

Works to the crusher are envisaged to commence in October 2013 with completion due in Quarter 1 2014.

The works associated with the SX-EW Plant require less earthmoving and ground preparation than other sections and therefore it is envisaged that the construction equipment demand will be less. The equipment fleet demand will likely require 2 medium sized excavators, 2 bulldozers, 10 to 12 earthmoving trucks and 1 or 2 sets of levelling and compaction equipment comprising of graders, rollers and water carts. The installation of the numerous structural elements will require intensive cranage with fixed cranes constructed on site.

Details of the construction personnel and materials are provided in Sections 5.4 and 5.7 respectively.

The works associated with the SX-EW plant are expected to be completed in Quarter 4 2014.

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5.3.4 Power Supply

The works associated with this section are the install of equipment for the substations installed under previous sections, the upgrade of existing installations and the installation of overhead power lines to support the site.

5.3.4.1 230 kV Step-Down Substation

This works involve the installation and testing of the equipment associated with the 230 kV step down substation. Works are due to commence following the completion of the civil and structural elements in Quarter 1 2014 with a duration of approximately 135 days.

5.3.4.2 Substation Upgrade

This section includes works to upgrade the existing 230 kV Nyaungpingyi substation to allow for extra capacity and provide linkage to the new 230 kV overhead line to the Letpadaung substation. Works are scheduled to commence in November 2013 and should be completed in January 2014.

5.3.4.3 230 kV Overhead Line

Construction of a new 230 kV overhead line is required between the existing Nyaungpingyi substation and the newly constructed step-down substation at the Letpadaung plant site. The construction will include the civil works and construction of the towers as well as the installation of the power lines. These works should commence in December 2013 with an estimated duration of approximately 3 months.

5.3.4.4 Substations and Distribution Rooms

This work will include the equipment installation for the 33 kV substations and 10 kV distribution rooms constructed in other sections. The work elements include the substations for the plant site, open pit, heap leach pads and the mine site. The works to each substation will commence as the civil works in other sections are completed, in general they will commence in December 2013 with a duration of approximately 110 days.

5.3.4.5 33 kV and 10 kV Overhead Lines

These works include the civil, structural and electrical works associated with installing both 33 kV and 10 kV overhead lines to facilitate power supply to the whole project. Works are due to commence in November 2013 with a 6 month duration.

The power supply works will require little in the way of heavy construction equipment as the major works involve equipment installation. However some equipment will be required for the clearing the power line corridor and installing the towers. It is envisaged that the small fleet of construction equipment will comprise of up to 2 bull dozers and small excavators, along with possibly 1 or 2 earthmoving trucks if required.

Details of the construction personnel and materials are provided in Sections 5.4 and 5.7 respectively.

The power supply works, including linkage and test of the whole systems, are expected to be completed in Quarter 2 2014.

5.3.5 Wastewater Pond

The works associated with this section are the construction of the wastewater pond (WWP). These works will be phased to construct the pond in two sections, north and south, and mainly involve the bulk earthworks to excavate the pond and create the embankments. The works, following the recovery and storage of vegetation and growth medium, can be summarised as follows:

- Excavation to form the pond shape and, where applicable, haul and compact to create the bulk fill embankment;

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- Import, placement and compaction of a low permeability clay layer in the pond basin and to the bulk fill embankment; and
- Fencing.

The works to the north pond will be undertaken first and are due to commence in November 2013 with a duration of 200 days to complete construction. Following the completion of the north pond, works to the south pond will commence in Quarter 2 2014 with a construction duration of 100 days.

The construction equipment required for the construction of both the north and south WWPs will be a fleet of at least 4 medium to large sized excavators, 2 large bulldozers, numerous earthmoving trucks as well as graders, rollers and water carts for levelling and compaction.

Details of the construction personnel and materials are provided in Sections 5.4 and 5.7 respectively.

The construction of both the northern and southern WWPs are expected to be completed in Quarter 3 2014.

5.4 CONSTRUCTION WORKFORCE

The construction workforce for each of the sections described above will reflect the quantity of work required as well as the complexity of the works. The workforce will be made up of a mix of local and expatriate employees and numbers will be ramped up over the initial period of the project with the intention that full manpower is employed by week 12 of the works. Table 5.2 below summarises the anticipated manpower for each section of the works.

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Table 5.2: Construction workforce

Construction Section	Total Manpower Requirements
Mine Infrastructure	300 persons
Heap Leach Pad and Infrastructure	380 persons
Plant Site and Infrastructure	140 persons
Power Supply	60 persons
Wastewater Ponds	160 persons

5.5 CONSTRUCTION SERVICES

To facilitate the works, numerous services will be provided, these are summarised in the sections below.

5.5.1 Transport

The provision of transportation will be provided by the EPCM Contractor for use by the individual contractors. This will include trucks for moving freight and construction materials from the river port on the Chindwin River during the wet season to the site on an existing dedicated haul road. Dry season transportation will be via the river port at Pakoku then the road network to the site, a distance of about 70 km. Bus transportation will be provided for workers from the construction accommodation camp to the construction site.

5.5.2 Basic Raw Materials

Basic raw materials will be supplied by the EPCM Contractor for use by the individual contractors. These materials will include the following;

- Diesel fuel and fuel trucks for construction equipment; and
- Fine grained soil (sand) for leach pads and associated infrastructure construction.

5.5.3 Concrete Supply

The supply of concrete and concrete aggregates will be provided by the EPCM Contractor for use by the individual construction contractors. Concrete will be produced on an onsite batching plant operated by a concrete subcontractor. Coarse aggregates for the production of concrete will be won from nearby operating quarries.

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5.6 HOURS OF OPERATION

Construction activities will be based on a 5 day week with a 8 hour working day.

5.7 CONSTRUCTION MATERIALS

5.7.1 Earthwork Materials

Where possible, earthworks material will be won from excavation on site in a cut to fill operation. It is intended that all bulk earthwork operations such as the creation of ‘plateaus’ for the construction of the HLPs and the levelling of the ground for the construction mine and plant site infrastructure pads will be constructed as a cut to fill operation. Any unsuitable material identified during this operation will be removed and stockpiled and any shortfall material will be won locally, either from surplus material from other operations such as pond excavation, or through the establishment of local borrow pits.

Fine grained soil material for placement above the HDPE liners will be sourced from a locally identified borrow area within the site which is within the footprint of waste rco dump 1 (WRD1) .

Low permeability clay material, for placement on the HLPs and ponds, will be sourced from a locally identified borrow area within the site which is within the footprint of the Storm Water Pond, Waste Water Pond and Intermediate Solution Pond.

5.7.2 Construction Water

Construction water for compaction, dust suppression and other uses will be supplied from the existing Chindwin River pumping station at Kyaukmyet. To facilitate this supply, a new pipeline will be constructed to service the Project site.

Where possible waste water generated from site, through surface water runoff, will be collected in the WWPs and treated. Where water quality allows this will be used for construction purposes.

5.8 CONSTRUCTION ACCOMMODATION

Accommodation for construction personnel will be provided in a dedicated construction camp in the north-west corner of the site. As present there are two options considered for the layout of the accommodation camps:

- Option 1 – 100 accommodation units which will house up to 400 personnel; and
- Option 2 – 210 accommodation units which will house between 420 and 840 personnel.

Accommodation is provided for expatriate and local personnel. Therefore, depending on the make-up of the construction personnel, the final accommodation camp requirements will be derived.

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5.9 MINING

The Letpadaung copper deposit is located approximately 7 km southeast of the existing Sabetaung mine (Figure 1.2.1). The deposit trends to the northwest and is approximately 2200 m long and 1400 m wide and is basically horizontal. Average thickness of the ore body is about 140 m with an average copper grade of 0.37%. Overlying the ore body is a highly weathered and oxidised leach cap varying in thickness between 10 m and 200 m. This material is essentially waste as it contains little economic copper mineralisation. The geochemical properties of this zone are not well understood.

The estimated resource for the deposit is 1,600 million tonnes (Mt) averaging 0.37% copper.

Letpadaung has a mineable reserve of approximately 954 Mt at an average grade of 0.43% copper with 946 Mt of waste resulting in a waste to ore ratio of 0.99:1. It is

proposed to mine at a production rate of approximately 30 Mt /annum, resulting in a mine life of around 33 years.

5.9.1 Mining Method

The Letpadaung deposit comprises two large hills and the valley between (Figure 5.9.1). It is planned to mine the open pit in two sections. Section I has a mine life of 19 years and Section 2 will be mined for an additional 13 years, resulting in one large pit over the life of the project, as shown in Figure 5.9.1. The total excavation area of the open pit will be 325.0 ha with Section I being 207.0 ha and Section 2 118.0 ha The final pit dimensions will be 2700 m long by 1900 m wide by 450 m deep. A diagram showing the Year 30 pit shell is provided at Figure 5.9.2.

Mining will be conducted using conventional open pit, truck and shovel methods. Initial development of the pit will require the stripping topsoil and vegetation from the initial mining area. The topsoil and vegetation will be stockpiled in safe areas and used for progressive rehabilitation of disturbed areas. The weathered overburden layer above the ore zone will then be stripped and trucked to the waste rock dump (WRD) providing access to the ore.

Mining will utilise a fleet of five 22 m^3 hydraulic shovels and twenty four 186 m^3 electric drive dump trucks. In addition there will be sundry front end loaders, bulldozers and excavators used. Ore will be trucked directly to a primary mobile crusher for sizing. Low grade ore will be trucked to low grade ore stockpiles, as shown in Figure 5.9.1.

A production rate of approximately 30 Mtpa (92Kt/day) has been adopted for the Project utilising 330 days/a, with three, 8 hour shifts/day.

5.9.2 Drilling and Blasting

Drilling and blasting will be required to break up rock formations. A combination of ANFO (ammonium nitrate and fuel oil) and emulsion explosive will be used at the site. An explosives preparation area and explosives magazine is located on the west of, and adjacent to, WRD 3 as shown in Figure 5.9.1.

The magazine comprises an enclosed area adjacent to the southern perimeter of the open pit. The area will incorporate a production division and magazine division, located at least 33 m from each other. The magazine facility will occupy an area of about 5 ha.

The production division will incorporate 3 ammonium nitrate warehouses in a hazardous building compound. Each warehouse stores 600 t of explosive, for a total storage of 1,800 t.

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The hazardous building compound includes No. 1 and No. 2 explosive initiator magazines. The No. 1 magazine has a Class 1.1 in hazard rating, containing a calculated 14 t of explosive. The No. 2 magazine has a Class 1.1 hazard rating and is planned to store 0.02 t of explosive.

5.9.3 Haul Roads

Mined ore will be hauled by truck to the semi-portable crushing stations in the pit and waste rock is hauled to WRDs located adjacent to the pit, as shown in Figure 5.9.1. The haul roads will be 26 m in width to allow safe passage of the large mining equipment. The roads will be graded regularly by graders and sprayed by water trucks, as needed, to reduce dust emissions.

5.9.4 Mine Water Management

5.9.4.1 Groundwater Management

The groundwater contours indicate pre-mining groundwater flows are from the southwest towards the north-east and the Chindwin River. Mining below the groundwater table will result in a localised steepening and reversal of the groundwater flow direction towards the Letpadaung pit. Based on the current pit design, the main eastern ramp in Stage II will intersect the high permeability Quaternary alluvium which will result in higher groundwater inflows to the pit and a steepening and reversal of the groundwater flow direction towards the pit that will extend under the south of WRD 1, WRD 2 and WRD 3.

MWMCL (April 2011) predicted groundwater inflows at two pit stages:

- Stage I Pit (<150 m) groundwater inflows of 26 L/s.
- Stage II Pit (<350 m) groundwater inflows of 116 L/s with 37.4 L/s coming from the andesite-dacite and 78.8 L/s (two thirds) of the inflow coming from a 430 m stretch of Quaternary alluvium at the eastern edge of the pit.

Groundwater inflows are therefore predicted to be between 26 and 116 L/s. A significant proportion of this flow will be later in the mine development when the main eastern pit ramp of the Stage II pit intersects the alluvial plain. If the pit was re-shaped to avoid cutting the alluvium this would reduce to 37.4 L/s. Inflow from the alluvium should be intercepted as it enters the pit prior to the water being affected by Acid Rock Drainage (ARD) deeper within the pit.

The above inflow estimates are preliminary based on limited field data and analytical equations based on simplifying assumptions. A numerical groundwater model could be developed to improve the inflow predictions and would also model the drawdown cone

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as it develops with time. Modelling to assess the post-mining pit lake/water recovery levels has also not been undertaken.

Groundwater inflow to the pit will be collected by in-pit sumps. The water from the sumps will be either pumped to one of the waste water ponds or used for dust control, depending upon the water quality.

5.9.4.2 Surface Water Management

The main area for control is located south of the open pit. Due to the influence of rainfall runoff around the open pit, an interception trench will be set at the upper part of each area to convey rainwater out of the area. The rainwater of each area will be discharged centrally after being collected.

Since the WRDs are adjacent to the open pit, the upstream catchment will be taken away by the runoff interception trench. Only the rainwater of the WRD itself will be considered, thus the flood interception trench may be built at the corner of each bench on the waste dump to intercept rainwater within the waste dump. Rainfall runoff from WRD1 will be discharged centrally to the waste water pond in the south-east. The clean water component will be discharged into the stormwater collection pond to the east of the mine site.

5.9.4.3 Structures for Flood Control and Discharge

Flood structures will consist of the following:

- Interception trenches around each main area, open pit and waste dump;
- Seepage and runoff control at the base of each waste dump; and
- Flood protection berm at the east edge of the mine site to prevent the flooding of Chindwin River from eroding the mine site.
- Development of a Resettlement Action Framework to be used in the event villages located near Chindwin River need to be relocated due to flood activity.

5.9.5 Waste Rock Dumps

The amount of waste rock within the mining boundary is about 946 Mt, of which 256 Mt will be mined from the 20th year of production and disposed of through in-pit dumping. The balance of the waste rock will be dumped outside the open pit and amounts to 690 Mt.

There will be three WRDs associated with the Project to store the estimated 30 Mtpa of waste generated. The WRDs are located on the alluvial plain of the Chindwin River to the northeast (WRD 1), the west (WRD 2) and the southeast (WRD 3) of the pit, as

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shown in Figure 5.9.1. The Stage I pit will also be used as a site for waste backfilling once mining has finished in this section.

Knight Piésold was commissioned by the proponent undertake preliminary design of the above-surface WRDs for the Project (Appendix I – Preliminary Waste Dump Design). The following information is derived from this study.

WRDs 1, 2 and 3 overlie Quaternary alluvial deposits that comprise medium to fine sand, sand, gravel and clay. The upper layer is clay, with a thickness of 4 to 6 m; below which is a medium to fine sand, sandy gravel and cobble gravel, with a thickness of 12 to 50 m (25.7 m on average).). On the alluvial plain, the depth to groundwater in the dry season ranges between 0.65 m to 19.12 m, with an average of 4.86 m. The upper Quaternary clay layer has the potential to form a low permeability base and hydraulically isolate and protect the alluvial aquifer from contaminated seepage emanating from the WRDs.

Waste will be transported by truck from the pit to the appropriate WRD and selectively placed according to its potential for generation of acid or metal leachates as set out in Sections 5.9.6 and 5.9.7.

The principal objective of the WRD design is to provide waste rock storage while ensuring protection of the environment during operations, closure and completion of the Project. The WRD design has taken the following requirements into account:

- Permanent and secure storage of all waste rock within engineered facilities.
- Waste dump placement and development scheduling to minimize equipment requirements, achieve stable slopes at closure and minimize closure measures.
- Control of drainage and runoff from the waste dumps during operations to the maximum practical extent.
- Collection of sediment from the waste dumps to the maximum practical extent.
- Treatment (if required) and discharge of excess drainage and runoff from the waste dumps.
- Monitoring for all aspects of the waste dumps to the maximum practical extent to ensure performance goals are achieved and design objectives are met.

The WRDs will be constructed as a series of lifts with seven metre wide benches every 12.5 m of height gain. The external walls of the waste dumps will have local slopes of 1V:2.5H and overall angles of 1V:2.9H.

5.9.6 Waste Rock Geochemistry

The Project geology is a high sulfidation porphyry system hosted in altered intrusive and volcanic rocks. A leach cap of highly weathered material is present above the main

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ore zone of between 10 and 200 m thick. Previous geochemical investigations at the Project have been limited in extent and poorly executed resulting in an overestimation of the acid generating potential of the material.

Knight Piésold was commissioned by the proponent to conduct a geochemical assessment of the waste material (Appendix J – Geochemical Study). The following is a summation of this study.

The study selected 150 samples of waste rock which were collected from boreholes distributed across the pit and from a depth range commensurate to that of the proposed pit. The samples were sent to an accredited laboratory in Perth, Western Australia for geochemical testing. Testing of the samples was conducted in accordance with internationally accepted methods for assessment of acid rock drainage potential and metal leaching potential. The test work included analysis of the mineralogical content, sulfur contents and sulphur forms, acid neutralising capacity and net acid generation to determine the potential for acid rock drainage from the waste rock, and multi-element analysis and distilled water extract to assess the risk of metal leaching from the waste.

Overall, approximately 71% of the samples were found to be potentially acid forming (PAF) with only 29% of the samples found to be non-acid forming (NAF). There was no relationship between the lithology of the samples and the acid formation potential. However, there was a clear trend of decreasing amounts of non-acid generating material with depth, and below 250 m depth essentially all samples were potentially acid forming. The presence and management of PAF materials is an extreme risk to the environment.

The multi-element analysis indicated the majority of the waste rock to be highly enriched with metals, and that some of these metals are readily soluble, especially under acidic conditions. Therefore, controlling the acid generation from PAF material will be key to managing the metalliferous drainage from both the PAF and NAF material. Management of waste rock to reduce the potential for leaching of metals from the rock is a very high risk to the environment and water use in areas in and around the mine site.

Additional characterisation of the waste rock at the project will be required prior to bulk mining to refine the design of the WRDs and the management for acid generation and metal leaching.

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It is proposed that a proportion of waste rock will be placed as backfill into the Stage I pit. There are unique ARD management challenges associated with in-pit waste rock disposal. This is discussed further in Section 5.9.9.

5.9.7 Acid Mine Drainage and Metal Leaching Management

Acid rock drainage (ARD) is caused by the exposure of PAF material to air and moisture through the mining process. Once exposed sulphur bearing minerals may oxidise to produce acidic by-products and liberate trace metals.

Testing will need to be conducted on grade control or blast hole samples to define the acid formation potential of the waste ahead of mining. The results of the testing will be used by the mine planner to define PAF and NAF waste zones and allow selective handling of each of these wastes so they can be placed in specific areas of the waste dump.

The waste rock will require certain handling and placement methods to reduce the risk of acid generation and metal leaching which will include:

- Preparation of the foundations below all WRD areas to prevent contaminant seepage into the soil.
- Placement of a layer of benign waste (i.e. non-acid generating, non-enriched and non-leachable) at the base of the dumps to act as a buffer between the PAF waste and the foundation material at the base of the dump.
- Full encapsulation of all waste with a suitable compacted soil liner to reduce oxygenation and water intrusion into the waste material.
- Cover of the WRD soil liner with a layer of benign (i.e. non-acid forming, non-enriched and non-leachable) waste or borrow material to prevent the soil liner from desiccating or eroding.
- Water management structures around all waste dump areas to collect potentially contaminated waters.
- Specialised in pit mine waste disposal to ensure that pit lake water quality is acceptable and that it is hydraulically contained.

Further details of water management and in pit mine waste disposal can be found in Sections 5.18 and 5.9.9 respectively.

In addition, the PAF waste will need to be identified during operations and will require further controls to reduce the risk of acid generation which will include:

- Placement of PAF waste in lifts not exceeding 3 to 5 metres in height which can be compacted by truck movement to minimise oxidation of the material.

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- Installation of interim covers reduces oxygenation and water intrusion into the waste material, the frequency of which is still to be determined.
- Instrumentation and monitoring of the quality of the construction and the performance of the encapsulation system will be required to confirm that the design intent is being achieved and sulphide oxidation has been reduced to acceptable levels.

Further discussion on the management of materials that are PAF and/or metal leaching are described in Section 8.3.

5.9.8 Low Grade Ore

Copper-containing low grade ore amount to approximately 99,375 kt. Depending on market conditions at the time, the low grade ore may be processed, so the copper-containing low grade ore will be segregated from the high grade ore within designated areas of the HLPs.

5.9.9 In-Pit Mine Waste Disposal

It is proposed to place a portion of the waste rock within the Stage 1 pit. As this waste will be exposed for a number of years, acid generation and metal leaching will occur. Therefore, the seepage will need to be collected and either treated prior to release or pumped to the leach pad for use in the process circuit to prevent outflows from the pit to groundwater. Once the waste has been placed to within 10 m of the estimated post-mining groundwater level, deposition must cease and the pit allowed to fill with water. Once the waste is fully submerged, acid generation will cease. Therefore, options to accelerate the pit filling should be considered. However, the pit cannot be allowed to fill to a level of the estimated post-mining groundwater level, otherwise outflow from the pit lake to groundwater could occur.

During pit filling, the water will require lime dosing to raise the pH. This should also result in a significant proportion of the metals precipitating, particularly if the pH is raised to around pH 10 or 11. Once the groundwater has rebounded, the pH can then be allowed to drop to almost pH 7circum neutral levels, as the metals should not be re-mobilised unless the pit lake becomes acidic.

Appropriate mitigation controls will be required if the pit lake water quality is predicted to be poor, and the water balance model indicates that outflows to off-site groundwater or surface water resources will likely occur.

5.10 CRUSHING CIRCUIT

Mined ore is subject to primary crushing prior to heap leaching.

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The crushing circuit will comprise:

- A semi-portable crushing station in the pit;
- A primary crushing product stockpile;
- A screening plant;
- A qualified crushed ore stockyard;
- A sub-station; and
- A transfer station.

The crushing area will occupy 13.5 ha.

The Semi-portable crushing station is located within the open pit to reduce truck haulage distance.

The crushing system will be arranged along the existing passage between the two hills in the shape of an “L” so as to optimise land and earthworks volume.

5.10.1 Primary Crushing

A semi-portable crushing station established in the pit is used for primary crushing. Mined ore is hauled by trucks and fed into the semi-portable crushing station and the crushed ore is delivered by 2 belt feeders to the main belt conveyors which then convey the ores to the primary crushing product stockpile for storage and further crushing.

5.10.2 Screening

Ore from the primary crushing product stockpile is fed by the bottom vibrating feeder and heavy apron feeder to belt conveyors which deliver the ore to the vibrating screen for screening. Ten (10) 3.6 m × 7.5 m circular vibrating screens are used for screening. The oversize is transported by belt conveyors to the primary crushing plant for resizing. The crushed ore is carried by belt conveyors to the screening plant together with the primary crushing products. The undersize is the final product (particle size 50～0 mm) which is delivered by belt conveyors to the final crushing product stockpile for storage and then carried by belt conveyors to the heap leach pad for stacking.

5.10.3 Power Supply

The power supply system is composed of a 230 kV step-down substation connected to the national electricity grid, a 35 kV sub-station and other various sub-stations. The 230 kV step-down substation will be located to the east of the SX-EW plant, and to the south of the administration area. The 35 kV substation will be located on the southern slope of the crushing area. The facility occupies an area of 1.1 ha.

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5.11 HEAP LEACH OPERATION

Extraction of the copper from the host ore will utilise a process known as heap leaching. In this process the ore is stockpiled on a pad and an acid solution is percolated through the ore, leaching the copper from the ore as it passes through. The resultant solution (pregnant leach solution), containing the copper compound, is collected in a pond for further processing in a plant equipped for solvent extraction and electro-winning of the extract to produce high grade copper sheets.

5.11.1 Method of Operation

Three heap leach pads (HLPs) situated to the south of the crusher complex are proposed to be built for the life of the operation, as shown in Figure 1.4.1. HLP1 and HLP2 will be utilised initially with HLP3 proposed to be commissioned after 14 years of operation.

HLP1 and HLP2 will each consist of 15 heap cells, with each cell covering an area of 300 m x 770 m. HLP1 covers an area of 3.465 km^2 and HLP2 covers an area of 3.460 km^2. Crushed ore will be transported to each cell by conveyor and stacked by mobile stackers to a raise height of 6 m. Cells will be developed sequentially, first HLP 1 then moving to HLP2. A total of 14 raises will occur on each HLP such that the final height of each pad will be 84 metres with a final slope of 26 degrees.

The base of the pad comprises an engineered HDPE lined foundation onto which a drainage layer and pipe work collection network is installed. Division of the cells will be achieved using independent drainpipe systems exiting the leach pad in individual outlet pipes into a solution collection channel or pipe running the length of the pad.

The copper loaded solution (pregnant leach solution, (PLS)) is collected at the base of each cell by a network of drainage pipes embedded in the base of the heap and the solution flows by gravity to a system of ponds. The outlet pipes may be throttled to direct solution flow either into a PLS pond, intermediate leach solution (ILS) pond or the single stormwater pond. The pipes carrying solution with the highest copper content will report to the PLS pond whilst lower concentration solution (as defined by the operators) will report to the ILS pond or the stormwater pond. Clean rainfall from unirrigated areas or overflow from the pad will report to the stormwater pond via the channel, thereby maximising copper concentration in the PLS pond by reducing potential dilution.

Once the copper is removed in the solvent extraction process the barren solution (raffinate) is recycled back into the irrigation delivery system, via the raffinate pond, to

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be re-used in the leaching process. Acid will be added to the ILS or raffinate as needed to ensure the pH is at the required level.

The leaching process to remove most of the copper from the heap takes approximately 400 days made up of the following cycles:

- 40 days first cycle (from ILS – reports to the PLS);
- 180 days second cycle (from ILS – reports to the ILS); and
- 180 days last cycle (from raffinate – reports to the ILS).

Once this cycle is completed a new 6 m stockpile of ore will be placed on the exhausted heap and the process repeated. It is envisaged that there will be 14 cycles for each cell.

The parameters used in the design of the heap leach are set out below in Table 5.11.1.

Table 5.3: Design parameters of heap leaching

Usable Particle Size P95 (mm)	Daily Ore Processing Capacity (kt/d)	Usable ore grade (%)	Irrigation Strength ($l/m^2 \cdot h$)	Heap Leaching PH Value	Lift Height (m)	Heap Leaching Period (d)	Leaching Rate (%)	Grade of Copper in Pregnant Solution (g/l)
50	92	0.42	9	1.4~1.8	6	400	81	4.0

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5.11.2 Leaching Circuit Solution Management

Three solutions are present in the leaching process comprising ILS for leaching, the PLS containing the leached copper and the raffinate solution which has had the copper removed. The solutions are contained in lined ponds located in the open space between each of the heap leach pads 1 and 2. Thus there is one ILS pond (60.0 m×470.0 m×3.0 m), one raffinate pond (60.0 m×130.0 m×3.0 m) and one PLS pond (60.0 m×245.0 m×3.0 m) for each heap leach pad. The location of the ponds is shown on Figure 5.11.1. Additional ponds will be constructed when the third heap leach pad is built 14 years after the commencement of the operation.

5.11.3 Drainage and Runoff Control

Stormwater runoff from the HLPs will be directed to a storm water pond (SWP) to the east of the HLP's (Figure 1.4.1). The SWP comprises a square HDPE lined facility (subdivided into four cells) as the main storage of excess water for the HLP, process ponds and plant site during rain events. The pond will be constructed to prevent seepage of the water which will contain elevated levels of metals from the heap and acidic runoff water. Anti-seepage measures will include a compacted clay layer for the

base and sides of the pond, an HDPE liner and provision of monitoring wells to detect any seepage.

The water from the SWP will be used as make-up water for the heap leaching operation and the process plant.

5.12 SOLVENT EXTRACTION AND ELECTROWINNING

The next stage of processing involves solvent extraction (SX) and electrowinning (EW) to produce the final copper cathode product.

The PLS from the leaching process is pumped to a solution storage tank in the SX plant where it is contacted with an organic solvent, referred to as the extractant, in the solvent extraction stage. Here the copper is extracted away from the aqueous phase leaving behind most of the impurities that were in the pregnant solution. Since the copper ion is exchanged for the hydrogen ion, the aqueous phase is returned to its original acidity as the raffinate solution and recycled to the leaching step of the process. The copper bearing organic phase is then stripped of its copper by contacting it with a strongly acidified aqueous solution. The copper-bearing solution is advanced to the EW stage of the process while the barren organic phase is returned to the extraction stage of the process. In the EW stage of the process the copper is reduced electrochemically from copper sulphate in solution to a metallic copper cathode.

After the cathode cycle, the cathode copper is lifted by crane into the cathode stripping section for removal of copper sulphate on the surface and stripping of cathode copper sheet. The design capacity of the SX/EW plant at Letpadaung is 100 kt/a.

Electro-won copper cathodes are as pure as, or purer, than electro-refined cathodes from the smelting process. Cathode copper purity is above 99.9%.

5.13 WATER STORAGE AND USES

For Project operation, water is required for the following uses:

- Heap leaching;
- Dust suppression (for mining and crushing);
- Emergency fire fighting;
- Camp;
- Process cooling; and
- Sewage system.

In broad terms water will be sourced from on-site run-off, open pit dewater, and the Chindwin River. Water quality requirements vary according to its proposed use, as detailed below in.

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Table 5.4: Proposed project water quality requirements according to use

Water Quality	Water Use	Potential Source(s)
Untreated raw water	heap leaching and dust suppression	on-site run-off, open pit dewater, and Chindwin River
Treated water (industrial use)	emergency fire fighting, process cooling, and sewage system	on-site run-off, open pit dewater, and Chindwin River
Purified water (potable)	camp	Chindwin River

Water used for process is not expected to require any form of treatment prior to use. Water used for emergency fire fighting, process cooling, and sewage system operation will require a basic level of treatment to remove the suspended solids. Potable water for the camp will be abstracted from the Chindwin prior to filtration and chlorine disinfection.

Preliminary water quality baseline data from the Chindwin indicates that it is suitable for all of the above uses with the appropriate treatment. With regard to its industrial usage on site, the Chindwin River water quality data indicates that it is suitable for use following sedimentation and filtration (as total suspended solids values vary from 70 mg/L to 1438 mg/L over a typical year).

Water storage infrastructure available on site will include the following:

- Wastewater pond (4,730,000 m^3 capacity);
- Stormwater pond (4,000,000 m^3 capacity);
- Waste water collection pond;
- Heap leach pad solution ponds;
- Sediment control dams (150,000 m^3 estimated combined capacity); and
- Sundry process storage tanks.

In terms of heap leach water recycle the options are as follows (in order of decreasing priority): SWP; WWP; and the Chindwin River.

The WWP is the largest storage on the site with several potential sources reporting to it as follows: runoff from WRDs; open pit dewater; discharge from the cooling towers; discharge from air compressors; runoff from the crushing area; and wastewater from the camp sewerage treatment plant.

Water abstracted from the Chindwin River has various uses and will be pumped to various storages around site. Dedicated head tanks (with capacity of up to 2,500 m^3) will be established for heap leaching and dust suppression. These tanks will receive

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water pumped directly from the Chindwin. Water for industrial use will also be abstracted from the Chindwin, and after treatment will be stored in the metallurgical head tank (capacity of 2,500 m^3) prior to distribution to local process ponds. Potable water, taken from the Chindwin River, will be stored in a 100 m^3 capacity stainless steel tank, after passing through the water purification plant.

5.14 REAGENT USE

The main reagents used in the heap leach and SX/EW process are listed below.

Table 5.5: Reagents used in ore processing

Description	Unit	Qty.
Sulfuric Acid	t/a	30,350
Extractant	t/a	450
Solvent naphtha 260#	m^3/a	4500
Active clay	t/a	400
Flux oil	t/a	4,500
Cobalt sulphate	t/a	75
Guar gum	t/a	30

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5.15 HAZARDOUS MATERIALS HANDLING AND STORAGE

The main hazardous materials used at the project are listed in Table 5.6.

Table 5.6: Hazardous materials used for the Letpadaung Project

Description	Unit	Qty.
Sulfuric Acid	t/a	30,350
Diesel	t/a	22,650,000
Extractant	t/a	450
Solvent naphtha 260#	m^3/a	4,500
Flux oil	t/a	4,500
Cobalt sulphate	t/a	75
Engine oil	t/a	1466.8
Granular ammonium nitrate	t/a	9,024
Powder ammonium nitrate	t/a	2,560
Explosion initiation devices	ea/a	42,386

5.15.1 Hazardous Substances Storage

- Storage areas will be designed to adequately and safely store a sufficient quantity of substances required for the project;

- The storage area will be properly designed to contain and prevent contamination of the environment, particularly soil and groundwater;
- Floor, curbing, walls and roofs will be designed to adequately contain spills and protect the storage area from weather where necessary;
- Spill kits, protective equipment, and other necessary equipment will be in the storage area or approximate to the storage area to clean and mitigate spills;
- Fire prevention systems will be designed to be appropriate and adequate to the material being stored;
- Only containers that are in good condition will be used;
- Incompatible (e.g., bases and acids) materials will not be stored in the same containment area and will be stored in safe manner and distance to prevent accidents;
- To provide a safe work area, walls, dykes, berms, or separate facilities of other means will separate incompatible materials;
- Drums, containers, and storage areas will be properly labelled, marked and secured;
- Material safety data sheets (MSDS) for each material will be stored on a database and placards containing the MSDS will be placed in the storage containment area for each material stored;
- Sufficient storage space between containers will be allowed for safe access and handling of containers;
- No smoking or electronic devices such as hand phones or hand-held radios will be allowed in storage areas; and
- Fire prevention and management practices will be developed specific to the materials being stored.

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5.15.2 Explosives Storage and Handling

- All blasting activity will be performed by a specialist contractor who will be responsible for blasting design, explosives calculations, delivering blasting agents to the blast-holes, placing powder or emulsion in the holes, charging the holes, placing detonators and boosters, filling the holes with stemming material and tie-in patterns;
- The blasting contractor will supply the explosives, boosters and detonators, transport them to site and store term, until required for blasting, in the explosive magazines. The contractor will also supply mixing and delivery trucks;
- Explosive magazines will be constructed away from receptors at designated limits in accordance with Myanmar legislation; and
- A plan will be produced of explosives storage locations.

5.16 NON - HAZARDOUS MATERIALS HANDLING AND STORAGE

A range of non-hazardous materials will be used on the Project ranging from industrial materials such as pipes and conveyor belts to domestic materials such as food and bedding.

Most of the industrial materials will be stored in the warehouse and maintenance area to the southwest of the pit. The domestic materials will be stored in the accommodation area located approximately 3km to the north-west of the Letpadaung mine area.

5.17 TRANSPORT

Transport methods will include road, river, sea and air transportation. The majority of materials will be shipped to the port of Pathein in the Irrawaddy Delta and will then be transported via river barge to the Letpadaung site. During the wet season the depth of flow in the Chindwin River (a tributary of the Irrawaddy that flows past Letpadaung) is adequate to allow barge access to a landing adjacent to the site. Over the dry season, river levels are such that barges can generally only venture as far upstream as the town of Pakokku. Thus, at this time of the year it will be necessary to transport materials via road between Pakokku and the Project site. The current plans are to use and upgrade the existing barge jetty and load-out facilities at Pakokku and Letpadaung.

It is estimated that approximately 50,000 tonnes of general freight and fuel will be delivered to the site each year. This equates to about 3 barge movements per month, or 4,500 tonnes of material. Based on a 20 tonne payload per truck, this freight mass will require 225 truck movements per month or 24 truck movements per weekday. In addition, there is expected to be 100,000 tonnes of product freighted by road to Pathein port per year. This equates to 28 truck movements per day of 30 tonnes payload. Thus, at the mine site, there is likely to be 52 truck movements to/from the site daily for movement of product, fuel and general freight.

5.17.1 Hazardous Material Transport

The main hazardous materials transported to the site are explosives, diesel fuel and sulphuric acid.

- Explosives – transported by road from China using the border crossing at the town of Muse. These materials will be transported in convoys that will deliver supplies monthly and are likely to comprise 50 – 100 vehicles per convoy;
- Diesel fuel – transported by barge to Letpadaung or Pakokku, then by truck to site. Approximately 1 barge/week; and
- Sulfuric acid - transported by barge to Letpadaung or Pakokku, then by truck to site. Approximately 1-2 barge(s)/week.

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5.17.2 Non - Hazardous Material Transport

Non-hazardous materials will be transported by barge to Letpadaung or Pakokku, then by truck to site. The volume of material will require approximately 15 barges/year.

The final copper cathode product will be transported by road from Letpadaung to Yangon for shipping to customers.

5.18 SITE WATER MANAGEMENT

5.18.1 Water Balance and Supply

The Letpadaung Project has been designed to contain site runoff for storm events up to and including that for a 1 in 100 year return interval. Process water for heap leaching will be recycled, in a closed loop system, with make-up water sourced from open pit dewater, site surface water runoff, and the Chindwin River (over the dry season).

A site water balance, incorporating water inputs and losses from the system, was completed for average, wet and dry conditions. Under average climate conditions, the leach pad water balance is shown to be in net water deficit for approximately 6 months of the year. During this time, due to the ongoing loss occurring on the leach pad, the SWP and WWP remain empty with any shortfall made up from the Chindwin River. The annual raw water requirement (for an average year) equates to around 6 Mm^3/year.

Under dry climatic conditions, the annual rainfall is reduced, thereby increasing reliance on external water sources during and after the wet season. The annual raw water requirement increases, under these circumstances, to around 9 Mm^3/year.

The existing SWP and WWP are suitable for containing 1 in 100 year recurrence interval storm events, with storage capacities of 4 Mm^3 and 4.8 Mm^3 respectively.

Use of HLP make-up water should be prioritised so that on-site, low pH water sources are used first. Make-up water may be taken from three potential sources, in order of decreasing priority, as follows: SWP; WWP; and the Chindwin River.

The estimated water consumption for an average year is given in Table 5.7.

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Table 5.7: Estimated water consumption (average year)

Area	Consumption (Mm^3 per annum)
Crushing and heap leaching	4.56
Mining operations / dust suppression	0.44
Electrowinning and extraction	0.30
Boiler and air compressor	0.04
Contingency	0.68
Camp domestic (potable)	0.11
Total	6.13

5.18.2 On Site Water Storage Ponds

Water for heap leaching will be supplied from site run-off (harvested in the SWP and WWP) and the open pit. Water for mining and dust suppression will be taken from the WWP. Where supply from the ponds is not sufficient to meet process and mining requirements, make-up water will be abstracted from the Chindwin River. Capacities for the WWP and SWP are 4.8 Mm^3 and 4.0 Mm^3 respectively.

5.18.3 Potable Water

Potable water for the camp will be abstracted from the Chindwin River using a floating barge mounted pump that will allow water to be conveyed around the site to local storages, via a pipeline network. Water for camp usage will be stored in a 100 m^3 capacity stainless steel tank, after passing through a water purification plant (involving a process of filtration and chlorine disinfection). The majority of the camp potable water will ultimately be transferred to the WWP as domestic sewage wastewater / grey-water.

5.18.4 River Diversion

To divert clean water from the upstream, undisturbed, catchment (east of the project area) the South Diversion Channel will be built along the western edge of HLP 1 and HLP 2 (as shown on Figure 5.18.1). The channel diverts runoff south and then west around the southwest edge of the Letpadaung site and back into its original catchment. This will minimise impacts on downstream users and ecosystems. The channel will be designed for a minimum 1 in 100 year flood event and will comprise a 1.5 km long open channel with a cut depth of up to 12 m.

5.18.5 Flood Protection

The eastern edge of the Project area sits on a flood plain for the Chindwin River. To protect this part of the site (and in particular to avoid flooding of the open pit) an earthfill flood protection bund will be constructed along the eastern boundary, and northeast and southeast corners of the site. The bund will be constructed to a level above that of

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the 1 in 100 year flood. The alignment of flood protection bund is shown on Figure 5.18.1.

5.18.6 Storm Water Management

The following principles are applied in the surface water management of the site:

- Identification of watershed catchments influenced by the proposed mine development;
- Reduction of hydrologic flow impacts of the development by maintaining pre-mining watershed catchment flow routing wherever possible;
- Classification of watershed catchments as either undisturbed (clean water) or disturbed (dirty water); and
- Separation and segregation of clean water and dirty water (so as to reduce handling requirements).

Surface water flowing within or adjacent to the site is classified in terms of quality according to the following categories: clean; sediment laden; contact (potentially acidic or enriched with metals); and process.

To reduce the environmental risks associated with storm water management on the site the following will be implemented:

- Progressive rehabilitation of WRDs (effectively encapsulating the mine waste). Runoff from rehabilitated surfaces will generate sediment but would be otherwise clean.
- Contact water (runoff from ore stockpiles) to be directed to the WWP and tested to assess its requirement for treatment prior to release.
- Segregation of different water quality streams to allow maximum potential discharge of water meeting release standards.

No contaminated water will be discharged from the site for events up to 1 in 100 year recurrence intervals. Infrastructure that will be in place to ensure that this is the case includes the following:

- Diversion of clean water (from upstream undisturbed catchments) around the site via the South Diversion Channel.
- Perimeter diversion channels around WRDs to direct sediment laden runoff to the WWP northern cell.
- Perimeter diversion channels around low grade ore and ore reserve stockpiles to direct contact runoff to the WWP southern cell.

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- The WWP will be operated as two cells with the northern cell used to contain sediment laden water and the southern cell used to contain contact water (that may require special treatment prior to release).
- Perimeter diversion channels around the heap leach pads to divert surface runoff to the SWP.
- Sediment control dams (SCDs) will be installed downstream from any disturbed catchments that report to offsite waterways, particularly along the northern boundary of the site.

To facilitate operation of the system the more environmentally problematic, low grade ore and ore reserve, stockpiles will be consolidated in the northern half of the HLP3 area. This location will allow the contact water from these stockpiles to be directed relatively easily to the south WWP cell. A plan showing the layout of the surface water infrastructure described above is presented in Figure 5.18.1.

5.18.7 Raw Water Supply

Raw water for the site will be abstracted from the Chindwin River, over the dry season, using a floating barge mounted pump. The water will be pumped to a number of storage tanks around the site via a pipeline network. Dedicated head tanks (with capacity of up to 2,500 m^3) will be established for heap leaching and dust suppression. These tanks will receive water pumped directly from the Chindwin. River water for industrial purposes will require primary treatment (to remove suspended solids) prior to being stored in the metallurgical head tank. Potable water, taken from the Chindwin River, will be stored in a 100 m^3 capacity stainless steel tank, after passing through the water purification plant.

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5.19 SITE WASTE MANAGEMENT

5.19.1 Non-Hazardous Waste

Non-hazardous waste management aims to ensure the effective collection, storage, management and disposal of non-hazardous industrial and domestic waste during operation of the Project. For the purposes of this exercise, industrial waste includes inert bulk wastes other than mining wastes, and domestic waste is defined as kitchen, biological, and general camp waste.

5.19.1.1 Waste Disposal and Reuse Philosophy

The Project will employ the waste hierarchy approach whereby the first aim will be to reduce the amount of waste generated through design, use of approved suppliers for materials, contract arrangements, minimisation of over-ordering etc. Under the waste

management hierarchy, management options will be evaluated in the following sequence to minimise the amount of waste generated for final disposal.

Reuse

As far as practicable, wastes will be reused. Recycle: There are currently no recycling facilities in Myanmar. Materials or goods that are waste but cannot be reused can often be recycled i.e. paper, wood, metal, plastic, and glass; this recycling may occur on the site, in the immediate communities or in the region.

Segregation

Segregation of inert, hazardous and non-hazardous wastes will be carried out. Segregation of materials such as wood, metal, plastic and inert materials should be the initial targets as this may provide benefits such as cost savings for waste disposal and benefits to the community.

Recovery

If neither reuse nor recycling can be carried out, materials should be considered for recovery as a last resort.

Disposal

Where none of the above is practicable the waste can be sent for disposal at controlled on-site disposal location.

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5.19.1.2 Non-Hazardous Wastes Produced by the Project

Typical non-hazardous wastes that will be generated are listed below:

Domestic Wastes

- Food waste (i.e., any food remains or wastes that have been in direct contact with food such as containers, napkins, wrappers);
- Paper and cardboard;
- Some plastics; and
- General camp and office wastes such as used office supplies, liners.

Inert Bulk Waste

- Conveyor belts, tyres;
- Crusher and chute liners, screen elements;
- Motors, v-belts;
- Piping and fittings;
- Reinforcing bars;

- Building and bulk debris, cladding, carpeting, drywall, light bulbs (except in the case of mercury vapour/low energy bulbs. These must be disposed of as per hazardous waste requirements), broken glass, insulation and timber; and
- Scrap metals.

5.19.1.3 Waste Disposal

Solid wastes will be segregated at source prior to being transported to the waste storage area on hard-standing with controlled access. The site will be installed with an apron and appropriate perimeter drainage. Areas used for loading and unloading will also have suitable drainage structures, spill containment and other control equipment. Suitable protection from rainfall and sunlight will be provided.

Purpose designed and built landfill cells will be prepared. Landfill cells will be designed to prevent the inflow of rainfall runoff from upslope areas and will be lined with a compacted soil layer. Once a cell is full, it will be covered with a low permeability compacted soil capping. The capping will be constructed to shed stormwater.

Domestic sewage and grey water treated effluent will be discharged to the WWP during operations.

5.19.2 Hazardous Waste

Hazardous waste management aims to ensure the effective storage, management and disposal of all hazardous materials used at the Project.

Hazardous materials include but are not limited to:

- Hydrocarbons;
- Solvents;
- Explosives;
- Acids; and
- Any other solid or liquid toxic chemical.

5.19.2.1 Disposal of Liquid Hazardous Waste

Liquid waste procedures apply to solvents and reagents, waste oils, solvents or greases from maintenance or workshop areas:

- Any spills of oils, grease, solvents or other hazardous materials in the maintenance areas, fuel storage areas or loading/unloading areas will be cleaned up using absorbent materials and placed in bins, not washed;
- Waste oils and solvents will be stored in separate drums on bunded pallets, on paved areas equipped with secondary containment and protected from the weather; drums will be clearly labelled with their contents;

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- Waste oils will not be stored for extended periods in underground sumps; tanks and sumps will be emptied and inspected regularly for any signs of cracks or holes. The findings of the inspection will be recorded; any cracks or holes will be repaired, and any repairs conducted will be recorded;
- As far as possible, waste oils will be reused;
- If waste oil is not of suitable quality for onsite use, it will be collected by a licensed contractor for offsite recycling; copies of contractor licenses will be retained onsite. If recycling is not possible it will be burnt;
- Spill clean-up and fire extinguishing equipment will be available in the storage area, and personnel will be trained in its use; and
- There will be no onsite disposal of waste oils and solvents direct to the soil surface or storm water collection system.

5.20 ACCOMMODATION

The Project will provide jobs for approximately 2,500 people at the peak of the Project operations.

The accommodation village will be located adjacent to the reserved area of S&K mine, approximately 3 km to the north-west of the Letpadaung mine area, near to the local arterial highway and mine access. The new accommodation village will become an extension of Mine Town which houses the bulk of the S&K mine workforce (Figure 5.20.1).

The existing Mine Town has a total population of 3,100 people and its infrastructure is significantly more advanced than other places near the mine. Housing includes 145 separate houses, 256 semi-detached houses and a 60-person male dormitory for semi-contract workers. The expanded mine town development will require construction of 444 new houses to accommodate a mixture of expatriate and local staff. Four different house types have been developed varying from three bedroom to one bedroom architectural designs. In addition to the dwellings described above new amenities and facilities will be constructed to improve the quality of life of the Mine Town residents. New amenities will include:

- Sports facilities including golf driving range, soccer pitch, volleyball, tennis, and basketball courts;
- A small hotel with dining room, café, laundry, gymnasium, games rooms, and cable TV;
- An Olympic size swimming pool;
- A supermarket; and

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- An administration building and visitors car park;

A new 10kV overhead power line and substation will be constructed to augment the existing Mine Town electrical infrastructure. Water will be pumped from the mine and will pass through a water purification plant before being stored in a tank on an elevated part of the Mine Town site (promoting flow under gravity). Each new house will be fitted with a solar hot water system. Mine Town sewage will be treated in a dedicated wastewater treatment plant to a level that will allow treated water to be used for watering of gardens and lawn.

5.21 MINE CLOSURE

Letpadaung's short term closure and reclamation objectives (during construction and operations) can be summarised as follows:

- Progressively reclaim disturbed areas as soon as they are no longer active:
- Minimise the risk and impact of wind and water erosion and sediment transportation;
- Stabilise slopes;
- Restore drainage; and
- Cover ground to prevent soil drifting/dust.

The long-term closure and reclamation objectives are to:

- Reclaim the land to a condition where long-term environmental degradation does not take place;
- Reduce care and maintenance requirements;
- Restore the natural drainage patterns as far as practicable to the original conditions;
- For areas which cannot be restored to the original conditions, rehabilitate the areas to create landforms which are physically and chemically stable in the long-term, and where possible, are in keeping with the prevailing topography in the area;
- Prevent physical or chemical pollutants from entering and subsequently degrading the downstream environment – including surface and ground waters;
- Develop the site to achieve the long term land use goals developed in consultation with the community and government;
- Reclaim/rehabilitate the land to a condition where safety risks and environmental associated with the mine to the public are minimised;

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- Restore the local environment to a natural, balanced ecosystem typical of the area, or leave it in such a state so as to encourage and enable the natural rehabilitation and/or reintroduction of a biologically diverse, stable environment;
- Seek to establish flora and fauna communities which are dynamic and resilient to disturbance from external influences (such as rain, wind, drought, harvesting, for example);
- Reclaim the land to a condition where local communities can use the site without inheriting significant future liability;
- To the extent practical, create an aesthetically pleasing environment;
- Ensure public health and safety is protected;
- Minimise adverse socio-economic impacts and provide positive social-economic benefits;
- Agree success/completion criteria with relevant stakeholders. Monitor achievement against those criteria and report results to the stakeholders;
- Ensure at all stages of operations there are adequate and readily available funds to implement the closure plan.

In order to develop the closure plan from the concept level to detailed design stage, a number of consultations and studies will be undertaken during the mine operation to refine the plan. These are likely to include:

- Consultation with the local population to determine preferred final land use options;
- Consultation with government to establish final land use parameters;
- Rehabilitation trials to assess most appropriate resoiling and revegetation strategies for each key area on the site.
- Ongoing investigation and reviews of available rehabilitation materials and new technologies to improve rehabilitation outcomes.

The conceptual closure plan in Appendix L allows integration with the design concepts and ensures that the design and operation of the site are compatible with the closure plan. After commissioning a detailed closure plan will be developed.

An outline closure land-use plan has been developed for the site. On closure the open pit will remain as a void with a permanent pit lake. The remaining areas will be rehabilitated to one of four land-use categories, namely:

i. Scrub/grazing;
ii. Agriculture;
iii. Pond or wetland areas; or

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iv. Landfill.

Progressive rehabilitation will be undertaken wherever possible. All equipment and infrastructure will be removed from site unless there is a beneficial use to the community such as buildings or roads.

Due to the potential for long-term environmental pollution, both the WRDs and HLPs are to be covered with low or very low permeability capping systems to reduce infiltration.

Surface water run-off and leachate from WRDs and HLPs will be controlled via a surface water management system that separates clean from potentially contaminated water, provides settling areas to reduce suspended load prior to discharge, and allows treatment of water which doesn't reach the necessary standards before release from site.

Some materials arising from clearance of the site will have a commercial use and value. These may include generators, pumps and pre-fabricated buildings. Where possible these will be removed from site and either sold or reused elsewhere. Any materials which cannot be handled in this manner are considered wastes for the purposes of this closure plan.

If it is possible to reuse a waste, either onsite or for a different application in the local community, then this should be adopted. Possible options include using old plastic pipework for fencing or corrugated metal sheeting as roofing on community buildings.

Where the wastes cannot be reused, attempts will be made to recycle those materials through off-site merchants and processing facilities. Types of waste that could be recycled include crushed concrete which can be used as aggregate and steelwork that can be sold as scrap metal.

If the waste cannot be reused or recycled then it should be disposed of in an appropriately-constructed landfill facility. It is intended that two landfills will be constructed on the site so that wastes are contained within the site boundary. One facility will accept inert/non-hazardous waste whilst the other will be a hazardous waste landfill.

As the closure plan is developed during the mine life, a set of completion criteria for rehabilitation, which are consistent with overall site closure objectives, will be determined and agreed with the regulator and relevant stakeholders. Through long-term monitoring of the site, it will be demonstrated that the development of rehabilitated areas is consistent with completion criteria.

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Closure costs will be developed concurrent with the closure plan and financial provision will be made to ensure that adequate funds are available for final closure.

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6. COMMUNITY CONSULTATION

6.1 INTRODUCTION

The Letpadaung Project has voluntarily undertaken to prepare an ESIA consistent with the good international practice. According to the World Bank/International Finance Corporation (WB/IFC) Performance Standard 1, stakeholder engagement is an ongoing process in the project lifecycle to "disclose project-related information and consult with local communities on matters that directly affect them."[40] For public consultation to be effective, communities must be knowledgeable about planned project activities and their potential impacts and given ample opportunities to express their concerns about project matters so that these concerns can be addressed through the Project's design and implementation arrangements. Instrumental in the process is a two-way and timely exchange of information between Project representatives and affected communities in which both parties are free to communicate without fear of reprisal. Public consultation also plays a role in ensuring that all affected persons, regardless of their social status, are given equal opportunities to express their concerns and receive a proportional share of the project's benefits even if it means Project planners make special arrangements to accommodate a person's circumstances and needs. When preparing the scoping study and Terms of Reference for this ESIA it was apparent that the concept of free, prior and informed consent in relation to this Project would not be achievable due to historical events associated with the Project and, more broadly, in Myanmar as a nation.

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6.2 STAKEHOLDER CONSULTATION REGARDING LAND COMPENSATION

Ministry of Mines received an application for issuing of Farm Land Nationalization Act (39) (La Na -39) for utilization of farm lands for the mining purpose (No.1 Mining Enterprise) on 18 January 2001 with reference No. 5/41-5(130)/Oo 6 from Sagaing Division Peace and Development Council. No.1 Mining Enterprise handed over La Na (39) to the Myanmar Economic Holdings Limited (MEHL) on 5th March 2010. According to La Na (39), the total area (7867.78) acre include the following-

a) Registered permanent farm land - 4826.70 Acres
b) Temporary farm land - 230.80 Acres
c) Other land (Including mountain area, road and other infrastructure) - 2810.28 Acres
d) Total - 7867.78 Acre

[40] International Finance Corporation. Performance Standard 1. Assessment and Management of Environmental and Social Risks and Impacts. January 2012.

Communication with the community regarding the Project had commenced as early as 2003, when the Myanmar Ivanhoe Copper Company Ltd. (MICCL) commenced collection of land information and land compensation as well as shifting the Taung Gyar Pagoda in preparation for development of the Project site. However, these activities were disbanded as the activities of MICCL focussed on the development of the S&K Project. It is unclear if community consultation occurred as part of the feasibility study and initial Environmental Impact Assessment process by Muir in 1997.

According to the contract between MWMCL and the Republic of the Union of Myanmar, the Government and its agencies were responsible for undertaking the public consultation associated with this Project. It is understood that discussions with the community regarding land acquisition and resettlement commenced as early as 2010, although there is no documented evidence of the content of that consultation, the issues raised or their resolution. MEHL undertook investigation of the current status of the land in 2010 with assistance from the local government and the local Settlement and Land Record Department. On 12 October 2010 they made a submission to regional authorities to set up two (2) land compensation committees to lead the land compensation process. One committee was formed of representatives from Regional authorities and the second from local authorities and village heads of the affected areas.

The Salingyi Township authority set about checking and recording the condition of farmland on the ground. The teams identified that the area of farmland had increased to 5487 acres in the ten (10) years since the original submission in 2001.

The committees made representation to government to increase the rates normally paid for land, including land that had been farmed without authority and this approval was granted. Compensation was also paid for the land for the resettlement villages. The initial compensation determination was completed on 20 August 2011.

Anecdotal evidence suggests there was at least some consultation regarding resettlement of the villages and the selection of the sites for the new villages. Indeed it appears land was offered in two (2) locations some distance from the Project area but this was not accepted by the villagers and the two (2) resettlement villages that have been developed were agreed in consultation with the villagers to be relocated.

There is also some evidence that the land compensation and resettlement negotiations have resulted in reconsideration of the land valuation process on at least two (2) occasions which has resulted in deputations presenting this case to the agents of the Government.

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The first occurred after the finalisation of the first round of land compensation in August 2011 in regard to unregistered farmland. It was agreed to compensate for this land, a process which was completed on 6 November 2012. The land compensation was based on the current market value of the three (3) years production from the land plus the value of any trees on the land.

On 3 August 2012, MEHL was granted a 60 year land grant over the Project area by the Ministry of Home Affairs.

Ultimately, many landholders did not accept the compensation offered and this has lead to subsequent protests and actions to limit access to the land by MWMCL. The most significant of these culminated in dispersion of the protest on 29 November 2012 and there have been many smaller protests since that time. The failure to resolve the land compensation issue to date has clouded any consultation with the community regarding this ESIA or discussions regarding the project status, including the commencement of early construction works.

6.3 SPECIAL INVESTIGATION COMMISSION

Following the protests that culminated on 29 November, the Government appointed a Special Investigation Commission (SIC) chaired by Daw Aung San Suu Kyi. This Commission conducted investigations in the period from January 2013 to March 2013 before delivering its report to the Parliament in March 2014. During this period all other consultation with the community was stopped at the request of the Government. As a result, the Scoping Study and Terms of Reference prepared to enable this ESIA were not developed in consultation with the community as their development coincided with the work of the SIC.

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The SIC's findings were developed after significant community consultation. During the operation of the SIC, no additional consultation was able to be carried out. As a result, no community consultation was undertaken during the scoping study which lead to the preparation of the terms of Reference for this ESIA.

In September 2013, in response to the SIC's findings, another round of compensation was paid to the households that lost their land. The rate of compensation was between 3 to 3.7 times the legal requirement. Approximately 56% of the compensation capital has been claimed by the villagers.

The Project sponsors are taking action to regain the trust of the communities by making concessions aligned with villagers' expectations, including back compensation payments to households affected by land take and re-evaluating decisions related to cultural property. MWMCL also changed its compensation criteria with respect to the

provision of jobs to affected households in response to information learned from the community consultations. Whereas previously one (1) job was to be allocated to each affected household regardless of the amount of land taken for the Project, the new criteria take the amount of land eligible for compensation into account. Wanbao will provide between one (1) to three (3) jobs per household based on the amount of acreage lost. These arrangements were approved by the Government in July 2013, in Phase 1 of the CSD Programme summarised below.

From a risk management perspective alone, it is strongly recommended that MWMCL develop the retrospective Resettlement Action Plan in line with IFC Performance Standard 5 and make corrective actions to protect communities and their assets from their exposure to the construction activities. A second effort at damage control would be for the Company to separate the compensation and livelihood restoration measures, including infrastructure works to be carried out in the new villages, from its broader philanthropic CSR Programme of community investments and communicate this distinction to the main community stakeholders. This will demarcate the social and community infrastructure investments associated with impact mitigation from those associated with the Company's philanthropic endeavours and good will.

6.4 CONSULTATION ASSOCIATED WITH ESIA PREPARATION

As mentioned previously, consultation during the preparation of the ESIA has been hindered by the ongoing disputation regarding land compensation and resettlement. As a consequence, the community has not been able to be informed of the undertaking of the ESIA and the field work associated with it. The ESIA has been developed with very little representative feedback from the community on the issues it considers are significant to the Project or on the management of those issues. This has resulted in:

- Staff collecting field data being asked to leave land within the Project area;
- Site reference markers being removed making inter-seasonal variations difficult to monitor;
- Permanent monitoring points being rendered useless through vandalism;
- The inability to leave monitoring equipment in the field for extended periods as good practice baseline definition requires; and
- The inability to involve the community in the data collection process in a representative manner.

In a normal community consultation process, the baseline data gained would be discussed with the community and their comments received and considered in its

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interpretation. This process could not be undertaken as the community was not receptive to such presentations.

The Project construction commenced before the development of the ESIA and as a result, stakeholder engagement with affected communities was less rigorous than the WB/IFC model. Free, prior and informed consent about the construction activities did not take place in the communities, and resulted in local tensions and protests that continue to undermine broad community support for the Letpadaung Project and create a rift between those persons and communities who support the Project and those who do not. The situation deteriorated with the commencement of the Early Works in November 2013 and remains problematic.

6.5 METHODOLOGY

MWMCL recognised the need to fill the gap in information being presented to the community. It also recognised the benefit of using local village representatives to communicate, within their communities, the progress and plans being made by MWMCL in preparing for the Project development in a manner approaching good practice.

Stakeholder engagement officially commenced on March 28, 2013 with a launching ceremony hosted by the Environmental Systems and Operational Development Manager and the Public Relations Manager with the newly contracted CSD leaders in attendance. This was followed by a week-long training workshop of the newly appointed CSD leaders representing villages near the Project site. Training consisted of brainstorming exercises in which the CSD leaders shared with the group the main problems and concerns facing the villages they represented, later consolidated into one list; conducted community mapping; and gained familiarity with the World Bank/ICMM/ESMAP Community Development Toolkit. The Community Development Toolkit was adopted as the reference standard and guidance for the upcoming village consultations. A second round of training was conducted by the Public Relations Manager and the newly hired CSD Team Project Manager in late April. On April 24, MWMCL's Managing Director sent a letter to the Sagaing Regional authorities and to MEHL officially informing them of the CSD Program and requesting their approval which was readily given. MWMCL subsequently approved the CSD programme.

To date, the Project has carried out consultations in two (2) phases, the planned activities of which were side-tracked by either Project delays or civil disobedience in some of the affected villages. The refusal of villages to participate in the community engagement activities and the general atmosphere of discord influenced the venue for

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consultation, the type of consultation technique used, and the amount of time spent obtaining information. In many instances, the quality of the stakeholder engagement methods utilised was compromised in response to the uncertainty posed by access restrictions to some of the villages (as a result of barred entry or the potential threat of physical harm by the protesters). That the CSD Team was able to obtain the volume of information it did is commendable and demonstrates the tenaciousness of the CSD Leaders to carry out their mandate.

Phase 1 Consultations

The intended purpose of the Phase 1 consultations (May – August 2013) was to ascertain village stakeholders knowledge base about the planned Project activities, demonstrate MWMCL's commitment to continuous stakeholder dialogue (through the implementation of a forthcoming Public Disclosure and Consultation Plan (PDCP), and discuss locations of the Early Works Project activities and potential impacts and collect feedback.

As the Early Works were rescheduled for October 2013, the CSD Team quickly changed the focus of the consultations toward corporate social responsibility and community development planning. They then developed an implementation schedule for Phase 1 activities, which involved:

(i.) public awareness raising;
(ii.) identification of community needs;
(iii.) implementation of Complaint Response Mechanism in the villages and training of the CSD leaders on the CRM;
(iv.) information gathering for media promotion;
(v.) estimates of employment vacancies in the construction period; and
(vi.) detailed proposal of the community and social development infrastructure to be financed in the villages in FY2014.

These activities, among others, formed the Draft PDCP. All of the activities in the implementation schedule were completed.

In line with good practice, the CSD Team identified the primary stakeholders with whom they would regularly consult. These primary stakeholders would be directly affected by the Project activities and were defined to be the 12 villages bordering the leased area and the 4 villages to be relocated. However, as it became known in the villages that the primary stakeholders would receive Project-related benefits from the CSD Programme, there was high demand to expand the group of primary stakeholders to include an additional 18 villages considered to be indirectly affected by the Project.

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The resulting group of primary stakeholders are the following 34 villages listed in Table 6.1 (33 with Zidaw and Sede merged into one village). It should be noted that data that was gathered for Palaing, Mingalargone, and Yonebinyoe but is not included in the consultation summary for the period of May to August 2013.

Table 6.1: List of villages defined as primary stakeholders and status of first round of consultations, May 2013

	Village	Status
	4 relocated villages:	R=Refused E= Engaged NE=Not Engaged
1	Zidaw/Sede	Old – R New - E
2	Kandaw	E
3	Wetme	Old – R New - E
	12 villages bordering the leased area:	
4	Moegyobyin (North)	E
5	Moegyobyin (South)	E
6	Moegyobyin (Central)	R
7	Wardan	E
8	Paungga (North)	E
9	Paungga (South)	E
10	Paungga (Central)	E
11	Dondaw	E
12	Ywatha	E
13	Gondaw	E
14	Kan Kone	E
15	Shwe Pan Khaing	E
	18 additional villages:	
16	Thedawayi	E
17	Yay Kyi Pin	E
18	Telpinkan	E
19	Phaung Kadar (South)	E
20	Kyaukpyudaing	E
21	Kyawywa	E
22	Taungpalu	E
23	Shwehlay	E
24	Ywarshay	NE
25	Ton Ywathit	R
26	Taw Kyaung	R
26	Aleywa	R

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	Village	Status
27	Ledi	E
28	Yonebinyoe	E
29	HtanDawGyi	NE
30	Palaing	NE
31	Palaung	E
32	Nyaungbingyi	NE
33	Mingalargone	NE

Following protocol, the CSD Team sent a letter to each Village Administrator requesting approval for the CSD Team to speak to the villagers in a public forum in which they would present the Draft PCDP and the draft questionnaire proposed for the socio-economic baseline data collection.[41] Six (6) of the 26 villages (24%) refused engagement (see Table 6.2.1).

In light of the volatile situation, the CSD Team could not present the PCDP in a public forum, but instead, made separate visits to the receptive villages where discussions were dominated by outstanding issues. Most of the villagers wanted to know the status of commitments made earlier by MWML regarding job placements, provision or upgrading of community infrastructure, and land compensation. Their daily reports provide the basis of information for the summary of issues raised and their resolution presented in the next section. An example of the meeting minutes for Kyawywa village is presented in the Table 6.6.5 at the end of this report.

In the first round of consultations, the CSD Team obtained agreement from most of the villagers to conduct interviews with willing households for the socio-economic baseline data collection (with Gondaw and Kan Kone declining). This was to take place the week of May 11, 2013. On May 11th, after being alerted to a strike demonstration organized by student protesters, the CSD Team decided to cancel/postpone the interviews in those villages located near the strike action, totalling six villages and another, Moegyobyin (North), where the household interviews were interrupted by the protesters.

After the fieldwork data collection, in June 2013, a second round of consultations followed in which MWMCL answered questions about the status of the villages' CSD requests and heard grievances expressed by the villagers. These complaints were recorded in a database which was updated to include the actions taken by Project staff

[41] At the time the letter was sent out, there were 26 primary stakeholders.

to investigate the complaint and seek resolution. The findings of the community consultations were communicated to Wanbao management who responded by making two (2) important commitments to the communities. As mentioned previously, one was the increase in the number of job opportunities available to households affected by land take. The second was a long-term financial commitment to support the communities for the life of the Project.

Wanbao, MEHL and Mining Enterprise 1 are apportioning 2% of their respective net profit from the Project for CSR activities once the Project is in full operation. Before then,the Project partners have committed USD 1 million annually toward community development activities. These financial commitments to the communities are specified in the Amendment to the Production Sharing Contract which was signed by the three (3) parties in July 2013.

Phase 2 Consultations

The objectives of the Phase 2 consultations were two-fold; first, to inform the villages about the modified Early Works activities and schedule and obtain their perceptions of the potential impacts of the planned works on their communities; and second, to gain community input into the proposed CESMS and ESIA impact and mitigation measures to be included in the EMPs and SMPs.

Phase 2 consultations commenced in late September 2013 with an issues identification exercise conducted by the CSD Team Leaders in their respective villages. The CSD Team was able to compile a list of environmental-related issues which will be used to tailor the EMPs and Environmental Control Procedures as appropriate in future consultations with the villages and to inform the planning of the Safety and Environmental Awareness Programme. As a deadline of September 30th for eligible households to accept financial compensation in return for their land, as presented in their compensation offer, was approaching, the discussions were overwhelmed by village requests for an extension to this deadline, requests to postpone the Early Works until after the harvest, and requests for the MWMCL to protect the villagers' livestock from Project construction activities. Households were encouraged to agree to the land compensation terms by the deadline by the CSD Team as well as being presented with an updated 12-week Construction schedule and map.

Although information did come out of the consultations in Phase 2, the process of stakeholder engagement was less than satisfactory. The disclosure of the Early Works activities to the villages should have occurred much earlier, as it had been planned as early as April 2013, with more time allowed for digestion of the material, conferment

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with Project technical staff on specific issues, and opportunities for villagers to express their concerns, receive feedback from the Project on specific grievances/queries, and make the necessary adjustments to their daily regime to manage any impositions/impacts from the construction activities (ideally with assistance from the Project). It would also have allowed for agreements to be made regarding deferment of planting of crops in the wet season.

The first blasting took place on October 9th, barely a week after the September 30th deadline and the disclosure of the Construction Schedule. The short notice given by the Company may have been perceived by the communities to be a forewarning of the upcoming construction works rather than a genuine effort to obtain informed feedback and broad consent.

After presenting the Construction Schedule in their respective villages, the CSD Team instructed the villagers to write down their concerns and drop them in the CRM box in the village. Only five (5) pieces of paper were received. This is not an unexpected outcome given the mood of the community and its focus on resolution of land compensation. The desire of MWMCL management to consult directly with the affected communities, particularly those who strongly opposed the Project, was hindered by refusal of entry into those communities and the lack of authority afforded to the company within the Product Sharing Contract to take on such a process. Even more worrisome is that it also creates the perception that the Company does not care about the well-being of the local people. This is damaging for the Company's reputation and may seriously put at risk not only the Company's "social license" to operate but its actual ability to operate.

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6.6 OUTPUTS FROM THE VILLAGE CONSULTATIONS

A total of 6 outputs were produced as a result of the Phase 1 consultations:

- Issues identification and priority ranking of village needs;
- Financing proposal for FY2014 CSD Programme and subsequent financial commitments;
- Data collection for the socio-economic baseline analysis and report;
- Effectiveness Evaluation Record;
- Public Consultation and Disclosure Plan (PCDP); and
- Complaint Response Mechanism (CRM).

A major outcome of the Phase 1 consultations was a list of priorities identified by the villages, a ranking of the top three priorities (also done with village participation) and concrete follow-on actions to be taken by the Company corresponding to each priority.

The Requirement List for six villages is presented in Table 6.6.1 at the end of this report. This list is continually being updated together with the actions taken or proposed and justifications for decisions made.

The activities undertaken to identify practical and realistic community infrastructure projects in the designated villages led to the development of a financing proposal for the FY2014 (See Table 6.6.2 in the Tables Section at the end of this report). It should be noted that the Table does not contain all the villages and requires updating for the villages listed.

The proposed activities and budget for the FY2014 CSD Program is subject to the approval of MWMCL's Managing Director and the Sagaing Regional Government. An amount of USD 1 million has been preliminarily allocated for FY2014.

The third output from the Phase 1 consultations was the collection of information required for the socio-economic baseline data analysis, the results of which are presented in Section 4.11.

The fourth output was the implementation of a process to evaluate the effectiveness of the Public Consultation and Disclosure Plan (PCDP). It involves the completion of an Effectiveness Evaluation Record (EER) pertaining to a set period of time by the CSD Project Manager. The EER for the Phase 1 consultations was signed and approved on September 30, 2013 and is presented Table 6.6.3 at the end of this report.

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While monitoring and evaluation of the public consultation activities is important and an integral part of the ESIA process, additional M&E tools need to be developed to supplement the EER. The EER also needs refinement in the area of indicator development. As is currently the case, the indicator defining achievement of the three conceptual goals related to the principles of free and informed participation is completion of the activity in the PCDP. This means that an activity is considered to be successful if it was completed or largely completed. The EER for Phase 1 was rated "largely achieved" because most of the activities were completed. While it is true that outputs were generated as a result of the public consultations, this in itself says nothing about the quality of the consultative process as perceived by independent evaluators.

The fifth output, the PCDP is problematic because there was little consultation on the Plan and the driver of the PCDP is Company management and Government and not the CSD Team in collaboration with the villages. It is doubtful the PCDP has broad based support and will likely need modification in line with the SMPs regulating stakeholder engagement and public consultation.

The sixth and final output of the Phase 1 consultations is the Complaint Response Mechanism (CRM) which serves as the chief mechanism for local persons and communities to express concerns about Project-related activities in an anonymous and confidential manner. A box for the collection of concerns has been placed in each of the 33 villages. The CRM needs to be developed further in terms of role definition, organizational responsibility, staffing, resourcing and training. Above all, it has to function as a true and effective mechanism for the fair and transparent consideration and redress of concerns and be perceived as such.

The main output from the Phase 2 consultations to date is the Issues Analysis matrix, which was based on the environmental-related issues raised in the village consultations in September and October 2013. From the Issues Analysis matrix, the MWMCL Village Environmental Awareness Program will be developed. (Table 6.6.4 for the Issues Analysis at the end of this report). The status of this report is not known.

6.7 ISSUES RAISED AND RESOLUTION

It appears that the CSD Team and Project community personnel are knowledgeable about the needs and priorities of the communities they visited in their consultations. These needs and priorities have informed the CSD Programme for 2014.

A less satisfactory outcome of the consultations is the lack of information collected on community concerns regarding the Early Works and the other Project activities required in the construction phase. The situation is made even more complex by the current stalemate between MEHL and the remaining 44% of land users yet to sign the compensation agreement and tensions resulting from the close proximity of the farmlands to the Early Works. A resolution is urgently needed to remedy the land acquisition issues and to improve and normalise broader Company-community relations. it is recommended, MWMCL should hire a team of dedicated and qualified Myanmar-based community mobilisers to lead the community engagement activities. This team should be skilled in appropriate public consultation techniques and just as importantly, trusted and accepted by the local communities. The team must be regarded as being fair and impartial and respectful of local traditions and opinions.

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7. ENVIRONMENTAL AND SOCIAL IMPACT ANALYSIS

7.1 INTRODUCTION

The project will inevitably bring negative effects, particularly given that it occupies land currently used by others and that it makes permanent changes to that land in the development of the Project. MWMCL has undertaken to mitigate impacts to the maximum practical extent and to ensure no person in the area will be worse-off because of the Project implementation.

The Project will provide economic and social benefit to the local community and to the national economy. The Letpadaung area population is mainly comprised of subsistence farmers and the Project will bring opportunities for employment and developments in social, economic and health infrastructure.

7.2 ASSESSMENT METHODOLOGY

The impact assessment has been undertaken based on a risk-based approach using the consequence of the impact, its probability and its severity. The resultant risk matrix is included at Table 7.2.1 attached. These criteria are defined as follows:

1. Impact Significance

The significance of the impact is a product of the consequence and the probability that the impact will occur (impact significance = consequence x probability).

2. Consequence

The consequence of the impact is based on the severity of the impact and the extent over which it occurs [consequence = (severity +extent)/2]

3. Severity

The severity of the impact is the sum of its intensity and duration (severity = [intensity + duration]/2))

Where the consequence of an event is not known or cannot be determined, the “precautionary principle” has been adhered to and the worst-case scenario assumed.

Each criterion is given a rating (see Table 7.2.2 and Table 7.2.).

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Table 7.2.2: Severity

INTENSITY = MAGNITUDE OF IMPACT	**Rating**
Insignificant: impact is of a very low magnitude	1
Low: impact is of low magnitude	2
Medium: impact is of medium magnitude	3
High: impact is of high magnitude	4
Very high: impact is of highest order possible	5
DURATION = HOW LONG THE IMPACT LASTS	**Rating**
Very short-term: impact lasts for a very short time (less than a month)	1
Short-term: impact lasts for a short time (months but less than a year)	2
Medium-term: impact lasts for the for more than a year but less than the life of operation.	3
Long-term: impact occurs over the operational life of the mine	4
Residual: impact is permanent (remains after closure)	5
EXTENT = SPATIAL SCOPE OF IMPACT	**Rating**
Limited: impact affects the immediate site only	1
Small: impact affects immediate site and surrounds	2
Medium: impact affects the entire project area	3
Large: impact affects an area greater than the site (including neighbouring areas).	4
Very Large: impact affects an area larger than the site and neighbouring areas.	5
Medium-term: impact lasts for the for more than a year but less than the life of operation.	3
Long-term: impact occurs over the operational life of the mine	4
Residual: impact is permanent (remains after closure)	5

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Table 7.2.3: Probability

PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	**Rating**
Highly unlikely: the impact is highly unlikely to occur	0.2
Unlikely: the impact is unlikely to occur	0.4
Possible: the impact could possibly occur	0.6
Probable: the impact will probably occur	0.8
Definite: the impact will occur	1

Table 7.2.4: Impact Significance

Negative Impacts		
≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.
Positive Impacts		
≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

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Mitigation measures for all significant impacts have been identified as part of the impact assessment. The impacts have been ranked before and after the implementation of the mitigation measures. Consideration has also been given to the confidence level that can be placed on the successful implementation of the mitigation level by MWMCL:

- High Confidence: mitigation measure easy and inexpensive to implement;
- Medium Confidence: mitigation measure expensive or difficult to implement; and
- Low Confidence: mitigation measure expensive and difficult to implement.

The significance of the impact is given without and with mitigation. Consideration is given to the mitigation confidence when determining the potential to reduce the impact significance. If the mitigation confidence is low the impact is unlikely to be reduced and this is reflected in the assessment of the significance with mitigation. If the mitigation confidence is high the impact significance is reduced. If the confidence significance is moderate the impact significance may change based upon experience that the measure can be implemented.

7.3 AIR QUALITY

The Project will give rise to atmospheric emissions during the construction, operation and closure phases of the project. The key sources of such emissions are given in Table 7.1.

Table 7.1: Key sources of air quality emissions

Pollutant	Activity
Particulates	Earthmoving for construction of roads
	Land clearing activities such as dozing and scraping of vegetation and topsoil
	Vehicles and construction equipment activity on the unpaved roads during construction and operations
	Drilling and blasting of waste rock and ore
	Tipping of material onto dumps and stockpiles
	Conveyor transfer points
	Erosion from exposed WRDs, stockpiles and HLPs
	Primary and secondary crushing
Gases and particles	Emissions from vehicles
	Acid mist from HLPs

Air quality dispersion modelling was undertaken by Knight Piésold Pty. Ltd in September 2013 (Appendix K) for the project's construction and operation phases, taking into account the influence of changes caused by the dry and wet season (mainly wind speed and direction variations due to monsoon influence).

Considering the Project's extractive characteristics, dust emissions (PM_{10} and $PM_{2.5}$) have been inventoried. Of these emissions, PM_{10} was selected for modelling emission dispersion, given that it is seen as an air quality impact indicator for extractive open pit mining activities was considered the most relevant characteristic to be managed.

7.3.1 Construction Phase

During the construction phase, activities related to drilling and blasting, earthworks (topsoil removal, excavations and land grading), loading and unloading of materials by trucks, and light and heavy vehicle traffic on paved and unpaved roads will take place.

Table 7.2 shows the modelled PM_{10} concentration at sensitive receptors adjacent to the Letpadaung Project for the construction phase. Figure 4.10.4 shows the location of the receptors.

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Table 7.2: Impact analysis of PM_{10} concentration – Construction phase

Receptor	Impacts of PM_{10} ($\mu g/m^3$)		Background concentration of PM_{10} ($\mu g/m^3$)[1]		Total PM_{10} ($\mu g/m^3$)	
	Annual	24 hours[2]	Annual	24 hours[2]	Annual	24 hours[2]
Station 1	1.5	13.3	11.3	14.3	12.8	27.6
Station 2	0.3	11.4	7.7	12.65	8	24.05
Station 3	2.2	21.4	7.8	11.4	10	32.8
Station 4	0.4	12.8	14.3	17.6	14.7	30.4
Station 5	0.2	3.7	20.0	22.3	20.2	26
Station 6	0.2	5.1	7.1	9.5	7.3	14.6
Station 7	0.1	1.8	15.0	19.2	15.1	21
Station 8	0.1	1.9	7.4	10.4	7.5	12.3
Monywa	0.2	11.9	-	-	-	-

Prepared by Knight Piésold

Notes:

[1] Results from air quality sampling

[2] Maximum 24 hour average concentrations

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The modelled values are well below the IFC standard for PM_{10} concentrations which is 20µg/m^3 (annual mean) and 50µg/m^3 (24-hour mean).

7.3.2 Operations Phase

During the operation phase, activities related to drilling and blasting, earthmoving, material loading and unloading, heavy vehicle traffic on paved roads between the pit and the WRDs (haul roads), wind erosion of stockpiles at WRDs, unloading at semi-mobile crushers, materials crushing, ore handling, ore transfer to heap leach piles (HLPs), and vehicle traffic along paved roads will take place.

Table 7.3 shows the modelled PM_{10} concentration at sensitive receptors adjacent to the Letpadaung Project for the operations phase.

Table 7.3: Impact analysis of PM_{10} concentration – Operations phase

Receptor	Impacts of PM_{10} ($\mu g/m^3$)		Background concentration of PM_{10} ($\mu g/m^3$)[1]		Total PM_{10} ($\mu g/m^3$)	
	Annual	24 hours[2]	Annual	24 hours[2]	Annual	24 hours[2]
Station 1	2.3	33.3	11.3	14.3	13.6	47.6
Station 2	1.2	15.6	7.7	12.65	8.9	28.3
Station 3	2.7	29.3	7.8	11.4	10.5	40.7
Station 4	1.0	14.4	14.3	17.6	15.3	32.0
Station 5	0.8	19.2	20.0	22.3	20.8	41.5
Station 6	0.4	10.3	7.1	9.5	7.5	19.8
Station 7	0.1	6.6	15.0	19.2	15.1	25.8
Station 8	0.2	6.1	7.4	10.4	7.6	16.5
Monywa	0.3	6.1	-	-	-	-

Prepared by Knight Piésold

Notes:

[1] Results from air quality sampling

[2] Maximum 24 hour average concentrations

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The modelled values are well below the IFC standard for PM_{10} concentrations which are $20\mu g/m^3$ (annual mean) and $50\mu g/m^3$ (24-hour mean).

Gaseous emissions from diesel equipment and light vehicles are expected to be low for both construction and operations. However, acid mist from the acid irrigation solution used on HLPs is considered to be an area of concern and requires careful monitoring and management.

7.3.3 Mitigation Measures

For the purposes of the air quality dispersion modelling, it was assumed that mitigation measures will be implemented including wet suppression of dust at ore handling points, haul roads and at crushers

Proposed mitigation measures to protect air quality include:

- Water sprays and chemical suppressants will be utilised to control dust on haul roads and access roads;
- A dust management plan will be prepared for the both the construction and operations phase;
- Blasting will take account of weather conditions, particularly wind direction;
- Planting of vegetative buffer zones to mitigate windblown dust;
- The use of drippers for dispersion of acid onto the surface of the HLPs;

- Adjustment of application rates to ensure no pooling of acid leach solution on the surface of the HLP;
- Adjustment of pumping pressure to ensure HLP drippers do not emit jets of solution;
- Minimum set back from HLPs of 350 m for villages;
- Consideration of wind direction and strength during operation of HLP irrigation system; and
- Checking of all irrigation pipework on HLPs to ensure no leakages.

7.4 NOISE AND VIBRATION

A noise and vibration survey was undertaken at the site and modelling was undertaken by Knight Piésold Pty. Ltd in September 2013 (Appendix K), taking into account the influence of changes caused by the dry and wet season.

7.4.1 Baseline Survey

For the purpose of characterizing the environmental baseline conditions of the Letpadaung Project, 10 noise stations were sampled during the dry and wet seasons of 2013, whose locations are shown in Figure 4.10.3. During the dry season, noise levels for the daytime period varied between 41.3 and 46.6 dB(A), while they varied between 41.5 and 46.3 dB(A) for the night-time period. It is important to point out that, except for the value determined for Station 3 during the night-time period, the remaining recorded values do not exceed international noise standards of 45 dB(A) night-time and 55 dB(A) for daytime, established by the IFC (2007).

On the other hand, values exceeding IFC standards were recorded during the wet season. These values range from 59.9 to 85.5 dB (A) during the daytime period, and from 66.7 to 74.6 dB(A) during the night-time period.

The criterion considered for assessing the results obtained at sampling stations close to vehicle traffic and built-up areas was the one established by the OECD (Organisation for Economic Cooperation and Development). This standard considers a value below 65 dB(A) to be an acceptable noise level for the daytime period, and a value below 55 dB(A) to be acceptable for the night-time period.

Noise and vibration modelling was undertaken for daytime and night-time to determine the level of impact on sensitive receptors adjacent to the Project.

7.4.2 Daytime Results

Table 7.4 outlines the results of noise modelling for the prediction of daytime noise impacts at sensitive locations adjacent to the Project.

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Table 7.4: Assessment of noise modelling results for operation phase - Daytime

Location	Predicted Noise Contribution dB(A) [1]	Background noise dB(A)[2]		Total noise dB(A)[3]		Standard dB(A)
		Dry season	Wet season	Dry season	Wet season	
Station 1	53.2	42.2	67.5	53.5	67.6	65 [4]
Station 2	51.7	42.8	72.9	52.2	73.0	65 [4]
Station 3	48.4	44.7	59.9	50.0	60.2	55 [5]
Station 4	16.5	46.6	66.5	46.6	66.5	55 [5]
Station 5	52.1	43.9	75.4	52.7	75.4	65 [4]
Station 6	16.5	43.8	63.8	43.9	63.8	55 [5]
Station 7	4.4	45.0	85.5	45.0	85.5	55 [5]
Station 8	43.2	42.2	67.9	45.7	67.9	55 [5]
Station 9	Not perceptible	42.3	67.8	42.3	67.8	55 [5]
Station 10	1	41.3	60.0	41.3	60.0	55 [5]

Prepared by Knight Piésold

[1] Results from noise modelling using SoundPLAN v. 7.2

[2] Results from noise quality sampling for environmental baseline.

[3] Total noise = background noise + predicted noise level.

[4] Acceptable standard for Leq < 65 dB(A) according to OECD.

[5] Acceptable standard for Leq < 55 dB(A) according to IFC and WHO.

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7.4.3 Night-time Results

Table 7.5 outlines the results of noise modelling for the prediction of night-time noise impacts at sensitive locations adjacent to the Project.

Table 7.5: Assessment of noise modelling results for operation phase – Night-time

Location	Predicted Noise Contribution dB(A) (1)	Background noise dB(A) (2)		Total noise dB(A) (3)		Standard dB(A)
		Dry season	Wet season	Dry season	Wet season	
Station 1	52	42.4	71.2	52.4	71.3	55 (4)
Station 2	49	42.4	68.9	49.9	68.9	55 (4)
Station 3	45	46.3	67.9	48.7	67.9	45 (5)
Station 4	16	44.0	74.6	44.0	74.6	45 (5)
Station 5	28.5	44.6	66.7	44.7	66.7	55 (4)
Station 6	16.5	44.4	74.0	44.4	74.0	45 (5)
Station 7	4.4	44.2	72.5	44.2	72.5	45 (5)
Station 8	35.5	42.0	68.7	42.9	68.7	45 (5)
Station 9	Not perceptible	42.2	67.0	42.2	67.0	45 (5)
Station 10	1	41.5	67.6	41.5	67.6	45 (5)

Prepared by Knight Piésold

(1) Results from noise modelling using SoundPLAN v. 7.2

(2) Results from noise quality sampling for environmental baseline.

(3) Total noise = background noise + predicted noise level.

(4) Acceptable standard for Leq < 55 dB(A) according to OECD.

(5) Acceptable standard for Leq < 45 dB(A) according to IFC and WHO.

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The largest increases of noise were observed for station 1, 2 and 5, which correspond to the levels recorded during the dry season; however these increases do not exceed the OECD standard.

Vibration levels from blasting were modelled and ranged from 0.2629 mm/s at the nearest receptor approximately 2.5 km from the blast area to 0.0032 mm/s at a receptor 9.5 km from the blast area. IFC does not have a standard for vibration associated with community health. The ANZEC (1990) guidelines[42] for ground vibration suggests the adoption of a standard of 5 mm/s for 95% of all blasts with no blast to exceed 10 mm/s.

7.4.4 Mitigation Measures

The noise impacts of the project have been predicted without the presence of acoustic barriers. The WRDs to the east, west and south of the pit can be utilised as acoustic barriers.

[42] Australian and New Zealand Environment Council (ANZEC). Technical basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration. September 1990.

Proposed mitigation measures to protect sensitive receptors from noise and vibration include:

- Schedule waste dumping away from sensitive receptors during night-time operations;
- Limit the extent of other noisy activities, as far as possible, during night-time operations;
- Monitoring of noise levels near sensitive receptors;
- Install acoustic barriers to reduce noise in sensitive areas;
- Management of blasting (timing/size); and
- Notification of receptors regarding blast times.

7.5 GROUNDWATER

7.5.1 Groundwater Supply

It is expected that the groundwater ingress into the mining open pit will be significant and is estimated at between 26 and 116 litres/second[43]. A significant proportion of this flow will be later in the mine development when the main eastern pit ramp of the Stage 2 pit intersects the alluvial plain. If the pit was re-shaped to avoid cutting the alluvium this would reduce to 37.4 L/s. Inflow from the alluvium should be intercepted as it enters the pit prior to the water being affected by ARD deeper within the pit.

It is likely that the change in the groundwater flow into the open pit could affect community groundwater wells.

7.5.1.1 Mitigation Measures

Proposed mitigation measures to prevent contamination of groundwater supply include:

- Monitoring bores to be established in the community, in order to monitor change in water levels at water supply points;
- Monitor water levels on a quarterly basis; and
- Identify potential alternative water sources if local wells are significantly impacted.

7.5.2 Groundwater Contamination

Mining and processing activities will generate acidic solutions that can contaminate groundwater. In particular the heap leaching process and WRDs are significant potential sources of groundwater contamination. Other sources of contamination are

[43] NFMKSDI, 2011

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hazardous chemicals such as hydrocarbons and chemical reagents, and waste material.

Geochemical sampling was undertaken in 2013 to evaluate the chemical composition of the waste rock that will be produced during the mining process and the potential for ARD. The primary conclusions from the geochemical study (Knight Piesold, August 2013 Appendix J) are:

- The waste rock samples were primary composed of quartz, clay minerals with a relatively high amorphous content. The main sulfide mineral in the waste samples was pyrite with trace chalcopyrite;
- The total sulfur contents of the samples was high to extremely high, however, this was in part a reflection of the high alunite and natroalunite contents;
- The Net Acid Generation test resulted in 96 samples producing acidic conditions, with the number of samples producing acid increasing with depth;
- Overall, 29% of the waste samples can considered as NAF, with the remaining 71% considered PAF. Of the NAF material identified, almost all of the material leached metals when contacted with water;
- The multi-element analysis indicated the majority of the waste rock to be highly enriched, and the distilled water extract testing indicated that some of these metals are readily soluble, especially under acidic conditions. Therefore, controlling the acid generation will be key to managing the metal leaching from both the PAF and NAF material; and
- Based on the results of the testing, active management of the potentially acid generating materials will be required.

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The acid and metals generation arising from waste rock is an extreme environmental risk to groundwater in the Project area.

7.5.2.1 Mitigation Measures

Proposed mitigation measures to prevent groundwater contamination include:

- Full compliance with EMP's, particularly those for groundwater contamination, acid rock drainage, metal leaching and waste dumps;
- Monitor groundwater quality in the proximity of potential pollution sources;
- Compacted clay liner with HDPE liner for the HLPs and any ore stockpiles to further reduce the risk of contamination from these sources;
- Seepage management systems for stockpiles and HLPs;
- Compacted clay liner for the WRDs to further reduce the risk of contamination from this source;

- Establish material availability for liners and capping material for WRDs;
- All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater;
- Monitor groundwater quality in the proximity of potential pollution sources;
- Facilities engineered to good international practice for the protection of groundwater are to be constructed on site for the disposal of general waste/hazardous waste;
- Bio-remediation facility to be implemented for hydrocarbon contaminated soils; and
- Temporary waste storage facilities to be engineered to prevent seepage of contaminants from such sites.

7.6 SURFACE WATER

Surface water issues arise from commencement of construction through the life of the project and beyond closure.

7.6.1 Loss of Catchment Yield

Downstream of the Project, surface water flowing to dams from local creeks is used primarily for subsistence agriculture, domestic purposes and livestock watering. The loss in yield associated with the Project will result from the containment of run-off from dirty areas and changes to surface hydrology.

7.6.1.1 Mitigation Measures

Proposed mitigation measures to prevent loss of catchment yield include:

- Reserve determination for the downstream users to be conducted and water supply to the catchment to be managed to ensure that the water requirements are met; and
- Installation of alternative water supplies.

7.6.2 Water Quality

Water will be collected or harvested from the following areas:

- Open pit in the form of groundwater ingress and rainfall from the pit area itself;
- Run-off and seepage from the WRDs and stockpiles;
- Run-off from the HLPs; and
- Run-off from hardstand areas around the processing plant and workshops.

Run-off from the WRDs and stockpile areas and the pit water can be expected to have a low pH, high level of soluble metals and high suspended solid content. The acid and

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metals generation arising from waste rock is an extreme environmental risk to surface water in the Project area and the water potentially discharged from the Project area.

All potentially contaminated waters will be harvested and pumped to the WWPs for use as process water during the operation phase of the Project. However, beyond closure these waters need to be contained within their respective structures and sealed in a manner that does not allow seepage from the containment. Failure to heed this requirement, from commencement of construction of these facilities, will leave a residual risk and legacy beyond closure of the operation.

Other potential surface water contaminant sources include spillages of hydrocarbons and chemicals from workshops and storage areas, spillage of chemicals from the process plant and leakage from pipes. Measures will be put in place to contain such spillages and prevent them from entering into any natural run-off area.

7.6.2.1 Mitigation Measures

Proposed mitigation measures to protect water quality include:

- Proper classification of waste rock prior to mining to enable location of the rock in appropriately prepared containment structures;
- Diversion of clean water around potential contaminant sources including the pit, WRDs, plant area and HLPs;
- The containment of water collected from areas with potential contaminants (including suspended solids) including the open pit, the WRDs, the pit area, HLPs, process plant and the workshops. This water is to be re-used;
- All diversion and containment measures are to be designed to accommodate the 1 in 100 year peak flow event and dirty water management measures are to be designed to have a risk of spill of 1% or less in any 1 year;
- All chemicals, reagents, hydrocarbons (fuel, greases, and oils) are to be stored in bunded areas, sized to contain spills;
- Oil interceptors and sediment traps will be installed and maintained to ensure any discharge to the environment carries a low sediment load;
- Storm water management drains and ponds will be maintained and kept clean in order to ensure that the capacity of such systems is not compromised during the life of the operations;
- Correct design of HLPs to reduce risk of slope failure; and
- Development of procedures to clean up uncontrolled release of HLP materials.

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7.7 GEOCHEMISTRY

Geochemical sampling was undertaken by Knight Piesold in August 2013 (Appendix J) to evaluate the chemical composition of the material that will be produced during the mining process for heap leaching and waste. The primary conclusions from the geochemical study are:

- The total sulfur contents of the samples was high to extremely high, however, this was in part a reflection of the high alunite and natroalunite contents;
- The Net Acid Generation test resulted in 96 of 150 samples producing acidic conditions, with the number of samples indicating acid increasing with depth;
- Overall, 29% of the waste samples can considered as NAF, with the remaining 71% considered PAF. Of the NAF material identified, almost all of the material leached metals when contacted with water;
- The multi-element analysis indicated the majority of the material to be highly enriched, and the distilled water extract testing indicated that some of these metals are readily soluble, especially under acidic conditions. Therefore, controlling the acid generation will be key to managing the metal leaching from both the PAF and NAF material; and
- Based on the results of the testing, active management of the potentially acid generating materials will be required.

7.7.1 Open Pit

The open pit will generate ARD during operation and post closure. Rock exposed in the pit walls has the potential to produce low-pH and/or metal-contaminated run-off water once it is exposed.

7.7.1.1 Mitigation Measures

Mitigation measures for the control of ARD and metal leaching in the open pit include:

- During operations, run-off from the in-pit waste dump and more generally from within the pit area, will be collected and pumped to the WWPs for use in processing;
- Specialised in pit mine waste disposal to ensure that pit water quality is acceptable and that it is hydraulically contained;
- On closure the pit will be flooded and water levels managed such that the waste rock and rock within the pit walls that has the potential to produce acid or leach metals remains submerged in perpetuity;
- Water levels will also be maintained at a level lower than the surrounding groundwater table to reduce seepage of contaminated water from the pit lake

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into groundwater, thus finished waste rock levels in the pit should not exceed three (3) metres below that level in the pit; and

- After closure, pit water shall be monitored quarterly and results compared to IFC standards quoted in Section 8.2.2 – Surface Water and 8.2.5 – Groundwater Contamination.

The water quality of the pit water will continue to degrade with the addition of acid and metaliferous leachate. However, if it is contained within the pit and does not seep into groundwater or surface water, the environmental impacts are not highly significant.

7.7.2 Heap Leach

The HLPs will be operated throughout the life of the mine with low-pH and high metal concentration leachate managed through the SW/EX plant. ARD and metals leaching are not issues during the operational phase.

From closure, the drawdown of the HLPs and any ongoing infiltration/ percolation will generate ARD and metal-rich leachate for many years.

7.7.2.1 Mitigation Measures

- All leachate produced by the HLPs will be collected and passed through the SX/EW plant and treated to render it acceptable for release to the environment;
- At closure, the HLPs will be capped with a very low permeability soil or geosynthetic cover system to reduce water ingress;
- Passive seepage management systems for stockpiles and HLPs;
- Connection of seepage management system to surface water management system;
- Monitor groundwater quality in the proximity of the HLPs; and
- Adoption of closure batter slopes for long term stability.

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7.7.3 Waste Rock

Approximately 946 Mt of waste rock lies within the mining boundary, of which 256 Mt will be mined from the 20th year of production and disposed of through in-pit dumping. The balance of 690 Mt of waste rock will be dumped outside the open pit in three WRDs.

Testing will need to be conducted on grade control and blast hole samples to define the acid formation potential of the waste ahead of mining. The results of the testing will be used by the mine planner to define PAF and NAF waste zones and allow selective handling of each of these wastes so they can be placed in specific areas of the waste dump.

7.7.3.1 Mitigation Measures

The waste rock will require certain handling and placement methods to reduce the risk of acid generation and metal leaching which will include:

- Mining practices are established which allow definition of the PAF and NAF waste in the field and allow for selective mining and placement of the material;
- Preparation of the foundations below all WRD areas to prevent contaminant seepage into the soil;
- Placement of a layer of benign waste (i.e. non-acid generating, non-enriched and non-leachable) at the base of the dumps to act as a buffer between the PAF waste and the foundation material at the base of the dump;
- All PAF waste is placed in lifts of no greater than 6.25 m in height to eliminate segregation of the waste which could lead to accelerated acid generation;
- All waste be encapsulated during operations with an engineered cover comprising fine grained soil material compacted with a high moisture content to reduce diffusion of oxygen through the cover system. The encapsulation material will need to be covered by benign waste or borrow material (i.e. non-acid generating, non-leachable and non-enriched) to prevent desiccation of the cover;
- Borrow areas for the encapsulation material be identified and samples of the proposed cover material be collected for geotechnical testing to allow detailed design of the cover system;
- Geotechnical testing be conducted during construction of the cover system to ensure that the cover system is constructed to the design specification;
- Geochemical monitoring of the cover system, comprising oxygen sampling points and thermistors, be conducted to allow the performance of the cover system to be verified during operations;
- A water management system be designed and constructed to prevent clean water from entering the waste dump area and to collect potentially contaminated water and direct this to a suitably designed water storage facility;
- Ongoing monitoring of the waste dump, encapsulation layer, cover system and drainage water will be required post closure until the integrity of the structure can be certain; and
- Should the drainage waters be found to be of an unacceptable quality, they will either need to be treated prior to release or contained.

It may be possible to direct seepage waters to the open pits on closure; however, this would require detailed hydrological, hydrogeological and geochemical modelling to

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determine whether off-site downstream groundwater or surface water resources would be impacted. The management of waste rock to minimise ARD and metal leaching is a crucial component of the Project and failure to do it adequately will seriously damage the environmental credibility of the Project.

7.8 SOILS

The soil groups within the Letpadaung area as described in Section 4.8 are of key importance when considering the impacts on soil and soil conservation. Two soil groups exist in the area:

- Letpadaung Hills - comprised deeply weathered profiles, with only minor bedrock being encountered, mainly along the hill crests; and
- Plains Around the Letpadaung Hills - the soils around the Letpadaung Hills grade from sandy materials close to the hills to fine grained soils near creeks and the Chindwin River. The undisturbed soils on the plains are near-neutral to slightly alkaline, non-saline and very low in organic matter (based on Muir (1997) results). They are also nutrient and zinc deficient but contain normal levels of copper and manganese.

The key impacts on soils and possible mitigation measures associated with the proposed mining activities include:

7.8.1 Sterilisation of Soil Resources

The development of infrastructure required for the Project will result in the sterilisation of soils within the footprint areas. Key activities that will impact on soils are the preparation of areas for the development of the open pit, waste rock dumps, heap leach pads, stockpile and loading areas, development of haul and site roads, founding excavations for the processing plant infrastructure, construction of buildings and the excavation of material for water storage ponds.

7.8.1.1 Mitigation Measures

All utilisable soil is to be stripped from footprint areas prior to construction or development and stockpiled as berms or low profile dumps of no more than six (6) metres high. Soil stripped from areas that will require rehabilitation at the end of the construction phase will be placed in berms adjacent to areas that will require rehabilitation. Soils will be separated in accordance with a soil utilisation plan and stockpile locations and volumes noted. Stockpiling of soils in close proximity to areas where the soil is required for rehabilitation limits the handling of such soils and reuse of the soil in the appropriate areas.

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7.8.2 Soil Contamination

Mining activities include the storage and handling of hazardous chemicals including hydrocarbons and chemical reagents. Spillage or leakage of these materials may make soils unsuitable for vegetation establishment. Containment measures (e.g. bunds and impervious materials) are to be put in place where such materials are stored or handled during the construction and operational phases to prevent the release of such chemicals into the soil environment.

7.8.2.1 Mitigation Measures

Proposed mitigation measures to prevent soil contamination include:

- All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater;
- Monitor groundwater quality in the proximity of potential pollution sources;
- Low permeability compacted soil /liner for WRDs and HLPs;
- Collection of contaminated run-off;
- Effective in-pit waste delineation plan;
- Application of mine waste management plan to reduce ingress of water and air in order to prevent ARD;
- Immediate clean up of spillage;
- Maintenance of plant infrastructure to prevent leaks and spills; and
- Design and placement of long term cover over WRDs.

7.8.3 Soil Erosion

Exposed soil surfaces are prone to erosion by wind and storm water run-off. Long-term stockpiles established for the operational and closure phases of the Project are to be provided with storm water diversion measures. Soil stockpiles are to be restricted in height to avoid compaction and damage to seed banks.

7.8.3.1 Mitigation Measures

Proposed mitigation measures to prevent soil erosion include:

- Long-term stockpiles are to be progressively re-vegetated to allow for stability of surfaces;
- Stockpiles not to exceed six (6) metres in height;
- Storm water to be diverted around long-terms stockpile areas; and
- Development of an erosion and sediment control plan.

7.9 BIODIVERSITY

Much of the area to be disturbed by the Project has been drastically transformed through long periods of agriculture and fuel wood removal. The composition of the

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aquatic environment shows modest levels of organic pollution but there are no severe anthropogenic impacts.

The Project does not pose any fatal flaws in relation to biodiversity as there does not appear to be any conflicts with international conventions, treaties, protocols or national legislation related to biodiversity. However, impacts are to be reduced by ensuring that sensitive areas are avoided where practicable and appropriate levels of environmental management are exercised.

7.9.1 Loss of Habitat

Most of the native woodland on the Letpadaung Hills has been removed for firewood. However, small remnant woodland exists that can be protected and rehabilitated. The remnant areas of vegetation offsite are proposed to be established as 'conservation' reserves. There are also proposals to enhance the quality of the vegetation in these and other areas around the Project area such that a total of 320 ha of vegetation will be retained in the 'reserved' areas and a further 160 ha of border plantings will be established around the site.

As part of the early works for the Project it is proposed to fence some areas of remnant vegetation and plant additional tree and shrub species (Figure 7.9.1). In addition there will be planting and management of buffer areas around the site boundary and within the site.

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7.9.2 Loss of Aquatic Life

The following consequences of the proposed development are likely to have an impact on aquatic life.

7.9.2.1 Change in Water Quality

Any changes in water quality can affect sensitive aquatic invertebrates. Accidental spills of pollutants could enter streams either directly or through surface water run-off. Such impacts on water quality will be of short duration especially on fish and aquatic invertebrates.

Vegetation clearance and mine pre-stripping may mobilise large quantities of sediment that may enter in to the surface water environment, particularly during rainfall events even though extensive silt traps will be installed. The increased turbidity in the river is expected to have a minimal impact as a result of the short-duration and also the existing clay-sandy soils that occur in the Project area that already provide a large sediment load.

The ecological implications of pollutants seeping from waste storage sites such as the WRDs are difficult to define but they could be significant. Seepage and runoff water from the WRDs are expected to be acidic and mobilisation of metals is thus likely.

The release of domestic wastewater into natural systems tends to elevate the nutrient levels as does nitrate residue that originates from blasting. All wastewater generated in the Project will be treated through sewerage treatment to minimise eutrophication of surface waters and impact on aquatic life.

Mitigation measures for surface water quality are outlined in Section 7.6.2.1.

7.9.3 Loss of Ecological Services

The development and operation of the mine will result in loss of firewood resources of the Letpadaung Hills and loss of some species of flora used for traditional food and medicines. The increased population associated with the mine could also result in added pressure on existing supplies of these resources.

It is proposed to prepare a natural resources management plan to outline measures to develop new or alternative sources of fuel and traditional food/firewood.

7.9.4 Proliferation of Alien Vegetation

Disturbed areas are usually colonised naturally by invasive, pioneer plants. Should these pioneers be alien invasive species, the disturbed areas become nodes of seed production for these unwanted plants. These species tend to replace indigenous species and reduce habitat diversity. The long-term impacts are the loss of both plant and animal diversity.

7.9.5 Proliferation of Disease Causing Species

Mining activities are likely to increase the prevalence of pest species. Of particular concern is the increase in the species that result in malaria and other mosquito borne diseases. These diseases are promoted by an increase in the presence of standing water that will result due to the implementation of the mining infrastructure.

7.9.6 Loss of Plant Productivity

High levels of dust fallout results in reduced plant production as a result of clogging stomata in the leaves. The impact is likely to be most prevalent in close proximity to dust sources (i.e. within the Project area). Since the habitat is transformed, the impact is not considered to be of significance.

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7.9.7 Mitigation Measures

Proposed biodiversity mitigation measures are generally discussed in preceding sections relating to water quality, soils, water quality and air quality. Specific additional measures include:

- Preparation of a weed management plan;
- Tree planting; and
- Preparation of a community health and safety management plan that includes measures to combat mosquito borne diseases.

7.10 TOPOGRAPHY

The development of the Project will result in a permanent impact on the topography. Key contributors to changes in the landscape character include:

- Excavation of the open pit to a depth of 450 m;
- Development of water storage ponds;
- Development of the waste rock dumps (125 m to 150 m high); and
- Development of the heap leach stacks (80 m high).

The backfilling of the Section 1 pit is proposed but not Section 2. Mine planning will investigate the backfilling of Section 2 or flooding of the pit to produce a lake. Site rehabilitation at closure will reduce and mitigate topographical impacts by contouring to resemble the surrounding landscape.

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7.11 CULTURAL HERITAGE

Cultural heritage impacts occur predominantly in the construction phase, because land clearance and other intrusive activities are required to prepare the site and build Project facilities. The Cultural Heritage Baseline Study has already identified the stupa situated in the valley of Letpadaung Taung as having religious, historical and cultural significance to local communities, and two monasteries are known to be situated in the Project footprint. In the operations phase, development of the open pit, waste rock dumps, soil stockpiles, dams and HLPs may also disturb cultural sites, but the likelihood of encountering any chance finds or hidden archaeological sites is very low as the Project area would have been cleared and surveyed in the construction phase.

7.11.1 Mitigation Measures

Proposed mitigation measures to minimise disturbance to the cultural sites at the site are:

- A site survey has been conducted to accurately map and identify all cultural sites prior to the commencement of construction activities;

- Sites will be relocated in accordance with legislative requirements and in consultation with community stakeholders;
- A Phase II survey will be undertaken for the excavation and documentation of all sites to be disturbed; and
- Only sites in Project footprint areas are to be disturbed, sites located outside the footprint are to be mapped, demarcated and protected.

7.12 SOCIO-ECONOMIC IMPACTS

The activities required to build and operate the mine are likely to impact local residents and Company personnel both positively and negatively. The more frequent the exposure of a person or group to a Project activity, the higher the likelihood the person or group will be affected by the activity. Communities and residents living near the Project boundary are therefore more likely to be adversely affected by many Project activities. The impact assessment does not take into account the cumulative effects of Project activities on affected persons and groups, but it is an important aspect to bear in mind.

7.12.1 Resettlement

The four (4) communities to be relocated from within the Project site are potentially highly impacted by the Project activities in the construction phase because the loss of land can threaten their ability to survive if replacement measures are not put in place, especially in the transitional period. The loss of land by members of the community who live outside the Project Area can also significantly impact their livelihood and ability to survive if they do not have alternative sources of food or income.

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7.12.1.1 Mitigation Measures

The Project proposes the following mitigation measures to support relocated persons, households and communities and those who have had their land acquired:

- A retrospective Resettlement Action Plan (and associated Grievance Mechanism) will be developed in consultation with affected communities in line with good practice (The Plan includes management of resettlement issues through the closure phase);
- Entitled relocated households will receive compensation at the market replacement value of the land acquired; and
- Every eligible relocated household will receive a minimum of one (1) job placement at MWMCL. The Company will provide other assistance to those families who do not meet the eligibility criteria for employment and/or fully reliant on farming.

7.12.2 Reduced Access to Land for Agriculture and Traditional Livelihoods

Local residents and previous land owners will no longer be able to use the land within the site boundary for farming and wood and herb collection important for sustenance and heating. The lower availability of resources requires residents to travel longer distances in search of suitable land, fuel supplies and medicinal plants. The scarcity of supply may also become a source of conflict among residents and communities.

7.12.2.1 Mitigation Measures

The Project proposes the following mitigation measures:

- Development of a Community Natural Resource Management Plan;
- Development of the non-farming sector; and
- Provision of alternative fuel sources.

7.12.3 Disruption of Leadership Structures and Associated Community Tension

The relocation of the four communities will affect the size and composition of the communities, with amalgamation of Zidaw/Sede and Wetme/Kandaw, and the integration of those households refusing to move into their respective communities at the new sites. Such changes may produce community tensions as traditional leadership structures are modified in response to the new environment. Migrant populations may also result in disruption of existing social structures with persons from outside areas not respecting the traditional leadership structures of the community.

7.12.3.1 Mitigation Measures

The Project proposes the following mitigation measures:

- Leadership structures will be addressed in the RAP using appropriate community consultation; and
- MWMCL will support the new leadership structures that have the broad support of the communities.

7.12.4 Influx of Persons into the Area

Persons from outside Saigaing Region will be attracted to the area in the hope of receiving employment at the Project. The immigration of persons into the area places pressure on social structures, land availability, housing, social amenities (schools, clinics, water supply), natural resources (water and wood) and thus has an indirect negative impact on the Project. Migration influx needs to be curtailed and managed. Currently persons aspiring to take up residence in a village require approval from the Village Administrator.

7.12.4.1 Mitigation Measures

The Project proposes the following mitigation measures:

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- The Company will support local leadership in managing migration influx;
- Preference for employment places will be given to local persons;
- There will be no ad hoc hiring on site;
- The Company will communicate its employment policies widely to discourage potential job seekers; and
- The Company will provide camp accommodation and transport for persons hired from outside the local area.

7.12.5 Increased Safety Risk to Road Users

Traffic to and from the Letpadaung Copper Mine will travel on paved and unpaved roads from Pakoku, Salingyi, Kyadet, Lingadaw, Monywa, and Yesago to an access road linked to the site. The access route passes through villages, including schools and markets. Livestock also cross the road.

Construction and operational traffic for the Project and increased population will substantially increase the number of heavy trucks and cars along the access road and this will pose a risk to current road users.

7.12.5.1 Mitigation Measures

The Project proposes the following mitigation measures to be implemented in all phases of the Project:

- The access route to the site will be upgraded in accordance with the Project proposal;
- A traffic safety awareness program will be put in place for communities situated along the access road;
- Warning signage will be placed along the route;
- Fencing will be erected adjacent to the schools along the route from Pakoku and exit/entry points will be clearly demarcated;
- Training of transport drivers;
- Use of safe and serviced vehicles only;
- Promotion of road safety;
- Drug and alcohol testing of drivers; and
- Restricted working hours for drivers and adequate rest breaks.

7.12.6 Increase in Social Problems Resulting from Exposure to New People

The influx of persons into the area including those employed at the mine may be expected to increase the proliferation of social ills. Of concern is the increase in the incidence of disease. Increased interaction between persons can enhance the spread of communicable diseases especially sexually transmitted infections (STI), including

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HIV and AIDS. Incidences of malaria and tuberculosis can also expect to increase should there be an increase in population density.

This will be exacerbated by the presence of large numbers of workers, especially during the construction phase of the Project. The circulation of money encourages the occurrence of commercial sex workers further increasing the risk of the spread of disease. The presence of money also can lead to increased occurrence of alcohol abuse.

Other social ills associated with the influx of persons include an increase in the incidence of crime also encouraged by the presence of money. The nature of the criminal activities may change and become more sophisticated, placing pressure on local policing services.

The exposure of communities to transient populations and new technologies, as they become more accessible from the presence of money, may bring about changes in societal norms and values from traditional approaches to more modern approaches. This may produce rifts between the older generation and the younger generation and between men and women who may adopt a different set of expectations and values from each other in response to new opportunities arising from employment and/or skills enhancement and almost certainly in response to large amounts of cash available as a result of lump sum compensation payments and wages.

Over time, it is possible that the presence of money circulating in the local and regional economy, as a result of population increase and employment at the mine, has the unintended effect of driving up the cost of goods and services. This may in turn widen the gap between the rich (those employed at the mine) and the poor (everyone else).

7.12.6.1 Mitigation Measures

The Project proposes the following mitigation measures to be employed in all three project phases:

- The RAP will address a sustainable mechanism for delivering cash benefits (or their equivalent) to the local communities in a manner which will least disrupt the local economy and encourage household saving and investment;
- MWMCL will support local policing structures, as appropriate;
- The Company will develop and enforce an STI Educational Policy on all contract workers;
- MWMCL, in collaboration with government, will conduct an integrated community awareness plan;
- MWMCL will implement the In-Migration Management Plan;

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- MWMCL will continue to support local health centres and will supply free condoms;
- Sanitation facilities will be provided and upgraded in the local communities;
- Accommodation camps will strictly enforce a code of conduct; and
- MWMCL will commit to the development of industry and micro-finance initiatives in the non-mining sectors so as to lessen economic inequality and reduce poverty.

7.12.7 Increase in Workplace Injuries

The incidence of workplace injuries and death is likely to be higher in the construction phase as a result of the relatively large number of unskilled workers and contractors required for land clearance and the building of Project facilities. Workplace injuries and deaths are a concern in Myanmar in light of ubiquitous acceptance of practices considered in the west as being "risky," and the absence of legislation and safety codes and their enforcement. As a result, mitigation measures are required in all phases of the Project.

7.12.7.1 Mitigation Measures

The Project proposes the following mitigation measures to reduce the incidence of workplace injuries and death:

- All employees and contractors will receive induction training;
- Training on safety will be tailored to meet the linguistic and educational needs of the workers;
- For certain occupation and tasks, hours will be restricted to reduce fatigue; and
- An Occupational Health and Safety Management System will be developed and implemented.

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7.12.8 Proliferation of Disease Causing Species

The presence of standing water in the operations phase will attract mosquitoes and thereby contribute to the spread of malaria and bilharzia. Measures to limit the spread of malaria and bilharzia include the management of standing water, prohibitions on swimming, mosquito nets and repellent and public awareness programs will be implemented during operations.

7.12.9 Increased Safety Risks

Project activities in the operational phase may increase the safety risk to workers and local populations in close proximity to the waste dumps due to fly rock from blasting, HLP/WRD rockfalls or land slips, explosion of hazardous/flammable materials and bush fire. These risks continue to be germane in the closure phase along with the increased

safety risk arising from the collapse of the pit's walls and from local people and livestock falling into the pit.

7.12.10 Mitigation Measures for the Increased Safety Risks

The Project proposes the following measures to mitigate against safety risk due to:

Fly rock from blasting

- Enforcement of the blast exclusion zone;
- Blast design; and
- Blast warning system.

HLP/WRD rockfalls or land slips

- Slope monitoring
- Safety setbacks from roads and villages;
- Exclusion of non-essential personnel and the general public;
- Batter slopes designed with acceptable factors of safety;
- Monitoring and inspection of waste rock dumps; and
- Adoption of closure batter slopes for increased stability.

Explosion of hazardous / flammable materials

- Construction of blast walls and bunding;
- Internal fire suppression systems;
- Separation distances for the explosives magazine; and
- Segregation of incompatible hazardous materials.

Bush fire

- Installation of fire suppression systems on items of large equipment
- Monitoring of tyre temperatures to guard against tyre fires
- Public awareness campaigns; and
- Strict enforcement of OHSM policies and procedures.

Pit

- Restrict access through the installation of 2 m bund wall around the full pit perimeter outside the area of potential future instability; and
- Install warning signs.

7.12.11 Loss of Employment at Closure

The decommissioning of the mine will have a direct impact on employees and contractors who will certainly lose their jobs and an indirect impact on the suppliers of goods and services in the support economy, particularly small businesses fully

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dependent on supply orders from the mine. The closure of the mine, if not managed properly, may contract the local economy and plunge local people into poverty. Mitigation measures to absorb mine workers into other industrial sectors will be employed. These along with the regional and local capacity developed by the Company's training programs and infrastructure investments will hopefully provide alternative income-earning opportunities that will offset the loss of employment with the mine.

7.12.11.1 Mitigation

The Mine Closure Plan shall include consideration of activities which will develop alternative economic opportunities progressively through the mine life to reduce dependence on the mine-induced economy at a local level.

7.12.12 Reduced Access to Land for Agriculture and Traditional Livelihoods at Closure

There is the possibility that the rehabilitated WRD and HLPs will be unsuitable for grazing and other uses by the local community as a result of damage to the capping system from people and livestock.

7.12.12.1 Mitigation

In development of the Mine Closure Plan, the local community shall be consulted to agree a suitable end land use for the various landforms within the site and the design of the closure plan will take into account the agreements with the community and a cost provision will be made to account for those end land uses.

7.12.13 Socio-economic Benefits

The Project will have an economic benefit for the local population. MWMCL is committed to the employment of local persons and will give preference to eligible households who were relocated or lost land as a result of Project activities. The community will benefit from the presence of the mine, especially in the operational phase when local workers will gradually replace ex-patriate workers. MWMCL plans to develop and diversify the local skill base away from farming through the provision of training programs, demonstration projects, and microfinance.

Employment on the Project site will have an indirect injection of money into the local economy, with persons working on the Project spending some of their wages in the local area. This in turn will encourage business activities supplying goods to such persons.

There will also be a need to provide goods and services to the Project and local entrepreneurs will position themselves to meet this demand. MWMCL will adopt a strategy to foster growth in local businesses through the use of training, microfinance

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and other commonly used mechanisms to develop a support economy. This will facilitate the volume of local procurement and improve access to markets.

In the construction phase, the new villages will be equipped with improved community infrastructure (a communal drinking point and proper sanitation facilities). All locals will benefit from the upgrading of roads and the upgrading of the bridge over Yamar Stream. The mobile health clinic will continue to service the villages and additional health clinics are to be built, staffed and equipped to increase the local population's access to basic health care.

In the operational and closure phases, the Project partners will continue to improve the provision and quality of medical services in the surrounding communities by scaling up its financial investment. The infrastructure in the new villages will be maintained and upgraded. Community and social infrastructure will continue to be built and maintained from the sub-projects and grants financed by the Corporate Social Responsibility Program. Much will depend on the joint commitment of the Project partners and the governments to improve local housing standards and continue to develop the infrastructure in the Sagaing Region from the Project proceeds.

Economic benefits to the regional economy will depend on the ability of local and regional businesses to provide a sufficiently high volume of goods and services to the Project. Efforts to develop the governance capacity of local government are anticipated in this phase to facilitate and maximise the potential for business development and job creation, and to provide Government with the tools to effectively govern after decommissioning.

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8. ENVIRONMENTAL MANAGEMENT PLANS

This section provides a series of outline Environmental Management Plans (EMPs) that are based on the findings of an impact analysis using a risk-based methodology for determination of significance, as described in Section 7 – Impact Analysis. The EMPs also address issues raised in the Community Consultation and reported in Section 6.

The EMPs are designed to lead the development of an Environmental and Social Monitoring Plan (see Section 10) and for expansion into the EMPs within the Environmental and Social Management System for the Letpadaung Copper Project.

The EMPs draw on recognized industry standards wherever possible, in the absence of specific environmental quality standards in Myanmar.

8.1 AIR QUALITY

The EMPs relating to air quality address the ambient air quality, dust as a specific element within the total suspended solids (TSP), acid mist and greenhouse gases through consideration of energy efficiency. Elements transmitted through the air, such as noise and vibration, that have specific human environmental concerns are addressed in the social management plans (SMPs).

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<table>
<tr><td>Section: 8.1</td><td>Title: Air Quality</td></tr>
<tr><td>Date: 7 October 2013</td><td>Sub-title: Ambient Air Quality</td></tr>
<tr><td>Purpose</td><td>This EMP relates principally to the control of fugitive emissions from heap leach pads, plant, equipment, vehicles and dust. Potential impacts associated with gaseous emissions include vegetation stress, nuisance impacts associated with odour and irritants, health impacts to the community and on-site personnel, visual impacts and community perception.</td></tr>
<tr><td>Timing</td><td>Ambient air quality will be monitored continuously over the construction, operations and closure phases of the project</td></tr>
<tr><td>Location</td><td>Two permanent air quality monitoring stations are located on the Letpadaung site – one on the southern boundary near the village of Kyauk Phyu Daung and one on the north boundary at the construction camp site. These locations take into account the prevailing wind directions in the dry seasons and wet season and will enable ambient air quality entering and leaving the site at any particular time to be monitored.</td></tr>
<tr><td>Action</td><td>The air quality monitoring stations shall be used to undertake continuous monitoring of SO_2, NO_2, CO and TSP. These parameters will be downloaded on a weekly basis.
Following receipt of a complaint regarding air quality, MWMCL staff will download the recordings hourly for a period of 50 hrs then daily for the following 10 days to determine the validity of the complaint.
Where the potential source of the complaint lies outside the collection zone of the monitoring stations, portable monitors shall be positioned to enable downwind samples to be taken at heights of 1, 3 and 5 m above the ground surface for a period of 1 hour sequentially for a period of 9 hours, to determine the likely emission source associated with the complaint. Wind direction measurements and intensity shall be taken at the same time.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>
<table>
<tr><td>Emission</td><td>Standard (µg/m^3)</td></tr>
<tr><td>TSP[44]</td><td>150 (Annual mean)
300 (24-hour mean)</td></tr>
<tr><td>NO_2[45]</td><td>40 (annual mean)
200 (1-hour mean)</td></tr>
<tr><td>SO_2[46]</td><td>20 (24-hour mean)
500 (10 minute mean)</td></tr>
<tr><td>Ozone (O_3)[47]</td><td>100 (8-hour mean)</td></tr>
</table>
</td></tr>
</table>

[44] EU standard
[45] WHO standard
[46] WHO standard
[47] IFC standard

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Reporting	Weekly	MWMCL Management Team
	Quarterly	Department of Environmental Conservation (DEC)
	Annually	DEC and Department of Mines
Notes		

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8.1.1 Dust

Section: 8.1.1	Title: Air Quality
Date: 9 October 2013	Sub-title: Dust
Purpose	This EMP relates principally to the control of fugitive dust emissions from the site. Potential impacts associated with dust emissions include vegetation stress, nuisance impacts associated with the soiling action of deposited dust within local communities, health impacts to the community and on-site personnel, visual impacts and community perception.
Timing	Air quality will be controlled and monitored for dust continuously over the construction, operations and closure phases of the project
Locations	Seven permanent dust monitoring stations are located on the Letpadaung site at the following locations: on the western boundary near the village of Moe Goe Pyn South; at the southeast corner of the site adjacent to the SX/EW plant; at the northeast corner of the site near the village of Tan Daw; on the northern boundary near the village of Kyaw; on the north-western boundary near the village of Phaunga South; on the eastern boundary near the village of Shwehlay; and at the northeast corner near the construction camp site. These locations take into account the prevailing wind directions in the dry seasons and wet season.
Actions	<u>Controls</u> General dust control measures during mining/production operations may include: use of dust collection systems for bulk materials unloading; use of dust control devices for crushing operations; minimisation of land disturbance; use of dust suppression measures (wetting work areas, roads, stockpiles and equipment; minimizing drop distances; and using dust hoods and shields). To limit dust emissions from topsoil stockpiles the following procedures will be adopted: • Stockpiles configured to minimise windblown dust; • Conditioning and seeding with native grasses; and • Use of vegetation screening. The following procedures will be adopted to limit dust emissions from access roads and cleared areas: • 50 kph maximum speed limit on site; • Vehicles to follow specific access routes and use designated turning areas; • Heavy vehicles leaving the site to be fitted with appropriate covers; unsealed roads to be watered at regular intervals; • Use of vegetation screening. Dusty work areas such as crushers, conveyors, hoppers and transfer points will be designed to avoid the generation of fugitive dust through careful siting and water spray equipment. <u>Monitoring</u> The air quality monitoring stations comprise the following equipment: 150 ±10mm diameter glass funnel; stand for gauge; glass bottle (minimum volume 1 litre); rubber stopper; and filtration apparatus.

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<table>
<tr><td></td><td>This equipment shall be used to undertake continuous monitoring of TSP, PM_{10}, and $PM_{2.5}$. These parameters will be downloaded on a weekly basis.
Following receipt of a complaint regarding dust, MWMCL staff will download the recordings hourly for a period of 50 hrs then daily for the following 10 days to determine the validity of the complaint.
Where the potential source of the complaint lies outside the collection zone of the monitoring stations, portable monitors shall be positioned to enable downwind samples to be taken at heights of 1, 3 and 5 m above the ground surface for a period of 1 hour sequentially for a period of 9 hours, to determine the likely emission source associated with the complaint. Wind direction measurements and intensity shall be taken at the same time.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Compliance Limits</td><td><table>
<tr><td>Parameter</td><td>Limit (µg/m^3)</td></tr>
<tr><td>TSP[48]</td><td>150 (Annual mean)
300 (24-hour mean)</td></tr>
<tr><td>PM_{10}[49]</td><td>20 (annual mean)
50 (24-hour mean)</td></tr>
<tr><td>$PM_{2.5}$[50]</td><td>10 (annual mean)
25 (24-hour mean)</td></tr>
</table></td></tr>
<tr><td>Reporting</td><td><table>
<tr><td>Weekly</td><td>MWMCL Management Team</td></tr>
<tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td>Annually</td><td>DEC and Department of Mines</td></tr>
</table></td></tr>
<tr><td>Notes</td><td></td></tr>
</table>

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[48] EU standard
[49] IFC standard
[50] IFC standard

8.1.2 Acid Mist

Section: 8.1.3	Title: Air Quality
Date: 9 October 2013	Sub-title: Acid Mist
Purpose	This EMP relates principally to the control of emissions of acid mist within and from the site. Potential impacts associated with gaseous emissions include vegetation stress, health impacts to the community and on-site personnel, visual impacts and community perception.
Timing	Acid mist generation should be measured continuously when acid is being added to heap leach pads and in and around the SX/EW plant during its operation.
Locations	<u>Monitoring</u> One permanent monitoring station is to be located on the Letpadaung site at the southeast corner of the site adjacent to the SX/EW plant. Additional monitoring should be undertaken, using portable monitors, along the southern and western boundaries of the site in the vicinity of areas of the HLP being irrigated. Monitoring inside the site should also be undertaken downwind of the areas of the HLPs being irrigated. These locations take into account the prevailing wind directions in the dry seasons and wet season. They will enable acid mist entering and leaving the site, particularly near sensitive receptors, to be monitored at any particular time.
Action	<u>Management</u> Distribution of solution onto HLPs shall be undertaken using drippers to avoid dispersion of acid mist through the movement of wind or equipment in the vicinity of areas with solution pooled on the surface or leached into the waste. <u>Controls</u> General acid mist control measures during mining/production activities may include: • Adjustment of application rates to ensure no pooling of acid leach solution on the surface of the leach pad; • Adjustment of pumping pressure to ensure drippers do not emit jets of solution; • Checking of all irrigation pipework to ensure no leakages; and Maintenance of pumping pressures to 80% of maximum design pressure of lowest strength pipework in the irrigation network <u>Monitoring</u> Following receipt of a complaint regarding dust, MWMCL staff will download the recordings hourly for a period of 50 hrs then daily for the following 10 days to determine the validity of the complaint. Where the potential source of the complaint lies outside the collection zone of the monitoring stations, portable monitors shall be positioned to enable downwind samples to be taken at heights of 1, 3 and 5 m above the ground surface for a period of 1 hour sequentially for a period of 9 hours, to determine the likely emission source associated with the complaint. Wind direction measurements and intensity shall be taken at the same time. Sampling may be performed by collection of sulphuric acid on a cellulose membrane filter and then analysis conducted using a

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<table>
<tr><td></td><td colspan="2">recognised laboratory technique to determine the level of sulphuric acid present. Alternatively detector tubes certified by OISH under 42CFR Part 84 can be used for direct reading of the acid level in the atmosphere.[51]</td></tr>
<tr><td>Responsibility</td><td colspan="2">Processing Department</td></tr>
<tr><td>Authority</td><td colspan="2">Department of Environmental Conservation (DEC); Department of Labour</td></tr>
<tr><td>Compliance Limits</td><td colspan="2"><table>
<tr><td>Parameter</td><td>Limit (µg/m^3)[52]</td></tr>
<tr><td>Acid Mist (workplace)</td><td>1 mg H_2SO_4/m^3 air (8 hr shift)</td></tr>
<tr><td>Acid Mist (public)</td><td>0.1mg/m^3 per incident [53]</td></tr>
</table></td></tr>
<tr><td>Reporting</td><td colspan="2"><table>
<tr><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td>Annually</td><td>DEC and Department of Labour</td></tr>
</table></td></tr>
<tr><td colspan="3">Notes:</td></tr>
</table>

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[51] Cited in http://www.cdc.gov/niosh/docs/81-123/pdfs/0577.pdf on 11/10/2013.
[52] Cited in http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/StrongInorganicAcidMists.pdf on 10/10/2013
[53] Cited in https://www.osha.gov/dts/chemicalsampling/data/CH_268700.html on 10/10/2013

8.1.3 Energy Efficiency

<table>
<tr><td>Section: 8.1.3</td><td>Title: Air Quality</td></tr>
<tr><td>Date: 10 October 2013</td><td>Sub-title: Energy Efficiency</td></tr>
<tr><td>Purpose</td><td>This EMP relates to the management of energy efficiency for the project. Energy costs can constitute as much as 15% of total mining and mineral processing input costs. Potential impacts associated with poor energy efficiency include higher operational costs and higher levels of greenhouse gases emissions.</td></tr>
<tr><td>Timing</td><td>Management will be undertaken continuously over the construction, operations and closure phases of the project.</td></tr>
<tr><td>Location</td><td>Energy efficiency management will take place throughout the project site.</td></tr>
<tr><td>Action</td><td>An energy assessment will be undertaken to determine the opportunity for energy savings. The study will include:
the energy profile of the site (where is most energy used and where are the most significant opportunities likely to be?);
the depth of the resource and the equipment used;
the mining or extraction method;
crushing strategy proposed; and
energy efficiency in materials movement and processing.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>The Myanmar Environmental Conservation Law (ECL) (March 2012).</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
</table>

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8.2 WATER

This section addresses issues related to surface water and groundwater and seeks to provide guidance on the management of surface water quality and quantity as well as the use and control of groundwater volumes and quantity. Specific recommendations for monitoring are specified.

8.2.1 Water Usage

Section: 8.2.1	Title: Water
Date: 8 October 2013	Sub-title: Water Usage
Purpose	This EMP relates principally to the management and efficient use of water in operation of the mine. The mine will use large quantities of water mostly in heap leaching, but also in mining, crushing, dust suppression and electrowinning. Most of the water in the system is lost through evaporation. Reduction in surface water availability due to mine operation may impact on the following: health of downstream habitats and ecosystems; viability of downstream businesses and agricultural enterprises; and community perception. Consequently water use on the site needs to be monitored to ensure that it is used efficiently.
Timing	Climatic data and water usage on the site will be monitored continuously over the construction, operations and closure phases of the project.
Locations	Water flows to, from and around the site will be measured and recorded. This will include measurement of the following (on a daily basis): • Raw water abstracted from the Chindwin River; • Water pumped to the WWP; • Water overflowing from the WWP; • Water flowing to the SWP; • HLP irrigation water pumped from the solution ponds and the SWP; • Groundwater pumped from dewatering wells; and • Surface water pumped from the pit. The following climatic data will be recorded from the two weather stations on site: temperature; relative humidity; wind speed; wind direction; precipitation; daily solar radiation; pressure; and pan evaporation.
Actions	<u>Controls</u> Efficient water usage will be promoted on site for all phases of the mine development and operation. This will be achieved by ongoing measurement and recording of water usage and flows around the site. These data will then be used as updated inputs for the water balance model to identify losses from the system and opportunities for improved water use efficiency. A general policy of maximising reuse of on-site water sources and minimising abstraction of raw water from the Chindwin River will be applied. <u>Monitoring</u> Flow meters will be fitted to pipelines onsite and will be used to measure water abstracted from the Chindwin River and water pumped between major infrastructure and ponds. Water overflow from the WWP will be measured using a v-notch weir.
Responsibility	Processing Department
Authority	Department of Environmental Conservation
Regulation	External limits regarding water usage will be applied for the following: • Maximum daily quantity of water abstracted from the Chindwin

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<table>
<tr><td></td><td>River – 35,000 m^3/day.
• Annual quantity of water abstracted from the Chindwin River – 5,350,000 m^3/yr.</td></tr>
<tr><td>Reporting</td><td><table>
<tr><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td>Annually</td><td>DEC and Department of Mines</td></tr>
</table></td></tr>
<tr><td colspan="2">Notes: Subject to abstraction licence being obtained.</td></tr>
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8.2.2 Surface Water

Section: 8.2.2	Title: Water
Date: 8 October 2013	Sub-title: Surface Water
Purpose	This EMP relates principally to the management of surface water flow through, around, and from the site both in terms of quality and quantity. Changes to the surface water flows, associated with the mine site, may impact on the following: health of the community; health of downstream habitats and ecosystems; viability of downstream businesses and agricultural enterprises; and community perception.
Timing	Surface water flows (quality and quality) will be monitored continuously over the construction, operations and closure phases of the project. The collection of data over periods of flooding is particularly important.
Locations	Seven permanent surface water monitoring stations are located on the Letpadaung site at the following sites: just upstream of the south diversion channel inlet; just downstream of the south diversion channel outlet; the irrigation channel at the upstream (southeast) corner; the irrigation channel at the downstream (northeast) corner; the spillway overflow for the waste water pond (north); the northwest project boundary (Phaunga South); and the Chindwin River. These locations account for stream flow directions and enable upstream and downstream flows and water quality at any particular time to be monitored.
Actions	<u>Management</u> Recommended practices to manage impacts associated with changes to hydrologic flow include: • Maintaining pre-mining watershed catchment flow routing wherever possible. • Ensuring that adequate flood modelling is performed so that changes to hydrologic flows have negligible downstream impact. Where downstream impacts are identified measures will be implemented to mitigate these or some form of compensation will be awarded. • Evaluation of the impacts of flooding after each event will be made with appropriate changes to management practices and procedures. Compensation (by way of alternative supply) where diversion of streams impacts on the livelihood and quality of life of water users surrounding the site. <u>Controls</u> Recommended practices to manage impacts to water quality include: • The quality and quantity of mine waste water will be managed and if necessary treated to meet effluent discharge limits. • Discharges to surface water will not result in contaminant concentrations in excess of local ambient water quality criteria outside an established mixing zone. • Oil and grease traps will be installed and maintained at refuelling facilities, workshops, parking areas, fuel storage depots, and containment areas.

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<table>
<tr><td></td><td>

Sanitary wastewater will be managed via septic or surface treatment and discharge systems.
Disturbed areas and waste rock dumps will be progressively rehabilitated to reduce sediment loads in surface runoff.
Runoff from watershed catchments shall be designated clean or dirty and clean water shall be segregated from dirty runoff so as to reduce handling requirements.
Dirty or contaminated water will be stored in appropriately sized and designed containment ponds. No contaminated water will be discharged from the site for events up to 1 in 100 year recurrence interval.

<u>Monitoring</u>
Surface water flow will be measured using a v-notch weir at each of the monitoring stations. Surface water quality will be measured in the field and samples will also be taken for laboratory testing. The following field equipment will be required: EC/TDS/pH/BOD meter; surface flow meter; water sampling gear, and GPS. Field measurements will be taken monthly, and during periods of flooding, and will include flow rate, water level, pH, electrical conductivity, temperature, and turbidity.
Laboratory testing of samples will be performed monthly and will include oil and grease, phosphates, sulphates, chlorides, phenols, COD, BOD_5, TDS, TSS, and metals.
</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulation</td><td>IFC (mining sector)[54] compliance limits will apply for all measured parameters with the exception of TSS. For TSS the greater of the following values will apply: within 10% of the receiving water body background value; or 50mg/L. These will apply to any water being released from the site.</td></tr>
<tr><td>Reporting</td><td>
<table>
<tr><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td>Annually</td><td>DEC and Department of Mines</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Notes: Myanmar compliance standards should replace the regulation specified when they are promulgated.</td></tr>
</table>

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[54] As cited at http://www.ifc.org/wps/wcm/connect/1f4dc28048855af4879cd76a6515bb18/Final%2B-%2BMining.pdf?MOD=AJPERES&id=1323153264157 on 10/10/2013

8.2.3 Groundwater Usage and Drawdown

Section: 8.2.3	Title: Water
Date: 8 October 2013	Sub-title: Groundwater Usage and Drawdown
Purpose	This EMP relates principally to the control of groundwater usage and drawdown. Groundwater abstraction rates (usage) are recorded for use as an input to the mine water balance; and to understand pit inflow control measures and potential drawdown effects. Groundwater levels are recorded for the management of inflow control measures; as an input to the pit slope stability analysis; to understand groundwater flow directions (and as a consequence the direction a groundwater contamination plume will travel); and to understand the drawdown of the piezometric surface around the pit to understand potential social and environmental impacts.
Timing	Groundwater usage and drawdown will be monitored over the construction, operations and closure phases of the project. Groundwater abstraction rates are recorded on a weekly or daily basis. Baseline groundwater level data are required to establish the pre-mining conditions. Operational phase groundwater levels are required to assess mining impacts.
Location	Recommended groundwater monitoring locations are included on Figure 4.3.1. The monitor bore locations have been selected to monitor groundwater levels and, as a consequence, groundwater flow directions, and to monitor possible drawdowns in the piezometric surface. The proposed bores are for environmental and social monitoring and are not intended to be used for detailed pit wall stability analysis.
Action	<u>Management</u> Groundwater abstraction shall only be undertaken to enable open pit mining to be undertaken in a safe and efficient manner. Groundwater abstraction shall not be undertaken as a means of securing water supply. <u>Controls</u> Groundwater levels and flows recorded in monitoring bores shall be recorded and inserted into a groundwater model, on a quarterly basis to determine the extent of drawdown. <u>Monitoring</u> Groundwater usage is recorded using accumulating flow gauges on each bore head works. Groundwater level monitoring is monitored manually using an electronic dipper or via the installation of electronic loggers. Monitoring bores constructed to recognised standards are required for the manual dipping and the installation of loggers. Water bores/wells in villages surrounding the Project site shall be monitored to check water levels and collect water samples annually to identify any changes in quality/quantity of water resources.
Responsibility	Mining Department
Authority	Department of Environmental Conservation

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<table>
<tr><td>Regulations</td><td>Regulation
The monitoring of groundwater usage and drawdown will aim to meet with requirements of the following laws, policies, and guidelines:
• The Myanmar Environmental Conservation Law (ECL) (March 2012);
• Myanmar's Rules of the Conservation of Water Resources and Rivers Law (2013);
• IFC Sustainability Framework[55]
• OP4.07 Water Resources Management, February 2000[56]
• Guideline GB/T14848 - 93: Quality Standard for Groundwater.[57]
• Guideline GB/T16453.1~16453.6-2008: The Standard on Comprehensive Water and Soil Conservation Treatment.[48]</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Weekly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes</td></tr>
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[55] As cited at http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC+Sustainability/Sustainability+Framework on 8/10/2013

[56] As cited at http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOPMANUAL/0,,contentMDK:20064755~pagePK:64141683~piPK:64141620~theSitePK:502184,00.html on 8/10/2013

[57] Standard of the People's Republic of China

8.2.4 Discharge to Groundwater

Section: 8.2.4	Title: Water
Date: 8 October 2013	Sub-title: Discharge to Groundwater
Purpose	This EMP relates principally to discharges to groundwater. Discharge to groundwater is monitored to prevent groundwater contamination and to detect and manage potential off site social and environmental impacts.
Timing	Discharge to groundwater will be monitored continuously over the construction, operations and closure phases of the Project. Baseline groundwater chemistry data are required to establish pre-mining, and receiving groundwater chemistry characteristics. Operational phase discharge water and receiving water quality are required to assess mining impacts.
Location	Discharge water should be sampled at the point of discharge and at up-gradients and down gradient monitor bores. The discharge point and associated bore locations will be determined in the mine construction phase.
Action	<u>Management</u> Action will be taken during construction to ensure all locations, where materials are placed/stored with the potential to contaminate groundwater, are adequately lined such that production of any leachate/fluid/reacted material with the potential to contaminate groundwater will not permeate into the groundwater. <u>Controls</u> • All hazardous goods storages will be formed with an impermeable base. • All WRDs containing materials with potential to produce acid or leach metals are encapsulated within the facility. • All HLPs are lined with a compacted clay liner covered with a HDPE liner and leachate collection facilities. • All ore storage occurs in areas with constructed lining as per HLP facilities. <u>Monitoring</u> Discharge flow rates should be recorded using an in-line accumulating flow gauge. Discharge water quality should be monitored at the point if discharge. Groundwater level and quality monitoring is undertaken in dedicated groundwater monitor bores. Monitor bores constructed to recognised standards are required.
Responsibility	Mining and Processing Departments
Authority	Department of Environmental Conservation
Regulations	The management of discharge to groundwater will aim to meet with requirements of the following laws, policies, and guidelines: • The Myanmar Environmental Conservation Law (ECL) (March 2012); • Myanmar's Rules of the Conservation of Water Resources and Rivers Law (2013); • IFC Operational Policies: • OP4.07 Water Resources Management, February 2000. • Guideline GB/T14848 - 93: Quality Standard for Groundwater.

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	• Guideline GB/T16453.1~16453.6-2008: The Standard on Comprehensive Water and Soil Conservation Treatment.		
Reporting	Quarterly	Department of Environmental Conservation (DEC)	
	Annually	DEC and Department of Mines	
Notes: For Regulation references see footnotes in Section 8.2.3			

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8.2.5 Groundwater Contamination

Section: 8.2.5	Title: Water
Date: 8 October 2013	Sub-title: Groundwater Contamination
Purpose	This EMP relates principally to the monitoring of groundwater contamination. Groundwater quality is recorded to understand the effectiveness of containment measures and to detect and manage potential off site social and environmental impacts.
Timing	Groundwater quality will be monitored during the construction, operations and closure phases of the Project. Baseline groundwater chemistry data are required to establish pre-mining conditions. Operational phase groundwater chemistry is required to assess mining impacts. Groundwater should be sampled and tested on a quarterly basis.
Location	Recommended groundwater sample locations are included on Figure 4.3.1. The bore locations have been selected to monitor the impacts of potential contaminant sources. The proposed bores are for environmental and social monitoring and are not intended to be used for detailed pit wall stability analysis.
Action	Groundwater is sampled using an electro submersible pump using a set procedure using monitor bores constructed to a specific design. Monitor bores constructed to recognised standards are required for the manual dipping and the installation of loggers. Monitor bores are often destroyed by mobile plant particularly during the construction phase and of bore availability/replacement bores need to be managed.
Responsibility	Safety and Environment Department.
Authority	Department of Environmental Conservation
Regulations	The monitoring of groundwater quality and drawdown will aim to meet with requirements of the following laws, policies, and guidelines: • The Myanmar Environmental Conservation Law (ECL) (March 2012); • Myanmar's Rules of the Conservation of Water Resources and Rivers Law (2013); • IFC Operational Policies: • OP4.07 Water Resources Management, February 2000 • Guideline GB/T14848 - 93: Quality Standard for Groundwater. • Guideline GB/T16453.1~16453.6-2008: The Standard on Comprehensive Water and Soil Conservation Treatment.
Reporting	Quarterly — Department of Environmental Conservation (DEC) Annually — DEC and Department of Mines
Notes: For Regulation references see footnotes in Section 8.2.3	

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8.3 SOIL AND WASTE ROCK

Soil and rock fall into two (2) categories: materials that can be utilized and materials that will be stored as waste. This section describes both types of material and their management, particularly as acid forming and metal leaching waste is predicted to be an extremely sensitive management issue and the supply of benign materials within the Project site is limited and the demand for those materials is very high in construction, operation and closure. Insufficient benign material will lead to a requirement to source materials outside the Project area as it is currently defined.

8.3.1 Construction Materials

Section: 8.3.1	Title: Soil and Rock
Date: 9 October 2013	Sub-title: Construction Materials
Purpose	The purpose of this management plan is to identify a process of defining the supply and extraction of basic raw materials (soil and rock) required to enable progressive closure and rehabilitation of areas, such as WRDs and complete closure of the site. It aims to ensure material use is planned and managed in such a way that materials suitable for these purposes are not disposed to waste and are reserved for this purpose.
Timing	This plan shall be implemented prior to the commencement of construction and be continually implemented over the life of the mine until finalisation of closure and return of the land to the community
Location	The plan applies to all activities across the Project area and into the surrounding environment.
Action	1. Undertake investigations to establish the properties and quantities of soil and rock with the characteristics to provide suitable materials for: • Providing a compacted impermeable base for WRDs and (HLPs and landfills; • Capping of WRDs, HLPs at closure and closed landfills; • Developing store and release covers where required; • Providing periodic covers for waste landfills; • Supply of benign rock for construction of drains, drop structures, and weirs; • Supply of benign rock for abandonment bund walls and protection bunds around the final and operating crest of the open pit, respectively. 2. Maintain an inventory of available materials, their location and volume. 3. Clearly mark all areas where materials are stored to identify their purpose. 4. Prepare a materials balance for the site and periodically update the balance sheet to ensure the quantities of material are known and utilisation of the material and

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<table>
<tr><td></td><td colspan="2">additions to stockpiles are recorded.
5. Plan, operate and rehabilitate borrow pits according to a known standard for basic raw materials.[58,59]</td></tr>
<tr><td>Responsibility</td><td colspan="2">Mining Department</td></tr>
<tr><td>Authority</td><td colspan="2">Department of Mining, Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td colspan="2"></td></tr>
<tr><td>Reporting</td><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td></td><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td></td><td>Annually</td><td>DEC and Department of Mines</td></tr>
<tr><td colspan="3">Notes: Management of topsoil and waste rock are described in separate EMPs.</td></tr>
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[58] CSI, 2011; Guidelines on Quarry Rehabilitation; Cement Sustainability Initiative, World Business Council for Sustainable Development; August 2011.
[59] DEC, 2008; Guidelines for Management and Operation of Basic Raw Materials; Department of Environment and Conservation, Government of Western Australia; August, 2008.

8.3.2 Topsoil Removal and Storage

Section: 8.3.2	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Topsoil Stripping and Stockpiling
Purpose	This EMP relates to the management of the stripping and stockpiling of topsoil on the site. Upon closure of the mining operation the intent is to rehabilitate disturbed areas including the WRDs, and HLPs. A critical aspect of the rehabilitation of these areas involves placement of previously stripped topsoil on rehabilitation surfaces prior to revegetation. Consequently the existing in situ topsoil and subsoil on site is a valuable resource that must be carefully conserved and stockpiled for future use. If topsoil stripping and stockpiling is not properly managed it may not be possible to meet the project closure commitments. This may impact on return of environmental bond monies, the company reputation, and its ability to do business in Myanmar in the future.
Timing	Topsoil stripping, stockpiling and re-spreading for rehabilitation will be monitored continuously over the construction, operations and closure phases of the project. In addition changes in topsoil conditions will be monitored to ensure that they do not undergo any adverse changes over the life of the project. It will require establishing representative sampling locations to assess the potential effects of acid deposition, fugitive dust emissions and the mobilization of metals / elements through changes in soil chemistry during construction and mine operations. Sampling of topsoil from rehabilitated areas and trial plots will be performed annually.
Locations	Topsoil monitoring locations will vary according to construction and rehabilitation activities around the site. These will be planned in advance and indicated on the topsoil inventory and plan. Samples of the topsoil will also be taken from test pits around the site.
Actions	<u>Management</u> All disturbed areas will: • Have permits approved prior to any surface disturbance being undertaken. • Two layers of soil (topsoil150 mm and subsoil250 mm-400mm) removed and stockpiled for reclamation and use during rehabilitation of disturbed and closed facilities. • Stockpiles will be a maximum height of 6 m. All stockpiles will be clearly marked and only reclaimed with approval from the Safety and Environment Department. <u>Controls</u> Recommended topsoil conservation control strategies include: • Use of Clearing Permits that require inclusion of the proposed clearing areas, stockpile locations, estimated volume, and the recovery method. • Development of a formal soil conservation and land use monitoring plan. • Planting of appropriate trees and vegetation will be promoted to provide shelter from the wind as well as reduce dust and soil erosion. • Seeding of topsoil stockpiles with natural leguminous shrubs

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<tr><td></td><td>and plants to regenerate nutrients within the stockpiles.
• Inclusion of leguminous shrub and plant species in the mix of species used in land rehabilitation works and buffer plantings around the site.
<u>Monitoring</u>
Monitoring will be conducted with test pits located up and down gradient (and up and down wind) from mine facilities at designated control points. The suite of analyses for the monitoring programme for soil chemistry will include: pH; anion exchange capacity; electrical conductivity; metals; and toluene-extractable organics. The suite of analyses for the monitoring programme for soil structure will include: clay fraction; particle size distribution; water retention; and permeability.
Sampling frequency and parameters analysed will be reassessed based on results from air quality and surface water monitoring results but are likely to be more frequent during the rainy season, to correspond with rains. Monitoring shall comprise inspecting, recording and reporting of the following: quantities of topsoil removed; storage locations and quantities; the type of topsoil; and storage procedures and methods. This data will be used to develop a topsoil inventory and plan for the site that will be maintained over the life of the project.</td></tr>
<tr><td>Responsibility</td><td>Mining and Engineering Departments</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>Compliance limits for topsoil loss from rehabilitated areas, stockpiles and trial plots will not be applied but this information will be used to refine and improve topsoil management, and rehabilitation practices.</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes</td></tr>
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8.3.3 Erosion and Sediment Control

Section: 8.3.3	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Erosion and Sediment Control
Purpose	This EMP relates principally to the management of erosion and sediment control on the site. Disturbance of catchments and placement of waste rock dumps, and topsoil / ore stockpiles will lead to increased erosion that, if not managed properly, could result in elevated sediment loads in downstream rivers and waterways. Increased sediment loads in waterways may impact on river flow, boat access, the health of downstream habitats and ecosystems, the viability of downstream businesses and agricultural enterprises, and community perception towards the Project.
Timing	Surface water flows and total suspended solids (TSS) will be monitored continuously over the construction, operations and closure phases of the Project. Collection of data over periods of flooding is particularly important. Sampling and testing of the different soils, ore, and waste rock materials around the site will also be required. Initially this will be done to establish baseline data and then will be continued as new materials are disturbed with progressive development of the mine. Sampling of topsoil from rehabilitated areas and trial plots will also be performed annually.
Locations	Seven permanent surface water monitoring stations are located on the Letpadaung site at the following sites: just upstream of the south diversion channel inlet; just downstream of the south diversion channel outlet; the irrigation channel at the upstream (southeast) corner; the irrigation channel at the downstream (northeast) corner; the spillway overflow for the waste water pond (north); the northwest project boundary (Phaunga South); and the Chindwin River. These locations account for stream flow directions and enable upstream and downstream flows and suspended solids at any particular time to be monitored. Samples of the different soils, ore, and waste rock materials will be taken from test pits and excavations around the site.
Actions	<u>Management</u> Prior to each wet season, a campaign to close and rehabilitate disturbed areas no longer required for construction and operations will be undertaken to reduce the area available for erosion and generation of sediments. New ground disturbing activities will be limited immediately prior to and during the wet season. <u>Controls</u> Recommended erosion prevention and control strategies include: • Establishing riparian setback zones. • Reducing exposure of sediment-generating materials to wind or water (e.g. proper placement of soil and rock piles). • Reducing or preventing off-site sediment transport (e.g. use of settlement ponds, silt fences). • Timely implementation of an appropriate combination of

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	contouring techniques, terracing, slope reduction /minimization, runoff velocity limitation and appropriate drainage installations to reduce erosion in both active and inactive areas. • Final grading of disturbed areas, including preparation of overburden before application of the final layers of growth medium, will be along the contour as far as can be achieved in a safe and practical manner. • Revegetation of reclaimed areas including seeding will be performed immediately following application of the growth medium to avoid erosion. • Access and haul roads will have gradients to limit erosion, and road drainage systems will be provided. • Stormwater drains, ditches, and stream channels will be protected against erosion through a combination of adequate dimensions, slope limitation techniques, and use of rip-rap. Temporary drainage installations will be designed for an annual recurrence interval (ARI) of at least a 10- year, while permanent drainage installations will be designed for a 100-year ARI. Consideration of the intended life of diversion structures, as well as the recurrence interval of any structures that drain into them, will be taken into account when the above intervals are defined. • Drainage structures will also have “low flow” channels for smaller frequent storms. • Surface drainage from disturbed areas, including areas that have been graded, seeded, or planted, will be treated for sediment removal. Stormwater settling facilities will be designed and maintained according to internationally accepted good engineering practices, including provisions for capturing of debris and floating matter. Sediment control facilities will be designed and operated to comply with TSS discharge limits. <u>Monitoring</u> Surface water flow will be measured using a vee-notch weir at each of the monitoring stations. Surface water turbidity will be measured in the field and samples will also be taken for laboratory testing to determine TSS. The following field water sampling equipment will be required: TDS /BOD meter; surface flow meter; water sampling gear, and GPS. Field water quality measurements will be taken monthly, and during periods of flooding, and will include flow rate, water level, and turbidity. Laboratory TSS testing of water samples will be performed monthly as part of the surface water sampling. Monitoring will be conducted with test pits located up and down gradient (and up and down wind) from mine facilities at designated control points. The suite of analyses for the monitoring programme for soil chemistry will include pH; anion exchange capacity; electrical conductivity; metals; and toluene-extractable organics. The suite of analyses for the monitoring programme will for soil structure will include: clay fraction (<0.002 mm); particle size distribution; water retention; permeability; and total suspended solids. Sampling frequency and parameters analysed will be reassessed

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<table>
<tr><td></td><td>based on results from air quality and surface water monitoring results but are likely to be more frequent during the rainy season, to correspond with rains. Erosion monitoring shall comprise inspecting, recording and reporting of the following: quantities of vegetation removed, storage locations, quantities and type of topsoil and overburden, storage procedures and methods used, areas prone to erosion, evidence of erosion, depth of remaining in situ topsoil, condition of access roads, condition of cleared areas, condition of perimeter drains and associated settlement ponds, compliance with applicable regulatory and corporate requirements.</td></tr>
<tr><td>Responsibility</td><td>Mining and Engineering Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>Beyond the agreed mixing zone of the receiving water body for TSS the greater of the following values will apply: within 10% of the receiving water body background value; or 50mg/L.
Compliance limits for topsoil loss from rehabilitated areas and trial plots will not be applied but this information will be used to refine and improve rehabilitation practices and closure designs.</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes</td></tr>
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8.3.4 Acid Rock Drainage and Metals Leaching - WRD

Section: 8.3.4	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Acid Rock Drainage and Metals Leaching – Waste Rock Dumps
Purpose	This EMP relates to the reduction of acid generation and metals leaching from waste rock placed within the WRDs. Potential impacts associated with acid drainage and metals leaching include contamination of surface and groundwater with potential loss of habitat, flora and fauna.
Timing	Waste rock will be produced throughout the mine life. Waste rock will be placed in the WRDs from Year 1 to approximately year 20 with waste after that disposed of in-pit (see separate EMP). Encapsulation of the waste will be continuous throughout the construction of the WRDs.
Location	The three WRDs will be located around the open pit within the site boundary.
Action	All waste rock shall be classified as benign, metal leaching or acid forming before excavation from the open pit. The waste encapsulation will be undertaken to meet the following objectives: • Reduce oxygen ingress; • Reduce water ingress; • Protect shallow groundwater; and • Protect surface water. Waste rock will be progressively placed within cells that are lined and capped with low permeability fill within the WRDs as shown in figures 8.3.1 to 8.3.4. On completion the WRDs will be capped with a 'store and release' cover to reduce water ingress as shown in Figure 8.3.5. Any contaminated seepage will be collected and passed through appropriate active or passive treatment systems to render it acceptable for release to the environment.
Responsibility	Mining Department
Authority	Department of Environmental Conservation
Regulations	• Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007; • Management of Tailings and Waste-Rock in Mining Activities, European Commission Reference Document on Best Available Techniques, January 2009; • British Columbia Ministry of Energy and Mines (August 1998). Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia; • Australian Government, Department of Industry, Tourism and Resources (February 2007). Managing Acid and Metalliferous Drainage.
Reporting	Monthly – MWMCL Management Team Quarterly – Department of Environmental

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		Conservation (DEC)
	Annually	DEC and Department of Mines
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8.3.5 Acid Rock Drainage and Metals Leaching – HLP

<table>
<tr><td>Section: 8.3.5</td><td>Title: Soil and Waste Rock</td></tr>
<tr><td>Date: 8 October 2013</td><td>Sub-title: Acid Rock Drainage and Metals Leaching – Heap Leach Pads</td></tr>
<tr><td>Purpose</td><td>This EMP relates to the reduction of acid generation and metals leaching from ore placed within the HLPs. Potential impacts associated with acid drainage and metals leaching include contamination of surface and groundwater with potential loss of habitat, flora and fauna.</td></tr>
<tr><td>Timing</td><td>The HLPs will be operated throughout the life of the mine with low-pH and high metal concentration leachate managed through the copper recovery plant. ARD and metals leaching are not issues during operation of the HLPs.
On closure the drawdown of the HLPs and any ongoing infiltration/ percolation will generate ARD and metal-rich leachate for many years.</td></tr>
<tr><td>Location</td><td>The three HLPs will be located in the southwest segment of the site.</td></tr>
<tr><td>Action</td><td>The ore encapsulation will be undertaken to meet the following objectives:
Reduce oxygen ingress.
Reduce water ingress.
Protect shallow groundwater.
Protect surface water.
On completion the HLPs will be capped with a very low permeability soil or geosynthetic cover system to reduce water ingress.
All leachate produced by the HLPs will be collected and passed through the SX/EW plant and treated to render it acceptable for release to the environment.</td></tr>
<tr><td>Responsibility</td><td>Processing Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007;
Management of Tailings and Waste-Rock in Mining Activities, European Commission Reference Document on Best Available Techniques, January 2009;
British Columbia Ministry of Energy and Mines (August 1998). Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia;
Australian Government, Department of Industry, Tourism and Resources (February 2007). Managing Acid and Metalliferous Drainage.</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
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8.3.6 Acid Rock Drainage and Metals Leaching – In Pit

Section: 8.3.6	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Acid Rock Drainage and Metals Leaching – In Pit
Purpose	This EMP relates to the reduction of acid generation and metals leaching from waste rock placed within the open pit and also exposed rock in the pit walls. Potential impacts associated with acid drainage and metals leaching include contamination of surface and groundwater with potential loss of habitat, flora and fauna.
Timing	Waste rock will be produced throughout the mine life. Waste will be placed in the surface WRDs from Year 1 to 20 approximately (see separate EMP) with waste after that disposed of in-pit. Encapsulation of the waste will be continuous throughout the placement of the waste rock in the pit void. Rock exposed in the pit walls has the potential to produce low-pH and/or metal-contaminated run-off water once it is exposed.
Location	Open Pit.
Action	The waste rock encapsulation will be undertaken to meet the following objectives: • Reduce oxygen ingress. • Reduce water ingress. • Protect shallow groundwater. • Protect surface water. Waste rock will be progressively placed within cells in the open pit void that are lined and capped with low permeability fill. During operations, run-off from the in-pit waste dump and more generally from within the pit area, will be collected and pumped to the WWP for use in the process or treatment prior to release. On closure, the pit will be flooded and water levels managed such that the waste rock and rock within the pit walls that has the potential to produce acid or leach metals remains submerged in perpetuity. Water levels will also be maintained at a level lower than the surrounding groundwater table to reduce seepage of contaminated water from the pit lake into groundwater, thus finished waste rock levels in the pit should not exceed that level in the pit. After closure, pit water shall be monitored quarterly and results compared to IFC standards quoted in Section 8.2.2 – Surface Water and 8.2.5 – Groundwater Contamination
Responsibility	Mining Department
Authority	Department of Environmental Conservation
Regulations	• Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007; • Management of Tailings and Waste-Rock in Mining Activities, European Commission Reference Document on Best Available Techniques, January 2009; • British Columbia Ministry of Energy and Mines (August 1998). Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia; • Australian Government, Department of Industry, Tourism and

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	Resources (February 2007). Managing Acid and Metalliferous Drainage.	
Reporting	Monthly	MWMCL Management Team
	Quarterly	Department of Environmental Conservation (DEC)
	Annually	DEC and Department of Mines
Notes:		

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8.3.7 Waste Rock Dumps

Section: 8.3.7	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Waste Rock Dumps
Purpose	This EMP relates to the construction and operation of the WRDs. Potential impacts associated with the WRDs include poor air quality (dust generation), contamination of surface water and groundwater with potential loss of habitat, flora and fauna.
Timing	Waste rock will be produced throughout the mine life. Waste will be placed in the WRDs from Year 1 to approximately Year 20 with waste after that disposed of in-pit. Construction of the waste dumps will be continuous throughout the mine life.
Location	The three WRDs will be located around the open pit within the site boundary.
Action	The WRD design and operation will take the following requirements into account: • Permanent and secure storage of all waste rock within engineered facilities (see separate EMP for Acid Rock Drainage and Metals Leaching); • Waste dump placement and development scheduling to minimize equipment requirements, achieve stable slopes at closure and reduce closure measures; • Control of drainage and runoff from the waste dumps during operations to the maximum practical extent; • Collection of sediment from the waste dumps to the maximum practical extent; • Treatment (if required) and discharge of excess drainage and runoff from the waste dumps; and • Monitoring for all aspects of the waste dumps to the maximum practical extent to ensure performance goals are achieved and design objectives are met.
Responsibility	Mining Department
Authority	Department of Environmental Conservation
Regulations	• Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007; • Management of Tailings and Waste-Rock in Mining Activities, European Commission Reference Document on Best Available Techniques, January 2009; • British Columbia Ministry of Energy and Mines (August 1998). Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia; • Australian Government, Department of Industry, Tourism and Resources (February 2007). Managing Acid and Metalliferous Drainage. • Code for Waste Dump Design of Nonferrous Metal Mines (2007). National Standard of the People's Republic of China, GB 504421-2007. Implemented 01 October 2007.
Reporting	Monthly: MWMCL Management Team Quarterly: Department of Environmental Conservation (DEC)

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8.3.8 Rehabilitation of Developed Landforms

<table>
<tr><td>Section: 8.3.8</td><td colspan="2">Title: Soil and Waste Rock</td></tr>
<tr><td>Date: 8 October 2013</td><td colspan="2">Sub-title: Rehabilitation of Developed Landforms</td></tr>
<tr><td>Purpose</td><td colspan="2">This EMP relates to the rehabilitation of developed landforms at the project site. Potential impacts associated with rehabilitation include erosion by wind and water and ultimately contamination, if the rehabilitation is unsuccessful.</td></tr>
<tr><td>Timing</td><td colspan="2">Rehabilitation will be undertaken progressively over the construction, operations and closure phases of the Project as landforms become available for rehabilitation.</td></tr>
<tr><td>Location</td><td colspan="2">Developed land at the Project site including open pits, WRDs, HLPs and stockpile areas.</td></tr>
<tr><td>Action</td><td colspan="2">The rehabilitation programme will be done to meet the following objectives:
All developed landforms that are temporary structure, such as topsoil/subsoil stockpiles and drainage bunds, shall be revegetated with leguminous local plants to maintain the soil nutrition and improve their value for rehabilitation of disturbed areas;
All developed landforms will be rehabilitated to a standard that achieves a safe, stable landform which supports self-sustaining native vegetation, is free draining and non-polluting and visually compatible with the surrounding landscape;
To ensure that environmental rehabilitation achieves an acceptable standard compatible with the intended land use and consistent with the conditions of approvals and other requirements;
Progressively rehabilitate disturbed areas as they become available; and
Rehabilitation meets completion criteria.
Monitoring should be carried out using the Landscape Function Analysis technique[60].</td></tr>
<tr><td>Responsibility</td><td colspan="2">Safety and Environment Department</td></tr>
<tr><td>Authority</td><td colspan="2">Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td colspan="2">• Environment Conservation Law (2012);
• Mine Rehabilitation Guideline- Leading Practice Sustainable Development Program for the Mining Industry (Government of Australia, 2006)</td></tr>
<tr><td>Reporting</td><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td></td><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td></td><td>Annually</td><td>DEC and Department of Mines</td></tr>
<tr><td colspan="3">Notes:</td></tr>
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[60] CSIRO 2004. Landscape Function Analysis: Procedures for monitoring and assessing landscapes. Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO). February 2004.

8.3.9 Rehabilitation of Disturbed Areas

Section: 8.3.9	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Rehabilitation of Disturbed Areas
Purpose	This EMP relates to the rehabilitation of disturbed land at the Project site. Potential impacts associated with rehabilitation include erosion by wind and water if the rehabilitation is unsuccessful.
Timing	Rehabilitation will be undertaken progressively over the construction, operations and closure phases of the Project as disturbed land becomes available.
Location	Disturbed land at the Project site including plant areas, workshop areas and roads.
Action	The rehabilitation programme will be done to meet the following objectives: • All disturbed areas rehabilitated to a standard that achieves a safe, stable landform which supports self-sustaining native vegetation, is free draining and non-polluting and is visually compatible with the surrounding landscape; • To ensure that environmental rehabilitation achieves an acceptable standard compatible with the intended land use and is consistent with the conditions of approvals and other requirements; • Progressively rehabilitate disturbed areas as they become available; and • Rehabilitation meets completion criteria. All monitoring shall be carried out using the Landscape Function Analysis technique (CSIRO, 2004).
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations	• Environment Conservation Law (2012); • Mine Rehabilitation Guideline- Leading Practice Sustainable Development Program for the Mining Industry (Government of Australia, 2006)
Reporting	Monthly: MWMCL Management Team Quarterly: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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8.3.10 Ore Handling and Placement

Section: 8.3.10	Title: Soil and Waste Rock
Date: 8 October 2013	Sub-title: Ore Handling and Placement
Purpose	This EMP relates to the management of ore handling and placement at the Project site. Potential impacts associated with these activities include dust and noise generation and contaminated runoff from stockpiles.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	Ore handling and placement will be carried out in the crushing circuit, stockpile areas and on the HLPs.
Action	The management programme will include: • Water will be used on the haul roads and in the crushing circuit to minimise dust generation. Contaminated water will be collected and recycled for use as process water; • Ore stockpile areas will be compacted and properly drained to prevent leachate from contaminating groundwater. Any leachate will be directed to the waste water pond for reuse; and • The HLPs will be compacted, covered with a plastic liner and drainage to prevent any loss of leached solution from the heaps.
Responsibility	Mining and Processing Departments
Authority	Department of Environmental Conservation
Regulations	• Environment Conservation Law (2012); • Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007; • Dust emission limits as per Air Quality EMP; • Noise limits as per Noise EMP.
Reporting	Monthly: MWMCL Management Team Quarterly: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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8.4 VEGETATION AND FAUNA

Whilst the vegetation and fauna on the site may be considered depauperate, the general loss of natural vegetation in the region and on the Project site requires the conservation of that remaining as a source for revegetation and recolonisation of the site as it is rehabilitated and then closed at the end of mine life.

This section describes EMPs to limit the threat to the existing resources with less focus on conservation and offsetting for loss of vegetation and habitat.

8.4.1 Weed Hygiene and Control

Section: 8.4.1	Title: Vegetation and Fauna
Date: 8 October 2013	Sub-title: Weed Hygiene and Control
Purpose	This EMP relates to the management of weeds at the Project site. Potential impacts associated weeds include invasion of native vegetation and degradation of rehabilitated areas.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	Weed hygiene and control will take place throughout the Project site.
Action	The management programme will include: • Delineation of areas of significant flora or remnant vegetation on the site; • Identification of known locations of rare or protected flora and known locations of weeds will be clearly shown on site database; • Prevent the introduction and spread of weeds into the Project area through vehicle, plant and equipment inspection and cleaning; • Maintain the abundance, diversity, geographic distribution and productivity of native flora and ecosystems; and • Ensure there is no unauthorised vehicle traffic outside of the Project disturbance area.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations	Weed hygiene and control of weed growth will aim to meet the requirements of the following laws and guidelines: • The Myanmar Environmental Conservation Law (ECL) (March 2012); • Department of Mines and Energy (DME) (2012). Weed Management *on Mine Sites- Advisory Note.* Northern Territory Government, NT.
Reporting	Monthly: MWMCL Management Team Quarterly: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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8.4.2 Fire

<table>
<tr><td>Section: 8.4.2</td><td>Title: Vegetation and Fauna</td></tr>
<tr><td>Date: 9 October 2013</td><td>Sub-title: Fire</td></tr>
<tr><td>Purpose</td><td>This EMP relates to the management of fire at the Project site. Potential impacts associated with fire include risk to site personnel and nearby villagers, damage to plant and equipment and damage to vegetation.</td></tr>
<tr><td>Timing</td><td>Management will be undertaken continuously during the construction, operations and closure phases of the Project.</td></tr>
<tr><td>Location</td><td>Fire management will take place throughout the Project site.</td></tr>
<tr><td>Action</td><td>The management programme will aim to:
Prevent fire as a result of construction and operation activities;
Ensure no uncontrolled fires are started as a direct result of the Project activities; and
Minimise the impact of any fires that do occur.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>Fire management will aim to meet the requirements of the following laws and guidelines:
The Myanmar Environmental Conservation Law (ECL) (March 2012);
Mining Regulations of the Union of Myanmar (1996)
Safety Regulation for Metal and Non-metal Mines, (GB16423-2006);[61]
Code of Design on Building Fire Protection and Prevention, (GB50016-2006);[62]
Code for Design of Electrical Installation for Explosive and Fire Hazardous Atmospheres (GB50058-92);[63]
Code for Design and Construction of Automobile Gasoline and Gas Filling Station (GB50156-2002).[64]</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
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[61] Standard of the Peoples Republic of China
[62] Standard of the Peoples Republic of China
[63] Standard of the Peoples Republic of China
[64] Standard of the Peoples Republic of China

8.4.3 Fauna Identification and Handling

Section: 8.4.3	Title: Vegetation and Fauna
Date: 10 October 2013	Sub-title: Fauna Identification and Handling
Purpose	This EMP relates to the identification and handling of fauna at, and around, the Project site. Fauna identification is a specialist occupation and should only be undertaken by personnel with the necessary skills. Potential impacts associated with fauna identification and handling are injury to fauna and injury to personnel.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	Fauna identification and handling will take place throughout the Project site and its surrounds.
Action	The management programme will aim to: • Minimise stress, injury and death to vertebrate fauna; • Maximise consistency of data collection; • Provide guidance to relevant personnel on fauna identification and handling; • Provide guidance to qualified field staff on fauna handling[65] and decisions for treatment or euthanasia; and • Ensure compliance with relevant legislation, policies and permits.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations	The fauna identification and handling EMP will aim to meet the requirements of the following laws and guidelines: • Environmental Conservation Law (ECL) (March 2012). • Protection of Wildlife and Protected Areas Law (1994)
Reporting	Monthly: MWMCL Management Team Quarterly: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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8.5 INDUSTRIAL WASTE MANAGEMENT

The site is expected to generate both hazardous and non-hazardous wastes. The EMPs make allowance for the options of processing of waste on or off site, as it is expected local capacity to process either class of material is limited.

[65] DEC, 2009; Standard Operating Procedure for Hand Capture of Wildlife; Department of Environment and Conservation, Government of Western Australia; June, 2009

8.5.1 Non-Hazardous Waste Management

<table>
<tr><td>Section: 8.5.1</td><td>Title: Industrial Waste Management</td></tr>
<tr><td>Date: 9 October 2013</td><td>Sub-title: Non-hazardous Waste Management</td></tr>
<tr><td>Purpose</td><td>This EMP relates to the management non-hazardous waste material at the Project site. Potential impacts associated with non-hazardous waste include pollution of water resources, danger to people and fauna and unsightly nature of rubbish.</td></tr>
<tr><td>Timing</td><td>Management will be undertaken continuously over the construction, operations and closure phases of the Project.</td></tr>
<tr><td>Location</td><td>Non-hazardous waste management will take place throughout the Project site.</td></tr>
<tr><td>Action</td><td>The Project will employ the waste hierarchy approach whereby the first aim will be to reduce the amount of waste generated through design, use of approved suppliers for materials, contract arrangements, minimisation of over-ordering etc.
Under the waste management hierarchy, management options will be evaluated in the sequence of re-use, segregation and recovery to minimise the amount of waste generated for final disposal.
A landfill will be constructed as an engineered cell within the WRD.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>Non-hazardous waste management will aim to meet the requirements of the following laws and guidelines:
Myanmar Environmental Conservation Law (ECL) (March 2012);
Mining Regulations of the Union of Myanmar (1996)
IFC Performance Standard 3. Resource Efficiency and Pollution Prevention. (IFC, 2012).</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
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8.5.2 Hazardous Waste Management

Section: 8.5.2	Title: Industrial Waste Management
Date: 9 October 2013	Sub-title: Hazardous Waste Management
Purpose	This EMP relates to the management hazardous waste material at the Project site. Potential impacts associated with hazardous waste include danger to mine personnel, pollution of water and soil, risk to villagers and risk to flora and fauna.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	Hazardous waste management will be undertaken in those areas where hazardous waste is generated such as the process plant, fuel farm, maintenance area and explosives area.
Action	Hazardous waste from the project will be managed as follows; • Recycled – waste such as waste oil can be recycled; • Removed from site by a licensed contractor; • Disposed of on-site by burying in a secure, lined, engineered cell and marked as contaminated land.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations	Hazardous waste management will aim to meet the requirements of the following laws and guidelines: • The Myanmar Environmental Conservation Law (ECL) (March 2012); • Mining Regulations of the Union of Myanmar (1996) • IFC Performance Standard 3. *Resource Efficiency and Pollution Prevention*. (IFC, 2012).
Reporting	Monthly – MWMCL Management Team Quarterly – Department of Environmental Conservation (DEC) Annually – DEC and Department of Mines
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8.5.3 Sewage and Wastewater

Section: 8.5.3	Title: Industrial Waste Management
Date: 10 October 2013	Sub-title: Sewage and Domestic Wastewater
Purpose	This EMP relates to the management of sewage and domestic wastewater at the Project site. Potential impacts associated with sewage and wastewater includes risk to health of mine personnel, pollution of water resources and risk to fauna.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	The main sources of sewage and domestic wastewater are the accommodation camp and the process plant.
Action	Sewage and domestic wastewater from the project will be managed as follows: • Segregation of wastewater streams to ensure compatibility with selected treatments option (e.g. septic system which can only accept domestic sewage); • Segregation and pre-treatment of effluents containing oil and grease (e.g. use of a grease trap) prior to discharge into sewer systems; • If sewage from the industrial facility is to be discharged to surface water, treatment to meet international or local standards for sanitary wastewater discharges; • If the sewage from the industrial facility is to be discharged to either a septic system, or where land is used as part of the treatment system, treatment to meet applicable international or local standards for sanitary wastewater discharges is required; • Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long-term sustainability of water and land resources; and • Monitoring at point of discharge. The monitoring location should be selected with the objective of providing representative monitoring data. Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations	Discharge water quality parameters.

Pollutant	Guideline Value	Units
pH	6 – 9	pH
BOD	30	mg/l
COD	125	mg/l
Total Nitrogen	10	mg/l
Total Phosphorus	2	mg/l
Oil and Grease	10	mg/l
Total Suspended Solids	50	mg/l
Total Coliform Bacteria	400	MPN[1] / 100 ml

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Reporting	Monthly	MWMCL Management Team	
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	Annually	DEC and Ministry of Health	
Notes: [1] MPN = Most Probable Number			

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8.6 CONCEPTUAL CLOSURE

This EMP is based on the Conceptual Closure Plan (Appendix H) and draws its contents and recommendations from it.

Section: 8.6	Title: Mine Closure
Date: 8 October 2013	
Purpose	This EMP relates to the management of mine closure and the Mine Closure Plan. Potential impacts associated with poor management of the closure process include a lack of materials for capping and rehabilitation, erosion and instability where progressive rehabilitation has not taken place and long-term environmental liabilities due to the presence of contaminated waste materials and/or loss of usable land.
Timing	The development schedule for the Mine Closure Plan will consist of the following stages: • The Conceptual Closure Plan will be prepared during the design stage (this report). This will allow integration with the design concepts and ensure that the design and operation of the site are compatible with the closure plan. • After commissioning the Detailed Closure Plan will be developed which incorporates the following: – A closure plan for each specific area / type of facility and structure on site. – Rehabilitation completion standards for approval with the regulators. – Testing program for assessment of short term and long term physical and chemical stability of waste dump and heap leach materials. – Rehabilitation trials to assess the viability of the closure concept plan. – Progressive rehabilitation plans for areas of the site which are no longer required for the ongoing operation. • During mine operation the closure plan will be updated every five years based on the results of the testwork programme and the changes in the operation and mine planning. • A minimum of five years before closure of the mine, a Final Closure Plan will be developed and approved with the regulators.
Location	The Mine Closure Plan applies to the whole site.
Action	Develop the closure design and the Mine Closure Plan in line with the above-defined schedule. This will include: • Ongoing design of the final land use and engineering development of the site. • Integration of the closure design into operational design to reduce works on closure and promote progressive rehabilitation. • Consultation with the local population to determine preferred final land use options; • Consultation with government to establish final land use parameters; • Rehabilitation trials to assess most appropriate resoiling and

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<table>
<tr><td></td><td>revegetation strategies for each key area on the site.
• Ongoing investigation and reviews of available rehabilitation materials and new technologies to improve rehabilitation outcomes.
Monitoring of the progress of the Mine Closure Plan should be undertaken on an annual basis with revision of the plan every three (3) years.</td></tr>
<tr><td>Responsibility</td><td>Environmental Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>• Environmental Conservation Law (2012),
• Foreign Investment Law (2012),
• Rules and Notification by Myanmar Investment Commission (2013),
• Rules of the Conservation of Water Resources and Rivers Law (2013),
• Land Acquisition Act
• Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007;
• Code for Waste Dump Design of Nonferrous Metal Mines (2007). National Standard of the People's Republic of China, GB 504421-2007. Implemented 01 October 2007
• European Commission Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities (January 2009)
• Guidelines for Preparing Mine Closure Plans, produced by the Government of Western Australia (June 2011)</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
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9. SOCIAL MANAGEMENT PLANS

9.1 NOISE

Section: 9.1	Title: Noise
Date: 10 October 2013	
Purpose	This SMP relates to the control of noise from the Project. Potential impacts associated with noise include health impacts to site personnel and nuisance to the community.
Timing	Noise emissions will be monitored over the construction, operations and closure phases of the Project.
Location	Noise monitoring shall be conducted using a digital sound level meter. Six noise monitoring stations are located on the Letpadaung site at the following locations: on the western boundary near the village of Moe Gyp Pyn South; at the southeast corner of the site adjacent to the SX/EW plant; north of the site near the village of Aungchans; on the northern boundary near the village of Kyaw; on the eastern boundary near the village of Shwehlay; and at the northeast corner near the construction camp site. These locations take into account the location of sensitive noise receptors such as villages and the accommodation area.
Action	Background noise levels around the site have been monitored and show a large variation between the dry season and the wet season. Modelling has also been carried out which shows that noise levels from the operation can be kept within 3dB of background levels at nearby noise sensitive premises with proper management. Noise monitoring should be carried out on an annual basis and more frequently if complaints occur from particular noise sensitive premises. In the event that public complaints arise, steps should be taken to investigate the root cause without delay and remedial action should be taken to correct any deficiency. General noise control measures during mining/production operations may include: • Comply with established noise limits; a 100 m wide buffer along the property perimeter will be considered; • Provide an air inlet silencer and exhaust silencers for combustion engines and other units; • Utilise sound insulation on equipment and sound barriers around stationary equipment; • Avoid trucking operations during night-time; • Select vehicles with minimum noise output including tyre noise, exhaust and compressor/fan noise; • Conduct noise survey at the property line and at the location of critical receptors when the Project attains full production capacity and annually thereafter during daytime and night-time hours to confirm compliance; and • Overpressure arising from blasting activities shall be monitored and recorded to assure compliance and respond to community complaints regarding blast noise.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation

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<table>
<tr><td>Regulations and Compliance</td><td>Blasting overpressure shall not exceed a sound power level of 115 dB(A) for 95% of all blasts and no blast shall exceed 120 dB(A) (ANZEC, 1990).
The following table shows maximum allowable noise emission levels adopted by IFC (2007). Noise levels should not exceed these levels, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.
<table>
<tr><td></td><td colspan="2">One Hour L_{Aeq} (dBA)</td></tr>
<tr><td>Receptor</td><td>Daytime 0700 – 2200 (hrs)</td><td>Night-time 2200 – 0700(hrs)</td></tr>
<tr><td>Residential, Institutional, Educational</td><td>55</td><td>45</td></tr>
<tr><td>Industrial, Commercial</td><td>70</td><td>70</td></tr>
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<tr><td>Reporting</td><td>
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<tr><td>Monthly</td><td>MWMCL Management Team</td></tr>
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<tr><td>Annually</td><td>DEC and Department of Mines</td></tr>
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9.2 VIBRATION

Section: 9.2	Title: Vibration
Date: 16 October 2013	
Purpose	This SMP relates to the control of vibration from the Project. Potential impacts associated with vibration include damage to buildings and nuisance to the community.
Timing	Vibration will be monitored continuously over the construction, operations and closure phases of the Project.
Location	Vibration monitoring will be conducted at the same location as for noise monitoring. Six monitoring stations are located on the Letpadaung site at the following locations: on the western boundary near the village of Moe Goe Pyn South; at the southeast corner of the site adjacent to the SX/EW plant; north of the site near the village of Aungchans; on the northern boundary near the village of Kyaw; on the eastern boundary near the village of Shwehlay; and at the northeast corner near the construction camp site. These locations take into account the location of sensitive receptors such as villages and the accommodation area.
Action	The primary source of vibration from the operational phase will be blasting in the pit. Background vibration levels at dwelling locations around the site have been measured to determine existing levels of vibration prior to operations. Modelling has also been carried out which shows that vibration levels from operational activities, particularly blasting, is within the levels set by the German standard used for acceptable vibration levels for protection of structures (DIN 4150-3).[66] Monitoring should be conducted to ensure that the blasting program is able to comply with the prescribed standard. This will enable changes to be made to the blasting methods if it is found that the levels do not comply. Monitoring should be done over a sufficient number of blasts to show consistent results, usually a minimum of five. General vibration control measures during mining/production operations may include: • Only blast during daytime hours; • Do not blast at the same time as nearby mines; • Monitor blasts and revise blast design, as required; • Limit ground-borne vibration and minimize air over pressure by taking care in unusual situations e.g. corners and geological considerations in blast; • Adequate stemming of holes; • Use of down-hole initiation with short delay detonators; this improves fragmentation whilst at the same time minimises ground vibration which is directly related to Maximum Instantaneous Charge (MIC) and not to the total charge in the blast; • Ensure the correct blasting ratio is obtained (the blasting ratio is a measure of the amount of work expected per unit volume of explosives i.e. tonnes/kg);

[66] DIN 4150-3 (1999-02) Structural vibration - Effects of vibration on structures

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<table>
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Notify nearest residences (if present) prior to the blast;
Eliminate exposed detonating cord and secondary blasting;
Restrict blasts to favourable weather conditions (wind and temperature gradient);
Use hole spacing to ensure that the explosive force is just sufficient to break the ore to the required size; and
Perform blasting in depressed pits.

</td></tr>
<tr><td>Regulations and Compliance</td><td>
IFC does not have a standard for vibration associated with community health. The ANZEC guideline for ground vibration suggests the adoption of a standard of 5 mm/s for 95% of all blasts with no blast to exceed 10mm/s.
The following table shows allowable vibration levels using the German standard DIN 4150-3 designed to protect structural integrity of buildings.
<table>
<tr><td>Type of Structure</td><td>Guideline values for velocity in mm/s, of vibration in horizontal plane of highest floor, at all frequencies</td></tr>
<tr><td>Buildings used for commercial purposes, industrial buildings, and buildings of similar design</td><td>10</td></tr>
<tr><td>Dwellings and buildings of similar design and/or occupancy</td><td>5</td></tr>
<tr><td>Structures that, because of their particular sensitivity to vibration, cannot be classified under the classifications above and are of great intrinsic value (e.g. listed buildings under preservation order or traditional structures)</td><td>3</td></tr>
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<tr><td>Reporting</td><td>
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<tr><td>Monthly</td><td>MWMCL Management Team</td></tr>
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9.3 BLASTING AND EXPLOSIVES

Section: 9.3	Title: Blasting and Explosives
Date: 16 October 2013	
Purpose	This SMP relates to the control of blasting and explosives use from the Project. Potential impacts associated with blasting include risk from flyrock to people and animals and nuisance to the community form dust, noise and vibration. The management of dust, noise and vibration have been set out in separate management plans.
Timing	Blasting and explosives use will be managed over the construction, operations and closure phases of the Project.
Location	The explosives magazines will be located in purpose built structures to the south of the pit adjacent to WRD3. Blasting will take place in the open pits during the life of the operation.
Action	In order to minimise effects to local communities, domestic livestock and wildlife as a result of blasting activities, the following provisions will be undertaken; • MWMCL will obtain approval from the relevant local authorities for the transportation, storage and use of explosives; • Shot-firers and other personnel using explosives must be licensed and appropriately trained for their duties; • Times for blasting will be selected when the community is least sensitive to blasting impacts (e.g. day time hours); • The local population shall be warned well in advance with dates and times of blasting (they must be allowed the opportunity to move livestock and prepare in advance); • Warning signs and security staff must be put into place to ensure the safety of the local population during blasting; • An audible pre-warning shall be given immediately before each blast or series of blasts; and • Approved blasting practices shall be followed at all times.
Responsibility	Mining Department
Authority	Department of Environmental Conservation
Regulations and Compliance	• Environment Conservation Law (2012); • Mining Regulations of the Union of Myanmar (1996); • Dust emission limits as per Air Quality EMP; • Vibration limits as per vibration SMP; • Noise limits as per Noise SMP.
Reporting	Monthly: MWMCL Management Team Annually: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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9.4 VISUAL AMENITY

Section: 9.4	Title: Visual Amenity
Date: 16 October 2013	
Purpose	This SMP relates to the management of visual amenity of the Project. Potential impacts associated with changes to visual amenity include loss of viewscape and loss of cultural amenity.
Timing	Visual amenity will be considered during design, operation and closure of the Project.
Location	The mining operation will be visible from all the surrounding villages as the Letpadaung hills are the only prominent feature in an otherwise flat landscape.
Action	• Construction area and mine site to be kept tidy; • Clearing of vegetation around the site to be minimised; • Revegetation of disturbed areas will be carried out progressively and as soon as practicable; • Landscape planting strategy to identify appropriate revegetation to act as a visual barrier.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations and Compliance	• Environment Conservation Law (2012); • Environmental, Health and Safety Guidelines for Mining, IFC/World Bank Group, 10th December 2007;
Reporting	Monthly: MWMCL Management Team Annually: Department of Environmental Conservation (DEC) Annually: DEC and Department of Mines
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9.5 CULTURAL HERITAGE

Section: 9.5	Title: Cultural Heritage
Date: 18 October 2013	
Purpose	The Cultural Heritage Management Plan (CHMP) is designed to ensure that the Project has minimal impact on cultural resources through the identification of sites and chance finds; consultation with cultural heritage authorities and local populations; and appropriate measures to protect the cultural resources, including Project design modifications and excavation and relocation. Cultural resources refer to archaeological/cultural sites, chance finds unearthed during construction, and sites which hold traditional and cultural significance to local populations, including minority subgroups.
Timing	Cultural heritage impacts occur predominately in the construction phase, because land clearance and other intrusive activities are required to prepare the site and build Project facilities. Although construction is phased, the facility footprint will be determined in the first year.
Location	Irrespective of exact location, cultural heritage management shall apply to sites which require protection from disturbance or destruction as a result of Project activities.
Actions	• A management plan will be prepared for the removal of the Villey Tawya Stupa and agreed with the Ministry of Religious Affairs. The Ministry shall undertake removal of all items of significance from the site and place them in a new or reconstructed pagoda for future worship and adoration. • The Project Manager shall ensure that the procedures in the CHMP are recognised, adopted and applied by Project staff and Project contractors prior to the commencement of construction works. Construction personnel will be trained to ensure proper management of construction activities around cultural heritage sites and to follow established procedures for handling chance finds. • In cooperation with the CSD Manager, the Project Manager will consult with archaeologists familiar with the area and local communities to understand the significance of the cultural resource and culturally acceptable actions to protect it from Project activities. • The Project footprint shall be surveyed and cleared of archaeological/cultural sites prior to intrusive construction works. • Chance finds and/or disturbance to cultural heritage sites will be reported to the CSD Manager within 24 hours. • Site specific protection/retrieval plans will be developed for each known site potentially impacted by Project activities. • Scouting investigations and expert consultations to identify any additional sites potentially impacted by the Project will be undertaken early in construction. • Subsurface evaluative testing will be conducted at potentially threatened sites prior to construction activities to determine if buried cultural deposits are present. • All testing and collection will be done under an approved plan

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<tr><td></td><td>and conducted by experienced archaeologists/work teams recognised by the National Museum of Myanmar.
• Scientific and cultural analysis and interpretation of the archaeological data collected during mitigation will be undertaken as soon as possible, and coordinated by the Community and Social Development Department.
• The Community and Social Development Department shall maintain an inventory of all archaeological monitoring activities and cultural heritage management documentation arising on site and shall transmit any necessary documentation to the Environmental Department and the National Museum.
• The Project Manager shall report to the CSD Manager on the implementation of the CHMP in the construction phase. Monitoring procedures include “watching briefs” conducted at sites, erection and maintenance of demarcation fencing around sites, careful siting of access routes or facilities, induction training to Project staff and contractors, cultural heritage complaints and actions taken, and causes of damage to or disruption of, cultural heritage properties and actions taken.
• The CSD Manager will conduct routine inspections of site activities in consultation with the Project Manager to assess the potential for chance finds at work sites and any other cultural heritage issue that may arise. He will also inspect sites where chance finds were unearthed to ensure that the correct control procedures and engagement activities were performed.</td></tr>
<tr><td>Responsibility</td><td>MWMCL Project Manager</td></tr>
<tr><td>Authority</td><td>MWMCL Managing Director</td></tr>
<tr><td>Regulations and Compliance</td><td>IFC Performance Standard 8, Cultural Heritage, 2012.</td></tr>
<tr><td>Reporting/Audits</td><td><table><tr><td>Monthly</td><td>MWMCL CSD Manager</td></tr><tr><td>Annually</td><td>MWMCL Project General Manager</td></tr></table></td></tr>
<tr><td colspan="2">Notes:</td></tr>
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9.6 COMMUNITY HEALTH, SAFETY AND SECURITY

Section: 9.6	Title: Community Health, Safety and Security
Date: 22 October 2013	
Purpose	This SMP is designed to ensure that the Letpadaung Project protects the health, safety and security of people and communities within the vicinity of the mine site and along the transport route to the port of Pakokku.
Timing	Management will be undertaken over the construction, operations and closure phases of the Project.
Location	The plan will apply to the mine and its environs and transport route to the port of Pakokku.
Action	The International Finance Corporation (IFC) Performance Standards for Social and Environmental Sustainability set out a range of recommendations with regard to community health, safety and security in Performance Standard 4. MWMCL will comply with requirements of IFC Performance Standard 4 that are relevant to the Letpadaung Project. A range of community health, safety and security procedures have been developed to ensure the protection of local people, their properties, assets and livestock from activities associated with the Project. These are outlined below. <u>Community Safety</u> • Implement an Alcohol and Substance Abuse Policy which clearly sets out the requirements and rules related to alcohol use during "on-duty" and "off-duty" hours (there will be a zero tolerance to drunkenness during "on-duty" hours); • Drug and alcohol testing will be carried out in accordance with the Alcohol and Substance Abuse Policy and the programme will reinforce the requirements of the policy; • The Code of Conduct will contain rules and regulations related to illegal activities, including crimes and violence and other expectations of the workforce; • At induction all MWMCL employees, Contractor personnel and subcontractors will be instructed on the requirements of the Code of Conduct prior to their commencing work; • The Project will implement disciplinary procedures related to its workforce and any illegal conduct by Project personnel; • Entertainment and sports facilities shall be provided at construction camps to encourage workers to remain within the camp boundaries during leisure time; • Measures to ensure community safety from transportation of goods and services for the Project are outlined in the Transport SMP (9.7.1); • Measures to ensure community safety from blasting activities at the Project are outlined in the Blasting and Explosives SMP(9.3); • A high security fence will be erected around 'high risk' mine facilities including the mill and crusher areas; • A manned security gate and personnel identification system will be implemented by MWMCL in the absence of other reasonable measures to control site access; • All site activities will be clearly demarcated where fencing is not

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	required to ensure that they are safe, visible and illuminated; • Where roads or other access routes cross site activity areas, MWMCL will be responsible for providing and maintaining safe diversions, temporary bridges, traffic controls, barricades, signs and warning lights as required; • Stock proof fencing will be erected in areas of danger for livestock and the Community Relations Team will decide on the areas to be fenced with relevant communities and livestock owners; • Watchmen should be employed to survey the Project construction sites and night-time vehicle storage areas and they will also discourage public infringement onto all Project sites; • Measures to manage the inflow of people seeking employment at the Project are outlined in the Human Resources, Training and Employment SMP (9.9.3). <u>Community Health and Wellbeing</u> • Employees will undertake a fitness to work assessment and baseline medical assessment on joining; • The health programme will include medical examination and immunisations (if required) of employees and main contractors on a regular basis; • Training will be provided to all staff, both national and expatriate, and will include awareness-raising on health considerations, including sexually transmitted diseases (STDs); • Health awareness training for workers will be conducted at induction and then periodically throughout construction and operations; • Health awareness materials will be provided in the appropriate language and disseminated through the meeting houses, Storefront Information Centres and local schools; • Medical facilities will be provided to all workers and their families at the site and there will be a dedicated ambulance service for the Project; • Medical staff from the Project may support government staff to conduct health awareness, health checks and other in-kind support services within local communities from time to time; • In the course of time, MWMCL may help to fund community inoculation programmes. <u>Community Health and Safety Awareness and Support</u> • MWMCL shall conduct a Community Health Assessment within the Project-affected villages; this will be a key piece of work and will serve to inform any health awareness and support programmes implemented by MWMCL; • Awareness-raising education and outreach events will be facilitated by MWMCL on health issues, particularly communicable diseases, including HIV/AIDS for communities close to the mine site; • MWMCL will work with local Health Departments and administrators to help them implement the Community Health Awareness Programme; • MWMCL will work with local Police Departments and administrators to help them implement a traffic awareness programme; • The Traffic Awareness Programme will inform affected communities of the potential hazards that could be encountered

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	from increased or altered traffic patterns and volumes on the roads used by Project-related vehicles. <u>Security and the Use of Force</u> • MWMCL will adhere to local laws as well as international standards on law enforcement in securing its operations, particularly those that relate to the use of force; • MWMCL will carry out risk assessments in relation to security issues at each of its Project sites; • Each MWMCL site will develop a Security Plan in order to prevent or mitigate any threats identified in its risk assessment. The Security Plan will determine how personnel will be deployed at the Project sites; • The objective of the Security Plan will be to ensure that security is deployed in a way that respects and protects human dignity and human rights, avoids creating conflict and addresses security threats in as peaceful a way as possible; • MWMCL will therefore seek to ensure that force is a last resort and is used in a way that minimizes damage and injury, and respects and preserves human life; • MWMCL will only use armed guards where the above risk assessment determines that this is the only way to mitigate the risks identified or where it is required by law; • Force should only be used for preventive and defensive purposes in proportion to the nature and extent of the threat; • Firearms will only be used in accordance with the above principles and where human life is at risk and less extreme measures are not sufficient; • In every instance in which a firearm is discharged, a report should be made promptly to MWMCL's central office; • Security personnel must ensure that medical aid is given to anybody injured in any incident at the earliest possible moment; • A community complaints process will be in place to allow the local community to express concerns about the security arrangements and acts of MWMCL security personnel; • MWMCL will investigate any credible allegations of unlawful or abusive acts of its security personnel, take action to prevent recurrence, and report unlawful and abusive acts to public authorities when appropriate; • Where MWMCL uses public or government security services to protect its operations, they must guarantee that existing international guidelines and standards for the use of force are respected; • MWMCL will conduct due diligence on security providers to avoid retaining the services of any group or individual that has previously been responsible for violations of human rights or humanitarian law; • MWMCL will provide training regarding the use of force (and where applicable, firearms) and appropriate conduct toward workers and the local community and monitor to ensure that security personnel abide by this standard. <u>Emergency Response</u> • Measures to manage community safety in the event of an emergency related to the Project are outlined in the Emergency Response SMP (9.10).

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<tr><td>Responsibility</td><td colspan="2">Environment/ Community Department</td></tr>
<tr><td>Authority</td><td colspan="2">Department of Environmental Conservation and Department of Mines</td></tr>
<tr><td>Regulations and Compliance</td><td colspan="2">• Environment Conservation Law (2012).
• IFC Performance Standards for Social and Environmental Sustainability; Performance Standard #4. January 2012</td></tr>
<tr><td>Reporting</td><td>Monthly</td><td>MWMCL Management Team</td></tr>
<tr><td></td><td>Annually</td><td>Department of Environmental Conservation and Department of Mines</td></tr>
<tr><td colspan="3">Notes:</td></tr>
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9.7 TRANSPORT

9.7.1 Road Transport

Section: 9.7.1	Title: Transport
Date: 21 October 2013	Sub-title: Road Transport
Purpose	This SMP relates principally to the road transport of materials and supplies to the site together with copper cathode and waste generated from the Project site. The predominant mode of transport will be via barge along the Irrawaddy River. However, over the dry season, river levels are such that barges can generally only venture as far upstream as the town of Pakokku. At this time of the year it will be necessary to transport materials via road between the Project and Pakokku. Explosives will be transported to the site by truck from China (crossing the border at the town of Muse). Potential road transport impacts include animal road kills, driver and public safety concerns, safety issues related to transportation along the route, and environmental risks due to spillage of hazardous materials. Road transport routes are shown in Figure 9.7.1.
Timing	Road transport of materials to and from site will occur over the construction and operation phases of the Project.
Location	Road transport monitoring and management for the Project will be conducted as follows: • Between the Project and Pakokku, over the dry season, for transport of general materials and copper cathode. • Between Muse and the Project, all year round, for haulage of explosives.
Action	Quality and condition of access roads, the number, frequency and size of trucks transporting materials to and from site, truck maintenance and mechanical inspection records, as well as any transport related incidents or accidents will be recorded and monitored. Related SMPs / EMPs that are applicable include those for noise, hydrocarbons, dust, air quality, community health and safety, emergency preparedness and response, and occupational health and safety. General measures to mitigate / manage road transport related impacts associated with mine construction and operation include: • Drivers and mechanics will be trained to ensure safe operation, maintenance, repair and material handling. • Vehicle transport will be limited to day light hours, as much as possible. • Truck traffic will be planned, where possible, to avoid passing through towns during busy pedestrian periods (e.g. market days and school start / finish). • At least one vehicle in each transportation convoy will be equipped with a suitable VHF radio for routine and emergency communications. • All drivers will be trained in safe handling of hydrocarbons /

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<tr><td></td><td>hazardous materials and EMSC emergency response procedures.
• Spill response equipment will be kept and maintained on trucks.
• Mine trucks will have a speed limit set for travel through villages where there are no posted speed limits.
• MWMCL will sponsor a Traffic Awareness Programme for affected villages to reduce the risk of accident.
• Access roads to site will be upgraded for safety and signage.
• Fencing and pedestrian crossings adjacent to schools.
• Drug and alcohol testing of drivers.
• Enforcement of safe working hours with adequate rest breaks for drivers.</td></tr>
<tr><td>Responsibility</td><td>Safety and Environment Department</td></tr>
<tr><td>Authority</td><td>Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td>IFC Environmental Health and Safety Guidelines for Mining will be used as a guide for various aspects of transportation associated with the project site.</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>Environmental Manager</td></tr><tr><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr><tr><td>Annually</td><td>DEC and Department of Mines</td></tr></table></td></tr>
<tr><td colspan="2">Notes</td></tr>
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9.7.2 River Transport

Section: 9.7.2	Title: Transport
Date: 21 October 2013	Sub-title: River Transport
Purpose	This SMP relates principally to the river transport of materials, supplies and copper cathode to and from the site. The destination of materials from the Project will be the port at Pathein in the Irrawaddy delta of Myanmar. The majority of materials, destined for site, will be shipped to the Port of Pathein and will then be transported via river barge to the Letpadaung site. Copper cathode and back-haul transport will follow the same route and the copper will be shipped from Pathein to China. The predominant mode of transport will be via barge along the Irrawaddy River. During the wet season the depth of flow in the Chindwin River (a tributary of the Irrawaddy that flows past Letpadaung) is adequate to allow barge access to a landing adjacent to site. However, over the dry season, river levels are such that barges can generally only venture as far upstream as the town of Pakokku. At this time of the year it will be necessary to transport materials via road between the Project and Pakokku. Transport of goods via barge is commonplace along the Irrawaddy and Chindwin Rivers so additional barge traffic associated with the Project is not expected to have significant impact. Potential river transport impacts include safety issues related to working over water, and environmental risks due to spillage of hazardous materials. River transport routes are shown in Figure 9.7.1.
Timing	Transport of materials to and from site will occur over the construction and operation phases of the Project.
Location	River transport monitoring and management for the Project will be conducted between the Project and the port of Pathein for transport of general materials and copper cathode.
Action	The number, frequency and size of barges transporting materials to and from site, barge condition, maintenance and mechanical inspection records, as well as any transport related incidents or accidents will be recorded and monitored. Related SMPs / EMPs that are applicable include those for hydrocarbons, surface water, emergency preparedness and response, and occupational health and safety. General measures to mitigate / manage river transport related impacts associated with mine construction and operation include: • Barge operators and mechanics will be trained to ensure safe operation, maintenance, repair and material handling. • Barge loading and unloading will be limited to day light hours, as much as possible. • Barges will be equipped with a suitable VHF radio for routine and emergency communications. • Barge operators will be trained in safe handling of hydrocarbons / hazardous materials and EMSC emergency response procedures. • Spill response equipment will be kept and maintained on barges and load out facilities.

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<tr><td></td><td colspan="2">• Drug and alcohol testing of barge operators.
• Enforcement of safe working hours with adequate rest breaks for barge operators.</td></tr>
<tr><td>Responsibility</td><td colspan="2">Safety and Environment Department</td></tr>
<tr><td>Authority</td><td colspan="2">Department of Environmental Conservation</td></tr>
<tr><td>Regulations</td><td colspan="2">A Field Guide to Fuel Handling, Transportation and Storage (British Colombia Ministry of Water, Land and Air Protection) will be used as general guide for managing potential river transport impacts.</td></tr>
<tr><td>Reporting</td><td>Monthly</td><td>Environmental Manager</td></tr>
<tr><td></td><td>Quarterly</td><td>Department of Environmental Conservation (DEC)</td></tr>
<tr><td></td><td>Annually</td><td>DEC and Department of Mines</td></tr>
<tr><td colspan="3">Notes</td></tr>
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9.8 LAND USE AND RESETTLEMENT

9.8.1 Future Land Use

Section: 9.8.1	Title: Land Use and Resettlement
Date: 16 October 2013	Sub-title: Future Land Use
Purpose	This SMP relates to planning of a future land use for the site prior to closure of mining operations.
Timing	Discussions will take place with the community and government departments to develop options for future land use during the course of operations such that a future land use plan can be put into effect at closure.
Location	The plan will cover the extent of the mining operation and leased area as well as those adjacent areas that experience change as a result of the Project.
Action	In order to develop a conceptual future land use plan, a number of consultations and studies will be undertaken during the mine operations phase to refine the plan. These are likely to include: • Identification of potential future land uses and land suitable for those purposes; • Consultation with the local population to determine preferred final land use options; • Consultation with government to establish final land use parameters; • Rehabilitation trials to assess most appropriate rehabilitation; • Revegetation strategies for each key area on the site; • Ongoing investigation and reviews of available rehabilitation materials and new technologies to improve rehabilitation outcomes and • Development of a strategic local and regional plan to address the likely changes in land use and economic development in the area during and after the Project life.
Responsibility	Community Relations/Environment Department
Authority	Department of Environmental Conservation/Department of Mines/Department of Regional Development/Salingyi Township Planning Department
Regulations and Compliance	• Environment Conservation Law (2012); • Mining Regulations of the Union of Myanmar (1996); • IFC (2012). Performance Standards for Social and Environmental Sustainability.
Reporting	Monthly: MWMCL Management Team Annually: Department of Environmental Conservation (DEC) and Department of Mines
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9.8.2 Resettlement Action Plan

A resettlement action plan is included at Appendix M.

9.9 COMMUNITY ENGAGEMENT

9.9.1 Community and Social Development

Section: 9.9.1	Title: Community and Social Development
Date: 18 October 2013	
Purpose	The community and social development plan (CSDP) is an action plan that sets out the roles and responsibilities of the Project towards designated communities considered to be affected by the Project, and the consultation approach and activities and capacity building measures to be implemented in these communities. Known direct impacts include relocation of communities and cultural resources, the provision of employment and training to targeted communities, upgrading and provision of medical facilities, inconveniences caused by Project activities (dust, noise, etc.). Consultations to obtain local input into Project design and in proposed mitigation measures are planned for the project phases. Monitoring, reporting, and budgeting of the CSD activities are also summarised. The management of the impacts on the communities are detailed in separate SMPs and EMPs. The CSDP complements the Stakeholder Engagement Management Plan.
Timing	Consultation with the communities takes place in all Project phases; the highest volume is in the construction phase when public disclosure about the Project activities and any foreseeable impacts takes place, and the solicitation of concerns on these activities and impacts is also ascertained and reported back to MWMCL for consideration in design and implementation arrangements.
Location	Community consultations predominately take place in the designated villages.
Actions	• MWMCL will develop new criteria to reselect project-affected communities for engagement; emphasis will be made on those particularly adversely affected by the Project activities, the number of which will be kept to a manageable number (maximum of 15). • MWMCL will adopt a consultation strategy, tailored for the specific Project activity, for all activities requiring information disclosure and/or no-objection from the target communities (TCs) for all phases of the Project. A brief action plan shall be made for each consultation. The strategy will distinguish between consultations about the Project activities and associated impacts and consultations about community social development based on MWMCL's philanthropy, which should be viewed as a separate group of activities altogether. • Regarding MWMCL's philanthropic strategy, the process for determining community priorities and deciding which priorities to fund will be elaborated therein. Community grants shall be made on an annual basis and shall require communities to contribute labour as partial payment towards the grant. In the case of infrastructure, MWMCL will train designated individuals

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<tr><td></td><td>from the recipient village(s) how to maintain the infrastructure. Monitoring of the maintenance requirements will be conducted on a regular basis, and any neglect of the infrastructure will result in the exclusion of the village from future financing.
• In order to fulfill the Corporate Social Responsibility (CSR), MWMCL is willing to implement the Community and Social Development Plan by providing cash, materials and/or free engineering construction, the value of which shall be approximately 1 million USD per year before the Letpadaung Project is in full operation.
• Once the Letpadaung Project is in full operation, the Parties concerned (ME(1), MEHL & MWMCL) agree to allocate (2%) of their respective net profit from the Letpadaung Project according to their respective audited annual financial report for the CSR activities, which should be discussed and allocated in the nearest JMC meeting.

• MWMCL will adopt engagement protocols that set out behavioural expectations for the consultative team(s) to adhere. These include: respecting local social and cultural practices, communicating in a culturally sensitive manner, adopting appropriate dress, using simple language and diagrams for ease of comprehension consistent with the capacity of the community, etc.
• MWMCL will ensure that there is adequate staff resources and funding for all CSD activities. MWMCL will hire professional CSD staff to serve on the CSD Team which will be managed by the CSD Team Project Manager. Key roles of the CSD personnel will be developed with experience and skill requirements for each position specified. The CSD Team will recruit liaison officers from the TCs to help them implement the CSD activities. The CSD Team Project Manager will coordinate CSD activities with the External Affairs Coordinator responsible for stakeholder engagement implementation.
• MWMCL managers and personnel working with the TCs (including media) shall be provided with training in social development/media relations as required.
• Monitoring of key performance indicators shall take place on a regular basis. The Community Relations Manager will report monthly on CSD activities, and the MWMCL Project General Manager will conduct quarterly audits.</td></tr>
<tr><td>Responsibility</td><td>MWMCL CSD Committee</td></tr>
<tr><td>Authority</td><td>MWMCL Managing Director</td></tr>
<tr><td>Regulations and Compliance</td><td>IFC Performance Standard 1, Assessment and Management of Environmental and Social Risks and Impacts.</td></tr>
<tr><td>Reporting

Audits</td><td><table>
<tr><td>Monthly</td><td>MWMCL Community Relations Manager</td></tr>
<tr><td>Annually</td><td>MWMCL Project General Manager</td></tr>
<tr><td>Annually</td><td>MWMCL CSD Committee</td></tr>
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9.9.2 Stakeholder Engagement

Section: 9.9.2	Title: Stakeholder Engagement
Date: 18 October 2013	
Purpose	The purpose of the SEMP is to set out the principles underlying, the processes for, and timing of, systematic and coordinated stakeholder engagement with Project stakeholders. The overall objectives of stakeholder engagement are to disclose information about the Project on a rolling basis and to learn how Project activities are viewed by the main stakeholders so that their concerns can be addressed in project design and implementation. In the construction phase particularly, the emphasis of stakeholder engagement is on informing, and gaining general consensus, from local communities about the nature and timing of the construction activities and on the resultant foreseeable social, health and environmental impacts and associated mitigation measures. The key tools for engaging local communities are the Community and Social Development Plan (CSDP) and the complimentary Resettlement Action Plan (RAP), Cultural Heritage Management Plan (CHMP) and the Natural Resources Management Plan (NRMP). Specified actions in these plans will be coordinated with the SEMP.
Timing	Consultation with stakeholders takes place in all Project phases. In the construction phase, the volume of consultations and topics for discussion is high and mainly concerns local communities' receptivity toward planned Project activities.
Location	Varies by stakeholder group and purpose of the consultation (interviews, meeting, focus groups, workshops, presentations, etc.)
Actions	• MWMCL shall adhere to the principle of free, prior and informed consent to the greatest extent possible (see note). In instances where it is not possible to obtain general consensus, MWMCL will pursue options that are congruent with international good practice. • MWMCL will identify the Project's primary and secondary stakeholder groups and the issues on which they shall be consulted. Likely primary stakeholders are: Sagaing Division Government and relevant land, cadastre, roads authorities; Project management and employees; Project Implementation Committee, Project-affected persons; community leaders; target communities; local business and community groups and NGOs; and suppliers. • MWMCL will construct a list of all the key consultations to be carried out in each phase of the Project, indicating the stakeholder group(s), purpose and issues to be addressed, timing with respect to Project activity, method of engagement, and venue for the consultation, and responsible party. All engagements shall be coordinated so as to maximise active stakeholder participation and receptivity. The actual hosting and planning of the consultation will reside with the relevant responsible party (e.g. the CSD team for village consultations). • MWMCL will establish stakeholder engagement procedures/protocols applicable to any consultation with non-

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<table>
<tr><td></td><td>Project persons and groups to guide the Project Management Team and Project contractors/subcontractors. Specific communication protocols shall be established for dealing with the media and NGOs.
• MWMCL shall maintain a master database of all consultations, specifying the outcome(s) and any resultant management actions and follow-up activities.
• MWMCL shall establish a Grievance Mechanism to process stakeholder complaints, take any corrective actions, and inform the complainant of the outcome.
• MWMCL will ensure that there is adequate staff resources and funding for all stakeholder engagement activities. MWMCL will hire a dedicated External Affairs Coordinator responsible for implementing the Project's Stakeholder Engagement Program who will report to the Deputy General Manager and work alongside the Public Relations Officer. The External Affairs Coordinator shall be a qualified Myanmar national with no immediate associations in Sagaing Division. S/he will be trained in MWMCL communication protocols for dealing with the media and NGOs.
• Performance indicators measuring the effectiveness of stakeholder engagement shall be tracked and assessed at regular intervals.</td></tr>
<tr><td>Responsibility</td><td>MWMCL Deputy General Manager</td></tr>
<tr><td>Authority</td><td>MWMCL Managing Director</td></tr>
<tr><td>Regulations and Compliance</td><td>IFC Performance Standard 1, Assessment and Management of Environmental and Social Risks and Impacts.</td></tr>
<tr><td>Reporting

Audits</td><td><table>
<tr><td>Monthly</td><td>MWMCL External Affairs Coordinator</td></tr>
<tr><td>Annually</td><td>MWMCL Project General Manager</td></tr>
<tr><td>Annually</td><td>MWMCL CSD Committee</td></tr>
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<tr><td colspan="2">Notes: Project construction was commenced prior to the commencement of the ESIA and stakeholder engagement and, as a result, the principle of free, prior and informed consent (FPIC) was not adopted.</td></tr>
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9.9.3 Human Resources, Engagement and Training

Section: 9.9.3	Title: Human Resources, Training and Employment
Date: 22 October 2013	
Purpose	The Human Resources (HR), Training and Employment Management Plan is designed to ensure that local employment is maximised and enhanced through effective, fair and transparent procedures for recruitment, employment and training of personnel. This Plan complements the Company's Recruitment and Training Arrangement Guidelines. Approximately 2000 workers will be required for the construction of the mine and ancillary facilities, and 1500 for the peak of the operational phase. Currently Myanmar Yang Tse Copper Ltd employs 1,831 personnel who come from villages located in Salingyi, Yin Mar Bin, Pale, and Monywa Townships, of which 555 are permanent staff. Eligible persons and households who are affected by resettlement will be given employment as compensation for loss of income resulting from displacement or land take. This Plan specifies the eligibility rules regarding the hiring of personnel from these households in the construction phase.
Timing	HR management is required at all phases of the Project, and is particularly demanding in the construction phase, where manpower (and associated training) requirements for the Project activities peak. Preferential employment of persons from the affected households will take place early in the construction phase.
Location	The vast majority of personnel will be based at the Project site, living in nearby villages or in accommodation housing. Some expatriate contractors will have fly in, fly out arrangements.
Action	The main elements of the Plan are: 1) Local preference: Expatriates will only be brought in as (a) skilled and experienced operators for specific mining and processing plant and machinery, not available in-country; (b) skilled and experienced mine trained supervisors in mining, processing and engineering; and (c) high level mining industry professionals. 2) Experienced Myanmar nationals with transferable skills will be identified and retrained to the standards required for an international mining project. 3) Most expat labour will be gradually replaced by local labour in the operational phase. 4) All employees and relevant contractors will be trained for the requirements of the position they are holding, including specialised training where applicable, e.g. chance finds procedures. 5) Recruitment procedures will be transparent, public and open to all and shall be publicised in advance, including distribution of information to affected communities and regional stakeholders. Priority will be given to applicants entitled to compensation (see below). 6) Efforts to control against migration influx of job seekers in to the Project area will take place through proactive policies

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7) Employment conditions will meet national laws and international standards. There shall be no discrimination on the basis of religion, ethnicity, gender, and age. Employment conditions, including recruitment policies and procedures, wages and salaries, overtime hours, leave, social security and training are specified in the Company's Recruitment and Training Arrangement Guidelines.
8) Principles of Preferential Employment to Eligible Affected Persons/Households.
• Applicants must be from households that are legally registered and entitled for compensation by the land requisition process of the Project.
• The applicant must pass the medical check-up arranged by the Company, aged between 18 to 60, and agree to accept the Company's Recruitment and Training Arrangement Guidelines, and abide by Company regulations.
• For the four relocated villages: The Company will provide one job to each household that was relocated to a new site.
• For the 26 affected villages: Households that lost less than 5 acres and all of its land will be allocated one job. Households that lost between 5 to 10 acres will be allocated one job. Households that lost between 10 to 20 acres will be allocated 2 jobs. Household that lost more than 20 acres will be allocated 3 jobs.
• All the certified full-time graduates in the affected villages will be recruited as on-the-job trainees and become the employees of Wanbao after trained by the Company for five months and proven to be qualified.
• Regarding those households with members who are not capable of working for the Company or those who don't meet the above criteria but fully rely on farming in the Project area for their livelihoods, the Company will provide specialised assistance on a case by case basis under the advice and assistance of the Regional Government.</td></tr>
<tr><td>Responsibility</td><td>Human Resources Department</td></tr>
<tr><td>Authority</td><td>Ministry of Labour, Employment and Social Security</td></tr>
<tr><td>Regulations and Compliance</td><td>• Recruitment and Training Arrangement Guidelines for Myanmar Wanbao Mining Copper Limited (2013).
• The Labour Organisation Law, (2011).
• The Settlement of Labour Dispute Law, (2012).
• The Minimum Wage Law (Draft), (2012).
• Employment and Training Act, (1950).
• Leave and Holiday Act, (1951).</td></tr>
<tr><td>Reporting</td><td><table><tr><td>Monthly</td><td>MWMCL Management Team</td></tr><tr><td>Annually</td><td>Ministry of Labour, Employment and Social Security</td></tr></table></td></tr>
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9.10 EMERGENCY RESPONSE

Section: 9.10	Title: Emergency Response
Date: 17 October 2013	
Purpose	This SMP relates to the management of emergency response. The plan will provide information to assist and inform all personnel on site so that they can respond to any site emergencies that have the potential to adversely affect the natural environment and/or the safety of personnel.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	The plan will apply throughout the Project site.
Action	The Emergency Response Plan allows for the fact that emergency events can occur and develop rapidly, requiring personnel to act without waiting for further guidance. The following shall be considered in the implementation of any emergency response: • Health or epidemic alert; • Liaison with the local health authorities; • Equipment requirements to assist in an emergency situation; • Training requirements; • Personnel needs – resources; • Public interface; • Environmental impact; • Social impact; and • Reputation of stakeholders and the Project. On discovery of an incident, the On-Scene Coordinator will undertake an initial assessment of the emergency and collect the following key information: • The nature of the incident; • What hazards are involved; • Who is in charge; • Location of the incident; • The physical situation; • Type of substances involved; and • Injuries to people. Following completion of the initial assessment, the On-Scene Coordinator shall consult with the General Manager or his designate to identify the need to notify government agencies for advice or assistance.
Responsibility	Safety and Environment Department
Authority	Department of Environmental Conservation
Regulations and Compliance	• Environment Conservation Law (2012); • Mining Regulations of the Union of Myanmar (1996); • Environmental, Health and Safety General Guidelines: Community Health and Safety, IFC/World Bank Group, 10th December 2007.

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Reporting	Monthly	MWMCL Management Team
	Annually	Department of Environmental Conservation (DEC)
	Annually	DEC and Department of Mines
Notes:		

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9.11 HEALTH

Section: 9.11	Title: Accommodation
Date: 17 October 2013	
Purpose	This SMP relates to the management of accommodation for the Project. The Accommodation Management Plan is designed to ensure that appropriate standards are adopted for the accommodation provided by the Letpadaung Project, for employees and contractors of MWMCL.
Timing	Management will be undertaken continuously over the construction, operations and closure phases of the Project.
Location	The plan will apply to those areas designated for accommodation of construction and operational personnel.
Action	The following standards apply to the accommodation facilities: 1. Accommodation and sanitary facilities: • Not more than eight workers accommodated in the same room, with separate beds for each worker, partitions to ensure privacy and a minimum distance of one metre between beds; • Not more than one worker per five square metre (surface) and one worker per ten cubic metre (volume); • 100 litres of water per worker per day are available on average for personal hygiene purposes. This water is drinking water quality unless explicitly marked otherwise; • One hand wash sink per ten persons; • One toilet per ten persons; • One urinal per fifteen persons; • One shower per ten persons; • Regular cleaning of sanitary facilities and regular washing of bed linen; • Separate storage provided for work boots and Personal Protective Equipment (PPE). 2. Gender: separate sleeping areas and separate sanitary facilities are provided for men and women; 3. Comfort, culture and recreation: • Facilities for the storage of workers' personal belongings are provided; • Facilities are provided for observance of religion as defined in consultation with workers' representatives; • Television and internet are provided in dedicated facilities allowing inexpensive phone calls. 4. Safety: • Both natural and artificial lighting are provided and maintained in living facilities. Emergency lighting is provided; • Extinguishers are provided and fire emergency procedures are in place, with trained Fire Wardens in each accommodation block.

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Responsibility	Environment/Community Department	
Authority	Department of Mines	
Regulations and Compliance	• Workers' Accommodation: Processes and Standards, IFC/EBRD, August 2009.	
Reporting	Monthly	MWMCL Management Team
	Annually	Department of Mines
Notes:		

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10. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

10.1 INTRODUCTION

Monitoring is a key tool to ensure that impact mitigation plans are working effectively and to assess compliance against regulatory requirements and other agreed performance standards. Monitoring is also used to identify areas of non-compliance and/or poor performance and to assess the effectiveness of measure to improve performance. Monitoring enables mitigation and management measures to be adjusted to respond to inevitable changing conditions and the unexpected.

Mitigation and management of a project before it is constructed depend on assessment of potential impacts and public and government concerns expressed through consultation and the approval process. It is almost impossible to fully and accurately predict all environmental impacts which might arise from a project at this early stage. Even the best impact assessment may fail to identify and mitigate all negative impacts which a project could have on the natural and social environment. In addition, no project is implemented in a static environment. Other changes in other conditions could lead to negative environmental impacts arising from a project which it would have been impossible to predict at the time of assessment. For these reasons, monitoring and evaluation of a project's environmental impact following approval and implementation is an important part of the overall project cycle.

General procedures regarding monitoring are included in each of the individual environmental and social management plans. Specific information pertaining to monitoring type, frequency, and locations is included herein.

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10.1 AIR QUALITY

Monitoring of changes in ambient air quality will be done to ensure that air quality in the area does not undergo any adverse changes over the life of the Project. It will require establishing representative sampling locations to assess the potential effects of fugitive emissions during construction and mine operations.

An air quality risk assessment plan shall be prepared which will:

- Identify zones (or areas) of different severity levels with respect to their vulnerability to potential impacts of air emissions;
- Help identify emissions or sources of greatest risk to beneficial uses of the environment;
- Provide for assessment of the environmental and health impacts of air emissions and establishment of air quality management priorities; and

- Serve as a basis for selecting locations for dust and gaseous emission monitoring and for establishing mitigation measures.
- An air quality emergency mitigation plan shall also be prepared which will:
- Outline procedures for coordinating activities with local authorities and local health institutions to develop an Emergency Abatement plan;
- Specify arrangements and procedures for having local communities report adverse health effects experienced as a result of release of dust and gaseous emissions into the environment; and
- Establish air pollution alert procedures and protocols; implementation strategy for an emergency abatement plan if the concentration of air quality indicator is predicted to exceed the standard limit.

The significant contributors to air quality impacts from the Project are dust and acid mist.

10.1.1 Dust

Seven permanent dust monitoring stations are located on the Letpadaung site at the following locations: on the western boundary near the village of Moe Gyp Pyn South; at the southeast corner of the site adjacent to the SX/EW plant; at the northeast corner of the site near the village of Tan Daw; on the northern boundary near the village of Kyaw; on the north-western boundary near the village of Phaunga South; on the eastern boundary near the village of Shwehlay; and at the northeast corner near the construction camp site (Figure 4.10.4). These locations take into account the prevailing wind directions in the dry seasons and wet season.

There will be continuous monitoring of TSP, PM10, and PM2.5. These parameters will be downloaded on a weekly basis.

Table 10.1: Dust sampling requirements

Parameter	Sampling Frequency	Sampling Duration
TSP	Weekly	24 hrs
PM_{10}	Weekly	24 hrs
$PM_{2.5}$	Weekly	24 hrs

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a weekly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;

- Planned activities during the next reporting period; and
- Any other issues of concern.

10.2.2 Acid Mist

Acid mist generation should be measured continuously when acid is being added to heap leach pads and in and around the SX/EW plant during its operation

Two permanent monitoring stations are to be located on the Letpadaung site at the southeast corner of the site adjacent to the SX/EW plant and further to the west adjacent to HLP 2. Additional monitoring should be undertaken, using portable monitors, along the southern and western boundaries of the site in the vicinity of areas of the HLP being irrigated. Monitoring inside the site should also be undertaken downwind of the areas of the HLPs being irrigated. These locations take into account the prevailing wind directions in the dry seasons and wet season. They will enable acid mist entering and leaving the site, particularly near sensitive receptors, to be monitored at any particular time.

Where the potential source of the complaint lies outside the collection zone of the monitoring stations, portable monitors shall be positioned to enable downwind samples to be taken at heights of 1, 3 and 5 m above the ground surface for a period of 1 hour sequentially for a period of 9 hours, to determine the likely emission source associated with the complaint. Wind direction measurements and intensity shall be taken at the same time.

Sampling may be performed by collection of sulphuric acid on a cellulose membrane filter and then analysis conducted using a recognised laboratory technique to determine the level of sulphuric acid present. Alternatively detector tubes certified by OISH under 42CFR Part 84 can be used for direct reading of the acid level in the atmosphere.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a weekly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern

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10.1.2 Greenhouse Gas

The monitoring of greenhouse gas (GHG) emissions is becoming a standard requirement under international good practice. MWMCL will conduct annual monitoring of GHG emissions. It is likely that GHG monitoring during operations will involve inventories being developed using mass balance, stoichiometric calculations and internationally accepted „factors". Key data that will be collected on a semi-continuous basis to support the inventory will include:

- Diesel consumption by mining vehicles;
- Explosives use;
- Extent of electricity import and export;
- Power generation/fuel type (emissions);
- Incineration (emissions);
- Employee road and air miles;
- Road miles by HGVs importing plant; and
- Road miles by HGVs exporting concentrate.

This data will be used to prepare an annual GHG emissions inventory and to track emissions over the course of Project development.

10.2 WATER

Surface and groundwater resources will be monitored during the life of the operation.

10.2.1 Water Usage

Water flows to, from and around the site will be measured and recorded. This will include measurement on a daily basis of the following:

- Raw water abstracted from the Chindwin River;
- Water pumped to the WWP;
- Water overflowing from the WWP;
- Water flowing to the SWP;
- HLP irrigation water pumped from the solution ponds and the SWP;
- Groundwater pumped from dewatering wells; and
- Surface water pumped from the pit.

The following climatic data will be recorded from the two weather stations on site:

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Table 10.2: Climate parameters to be recorded at site weather stations

Parameter	Sampling Frequency
Temperature (^{o}C)	Twice daily (minimum and maximum)
Relative humidity (%)	Daily
Wind speed (m/s)	Every 1 to 3 hrs
Wind direction (deg.)	Every 1 to 3 hrs
Precipitation (mm)	As frequently as possible (use electronic tipping bucket)
Daily solar radiation (Wh/m^2)	Daily
Pressure (mb)	Daily
Pan evaporation (mm)	Daily

Flow meters will be fitted to pipelines onsite and will be used to measure water abstracted from the Chindwin River and water pumped between major infrastructure and ponds. Water overflow from the WWP will be measured using a v-notch weir.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

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10.2.2 Surface Water Quality and Quantity

Seven permanent surface water monitoring stations are located on the Letpadaung site at the following sites (Figure 10.3.1):

- Just upstream of the south diversion channel inlet;
- Just downstream of the south diversion channel outlet;
- The irrigation channel at the upstream (southeast) corner; the irrigation channel at the downstream (northeast) corner;
- The spillway overflow for the WWP (north);
- The northwest Project boundary (Phaunga South); and
- The Chindwin River.

These locations account for stream flow directions and enable upstream and downstream flows and water quality at any particular time to be monitored.

Surface water flow will be measured using a v-notch weir at each of the monitoring stations. Surface water quality will be measured in the field and samples will also be

taken for laboratory testing. The following field equipment will be required: EC/TDS/pH/BOD meter; surface flow meter; water sampling gear, and GPS.

Field measurements will be taken monthly, and during periods of flooding.

Table 10.3: Surface water quality sampling requirements

Parameter	Sampling Frequency
Flow rate	Monthly
Water level	Monthly
pH	Monthly
Electrical conductivity	Monthly
Temperature	Monthly
Turbidity	Monthly

Laboratory testing of samples will be performed monthly and will include oil and grease, phosphates, sulphates, chlorides, phenols, COD, BOD_5, TDS, TSS, and metals.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

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10.2.3 Groundwater

Groundwater quantity and quality will be measured both on and off the site. A detailed groundwater level and quality monitoring network will be established over the region to monitor the impacts of production from water wells and from pit dewatering activities (Figure 10.3.1). The monitoring will include points in the shallow alluvial aquifers used by the local populace and in the deeper bedrock aquifers. The exact location of monitoring will depend on the location of the production water wells. Monitoring will commence before mining starts and will continue post mining. Water quality samples will be collected monthly throughout the life of the mine. Automated water level monitoring will be established to collect data on a regular basis to observe long term trends. Monitoring bore construction details are shown in Figure 10.2.1.

The development of a groundwater monitoring plan will involve:

- Collection of climate data as outlined in Table 10.2.1;

- Development of a numerical model to obtain a long-term prediction of the effects due to groundwater withdrawal/dewatering;
- The effect of groundwater withdrawal/dewatering and its implications for other environmental resources, including habitat diversity, surface water, vegetation and soil saturation;
- An inventory of all groundwater users, identifying any potential conflicts and proposed resolutions; and
- Inspection of groundwater wells.

Sampling of groundwater monitoring bores will be undertaken covering the following parameters:

Table 10.2.3: Groundwater quality sampling requirements

Parameter	Sampling Frequency
Water level	Monthly
pH	Monthly
Electrical conductivity	Monthly
Temperature	Monthly

Laboratory testing of samples will be performed monthly and will include alkalinity, nitrates, phosphates, sulphates, chlorides, COD, TDS, TSS, metals, and initially, total coliform bacteria.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.3 SOIL AND WASTE ROCK

10.3.1 Topsoil

Topsoil stripping, stockpiling and re-spreading for rehabilitation will be monitored continuously over the construction, operations and closure phases of the project. In addition changes in topsoil conditions will be monitored to ensure that they do not undergo any adverse changes over the life of the project. It will require establishing representative sampling locations to assess the potential effects of acid deposition, fugitive dust emissions and the mobilization of metals / elements through changes in

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soil chemistry during construction and mine operations. Sampling of topsoil from rehabilitated areas and trial plots will be performed annually.

Monitoring will be conducted with test pits located up and down gradient (and up and down wind) from mine facilities at designated control points. The suite of analyses for the monitoring programme for soil chemistry will include:

- pH;
- anion exchange capacity;
- electrical conductivity;
- metals; and
- toluene-extractable organics.

The suite of analyses for the monitoring programme for soil structure will include:

- clay fraction;
- particle size distribution;
- water retention; and
- permeability.

Sampling frequency and parameters analysed will be reassessed based on results from air quality and surface water monitoring results but are likely to be more frequent during the rainy season, to correspond with rains. Monitoring shall comprise inspecting, recording and reporting of the following: quantities of topsoil removed; storage locations and quantities; the type of topsoil; and storage procedures and methods. This data will be used to develop a topsoil inventory and plan for the site that will be maintained over the life of the project.

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The MWMCL Mining Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.3.2 Waste Rock Dumps

The main performance concern for the WRDs will be maintenance of the water management facilities. During mining operations, runoff collection ditches and ponds will be inspected after every major rain event, and maintenance carried out as necessary.

Physical stability of WRD slopes shall be assessed by regular pickups of survey pins installed at critical locations on dump batter slopes.

Acid rock drainage and metal leaching from waste rock and seepage will be monitored on a monthly basis during operations and continue post mining. A field assessment of waste rock net acid production potential shall be made on a flitch by flitch basis using the hydrogen peroxide oxidation method. In addition, the need for treatment of ARD drainage will be assessed from water quality samples collected during the operations and closure phases. The physical stability of WRDs and the water diversion system will be monitored annually by an independent geotechnical engineer and a report prepared for MWMCL which will be forwarded to the relevant government regulatory body. Weekly visual inspections of these facilities will be conducted by mine personnel and observations logged for inspection by the independent geotechnical engineer, and government regulators upon request. In addition, visual inspections will be done after every major rain and earthquake event.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

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10.3.3 Erosion and Sediment Control

Sampling and testing of the different soils, ore, and waste rock materials around the site will be required. Initially this will be done to establish baseline data and then will be continued as new materials are disturbed with progressive development of the mine.

Monitoring will be conducted with test pits located up and down gradient (and up and down wind) from mine facilities at designated control points. The suite of analyses for the monitoring programme for soil chemistry will include pH; anion exchange capacity; electrical conductivity; metals; and toluene-extractable organics. The suite of analyses for the monitoring programme for soil structure will include: clay fraction (<0.002 mm); particle size distribution; water retention; permeability; and total suspended solids. Surface water turbidity will be measured in the field and samples will also be taken for laboratory testing to determine TSS.

Sampling frequency and parameters analysed will be reassessed based on results from air quality and surface water monitoring results but are likely to be more frequent

during the rainy season, to correspond with rains. Erosion monitoring shall comprise inspecting, recording and reporting of the following: quantities of vegetation removed, storage locations, quantities and type of topsoil and overburden, storage procedures and methods used, areas prone to erosion, evidence of erosion, depth of remaining in situ topsoil, condition of access roads, condition of cleared areas, condition of perimeter drains and associated settlement ponds, compliance with applicable regulatory and corporate requirements.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.3.4 Rehabilitation

Landscape Function Analysis (LFA) is a monitoring procedure developed by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO). It provides a rapid, reliable, and easily applied method for assessing and monitoring landscape restoration or rehabilitation projects.

It uses visible indicators of plants, litter and soil surface condition that gauge how effectively a landscape is infiltrating water, cycling nutrients and keeping the soil stable, healthy and productive.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern

10.4 VEGETATION AND FAUNA

10.4.1 Weed Hygiene and Control

Monitoring of weed hygiene shall be as follows:

- Inspection for evidence of invasive flora shall be performed on a monthly basis; and

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- The type of invasive flora, its extent, herbicide treatment, and location shall be recorded in a database and layout plan or uploaded onto a GIS database.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern

10.4.2 Fire

Monitoring of fire shall be as follows:

- Fires within and around the Project footprint shall be reported immediately as well as the likely cause and the circumstances; and
- House-keeping and vehicle inspections (as part of general site inspections) shall be undertaken and documented. Any areas of concern or non-compliances shall be recorded.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern

10.4.3 Fauna

The Environment Manager will maintain updated records on the following:

- Wildlife mortalities (e.g., from air strikes, vehicle strikes, shooting, other sources);
- Wildlife monitoring - weekly site inspections and wildlife counts. This will include the numbers and location of:
    - Large mammals;
    - Birds (including migratory birds);
    - Reptiles (watercourses and ponds);

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The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.5 INDUSTRIAL WASTE MANAGEMENT

10.5.1 Non-hazardous Waste Management

The MWMCL Construction Manager shall record on a monthly basis the following:

- Construction of waste storage facilities;
- Use of recycling facilities;
- Vermin and litter control; and
- Status of wastes inventory.

The MWMCL Environment Manager shall prepare and update the Waste Inventory as the mine develops.

Inspection records will comprise the following:

- Designated waste storage locations marked on a plan;
- Each waste storage area will be numbered to facilitate inspections;
- Any spills, leaks, poor containment, lack of labelling or other issues will be recorded and reported to the relevant department for corrective action; and
- Corrective actions will be documented on completion.

The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.5.2 Hazardous Materials Management

All hazardous materials will be subject to strict inventory control from the time they enter the site. The MWMCL Supply Department will maintain an inventory of all hazardous substances purchased, delivered, stored and used at the mine site. This inventory will be updated on a monthly basis. Logs will be kept as required for

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inspection by the regulatory agencies. The MWMCL Construction Manager will conduct routine inspections of all hazardous substances storage areas, and worksite areas to look for spills, leaks, overflows and compliance with the procedures. Where necessary, corrective actions will be recommended. The MWMCL Environmental Manager will monitor all activities to do with explosives use and storage. The MWMCL Supply Department will collect and maintain records on hazardous substances in consultation with the construction manager, for the following:

- Reconciled bulk inventory;
- Weekly use summaries;
- Weekly reconciliation for each storage area;
- Overfill alarm tests;
- Pressure tests (if applicable);
- Inspections and maintenance checks of storage tank system, piping and delivery system;
- Any alteration to the system;
- Reports of leaks or losses;
- Reports of spill responses; and
- Records of training.

10.5.3 Sewage and Wastewater

Down gradient monitoring wells will be installed 50 m from the outer perimeter of the leach field at three sites on each of the distal sides of the field from the septic tanks Shallow groundwater quality will be monitored when present on a monthly basis for parameters including:

- Faecal bacteria;
- Phosphates;
- Nitrates;
- BOD;
- Metals;
- Oil and grease (largely removed by grease traps where required); and
- Total suspended solids.

Should an increasing trend in any of the parameters become apparent, monitoring will be increased to weekly until the source of the increase is determined and management actions result in a decrease in the subject pollutant.

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The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.6 CONCEPTUAL CLOSURE

Closure and post-closure monitoring will document the progress of the closure and reclamation effort. The elements of these monitoring programs will include:

- Inspection of the physical conditions (e.g., for evidence of erosion and landslides) at the end of the initial rainy season post-closure;
- Inspection of the plantings after the first year post-closure;
- After two years, evaluation of the effectiveness of the reclamation effort (e.g., number and type of plant species, plant heights, productivity);
- Demonstration that water quality objectives are met; and
- Assessment of the adequacy and performance of drainage structures and sediment control systems.

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10.7 NOISE AND VIBRATION

Monitoring of changes in noise and vibration levels within the operational areas will be done to ensure that levels do not increase significantly over the life of the Project and do not breach thresholds limits.

Six noise monitoring stations are located on the Letpadaung site at the following locations: on the western boundary near the village of Moe Gyp Pyn South; at the southeast corner of the site adjacent to the SX/EW plant; north of the site near the village of Aungchans; on the northern boundary near the village of Kyaw; on the eastern boundary near the village of Shwehlay; and at the northeast corner near the construction camp site (Figure 4.10.3). These locations take into account the location of sensitive noise receptors such as villages and the accommodation area.

Any complaints from the community should be documented and managed through to resolution. In the event that public complaints arise, steps should be taken to investigate the root cause without delay and remedial action should be taken to correct the deficiency. Actions should ensure that similar incidents do not recur and should be reported as part of the performance reporting process.

The monitoring programme will:

- Provide clearly regulatory requirements and corporate standards for environmental performance pertaining to noise and vibration control;
- Form the link between operations, safety and environmental programs;
- Provide monitoring results that will be regularly reviewed to ensure the noise and vibration management systems are operating as designed;
- Identify the reporting requirements to document and communicate the monitoring results; and
- Ensure that all environment, health and safety (EH&S) risks are addressed.

The ambient noise monitoring program during both, the construction and operation stages should include one full day (day and night) measurements semi-annually (during wet and dry seasons) to determine noise parameters such as the equivalent continuous noise level (Leq) in decibels (dBA), the A-weighted sound pressure level that is exceeded for 10%, 50% and 90% of the time over which a given sound is measured (L10, L50 and L90) and frequency noise analysis.

A five day vibration and air blast monitoring programme should be undertaken to ensure the desired vibration (ppv not greater than 5 mm/s and 115dB(A) at Sensitive Sites) can be achieved and, if not, blast techniques amended to achieve that result.

The following items are to be included in a noise and vibration monitoring report:

- The type of monitoring test conducted (that is, the construction stage or operation);
- The noise and vibration limits (daytime & night time) for the facility;
- Description of the nearest affected receivers;
- The monitoring locations;
- The noise and vibration instrumentation used;
- The weather conditions during noise survey;
- The time and duration of monitoring, including dates;
- The results of noise and vibration monitoring at each monitoring location; and
- A statement outlining the Project's compliance or non-compliance with the limit; and
- Where noise and vibration exceedances are found; the reason for non-compliance should be stated; and the strategies to be used to manage the noise and vibration exceedance.

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The MWMCL Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.8 CULTURAL HERITAGE

Cultural heritage monitoring procedures shall be as follows:

The Mining Manager shall report on a monthly basis to the Community Relations Manager on the implementation of the Management Plan during the operations phase, including:

- ”Watching briefs” participated in at specific areas/construction sites;
- The erection and maintenance of demarcation fencing around sites;
- The protection of sites by careful siting of access routes or facilities;
- Induction training including cultural heritage awareness given to staff and planned training;
- Cultural heritage-related complaints and actions taken; and
- Cases of damage to, or disruption of, cultural heritage properties and actions taken.

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The Community Relations Manager will conduct routine inspections of site activities in consultation with the Project Manager to assess the potential for chance finds at work sites and any other cultural heritage issues that may arise.

The Community Relations Manager will conduct an inspection of any cultural heritage field activities and documentation that are implemented as a result of a chance find or other event that results in archaeological field work. The inspection shall include:

- Details of all work specifications prepared and implemented;
- Monitoring/”watching briefs” conducted at specific construction and other sites;
- Consultation with local communities related to cultural resources;
- Communication and cooperation with the Construction Department and the National Museum;
- Review of how the Cultural Heritage Database is being maintained;
- Information dissemination regarding cultural heritage;

- Performance of the Construction Department in managing cultural resources at specific construction sites;
- Cultural heritage-related complaints and actions taken; and
- Cases of damage to, or disruption of, cultural heritage properties and actions taken.

The MWMCL Community Relations Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.9 COMMUNITY HEALTH SAFETY AND SECURITY

It is important to monitor activities at the mine site, as well as those that occur off-site, including transportation of supplies and concentrate to and from Letpadaung, to ensure that local and regional communities are protected. Community Health and Safety Monitoring Procedures shall be as follows:

Designated personnel shall report on a monthly basis to the MWMCL Community Relations Manager on the implementation of the Management Plan including:

- Workforce conduct within the community;
- Any instances of workforce non-compliance with Project rules and regulations;
- Condition of access roads and dust suppression activities;
- Security arrangement;
- Employee Personal Health Programme;
- Implementation of the substance and alcohol abuse policy; and
- Time lost to illness or disease by workers.

MWMCL Community Relations Manager shall inspect the condition of areas of activity at the site on a monthly basis and shall maintain appropriate records. The inspection shall include:

- Safety practices in areas that could impact communities;
- Spot checks of vehicles entering/exiting nearby local communities;
- Spot checks to indicate that workers and communities are aware of health issues, the Code of Conduct and other Project rules;
- Conditions of roads and other areas prone to dust;

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- Health and safety inductions;
- Record for the Personal Health Programme;
- Records for the Drug and Alcohol Testing Programme;
- Lost time incident statistics; and
- Records related to education event to raise health and safety awareness in communities.

The MWMCL Community Relations Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

10.10 TRANSPORT

The designated manager shall report on a monthly basis to the Environment Manager on the implementation of the Management Plan during both the construction and operations phase, including:

- Quality of access roads; and
- Number and size of trucks used

The Environment Manager shall inspect the condition of areas on monthly basis and shall maintain appropriate records. The inspection shall include:

- Road conditions along the preferred truck routes;
- Driver / barge operator orientation;
- Driver / barge operator updates;
- Maintenance and mechanical inspection of trucks / barges; and
- Compliance with applicable regulatory and corporate requirements.

In addition, all trucks / barges shall be inspected for essential systems prior to each trip. The Environment Manager shall be responsible for record-keeping.

The MWMCL Community Relations Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period;

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- Any other issues of concern.

10.11 STAKEHOLDER ENGAGEMENT

The Community Development Officer (CSD) shall report on a monthly basis to the Community Relations Manager, including on:

- Engagement activities;
- Level of participation by different stakeholder groups (e.g. women);
- Comments from, and feedback provided to, stakeholders;
- Commitments made to local communities by the Project;
- Disclosure materials disseminated: types, frequency, and location;
- Community attitudes and perceptions;
- Community complaints and their resolution;
- Community relations staff, their duties/activities and staff changes;
- Committees, groups and partnership activities related to engagement; and
- Project website.

The stakeholder engagement process will be used to measure the effectiveness of Letpadaung activities within the community and to track changes in the relationship between the Project and its host communities over the life of the project. MWMCL will conduct regular consultation with local communities and governments and will make known any complaints regarding the project. Monitoring will be conducted to ensure that MWMCL is achieving the actions defined in the stakeholder engagement program as well as to monitor community perceptions and attitudes. MWMCL will use the stakeholder database and tracking system that contains records for all engagement activities for the project to establish a monitoring program.

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10.12 COMMUNITY AND SOCIAL DEVELOPMENT

The CSD shall monitor the implementation of the community Development program and report to the Community Relations Manager on at least a quarterly basis, including:

- Reporting of village consultation prior to projects approval;
- Reporting of any incidents or accidents;
- New or improved infrastructure developments funded;
- Reporting completion of projects and acceptance by communities;
- Reporting of feedback from communities; and
- Training, skills development and capacity building provided including the number of sessions held and number of people trained;
- The number of awareness raising materials distributed to target stakeholders;
- Public attitudes to community development initiatives; and

- Performance of the community group and implementing partners.

The Community Relations Manager shall inspect community assistance projects and documentation on a quarterly basis and shall maintain appropriate records. The inspection shall include:

- Records of community assistance activities/meetings/events;
- Records of funds disbursed;
- Feedback from local communities related to projects implemented;
- Records of training given to communities;
- Condition and operation of specific projects (e.g. for infrastructure projects);
- Status of projects already implemented;
- Review of projects being planned;
- Spot checks on the activities of the Community Action Group; and
- Review of progress and performance of implementing partners or operators.

The MWMCL Community Relations Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period; and
- Any other issues of concern.

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10.13 HUMAN RESOURCES, TRAINING AND EMPLOYMENT

It is important to monitor employment and training to ensure that employment targets are met and the efforts to enhance local and national skills and employment opportunities are maximised. Human resources, employment and training monitoring procedures shall be as follows.

The Human Resources Manager shall maintain records on the following:

- Recruitment conducted;
- Recruitment and employment targets;
- How the Employment Database is being maintained;
- Training conducted/given to staff and planned;
- Interviews and random selection processes;
- Job descriptions and selection criteria;
- Information dissemination regarding employment, including vacancy announcements;

- Operation of recruitment offices;
- Equities and inequities in recruitment process (e.g. gender, ethnicity, age);
- Employee grievances and actions taken;
- Cases of corruption and disciplinary actions taken; and
- Working conditions and related issue.

The Human Resources Manager shall inspect recruitment offices and MWMCL / Contractor documentation on a monthly basis and shall maintain appropriate records. The inspection shall include:

- Records of recruitment processes;
- Records of employees hired;
- Records of hours worked;
- Records of wages paid;
- Records of National Service Demobilisation Certificates;
- Records of grievances and of disciplinary actions taken;
- Condition of workers on site and worker camp areas;
- Records of training given to staff;
- Condition and operation of recruitment offices;
- Other spot checks of relevant practices and documentation; and
- Compliance with applicable regulatory and corporate requirements.

10.14 EMERGENCY RESPONSE

A key part of preparedness for emergencies is to ensure that all preparations and emergency equipment are in place and functioning as intended. There are two aspects to this:

- routine site inspections; and
- training updates.

The Mining Manager shall report on a monthly basis to the Environment Manager on the implementation of the Management Plan including:

- Training undertaken (numbers of staff, courses etc);
- PPE quantities and locations;

The Environment Manager shall inspect the Project on a monthly basis and shall maintain appropriate records. The inspection shall include:

- Training;
- PPE;
- Site conditions;

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- Observations of management practices;
- Rehearsals and exercises; and
- Compliance with applicable regulatory and corporate requirements.

The Environment Manager shall prepare and update the Emergency Response Plan on a periodic basis.

The Environment Manager will be responsible for record-keeping. Regular reporting will be undertaken via a monthly report that will be prepared and submitted to the MWMCL management team. Reporting will include:

- A summary of activities undertaken during the reporting period;
- Any material deviations or non-compliances to the Management Plan;
- Planned activities during the next reporting period;
- Any other issues of concern.

10.15 ANNUAL REPORTING

A key element in maintaining an overall understanding of the sustainability of the Project is the development of an annual report which describes all facets of the Project activities and provides the metrics to support the description provided.

MWMCL will prepare an annual report which addresses the sustainability reporting requirements of the Global Reporting Initiative (GRI). The report will address all the elements of the Initiative guidelines and the metric to demonstrate its performance consistent with the GRI intent.

MWMCL will make the report available for public review and comment and also communicate the findings through its community consultation with project-affected villages.

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11. LIST OF COMMITMENTS

A consolidated summary list of environmental and social commitments that MWMCL will be expected to adopt in order to manage and mitigate potential impacts associated with the project development is provided below in Table 11.1.

Table 11.1: Project key commitments

Commitment Source	Commitment
ESIA Executive Summary	MWMCL will develop a ISO14001 compliant and certified EMS within 2 years of commencing operations.
ESIA Section 5.17	Upgrade existing barge jetty and load-out facilities at Pakokku and Letpadaung
ESIA Section 5.18.6 and 5.21	MWMCL will undertake progressive rehabilitation of Waste Rock Dumps (WRD) and other disturbed areas as they become available to a standard that achieves a safe, stable landform which supports self-sustaining native vegetation, is free draining and non-pol
ESIA Section 8.1	Continuous monitoring of air quality at two permanent monitoring stations as well as temporary mobile monitoring when complaints are made. MWMCL shall ensure that air quality complies with the standards set out in the Air Quality EMP.
ESIA Section 8.1.1	Dust Emissions from the site will meet IFC ambient air quality standards at receptor locations.
ESIA Section 8.1.2	Acid mist emissions will meet the following standards; a)Workplace - 1 mg H2SO4/m3 air (8 hr shift); b)Public - 0.1mg/m3 per incident.
ESIA Section 8.1.3	MWMCL will complete an energy assessment in order to determine the opportunities for energy savings.
ESIA Section 8.2.3	MWMCL will monitor groundwater level, quality, and extraction during the life of the Project.
ESIA Section 5.18.6	No contaminated water will be discharged from the site for events up to 1 in 100 year recurrence intervals
ESIA Section 8.2.2	An alternative water supply will be provided to users where their existing supply has been impacted by the Project.
ESIA Section 8.2.4	MWMCL will not allow contaminants to permeate into the groundwater through the use of adequate foundation lining in the HLPs, ore stockpiles, waste rock dumps and temporary storage facilities.
	Storage of hazardous materials shall be on an impermeable base and bunded to contain spillage.
ESIA Section 8.3.2	Topsoil and subsoil shall be stripped to an adequate depth and correctly stored for use in rehabilitation. Topsoil and subsoil stockpiles shall consist of a layer of topsoil on top of a layer of subsoil. The maximum thickness of each layer shall be 3m.
ESIA Section 8.3.4	MWMCL shall complete a materials balance study to determine the quantity of PAF and NAF material on the site.
	MWMCL shall classify all waste rock as either benign, metal leaching or acid forming prior to its excavation. Waste rock will be progressively placed within cells that are lined and capped with low permeability fill within the WRDs. On completion the WRD
ESIA Section 8.3.6	On closure the pit will be flooded and water levels managed such that the waste rock and rock within the pit walls that has the potential to produce acid or leach metals remains submerged in perpetuity. Water levels will also be maintained at a level low
ESIA Section 9.3	MWMCL will obtain approval from the relevant local authorities for the transportation, storage and use of explosives;
SWM Report	MWMCL shall operate the Storm Water Pond (SWP) and the Waste Water Pond (WWP) as specified in the Surface Water Management report. That is stormwater from the Heap Leach Pads (HLP) shall be stored in the stormwater pond. The ponds will be built such as th
SWM Report	No contaminated water will be discharged from the site for events up to 1 in 100 year recurrence intervals. Sediment laden water released from the site must comply with IFC standards, with TSS levels within 10% of the receiving water body background value
ESIA Section 9.1	Noise emissions shall conform to IFC (2007) standards for noise sensitive premises.
	Blasting overpressure shall not exceed a sound power level of 115 dB(A) for 95% of all blasts and no blast shall exceed 120 dB(A).
	Vibration levels from blasting at sensitive receptors shall not exceed a standard of 5mm/s for 95% of all blasts with no blast to exceed 10mm/s.

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Table 11.2 Cont'd: Project key commitments

ESIA Section 10.15	MWMCL will prepare an annual report which addresses the sustainability reporting requirements of the Global Reporting Initiative (GRI). The report will address all the elements of the Initiative guidelines and the metric to demonstrate its performance co
	MWMCL will make the annual report available for public review and comment and also communicate the findings through its community consultation with project-affected villages.
ESIA Section 9.9.1	**Development of a Corporate Responsibility Management Plan to guide the planning and implementation of the Company's philanthropic activities in the local community. Specific actions to be included in this plan are:** MWMCL will set up a steering committee to allocate the 2% respective contributions of net profit from MEHL, Wanbao and ME1 for community social development in the form of community sub-projects/grants. The Steering Committee will consist of key represent From the overall parameters set by the Steering Committee, MWMCL will develop an operational project cycle for the subprojects. This will involve the following 4 phases: (i.) preparation and planning, (ii.) decision-making and approval, (iii.) implementa MWMCL will set up a new department responsible for implementing the program, "Corporate Social Responsibility (CSR)". This department will hire a local project manager with experience managing projects in Myanmar communities and the appropriate staff dedi
	MWMCL will change the remit of the CSD Department. The new remit of the CSD Department will be to manage the consultations of communities directly affected by the Project activities, so as to safeguard communities and their assets from harm and obtain l Recruit a CSD Team Project Manager with professional experience implementing community programs in Myanmar and who is a Myanmar national. Replace the contracted CSD Team members with a small team of professional dedicated staff of Myanmar nationals with experience implementing community programs in Myanmar. The former CSD Team members can act as liaisons with the villages and assist in CSD Develop roles and responsibilities for the CSD Team in relation to its mandate with respect to the communities and the Company. The CSD Team should not have to deliver messages from Company management/personnel as it would significantly damage the rapport Establish criteria for selecting the villages at the highest risk of being adversely impacted by the Project activities. Apply the criteria for identifying the primary village stakeholders who will be consulted on all Project-related activities and for e Develop a Consultation Plan for the construction phase with stakeholder group(s), timing and consultation method(s) specified for each Project activity/impact. Develop an internal plan for coordinating the consultations sufficiently early to obtain inform Adopt engagement protocols that set out the behavioural expectations for the CSD Team and visitors to adhere. These protocols should follow good practice in accordance with village norms and culture. Develop monitoring indicators that look at impact, such as measures of community satisfaction with the consultative process, rather than inputs used.
ESIA Section 9.9.2	**Stakeholder Engagement**
	MWMCL will hire a local External Affairs Coordinator responsible for implementing the Project's Stakeholder Engagement Program and dedicated staff to carry out all but the village consultations. All staff shall be Myanmar nationals with at least a univers
	MWMCL will train staff working on CSR, CSD and public relations/social media in MWMCL's communication protocols for dealing with questions from the media and NGOs.
	MWMCL will set out the principles for stakeholder engagement it will adopt in accordance with good practice.
ESIA Section 9	MWMCL will develop an organizational structure for the newly established CSR Department, the CSD Department, Stakeholder Engagement Program, External Affairs, Public Relations for the CESMS.

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Table 11.3 Cont'd: Project key commitments

ESIA Section 9	MWMCL will develop an organizational structure for the newly established CSR Department, the CSD Department, Stakeholder Engagement Program, External Affairs, Public Relations for the CESMS.
ESIA Sections 4.10.5 and 9.5	**Cultural Heritage**
	Determine the boundaries of the Project footprint.
	Survey and relocate archaeological/cultural sites prior to intrusive construction works.
	Relocation of cemeteries and gravesites will be in accordance with legislative requirements and in consultation with descendants and Tribal authorities.
	A Phase II survey will be conducted for the excavation and documentation of all archaeological sites to be disturbed as a result of construction or operations
	Construction personnel will be trained to ensure proper management of construction activities around cultural heritage sites and to follow established procedures for handling chance finds.
ESIA Section 9.9.3	**Human Resources, Training, and Employment**
	Preference for jobs will go to eligible Project-affected households/persons in accordance with the amount of land taken from the household in the 26 affected villages. MWMCL will allocate a minimum of one job to each household that was relocated to the n
	MWMCL will provide a suitable form of livelihood assistance for those affected households fully reliant on farming in the Project area who are not capable of working for the Company or don't meet the eligibility criteria.
	MWMCL will recruit all certified full-time graduates in the affected villages as on-the-job trainees. These graduates will become employed by Wanbao after trained for five months and proven to be qualified.
	Experienced Myanmar nationals with transferable skills will be identified and retrained to the standards required for an international mining project.
	All employees and relevant contractors will be trained for the requirements of the position they are holding, including specialised training indicated in an EMP/SMP.
	Working conditions will meet international standards, to which the Republic of the Union of Myanmar is a signatory, and national standards.
	MWMCL will adopt recruitment procedures that are fair, transparent, public and open to all. These procedures will be advertised in advance, especially in the affected communities and local area overall.
ESIA Section 4.10.6	MWMCL will develop a Community Natural Resources Management Plan to compensate for restricted access to medicinal plants and other botanic resources in the Project area.
ESIA Section 9.9.6	MWMCL will comply with the requirements of IFC Performance Standard 4 with respect to community health, safety and security.
ESIA Section 4.10.4	MWMCL will develop a Resettlement Action Plan aligned with IFC Performance Standards 5, 6, and 7.
	MWMCL will develop a Grievance Mechanism that quickly and fairly addresses complaints related to resettlement, compensation and livelihood restoration.
	MWMCL will provide compensation to entitled households commensurate with the market value of land. It shall not pay compensation amounts in gross excess of current land prices.
ESIA Section 4.10.23	MWMCL will restore or improve livelihoods of relocated households through employment, training, and other assistance. It will provide transitional assistance (cash or in-kind) to relocated households in the interim period between relocation and three mon
ESIA Section 9.9.3	For those relocated households whose members are physically incapable of working for the Company or do not meet the Company's employment criteria or are fully reliant on farming, the Company will provide tangible assistance, including monetary support, up
ESIA Section 7.12.6	MWMCL will support local structures to retain/reinforce traditional values and cultural systems should they be eroding and causing intergenerational and/or family tension as a result of information diffusion and opportunities directly or indirectly result

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Table 11.4 Cont'd: Project key commitments

ESIA Section 7.12.6	MWMCL will control migration influx by restricting employment to local persons and supporting local structures to manage in-migration.
ESIA Section 4.10.20	MWMCL will design the accommodation village in an appropriate town planning layout and incorporating local architectural styles.
	Sanitation, water, electricity, fuel supply infrastructure in villages will be maintained and upgraded.
	Housing conditions will be improved in the villages
ESIA Section 9.9.3	MWMCL will promote local employment by gradually replacing ex-pat personnel with locals and adopt training programs to facilitate this process
ESIA Table 7.2.1(a): Construction Phase Risk Matrix	MWMCL will progressively upgrade roads and road intersections
ESIA Section 4.10.26	MWMCL will work with government to identify alternative industries capable of absorbing mine site employees who will lose their jobs upon mine closure
ESIA Section 4.10.13	MWMCL will continue to support the provision of progressively higher quality medical care through its usual efforts and additional ones to upgrade clinics to hospital standard facilities, recruit more doctors and reduce the travel distance for basic medic
ESIA Table 7.2.1(a): Construction Phase Risk Matrix	MWMCL shall landscape and revegetate landforms back to their original character.
	MWMCL shall increase agricultural productivity of farm land around the site perimeter.
	All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into soil or groundwater.
	MWMCL will develop and implement a soil management plan.
	Waste disposal will take place off-site until general and hazardous waste sites are developed.
	MWMCL will not allow effluents to be released. Effluents are to be contained and treated.
	MWMCL will construct drainage areas, sediment control dams and use source control BMPs to mitigate against erosion.
	MWMCL will conduct additional flood modelling of the Chindwin River.
	MWMCL will resettle any dwellings significantly at risk of flooding.
	MWMCL will prepare a Resettlement Action Framework for areas potentially requiring relocation of households.
	MWMCL will take measures to reduce concentrations of dust in accordance with a Dust Management Plan which MWMCL will develop.
	MWMCL will use low sulphur fuel and monitor fuel usage and engine performance to limit greenhouse gas emissions.
	MWMCL will reduce noise disturbances by installing noise buffers in critical areas and around the perimeter, relocating noise receptors, notifying the public on blast times, limiting construction activities to daytime hours except when night time work is
	MWMCL will demarcate and protect the balance of primary woodland within the proposed mining area and prepare a Reforestation Plan.
	MWMCL will implement reforestation projects with district authorities.
	MWMCL will plant buffer areas in and around the site boundary and reserve remnant vegetation in surrounding areas. Any buffer area destroyed by fire will be rehabilitated.
	MWMCL will relocate all rare or endemic species found.
	MWMCL will implement measures to curtail the loss of wood and other natural resources.
	MWMCL will clean vehicles and inspect containers prior to entering the site to limit the spread of invasive weeds and pest species.
	MWMCL will rehabilitate construction areas after implementation.
	MWMCL will take measures to minimise light disturbances.
	MWMCL will take measures to minimise the safety risks associated with increased traffic, such as upgrading of the access route to the site, warning signage along the access road, and fencing around schools. It will also promote road safety through awarene
	MWMCL will support local policing structures and programs to limit prostitution near the site.
	MWMCL will develop and implement a Sexually Transmitted Infections Education Policy for employees and contractors, with specific controls enforced in accommodation camps.
	MWMCL will develop in conjunction with government an integrated community STI awareness campaign.
	MWMCL will support local health centres prevent the spread of communicable diseases.
	MWMCL will develop and strictly enforce an Occupational Health Management System.
	MWMCL will monitor near misses, workplace injuries and deaths associated with Project activities, including road transport and seek to lower the incidence of harmful outcomes through training, restricted working hours for requiring deep concentration, and
	MWMCL will give preference to local service providers and suppliers of goods.
	MWMCL will support microfinance initiatives and other means to promote local procurement opportunities, improve access to markets, and develop the non-mining sector.
	MWMCL will maintain the infrastructure built at the resettled villages.
	MWMCL will train and recruit medical staff to the project area through the provision of scholarships and provide medical supplies and equipment.

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Table 11.5 Cont'd: Project key commitments

ESIA Table 7.2.1(b): Operational Phase Risk Matrix	MWMCL will construct the SX/EW Plant on a structurally sound, impermeable concrete base which will be regularly maintained to prevent leaks and cleaned after spills.
	Any contaminated residue removed from the solution, stormwater and wastewater ponds will be disposed of so as to minimise risk of soil contamination.
	MWMCL will develop and implement procedures to clean up uncontrolled release of HLP materials.
	Facilities engineered to good international practice for the protection of groundwater are to be constructed on site for the disposal of general waste, hazardous waste.
	Bio-remediation facility to be implemented for hydrocarbon contaminated soils.
	Water supply reserve to downstream creek users will be determined and supplemented with alternative water supplies if necessary.
	Pollution control dams will be put in place and engineered as per project proposal.
	Surface Water Management Plan to be implemented.
	MWMCL will use HLP dripper irrigation and monitor wind direction during operation of the irrigation system to minimise sulphur acid concentrations in the ambient air.
	MWMCL will enforce measures to prevent the spread of malaria and bilharzia resulting from mosquitos and other pests.
	MWMCL will establish multiple controls to reduce the safety risk due to fly rock, WRD rock falls and land slips, explosion of hazardous materials, and bush fire.
	MWMCL will support the improvement of farming practices to increase agricultural productivity to offset higher costs of living associated with a mining development.
ESIA Table 7.2.1(c): Closure Phase Risk Matrix	Care will be taken during decommissioning to prevent the release of contaminants and manage contaminated water and sediment.
	Monitoring boreholes are to be established in communities to monitor change in water levels at water supply points. MWMCL will monitor water levels on a quarterly basis and identify potential alternative water sources if local wells are significantly impa
	MWMCL will develop and implement a Care and Maintenance Plan for the management of seepage from HLP or waste rock material into the groundwater. It will also minimise the catchment area of the pit and maintain a pit lake elevation at a suitable depth to m
	MWMCL will decommission ponds and release of storm water to environment where quality is within suitable limits.
	MWMCL will develop and implement a Care and Maintenance Plan for the management of dirty water run-off from the plant area, pit, waste rock and HLP area and will install a passive water treatment wetland system. MWMCL will identify the ponds to be used o
	MWMCL will develop and implement a Care and Maintenance Plan to manage potential contamination resulting from slope failure of HLPs.
	MWMCL will erect a fence around the project site to restrict access to revegetated areas.

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12. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the development of the Letpadaung Copper Project will not have a significant impact on the environment provided the management measures described in this document are implemented.

The following are considered to be key impacts associated with the Project.

12.1 ACID ROCK DRAINAGE

The acid and metals generation arising from waste rock is an extreme environmental risk to surface and groundwater in the Project area and the water potentially discharged from the Project area. Although the largest volume of this material is stored in WRDs, waste rock will also be placed in the pit. The ore in the HLPs is also acid generating and metal leaching creating a significant management issue post closure.

Unless appropriate management measures, as outlined in the EMPs in Section 8, are implemented ARD could become a fatal flaw in the environmental acceptability of the Project.

Failure to heed these requirements, from commencement of construction through operation and closure of these facilities, will leave a residual risk and legacy beyond closure of the operation.

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12.2 RESETTLEMENT

Four villages within the Project lease area have been relocated to two sites prior to the commencement of construction. The Government and MEHL organised the resettlement following a consultative process with the relevant stakeholders and the participation of affected households in site selection. Broad community support for resettlement collapsed however in 2012 following NGO agitation demanding better compensation terms for the affected households. This resulted in the relocation of cooperative households only numbering 220 houses. The old villages of Sede, Zidaw, Wetme and Kandaw still exist and its residents continue to refuse to move. Other households owning land in the Project lease area refuse to relinquish it and accept compensation. Currently within the Project lease area early works activities are being carried out alongside working farms with farmers and livestock present.

The stand-off between the protesting villagers and MWMCL requires an immediate solution. A number of issues require clarification and possibly remediation. A process of identifying areas of contention and finding workable and practicable solutions is urgently required. Such a process should be undertaken within a larger process to complete the Resettlement Action Plan (RAP). The RAP should be retrospective in

nature, making corrective actions if necessary and follow good practice approaches consistent with the requirements specified in IFC Performance Standard 5.

An important feature of the RAP is the development of mitigation measures to restore/improve the livelihoods of households physically and/or economically displaced as a result of the Project. Some of these mitigation measures are incorporated in the Letpadaung Copper Mine Project, including provision of jobs at the mine, training for the acquisition and/or retention of skills, and microfinance initiatives to build local capacity especially in the non-farm sectors. Other measures remain to be developed, such as the identification of long-term income earning opportunities to those affected households who are incapable of working at the mine or do not meet the employment criteria. The proposed Community Natural Resource Management Plan is also an important mitigation measure to restore/improve living standards among those households who depend on the land in the Project area but no longer have access to it.

The ESIA also highlighted the necessity to develop a Resettlement Action Framework (RAF) as a planning device to be used in the event that households situated in the flood plain adjacent to the Chindwin River need to be relocated as a result of possible flooding. IFC Performance Standard 5 requires a RAF for sub-projects / project components whose activities may displace populations economically or physically in the future.

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12.3 SOCIAL LICENSE TO OPERATE

The discord in the communities surrounding the Project area underlies the need for MWMCL to regain the trust of the villagers and the Company's "social license to operate." The first step in this process is for MWMCL to re-establish control of the consultation agenda. It can only do this through the willing and active participation of the villages. MWMCL needs the villagers to listen to the messages it wishes to convey, most importantly to safeguard them against potential harm posed by high risk Project activities, as well as to obtain their views on Project activities so that their concerns can be effectively addressed either through a discussion of the issues or by subsequently implementing tangible measures. Currently MWMCL is shut out from initiating dialogue with the dissenting villages.

To re-establish its leadership role in the consultative process, MWMCL must start with a "clean slate". For this to happen, it needs to resolve all outstanding issues expediently and fairly using processes and institutions trusted by the communities. It also needs to rebrand the CSD Programme following the recommendations in the SMPs on Public Consultation and Stakeholder Engagement. Critical in the rebranding

is the separation of consultation to ameliorate adverse impacts resulting from Project activities from consultation activities required (and the process overall) for delivering community and social infrastructure in the local area. New departments reflecting these two separate processes need to be developed and staffed with knowledgeable professionals who are accepted by those villages who will take part in the consultation programs.

Rebranding alone is insufficient to rebuild rapport with the communities; it must be followed by repeated demonstrations of MWMCL's commitment to improve the quality of life in the stakeholder communities and the local area in general. Establishing genuine and effective processes to enable community members to participate in the Project and take advantage of the proposed trainings and other opportunities to better position themselves and their children in the market place is fundamental to building and maintaining trust and rapport.

12.4 CORPORATE SOCIAL RESPONSIBILITY

A number of policy choices need to be made by Wanbao in conjunction with Regional and Local Government.

First, living standards in Myanmar are among the lowest in the world; indeed, 96% of the households interviewed for the socio-baseline subsist on less than $1.25 per day – that is, they are "extremely poor" in absolute terms. It would be entirely warranted for MWMCL to seek to improve the standard of living of all of the villages designated for investment.

Second, the socio-economic baseline identified communities who are poor in relative terms. They are the poorest of the poor. Some of the communities have a concentration of households who are relatively worse off with respect to (reported) income, while other members live in cramped housing conditions or in housing made of leaves and bamboo which provide inadequate shelter against the elements. Some communities have large concentrations of children who do not attend school regularly, if at all, because there are no primary or secondary schools in the local vicinity for schooling to be practical.

MWMCL may want to target investments to reduce poverty, increase school attendance, and improve health access and health status in those communities who have the most to gain from the intervention. This is a means-tested approach that directs investment and assistance to the most vulnerable members of society. Before adopting this approach, MWMCL would need to confirm the findings of the socio-

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economic baseline analysis in consultation with the appropriate regional and local agencies.

Third, regardless of the strategy employed to direct the financing of community social development subprojects and grants, it is imperative that the funds are used as intended and that the decision-making processes for allocating the investments are publically disclosed and conducted in a fair, transparent, and auditable manner.

Fourth, good practice dictates that community investments be sustainable over time. Communities are more likely to maintain donated infrastructure when it is desired by the community, when communities are involved in the planning decisions of the infrastructure, and when community members are trained in the infrastructure's operation and/or maintenance and its monitoring. It is highly recommended that MWMCL's CSR Program incorporates mechanisms to facilitate active and informed participation of the recipient communities.

Fifth, high return investments in community infrastructure are difficult to achieve under the most favourable conditions. Experience has shown that the carte blanche injection of money into a community brings little social return and more often than not, the money is squandered to fulfil short-term needs and desires and/or diverted for unknown purposes. For investments to be sustainable:

- They must be grounded in evidence-based research; and
- Build the capacity of community members and local government to gain competency in running the activity/maintaining the infrastructure.

It is recommended that MWMCL utilise experienced national personnel and technical assistance to design and implement its CSR Plan in a professional and auditable manner.

Lastly, the success of the proposed Mine Closure Plan will ultimately depend on MWMCL's provision of capacity-building opportunities in the operational phase of the mine and the uptake of these opportunities by local residents. At mine decommissioning, the level of development in the local area should have progressively improved to a point where local government, local businesses and individual members of society are able to position themselves in the market place so that the economic, community and social developments brought about by the Letpadaung Copper Mine Project continue to function and contribute to the improved living standards of the local population.

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12.5 PROTECTION OF WATER RESOURCES

Communities surrounding the Project rely on streams and community wells as the primary water sources in the area. It is thus essential that these resources be protected. Management measures to prevent the contamination of these resources are essential. Aside from waste rock, there are other potentially significant sources of pollution from the Project, such as hydrocarbons and chemical reagents used in processing. Therefore, run-off from areas where these materials are used, stored or disposed of should be contained and prevented from entering into the environment. This is also important to contain the sediment loads, detrimental to aquatic life, within the Project site. The monitoring of the impact of dewatering on the resources within community wells is also required and actions will need to be implemented to ensure that no member of the community is left without water.

12.6 NOISE AND VIBRATION

Construction and operation of the Project will result in the generation of noise and vibration. There are a number of villages close to the boundary of the Project area that are likely to be impacted by noise and vibration to a level of nuisance even with management. However, these should be events of short duration such as blasting.

The operation of vehicles and machinery, particularly at night, has the potential to be disruptive if not well managed. Management measures described in the document should prevent undue interference with people's amenity.

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12.7 AIR QUALITY

Construction and operation of the Project has the potential to impact air quality. Clearing of the site and provision of exposed surfaces will result in dust if not properly managed. The acid irrigation of the HLPs can lead to acid mist which has the potential, depending upon weather conditions, to cross the boundary of the Project area and impact the community.

A range of management measures have been developed to prevent or minimise air quality impacts and if these are properly implemented impacts are unlikely.

12.8 INFLUX OF PERSONS

It is anticipated that the development of the Project will result in the immigration of persons to the area and this will need to be managed. Key to the reduction in immigration of people is the implementation of a stringent recruitment policy, particularly during the construction phase of the project, and close liaison with Village Administrators to ensure there is control on settlement of in-migrants into the

community. No persons are to be recruited on site and preference is to be given to existing members of community. A skills audit is to be undertaken and a register compiled of persons who have skills that could be used by the Project. This should be compiled as a matter of urgency and the recruitment policy communicated with the general public.

The surrounding communities are to be sensitised to the risks associated with the influx of persons. MWMCL is to implement a Community Awareness Plan that addresses such issues. In addition the influx of persons will place a strain on available resources and thus needs to be minimised.

MWMCL is to give support to local community leaders in the management of the influx of persons into the area. It is important that the integrity of the traditional structures is maintained. MWMCL is to take positive action to mitigate the negative social impacts including AIDS awareness programmes, service capacity building and ongoing and extensive community consultation.

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TABLES

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Table 6.6.1: Requirement List of Local Villages

Sr No	Village Name	Requirements	Priority			Action Plan	Remarks
			1	2	3		
1	Palaung	1)Job opportunity	1			To explain job opportunity is1st priority for 4 relocated villages and 2nd priority for poor and nearest villages to minesite. When we start construction phase and operation phase, Myanmar Wanbao and supplier can hire more employee but degree holders have more priority.	
		2)Library Building		2		Plan to calculate cost for construction and company will review and support.	
		3)Clinic			*	Not urgent due to mobile medical team is providing medical treatment to local villages weekly and also one country hospital is under construction for local villages.	
		4)Computer Training Class			*	Should attend in the computer training class that is conducting in Wet Mhay/KanTaw(new) village. In the next step, we will arrange more training for villagers.	
		5)Electricity for monastery	1			To calculate estimated cost and submit to the company for reviewing and supporting.	
		6)Water tube well and purification unit		2		Will put it in next year CSD plan and will discuss local government how to do.	
2	ShweHlay	1)Electricity	1			To install power line and distribute lighting for all roads and community buildings (such as monastery & school), for every households should be arranged by themselves.	
		2) Library Building		2		Plan to calculate cost for construction and company will review and support.	
		3)Firefighting truck			*	No need because the village is located between the 2 new villages which are available for fire trucks whenever they need.	
		4) Job opportunity	1			To explain job opportunity is1st priority for 4 relocated villages and 2nd priority for poor & nearest villages to mine site. When we start construction phase and operation phase, Myanmar Wanbao and supplier can hire more employee but degree holders have more priority.	

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Sr No	Village Name	Requirements	Priority			Action Plan	Remarks
			1	2	3		
		5)Cemetery compound	1			Will check with engineering department that place is included or not in company's construction plan.	
		6)Water purification unit		2		Put it in next year CSD plan.	
		7) Cleaning for play ground		2		Will assist to do levelling the playground when we start construction of playground in Wet Mhay/ KanTaw (new) village.	
3	Lae Ti	1)Electricity	1			(a) To install power line and distribute lighting for all roads and community buildings (such as monastery and school), for every households should be arranged by their self. (b) Will provide Diesel (15gal/month) for road light lighting until electricity available.	
		2) Library Building		2		Plan to calculate cost for construction and company will review and support.	
		3) Construction for primary school		2		No need to do urgently and will discuss to put in next year CSD plan.	
		4) Job opportunity	1			To explain job opportunity is1stpriority for 4 relocated villages and 2nd priority for poor & nearest villages to mine site. When we start construction phase and operation phase, Myanmar Wanbao and supplier can hire more employee but degree holders have more priority.	
		5)Animal husbandry (chicken)	1			Will discuss with local government how to provide the need.	
		6)Scholarship for 3 university students	1			To submit detail facts of these 3 university students.	
		7) to offer job for one male degree holder (BA-economic)				To submit detail facts and application form.	
4	PhaungKa Tar	1)(a)ceiling for traditional Medicine clinic (b)Ceiling for meeting room	1			Will provide fan(2)Nos. Will provide fan(2)Nos.	
		2) (a)Roof repairing for Administrator's office (b) to construct toile		2		To estimate detail cost for reviewing and supporting.(will provide cash) To estimate detail cost for reviewing and supporting.(will provide	

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Sr No	Village Name	Requirements	Priority			Action Plan	Remarks
			1	2	3		
						cash)	
		3)Refrigerator for traditional medicine clinic			3	Not urgently. (if possible, will donate used one)	
		4)Job opportunity for degree holders (a) BE(Mechanical) (1) person (b) BSc (Botanical) (1) person (c) Electrical Installation (experienced man) (1) person (d) others degree holder (3) person	 1 1 	 2 2		 To submit detail facts and application form. To submit detail facts and application form. To submit detail facts and application form. To submit detail facts and application form.	
5	Wardann	1) Job opportunity (a) For degree holders	1			To collect degree holders list and will pay a priority when job opportunity appear. To submit detail facts and application form to company via CSD member.	
		2) Electricity	1			Responsible of local government and need to take a time hopefully for complete in this year.	
		3) Drinking and domestic used water	1			Still construction for water line to the village from water source at mine town.	
		4) Library		2		Plan to calculate cost for construction and company will review and support.	
		6) Land compensation for SK extension cell line area.	1			Will do urgently for to get suitable compensation for their crops according to the standard compensation rate under the supervision of local government.	
		7) provision Diesel for their road lighting	1			To provide required diesel 2 gal/ day for road lighting and required lighting cable &temporary pole until electricity available in the village.	
6	Tel Pin Kan	1) Job opportunity (a) For degree holders	1			To collect degree holders list and will pay a priority when job opportunity appear. To submit detail facts and application form to company via CSD member.	
		2) Electricity	1			Electricity installation is mainly responsible for local government and need to take a time and hopefully for complete in this year.	

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Sr No	Village Name	Requirements	Priority			Action Plan	Remarks
			1	2	3		
		3) Drinking water	1			Will install submersible pump with solar system on the Dam and to install water distribution pipe for each household.	
		4) Road repairing in the village	1			Will start road repairing in the village in next week and will finish within 3 weeks.	

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Table 6.6.2: Proposal for community social development

Proposal for Community Social Development of Local villages (FY2014)

S/N	Vilage Name	Books & furniture	Medical Service(☆Mine Town Hospital& Mobile Team)	Electricity (☆ Power Lines to the villages, instead of every household)	Drinking Water	Road Repairing	Playground	Kindergartens	School Repairing	TOTAL
1	Shwe Pann Khaing	650,000	As we signed a service agreement with Yangong International Clinic (YIC), we paid 16,800 dollars every month for medical service charge of the doctors and nurse. And the average expense for madicine cost about 5,000 dollars per month. The service charge and medicine cost(21,800 dollars per monthe and 261,600 dollars for one year) include Mine Town Hospital and Mobile Medical Teams. The mobile medical service is totally free for local villagers. According to our monthly record in Mine Town Hospital, we treated more than one thousand villagers for free and only less than 20 company employees every month.	Long distance to install						650,000
2	Ywar Thar Ywar	650,000								650,000
3	Gone Taw	650,000								650,000
4	Doon Taw	650,000								650,000
5	War Dan	650,000		111,300,000	20,160,000	14,150,000				146,260,000
6	Tal Pin Kan	650,000		83,670,000	37,670,000	14,810,000				136,800,000
7	Kan Kone	650,000							40,000,000	40,650,000
8	Phaung Kar (North)	650,000								650,000
9	Phaung Kar (Middle)	650,000								650,000
10	Phaung Kar (South)	650,000								650,000
11	Moe Kyo Pyin(North)	650,000			72,840,000	1,930,000				75,420,000
12	Moe Kyo Pyin(Middle)	650,000								650,000
13	Moe Kyo Pyin(South)	650,000								650,000
14	Yey Kyi Pin	650,000		Long distance to install						650,000
15	The' Taw Gyi	650,000		Long distance to install						650,000
16	Taung Pa Lu	650,000							30,000,000	30,650,000
17	Kyaw Ywar	650,000							8,880,000	9,530,000
18	Nyaung Pin Gyi	650,000							30,000,000	30,650,000
19	Ywar Shay	650,000								650,000
20	Pal Laung	650,000								650,000
21	Wet Hmay (new)	650,000					11,850,000	65,500,000		78,000,000
22	Kan Daw (New)	650,000								650,000
23	Sei Te' (New)	650,000								650,000
24	Zee Taw (New)	650,000						65,500,000		66,150,000
25	Ton/YwarThit	650,000								650,000
26	Taw Kyaung	650,000								650,000
27	A Lel Taw/ Lae Ti	650,000		20,520,000						21,170,000
28	Phaung Kadar	650,000								650,000
29	Kyauk Phyu Dine	650,000		61,950,000						62,600,000
30	Shwe Hlay	650,000		60,200,000						60,850,000
	TOTAL Cost (Kyats)	19500000	222,360,000	337640000	130,670,000	30,890,000	11,850,000	131,000,000	108,880,000	992,790,000
	TOTAL Cost (FEC)	22,941	261,600	397,224	153,729	36,341	13,941	154,118	128,094	1,167,988

Table 6.6.3: Effective Evaluation Record

PCDP Effectiveness Evaluation Record				
EVALUATION CRITERIA AND RESULTS				
Title: Phase 1 Public Consultation and Disclosure Plan				
Date: 30 September 2013				
Goal Statements: • adequate and timely information is provided to project-affected stakeholders; • these stakeholders are given sufficient opportunity to voice their opinions and concerns; and • these concerns influence the ESIA process and project decisions.				
	Evidence used	**Progress**	**Comments**	**Rating**
Activity 1 Select CSD from each village and provide training for smooth communication between affected villages and company.	Altogether an updated from 16 to 22 CSD have been recruited for 22 villages as contract Employees.	Completed	Due to the instable situation, the CSD selection was not done via mass meetings with the villagers.	4
Consultation and information sharing in placed between the company and the villagers.	Grievance Process is developed. Community Consultation Summary Table. Consultation Meeting minutes Performa.	Completed as per phase 1 plan.	Provided information to the villages should be implemented as much as possible according to the plan.	2
Activity 2 Conduct Village Situation Analysis Questionnaire data collection in the surrounding villages	Hard copy collected questionnaires are kept in file and computerized.	Completed in 16 villages but the 6 villages which did not allow doing questionnaire were left out.		2
Output 2 The villages' social information are collected for the ESIA and kept as village information for further social development activities.	Collected questionnaires are filed and sent to EMC for baseline data entry.	70% completed against the plan since some of the villages did not allow the team to go in.		2

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Activity 3 Consult to the affected villages regarding early work constructions of Letpadaung project	Meeting Minutes Performa. Pamphlets Photo records Community info Centre Established	Completed in 16 villages but the 6 villages which not allowed the consultation team were left out. However, the pamphlets were distributed to those 6 villages.	The villagers were more interested in the job opportunity and social development. Apart from few people who concern about environmental impact.	2
Output 3 CSD team ensured the project affected villages are consulted about early work constructions of Letpadaung project.	Grievance Log Villages' request summary table Pamphlets Photos Meeting Minutes Performa.	70% completed against plan		2

Achieving Goals

Targeted Goals were for the most part achieved in regards to Public Engagement. Intervention from the Government and Wanbao management to focus on CSR activities to ease the tensions between MWMCL and the communities, and to build trust with the communities became the prime directive. Early Works were postponed and consultation with Government Agencies and the Implementation Committee were conducted for future planning.

Action (if required): The computerized data should be shared to the project after entering the data in Yangon. A Data-base has been created and now requires input. The consulted community requests (the neediest things) should be prioritized to be addressed in coming year CSD plan.

A Phase-2 Consultation Planning will commence October 1st.

Lessons Learned:

. PCDP structure and contents: Any of the project activities related to the village should be consulted with CSD team to be more effective support for the community. In order to minimize the confusion in the community, the information channel should be clearly identified and maintained. The role of CSD should be clarified so that the CSD team will be a meaningful resource both to the company and community.

. Consultation methods/stakeholder: The PCDP could not conduct the workshop due to the complex situation. A coordination meeting should be done with higher level Government administration on regular basis, sharing information about PCDP.

. Integration of consultations with ESIA process and Project activities: This activity need to be strengthened within the company department for mutual understanding and supporting each other.

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Staff responsible for review: Daw Myat Htwe Mon CSD Project Manager	Date September 30th 2013
Senior Manager approval: Glenn R. Wallis Environmental Systems & Operational Development Manager	Date: September 30th 2013

Rating key

1 = Completely achieved
2 = Largely achieved
3 = Partially achieved
4 = Achieved to a very limited extent
5 = Not realised
X = Too early to judge extent of achievement

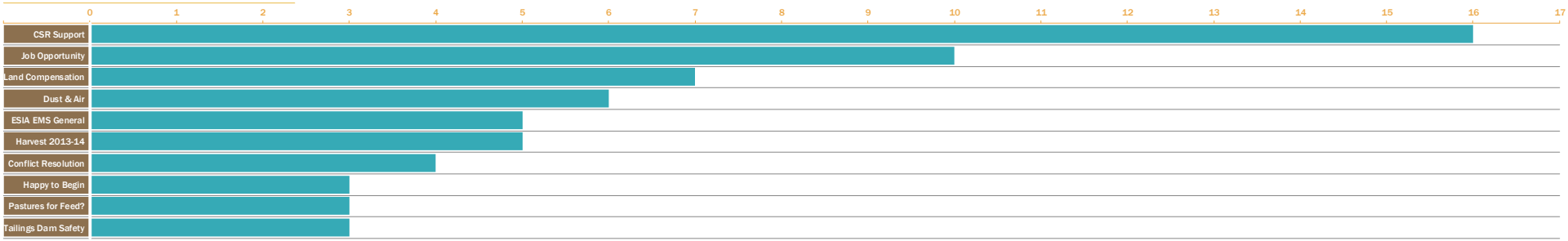
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Table 6.6.4: Issue Analysis

Summary | Inventory

Letpadaung Village Region Issue Analysis

Top 10 Village Issues



Village Count of Issues

Type	Count
Acid Mist	1
Blasting Standards	0
Conflict Resolution	4
CSR Support	16
Dust & Air	6
ESIA EMS General	5
Fencing for Safety	1
Harvest 2013-14	5
Job Opportunity	10
Land Compensation	7
Pastures for Feed?	3
Public Roads	2
Rehabilitation	1
Surface Water	2
Tailings Dam Safety	3
Vibration	1
Grand Total	67

Table 6.6.5: Example of Meeting Minutes

Meeting Minutes Proforma - Table

Date of Meeting	15 May 2013	
Venue for Meeting	School Compound, Kyawywa village	
Consultation Phase	Phase 1	
Meeting Reference	Meeting Report and photos	
Goal and Objectives	Community consultation	
Subject	Early construction work of Wanbao mining project, the objective of CSD and household questionnaire data collection	
Materials Used	Pamphlets and Questionnaire	
Materials Circulated	Format Pamphlets	Circulation Individual distribution
Meeting Organizer(s)	Name	Affiliation and Position
Meeting Facilitator(s)	Daw Myat Htwe Mon and CSD members CSD Team	CSD Project Manager and CTS team
Recorder	Daw Mya Mya Moe	CSD Supervisor
Method(s) of Record	Note Taking and photo taking	
Technical Expert(s)		
Independent Observer		
Interpreter		
Letpadaung Project Representative(s)	Mr. Glenn R Wallis	Environmental Systems and Operational Development Manager
Agenda	- CSD Introduction - Information Provision about early construction and job opportunity - Household questionnaire Data Collection - Question and Answer session for villagers' concern and queries	

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Questions Raised

Number	Topic	Details of Question	Raised By Whom	Response Provided	By Whom

Comments / Proposals / Recommendations put forward

Number	Topic	Details	Proposed By Whom	Response Provided	By Whom
The villagers asked for job opportunity. Some farmers want to use some lands as their animals' pasture. And some villagers want know more how the project will impact on their environment and how the company will protect.					

Information Provided

Number	Topic	Details	Provided By Whom	Response Provided	By Whom

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Actions Agreed

Number	Topic	Details of Action Agreed	Actionee	Milestone

Summary of Level of Stakeholder Interest / Concern and Stance towards Project by Issue

Stakeholder Organization - Individual or Category	Topic	Level of Stakeholder Interest - Concern (High, Medium, Low)	Comments

Attendees List

Date of Meeting	15th May 2013
Venue for Meeting	School Compound, Kyawywa village
Consultation Phase	Phase 1
Meeting Reference	Daily report

Name of Organization	Name of Individual	Position of Individual in Org.	Contact Details: Address	Contact Details: Tel. Number	Contact Details: Email	Signature	Key Area of Interest of Organization /Individual
Unable to get the signature of meeting attendees due to the sensitivity in Letpadaung Project Area. However, photos were taken as the record of this meeting for anytime reference.							

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Summary of Community Consultation (May – August 2013)

Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
1	Shwehlay	LPD	Job opportunities for landless people				3 recruited - in WB	% of on job training opportunity will be given to graduates
			Job opportunities for land lost people					1 employee for 10acre lost, 2 employee for 20 acre lost and 3 employee for above 20Acre opportunity will be given when the company start in Oct.
			Land Compensation amount is low					
			Levelling the football ground with the machines	Yes			100% completed	
			Village road earth filling for preventing flood		No			The village is geographically flooded every year so that need to have further discussion with government
			Elderly care support		No			Considering but not yet taken into action
			Electricity	Yes			35% completed	
2	Don Taw	SK	The renovated road quality is poor		No			No action taken
			To test water level and quality			Pending		No action taken
			To support water scarcity as the water level is getting deeper due to the mine pits	Yes			One water purification system is provided	But the water is not enough and asked for another assistance
			To access Mine Hospital for minor health cases		No			No consideration
			SK job opportunities have bias	Yes			Explained to the villagers if they have any specifice information, they can bring it up to the CSD and HR.	

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
			Transparency on job employment and give priority to the poor	Yes			Unskilled labor are chosen by the village head	
			Periodically environmental impact assessment should be conducted					
			U Mya Aung's land compensation		No			Still negotaiting
			Water pipeline for farmlands arrigation		No			Not yet started
			School bus for children		No			Not possible
			To support money for land purchaing to construct village health center		No			Not possible
			Job opportunity	Yes			3 in WB, 4 in sino, 75 in sk	Out of 75, 65 are casual labor
3	Kyaut Phyu Taing	LPD	Electricity	Yes			60% accomplished	
			Library	Yes				Will be provided in Mid August
			Job opportunity for landless and land lost people	Yes			1 in WB, 1 in Sino	1 employee for 10acre lost, 2 employee for 20 acre lost and 3 employee for above 20Acre opportunity will be given when the company start in Oct.
			Land Compensation amount is low					
			School benches and supplies		No			Not included in this year CSR plan
4	Leiti	LPD	Village road renovation	Yes			100% completed	
			Education support	Yes			3 high school students provided	
			Electricity	Yes			50% completed	

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
5	Kyaw village	LPD	Job opportunity				7 in WB, 6 in Sino, 9 in Norbenco, 11 in Ytse	
			Education support			Pending		But there is a plan to provide education support
			Drinking water	Yes			Plan 14 Sep - 16 Oct	
			School Construction	Yes			100% completed	
7,8,9,10	Relocated 4 villages	LPD	Job opportunity 2 HH per family at least		No			But recruited one house per family
			Complaint on ladders	Yes				The list was sent to Htoo Comp. to renovate
			Complaint on houses' quality	Yes				The list was sent to Htoo Comp. to renovate
			The public electricity bill should be paid by the Gov. or company			Pending		Not yet confirmed
			To provide salary for water pumper and maintenance			Pending		Not yet taken action
			To provide village sign board			Pending		Public Relation Center is opened in Zitaw Seite village to address all the pendings in new relocated villages
			To provide vocational training to unskilled labor or uneducated people who only knows working in the farm			Pending		
			To create job opportunity by operating factories and small enterprises			Pending		
			To provide incentives for other village development committee members who are formed by the Government			Pending		
			To provide relocation cost			Pending		
			To support house moving cost (transport)			Pending		

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
			To provide compounds in new village for those who own more than one compound			Pending		
			To provide extension rooms for the family member of 3 and 4	Yes				Approved by Government to take action but not yet starte
			To renovate the drains with concrete as it can be eroased by heavy rain			Pending		
			To renovate the lamp-posts bottoms as they are erosed by the rain and as they are closed to the drain.	Yes			12 lamp-posts completed but the rest are on going	
			Complaint to some CSDs	Yes			No specific complaints	
			Pastures and spaces to keep the animals			Pending		
			Elederly land lost people who cannot work in the company			Pending		
			To think of the families who do not have workers as per the land lost job opportunity.			Pending		Not yet consider
			To consider Education support for the families			Pending		Plan to do educational support
			To specify the Zitaw-Seite village boundry line			Pending		
			To recruit the ECCD teachers from the village - not from outside (Early Child Care Development)			Pending		
			To solve the land for Cemetry (Zitaw-Seite)			Pending		

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
11	Phaung Katar (N)	LPD	To provide CSD		No			1 CSD is provided for Phaung Katar (N) and (S)
			Books and chairs for library			Pending		Considering but not yet taken into action
			Job opportunity	Yes			2 in WB, 6 in Norbenco	
			Complaint to Phaung Katar (S) CSD	Yes			The villagers are welcomed to raise up if there is any specific factors	
12	Ywar Thar	SK	Road Renovation	Yes			100% completed	
			Retaining wall	Yes			100% completed	
			Library			Pending		
			Job opportunity				61 in SK	out of 61, 43 are casual labor
			Dust and betel leave issues	Yes			Ongoing	
13	Moegyobyin (N)	LPD	Classroom extension			Pending		Not included in this year CSR plan
			Tube well for drinking water			Pending		Government responsible
			Library			Pending		
			Pond renovation for animals' drinking water			Pending		Not included in this year CSR plan
			Electricity			Pending		Not included in this year CSR plan
			Clinic renovation					
			Job opportunity				22 in SK, 5 in WB, 1 in Sino, 1 in NoB, 2 in Norinco	
			Education support			Pending		There is a plan to provide education support
14	Ton Ywar Ma	LPD	Plastic chairs 20 numbers by village head			Pending		If the villagers accept the company come and donate in the village
			To recruit CSD by village head			Pending		If the villagers accept the company

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
								to cooperate
15	Kangon	SK	Land compensation for the land occupied by over 20 yrs ago		No			
			Water supplies	Yes			Set up water purification and tube well	But not yet found good water quality within the village
			School buildings	Yes			25% completed	
			Job opportunity	Yes			42 in Wb, 25 in Sino, 20 in Norbenco, 4 in Norinco, 4 in 8MCC	
			To do EIA and SIA	Yes			On the process	
			Hospital	Yes			Tendering process	
			Provide vocational training to school drop out youth		No			No consideration for this so far
16	Taungpalu	LPD	Education support			Pending		There is a plan to provide education support
			Job opportunity				1 in WB, 2 in Sino, 1 in Norbenco	
			Electricity	Yes			100% completed	
17	Moegyobyin (S)	LPD	Drinking water supplies	Yes			Plan to start in Aug	Government responsibility
			To upgrade Primary school to Middle school			Pending		Government responsibility
			Electricity			Pending		Not included in this year CSR plan
			Job opportunity			Pending		Coming up job opportunity will fulfill this request
18	Shwe Pan Khaing	SK	Concrete bridge on the village connection road			Pending		Submitted to Regeional government for approval.
			Monastery renovation			Pending		
			Job Opportunity	Yes			30 no. recruited	
			Electricity		No			Far distance

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
			To complete the road renovation	Yes			100% completed	
			School benches and supplies			Pending		Not included in this year CSR plan
			To support the village social group			Pending		Not included in this year CSR plan
			To increase wages for daily wages workers		No			According to the market price
			Land resettlement assistance	Yes			Land measurement and amount calculation is finished but not yet provided	
19	Paungga (S)	LPD	To provide CSD	Yes			Recruited on 16 Aug	
			Drinking water supplies			Pending		Not included in this year CSR plan
			School Construction	Yes				Government's responsibility
			Job opportunity for landless and land lost people	Yes			152 no. recruited in SK, WB and Sino for Paungga (S) (N) (M)	Coming up job opportunity and on job training will fulfill this request in Oct
			To donate some construction items for monastery renovation		No			Not included in this year CSR plan
20	Wadan	SK	To complete the road renovation, removing the tailings	Yes			100% completed	
			Job opportunity (employment to be transparent)	Yes			Given the chance to raise up any doubt throug suggestion box or in person	
			Electricity	Yes			35% completed	
			Drinking water supplies	Yes			100% completed	
			School compound cleaning with machines	Yes			100% completed	
			Lamp-post quality complaint (the contactor)	Yes			The villagers are asked not to accept if the quality is not good	

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
			Land resettlement assistance	Yes			Land measurement and amount calculation is finished but not yet provided	
21	Palung	LPD	Library	Yes			Tendering process and plan to start in mid Aug	
			Job opportunity	Yes			2 casual labor in WB	Coming up job opportunity and on job training will fulfill this request in Oct
			Electricity supplies for monastery	Yes			100% completed	
			School Construction	Yes				Government's responsibility
			To give awareness training on Enviromental Impact and the mine project's implementation			Pending		No action taken
22	Teipinkan	SK	Library fencing			Pending		Not included in this year CSR plan
			Drinking water supplies	Yes			80% completed	
			Complaint to CSD member	Yes			Cleared	
			Job opportunity	Yes			27 recruited	
			Land measurement and compensation for SK project extension	Yes			Land measurement and amount calculation is finished but not yet provided	
24	Thedawgyi	SK	Library	Yes			Tendering process and plan to start in mid Aug	
			Job opportunity	Yes			3 no. recruited	
			School supplies			Pending		Not included in this year CSR plan
			To complete road renovation	Yes			100% completed	

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
25	Yaykyibin	SK	Library			Pending		Not included in this year CSR plan
			School building construction	Yes			Tendering process but plan to start in Sep	
			Mobile medical care	Yes			3 weeks per month provided	
			Land resettlement assistance	Yes			Land measurement and amount calculation is finished but not yet provided	
			Road Renovation			Pending		Not included in this year CSR plan
			Job opportunity	Yes			60 people recruited	
			Dust and Betel leave, pasture and other crops	Yes			Betel leave issue is under process	SE dept. should do assessment on pastures and other crops
26	Gon Taw	SK	School fencing			Pending		Not included in this year CSR plan but should not be by brick
			School earth filling	Yes			Plan to start in Oct	
			Arrigation for farming	Yes				Government's responsibility
			Job opportunity	Yes			56 people recurited	Coming up job opportunity and on job training will fulfill this request in Oct
			Cement for monastery	Yes			200 bags of cement donated	
27	Paungga (M)	LPD	2 water cart during monastery construction		No			Due to road accessibilitey, it was not helped
			Library			Pending		Not included in this year CSR plan
			Bridge			Pending		Not included in this year CSR plan
			Job opportunity	Yes			152 no. recruited in SK, WB and Sino for Paungga (S) (N) (M)	Coming up job opportunity and on job training will fulfill this request in Oct
			Road Renovation (village to	Yes			Plan to start on 19 Aug	

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
			Paungga dam)					
28	Paungga (N)	LPD	Road Renovation (village to cemetry)	Yes			Plan to start on 19 Aug	
			Cement for monastery	Yes			40 bags of cement donated	
			Job opportunity for uneducated people	Yes			152 no. recruited in SK, WB and Sino for Paungga (S) (N) (M)	Coming up job opportunity and on job training will fulfill this request in Oct
			Education support			Pending		There is a plan to provide education support
29	Taw Kyaung	LPD	No consultation so far due to villagers' unacceptance					
30	Ton Ywar Ma	LPD	No consultation so far due to villagers' unacceptance					
31	Moegyobyin (M)	LPD	Complaint about the land measurement and the toddy palm trees counting by the land department and by the authorities					The villagers do not accept the company to do consultation
			No consultation with mass meeting due to villagers' unacceptance					The villagers do not accept the company to do consultation
32	Ywarshay	LPD	Library			Pending		Not included in this year CSR plan
			School Compound earth filling	Yes			Completed	
			School benches and supplies		No			Not included in this year CSR plan
33	Htan Taw (Nyaungbingyi)	LPD	One CSD for Htan Taw village			Pending		Considering but not yet taken into action

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Sr. No.	Village Name	Area	Consultation Minutes	Addressed			Progress	Remark
				Yes	No	Pending		
34	HtanDawGyi (YinMarPin)	SK	BEHS school building painting	Yes			Donated	
			Mobile medical care for the whole day since there are over 100 patients want to get the treatment. Half day medical service only cover round about 50 patients			Pending		Considering but not yet taken into action
35	Zitaw, Seitei (old village)	LPD	To release the arrested 3 people					informed to management team
			To withdraw the section 144					
			To take action the responsible person of giving command to use the bomb to crackdown the protests.					
			Imlementation committee should come and negotiate the villagers					
36	Ton Ywathit	LPD	No consultation so far due to villagers' unacceptance					

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Table 7.2.1(a): Construction Phase Environmental and Social Risk Matrix

ENVIRONMENTAL IMPACT	ASPECT	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
CONSTRUCTION PHASE												
TOPOGRAPHY												
Change in landform and landscape character	(1) Excavations for the South Diversion Channel and other water management works.	2	5	3.5	2	2.8	1.0	2.8	Medium	Low	(1) Revegetate and provide crossing point for local people. (2) Flatten side slopes.	Low
	(2) Development of platforms for plant and infrastructure construction	3	4	3.5	1	2.3	1.0	2.3	Medium	Low	(1) Platforms will be landscaped and revegetated to original landform at the end of the project.	
	(3) Excavation for and establishment of pollution control dams.	1	4	2.5	2	2.3	1.0	2.3	Medium	Low	(1) Revegetate side slope.	
	(4) Development of flood protection bund	2	4	3.0	2	2.5	1.0	2.5	Low	Medium	(1) Revegetate side slope.	
SOILS												
Sterilisation of soil resources	(1) Development of mine infrastructure including plant, roads, stockpile platforms, waste rock dumps, heap leach pads, dams and buildings.	4	4	4.0	2	3.0	1.0	3.0	Low	Medium	(1) Stripping and stockpiling of soil resources prior to construction	Medium
	(2) Loss of agricultural land	3	5	4.0	3	3.5	1.0	3.5	High	Medium	(1) Increase of agricultural productivity of surounding farm land.	
Soil contamination	(1) Leakage or spillage of hazardous chemicals including hydrocarbons.	4	3	3.5	1	2.3	0.8	1.8	High	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into soil or groundwater.	
Loss of soil resources	(1) Wind and storm water erosion of stockpiles and exposed soil surfaces.	2	4	3.0	3	3.0	1.0	3.0	High	Low	(1) Long-term stockpiles are to be progressively re-vegetated to allow for stability of surfaces. (2) Stockpiles not to exceed 4.5 m in height. (3) Storm water to be diverted around long-terms stockpile areas. (4) Erosion and sediment control plan.	
	(2) Mismanagement of soil recovery	3	5	4.0	3	3.5	0.8	2.8	Medium	Medium	(1) Development and implimentation of a soil management plan.	
GROUNDWATER												
Contamination of groundwater resources	(1) Inappropriate disposal of hazardous and general waste during construction.	2	3	2.5	2	2.3	0.6	1.4	Low	Low	(1) Facilities for the temporary storage of general and hazardous waste will be provided that prevent run-off or seepage into the environment. (2) Waste disposal to take place off-site at available facilities until such a time that the general and hazardous waste sites are developed.	Low
	(2) Leakage or spillage of hazardous chemicals including hydrocarbons.	2	4	3.0	2	2.5	0.4	1.0	Medium	Very Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater.	
SURFACE WATER (HYDROLOGY AND RIVERS)												
Contamination of rivers and watercourses	(1) Release of effluent and contaminants into the environment.	4	3	3.5	4	3.8	0.6	2.3	High	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into water courses. (2) No effluent is to be released into the environment (3) Effluent is to be contained and treated (e.g. sewage treatment plant prior to release).	Medium
	(2) Sediment loads due to erosion of exposed surfaces.	3	4	3.5	4	3.8	1.0	3.8	Medium	Medium	(1) Drainage areas will be constructed with protective features to mitigate erosion. (2) Use of source control BMPs (3) Construction of Sediment Control Dams	
Increase of flood frequency and severity	(1) Construction of flood protection bund resulting in a bottle neck of the Chindwin River.	4	4	4.0	4	4.0	0.2	0.8	Low	Very Low	(1) Additional flood modelling. (2) Resettlement of significantly at risk village dwellings.	

ENVIRONMENTAL IMPACT	ASPECT	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
AIR QUALITY												
Exceedance of health screening guidelines for ground level concentrations of dust	(1) Movement of vehicles and machinery and entrainment from exposed surfaces.	3	4	3.5	4	3.8	1.0	3.8	Medium	Medium	(1) Surface wetting of construction roads. (2) Minimisation of the exposed surfaces to that necessary for development. (3) Dust management plan.	Medium
	(1) Quarrying and crushing of agregate	3	3	3.0	4	3.5	0.8	2.8	Medium	Medium	(1) shrouds over equipment. (2) Dampening of stockpiles (3) Covers on trucks transporting materials to site.	
	(1) Blasting on site during construction	4	2	3.0	4	3.5	1.0	3.5	Low	High	(1) Management of blasting according to weather conditions.	
	(1) Wind blown dust from exposed surfaces	2	4	3.0	4	3.5	1.0	3.5	High	Medium	(1) Progressive clearing and grubbing of working areas. (2) Planting of vegetation buffer zones.	
Exceedance of health screening guidelines for ground level concentrations of SO2, NO2, NO3, DPM and CO.	(1) Exhaust emissions (2) Diesel generators	1	3	2.0	4	3.0	0.2	0.6		Very Low	(1) Options for lowering exhaust emissions should be considered.	
Green House Gas emissions	(1) Use of fuel on site by various equipment	1	5	3.0	3	3.0	1.0	3.0	Medium	Medium	(1) Low Sulphur Fuel (2) High efficiency motors and engines (3) Monitoring fuel usage and engine performance	
NOISE & VIBRATION												
Disturbance of noise receptors during the day	(1) Movement of machinery and vehicles	2	3	2.5	3	2.8	1.0	2.8	Medium	Medium	(1) Noise buffer in critical areas and around perimeter. (2) Control working hours (3) Relocation of receptors (4) Monitoring of noise levels near sensitive receptors.	Medium
	(1) Blasting	4	3	3.5	4	3.8	1.0	3.8	Medium	High	(1) Management of blasting (timing/size) (2) Notification of receptors regarding blast times. (3) Monitoring of noise levels near sensitive receptors.	
Disturbance of noise receptors at night	(1) Movement of vehicles, machinery and mechanical operation of plant components e.g. crushers	3	3	3.0	4	3.5	0.2	0.7		Very Low	(1) Limit the construction activities as night to that which is absolutely necessary to complete the project within schedule. (2) Monitoring of noise levels near sensitive receptors.	
Disturbance to receptors due to blast vibrations	(1) Blasting	3	3	3.0	3	3.0	1.0	3.0	Medium	Medium	(1) Management of blasting (timing/size) (2) Notification of receptors regarding blast times. (3) Monitoring of vibration levels near sensitive receptors.	

ENVIRONMENTAL IMPACT	ASPECT	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
BIODIVERSITY												
Loss of habitat	(1) Land clearing	3	4	3.5	2	2.8	1.0	2.8	Medium	Low	(1) Balance of Primary Woodland within the proposed mining area is to be demarcated and protected from damage. (2) Reforestation plan for balance of primary woodland. (3) Planting of buffer areas around the site boundary and within the site. (4) Identification and reservation of remenant vegetation in the surounding areas.	Medium
	(1) Fire Damage	2	3	2.5	3	2.8	0.2	0.6		Very Low	(1) Installation of fire suppression systems on itmes of large equipment. (2) Monitoring of tire temperatures to guard against tire fires. (3) Public awareness campaigns. (4) Strict enforecment of OHSM policies and procedures.	
Loss of natural vegetation	(1) Land clearing	3	4	3.5	2	2.8	1.0	2.8	Medium	Medium	(1) Revegitation and planting of buffer zones.	
	(1) Fire Damage	2	3	2.5	3	2.8	0.2	0.6		Very Low		
Loss of Rare or Endemic species	(1) Habitat loss (2) Biogeographical isolation (3) Road kill	1	4	2.5	4	3.3	0.6	2.0	Medium	Low	(1) Relocation if found.	
Increased pressure on ecological services	(1) Increased collection of fuel wood associated with influx of people. (2) Loss of current fuel wood sources and impact translocation. (3) Disruption of livelihood activities resulting from resettlement.	3	4	3.5	4	3.8	0.8	3.0	High	Low	(1) MWMCL will implement measures to reduce influx of work seekers into the area. (2) MWMCL together with district authorities will implement reforestation projects. (3) Development of alternative fuel sources.	
Spread of invasive weeds and pest species	(1) Movement of machinery and vehicles spreading seeds.	2	3	2.5	3	2.8	0.8	2.2	Low	Medium	(1) Vehicle clean downs prior to entering the site	
	(1) Importation of materials	2	4	3.0	2	2.5	0.8	2.0	Low	Low	(1) Inspection of containers prior to entry of site	
CULTURAL HERITAGE												
Disturbance of cemeteries and grave sites	(1) Site clearance and excavations	2	4	3.0	3	3.0	0.2	0.6		Very Low	(1) Site survey to be undertaken to accurately map and identify all burial sites prior to construction (2) Relocation of sites in accordance with legislative requirements and in consultation with descendants and Tribal Authorities.	Low
Disturbance of archaeological sites	(1) Site clearance and excavations	1	4	2.5	2	2.3	0.2	0.5		Very Low	(1) Site survey to be undertaken to map all sites prior to construction. (2) Phase II survey for the excavation and documentation of all sites to be disturbed. (3) Only sites in footprint areas to be disturbed, remaining sites to be mapped, demarcated and protected.	
Disturbance of cultural sites	(1) Site clearance and excavations	5	5	5.0	4	4.5	1.0	4.5	High	Medium	(1) Dismantling and relocating cultural site or moving entire site including vegetation.	
VISUAL												
Disturbance of view scape	(1) Development of processing plant and other infrastructure (2) Development of topsoil stockpiles (3) Construction infrastructure.	3	4	3.5	4	3.8	1.0	3.8		Medium	(1) Rehabilitation of construction areas at end of the implementation phase.	Medium
Light and nightglow	(1) Lighting masts	1	4	2.5	2	2.3	1.0	2.3	High	Low	(1) Minimise use of high lighting masts (2) Direct lights towards areas of work. (3) Lights to be provided with hoods to reduce light spill.	

ENVIRONMENTAL IMPACT	ASPECT	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
SOCIO-ECONOMICS												
NEGATIVE IMPACTS												
Resettlement of members of the community	(1) Persons living within the mining area and the blast exclusion zone are to be relocated to allow for mining to continue.	5	5	5.0	4	4.5	1.0	4.5	High	High	(1) Development of Resettlement Action Plan (RAP) and associated greivance mechanism. (2) Fair compensation for entitled households. (3) MWMCL to be actively involved in compensation and resettlement process to ensure company social responsibility objectives are met.	High
Reduced access to land for agriculture and traditional livelihood	(1) Local residents and previous land owners to be excluded from project area.	5	4	4.5	3	3.8	1.0	3.8	Medium	High	(1) A community natural resource management plan will be developed. (Additional SMP or EMP required) (2) Development of alternative (non agricultural) industries. (3) Provision of alternative fuel sources.	
Disruption of leadership structures and associated community tension	(1) Resettlement of communities.	3	3	3.0	4	3.5	0.6	2.1	Medium	Low	(1) Leadership structures are to be agreed with consultation with local communities. (2) Leadership structures to be addressed in the RAP	
Influx of persons into the area	(1) Job seekers and persons attracted to economic benefits	2	3	2.5	4	3.3	0.8	2.6	High	Low	(1) Support local leadership in managing influx of persons. (2) Preference to be given to local community in employment. (3) MWMCL to provide camp accommodation and transport for persons from outside the immediate area. (4) Employment strategy to be clearly communicated by MWMCL and persons discouraged from moving to the area.	
Increased safety risk to road users	(1) Construction traffic to and from site. (2) Increased traffic due to increased population	4	3	3.5	5	4.3	1.0	4.3	Low	High	(1) Access route to the site will be upgraded in accordance with project proposal. (2) Traffic safety awareness programme to be put in place for communities along the access road. (3) Warning signage to be put in place along the route. (4) Fencing to be put in place adjacent to schools along the route from Pakoku and exit/entry points are to be clearly demarcated. (5) Transport driver training (6) Use of only safe and serviced vehicles (7) Promotion of road safety (8) Drug and alcohol testing of drivers. (9) Restricted working hours for drivers and adequate rest breaks	
Increase in the spread of communicable disease (including HIV/AIDS)	(1) Influx of persons into the area (work-seekers and service providers) (2) Increased population density. (3) Greater transient workforce.	3	4	3.5	5	4.3	0.8	3.4	Medium	Medium	(1) MWMCL to develop a Sexually Transmitted Infections Education Policy and to enforce this on all contract workers. (2) An integrated community awareness plan (in collaboration with government) on to be put in place prior to construction. (3) Implement measures to discourage influx of persons into the area. (4) MWMCL to provide support to local health centres. (5) Provision of free condoms (6) Sanitation (7) Management of accommodation camps	
Increase in crime (including theft and prostitution)	(1) Influx of persons and increase in financial resources	2	4	3.0	4	3.5	0.8	2.8	Medium	Low	(1) MWMCL to provide support to local policing structures, as appropriate. (2) Implement measures to prevent influx of persons into the area. (3) Enforcement of a code of conduct in accommodation camps.	
Increase in workplace injuries	(1) Employment of unskilled workers. (2) Cultural of disregard for safety. (3) Inadequate local safety codes. (4) Language issues.	3	3	3.0	2	2.5	1.0	2.5	Medium	Low	(1) Training (Safety and language) (2) Strong supervision (3) Development of an occupational health and safety management system. (4) Resticted working hours to reduce fatigue.	
Change in tranditional values and norms	(1) Greater exposure to transient populations and new technologies.	4	5	4.5	3	3.8	1.0	3.8	Low	High		

ENVIRONMENTAL IMPACT	ASPECT	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
POSITIVE IMPACTS												
Economic benefits to local community	(1) Employment of local persons	4	3	3.5	4	3.8	0.6	2.3	Low	Low Positive	(1) Preference to be given to local persons for employment. (2) Local skill base to be developed (training programmes).	Moderate Positive
	(2) Local procurement	2	3	2.5	4	3.3	0.6	2.0	High	ModeratePositive	(1) Preference will be given to local services providers and suppliers of goods. (2) Training and advice (microfinance will also be investigated.)	
	(3) Improved access to markets	2	4	3.0	2	2.5	0.6	1.5	High	ModeratePositive	(1) Provision of training to develop skills	
Improved infrastructure (Sanitation, Electricty, Water, Fuel supply)	(1) New villages equipped with communal drinking water point	3	4	3.5	2	2.8	1	2.8	Low	ModeratePositive	(1) Maintenance of infrastructure.	
	(2) New villages equipped with proper sanitation facilities	3	4	3.5	2	2.8	1	2.8	Low	ModeratePositive	(1) Maintenance of infrastructure.	
Improved housing conditions	(1) Provision of new villages built with modern materials	3	4	3.5	2	2.8	1	2.8	Low	ModeratePositive	(1) Maintenance of infrastructure.	
Improved Road Infrastructure	(1) Upgrading roads. (2) Upgrading bridge over Yama Creek	3	3	3.0	3	3.0	0.6	1.8	Medium	Low Positive	(1) Maintenance of infrastructure.	
Improved Provision of Medical Services	(1) Construction of new clinics in surounding area. (2) Additional medical staff.	3	4	3.5	3	3.3	0.8	2.6	Medium	Moderate Positive	(1) Community and social development program will be continued. (2) Training and recruitment of medical staff to the project area. (3) Provision of medical supplies and equipment.	

Table 7.2.1(b): Operational Phase Environmental and Social Risk Matrix

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
OPERATIONAL PHASE												
TOPOGRAPHY												
Change in landform and landscape character	(1) Excavation of open pit	5	5	5.0	3	4.0	1.0	4	Low	High	(1) Mine planning to include investigation into the backfilling of waste rock or flooding of the pit to produce a lake. (2) Designing the pit to reduce visual impact from a regional perspective.	High
	(2) Development of dams, HLPs and waste rock dumps	4	5	4.5	4	4.3	1.0	4.25	Low	Very High	(1) Progressive rehabilitation of waste rock dumps, including adoption of closure slopes and revegetation. (2) Vegetation screens around HLPs and dams.	
	(3) Operations accommodation village.	1	5	3.0	1	2.0	1.0	2	Medium	Low	(1) Vegetation screening. (2) Height limit on structures within village. (3) Incorporation of typical architecture for the area. (4) Appropriate town planning/layout.	
SOILS												
Sterilisation of soil resources	(1) Development of open-pit, waste rock dumps and HLPs.	4	4	4.0	2	3.0	1.0	3	Low	Medium	(1) Utilisable soil is to be stripped and stockpiled prior to development.	High
Soil contamination	(1) Leakage or spillage of hazardous chemicals including hydrocarbons	4	4	4.0	1	2.5	1.0	2.5	High	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater. (2) Monitor groundwater quality in the proximity of potential pollution sources.	
	(2) Acid rock drainage (ARD) and metal leaching associated with waste rock dumps	5	5	5.0	4	4.5	1.0	4.5	Low	High*	(1) Low permeability compacted soil liner. (2) Effective in-pit waste identification. (3) Application of mine waste management plan to reduce ingress of water and air in order to prevent ARD. (4) Adoption of pit back fill. (5) Design and placement of long term cover. *Current unmitigated impact significance is still High. If all mitigation measures are followed this impact could be reduced.	
	(3) ARD and metal leaching associated with HLPs	5	5	5.0	4	4.5	0.8	3.6	Medium	Medium	(1) Low permeability compacted soil and HDPE liner under HLPs. (2) Seepage management systems for HLPs. (3) Connection of seepage management system to surface water management system. (4) Monitor groundwater quality in the proximity of HLPs.	
	(4) SX/EW Plant	4	4	4.0	2	3.0	0.6	1.8	Medium	Low	(1) Construct plant on a structurally sound, impermeable concrete base. (2) Continual maintenance of concrete to maintain impermeable base. (3) Immediate clean up of spillage. (4) Maintenance of plant infrastructure to prevent leaks and spills.	
	(5) Solution ponds, stormwater ponds and waste water ponds.	4	4	4.0	3	3.5	0.8	2.8	Medium	Medium	(1) Low permeability liners. (2) Management of contaminated residue removed from ponds. (3) Hydraulic design of ponds to contain overflow from upstream ponds.	
	(6) Slope failure of HLP leading to an uncontrolled release of leached ore	4	4	4.0	2	3.0	0.6	1.8	Medium	Low	(1) Correct closure design of HLPs to reduce risk of slope failure. (2) Ongoing monitoring and maintenance of HLP batter slopes. (3) Development of procedures to clean up spilt leached ore.	
Loss of soil resources	(1) Wind and storm water erosion of stockpiles and exposed soil surfaces	1	4	2.5	2	2.3	0.8	1.8	High	Low	(1) Long-term stockpiles are to be progressively re-vegetated to allow for stability of surfaces. (2) Stockpiles not to exceed 4.5 m in height. (3) Storm water to be diverted around long-terms stockpile areas. (4) Implementation of erosion and sediment control plan.	

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
GROUNDWATER												
Lowering of groundwater table reducing groundwater supply	(1) Decrease of groundwater level elevation due to pit dewatering	3	4	3.5	4	3.8	1.0	3.75	Medium	Medium	(1) Monitoring boreholes to be established in the community, in order to monitor change in groundwater level. (2) Monitoring of water levels on a quarterly basis. (3) Identification of potential alternative water sources if local wells are significantly impacted.	High
Contamination of groundwater resources	(1) Seepage from the HLP or waste rockdumps	5	5	5.0	4	4.5	1.0	4.5	Low	High*	(1) Full compliance with EMPs. (2) Monitoring of groundwater quality in the proximity of potential pollution sources. (3) Compacted clay liner with HDPE liner for the HLPs. (4) Seepage management systems for HLPs. (5) Compacted clay liner for the WRDs. (6)Confirm material availability for liners and closure cover systems. *Current unmitigated impact significance is still High. If all mitigation measures are followed this impact could be reduced.	
	(3) Spillage and seepage of hazardous chemicals (including hydrocarbons) from operational and storage sites	3	4	3.5	3	3.3	0.4	1.3	Medium	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater. (2) Monitor groundwater quality in the proximity of potential pollution sources.	
	(4) Inappropriate disposal of hazardous and general waste produced during operation	3	5	4.0	3	3.5	0.8	2.8	Medium	Low	(1) Facilities engineered to best international practice for the protection of groundwater are to be constructed on site for the disposal of general waste, hazardous waste. (2) Bio-remediation facility to be implemented for hydrocarbon contaminated soils. (3) Temporary waste storage facilities to be engineered to prevent seepage of contaminants from such sites.	
SURFACE WATER (HYDROLOGY AND RIVERS)												
Loss of catchment yield	(1) Containment of storm water run-off (2) Change in creek hydrology	3	4	3.5	3	3.3	1.0	3.25	Medium	Medium	(1) Reserve determination for the downstream users to be determined and water supply to the catchment to be managed to ensure that the water requirements are met. (2) Installation of alternative water supplies.	High
Contamination of rivers and watercourses	(1) Dirty water run-off from plant area, pit, waste rock and HLP area	5	4	4.5	5	4.8	1.0	4.75	Low	High*	(1) Dirty water containment measures e.g. pollution control dams to be put in place and engineered as per project proposal. (2) Surface Water Management Plan to be implemented *Current unmitigated impact significance is still High. If all mitigation measures are followed this impact could be reduced.	
	(2) Slope failure of HLP / waste rock dump resulting in exposure of PAF leached ore / mine waste to surface water runoff.	5	3	4.0	3	3.5	0.6	2.1	Medium	Low	(1) Correct design of HLPs / waste rock dumps to reduce risk of slope failure. (2) Monitoring and maintenance of HLP / waste rock dump batter slopes. (3) Development of procedures to clean up spilt leached ore. (4) Adoption of closure batter slopes for long term stability and erosion resistance.	
AIR QUALITY												
Exceedance of health screening guidelines for ground level concentrations of dust	(1) Movement of vehicles and machinery and entrainment from exposed surfaces	3	4	3.5	4	3.8	1.0	3.75	Medium	Medium	(1) Regular spraying of haul roads. (2) Implementation of dust management plan.	Medium
	(1) Blasting on site for mining.	4	2	3.0	4	3.5	1.0	3.5	Low	High	(1) Management of blasting according to weather conditions. (2) Implementation of dust management plan.	
	(1) Wind blown dust from exposed surfaces	2	4	3.0	4	3.5	1.0	3.5	High	Medium	(1) Planting of vegetation buffer zones. (2) Implementation of dust management plan.	
Exceedance of health screening guidelines for ground level concentrations of SO2, NO2, NO3, DPM and CO.	(1) Exhaust emissions (2) Diesel generators	1	3	2.0	4	3.0	0.2	0.6		Very Low	(1) Options for lowering exhaust emissions should be considered.	

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
Production of Green House Gases	(1) Use of fuel on site by various equipment (2) On-site backup power generation (3) Off-site power generation	1	5	3.0	3	3.0	1.0	3	Medium	Medium	(1) Use of low sulphur fuel. (2) Use of high efficiency motors and engines. (3) Monitoring fuel usage and engine performance. (4) Use of renewable energy (e.g. hydro-power).	
Exceedence of health screening guidelines for ground level concentrations of sulphuric acid	(1) Acid mist from HLPs	4	4	4.0	4	4.0	0.8	3.2	Medium	Medium	(1) Use of HLP dripper irrigation (2) Minimum set back from HLPs for villages (3) Consideration of wind direction and strength during operation of irrigation system.	
NOISE & VIBRATION												
Disturbance of noise receptors during the day	(1) Movement of machinery and vehicles	3	4	3.5	4	3.8	1.0	3.75	Medium	Medium	(1) Use of noise buffers in critical areas and around perimeter. (2) Control of working hours. (3) Relocation of receptors. (4) Monitoring of noise levels near sensitive receptors.	High
	(1) Blasting	4	4	4.0	4	4.0	1.0	4	Medium	High	(1) Management of blasting (timing/size). (2) Notification of receptors regarding blast times. (3) Monitoring of noise levels near sensitive receptors.	
Disturbance of noise receptors at night	(1) Movement of vehicles, machinery and mechanical operation of plant components (e.g. crushers)	4	4	4.0	4	4.0	1.0	4.0	Low	High	(1) Limit the operational activities as night to that which is absolutely necessary to complete the project within schedule. (2) Limit the operational activities spacially at night to reduce noise disturbance of receptors. (3) Monitoring of noise levels near sensitive receptors.	
Disturbance to receptors due to blast vibrations	(1) Blasting associated with open pit mining	4	4	4.0	4	4.0	1.0	4.0	Medium	Medium	(1) Management of blasting (timing/size) (2) Notification of receptors regarding blast times. (3) Monitoring of vibration levels near sensitive receptors.	
BIODIVERSITY												
Loss of habitat	(1) Development of infrastructure and the pit	3	4	3.5	2	2.8	1.0	2.75	Medium	Low	(1) Balance of primary woodland within the proposed mining area is to be demarcated and protected from damage. (2) Implementation of reforestation plan for balance of primary woodland. (3) Planting and management of vegetation buffer areas around the site boundary and within the site.	Medium
	(1) Fire damage	2	4	3.0	3	3.0	0.2	0.6		Very Low	(1) Installation of fire suppression systems on large equipment. (2) Monitoring of tyre temperatures to guard against tyre fires. (3) Public awareness campaigns. (4) Strict enforcement of OHSM policies and procedures.	
Loss of aquatic life	(1) Change in water quality	4	5	4.5	4	4.3	0.6	2.55	Medium	Medium	(1) Implement measures for the protection of water quality and the separation of clean and dirty water. (2) Implementation of the Surface Water Management Plan.	
	(2) Change in flow regimes	2	5	3.5	3	3.3	0.6	1.95	Medium	Low	(1) Ecological reserve determination to be undertaken for the catchments downstream of the site.	
Increased pressure on ecological services	(1) Increased collection of fuel wood associated with influx of people	3	4	3.5	4	3.8	1.0	3.8	Low	High	(1) Implement measure to reduce influx of work seekers into the area. (2) MWMCL together with district authorities to implement re forestation projects. (3) Development of alternative fuel sources. (4) Development of a natural resource management plan.	
	(1) Bio-ethnology (loss of traditionally used plants and medicinal resources due to site access restrictions)	3	4	3.5	4	3.8	1.0	3.8	Low	High	(1) Finding and managing alternative sources of plants and herbs for foor and medicine. (2) Developing alternative sources.	

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
Spread of invasive weeds and pest species	(1) Movement of machinery and vehicles spreading seeds	2	4	3.0	3	3.0	0.8	2.4	Low	Medium	(1) Vehicle clean downs prior to entering the site. (2) Alien invasive species management programme to be implemented.	
	(1) Importation of materials	2	4	3.0	2	2.5	0.8	2	Low	Low	(1) Inspection of containers prior to entry of site. (2) Alien invasive species management programme to be implemented.	
Vegetation clearance and loss of plant productivity	(1) Influx of persons into the area (work-seekers and service providers) requiring fuel and land	3	4	3.5	4	3.8	1.0	3.75	Low	High	(1) Sensitive habitats in the mining area to be protected from disturbance by surrounding communities. (2) MWMCL will implement measures to reduce influx of work seekers into the area. (3) MWMCL together with district authorities will implement reforestation projects. (4) Development of alternative fuel sources.	
	(2) Die back of vegetation due to dust fallout	2	4	3.0	4	3.5	0.6	2.1	Medium	Medium	(1) Implementation of the Dust Management Plan.	
Disturbance to rare or endemic fauna	(1) Traffic (road kill) (2) Noise	1	4	2.5	4	3.3	0.6	1.95	Low	Low	(1) Relocation of fauna if found on site.	
CULTURAL HERITAGE												
Disturbance of cemeteries and grave sites	(1) Development of open pit, waste rock dumps, soil stockpiles, dams and HLPs	2	4	3.0	3	3.0	0.1	0.3	High	Very Low	(1) Site survey to be undertaken to accurately map and identify all burial sites prior to disturbance of any area. (2) Relocation of sites in accordance with legislative requirements and in consultation with descendants and Tribal Authorities. (3) Only sites in footprint areas to be disturbed, remaining sites to be mapped, demarcated and protected.	Low
Disturbance of archaeological sites	(1) Development of open pit, waste rock dumps, soil stockpiles, dams and HLPs	1	4	2.5	2	2.3	0.1	0.2	Medium	Very Low	(1) Site survey to be undertaken to map all sites prior to disturbance of any area. (2) Phase II survey for the excavation and documentation of all sites to be disturbed. (3) Only sites in footprint areas to be disturbed, remaining sites to be mapped, demarcated and protected.	
Disturbance of cultural sites	(1) Development of open pit, waste rock dumps, soil stockpiles, dams and HLPs	3	4	3.5	2	2.8	1.0	2.75	High	Medium	(1) Negotiate relocation requirements with the regulator and the community.	
VISUAL												
Disturbance of view scape	(1) Development of pit (2) Development of waste dumps. (3) HLP development	4	5	4.5	4	4.3	1.0	4.25	Medium	High	(1) Progressive rehabilitation of inactive areas of waste rock dumps and stockpiles. (2) Planting of vegetation buffers to screen infrastructure.	Medium
Light and nightglow	(1) Lighting masts	1	4	2.5	2	2.3	1.0	2.25	Medium	Medium	(1) Minimise use of high lighting masts (2) Direct lights towards areas of work. (3) Lights to be provided with hoods to reduce light spill.	
SOCIO-ECONOMICS												
NEGATIVE IMPACTS												
Influx of persons into the area	(1) Job seekers and persons attracted to economic benefits	1	4	2.5	4	3.3	0.8	2.6	High	Low	(1) Support local leadership in managing influx of persons. (2) Preference to be given to local community in employment. (3) MWMCL to provide housing and transport for persons from outside the immediate area. (4) Employment strategy to be clearly communicated by MWMCL and persons discouraged from moving to the area.	
Increased safety risk to road users	(1) Operations traffic to and from site (2) Increased traffic due to increased population	3	4	3.5	5	4.3	1.0	4.25	Low	High	(1) Access route to the site will be upgraded in accordance with project proposal. (2) Traffic safety awareness programme to be put in place for communities along the access road. (3) Warning signage to be put in place along the route. (4) Fencing to be put in place adjacent to schools along the route from Pakoku and exit/entry points are to be clearly demarcated. (5) Transport driver training (6) Use of only safe and serviced vehicles (7) Promotion of road safety (8) Drug and alcohol testing of drivers. (9) Restricted working hours for drivers and adequate rest breaks	

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
Increase in the spread of communicable disease (including HIV/AIDS)	(1) Influx of persons into the area (work-seekers and service providers)	2	4	3.0	5	4.0	0.8	3.2	Medium	Medium	(1) MWMCL to develop a Sexually Transmitted Infections Education Policy and to enforce this on all contract workers. (2) An integrated community awareness plan (in collaboration with government) on to be put in place prior to construction. (3) Implement measures to discourage influx of persons into the area. (4) MWMCL to provide support to local health centres. (5) Provision of free condoms (6) Sanitation (7) Management of accommodation camps	Medium
Proliferation of disease causing species e.g. malaria and bilharzia	(1) Standing water	3	4	3.5	4	3.8	0.8	3	Medium	Low	(1) Standing water will be managed and minimised and treated to avoid mosquitoes. (2)No swimming to be allowed within mine dams including the clean water dam. (3) Malaria prevention measures to be implemented at mine residences. (4) Community education on the spread of diseases such as malaria and bilharzia. (5) Investigation of natural pest species controls. (6) Provision of mosquito nets and repellant.	
Increase in crime (including theft and prostitution)	(1) Influx of persons and increase in financial resources	2	4	3.0	4	3.5	0.5	1.75	Low	Low	(1) MWMCL to provide support to local policing structures, as appropriate. (2) Implement measures to prevent influx of persons into the area. (3) Enforcement of a code of conduct in accommodation camps and villages.	
Increased safety risk due to fly rock from blasting	(1) Mining - blasting of hard rock for the pit	4	3	3.5	2	2.8	0.4	1.1	High	Low	(1) Enforcement of the blast exclusion zone. (2) Proper blast design. (3) Use of blast warning system.	
Increased safety risk due to WRD rockfalls or land slips	(1) Slope instability (2) Inappropriate dumping practises. (3) Proximity of villages and the public to the WRDs (4) Proximity of site facilities to waste dumps	4	5	4.5	2	3.3	0.4	1.3	High	Very Low	(1) Safety set backs from roads and villages. (2) Exclusion of non essential personel and the general public. (3) Batter slopes designed with acceptable factors of safety. (4) Monitoring and inspection of waste rock dumps.	
Increased safety risk due to explosion of hazardous / flammable materials	(1) SX/EW Plant (2) Explosives magazines (3) Fuel Storage	4	4	4.0	4	4.0	0.4	1.6	High	Low	(1) Construction of blast walls and bunding. (2) Internal fire suppression systems. (3) Separation distances for the explosives magazine. (4) Segregation of incompatible hazardous materials.	
Increased safety risk due to bush fire	(1) Vehicles and machinery (2) Cigarette butts (3) Vehicle tyre fires	3	4	3.5	4	3.8	0.2	0.75		Very Low	(1) Installation of fire suppression systems on large equipment. (2) Monitoring of tyre temperatures to guard against tyre fires. (3) Public awareness campaigns. (4) Strict enforcement of OHSM policies and procedures.	
Economic inequality due to comparative high wage of locals employed at the mine	(1) Cost of local goods and services increase	2	4	3.0	4	3.5	0.8	2.8	Low	Medium	(1) Micro financing for non mine personnel. (2) Development of new industries in the area outside of the mine. (3) Improvement of farming practises to increase productivity.	

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
POSITIVE IMPACTS												
Economic benefits to local community	(1) Employment of local persons	3	4	3.5	4	3.8	0.8	3.0	Medium	Moderate Positive	(1) Preference to be given to local persons for employment. (2) Local skill base to be developed (training programmes). (3) Management commitment to promote locals with long term view of replacing ex-pats with locals.	Low Positive
	(2) Local procurement	1	4	2.5	4	3.3	0.6	2.0	Medium	Low Positive	(1) Preference given to local services providers and suppliers of goods. (2) Training and advice (and microfinancing to be investigated).	
	(3) Improved access to markets	3	5	4.0	2	3.0	0.6	1.8	Low	Low Positive	(1) Provision of training to develop skills	
Improved infrastructure (Sanitation, Electricty, Water, Fuel supply)	(1) Infrastucture of villages maintained and upgraded	3	4	3.5	3	3.3	0.6	2.0	Low	Low Positive	(1) Maintenance of infrastructure by MWMCL. (2) Commitment of management and government to the continuous development of the regions infrastructure.	
Improved housing conditions	(1) Upgrade of existing village housing (2) Improved income.	3	4	3.5	2	2.8	0.2	0.6	Low	Very Low Positive	(1) Commitment of management and government to the improvement of local housing standards. (2) Assistance with financial management and housing aid.	
Improved Road Infrastructure	(1) Upgrade of roads and intersections	3	4	3.5	4	3.8	0.8	3.0	Medium	Moderate Positive	(1) Upgrading of roads to dual lane. (2) Improving road intersections to accommodate heavy traffic. (3) Commitment of government to progressive upgrading of road network.	
Improved Provision of Medical Services	(1) Construction of additional clinics in surounding area. (2) Continued hiring of trained medical professionals.	3	5	4.0	3	3.5	0.8	2.8	Medium	Moderate Positive	(1) Community and social development program to be continued. (2) Training and recruitment of medical staff to the project area through the provision of scholarships. (3) Provision of medical supplies and equipment. (4) Upgrading clinic(s) to hospital standard facility. (5) Improve ratio of doctors to population and reducing travel distance for basic medical services. (6) Provision of pre and post natal services and family planning services. (7) Provision of nutritional advice.	
Benefit to regional economy	(1) Purchase of goods and services in the Monywa regional centres	1	5	3.0	4	3.5	0.2	0.7	Low	Very Low Positive	(1) Preference to be given to local services providers and suppliers of goods, where practicable. (2) Develop governance capacity within local government institutions.	
Benefit to the national economy	(1) In accordance with agreement with national government	1	4	2.5	5	3.8	0.6	2.3	Medium	Moderate Positive	(1) In accordance with Development Agreement	
Benefit to the local community due to improved education and training opportunities	(1) Employment and skills training (2) Building of new schools (3) Local employment opportunities associated with CSD programs and local industry	2	4	3.0	3	3.0	0.6	1.8	Low	Very Low Positive	(1) Follow commitments to employment, local supply and CSD plan.	

Table 7.2.1(c): Closure Phase Environmental and Social Risk Matrix

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Duration	Severity	Extent	Consequence	Probability	Impact Significance			Mitigation Measures	Overall Significance
								Without Mitigation	Mitigation Confidence	With Mitigation		
CLOSURE PHASE												
TOPOGRAPHY												
Change in landform and landscape character	(1) Establishment of permanent pit lake	3	5	4.0	3	3.5	1.0	3.5	Medium	Medium	(1) Vegetation screens and bunds around pit. (3) Maintenance and management of rehabilitated and revegetated areas.	Medium
	(2) Establishment of permanent dams, and revegetated heaps and waste rock dumps dumps	3	5	4.0	3	3.5	1.0	3.5	Medium	Medium	(1) Rehabilitation of HLPs and WRDs prior to closure. (2) Vegetation screens around HLPs and dams. (3) Maintenance and management of rehabilitated and revegetated areas.	
SOILS												
Soil contamination	(1) Leakage or spillage of hazardous chemicals including hydrocarbons during closure phase	3	3	3.0	1	2.0	1.0	2	High	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater. (2) Monitor groundwater quality in the proximity of potential pollution sources.	High
	(2) Long term Acid rock drainage (ARD) and metal leaching associated with waste rock dumps	4	5	4.5	3	3.8	1.0	3.75	Low	High*	(1) Monitoring and maintenance of long term cover system. (2) Restrict access to revegetated WRDs and manage post closure land usage to prevent erosion damage to the cover due to clearing or over grazing. *Current mitigated impact significance is still High. If all mitigation measures are followed impact could be lowered.	
	(3) Long term ARD and metal leaching associated with HLPs.	4	5	4.5	3	3.8	1.0	3.75	Medium	High*	(1) Monitoring and maintenance of long term cover system. (2) Restrict access to revegetated WRDs and manage post closure land usage to prevent erosion damage to the cover due to clearing or over grazing. *Current mitigated impact significance is still High. If all mitigation measures are followed impact could be lowered.	
	(4) SX/EW Plant	4	4	4.0	2	3.0	0.6	1.8	Medium	Low	(1) Care taken during decomissioning to prevent any spills or release of contaminants.	
	(5) Solution ponds, stormwater ponds and waste water ponds.	4	4	4.0	3	3.5	0.8	2.8	Medium	Medium	(1) Careful decommisioning and management of contaminated water and sediment.	
	(6) Slope failure of HLP leading to an uncontrolled release of leached ore.	4	4	4.0	2	3.0	0.6	1.8	Medium	Low	(1) Correct closure design of HLPs to reduce risk of slope failure. (2) Ongoing monitoring and maintenance of HLP batter slopes. (3) Development of procedures to clean up spilt leached ore. (3) Adoption of closure batter slopes for long term stability.	
GROUNDWATER												
Contamination of groundwater resources	(1) Seepage from HLPs or waste rock dumps	3	5	4.0	4	4.0	1.0	4	Low	High*	(1) Full compliance with EMPS. (2) Placement of an appropriate cover system to reduce infiltration into the HLPs and WRDs and provide a growth medium suitable for rehabilitation. (3) Flushing of HLPs with freshwater in order to reduce amount of free acid in the heaps. (4) Post-Closure Care and Maintenance Plan to be developed and implemented. *Current mitigated impact significance is still High. If all mitigation measures are followed impact could be lowered.	
	(2) Leakage or spillage of hazardous chemicals including hydrocarbons during closure phase	3	3	3.0	2	2.5	0.8	2	Medium	Low	(1) All hazardous chemicals are to be stored and handled in facilities that are engineered to prevent spillage or seepage of contaminants into groundwater. (2) Monitor groundwater quality in the proximity of potential pollution sources.	
	(3) Seepage of contaminated water from the pit lake	5	5	5.0	4	4.5	0.6	2.7	Low	Medium	(1) Minimise catchment area of the pit. (2) Maintain pit lake elevation below that of adjacent aquifers to ensure that pit is maintained as a groundwater sink.	

SURFACE WATER (HYDROLOGY AND RIVERS)											
Loss of catchment yield	(1) Containment of storm water run-off (2) Change in creek hydrology	2	3	2.5	3	2.8	1.0	2.75	Medium	Medium	(1) Reserve determination for the downstream users to be determined and water supply to the catchment to be managed to ensure that the water requirements are met. (2) Installation of alternative water supplies. (3) Decomissioning of ponds and release of stormwater to environment where quality is within suitable limits. (4) Hand over of ponds for agricultural use when water quality is acceptable.	High
Contamination of rivers and watercourses	(1) Dirty water run-off from waste rock dumps and HLPs	2	3	2.5	4	3.3	1.0	3.25	Low	High*	(1) Maintenance of sediment control ponds after closure to detain runoff long enough for sediment to fall from suspnesion prior to release. (2) Installation of passive water treatment wetland system to deal with low pH seepage. (3) Post-Closure Care and Maintenance Plan to be developed and implemented. *Current mitigated impact significance is still High. If all mitigation measures are followed impact could be lowered.	
	(2) Slope failure of HLP / waste rock dump resulting in exposure of PAF leached ore / mine waste to surface water runoff.	5	5	5.0	3	4.0	0.8	3.2	Medium	Medium	(1) Correct design of HLPs / waste rock dumps to reduce risk of slope failure. (2) Ongoing monitoring and maintenance of HLP / waste rock dump batter slopes. (3) Development of procedures to clean up spilt leached ore. (4) Adoption of closure batter slopes for long term stability and erosion resistance. (5) Post-Closure Care and Maintenance Plan to be developed and implemented. *Current mitigated impact significance is still High. If all mitigation measures are followed impact could be lowered.	
AIR QUALITY											
Exceedance of health screening guidelines for ground level concentrations of dust	(1) Movement of vehicles and machinery and entrainment from exposed surfaces during closure phase	2	3	2.5	4	3.3	0.8	2.6	Medium	Low	(1) Surface wetting of haul roads. (2) Dust management plan.	Low
	(1) Wind blown dust from exposed surfaces	2	3	2.5	4	3.3	0.8	2.6	High	Low	(1) Continued management of vegetation buffer zones. (2) Dust management plan.	
Exceedance of health screening guidelines for ground level concentrations of SO2, NO2, NO3, DPM and CO.	(1) Exhaust emissions during closure phase	1	3	2.0	4	3.0	0.2	0.6		Very Low	(1) Options for lowering exhaust emissions should be considered.	
Production of Green House Gases	(1) Use of fuel on site by various equipment during closure phase (2) On-site backup power generation (3) Off-site power generation	1	2	1.5	2	1.8	1.0	1.75	Medium	Low	(1) Use of low sulphur fuel. (2) Use of high efficiency motors and engines. (3) Monitoring fuel usage and engine performance.	

NOISE & VIBRATION											
Disturbance of noise receptors during the day	(1) Movement of machinery and vehicles during closure phase	1	3	2.0	4	3.0	1.0	3	Medium	Low	(1) Construction of noise buffers in critical areas and around site perimeter. (2) Control working hours. (3) Relocation of receptors. (4) Monitoring of noise levels near sensitive receptors.	Low
BIODIVERSITY											
Loss of habitat	(1) Fire damage to forested and rehabilitated areas during closure phase	2	3	2.5	3	2.8	0.2	0.55		Very Low	(1) Installation of fire suppression systems on large equipment. (2) Monitoring of tyre temperatures to guard against tyre fires. (3) Public awareness campaigns. (4) Strict enforecment of OHSM policies and procedures.	Low
Loss of aquatic life	(1) Change in water quality	4	5	4.5	4	4.3	0.6	2.55	Medium	Medium	(1) Implement measures for the protection of water quality and the separation of clean and dirty water. (2) Installation of passive water treatment options such as wetlands to treat runoff.	
	(2) Change in flow regimes	2	5	3.5	3	3.3	0.6	1.95	Medium	Low	(1) Ecological reserve determination to be undertaken for the catchments downstream of the site.	
Increased pressure on ecological services	(1) Bio-Ethnology (loss of traditionally used natural food and medicinal resources)	2	4	3.0	4	3.5	0.8	2.8	Low	Medium	(1) Revegetation of rehabilitated areas of the site with traditional plants and medicinal herbs.	
Spread of invasive weeds and pest species	(1) Movement of machinery and vehicles spreading seeds during closure phase	1	3	2.0	3	2.5	0.8	2	Low	Low	(1) Vehicle clean downs prior to entering the site (2) Alien invasive species management programme to be implemented	
	(1) Importation of materials during closure phase	1	3	2.0	2	2.0	0.8	1.6	Low	Low	(1) Inspection of containers prior to entry of site (2) Alien invasive species management programme to be implemented	
Development of protected vegetation areas	(1) Establishment of forested and revegetated parts of project area	1	4	2.5	2	2.3	0.8	1.8	Low	Very Low Positive	(1) Development of forestry management plans to prevent over utilisation of revegetated areas, particularly excessive harvesting of firewood.	
VISUAL											
Disturbance of view scape	(1) Establishment of permanent pit lake (2) Establishment of permanent waste rock dumps (3) Establishment of permanent HLP heaps	2	5	3.5	4	3.8	1.0	3.75	Medium	Medium	(1) Progressive rehabilitation of inactive areas of waste rock dumps. (2) Rehabilitation of HLP heaps at closure. (3) Planting of vegetation buffers to screen infrastructure.	Medium

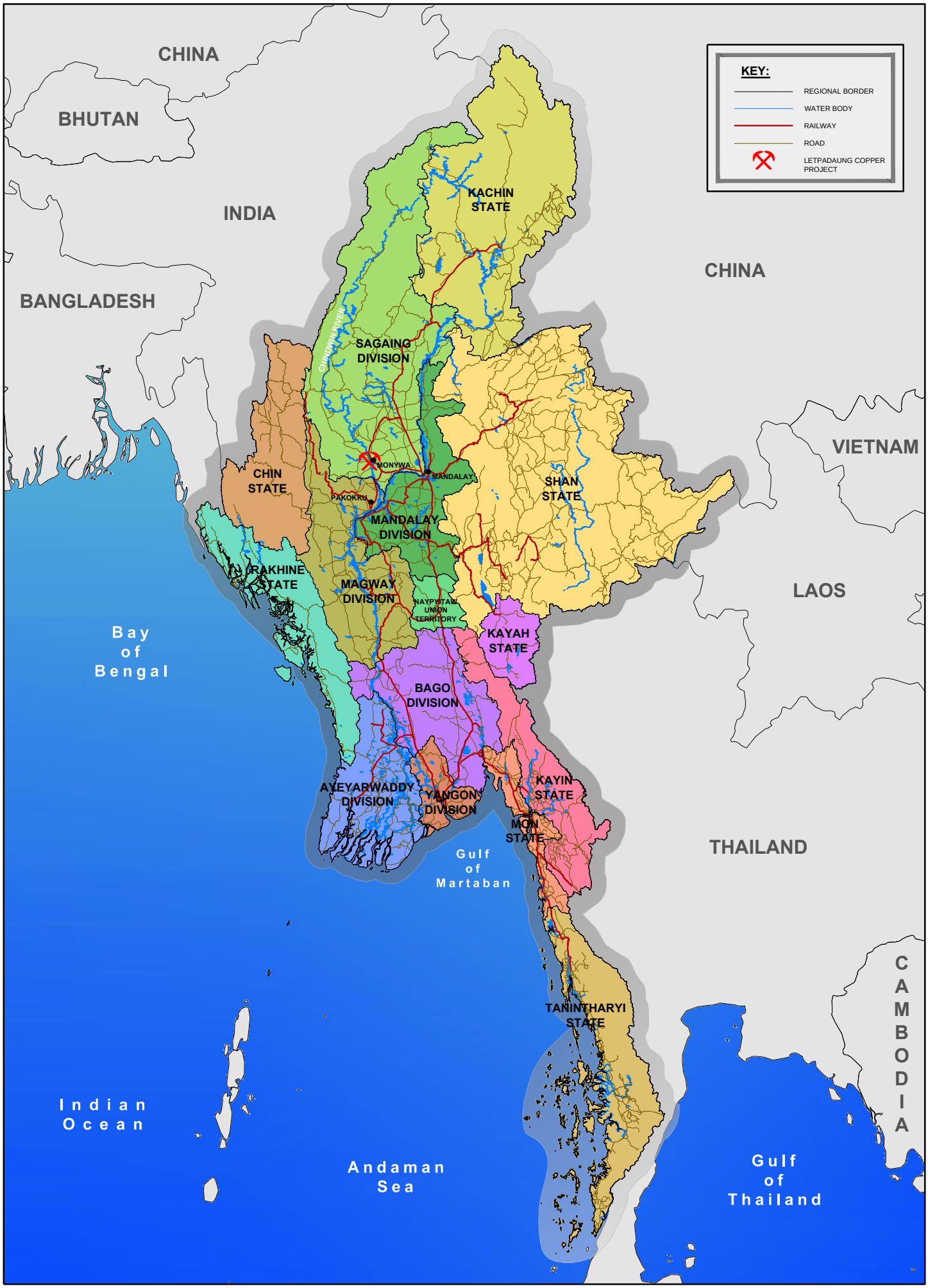
SOCIO-ECONOMICS											
NEGATIVE IMPACTS											
Loss of jobs	(1) Direct loss of jobs at mine after operations cease (2) Indirect loss of jobs in surrounding area from industries linked to mine and mine employees	3	5	4.0	3	3.5	1.0	3.5	Medium	High	(1) Development of alternate industries capable of absorbing mine site employees.	Medium
Proliferation of Disease Causing Species e.g. malaria and bilharzia	(1) Standing water (2) Passive water treatment wetlands	3	4	3.5	4	3.8	0.8	3	Medium	Low	(1) Standing water will be managed and minimised and treated to avoid mosquitoes. (2) No swimming to be allowed within mine dams including the clean water dam. (3) Malaria prevention measures to be implemented at mine residences. (4) Community education on the spread of water borne diseases such as malaria and bilharzia. (5) Investigation of natural pest species controls. (6) Mosquito nets and repellant.	
Increased safety risk due to WRD rockfalls or land slips	(1) Slope instability (2) Proximity of villages and the public to the waste dumps	4	5	4.5	2	3.3	0.4	1.3	High	Very Low	(1) Safety set backs from roads and villages (2) Exclusion of non essential personel and the general public. (3) Batter slopes designed with acceptable factors of safety. (4) Monitoring and inspection of waste rock dumps. (5) Adoption of closure batter slopes for increased stability.	
Increased safety risk due to pit lake	(1) Local people and livestock could fall into the pit. (2) Pit wall instabillity	3	5	4.0	2	3.0	0.4	1.2		Low	(1) Restrict access through the installation of a 2 m bund wall around the full pit perimeter outside the area of potential future instability. (2) Installation of warning signs.	
Increased safety risk due to bush fire	(1) Vehicle and machinery use during closure phase (2) Cigarette butts (3) Tyre fires	3	4	3.5	4	3.8	0.2	0.75		Very Low	(1) Installation of fire suppression systems on itmes of large equipment. (2) Monitoring of tire temperatures to guard against tire fires. (3) Public awareness campaigns. (4) Strict enforecment of OHSM policies and procedures.	
Loss of land for agriculture and traditional livelihood	(1) Rehabilitated WRDs and HLPs unsuitable for grazing or cultivation of crops due to potential for damage to cover system	2	5	3.5	3	3.3	1.0	3.25	Low	Medium	(1) Slackening of closure slopes. (2) Installation of a more robust capping system. (3) In development of the mine closure plan, the local community shall be consulted to agree a suitable end land use for the various landforms within the site and the design of the closure plan will take into account the agreements with the community and a cost provision will be made to account for those end land uses.	

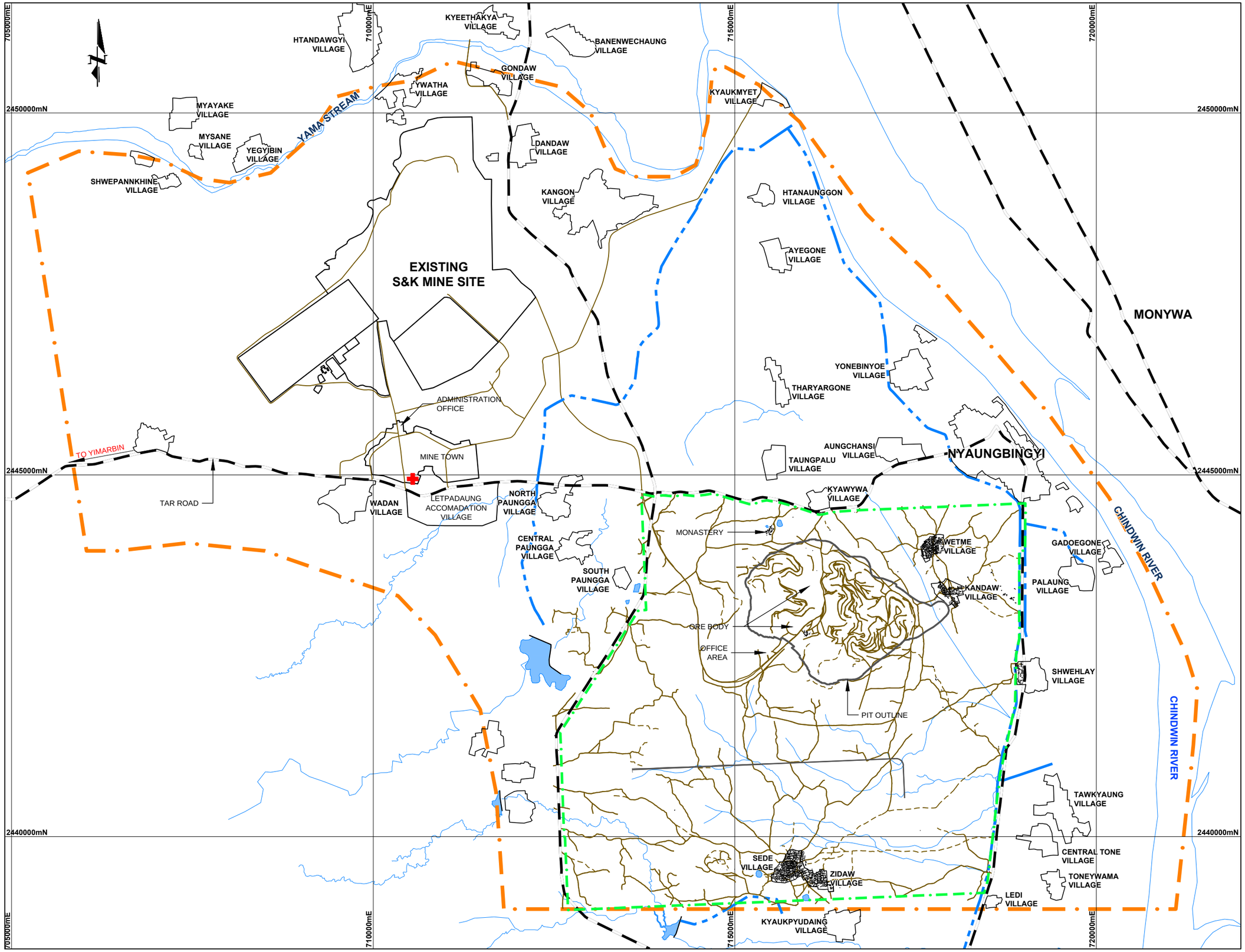
POSITIVE IMPACTS												
Economic benefits to local community	(1) Employment of local persons during closure phase	1	3	2.0	2	2.0	0.8	1.6	Medium	Low Positive	(1) Preference to be given to local persons for employment. (2) Local skill base to be developed (training programmes).	**Very Low Positive**
	(2) Local procurement of materials and services required during mine closure.	1	3	2.0	4	3.0	0.6	1.8	Medium	Low Positive	(1) Preference will be given to local services providers and suppliers of goods. (2) Training and advice (microfinance will also be investigated.)	
	(3) Improved access to markets	1	4	2.5	2	2.3	0.6	1.4	Low	Very Low Positive	(1) Provision of training to develop skills	
	(4) Development of sustainable alternative industries to maintain local economy after mine closure	1	5	3.0	4	3.5	0.5	1.8	Low	Very Low Positive	(1) Consultation with local community to identify potential alternative industries and businesses. (2) Development of alternative industries and businesses prior to closure with MWMCL sponsorship of education and training.	
Improved infrastructure (Sanitation, Electricty, Water, Fuel supply)	(1) Ongoing maintenance of village infrastucture	2	5	3.5	3	3.3	0.6	2.0	Low	Very Low Positive	(1) Maintenance of infrastructure by district shire. (2) Maintenance of the regional infrastructure to be included in mine closure plan.	
Improved housing conditions	(1) Maintenance of existing village housing. (2) Improved income.	2	5	3.5	2	2.8	0.2	0.6	Low	Very Low Positive	(1) Commitment of management and government to the long term maintenance of local housing standards. (2) Maintenance of local housing to be included in mine closure plan.	
Improved Road Infrastructure	(1) Ongoing maintenance of roads and intersections	2	5	3.5	4	3.8	0.4	1.5	Low	Very Low Positive	(1) Upgrading roads to dual lane roads. (2) Improving road intersections to accommodate heavy traffic. (3) Commitment of government to progressive upgrading of road network.	
Improved Provision of Medical Services	(1) Maintenance of local medical clinics	2	5	3.5	3	3.3	0.4	1.3	Low	Very Low Positive	(1) Commitment of management and government to the long term maintenance of local medical clinics and hospitals. (2) Maintenance of local medical clinics and hospitals to be included in mine closure plan.	

FIGURES

DRAFT

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KEY:
REGIONAL BORDER
WATER BODY
RAILWAY
ROAD
LETPADAUNG COPPER PROJECT
CHINA
BHUTAN
INDIA
BANGLADESH
CHINA
VIETNAM
LAOS
THAILAND
CAMBODIA
KACHIN STATE
SAGAING DIVISION
CHINDWIN RIVER
MONYWA
MANDALAY
PAKOKKU
CHIN STATE
SHAN STATE
MANDALAY DIVISION
RAKHINE STATE
MAGWAY DIVISION
NAYPYITAW UNION TERRITORY
KAYAH STATE
BAGO DIVISION
AYEYARWADDY DIVISION
YANGON DIVISION
KAYIN STATE
MON STATE
TANINTHARYI STATE
Bay of Bengal
Gulf of Martaban
Indian Ocean
Andaman Sea
Gulf of Thailand



LEGEND:

- HOSPITAL
- EXISTING CANAL
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- STUDY AREA EXTENT
- LEASE BOUNDARY

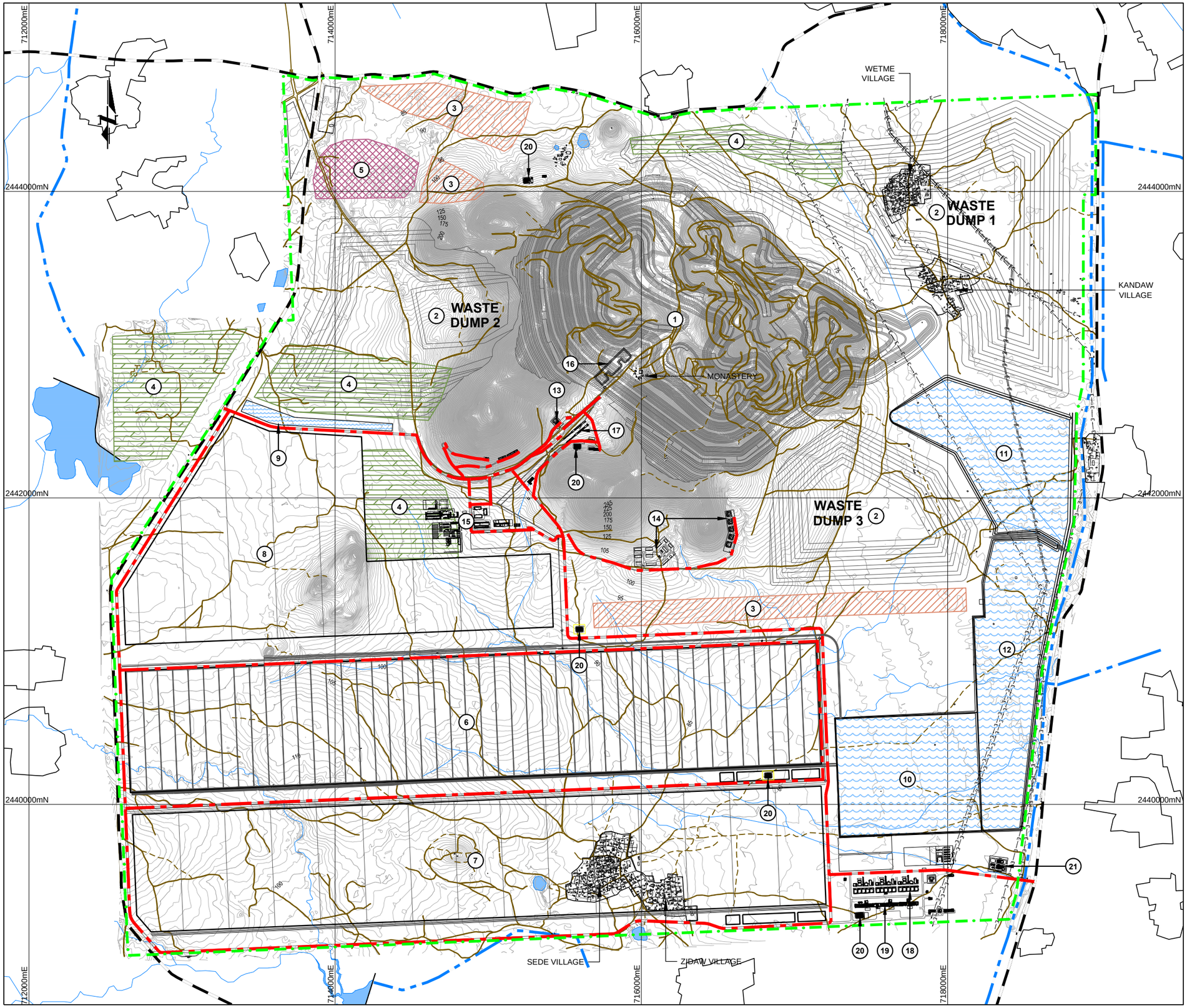
NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.

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LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
PROJECT LOCALITY PLAN

Ref: PE701-00022/13
Figure 1.2.1



LEGEND:

- EXISTING POWER LINE
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG PROJECT LEASE BOUNDARY
- SITE ROAD ALIGNMENT

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 1m CONTOUR INTERVALS SHOWN.

KEY:

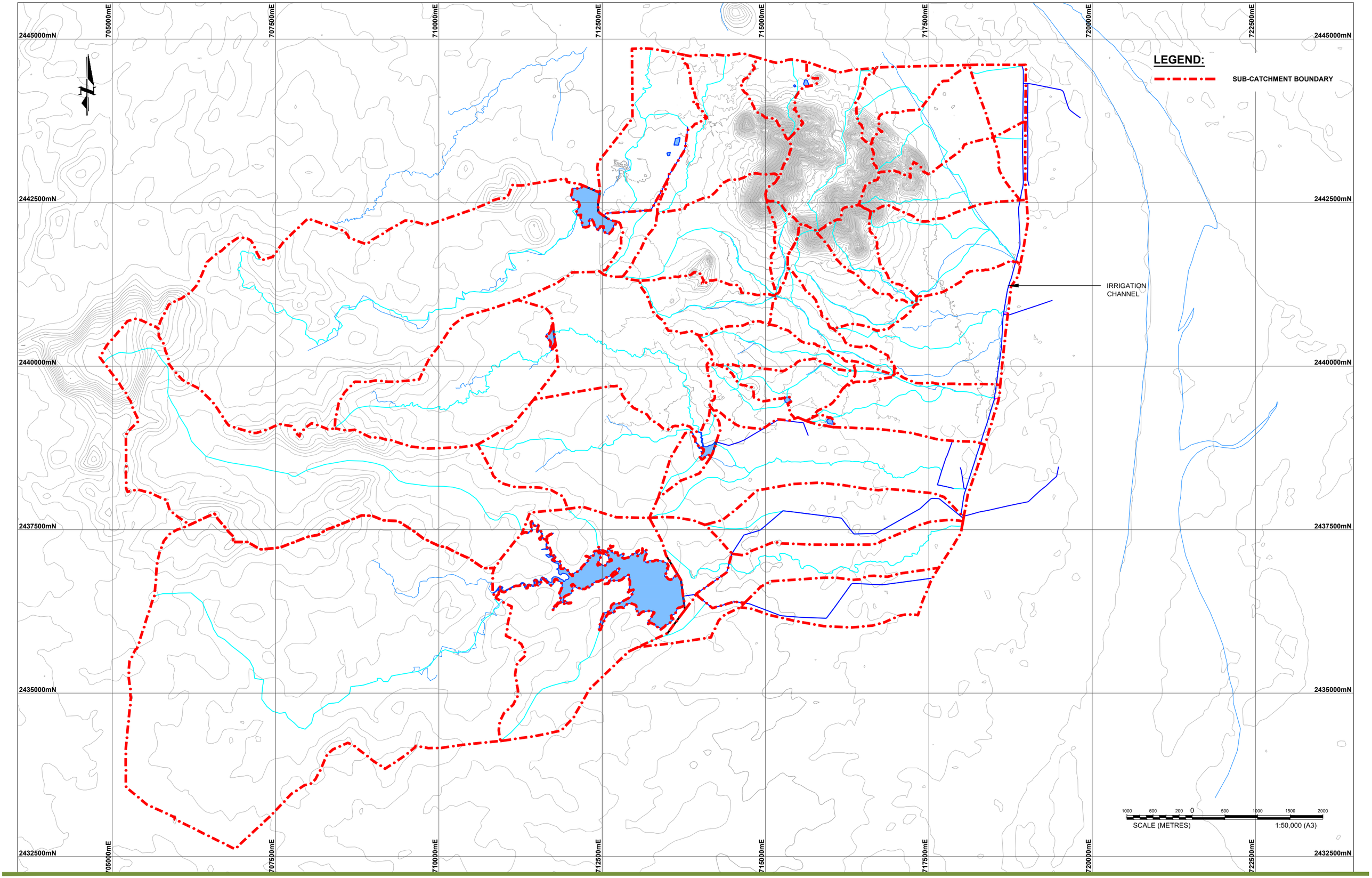
1. PIT
2. WASTE DUMP
3. TOPSOIL STOCKPILE
4. LOW GRADE ORE STOCKPILE
5. RESERVE ORE STOCKPILE
6. HEAP LEACH PAD No.1
7. HEAP LEACH PAD No.2
8. HEAP LEACH PAD No.3
9. WASTE WATER COLLECTION POND
10. HEAP LEACH STORM WATER POND
11. WASTE WATER RESERVOIR (NORTH)
12. WASTE WATER RESERVOIR (SOUTH)
13. FUEL STATION
14. EXPLOSIVES AREA
15. OFFICES/ WAREHOUSES/ MAINTENANCE AREA
16. MOBILE CRUSHER FOR QUARRY
17. CONVEYOR FOUNDATIONS
18. EXTRACTION PLANT
19. ELECTROWINNING PLANT
20. 33Kv SUB STATION
21. 230kV SUB STATION

500 300 100 0 250 500 750 1000
SCALE (METRES) 1:25,000 (A3)

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LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
SITE GENERAL ARRANGEMENT

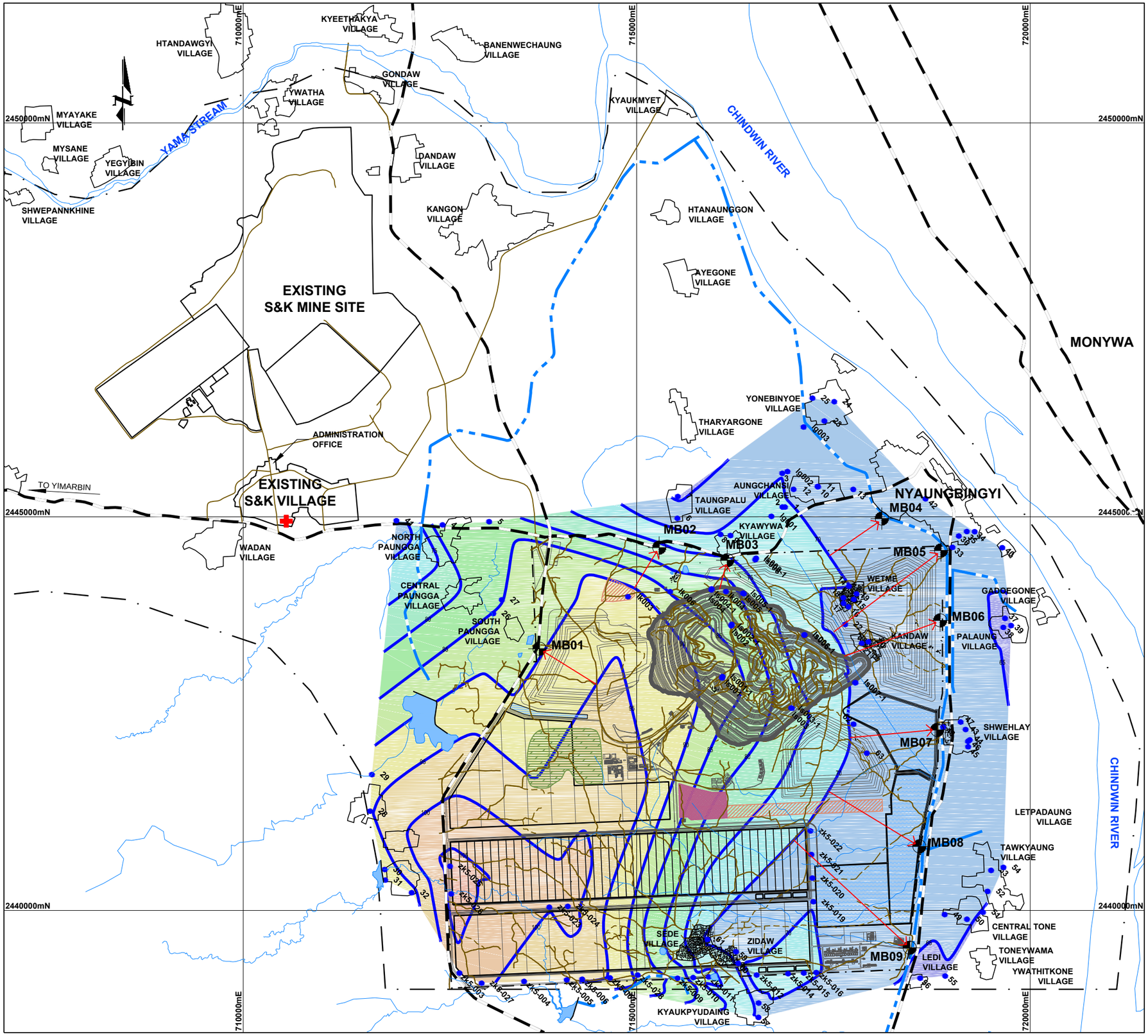
Ref: PE701-00022/13
Figure 1.4.1



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LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
CATCHMENT DELINEATION - EXISTING CONDITIONS

Ref: PE701-00022/13
Figure 4.2.1



LEGEND:

- HOSPITAL
- EXISTING CANAL
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- STUDY AREA EXTENT
- PROJECT AREA BOUNDARY
- BOREHOLE LOCATION
- GROUND WATER CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION
- MONITORING BORE LOCATION

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 1m CONTOUR INTERVALS SHOWN.

LEVELS TABLE

COLOUR CODE	DEPTH (FROM)	DEPTH (TO)
	60	65
	65	70
	70	75
	75	80
	80	85
	85	90
	90	95
	95	100
	100	105
	105	110

AQUIFER THICKNESS

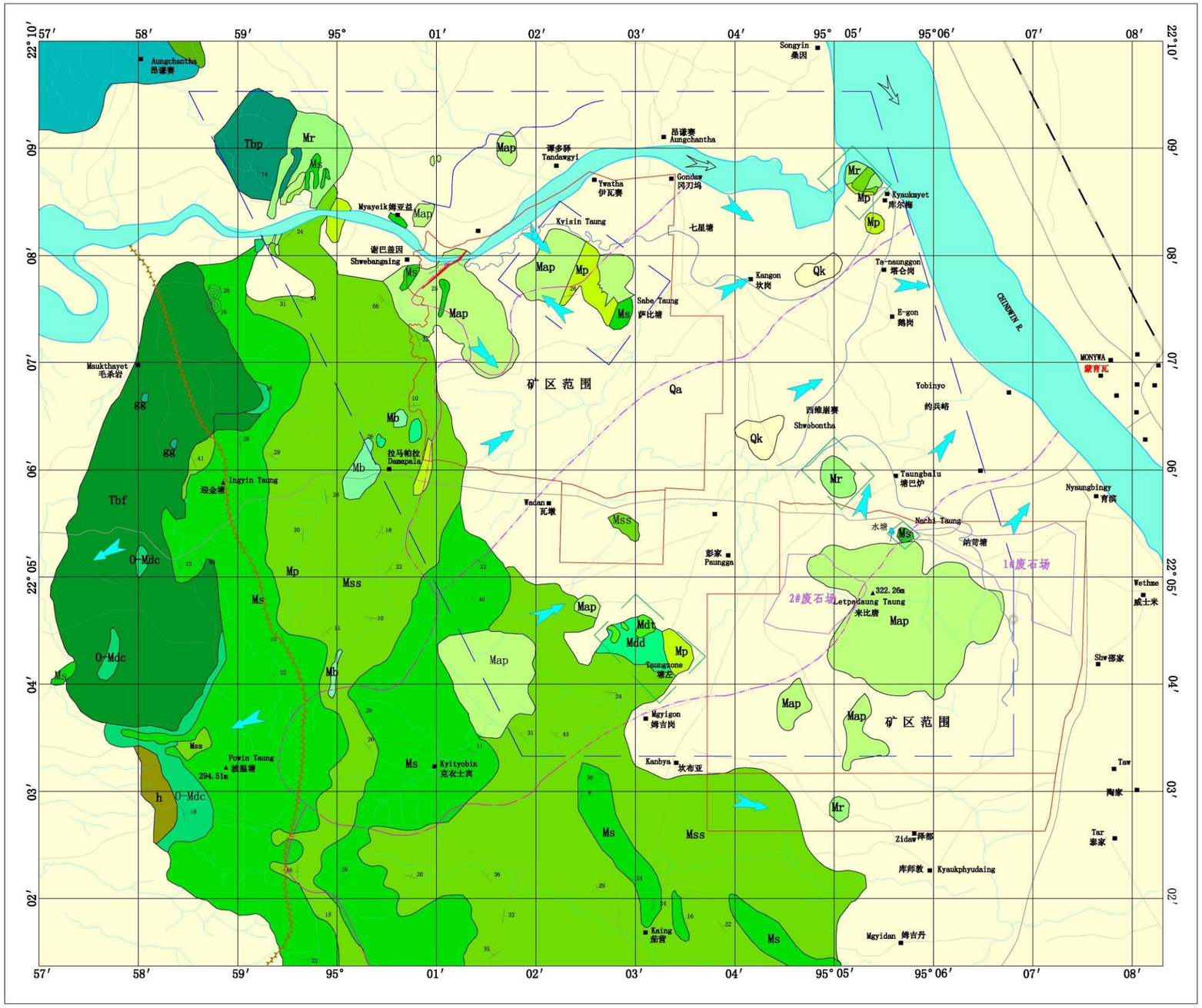
BORE I.D.	EASTING	NORTHING	ELEVATION	AI	CoI	HW	MW	SW
Ig001	716710.7	2445004	71.97		19.42		30.82	
Ig002	716914.7	2445572	69.42		32.1		17.71	
Ig003	717119.8	2446137	67.17		50.09		2.06	
Ik002			-	0.8			171.29	
Ik003	714888.7	2443982	93.41	1.6			148.35	
Ik004	716132.9	2444049	82.84	3.55		110.6	36.13	
Ik005			-	15		35.05	100.21	
Ik006	715424.4	2444047	84.82	4.75		65.91	150.26	
Is001	716082.9	2442952	88.31	3.34		55.51	401.5	
Is001-1	716088.2	2442970	89.1	6.45		60.25	33.85	
Is002	716200.5	2443615	83.13	4.6		45.54	598.46	21.9
Is002-1	716207.7	2443633	83.75	4.3		50.66	45.84	
Is003	716962.7	2442570	77.12	4.55		136.15	309.84	
Is003-1	716971.6	2442567	77.07	3.85		96.73		
Is004	715947.6	2444070	82.57	15.9		4.31	130.29	
Is004-1	715952.7	2444083	82.41	17.32		4.78	78.1	
Is005	716359.5	2444021	79.21	6.97		13.52	132.55	
Is005-1	716351.7	2444029	78.96	3.52		19.68	77.17	
Is006	717127.9	2443494	70.71	12.16		138.05		
Is006-1	717132	2443502	70.4	22.62		77.95		
Is007	717777.1	2442890	69.74		25.44	25.43		
Is007-1	717779.2	2442894	69.95		27.09	23.61		
Is008	716505.6	2444452	71.14		13.8	36.93		
Is008-1	716515.8	2444471	71.36		12.7	38.06		

1000 600 200 0 500 1000 1500 2000
SCALE (METRES) 1:50,000 (A3)

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LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
GROUNDWATER CONTOURS

Ref: PE701-00022/13
Figure 4.3.1



Symbol 图例

Quaternary 第四系

- Qa — Alluvial pore water 冲积砂、砾石，砂质粘土孔隙水
- Qk — Kangon sand, sandstone and conglomerate pore water 坎岗砂岩与砾岩孔隙水
- Qbc — Basaltic conglomerate pore water 玄武质砾岩孔隙水
- Qbb — Olivine basalt blocky lava pore water 含橄榄玄武岩块的熔岩孔隙水

Upper Miocene 上中新统

- Map — Andesite and quartz andesite porphyry crack water 安山岩－英安岩体裂隙水
- Mr — Rhyolite crack water 流纹岩裂隙水

Upper and Middle Miocene 中上中新统

- Mb — Basalt lava, lastics, mudstone boulders pore water 玄武岩流，含碎屑泥岩、漂砾孔隙水
- Mp — Andestic to dacitic pyroclastics, epiclasics crack wate 鞍山质-英安质火山碎屑岩，浅成碎屑岩裂隙水
- Mdt — Dacite boulder debris flow boulders pore water 英安质砾块、碎屑流孔隙水
- Mdd — Dacite lava crack water 英安岩岩流裂隙水

Middle Miocene to LowerMiocene? 中下中新统

- Mss — Sandstone-siltstone alternations, minor pyroclastics crack water 蚀变砂岩-粉砂岩，含少量火山碎屑岩裂隙水
- Ms — Medium-thick bedded sandstone, minor mudstone crack water 中厚层砂岩夹少量泥岩裂隙水

Upper Oligocene and Lower Miocene 上渐新统至下渐新统

- O-Mdc — Gritty sandstone, conglomerate crack water 粗粒砂岩，砾岩裂隙水

Upper Palaeocene? 上古新统

- Pw — Wazin Taung Conglomerate crack water 瓦津塘砾岩裂隙水

达马帕拉组

Upper Cretaceous? 上白垩系

- Kgd — Diorite and granodiorite crack water 闪长岩和花岗闪长岩裂隙水
- Kbg — Biotite granite crack water 黑云母花岗岩裂隙水
- gg — Garnet granite(float) crack water 石榴石花岗岩（上溶带）裂隙水

Middle Cretaceous? 中白垩系

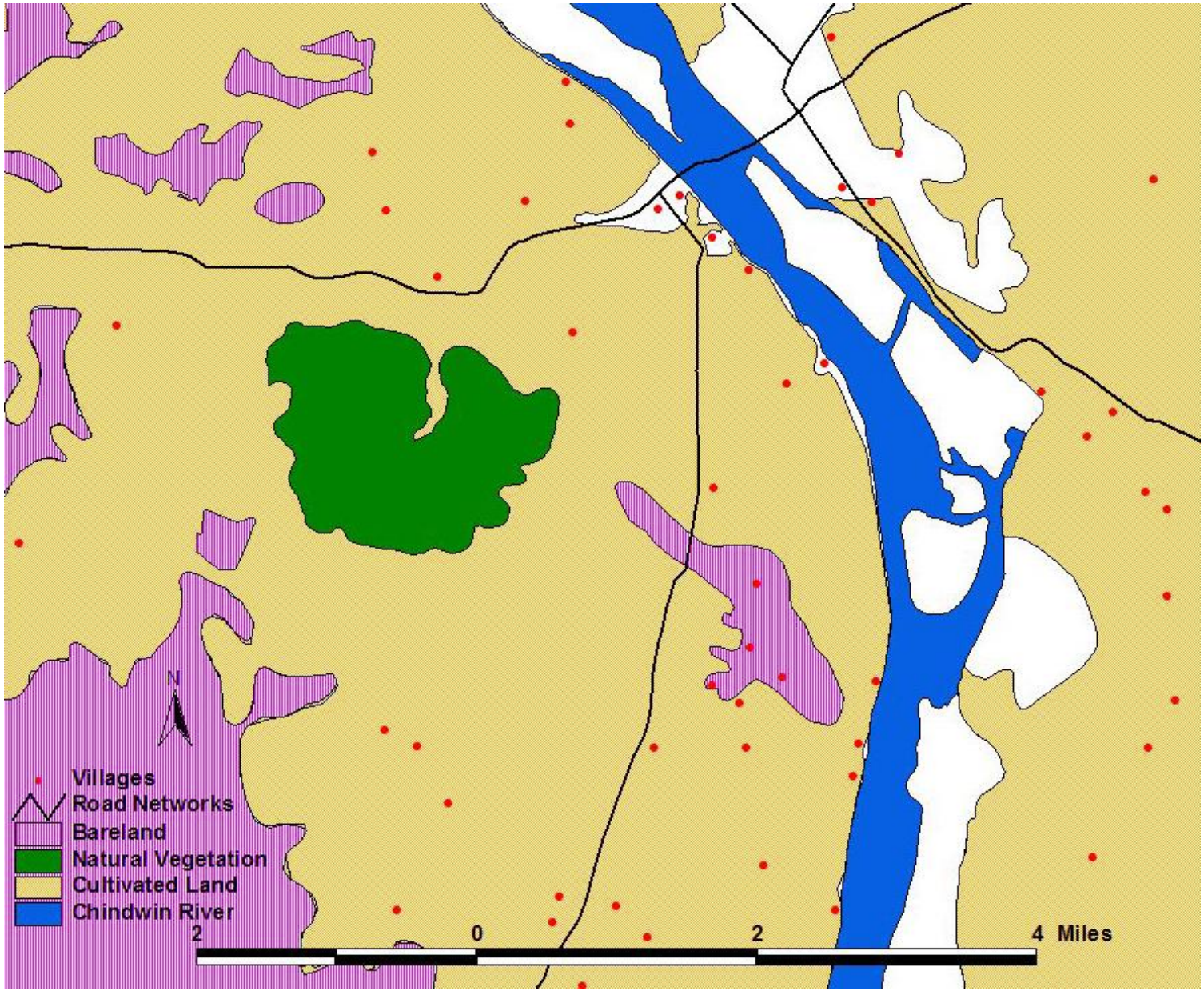
- Km — Micritic limestons crack water 微泥晶灰岩裂隙水

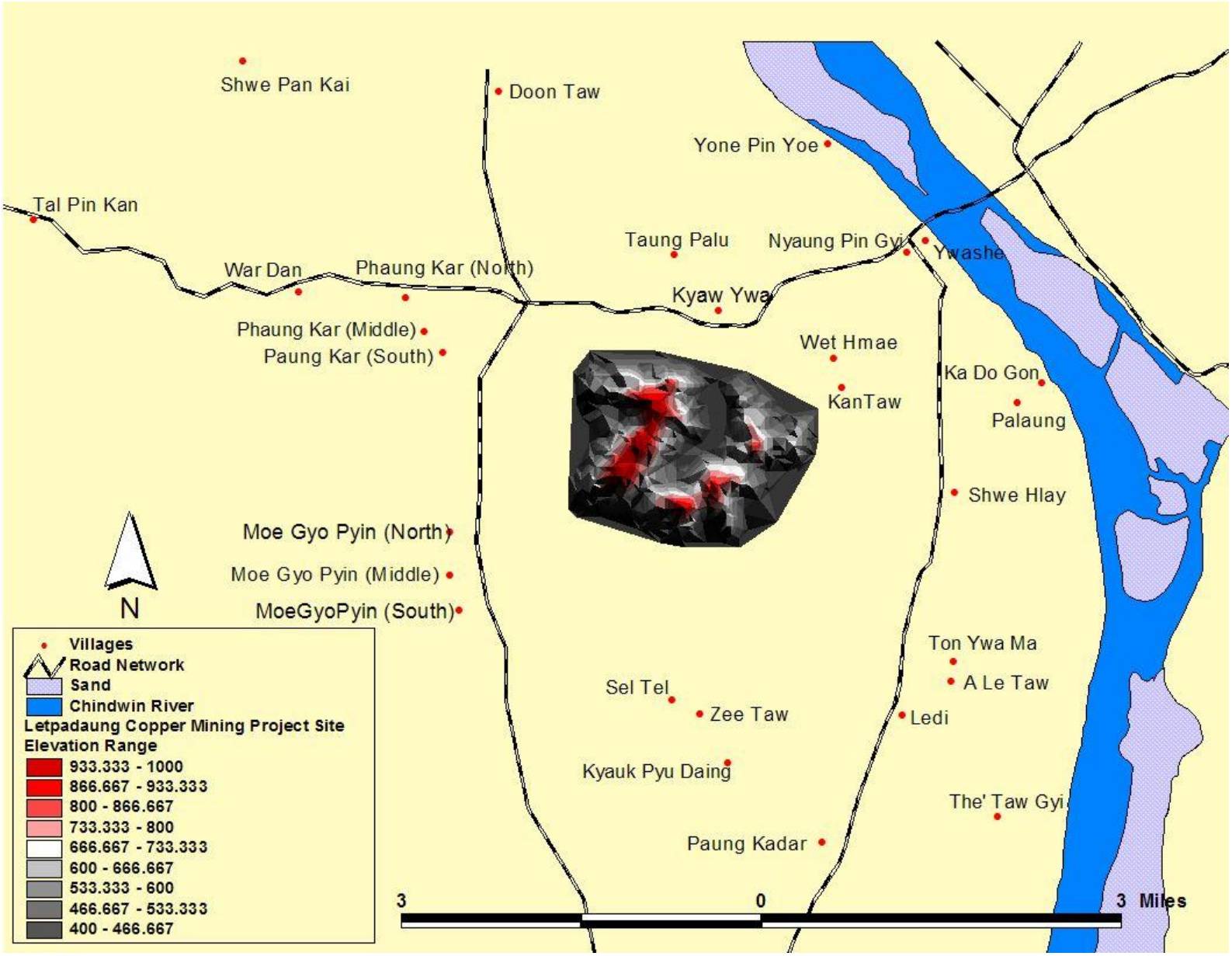
Upper Triassic 上三叠系

- Tbf — Basalt flow breccia crack water 玄武岩流角砾裂隙水
- Tbp — Basalt pillow lava crack water 枕状玄武岩流裂隙水
- h — Hornblende schist crack water 角闪片岩裂隙水

- Strike and dip of befd 地层走向与倾角
- Strke and dip of fault 断层走向与倾角
- Lithologic boundary 岩性界限
- Fossil Locality 化石产地
- Base metal vein 贱金属脉
- 拟建场地范围
- Copper deposits 铜矿床
- Gold Prospects 金远景区
- Road 道路
- Railway 铁路
- Stream 河流
- Catchment range 汇水范围
- Groundwater flow 地下水流向
- Surface water flow 地表水流向

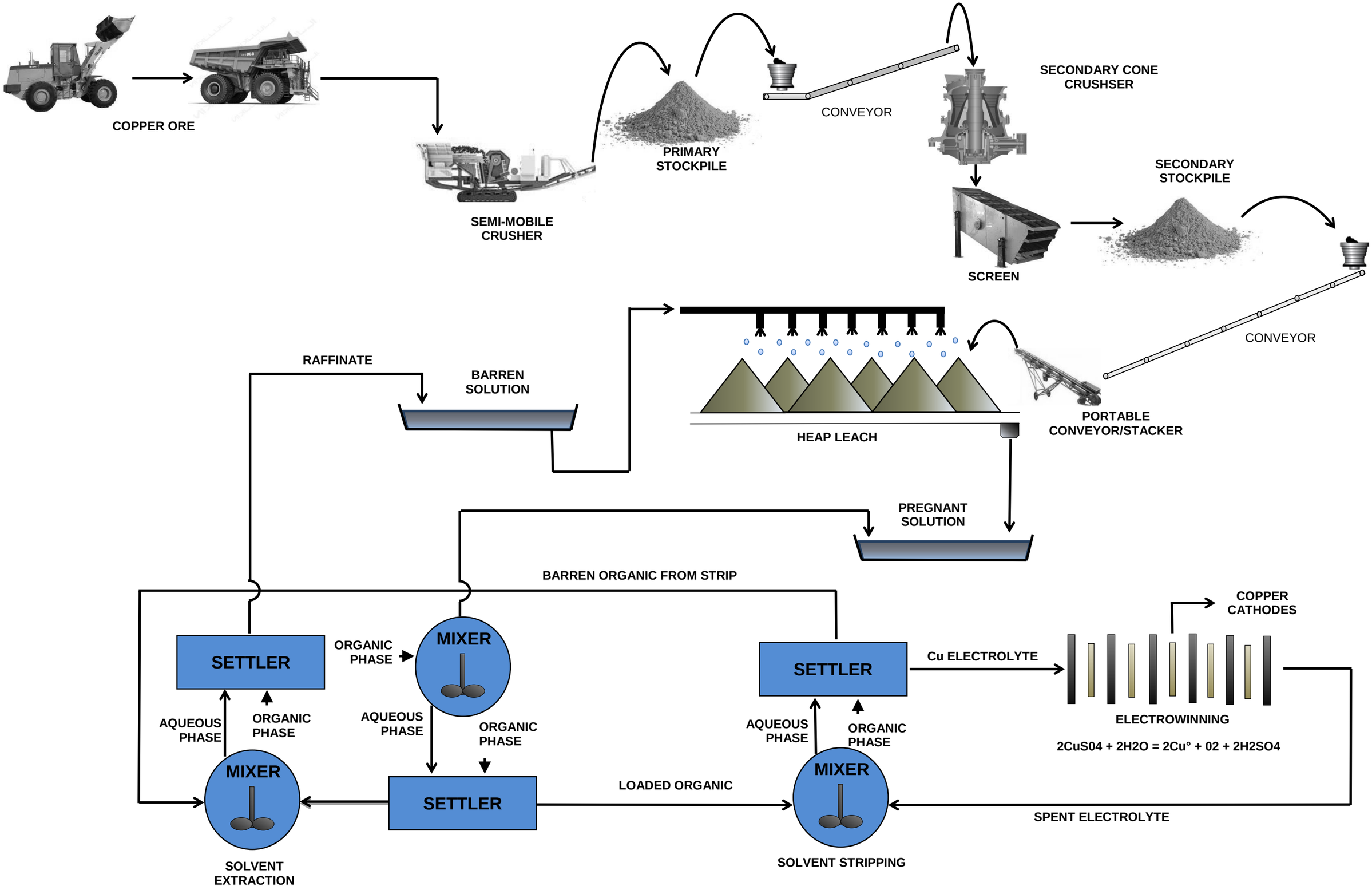
0 0.5 1.0 1.5 2.0 2.5km


N
Villages
Road Networks
Bareland
Natural Vegetation
Cultivated Land
Chindwin River
2
0
2
4 Miles


Shwe Pan Kai
Doon Taw
Yone Pin Yoe
Tal Pin Kan
Taung Palu
Nyaung Pin Gyi
Ywashe
War Dan
Phaung Kar (North)
Kyaw Ywa
Phaung Kar (Middle)
Paung Kar (South)
Wet Hmae
KanTaw
Ka Do Gon
Palaung
Shwe Hlay
Moe Gyo Pyin (North)
Moe Gyo Pyin (Middle)
MoeGyoPyin (South)
N
Villages
Road Network
Sand
Chindwin River
Letpadaung Copper Mining Project Site
Elevation Range
933.333 - 1000
866.667 - 933.333
800 - 866.667
733.333 - 800
666.667 - 733.333
600 - 666.667
533.333 - 600
466.667 - 533.333
400 - 466.667
Ton Ywa Ma
A Le Taw
Sel Tel
Zee Taw
Ledi
Kyauk Pyu Daing
The' Taw Gyi
Paung Kadar
3
0
3 Miles


7
6
Damapala
1
2
5
Monywa
Kadogon In
Kyaukka Rd
Monywa-Mandalay Hwy
3
10
8
4
9


5
4
Kyaukka Rd
Monywa
Damapala
Kadogon In
3
8
1
6
2
7


COPPER ORE
SEMI-MOBILE CRUSHER
PRIMARY STOCKPILE
CONVEYOR
SECONDARY CONE CRUSHSER
SCREEN
SECONDARY STOCKPILE
CONVEYOR
PORTABLE CONVEYOR/STACKER
HEAP LEACH
RAFFINATE
BARREN SOLUTION
PREGNANT SOLUTION
BARREN ORGANIC FROM STRIP
SETTLER
ORGANIC PHASE
MIXER
AQUEOUS PHASE
ORGANIC PHASE
AQUEOUS PHASE
ORGANIC PHASE
MIXER
SETTLER
LOADED ORGANIC
SOLVENT EXTRACTION
SETTLER
Cu ELECTROLYTE
AQUEOUS PHASE
ORGANIC PHASE
MIXER
SOLVENT STRIPPING
COPPER CATHODES
ELECTROWINNING
2CuS04 + 2H2O = 2Cu° + 02 + 2H2SO4
SPENT ELECTROLYTE

712000mE
714000mE
716000mE
718000mE
2444000mN
2442000mN
2440000mN

WETME VILLAGE
KANDAW VILLAGE
MONASTERY
SEDE VILLAGE
ZIDAW VILLAGE

WRD No.1
WRD No.2
WRD No.3

LEGEND:

- EXISTING POWER LINE
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG LEASE BOUNDARY
- SITE ROAD ALIGNMENT
- KEY CONSTRUCTION AREAS

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 1m CONTOUR INTERVALS SHOWN.

KEY:

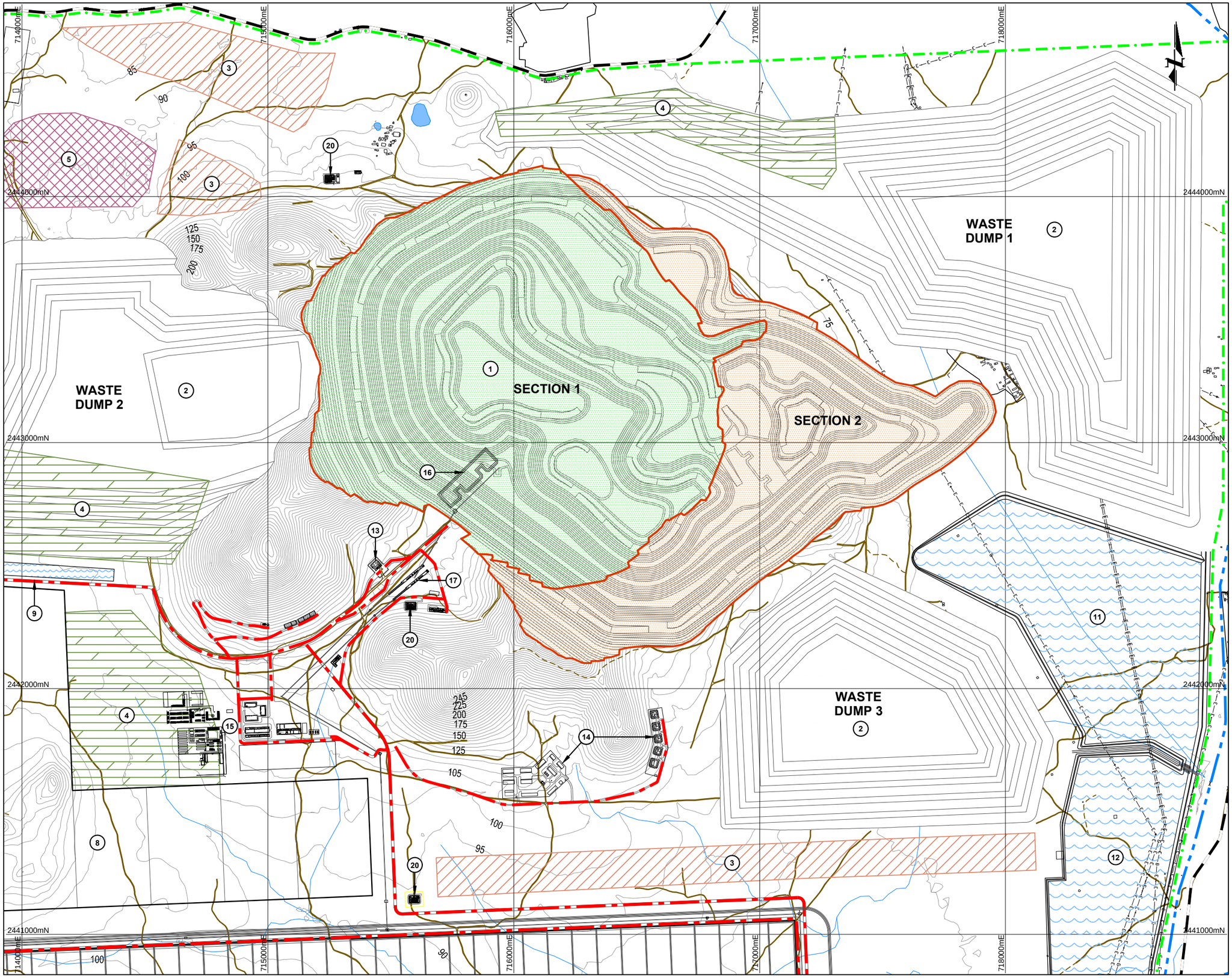
1. PIT
2. WASTE DUMP
3. TOPSOIL STOCKPILE
4. LOW GRADE ORE STOCKPILE
5. RESERVE ORE STOCKPILE
6. HEAP LEACH PAD No.1
7. HEAP LEACH PAD No.2
8. HEAP LEACH PAD No.3
9. WASTE WATER COLLECTION POND
10. HEAP LEACH STORM WATER POND
11. WASTE WATER RESERVOIR (NORTH)
12. WASTE WATER RESERVOIR (SOUTH)
13. FUEL STATION
14. EXPLOSIVES AREA
15. OFFICES/ WAREHOUSES/ MAINTENANCE AREA
16. MOBILE CRUSHER FOR QUARRY
17. CONVEYOR FOUNDATIONS
18. EXTRACTION PLANT
19. ELECTROWINNING PLANT
20. 33Kv SUBSTATION
21. 230kV SUBSTATION
22. WATER PURIFICATION AREA
23. ACID STORAGE AREA
24. STAFF ACCOMMODATION
25. 2Mw DIESEL POWER STATION

500 300 100 0 250 500 750 1000
SCALE (METRES) 1:25,000 (A3)

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LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
KEY CONSTRUCTION AREAS

Ref: PE701-00022/13
Figure 5.3.1



LEGEND:

- EXISTING POWER LINE
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG PROJECT LEASE BOUNDARY
- SITE ROAD ALIGNMENT
- PIT SECTION 1
- PIT SECTION 2

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 5m CONTOUR INTERVALS SHOWN.

KEY:

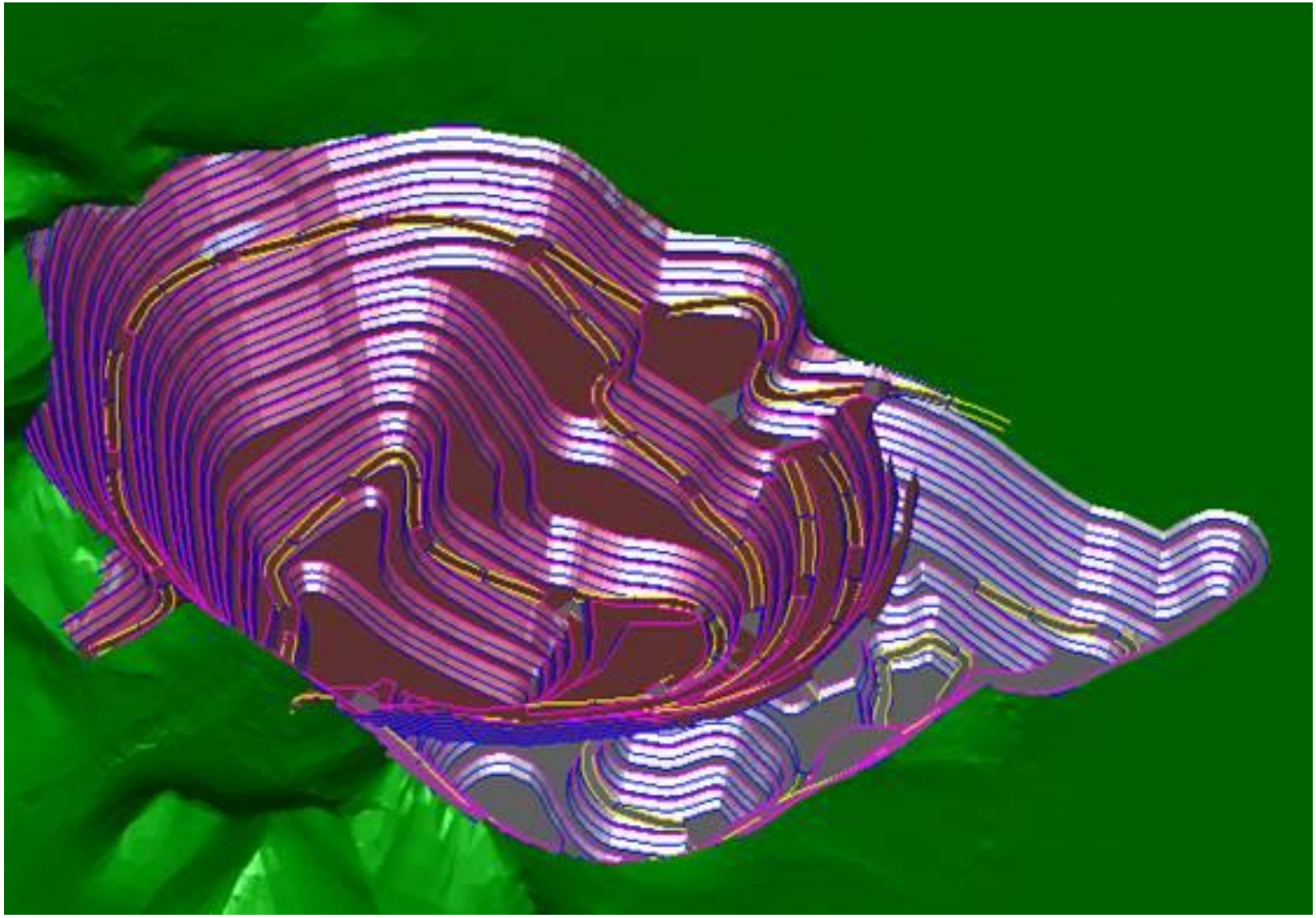
1	PIT
2	WASTE DUMP
3	TOPSOIL STOCKPILE
4	LOW GRADE ORE STOCKPILE
5	RESERVE ORE STOCKPILE
6	HEAP LEACH PAD No.1
7	HEAP LEACH PAD No.2
9	WASTE WATER COLLECTION POND
11	WASTE WATER RESERVOIR (NORTH)
12	WASTE WATER RESERVOIR (SOUTH)
13	FUEL STATION
14	EXPLOSIVES AREA
15	OFFICES/ WAREHOUSES/ MAINTENANCE AREA
16	MOBILE CRUSHER FOR QUARRY
17	CONVEYOR FOUNDATIONS
20	33Kv SUB STATION

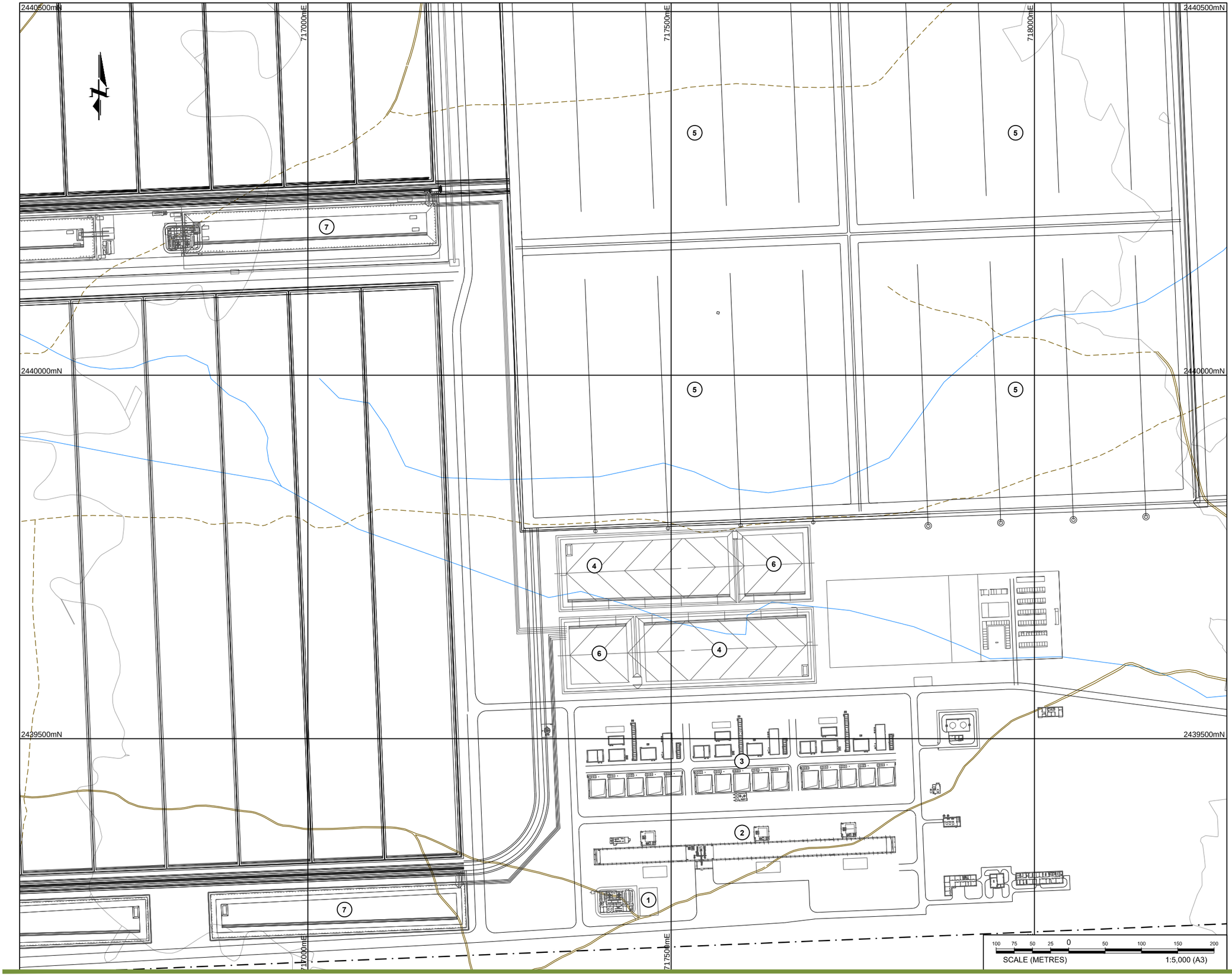
250 150 50 0 250 500 750
SCALE (METRES) 1:15,000 (A3)

Knight Piésold CONSULTING

LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
PIT AND WASTE DUMPS

Ref: PE701-00022/13
Figure 5.9.1





LEGEND:

- WATER COURSE
- EXISTING ROAD/TRACK (UNSEALED)
- LEASE BOUNDARY

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 5m CONTOUR INTERVALS SHOWN.

KEY:

1. 33kv SUB-STATION
2. ELECTROWINNING PLANT
3. EXTRACTION PLANT
4. PREGNANT LEACH SOLUTION POND
5. STORM WATER POND
6. RAFINATE POND
7. INTERMEDIATE LEACH SOLUTION POND

712000mE
714000mE
716000mE
718000mE
2444000mN
2442000mN
2440000mN

SEDIMENT DAMS
SEDIMENT DAM
STAFF ACCOMMODATION
TOPSOIL STOCKPILE
WASTE DUMP No.1
PIT
WASTE DUMP No.2
WASTE WATER COLLECTION POND
FLOOD PROTECTION BUND
WASTE WATER POND (NORTH)
RESERVE ORE STOCKPILE
OFFICES WAREHOUSES & MAINTENANCE
EXPLOSIVES AREA
WASTE DUMP No.3
LOW GRADE ORE STOCKPILE
TOPSOIL STOCKPILE
WASTE WATER POND (SOUTH)
HEAP LEACH PAD No.1
HEAP LEACH STORM WATER POND
HEAP LEACH PAD No.2
ELECTROWINNING PLANT
SOUTH DIVERSION CHANNEL

LEGEND:

- EXISTING CANAL
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG LEASE BOUNDARY
- FLOOD PROTECTION BUND
- MAJOR DIVERSION CHANNEL
- INTERNAL DIVERSION CHANNELS

NOTES:

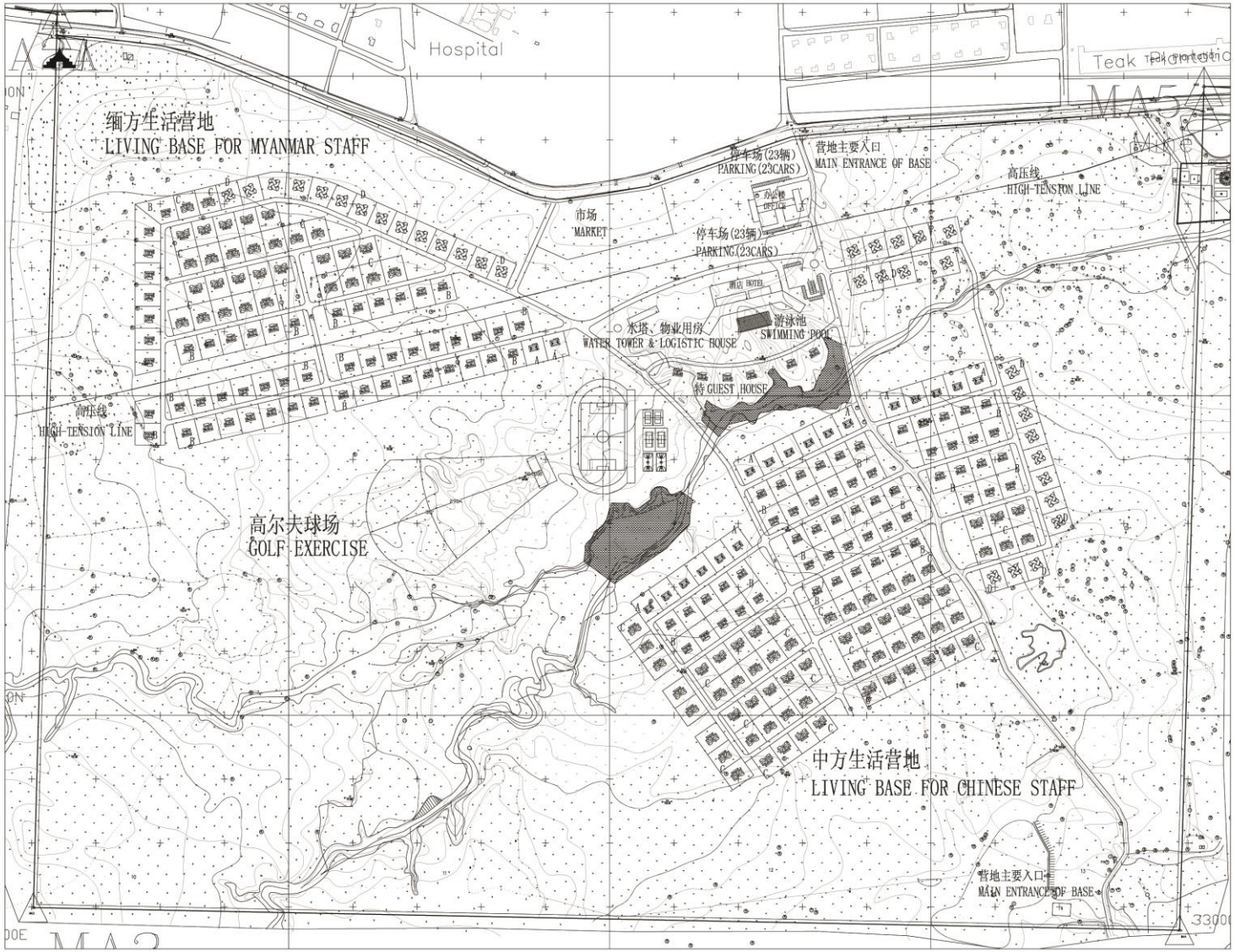
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2. 5m CONTOUR INTERVALS SHOWN.

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SCALE (METRES)
1:25,000 (A3)

Knight Piésold CONSULTING

LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
SITE WATER MANAGEMENT PLAN

Ref: PE701-00022/13
Figure 5.18.1


Hospital
缅方生活营地
LIVING BASE FOR MYANMAR STAFF
停车场(23辆)
PARKING(23CARS)
营地主要入口
MAIN ENTRANCE OF BASE
高压线
HIGH-TENSION LINE
市场
MARKET
停车场(23辆)
PARKING(23CARS)
水塔、物业用房
WATER TOWER & LOGISTIC HOUSE
游泳池
SWIMMING POOL
特 GUEST HOUSE
高压线
HIGH-TENSION LINE
高尔夫球场
GOLF EXERCISE
中方生活营地
LIVING BASE FOR CHINESE STAFF
营地主要入口
MAIN ENTRANCE OF BASE

712000mE
714000mE
716000mE
718000mE
2444000mN
2442000mN
2440000mN

WETME VILLAGE
KANDAW VILLAGE
MONASTERY
SEDE VILLAGE
ZIDAW VILLAGE

LEGEND:

- EXISTING POWER LINE
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG LEASE BOUNDARY
- AFFORESTATION AND TREE PLANTING AREAS
- TREE LINED BOUNDARY

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 5m CONTOUR INTERVALS SHOWN.

KEY:

1. PIT
2. PIT BLAST EXTENT
3. WASTE ROCK DUMP No.1
4. WASTE ROCK DUMP No.2
5. WASTE ROCK DUMP No.3
6. HEAP LEACH PAD No.1
7. HEAP LEACH PAD No.2
8. HEAP LEACH PAD No.3
9. WASTE WATER COLLECTION POND
10. HEAP LEACH STORM WATER POND
11. WASTE WATER RESERVOIR (NORTH)
12. WASTE WATER RESERVOIR (SOUTH)
13. FUEL STATION
14. EXPLOSIVES AREA
15. OFFICES/ WAREHOUSES/ MAINTENANCE AREA
16. MOBILE CRUSHER FOR QUARRY
17. CONVEYOR FOUNDATIONS
18. EXTRACTION PLANT
19. ELECTROWINNING PLANT
20. 33Kv SUBSTATION
21. 230kV SUBSTATION
22. ACCOMMODATION VILLAGE

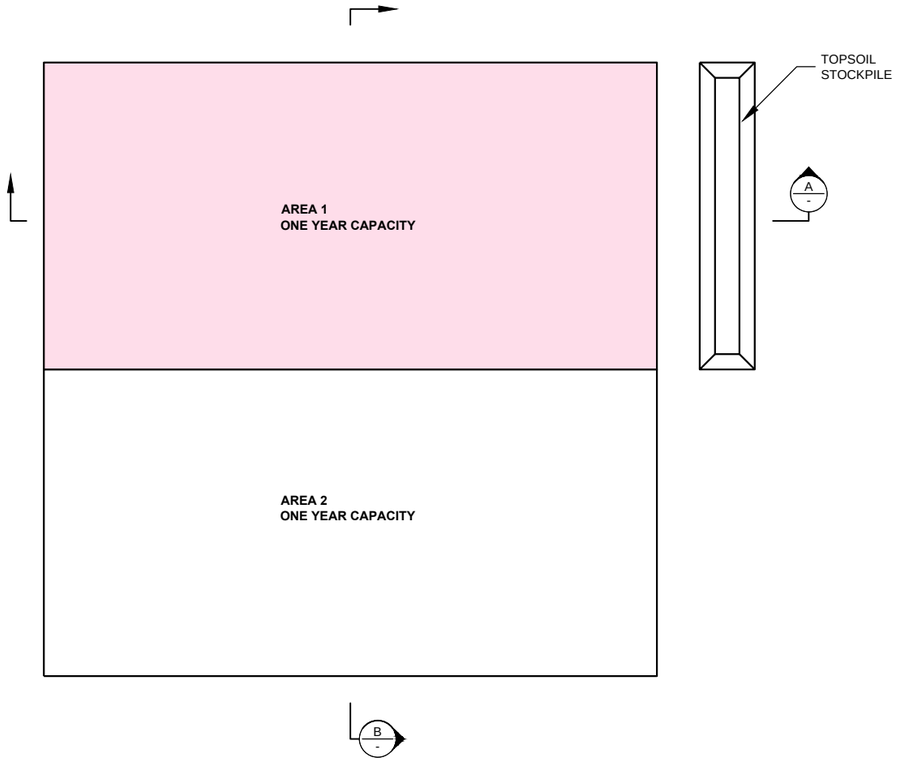
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SCALE (METRES)
1:25,000 (A3)

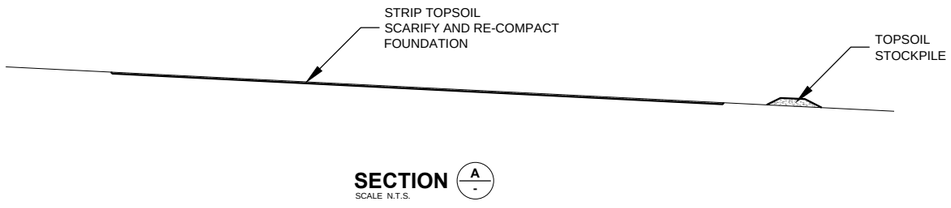
Knight Piésold CONSULTING

LETPADAUNG PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
AFFORESTATION AND TREE PLANTING EXTENTS

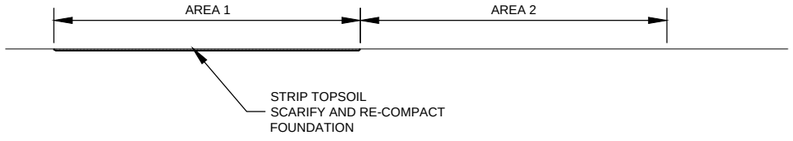
Ref: PE701-00022/13
Figure 7.9.1

STEP 1:



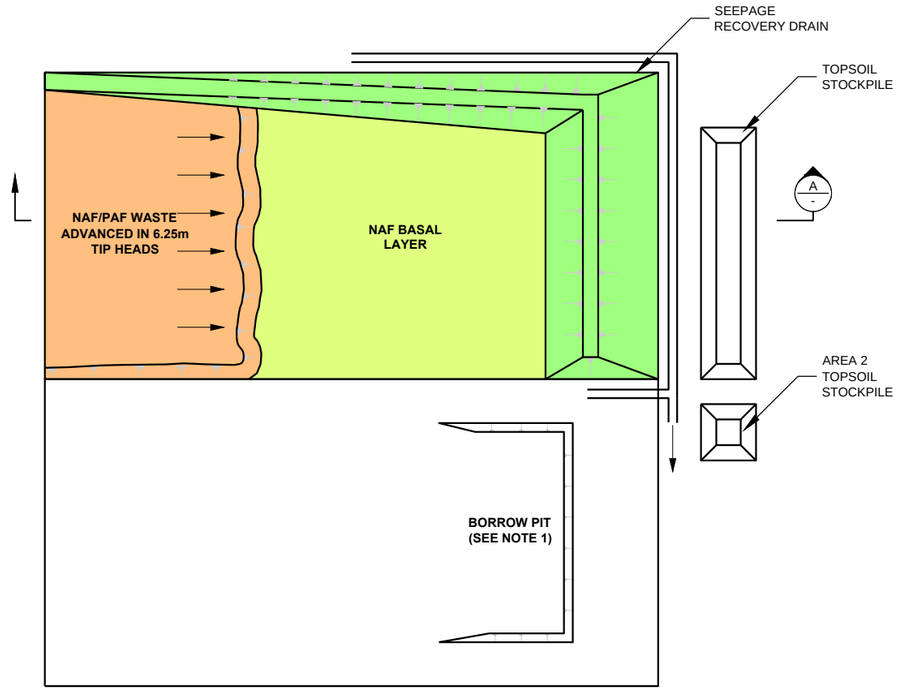


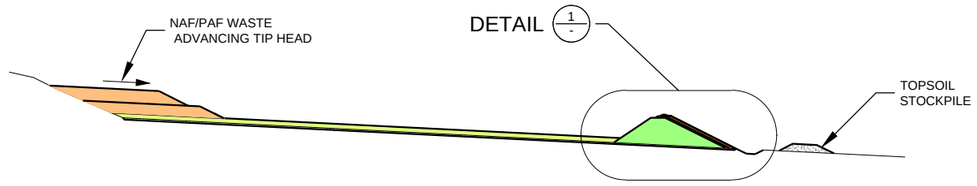
SECTION A - SCALE N.T.S.



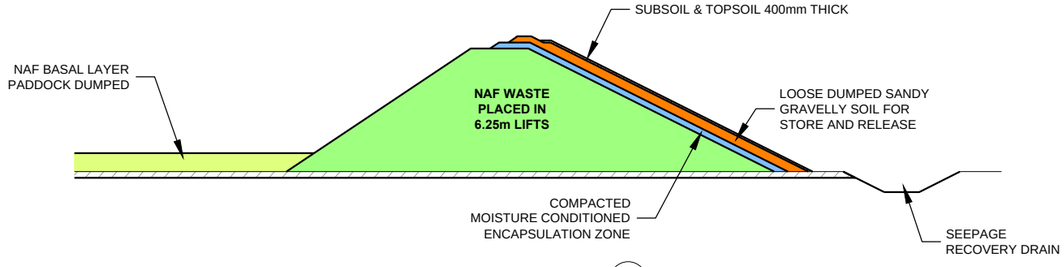
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STEP 2:





SECTION A - SCALE N.T.S.

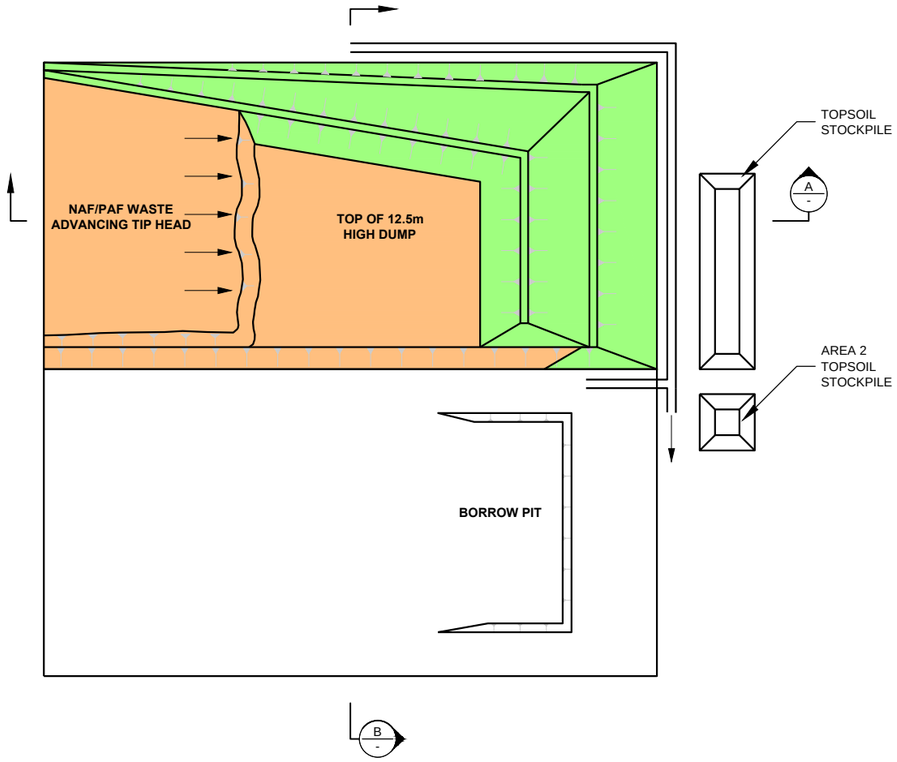


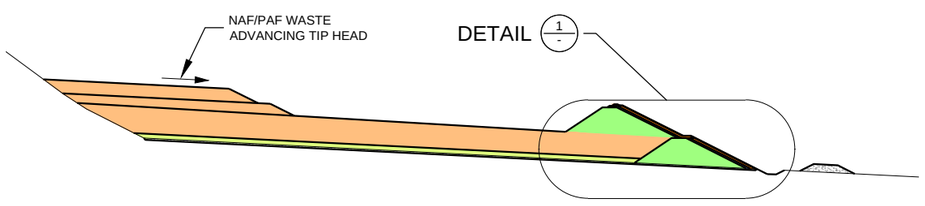
DETAIL 1 - SCALE N.T.S.

NOTE:

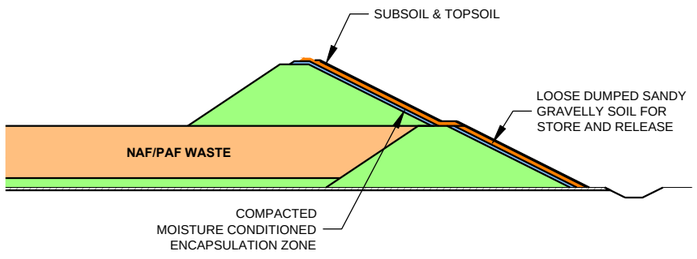
1. BORROW PIT IN NEXT WASTE DUMP AREA TO SUPPLY ENCAPSULATION MATERIAL AND STORE AND RELEASE ZONE.
2. LOCAL OUTER BATTER SLOPE ANGLES TO BE CONFIRMED.

STEP 3:



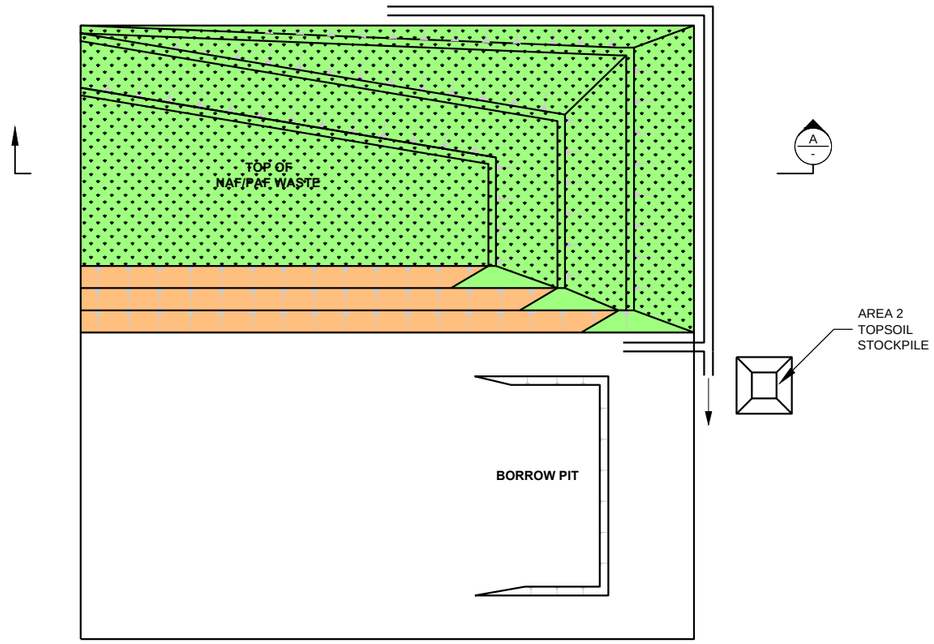


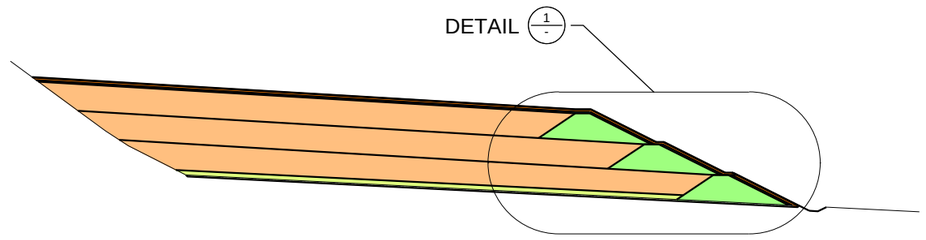
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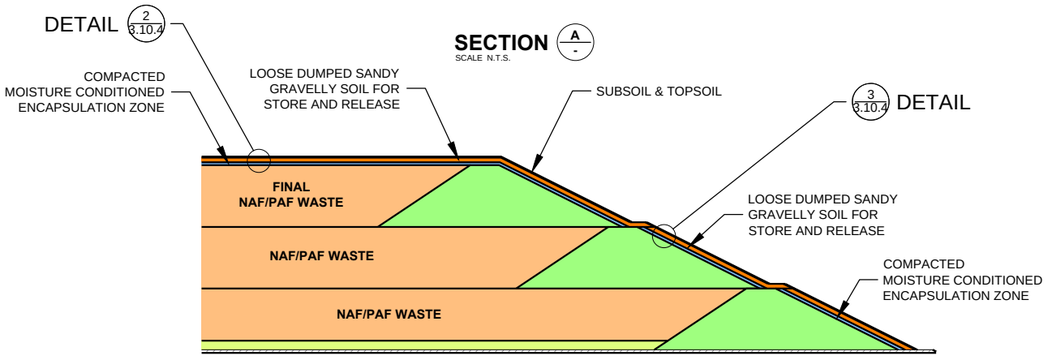


DETAIL 1 / - SCALE N.T.S.

STEP 4:



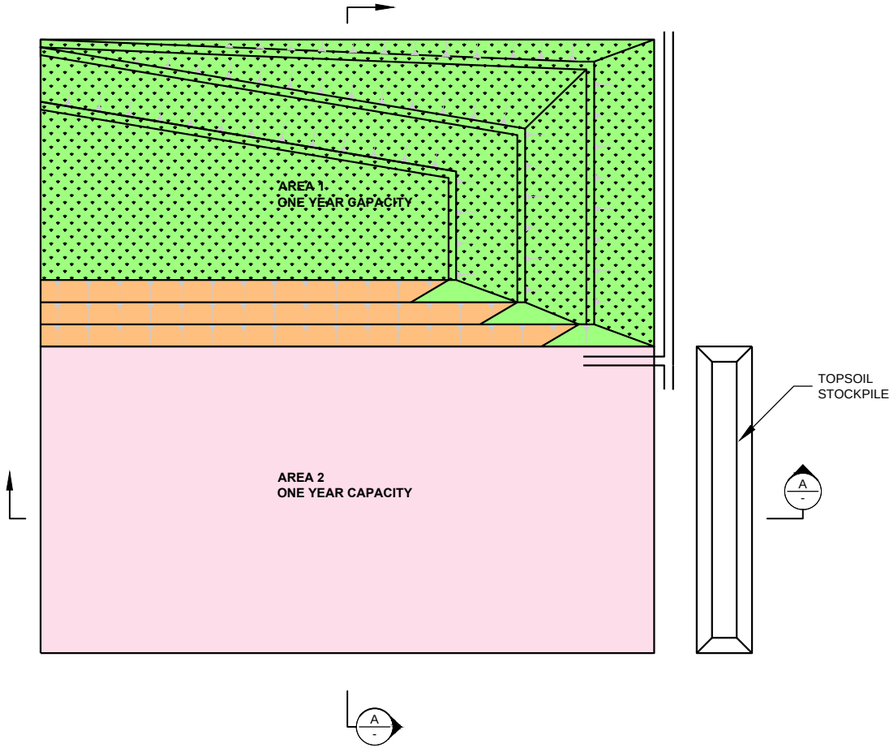


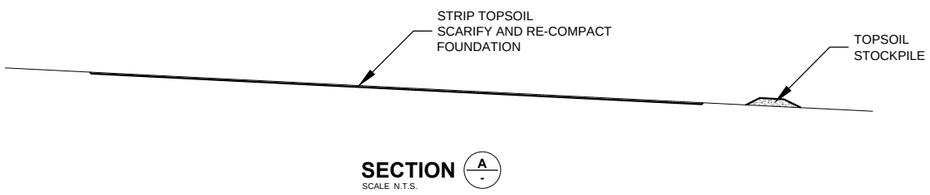


SECTION A / - SCALE N.T.S.

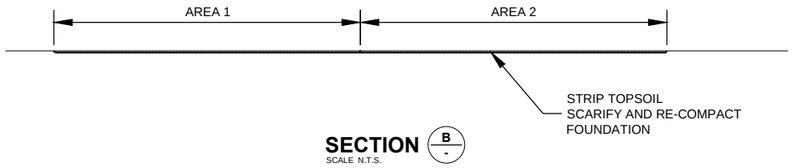
DETAIL 1 / - SCALE N.T.S.

STEP 5:



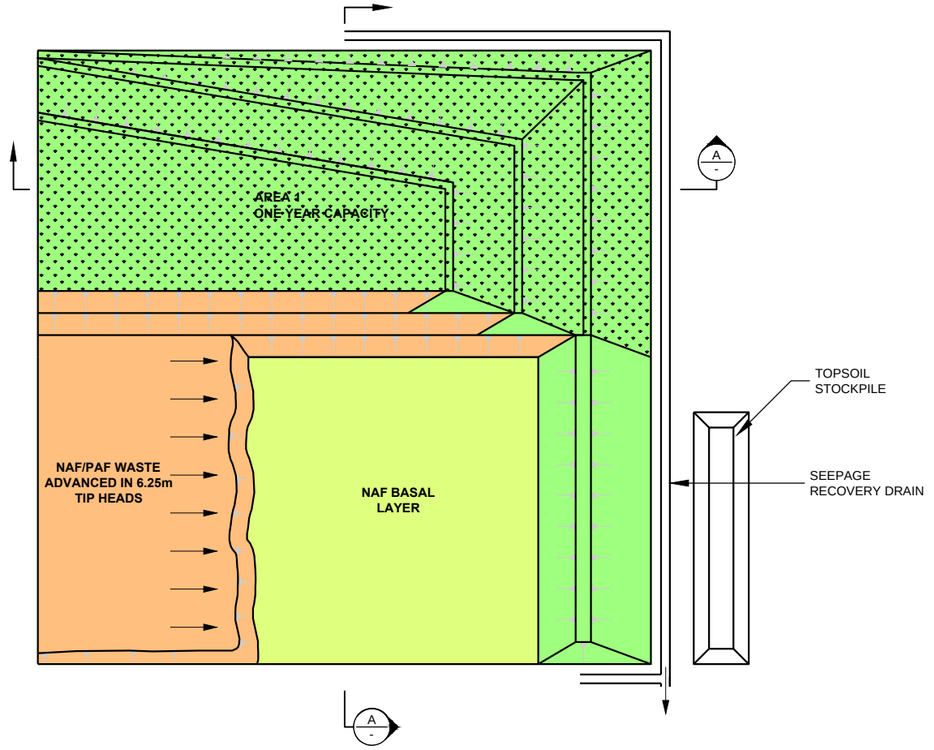


SECTION A
SCALE N.T.S.



SECTION B
SCALE N.T.S.

STEP 6:

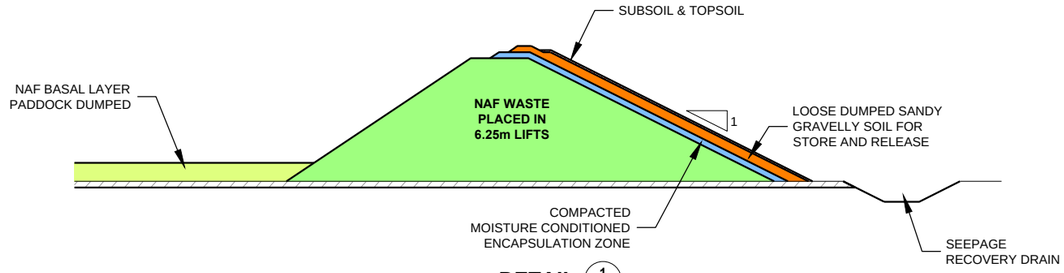




SECTION A
SCALE N.T.S.

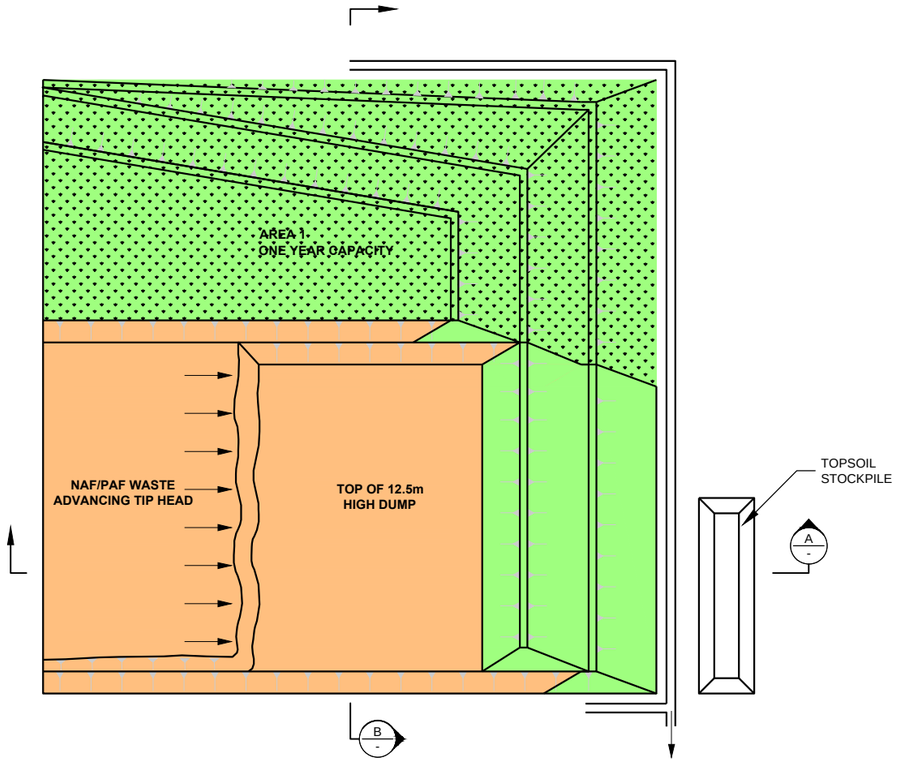


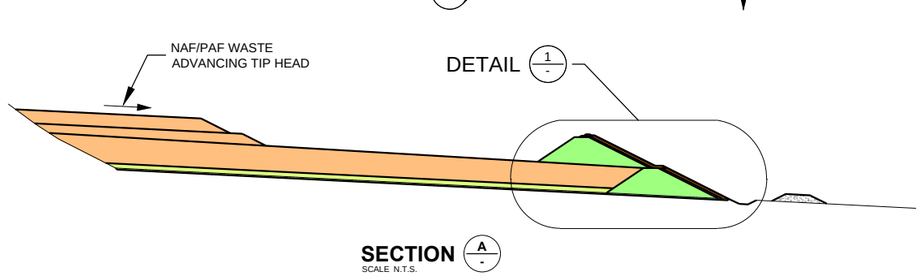
SECTION B
SCALE N.T.S.

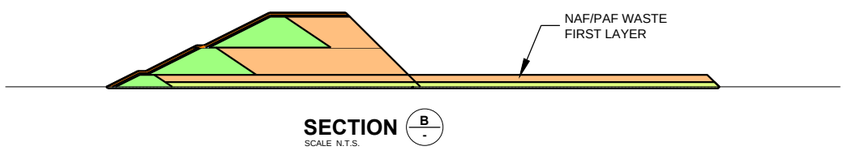


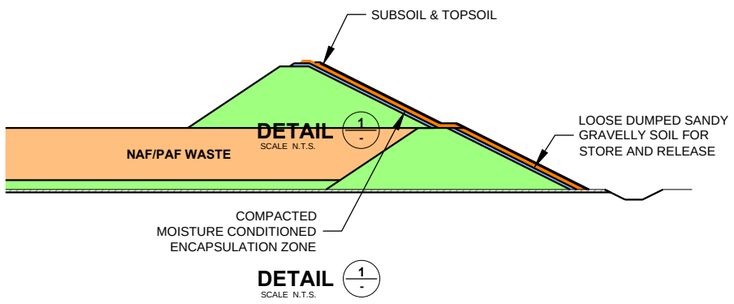
DETAIL 1
SCALE N.T.S.

STEP 7:

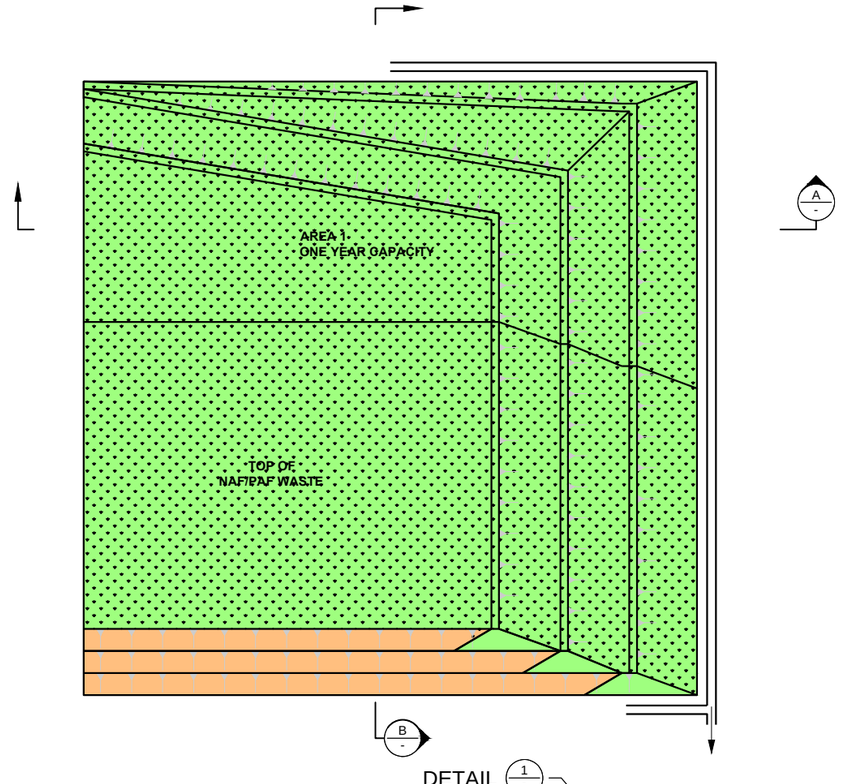

AREA 1
ONE YEAR CAPACITY
NAF/PAF WASTE
ADVANCING TIP HEAD
TOP OF 12.5m
HIGH DUMP
TOPSOIL
STOCKPILE
A
B

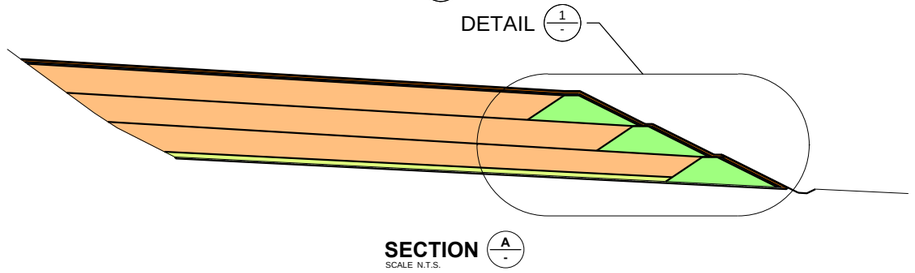

NAF/PAF WASTE
ADVANCING TIP HEAD
DETAIL 1
SECTION A
SCALE N.T.S.

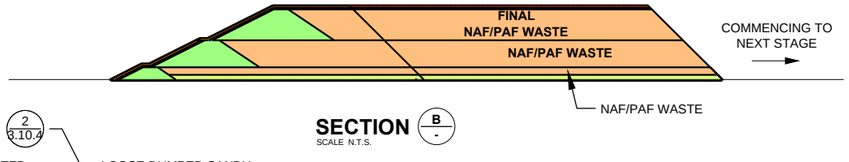

NAF/PAF WASTE
FIRST LAYER
SECTION B
SCALE N.T.S.

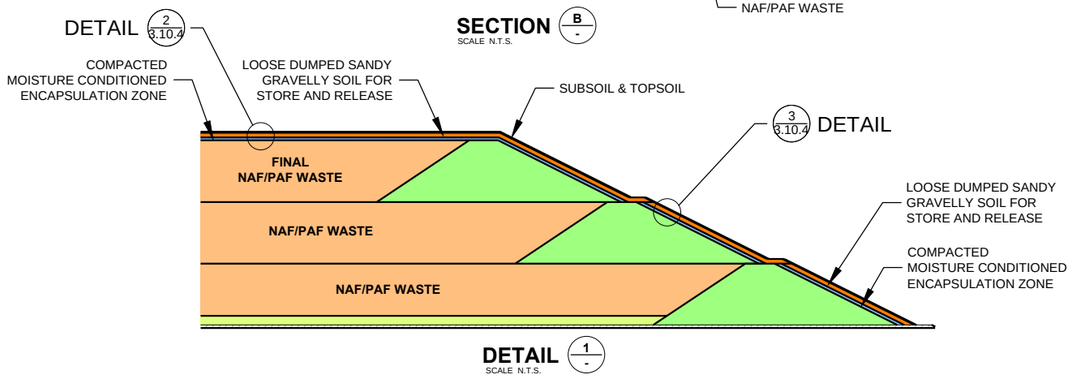

SUBSOIL & TOPSOIL
DETAIL 1
SCALE N.T.S.
NAF/PAF WASTE
LOOSE DUMPED SANDY
GRAVELLY SOIL FOR
STORE AND RELEASE
COMPACTED
MOISTURE CONDITIONED
ENCAPSULATION ZONE
DETAIL 1
SCALE N.T.S.

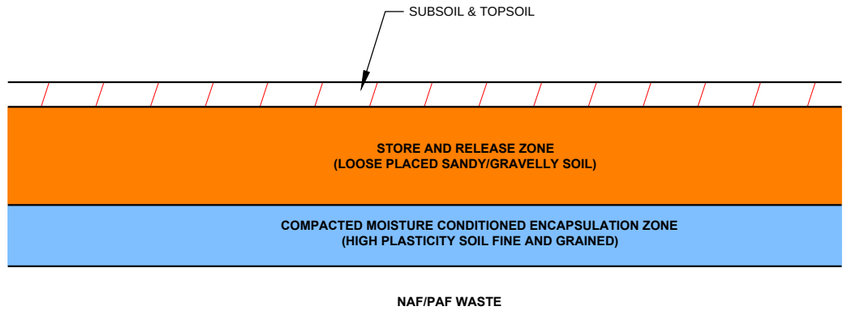
STEP 8:


AREA 1
ONE YEAR CAPACITY
TOP OF
NAF/PAF WASTE
A
B

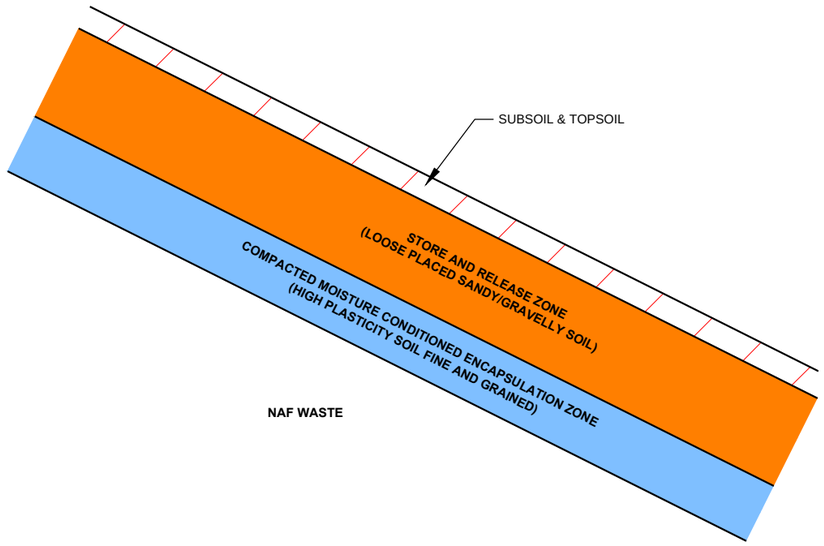

DETAIL 1
SECTION A
SCALE N.T.S.


FINAL
NAF/PAF WASTE
NAF/PAF WASTE
COMMENCING TO
NEXT STAGE
NAF/PAF WASTE
SECTION B
SCALE N.T.S.


DETAIL 2
3.10.4
COMPACTED
MOISTURE CONDITIONED
ENCAPSULATION ZONE
LOOSE DUMPED SANDY
GRAVELLY SOIL FOR
STORE AND RELEASE
SUBSOIL & TOPSOIL
3
3.10.4
DETAIL
FINAL
NAF/PAF WASTE
NAF/PAF WASTE
NAF/PAF WASTE
LOOSE DUMPED SANDY
GRAVELLY SOIL FOR
STORE AND RELEASE
COMPACTED
MOISTURE CONDITIONED
ENCAPSULATION ZONE
DETAIL 1
SCALE N.T.S.



DETAIL 2/3.10.2 2/3.10.3 WRD CLOSURE COVER SYSTEM FOR TOP OF DUMP
SCALE 1:100

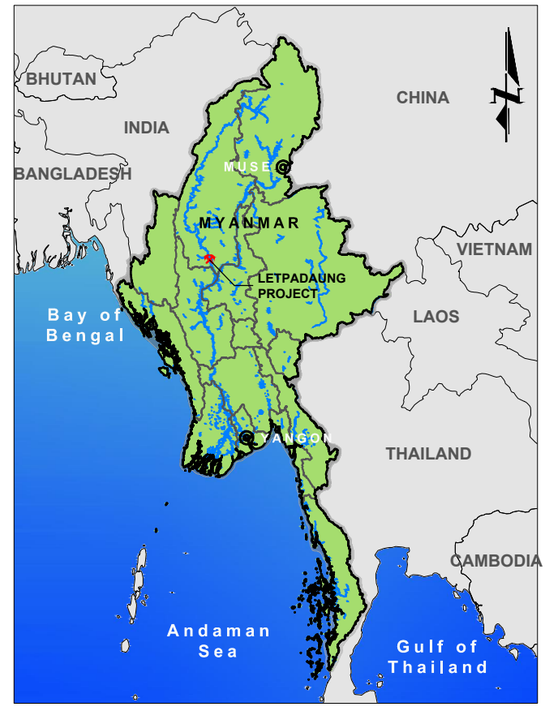


DETAIL 3/3.10.2 3/3.10.3 WRD CLOSURE COVER SYSTEM FOR DUMP BATTER SLOPES
SCALE 1:100

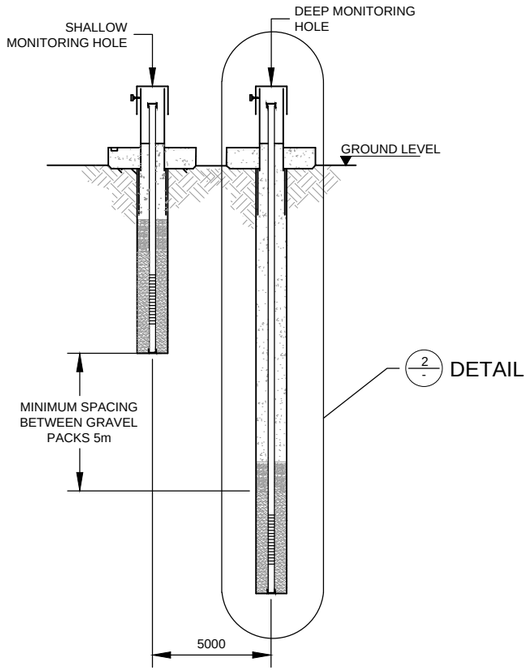


LEGEND:

- CITIES
- MAJOR HIGHWAY
- RAILWAY
- AIRPORT
- BARGE ROUTE (WET/DRY SEASON)
- BARGE ROUTE (DRY SEASON)
- ROAD (DRY SEASON)
- ROAD (EXPLOSIVE ROUTE)

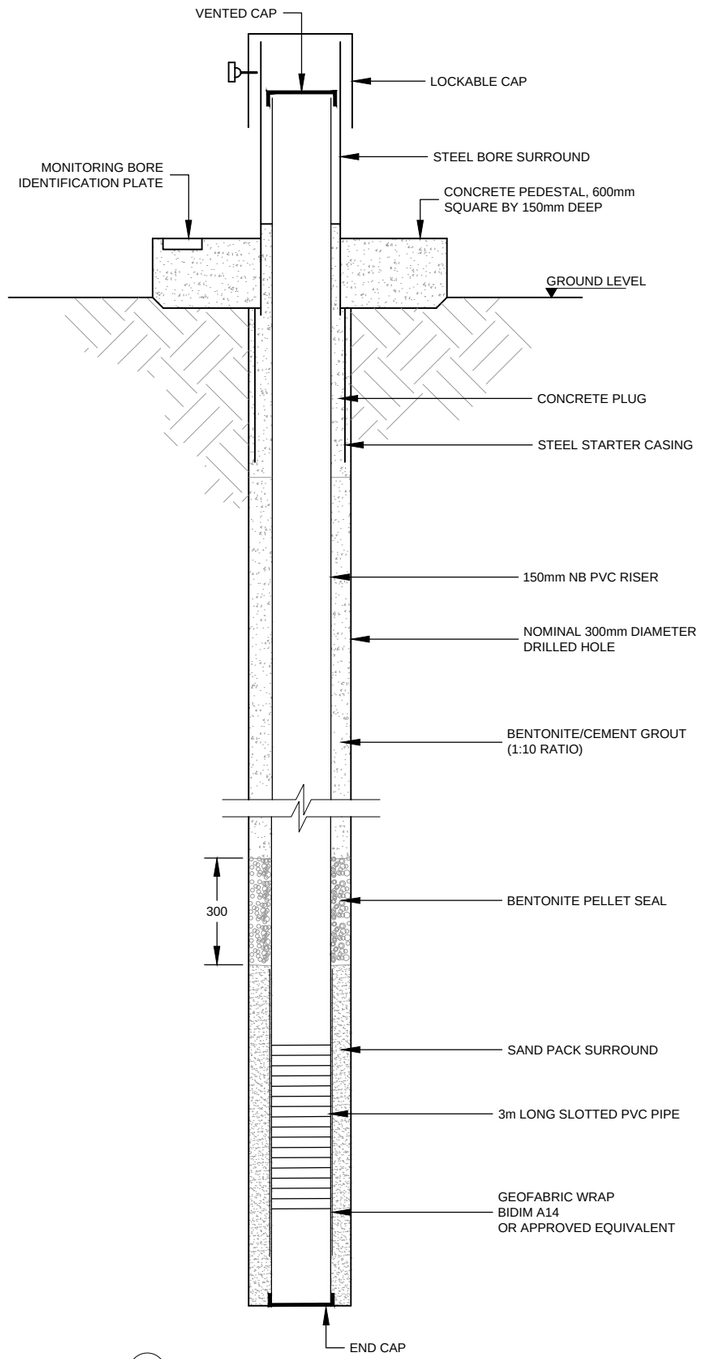


TRANSPORT SUMMARY PLAN		
DESCRIPTION	**DESTINATIONS**	**TRANSPORT MODE**
PEOPLE		
LOCALS	VILLAGE <--->MINE	BY BUS
EXPATS	MANDALAY <--->MINE HOME <--->MINE	BY BUS BY AIR
MATERIALS/COPPER		
DRY SEASON	PATHEIN <--->MINE PAKOKKA <--->MINE PATHEIN <--->CHINA	BY RIVER BARGE BY TRUCK BY SHIP
WET SEASON	PATHEIN <--->MINE PATHEIN <--->CHINA	BY RIVER BARGE BY SHIP
EXPLOSIVES	CHINA <---> MINE (VIA MUSE)	BY TRUCK



MONITORING BORE STATIONS

SCALE N.T.S.

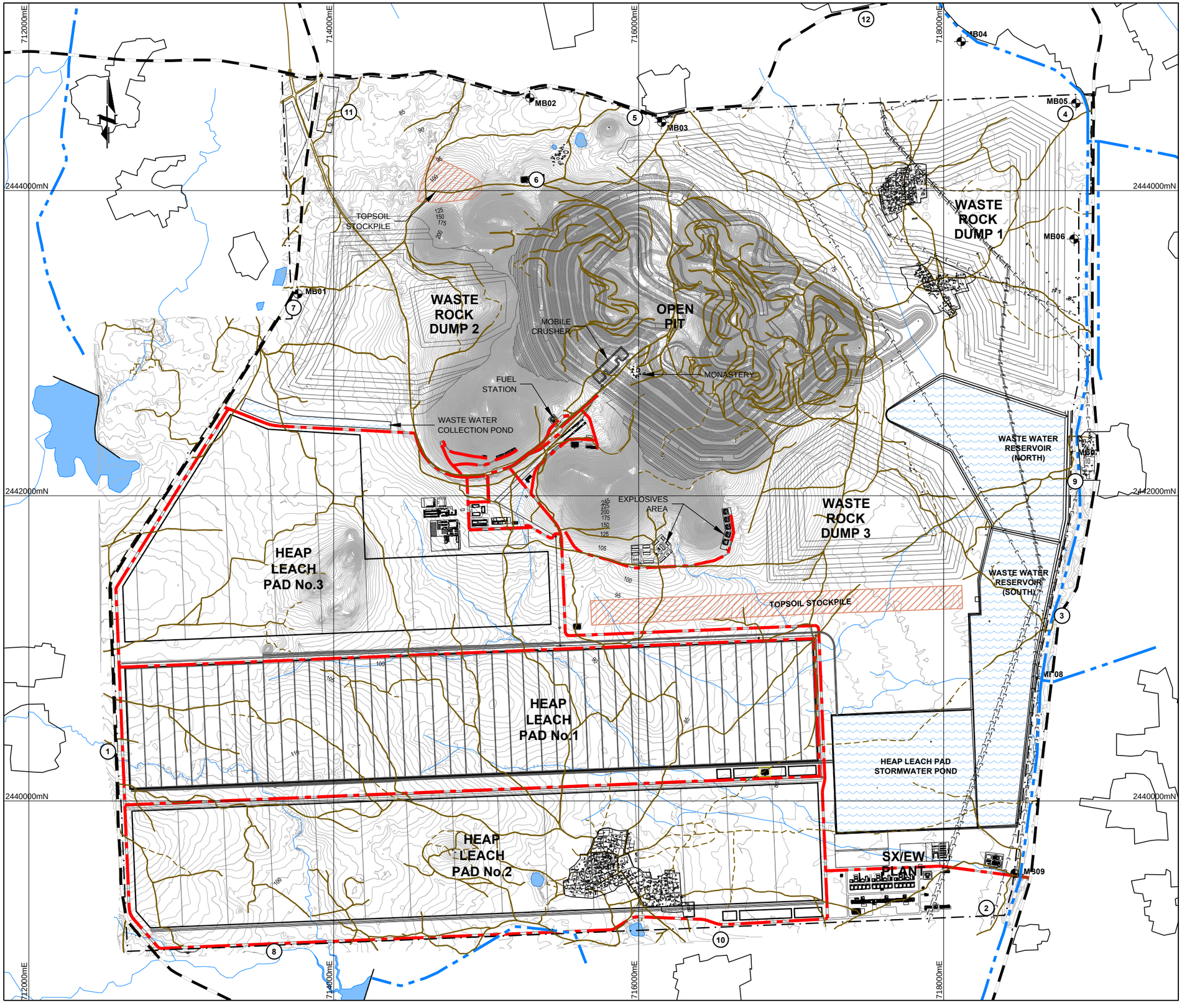


DETAIL 2/- **MONITORING BORE INSTALLATION DETAIL**

SCALE N.T.S

NOTES:

1. DEPTH OF MONITORING BORES TO BE DETERMINED ON SITE. (APPROXIMATELY 10m AND 20m)
2. BOREHOLE DRILLING TO BE SUPERVISED BY ENGINEER FOR GEOLOGICAL LOGGING.
3. INSTRUMENTATION LOCATIONS TO BE DETERMINED BY THE ENGINEER ON SITE.



LEGEND:

- EXISTING VILLAGE EXTENT
- EXISTING POWER LINE
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG LEASE BOUNDARY
- SITE ROAD ALIGNMENT
- TOPSOIL STOCKPILE
- V MONITORING BORE LOCATION GROUNDWATER

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 1m CONTOUR INTERVALS SHOWN.

MONITORING POINTS:

1. MOE GYP PYN SOUTH
2. SX/EW PLANT
3. CLEAN WATER OUTLET
4. TAN DAW
5. KYAW
6. OPEN PIT MINE HV SUBSTATION
7. PHAUNGA SOUTH
8. GRID POINT 40/14
9. SHWEHLAY
10. KYAUK PHYU DAUNG
11. CONSTRUCTION CAMP
12. AUNG CHAN SI

SUMMARY OF MONITORING PLAN

MONITORING POINT	MONITORED PARAMETER						
	DUST	AMBIENT AIR QUALITY	NOISE & VIBRATION	SURFACE WATER QUALITY	SURFACE WATER FLOW	WEATHER STATION	ACID MIST
1	X		X	X	X		
2	X		X	X	X	X	
3							
4	X		X	X	X		
5	X		X				
6						X	
7	X		X	X	X		
8				X	X		X
9	X		X	X	X		
10		X					X
11	X	X					
12			X				

SCALE (METRES) 500 300 100 0 250 500 750 1000

1:25,000 (A3)

Knight Piésold CONSULTING

LETPADAUNG COPPER PROJECT
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
MONITORING PLAN

Ref: PE701-00022/13
Figure 10.3.1

APPENDIX A

Surface Water Management

DRAFT

Knight Piésold CONSULTING

APPENDIX B

Groundwater Monitoring Data

DRAFT

Knight Piésold CONSULTING

APPENDIX C

Baseline Studies – Flora

Prepared by EMC

DRAFT

Knight Piésold CONSULTING

APPENDIX D

Baseline Studies - Fauna

DRAFT

Knight Piésold CONSULTING

APPENDIX E

Baseline Studies – Aquatic Ecology

DRAFT

Knight Piésold CONSULTING

APPENDIX F

Baseline Study – Socio Economic

Prepared by EMC

DRAFT

Knight Piésold CONSULTING

APPENDIX G

Socio Economic Survey Data Sheets

To Be Provided by EMC

DRAFT

Knight Piésold CONSULTING

APPENDIX H

Health Table

DRAFT

Knight Piésold CONSULTING

APPENDIX I

Preliminary Waste Dump Design

DRAFT

Knight Piésold CONSULTING

APPENDIX J

Geochemical Study

DRAFT

Knight Piésold CONSULTING

APPENDIX K

Air Quality, Noise and Vibration Modeling

DRAFT

Knight Piésold CONSULTING

APPENDIX L

Conceptual Closure Plan

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APPENDIX M

Resettlement Action Plan

Prepared by MWMCL

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APPENDIX A

Surface Water Management

Knight Piésold CONSULTING

MYANMAR WANBAO MINING COPPER LTD
LETPADAUNG COPPER PROJECT





SURFACE WATER MANAGEMENT PLAN

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MYANMAR WANBAO MINING COPPER LTD (MWMCL)

LETPADAUNG COPPER PROJECT

SURFACE WATER MANAGEMENT PLAN

KP Job No. PE701-00022/18

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EXECUTIVE SUMMARY

General

The Letpadaung Copper Project is located in the south of the Sagaing Division, Myanmar, approximately 730 km north of Yangon.

Myanmar Wanbao Mining Copper Limited (MWMCL) are contemplating developing the project, which will comprise an open pit copper mine and processing facilities including the following:

- A crushing circuit and heap leaching operation (comprising three heap leach pads);
- A solvent extraction and electrowinning (SX/EW) plant;
- Three associated waste rock dumps (WRDs);
- Process and stormwater ponds;
- On site accommodation villages; and
- Associated access roads and typical mine support infrastructure.

The site is characterised by flat alluvial plains punctuated by steep sided hills up to 300 m high. The site on occasions experiences high intensity rainfall events, particularly during the wet season.

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An important aspect of the project design process concerns surface water management so as to understand and, if necessary, mitigate downstream social and environmental impacts associated with development of the project, from early works through to closure.

Development of the mine will involve disturbance of existing watershed catchments both in terms of hydrologic flows and in terms of water quality. Excavation of the open pit and establishment of WRDs and heap leach pads (HLPs) will result in rainfall runoff from the effected catchments being diverted into adjacent sub-catchments and catchments.

Disturbance of the catchments will result in soil erosion, that if not managed properly, could result in elevated sediment loads in downstream rivers and waterways. The mine waste and ore has the potential to generate acid and will generally be enriched with metals. Surface water runoff from the WRDs, low grade ore stockpiles, and HLPs will need to be stored, tested (and treated if not meeting the relevant release criteria potentially) before release to downstream river systems.

The surface water management concept design was undertaken by MWMCL. Knight Piésold were engaged to review the potential environmental impacts and outcomes of the design. This report provides a general, high level description of the hydrologic and water quality impacts associated with the development as well as recommendations to improve management of surface water on the project site.

The hydrologic run-off flows and volumes for the surface water management structures were assessed using a 100 year annual return interval (ARI) design storm. Two different duration design storms were considered as follows:

- Long duration (48 hours); and
- Short duration (6 hours).

For the water balance modelling and pond sizing wet conditions ranging from 1 day to yearly durations were used

Climatology

Average annual rainfall is in the order of 774 mm with the majority of the rain falling in the months of April through to November. Annual average lake evaporation is estimated at 1412 mm.

For Letpadaung it is clear that in the wet season, particularly during September and October, there will be a build up of water in the various storage ponds across the site. For the rest of the year, areas such as the HLPs, which are continuously wetted (thus acting as an evaporative surface) will operate with a moderate to large water deficit.

For storm runoff and waste rock dump collection ponds the transition from water surplus to deficit would be likely to be only for the peak dry season (February to April). It is estimated that for the overall site the large shortfall from the heap leach pad water balance is likely to result in an overall site deficit. Adequate water storage and careful management of available water resources will therefore be critical to successful operation of the mine.

Hydrologic Flow Impacts

The core principles of good surface water management practice are as follows:

- Identify watershed catchments influenced by the proposed development;
- Reduce hydrologic flow impacts of the development by maintaining pre-mining watershed catchment flow routing wherever possible;
- Classify watershed catchments as either undisturbed (clean water) or disturbed (dirty water); and

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- Separate and segregate clean water and dirty water (so as to reduce handling requirements).

In order to divert clean water from the upstream, undisturbed, catchment (east of the project area) the South Diversion Channel will be built along the western edge of HLP 1 and HLP 2. The channel diverts runoff south and then west around the southwest edge of the Letpadaung site and back into its original catchment. This will minimise impacts on downstream users and ecosystems.

- Hydrologic modelling of the project catchment was completed allowing comparison of pre-mining and post-mining hydrologic flows. The impact of the operational mine on pre-mining hydrologic flows is summarised as follows:
- The volume of clean runoff water reporting to the community water dams south of the proposed Heap Leach Pad No. 2 is expected to be reduced significantly.
- During operations, runoff from a large proportion of the northern part of the site is directed to the WWP which would in turn overflow (when full) into the irrigation canal, running along the eastern boundary of the site. Prior to development of the mine this runoff would have reported directly to the irrigation canal. If the WWP is operated in accordance with the design the volume of surface water from the northern area of the site flowing into the irrigation canal decreases by around 60-80%.
- The overall impact to runoff volume reporting east to the Chindwin River, from the Letpadaung site, is expected to decrease due to the exclusion and rerouting of runoff. Assuming the WWP is operated in accordance with the design concepts, the runoff reporting to the Chindwin River is expected to decrease by roughly 28%.
- The overall impact of runoff volume reporting north, to the Yama Stream, from the Letpadaung site is expected to decrease by around 18% due to the exclusion and rerouting of runoff.

HLP Water Balance

A site water balance, incorporating water inputs and losses from the system, was completed for average, wet and dry conditions. The main purpose of the exercise was to check sizing of ponds and design allowances for system water make-up.

Under average climate conditions, the leach pad water balance is shown to be in net water deficit for approximately 6 months of the year. During this time, due to the ongoing loss occurring on the leach pad, the SWP and WWP remain empty and all shortfall will need to be made up from the Chindwin River. The annual requirement equates to around 6 Mm^3/year which is similar to the figure quoted in the China Nerin

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Engineering Basic Design report. Both ponds are adequately sized for average conditions.

Under dry climatic conditions, the annual rainfall is reduced by 45%, thereby increasing the reliance on external water sources during and after the wet season. The peak requirement in the dry season remains unchanged as it is based on a zero rainfall period of operation. However, the annual requirement from external sources increases to around 9 Mm^3/year.

Under average climatic conditions and expected operation parameters, the SWP is unlikely to overflow. It is maintained as the primary source of makeup water on site. The peak makeup water requirement is not influenced by rainfall conditions as it occurs continuously throughout the dry season. The annual makeup water requirement however is highly dependent on rainfall and dripper loss with ore absorption losses being less significant. Contingency for greater make-up water requirements should be made until system dripper losses have been measured.

The existing SWP size is suitable for containing 1 or 2 day, 1 in 100 year ARI storm events. Longer durations than this will begin to accumulate water at a higher rate than evaporation and absorption losses combined. To reduce the likelihood of SWP outflow, its capacity will need to be increased. It is recommended that the SWP storage capacity be increased to at least 4 Mm^3 in order to contain longer duration rainfall events. This can be achieved by excavating the basin of the SWP deeper while maintaining the same area.

Under average climatic conditions the WWP will store a peak volume of about 1.42 Mm^3. A long duration storm event (48 hour; 100 year ARI) will require 3.31 Mm^3. On this basis it is recommended that the WWP capacity be increased to 4.8 Mm3 from the current 4.64 Mm^3 capacity.

Use of HLP make-up water should be prioritised so that on-site, low pH water sources are used first. Make-up water may be taken from three potential sources, in order of decreasing priority, as follows: HLP stormwater pond; WWP; and the Chindwin River.

Stormwater reporting to the SWP should be re-used for irrigation of the HLPs as soon as possible.

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Runoff Water Quality

Surface water flowing within or adjacent to the site should be classified in terms of quality according to the following categories: clean; sediment laden; contact (potentially acidic or enriched with metals); and process.

Runoff from stockpiles and disturbed areas of the site is directed to the WWP. Runoff water is a combination of sediment laden and contact water. Most of the suspended solids will naturally fall out of suspension in the WWP, limiting the requirement for specialised water treatment prior to release, from a suspended solids perspective. Of greater concern is the issue of managing the potentially acidic, metal enriched contact water (running off the ore stockpiles). Mixing of the various runoff water classes, within the WWP, will lead to an approximate eight-fold dilution of the contact water. Dilution will improve the contact water quality but, depending on its constituents dilution alone is unlikely to be sufficient to preclude the need for water treatment prior to release.

To reduce the environmental risks associated with rainfall runoff on the site the following is required:

- WRDs need to be rehabilitated progressively (effectively encapsulating the mine waste). Runoff from rehabilitated surfaces will be sediment laden but would be otherwise clean.
- Contact water (runoff from ore stockpiles) must be directed to the WWP and tested to assess its requirement for treatment prior to release.
- The different water quality streams should be segregated to allow maximum potential discharge of water meeting release standards.

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To accurately evaluate contact water quality it is recommended that further sampling and testing of mine waste and ore material be undertaken. This in turn will allow a more rigorous, quantitative assessment of site runoff water quality and potential water treatment solutions.

Hydrological and Sediment Load Baseline Monitoring

The models used are based on a number of assumptions that need to be confirmed in the field. As such it is recommended that rain gauges and flow meters be installed on major drainage paths to monitor rainfall and runoff. Furthermore, baseline sediment load monitoring along major drainage paths should be undertaken for a range of seasonal flows.

Sediment Control and Modelling

SCDs should be installed downstream from any disturbed catchments that report to off site waterways, particularly along the northern boundary of the site. (The original Nerin concept design did not include SCDs, assuming that sediment laden runoff generated along the northern boundary could be released directly in to adjacent waterways). The northeast corner of the site represents a topographic low and as such WRD runoff will report to this spot. Consequently this corner will effectively operate as an SCD with the flood protection bund acting as a dam wall. Water accumulating in this dam will have to be either pumped to the Waste Water Pond (WWP) or discharged to downstream waterways (depending on water quality).

SCD and WWP sizes should be refined after more rigorous sediment modelling has been undertaken.

Improvements to Site Surface Water Management

Where ever possible the different surface water quality streams should be segregated from one another. In particular sediment laden water should be separated out from the contact water (running off the ore stockpiles or geochemically problematic mine waste) so as to reduce the quantity of poor quality water that may require treatment. This would best be achieved by operating the existing division of WWP as two ponds with the northern pond used to contain sediment laden water and the southern pond used to contain contact water (that may require special treatment prior to release).

To facilitate operation of the system it is recommended that the more environmentally problematic, low grade ore and ore reserve, stockpiles be consolidated in the northern half of HLP3. This location will allow the contact water from these stockpiles to be directed relatively easily to the south WWP cell.

Timing for construction of ECDs and diversion channels needs to be reconciled with the latest mining plan. In particular this will determine which structures are required early in the project and which can be deferred.

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1. INTRODUCTION

The Letpadaung Copper Project is located in the south of the Sagaing Division, Myanmar, approximately 730 km north of Yangon.

Myanmar Wanbao Mining Copper Limited (MWMCL) are contemplating developing the project, which will comprise an open pit copper mine and processing facilities including the following:

- A crushing circuit and heap leaching operation (comprising three heap leach pads), with an average throughput of 92,000 tonnes per day and potential for expansion;
- A solvent extraction and electrowinning (SX/EW) plant to produce 100,000 tonnes per annum of cathode copper;
- Three associated waste rock dumps (WRDs);
- On site accommodation villages; and
- Associated access roads and typical mine support infrastructure.

The Project layout showing the location of key infrastructure items is shown on Figure 1.1.

The site is characterised by flat alluvial plains punctuated by steep sided hills up to 300 m high. The site on occasions experiences high intensity rainfall events, particularly during the wet season. Average annual rainfall is in the order of 774 mm with the majority of the rain falling in the months of April through to November.

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An important aspect of the project design process concerns surface water management so as to understand and, if necessary, mitigate downstream social and environmental impacts associated with development of the project, from early works through to closure.

Development of the mine will involve disturbance of existing watershed catchments both in terms of hydrologic flows and in terms of water quality. Excavation of the open pit and establishment of WRDs and heap leach pads (HLPs) will result in rainfall runoff from the effected catchments being diverted into adjacent sub-catchments and catchments.

Disturbance of the catchments will result in soil erosion, that if not managed properly, could result in elevated sediment loads in downstream rivers and waterways. The mine waste and ore has the potential to generate acid and will be enriched with metals. Surface water runoff from the WRDs, low grade ore stockpiles, and HLPs will need to be stored, tested (and treated if unable to meet release criteria) before release to the

downstream river system. On this basis the potential impact of the mine development in terms of surface water quality needs to be modelled.

The core principles of good surface water management practice are as follows:

- Identify watershed catchments influenced by the proposed development;
- Reduce hydrologic flow impacts of the development by maintaining pre-mining watershed catchment flow routing wherever possible;
- Classify watershed catchments as either undisturbed (clean water) or disturbed (contact water); and
- Separate and segregate clean water and contact water (so as to reduce handling requirements).

The surface water management concept design was undertaken by MWMCL. Knight Piésold were engaged to review the potential environmental impacts and outcomes of the design. This report provides a general, high level description of the hydrologic and water quality impacts associated with the development as well as recommendations to improve management of surface water on the project site, in accordance with the aforementioned principles.

1.1 SCOPE OF WORK

Consistent with the scope of work it was agreed that the following outputs would be generated from the of the site water management assessment:

- A baseline climate analysis including discussion of potential climate change impacts;
- Definition of water inputs and outputs for each classification of water under normal, extreme dry and extreme wet climatic conditions;
- A description of the current hydrologic flows before the project is implemented and changes that will occur progressively as it is implemented with definition of the impact of the changes;
- An estimate of the potential water quality levels in ponds and discharge zones across the site (for each water classification) and an assessment of the requirements for treatment.
- A discussion of options to mitigate impacts of water use on the site, changes in hydrologic flows, changes in water quality, volumes to be released from the site and management recommendations.

Small scale sediment control structures are described in the “Erosion and Sediment Control Guidelines” report (Ref.1) and are therefore not discussed herein. However, Sediment Control Dams are discussed briefly in Section 6.0.

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1.2 DESIGN OBJECTIVES

An important aspect of the project will be the management of surface water runoff in order to achieve the following objectives:

- Mitigate the risk of contamination of nearby waterways due to runoff from heap leach pads, waste rock dumps, the plant site, and other site infrastructure.
- Control soil erosion and subsequent re-deposition, thereby reducing adverse impacts to downstream environments for all aspects of the project, from initial development through to closure.

The contamination management objectives are as follows:

- Identify and separate benign mine waste from mine waste that is potentially contaminated with: heavy metals; or potentially acid forming (PAF) sulphide minerals.
- Direct potentially contaminated surface runoff (contact water) to stormwater retention ponds which will in turn report to a polishing pond (and treatment as necessary) before release to the environment.
- Identification of undisturbed catchments to allow segregation of freshwater from contact water.

The erosion and sediment control objectives are as follows:

- Reduce sediment loadings within runoff reporting from impacted project areas to the downstream environment by implementing practical and cost-effective solutions for both short and long-term erosion and sediment control.
- Fully integrate the erosion and sediment control measures with the project development and operations.
- Reduce maintenance costs for the project infrastructure arising from inadequate surface water management.
- Provide long-term post-mining surface water management, including erosion and sediment control measures, for the establishment of stabilised and protected final reclaimed surfaces that require low maintenance.
- Comply with environmental discharge limits with respect to total suspended solids.

The incorporation of surface water management methods throughout the project life can substantially reduce the volume of eroded sediment produced and the volume transported to the downstream environment. Properly implemented, it will also lead to lower infrastructure maintenance costs (i.e. prevention of sedimentation or washout of drainage ditches, roads, culverts, etc.) as well as reduced capital and maintenance

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costs for reclamation of impacted project areas (i.e. prevention of slope erosion, sedimentation or washout of surface water diversion and control structures, etc.).

1.3 DESIGN CRITERIA

1.3.1 Selection of Design Annual Recurrance Interval (ARI)

For design purposes the ARI should vary depending on importance of structure, cost of repair and consequences of failure. The operational life of a structure should also be considered when assigning a design ARI. Probability of exceedance over the operational life of a structure varies with its design life according to the following equation:

$$Return\ Exceedence = 1 - (1 - AEP)^{Operational\ Life}$$

AEP represents the Annual Exceedance Probability (AEP = 1 / ARI). It is assumed that the operational life of all structures is equal to the project life of 31 years. Application of the above equation demonstrates that the longer the operational life of the structure the greater the probability of exceedance over this period of time for a given ARI. An indication of return exceedance, over the project life, for a given annual return interval is shown in Table 1.3.1.

Table 1.3.1: Variation of return exceedance with ARI (for 31 year operation life)

ARI	Return Exceedance
20 years	80%
50 years	47%
100 years	27%

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An ARI of 100 years has been conservatively adopted for the analysis herein.

1.3.2 Design Storms

The hydrologic run-off flows and volumes for the surface water management structures were assessed using a 100 year annual return interval (ARI) design storm. Two different duration design storms were considered as follows:

- Long duration (48 hours); and
- Short duration (6 hours).

The total storm depths of these two design storms were taken from the site Intensity / Duration / Frequency (IDF) curve. The Rainfall Ratio Method was used to extrapolate results to durations both less than and greater than 24 hours. The total storm depths were then temporally distributed using hyetograph patterns derived from historic data.

Further detail concerning the derivation of both the site IDF curves and hyetograph patterns is provided in Section 2.

The above design criteria were applied when reviewing hydrologic flows / volumes for the following structures:

- Ditches and diversion channels.
- WRD stormwater and environmental retention ponds.

Leach pad water balances are typically influenced by both short term high intensity events for small process pond overflows and long term wet season build up of runoff volumes in stormwater ponds. As a result, a range of additional durations have been modelled for the HLPs as outlined below.

1.3.3 Climatic Modelling for HLPs

As the water balance model was conducted on a daily basis, average and extreme rainfall patterns were scaled from historical rainfall patterns. Historical rainfall was obtained from nearby climate stations.

The following conditions were examined for the HLP water balance scenarios:

- Average rainfall conditions;
- Storm events of 1, 2, 3, 4, 7, 14 and 30 days;
- Wet season events of 60, 90, 120 and 180 days;
- Annual events of 1 and 2 year wet and dry cycles.

All wet event scenarios were based on an ARI of 100 years. Details of the assumptions and design criteria applied for the HLP related climate modelling are described in Section 4.

1.3.4 Runoff Coefficients

The SCS Curve Number Method, as described in the US Department of Agriculture Technical Note (Ref. 2) was used for the surface water management models. Each individual catchment was assigned a curve number which was done by breaking the catchment areas into definable area types. For the existing conditions (pre-mining) model, catchments were defined as consisting of a mixture of the three area types as described in Table 1.3.2. The proportion of each area type making up the catchment was estimated. The curve number for individual catchments was calculated as a weighted average of curve numbers, according to area types, and their catchment proportions.

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Table 1.3.2: Curve numbers for the existing conditions model

Area Type:	Natural Vegetation	Farmland	Water Pond
Cover Description:	Brush	Pasture	N/A
Soil Type:	C	C	N/A
Hydrologic condition:	Good	Fair	N/A
SCS CN for AMC II:	65	79	98

For the planned conditions (operations phase) model, curve numbers were calculated using the same methodology as above, assuming five area types, as detailed in Table 1.3.3.

Table 1.3.3: Curve numbers for the planned conditions model

Area Type:	Natural Vegetation	Farmland	Developed / Disturbed Areas	Leach Pad	Water Pond
Cover Description:	Brush	Pasture	Newly graded areas (no vegetation)	Newly graded areas (no vegetation)	N/A
Soil Type:	C	C	C	A	N/A
Hydrologic condition:	Good	Fair	N/A	N/A	N/A
SCS CN for AMC II:	65	79	91	77	98

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For all of the Area Types, excluding the Leach Pads and Water Ponds, soil type “C” was adopted. This is because the soils of the Letpadaung Project site were assumed to have low infiltration rates. The HLPs were assigned soil type “A”, as the leached ore heaps are assumed to have low runoff potential and high infiltration rates. Soil types are as defined in *Design Hydrology and Sedimentology for Small Catchments* (Ref 3).

The Antecedent Moisture Condition (AMC) of the catchments was assumed to be AMC III. This assumes that the soils are already thoroughly wetted which is expected to be the case during the wet season. The AMC III curve number is calculated from the AMC II curve number using the following equation:

2. CLIMATOLOGY

2.1 GENERAL

A complete baseline design climatology study was completed by KP (and is attached as Appendix A). This study defines the preliminary hydrologic basis for on-going and future design work. The following sub-sections outline key results from this report.

2.2 DATA SOURCES

Four different sources of historic climate data were used to derive baseline design climate estimates:

- Daily historic data spanning the period (1961-2013) from the Monywa Township climate station, located 5.6 km northeast of Letpadaung Hill, was employed for deriving precipitation estimates.
- Monthly historic pan evaporation data spanning the period (2000-2013) from the Yangtse climate station, located 7.6 km northwest of Letpadaung Hill at the Sabetaung and Kysintaung (S&K) operations site was employed for deriving evaporation estimates.
- Daily temperature data spanning the period (1981-2012) from the World Meteorological Organization (WMO) climate station number 48037, located 4.7 km northeast of Letpadaung Hill was used for determining temperature normals.
- Hourly wind speed, wind direction and precipitation data spanning the period (2010-2012) derived from the MM5 (5th generation Mesoscale Model) and SAMSON hourly surface meteorological datasets at a sampling location 0.9 km northwest of Letpadaung Hill was used for characterization of prevailing wind normals and in developing precipitation temporal distributions.

2.3 PRECIPITATION

2.3.1 Monthly Pattern

The historic precipitation dataset outlined in Section 2.2 was aggregated on annual and monthly time scales and used to compute sampling statistics to define normal precipitation patterns at Letpadaung Hill. The resulting normal pattern of monthly precipitation is reproduced in Table 2.3.1.

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Table 2.3.1: Monthly precipitation statistics – Monywa Township (1961-2013)

Month	Average (mm)	Median (mm)	Std. Dev. (mm)	Min. (mm)	Max. (mm)	Average # of Rain Days[*1]
Jan	2	0	6	0	31	0
Feb	3	0	15	0	102	0
Mar	5	1	14	0	96	1
Apr	26	21	22	0	100	4
May	102	94	70	12	386	9
Jun	100	72	79	0	342	9
Jul	67	59	43	2	182	8
Aug	121	103	80	0	356	10
Sep	166	150	89	47	496	11
Oct	142	136	95	15	513	10
Nov	33	12	44	0	186	3
Dec	6	0	17	0	85	1

*1 Incomplete data from 1995 (Jan – Jun), 1999 (Jan – Apr) and 2013 (Jun – Dec) were excluded from this analysis.

Annual average precipitation is 774 mm, normally occurring over 65 rain days each year. The wet season lasts for eight months, from April through the end of November. The wettest month of the year is September (166 mm on average) and the driest is January (1.9 mm on average).

2.3.2 Design Rainfall Totals

Frequency analysis was performed on daily precipitation data with EasyFit Professional 5.4 software (Ref. 4) in order to determine the best-fitting probability distribution for use in estimating extreme short-duration design storms totals at the project site. After the design totals were augmented to account for potential straddling errors caused by the use of fixed 24 hour periods (Ref 5), the Rainfall Ratio method (Ref. 6) was used with tabulated fitting coefficients appropriate to the Letpadaung site to derive the Intensity / Frequency / Duration (IDF) relationship describing design rainfall. The resulting IDF curve is reproduced in Table 2.3.2

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Table 2.3.2: Letpadaung intensity / frequency / duration results

Storm Duration	Precipitation Intensity (mm/h) for given ARI (year) Storm[*1]							
	2	5	10	20	50	100	200	500
5 min	157	205	235	262	295	319	341	369
10 min	128	167	192	214	241	260	279	302
15 min	109	142	163	182	205	221	237	256
30 min	76	99	114	127	143	154	165	178
1 h	49	63	72	81	91	98	105	114
2 h	29	38	43	48	55	59	63	68
3 h	21	28	32	35	40	43	46	50
6 h	12	16	18	20	23	24	26	28
12 h	7	9	10	11	13	14	15	16
18 h	5	6	7	8	9	10	10	11
24 h[*2]	4	5	6	6	7	8	8	9
48 h[*3]	2	3	3	4	5	5	6	6
72 h[*4]	2	2	3	3	4	4	5	6

*1 Intensity values are shown rounded to the nearest mm/h.

*2 Intensity values for 24 hour duration storms have been augmented 14.3% to account for potential straddling errors in sampling which may occur from the usage of fixed 24 hour duration observational periods in deriving daily and sub-daily design storm estimates (Ref 5).

*3 Intensity values for 48 hour duration storms have been augmented 6.7% (Ref 5).

*4 Intensity values for 72 hour duration storms have been augmented 4.4% (Ref 5).

2.3.3 Design Temporal Distributions

Site temporal patterns (hyetographs) of precipitation were derived from hourly precipitation data included with the wind sampling dataset for storm durations ranging between 2 and 45 hours. The resulting hyetographs from a subset of storms considered (durations between 2 and 9 hours) are reproduced in Table 2.3.3.

Table 2.3.3: Letpadaung hyetograph results for 2 through 9 hour storms

Elapsed Time (h)	Cumulative Percentage of Total Precipitation for *n* hour Storm							
	2	3	4	5	6	7	8	9
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	55.3%	22.9%	15.3%	6.6%	8.1%	6.7%	0.9%	3.8%
2	100.0%	77.0%	56.2%	37.2%	24.3%	19.0%	4.7%	13.7%
3		100.0%	90.1%	67.8%	45.3%	43.0%	15.6%	34.9%
4			100.0%	93.7%	76.5%	70.1%	51.5%	63.4%
5				100.0%	97.1%	88.5%	73.8%	81.3%
6					100.0%	98.4%	88.3%	88.9%
7						100.0%	97.5%	93.7%
8							100.0%	97.8%
9								100.0%

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2.3.4 Trend Analysis

Precipitation trend analysis was performed on the full historic dataset. The results of this analysis show that there is no statistically significant trend observable in annual precipitation values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future precipitation cycles due to observed climate change. Details of this analysis are provided in Appendix A.

2.3.5 Water Balance Scenarios

Frequency analysis was performed on 15 candidate water balance cycle durations to estimate the statistical likelihood of experiencing extremely "Wet" or "Dry" years at the Letpadaung site and the corresponding design totals. The durations considered include:

- Long duration cycles of 1, 2, 3, 4 and 5 years and
- Short duration cycles of 2, 3, 4, 7, 14, 30, 60, 90, 120 and 180 days.

The wettest (or wettest and driest in the case of the 1 year duration precipitation cycle) historical records of continuous rainfall were converted to a series of cumulative daily percentages for use in apportioning water balance cycle design totals to daily amounts. A summary of these results is shown in Table 2.4.

Table 2.3.4: Letpadaung water balance scenario summary

Scenario	100-yr ARI Total Depth (mm)	500-yr ARI Total Depth (mm)	Temporal Pattern Based on Historic Period
5 Year Wet	5,479	5,839	1973 – 1979
4 Year Wet	4,630	5,083	1973 – 1976
3 Year Wet	3,644	4,083	1975 – 1977
2 Year Wet	2,544	2,844	2010 – 2011
1 Year Wet	1,555	1,902	1973
1 Year Dry	424	383	1982
180 Day Wet	1,437	1,767	25/05/1973 – 20/11/1973
120 Day Wet	1,067	1,272	2/07/2010 – 29/10/2010
90 Day Wet	921	1,101	30/07/1965 –27/10/1965
60 Day Wet	740	865	29/08/1965 – 27/10/1965
30 Day Wet	520	596	29/09/2010 – 28/10/2010
14 Day Wet	440	563	9/05/2007 – 22/05/2007
7 Day Wet[*1]	343	447	9/05/2007 – 15/05/2007
4 Day Wet[*2]	308	410	1/06/1984 – 4/06/1984
3 Day Wet[*3]	298	401	1/06/1984 – 3/06/1984
2 Day Wet[*4]	214	249	2/06/1984 – 3/06/1984

*1 Scenario totals for 7 day duration cycles have been augmented 1.8% to account for potential straddling errors in sampling (Ref. 5).

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*2 Scenario totals for 4 day duration cycles have been augmented 3.4% (Ref. 5).

*3 Scenario totals for 3 day duration cycles have been augmented 4.4% (Ref. 5).

*4 Scenario totals for 2 day duration cycles have been augmented 6.7% (Ref. 5).

Details of all 32 derived water balance scenarios are provided in Appendix A.

2.4 EVAPORATION

2.4.1 Monthly Pattern

The historic evaporation dataset outlined in Section 2.2 was aggregated on annual and monthly time scales and used to compute sampling statistics to define normal evaporation patterns at Letpadaung Hill. The resulting normal pattern of monthly evaporation is reproduced in Table 2.4.1

Table 2.4.1: Monthly pan evaporation statistics – Yangtse climate station (2000-2006)

Month[*1]	Average (mm)	Median (mm)	Std. Dev. (mm)	Min. (mm)	Max. (mm)
Jan	123	121	5	119	134
Feb	149	151	13	130	166
Mar	210	213	14	188	224
Apr	228	236	21	191	248
May	202	205	43	118	256
Jun	203	187	36	165	270
Jul	172	174	12	153	187
Aug	184	175	38	133	248
Sep	160	150	27	128	208
Oct	145	148	27	102	184
Nov	125	130	17	102	146
Dec	117	112	12	98	131

*1 All computed pan evaporation statistics are measured in (mm).

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Annual average lake evaporation is estimated at 1,412 mm, which assumes a pan coefficient of 0.7 applied to the calculated annual average pan evaporation (2,017 mm).

2.4.2 Trend Analysis

Trend analysis was performed on the full historic dataset of pan evaporation. The results of this analysis showed an unexplained downshift of nearly 600 mm in annual average pan evaporation between 2006 and 2007. As a shift of this magnitude is highly unusual, further investigation was performed in an attempt to explain the variation.

The results of this additional investigation, detailed in Appendix A, led KP to exclude the historic period (2007-2012) of pan evaporation from consideration. Accordingly

only data from the historic period (2000-2006) was used for forming the design data values provided in Table 2.5.

Inspection of this reduced dataset shows no statistically significant trend observable in annual pan evaporation values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future pan evaporation due to observed climate change. Details of this analysis are provided in Appendix A.

2.4.3 Comparison of Precipitation and Evaporation

Average monthly values of precipitation (taken from Section 2.3.1) and pan evaporation (taken from Section 2.4.1) were compared to determine if the site is expected to run under annual water surplus or deficit conditions. The comparison is provided in Table 2.4.2.

Table 2.4.2: Comparision of monthly average precipitation and evaporation

Month	Ave. Precipitation (mm)	Ave. Pan Evaporation (mm)	Ave. Lake[*1] Evaporation (mm)	Precip. minus Lake Evap. (mm)
Jan	2	123	86	-84
Feb	3	149	105	-101
Mar	5	210	147	-142
Apr	26	228	160	-134
May	102	202	142	-40
Jun	100	203	142	-42
Jul	67	172	121	-54
Aug	121	184	129	-7
Sep	166	160	112	54
Oct	142	145	101	50
Nov	33	125	87	-55
Dec	6	117	82	-75
Totals	773	2,017	1,412	-639

*1 Assumed pan coefficient = 0.7.

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Additional details concerning the comparison of precipitation to pan evaporation are given in Appendix A.

The comparison between precipitation and evaporation can be used to indicate general trends in water build up or reduction on the site as follows:

- If precipitation is higher than evaporation, a water surplus usually results.
- If evaporation is larger than precipitation, the water surplus – deficit relationship is controlled by the ratio of runoff catchment area to evaporation surface area. This

scenario requires site specific modelling to draw any meaningful conclusions with regards to the site water balance.

For Letpadaung it is clear that in the wet season, particularly during September and October, there will be a build up of water in the various storage ponds across the site. For the rest of the year, areas such as the HLPs, which are continuously wetted (thus acting as an evaporative surface) will operate with a moderate to large water deficit.

For storm runoff and waste rock dump collection ponds the transition from water surplus to deficit would be likely to be only for the peak dry season (February to April). It is estimated that for the overall site the large shortfall from the heap leach pad water balance is likely to result in an overall site deficit. Adequate water storage and careful management of available water resources will be critical for the mining operations at Letpadaung.

2.5 TEMPERATURE

2.5.1 Monthly Patterns

The historic temperature dataset outlined in Section 2.2 was aggregated on annual and monthly time scales and used to compute sampling statistics to define normal temperature patterns at Letpadaung Hill. The resulting normal pattern of monthly average temperature is reproduced in Table 2.5.1.

Table 2.5.1: Monthly average temperature statistics – WMO 48037 station (1981-2012)

Month[*1]	Average	Median	Std. Dev.	Min.	Max.
Jan	21.9	21.9	1.9	18.4	28.0
Feb	24.0	23.6	2.3	21.1	32.9
Mar	28.1	28.0	2.3	23.1	35.5
Apr	30.9	30.9	1.4	25.9	33.1
May	31.0	31.0	1.4	28.1	33.8
Jun	30.6	30.5	1.1	27.8	32.9
Jul	30.5	30.8	1.2	26.8	32.5
Aug	29.9	29.8	1.0	28.4	32.1
Sep	29.3	29.3	0.7	27.8	30.4
Oct	28.0	28.	0.7	26.5	29.8
Nov	25.1	25.3	1.1	23.0	27.6
Dec	22.2	22.0	1.9	18.4	28.0

*1 All computed temperature statistics are measured in (℃).

Monthly temperature ranges were also analysed through the computation of monthly averages on daily temperature maxima and minima. The results of this computation are reproduced as Table 2.5.2.

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Table 2.5.2: Monthly temperature ranges – WMO 48037 station (1981-2012)

Month[*1]	Max. (℃)	Average (℃)	Min. (℃)
Jan	28.5	21.9	15.4
Feb	31.6	24.0	16.9
Mar	36.0	28.1	20.5
Apr	38.4	30.9	24.0
May	36.8	31.0	25.5
Jun	35.4	30.6	26.0
Jul	35.5	30.5	26.1
Aug	34.3	29.9	25.7
Sep	33.4	29.3	25.3
Oct	32.5	28.0	23.8
Nov	30.4	25.1	19.9
Dec	28.0	22.2	16.4

Temperatures are fairly consistent during the six warm months of the year: April through September, when the average value is 30.4℃. The other four "shoulder" months exhibit a cyclical transition from the warm period to the coldest two months of the year: December and January, when the average temperature is 22.1℃, Minimum temperature generally occurs in January (15.4℃) and the maximum in April (38.4℃).

2.5.2 Trend Analysis

Temperature trend analysis was performed on the full historic dataset. The results of this analysis show that there is no statistically significant trend observable in annual values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future temperature due to observed climate change. Details of this analysis are provided in Appendix A.

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2.6 WIND

Winds generally blow from the North (0°) to North by Northwest (337.5°) at an average speed of 3.0 m/s, with a maximum speed of 9.2 m/s. These correspond to Beaufort scale readings of 2 "light breeze" to 5 "fresh breeze". The direction the wind blows from tends to reverse during the afternoon, blowing from the South (180°) to Southeast (225°). Available data indicates that high wind storms are unlikely at the Letpadaung site. The Letpadaung wind rose plot, including all daily measurements are included in Appendix A.

Seasonal variability was also considered. The dataset was divided into the Wet (May through October) and Dry (November through April) Seasons. Wind rose plots were produced for each season. During the Wet Season, winds generally blow along the North / South cardinal directions, with the preponderance of statistical data suggesting

that winds blow from the South (180°) to South by Southeast (157.5°). In the Dry Season, the wind blows predominantly from the North (0°) to North by Northwest (337.5°). Letpadaung Wet Season and Dry Season wind rose plots are included in Appendix A.

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3. SURFACE WATER MANAGEMENT IMPACT ASSESSMENT

3.1 GENERAL

The Letpadaung Surface Water Management Impact Assessment aims to quantify the impact of the planned development at the Letpadaung project site on surface water runoff resulting from selected design rainfalls. In the context of the report, this section deals with the likely impacts of the development on the quantity and timing of runoff flows from the site. Water quality impacts are discussed in Section 5. Management and design of the HLP surface water infrastructure is discussed in Section 6.

The impact assessment was made through the construction and subsequent use of two site-wide rainfall / runoff models that were constructed using HEC-HMS software (Ref. 7), one model corresponding to existing (pre-mining) conditions and the other to planned future (operational) conditions. The existing catchments are provided in Figure 3.1 while the revised catchment configurations after construction of the mine are shown in Figure 3.2. Results were tabulated at key locations common to both models and used for purposes of comparison.

The following sub-sections provide details regarding modelling methods and assumptions, results of the simulations, and various considerations and recommendations for future surface water planning and design (based on the modelling results).

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3.2 MODELLING METHODOLOGY AND ASSUMPTIONS

The approach for estimating runoff to various locations in the Letpadaung catchment (both for existing and planned future conditions) was to simulate runoff from the total area using a rainfall / runoff model constructed using HEC-HMS software (Ref. 7). By simulating the runoff hydrographs resulting from rainfall on each sub-catchment (or basin) reporting to and from the Letpadaung project area and routing them (combining hydrographs as necessary) throughout the natural and man-made sections of the overall drainage network, it was possible to determine peak runoff flow rate, time to peak runoff and total volume of runoff which reports to (or past) selected locations throughout the site. These results form the quantitative basis for impact assessment.

Background assumptions and methods employed in the Letpadaung HEC-HMS models for existing and planned future conditions are discussed in more detail in Appendix B.

Unless otherwise stated, the various water ponds in the Letpadaung hydrologic models were simulated assuming all ponds were full. Furthermore, since the majority of the design inputs for the water ponds were assumed, pond attenuation results are

indicative only. Precipitation was estimated using the SCS Curve Number Method, as described in Section 1.3.

Two potential 100 year ARI design storms, one of long duration (48 hours) and one of short duration (6 hours) were estimated for use as hydrologic inputs to the models. The total storm depths were then temporally distributed using the hyetograph patterns that were derived from historic data.

The operational model was run under two initial pond conditions for the Waste Water Pond. The two initial pond conditions are full and empty, where the pond was assumed to be either filled to the spillway invert level or completely empty. This was done due to uncertainty as to the typical pond volume. The scenario with the full pond provides the most conservative assumption for the sizing of outflows from the Waste Water Pond. The scenario with the empty pond provides the most conservative assumption for the estimation of the reduction of run off from the site (and potential impact on downstream users or the environment).

3.3 DESCRIPTION OF SURFACE WATER MANAGEMENT STRUCTURES

3.3.1 Overview

The surface water management structures for the site (excluding those associated with the HLPs) comprise the following:

- The South Diversion Channel.
- The Waste Water Pond (WWP).
- The Flood Protection Bund.
- Sundry minor diversion channels conveying runoff from WRDs and ore stockpiles to the WWP.
- Sundary minor retention ponds and silt traps used as temporary on site storage between their sub-catchments and the WWP.

These structures are shown on Figure 1.1 and briefly described below.

3.3.2 South Diversion Channel

The undisturbed catchment to the southwest of the Letpadaung project area drains to a river which currently flows through the area planned for construction of HLP 1 and HLP 2. In the early stages of planning the option of diverting runoff from this catchment through the middle of the site was contemplated. In light of the environmental, operational, construction, and commercial risks MWMCL decided to evaluate an alternative to this concept. In consultation with KP it was agreed that the South Diversion Channel would be built along the western edge of HLP 1 and HLP 2, in order

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to divert runoff south and then west around the southwest edge of the Letpadaung site and back into its original catchment, draining to the existing water pond (WP-EX-002/WP-PL-002). In order to accomplish this, the channel could be located either immediately adjacent to the current southern and western lease boundaries (which would require additional property acquisition), or the western boundary of HLP 1 and HLP 2 could be moved slightly east in order to allow for construction of the diversion on currently owned land. There are several significant advantages associated with the South Diversion Channel option as follows:

- Runoff would be maintained in its natural catchment, thereby minimising impacts on downstream users and ecosystems.
- Construction of this option may be easily converted to a permanent surface water management system that is suitable for closure conditions. (The current Nerin-designed western diversion would only be temporary, requiring redesign and replacement at mine closure.)
- Use of this option provides a conveniently located source of clean construction material that could be borrowed during excavation of the channel.

3.3.3 Waste Water Pond (WWP)

The Waste Water Pond (WWP) is located on the eastern project boundary, with the flood protection bund acting as the eastern embankment. The WWP collects water from a number of on site sources, with the main one listed as follows:

- Runoff from WRDs;
- Open pit dewater;
- Runoff from low grade ore stockpiles;
- Runoff from reserve ore stockpiles; and
- Runoff from topsoil stockpiles.

Additional, minor sources include:

- Treated effluent from the site sewerage treatment plant; and
- Discharge from on-site cooling towers and compressors.

3.3.4 Flood Protection Bund

The purpose of the flood protection bund, along the eastern boundary of the project, is to mitigate the risk of flooding from the Chindwin River. The flood protection bund was designed by others and is outside of the scope of this report. Though outside the scope of this report, there are concerns regarding the potential impact of the flood protection bund. The main concern being that the bund could act as a bottleneck, concentrating

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the flow of the Chindwin during periods of flooding. This may increase the frequency and severity of flooding of the villages located between the site and the Chindwin River. Further flood modelling and analysis is warranted to better understand the risks associated with the proposed flood protection bund.

3.3.5 Minor Internal Diversion Channels

A network of diversion channels extends around the site to ensure that contact water from stockpiles and runoff from disturbed catchments is conveyed to the WWP.

3.3.6 Minor Retention Ponds and Silt Traps

Sundry minor retention ponds and silt traps are distributed around the site for temporary storage before release to the downstream environment or before pumping to the WWP. These would include the silt traps along the northern boundary of the site and the waste water collection pond, immediately south of WRD 2.

3.4 RESULTS OF MODELLING

3.4.1 Comparison of Hydrologic Flows

The pre-mining and operational rainfall / runoff models were run and the detailed results are provided in Appendix B. A summary of the primary impacts is provided below.

The following parameters were estimated, for pre-mining and operational conditions, at key locations on and around the Letpadaung site:

- Drainage area;
- Peak runoff rate; and
- Total runoff volume.

Comparison of the above parameters was done to gauge the impact of the development on the downstream environment, primarily in terms of total runoff quantity. With respect to hydrologic flows, the main impacts associated with the mine development are detailed below.

- The volume of clean runoff water reporting to the large water pond located immediately southwest of proposed Heap Leach Pad No. 2 (WP-EX-002/WP-PL-002) is expected to be reduced by 21% under both long- and short-duration storms. This is a direct result of either the removal or diversion of runoff from the pre-mining catchment area.
- The volume of clean runoff water reporting to the small water pond located immediately southeast of proposed Heap Leach Pad No. 2 (WP-EX-004/WP-PL-003)

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is expected to be reduced by up to to 47% as a result of removal of original catchment.

- During operations, runoff from a large proportion of the northern part of the site will be directed to the WWP which in turn overflows (when full) into the irrigation canal, running along the eastern boundary of the site. Prior to development of the mine this runoff would have reported directly to the irrigation canal. The impact of the WWP on hydrologic flows varies according to whether the WWP is assumed to be full or empty. If empty, most of the runoff is stored and the volume of runoff passing comparison points CP-EX-033/CP-PL-025 and CP-EX-20/CP-PL-023 decreases by around 80% and 90% respectively.
- In the pre-mining catchment configuration rainfall runoff enters the irrigation channel at a number of points along its length. After the mine is constructed all of these catchments are directed into the WWP and overflow from the WWP enters the irrigation channel at one location (CP-EX-033/CP-PL-025). As a result if the WWP is full at the commencement of the storm the volume of run off reporting to CP-EX-033/CP-PL-025 is expected to increase by around 84%. At a control point south of the relevant catchments (CP-EX-020/CP-PL-23) the flow decreases by 18%. It should be noted that under average conditions the WWP (even in the peak of the wet season) is less than 30% full.
- The volume of runoff water reporting to the northeast corner of the Letpadaung property (CP-EX-044/CP-PL-065) is expected to increase by up to 176% as a result of planned stormwater diversions along the north edge of the mine site. This result was expected as the catchment area which reports to this location will increase by around 1 km^2 under operational conditions. As this area is a topographical low point this corner of the site will effectively operate as an SCD with the flood protection bund acting as a dam wall. Water accumulating in this dam has to be either pumped to the WWP or discharged to the downstream irrigation canal (depending on water quality).
- In the event of release of water into the downstream irrigation canal, design flows reporting to the canal are likely to increase. The irrigation canal design should be checked to ensure that it has adequate capacity to accept such a flow increase.
- The overall impact to runoff volume reporting east to the Chindwin River, from the Letpadaung site, is expected to decrease due to the exclusion and rerouting of contact water runoff. Assuming the WWP is empty, the runoff reporting to the Chindwin River is expected to decrease by roughly 28%.

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- Similarly, the overall impact of runoff volume reporting north to the Yama Stream from the Letpadaung site is expected to decrease by around 18% due to the exclusion and rerouting of contact water runoff.

Details of outputs from the hydrologic models are provided in Appendix B.

3.4.2 Diversion Channel Sizing

Results of the operational hydrologic model for the short-duration design storm (100 year ARI, 6 hour duration) were reviewed to provide preliminary runoff flow rates for the design of selected diversion channels onsite as indicated in Table 3.4.1.

Table 3.4.1: Preliminary diversion channel design flows

Sub-Catchment	Peak Inlet Design Flow (m^3/s)	Peak Outlet Design Flow (m^3/s)
South Diversion Channel	26	26
Contact water diversion from HLP 1 (DC-PL-032)	51	51
Contact water diversion from HLP 2 (DC-PL-031)	51	51
Contact water diversion through center of site (DC-PL-042, DC-PL-041, … DC-PL-034)	6	49
Contact water diversion along the southern edge of the northeast waste dump (DC-PL-046)	23	23
Clean water diversion along the northern edge of the mine site (DC-PL-059, DC-PL-058, … DC-PL-052)	2	16

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Design flow rates listed are to be considered preliminary due to the assumed geometric and topographic configuration of the storm water conveyance system. Appropriate sizing of the storm water conveyance system should be performed and the model results updated prior to final design. Details of outputs from the hydrologic models are provided in Appendix B.

4. HEAP LEACH PAD WATER BALANCE MODEL

4.1 GENERAL

A water balance model incorporating the leach pads, process water ponds and stormwater pond was developed. The model was used to assess the water build-up during wet periods and to quantify the make-up water required during dry periods each year. The heap leaching process involves the management of a large volume of acidic solution, and considerations of water balance are of considerable importance to the successful operation of the facility. The modelling parameters used were predominantly based on information provided in the Basic Design report (Ref 8) and are shown schematically in Figure 4.1 (with units of m^3/day). To illustrate the processing details a flowchart is shown on Figure 4.2. The water balance, conducted by KP, included a full year of operation and additional modelling for extreme climatic conditions and sensitivity of critical parameters. The model was based on a daily time step using a series of historical rainfall input patterns to model the resulting fluctuations in various process ponds, the stormwater pond and raw water makeup requirements.

On average, the site has about 774 mm of rainfall annually and an annual pan evaporation of 2,017 mm. This indicates that an overall annual water shortfall is expected. The majority of the rain however occurs over a 6 month period, coinciding with the lower evaporation months, resulting in a distinct water positive period for a number of months before returning to a shortfall for the remainder of the year. Hence, longer duration wet seasons tend to be more critical for maximum pond volumes than short term storm events. A range of events with durations from 1 day to 1 year have been modelled in the water balance. For the purposes of the water management, the heap leach facility has been designed to contain all run-off resulting from a 1 in 100 year return interval event. No allowance has been made for treatment and release of excess water in the model.

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4.2 WATER BALANCE MODEL

The modelling of the water balance was set up using the EXTEND simulation software package. EXTEND allows construction of a dynamic model of the water management system that can include multiple operational controls, limits and links between various system parts.

In order to provide information for the input and output data, the model was set up linked to an EXCEL spreadsheet. The EXCEL spreadsheet contains the relevant input and output data for each model run. A layout of the Extend model is shown in Figure 4.3.

4.3 MODEL COMPONENTS

The following section discusses the individual model components as standalone modules which each have modelled inputs/inflows and calculated outputs/outflows. Components are then duplicated and linked within the EXTEND model to examine the combined effect of all components acting together.

4.3.1 Heap Leach Pad

Each Heap Leach Pad (HLP) comprises a defined area onto which crushed ore is continuously stacked over the course of the mine life. The surface of the freshly stacked ore is irrigated with acid solution through a network of drippers for a predetermined period of about 400 days. Copper is progressively extracted from the crushed ore until the return of copper concentrate ceases to be economic. After this period, a subsequent lift (approximately 6 m high) is stacked on top of the pad to allow additional ore to be irrigated on the same pad. The process is repeated until the pad size becomes too small for further stacking or irrigation.

The base of the pad comprises an engineered HDPE lined foundation onto which a drainage layer and pipework collection network is installed. The pad is divided into a number of discrete cells which have been defined by both stacking and irrigation requirements, and topography. Division of the cells will be achieved using independent drainpipe systems exiting the leach pad in individual outlet pipes into a solution collection channel or pipe running the length of the pad. The outlet pipes may be throttled to direct solution flow either into a Pregnant Liquor Solution (PLS) pond, Intermediate Liquor Solution (ILS) pond or the single stormwater pond. The pipes carrying solution with the highest copper content will report to the PLS pond whilst lower concentration solution (as defined by the operators) will report to the ILS pond or the stormwater pond. Clean rainfall from unirrigated areas or overflow from the pad will report to the stormwater pond via the channel, thereby maximising copper concentration in the PLS pond by reducing potential dilution.

The model allows for the following inputs into the HLP:

- Direct rainfall on the HLP surface;
- Direct irrigation on the HLP surface area designated for leaching.

Outputs from the HLP included:

- Evaporation losses from the irrigation system to the atmosphere as a percentage of irrigation application rate;
- Evaporation losses from the wetted irrigation area;

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- Permanent moisture content loss of water retained in the ore at the water retention moisture limit. This is determined as being the difference between the stacked ore moisture content and the remaining moisture content after irrigation which can no longer drain due to gravity. The short term loss during irrigation at the operating moisture limit has been ignored as water is progressively both lost and returned to the system as areas progressively commence and cease irrigation; and
- Water exiting the solution collection system at the base of the pad to be directed to the designated solution ponds.

The model utilises the required cycle time, stacking rate, stacking lift height and stacked density to determine the required irrigation area. The required irrigation area was divided into 3 zones based on the duration of irrigation each cell has experienced. On this basis, the freshly stacked ore will generate liquor solution of the highest copper concentration and should report to the PLS pond for maximum process plant efficiency. As the duration of irrigation continues and concentrations reduce, liquor solution will be directed to the ILS pond. Barren solution after the process plant copper extraction and with the highest acid concentration will be discharged on to the irrigation area nearing the completion of irrigation.

4.3.2 Process Plant

The process plant has a complex water balance which includes various pumping systems, storage tanks and losses. The plant balance was completed by China Nerin Engineering (Ref 8) and is assumed to be self balancing. Therefore, the plant has been simplified greatly for the purposes of the HLP water balance. The process plant has been modelled as a single component which extracts water from the PLS pond and discharges the solution back into the Raffinate pond after copper extraction and pH adjustments for re-irrigation has been completed. The process plant also requires a minimum daily quantity of fresh water. In addition, the plant has a continuous water loss from evaporative cooling towers and dust suppression.

4.3.3 Process Water Ponds

A number of process water ponds are located adjacent to each HLP to collect and store the leached solution before being pumped to either the process plant or back to the top of the pad for further irrigation. The designated process ponds in the system are the Pregnant Liquor Solution (PLS) pond, Intermediate Liquor Solution (ILS) pond and the Raffinate pond. All process water ponds comprise a rectangular HDPE lined facility excavated below natural ground. Any internal division within a pond for a presettler section has been ignored. The model allowed for the following inputs into each pond:

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- Rainfall runoff from the direct pond surface;
- Rainfall runoff from the direct lined area of the pond;
- HLP outflow from leachate collection system directed to the designated pond based on copper concentration;
- Spillway discharge from the upstream process water ponds (i.e. each PLS pond will discharge into the following ILS pond then to the Raffinate pond); and
- Process plant discharge of barren solution into the Raffinate pond.

Outputs from each pond included:

- Evaporation losses from the free water surface;
- Seepage losses;
- Water returned to the process plant from the PLS pond for processing;
- Water returned to the HLP irrigation circuit; and
- Water discharged via the spillway.

The model utilises stage storages to determine the increase in surface area of the ponds resulting from changes to the volume of water stored in the system. A maximum capacity was assigned to each pond to calculate the potential spillway level trigger before spilling water.

4.3.4 Stormwater Pond

The Storm Water Pond (SWP) comprises a single square HDPE lined facility as the main storage of excess water for the HLP, process ponds and plant site during rain events. The SWP then progressively supplies the makeup water requirements for irrigation of the HLP as well as general evaporation losses. The model allows for the following inputs into the SWP:

- Rainfall runoff from the SWP pond surface;
- Rainfall runoff from the direct lined catchment area of 72 Ha; and
- Spillway discharge from the Raffinate ponds.

Outputs from the SWP included:

- Evaporation losses from the free water surface;
- Seepage losses;
- Water returned to the process plant as make-up water;
- Water used as irrigation make-up water; and
- Water discharged via the SWP spillway.

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The model utilises the stage storage to determine the increase in water area resulting from changes to the volume of water stored in the system. A maximum capacity was assigned to the facility to calculate the potential spillway level trigger before releasing water. As part of the modelling, the spillway capacity was also artificially increased to determine what pond capacity was required to contain the design storm event runoff.

4.3.5 Waste Water Pond

The Waste Water Pond (WWP) is located downstream of the SWP and collects water from a number of on site sources. As the HLP is designed as a no release system with no SWP water overflow, the WWP was only modelled as a source of makeup water for the system. The design capacity is based on the site water balance modelling from short duration storm events.

4.3.6 River Makeup

The Chindwin River is the projects source of all year round fresh water and any process water makeup as required. The model assumed the river can supply an unlimited quantity of water for make up once all other site sources have been exhausted.

4.3.7 Waste Rock Dump 1 and Open Pit

Waste Rock Dump 1 and the Open Pit have been simplified to be modelled as contributing rainfall areas to the WWP volume.

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4.4 BLOCK MODEL

A block model layout of the EXTEND model is shown in Figure 4.4 showing the cycle of water around the HLP and ponds. The flowsheet for the facility is described as follows starting at the irrigation of new ore:

- The Fresh Stacked Ore leach area comprises those cells currently being leached producing the highest copper grade, with drainage reporting to the PLS pond. The area is approximely equivalent to 40 days of irrigation;
- The volume in the PLS pond is monitored by the operators to ensure that the pond level remains between the defined minimum and maximum operating level to provide a constant supply to the process plant. In cases of sudden extreme rainfall the pond would overflow to the ILS pond;
- The Proces Plant (SX/EW) takes a constant flow from the PLS pond of up to 81,294.5 m3/day, strips the copper from the pregnant solution and discharges barren solution to the Raffinate pond;

- The Raffinate pond collects treated solution from the Process Plant, overflow from the PLS and ILS pond and may also require make-up water pumped from the SWP to supliment the required irrigation rate;
- The Raffinate pond is used to irrigate the area of the pad which has had the longest period of irrigation and is nearing completion. The returned solution is directed to the ILS pond. The area is approximely equivalent to 180 days of irrigation;
- The ILS pond is used to irrigate the area of the pad which has an intermediate copper concentration reporting out of the pad and also the freshly stacked ore area. The intermediate leaching area reports back to the ILS pond to be reirrigated again. The area is approximely equivalent to 180 days of irrigation;
- The non-leaching area is the balance of the leach pad area which is not under leach or is currently being stacked and which cannot be diverted. The area may produce solution with very low reagent and copper content or sediment. This can be sent to any pond but has been assumed to report to the SWP;
- The process plant sources water from either the SWP (and WWP) or Chindwin River to ensure there is adequate irrigation volume to account for irrigation area and plant evaporation losses; and
- Each section of the pad or ponds in the model receives daily rainfall on its area which is included in the runoff from the pad or accumlation within the ponds. Water losses from the ponds are in proportion to the evaporation rate and free water pan factor. The model automatically calculates the daily volume of solution in the ponds and any overflow volumes.

The Basic Design report (Ref. 8) indicated each pad would consist of one PLS pond, three ILS ponds, three Raffinate ponds, and a single SWP for the project. The duplicated ILS and Raffinate ponds are spaced along the alignment of the southern toe channel while the PLS is located at the south east corner of each pad. For the purposes of modelling, it was assumed only one PLS pond, one ILS pond and one Raffinate pond was required for each pad on the basis that the additional ILS and Raffinate ponds are only operational when certain areas of the pad are being irrigated. The influence of the additional ponds will be extremely minor for stormwater and makeup calculations, but would assist in water control of solution concentrations during operations.

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4.5 DESIGN CRITERIA

The design criteria used in the water balance modelling are taken from the Basic Design report (Ref 8) with additional climatic parameters and sensitivity determined by KP. Key criteria used in the model are discussed below.

4.5.1 Climatic Parameters

Leach pad water balances are typically influenced by both short term high intensity events for small process pond overflows and long term wet season build up of runoff volumes in stormwater ponds. As a result, a range of climatic extremes have been modelled.

Climatic parameters used for the model were determined from the Baseline Design Climatology assessment conducted by KP (Appendix A). As the water balance model was conducted on a daily basis, average and extreme rainfall patterns were scaled from historical rainfall patterns. Historical rainfall was obtained from Monywa Township climate station, located 5.6 km northeast of Letpadaung Hill, and evaporation data from Yangtse climate station, 7.6 km northwest at the S&K operations site. Daily precipitation analysis was conducted on the Monywa climate station and is presented in Appendix A.

The following conditions were examined for the water balance scenarios:

- Average rainfall conditions;
- Less than 30 day storm events of 1, 2, 3, 4, 7, 14 and 30 days;
- Wet season events of 60, 90, 120 and 180 days;
- Annual events of 1 and 2 year wet and dry cycles.

All extreme conditions were modelled assuming a 100 year ARI. The nominal rainfall sequences are provided in Table 4.5.1.

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Table 4.5.1: Water balance rainfall scenarios

Scenario	100-yr ARI Total Depth (mm)	Temporal Pattern Based on
Average	774	2006
2 Year Wet	2,544	2010 – 2011
1 Year Wet	1,555	1973
1 Year Dry	424	1982
180 Day Wet	1,437	25/05/1973 – 20/11/1973
120 Day Wet	1,067	2/07/2010 – 29/10/2010
90 Day Wet	921	30/07/1965 –27/10/1965
60 Day Wet	740	29/08/1965 – 27/10/1965
30 Day Wet	520	29/09/2010 – 28/10/2010
14 Day Wet	440	9/05/2007 – 22/05/2007
7 Day Wet	343	9/05/2007 – 15/05/2007
4 Day Wet	308	1/06/1984 – 4/06/1984
3 Day Wet	298	1/06/1984 – 3/06/1984
2 Day Wet	214	2/06/1984 – 3/06/1984
1 Day Wet	159	-

Monthly pan evaporation rates were converted to daily by dividing the monthly values by day per month. The values used in the modelling are provided in Table 4.5.2.

Table 4.5.2: Monthly pan evaporation

Month[*1]	Average
Jan	123
Feb	149
Mar	210
Apr	228
May	202
Jun	203
Jul	172
Aug	184
Sep	160
Oct	145
Nov	125
Dec	117
Total	2017

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4.5.2 Heap Leach Pad

The ore production and stacking parameters for the project are as follows:

- Ore processing capacity 92,000 kt/day;
- Total ore processing 954 Mt;
- Ore density 2.55 t/m^3;
- Days of Operation 330 d/year;
- Life of Operation 33 years;
- Stacking height of 6 m and 37° slopes
- Internal benches of 4.5 m for an overall slope at closure of 26°;
- Stacking density 1.6 t/m^3;
- Stacking moisture content 5%;

The leaching parameters for the project are as follows:

- Irrigation leaching rate 9 L / h / m^2;
- Leaching total period of 400 days made up of the following cycles:
  - 40 days first cycle (from ILS – reports to the PLS)
  - 180 days second cycle (from ILS – reports to the ILS)
  - 180 days last cycle (from Raffinate – reports to the ILS)
- Retained ore moisture content of 9% (predicted by KP and sensitivity conducted);
- Loss from Dripper irrigation of 4% (predicted by KP and sensitivity conducted);

Based on the stacking rate and cycle time the following irrigation area and application rate for the water balance was calculated:

92,000t/day / 1.6 t/m^3 / 6 m lifts x 400 days = 3,833,333 m^2 of irrigation area

3,833,333 m^2 x 9l/h/m^2 x 24 hours / 1000 = 828,000m^3 / day of irrigation.

A review of the proposed stacking plan of the three leach pad cells was conducted. The main results are summarised in tables Table 4.5.3 and Table 4.5.4. A cycle of 460 days was allowed for to include setting up of irrigation, irrigation, rinsing and removal of irrigation systems.

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Table 4.5.3: Leach pads HLP1 and HLP2 geometry

Layer Number	Area Base (m^2)	Area Top (m^2)	Stacking Height (m)	Volume (m^3)	Ore (t)	Placement (days)
Layer 1	3,465,000	3,381,331	6	20,538,994	32,862,390	357
Layer 2	3,334,269	3,251,394	6	19,756,989	31,611,182	344
Layer 3	3,204,780	3,122,699	6	18,982,439	30,371,902	330
Layer 4	3,076,534	2,995,247	6	18,215,343	29,144,549	317
Layer 5	2,949,530	2,869,037	6	17,455,702	27,929,124	304
Layer 6	2,823,769	2,744,070	6	16,703,517	26,725,627	290
Layer 7	2,699,250	2,620,345	6	15,958,786	25,534,057	278
Layer 8	2,575,974	2,497,862	6	15,221,509	24,354,415	265
Layer 9	2,453,940	2,376,622	6	14,491,688	23,186,700	252
Layer 10	2,333,149	2,256,625	6	13,769,321	22,030,914	239
Layer 11	2,213,600	2,137,870	6	13,054,409	20,887,055	227
Layer 12	2,095,294	2,020,357	6	12,346,952	19,755,123	215
Layer 13	1,978,230	1,904,087	6	11,646,950	18,635,120	203
Layer 14	1,862,408	1,789,059	6	10,954,402	17,527,044	191
Total				219,097,001	350,555,202	3812

Table 4.5.4: Leach pad HLP3 geometry

Layer Number	Area Base (m^2)	Area Top (m^2)	Stacking Height (m)	Volume (m^3)	Ore (t)	Placement (days)
Layer 1	2,394,579	2,312,580	6	14,121,477	22,594,363	246
Layer 2	2,277,700	2,196,925	6	13,423,875	21,478,200	233
Layer 3	2,162,570	2,083,018	6	12,736,764	20,378,822	222
Layer 4	2,049,187	1,970,856	6	12,060,129	19,296,206	210
Layer 5	1,937,552	1,970,859	6	11,725,230	18,760,369	204
Layer 6	1,937,552	1,860,447	6	11,393,996	18,230,393	198
Layer 7	1,827,664	1,751,783	6	10,738,342	17,181,348	187
Layer 8	1,719,525	1,644,867	6	10,093,176	16,149,081	176
Layer 9	1,613,133	1,539,699	6	9,458,496	15,133,594	164
Layer 10	1,508,489	1,436,279	6	8,834,304	14,134,886	154
Layer 11	1,405,593	1,334,606	6	8,220,598	13,152,956	143
Layer 12	1,304,445	1,234,681	6	7,617,379	12,187,806	132
Layer 13	1,205,045	1,136,504	6	7,024,646	11,239,434	122
Layer 14	1,107,392	1,040,075	6	6,442,401	10,307,841	112
Total				143,890,813	230,225,299	2503

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Based on the developed stacking plan HLP1 and HLP2 will operate until approximately the end of Year 12 when HLP3 is required to commence operation to compensate for the reducing area on the two initial leaching areas.

4.5.3 Process Plant

The process plant flows have been simplified into a single minimum raw water makeup and PLS return rate into the plant. The plant is then balanced to discharge water to the Raffinate pond and WWP while losing a set amount from cooling towers. The simplified parameters are shown in Figure 4.5. Additional make up above the minimum raw water (predominately loss at the HLP) is made up of input from either SWP, WWP or Chindwin River and is part of the model output results.

The process plant is modelled to operate at 330 days per year by the inclusion of a random daily availability number to turn off all pumped flows in the system. All gravity flows and rainfall will continue during these times. The process plant is designed to source up to 81,294.5 m^3/day from the PLS ponds or equivalent to a leaching area of 376,363 m^2 at 9L/h/m^2.

4.5.4 Process Water Ponds

Three types of process water ponds are modelled. The dimensions and parameters of each pond as it is modelled are described below.

PLS Pond

- 60 m wide x 245 m long x 3 m deep;
- Side slopes of 2H:1V;
- Total Capacity = 35,000 m3;
- HDPE lined.

ILS Pond

- 60 m wide x 470 m long x 3 m deep
- Side slopes of 2H:1V;
- Total Capacity = 70,000 m3;
- HDPE lined.

Raffinate Pond

- 60 m wide x 130 m long x 3 m deep
- Side slopes of 2H:1V;
- Total Capacity = 18,000 m3;
- HDPE lined.

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SWP

- Plan area of 636,000 m2;
- Side slopes of 2H:1V;
- Total Capacity = 2,224,000 m3;
- HDPE lined.

WWP

- Plan area of 1,558,000 m2;
- Side slopes of 2H:1V;
- Total Capacity = 4,645,000 m3;
- Soil lined.

For all ponds an evaporation pan factor of 0.7 was used to adjust from pan evaporation to equivalent pond evaporation. The size of the SWP was increased from that above as part of the modelling results in order to contain the volume of a 1 in 100 year wet r climatic event.

4.5.5 Waste Rock Dump 1 and Open Pit

For the purpose of the modelling, the contributing catchment from WRD1 and the Open Pit reported to the WWP on a daily basis. This water is to provide makeup water before relying on the Chindwin River as the final source of makeup. From the Basic Design report, the following areas were used:

- WRD1 Runoff Area = 252 Ha;
- Open Pit Catchment Area = 207 Ha;

During operation, more areas around the site may report to the WWP for containment than modelled. This will either reduce the overall annual demand from the Chindwin River or may alternatively require release of excess water in the wet season. A run off coefficient of 0.7 was used to determine runoff quantities.

4.6 RESULTS OF MODELLING

The leach pad water balance model was run for various scenarios using the design parameters discussed above. Each modelling run tracked daily pond volumes, discharges and levels and accumulated site shortfalls over a year long period. The following models were run:

- Average climatic conditions to determine typical expected operating results;

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- Dry conditions (1 in 100 year annual) to determine potential extreme shortfall quantities above those under average conditions;
- Dry and average conditions with a sensitivity analysis on the Dripper loss and ore absoption quantity on the makeup requirements;
- Wet conditions (1 in 100 year storm events up to annual wet years) to determine potential extreme pond volumes or spillways flows through the system;
- Sensitivity analysis on the Dripper loss and ore absoption quantity under wet conditions on the pond volumes;
- Recommendations for modifications to the system.

Outputs from the above modelling runs are discussed in the sections that follow

4.6.1 Average Climatic Conditions

Average climatic conditions were modelled by selecting the year of historical daily rainfall record which most closely matched the total annual average of the precipitation data set. The daily pattern was then scaled to equal the average annual rainfall.

Under average conditions, the leach pad water balance is shown to be in net water deficit for approximately 6 months of the year. During this time, due to the ongoing loss occurring on the leach pad, the SWP and WWP remain empty and all shortfall will need to be made up from the Chindwin River. The PLS and Raffinate ponds are generally expected to be empty during this period as reclaim back to the plant has a greater capacity than discharge out from the pad during low rainfall events. The ILS pond was found to be continually discharging to the Raffinate pond based on a larger irrigation area reporting to the ILS pond. This is not considered an issue and would be controlled during operation based on directing each cell to the appropriate pond based on copper concentrate.

The annual shortfall requirement equates to 5.96 Mm^3/year and closely resembles the rate determined in the Basic Design document (Ref. 8) of 16,800 m^3/day if averaged over the entire year. For ease of reference the site water balance inputs and outputs are summarised in Figure 4.1 which is taken from the Basic Design report (Ref. 8). The makeup water requirement during this period has a maximum rate of 40,740 m^3/day, which also closely resembles the maximum make up of 39,696 m^3/day (shown on Figure 4.1) if both the SWP and WWP return flows are reduced to zero.

During periods of higher rainfall, the SWP and WWP begin to accumulate water as rainfall runoff exceeds evaporation losses and no additional external makeup water is required. The SWP peaks at a volume of about 620,000 m^3 while the WWP peaks at a volume of about 1.4 Mm^3 based on the assumed catchment areas (WRD 1 and Open

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pit only). The pond volumes and make-up water return are shown on Figure 4.6. The two ponds are adequately sized for average conditions.

4.6.2 Dry Climatic Conditions

Under dry climatic conditions, the annual rainfall is reduced by 45%, thereby increasing the reliance on external water sources during and after the wet season. The peak requirement in the dry season remains unchanged as it is based on an effective zero rainfall period of operation. As a result however, the annual requirement from external sources increases to 9.29 Mm^3/year. Figure 4.7 shows the reduced SWP and WWP volumes under this condition and the increased periods of full make up requirement.

4.6.3 Dripper Loss and Ore Absorption Sensitivity

As a result of the large irrigation flows and high throughput, a sensitivity modelling run varying the high loss parameters was conducted to assess the impact on makeup water. The dripper loss percentage was adjusted from the design rate of 4% loss to both 6% and 8% while independently, the ore absorption was increased from a 5% increase in ore moisture content to 10% and 15% increase in ore moisture content. Average and dry conditions were run for all cases. A summary of all model runs is presented in Table 4.6.1.

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Table 4.6.1: River makeup requirements – sensitivity to ore absorption and dripper loss

Dripper Loss (%)	Ore Absorption (%)	Climate	River Makeup (Mm^3/year)
4	5	Average	5.96
		Dry	9.29
	10	Average	7.07
		Dry	10.65
	15	Average	8.81
		Dry	12.68
6	5	Average	11.18
		Dry	14.40
	10	Average	12.09
		Dry	16.70
	15	Average	13.95
		Dry	17.68
8	5	Average	16.32
		Dry	20.08
	10	Average	18.61
		Dry	21.01
	15	Average	19.27
		Dry	23.21

The results indicate the selection and operation of the irrigation system will have a significant impact on the water loss and resulting makeup requirements. The cost or limitations of makeup water from the river in the dry season is not assessed but will need to be confirmed prior to operation.

The ore absorption is a less sensitive parameter and will be under less control by the operators or designers of the HLP and more governed by ore type and particle size. Ore absorption losses are best calibrated with a site water balance during operation.

4.6.4 Wet Climatic Conditions

The water balance model was run for 100 year ARI wet conditions with durations ranging from 1 day events through to 1 year events. As it was found that longer duration events generated larger pond volumes, the SWP capacity was increased to determine storm storage requirements. A summary of the SWP volumes for multiple events in presented in Table 4.6.2 and shown against time in Figure 4.8. The SWP's volume peak towards the end of the wet season and then take several months to return to minimum from the ongoing water losses within the system. During this time, no makeup is required from the river (except minimum raw water). All events resulted in the SWP volume returning to minimum prior to the next wet season indicating there will be no cumulative effects between multiple years.

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Table 4.6.2: Wet SWP volume results

Climatic Condition	Maximum SWP Volume (m^3)
Average	620,000
1 Day Wet	1,477,000
2 Day Wet	1,839,000
3 Day Wet	2,609,000
4 Day Wet	2,709,000
7 Day Wet	2,636,000
14 Day Wet	3,392,000
30 Day Wet	3,599,000
60 Day Wet	3,821,000
90 Day Wet	4,546,000
120 Day Wet	5,070,000
180 Day Wet	5,401,000
1 Year Wet	5,509,000

As the SWP capacity is currently 2.2 Mm^3, a 1 or 2 day event can be fully contained. In order to contain longer events, KP suggests increasing the SWP capacity (by excavation of the SWP basin) to increase the pond capacity to approximately 4.0 Mm^3, while maintaining the same footprint and approximate liner area. For events longer than 60 days, it is envisaged that water storage capacity in the WWP will be available.

For the wet conditions modelling, a sensitivity analysis was also conducted on the ore absorption and dripper loss for selected scenarios. The results for the same wet climatic conditions are in Table 4.6.3. As the percentage losses increase, the shorter duration storm event become more critical due to the increase in the long term losses.

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Table 4.6.3: Wet SWP sensitivity to dripper and ore absorption losses

Climatic Condition	Maximum SWP Volume (m^3)		
	Dripper– 4% Ore – 5%	Dripper – 6% Ore – 10%	Dripper – 8% Ore – 15%
Average	620,000	575,000	560,000
1 Day Wet	1,477,000	1,302,000	1,287,000
2 Day Wet	1,839,000	1,745,000	1,692,000
3 Day Wet	2,609,000	2,419,000	2,437,000
4 Day Wet	2,709,000	2,423,000	2,360,000
7 Day Wet	2,636,000	2,453,000	2,479,000
14 Day Wet	3,392,000	3,094,000	2,795,000
30 Day Wet	3,599,000	3,319,000	2,912,000
60 Day Wet	3,821,000	2,506,000	1,506,000
90 Day Wet	4,546,000	3,140,000	2,137,000
120 Day Wet	5,070,000	2,902,000	2,397,000
180 Day Wet	5,401,000	2,300,000	1,278,000
1 Year Wet	5,509,000	2,818,000	1,367,000

The recommended increase to 4.0 Mm^3 would cover up to a 90 day event for these higher loss scenarios.

4.7 CONCLUSIONS

Under average climatic conditions and expected operation parameters, the SWP is unlikely to overflow. It will be maintained as the primary source of makeup water on site. The peak makeup water requirement is not influenced by rainfall conditions as it occurs continuously throughout the dry season when rainfall is effectively zero. The annual makeup water requirement however is highly dependent on rainfall and dripper loss with ore absorption losses being less critical. As there is currently no known restrictions on the amount of water that can be sourced from the Chindwin River, higher water losses or dry events were not considered critical provided the pump system is sized for the peak condition.

The existing SWP size is suitable for containing 1 or 2 day, 1 in 100 year ARI storm events. Longer durations than this will begin to accumulate water at a higher rate than evaporation and absorption losses combined. To reduce the likelihood of SWP outflow, its capacity will need to be increased. KP recommend the SWP design is increased to above 4.0 Mm^3 in order to contain longer duration rainfall events. This can be achieved by excavating the basin of the SWP deeper while maintaining the same footprint area.

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5. WATER QUALITY

5.1 GENERAL

A high level water quality assessment has been conducted for the site based on measured catchment areas, water flows from the modelling and assumptions regarding dilution. Limited water quality information was available in terms of baseline data or projected waste rock dump and HLP runoff. On this basis a quantitative evaluation of site runoff water quality was not possible. To assist preliminary design a simple assessment, based on catchment size and the type of use within each area, has been conducted.

5.2 WATER QUALITY DEFINITIONS

Site runoff was classified in terms of quality according to expected land usage. For the purposes of this report the following four runoff water quality categories were applied:

- Category 1: Clean water – this would consist of runoff water from the surrounding watershed catchment that has had no contact with the site (or runoff from the project site). The pit dewatering may be included in this category if it meets World Health Organisation drinking water standards. Otherwise it would need to be classified as a lower standard water type. Direct rainfall onto ponds will dilute any existing pond water;
- Category 2: Clean water containing sediment – this would include sediment laden surface water runoff from disturbed areas of the site (including topsoil stockpiles). It excludes potentially contaminated contact water. After sediment removal this water could be released to the environment;
- Category 3: Contact water – water which has been in contact with ore or PAF waste that is potentially acidic and / or enriched with dissolved metals. This water would need to be contained, tested and if necessary treated prior to release to the external environment; and
- Category 4: Process water – This would be acidic water, containing soluble metals, associated with the heap leaching process. This water should be contained and recycled to the process, to minimise the risk of release to the environment.

For the purpose of the dilution assessment, it was assumed that the Category 1 and 2 water will evenly dilute Category 3 water if mixed. It is recommended however that poor quality water be separated for as long as possible, from clean water, using internal divider walls to compartmentalise ponds.

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5.3 DESIGNATED SUBCATCHMENT AREAS

The various sub-catchment areas, defined in the site water model, were assigned a ratio for each of the three water quality categories based on assumptions pertaining to land usage extents. Only the HLP area was assigned a Category 4 classification. Subcatchment areas and runoff water quality categories are summarised in Table 5.3.1.

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Table 5.3.1: Site sub-catchment areas and water quality designation

Sub-Catchment	Area (km^2)	Category 1	Category 2	Category 3	Category 4
BA-PL-021	0.03094	0	0.85	0.15	0
BA-PL-022	0.07116	0	0.85	0.15	0
BA-PL-023	0.09257	0	0.85	0.15	0
BA-PL-024	0.21727	0	0.85	0.15	0
BA-PL-025	0.79950	0	0.85	0.15	0
BA-PL-028	0.09586	0	0.85	0.15	0
BA-PL-029	0.43793	0	0.85	0.15	0
BA-PL-030	1.0583	0	0.85	0.15	0
BA-PL-032	0.631	0.5	0	0.5	0
BA-PL-035	0.493	1.0	0	0	0
WP-PL-005/006P	1.461	1.0	0	0	0
BA-PL-036	0.783	0.2	0.8	0	0
BA-PL-037	0.623	0.1	0.9	0	0
BA-PL-038	0.820	0.75	0.25	0	0
BA-PL-039	0.496	0.65	0.35	0	0
BA-PL-040	0.116	0.9	0.1	0	0
BA-PL-041	1.077	0.4	0.35	0.25	0
BA-PL-042	0.459	0.05	0.8	0.15	0
BA-PL-043	0.543	0	0.55	0.45	0
WP-PL-008P	0.100	1.0	0	0	0
BA-PL-044	0.594	0.3	0.5	0.2	0
BA-PL-045	1.824	0.25	0.65	0.1	0
BA-PL-046	0.378	0.7	0.3	0	0
BA-PL-047	0.752	0	1.0	0	0
BA-PL-048	0.387	0	0.55	0.45	0
BA-PL-033	4.380	0	0	0	1
BA-PL-034	4.428	0	0	0	1
WP-PL-007P	0.717	1.0	0	0	0
BA-PL-050	0.191	0.9	0.1	0	0
BA-PL-051	0.116	0.9	0.1	0	0
BA-PL-052	0.461	0.9	0.1	0	0
BA-PL-053	0.138	0.9	0.1	0	0
BA-PL-054	0.281	0.8	0.2	0	0
BA-PL-055	0.187	0.8	0.2	0	0
BA-PL-056	0.161	0	10	0	0

A pictorial representation of site sub-catchments and relative rainfall runoff quality is shown on Figure 5.1.

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5.4 RESULTS

5.4.1 Overview

With respect to rainfall run-off on site, and its impact on water quality, there are two aspects to this that were considered in the analysis, as follows:

- Site surface water runoff quality and its management.
- Heap leach pad surface water runoff and its management.

The results of this are discussed in the sections that follow.

5.4.2 Surface Water Management

The majority of surface water runoff from site reports to the WWP. Some small catchments for Category 1 and 2 runoff (located on the northern boundary) are managed by perimeter sediment dams which can either discharge water off site directly or return water to the site via a pumped system. These sediment dams have not been reviewed and are assumed to be sized appropriately (allowing for plan area and dead sediment storage) for the required particle size removal for a given ARI peak inflow. On this basis, for all intents and purposes the quality of the surface water run-off from the site depends on how effectively the WWP operates.

The WWP pond has a reporting catchment area of 13.2 km^2, not including pit flows. The 6 hour and 48 hour, 100 year ARI, events were run on the initial condition of the WWP being empty, to estimate minimum required pond volumes. The resulting pond runoff volumes were 1.78 Mm^3 and 3.31 Mm^3 respectively. The heap leach water balance indicates under average climatic conditions a peak volume in the WWP of 1.42 Mm^3. This at the peak of the wet season in order to store the average climatic condition wet pond plus the 48 hour storm event a capacity of 4.73 Mm^3 is required. Thus it is recommended that the WWP be increased in capacity to 4.8 Mm3 by deepening the base of the pond.

Based on Category 1 and 2 water diluting Category 3 water, an approximate eight fold dilution is possible, with the current layout, prior to discharge. This assumes perfect mixing of the runoff in the WWP. A summary of flow volumes is shown in Table 5.4.1.

Table 5.4.1: Runoff quantities reporting to WWP

	Runoff Quantities		
	Category 1	Category 2	Category 3
6 Hour Event	638,000 m^3	926,000 m^3	223,000 m^3
48 Hour Event	1,101,000 m^3	1,627,000 m^3	390,000 m^3
Runoff Proportions	36%	52%	12%

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The Nerin configuration of water flows into the WWP indicates the majority of the site surface runoff will report to the northern pond before flowing southwards to the southern part of the pond, through a channel or pipe connecting the two. Therefore, the northern pond should be subdivided into cells to promote even mixing and sediment drop out. Individual ponds can be tested for water quality and specific active treatment applied and directed south or directly released. Any Category 1 pumped water flows (i.e. the clean pit water or other site sediment dams) should then be directed to the southern pond where the final spillway to the environment should be located. The northern pond (cell of lowest water quality) should be prioritised as the primary make up water source (after the SWP). KP recommends an adjustment to the configuration as outlined in Section 5.5.

5.4.3 HLP Water Balance

The HLP pad system consists of numerous solution ponds, leach pad area and a stormwater pond. During normal operation with no rain, the copper concentrate in the process ponds will operate as follows (according to the daily manipulation of the HLP launders by the operators):

PLS at the grade of 4.0g/L is pumped to SX system while that under such grade is returned to irrigation process. The leach solution or rainwater at copper grade in the range of 1～3g/L shall be led to ILS pond and those at copper grade lower than 1g/L will be discharged to the flood pond.

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The HLP irrigation is expected to operate at a pH range of 1.4 – 1.8. Therefore, with regards to SWP water quality, it was assumed that any pad runoff or process pond overflow was Category 4 and any direct rainfall on the SWP was Category 1. As water is returned to the process plant for makeup, it will be returned at the diluted rate for that day based on the inflows and outflows. Evaporation from the pond will slightly increase the concentration of the SWP.

The HLP water balance was run for average and 1 in 100 year ARI Wet Year conditions and the above water quality assessment was conducted by assigning pad irrigation as a unit value of 1 and direct rain as a unit value of 0. The water in the SWP was tracked for concentration based on water inflow from the pads or ponds and water outflow as evaporation or makeup water. The plot of expected water concentration based on a unit value of 1 is shown in Figure 5.2.

The results indicate that the rainfall, either average or wet, has only a minor impact on the quality of the SWP water relative to the irrigation water quality. This is due to the rainfall being relatively low compared to the irrigation rate, therefore providing little in

the way of dilution. However it is enough additional water to cause the process water ponds to overflow into the SWP during rain events. By comparison, the 100 year ARI wet year rainfall, of 1,555 mm, is insignificant given the irrigation rate of 9 L / h / m^2 is equivalent to 216 mm of rainfall falling on the pad every day.. Therefore the water treatment design for the SWP should assume that runoff water has little to no dilution due to rainfall and water quality would be similar to that being discharged from the base of the pad.

5.5 RECOMMENDATIONS

KP has conducted a high level review of site water management system and has identified possible improvements. The system could operate more effectively by adopting an alternative layout that involves segregating site rainfall runoff according to its quality as follows:

- Installing a divider wall in the WWP so as to create a north cell and a south cell.
- Category 1 and Category 2 runoff would be directed to the WWP north cell.
- Category 3 runoff would be directed to the WWP south cell.

The southern pond would then be prioritised as the primary make up water source (after the SWP). The north and south cells would be hydraulically separated, with a weir between them. A spillway would then be located on the northern pond (flood protection bund wall) that would, when required, release water to the environment. This alternative layout has a number of benefits which include:

- The northern WWP would generally only contain Category 1 and 2 water and would act as a sediment pond, treating the Category 2 water. This water could then be used for dust control around the site without the risk of further contamination.
- If the southern WWP cell weir overflowed, it would spill into the northern WWP cell where it would most likely be contained.
- If both the northern and southern WWP cells overflowed, the Category 3 water from the southern cell would be diluted in the northern cell before being released to the environment.

To facilitate operation of the system described above it is recommended that the more environmentally problematic, low grade ore and ore reserve, stockpiles be consolidated in one location. KP have nominated the northern half of HLP3 for this purpose as this location will allow the contact water from these stockpiles to be directed relatively easily to the south WWP cell. Considering that HLP3 is not developed until much later in the life of the operation it is assumed that this can be accommodated from an operational

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and construction perspective. It should be noted that in order to develop a system that largely flows under gravity it will be necessary, in some instances, to place internal diversion channels (both for contact and sediment laden water) on engineered fill or WRD benches.

A schematic figure illustrating the above system is presented in Figure 5.3.

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6. SEDIMENT CONTROL

6.1 GENERAL

Surface water run-off from cleared areas and WRDs is likely to be laden with suspended solids. If sediment laden run-off reports directly to waterways it has the potential to impact on riverine ecosystems and downstream users. To mitigate these environmental and social risks it is important that strategies and systems are in place to reduce soil erosion and contain sediment laden water on site until it is suitable for release. A typical approach to erosion and sediment control involves a combination of source management and downstream management (at the property boundary).

Source management requires progressive rehabilitation combined with strategic placement of small scale structures such as diversion ditches, brushwood barriers, geotextile silt fences, rock check dams, level spreaders, and sediment traps. If implemented properly on site their use will improve the effectiveness of the larger scale engineered sediment control structures (and in some instances may eliminate their necessity). Further details of sediment source control practices and the associated small scale structures are provided in the Erosion and Sediment Control Guidelines (Ref. 1).

In addition to source control it is proposed that a number of sediment control dams (SCDs) are to be located at strategic locations around the site. SCDs are utilised to contain uncontaminated, sediment laden water for a period of time to allow the sediment to drop out of suspension.

Environmentally it is important to achieve a level of total suspended solids (TSS) similar to the quality of the water moving through the area prior to disturbance. The TSS of the Chindwin river varies seasonally, with values as low as 11 mg/L in the dry season and as high as 1400 mg/L in the wet season. As the SCDs will most likely only operate in the wet season, it is not expected to be difficult to reduce the TSS to a levels comparable to that of local waterways.

6.2 DESIGN PHILOSOPHY

Sediment generation is influenced by the terrain, rainfall, soil type, and vegetation cover. Each of these factors interact in a complex way that can be approximately modelled in accordance with the revised universal soil loss equation (RUSLE). Generation of a sediment model, for impacted sub-catchments, would require detailed baseline data concerning soil and waste rock erosion susceptibility and is beyond the scope of this report. However SCDs may be approximately sized according to typical catchment areas and terrain. For present purposes a typical SCD embankment height

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of 5 m may be adopted across the project site. Based on experience with similar terrain in southeast Asia this assumption is considered to be reasonable for preliminary design.

It is envisaged that SCDs will be constructed progressively, as required, throughout the life of the mine. Therefore, it is recommended that the waste dump footprints should be cleared and developed progressively over several years. In addition, small scale sediment control structures will be constructed within each waste dump stage footprint. These intermediate structures will then be buried by successive stages of waste dump development.

Vegetation is an effective form of erosion control as it filters and uses water. Vegetation will act as a sediment filter, with sediment sizes >0.02 mm being trapped by relatively short (5 - 10 m) widths of filter strip. Therefore, where possible, vegetation strips within the waste dump footprint should be retained that will be progressively buried by mine waste. This reflects current experience in southeast Asia where the existing vegetation forms very effective silt barriers.

SCDs are required downstream from any catchments where construction or mining activities are likely to lead to elevated levels of sediment in runoff reporting to local waterways. It can be expected that three SCDs will be required along the northern boundary of the Letpadaung project. The proposed SCD locations are shown on Figure 1.1.

A typical SCD comprises a small homogeneous earthfill embankment structure approximately 5 m in height. It is designed to impound enough water for a sufficient period of time to allow settlement of suspended solids.

The SCD is equipped with two discharge structures: a floating offtake arrangement for draining water from the surface of the dam under normal conditions; and an overflow spillway for flows in excess of the containment capacity. The floating offtake system comprises a length of flexible hose pipe connected to a small pontoon at the upstream end and a discharge pipe (passing through the dam wall) at the other end, The pontoon sits on the surface of the SCD pond so that the mouth of the pipe sits just below the pond surface, allowing the cleanest water to be abstracted from the dam. The discharge pipe would comprise an HDPE conduit with a gate valve on the downstream end that would be manually opened to allow release of water from the dam, when TSS levels are similar to that of downstream receiving waters.

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7. CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Additional investigation, monitoring and analysis are required before proceeding to detailed design of the Letpadaung project surface water management systems. A brief summary of future work required for the detailed design phase is described below.

7.1 HYDROLOGICAL AND SEDIMENT LOAD BASELINE MONITORING

The models used are based on a number of assumptions that should be confirmed in the field. As such it is recommended that rain gauges and flow meters be installed on major drainage paths to monitor rainfall and runoff. Furthermore, baseline sediment load monitoring along major drainage paths should be undertaken for a range of seasonal flows.

In terms of sediment management and monitoring, a sediment control plan needs to be developed to mitigate the impacts of existing and future farming and non-mining activities in upstream catchments outside of the mine site development area.

7.2 SEDIMENT CONTROL AND MODELLING

SCDs should be installed downstream from any disturbed catchments that report to off site waterways, particularly along the northern boundary of the site. The northeast corner of the site represents a topographic low and as such WRD runoff will report to this spot. Consequently this corner will effectively operate as an SCD with the flood protection bund acting as a dam wall. Water accumulating in this dam will have to be either pumped to the Waste Water Pond (WWP) or discharged to downstream waterways (depending on water quality).

SCD and WWP sizes should be refined after more rigorous sediment modelling has been undertaken. This will allow individual SCD and WWP basin volumes, extents and embankment heights to be confirmed.

7.3 WASTE MATERIAL GEOCHEMISTRY

Mine waste material has been assessed in the KP Report on Mine Waste Geochemistry (Ref 9). This report recommended further sampling and testing of waste and ore material to assess the leachate chemistry from the potentially acid forming and heavy metal enriched materials. A better understanding of the mine waste and ore geochemistry will allow a more rigorous, quantitative assessment of site rainfall runoff water quality. This will in turn allow an assessment of potential water treatment requirements.

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7.4 CONSTRUCTION TIMING

Timing for construction of ECDs and diversion channels needs to be reconciled with the latest mining plan. In particular this will determine which structures are required early in the project and which can be deferred.

7.5 HEAP LEACH PAD WATER MANAGEMENT

Use of HLP make-up water should be prioritised so that on-site, low pH water sources are used first. Make-up water may be taken from three potential sources, in order of decreasing priority, as follows: HLP stormwater pond; WWP; and the Chindwin River.

Stormwater reporting to the SWP should be re-used for irrigation of the HLPs as soon as possible. A larger SWP is required to store run-off from extreme events. The SWP should be subdivided into cells. One cell should be capable of storing one day's process water drawdown (i.e. approximately 800,000 m^3). The WWP capacity should also be increased to 4.8 Mm^3.

7.6 SITE SURFACE WATER MANAGEMENT

Surface water flowing within or adjacent to the site should be classified in terms of quality according to the following categories: clean; sediment laden; contact (potentially acidic or enriched with metals); and process.

Where ever possible the different surface water quality streams should be segregated from one another. In particular sediment laden water should be separated out from the contact water (running of the ore stockpiles or geochemically problematic mine waste) so as to reduce the quantity of poor quality water that may require treatment. This would best be achieved by dividing the WWP into two ponds with the northern pond used to contain sediment laden water and the southern pond used to contain contact water (that may require special treatment prior to release).

To facilitate operation of the system it is recommended that the more environmentally problematic, low grade ore and ore reserve, stockpiles be consolidated in the northern half of HLP3. This location will allow the contact water from these stockpiles to be directed relatively easily to the south WWP cell.

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8. REFERENCES

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FIGURES

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712000mE
714000mE
716000mE
718000mE
720000mE
2444000mN
2442000mN
2440000mN
2438000mN

SEDIMENT DAMS
SEDIMENT DAM
STAFF ACCOMMODATION
FLOOD PROTECTION BUND
WASTE DUMP No.1
WASTE DUMP No.2
PIT
WASTE WATER COLLECTION POND
WASTE WATER POND (NORTH)
HEAP LEACH PAD No.3
OFFICES WAREHOUSES & MAINTENANCE
EXPLOSIVES AREA
WASTE DUMP No.3
FLOOD PROTECTION BUND
WASTE WATER POND (SOUTH)
HEAP LEACH PAD No.1
HEAP LEACH STORM WATER POND
SOUTH DIVERSION CHANNEL
HEAP LEACH PAD No.2
ELECTROWINNING PLANT
WP-EX-0002/WP-PL-002

LEGEND:

- LETPADAUNG LEASE BOUNDARY
- FLOOD PROTECTION BUND
- DIVERSION CHANNEL
- DIVERSION DRAIN
- LOW GRADE ORE STOCKPILE
- RESERVE ORE STOCKPILE
- TOPSOIL STOCKPILE

NOTES:

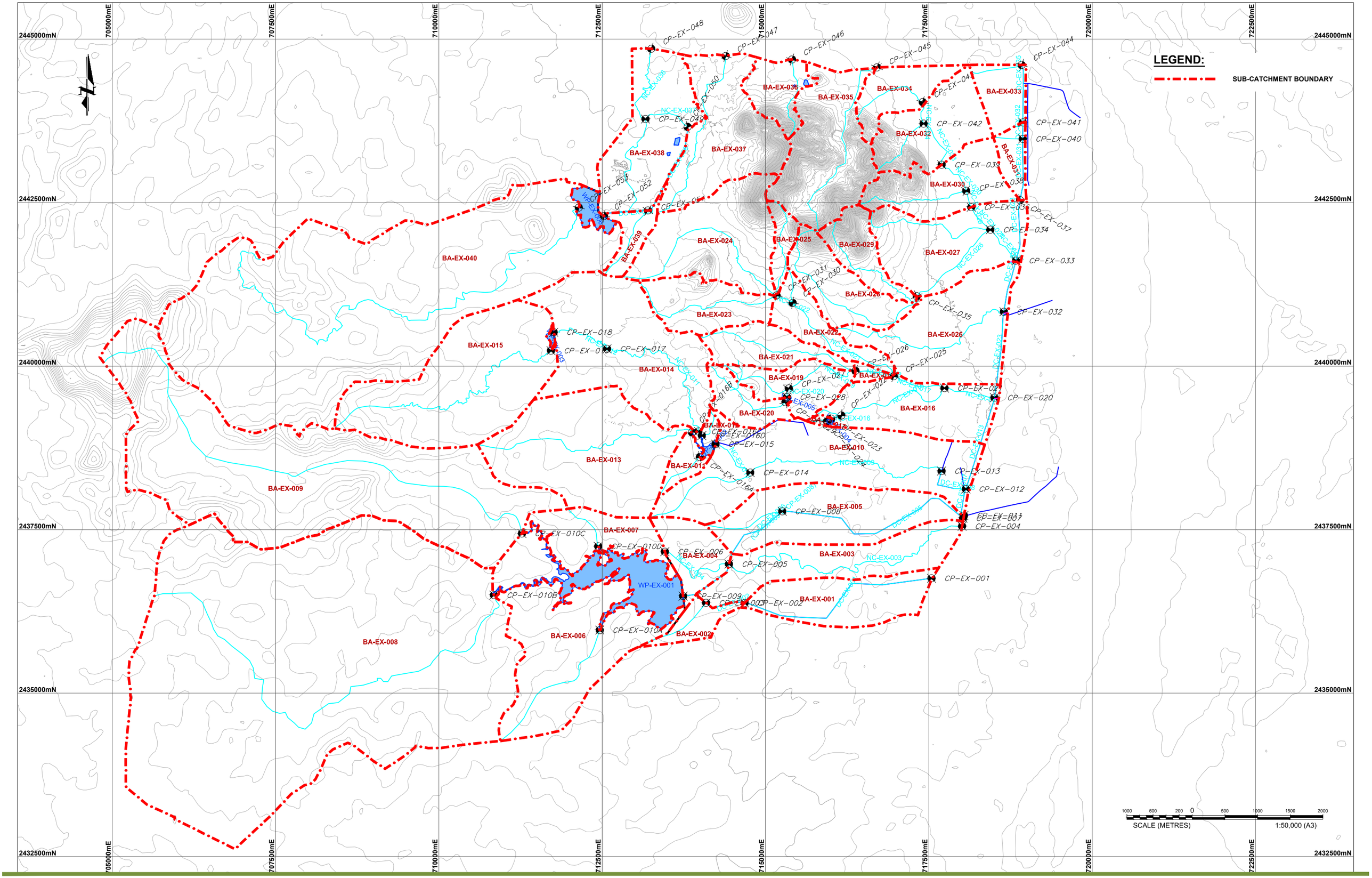
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LETPADAUNG PROJECT
SURFACE WATER MANAGEMENT
GENERAL ARRANGEMENT

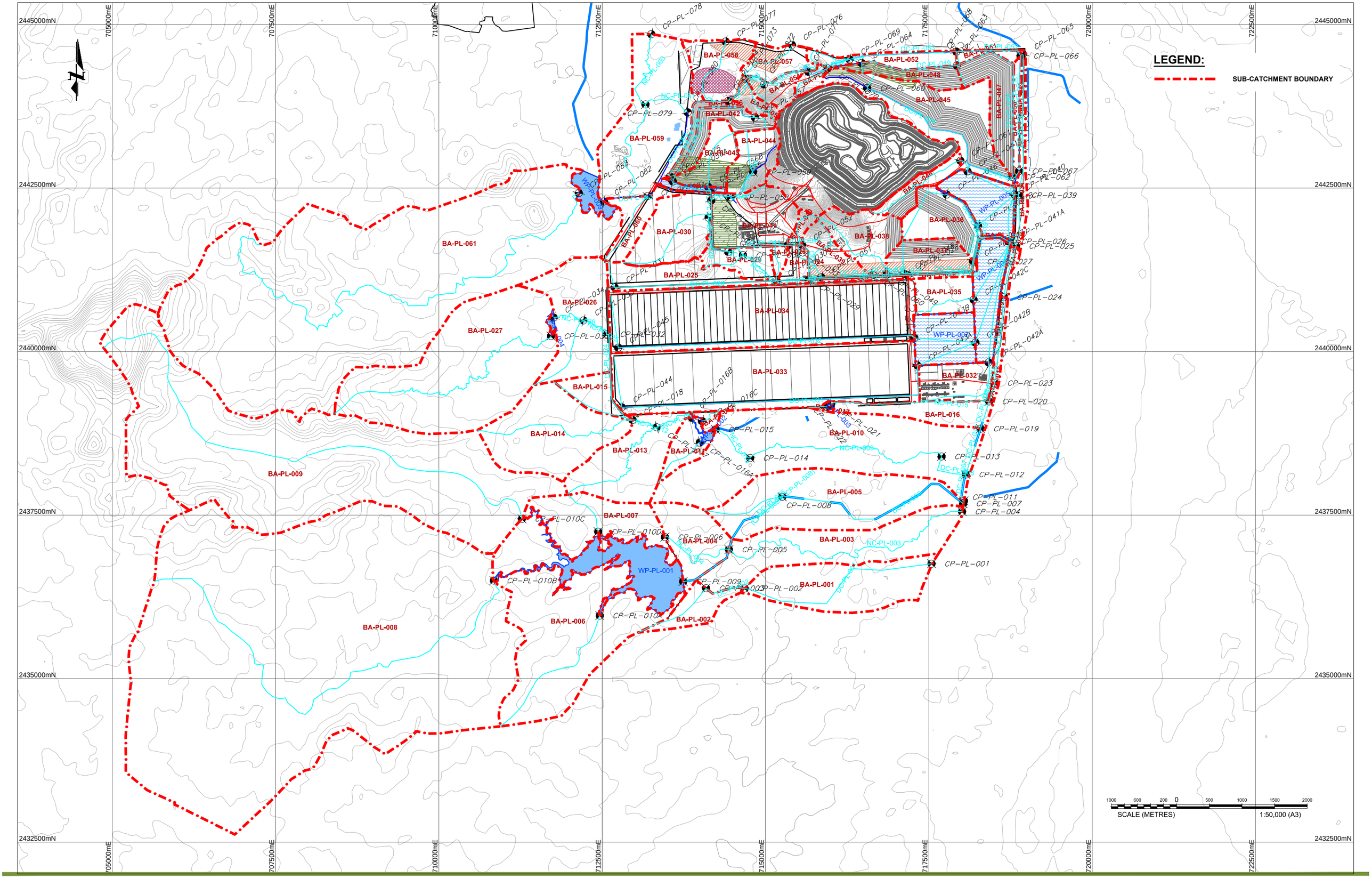
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Figure 1.1



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LETPADAUNG COPPER PROJECT
SURFACE WATER MANAGEMENT PLAN
CATCHMENT DELINEATION - EXISTING CONDITIONS

Ref: PE701-00022/18
Figure 3.1

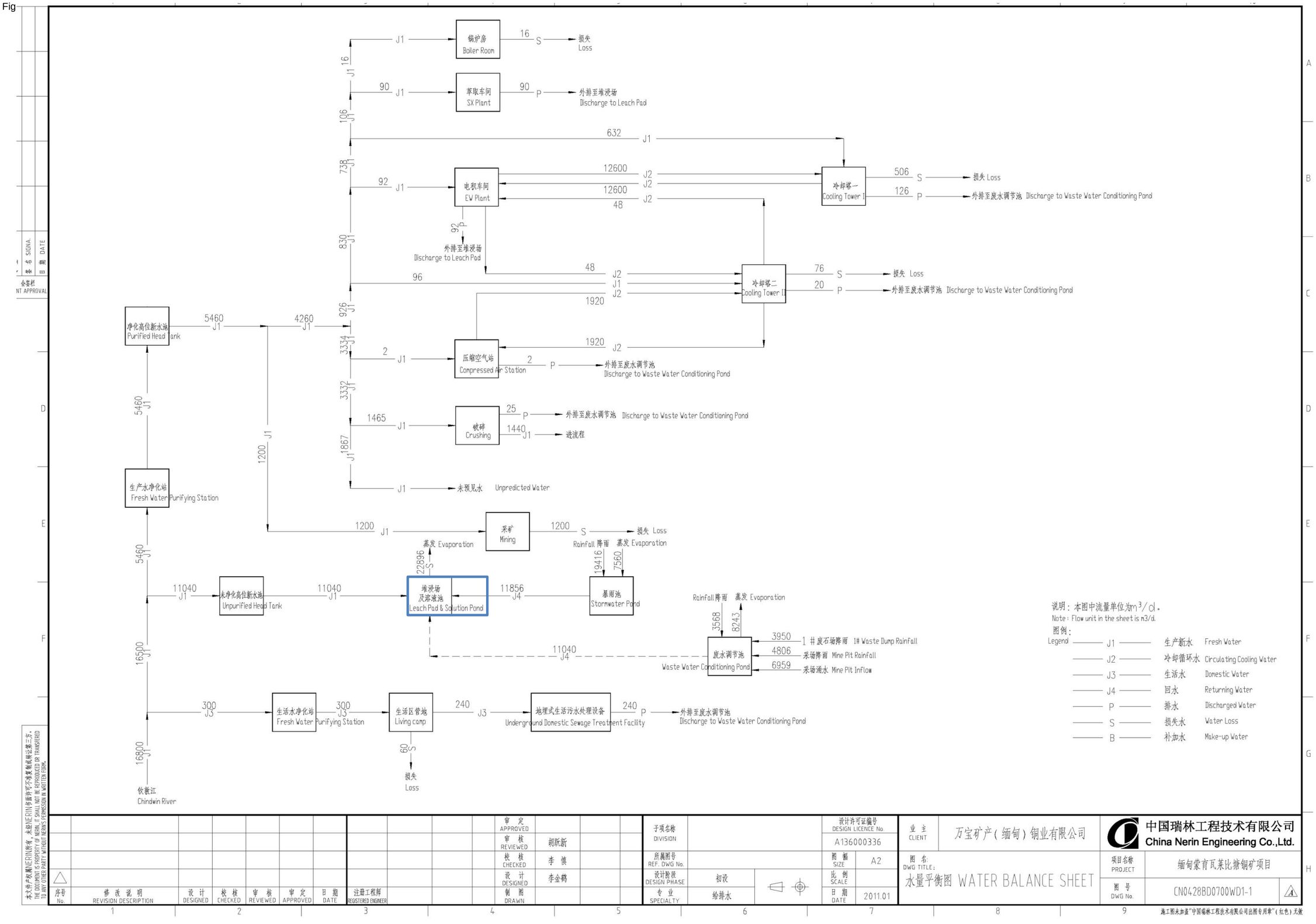


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LETPADAUNG COPPER PROJECT
SURFACE WATER MANAGEMENT PLAN
CATCHMENT DELINEATION - PLANNED CONDITIONS

Ref: PE701-00022/18
Figure 3.2

Fig



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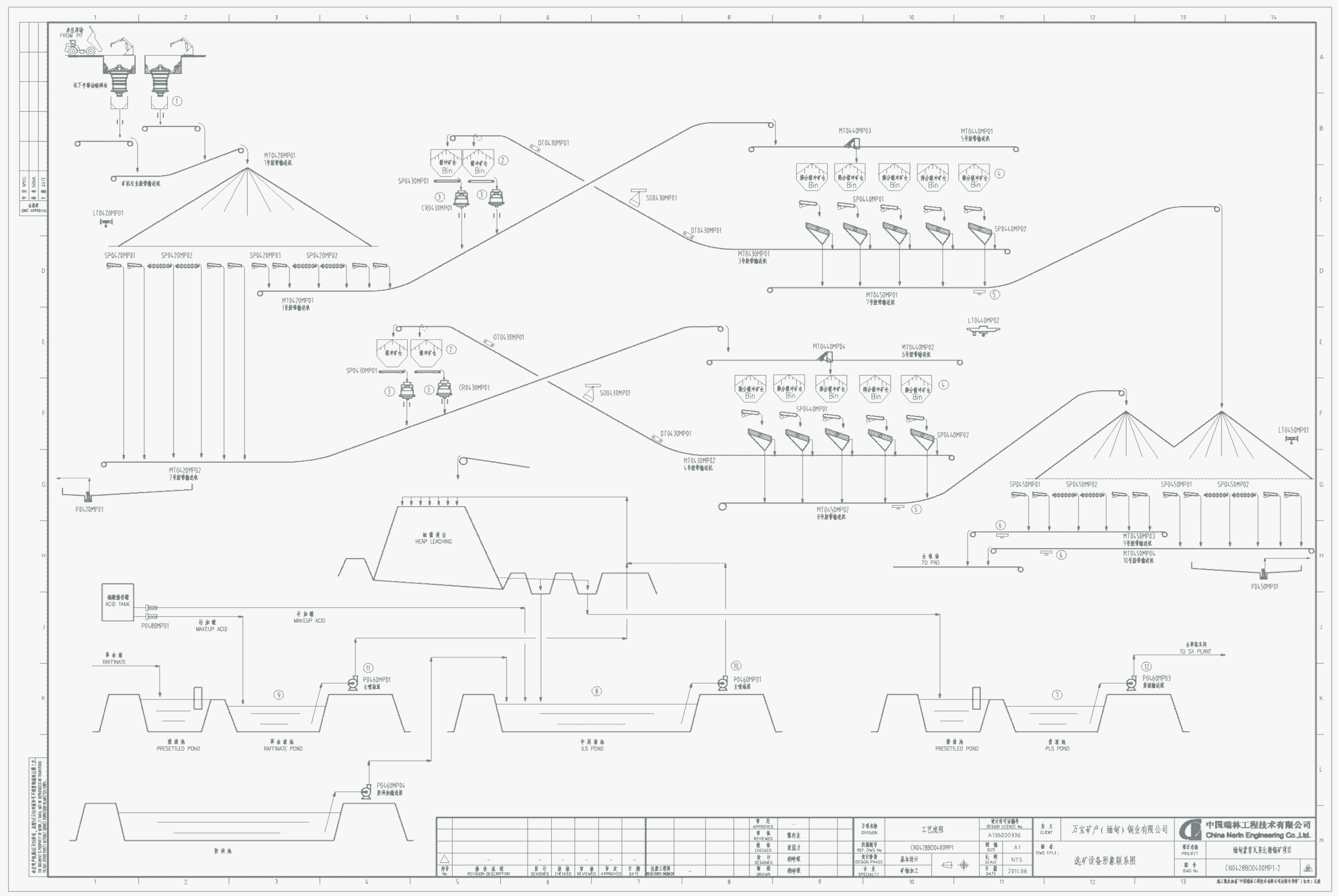
注册工程师 REGISTERED ENGINEER

审定 APPROVED		
审核 REVIEWED	胡跃新	
校核 CHECKED	李慎	
设计 DESIGNED	李金鹤	
制图 DRAWN		

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专业 SPECIALTY	给排水	日期 DATE	2011.01

业主 CLIENT	万宝矿产（缅甸）铜业有限公司	中国瑞林工程技术有限公司 China Nerin Engineering Co.,Ltd.	
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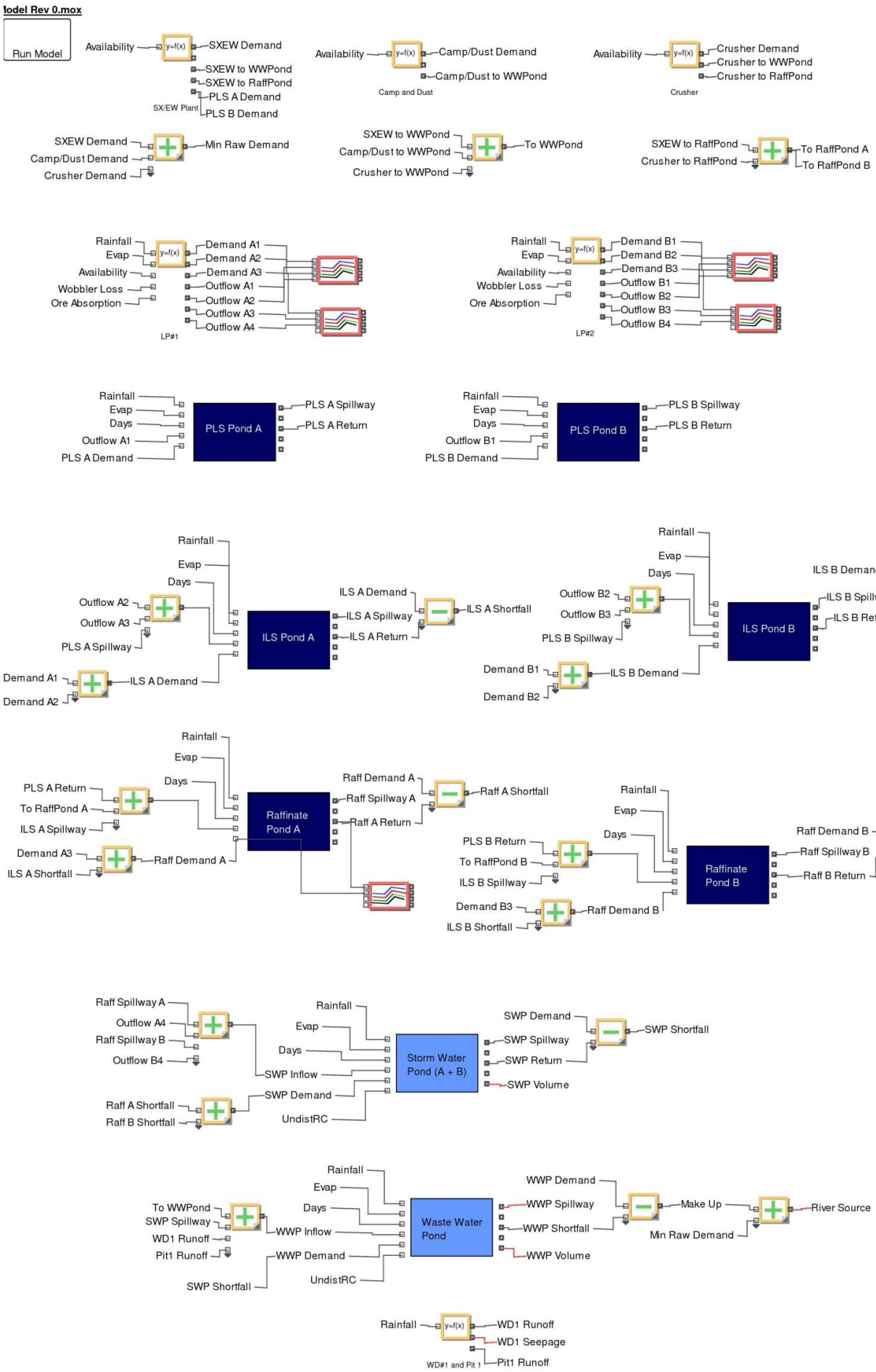
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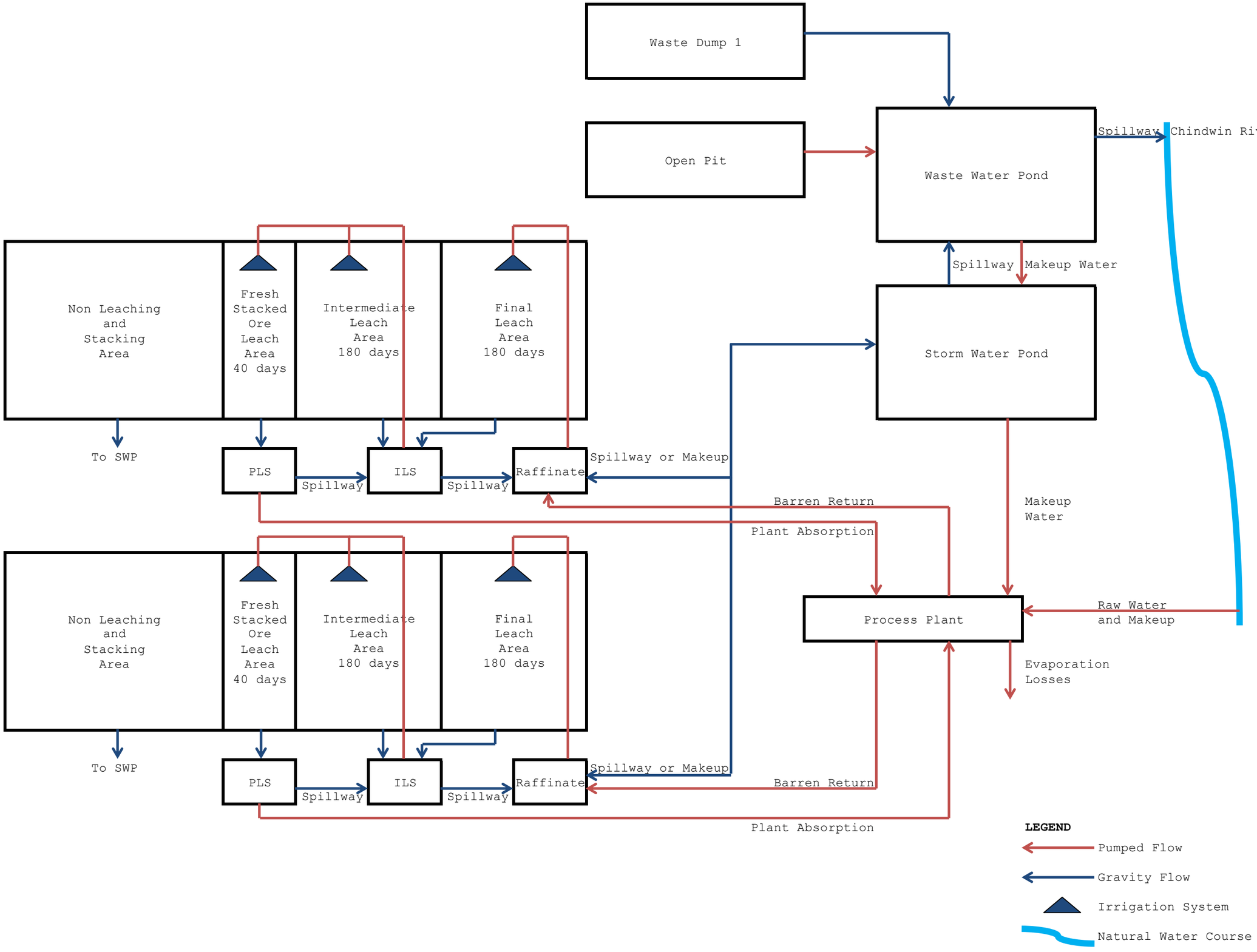


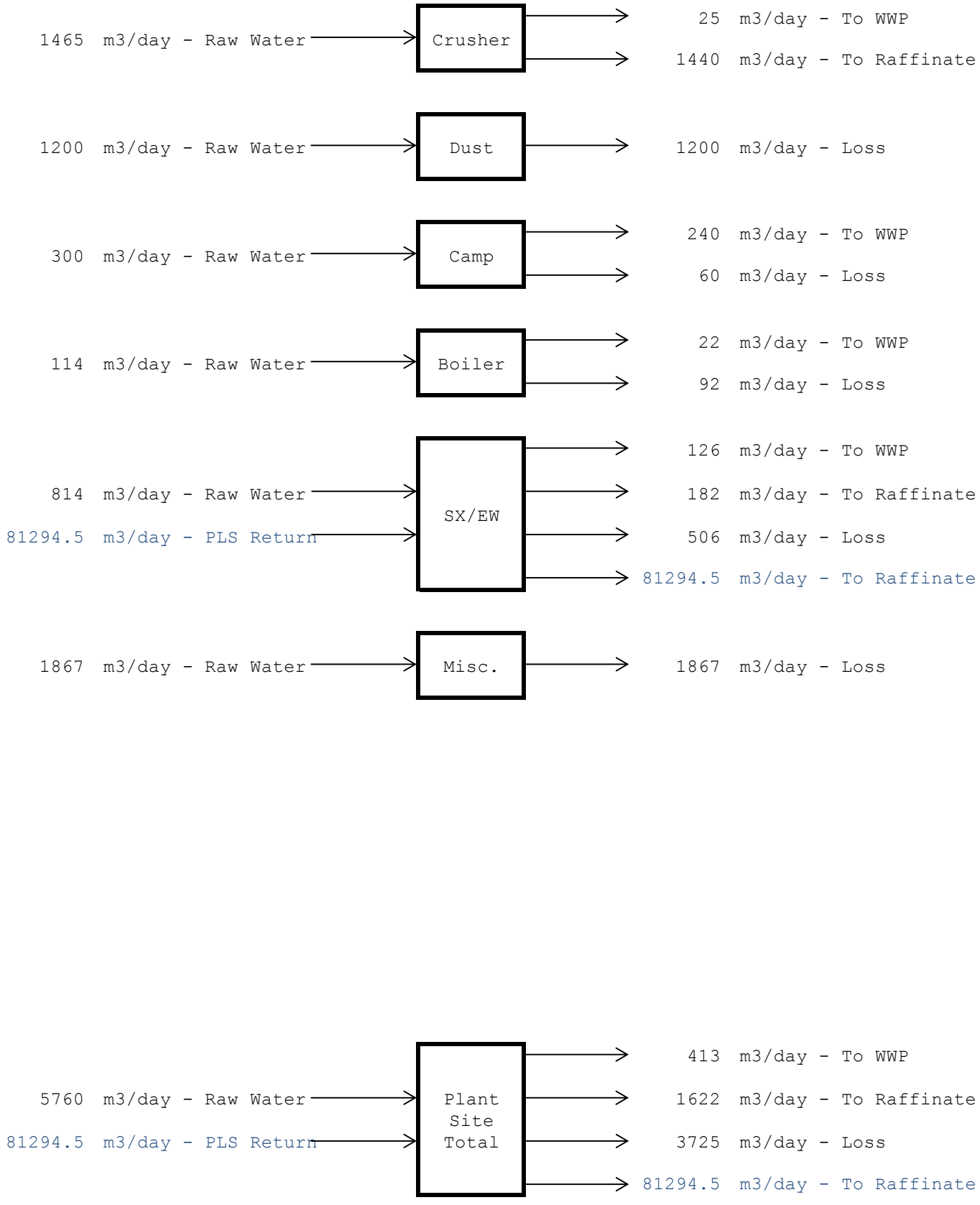
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LETPADAUNG COPPER PROJECT
SURFACE WATER MANAGEMENT PLAN
HEAP LEACH FACILITY - PROCESS FLOW CHART

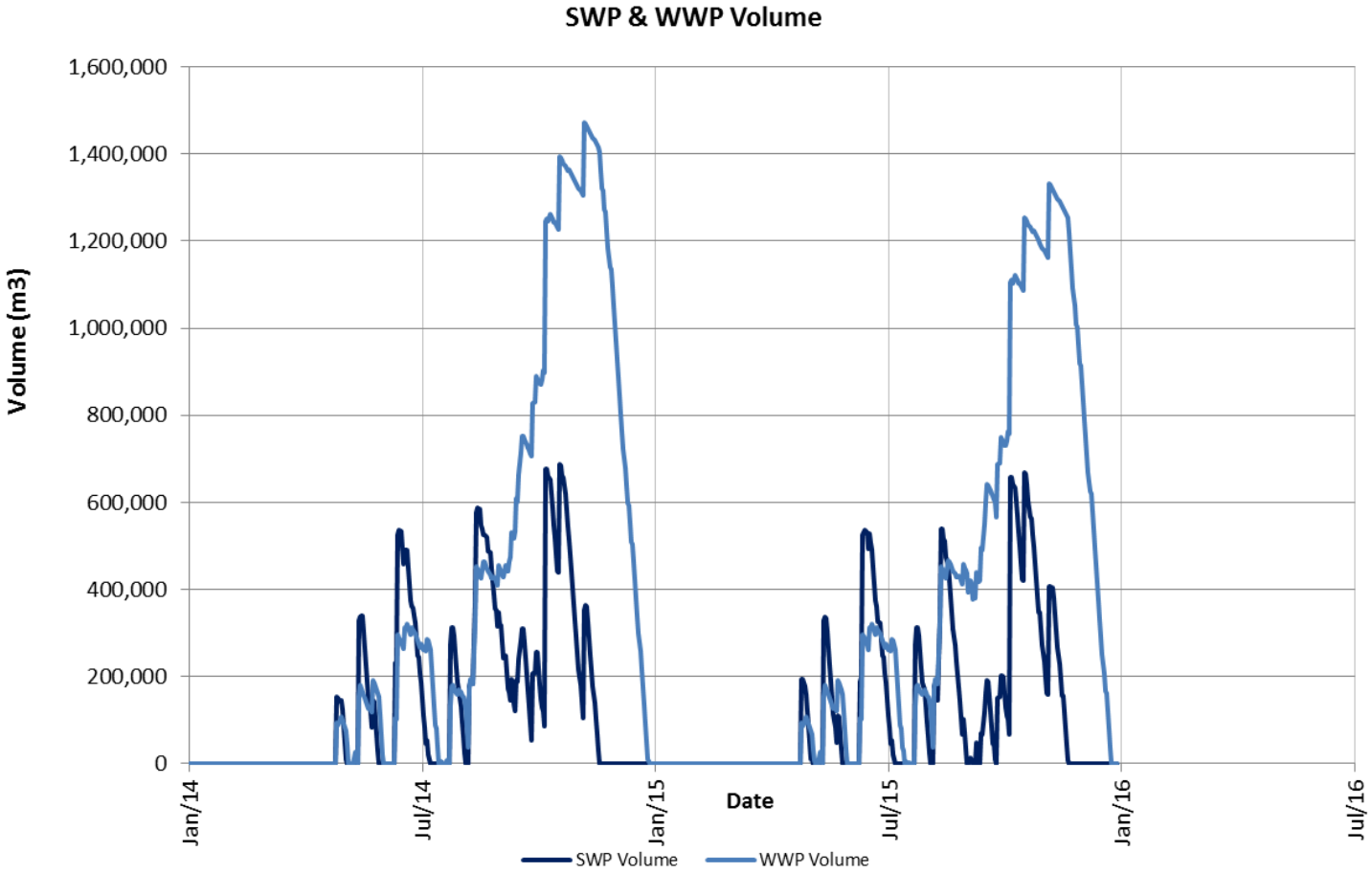
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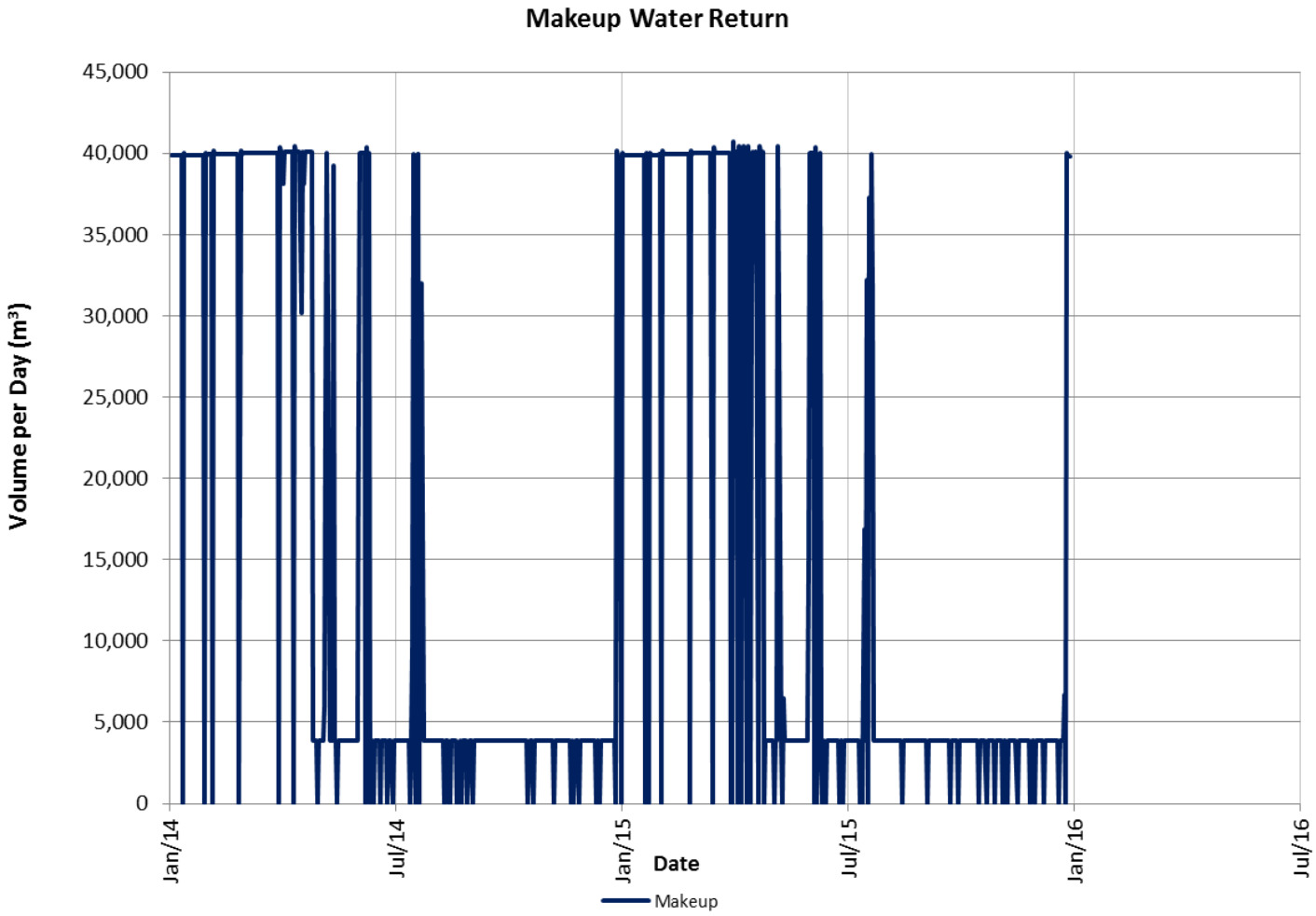

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Run Model
Availability
SXEW Demand
SXEW to WWPond
SXEW to RaffPond
PLS A Demand
PLS B Demand
SX/EW Plant
Camp/Dust Demand
Camp/Dust to WWPond
Camp and Dust
Crusher Demand
Crusher to WWPond
Crusher to RaffPond
Crusher
Min Raw Demand
To WWPond
To RaffPond A
To RaffPond B
Rainfall
Evap
Days
Demand A1
Demand A2
Demand A3
Outflow A1
Outflow A2
Outflow A3
Outflow A4
Wobbler Loss
Ore Absorption
LP#1
Demand B1
Demand B2
Demand B3
Outflow B1
Outflow B2
Outflow B3
Outflow B4
LP#2
PLS Pond A
PLS A Spillway
PLS A Return
PLS Pond B
PLS B Spillway
PLS B Return
ILS Pond A
ILS A Demand
ILS A Spillway
ILS A Return
ILS A Shortfall
ILS Pond B
ILS B Demand
ILS B Spillway
ILS B Return
ILS B Shortfall
Raffinate Pond A
Raff Demand A
Raff Spillway A
Raff A Return
Raff A Shortfall
Raffinate Pond B
Raff Demand B
Raff Spillway B
Raff B Return
Raff B Shortfall
Storm Water Pond (A + B)
SWP Inflow
SWP Demand
SWP Spillway
SWP Return
SWP Volume
SWP Shortfall
UndistRC
Waste Water Pond
WWP Inflow
WWP Demand
WWP Spillway
WWP Shortfall
WWP Volume
Make Up
River Source
WD1 Runoff
Pit1 Runoff
WD1 Seepage
WD#1 and Pit 1

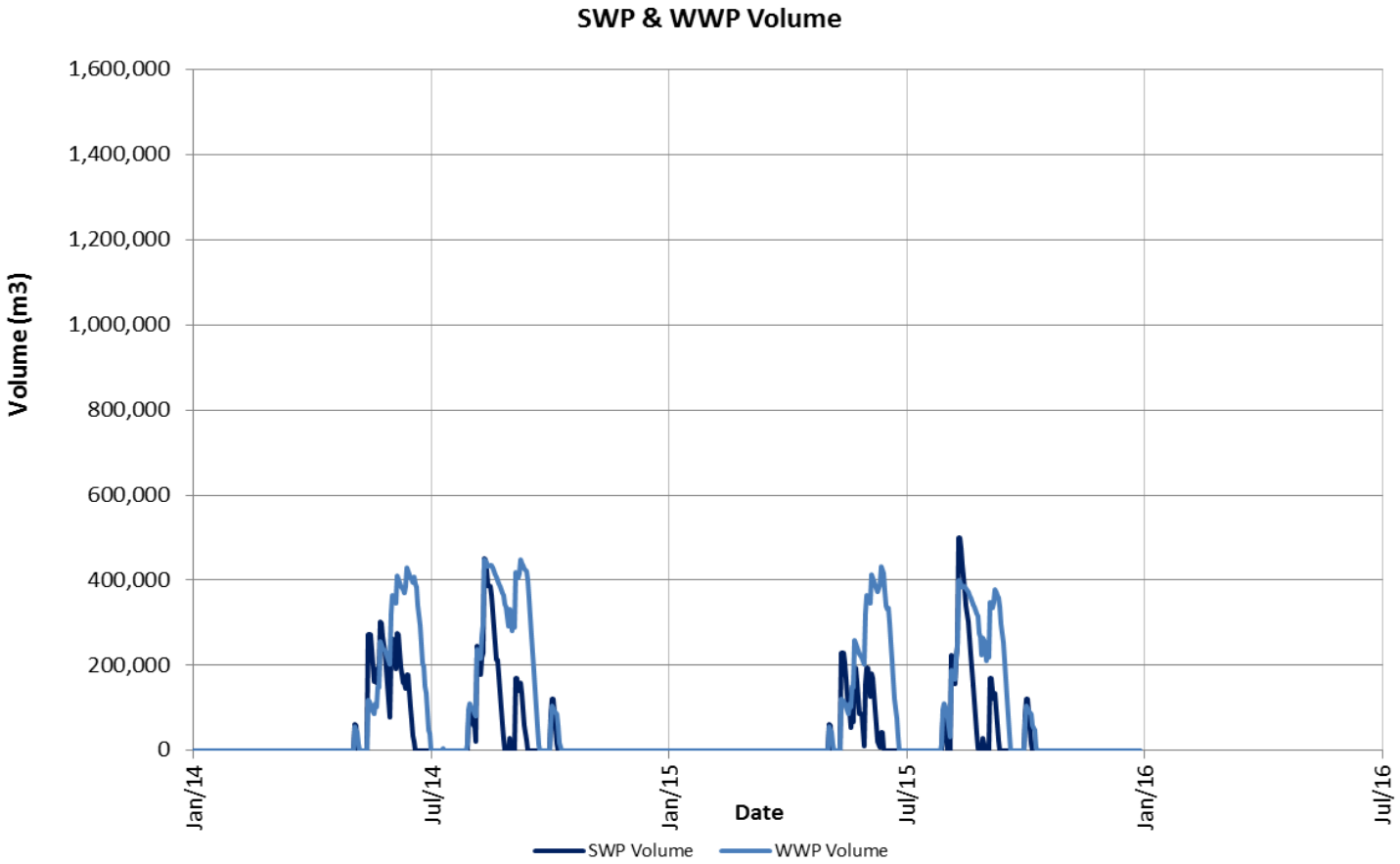

Waste Dump 1
Open Pit
Waste Water Pond
Spillway
Chindwin River
Spillway
Makeup Water
Storm Water Pond
Non Leaching and Stacking Area
Fresh Stacked Ore Leach Area 40 days
Intermediate Leach Area 180 days
Final Leach Area 180 days
To SWP
PLS
Spillway
ILS
Spillway
Raffinate
Spillway or Makeup
Barren Return
Plant Absorption
Makeup Water
Process Plant
Raw Water and Makeup
Evaporation Losses
LEGEND
Pumped Flow
Gravity Flow
Irrigation System
Natural Water Course

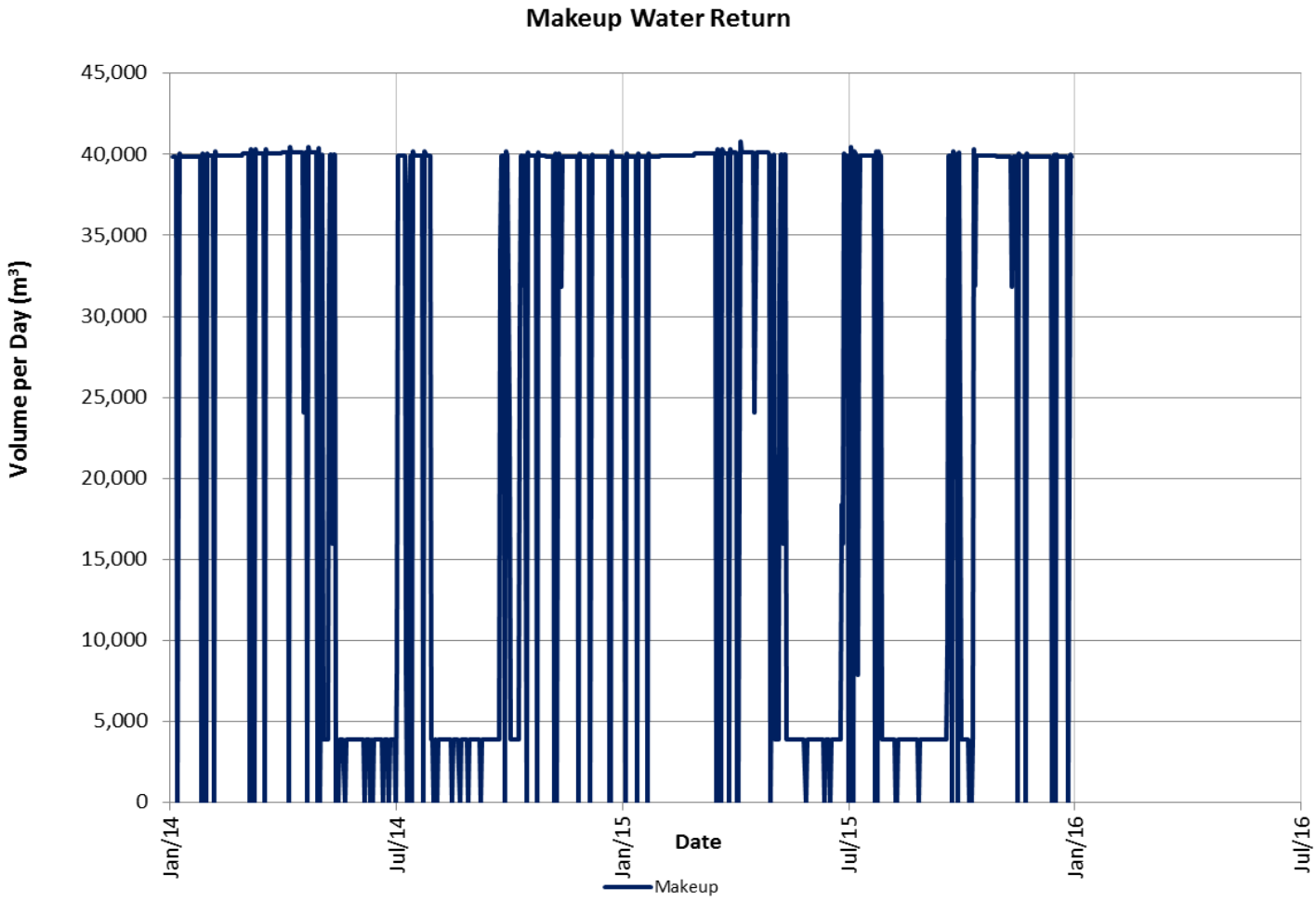


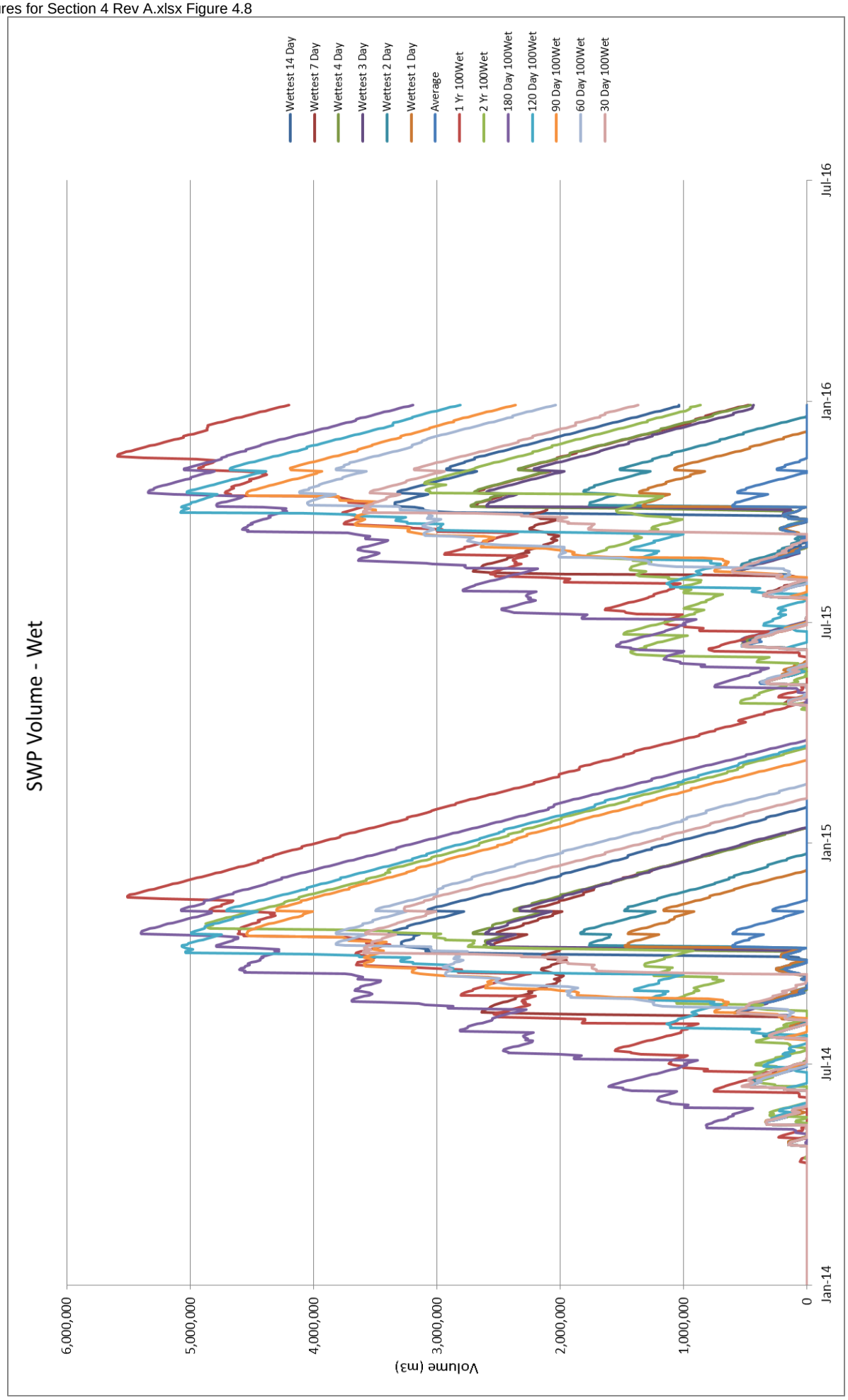
Figures obtained from DRG No CN0428BD0700WD1-1 (Figure 4.1.1)

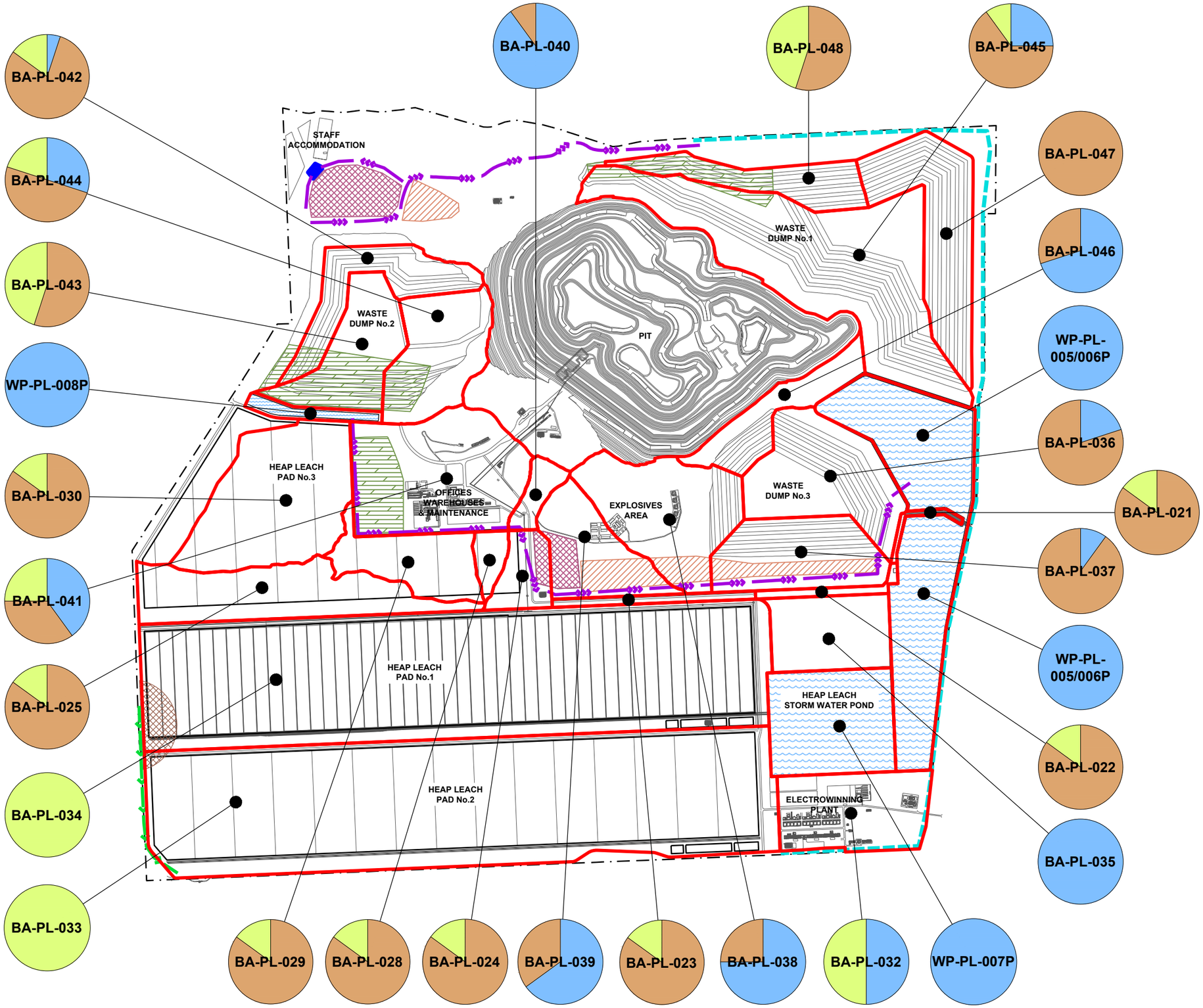

SWP & WWP Volume
Volume (m3)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jan/14
Jul/14
Jan/15
Jul/15
Jan/16
Jul/16
Date
SWP Volume
WWP Volume


Makeup Water Return
Volume per Day (m³)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan/14
Jul/14
Jan/15
Jul/15
Jan/16
Jul/16
Date
Makeup


SWP & WWP Volume
Volume (m3)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Jan/14
Jul/14
Jan/15
Jul/15
Jan/16
Jul/16
Date
SWP Volume
WWP Volume


Makeup Water Return
Volume per Day (m³)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan/14
Jul/14
Jan/15
Jul/15
Jan/16
Jul/16
Date
Makeup


SWP Volume - Wet
Wettest 14 Day
Wettest 7 Day
Wettest 4 Day
Wettest 3 Day
Wettest 2 Day
Wettest 1 Day
Average
1 Yr 100Wet
2 Yr 100Wet
180 Day 100Wet
120 Day 100Wet
90 Day 100Wet
60 Day 100Wet
30 Day 100Wet
Volume (m3)
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16

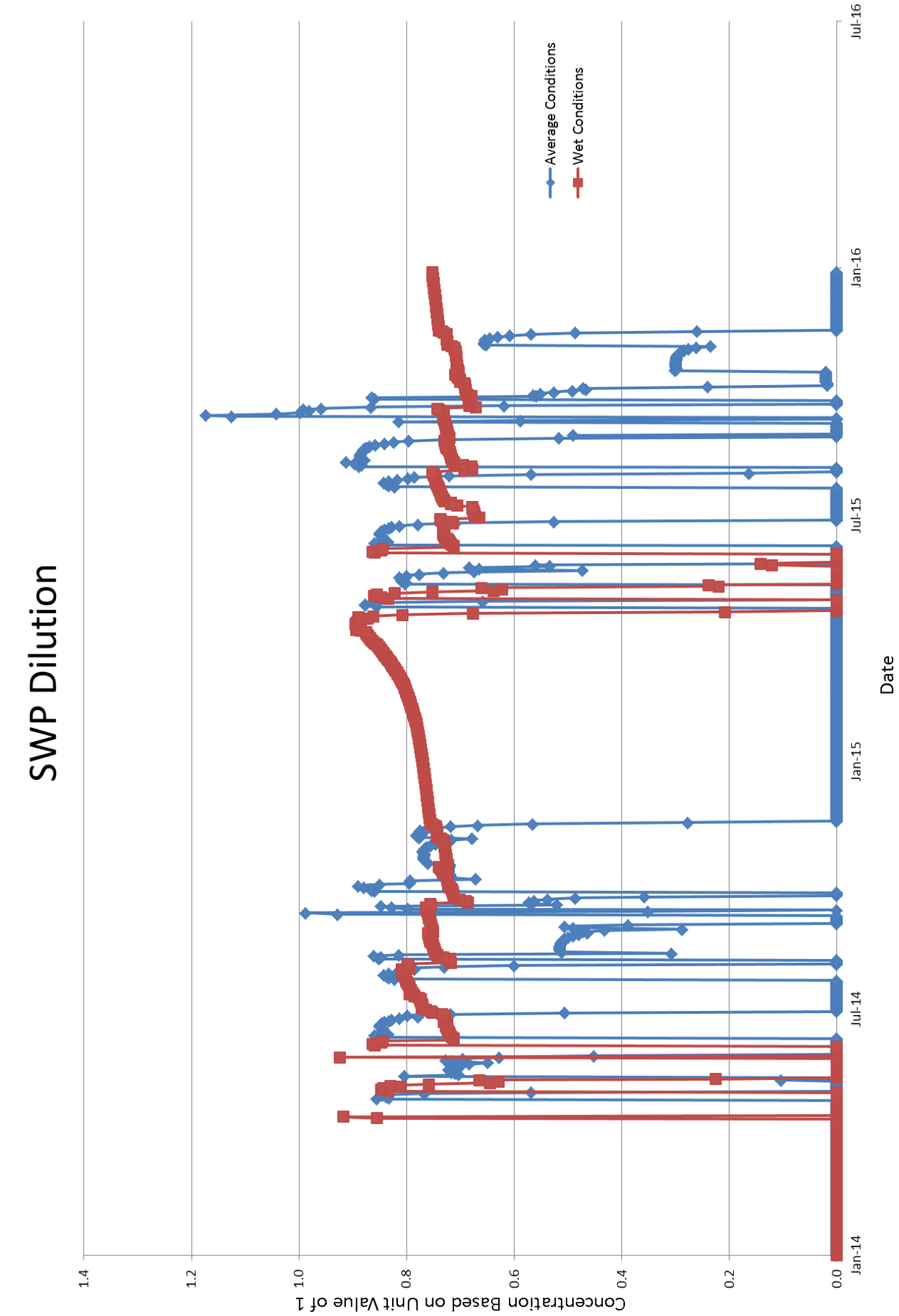


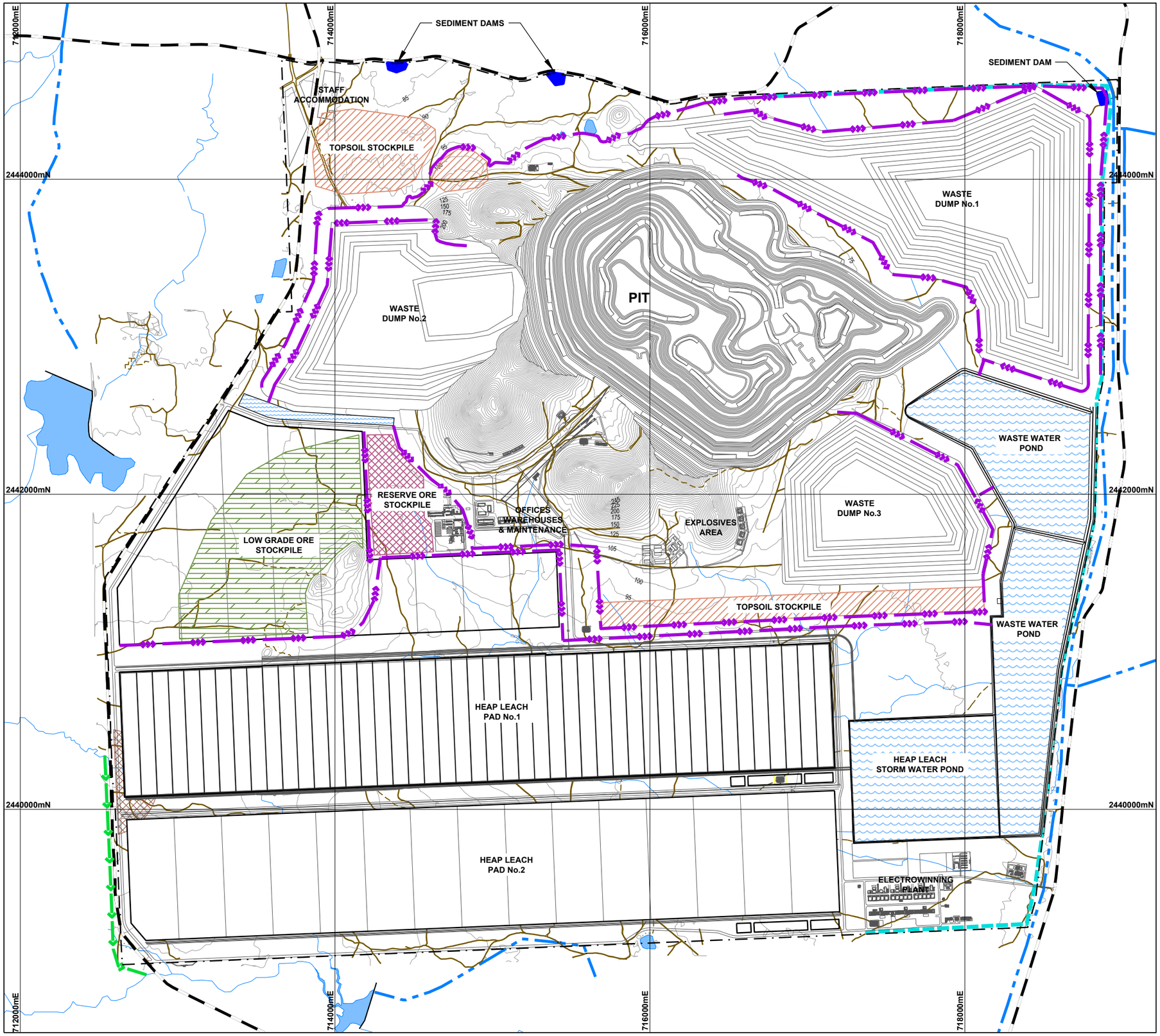
LEGEND:

- LETPADAUNG LEASE BOUNDARY
- FLOOD PROTECTION BUND
- DIVERSION CHANNEL
- DIVERSION DRAIN
- SUB CATCHMENT BOUNDARY
- CATEGORY 1 - CLEAN WATER
- CATEGORY 2 - SEDIMENT/DIRTY WATER
- CATEGORY 3 - CONTAMINATED WATER

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.


SWP Dilution
Average Conditions
Wet Conditions
Concentration Based on Unit Value of 1
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Date



LEGEND:

- EXISTING CANAL
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LETPADAUNG LEASE BOUNDARY
- FLOOD PROTECTION BUND
- MAJOR DIVERSION CHANNEL
- INTERNAL DIVERSION CHANNELS

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 5m CONTOUR INTERVALS SHOWN.

Knight Piésold CONSULTING

LETPADUANG PROJECT
SURFACE WATER MANAGEMENT
RECOMMENDED SITE LAYOUT

Ref: PE701-00022-18
Figure 5.3

APPENDIX A

Basic Climatology Study

DRAFT

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To:	**MYANMAR WANBAO MINING COPPER LTD (MWMCL)**	**Date:**	17th September 2013
Attn:	Glenn Wallis	**Our Ref:**	PE13-00838
		KP File Ref.:	**PE701-22/4-A bl M13017**
cc:		**From:**	Brett Loney

RE: LETPADAUNG COPPER PROJECT – BASELINE DESIGN CLIMATOLOGY

Please find herein baseline design climatology that has been developed for the Letpadaung project site in Myanmar. The investigation and calculations discussed herein provide the preliminary hydrologic basis for on-going and future design work.

1. DATA SOURCES

Historic climate data from four separate locations were used in deriving baseline design climate estimates. The stations, illustrated on Figure 1.1, are:

- Monywa Township climate station, which is located 5.6 kilometres (km) northeast of Letpadaung Hill. At the time this memorandum was written, Knight Piésold (KP) was unable to confirm the precise location and elevation of this monitoring station; accordingly the location shown in Figure 1.1 was assumed to be within the city of Monywa. Daily precipitation data from this station provided by Myanmar Wanbao Mining Copper Ltd. (MWMCL) cover the period (1961–2013).
- Yangtse climate station, which is located 7.6 km northwest of Letpadaung Hill at the Sabetaung and Kyisintaung (S&K) operations site. Monthly pan evaporation data from this station which was previously collected by KP whilst working on the (S&K) project and subsequently extended by MWMCL cover the period (2000-2013).
- World Meteorological Organization (WMO) climate station number 48037, which is located 4.7 km northeast of Letpadaung Hill. Although the location shown on Figure 1.1 accurately depicts WMO records, KP suspects that the actual location of this station is somewhere nearby and not on a sandbar in the Chindwin River as shown. Daily temperature data from this station was sourced by KP from the Research Data Archive (RDA) at the National Center for Atmospheric Research (NCAR), Computational and Information Systems Laboratory (CISL) in Boulder, Colorado USA. The daily temperature data span the period (1981-2012).
- The Wind Rose sampling point, which is located 0.9 km northwest of Letpadaung Hill; this location was used by Lakes Environmental Consultants (LEC) as a sampling point for extracting processed surface and upper air meteorological data from the results of the MM5 (5th generation Mesoscale Model) and SAMSON hourly surface meteorological datasets. More information about these datasets may be reviewed online at:
  - MM5, refer to http://www.mmm.ucar.edu/mm5/mm5-home.html and
  - SAMSON, refer to http://www.webmet.com/MetGuide/Samson.html.

  Hourly wind speed, wind direction and precipitation data from this source span the period (2010-2012).

2. PRECIPITATION ANALYSIS

Precipitation data from the Monywa Township and Wind Rose sampling point datasets were reduced into a standardised format and then analysed on annual, monthly, and daily time scales as appropriate. Annual data is used for climate characterisation and evaluation of climate change. Monthly data is used primarily for water balance modelling purposes. Daily data is used to derive design storms for sizing water conveyance infrastructure: spillways, channels, etc. The following sections detail the various analyses conducted and the results achieved.

2.1 ANNUAL PRECIPITATION ANALYSIS

Daily precipitation records from the Monywa Township climate station were summed to produce annual totals for the entire period of available record. Incomplete years of record were excluded from the analysis if 15% or greater of the values in that year were missing (approximately two months). This was done to prevent sampling bias from distorting the results. Sampling statistics were computed on these annual sums to provide a broad overview of the variability of annual precipitation in the region surrounding the project site, as given in Table 2.1.

Table 2.1: Annual precipitation statistics – Monywa Township (1961-2013)

Selected Statistic	Statistic*1 Value
Average number of rain days	65
Average (mm)	774
Median (mm)	727
Std. Deviation (mm)	230
Minimum (mm)	411
Maximum (mm)	1,370
25th Percentile (mm)	610
75th Percentile (mm)	894
Count (yr)	50
Distance to site (km)	5.6

*1 Incomplete data from 1995, 1999 and 2013 were excluded from this analysis.

The sample statistics for annual precipitation at this site were also depicted graphically, as a “box and whisker” plot to illustrate the variability of annual precipitation, as shown on Figure 2.1. For each year shown, the “box and whisker” plot is read as follows:

- Top of each “box” indicates the 75th percentile annual precipitation;
- Central line within each “box” indicates the median (or 50th percentile) annual precipitation;
- Bottom of each “box” indicates the 25th percentile annual precipitation;
- Red diamond inside each “box” indicates the average annual precipitation;
- The “whiskers”, each of length 1.5 times the inter-quartile range (which is the 75th minus the 25th percentile values) indicate the range of expected readings above and below each “box”. Values above and below the “whiskers” are considered to be outliers; and
- Individual yearly outlier values are indicated as blue crosses with values adjacent.

Details of the annual precipitation analysis are given in Attachment 2.1.

2.2 MONTHLY PRECIPITATION ANALYSIS

Daily precipitation records from the Monywa Township dataset were summed in a manner similar to that described in Section 2.1 to produce monthly totals. Incomplete months of record were excluded from the analysis if 25% or greater of the values in that month were missing (approximately one week). As described in Section 2.1, data exclusions were made to prevent sampling bias. Sampling statistics were computed on the values to describe the variability of monthly precipitation at the project site, as given in Table 2.2.

Table 2.2: Monthly precipitation statistics – Monywa Township (1961-2013)

Month	Average (mm)	Median (mm)	Std. Dev. (mm)	Min. (mm)	Max. (mm)	25th Pct. (mm)	75th Pct. (mm)	Average # of Rain Days*1
Jan	2	0	6	0	31	0	0	0
Feb	3	0	15	0	102	0	0	0
Mar	5	1	14	0	96	0	5	1
Apr	26	21	22	0	100	9	38	4
May	102	94	70	12	386	54	141	9
Jun	100	72	79	0	342	42	129	9
Jul	67	59	43	2	182	34	83	8
Aug	121	103	80	0	356	64	172	10
Sep	166	150	89	47	496	99	212	11
Oct	142	136	95	15	513	83	180	10
Nov	33	12	44	0	186	0	45	3
Dec	6	0	17	0	85	0	2	1

*1 Incomplete data from 1995 (January – June), 1999 (January – April) and 2013 (June – December) were excluded from this analysis.

The sample statistics for monthly precipitation from the Monywa Township dataset were also depicted as a “box and whisker” plot to illustrate the variability of monthly precipitation at the project site, as shown on Figure 2.2. September is the wettest month of the year onsite and the primary wet season starts (on average) about the beginning of April and finishes at the end of November. Accordingly, the wet season typically lasts 8 months out of each year, with the remaining 4 months experiencing negligible rainfall. Details of the monthly precipitation analysis are given in Attachment 2.2.

2.3 DAILY PRECIPITATION ANALYSIS

KP performed frequency analysis on daily precipitation data (from the Monywa dataset) to estimate the statistical likelihood of experiencing extreme short-duration storms at the project site. A large number of different probability distributions, e.g.: Log-Pearson 3, Generalised Extreme Value (GEV), Generalised Logistic, Wakeby, Burr, etc. were fitted to the annual maxima of the daily precipitation data using EasyFit Professional 5.4 software (Ref. 1).

Three of the best fits were selected for comparison, as shown on Figure 2.3. Based on the comparison, and to maintain compatibility with other *n* day duration frequency analyses, discussed in Section 2.6, KP selected the GEV fit for use at the Letpadaung site. The results of the GEV fit to historic precipitation records are given in Table 2.3 and details of the daily precipitation frequency analysis are given in Attachment 2.3.

KP notes that frequency is generally expressed as Average Recurrence Interval (ARI), measured in years.

Table 2.3: Extreme daily (24-h) design precipitation

Annual Exceedance Probability (AEP)[*1]	Annual Recurrence Interval (ARI) (yr)	24-h Duration Precipitation	
		Uncorrected Depth (mm)	Corrected[*2] Depth (mm)
0.001	1,000	194	222
0.002	500	184	211
0.005	200	170	195
0.010	100	159	182
0.020	50	147	168
0.050	20	131	149
0.100	10	117	134
0.200	5	102	117
0.500	2	79	90

*1 AEP calculated using the Weibull probability plotting formulation.

*2 Values have been augmented 14.3% to account for potential straddling errors in sampling which may occur from the usage of fixed 24 hour duration observational periods in deriving daily and sub-daily design storm estimates (Ref. 2).

KP utilised the daily design precipitation information in Table 2.3 to derive Intensity / Duration / Frequency (IDF) curves for short duration storms. The rainfall ratio method as given in (Ref. 3) was employed for this purpose. By using tabulated fitting coefficients from (Ref. 4) for the most similar (in climate) listed location (Phnom Penh, Cambodia) and correction factors for 24, 48 and 72 hour duration storms taken from (Ref. 2); KP obtained estimates for the Letpadaung project site, as given in Table 2.4 and illustrated on Figure 2.4.

(KP notes that the world maximum intensity / duration envelope, taken from (Ref. 5) is shown on Figure 2.4 for purposes of comparison.)

Table 2.4: Letpadaung intensity / duration / frequency results

Storm Duration	Precipitation Intensity (mm/h) for given ARI (year) Storm[*1]							
	2	5	10	20	50	100	200	500
5 min	157	205	235	262	295	319	341	369
10 min	128	167	192	214	241	260	279	302
15 min	109	142	163	182	205	221	237	256
30 min	76	99	114	127	143	154	165	178
1 h	49	63	72	81	91	98	105	114
2 h	29	38	43	48	55	59	63	68
3 h	21	28	32	35	40	43	46	50
6 h	12	16	18	20	23	24	26	28
12 h	7	9	10	11	13	14	15	16
18 h	5	6	7	8	9	10	10	11
24 h[*2]	4	5	6	6	7	8	8	9
48 h[*3]	2	3	3	4	5	5	6	6
72 h[*4]	2	2	3	3	4	4	5	6

*1 Intensity values are shown rounded to the nearest mm/h.

*2 Intensity values for 24 hour duration storms have been augmented 14.3% to account for potential straddling errors in sampling which may occur from the usage of fixed 24 hour duration observational periods in deriving daily and sub-daily design storm estimates (Ref. 2).

*3 Intensity values for 48 hour duration storms have been augmented 6.7% (Ref. 2).

*4 Intensity values for 72 hour duration storms have been augmented 4.4% (Ref. 2).

Details of the IDF curve analysis are given in Attachment 2.4.

2.4 TEMPORAL DISTRIBUTION OF PRECIPITATION

KP analysed the hourly precipitation data from the Wind Rose sampling point dataset (2010-2012) to determine the temporal distributions (i.e. hyetographs) of short-duration storms to be used with the IDF results from Section 2.3 in rainfall-runoff modelling. For candidate storm durations ranging from 2 to 45 hours (the longest storm identified in the historic dataset was 45 hours), the hyetograph analysis entailed the following steps:

- Delineate all storms of *n* duration (where *n* is the candidate duration, measured in integer hours).
- Convert hourly readings within each delineated storm of *n* duration to a cumulative percentage basis; this puts the *n* hour storms on a dimensionless basis.
- Select all *n* hour dimensionless storms with total precipitation equal to or exceeding the 85th percentile of all *n* hour storms; which restricts derived hyetal patterns to those associated with heavy rainfall. Then, compute averages for every hour within the selected subset of *n* hour storms. The results of these computations are the dimensionless design hyetographs to be used in rainfall-runoff modelling.

The results of the analysis for a subset of the storms considered (durations ranging between 2 and 9 hours) are given in Table 2.5, with a typical hyetograph (for 4 hour storms) shown on Figure 2.5. Complete results of the Letpadaung hyetograph analysis (i.e. tabulated patterns for all 24 derived durations with corresponding hyetographs) are given in Attachment 2.5.

Table 2.5: Letpadaung hyetograph results for 2 through 9 hour storms

Elapsed Time (h)	Cumulative Percentage of Total Precipitation for *n* hour Storm							
	2	3	4	5	6	7	8	9
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	55.3%	22.9%	15.3%	6.6%	8.1%	6.7%	0.9%	3.8%
2	100.0%	77.0%	56.2%	37.2%	24.3%	19.0%	4.7%	13.7%
3		100.0%	90.1%	67.8%	45.3%	43.0%	15.6%	34.9%
4			100.0%	93.7%	76.5%	70.1%	51.5%	63.4%
5				100.0%	97.1%	88.5%	73.8%	81.3%
6					100.0%	98.4%	88.3%	88.9%
7						100.0%	97.5%	93.7%
8							100.0%	97.8%
9								100.0%

KP notes that hyetographs for intermediate durations may be estimated via interpolation, after the bounding storms have been put on a dimensionless temporal basis. Storm hyetographs for durations outside of the range given in Attachment 2.5 may be assumed as follows:

- Durations less than 2 hours should employ the 2 hour duration hyetograph, after scaling to the smaller duration;
- Durations in the range (45 h ≤ *n* ≤ 72 h) should employ the 45 hour duration hyetograph, after scaling to the larger duration; and
- Durations greater than 72 hours should not employ the derived hyetographs. Additional studies are required to estimate design hyetographs for long duration continuous storms.

2.5 PRECIPITATION TREND ANALYSIS

KP performed trend analysis on annual precipitation totals from the Monywa Township dataset (1961-2013) in order to ascertain potential impacts of trends in precipitation on planned site development. The results of this analysis, illustrated on Figure 2.6, show that there is no statistically significant trend observable in annual precipitation values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future precipitation cycles due to observed climate change.

Details of the precipitation trend analysis are given in Attachment 2.6.

2.6 WATER BALANCE SCENARIOS

KP performed frequency analysis on precipitation values for 15 candidate water balance cycle durations to estimate the statistical likelihood of experiencing extremely “Wet” or “Dry” years at the Letpadaung site. The durations considered include:

- Long duration cycles of 1, 2, 3, 4 and 5 years and
- Short duration cycles of 2, 3, 4, 7, 14, 30, 60, 90, 120 and 180 days.

Exceedance and non-exceedance probabilities were assigned to the *n* (year or day) totals of daily precipitation values, by sorting the values in descending (for the “Wet” series) and ascending (for the “Dry” series) order. The requisite frequency analyses were then conducted in a manner similar to that described in Section 2.3.

For each of the candidate water balance cycle durations, the three best fitting probability distributions were selected for comparison. Based on the comparison, the probability

distribution which fits Monywa Township (1961-2013) historical data best for all considered durations is the Generalised Extreme Value (GEV) distribution. Details of the water balance scenario frequency analysis are given in Attachment 2.7.

In order to apportion the statistically-computed climate cycle precipitation totals to daily time series for use in water balance modelling, the wettest (or wettest and driest, in the case of the 1 year duration cycle) *n* (year or day) continuous records of historical rainfall in the Monywa Township (1963-2013) dataset were identified and converted to series of cumulative daily percentages (of total observed rainfall). These series were then multiplied by the 100 and 500 year ARI depths (for each duration *n*) to derive 32 daily water balance scenarios, which are detailed in Attachment 2.8. A summary of the derived scenarios is given in Table 2.6.

Table 2.6: Letpadaung water balance scenario summary

Scenario	100-yr ARI Total Depth (mm)	500-yr ARI Total Depth (mm)	Temporal Pattern Based on
5 Year Wet	5,479	5,839	1973 – 1979
4 Year Wet	4,630	5,083	1973 – 1976
3 Year Wet	3,644	4,083	1975 – 1977
2 Year Wet	2,544	2,844	2010 – 2011
1 Year Wet	1,555	1,902	1973
1 Year Dry	424	383	1982
180 Day Wet	1,437	1,767	25/05/1973 – 20/11/1973
120 Day Wet	1,067	1,272	2/07/2010 – 29/10/2010
90 Day Wet	921	1,101	30/07/1965 –27/10/1965
60 Day Wet	740	865	29/08/1965 – 27/10/1965
30 Day Wet	520	596	29/09/2010 – 28/10/2010
14 Day Wet	440	563	9/05/2007 – 22/05/2007
7 Day Wet[*1]	343	447	9/05/2007 – 15/05/2007
4 Day Wet[*2]	308	410	1/06/1984 – 4/06/1984
3 Day Wet[*3]	298	401	1/06/1984 – 3/06/1984
2 Day Wet[*4]	214	249	2/06/1984 – 3/06/1984

*1 Scenario totals for 7 day duration cycles have been augmented 1.8% to account for potential straddling errors in sampling which may occur from the usage of fixed 24 hour duration observational periods in deriving daily design storm estimates (Ref. 2).

*2 Scenario totals for 4 day duration cycles have been augmented 3.4% (Ref. 2).

*3 Scenario totals for 3 day duration cycles have been augmented 4.4% (Ref. 2).

*4 Scenario totals for 2 day duration cycles have been augmented 6.7% (Ref. 2).

3. EVAPORATION ANALYSIS

Pan evaporation data from the Yangtse climate station dataset was reduced into a standardised format and then analysed on annual and monthly time scales as appropriate. Annual data is used for climate characterisation and evaluation of climate change. Monthly data is used primarily for water balance modelling purposes.

Pan evaporation values may be used to estimate evaporation from natural water bodies (lakes, ponds, etc.). Evaporation from a natural body of water is usually at a lower rate because the body of water does not have metal sides that get hot with the sun. Also, while

light penetration in a pan is essentially uniform, light penetration in natural bodies of water decreases with depth. Accordingly, lake evaporation can be estimated by multiplying pan evaporation by a coefficient, which may be assumed as 0.7 in lieu of experimentally calibrated results.

The following sections detail the various analyses conducted and the results achieved.

3.1 ANNUAL EVAPORATION ANALYSIS

Monthly pan evaporation records from the Yangtse climate station were summed to produce annual totals for the entire period of available record. Recorded data from 2007 and onwards was excluded from consideration because the evaporation trend analysis, discussed in Section 3.3, revealed an unexplained shift in recorded values between 2006 and 2007. If the full dataset were to be used "as is", spurious analysis results are likely.

Sampling statistics were computed on these annual sums from the reduced dataset (2000-2006) to provide a broad overview of the typical variability of annual pan evaporation in the region surrounding the project site, as given in Table 3.1.

Table 3.1: Annual pan evaporation statistics – Yangtse climate station (2000-2006)

Selected Statistic	Statistic Value
Average (mm)	2,017
Median (mm)	2,051
Std. Deviation (mm)	75
Minimum (mm)	1,922
Maximum (mm)	2,109
25th Percentile (mm)	1,951
75th Percentile (mm)	2,067
Count (yr)	7
Distance to site (km)	7.6

The sample statistics for annual precipitation at this site were also depicted graphically, as a "box and whisker" plot, as shown on Figure 3.1. Details of the annual pan evaporation analysis are given in Attachment 3.1.

3.2 MONTHLY EVAPORATION ANALYSIS

Monthly pan evaporation from the Yangtse climate station was employed in this analysis. As discussed in Section 3.1, recorded data from 2007 and onwards was excluded from consideration. Sampling statistics were computed on these values to describe the variability of monthly pan evaporation at the project site, as given in Table 3.2.

Table 3.2: Monthly pan evaporation statistics – Yangtse climate station (2000-2006)

Month[*1]	Average	Median	Std. Dev.	Min.	Max.	25th Pct.	75th Pct.
Jan	123	121	5	119	134	121	122
Feb	149	151	13	130	166	141	158
Mar	210	213	14	188	224	201	220
Apr	228	236	21	191	248	218	242
May	202	205	43	118	256	197	223
Jun	203	187	36	165	270	181	219
Jul	172	174	12	153	187	166	180
Aug	184	175	38	133	248	167	198
Sep	160	150	27	128	208	145	173
Oct	145	148	27	102	184	132	157
Nov	125	130	17	102	146	111	137
Dec	117	112	12	98	131	110	127

*1 All computed pan evaporation statistics are measured in (mm).

The sample statistics for monthly pan evaporation were also depicted as a “box and whisker” plot, as shown on Figure 3.2. A cyclical pattern was observed, with the greatest pan evaporation occurring in April and the smallest in December. Details of the monthly pan evaporation analysis are given in Attachment 3.2.

3.3 EVAPORATION TREND ANALYSIS

KP performed trend analysis on annual pan evaporation totals from the Yangtse climate station dataset (2000-2013) in order to ascertain potential impacts of trends in pan evaporation on planned site development. The results of this analysis, illustrated on Figure 3.3, show a statistically significant negative trend. However, further inspection of the data showed an unexplained downshift of nearly 600 mm in annual average pan evaporation between 2006 and 2007.

A shift this large is highly unusual, if not impossible, in nature. Therefore, an attempt was made to try and find an explanation for this behaviour. As no records of a sudden shift in pan evaporation of this magnitude were found for this period in Myanmar, KP efforts shifted to trying to determine which sub-period in the provided historical dataset, either (2000-2006) or (2007-2012) was most likely.

A contour map of iso-lines of equal lake evaporation for Myanmar was obtained from (Ref. 6). This map, reproduced as Figure 3.4, shows that annual average lake evaporation at Monywa City is approximately 1,600 mm/yr, which converts to an equivalent 2,300 mm/yr after application of a 0.7 pan coefficient, which is considerably closer to the average annual evaporation of the first sub-period rather than the second. Based on this observation, KP selected the (2000-2006) period for estimating site pan evaporation values. The data from the second (2007-2012) period was excluded from further consideration.

Focusing on the (2000-2006) period, there is no statistically significant trend observable in annual pan evaporation values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future pan evaporation due to observed climate change.

Details of the pan evaporation trend analysis are given in Attachment 3.3.

3.4 COMPARISON OF PRECIPITATION & EVAPORATION

Average monthly values of precipitation (taken from Section 2.2) and pan evaporation (taken from Section 3.2) were compared to determine if the Letpadaung site is expected to run with a surplus of water from precipitation or if an annual deficit is expected. The results of this comparison are summarised in Table 3.3 and illustrated on Figure 3.5.

Table 3.3: Comparison of monthly average precipitation & evaporation

Month	Ave. Precipitation (mm)	Ave. Pan Evaporation (mm)	Ave. Lake*1 Evaporation (mm)	Precip. minus Lake Evap. (mm)
Jan	2	123	86	-84
Feb	3	149	105	-101
Mar	5	210	147	-142
Apr	26	228	160	-134
May	102	202	142	-40
Jun	100	203	142	-42
Jul	67	172	121	-54
Aug	121	184	129	-7
Sep	166	160	112	54
Oct	142	145	101	50
Nov	33	125	87	-55
Dec	6	117	82	-75
Totals	773	2,017	1,412	-639

*1 Assumed pan coefficient = 0.7.

As Table 3.3 clearly shows, the Letpadaung site is expected to run a strong water deficit on average. The only two months where a positive balance is indicated are September and October. Annual average water augmentation to maintain a neutral balance, not considering storage and additional losses, is 639 mm. Additional details of this comparison are provided in Attachment 3.4.

4. TEMPERATURE ANALYSIS

Average daily temperature data from the WMO 48037 climate station dataset was reduced into a standardised format and then analysed on annual and monthly time scales as appropriate. The following sections detail the various analyses conducted and the results achieved.

4.1 ANNUAL TEMPERATURE ANALYSIS

Daily average temperature records from the WMO 48037 climate station were summed to produce annual totals for the entire period of available record. Incomplete years of record were excluded from the analysis if 15% or greater of the values in that year were missing (approximately two months). This was done to prevent sampling bias. Sampling statistics were computed on these annual sums, as given in Table 4.1.

Table 4.1: Annual average temperature statistics – WMO 48037 station (1981-2012)

Selected Statistic	Statistic[*1] Value
Average (℃)	27.8
Median (℃)	27.8
Std. Deviation (℃)	0.8
Minimum (℃)	26.1
Maximum (℃)	29.7
25th Percentile (℃)	27.2
75th Percentile (℃)	28.2
Count (yr)	25
Distance to site (km)	4.7

*1 Incomplete data from 1981, 1986-1989, 1992 and 2012 were excluded from this analysis.

The sample statistics for annual average precipitation at this site were also depicted graphically, as a "box and whisker" plot, as shown on Figure 4.1.

Details of the annual average temperature analysis are given in Attachment 4.1.

4.2 MONTHLY TEMPERATURE ANALYSIS

Daily temperature records from the WMO 48037 dataset were summed in a manner similar to that described in Section 4.1 to produce monthly totals. Incomplete months of record were excluded from the analysis if 25% or greater of the values in that month were missing (approximately one week). This was done to prevent sampling bias. Sampling statistics were computed on these values, as given in Table 4.2.

Table 4.2: Monthly average temperature statistics – WMO 48037 station (1981-2012)

Month[*1]	Average	Median	Std. Dev.	Min.	Max.	25th Pct.	75th Pct.
Jan	21.9	21.9	1.9	18.4	28.0	21.2	22.5
Feb	24.0	23.6	2.3	21.1	32.9	23.0	24.8
Mar	28.1	28.0	2.3	23.1	35.5	27.0	29.2
Apr	30.9	30.9	1.4	25.9	33.1	30.3	31.7
May	31.0	31.0	1.4	28.1	33.8	30.4	31.7
Jun	30.6	30.5	1.1	27.8	32.9	29.9	31.3
Jul	30.5	30.8	1.2	26.8	32.5	30.1	31.3
Aug	29.9	29.8	1.0	28.4	32.1	29.2	30.6
Sep	29.3	29.3	0.7	27.8	30.4	28.8	29.8
Oct	28.0	28.	0.7	26.5	29.8	27.6	28.4
Nov	25.1	25.3	1.1	23.0	27.6	24.4	25.8
Dec	22.2	22.0	1.9	18.4	28.0	21.3	22.9

*1 All computed temperature statistics are measured in (℃).

The sample statistics for monthly average temperature from the WMO 48037 dataset were also depicted as a "box and whisker" plot, as shown on Figure 4.2. The hottest month (on average) each year is May, with a cyclical pattern shown. Details of the monthly average temperature analysis are given in Attachment 4.2.

Monthly ranges in temperature were also analysed by computing monthly averages on daily temperature maxima and minima. The results of this analysis are given in Table 4.3 and are illustrated on Figure 4.3.

Table 4.3: Monthly temperature ranges – WMO 48037 station (1981-2012)

Month[*1]	Max.	Average	Min.
Jan	28.5	21.9	15.4
Feb	31.6	24.0	16.9
Mar	36.0	28.1	20.5
Apr	38.4	30.9	24.0
May	36.8	31.0	25.5
Jun	35.4	30.6	26.0
Jul	35.5	30.5	26.1
Aug	34.3	29.9	25.7
Sep	33.4	29.3	25.3
Oct	32.5	28.0	23.8
Nov	30.4	25.1	19.9
Dec	28.0	22.2	16.4

*1 All computed temperature statistics are measured in (℃).

Temperatures are fairly consistent for six months of the year: April through September. The other four "shoulder" months exhibit a cyclical transition from the warm period to the coldest two months of the year: December and January. Details of the monthly temperature range analysis are given in Attachment 4.3.

4.3 TEMPERATURE TREND ANALYSIS

KP performed trend analysis on annual average temperature totals from the WMO 48037 dataset (1981-2012) in order to ascertain potential impacts of trends in temperature on planned site development. The results of this analysis, illustrated on Figure 4.4, show that there is no statistically significant trend observable in annual average temperature values at the Letpadaung site. Accordingly, no additional scaling factors are necessary for employing statistical estimates of future temperature due to observed climate change.

Details of the precipitation trend analysis are given in Attachment 4.4.

5. WIND ROSE ANALYSIS

Wind speed and direction data from the Wind Rose sampling point dataset were analysed using WindRose Pro 3.01 software (Ref. 7). Hourly data spanning the historic period (2010-2012) were used as inputs to the program to produce wind rose plots. Each concentric circle on a wind rose plot represents a different frequency, starting at zero in the center and increasing as the circles move outwards. The direction of each "spoke" indicates the cardinal direction that winds are blowing *from* over the historic period analysed. Additionally, the colours of portions of each spoke indicate the speed with which the wind blows from in a particular direction.

The hourly wind data were used to prepare nine wind rose plots, as follows:

- All wind measurements are shown on Figure 5.1;
- Wind measurements for the period (00:00 – 03:00) are shown on Figure 5.2;
- Wind measurements for the period (03:00 – 06:00) are shown on Figure 5.3;
- Wind measurements for the period (06:00 – 09:00) are shown on Figure 5.4;

- Wind measurements for the period (09:00 – 12:00) are shown on Figure 5.5;
- Wind measurements for the period (12:00 – 15:00) are shown on Figure 5.6;
- Wind measurements for the period (15:00 – 18:00) are shown on Figure 5.7;
- Wind measurements for the period (18:00 – 21:00) are shown on Figure 5.8;
- Wind measurements for the period (21:00 – 00:00) are shown on Figure 5.9;
- Wind measurements for the Wet Season are shown on Figure 5.10; and
- Wind measurements for the Dry Season are shown on Figure 5.11.

Wind rose data may be used for noise and dust analysis as well as for siting airstrips and for calculating fetch lengths for wave run-up calculations that are used in pond / dam sizing.

Details of the wind rose analysis are given in Attachment 5.1. The two years of available data indicate that at Letpadaung, winds blow from the North (0°) to North by Northwest (337.5°) at an average of 3.0 m/s which, on the Bea ufort scale is classified as 2 "light breeze". Maximum recorded wind speed during this period is 9.2 m/s, which corresponds to 5 "fresh breeze" on the Beaufort scale.

The direction the wind blows from also tends to reverse during the afternoon, blowing from the South (180°) to Southeast (225°). Generally sp eaking, the data does not indicate that high wind storms are likely at this site.

Seasonal variability was also considered. The dataset was divided into the Wet (May through October) and Dry (November through April) Seasons. Wind rose plots were produced for each season. During the Wet Season, winds generally blow along the North / South cardinal directions, with the preponderance of statistical data suggesting that winds blow from the South (180°) to South by Southeast (1 57.5°). In the Dry Season, the wind blows predominantly from the North (0°) to North by Northwest (337.5°). Letpadaung Wet Season and Dry Season wind rose plots are shown in figures 5.10 and 5.11.

6. SUMMARY / CONCLUSIONS

Historic data from four different locations were analysed to derive design values associated with climate parameters of interest: precipitation, evaporation, temperature and wind. The specific design values associated with each climate parameter that have been addressed in this memorandum are listed below.

Precipitation parameters:

- Typical variability of annual precipitation and average number of rain days;
- Typical variability of monthly precipitation and average number of rain days;
- Intensity / Duration / Frequency (IDF) curves for short-duration extreme rainfall events;
- Temporal distributions (i.e. hyetographs) of short-duration precipitation to be used with the IDF curves in rainfall-runoff modelling. Design hyetographs were derived for storm durations ranging from 2 to 45 hours;
- Trend analysis of annual precipitation totals, for ascertaining potential impacts of climate trends on site development; and
- Daily precipitation amounts for 32 climate scenarios (15 durations x 2 storm frequencies for each duration, with the 1 year scenario considered for both Wet and Dry cycles) to be used with water balance modelling, as follows:
  - 500 year Annual Recurrence Interval (ARI), 5 year duration Wet cycle;
  - 100 year ARI, 5 year duration Wet cycle;
  - 500 year ARI, 4 year duration Wet cycle;
  - 100 year ARI, 4 year duration Wet cycle;
  - 500 year ARI, 3 year duration Wet cycle;
  - 100 year ARI, 3 year duration Wet cycle;
  - 500 year ARI, 2 year duration Wet cycle;

- 100 year ARI, 2 year duration Wet cycle;
- 500 year ARI, 1 year duration Wet cycle;
- 100 year ARI, 1 year duration Wet cycle;
- 500 year ARI, 1 year duration Dry cycle;
- 100 year ARI, 1 year duration Dry cycle;
- 500 year ARI, 180 day duration Wet cycle;
- 100 year ARI, 180 day duration Wet cycle;
- 500 year ARI, 120 day duration Wet cycle;
- 100 year ARI, 120 day duration Wet cycle;
- 500 year ARI, 90 day duration Wet cycle;
- 100 year ARI, 90 day duration Wet cycle;
- 500 year ARI, 60 day duration Wet cycle;
- 100 year ARI, 60 day duration Wet cycle;
- 500 year ARI, 30 day duration Wet cycle;
- 100 year ARI, 30 day duration Wet cycle;
- 500 year ARI, 14 day duration Wet cycle;
- 100 year ARI, 14 day duration Wet cycle;
- 500 year ARI, 7 day duration Wet cycle;
- 100 year ARI, 7 day duration Wet cycle;
- 500 year ARI, 4 day duration Wet cycle;
- 100 year ARI, 4 day duration Wet cycle;
- 500 year ARI, 3 day duration Wet cycle;
- 100 year ARI, 3 day duration Wet cycle;
- 500 year ARI, 2 day duration Wet cycle; and
- 100 year ARI, 2 day duration Wet cycle.

Annual average precipitation is 774 mm, normally occurring over 65 rain days each year. The wet season lasts for eight months, from April through the end of November. The wettest month of the year is September (166 mm on average) and the driest is January (1.9 mm on average).

Evaporation parameters:

- Typical variability of annual evaporation;
- Typical variability of monthly evaporation; and
- Trend analysis of annual evaporation totals, for ascertaining potential impacts of climate trends on site development.

Annual average lake evaporation is estimated at 1,412 mm, which assumes a pan coefficient of 0.7 applied to calculated annual average pan evaporation (2,017 mm). A comparison of precipitation and lake evaporation indicates that the Letpadaung site is expected to run a strong water deficit on average. The only two months where a positive balance is indicated are September and October. Annual average water augmentation to maintain a neutral balance, not considering storage and additional losses, is 639 mm. Adequate water storage and careful management of available water resources will be critical to successful mining operations at Letpadaung.

Temperature parameters:

- Typical variability of annual mean temperature;
- Typical variability of monthly mean temperature, as well as the range of monthly mean temperature between maximum and minimum; and
- Trend analysis of annual temperature averages, for ascertaining potential impacts of climate trends on site development.

Temperatures are fairly consistent during the six warm months of the year: April through September, when the average value is 30.4°C. The other four “shoulder” months exhibit a cyclical transition from the warm period to the coldest two months of the year: December

and January, when the average temperature is 22.1°C. Minimum temperature generally occurs in January (15.4°C) and the maximum in April (38.4°C).

Wind parameters:

- Typical variability of wind speed and direction on daily and eight sub-daily time periods (each of 3 hours duration), which are illustrated graphically through the use of wind rose plots.

Winds generally blow from the North (0°) to North by Northwest (337.5°) at an average of 3.0 m/s, with a maximum of is 9.2 m/s. These correspond to Beaufort scale readings of 2 "light breeze" to 5 "fresh breeze". The direction the wind blows from also tends to reverse during the afternoon, blowing from the South (180°) to Southeast (225°). Available wind data indicates that high wind storms are unlikely at the Letpadaung site.

We trust that these results are sufficient for any preliminary design computations.

Yours faithfully
KNIGHT PIÉSOLD PTY LTD

TODD LEWIS
Lead Engineer, Hydrology and Hydraulics

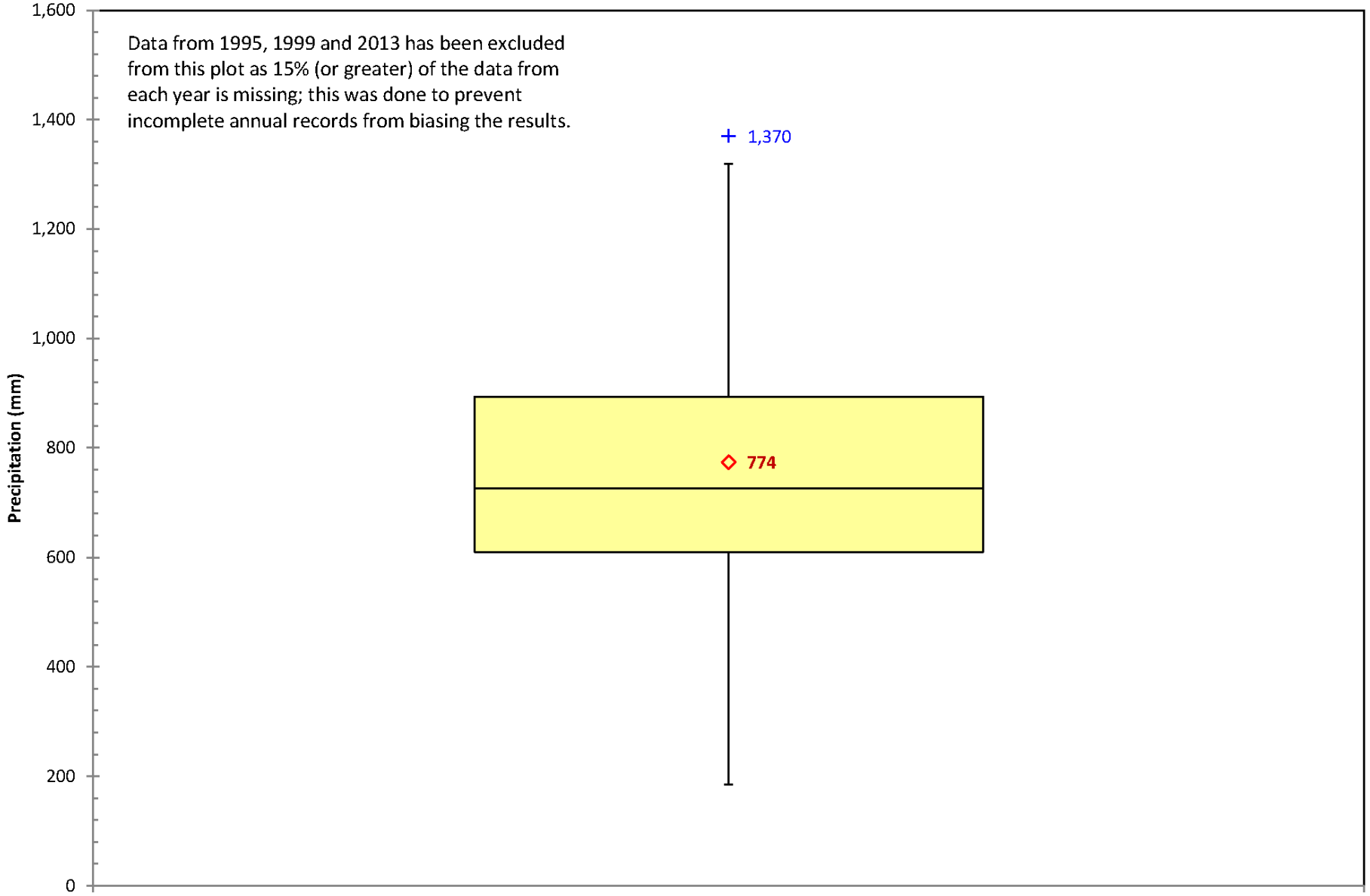
BRETT LONEY
Manager Environmental Services

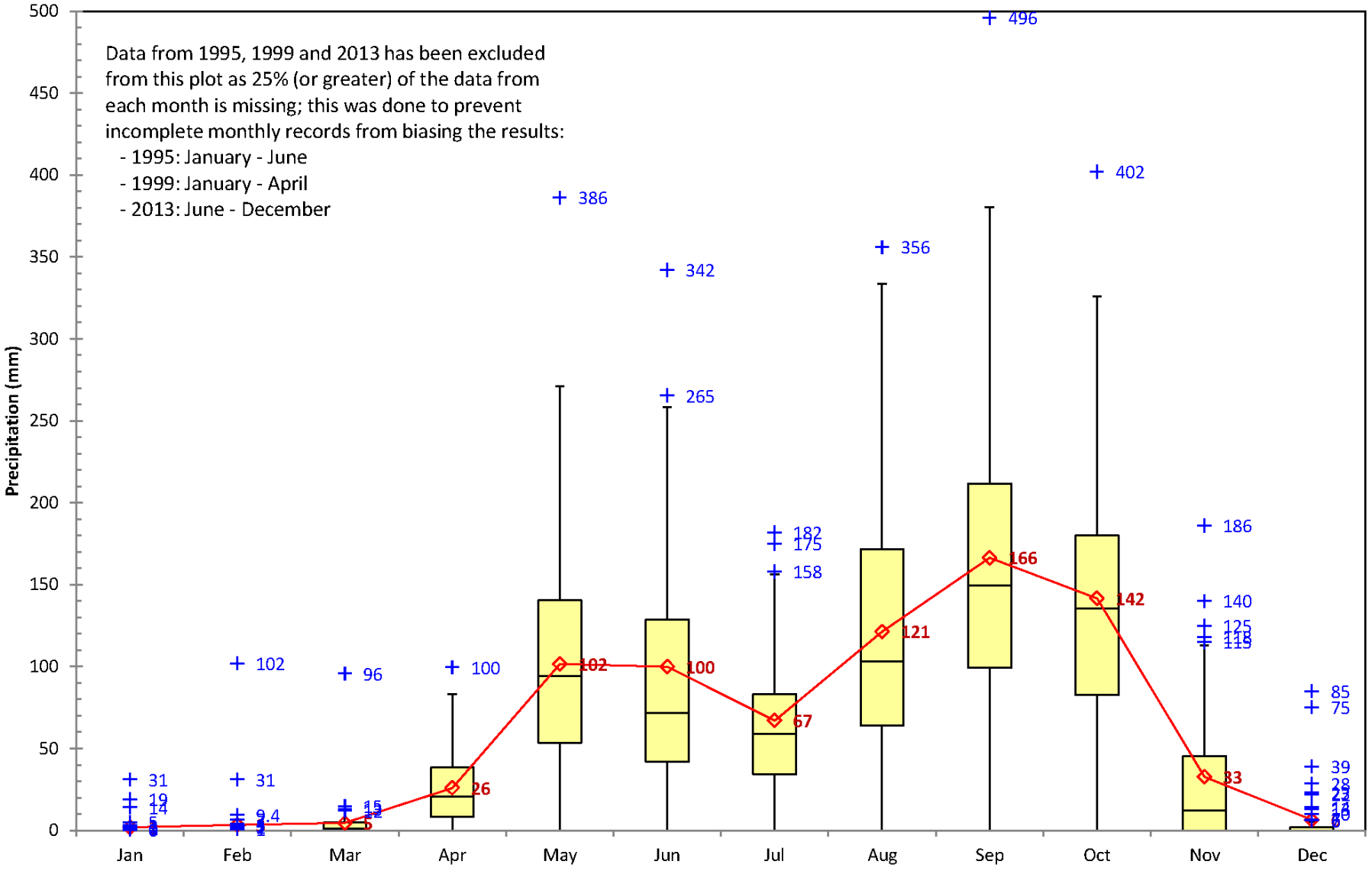
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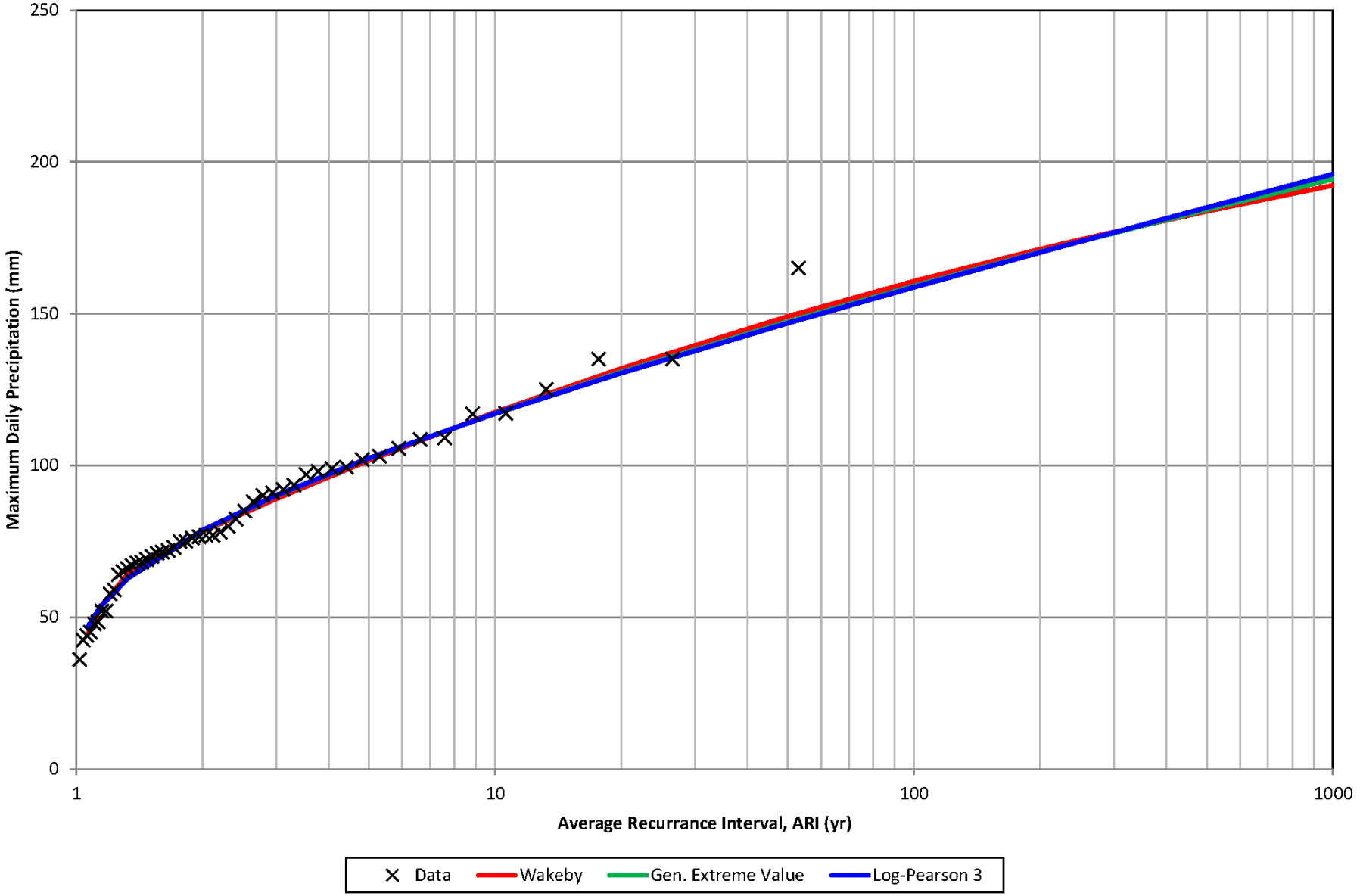
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7. Enviroware. *"WindRose Pro 3.01.46"*, [computer software], 2013.

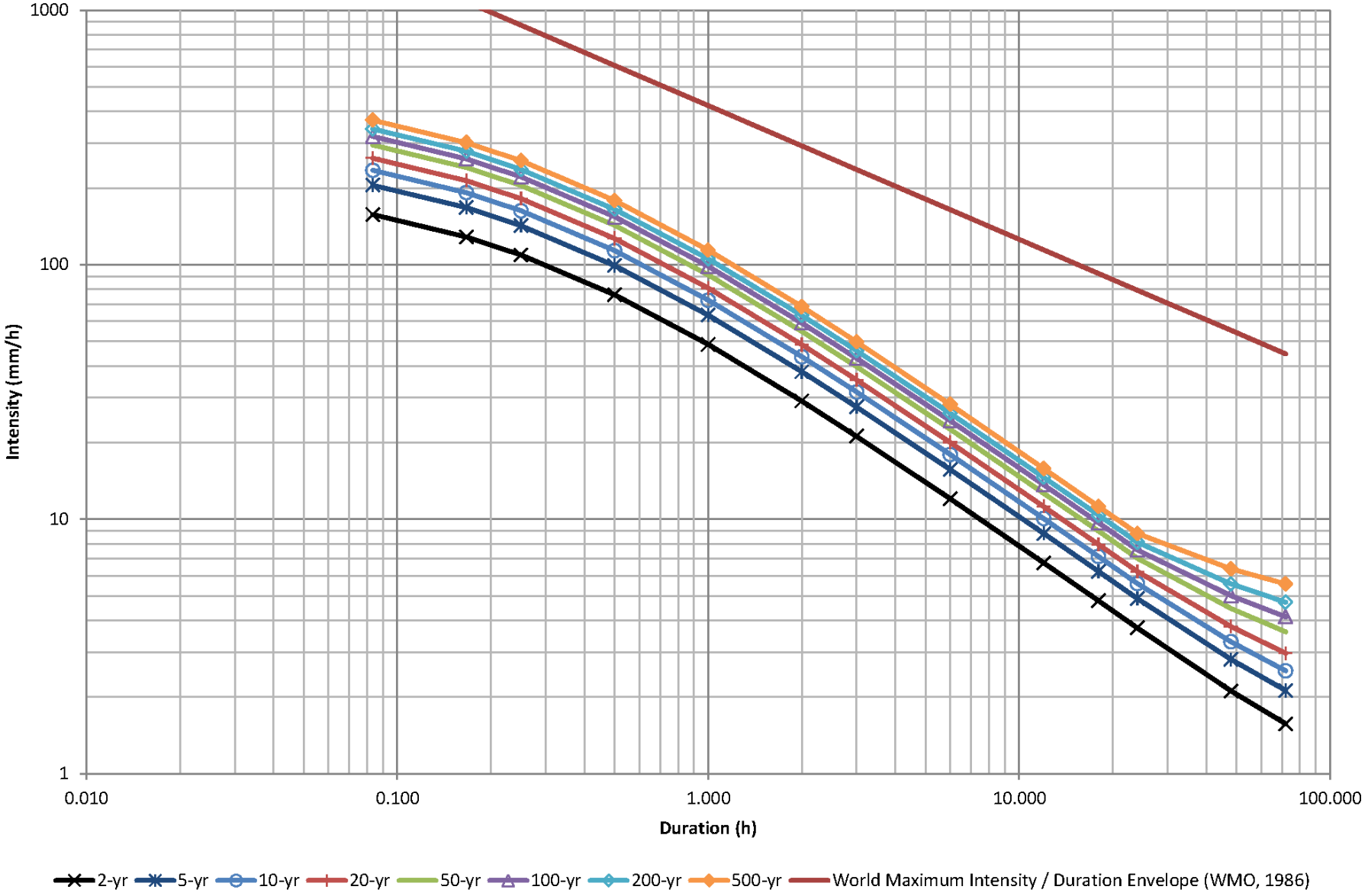
FIGURES

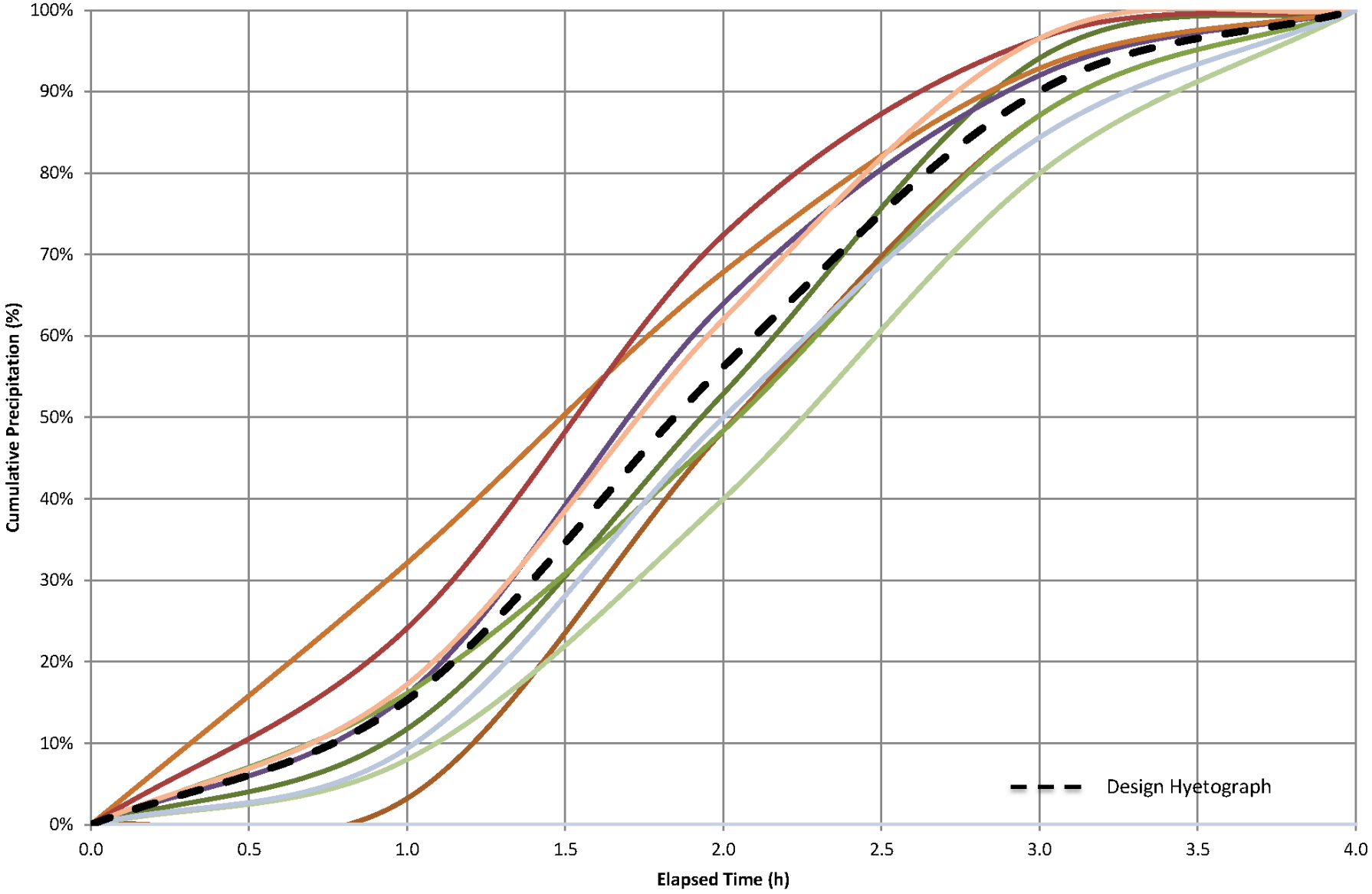

Yama Stream
Sabetaung & Kyisintaung (S&K) Project
Yangtse (S&K) Climate Station
Kyaukka Rd
Ayone Rd
Monywa Township Climate Station (Assumed)
Federal Rd
WMO 480370 Climate Station
Damapala
Wind Rose Sampling Point
Letpadaung Hill
Chindwin River
Image © 2013 DigitalGlobe
© 2013 Google
5.00 km
Imagery Date: 4/10/2013
46 Q 716623.92 m E 2446525.79 m N elev 75 m
Eye alt 21.85 km
Google earth

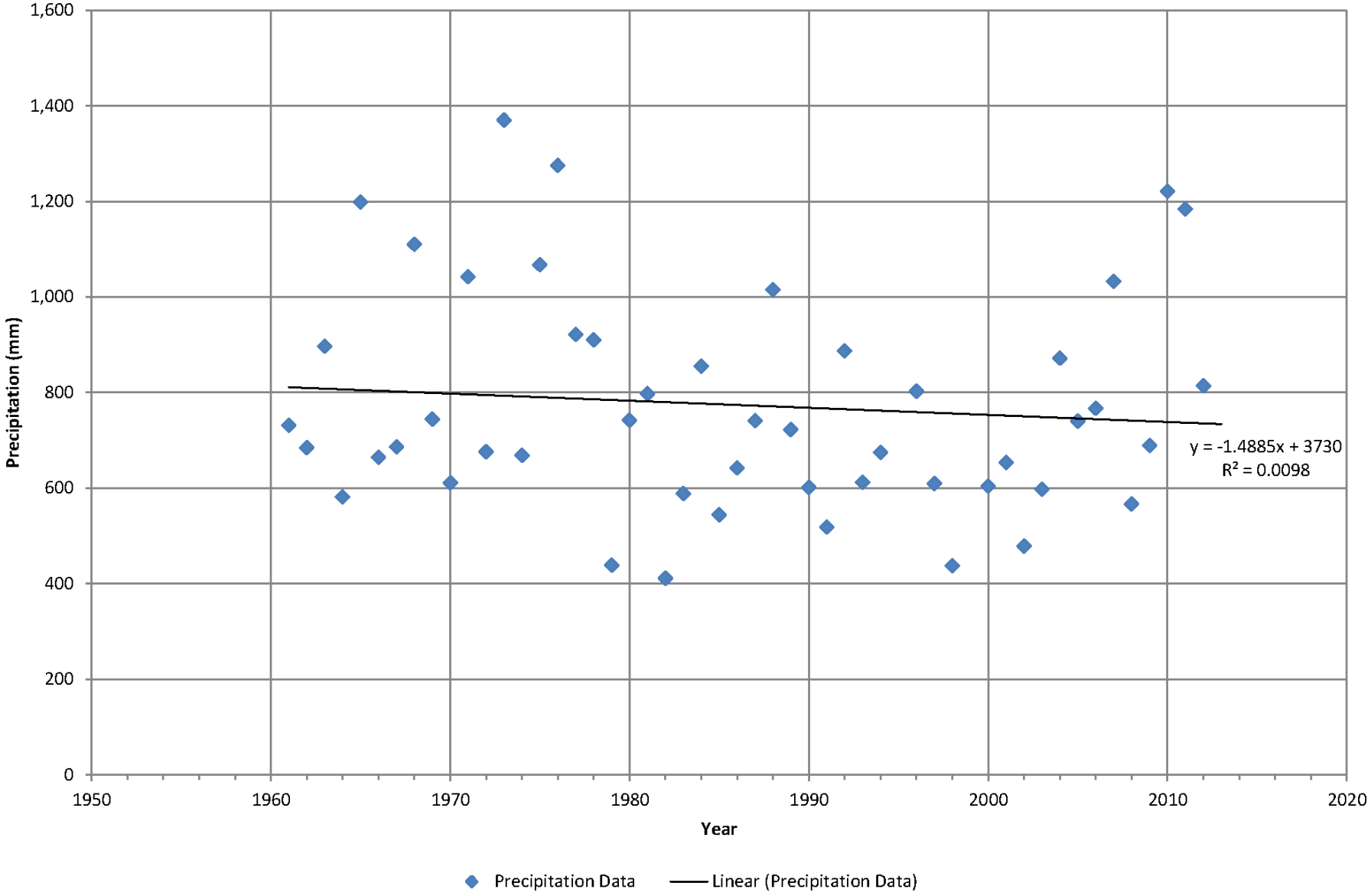

Data from 1995, 1999 and 2013 has been excluded from this plot as 15% (or greater) of the data from each year is missing; this was done to prevent incomplete annual records from biasing the results.
Precipitation (mm)
1,600
1,400
1,200
1,000
800
600
400
200
0
1,370
774

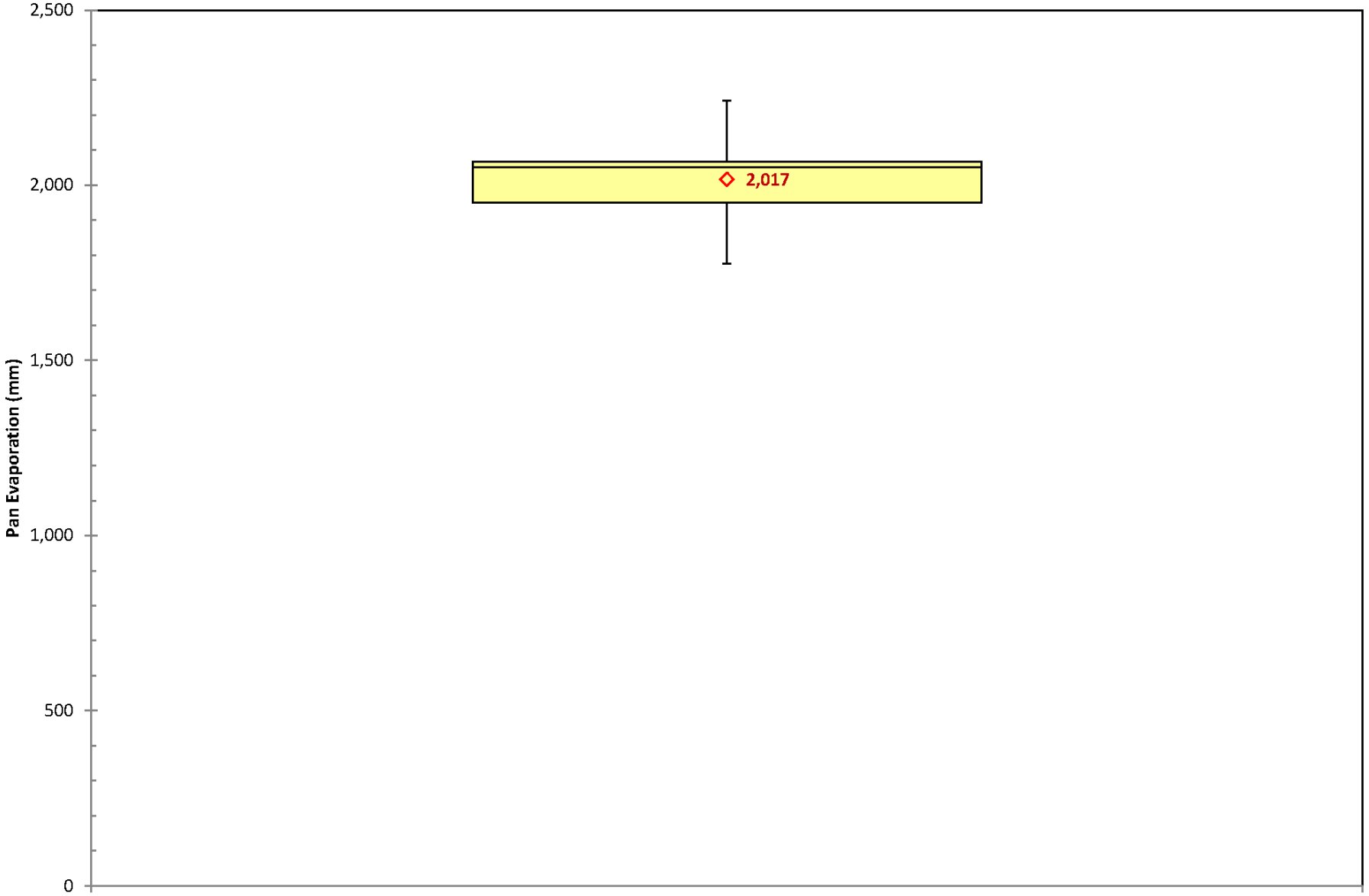

Data from 1995, 1999 and 2013 has been excluded from this plot as 25% (or greater) of the data from each month is missing; this was done to prevent incomplete monthly records from biasing the results:
- 1995: January - June
- 1999: January - April
- 2013: June - December
Precipitation (mm)
500
450
400
350
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
496
402
386
356
342
265
182
175
158
102
96
100
186
140
125
118
115
85
75
39
31
31
19
14
9.4
26
102
100
67
121
166
142
33

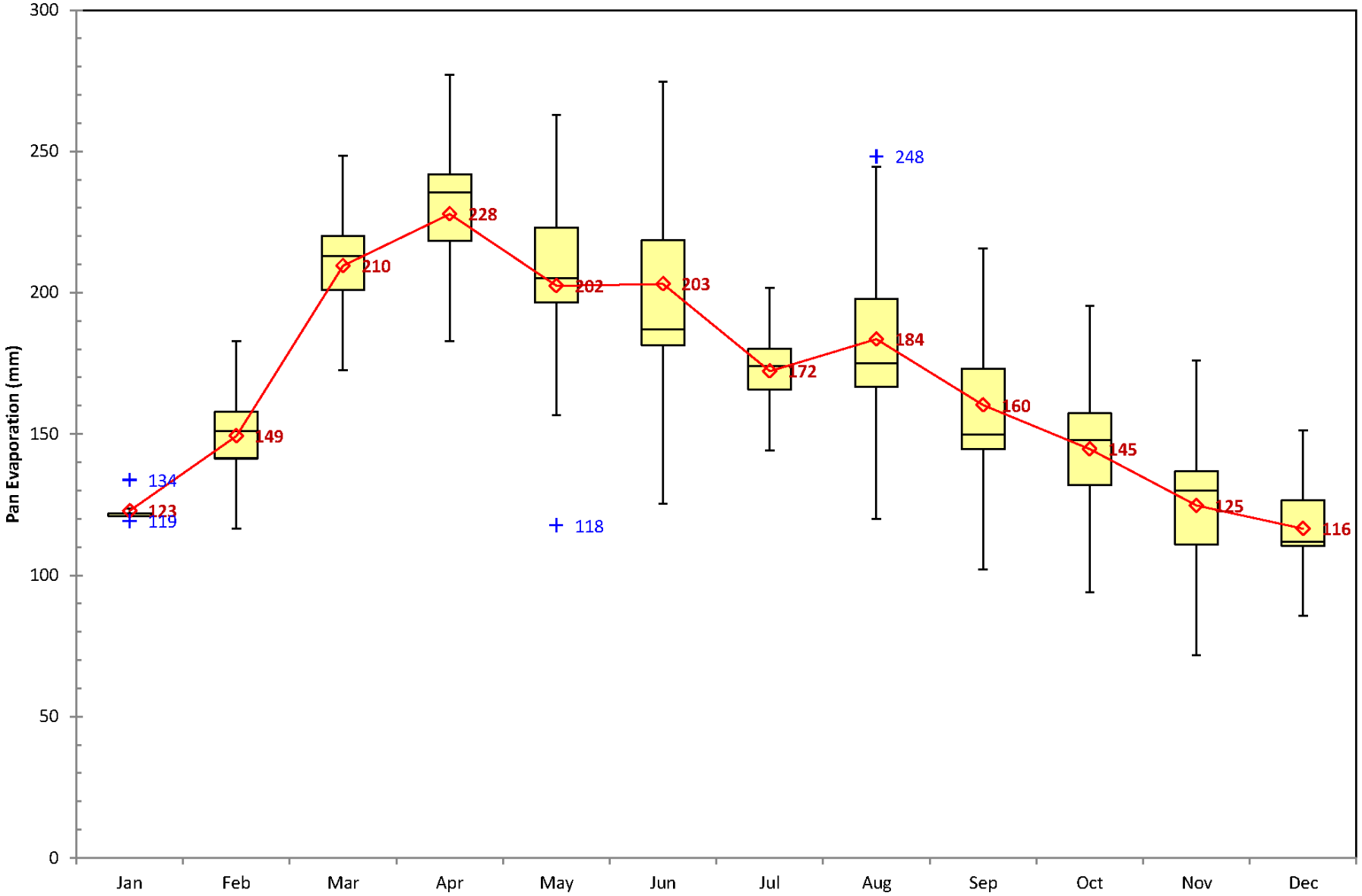

250
200
150
100
50
0
Maximum Daily Precipitation (mm)
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3


1000
100
10
1
Intensity (mm/h)
0.010
0.100
1.000
10.000
100.000
Duration (h)
2-yr
5-yr
10-yr
20-yr
50-yr
100-yr
200-yr
500-yr
World Maximum Intensity / Duration Envelope (WMO, 1986)


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Elapsed Time (h)
Design Hyetograph


1,600
1,400
1,200
1,000
800
600
400
200
0
Precipitation (mm)
1950
1960
1970
1980
1990
2000
2010
2020
Year
y = -1.4885x + 3730
R² = 0.0098
Precipitation Data
Linear (Precipitation Data)

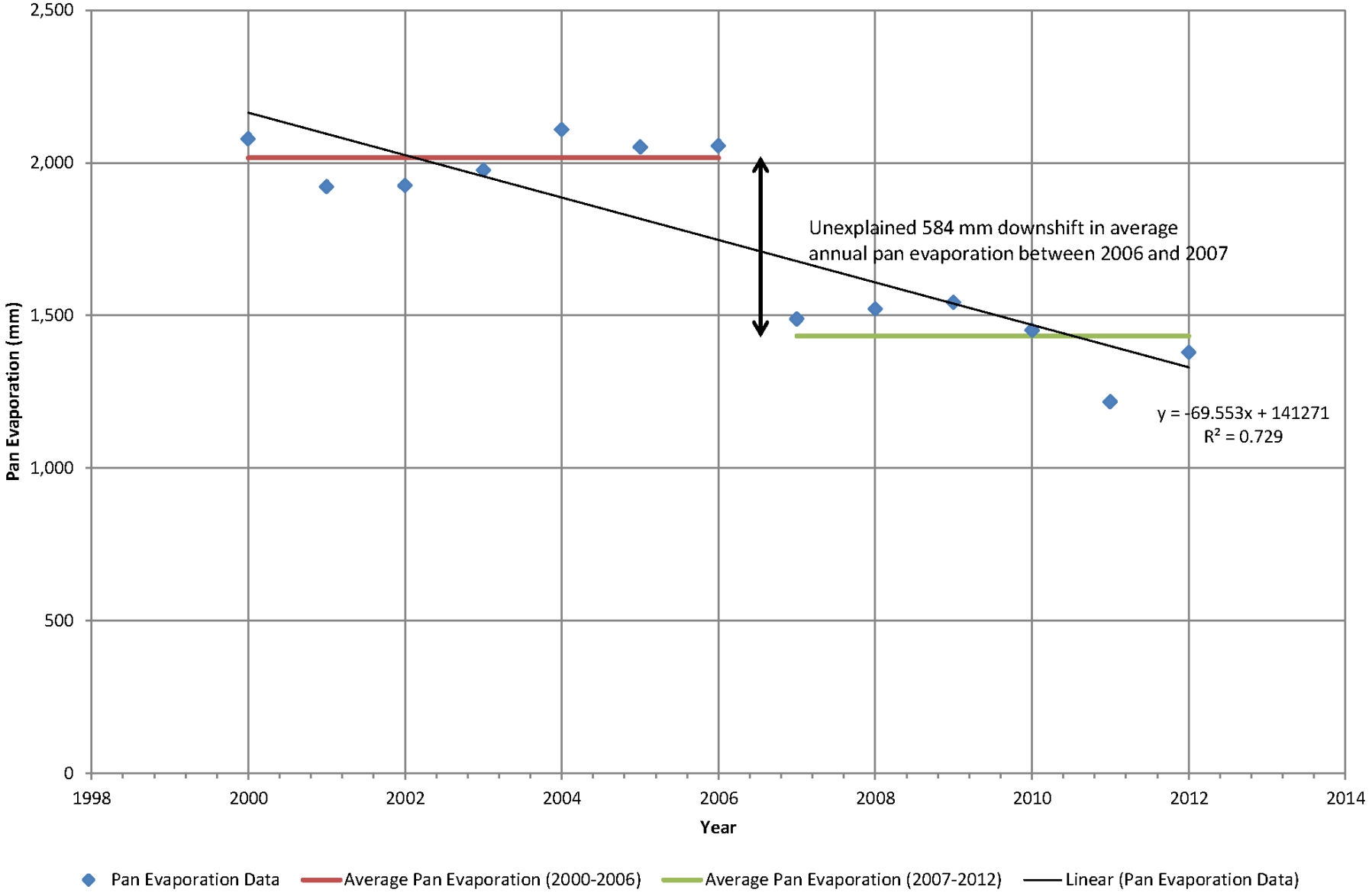

2,500
2,000
1,500
1,000
500
0
Pan Evaporation (mm)
2,017



Knight Piésold CONSULTING

LETPADAUNG COPPER PROJECT – BASELINE DESIGN CLIMATOLOGY
PAN EVAPORATION MONTHLY SAMPLE STATISTICS
YANGTSE CLIMATE STATION (2000-2006)

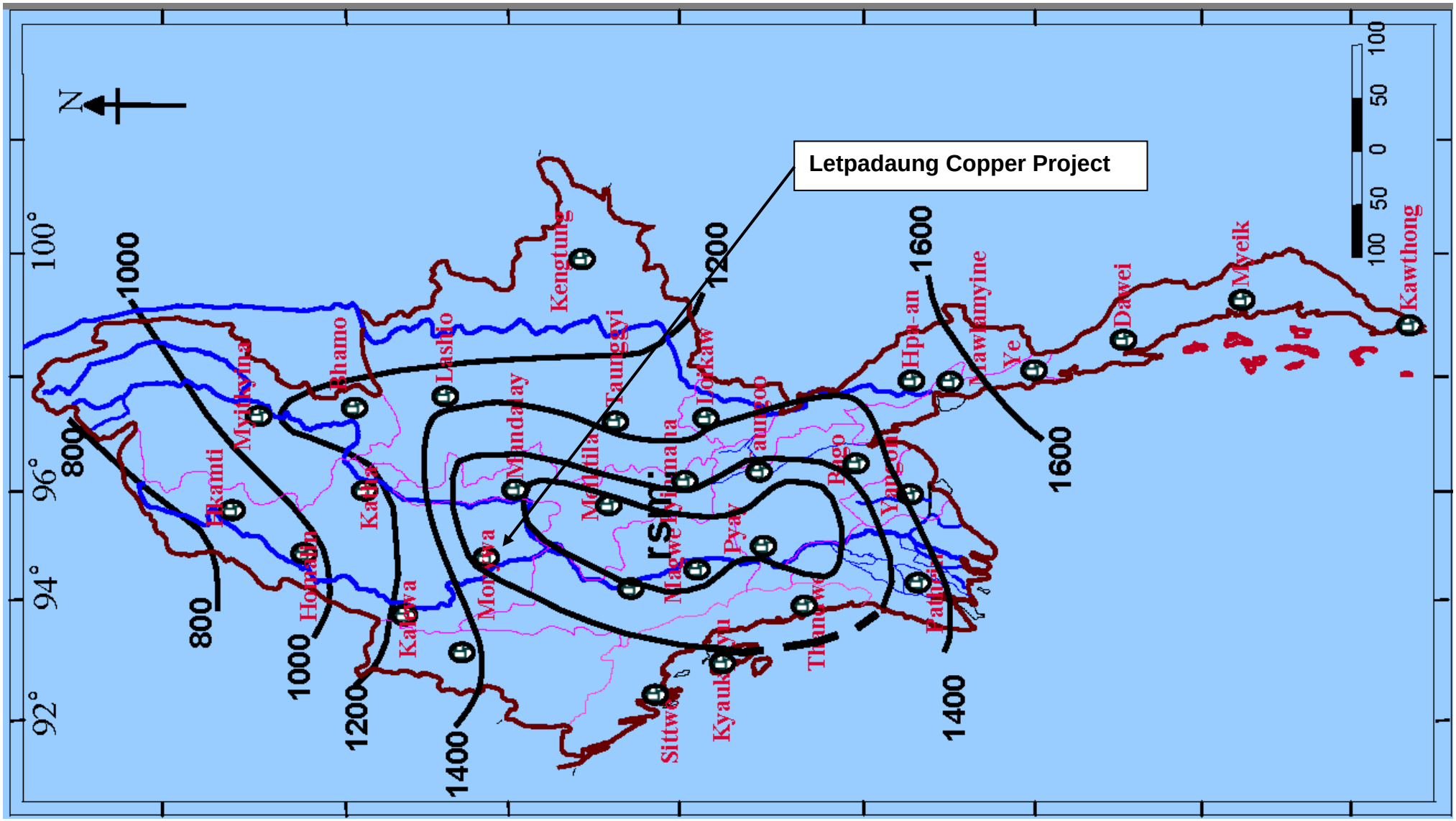
Ref: PE701-00022 M13017
Figure 3.2

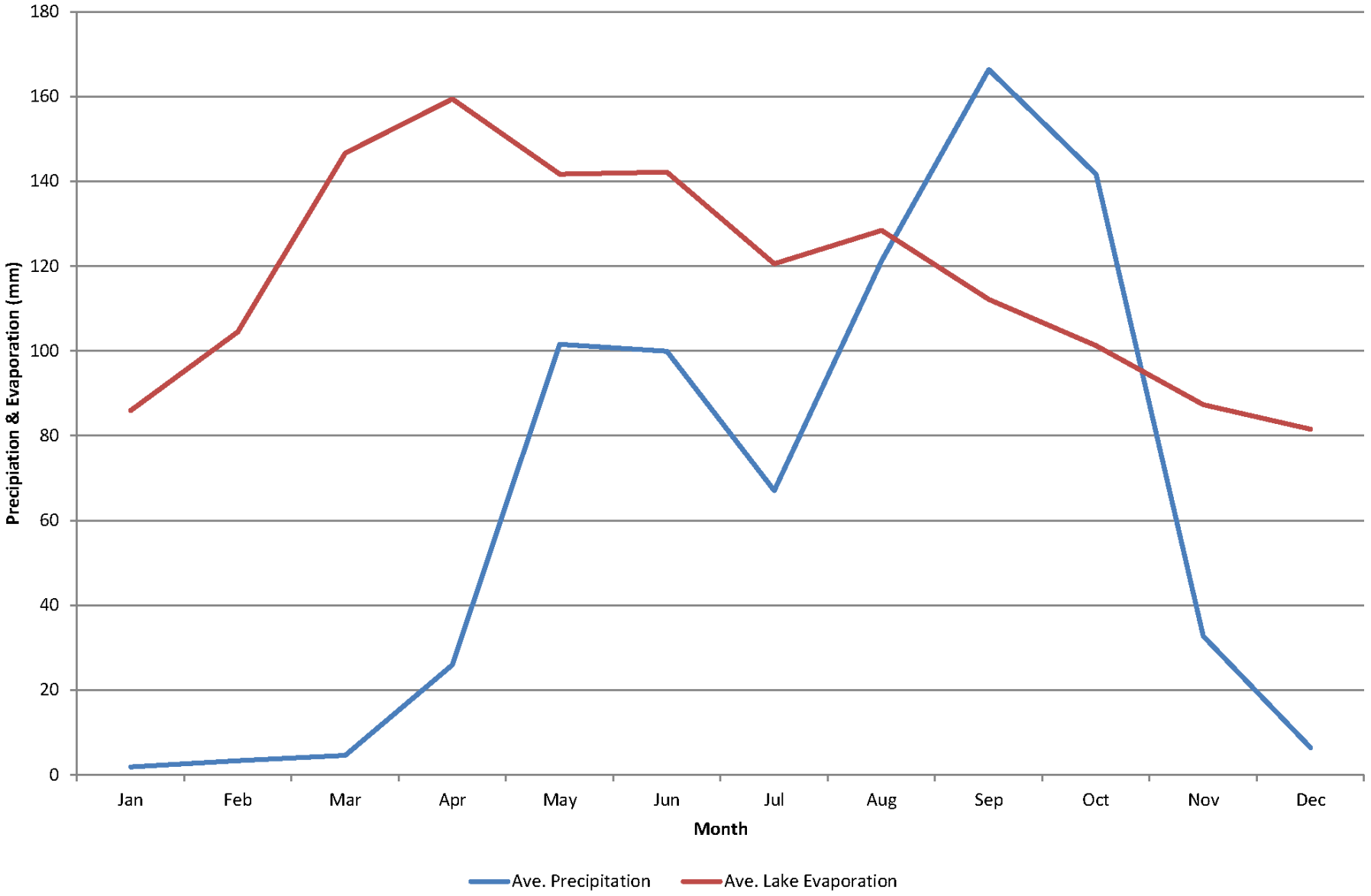


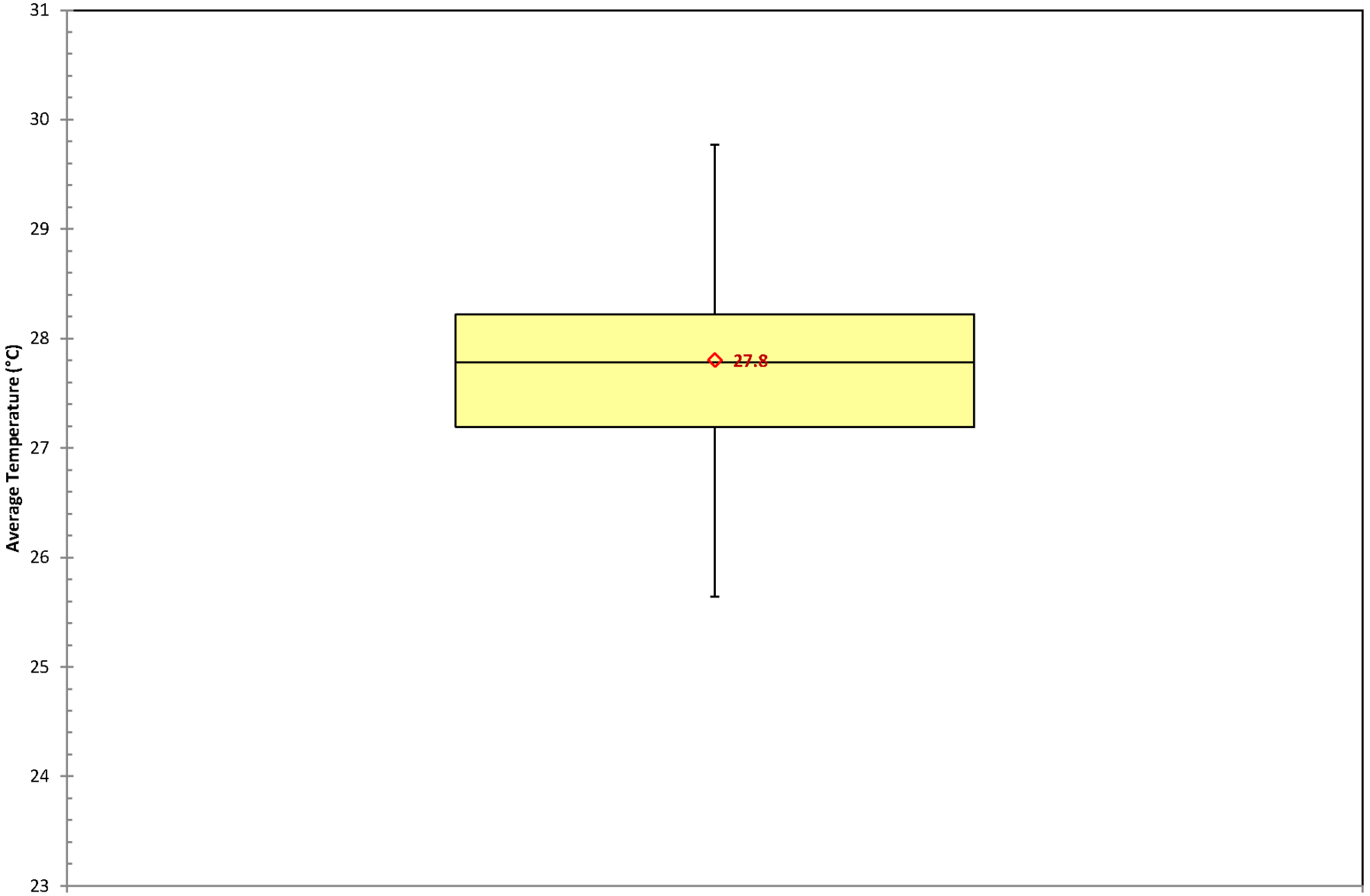
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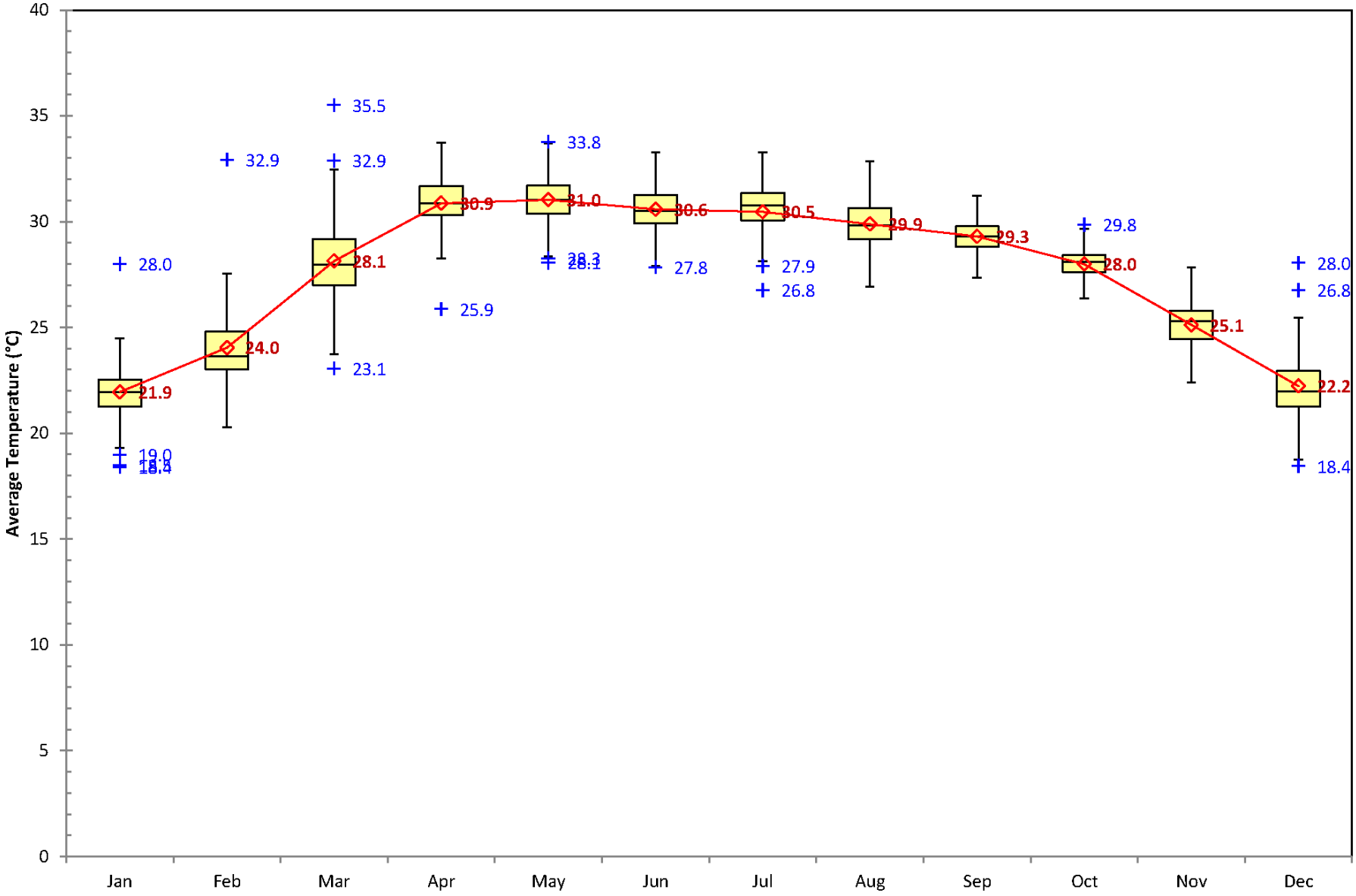
LETPADAUNG COPPER PROJECT – BASELINE DESIGN CLIMATOLOGY
PAN EVAPORATION TREND ANALYSIS RESULTS
YANGTSE CLIMATE STATION (2000-2013)

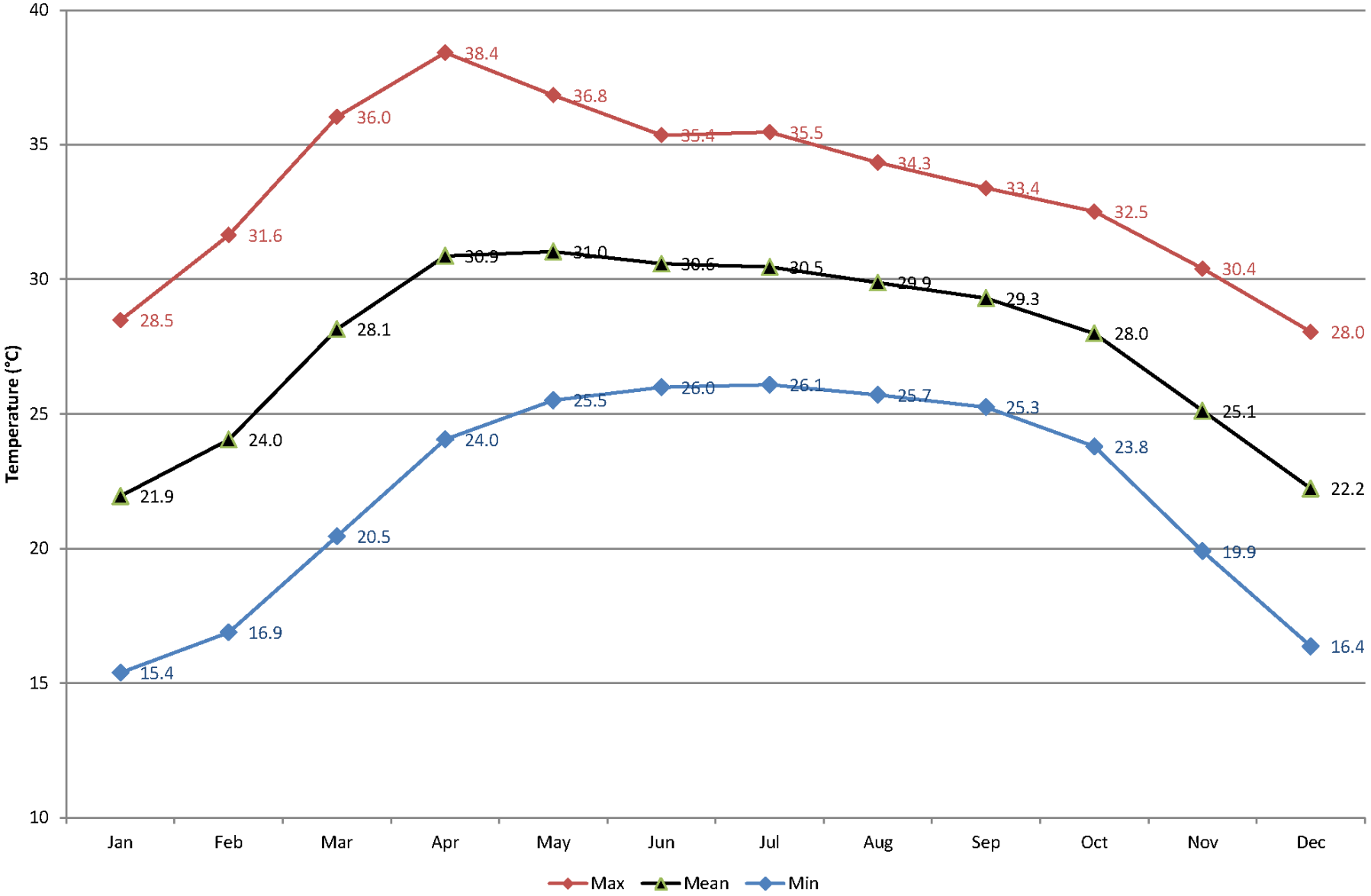
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Figure 3.3

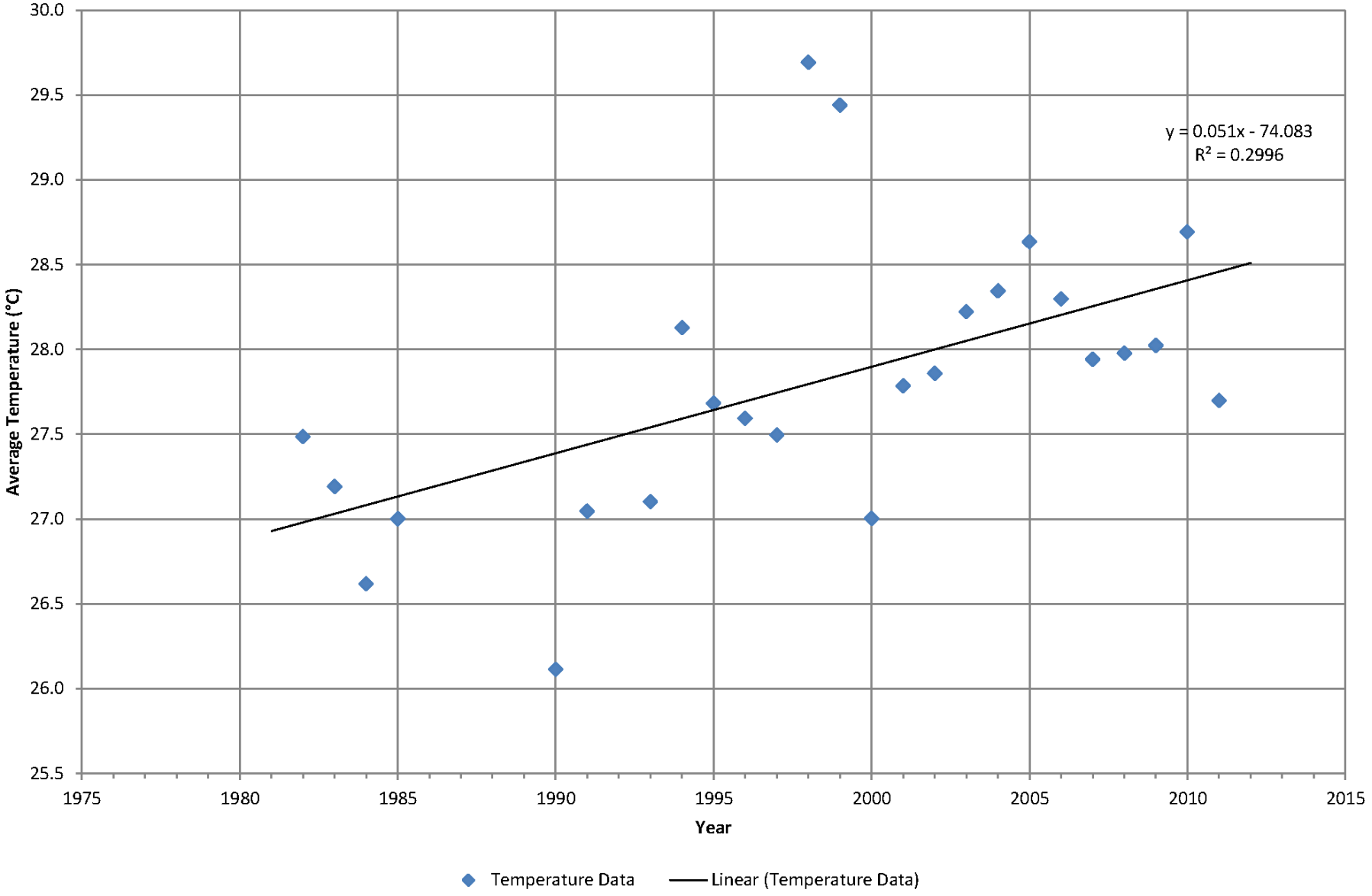

Letpadaung Copper Project
N
100°
96°
94°
92°
800
1000
1200
1400
1600
Kengtung
Lashio
Mandalay
Taunggyi
Loikaw
Hpa-an
Dawei
Myeik
Kawthong
Myitkyina
Bhamo
Hkamti
Katha
Monywa
Magwe
Pyay
Bago
Thanlwin
Kyaukpyu
Sittwe
rsm

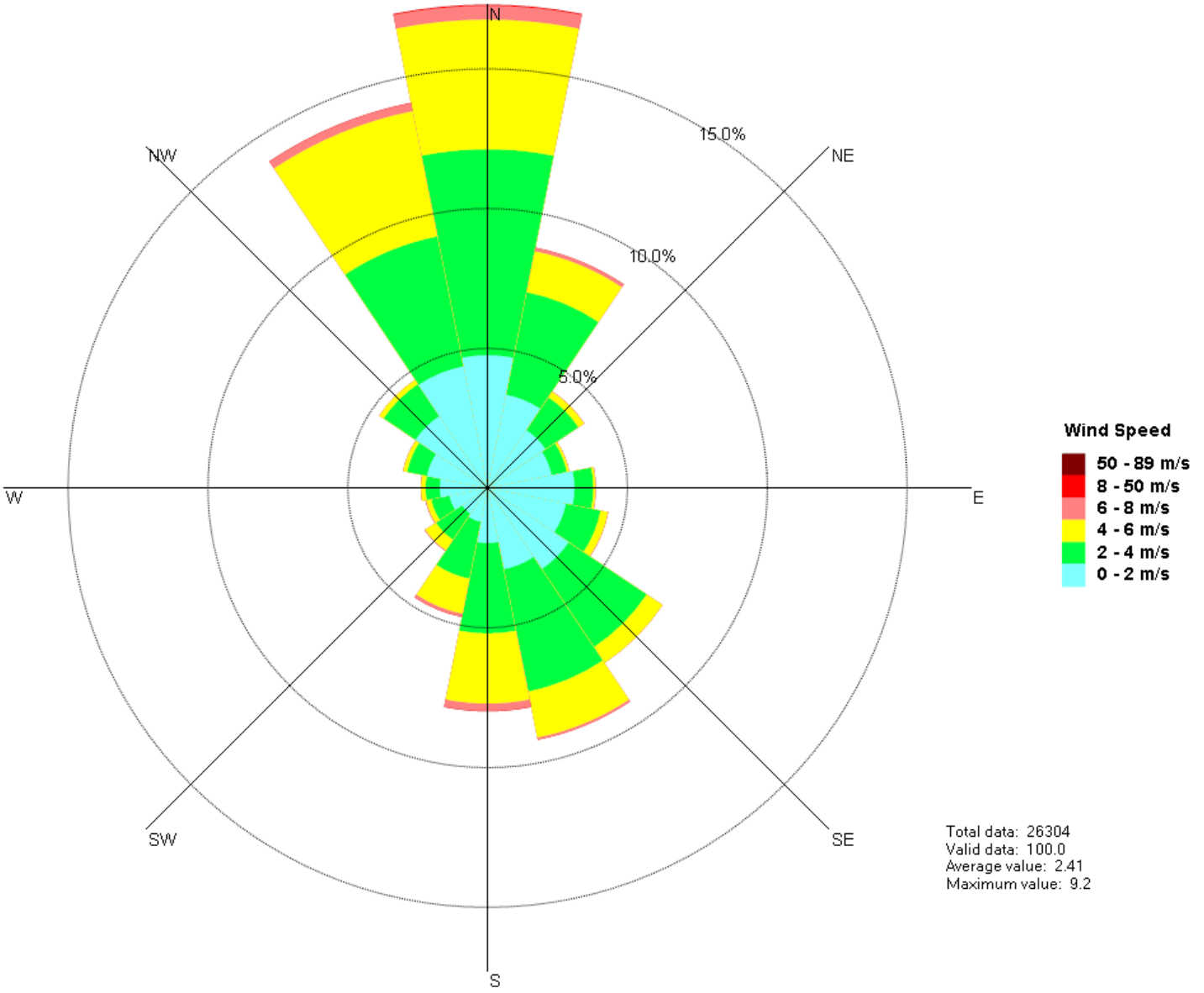

180
160
140
120
100
80
60
40
20
0
Precipiation & Evaporation (mm)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Ave. Precipitation
Ave. Lake Evaporation

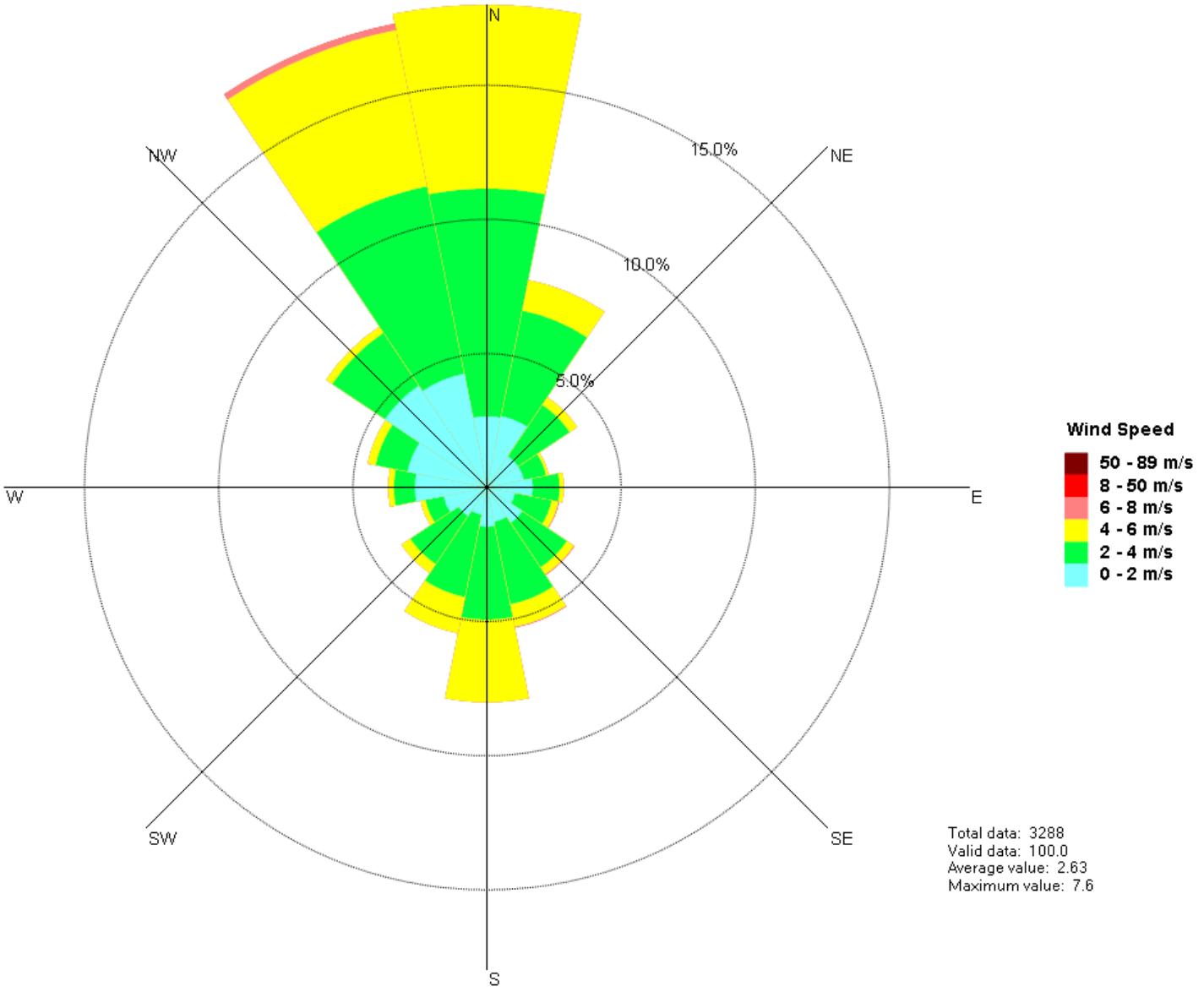

31
30
29
28
27
26
25
24
23
Average Temperature (°C)
27.8

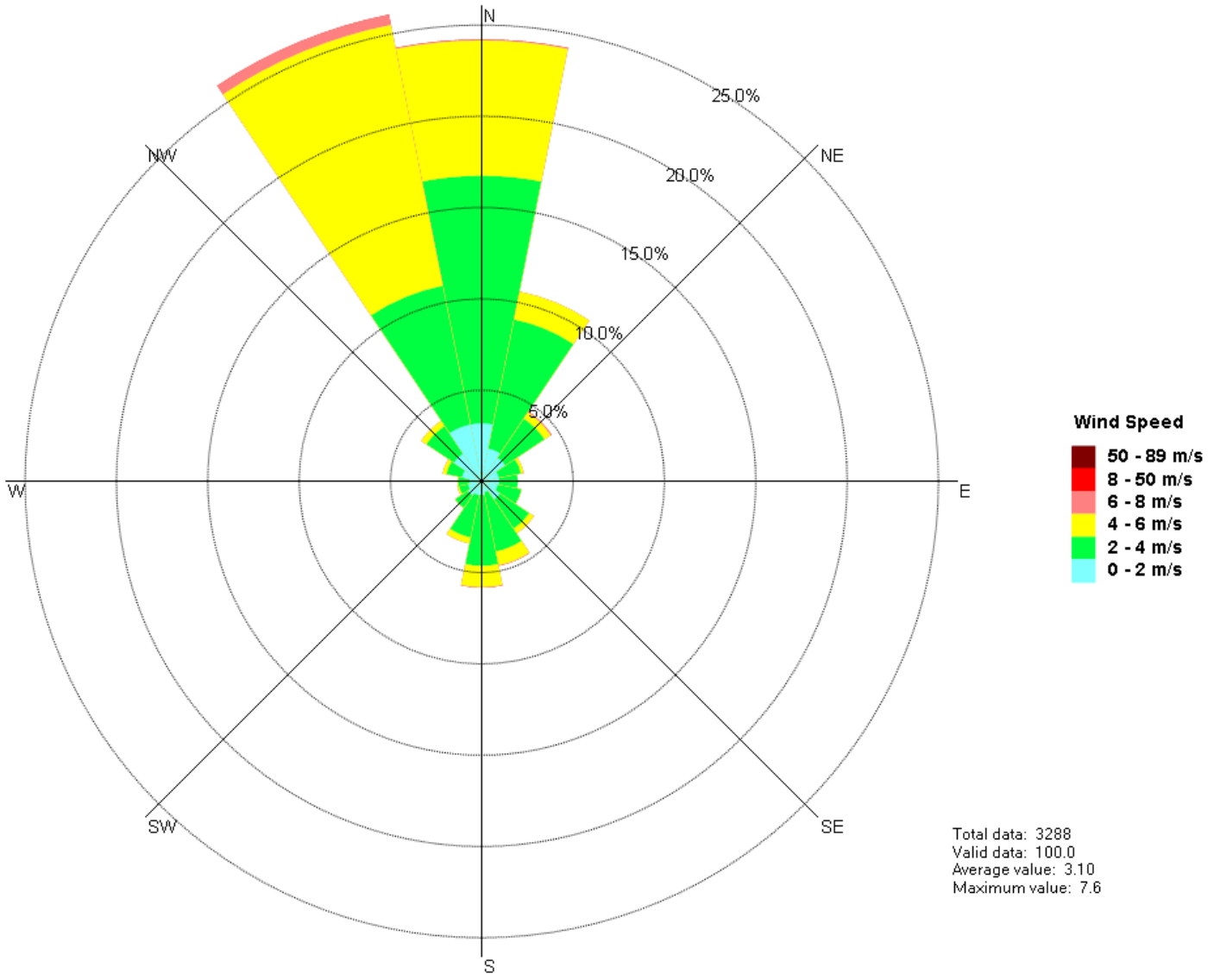

Average Temperature (°C)
40
35
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
21.9
24.0
28.1
30.9
31.0
30.6
30.5
29.9
29.3
28.0
25.1
22.2
28.0
32.9
35.5
32.9
25.9
33.8
28.1
27.8
27.9
26.8
29.8
28.0
26.8
18.4

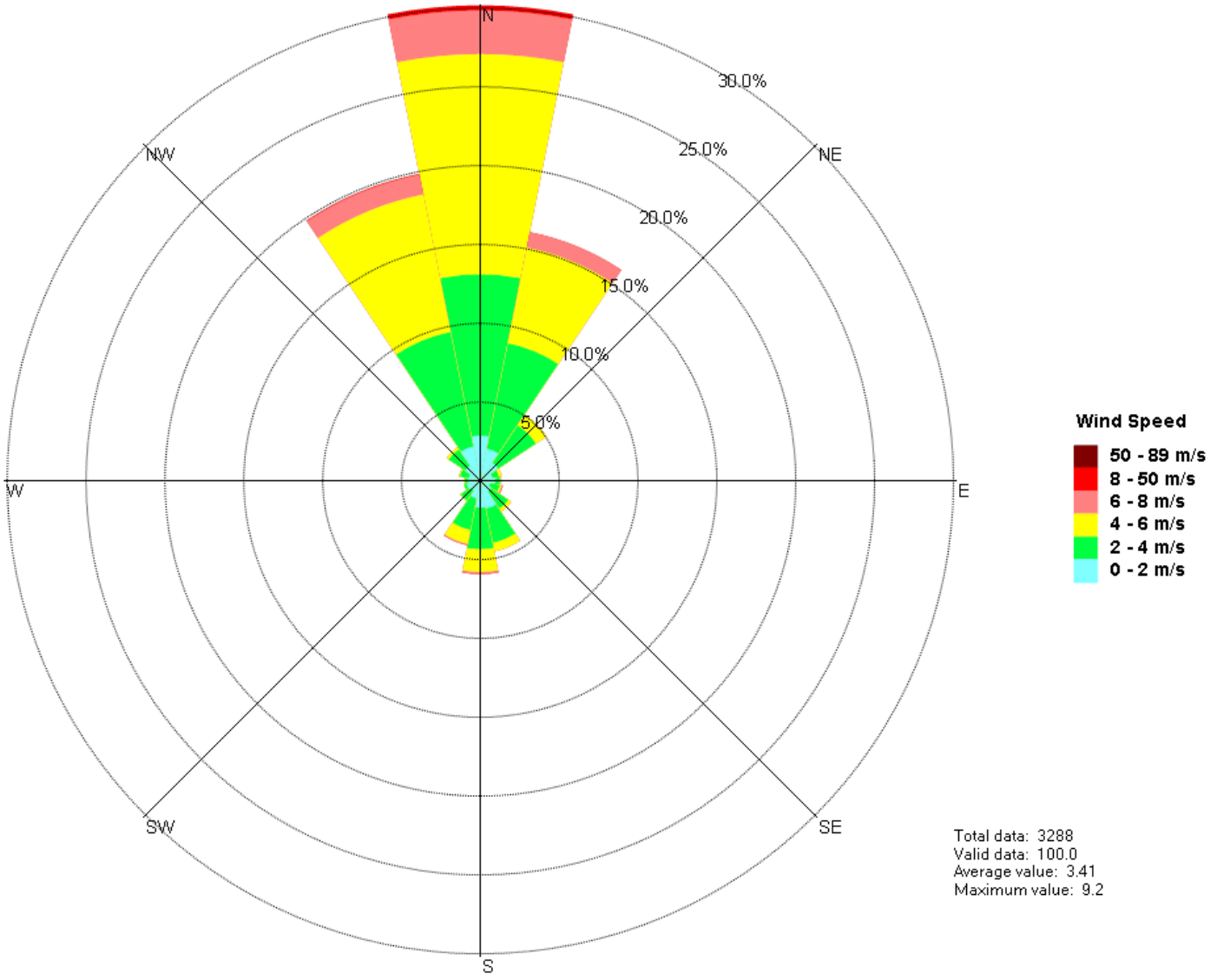

Temperature (°C)
40
35
30
25
20
15
10
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
38.4
36.8
36.0
35.4
35.5
34.3
33.4
32.5
30.4
28.0
31.6
28.5
30.9
31.0
30.6
30.5
29.9
29.3
28.0
25.1
22.2
28.1
24.0
21.9
25.5
26.0
26.1
25.7
25.3
23.8
19.9
16.4
24.0
20.5
16.9
15.4
Max
Mean
Min

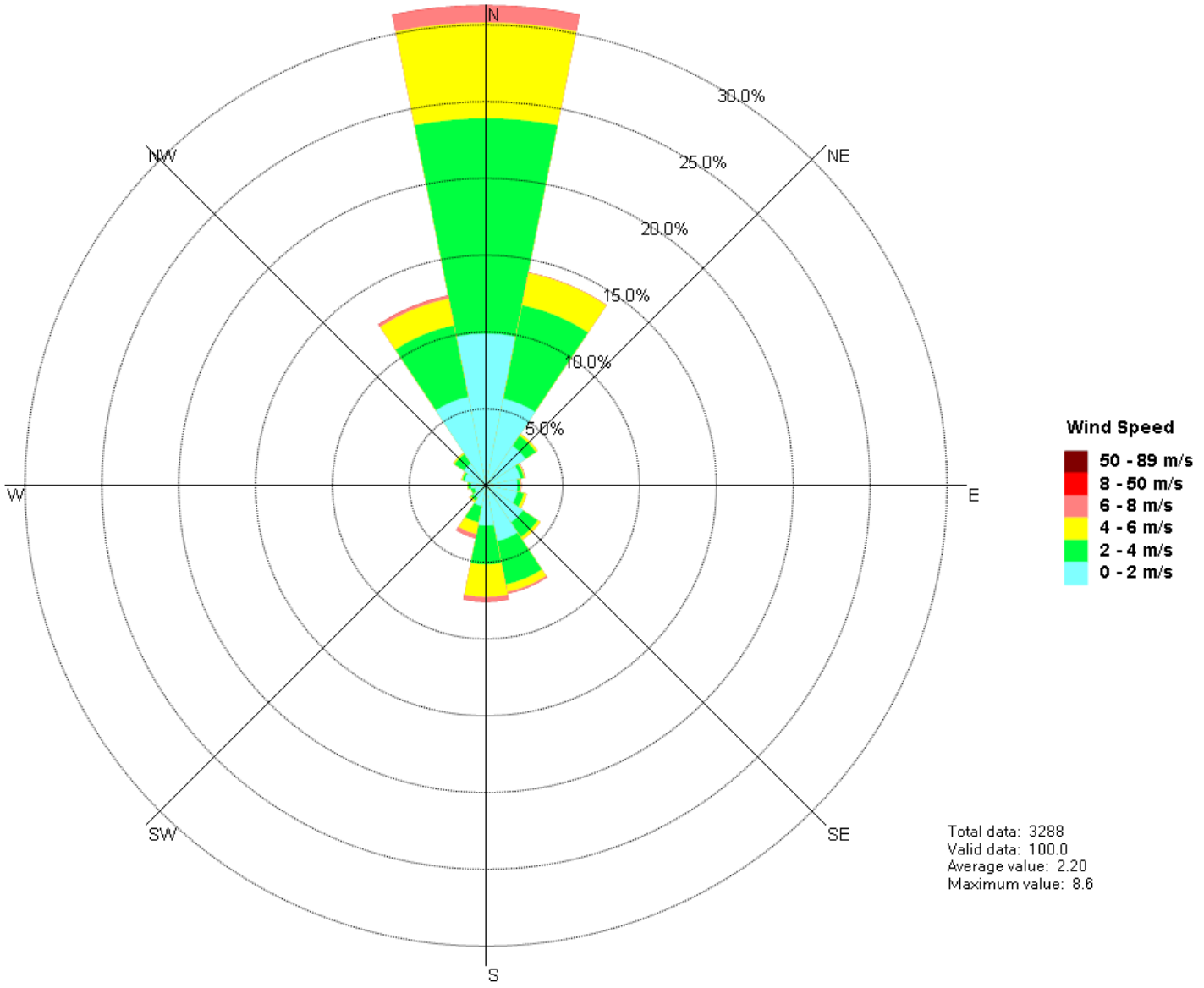

30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
Average Temperature (°C)
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
y = 0.051x - 74.083
R² = 0.2996
Temperature Data
Linear (Temperature Data)

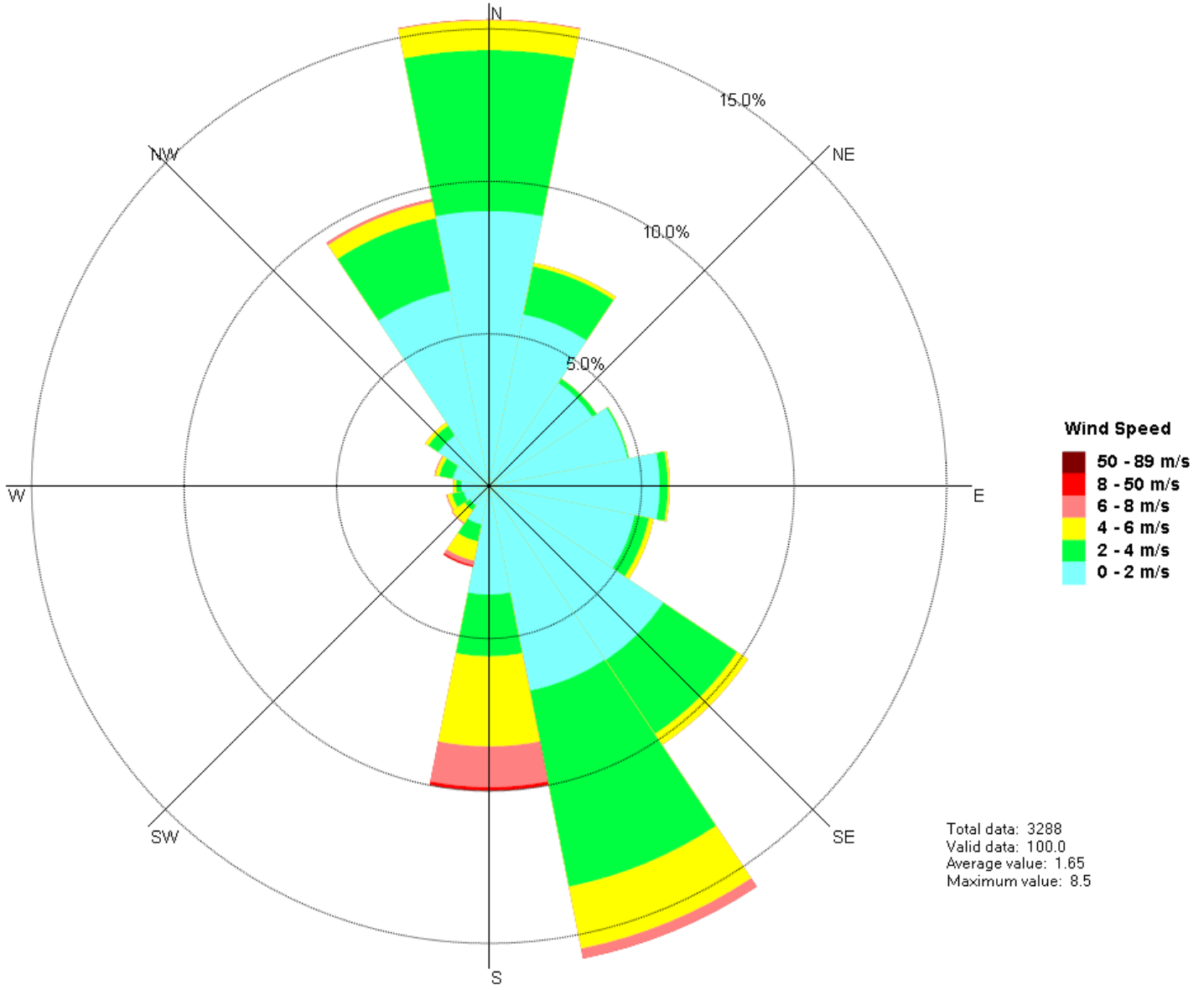

N
NE
E
SE
S
SW
W
NW
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 26304
Valid data: 100.0
Average value: 2.41
Maximum value: 9.2

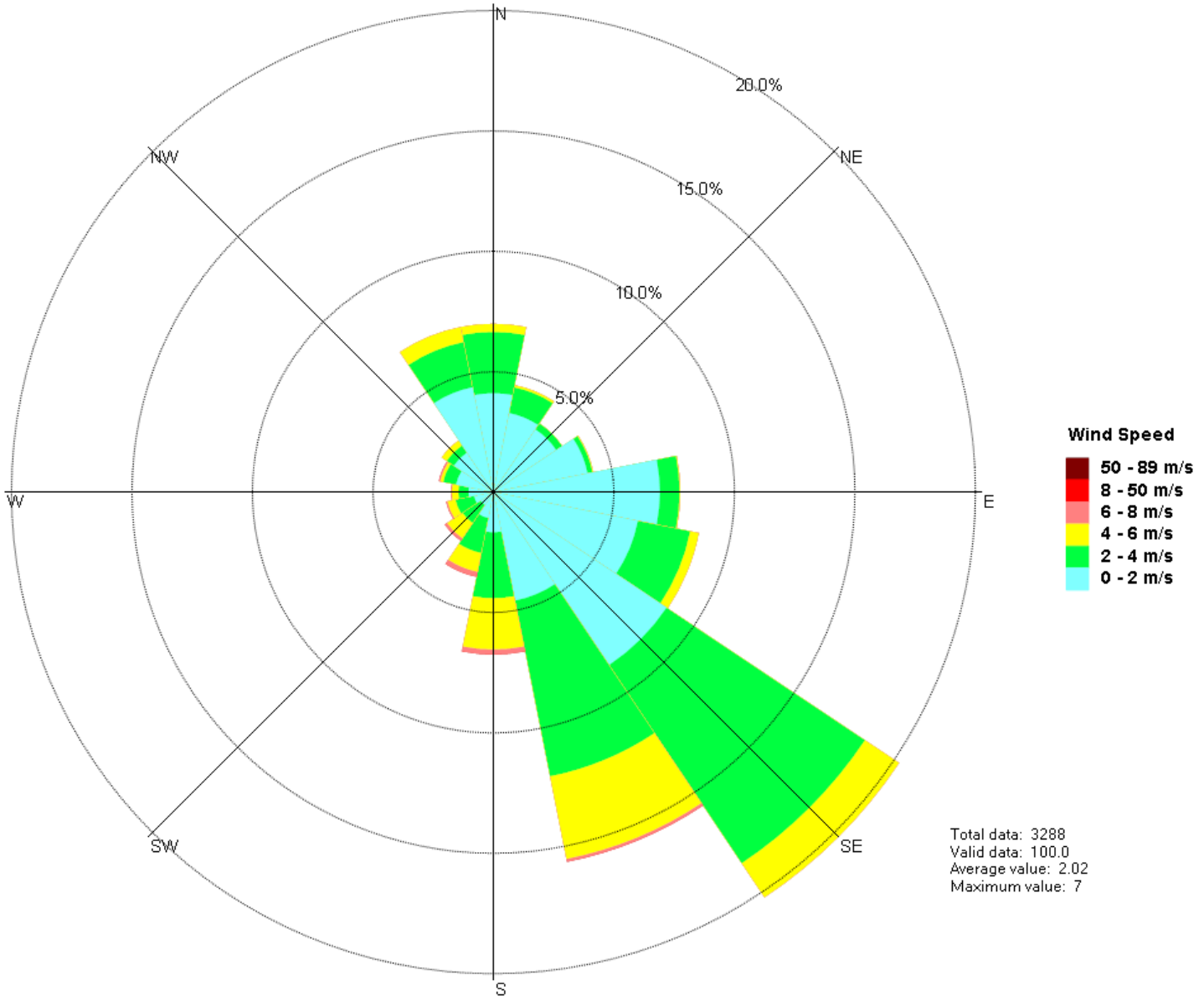

N
NE
E
SE
S
SW
W
NW
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 2.63
Maximum value: 7.6

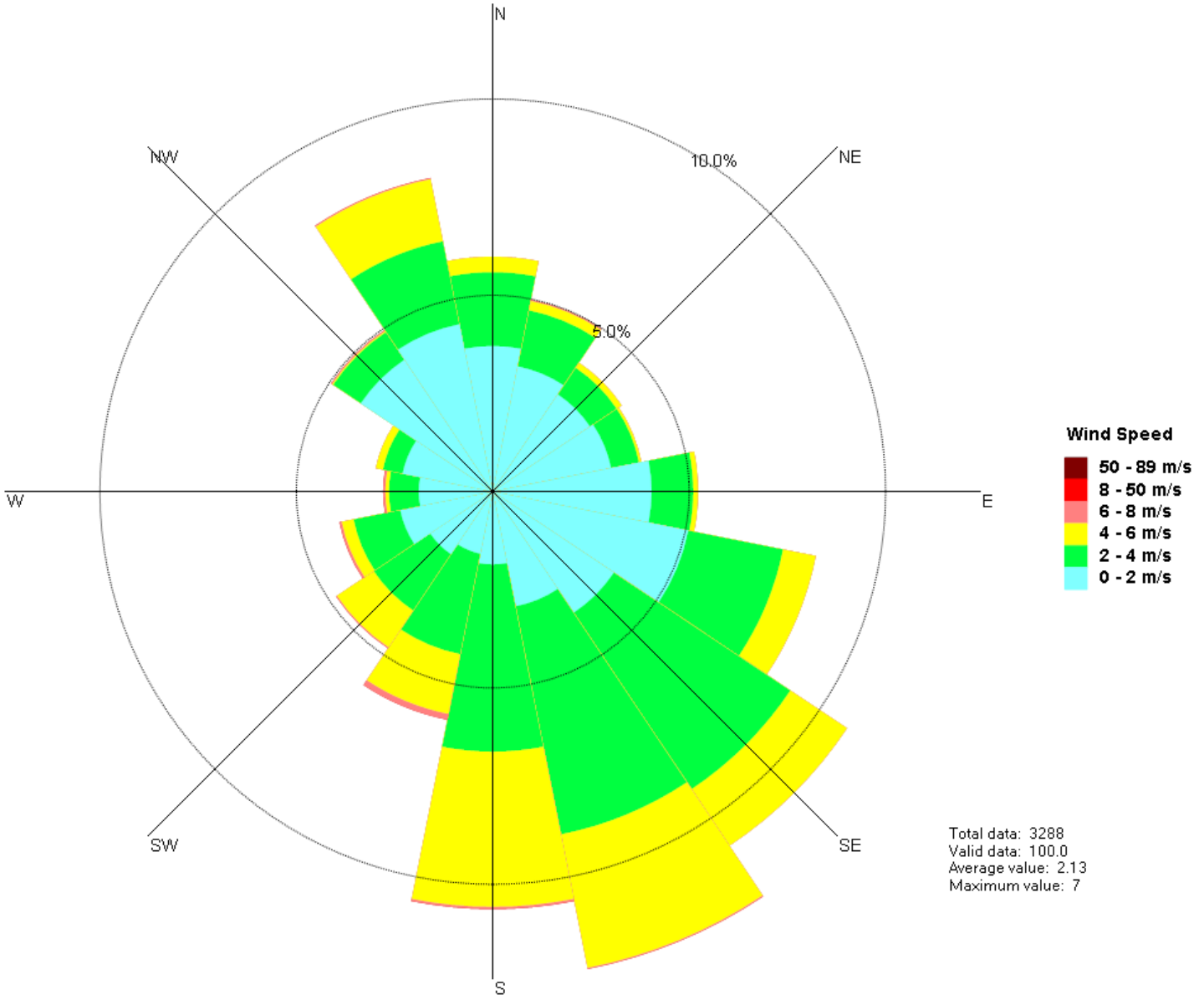

N
NE
E
SE
S
SW
W
NW
25.0%
20.0%
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 3.10
Maximum value: 7.6

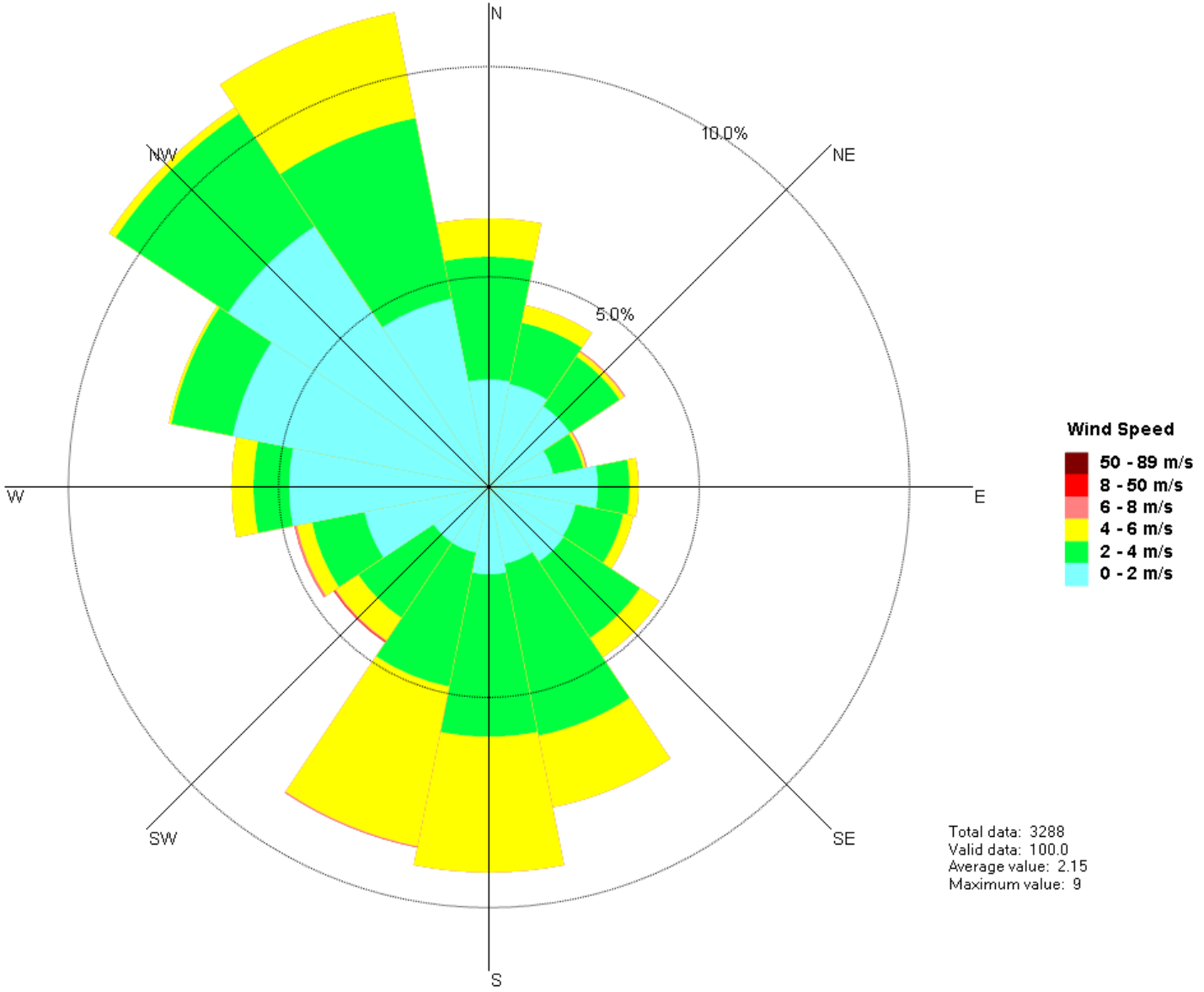

N
NE
E
SE
S
SW
W
NW
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 3.41
Maximum value: 9.2

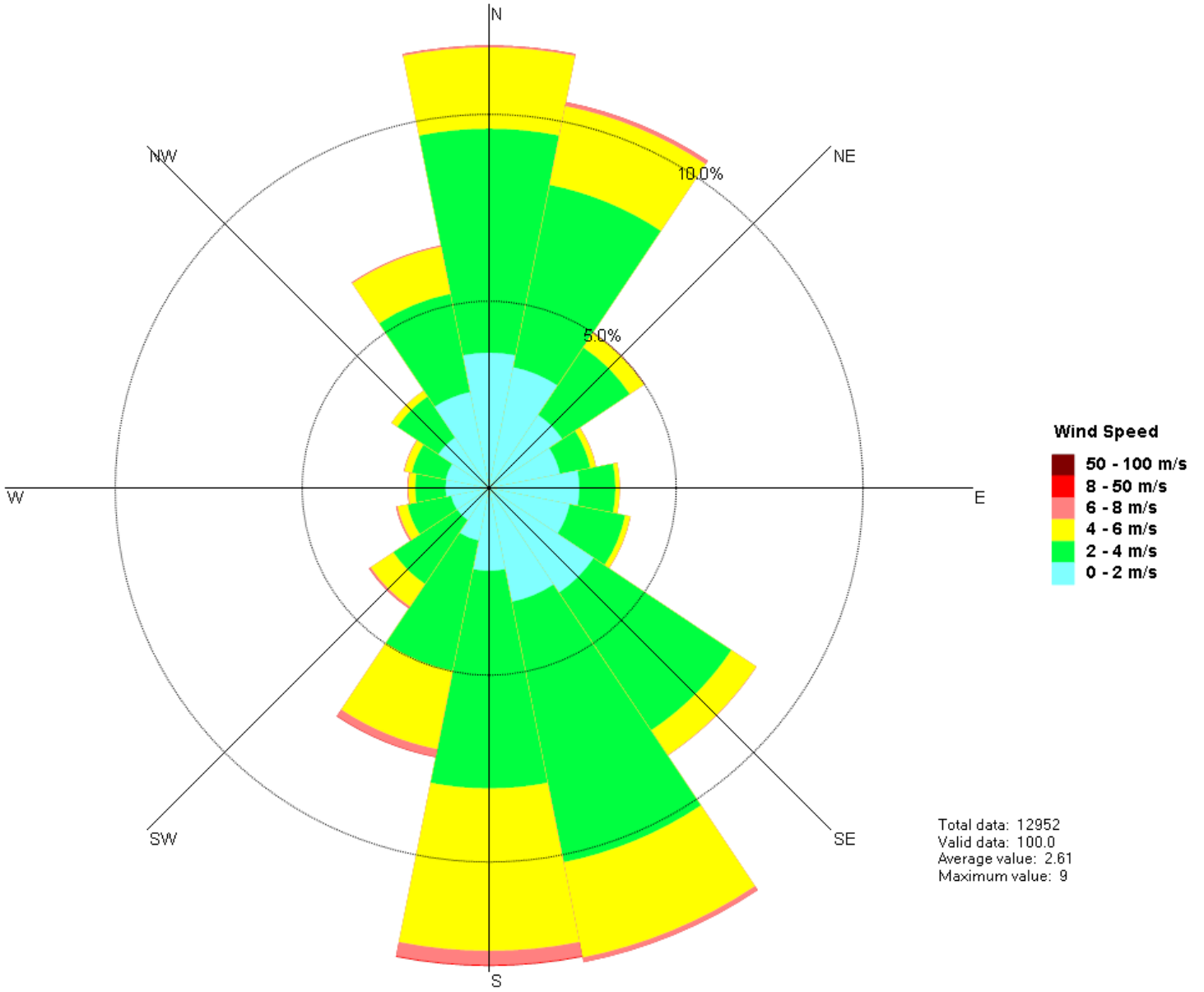

N
NE
E
SE
S
SW
W
NW
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 2.20
Maximum value: 8.6

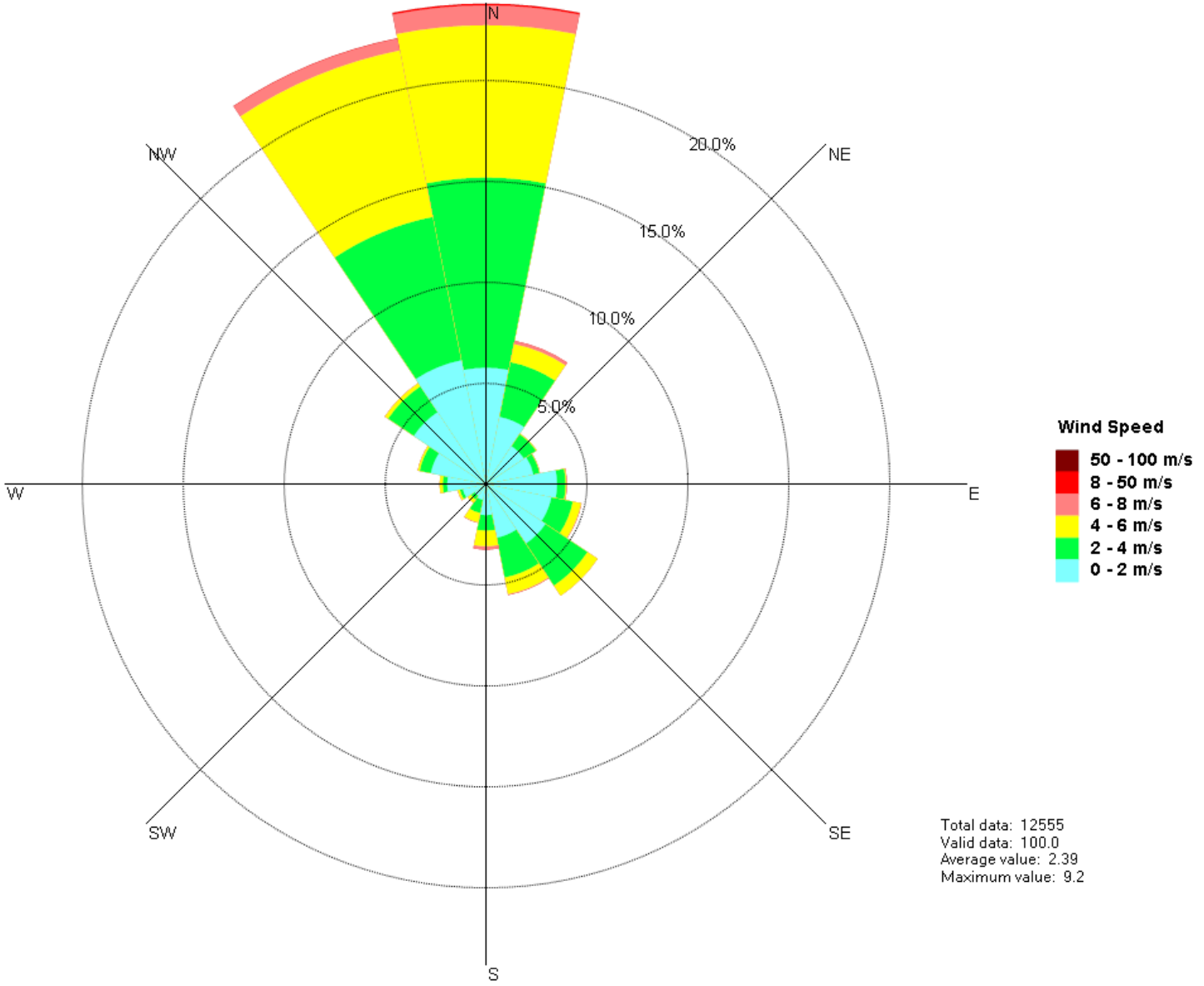

N
NE
E
SE
S
SW
W
NW
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 1.65
Maximum value: 8.5


N
NE
E
SE
S
SW
W
NW
20.0%
15.0%
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 2.02
Maximum value: 7


N
NE
E
SE
S
SW
W
NW
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 2.13
Maximum value: 7


N
NE
E
SE
S
SW
W
NW
10.0%
5.0%
Wind Speed
50 - 89 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 3288
Valid data: 100.0
Average value: 2.15
Maximum value: 9


N
NE
E
SE
S
SW
W
NW
10.0%
5.0%
Wind Speed
50 - 100 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 12952
Valid data: 100.0
Average value: 2.61
Maximum value: 9


N
NE
E
SE
S
SW
W
NW
20.0%
15.0%
10.0%
5.0%
Wind Speed
50 - 100 m/s
8 - 50 m/s
6 - 8 m/s
4 - 6 m/s
2 - 4 m/s
0 - 2 m/s
Total data: 12555
Valid data: 100.0
Average value: 2.39
Maximum value: 9.2

ATTACHMENT 2.1

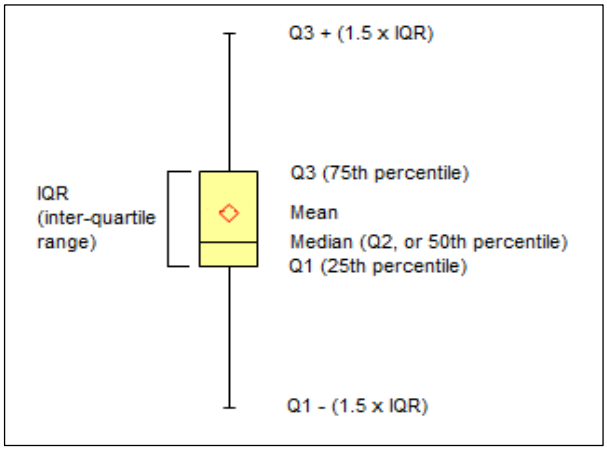
Annual Precipitation Analysis

Annual Precipitation Data: Monywa Township (1961-2013)

Year	Precip. (mm)	Rain Days
1961	731.0	61
1962	684.0	53
1963	896.0	63
1964	581.0	50
1965	1,198.0	91
1966	664.0	60
1967	686.0	67
1968	1,110.0	66
1969	744.0	50
1970	611.0	66
1971	1,042.0	62
1972	676.0	55
1973	1,370.0	99
1974	668.0	61
1975	1,067.0	73
1976	1,275.0	86
1977	921.0	70
1978	910.0	76
1979	438.0	38
1980	742.0	52
1981	797.0	67
1982	411.0	44
1983	588.0	59
1984	855.0	55
1985	544.0	57
1986	642.0	50
1987	741.0	58
1988	1,015.0	62
1989	722.0	49
1990	601.0	50
1991	518.0	55
1992	887.0	68
1993	612.0	60
1994	674.6	58
1995	Exclude	Exclude
1996	802.4	101
1997	609.6	75
1998	437.2	61
1999	Exclude	Exclude
2000	604.2	77
2001	653.3	80
2002	478.2	82
2003	597.4	63
2004	871.6	76
2005	739.9	77
2006	766.8	88
2007	1,032.5	73
2008	566.2	48
2009	689.2	51
2010	1,220.9	64
2011	1,184.2	81
2012	813.7	54
2013	Exclude	Exclude

Stat	Precip. (mm)
Mean	773.8
SD	230.0
Median	726.5
Q1	610.0
Q3	893.8
Minimum	411.0
Maximum	1,370.0
Count	50
Ext Max	1,319.4
Ext Min	184.3
25th Pct	610.0
50th Pct	116.5
75th Pct	167.3
1.5 * IQR	425.7

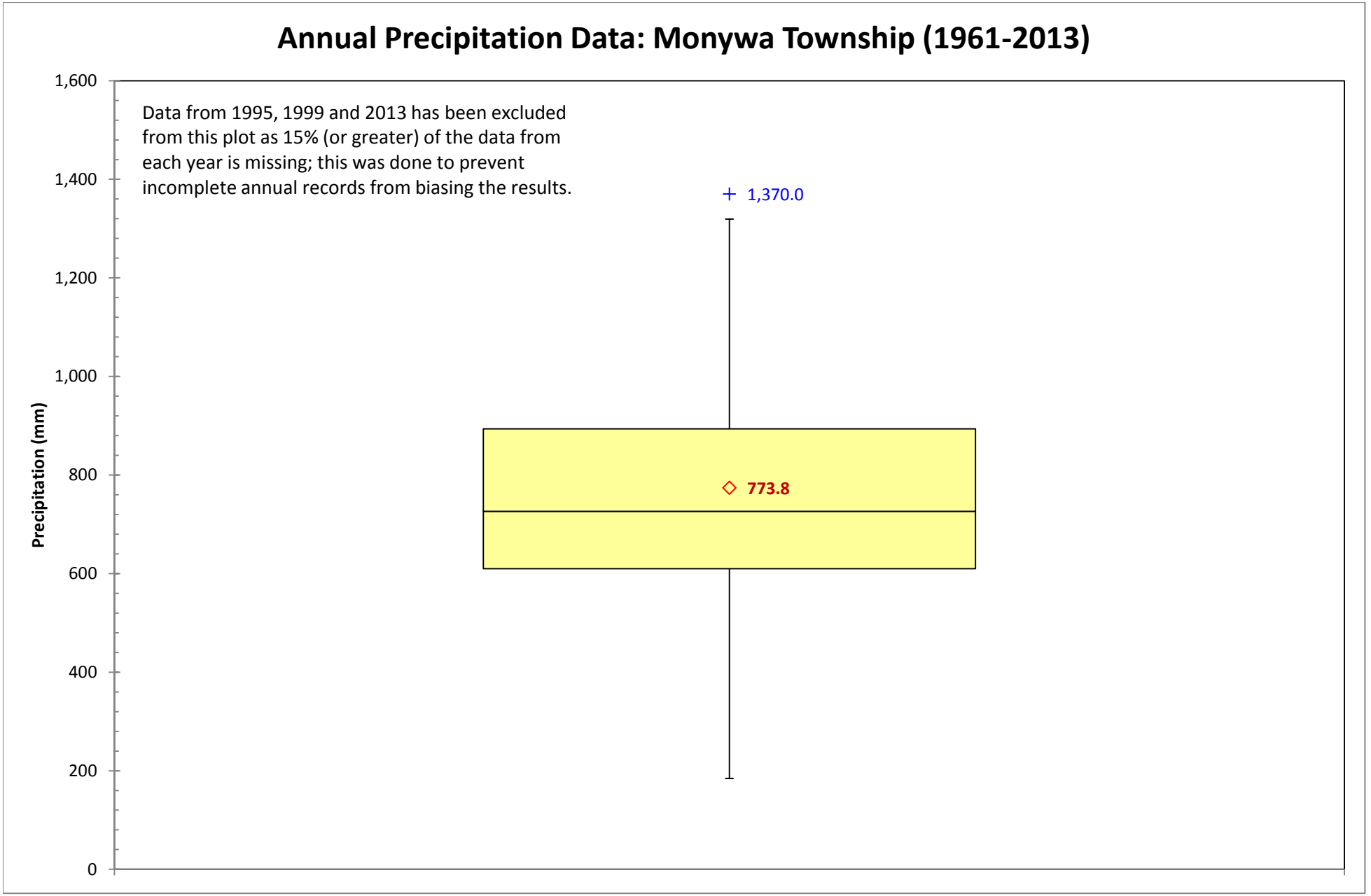
Stat	Rain Days
Mean	64.8



Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered outliers

Annual Precipitation Data: Monywa Township (1961-2013)



ATTACHMENT 2.2

Monthly Precipitation Analysis

Precipitation Data, Monthly Sampling Frequency: Monywa Township (1961-2013) (Analysis Format)

Precipitation Data (mm)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1961	0.0	0.0	12.0	60.0	126.0	41.0	72.0	88.0	255.0	38.0	39.0	0.0
1962	1.0	4.0	0.0	1.0	145.0	67.0	82.0	98.0	95.0	191.0	0.0	0.0
1963	0.0	0.0	1.0	58.0	149.0	47.0	51.0	84.0	246.0	260.0	0.0	0.0
1964	0.0	2.0	1.0	3.0	183.0	0.0	48.0	112.0	137.0	85.0	10.0	0.0
1965	5.0	0.0	0.0	2.0	79.0	50.0	69.0	166.0	496.0	236.0	10.0	85.0
1966	0.0	0.0	1.0	27.0	140.0	131.0	15.0	62.0	166.0	112.0	0.0	10.0
1967	19.0	0.0	5.0	12.0	71.0	113.0	80.0	96.0	107.0	183.0	0.0	0.0
1968	14.0	3.0	1.0	44.0	143.0	248.0	100.0	81.0	215.0	261.0	0.0	0.0
1969	0.0	0.0	0.0	31.0	90.0	93.0	114.0	33.0	211.0	172.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	96.0	76.0	16.0	67.0	80.0	166.0	88.0	22.0
1971	0.0	0.0	0.0	55.0	263.0	136.0	120.0	235.0	100.0	118.0	15.0	0.0
1972	0.0	0.0	0.0	61.0	49.0	46.0	23.0	356.0	64.0	28.0	49.0	0.0
1973	0.0	0.0	2.0	19.0	77.0	233.0	134.0	308.0	191.0	219.0	186.0	1.0
1974	0.0	0.0	9.0	8.0	194.0	64.0	34.0	95.0	199.0	21.0	44.0	0.0
1975	31.0	0.0	0.0	10.0	176.0	126.0	46.0	187.0	232.0	180.0	76.0	3.0
1976	0.0	102.0	13.0	8.0	178.0	193.0	60.0	74.0	124.0	402.0	115.0	6.0
1977	0.0	0.0	0.0	29.0	35.0	53.0	44.0	197.0	319.0	173.0	71.0	0.0
1978	0.0	0.0	0.0	16.0	114.0	116.0	182.0	140.0	164.0	178.0	0.0	0.0
1979	0.0	0.0	0.0	2.0	15.0	56.0	158.0	70.0	70.0	28.0	0.0	39.0
1980	0.0	0.0	0.0	40.0	55.0	183.0	123.0	73.0	151.0	117.0	0.0	0.0
1981	0.0	0.0	13.0	32.0	139.0	243.0	31.0	92.0	47.0	82.0	118.0	0.0
1982	0.0	0.0	0.0	2.0	106.0	81.0	11.0	117.0	60.0	33.0	1.0	0.0
1983	0.0	0.0	3.0	12.0	17.0	18.0	17.0	49.0	66.0	252.0	140.0	14.0
1984	0.0	0.0	0.0	83.0	59.0	342.0	80.0	108.0	86.0	95.0	0.0	2.0
1985	0.0	0.0	1.0	53.0	113.0	36.0	98.0	17.0	107.0	79.0	40.0	0.0
1986	0.0	0.0	0.0	14.0	20.0	40.0	75.0	185.0	211.0	71.0	26.0	0.0
1987	3.0	31.0	1.0	54.0	27.0	91.0	53.0	315.0	78.0	57.0	31.0	0.0
1988	0.0	0.0	0.0	12.0	116.0	219.0	175.0	125.0	63.0	180.0	125.0	0.0
1989	0.0	0.0	0.0	12.0	27.0	43.0	59.0	173.0	247.0	159.0	2.0	0.0
1990	0.0	0.0	11.0	5.0	86.0	11.0	17.0	41.0	240.0	83.0	107.0	0.0
1991	0.0	0.0	0.0	44.0	12.0	65.0	29.0	62.0	123.0	106.0	77.0	0.0
1992	1.0	4.0	0.0	7.0	142.0	33.0	42.0	171.0	205.0	192.0	67.0	23.0
1993	0.0	3.0	2.0	24.0	114.0	96.0	26.0	0.0	242.0	105.0	0.0	0.0
1994	0.0	2.0	5.1	4.1	25.7	216.9	58.9	185.7	126.2	18.0	32.0	0.0
1995	N/D	N/D	N/D	N/D	N/D	N/D	50.5	147.6	199.4	98.6	35.1	0.0
1996	0.0	2.8	95.8	32.5	36.8	81.0	73.1	236.0	75.2	94.0	0.0	75.2
1997	0.0	0.8	5.3	25.9	85.1	39.4	111.7	173.5	96.8	71.1	0.0	0.0
1998	0.0	0.0	14.7	9.4	12.5	11.9	111.3	12.7	181.9	82.8	0.0	0.0
1999	N/D	N/D	N/D	N/D	102.6	33.3	82.5	64.5	238.2	163.1	56.1	1.8
2000	0.0	6.6	7.3	25.2	108.7	49.5	26.2	40.1	185.4	154.4	0.8	0.0
2001	0.0	0.0	0.3	2.3	97.0	33.8	34.5	171.4	130.1	163.1	20.8	0.0
2002	2.3	0.0	3.3	3.8	38.4	33.5	52.6	169.6	127.3	33.0	14.5	0.0
2003	0.0	0.0	0.0	19.8	108.9	35.1	40.9	42.9	213.6	133.6	0.0	2.5
2004	0.0	0.0	0.0	27.4	143.8	230.2	74.4	31.0	346.7	15.0	2.0	1.0
2005	0.3	0.0	4.6	36.8	14.7	189.7	21.3	89.4	198.6	146.3	9.7	28.4
2006	0.0	0.0	0.0	39.9	92.8	106.1	80.3	123.7	148.1	137.4	38.6	0.0
2007	0.0	9.4	0.0	48.3	386.2	60.9	37.6	148.0	140.1	185.0	17.0	0.0
2008	19.0	0.0	2.5	28.5	163.3	75.2	73.1	18.5	101.6	83.2	1.3	0.0
2009	0.0	0.0	3.7	20.5	197.5	71.5	2.0	118.5	119.0	156.5	0.0	0.0
2010	0.0	0.0	9.0	18.0	83.0	116.0	131.6	185.0	152.8	512.5	0.0	13.0
2011	0.0	0.0	5.5	99.5	88.5	265.4	85.4	235.2	95.2	303.0	0.0	6.5
2012	0.0	0.0	0.0	32.5	64.5	57.5	54.5	37.0	378.0	153.7	36.0	0.0
2013	0.0	0.0	0.0	9.0	74.5	N/D	N/D	N/D	N/D	N/D	N/D	N/D

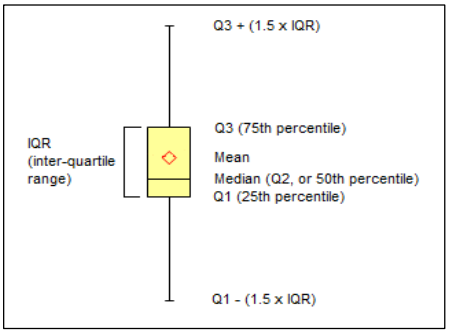
Precipitation Data Summary Statistics (mm)												
Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave. # of Rain Days	0	0	1	4	9	9	8	10	11	10	3	1
Mean	1.9	3.3	4.6	25.9	101.5	99.9	67.1	121.3	166.4	141.7	32.7	6.4
SD	5.9	14.8	13.7	22.3	69.5	79.4	42.5	80.4	89.1	94.9	44.4	16.9
Median	0.0	0.0	1.0	20.5	94.4	71.5	59.0	103.0	149.5	135.5	12.2	0.0
Q1	0.0	0.0	0.0	8.5	53.5	42.0	34.4	63.9	99.2	82.6	0.0	0.0
Q3	0.0	0.0	4.8	38.4	140.5	128.5	83.3	171.8	211.7	180.0	45.3	2.1
Minimum	0.0	0.0	0.0	0.0	12.0	0.0	2.0	0.0	47.0	15.0	0.0	0.0
Maximum	31.0	102.0	95.8	99.5	386.2	342.0	182.0	356.0	496.0	512.5	186.0	85.0
Count	51	51	51	51	52	51	52	52	52	52	52	52
Ext Max	0.0	0.0	12.0	83.1	271.0	258.3	156.5	333.8	380.4	326.1	113.1	5.3
Ext Min	0.0	0.0	-7.2	-36.3	-77.0	-87.8	-38.9	-98.0	-69.5	-63.5	-67.9	-3.2
25th Pct	0.0	0.0	0.0	8.5	53.5	42.0	34.4	63.9	99.2	82.6	0.0	0.0
50th Pct	0.0	0.0	1.0	12.0	40.9	29.5	24.6	39.1	50.3	52.9	12.2	0.0
75th Pct	0.0	0.0	3.8	17.9	46.1	57.0	24.3	68.8	62.1	44.5	33.0	2.1
1.5 * IQR	0.0	0.0	7.2	44.8	130.5	129.8	73.3	161.9	168.7	146.1	67.9	3.2

Note: N/D = No Data Available, N/A = Not Applicable.

Precipitation Data, Monthly Sampling Frequency: Monywa Township (1961-2013) (Analysis Format)

Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered statistical outliers



Precipitation Data, Monthly Sampling Frequency: Monywa Township (1961-2013)
(Analysis Format | Outliers Removed)

Precipitation Data (mm)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1961	0.0	0.0		60.0	126.0	41.0	72.0	88.0	255.0	38.0	39.0	0.0
1962			0.0	1.0	145.0	67.0	82.0	98.0	95.0	191.0	0.0	0.0
1963	0.0	0.0	1.0	58.0	149.0	47.0	51.0	84.0	246.0	260.0	0.0	0.0
1964	0.0		1.0	3.0	183.0	0.0	48.0	112.0	137.0	85.0	10.0	0.0
1965		0.0	0.0	2.0	79.0	50.0	69.0	166.0		236.0	10.0	
1966	0.0	0.0	1.0	27.0	140.0	131.0	15.0	62.0	166.0	112.0	0.0	
1967		0.0	5.0	12.0	71.0	113.0	80.0	96.0	107.0	183.0	0.0	0.0
1968			1.0	44.0	143.0	248.0	100.0	81.0	215.0	261.0	0.0	0.0
1969	0.0	0.0	0.0	31.0	90.0	93.0	114.0	33.0	211.0	172.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	96.0	76.0	16.0	67.0	80.0	166.0	88.0	
1971	0.0	0.0	0.0	55.0	263.0	136.0	120.0	235.0	100.0	118.0	15.0	0.0
1972	0.0	0.0	0.0	61.0	49.0	46.0	23.0		64.0	28.0	49.0	0.0
1973	0.0	0.0	2.0	19.0	77.0	233.0	134.0	308.0	191.0	219.0		1.0
1974	0.0	0.0	9.0	8.0	194.0	64.0	34.0	95.0	199.0	21.0	44.0	0.0
1975		0.0	0.0	10.0	176.0	126.0	46.0	187.0	232.0	180.0	76.0	3.0
1976	0.0			8.0	178.0	193.0	60.0	74.0	124.0			
1977	0.0	0.0	0.0	29.0	35.0	53.0	44.0	197.0	319.0	173.0	71.0	0.0
1978	0.0	0.0	0.0	16.0	114.0	116.0		140.0	164.0	178.0	0.0	0.0
1979	0.0	0.0	0.0	2.0	15.0	56.0		70.0	70.0	28.0	0.0	
1980	0.0	0.0	0.0	40.0	55.0	183.0	123.0	73.0	151.0	117.0	0.0	0.0
1981	0.0	0.0		32.0	139.0	243.0	31.0	92.0	47.0	82.0		0.0
1982	0.0	0.0	0.0	2.0	106.0	81.0	11.0	117.0	60.0	33.0	1.0	0.0
1983	0.0	0.0	3.0	12.0	17.0	18.0	17.0	49.0	66.0	252.0		
1984	0.0	0.0	0.0	83.0	59.0		80.0	108.0	86.0	95.0	0.0	2.0
1985	0.0	0.0	1.0	53.0	113.0	36.0	98.0	17.0	107.0	79.0	40.0	0.0
1986	0.0	0.0	0.0	14.0	20.0	40.0	75.0	185.0	211.0	71.0	26.0	0.0
1987			1.0	54.0	27.0	91.0	53.0	315.0	78.0	57.0	31.0	0.0
1988	0.0	0.0	0.0	12.0	116.0	219.0		125.0	63.0	180.0		0.0
1989	0.0	0.0	0.0	12.0	27.0	43.0	59.0	173.0	247.0	159.0	2.0	0.0
1990	0.0	0.0	11.0	5.0	86.0	11.0	17.0	41.0	240.0	83.0	107.0	0.0
1991	0.0	0.0	0.0	44.0	12.0	65.0	29.0	62.0	123.0	106.0	77.0	0.0
1992			0.0	7.0	142.0	33.0	42.0	171.0	205.0	192.0	67.0	
1993	0.0		2.0	24.0	114.0	96.0	26.0	0.0	242.0	105.0	0.0	0.0
1994	0.0		5.1	4.1	25.7	216.9	58.9	185.7	126.2	18.0	32.0	0.0
1995	N/D	N/D	N/D	N/D	N/D	N/D	50.5	147.6	199.4	98.6	35.1	0.0
1996	0.0			32.5	36.8	81.0	73.1	236.0	75.2	94.0	0.0	
1997	0.0		5.3	25.9	85.1	39.4	111.7	173.5	96.8	71.1	0.0	0.0
1998	0.0	0.0		9.4	12.5	11.9	111.3	12.7	181.9	82.8	0.0	0.0
1999	N/D	N/D	N/D	N/D	102.6	33.3	82.5	64.5	238.2	163.1	56.1	1.8
2000	0.0		7.3	25.2	108.7	49.5	26.2	40.1	185.4	154.4	0.8	0.0
2001	0.0	0.0	0.3	2.3	97.0	33.8	34.5	171.4	130.1	163.1	20.8	0.0
2002		0.0	3.3	3.8	38.4	33.5	52.6	169.6	127.3	33.0	14.5	0.0
2003	0.0	0.0	0.0	19.8	108.9	35.1	40.9	42.9	213.6	133.6	0.0	2.5
2004	0.0	0.0	0.0	27.4	143.8	230.2	74.4	31.0	346.7	15.0	2.0	1.0
2005		0.0	4.6	36.8	14.7	189.7	21.3	89.4	198.6	146.3	9.7	
2006	0.0	0.0	0.0	39.9	92.8	106.1	80.3	123.7	148.1	137.4	38.6	0.0
2007	0.0		0.0	48.3		60.9	37.6	148.0	140.1	185.0	17.0	0.0
2008		0.0	2.5	28.5	163.3	75.2	73.1	18.5	101.6	83.2	1.3	0.0
2009	0.0	0.0	3.7	20.5	197.5	71.5	2.0	118.5	119.0	156.5	0.0	0.0
2010	0.0	0.0	9.0	18.0	83.0	116.0	131.6	185.0	152.8		0.0	
2011	0.0	0.0	5.5		88.5		85.4	235.2	95.2	303.0	0.0	
2012	0.0	0.0	0.0	32.5	64.5	57.5	54.5	37.0	378.0	153.7	36.0	0.0
2013	0.0	0.0	0.0	9.0	74.5	N/D	N/D	N/D	N/D	N/D	N/D	N/D

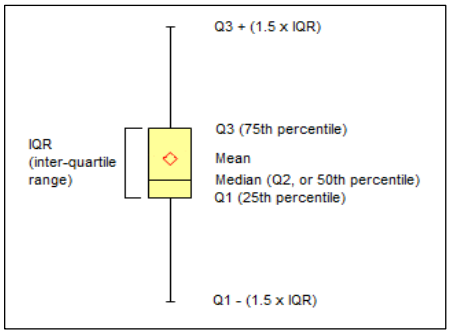
Precipitation Data Summary Statistics (mm)												
Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain Days	0.3	0.4	1.0	3.8	9.0	8.6	7.7	10.0	11.3	9.5	2.7	1.0
Mean	0.0	0.0	1.8	24.5	96.0	91.6	60.6	116.7	159.9	129.0	21.6	0.3
SD	0.0	0.0	2.9	19.8	57.3	68.6	34.5	73.9	76.6	70.8	28.4	0.7
Median	0.0	0.0	0.0	20.2	92.8	67.0	54.5	98.0	148.1	125.8	9.7	0.0
Q1	0.0	0.0	0.0	8.3	52.0	41.0	34.0	63.3	98.4	82.2	0.0	0.0
Q3	0.0	0.0	2.9	35.8	139.5	116.0	80.3	171.2	211.0	176.8	37.3	0.0
Minimum	0.0	0.0	0.0	0.0	12.0	0.0	2.0	0.0	47.0	15.0	0.0	0.0
Maximum	0.0	0.0	11.0	83.0	263.0	248.0	134.0	315.0	378.0	303.0	107.0	3.0
Count	41	39	46	50	51	49	49	51	51	50	47	41
Ext Max	0.0	0.0	7.2	77.0	270.8	228.5	149.6	333.2	379.9	318.6	93.2	0.0
Ext Min	0.0	0.0	-4.3	-33.0	-79.3	-71.5	-35.4	-98.7	-70.5	-59.6	-55.9	0.0
25th Pct	0.0	0.0	0.0	8.3	52.0	41.0	34.0	63.3	98.4	82.2	0.0	0.0
50th Pct	0.0	0.0	0.0	11.9	40.8	26.0	20.5	34.7	49.7	43.6	9.7	0.0
75th Pct	0.0	0.0	2.9	15.6	46.7	49.0	25.8	73.2	62.9	50.9	27.6	0.0
1.5 * IQR	0.0	0.0	4.3	41.3	131.3	112.5	69.4	161.9	168.9	141.8	55.9	0.0

Note: N/D = No Data Available, N/A = Not Applicable.

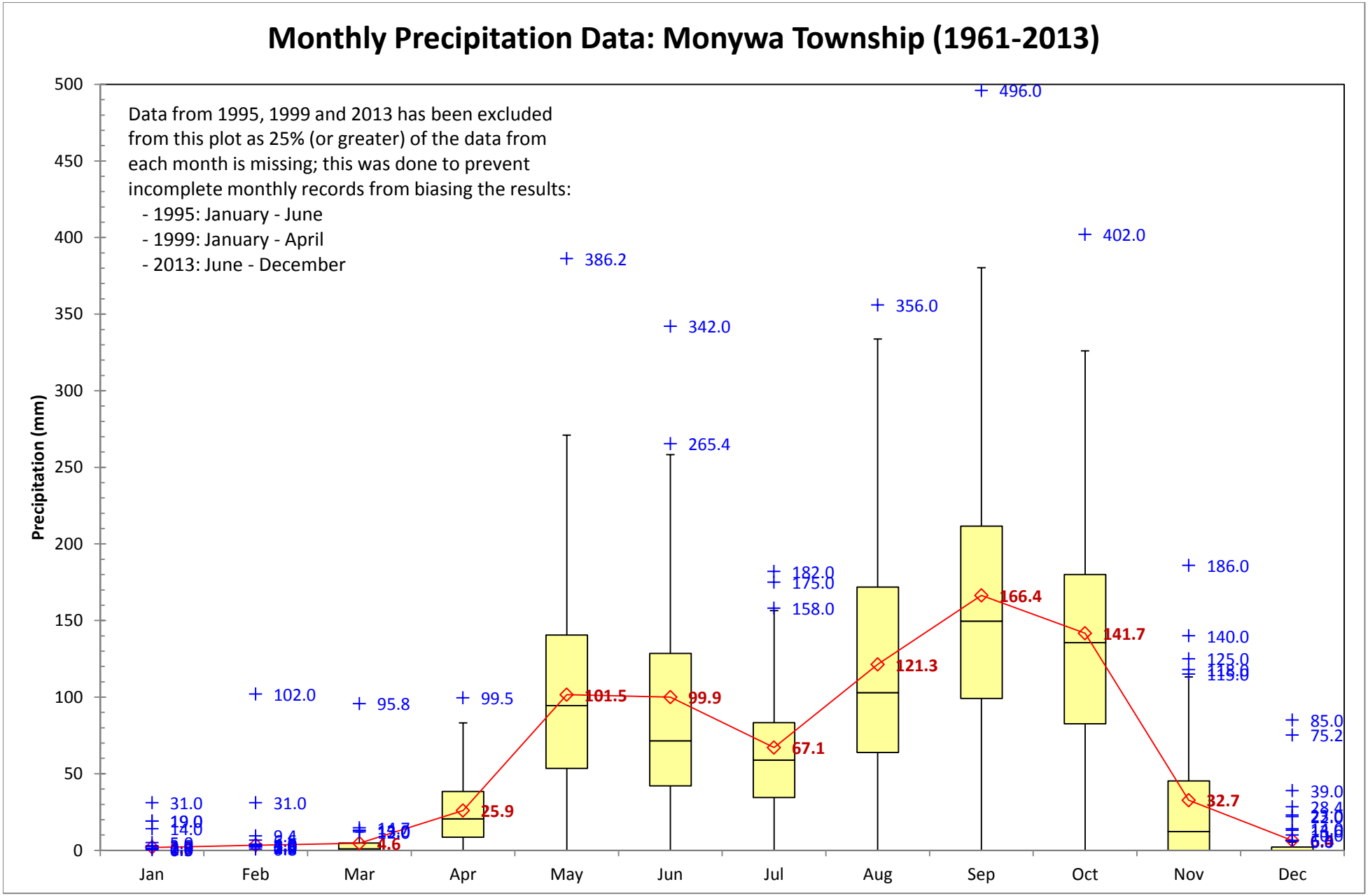
Precipitation Data, Monthly Sampling Frequency: Monywa Township (1961-2013) (Analysis Format | Outliers Removed)

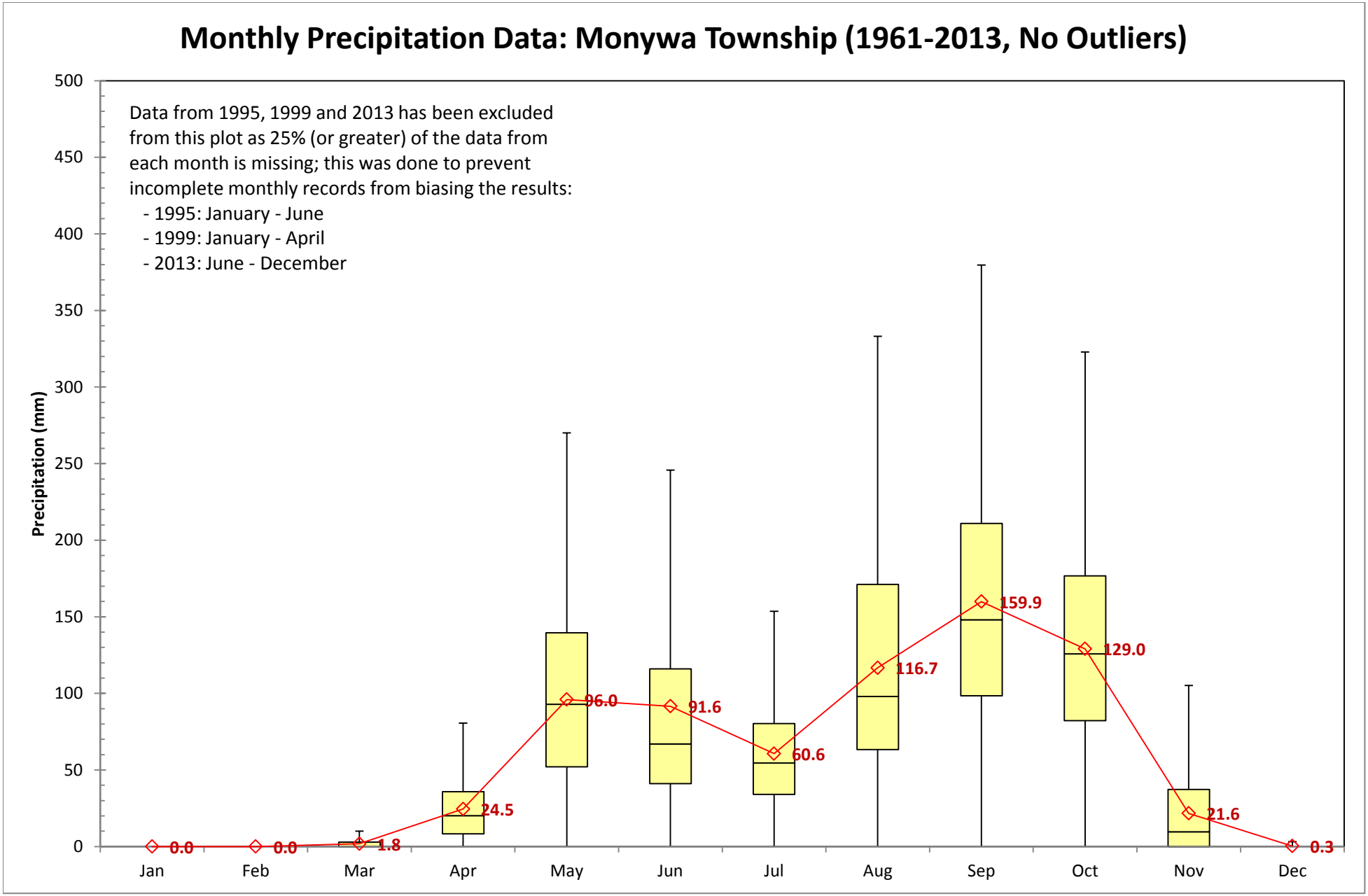
Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered statistical outliers



Monthly Precipitation Data: Monywa Township (1961-2013)




Monthly Precipitation Data: Monywa Township (1961-2013, No Outliers)
Data from 1995, 1999 and 2013 has been excluded from this plot as 25% (or greater) of the data from each month is missing; this was done to prevent incomplete monthly records from biasing the results:
- 1995: January - June
- 1999: January - April
- 2013: June - December
Precipitation (mm)
500
450
400
350
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.0
0.0
1.8
24.5
96.0
91.6
60.6
116.7
159.9
129.0
21.6
0.3

ATTACHMENT 2.3

Daily Precipitation Frequency Analysis

Precipitation Frequency Analysis, Maximum Annual Daily: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

Max Daily Data		Rank	Weibull	ARI	Ranked
Year	Precip. (mm)	(highest to lowest) m	Exceedance Probability p	(yrs)	Precip (mm)
1961	77.0	1	0.019	53.00	165.0
1962	59.0	2	0.038	26.50	135.0
1963	76.0	3	0.057	17.67	135.0
1964	98.0	4	0.075	13.25	125.0
1965	90.0	5	0.094	10.60	117.1
1966	75.0	6	0.113	8.83	117.0
1967	125.0	7	0.132	7.57	109.0
1968	109.0	8	0.151	6.63	108.5
1969	73.0	9	0.170	5.89	105.5
1970	65.0	10	0.189	5.30	103.0
1971	92.0	11	0.208	4.82	102.0
1972	71.0	12	0.226	4.42	99.3
1973	103.0	13	0.245	4.08	99.0
1974	85.0	14	0.264	3.79	98.0
1975	69.0	15	0.283	3.53	97.0
1976	102.0	16	0.302	3.31	93.5
1977	72.0	17	0.321	3.12	92.0
1978	70.0	18	0.340	2.94	91.0
1979	99.0	19	0.358	2.79	90.0
1980	52.0	20	0.377	2.65	88.0
1981	97.0	21	0.396	2.52	85.0
1982	36.0	22	0.415	2.41	82.3
1983	80.0	23	0.434	2.30	80.0
1984	135.0	24	0.453	2.21	78.0
1985	52.0	25	0.472	2.12	77.0
1986	78.0	26	0.491	2.04	77.0
1987	91.0	27	0.509	1.96	76.5
1988	117.0	28	0.528	1.89	76.0
1989	64.0	29	0.547	1.83	75.0
1990	75.0	30	0.566	1.77	75.0
1991	45.0	31	0.585	1.71	73.0
1992	88.0	32	0.604	1.66	72.0
1993	66.0	33	0.623	1.61	71.4
1994	117.1	34	0.642	1.56	71.0
1995	68.1	35	0.660	1.51	70.0
1996	57.7	36	0.679	1.47	69.0
1997	47.7	37	0.698	1.43	68.1
1998	48.4	38	0.717	1.39	67.8
1999	82.3	39	0.736	1.36	67.0
2000	67.8	40	0.755	1.33	66.0
2001	76.5	41	0.774	1.29	65.0
2002	43.9	42	0.792	1.26	64.0
2003	93.5	43	0.811	1.23	59.0
2004	99.3	44	0.830	1.20	57.7
2005	71.4	45	0.849	1.18	52.0
2006	77.0	46	0.868	1.15	52.0
2007	105.5	47	0.887	1.13	48.4
2008	42.4	48	0.906	1.10	47.7
2009	67.0	49	0.925	1.08	45.0
2010	108.5	50	0.943	1.06	43.9
2011	165.0	51	0.962	1.04	42.4
2012	135.0	52	0.981	1.02	36.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Wakeby	1	1	1
Pearson 5 (3P)	2	5	10
Pearson 6	6	6	36
Gen. Logistic	12	3	36
Burr	18	2	36
Pearson 6 (4P)	5	10	50
Log-Logistic (3P)	4	14	56
Gumbel Max	3	26	78
Gen. Extreme Value	13	7	91
Log-Pearson 3	11	13	143

Three fits were selected for comparison:

1) **Wakeby** (Best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

Note that these predictions should be multiplied by **1.143** to account for potential straddling errors in sampling which may occur from fixed 24-h observational periods, as discussed in:

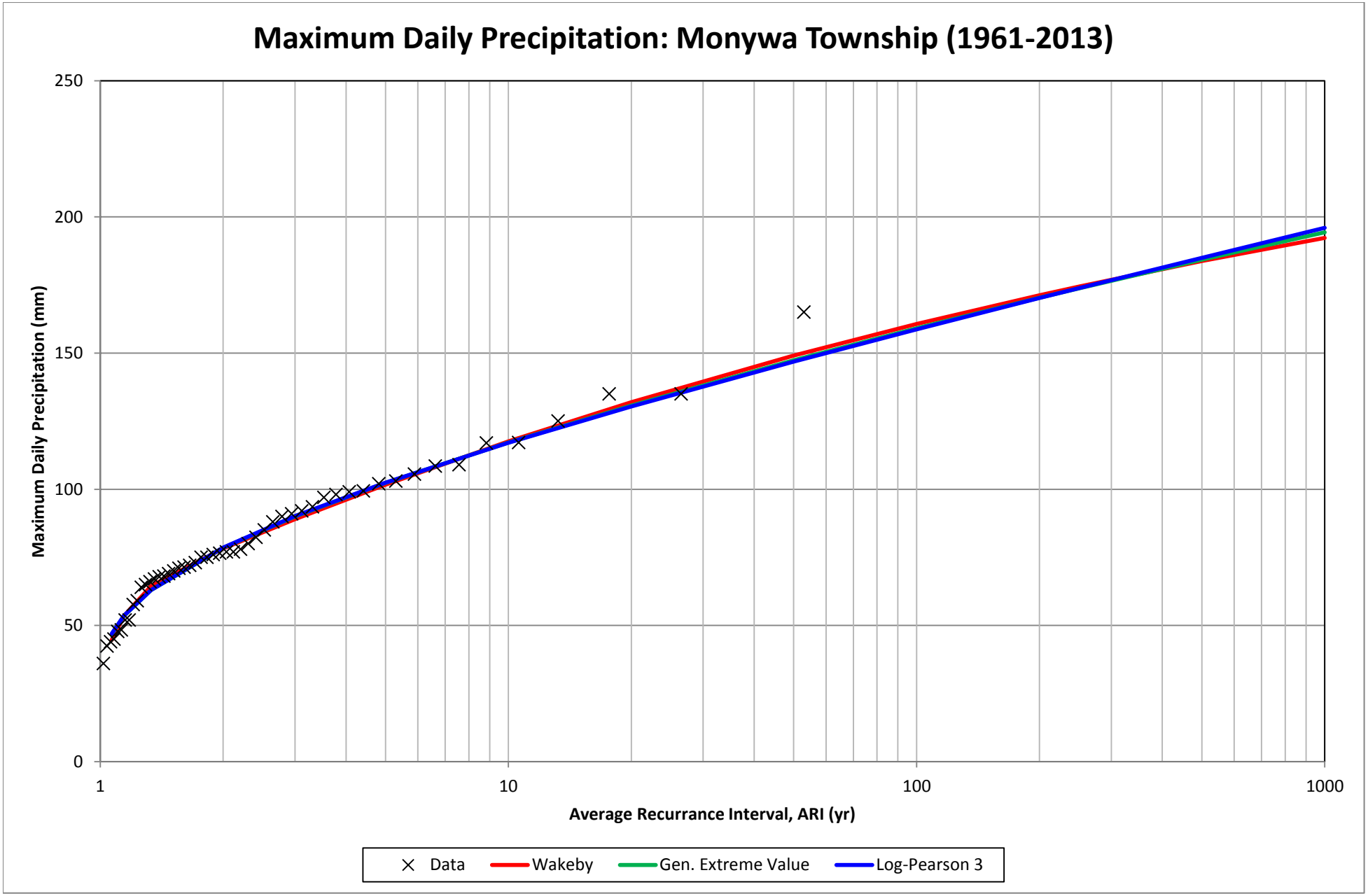
Weiss, L.L., 1964, Ratio of true to fixed-interval maximum rainfall: American Society of Civil Engineers, Journal of Hydraulics Division, v.90, HY-1, p. 77-82.

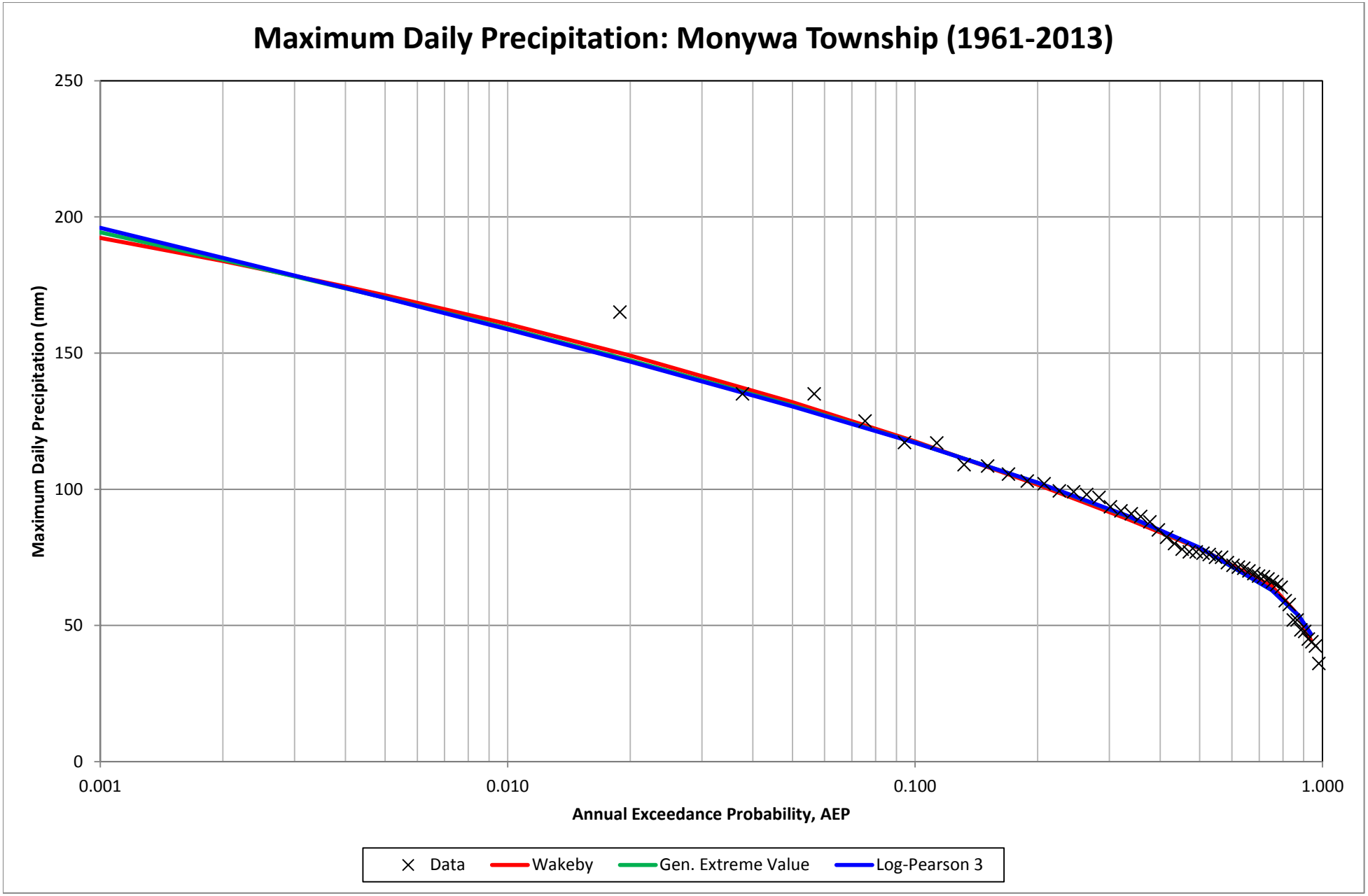
2013 was excluded from this analysis as a significant portion of data from the wet season was missing.

Precipitation Frequency Analysis, Maximum Annual Daily: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent short-term storm precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Wakeby		Gen. Extreme Value		Log-Pearson 3	
			α =	221.90042	k =	-0.06676115	α =	148.2847421
			β =	8.2130851	σ =	22.3984849	β =	-0.0264996
			γ =	29.8116959	μ =	70.39076611	γ =	8.285147763
			δ =	-0.1356425				
			ξ =	31.5886933				
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	192.3	N/A	194.3	26.53	196.0	26.44
0.998	0.002	500	183.8	N/A	184.3	26.53	185.0	26.44
0.996	0.004	250	174.5	N/A	173.8	26.53	173.9	26.44
0.995	0.005	200	171.3	N/A	170.3	26.53	170.2	26.44
0.990	0.010	100	160.7	N/A	159.1	26.53	158.7	26.44
0.980	0.020	50	149.1	N/A	147.3	26.53	146.9	26.44
0.950	0.050	20	132.0	N/A	130.7	26.53	130.4	26.44
0.900	0.100	10	117.6	N/A	117.2	26.53	117.1	26.44
0.800	0.200	5	101.7	N/A	102.4	26.53	102.5	26.44
0.667	0.333	3	89.0	N/A	90.0	26.53	90.2	26.44
0.500	0.500	2.0	78.2	N/A	78.5	26.53	78.6	26.44
0.250	0.750	1.3	64.5	N/A	63.0	26.53	63.0	26.44
0.125	0.875	1.1	53.5	N/A	53.6	26.53	53.6	26.44
0.063	0.937	1.1	44.7	N/A	46.8	26.53	47.0	26.44
Kolmogorov Smirnov (Statistic, Rank)			0.06197	1	0.07306	13	0.07296	11
Anderson Darling (Statistic, Rank)			0.16639	1	0.22384	7	0.22713	13


Maximum Daily Precipitation: Monywa Township (1961-2013)
Maximum Daily Precipitation (mm)
250
200
150
100
50
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3


Maximum Daily Precipitation: Monywa Township (1961-2013)
Maximum Daily Precipitation (mm)
250
200
150
100
50
0
0.001
0.010
0.100
1.000
Annual Exceedance Probability, AEP
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3

ATTACHMENT 2.4

Precipitation IDF Curve Analysis

Derivation of Intensity / Duration / Frequency (IDF) Curves from Daily ARI Data

IDF curves for the **Letpadaung Copper** project are derived using the Rainfall Ratio method discussed in Chapter 4 of "Highway and Urban Hydrology in the Tropics", 1984, L.H. Watkins and D. Fiddes - London, Great Britain - Pentech Press, Ltd.

Twenty-four hour duration precipitation intensities for various average recurrence interval (ARI) events are used along with empirically-derived coefficients from Table 4.6 of (Watkins & Fiddes, 1984) to construct IDF curves. The fundamental equations used with this technique are:

$I_t = a / (b + t)^n$ and $RR_t = (I_t \cdot t) / (I_{24} \cdot 24)$

where:

I_t = precipitation intensity for a t-hour duration storm (mm/h)

RR_t = rainfall ratio for a t-hour duration storm (mm/mm)

t = precipitation duration (h)

a, b and n = fitting coefficients

by substituting the first expression into the second, the fitting coefficient "a" is eliminated, leaving:

$RR_t = (t / 24) * ((b + 24) / (b + t))^n$

The basic approach then, is using a list of twenty-four hour duration intensities (depth / 24 hours) for various ARI periods and fitting coefficients "b" and "n" selected from Table 4.6 of (Watkins & Fiddes, 1984):

1) Compute the corresponding rainfall ratio (RR_t) for a select duration (t) using the third relationship and then
2) Solve the second relationship for I_t as follows: $I_t = (RR_t * I_{24} * 24) / t$

In this case, the value for Phnom Penh, Cambodia were applied, as given in "Best Practise Guidelines for Flood Risk Assessment", Mekong River Commission, December 2009.

This process is completed for all of the various ARI's and periods selected to construct an IDF curve using the following five-step process.

First, the I_{24} values for the each of the selected ARI's are tabulated:

Annual Exceedance Probability	Average Recurrance Interval (yr)	24-hr Precip. (mm)	24-hr Precip. Factored (mm)	24-hr Intensity I_{24} (mm/h)
50.0%	2	78.5	89.7	3.7
20.0%	5	102.4	117.0	4.9
10.0%	10	117.2	134.0	5.6
5.0%	20	130.7	149.4	6.2
2.0%	50	147.3	168.4	7.0
1.0%	100	159.1	181.9	7.6
0.5%	200	170.3	194.7	8.1
0.2%	500	184.3	210.7	8.8

Second, the fitting coefficient "b" is selected from the aforementioned reference for Phnom Penh, Cambodia: **b =** 0.23

Third, the fitting coefficient "n" is selected from the aforementioned reference for Phnom Penh, Cambodia: **n =** 0.86

Fourth, rainfall ratios (RR_t) and the intensities (I_t) which follow the range of selected durations (t) are computed and tabulated:

Note: IDF and DDF values for 48 and 72 hour storm events were calculated using frequency analysis. Storm depths for 24, 48 and 72 hour events were factored following "Ratio of true to fixed-interval maximum rainfall", ASCE Journal of the Hydraulics Division: Weiss, 1964.

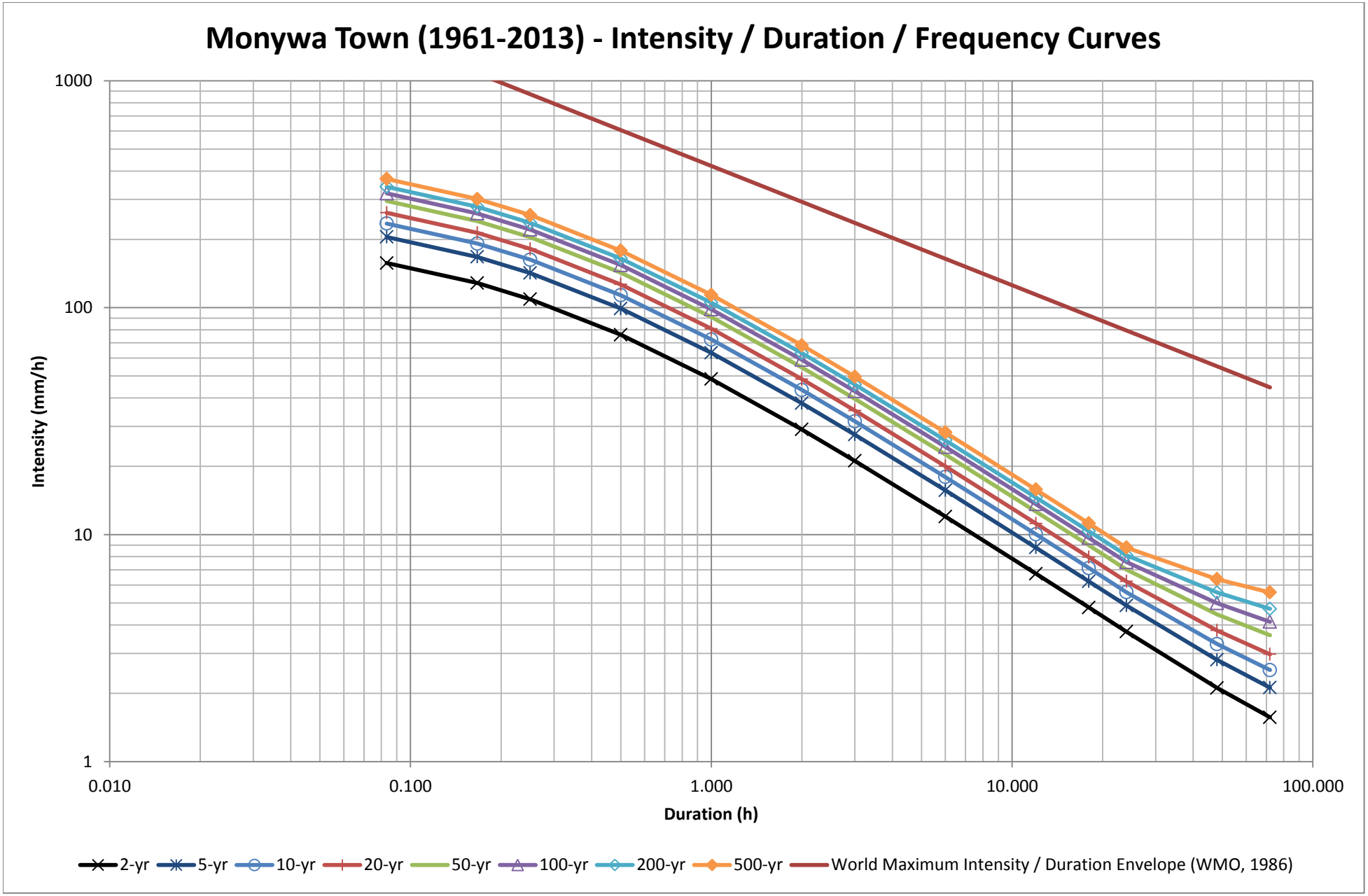
Duration	24	48	72
Factor	1.143	1.067	1.044

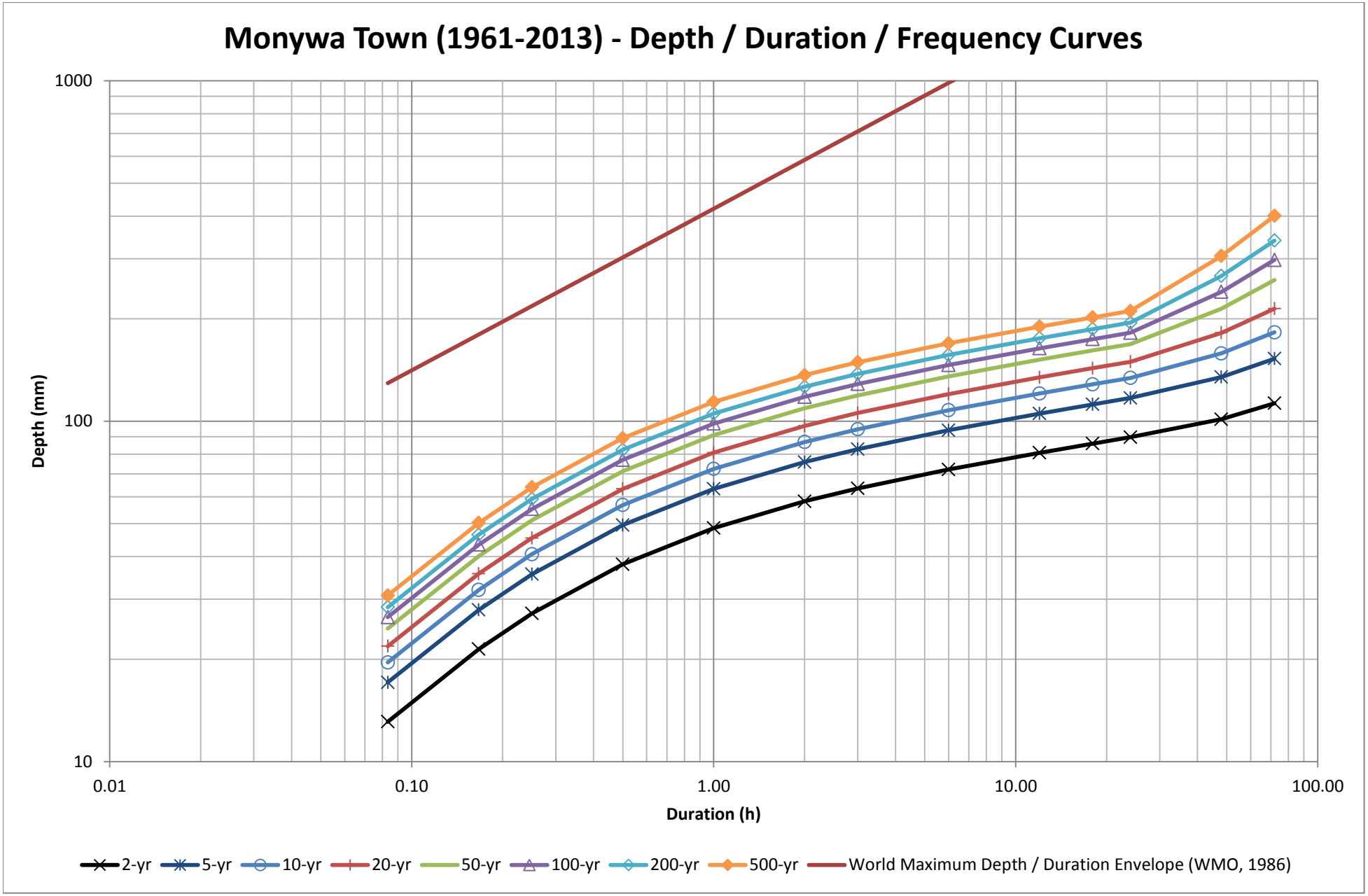
Precipitation Duration t		Rainfall Ratio RR_t	Precipitation Intensity (I_t) for given AEP (%) or ARI (1 in _ year) Storm (mm/h)							
			AEP (%)	50.0%	20.0%	10.0%	5.0%	2.0%	1.0%	0.5%	0.2%
			ARI (yr)	2	5	10	20	50	100	200	500
(min)	(h)	(mm/mm)	I_{24} (mm/h)	3.7	4.9	5.6	6.2	7.0	7.6	8.1	8.8
5	0.083	0.146		157.3	205.1	234.8	261.9	295.2	318.8	341.2	369.3
10	0.167	0.239		128.4	167.4	191.7	213.9	241.0	260.3	278.6	301.5
15	0.25	0.304		109.0	142.1	162.7	181.5	204.6	220.9	236.5	255.9
30	0.50	0.423		76.0	99.1	113.5	126.6	142.6	154.0	164.9	178.4
60	1	0.541		48.5	63.3	72.4	80.8	91.1	98.3	105.3	113.9
120	2	0.648		29.1	37.9	43.4	48.4	54.6	59.0	63.1	68.3
180	3	0.707		21.2	27.6	31.6	35.2	39.7	42.9	45.9	49.7
360	6	0.804		12.0	15.7	17.9	20.0	22.6	24.4	26.1	28.2
720	12	0.900		6.7	8.8	10.0	11.2	12.6	13.6	14.6	15.8
1080	18	0.958		4.8	6.2	7.1	8.0	9.0	9.7	10.4	11.2
1440	24	1.000		3.7	4.9	5.6	6.2	7.0	7.6	8.1	8.8
2880	48			2.1	2.8	3.3	3.8	4.5	5.0	5.6	6.4
4320	72			1.6	2.1	2.5	3.0	3.6	4.1	4.7	5.6

Derivation of Intensity / Duration / Frequency (IDF) Curves from Daily ARI Data

Also tabulate the total storm depths:

Precipitation Duration t		Rainfall Ratio RR_t	Precipitation Depth (d_t) for given AEP (%) or ARI (1 in _ year) Storm (mm)							
			AEP (%)	50.0%	20.0%	10.0%	5.0%	2.0%	1.0%	0.5%	0.2%
			ARI (yr)	2	5	10	20	50	100	200	500
(min)	(h)	(mm/mm)	d_{24} (mm)	89.7	117.0	134.0	149.4	168.4	181.9	194.7	210.7
5	0.083	0.146		13.1	17.1	19.6	21.8	24.6	26.6	28.4	30.8
10	0.167	0.239		21.4	27.9	32.0	35.6	40.2	43.4	46.4	50.2
15	0.25	0.304		27.2	35.5	40.7	45.4	51.1	55.2	59.1	64.0
30	0.50	0.423		38.0	49.5	56.7	63.3	71.3	77.0	82.4	89.2
60	1	0.541		48.5	63.3	72.4	80.8	91.1	98.3	105.3	113.9
120	2	0.648		58.2	75.9	86.8	96.9	109.2	117.9	126.2	136.6
180	3	0.707		63.5	82.7	94.7	105.7	119.1	128.6	137.7	149.0
360	6	0.804		72.1	94.1	107.7	120.1	135.4	146.2	156.5	169.4
720	12	0.900		80.8	105.3	120.6	134.5	151.6	163.7	175.2	189.6
1080	18	0.958		86.0	112.1	128.3	143.1	161.3	174.2	186.5	201.8
1440	24	1.000		89.7	117.0	134.0	149.4	168.4	181.9	194.7	210.7
2880	48			101.3	134.8	158.2	181.7	214.0	239.8	267.0	305.7
4320	72			112.9	152.6	182.4	214.0	259.6	297.7	339.4	400.7


Monywa Town (1961-2013) - Intensity / Duration / Frequency Curves
Intensity (mm/h)
1000
100
10
1
0.010
0.100
1.000
10.000
100.000
Duration (h)
2-yr
5-yr
10-yr
20-yr
50-yr
100-yr
200-yr
500-yr
World Maximum Intensity / Duration Envelope (WMO, 1986)


Monywa Town (1961-2013) - Depth / Duration / Frequency Curves
1000
100
10
Depth (mm)
0.01
0.10
1.00
10.00
100.00
Duration (h)
2-yr
5-yr
10-yr
20-yr
50-yr
100-yr
200-yr
500-yr
World Maximum Depth / Duration Envelope (WMO, 1986)

ATTACHMENT 2.5

Precipitation Hyetograph Analysis

Design Hyetographs

In some instances there was only one hyetograph available for a certain storm duration. For these durations the singular Hyetograph will be used instead of the design hyetograph which is based on several patterns. All hyetograph patterns are based on storms equal to or exceeding the 85th percentile of measured precipitation depth for storms of the selected duration.

2 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	55.3%
2	100.0%

3 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	22.9%
2	77.0%
3	100.0%

4 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	15.3%
2	56.2%
3	90.1%
4	100.0%

5 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	6.6%
2	37.2%
3	67.8%
4	93.7%
5	100.0%

6 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	8.1%
2	24.3%
3	45.3%
4	76.5%
5	97.1%
6	100.0%

7 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	6.7%
2	19.0%
3	43.0%
4	70.1%
5	88.5%
6	98.4%
7	100.0%

8 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.9%
2	4.7%
3	15.6%
4	51.5%
5	73.8%
6	88.3%
7	97.5%
8	100.0%

9 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	3.8%
2	13.7%
3	34.9%
4	63.4%
5	81.3%
6	88.9%
7	93.7%
8	97.8%
9	100.0%

10 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.4%
2	3.3%
3	7.9%
4	13.6%
5	21.5%
6	45.0%
7	71.5%
8	83.1%
9	97.5%
10	100.0%

11 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	1.8%
2	4.8%
3	12.3%
4	22.4%
5	37.3%
6	52.2%
7	66.2%
8	79.8%
9	91.2%
10	98.2%
11	100.0%

12 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	1.1%
2	4.5%
3	9.0%
4	13.5%
5	18.0%
6	23.6%
7	30.3%
8	42.7%
9	61.8%
10	84.3%
11	96.6%
12	100.0%

13 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	2.8%
2	6.6%
3	11.3%
4	17.9%
5	23.6%
6	32.1%
7	47.2%
8	66.0%
9	84.9%
10	93.4%
11	97.2%
12	99.1%
13	100.0%

Design Hyetographs

In some instances there was only one hyetograph available for a certain storm duration. For these durations the singular Hyetograph will be used instead of the design hyetograph which is based on several patterns. All hyetograph patterns are based on storms equal to or exceeding the 85th percentile of measured precipitation depth for storms of the selected duration.

14 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	3.0%
2	8.7%
3	13.1%
4	15.4%
5	17.3%
6	20.6%
7	27.6%
8	39.9%
9	55.6%
10	67.8%
11	80.8%
12	92.6%
13	98.8%
14	100.0%

15 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	4.0%
2	15.1%
3	30.2%
4	41.3%
5	50.0%
6	57.1%
7	63.5%
8	71.4%
9	81.0%
10	88.1%
11	91.3%
12	94.4%
13	97.6%
14	99.2%
15	100.0%

16 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.9%
2	5.7%
3	12.3%
4	16.0%
5	20.8%
6	34.9%
7	45.3%
8	50.9%
9	62.3%
10	68.9%
11	72.6%
12	74.5%
13	80.2%
14	89.6%
15	97.2%
16	100.0%

18 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.9%
2	6.2%
3	10.6%
4	14.2%
5	22.1%
6	28.3%
7	34.5%
8	40.7%
9	46.0%
10	52.2%
11	61.1%
12	65.5%
13	70.8%
14	78.8%
15	86.7%
16	95.6%
17	99.1%
18	100.0%

19 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	4.3%
2	11.4%
3	21.4%
4	31.4%
5	41.4%
6	48.6%
7	58.6%
8	70.0%
9	80.0%
10	85.7%
11	88.6%
12	90.0%
13	91.4%
14	92.9%
15	94.3%
16	95.7%
17	97.1%
18	98.6%
19	100.0%

20 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	1.7%
2	3.3%
3	5.0%
4	7.5%
5	13.3%
6	22.5%
7	30.0%
8	37.5%
9	41.7%
10	43.3%
11	44.2%
12	51.7%
13	60.0%
14	68.3%
15	75.8%
16	83.3%
17	90.8%
18	95.8%
19	99.2%
20	100.0%

21 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	1.4%
2	4.3%
3	7.1%
4	11.4%
5	17.1%
6	21.4%
7	25.7%
8	30.0%
9	34.3%
10	37.1%
11	41.4%
12	47.1%
13	52.9%
14	60.0%
15	68.6%
16	77.1%
17	84.3%
18	90.0%
19	95.7%
20	98.6%
21	100.0%

23 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.4%
2	0.8%
3	3.5%
4	6.2%
5	8.1%
6	10.8%
7	15.1%
8	22.4%
9	31.7%
10	40.2%
11	47.5%
12	51.7%
13	53.3%
14	54.4%
15	56.0%
16	57.5%
17	59.8%
18	66.4%
19	79.9%
20	91.5%
21	97.3%
22	99.6%
23	100.0%

Design Hyetographs

In some instances there was only one hyetograph available for a certain storm duration. For these durations the singular Hyetograph will be used instead of the design hyetograph which is based on several patterns. All hyetograph patterns are based on storms equal to or exceeding the 85th percentile of measured precipitation depth for storms of the selected duration.

27 Hour

Design Hyetograph	
Hour	% Cum.
0	0.0%
1	2.1%
2	6.7%
3	23.5%
4	52.5%
5	58.1%
6	59.5%
7	60.1%
8	60.4%
9	61.0%
10	62.5%
11	64.8%
12	67.2%
13	69.5%
14	72.1%
15	74.5%
16	76.2%
17	77.4%
18	78.0%
19	78.3%
20	78.9%
21	83.3%
22	89.7%
23	95.0%
24	97.9%
25	99.1%
26	99.7%
27	100.0%

30 Hour

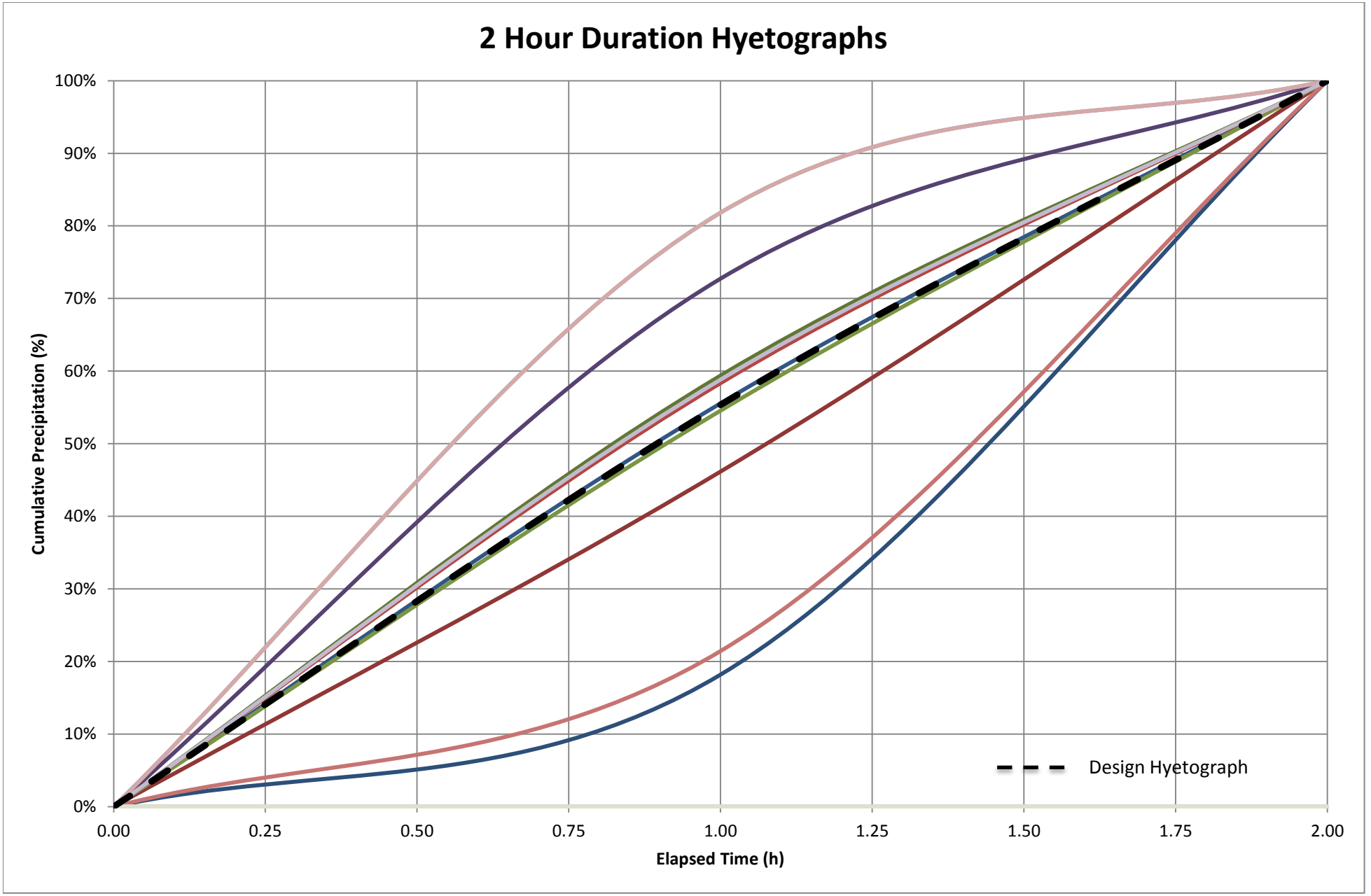
Design Hyetograph	
Hour	% Cum.
0	0.0%
1	1.1%
2	3.7%
3	7.0%
4	11.2%
5	16.0%
6	20.3%
7	24.1%
8	27.3%
9	29.9%
10	31.6%
11	32.6%
12	33.2%
13	33.7%
14	35.3%
15	38.0%
16	41.2%
17	44.4%
18	48.7%
19	56.7%
20	67.9%
21	73.3%
22	74.9%
23	75.9%
24	77.0%
25	79.1%
26	82.4%
27	85.6%
28	89.3%
29	94.7%
30	100.0%

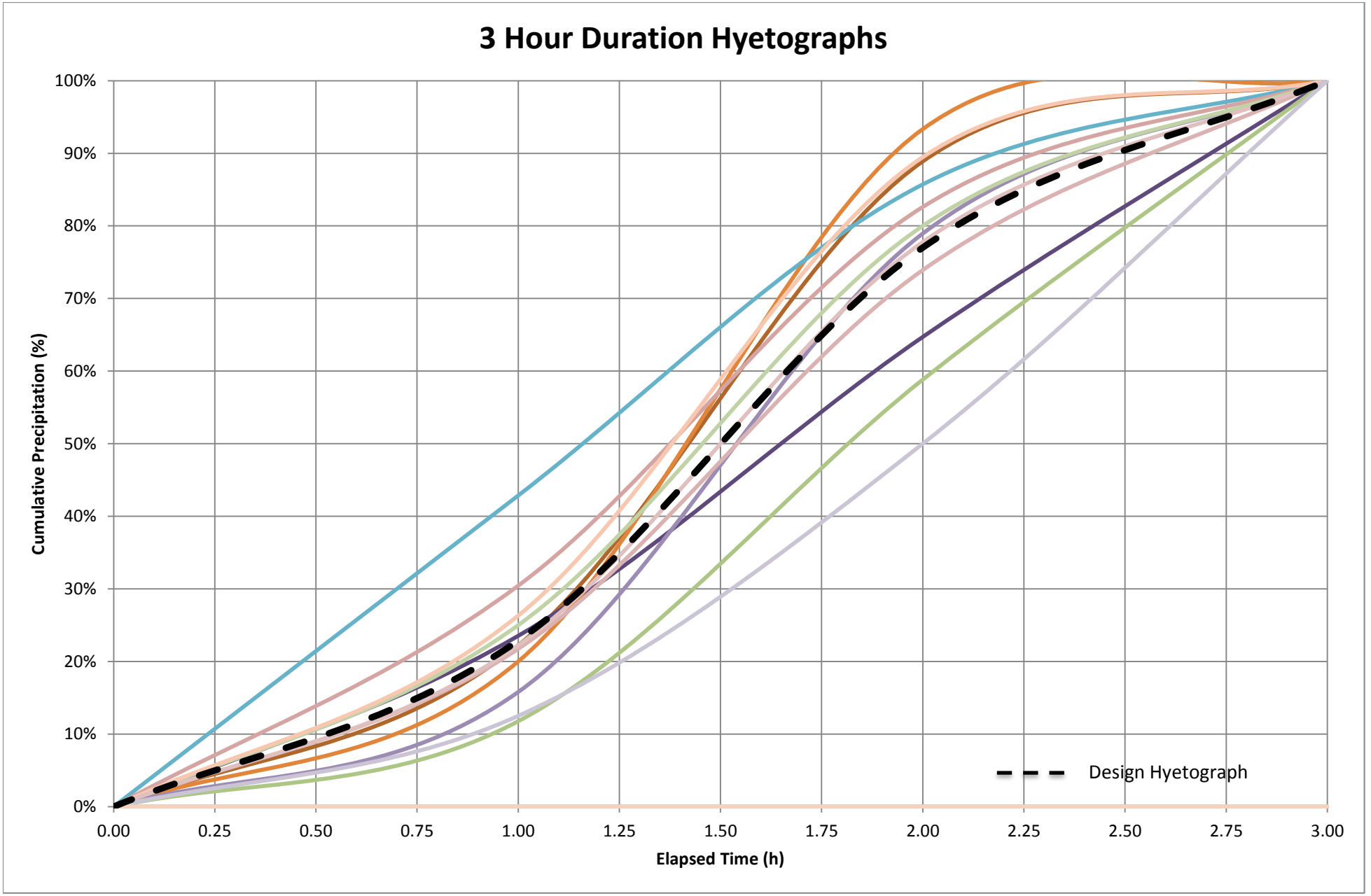
44 Hour

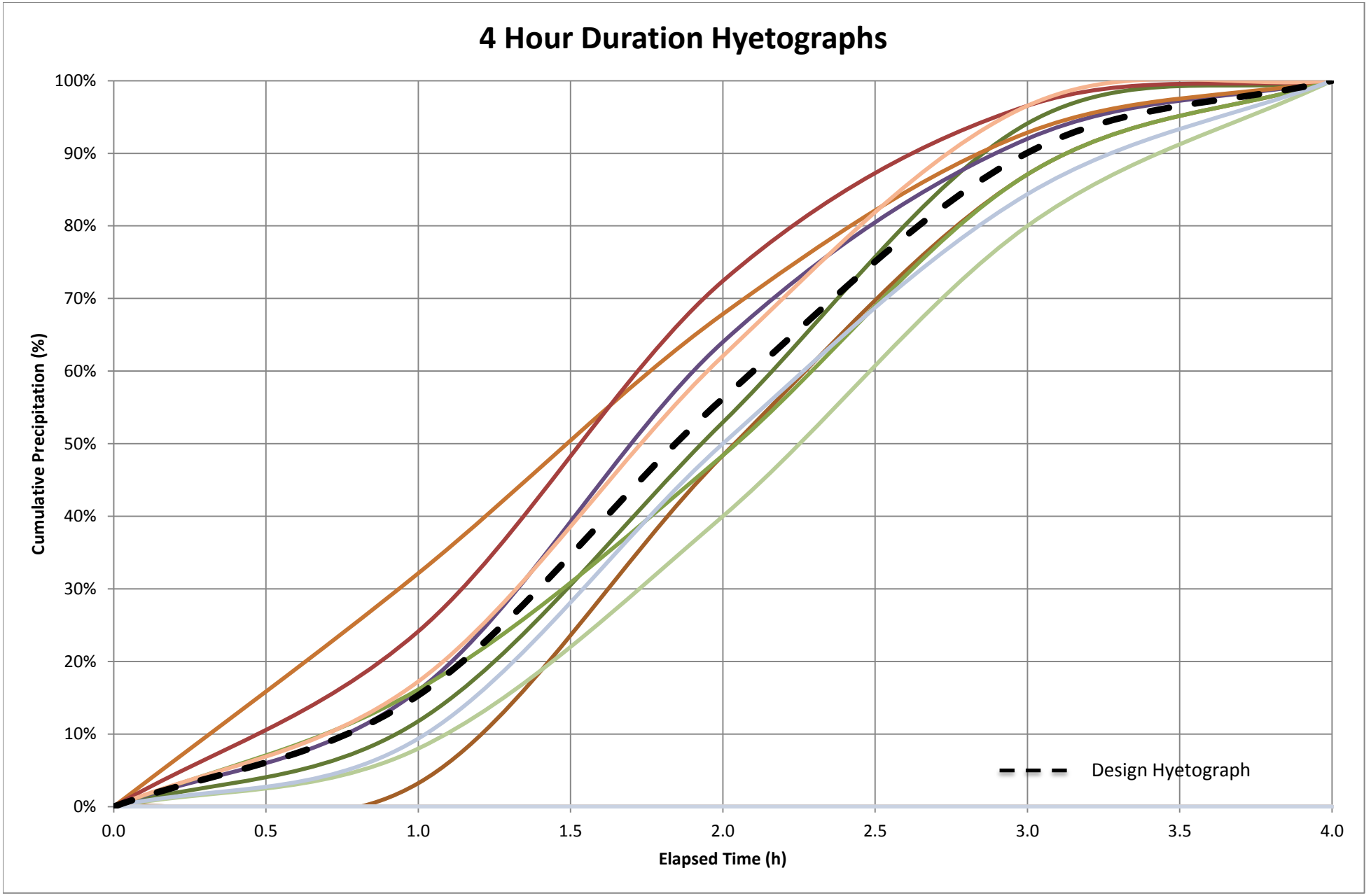
Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.3%
2	1.0%
3	2.9%
4	4.5%
5	6.2%
6	7.9%
7	10.5%
8	14.0%
9	18.4%
10	23.6%
11	24.7%
12	26.5%
13	29.0%
14	31.4%
15	35.4%
16	40.6%
17	43.9%
18	45.9%
19	47.9%
20	49.8%
21	51.8%
22	53.1%
23	53.6%
24	53.8%
25	54.0%
26	54.1%
27	54.2%
28	54.7%
29	56.7%
30	61.8%
31	68.9%
32	74.9%
33	79.2%
34	82.6%
35	85.6%
36	88.7%
37	91.2%
38	93.1%
39	94.7%
40	96.5%
41	98.0%
42	99.1%
43	99.9%
44	100.0%

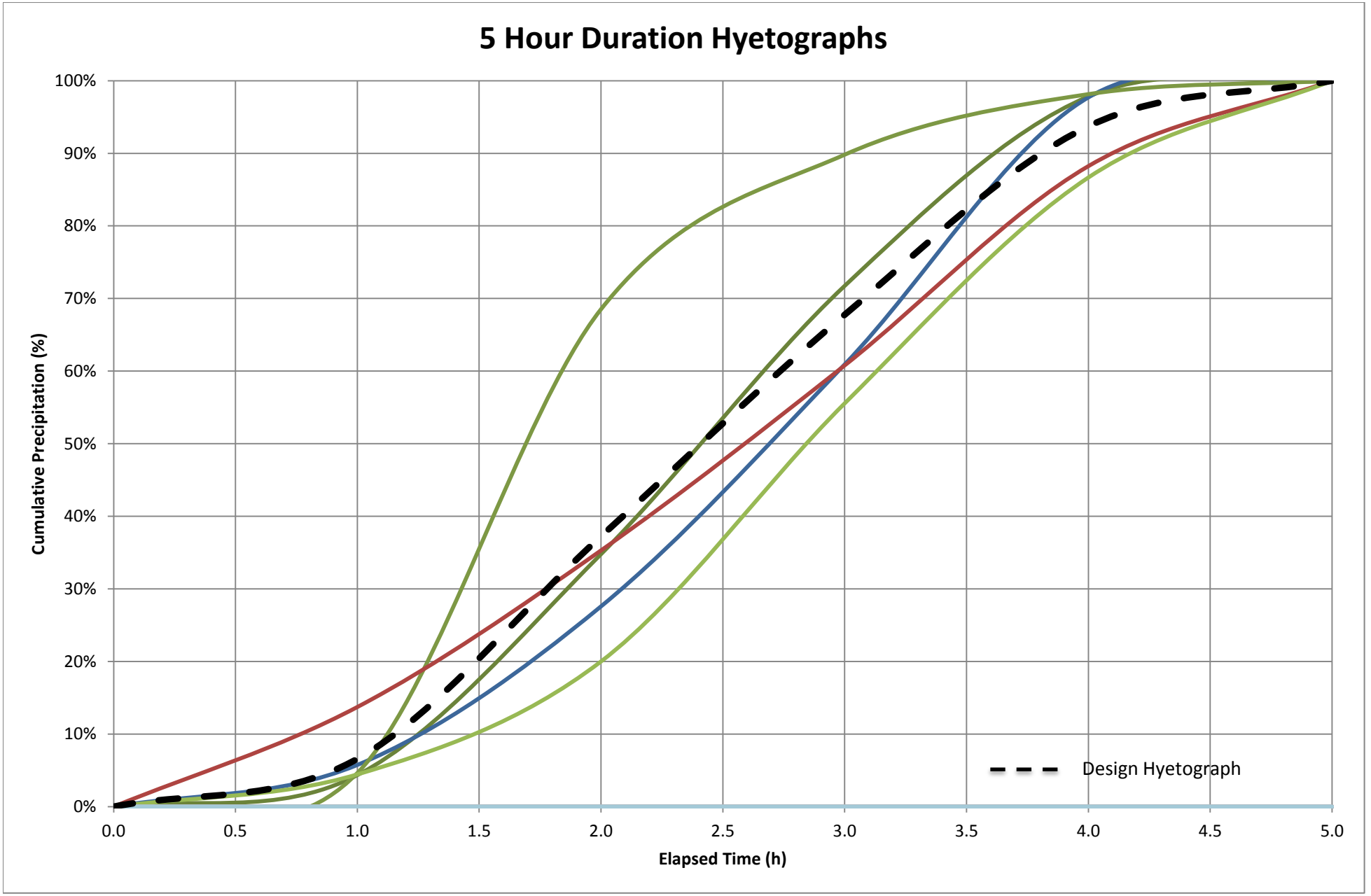
45 Hour

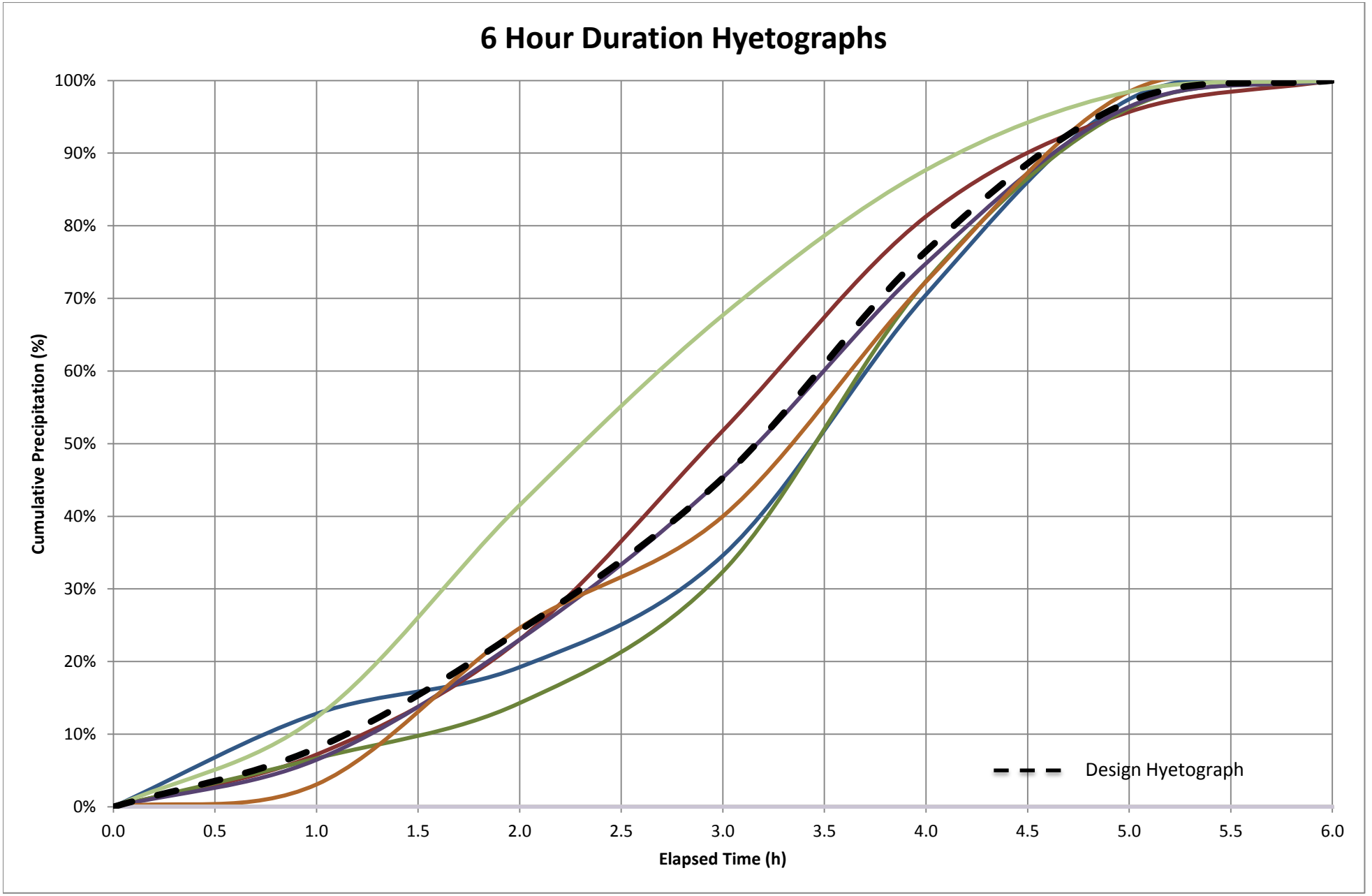
Design Hyetograph	
Hour	% Cum.
0	0.0%
1	0.3%
2	1.5%
3	5.4%
4	10.2%
5	14.8%
6	20.0%
7	25.2%
8	30.2%
9	35.4%
10	40.3%
11	42.0%
12	43.4%
13	45.2%
14	46.9%
15	48.9%
16	50.5%
17	51.4%
18	51.9%
19	52.5%
20	52.7%
21	52.8%
22	53.0%
23	53.1%
24	53.2%
25	53.5%
26	55.5%
27	60.0%
28	65.6%
29	70.1%
30	73.4%
31	76.3%
32	78.9%
33	81.7%
34	84.8%
35	88.3%
36	91.7%
37	93.0%
38	93.2%
39	93.4%
40	94.0%
41	95.1%
42	96.4%
43	98.0%
44	99.5%
45	100.0%

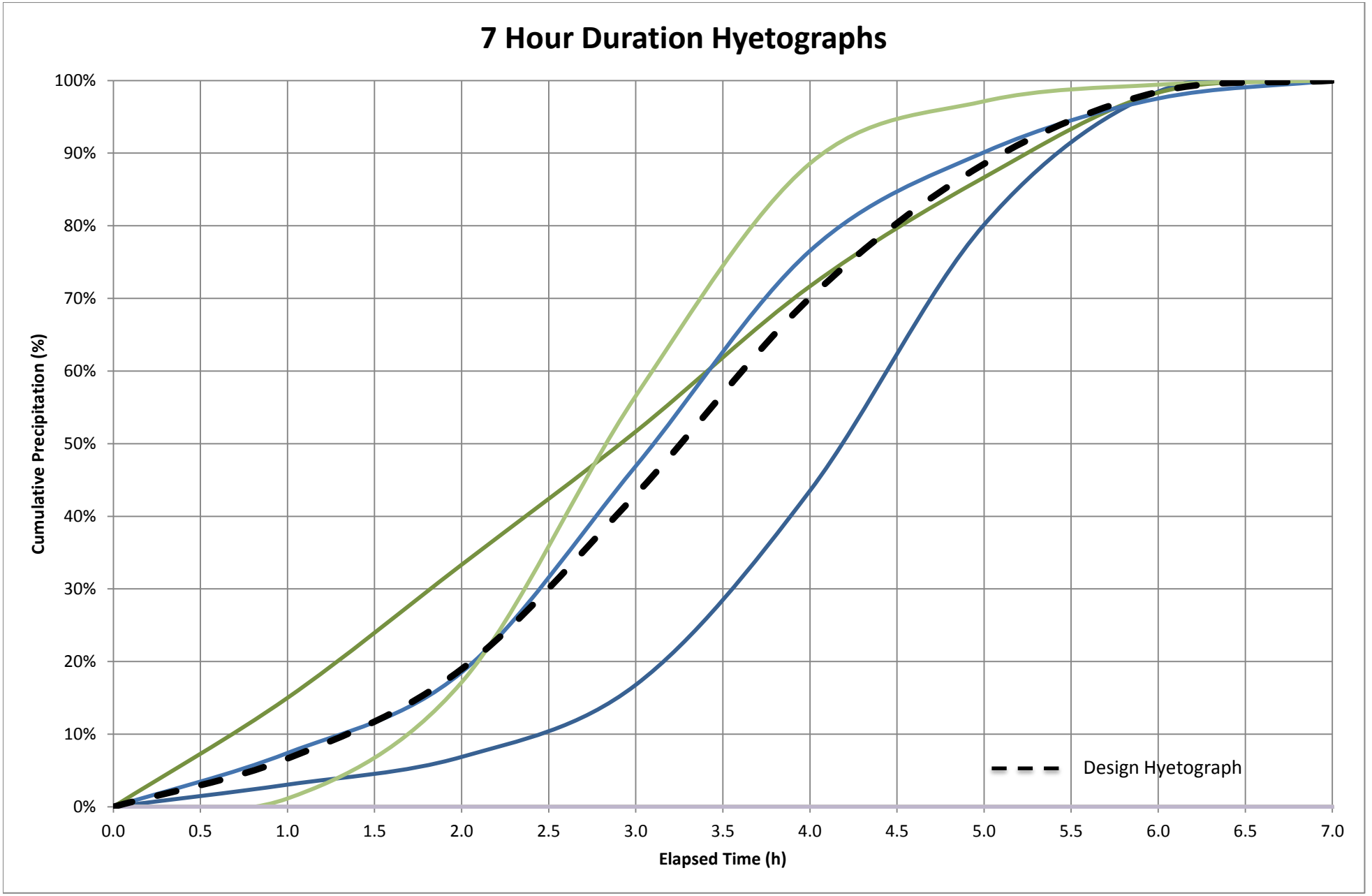

2 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Elapsed Time (h)
Design Hyetograph

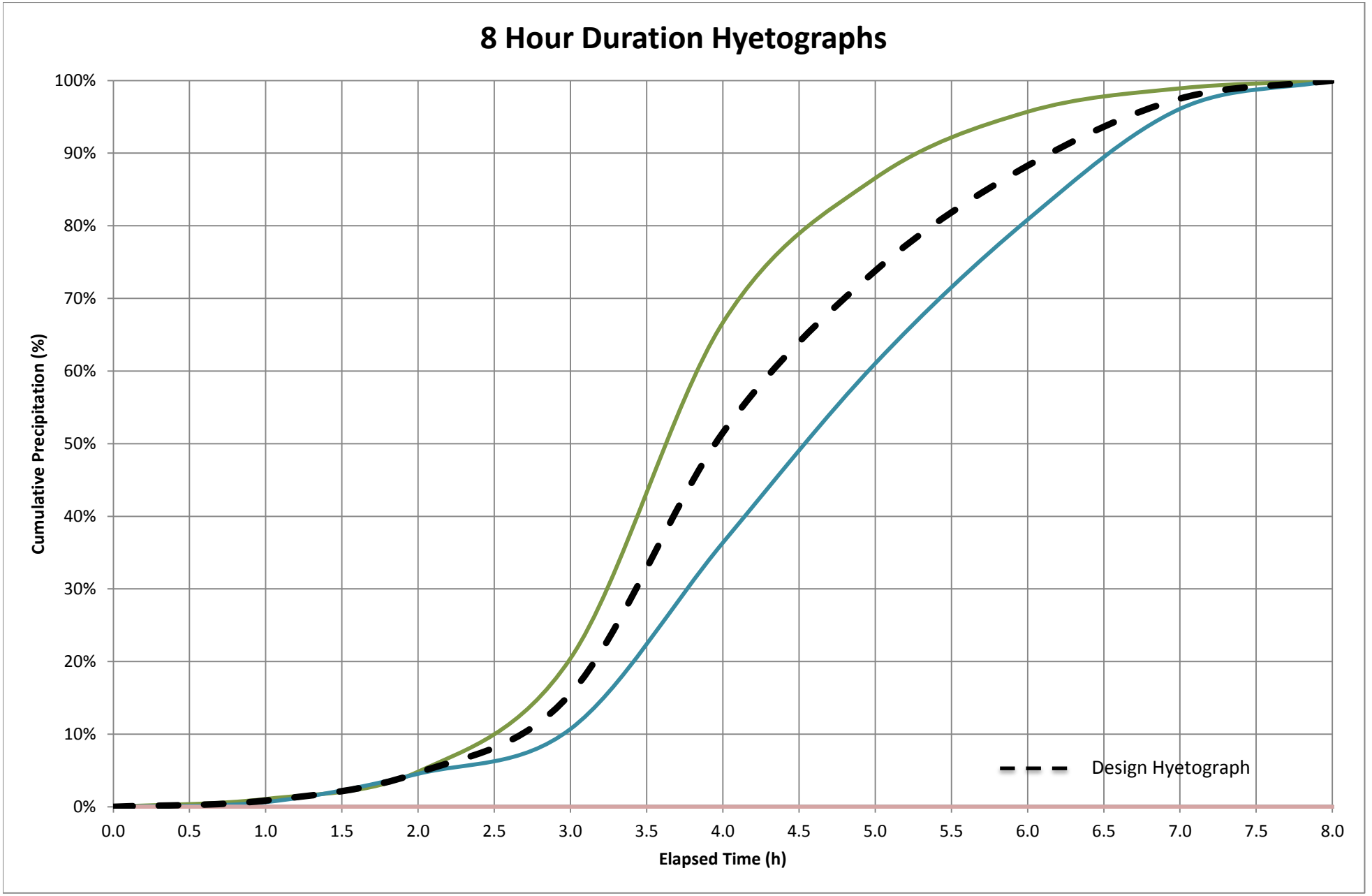

3 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
Elapsed Time (h)
Design Hyetograph

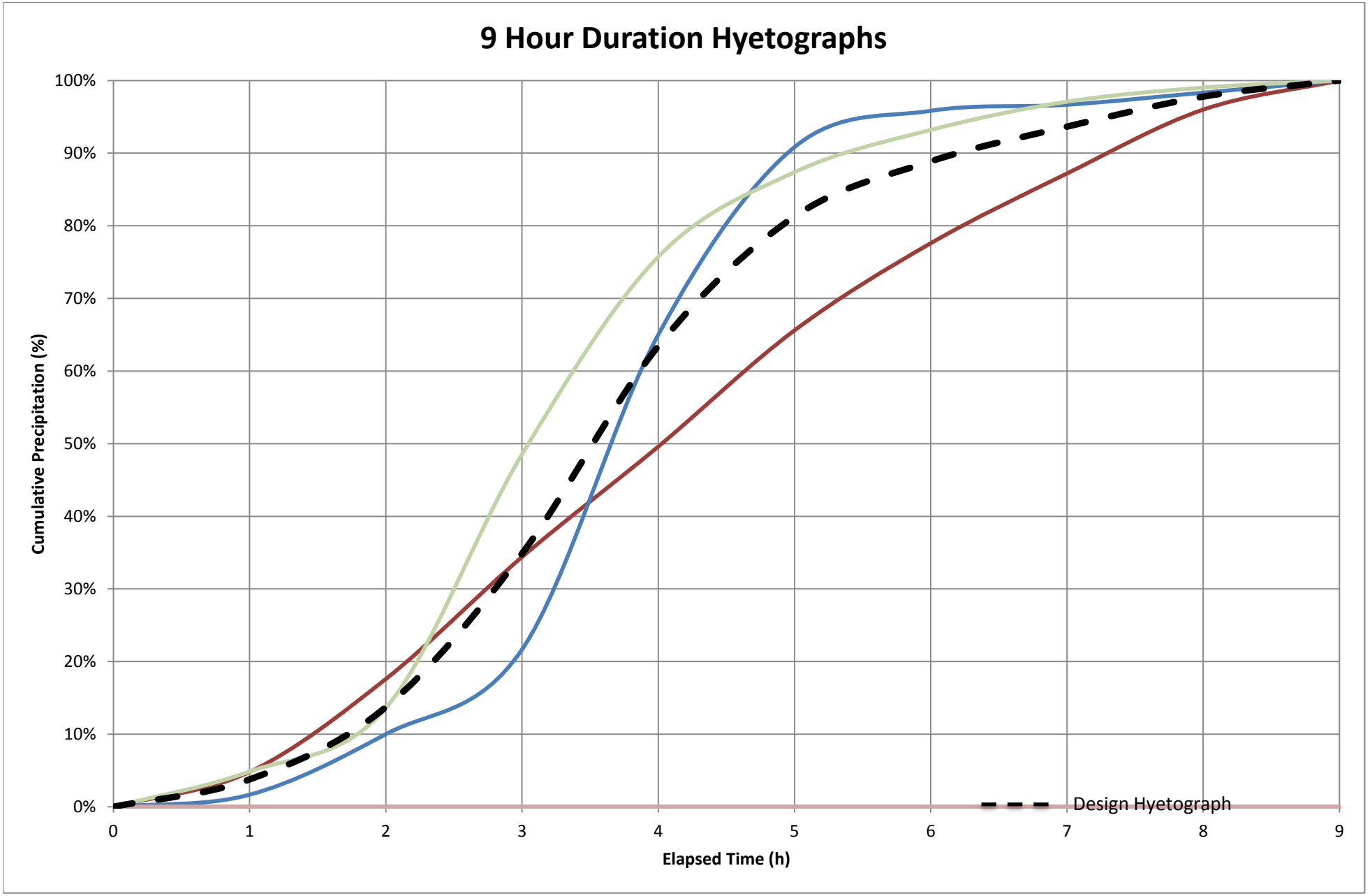

4 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Elapsed Time (h)
Design Hyetograph

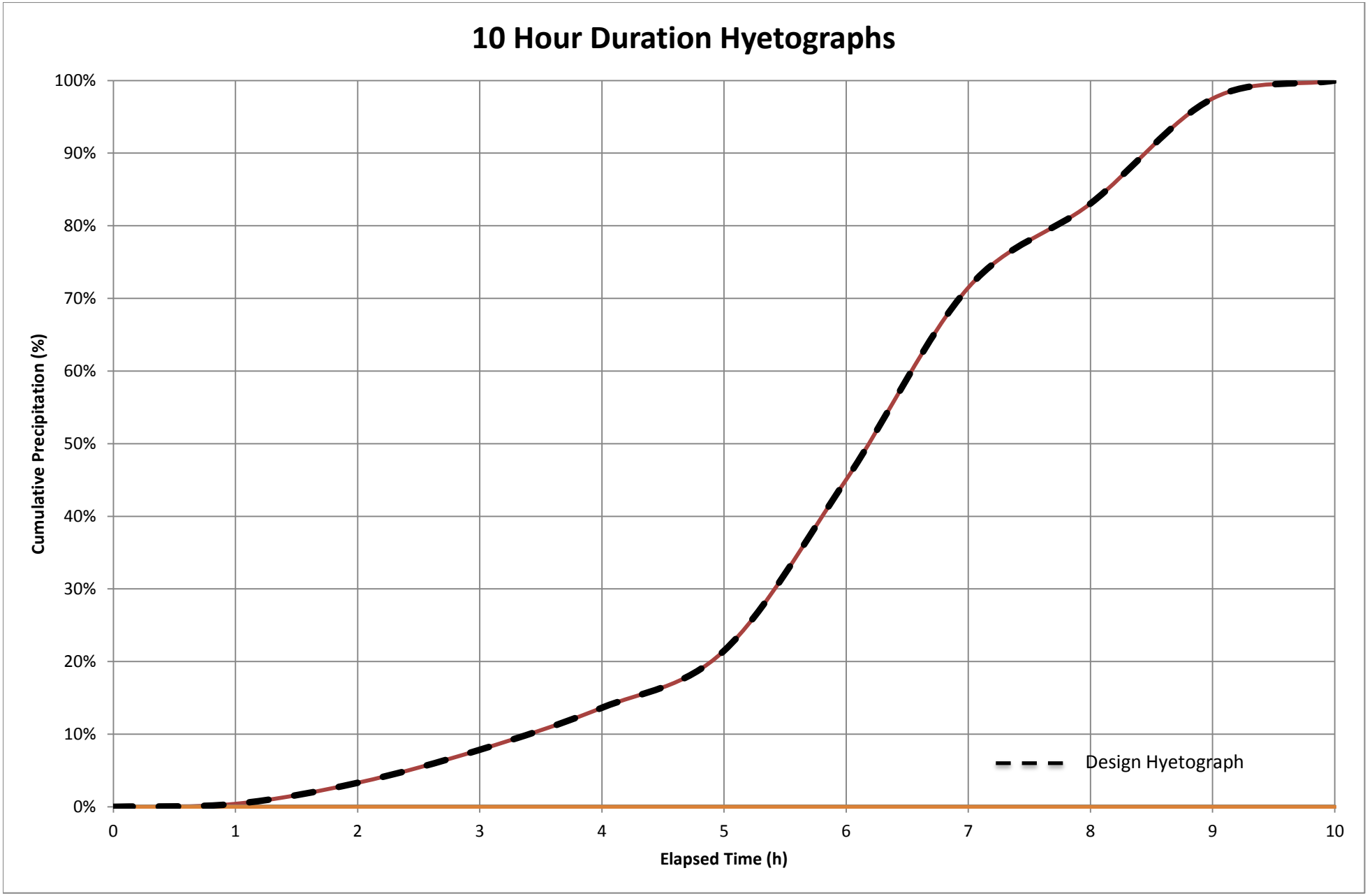

5 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (h)
Design Hyetograph

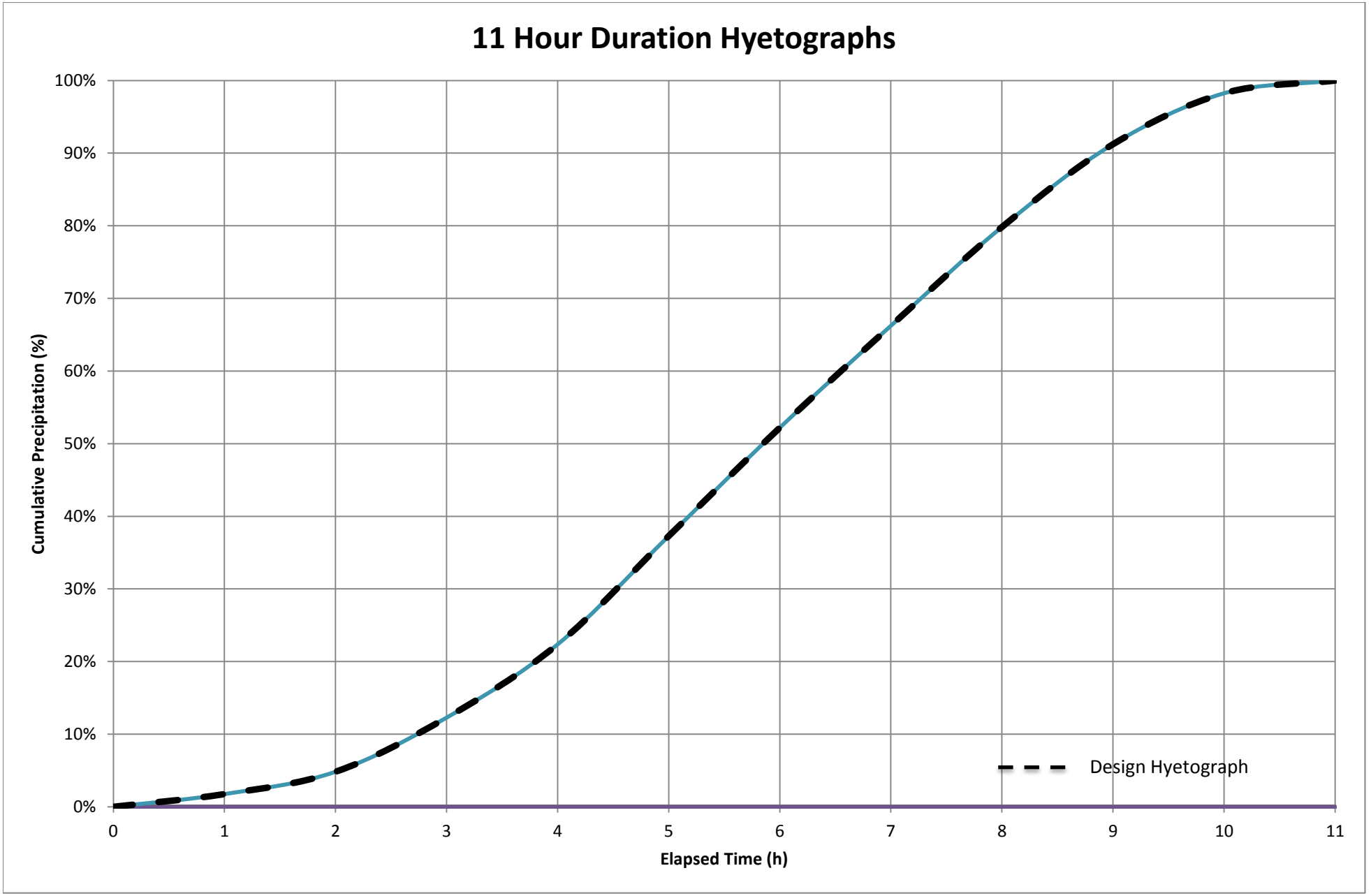

6 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Elapsed Time (h)
Design Hyetograph

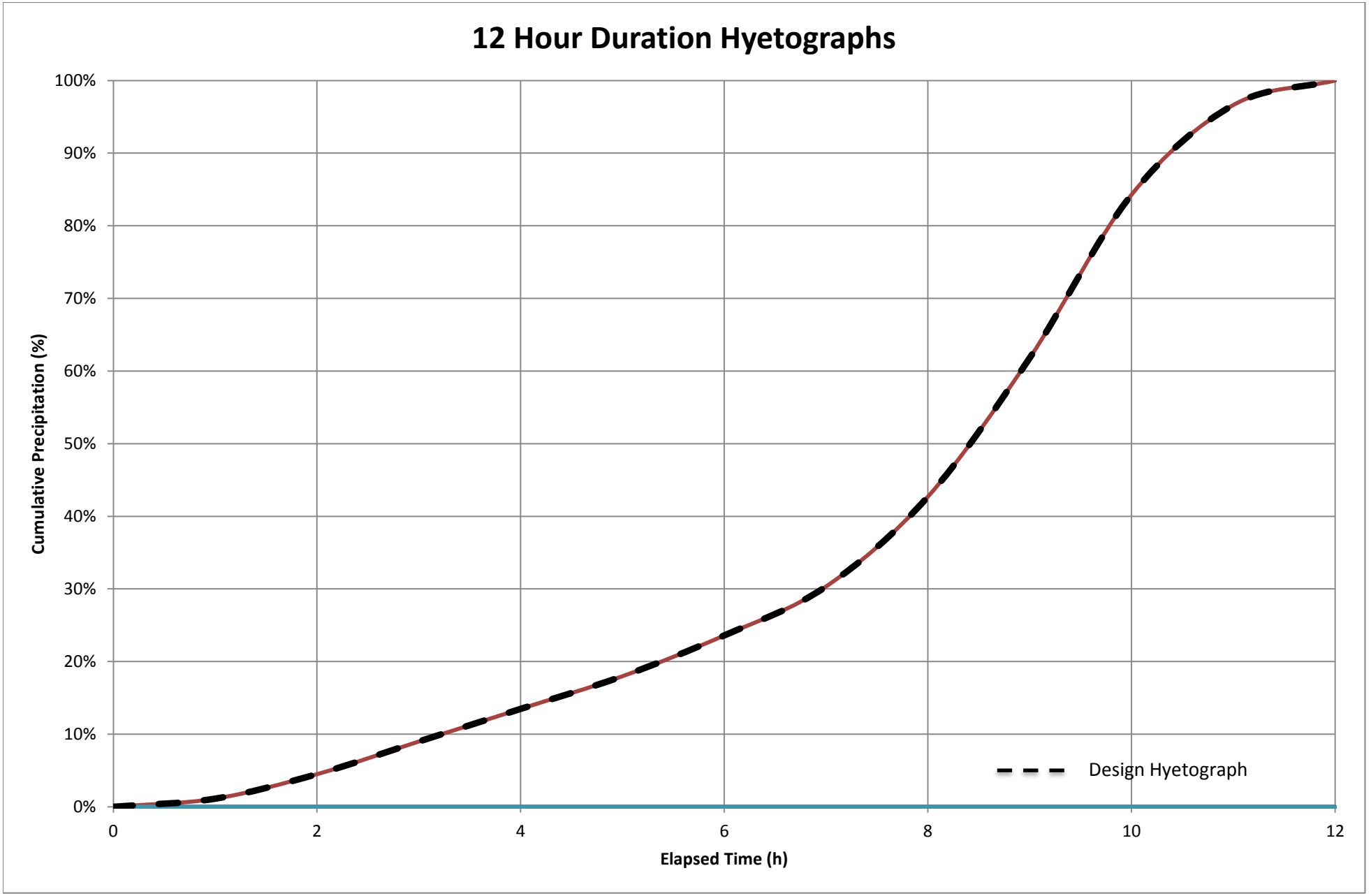

7 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
Elapsed Time (h)
Design Hyetograph

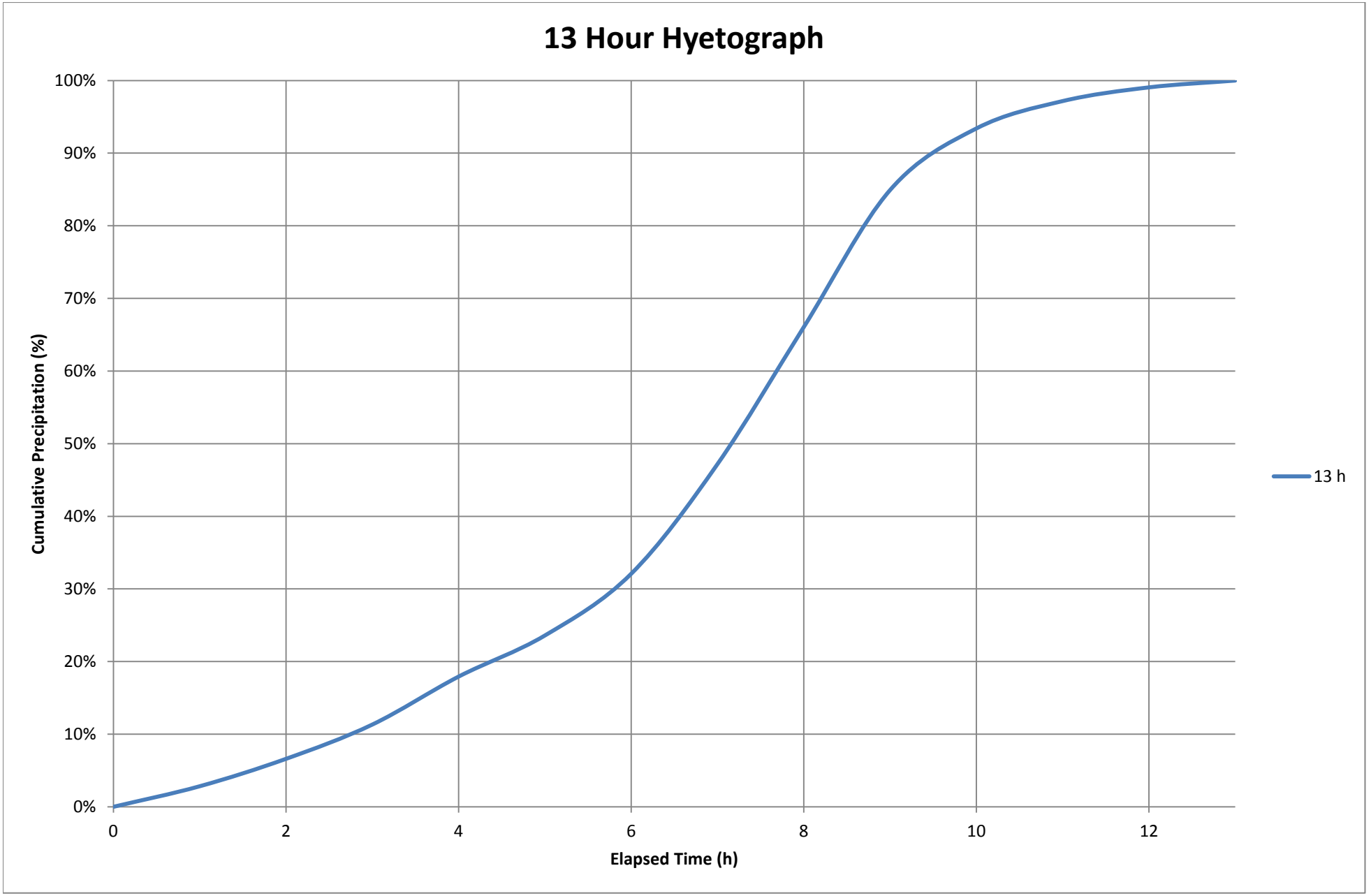

8 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
Elapsed Time (h)
Design Hyetograph

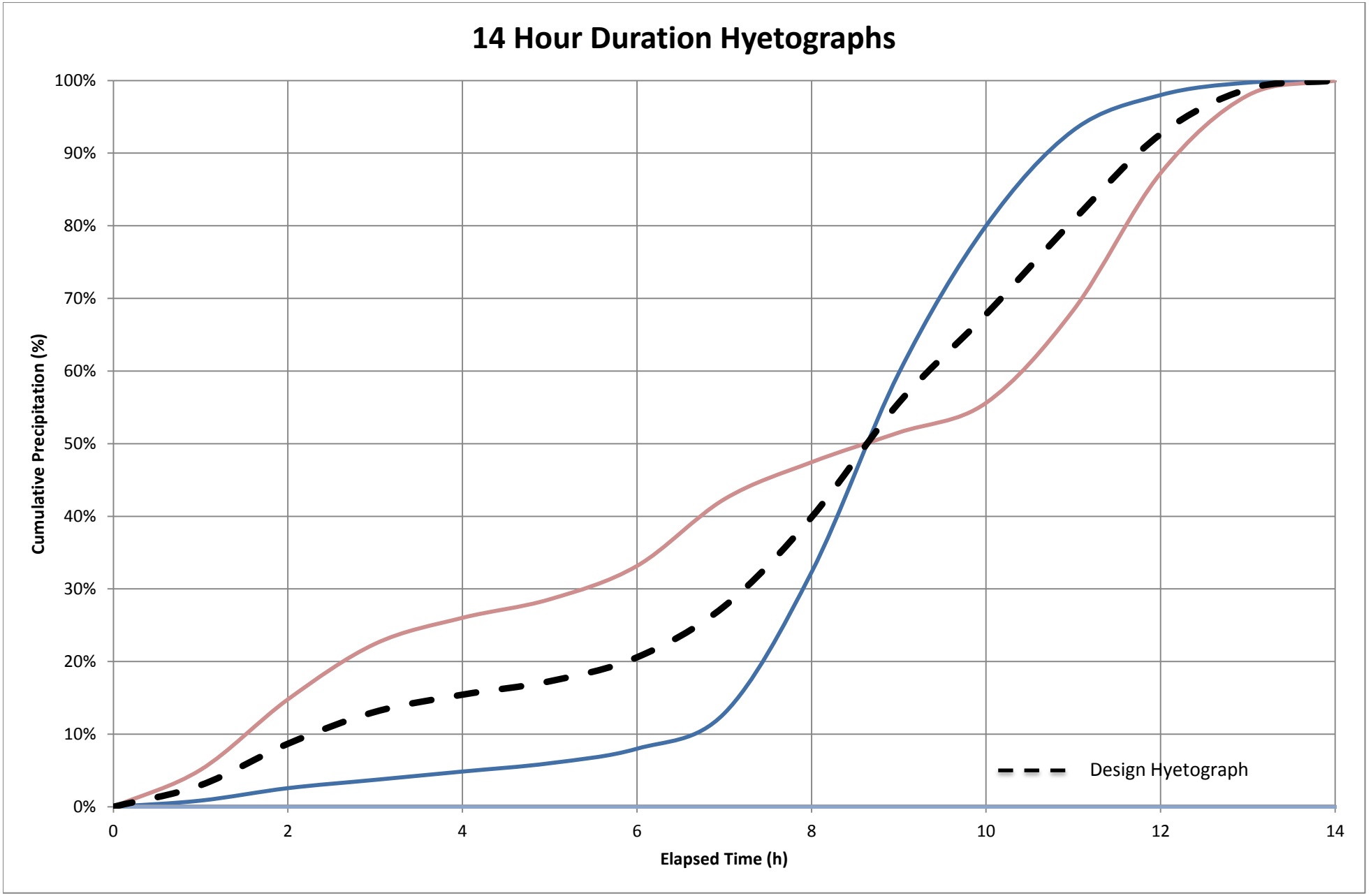

9 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
1
2
3
4
5
6
7
8
9
Elapsed Time (h)
Design Hyetograph

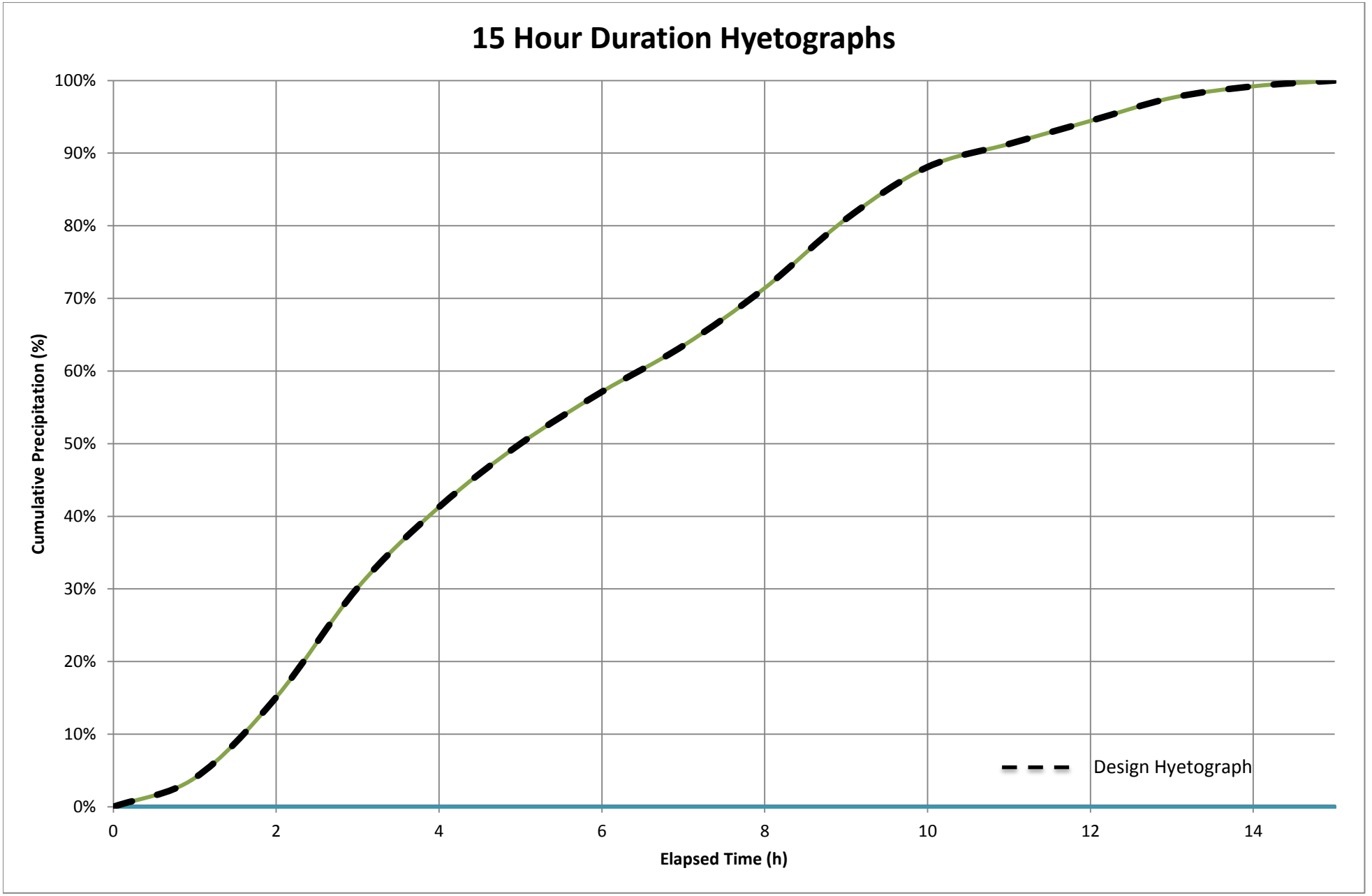

10 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
1
2
3
4
5
6
7
8
9
10
Elapsed Time (h)
Design Hyetograph

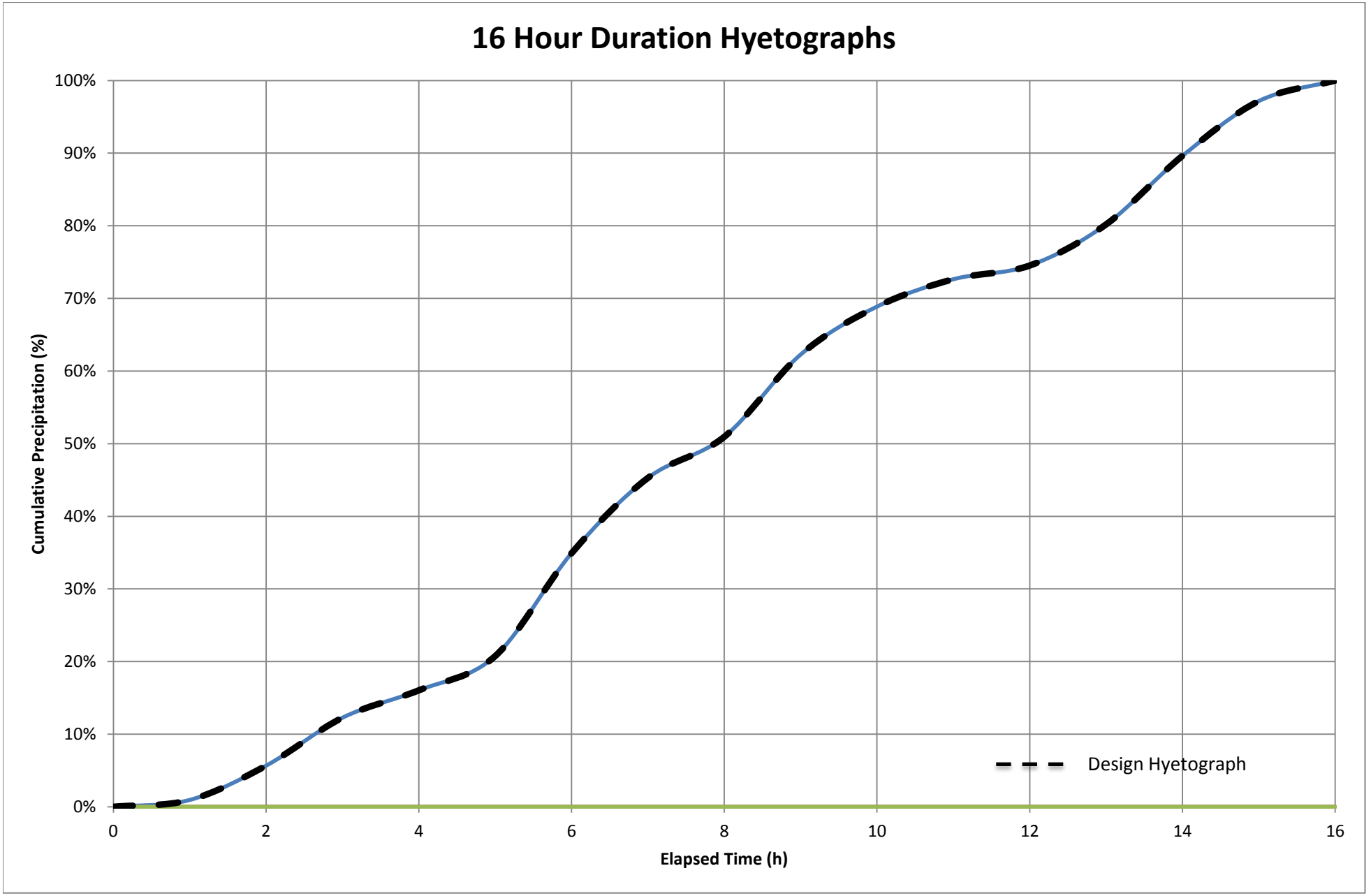

11 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
1
2
3
4
5
6
7
8
9
10
11
Elapsed Time (h)
Design Hyetograph

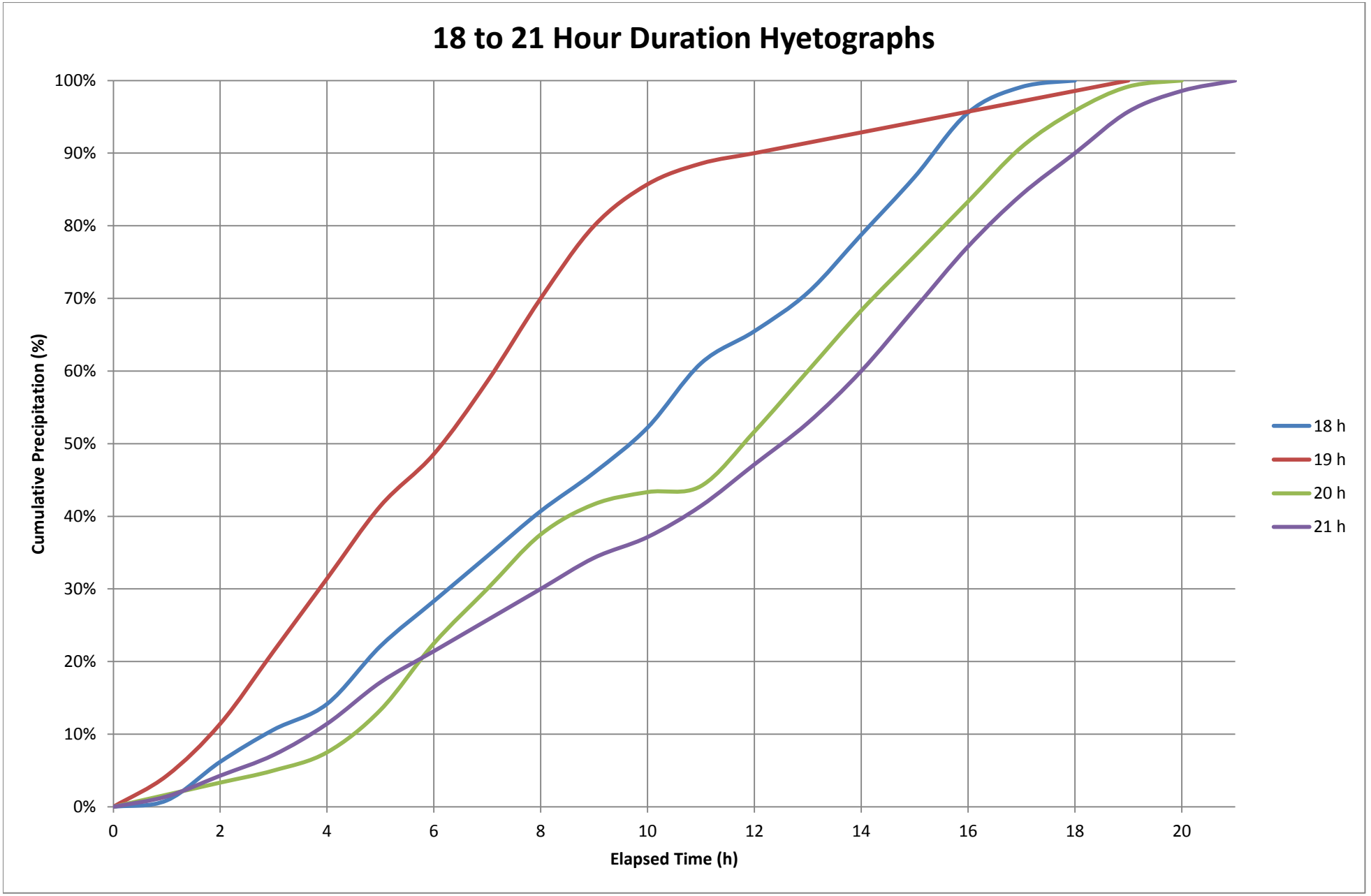

12 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
Elapsed Time (h)
Design Hyetograph

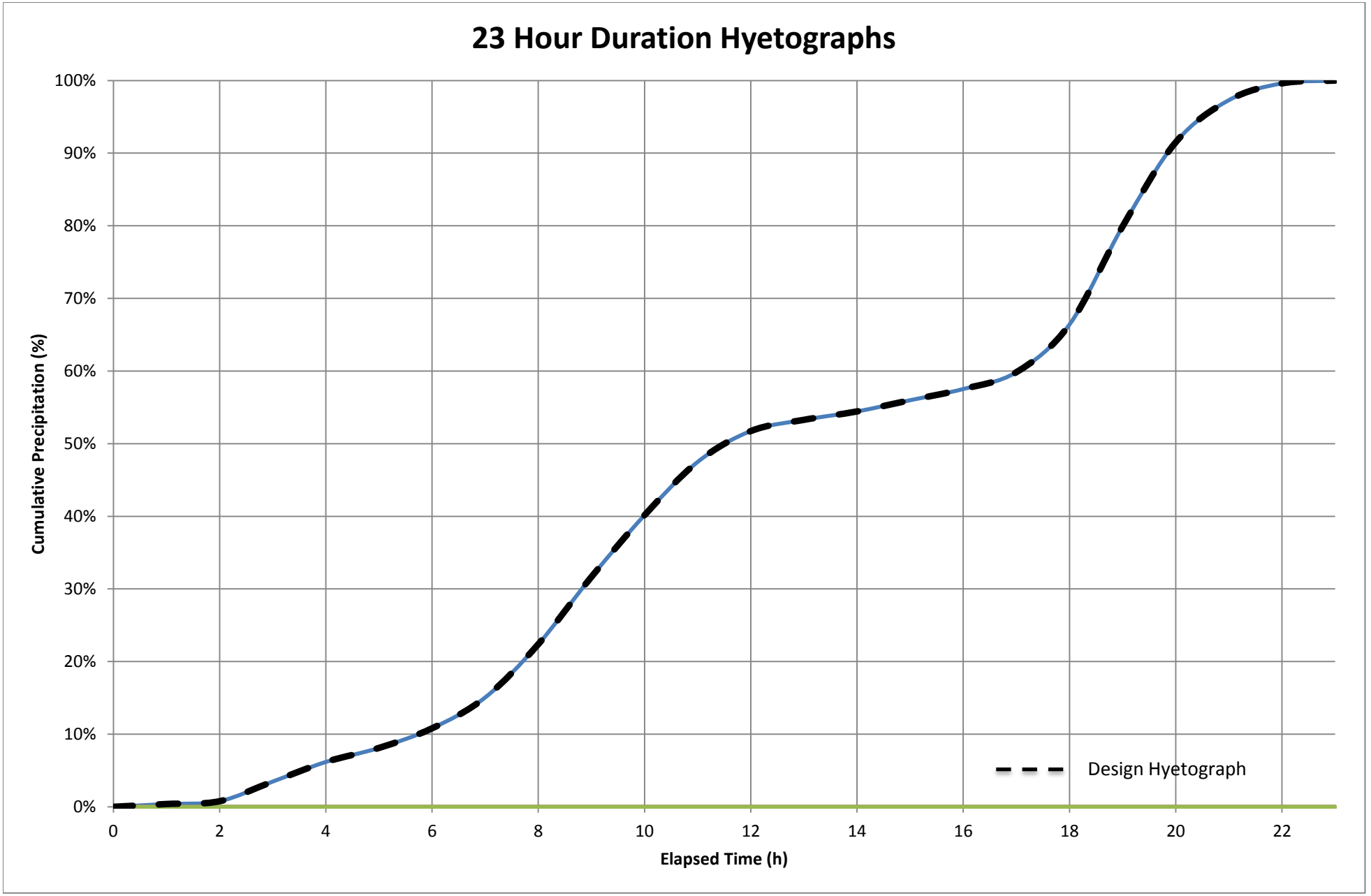

13 Hour Hyetograph
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
Elapsed Time (h)
13 h

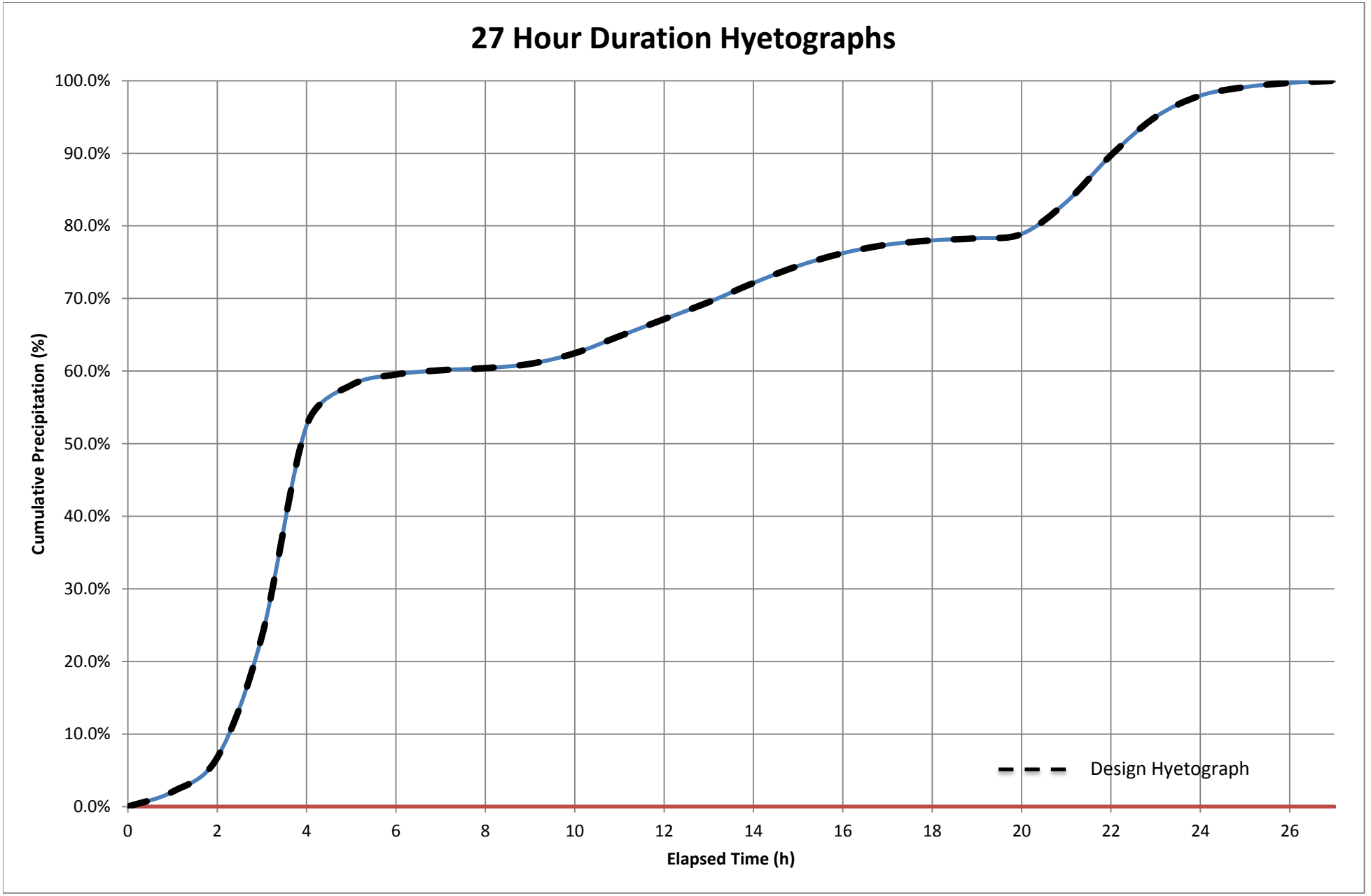

14 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
14
Elapsed Time (h)
Design Hyetograph

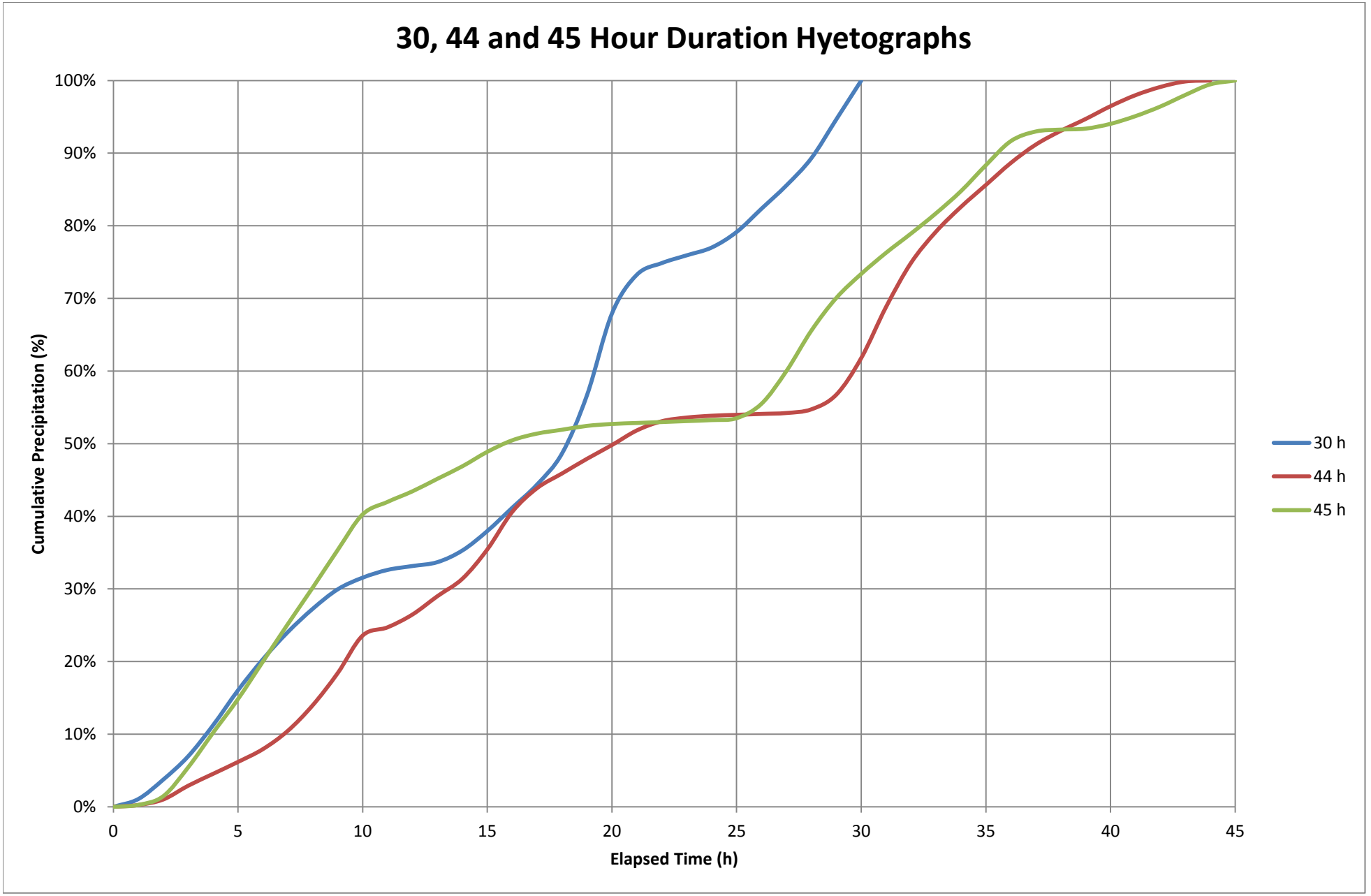

15 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
14
Elapsed Time (h)
Design Hyetograph


16 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
14
16
Elapsed Time (h)
Design Hyetograph


18 to 21 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
2
4
6
8
10
12
14
16
18
20
Elapsed Time (h)
18 h
19 h
20 h
21 h


23 Hour Duration Hyetographs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
14
16
18
20
22
Elapsed Time (h)
Design Hyetograph


27 Hour Duration Hyetographs
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Cumulative Precipitation (%)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Elapsed Time (h)
Design Hyetograph

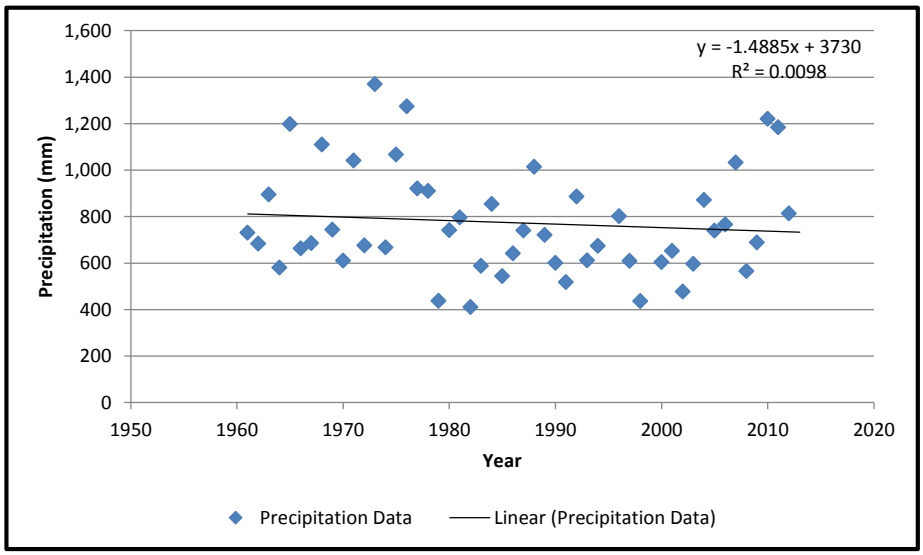

30, 44 and 45 Hour Duration Hyetographs
Cumulative Precipitation (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
5
10
15
20
25
30
35
40
45
Elapsed Time (h)
30 h
44 h
45 h

ATTACHMENT 2.6

Precipitation Trend Analysis

Climatic Trend Analysis: Monywa Township Precipitation (1961-2013)

Year	Precip (mm)
1961	731
1962	684
1963	896
1964	581
1965	1,198
1966	664
1967	686
1968	1,110
1969	744
1970	611
1971	1,042
1972	676
1973	1,370
1974	668
1975	1,067
1976	1,275
1977	921
1978	910
1979	438
1980	742
1981	797
1982	411
1983	588
1984	855
1985	544
1986	642
1987	741
1988	1,015
1989	722
1990	601
1991	518
1992	887
1993	612
1994	675
1995	Exclude
1996	802
1997	610
1998	437
1999	Exclude
2000	604
2001	653
2002	478
2003	597
2004	872
2005	740
2006	767
2007	1,032
2008	566
2009	689
2010	1,221
2011	1,184
2012	814
2013	Exclude



From the above, KP concludes that there is no statistically significant trend observable in annual precipitation values at this site.

ATTACHMENT 2.7

Water Balance Scenario Frequency Analysis

Precipitation Frequency Analysis, 5 Year Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 39

5 Year Data		Rank	Weibull	ARI	Ranked
Years	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	5 yr Wet Precip (mm)
1961 - 1965	4090.0	1	0.025	40.00	5301.0
1962 - 1966	4023.0	2	0.050	20.00	5056.0
1963 - 1967	4025.0	3	0.075	13.33	4841.0
1964 - 1968	4239.0	4	0.100	10.00	4823.0
1965 - 1969	4402.0	5	0.125	8.00	4693.0
1966 - 1970	3815.0	6	0.150	6.67	4611.0
1967 - 1971	4193.0	7	0.175	5.71	4474.2
1968 - 1972	4183.0	8	0.200	5.00	4443.0
1969 - 1973	4443.0	9	0.225	4.44	4402.0
1970 - 1974	4367.0	10	0.250	4.00	4367.0
1971 - 1975	4823.0	11	0.275	3.64	4286.0
1972 - 1976	5056.0	12	0.300	3.33	4275.6
1973 - 1977	5301.0	13	0.325	3.08	4239.0
1974 - 1978	4841.0	14	0.350	2.86	4193.0
1975 - 1979	4611.0	15	0.375	2.67	4183.0
1976 - 1980	4286.0	16	0.400	2.50	4090.0
1977 - 1981	3808.0	17	0.425	2.35	4025.0
1978 - 1982	3298.0	18	0.450	2.22	4023.0
1979 - 1983	2976.0	19	0.475	2.11	4008.1
1980 - 1984	3393.0	20	0.500	2.00	3976.9
1981 - 1985	3195.0	21	0.525	1.90	3815.0
1982 - 1986	3040.0	22	0.550	1.82	3808.0
1983 - 1987	3370.0	23	0.575	1.74	3797.0
1984 - 1988	3797.0	24	0.600	1.67	3794.6
1985 - 1989	3664.0	25	0.625	1.60	3743.0
1986 - 1990	3721.0	26	0.650	1.54	3721.0
1987 - 1991	3597.0	27	0.675	1.48	3664.0
1988 - 1992	3743.0	28	0.700	1.43	3597.0
1989 - 1993	3340.0	29	0.725	1.38	3453.9
1990 - 1994	3292.6	30	0.750	1.33	3393.0
1991 - 1995	Exclude	31	0.775	1.29	3370.0
1992 - 1996	Exclude	32	0.800	1.25	3340.4
1993 - 1997	Exclude	33	0.825	1.21	3340.0
1994 - 1998	Exclude	34	0.850	1.18	3298.0
1995 - 1999	Exclude	35	0.875	1.14	3292.6
1996 - 2000	Exclude	36	0.900	1.11	3204.7
1997 - 2001	Exclude	37	0.925	1.08	3195.0
1998 - 2002	Exclude	38	0.950	1.05	3040.0
1999 - 2003	Exclude	39	0.975	1.03	2976.0
2000 - 2004	3204.7				
2001 - 2005	3340.4				
2002 - 2006	3453.9				
2003 - 2007	4008.1				
2004 - 2008	3976.9				
2005 - 2009	3794.6				
2006 - 2010	4275.6				
2007 - 2011	4693.0				
2008 - 2012	4474.2				
2009 - 2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Wakeby	1	1	1
Johnson SB	3	2	6
Gen. Extreme Value	6	3	18
Error	5	5	25
Nakagami	9	4	36
Weibull (3P)	8	7	56
Rayleigh (2P)	7	10	70
Beta	2	41	82
Gamma	15	6	90
Log-Pearson 3	18	9	162

Three fits were selected for comparison:

1) **Johnson SB** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

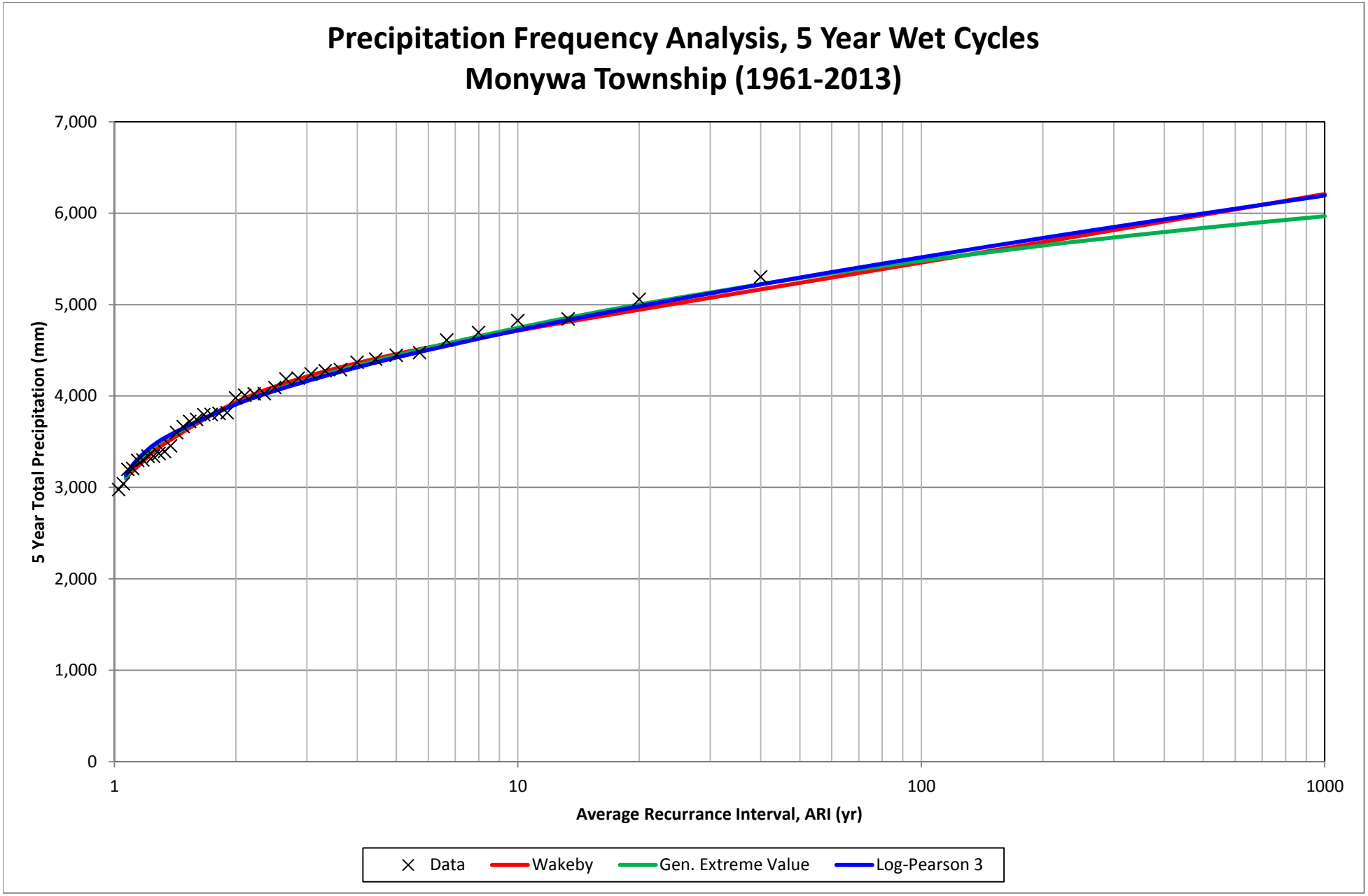
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

Any 5 year series including 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 5 Year Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 5 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Wakeby		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	α =	1911.522	k =	-0.16718292	α =	2422.254636
			β =	1.802226	σ =	549.6462521	β =	0.002964861
			γ =	302.7783	μ =	3714.507579	γ =	1.090119469
			δ =	0.012517				
			ξ =	2963.906				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	6209.2	N/A	5966.2	592.61	6192.9	581.77
0.998	0.002	500	5981.3	N/A	5838.8	592.61	5996.6	581.77
0.996	0.004	250	5755.4	N/A	5695.6	592.61	5794.8	581.77
0.995	0.005	200	5683.1	N/A	5645.8	592.61	5728.4	581.77
0.990	0.010	100	5459.6	N/A	5478.5	592.61	5517.0	581.77
0.980	0.020	50	5237.6	N/A	5289.9	592.61	5295.5	581.77
0.950	0.050	20	4944.0	N/A	5001.3	592.61	4981.4	581.77
0.900	0.100	10	4715.1	N/A	4745.4	592.61	4719.2	581.77
0.800	0.200	5	4458.5	N/A	4443.7	592.61	4421.7	581.77
0.667	0.333	3	4213.6	N/A	4175.6	592.61	4162.8	581.77
0.500	0.500	2.0	3931.2	N/A	3909.9	592.61	3908.0	581.77
0.250	0.750	1.3	3480.3	N/A	3530.0	592.61	3543.3	581.77
0.125	0.875	1.14	3231.2	N/A	3286.5	592.61	3308.5	581.77
0.063	0.937	1.07	3101.0	N/A	3105.2	592.61	3133.3	581.77
Kolmogorov Smirnov (Statistic, Rank)			0.0563	1	0.0822	6	0.0916	18
Anderson Darling (Statistic, Rank)			0.1431	1	0.2045	3	0.2438	9


Precipitation Frequency Analysis, 5 Year Wet Cycles
Monywa Township (1961-2013)
5 Year Total Precipitation (mm)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 4 Year Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 41

4 Year Data		Rank	Weibull	ARI	Ranked
Years	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	4 yr Wet Precip (mm)
1961 - 1964	2892.0	1	0.024	42.00	4380.0
1962 - 1965	3359.0	2	0.048	21.00	4173.0
1963 - 1966	3339.0	3	0.071	14.00	3931.0
1964 - 1967	3129.0	4	0.095	10.50	3908.0
1965 - 1968	3658.0	5	0.119	8.40	3781.0
1966 - 1969	3204.0	6	0.143	7.00	3756.0
1967 - 1970	3151.0	7	0.167	6.00	3699.0
1968 - 1971	3507.0	8	0.190	5.25	3660.5
1969 - 1972	3073.0	9	0.214	4.67	3658.0
1970 - 1973	3699.0	10	0.238	4.20	3544.0
1971 - 1974	3756.0	11	0.262	3.82	3508.8
1972 - 1975	3781.0	12	0.286	3.50	3507.0
1973 - 1976	4380.0	13	0.310	3.23	3410.7
1974 - 1977	3931.0	14	0.333	3.00	3359.0
1975 - 1978	4173.0	15	0.357	2.80	3339.0
1976 - 1979	3544.0	16	0.381	2.63	3204.0
1977 - 1980	3011.0	17	0.405	2.47	3151.0
1978 - 1981	2887.0	18	0.429	2.33	3129.0
1979 - 1982	2388.0	19	0.452	2.21	3120.0
1980 - 1983	2538.0	20	0.476	2.10	3105.4
1981 - 1984	2651.0	21	0.500	2.00	3079.0
1982 - 1985	2398.0	22	0.524	1.91	3073.0
1983 - 1986	2629.0	23	0.548	1.83	3054.7
1984 - 1987	2782.0	24	0.571	1.75	3011.0
1985 - 1988	2942.0	25	0.595	1.68	2975.7
1986 - 1989	3120.0	26	0.619	1.62	2942.0
1987 - 1990	3079.0	27	0.643	1.56	2892.0
1988 - 1991	2856.0	28	0.667	1.50	2887.0
1989 - 1992	2728.0	29	0.690	1.45	2856.0
1990 - 1993	2618.0	30	0.714	1.40	2782.0
1991 - 1994	2691.6	31	0.738	1.35	2728.0
1992 - 1995	Exclude	32	0.762	1.31	2691.6
1993 - 1996	Exclude	33	0.786	1.27	2687.1
1994 - 1997	Exclude	34	0.810	1.24	2651.0
1995 - 1998	Exclude	35	0.833	1.20	2629.0
1996 - 1999	Exclude	36	0.857	1.17	2618.0
1997 - 2000	Exclude	37	0.881	1.14	2600.5
1998 - 2001	Exclude	38	0.905	1.11	2538.0
1999 - 2002	Exclude	39	0.929	1.08	2398.0
2000 - 2003	2333.2	40	0.952	1.05	2388.0
2001 - 2004	2600.5				
2002 - 2005	2687.1				
2003 - 2006	2975.7				
2004 - 2007	3410.7				
2005 - 2008	3105.4				
2006 - 2009	3054.7				
2007 - 2010	3508.8				
2008 - 2011	3660.5				
2009 - 2012	3908.0				
2010 - 2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Wakeby	1	2	2
Johnson SB	3	1	3
Gen. Extreme Value	4	4	16
Weibull (3P)	6	3	18
Rayleigh (2P)	10	6	60
Gamma (3P)	12	5	60
Log-Pearson 3	8	9	72
Erlang (3P)	7	11	77
Fatigue Life (3P)	13	7	91
Gen. Pareto	2	51	102

Three fits were selected for comparison:

1) **Wakeby** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

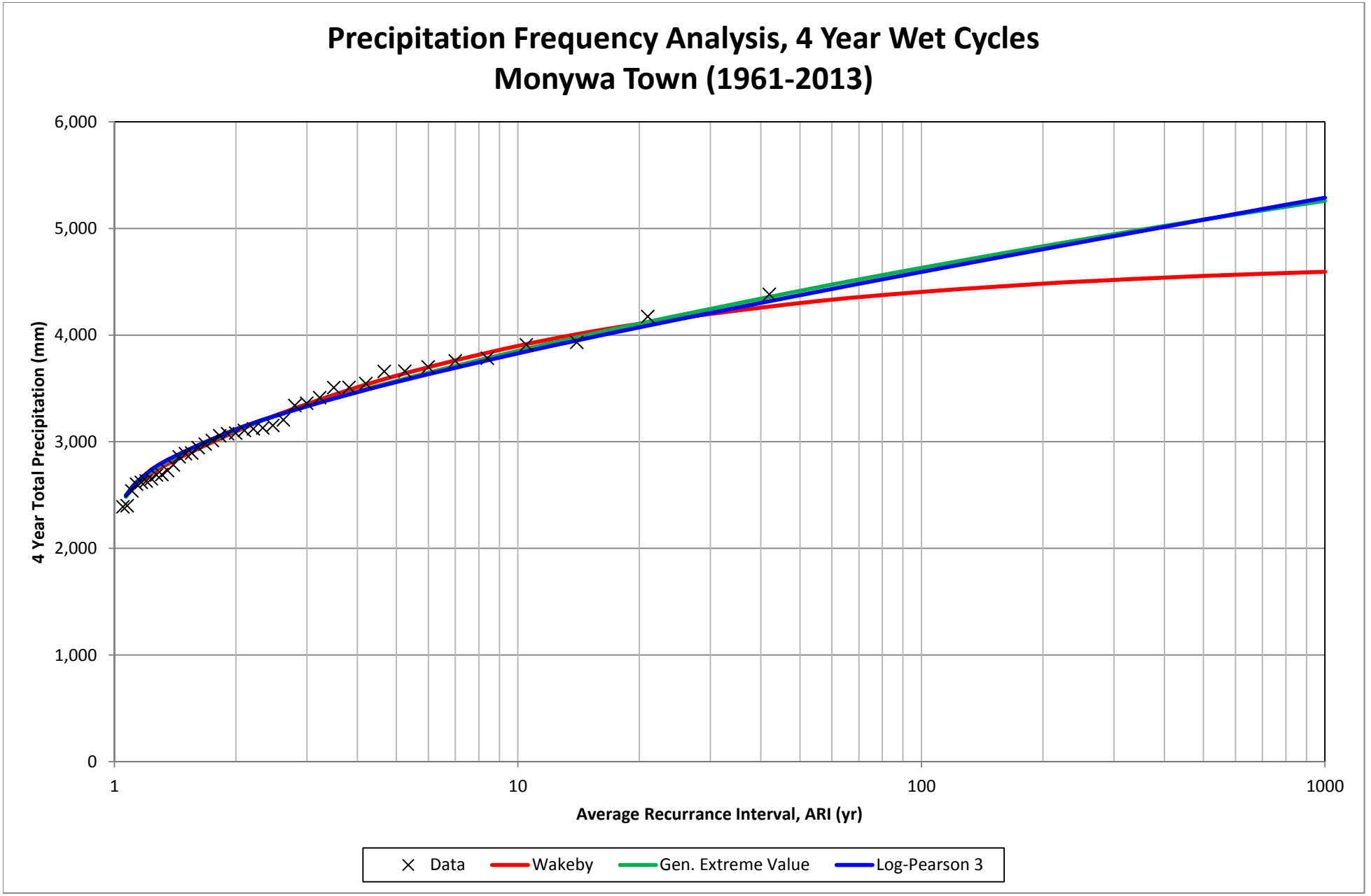
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

Any 4 year series including 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 4 Year Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 4 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Wakeby		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	α =	2021.286	k =	-0.083376416	α =	84.55063094
			β =	9.582717	σ =	439.7441449	β =	0.016726578
			γ =	927.1087	μ =	2950.042696	γ =	6.635654783
			δ =	-0.42826				
			ξ =	2330.035				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	4593.4	N/A	5259.1	511.81	5287.9	499.12
0.998	0.002	500	4554.6	N/A	5082.6	511.81	5081.2	499.12
0.996	0.004	250	4502.3	N/A	4895.4	511.81	4872.7	499.12
0.995	0.005	200	4481.9	N/A	4832.7	511.81	4804.9	499.12
0.990	0.010	100	4404.5	N/A	4630.2	511.81	4592.1	499.12
0.980	0.020	50	4300.4	N/A	4414.7	511.81	4373.9	499.12
0.950	0.050	20	4105.7	N/A	4107.0	511.81	4072.6	499.12
0.900	0.100	10	3898.2	N/A	3852.3	511.81	3828.5	499.12
0.800	0.200	5	3619.2	N/A	3570.1	511.81	3559.8	499.12
0.667	0.333	3	3354.0	N/A	3332.9	511.81	3332.9	499.12
0.500	0.500	2.0	3096.7	N/A	3108.8	511.81	3116.1	499.12
0.250	0.750	1.3	2778.5	N/A	2804.4	511.81	2816.8	499.12
0.125	0.875	1.14	2602.6	N/A	2618.1	511.81	2631.0	499.12
0.063	0.937	1.07	2487.4	N/A	2483.4	511.81	2495.9	499.12
Kolmogorov Smirnov (Statistic, Rank)			0.0616	1	0.0693	4	0.0733	8
Anderson Darling (Statistic, Rank)			0.1472	2	0.2029	4	0.2365	9


Precipitation Frequency Analysis, 4 Year Wet Cycles
Monywa Town (1961-2013)
4 Year Total Precipitation (mm)
6,000
5,000
4,000
3,000
2,000
1,000
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 3 Year Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 44

3 Year Data		Rank	Weibull	ARI	Ranked
Years	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	3 yr Wet Precip (mm)
1961 - 1963	2311.0	1	0.022	45.00	3263.0
1962 - 1964	2161.0	2	0.044	22.50	3218.8
1963 - 1965	2675.0	3	0.067	15.00	3106.0
1964 - 1966	2443.0	4	0.089	11.25	3105.0
1965 - 1967	2548.0	5	0.111	9.00	3094.3
1966 - 1968	2460.0	6	0.133	7.50	3088.0
1967 - 1969	2540.0	7	0.156	6.43	3010.0
1968 - 1970	2465.0	8	0.178	5.63	2714.0
1969 - 1971	2397.0	9	0.200	5.00	2675.0
1970 - 1972	2329.0	10	0.222	4.50	2548.0
1971 - 1973	3088.0	11	0.244	4.09	2540.0
1972 - 1974	2714.0	12	0.267	3.75	2539.2
1973 - 1975	3105.0	13	0.289	3.46	2478.0
1974 - 1976	3010.0	14	0.311	3.21	2476.3
1975 - 1977	3263.0	15	0.333	3.00	2465.0
1976 - 1978	3106.0	16	0.356	2.81	2460.0
1977 - 1979	2269.0	17	0.378	2.65	2443.0
1978 - 1980	2090.0	18	0.400	2.50	2398.0
1979 - 1981	1977.0	19	0.422	2.37	2397.0
1980 - 1982	1950.0	20	0.444	2.25	2378.3
1981 - 1983	1796.0	21	0.467	2.14	2365.5
1982 - 1984	1854.0	22	0.489	2.05	2338.0
1983 - 1985	1987.0	23	0.511	1.96	2329.0
1984 - 1986	2041.0	24	0.533	1.88	2311.0
1985 - 1987	1927.0	25	0.556	1.80	2287.9
1986 - 1988	2398.0	26	0.578	1.73	2269.0
1987 - 1989	2478.0	27	0.600	1.67	2208.9
1988 - 1990	2338.0	28	0.622	1.61	2173.6
1989 - 1991	1841.0	29	0.644	1.55	2161.0
1990 - 1992	2006.0	30	0.667	1.50	2090.0
1991 - 1993	2017.0	31	0.689	1.45	2041.0
1992 - 1994	2173.6	32	0.711	1.41	2017.0
1993 - 1995	Exclude	33	0.733	1.36	2006.0
1994 - 1996	Exclude	34	0.756	1.32	1987.0
1995 - 1997	Exclude	35	0.778	1.29	1977.0
1996 - 1998	1849.3	36	0.800	1.25	1950.0
1997 - 1999	Exclude	37	0.822	1.22	1947.2
1998 - 2000	Exclude	38	0.844	1.18	1927.0
1999 - 2001	Exclude	39	0.867	1.15	1854.0
2000 - 2002	1735.8	40	0.889	1.13	1849.3
2001 - 2003	1728.9	41	0.911	1.10	1841.0
2002 - 2004	1947.2	42	0.933	1.07	1796.0
2003 - 2005	2208.9	43	0.956	1.05	1735.8
2004 - 2006	2378.3	44	0.978	1.02	1728.9
2005 - 2007	2539.2				
2006 - 2008	2365.5				
2007 - 2009	2287.9				
2008 - 2010	2476.3				
2009 - 2011	3094.3				
2010 - 2012	3218.8				
2011 - 2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Extreme Value	2	3	6
Pearson 5 (3P)	1	10	10
Wakeby	16	1	16
Frechet (3P)	3	11	33
Weibull (3P)	9	4	36
Johnson SB	22	2	44
Log-Pearson 3	5	9	45
Log-Logistic (3P)	4	12	48
Lognormal (3P)	7	8	56
Inv. Gaussian (3P)	10	6	60

Three fits were selected for comparison:

1) **Pearson 5** (2nd best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

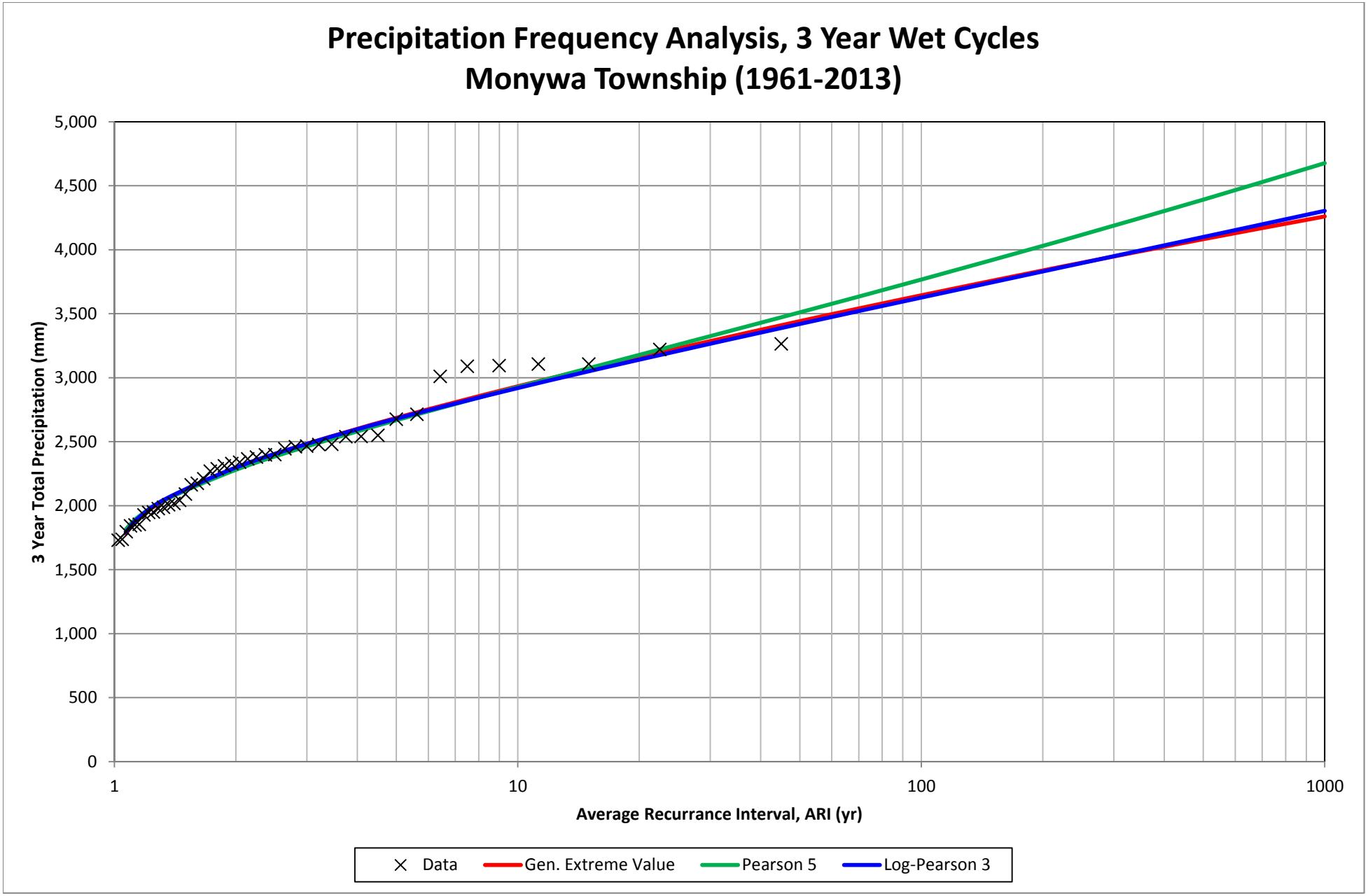
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

Any 3 year series including 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 3 Year Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 3 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Extreme Value		Pearson 5		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	k =	-0.05346	α =	13.63980555	α =	46.42243888
			σ =	363.1438	β =	19090.81617	β =	0.025855566
			μ =	2162.971	γ =	845.7300296	γ =	6.548325006
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	4260.3	436.49	4676.7	442.70	4304.0	429.50
0.998	0.002	500	4082.9	436.49	4391.5	442.70	4099.6	429.50
0.996	0.004	250	3898.7	436.49	4116.7	442.70	3896.0	429.50
0.995	0.005	200	3837.9	436.49	4030.3	442.70	3830.4	429.50
0.990	0.010	100	3643.9	436.49	3767.1	442.70	3626.4	429.50
0.980	0.020	50	3441.9	436.49	3510.8	442.70	3420.3	429.50
0.950	0.050	20	3160.3	436.49	3178.4	442.70	3141.0	429.50
0.900	0.100	10	2932.9	436.49	2927.1	442.70	2919.5	429.50
0.800	0.200	5	2686.4	436.49	2668.2	442.70	2680.6	429.50
0.667	0.333	3	2483.4	436.49	2463.9	442.70	2483.3	429.50
0.500	0.500	2.0	2294.8	436.49	2280.3	442.70	2298.5	429.50
0.250	0.750	1.3	2043.3	436.49	2045.1	442.70	2049.9	429.50
0.125	0.875	1.14	1891.8	436.49	1909.5	442.70	1899.7	429.50
0.063	0.937	1.07	1783.5	436.49	1815.7	442.70	1792.5	429.50
Kolmogorov Smirnov (Statistic, Rank)			0.0806	2	0.0794	1	0.0834	5
Anderson Darling (Statistic, Rank)			0.4176	3	0.4473	10	0.4428	9


Precipitation Frequency Analysis, 3 Year Wet Cycles
Monywa Township (1961-2013)
3 Year Total Precipitation (mm)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Extreme Value
Pearson 5
Log-Pearson 3

Precipitation Frequency Analysis, 2 Year Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 47

2 Year Data		Rank	Weibull	ARI	Ranked
Years	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	2 yr Wet Precip (mm)
1961 - 1962	1415.0	1	0.021	48.00	2405.1
1962 - 1963	1580.0	2	0.042	24.00	2342.0
1963 - 1964	1477.0	3	0.063	16.00	2196.0
1964 - 1965	1779.0	4	0.083	12.00	2046.0
1965 - 1966	1862.0	5	0.104	9.60	2038.0
1966 - 1967	1350.0	6	0.125	8.00	1997.9
1967 - 1968	1796.0	7	0.146	6.86	1910.1
1968 - 1969	1854.0	8	0.167	6.00	1862.0
1969 - 1970	1355.0	9	0.188	5.33	1854.0
1970 - 1971	1653.0	10	0.208	4.80	1831.0
1971 - 1972	1718.0	11	0.229	4.36	1799.3
1972 - 1973	2046.0	12	0.250	4.00	1796.0
1973 - 1974	2038.0	13	0.271	3.69	1779.0
1974 - 1975	1735.0	14	0.292	3.43	1756.0
1975 - 1976	2342.0	15	0.313	3.20	1737.0
1976 - 1977	2196.0	16	0.333	3.00	1735.0
1977 - 1978	1831.0	17	0.354	2.82	1718.0
1978 - 1979	1348.0	18	0.375	2.67	1653.0
1979 - 1980	1180.0	19	0.396	2.53	1611.5
1980 - 1981	1539.0	20	0.417	2.40	1598.7
1981 - 1982	1208.0	21	0.438	2.29	1580.0
1982 - 1983	999.0	22	0.458	2.18	1539.0
1983 - 1984	1443.0	23	0.479	2.09	1506.7
1984 - 1985	1399.0	24	0.500	2.00	1499.0
1985 - 1986	1186.0	25	0.521	1.92	1477.0
1986 - 1987	1383.0	26	0.542	1.85	1469.0
1987 - 1988	1756.0	27	0.563	1.78	1443.0
1988 - 1989	1737.0	28	0.583	1.71	1415.0
1989 - 1990	1323.0	29	0.604	1.66	1412.0
1990 - 1991	1119.0	30	0.625	1.60	1405.0
1991 - 1992	1405.0	31	0.646	1.55	1399.0
1992 - 1993	1499.0	32	0.667	1.50	1383.0
1993 - 1994	1286.6	33	0.688	1.45	1355.0
1994 - 1995	Exclude	34	0.708	1.41	1350.0
1995 - 1996	Exclude	35	0.729	1.37	1348.0
1996 - 1997	1412.0	36	0.750	1.33	1323.0
1997 - 1998	1046.9	37	0.771	1.30	1286.6
1998 - 1999	Exclude	38	0.792	1.26	1257.5
1999 - 2000	Exclude	39	0.813	1.23	1255.4
2000 - 2001	1257.5	40	0.833	1.20	1208.0
2001 - 2002	1131.5	41	0.854	1.17	1186.0
2002 - 2003	1075.6	42	0.875	1.14	1180.0
2003 - 2004	1469.0	43	0.896	1.12	1131.5
2004 - 2005	1611.5	44	0.917	1.09	1119.0
2005 - 2006	1506.7	45	0.938	1.07	1075.6
2006 - 2007	1799.3	46	0.958	1.04	1046.9
2007 - 2008	1598.7	47	0.979	1.02	999.0
2008 - 2009	1255.4				
2009 - 2010	1910.1				
2010 - 2011	2405.1				
2011 - 2012	1997.9				
2012 - 2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Gamma (4P)	1	8	8
Rice	2	29	58
Johnson SB	3	1	3
Triangular	4	43	172
Beta	5	41	205
Wakeby	6	2	12
Rayleigh (2P)	7	5	35
Gamma	8	19	152
Gen. Extreme Value	10	4	40
Log-Pearson 3	16	6	96

Three fits were selected for comparison:

1) **Gen. Gamma (4P)** (Best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

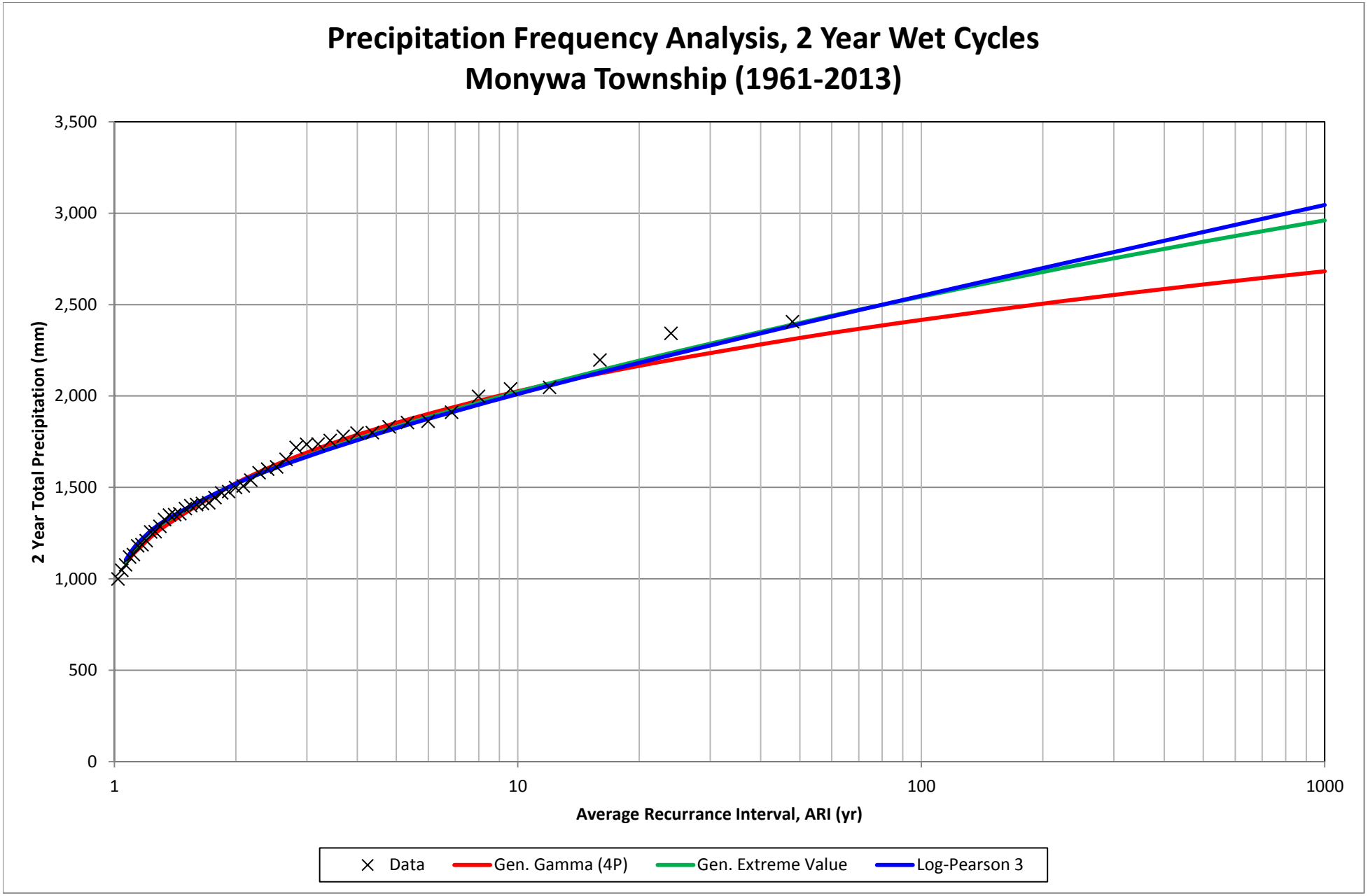
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

Any 2 year series including 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 2 Year Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 2 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Gamma (4P)		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	k =	3.002649	k =	-0.087925417	α =	422.6834021
			α =	0.416684	σ =	299.2902393	β =	0.010413888
			β =	982.5662	μ =	1411.245461	γ =	2.928064568
			γ =	991.0833				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	2682.4	338.35	2960.7	346.72	3045.0	341.68
0.998	0.002	500	2610.1	338.35	2844.1	346.72	2896.9	341.68
0.996	0.004	250	2531.8	338.35	2720.0	346.72	2747.9	341.68
0.995	0.005	200	2505.0	338.35	2678.4	346.72	2699.6	341.68
0.990	0.010	100	2416.4	338.35	2543.6	346.72	2548.3	341.68
0.980	0.020	50	2317.5	338.35	2399.8	346.72	2393.8	341.68
0.950	0.050	20	2165.2	338.35	2193.6	346.72	2181.6	341.68
0.900	0.100	10	2025.9	338.35	2022.3	346.72	2010.9	341.68
0.800	0.200	5	1853.3	338.35	1831.8	346.72	1824.3	341.68
0.667	0.333	3	1690.8	338.35	1671.3	346.72	1668.0	341.68
0.500	0.500	2.0	1522.9	338.35	1519.2	346.72	1519.9	341.68
0.250	0.750	1.3	1287.6	338.35	1312.1	346.72	1317.6	341.68
0.125	0.875	1.14	1160.6	338.35	1184.9	346.72	1193.6	341.68
0.063	0.937	1.07	1089.0	338.35	1092.9	346.72	1104.3	341.68
Kolmogorov Smirnov (Statistic, Rank)			0.0580	1	0.0723	10	0.0765	16
Anderson Darling (Statistic, Rank)			0.1597	8	0.1427	4	0.1586	6


Precipitation Frequency Analysis, 2 Year Wet Cycles
Monywa Township (1961-2013)
2 Year Total Precipitation (mm)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Gamma (4P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 1 Year Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 50

Annual Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	1 yr Wet Precip (mm)
1961	731.0	1	0.020	51.00	1370.0
1962	684.0	2	0.039	25.50	1275.0
1963	896.0	3	0.059	17.00	1220.9
1964	581.0	4	0.078	12.75	1198.0
1965	1198.0	5	0.098	10.20	1184.2
1966	664.0	6	0.118	8.50	1110.0
1967	686.0	7	0.137	7.29	1067.0
1968	1110.0	8	0.157	6.38	1042.0
1969	744.0	9	0.176	5.67	1032.5
1970	611.0	10	0.196	5.10	1015.0
1971	1042.0	11	0.216	4.64	921.0
1972	676.0	12	0.235	4.25	910.0
1973	1370.0	13	0.255	3.92	896.0
1974	668.0	14	0.275	3.64	887.0
1975	1067.0	15	0.294	3.40	871.6
1976	1275.0	16	0.314	3.19	855.0
1977	921.0	17	0.333	3.00	813.7
1978	910.0	18	0.353	2.83	802.4
1979	438.0	19	0.373	2.68	797.0
1980	742.0	20	0.392	2.55	766.8
1981	797.0	21	0.412	2.43	744.0
1982	411.0	22	0.431	2.32	742.0
1983	588.0	23	0.451	2.22	741.0
1984	855.0	24	0.471	2.13	739.9
1985	544.0	25	0.490	2.04	731.0
1986	642.0	26	0.510	1.96	722.0
1987	741.0	27	0.529	1.89	689.2
1988	1015.0	28	0.549	1.82	686.0
1989	722.0	29	0.569	1.76	684.0
1990	601.0	30	0.588	1.70	676.0
1991	518.0	31	0.608	1.65	674.6
1992	887.0	32	0.627	1.59	668.0
1993	612.0	33	0.647	1.55	664.0
1994	674.6	34	0.667	1.50	653.3
1995	Exclude	35	0.686	1.46	642.0
1996	802.4	36	0.706	1.42	612.0
1997	609.6	37	0.725	1.38	611.0
1998	437.2	38	0.745	1.34	609.6
1999	Exclude	39	0.765	1.31	604.2
2000	604.2	40	0.784	1.28	601.0
2001	653.3	41	0.804	1.24	597.4
2002	478.2	42	0.824	1.21	588.0
2003	597.4	43	0.843	1.19	581.0
2004	871.6	44	0.863	1.16	566.2
2005	739.9	45	0.882	1.13	544.0
2006	766.8	46	0.902	1.11	518.0
2007	1032.5	47	0.922	1.09	478.2
2008	566.2	48	0.941	1.06	438.0
2009	689.2	49	0.961	1.04	437.2
2010	1220.9	50	0.980	1.02	411.0
2011	1184.2				
2012	813.7				
2013	Exclude				

EasyFit 5.3 Professional Fit Results

Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Log-Logistic (3P)	2	1	2
Gen. Extreme Value	3	2	6
Pearson 5	4	3	12
Wakeby	1	14	14
Pearson 5 (3P)	8	4	32
Pearson 6 (4P)	9	5	45
Lognormal (3P)	10	6	60
Inv. Gaussian (3P)	11	7	77
Log-Logistic	5	17	85
Log-Pearson 3	17	11	187

Three fits were selected for comparison:

1) **Log-Logistic (3P)** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

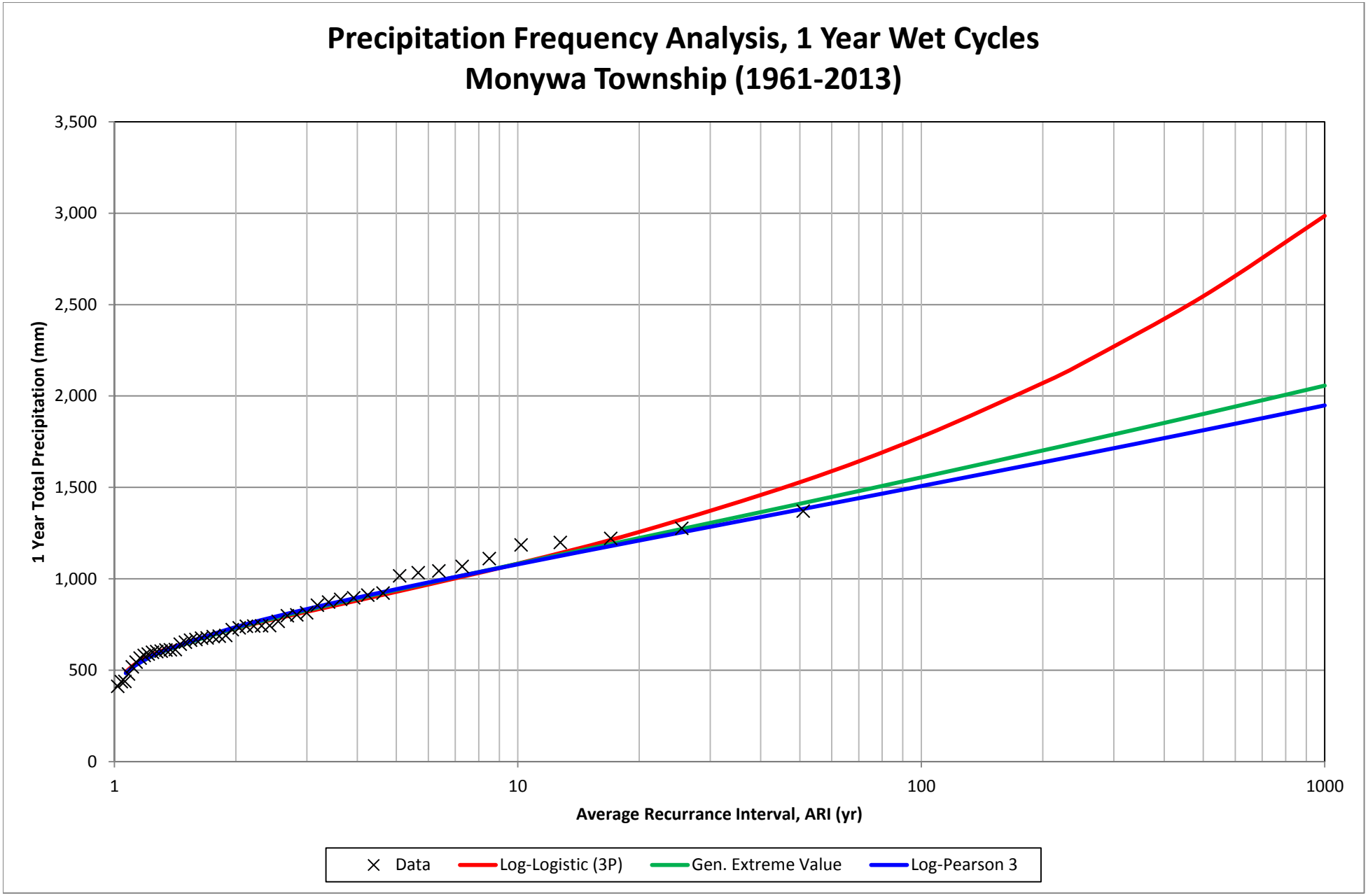
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

The years 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 1 Year Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 1 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Log-Logistic (3P)		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	α =	3.967234	k =	0.034040351	α =	120.6291083
			β =	479.8937	σ =	178.832219	β =	0.026212465
			γ =	248.5273	μ =	664.3371342	γ =	3.448149075
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	2985.2	282.20	2056.9	240.34	1948.7	234.14
0.998	0.002	500	2546.0	282.20	1901.8	240.34	1812.7	234.14
0.996	0.004	250	2176.7	282.20	1750.2	240.34	1679.6	234.14
0.995	0.005	200	2070.8	282.20	1702.1	240.34	1637.3	234.14
0.990	0.010	100	1776.7	282.20	1554.9	240.34	1507.4	234.14
0.980	0.020	50	1528.5	282.20	1410.6	240.34	1379.0	234.14
0.950	0.050	20	1256.6	282.20	1223.3	240.34	1209.7	234.14
0.900	0.100	10	1083.5	282.20	1082.6	240.34	1079.5	234.14
0.800	0.200	5	929.1	282.20	939.5	240.34	943.4	234.14
0.667	0.333	3	820.3	282.20	828.5	240.34	834.7	234.14
0.500	0.500	2.0	728.4	282.20	730.3	240.34	736.1	234.14
0.250	0.750	1.3	612.3	282.20	606.2	240.34	608.8	234.14
0.125	0.875	1.14	542.4	282.20	535.0	240.34	535.0	234.14
0.063	0.937	1.07	491.5	282.20	485.6	240.34	483.9	234.14
Kolmogorov Smirnov (Statistic, Rank)			0.0684	2	0.0741	3	0.0853	17
Anderson Darling (Statistic, Rank)			0.2649	1	0.2731	2	0.3027	11


Precipitation Frequency Analysis, 1 Year Wet Cycles
Monywa Township (1961-2013)
1 Year Total Precipitation (mm)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Log-Logistic (3P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 1 Year Dry Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 50

Annual Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(lowest to highest) m	Exceedance Probability p	(yr)	1 yr Dry Precip (mm)
1961	731.0	1	0.020	51.00	411.0
1962	684.0	2	0.039	25.50	437.2
1963	896.0	3	0.059	17.00	438.0
1964	581.0	4	0.078	12.75	478.2
1965	1198.0	5	0.098	10.20	518.0
1966	664.0	6	0.118	8.50	544.0
1967	686.0	7	0.137	7.29	566.2
1968	1110.0	8	0.157	6.38	581.0
1969	744.0	9	0.176	5.67	588.0
1970	611.0	10	0.196	5.10	597.4
1971	1042.0	11	0.216	4.64	601.0
1972	676.0	12	0.235	4.25	604.2
1973	1370.0	13	0.255	3.92	609.6
1974	668.0	14	0.275	3.64	611.0
1975	1067.0	15	0.294	3.40	612.0
1976	1275.0	16	0.314	3.19	642.0
1977	921.0	17	0.333	3.00	653.3
1978	910.0	18	0.353	2.83	664.0
1979	438.0	19	0.373	2.68	668.0
1980	742.0	20	0.392	2.55	674.6
1981	797.0	21	0.412	2.43	676.0
1982	411.0	22	0.431	2.32	684.0
1983	588.0	23	0.451	2.22	686.0
1984	855.0	24	0.471	2.13	689.2
1985	544.0	25	0.490	2.04	722.0
1986	642.0	26	0.510	1.96	731.0
1987	741.0	27	0.529	1.89	739.9
1988	1015.0	28	0.549	1.82	741.0
1989	722.0	29	0.569	1.76	742.0
1990	601.0	30	0.588	1.70	744.0
1991	518.0	31	0.608	1.65	766.8
1992	887.0	32	0.627	1.59	797.0
1993	612.0	33	0.647	1.55	802.4
1994	674.6	34	0.667	1.50	813.7
1995	Exclude	35	0.686	1.46	855.0
1996	802.4	36	0.706	1.42	871.6
1997	609.6	37	0.725	1.38	887.0
1998	437.2	38	0.745	1.34	896.0
1999	Exclude	39	0.765	1.31	910.0
2000	604.2	40	0.784	1.28	921.0
2001	653.3	41	0.804	1.24	1015.0
2002	478.2	42	0.824	1.21	1032.5
2003	597.4	43	0.843	1.19	1042.0
2004	871.6	44	0.863	1.16	1067.0
2005	739.9	45	0.882	1.13	1110.0
2006	766.8	46	0.902	1.11	1184.2
2007	1032.5	47	0.922	1.09	1198.0
2008	566.2	48	0.941	1.06	1220.9
2009	689.2	49	0.961	1.04	1275.0
2010	1220.9	50	0.980	1.02	1370.0
2011	1184.2				
2012	813.7				
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Log-Logistic (3P)	2	1	2
Gen. Extreme Value	3	2	6
Pearson 5	4	3	12
Wakeby	1	14	14
Pearson 5 (3P)	8	4	32
Pearson 6 (4P)	9	5	45
Lognormal (3P)	10	6	60
Inv. Gaussian (3P)	11	7	77
Log-Logistic	5	17	85
Log-Pearson 3	17	11	187

Three fits were selected for comparison:

1) **Log-Logistic (3P)** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

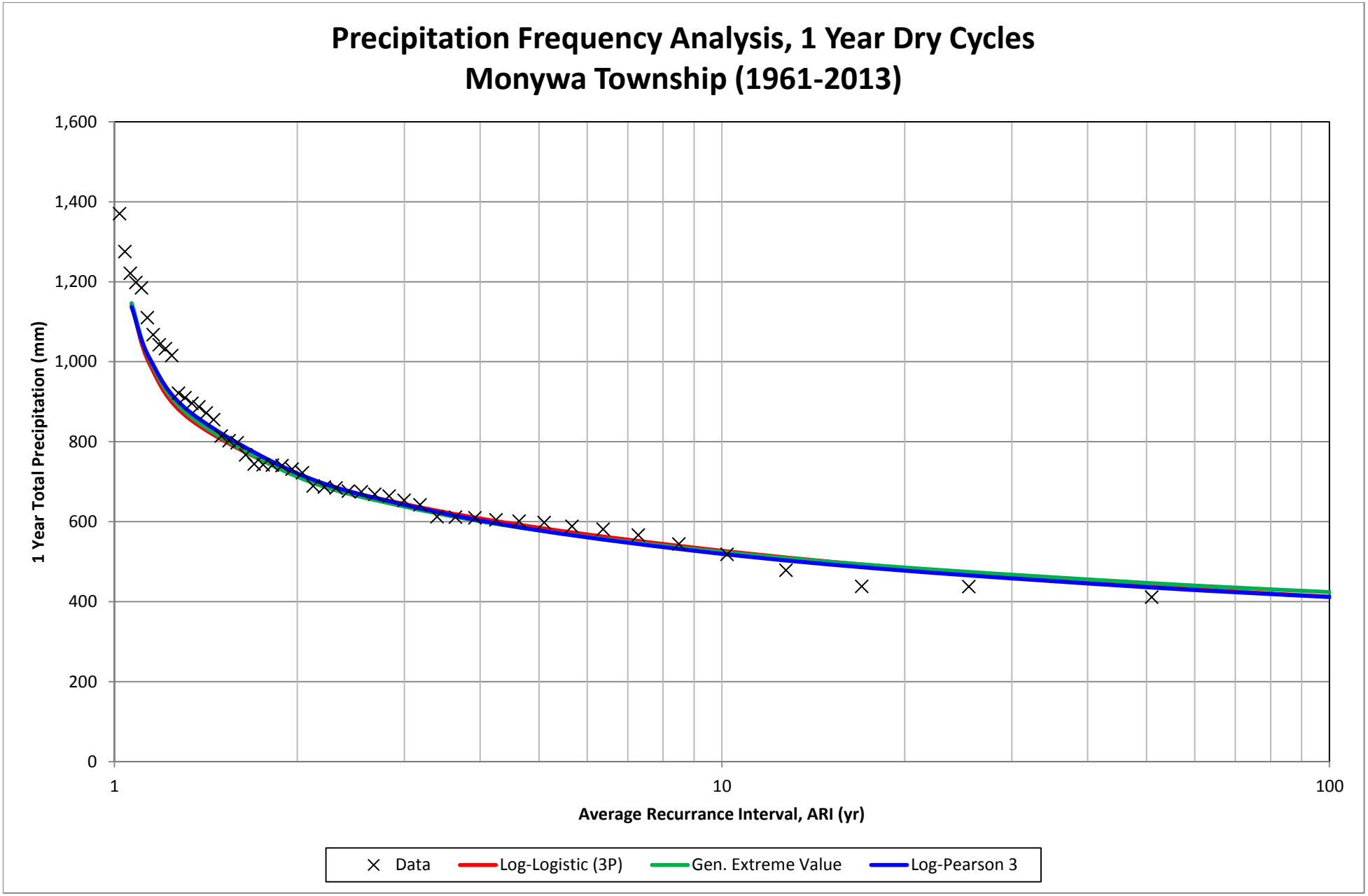
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

The years 1995, 1999 and 2013 were excluded from the analysis as a significant portion of the precipitation data from those years was missing.

Precipitation Frequency Analysis, 1 Year Dry Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent dry-cycle 1 year precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Log-Logistic (3P)		Gen. Extreme Value		Log-Pearson 3	
			α =	3.967234	k =	0.034040351	α =	120.6291083
			β =	479.8937	σ =	178.832219	β =	0.026212465
			γ =	248.5273	μ =	664.3371342	γ =	3.448149075
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.001	0.999	1000	351.1	259.33	368.2	233.54	354.0	224.66
0.002	0.998	500	365.9	259.33	382.6	233.54	368.6	224.66
0.004	0.996	250	383.5	259.33	398.8	233.54	385.3	224.66
0.005	0.995	200	389.9	259.33	404.5	233.54	391.3	224.66
0.010	0.990	100	412.3	259.33	424.0	233.54	411.8	224.66
0.020	0.980	50	439.1	259.33	447.0	233.54	436.3	224.66
0.050	0.950	20	483.8	259.33	485.4	233.54	477.6	224.66
0.100	0.900	10	527.3	259.33	524.1	233.54	519.6	224.66
0.200	0.800	5	584.8	259.33	578.3	233.54	578.3	224.66
0.333	0.667	3	644.1	259.33	637.7	233.54	642.1	224.66
0.500	0.500	2.0	714.9	259.33	712.5	233.54	720.9	224.66
0.750	0.250	1.3	855.7	259.33	863.4	233.54	873.5	224.66
0.875	0.125	1.14	994.2	259.33	1005.0	233.54	1008.6	224.66
0.937	0.063	1.07	1144.8	259.33	1146.5	233.54	1137.1	224.66
Kolmogorov Smirnov (Statistic, Rank)			0.0684	2	0.0741	3	0.0853	17
Anderson Darling (Statistic, Rank)			0.2649	1	0.2731	2	0.3027	11


Precipitation Frequency Analysis, 1 Year Dry Cycles
Monywa Township (1961-2013)
1 Year Total Precipitation (mm)
1,600
1,400
1,200
1,000
800
600
400
200
0
1
10
100
Average Recurrance Interval, ARI (yr)
Data
Log-Logistic (3P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 180 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

180 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	180 d Wet Precip (mm)
1961	653.0	1	0.019	53.00	1288.0
1962	678.0	2	0.038	26.50	1180.9
1963	837.0	3	0.057	17.67	1139.7
1964	565.0	4	0.075	13.25	1098.0
1965	1098.0	5	0.094	10.60	1046.0
1966	628.0	6	0.113	8.83	1024.0
1967	640.0	7	0.132	7.57	994.0
1968	1024.0	8	0.151	6.63	971.8
1969	713.0	9	0.170	5.89	965.0
1970	560.0	10	0.189	5.30	903.0
1971	965.0	11	0.208	4.82	901.0
1972	600.0	12	0.226	4.42	864.5
1973	1288.0	13	0.245	4.08	863.0
1974	614.0	14	0.264	3.79	851.0
1975	994.0	15	0.283	3.53	837.0
1976	1046.0	16	0.302	3.31	821.0
1977	863.0	17	0.321	3.12	753.7
1978	903.0	18	0.340	2.94	724.2
1979	415.0	19	0.358	2.79	720.0
1980	702.0	20	0.377	2.65	715.2
1981	650.0	21	0.396	2.52	713.0
1982	410.0	22	0.415	2.41	702.0
1983	545.0	23	0.434	2.30	678.0
1984	821.0	24	0.453	2.21	673.6
1985	459.0	25	0.472	2.12	665.0
1986	614.0	26	0.491	2.04	653.0
1987	645.0	27	0.509	1.96	650.0
1988	901.0	28	0.528	1.89	645.7
1989	720.0	29	0.547	1.83	645.0
1990	572.0	30	0.566	1.77	640.0
1991	472.0	31	0.585	1.71	637.8
1992	851.0	32	0.604	1.66	628.0
1993	573.0	33	0.623	1.61	616.5
1994	637.8	34	0.642	1.56	614.0
1995	531.1	35	0.660	1.51	614.0
1996	616.5	36	0.679	1.47	602.3
1997	602.3	37	0.698	1.43	600.0
1998	413.1	38	0.717	1.39	576.3
1999	715.2	39	0.736	1.36	573.0
2000	556.8	40	0.755	1.33	572.0
2001	645.7	41	0.774	1.29	565.0
2002	454.4	42	0.792	1.26	560.0
2003	576.3	43	0.811	1.23	556.8
2004	864.5	44	0.830	1.20	545.0
2005	673.6	45	0.849	1.18	531.1
2006	724.2	46	0.868	1.15	514.9
2007	971.8	47	0.887	1.13	472.0
2008	514.9	48	0.906	1.10	459.0
2009	665.0	49	0.925	1.08	454.4
2010	1180.9	50	0.943	1.06	415.0
2011	1139.7	51	0.962	1.04	413.1
2012	753.7	52	0.981	1.02	410.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Log-Logistic (3P)	1	3	3
Gen. Extreme Value	3	1	3
Burr	2	2	4
Lognormal (3P)	7	4	28
Pearson 6 (4P)	5	6	30
Pearson 5 (3P)	6	5	30
Frechet (3P)	8	9	72
Log-Logistic	4	19	76
Inv. Gaussian (3P)	11	7	77
Log-Pearson 3	17	11	187

Three fits were selected for comparison:

1) **Log-Logistic (3P)** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

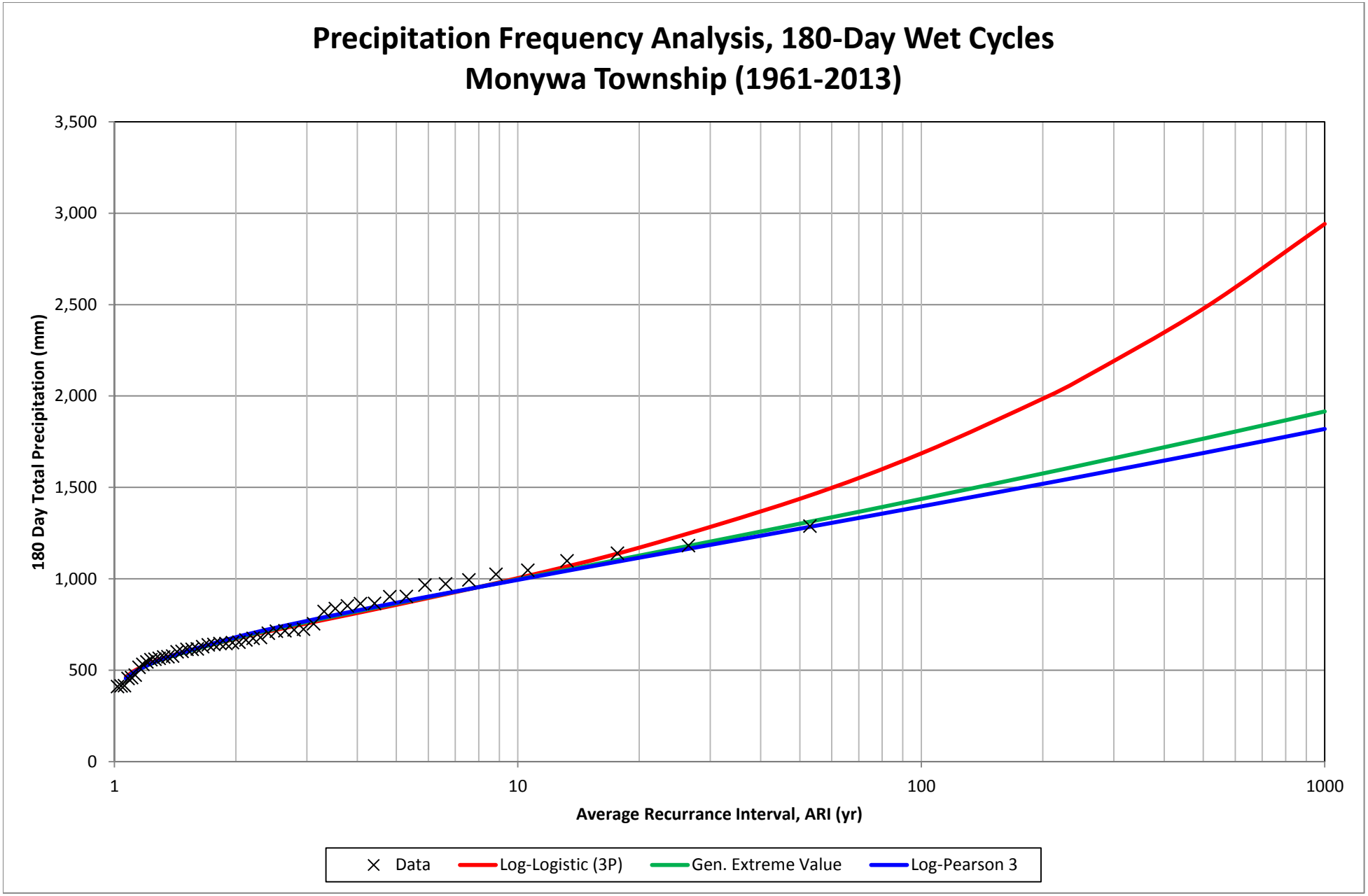
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 180 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 180 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Log-Logistic (3P)		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	α =	3.636479	k =	0.043959129	α =	63.28937577
			β =	399.3156	σ =	160.9920019	β =	0.03539472
			γ =	273.2777	μ =	616.2480698	γ =	4.294614079
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	2941.2	270.39	1915.6	219.52	1819.9	213.97
0.998	0.002	500	2477.6	270.39	1766.5	219.52	1688.2	213.97
0.996	0.004	250	2094.0	270.39	1621.9	219.52	1560.2	213.97
0.995	0.005	200	1985.2	270.39	1576.2	219.52	1519.7	213.97
0.990	0.010	100	1686.1	270.39	1437.0	219.52	1395.9	213.97
0.980	0.020	50	1437.7	270.39	1301.5	219.52	1274.4	213.97
0.950	0.050	20	1170.6	270.39	1127.0	219.52	1115.6	213.97
0.900	0.100	10	1004.0	270.39	997.1	219.52	994.6	213.97
0.800	0.200	5	857.9	270.39	865.9	219.52	869.2	213.97
0.667	0.333	3	756.6	270.39	764.7	219.52	769.9	213.97
0.500	0.500	2.0	672.6	270.39	675.7	219.52	680.6	213.97
0.250	0.750	1.3	568.5	270.39	564.0	219.52	566.2	213.97
0.125	0.875	1.14	507.1	270.39	500.3	219.52	500.4	213.97
0.063	0.937	1.07	463.3	270.39	456.1	219.52	455.1	213.97
Kolmogorov Smirnov (Statistic, Rank)			0.0671	1	0.0764	2	0.0863	17
Anderson Darling (Statistic, Rank)			0.3558	2	0.3565	3	0.3842	10


Precipitation Frequency Analysis, 180-Day Wet Cycles
Monywa Township (1961-2013)
180 Day Total Precipitation (mm)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Log-Logistic (3P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 120 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

120 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	120 d Wet Precip (mm)
1961	493.0	1	0.019	53.00	980.9
1962	466.0	2	0.038	26.50	977.0
1963	641.0	3	0.057	17.67	928.0
1964	384.0	4	0.075	13.25	802.0
1965	977.0	5	0.094	10.60	781.0
1966	432.0	6	0.113	8.83	754.2
1967	456.0	7	0.132	7.57	718.0
1968	695.0	8	0.151	6.63	717.0
1969	551.0	9	0.170	5.89	712.8
1970	420.0	10	0.189	5.30	703.0
1971	802.0	11	0.208	4.82	695.0
1972	497.0	12	0.226	4.42	673.0
1973	928.0	13	0.245	4.08	654.0
1974	423.0	14	0.264	3.79	653.0
1975	703.0	15	0.283	3.53	641.0
1976	717.0	16	0.302	3.31	640.0
1977	781.0	17	0.321	3.12	636.2
1978	718.0	18	0.340	2.94	632.7
1979	375.0	19	0.358	2.79	597.9
1980	558.0	20	0.377	2.65	589.8
1981	520.0	21	0.396	2.52	577.0
1982	351.0	22	0.415	2.41	558.0
1983	523.0	23	0.434	2.30	551.0
1984	653.0	24	0.453	2.21	544.3
1985	316.0	25	0.472	2.12	537.0
1986	577.0	26	0.491	2.04	532.9
1987	537.0	27	0.509	1.96	531.4
1988	640.0	28	0.528	1.89	523.0
1989	654.0	29	0.547	1.83	520.0
1990	488.0	30	0.566	1.77	505.5
1991	372.0	31	0.585	1.71	497.0
1992	673.0	32	0.604	1.66	496.6
1993	416.0	33	0.623	1.61	493.0
1994	589.8	34	0.642	1.56	488.0
1995	496.6	35	0.660	1.51	466.0
1996	532.9	36	0.679	1.47	465.1
1997	465.1	37	0.698	1.43	456.0
1998	388.7	38	0.717	1.39	452.0
1999	597.9	39	0.736	1.36	432.0
2000	405.1	40	0.755	1.33	431.1
2001	505.5	41	0.774	1.29	423.0
2002	383.2	42	0.792	1.26	420.0
2003	431.1	43	0.811	1.23	416.0
2004	712.8	44	0.830	1.20	405.1
2005	531.4	45	0.849	1.18	388.7
2006	544.3	46	0.868	1.15	384.0
2007	632.7	47	0.887	1.13	383.2
2008	340.1	48	0.906	1.10	375.0
2009	452.0	49	0.925	1.08	372.0
2010	980.9	50	0.943	1.06	351.0
2011	754.2	51	0.962	1.04	340.1
2012	636.2	52	0.981	1.02	316.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results

Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Gamma (4P)	1	3	3
Weibull (3P)	5	1	5
Johnson SB	3	2	6
Inv. Gaussian	6	10	60
Gamma (3P)	16	4	64
Gen. Extreme Value	14	5	70
Triangular	2	41	82
Log-Pearson 3	15	8	120
Fatigue Life (3P)	21	6	126
Fatigue Life	8	18	144

Three fits were selected for comparison:

1) **Gen. Gamma (4P)** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

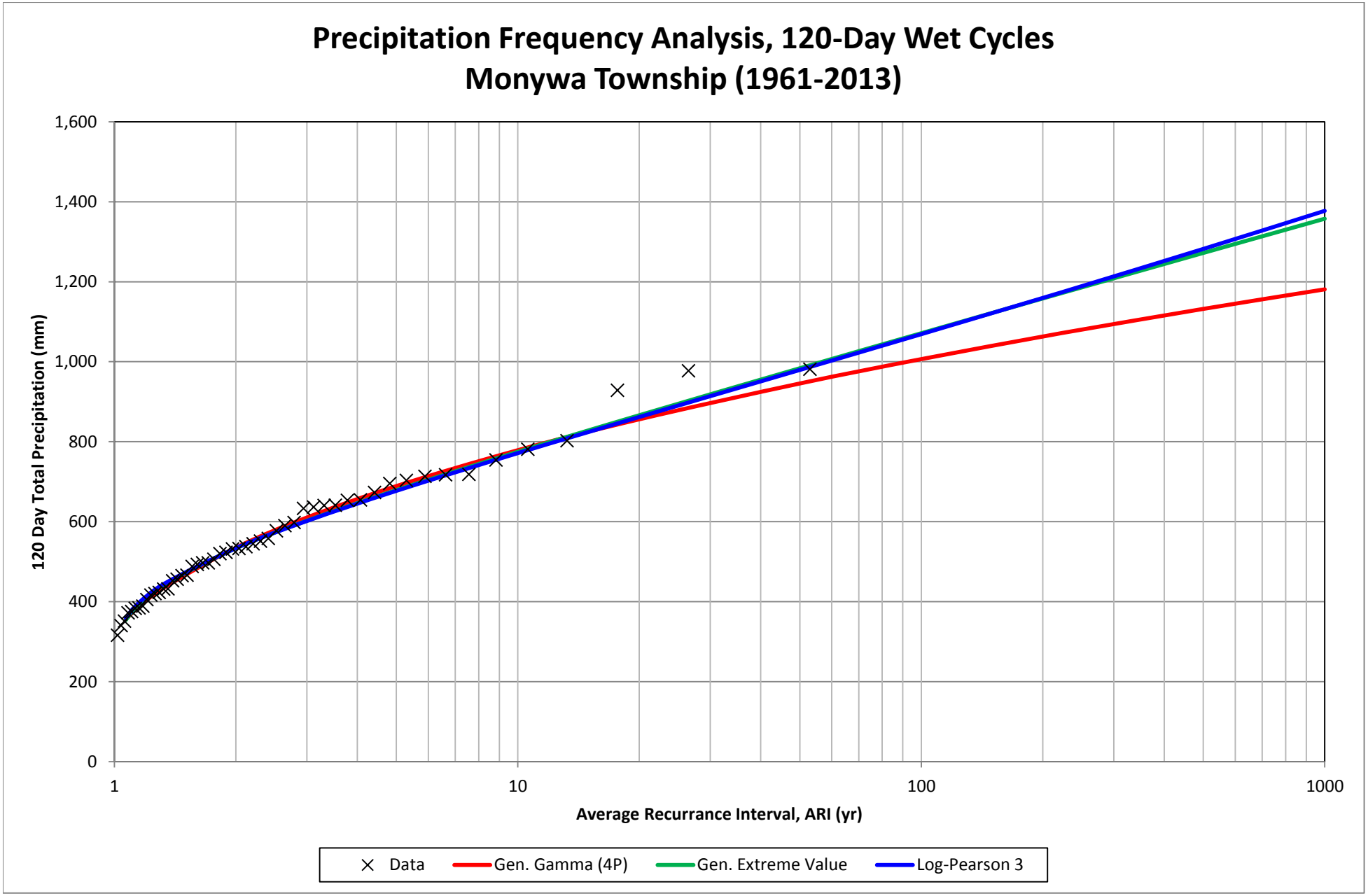
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 120 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 120 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Gamma (4P)		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	k =	2.014351	k =	-0.007127425	α =	79.44577123
			α =	0.680568	σ =	129.2860825	β =	0.030828944
			β =	357.1653	μ =	486.2314488	γ =	3.840998652
			γ =	311.3739				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	1181.0	137.96	1357.6	164.29	1377.3	162.20
0.998	0.002	500	1132.1	137.96	1272.0	164.29	1282.0	162.20
0.996	0.004	250	1080.3	137.96	1186.0	164.29	1189.0	162.20
0.995	0.005	200	1063.0	137.96	1158.1	164.29	1159.5	162.20
0.990	0.010	100	1006.5	137.96	1071.3	164.29	1068.9	162.20
0.980	0.020	50	945.6	137.96	983.7	164.29	979.5	162.20
0.950	0.050	20	856.1	137.96	866.2	164.29	861.8	162.20
0.900	0.100	10	778.8	137.96	774.9	164.29	771.5	162.20
0.800	0.200	5	689.2	137.96	679.1	164.29	677.2	162.20
0.667	0.333	3	610.6	137.96	602.7	164.29	602.0	162.20
0.500	0.500	2.0	535.0	137.96	533.6	164.29	533.8	162.20
0.250	0.750	1.3	436.5	137.96	444.0	164.29	445.7	162.20
0.125	0.875	1.14	385.1	137.96	391.3	164.29	394.7	162.20
0.063	0.937	1.07	355.8	137.96	354.3	164.29	359.3	162.20
Kolmogorov Smirnov (Statistic, Rank)			0.0550	1	0.0719	14	0.0740	15
Anderson Darling (Statistic, Rank)			0.1466	3	0.1704	5	0.1777	8


Precipitation Frequency Analysis, 120-Day Wet Cycles
Monywa Township (1961-2013)
120 Day Total Precipitation (mm)
1,600
1,400
1,200
1,000
800
600
400
200
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Gamma (4P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 90 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

90 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	90 d Wet Precip (mm)
1961	420.0	1	0.019	53.00	899.0
1962	370.0	2	0.038	26.50	864.8
1963	590.0	3	0.057	17.67	738.0
1964	348.0	4	0.075	13.25	718.0
1965	899.0	5	0.094	10.60	683.0
1966	346.0	6	0.113	8.83	654.4
1967	377.0	7	0.132	7.57	605.0
1968	557.0	8	0.151	6.63	596.7
1969	416.0	9	0.170	5.89	594.0
1970	385.0	10	0.189	5.30	590.0
1971	533.0	11	0.208	4.82	585.0
1972	450.0	12	0.226	4.42	561.0
1973	718.0	13	0.245	4.08	557.0
1974	368.0	14	0.264	3.79	555.0
1975	605.0	15	0.283	3.53	536.0
1976	683.0	16	0.302	3.31	533.0
1977	738.0	17	0.321	3.12	517.0
1978	561.0	18	0.340	2.94	515.6
1979	298.0	19	0.358	2.79	503.0
1980	440.0	20	0.377	2.65	503.0
1981	473.0	21	0.396	2.52	486.9
1982	254.0	22	0.415	2.41	473.0
1983	466.0	23	0.434	2.30	470.7
1984	555.0	24	0.453	2.21	466.0
1985	266.0	25	0.472	2.12	465.9
1986	517.0	26	0.491	2.04	465.6
1987	503.0	27	0.509	1.96	463.6
1988	536.0	28	0.528	1.89	460.5
1989	585.0	29	0.547	1.83	450.0
1990	442.0	30	0.566	1.77	445.8
1991	354.0	31	0.585	1.71	443.5
1992	594.0	32	0.604	1.66	442.0
1993	347.0	33	0.623	1.61	440.0
1994	486.9	34	0.642	1.56	420.0
1995	460.5	35	0.660	1.51	416.0
1996	470.7	36	0.679	1.47	396.5
1997	445.8	37	0.698	1.43	394.0
1998	363.0	38	0.717	1.39	385.0
1999	515.6	39	0.736	1.36	380.0
2000	380.0	40	0.755	1.33	377.0
2001	463.6	41	0.774	1.29	370.0
2002	349.5	42	0.792	1.26	368.0
2003	396.5	43	0.811	1.23	363.0
2004	465.9	44	0.830	1.20	354.0
2005	443.5	45	0.849	1.18	349.5
2006	465.6	46	0.868	1.15	348.0
2007	503.0	47	0.887	1.13	347.0
2008	311.6	48	0.906	1.10	346.0
2009	394.0	49	0.925	1.08	311.6
2010	864.8	50	0.943	1.06	298.0
2011	654.4	51	0.962	1.04	266.0
2012	596.7	52	0.981	1.02	254.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Logistic	1	1	1
Log-Logistic (3P)	4	2	8
Burr	2	8	16
Log-Gamma	3	13	39
Pearson 5 (3P)	9	5	45
Frechet (3P)	16	3	48
Pearson 6 (4P)	10	6	60
Gumbel Max	18	4	72
Log-Pearson 3	15	10	150
Gen. Extreme Value	22	9	198

Three fits were selected for comparison:

1) **Gen. Logistic** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

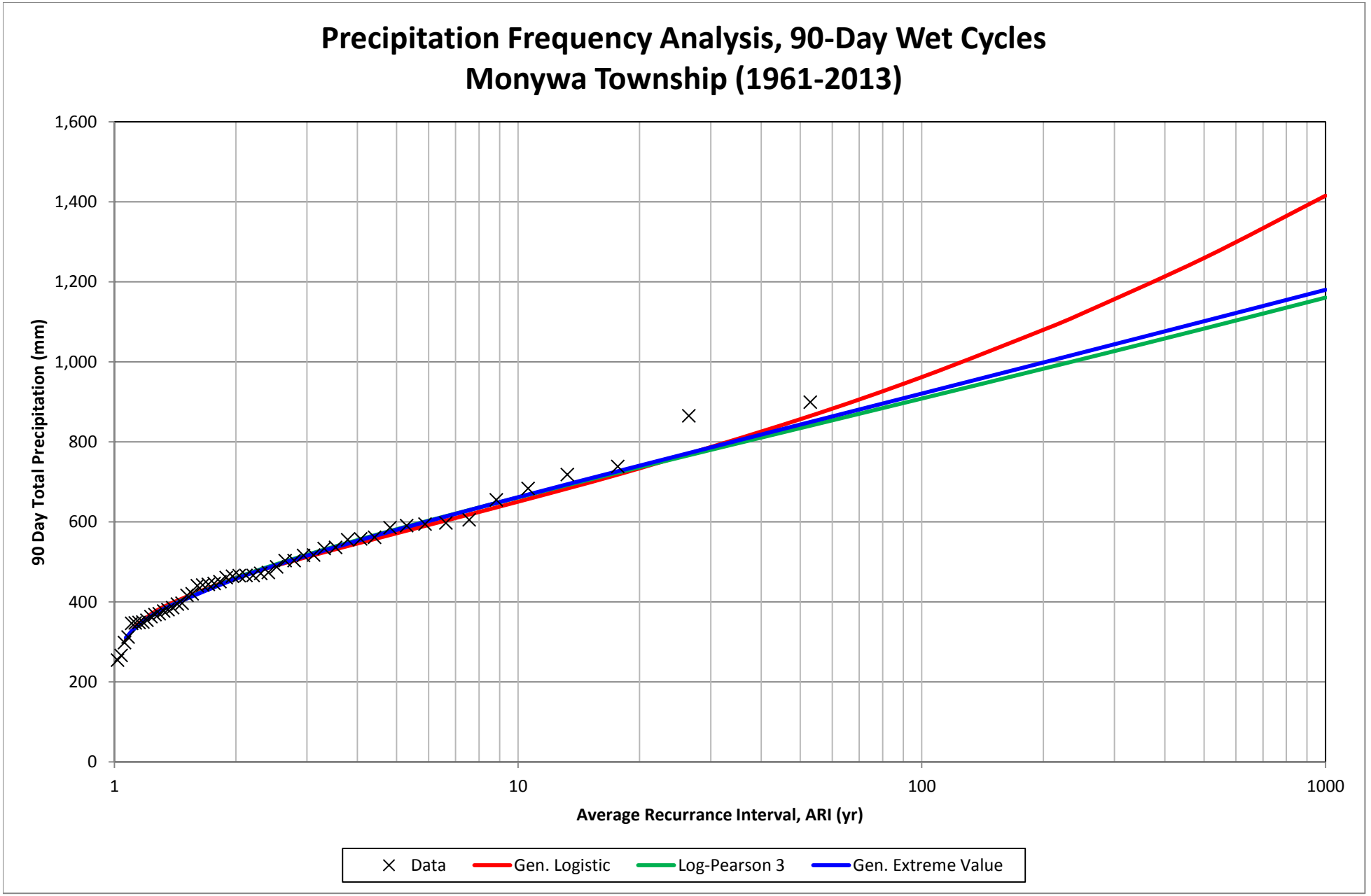
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 90 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 90 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Logistic		Log-Pearson 3		Gen. Extreme Value	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	α = 0.175342 β = 71.06012 ξ = 460.0164		α = 107.5755695 β = 0.026267129 γ = 3.313707262		k = 0.008412194 σ = 107.0507724 μ = 418.5725416	
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	1415.2	N/A	1160.5	137.46	1179.9	138.84
0.998	0.002	500	1259.3	N/A	1083.0	137.46	1101.4	138.84
0.996	0.004	250	1121.1	N/A	1007.0	137.46	1023.4	138.84
0.995	0.005	200	1080.0	N/A	982.8	137.46	998.3	138.84
0.990	0.010	100	961.9	N/A	908.3	137.46	920.7	138.84
0.980	0.020	50	856.6	N/A	834.4	137.46	843.2	138.84
0.950	0.050	20	733.9	N/A	736.5	137.46	740.5	138.84
0.900	0.100	10	650.5	N/A	661.0	137.46	661.8	138.84
0.800	0.200	5	571.5	N/A	581.6	137.46	580.2	138.84
0.667	0.333	3	512.5	N/A	517.8	137.46	515.7	138.84
0.500	0.500	2.0	460.0	N/A	459.7	137.46	457.9	138.84
0.250	0.750	1.3	389.0	N/A	384.2	137.46	383.7	138.84
0.125	0.875	1.14	342.9	N/A	340.1	137.46	340.4	138.84
0.063	0.937	1.07	307.2	N/A	309.5	137.46	310.2	138.84
Kolmogorov Smirnov (Statistic, Rank)			0.0629	1	0.0702	15	0.0756	22
Anderson Darling (Statistic, Rank)			0.1745	1	0.1825	10	0.1820	9


Precipitation Frequency Analysis, 90-Day Wet Cycles
Monywa Township (1961-2013)
90 Day Total Precipitation (mm)
1,600
1,400
1,200
1,000
800
600
400
200
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Logistic
Log-Pearson 3
Gen. Extreme Value

Precipitation Frequency Analysis, 60 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

60 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	60 d Wet Precip (mm)
1961	352.0	1	0.019	53.00	749.0
1962	286.0	2	0.038	26.50	666.3
1963	506.0	3	0.057	17.67	643.0
1964	314.0	4	0.075	13.25	574.0
1965	749.0	5	0.094	10.60	556.7
1966	315.0	6	0.113	8.83	522.0
1967	323.0	7	0.132	7.57	506.0
1968	476.0	8	0.151	6.63	498.0
1969	383.0	9	0.170	5.89	481.0
1970	282.0	10	0.189	5.30	476.0
1971	423.0	11	0.208	4.82	474.6
1972	420.0	12	0.226	4.42	473.0
1973	522.0	13	0.245	4.08	456.2
1974	303.0	14	0.264	3.79	447.0
1975	498.0	15	0.283	3.53	443.0
1976	574.0	16	0.302	3.31	442.0
1977	643.0	17	0.321	3.12	441.7
1978	402.0	18	0.340	2.94	428.0
1979	251.0	19	0.358	2.79	423.0
1980	343.0	20	0.377	2.65	420.0
1981	382.0	21	0.396	2.52	414.1
1982	187.0	22	0.415	2.41	413.0
1983	447.0	23	0.434	2.30	402.0
1984	481.0	24	0.453	2.21	388.4
1985	194.0	25	0.472	2.12	386.8
1986	413.0	26	0.491	2.04	383.5
1987	442.0	27	0.509	1.96	383.0
1988	428.0	28	0.528	1.89	382.0
1989	473.0	29	0.547	1.83	352.8
1990	335.0	30	0.566	1.77	352.0
1991	301.0	31	0.585	1.71	347.2
1992	443.0	32	0.604	1.66	347.2
1993	335.0	33	0.623	1.61	343.0
1994	352.8	34	0.642	1.56	339.8
1995	347.2	35	0.660	1.51	335.0
1996	388.4	36	0.679	1.47	335.0
1997	300.7	37	0.698	1.43	323.6
1998	282.0	38	0.717	1.39	323.0
1999	441.7	39	0.736	1.36	315.0
2000	339.8	40	0.755	1.33	314.0
2001	313.5	41	0.774	1.29	313.5
2002	299.7	42	0.792	1.26	303.0
2003	347.2	43	0.811	1.23	301.0
2004	414.1	44	0.830	1.20	300.7
2005	386.8	45	0.849	1.18	299.7
2006	323.6	46	0.868	1.15	286.0
2007	474.6	47	0.887	1.13	282.0
2008	238.5	48	0.906	1.10	282.0
2009	383.5	49	0.925	1.08	251.0
2010	666.3	50	0.943	1.06	238.5
2011	456.2	51	0.962	1.04	194.0
2012	556.7	52	0.981	1.02	187.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Extreme Value	2	4	8
Gumbel Max	1	5	5
Log-Logistic (3P)	22	1	22
Lognormal	3	8	24
Gen. Logistic	20	6	120
Pearson 5 (3P)	12	7	84
Log-Gamma	5	2	10
Fatigue Life	6	9	54
Burr	24	3	72
Log-Pearson 3	10	10	100

Three fits were selected for comparison:

1) **Gumbel Max** (2nd best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

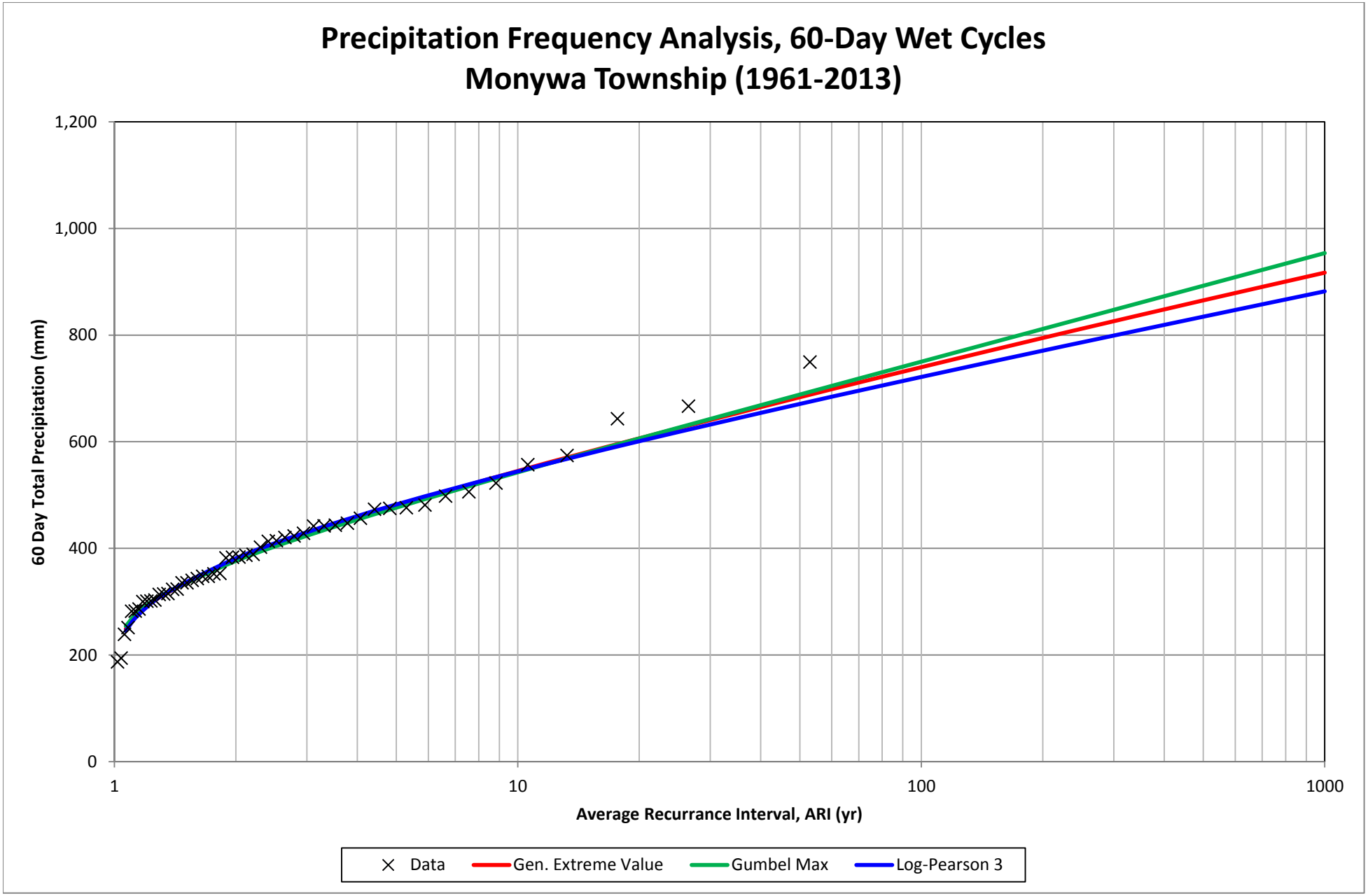
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 60 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 60 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Extreme Value		Gumbel Max		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	k =	-0.03209	σ =	88.26703134	α =	671.7214009
			σ =	92.41894	μ =	344.0374253	β =	-0.01090416
			μ =	344.491			γ =	13.26444653
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	917.0	113.87	953.7	113.21	882.0	112.70
0.998	0.002	500	865.1	113.87	892.5	113.21	834.5	112.70
0.996	0.004	250	812.0	113.87	831.2	113.21	786.4	112.70
0.995	0.005	200	794.6	113.87	811.5	113.21	770.7	112.70
0.990	0.010	100	739.7	113.87	750.1	113.21	721.4	112.70
0.980	0.020	50	683.4	113.87	688.4	113.21	670.8	112.70
0.950	0.050	20	606.3	113.87	606.2	113.21	600.9	112.70
0.900	0.100	10	545.1	113.87	542.7	113.21	544.4	112.70
0.800	0.200	5	479.8	113.87	476.4	113.21	482.4	112.70
0.667	0.333	3	426.8	113.87	423.8	113.21	430.4	112.70
0.500	0.500	2.0	378.2	113.87	376.4	113.21	381.3	112.70
0.250	0.750	1.3	314.1	113.87	315.2	113.21	314.6	112.70
0.125	0.875	1.14	276.0	113.87	279.4	113.21	274.2	112.70
0.063	0.937	1.07	249.0	113.87	254.3	113.21	245.4	112.70
Kolmogorov Smirnov (Statistic, Rank)			0.0650	2	0.0603	1	0.0694	10
Anderson Darling (Statistic, Rank)			0.2320	6	0.2507	14	0.2444	10


Precipitation Frequency Analysis, 60-Day Wet Cycles
Monywa Township (1961-2013)
60 Day Total Precipitation (mm)
1,200
1,000
800
600
400
200
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Extreme Value
Gumbel Max
Log-Pearson 3

Precipitation Frequency Analysis, 30 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

30 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	30 d Wet Precip (mm)
1961	259.0	1	0.019	53.00	518.0
1962	194.0	2	0.038	26.50	496.0
1963	342.0	3	0.057	17.67	415.0
1964	205.0	4	0.075	13.25	394.2
1965	496.0	5	0.094	10.60	388.0
1966	232.0	6	0.113	8.83	372.0
1967	223.0	7	0.132	7.57	365.0
1968	320.0	8	0.151	6.63	357.0
1969	230.0	9	0.170	5.89	353.2
1970	229.0	10	0.189	5.30	351.0
1971	298.0	11	0.208	4.82	347.0
1972	357.0	12	0.226	4.42	342.0
1973	312.0	13	0.245	4.08	340.0
1974	240.0	14	0.264	3.79	334.0
1975	347.0	15	0.283	3.53	321.0
1976	415.0	16	0.302	3.31	320.0
1977	365.0	17	0.321	3.12	312.0
1978	272.0	18	0.340	2.94	306.0
1979	178.0	19	0.358	2.79	301.0
1980	222.0	20	0.377	2.65	298.0
1981	340.0	21	0.396	2.52	294.9
1982	142.0	22	0.415	2.41	292.0
1983	306.0	23	0.434	2.30	285.2
1984	372.0	24	0.453	2.21	272.0
1985	127.0	25	0.472	2.12	272.0
1986	239.0	26	0.491	2.04	269.0
1987	334.0	27	0.509	1.96	261.1
1988	292.0	28	0.528	1.89	259.0
1989	321.0	29	0.547	1.83	252.0
1990	240.0	30	0.566	1.77	242.0
1991	172.0	31	0.585	1.71	240.0
1992	227.0	32	0.604	1.66	240.0
1993	242.0	33	0.623	1.61	239.0
1994	272.0	34	0.642	1.56	232.0
1995	230.9	35	0.660	1.51	230.9
1996	269.0	36	0.679	1.47	230.0
1997	188.7	37	0.698	1.43	229.0
1998	195.1	38	0.717	1.39	227.0
1999	294.9	39	0.736	1.36	223.0
2000	261.1	40	0.755	1.33	222.0
2001	180.9	41	0.774	1.29	217.2
2002	171.0	42	0.792	1.26	205.0
2003	301.0	43	0.811	1.23	195.1
2004	351.0	44	0.830	1.20	194.0
2005	285.2	45	0.849	1.18	188.7
2006	217.2	46	0.868	1.15	180.9
2007	394.2	47	0.887	1.13	178.7
2008	178.7	48	0.906	1.10	178.0
2009	252.0	49	0.925	1.08	172.0
2010	518.0	50	0.943	1.06	171.0
2011	353.2	51	0.962	1.04	142.0
2012	388.0	52	0.981	1.02	127.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results

Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Johnson SB	11	1	11
Log-Gamma	1	19	19
Fatigue Life	3	11	33
Log-Pearson 3	17	2	34
Gamma (3P)	10	4	40
Frechet (3P)	2	20	40
Gen. Extreme Value	16	3	48
Gen. Gamma (4P)	12	5	60
Lognormal	5	14	70
Rayleigh (2P)	4	18	72

Three fits were selected for comparison:

1) **Johnson SB** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

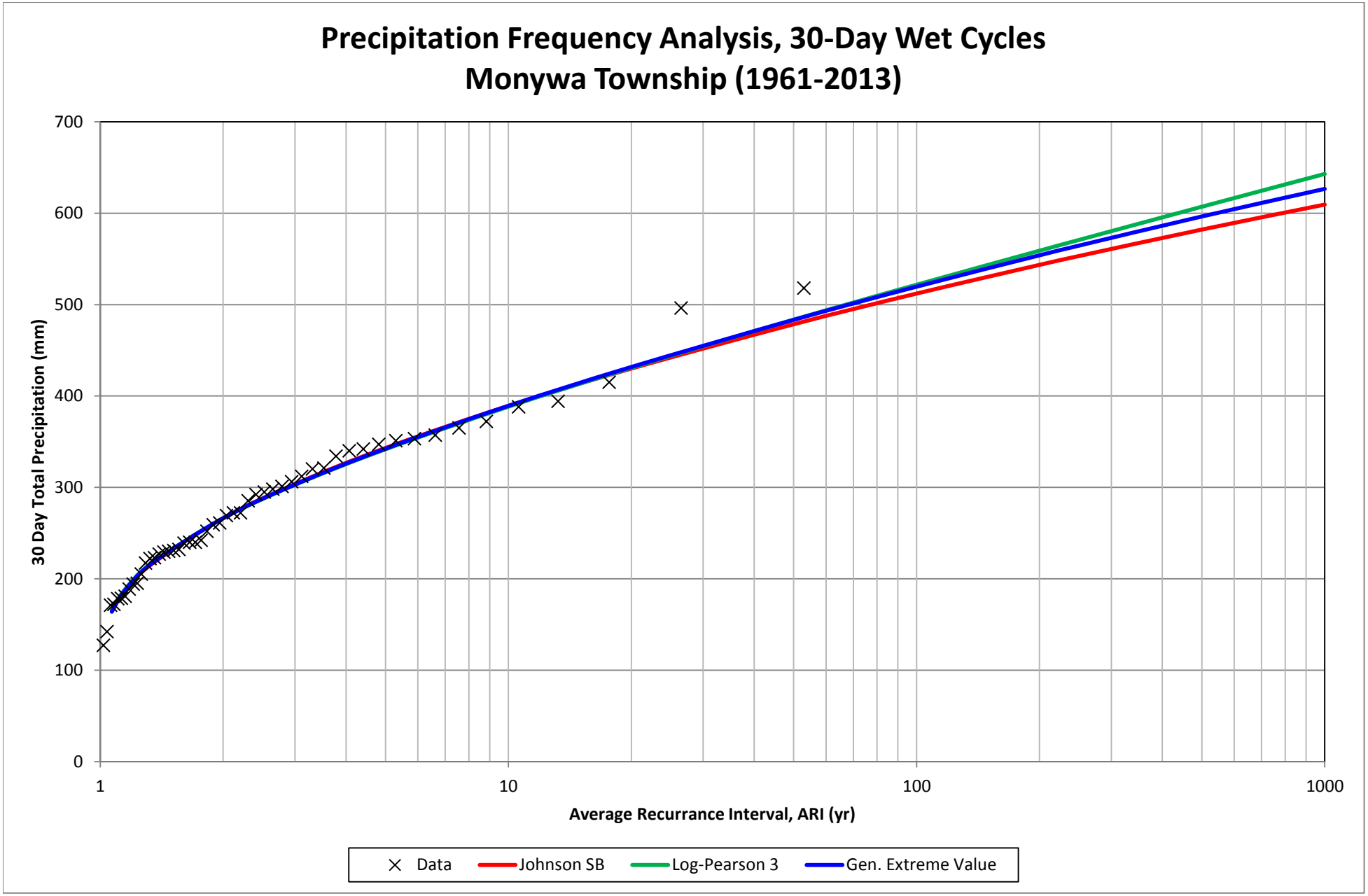
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 30 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 30 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Johnson SB		Log-Pearson 3		Gen. Extreme Value	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	γ =	3.1891087	α =	373.2489569	k =	-0.07695247
			δ =	2.282648	β =	-0.015596338	σ =	72.10509295
			λ =	1179.23	γ =	11.40050618	μ =	240.2813801
			ξ =	32.561480				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	609.4	N/A	643.0	84.04	626.6	84.48
0.998	0.002	500	582.1	N/A	607.1	84.04	596.4	84.48
0.996	0.004	250	553.1	N/A	570.7	84.04	564.5	84.48
0.995	0.005	200	543.4	N/A	558.9	84.04	553.9	84.48
0.990	0.010	100	512.1	N/A	521.7	84.04	519.6	84.48
0.980	0.020	50	478.5	N/A	483.6	84.04	483.3	84.48
0.950	0.050	20	430.0	N/A	430.9	84.04	431.7	84.48
0.900	0.100	10	389.2	N/A	388.3	84.04	389.3	84.48
0.800	0.200	5	343.2	N/A	341.8	84.04	342.4	84.48
0.667	0.333	3	303.8	N/A	302.9	84.04	303.2	84.48
0.500	0.500	2.0	266.4	N/A	266.2	84.04	266.3	84.48
0.250	0.750	1.3	215.9	N/A	216.8	84.04	216.4	84.48
0.125	0.875	1.14	185.8	N/A	187.0	84.04	186.0	84.48
0.063	0.937	1.07	165.0	N/A	165.9	84.04	164.0	84.48
Kolmogorov Smirnov (Statistic, Rank)			0.0638	11	0.0660	17	0.0657	16
Anderson Darling (Statistic, Rank)			0.1768	1	0.1804	2	0.1808	3


Precipitation Frequency Analysis, 30-Day Wet Cycles
Monywa Township (1961-2013)
30 Day Total Precipitation (mm)
700
600
500
400
300
200
100
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Johnson SB
Log-Pearson 3
Gen. Extreme Value

Precipitation Frequency Analysis, 14 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

14 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	14 d Wet Precip (mm)
1961	169.0	1	0.019	53.00	365.9
1962	145.0	2	0.038	26.50	359.0
1963	270.0	3	0.057	17.67	338.0
1964	166.0	4	0.075	13.25	333.0
1965	297.0	5	0.094	10.60	324.5
1966	171.0	6	0.113	8.83	297.0
1967	153.0	7	0.132	7.57	285.0
1968	245.0	8	0.151	6.63	280.0
1969	167.0	9	0.170	5.89	270.0
1970	173.0	10	0.189	5.30	247.0
1971	227.0	11	0.208	4.82	245.0
1972	280.0	12	0.226	4.42	244.0
1973	210.0	13	0.245	4.08	235.0
1974	193.0	14	0.264	3.79	230.0
1975	221.0	15	0.283	3.53	227.0
1976	359.0	16	0.302	3.31	224.5
1977	197.0	17	0.321	3.12	221.0
1978	199.0	18	0.340	2.94	210.0
1979	133.0	19	0.358	2.79	203.5
1980	146.0	20	0.377	2.65	203.0
1981	203.0	21	0.396	2.52	199.0
1982	118.0	22	0.415	2.41	197.9
1983	244.0	23	0.434	2.30	197.0
1984	338.0	24	0.453	2.21	193.0
1985	93.0	25	0.472	2.12	182.0
1986	182.0	26	0.491	2.04	173.0
1987	230.0	27	0.509	1.96	172.5
1988	235.0	28	0.528	1.89	171.0
1989	247.0	29	0.547	1.83	169.0
1990	139.0	30	0.566	1.77	168.4
1991	115.0	31	0.585	1.71	168.1
1992	164.0	32	0.604	1.66	167.0
1993	161.0	33	0.623	1.61	166.0
1994	154.9	34	0.642	1.56	164.0
1995	149.9	35	0.660	1.51	161.0
1996	172.5	36	0.679	1.47	155.7
1997	132.3	37	0.698	1.43	154.9
1998	168.1	38	0.717	1.39	153.5
1999	203.5	39	0.736	1.36	153.0
2000	141.5	40	0.755	1.33	149.9
2001	155.7	41	0.774	1.29	146.0
2002	112.2	42	0.792	1.26	145.0
2003	197.9	43	0.811	1.23	141.5
2004	333.0	44	0.830	1.20	139.7
2005	168.4	45	0.849	1.18	139.0
2006	139.7	46	0.868	1.15	133.0
2007	365.9	47	0.887	1.13	132.3
2008	121.5	48	0.906	1.10	121.5
2009	153.5	49	0.925	1.08	118.0
2010	285.0	50	0.943	1.06	115.0
2011	224.5	51	0.962	1.04	112.2
2012	324.5	52	0.981	1.02	93.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Extreme Value	10	1	10
Log-Logistic (3P)	1	16	16
Wakeby	12	2	24
Pearson 5 (3P)	11	3	33
Frechet	9	4	36
Pearson 6 (4P)	2	25	50
Lognormal (3P)	8	7	56
Burr	13	5	65
Erlang (3P)	6	14	84
Log-Pearson 3	16	9	144

Three fits were selected for comparison:

1) **Log-Logistic (3P)** (2nd best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

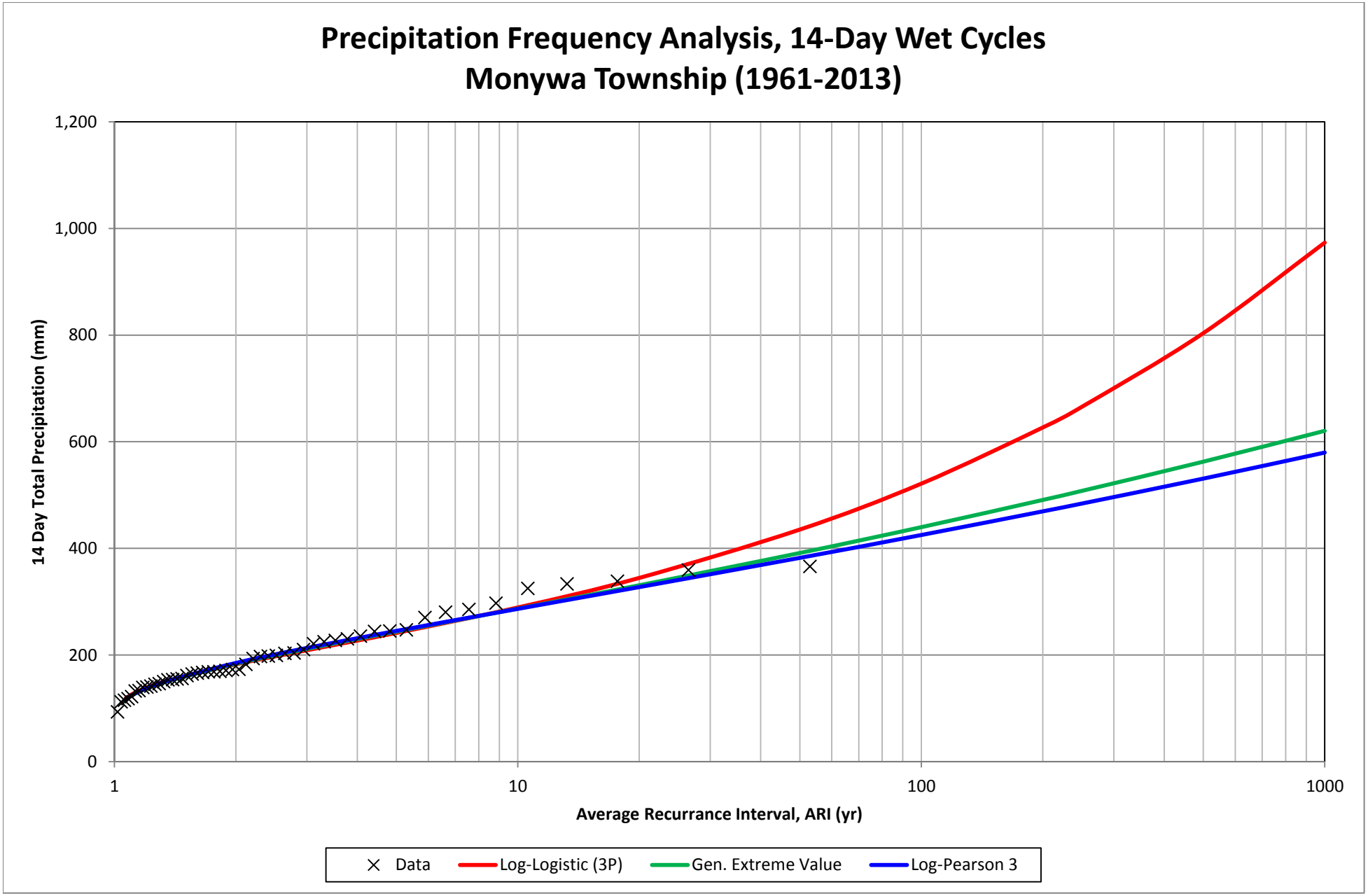
Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

Precipitation Frequency Analysis, 14 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 14 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Extreme Value		Log-Logistic (3P)		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	k =	0.079888	α =	3.342476125	α =	51.89373803
			σ =	49.38084	β =	114.6736834	β =	0.044826575
			μ =	165.2531	γ =	67.8774572	γ =	2.909563599
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	620.4	71.22	973.3	90.18	579.7	69.03
0.998	0.002	500	562.6	71.22	803.5	90.18	530.8	69.03
0.996	0.004	250	507.8	71.22	665.4	90.18	484.0	69.03
0.995	0.005	200	490.8	71.22	626.6	90.18	469.4	69.03
0.990	0.010	100	439.8	71.22	521.3	90.18	425.0	69.03
0.980	0.020	50	391.3	71.22	435.3	90.18	382.2	69.03
0.950	0.050	20	330.8	71.22	344.6	90.18	327.4	69.03
0.900	0.100	10	287.0	71.22	289.2	90.18	286.6	69.03
0.800	0.200	5	243.9	71.22	241.5	90.18	245.3	69.03
0.667	0.333	3	211.5	71.22	209.0	90.18	213.3	69.03
0.500	0.500	2.0	183.6	71.22	182.6	90.18	185.1	69.03
0.250	0.750	1.3	149.3	71.22	150.4	90.18	150.0	69.03
0.125	0.875	1.14	130.1	71.22	131.9	90.18	130.4	69.03
0.063	0.937	1.07	117.0	71.22	119.0	90.18	117.1	69.03
Kolmogorov Smirnov (Statistic, Rank)			0.0942	8	0.0914	7	0.1032	19
Anderson Darling (Statistic, Rank)			0.2409	1	0.2425	2	0.2683	10


Precipitation Frequency Analysis, 14-Day Wet Cycles
Monywa Township (1961-2013)
14 Day Total Precipitation (mm)
1,200
1,000
800
600
400
200
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Log-Logistic (3P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 7 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

7 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	7 d Wet Precip (mm)
1961	122.0	1	0.019	53.00	319.4
1962	116.0	2	0.038	26.50	309.0
1963	165.0	3	0.057	17.67	232.7
1964	141.0	4	0.075	13.25	225.5
1965	178.0	5	0.094	10.60	221.0
1966	141.0	6	0.113	8.83	212.0
1967	144.0	7	0.132	7.57	208.0
1968	203.0	8	0.151	6.63	206.5
1969	112.0	9	0.170	5.89	203.0
1970	96.0	10	0.189	5.30	186.0
1971	159.0	11	0.208	4.82	183.0
1972	162.0	12	0.226	4.42	178.0
1973	183.0	13	0.245	4.08	174.0
1974	186.0	14	0.264	3.79	173.0
1975	166.0	15	0.283	3.53	172.0
1976	221.0	16	0.302	3.31	166.0
1977	150.0	17	0.321	3.12	165.0
1978	131.0	18	0.340	2.94	162.0
1979	119.0	19	0.358	2.79	159.0
1980	109.0	20	0.377	2.65	157.0
1981	132.0	21	0.396	2.52	150.0
1982	89.0	22	0.415	2.41	149.4
1983	174.0	23	0.434	2.30	145.0
1984	309.0	24	0.453	2.21	144.0
1985	92.0	25	0.472	2.12	141.7
1986	172.0	26	0.491	2.04	141.0
1987	157.0	27	0.509	1.96	141.0
1988	208.0	28	0.528	1.89	132.0
1989	212.0	29	0.547	1.83	131.0
1990	98.0	30	0.566	1.77	129.5
1991	108.0	31	0.585	1.71	128.5
1992	145.0	32	0.604	1.66	125.2
1993	118.0	33	0.623	1.61	122.0
1994	120.1	34	0.642	1.56	120.1
1995	132.3	35	0.660	1.51	119.0
1996	128.5	36	0.679	1.47	118.0
1997	91.9	37	0.698	1.43	116.0
1998	100.3	38	0.717	1.39	115.5
1999	141.7	39	0.736	1.36	112.0
2000	125.2	40	0.755	1.33	109.0
2001	107.4	41	0.774	1.29	108.0
2002	99.0	42	0.792	1.26	107.4
2003	149.4	43	0.811	1.23	100.6
2004	232.7	44	0.830	1.20	100.3
2005	129.5	45	0.849	1.18	99.0
2006	100.6	46	0.868	1.15	98.0
2007	319.4	47	0.887	1.13	96.0
2008	84.9	48	0.906	1.10	92.0
2009	115.5	49	0.925	1.08	91.9
2010	225.5	50	0.943	1.06	89.0
2011	173.0	51	0.962	1.04	84.9
2012	206.5	52	0.981	1.02	80.8
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Wakeby	1	1	1
Weibull (3P)	2	3	6
Johnson SB	5	2	10
Phased Bi-Weibull	3	6	18
Gen. Extreme Value	4	7	28
Gamma (3P)	7	4	28
Log-Pearson 3	6	5	30
Lognormal (3P)	12	10	120
Inv. Gaussian (3P)	14	9	126
Gen. Logistic	8	16	128

Three fits were selected for comparison:

1) **Wakeby** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

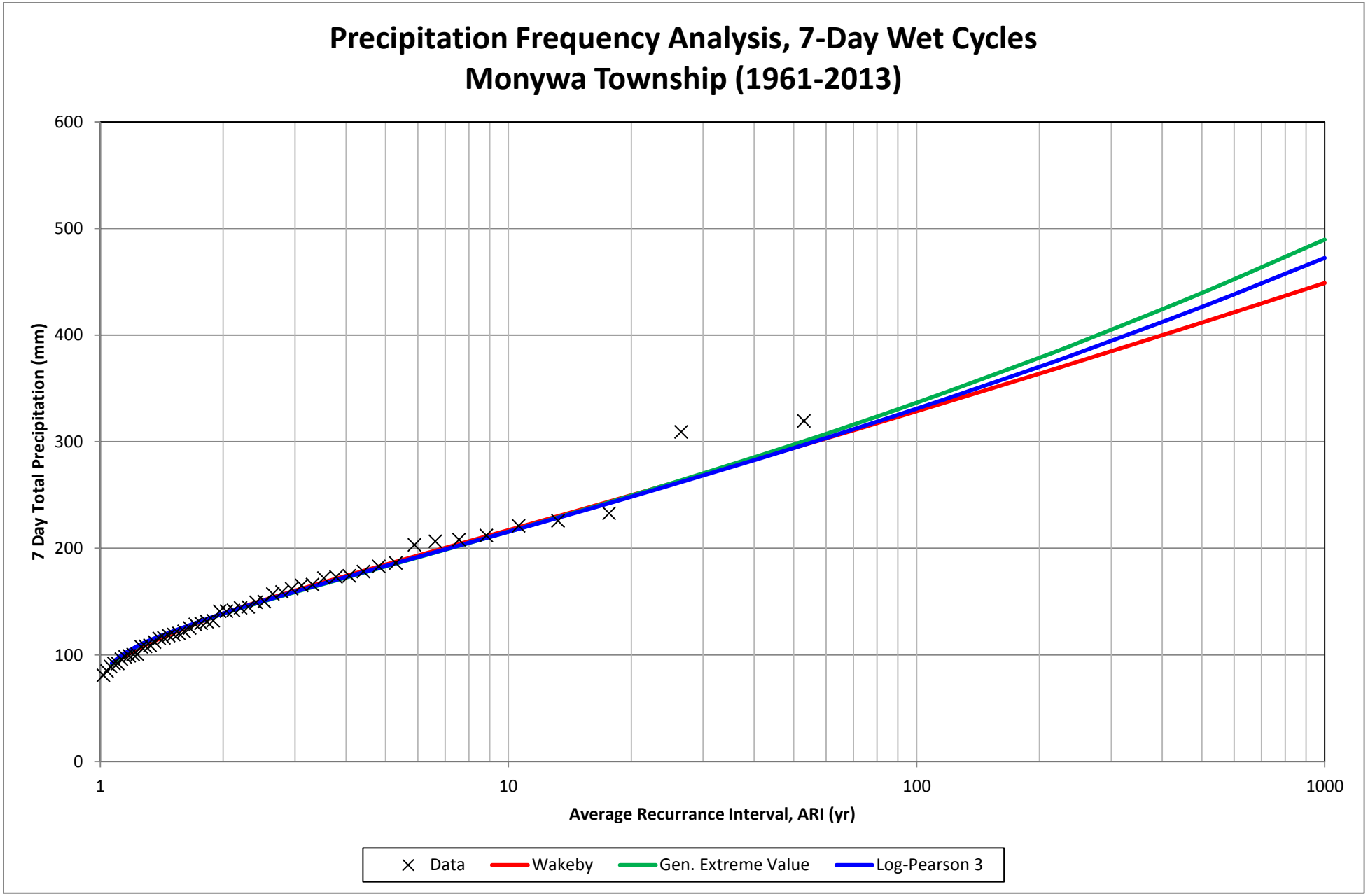
Note that these predictions should be multiplied by **1.018** to account for potential straddling errors in sampling which may occur from fixed 24-h observational periods, as discussed in:

Weiss, L.L., 1964, Ratio of true to fixed-interval maximum rainfall: American Society of Civil Engineers, Journal of Hydraulics Division, v.90, HY-1, p. 77-82.

Precipitation Frequency Analysis, 7 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 7 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Wakeby		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	α =	73.72227	k =	0.108755469	α =	14.5565948
			β =	2.488256	σ =	35.37236791	β =	0.08155159
			γ =	43.14648	μ =	125.3784974	γ =	3.773859131
			δ =	0.033106				
			ξ =	84.27241				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	448.8	N/A	489.5	53.60	472.3	52.50
0.998	0.002	500	411.6	N/A	439.4	53.60	426.3	52.50
0.996	0.004	250	375.3	N/A	392.9	53.60	383.4	52.50
0.995	0.005	200	363.8	N/A	378.7	53.60	370.2	52.50
0.990	0.010	100	328.5	N/A	336.5	53.60	330.9	52.50
0.980	0.020	50	294.1	N/A	297.3	53.60	294.0	52.50
0.950	0.050	20	249.8	N/A	249.4	53.60	248.3	52.50
0.900	0.100	10	217.0	N/A	215.6	53.60	215.5	52.50
0.800	0.200	5	184.7	N/A	183.0	53.60	183.4	52.50
0.667	0.333	3	160.3	N/A	159.0	53.60	159.4	52.50
0.500	0.500	2.0	138.9	N/A	138.6	53.60	138.9	52.50
0.250	0.750	1.3	111.9	N/A	114.0	53.60	114.3	52.50
0.125	0.875	1.14	98.4	N/A	100.5	53.60	101.1	52.50
0.063	0.937	1.07	91.5	N/A	91.3	53.60	92.3	52.50
Kolmogorov Smirnov (Statistic, Rank)			0.0392	1	0.0473	4	0.0520	6
Anderson Darling (Statistic, Rank)			0.1049	1	0.1532	7	0.1465	5


Precipitation Frequency Analysis, 7-Day Wet Cycles
Monywa Township (1961-2013)
7 Day Total Precipitation (mm)
600
500
400
300
200
100
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 4 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

4 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	4 d Wet Precip (mm)
1961	96.0	1	0.019	53.00	294.0
1962	116.0	2	0.038	26.50	288.0
1963	128.0	3	0.057	17.67	216.0
1964	109.0	4	0.075	13.25	204.0
1965	152.0	5	0.094	10.60	190.0
1966	141.0	6	0.113	8.83	174.0
1967	144.0	7	0.132	7.57	168.0
1968	168.0	8	0.151	6.63	158.0
1969	108.0	9	0.170	5.89	154.0
1970	96.0	10	0.189	5.30	153.0
1971	158.0	11	0.208	4.82	152.0
1972	125.0	12	0.226	4.42	147.6
1973	124.0	13	0.245	4.08	145.0
1974	154.0	14	0.264	3.79	144.0
1975	145.0	15	0.283	3.53	143.0
1976	128.0	16	0.302	3.31	141.7
1977	127.0	17	0.321	3.12	141.0
1978	85.0	18	0.340	2.94	139.0
1979	112.0	19	0.358	2.79	128.8
1980	97.0	20	0.377	2.65	128.0
1981	108.0	21	0.396	2.52	128.0
1982	55.0	22	0.415	2.41	127.0
1983	108.0	23	0.434	2.30	125.0
1984	294.0	24	0.453	2.21	124.0
1985	72.0	25	0.472	2.12	119.1
1986	143.0	26	0.491	2.04	116.0
1987	114.0	27	0.509	1.96	115.5
1988	153.0	28	0.528	1.89	114.0
1989	174.0	29	0.547	1.83	112.0
1990	87.0	30	0.566	1.77	109.0
1991	107.0	31	0.585	1.71	108.0
1992	106.0	32	0.604	1.66	108.0
1993	90.0	33	0.623	1.61	108.0
1994	119.1	34	0.642	1.56	107.0
1995	87.1	35	0.660	1.51	106.0
1996	95.8	36	0.679	1.47	97.0
1997	73.9	37	0.698	1.43	96.3
1998	96.3	38	0.717	1.39	96.0
1999	141.7	39	0.736	1.36	96.0
2000	72.1	40	0.755	1.33	95.8
2001	90.2	41	0.774	1.29	90.2
2002	87.6	42	0.792	1.26	90.0
2003	147.6	43	0.811	1.23	87.6
2004	204.0	44	0.830	1.20	87.1
2005	128.8	45	0.849	1.18	87.0
2006	86.6	46	0.868	1.15	86.6
2007	288.0	47	0.887	1.13	85.0
2008	69.6	48	0.906	1.10	73.9
2009	115.5	49	0.925	1.08	72.1
2010	216.0	50	0.943	1.06	72.0
2011	139.0	51	0.962	1.04	69.6
2012	190.0	52	0.981	1.02	55.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results			
Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Dagum (4P)	1	6	6
Gen. Logistic	7	1	7
Burr (4P)	3	3	9
Frechet (3P)	2	7	14
Log-Logistic (3P)	10	2	20
Dagum	9	4	36
Pearson 6	4	11	44
Pearson 5 (3P)	6	9	54
Gen. Extreme Value	14	8	112
Log-Pearson 3	13	14	182

Three fits were selected for comparison:

1) **Dagum (4P)** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

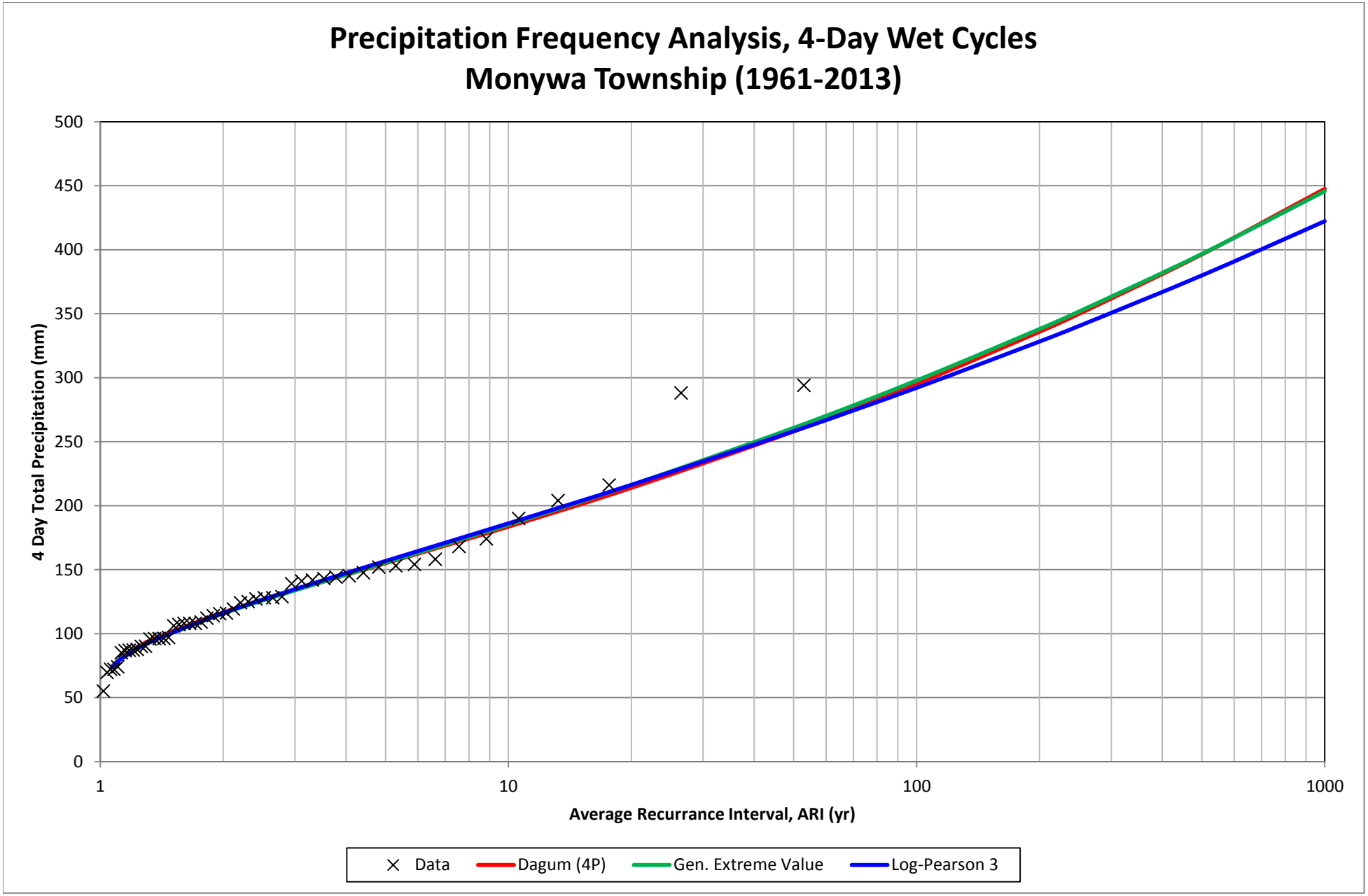
Note that these predictions should be multiplied by **1.034** to account for potential straddling errors in sampling which may occur from fixed 24-h observational periods. The correction factor for 4 day durations was linearly interpolated from values given in:

Weiss, L.L., 1964, Ratio of true to fixed-interval maximum rainfall: American Society of Civil Engineers, Journal of Hydraulics Division, v.90, HY-1, p. 77-82.

Precipitation Frequency Analysis, 4 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 4 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Dagum (4P)		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	k =	5.96752	k =	0.124568917	α =	19.47467782
			α =	6.967524	σ =	31.19983548	β =	0.076595668
			β =	155.2871	μ =	104.0418997	γ =	3.288776571
			γ =	-93.1777				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	447.6	48.07	445.7	48.66	422.3	48.01
0.998	0.002	500	396.3	48.07	396.7	48.66	379.9	48.01
0.996	0.004	250	349.9	48.07	351.7	48.66	340.4	48.01
0.995	0.005	200	335.9	48.07	338.0	48.66	328.3	48.01
0.990	0.010	100	295.1	48.07	297.8	48.66	292.1	48.01
0.980	0.020	50	258.0	48.07	260.8	48.66	258.2	48.01
0.950	0.050	20	214.0	48.07	216.2	48.66	216.3	48.01
0.900	0.100	10	183.6	48.07	185.1	48.66	186.2	48.01
0.800	0.200	5	155.0	48.07	155.5	48.66	156.8	48.01
0.667	0.333	3	134.2	48.07	133.9	48.66	134.9	48.01
0.500	0.500	2.0	116.6	48.07	115.7	48.66	116.2	48.01
0.250	0.750	1.3	95.1	48.07	94.1	48.66	93.8	48.01
0.125	0.875	1.14	82.9	48.07	82.2	48.66	81.7	48.01
0.063	0.937	1.07	74.4	48.07	74.2	48.66	73.8	48.01
Kolmogorov Smirnov (Statistic, Rank)			0.0547	1	0.0639	14	0.0630	13
Anderson Darling (Statistic, Rank)			0.1956	6	0.2235	8	0.2428	14


Precipitation Frequency Analysis, 4-Day Wet Cycles
Monywa Township (1961-2013)
4 Day Total Precipitation (mm)
500
450
400
350
300
250
200
150
100
50
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Dagum (4P)
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 3 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

3 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	3 d Wet Precip (mm)
1961	92.0	1	0.019	53.00	279.0
1962	116.0	2	0.038	26.50	265.0
1963	123.0	3	0.057	17.67	216.0
1964	104.0	4	0.075	13.25	195.3
1965	137.0	5	0.094	10.60	185.5
1966	139.0	6	0.113	8.83	165.0
1967	144.0	7	0.132	7.57	160.0
1968	165.0	8	0.151	6.63	144.0
1969	106.0	9	0.170	5.89	142.0
1970	88.0	10	0.189	5.30	141.0
1971	134.0	11	0.208	4.82	140.5
1972	107.0	12	0.226	4.42	139.0
1973	111.0	13	0.245	4.08	137.0
1974	129.0	14	0.264	3.79	135.0
1975	141.0	15	0.283	3.53	134.0
1976	120.0	16	0.302	3.31	130.0
1977	127.0	17	0.321	3.12	129.0
1978	79.0	18	0.340	2.94	128.8
1979	112.0	19	0.358	2.79	127.0
1980	97.0	20	0.377	2.65	123.0
1981	99.0	21	0.396	2.52	120.0
1982	54.0	22	0.415	2.41	119.1
1983	99.0	23	0.434	2.30	116.0
1984	279.0	24	0.453	2.21	114.0
1985	70.0	25	0.472	2.12	112.0
1986	142.0	26	0.491	2.04	112.0
1987	114.0	27	0.509	1.96	111.0
1988	130.0	28	0.528	1.89	107.0
1989	160.0	29	0.547	1.83	106.0
1990	75.0	30	0.566	1.77	106.0
1991	79.0	31	0.585	1.71	104.0
1992	106.0	32	0.604	1.66	99.0
1993	87.0	33	0.623	1.61	99.0
1994	119.1	34	0.642	1.56	97.0
1995	83.6	35	0.660	1.51	95.8
1996	95.8	36	0.679	1.47	92.0
1997	65.3	37	0.698	1.43	90.2
1998	82.5	38	0.717	1.39	88.0
1999	82.6	39	0.736	1.36	87.1
2000	68.1	40	0.755	1.33	87.0
2001	90.2	41	0.774	1.29	83.6
2002	87.1	42	0.792	1.26	82.8
2003	140.5	43	0.811	1.23	82.6
2004	195.3	44	0.830	1.20	82.5
2005	128.8	45	0.849	1.18	79.0
2006	82.8	46	0.868	1.15	79.0
2007	265.0	47	0.887	1.13	75.0
2008	68.1	48	0.906	1.10	70.0
2009	112.0	49	0.925	1.08	68.1
2010	216.0	50	0.943	1.06	68.1
2011	135.0	51	0.962	1.04	65.3
2012	185.5	52	0.981	1.02	54.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results

Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Gen. Logistic	4	1	4
Log-Logistic (3P)	5	2	10
Burr	2	9	18
Dagum (4P)	7	3	21
Dagum	6	5	30
Frechet (3P)	8	4	32
Log-Logistic	3	13	39
Wakeby	1	45	45
Gen. Extreme Value	9	6	54
Log-Pearson 3	13	11	143

Three fits were selected for comparison:

1) **Gen. Logistic** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

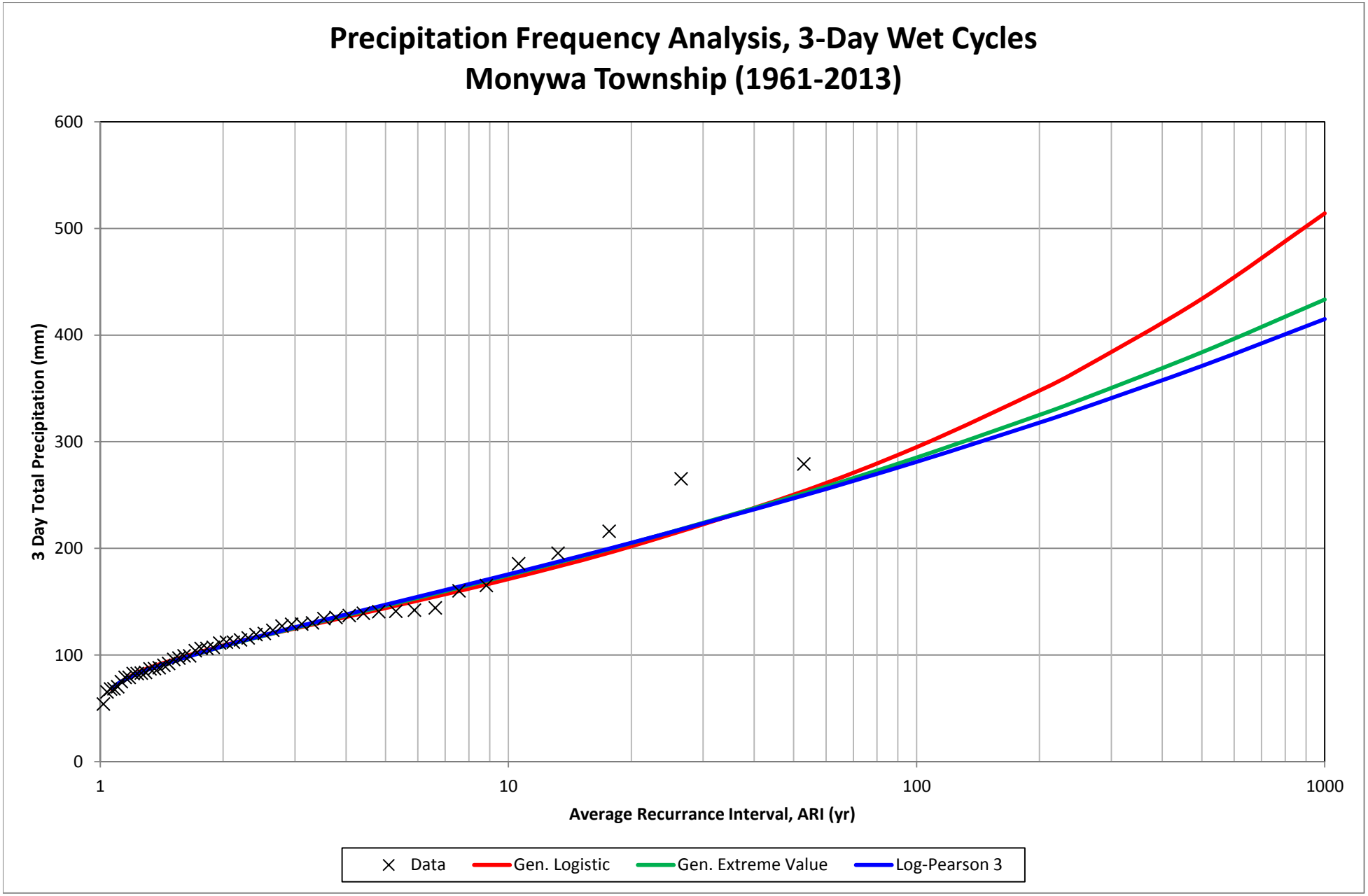
Note that these predictions should be multiplied by **1.044** to account for potential straddling errors in sampling which may occur from fixed 24-h observational periods, as discussed in:

Weiss, L.L., 1964, Ratio of true to fixed-interval maximum rainfall: American Society of Civil Engineers, Journal of Hydraulics Division, v.90, HY-1, p. 77-82.

Precipitation Frequency Analysis, 3 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 3 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Gen. Logistic		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI) (yr)	k =	0.259058	k =	0.134098497	α =	15.06559838
			σ =	21.05745	σ =	29.56566364	β =	0.088278212
			μ =	108.9025	μ =	97.07074459	γ =	3.384985514
			Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	514.1	N/A	433.3	46.96	415.0	46.38
0.998	0.002	500	434.0	N/A	383.9	46.96	371.0	46.38
0.996	0.004	250	367.1	N/A	338.8	46.96	330.3	46.38
0.995	0.005	200	347.9	N/A	325.1	46.96	317.9	46.38
0.990	0.010	100	294.9	N/A	285.2	46.96	281.1	46.38
0.980	0.020	50	250.4	N/A	248.6	46.96	247.0	46.38
0.950	0.050	20	201.9	N/A	204.9	46.96	205.2	46.38
0.900	0.100	10	171.2	N/A	174.7	46.96	175.7	46.38
0.800	0.200	5	144.0	N/A	146.2	46.96	147.2	46.38
0.667	0.333	3	124.9	N/A	125.5	46.96	126.1	46.38
0.500	0.500	2.0	108.9	N/A	108.2	46.96	108.4	46.38
0.250	0.750	1.3	88.8	N/A	87.6	46.96	87.4	46.38
0.125	0.875	1.14	76.7	N/A	76.5	46.96	76.3	46.38
0.063	0.937	1.07	68.0	N/A	69.0	46.96	69.0	46.38
Kolmogorov Smirnov (Statistic, Rank)			0.0655	4	0.0765	9	0.0814	13
Anderson Darling (Statistic, Rank)			0.1778	1	0.1925	6	0.2033	11


Precipitation Frequency Analysis, 3-Day Wet Cycles
Monywa Township (1961-2013)
3 Day Total Precipitation (mm)
600
500
400
300
200
100
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Gen. Logistic
Gen. Extreme Value
Log-Pearson 3

Precipitation Frequency Analysis, 2 Day Wet Cycles: Monywa Township (1961-2013)

Distribution fitting performed using EasyFit 5.3 Professional.

Count, n: 52

2 Day Data		Rank	Weibull	ARI	Ranked
Year	Precip (mm)	(highest to lowest) m	Exceedance Probability p	(yr)	2 d Wet Precip (mm)
1961	92.0	1	0.019	53.00	204.0
1962	95.0	2	0.038	26.50	197.8
1963	90.0	3	0.057	17.67	183.5
1964	104.0	4	0.075	13.25	164.0
1965	114.0	5	0.094	10.60	144.3
1966	75.0	6	0.113	8.83	139.0
1967	139.0	7	0.132	7.57	128.8
1968	122.0	8	0.151	6.63	124.0
1969	104.0	9	0.170	5.89	124.0
1970	78.0	10	0.189	5.30	123.0
1971	109.0	11	0.208	4.82	122.0
1972	98.0	12	0.226	4.42	122.0
1973	104.0	13	0.245	4.08	120.7
1974	105.0	14	0.264	3.79	119.1
1975	123.0	15	0.283	3.53	117.0
1976	102.0	16	0.302	3.31	114.0
1977	124.0	17	0.321	3.12	113.0
1978	76.0	18	0.340	2.94	109.0
1979	106.0	19	0.358	2.79	107.0
1980	77.0	20	0.377	2.65	106.0
1981	97.0	21	0.396	2.52	105.0
1982	41.0	22	0.415	2.41	105.0
1983	99.0	23	0.434	2.30	104.0
1984	204.0	24	0.453	2.21	104.0
1985	63.0	25	0.472	2.12	104.0
1986	107.0	26	0.491	2.04	103.0
1987	113.0	27	0.509	1.96	102.0
1988	117.0	28	0.528	1.89	99.0
1989	122.0	29	0.547	1.83	98.0
1990	75.0	30	0.566	1.77	97.0
1991	73.0	31	0.585	1.71	95.3
1992	105.0	32	0.604	1.66	95.0
1993	87.0	33	0.623	1.61	92.0
1994	119.1	34	0.642	1.56	90.0
1995	70.6	35	0.660	1.51	89.2
1996	95.3	36	0.679	1.47	87.0
1997	57.9	37	0.698	1.43	82.3
1998	67.8	38	0.717	1.39	79.5
1999	82.3	39	0.736	1.36	78.0
2000	68.1	40	0.755	1.33	77.0
2001	89.2	41	0.774	1.29	76.0
2002	52.1	42	0.792	1.26	75.0
2003	120.7	43	0.811	1.23	75.0
2004	144.3	44	0.830	1.20	73.0
2005	128.8	45	0.849	1.18	70.6
2006	79.5	46	0.868	1.15	68.1
2007	197.8	47	0.887	1.13	67.8
2008	42.5	48	0.906	1.10	63.0
2009	103.0	49	0.925	1.08	57.9
2010	164.0	50	0.943	1.06	52.1
2011	124.0	51	0.962	1.04	42.5
2012	183.5	52	0.981	1.02	41.0
2013	Exclude				

EasyFit 5.3 Professional Fit Results

Fitted Probability Distribution	Kolmogorov Smirnov Ranking	Anderson Darling Ranking	Weighted Ranking
Wakeby	1	1	1
Log-Logistic (3P)	2	3	6
Gen. Logistic	4	2	8
Burr	3	4	12
Pearson 5 (3P)	16	5	80
Gumbel Max	6	15	90
Pearson 6 (4P)	15	6	90
Gen. Extreme Value	14	8	112
Cauchy	5	26	130
Log-Pearson 3	27	14	378

Three fits were selected for comparison:

1) **Wakeby** (best weighted ranking)
2) **Gen. Extreme Value** (std. hydrologic distribution)
3) **Log-Pearson 3** (std. hydrologic distribution)

Additional details (goodness-of-fit) testing may be examined through the EasyFit 5.3 Professional software interface.

2013 was excluded from the analysis as a significant portion of the wet season data from that year was missing or has yet to occur.

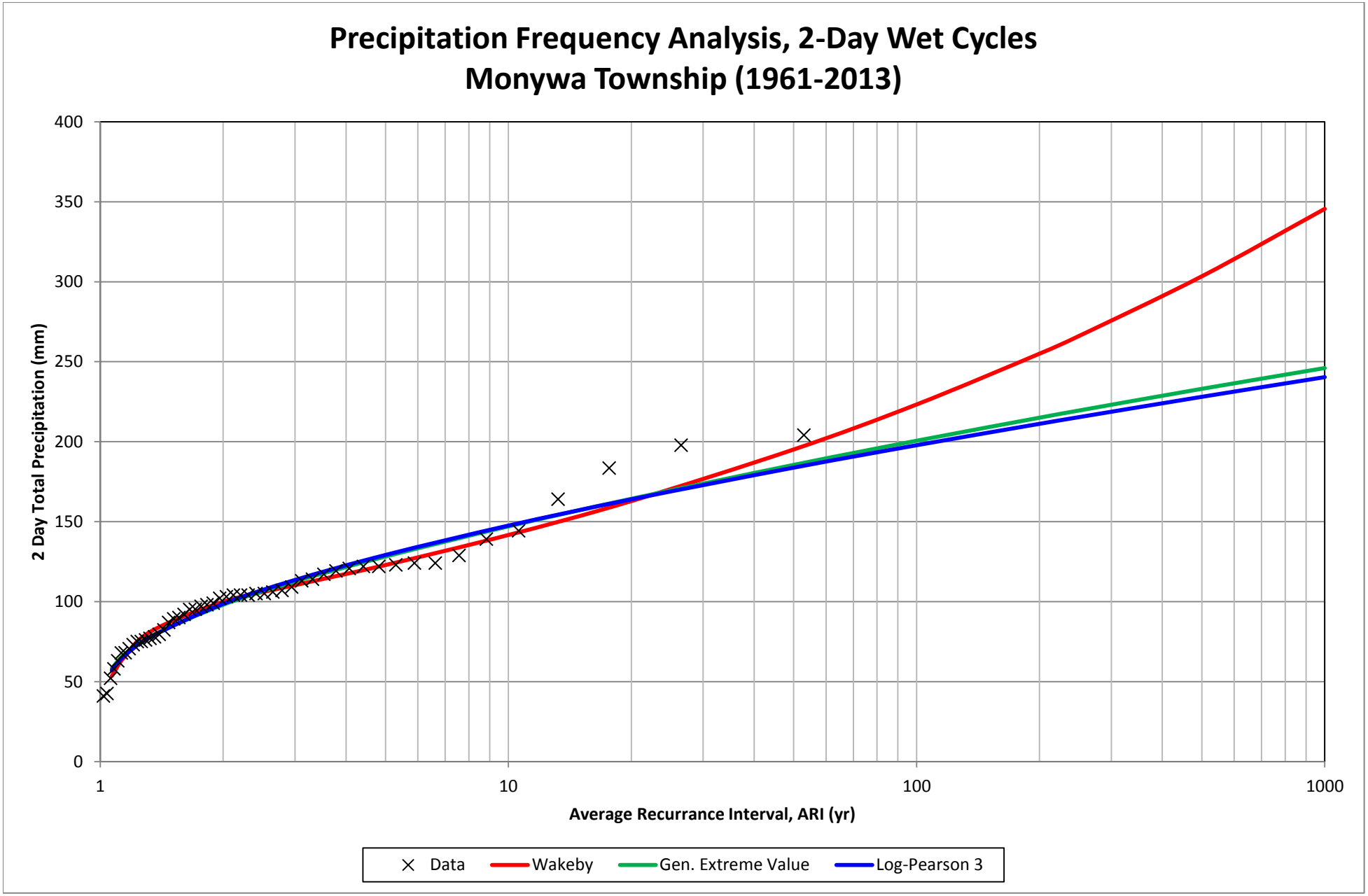
Note that these predictions should be multiplied by **1.067** to account for potential straddling errors in sampling which may occur from fixed 24-h observational periods, as discussed in:

Weiss, L.L., 1964, Ratio of true to fixed-interval maximum rainfall: American Society of Civil Engineers, Journal of Hydraulics Division, v.90, HY-1, p. 77-82.

Precipitation Frequency Analysis, 2 Day Wet Cycles: Monywa Township (1961-2013)

After consideration of these results, and the other n-day precipitation frequency analysis results, Knight Piésold selected the **Gen. Extreme Value** probability distribution to represent wet-cycle 2 day precipitation for the **Monywa Township** climate station near the **Letpadaung Copper** project. This distribution is the best common fit for all of the various durations considered. For consistency, one probability distribution was employed.

Probability Plotting Location			Wakeby		Gen. Extreme Value		Log-Pearson 3	
Annual Non Exceedance Probability (ANEP)	Annual Exceedance Probability (AEP)	Annual Recurrance Interval (ARI)	α =	245.3084	k =	-0.062569239	α =	53.52555281
			β =	5.045338	σ =	28.20174054	β =	-0.0457566
			γ =	19.16715	μ =	87.88256944	γ =	7.02549131
			δ =	0.175864				
			ξ =	38.67424				
		(yr)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)	Prediction (mm)	Std. Dev. (mm)
0.999	0.001	1000	345.6	N/A	246.0	33.56	240.4	33.72
0.998	0.002	500	303.4	N/A	233.1	33.56	228.1	33.72
0.996	0.004	250	266.1	N/A	219.5	33.56	215.4	33.72
0.995	0.005	200	255.0	N/A	215.0	33.56	211.2	33.72
0.990	0.010	100	223.3	N/A	200.6	33.56	197.8	33.72
0.980	0.020	50	195.2	N/A	185.5	33.56	183.8	33.72
0.950	0.050	20	162.9	N/A	164.3	33.56	164.0	33.72
0.900	0.100	10	141.7	N/A	147.1	33.56	147.6	33.72
0.800	0.200	5	122.9	N/A	128.3	33.56	129.2	33.72
0.667	0.333	3	110.4	N/A	112.7	33.56	113.6	33.72
0.500	0.500	2.0	100.0	N/A	98.1	33.56	98.7	33.72
0.250	0.750	1.3	81.6	N/A	78.6	33.56	78.2	33.72
0.125	0.875	1.14	65.1	N/A	66.8	33.56	65.9	33.72
0.063	0.937	1.07	53.5	N/A	58.3	33.56	57.1	33.72
Kolmogorov Smirnov (Statistic, Rank)			0.0577	1	0.0968	14	0.1047	27
Anderson Darling (Statistic, Rank)			0.2143	1	0.4281	8	0.4728	14


Precipitation Frequency Analysis, 2-Day Wet Cycles
Monywa Township (1961-2013)
2 Day Total Precipitation (mm)
400
350
300
250
200
150
100
50
0
1
10
100
1000
Average Recurrance Interval, ARI (yr)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3

ATTACHMENT 2.8

Water Balance Scenarios

Precipitation, 5 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1415.9	690.4	1102.7	1317.7	951.8
Day	Year 1	Year 2	Year 3	Year 4	Year 5
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	3.1	0.0	0.0
11	0.0	0.0	28.9	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	105.4	0.0
38	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0	0.0
68	2.1	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0

500 year ARI (mm)

Total	1509.0	735.8	1175.2	1404.3	1014.4
Day	Year 1	Year 2	Year 3	Year 4	Year 5
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	3.3	0.0	0.0
11	0.0	0.0	30.8	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	112.3	0.0
38	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0	0.0
68	2.2	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0

Precipitation, 5 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1415.9	690.4	1102.7	1317.7	951.8
Day	Year 1	Year 2	Year 3	Year 4	Year 5
75	0.0	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	13.4	0.0
77	0.0	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0	0.0
79	0.0	1.0	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0
81	0.0	2.1	0.0	0.0	0.0
82	0.0	3.1	0.0	0.0	0.0
83	0.0	0.0	0.0	0.0	0.0
84	0.0	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0	0.0
88	0.0	1.0	0.0	0.0	0.0
89	0.0	0.0	0.0	0.0	0.0
90	0.0	2.1	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	2.1	0.0	4.1
93	0.0	4.1	0.0	0.0	3.1
94	0.0	0.0	0.0	0.0	1.0
95	0.0	0.0	0.0	0.0	0.0
96	0.0	4.1	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	3.1	8.3
101	0.0	0.0	0.0	0.0	0.0
102	0.0	0.0	0.0	0.0	0.0
103	16.5	0.0	0.0	0.0	6.2
104	0.0	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0	0.0
106	0.0	0.0	0.0	0.0	1.0
107	0.0	0.0	0.0	0.0	0.0
108	0.0	0.0	0.0	0.0	0.0
109	0.0	0.0	0.0	0.0	5.2
110	0.0	0.0	0.0	4.1	0.0
111	0.0	0.0	8.3	0.0	0.0
112	0.0	0.0	0.0	0.0	0.0
113	0.0	0.0	0.0	0.0	1.0
114	0.0	0.0	0.0	0.0	0.0
115	3.1	0.0	0.0	0.0	0.0
116	0.0	0.0	0.0	1.0	0.0
117	0.0	0.0	0.0	0.0	0.0
118	0.0	0.0	0.0	0.0	0.0
119	0.0	0.0	0.0	0.0	0.0
120	0.0	0.0	0.0	0.0	0.0
121	0.0	0.0	0.0	0.0	0.0
122	0.0	0.0	0.0	0.0	0.0
123	34.1	0.0	0.0	0.0	0.0
124	0.0	0.0	0.0	1.0	0.0
125	0.0	0.0	11.4	0.0	0.0
126	0.0	0.0	0.0	0.0	5.2
127	0.0	0.0	0.0	0.0	2.1
128	0.0	0.0	0.0	1.0	0.0
129	1.0	0.0	0.0	0.0	0.0
130	6.2	0.0	0.0	42.4	0.0
131	8.3	1.0	0.0	0.0	0.0
132	0.0	0.0	0.0	0.0	3.1
133	0.0	0.0	0.0	47.5	6.2
134	0.0	0.0	11.4	0.0	2.1
135	0.0	0.0	0.0	15.5	0.0
136	2.1	0.0	0.0	0.0	0.0
137	0.0	0.0	27.9	3.1	0.0
138	1.0	7.2	0.0	0.0	0.0
139	0.0	0.0	0.0	0.0	1.0
140	6.2	0.0	0.0	0.0	0.0
141	0.0	0.0	8.3	40.3	0.0
142	0.0	12.4	0.0	0.0	0.0
143	2.1	0.0	0.0	6.2	0.0
144	1.0	20.7	11.4	0.0	0.0
145	6.2	87.8	13.4	14.5	10.3
146	1.0	6.2	50.6	12.4	4.1
147	1.0	24.8	19.6	0.0	0.0
148	9.3	40.3	0.0	0.0	0.0

500 year ARI (mm)

Total	1509.0	735.8	1175.2	1404.3	1014.4
Day	Year 1	Year 2	Year 3	Year 4	Year 5
75	0.0	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	14.3	0.0
77	0.0	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0	0.0
79	0.0	1.1	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0
81	0.0	2.2	0.0	0.0	0.0
82	0.0	3.3	0.0	0.0	0.0
83	0.0	0.0	0.0	0.0	0.0
84	0.0	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0	0.0
88	0.0	1.1	0.0	0.0	0.0
89	0.0	0.0	0.0	0.0	0.0
90	0.0	2.2	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	2.2	0.0	4.4
93	0.0	4.4	0.0	0.0	3.3
94	0.0	0.0	0.0	0.0	1.1
95	0.0	0.0	0.0	0.0	0.0
96	0.0	4.4	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	3.3	8.8
101	0.0	0.0	0.0	0.0	0.0
102	0.0	0.0	0.0	0.0	0.0
103	17.6	0.0	0.0	0.0	6.6
104	0.0	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0	0.0
106	0.0	0.0	0.0	0.0	1.1
107	0.0	0.0	0.0	0.0	0.0
108	0.0	0.0	0.0	0.0	0.0
109	0.0	0.0	0.0	0.0	5.5
110	0.0	0.0	0.0	4.4	0.0
111	0.0	0.0	8.8	0.0	0.0
112	0.0	0.0	0.0	0.0	0.0
113	0.0	0.0	0.0	0.0	1.1
114	0.0	0.0	0.0	0.0	0.0
115	3.3	0.0	0.0	0.0	0.0
116	0.0	0.0	0.0	1.1	0.0
117	0.0	0.0	0.0	0.0	0.0
118	0.0	0.0	0.0	0.0	0.0
119	0.0	0.0	0.0	0.0	0.0
120	0.0	0.0	0.0	0.0	0.0
121	0.0	0.0	0.0	0.0	0.0
122	0.0	0.0	0.0	0.0	0.0
123	36.3	0.0	0.0	0.0	0.0
124	0.0	0.0	0.0	1.1	0.0
125	0.0	0.0	12.1	0.0	0.0
126	0.0	0.0	0.0	0.0	5.5
127	0.0	0.0	0.0	0.0	2.2
128	0.0	0.0	0.0	1.1	0.0
129	1.1	0.0	0.0	0.0	0.0
130	6.6	0.0	0.0	45.2	0.0
131	8.8	1.1	0.0	0.0	0.0
132	0.0	0.0	0.0	0.0	3.3
133	0.0	0.0	0.0	50.7	6.6
134	0.0	0.0	12.1	0.0	2.2
135	0.0	0.0	0.0	16.5	0.0
136	2.2	0.0	0.0	0.0	0.0
137	0.0	0.0	29.7	3.3	0.0
138	1.1	7.7	0.0	0.0	0.0
139	0.0	0.0	0.0	0.0	1.1
140	6.6	0.0	0.0	0.0	0.0
141	0.0	0.0	8.8	43.0	0.0
142	0.0	13.2	0.0	0.0	0.0
143	2.2	0.0	0.0	6.6	0.0
144	1.1	22.0	12.1	0.0	0.0
145	6.6	93.6	14.3	15.4	11.0
146	1.1	6.6	54.0	13.2	4.4
147	1.1	26.4	20.9	0.0	0.0
148	9.9	43.0	0.0	0.0	0.0

Precipitation, 5 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1415.9	690.4	1102.7	1317.7	951.8
Day	Year 1	Year 2	Year 3	Year 4	Year 5
149	0.0	0.0	9.3	0.0	0.0
150	0.0	0.0	0.0	0.0	2.1
151	0.0	0.0	18.6	0.0	0.0
152	7.2	0.0	0.0	0.0	25.8
153	0.0	0.0	0.0	2.1	0.0
154	0.0	0.0	1.0	58.9	0.0
155	5.2	0.0	14.5	25.8	0.0
156	0.0	0.0	4.1	5.2	0.0
157	16.5	0.0	14.5	0.0	0.0
158	4.1	0.0	0.0	0.0	0.0
159	6.2	0.0	0.0	0.0	0.0
160	8.3	0.0	0.0	2.1	0.0
161	79.6	1.0	0.0	24.8	0.0
162	4.1	0.0	0.0	6.2	0.0
163	0.0	16.5	0.0	0.0	0.0
164	0.0	0.0	0.0	0.0	2.1
165	0.0	0.0	0.0	0.0	0.0
166	4.1	26.9	0.0	7.2	1.0
167	1.0	4.1	0.0	0.0	0.0
168	0.0	0.0	26.9	1.0	0.0
169	1.0	0.0	26.9	18.6	0.0
170	0.0	0.0	18.6	0.0	0.0
171	0.0	0.0	14.5	0.0	0.0
172	6.2	0.0	1.0	19.6	0.0
173	0.0	0.0	0.0	1.0	0.0
174	0.0	6.2	0.0	0.0	3.1
175	0.0	2.1	0.0	22.7	7.2
176	2.1	9.3	0.0	2.1	14.5
177	1.0	0.0	8.3	0.0	1.0
178	68.2	0.0	0.0	0.0	0.0
179	0.0	0.0	0.0	2.1	0.0
180	0.0	0.0	0.0	0.0	0.0
181	25.8	0.0	0.0	0.0	0.0
182	0.0	0.0	0.0	0.0	0.0
183	17.6	0.0	0.0	23.8	0.0
184	10.3	0.0	0.0	0.0	1.0
185	0.0	0.0	0.0	0.0	0.0
186	5.2	0.0	0.0	0.0	0.0
187	6.2	0.0	0.0	0.0	0.0
188	0.0	0.0	0.0	0.0	0.0
189	0.0	0.0	0.0	1.0	0.0
190	1.0	0.0	0.0	0.0	0.0
191	4.1	0.0	0.0	0.0	0.0
192	48.6	0.0	0.0	0.0	0.0
193	14.5	0.0	0.0	0.0	0.0
194	1.0	0.0	0.0	0.0	0.0
195	21.7	0.0	0.0	0.0	22.7
196	0.0	0.0	20.7	0.0	2.1
197	0.0	0.0	0.0	0.0	1.0
198	0.0	0.0	0.0	0.0	0.0
199	0.0	1.0	0.0	0.0	0.0
200	0.0	10.3	0.0	0.0	1.0
201	1.0	0.0	0.0	0.0	0.0
202	0.0	0.0	12.4	0.0	0.0
203	0.0	0.0	0.0	0.0	13.4
204	0.0	4.1	0.0	0.0	1.0
205	0.0	0.0	1.0	0.0	3.1
206	0.0	0.0	0.0	31.0	0.0
207	0.0	0.0	0.0	1.0	0.0
208	1.0	3.1	0.0	0.0	0.0
209	0.0	10.3	3.1	0.0	0.0
210	0.0	6.2	10.3	3.1	0.0
211	2.1	0.0	0.0	0.0	0.0
212	4.1	0.0	0.0	0.0	0.0
213	0.0	2.1	0.0	2.1	0.0
214	8.3	0.0	1.0	0.0	0.0
215	3.1	0.0	49.6	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0
217	0.0	0.0	0.0	0.0	0.0
218	106.4	0.0	0.0	2.1	0.0
219	1.0	0.0	3.1	0.0	0.0
220	0.0	0.0	0.0	0.0	0.0
221	3.1	0.0	0.0	0.0	0.0
222	30.0	0.0	3.1	2.1	0.0

500 year ARI (mm)

Total	1509.0	735.8	1175.2	1404.3	1014.4
Day	Year 1	Year 2	Year 3	Year 4	Year 5
149	0.0	0.0	9.9	0.0	0.0
150	0.0	0.0	0.0	0.0	2.2
151	0.0	0.0	19.8	0.0	0.0
152	7.7	0.0	0.0	0.0	27.5
153	0.0	0.0	0.0	2.2	0.0
154	0.0	0.0	1.1	62.8	0.0
155	5.5	0.0	15.4	27.5	0.0
156	0.0	0.0	4.4	5.5	0.0
157	17.6	0.0	15.4	0.0	0.0
158	4.4	0.0	0.0	0.0	0.0
159	6.6	0.0	0.0	0.0	0.0
160	8.8	0.0	0.0	2.2	0.0
161	84.8	1.1	0.0	26.4	0.0
162	4.4	0.0	0.0	6.6	0.0
163	0.0	17.6	0.0	0.0	0.0
164	0.0	0.0	0.0	0.0	2.2
165	0.0	0.0	0.0	0.0	0.0
166	4.4	28.6	0.0	7.7	1.1
167	1.1	4.4	0.0	0.0	0.0
168	0.0	0.0	28.6	1.1	0.0
169	1.1	0.0	28.6	19.8	0.0
170	0.0	0.0	19.8	0.0	0.0
171	0.0	0.0	15.4	0.0	0.0
172	6.6	0.0	1.1	20.9	0.0
173	0.0	0.0	0.0	1.1	0.0
174	0.0	6.6	0.0	0.0	3.3
175	0.0	2.2	0.0	24.2	7.7
176	2.2	9.9	0.0	2.2	15.4
177	1.1	0.0	8.8	0.0	1.1
178	72.7	0.0	0.0	0.0	0.0
179	0.0	0.0	0.0	2.2	0.0
180	0.0	0.0	0.0	0.0	0.0
181	27.5	0.0	0.0	0.0	0.0
182	0.0	0.0	0.0	0.0	0.0
183	18.7	0.0	0.0	25.3	0.0
184	11.0	0.0	0.0	0.0	1.1
185	0.0	0.0	0.0	0.0	0.0
186	5.5	0.0	0.0	0.0	0.0
187	6.6	0.0	0.0	0.0	0.0
188	0.0	0.0	0.0	0.0	0.0
189	0.0	0.0	0.0	1.1	0.0
190	1.1	0.0	0.0	0.0	0.0
191	4.4	0.0	0.0	0.0	0.0
192	51.8	0.0	0.0	0.0	0.0
193	15.4	0.0	0.0	0.0	0.0
194	1.1	0.0	0.0	0.0	0.0
195	23.1	0.0	0.0	0.0	24.2
196	0.0	0.0	22.0	0.0	2.2
197	0.0	0.0	0.0	0.0	1.1
198	0.0	0.0	0.0	0.0	0.0
199	0.0	1.1	0.0	0.0	0.0
200	0.0	11.0	0.0	0.0	1.1
201	1.1	0.0	0.0	0.0	0.0
202	0.0	0.0	13.2	0.0	0.0
203	0.0	0.0	0.0	0.0	14.3
204	0.0	4.4	0.0	0.0	1.1
205	0.0	0.0	1.1	0.0	3.3
206	0.0	0.0	0.0	33.0	0.0
207	0.0	0.0	0.0	1.1	0.0
208	1.1	3.3	0.0	0.0	0.0
209	0.0	11.0	3.3	0.0	0.0
210	0.0	6.6	11.0	3.3	0.0
211	2.2	0.0	0.0	0.0	0.0
212	4.4	0.0	0.0	0.0	0.0
213	0.0	2.2	0.0	2.2	0.0
214	8.8	0.0	1.1	0.0	0.0
215	3.3	0.0	52.9	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0
217	0.0	0.0	0.0	0.0	0.0
218	113.4	0.0	0.0	2.2	0.0
219	1.1	0.0	3.3	0.0	0.0
220	0.0	0.0	0.0	0.0	0.0
221	3.3	0.0	0.0	0.0	0.0
222	31.9	0.0	3.3	2.2	0.0

Precipitation, 5 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1415.9	690.4	1102.7	1317.7	951.8
Day	Year 1	Year 2	Year 3	Year 4	Year 5
223	48.6	71.3	5.2	0.0	0.0
224	0.0	3.1	0.0	0.0	0.0
225	12.4	2.1	0.0	0.0	0.0
226	0.0	0.0	0.0	1.0	0.0
227	0.0	0.0	0.0	0.0	0.0
228	0.0	4.1	31.0	0.0	0.0
229	0.0	1.0	0.0	1.0	0.0
230	0.0	3.1	0.0	0.0	16.5
231	0.0	0.0	1.0	0.0	33.1
232	1.0	0.0	3.1	0.0	53.7
233	0.0	0.0	6.2	11.4	19.6
234	14.5	0.0	1.0	0.0	12.4
235	0.0	0.0	0.0	0.0	3.1
236	9.3	11.4	0.0	0.0	16.5
237	6.2	0.0	18.6	0.0	0.0
238	0.0	0.0	0.0	1.0	23.8
239	2.1	0.0	12.4	8.3	0.0
240	0.0	0.0	50.6	0.0	0.0
241	72.3	0.0	0.0	0.0	0.0
242	0.0	0.0	6.2	14.5	3.1
243	0.0	0.0	1.0	24.8	21.7
244	0.0	0.0	2.1	10.3	14.5
245	0.0	0.0	2.1	0.0	22.7
246	0.0	0.0	0.0	5.2	0.0
247	0.0	0.0	0.0	1.0	0.0
248	0.0	0.0	0.0	0.0	4.1
249	0.0	0.0	0.0	0.0	0.0
250	0.0	4.1	0.0	0.0	47.5
251	0.0	28.9	2.1	0.0	16.5
252	0.0	0.0	13.4	0.0	9.3
253	2.1	0.0	27.9	0.0	1.0
254	0.0	0.0	11.4	0.0	36.2
255	0.0	0.0	0.0	0.0	14.5
256	0.0	0.0	0.0	15.5	0.0
257	0.0	0.0	0.0	6.2	0.0
258	0.0	0.0	9.3	6.2	4.1
259	0.0	4.1	0.0	20.7	3.1
260	70.3	2.1	0.0	2.1	0.0
261	0.0	2.1	0.0	33.1	0.0
262	0.0	15.5	0.0	1.0	0.0
263	34.1	1.0	4.1	0.0	0.0
264	11.4	14.5	18.6	0.0	53.7
265	34.1	0.0	55.8	0.0	74.4
266	30.0	0.0	71.3	0.0	3.1
267	0.0	0.0	0.0	0.0	0.0
268	3.1	0.0	18.6	0.0	0.0
269	0.0	0.0	3.1	19.6	0.0
270	0.0	26.9	0.0	4.1	0.0
271	0.0	62.0	0.0	0.0	0.0
272	3.1	44.4	0.0	0.0	23.8
273	9.3	0.0	0.0	12.4	1.0
274	16.5	0.0	0.0	1.0	0.0
275	11.4	11.4	0.0	0.0	0.0
276	0.0	0.0	56.8	2.1	0.0
277	0.0	0.0	0.0	4.1	0.0
278	0.0	0.0	1.0	0.0	0.0
279	0.0	0.0	37.2	0.0	0.0
280	0.0	0.0	8.3	0.0	0.0
281	0.0	0.0	19.6	0.0	0.0
282	0.0	0.0	15.5	0.0	38.2
283	0.0	0.0	0.0	0.0	5.2
284	28.9	0.0	0.0	1.0	66.1
285	0.0	0.0	0.0	26.9	7.2
286	0.0	0.0	0.0	45.5	1.0
287	13.4	1.0	0.0	51.7	13.4
288	11.4	0.0	2.1	5.2	0.0
289	12.4	0.0	6.2	2.1	0.0
290	90.9	0.0	0.0	24.8	0.0
291	0.0	0.0	0.0	20.7	0.0
292	12.4	0.0	7.2	78.5	0.0
293	0.0	0.0	0.0	0.0	0.0
294	1.0	0.0	0.0	0.0	5.2
295	5.2	0.0	0.0	53.7	7.2
296	0.0	0.0	0.0	3.1	0.0

500 year ARI (mm)

Total	1509.0	735.8	1175.2	1404.3	1014.4
Day	Year 1	Year 2	Year 3	Year 4	Year 5
223	51.8	76.0	5.5	0.0	0.0
224	0.0	3.3	0.0	0.0	0.0
225	13.2	2.2	0.0	0.0	0.0
226	0.0	0.0	0.0	1.1	0.0
227	0.0	0.0	0.0	0.0	0.0
228	0.0	4.4	33.0	0.0	0.0
229	0.0	1.1	0.0	1.1	0.0
230	0.0	3.3	0.0	0.0	17.6
231	0.0	0.0	1.1	0.0	35.2
232	1.1	0.0	3.3	0.0	57.3
233	0.0	0.0	6.6	12.1	20.9
234	15.4	0.0	1.1	0.0	13.2
235	0.0	0.0	0.0	0.0	3.3
236	9.9	12.1	0.0	0.0	17.6
237	6.6	0.0	19.8	0.0	0.0
238	0.0	0.0	0.0	1.1	25.3
239	2.2	0.0	13.2	8.8	0.0
240	0.0	0.0	54.0	0.0	0.0
241	77.1	0.0	0.0	0.0	0.0
242	0.0	0.0	6.6	15.4	3.3
243	0.0	0.0	1.1	26.4	23.1
244	0.0	0.0	2.2	11.0	15.4
245	0.0	0.0	2.2	0.0	24.2
246	0.0	0.0	0.0	5.5	0.0
247	0.0	0.0	0.0	1.1	0.0
248	0.0	0.0	0.0	0.0	4.4
249	0.0	0.0	0.0	0.0	0.0
250	0.0	4.4	0.0	0.0	50.7
251	0.0	30.8	2.2	0.0	17.6
252	0.0	0.0	14.3	0.0	9.9
253	2.2	0.0	29.7	0.0	1.1
254	0.0	0.0	12.1	0.0	38.6
255	0.0	0.0	0.0	0.0	15.4
256	0.0	0.0	0.0	16.5	0.0
257	0.0	0.0	0.0	6.6	0.0
258	0.0	0.0	9.9	6.6	4.4
259	0.0	4.4	0.0	22.0	3.3
260	74.9	2.2	0.0	2.2	0.0
261	0.0	2.2	0.0	35.2	0.0
262	0.0	16.5	0.0	1.1	0.0
263	36.3	1.1	4.4	0.0	0.0
264	12.1	15.4	19.8	0.0	57.3
265	36.3	0.0	59.5	0.0	79.3
266	31.9	0.0	76.0	0.0	3.3
267	0.0	0.0	0.0	0.0	0.0
268	3.3	0.0	19.8	0.0	0.0
269	0.0	0.0	3.3	20.9	0.0
270	0.0	28.6	0.0	4.4	0.0
271	0.0	66.1	0.0	0.0	0.0
272	3.3	47.4	0.0	0.0	25.3
273	9.9	0.0	0.0	13.2	1.1
274	17.6	0.0	0.0	1.1	0.0
275	12.1	12.1	0.0	0.0	0.0
276	0.0	0.0	60.6	2.2	0.0
277	0.0	0.0	0.0	4.4	0.0
278	0.0	0.0	1.1	0.0	0.0
279	0.0	0.0	39.7	0.0	0.0
280	0.0	0.0	8.8	0.0	0.0
281	0.0	0.0	20.9	0.0	0.0
282	0.0	0.0	16.5	0.0	40.8
283	0.0	0.0	0.0	0.0	5.5
284	30.8	0.0	0.0	1.1	70.5
285	0.0	0.0	0.0	28.6	7.7
286	0.0	0.0	0.0	48.5	1.1
287	14.3	1.1	0.0	55.1	14.3
288	12.1	0.0	2.2	5.5	0.0
289	13.2	0.0	6.6	2.2	0.0
290	96.9	0.0	0.0	26.4	0.0
291	0.0	0.0	0.0	22.0	0.0
292	13.2	0.0	7.7	83.7	0.0
293	0.0	0.0	0.0	0.0	0.0
294	1.1	0.0	0.0	0.0	5.5
295	5.5	0.0	0.0	57.3	7.7
296	0.0	0.0	0.0	3.3	0.0

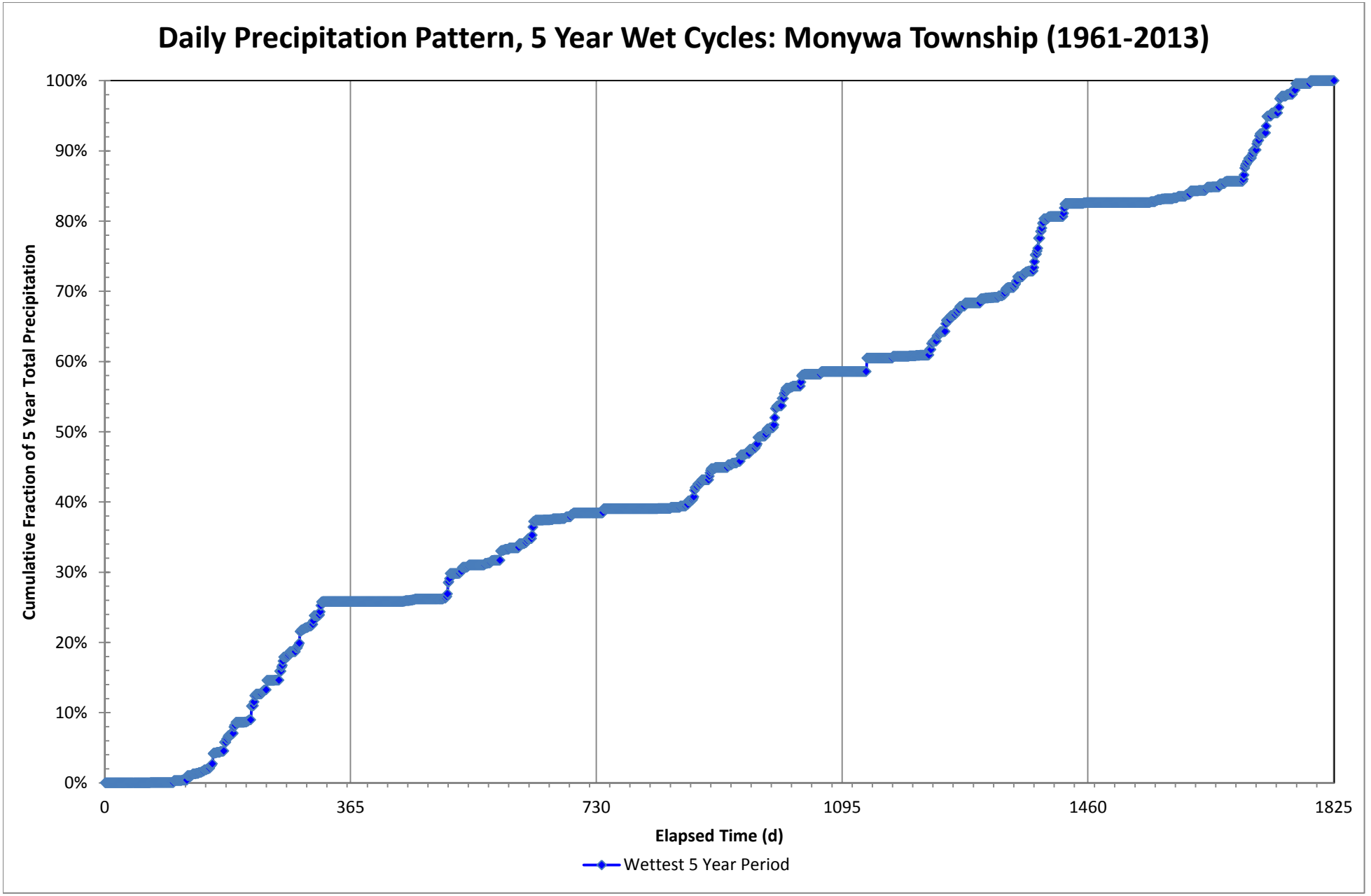
Precipitation, 5 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1415.9	690.4	1102.7	1317.7	951.8
Day	Year 1	Year 2	Year 3	Year 4	Year 5
297	7.2	2.1	0.0	21.7	2.1
298	2.1	0.0	0.0	37.2	0.0
299	1.0	0.0	0.0	6.2	0.0
300	1.0	0.0	0.0	31.0	0.0
301	2.1	6.2	0.0	0.0	0.0
302	2.1	0.0	0.0	0.0	0.0
303	7.2	0.0	0.0	0.0	0.0
304	0.0	1.0	32.0	0.0	33.1
305	0.0	0.0	48.6	0.0	0.0
306	2.1	0.0	6.2	2.1	0.0
307	1.0	0.0	1.0	12.4	0.0
308	10.3	0.0	0.0	0.0	50.6
309	0.0	0.0	4.1	3.1	0.0
310	28.9	0.0	0.0	0.0	0.0
311	39.3	0.0	0.0	0.0	0.0
312	1.0	0.0	0.0	0.0	0.0
313	0.0	1.0	0.0	0.0	0.0
314	0.0	0.0	0.0	0.0	0.0
315	0.0	0.0	0.0	0.0	0.0
316	0.0	0.0	0.0	0.0	0.0
317	0.0	0.0	0.0	0.0	0.0
318	0.0	0.0	0.0	0.0	0.0
319	4.1	6.2	0.0	0.0	0.0
320	24.8	5.2	0.0	0.0	0.0
321	49.6	3.1	0.0	0.0	0.0
322	26.9	0.0	0.0	0.0	0.0
323	1.0	0.0	0.0	0.0	0.0
324	3.1	0.0	0.0	0.0	0.0
325	0.0	0.0	0.0	0.0	0.0
326	0.0	0.0	0.0	0.0	0.0
327	0.0	0.0	0.0	0.0	0.0
328	0.0	16.5	0.0	0.0	0.0
329	0.0	0.0	0.0	23.8	0.0
330	0.0	4.1	0.0	41.3	22.7
331	0.0	6.2	0.0	30.0	0.0
332	0.0	2.1	0.0	6.2	0.0
333	0.0	1.0	0.0	0.0	0.0
334	0.0	0.0	18.6	0.0	0.0
335	0.0	0.0	3.1	0.0	0.0
336	0.0	0.0	0.0	0.0	0.0
337	0.0	0.0	0.0	0.0	0.0
338	0.0	0.0	0.0	0.0	0.0
339	0.0	0.0	0.0	0.0	0.0
340	0.0	0.0	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0	0.0
342	0.0	0.0	0.0	0.0	0.0
343	0.0	0.0	0.0	0.0	0.0
344	1.0	0.0	0.0	0.0	0.0
345	0.0	0.0	0.0	0.0	0.0
346	0.0	0.0	0.0	0.0	0.0
347	0.0	0.0	0.0	0.0	0.0
348	0.0	0.0	0.0	0.0	0.0
349	0.0	0.0	0.0	0.0	0.0
350	0.0	0.0	0.0	0.0	0.0
351	0.0	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0	0.0
353	0.0	0.0	0.0	0.0	0.0
354	0.0	0.0	0.0	0.0	0.0
355	0.0	0.0	0.0	0.0	0.0
356	0.0	0.0	0.0	0.0	0.0
357	0.0	0.0	0.0	0.0	0.0
358	0.0	0.0	0.0	0.0	0.0
359	0.0	0.0	0.0	4.1	0.0
360	0.0	0.0	0.0	0.0	0.0
361	0.0	0.0	0.0	0.0	0.0
362	0.0	0.0	0.0	1.0	0.0
363	0.0	0.0	0.0	1.0	0.0
364	0.0	0.0	0.0	0.0	0.0
365	0.0	0.0	0.0	0.0	0.0
366				0.0	

500 year ARI (mm)

Total	1509.0	735.8	1175.2	1404.3	1014.4
Day	Year 1	Year 2	Year 3	Year 4	Year 5
297	7.7	2.2	0.0	23.1	2.2
298	2.2	0.0	0.0	39.7	0.0
299	1.1	0.0	0.0	6.6	0.0
300	1.1	0.0	0.0	33.0	0.0
301	2.2	6.6	0.0	0.0	0.0
302	2.2	0.0	0.0	0.0	0.0
303	7.7	0.0	0.0	0.0	0.0
304	0.0	1.1	34.1	0.0	35.2
305	0.0	0.0	51.8	0.0	0.0
306	2.2	0.0	6.6	2.2	0.0
307	1.1	0.0	1.1	13.2	0.0
308	11.0	0.0	0.0	0.0	54.0
309	0.0	0.0	4.4	3.3	0.0
310	30.8	0.0	0.0	0.0	0.0
311	41.9	0.0	0.0	0.0	0.0
312	1.1	0.0	0.0	0.0	0.0
313	0.0	1.1	0.0	0.0	0.0
314	0.0	0.0	0.0	0.0	0.0
315	0.0	0.0	0.0	0.0	0.0
316	0.0	0.0	0.0	0.0	0.0
317	0.0	0.0	0.0	0.0	0.0
318	0.0	0.0	0.0	0.0	0.0
319	4.4	6.6	0.0	0.0	0.0
320	26.4	5.5	0.0	0.0	0.0
321	52.9	3.3	0.0	0.0	0.0
322	28.6	0.0	0.0	0.0	0.0
323	1.1	0.0	0.0	0.0	0.0
324	3.3	0.0	0.0	0.0	0.0
325	0.0	0.0	0.0	0.0	0.0
326	0.0	0.0	0.0	0.0	0.0
327	0.0	0.0	0.0	0.0	0.0
328	0.0	17.6	0.0	0.0	0.0
329	0.0	0.0	0.0	25.3	0.0
330	0.0	4.4	0.0	44.1	24.2
331	0.0	6.6	0.0	31.9	0.0
332	0.0	2.2	0.0	6.6	0.0
333	0.0	1.1	0.0	0.0	0.0
334	0.0	0.0	19.8	0.0	0.0
335	0.0	0.0	3.3	0.0	0.0
336	0.0	0.0	0.0	0.0	0.0
337	0.0	0.0	0.0	0.0	0.0
338	0.0	0.0	0.0	0.0	0.0
339	0.0	0.0	0.0	0.0	0.0
340	0.0	0.0	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0	0.0
342	0.0	0.0	0.0	0.0	0.0
343	0.0	0.0	0.0	0.0	0.0
344	1.1	0.0	0.0	0.0	0.0
345	0.0	0.0	0.0	0.0	0.0
346	0.0	0.0	0.0	0.0	0.0
347	0.0	0.0	0.0	0.0	0.0
348	0.0	0.0	0.0	0.0	0.0
349	0.0	0.0	0.0	0.0	0.0
350	0.0	0.0	0.0	0.0	0.0
351	0.0	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0	0.0
353	0.0	0.0	0.0	0.0	0.0
354	0.0	0.0	0.0	0.0	0.0
355	0.0	0.0	0.0	0.0	0.0
356	0.0	0.0	0.0	0.0	0.0
357	0.0	0.0	0.0	0.0	0.0
358	0.0	0.0	0.0	0.0	0.0
359	0.0	0.0	0.0	4.4	0.0
360	0.0	0.0	0.0	0.0	0.0
361	0.0	0.0	0.0	0.0	0.0
362	0.0	0.0	0.0	1.1	0.0
363	0.0	0.0	0.0	1.1	0.0
364	0.0	0.0	0.0	0.0	0.0
365	0.0	0.0	0.0	0.0	0.0
366				0.0	


Daily Precipitation Pattern, 5 Year Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 5 Year Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
365
730
1095
1460
1825
Elapsed Time (d)
Wettest 5 Year Period

Precipitation, 4 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1448.3	706.2	1127.9	1347.8
Day	Year 1	Year 2	Year 3	Year 4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	3.2	0.0
11	0.0	0.0	29.6	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	107.8
38	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0
68	2.1	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0

500 year ARI (mm)

Total	1589.8	775.1	1238.1	1479.5
Day	Year 1	Year 2	Year 3	Year 4
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	3.5	0.0
11	0.0	0.0	32.5	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	118.4
38	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0
68	2.3	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0

Precipitation, 4 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1448.3	706.2	1127.9	1347.8
Day	Year 1	Year 2	Year 3	Year 4
75	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	13.7
77	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0
79	0.0	1.1	0.0	0.0
80	0.0	0.0	0.0	0.0
81	0.0	2.1	0.0	0.0
82	0.0	3.2	0.0	0.0
83	0.0	0.0	0.0	0.0
84	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0
88	0.0	1.1	0.0	0.0
89	0.0	0.0	0.0	0.0
90	0.0	2.1	0.0	0.0
91	0.0	0.0	0.0	0.0
92	0.0	0.0	2.1	0.0
93	0.0	4.2	0.0	0.0
94	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0
96	0.0	4.2	0.0	0.0
97	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	3.2
101	0.0	0.0	0.0	0.0
102	0.0	0.0	0.0	0.0
103	16.9	0.0	0.0	0.0
104	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0
106	0.0	0.0	0.0	0.0
107	0.0	0.0	0.0	0.0
108	0.0	0.0	0.0	0.0
109	0.0	0.0	0.0	0.0
110	0.0	0.0	0.0	4.2
111	0.0	0.0	8.5	0.0
112	0.0	0.0	0.0	0.0
113	0.0	0.0	0.0	0.0
114	0.0	0.0	0.0	0.0
115	3.2	0.0	0.0	0.0
116	0.0	0.0	0.0	1.1
117	0.0	0.0	0.0	0.0
118	0.0	0.0	0.0	0.0
119	0.0	0.0	0.0	0.0
120	0.0	0.0	0.0	0.0
121	0.0	0.0	0.0	0.0
122	0.0	0.0	0.0	0.0
123	34.9	0.0	0.0	0.0
124	0.0	0.0	0.0	1.1
125	0.0	0.0	11.6	0.0
126	0.0	0.0	0.0	0.0
127	0.0	0.0	0.0	0.0
128	0.0	0.0	0.0	1.1
129	1.1	0.0	0.0	0.0
130	6.3	0.0	0.0	43.3
131	8.5	1.1	0.0	0.0
132	0.0	0.0	0.0	0.0
133	0.0	0.0	0.0	48.6
134	0.0	0.0	11.6	0.0
135	0.0	0.0	0.0	15.9
136	2.1	0.0	0.0	0.0
137	0.0	0.0	28.5	3.2
138	1.1	7.4	0.0	0.0
139	0.0	0.0	0.0	0.0
140	6.3	0.0	0.0	0.0
141	0.0	0.0	8.5	41.2
142	0.0	12.7	0.0	0.0
143	2.1	0.0	0.0	6.3
144	1.1	21.1	11.6	0.0
145	6.3	89.9	13.7	14.8
146	1.1	6.3	51.8	12.7
147	1.1	25.4	20.1	0.0
148	9.5	41.2	0.0	0.0

500 year ARI (mm)

Total	1589.8	775.1	1238.1	1479.5
Day	Year 1	Year 2	Year 3	Year 4
75	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	15.1
77	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0
79	0.0	1.2	0.0	0.0
80	0.0	0.0	0.0	0.0
81	0.0	2.3	0.0	0.0
82	0.0	3.5	0.0	0.0
83	0.0	0.0	0.0	0.0
84	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0
88	0.0	1.2	0.0	0.0
89	0.0	0.0	0.0	0.0
90	0.0	2.3	0.0	0.0
91	0.0	0.0	0.0	0.0
92	0.0	0.0	2.3	0.0
93	0.0	4.6	0.0	0.0
94	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0
96	0.0	4.6	0.0	0.0
97	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	3.5
101	0.0	0.0	0.0	0.0
102	0.0	0.0	0.0	0.0
103	18.6	0.0	0.0	0.0
104	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0
106	0.0	0.0	0.0	0.0
107	0.0	0.0	0.0	0.0
108	0.0	0.0	0.0	0.0
109	0.0	0.0	0.0	0.0
110	0.0	0.0	0.0	4.6
111	0.0	0.0	9.3	0.0
112	0.0	0.0	0.0	0.0
113	0.0	0.0	0.0	0.0
114	0.0	0.0	0.0	0.0
115	3.5	0.0	0.0	0.0
116	0.0	0.0	0.0	1.2
117	0.0	0.0	0.0	0.0
118	0.0	0.0	0.0	0.0
119	0.0	0.0	0.0	0.0
120	0.0	0.0	0.0	0.0
121	0.0	0.0	0.0	0.0
122	0.0	0.0	0.0	0.0
123	38.3	0.0	0.0	0.0
124	0.0	0.0	0.0	1.2
125	0.0	0.0	12.8	0.0
126	0.0	0.0	0.0	0.0
127	0.0	0.0	0.0	0.0
128	0.0	0.0	0.0	1.2
129	1.2	0.0	0.0	0.0
130	7.0	0.0	0.0	47.6
131	9.3	1.2	0.0	0.0
132	0.0	0.0	0.0	0.0
133	0.0	0.0	0.0	53.4
134	0.0	0.0	12.8	0.0
135	0.0	0.0	0.0	17.4
136	2.3	0.0	0.0	0.0
137	0.0	0.0	31.3	3.5
138	1.2	8.1	0.0	0.0
139	0.0	0.0	0.0	0.0
140	7.0	0.0	0.0	0.0
141	0.0	0.0	9.3	45.3
142	0.0	13.9	0.0	0.0
143	2.3	0.0	0.0	7.0
144	1.2	23.2	12.8	0.0
145	7.0	98.6	15.1	16.2
146	1.2	7.0	56.9	13.9
147	1.2	27.8	22.0	0.0
148	10.4	45.3	0.0	0.0

Precipitation, 4 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1448.3	706.2	1127.9	1347.8
Day	Year 1	Year 2	Year 3	Year 4
149	0.0	0.0	9.5	0.0
150	0.0	0.0	0.0	0.0
151	0.0	0.0	19.0	0.0
152	7.4	0.0	0.0	0.0
153	0.0	0.0	0.0	2.1
154	0.0	0.0	1.1	60.3
155	5.3	0.0	14.8	26.4
156	0.0	0.0	4.2	5.3
157	16.9	0.0	14.8	0.0
158	4.2	0.0	0.0	0.0
159	6.3	0.0	0.0	0.0
160	8.5	0.0	0.0	2.1
161	81.4	1.1	0.0	25.4
162	4.2	0.0	0.0	6.3
163	0.0	16.9	0.0	0.0
164	0.0	0.0	0.0	0.0
165	0.0	0.0	0.0	0.0
166	4.2	27.5	0.0	7.4
167	1.1	4.2	0.0	0.0
168	0.0	0.0	27.5	1.1
169	1.1	0.0	27.5	19.0
170	0.0	0.0	19.0	0.0
171	0.0	0.0	14.8	0.0
172	6.3	0.0	1.1	20.1
173	0.0	0.0	0.0	1.1
174	0.0	6.3	0.0	0.0
175	0.0	2.1	0.0	23.3
176	2.1	9.5	0.0	2.1
177	1.1	0.0	8.5	0.0
178	69.8	0.0	0.0	0.0
179	0.0	0.0	0.0	2.1
180	0.0	0.0	0.0	0.0
181	26.4	0.0	0.0	0.0
182	0.0	0.0	0.0	0.0
183	18.0	0.0	0.0	24.3
184	10.6	0.0	0.0	0.0
185	0.0	0.0	0.0	0.0
186	5.3	0.0	0.0	0.0
187	6.3	0.0	0.0	0.0
188	0.0	0.0	0.0	0.0
189	0.0	0.0	0.0	1.1
190	1.1	0.0	0.0	0.0
191	4.2	0.0	0.0	0.0
192	49.7	0.0	0.0	0.0
193	14.8	0.0	0.0	0.0
194	1.1	0.0	0.0	0.0
195	22.2	0.0	0.0	0.0
196	0.0	0.0	21.1	0.0
197	0.0	0.0	0.0	0.0
198	0.0	0.0	0.0	0.0
199	0.0	1.1	0.0	0.0
200	0.0	10.6	0.0	0.0
201	1.1	0.0	0.0	0.0
202	0.0	0.0	12.7	0.0
203	0.0	0.0	0.0	0.0
204	0.0	4.2	0.0	0.0
205	0.0	0.0	1.1	0.0
206	0.0	0.0	0.0	31.7
207	0.0	0.0	0.0	1.1
208	1.1	3.2	0.0	0.0
209	0.0	10.6	3.2	0.0
210	0.0	6.3	10.6	3.2
211	2.1	0.0	0.0	0.0
212	4.2	0.0	0.0	0.0
213	0.0	2.1	0.0	2.1
214	8.5	0.0	1.1	0.0
215	3.2	0.0	50.7	0.0
216	0.0	0.0	0.0	0.0
217	0.0	0.0	0.0	0.0
218	108.9	0.0	0.0	2.1
219	1.1	0.0	3.2	0.0
220	0.0	0.0	0.0	0.0
221	3.2	0.0	0.0	0.0
222	30.7	0.0	3.2	2.1

500 year ARI (mm)

Total	1589.8	775.1	1238.1	1479.5
Day	Year 1	Year 2	Year 3	Year 4
149	0.0	0.0	10.4	0.0
150	0.0	0.0	0.0	0.0
151	0.0	0.0	20.9	0.0
152	8.1	0.0	0.0	0.0
153	0.0	0.0	0.0	2.3
154	0.0	0.0	1.2	66.1
155	5.8	0.0	16.2	29.0
156	0.0	0.0	4.6	5.8
157	18.6	0.0	16.2	0.0
158	4.6	0.0	0.0	0.0
159	7.0	0.0	0.0	0.0
160	9.3	0.0	0.0	2.3
161	89.4	1.2	0.0	27.8
162	4.6	0.0	0.0	7.0
163	0.0	18.6	0.0	0.0
164	0.0	0.0	0.0	0.0
165	0.0	0.0	0.0	0.0
166	4.6	30.2	0.0	8.1
167	1.2	4.6	0.0	0.0
168	0.0	0.0	30.2	1.2
169	1.2	0.0	30.2	20.9
170	0.0	0.0	20.9	0.0
171	0.0	0.0	16.2	0.0
172	7.0	0.0	1.2	22.0
173	0.0	0.0	0.0	1.2
174	0.0	7.0	0.0	0.0
175	0.0	2.3	0.0	25.5
176	2.3	10.4	0.0	2.3
177	1.2	0.0	9.3	0.0
178	76.6	0.0	0.0	0.0
179	0.0	0.0	0.0	2.3
180	0.0	0.0	0.0	0.0
181	29.0	0.0	0.0	0.0
182	0.0	0.0	0.0	0.0
183	19.7	0.0	0.0	26.7
184	11.6	0.0	0.0	0.0
185	0.0	0.0	0.0	0.0
186	5.8	0.0	0.0	0.0
187	7.0	0.0	0.0	0.0
188	0.0	0.0	0.0	0.0
189	0.0	0.0	0.0	1.2
190	1.2	0.0	0.0	0.0
191	4.6	0.0	0.0	0.0
192	54.5	0.0	0.0	0.0
193	16.2	0.0	0.0	0.0
194	1.2	0.0	0.0	0.0
195	24.4	0.0	0.0	0.0
196	0.0	0.0	23.2	0.0
197	0.0	0.0	0.0	0.0
198	0.0	0.0	0.0	0.0
199	0.0	1.2	0.0	0.0
200	0.0	11.6	0.0	0.0
201	1.2	0.0	0.0	0.0
202	0.0	0.0	13.9	0.0
203	0.0	0.0	0.0	0.0
204	0.0	4.6	0.0	0.0
205	0.0	0.0	1.2	0.0
206	0.0	0.0	0.0	34.8
207	0.0	0.0	0.0	1.2
208	1.2	3.5	0.0	0.0
209	0.0	11.6	3.5	0.0
210	0.0	7.0	11.6	3.5
211	2.3	0.0	0.0	0.0
212	4.6	0.0	0.0	0.0
213	0.0	2.3	0.0	2.3
214	9.3	0.0	1.2	0.0
215	3.5	0.0	55.7	0.0
216	0.0	0.0	0.0	0.0
217	0.0	0.0	0.0	0.0
218	119.5	0.0	0.0	2.3
219	1.2	0.0	3.5	0.0
220	0.0	0.0	0.0	0.0
221	3.5	0.0	0.0	0.0
222	33.7	0.0	3.5	2.3

Precipitation, 4 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1448.3	706.2	1127.9	1347.8
Day	Year 1	Year 2	Year 3	Year 4
223	49.7	72.9	5.3	0.0
224	0.0	3.2	0.0	0.0
225	12.7	2.1	0.0	0.0
226	0.0	0.0	0.0	1.1
227	0.0	0.0	0.0	0.0
228	0.0	4.2	31.7	0.0
229	0.0	1.1	0.0	1.1
230	0.0	3.2	0.0	0.0
231	0.0	0.0	1.1	0.0
232	1.1	0.0	3.2	0.0
233	0.0	0.0	6.3	11.6
234	14.8	0.0	1.1	0.0
235	0.0	0.0	0.0	0.0
236	9.5	11.6	0.0	0.0
237	6.3	0.0	19.0	0.0
238	0.0	0.0	0.0	1.1
239	2.1	0.0	12.7	8.5
240	0.0	0.0	51.8	0.0
241	74.0	0.0	0.0	0.0
242	0.0	0.0	6.3	14.8
243	0.0	0.0	1.1	25.4
244	0.0	0.0	2.1	10.6
245	0.0	0.0	2.1	0.0
246	0.0	0.0	0.0	5.3
247	0.0	0.0	0.0	1.1
248	0.0	0.0	0.0	0.0
249	0.0	0.0	0.0	0.0
250	0.0	4.2	0.0	0.0
251	0.0	29.6	2.1	0.0
252	0.0	0.0	13.7	0.0
253	2.1	0.0	28.5	0.0
254	0.0	0.0	11.6	0.0
255	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	15.9
257	0.0	0.0	0.0	6.3
258	0.0	0.0	9.5	6.3
259	0.0	4.2	0.0	21.1
260	71.9	2.1	0.0	2.1
261	0.0	2.1	0.0	33.8
262	0.0	15.9	0.0	1.1
263	34.9	1.1	4.2	0.0
264	11.6	14.8	19.0	0.0
265	34.9	0.0	57.1	0.0
266	30.7	0.0	72.9	0.0
267	0.0	0.0	0.0	0.0
268	3.2	0.0	19.0	0.0
269	0.0	0.0	3.2	20.1
270	0.0	27.5	0.0	4.2
271	0.0	63.4	0.0	0.0
272	3.2	45.5	0.0	0.0
273	9.5	0.0	0.0	12.7
274	16.9	0.0	0.0	1.1
275	11.6	11.6	0.0	0.0
276	0.0	0.0	58.1	2.1
277	0.0	0.0	0.0	4.2
278	0.0	0.0	1.1	0.0
279	0.0	0.0	38.1	0.0
280	0.0	0.0	8.5	0.0
281	0.0	0.0	20.1	0.0
282	0.0	0.0	15.9	0.0
283	0.0	0.0	0.0	0.0
284	29.6	0.0	0.0	1.1
285	0.0	0.0	0.0	27.5
286	0.0	0.0	0.0	46.5
287	13.7	1.1	0.0	52.9
288	11.6	0.0	2.1	5.3
289	12.7	0.0	6.3	2.1
290	93.0	0.0	0.0	25.4
291	0.0	0.0	0.0	21.1
292	12.7	0.0	7.4	80.3
293	0.0	0.0	0.0	0.0
294	1.1	0.0	0.0	0.0
295	5.3	0.0	0.0	55.0
296	0.0	0.0	0.0	3.2

500 year ARI (mm)

Total	1589.8	775.1	1238.1	1479.5
Day	Year 1	Year 2	Year 3	Year 4
223	54.5	80.1	5.8	0.0
224	0.0	3.5	0.0	0.0
225	13.9	2.3	0.0	0.0
226	0.0	0.0	0.0	1.2
227	0.0	0.0	0.0	0.0
228	0.0	4.6	34.8	0.0
229	0.0	1.2	0.0	1.2
230	0.0	3.5	0.0	0.0
231	0.0	0.0	1.2	0.0
232	1.2	0.0	3.5	0.0
233	0.0	0.0	7.0	12.8
234	16.2	0.0	1.2	0.0
235	0.0	0.0	0.0	0.0
236	10.4	12.8	0.0	0.0
237	7.0	0.0	20.9	0.0
238	0.0	0.0	0.0	1.2
239	2.3	0.0	13.9	9.3
240	0.0	0.0	56.9	0.0
241	81.2	0.0	0.0	0.0
242	0.0	0.0	7.0	16.2
243	0.0	0.0	1.2	27.8
244	0.0	0.0	2.3	11.6
245	0.0	0.0	2.3	0.0
246	0.0	0.0	0.0	5.8
247	0.0	0.0	0.0	1.2
248	0.0	0.0	0.0	0.0
249	0.0	0.0	0.0	0.0
250	0.0	4.6	0.0	0.0
251	0.0	32.5	2.3	0.0
252	0.0	0.0	15.1	0.0
253	2.3	0.0	31.3	0.0
254	0.0	0.0	12.8	0.0
255	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	17.4
257	0.0	0.0	0.0	7.0
258	0.0	0.0	10.4	7.0
259	0.0	4.6	0.0	23.2
260	78.9	2.3	0.0	2.3
261	0.0	2.3	0.0	37.1
262	0.0	17.4	0.0	1.2
263	38.3	1.2	4.6	0.0
264	12.8	16.2	20.9	0.0
265	38.3	0.0	62.7	0.0
266	33.7	0.0	80.1	0.0
267	0.0	0.0	0.0	0.0
268	3.5	0.0	20.9	0.0
269	0.0	0.0	3.5	22.0
270	0.0	30.2	0.0	4.6
271	0.0	69.6	0.0	0.0
272	3.5	49.9	0.0	0.0
273	10.4	0.0	0.0	13.9
274	18.6	0.0	0.0	1.2
275	12.8	12.8	0.0	0.0
276	0.0	0.0	63.8	2.3
277	0.0	0.0	0.0	4.6
278	0.0	0.0	1.2	0.0
279	0.0	0.0	41.8	0.0
280	0.0	0.0	9.3	0.0
281	0.0	0.0	22.0	0.0
282	0.0	0.0	17.4	0.0
283	0.0	0.0	0.0	0.0
284	32.5	0.0	0.0	1.2
285	0.0	0.0	0.0	30.2
286	0.0	0.0	0.0	51.1
287	15.1	1.2	0.0	58.0
288	12.8	0.0	2.3	5.8
289	13.9	0.0	7.0	2.3
290	102.1	0.0	0.0	27.8
291	0.0	0.0	0.0	23.2
292	13.9	0.0	8.1	88.2
293	0.0	0.0	0.0	0.0
294	1.2	0.0	0.0	0.0
295	5.8	0.0	0.0	60.3
296	0.0	0.0	0.0	3.5

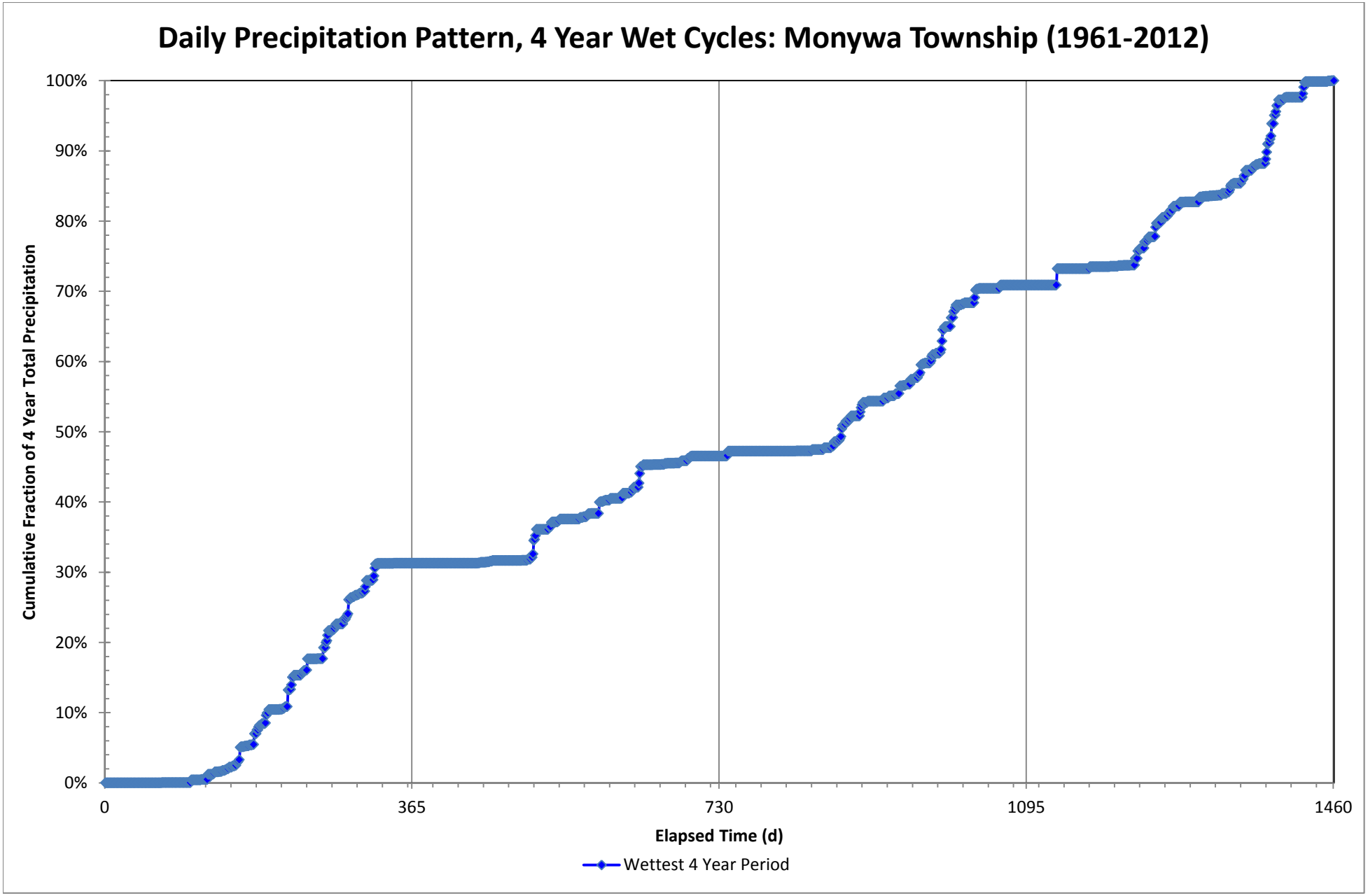
Precipitation, 4 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1448.3	706.2	1127.9	1347.8
Day	Year 1	Year 2	Year 3	Year 4
297	7.4	2.1	0.0	22.2
298	2.1	0.0	0.0	38.1
299	1.1	0.0	0.0	6.3
300	1.1	0.0	0.0	31.7
301	2.1	6.3	0.0	0.0
302	2.1	0.0	0.0	0.0
303	7.4	0.0	0.0	0.0
304	0.0	1.1	32.8	0.0
305	0.0	0.0	49.7	0.0
306	2.1	0.0	6.3	2.1
307	1.1	0.0	1.1	12.7
308	10.6	0.0	0.0	0.0
309	0.0	0.0	4.2	3.2
310	29.6	0.0	0.0	0.0
311	40.2	0.0	0.0	0.0
312	1.1	0.0	0.0	0.0
313	0.0	1.1	0.0	0.0
314	0.0	0.0	0.0	0.0
315	0.0	0.0	0.0	0.0
316	0.0	0.0	0.0	0.0
317	0.0	0.0	0.0	0.0
318	0.0	0.0	0.0	0.0
319	4.2	6.3	0.0	0.0
320	25.4	5.3	0.0	0.0
321	50.7	3.2	0.0	0.0
322	27.5	0.0	0.0	0.0
323	1.1	0.0	0.0	0.0
324	3.2	0.0	0.0	0.0
325	0.0	0.0	0.0	0.0
326	0.0	0.0	0.0	0.0
327	0.0	0.0	0.0	0.0
328	0.0	16.9	0.0	0.0
329	0.0	0.0	0.0	24.3
330	0.0	4.2	0.0	42.3
331	0.0	6.3	0.0	30.7
332	0.0	2.1	0.0	6.3
333	0.0	1.1	0.0	0.0
334	0.0	0.0	19.0	0.0
335	0.0	0.0	3.2	0.0
336	0.0	0.0	0.0	0.0
337	0.0	0.0	0.0	0.0
338	0.0	0.0	0.0	0.0
339	0.0	0.0	0.0	0.0
340	0.0	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0
342	0.0	0.0	0.0	0.0
343	0.0	0.0	0.0	0.0
344	1.1	0.0	0.0	0.0
345	0.0	0.0	0.0	0.0
346	0.0	0.0	0.0	0.0
347	0.0	0.0	0.0	0.0
348	0.0	0.0	0.0	0.0
349	0.0	0.0	0.0	0.0
350	0.0	0.0	0.0	0.0
351	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0
353	0.0	0.0	0.0	0.0
354	0.0	0.0	0.0	0.0
355	0.0	0.0	0.0	0.0
356	0.0	0.0	0.0	0.0
357	0.0	0.0	0.0	0.0
358	0.0	0.0	0.0	0.0
359	0.0	0.0	0.0	4.2
360	0.0	0.0	0.0	0.0
361	0.0	0.0	0.0	0.0
362	0.0	0.0	0.0	1.1
363	0.0	0.0	0.0	1.1
364	0.0	0.0	0.0	0.0
365	0.0	0.0	0.0	0.0
366				0.0

500 year ARI (mm)

Total	1589.8	775.1	1238.1	1479.5
Day	Year 1	Year 2	Year 3	Year 4
297	8.1	2.3	0.0	24.4
298	2.3	0.0	0.0	41.8
299	1.2	0.0	0.0	7.0
300	1.2	0.0	0.0	34.8
301	2.3	7.0	0.0	0.0
302	2.3	0.0	0.0	0.0
303	8.1	0.0	0.0	0.0
304	0.0	1.2	36.0	0.0
305	0.0	0.0	54.5	0.0
306	2.3	0.0	7.0	2.3
307	1.2	0.0	1.2	13.9
308	11.6	0.0	0.0	0.0
309	0.0	0.0	4.6	3.5
310	32.5	0.0	0.0	0.0
311	44.1	0.0	0.0	0.0
312	1.2	0.0	0.0	0.0
313	0.0	1.2	0.0	0.0
314	0.0	0.0	0.0	0.0
315	0.0	0.0	0.0	0.0
316	0.0	0.0	0.0	0.0
317	0.0	0.0	0.0	0.0
318	0.0	0.0	0.0	0.0
319	4.6	7.0	0.0	0.0
320	27.8	5.8	0.0	0.0
321	55.7	3.5	0.0	0.0
322	30.2	0.0	0.0	0.0
323	1.2	0.0	0.0	0.0
324	3.5	0.0	0.0	0.0
325	0.0	0.0	0.0	0.0
326	0.0	0.0	0.0	0.0
327	0.0	0.0	0.0	0.0
328	0.0	18.6	0.0	0.0
329	0.0	0.0	0.0	26.7
330	0.0	4.6	0.0	46.4
331	0.0	7.0	0.0	33.7
332	0.0	2.3	0.0	7.0
333	0.0	1.2	0.0	0.0
334	0.0	0.0	20.9	0.0
335	0.0	0.0	3.5	0.0
336	0.0	0.0	0.0	0.0
337	0.0	0.0	0.0	0.0
338	0.0	0.0	0.0	0.0
339	0.0	0.0	0.0	0.0
340	0.0	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0
342	0.0	0.0	0.0	0.0
343	0.0	0.0	0.0	0.0
344	1.2	0.0	0.0	0.0
345	0.0	0.0	0.0	0.0
346	0.0	0.0	0.0	0.0
347	0.0	0.0	0.0	0.0
348	0.0	0.0	0.0	0.0
349	0.0	0.0	0.0	0.0
350	0.0	0.0	0.0	0.0
351	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0
353	0.0	0.0	0.0	0.0
354	0.0	0.0	0.0	0.0
355	0.0	0.0	0.0	0.0
356	0.0	0.0	0.0	0.0
357	0.0	0.0	0.0	0.0
358	0.0	0.0	0.0	0.0
359	0.0	0.0	0.0	4.6
360	0.0	0.0	0.0	0.0
361	0.0	0.0	0.0	0.0
362	0.0	0.0	0.0	1.2
363	0.0	0.0	0.0	1.2
364	0.0	0.0	0.0	0.0
365	0.0	0.0	0.0	0.0
366				0.0


Daily Precipitation Pattern, 4 Year Wet Cycles: Monywa Township (1961-2012)
Cumulative Fraction of 4 Year Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
365
730
1095
1460
Elapsed Time (d)
Wettest 4 Year Period

Precipitation, 3 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1191.6	1423.8	1127.9
Day	Year 1	Year 2	Year 3
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	3.2
10	3.4	0.0	29.6
11	31.3	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
32	0.0	0.0	0.0
33	0.0	0.0	0.0
34	0.0	0.0	0.0
35	0.0	0.0	0.0
36	0.0	0.0	0.0
37	0.0	113.9	0.0
38	0.0	0.0	0.0
39	0.0	0.0	0.0
40	0.0	0.0	0.0
41	0.0	0.0	0.0
42	0.0	0.0	0.0
43	0.0	0.0	0.0
44	0.0	0.0	0.0
45	0.0	0.0	0.0
46	0.0	0.0	0.0
47	0.0	0.0	0.0
48	0.0	0.0	0.0
49	0.0	0.0	0.0
50	0.0	0.0	0.0
51	0.0	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	0.0
56	0.0	0.0	0.0
57	0.0	0.0	0.0
58	0.0	0.0	0.0
59	0.0	0.0	0.0
60	0.0	0.0	0.0
61	0.0	0.0	0.0
62	0.0	0.0	0.0
63	0.0	0.0	0.0
64	0.0	0.0	0.0
65	0.0	0.0	0.0
66	0.0	0.0	0.0
67	0.0	0.0	0.0
68	0.0	0.0	0.0
69	0.0	0.0	0.0
70	0.0	0.0	0.0
71	0.0	0.0	0.0
72	0.0	0.0	0.0
73	0.0	0.0	0.0
74	0.0	0.0	0.0

500 year ARI (mm)

Total	1335.1	1595.4	1152.4
Day	Year 1	Year 2	Year 3
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	3.8	0.0	0.0
11	35.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
32	0.0	0.0	0.0
33	0.0	0.0	0.0
34	0.0	0.0	0.0
35	0.0	0.0	0.0
36	0.0	0.0	0.0
37	0.0	127.6	0.0
38	0.0	0.0	0.0
39	0.0	0.0	0.0
40	0.0	0.0	0.0
41	0.0	0.0	0.0
42	0.0	0.0	0.0
43	0.0	0.0	0.0
44	0.0	0.0	0.0
45	0.0	0.0	0.0
46	0.0	0.0	0.0
47	0.0	0.0	0.0
48	0.0	0.0	0.0
49	0.0	0.0	0.0
50	0.0	0.0	0.0
51	0.0	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	0.0
56	0.0	0.0	0.0
57	0.0	0.0	0.0
58	0.0	0.0	0.0
59	0.0	0.0	0.0
60	0.0	0.0	0.0
61	0.0	0.0	0.0
62	0.0	0.0	0.0
63	0.0	0.0	0.0
64	0.0	0.0	0.0
65	0.0	0.0	0.0
66	0.0	0.0	0.0
67	0.0	0.0	0.0
68	0.0	0.0	0.0
69	0.0	0.0	0.0
70	0.0	0.0	0.0
71	0.0	0.0	0.0
72	0.0	0.0	0.0
73	0.0	0.0	0.0
74	0.0	0.0	0.0

Precipitation, 3 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1191.6	1423.8	1127.9
Day	Year 1	Year 2	Year 3
75	0.0	0.0	0.0
76	0.0	14.5	0.0
77	0.0	0.0	0.0
78	0.0	0.0	0.0
79	0.0	0.0	0.0
80	0.0	0.0	0.0
81	0.0	0.0	0.0
82	0.0	0.0	0.0
83	0.0	0.0	0.0
84	0.0	0.0	0.0
85	0.0	0.0	0.0
86	0.0	0.0	0.0
87	0.0	0.0	0.0
88	0.0	0.0	0.0
89	0.0	0.0	0.0
90	0.0	0.0	0.0
91	0.0	0.0	2.1
92	2.2	0.0	0.0
93	0.0	0.0	0.0
94	0.0	0.0	0.0
95	0.0	0.0	0.0
96	0.0	0.0	0.0
97	0.0	0.0	0.0
98	0.0	0.0	0.0
99	0.0	0.0	0.0
100	0.0	3.4	0.0
101	0.0	0.0	0.0
102	0.0	0.0	0.0
103	0.0	0.0	0.0
104	0.0	0.0	0.0
105	0.0	0.0	0.0
106	0.0	0.0	0.0
107	0.0	0.0	0.0
108	0.0	0.0	0.0
109	0.0	0.0	0.0
110	0.0	4.5	8.5
111	8.9	0.0	0.0
112	0.0	0.0	0.0
113	0.0	0.0	0.0
114	0.0	0.0	0.0
115	0.0	0.0	0.0
116	0.0	1.1	0.0
117	0.0	0.0	0.0
118	0.0	0.0	0.0
119	0.0	0.0	0.0
120	0.0	0.0	0.0
121	0.0	0.0	0.0
122	0.0	0.0	0.0
123	0.0	0.0	0.0
124	0.0	1.1	11.6
125	12.3	0.0	0.0
126	0.0	0.0	0.0
127	0.0	0.0	0.0
128	0.0	1.1	0.0
129	0.0	0.0	0.0
130	0.0	45.8	0.0
131	0.0	0.0	0.0
132	0.0	0.0	0.0
133	0.0	51.4	11.6
134	12.3	0.0	0.0
135	0.0	16.8	0.0
136	0.0	0.0	28.5
137	30.2	3.4	0.0
138	0.0	0.0	0.0
139	0.0	0.0	0.0
140	0.0	0.0	8.5
141	8.9	43.6	0.0
142	0.0	0.0	0.0
143	0.0	6.7	11.6
144	12.3	0.0	13.7
145	14.5	15.6	51.8
146	54.7	13.4	20.1
147	21.2	0.0	0.0
148	0.0	0.0	9.5

500 year ARI (mm)

Total	1335.1	1595.4	1152.4
Day	Year 1	Year 2	Year 3
75	0.0	0.0	0.0
76	0.0	16.3	0.0
77	0.0	0.0	0.0
78	0.0	0.0	0.0
79	0.0	0.0	0.0
80	0.0	0.0	0.0
81	0.0	0.0	0.0
82	0.0	0.0	0.0
83	0.0	0.0	0.0
84	0.0	0.0	0.0
85	0.0	0.0	0.0
86	0.0	0.0	0.0
87	0.0	0.0	0.0
88	0.0	0.0	0.0
89	0.0	0.0	0.0
90	0.0	0.0	0.0
91	0.0	0.0	0.0
92	2.5	0.0	5.0
93	0.0	0.0	3.8
94	0.0	0.0	1.3
95	0.0	0.0	0.0
96	0.0	0.0	0.0
97	0.0	0.0	0.0
98	0.0	0.0	0.0
99	0.0	0.0	0.0
100	0.0	3.8	10.0
101	0.0	0.0	0.0
102	0.0	0.0	0.0
103	0.0	0.0	7.5
104	0.0	0.0	0.0
105	0.0	0.0	0.0
106	0.0	0.0	1.3
107	0.0	0.0	0.0
108	0.0	0.0	0.0
109	0.0	0.0	6.3
110	0.0	5.0	0.0
111	10.0	0.0	0.0
112	0.0	0.0	0.0
113	0.0	0.0	1.3
114	0.0	0.0	0.0
115	0.0	0.0	0.0
116	0.0	1.3	0.0
117	0.0	0.0	0.0
118	0.0	0.0	0.0
119	0.0	0.0	0.0
120	0.0	0.0	0.0
121	0.0	0.0	0.0
122	0.0	0.0	0.0
123	0.0	0.0	0.0
124	0.0	1.3	0.0
125	13.8	0.0	0.0
126	0.0	0.0	6.3
127	0.0	0.0	2.5
128	0.0	1.3	0.0
129	0.0	0.0	0.0
130	0.0	51.3	0.0
131	0.0	0.0	0.0
132	0.0	0.0	3.8
133	0.0	57.6	7.5
134	13.8	0.0	2.5
135	0.0	18.8	0.0
136	0.0	0.0	0.0
137	33.8	3.8	0.0
138	0.0	0.0	0.0
139	0.0	0.0	1.3
140	0.0	0.0	0.0
141	10.0	48.8	0.0
142	0.0	0.0	0.0
143	0.0	7.5	0.0
144	13.8	0.0	0.0
145	16.3	17.5	12.5
146	61.3	15.0	5.0
147	23.8	0.0	0.0
148	0.0	0.0	0.0

Precipitation, 3 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1191.6	1423.8	1127.9
Day	Year 1	Year 2	Year 3
149	10.1	0.0	0.0
150	0.0	0.0	19.0
151	20.1	0.0	0.0
152	0.0	0.0	0.0
153	0.0	2.2	1.1
154	1.1	63.7	14.8
155	15.6	27.9	4.2
156	4.5	5.6	14.8
157	15.6	0.0	0.0
158	0.0	0.0	0.0
159	0.0	0.0	0.0
160	0.0	2.2	0.0
161	0.0	26.8	0.0
162	0.0	6.7	0.0
163	0.0	0.0	0.0
164	0.0	0.0	0.0
165	0.0	0.0	0.0
166	0.0	7.8	0.0
167	0.0	0.0	27.5
168	29.0	1.1	27.5
169	29.0	20.1	19.0
170	20.1	0.0	14.8
171	15.6	0.0	1.1
172	1.1	21.2	0.0
173	0.0	1.1	0.0
174	0.0	0.0	0.0
175	0.0	24.6	0.0
176	0.0	2.2	8.5
177	8.9	0.0	0.0
178	0.0	0.0	0.0
179	0.0	2.2	0.0
180	0.0	0.0	0.0
181	0.0	0.0	0.0
182	0.0	0.0	0.0
183	0.0	25.7	0.0
184	0.0	0.0	0.0
185	0.0	0.0	0.0
186	0.0	0.0	0.0
187	0.0	0.0	0.0
188	0.0	0.0	0.0
189	0.0	1.1	0.0
190	0.0	0.0	0.0
191	0.0	0.0	0.0
192	0.0	0.0	0.0
193	0.0	0.0	0.0
194	0.0	0.0	0.0
195	0.0	0.0	21.1
196	22.3	0.0	0.0
197	0.0	0.0	0.0
198	0.0	0.0	0.0
199	0.0	0.0	0.0
200	0.0	0.0	0.0
201	0.0	0.0	12.7
202	13.4	0.0	0.0
203	0.0	0.0	0.0
204	0.0	0.0	1.1
205	1.1	0.0	0.0
206	0.0	33.5	0.0
207	0.0	1.1	0.0
208	0.0	0.0	3.2
209	3.4	0.0	10.6
210	11.2	3.4	0.0
211	0.0	0.0	0.0
212	0.0	0.0	0.0
213	0.0	2.2	1.1
214	1.1	0.0	50.7
215	53.6	0.0	0.0
216	0.0	0.0	0.0
217	0.0	0.0	0.0
218	0.0	2.2	3.2
219	3.4	0.0	0.0
220	0.0	0.0	0.0
221	0.0	0.0	3.2
222	3.4	2.2	5.3

500 year ARI (mm)

Total	1335.1	1595.4	1152.4
Day	Year 1	Year 2	Year 3
149	11.3	0.0	0.0
150	0.0	0.0	2.5
151	22.5	0.0	0.0
152	0.0	0.0	31.3
153	0.0	2.5	0.0
154	1.3	71.3	0.0
155	17.5	31.3	0.0
156	5.0	6.3	0.0
157	17.5	0.0	0.0
158	0.0	0.0	0.0
159	0.0	0.0	0.0
160	0.0	2.5	0.0
161	0.0	30.0	0.0
162	0.0	7.5	0.0
163	0.0	0.0	0.0
164	0.0	0.0	2.5
165	0.0	0.0	0.0
166	0.0	8.8	1.3
167	0.0	0.0	0.0
168	32.5	1.3	0.0
169	32.5	22.5	0.0
170	22.5	0.0	0.0
171	17.5	0.0	0.0
172	1.3	23.8	0.0
173	0.0	1.3	0.0
174	0.0	0.0	3.8
175	0.0	27.5	8.8
176	0.0	2.5	17.5
177	10.0	0.0	1.3
178	0.0	0.0	0.0
179	0.0	2.5	0.0
180	0.0	0.0	0.0
181	0.0	0.0	0.0
182	0.0	0.0	0.0
183	0.0	28.8	0.0
184	0.0	0.0	1.3
185	0.0	0.0	0.0
186	0.0	0.0	0.0
187	0.0	0.0	0.0
188	0.0	0.0	0.0
189	0.0	1.3	0.0
190	0.0	0.0	0.0
191	0.0	0.0	0.0
192	0.0	0.0	0.0
193	0.0	0.0	0.0
194	0.0	0.0	0.0
195	0.0	0.0	27.5
196	25.0	0.0	2.5
197	0.0	0.0	1.3
198	0.0	0.0	0.0
199	0.0	0.0	0.0
200	0.0	0.0	1.3
201	0.0	0.0	0.0
202	15.0	0.0	0.0
203	0.0	0.0	16.3
204	0.0	0.0	1.3
205	1.3	0.0	3.8
206	0.0	37.5	0.0
207	0.0	1.3	0.0
208	0.0	0.0	0.0
209	3.8	0.0	0.0
210	12.5	3.8	0.0
211	0.0	0.0	0.0
212	0.0	0.0	0.0
213	0.0	2.5	0.0
214	1.3	0.0	0.0
215	60.1	0.0	0.0
216	0.0	0.0	0.0
217	0.0	0.0	0.0
218	0.0	2.5	0.0
219	3.8	0.0	0.0
220	0.0	0.0	0.0
221	0.0	0.0	0.0
222	3.8	2.5	0.0

Precipitation, 3 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1191.6	1423.8	1127.9
Day	Year 1	Year 2	Year 3
223	5.6	0.0	0.0
224	0.0	0.0	0.0
225	0.0	0.0	0.0
226	0.0	1.1	0.0
227	0.0	0.0	31.7
228	33.5	0.0	0.0
229	0.0	1.1	0.0
230	0.0	0.0	1.1
231	1.1	0.0	3.2
232	3.4	0.0	6.3
233	6.7	12.3	1.1
234	1.1	0.0	0.0
235	0.0	0.0	0.0
236	0.0	0.0	19.0
237	20.1	0.0	0.0
238	0.0	1.1	12.7
239	13.4	8.9	51.8
240	54.7	0.0	0.0
241	0.0	0.0	6.3
242	6.7	15.6	1.1
243	1.1	26.8	2.1
244	2.2	11.2	2.1
245	2.2	0.0	0.0
246	0.0	5.6	0.0
247	0.0	1.1	0.0
248	0.0	0.0	0.0
249	0.0	0.0	0.0
250	0.0	0.0	2.1
251	2.2	0.0	13.7
252	14.5	0.0	28.5
253	30.2	0.0	11.6
254	12.3	0.0	0.0
255	0.0	0.0	0.0
256	0.0	16.8	0.0
257	0.0	6.7	9.5
258	10.1	6.7	0.0
259	0.0	22.3	0.0
260	0.0	2.2	0.0
261	0.0	35.7	0.0
262	0.0	1.1	4.2
263	4.5	0.0	19.0
264	20.1	0.0	57.1
265	60.3	0.0	72.9
266	77.1	0.0	0.0
267	0.0	0.0	19.0
268	20.1	0.0	3.2
269	3.4	21.2	0.0
270	0.0	4.5	0.0
271	0.0	0.0	0.0
272	0.0	0.0	0.0
273	0.0	13.4	0.0
274	0.0	1.1	0.0
275	0.0	0.0	58.1
276	61.4	2.2	0.0
277	0.0	4.5	1.1
278	1.1	0.0	38.1
279	40.2	0.0	8.5
280	8.9	0.0	20.1
281	21.2	0.0	15.9
282	16.8	0.0	0.0
283	0.0	0.0	0.0
284	0.0	1.1	0.0
285	0.0	29.0	0.0
286	0.0	49.1	0.0
287	0.0	55.8	2.1
288	2.2	5.6	6.3
289	6.7	2.2	0.0
290	0.0	26.8	0.0
291	0.0	22.3	7.4
292	7.8	84.9	0.0
293	0.0	0.0	0.0
294	0.0	0.0	0.0
295	0.0	58.1	0.0
296	0.0	3.4	0.0

500 year ARI (mm)

Total	1335.1	1595.4	1152.4
Day	Year 1	Year 2	Year 3
223	6.3	0.0	0.0
224	0.0	0.0	0.0
225	0.0	0.0	0.0
226	0.0	1.3	0.0
227	0.0	0.0	0.0
228	37.5	0.0	0.0
229	0.0	1.3	0.0
230	0.0	0.0	20.0
231	1.3	0.0	40.0
232	3.8	0.0	65.1
233	7.5	13.8	23.8
234	1.3	0.0	15.0
235	0.0	0.0	3.8
236	0.0	0.0	20.0
237	22.5	0.0	0.0
238	0.0	1.3	28.8
239	15.0	10.0	0.0
240	61.3	0.0	0.0
241	0.0	0.0	0.0
242	7.5	17.5	3.8
243	1.3	30.0	26.3
244	2.5	12.5	17.5
245	2.5	0.0	27.5
246	0.0	6.3	0.0
247	0.0	1.3	0.0
248	0.0	0.0	5.0
249	0.0	0.0	0.0
250	0.0	0.0	57.6
251	2.5	0.0	20.0
252	16.3	0.0	11.3
253	33.8	0.0	1.3
254	13.8	0.0	43.8
255	0.0	0.0	17.5
256	0.0	18.8	0.0
257	0.0	7.5	0.0
258	11.3	7.5	5.0
259	0.0	25.0	3.8
260	0.0	2.5	0.0
261	0.0	40.0	0.0
262	0.0	1.3	0.0
263	5.0	0.0	0.0
264	22.5	0.0	65.1
265	67.6	0.0	90.1
266	86.3	0.0	3.8
267	0.0	0.0	0.0
268	22.5	0.0	0.0
269	3.8	23.8	0.0
270	0.0	5.0	0.0
271	0.0	0.0	0.0
272	0.0	0.0	28.8
273	0.0	15.0	1.3
274	0.0	1.3	0.0
275	0.0	0.0	0.0
276	68.8	2.5	0.0
277	0.0	5.0	0.0
278	1.3	0.0	0.0
279	45.0	0.0	0.0
280	10.0	0.0	0.0
281	23.8	0.0	0.0
282	18.8	0.0	46.3
283	0.0	0.0	6.3
284	0.0	1.3	80.1
285	0.0	32.5	8.8
286	0.0	55.1	1.3
287	0.0	62.6	16.3
288	2.5	6.3	0.0
289	7.5	2.5	0.0
290	0.0	30.0	0.0
291	0.0	25.0	0.0
292	8.8	95.1	0.0
293	0.0	0.0	0.0
294	0.0	0.0	6.3
295	0.0	65.1	8.8
296	0.0	3.8	0.0

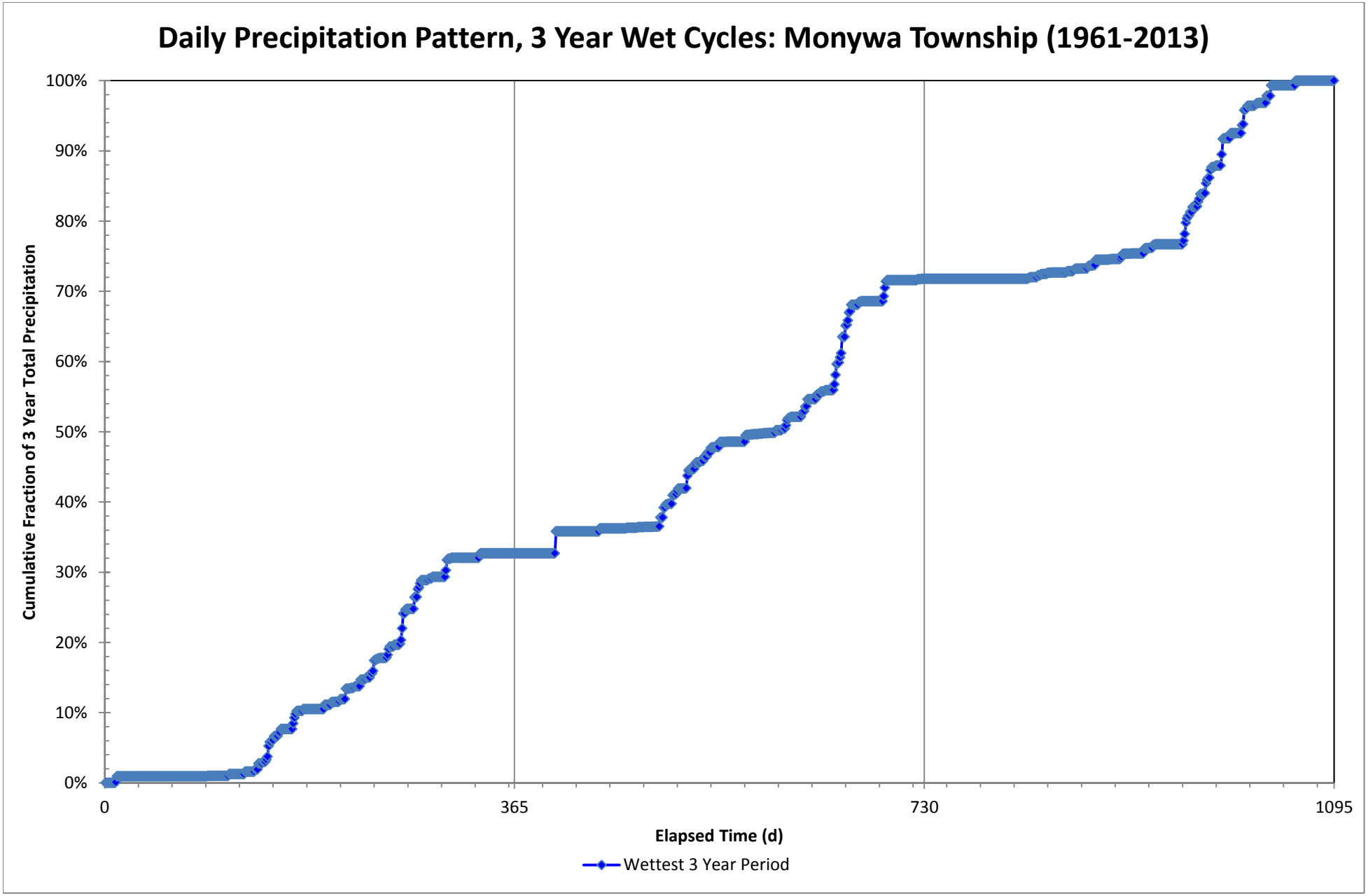
Precipitation, 3 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1191.6	1423.8	1127.9
Day	Year 1	Year 2	Year 3
297	0.0	23.5	0.0
298	0.0	40.2	0.0
299	0.0	6.7	0.0
300	0.0	33.5	0.0
301	0.0	0.0	0.0
302	0.0	0.0	0.0
303	0.0	0.0	32.8
304	34.6	0.0	49.7
305	52.5	0.0	6.3
306	6.7	2.2	1.1
307	1.1	13.4	0.0
308	0.0	0.0	4.2
309	4.5	3.4	0.0
310	0.0	0.0	0.0
311	0.0	0.0	0.0
312	0.0	0.0	0.0
313	0.0	0.0	0.0
314	0.0	0.0	0.0
315	0.0	0.0	0.0
316	0.0	0.0	0.0
317	0.0	0.0	0.0
318	0.0	0.0	0.0
319	0.0	0.0	0.0
320	0.0	0.0	0.0
321	0.0	0.0	0.0
322	0.0	0.0	0.0
323	0.0	0.0	0.0
324	0.0	0.0	0.0
325	0.0	0.0	0.0
326	0.0	0.0	0.0
327	0.0	0.0	0.0
328	0.0	0.0	0.0
329	0.0	25.7	0.0
330	0.0	44.7	0.0
331	0.0	32.4	0.0
332	0.0	6.7	0.0
333	0.0	0.0	19.0
334	20.1	0.0	3.2
335	3.4	0.0	0.0
336	0.0	0.0	0.0
337	0.0	0.0	0.0
338	0.0	0.0	0.0
339	0.0	0.0	0.0
340	0.0	0.0	0.0
341	0.0	0.0	0.0
342	0.0	0.0	0.0
343	0.0	0.0	0.0
344	0.0	0.0	0.0
345	0.0	0.0	0.0
346	0.0	0.0	0.0
347	0.0	0.0	0.0
348	0.0	0.0	0.0
349	0.0	0.0	0.0
350	0.0	0.0	0.0
351	0.0	0.0	0.0
352	0.0	0.0	0.0
353	0.0	0.0	0.0
354	0.0	0.0	0.0
355	0.0	0.0	0.0
356	0.0	0.0	0.0
357	0.0	0.0	0.0
358	0.0	0.0	0.0
359	0.0	4.5	0.0
360	0.0	0.0	0.0
361	0.0	0.0	0.0
362	0.0	1.1	0.0
363	0.0	1.1	0.0
364	0.0	0.0	0.0
365	0.0	0.0	0.0
366		0.0	

500 year ARI (mm)

Total	1335.1	1595.4	1152.4
Day	Year 1	Year 2	Year 3
297	0.0	26.3	2.5
298	0.0	45.0	0.0
299	0.0	7.5	0.0
300	0.0	37.5	0.0
301	0.0	0.0	0.0
302	0.0	0.0	0.0
303	0.0	0.0	0.0
304	38.8	0.0	40.0
305	58.8	0.0	0.0
306	7.5	2.5	0.0
307	1.3	15.0	0.0
308	0.0	0.0	61.3
309	5.0	3.8	0.0
310	0.0	0.0	0.0
311	0.0	0.0	0.0
312	0.0	0.0	0.0
313	0.0	0.0	0.0
314	0.0	0.0	0.0
315	0.0	0.0	0.0
316	0.0	0.0	0.0
317	0.0	0.0	0.0
318	0.0	0.0	0.0
319	0.0	0.0	0.0
320	0.0	0.0	0.0
321	0.0	0.0	0.0
322	0.0	0.0	0.0
323	0.0	0.0	0.0
324	0.0	0.0	0.0
325	0.0	0.0	0.0
326	0.0	0.0	0.0
327	0.0	0.0	0.0
328	0.0	0.0	0.0
329	0.0	28.8	0.0
330	0.0	50.1	27.5
331	0.0	36.3	0.0
332	0.0	7.5	0.0
333	0.0	0.0	0.0
334	22.5	0.0	0.0
335	3.8	0.0	0.0
336	0.0	0.0	0.0
337	0.0	0.0	0.0
338	0.0	0.0	0.0
339	0.0	0.0	0.0
340	0.0	0.0	0.0
341	0.0	0.0	0.0
342	0.0	0.0	0.0
343	0.0	0.0	0.0
344	0.0	0.0	0.0
345	0.0	0.0	0.0
346	0.0	0.0	0.0
347	0.0	0.0	0.0
348	0.0	0.0	0.0
349	0.0	0.0	0.0
350	0.0	0.0	0.0
351	0.0	0.0	0.0
352	0.0	0.0	0.0
353	0.0	0.0	0.0
354	0.0	0.0	0.0
355	0.0	0.0	0.0
356	0.0	0.0	0.0
357	0.0	0.0	0.0
358	0.0	0.0	0.0
359	0.0	5.0	0.0
360	0.0	0.0	0.0
361	0.0	0.0	0.0
362	0.0	1.3	0.0
363	0.0	1.3	0.0
364	0.0	0.0	0.0
365	0.0	0.0	0.0
366		0.0	


Daily Precipitation Pattern, 3 Year Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 3 Year Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
365
730
1095
Elapsed Time (d)
Wettest 3 Year Period

Precipitation, 2 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1291.2	1252.4
Day	Year 1	Year 2
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	0.0	0.0
26	0.0	0.0
27	0.0	0.0
28	0.0	0.0
29	0.0	0.0
30	0.0	0.0
31	0.0	0.0
32	0.0	0.0
33	0.0	0.0
34	0.0	0.0
35	0.0	0.0
36	0.0	0.0
37	0.0	0.0
38	0.0	0.0
39	0.0	0.0
40	0.0	0.0
41	0.0	0.0
42	0.0	0.0
43	0.0	0.0
44	0.0	0.0
45	0.0	0.0
46	0.0	0.0
47	0.0	0.0
48	0.0	0.0
49	0.0	0.0
50	0.0	0.0
51	0.0	0.0
52	0.0	0.0
53	0.0	0.0
54	0.0	0.0
55	0.0	0.0
56	0.0	0.0
57	0.0	0.0
58	0.0	0.0
59	0.0	0.0
60	0.0	0.0
61	0.0	0.0
62	0.0	0.0
63	0.0	0.0
64	0.0	0.0
65	0.0	0.0
66	0.0	0.0
67	0.0	0.0
68	0.0	0.0
69	0.0	0.0
70	0.0	0.0
71	0.0	0.0
72	0.0	0.0
73	0.0	0.0
74	0.0	0.0

500 year ARI (mm)

Total	1443.7	1400.3
Day	Year 1	Year 2
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	0.0
13	0.0	0.0
14	0.0	0.0
15	0.0	0.0
16	0.0	0.0
17	0.0	0.0
18	0.0	0.0
19	0.0	0.0
20	0.0	0.0
21	0.0	0.0
22	0.0	0.0
23	0.0	0.0
24	0.0	0.0
25	0.0	0.0
26	0.0	0.0
27	0.0	0.0
28	0.0	0.0
29	0.0	0.0
30	0.0	0.0
31	0.0	0.0
32	0.0	0.0
33	0.0	0.0
34	0.0	0.0
35	0.0	0.0
36	0.0	0.0
37	0.0	0.0
38	0.0	0.0
39	0.0	0.0
40	0.0	0.0
41	0.0	0.0
42	0.0	0.0
43	0.0	0.0
44	0.0	0.0
45	0.0	0.0
46	0.0	0.0
47	0.0	0.0
48	0.0	0.0
49	0.0	0.0
50	0.0	0.0
51	0.0	0.0
52	0.0	0.0
53	0.0	0.0
54	0.0	0.0
55	0.0	0.0
56	0.0	0.0
57	0.0	0.0
58	0.0	0.0
59	0.0	0.0
60	0.0	0.0
61	0.0	0.0
62	0.0	0.0
63	0.0	0.0
64	0.0	0.0
65	0.0	0.0
66	0.0	0.0
67	0.0	0.0
68	0.0	0.0
69	0.0	0.0
70	0.0	0.0
71	0.0	0.0
72	0.0	0.0
73	0.0	0.0
74	0.0	0.0

Precipitation, 2 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1291.2	1252.4
Day	Year 1	Year 2
75	0.0	0.0
76	0.0	0.0
77	0.0	0.0
78	0.0	0.0
79	0.0	0.0
80	0.0	0.0
81	0.0	0.0
82	0.0	0.0
83	0.0	0.0
84	0.0	0.0
85	0.0	0.0
86	0.0	3.7
87	0.0	0.0
88	3.2	1.6
89	0.0	0.5
90	6.3	0.0
91	0.0	0.0
92	0.0	1.6
93	0.0	0.0
94	0.0	0.0
95	0.0	0.0
96	0.0	0.0
97	0.0	0.0
98	0.0	0.0
99	0.0	0.0
100	0.0	0.0
101	0.0	0.0
102	0.0	0.0
103	0.0	0.0
104	0.0	0.0
105	0.0	0.0
106	10.6	0.0
107	0.0	0.0
108	0.0	0.0
109	0.0	0.0
110	0.0	0.0
111	0.0	0.0
112	0.0	0.0
113	0.0	15.9
114	0.0	1.1
115	4.2	0.0
116	0.0	0.0
117	0.0	8.5
118	4.2	73.0
119	0.0	2.1
120	0.0	3.2
121	0.0	0.0
122	0.0	0.0
123	0.0	0.0
124	0.0	7.9
125	0.0	0.0
126	8.5	5.9
127	0.0	0.0
128	0.0	0.5
129	0.0	0.0
130	0.0	0.0
131	0.0	0.0
132	0.0	0.0
133	0.0	0.0
134	0.0	0.0
135	0.0	0.0
136	21.7	5.3
137	0.0	12.2
138	0.0	1.1
139	0.0	0.0
140	1.1	0.0
141	44.4	9.0
142	0.0	0.0
143	0.0	7.9
144	12.2	12.2
145	0.0	0.0
146	0.0	0.0
147	0.0	11.0
148	0.0	5.8

500 year ARI (mm)

Total	1443.7	1400.3
Day	Year 1	Year 2
75	0.0	0.0
76	0.0	0.0
77	0.0	0.0
78	0.0	0.0
79	0.0	0.0
80	0.0	0.0
81	0.0	0.0
82	0.0	0.0
83	0.0	0.0
84	0.0	0.0
85	0.0	0.0
86	0.0	4.1
87	0.0	0.0
88	3.5	1.8
89	0.0	0.6
90	7.1	0.0
91	0.0	0.0
92	0.0	1.8
93	0.0	0.0
94	0.0	0.0
95	0.0	0.0
96	0.0	0.0
97	0.0	0.0
98	0.0	0.0
99	0.0	0.0
100	0.0	0.0
101	0.0	0.0
102	0.0	0.0
103	0.0	0.0
104	0.0	0.0
105	0.0	0.0
106	11.8	0.0
107	0.0	0.0
108	0.0	0.0
109	0.0	0.0
110	0.0	0.0
111	0.0	0.0
112	0.0	0.0
113	0.0	17.7
114	0.0	1.2
115	4.7	0.0
116	0.0	0.0
117	0.0	9.5
118	4.7	81.6
119	0.0	2.4
120	0.0	3.5
121	0.0	0.0
122	0.0	0.0
123	0.0	0.0
124	0.0	8.9
125	0.0	0.0
126	9.5	6.6
127	0.0	0.0
128	0.0	0.6
129	0.0	0.0
130	0.0	0.0
131	0.0	0.0
132	0.0	0.0
133	0.0	0.0
134	0.0	0.0
135	0.0	0.0
136	24.2	5.9
137	0.0	13.6
138	0.0	1.2
139	0.0	0.0
140	1.2	0.0
141	49.7	10.1
142	0.0	0.0
143	0.0	8.9
144	13.6	13.6
145	0.0	0.0
146	0.0	0.0
147	0.0	12.3
148	0.0	6.5

Precipitation, 2 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1291.2	1252.4
Day	Year 1	Year 2
149	0.0	14.8
150	0.0	0.0
151	0.0	0.0
152	0.0	48.6
153	0.0	0.0
154	0.0	3.2
155	4.2	0.0
156	0.0	0.0
157	0.0	105.8
158	0.0	25.4
159	0.0	11.6
160	0.0	4.2
161	0.0	0.0
162	0.0	0.0
163	0.0	0.0
164	0.0	0.0
165	0.0	9.0
166	41.2	0.0
167	3.2	0.5
168	20.1	2.1
169	12.2	0.0
170	0.0	0.0
171	0.0	0.0
172	0.0	0.0
173	0.0	0.0
174	7.4	0.0
175	28.6	69.7
176	1.6	0.5
177	0.0	0.0
178	0.0	0.0
179	4.2	0.0
180	0.0	0.0
181	0.0	0.0
182	0.0	0.0
183	29.3	0.0
184	0.0	0.0
185	0.0	0.0
186	0.0	0.0
187	0.0	0.0
188	0.0	0.0
189	0.0	0.0
190	0.0	0.0
191	0.0	1.6
192	0.0	0.0
193	0.0	0.7
194	0.0	0.0
195	0.0	0.0
196	0.0	29.1
197	5.9	0.0
198	20.6	0.0
199	9.8	0.0
200	2.6	0.0
201	8.5	3.9
202	34.9	0.0
203	0.0	0.0
204	0.0	1.1
205	0.0	4.2
206	0.0	0.5
207	5.3	0.5
208	0.0	0.0
209	0.0	46.5
210	5.8	0.0
211	1.1	0.0
212	15.3	2.1
213	0.0	20.6
214	0.0	0.0
215	0.0	0.0
216	13.2	0.0
217	0.0	0.0
218	0.0	0.0
219	0.0	8.1
220	0.0	4.8
221	0.0	41.2
222	0.0	2.6

500 year ARI (mm)

Total	1443.7	1400.3
Day	Year 1	Year 2
149	0.0	16.6
150	0.0	0.0
151	0.0	0.0
152	0.0	54.4
153	0.0	0.0
154	0.0	3.5
155	4.7	0.0
156	0.0	0.0
157	0.0	118.3
158	0.0	28.4
159	0.0	13.0
160	0.0	4.7
161	0.0	0.0
162	0.0	0.0
163	0.0	0.0
164	0.0	0.0
165	0.0	10.1
166	46.1	0.0
167	3.5	0.6
168	22.5	2.4
169	13.6	0.0
170	0.0	0.0
171	0.0	0.0
172	0.0	0.0
173	0.0	0.0
174	8.3	0.0
175	31.9	77.9
176	1.8	0.6
177	0.0	0.0
178	0.0	0.0
179	4.7	0.0
180	0.0	0.0
181	0.0	0.0
182	0.0	0.0
183	32.8	0.0
184	0.0	0.0
185	0.0	0.0
186	0.0	0.0
187	0.0	0.0
188	0.0	0.0
189	0.0	0.0
190	0.0	0.0
191	0.0	1.8
192	0.0	0.0
193	0.0	0.8
194	0.0	0.0
195	0.0	0.0
196	0.0	32.5
197	6.6	0.0
198	23.1	0.0
199	11.0	0.0
200	3.0	0.0
201	9.5	4.4
202	39.0	0.0
203	0.0	0.0
204	0.0	1.2
205	0.0	4.7
206	0.0	0.6
207	5.9	0.6
208	0.0	0.0
209	0.0	52.0
210	6.5	0.0
211	1.2	0.0
212	17.1	2.4
213	0.0	23.1
214	0.0	0.0
215	0.0	0.0
216	14.8	0.0
217	0.0	0.0
218	0.0	0.0
219	0.0	9.1
220	0.0	5.3
221	0.0	46.1
222	0.0	3.0

Precipitation, 2 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1291.2	1252.4
Day	Year 1	Year 2
223	4.2	36.0
224	2.6	9.0
225	0.0	0.0
226	0.0	0.0
227	0.0	0.0
228	0.0	25.4
229	47.6	2.6
230	18.5	0.0
231	0.0	3.7
232	0.0	0.5
233	0.0	0.0
234	89.9	0.0
235	0.0	0.0
236	7.4	27.5
237	10.0	1.1
238	0.0	42.8
239	0.0	13.2
240	0.0	9.5
241	2.1	0.0
242	0.0	0.0
243	0.0	0.0
244	0.0	0.0
245	0.0	0.0
246	9.0	0.0
247	9.3	3.7
248	0.0	0.0
249	0.0	0.0
250	0.0	0.0
251	0.0	0.0
252	0.0	4.8
253	0.0	0.0
254	20.1	0.0
255	0.0	0.0
256	1.6	15.9
257	68.2	4.2
258	0.0	0.0
259	0.0	0.0
260	2.1	0.0
261	0.0	0.0
262	0.0	0.0
263	9.0	14.8
264	0.0	1.1
265	35.4	0.0
266	0.0	0.0
267	0.0	0.0
268	0.0	0.0
269	0.0	0.0
270	0.0	0.0
271	0.0	21.7
272	6.9	3.9
273	0.0	30.7
274	0.0	14.8
275	0.0	10.6
276	0.0	14.3
277	0.0	6.9
278	0.0	3.7
279	83.6	0.0
280	89.9	0.0
281	55.0	0.0
282	0.0	0.0
283	1.6	0.0
284	2.1	0.0
285	6.3	0.0
286	5.3	0.0
287	37.0	0.0
288	0.0	2.1
289	20.6	0.0
290	0.0	38.1
291	0.0	22.7
292	0.0	174.5
293	55.5	0.0
294	0.0	0.0
295	54.5	0.0
296	114.7	0.0

500 year ARI (mm)

Total	1443.7	1400.3
Day	Year 1	Year 2
223	4.7	40.2
224	3.0	10.1
225	0.0	0.0
226	0.0	0.0
227	0.0	0.0
228	0.0	28.4
229	53.2	3.0
230	20.7	0.0
231	0.0	4.1
232	0.0	0.6
233	0.0	0.0
234	100.5	0.0
235	0.0	0.0
236	8.3	30.7
237	11.2	1.2
238	0.0	47.9
239	0.0	14.8
240	0.0	10.6
241	2.4	0.0
242	0.0	0.0
243	0.0	0.0
244	0.0	0.0
245	0.0	0.0
246	10.1	0.0
247	10.4	4.1
248	0.0	0.0
249	0.0	0.0
250	0.0	0.0
251	0.0	0.0
252	0.0	5.3
253	0.0	0.0
254	22.5	0.0
255	0.0	0.0
256	1.8	17.7
257	76.3	4.7
258	0.0	0.0
259	0.0	0.0
260	2.4	0.0
261	0.0	0.0
262	0.0	0.0
263	10.1	16.6
264	0.0	1.2
265	39.6	0.0
266	0.0	0.0
267	0.0	0.0
268	0.0	0.0
269	0.0	0.0
270	0.0	0.0
271	0.0	24.2
272	7.7	4.4
273	0.0	34.3
274	0.0	16.6
275	0.0	11.8
276	0.0	16.0
277	0.0	7.7
278	0.0	4.1
279	93.4	0.0
280	100.5	0.0
281	61.5	0.0
282	0.0	0.0
283	1.8	0.0
284	2.4	0.0
285	7.1	0.0
286	5.9	0.0
287	41.4	0.0
288	0.0	2.4
289	23.1	0.0
290	0.0	42.6
291	0.0	25.4
292	0.0	195.1
293	62.1	0.0
294	0.0	0.0
295	60.9	0.0
296	128.3	0.0

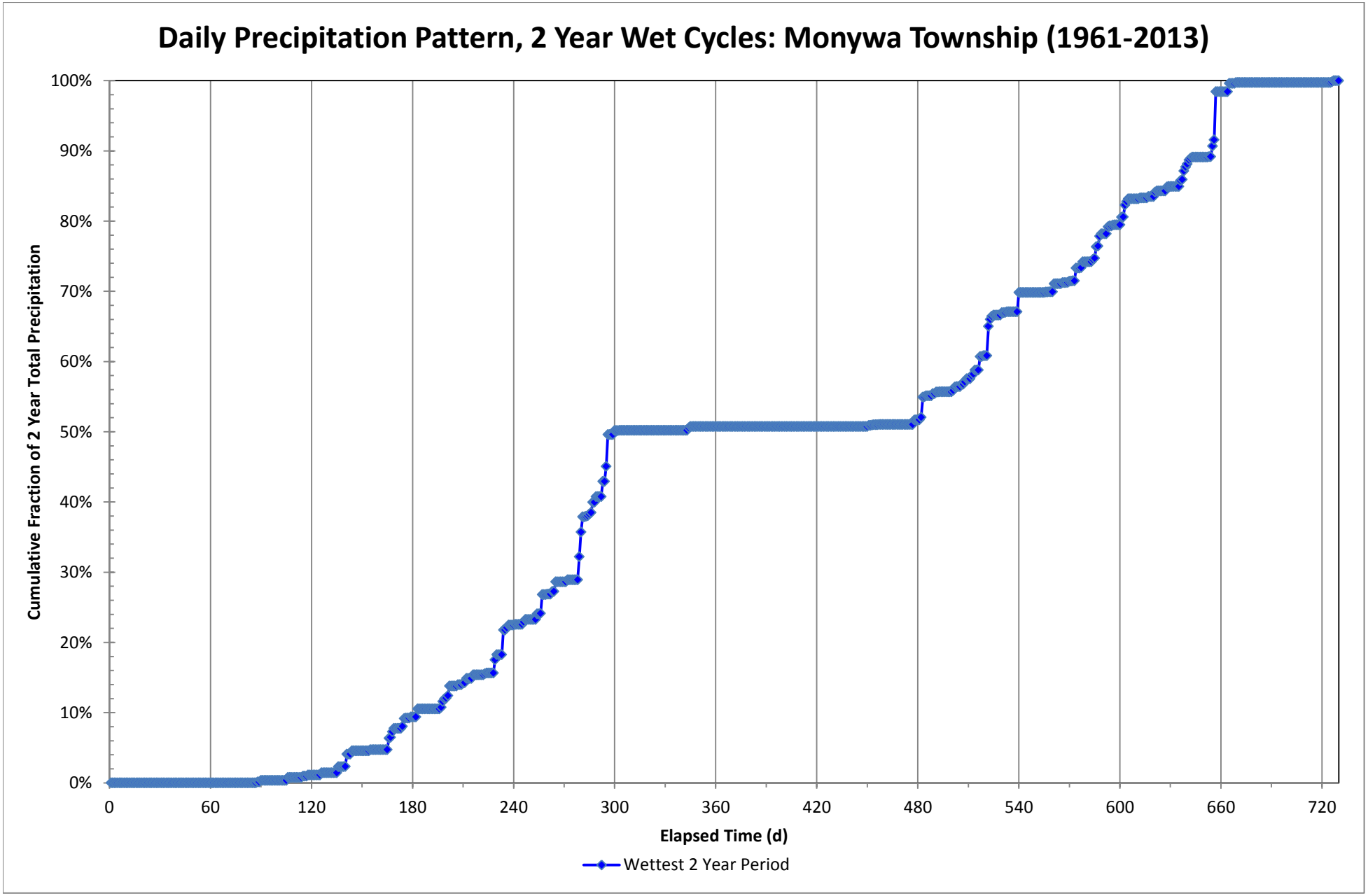
Precipitation, 2 Year Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	1291.2	1252.4
Day	Year 1	Year 2
297	0.0	0.0
298	0.0	0.0
299	0.0	0.0
300	14.8	29.6
301	0.0	0.0
302	0.0	0.0
303	1.1	0.0
304	0.0	3.2
305	0.0	0.0
306	0.0	0.0
307	0.0	0.0
308	0.0	0.0
309	0.0	0.0
310	0.0	0.0
311	0.0	0.0
312	0.0	0.0
313	0.0	0.0
314	0.0	0.0
315	0.0	0.0
316	0.0	0.0
317	0.0	0.0
318	0.0	0.0
319	0.0	0.0
320	0.0	0.0
321	0.0	0.0
322	0.0	0.0
323	0.0	0.0
324	0.0	0.0
325	0.0	0.0
326	0.0	0.0
327	0.0	0.0
328	0.0	0.0
329	0.0	0.0
330	0.0	0.0
331	0.0	0.0
332	0.0	0.0
333	0.0	0.0
334	0.0	0.0
335	0.0	0.0
336	0.0	0.0
337	0.0	0.0
338	0.0	0.0
339	0.0	0.0
340	0.0	0.0
341	0.0	0.0
342	0.0	0.0
343	0.0	0.0
344	8.5	0.0
345	5.3	0.0
346	0.0	0.0
347	0.0	0.0
348	0.0	0.0
349	0.0	0.0
350	0.0	0.0
351	0.0	0.0
352	0.0	0.0
353	0.0	0.0
354	0.0	0.0
355	0.0	0.0
356	0.0	0.0
357	0.0	0.0
358	0.0	0.0
359	0.0	0.0
360	0.0	0.0
361	0.0	2.6
362	0.0	4.2
363	0.0	0.0
364	0.0	0.0
365	0.0	0.0
366		0.0

500 year ARI (mm)

Total	1443.7	1400.3
Day	Year 1	Year 2
297	0.0	0.0
298	0.0	0.0
299	0.0	0.0
300	16.6	33.1
301	0.0	0.0
302	0.0	0.0
303	1.2	0.0
304	0.0	3.5
305	0.0	0.0
306	0.0	0.0
307	0.0	0.0
308	0.0	0.0
309	0.0	0.0
310	0.0	0.0
311	0.0	0.0
312	0.0	0.0
313	0.0	0.0
314	0.0	0.0
315	0.0	0.0
316	0.0	0.0
317	0.0	0.0
318	0.0	0.0
319	0.0	0.0
320	0.0	0.0
321	0.0	0.0
322	0.0	0.0
323	0.0	0.0
324	0.0	0.0
325	0.0	0.0
326	0.0	0.0
327	0.0	0.0
328	0.0	0.0
329	0.0	0.0
330	0.0	0.0
331	0.0	0.0
332	0.0	0.0
333	0.0	0.0
334	0.0	0.0
335	0.0	0.0
336	0.0	0.0
337	0.0	0.0
338	0.0	0.0
339	0.0	0.0
340	0.0	0.0
341	0.0	0.0
342	0.0	0.0
343	0.0	0.0
344	9.5	0.0
345	5.9	0.0
346	0.0	0.0
347	0.0	0.0
348	0.0	0.0
349	0.0	0.0
350	0.0	0.0
351	0.0	0.0
352	0.0	0.0
353	0.0	0.0
354	0.0	0.0
355	0.0	0.0
356	0.0	0.0
357	0.0	0.0
358	0.0	0.0
359	0.0	0.0
360	0.0	0.0
361	0.0	3.0
362	0.0	4.7
363	0.0	0.0
364	0.0	0.0
365	0.0	0.0
366		0.0


Daily Precipitation Pattern, 2 Year Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 2 Year Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
60
120
180
240
300
360
420
480
540
600
660
720
Elapsed Time (d)
Wettest 2 Year Period

Precipitation, 1 Year Wet and Dry Cycles: Monywa Township (1961-2013)

Wet, 100 year ARI (mm)

Total	1554.9
Day	Year 1
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0
19	0.0
20	0.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	0.0
31	0.0
32	0.0
33	0.0
34	0.0
35	0.0
36	0.0
37	0.0
38	0.0
39	0.0
40	0.0
41	0.0
42	0.0
43	0.0
44	0.0
45	0.0
46	0.0
47	0.0
48	0.0
49	0.0
50	0.0
51	0.0
52	0.0
53	0.0
54	0.0
55	0.0
56	0.0
57	0.0
58	0.0
59	0.0
60	0.0
61	0.0
62	0.0
63	0.0
64	0.0
65	0.0
66	0.0
67	0.0
68	2.3
69	0.0
70	0.0
71	0.0
72	0.0
73	0.0
74	0.0

Wet, 500 year ARI (mm)

Total	1901.8
Day	Year 1
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0
19	0.0
20	0.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	0.0
31	0.0
32	0.0
33	0.0
34	0.0
35	0.0
36	0.0
37	0.0
38	0.0
39	0.0
40	0.0
41	0.0
42	0.0
43	0.0
44	0.0
45	0.0
46	0.0
47	0.0
48	0.0
49	0.0
50	0.0
51	0.0
52	0.0
53	0.0
54	0.0
55	0.0
56	0.0
57	0.0
58	0.0
59	0.0
60	0.0
61	0.0
62	0.0
63	0.0
64	0.0
65	0.0
66	0.0
67	0.0
68	2.8
69	0.0
70	0.0
71	0.0
72	0.0
73	0.0
74	0.0

Dry, 100 year ARI (mm)

Total	424.0
Day	Year 1
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0
19	0.0
20	0.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	0.0
31	0.0
32	0.0
33	0.0
34	0.0
35	0.0
36	0.0
37	0.0
38	0.0
39	0.0
40	0.0
41	0.0
42	0.0
43	0.0
44	0.0
45	0.0
46	0.0
47	0.0
48	0.0
49	0.0
50	0.0
51	0.0
52	0.0
53	0.0
54	0.0
55	0.0
56	0.0
57	0.0
58	0.0
59	0.0
60	0.0
61	0.0
62	0.0
63	0.0
64	0.0
65	0.0
66	0.0
67	0.0
68	0.0
69	0.0
70	0.0
71	0.0
72	0.0
73	0.0
74	0.0

Dry, 500 year ARI (mm)

Total	382.6
Day	Year 1
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0
19	0.0
20	0.0
21	0.0
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	0.0
31	0.0
32	0.0
33	0.0
34	0.0
35	0.0
36	0.0
37	0.0
38	0.0
39	0.0
40	0.0
41	0.0
42	0.0
43	0.0
44	0.0
45	0.0
46	0.0
47	0.0
48	0.0
49	0.0
50	0.0
51	0.0
52	0.0
53	0.0
54	0.0
55	0.0
56	0.0
57	0.0
58	0.0
59	0.0
60	0.0
61	0.0
62	0.0
63	0.0
64	0.0
65	0.0
66	0.0
67	0.0
68	0.0
69	0.0
70	0.0
71	0.0
72	0.0
73	0.0
74	0.0

Precipitation, 1 Year Wet and Dry Cycles: Monywa Township (1961-2013)

Wet, 100 year ARI (mm)

Total	1554.9
Day	Year 1
75	0.0
76	0.0
77	0.0
78	0.0
79	0.0
80	0.0
81	0.0
82	0.0
83	0.0
84	0.0
85	0.0
86	0.0
87	0.0
88	0.0
89	0.0
90	0.0
91	0.0
92	0.0
93	0.0
94	0.0
95	0.0
96	0.0
97	0.0
98	0.0
99	0.0
100	0.0
101	0.0
102	0.0
103	18.2
104	0.0
105	0.0
106	0.0
107	0.0
108	0.0
109	0.0
110	0.0
111	0.0
112	0.0
113	0.0
114	0.0
115	3.4
116	0.0
117	0.0
118	0.0
119	0.0
120	0.0
121	0.0
122	0.0
123	37.5
124	0.0
125	0.0
126	0.0
127	0.0
128	0.0
129	1.1
130	6.8
131	9.1
132	0.0
133	0.0
134	0.0
135	0.0
136	2.3
137	0.0
138	1.1
139	0.0
140	6.8
141	0.0
142	0.0
143	2.3
144	1.1
145	6.8
146	1.1
147	1.1
148	10.2

Wet, 500 year ARI (mm)

Total	1901.8
Day	Year 1
75	0.0
76	0.0
77	0.0
78	0.0
79	0.0
80	0.0
81	0.0
82	0.0
83	0.0
84	0.0
85	0.0
86	0.0
87	0.0
88	0.0
89	0.0
90	0.0
91	0.0
92	0.0
93	0.0
94	0.0
95	0.0
96	0.0
97	0.0
98	0.0
99	0.0
100	0.0
101	0.0
102	0.0
103	22.2
104	0.0
105	0.0
106	0.0
107	0.0
108	0.0
109	0.0
110	0.0
111	0.0
112	0.0
113	0.0
114	0.0
115	4.2
116	0.0
117	0.0
118	0.0
119	0.0
120	0.0
121	0.0
122	0.0
123	45.8
124	0.0
125	0.0
126	0.0
127	0.0
128	0.0
129	1.4
130	8.3
131	11.1
132	0.0
133	0.0
134	0.0
135	0.0
136	2.8
137	0.0
138	1.4
139	0.0
140	8.3
141	0.0
142	0.0
143	2.8
144	1.4
145	8.3
146	1.4
147	1.4
148	12.5

Dry, 100 year ARI (mm)

Total	424.0
Day	Year 1
75	0.0
76	0.0
77	0.0
78	0.0
79	0.0
80	0.0
81	0.0
82	0.0
83	0.0
84	0.0
85	0.0
86	0.0
87	0.0
88	0.0
89	0.0
90	0.0
91	0.0
92	0.0
93	0.0
94	0.0
95	0.0
96	0.0
97	0.0
98	0.0
99	0.0
100	0.0
101	0.0
102	0.0
103	0.0
104	0.0
105	0.0
106	0.0
107	0.0
108	0.0
109	2.1
110	0.0
111	0.0
112	0.0
113	0.0
114	0.0
115	0.0
116	0.0
117	0.0
118	0.0
119	0.0
120	0.0
121	0.0
122	0.0
123	4.1
124	0.0
125	17.5
126	0.0
127	0.0
128	0.0
129	0.0
130	0.0
131	0.0
132	3.1
133	0.0
134	0.0
135	37.1
136	1.0
137	0.0
138	0.0
139	0.0
140	0.0
141	7.2
142	0.0
143	12.4
144	1.0
145	25.8
146	0.0
147	0.0
148	0.0

Dry, 500 year ARI (mm)

Total	382.6
Day	Year 1
75	0.0
76	0.0
77	0.0
78	0.0
79	0.0
80	0.0
81	0.0
82	0.0
83	0.0
84	0.0
85	0.0
86	0.0
87	0.0
88	0.0
89	0.0
90	0.0
91	0.0
92	0.0
93	0.0
94	0.0
95	0.0
96	0.0
97	0.0
98	0.0
99	0.0
100	0.0
101	0.0
102	0.0
103	0.0
104	0.0
105	0.0
106	0.0
107	0.0
108	0.0
109	1.9
110	0.0
111	0.0
112	0.0
113	0.0
114	0.0
115	0.0
116	0.0
117	0.0
118	0.0
119	0.0
120	0.0
121	0.0
122	0.0
123	3.7
124	0.0
125	15.8
126	0.0
127	0.0
128	0.0
129	0.0
130	0.0
131	0.0
132	2.8
133	0.0
134	0.0
135	33.5
136	0.9
137	0.0
138	0.0
139	0.0
140	0.0
141	6.5
142	0.0
143	11.2
144	0.9
145	23.3
146	0.0
147	0.0
148	0.0

Precipitation, 1 Year Wet and Dry Cycles: Monywa Township (1961-2013)

Wet, 100 year ARI (mm)

Total	1554.9
Day	Year 1
149	0.0
150	0.0
151	0.0
152	7.9
153	0.0
154	0.0
155	5.7
156	0.0
157	18.2
158	4.5
159	6.8
160	9.1
161	87.4
162	4.5
163	0.0
164	0.0
165	0.0
166	4.5
167	1.1
168	0.0
169	1.1
170	0.0
171	0.0
172	6.8
173	0.0
174	0.0
175	0.0
176	2.3
177	1.1
178	74.9
179	0.0
180	0.0
181	28.4
182	0.0
183	19.3
184	11.3
185	0.0
186	5.7
187	6.8
188	0.0
189	0.0
190	1.1
191	4.5
192	53.3
193	15.9
194	1.1
195	23.8
196	0.0
197	0.0
198	0.0
199	0.0
200	0.0
201	1.1
202	0.0
203	0.0
204	0.0
205	0.0
206	0.0
207	0.0
208	1.1
209	0.0
210	0.0
211	2.3
212	4.5
213	0.0
214	9.1
215	3.4
216	0.0
217	0.0
218	116.9
219	1.1
220	0.0
221	3.4
222	32.9

Wet, 500 year ARI (mm)

Total	1901.8
Day	Year 1
149	0.0
150	0.0
151	0.0
152	9.7
153	0.0
154	0.0
155	6.9
156	0.0
157	22.2
158	5.6
159	8.3
160	11.1
161	106.9
162	5.6
163	0.0
164	0.0
165	0.0
166	5.6
167	1.4
168	0.0
169	1.4
170	0.0
171	0.0
172	8.3
173	0.0
174	0.0
175	0.0
176	2.8
177	1.4
178	91.6
179	0.0
180	0.0
181	34.7
182	0.0
183	23.6
184	13.9
185	0.0
186	6.9
187	8.3
188	0.0
189	0.0
190	1.4
191	5.6
192	65.2
193	19.4
194	1.4
195	29.2
196	0.0
197	0.0
198	0.0
199	0.0
200	0.0
201	1.4
202	0.0
203	0.0
204	0.0
205	0.0
206	0.0
207	0.0
208	1.4
209	0.0
210	0.0
211	2.8
212	5.6
213	0.0
214	11.1
215	4.2
216	0.0
217	0.0
218	143.0
219	1.4
220	0.0
221	4.2
222	40.3

Dry, 100 year ARI (mm)

Total	424.0
Day	Year 1
149	0.0
150	0.0
151	0.0
152	0.0
153	27.9
154	11.3
155	1.0
156	0.0
157	0.0
158	16.5
159	0.0
160	0.0
161	0.0
162	0.0
163	0.0
164	5.2
165	11.3
166	0.0
167	0.0
168	0.0
169	1.0
170	0.0
171	5.2
172	1.0
173	0.0
174	0.0
175	0.0
176	0.0
177	0.0
178	0.0
179	0.0
180	3.1
181	0.0
182	0.0
183	0.0
184	0.0
185	0.0
186	0.0
187	0.0
188	0.0
189	0.0
190	0.0
191	0.0
192	4.1
193	1.0
194	0.0
195	0.0
196	0.0
197	0.0
198	0.0
199	0.0
200	0.0
201	0.0
202	0.0
203	0.0
204	0.0
205	0.0
206	0.0
207	0.0
208	0.0
209	0.0
210	0.0
211	0.0
212	6.2
213	19.6
214	4.1
215	0.0
216	0.0
217	0.0
218	0.0
219	36.1
220	0.0
221	0.0
222	0.0

Dry, 500 year ARI (mm)

Total	382.6
Day	Year 1
149	0.0
150	0.0
151	0.0
152	0.0
153	25.1
154	10.2
155	0.9
156	0.0
157	0.0
158	14.9
159	0.0
160	0.0
161	0.0
162	0.0
163	0.0
164	4.7
165	10.2
166	0.0
167	0.0
168	0.0
169	0.9
170	0.0
171	4.7
172	0.9
173	0.0
174	0.0
175	0.0
176	0.0
177	0.0
178	0.0
179	0.0
180	2.8
181	0.0
182	0.0
183	0.0
184	0.0
185	0.0
186	0.0
187	0.0
188	0.0
189	0.0
190	0.0
191	0.0
192	3.7
193	0.9
194	0.0
195	0.0
196	0.0
197	0.0
198	0.0
199	0.0
200	0.0
201	0.0
202	0.0
203	0.0
204	0.0
205	0.0
206	0.0
207	0.0
208	0.0
209	0.0
210	0.0
211	0.0
212	5.6
213	17.7
214	3.7
215	0.0
216	0.0
217	0.0
218	0.0
219	32.6
220	0.0
221	0.0
222	0.0

Precipitation, 1 Year Wet and Dry Cycles: Monywa Township (1961-2013)

Wet, 100 year ARI (mm)

Total	1554.9
Day	Year 1
223	53.3
224	0.0
225	13.6
226	0.0
227	0.0
228	0.0
229	0.0
230	0.0
231	0.0
232	1.1
233	0.0
234	15.9
235	0.0
236	10.2
237	6.8
238	0.0
239	2.3
240	0.0
241	79.4
242	0.0
243	0.0
244	0.0
245	0.0
246	0.0
247	0.0
248	0.0
249	0.0
250	0.0
251	0.0
252	0.0
253	2.3
254	0.0
255	0.0
256	0.0
257	0.0
258	0.0
259	0.0
260	77.2
261	0.0
262	0.0
263	37.5
264	12.5
265	37.5
266	32.9
267	0.0
268	3.4
269	0.0
270	0.0
271	0.0
272	3.4
273	10.2
274	18.2
275	12.5
276	0.0
277	0.0
278	0.0
279	0.0
280	0.0
281	0.0
282	0.0
283	0.0
284	31.8
285	0.0
286	0.0
287	14.8
288	12.5
289	13.6
290	99.9
291	0.0
292	13.6
293	0.0
294	1.1
295	5.7
296	0.0

Wet, 500 year ARI (mm)

Total	1901.8
Day	Year 1
223	65.2
224	0.0
225	16.7
226	0.0
227	0.0
228	0.0
229	0.0
230	0.0
231	0.0
232	1.4
233	0.0
234	19.4
235	0.0
236	12.5
237	8.3
238	0.0
239	2.8
240	0.0
241	97.2
242	0.0
243	0.0
244	0.0
245	0.0
246	0.0
247	0.0
248	0.0
249	0.0
250	0.0
251	0.0
252	0.0
253	2.8
254	0.0
255	0.0
256	0.0
257	0.0
258	0.0
259	0.0
260	94.4
261	0.0
262	0.0
263	45.8
264	15.3
265	45.8
266	40.3
267	0.0
268	4.2
269	0.0
270	0.0
271	0.0
272	4.2
273	12.5
274	22.2
275	15.3
276	0.0
277	0.0
278	0.0
279	0.0
280	0.0
281	0.0
282	0.0
283	0.0
284	38.9
285	0.0
286	0.0
287	18.0
288	15.3
289	16.7
290	122.2
291	0.0
292	16.7
293	0.0
294	1.4
295	6.9
296	0.0

Dry, 100 year ARI (mm)

Total	424.0
Day	Year 1
223	13.4
224	7.2
225	35.1
226	1.0
227	0.0
228	0.0
229	2.1
230	2.1
231	0.0
232	0.0
233	0.0
234	0.0
235	0.0
236	0.0
237	0.0
238	0.0
239	0.0
240	0.0
241	0.0
242	0.0
243	0.0
244	10.3
245	0.0
246	0.0
247	7.2
248	2.1
249	29.9
250	0.0
251	0.0
252	4.1
253	8.3
254	0.0
255	0.0
256	0.0
257	0.0
258	0.0
259	0.0
260	0.0
261	0.0
262	0.0
263	0.0
264	0.0
265	0.0
266	0.0
267	0.0
268	0.0
269	0.0
270	0.0
271	0.0
272	0.0
273	0.0
274	0.0
275	2.1
276	19.6
277	10.3
278	0.0
279	0.0
280	0.0
281	1.0
282	0.0
283	0.0
284	0.0
285	0.0
286	0.0
287	1.0
288	0.0
289	0.0
290	0.0
291	0.0
292	0.0
293	0.0
294	0.0
295	0.0
296	0.0

Dry, 500 year ARI (mm)

Total	382.6
Day	Year 1
223	12.1
224	6.5
225	31.6
226	0.9
227	0.0
228	0.0
229	1.9
230	1.9
231	0.0
232	0.0
233	0.0
234	0.0
235	0.0
236	0.0
237	0.0
238	0.0
239	0.0
240	0.0
241	0.0
242	0.0
243	0.0
244	9.3
245	0.0
246	0.0
247	6.5
248	1.9
249	27.0
250	0.0
251	0.0
252	3.7
253	7.4
254	0.0
255	0.0
256	0.0
257	0.0
258	0.0
259	0.0
260	0.0
261	0.0
262	0.0
263	0.0
264	0.0
265	0.0
266	0.0
267	0.0
268	0.0
269	0.0
270	0.0
271	0.0
272	0.0
273	0.0
274	0.0
275	1.9
276	17.7
277	9.3
278	0.0
279	0.0
280	0.0
281	0.9
282	0.0
283	0.0
284	0.0
285	0.0
286	0.0
287	0.9
288	0.0
289	0.0
290	0.0
291	0.0
292	0.0
293	0.0
294	0.0
295	0.0
296	0.0

Precipitation, 1 Year Wet and Dry Cycles: Monywa Township (1961-2013)

Wet, 100 year ARI (mm)

Total	1554.9
Day	Year 1
297	7.9
298	2.3
299	1.1
300	1.1
301	2.3
302	2.3
303	7.9
304	0.0
305	0.0
306	2.3
307	1.1
308	11.3
309	0.0
310	31.8
311	43.1
312	1.1
313	0.0
314	0.0
315	0.0
316	0.0
317	0.0
318	0.0
319	4.5
320	27.2
321	54.5
322	29.5
323	1.1
324	3.4
325	0.0
326	0.0
327	0.0
328	0.0
329	0.0
330	0.0
331	0.0
332	0.0
333	0.0
334	0.0
335	0.0
336	0.0
337	0.0
338	0.0
339	0.0
340	0.0
341	0.0
342	0.0
343	0.0
344	1.1
345	0.0
346	0.0
347	0.0
348	0.0
349	0.0
350	0.0
351	0.0
352	0.0
353	0.0
354	0.0
355	0.0
356	0.0
357	0.0
358	0.0
359	0.0
360	0.0
361	0.0
362	0.0
363	0.0
364	0.0
365	0.0

Wet, 500 year ARI (mm)

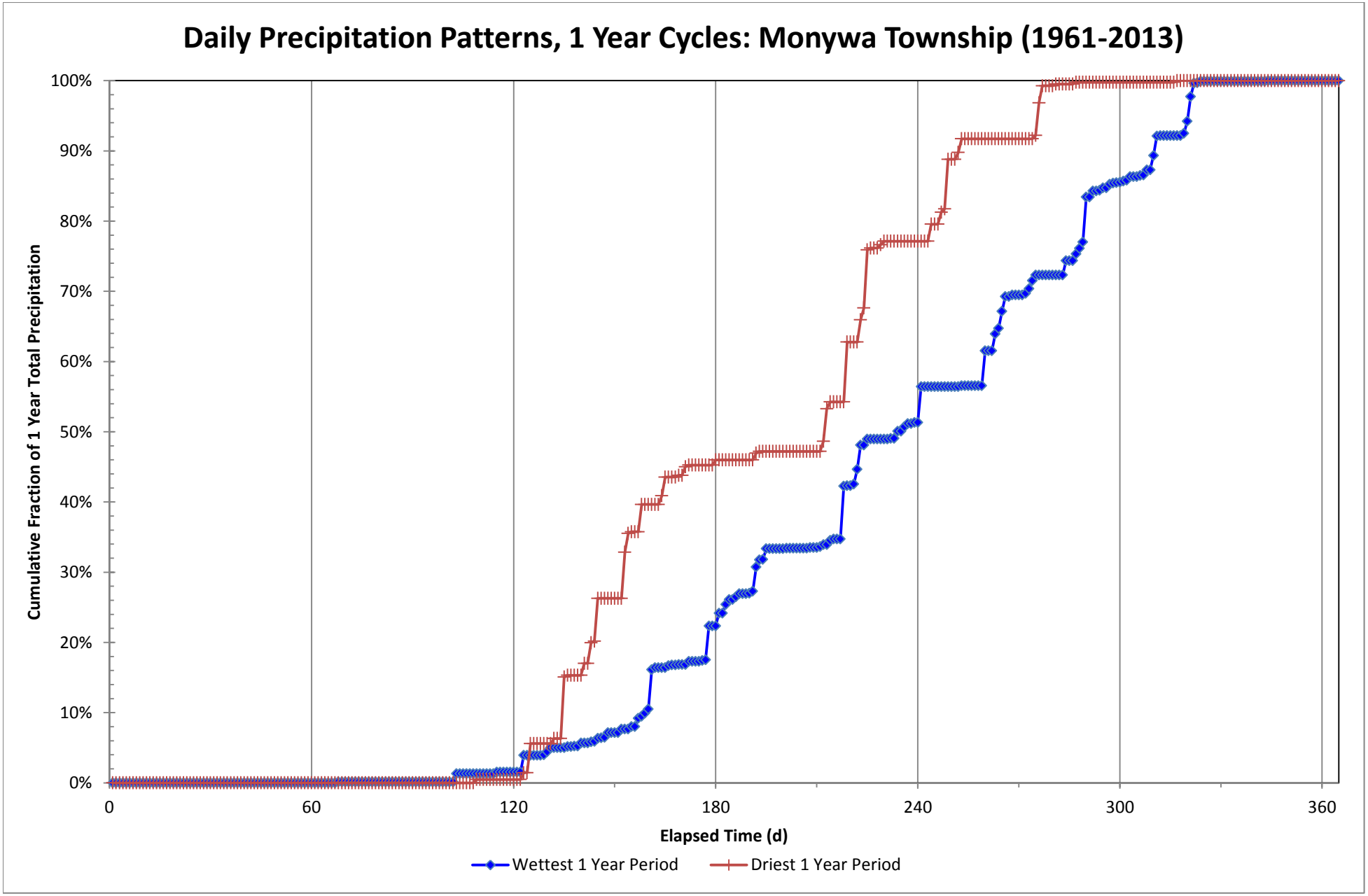
Total	1901.8
Day	Year 1
297	9.7
298	2.8
299	1.4
300	1.4
301	2.8
302	2.8
303	9.7
304	0.0
305	0.0
306	2.8
307	1.4
308	13.9
309	0.0
310	38.9
311	52.8
312	1.4
313	0.0
314	0.0
315	0.0
316	0.0
317	0.0
318	0.0
319	5.6
320	33.3
321	66.6
322	36.1
323	1.4
324	4.2
325	0.0
326	0.0
327	0.0
328	0.0
329	0.0
330	0.0
331	0.0
332	0.0
333	0.0
334	0.0
335	0.0
336	0.0
337	0.0
338	0.0
339	0.0
340	0.0
341	0.0
342	0.0
343	0.0
344	1.4
345	0.0
346	0.0
347	0.0
348	0.0
349	0.0
350	0.0
351	0.0
352	0.0
353	0.0
354	0.0
355	0.0
356	0.0
357	0.0
358	0.0
359	0.0
360	0.0
361	0.0
362	0.0
363	0.0
364	0.0
365	0.0

Dry, 100 year ARI (mm)

Total	424.0
Day	Year 1
297	0.0
298	0.0
299	0.0
300	0.0
301	0.0
302	0.0
303	0.0
304	0.0
305	0.0
306	0.0
307	0.0
308	0.0
309	0.0
310	0.0
311	0.0
312	0.0
313	0.0
314	0.0
315	0.0
316	0.0
317	1.0
318	0.0
319	0.0
320	0.0
321	0.0
322	0.0
323	0.0
324	0.0
325	0.0
326	0.0
327	0.0
328	0.0
329	0.0
330	0.0
331	0.0
332	0.0
333	0.0
334	0.0
335	0.0
336	0.0
337	0.0
338	0.0
339	0.0
340	0.0
341	0.0
342	0.0
343	0.0
344	0.0
345	0.0
346	0.0
347	0.0
348	0.0
349	0.0
350	0.0
351	0.0
352	0.0
353	0.0
354	0.0
355	0.0
356	0.0
357	0.0
358	0.0
359	0.0
360	0.0
361	0.0
362	0.0
363	0.0
364	0.0
365	0.0

Dry, 500 year ARI (mm)

Total	382.6
Day	Year 1
297	0.0
298	0.0
299	0.0
300	0.0
301	0.0
302	0.0
303	0.0
304	0.0
305	0.0
306	0.0
307	0.0
308	0.0
309	0.0
310	0.0
311	0.0
312	0.0
313	0.0
314	0.0
315	0.0
316	0.0
317	0.9
318	0.0
319	0.0
320	0.0
321	0.0
322	0.0
323	0.0
324	0.0
325	0.0
326	0.0
327	0.0
328	0.0
329	0.0
330	0.0
331	0.0
332	0.0
333	0.0
334	0.0
335	0.0
336	0.0
337	0.0
338	0.0
339	0.0
340	0.0
341	0.0
342	0.0
343	0.0
344	0.0
345	0.0
346	0.0
347	0.0
348	0.0
349	0.0
350	0.0
351	0.0
352	0.0
353	0.0
354	0.0
355	0.0
356	0.0
357	0.0
358	0.0
359	0.0
360	0.0
361	0.0
362	0.0
363	0.0
364	0.0
365	0.0


Daily Precipitation Patterns, 1 Year Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 1 Year Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
60
120
180
240
300
360
Elapsed Time (d)
Wettest 1 Year Period
Driest 1 Year Period

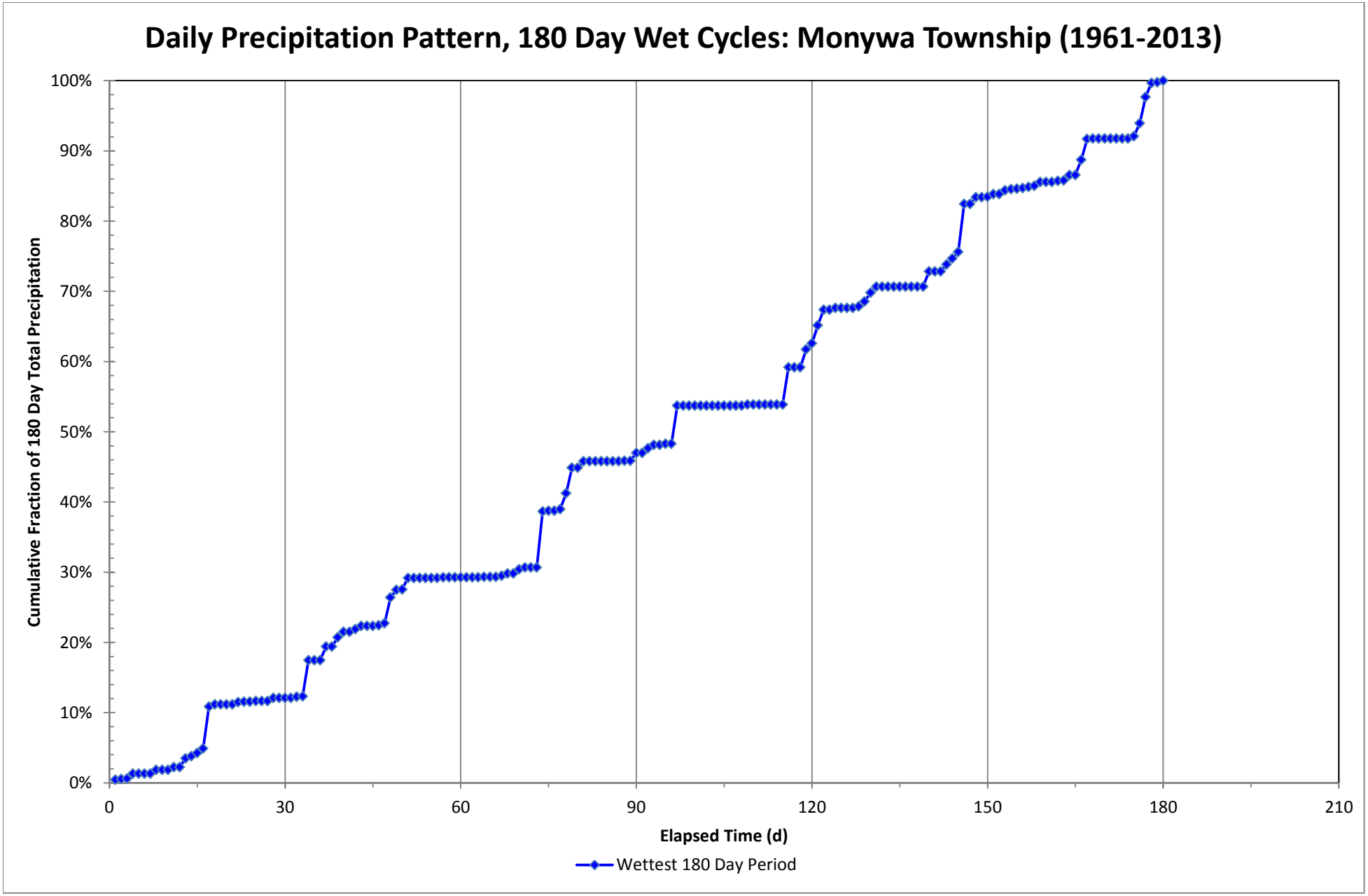
Precipitation, 180 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	174.1	254.4	300.1
Day	Day +0	Day +60	Day +120
1	6.7	0.0	36.8
2	1.1	0.0	32.4
3	1.1	0.0	0.0
4	10.0	1.1	3.3
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	2.2	0.0
8	7.8	4.5	3.3
9	0.0	0.0	10.0
10	0.0	8.9	17.9
11	5.6	3.3	12.3
12	0.0	0.0	0.0
13	17.9	0.0	0.0
14	4.5	114.9	0.0
15	6.7	1.1	0.0
16	8.9	0.0	0.0
17	85.9	3.3	0.0
18	4.5	32.4	0.0
19	0.0	52.4	0.0
20	0.0	0.0	31.2
21	0.0	13.4	0.0
22	4.5	0.0	0.0
23	1.1	0.0	14.5
24	0.0	0.0	12.3
25	1.1	0.0	13.4
26	0.0	0.0	98.2
27	0.0	0.0	0.0
28	6.7	1.1	13.4
29	0.0	0.0	0.0
30	0.0	15.6	1.1
31	0.0	0.0	5.6
32	2.2	10.0	0.0
33	1.1	6.7	7.8
34	73.6	0.0	2.2
35	0.0	2.2	1.1
36	0.0	0.0	1.1
37	27.9	78.1	2.2
38	0.0	0.0	2.2
39	19.0	0.0	7.8
40	11.2	0.0	0.0
41	0.0	0.0	0.0
42	5.6	0.0	2.2
43	6.7	0.0	1.1
44	0.0	0.0	11.2
45	0.0	0.0	0.0
46	1.1	0.0	31.2
47	4.5	0.0	42.4
48	52.4	0.0	1.1
49	15.6	2.2	0.0
50	1.1	0.0	0.0
51	23.4	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	4.5
56	0.0	75.9	26.8
57	1.1	0.0	53.6
58	0.0	0.0	29.0
59	0.0	36.8	1.1
60	0.0	12.3	3.3

500 year ARI (mm)

Total	214.0	312.7	368.9
Day	Day +0	Day +60	Day +120
1	8.2	0.0	45.3
2	1.4	0.0	39.8
3	1.4	0.0	0.0
4	12.3	1.4	4.1
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	2.7	0.0
8	9.6	5.5	4.1
9	0.0	0.0	12.3
10	0.0	11.0	21.9
11	6.9	4.1	15.1
12	0.0	0.0	0.0
13	21.9	0.0	0.0
14	5.5	141.3	0.0
15	8.2	1.4	0.0
16	11.0	0.0	0.0
17	105.6	4.1	0.0
18	5.5	39.8	0.0
19	0.0	64.5	0.0
20	0.0	0.0	38.4
21	0.0	16.5	0.0
22	5.5	0.0	0.0
23	1.4	0.0	17.8
24	0.0	0.0	15.1
25	1.4	0.0	16.5
26	0.0	0.0	120.7
27	0.0	0.0	0.0
28	8.2	1.4	16.5
29	0.0	0.0	0.0
30	0.0	19.2	1.4
31	0.0	0.0	6.9
32	2.7	12.3	0.0
33	1.4	8.2	9.6
34	90.5	0.0	2.7
35	0.0	2.7	1.4
36	0.0	0.0	1.4
37	34.3	96.0	2.7
38	0.0	0.0	2.7
39	23.3	0.0	9.6
40	13.7	0.0	0.0
41	0.0	0.0	0.0
42	6.9	0.0	2.7
43	8.2	0.0	1.4
44	0.0	0.0	13.7
45	0.0	0.0	0.0
46	1.4	0.0	38.4
47	5.5	0.0	52.1
48	64.5	0.0	1.4
49	19.2	2.7	0.0
50	1.4	0.0	0.0
51	28.8	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	5.5
56	0.0	93.3	32.9
57	1.4	0.0	65.8
58	0.0	0.0	35.7
59	0.0	45.3	1.4
60	0.0	15.1	4.1


Daily Precipitation Pattern, 180 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 180 Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60
90
120
150
180
210
Elapsed Time (d)
Wettest 180 Day Period

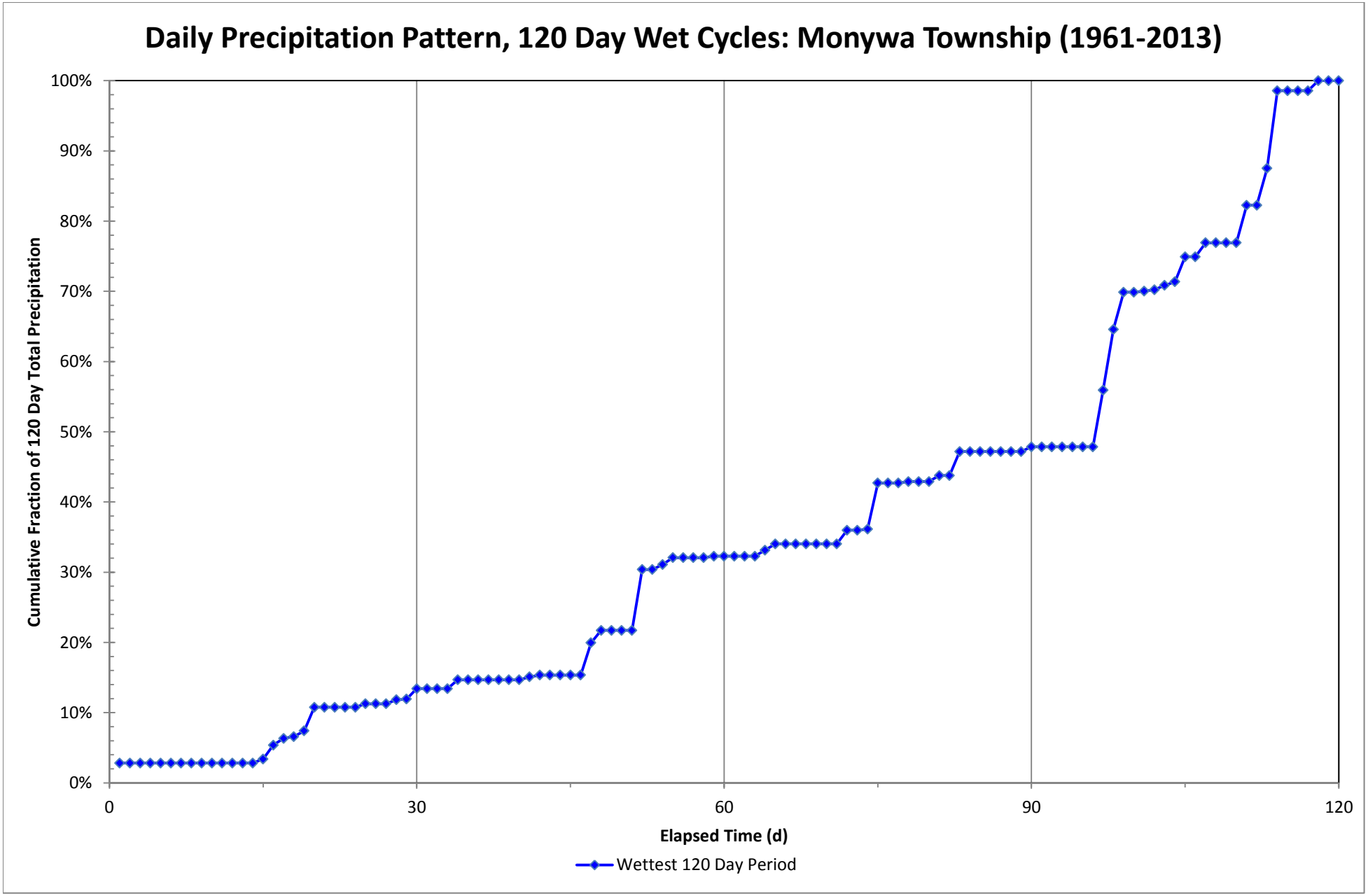
Precipitation, 120 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	143.7	166.9
Day	Day +0	Day +60
1	30.3	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	9.3
5	0.0	9.6
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	20.8
13	0.0	0.0
14	0.0	1.6
15	6.1	70.4
16	21.3	0.0
17	10.2	0.0
18	2.7	2.2
19	8.7	0.0
20	36.0	0.0
21	0.0	9.3
22	0.0	0.0
23	0.0	36.6
24	0.0	0.0
25	5.5	0.0
26	0.0	0.0
27	0.0	0.0
28	6.0	0.0
29	1.1	0.0
30	15.8	7.1
31	0.0	0.0
32	0.0	0.0
33	0.0	0.0
34	13.7	0.0
35	0.0	0.0
36	0.0	0.0
37	0.0	86.3
38	0.0	92.8
39	0.0	56.8
40	0.0	0.0
41	4.4	1.6
42	2.7	2.2
43	0.0	6.6
44	0.0	5.5
45	0.0	38.2
46	0.0	0.0
47	49.1	21.3
48	19.1	0.0
49	0.0	0.0
50	0.0	0.0
51	0.0	57.3
52	92.8	0.0
53	0.0	56.2
54	7.6	118.5
55	10.4	0.0
56	0.0	0.0
57	0.0	0.0
58	0.0	15.3
59	2.2	0.0
60	0.0	0.0

500 year ARI (mm)

Total	170.7	198.2
Day	Day +0	Day +60
1	35.9	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	11.0
5	0.0	11.4
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0
11	0.0	0.0
12	0.0	24.6
13	0.0	0.0
14	0.0	1.9
15	7.3	83.6
16	25.3	0.0
17	12.1	0.0
18	3.2	2.6
19	10.4	0.0
20	42.8	0.0
21	0.0	11.0
22	0.0	0.0
23	0.0	43.4
24	0.0	0.0
25	6.5	0.0
26	0.0	0.0
27	0.0	0.0
28	7.1	0.0
29	1.3	0.0
30	18.8	8.4
31	0.0	0.0
32	0.0	0.0
33	0.0	0.0
34	16.2	0.0
35	0.0	0.0
36	0.0	0.0
37	0.0	102.4
38	0.0	110.2
39	0.0	67.4
40	0.0	0.0
41	5.2	1.9
42	3.2	2.6
43	0.0	7.8
44	0.0	6.5
45	0.0	45.4
46	0.0	0.0
47	58.4	25.3
48	22.7	0.0
49	0.0	0.0
50	0.0	0.0
51	0.0	68.1
52	110.2	0.0
53	0.0	66.8
54	9.1	140.7
55	12.3	0.0
56	0.0	0.0
57	0.0	0.0
58	0.0	18.2
59	2.6	0.0
60	0.0	0.0


Daily Precipitation Pattern, 120 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 120 Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60
90
120
Elapsed Time (d)
Wettest 120 Day Period

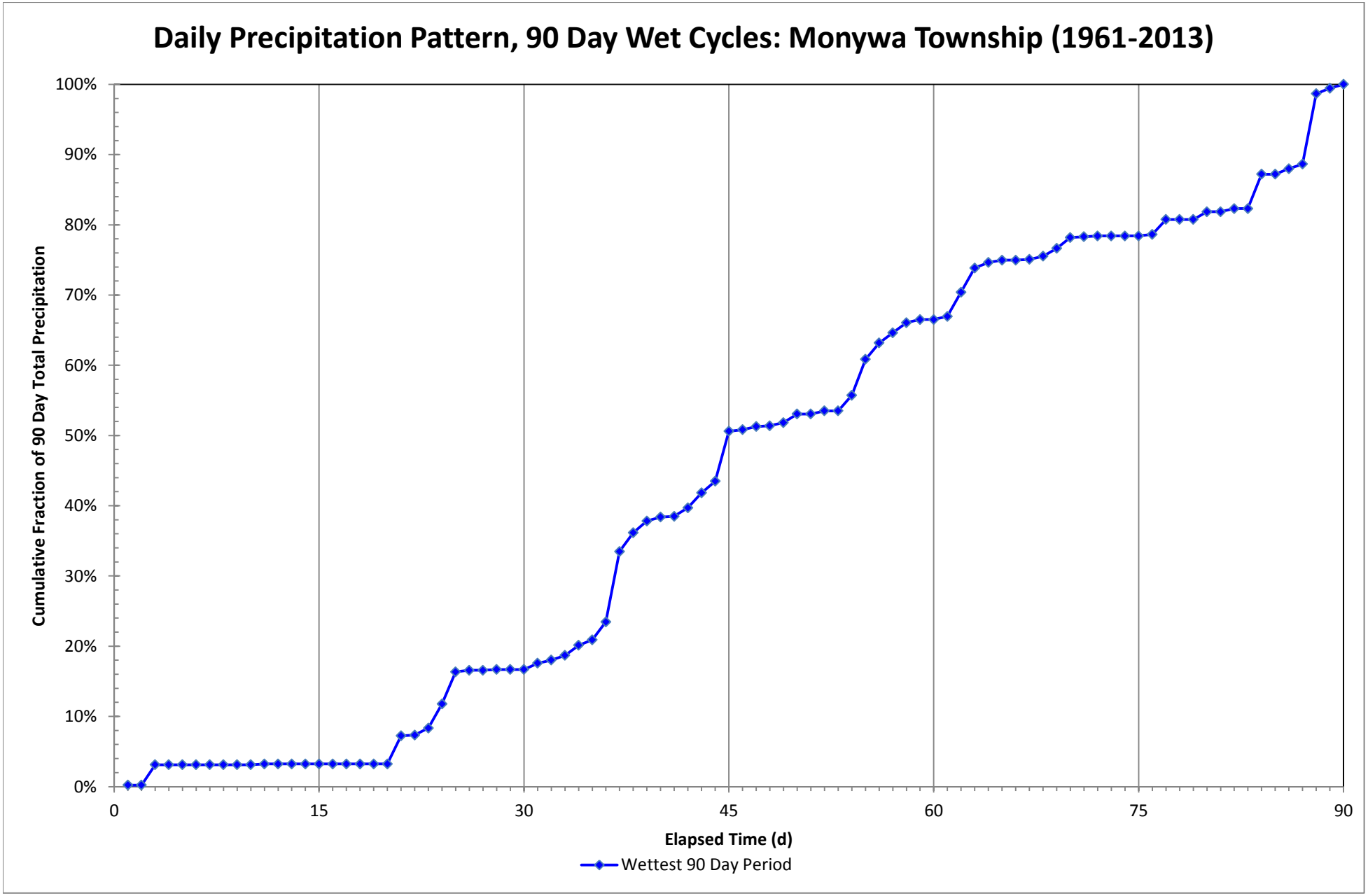
Precipitation, 90 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	153.6	458.8	308.3
Day	Day +0	Day +30	Day +60
1	2.0	8.2	4.1
2	0.0	4.1	31.7
3	26.6	6.1	31.7
4	0.0	13.3	7.2
5	0.0	7.2	3.1
6	0.0	23.6	0.0
7	0.0	92.2	1.0
8	0.0	24.6	4.1
9	0.0	15.4	10.2
10	0.0	5.1	14.3
11	1.0	1.0	1.0
12	0.0	11.3	1.0
13	0.0	19.5	0.0
14	0.0	15.4	0.0
15	0.0	65.5	0.0
16	0.0	2.0	2.0
17	0.0	4.1	19.5
18	0.0	1.0	0.0
19	0.0	4.1	0.0
20	0.0	11.3	10.2
21	36.9	0.0	0.0
22	1.0	4.1	4.1
23	9.2	0.0	0.0
24	31.7	20.5	45.1
25	42.0	47.1	0.0
26	2.0	21.5	7.2
27	0.0	13.3	6.1
28	1.0	13.3	92.2
29	0.0	4.1	7.2
30	0.0	0.0	5.1

500 year ARI (mm)

Total	183.8	548.9	368.8
Day	Day +0	Day +30	Day +60
1	2.5	9.8	4.9
2	0.0	4.9	38.0
3	31.9	7.4	38.0
4	0.0	15.9	8.6
5	0.0	8.6	3.7
6	0.0	28.2	0.0
7	0.0	110.3	1.2
8	0.0	29.4	4.9
9	0.0	18.4	12.3
10	0.0	6.1	17.2
11	1.2	1.2	1.2
12	0.0	13.5	1.2
13	0.0	23.3	0.0
14	0.0	18.4	0.0
15	0.0	78.4	0.0
16	0.0	2.5	2.5
17	0.0	4.9	23.3
18	0.0	1.2	0.0
19	0.0	4.9	0.0
20	0.0	13.5	12.3
21	44.1	0.0	0.0
22	1.2	4.9	4.9
23	11.0	0.0	0.0
24	38.0	24.5	53.9
25	50.2	56.4	0.0
26	2.5	25.7	8.6
27	0.0	15.9	7.4
28	1.2	15.9	110.3
29	0.0	4.9	8.6
30	0.0	0.0	6.1


Daily Precipitation Pattern, 90 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 90 Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
15
30
45
60
75
90
Elapsed Time (d)
Wettest 90 Day Period

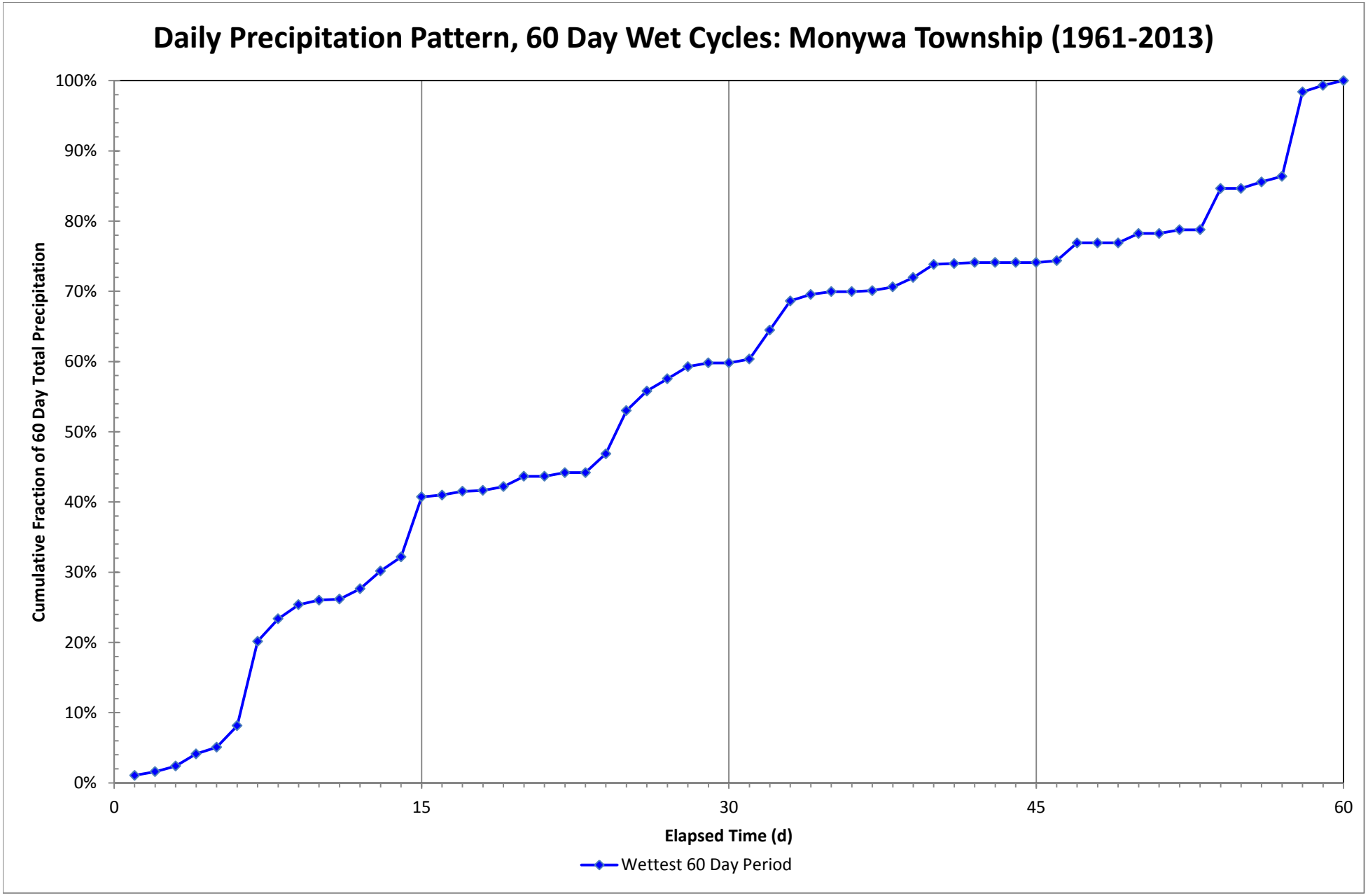
Precipitation, 60 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	442.5	297.3
Day	Day +0	Day +30
1	7.9	4.0
2	4.0	30.6
3	5.9	30.6
4	12.8	6.9
5	6.9	3.0
6	22.7	0.0
7	88.9	1.0
8	23.7	4.0
9	14.8	9.9
10	4.9	13.8
11	1.0	1.0
12	10.9	1.0
13	18.8	0.0
14	14.8	0.0
15	63.2	0.0
16	2.0	2.0
17	4.0	18.8
18	1.0	0.0
19	4.0	0.0
20	10.9	9.9
21	0.0	0.0
22	4.0	4.0
23	0.0	0.0
24	19.8	43.5
25	45.4	0.0
26	20.7	6.9
27	12.8	5.9
28	12.8	88.9
29	4.0	6.9
30	0.0	4.9

500 year ARI (mm)

Total	517.4	347.7
Day	Day +0	Day +30
1	9.2	4.6
2	4.6	35.8
3	6.9	35.8
4	15.0	8.1
5	8.1	3.5
6	26.6	0.0
7	104.0	1.2
8	27.7	4.6
9	17.3	11.6
10	5.8	16.2
11	1.2	1.2
12	12.7	1.2
13	21.9	0.0
14	17.3	0.0
15	73.9	0.0
16	2.3	2.3
17	4.6	21.9
18	1.2	0.0
19	4.6	0.0
20	12.7	11.6
21	0.0	0.0
22	4.6	4.6
23	0.0	0.0
24	23.1	50.8
25	53.1	0.0
26	24.3	8.1
27	15.0	6.9
28	15.0	104.0
29	4.6	8.1
30	0.0	5.8


Daily Precipitation Pattern, 60 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 60 Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
15
30
45
60
Elapsed Time (d)
Wettest 60 Day Period

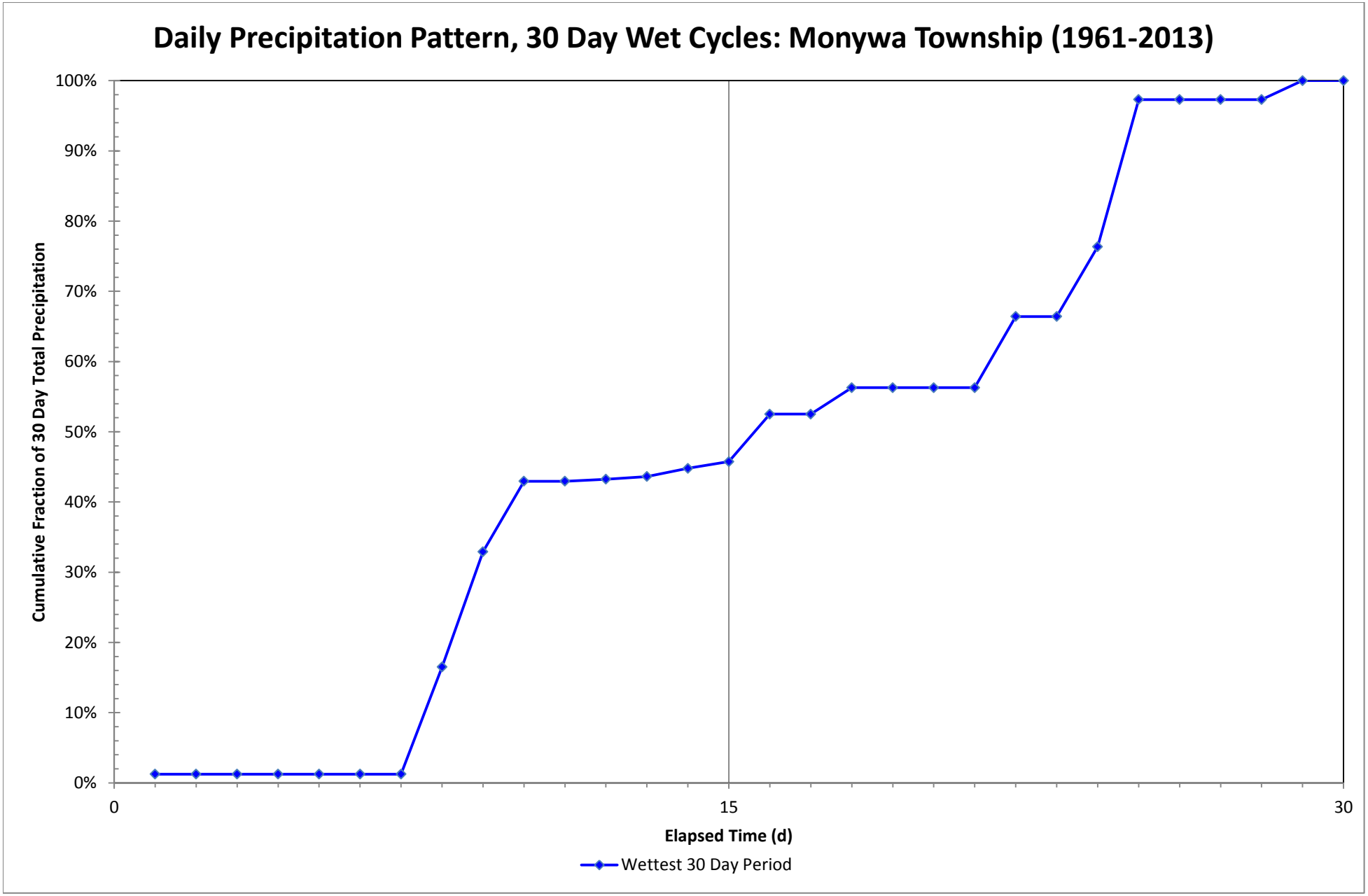
Precipitation, 30 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	519.6
Day	Day +0
1	6.5
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	79.2
9	85.3
10	52.2
11	0.0
12	1.5
13	2.0
14	6.0
15	5.0
16	35.1
17	0.0
18	19.6
19	0.0
20	0.0
21	0.0
22	52.7
23	0.0
24	51.7
25	108.8
26	0.0
27	0.0
28	0.0
29	14.0
30	0.0

500 year ARI (mm)

Total	596.4
Day	Day +0
1	7.5
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	91.0
9	97.9
10	59.9
11	0.0
12	1.7
13	2.3
14	6.9
15	5.8
16	40.3
17	0.0
18	22.5
19	0.0
20	0.0
21	0.0
22	60.4
23	0.0
24	59.3
25	124.9
26	0.0
27	0.0
28	0.0
29	16.1
30	0.0


Daily Precipitation Pattern, 30 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of 30 Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
15
30
Elapsed Time (d)
Wettest 30 Day Period

Precipitation, < 30 Day Wet Cycles: Monywa Township (1961-2013)

100 year ARI (mm)

Total	439.8
Day	Day +0
1	17.2
2	5.8
3	14.8
4	110.9
5	126.8
6	80.8
7	27.6
8	0.0
9	0.0
10	17.4
11	19.8
12	10.2
13	3.0
14	5.4

500 year ARI (mm)

Total	562.6
Day	Day +0
1	22.0
2	7.4
3	18.9
4	141.9
5	162.2
6	103.3
7	35.4
8	0.0
9	0.0
10	22.3
11	25.4
12	13.1
13	3.8
14	6.9

100 year ARI (mm)

Total	342.6
Day	Day +0
1	15.3
2	5.1
3	13.2
4	99.0
5	113.2
6	72.1
7	24.7

500 year ARI (mm)

Total	447.3
Day	Day +0
1	20.0
2	6.7
3	17.2
4	129.3
5	147.8
6	94.1
7	32.2

100 year ARI (mm)

Total	307.9
Day	Day +0
1	78.5
2	72.3
3	141.4
4	15.7

500 year ARI (mm)

Total	410.1
Day	Day +0
1	104.6
2	96.3
3	188.3
4	20.9

100 year ARI (mm)

Total	297.7
Day	Day +0
1	80.0
2	73.6
3	144.1

500 year ARI (mm)

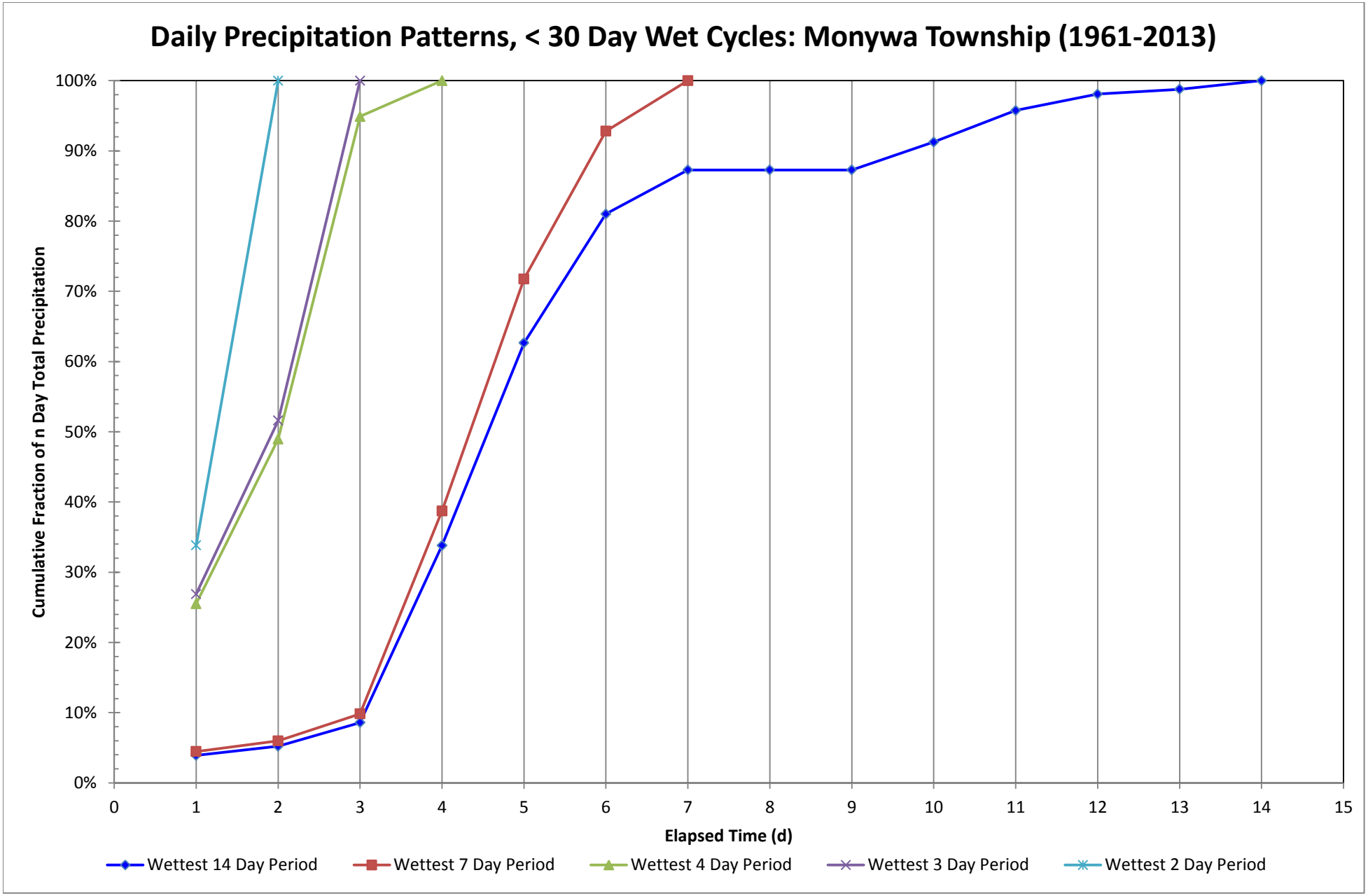
Total	400.7
Day	Day +0
1	107.7
2	99.1
3	193.9

100 year ARI (mm)

Total	214.1
Day	Day +0
1	72.4
2	141.7

500 year ARI (mm)

Total	248.7
Day	Day +0
1	84.1
2	164.6


Daily Precipitation Patterns, < 30 Day Wet Cycles: Monywa Township (1961-2013)
Cumulative Fraction of n Day Total Precipitation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Elapsed Time (d)
Wettest 14 Day Period
Wettest 7 Day Period
Wettest 4 Day Period
Wettest 3 Day Period
Wettest 2 Day Period

ATTACHMENT 3.1

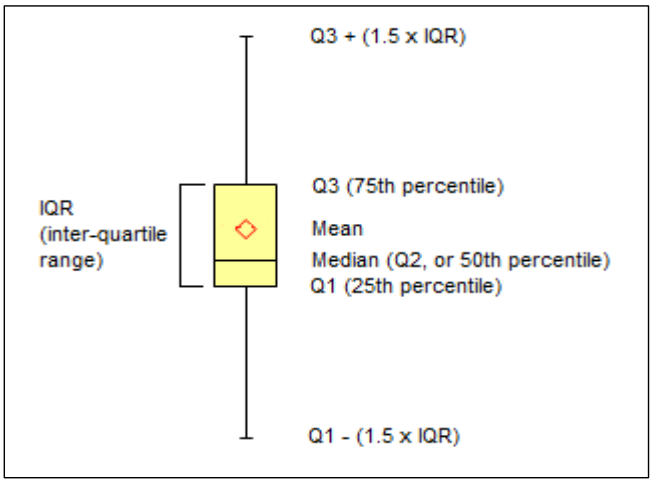
Annual Pan Evaporation Analysis

Pan Evaporation Data, Annual Sampling Frequency: Yangtse Climate Station (2000-2013) (Analysis Format)

Year	Evap. (mm)
2000	2,078.3
2001	1,921.7
2002	1,925.4
2003	1,975.8
2004	2,108.6
2005	2,051.4
2006	2,055.8
2007	Exclude
2008	Exclude
2009	Exclude
2010	Exclude
2011	Exclude
2012	Exclude
2013	Exclude

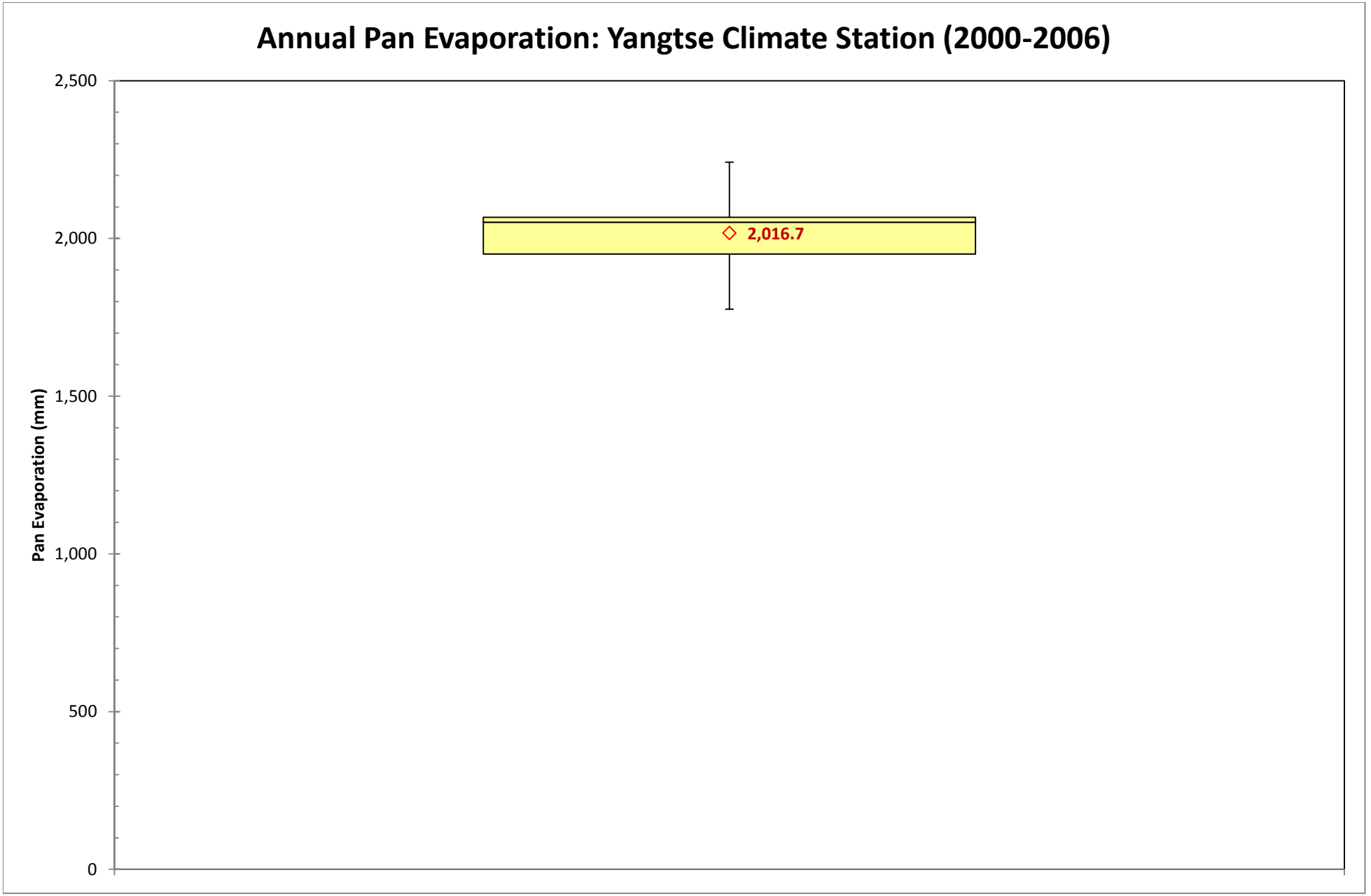
Stat	Evap. (mm)
Mean	2,016.7
SD	75.3
Median	2,051.4
Q1	1,950.6
Q3	2,067.0
Minimum	1,921.7
Maximum	2,108.6
Count	7
Ext Max	2,241.7
Ext Min	1,775.9
25th Pct	1,950.6
50th Pct	100.8
75th Pct	15.7
1.5 * IQR	174.7

Pan evaporation values from 2007 and onwards were excluded due to an unexplained discrepancy in annual evaporation. For more discussion on this issue, refer to the climate trend analysis worksheet.



Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered outliers


Annual Pan Evaporation: Yangtse Climate Station (2000-2006)
Pan Evaporation (mm)
2,500
2,000
1,500
1,000
500
0
2,016.7

ATTACHMENT 3.2

Monthly Pan Evaporation Analysis

Pan Evaporation Data, Monthly Sampling Frequency: Yangtse Climate Station (2000-2013) (Analysis Format)

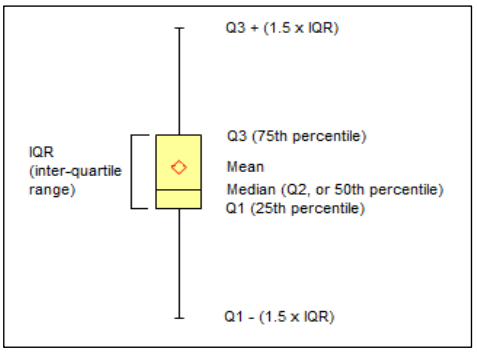
Pan Evaporation Data (mm)												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2000	133.7	154.2	218.7	240.0	117.6	211.7	183.6	215.9	168.5	165.9	137.2	131.2
2001	120.9	151.1	209.8	191.2	193.7	178.5	164.1	248.2	149.2	102.2	102.1	110.7
2002	120.9	165.6	221.3	230.2	199.2	164.8	152.5	169.9	128.3	148.7	112.2	111.8
2003	120.9	140.1	187.5	247.8	205.0	184.2	187.3	175.0	149.7	119.1	129.9	129.3
2004	121.0	161.7	212.9	206.3	213.4	269.8	174.1	163.5	177.5	147.8	136.5	124.1
2005	123.0	129.6	192.2	235.5	255.5	186.9	176.7	179.7	208.2	144.8	109.4	109.9
2006	119.2	142.7	224.4	243.7	232.6	225.6	167.3	132.5	140.1	183.9	145.5	98.3
2007	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2008	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2009	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2010	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2011	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2012	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2013	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude

Pan Evaporation Data Summary Statistics (mm)												
Stat.	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mean	122.8	149.3	209.5	227.8	202.4	203.1	172.2	183.5	160.2	144.6	124.7	116.5
SD	4.9	12.7	14.4	21.1	43.1	35.9	12.0	37.6	26.9	27.3	16.6	12.0
Median	120.9	151.1	212.9	235.5	205.0	186.9	174.1	175.0	149.7	147.8	129.9	111.8
Q1	120.9	141.4	201.0	218.3	196.5	181.4	165.7	166.7	144.7	132.0	110.8	110.3
Q3	122.0	158.0	220.0	241.8	223.0	218.7	180.1	197.8	173.0	157.3	136.9	126.7
Minimum	119.2	129.6	187.5	191.2	117.6	164.8	152.5	132.5	128.3	102.2	102.1	98.3
Maximum	133.7	165.6	224.4	247.8	255.5	269.8	187.3	248.2	208.2	183.9	145.5	131.2
Count	7	7	7	7	7	7	7	7	7	7	7	7
Ext Max	123.7	182.8	248.6	277.2	262.8	274.7	201.8	244.4	215.6	195.3	175.9	151.3
Ext Min	119.2	116.5	172.4	182.9	156.6	125.4	144.1	120.1	102.1	94.0	71.7	85.7
25th Pct	120.9	141.4	201.0	218.3	196.5	181.4	165.7	166.7	144.7	132.0	110.8	110.3
50th Pct	0.0	9.7	11.9	17.2	8.5	5.5	8.4	8.3	5.1	15.9	19.1	1.5
75th Pct	1.1	6.9	7.1	6.3	18.0	31.8	6.0	22.8	23.3	9.5	7.0	14.9
1.5 * IQR	1.7	24.9	28.5	35.4	39.8	56.0	21.6	46.6	42.6	38.0	39.1	24.6

Note: N/D = No Data Available, N/A = Not Applicable.

Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered statistical outliers



Pan evaporation values from 2007 and onwards were excluded due to an unexplained discrepancy in annual evaporation.
For more discussion on this issue, refer to the climate trend analysis worksheet.

Pan Evaporation Data, Monthly Sampling Frequency: Yangtse Climate Station (2000-2013) (Analysis Format | Outliers Removed)

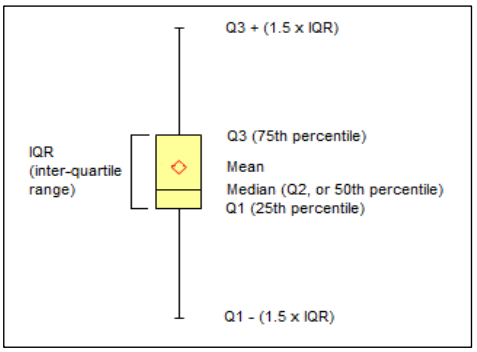
Pan Evaporation Data (mm)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000		154.2	218.7	240.0		211.7	183.6	215.9	168.5	165.9	137.2	131.2
2001	120.9	151.1	209.8	191.2	193.7	178.5	164.1		149.2	102.2	102.1	110.7
2002	120.9	165.6	221.3	230.2	199.2	164.8	152.5	169.9	128.3	148.7	112.2	111.8
2003	120.9	140.1	187.5	247.8	205.0	184.2	187.3	175.0	149.7	119.1	129.9	129.3
2004	121.0	161.7	212.9	206.3	213.4	269.8	174.1	163.5	177.5	147.8	136.5	124.1
2005	123.0	129.6	192.2	235.5	255.5	186.9	176.7	179.7	208.2	144.8	109.4	109.9
2006		142.7	224.4	243.7	232.6	225.6	167.3	132.5	140.1	183.9	145.5	98.3
2007	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2008	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2009	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2010	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2011	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2012	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
2013	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude

Pan Evaporation Data Summary Statistics (mm)												
Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	121.3	149.3	209.5	227.8	216.6	203.1	172.2	172.7	160.2	144.6	124.7	116.5
SD	0.9	12.7	14.4	21.1	23.4	35.9	12.0	26.9	26.9	27.3	16.6	12.0
Median	120.9	151.1	212.9	235.5	209.2	186.9	174.1	172.5	149.7	147.8	129.9	111.8
Q1	120.9	141.4	201.0	218.3	200.7	181.4	165.7	165.1	144.7	132.0	110.8	110.3
Q3	121.0	158.0	220.0	241.8	227.8	218.7	180.1	178.5	173.0	157.3	136.9	126.7
Minimum	120.9	129.6	187.5	191.2	193.7	164.8	152.5	132.5	128.3	102.2	102.1	98.3
Maximum	123.0	165.6	224.4	247.8	255.5	269.8	187.3	215.9	208.2	183.9	145.5	131.2
Count	5	7	7	7	6	7	7	6	7	7	7	7
Ext Max	121.2	182.8	248.6	277.2	268.6	274.7	201.8	198.6	215.6	195.3	175.9	151.3
Ext Min	120.8	116.5	172.4	182.9	159.9	125.4	144.1	145.0	102.1	94.0	71.7	85.7
25th Pct	120.9	141.4	201.0	218.3	200.7	181.4	165.7	165.1	144.7	132.0	110.8	110.3
50th Pct	0.0	9.7	11.9	17.2	8.5	5.5	8.4	7.3	5.1	15.9	19.1	1.5
75th Pct	0.1	6.9	7.1	6.3	18.6	31.8	6.0	6.1	23.3	9.5	7.0	14.9
1.5 * IQR	0.1	24.9	28.5	35.4	40.7	56.0	21.6	20.1	42.6	38.0	39.1	24.6

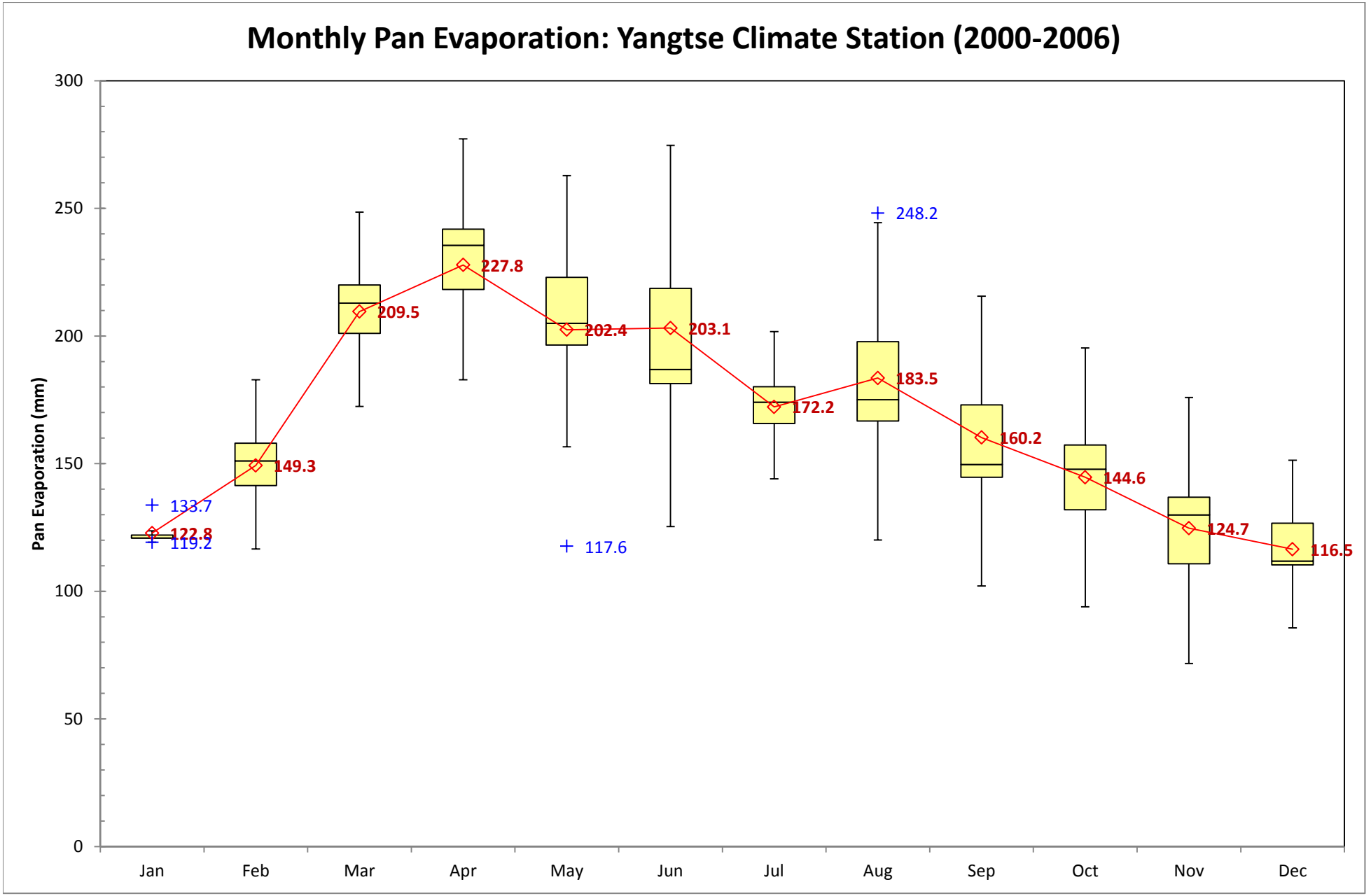
Note: N/D = No Data Available, N/A = Not Applicable.

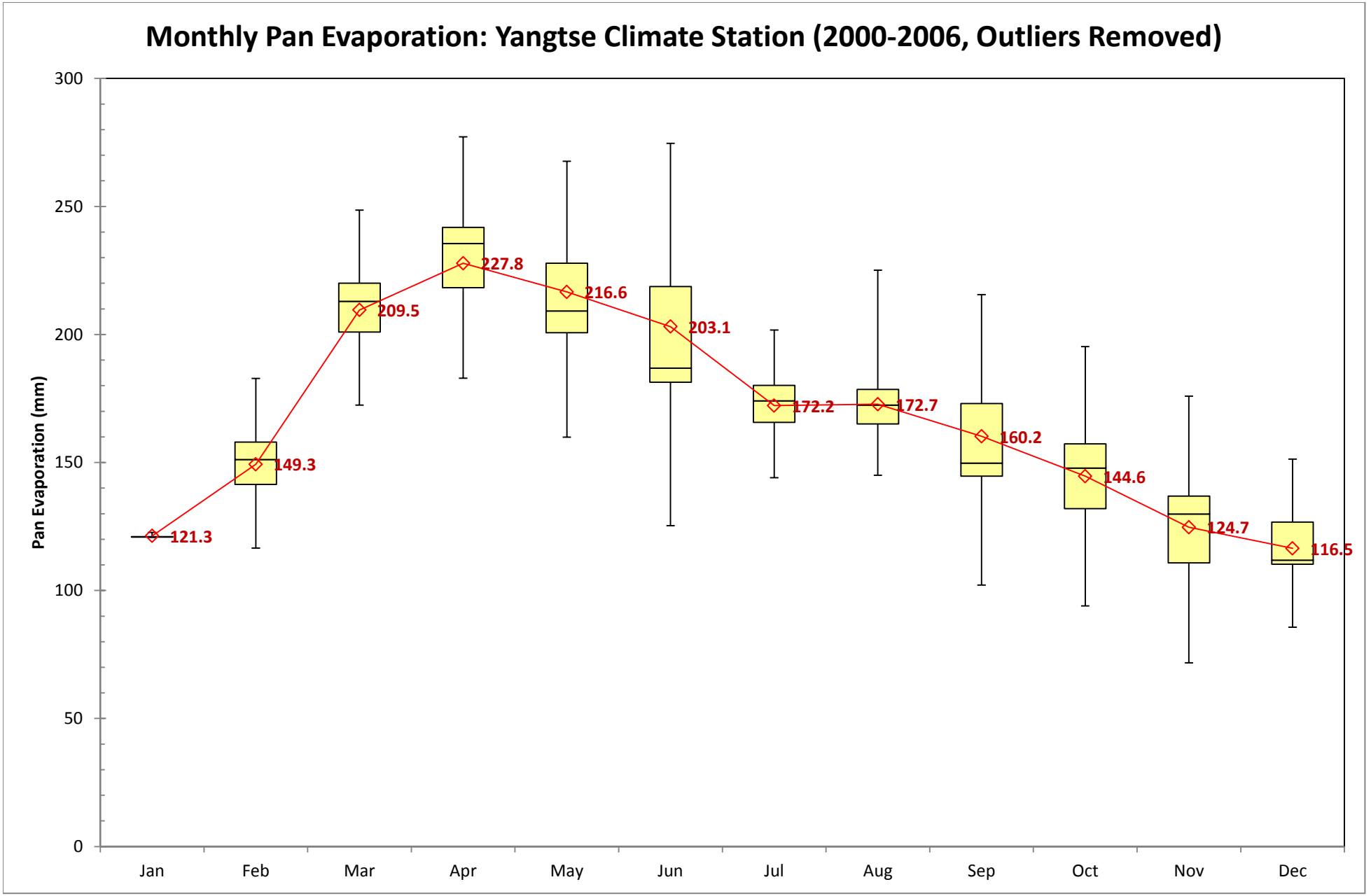
Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered statistical outliers



Pan evaporation values from 2007 and onwards were excluded due to an unexplained discrepancy in annual evaporation.
For more discussion on this issue, refer to the climate trend analysis worksheet.


Monthly Pan Evaporation: Yangtse Climate Station (2000-2006)
Pan Evaporation (mm)
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
133.7
122.8
119.2
149.3
209.5
227.8
202.4
117.6
203.1
172.2
248.2
183.5
160.2
144.6
124.7
116.5


Monthly Pan Evaporation: Yangtse Climate Station (2000-2006, Outliers Removed)
Pan Evaporation (mm)
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
121.3
149.3
209.5
227.8
216.6
203.1
172.2
172.7
160.2
144.6
124.7
116.5

ATTACHMENT 3.3

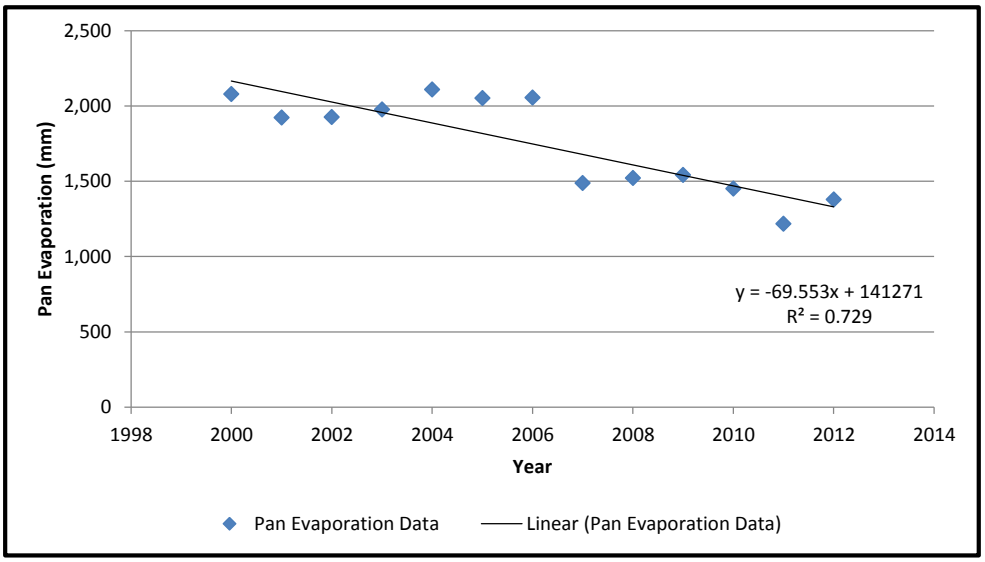
Pan Evaporation Trend Analysis

Knight Piésold CONSULTING	Subject	Myanmar Wanbao Mining	Made by	AB	Job No.	PE701-00022/04
		Copper Ltd. | Letpadaung Copper Project	Checked	TML	Date	25/06/2013
		Basic Climatology	Approved			

Climatic Trend Analysis: Monywa Township Pan Evaporation (2000-2013)

Year	Evap (mm)
2000	2,078
2001	1,922
2002	1,925
2003	1,976
2004	2,109
2005	2,051
2006	2,056
2007	1,488
2008	1,521
2009	1,542
2010	1,451
2011	1,217
2012	1,379
2013	Exclude

Period	Ave. Pan Evap. (mm)
2000-2006	2,017
2007-2012	1,433
2000-2012	1,747



Even though a statistically significant negative trend is shown on the above graph, KP questions its validity. From the dramatic shift in annual pan evaporation occurring from 2007 and onwards (~ 600 mm/yr less), the only conclusion we can draw is that either there was a problem with the instrumentation or that the data was from another site. At this time, there is no satisfactory answer to this question and as a result, pan evaporation data from 2007 and onwards is to be excluded from climate analysis.

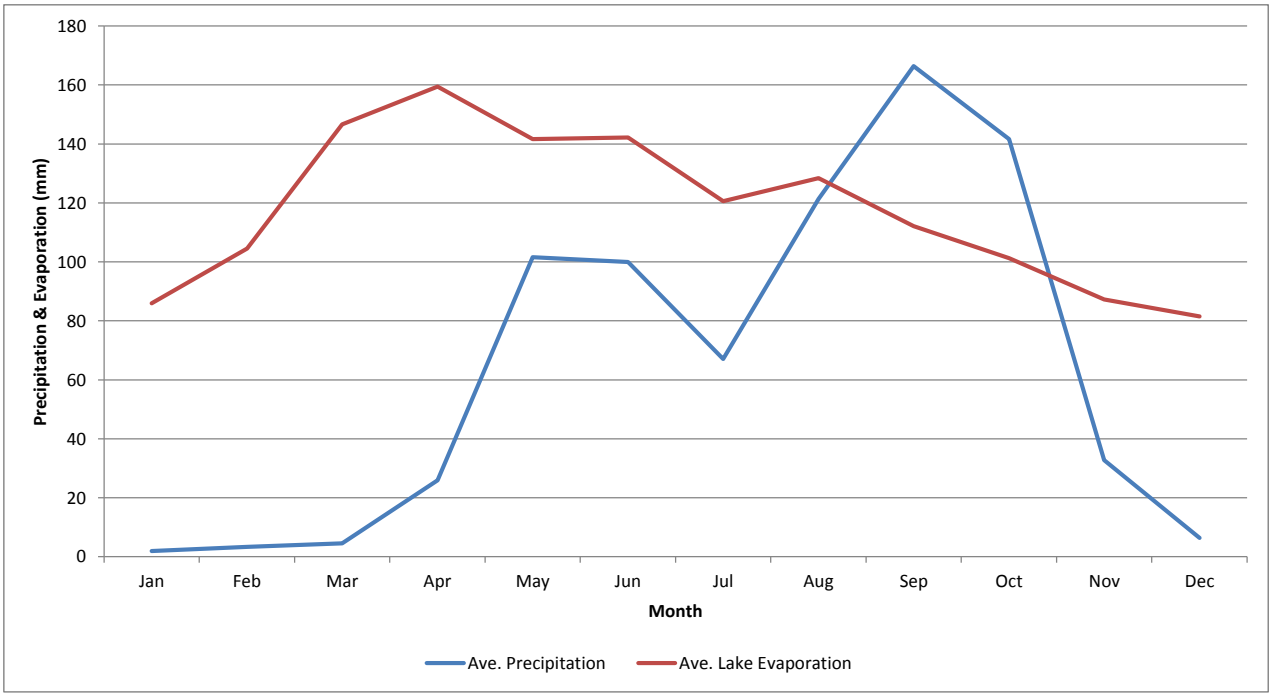
ATTACHMENT 3.4

Comparison of Monthly Average
Precipitation & Evaporation

Comparison of Average Monthly Precipitation and Lake Evaporation

Comparison Data (mm)												
Variable	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Ave. Precipitation	1.9	3.3	4.6	25.9	101.5	99.9	67.1	121.3	166.4	141.7	32.7	6.4
Ave. Pan Evaporation	122.8	149.3	209.5	227.8	202.4	203.1	172.2	183.5	160.2	144.6	124.7	116.5
Ave. Lake Evaporation	86.0	104.5	146.7	159.5	141.7	142.2	120.5	128.5	112.1	101.2	87.3	81.6
Precipitation minus Lake Evaporation	-84.1	-101.2	-142.1	-133.5	-40.1	-42.2	-53.5	-7.2	54.2	40.4	-54.6	-75.1

Pan Coefficient = 0.7 **Net Annual Precipiation minus Lake Evaporation =** -638.9 **mm**



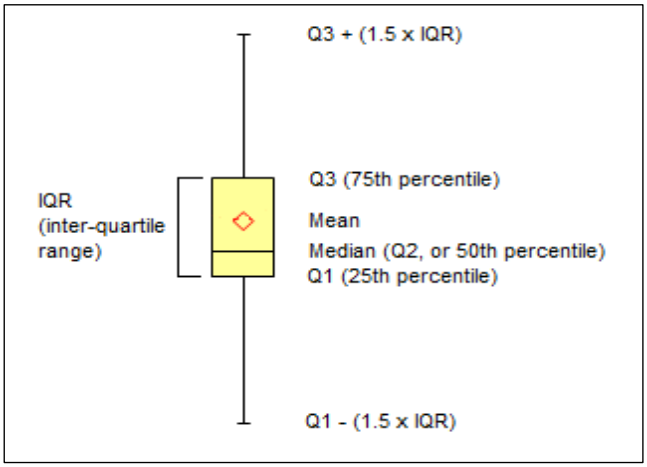
ATTACHMENT 4.1

Annual Average Temperature Analysis

Temperature Data, Annual Sampling Frequency: WMO 48037 Climate Station (1981-2012) (Analysis Format)

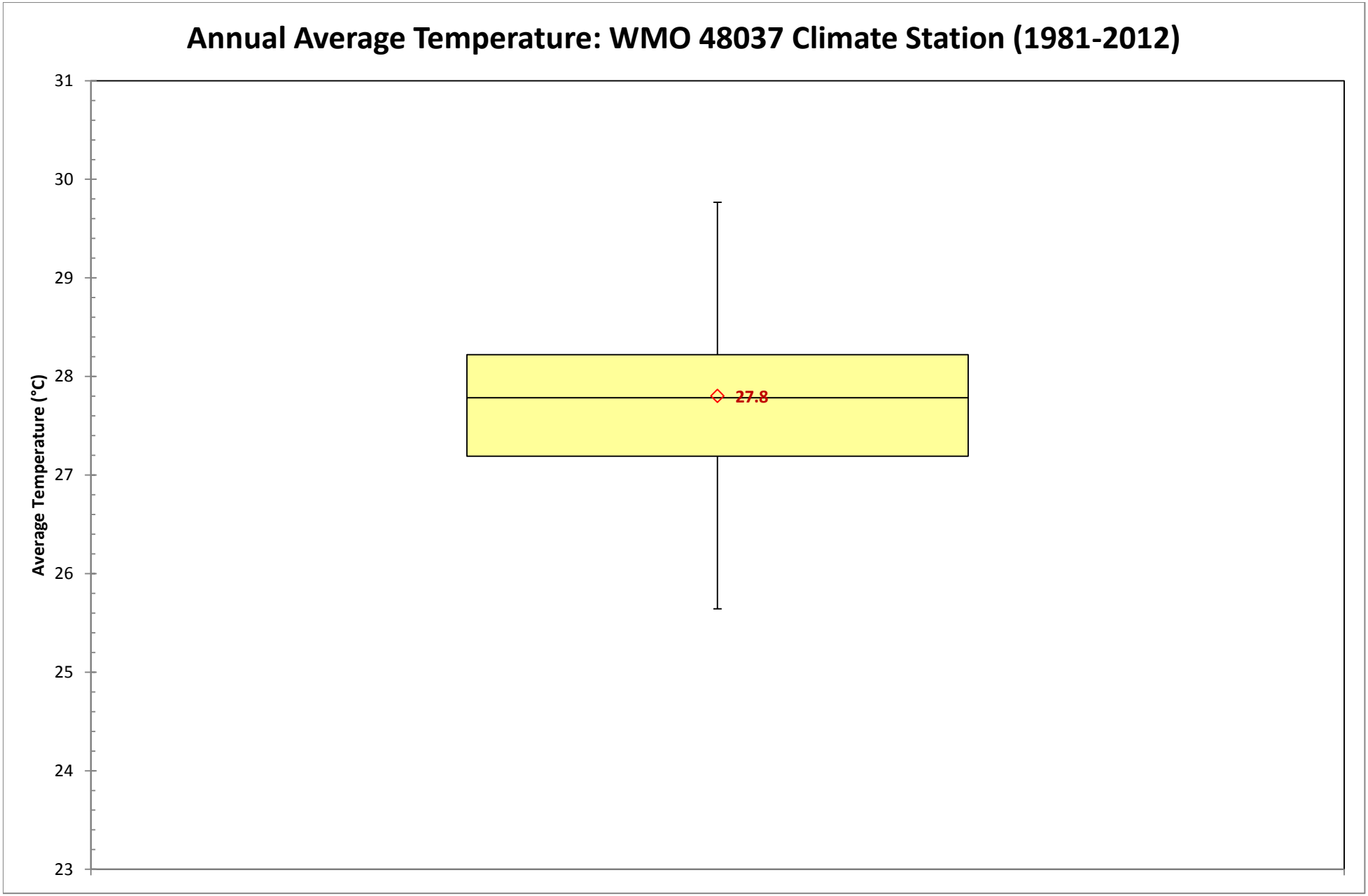
Year	Ave. Temp (°C)
1981	Exclude
1982	27.5
1983	27.2
1984	26.6
1985	27.0
1986	Exclude
1987	Exclude
1988	Exclude
1989	Exclude
1990	26.1
1991	27.0
1992	Exclude
1993	27.1
1994	28.1
1995	27.7
1996	27.6
1997	27.5
1998	29.7
1999	29.4
2000	27.0
2001	27.8
2002	27.9
2003	28.2
2004	28.3
2005	28.6
2006	28.3
2007	27.9
2008	28.0
2009	28.0
2010	28.7
2011	27.7
2012	Exclude

Stat	Ave. Temp (°C)
Mean	27.8
SD	0.8
Median	27.8
Q1	27.2
Q3	28.2
Minimum	26.1
Maximum	29.7
Count	25
Ext Max	29.8
Ext Min	25.6
25th Pct	27.2
50th Pct	0.6
75th Pct	0.4
1.5 * IQR	1.5



Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered outliers


Annual Average Temperature: WMO 48037 Climate Station (1981-2012)
Average Temperature (°C)
31
30
29
28
27
26
25
24
23
27.8

ATTACHMENT 4.2

Monthly Average Temperature Analysis

Temperature Data, Monthly Sampling Frequency: WMO 48037 Climate Station (1981-2012) (Analysis Format)

Average Temperature Data (°C)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	23.0	21.5
1982	21.4	23.4	26.3	30.5	31.4	29.9	31.4	29.9	30.3	28.2	25.8	21.3
1983	18.4	21.5	27.2	31.3	32.7	31.2	31.4	29.6	30.1	28.0	23.7	21.1
1984	20.2	23.0	26.9	30.6	30.6	29.4	29.5	29.3	28.0	26.5	23.4	22.0
1985	22.5	22.3	28.7	31.1	30.6	30.1	26.8	29.2	30.4	26.7	23.8	21.9
1986	21.1	23.2	27.6	31.6	32.3	31.1	30.1	28.9	28.8	26.8	N/D	N/D
1987	N/D	21.9	23.1	30.9	28.1	N/D	N/D	29.0	28.9	28.1	24.8	22.7
1988	21.2	N/D	N/D	N/D	30.4	27.8	28.7	28.4	N/D	N/D	N/D	N/D
1989	N/D	N/D	24.8	N/D	31.0	29.3	27.9	28.6	28.2	27.0	23.7	19.9
1990	21.6	21.1	25.8	25.9	28.3	29.0	29.0	30.1	27.8	28.4	25.4	21.2
1991	20.4	23.8	29.5	30.1	30.4	30.6	30.0	29.4	29.3	27.7	23.4	20.1
1992	18.5	21.3	25.9	30.7	31.7	N/D	N/D	29.3	29.8	27.0	23.9	18.4
1993	19.0	22.2	27.8	29.5	30.5	30.7	30.7	29.8	29.1	27.9	25.0	23.1
1994	23.4	23.1	27.2	31.8	32.5	31.9	31.2	32.1	29.7	27.6	25.6	21.4
1995	21.9	25.0	27.4	30.9	31.4	31.9	30.4	29.9	28.8	28.6	25.3	20.7
1996	21.6	23.9	27.4	30.3	31.4	29.3	30.1	28.6	28.6	27.5	25.7	26.8
1997	20.7	23.2	26.6	29.3	33.4	30.5	30.8	29.2	28.4	28.1	26.0	23.8
1998	24.3	24.2	35.5	30.3	31.3	32.9	31.4	31.4	29.7	29.8	27.6	28.0
1999	28.0	32.9	32.9	33.1	29.5	31.8	31.3	30.0	30.3	28.3	24.8	20.4
2000	22.5	22.8	26.5	30.2	29.2	29.9	30.1	31.0	28.6	27.6	24.4	21.3
2001	21.3	24.8	28.0	32.1	29.9	30.1	30.6	29.5	30.4	28.2	25.3	23.3
2002	23.0	25.9	28.9	31.8	30.6	31.2	29.8	28.7	29.2	28.0	24.6	22.6
2003	21.9	24.5	28.0	32.8	29.9	30.3	31.7	30.9	29.7	29.0	26.3	23.8
2004	22.5	24.5	29.5	30.8	33.8	29.9	30.3	31.4	28.9	28.4	27.2	22.9
2005	23.2	27.1	30.4	28.8	32.9	32.0	31.4	30.9	28.9	29.1	25.8	23.1
2006	23.5	25.6	29.3	31.6	31.1	31.2	31.1	30.0	29.0	28.5	26.5	22.0
2007	22.4	23.3	28.8	31.6	30.5	31.4	31.0	30.3	29.5	28.1	25.5	22.9
2008	22.1	23.4	29.5	32.3	30.1	30.5	30.8	30.8	30.3	28.1	24.9	22.9
2009	23.5	26.1	28.1	31.5	31.6	30.2	31.3	30.2	29.4	27.8	25.4	21.3
2010	21.8	24.5	30.9	32.4	33.1	31.9	32.5	30.8	29.8	28.6	26.3	21.8
2011	22.4	23.6	28.1	30.6	31.1	30.2	31.4	29.2	29.8	27.9	25.4	22.5
2012	22.3	25.3	27.9	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

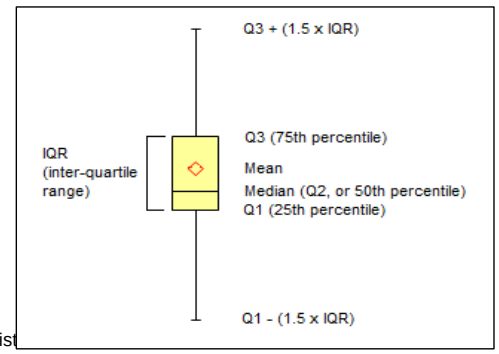
Average Temperature Data Summary Statistics (°C)

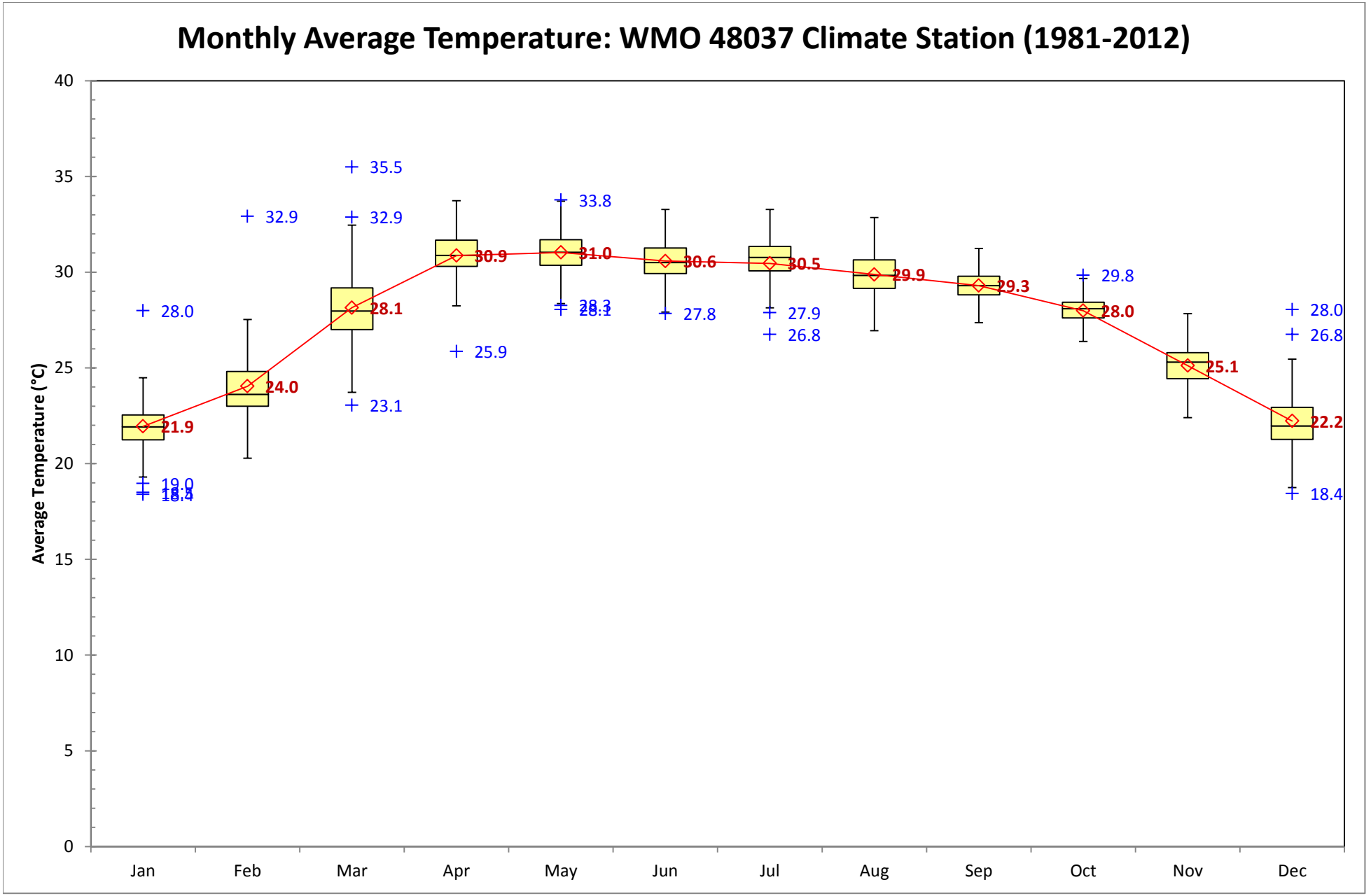
Stat.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	21.9	24.0	28.1	30.9	31.0	30.6	30.5	29.9	29.3	28.0	25.1	22.2
SD	1.9	2.3	2.3	1.4	1.4	1.1	1.2	1.0	0.7	0.7	1.1	1.9
Median	21.9	23.6	28.0	30.9	31.0	30.5	30.8	29.8	29.3	28.1	25.3	22.0
Q1	21.2	23.0	27.0	30.3	30.4	29.9	30.1	29.2	28.8	27.6	24.4	21.3
Q3	22.5	24.8	29.2	31.7	31.7	31.3	31.3	30.6	29.8	28.4	25.8	22.9
Minimum	18.4	21.1	23.1	25.9	28.1	27.8	26.8	28.4	27.8	26.5	23.0	18.4
Maximum	28.0	32.9	35.5	33.1	33.8	32.9	32.5	32.1	30.4	29.8	27.6	28.0
Count	29	29	30	28	30	28	28	30	29	29	29	29
Ext Max	24.5	27.5	32.5	33.7	33.7	33.3	33.3	32.9	31.2	29.7	27.8	25.5
Ext Min	19.3	20.3	23.7	28.2	28.4	27.9	28.1	26.9	27.4	26.4	22.4	18.7
25th Pct	21.2	23.0	27.0	30.3	30.4	29.9	30.1	29.2	28.8	27.6	24.4	21.3
50th Pct	0.7	0.6	1.0	0.6	0.7	0.6	0.7	0.7	0.5	0.5	0.9	0.7
75th Pct	0.6	1.2	1.2	0.8	0.7	0.8	0.6	0.8	0.5	0.3	0.5	1.0
1.5 * IQR	1.9	2.7	3.3	2.1	2.0	2.0	1.9	2.2	1.5	1.2	2.0	2.5

Note: N/D = No Data Available, N/A = Not Applicable.

Explanation of statistical and computed values above

Mean	Average of the given dataset, AVERAGE({data})
SD	Standard deviation of the given dataset, STDEV({data})
Median	Median of the given dataset, MEDIAN({data})
Q1	First quartile of the given dataset, PERCENTILE({data},0.25)
Q3	Third quartile of the given dataset, PERCENTILE({data},0.75)
Minimum	Minimum value of the given dataset, MIN({data})
Maximum	Maximum value of the given dataset, MIN({data})
Count	Number of valid entries in the given dataset, COUNTIF({data},">=0")
25th Pct	Plotting value of the first quartile = Q1
50th Pct	Lower box height = Median - Q1
75th Pct	Upper box height = Q3 - Median
1.5 * IQR	Whisker (error bar) length = 1.5 * (Q3 - Q1); values beneath (Q1 **minus** this) or above (Q3 **plus** this) are considered statist




Monthly Average Temperature: WMO 48037 Climate Station (1981-2012)
Average Temperature (°C)
40
35
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
28.0
19.0
18.4
21.9
32.9
24.0
35.5
32.9
28.1
23.1
30.9
25.9
33.8
31.0
28.3
28.1
30.6
27.8
30.5
27.9
26.8
29.9
29.3
29.8
28.0
25.1
28.0
26.8
22.2
18.4

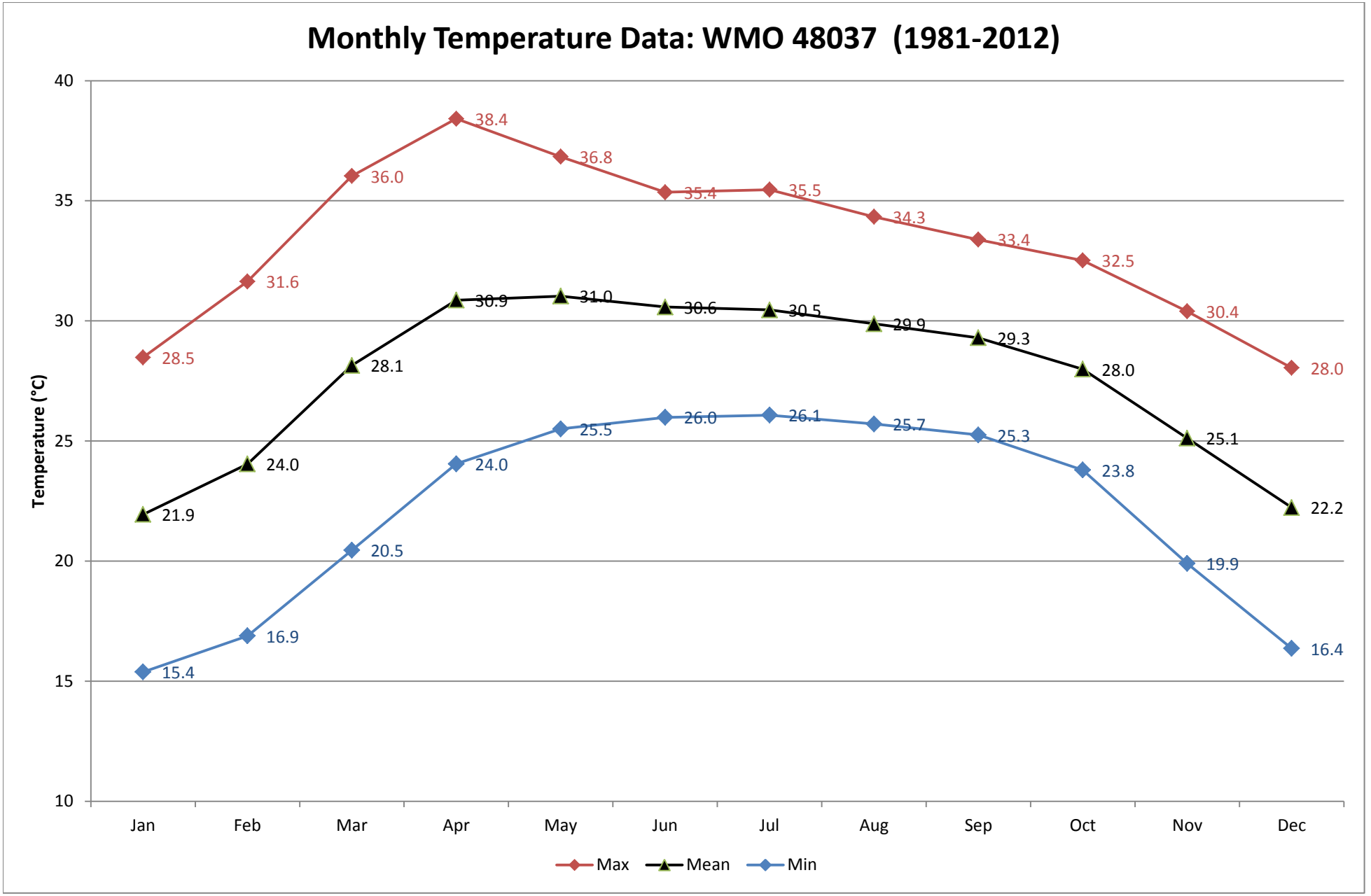
ATTACHMENT 4.3

Monthly Temperature Range Analysis

Knight Piésold CONSULTING	Subject	Myanmar Wanbao Mining	Made by	AB	Job No.	PE701-00022/04
		Copper Ltd. | Letpadaung Copper Project	Checked	TML	Date	21/06/2013
		Basic Climatology	Approved		Sheet No.	

Monthly Temperature Analysis: WMO 48037 (1981-2012)

Temperature Summary Statistics (°C)												
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Max	28.5	31.6	36.0	38.4	36.8	35.4	35.5	34.3	33.4	32.5	30.4	28.0
Mean	21.9	24.0	28.1	30.9	31.0	30.6	30.5	29.9	29.3	28.0	25.1	22.2
Min	15.4	16.9	20.5	24.0	25.5	26.0	26.1	25.7	25.3	23.8	19.9	16.4

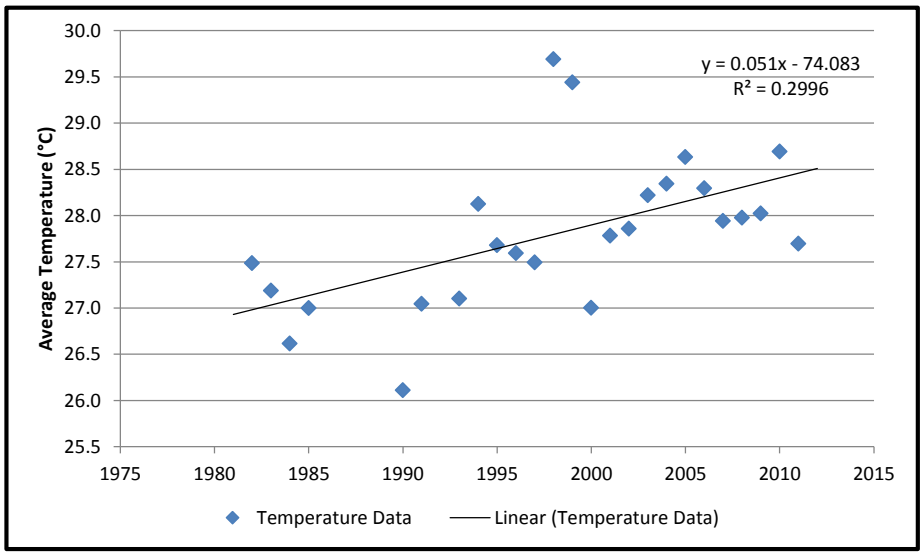

Monthly Temperature Data: WMO 48037 (1981-2012)
Temperature (°C)
40
35
30
25
20
15
10
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
28.5
31.6
36.0
38.4
36.8
35.4
35.5
34.3
33.4
32.5
30.4
28.0
21.9
24.0
28.1
30.9
31.0
30.6
30.5
29.9
29.3
28.0
25.1
22.2
15.4
16.9
20.5
24.0
25.5
26.0
26.1
25.7
25.3
23.8
19.9
16.4
Max
Mean
Min

ATTACHMENT 4.4

Temperature Trend Analysis

Climatic Trend Analysis: WMO 48037 Average Temperature (1981-2012)

Year	Temp (°C)
1981	Exclude
1982	27.5
1983	27.2
1984	26.6
1985	27.0
1986	Exclude
1987	Exclude
1988	Exclude
1989	Exclude
1990	26.1
1991	27.0
1992	Exclude
1993	27.1
1994	28.1
1995	27.7
1996	27.6
1997	27.5
1998	29.7
1999	29.4
2000	27.0
2001	27.8
2002	27.9
2003	28.2
2004	28.3
2005	28.6
2006	28.3
2007	27.9
2008	28.0
2009	28.0
2010	28.7
2011	27.7
2012	Exclude



From the above, KP concludes that there is no statistically significant trend observable in annual average temperature values at this site.

ATTACHMENT 5.1

Wind Rose Analysis

Wind Rose Analysis Results (All Values): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 26,304 **Number of Valid Points:** 26,304 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.10	0.90	2.40	3.70	5.10	9.20

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	17.29	0.000	3.015	9.200
22.5	8.76	0.000	2.481	7.400
45.0	4.16	0.000	1.660	7.400
67.5	2.98	0.000	1.047	6.700
90.0	3.87	0.000	1.045	7.300
112.5	4.40	0.000	1.612	6.300
135.0	7.52	0.000	2.141	6.200
157.5	9.18	0.000	2.656	7.600
180.0	7.98	0.000	3.185	8.500
202.5	4.70	0.000	2.997	8.300
225.0	2.71	0.000	2.333	9.000
247.5	2.26	0.000	1.601	7.100
270.0	2.39	0.000	1.354	7.000
292.5	3.09	0.000	1.370	6.700
315.0	4.66	0.000	1.550	6.800
337.5	14.05	0.000	2.961	8.100
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	11,172	42.473	0	26,304	100
2 - 4	9,826	37.356	2	15,132	57.527
4 - 6	4,884	18.568	4	5,306	20.172
6 - 8	400	1.521	6	422	1.604
8 - 50	22	0.084	8	22	0.084
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 00:00 to 03:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.20	1.30	2.90	3.90	4.60	7.60

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	17.97	0.000	3.294	5.400
22.5	7.88	0.000	2.608	5.600
45.0	4.05	0.000	2.386	5.300
67.5	2.34	0.000	1.700	4.900
90.0	2.86	0.100	1.723	5.400
112.5	2.74	0.000	2.263	6.000
135.0	3.92	0.100	2.332	6.200
157.5	5.32	0.000	2.825	6.600
180.0	8.00	0.000	3.275	5.600
202.5	5.54	0.000	3.082	5.000
225.0	3.83	0.000	2.329	4.800
247.5	2.52	0.000	1.440	4.500
270.0	3.68	0.000	1.347	4.400
292.5	4.53	0.000	1.602	5.500
315.0	7.21	0.000	1.708	5.000
337.5	17.61	0.000	3.075	7.600
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	1,111	33.79	0	3,288	100
2 - 4	1,452	44.161	2	2,177	66.21
4 - 6	714	21.715	4	725	22.05
6 - 8	11	0.335	6	11	0.335
8 - 50	0	0	8	0	0
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 03:00 to 06:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.40	2.30	3.40	4.00	4.90	7.60

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	24.18	0.000	3.381	6.600
22.5	10.58	0.100	2.971	5.500
45.0	4.59	0.100	2.530	6.400
67.5	2.34	0.000	2.174	4.900
90.0	1.98	0.000	1.908	3.800
112.5	2.22	0.000	2.156	3.800
135.0	3.44	0.000	2.471	4.900
157.5	4.71	0.000	3.098	7.600
180.0	5.81	0.100	3.228	7.600
202.5	3.47	0.000	2.687	4.500
225.0	1.76	0.000	1.817	3.900
247.5	1.37	0.000	1.540	4.500
270.0	1.34	0.000	1.809	4.100
292.5	2.19	0.000	2.089	5.500
315.0	3.98	0.000	2.198	5.100
337.5	26.03	0.000	3.815	7.100
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	692	21.046	0	3,288	100
2 - 4	1,675	50.943	2	2,596	78.954
4 - 6	896	27.251	4	921	28.011
6 - 8	25	0.76	6	25	0.76
8 - 50	0	0	8	0	0
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 06:00 to 09:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.40	2.30	3.50	4.60	6.10	9.20

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	30.17	0.000	4.112	9.200
22.5	16.09	0.000	3.674	7.400
45.0	5.05	0.000	2.655	5.500
67.5	1.40	0.000	2.022	4.900
90.0	1.31	0.000	1.460	7.300
112.5	1.46	0.000	2.354	6.300
135.0	2.37	0.000	2.205	4.700
157.5	4.56	0.000	2.319	5.700
180.0	5.93	0.000	2.973	6.700
202.5	4.17	0.100	2.889	6.800
225.0	1.55	0.000	1.863	4.000
247.5	1.06	0.100	1.426	3.800
270.0	1.03	0.100	1.229	4.600
292.5	1.40	0.000	1.861	4.400
315.0	2.59	0.000	2.042	4.900
337.5	19.86	0.000	3.887	8.100
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	679	20.651	0	3,288	100
2 - 4	1,319	40.116	2	2,609	79.349
4 - 6	1,099	33.425	4	1,290	39.234
6 - 8	178	5.414	6	191	5.809
8 - 50	13	0.395	8	13	0.395
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 09:00 to 12:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.10	0.70	2.10	3.40	5.20	8.60

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	31.27	0.000	2.813	8.600
22.5	14.14	0.000	2.300	6.500
45.0	4.05	0.000	1.077	5.800
67.5	2.62	0.000	0.765	6.700
90.0	2.31	0.000	0.736	7.100
112.5	2.71	0.000	1.281	5.600
135.0	4.26	0.000	1.354	5.700
157.5	7.18	0.000	2.002	7.400
180.0	7.57	0.000	2.861	7.800
202.5	3.50	0.000	2.720	7.700
225.0	1.34	0.000	1.161	5.100
247.5	1.00	0.000	1.012	3.800
270.0	1.22	0.000	0.893	5.200
292.5	1.64	0.000	0.661	4.600
315.0	2.59	0.000	1.408	5.200
337.5	12.62	0.000	2.273	8.000
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	1,559	47.415	0	3,288	100
2 - 4	1,185	36.04	2	1,729	52.585
4 - 6	472	14.355	4	544	16.545
6 - 8	70	2.129	6	72	2.19
8 - 50	2	0.061	8	2	0.061
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 12:00 to 15:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.00	0.20	1.20	2.60	5.00	8.50

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	15.33	0.000	1.768	6.000
22.5	7.48	0.000	1.181	4.700
45.0	4.26	0.000	0.425	3.300
67.5	4.68	0.000	0.203	2.400
90.0	5.93	0.000	0.411	4.500
112.5	5.51	0.000	0.728	5.500
135.0	10.22	0.000	1.469	5.500
157.5	15.82	0.000	2.317	6.700
180.0	10.01	0.000	3.297	8.500
202.5	2.71	0.000	2.581	8.300
225.0	1.49	0.000	2.418	6.500
247.5	1.43	0.000	1.638	6.200
270.0	1.19	0.000	1.249	5.600
292.5	1.83	0.000	1.565	6.400
315.0	2.52	0.000	1.083	5.600
337.5	9.61	0.000	1.577	6.700
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	2,130	64.781	0	3,288	100
2 - 4	792	24.088	2	1,158	35.219
4 - 6	293	8.911	4	366	11.131
6 - 8	67	2.038	6	73	2.22
8 - 50	6	0.182	8	6	0.182
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 15:00 to 18:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.10	0.70	1.80	3.10	4.70	7.00

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	7.00	0.000	1.830	5.300
22.5	4.53	0.000	1.410	5.000
45.0	3.44	0.000	0.867	3.400
67.5	4.23	0.000	0.630	4.000
90.0	7.76	0.000	0.808	4.100
112.5	8.70	0.100	1.522	5.800
135.0	20.26	0.000	2.281	5.500
157.5	15.66	0.100	2.797	6.600
180.0	6.75	0.000	3.191	7.000
202.5	3.59	0.000	2.914	7.000
225.0	2.43	0.000	3.099	6.900
247.5	2.01	0.000	2.464	6.900
270.0	1.76	0.000	1.995	6.400
292.5	2.31	0.000	1.403	6.700
315.0	2.59	0.000	1.351	5.300
337.5	7.00	0.000	1.837	5.700
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	1,778	54.075	0	3,288	100
2 - 4	1,110	33.759	2	1,510	45.925
4 - 6	373	11.344	4	400	12.165
6 - 8	27	0.821	6	27	0.821
8 - 50	0	0	8	0	0
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 18:00 to 21:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.00	0.50	2.00	3.60	4.80	7.00

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	5.99	0.000	1.550	4.600
22.5	4.99	0.000	1.399	6.800
45.0	3.95	0.000	1.217	5.000
67.5	3.86	0.000	1.030	4.800
90.0	5.23	0.000	1.226	5.600
112.5	8.39	0.000	1.866	5.200
135.0	10.86	0.000	2.585	5.800
157.5	12.41	0.000	3.027	6.200
180.0	10.65	0.000	3.359	6.300
202.5	5.93	0.000	3.003	6.300
225.0	4.81	0.000	2.452	6.700
247.5	3.98	0.000	1.595	6.600
270.0	2.80	0.000	1.386	7.000
292.5	3.04	0.000	1.055	5.500
315.0	4.96	0.000	1.013	6.800
337.5	8.15	0.000	2.057	6.200
Sum:	100.00			

Wind speed bin statistics					
Bin	Counts	Frequency	Exceeding		
			Values >	Counts	Frequency
(m/s)		(%)	(m/s)		(%)
>0 - 2	1,619	49.24	0	3,288	100
2 - 4	1,131	34.398	2	1,669	50.76
4 - 6	522	15.876	4	538	16.363
6 - 8	16	0.487	6	16	0.487
8 - 50	0	0	8	0	0
50 - 89	0	0.000	50	0	0.000

Wind Rose Analysis Results (Values from 21:00 to 00:00): Wind Rose Dataset (2010-2012)

Analysis performed using WindRose Pro 3.1 software.

Number of points: 3,288 **Number of Valid Points:** 3,288 **Number of excuded samples:** 0

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.00	0.10	0.70	2.00	3.50	4.60	9.00

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	6.39	0.000	2.322	5.000
22.5	4.41	0.000	1.839	4.800
45.0	3.89	0.000	1.698	7.400
67.5	2.37	0.000	1.468	6.500
90.0	3.56	0.000	1.377	5.100
112.5	3.50	0.000	1.707	5.200
135.0	4.87	0.000	2.244	5.700
157.5	7.76	0.000	2.892	5.100
180.0	9.16	0.000	3.157	5.400
202.5	8.73	0.000	3.389	6.500
225.0	4.44	0.000	2.483	9.000
247.5	4.71	0.000	1.496	7.100
270.0	6.11	0.000	1.192	5.500
292.5	7.76	0.000	1.160	4.500
315.0	10.86	0.000	1.526	4.900
337.5	11.50	0.000	2.493	5.700
Sum:	100.00			

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	1,604	48.783	0	3,288	100
2 - 4	1,162	35.341	2	1,684	51.217
4 - 6	515	15.663	4	522	15.876
6 - 8	6	0.182	6	7	0.213
8 - 50	1	0.03	8	1	0.03
50 - 89	0	0.000	50	0	0.000

ATTACHMENT 5.2

Wind Rose Analysis – Seasonal Variability

Wind Rose Analysis Results (All Values from Wet Season): Wind Rose Dataset (2010-2012)

The "Wet Season" was assumed to span from May to October.
Analysis performed using WindRose Pro 3.1 software.

Number of points: 13,248 **Number of Valid Points:** 12,952 **Number of excuded samples:** 296

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.10	0.20	1.40	2.80	3.70	4.90	9.00

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	11.84	0.100	2.732	7.300
22.5	10.53	0.100	2.711	6.800
45.0	5.01	0.100	2.072	7.400
67.5	2.92	0.100	1.436	6.500
90.0	3.50	0.100	1.380	5.600
112.5	3.86	0.100	1.765	6.000
135.0	8.60	0.100	2.310	6.200
157.5	12.93	0.100	2.899	7.600
180.0	12.79	0.100	3.406	8.500
202.5	7.34	0.100	3.250	8.300
225.0	3.87	0.100	2.829	9.000
247.5	2.54	0.100	2.371	7.100
270.0	2.19	0.100	2.015	7.000
292.5	2.32	0.100	2.028	6.700
315.0	3.14	0.100	1.941	5.600
337.5	6.62	0.100	2.508	6.800
Sum:	100.00			

Wind speed bin statistics			
Bin (m/s)	Counts	Frequency (%)	Comment
0	296	2.23	Excluded
>0	12,952	97.77	Analysed
N/D	0	0.00	Excluded

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	4,475	34.551	0	12,952	100
2 - 4	6,015	46.441	2	8,477	65.449
4 - 6	2,313	17.858	4	2,462	19.009
6 - 8	142	1.096	6	149	1.15
8 - 50	7	0.054	8	7	0.054
>50	0	0.000	50	0	0.000

Wind Rose Analysis Results (All Values from Dry Season): Wind Rose Dataset (2010-2012)

The "Dry Season" was assumed to span from November to April.
Analysis performed using WindRose Pro 3.1 software.

Number of points: 13,056 **Number of Valid Points:** 12,377 **Number of excuded samples:** 679

Non-directional wind speed sampling statistics						
Min. (m/s)	5th Pct. (m/s)	25th Pct. (m/s)	50th Pct. (m/s)	75th Pct. (m/s)	95th Pct. (m/s)	Max. (m/s)
0.10	0.10	0.80	2.20	3.90	5.30	9.20

Directional wind speed sampling statistics				
Wind Direction		Wind Speed		
Direction (°)	Frequency (%)	Min. (m/s)	Ave. (m/s)	Max. (m/s)
0.0	23.82	0.100	3.223	9.200
22.5	7.25	0.100	2.275	7.400
45.0	3.03	0.100	1.247	4.700
67.5	2.73	0.100	0.817	6.700
90.0	4.01	0.100	0.873	7.300
112.5	4.83	0.100	1.630	6.300
135.0	6.65	0.100	2.019	5.500
157.5	5.60	0.100	2.229	6.600
180.0	3.24	0.100	2.585	7.300
202.5	1.96	0.100	2.512	6.300
225.0	1.12	0.100	1.744	5.700
247.5	1.44	0.100	0.952	6.000
270.0	2.31	0.100	0.970	5.500
292.5	3.46	0.100	1.157	6.400
315.0	6.04	0.100	1.476	6.800
337.5	22.53	0.100	3.155	8.100
Sum:	100.00			

Wind speed bin statistics			
Bin (m/s)	Counts	Frequency (%)	Comment
0	679	5.20	Excluded
>0	12,555	96.16	Analysed
N/D	0	0.00	Excluded

Wind speed bin statistics					
Bin (m/s)	Counts	Frequency (%)	Exceeding		
			Values > (m/s)	Counts	Frequency (%)
>0 - 2	5,817	46.332	0	12,555	100
2 - 4	3,861	30.753	2	6,738	53.668
4 - 6	2,604	20.741	4	2,877	22.915
6 - 8	258	2.055	6	273	2.174
8 - 50	15	0.119	8	15	0.119
50 - 89	0	0.000	50	0	0.000

APPENDIX B

Site Wide Rainfall/Runoff Modelling

DRAFT

Knight Piésold CONSULTING

APPENDIX B

Surface Water Management

B.1 – Model Development

B.2 – Sub-Catchment Input Parameters

B.3 – HEC-HMS Water Pond Input

B.4 – HEC-HMS Channel Topography

B.5 – HEC-HMS Hyetograph Input

B.6 – Simulation Results – Comparison at Selected Locations

B.7 – Simulation Results – Summary Table at Control Points

B.8 – Simulation Results – Time Series Plots at Control Points

B.9 – Simulation Results – Time Series Plots at Water Ponds

B.10 – Catchment Model Schematics

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1. METHODS AND ASSUMPTIONS FOR MODEL DEELOPMENT

The selected approach for estimating runoff to various locations in the Letpadaung catchment (both for existing and planned future conditions) was to simulate runoff from the total area using a rainfall / runoff model constructed using HEC-HMS software (Ref. 1). By simulating the runoff hydrographs resulting from rainfall on each sub-catchment (or basin) reporting to and from the Letpadaung project area and routing them (combining hydrographs as necessary) throughout the natural and man-made sections of the overall drainage network, it was possible to determine peak runoff flow rate, time to peak runoff and total volume of runoff which reports to (or past) selected locations throughout the site. These results form the quantitative basis for impact assessment.

1.1 MODEL NOMENCLATURE

All hydrologic features on the Letpadaung site are assigned an alphanumeric "feature code" for purposes of uniquely identifying each feature within the framework of the Letpadaung HEC-HMS rainfall / runoff models as follows:

"AA-BB-NNN"

where:

- AA denotes a two character "structure code" for the type of hydrologic feature described. The structure codes used for these models are:
  - BA indicates a sub-catchment (or basin) area which generates runoff in response to direct rainfall;
  - CP indicates a control point, where various runoff information is reported;
  - DC indicates a diversion (man-made) channel which conveys runoff from one location to another;
  - NC indicates a natural channel which conveys runoff from one location to another; and
  - WP indicates a water pond, which both stores and discharges water simultaneously, depending on the elevation of water within it.
- BB denotes a two character "stage code" for the time at which the feature is to be considered. The stage codes used in these models are:
  - EX indicates exsting conditions and

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  - PL indicates planned future conditions. Specifically, the future condition assumed for assessment is assumed to be after Heap Leach Pad (HLP) No. 2 construction is complete, but before commencement of construction on HLP 3. Following current development plans, this is roughly 10 years after commencement of mining operations at the Letpadaug site.

- NNN denotes a three digit "feature number", which increases sequentially from 1 and is padded with zeros (e.g. 001, 002, etc.). The feature number indicates the specific feature for a given structure type and time at which the feature is considered.
- Three exceptions exist to the above nomenclature rules:
  - Water ponds may have more the one runoff reporting node where water flows into said pond. Control points fitting this description (i.e. more than one inflow point into a water pond) are indicated by appending a single letter (in ascending order, by inflow point) to the feature code of the selected control point (e.g. CP-EX-016A, CP-EX-016B, etc.)
  - The surface area of water ponds which receives direct rainfall is indicated by appending the letter "P" to the feature code of that water pond (e.g. WP-EX-001P, WP-PL-005P, etc.). Locations matching this description are a special subset of the control point classification.
  - Cross sections used to describe the geometry of a conveyance pathway, either a diversion channel (DC) or natural channel (NC) are indicated by prefixing the letters "XS-" to the feature code of the channel which the given cross section belongs to (e.g. XS-DC-EX-008, XS-NC-PL-011, etc.)

A feature code is merely the combination of specific values of structure code, stage code and feature number, separated by hyphens "-" and subject to the three naming exceptions given above.

1.2 CATCHMENT DELINATION AND MODEL SKELETONIZATION

The total existing (EX) Letpadaung catchment area is 110.2 square kilometres (km^2) and the total planned (PL) Letpadaung catchment area is 106.1 km^2, after subtraction of the developed pit area which does not generate runoff to the exterior of the mine

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site. These catchments were sub-delineated into basins using AutoCAD Civil 3D 2013 (Ref. 2) as follows:

- The EX model catchment sub-delineation is shown on Figure 3.1. This catchment is comprised of the following hydrologic features:
  - 40 basins;
  - 39 channels (14 man-made diversions and 25 natural water courses) with associated cross sections;
  - 59 control points;
  - 2 sinks (Chindwin River and Yama Stream); and
  - 6 water ponds.
- The PL model catchment sub-delineation is shown on Figure 3.2. This catchment is comprised of the following hydrologic features:
  - 61 basins;
  - 63 channels (50 man-made diversions and 13 natural water courses) with associated cross sections;
  - 93 control points;
  - 2 sinks (Chindwin River and Yama Stream); and
  - 9 water ponds.

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The AutoCAD electronic catchment maps were converted into simplified routing diagrams as part of the HEC-HMS model construction. These resulting catchment model schematics are shown in Appendix B.10 for EX and PL models, respectively.

1.3 SUB-CATCHMENT PARAMETERS

The delineated basins and water pond surfaces define the area which generates runoff in response to rainfall in the HEC-HMS surface water management (SWM) models. Generation of runoff from rainfall in the HEC-HMS SWM models employs three primary hydrologic methods:

- Precipitation excess was estimated using the SCS Curve Number Method as described in (Ref. 3). With the SCS Curve Number Method, generation of excess precipitation from a given area is defined through the use of a “curve number” (CN) which ranges between 0 and 100. (KP notes that CN = 0 means no excess is generated in response to rainfall, while CN = 100 means

that all rainfall is treated as excess precipitation, i.e. no losses occur.) CN is adjusted based upon antecedent moisture conditions (AMC).

- Transformation of excess precipitation to runoff was accomplished using the SCS Unit Hydrograph Method as described (Ref. 4). With the SCS Unit Hydrograph Method, the transformation of excess precipitation to runoff hydrographs is governed by CN and by lag time (t_L) for each basin. Formulae for estimating lag time are given in (Ref. 3).
- Baseflow (i.e. the groundwater component of runoff) is not considered in the Letpadaung EX and PL SWM models. Generally speaking, the baseflow response to individual storms is smaller in magnitude and delayed in time. Consequently, KP excluded consideration of baseflow from storm water modelling.

A summary of the primary basin parameters for the Letpadaung EX and PL SWM models are given in tables 1.1 and 1.2, respectively.

Table 1.1: Basin hydrologic parameter summary: EX SWM model

Sub-Catchment	Reports to Location	Area (km^2)	CN*	t_L (min)	Antecedent Moisture Condition
BA-EX-001	CP-EX-001	1.76	89.6	161	III
BA-EX-002	CP-EX-003	0.44	89.6	75	III
BA-EX-003	CP-EX-004	2.22	89.2	334	III
BA-EX-004	CP-EX-005	0.91	88	69	III
BA-EX-005	CP-EX-007	2.72	89.6	203	III
WP-EX-001P	WP-EX-001	1.11	98	4	III
BA-EX-006	CP-EX-010A	3.67	89.6	149	III
BA-EX-007	CP-EX-010D	1.35	89.6	25	III
BA-EX-008	CP-EX-010B	21.29	88.8	330	III
BA-EX-009	CP-EX-010C	10.54	87.6	204	III
BA-EX-010	CP-EX-011	4.51	88.4	241	III
WP-EX-002P	WP-EX-002	0.06	98	4	III
BA-EX-011	CP-EX-016A	0.33	89.2	33	III
BA-EX-012	CP-EX-016D	0.11	89.6	37	III
BA-EX-013	CP-EX-016B	4.09	89.6	134	III
BA-EX-014	CP-EX-016C	4.16	89.6	212	III
WP-EX-003P	WP-EX-003	0.02	98	4	III
BA-EX-015	CP-EX-019	4.51	88.8	147	III
BA-EX-016	CP-EX-020	1.99	89.6	125	III
WP-EX-004P	WP-EX-004	0.01	98	4	III
BA-EX-017	CP-EX-024	0.05	89.6	21	III
BA-EX-018	CP-EX-025	0.12	89.6	59	III
BA-EX-019	CP-EX-026	0.98	88.8	108	III
WP-EX-005P	WP-EX-005	0.02	98	4	III
BA-EX-020	CP-EX-029	0.66	89.2	65	III
BA-EX-021	CP-EX-026	1.03	89.6	101	III
BA-EX-022	CP-EX-025	0.9	89.6	124	III

Table 1.1 Cont'd: Basin hydrologicparameter summary: EX model

Sub-Catchment	Reports to Location	Area (km^2)	CN*	t_L (min)	Antecedent Moisture Condition
BA-EX-023	CP-EX-031	1.28	89.2	115	III
BA-EX-024	CP-EX-031	2.71	87.6	171	III
BA-EX-025	CP-EX-031	0.36	87.6	24	III
BA-EX-026	CP-EX-032	2.82	89.6	176	III
BA-EX-027	CP-EX-033	2.44	88.8	41	III
BA-EX-028	CP-EX-035	1.37	88.4	58	III
BA-EX-029	CP-EX-035	0.85	88	34	III
BA-EX-030	CP-EX-036	2.03	88	27	III
BA-EX-031	CP-EX-037	0.39	89.6	85	III
BA-EX-032	CP-EX-039	1.78	88	26	III
BA-EX-033	CP-EX-044	0.69	89.6	135	III
BA-EX-034	CP-EX-043	0.87	88.8	28	III
BA-EX-035	CP-EX-045	2.64	83.3	68	III
BA-EX-036	CP-EX-046	0.79	87.2	18	III
BA-EX-037	CP-EX-047	2.6	88	155	III
BA-EX-038	CP-EX-048	2.45	89.6	190	III
BA-EX-039	CP-EX-051	0.45	89.6	62	III
WP-EX-006P	WP-EX-006	0.24	98	4	III
BA-EX-040	CP-EX-053	13.95	88	350	III

* SCS curve numbers for Antecedent Moisture Condition III derived using relationships from (Ref. 5).

Table 1.2: Basin hydrologic parameter summary: PL SWM model

Sub-Catchment	Reports to Location	Area (km^2)	CN*	t_L (min)	Antecedent Moisture Condition
BA-PL-001	CP-PL-001	1.76	89.6	161	III
BA-PL-002	CP-PL-003	0.44	89.6	75	III
BA-PL-003	CP-PL-004	2.22	89.2	334	III
BA-PL-004	CP-PL-005	0.91	88	69	III
BA-PL-005	CP-PL-007	2.72	89.6	203	III
WP-PL-001P	CP-PL-009	1.11	98	4	III
BA-PL-006	CP-PL-010A	3.67	89.6	149	III
BA-PL-007	CP-PL-010D	1.35	89.6	25	III
BA-PL-008	CP-PL-010B	21.29	88.8	330	III
BA-PL-009	CP-PL-010C	10.54	87.6	204	III
BA-PL-010	CP-PL-013	4.48	89.1	167	III
WP-PL-002P	CP-PL-015	0.06	98	4	III
BA-PL-011	CP-PL-016A	0.33	89.2	33	III
BA-PL-012	CP-PL-016C	0.08	89.6	36	III
BA-PL-013	CP-PL-017	1.45	88.4	90	III
BA-PL-014	CP-PL-018	2.01	88.8	99	III
BA-PL-015	CP-PL-018	0.4	89.6	58	III
BA-PL-016	CP-PL-020	0.66	89.6	162	III
WP-PL-003P	CP-PL-021	0.01	98	4	III
BA-PL-017	CP-PL-022	0.02	89.6	18	III
BA-PL-018	CP-PL-020	0.03	89.6	8	III
BA-PL-019	CP-PL-023	0.16	896	9	III
BA-PL-020	CP-PL-024	0.1	89.6	9	III
BA-PL-021	CP-PL-025	0.03	95.9	3	III

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Table 1.2 Cont'd: Basin hydrologic parameter summary: PL SWM model

Sub-Catchment	Reports to Location	Area (km^2)	CN*	t_L (min)	Antecedent Moisture Condition
BA-PL-022	CP-PL-027	0.07	95.9	6	III
BA-PL-023	CP-PL-028	0.09	95.9	6	III
BA-PL-024	CP-PL-030	0.22	89.6	28	III
BA-PL-025	CP-PL-031	0.8	89.2	27	III
BA-PL-026	CP-PL-032	1.66	90.6	62	III
WP-PL-004P	CP-PL-034	0.02	98	4	III
BA-PL-027	CP-PL-035	4.51	88.8	148	III
BA-PL-028	CP-PL-030	0.1	89.6	20	III
BA-PL-029	CP-PL-030	0.44	89.2	38	III
BA-PL-030	CP-PL-038	1.06	89.2	88	III
BA-PL-031	CP-PL-025	0.17	91.3	15	III
WP-PL-005P / WP-PL-006P	CP-PL-040	1.46	98	4	III
WP-PL-007P	CP-PL-042B	0.72	98	4	III
BA-PL-032	CP-PL-042A	0.63	98.9	103	III
BA-PL-033	CP-PL-044	4.38	88.5	14	III
BA-PL-034	CP-PL-045	4.43	88.5	14	III
BA-PL-035	CP-PL-042C	0.49	95.9	54	III
BA-PL-036	CP-PL-046	0.78	95.9	11	III
BA-PL-037	CP-PL-048	0.62	95.9	4	III
BA-PL-038	CP-PL-049	0.82	89.1	22	III
BA-PL-039	CP-PL-051	0.5	92.6	12	III
BA-PL-040	CP-PL-052	0.12	86	10	III
BA-PL-041	CP-PL-058	1.08	93.3	5	III
WP-PL-008P	CP-PL-055	0.1	98	4	III
BA-PL-042	CP-PL-057	0.46	95.9	3	III
BA-PL-043	CP-PL-056B	0.54	95.9	9	III
BA-PL-044	CP-PL-059	0.59	95.9	7	III
BA-PL-045	CP-PL-060	1.82	95.9	2	III
BA-PL-046	CP-PL-061	0.38	92.6	37	III
BA-PL-047	CP-PL-063	0.75	95.9	2	III
BA-PL-048	CP-PL-064	0.39	95.9	1	III
BA-PL-049	CP-PL-065	1.18	95.9	4	III
BA-PL-050	CP-PL-067	0.19	95.9	11	III
BA-PL-051	CP-PL-068	0.12	95.9	41	III
BA-PL-052	CP-PL-069	0.46	95.9	14	III
BA-PL-053	CP-PL-070	0.14	92.6	11	III
BA-PL-054	CP-PL-072	0.28	88.3	5	III
BA-PL-055	CP-PL-073	0.19	84.4	14	III
BA-PL-056	CP-PL-074	0.16	95.9	1	III
BA-PL-057	CP-PL-076	0.43	94.1	28	III
BA-PL-058	CP-PL-077	0.76	95.9	39	III
BA-PL-059	CP-PL-078	2.52	90.3	186	III
BA-PL-060	CP-PL-081	0.49	89.6	62	III
WP-PL-009P	CP-PL-082	0.24	98	4	III
BA-PL-061	CP-PL-083	13.95	88.8	350	III

* SCS curve numbers for Antecedent Moisture Condition III derived using relationships from (Ref. 5).

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Additional details pertaining to the estimation and assignment of sub-catchment modelling parameters are given in Appendix B.2.

1.4 WATER POND PARAMETERS

The various water ponds in the Letpadaung EX and PL SWM models were simulated using level pool routing methodology with two functional relationships that were developed for each water pond:

- Water pond outflow (discharge) as a function of water surface elevation (stage); in each instance, a functional relationship was calculated using the broad-crested weir equation with tabulated coefficients taken from (Ref. 6) and spillway dimensions which were either inferred from Google Earth satellite photography or assumed because as-built dimensions for the water ponds were not available at the time of this study.
- Water pond volume (storage) as a function water surface elevation (stage); in each instance, a functional relationship was developed using available topographic mapping with Rift TD software (Ref. 7).

The two functional relationships were tabulated and then graphed for all 15 of the water ponds in the Letpadaung EX and PL SWM models. The rating tables and the corresponding rating curves are given in Appendix B.3.

KP notes that when the simulations were performed, all ponds were assumed to be full to the assumed invert elevations of their corresponding spillways. Further, since the majority of the design inputs for the water ponds were assumed, pond attenuation results are indicative only.

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1.5 CHANNEL PARAMETERS

Runoff routing was performed in the Letpadaung EX and PL SWM HEC-HMS models using the Muskingum Cunge Method (Ref. 5). This method employs 8-point approximations of internal channel cross sections, typical Manning's hydraulic roughness (n) coefficients taken from (Ref. 8), average ground slopes, and channel lengths to estimate attenuation effects on the passing flood wave.

For the various natural channels (NC) in the EX and PL SWM models, typical cross section topography was extracted from available site topography and approximated using 8 points for each channel. For the man-made channels (DC), dimensions were either inferred from Google Earth satellite photography or assumed because as-built dimensions were not available at the time of this study. Tables and graphs of the

assumed 8-point cross sectional topography for all 102 channel reaches used in the EX and PL SWM models are given in Appendix B.4.

1.6 DESIGN STORMS

Two potential 100 year ARI design storms, one of long (48 hours) and one of short (6 hours) duration were estimated for use as hydrologic inputs to the EX and PL SWM models. The total storm depths of these two design storms were taken from the site Intensity / Duration / Frequency (IDF) curve, which was developed through usage of EasyFit 5.4 software (Ref. 9) for frequency analysis on historic annual rainfall maxima and subsequent application of the Rainfall Ratio Method, as discussed in (Ref. 10) to extrapolate results to durations both less than and greater than 24 hours. The total storm depths were then temporally distributed using the hyetograph patterns that were derived from historic data.

The results of these computations are tabulated and illustrated in Appendix B.5.

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2. REFERENCES

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Surface Water Existing (EX) Conditions: Estimation of loss parameters for modelling

The peak flow rate resulting from the selected design storm under existing conditions is estimated. The following methods were employed for this effort:

Runoff Estimation Method = SCS Curve Number
Time of Concentration Estimation Method = SCS Lag Method
Hydrograph Routing Method = SCS TR-20
Assumed Storm Hyetograph Distribution = Design Hyetographs

The soil class for the entire Letpadaung project site under existing conditions was assumed to be "C", loamy clay soil.

Catchments were then divided between either "Pasture - Fair" or "Brush - Good" as per Table 2.2c from *"Urban Hydrology for Small Watersheds"*. Where a catchment was composed of a mixture of the two cover types, the curve number was calculated using an area weighted average.

Cover Description:	Brush	Pasture
Soil Type:	C	C
Hydrologic condition:	Good	Fair
SCS CN for AMC II:	65	79

Basic catchment data was then compiled for use with the above methods:

Catchment ID	Catchment Reports to Point	Catchment Area (ha)	Catchment Composite SCS CN for Antecedent Moisture Condition (AMC)			Hydraulic Length (m)	Catchment Ave. Slope (m/m)	Antecedent Moisture Condition
			AMC I	AMC II	AMC III			
BA-EX-001	CP-EX-001	175.9166	61.2	79.0	89.6	3,170.0	0.006	III
BA-EX-002	CP-EX-003	44.2642	61.2	79.0	89.6	1,910.4	0.013	III
BA-EX-003	CP-EX-004	222.0805	60.2	78.3	89.2	4,885.0	0.003	III
BA-EX-004	CP-EX-005	90.6424	57.4	76.2	88.0	1,383.7	0.011	III
BA-EX-005	CP-EX-007	272.2658	61.2	79.0	89.6	4,416.4	0.007	III
WP-EX-001P	WP-EX-001	110.5155	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-006	CP-EX-010A	366.8125	61.2	79.0	89.6	2,452.5	0.005	III
BA-EX-007	CP-EX-010D	134.5052	61.2	79.0	89.6	790.6	0.028	III
BA-EX-008	CP-EX-010B	2,128.6787	59.3	77.6	88.8	7,685.5	0.007	III
BA-EX-009	CP-EX-010C	1,054.1859	56.4	75.5	87.6	8,204.5	0.022	III
BA-EX-010	CP-EX-011	451.2104	58.3	76.9	88.4	5,214.9	0.007	III
WP-EX-002P	WP-EX-002	5.5452	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-011	CP-EX-016A	33.2129	60.2	78.3	89.2	924.2	0.022	III
BA-EX-012	CP-EX-016D	10.8962	61.2	79.0	89.6	593.6	0.008	III
BA-EX-013	CP-EX-016B	409.4391	61.2	79.0	89.6	3,758.2	0.012	III
BA-EX-014	CP-EX-016C	415.7292	61.2	79.0	89.6	3,991.2	0.005	III
WP-EX-003P	WP-EX-003	2.4404	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-015	CP-EX-019	451.2576	59.3	77.6	88.8	4,931.1	0.017	III
BA-EX-016	CP-EX-020	199.0365	61.2	79.0	89.6	2,447.1	0.007	III
WP-EX-004P	WP-EX-004	0.6419	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-017	CP-EX-024	4.6547	61.2	79.0	89.6	333.0	0.011	III
BA-EX-018	CP-EX-025	11.8689	61.2	79.0	89.6	602.4	0.003	III
BA-EX-019	CP-EX-026	97.6495	59.3	77.6	88.8	2,601.5	0.011	III
WP-EX-005P	WP-EX-005	1.5380	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-020	CP-EX-029	65.8895	60.2	78.3	89.2	1,485.6	0.012	III
BA-EX-021	CP-EX-026	102.7839	61.2	79.0	89.6	2,635.6	0.012	III
BA-EX-022	CP-EX-025	89.8874	61.2	79.0	89.6	2,654.4	0.008	III
BA-EX-023	CP-EX-031	128.2843	60.2	78.3	89.2	2,618.3	0.010	III
BA-EX-024	CP-EX-031	270.5781	56.4	75.5	87.6	3,381.9	0.008	III
BA-EX-025	CP-EX-031	36.3773	56.4	75.5	87.6	1,774.1	0.134	III
BA-EX-026	CP-EX-032	281.5133	61.2	79.0	89.6	3,262.0	0.006	III
BA-EX-027	CP-EX-033	243.5105	59.3	77.6	88.8	2,262.5	0.062	III
BA-EX-028	CP-EX-035	137.3354	58.3	76.9	88.4	3,309.2	0.060	III
BA-EX-029	CP-EX-035	84.7190	57.4	76.2	88.0	2,271.2	0.100	III
BA-EX-030	CP-EX-036	203.3458	57.4	76.2	88.0	1,811.3	0.108	III

Surface Water Existing (EX) Conditions: Estimation of loss parameters for modelling

BA-EX-031	CP-EX-037	39.3618	61.2	79.0	89.6	451.7	0.001	III
BA-EX-032	CP-EX-039	178.1041	57.4	76.2	88.0	1,928.2	0.131	III
BA-EX-033	CP-EX-044	69.1503	61.2	79.0	89.6	804.0	0.001	III
BA-EX-034	CP-EX-043	87.3353	59.3	77.6	88.8	1,394.0	0.062	III
BA-EX-035	CP-EX-045	263.7901	47.7	68.5	83.3	3,151.5	0.064	III
BA-EX-036	CP-EX-046	78.5387	55.5	74.8	87.2	1,362.1	0.170	III
BA-EX-037	CP-EX-047	259.8394	57.4	76.2	88.0	3,108.1	0.008	III
BA-EX-038	CP-EX-048	244.9021	61.2	79.0	89.6	3,341.9	0.005	III
BA-EX-039	CP-EX-051	45.4595	61.2	79.0	89.6	1,234.9	0.009	III
WP-EX-006P	WP-EX-006	23.6015	95.4	98.0	98.0	#N/A	#N/A	III
BA-EX-040	CP-EX-053	1,395.4265	57.4	76.2	88.0	9,194.3	0.009	III

The following equations are used to estimate the Time of Concentration expected for each given catchment (SCS Lag Method):

$T_c = T_L / 0.6$ $\quad T_L = ((L^{0.8}) \cdot ((S+1)^{0.7})) / (1{,}900 \cdot (Y^{0.5}))$ $\quad S = (1{,}000 / CN) - 10$

where:

T_c = time of concentration (hr);
T_L = lag time (hr);
L = hydraulic length of watershed (ft);
S = maximum soil water retention (in) - note this is taken at AMC II conditions;
CN = area-weighted SCS curve number (at AMC II conditions); and
Y = average catchment slope (%).

Catchment times of concentration are estimated as:

Catchment ID	Catchment Reports to Point	Hyd. Length L (ft)	AMC II CN	Max Ret. S (in)	Ave. Slope Y (%)	Lag Time T_L (h)	Time of Concentration T_c (h)	Time of Concentration T_c (min)
BA-EX-001	CP-EX-001	10,400	79.0	2.7	0.6	2.69	4.5	268.6
BA-EX-002	CP-EX-003	6,268	79.0	2.7	1.3	1.24	2.1	124.4
BA-EX-003	CP-EX-004	16,027	78.3	2.8	0.3	5.56	9.3	556.0
BA-EX-004	CP-EX-005	4,540	76.2	3.1	1.1	1.15	1.9	114.8
BA-EX-005	CP-EX-007	14,490	79.0	2.7	0.7	3.38	5.6	337.6
WP-EX-001P	WP-EX-001	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-006	CP-EX-010A	8,046	79.0	2.7	0.5	2.48	4.1	248.4
BA-EX-007	CP-EX-010D	2,594	79.0	2.7	2.8	0.42	0.7	42.1
BA-EX-008	CP-EX-010B	25,215	77.6	2.9	0.7	5.50	9.2	549.7
BA-EX-009	CP-EX-010C	26,918	75.5	3.2	2.2	3.40	5.7	340.2
BA-EX-010	CP-EX-011	17,109	76.9	3.0	0.7	4.02	6.7	401.9
WP-EX-002P	WP-EX-002	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-011	CP-EX-016A	3,032	78.3	2.8	2.2	0.55	0.9	55.3
BA-EX-012	CP-EX-016D	1,948	79.0	2.7	0.8	0.61	1.0	60.9
BA-EX-013	CP-EX-016B	12,330	79.0	2.7	1.2	2.23	3.7	223.5
BA-EX-014	CP-EX-016C	13,094	79.0	2.7	0.5	3.54	5.9	353.7
WP-EX-003P	WP-EX-003	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-015	CP-EX-019	16,178	77.6	2.9	1.7	2.44	4.1	244.4
BA-EX-016	CP-EX-020	8,028	79.0	2.7	0.7	2.08	3.5	208.1
WP-EX-004P	WP-EX-004	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-017	CP-EX-024	1,092	79.0	2.7	1.1	0.34	0.6	34.3
BA-EX-018	CP-EX-025	1,976	79.0	2.7	0.3	0.98	1.6	98.1
BA-EX-019	CP-EX-026	8,535	77.6	2.9	1.1	1.80	3.0	180.0
WP-EX-005P	WP-EX-005	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-020	CP-EX-029	4,874	78.3	2.8	1.2	1.08	1.8	108.0
BA-EX-021	CP-EX-026	8,647	79.0	2.7	1.2	1.68	2.8	168.4
BA-EX-022	CP-EX-025	8,709	79.0	2.7	0.8	2.07	3.5	207.2
BA-EX-023	CP-EX-031	8,590	78.3	2.8	1.0	1.91	3.2	191.4
BA-EX-024	CP-EX-031	11,096	75.5	3.2	0.8	2.84	4.7	284.4
BA-EX-025	CP-EX-031	5,821	75.5	3.2	13.4	0.41	0.7	40.7

Surface Water Existing (EX) Conditions: Estimation of loss parameters for modelling

BA-EX-026	CP-EX-032	10,702	79.0	2.7	0.6	2.94	4.9	293.9
BA-EX-027	CP-EX-033	7,423	77.6	2.9	6.2	0.68	1.1	68.3
BA-EX-028	CP-EX-035	10,857	76.9	3.0	6.0	0.96	1.6	95.9
BA-EX-029	CP-EX-035	7,451	76.2	3.1	10.0	0.56	0.9	56.3
BA-EX-030	CP-EX-036	5,942	76.2	3.1	10.8	0.45	0.8	45.2
BA-EX-031	CP-EX-037	1,482	79.0	2.7	0.1	1.42	2.4	142.0
BA-EX-032	CP-EX-039	6,326	76.2	3.1	13.1	0.43	0.7	43.1
BA-EX-033	CP-EX-044	2,638	79.0	2.7	0.1	2.25	3.8	225.2
BA-EX-034	CP-EX-043	4,573	77.6	2.9	6.2	0.46	0.8	46.5
BA-EX-035	CP-EX-045	10,340	68.5	4.6	6.4	1.13	1.9	112.7
BA-EX-036	CP-EX-046	4,469	74.8	3.4	17.0	0.30	0.5	29.9
BA-EX-037	CP-EX-047	10,197	76.2	3.1	0.8	2.58	4.3	258.3
BA-EX-038	CP-EX-048	10,964	79.0	2.7	0.5	3.17	5.3	316.8
BA-EX-039	CP-EX-051	4,051	79.0	2.7	0.9	1.04	1.7	104.0
WP-EX-006P	WP-EX-006	#N/A	98.0	0.2	#N/A	0.06	0.1	6.0
BA-EX-040	CP-EX-053	30,165	76.2	3.1	0.9	5.83	9.7	583.1

(Note: a minimum 6 minute time of concentration was assumed for all water pool areas: WP-EX-001P, WP-EX-002P, etc.)

With the sub-catchment times of concentration estimated, a hydrologic model for the study area was prepared. HEC-HMS software was used for this effort and the following additional assumptions were made:

Antecedent Moisture Condition = AMC III

Design Storms = 100-yr, 6-h
100-yr, 48-h

Surface Water Planned (PL) Conditions: Estimation of loss parameters for modelling

The peak flow rate resulting from the selected design storm under planned conditions is estimated. The following methods were employed for this effort:

Runoff Estimation Method = SCS Curve Number
Time of Concentration Estimation Method = SCS Lag Method
Hydrograph Routing Method = SCS TR-20
Assumed Storm Hyetograph Distribution = Design Hyetographs

The soil class for the entire Letpadaung project site, under planned conditions was assumed to be "C", loamy clay soil.

Catchments were then divided between either "Pasture - Fair" or "Brush - Good" as per Table 2.2c from *"Urban Hydrology for Small Watersheds"*. Where a catchment was composed of a mixture of the two cover types, the curve number was calculated using an area weighted average.

Cover Description:	Natural Vegetation	Farmland	Developed Areas	Leach Pad	Water Pond
Cover Description:	Brush	Pasture	Newly graded areas (no vegetation)	Newly graded areas (no vegetation)	N/A
Soil Type:	C	C	C	A	N/A
Hydrologic condition:	Good	Fair	N/A	N/A	N/A
SCS CN for AMC II:	65	79	91	77	98

Basic catchment data was then compiled for use with the above methods:

Catchment ID	Catchment Reports to Point	Catchment Area (ha)	Catchment Composite SCS CN for Antecedent Moisture Condition (AMC)			Hydraulic Length (m)	Catchment Ave. Slope (m/m)	Antecedent Moisture Condition
			AMC I	AMC II	AMC III			
BA-PL-001	CP-PL-001	175.9166	61.2	79.0	89.6	3,170.0	0.006	III
BA-PL-002	CP-PL-003	44.2642	61.2	79.0	89.6	1,910.4	0.013	III
BA-PL-003	CP-PL-004	222.0805	60.2	78.3	89.2	4,885.0	0.003	III
BA-PL-004	CP-PL-005	90.6424	57.4	76.2	88.0	1,383.7	0.011	III
BA-PL-005	CP-PL-007	272.2658	61.2	79.0	89.6	4,416.4	0.007	III
WP-PL-001P	CP-PL-009	110.5155	95.4	98.0	98.0	N/A	N/A	III
BA-PL-006	CP-PL-010A	366.8125	61.2	79.0	89.6	2,452.5	0.005	III
BA-PL-007	CP-PL-010D	134.5052	61.2	79.0	89.6	790.6	0.028	III
BA-PL-008	CP-PL-010B	2,128.6787	59.3	77.6	88.8	7,685.5	0.007	III
BA-PL-009	CP-PL-010C	1,054.1859	56.4	75.5	87.6	8,204.5	0.022	III
BA-PL-010	CP-PL-013	447.6518	60.0	78.1	89.1	4,119.4	0.009	III
WP-PL-002P	CP-PL-015	5.5452	95.4	98.0	98.0	N/A	N/A	III
BA-PL-011	CP-PL-016A	33.2129	60.2	78.3	89.2	924.2	0.022	III
BA-PL-012	CP-PL-016C	8.4539	61.2	79.0	89.6	367.3	0.004	III
BA-PL-013	CP-PL-017	145.4770	58.3	76.9	88.4	2,383.1	0.015	III
BA-PL-014	CP-PL-018	201.2272	59.3	77.6	88.8	2,693.1	0.014	III
BA-PL-015	CP-PL-018	39.7289	61.2	79.0	89.6	1,370.2	0.013	III
BA-PL-016	CP-PL-020	65.5815	61.2	79.0	89.6	2,434.1	0.004	III
WP-PL-003P	CP-PL-021	0.6419	95.4	98.0	98.0	N/A	N/A	III
BA-PL-017	CP-PL-022	2.1624	61.2	79.0	89.6	284.5	0.011	III
BA-PL-018	CP-PL-020	2.8674	61.2	79.0	89.6	69.0	0.005	III
BA-PL-019	CP-PL-023	15.6214	61.2	79.0	89.6	71.7	0.005	III
BA-PL-020	CP-PL-024	9.5835	61.2	79.0	89.6	77.6	0.005	III
BA-PL-021	CP-PL-026	3.0936	80.9	91.0	95.9	30.0	0.005	III
BA-PL-022	CP-PL-027	7.1155	80.9	91.0	95.9	70.0	0.005	III
BA-PL-023	CP-PL-028	9.2567	80.9	91.0	95.9	70.0	0.005	III
BA-PL-024	CP-PL-030	21.7268	61.2	79.0	89.6	641.5	0.016	III
BA-PL-025	CP-PL-031	79.9501	60.2	78.3	89.2	450.7	0.010	III
BA-PL-026	CP-PL-032	166.0356	63.9	80.8	90.6	1,352.5	0.010	III
WP-PL-004P	CP-PL-034	2.4404	95.4	98.0	98.0	N/A	N/A	III
BA-PL-027	CP-PL-035	451.2576	59.3	77.6	88.8	4,931.1	0.017	III
BA-PL-028	CP-PL-030	9.5861	61.2	79.0	89.6	557.1	0.025	III
BA-PL-029	CP-PL-030	43.7933	60.2	78.3	89.2	1,392.2	0.032	III

Surface Water Planned (PL) Conditions: Estimation of loss parameters for modelling

BA-PL-030	CP-PL-038	105.8290	60.2	78.3	89.2	1,737.2	0.008	III
BA-PL-031	CP-PL-025	17.2394	65.7	82.0	91.3	153.2	0.005	III
WP-PL-005/006P	CP-PL-040	146.0679	95.4	98.0	98.0	N/A	N/A	III
WP-PL-007P	CP-PL-042B	71.6789	95.4	98.0	98.0	N/A	N/A	III
BA-PL-032	CP-PL-042A	63.1434	80.9	91.0	95.9	1,498.4	0.002	III
BA-PL-033	CP-PL-044	438.0285	58.4	77.0	88.5	795.2	0.106	III
BA-PL-034	CP-PL-045	442.8296	58.4	77.0	88.5	818.8	0.103	III
BA-PL-035	CP-PL-042C	49.3441	80.9	91.0	95.9	1,014.7	0.004	III
BA-PL-036	CP-PL-046	78.3403	80.9	91.0	95.9	1,145.3	0.111	III
BA-PL-037	CP-PL-048	62.3393	80.9	91.0	95.9	511.9	0.235	III
BA-PL-038	CP-PL-049	82.0277	59.8	78.0	89.1	1,573.8	0.123	III
BA-PL-039	CP-PL-051	49.5972	69.6	84.5	92.6	1,167.8	0.158	III
BA-PL-040	CP-PL-052	11.6139	52.9	72.8	86.0	738.2	0.233	III
BA-PL-041	CP-PL-058	107.6777	71.7	85.8	93.3	625.3	0.334	III
WP-PL-008P	CP-PL-055	10.0232	95.4	98.0	98.0	N/A	N/A	III
BA-PL-042	CP-PL-057	45.8602	80.9	91.0	95.9	308.0	0.227	III
BA-PL-043	CP-PL-056B	54.2571	80.9	91.0	95.9	1,004.9	0.144	III
BA-PL-044	CP-PL-059	59.3838	80.9	91.0	95.9	634.2	0.118	III
BA-PL-045	CP-PL-060	182.3637	80.9	91.0	95.9	240.2	0.283	III
BA-PL-046	CP-PL-061	37.7778	69.6	84.5	92.6	1,741.3	0.032	III
BA-PL-047	CP-PL-063	75.1868	80.9	91.0	95.9	358.8	0.421	III
BA-PL-048	CP-PL-064	38.6927	80.9	91.0	95.9	159.2	0.459	III
BA-PL-049	CP-PL-065	17.7913	80.9	91.0	95.9	46.3	0.005	III
BA-PL-050	CP-PL-067	19.1014	80.9	91.0	95.9	153.8	0.005	III
BA-PL-051	CP-PL-068	11.5504	80.9	91.0	95.9	844.0	0.005	III
BA-PL-052	CP-PL-069	46.0531	80.9	91.0	95.9	841.1	0.045	III
BA-PL-053	CP-PL-070	13.7832	69.6	84.5	92.6	719.9	0.090	III
BA-PL-054	CP-PL-072	28.0652	58.0	76.7	88.3	433.4	0.300	III
BA-PL-055	CP-PL-073	18.6877	49.7	70.2	84.4	890.6	0.184	III
BA-PL-056	CP-PL-074	16.1208	80.9	91.0	95.9	74.3	0.605	III
BA-PL-057	CP-PL-076	43.3901	74.4	87.4	94.1	975.2	0.017	III
BA-PL-058	CP-PL-077	76.4254	80.9	91.0	95.9	1,249.8	0.010	III
BA-PL-059	CP-PL-078	251.7544	63.0	80.2	90.3	3,341.9	0.005	III
BA-PL-060	CP-PL-081	48.9104	61.2	79.0	89.6	1,234.9	0.009	III
WP-PL-009P	CP-PL-082	23.6015	95.4	98.0	98.0	N/A	N/A	III
BA-PL-061	CP-PL-083	1,395.4265	57.4	76.2	88.0	9,194.3	0.009	III

The following equations are used to estimate the Time of Concentration expected for each given catchment (SCS Lag Method):

$T_c = T_L / 0.6$ $\quad T_L = ((L^{0.8}) \cdot ((S+1)^{0.7})) / (1{,}900 \cdot (Y^{0.5}))$ $\quad S = (1{,}000 / CN) - 10$

where:

T_c = time of concentration (hr);
T_L = lag time (hr);
L = hydraulic length of watershed (ft);
S = maximum soil water retention (in) - note this is taken at AMC II conditions;
CN = area-weighted SCS curve number (at AMC II conditions); and
Y = average catchment slope (%).

Catchment times of concentration are estimated as:

Catchment ID	Catchment Reports to Point	Hyd. Length L (ft)	AMC II CN	Max Ret. S (in)	Ave. Slope Y (%)	Lag Time T_L (hr)	Time of Concentration T_c (hr)	Time of Concentration T_c (min)
BA-PL-001	CP-PL-001	10,400	79.0	2.7	0.6	2.69	4.5	268.6
BA-PL-002	CP-PL-003	6,268	79.0	2.7	1.3	1.24	2.1	124.4
BA-PL-003	CP-PL-004	16,027	78.3	2.8	0.3	5.56	9.3	556.0
BA-PL-004	CP-PL-005	4,540	76.2	3.1	1.1	1.15	1.9	114.8
BA-PL-005	CP-PL-007	14,490	79.0	2.7	0.7	3.38	5.6	337.6

Surface Water Planned (PL) Conditions: Estimation of loss parameters for modelling

WP-PL-001P	CP-PL-009	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-006	CP-PL-010A	8,046	79.0	2.7	0.5	2.48	4.1	248.4
BA-PL-007	CP-PL-010D	2,594	79.0	2.7	2.8	0.42	0.7	42.1
BA-PL-008	CP-PL-010B	25,215	77.6	2.9	0.7	5.50	9.2	549.7
BA-PL-009	CP-PL-010C	26,918	75.5	3.2	2.2	3.40	5.7	340.2
BA-PL-010	CP-PL-013	13,515	78.1	2.8	0.9	2.78	4.6	277.9
WP-PL-002P	CP-PL-015	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-011	CP-PL-016A	3,032	78.3	2.8	2.2	0.55	0.9	55.3
BA-PL-012	CP-PL-016C	1,205	79.0	2.7	0.4	0.60	1.0	59.5
BA-PL-013	CP-PL-017	7,818	76.9	3.0	1.5	1.49	2.5	149.3
BA-PL-014	CP-PL-018	8,836	77.6	2.9	1.4	1.66	2.8	165.6
BA-PL-015	CP-PL-018	4,496	79.0	2.7	1.3	0.97	1.6	96.5
BA-PL-016	CP-PL-020	7,986	79.0	2.7	0.4	2.70	4.5	269.5
WP-PL-003P	CP-PL-021	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-017	CP-PL-022	933	79.0	2.7	1.1	0.30	0.5	30.2
BA-PL-018	CP-PL-020	226	79.0	2.7	0.5	0.14	0.2	14.1
BA-PL-019	CP-PL-023	235	79.0	2.7	0.5	0.15	0.2	14.6
BA-PL-020	CP-PL-024	255	79.0	2.7	0.5	0.16	0.3	15.5
BA-PL-021	CP-PL-026	98	91.0	1.0	0.5	0.05	0.1	6.0
BA-PL-022	CP-PL-027	230	91.0	1.0	0.5	0.09	0.2	9.3
BA-PL-023	CP-PL-028	230	91.0	1.0	0.5	0.09	0.2	9.3
BA-PL-024	CP-PL-030	2,105	79.0	2.7	1.6	0.46	0.8	46.5
BA-PL-025	CP-PL-031	1,479	78.3	2.8	1.0	0.46	0.8	45.8
BA-PL-026	CP-PL-032	4,437	80.8	2.4	1.0	1.04	1.7	104.1
WP-PL-004P	CP-PL-034	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-027	CP-PL-035	16,178	77.6	2.9	1.7	2.46	4.1	245.8
BA-PL-028	CP-PL-030	1,828	79.0	2.7	2.5	0.33	0.6	33.5
BA-PL-029	CP-PL-030	4,568	78.3	2.8	3.2	0.63	1.1	63.5
BA-PL-030	CP-PL-038	5,700	78.3	2.8	0.8	1.46	2.4	146.2
BA-PL-031	CP-PL-025	503	82.0	2.2	0.5	0.24	0.4	24.3
WP-PL-005/006P	CP-PL-040	N/A	98.0	0.2	N/A	0.06	0.1	6.0
WP-PL-007P	CP-PL-042B	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-032	CP-PL-042A	4,916	91.0	1.0	0.2	1.71	2.8	170.9
BA-PL-033	CP-PL-044	2,609	77.0	3.0	10.6	0.23	0.4	23.1
BA-PL-034	CP-PL-045	2,686	77.0	3.0	10.3	0.24	0.4	24.0
BA-PL-035	CP-PL-042C	3,329	91.0	1.0	0.4	0.89	1.5	89.2
BA-PL-036	CP-PL-046	3,758	91.0	1.0	11.1	0.19	0.3	18.5
BA-PL-037	CP-PL-048	1,680	91.0	1.0	23.5	0.07	0.1	6.7
BA-PL-038	CP-PL-049	5,163	78.0	2.8	12.3	0.36	0.6	35.9
BA-PL-039	CP-PL-051	3,831	84.5	1.8	15.8	0.20	0.3	20.2
BA-PL-040	CP-PL-052	2,422	72.8	3.7	23.3	0.17	0.3	16.5
BA-PL-041	CP-PL-058	2,052	85.8	1.7	33.4	0.08	0.1	8.0
WP-PL-008P	CP-PL-055	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-042	CP-PL-057	1,011	91.0	1.0	22.7	0.05	0.1	6.0
BA-PL-043	CP-PL-056B	3,297	91.0	1.0	14.4	0.15	0.2	14.6
BA-PL-044	CP-PL-059	2,081	91.0	1.0	11.8	0.11	0.2	11.2
BA-PL-045	CP-PL-060	788	91.0	1.0	28.3	0.03	0.1	6.0
BA-PL-046	CP-PL-061	5,713	84.5	1.8	3.2	0.62	1.0	62.2
BA-PL-047	CP-PL-063	1,177	91.0	1.0	42.1	0.04	0.1	6.0
BA-PL-048	CP-PL-064	522	91.0	1.0	45.9	0.02	0.1	6.0
BA-PL-049	CP-PL-065	152	91.0	1.0	0.5	0.07	0.1	6.7
BA-PL-050	CP-PL-067	505	91.0	1.0	0.5	0.18	0.3	17.5
BA-PL-051	CP-PL-068	2,769	91.0	1.0	0.5	0.68	1.1	68.3
BA-PL-052	CP-PL-069	2,760	91.0	1.0	4.5	0.23	0.4	22.8
BA-PL-053	CP-PL-070	2,362	84.5	1.8	9.0	0.18	0.3	18.2
BA-PL-054	CP-PL-072	1,422	76.7	3.0	30.0	0.08	0.1	8.5
BA-PL-055	CP-PL-073	2,922	70.2	4.2	18.4	0.23	0.4	23.2

Surface Water Planned (PL) Conditions: Estimation of loss parameters for modelling

BA-PL-056	CP-PL-074	244	91.0	1.0	60.5	0.01	0.1	6.0
BA-PL-057	CP-PL-076	3,199	87.4	1.4	1.7	0.47	0.8	47.4
BA-PL-058	CP-PL-077	4,100	91.0	1.0	1.0	0.65	1.1	64.9
BA-PL-059	CP-PL-078	10,964	80.2	2.5	0.5	3.10	5.2	309.9
BA-PL-060	CP-PL-081	4,051	79.0	2.7	0.9	1.04	1.7	104.0
WP-PL-009P	CP-PL-082	N/A	98.0	0.2	N/A	0.06	0.1	6.0
BA-PL-061	CP-PL-083	30,165	76.2	3.1	0.9	5.83	9.7	583.1

(Note: a minimum 6 minute time of concentration was assumed for all water pool areas: WP-PL-001P, WP-PL-002P, etc.)

With the sub-catchment times of concentration estimated, a hydrologic model for the study area was prepared. HEC-HMS software was used for this effort and the following additional assumptions were made:

Antecedent Moisture Condition = AMC III

Design Storms = 100-yr, 6-h
100-yr, 48-h

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
103.0	0	0	#N/A	0.0	#N/A	#N/A	0.0
103.1	18,844	1,677	#N/A	0.0	#N/A	#N/A	0.0
103.2	22,962	3,768	#N/A	0.0	#N/A	#N/A	0.0
103.3	27,042	6,268	#N/A	0.0	#N/A	#N/A	0.0
103.4	31,085	9,175	#N/A	0.0	#N/A	#N/A	0.0
103.5	35,091	12,484	#N/A	0.0	#N/A	#N/A	0.0
103.6	39,058	16,192	#N/A	0.0	#N/A	#N/A	0.0
103.7	42,989	20,294	#N/A	0.0	#N/A	#N/A	0.0
103.8	46,881	24,788	#N/A	0.0	#N/A	#N/A	0.0
103.9	50,736	29,669	#N/A	0.0	#N/A	#N/A	0.0
104.0	54,519	34,933	#N/A	0.0	#N/A	#N/A	0.0
104.1	67,628	41,464	#N/A	0.0	#N/A	#N/A	0.0
104.2	72,442	48,466	#N/A	0.0	#N/A	#N/A	0.0
104.3	77,476	55,960	#N/A	0.0	#N/A	#N/A	0.0
104.4	82,718	63,968	#N/A	0.0	#N/A	#N/A	0.0
104.5	88,160	72,510	#N/A	0.0	#N/A	#N/A	0.0
104.6	93,801	81,607	#N/A	0.0	#N/A	#N/A	0.0
104.7	99,642	91,277	#N/A	0.0	#N/A	#N/A	0.0
104.8	105,683	101,542	#N/A	0.0	#N/A	#N/A	0.0
104.9	111,923	112,420	#N/A	0.0	#N/A	#N/A	0.0
105.0	118,368	123,933	#N/A	0.0	#N/A	#N/A	0.0
105.1	133,673	136,908	#N/A	0.0	#N/A	#N/A	0.0
105.2	141,633	150,673	#N/A	0.0	#N/A	#N/A	0.0
105.3	149,738	165,240	#N/A	0.0	#N/A	#N/A	0.0
105.4	157,989	180,625	#N/A	0.0	#N/A	#N/A	0.0
105.5	166,385	196,843	#N/A	0.0	#N/A	#N/A	0.0
105.6	174,927	213,907	#N/A	0.0	#N/A	#N/A	0.0
105.7	183,623	231,833	#N/A	0.0	#N/A	#N/A	0.0
105.8	192,478	250,637	#N/A	0.0	#N/A	#N/A	0.0
105.9	201,494	270,334	#N/A	0.0	#N/A	#N/A	0.0
106.0	210,670	290,941	#N/A	0.0	#N/A	#N/A	0.0
106.1	219,765	312,487	#N/A	0.0	#N/A	#N/A	0.0
106.2	228,409	334,895	#N/A	0.0	#N/A	#N/A	0.0
106.3	237,095	358,170	#N/A	0.0	#N/A	#N/A	0.0
106.4	245,823	382,316	#N/A	0.0	#N/A	#N/A	0.0
106.5	254,597	407,336	#N/A	0.0	#N/A	#N/A	0.0
106.6	263,423	433,237	#N/A	0.0	#N/A	#N/A	0.0
106.7	272,300	460,023	#N/A	0.0	#N/A	#N/A	0.0
106.8	281,230	487,699	#N/A	0.0	#N/A	#N/A	0.0
106.9	290,211	516,270	#N/A	0.0	#N/A	#N/A	0.0
107.0	299,243	545,743	#N/A	0.0	#N/A	#N/A	0.0
107.1	308,849	576,160	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
107.2	318,267	607,515	#N/A	0.0	#N/A	#N/A	0.0
107.3	327,766	639,816	#N/A	0.0	#N/A	#N/A	0.0
107.4	337,348	673,071	#N/A	0.0	#N/A	#N/A	0.0
107.5	347,011	707,288	#N/A	0.0	#N/A	#N/A	0.0
107.6	356,752	742,476	#N/A	0.0	#N/A	#N/A	0.0
107.7	366,572	778,641	#N/A	0.0	#N/A	#N/A	0.0
107.8	376,470	815,793	#N/A	0.0	#N/A	#N/A	0.0
107.9	386,446	853,938	#N/A	0.0	#N/A	#N/A	0.0
108.0	396,500	893,085	#N/A	0.0	#N/A	#N/A	0.0
108.1	416,267	934,313	#N/A	0.0	#N/A	#N/A	0.0
108.2	424,227	976,338	#N/A	0.0	#N/A	#N/A	0.0
108.3	432,184	1,019,159	#N/A	0.0	#N/A	#N/A	0.0
108.4	440,134	1,062,775	#N/A	0.0	#N/A	#N/A	0.0
108.5	448,078	1,107,185	#N/A	0.0	#N/A	#N/A	0.0
108.6	456,016	1,152,390	#N/A	0.0	#N/A	#N/A	0.0
108.7	463,948	1,198,388	#N/A	0.0	#N/A	#N/A	0.0
108.8	471,874	1,245,179	#N/A	0.0	#N/A	#N/A	0.0
108.9	479,795	1,292,763	#N/A	0.0	#N/A	#N/A	0.0
109.0	487,711	1,341,138	#N/A	0.0	#N/A	#N/A	0.0
109.1	499,121	1,390,644	#N/A	0.0	#N/A	#N/A	0.0
109.2	507,216	1,440,961	#N/A	0.0	#N/A	#N/A	0.0
109.3	515,268	1,492,085	#N/A	0.0	#N/A	#N/A	0.0
109.4	523,277	1,544,013	#N/A	0.0	#N/A	#N/A	0.0
109.5	531,243	1,596,739	#N/A	0.0	#N/A	#N/A	0.0
109.6	539,165	1,650,260	#N/A	0.0	#N/A	#N/A	0.0
109.7	547,045	1,704,571	#N/A	0.0	#N/A	#N/A	0.0
109.8	554,882	1,759,668	#N/A	0.0	#N/A	#N/A	0.0
109.9	562,677	1,815,546	#N/A	0.0	#N/A	#N/A	0.0
110.0	570,430	1,872,202	#N/A	0.0	#N/A	#N/A	0.0
110.1	579,682	1,929,725	#N/A	0.0	#N/A	#N/A	0.0
110.2	588,947	1,988,153	#N/A	0.0	#N/A	#N/A	0.0
110.3	598,641	2,047,528	#N/A	0.0	#N/A	#N/A	0.0
110.4	608,766	2,107,895	#N/A	0.0	#N/A	#N/A	0.0
110.5	619,321	2,169,296	#N/A	0.0	#N/A	#N/A	0.0
110.6	630,300	2,231,773	#N/A	0.0	#N/A	#N/A	0.0
110.7	641,699	2,295,370	#N/A	0.0	#N/A	#N/A	0.0
110.8	653,517	2,360,127	#N/A	0.0	#N/A	#N/A	0.0
110.9	665,754	2,426,087	#N/A	0.0	#N/A	#N/A	0.0
111.0	678,439	2,493,293	#N/A	0.0	#N/A	#N/A	0.0
111.1	700,936	2,562,582	#N/A	0.0	#N/A	#N/A	0.0
111.2	716,957	2,633,477	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
111.3	732,889	2,705,970	#N/A	0.0	#N/A	#N/A	0.0
111.4	748,733	2,780,052	#N/A	0.0	#N/A	#N/A	0.0
111.5	764,490	2,855,714	#N/A	0.0	#N/A	#N/A	0.0
111.6	780,161	2,932,947	#N/A	0.0	#N/A	#N/A	0.0
111.7	795,751	3,011,743	#N/A	0.0	#N/A	#N/A	0.0
111.8	811,261	3,092,095	#N/A	0.0	#N/A	#N/A	0.0
111.9	826,692	3,173,993	#N/A	0.0	#N/A	#N/A	0.0
112.0	842,047	3,257,431	#N/A	0.0	#N/A	#N/A	0.0
112.1	866,642	3,343,247	#N/A	0.0	#N/A	#N/A	0.0
112.2	883,641	3,430,760	#N/A	0.0	#N/A	#N/A	0.0
112.3	900,682	3,519,976	#N/A	0.0	#N/A	#N/A	0.0
112.4	917,754	3,610,898	#N/A	0.0	#N/A	#N/A	0.0
112.5	934,856	3,703,528	#N/A	0.0	#N/A	#N/A	0.0
112.6	951,988	3,797,870	#N/A	0.0	#N/A	#N/A	0.0
112.7	969,163	3,893,927	#N/A	0.0	#N/A	#N/A	0.0
112.8	986,394	3,991,704	#N/A	0.0	#N/A	#N/A	0.0
112.9	1,003,681	4,091,208	#N/A	0.0	#N/A	#N/A	0.0
113.0	1,021,024	4,192,443	#N/A	0.0	#N/A	#N/A	0.0
113.1	1,043,183	4,295,805	#N/A	0.0	#N/A	#N/A	0.0
113.2	1,061,974	4,401,066	#N/A	0.0	#N/A	#N/A	0.0
113.3	1,080,373	4,508,187	#N/A	0.0	#N/A	#N/A	0.0
113.4	1,098,472	4,617,130	#N/A	0.0	#N/A	#N/A	0.0
113.5	1,116,472	4,727,878	#N/A	0.0	#N/A	#N/A	0.0
113.6	1,134,379	4,840,421	#N/A	0.0	#N/A	#N/A	0.0
113.7	1,151,985	4,954,743	#N/A	0.0	#N/A	#N/A	0.0
113.8	1,169,344	5,070,811	#N/A	0.0	#N/A	#N/A	0.0
113.9	1,186,501	5,188,605	#N/A	0.0	#N/A	#N/A	0.0
114.0	1,203,688	5,308,110	#N/A	0.0	#N/A	#N/A	0.0
114.1	1,234,448	5,430,671	#N/A	0.0	#N/A	#N/A	0.0
114.2	1,252,103	5,554,999	#N/A	0.0	#N/A	#N/A	0.0
114.3	1,269,744	5,681,091	#N/A	0.0	#N/A	#N/A	0.0
114.4	1,287,367	5,808,947	#N/A	0.0	#N/A	#N/A	0.0
114.5	1,304,966	5,938,564	#N/A	0.0	#N/A	#N/A	0.0
114.6	1,322,507	6,069,938	#N/A	0.0	#N/A	#N/A	0.0
114.7	1,339,959	6,203,063	#N/A	0.0	#N/A	#N/A	0.0
114.8	1,357,316	6,337,926	#N/A	0.0	#N/A	#N/A	0.0
114.9	1,374,695	6,474,527	#N/A	0.0	#N/A	#N/A	0.0
115.0	1,392,101	6,612,866	#N/A	0.0	#N/A	#N/A	0.0
115.1	1,448,887	6,756,472	#N/A	0.0	#N/A	#N/A	0.0
115.2	1,474,672	6,902,649	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
115.3	1,500,607	7,051,411	#N/A	0.0	#N/A	#N/A	0.0
115.4	1,526,692	7,202,775	#N/A	0.0	#N/A	#N/A	0.0
115.5	1,552,931	7,356,755	#N/A	0.0	#N/A	#N/A	0.0
115.6	1,579,327	7,513,366	#N/A	0.0	#N/A	#N/A	0.0
115.7	1,605,879	7,672,625	#N/A	0.0	#N/A	#N/A	0.0
115.8	1,632,591	7,834,548	#N/A	0.0	#N/A	#N/A	0.0
115.9	1,659,468	7,999,149	#N/A	0.0	#N/A	#N/A	0.0
116.0	1,686,516	8,166,447	#N/A	0.0	#N/A	#N/A	0.0
116.1	1,725,666	8,337,505	1.490	0.2	#N/A	#N/A	0.2
116.2	1,755,791	8,511,578	1.490	0.7	#N/A	#N/A	0.7
116.3	1,785,869	8,688,662	1.450	1.2	#N/A	#N/A	1.2
116.4	1,815,891	8,868,750	1.460	1.8	#N/A	#N/A	1.8
116.5	1,845,839	9,051,837	1.450	2.6	#N/A	#N/A	2.6
116.6	1,875,711	9,237,916	1.450	3.4	#N/A	#N/A	3.4
116.7	1,905,508	9,426,977	1.450	4.2	#N/A	#N/A	4.2
116.8	1,935,229	9,619,015	1.450	5.2	#N/A	#N/A	5.2
116.9	1,964,845	9,814,020	1.450	6.2	#N/A	#N/A	6.2
117.0	1,994,242	10,011,976	1.450	7.3	#N/A	#N/A	7.3
117.1	2,029,941	10,213,456	1.450	8.4	#N/A	#N/A	8.4
117.2	2,060,345	10,417,969	1.450	9.5	#N/A	#N/A	9.5
117.3	2,090,902	10,625,530	1.450	10.7	#N/A	#N/A	10.7
117.4	2,121,575	10,836,153	1.450	12.0	#N/A	#N/A	12.0
117.5	2,152,347	11,049,849	1.450	13.3	#N/A	#N/A	13.3
117.6	2,183,217	11,266,626	1.450	14.7	#N/A	#N/A	14.7
117.7	2,214,185	11,486,495	1.450	16.1	#N/A	#N/A	16.1
117.8	2,245,243	11,709,466	1.450	17.5	#N/A	#N/A	17.5
117.9	2,276,369	11,935,546	1.450	19.0	#N/A	#N/A	19.0
118.0	2,307,561	12,164,742	1.450	20.5	#N/A	#N/A	20.5
118.5	2,463,523	13,310,722	1.450	28.7	#N/A	#N/A	28.7
119.0	2,619,485	14,456,702	1.450	37.7	#N/A	#N/A	37.7
119.5	2,775,446	15,602,682	1.450	47.5	#N/A	#N/A	47.5
120.0	2,931,408	16,748,662	1.450	58.0	#N/A	#N/A	58.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-002

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	10.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	99.0 m	Dam crest invert elevation is:	101.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
98.1	0	0	#N/A	0.0	#N/A	#N/A	0.0
98.2	1,639	84	#N/A	0.0	#N/A	#N/A	0.0
98.3	3,697	344	#N/A	0.0	#N/A	#N/A	0.0
98.4	6,403	845	#N/A	0.0	#N/A	#N/A	0.0
98.5	9,535	1,638	#N/A	0.0	#N/A	#N/A	0.0
98.6	18,037	3,063	#N/A	0.0	#N/A	#N/A	0.0
98.7	27,273	5,305	#N/A	0.0	#N/A	#N/A	0.0
98.8	34,242	8,373	#N/A	0.0	#N/A	#N/A	0.0
98.9	42,587	12,213	#N/A	0.0	#N/A	#N/A	0.0
99.0	50,234	16,868	#N/A	0.0	#N/A	#N/A	0.0
99.1	56,839	22,225	1.490	0.5	#N/A	#N/A	0.5
99.2	63,405	28,235	1.490	1.3	#N/A	#N/A	1.3
99.3	70,343	34,918	1.450	2.4	#N/A	#N/A	2.4
99.4	77,420	42,303	1.460	3.7	#N/A	#N/A	3.7
99.5	84,269	50,386	1.450	5.1	#N/A	#N/A	5.1
99.6	91,194	59,159	1.450	6.7	#N/A	#N/A	6.7
99.7	97,897	68,617	1.450	8.5	#N/A	#N/A	8.5
99.8	104,308	78,729	1.450	10.4	#N/A	#N/A	10.4
99.9	112,914	89,573	1.450	12.4	#N/A	#N/A	12.4
100.0	123,069	101,379	1.450	14.5	#N/A	#N/A	14.5
100.1	133,890	114,217	1.450	16.7	#N/A	#N/A	16.7
100.2	145,510	128,183	1.450	19.1	#N/A	#N/A	19.1
100.3	157,636	143,337	1.450	21.5	#N/A	#N/A	21.5
100.4	170,334	159,731	1.450	24.0	#N/A	#N/A	24.0
100.5	183,952	177,436	1.450	26.6	#N/A	#N/A	26.6
100.6	200,227	196,613	1.450	29.3	#N/A	#N/A	29.3
100.7	220,360	217,627	1.450	32.1	#N/A	#N/A	32.1
100.8	240,430	240,699	1.450	35.0	#N/A	#N/A	35.0
100.9	257,509	265,665	1.450	38.0	#N/A	#N/A	38.0
101.0	271,272	291,416	1.450	41.0	#N/A	#N/A	41.0
101.5	340,084	420,171	1.450	57.3	#N/A	#N/A	57.3
102.0	408,897	548,925	1.450	75.3	#N/A	#N/A	75.3
102.5	477,710	677,680	1.450	94.9	#N/A	#N/A	94.9
103.0	546,522	806,435	1.450	116.0	#N/A	#N/A	116.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-003

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	117.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
115.4	0	0	#N/A	0.0	#N/A	#N/A	0.0
115.4	23	1	#N/A	0.0	#N/A	#N/A	0.0
115.5	527	21	#N/A	0.0	#N/A	#N/A	0.0
115.6	1,793	133	#N/A	0.0	#N/A	#N/A	0.0
115.7	3,246	384	#N/A	0.0	#N/A	#N/A	0.0
115.8	4,771	785	#N/A	0.0	#N/A	#N/A	0.0
115.9	6,375	1,341	#N/A	0.0	#N/A	#N/A	0.0
116.0	8,068	2,063	#N/A	0.0	#N/A	#N/A	0.0
116.1	9,850	2,958	#N/A	0.0	#N/A	#N/A	0.0
116.2	11,722	4,036	#N/A	0.0	#N/A	#N/A	0.0
116.3	13,683	5,305	#N/A	0.0	#N/A	#N/A	0.0
116.4	15,733	6,775	#N/A	0.0	#N/A	#N/A	0.0
116.5	17,872	8,455	#N/A	0.0	#N/A	#N/A	0.0
116.6	20,104	10,353	#N/A	0.0	#N/A	#N/A	0.0
116.7	22,487	12,480	#N/A	0.0	#N/A	#N/A	0.0
116.8	25,216	14,862	#N/A	0.0	#N/A	#N/A	0.0
116.9	28,235	17,534	#N/A	0.0	#N/A	#N/A	0.0
117.0	31,170	20,505	#N/A	0.0	#N/A	#N/A	0.0
117.1	33,983	23,763	1.490	0.2	#N/A	#N/A	0.2
117.2	37,075	27,312	1.490	0.7	#N/A	#N/A	0.7
117.3	40,743	31,198	1.450	1.2	#N/A	#N/A	1.2
117.4	45,007	35,480	1.460	1.8	#N/A	#N/A	1.8
117.5	49,819	40,217	1.450	2.6	#N/A	#N/A	2.6
117.6	56,461	45,514	1.450	3.4	#N/A	#N/A	3.4
117.7	63,484	51,513	1.450	4.2	#N/A	#N/A	4.2
117.8	70,395	58,207	1.450	5.2	#N/A	#N/A	5.2
117.9	77,221	65,589	1.450	6.2	#N/A	#N/A	6.2
118.0	83,919	73,632	1.450	7.3	#N/A	#N/A	7.3
118.1	90,518	82,007	1.450	8.4	#N/A	#N/A	8.4
118.2	97,116	90,383	1.450	9.5	#N/A	#N/A	9.5
118.3	103,714	98,758	1.450	10.7	#N/A	#N/A	10.7
118.4	110,313	107,134	1.450	12.0	#N/A	#N/A	12.0
118.5	116,911	115,509	1.450	13.3	#N/A	#N/A	13.3
118.6	123,510	123,884	1.450	14.7	#N/A	#N/A	14.7
118.7	130,108	132,260	1.450	16.1	#N/A	#N/A	16.1
118.8	136,707	140,635	1.450	17.5	#N/A	#N/A	17.5
118.9	143,305	149,011	1.450	19.0	#N/A	#N/A	19.0
119.0	149,903	157,386	1.450	20.5	#N/A	#N/A	20.5
119.5	182,895	199,263	1.450	28.7	#N/A	#N/A	28.7
120.0	215,888	241,140	1.450	37.7	#N/A	#N/A	37.7
120.5	248,880	283,018	1.450	47.5	#N/A	#N/A	47.5
121.0	281,872	324,895	1.450	58.0	#N/A	#N/A	58.0

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-004

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	2.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	92.5 m	Dam crest invert elevation is:	93.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
91.0	4,200	0	#N/A	0.0	#N/A	#N/A	0.0
91.1	4,303	425	#N/A	0.0	#N/A	#N/A	0.0
91.2	4,409	861	#N/A	0.0	#N/A	#N/A	0.0
91.3	4,590	1,311	#N/A	0.0	#N/A	#N/A	0.0
91.4	4,720	1,776	#N/A	0.0	#N/A	#N/A	0.0
91.5	4,850	2,255	#N/A	0.0	#N/A	#N/A	0.0
91.6	4,980	2,746	#N/A	0.0	#N/A	#N/A	0.0
91.7	5,110	3,251	#N/A	0.0	#N/A	#N/A	0.0
91.8	5,240	3,768	#N/A	0.0	#N/A	#N/A	0.0
91.9	5,370	4,299	#N/A	0.0	#N/A	#N/A	0.0
92.0	5,500	4,842	#N/A	0.0	#N/A	#N/A	0.0
92.1	5,630	5,399	#N/A	0.0	#N/A	#N/A	0.0
92.2	5,760	5,968	#N/A	0.0	#N/A	#N/A	0.0
92.3	5,890	6,551	#N/A	0.0	#N/A	#N/A	0.0
92.4	6,020	7,146	#N/A	0.0	#N/A	#N/A	0.0
92.5	6,150	7,755	#N/A	0.0	#N/A	#N/A	0.0
92.6	6,280	8,376	1.490	0.1	#N/A	#N/A	0.1
92.7	6,410	9,011	1.490	0.3	#N/A	#N/A	0.3
92.8	6,540	9,658	1.450	0.5	#N/A	#N/A	0.5
92.9	6,670	10,319	1.460	0.7	#N/A	#N/A	0.7
93.0	6,800	10,992	1.450	1.0	#N/A	#N/A	1.0
93.1	6,930	11,666	1.450	1.3	#N/A	#N/A	1.3
93.2	7,060	12,339	1.450	1.7	#N/A	#N/A	1.7
93.3	7,190	13,013	1.450	2.1	#N/A	#N/A	2.1
93.4	7,320	13,686	1.450	2.5	#N/A	#N/A	2.5
93.5	7,450	14,360	1.450	2.9	#N/A	#N/A	2.9
93.6	7,580	15,033	1.450	3.3	#N/A	#N/A	3.3
93.7	7,710	15,707	1.450	3.8	#N/A	#N/A	3.8
93.8	7,840	16,380	1.450	4.3	#N/A	#N/A	4.3
93.9	7,970	17,054	1.450	4.8	#N/A	#N/A	4.8
94.0	8,100	17,727	1.450	5.3	#N/A	#N/A	5.3
94.1	8,230	18,401	1.450	5.9	#N/A	#N/A	5.9
94.2	8,360	19,074	1.450	6.4	#N/A	#N/A	6.4
94.3	8,490	19,748	1.450	7.0	#N/A	#N/A	7.0
94.4	8,620	20,421	1.450	7.6	#N/A	#N/A	7.6
94.5	8,750	21,095	1.450	8.2	#N/A	#N/A	8.2

Surface Water Existing (EX) Conditions: Rating tables for WP-EX-005

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	2.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	93.5 m	Dam crest invert elevation is:	94.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
(m)							
91.0	970	0	#N/A	0.0	#N/A	#N/A	0.0
91.1	1,103	104	#N/A	0.0	#N/A	#N/A	0.0
91.2	1,237	221	#N/A	0.0	#N/A	#N/A	0.0
91.3	1,370	351	#N/A	0.0	#N/A	#N/A	0.0
91.4	1,504	495	#N/A	0.0	#N/A	#N/A	0.0
91.5	1,637	652	#N/A	0.0	#N/A	#N/A	0.0
91.6	1,771	822	#N/A	0.0	#N/A	#N/A	0.0
91.7	1,904	1,006	#N/A	0.0	#N/A	#N/A	0.0
91.8	2,038	1,203	#N/A	0.0	#N/A	#N/A	0.0
91.9	2,171	1,414	#N/A	0.0	#N/A	#N/A	0.0
92.0	2,305	1,637	#N/A	0.0	#N/A	#N/A	0.0
92.1	2,438	1,875	#N/A	0.0	#N/A	#N/A	0.0
92.2	2,572	2,125	#N/A	0.0	#N/A	#N/A	0.0
92.3	2,705	2,389	#N/A	0.0	#N/A	#N/A	0.0
92.4	2,839	2,666	#N/A	0.0	#N/A	#N/A	0.0
92.5	2,972	2,957	#N/A	0.0	#N/A	#N/A	0.0
92.6	3,106	3,261	#N/A	0.0	#N/A	#N/A	0.0
92.7	3,239	3,578	#N/A	0.0	#N/A	#N/A	0.0
92.8	3,373	3,909	#N/A	0.0	#N/A	#N/A	0.0
92.9	3,506	4,253	#N/A	0.0	#N/A	#N/A	0.0
93.0	3,800	4,610	#N/A	0.0	#N/A	#N/A	0.0
93.1	4,263	5,013	#N/A	0.0	#N/A	#N/A	0.0
93.2	4,726	5,463	#N/A	0.0	#N/A	#N/A	0.0
93.3	5,189	5,958	#N/A	0.0	#N/A	#N/A	0.0
93.4	5,652	6,500	#N/A	0.0	#N/A	#N/A	0.0
93.5	6,116	7,089	#N/A	0.0	#N/A	#N/A	0.0
93.6	6,579	7,724	1.490	0.1	#N/A	#N/A	0.1
93.7	7,042	8,405	1.490	0.3	#N/A	#N/A	0.3
93.8	7,505	9,132	1.450	0.5	#N/A	#N/A	0.5
93.9	7,968	9,906	1.460	0.7	#N/A	#N/A	0.7
94.0	8,432	10,726	1.450	1.0	#N/A	#N/A	1.0
94.1	8,895	11,546	1.450	1.3	#N/A	#N/A	1.3
94.2	9,358	12,366	1.450	1.7	#N/A	#N/A	1.7
94.3	9,821	13,186	1.450	2.1	#N/A	#N/A	2.1
94.4	10,284	14,006	1.450	2.5	#N/A	#N/A	2.5
94.5	10,748	14,826	1.450	2.9	#N/A	#N/A	2.9
94.6	11,211	15,646	1.450	3.3	#N/A	#N/A	3.3
94.7	11,674	16,466	1.450	3.8	#N/A	#N/A	3.8
94.8	12,137	17,286	1.450	4.3	#N/A	#N/A	4.3
94.9	12,600	18,106	1.450	4.8	#N/A	#N/A	4.8
95.0	13,064	18,926	1.450	5.3	#N/A	#N/A	5.3
95.1	13,527	19,746	1.450	5.9	#N/A	#N/A	5.9
95.2	13,990	20,566	1.450	6.4	#N/A	#N/A	6.4
95.3	14,453	21,386	1.450	7.0	#N/A	#N/A	7.0
95.4	14,916	22,206	1.450	7.6	#N/A	#N/A	7.6
95.5	15,380	23,026	1.450	8.2	#N/A	#N/A	8.2

Surface Water Existing Conditions: (EX) Rating tables for WP-EX-006

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	960.9 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	109.0 m	Dam crest invert elevation is:	111.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
106.7	0	0	#N/A	0.0	#N/A	#N/A	0.0
106.8	46	2	#N/A	0.0	#N/A	#N/A	0.0
106.9	215	13	#N/A	0.0	#N/A	#N/A	0.0
107.0	538	50	#N/A	0.0	#N/A	#N/A	0.0
107.1	999	125	#N/A	0.0	#N/A	#N/A	0.0
107.2	1,565	253	#N/A	0.0	#N/A	#N/A	0.0
107.3	2,270	443	#N/A	0.0	#N/A	#N/A	0.0
107.4	3,089	710	#N/A	0.0	#N/A	#N/A	0.0
107.5	3,950	1,062	#N/A	0.0	#N/A	#N/A	0.0
107.6	4,823	1,501	#N/A	0.0	#N/A	#N/A	0.0
107.7	5,755	2,029	#N/A	0.0	#N/A	#N/A	0.0
107.8	6,799	2,655	#N/A	0.0	#N/A	#N/A	0.0
107.9	7,972	3,392	#N/A	0.0	#N/A	#N/A	0.0
108.0	9,276	4,254	#N/A	0.0	#N/A	#N/A	0.0
108.1	10,719	5,252	#N/A	0.0	#N/A	#N/A	0.0
108.2	12,325	6,403	#N/A	0.0	#N/A	#N/A	0.0
108.3	14,114	7,723	#N/A	0.0	#N/A	#N/A	0.0
108.4	16,091	9,232	#N/A	0.0	#N/A	#N/A	0.0
108.5	18,274	10,948	#N/A	0.0	#N/A	#N/A	0.0
108.6	20,674	12,894	#N/A	0.0	#N/A	#N/A	0.0
108.7	23,474	15,096	#N/A	0.0	#N/A	#N/A	0.0
108.8	26,914	17,609	#N/A	0.0	#N/A	#N/A	0.0
108.9	31,061	20,502	#N/A	0.0	#N/A	#N/A	0.0
109.0	35,832	23,841	#N/A	0.0	#N/A	#N/A	0.0
109.1	41,175	27,687	1.490	0.0	#N/A	#N/A	0.0
109.2	46,989	32,092	1.490	0.2	#N/A	#N/A	0.2
109.3	53,375	37,102	1.450	0.2	#N/A	#N/A	0.2
109.4	60,661	42,798	1.460	0.7	#N/A	#N/A	0.7
109.5	68,339	49,247	1.450	1.2	#N/A	#N/A	1.2
109.6	76,043	56,465	2.450	3.1	#N/A	#N/A	3.1
109.7	84,086	64,466	3.450	6.1	#N/A	#N/A	6.1
109.8	92,808	73,304	4.450	10.3	#N/A	#N/A	10.3
109.9	102,652	83,063	5.450	16.0	#N/A	#N/A	16.0
110.0	114,020	93,877	6.450	23.1	#N/A	#N/A	23.1
110.1	127,166	105,921	7.450	31.8	#N/A	#N/A	31.8
110.2	142,916	119,394	8.450	42.3	#N/A	#N/A	42.3
110.3	161,883	134,605	9.450	54.5	#N/A	#N/A	54.5
110.4	183,670	151,851	10.450	68.7	#N/A	#N/A	68.7
110.5	210,151	171,475	11.450	84.9	#N/A	#N/A	84.9
110.6	238,209	193,888	12.450	103.1	#N/A	#N/A	103.1
110.7	264,615	219,056	13.450	123.5	#N/A	#N/A	123.5
110.8	288,006	246,713	14.450	146.2	#N/A	#N/A	146.2
110.9	309,183	276,614	15.450	171.2	#N/A	#N/A	171.2
111.0	327,266	308,261	16.450	198.6	#N/A	#N/A	198.6

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
103.0	0	0	#N/A	0.0	#N/A	#N/A	0.0
103.1	18,844	1,677	#N/A	0.0	#N/A	#N/A	0.0
103.2	22,962	3,768	#N/A	0.0	#N/A	#N/A	0.0
103.3	27,042	6,268	#N/A	0.0	#N/A	#N/A	0.0
103.4	31,085	9,175	#N/A	0.0	#N/A	#N/A	0.0
103.5	35,091	12,484	#N/A	0.0	#N/A	#N/A	0.0
103.6	39,058	16,192	#N/A	0.0	#N/A	#N/A	0.0
103.7	42,989	20,294	#N/A	0.0	#N/A	#N/A	0.0
103.8	46,881	24,788	#N/A	0.0	#N/A	#N/A	0.0
103.9	50,736	29,669	#N/A	0.0	#N/A	#N/A	0.0
104.0	54,519	34,933	#N/A	0.0	#N/A	#N/A	0.0
104.1	67,628	41,464	#N/A	0.0	#N/A	#N/A	0.0
104.2	72,442	48,466	#N/A	0.0	#N/A	#N/A	0.0
104.3	77,476	55,960	#N/A	0.0	#N/A	#N/A	0.0
104.4	82,718	63,968	#N/A	0.0	#N/A	#N/A	0.0
104.5	88,160	72,510	#N/A	0.0	#N/A	#N/A	0.0
104.6	93,801	81,607	#N/A	0.0	#N/A	#N/A	0.0
104.7	99,642	91,277	#N/A	0.0	#N/A	#N/A	0.0
104.8	105,683	101,542	#N/A	0.0	#N/A	#N/A	0.0
104.9	111,923	112,420	#N/A	0.0	#N/A	#N/A	0.0
105.0	118,368	123,933	#N/A	0.0	#N/A	#N/A	0.0
105.1	133,673	136,908	#N/A	0.0	#N/A	#N/A	0.0
105.2	141,633	150,673	#N/A	0.0	#N/A	#N/A	0.0
105.3	149,738	165,240	#N/A	0.0	#N/A	#N/A	0.0
105.4	157,989	180,625	#N/A	0.0	#N/A	#N/A	0.0
105.5	166,385	196,843	#N/A	0.0	#N/A	#N/A	0.0
105.6	174,927	213,907	#N/A	0.0	#N/A	#N/A	0.0
105.7	183,623	231,833	#N/A	0.0	#N/A	#N/A	0.0
105.8	192,478	250,637	#N/A	0.0	#N/A	#N/A	0.0
105.9	201,494	270,334	#N/A	0.0	#N/A	#N/A	0.0
106.0	210,670	290,941	#N/A	0.0	#N/A	#N/A	0.0
106.1	219,765	312,487	#N/A	0.0	#N/A	#N/A	0.0
106.2	228,409	334,895	#N/A	0.0	#N/A	#N/A	0.0
106.3	237,095	358,170	#N/A	0.0	#N/A	#N/A	0.0
106.4	245,823	382,316	#N/A	0.0	#N/A	#N/A	0.0
106.5	254,597	407,336	#N/A	0.0	#N/A	#N/A	0.0
106.6	263,423	433,237	#N/A	0.0	#N/A	#N/A	0.0
106.7	272,300	460,023	#N/A	0.0	#N/A	#N/A	0.0
106.8	281,230	487,699	#N/A	0.0	#N/A	#N/A	0.0
106.9	290,211	516,270	#N/A	0.0	#N/A	#N/A	0.0
107.0	299,243	545,743	#N/A	0.0	#N/A	#N/A	0.0
107.1	308,849	576,160	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-001

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	116.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
107.2	318,267	607,515	#N/A	0.0	#N/A	#N/A	0.0
107.3	327,766	639,816	#N/A	0.0	#N/A	#N/A	0.0
107.4	337,348	673,071	#N/A	0.0	#N/A	#N/A	0.0
107.5	347,011	707,288	#N/A	0.0	#N/A	#N/A	0.0
107.6	356,752	742,476	#N/A	0.0	#N/A	#N/A	0.0
107.7	366,572	778,641	#N/A	0.0	#N/A	#N/A	0.0
107.8	376,470	815,793	#N/A	0.0	#N/A	#N/A	0.0
107.9	386,446	853,938	#N/A	0.0	#N/A	#N/A	0.0
108.0	396,500	893,085	#N/A	0.0	#N/A	#N/A	0.0
108.1	416,267	934,313	#N/A	0.0	#N/A	#N/A	0.0
108.2	424,227	976,338	#N/A	0.0	#N/A	#N/A	0.0
108.3	432,184	1,019,159	#N/A	0.0	#N/A	#N/A	0.0
108.4	440,134	1,062,775	#N/A	0.0	#N/A	#N/A	0.0
108.5	448,078	1,107,185	#N/A	0.0	#N/A	#N/A	0.0
108.6	456,016	1,152,390	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-002

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	10.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	99.0 m	Dam crest invert elevation is:	101.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
98.1	0	0	#N/A	0.0	#N/A	#N/A	0.0
98.2	1,639	84	#N/A	0.0	#N/A	#N/A	0.0
98.3	3,697	344	#N/A	0.0	#N/A	#N/A	0.0
98.4	6,403	845	#N/A	0.0	#N/A	#N/A	0.0
98.5	9,535	1,638	#N/A	0.0	#N/A	#N/A	0.0
98.6	18,037	3,063	#N/A	0.0	#N/A	#N/A	0.0
98.7	27,273	5,305	#N/A	0.0	#N/A	#N/A	0.0
98.8	34,242	8,373	#N/A	0.0	#N/A	#N/A	0.0
98.9	42,587	12,213	#N/A	0.0	#N/A	#N/A	0.0
99.0	50,234	16,868	#N/A	0.0	#N/A	#N/A	0.0
99.1	56,839	22,225	1.490	0.5	#N/A	#N/A	0.5
99.2	63,405	28,235	1.490	1.3	#N/A	#N/A	1.3
99.3	70,343	34,918	1.450	2.4	#N/A	#N/A	2.4
99.4	77,420	42,303	1.460	3.7	#N/A	#N/A	3.7
99.5	84,269	50,386	1.450	5.1	#N/A	#N/A	5.1
99.6	91,194	59,159	1.450	6.7	#N/A	#N/A	6.7
99.7	97,897	68,617	1.450	8.5	#N/A	#N/A	8.5
99.8	104,308	78,729	1.450	10.4	#N/A	#N/A	10.4
99.9	112,914	89,573	1.450	12.4	#N/A	#N/A	12.4
100.0	123,069	101,379	1.450	14.5	#N/A	#N/A	14.5
100.1	133,890	114,217	1.450	16.7	#N/A	#N/A	16.7
100.2	145,510	128,183	1.450	19.1	#N/A	#N/A	19.1
100.3	157,636	143,337	1.450	21.5	#N/A	#N/A	21.5
100.4	170,334	159,731	1.450	24.0	#N/A	#N/A	24.0
100.5	183,952	177,436	1.450	26.6	#N/A	#N/A	26.6
100.6	200,227	196,613	1.450	29.3	#N/A	#N/A	29.3
100.7	220,360	217,627	1.450	32.1	#N/A	#N/A	32.1
100.8	240,430	240,699	1.450	35.0	#N/A	#N/A	35.0
100.9	257,509	265,665	1.450	38.0	#N/A	#N/A	38.0
101.0	271,272	291,416	1.450	41.0	#N/A	#N/A	41.0
101.5	340,084	420,171	1.450	57.3	#N/A	#N/A	57.3
102.0	408,897	548,925	1.450	75.3	#N/A	#N/A	75.3
102.5	477,710	677,680	1.450	94.9	#N/A	#N/A	94.9
103.0	546,522	806,435	1.450	116.0	#N/A	#N/A	116.0

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-003

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	2.0 m	Dam crest length is:	#N/A m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	92.5 m	Dam crest invert elevation is:	93.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
	Area	Volume	Weir	{Weir Eqn.}	Weir	{Weir Eqn.}	Total
(m)	(m^2)	(m^3)	Coefficient	(m^3/s)	Coefficient	(m^3/s)	(m^3/s)
91.0	4,200	0	#N/A	0.0	#N/A	#N/A	0.0
91.1	4,303	425	#N/A	0.0	#N/A	#N/A	0.0
91.2	4,409	861	#N/A	0.0	#N/A	#N/A	0.0
91.3	4,590	1,311	#N/A	0.0	#N/A	#N/A	0.0
91.4	4,720	1,776	#N/A	0.0	#N/A	#N/A	0.0
91.5	4,850	2,255	#N/A	0.0	#N/A	#N/A	0.0
91.6	4,980	2,746	#N/A	0.0	#N/A	#N/A	0.0
91.7	5,110	3,251	#N/A	0.0	#N/A	#N/A	0.0
91.8	5,240	3,768	#N/A	0.0	#N/A	#N/A	0.0
91.9	5,370	4,299	#N/A	0.0	#N/A	#N/A	0.0
92.0	5,500	4,842	#N/A	0.0	#N/A	#N/A	0.0
92.1	5,630	5,399	#N/A	0.0	#N/A	#N/A	0.0
92.2	5,760	5,968	#N/A	0.0	#N/A	#N/A	0.0
92.3	5,890	6,551	#N/A	0.0	#N/A	#N/A	0.0
92.4	6,020	7,146	#N/A	0.0	#N/A	#N/A	0.0
92.5	6,150	7,755	#N/A	0.0	#N/A	#N/A	0.0
92.6	6,280	8,376	1.490	0.1	#N/A	#N/A	0.1
92.7	6,410	9,011	1.490	0.3	#N/A	#N/A	0.3
92.8	6,540	9,658	1.450	0.5	#N/A	#N/A	0.5
92.9	6,670	10,319	1.460	0.7	#N/A	#N/A	0.7
93.0	6,800	10,992	1.450	1.0	#N/A	#N/A	1.0
93.1	6,930	11,666	1.450	1.3	#N/A	#N/A	1.3
93.2	7,060	12,339	1.450	1.7	#N/A	#N/A	1.7
93.3	7,190	13,013	1.450	2.1	#N/A	#N/A	2.1
93.4	7,320	13,686	1.450	2.5	#N/A	#N/A	2.5
93.5	7,450	14,360	1.450	2.9	#N/A	#N/A	2.9
93.6	7,580	15,033	1.450	3.3	#N/A	#N/A	3.3
93.7	7,710	15,707	1.450	3.8	#N/A	#N/A	3.8
93.8	7,840	16,380	1.450	4.3	#N/A	#N/A	4.3
93.9	7,970	17,054	1.450	4.8	#N/A	#N/A	4.8
94.0	8,100	17,727	1.450	5.3	#N/A	#N/A	5.3
94.1	8,230	18,401	1.450	5.9	#N/A	#N/A	5.9
94.2	8,360	19,074	1.450	6.4	#N/A	#N/A	6.4
94.3	8,490	19,748	1.450	7.0	#N/A	#N/A	7.0
94.4	8,620	20,421	1.450	7.6	#N/A	#N/A	7.6
94.5	8,750	21,095	1.450	8.2	#N/A	#N/A	8.2

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-004

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	1487.6 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	117.0 m	Dam crest invert elevation is:	118.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
115.4	0	0	#N/A	0.0	#N/A	#N/A	0.0
115.5	527	21	#N/A	0.0	#N/A	#N/A	0.0
115.6	1,793	133	#N/A	0.0	#N/A	#N/A	0.0
115.7	3,246	384	#N/A	0.0	#N/A	#N/A	0.0
115.8	4,771	785	#N/A	0.0	#N/A	#N/A	0.0
115.9	6,375	1,341	#N/A	0.0	#N/A	#N/A	0.0
116.0	8,068	2,063	#N/A	0.0	#N/A	#N/A	0.0
116.1	9,850	2,958	#N/A	0.0	#N/A	#N/A	0.0
116.2	11,722	4,036	#N/A	0.0	#N/A	#N/A	0.0
116.3	13,683	5,305	#N/A	0.0	#N/A	#N/A	0.0
116.4	15,733	6,775	#N/A	0.0	#N/A	#N/A	0.0
116.5	17,872	8,455	#N/A	0.0	#N/A	#N/A	0.0
116.6	20,104	10,353	#N/A	0.0	#N/A	#N/A	0.0
116.7	22,487	12,480	#N/A	0.0	#N/A	#N/A	0.0
116.8	25,216	14,862	#N/A	0.0	#N/A	#N/A	0.0
116.9	28,235	17,534	#N/A	0.0	#N/A	#N/A	0.0
117.0	31,170	20,505	#N/A	0.0	#N/A	#N/A	0.0
117.1	33,983	23,763	1.490	0.2	#N/A	#N/A	0.2
117.2	37,075	27,312	1.490	0.7	#N/A	#N/A	0.7
117.3	40,743	31,198	1.450	1.2	#N/A	#N/A	1.2
117.4	45,007	35,480	1.460	1.8	#N/A	#N/A	1.8
117.5	49,819	40,217	1.450	2.6	#N/A	#N/A	2.6
117.6	56,461	45,514	1.450	3.4	#N/A	#N/A	3.4
117.7	63,484	51,513	1.450	4.2	#N/A	#N/A	4.2
117.8	70,395	58,207	1.450	5.2	#N/A	#N/A	5.2
117.9	77,221	65,589	1.450	6.2	#N/A	#N/A	6.2
118.0	83,919	73,632	1.450	7.3	#N/A	#N/A	7.3
118.1	90,518	82,007	1.450	8.4	#N/A	#N/A	8.4
118.2	97,116	90,383	1.450	9.5	#N/A	#N/A	9.5
118.3	103,714	98,758	1.450	10.7	#N/A	#N/A	10.7
118.4	110,313	107,134	1.450	12.0	#N/A	#N/A	12.0
118.5	116,911	115,509	1.450	13.3	#N/A	#N/A	13.3
118.6	123,510	123,884	1.450	14.7	#N/A	#N/A	14.7
118.7	130,108	132,260	1.450	16.1	#N/A	#N/A	16.1
118.8	136,707	140,635	1.450	17.5	#N/A	#N/A	17.5
118.9	143,305	149,011	1.450	19.0	#N/A	#N/A	19.0
119.0	149,903	157,386	1.450	20.5	#N/A	#N/A	20.5
119.5	182,895	199,263	1.450	28.7	#N/A	#N/A	28.7
120.0	215,888	241,140	1.450	37.7	#N/A	#N/A	37.7
120.5	248,880	283,018	1.450	47.5	#N/A	#N/A	47.5
121.0	281,872	324,895	1.450	58.0	#N/A	#N/A	58.0

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-005 / WP-PL-006

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	25.0 m	Dam crest length is:	3713.1 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	3.0 m
Assume spillway invert elevation is:	74.5 m	Dam crest invert elevation is:	75.5 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
	Area	Volume	Weir	{Weir Eqn.}	Weir	{Weir Eqn.}	Total
(m)	(m^2)	(m^3)	Coefficient	(m^3/s)	Coefficient	(m^3/s)	(m^3/s)
71.3	0	0	#N/A	0.0	#N/A	#N/A	0.0
71.4	1,359,729	135,872	#N/A	0.0	#N/A	#N/A	0.0
71.5	1,361,755	271,946	#N/A	0.0	#N/A	#N/A	0.0
71.6	1,363,782	408,223	#N/A	0.0	#N/A	#N/A	0.0
71.7	1,365,810	544,702	#N/A	0.0	#N/A	#N/A	0.0
71.8	1,367,839	681,385	#N/A	0.0	#N/A	#N/A	0.0
71.9	1,369,869	818,270	#N/A	0.0	#N/A	#N/A	0.0
72.0	1,371,899	955,359	#N/A	0.0	#N/A	#N/A	0.0
72.1	1,373,931	1,092,650	#N/A	0.0	#N/A	#N/A	0.0
72.1	1,375,964	1,230,145	#N/A	0.0	#N/A	#N/A	0.0
72.2	1,377,997	1,367,843	#N/A	0.0	#N/A	#N/A	0.0
72.3	1,380,032	1,505,744	#N/A	0.0	#N/A	#N/A	0.0
72.4	1,382,067	1,643,849	#N/A	0.0	#N/A	#N/A	0.0
72.5	1,384,103	1,782,158	#N/A	0.0	#N/A	#N/A	0.0
72.6	1,386,140	1,920,670	#N/A	0.0	#N/A	#N/A	0.0
72.7	1,388,178	2,059,386	#N/A	0.0	#N/A	#N/A	0.0
72.8	1,390,218	2,198,306	#N/A	0.0	#N/A	#N/A	0.0
72.9	1,392,257	2,337,429	#N/A	0.0	#N/A	#N/A	0.0
73.0	1,394,298	2,476,757	#N/A	0.0	#N/A	#N/A	0.0
73.1	1,396,340	2,616,289	#N/A	0.0	#N/A	#N/A	0.0
73.2	1,398,383	2,756,025	#N/A	0.0	#N/A	#N/A	0.0
73.3	1,400,427	2,895,966	#N/A	0.0	#N/A	#N/A	0.0
73.4	1,402,471	3,036,110	#N/A	0.0	#N/A	#N/A	0.0
73.5	1,404,517	3,176,460	#N/A	0.0	#N/A	#N/A	0.0
73.6	1,406,563	3,317,014	#N/A	0.0	#N/A	#N/A	0.0
73.7	1,408,610	3,457,772	#N/A	0.0	#N/A	#N/A	0.0
73.8	1,410,659	3,598,736	#N/A	0.0	#N/A	#N/A	0.0
73.9	1,412,708	3,739,904	#N/A	0.0	#N/A	#N/A	0.0
74.0	1,414,758	3,881,277	#N/A	0.0	#N/A	#N/A	0.0
74.1	1,416,809	4,022,856	#N/A	0.0	#N/A	#N/A	0.0
74.2	1,418,861	4,164,639	#N/A	0.0	#N/A	#N/A	0.0
74.3	1,420,914	4,306,628	#N/A	0.0	#N/A	#N/A	0.0
74.4	1,422,967	4,448,822	#N/A	0.0	#N/A	#N/A	0.0
74.5	1,423,995	4,519,996	#N/A	0.0	#N/A	#N/A	0.0
74.6	1,426,049	4,662,344	1.490	1.2	#N/A	#N/A	1.2
74.7	1,429,230	4,876,038	1.490	3.3	#N/A	#N/A	3.3
74.8	1,432,412	5,089,731	1.450	6.0	#N/A	#N/A	6.0
74.9	1,435,593	5,303,425	1.460	9.2	#N/A	#N/A	9.2
75.0	1,438,774	5,517,119	1.450	12.8	#N/A	#N/A	12.8
75.1	1,441,955	5,730,812	1.450	16.8	#N/A	#N/A	16.8
75.2	1,445,137	5,944,506	1.450	21.2	#N/A	#N/A	21.2
75.3	1,448,318	6,158,199	1.450	25.9	#N/A	#N/A	25.9
75.4	1,451,499	6,371,893	1.450	31.0	#N/A	#N/A	31.0
75.5	1,454,680	6,585,586	1.450	36.2	#N/A	#N/A	36.2

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-007

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition",* New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations. Initial pond volume of approximately 620,000 m3 is assumed as per water balance model results.

Assume spillway crest length is:	50.0 m	Dam crest length is:	3398.7 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	77.5 m	Dam crest invert elevation is:	78.5 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
72.5	0	0	#N/A	0.0	#N/A	#N/A	0.0
72.6	12,514	3,129	#N/A	0.0	#N/A	#N/A	0.0
72.7	25,029	6,257	#N/A	0.0	#N/A	#N/A	0.0
72.8	37,543	9,386	#N/A	0.0	#N/A	#N/A	0.0
72.9	50,057	12,514	#N/A	0.0	#N/A	#N/A	0.0
73.0	62,572	15,643	#N/A	0.0	#N/A	#N/A	0.0
73.1	75,170	25,050	#N/A	0.0	#N/A	#N/A	0.0
73.2	87,769	34,457	#N/A	0.0	#N/A	#N/A	0.0
73.3	100,367	43,863	#N/A	0.0	#N/A	#N/A	0.0
73.4	112,965	53,270	#N/A	0.0	#N/A	#N/A	0.0
73.5	125,564	62,677	#N/A	0.0	#N/A	#N/A	0.0
73.6	138,246	78,404	#N/A	0.0	#N/A	#N/A	0.0
73.7	150,929	94,131	#N/A	0.0	#N/A	#N/A	0.0
73.8	163,611	109,858	#N/A	0.0	#N/A	#N/A	0.0
73.9	176,294	125,585	#N/A	0.0	#N/A	#N/A	0.0
74.0	188,976	141,312	#N/A	0.0	#N/A	#N/A	0.0
74.1	201,743	163,401	#N/A	0.0	#N/A	#N/A	0.0
74.2	214,509	185,490	#N/A	0.0	#N/A	#N/A	0.0
74.3	227,276	207,580	#N/A	0.0	#N/A	#N/A	0.0
74.4	240,042	229,669	#N/A	0.0	#N/A	#N/A	0.0
74.5	252,809	251,758	#N/A	0.0	#N/A	#N/A	0.0
74.6	265,659	280,252	#N/A	0.0	#N/A	#N/A	0.0
74.7	278,510	308,745	#N/A	0.0	#N/A	#N/A	0.0
74.8	291,360	337,239	#N/A	0.0	#N/A	#N/A	0.0
74.9	304,211	365,732	#N/A	0.0	#N/A	#N/A	0.0
75.0	317,061	394,226	#N/A	0.0	#N/A	#N/A	0.0
75.1	329,996	429,166	#N/A	0.0	#N/A	#N/A	0.0
75.2	342,931	464,105	#N/A	0.0	#N/A	#N/A	0.0
75.3	355,865	499,045	#N/A	0.0	#N/A	#N/A	0.0
75.4	368,800	533,985	#N/A	0.0	#N/A	#N/A	0.0
75.5	381,734	568,925	#N/A	0.0	#N/A	#N/A	0.0
75.6	394,753	610,353	#N/A	0.0	#N/A	#N/A	0.0
75.7	407,772	651,781	#N/A	0.0	#N/A	#N/A	0.0
75.8	420,790	693,209	#N/A	0.0	#N/A	#N/A	0.0
75.9	433,809	734,637	#N/A	0.0	#N/A	#N/A	0.0
76.0	446,828	776,065	#N/A	0.0	#N/A	#N/A	0.0
76.1	459,930	824,024	#N/A	0.0	#N/A	#N/A	0.0
76.2	473,033	871,982	#N/A	0.0	#N/A	#N/A	0.0
76.3	486,136	919,941	#N/A	0.0	#N/A	#N/A	0.0
76.4	499,238	967,899	#N/A	0.0	#N/A	#N/A	0.0
76.5	512,341	1,015,857	#N/A	0.0	#N/A	#N/A	0.0
76.6	525,528	1,070,388	#N/A	0.0	#N/A	#N/A	0.0

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-007

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations. Initial pond volume of approximately 620,000 m3 is assumed as per water balance model results.

Assume spillway crest length is:	50.0 m	Dam crest length is:	3398.7 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	77.5 m	Dam crest invert elevation is:	78.5 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
76.7	538,715	1,124,919	#N/A	0.0	#N/A	#N/A	0.0
76.8	551,901	1,179,450	#N/A	0.0	#N/A	#N/A	0.0
76.9	565,088	1,233,981	#N/A	0.0	#N/A	#N/A	0.0
77.0	578,275	1,288,511	#N/A	0.0	#N/A	#N/A	0.0
77.1	591,546	1,349,657	#N/A	0.0	#N/A	#N/A	0.0
77.2	604,816	1,410,802	#N/A	0.0	#N/A	#N/A	0.0
77.3	618,087	1,471,947	#N/A	0.0	#N/A	#N/A	0.0
77.4	631,358	1,533,092	#N/A	0.0	#N/A	#N/A	0.0
77.5	644,629	1,594,237	#N/A	0.0	#N/A	#N/A	0.0
77.6	657,983	1,662,039	#N/A	0.0	#N/A	#N/A	0.0
77.7	671,338	1,729,840	#N/A	0.0	#N/A	#N/A	0.0
77.8	684,693	1,797,642	#N/A	0.0	#N/A	#N/A	0.0
77.9	698,048	1,865,443	#N/A	0.0	#N/A	#N/A	0.0
78.0	711,403	1,933,245	#N/A	0.0	#N/A	#N/A	0.0
78.1	712,251	2,004,597	#N/A	0.0	#N/A	#N/A	0.0
78.2	713,099	2,075,950	#N/A	0.0	#N/A	#N/A	0.0
78.3	713,948	2,147,302	#N/A	0.0	#N/A	#N/A	0.0
78.4	714,796	2,218,654	#N/A	0.0	#N/A	#N/A	0.0
78.5	715,644	2,290,007	#N/A	0.0	#N/A	#N/A	0.0
78.6	716,492	2,361,359	1.490	2.4	#N/A	#N/A	2.4
78.7	717,341	2,432,711	1.490	6.7	#N/A	#N/A	6.7
78.8	718,189	2,504,064	1.450	11.9	#N/A	#N/A	11.9
78.9	719,037	2,575,416	1.460	18.5	#N/A	#N/A	18.5
79.0	719,885	2,646,768	1.450	25.6	#N/A	#N/A	25.6
79.1	720,734	2,718,121	1.450	33.7	#N/A	#N/A	33.7
79.2	721,582	2,789,473	1.450	42.5	#N/A	#N/A	42.5
79.3	722,430	2,860,825	1.450	51.9	#N/A	#N/A	51.9
79.4	723,278	2,932,178	1.450	61.9	#N/A	#N/A	61.9
79.5	724,127	3,003,530	1.450	72.5	#N/A	#N/A	72.5

Surface Water Planned (PL) Conditions: Rating tables for WP-PL-008

The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

Assume spillway crest length is:	5.0 m	Dam crest length is:	2230.2 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	3.0 m
Assume spillway invert elevation is:	107.0 m	Dam crest invert elevation is:	108.0 m

Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
104.0	0	0	#N/A	0.0	#N/A	#N/A	0.0
104.1	10,023	5,012	#N/A	0.0	#N/A	#N/A	0.0
104.2	20,046	10,023	#N/A	0.0	#N/A	#N/A	0.0
104.3	30,070	15,035	#N/A	0.0	#N/A	#N/A	0.0
104.4	40,093	20,046	#N/A	0.0	#N/A	#N/A	0.0
104.5	50,116	25,058	#N/A	0.0	#N/A	#N/A	0.0
104.6	60,139	30,070	#N/A	0.0	#N/A	#N/A	0.0
104.7	70,162	35,081	#N/A	0.0	#N/A	#N/A	0.0
104.8	80,186	40,093	#N/A	0.0	#N/A	#N/A	0.0
104.9	90,209	45,104	#N/A	0.0	#N/A	#N/A	0.0
105.0	100,232	50,116	#N/A	0.0	#N/A	#N/A	0.0
105.1	100,232	61,253	#N/A	0.0	#N/A	#N/A	0.0
105.2	100,232	72,390	#N/A	0.0	#N/A	#N/A	0.0
105.3	100,232	83,527	#N/A	0.0	#N/A	#N/A	0.0
105.4	100,232	94,663	#N/A	0.0	#N/A	#N/A	0.0
105.5	100,232	105,800	#N/A	0.0	#N/A	#N/A	0.0
105.6	100,232	116,937	#N/A	0.0	#N/A	#N/A	0.0
105.7	100,232	128,074	#N/A	0.0	#N/A	#N/A	0.0
105.8	100,232	139,211	#N/A	0.0	#N/A	#N/A	0.0
105.9	100,232	150,348	#N/A	0.0	#N/A	#N/A	0.0
106.0	100,232	161,485	#N/A	0.0	#N/A	#N/A	0.0
106.1	100,232	172,622	#N/A	0.0	#N/A	#N/A	0.0
106.2	100,232	183,758	#N/A	0.0	#N/A	#N/A	0.0
106.3	100,232	194,895	#N/A	0.0	#N/A	#N/A	0.0
106.4	100,232	206,032	#N/A	0.0	#N/A	#N/A	0.0
106.5	100,232	217,169	#N/A	0.0	#N/A	#N/A	0.0
106.6	100,232	228,306	#N/A	0.0	#N/A	#N/A	0.0
106.7	100,232	239,443	#N/A	0.0	#N/A	#N/A	0.0
106.8	100,232	250,580	#N/A	0.0	#N/A	#N/A	0.0
106.9	100,232	261,717	#N/A	0.0	#N/A	#N/A	0.0
107.0	100,232	272,853	#N/A	0.0	#N/A	#N/A	0.0
107.1	100,232	283,990	1.490	0.2	#N/A	#N/A	0.2
107.2	100,232	295,127	1.490	0.7	#N/A	#N/A	0.7
107.3	100,232	306,264	1.450	1.2	#N/A	#N/A	1.2
107.4	100,232	317,401	1.460	1.8	#N/A	#N/A	1.8
107.5	100,232	328,538	1.450	2.6	#N/A	#N/A	2.6
107.6	100,232	339,675	1.450	3.4	#N/A	#N/A	3.4
107.7	100,232	350,812	1.450	4.2	#N/A	#N/A	4.2
107.8	100,232	361,949	1.450	5.2	#N/A	#N/A	5.2
107.9	100,232	373,085	1.450	6.2	#N/A	#N/A	6.2
108.0	100,232	384,222	1.450	7.3	#N/A	#N/A	7.3

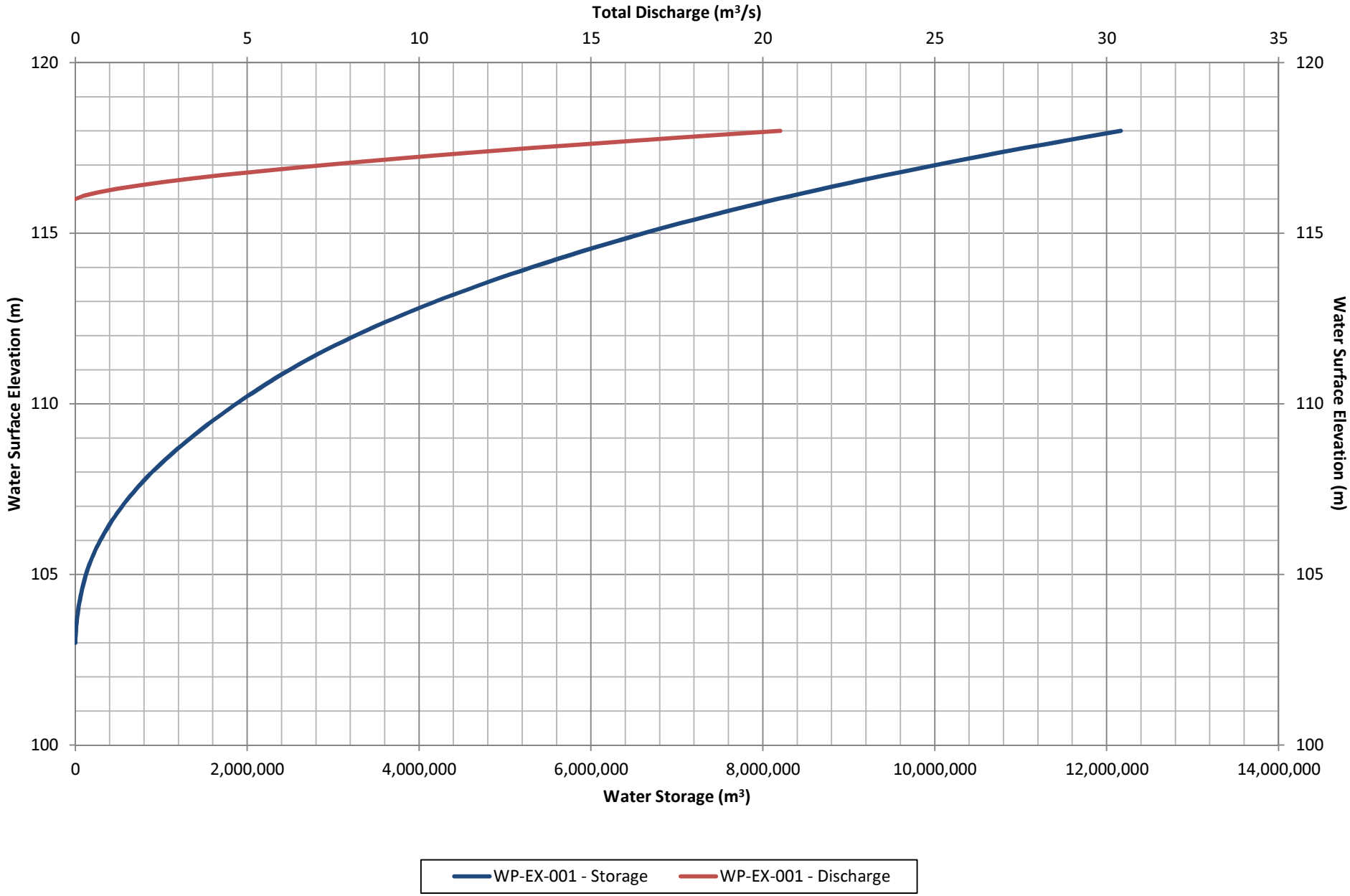
Surface Water Planned (PL) Conditions: Rating tables for WP-PL-009

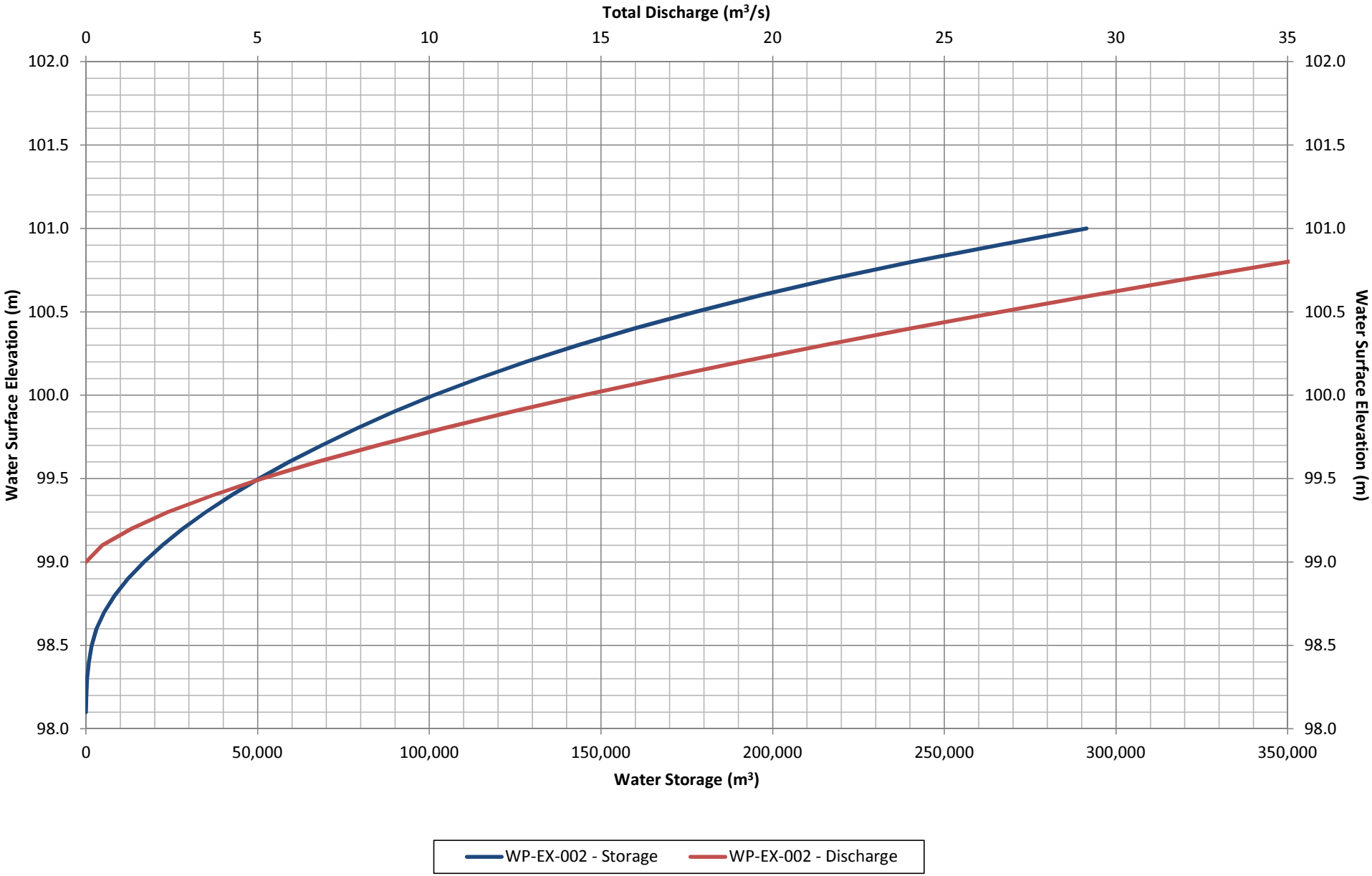
The following information was developed for use in hydrologic routing of the water pond spillway, which operates under broad-crested weir control ($Q = C * L * H^{1.5}$), with coefficient "C" taken from: *Brater, E.F. & King, H.W. (1996) "Handbook of Hydraulics, Seventh Edition"*, New York, N.Y: McGraw-Hill.

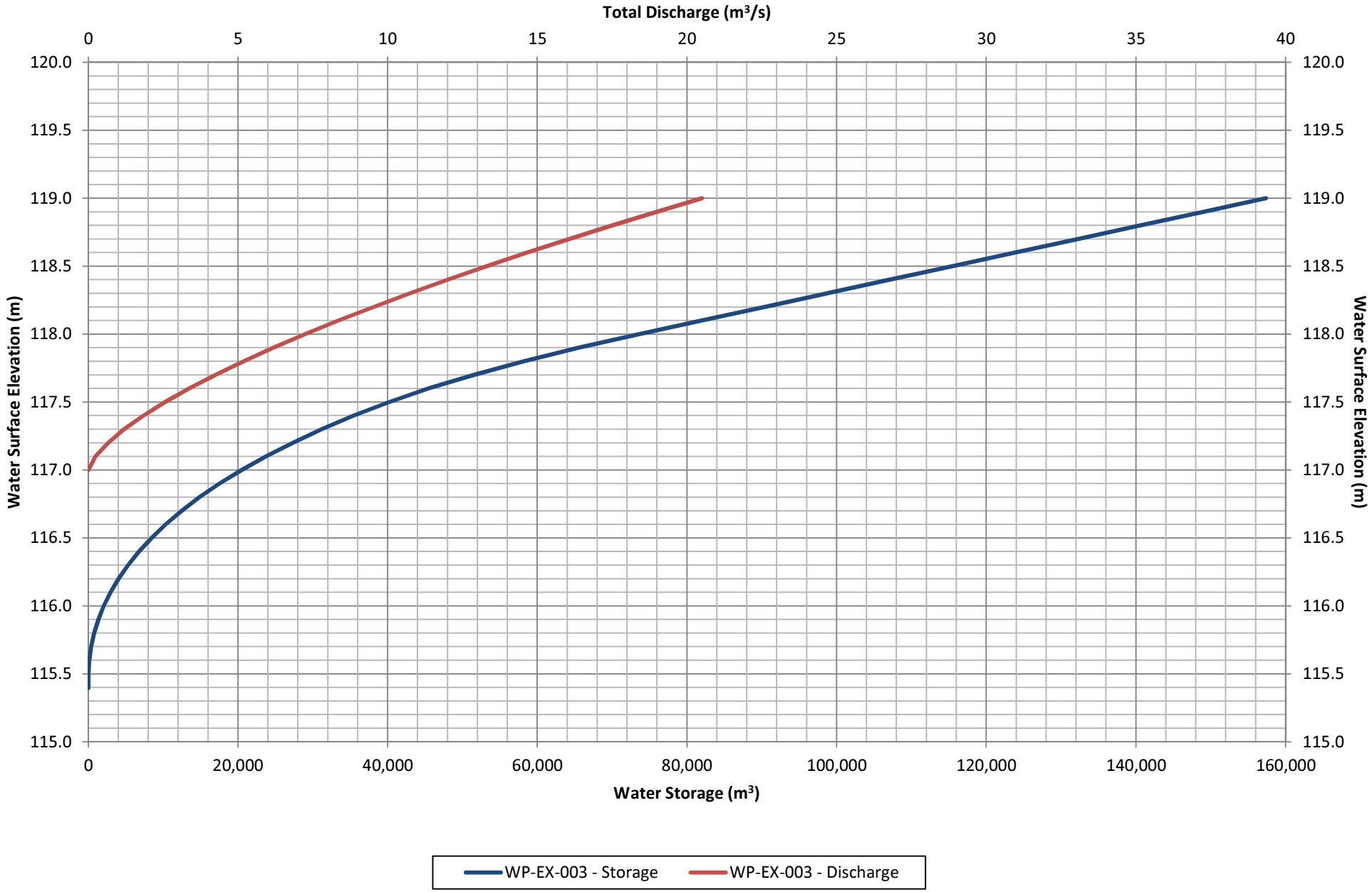
Table entries were derived either from a RIFT model using global SRTM topography or were approximated using pond area and assumed depth. Where nessesary, the stage storages were linearly extrapolated such that they extended 2.0 m above the spillway invert. Crest flow was not considered in these calculations.

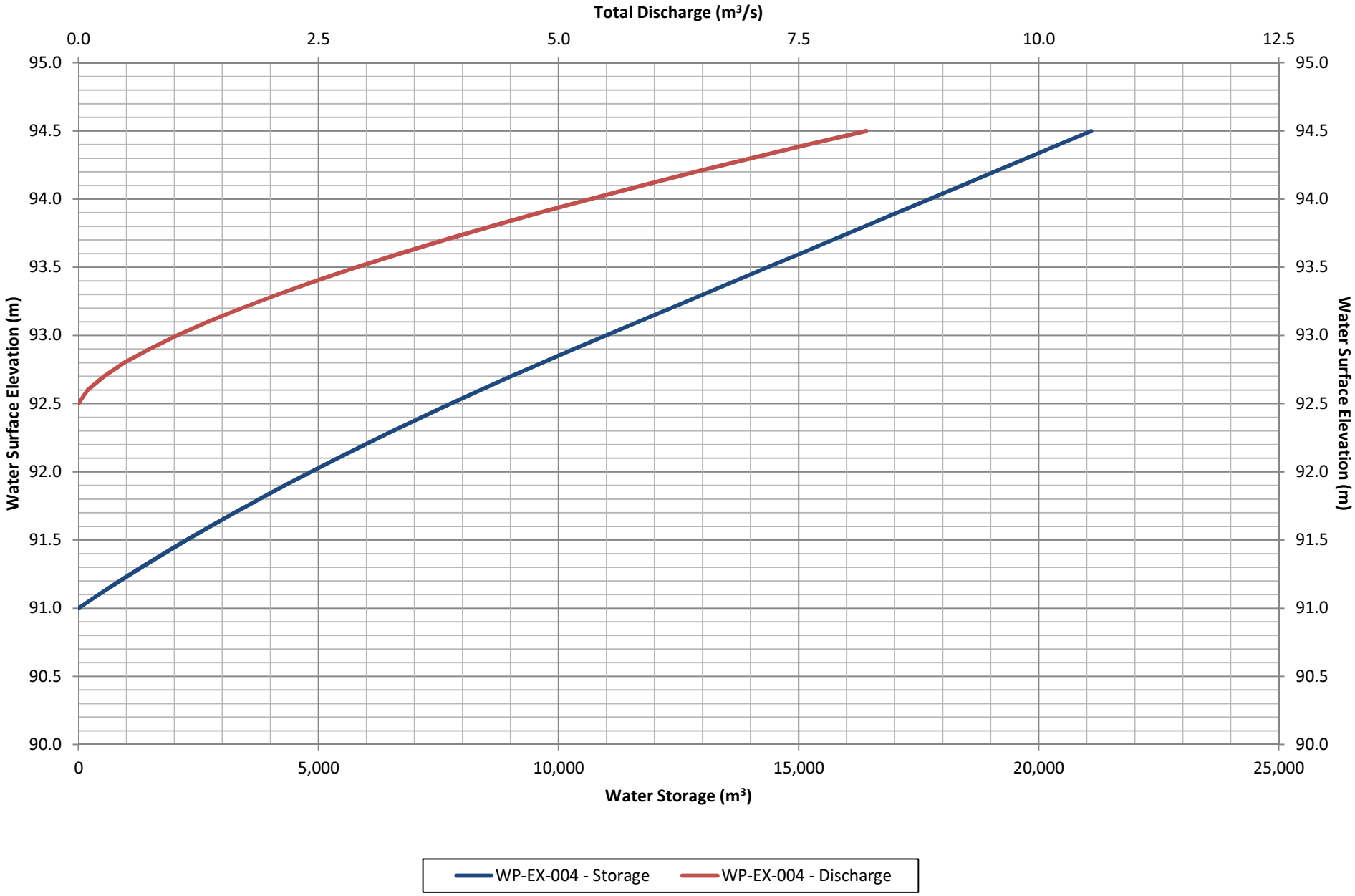
Assume spillway crest length is:	5.0 m	Dam crest length is:	960.9 m
Assume spillway crest breadth is:	>4.5 m	Dam crest breadth is:	5.0 m
Assume spillway invert elevation is:	109.0 m	Dam crest invert elevation is:	111.0 m

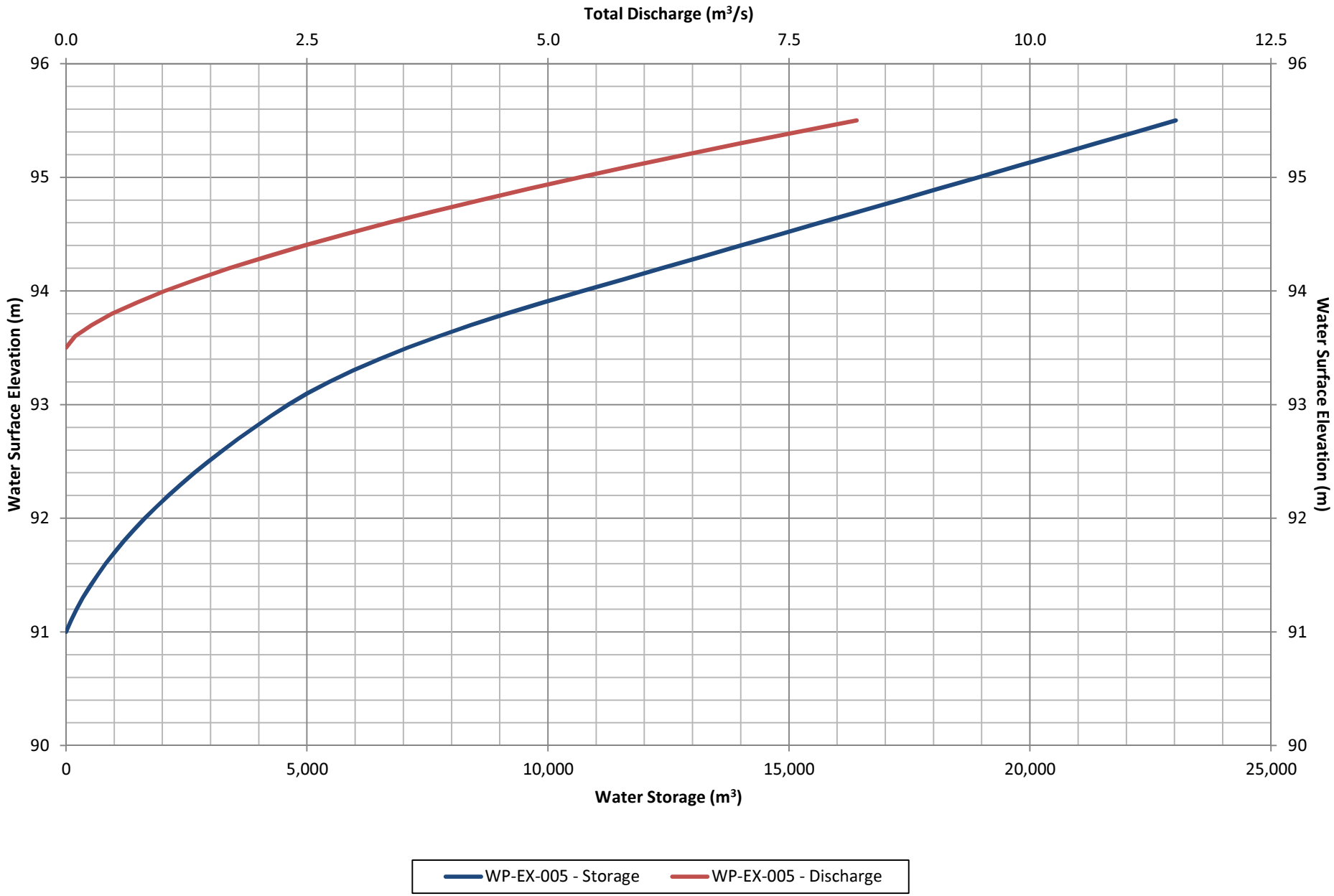
Elevation	Water Surface		Channel Spillway Outflow		Crest Overflow		Combined
(m)	Area (m^2)	Volume (m^3)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Weir Coefficient	{Weir Eqn.} (m^3/s)	Total (m^3/s)
106.7	0	0	#N/A	0.0	#N/A	#N/A	0.0
106.8	46	2	#N/A	0.0	#N/A	#N/A	0.0
106.9	215	13	#N/A	0.0	#N/A	#N/A	0.0
107.0	538	50	#N/A	0.0	#N/A	#N/A	0.0
107.1	999	125	#N/A	0.0	#N/A	#N/A	0.0
107.2	1,565	253	#N/A	0.0	#N/A	#N/A	0.0
107.3	2,270	443	#N/A	0.0	#N/A	#N/A	0.0
107.4	3,089	710	#N/A	0.0	#N/A	#N/A	0.0
107.5	3,950	1,062	#N/A	0.0	#N/A	#N/A	0.0
107.6	4,823	1,501	#N/A	0.0	#N/A	#N/A	0.0
107.7	5,755	2,029	#N/A	0.0	#N/A	#N/A	0.0
107.8	6,799	2,655	#N/A	0.0	#N/A	#N/A	0.0
107.9	7,972	3,392	#N/A	0.0	#N/A	#N/A	0.0
108.0	9,276	4,254	#N/A	0.0	#N/A	#N/A	0.0
108.1	10,719	5,252	#N/A	0.0	#N/A	#N/A	0.0
108.2	12,325	6,403	#N/A	0.0	#N/A	#N/A	0.0
108.3	14,114	7,723	#N/A	0.0	#N/A	#N/A	0.0
108.4	16,091	9,232	#N/A	0.0	#N/A	#N/A	0.0
108.5	18,274	10,948	#N/A	0.0	#N/A	#N/A	0.0
108.6	20,674	12,894	#N/A	0.0	#N/A	#N/A	0.0
108.7	23,474	15,096	#N/A	0.0	#N/A	#N/A	0.0
108.8	26,914	17,609	#N/A	0.0	#N/A	#N/A	0.0
108.9	31,061	20,502	#N/A	0.0	#N/A	#N/A	0.0
109.0	35,832	23,841	#N/A	0.0	#N/A	#N/A	0.0
109.1	41,175	27,687	1.490	0.0	#N/A	#N/A	0.0
109.2	46,989	32,092	1.490	0.2	#N/A	#N/A	0.2
109.3	53,375	37,102	1.450	0.2	#N/A	#N/A	0.2
109.4	60,661	42,798	1.460	0.7	#N/A	#N/A	0.7
109.5	68,339	49,247	1.450	1.2	#N/A	#N/A	1.2
109.6	76,043	56,465	2.450	3.1	#N/A	#N/A	3.1
109.7	84,086	64,466	3.450	6.1	#N/A	#N/A	6.1
109.8	92,808	73,304	4.450	10.3	#N/A	#N/A	10.3
109.9	102,652	83,063	5.450	16.0	#N/A	#N/A	16.0
110.0	114,020	93,877	6.450	23.1	#N/A	#N/A	23.1
110.1	127,166	105,921	7.450	31.8	#N/A	#N/A	31.8
110.2	142,916	119,394	8.450	42.3	#N/A	#N/A	42.3
110.3	161,883	134,605	9.450	54.5	#N/A	#N/A	54.5
110.4	183,670	151,851	10.450	68.7	#N/A	#N/A	68.7
110.5	210,151	171,475	11.450	84.9	#N/A	#N/A	84.9
110.6	238,209	193,888	12.450	103.1	#N/A	#N/A	103.1
110.7	264,615	219,056	13.450	123.5	#N/A	#N/A	123.5
110.8	288,006	246,713	14.450	146.2	#N/A	#N/A	146.2
110.9	309,183	276,614	15.450	171.2	#N/A	#N/A	171.2
111.0	327,266	308,261	16.450	198.6	#N/A	#N/A	198.6

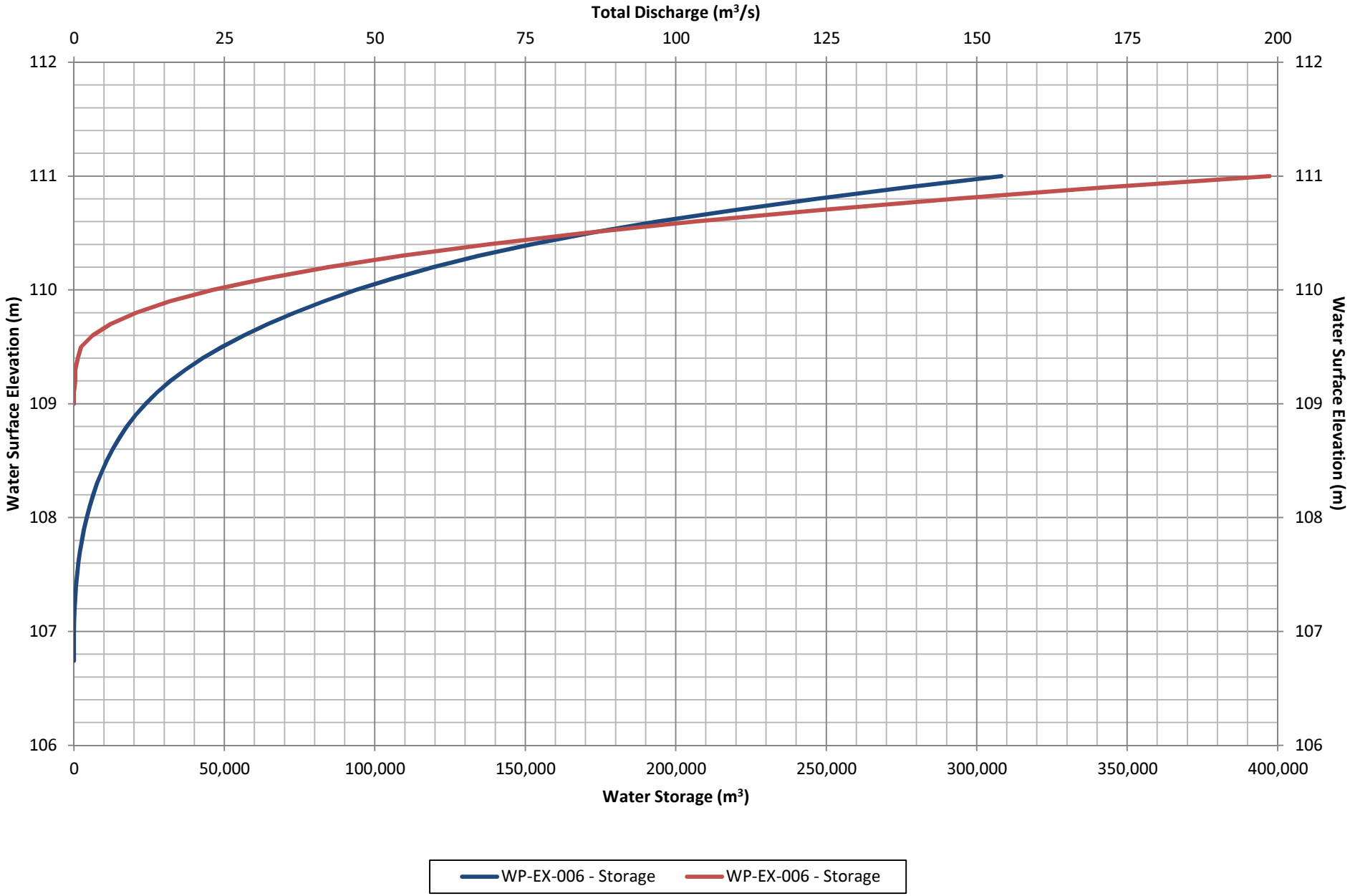

Total Discharge (m³/s)
0
5
10
15
20
25
30
35
120
115
110
105
100
Water Surface Elevation (m)
Water Surface Elevation (m)
0
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
12,000,000
14,000,000
Water Storage (m³)
WP-EX-001 - Storage
WP-EX-001 - Discharge

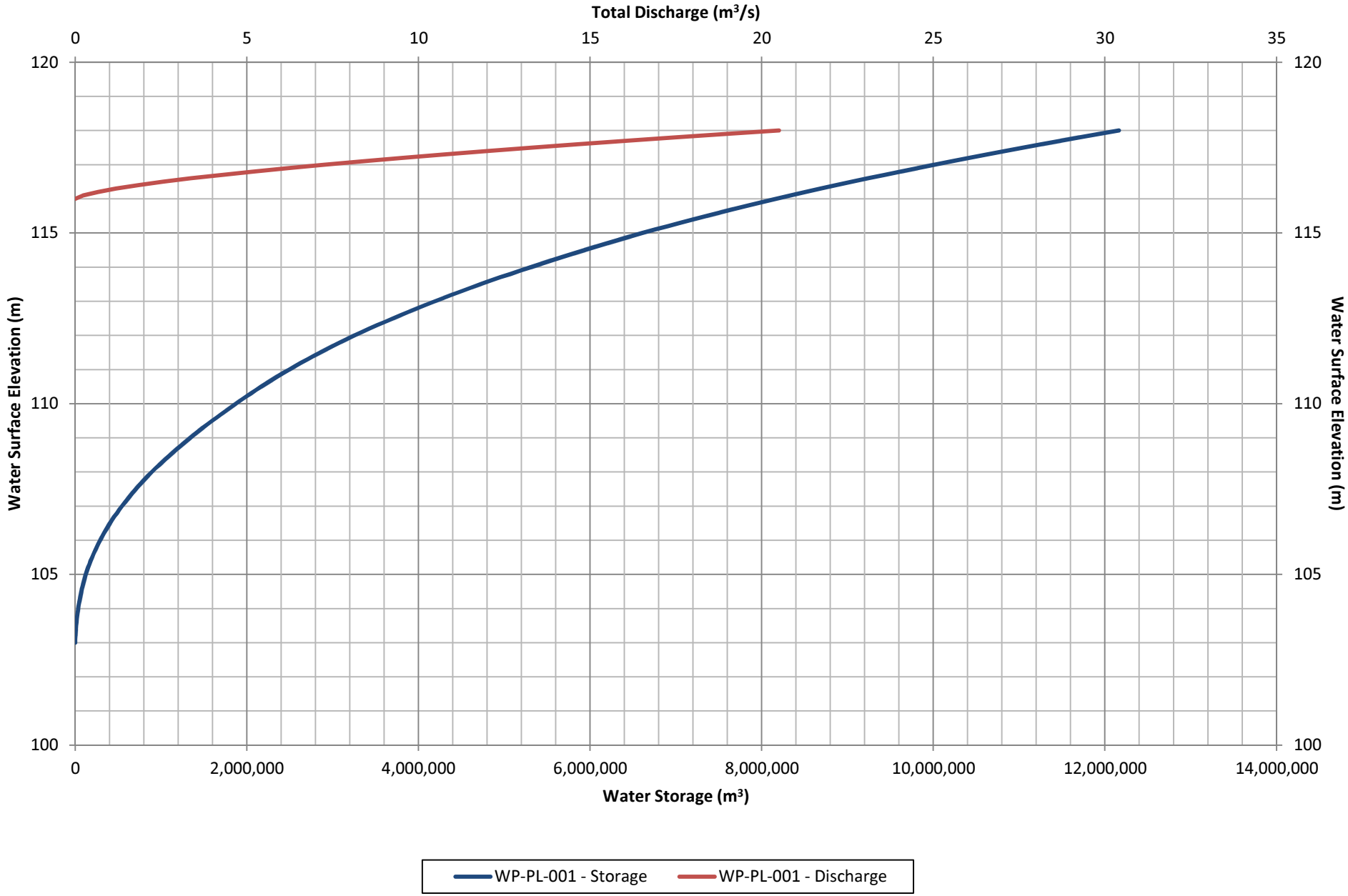

Total Discharge (m³/s)
0
5
10
15
20
25
30
35
102.0
101.5
101.0
100.5
100.0
99.5
99.0
98.5
98.0
Water Surface Elevation (m)
Water Surface Elevation (m)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
Water Storage (m³)
WP-EX-002 - Storage
WP-EX-002 - Discharge

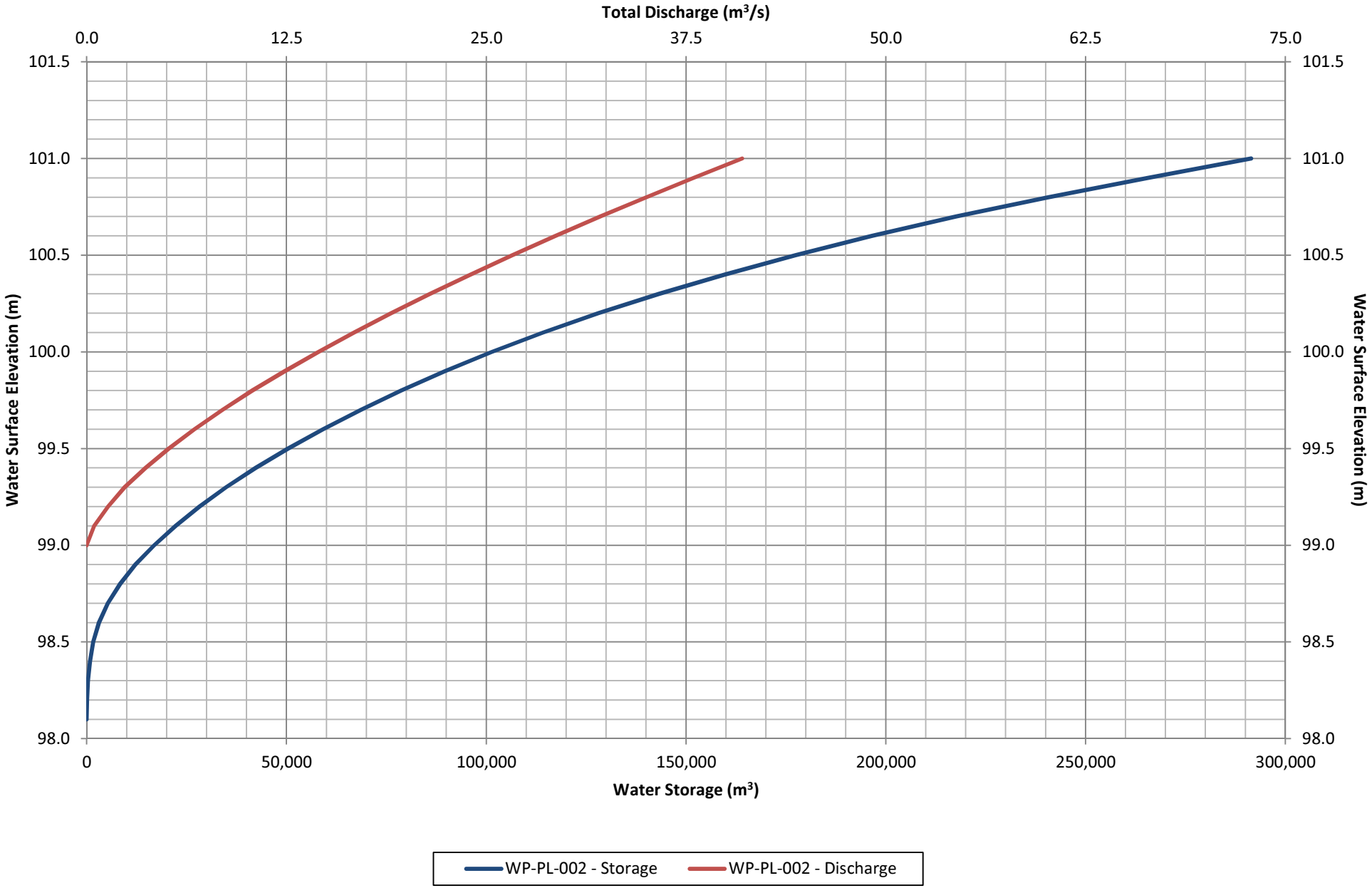

Total Discharge (m³/s)
0
5
10
15
20
25
30
35
40
Water Surface Elevation (m)
120.0
119.5
119.0
118.5
118.0
117.5
117.0
116.5
116.0
115.5
115.0
Water Storage (m³)
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
WP-EX-003 - Storage
WP-EX-003 - Discharge

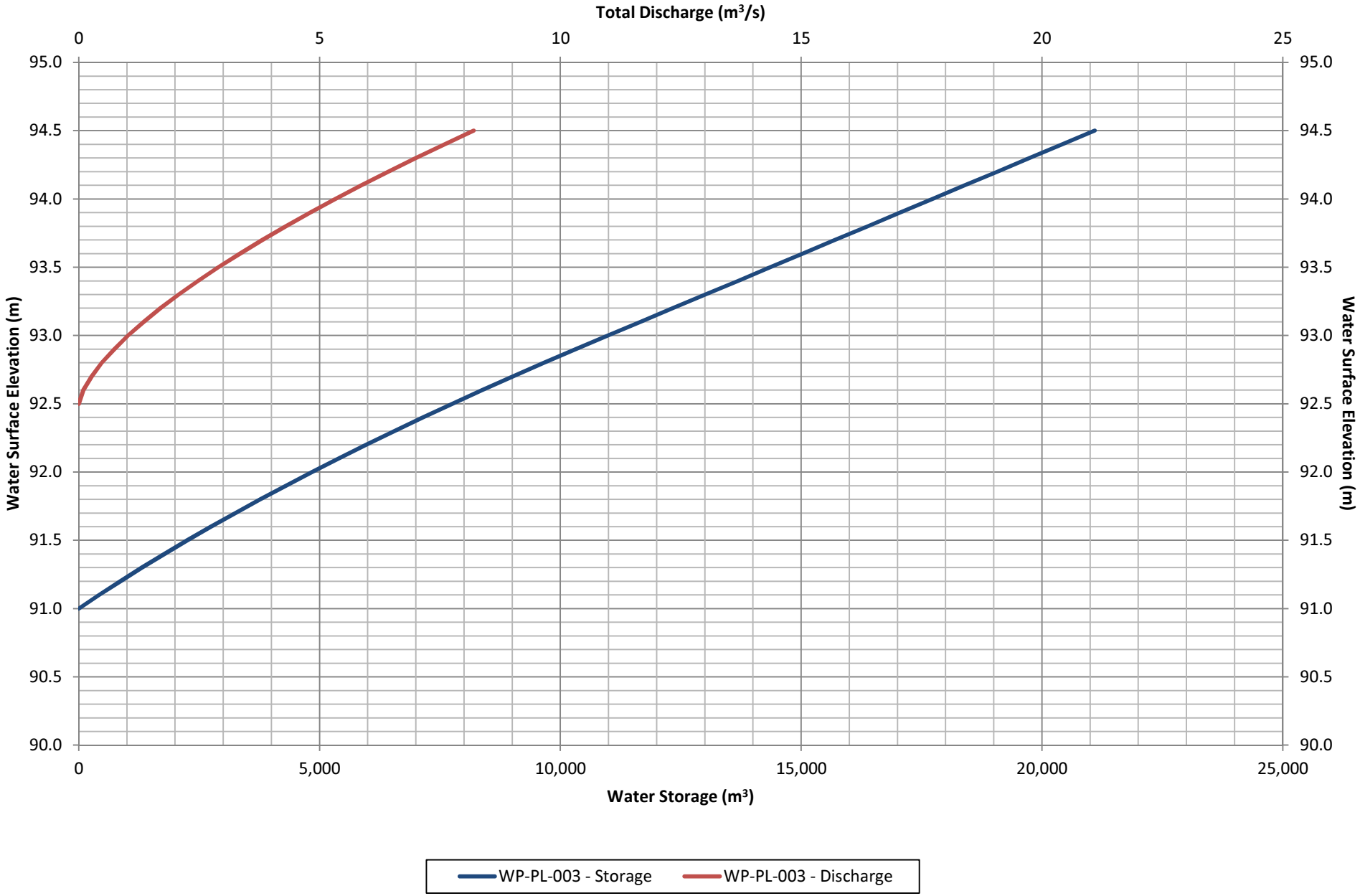

Total Discharge (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
95.0
94.5
94.0
93.5
93.0
92.5
92.0
91.5
91.0
90.5
90.0
Water Surface Elevation (m)
Water Surface Elevation (m)
0
5,000
10,000
15,000
20,000
25,000
Water Storage (m³)
WP-EX-004 - Storage
WP-EX-004 - Discharge

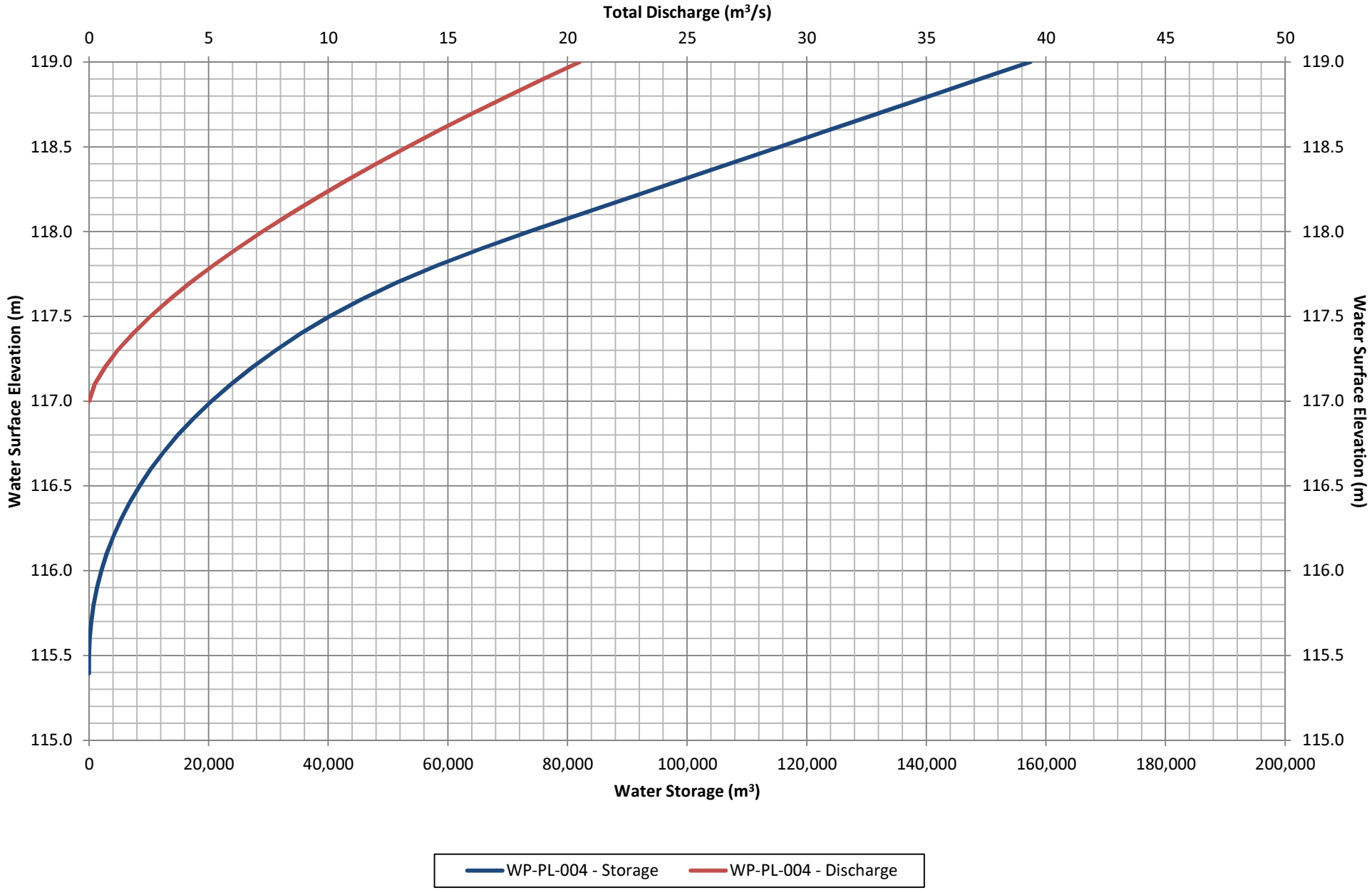

Total Discharge (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
96
95
94
93
92
91
90
Water Surface Elevation (m)
Water Surface Elevation (m)
0
5,000
10,000
15,000
20,000
25,000
Water Storage (m³)
WP-EX-005 - Storage
WP-EX-005 - Discharge

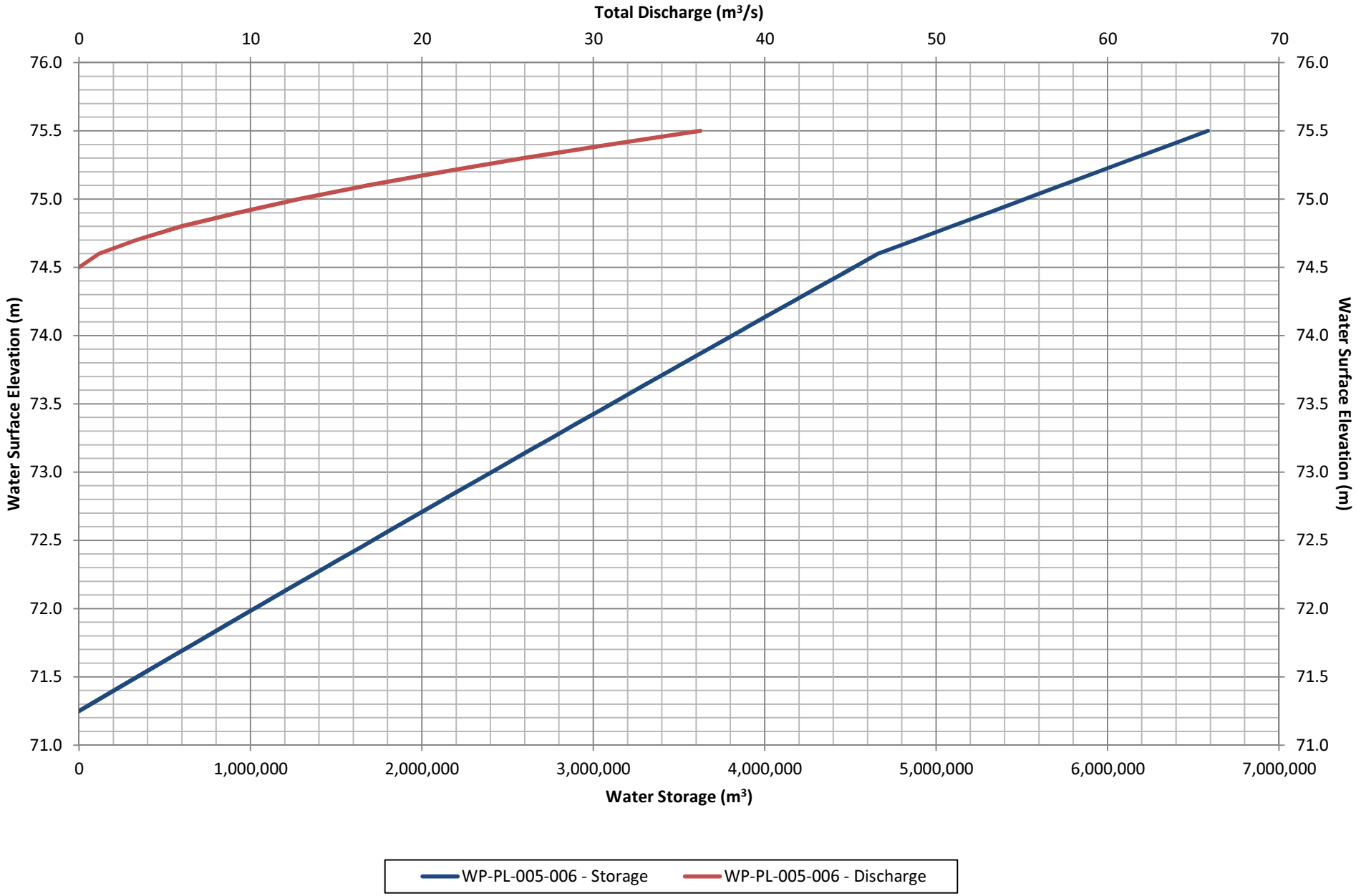

Total Discharge (m³/s)
0
25
50
75
100
125
150
175
200
112
111
110
109
108
107
106
Water Surface Elevation (m)
Water Surface Elevation (m)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
Water Storage (m³)
WP-EX-006 - Storage
WP-EX-006 - Storage

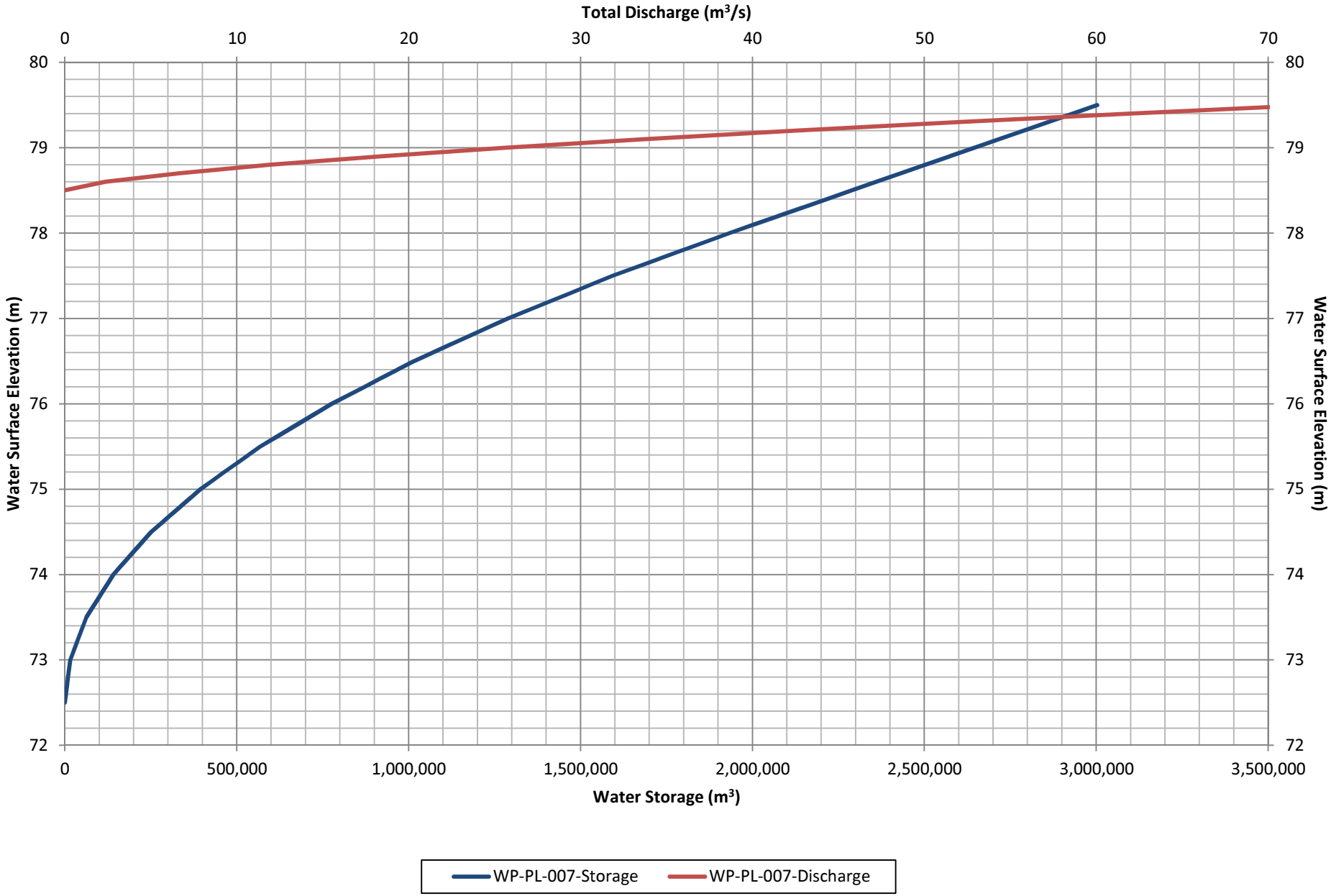

Total Discharge (m³/s)
0
5
10
15
20
25
30
35
120
115
110
105
100
Water Surface Elevation (m)
Water Surface Elevation (m)
0
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
12,000,000
14,000,000
Water Storage (m³)
WP-PL-001 - Storage
WP-PL-001 - Discharge

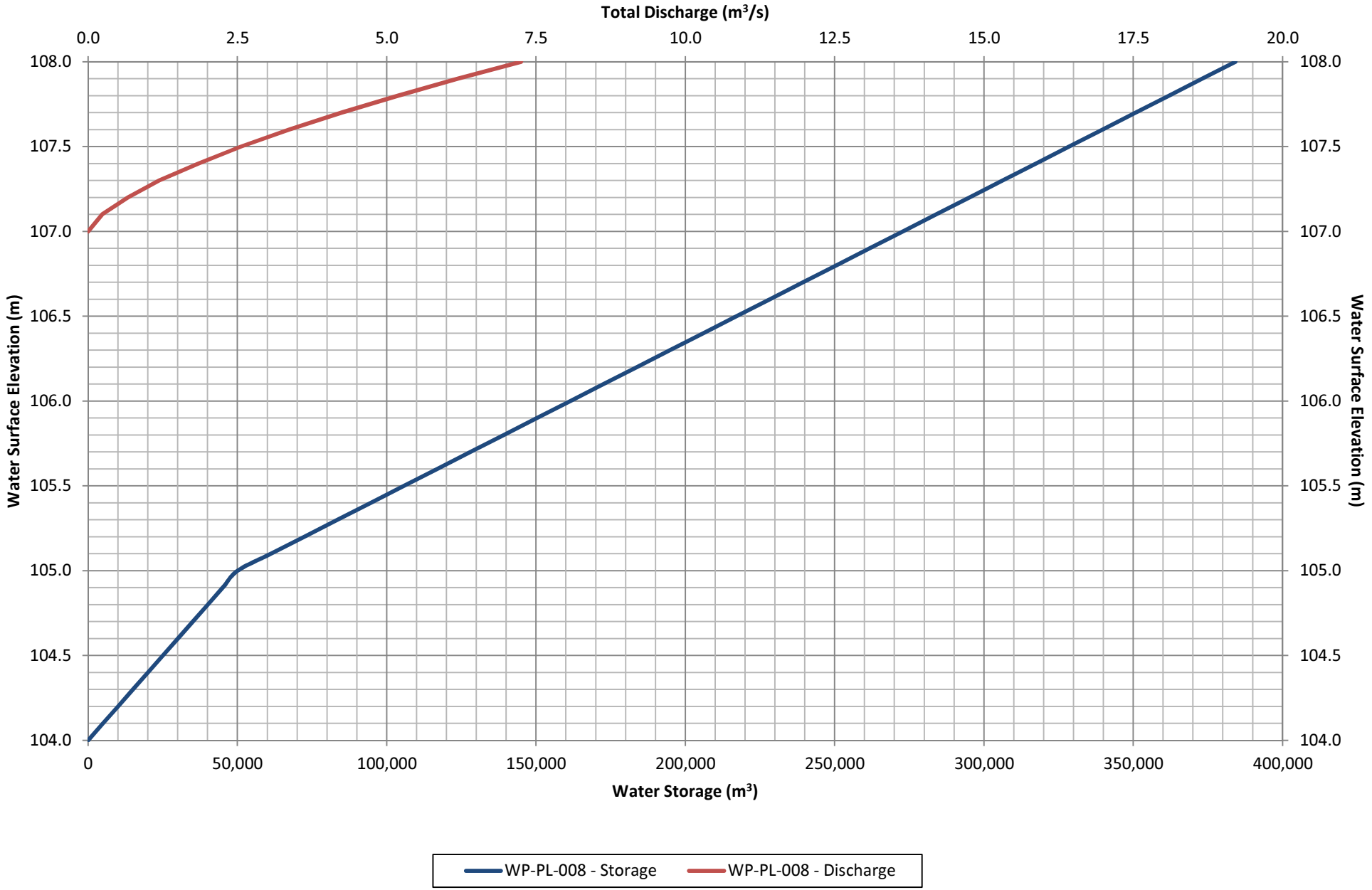

Total Discharge (m³/s)
0.0
12.5
25.0
37.5
50.0
62.5
75.0
Water Surface Elevation (m)
101.5
101.0
100.5
100.0
99.5
99.0
98.5
98.0
0
50,000
100,000
150,000
200,000
250,000
300,000
Water Storage (m³)
WP-PL-002 - Storage
WP-PL-002 - Discharge

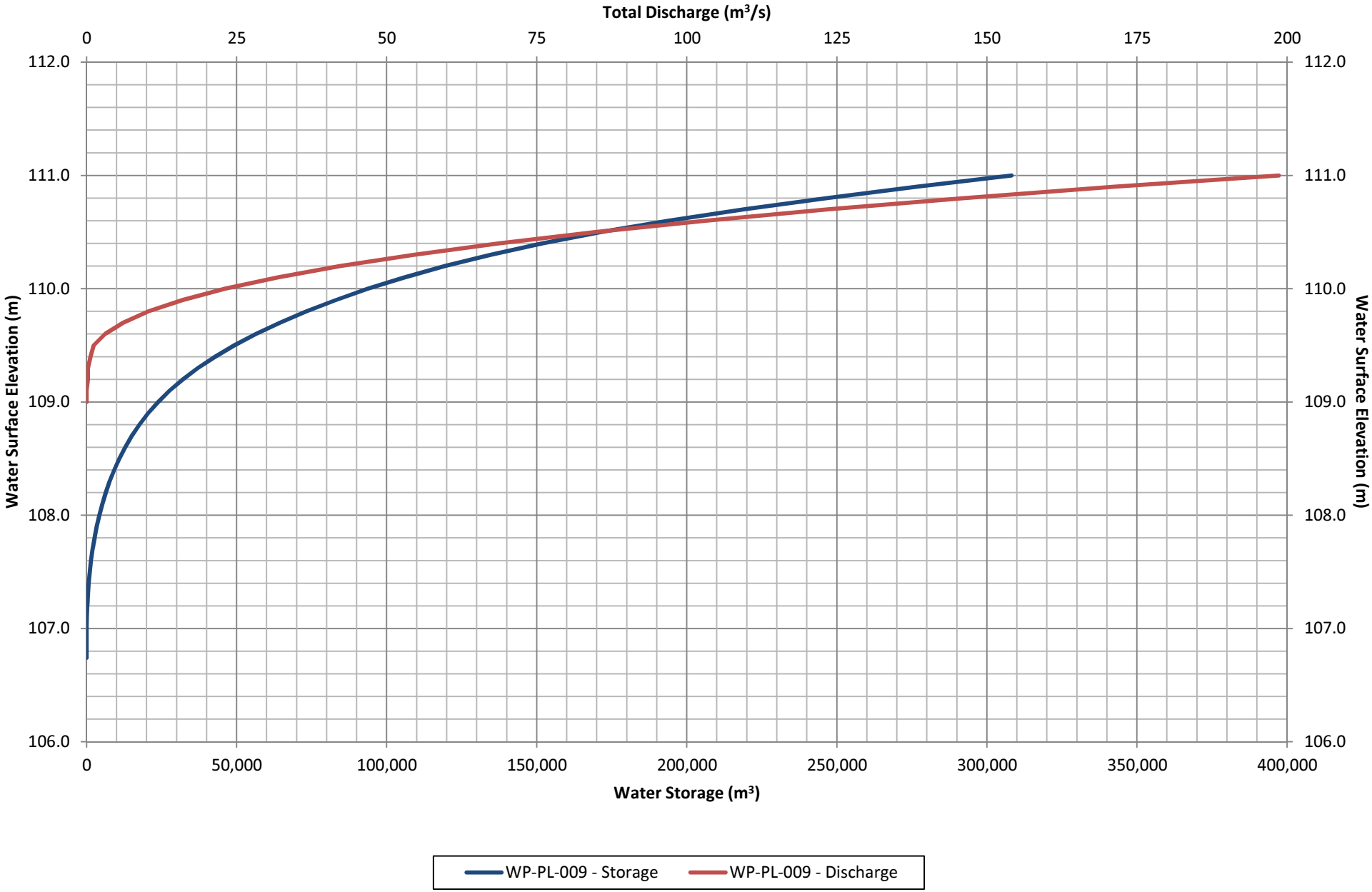

Total Discharge (m³/s)
0
5
10
15
20
25
95.0
94.5
94.0
93.5
93.0
92.5
92.0
91.5
91.0
90.5
90.0
Water Surface Elevation (m)
Water Surface Elevation (m)
0
5,000
10,000
15,000
20,000
25,000
Water Storage (m³)
WP-PL-003 - Storage
WP-PL-003 - Discharge


Total Discharge (m³/s)
0
5
10
15
20
25
30
35
40
45
50
Water Surface Elevation (m)
119.0
118.5
118.0
117.5
117.0
116.5
116.0
115.5
115.0
Water Surface Elevation (m)
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
180,000
200,000
Water Storage (m³)
WP-PL-004 - Storage
WP-PL-004 - Discharge


Total Discharge (m³/s)
0
10
20
30
40
50
60
70
Water Surface Elevation (m)
76.0
75.5
75.0
74.5
74.0
73.5
73.0
72.5
72.0
71.5
71.0
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
7,000,000
Water Storage (m³)
WP-PL-005-006 - Storage
WP-PL-005-006 - Discharge


Total Discharge (m³/s)
0
10
20
30
40
50
60
70
80
79
78
77
76
75
74
73
72
Water Surface Elevation (m)
Water Surface Elevation (m)
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
3,500,000
Water Storage (m³)
WP-PL-007-Storage
WP-PL-007-Discharge


Total Discharge (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Water Surface Elevation (m)
108.0
107.5
107.0
106.5
106.0
105.5
105.0
104.5
104.0
Water Surface Elevation (m)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
Water Storage (m³)
WP-PL-008 - Storage
WP-PL-008 - Discharge

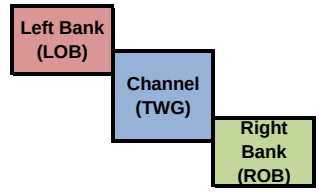

Total Discharge (m³/s)
0
25
50
75
100
125
150
175
200
112.0
111.0
110.0
109.0
108.0
107.0
106.0
Water Surface Elevation (m)
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
Water Storage (m³)
WP-PL-009 - Storage
WP-PL-009 - Discharge

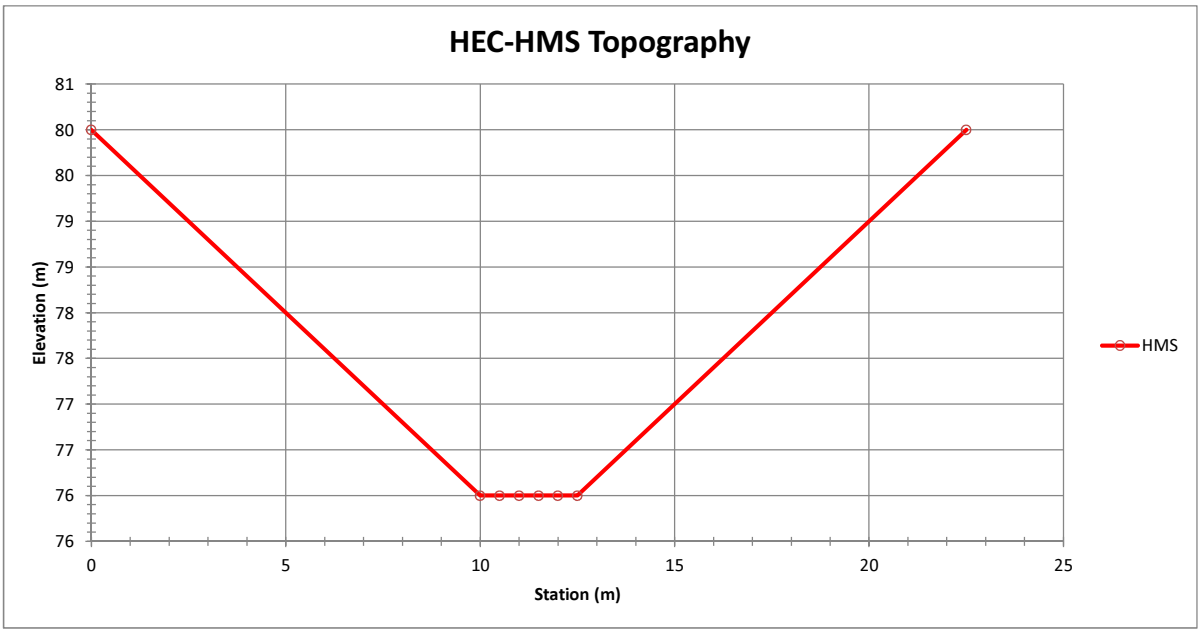
HEC-HMS Channel Topography (For DC-EX-001)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	3170.0	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



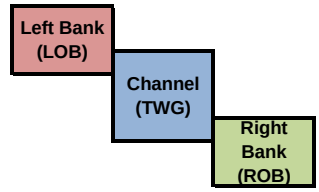


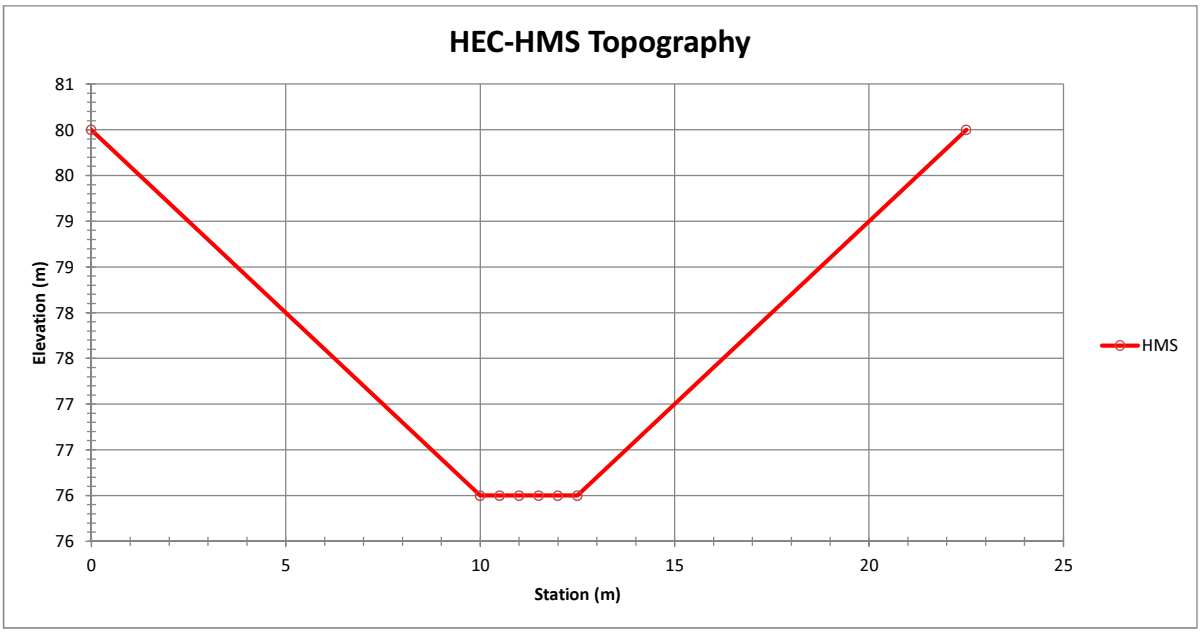
HEC-HMS Channel Topography (For DC-EX-002)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	836.7	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



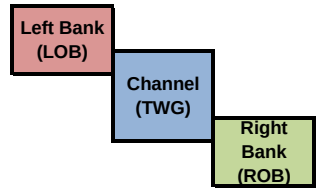


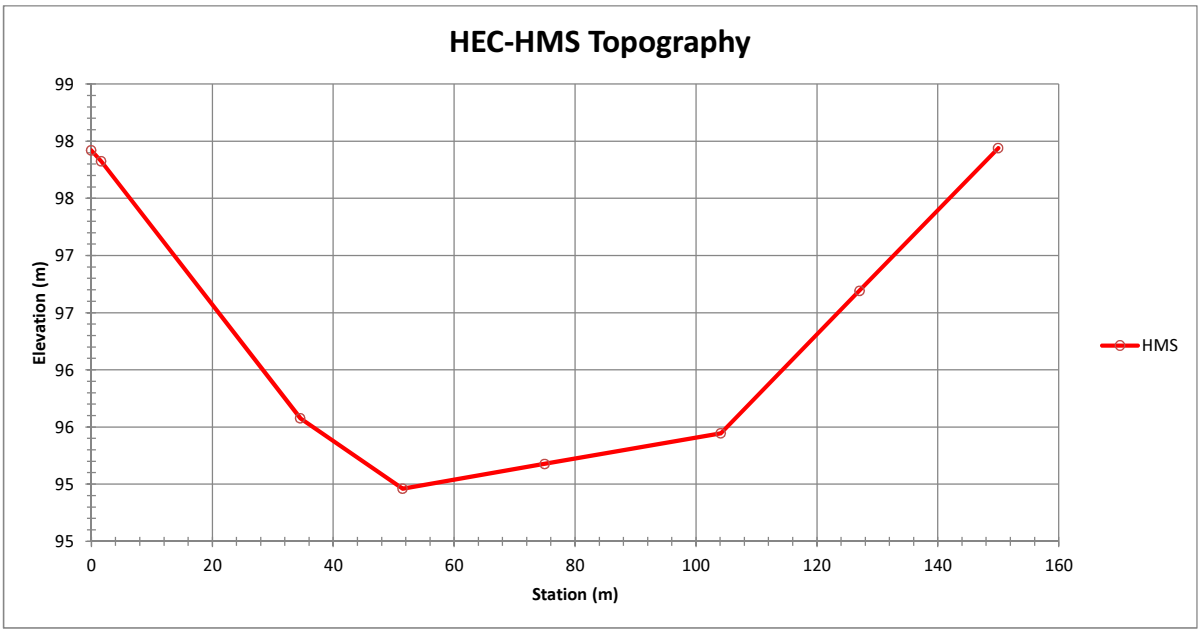
HEC-HMS Channel Topography (For NC-EX-003)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 4885.0 **(m)**
Channel slope, S = 0.003 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	97.919	1
1.632	97.824	2
34.528	95.576	**3**
51.508	94.961	4
75.000	95.177	5
104.127	95.444	**6**
127.064	96.692	7
150.000	97.940	8



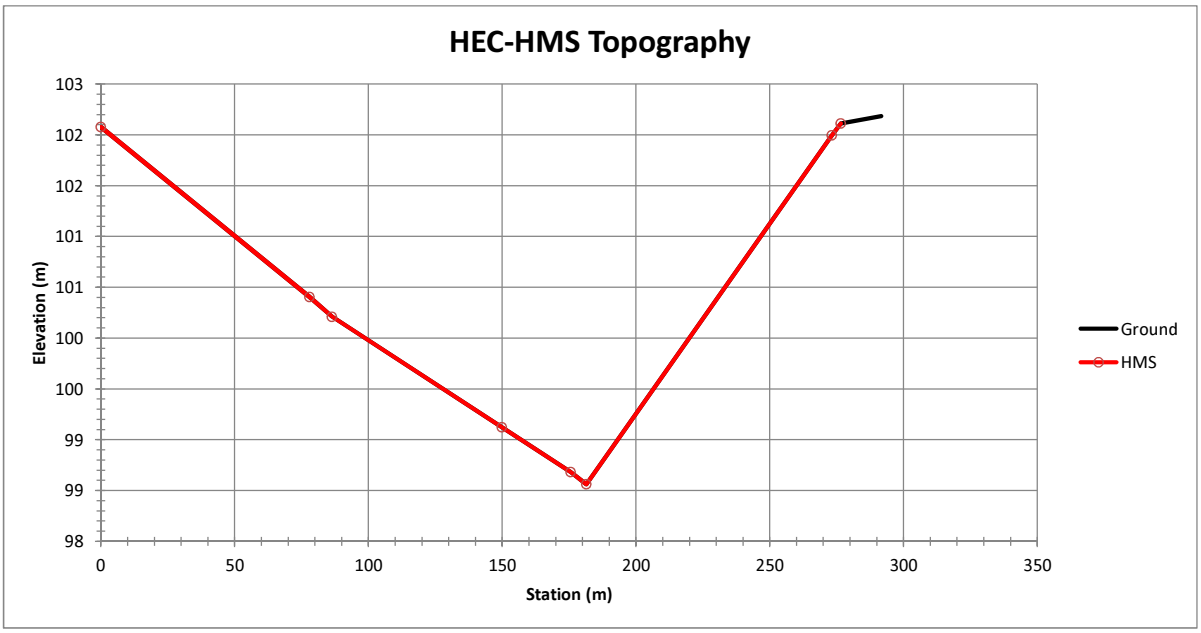


HEC-HMS Channel Topography (For NC-EX-004)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1383.7 **(m)**
Channel slope, S = 0.011 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	102.078	1
78.005	100.404	2
86.383	100.211	**3**
149.917	99.122	4
175.632	98.681	5
181.500	98.563	**6**
273.261	101.997	7
276.618	102.111	8

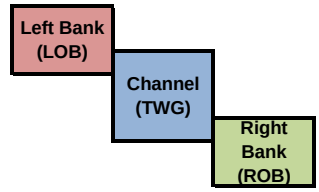


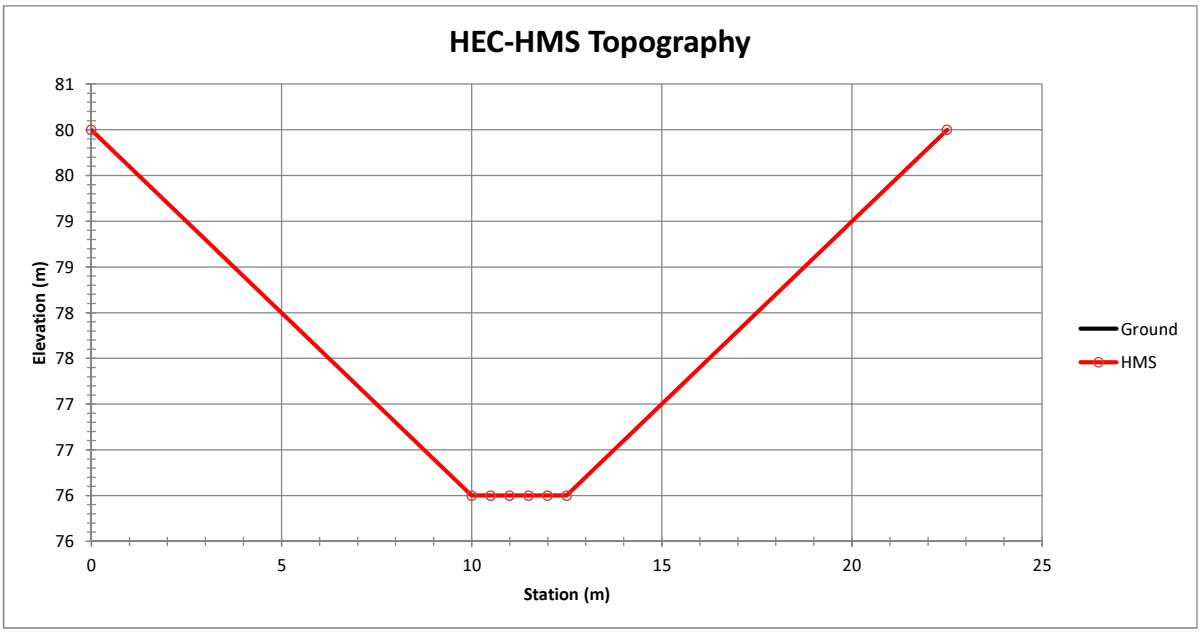
HEC-HMS Channel Topography (For DC-EX-005)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	3158.1	**(m)**
Channel slope, S =	0.003	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



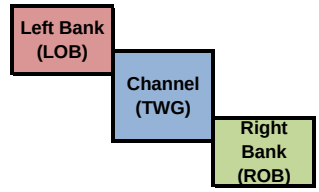


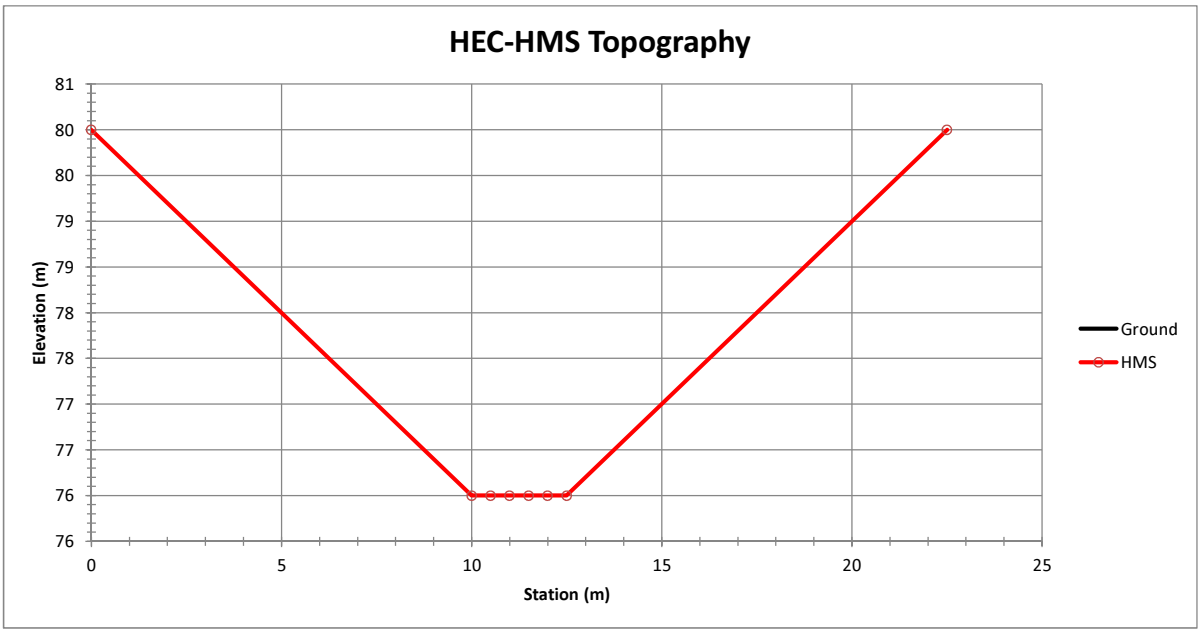
HEC-HMS Channel Topography (For DC-EX-006)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2079.0	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



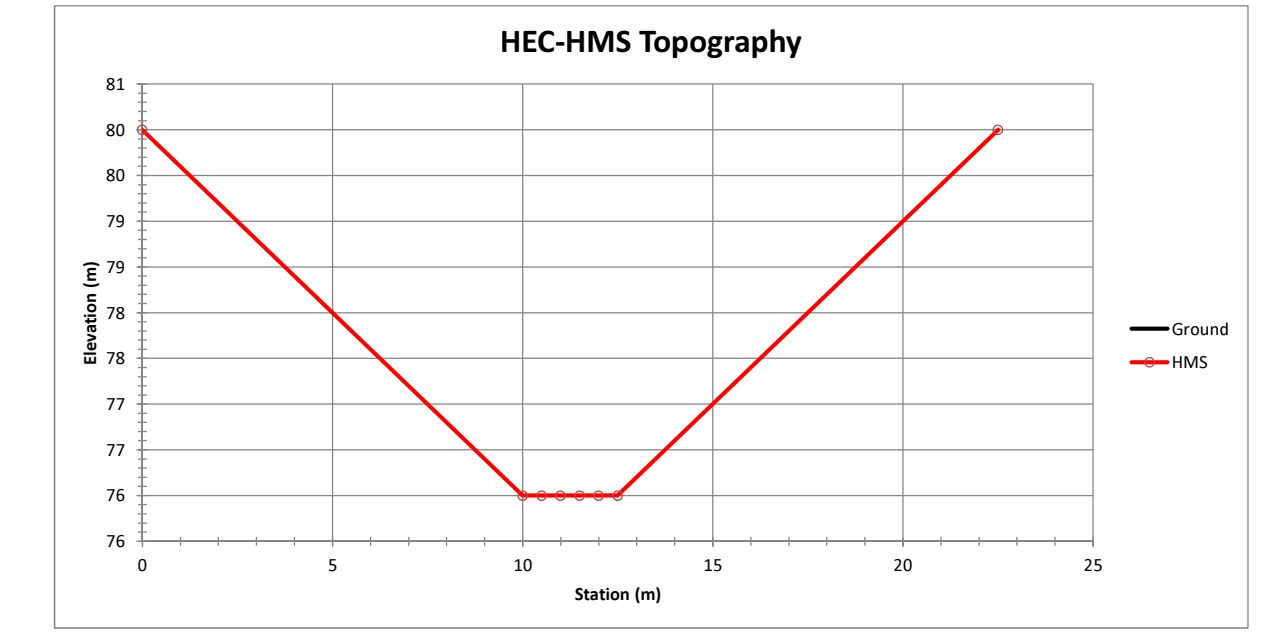


HEC-HMS Channel Topography (For DC-EX-007)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	433.4	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8

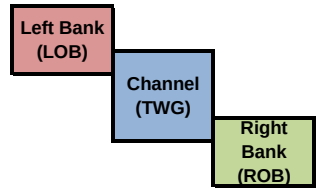


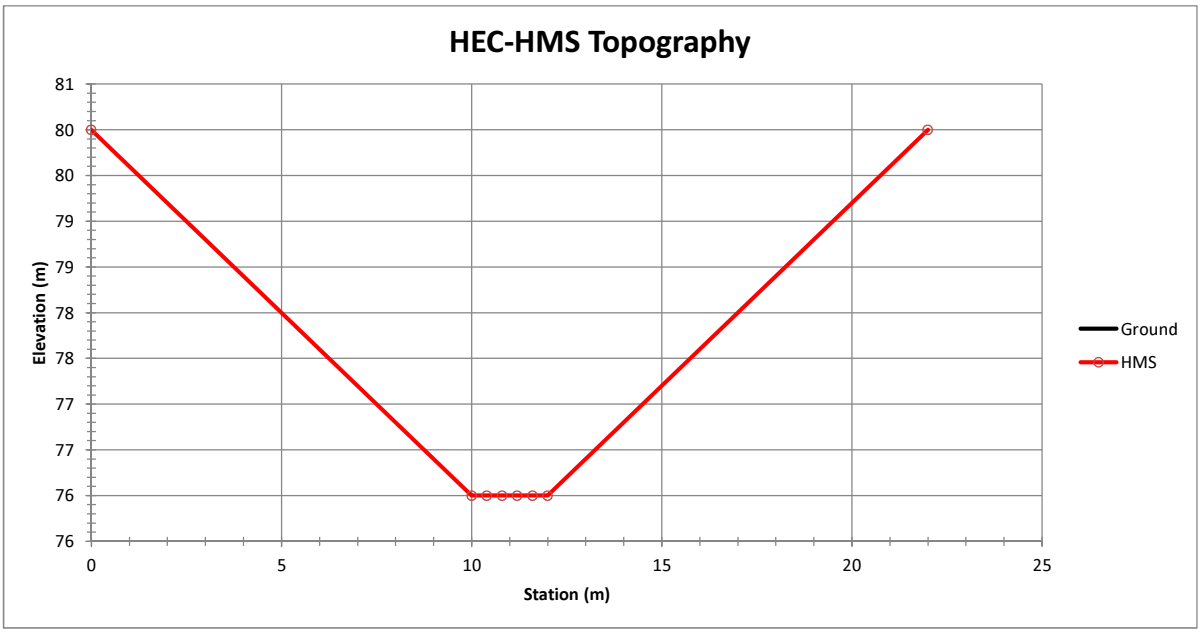
HEC-HMS Channel Topography (For DC-EX-008)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	473.7	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



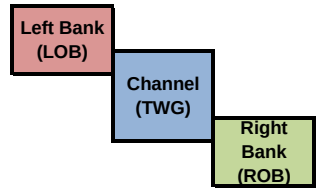


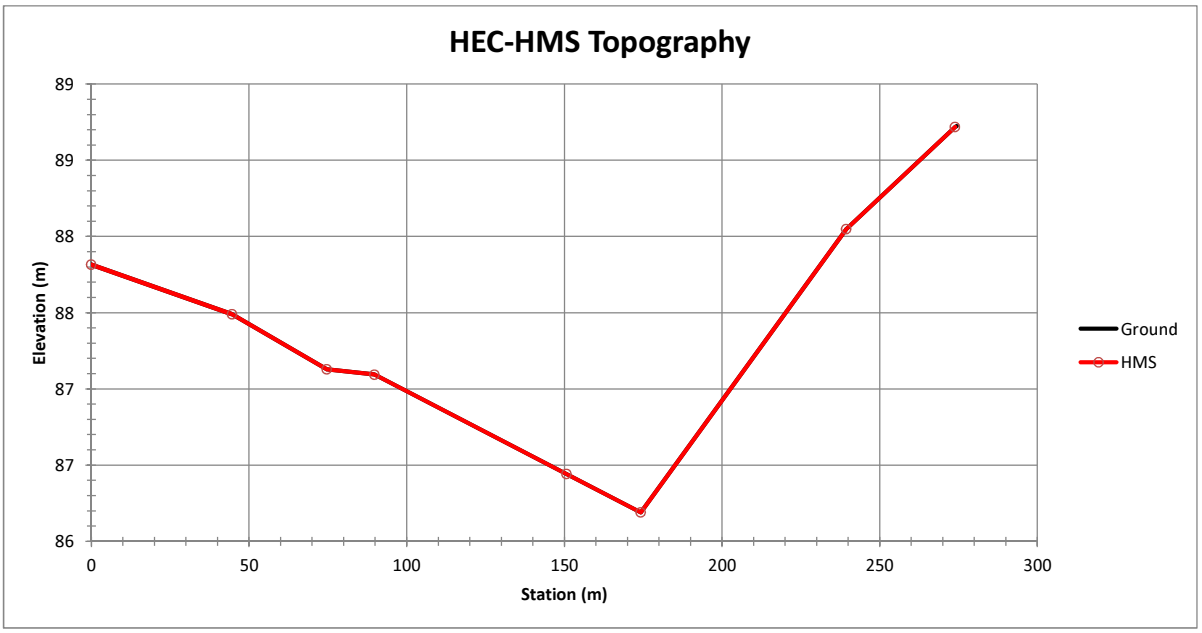
HEC-HMS Channel Topography (For NC-EX-009)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	3367.893	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	87.816	1
44.672	87.489	2
74.686	87.129	**3**
89.765	87.094	4
150.729	86.442	5
174.289	86.190	**6**
239.410	88.048	7
273.891	88.718	8



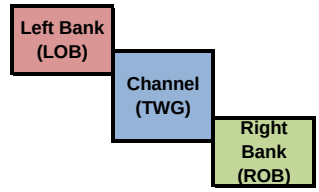


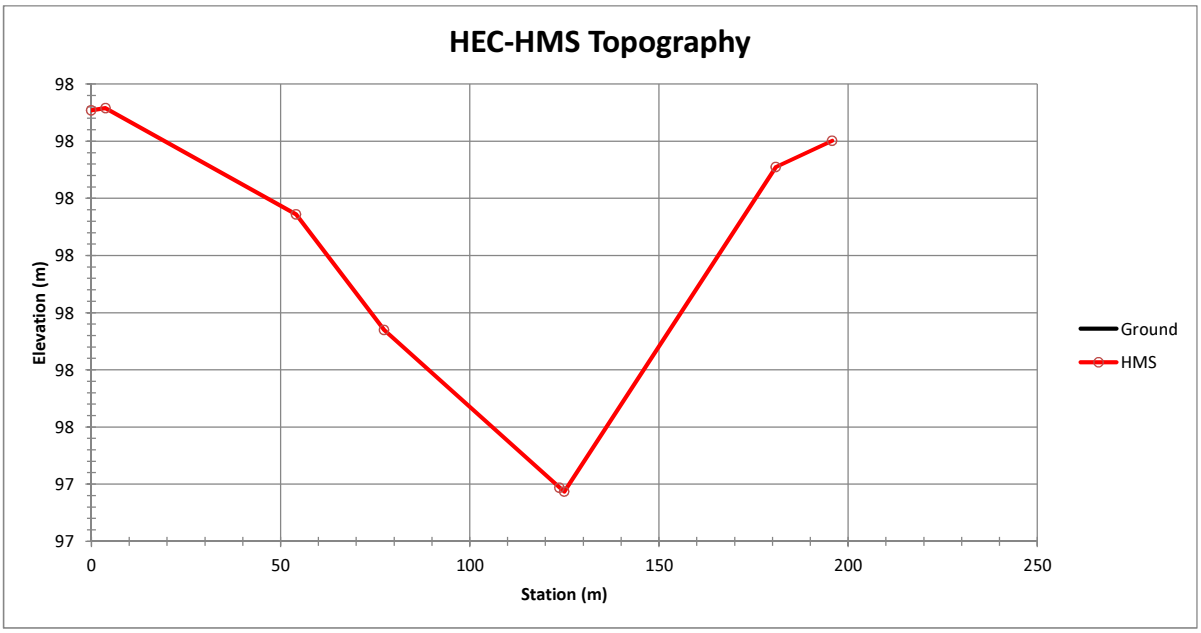
HEC-HMS Channel Topography (For NC-EX-010)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 751.5 **(m)**
Channel slope, S = 0.001 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	98.054	1
3.732	98.058	2
54.141	97.872	**3**
77.378	97.670	4
123.701	97.394	5
124.982	97.387	**6**
180.874	97.955	7
195.823	98.001	8



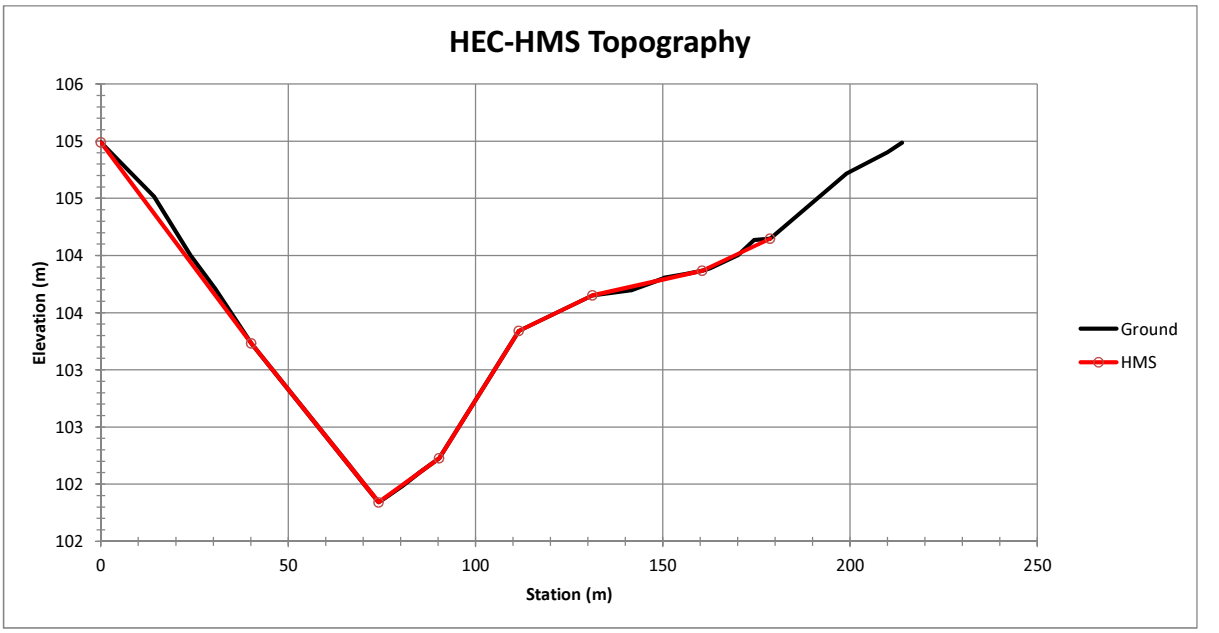


HEC-HMS Channel Topography (For NC-EX-011)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 2850.6 **(m)**
Channel slope, S = 0.004 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	104.989	1
40.175	103.232	2
74.184	101.841	**3**
90.298	102.227	4
111.616	103.340	5
131.256	103.652	**6**
160.528	103.867	7
178.653	104.147	8

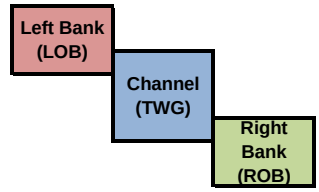


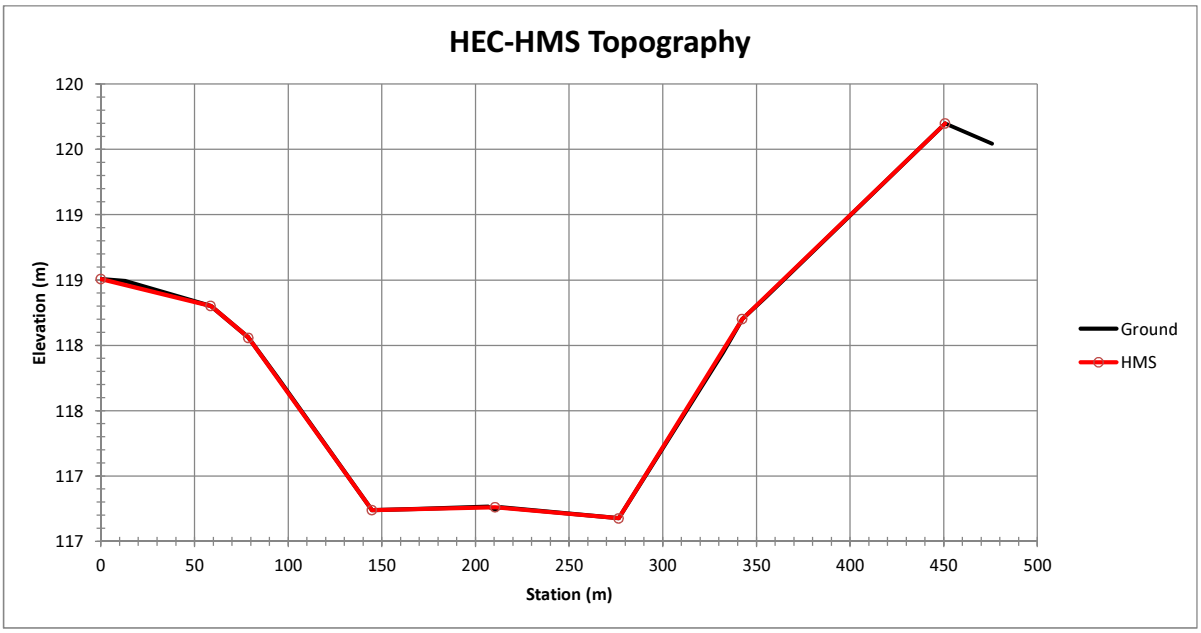
HEC-HMS Channel Topography (For NC-EX-012)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1140.5 **(m)**
Channel slope, S = 0.007 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	118.507	1
58.568	118.302	2
78.809	118.058	**3**
144.710	116.738	4
210.610	116.760	5
276.511	116.676	**6**
342.411	118.202	7
450.803	119.698	8



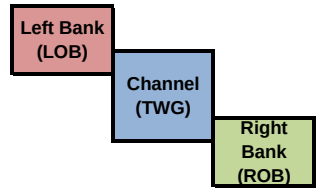


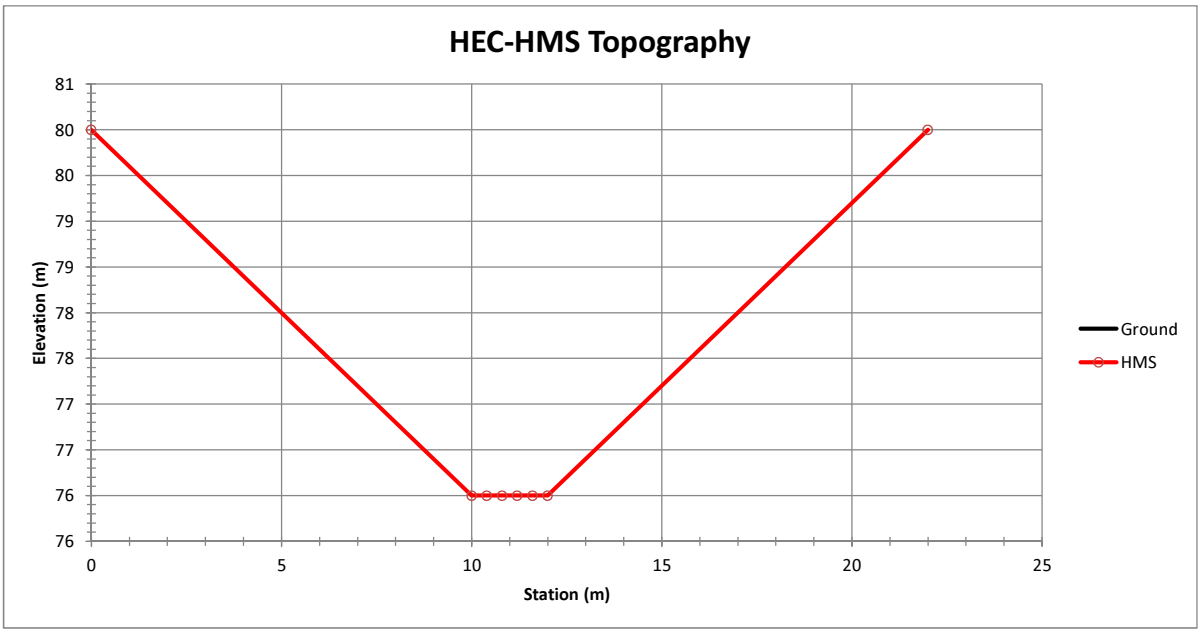
HEC-HMS Channel Topography (For DC-EX-013)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1466.5	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



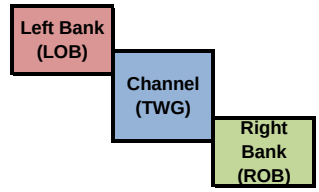


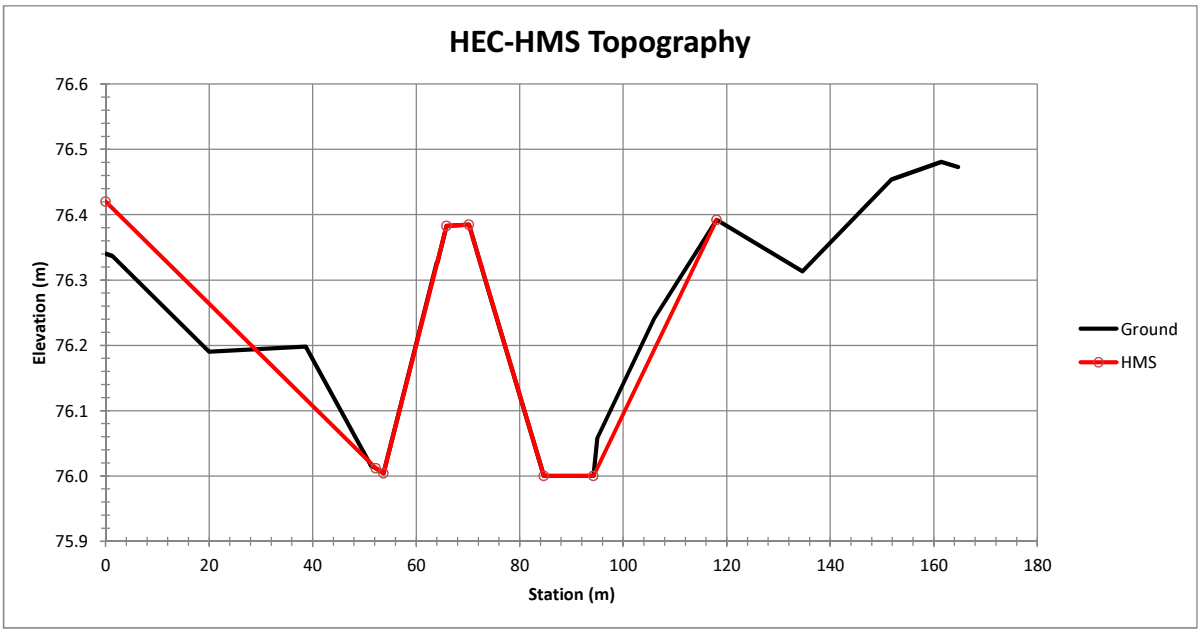
HEC-HMS Channel Topography (For NC-EX-014)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 793.1 **(m)**
Channel slope, S = 0.003 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	76.420	1
52.179	76.012	2
53.687	76.004	**3**
65.895	76.383	4
70.181	76.385	5
84.640	76.000	**6**
94.254	76.000	7
118.033	76.392	8



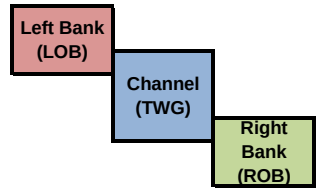


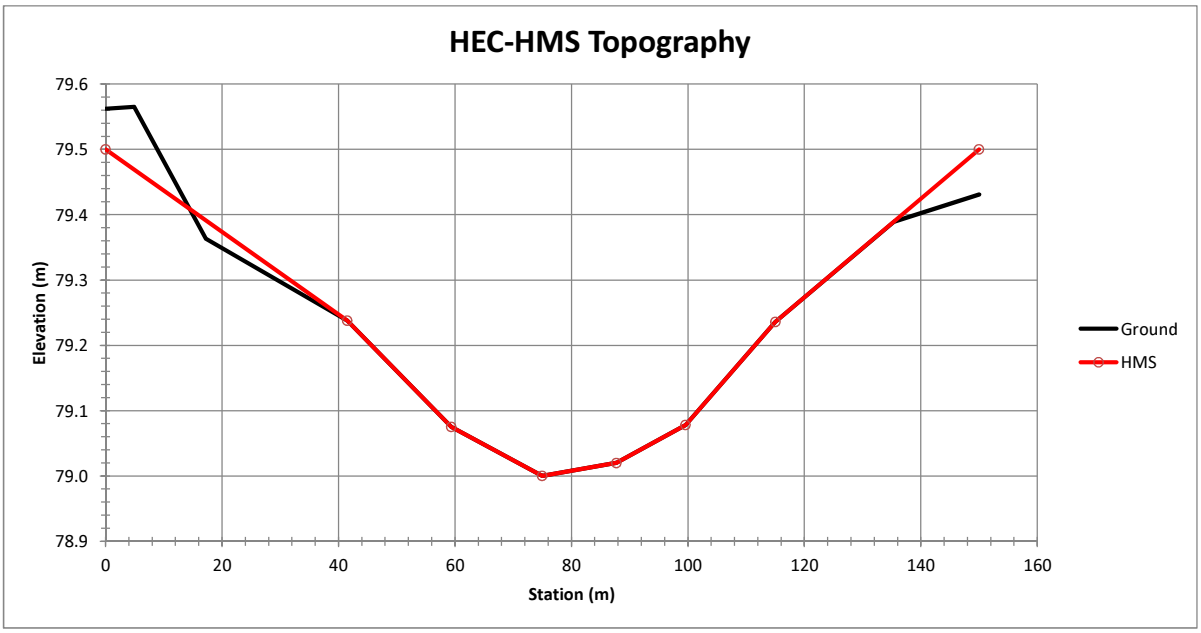
HEC-HMS Channel Topography (For NC-EX-015)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1914.2 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	79.500	1
41.492	79.238	2
59.397	79.075	**3**
75.000	79.000	4
87.724	79.020	5
99.599	79.078	**6**
115.026	79.236	7
150.000	79.500	8



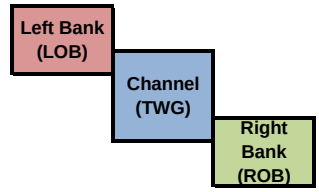


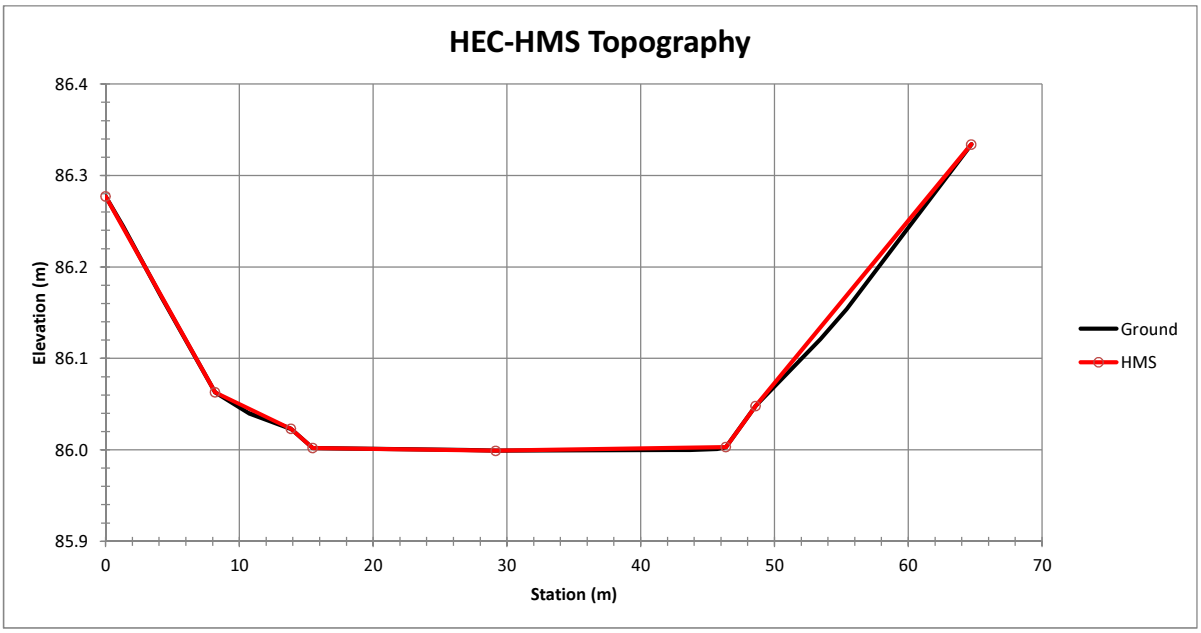
HEC-HMS Channel Topography (For NC-EX-016)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	167.9	**(m)**
Channel slope, S =	0.018	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	86.277	1
8.184	86.063	2
13.854	86.023	**3**
15.481	86.002	4
29.170	85.999	5
46.378	86.003	**6**
48.603	86.048	7
64.724	86.334	8



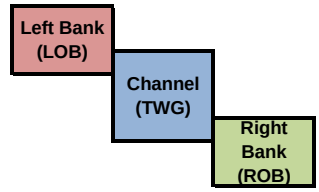


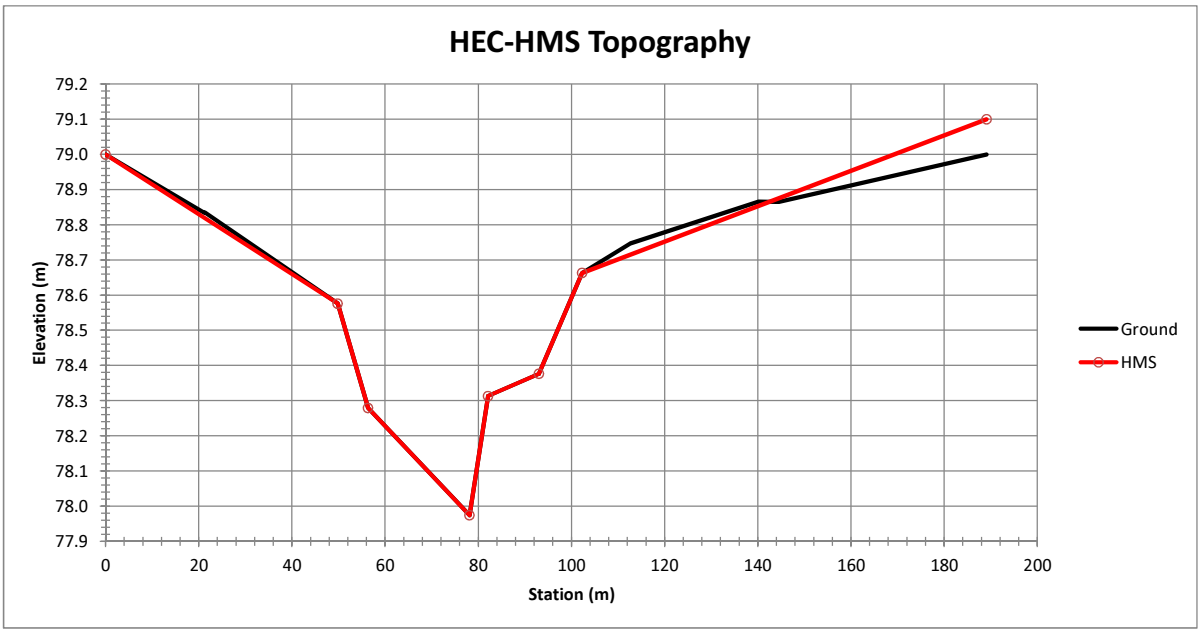
HEC-HMS Channel Topography (For NC-EX-017)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	821.0	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	79.000	1
49.808	78.576	2
56.363	78.279	**3**
78.145	77.974	4
82.115	78.313	5
93.048	78.376	**6**
102.345	78.663	7
189.127	79.100	8



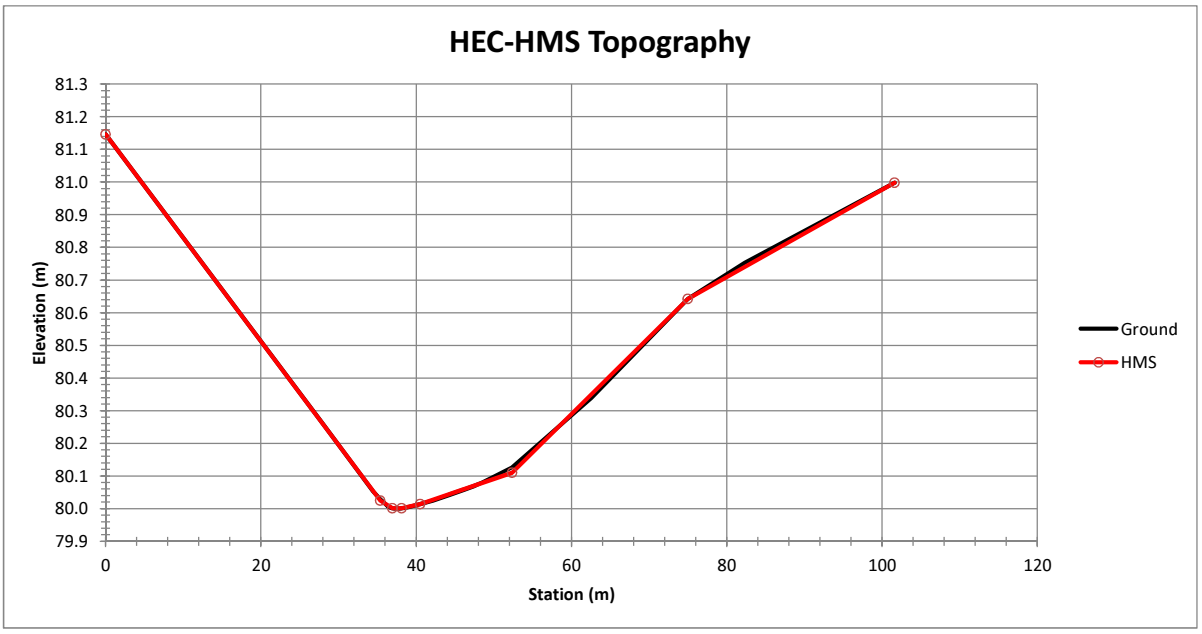


HEC-HMS Channel Topography (For NC-EX-018)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	602.4	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	81.146	1
35.384	80.025	2
36.940	80.001	**3**
38.152	80.001	4
40.542	80.014	5
52.355	80.110	**6**
75.000	80.642	7
101.637	80.998	8



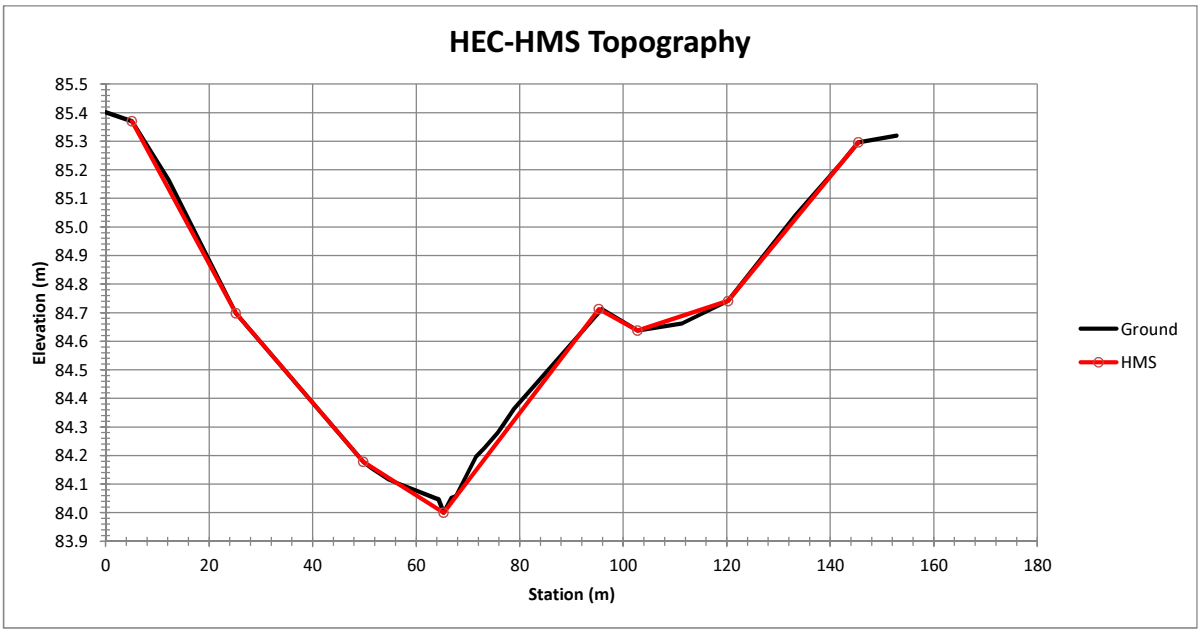
HEC-HMS Channel Topography (For NC-EX-019)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1278.2	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

120.299 84.741

Eight-point channel shape		
Station (m)	**Elevation (m)**	
5.067	85.370	1
25.196	84.698	2
49.784	84.178	**3**
65.297	84.000	4
95.300	84.712	5
102.797	84.637	**6**
120.299	84.741	7
145.436	85.296	8

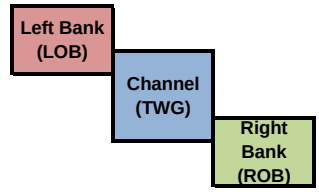


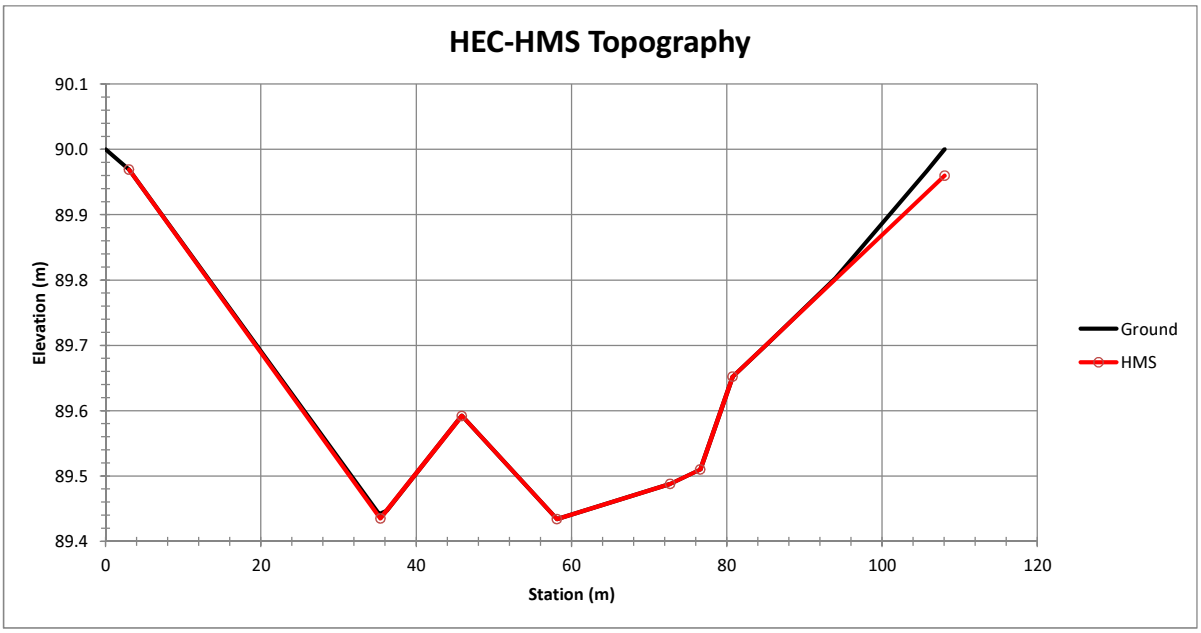
HEC-HMS Channel Topography (For NC-EX-020)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 138.6 **(m)**
Channel slope, S = 0.029 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
3.019	89.969	1
35.400	89.435	2
45.904	89.592	**3**
58.137	89.434	4
72.713	89.488	5
76.614	89.510	**6**
80.773	89.652	7
108.075	89.960	8



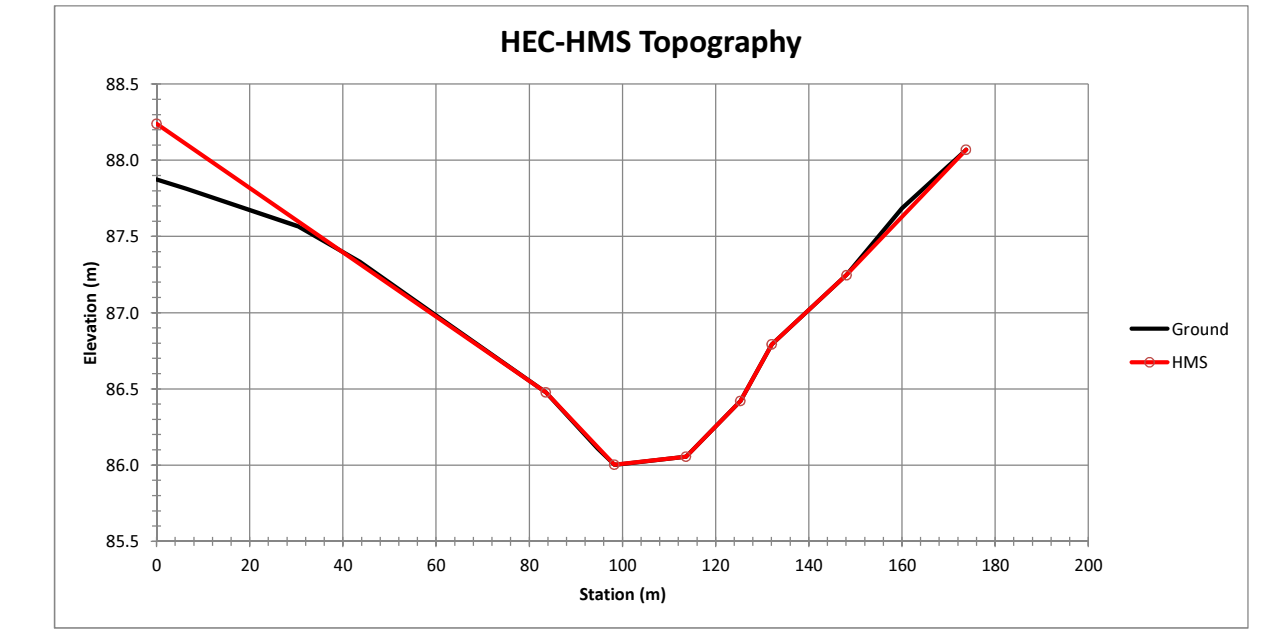


HEC-HMS Channel Topography (For NC-EX-021)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 2102.5 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	88.240	1
83.533	86.478	2
98.264	86.002	**3**
113.666	86.055	4
125.317	86.420	5
132.046	86.792	**6**
148.110	87.247	7
173.779	88.070	8

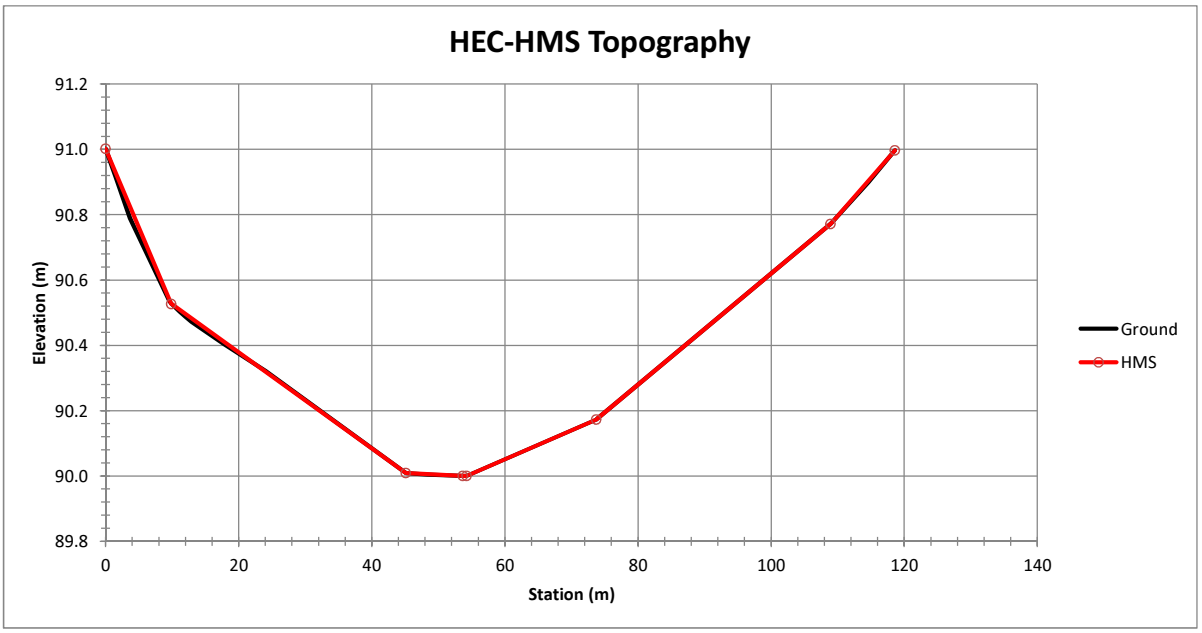


HEC-HMS Channel Topography (For NC-EX-022)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	277.1	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	91.002	1
9.877	90.527	2
45.117	90.009	**3**
53.672	90.000	4
54.260	90.000	5
73.721	90.173	**6**
108.959	90.772	7
118.620	90.997	8

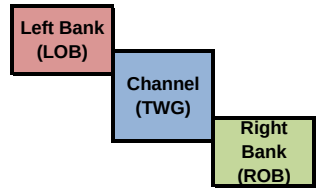


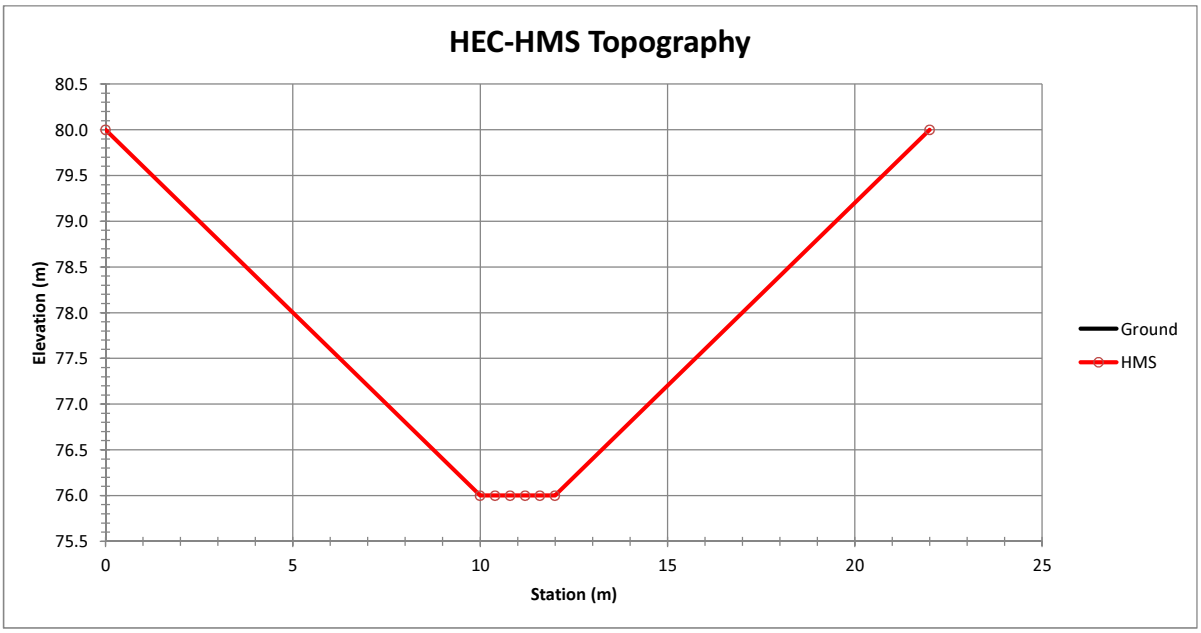
HEC-HMS Channel Topography (For DC-EX-023)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1321.5	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



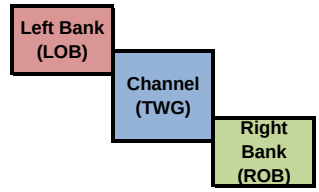


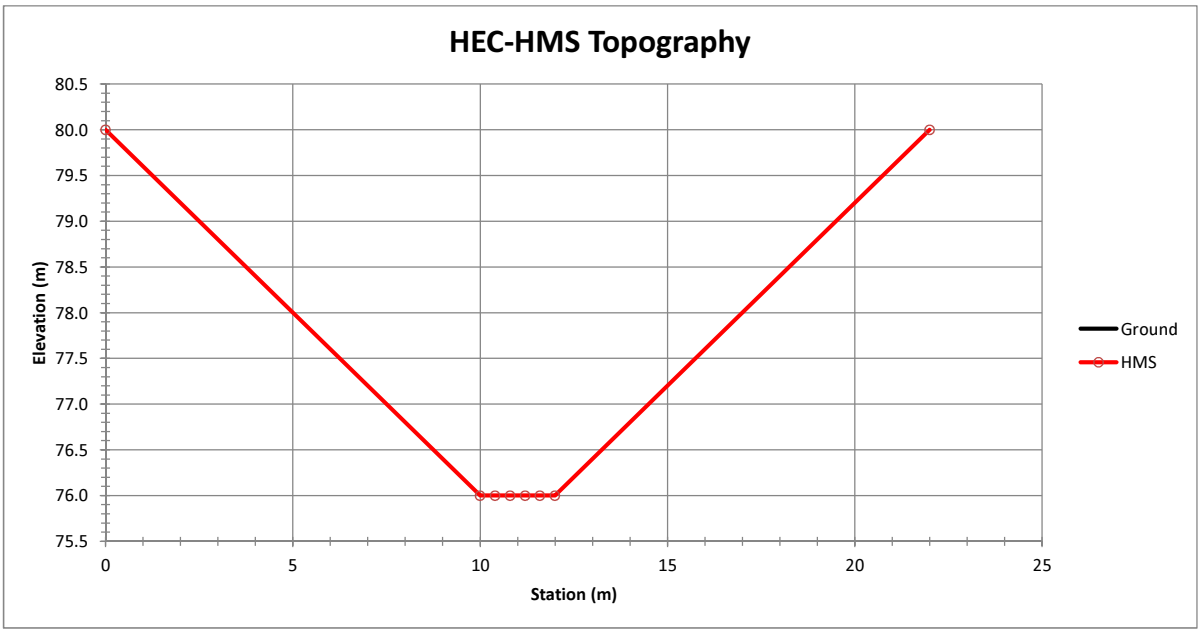
HEC-HMS Channel Topography (For DC-EX-024)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	805.4	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



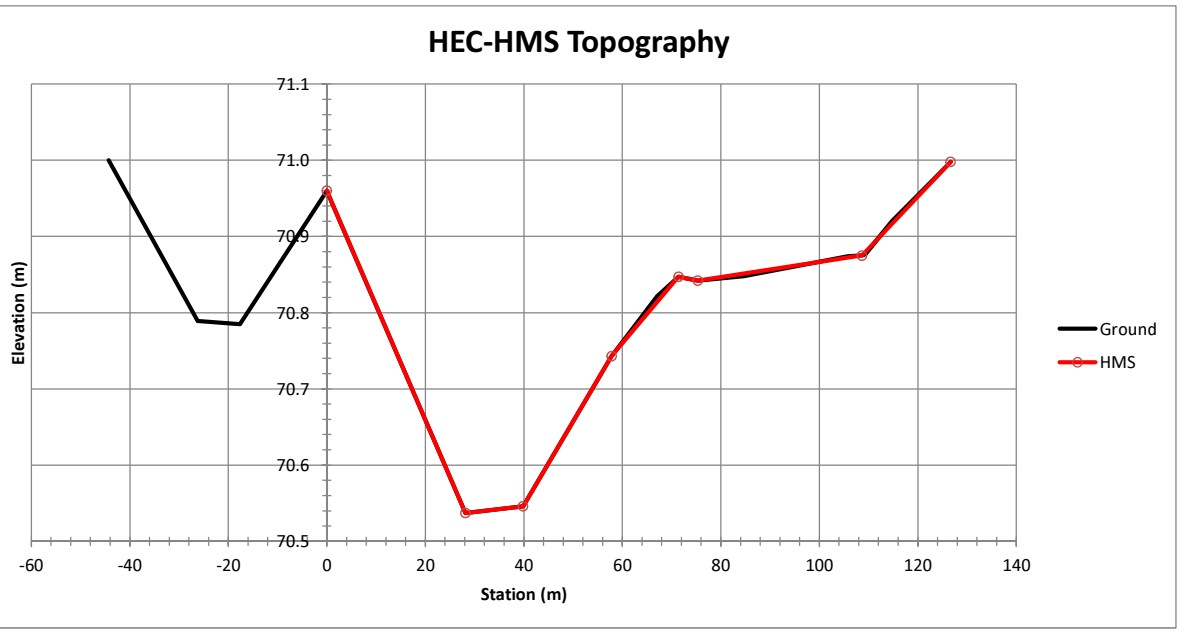


HEC-HMS Channel Topography (For NC-EX-025)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	634.7	**(m)**
Channel slope, S =	0.002	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	70.960	1
28.138	70.537	2
39.840	70.546	**3**
57.832	70.743	4
71.419	70.847	5
75.355	70.842	**6**
108.698	70.875	7
126.691	70.998	8

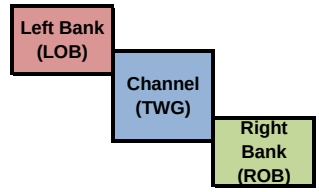


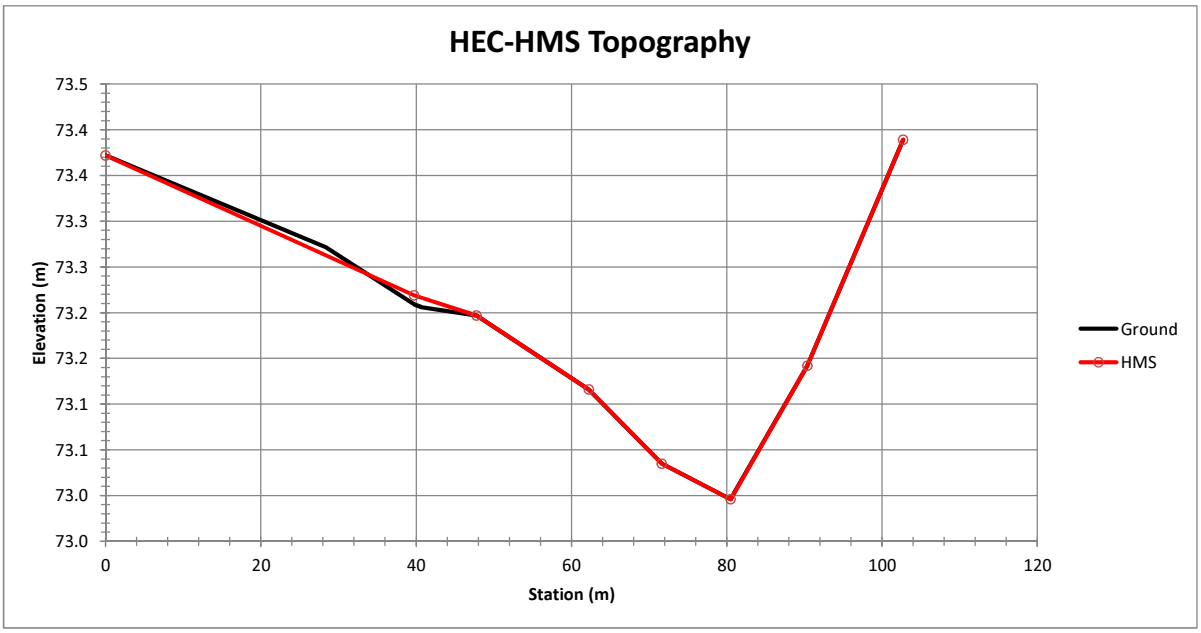
HEC-HMS Channel Topography (For NC-EX-026)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 138.6 **(m)**
Channel slope, S = 0.029 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	73.372	1
39.733	73.219	2
47.775	73.197	**3**
62.233	73.116	4
71.636	73.035	5
80.514	72.996	**6**
90.386	73.142	7
102.719	73.389	8



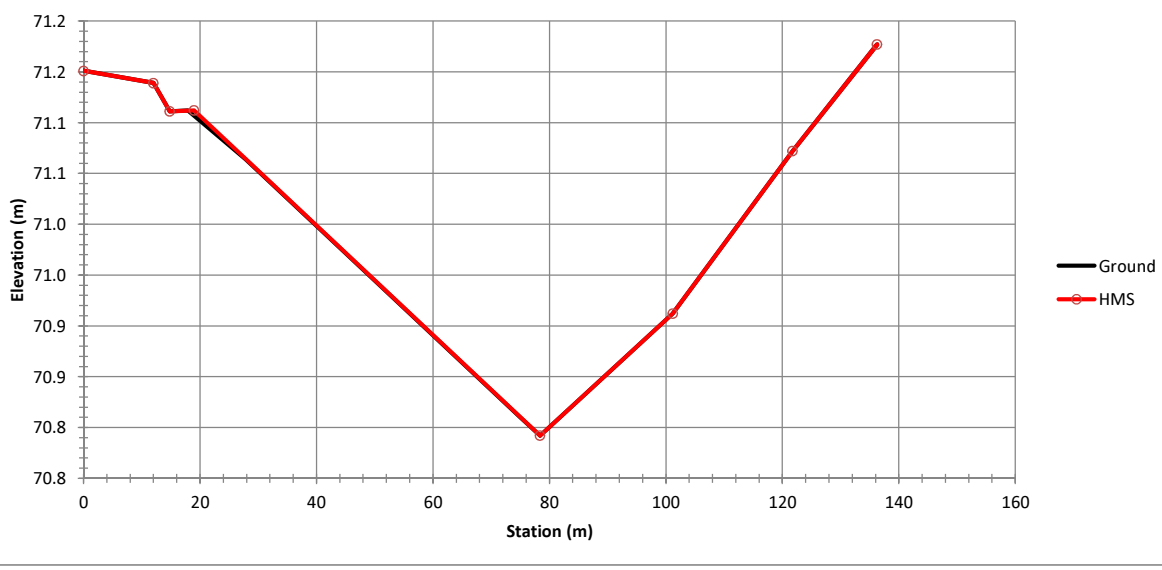


HEC-HMS Channel Topography (For NC-EX-026)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	457.1	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	71.151	1
11.996	71.139	2
14.826	71.111	**3**
19.000	71.112	4
78.386	70.792	5
101.173	70.912	**6**
121.775	71.072	7
136.271	71.177	8

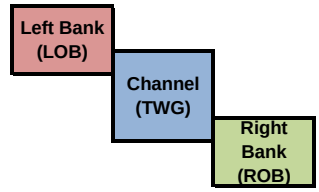


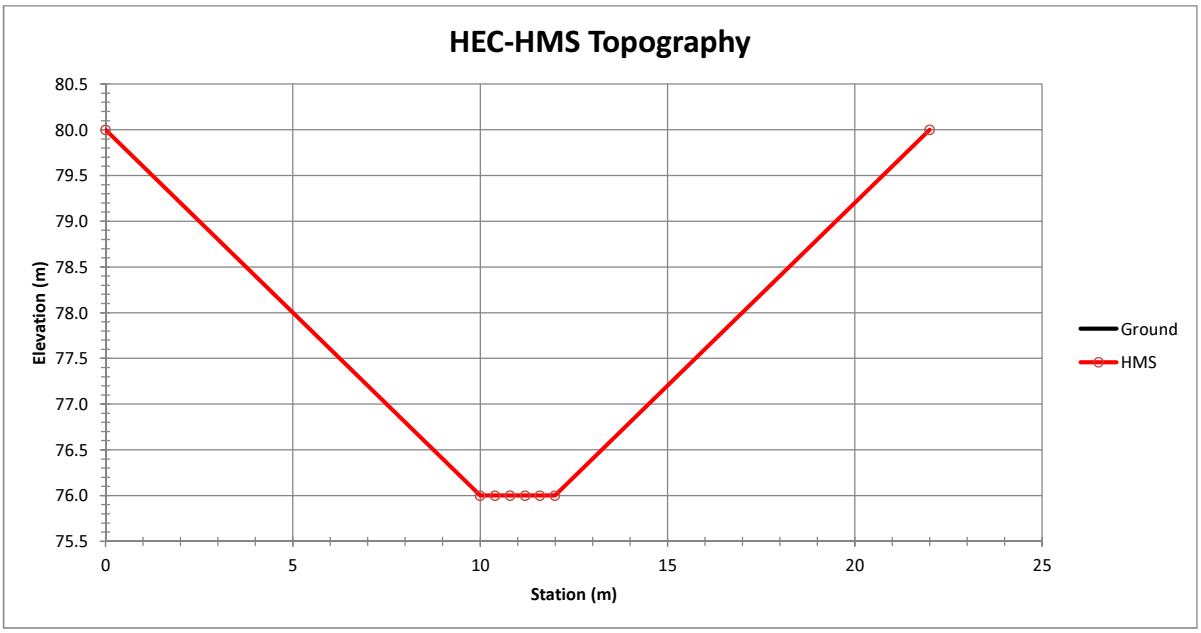
HEC-HMS Channel Topography (For DC-EX-028)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	934.2	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



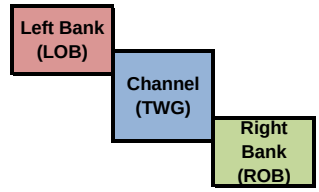


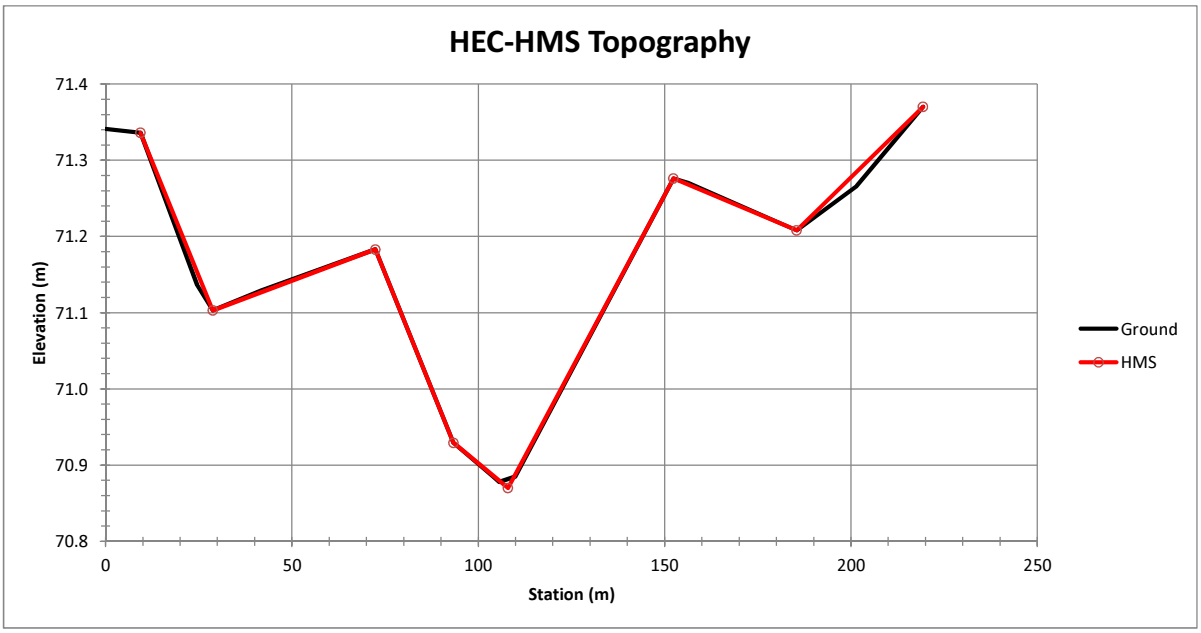
HEC-HMS Channel Topography (For NC-EX-029)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	261.4	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
9.348	71.336	1
28.831	71.103	2
72.415	71.183	**3**
93.352	70.929	4
108.000	70.870	5
152.386	71.276	**6**
185.404	71.208	7
219.350	71.370	8



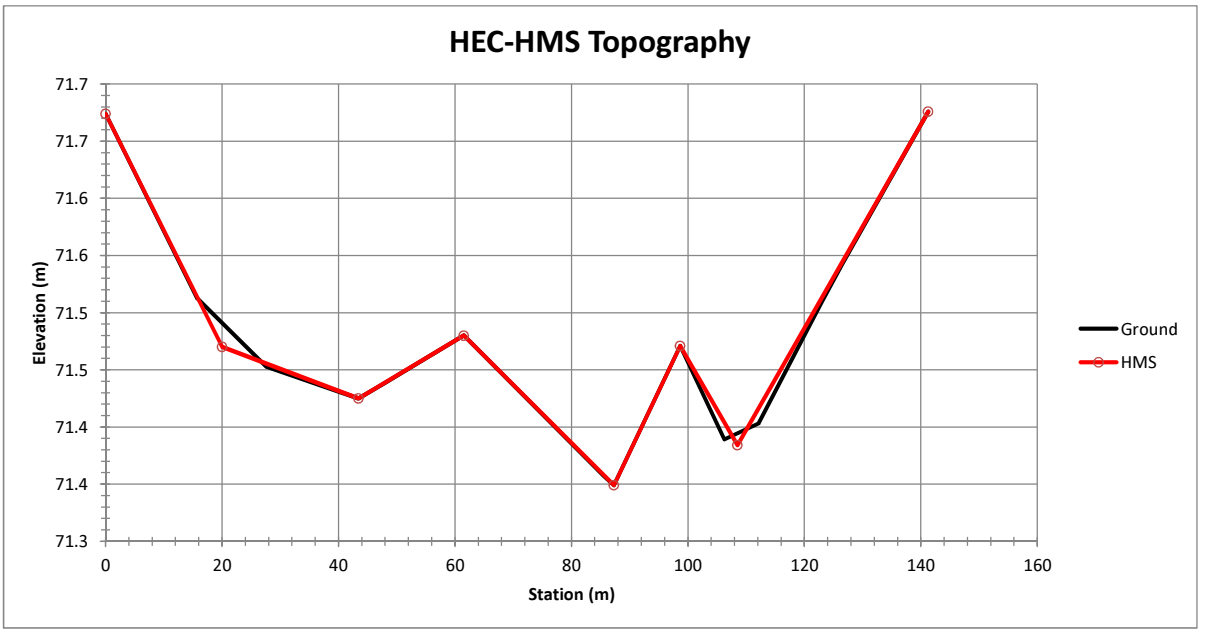


HEC-HMS Channel Topography (For NC-EX-030)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 596.5 **(m)**
Channel slope, S = 0.001 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	71.674	1
20.000	71.470	2
43.438	71.425	**3**
61.513	71.480	4
87.278	71.349	5
98.692	71.471	**6**
108.500	71.384	7
141.283	71.676	8

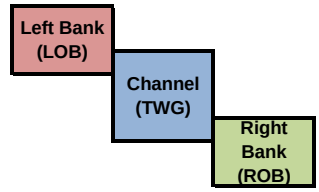


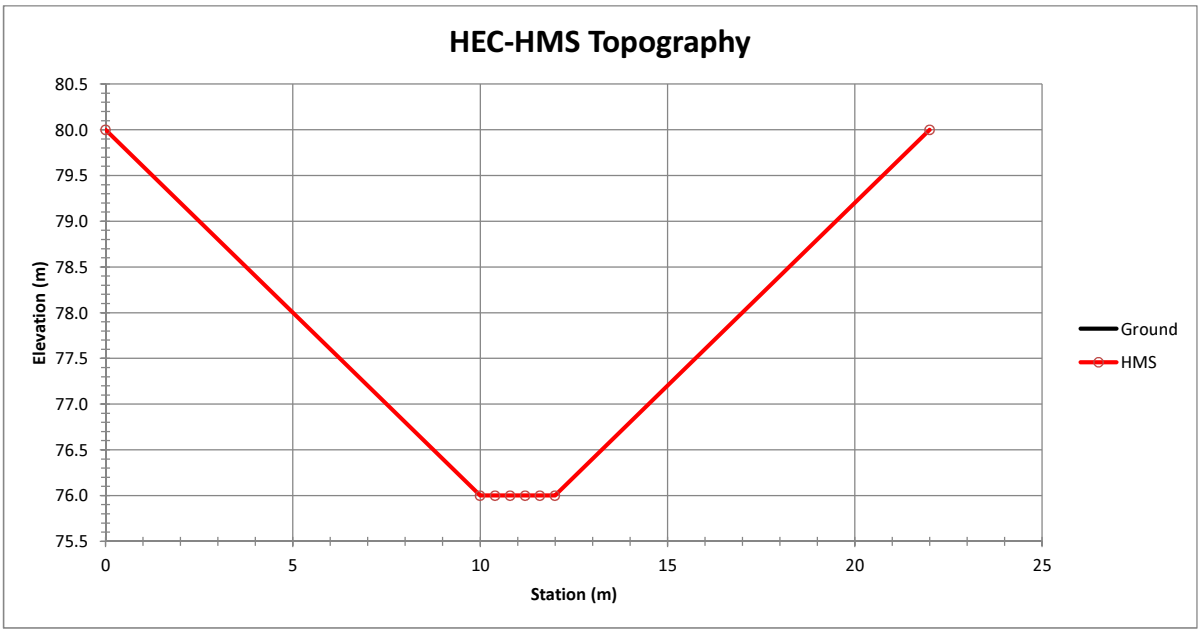
HEC-HMS Channel Topography (For DC-EX-031)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	942.3	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



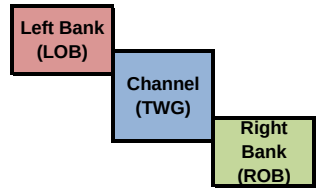


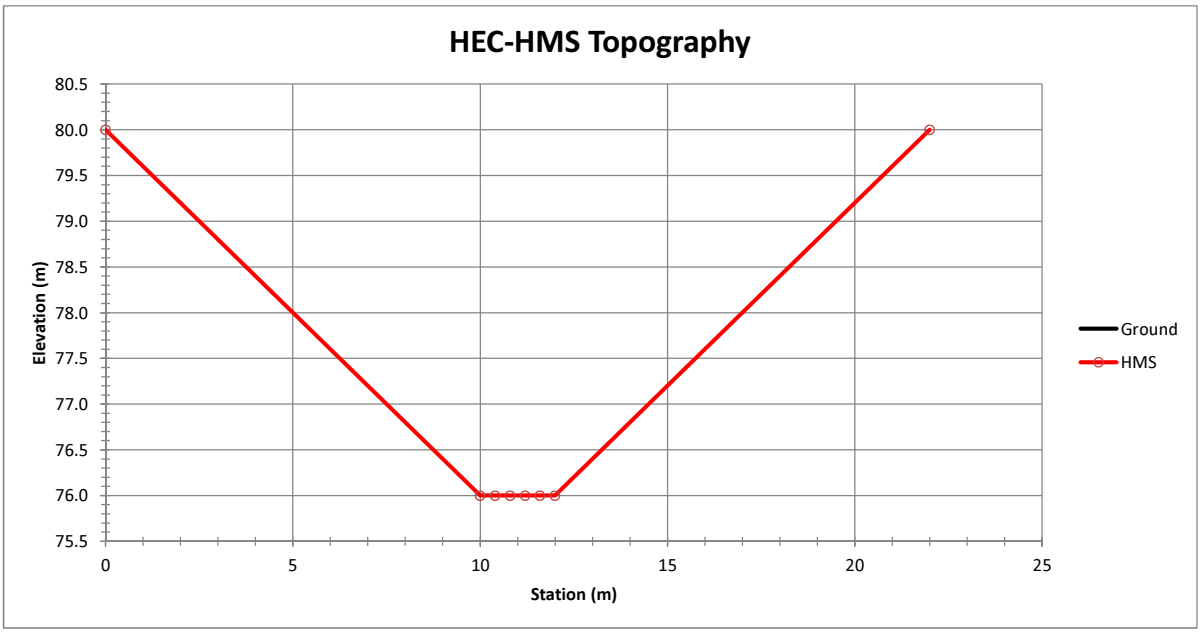
HEC-HMS Channel Topography (For DC-EX-032)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	251.9	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



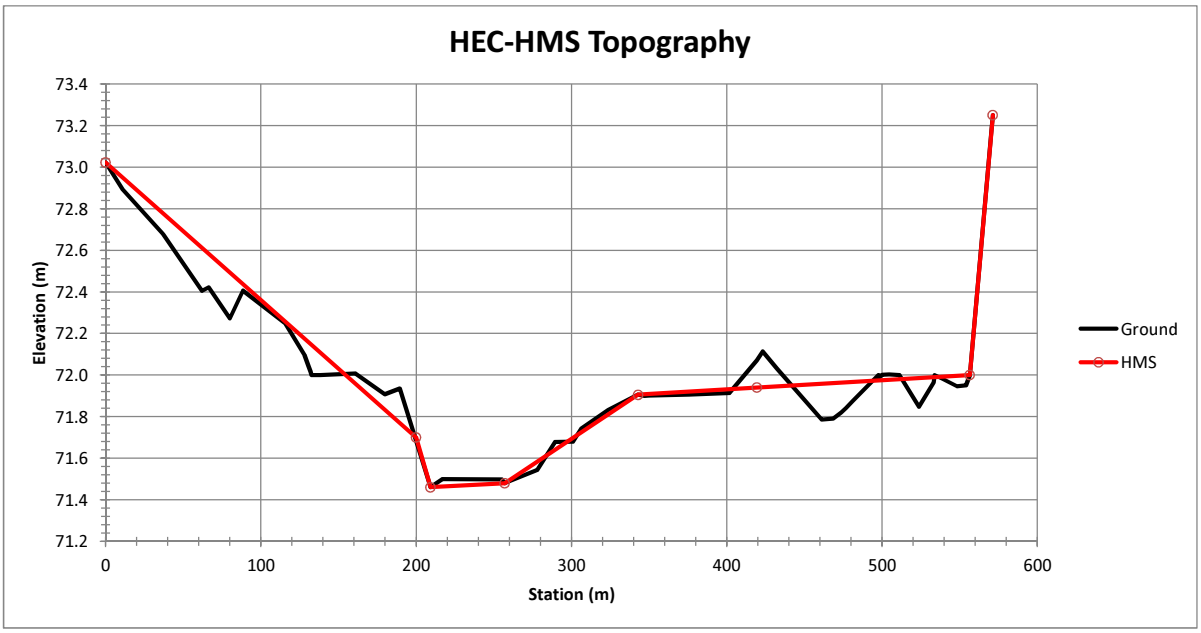


HEC-HMS Channel Topography (For NC-EX-033)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	807.2	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	73.022	1
200.000	71.700	2
209.199	71.460	**3**
257.006	71.479	4
342.916	71.905	5
419.447	71.940	**6**
556.540	72.000	7
571.412	73.251	8

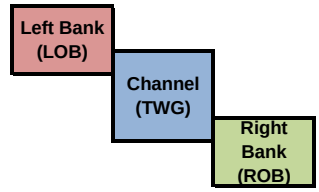


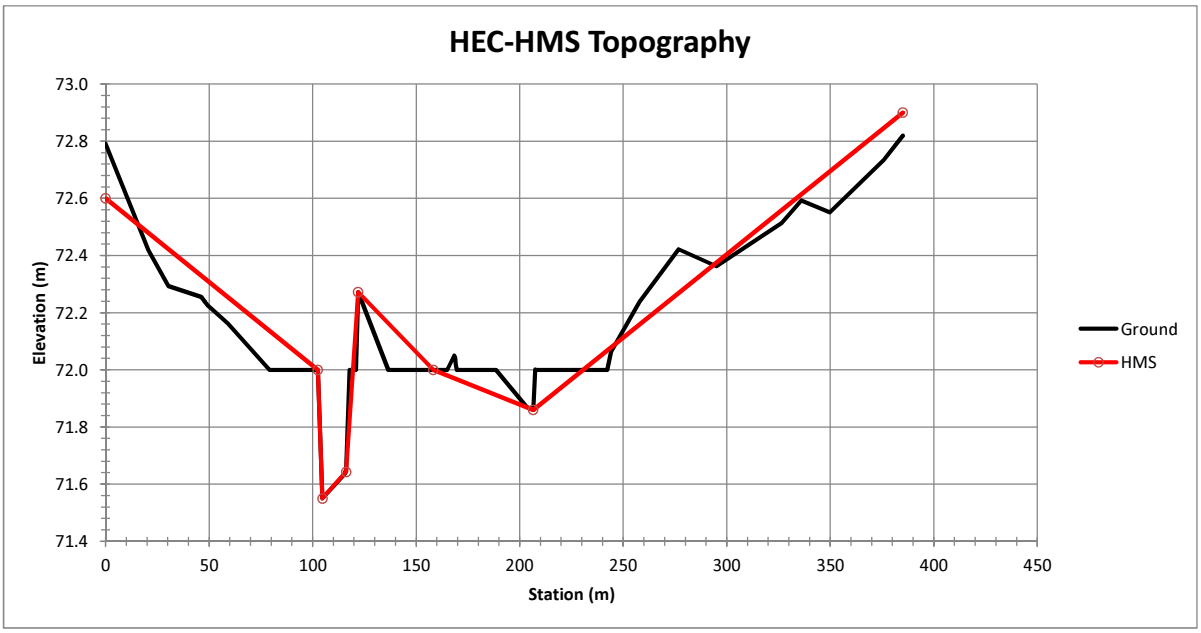
HEC-HMS Channel Topography (For NC-EX-034)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	355.8	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	72.600	1
102.471	72.000	2
104.771	71.550	**3**
116.209	71.643	4
122.003	72.272	5
158.267	72.000	**6**
206.558	71.860	7
385.104	72.900	8



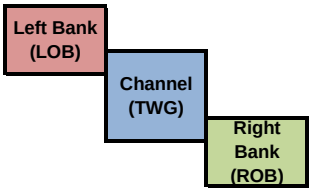


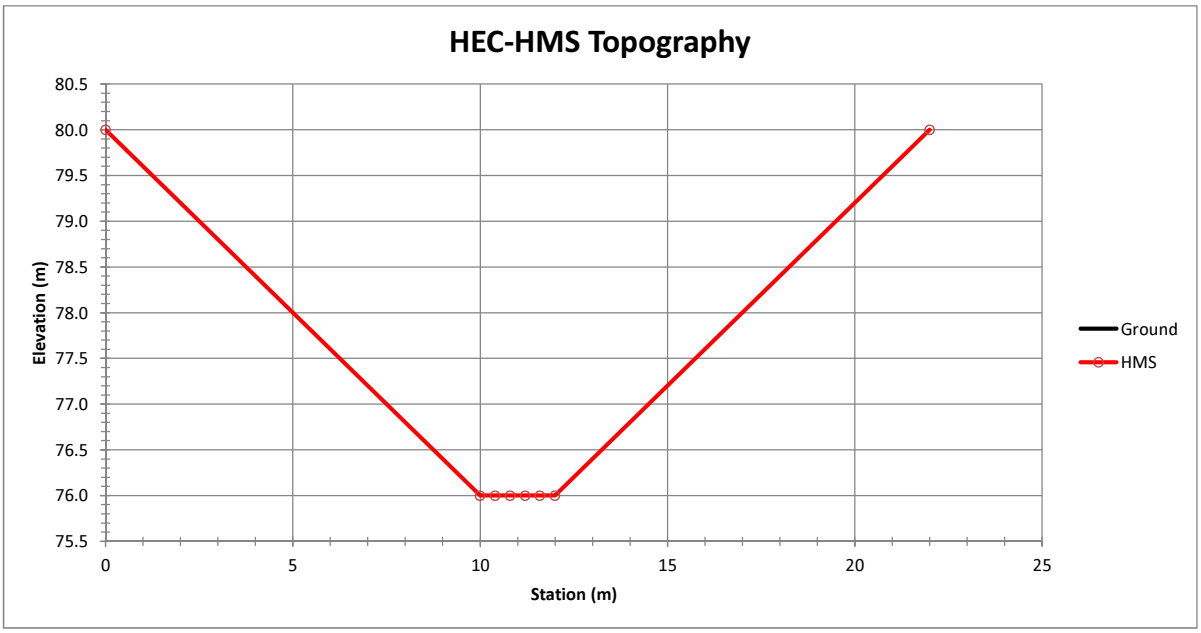
HEC-HMS Channel Topography (For DC-EX-035)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	882.8	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



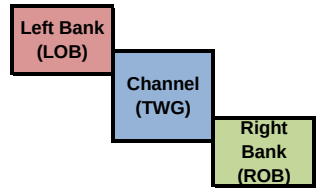


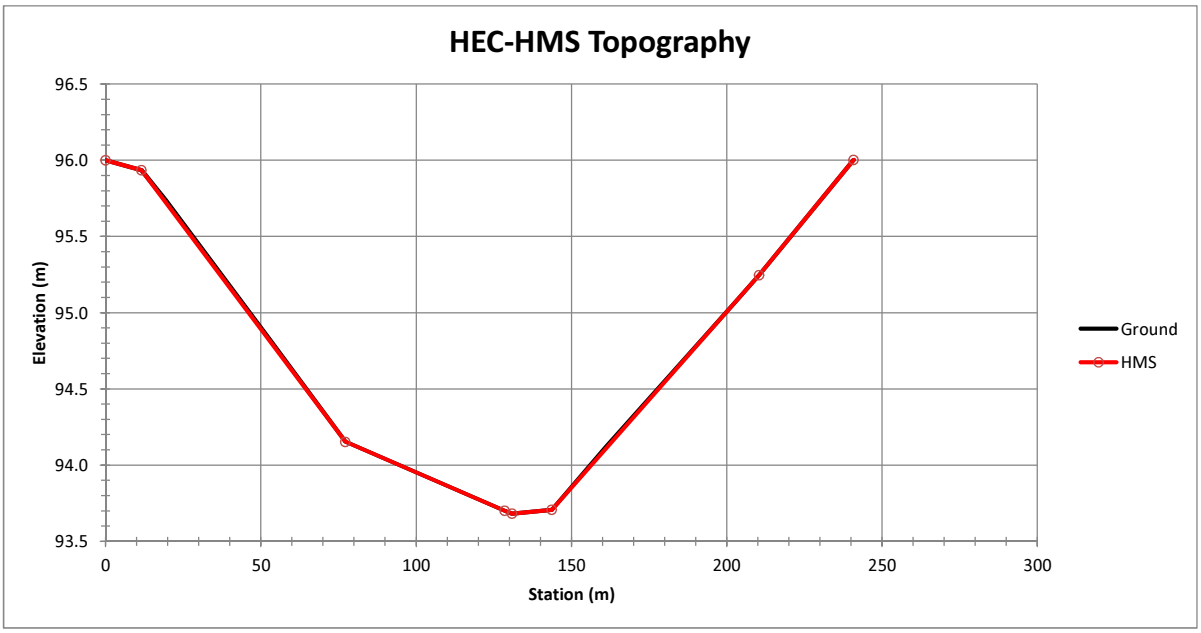
HEC-HMS Channel Topography (For NC-EX-036)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1472.2 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	96.000	1
11.553	95.934	2
77.264	94.153	**3**
128.570	93.701	4
130.885	93.681	5
143.658	93.706	**6**
210.437	95.247	7
240.847	96.002	8



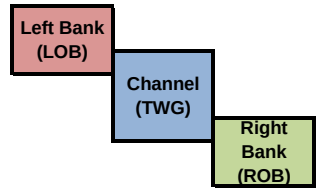


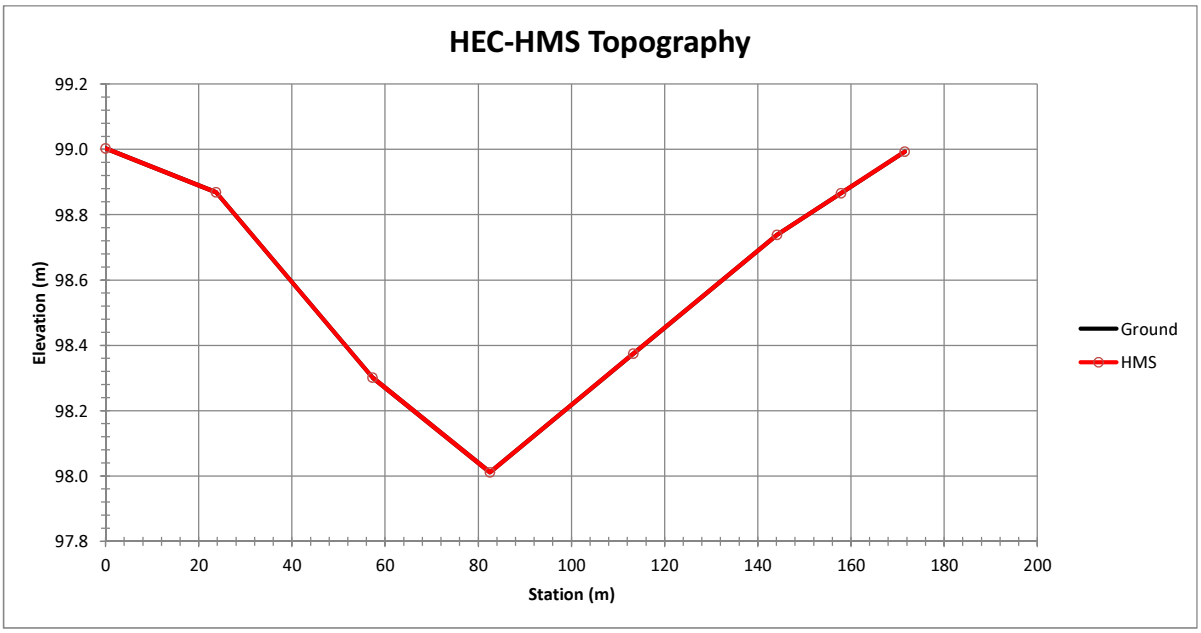
HEC-HMS Channel Topography (For NC-EX-037)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 758.8 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	99.003	1
23.737	98.869	2
57.306	98.301	**3**
82.515	98.011	4
113.323	98.375	5
144.130	98.738	**6**
157.861	98.866	7
171.592	98.993	8



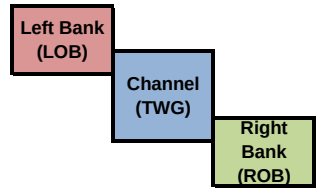


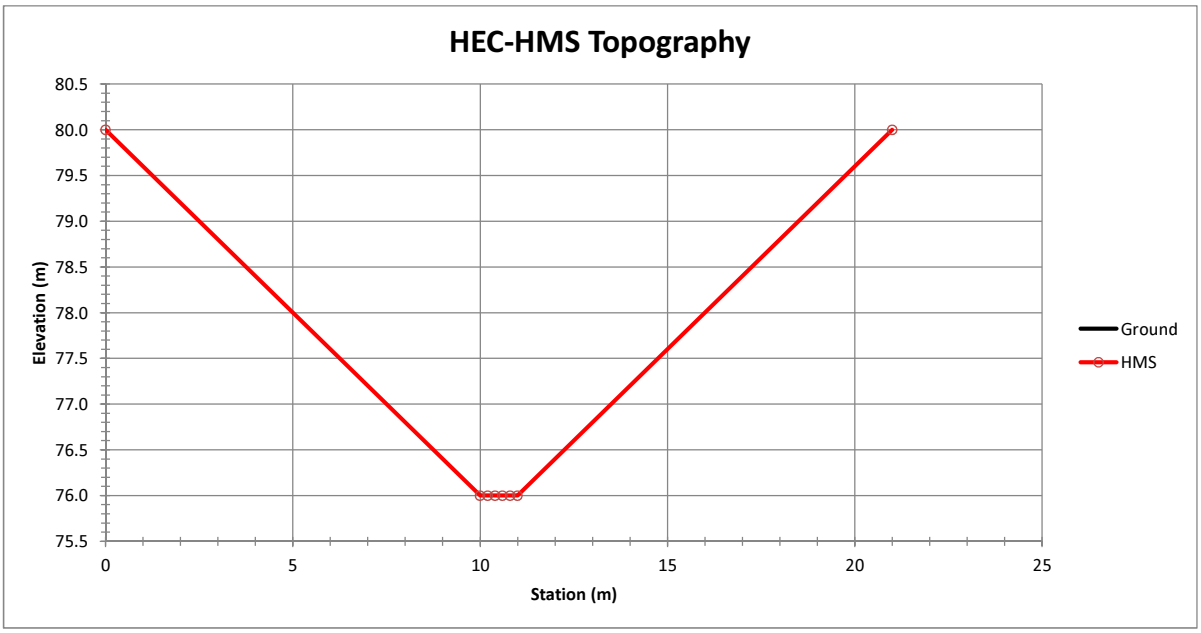
HEC-HMS Channel Topography (For DC-EX-038)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1467.2	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	1.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.200	76.000	**3**
10.400	76.000	4
10.600	76.000	5
10.800	76.000	**6**
11.000	76.000	7
21.000	80.000	8



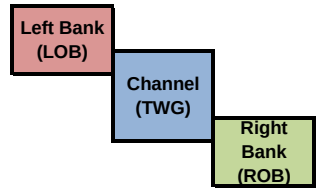


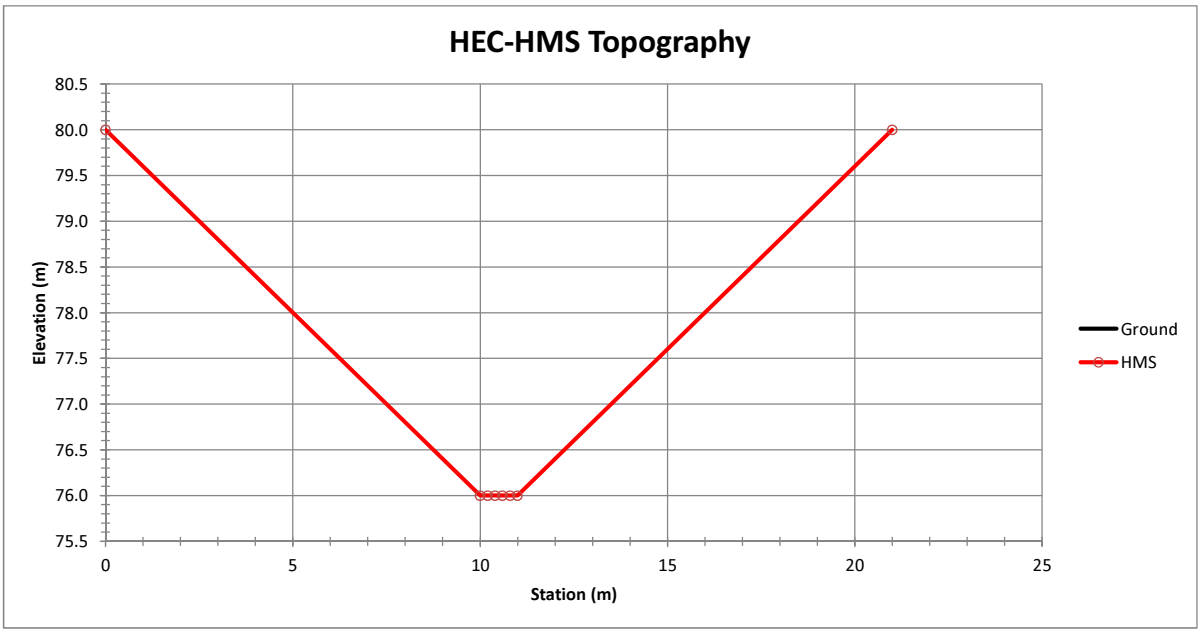
HEC-HMS Channel Topography (For DC-EX-039)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	696.4	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	1.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.200	76.000	**3**
10.400	76.000	4
10.600	76.000	5
10.800	76.000	**6**
11.000	76.000	7
21.000	80.000	8



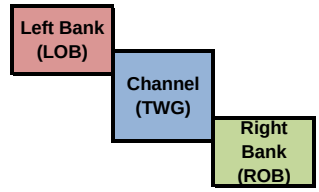


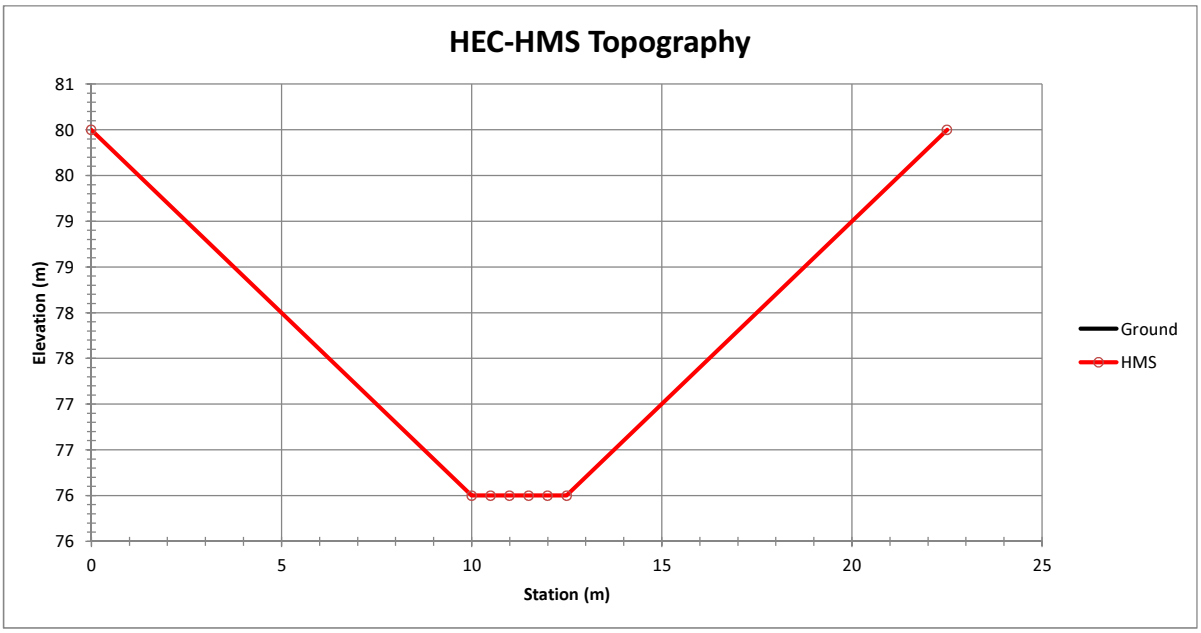
HEC-HMS Channel Topography (For DC-PL-001)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	3170.0	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



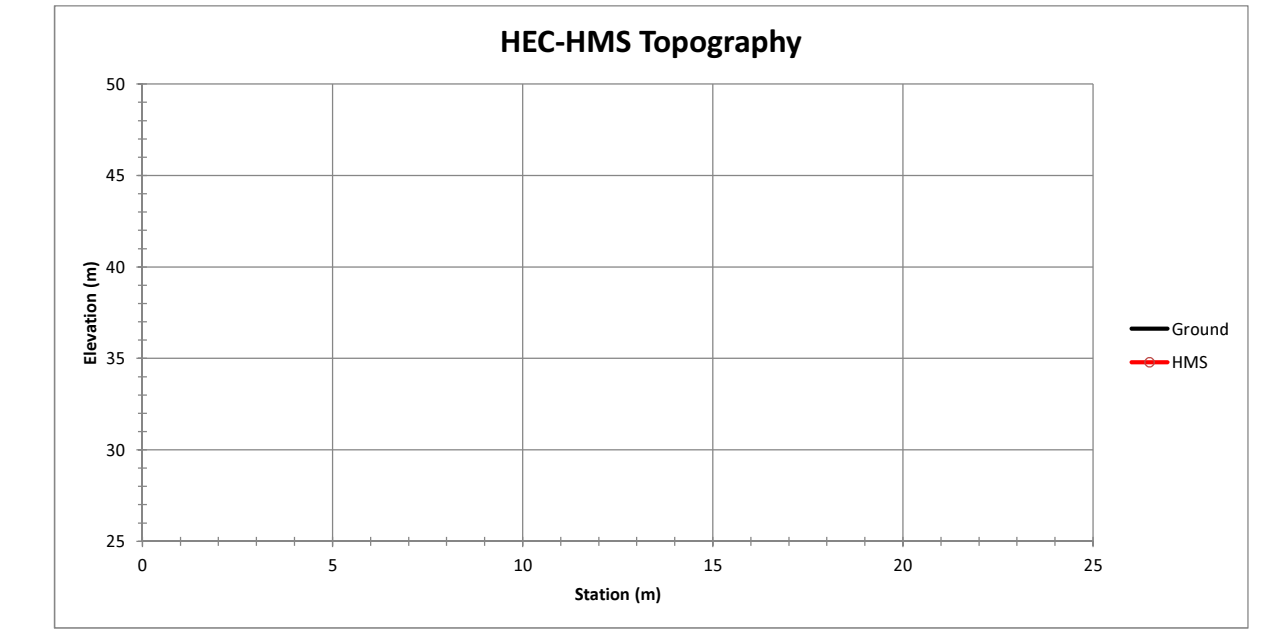


HEC-HMS Channel Topography (For DC-PL-002)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	836.7	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8

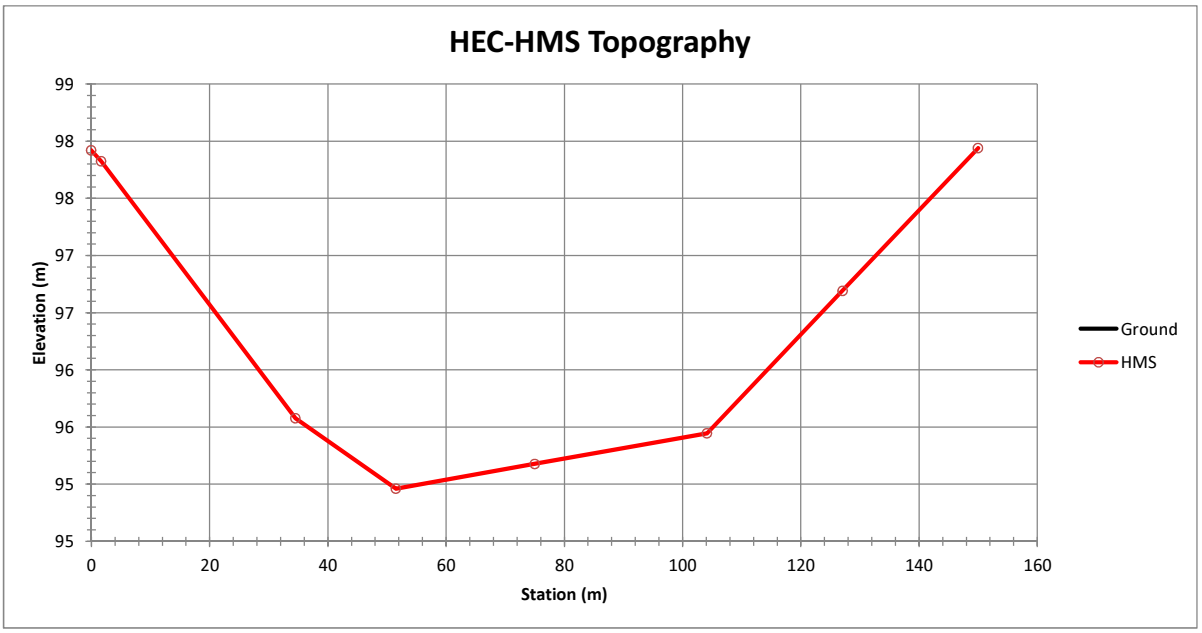


HEC-HMS Channel Topography (For NC-PL-003)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 4885.0 **(m)**
Channel slope, S = 0.003 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	97.919	1
1.632	97.824	2
34.528	95.576	**3**
51.508	94.961	4
75.000	95.177	5
104.127	95.444	**6**
127.064	96.692	7
150.000	97.940	8

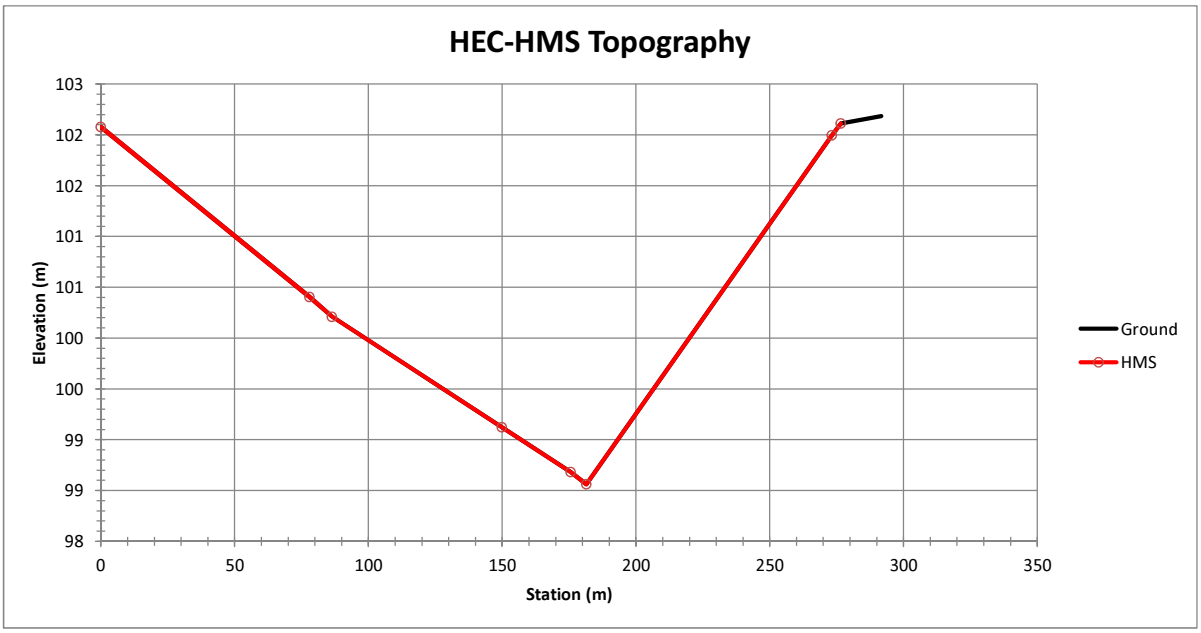


HEC-HMS Channel Topography (For NC-PL-004)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1383.7 **(m)**
Channel slope, S = 0.011 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	102.078	1
78.005	100.404	2
86.383	100.211	**3**
149.917	99.122	4
175.632	98.681	5
181.500	98.563	**6**
273.261	101.997	7
276.618	102.111	8

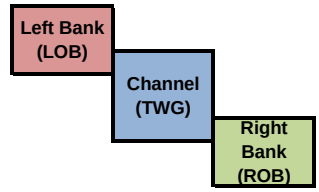


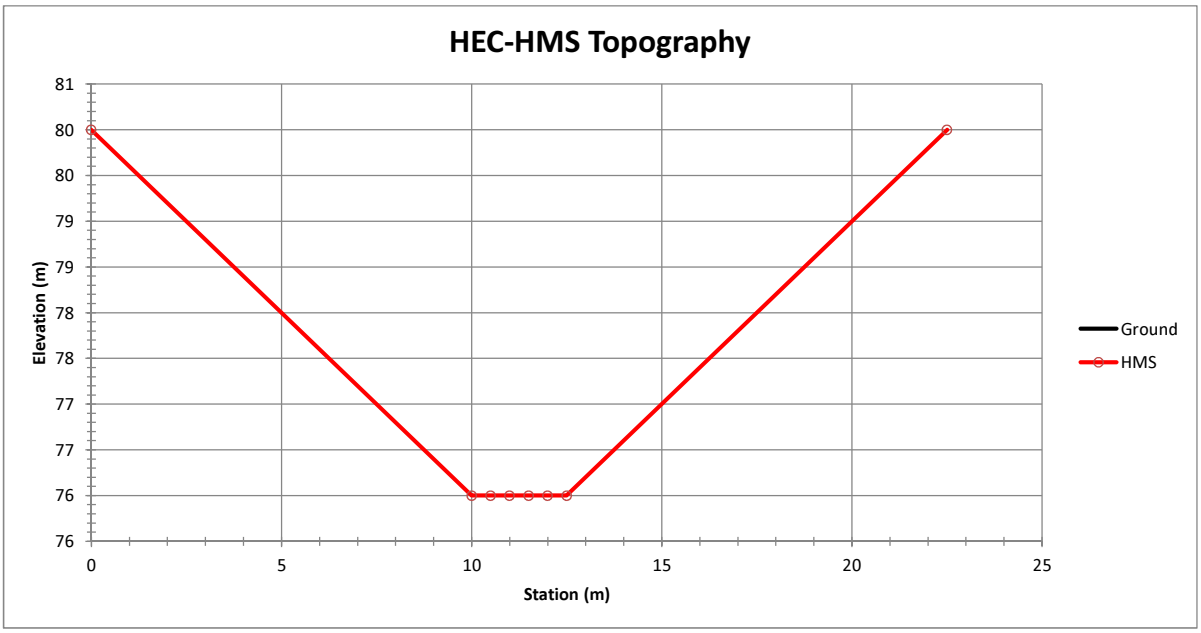
HEC-HMS Channel Topography (For DC-PL-005)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	3158.1	**(m)**
Channel slope, S =	0.003	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



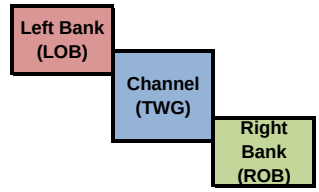


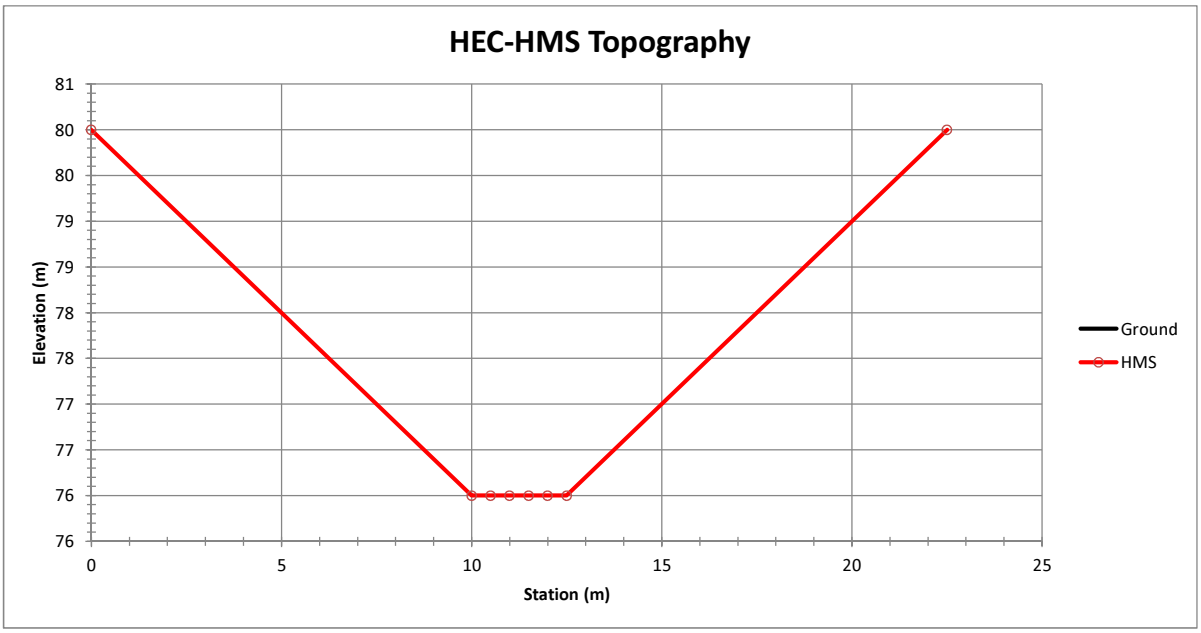
HEC-HMS Channel Topography (For DC-PL-006)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2079.0	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



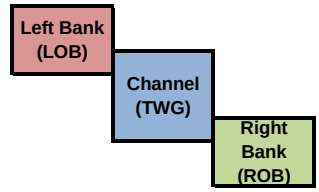


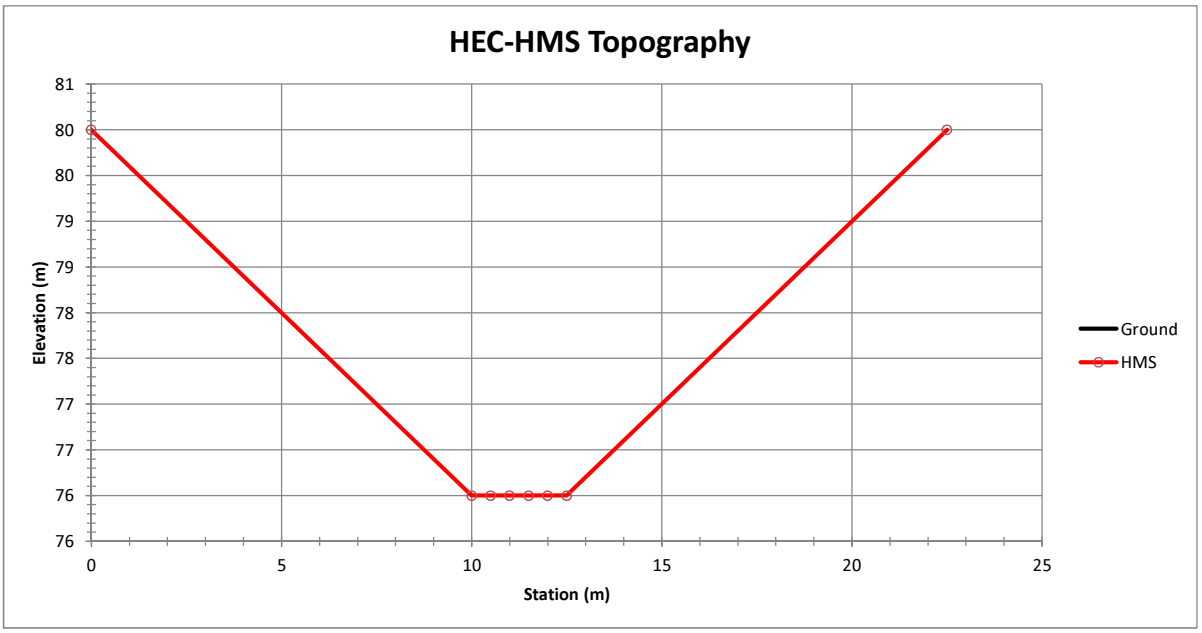
HEC-HMS Channel Topography (For DC-PL-007)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	433.4	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.5	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.500	76.000	**3**
11.000	76.000	4
11.500	76.000	5
12.000	76.000	**6**
12.500	76.000	7
22.500	80.000	8



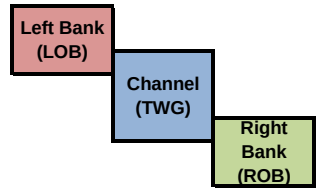


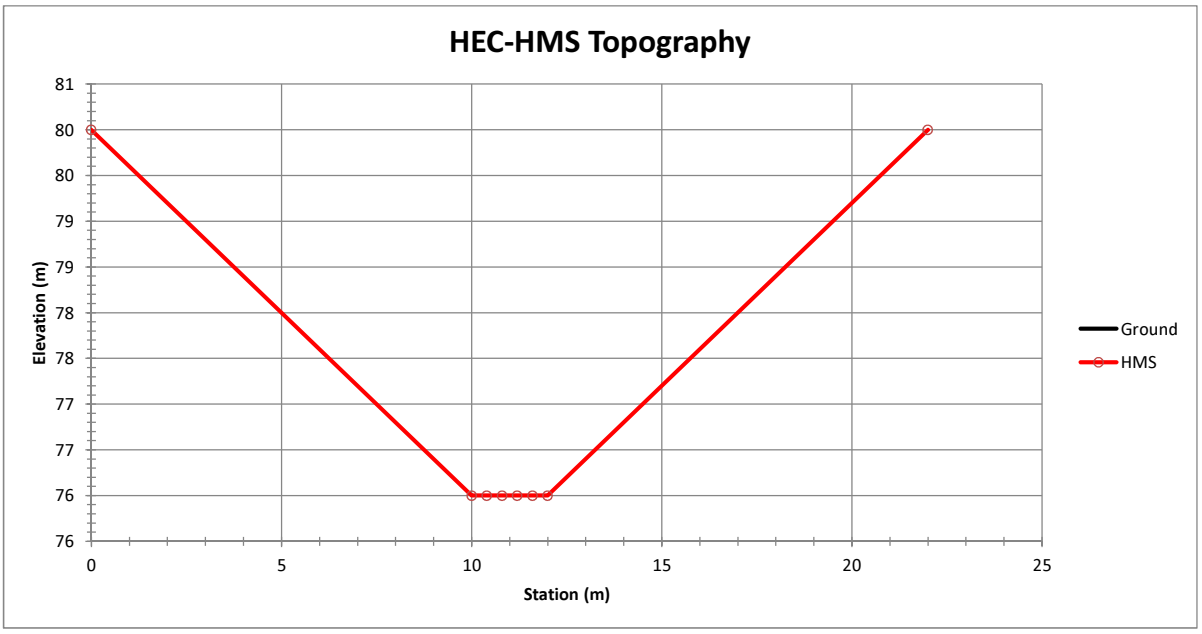
HEC-HMS Channel Topography (For DC-PL-008)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	473.7	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



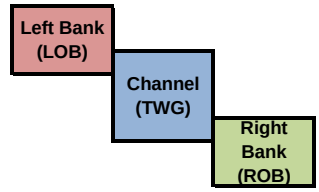


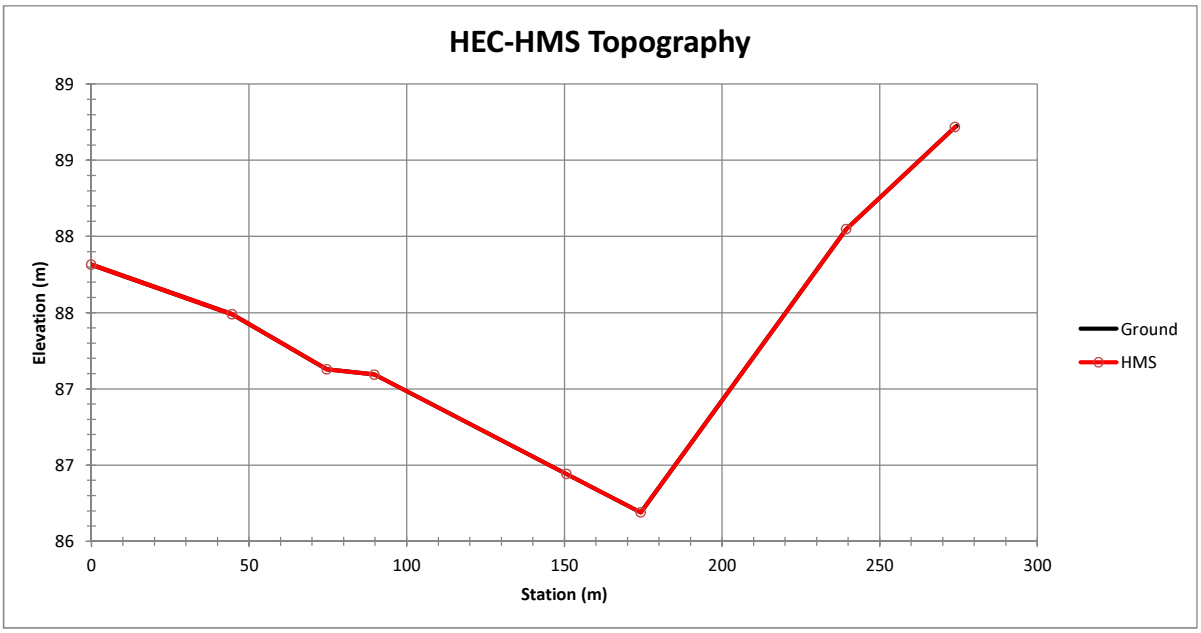
HEC-HMS Channel Topography (For NC-PL-009)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 3367.893 **(m)**
Channel slope, S = 0.004 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	87.816	1
44.672	87.489	2
74.686	87.129	**3**
89.765	87.094	4
150.729	86.442	5
174.289	86.190	**6**
239.410	88.048	7
273.891	88.718	8



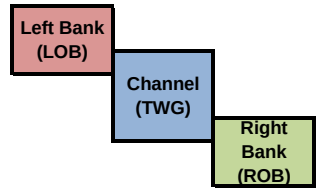


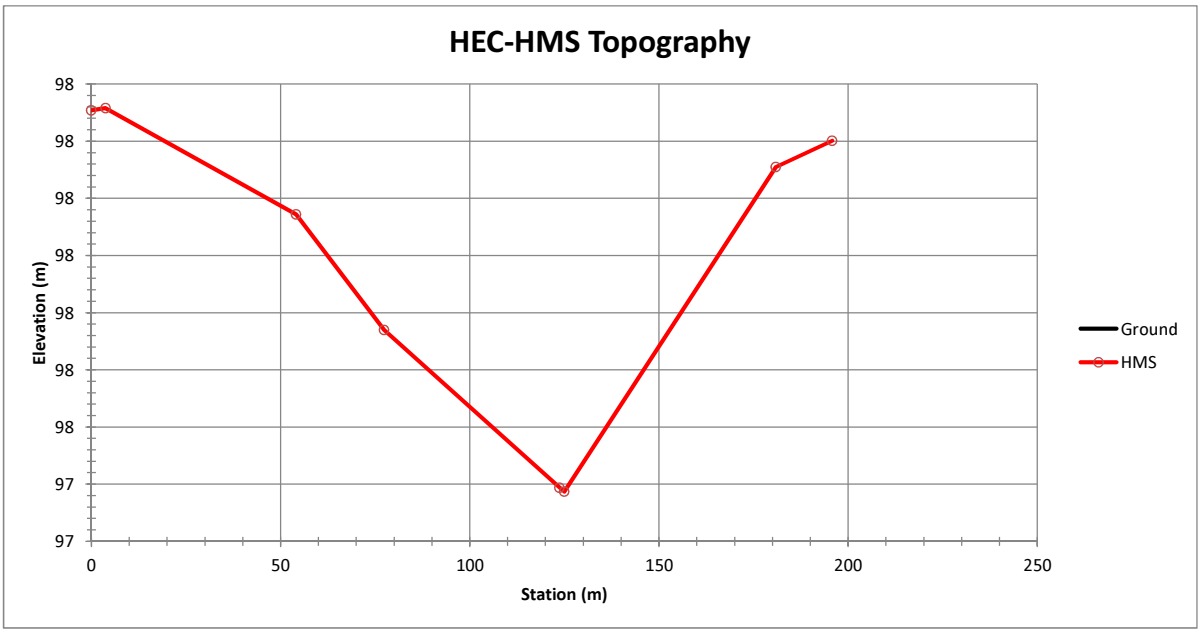
HEC-HMS Channel Topography (For NC-PL-010)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 751.499 **(m)**
Channel slope, S = 0.001 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	98.054	1
3.732	98.058	2
54.141	97.872	**3**
77.378	97.670	4
123.701	97.394	5
124.982	97.387	**6**
180.874	97.955	7
195.823	98.001	8



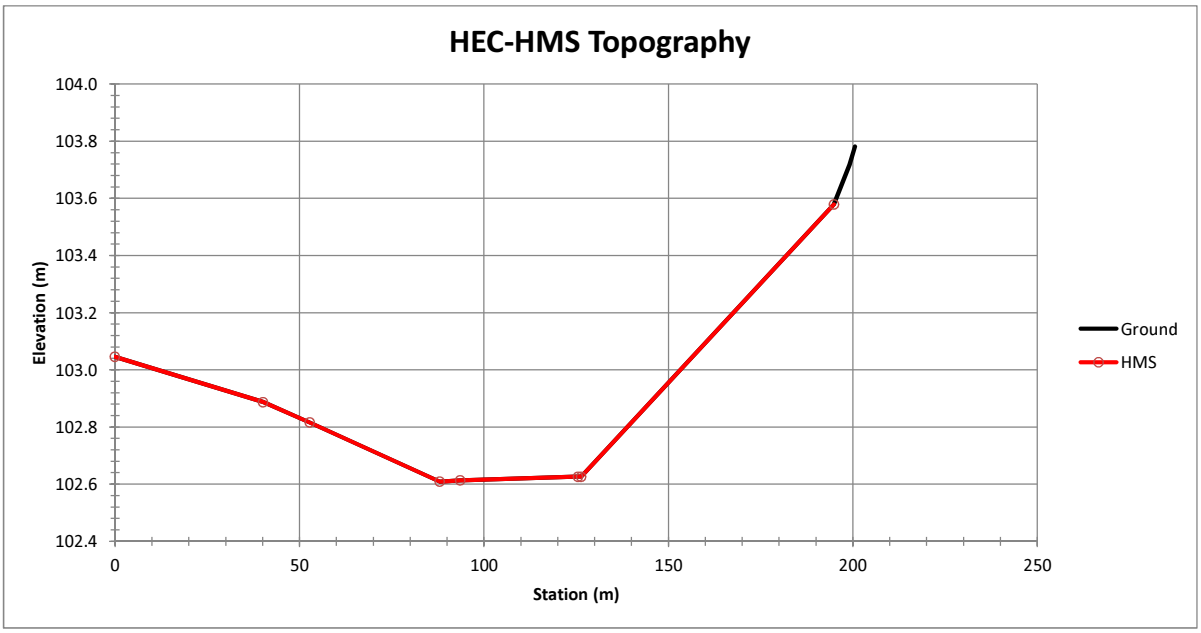


HEC-HMS Channel Topography (For NC-EX-011)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 651.444 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	103.046	1
40.117	102.887	2
52.768	102.816	**3**
88.051	102.609	4
93.572	102.613	5
125.551	102.626	**6**
126.409	102.626	7
194.878	103.579	8

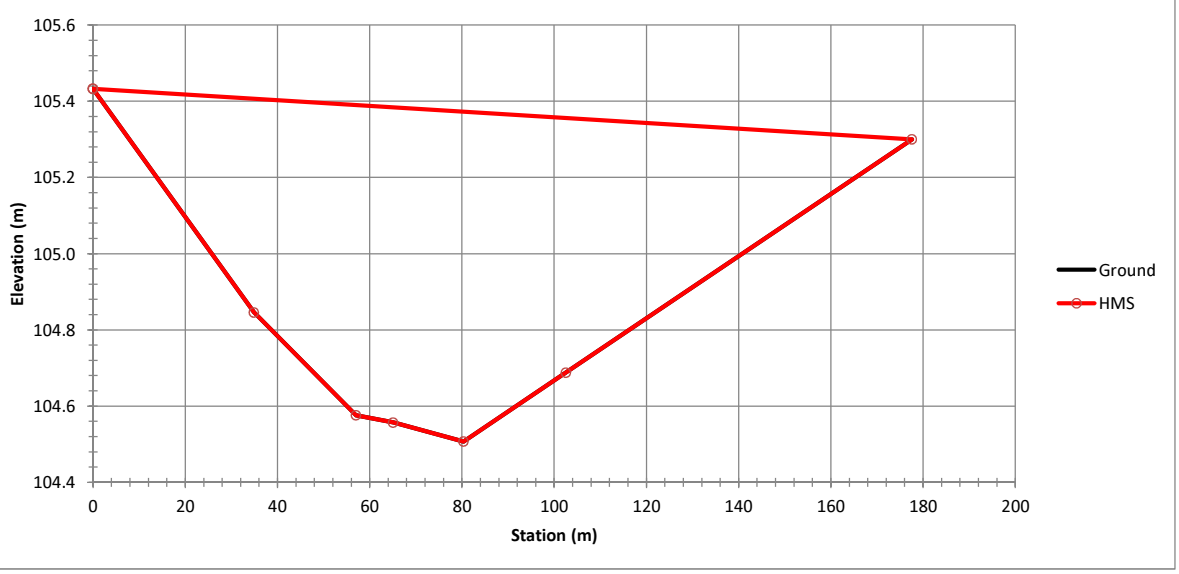


HEC-HMS Channel Topography (For NC-EX-012)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	413.639	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	105.433	1
34.895	104.846	2
57.010	104.576	**3**
65.082	104.557	4
80.367	104.507	5
102.582	104.688	**6**
177.582	105.300	7
#NAME?	105.433	8

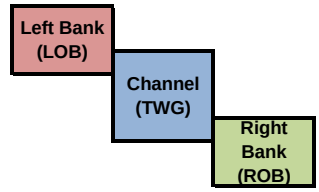


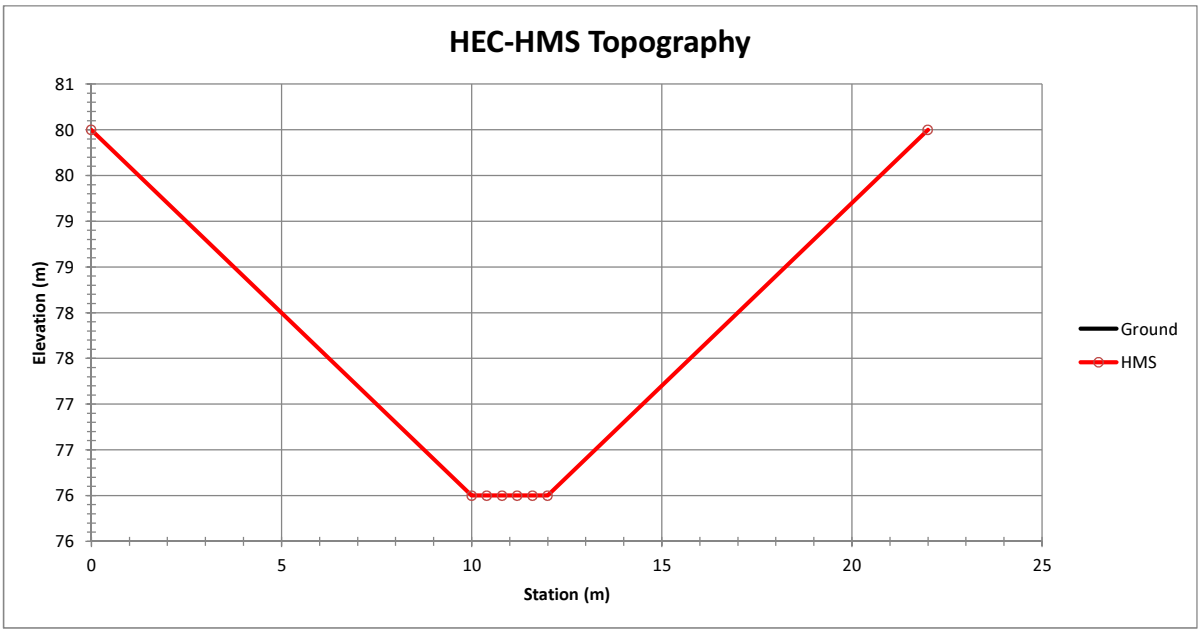
HEC-HMS Channel Topography (For DC-PL-013)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	735.350	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



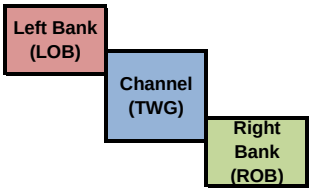


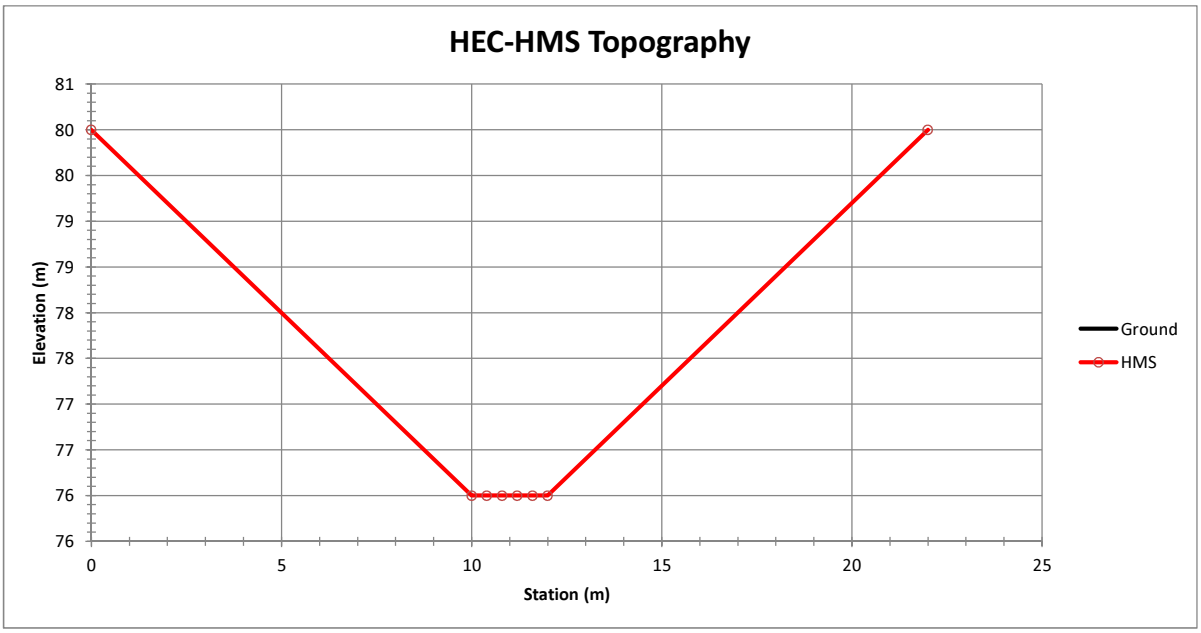
HEC-HMS Channel Topography (For DC-PL-014)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	436.753	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8





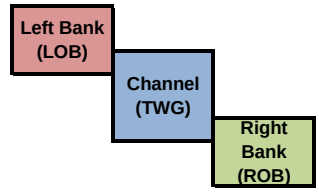
HEC-HMS Channel Topography (For NC-PL-015)

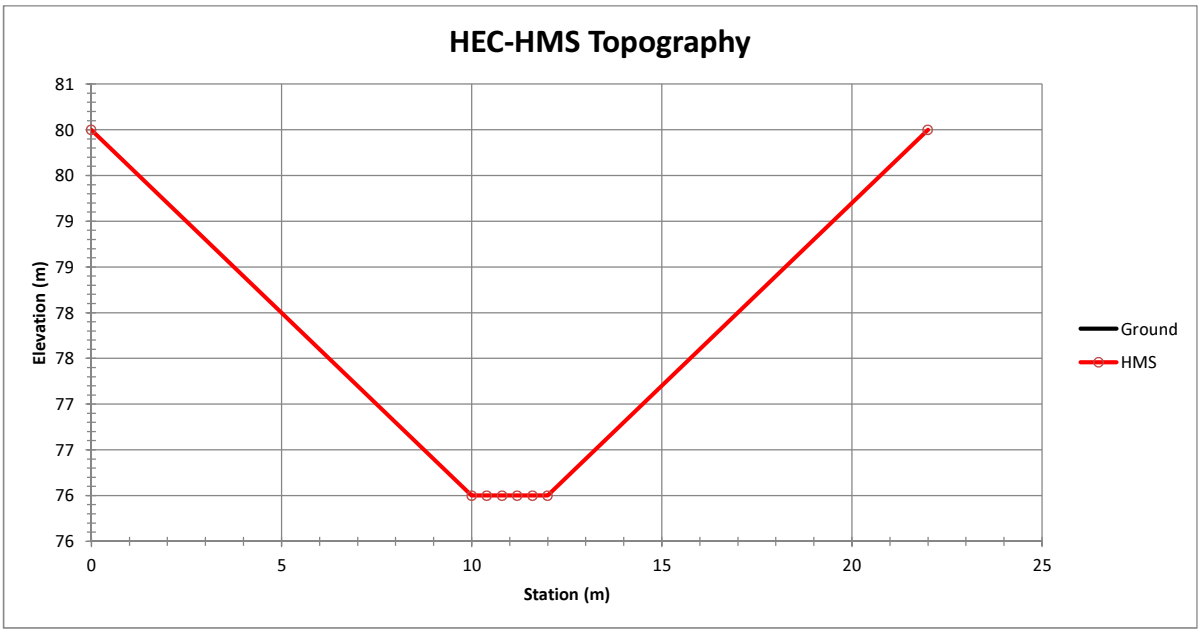
***The cross section for NC-PL-015 was assumed to be that of a design channel with a 2 m base.**

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2434.131	**(m)**
Channel slope, S =	0.006	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.030	
Right bank Manning's roughness, n_{ROB} =	0.030	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



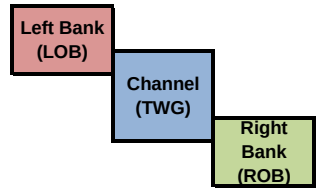


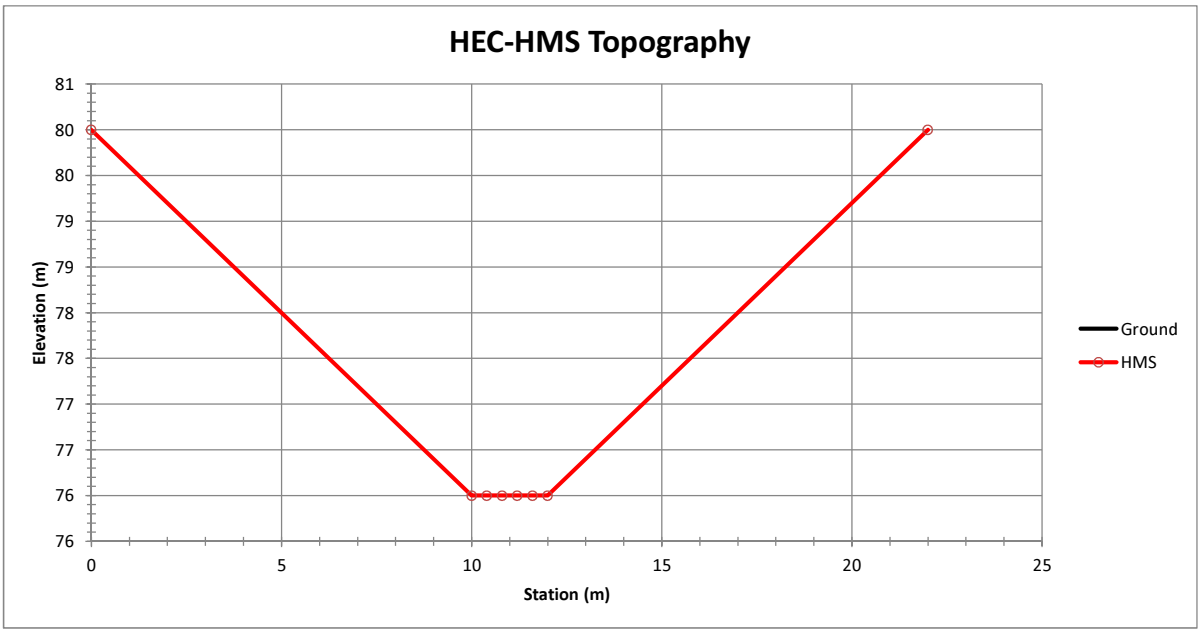
HEC-HMS Channel Topography (For DC-PL-016)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	294.351	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



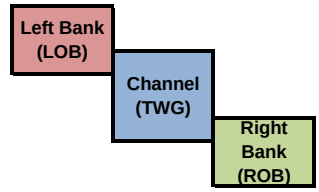


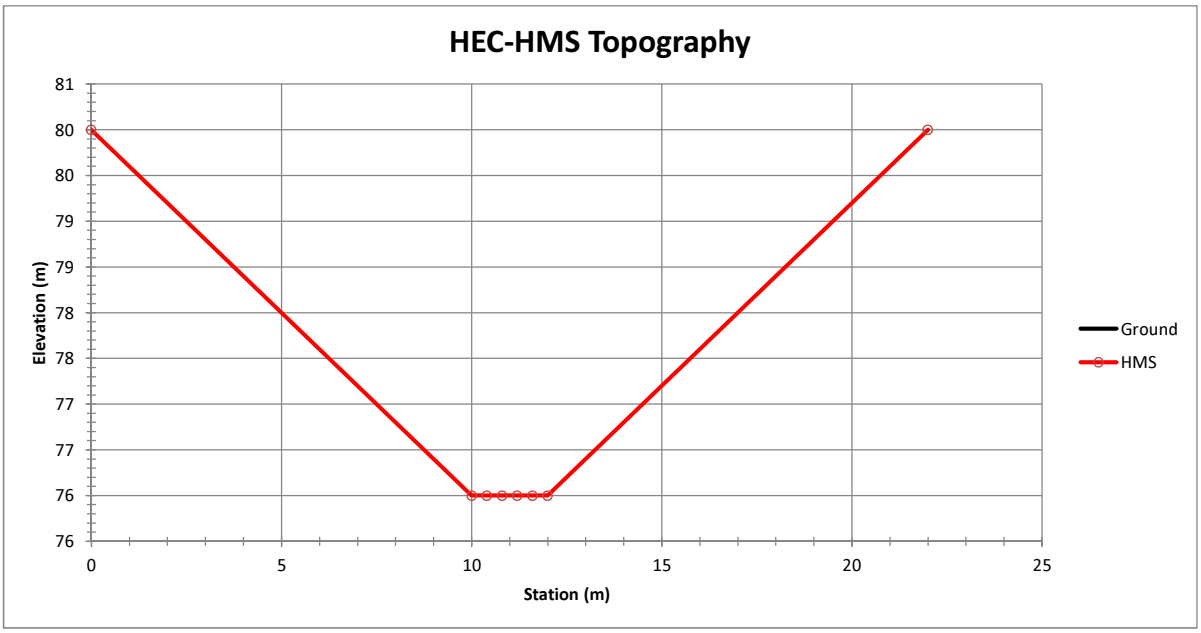
HEC-HMS Channel Topography (For DC-PL-017)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1321.547	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



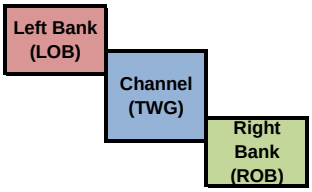


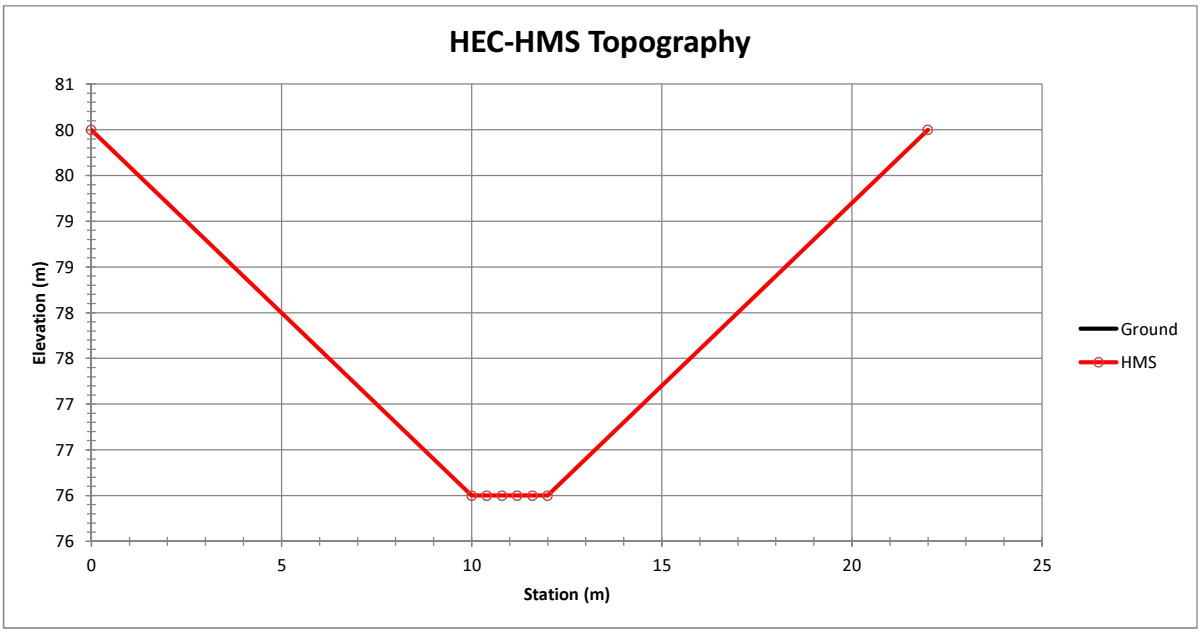
HEC-HMS Channel Topography (For DC-PL-018)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	805.376	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



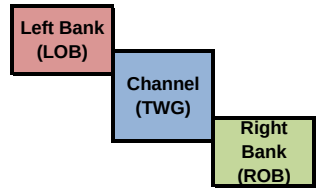


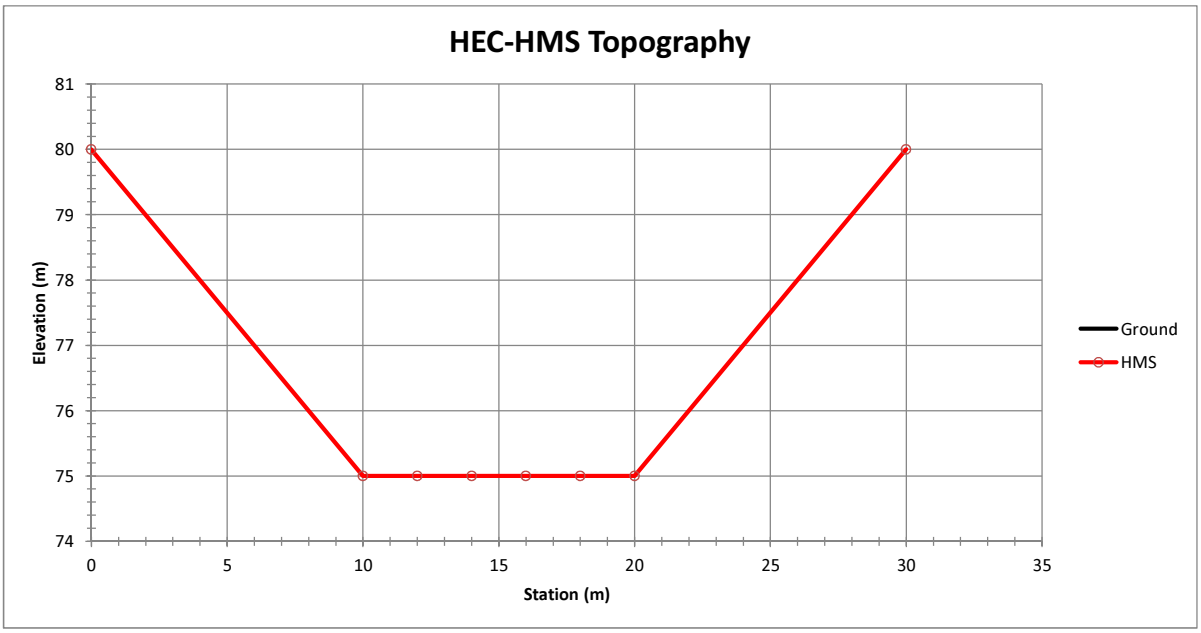
HEC-HMS Channel Topography (For DC-PL-019)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	843.796	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8



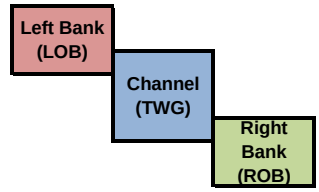


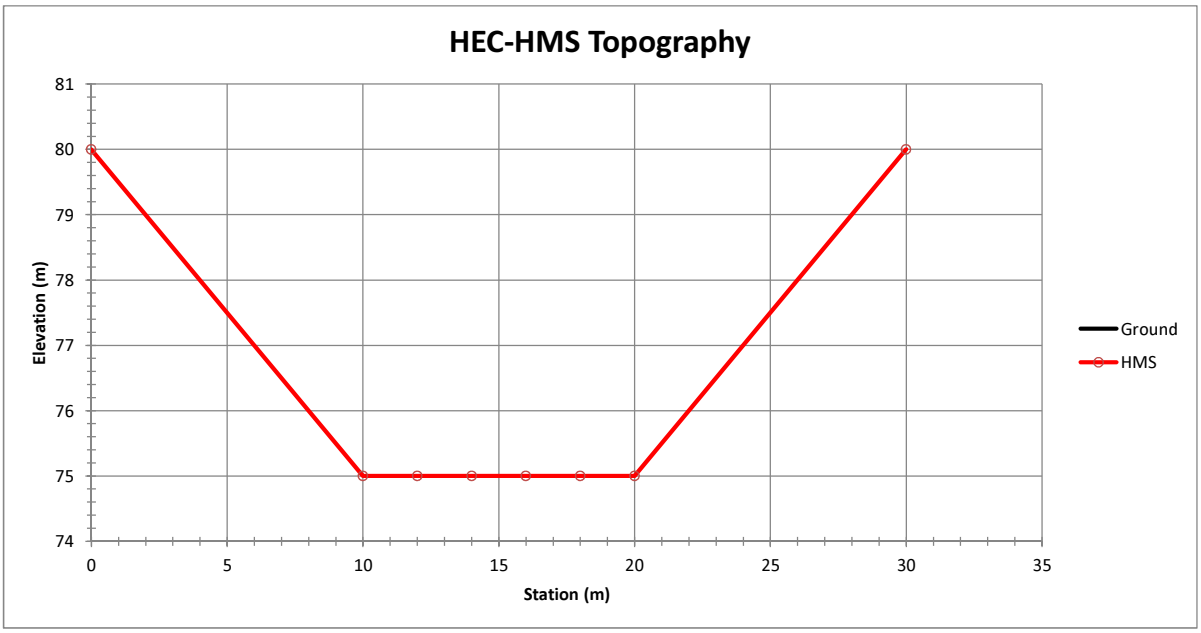
HEC-HMS Channel Topography (For DC-PL-020)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1137.573	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8



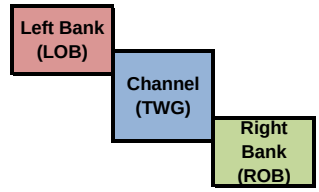


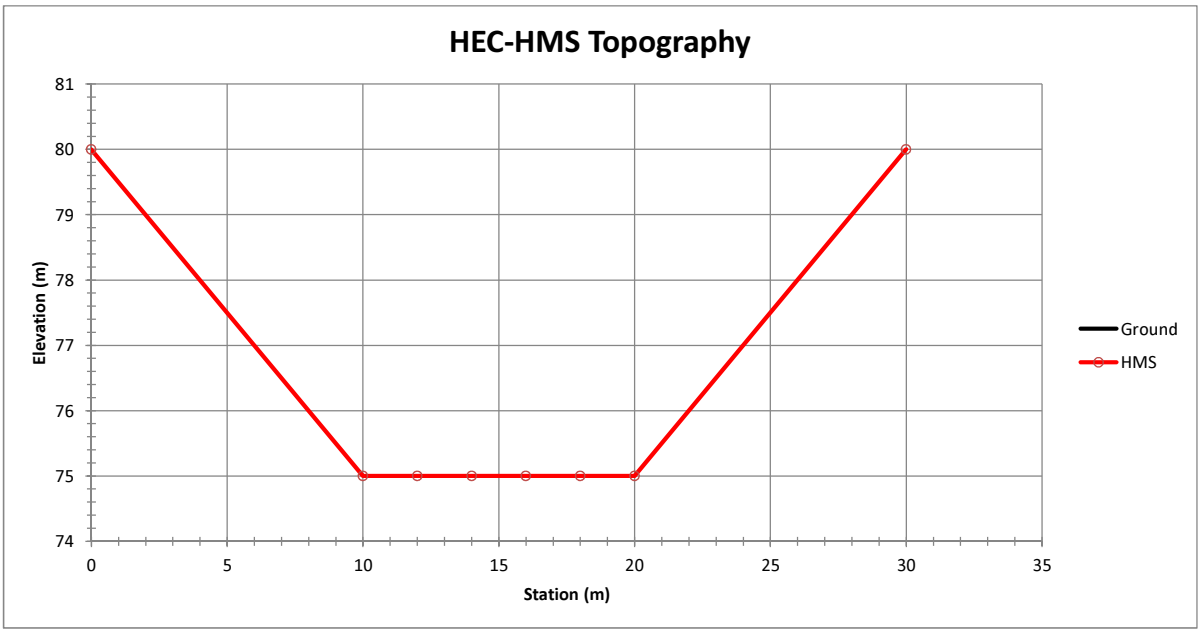
HEC-HMS Channel Topography (For DC-PL-021)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1514.570	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8



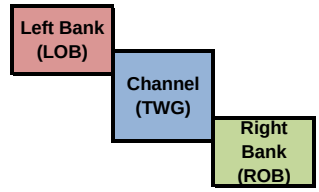


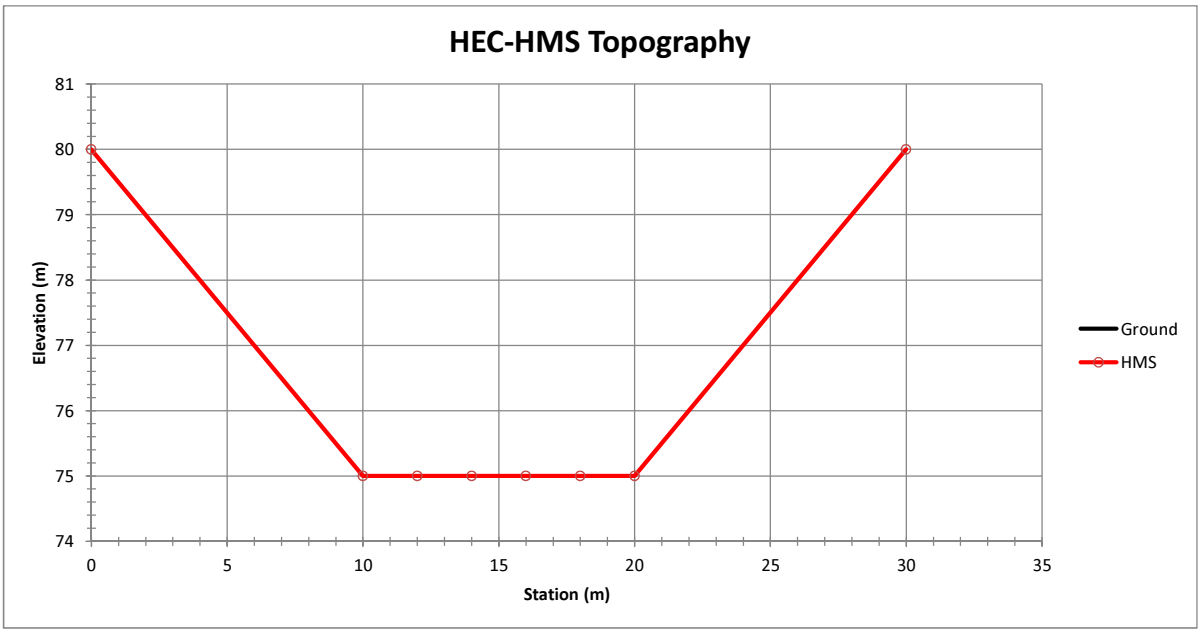
HEC-HMS Channel Topography (For DC-PL-022)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	497.205	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8



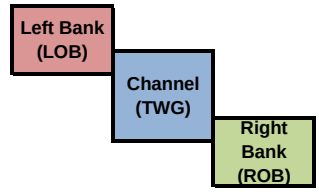


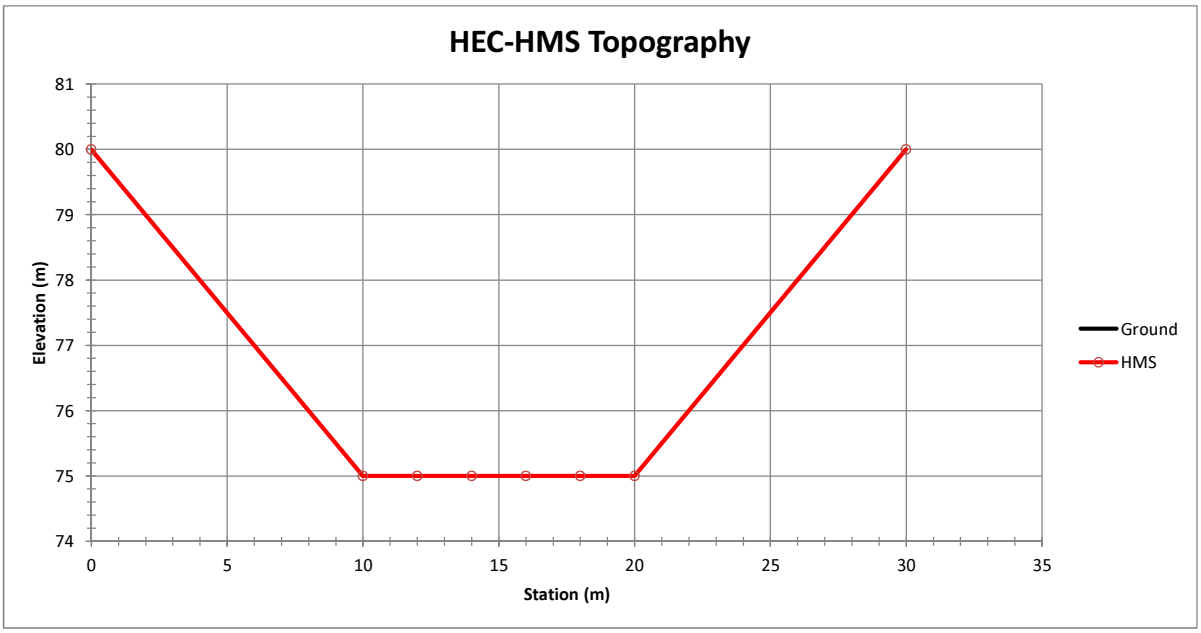
HEC-HMS Channel Topography (For DC-PL-023)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2479.689	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8



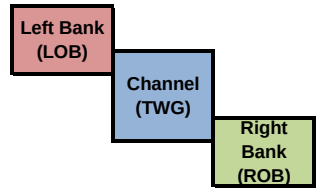


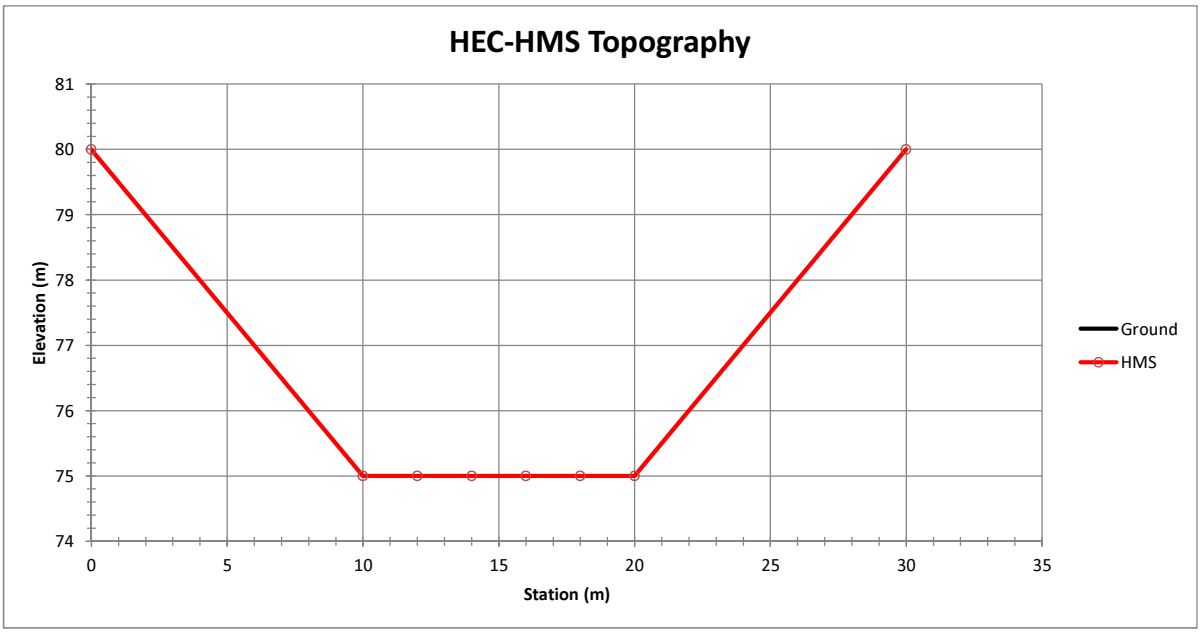
HEC-HMS Channel Topography (For DC-PL-024)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1351.837	**(m)**
Channel slope, S =	0.003	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.035	
Channel invert elevation, Z_o =		**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.035	
Right bank Manning's roughness, n_{ROB} =	0.035	
Approximate Channel Base Width =	10.0	**(m)**

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	80.000	1
10.000	75.000	2
12.000	75.000	**3**
14.000	75.000	4
16.000	75.000	5
18.000	75.000	**6**
20.000	75.000	7
30.000	80.000	8





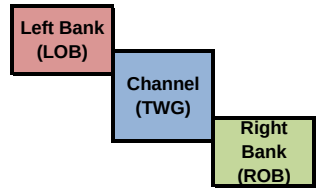
HEC-HMS Channel Topography (For NC-PL-025)

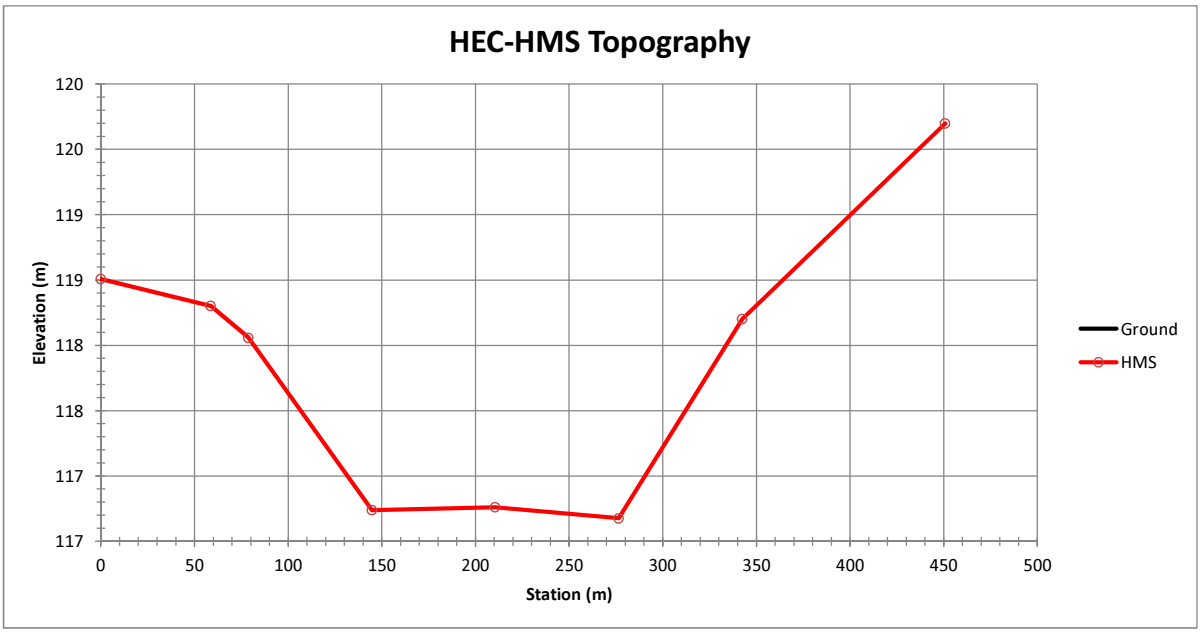
***NC-PL-025 was assumed to have the same channel shape as NC-PL-026**

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	584.546	**(m)**
Channel slope, S =	0.009	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	118.507	1
58.568	118.302	2
78.809	118.058	**3**
144.710	116.738	4
210.610	116.760	5
276.511	116.676	**6**
342.411	118.202	7
450.803	119.698	8



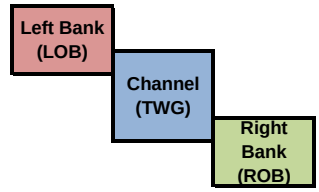


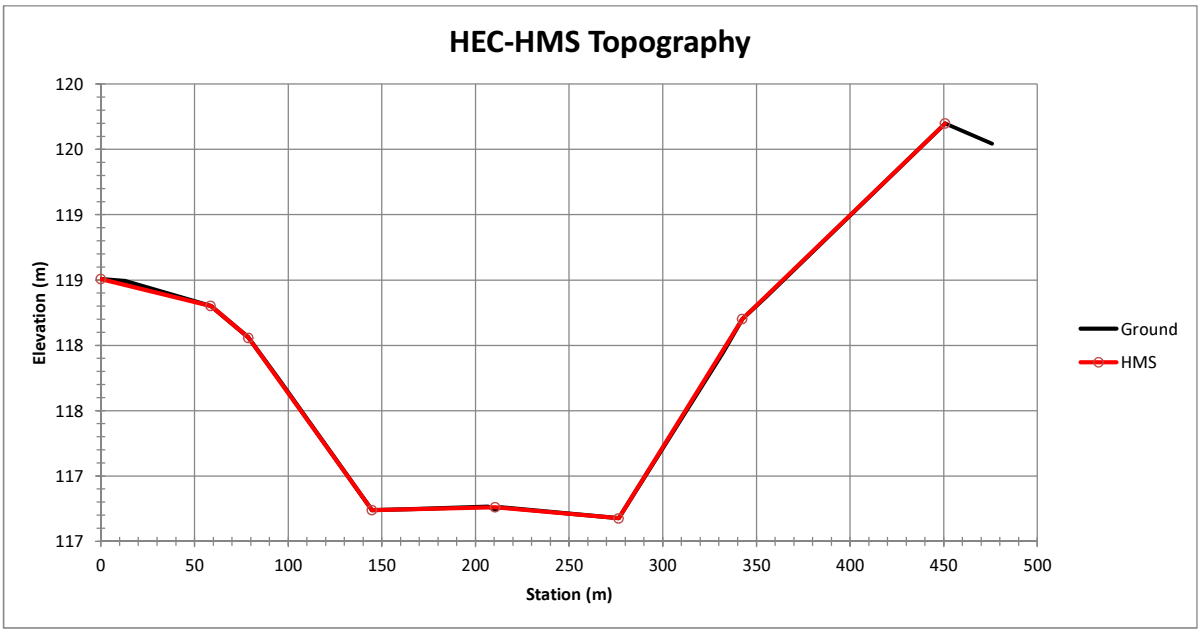
HEC-HMS Channel Topography (For NC-PL-026)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 556.000 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	118.507	1
58.568	118.302	2
78.809	118.058	**3**
144.710	116.738	4
210.610	116.760	5
276.511	116.676	**6**
342.411	118.202	7
450.803	119.698	8



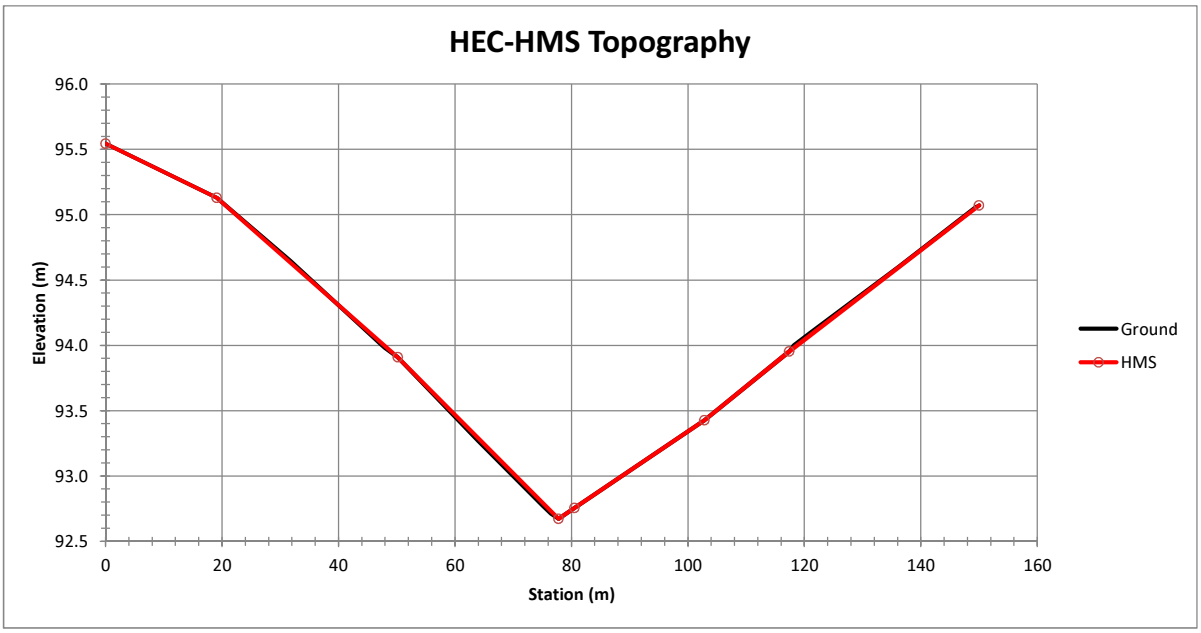


HEC-HMS Channel Topography (For NC-PL-027)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	682.683	**(m)**
Channel slope, S =	0.008	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.030	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.050	
Right bank Manning's roughness, n_{ROB} =	0.050	

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	95.545	1
19.113	95.129	2
50.169	93.910	**3**
77.767	92.672	4
80.533	92.756	5
102.841	93.428	**6**
117.394	93.953	7
150.000	95.071	8

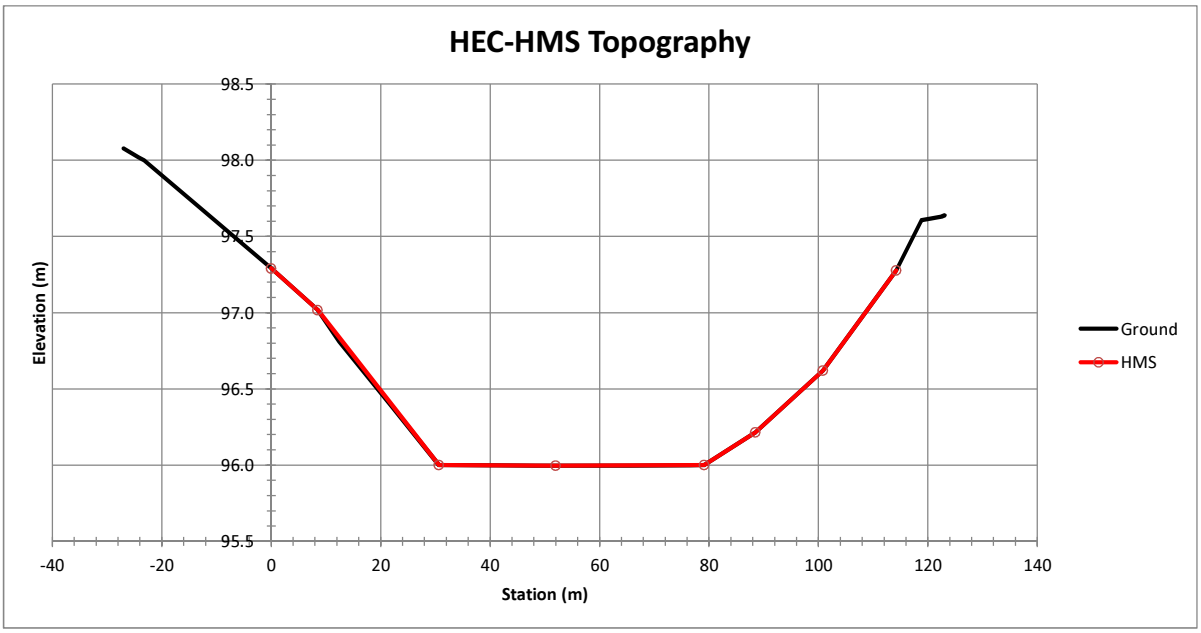


HEC-HMS Channel Topography (For NC-PL-028)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 281.377 **(m)**
Channel slope, S = 0.019 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	97.291	1
8.491	97.018	2
30.610	96.000	**3**
51.983	95.996	4
79.104	96.000	5
88.467	96.214	**6**
100.833	96.620	7
114.200	97.278	8

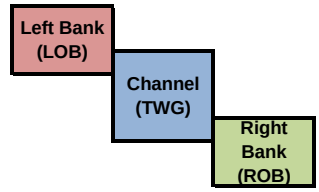


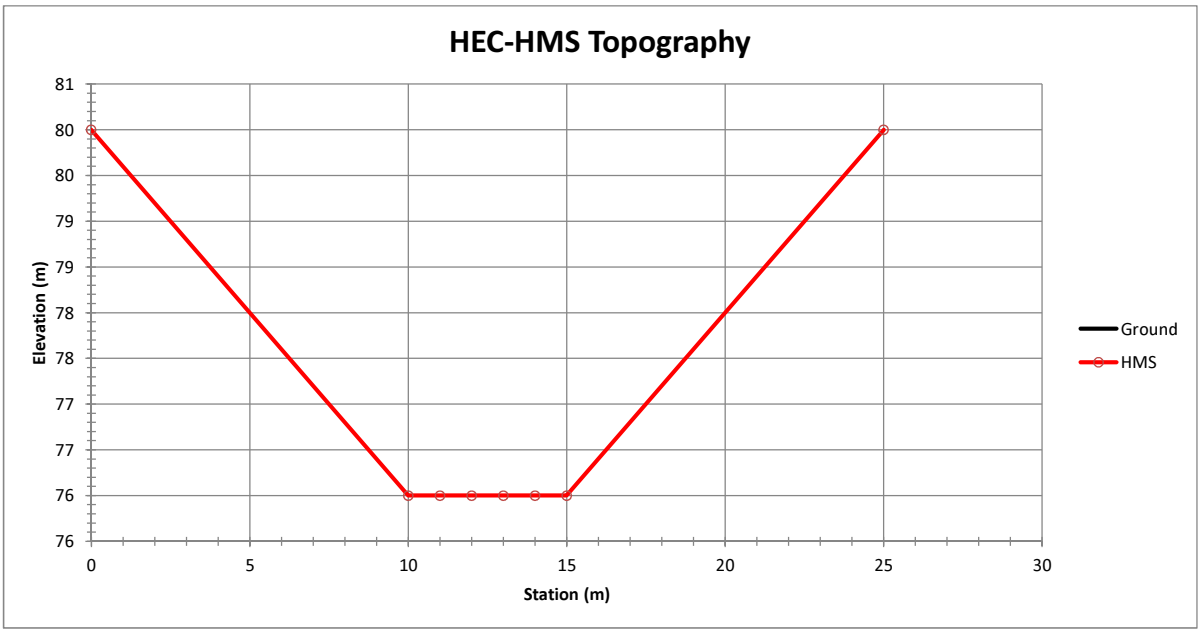
HEC-HMS Channel Topography (For DC-PL-029)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	730.528	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



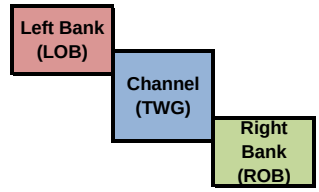


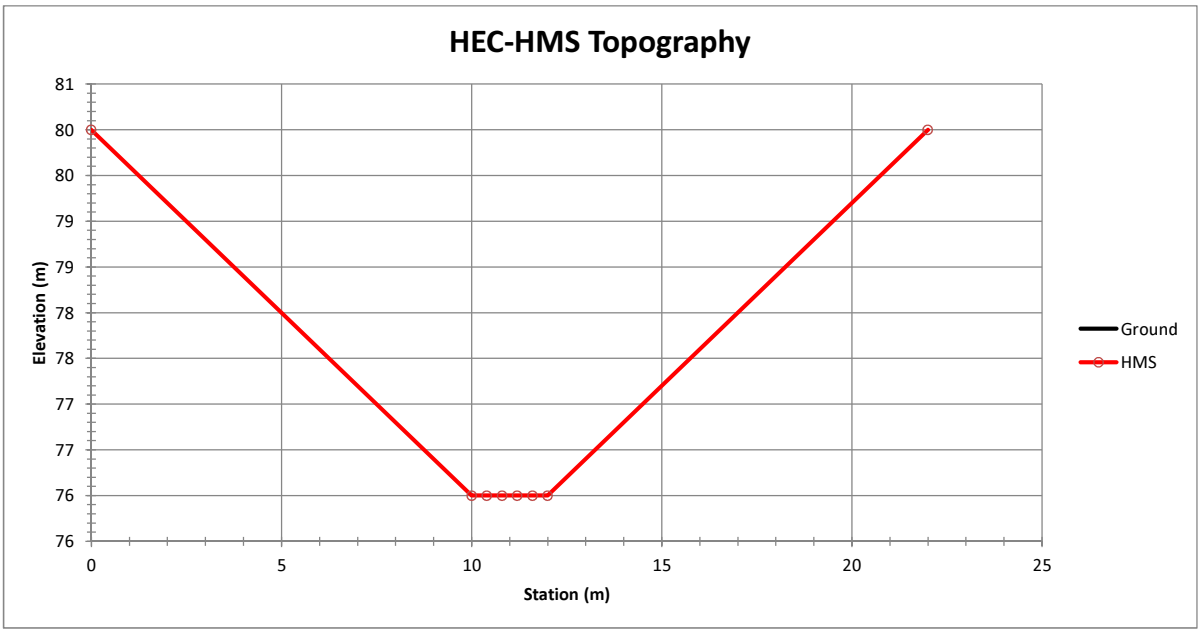
HEC-HMS Channel Topography (For DC-PL-030)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	785.160	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



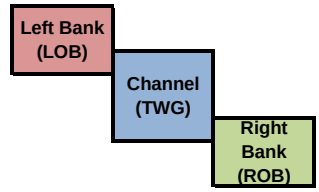


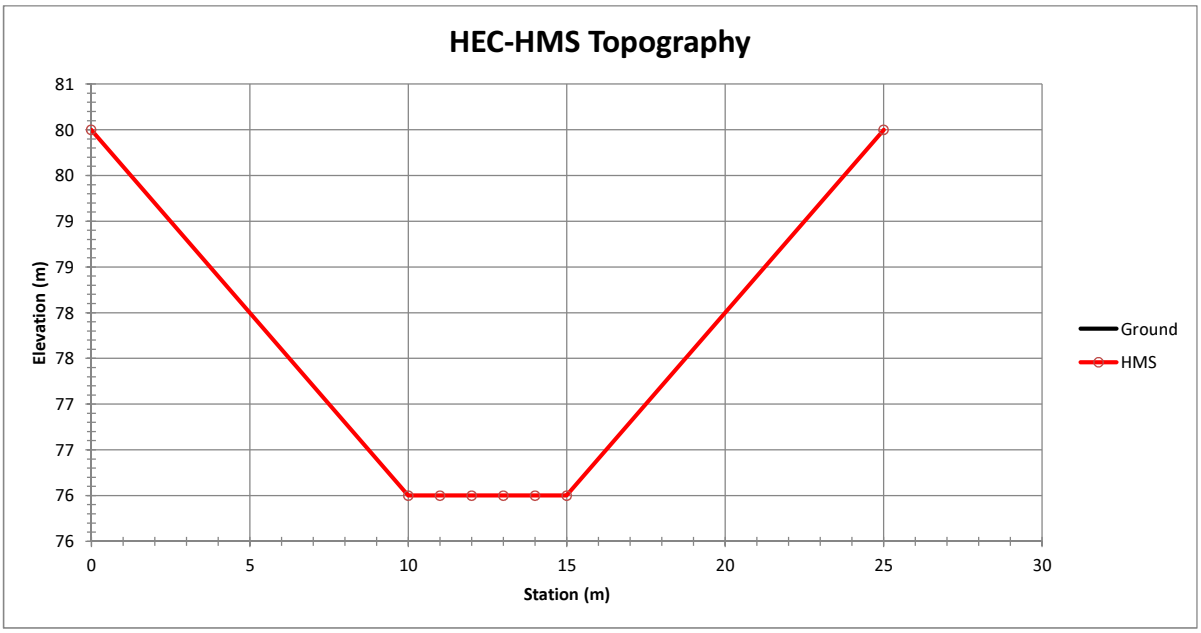
HEC-HMS Channel Topography (For DC-PL-031)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	5001.976	**(m)**
Channel slope, S =	0.006	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.013	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.013	
Right bank Manning's roughness, n_{ROB} =	0.013	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



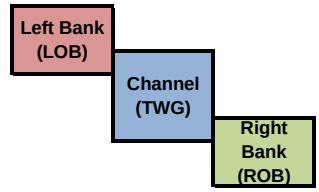


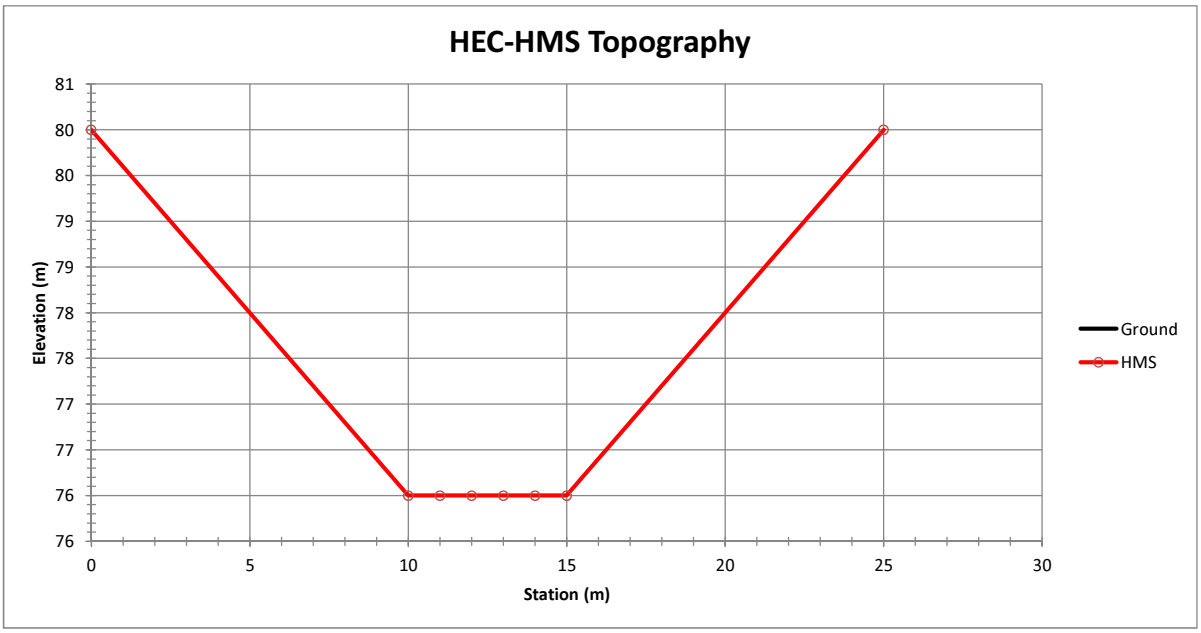
HEC-HMS Channel Topography (For DC-PL-032)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	4554.978	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.013	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.013	
Right bank Manning's roughness, n_{ROB} =	0.013	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



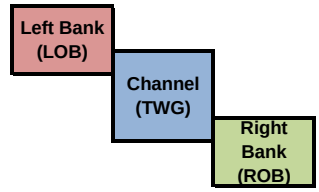


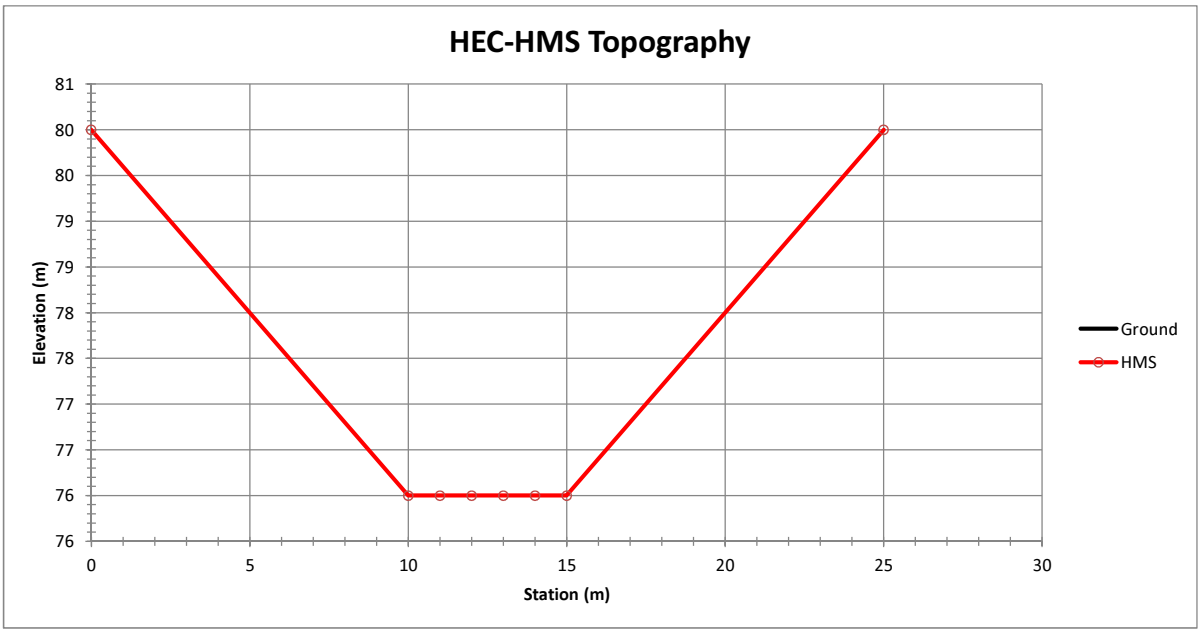
HEC-HMS Channel Topography (For DC-PL-033)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	715.441	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



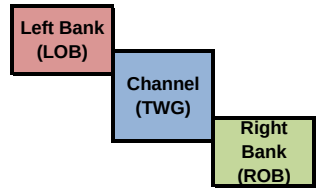


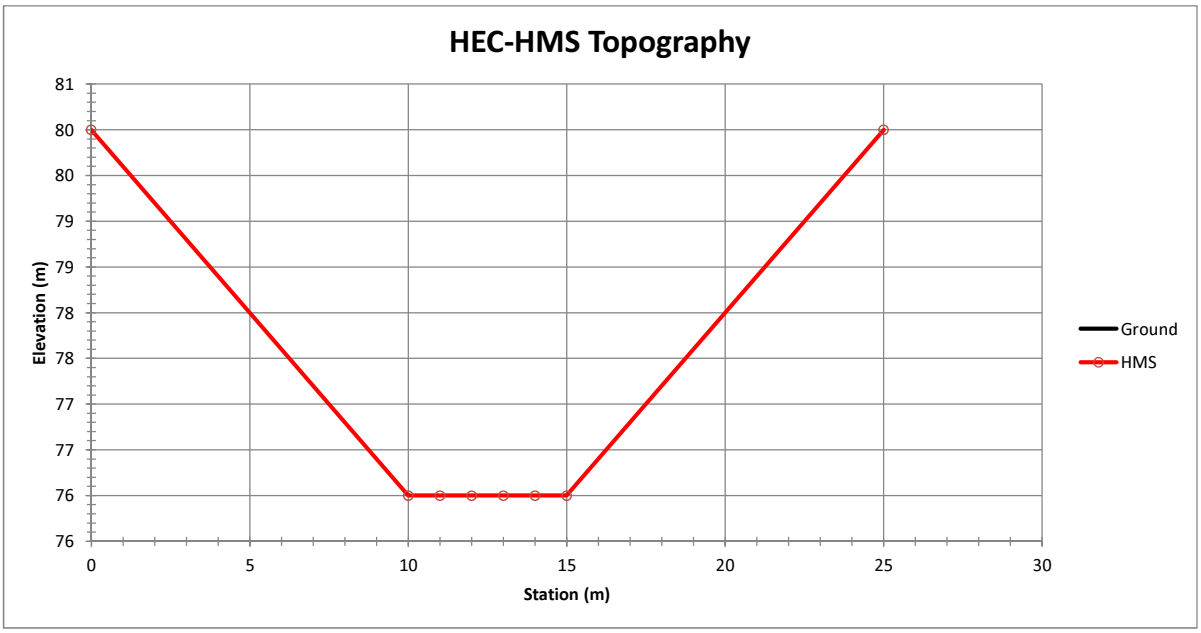
HEC-HMS Channel Topography (For DC-PL-034)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	550.308	**(m)**
Channel slope, S =	0.003	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



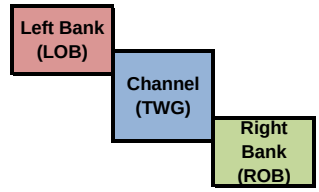


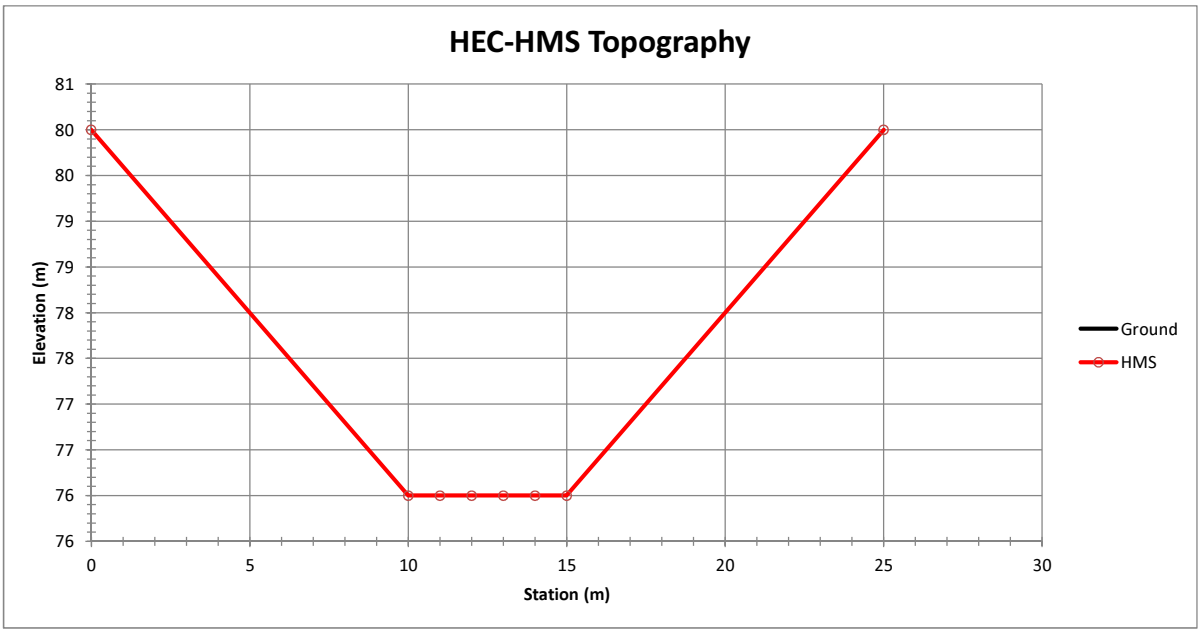
HEC-HMS Channel Topography (For DC-PL-035)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1180.350	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



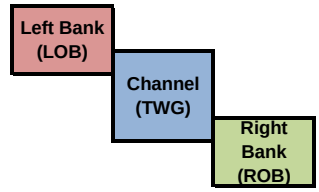


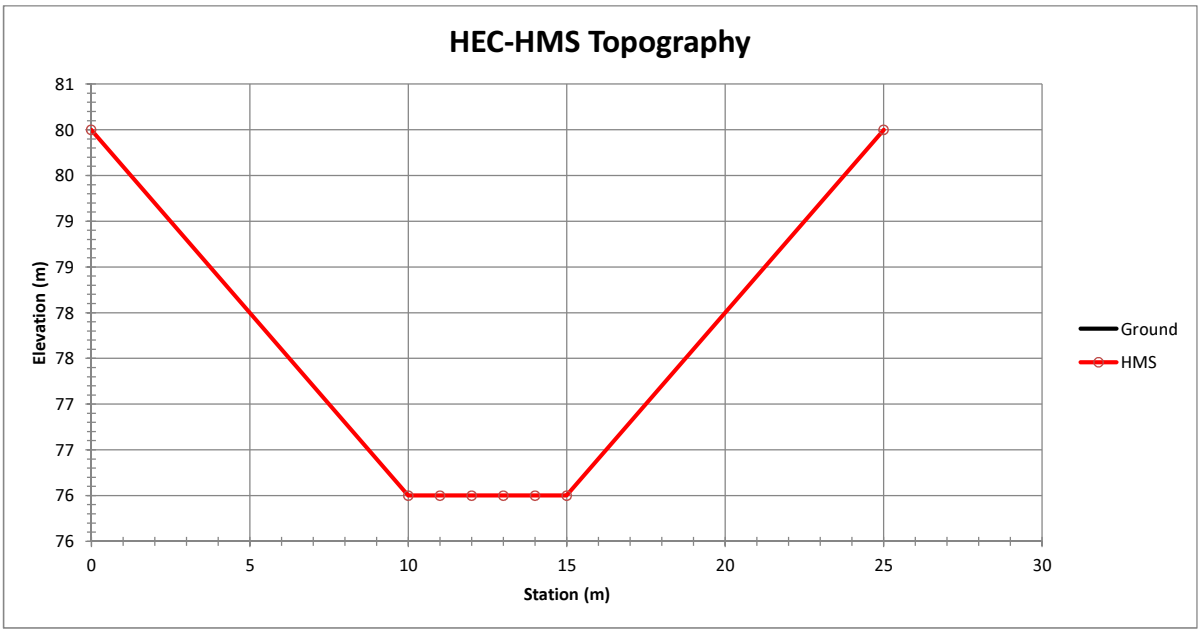
HEC-HMS Channel Topography (For DC-PL-036)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	261.544	**(m)**
Channel slope, S =	0.013	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



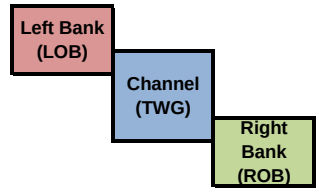


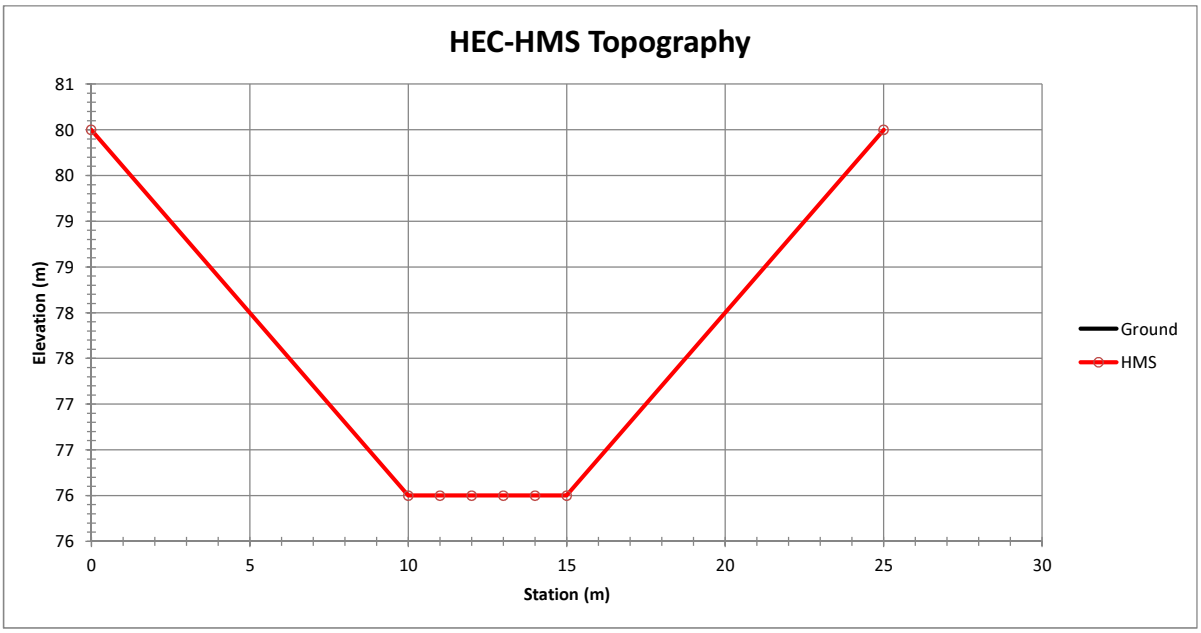
HEC-HMS Channel Topography (For DC-PL-037)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	208.348	**(m)**
Channel slope, S =	0.029	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



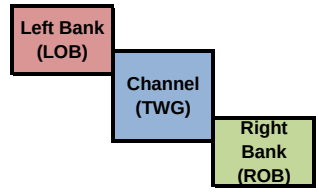


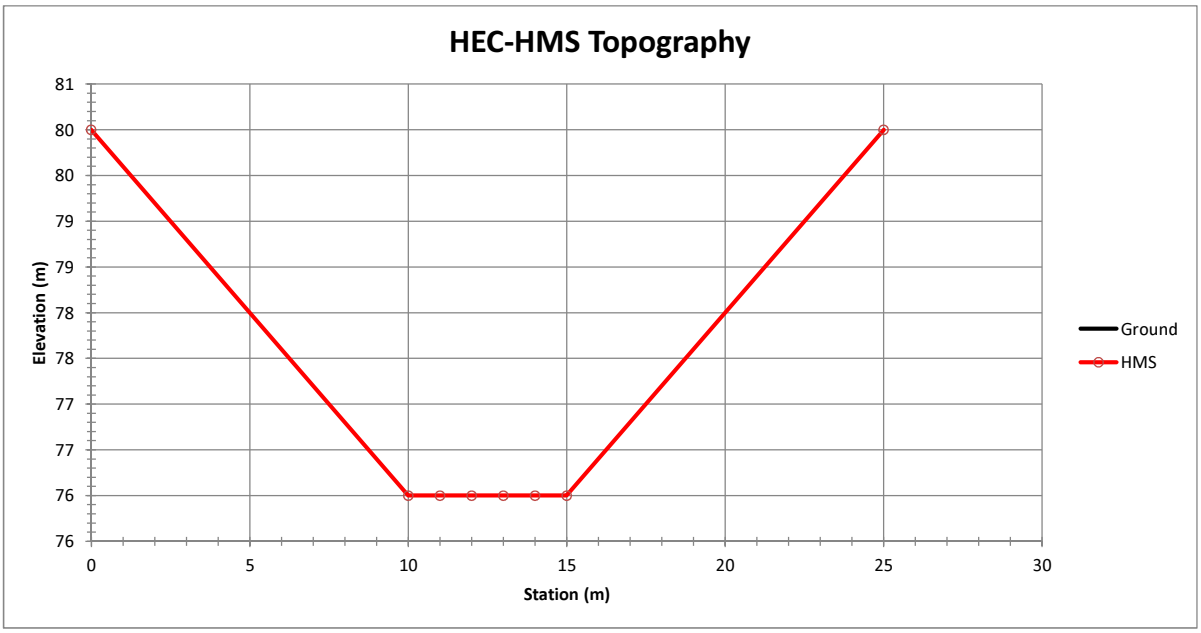
HEC-HMS Channel Topography (For DC-PL-038)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	793.079	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



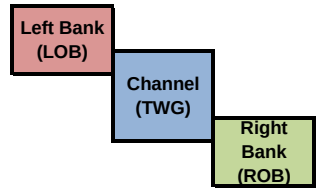


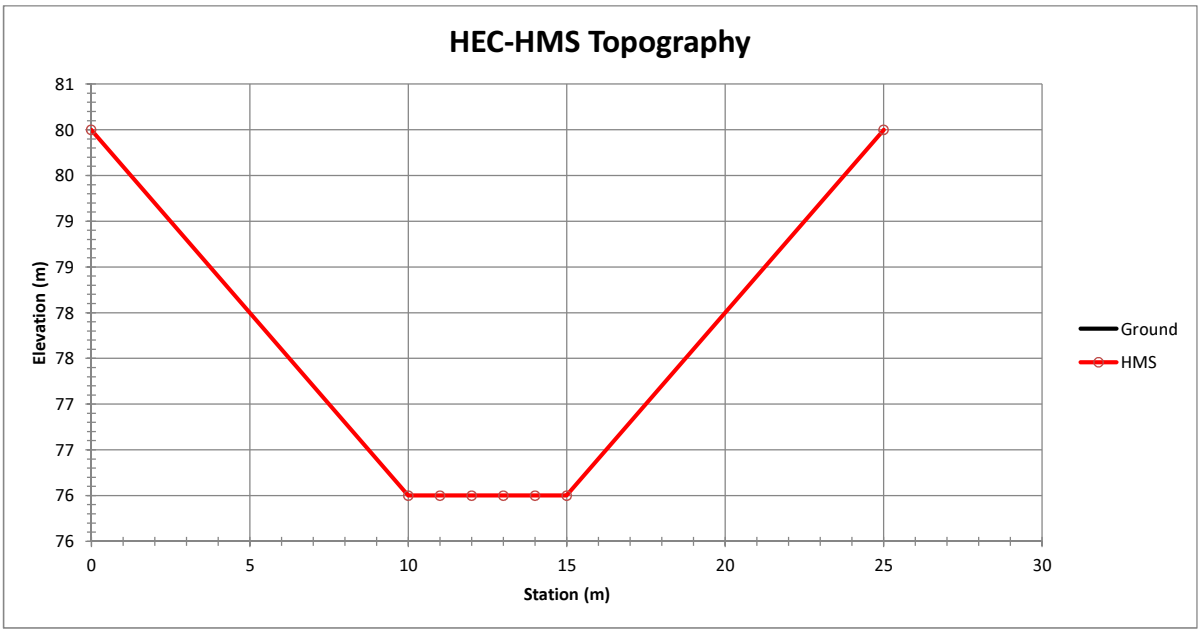
HEC-HMS Channel Topography (For DC-PL-039)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	725.708	**(m)**
Channel slope, S =	0.019	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



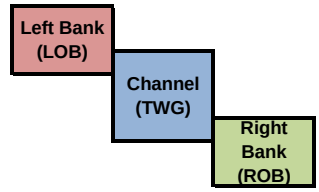


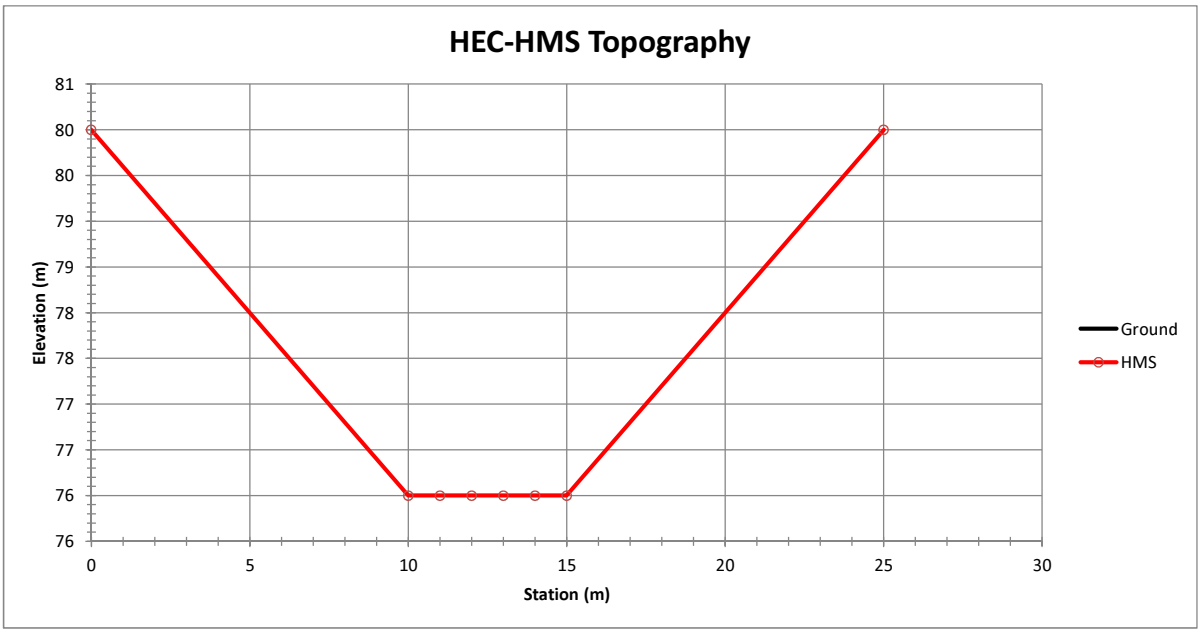
HEC-HMS Channel Topography (For DC-PL-040)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	218.236	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



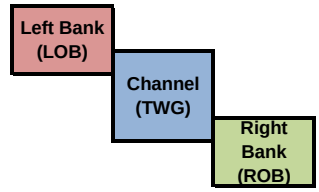


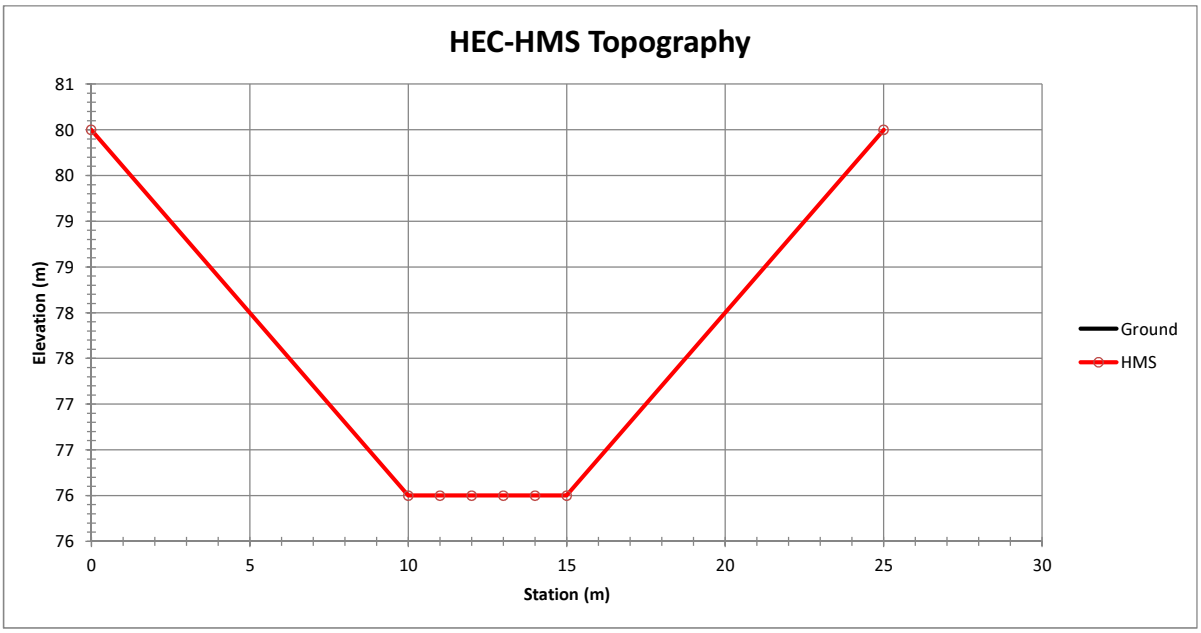
HEC-HMS Channel Topography (For DC-PL-041)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1876.266	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



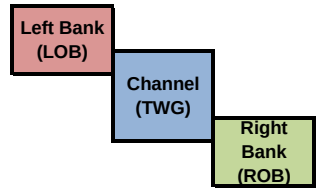


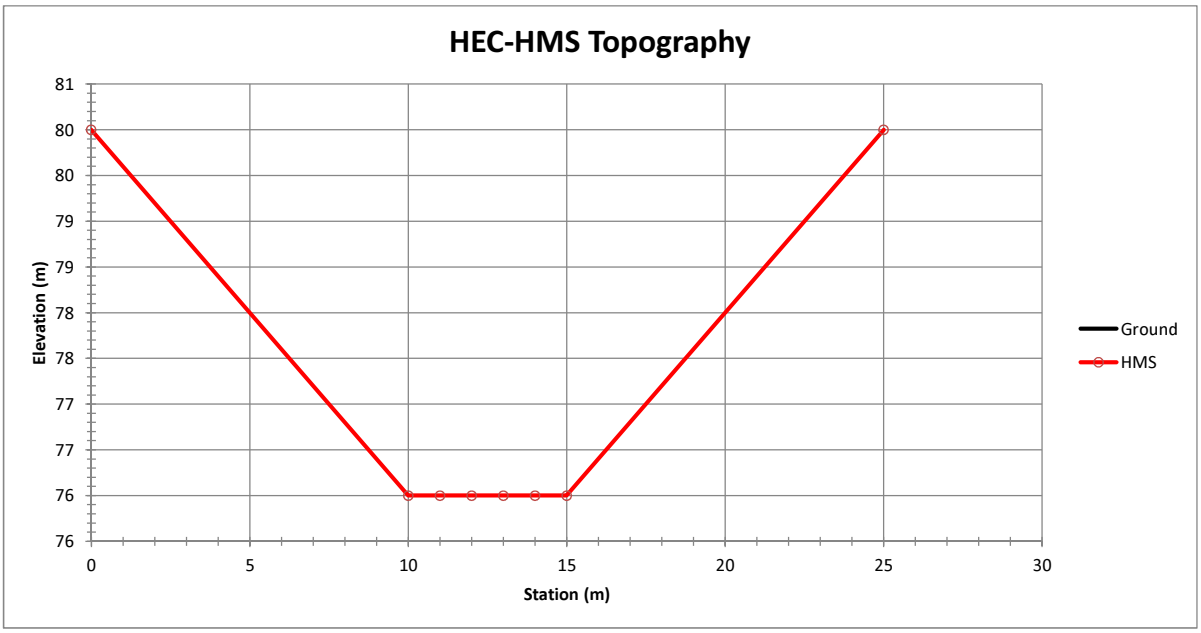
HEC-HMS Channel Topography (For DC-PL-042)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	119.484	**(m)**
Channel slope, S =	0.008	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



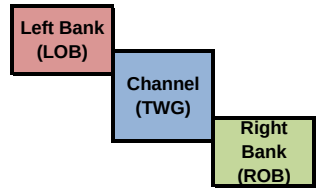


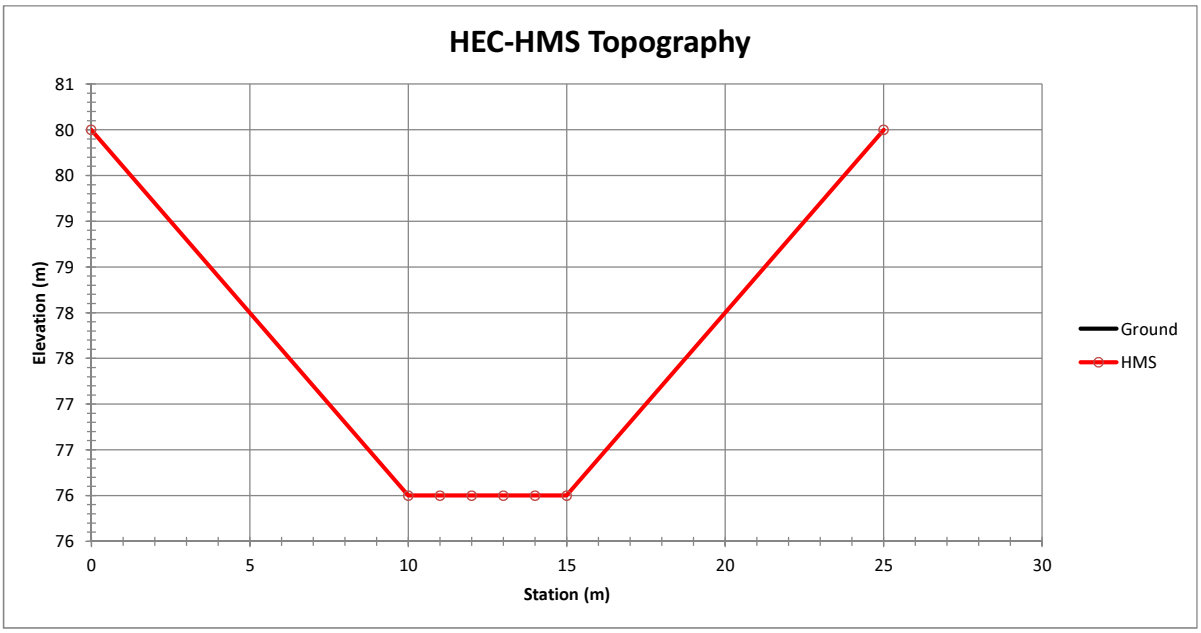
HEC-HMS Channel Topography (For DC-PL-043)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2194.740	**(m)**
Channel slope, S =	0.029	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



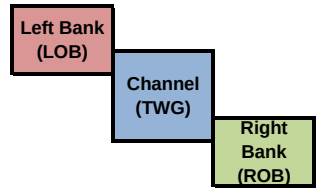


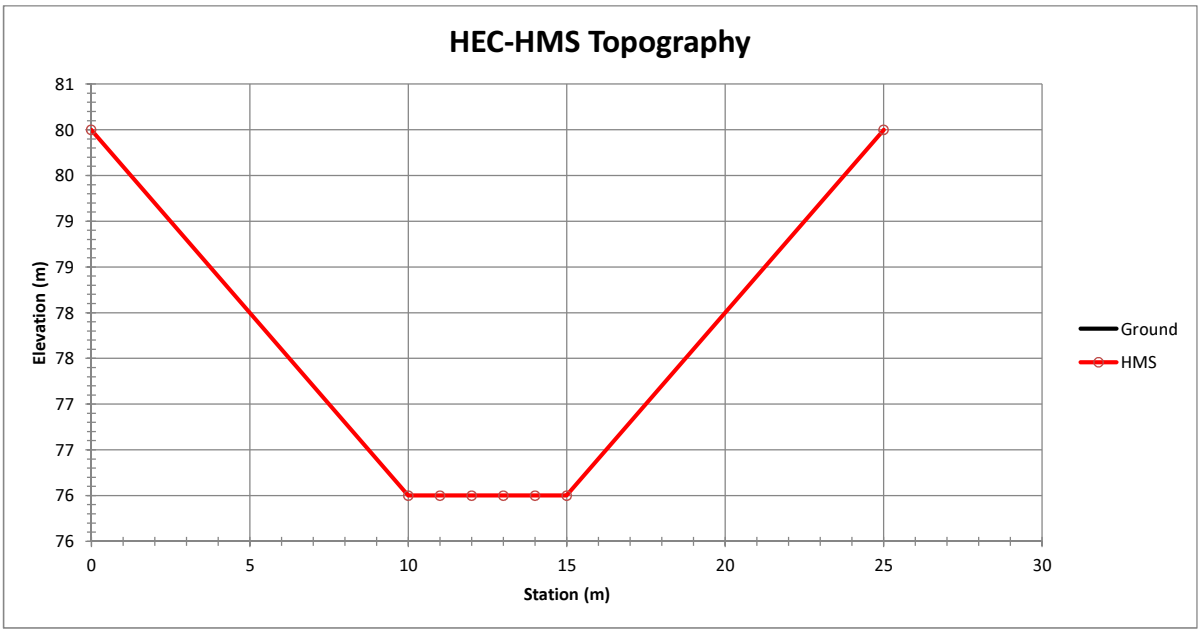
HEC-HMS Channel Topography (For DC-PL-044)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	352.362	**(m)**
Channel slope, S =	0.017	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



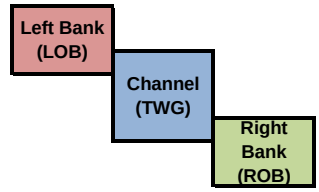


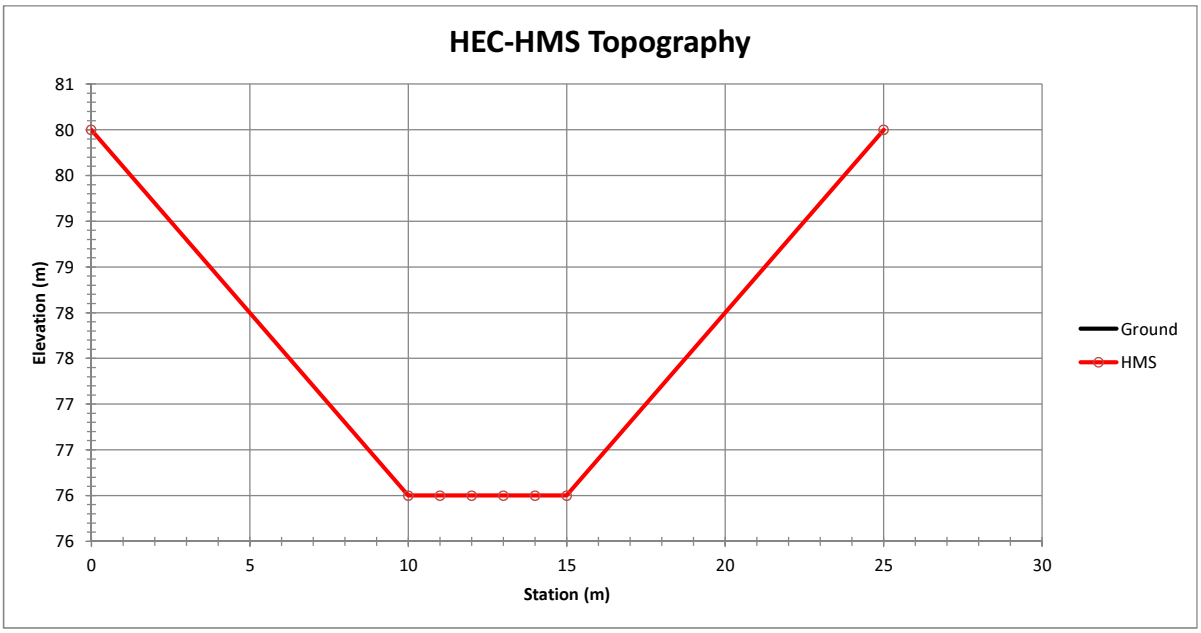
HEC-HMS Channel Topography (For DC-PL-045)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	558.204	**(m)**
Channel slope, S =	0.118	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



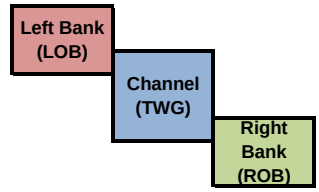


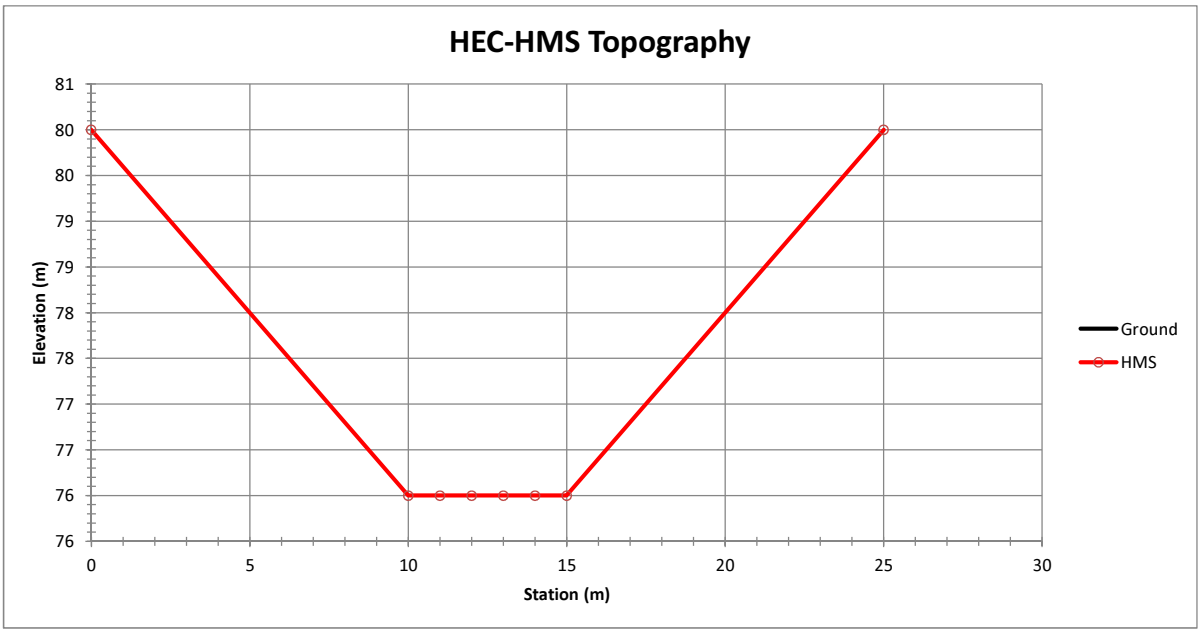
HEC-HMS Channel Topography (For DC-PL-046)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2273.05	**(m)**
Channel slope, S =	0.004	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



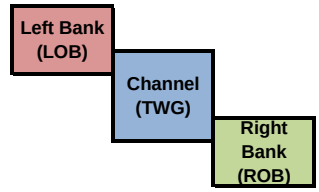


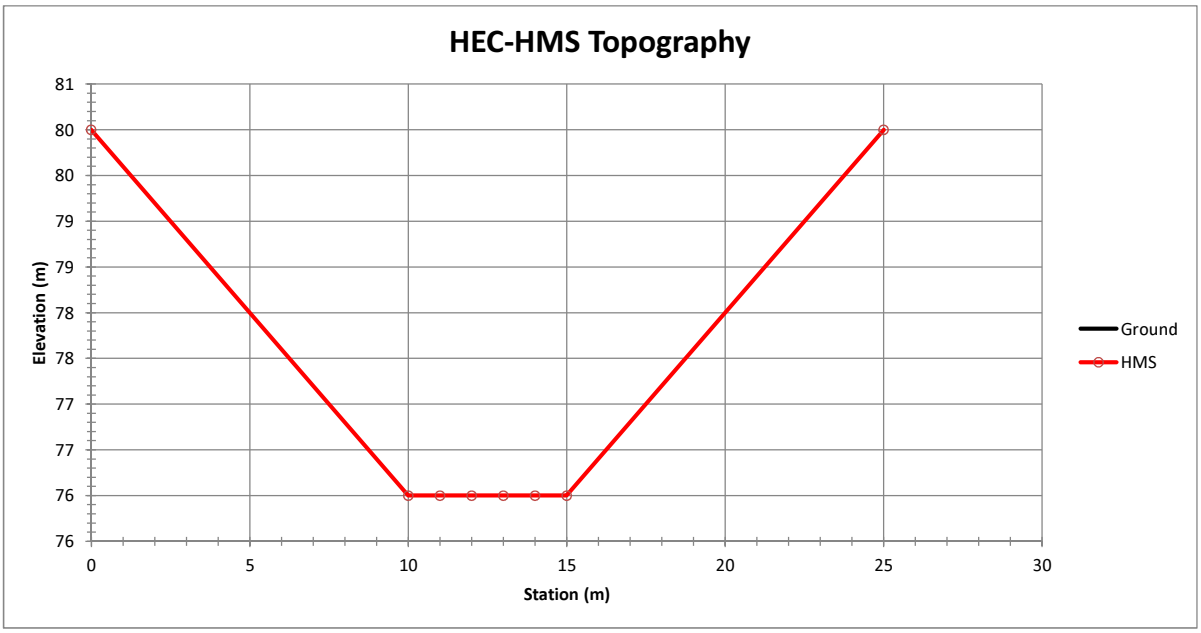
HEC-HMS Channel Topography (For DC-PL-047)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	785.016	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



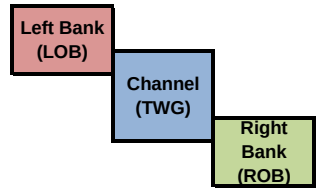


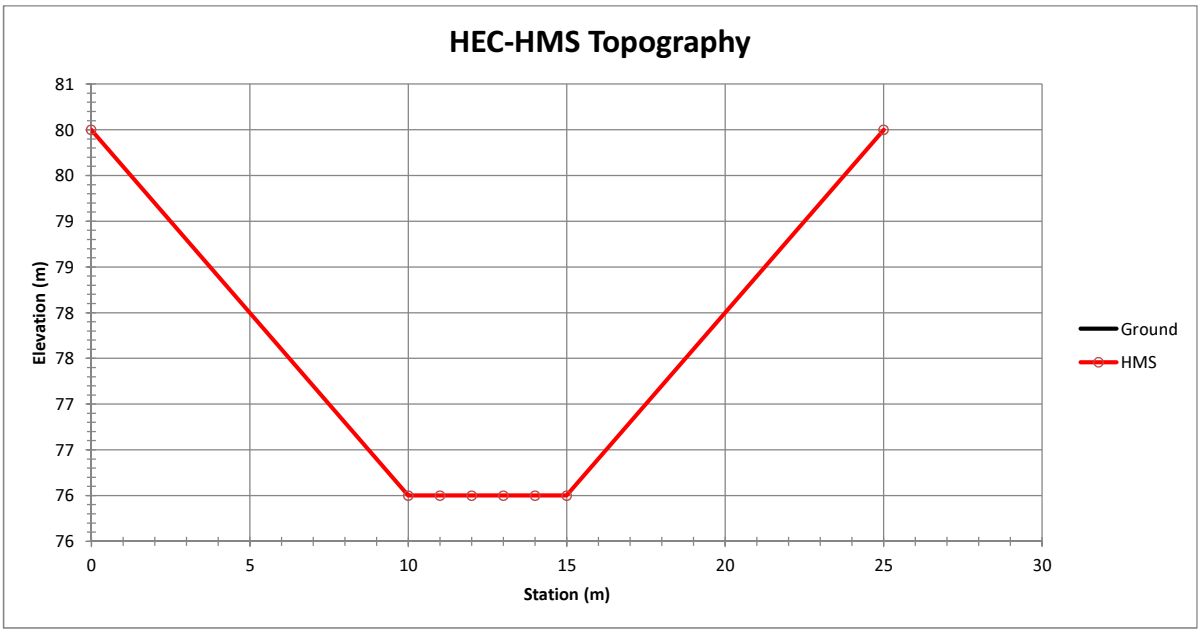
HEC-HMS Channel Topography (For DC-PL-048)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2685.698	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



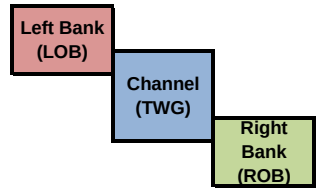


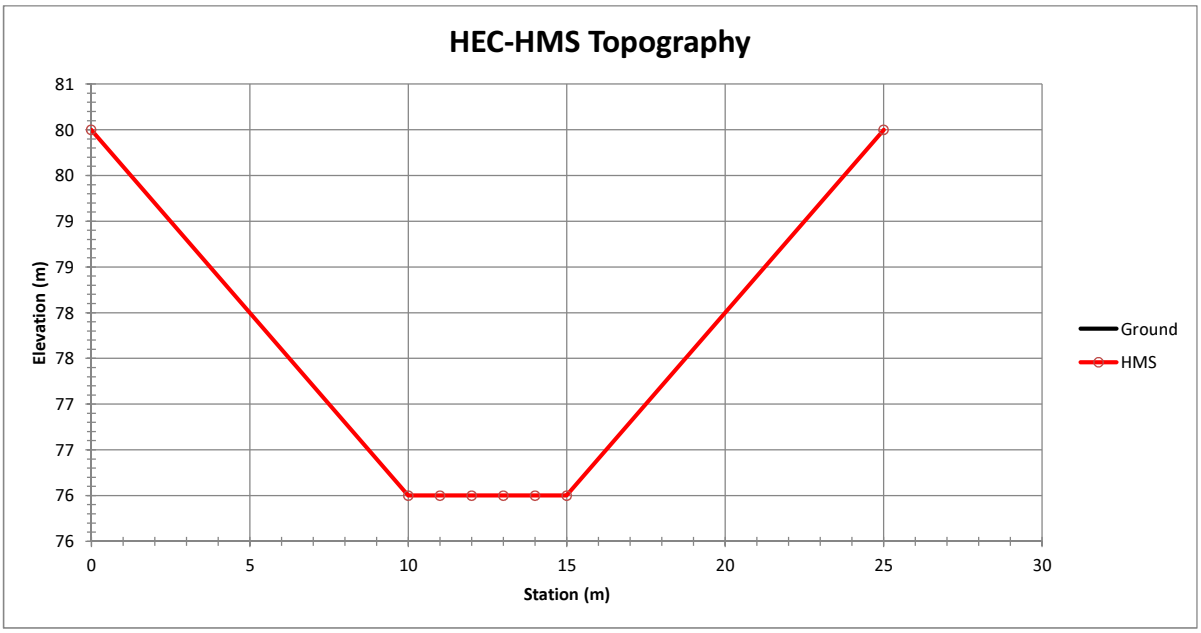
HEC-HMS Channel Topography (For DC-PL-049)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1488.798	**(m)**
Channel slope, S =	0.002	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



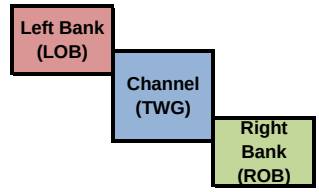


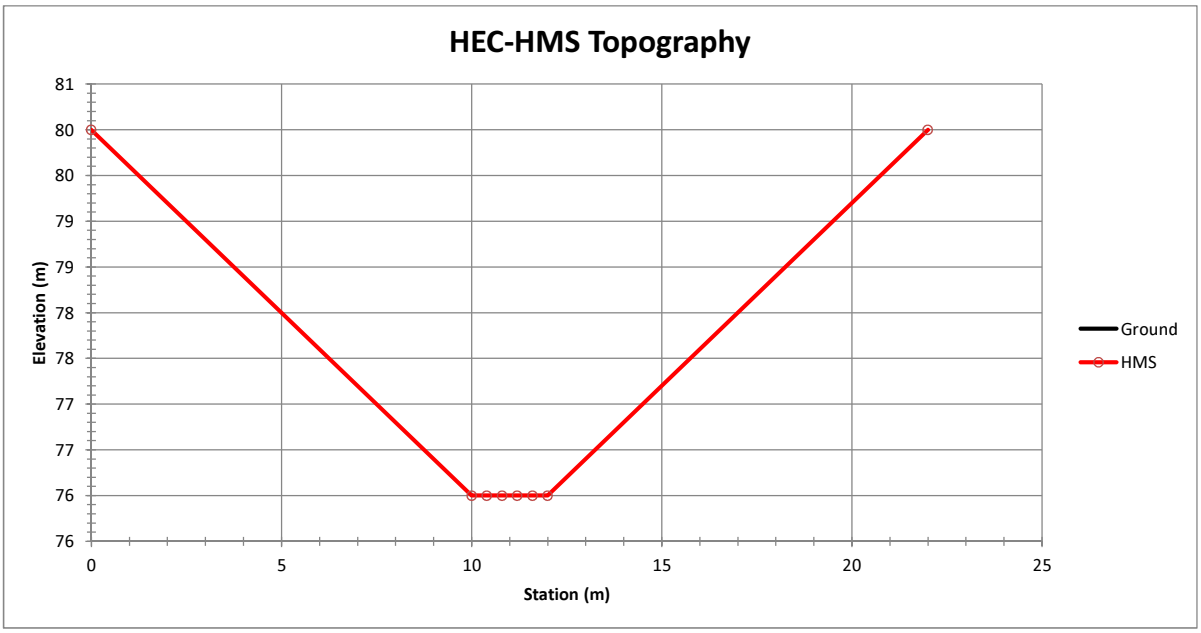
HEC-HMS Channel Topography (For DC-PL-050)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	2163.060	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.017	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.017	
Right bank Manning's roughness, n_{ROB} =	0.017	
Approximate Channel Base Width =	2.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.400	76.000	**3**
10.800	76.000	4
11.200	76.000	5
11.600	76.000	**6**
12.000	76.000	7
22.000	80.000	8



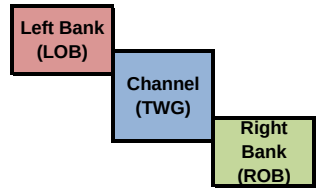


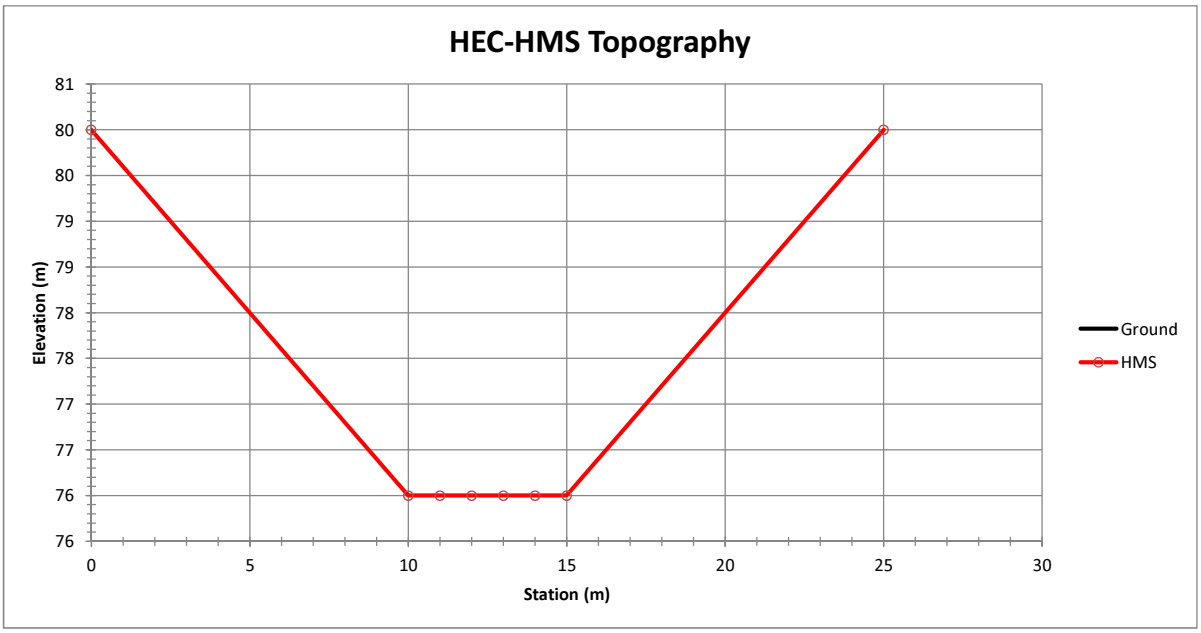
HEC-HMS Channel Topography (For DC-PL-051)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1760.959	**(m)**
Channel slope, S =	0.001	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



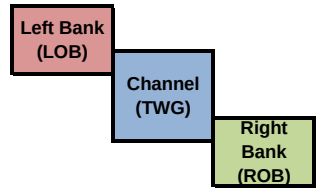


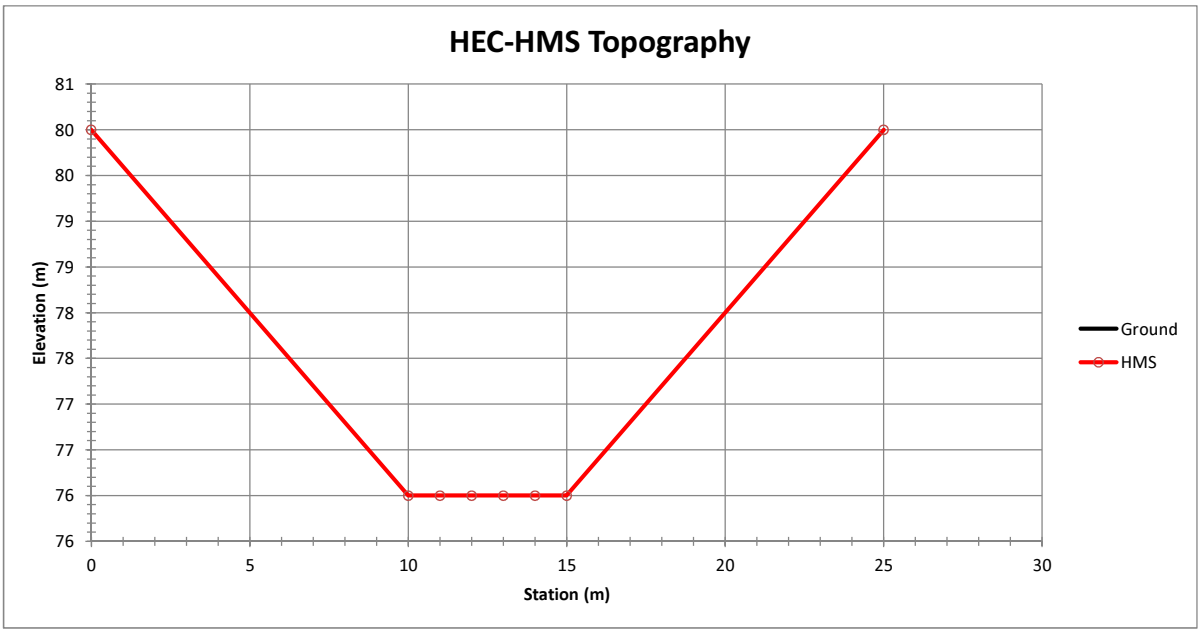
HEC-HMS Channel Topography (For DC-PL-052)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1031.713	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



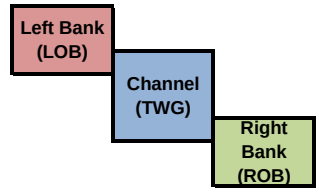


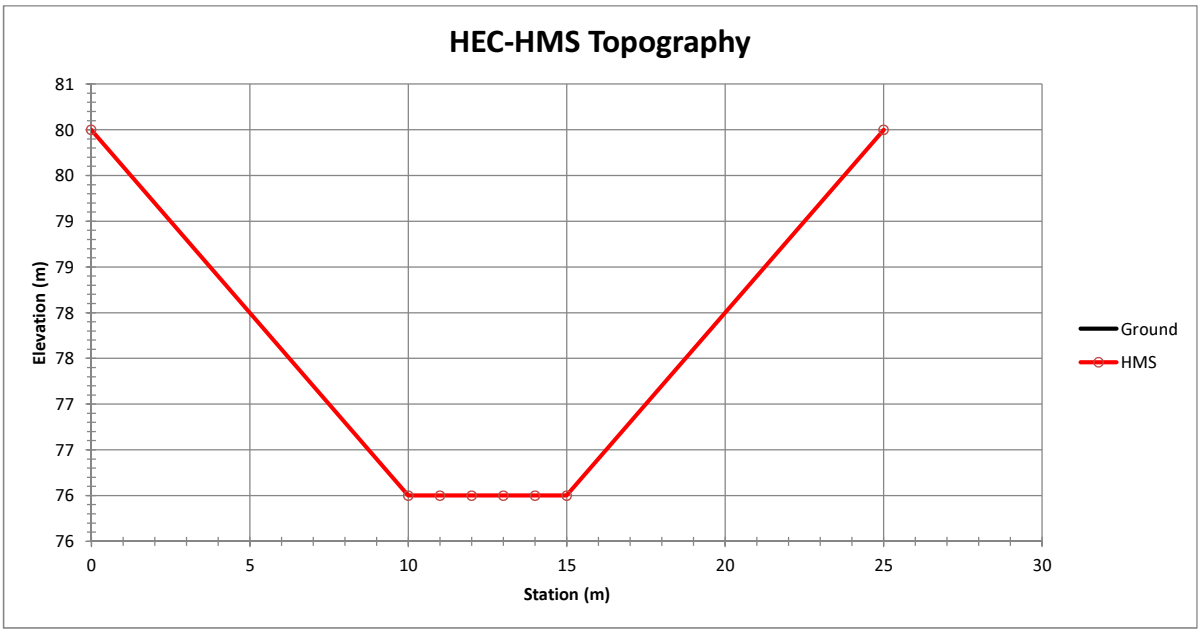
HEC-HMS Channel Topography (For DC-PL-053)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1644.206	**(m)**
Channel slope, S =	0.002	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



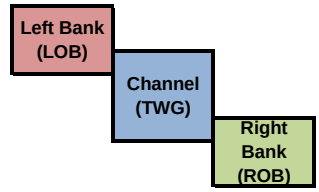


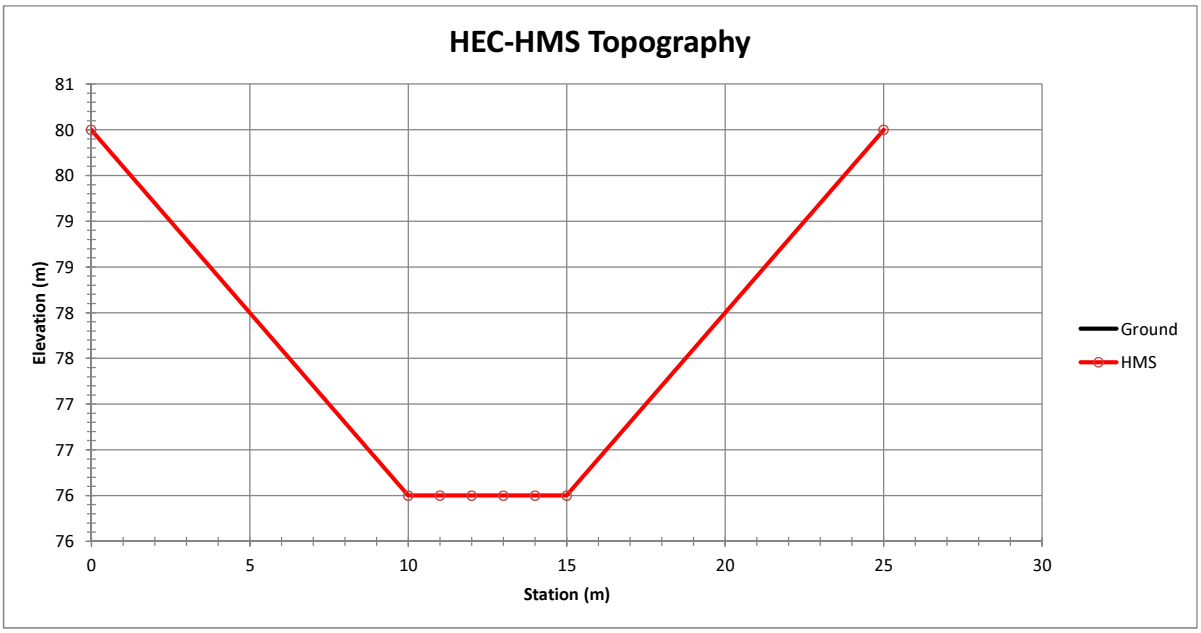
HEC-HMS Channel Topography (For DC-PL-054)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	372.875	**(m)**
Channel slope, S =	0.025	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



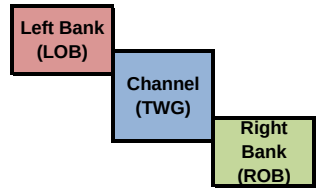


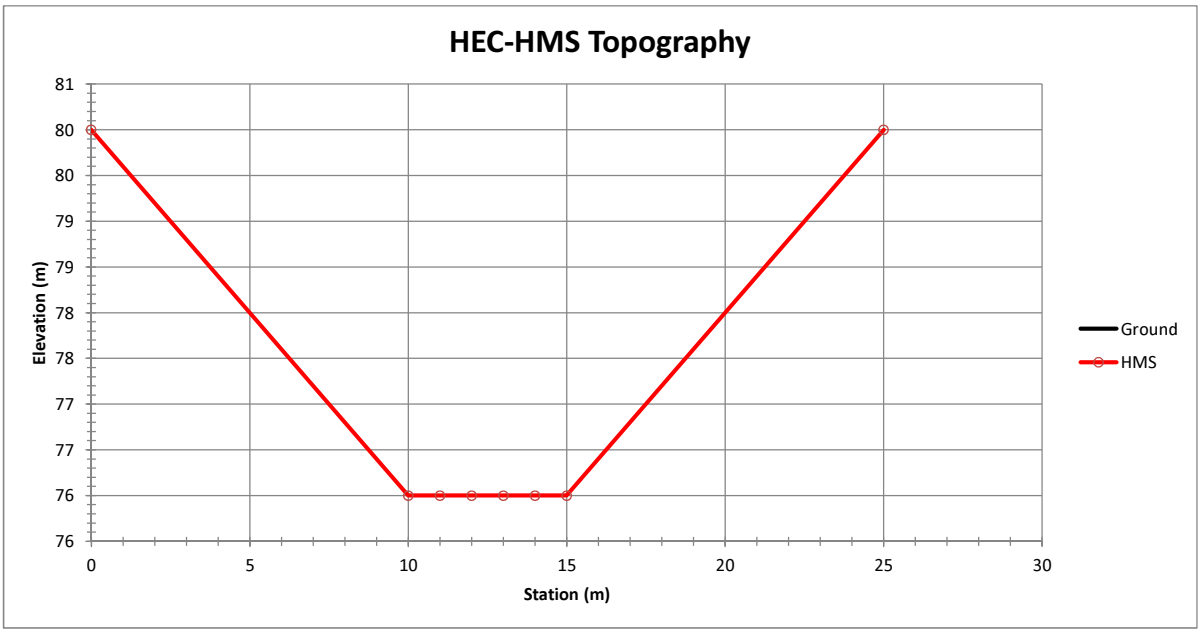
HEC-HMS Channel Topography (For DC-PL-055)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	336.284	**(m)**
Channel slope, S =	0.003	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



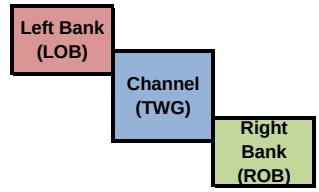


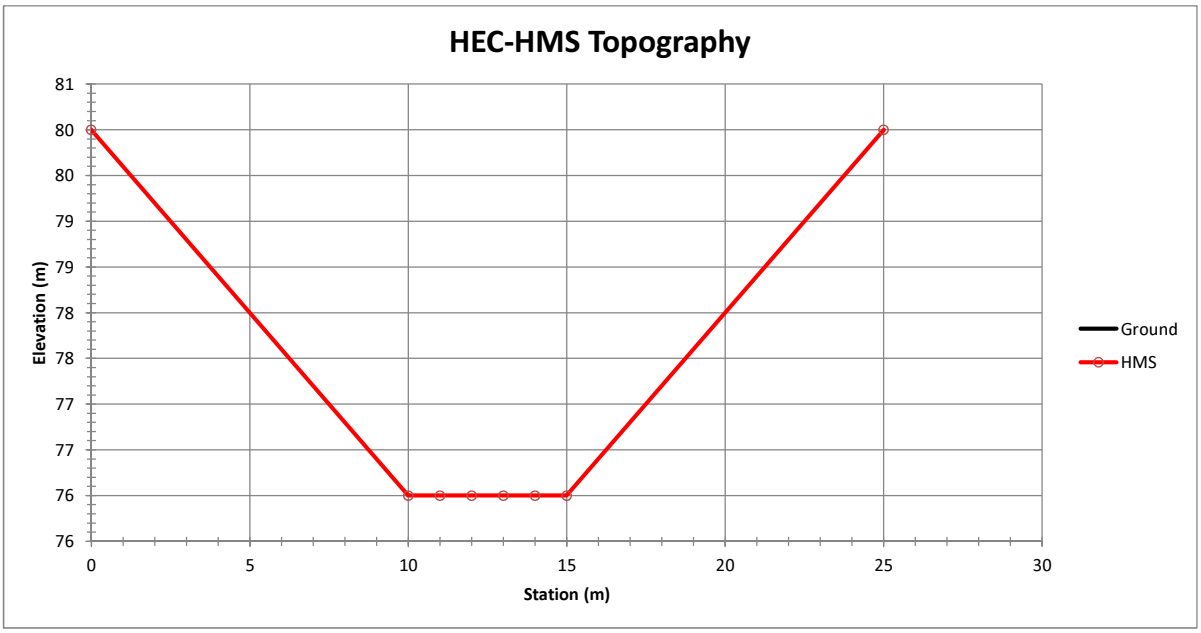
HEC-HMS Channel Topography (For DC-PL-056)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	741.107	**(m)**
Channel slope, S =	0.009	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



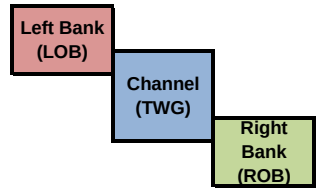


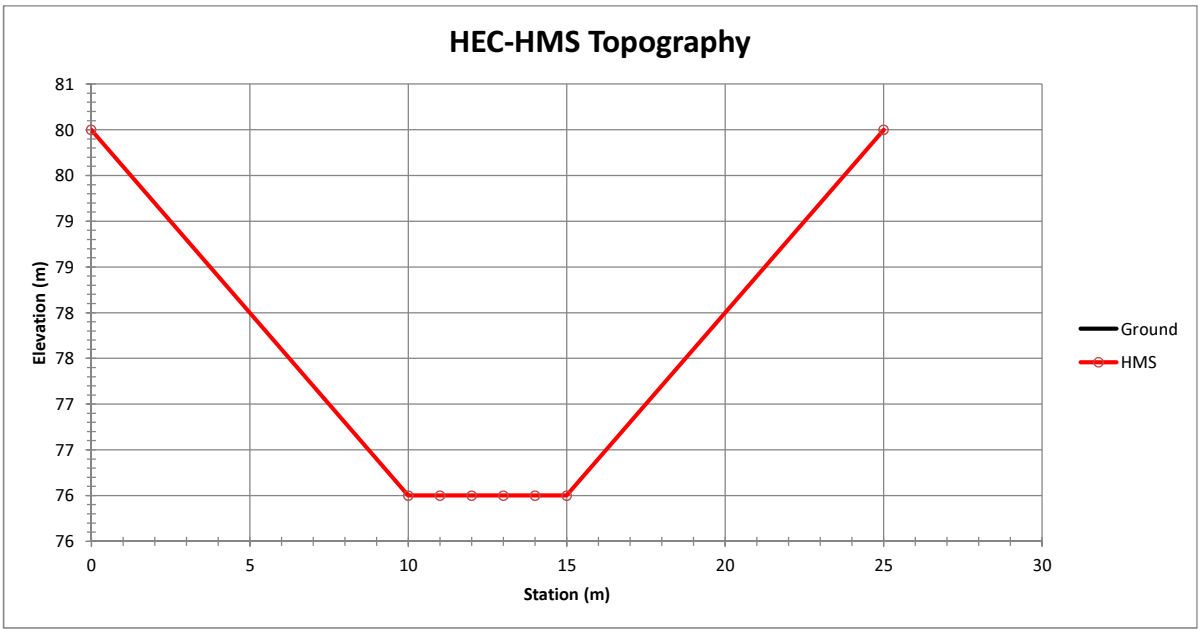
HEC-HMS Channel Topography (For DC-PL-057)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	350.183	**(m)**
Channel slope, S =	0.007	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



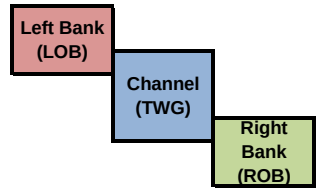


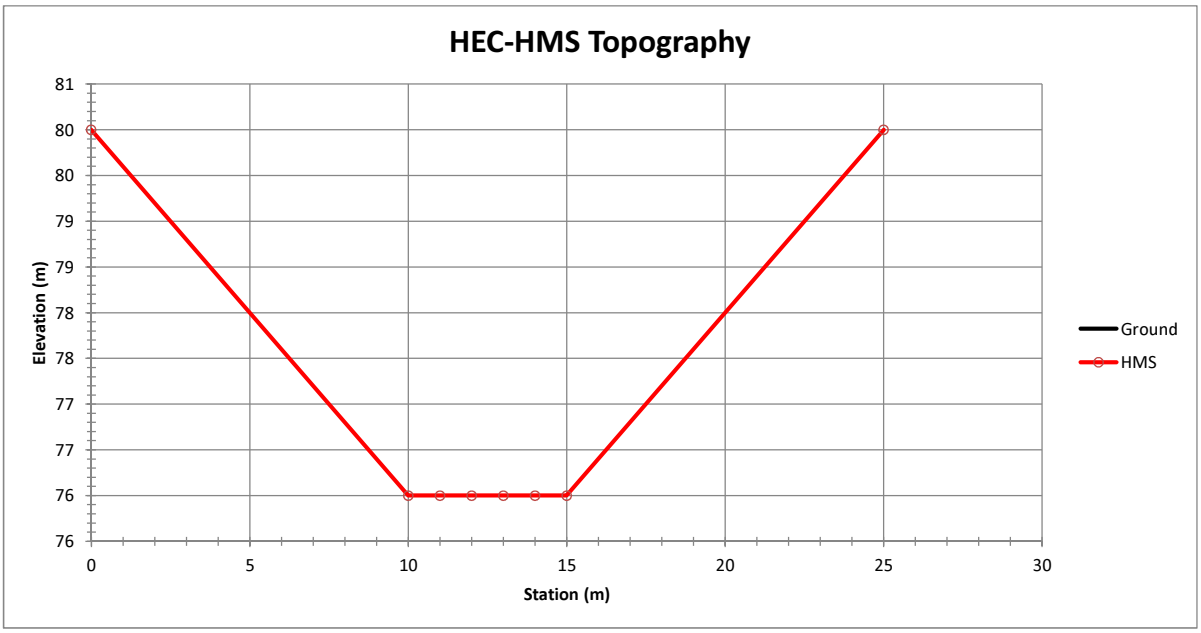
HEC-HMS Channel Topography (For DC-PL-058)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	493.421	**(m)**
Channel slope, S =	0.002	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



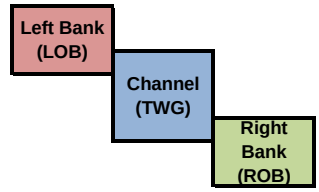


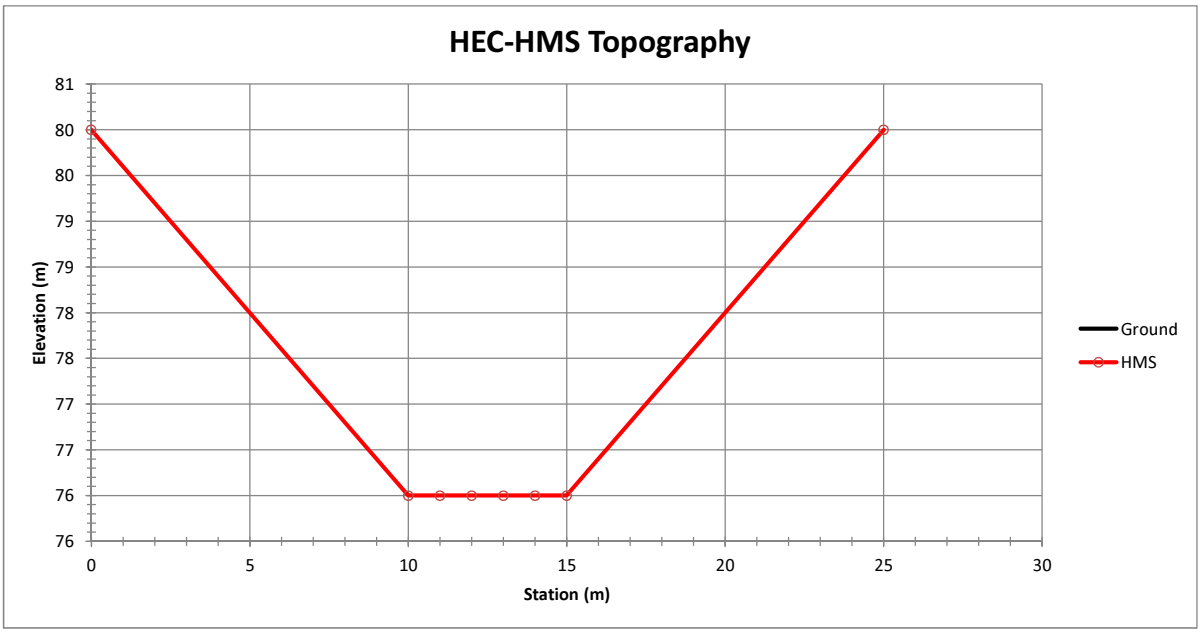
HEC-HMS Channel Topography (For DC-PL-059)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1725.550	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	5.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
11.000	76.000	**3**
12.000	76.000	4
13.000	76.000	5
14.000	76.000	**6**
15.000	76.000	7
25.000	80.000	8



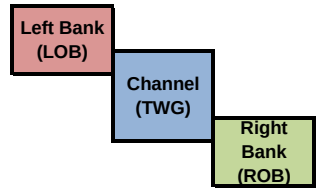


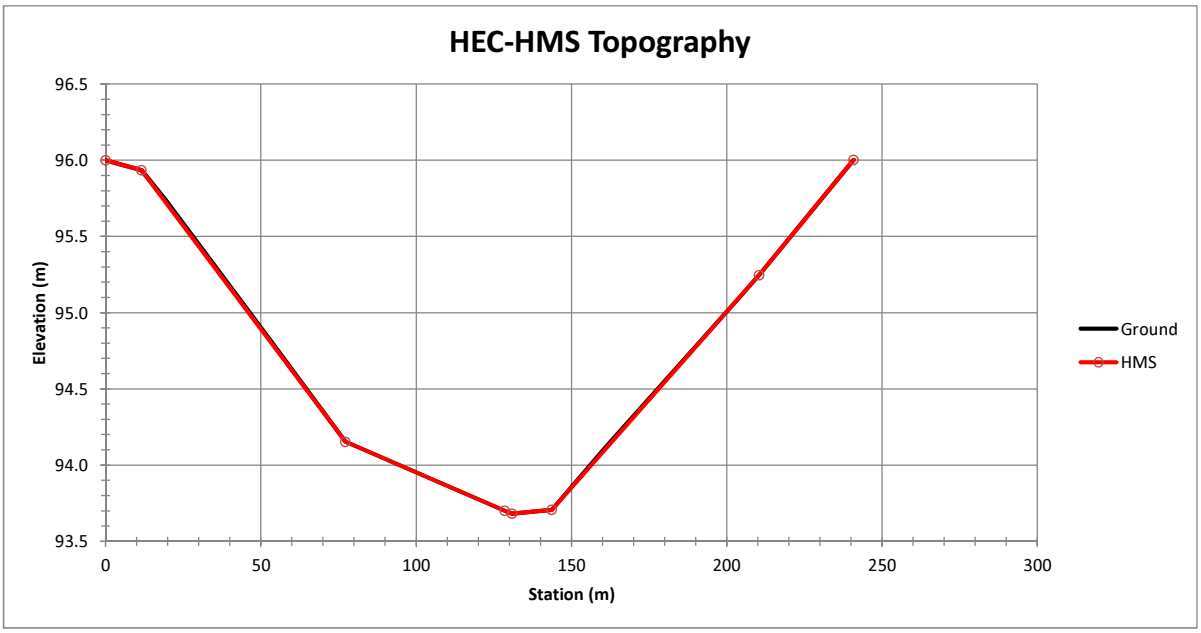
HEC-HMS Channel Topography (For NC-PL-060)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 1472.162 **(m)**
Channel slope, S = 0.005 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	96.000	1
11.553	95.934	2
77.264	94.153	**3**
128.570	93.701	4
130.885	93.681	5
143.658	93.706	**6**
210.437	95.247	7
240.847	96.002	8



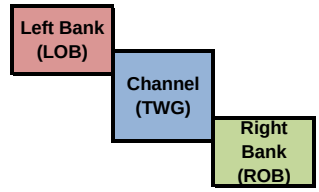


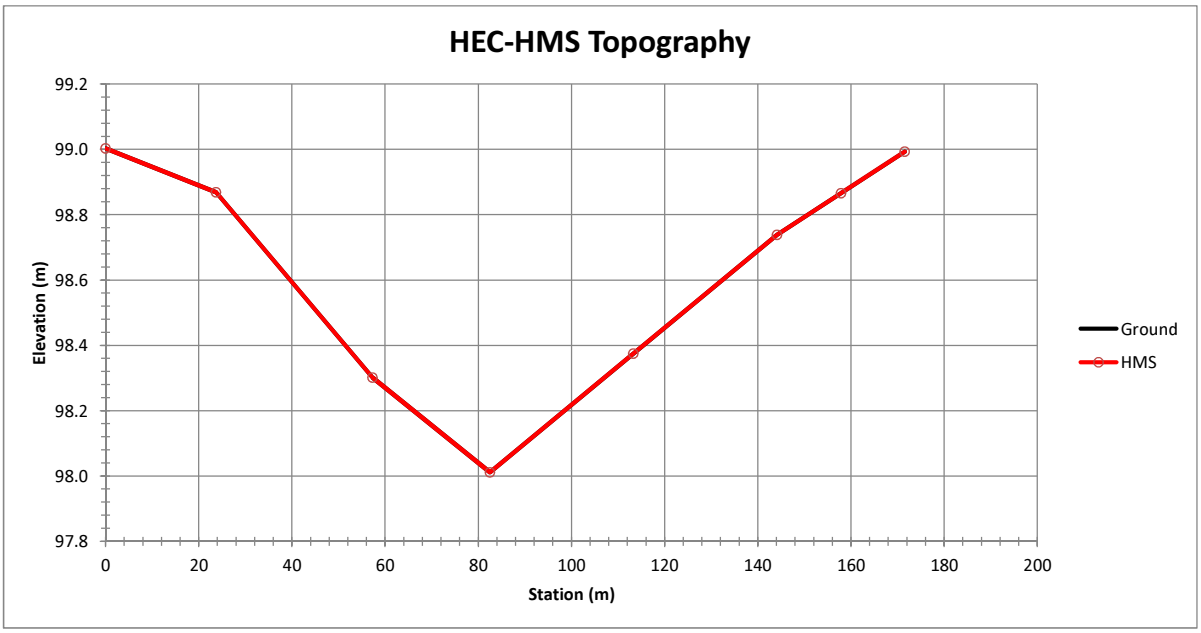
HEC-HMS Channel Topography (For NC-PL-061)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L = 758.839 **(m)**
Channel slope, S = 0.001 **(m/m)**
Channel Manning's roughness, n_{TWG} = 0.030
Channel invert elevation, Z_o = N/A **(m)**
Channel shape = Eight-point
Left bank Manning's roughness, n_{LOB} = 0.050
Right bank Manning's roughness, n_{ROB} = 0.050

Eight-point channel shape		
Station (m)	Elevation (m)	
0.000	99.003	1
23.737	98.869	2
57.306	98.301	**3**
82.515	98.011	4
113.323	98.375	5
144.130	98.738	**6**
157.861	98.866	7
171.592	98.993	8



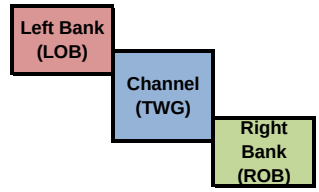


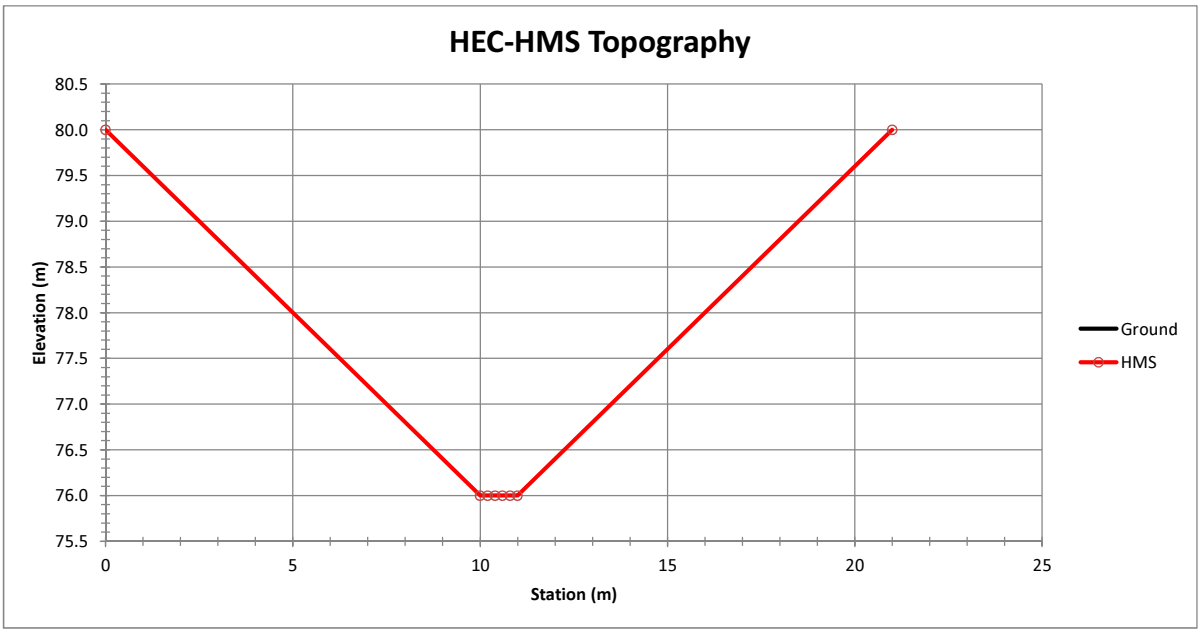
HEC-HMS Channel Topography (For DC-PL-067)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	1467.232	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	1.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.200	76.000	**3**
10.400	76.000	4
10.600	76.000	5
10.800	76.000	**6**
11.000	76.000	7
21.000	80.000	8



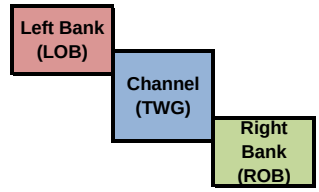


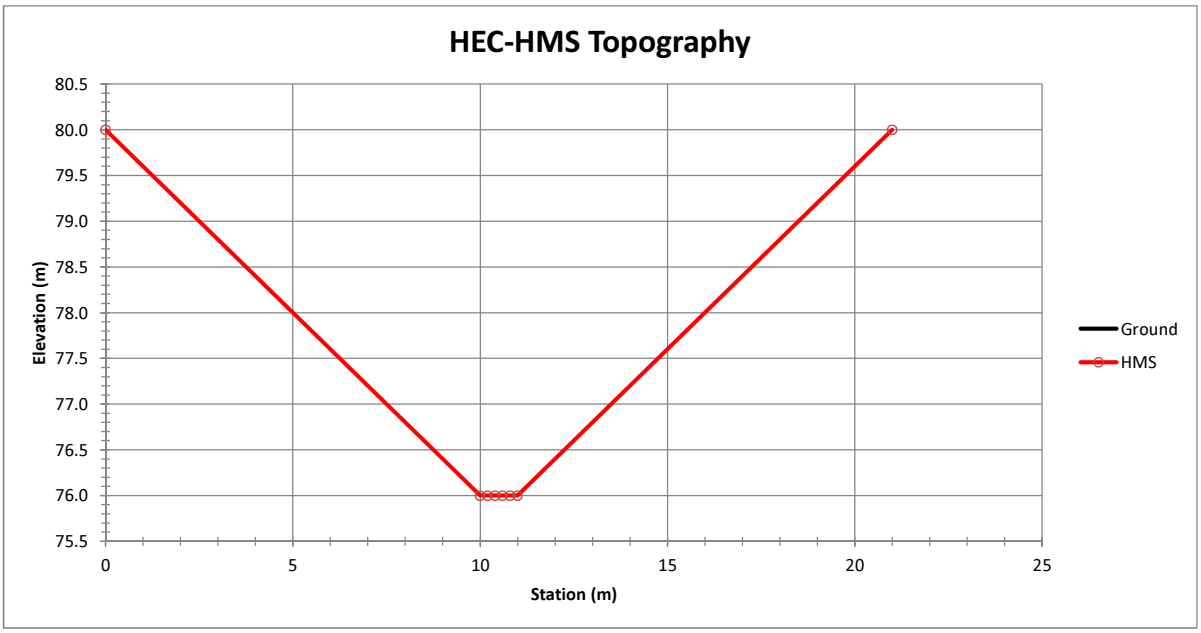
HEC-HMS Channel Topography (For DC-PL-068)

In order to create the HEC-HMS flood routing model, the Muskingum-Cunge 8-point channel routing method is used with the following geometric properties for representing the portion of the downstream channel between the indicated cross sections, assuming the upstream cross sectional shape remains constant through the channel.

Channel length, L =	696.378	**(m)**
Channel slope, S =	0.005	**(m/m)**
Channel Manning's roughness, n_{TWG} =	0.022	
Channel invert elevation, Z_o =	N/A	**(m)**
Channel shape =	Eight-point	
Left bank Manning's roughness, n_{LOB} =	0.022	
Right bank Manning's roughness, n_{ROB} =	0.022	
Approximate Channel Base Width =	1.0	**(m)**

Eight-point channel shape		
Station (m)	**Elevation (m)**	
0.000	80.000	1
10.000	76.000	2
10.200	76.000	**3**
10.400	76.000	4
10.600	76.000	5
10.800	76.000	**6**
11.000	76.000	7
21.000	80.000	8





Surface Water Existing (EX) and Planned (PL) Conditions: Estimation of precipitation hyetographs

100-year ARI storm depths of various duration were taken from the site IDF curve, which was derived using the Rainfall Ratio Method. The various storm depths were distributed using rainfall patterns established through analysis of sub-daily rainfall data.

100-yr Storm Depths

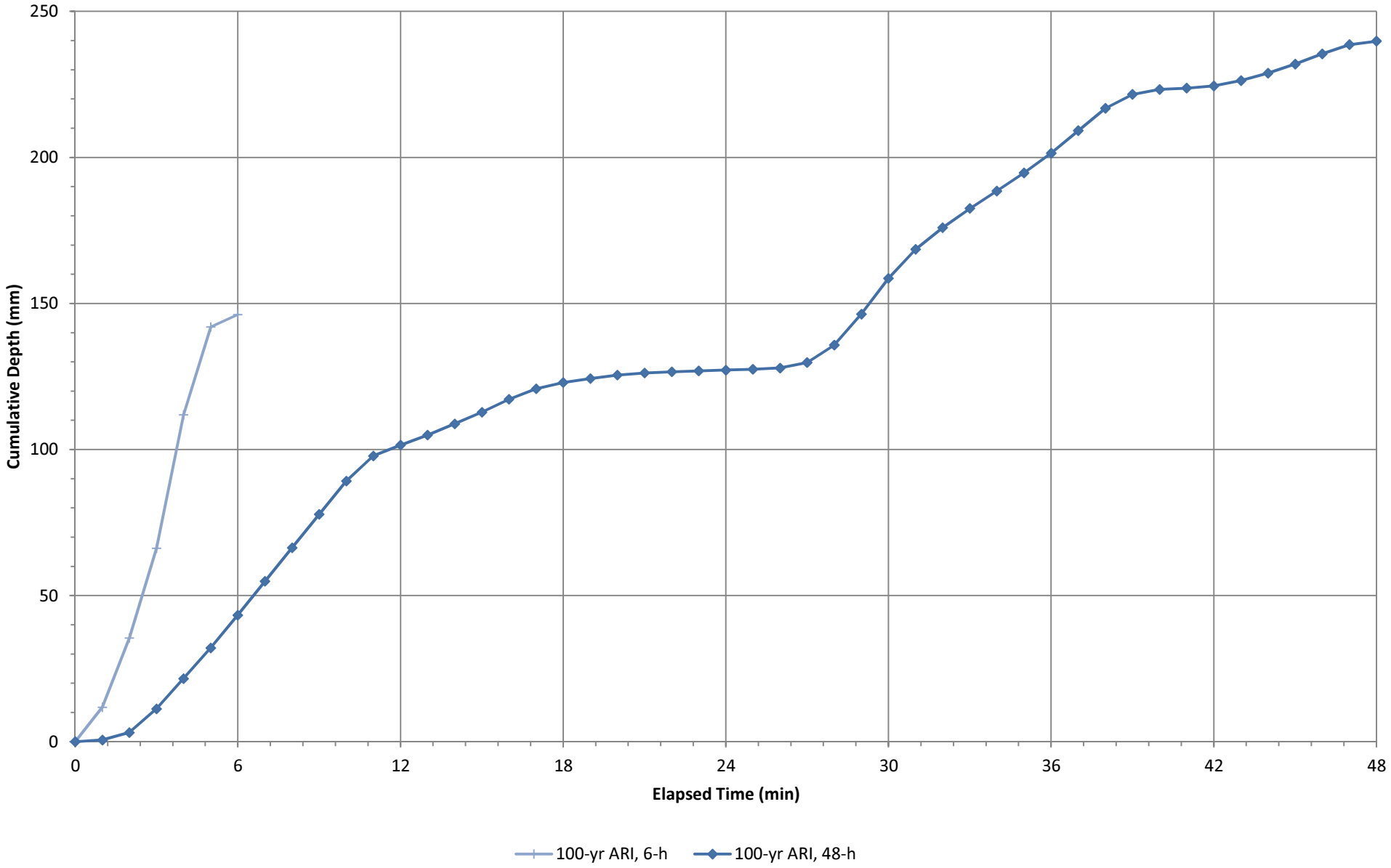
Depth (mm)	146.2	239.8
Duration (h)	6	48

6 Hour Pattern

Hour	% Cumulative Precip.	Cumulative Precip.
0	0.0%	0.0
1	8.1%	11.8
2	24.3%	35.5
3	45.3%	66.2
4	76.5%	111.8
5	97.1%	142.0
6	100.0%	146.2

48 Hour Pattern

Hour	% Cumulative Precip.	Cumulative Precip.
0	0.0%	0.0
1	0.2%	0.6
2	1.3%	3.1
3	4.7%	11.2
4	9.0%	21.6
5	13.4%	32.1
6	18.1%	43.3
7	22.9%	54.9
8	27.7%	66.4
9	32.5%	77.8
10	37.2%	89.2
11	40.8%	97.8
12	42.4%	101.6
13	43.8%	104.9
14	45.4%	108.8
15	47.0%	112.7
16	48.9%	117.2
17	50.4%	120.8
18	51.3%	123.0
19	51.8%	124.3
20	52.3%	125.5
21	52.6%	126.2
22	52.8%	126.6
23	52.9%	126.9
24	53.0%	127.2
25	53.2%	127.5
26	53.3%	127.9
27	54.1%	129.8
28	56.6%	135.8
29	61.0%	146.4
30	66.1%	158.6
31	70.3%	168.5
32	73.4%	175.9
33	76.1%	182.5
34	78.6%	188.5
35	81.2%	194.7
36	84.0%	201.4
37	87.2%	209.2
38	90.4%	216.8
39	92.4%	221.6
40	93.1%	223.3
41	93.3%	223.7
42	93.6%	224.5
43	94.4%	226.3
44	95.4%	228.8
45	96.7%	231.9
46	98.2%	235.5
47	99.5%	238.6
48	100.0%	239.8


250
200
150
100
50
0
Cumulative Depth (mm)
0
6
12
18
24
30
36
42
48
Elapsed Time (min)
100-yr ARI, 6-h
100-yr ARI, 48-h

Results comparison of design runoff under existing and planned conditions for 100 year ARI, 6 hour duration storms

The HEC-HMS models were executed with 100 year ARI, 6 hour duration storms to estimate the hydrologic response of the Letpadaung site. A summary of results at key runoff reporting points is given below.

In this scenario, all water dams were assumed to be full at the start of the simulation excluding WP-PL-005/006 and WP-PL-007. WP-PL-005/006 was assumed to be empty whilst WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6 m)

Runoff Reporting Point	Existing (EX) Conditions Results for 100 yr ARI, 6 hour storm				Runoff Reporting Point	Planned (PL) Conditions Results for 100 yr ARI, 6 hour storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
Selected Runon and Runoff Points from the Letpadaung property in the Chindwin River catchment									
WP-EX-002	13.29	52.1	1,431,800	8.53	WP-PL-002	10.53	42.4	1,127,200	7.10
CP-EX-017	4.54	24.0	480,800	7.60	CP-PL-032	6.20	26.1	666,900	7.05
WP-EX-004	0.05	0.5	6,000	4.48	WP-PL-003	0.03	0.3	3,200	4.42
CP-EX-020	23.34	161.8	2,463,800	5.45	CP-PL-023	26.00	24.4	254,300	4.23
CP-EX-033	10.43	98.4	1,088,800	4.57	CP-PL-025	25.75	22.1	227,000	4.17
{Area cut-off}	0.00	0.0	0	#N/A	CP-PL-040	23.87	0.0	0	0.00
CP-EX-044	0.69	5.1	75,100	6.00	CP-PL-065	1.71	20.2	207,300	4.02
Chindwin River	87.13	222.6	8,694,000	5.83	Chindwin River	87.72	117.3	6,264,600	6.98
Selected Runon and Runoff Points from the Letpadaung property in the Yama Stream catchment									
CP-EX-045	2.64	21.8	229,100	5.00	{Area cut-off}	0.00	0.0	0	#N/A
CP-EX-046	0.79	8.9	78,700	4.07	CP-PL-076	0.43	5.2	54,100	4.13
CP-EX-047	2.60	17.0	267,500	6.35	CP-PL-077	0.76	8.9	100,200	4.27
CP-EX-048	17.09	53.4	1,781,300	9.75	CP-PL-078	17.20	52.9	1,798,300	9.92
Yama Stream	23.12	59.1	2,356,600	5.90	Yama Stream	18.40	52.9	1,952,500	9.92

Results comparison of design runoff under existing and planned conditions for 100 year ARI, 48 hour duration storms

The HEC-HMS models were executed with 100 year ARI, 48 hour duration storms to estimate the hydrologic response of the Letpadaung site. A summary of results at key runoff reporting points is given below.

In this scenario, all water dams were assumed to be full at the start of the simulation excluding WP-PL-005/006 and WP-PL-007. WP-PL-005/006 was assumed to be empty whilst WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6 m)

Runoff Reporting Point	Existing (EX) Conditions Results for 100 yr ARI, 48 hour storm				Runoff Reporting Point	Planned (PL) Conditions Results for 100 yr ARI, 48 hour storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
Selected Runon and Runoff Points from the Letpadaung property in the Chindwin River catchment									
WP-EX-002	13.29	26.7	2,648,000	13.58	WP-PL-002	10.53	21.4	2,090,400	12.45
CP-EX-017	4.54	10.1	895,100	13.07	CP-PL-032	6.20	13.1	1,234,000	11.62
WP-EX-004	0.05	0.2	10,800	10.12	WP-PL-003	0.03	0.1	5,800	10.17
CP-EX-020	23.34	59.8	4,595,800	10.72	CP-PL-023	26.00	6.8	451,700	30.37
CP-EX-033	10.43	30.1	2,040,900	30.67	CP-PL-025	25.75	6.1	401,300	30.23
{Area cut-off}	0.00	0.0	0	#N/A	CP-PL-040	23.87	0.0	0	0.00
CP-EX-044	0.69	1.8	138,400	11.18	CP-PL-065	1.71	5.6	365,600	30.35
Chindwin River	87.13	115.9	16,277,800	38.73	Chindwin River	87.72	70.9	11,724,100	39.22
Selected Runon and Runoff Points from the Letpadaung property in the Yama Stream catchment									
CP-EX-045	2.64	7.5	462,200	30.78	{Area cut-off}	0.00	0.0	0	#N/A
CP-EX-046	0.79	2.5	149,800	30.02	CP-PL-076	0.43	1.4	94,400	30.12
CP-EX-047	2.60	6.4	503,900	11.53	CP-PL-077	0.76	2.5	171,500	30.25
CP-EX-048	17.09	31.7	3,338,800	38.63	CP-PL-078	17.20	32.0	3,366,100	38.75
Yama Stream	23.12	43.3	4,454,700	38.15	Yama Stream	18.40	34.3	3,632,000	38.25

Results comparison of design runoff under existing and planned conditions for 100 year ARI, 6 hour duration storms

The HEC-HMS models were executed with 100 year ARI, 6 hour duration storms to estimate the hydrologic response of the Letpadaung site. A summary of results at key runoff reporting points is given below.

In this scenario, all water dams were assumed full excluding WP-PL-007. WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6

Runoff Reporting Point	Existing (EX) Conditions Results for 100 yr ARI, 6 hour storm				Runoff Reporting Point	Planned (PL) Conditions Results for 100 yr ARI, 6 hour storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
Selected Runon and Runoff Points from the Letpadaung property in the Chindwin River catchment									
WP-EX-002	13.29	52.1	1,431,800	8.53	WP-PL-002	10.53	42.4	1,127,200	7.10
CP-EX-017	4.54	24.0	480,800	7.60	CP-PL-032	6.20	26.1	666,900	7.05
WP-EX-004	0.05	0.5	6,000	4.48	WP-PL-003	0.03	0.3	3,200	4.42
CP-EX-020	23.34	161.8	2,463,800	5.45	CP-PL-023	26.00	35.5	2,031,800	4.67
CP-EX-033	10.43	98.4	1,088,800	4.57	CP-PL-025	25.75	33.5	2,004,400	4.55
{Area cut-off}	0.00	0.0	0	#N/A	CP-PL-040	23.87	21.3	1,777,500	6.90
CP-EX-044	0.69	5.1	75,100	6.00	CP-PL-065	1.71	20.2	207,300	4.02
Chindwin River	87.13	222.6	8,694,000	5.83	Chindwin River	87.72	138.2	8,041,900	7.03
Selected Runon and Runoff Points from the Letpadaung property in the Yama Stream catchment									
CP-EX-045	2.64	21.8	229,100	5.00	{Area cut-off}	0.00	0.0	0	#N/A
CP-EX-046	0.79	8.9	78,700	4.07	CP-PL-076	0.43	5.2	54,100	4.13
CP-EX-047	2.60	17.0	267,500	6.35	CP-PL-077	0.76	8.9	100,200	4.27
CP-EX-048	17.09	53.4	1,781,300	9.75	CP-PL-078	17.20	52.9	1,798,300	9.92
Yama Stream	23.12	59.1	2,356,600	5.90	Yama Stream	18.40	52.9	1,952,500	9.92

Results comparison of design runoff under existing and planned conditions for 100 year ARI, 48 hour duration storms

The HEC-HMS models were executed with 100 year ARI, 48 hour duration storms to estimate the hydrologic response of the Letpadaung site. A summary of results at key runoff reporting points is given below.

In this scenario, all water dams were assumed full excluding WP-PL-007. WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6

Runoff Reporting Point	Existing (EX) Conditions Results for 100 yr ARI, 48 hour storm: Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)	Runoff Reporting Point	Planned (PL) Conditions Results for 100 yr ARI, 48 hour storm: Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
Selected Runon and Runoff Points from the Letpadaung property in the Chindwin River catchment									
WP-EX-002	13.29	26.7	2,648,000	13.58	WP-PL-002	10.53	21.4	2,090,400	12.45
CP-EX-017	4.54	10.1	895,100	13.07	CP-PL-032	6.20	13.1	1,234,000	11.62
WP-EX-004	0.05	0.2	10,800	10.12	WP-PL-003	0.03	0.1	5,800	10.17
CP-EX-020	23.34	59.8	4,595,800	10.72	CP-PL-023	26.00	23.4	3,765,200	38.12
CP-EX-033	10.43	30.1	2,040,900	30.67	CP-PL-025	25.75	23.0	3,715,000	38.23
{Area cut-off}	0.00	0.0	0	#N/A	CP-PL-040	23.87	19.5	3,313,800	39.43
CP-EX-044	0.69	1.8	138,400	11.18	CP-PL-065	1.71	5.6	365,600	30.35
Chindwin River	87.13	115.9	16,277,800	38.73	Chindwin River	87.72	90.1	15,037,500	39.15
Selected Runon and Runoff Points from the Letpadaung property in the Yama Stream catchment									
CP-EX-045	2.64	7.5	462,200	30.78	{Area cut-off}	0.00	0.0	0	#N/A
CP-EX-046	0.79	2.5	149,800	30.02	CP-PL-076	0.43	1.4	94,400	30.12
CP-EX-047	2.60	6.4	503,900	11.53	CP-PL-077	0.76	2.5	171,500	30.25
CP-EX-048	17.09	31.7	3,338,800	38.63	CP-PL-078	17.20	32.0	3,366,100	38.75
Yama Stream	23.12	43.3	4,454,700	38.15	Yama Stream	18.40	34.3	3,632,000	38.25

Surface Water Existing (EX) Conditions: Results for estimation of design runoff

The HEC-HMS Existing Conditions model was executed with storms of various duration to estimate the hydrologic response of the Letpadaung site. A summary of results at all runoff reporting points is given below.

Runoff Reporting Point	Results for 100 yr ARI, 6 hour duration storm				Runoff Reporting Point	Results for 100 yr ARI, 48 hour duration storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
CP-EX-001	2.20	15.16	239,100	6.08	CP-EX-001	2.20	5.7	440,800	11.33
CP-EX-002	0.44	4.13	48,100	5.10	CP-EX-002	0.44	1.3	88,600	31.05
CP-EX-003	0.44	4.13	48,100	5.00	CP-EX-003	0.44	1.3	88,600	30.93
CP-EX-004	3.13	13.73	331,200	7.03	CP-EX-004	3.13	6.4	616,900	13.15
CP-EX-005	0.91	8.36	93,300	4.90	CP-EX-005	0.91	2.7	175,800	30.80
CP-EX-006	0.00	0.00	0	0.00	CP-EX-006	0.00	0.0	0	0.00
CP-EX-007	40.67	19.27	3,757,600	7.83	CP-EX-007	40.67	29.0	7,094,400	48.63
CP-EX-008	37.95	16.51	3,464,600	16.37	CP-EX-008	37.95	27.0	6,554,200	49.20
CP-EX-009	37.95	16.51	3,465,700	16.22	CP-EX-009	37.95	27.0	6,556,300	49.08
CP-EX-010A	3.67	25.61	398,300	6.22	CP-EX-010A	3.67	9.6	734,400	11.37
CP-EX-010B	21.29	80.32	2,251,700	9.13	CP-EX-010B	21.29	40.8	4,195,600	14.27
CP-EX-010C	10.54	56.76	1,070,700	7.12	CP-EX-010C	10.54	23.7	2,027,800	12.28
CP-EX-010D	1.35	15.41	146,000	4.13	CP-EX-010D	1.35	4.4	269,300	30.08
CP-EX-011	41.13	184.28	4,366,200	5.72	CP-EX-011	41.13	85.1	8,125,700	11.62
CP-EX-012	41.13	184.29	4,366,200	5.70	CP-EX-012	41.13	85.1	8,125,700	11.60
CP-EX-013	17.80	70.01	1,902,400	8.90	CP-EX-013	17.80	35.5	3,529,900	14.13
CP-EX-014	13.29	52.01	1,431,600	8.80	CP-EX-014	13.29	26.7	2,647,800	13.93
CP-EX-015	13.29	52.10	1,431,800	8.53	CP-EX-015	13.29	26.7	2,648,000	13.58
CP-EX-016A	0.33	3.66	35,600	4.23	CP-EX-016A	0.33	1.1	66,000	30.17
CP-EX-016B	4.09	30.30	444,600	5.98	CP-EX-016B	4.09	10.9	819,800	11.17
CP-EX-016C	8.69	45.59	932,100	7.77	CP-EX-016C	8.69	19.4	1,727,500	13.03
CP-EX-016D	0.11	1.19	11,800	4.28	CP-EX-016D	0.11	0.4	21,800	30.22
CP-EX-017	4.54	24.01	480,800	7.60	CP-EX-017	4.54	10.1	895,100	13.07
CP-EX-018	4.54	24.02	480,800	7.38	CP-EX-018	4.54	10.1	895,100	12.77
CP-EX-019	4.51	31.19	477,300	6.20	CP-EX-019	4.51	11.5	889,400	11.37
CP-EX-020	23.34	161.80	2,463,800	5.45	CP-EX-020	23.34	59.8	4,595,800	10.72
CP-EX-021	8.10	55.13	853,300	6.07	CP-EX-021	8.10	20.5	1,592,600	11.47
CP-EX-022	0.05	0.49	6,000	4.55	CP-EX-022	0.05	0.2	10,800	10.22
CP-EX-023	0.05	0.49	6,000	4.48	CP-EX-023	0.05	0.2	10,800	10.12
CP-EX-024	0.05	0.54	5,100	4.07	CP-EX-024	0.05	0.2	9,300	30.03
CP-EX-025	8.05	54.69	847,300	5.85	CP-EX-025	8.05	20.3	1,581,700	11.32
CP-EX-026	2.68	22.62	287,700	5.53	CP-EX-026	2.68	7.4	532,700	31.63
CP-EX-027	0.67	6.10	72,800	5.22	CP-EX-027	0.67	1.9	134,500	31.38
CP-EX-028	0.67	6.10	72,800	5.20	CP-EX-028	0.67	1.9	134,500	31.35
CP-EX-029	0.66	6.33	70,600	4.78	CP-EX-029	0.66	2.0	130,900	30.70
CP-EX-030	4.35	26.06	449,200	6.20	CP-EX-030	4.35	10.5	845,300	11.25
CP-EX-031	4.35	26.07	449,300	6.13	CP-EX-031	4.35	10.5	845,300	11.17
CP-EX-032	13.24	106.89	1,394,500	4.67	CP-EX-032	13.24	35.1	2,604,600	10.45
CP-EX-033	10.43	98.38	1,088,800	4.57	CP-EX-033	10.43	30.1	2,040,900	30.67
CP-EX-034	6.91	68.30	713,700	4.45	CP-EX-034	6.91	20.7	1,343,800	30.50
CP-EX-035	2.22	21.94	230,600	4.43	CP-EX-035	2.22	6.8	432,800	30.35
CP-EX-036	4.69	46.74	483,500	4.32	CP-EX-036	4.69	14.0	911,100	30.33
CP-EX-037	1.09	7.99	117,700	5.78	CP-EX-037	1.09	2.9	217,200	11.00
CP-EX-038	2.65	26.29	274,400	4.47	CP-EX-038	2.65	8.0	517,000	30.55
CP-EX-039	2.65	26.73	274,800	4.25	CP-EX-039	2.65	8.1	517,000	30.20
CP-EX-040	0.69	5.08	75,000	6.18	CP-EX-040	0.69	1.8	138,400	11.40
CP-EX-041	0.69	5.09	75,100	6.15	CP-EX-041	0.69	1.8	138,400	11.35
CP-EX-042	0.87	9.49	92,100	4.42	CP-EX-042	0.87	2.8	171,900	30.42
CP-EX-043	0.87	9.78	92,400	4.17	CP-EX-043	0.87	2.8	172,100	30.10
CP-EX-044	0.69	5.10	75,100	6.00	CP-EX-044	0.69	1.8	138,400	11.18
CP-EX-045	2.64	21.83	229,100	5.00	CP-EX-045	2.64	7.5	462,200	30.78
CP-EX-046	0.79	8.86	78,700	4.07	CP-EX-046	0.79	2.5	149,800	30.02
CP-EX-047	2.60	17.02	267,500	6.35	CP-EX-047	2.60	6.4	503,900	11.53
CP-EX-048	17.09	53.37	1,781,300	9.75	CP-EX-048	17.09	31.7	3,338,800	38.63
CP-EX-049	14.64	48.38	1,515,400	10.08	CP-EX-049	14.64	27.1	2,848,500	38.33
CP-EX-050	14.64	48.38	1,515,400	9.95	CP-EX-050	14.64	27.1	2,848,500	38.20

Surface Water Existing (EX) Conditions: Results for estimation of design runoff

CP-EX-051	14.64	48.38	1,515,400	9.87	CP-EX-051	14.64	27.1	2,848,500	38.10
CP-EX-052	14.19	48.38	1,466,000	9.82	CP-EX-052	14.19	26.2	2,757,500	38.05
CP-EX-053	13.95	48.70	1,436,800	9.47	CP-EX-053	13.95	25.7	2,706,100	37.93
WP-EX-001	37.95	16.51	3,465,700	16.22	WP-EX-001	37.95	27.0	6,556,300	49.08
WP-EX-002	13.29	52.10	1,431,800	8.53	WP-EX-002	13.29	26.7	2,648,000	13.58
WP-EX-003	4.54	24.02	480,800	7.38	WP-EX-003	4.54	10.1	895,100	12.77
WP-EX-004	0.05	0.49	6,000	4.48	WP-EX-004	0.05	0.2	10,800	10.12
WP-EX-005	0.67	6.10	72,800	5.20	WP-EX-005	0.67	1.9	134,500	31.35
WP-EX-006	14.19	48.38	1,466,000	9.82	WP-EX-006	14.19	26.2	2,757,500	38.05
Chindwin River	87.13	222.56	8,694,000	5.83	Chindwin River	87.13	115.9	16,277,800	38.73
Yama Stream	23.12	59.11	2,356,600	5.90	Yama Stream	23.12	43.3	4,454,700	38.15

Surface Water Planned (PL) Conditions: Results for estimation of design runoff

The HEC-HMS Planned Conditions model was executed with storms of various duration to estimate the hydrologic response of the Letpadaung site. A summary of results at all runoff reporting points is given below.

All water dams were assumed full excluding WP-PL-005/006 and WP-PL-007. WP-PL-005/006 was assumed to be empty whilst WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6 m)

Runoff Reporting Point	Results for 100 yr ARI, 6 hour duration storm				Runoff Reporting Point	Results for 100 yr ARI, 48 hour duration storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
CP-PL-001	2.20	15.16	239,100	6.08	CP-PL-001	2.20	5.7	440,800	11.33
CP-PL-002	0.44	4.13	48,100	5.10	CP-PL-002	0.44	1.3	88,600	31.05
CP-PL-003	0.44	4.13	48,100	5.00	CP-PL-003	0.44	1.3	88,600	30.93
CP-PL-004	3.13	13.73	331,200	7.03	CP-PL-004	3.13	6.4	616,900	13.15
CP-PL-005	0.91	8.36	93,300	4.90	CP-PL-005	0.91	2.7	175,800	30.80
CP-PL-006	0.00	0.00	0	0.00	CP-PL-006	0.00	0.0	0	0.00
CP-PL-007	40.67	19.27	3,757,500	7.83	CP-PL-007	40.67	29.0	7,094,300	48.63
CP-PL-008	37.95	16.51	3,464,600	16.37	CP-PL-008	37.95	27.0	6,554,200	49.20
CP-PL-009	37.95	16.51	3,465,700	16.22	CP-PL-009	37.95	27.0	6,556,200	49.08
CP-PL-010A	3.67	25.61	398,300	6.22	CP-PL-010A	3.67	9.6	734,400	11.37
CP-PL-010B	21.29	80.32	2,251,700	9.13	CP-PL-010B	21.29	40.8	4,195,500	14.27
CP-PL-010C	10.54	56.76	1,070,700	7.12	CP-PL-010C	10.54	23.7	2,027,700	12.28
CP-PL-010D	1.35	15.41	146,000	4.13	CP-PL-010D	1.35	4.4	269,300	30.08
CP-PL-011	41.72	72.08	1,936,800	7.12	CP-PL-011	41.72	35.8	3,572,100	12.18
CP-PL-012	41.72	72.08	1,936,800	7.10	CP-PL-012	41.72	35.8	3,572,100	12.17
CP-PL-013	15.01	66.12	1,604,900	7.25	CP-PL-013	15.01	30.9	2,977,500	12.93
CP-PL-014	10.53	42.28	1,126,900	7.38	CP-PL-014	10.53	21.4	2,090,100	12.80
CP-PL-015	10.53	42.37	1,127,200	7.10	CP-PL-015	10.53	21.4	2,090,400	12.45
CP-PL-016A	0.33	3.66	35,600	4.23	CP-PL-016A	0.33	1.1	66,000	30.17
CP-PL-016B	10.06	56.83	1,074,600	5.72	CP-PL-016B	10.06	22.9	1,994,600	11.35
CP-PL-016C	0.08	0.93	9,200	4.27	CP-PL-016C	0.08	0.3	16,900	30.20
CP-PL-017	10.06	56.84	1,074,600	5.58	CP-PL-017	10.06	22.9	1,994,600	11.18
CP-PL-018	8.61	44.74	922,800	5.65	CP-PL-018	8.61	19.1	1,710,100	11.25
CP-PL-019	26.71	26.58	331,900	4.32	CP-PL-019	26.71	8.0	594,600	10.12
CP-PL-020	26.71	26.59	331,900	4.30	CP-PL-020	26.71	8.0	594,600	10.08
CP-PL-021	0.03	0.26	3,200	4.42	CP-PL-021	0.03	0.1	5,800	10.17
CP-PL-022	0.02	0.25	2,300	4.05	CP-PL-022	0.02	0.1	4,300	30.02
CP-PL-023	26.00	24.40	254,300	4.23	CP-PL-023	26.00	6.8	451,700	30.37
CP-PL-024	25.85	23.04	237,400	4.20	CP-PL-024	25.85	6.3	420,400	30.28
CP-PL-025	25.75	22.13	227,000	4.17	CP-PL-025	25.75	6.1	401,300	30.23
CP-PL-026	2.80	25.00	305,400	4.95	CP-PL-026	2.80	7.9	562,400	31.18
CP-PL-027	2.77	24.75	301,300	4.87	CP-PL-027	2.77	7.9	555,400	31.07
CP-PL-028	2.70	24.17	292,000	4.75	CP-PL-028	2.70	7.7	539,500	31.00
CP-PL-029	2.61	23.41	279,900	4.60	CP-PL-029	2.61	7.4	518,700	30.80
CP-PL-030	2.39	21.38	256,300	4.60	CP-PL-030	2.39	6.8	475,200	30.77
CP-PL-031	0.80	9.03	85,700	4.15	CP-PL-031	0.80	2.6	158,800	30.10
CP-PL-032	6.20	26.07	666,900	7.05	CP-PL-032	6.20	13.1	1,234,000	11.62
CP-PL-033	6.20	26.07	666,900	6.92	CP-PL-033	6.20	13.1	1,234,000	11.47
CP-PL-034	4.54	23.95	480,800	7.40	CP-PL-034	4.54	10.1	895,100	12.78
CP-PL-035	4.51	31.08	477,300	6.22	CP-PL-035	4.51	11.5	889,400	11.38
CP-PL-036	1.06	9.30	113,300	5.42	CP-PL-036	1.06	3.0	210,200	31.45
CP-PL-037	1.06	9.30	113,300	5.38	CP-PL-037	1.06	3.0	210,200	31.40
CP-PL-038	1.06	9.33	113,400	5.27	CP-PL-038	1.06	3.0	210,200	31.23
CP-PL-039	25.58	20.20	207,300	4.15	CP-PL-039	25.58	5.6	365,600	30.52
CP-PL-040	23.87	0.00	0	0.00	CP-PL-040	23.87	0.0	0	0.00
CP-PL-041A	10.65	10.75	147,500	4.87	CP-PL-041A	10.65	6.4	475,000	47.55
CP-PL-041B	5.61	58.44	695,700	4.08	CP-PL-041B	5.61	16.2	1,216,900	30.13
CP-PL-041C	3.34	41.21	432,000	4.10	CP-PL-041C	3.34	11.2	744,200	30.17
CP-PL-042A	0.63	5.89	82,800	5.37	CP-PL-042A	0.63	1.9	141,700	10.32
CP-PL-042B	9.53	0.00	0	0.00	CP-PL-042B	9.53	5.5	222,600	47.62
CP-PL-042C	0.49	5.46	64,700	4.50	CP-PL-042C	0.49	1.6	110,700	30.48
CP-PL-043A	4.38	50.89	458,500	4.20	CP-PL-043A	4.38	14.3	857,900	30.25
CP-PL-043B	4.43	51.42	463,500	4.18	CP-PL-043B	4.43	14.4	867,300	30.22

Surface Water Planned (PL) Conditions: Results for estimation of design runoff

CP-PL-044	4.38	50.95	458,500	4.03	CP-PL-044	4.38	14.3	857,900	30.00
CP-PL-045	4.43	51.45	463,500	4.03	CP-PL-045	4.43	14.5	867,300	30.00
CP-PL-046	0.78	9.82	102,700	4.00	CP-PL-046	0.78	2.6	175,800	30.00
CP-PL-047	4.83	48.77	593,200	4.07	CP-PL-047	4.83	13.6	1,041,200	30.10
CP-PL-048	4.83	48.87	593,200	4.02	CP-PL-048	4.83	13.6	1,041,200	30.02
CP-PL-049	4.20	41.46	511,500	4.13	CP-PL-049	4.20	11.6	901,300	30.13
CP-PL-050	3.38	32.05	424,000	4.13	CP-PL-050	3.38	9.2	738,800	10.13
CP-PL-051	3.38	32.23	424,400	4.08	CP-PL-051	3.38	9.2	738,900	10.07
CP-PL-052	2.89	26.38	365,300	4.13	CP-PL-052	2.89	7.8	633,900	10.13
CP-PL-053	2.77	25.18	354,200	4.13	CP-PL-053	2.77	7.5	612,300	10.17
CP-PL-054	2.77	25.29	354,200	4.02	CP-PL-054	2.77	7.5	612,300	10.02
CP-PL-055	1.10	6.13	145,300	5.17	CP-PL-055	1.10	2.4	248,100	11.08
CP-PL-056A	0.46	5.76	60,100	4.10	CP-PL-056A	0.46	1.5	102,900	30.13
CP-PL-056B	0.54	6.80	71,100	4.00	CP-PL-056B	0.54	1.8	121,800	30.00
CP-PL-057	0.46	5.76	60,100	4.00	CP-PL-057	0.46	1.5	102,900	30.00
CP-PL-058	1.67	20.75	208,900	4.00	CP-PL-058	1.67	5.6	364,200	30.00
CP-PL-059	0.59	7.45	77,900	4.00	CP-PL-059	0.59	2.0	133,300	30.00
CP-PL-060	1.82	22.90	239,100	4.00	CP-PL-060	1.82	6.2	409,200	30.00
CP-PL-061	0.38	4.30	45,000	4.27	CP-PL-061	0.38	1.2	80,000	30.22
CP-PL-062	1.14	14.16	148,100	4.08	CP-PL-062	1.14	3.8	255,000	30.22
CP-PL-063	1.14	14.29	149,200	4.00	CP-PL-063	1.14	3.8	255,500	30.00
CP-PL-064	0.39	4.86	50,700	4.00	CP-PL-064	0.39	1.3	86,800	30.00
CP-PL-065	1.71	20.25	207,300	4.02	CP-PL-065	1.71	5.6	365,600	30.35
CP-PL-066	1.53	18.37	183,900	4.25	CP-PL-066	1.53	5.1	325,700	30.35
CP-PL-067	0.19	2.39	25,000	4.00	CP-PL-067	0.19	0.6	42,900	30.00
CP-PL-068	1.34	16.00	159,100	4.18	CP-PL-068	1.34	4.4	282,900	30.23
CP-PL-069	1.23	14.73	144,000	4.03	CP-PL-069	1.23	4.1	257,000	30.02
CP-PL-070	0.77	8.98	83,700	4.05	CP-PL-070	0.77	2.5	153,700	30.02
CP-PL-071	0.63	7.32	67,200	4.05	CP-PL-071	0.63	2.0	124,500	30.07
CP-PL-072	0.63	7.32	67,200	4.00	CP-PL-072	0.63	2.0	124,500	30.00
CP-PL-073	0.35	4.05	38,000	4.05	CP-PL-073	0.35	1.1	69,700	30.02
CP-PL-074	0.16	2.02	21,100	4.13	CP-PL-074	0.16	0.5	36,200	30.23
CP-PL-075	0.16	2.02	21,100	4.00	CP-PL-075	0.16	0.5	36,200	30.00
CP-PL-076	0.43	5.19	54,100	4.13	CP-PL-076	0.43	1.4	94,400	30.12
CP-PL-077	0.76	8.94	100,200	4.27	CP-PL-077	0.76	2.5	171,500	30.25
CP-PL-078	17.20	52.91	1,798,300	9.92	CP-PL-078	17.20	32.0	3,366,100	38.75
CP-PL-079	14.68	48.30	1,518,800	10.22	CP-PL-079	14.68	27.2	2,855,300	38.40
CP-PL-080	14.68	48.38	1,519,100	9.95	CP-PL-080	14.68	27.2	2,855,400	38.20
CP-PL-081	14.68	48.39	1,519,100	9.87	CP-PL-081	14.68	27.2	2,855,400	38.10
CP-PL-082	14.19	48.38	1,466,000	9.82	CP-PL-082	14.19	26.2	2,757,500	38.05
CP-PL-083	13.95	48.70	1,436,800	9.47	CP-PL-083	13.95	25.7	2,706,200	37.93
WP-PL-001	37.95	16.51	3,465,700	16.22	WP-PL-001	37.95	27.0	6,556,200	49.08
WP-PL-002	10.53	42.37	1,127,200	7.10	WP-PL-002	10.53	21.4	2,090,400	12.45
WP-PL-003	0.03	0.26	3,200	4.42	WP-PL-003	0.03	0.1	5,800	10.17
WP-PL-004	4.54	23.95	480,800	7.40	WP-PL-004	4.54	10.1	895,100	12.78
WP-PL-005/006	23.87	0.00	0	0.00	WP-PL-005/006	23.87	0.0	0	0.00
WP-PL-007	9.53	0.00	0	0.00	WP-PL-007	9.53	5.5	222,600	47.62
WP-PL-008	1.10	6.13	145,300	5.17	WP-PL-008	1.10	2.4	248,100	11.08
WP-PL-009	14.19	48.38	1,466,000	9.82	WP-PL-009	14.19	26.2	2,757,500	38.05
Chindwin River	87.72	117.28	6,264,600	6.98	Chindwin River	87.72	70.9	11,724,100	39.22
Yama Stream	18.40	52.91	1,952,500	9.92	Yama Stream	18.40	34.3	3,632,000	38.25

Surface Water Planned (PL) Conditions: Results for estimation of design runoff

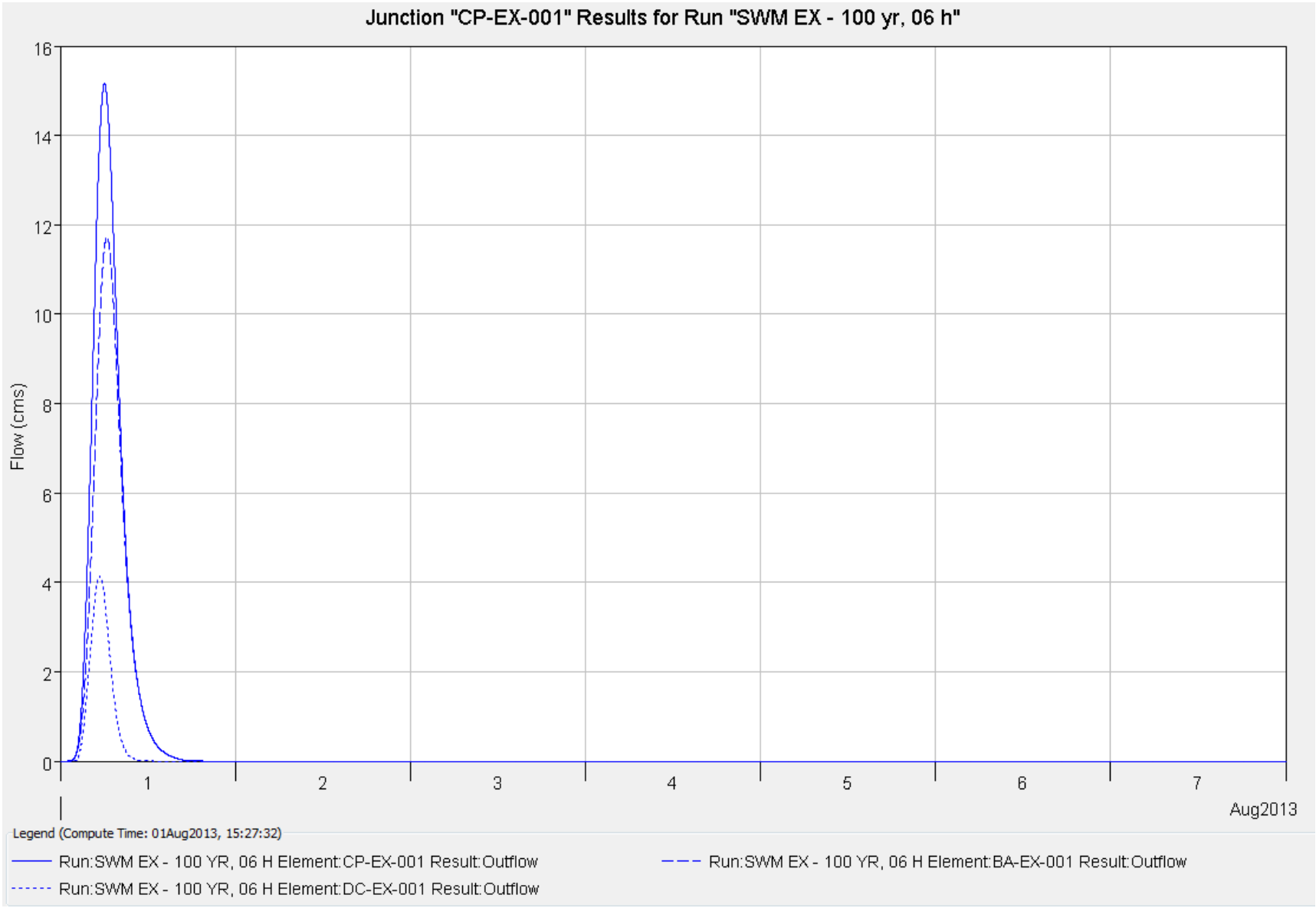
The HEC-HMS Planned Conditions model was executed with storms of various duration to estimate the hydrologic response of the Letpadaung site. A summary of results at all runoff reporting points is given below.

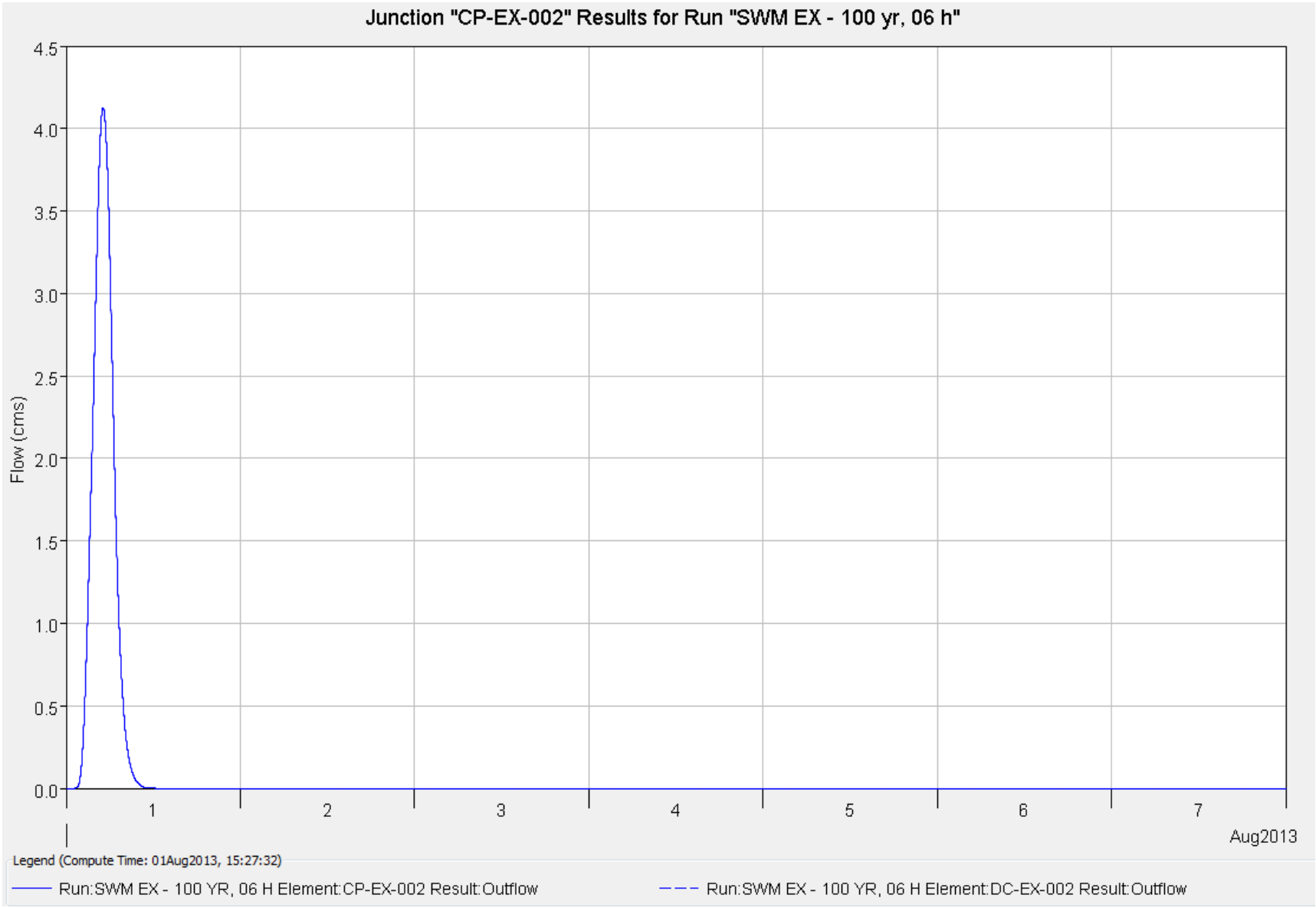
All water dams were assumed full excluding WP-PL-007. WP-PL-007 was assumed to have 620,000 m3 of water currently in it (or a water level of 75.6 m)

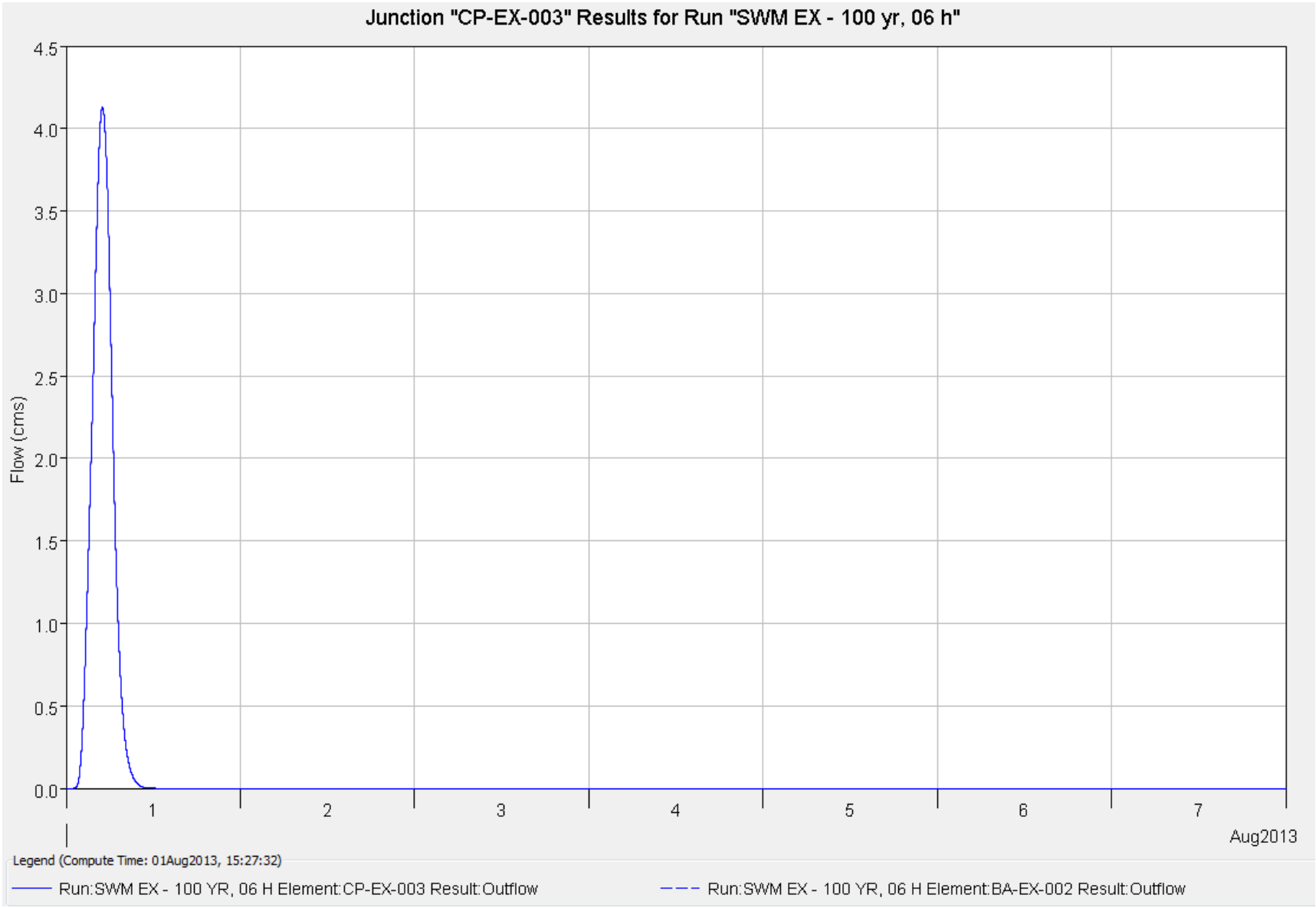
Runoff Reporting Point	Results for 100 yr ARI, 6 hour duration storm				Runoff Reporting Point	Results for 100 yr ARI, 48 hour duration storm			
	Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)		Drainage Area (km^2)	Peak Runoff Rate (m^3/s)	Total Runoff Volume (m^3)	Time to Peak Runoff Rate (h)
CP-PL-001	2.20	15.16	239,100	6.08	CP-PL-001	2.20	5.7	440,800	11.33
CP-PL-002	0.44	4.13	48,100	5.10	CP-PL-002	0.44	1.3	88,600	31.05
CP-PL-003	0.44	4.13	48,100	5.00	CP-PL-003	0.44	1.3	88,600	30.93
CP-PL-004	3.13	13.73	331,200	7.03	CP-PL-004	3.13	6.4	616,900	13.15
CP-PL-005	0.91	8.36	93,300	4.90	CP-PL-005	0.91	2.7	175,800	30.80
CP-PL-006	0.00	0.00	0	0.00	CP-PL-006	0.00	0.0	0	0.00
CP-PL-007	40.67	19.27	3,757,500	7.83	CP-PL-007	40.67	29.0	7,094,300	48.63
CP-PL-008	37.95	16.51	3,464,600	16.37	CP-PL-008	37.95	27.0	6,554,200	49.20
CP-PL-009	37.95	16.51	3,465,700	16.22	CP-PL-009	37.95	27.0	6,556,200	49.08
CP-PL-010A	3.67	25.61	398,300	6.22	CP-PL-010A	3.67	9.6	734,400	11.37
CP-PL-010B	21.29	80.32	2,251,700	9.13	CP-PL-010B	21.29	40.8	4,195,500	14.27
CP-PL-010C	10.54	56.76	1,070,700	7.12	CP-PL-010C	10.54	23.7	2,027,700	12.28
CP-PL-010D	1.35	15.41	146,000	4.13	CP-PL-010D	1.35	4.4	269,300	30.08
CP-PL-011	41.72	93.02	3,714,200	7.12	CP-PL-011	41.72	53.1	6,885,500	38.98
CP-PL-012	41.72	93.02	3,714,200	7.10	CP-PL-012	41.72	53.1	6,885,500	38.97
CP-PL-013	15.01	66.12	1,604,900	7.25	CP-PL-013	15.01	30.9	2,977,500	12.93
CP-PL-014	10.53	42.28	1,126,900	7.38	CP-PL-014	10.53	21.4	2,090,100	12.80
CP-PL-015	10.53	42.37	1,127,200	7.10	CP-PL-015	10.53	21.4	2,090,400	12.45
CP-PL-016A	0.33	3.66	35,600	4.23	CP-PL-016A	0.33	1.1	66,000	30.17
CP-PL-016B	10.06	56.83	1,074,600	5.72	CP-PL-016B	10.06	22.9	1,994,600	11.35
CP-PL-016C	0.08	0.93	9,200	4.27	CP-PL-016C	0.08	0.3	16,900	30.20
CP-PL-017	10.06	56.84	1,074,600	5.58	CP-PL-017	10.06	22.9	1,994,600	11.18
CP-PL-018	8.61	44.74	922,800	5.65	CP-PL-018	8.61	19.1	1,710,100	11.25
CP-PL-019	26.71	38.45	2,109,300	4.73	CP-PL-019	26.71	24.7	3,908,100	38.15
CP-PL-020	26.71	38.46	2,109,300	4.72	CP-PL-020	26.71	24.7	3,908,100	38.13
CP-PL-021	0.03	0.26	3,200	4.42	CP-PL-021	0.03	0.1	5,800	10.17
CP-PL-022	0.02	0.25	2,300	4.05	CP-PL-022	0.02	0.1	4,300	30.02
CP-PL-023	26.00	35.53	2,031,800	4.67	CP-PL-023	26.00	23.4	3,765,200	38.12
CP-PL-024	25.85	34.29	2,014,800	4.58	CP-PL-024	25.85	23.1	3,734,100	38.23
CP-PL-025	25.75	33.53	2,004,400	4.55	CP-PL-025	25.75	23.0	3,715,000	38.23
CP-PL-026	2.80	25.00	305,400	4.95	CP-PL-026	2.80	7.9	562,400	31.18
CP-PL-027	2.77	24.75	301,300	4.87	CP-PL-027	2.77	7.9	555,400	31.07
CP-PL-028	2.70	24.17	292,000	4.75	CP-PL-028	2.70	7.7	539,500	31.00
CP-PL-029	2.61	23.41	279,900	4.60	CP-PL-029	2.61	7.4	518,700	30.80
CP-PL-030	2.39	21.38	256,300	4.60	CP-PL-030	2.39	6.8	475,200	30.77
CP-PL-031	0.80	9.03	85,700	4.15	CP-PL-031	0.80	2.6	158,800	30.10
CP-PL-032	6.20	26.07	666,900	7.05	CP-PL-032	6.20	13.1	1,234,000	11.62
CP-PL-033	6.20	26.07	666,900	6.92	CP-PL-033	6.20	13.1	1,234,000	11.47
CP-PL-034	4.54	23.95	480,800	7.40	CP-PL-034	4.54	10.1	895,100	12.78
CP-PL-035	4.51	31.08	477,300	6.22	CP-PL-035	4.51	11.5	889,400	11.38
CP-PL-036	1.06	9.30	113,300	5.42	CP-PL-036	1.06	3.0	210,200	31.45
CP-PL-037	1.06	9.30	113,300	5.38	CP-PL-037	1.06	3.0	210,200	31.40
CP-PL-038	1.06	9.33	113,400	5.27	CP-PL-038	1.06	3.0	210,200	31.23
CP-PL-039	25.58	32.08	1,984,700	4.50	CP-PL-039	25.58	22.8	3,679,400	38.67
CP-PL-040	23.87	21.25	1,777,500	6.90	CP-PL-040	23.87	19.5	3,313,800	39.43
CP-PL-041A	10.65	10.75	147,500	4.87	CP-PL-041A	10.65	6.4	475,000	47.55
CP-PL-041B	5.61	58.44	695,700	4.08	CP-PL-041B	5.61	16.2	1,216,900	30.13
CP-PL-041C	3.34	41.21	432,000	4.10	CP-PL-041C	3.34	11.2	744,200	30.17
CP-PL-042A	0.63	5.89	82,800	5.37	CP-PL-042A	0.63	1.9	141,700	10.32
CP-PL-042B	9.53	0.00	0	0.00	CP-PL-042B	9.53	5.5	222,600	47.62
CP-PL-042C	0.49	5.46	64,700	4.50	CP-PL-042C	0.49	1.6	110,700	30.48
CP-PL-043A	4.38	50.89	458,500	4.20	CP-PL-043A	4.38	14.3	857,900	30.25
CP-PL-043B	4.43	51.42	463,500	4.18	CP-PL-043B	4.43	14.4	867,300	30.22

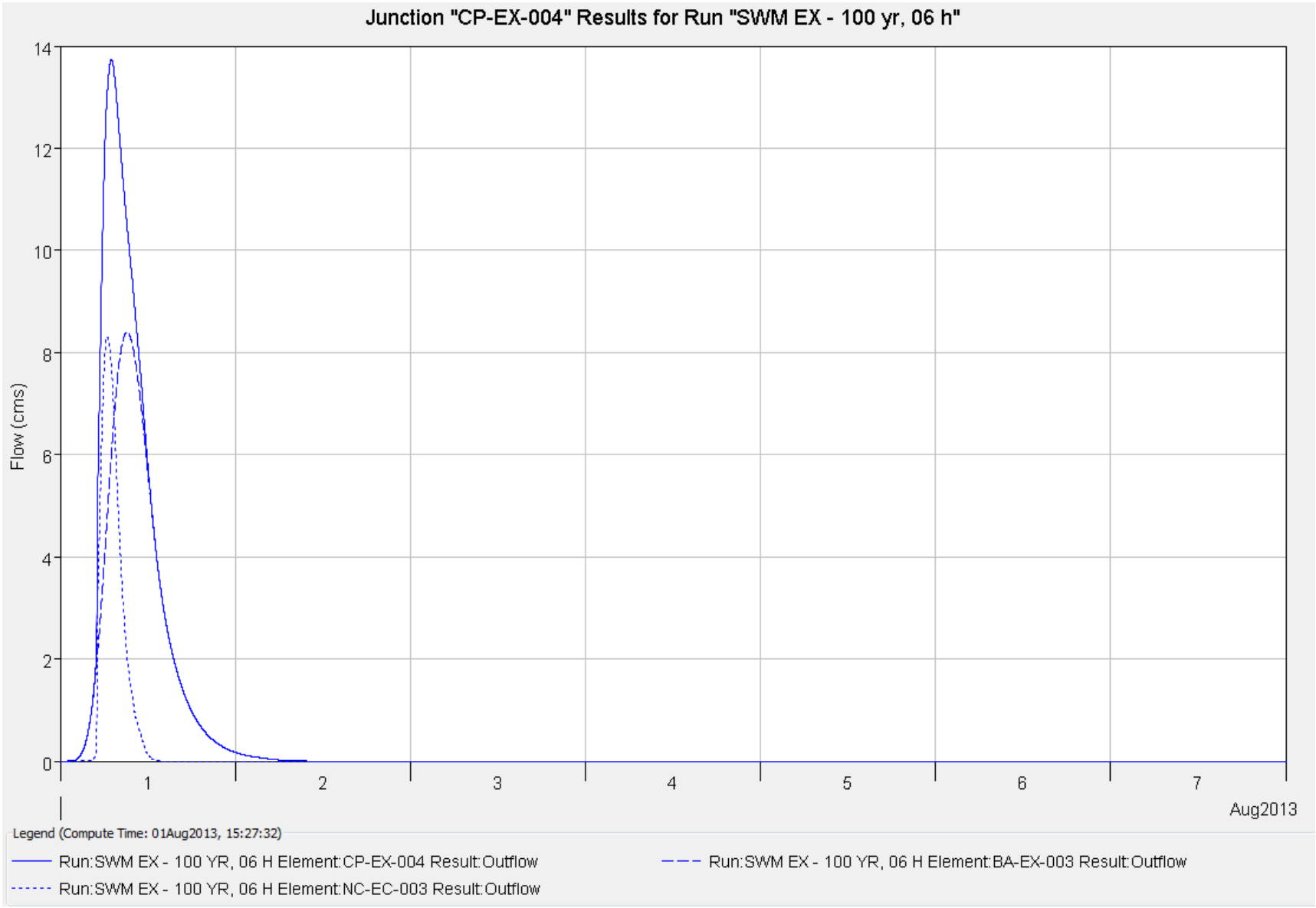
Surface Water Planned (PL) Conditions: Results for estimation of design runoff

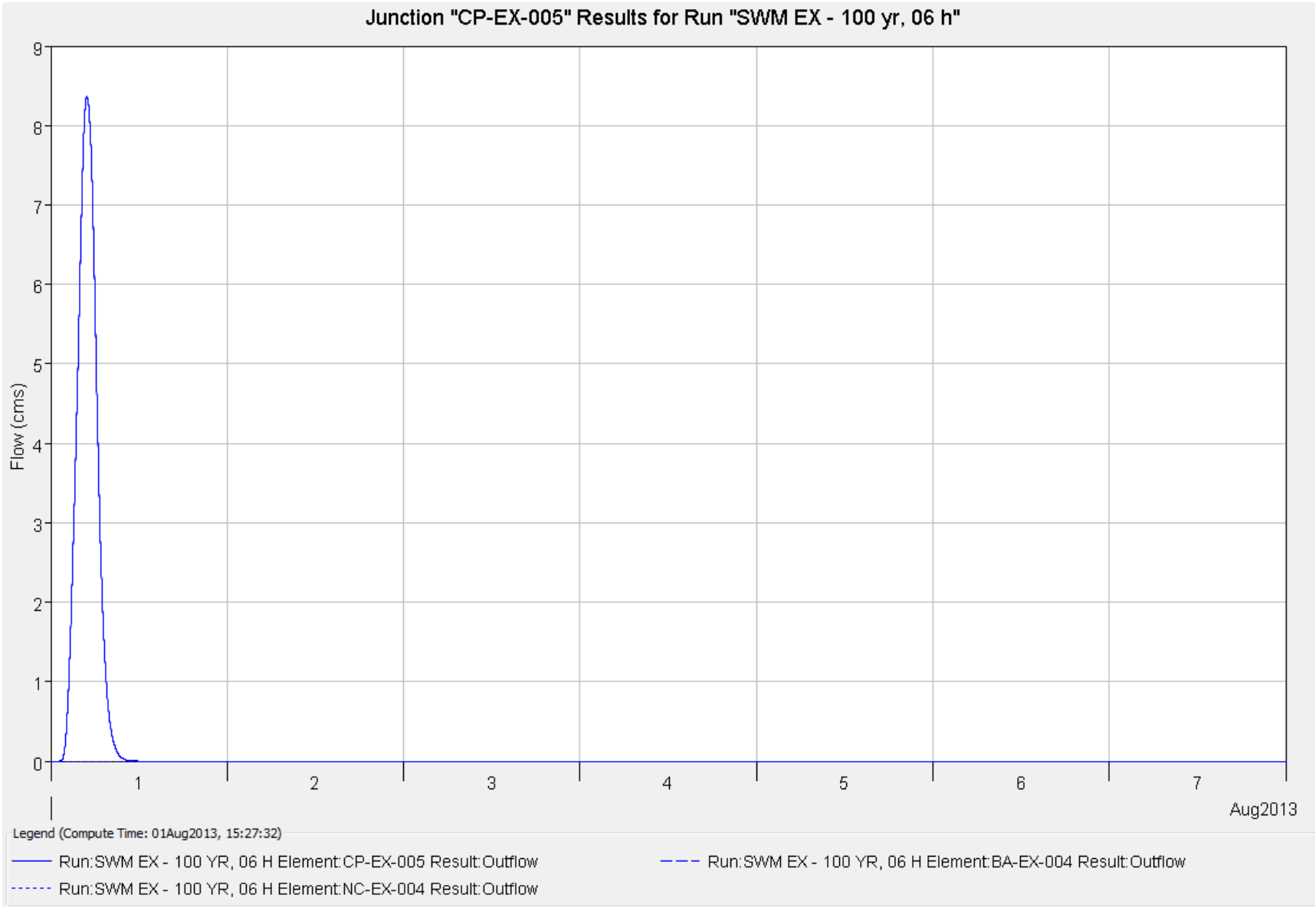
CP-PL-044	4.38	50.95	458,500	4.03	CP-PL-044	4.38	14.3	857,900	30.00
CP-PL-045	4.43	51.45	463,500	4.03	CP-PL-045	4.43	14.5	867,300	30.00
CP-PL-046	0.78	9.82	102,700	4.00	CP-PL-046	0.78	2.6	175,800	30.00
CP-PL-047	4.83	48.77	593,200	4.07	CP-PL-047	4.83	13.6	1,041,200	30.10
CP-PL-048	4.83	48.87	593,200	4.02	CP-PL-048	4.83	13.6	1,041,200	30.02
CP-PL-049	4.20	41.46	511,500	4.13	CP-PL-049	4.20	11.6	901,300	30.13
CP-PL-050	3.38	32.05	424,000	4.13	CP-PL-050	3.38	9.2	738,800	10.13
CP-PL-051	3.38	32.23	424,400	4.08	CP-PL-051	3.38	9.2	738,900	10.07
CP-PL-052	2.89	26.38	365,300	4.13	CP-PL-052	2.89	7.8	633,900	10.13
CP-PL-053	2.77	25.18	354,200	4.13	CP-PL-053	2.77	7.5	612,300	10.17
CP-PL-054	2.77	25.29	354,200	4.02	CP-PL-054	2.77	7.5	612,300	10.02
CP-PL-055	1.10	6.13	145,300	5.17	CP-PL-055	1.10	2.4	248,100	11.08
CP-PL-056A	0.46	5.76	60,100	4.10	CP-PL-056A	0.46	1.5	102,900	30.13
CP-PL-056B	0.54	6.80	71,100	4.00	CP-PL-056B	0.54	1.8	121,800	30.00
CP-PL-057	0.46	5.76	60,100	4.00	CP-PL-057	0.46	1.5	102,900	30.00
CP-PL-058	1.67	20.75	208,900	4.00	CP-PL-058	1.67	5.6	364,200	30.00
CP-PL-059	0.59	7.45	77,900	4.00	CP-PL-059	0.59	2.0	133,300	30.00
CP-PL-060	1.82	22.90	239,100	4.00	CP-PL-060	1.82	6.2	409,200	30.00
CP-PL-061	0.38	4.30	45,000	4.27	CP-PL-061	0.38	1.2	80,000	30.22
CP-PL-062	1.14	14.16	148,100	4.08	CP-PL-062	1.14	3.8	255,000	30.22
CP-PL-063	1.14	14.29	149,200	4.00	CP-PL-063	1.14	3.8	255,500	30.00
CP-PL-064	0.39	4.86	50,700	4.00	CP-PL-064	0.39	1.3	86,800	30.00
CP-PL-065	1.71	20.25	207,300	4.02	CP-PL-065	1.71	5.6	365,600	30.35
CP-PL-066	1.53	18.37	183,900	4.25	CP-PL-066	1.53	5.1	325,700	30.35
CP-PL-067	0.19	2.39	25,000	4.00	CP-PL-067	0.19	0.6	42,900	30.00
CP-PL-068	1.34	16.00	159,100	4.18	CP-PL-068	1.34	4.4	282,900	30.23
CP-PL-069	1.23	14.73	144,000	4.03	CP-PL-069	1.23	4.1	257,000	30.02
CP-PL-070	0.77	8.98	83,700	4.05	CP-PL-070	0.77	2.5	153,700	30.02
CP-PL-071	0.63	7.32	67,200	4.05	CP-PL-071	0.63	2.0	124,500	30.07
CP-PL-072	0.63	7.32	67,200	4.00	CP-PL-072	0.63	2.0	124,500	30.00
CP-PL-073	0.35	4.05	38,000	4.05	CP-PL-073	0.35	1.1	69,700	30.02
CP-PL-074	0.16	2.02	21,100	4.13	CP-PL-074	0.16	0.5	36,200	30.23
CP-PL-075	0.16	2.02	21,100	4.00	CP-PL-075	0.16	0.5	36,200	30.00
CP-PL-076	0.43	5.19	54,100	4.13	CP-PL-076	0.43	1.4	94,400	30.12
CP-PL-077	0.76	8.94	100,200	4.27	CP-PL-077	0.76	2.5	171,500	30.25
CP-PL-078	17.20	52.91	1,798,300	9.92	CP-PL-078	17.20	32.0	3,366,100	38.75
CP-PL-079	14.68	48.30	1,518,800	10.22	CP-PL-079	14.68	27.2	2,855,300	38.40
CP-PL-080	14.68	48.38	1,519,100	9.95	CP-PL-080	14.68	27.2	2,855,400	38.20
CP-PL-081	14.68	48.39	1,519,100	9.87	CP-PL-081	14.68	27.2	2,855,400	38.10
CP-PL-082	14.19	48.38	1,466,000	9.82	CP-PL-082	14.19	26.2	2,757,500	38.05
CP-PL-083	13.95	48.70	1,436,800	9.47	CP-PL-083	13.95	25.7	2,706,200	37.93
WP-PL-001	37.95	16.51	3,465,700	16.22	WP-PL-001	37.95	27.0	6,556,200	49.08
WP-PL-002	10.53	42.37	1,127,200	7.10	WP-PL-002	10.53	21.4	2,090,400	12.45
WP-PL-003	0.03	0.26	3,200	4.42	WP-PL-003	0.03	0.1	5,800	10.17
WP-PL-004	4.54	23.95	480,800	7.40	WP-PL-004	4.54	10.1	895,100	12.78
WP-PL-005/006	23.87	21.25	1,777,500	6.90	WP-PL-005/006	23.87	19.5	3,313,800	39.43
WP-PL-007	9.53	0.00	0	0.00	WP-PL-007	9.53	5.5	222,600	47.62
WP-PL-008	1.10	6.13	145,300	5.17	WP-PL-008	1.10	2.4	248,100	11.08
WP-PL-009	14.19	48.38	1,466,000	9.82	WP-PL-009	14.19	26.2	2,757,500	38.05
Chindwin River	87.72	138.18	8,041,900	7.03	Chindwin River	87.72	90.1	15,037,500	39.15
Yama Stream	18.40	52.91	1,952,500	9.92	Yama Stream	18.40	34.3	3,632,000	38.25

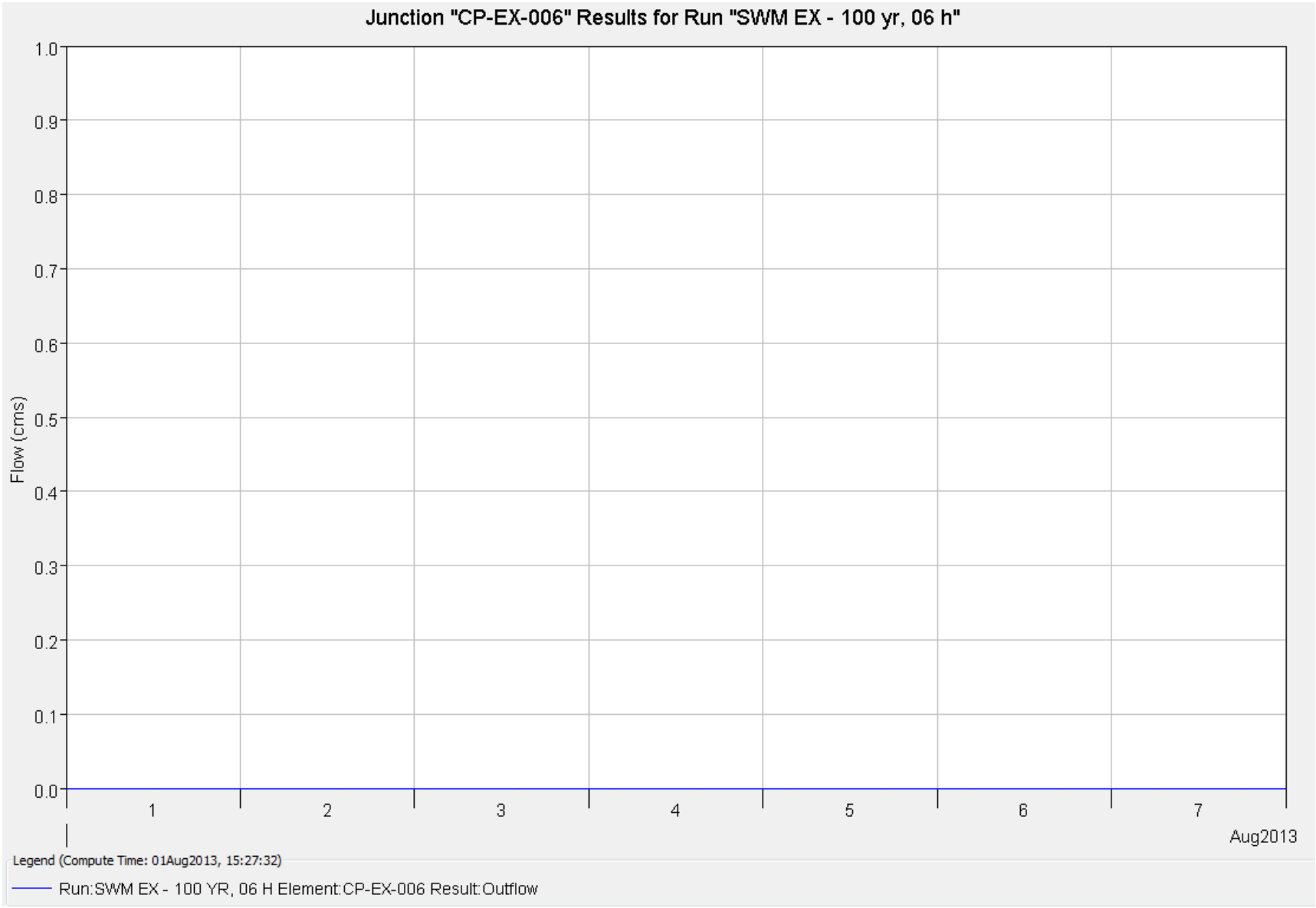

Junction "CP-EX-001" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-001 Result:Outflow

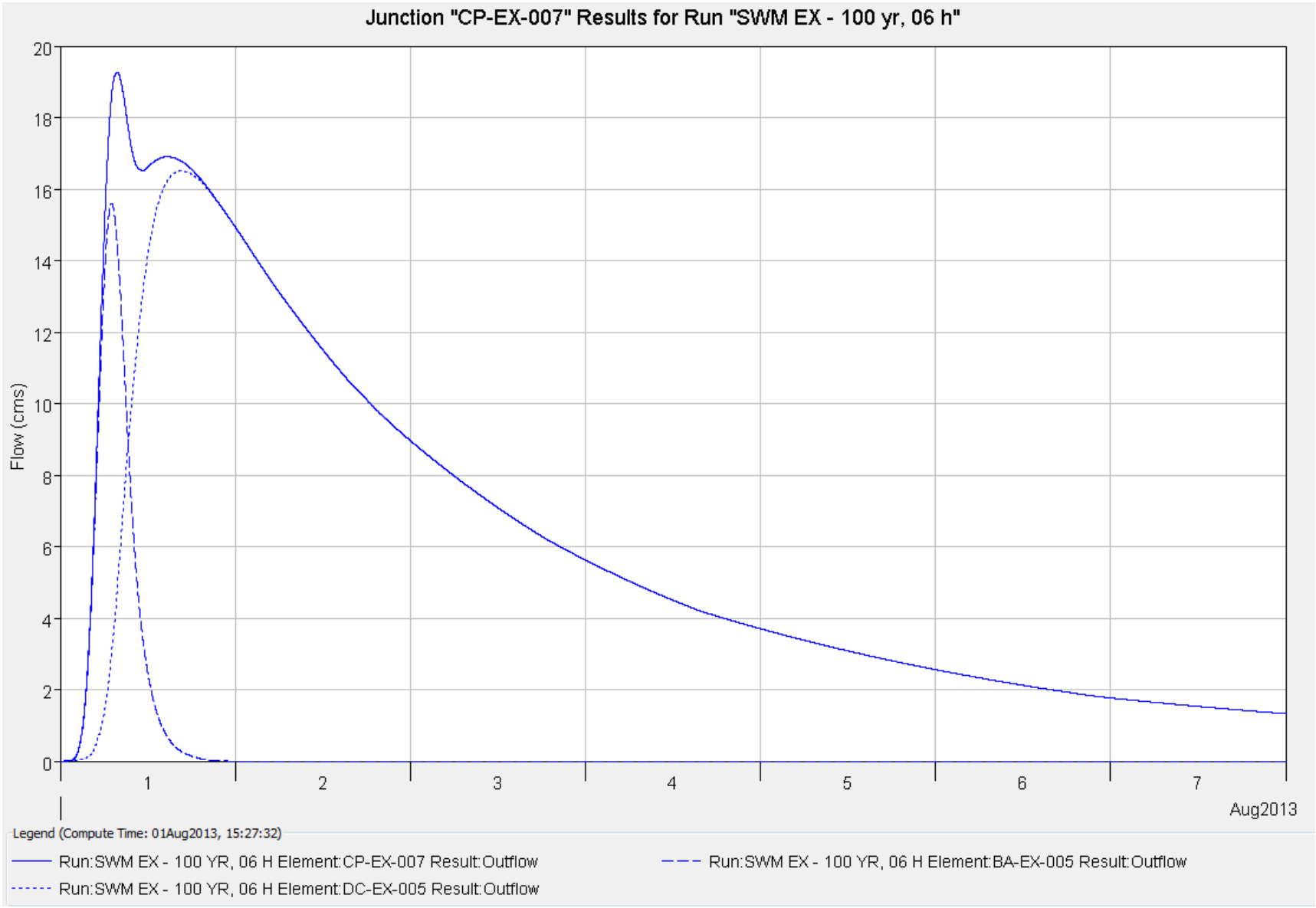

Junction "CP-EX-002" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-002 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-002 Result:Outflow

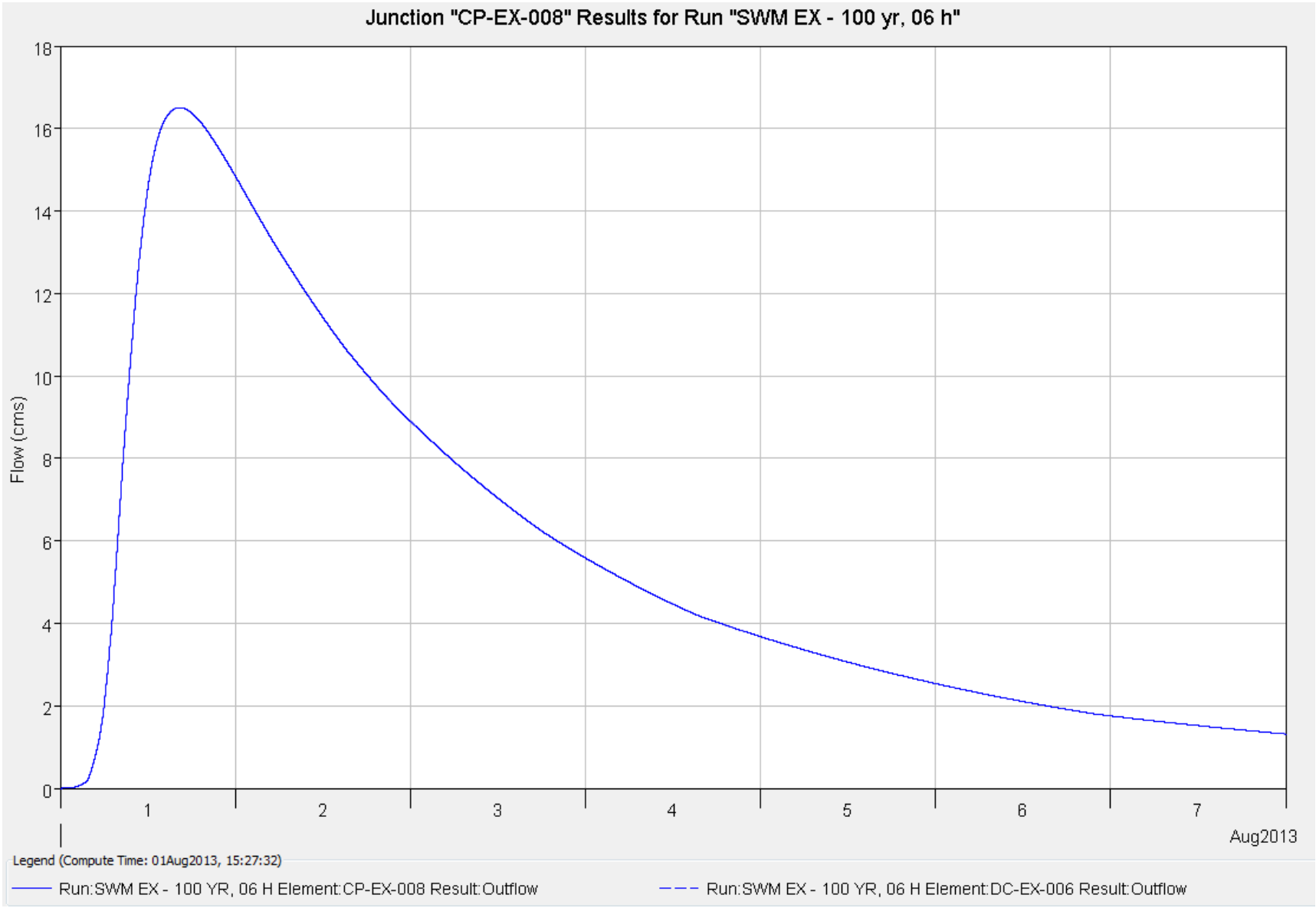

Junction "CP-EX-003" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-002 Result:Outflow

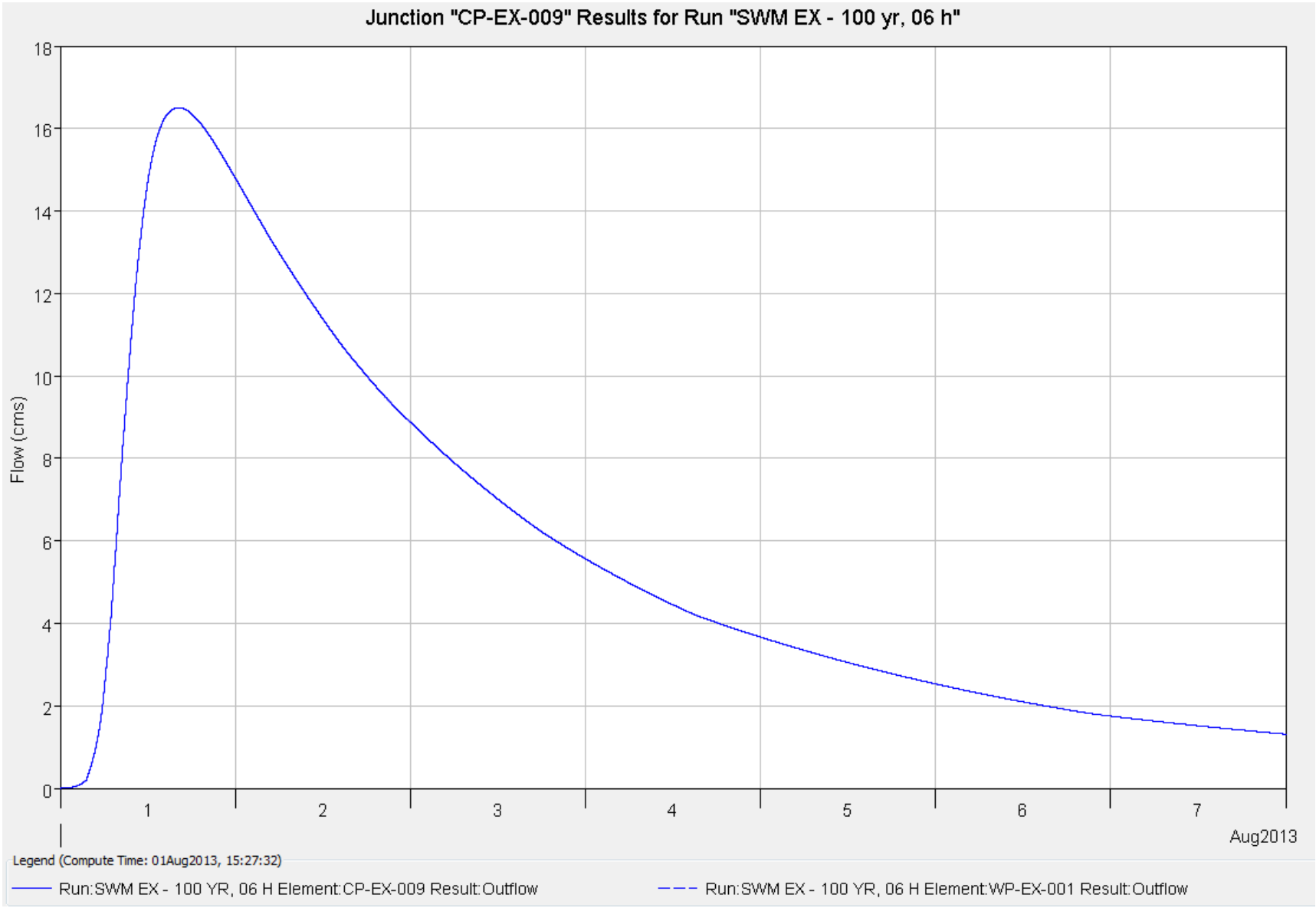

Junction "CP-EX-004" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EC-003 Result:Outflow

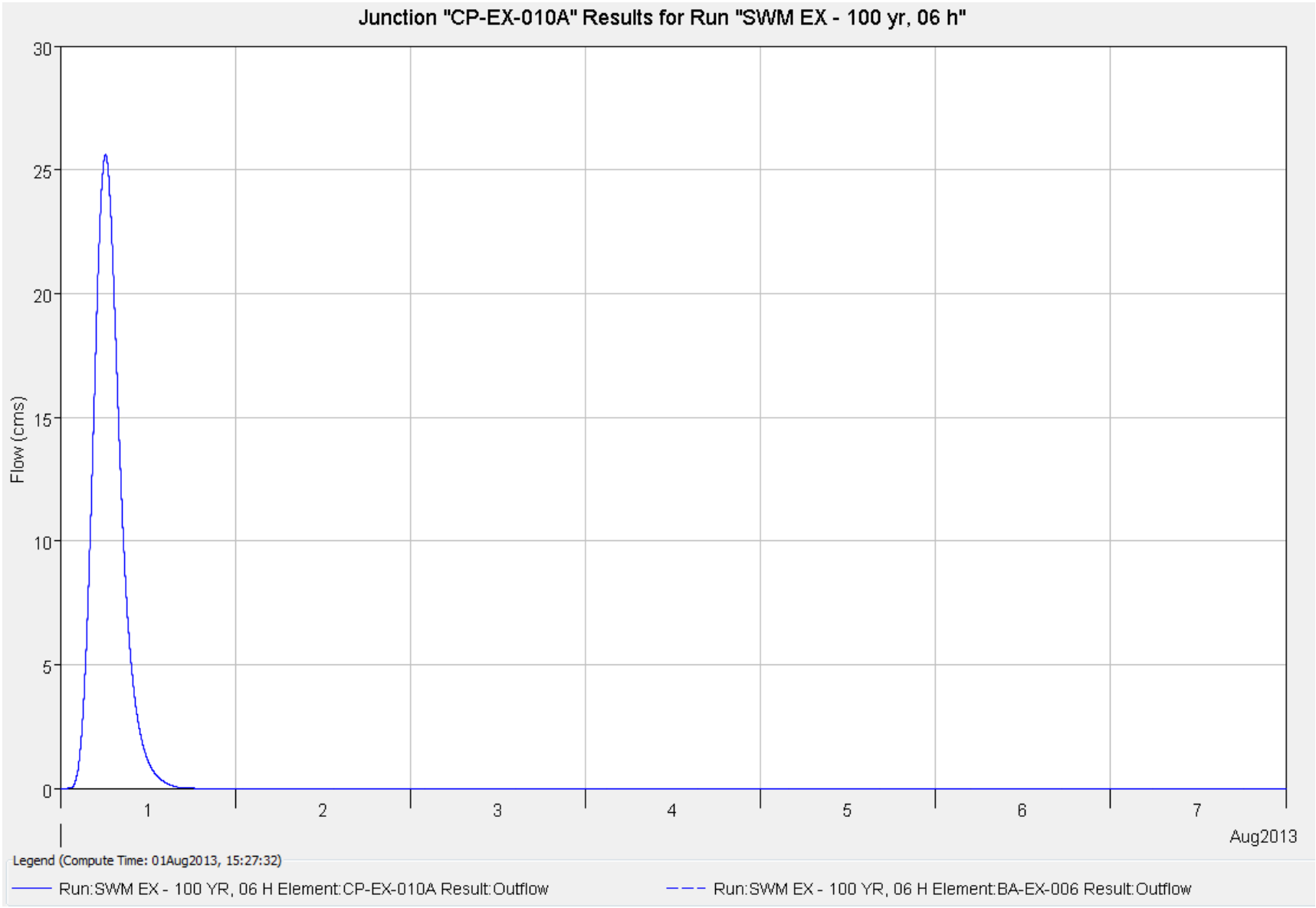

Junction "CP-EX-005" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-004 Result:Outflow

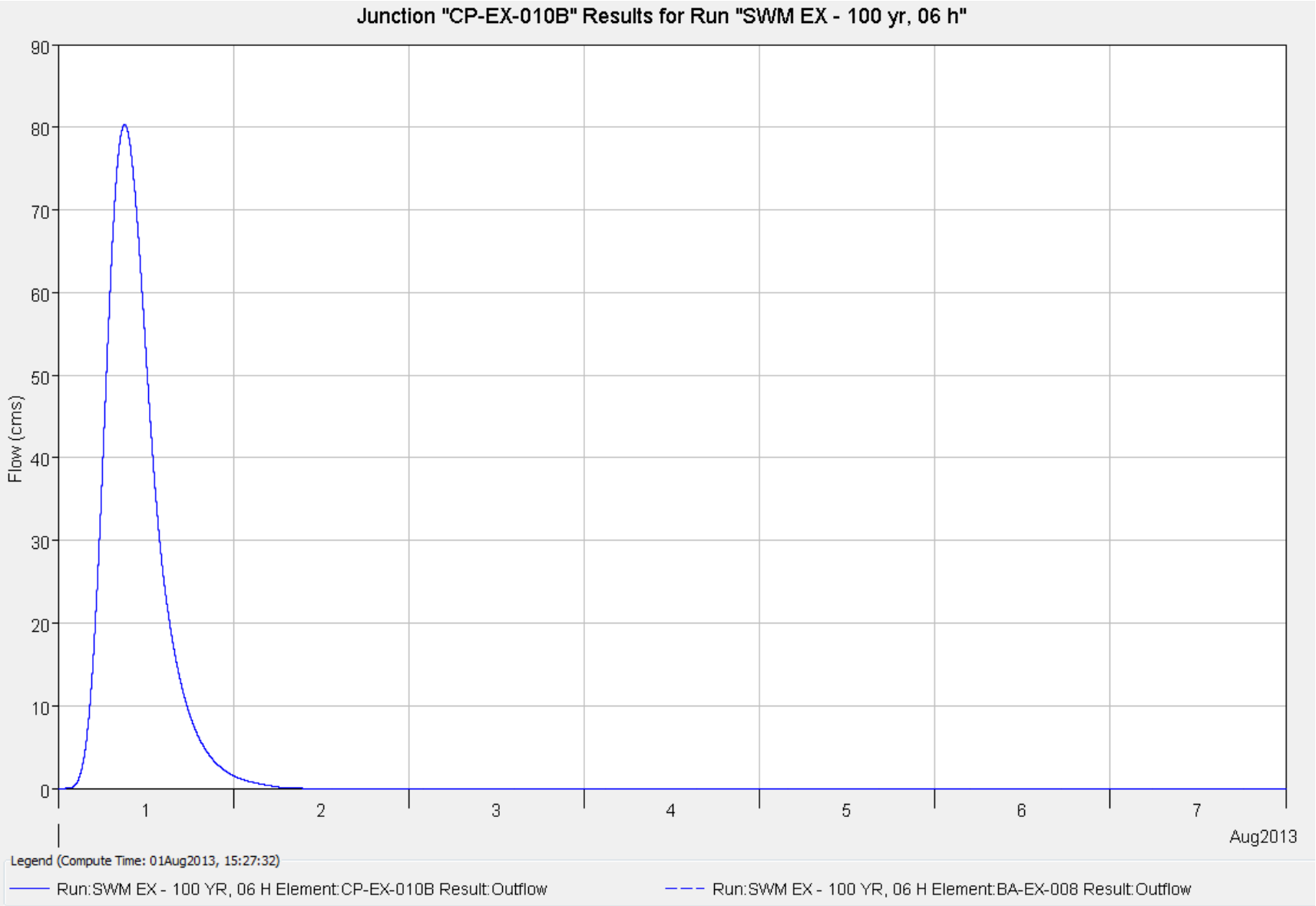

Junction "CP-EX-006" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-006 Result:Outflow

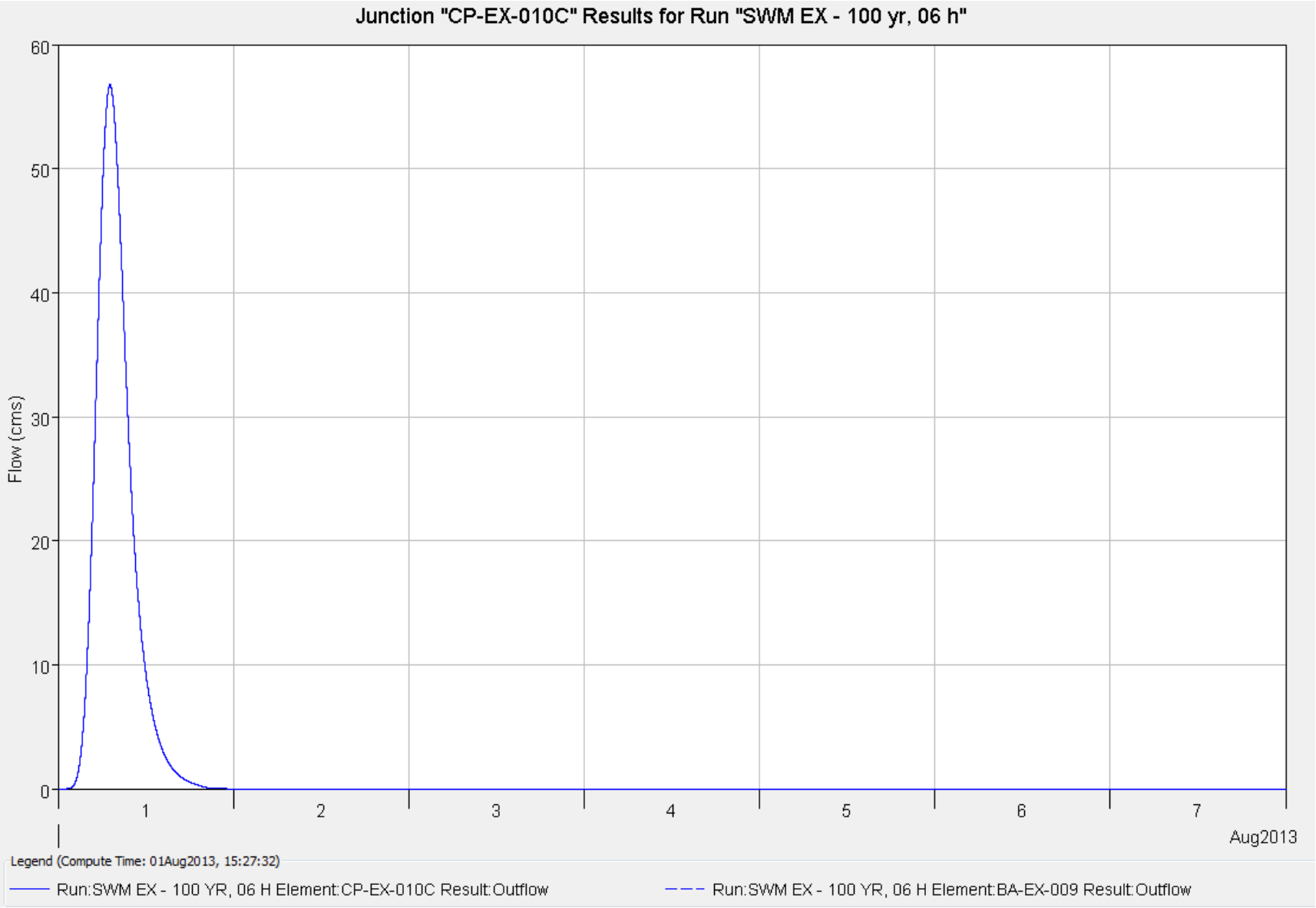

Junction "CP-EX-007" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-007 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-005 Result:Outflow

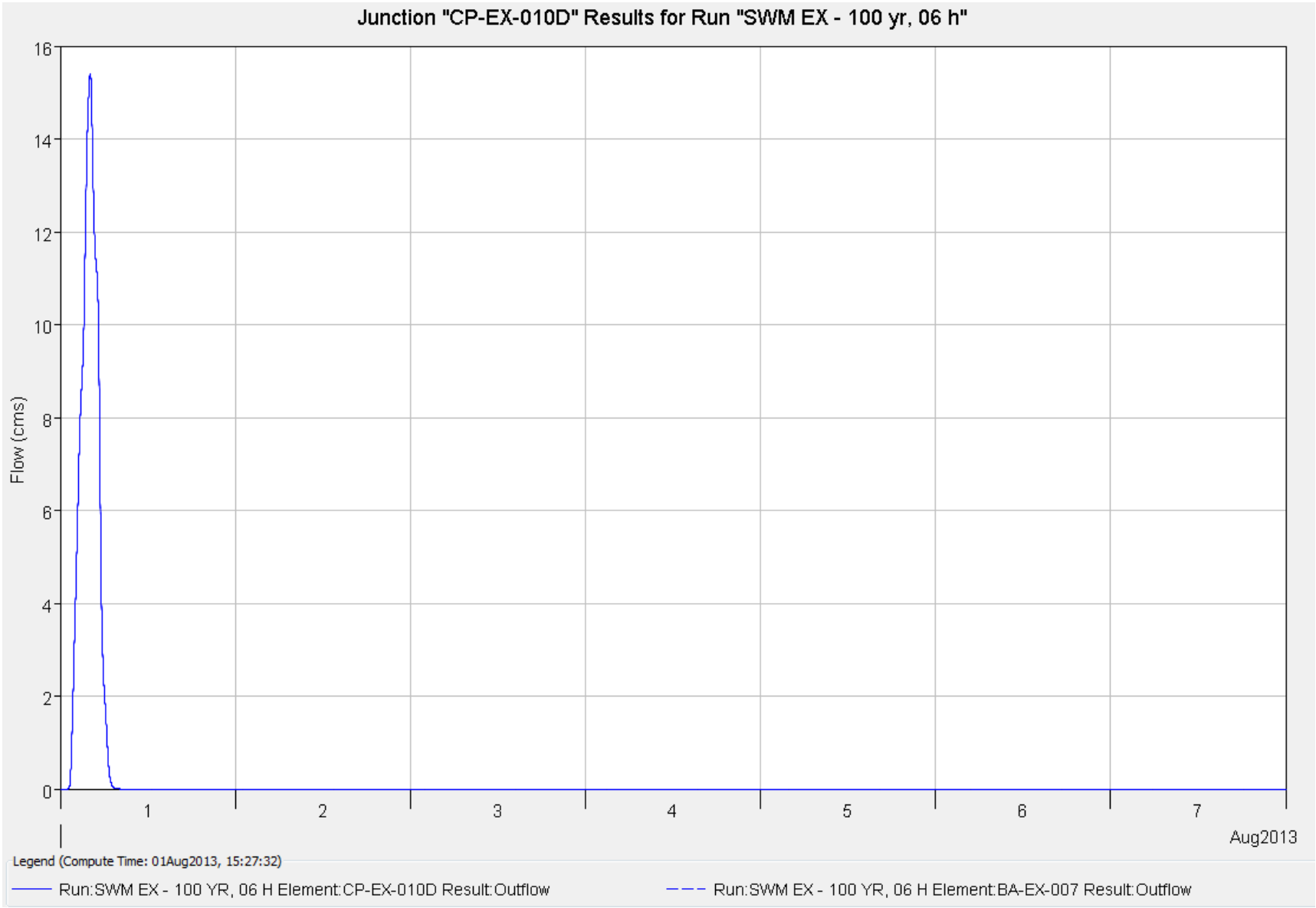

Junction "CP-EX-008" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-008 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-006 Result:Outflow

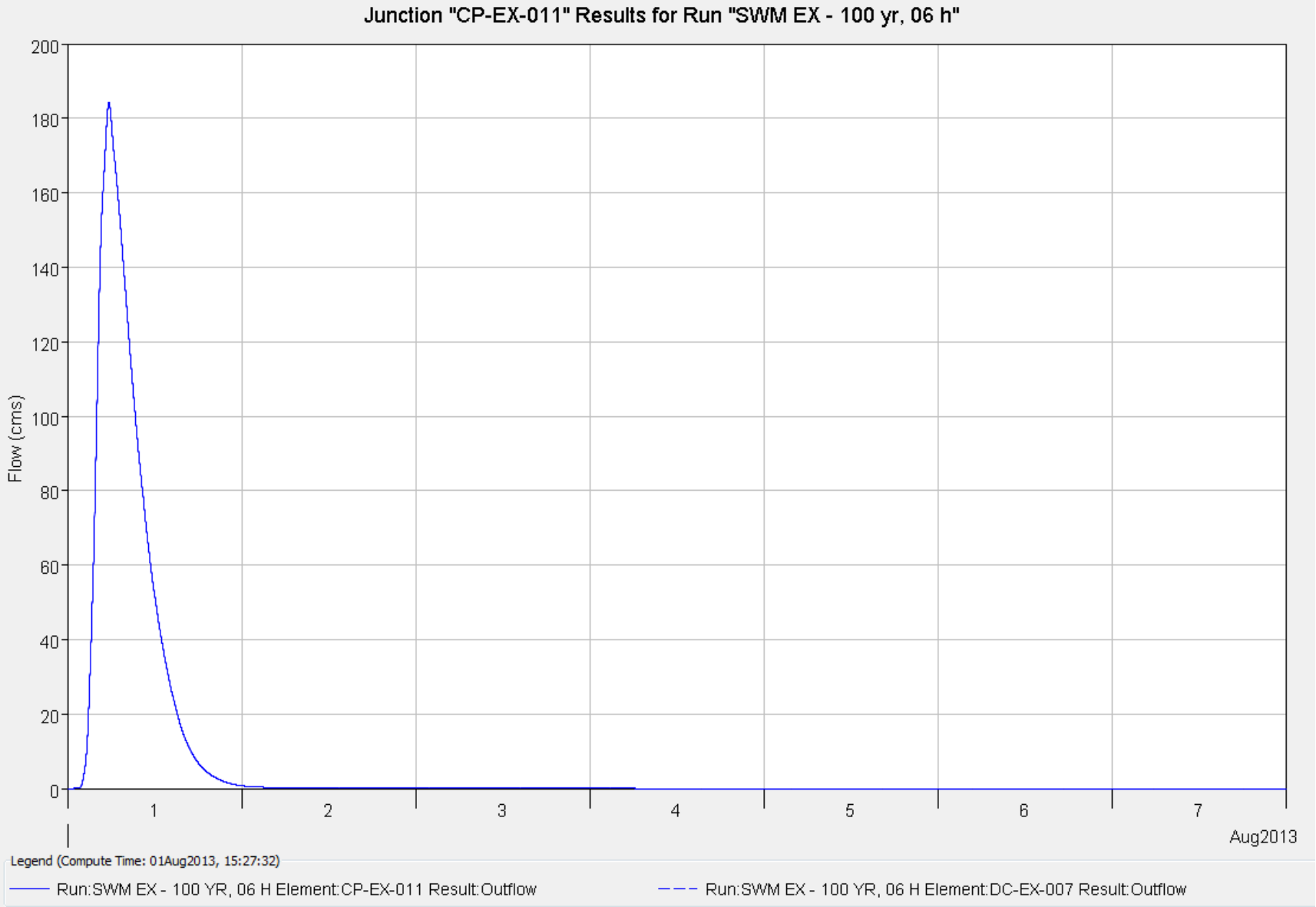

Junction "CP-EX-009" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
2
4
6
8
10
12
14
16
18
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-009 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-001 Result:Outflow

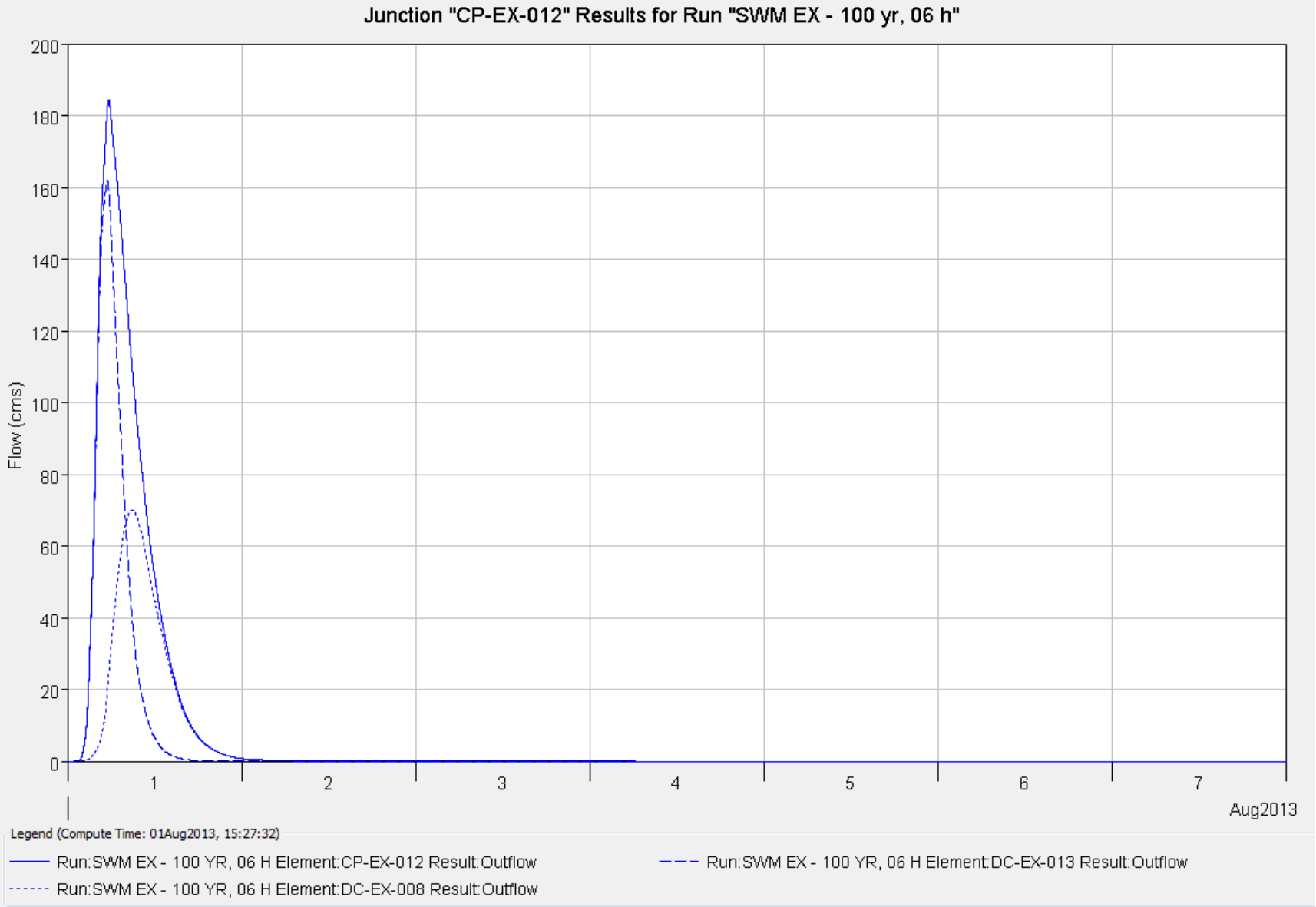

Junction "CP-EX-010A" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-010A Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-006 Result:Outflow

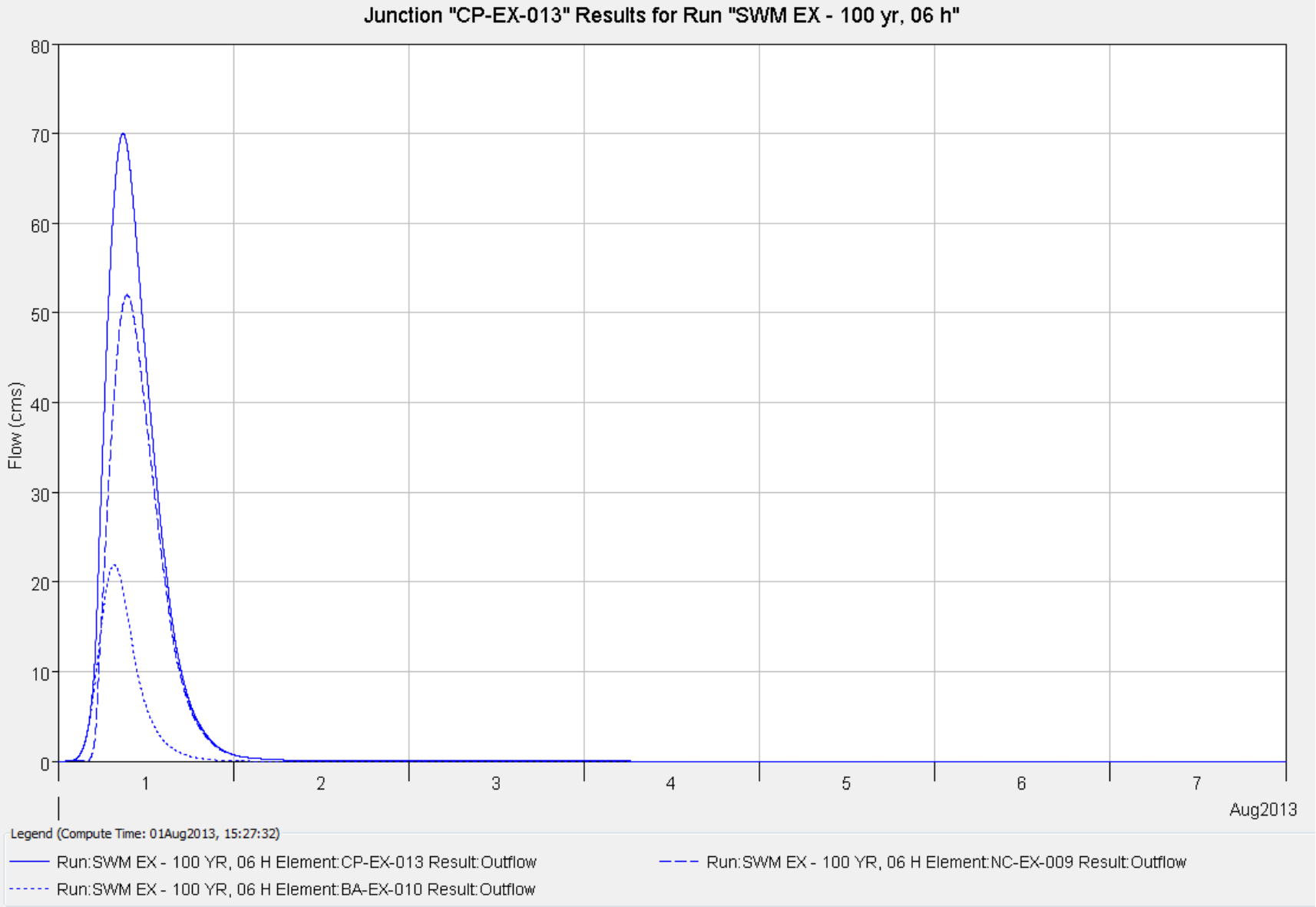

Junction "CP-EX-010B" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-010B Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-008 Result:Outflow

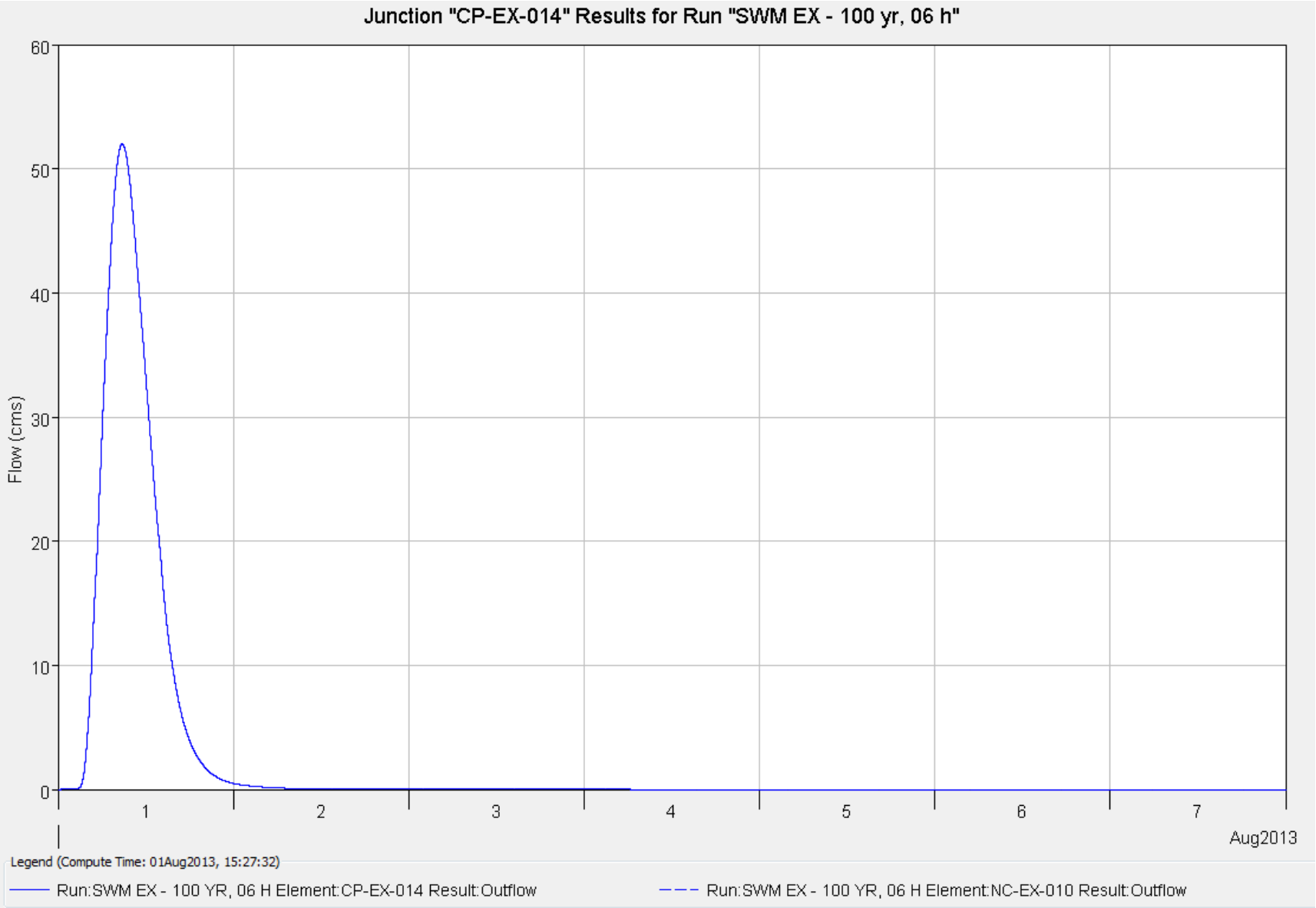

Junction "CP-EX-010C" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-010C Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-009 Result:Outflow

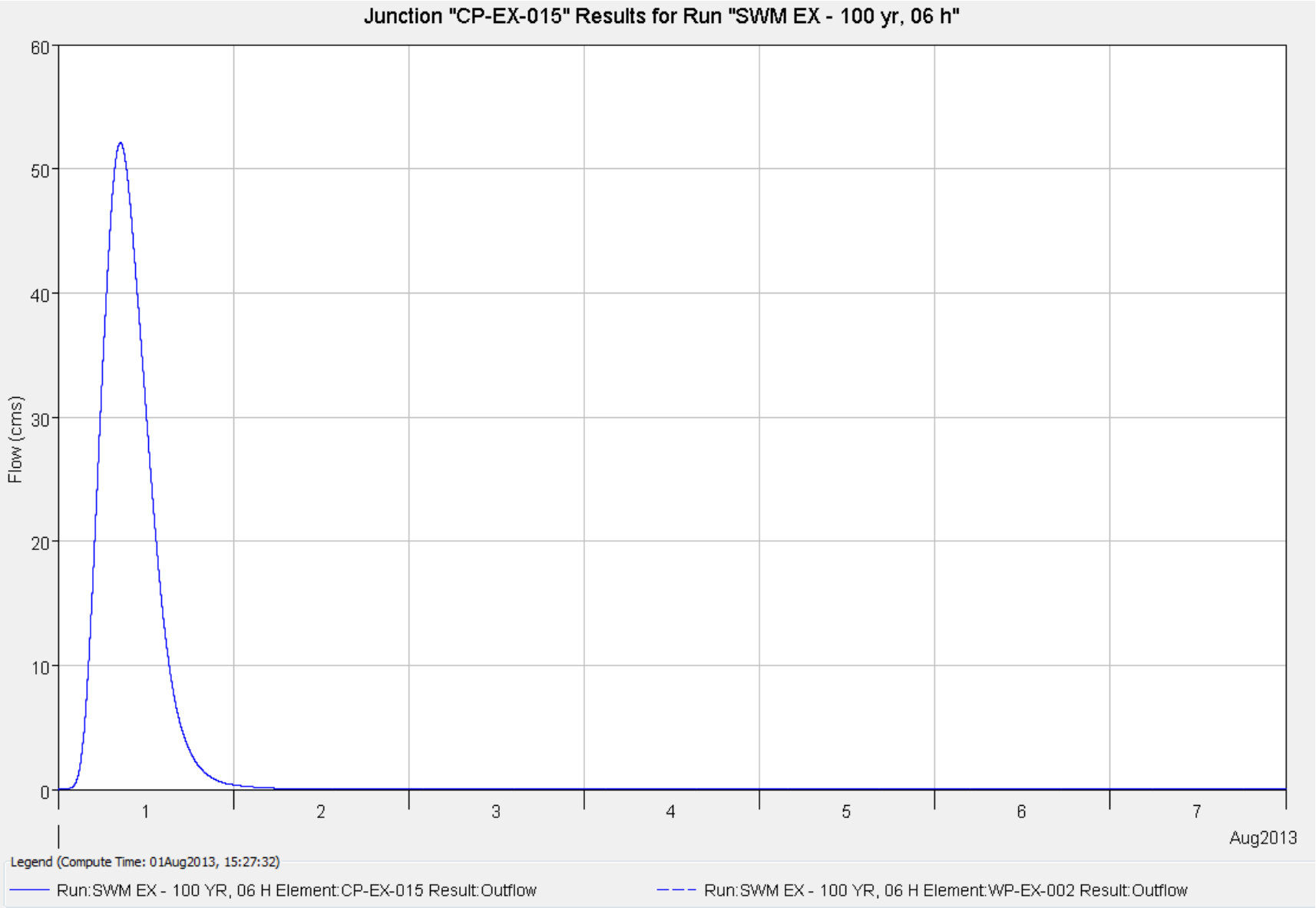

Junction "CP-EX-010D" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-010D Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-007 Result:Outflow

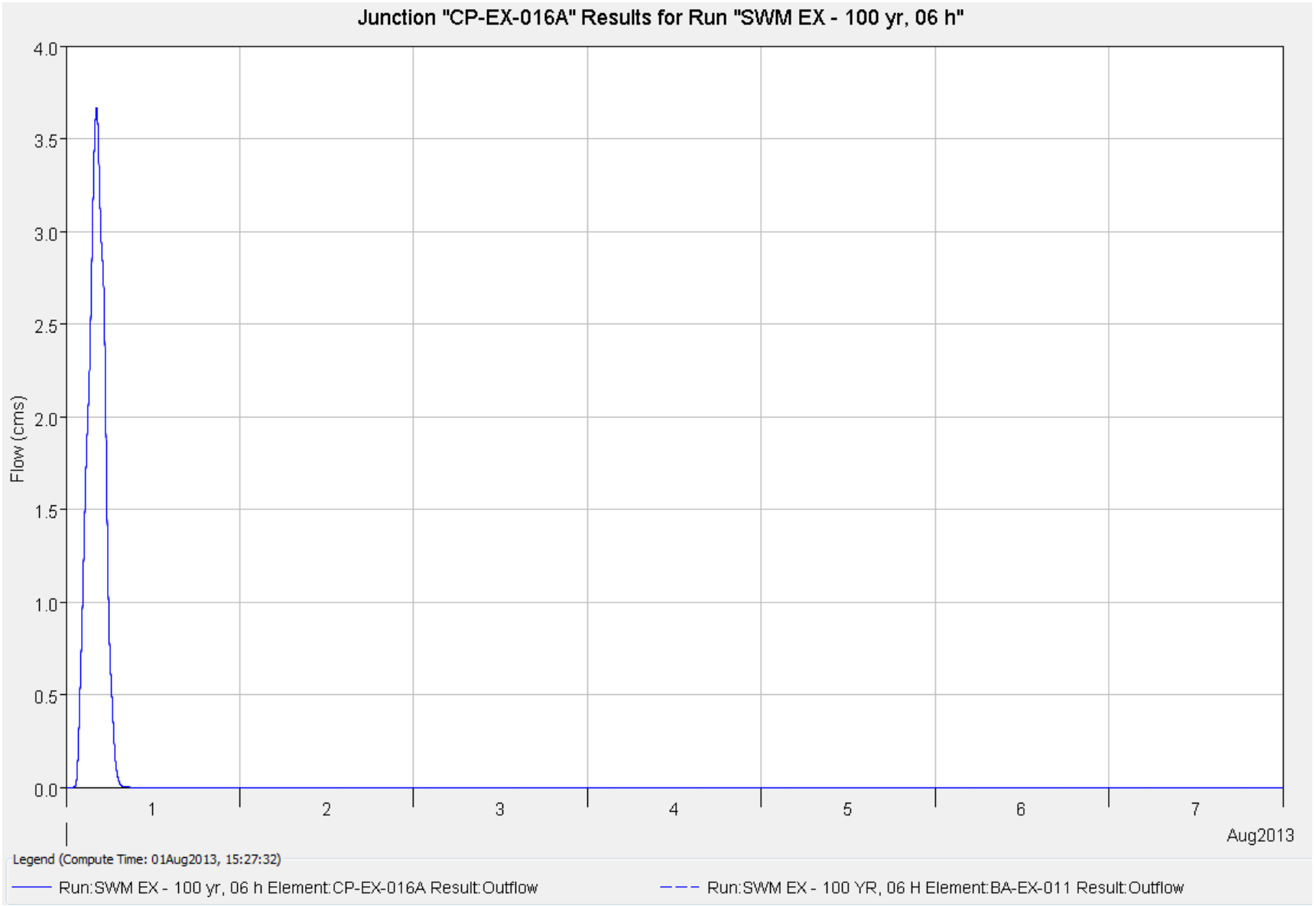

Junction "CP-EX-011" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
200
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-011 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-007 Result:Outflow

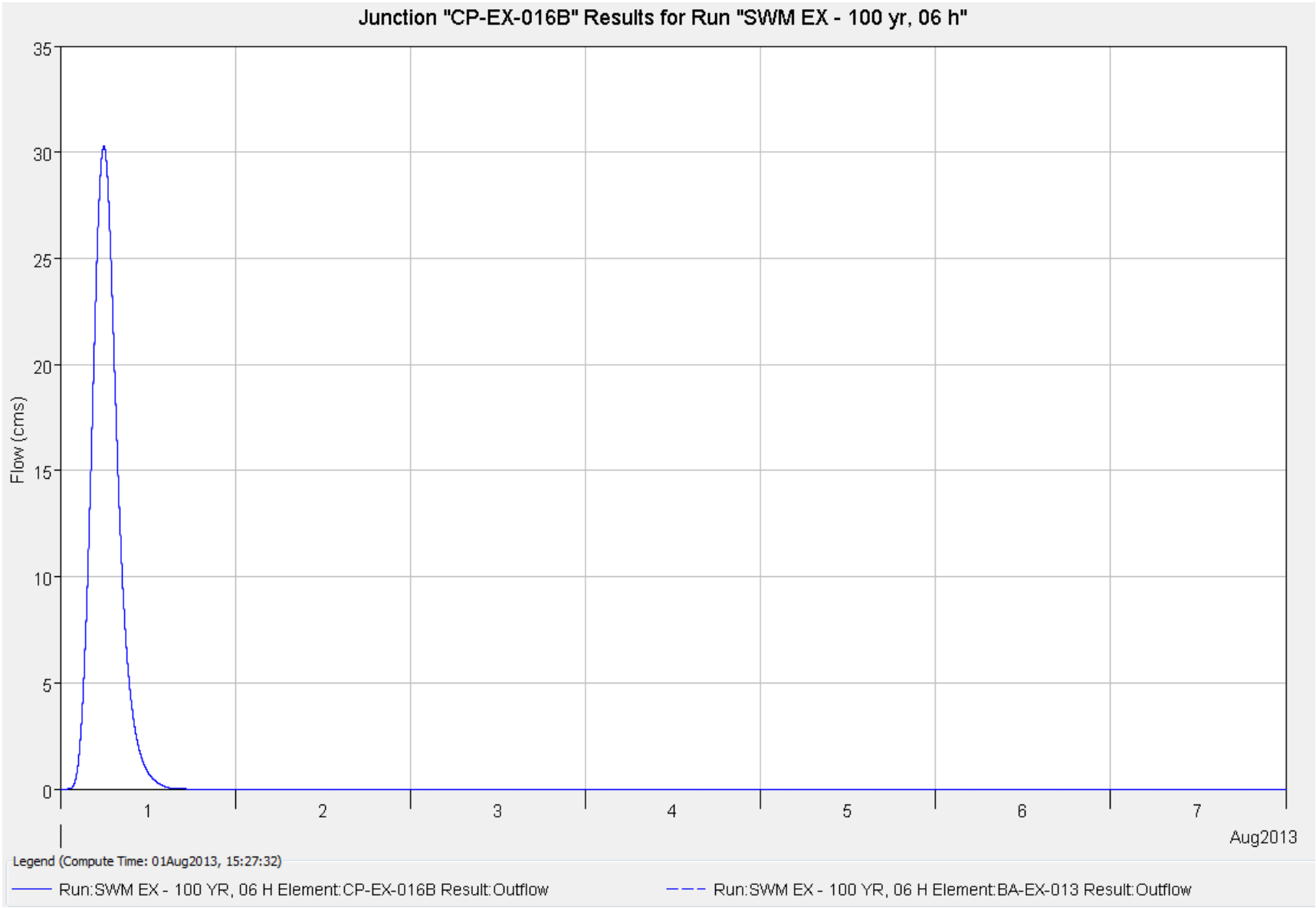

Junction "CP-EX-012" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
200
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-012 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-013 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-008 Result:Outflow

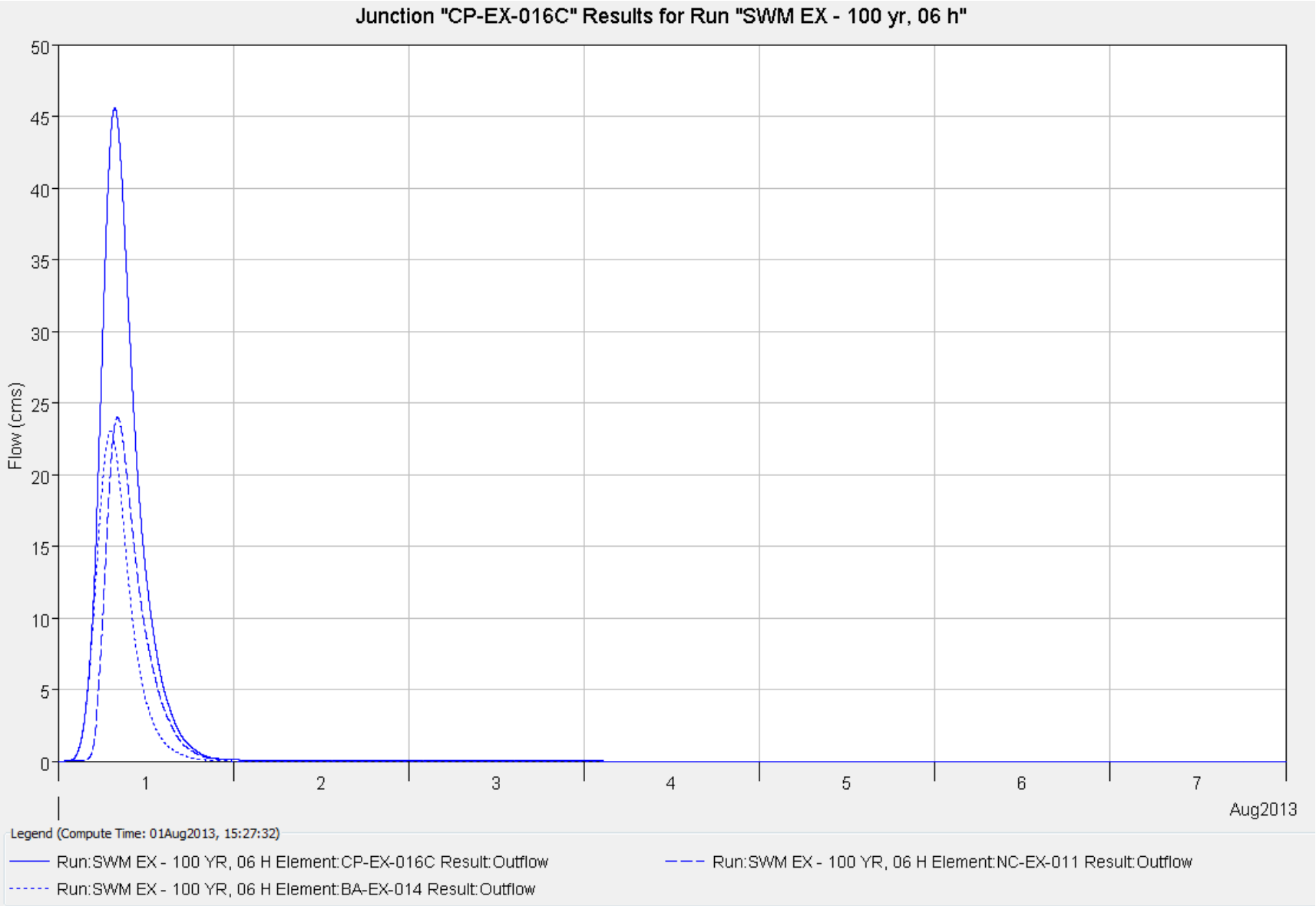

Junction "CP-EX-013" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-013 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-009 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-010 Result:Outflow

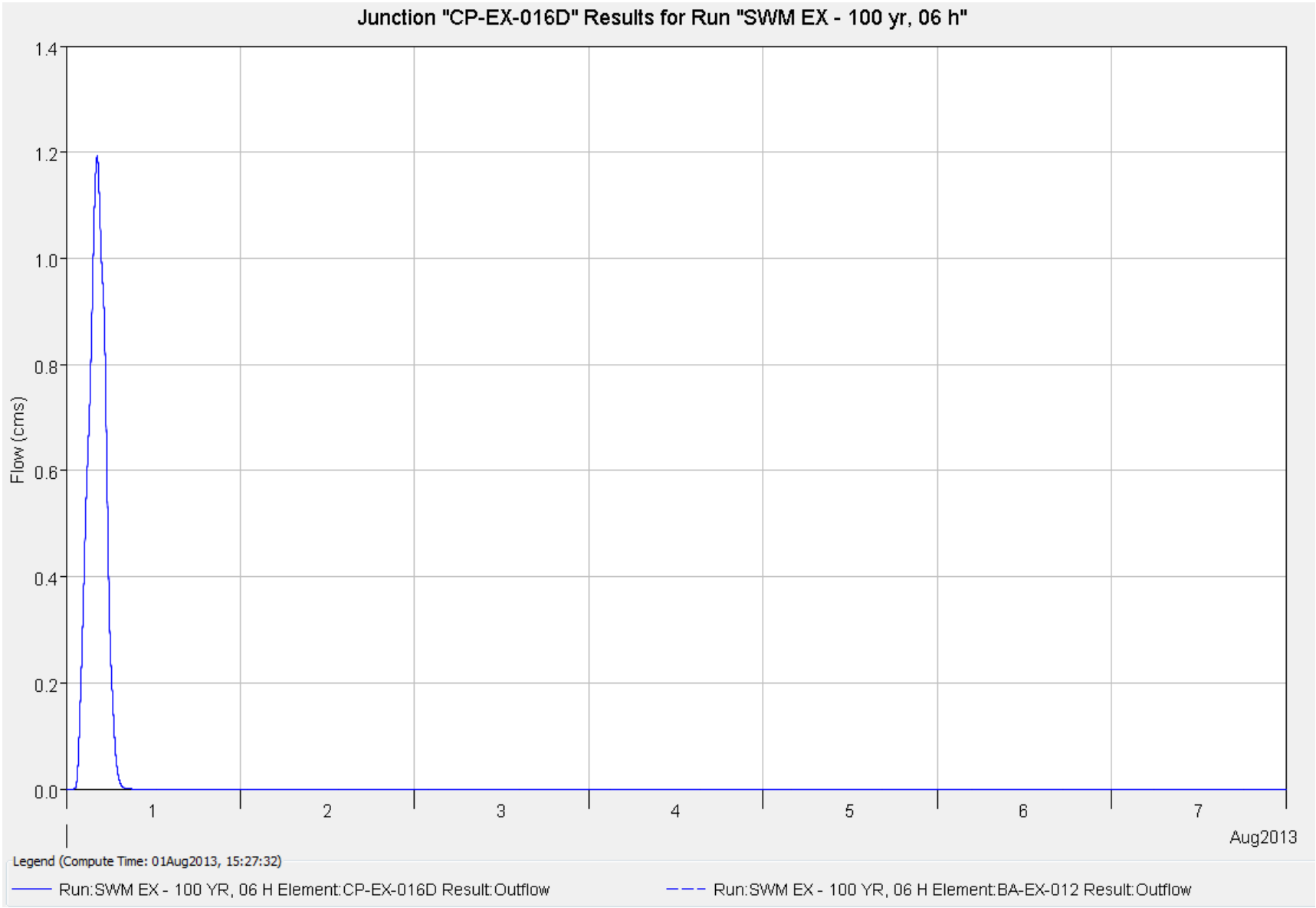

Junction "CP-EX-014" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-014 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-010 Result:Outflow

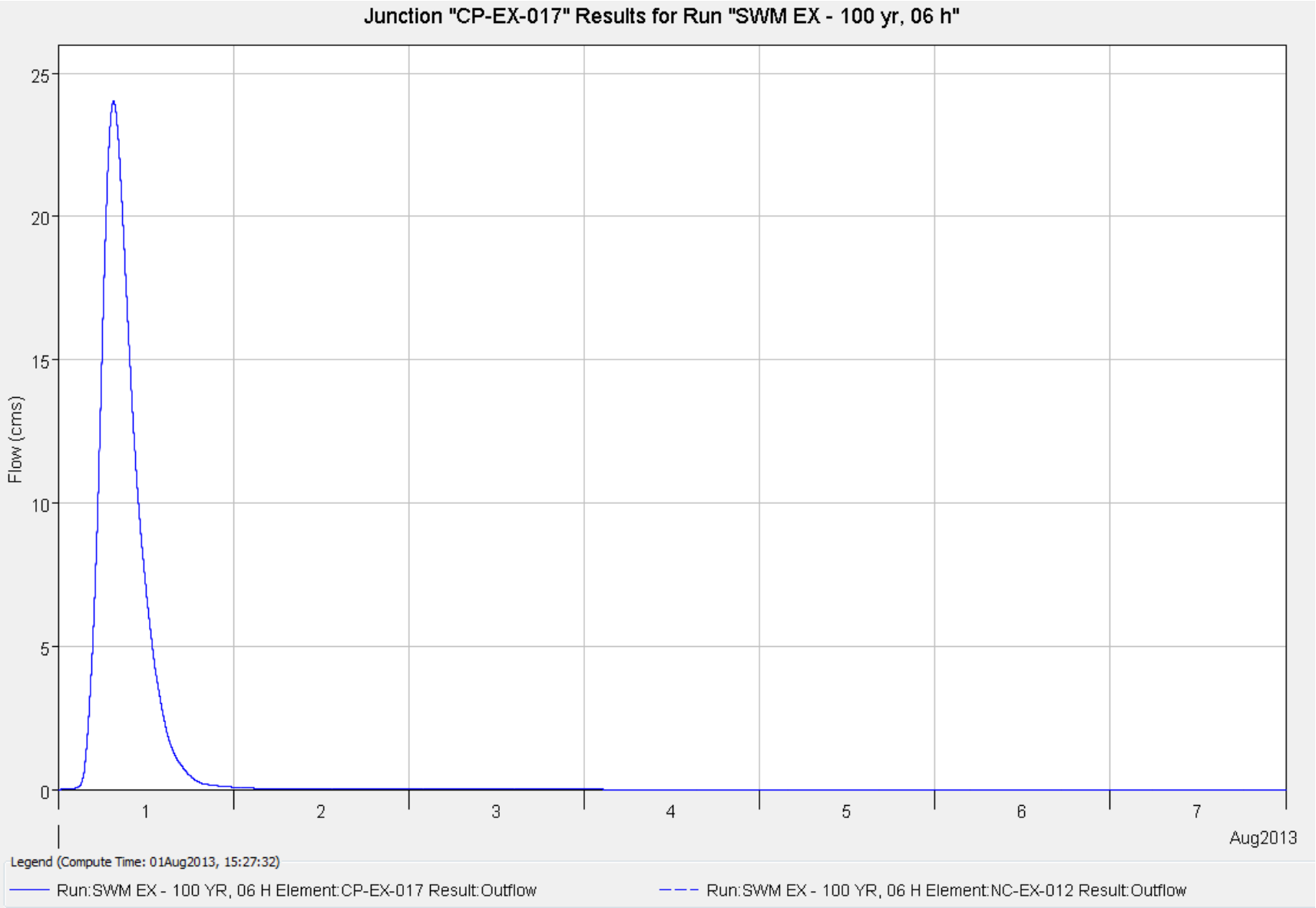

Junction "CP-EX-015" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-015 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-002 Result:Outflow

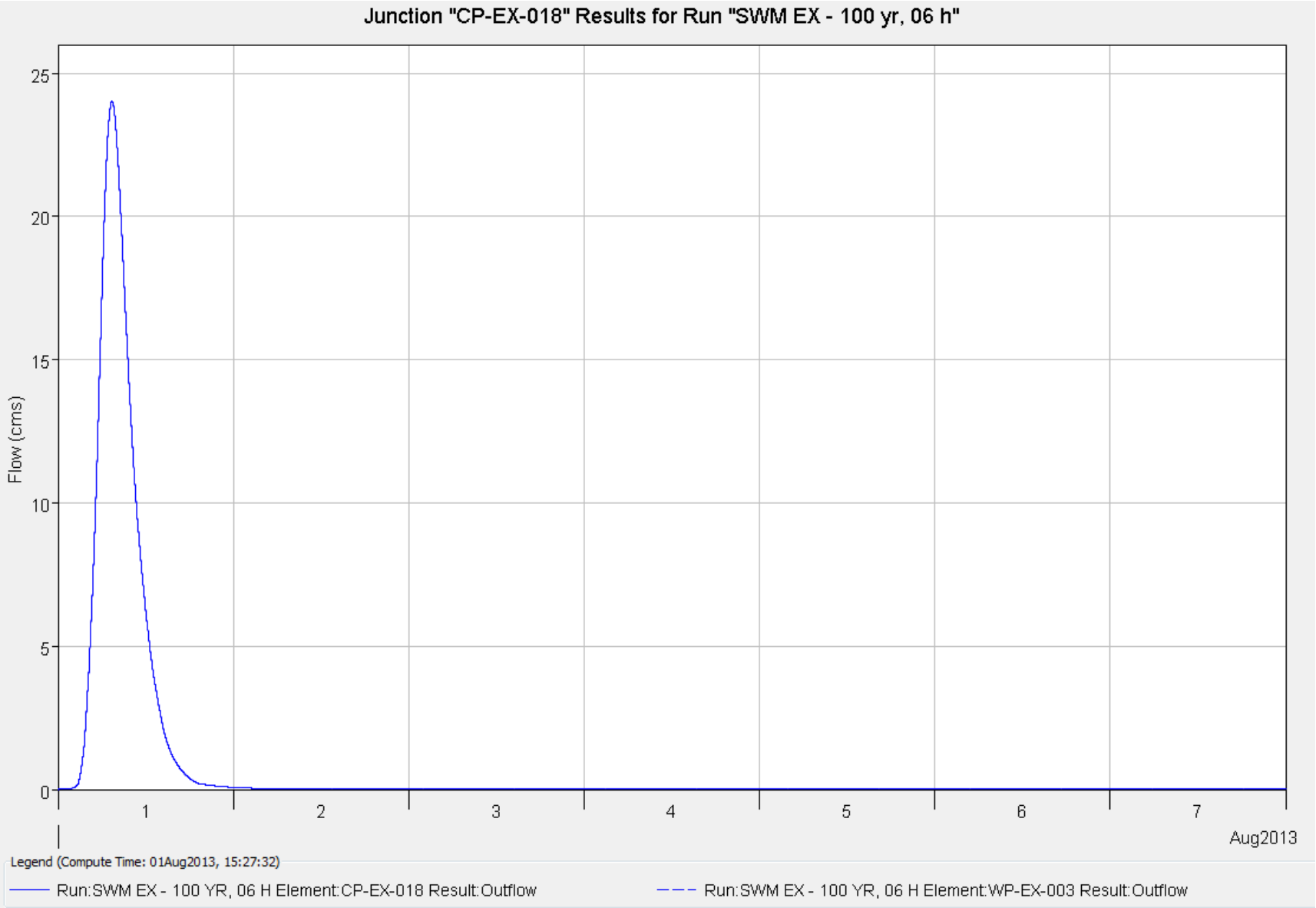

Junction "CP-EX-016A" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 yr, 06 h Element:CP-EX-016A Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-011 Result:Outflow

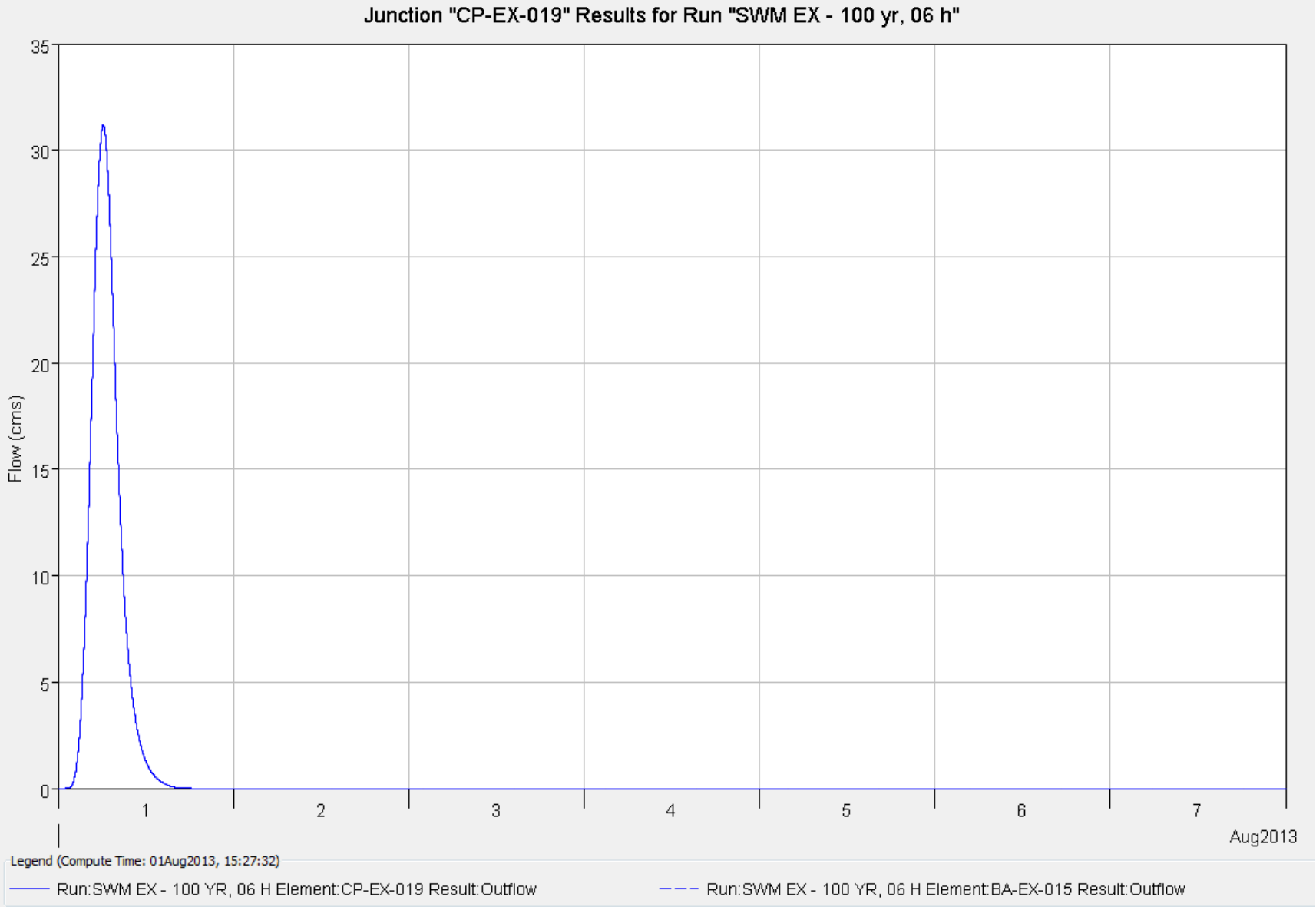

Junction "CP-EX-016B" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-016B Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-013 Result:Outflow

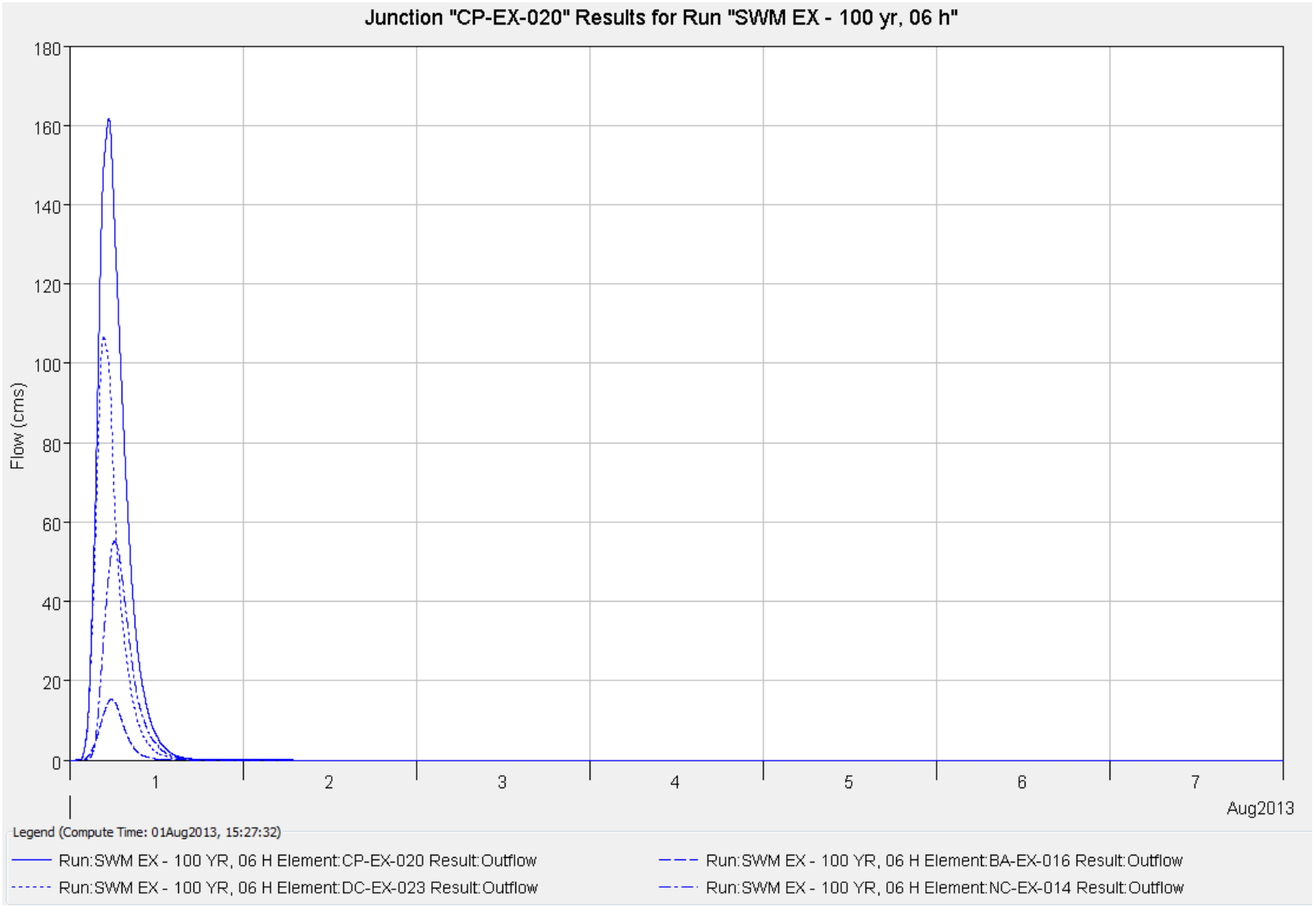

Junction "CP-EX-016C" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-016C Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-011 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-014 Result:Outflow

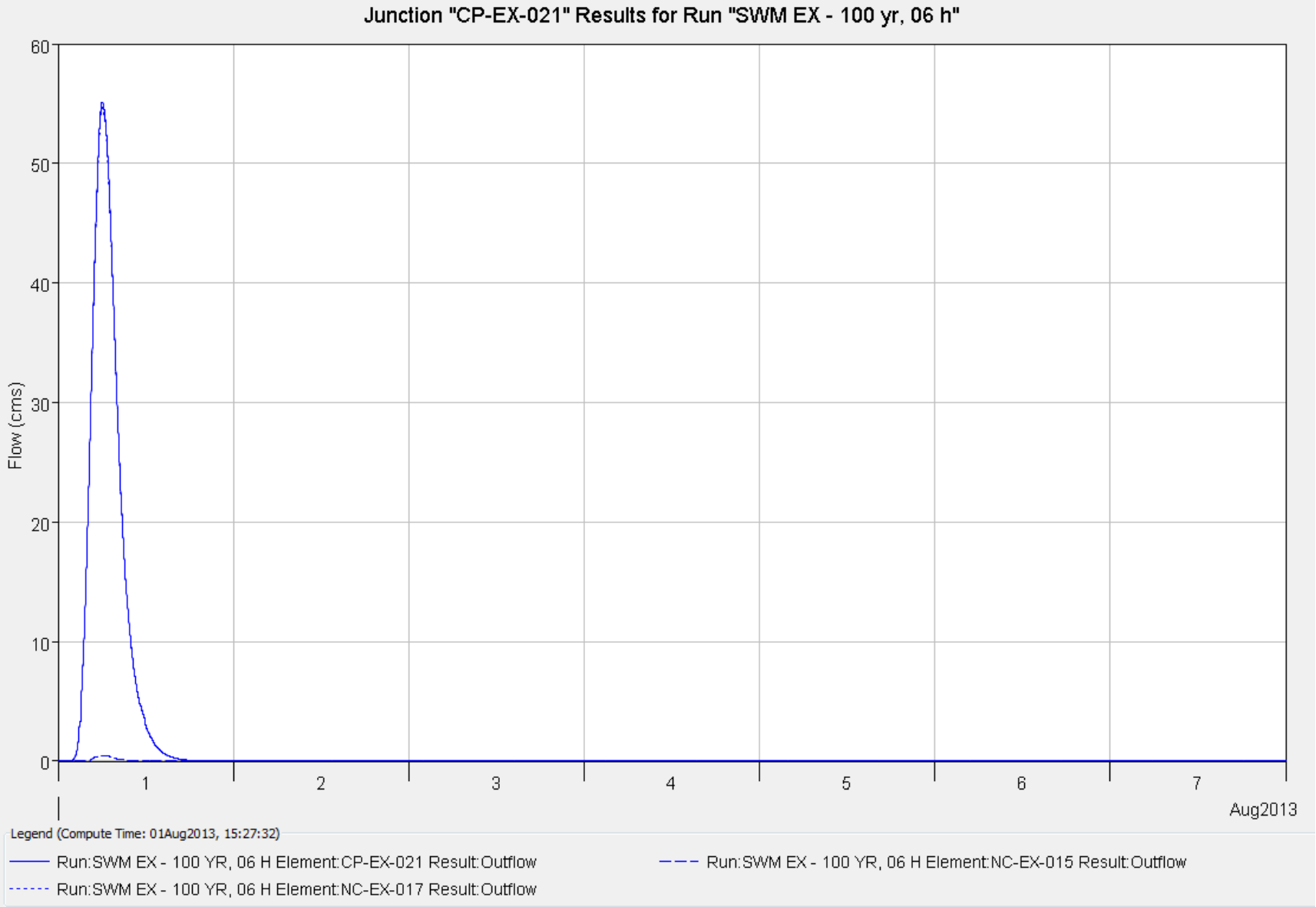

Junction "CP-EX-016D" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-016D Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-012 Result:Outflow

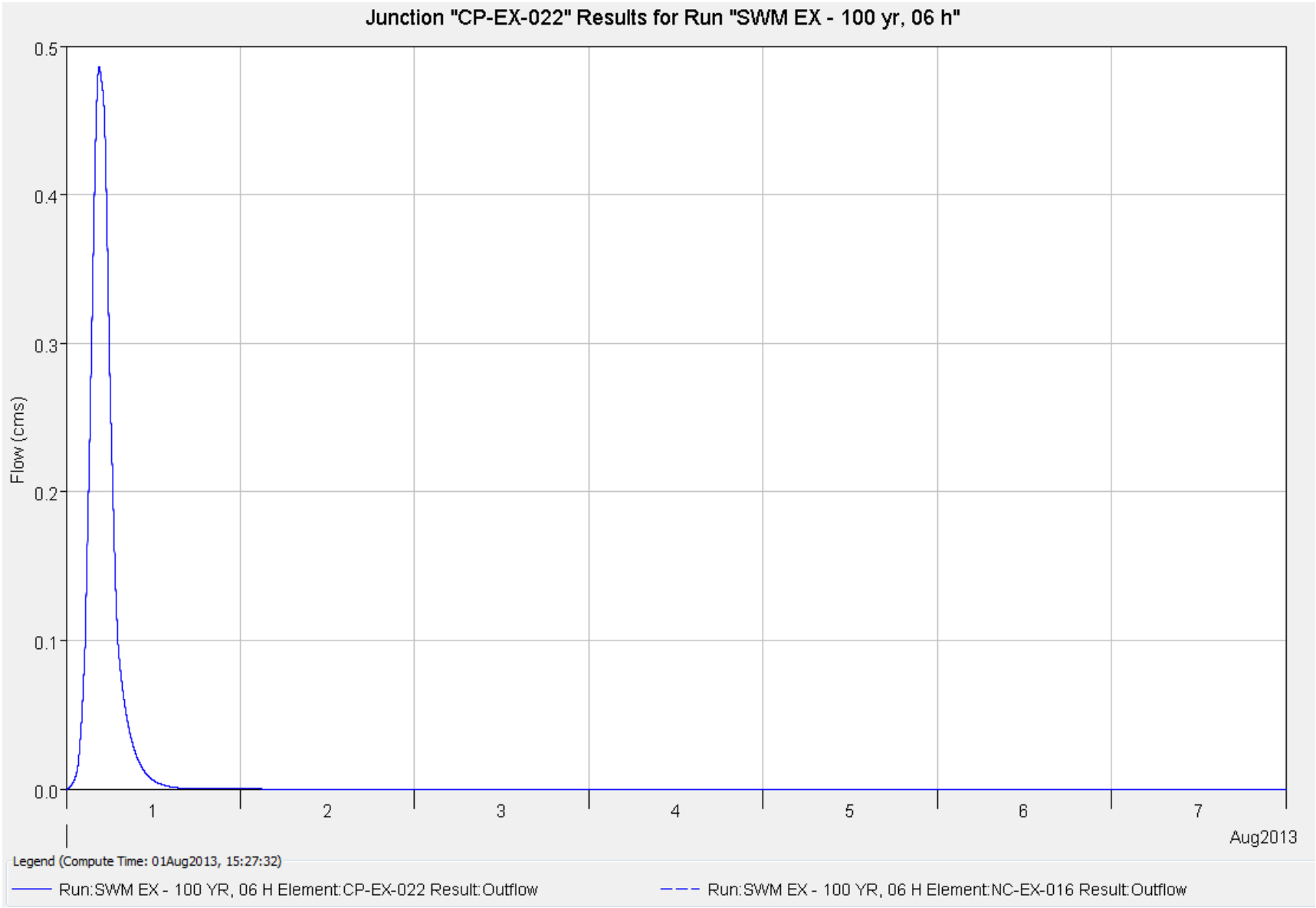

Junction "CP-EX-017" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-017 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-012 Result:Outflow

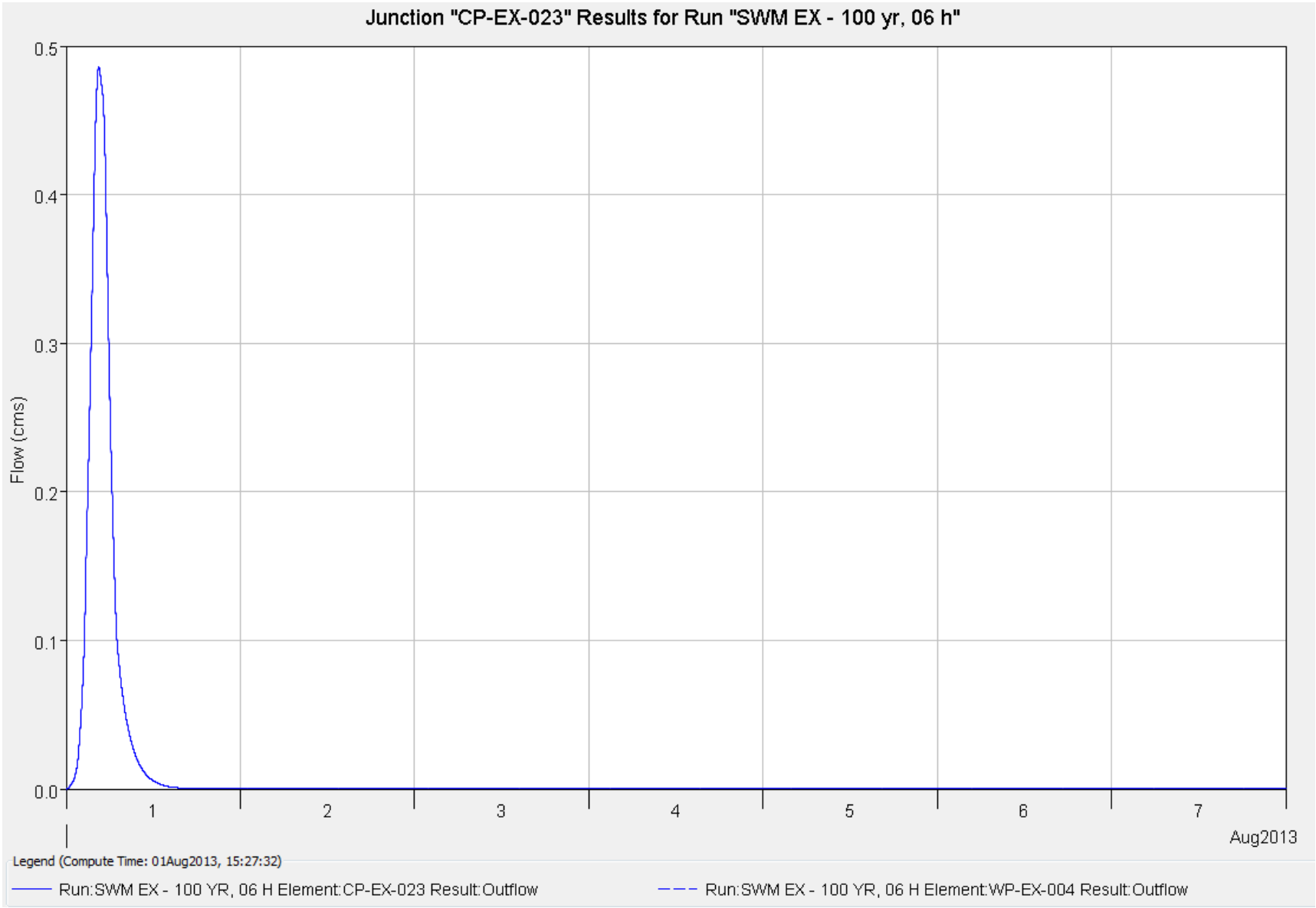

Junction "CP-EX-018" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-018 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-003 Result:Outflow

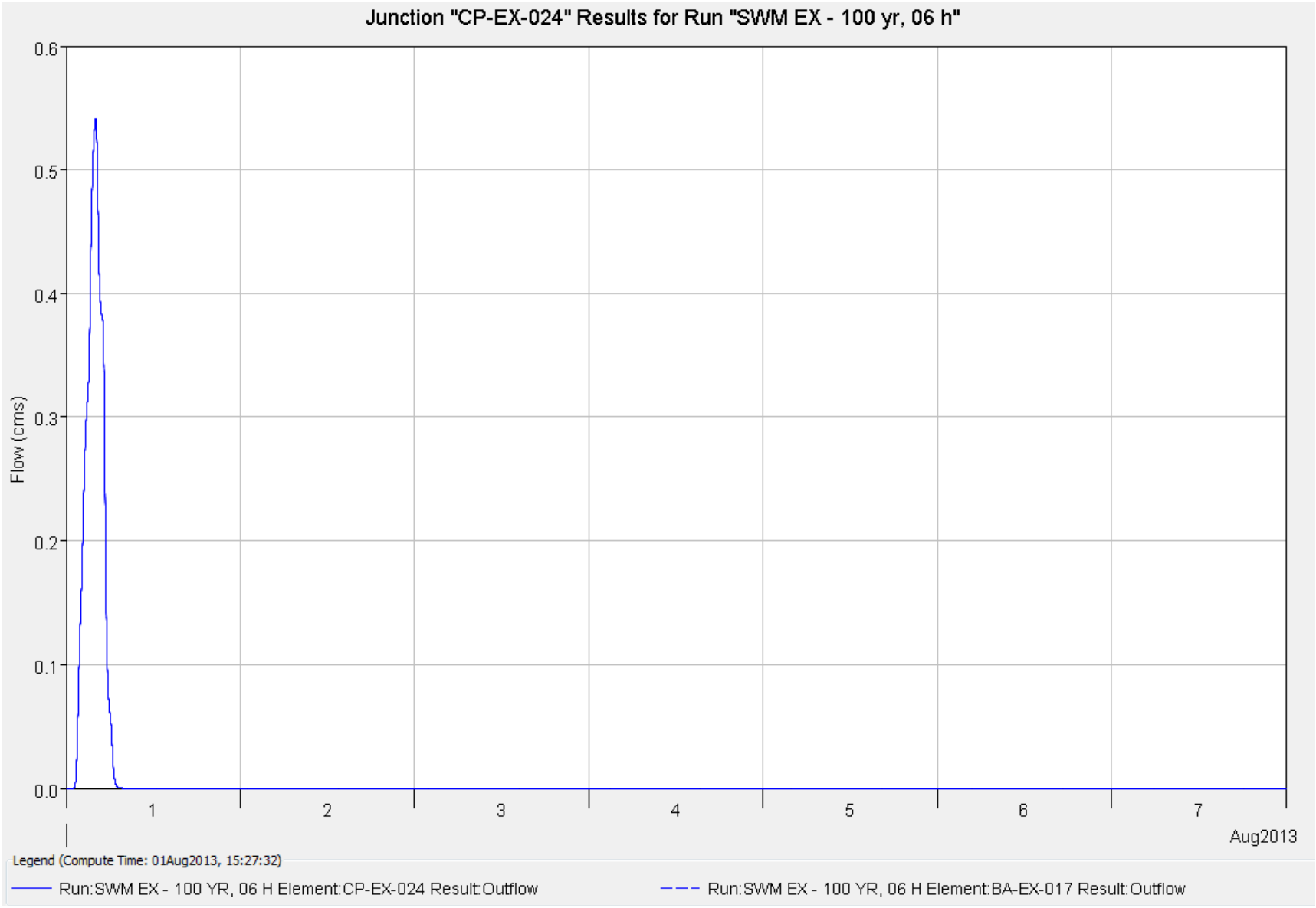

Junction "CP-EX-019" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-019 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-015 Result:Outflow

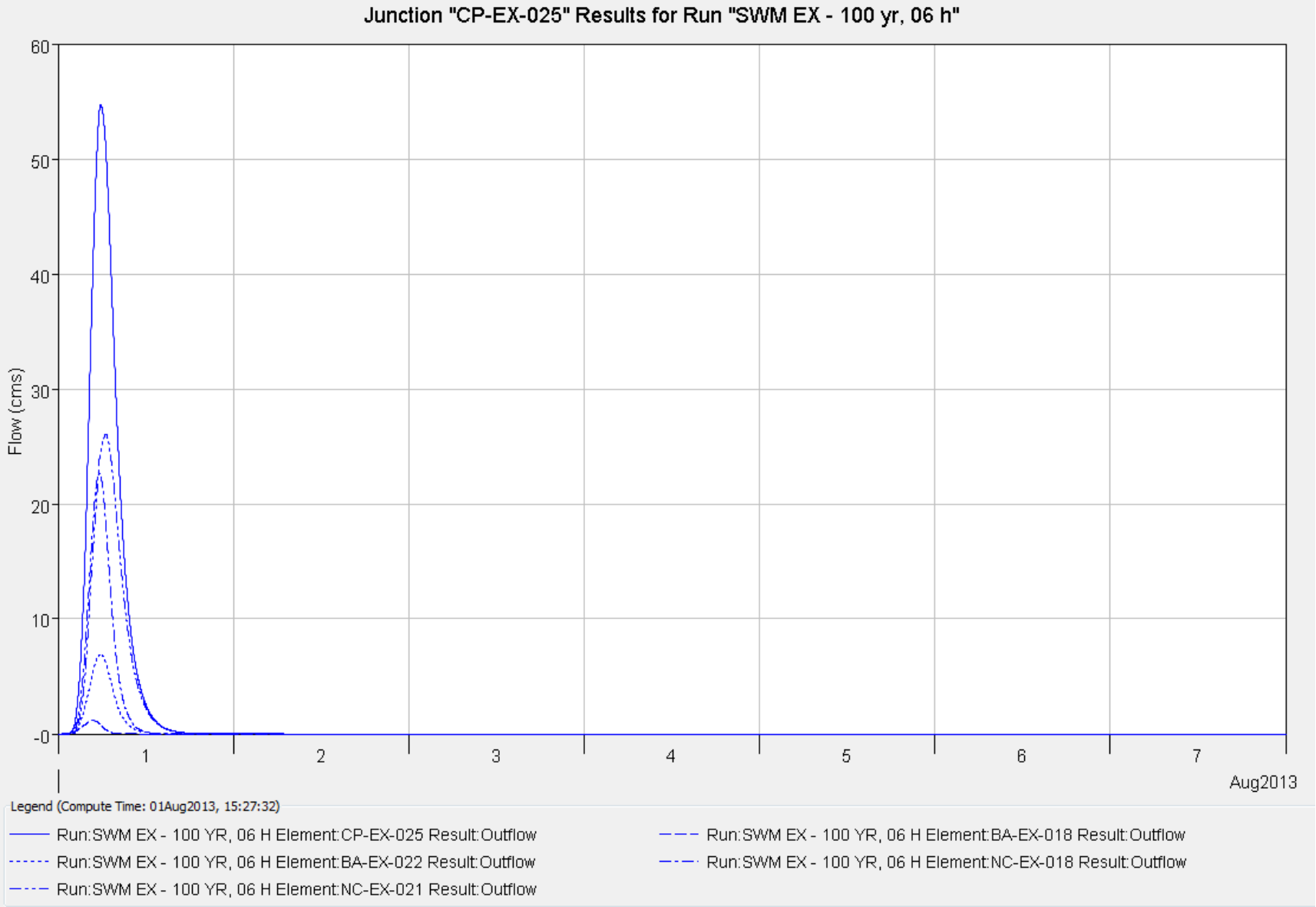

Junction "CP-EX-020" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-020 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-016 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-014 Result:Outflow

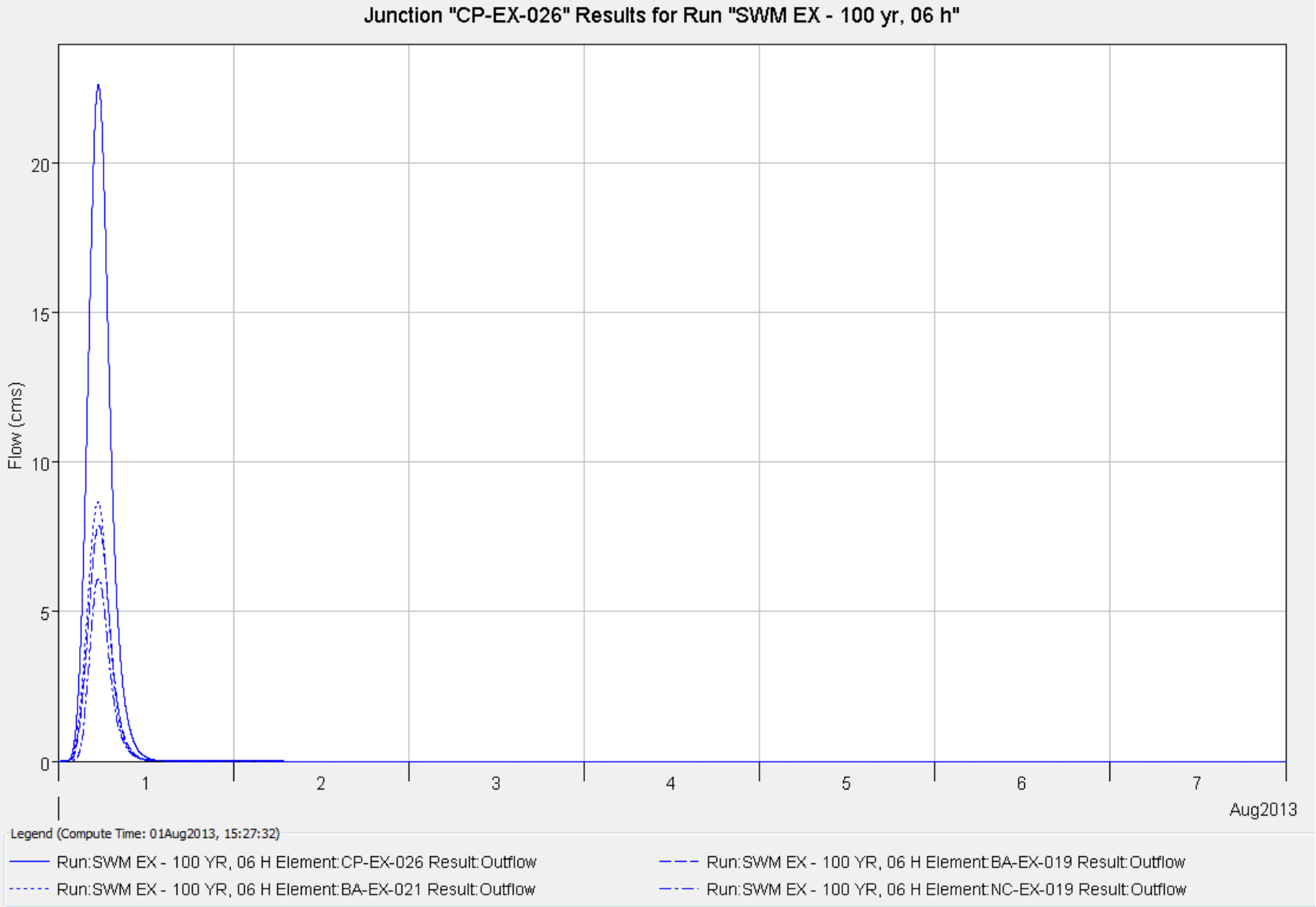

Junction "CP-EX-021" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-015 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-017 Result:Outflow

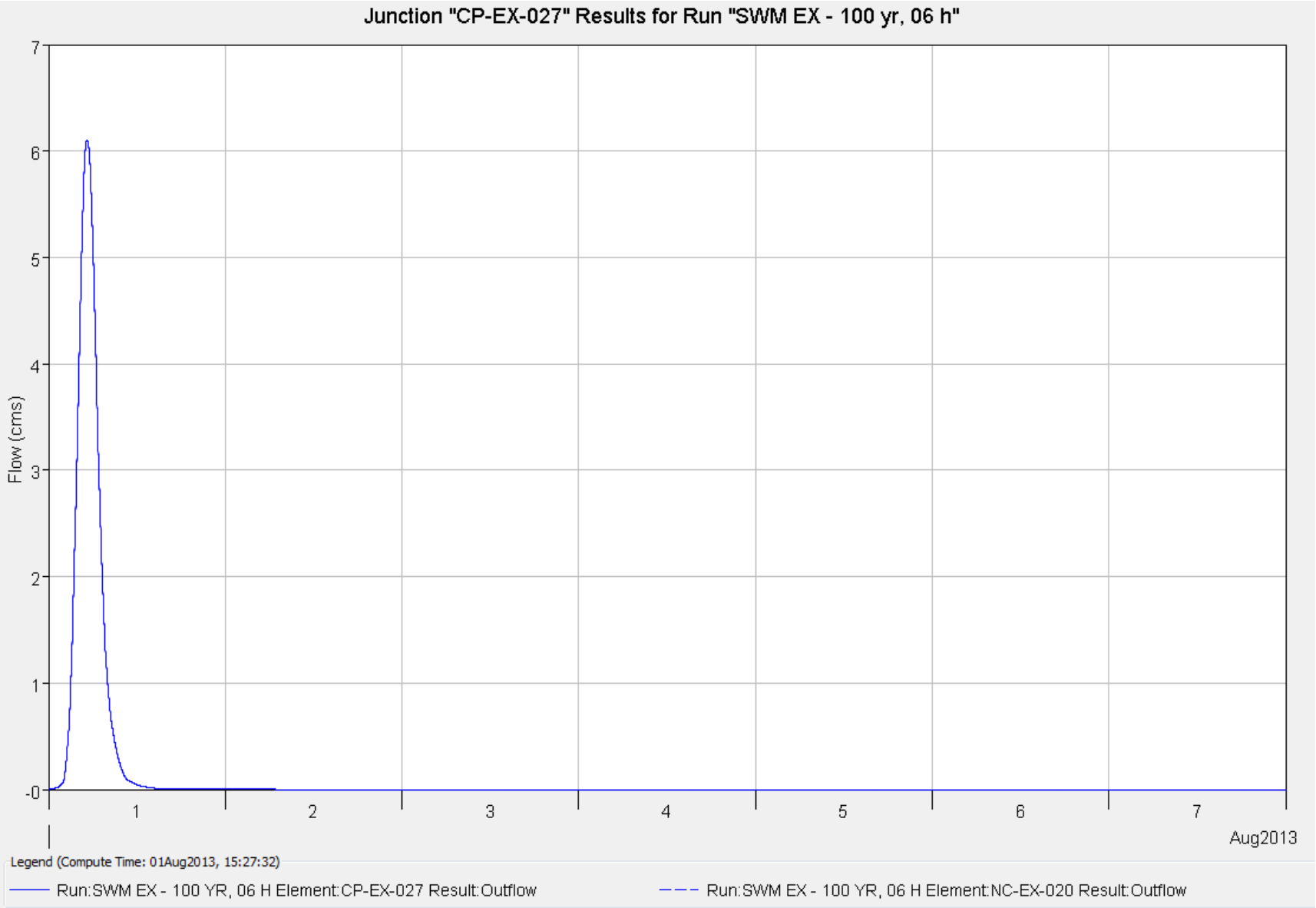

Junction "CP-EX-022" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-022 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-016 Result:Outflow

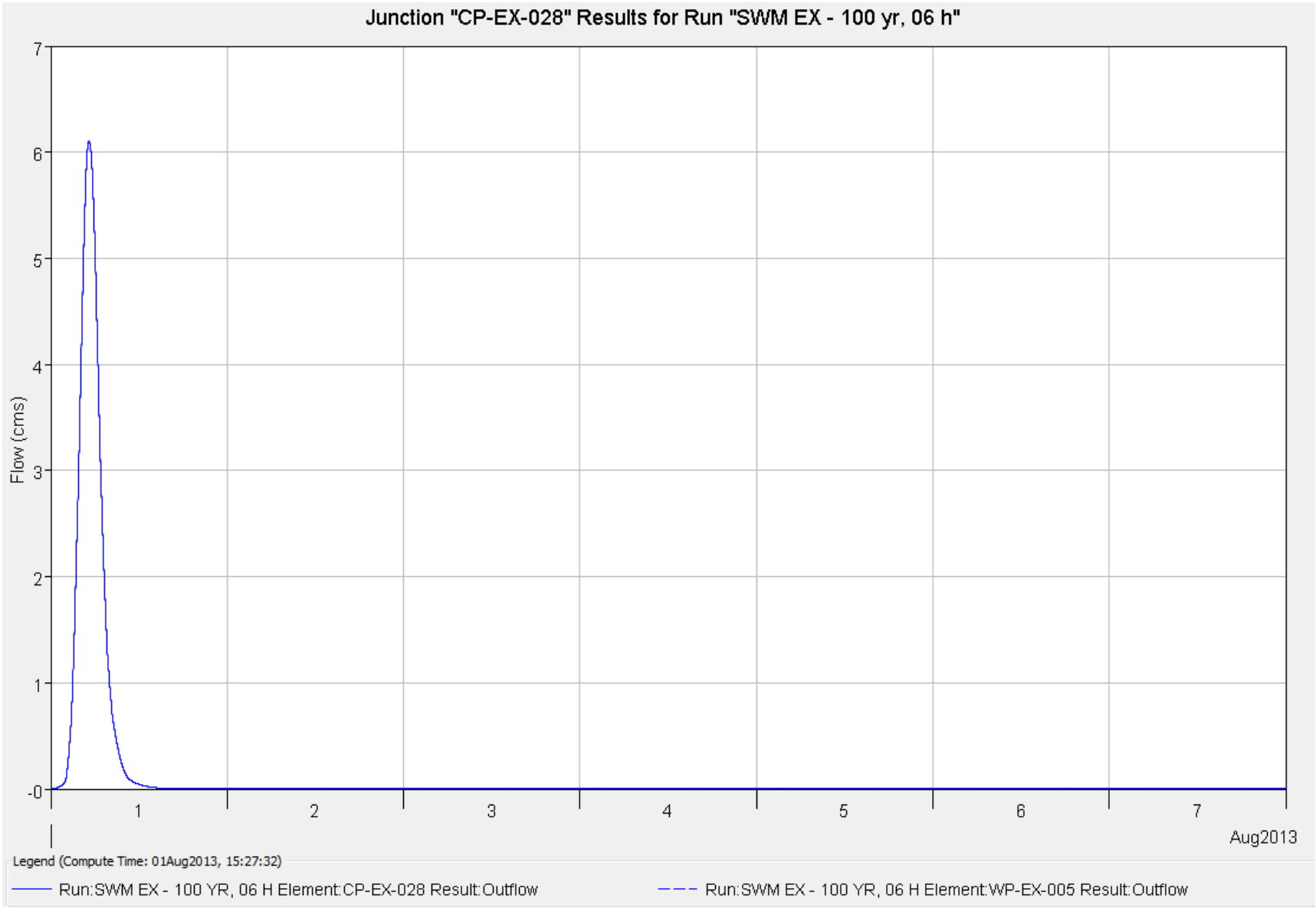

Junction "CP-EX-023" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-004 Result:Outflow

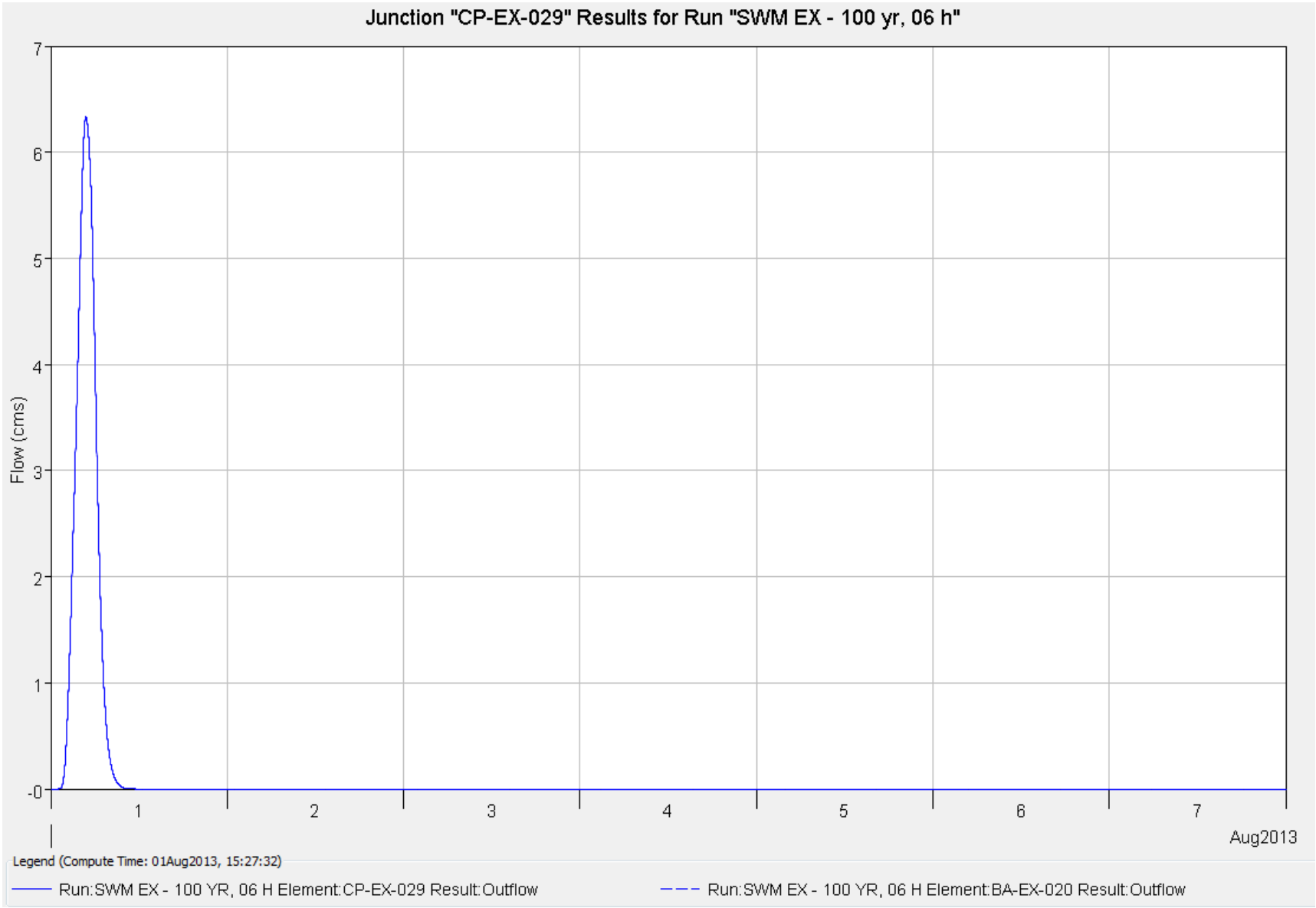

Junction "CP-EX-024" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-024 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-017 Result:Outflow

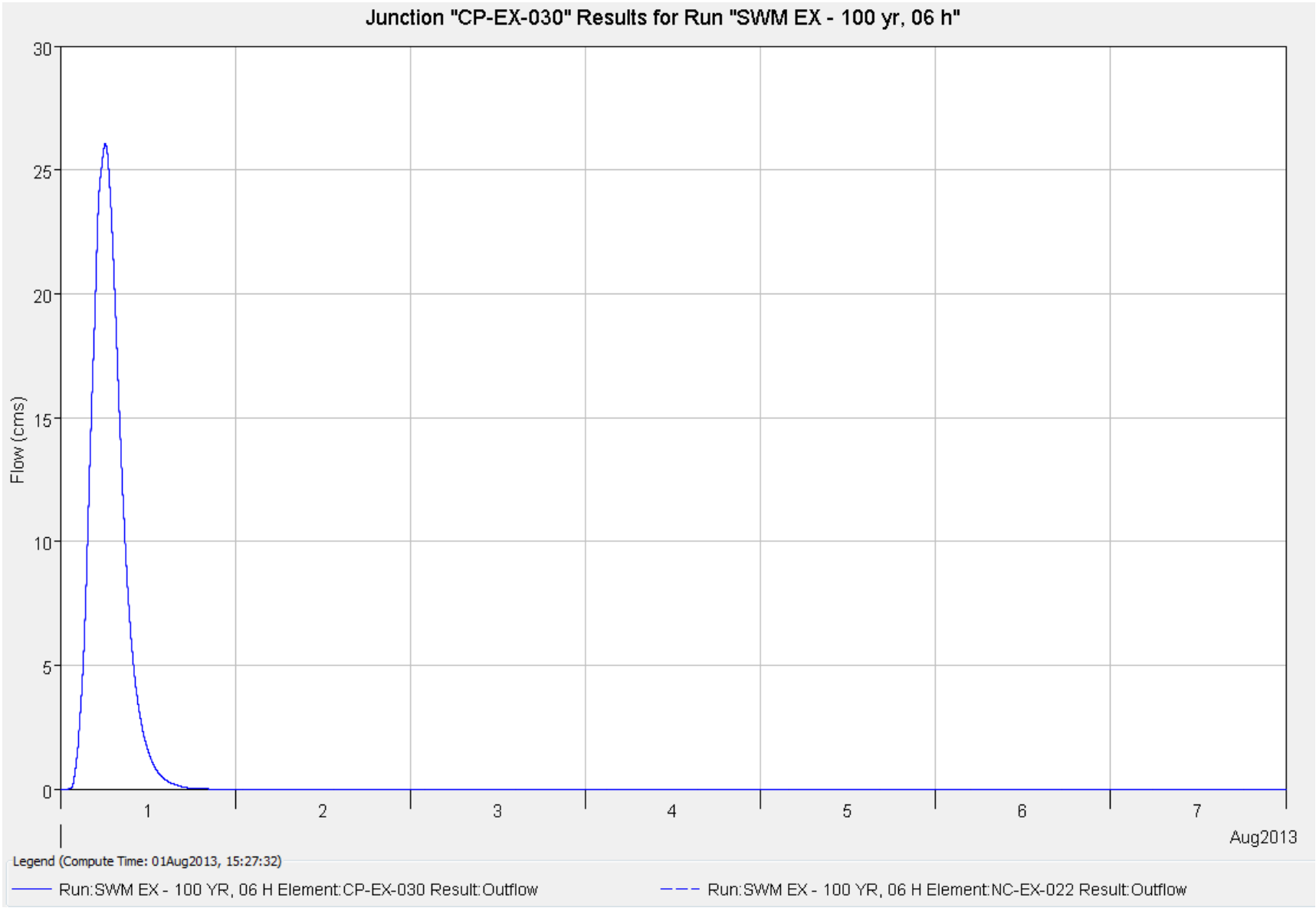

Junction "CP-EX-025" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-025 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-022 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-018 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-018 Result:Outflow

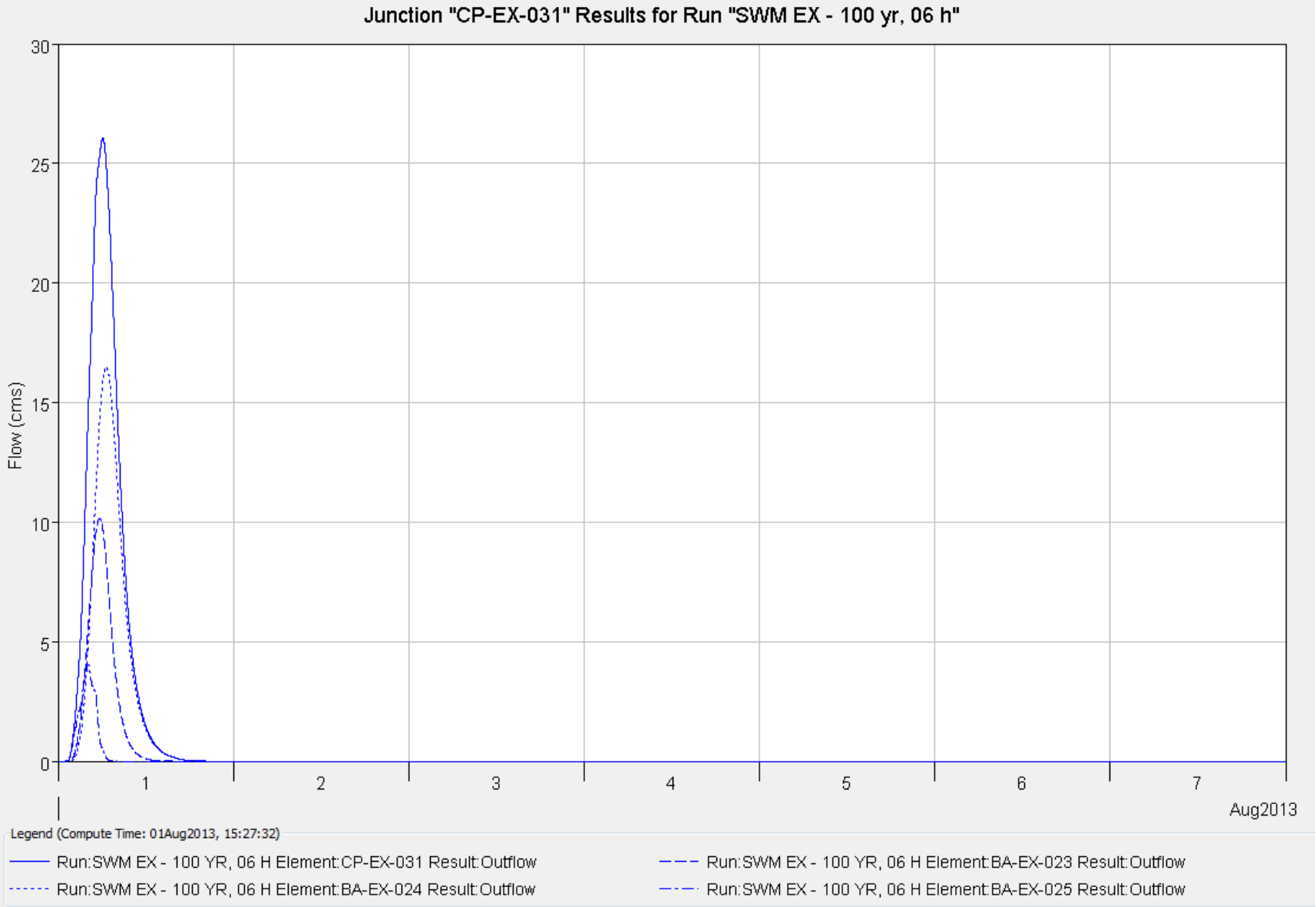

Junction "CP-EX-026" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-019 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-019 Result:Outflow

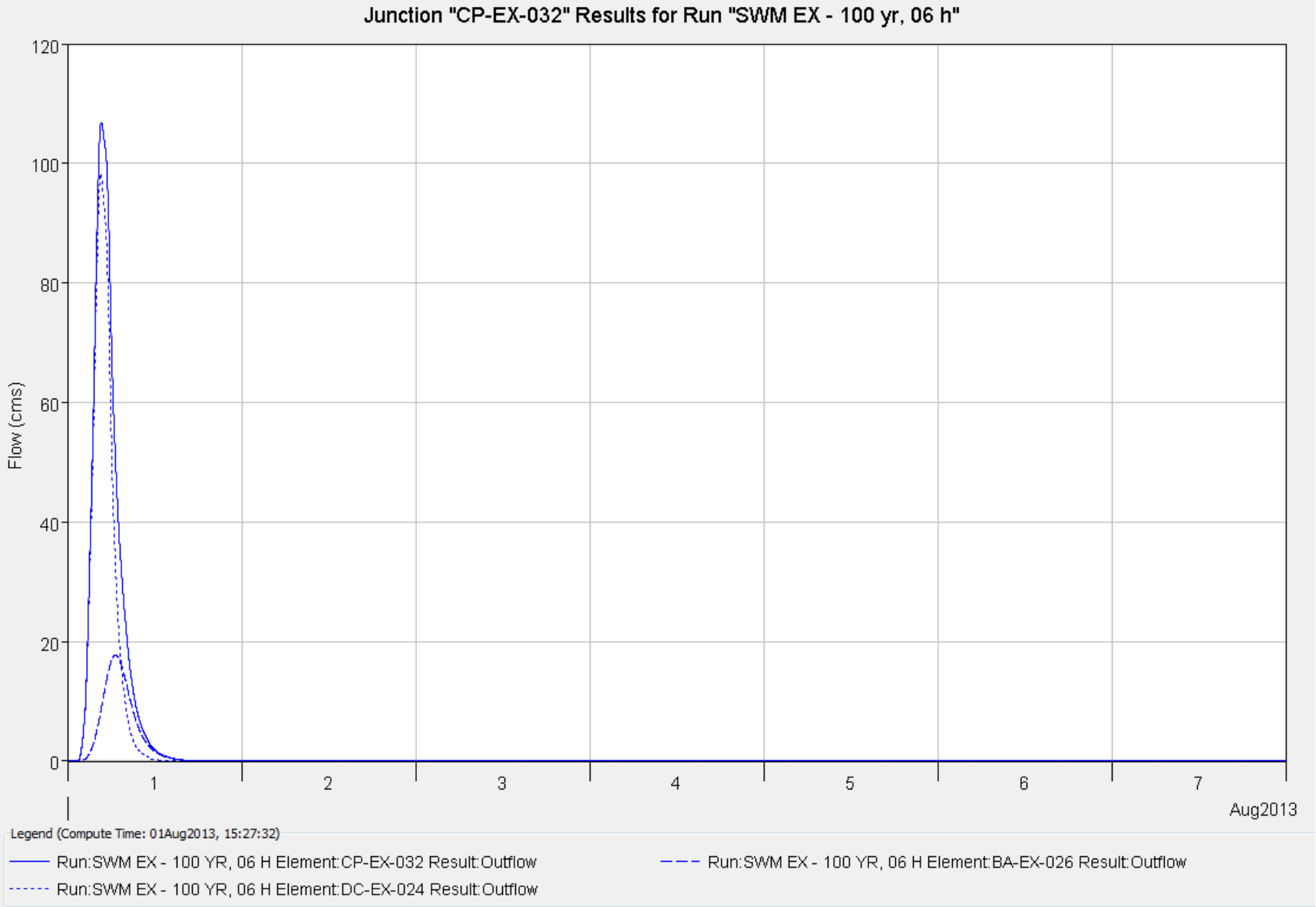

Junction "CP-EX-027" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-027 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-020 Result:Outflow

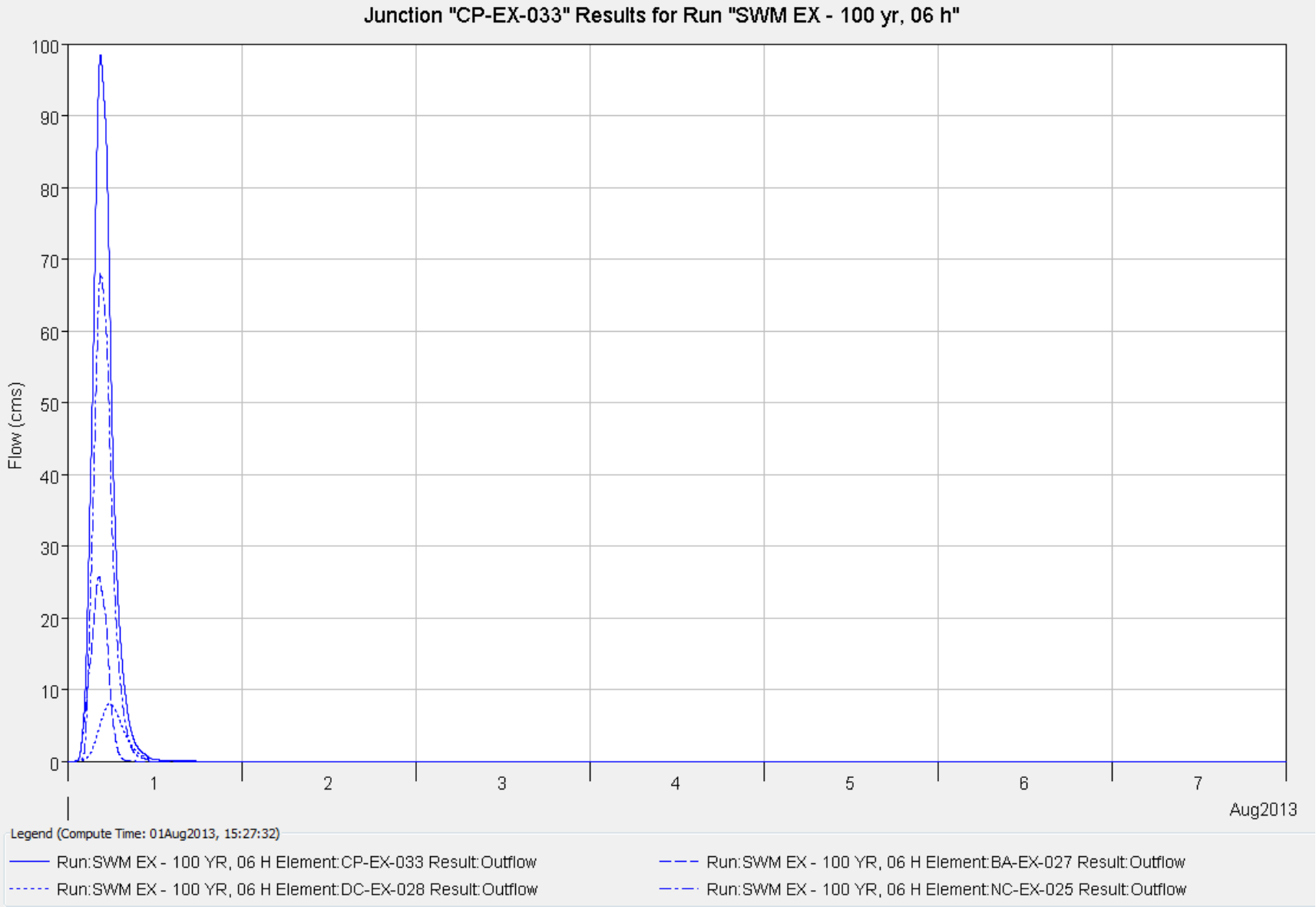

Junction "CP-EX-028" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-005 Result:Outflow

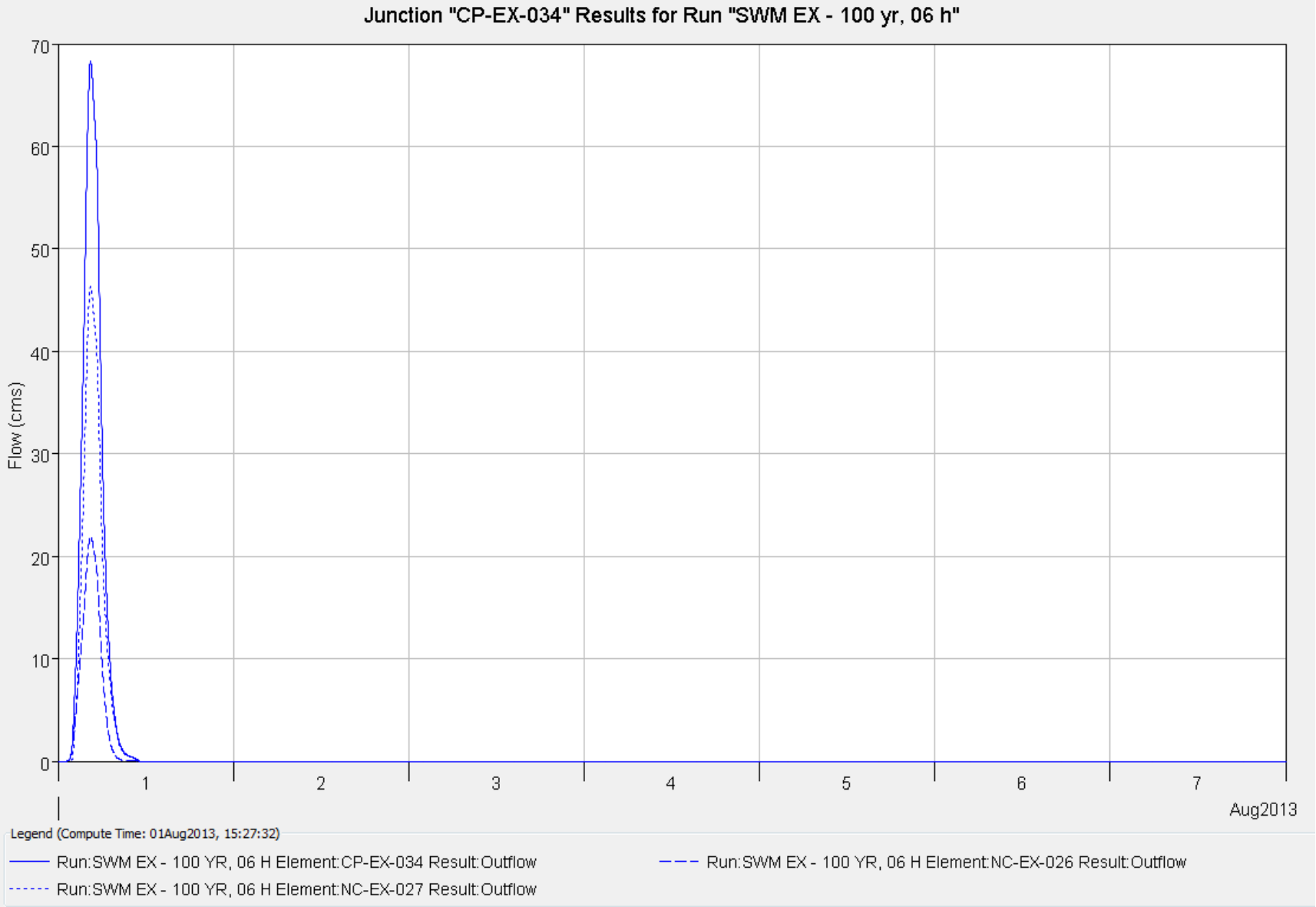

Junction "CP-EX-029" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-029 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-020 Result:Outflow

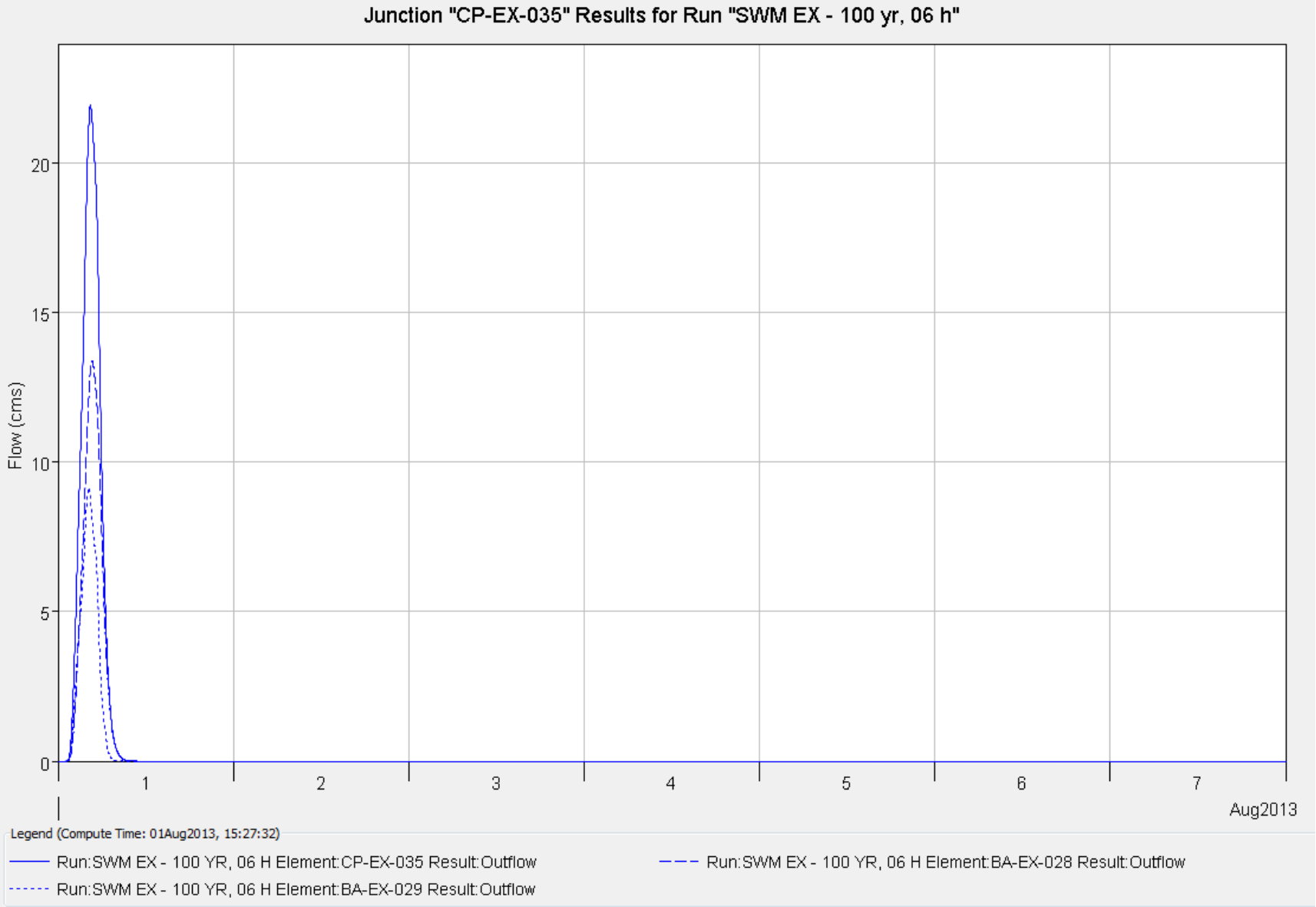

Junction "CP-EX-030" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-030 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-022 Result:Outflow

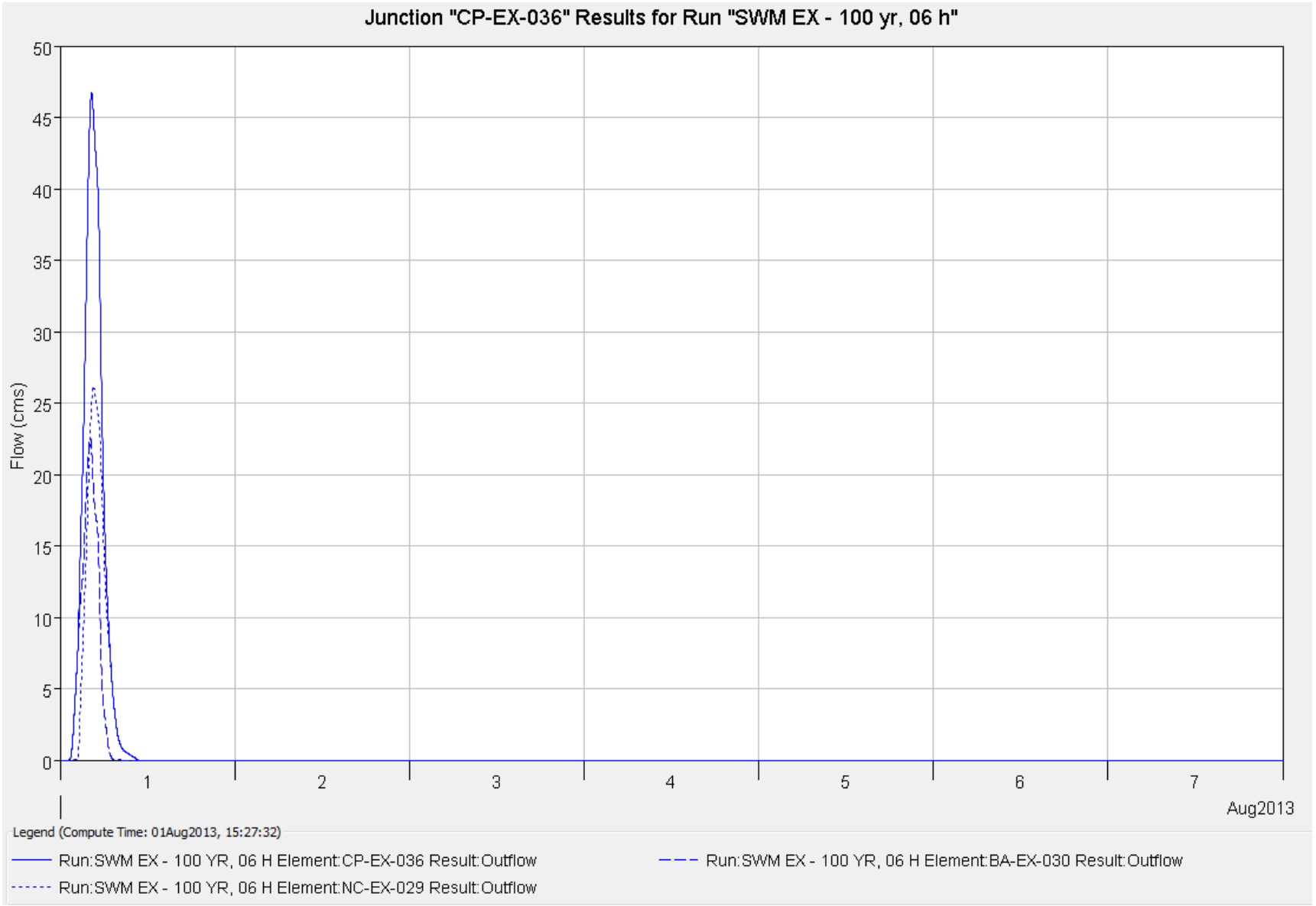

Junction "CP-EX-031" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-031 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-024 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-025 Result:Outflow

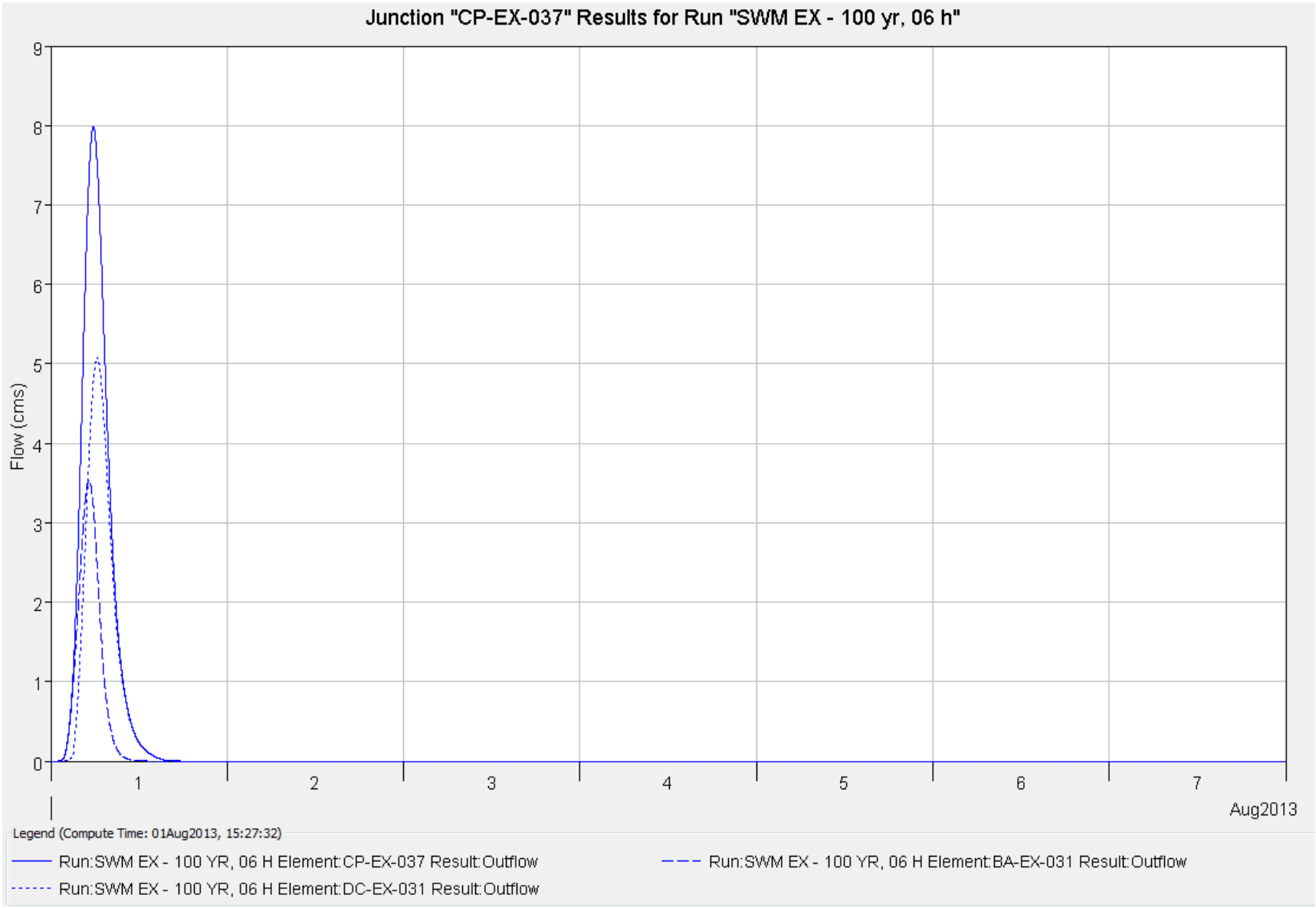

Junction "CP-EX-032" Results for Run "SWM EX - 100 yr, 06 h"
120
100
80
60
40
20
0
Flow (cms)
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-032 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-024 Result:Outflow

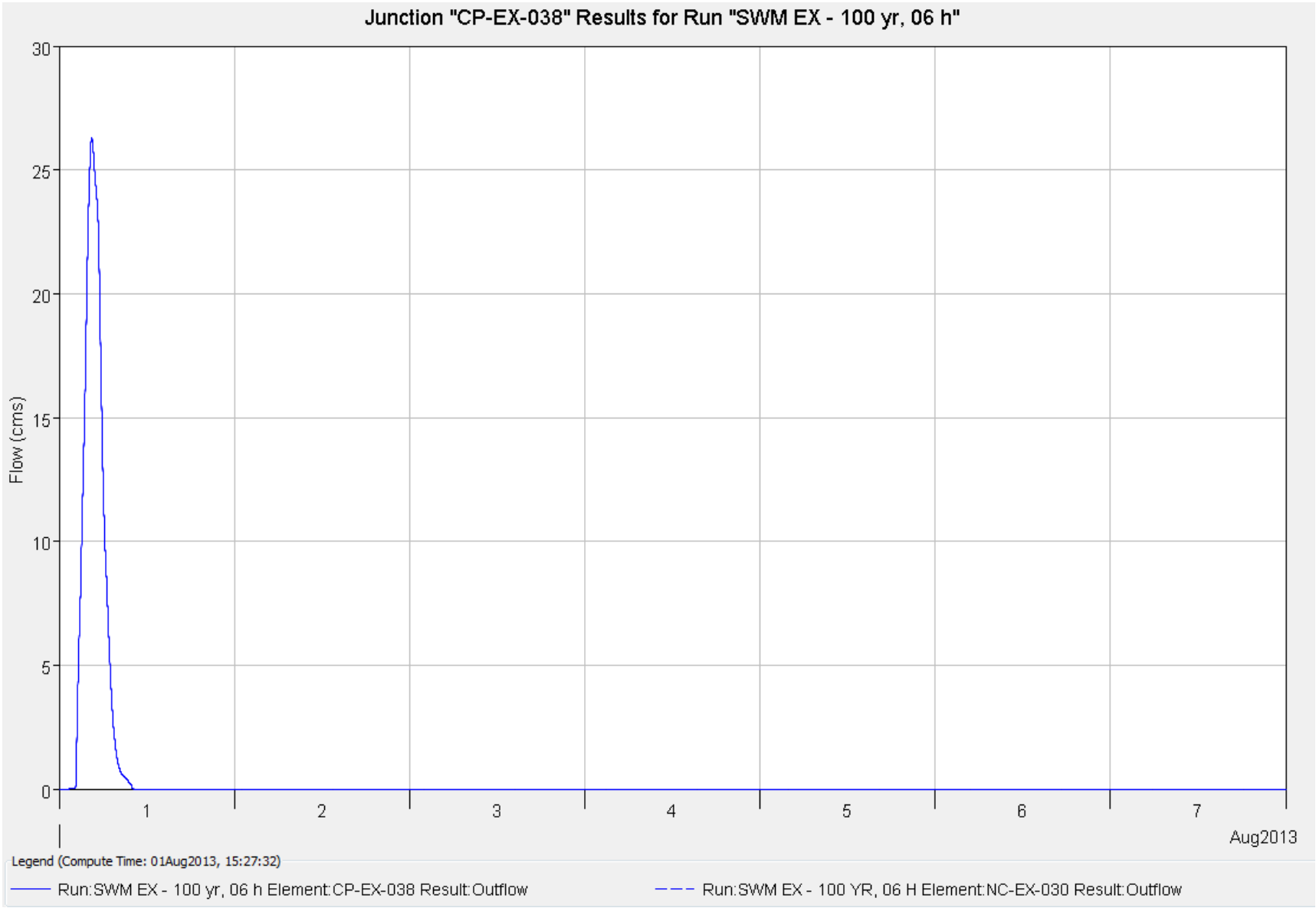

Junction "CP-EX-033" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-033 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-027 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-025 Result:Outflow

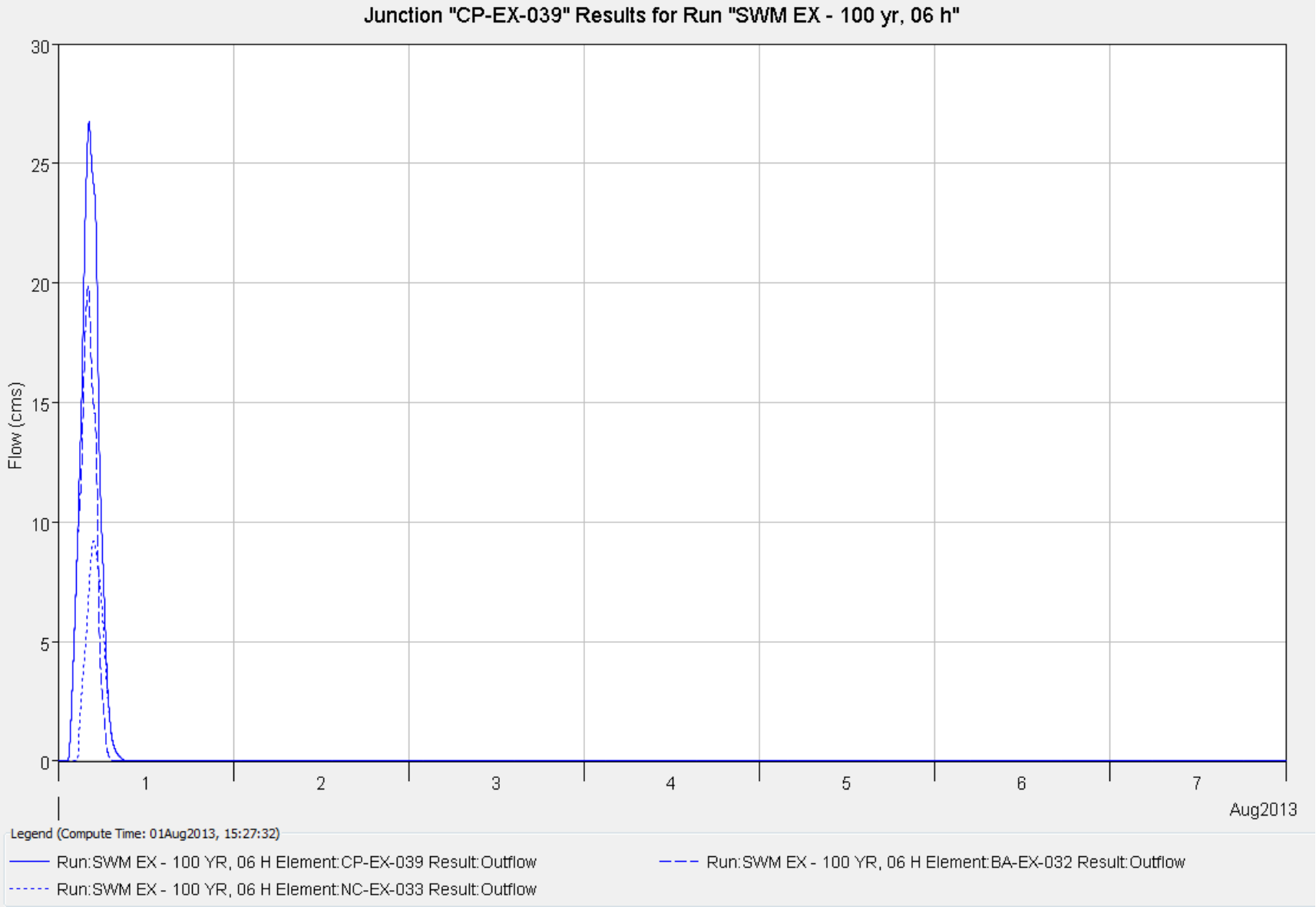

Junction "CP-EX-034" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-034 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-027 Result:Outflow

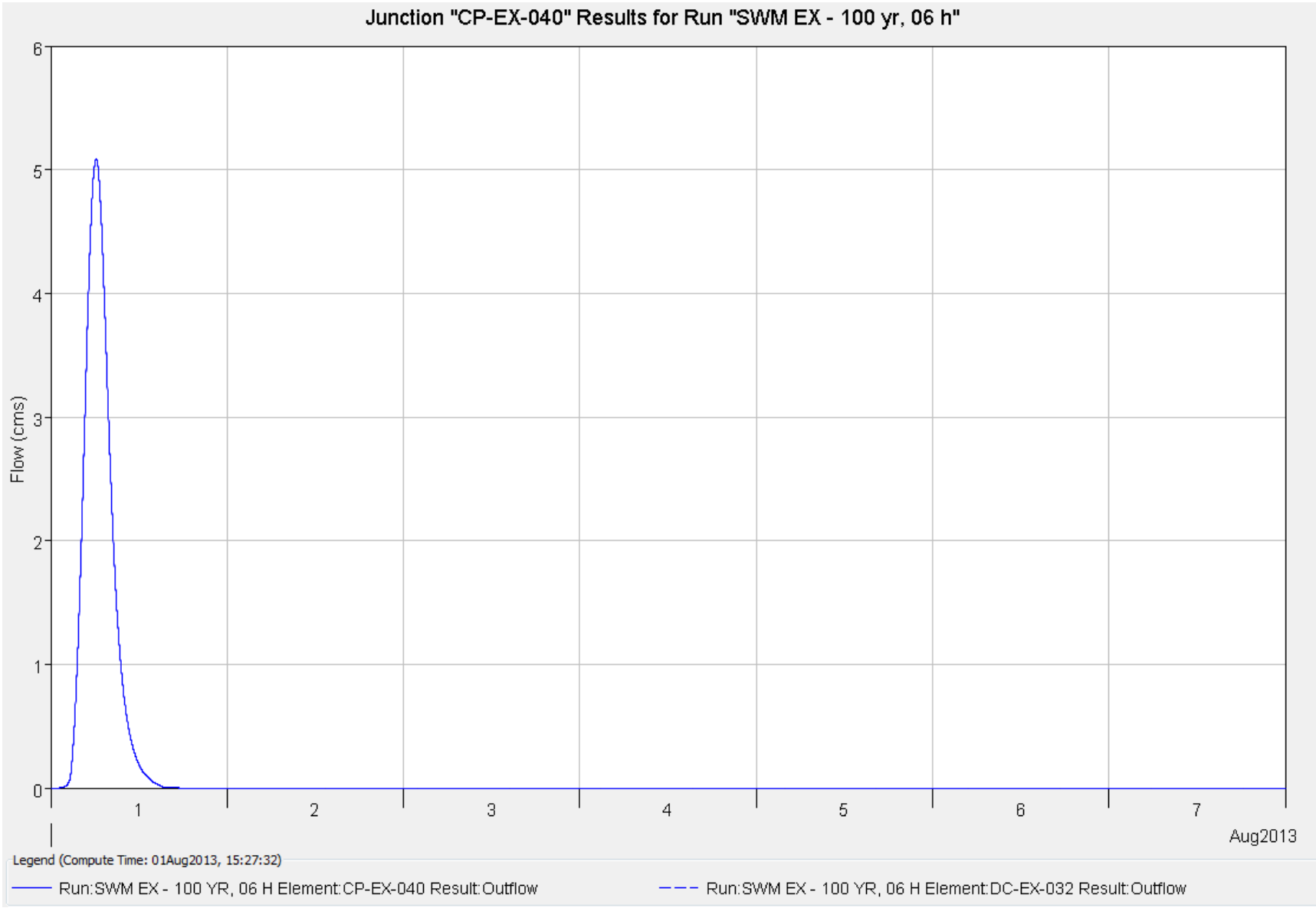

Junction "CP-EX-035" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-035 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-029 Result:Outflow

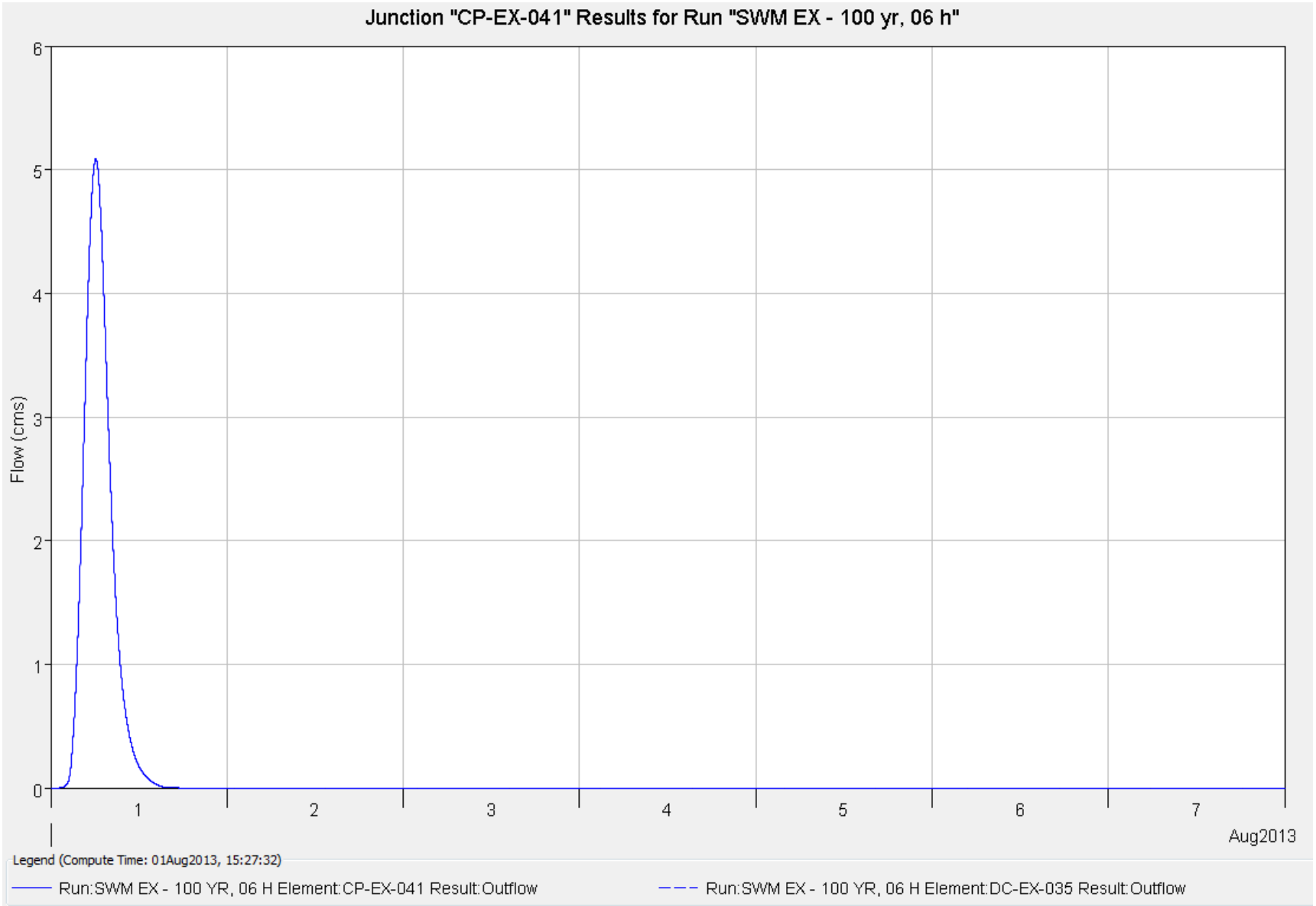

Junction "CP-EX-036" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-036 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-030 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-029 Result:Outflow

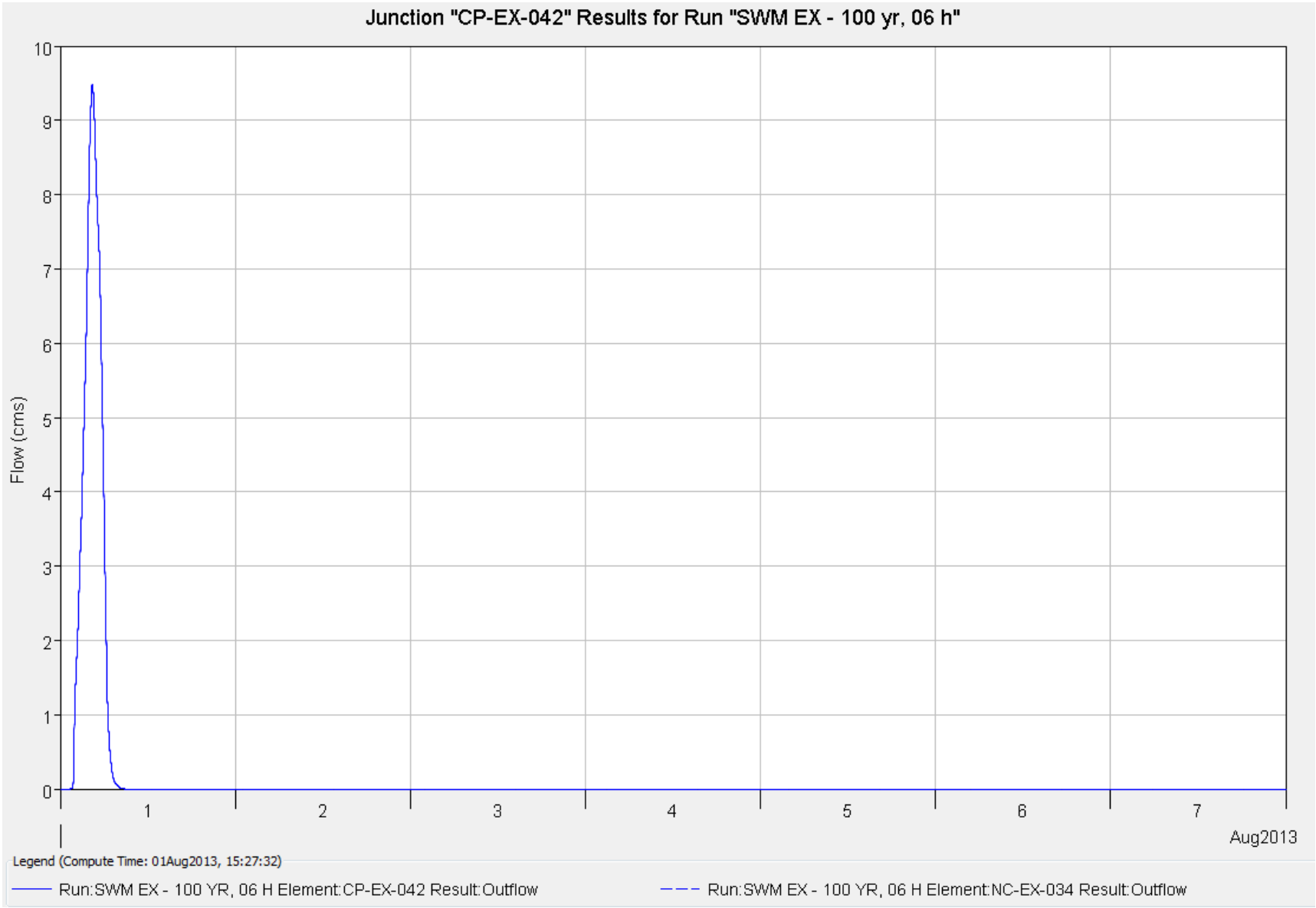

Junction "CP-EX-037" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-037 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-031 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-031 Result:Outflow

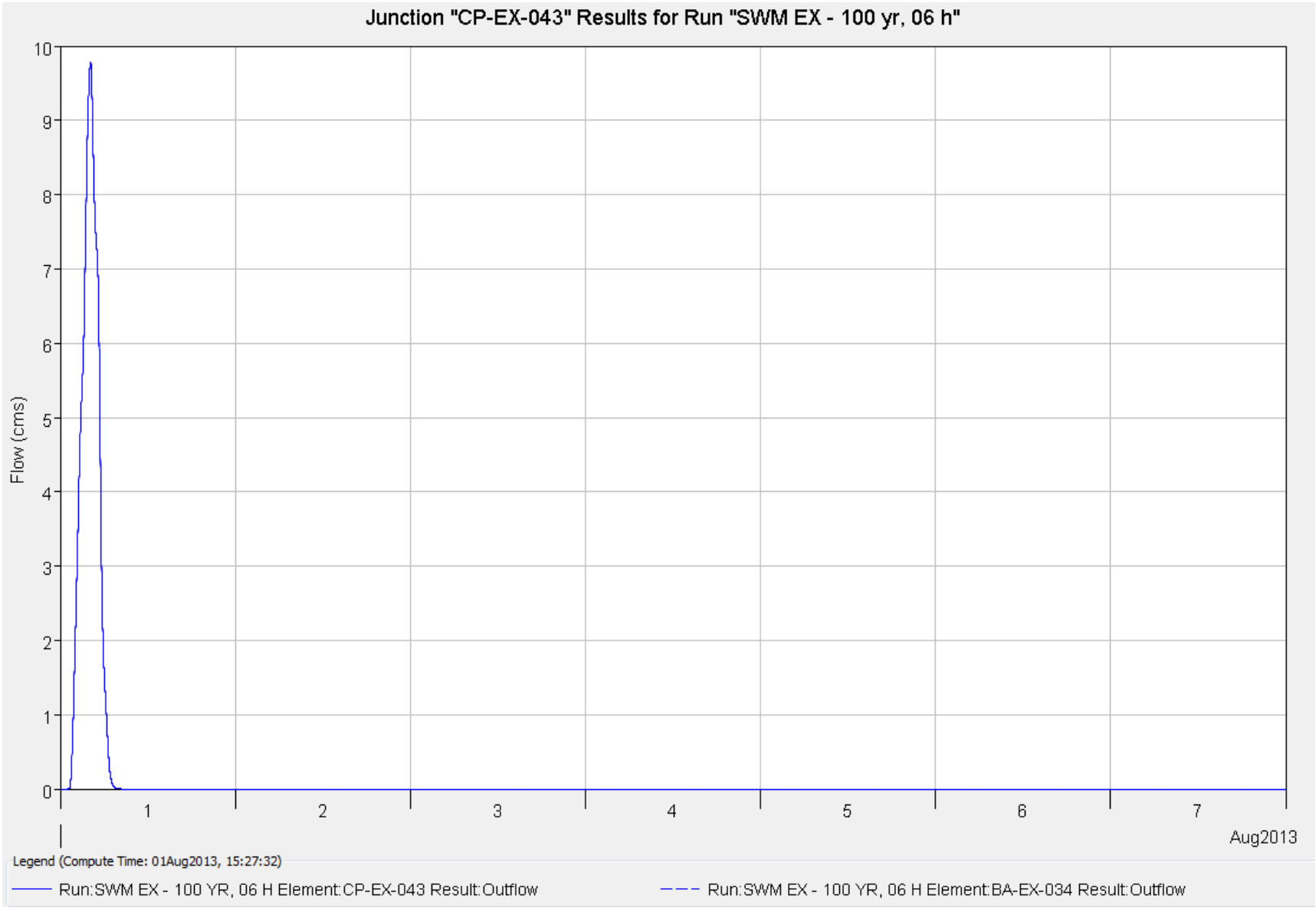

Junction "CP-EX-038" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 yr, 06 h Element:CP-EX-038 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-030 Result:Outflow

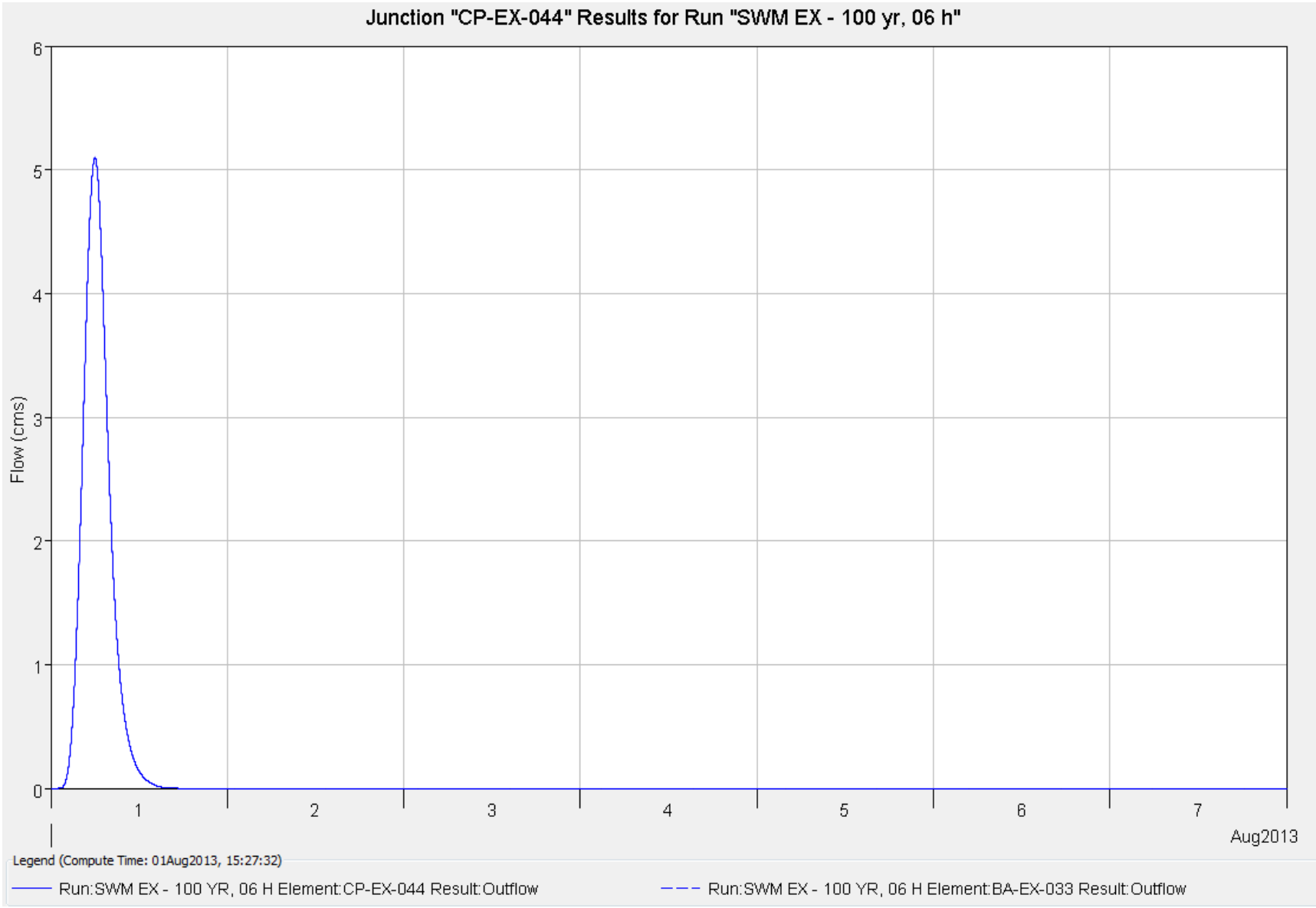

Junction "CP-EX-039" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-039 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-032 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-033 Result:Outflow

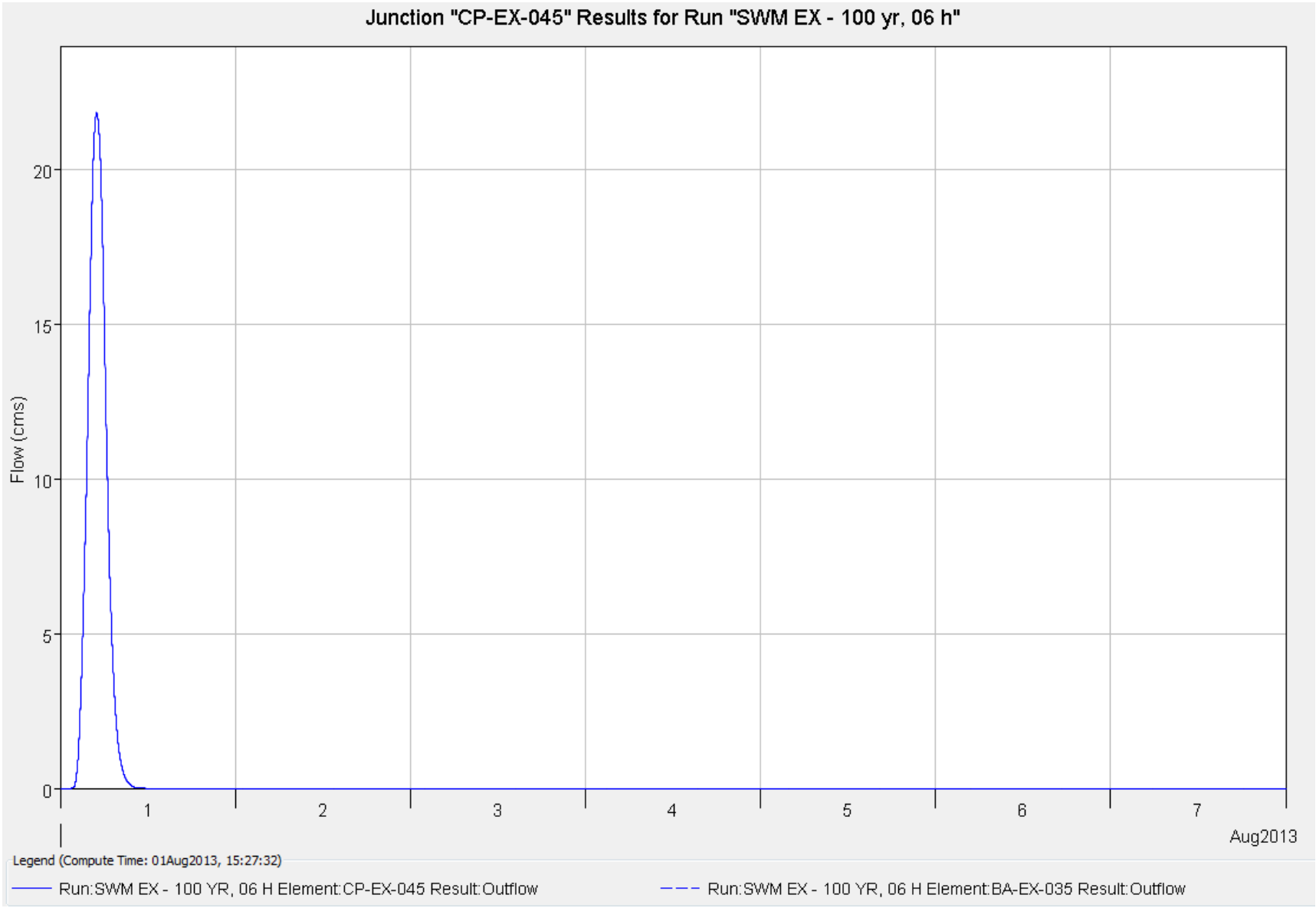

Junction "CP-EX-040" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-040 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-032 Result:Outflow

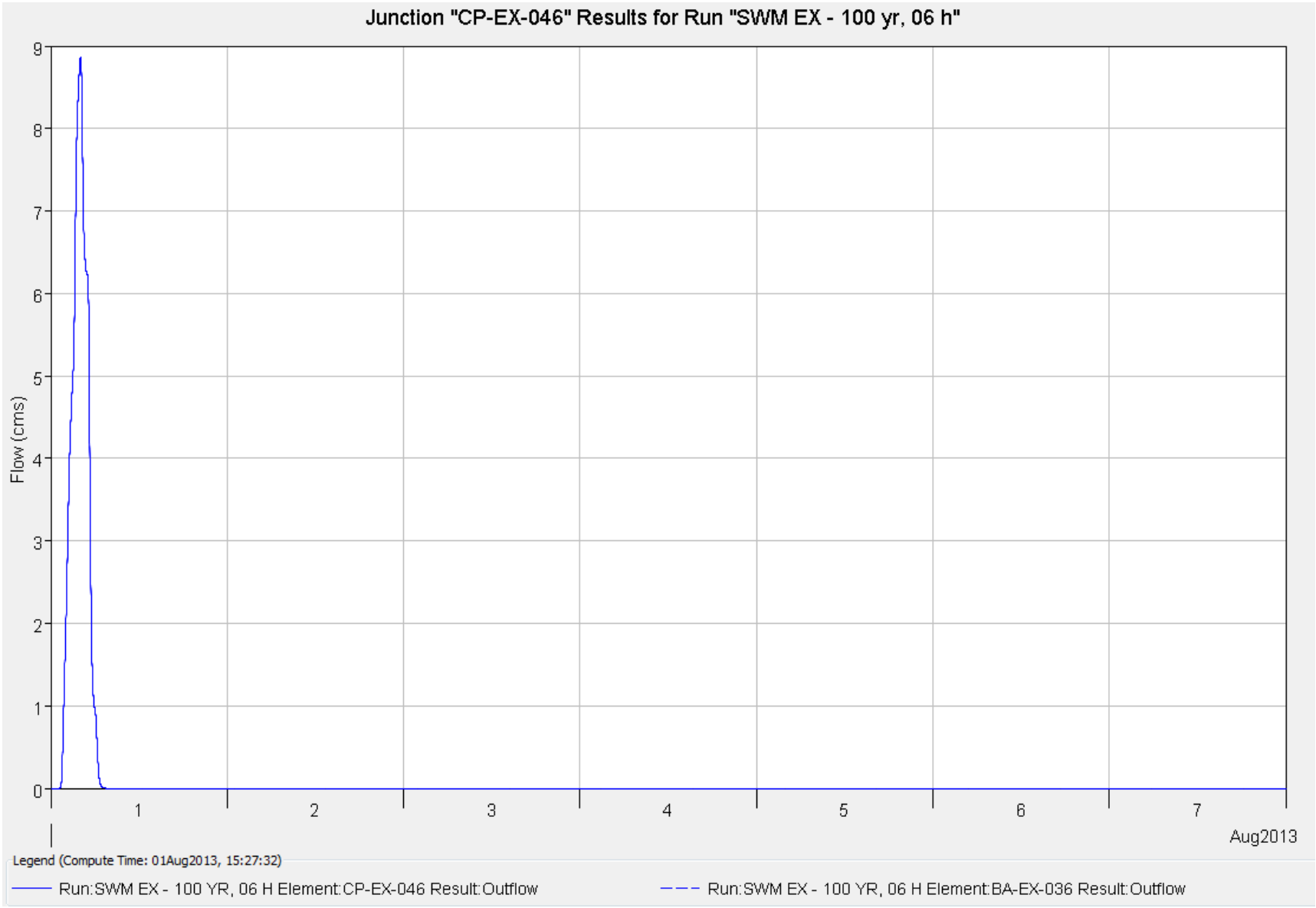

Junction "CP-EX-041" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-041 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-035 Result:Outflow

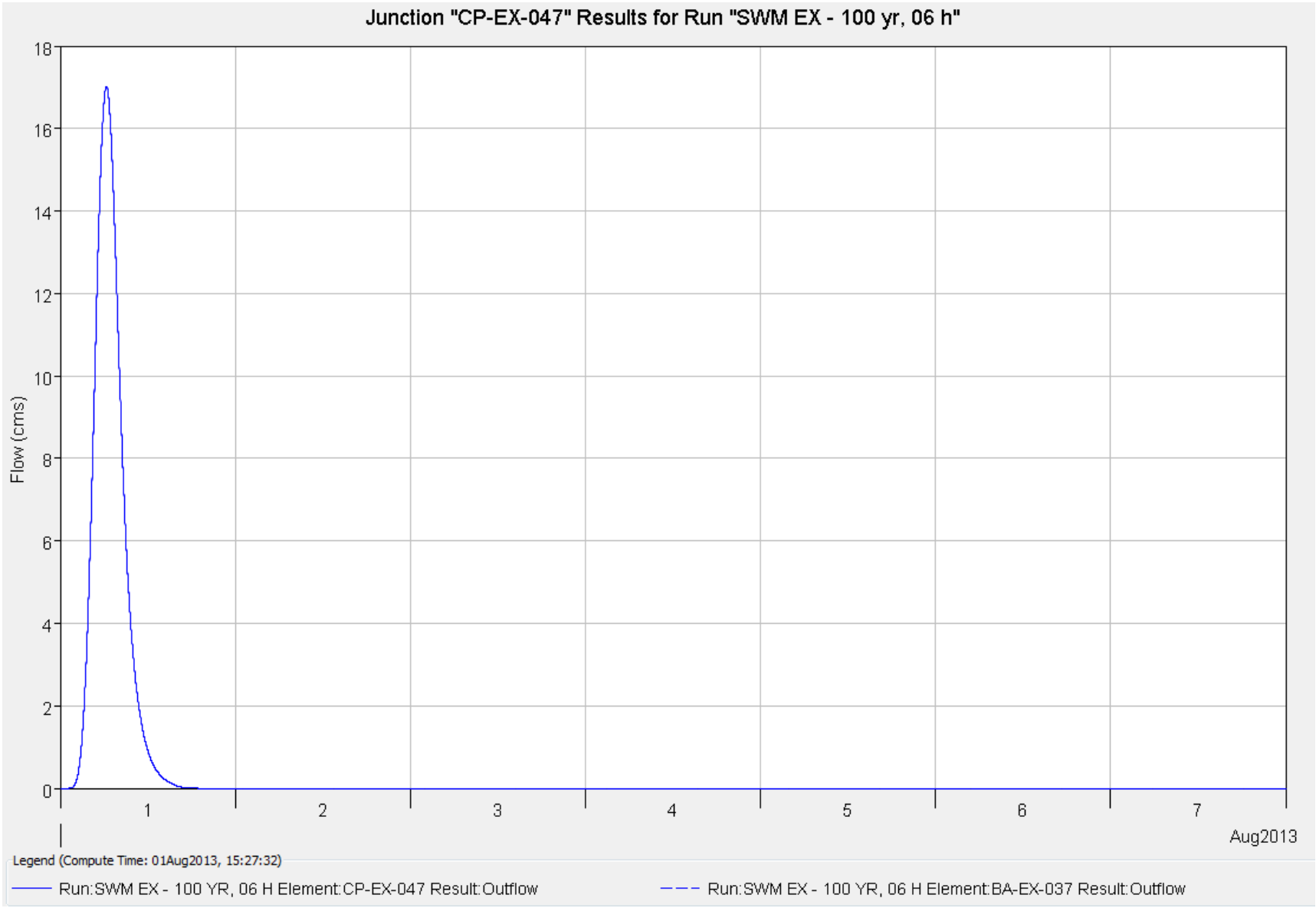

Junction "CP-EX-042" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-042 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-034 Result:Outflow

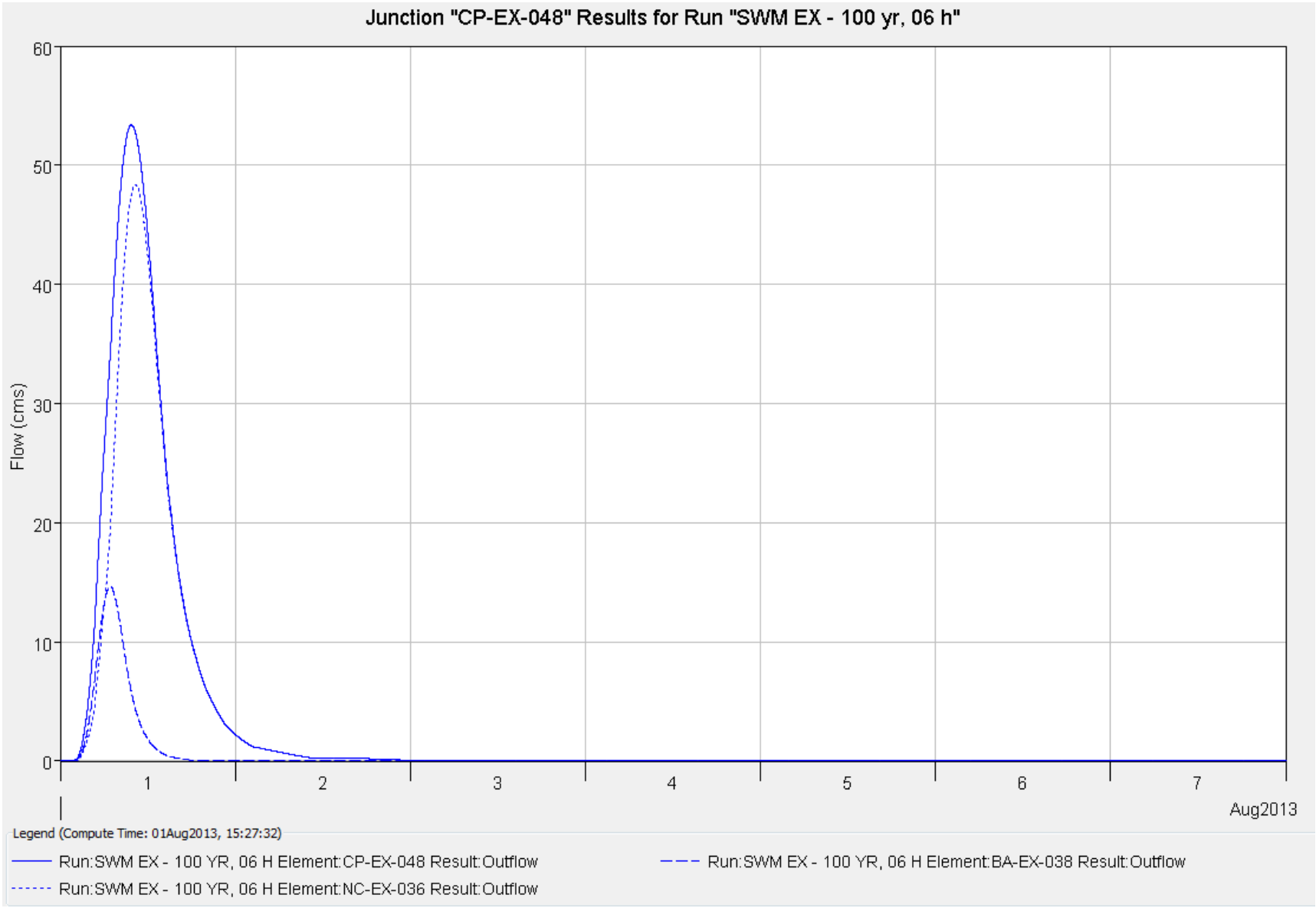

Junction "CP-EX-043" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-043 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-034 Result:Outflow

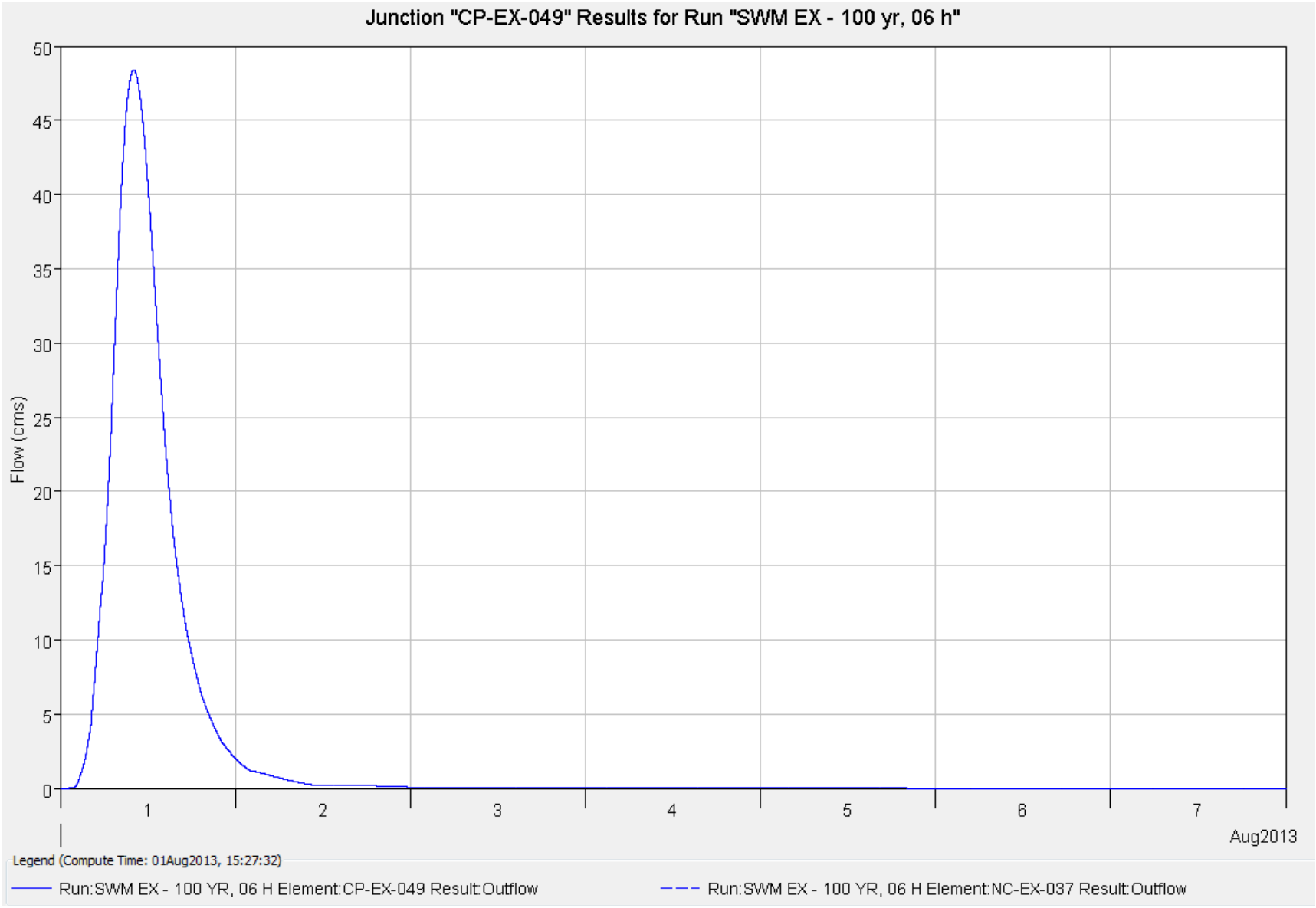

Junction "CP-EX-044" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-044 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-033 Result:Outflow

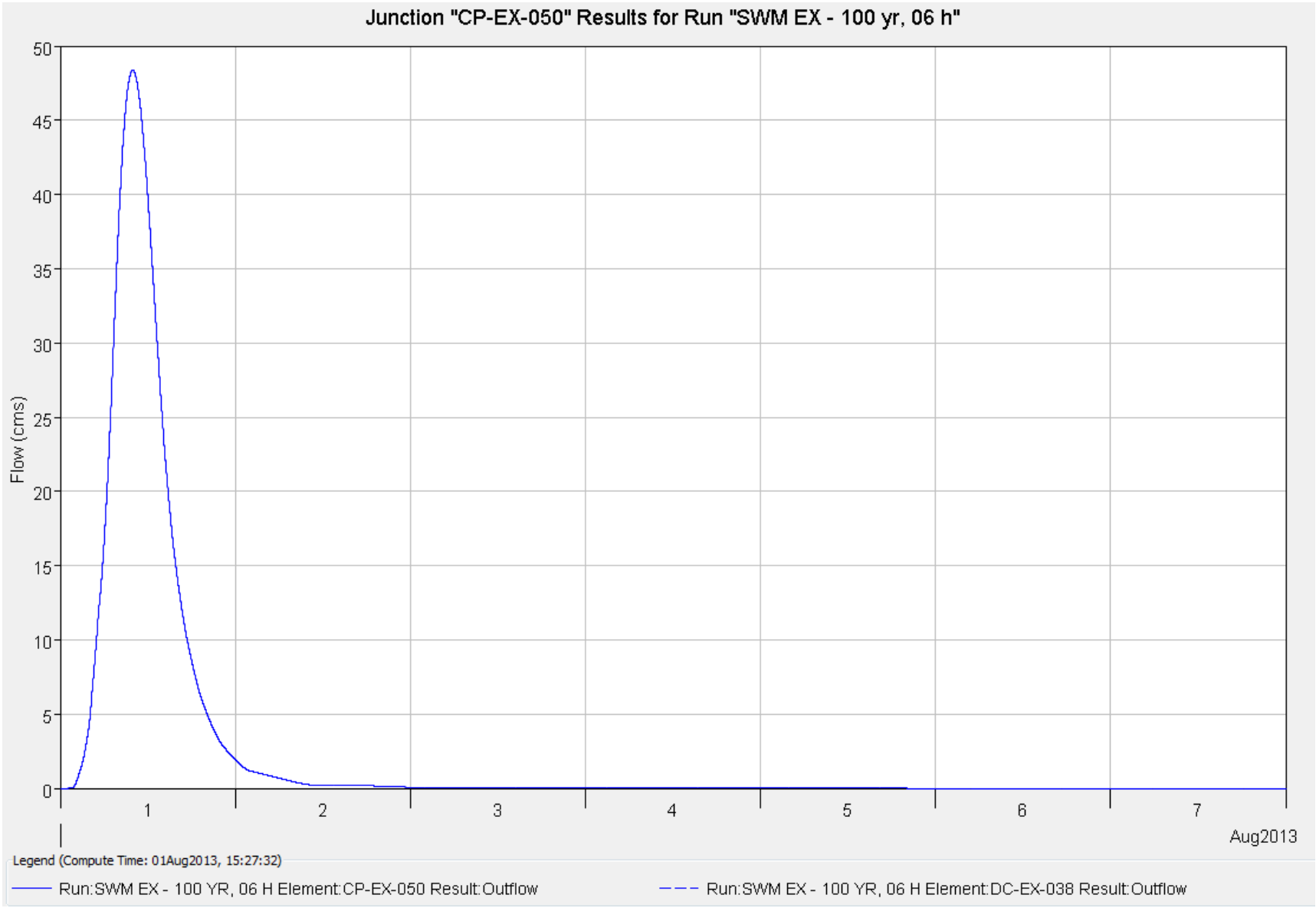

Junction "CP-EX-045" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-045 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-035 Result:Outflow

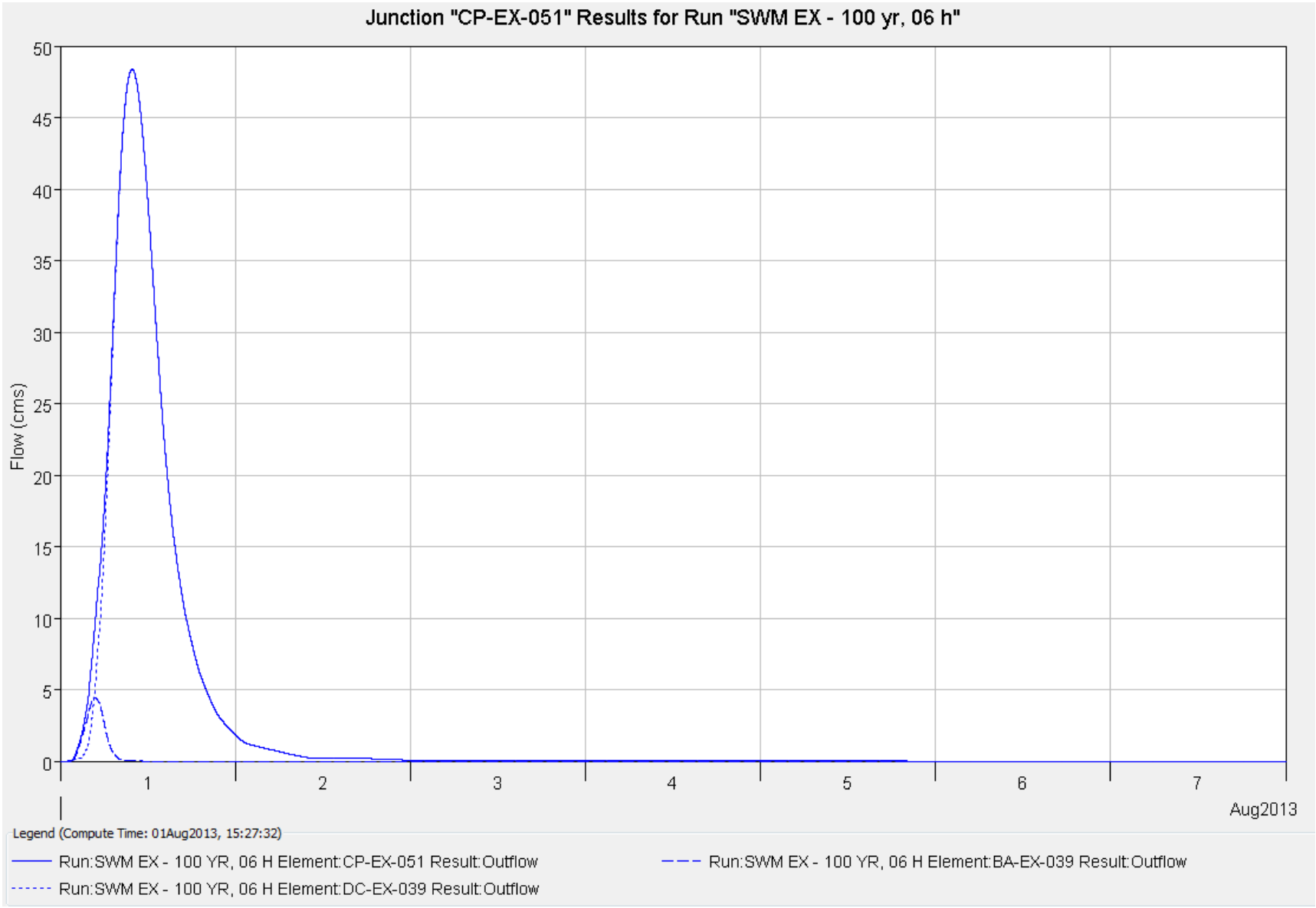

Junction "CP-EX-046" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-046 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-036 Result:Outflow

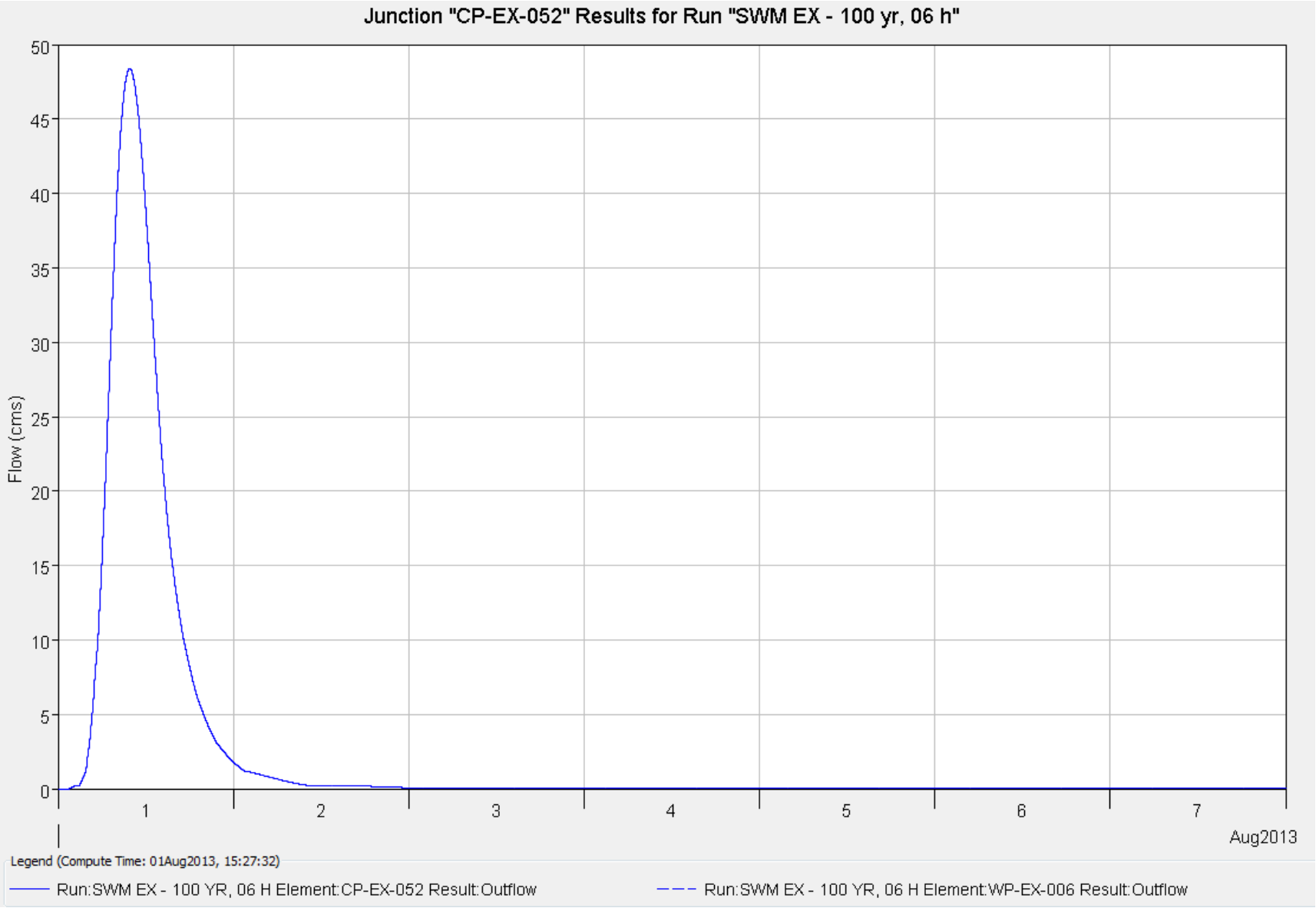

Junction "CP-EX-047" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-047 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-037 Result:Outflow

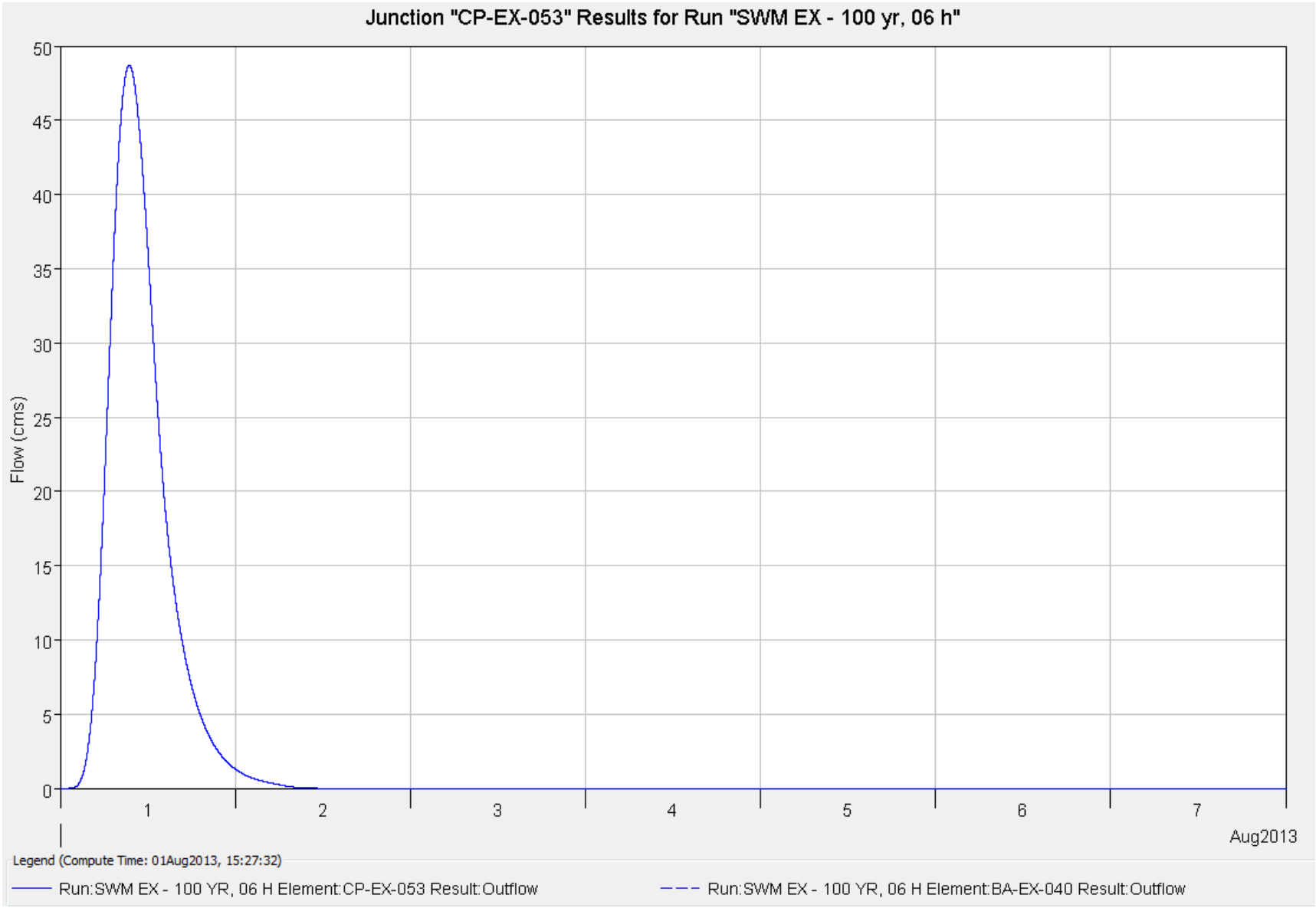

Junction "CP-EX-048" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-048 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-038 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-036 Result:Outflow

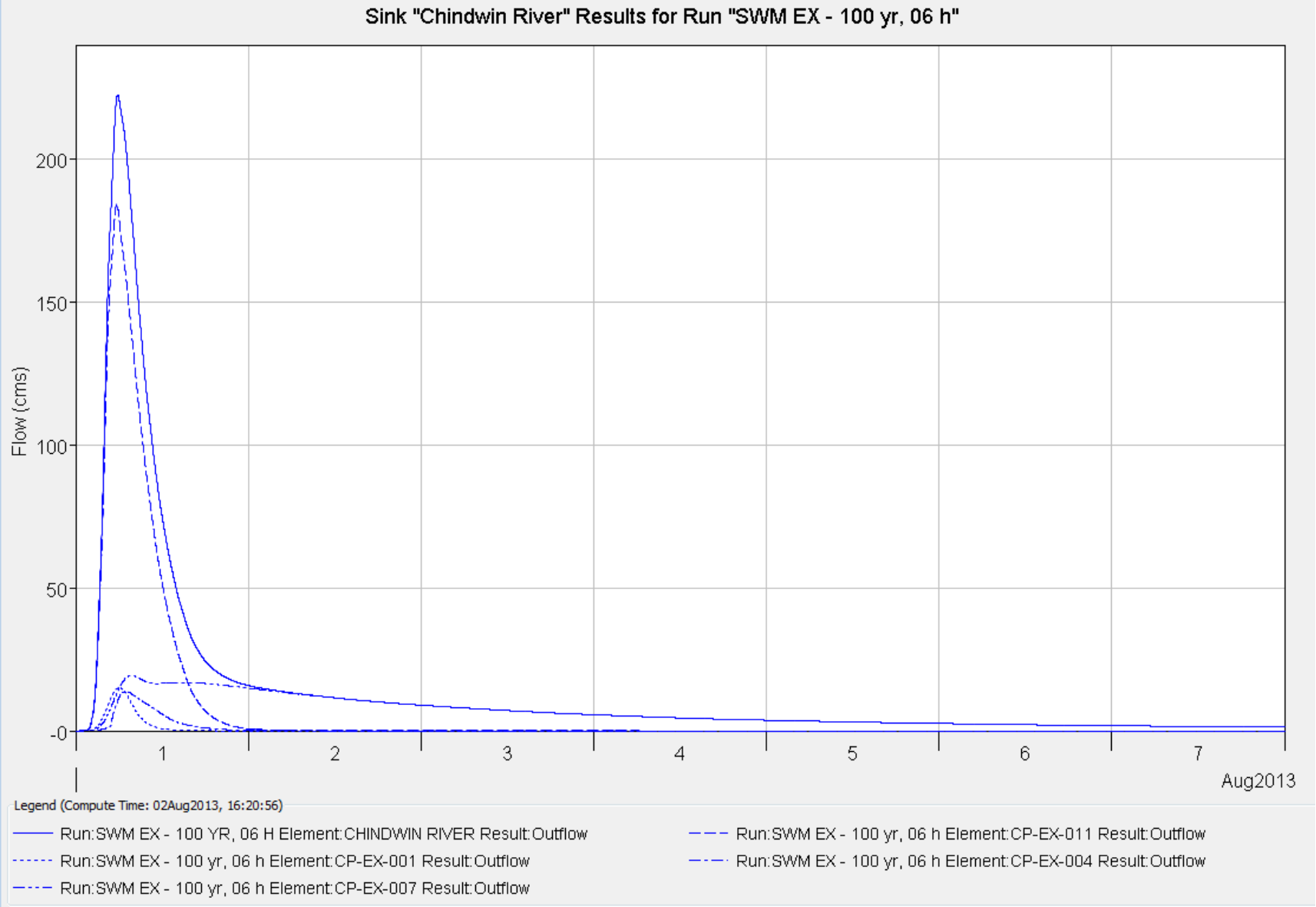

Junction "CP-EX-049" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-049 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:NC-EX-037 Result:Outflow

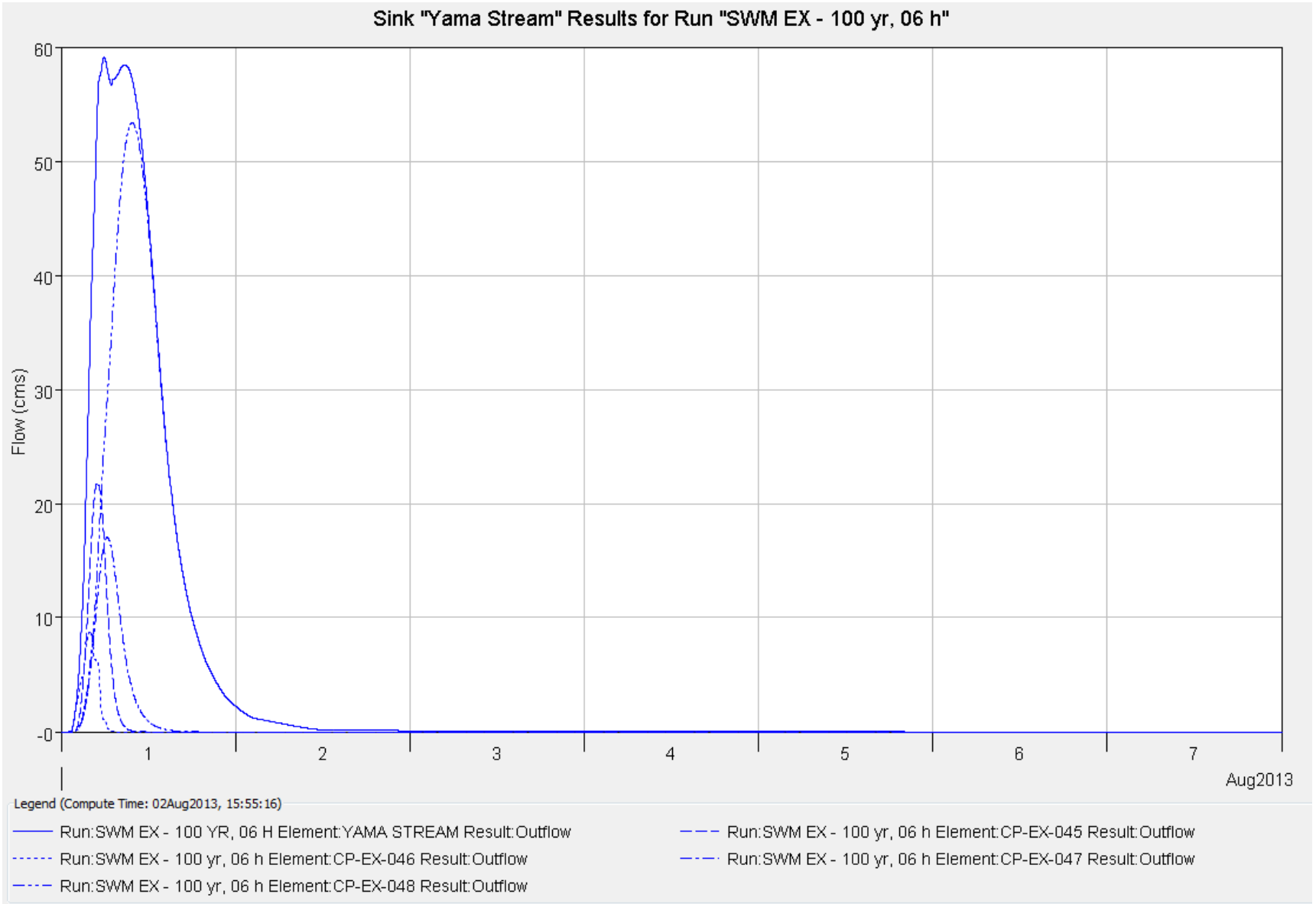

Junction "CP-EX-050" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-050 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-038 Result:Outflow

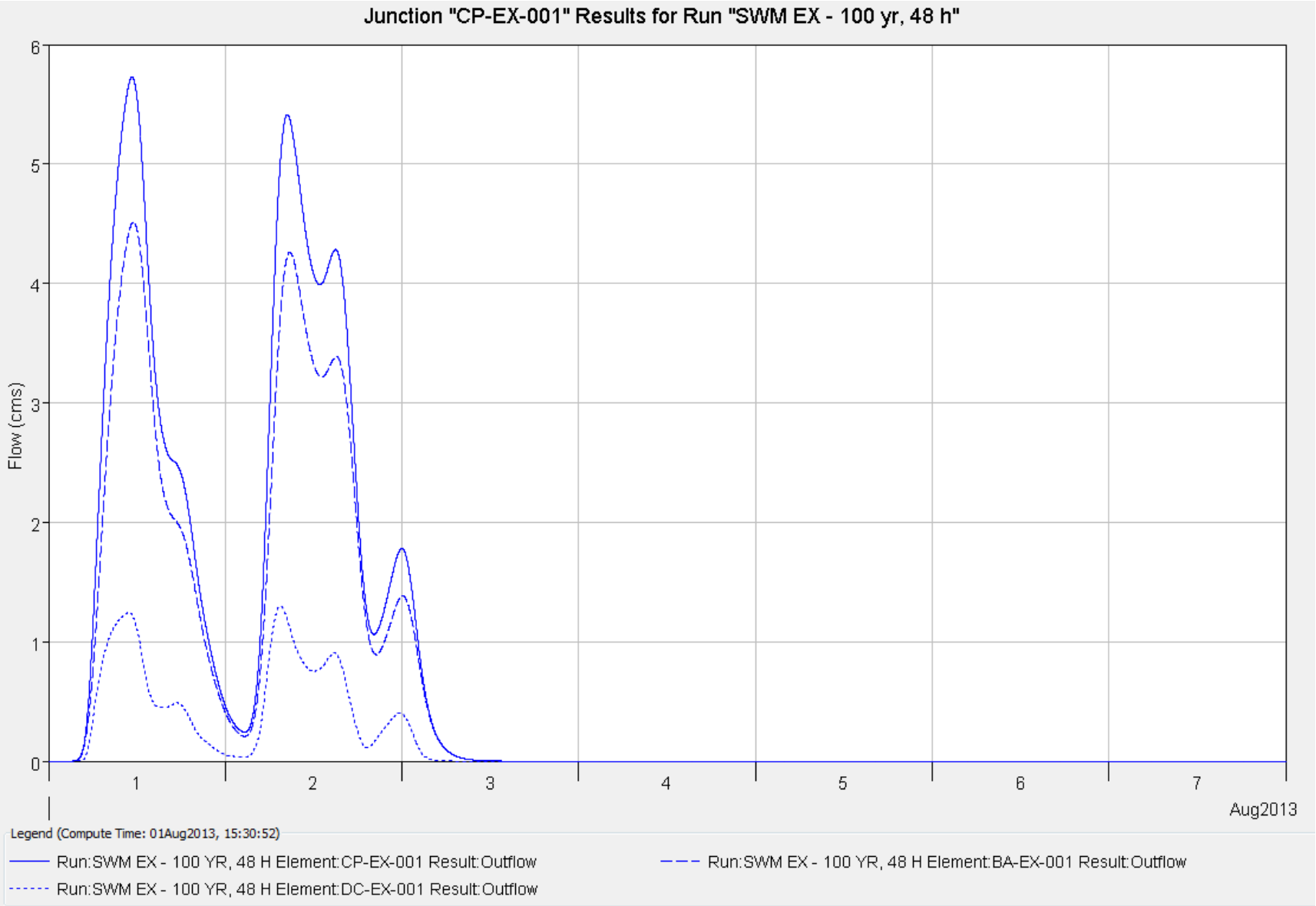

Junction "CP-EX-051" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-051 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-039 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:DC-EX-039 Result:Outflow

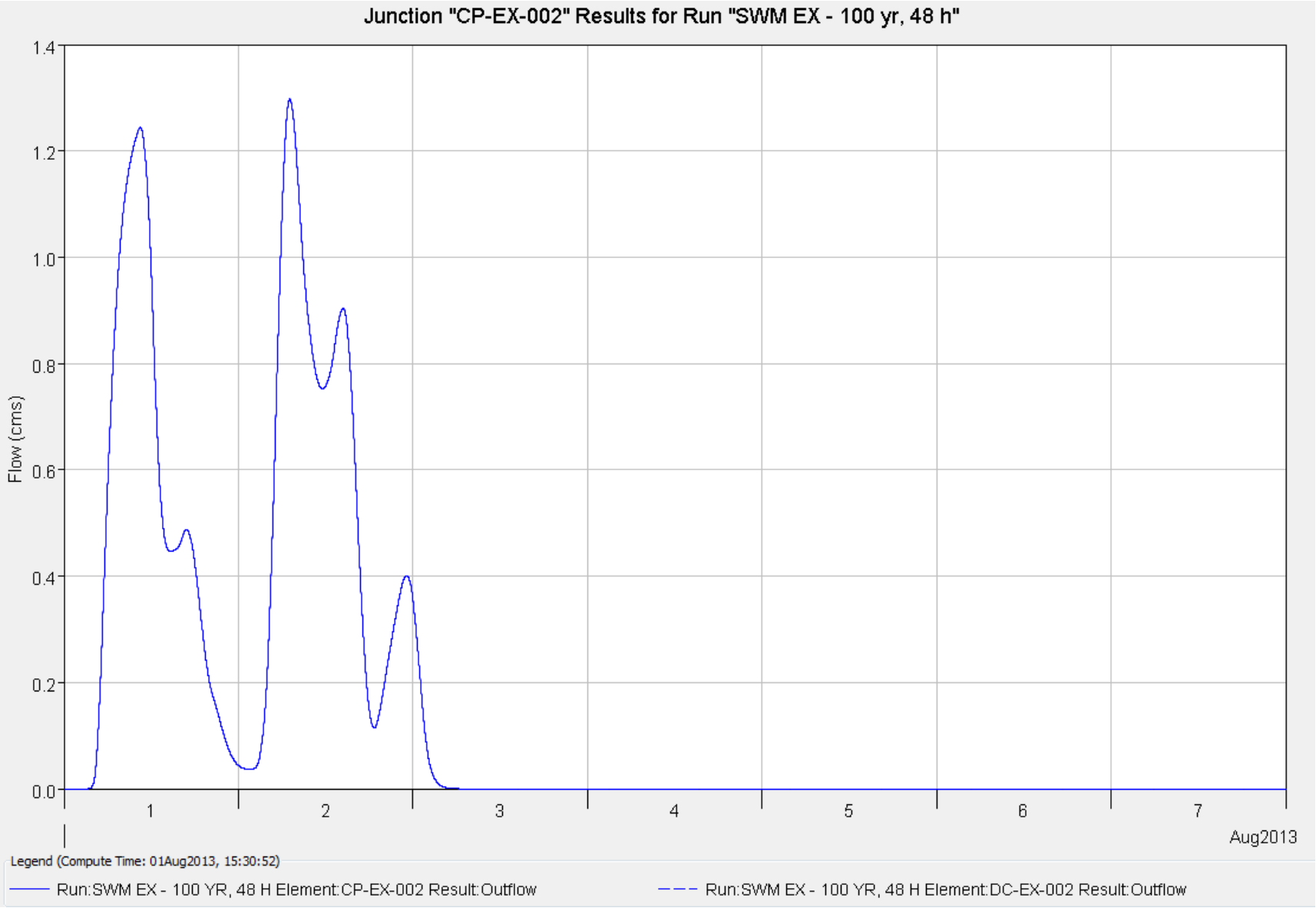

Junction "CP-EX-052" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-052 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-006 Result:Outflow

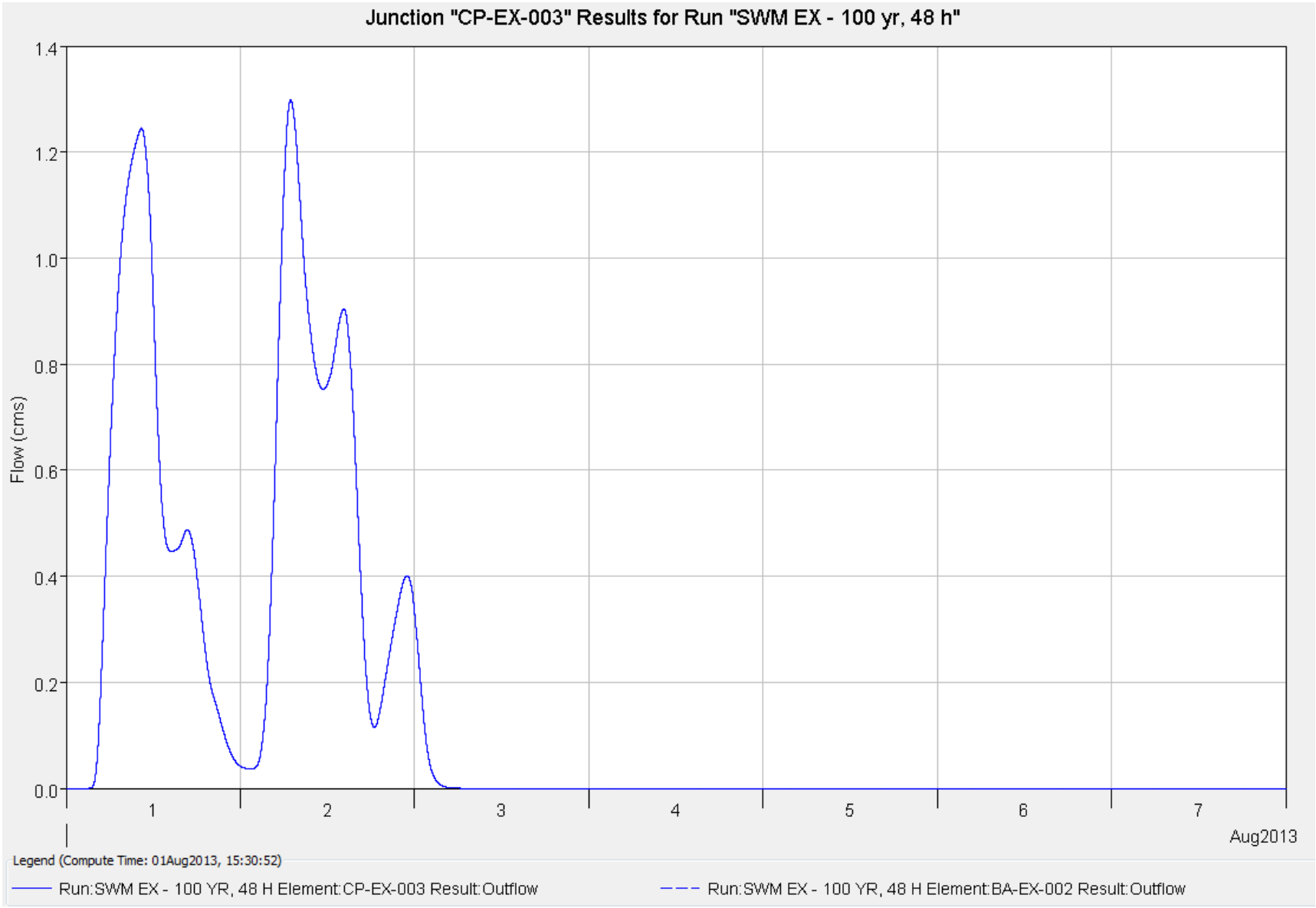

Junction "CP-EX-053" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:CP-EX-053 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:BA-EX-040 Result:Outflow

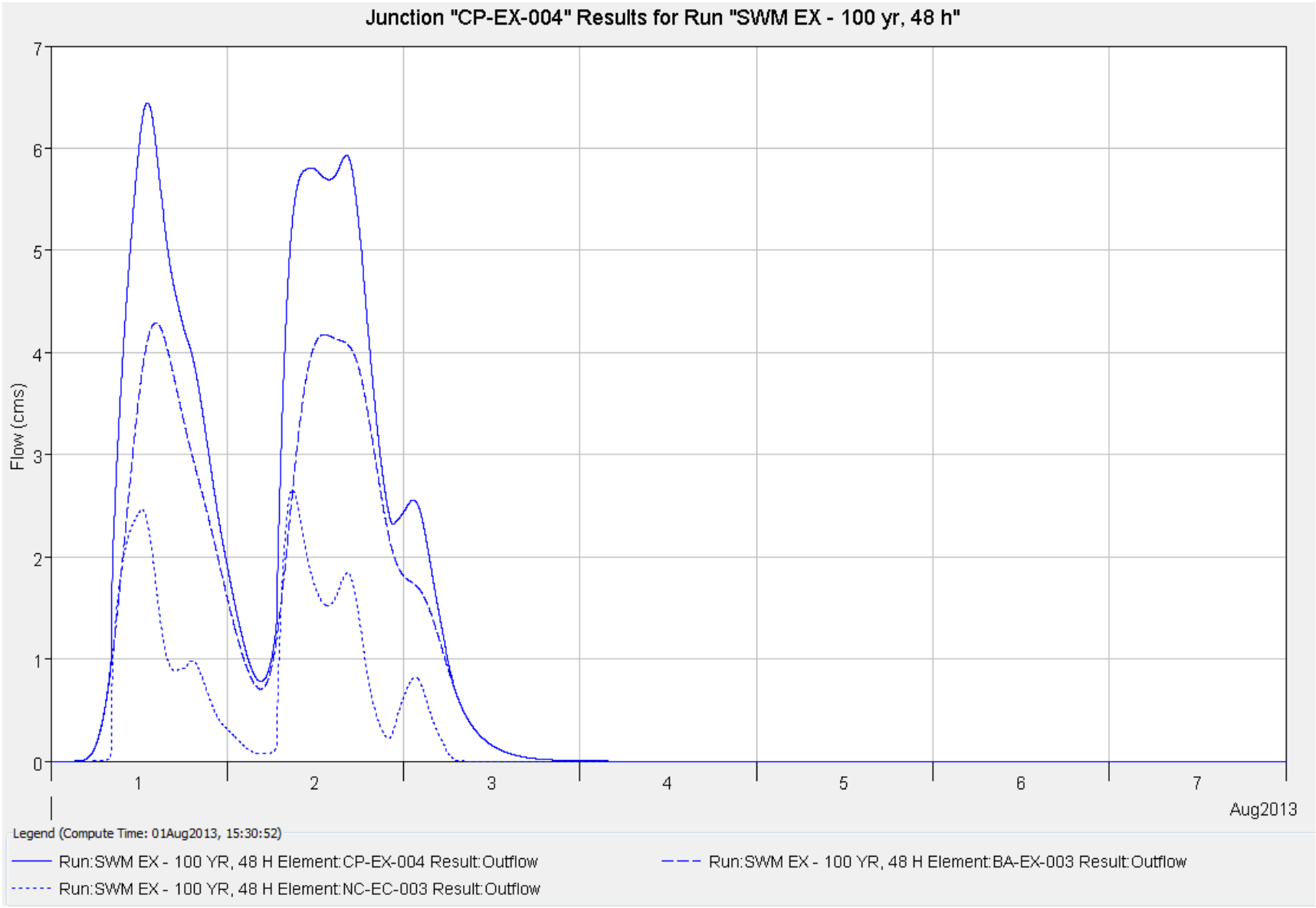

Sink "Chindwin River" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
200
150
100
50
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 02Aug2013, 16:20:56)
Run:SWM EX - 100 YR, 06 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-011 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-001 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-004 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-007 Result:Outflow

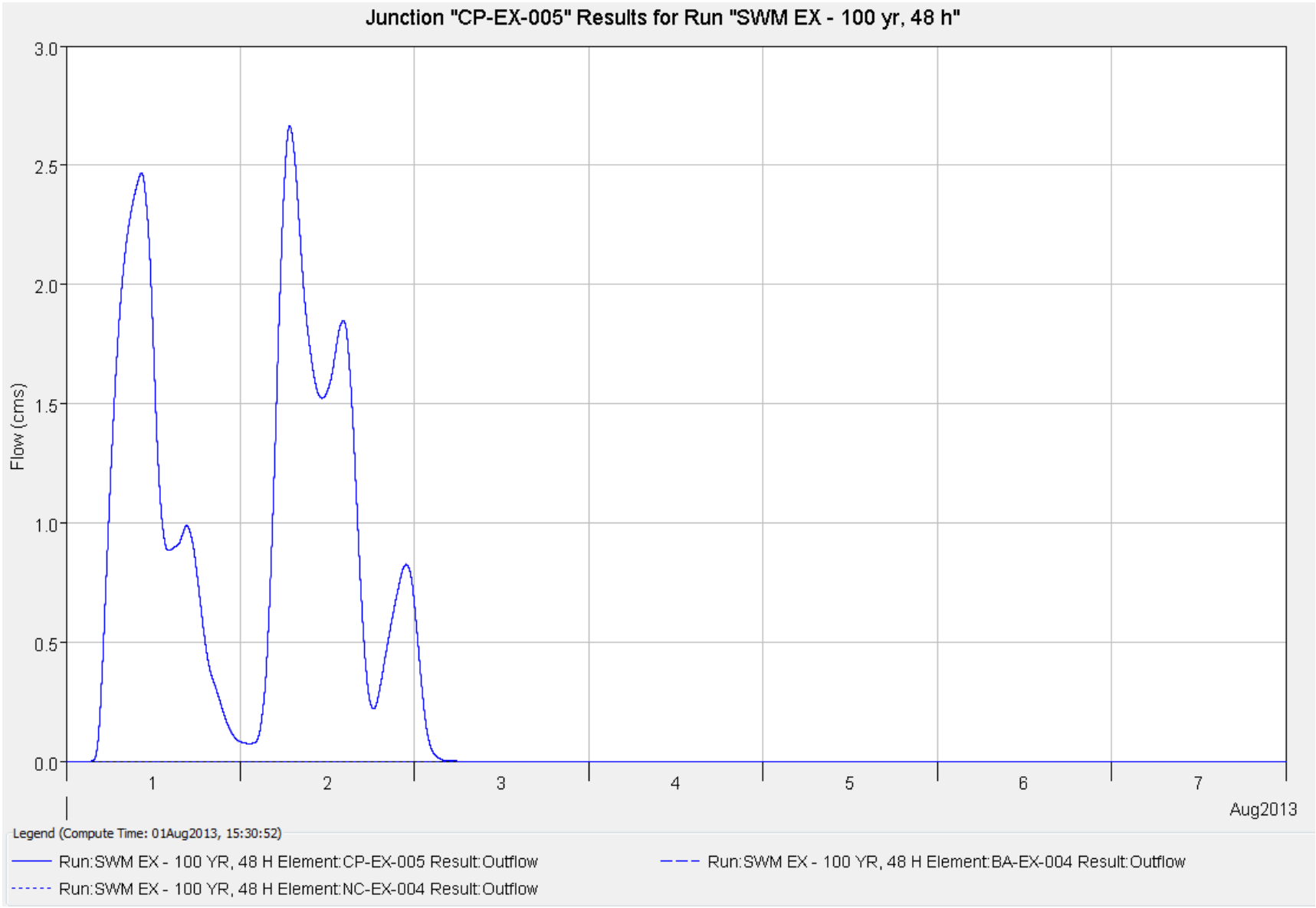

Sink "Yama Stream" Results for Run "SWM EX - 100 yr, 06 h"
Flow (cms)
60
50
40
30
20
10
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 02Aug2013, 15:55:16)
Run:SWM EX - 100 YR, 06 H Element:YAMA STREAM Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-045 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-046 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-047 Result:Outflow
Run:SWM EX - 100 yr, 06 h Element:CP-EX-048 Result:Outflow

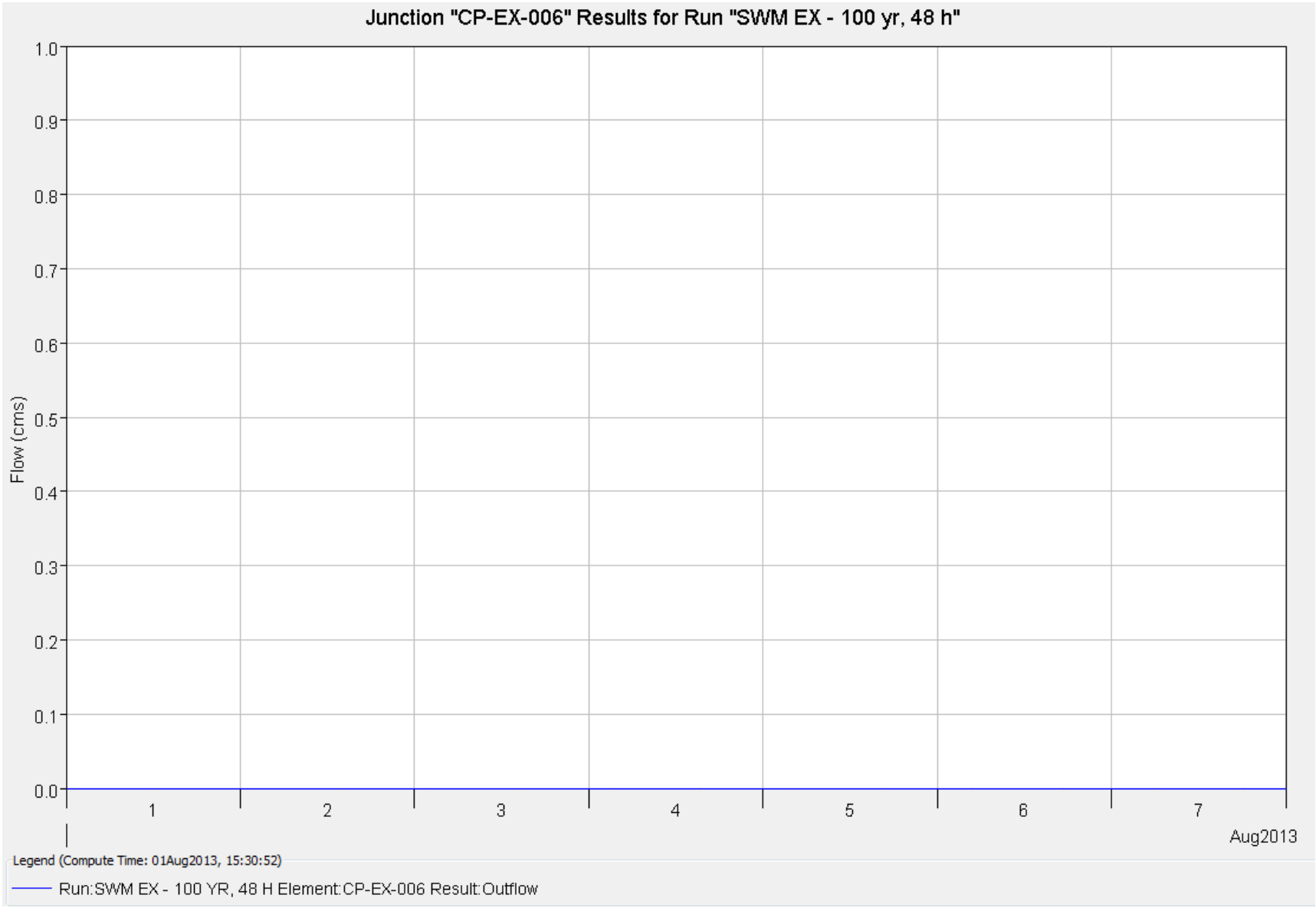

Junction "CP-EX-001" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-001 Result:Outflow

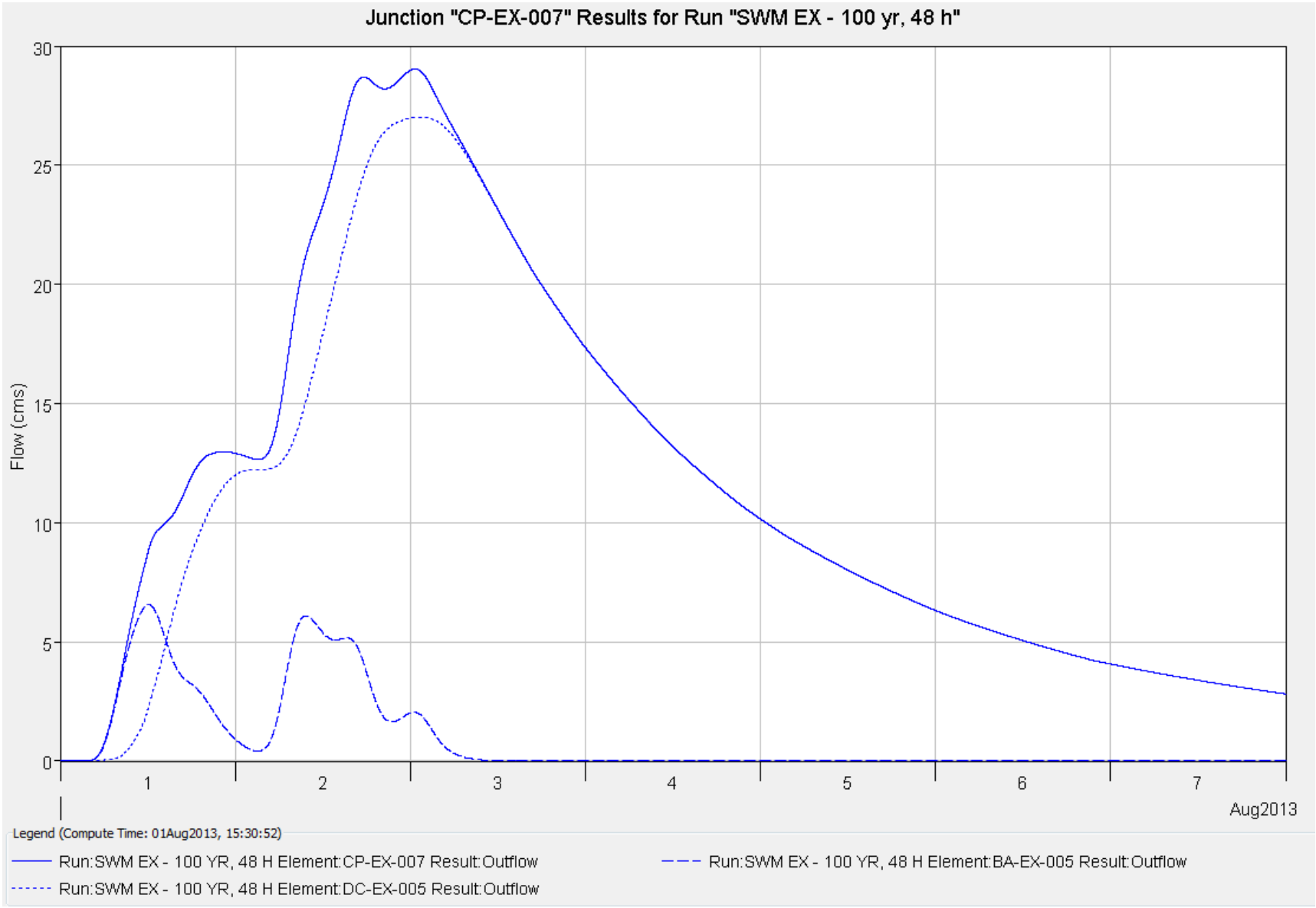

Junction "CP-EX-002" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-002 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-002 Result:Outflow

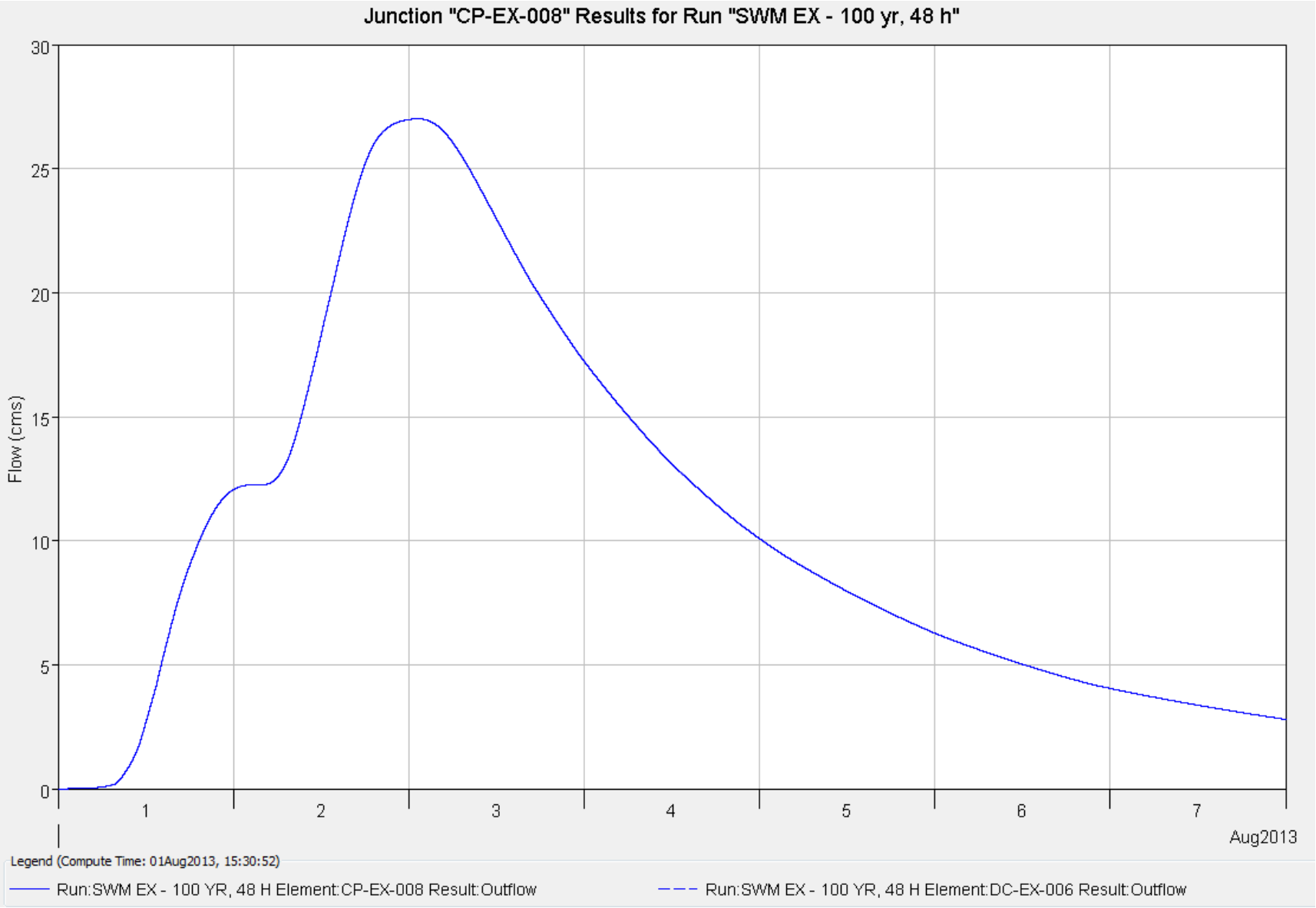

Junction "CP-EX-003" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-002 Result:Outflow

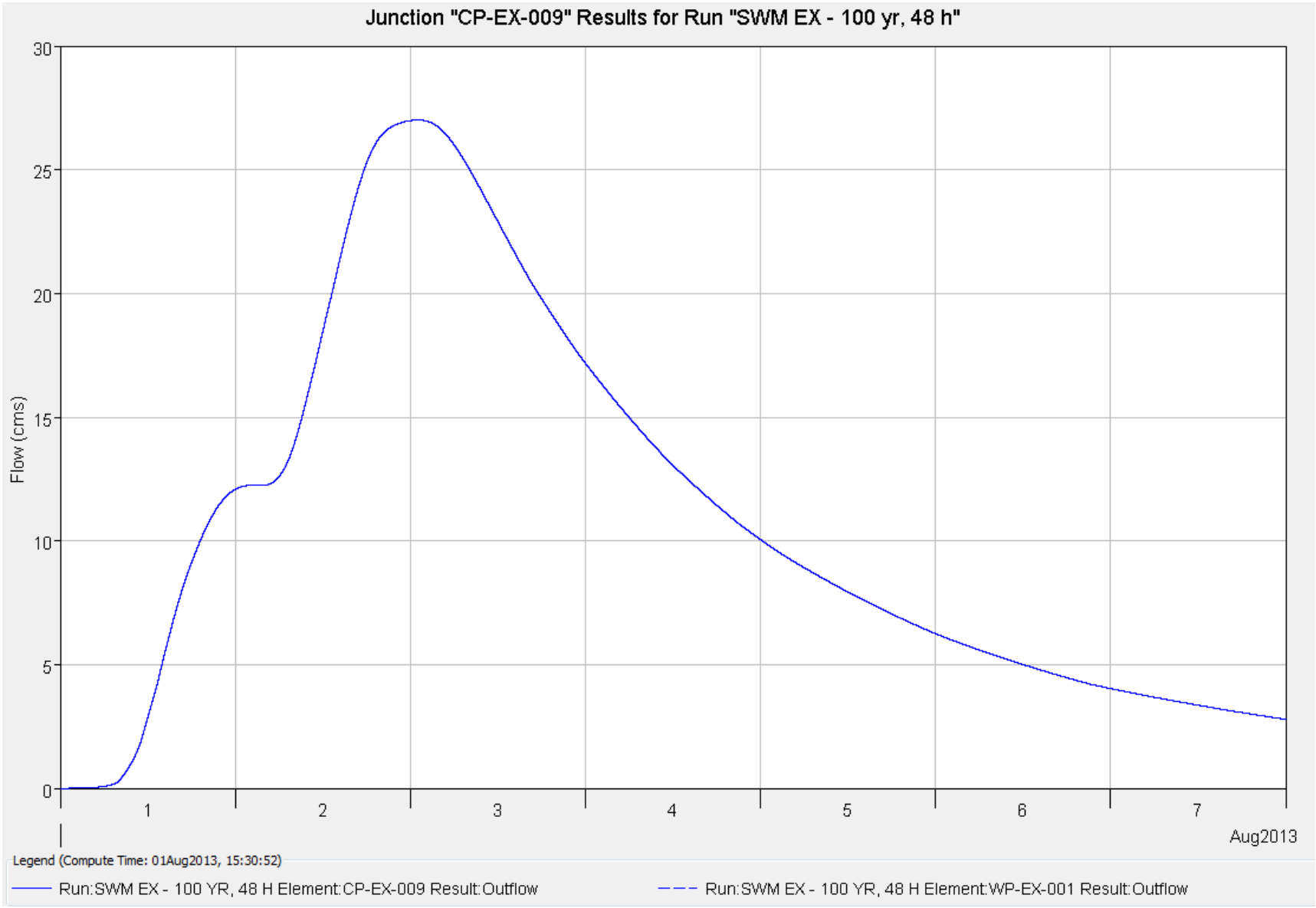

Junction "CP-EX-004" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EC-003 Result:Outflow

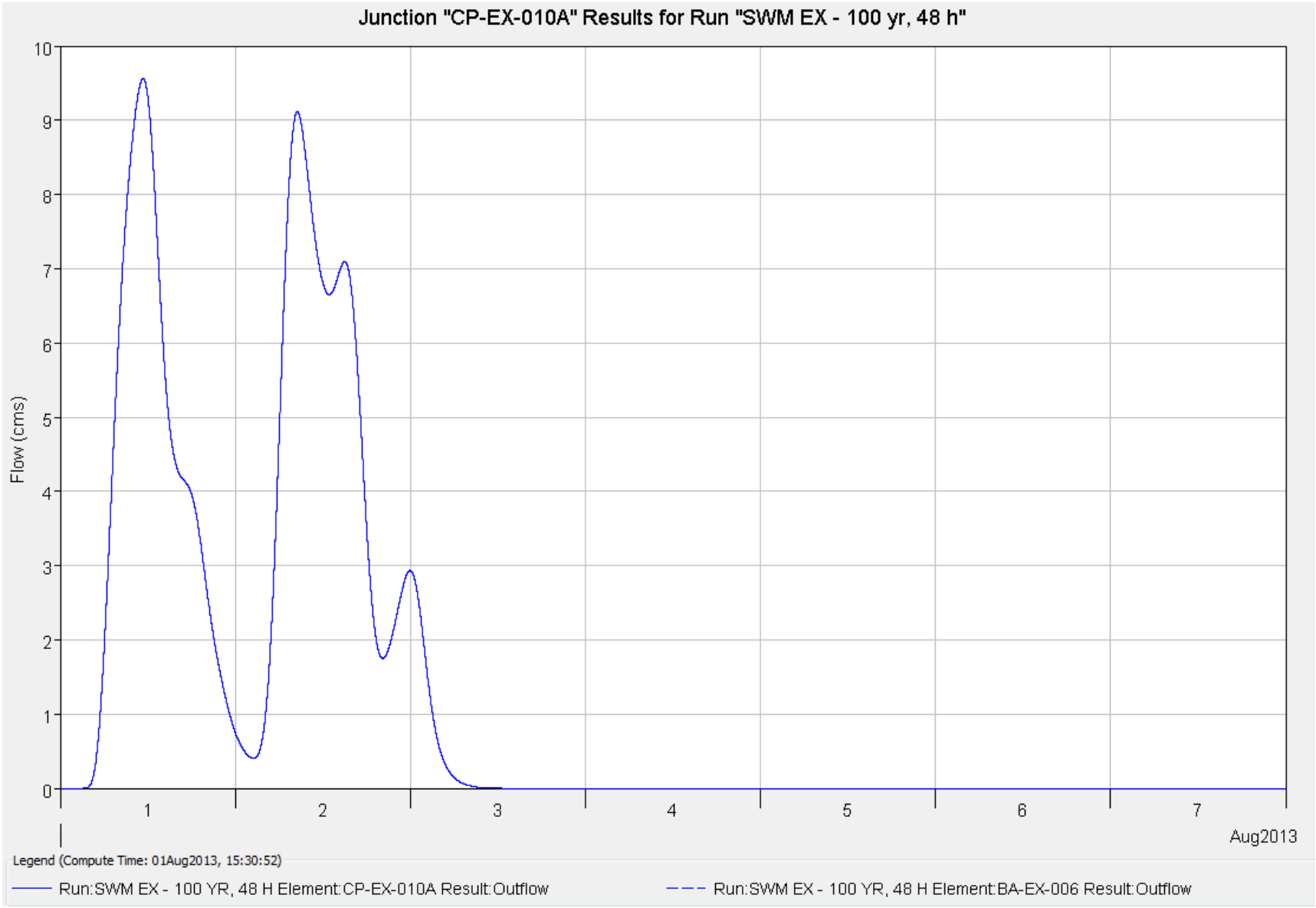

Junction "CP-EX-005" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-004 Result:Outflow

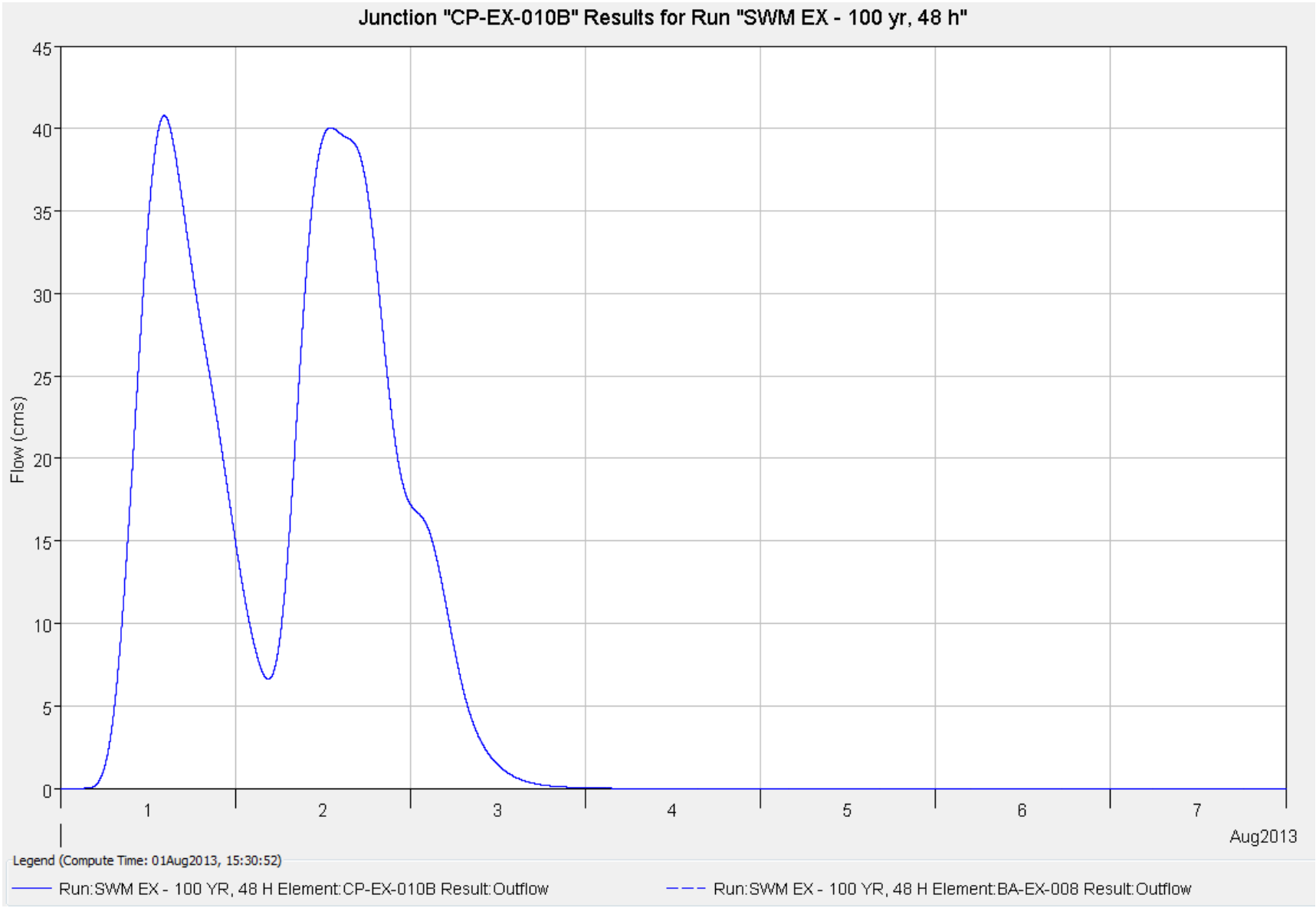

Junction "CP-EX-006" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-006 Result:Outflow

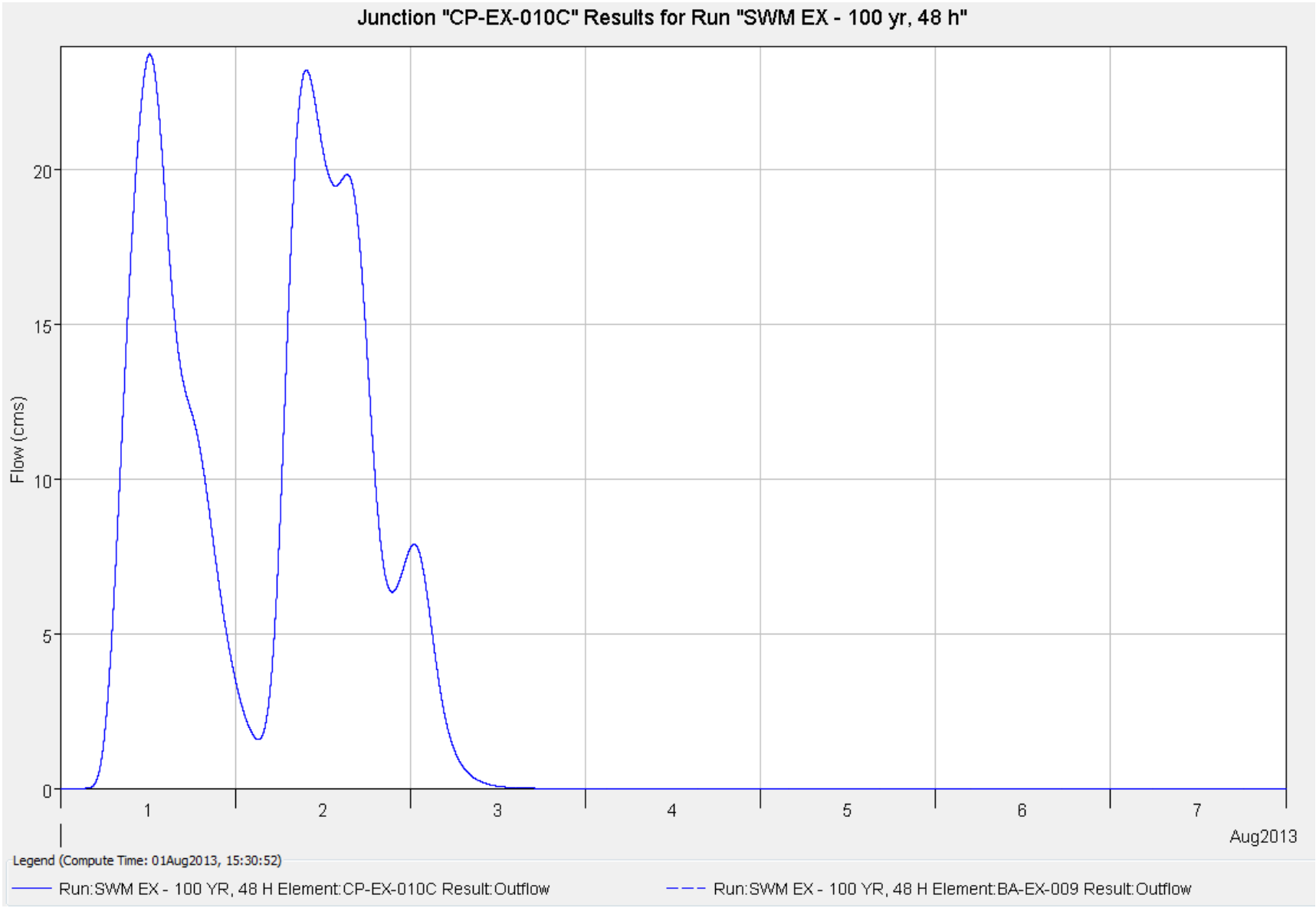

Junction "CP-EX-007" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-007 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-005 Result:Outflow

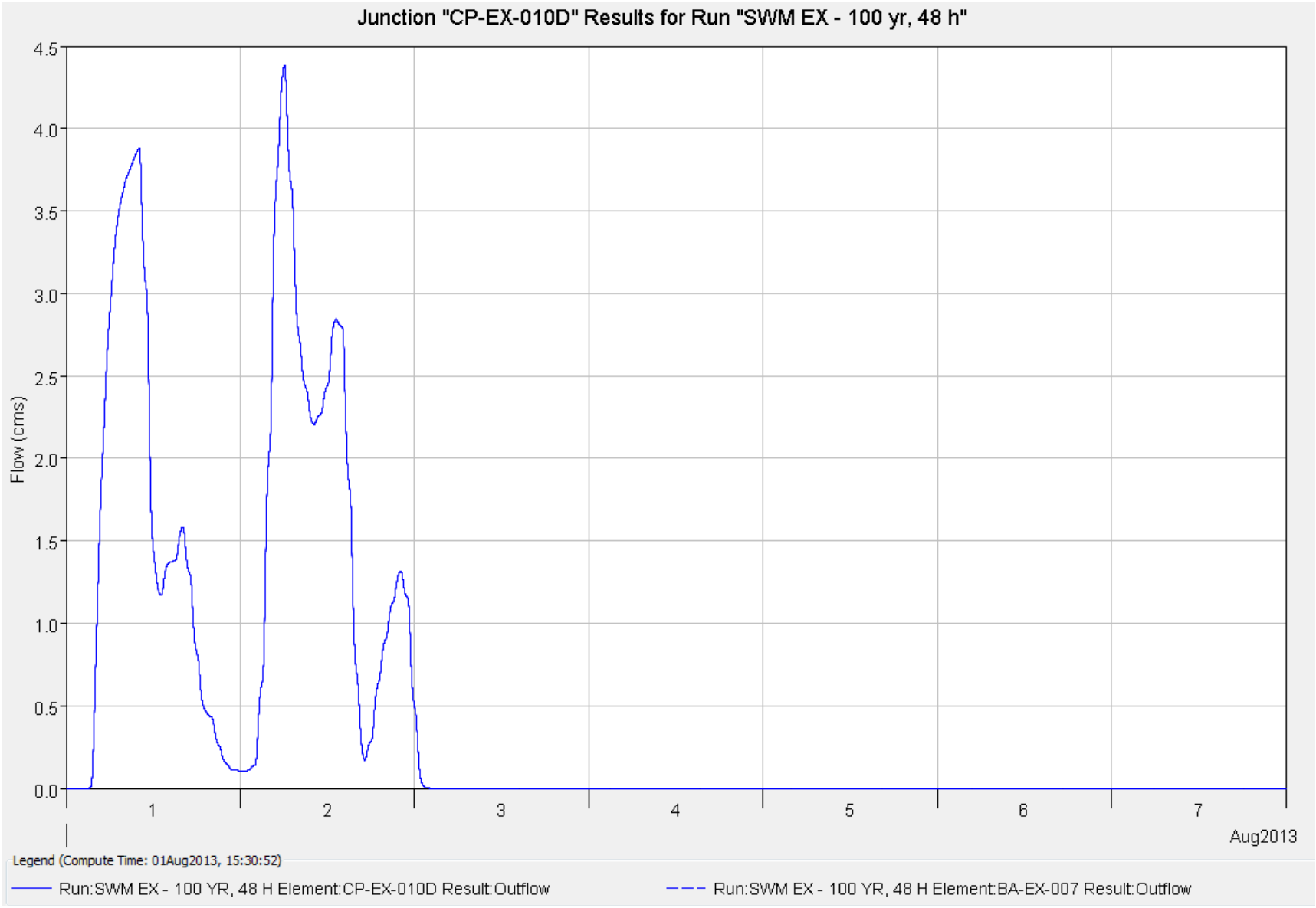

Junction "CP-EX-008" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-008 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-006 Result:Outflow

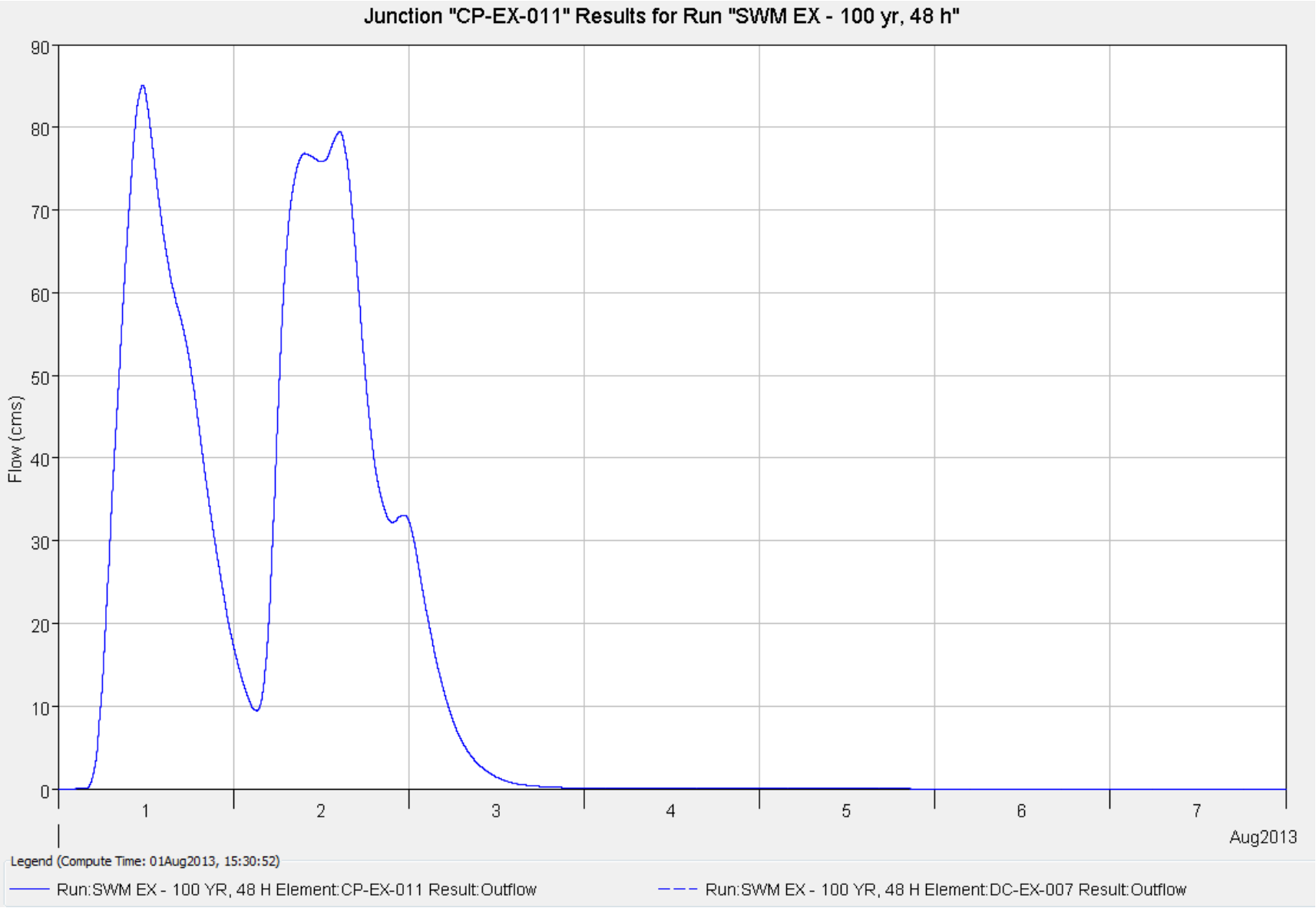

Junction "CP-EX-009" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-009 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-001 Result:Outflow

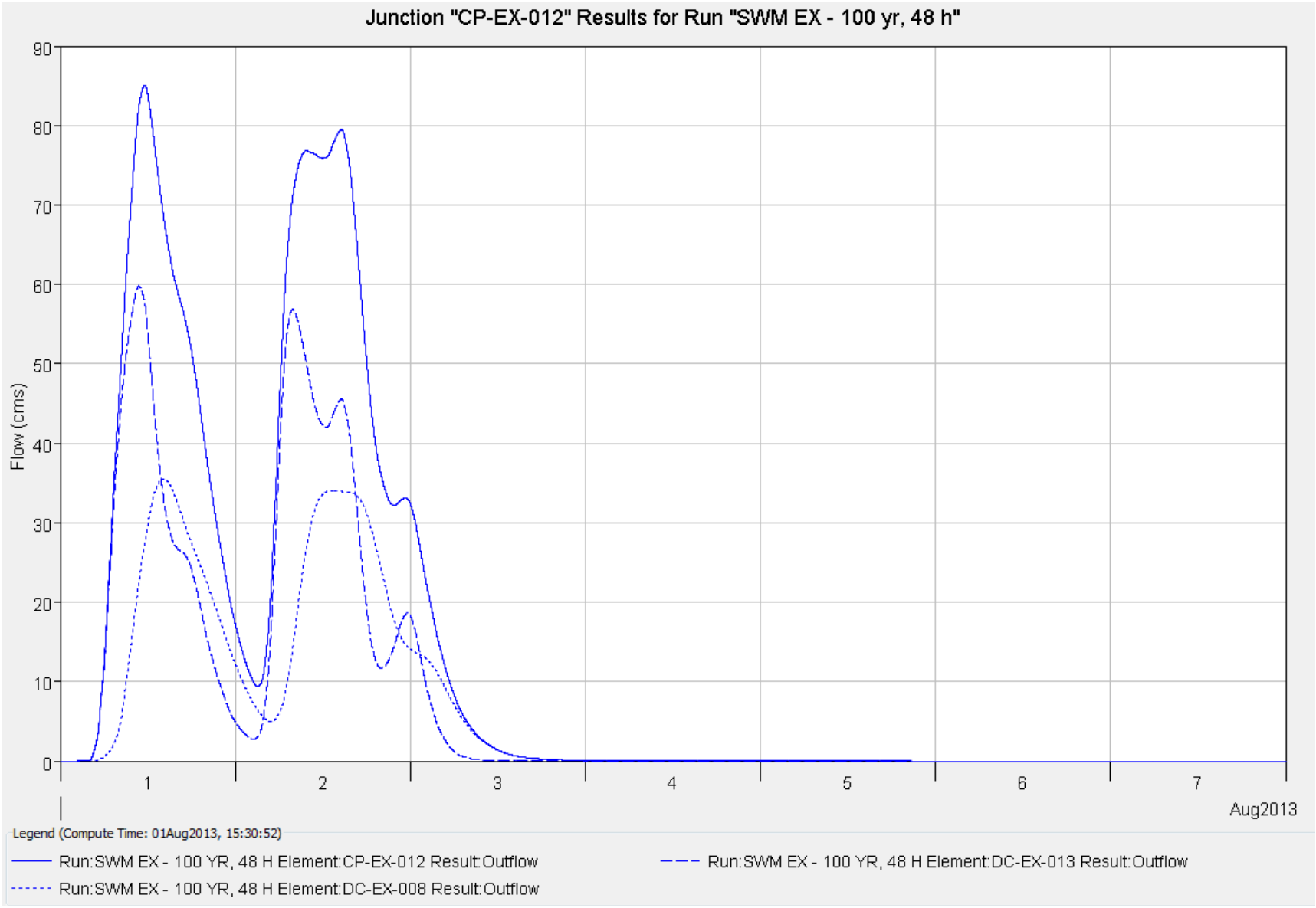

Junction "CP-EX-010A" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-010A Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-006 Result:Outflow

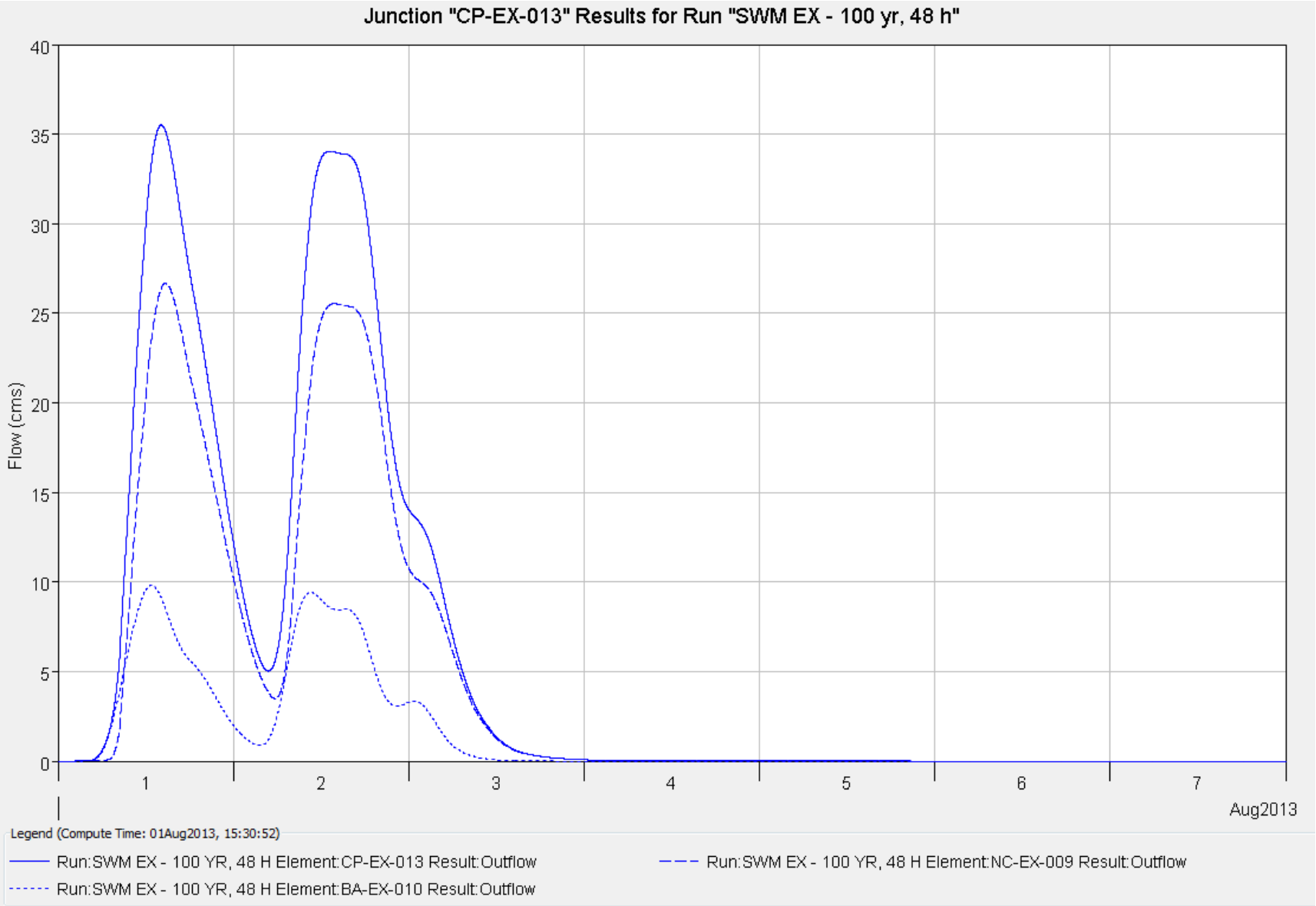

Junction "CP-EX-010B" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-010B Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-008 Result:Outflow

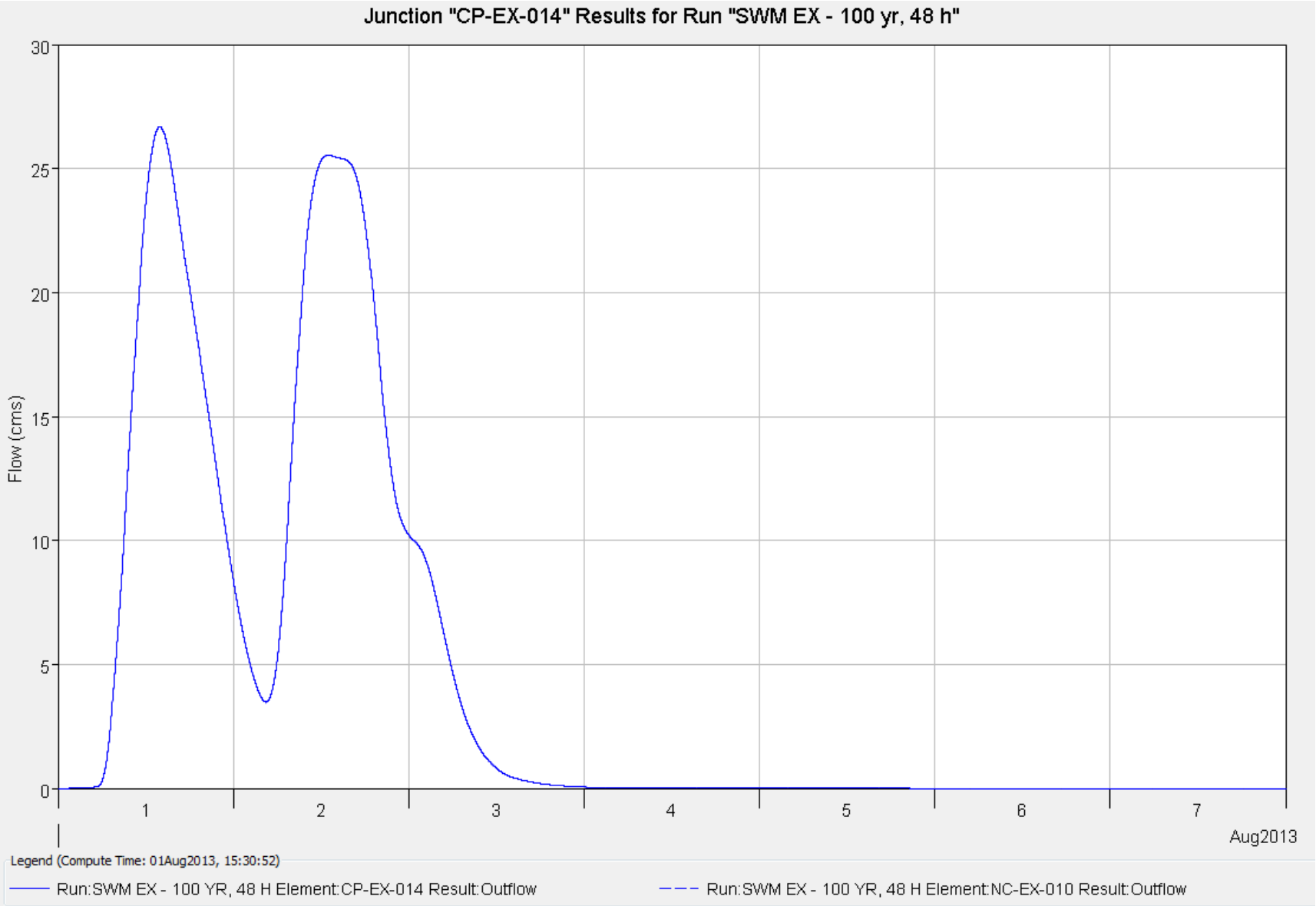

Junction "CP-EX-010C" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-010C Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-009 Result:Outflow

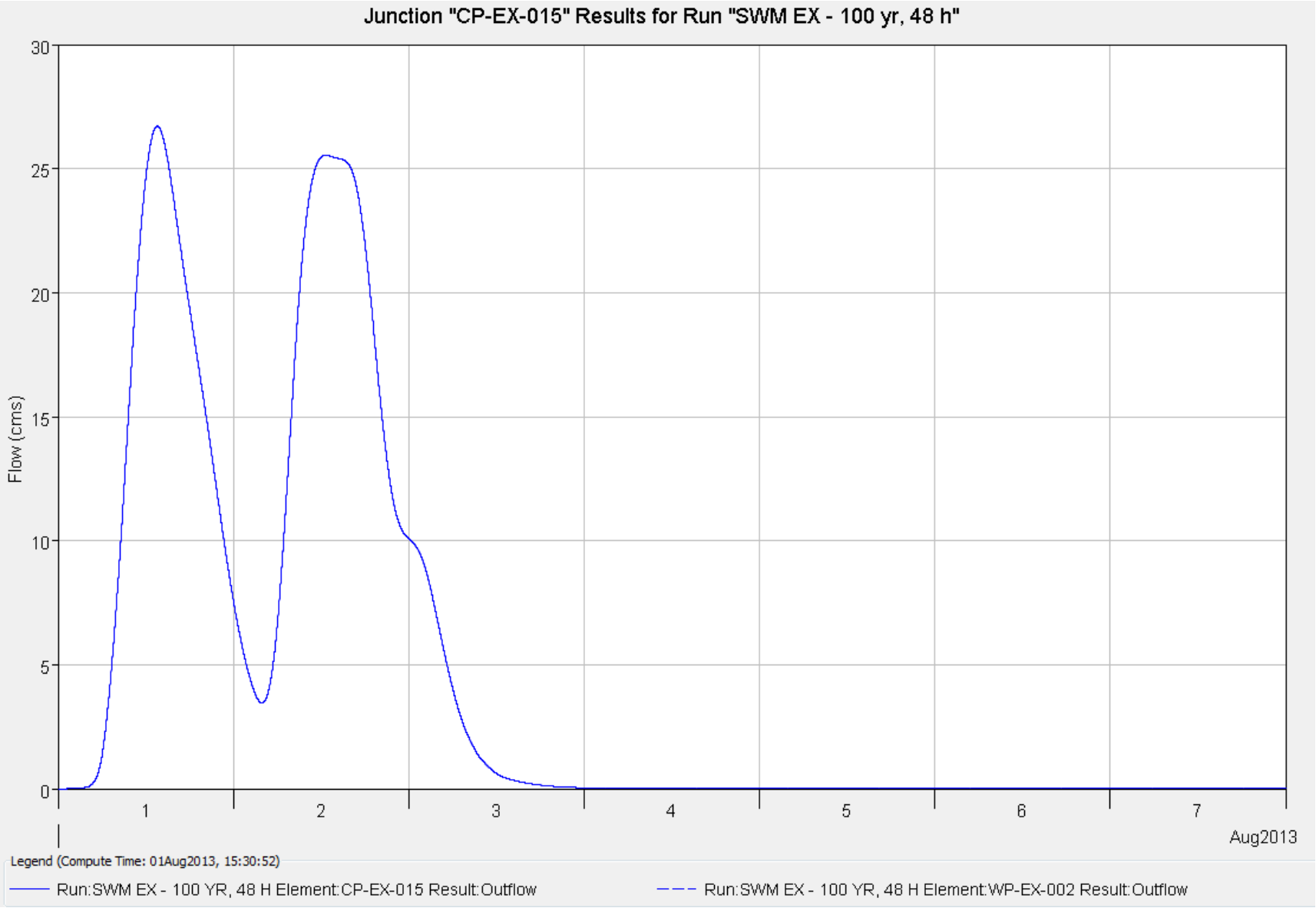

Junction "CP-EX-010D" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-010D Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-007 Result:Outflow

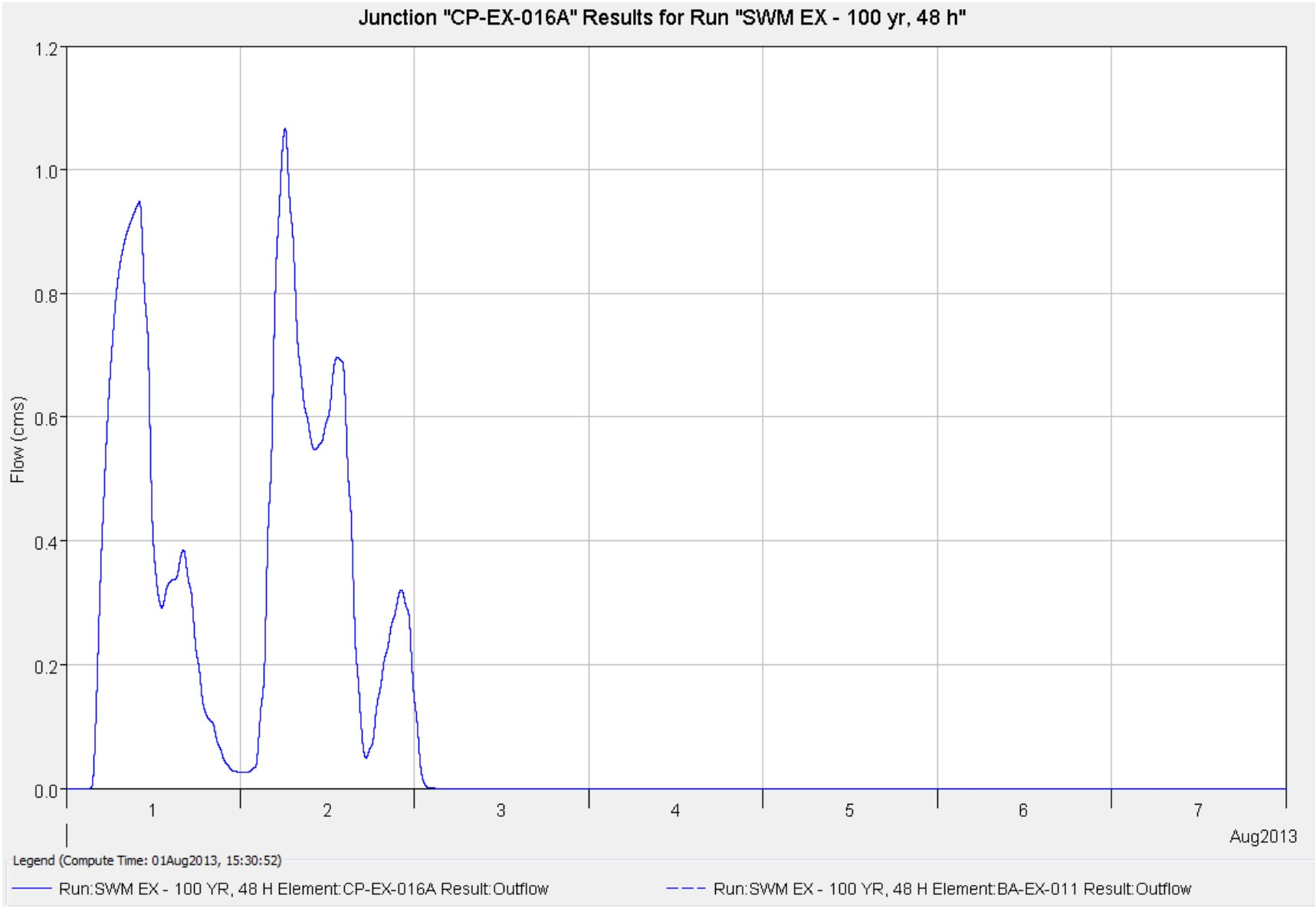

Junction "CP-EX-011" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-011 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-007 Result:Outflow

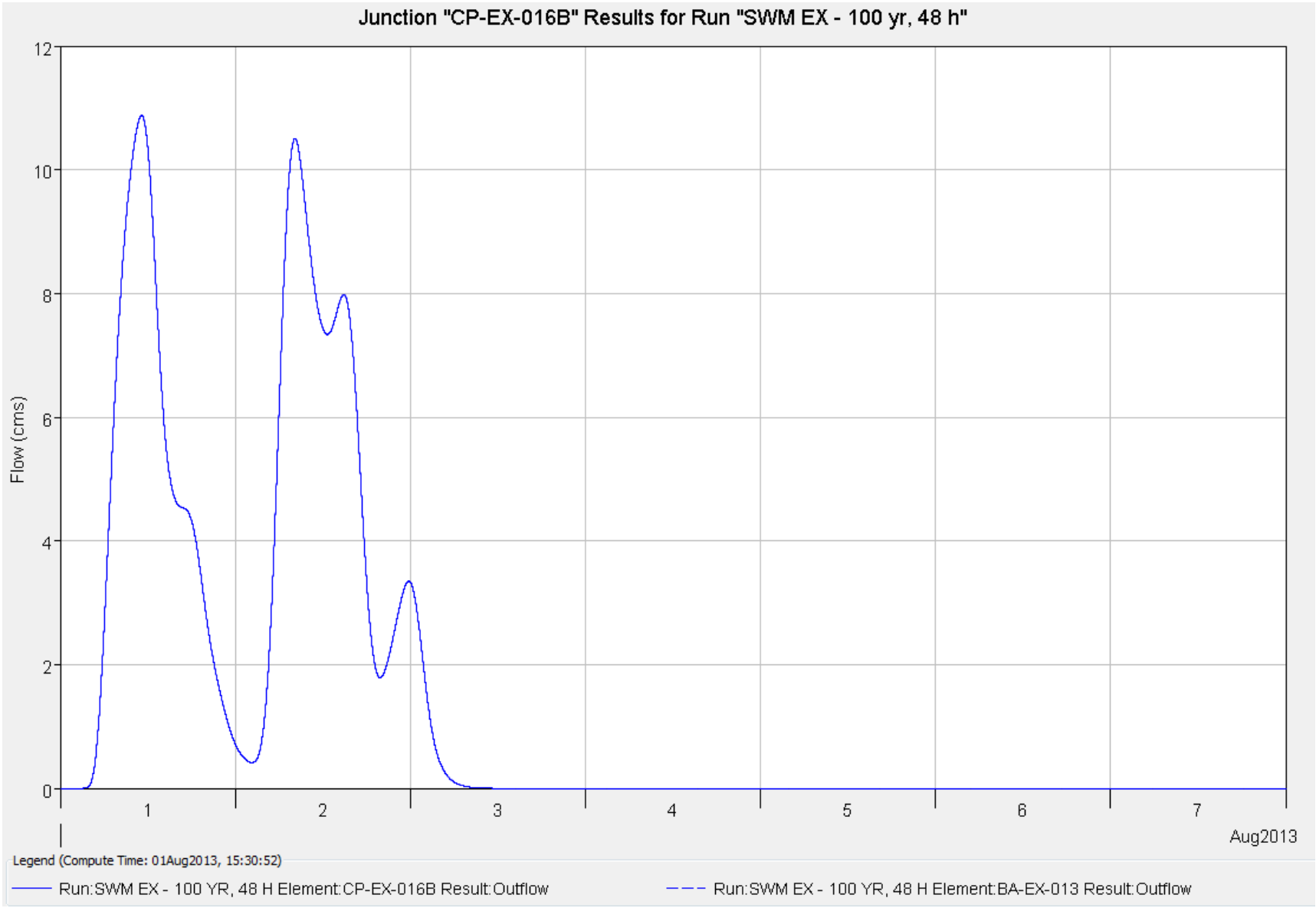

Junction "CP-EX-012" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-012 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-013 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-008 Result:Outflow

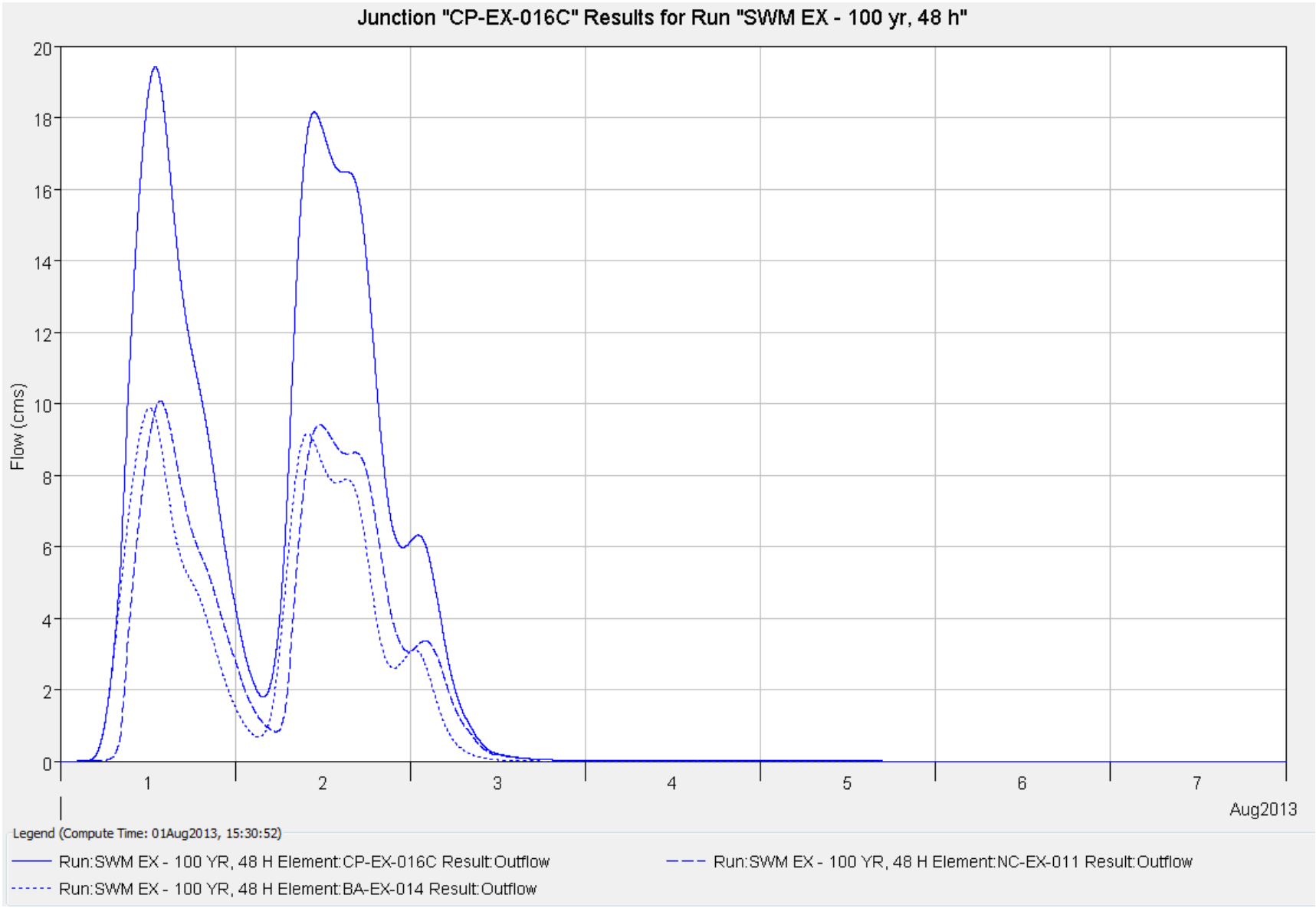

Junction "CP-EX-013" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-013 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-009 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-010 Result:Outflow

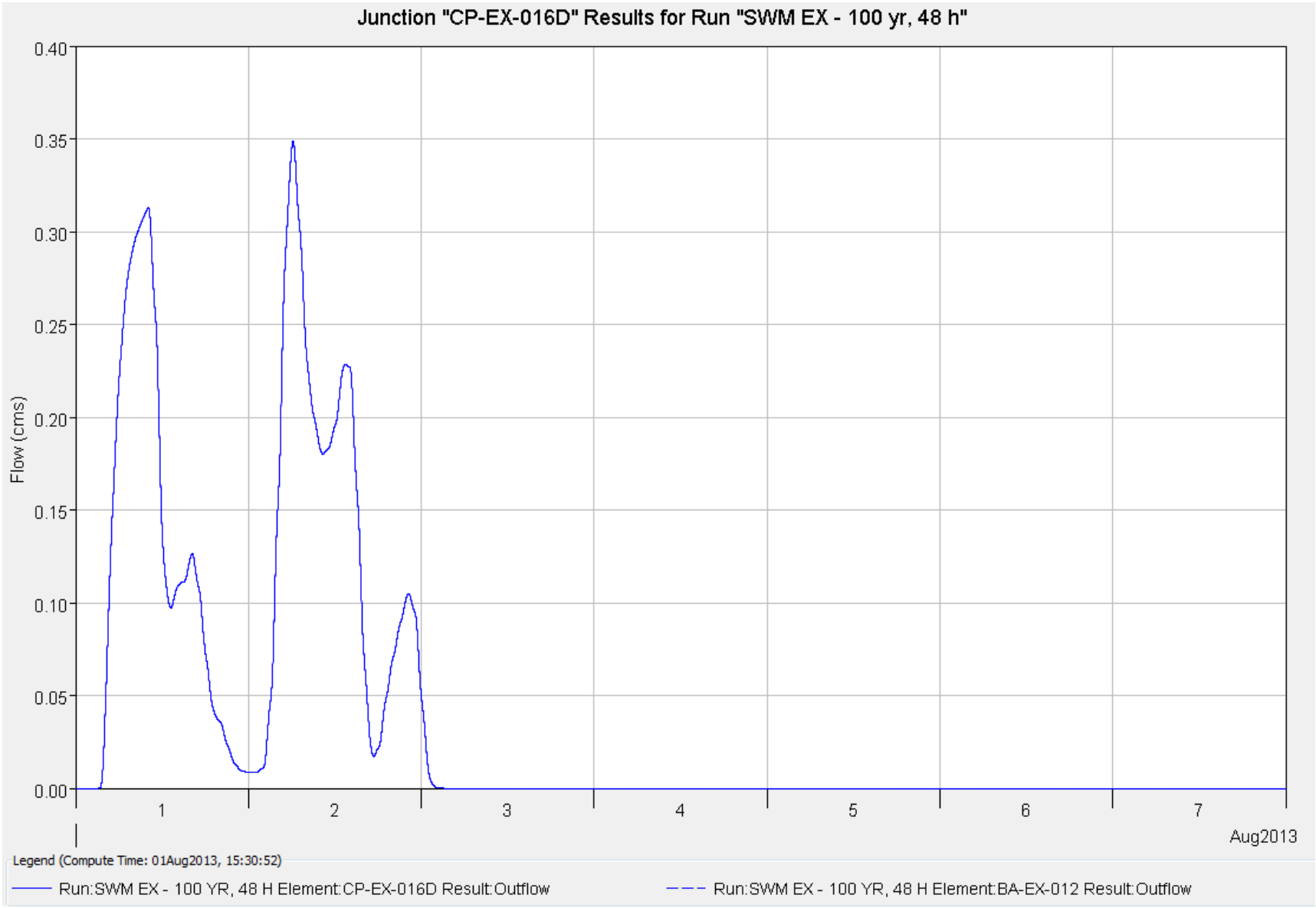

Junction "CP-EX-014" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-014 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-010 Result:Outflow

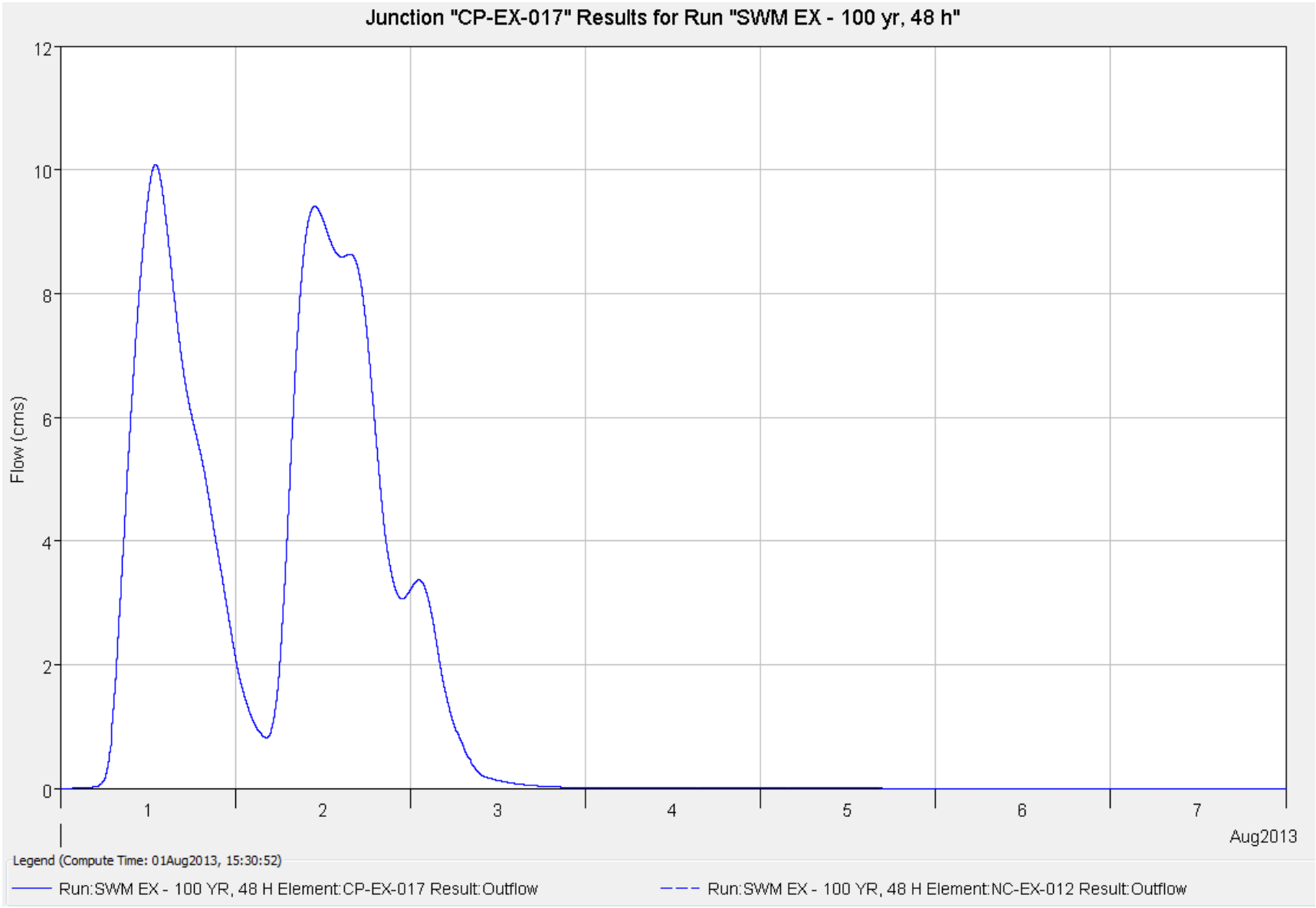

Junction "CP-EX-015" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-015 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-002 Result:Outflow

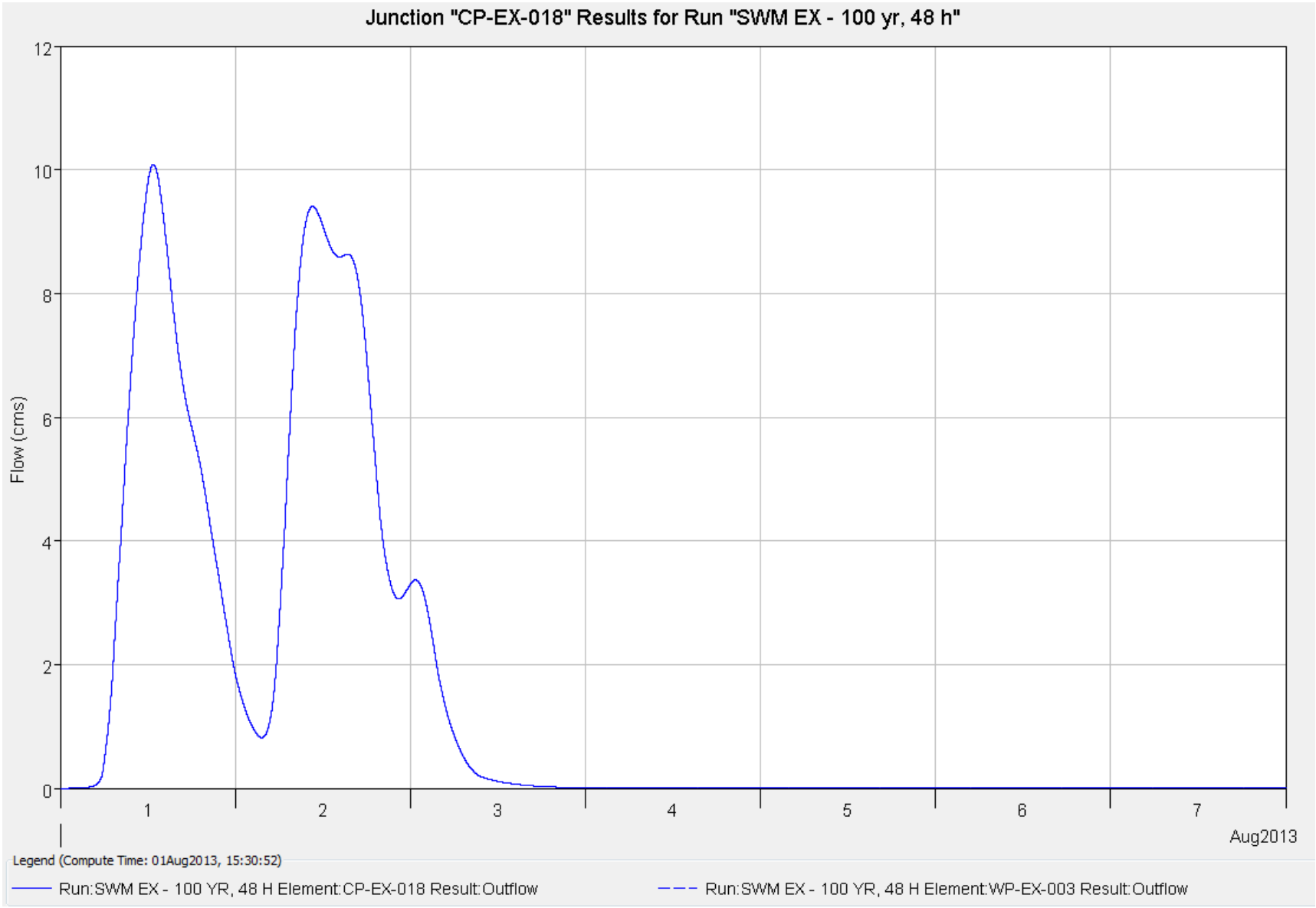

Junction "CP-EX-016A" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-016A Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-011 Result:Outflow

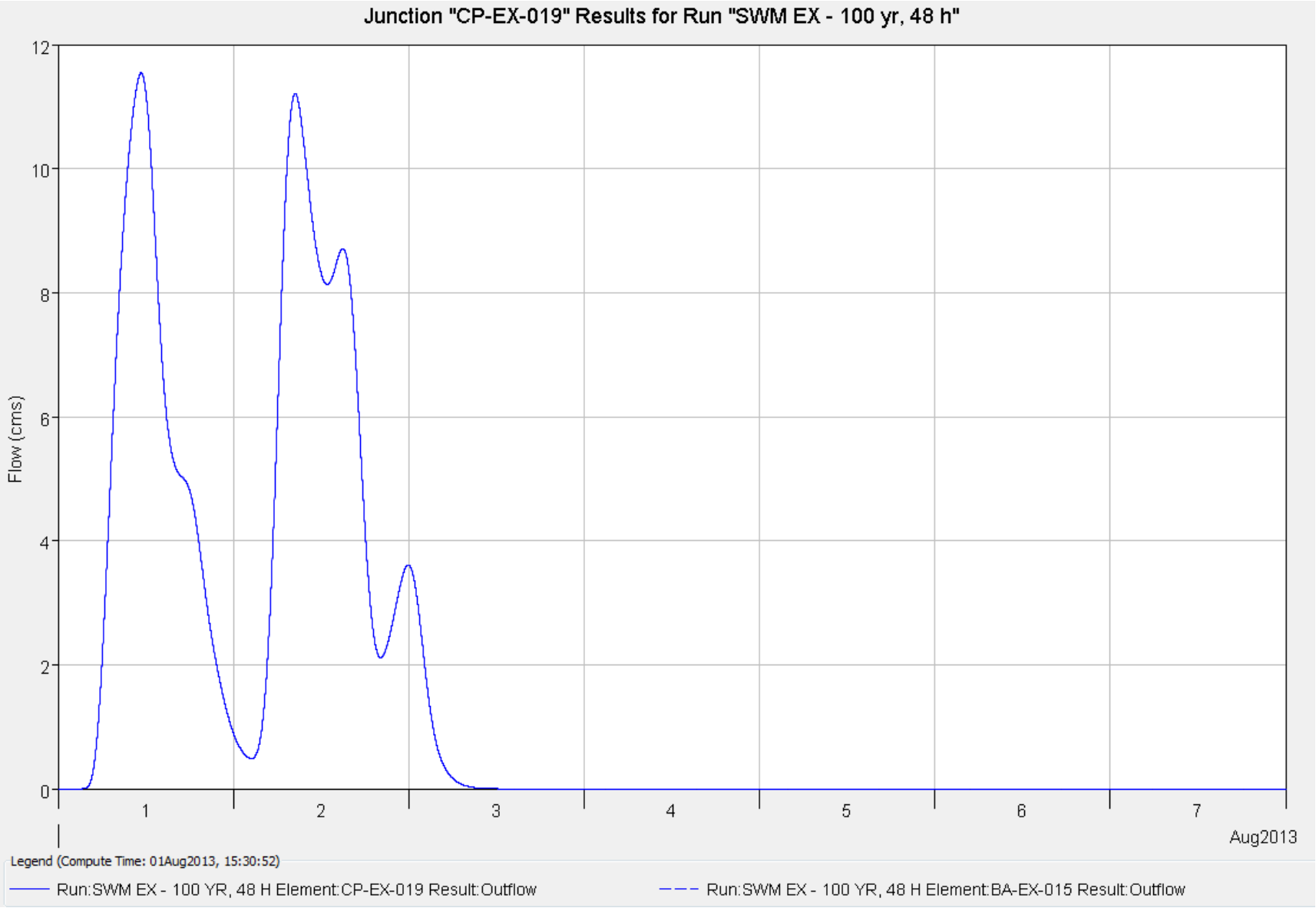

Junction "CP-EX-016B" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-016B Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-013 Result:Outflow

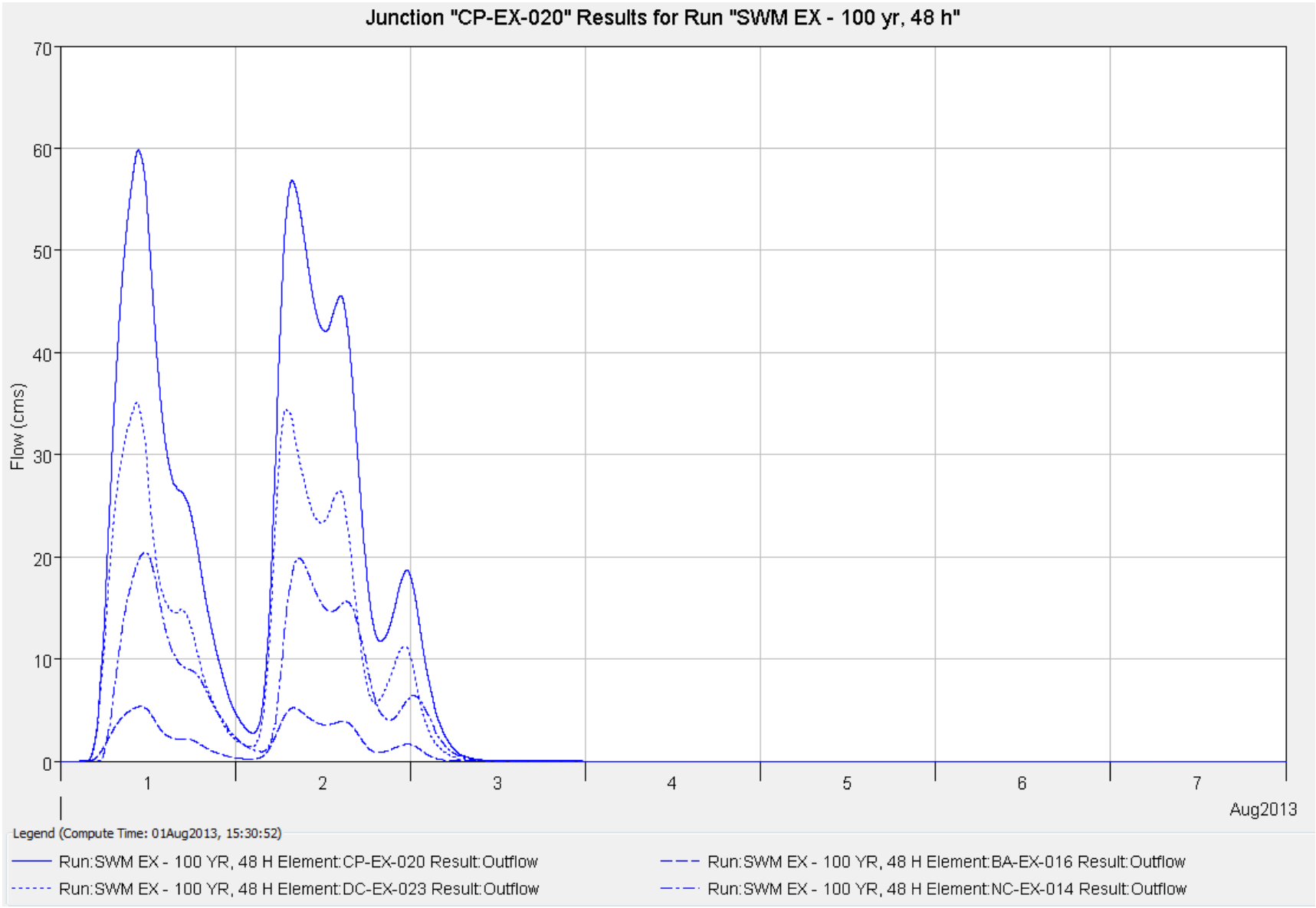

Junction "CP-EX-016C" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-016C Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-011 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-014 Result:Outflow

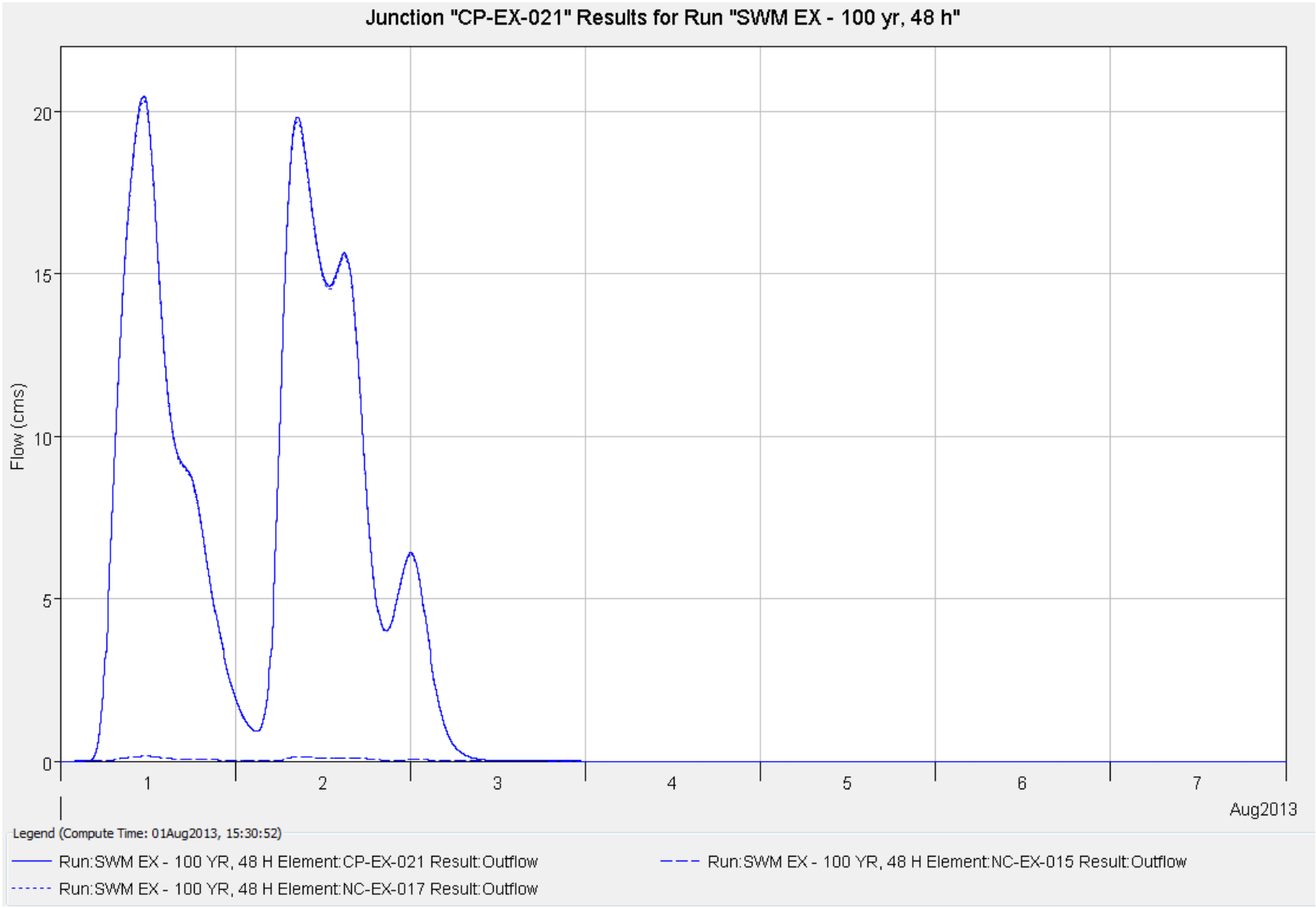

Junction "CP-EX-016D" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-016D Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-012 Result:Outflow

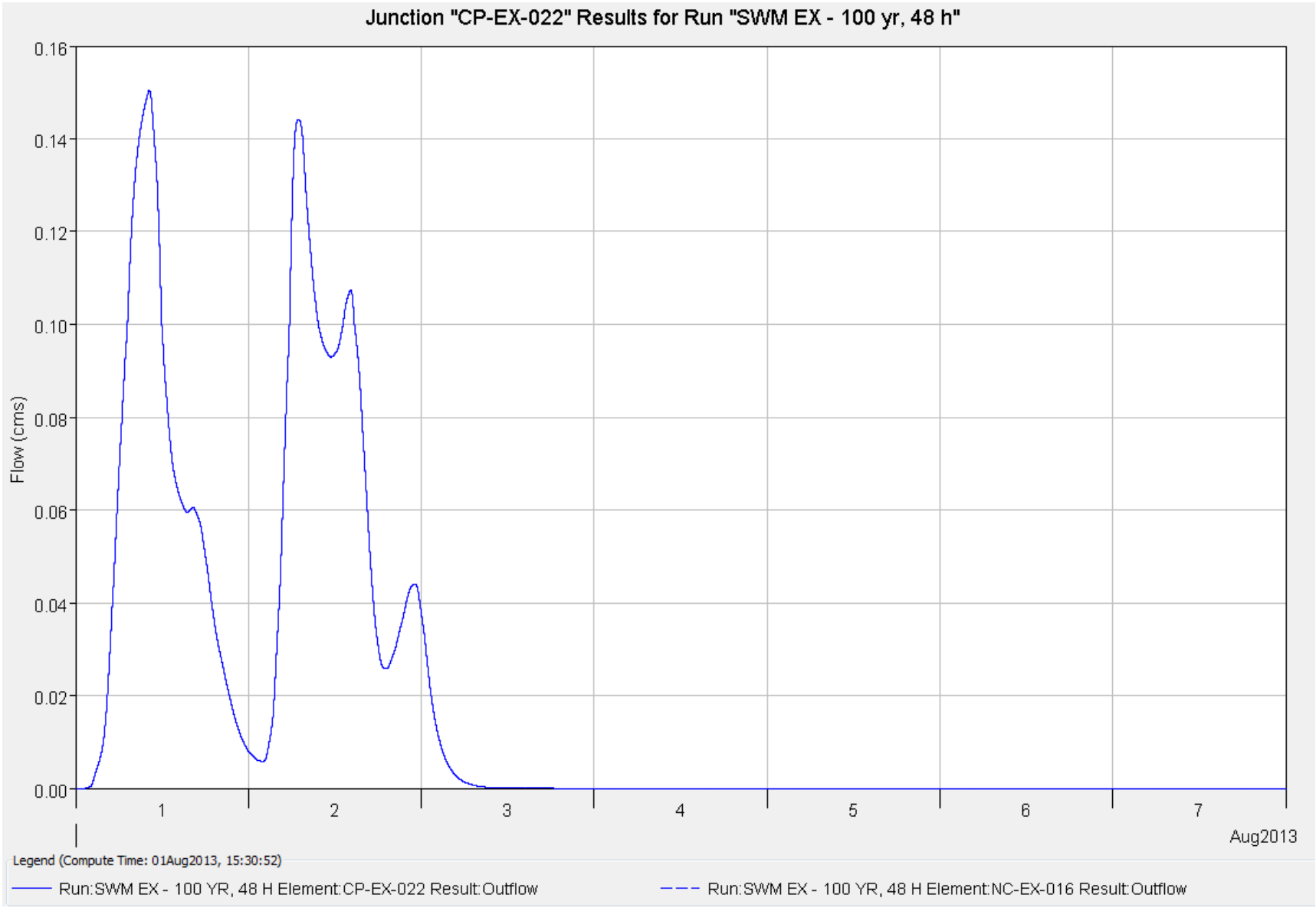

Junction "CP-EX-017" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-017 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-012 Result:Outflow

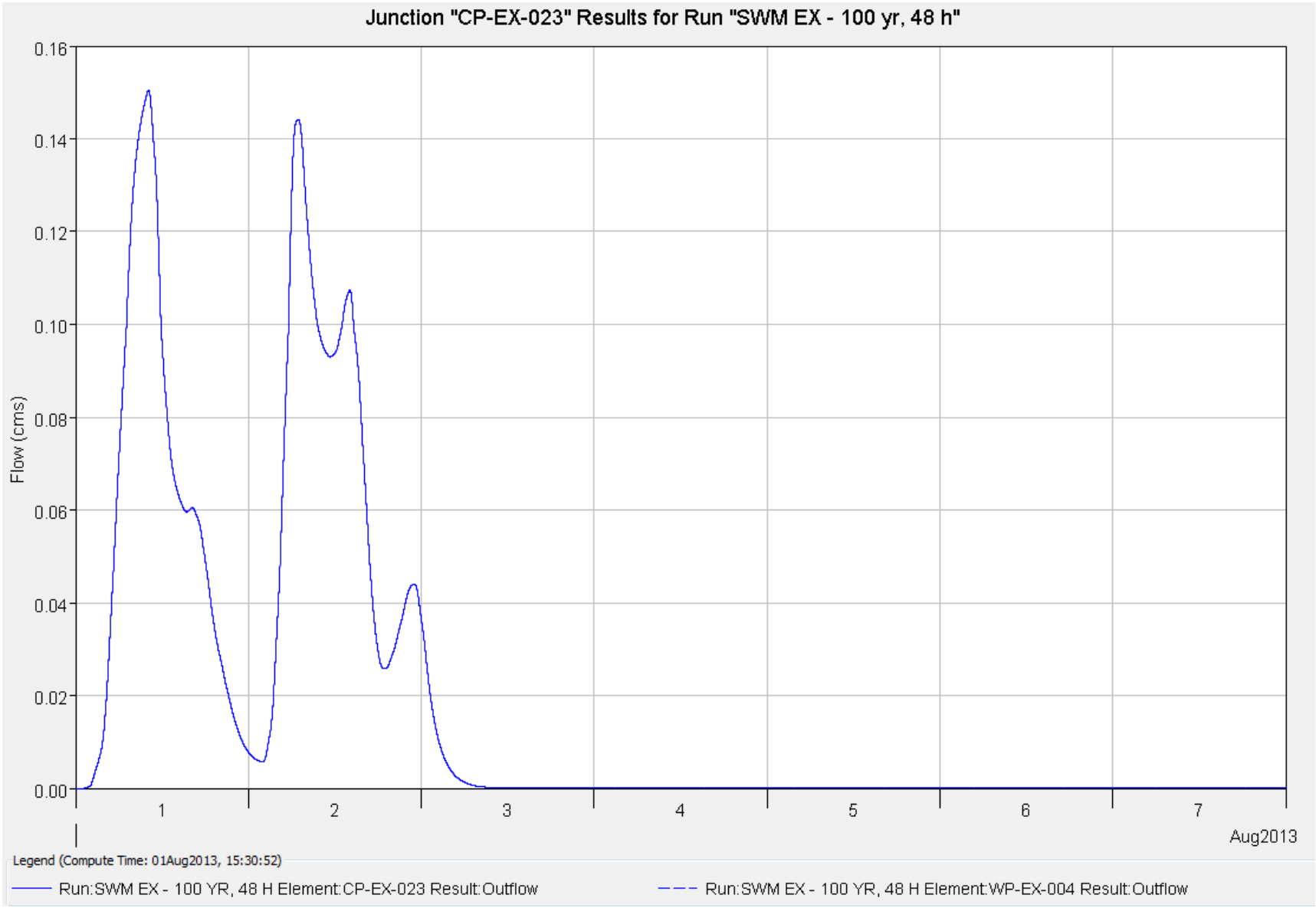

Junction "CP-EX-018" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-018 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-003 Result:Outflow

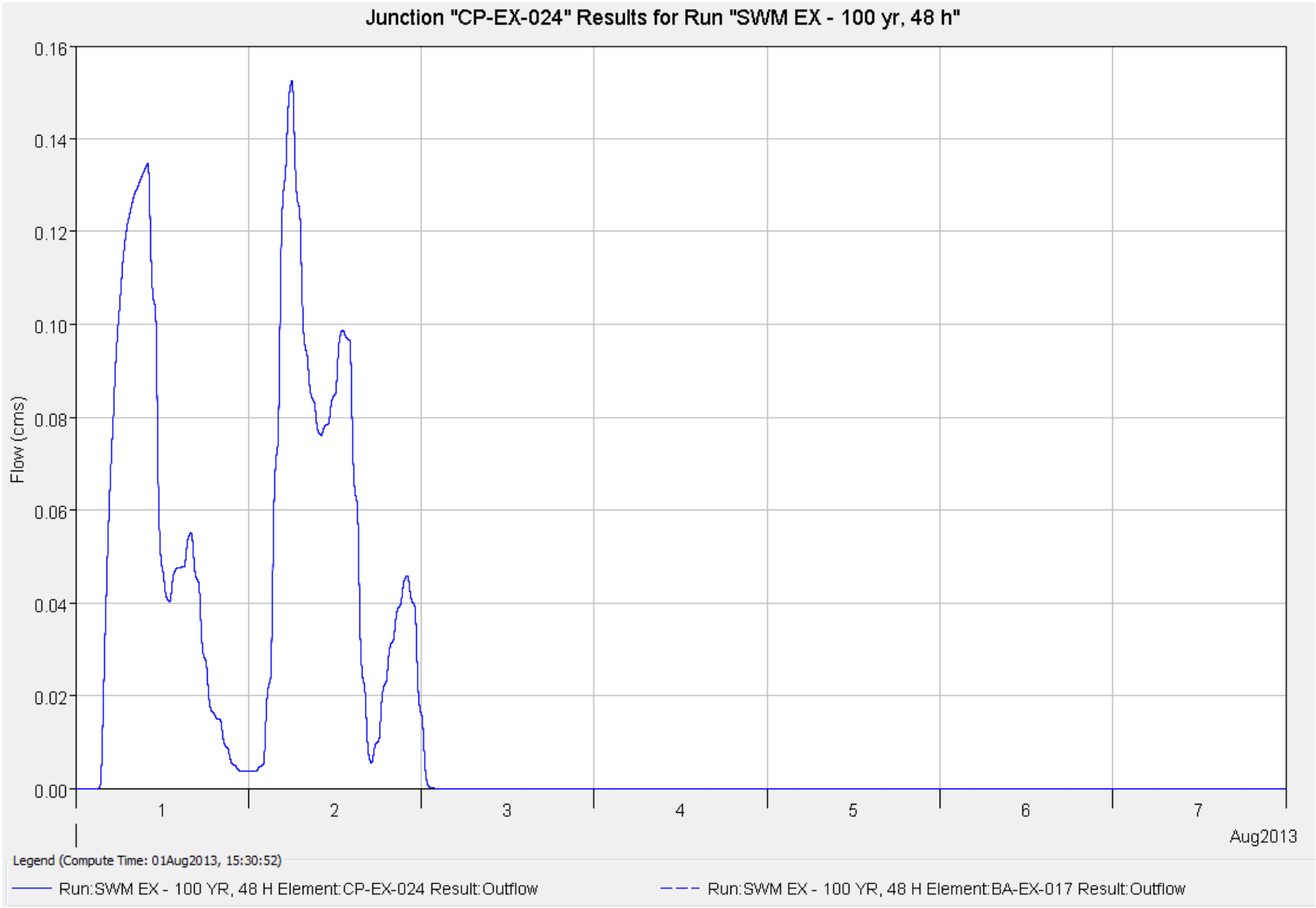

Junction "CP-EX-019" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-019 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-015 Result:Outflow

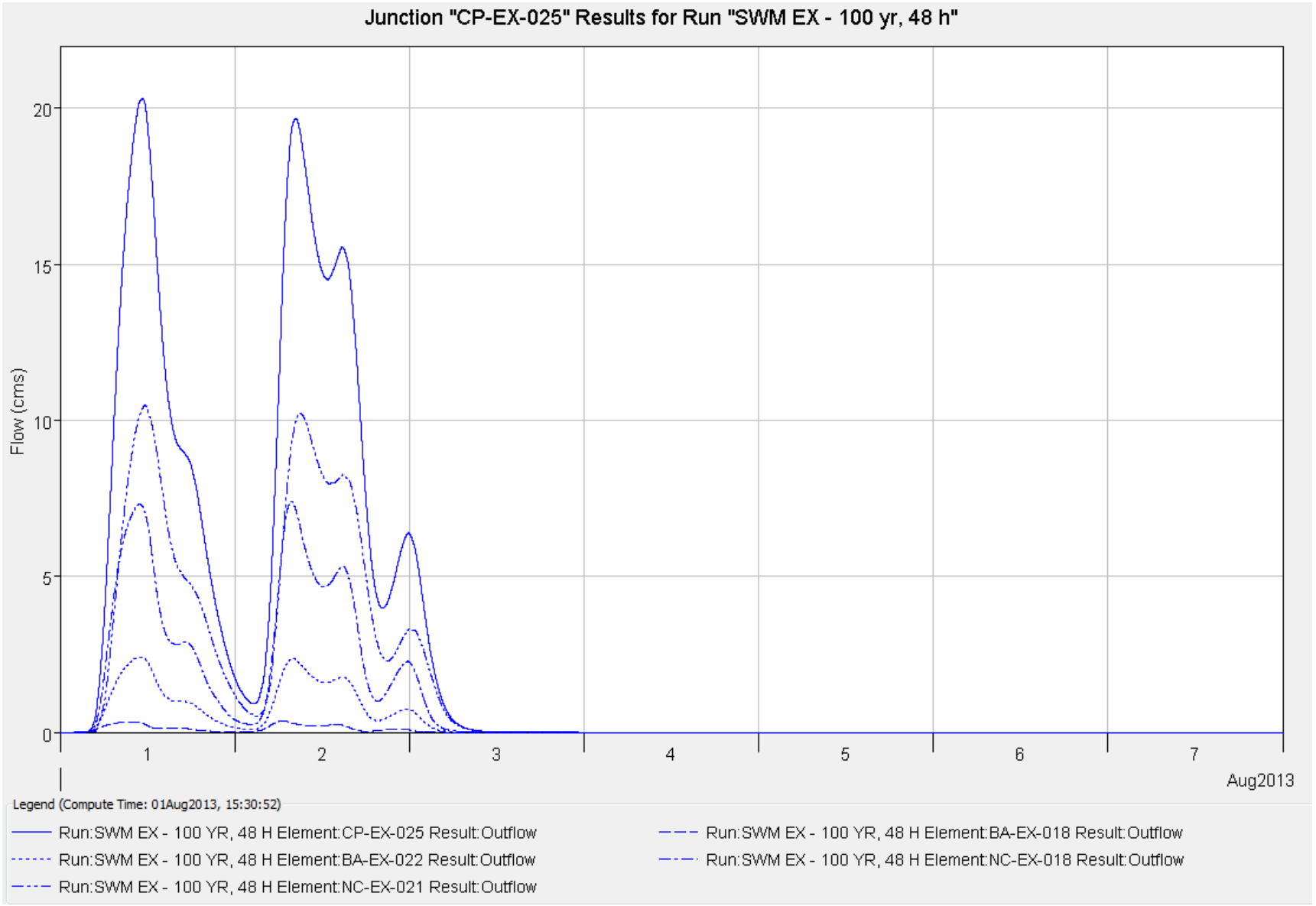

Junction "CP-EX-020" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-020 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-016 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-014 Result:Outflow

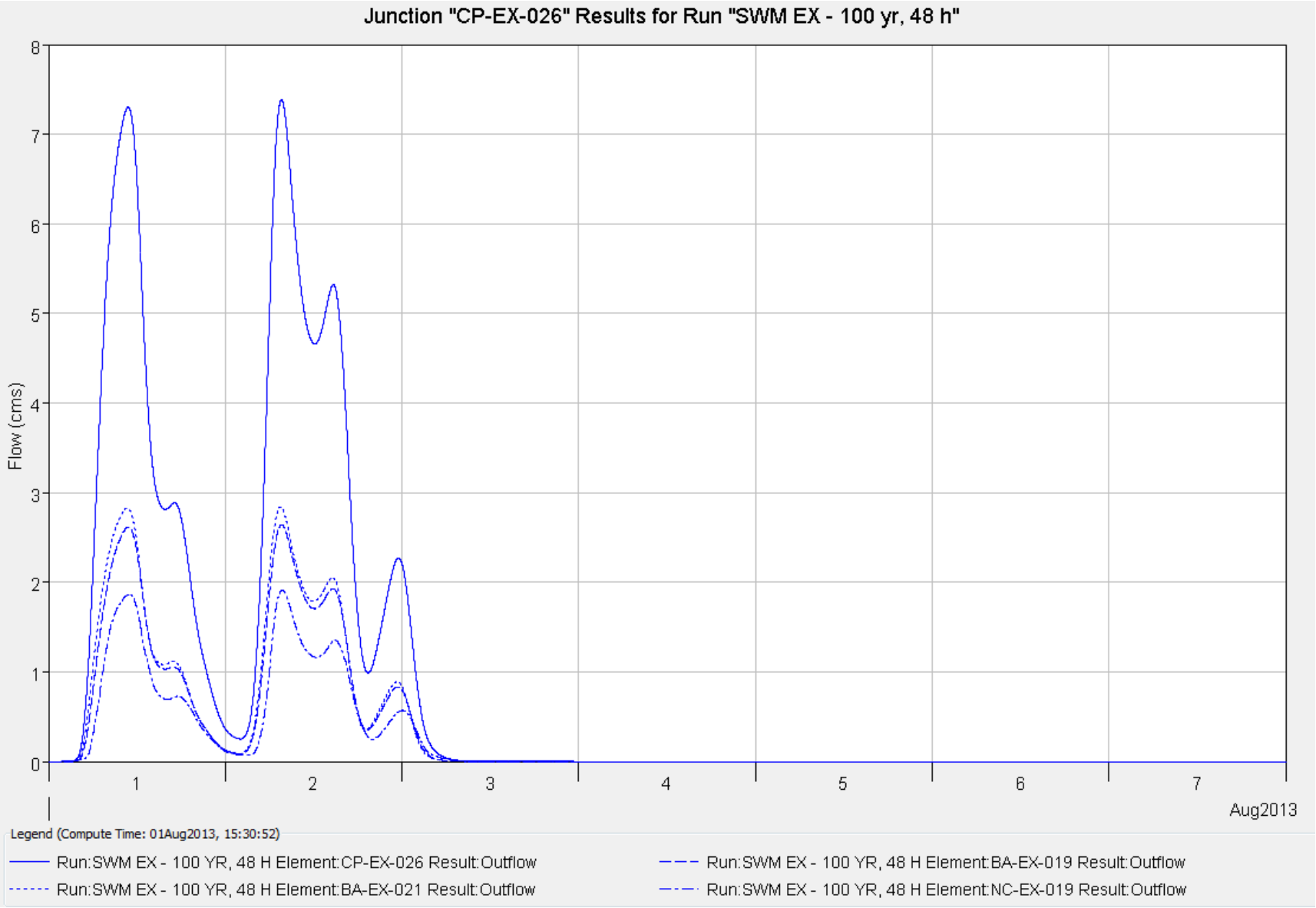

Junction "CP-EX-021" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-015 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-017 Result:Outflow

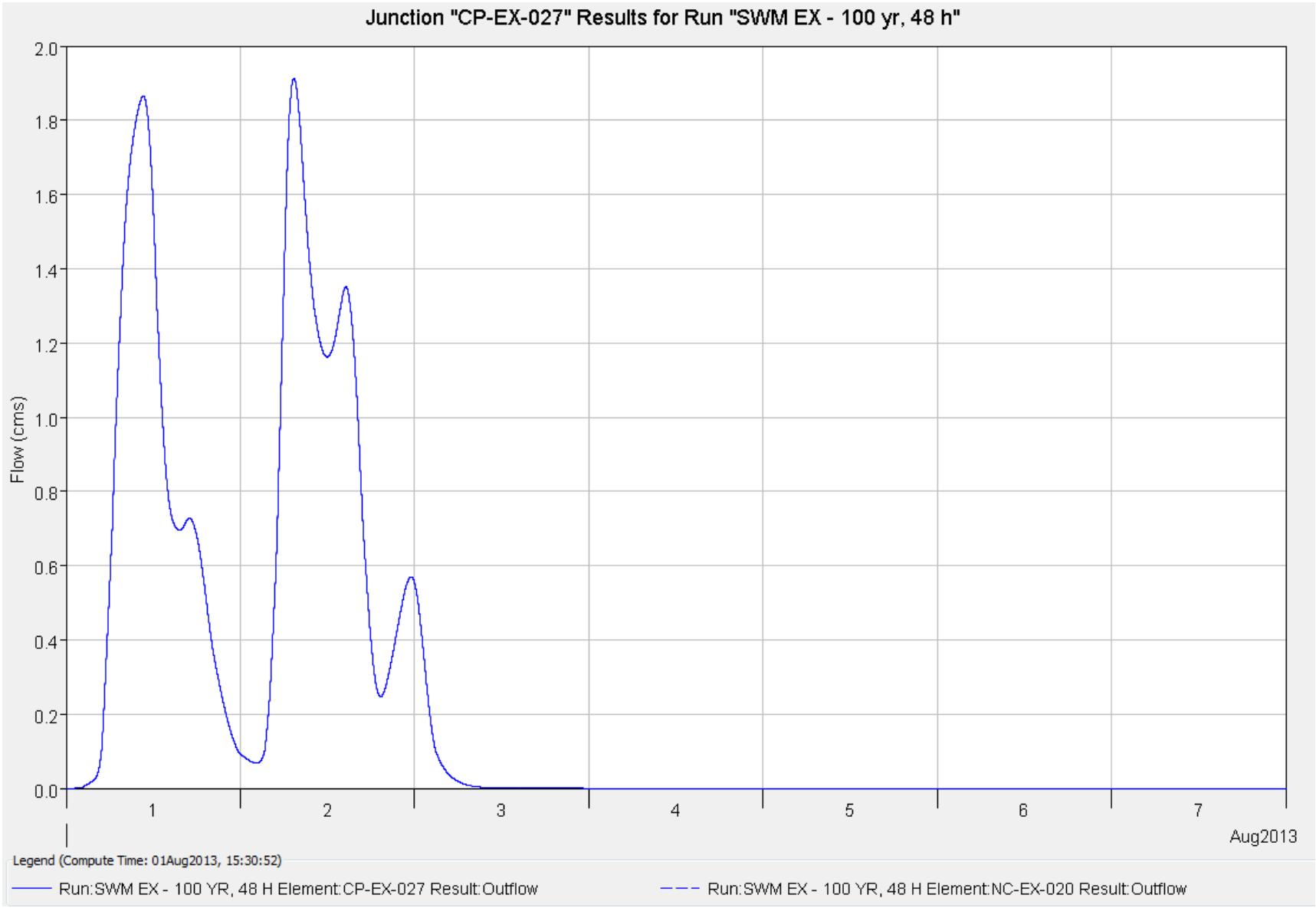

Junction "CP-EX-022" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-022 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-016 Result:Outflow

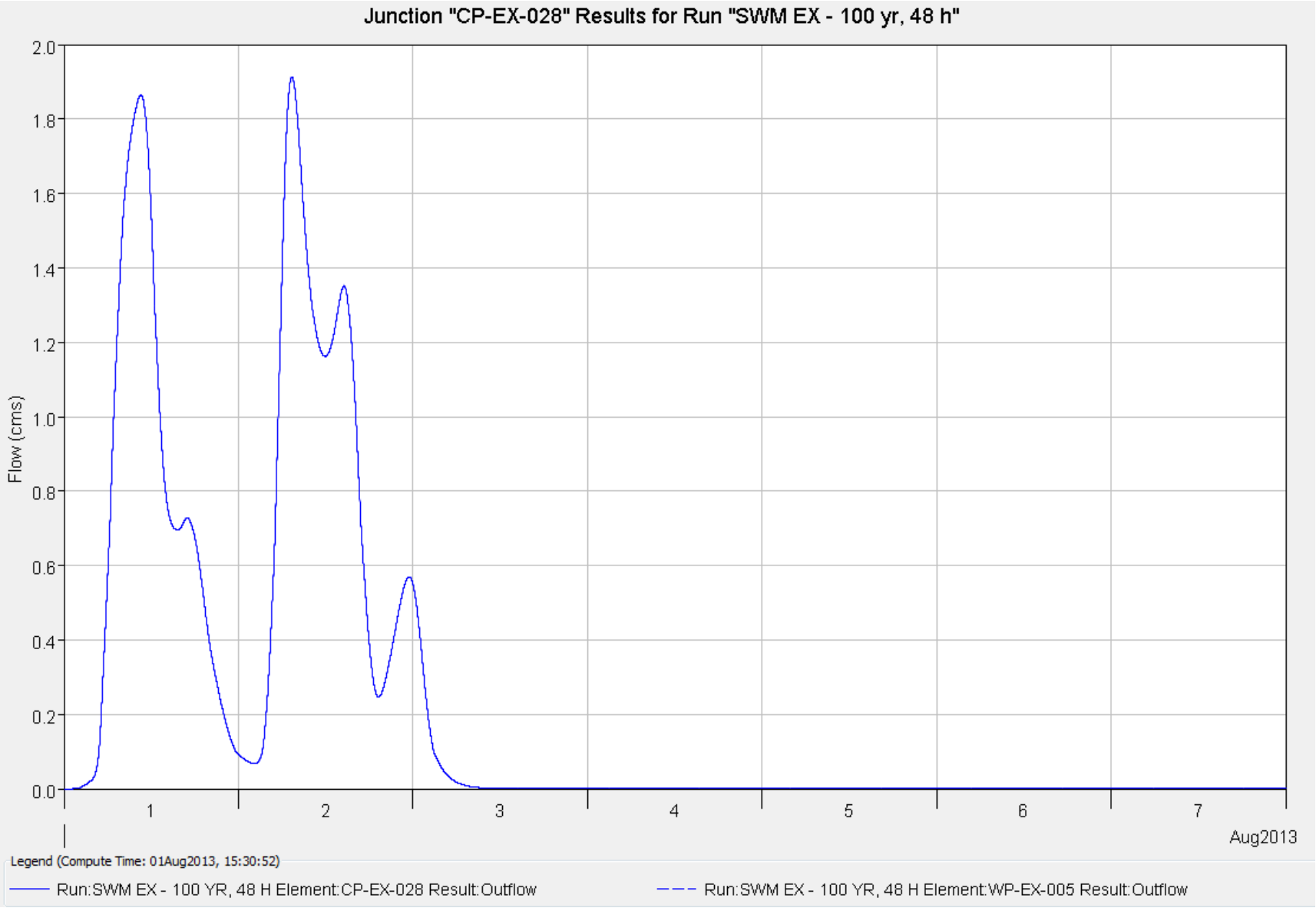

Junction "CP-EX-023" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-004 Result:Outflow

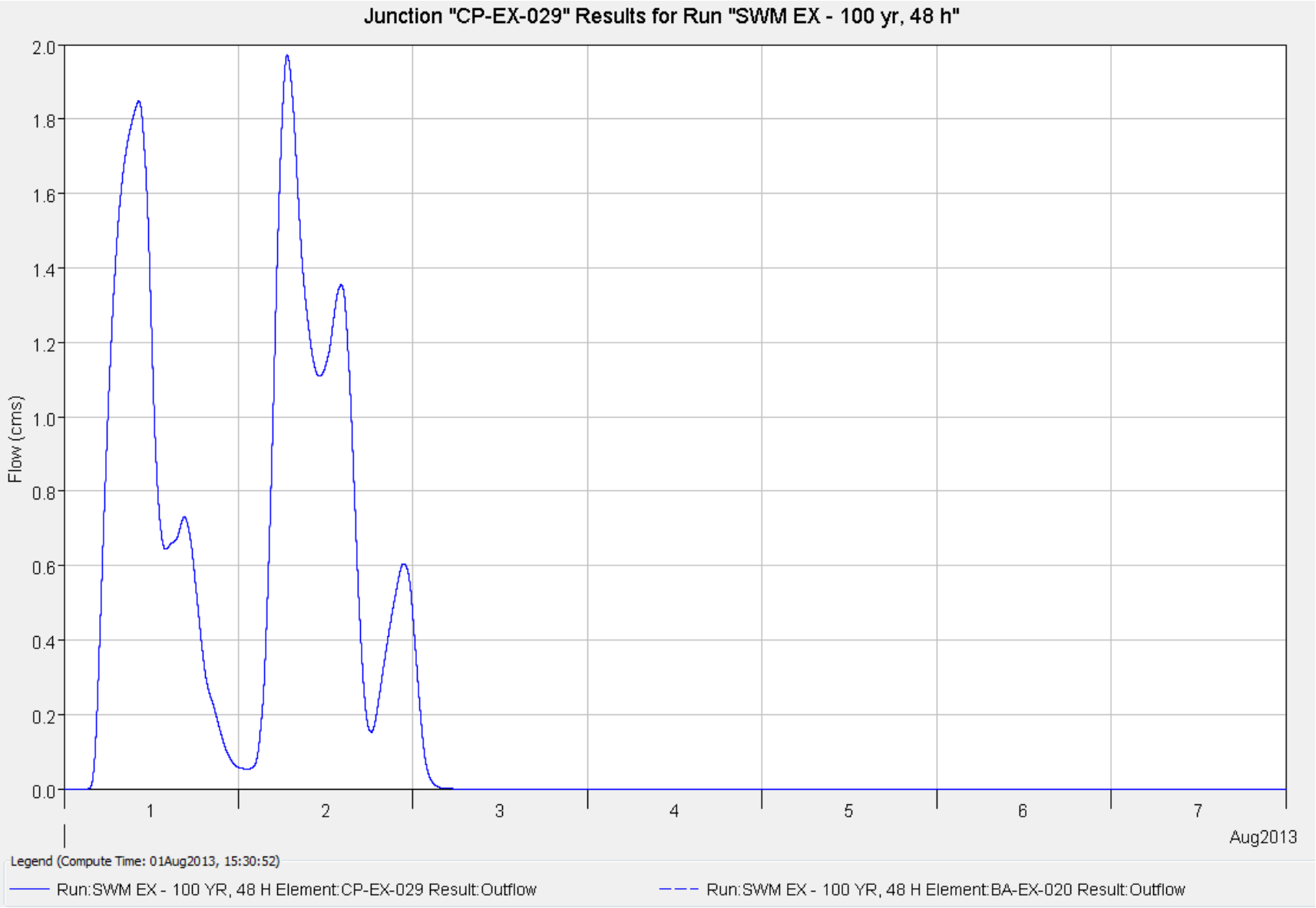

Junction "CP-EX-024" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-024 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-017 Result:Outflow

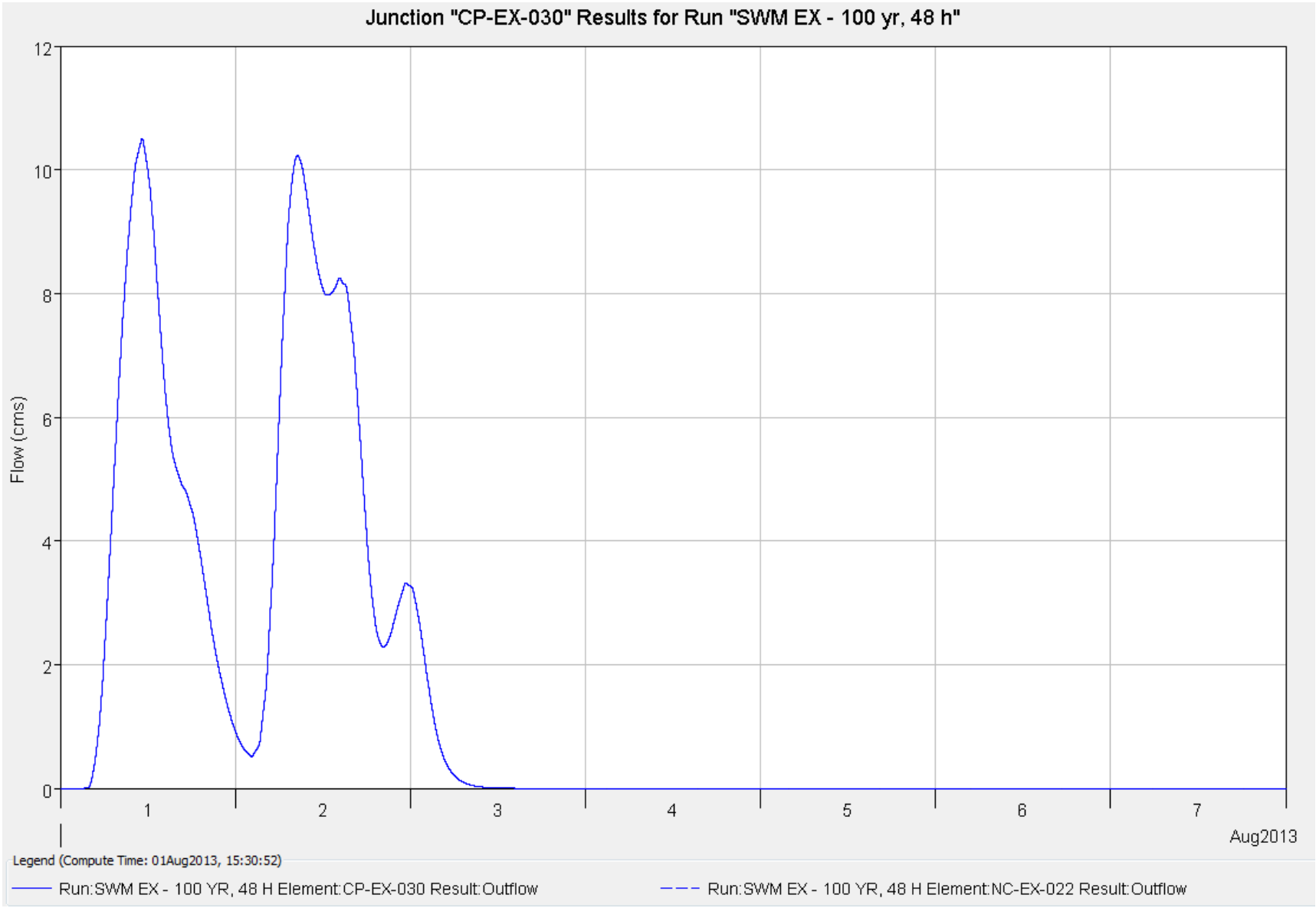

Junction "CP-EX-025" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-025 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-022 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-018 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-018 Result:Outflow

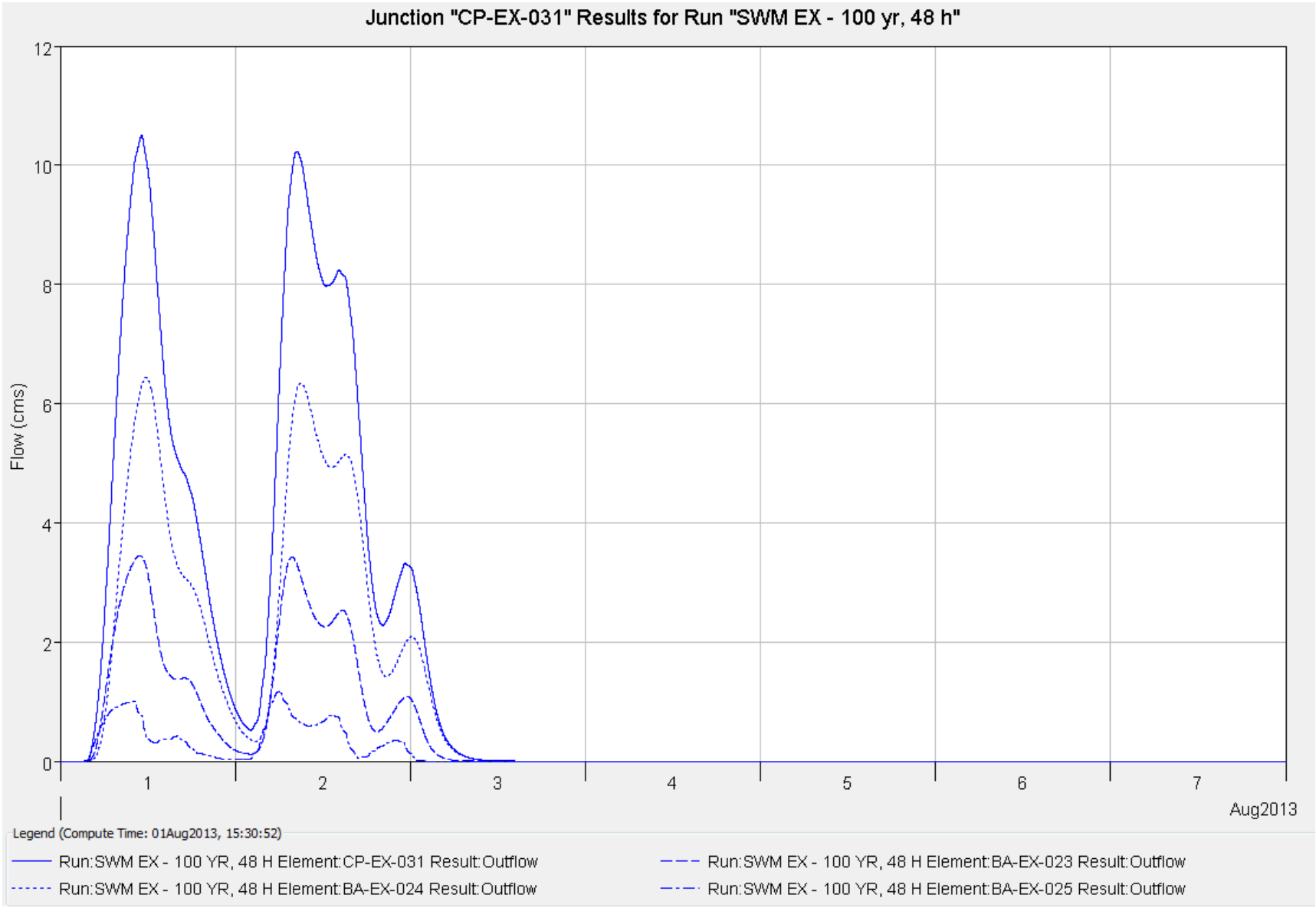

Junction "CP-EX-026" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-019 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-021 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-019 Result:Outflow

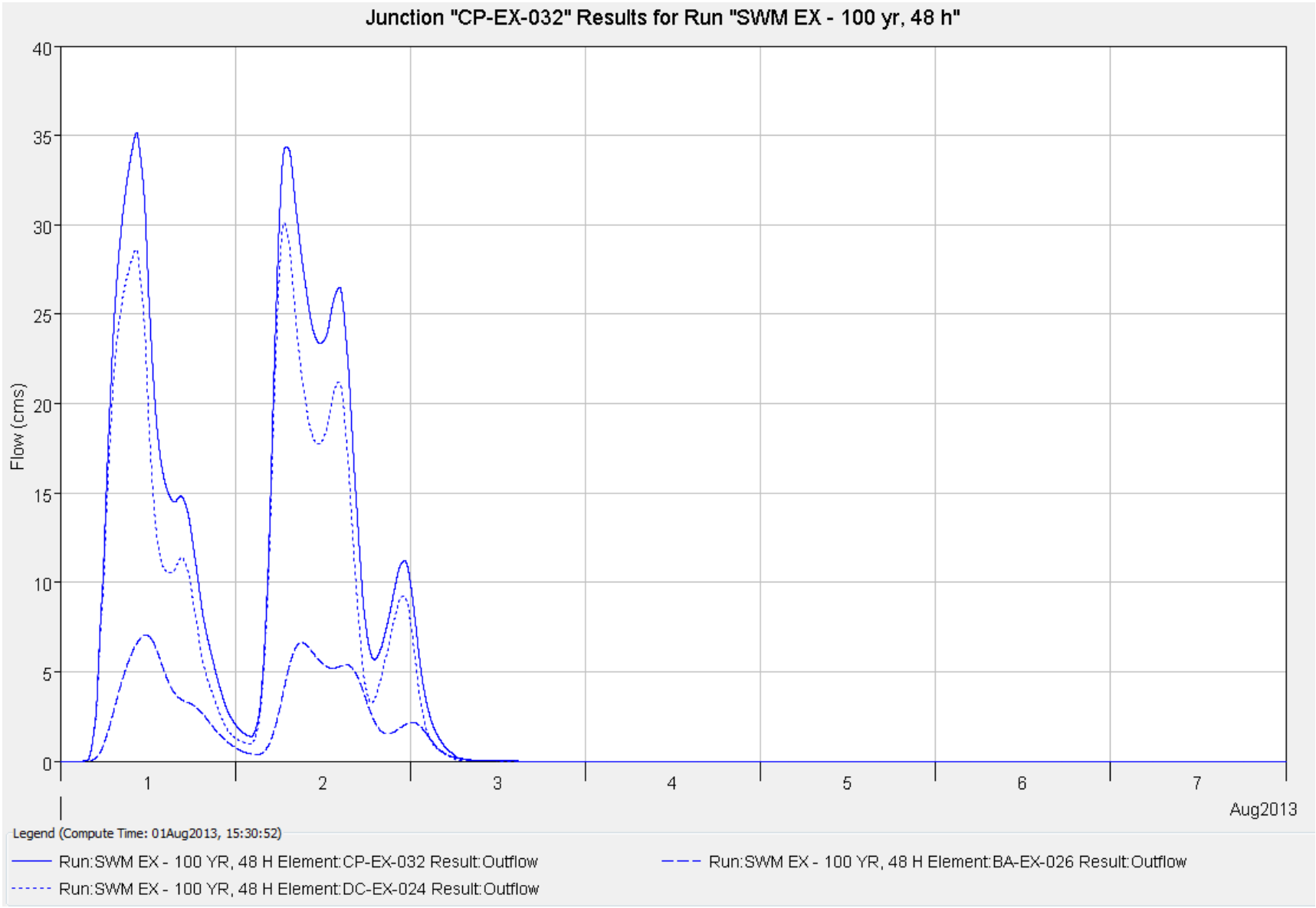

Junction "CP-EX-027" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-027 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-020 Result:Outflow

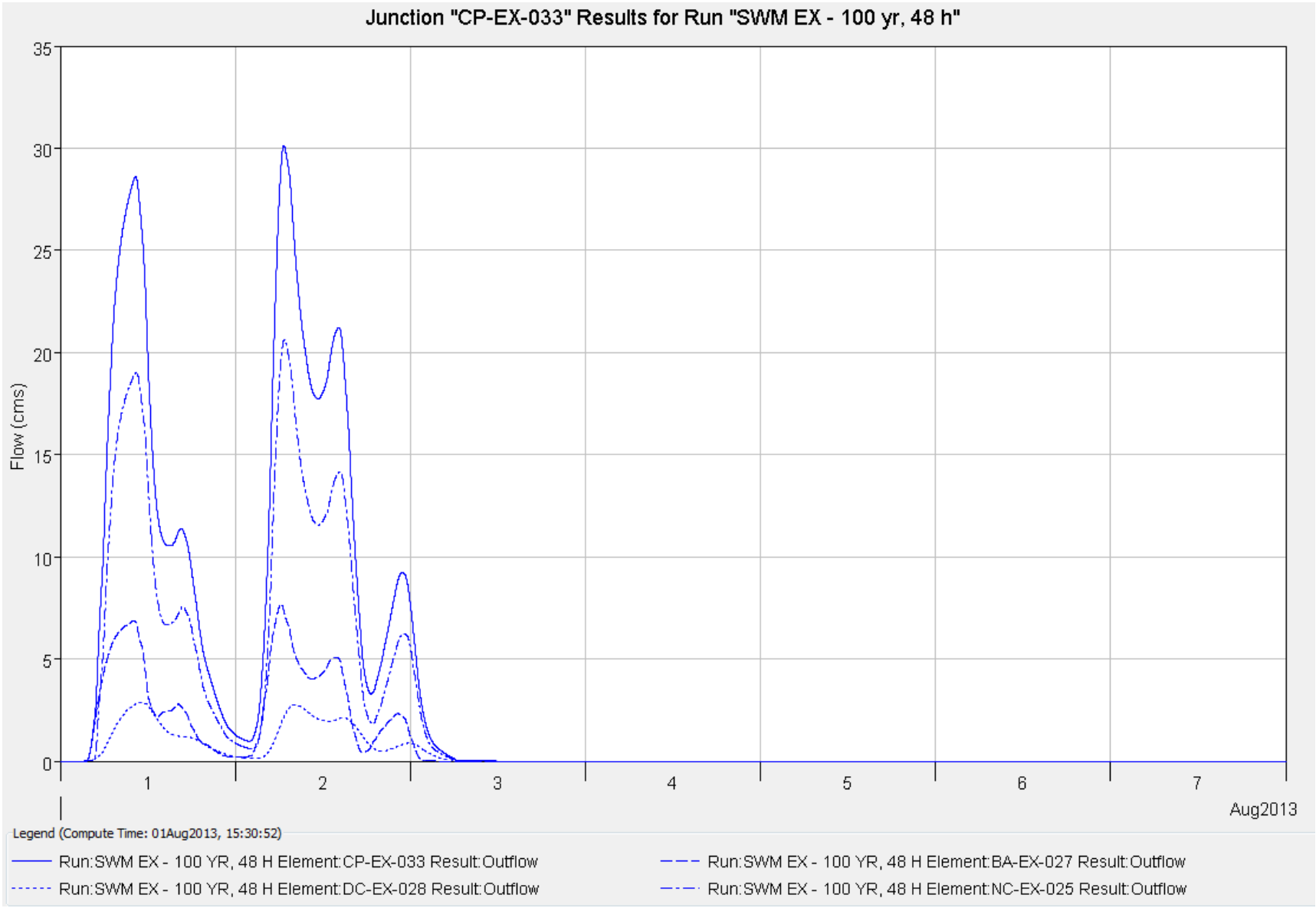

Junction "CP-EX-028" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-005 Result:Outflow

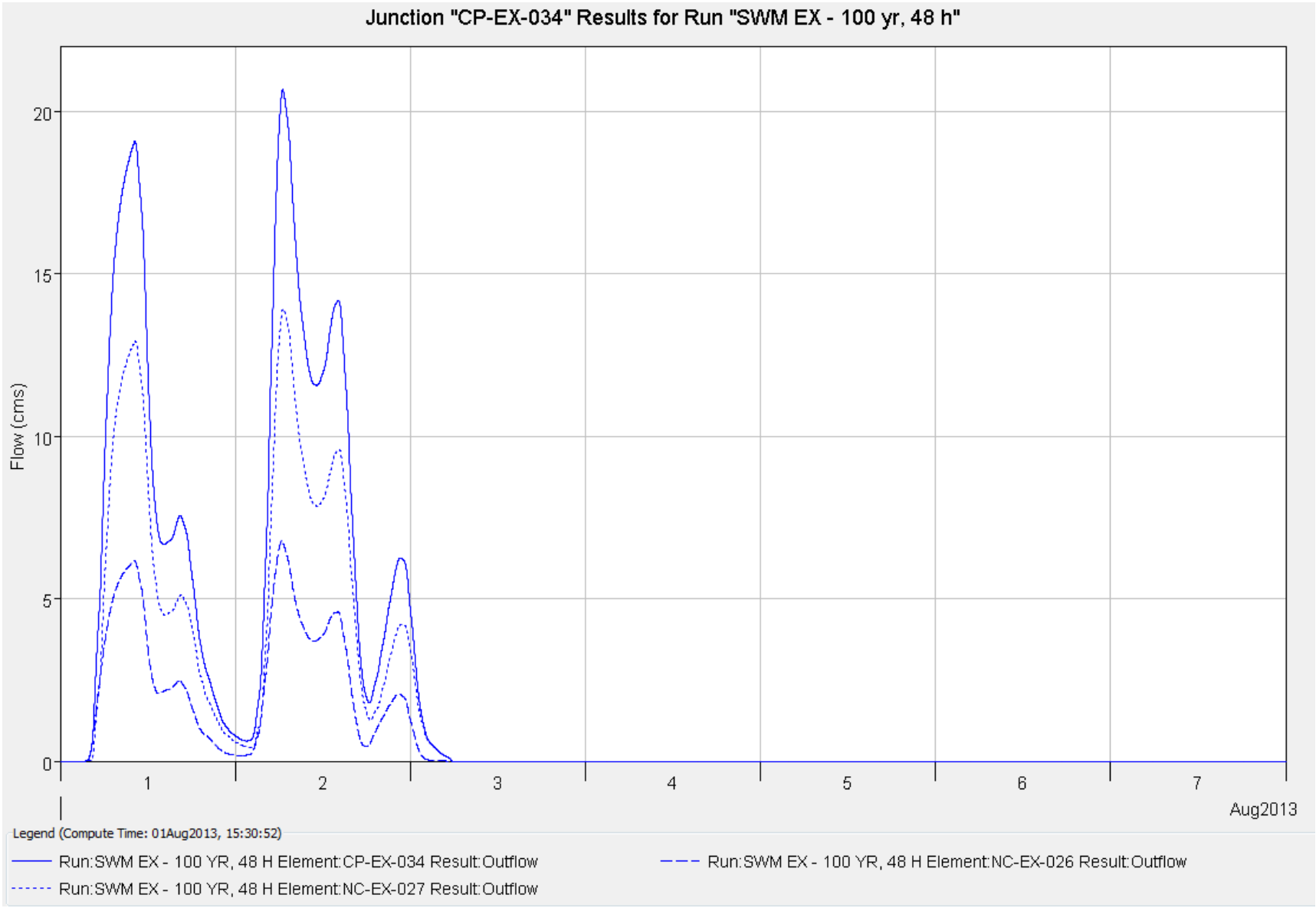

Junction "CP-EX-029" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-029 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-020 Result:Outflow

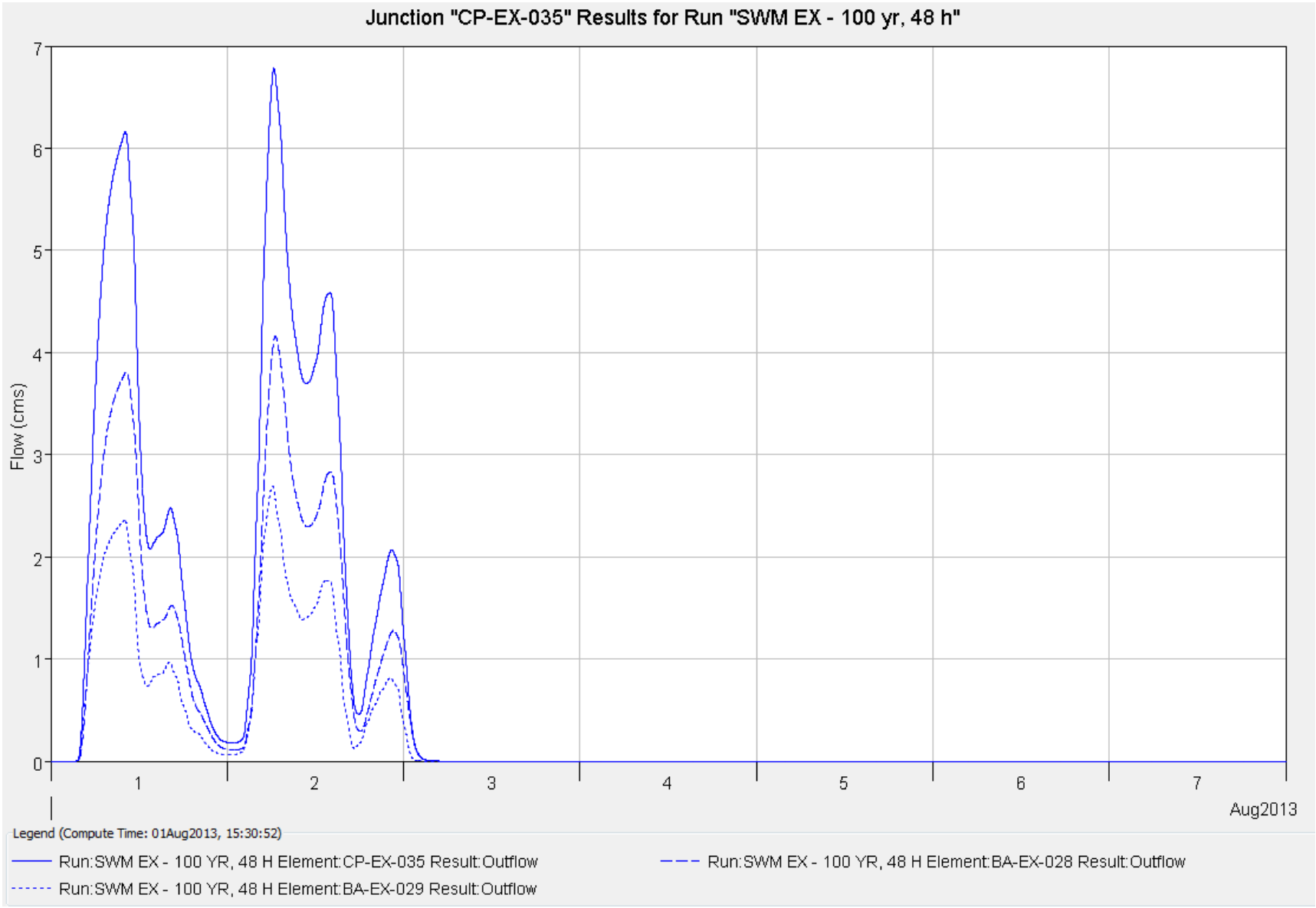

Junction "CP-EX-030" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-030 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-022 Result:Outflow

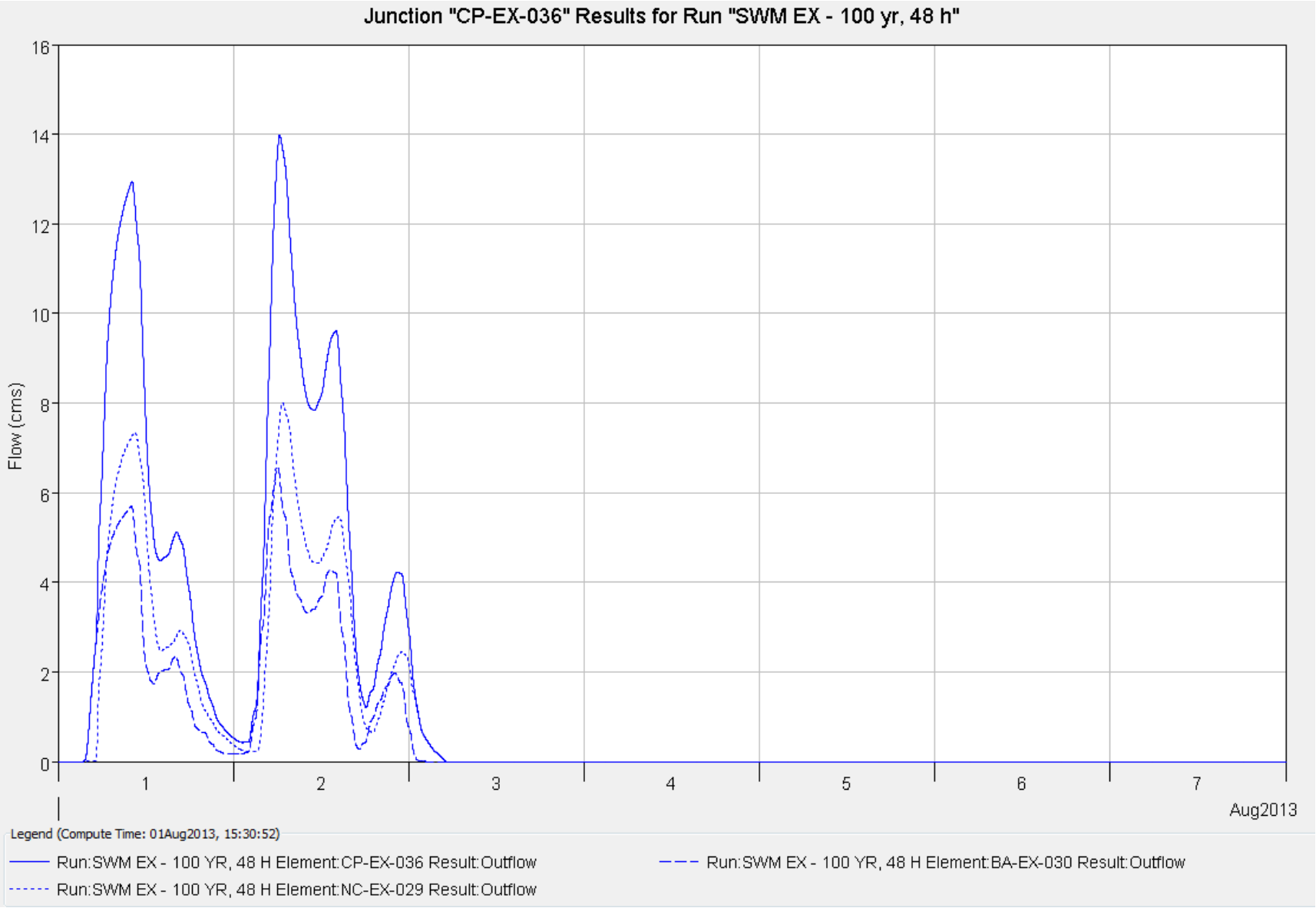

Junction "CP-EX-031" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-031 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-023 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-024 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-025 Result:Outflow

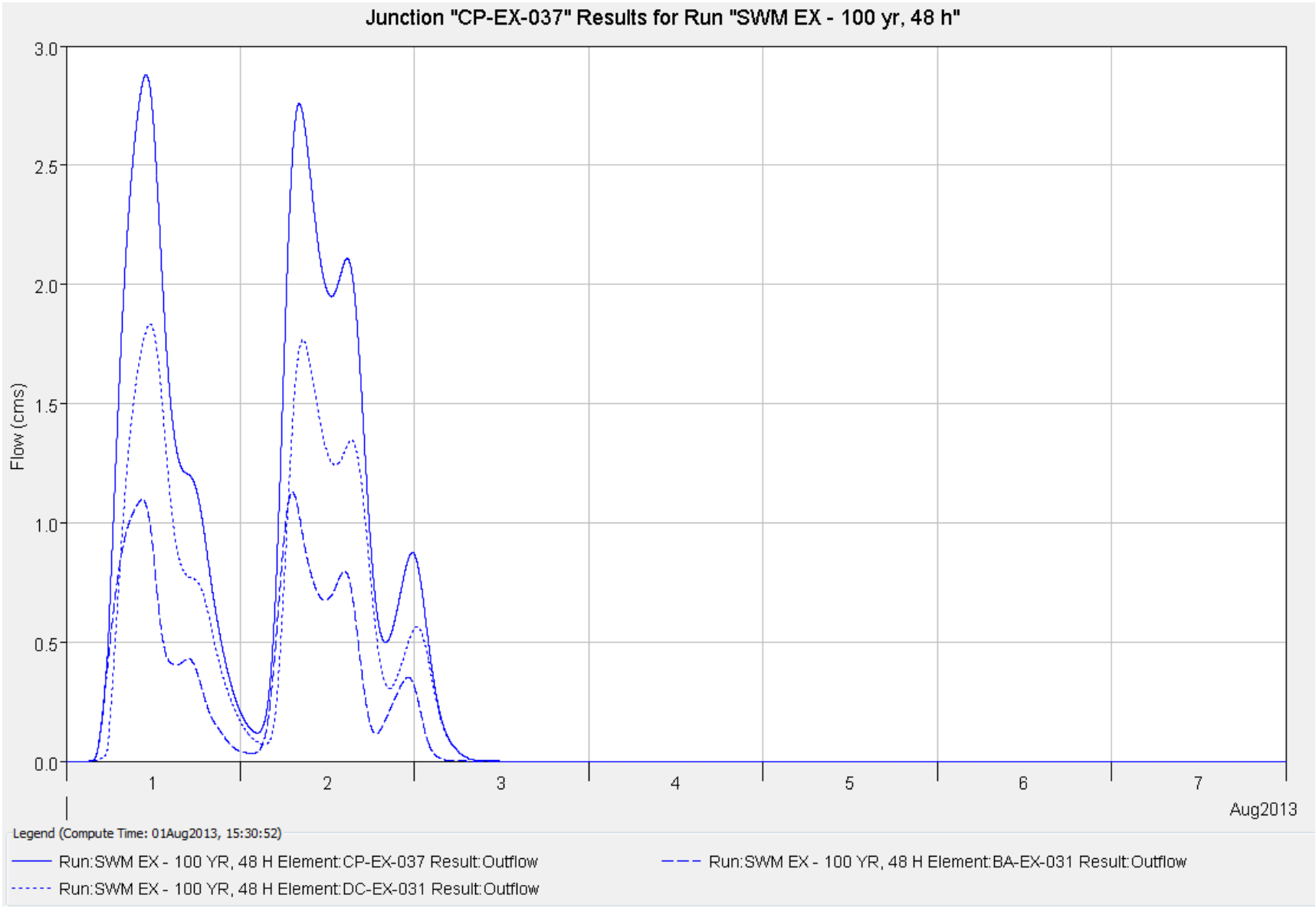

Junction "CP-EX-032" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-032 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-024 Result:Outflow

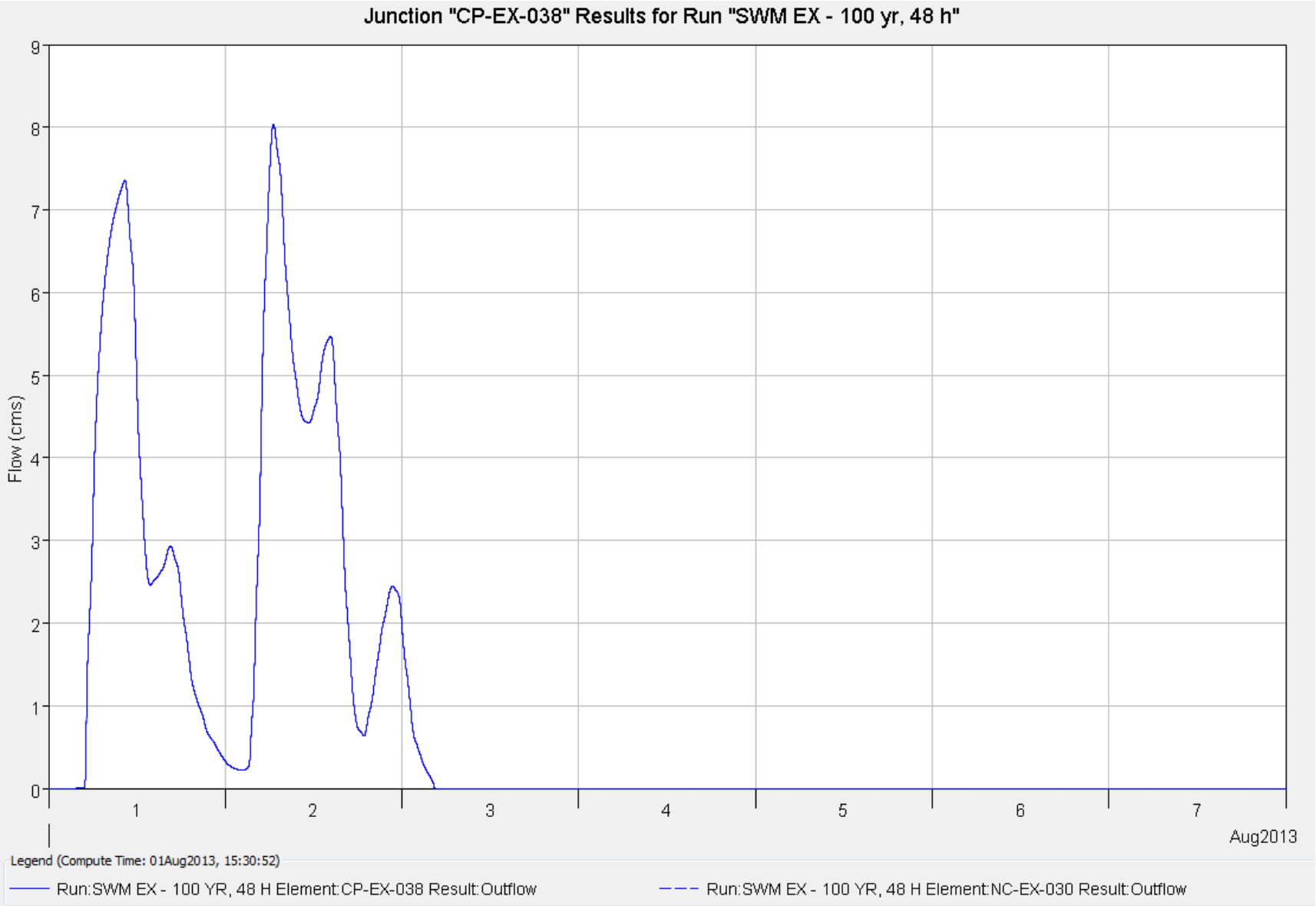

Junction "CP-EX-033" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-033 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-027 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-025 Result:Outflow

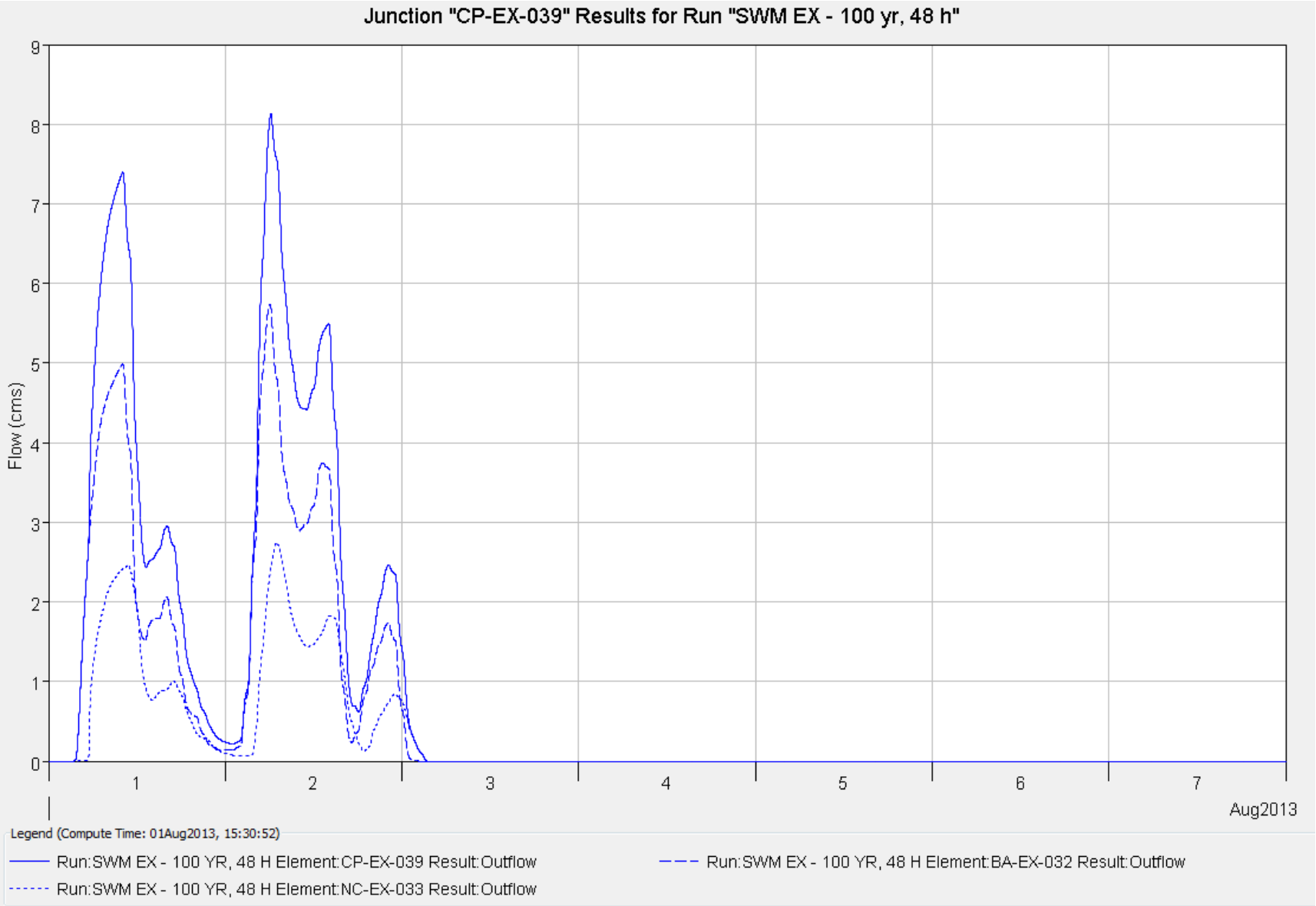

Junction "CP-EX-034" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-034 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-026 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-027 Result:Outflow

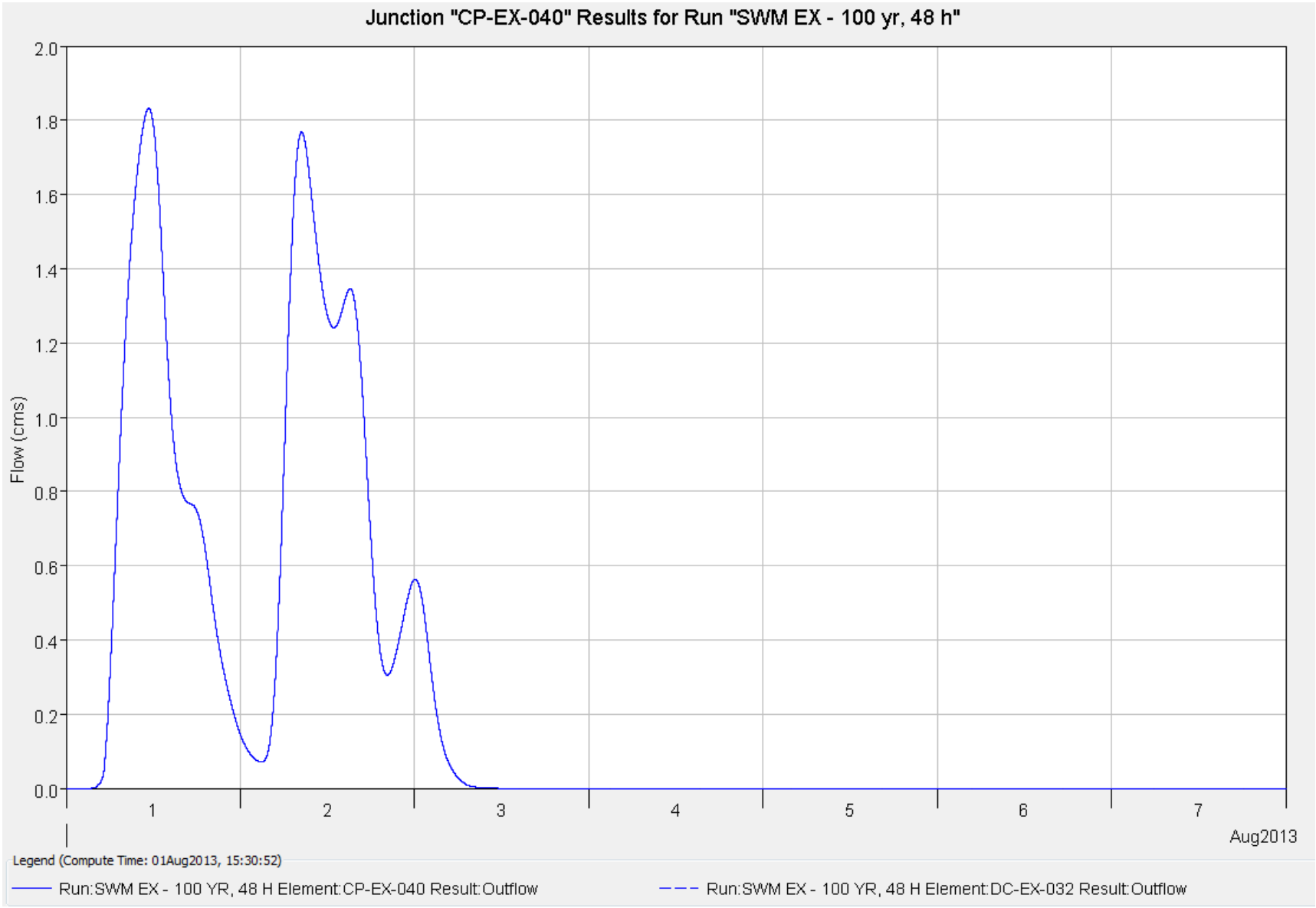

Junction "CP-EX-035" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-035 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-028 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-029 Result:Outflow

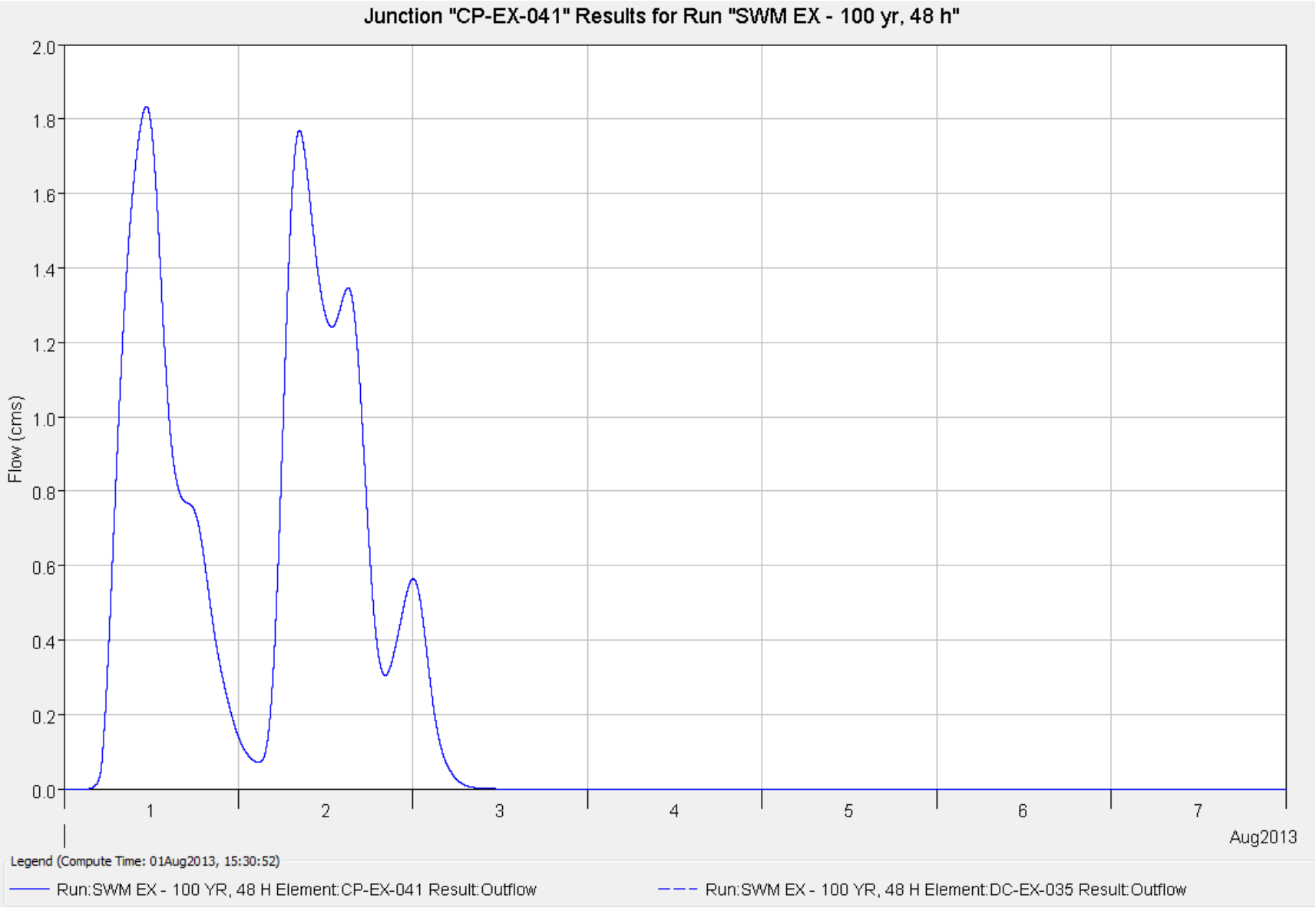

Junction "CP-EX-036" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-036 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-030 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-029 Result:Outflow

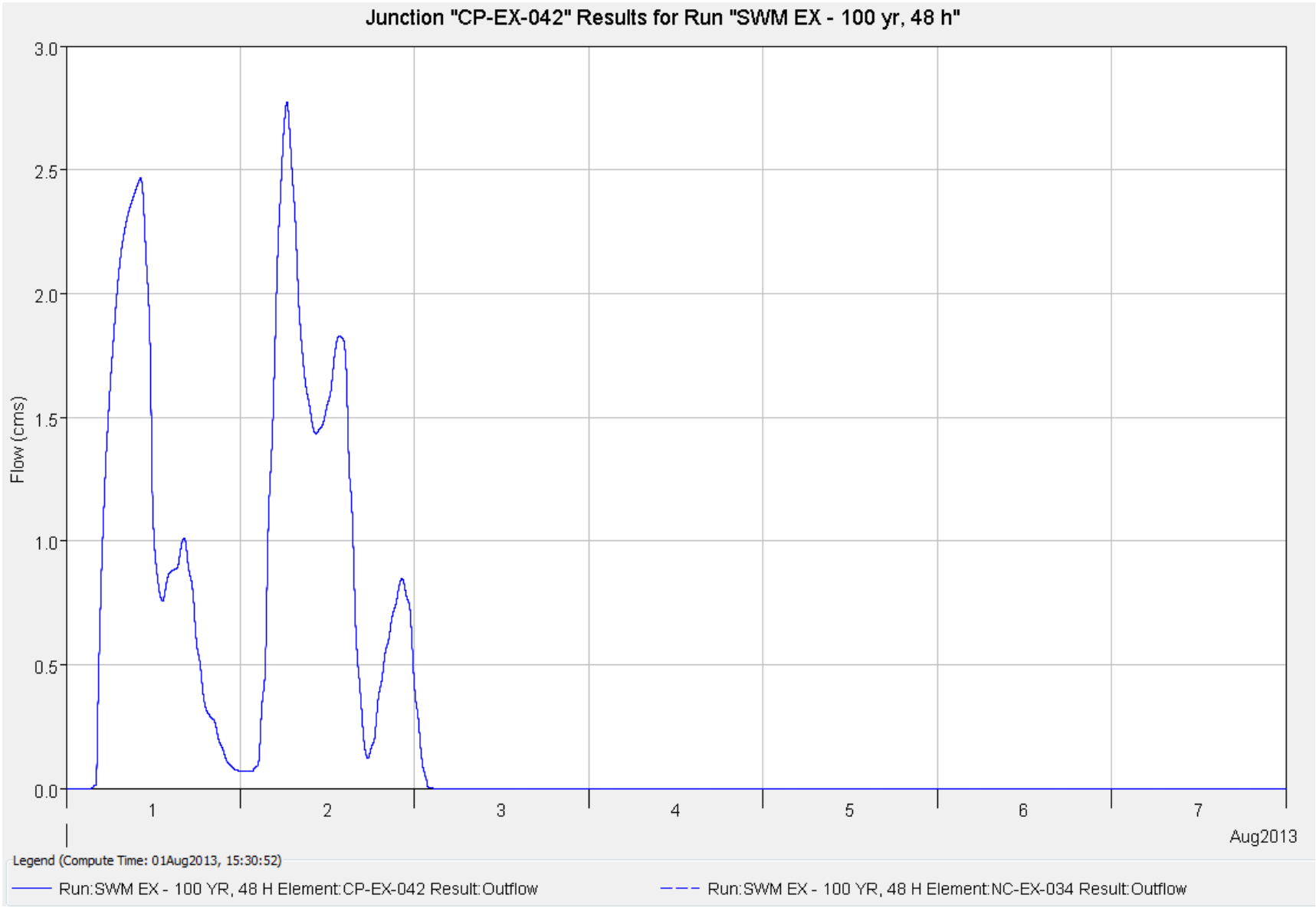

Junction "CP-EX-037" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-037 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-031 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-031 Result:Outflow

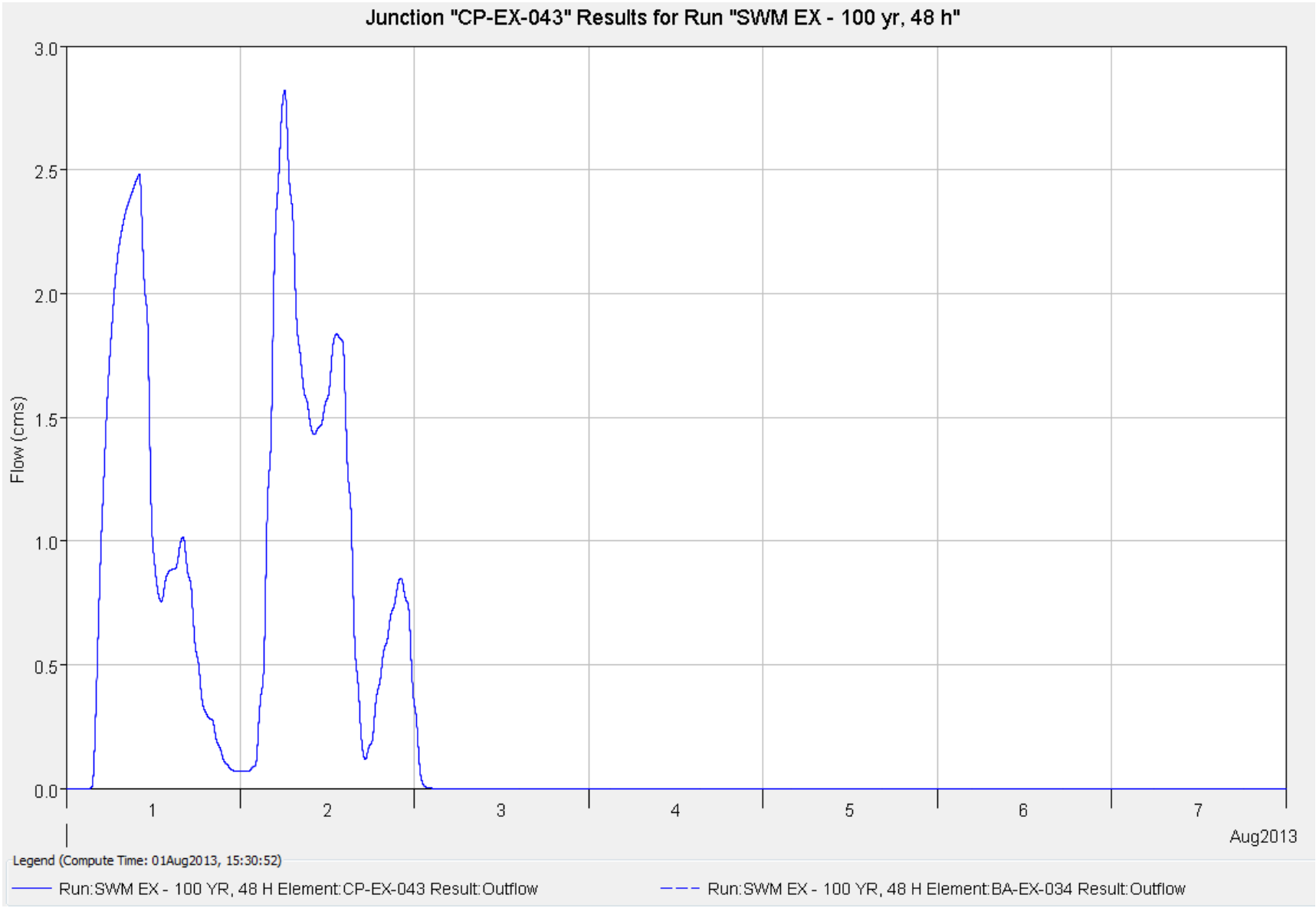

Junction "CP-EX-038" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-038 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-030 Result:Outflow

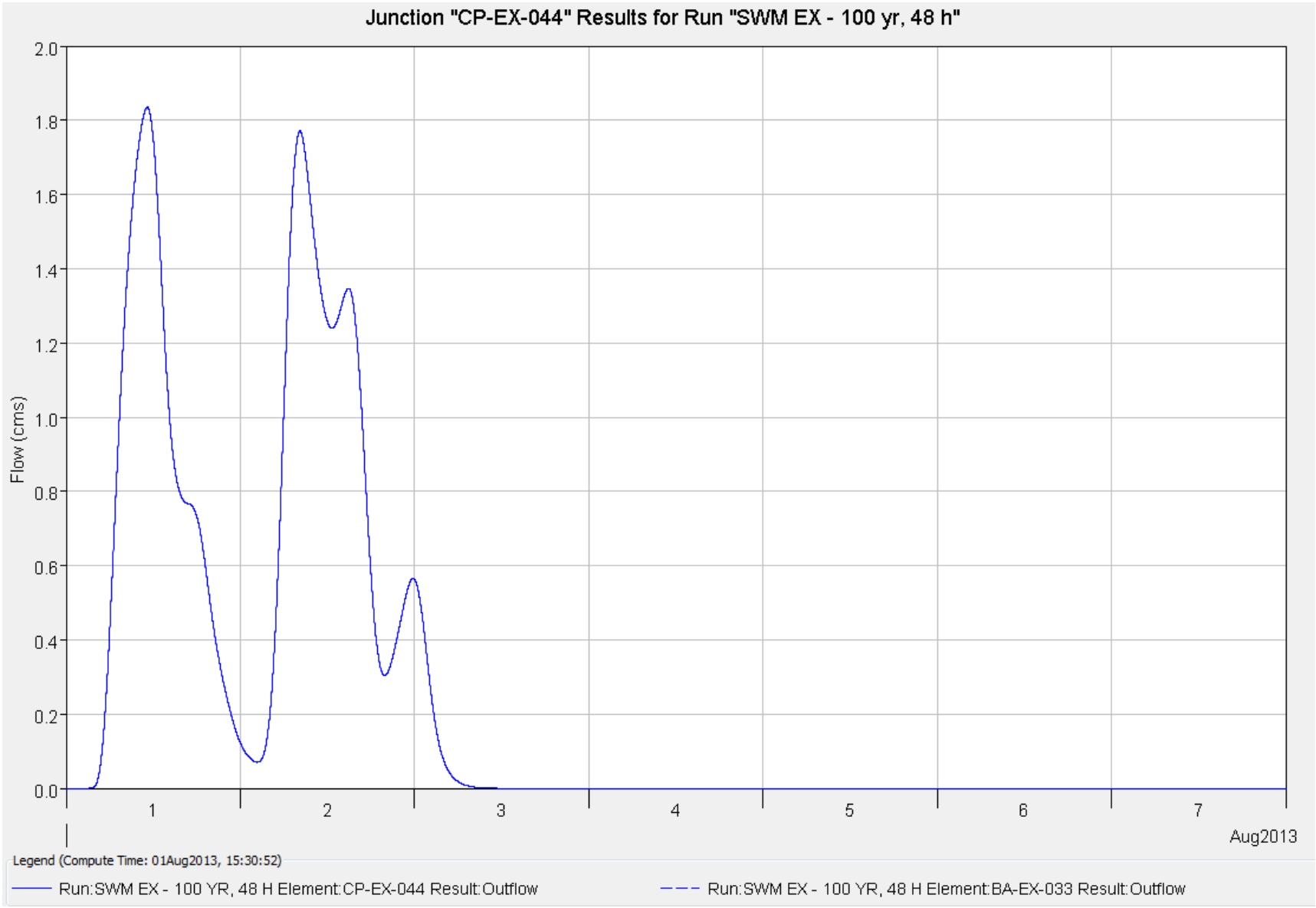

Junction "CP-EX-039" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-039 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-032 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-033 Result:Outflow

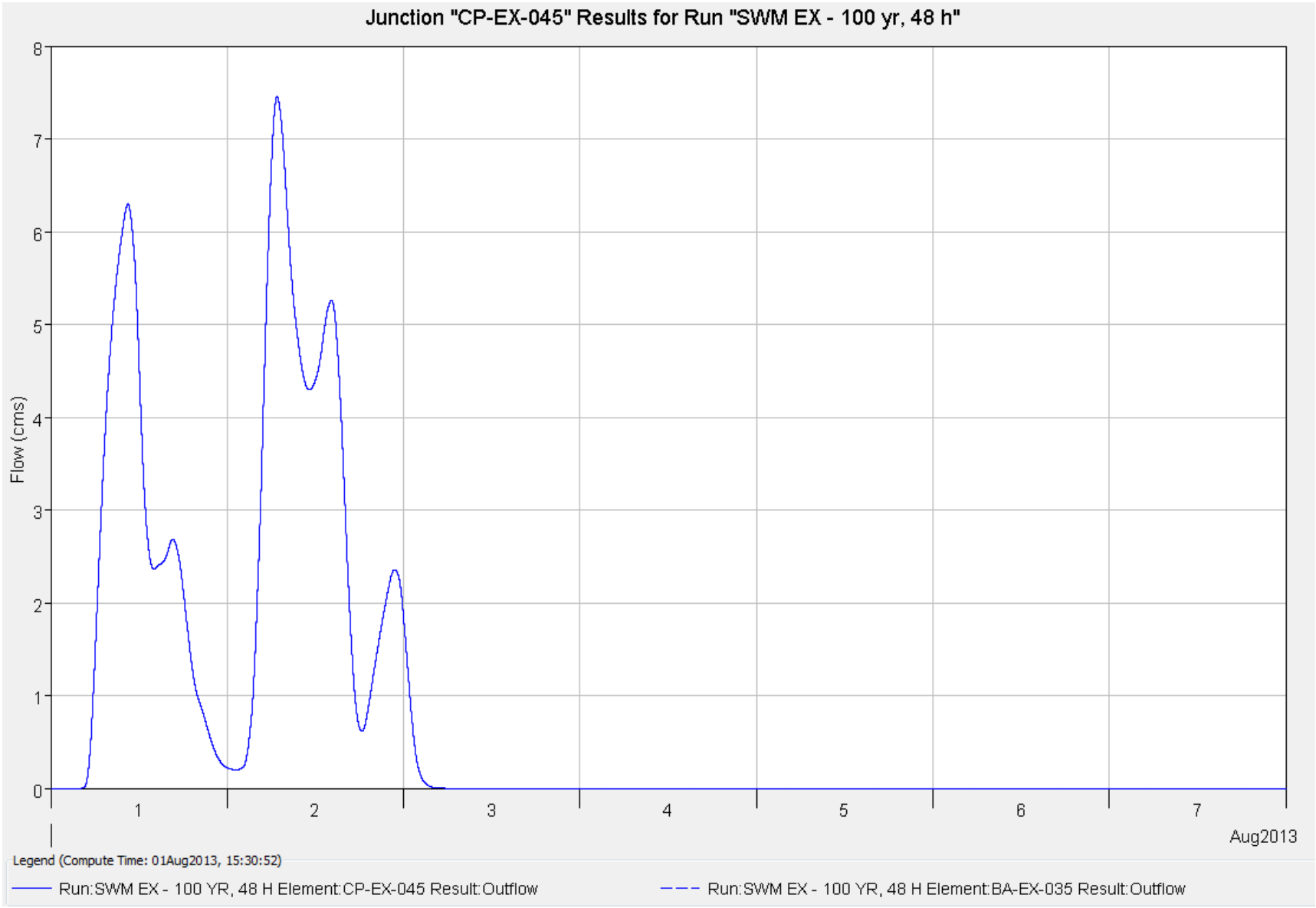

Junction "CP-EX-040" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-040 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-032 Result:Outflow

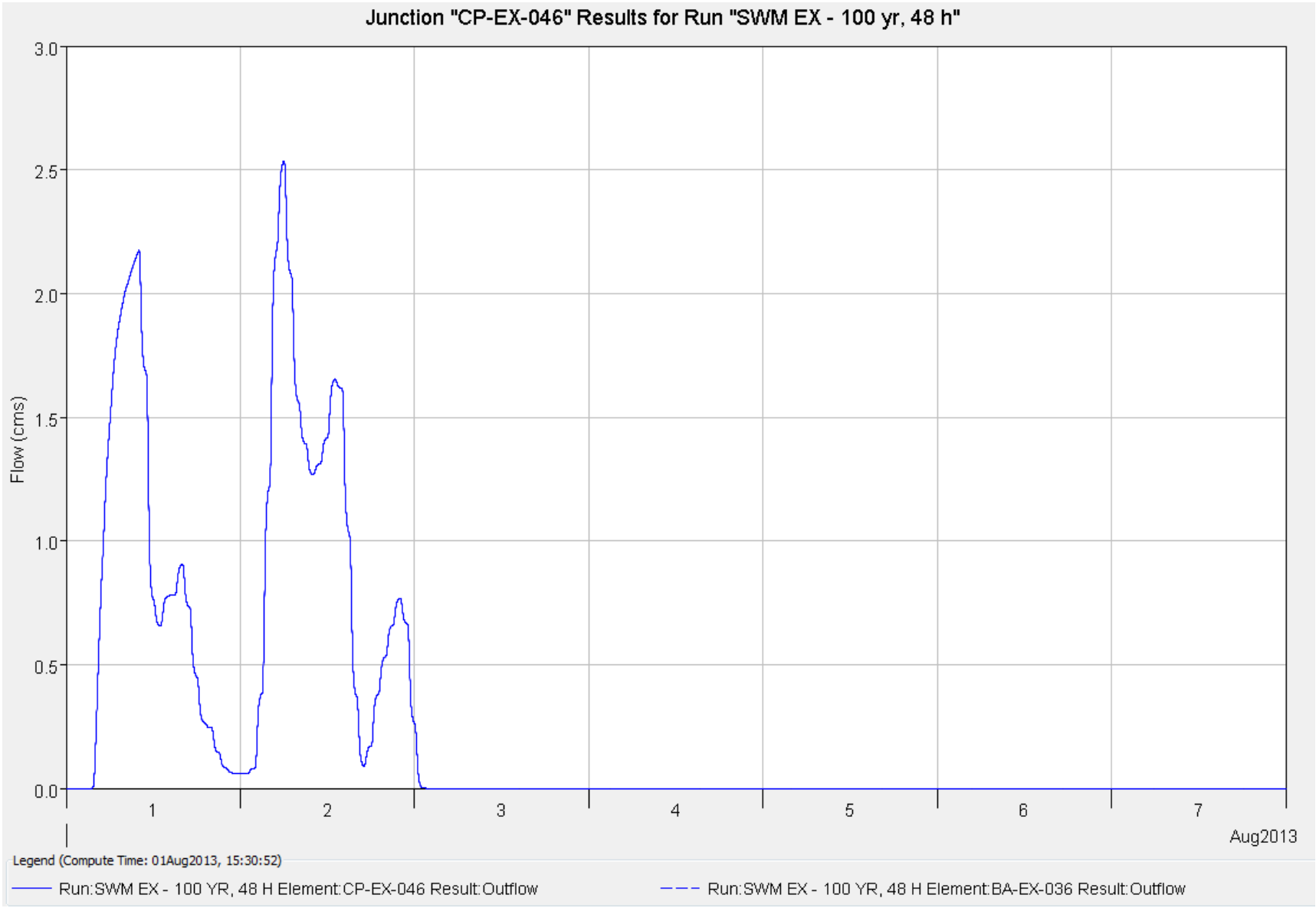

Junction "CP-EX-041" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-041 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-035 Result:Outflow

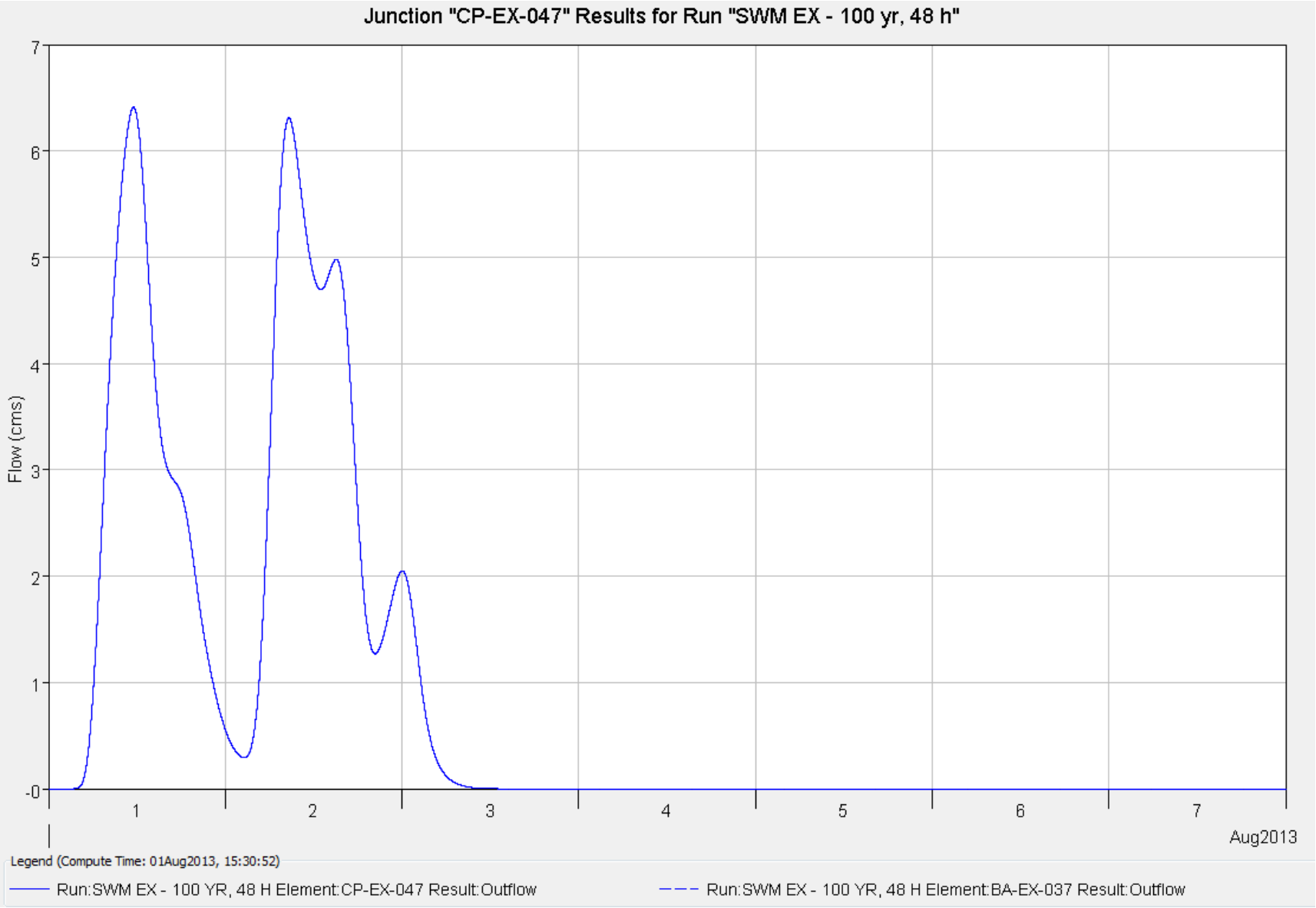

Junction "CP-EX-042" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-042 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-034 Result:Outflow

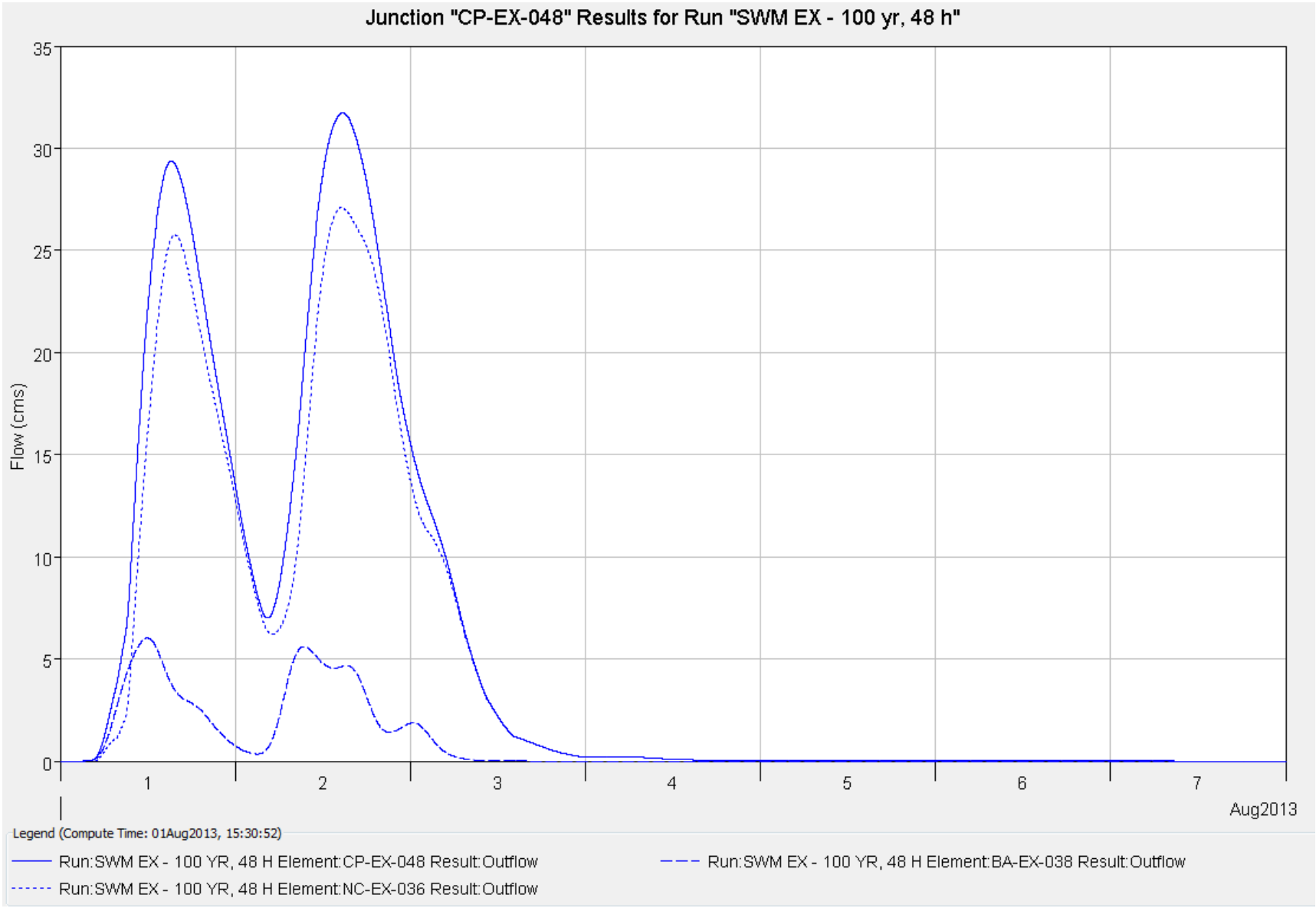

Junction "CP-EX-043" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-043 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-034 Result:Outflow

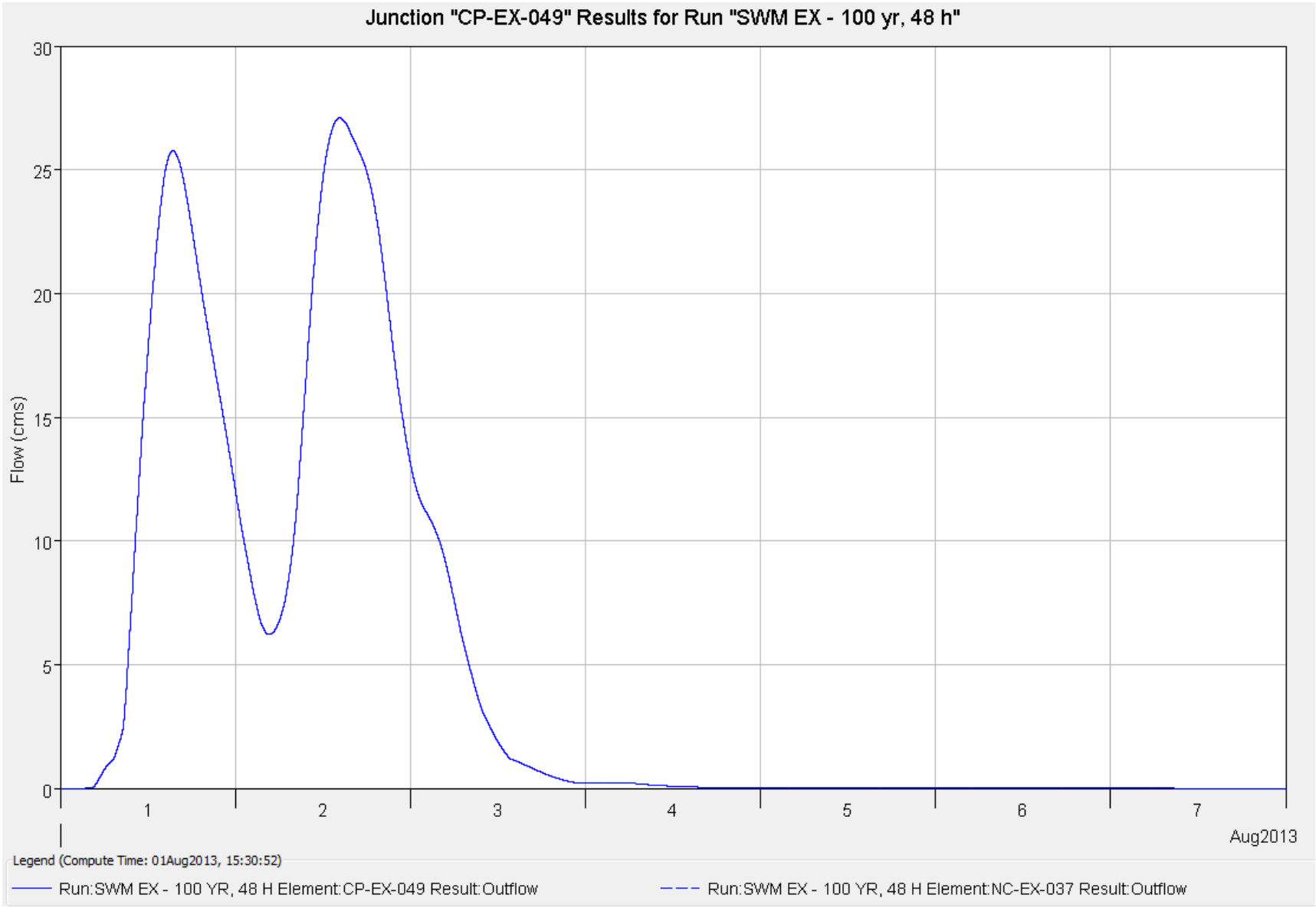

Junction "CP-EX-044" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-044 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-033 Result:Outflow

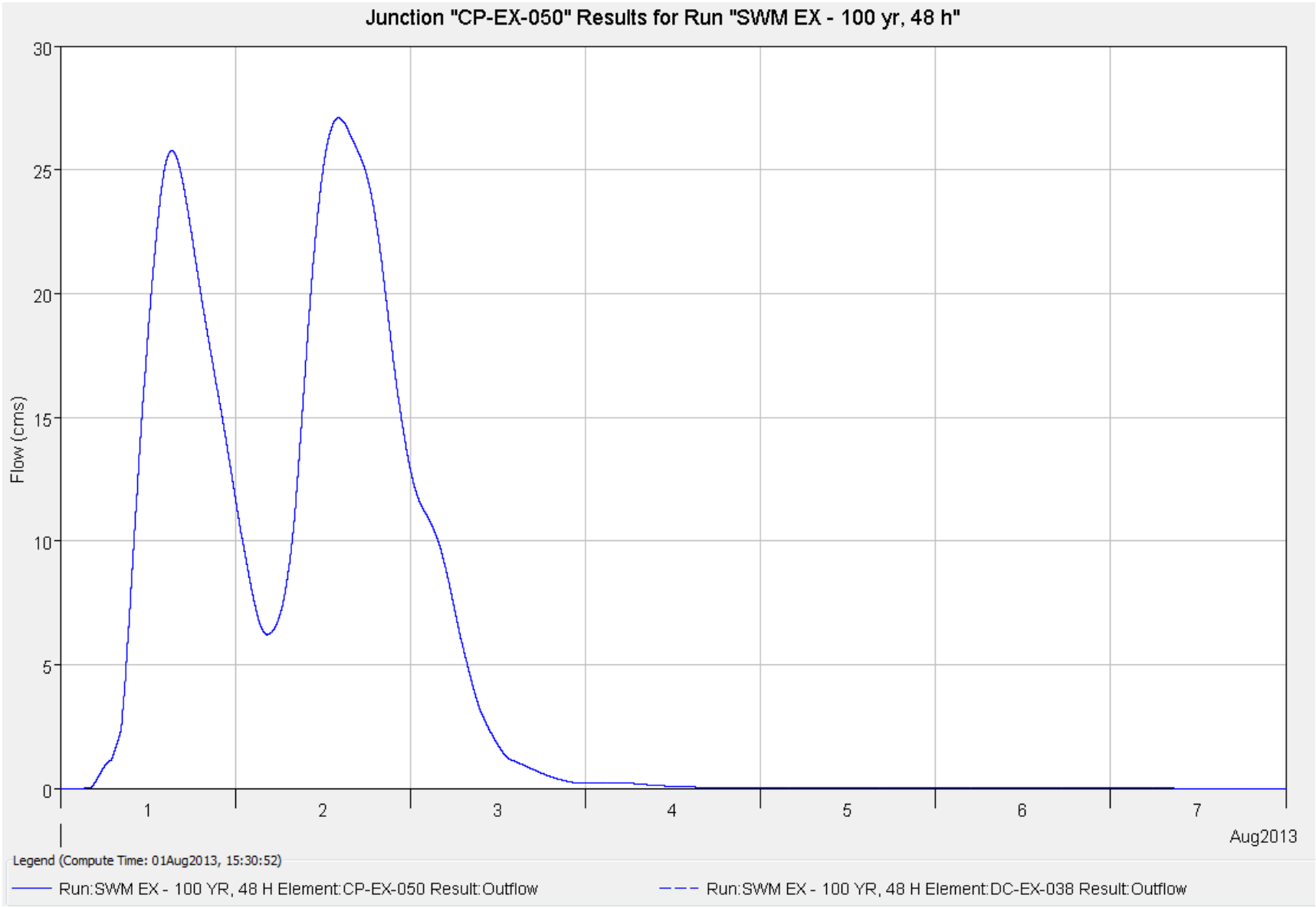

Junction "CP-EX-045" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-045 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-035 Result:Outflow

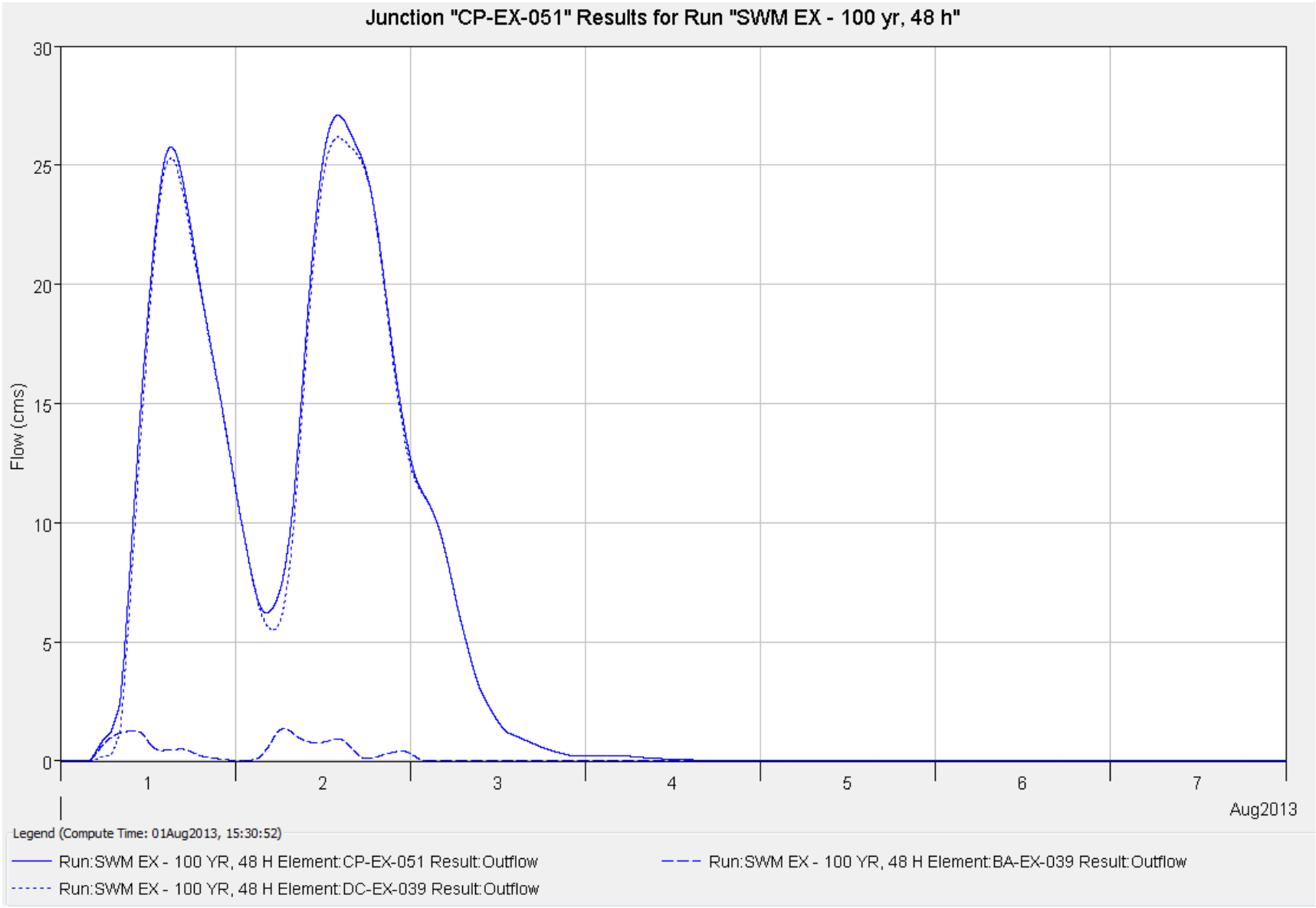

Junction "CP-EX-046" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-046 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-036 Result:Outflow

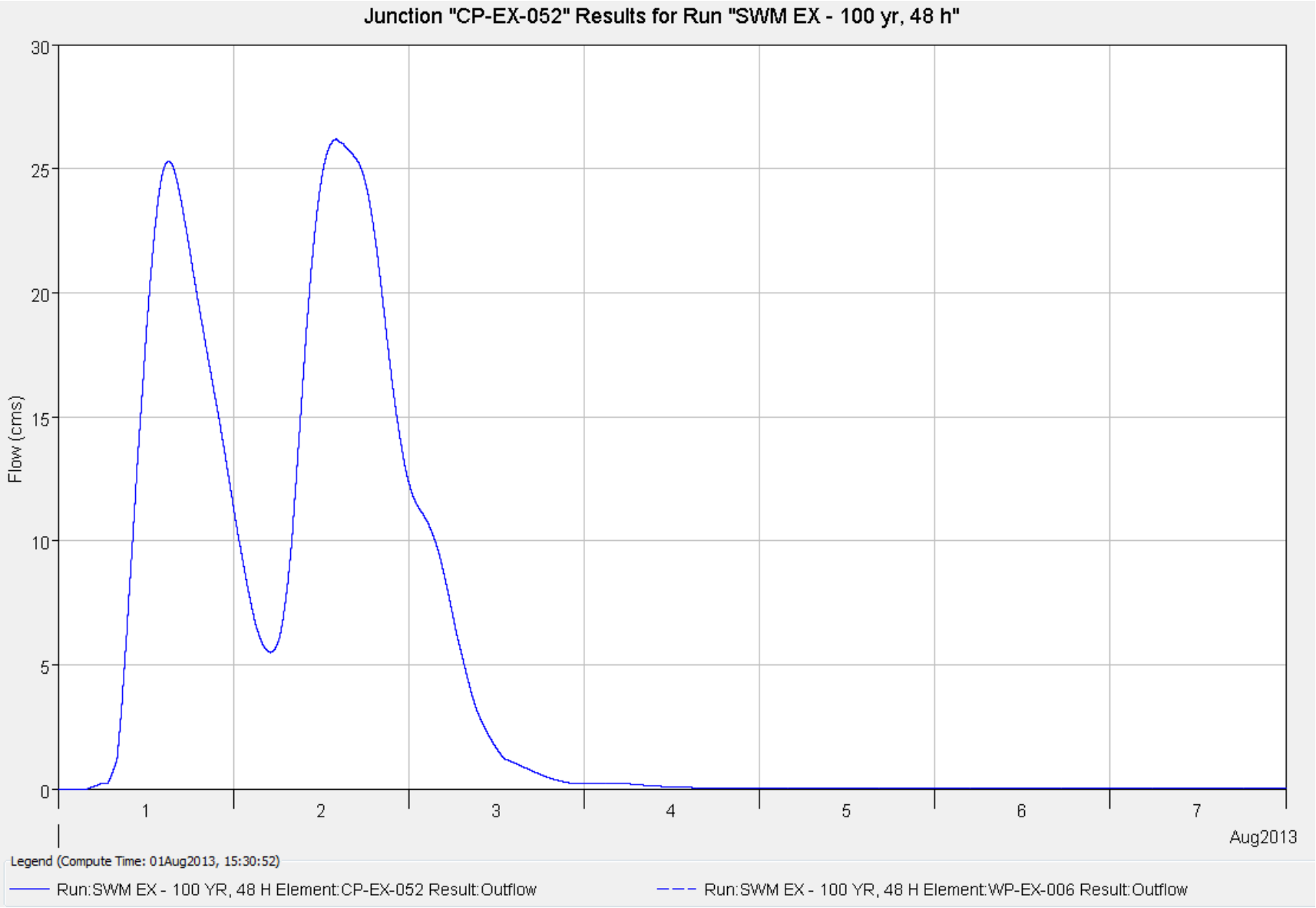

Junction "CP-EX-047" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-047 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-037 Result:Outflow

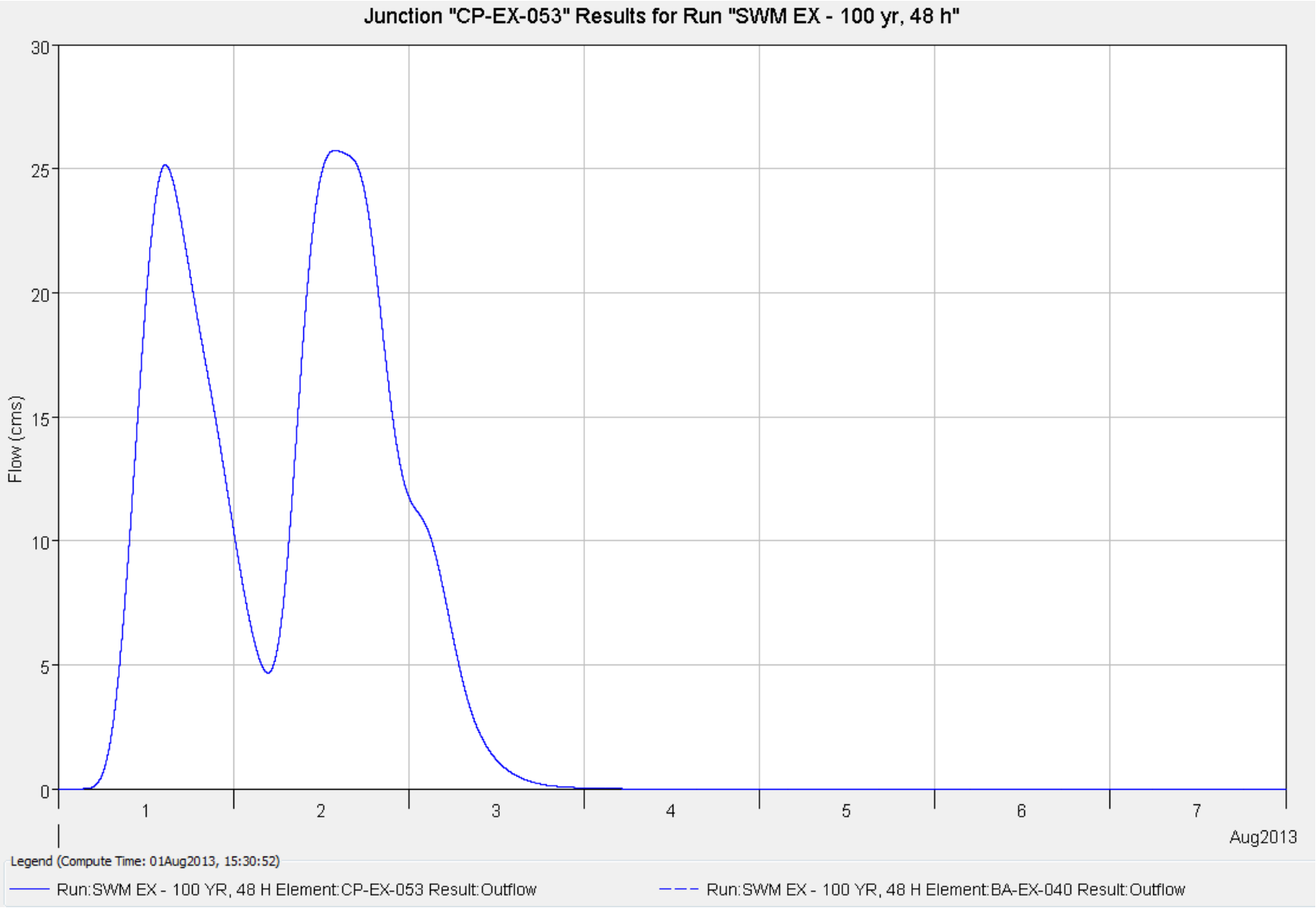

Junction "CP-EX-048" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-048 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-038 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-036 Result:Outflow

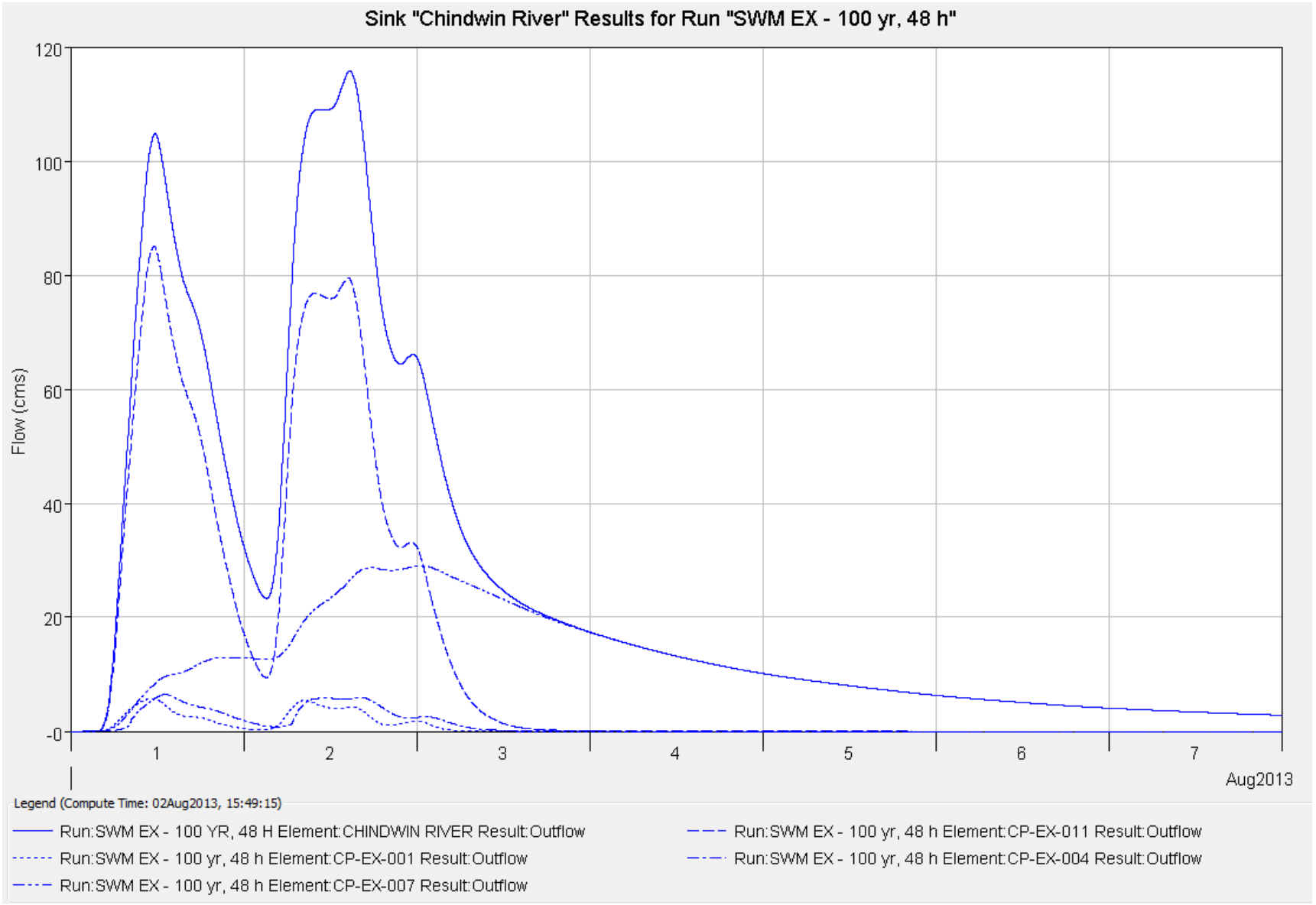

Junction "CP-EX-049" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-049 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:NC-EX-037 Result:Outflow

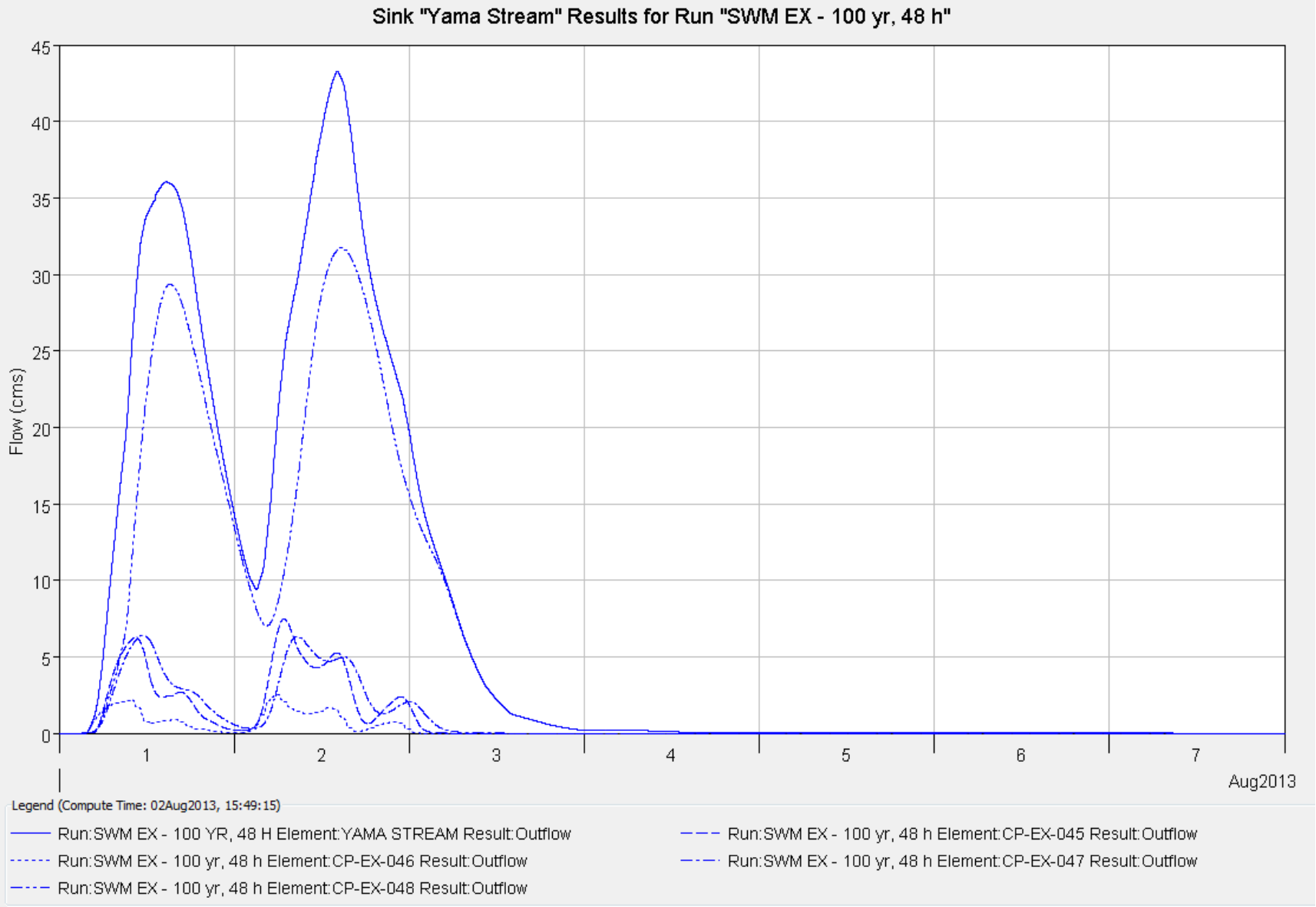

Junction "CP-EX-050" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-050 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-038 Result:Outflow

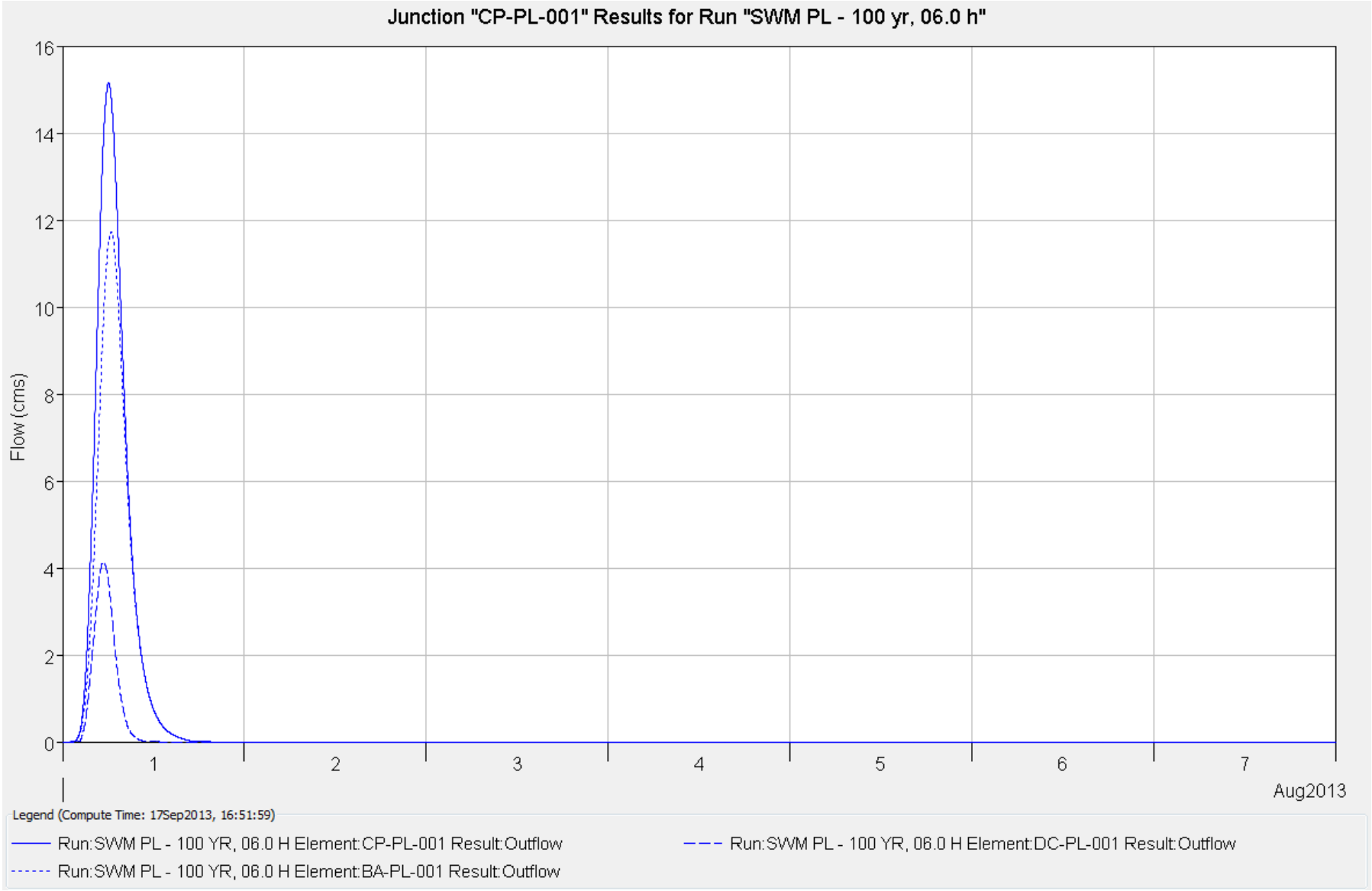

Junction "CP-EX-051" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-051 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-039 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:DC-EX-039 Result:Outflow

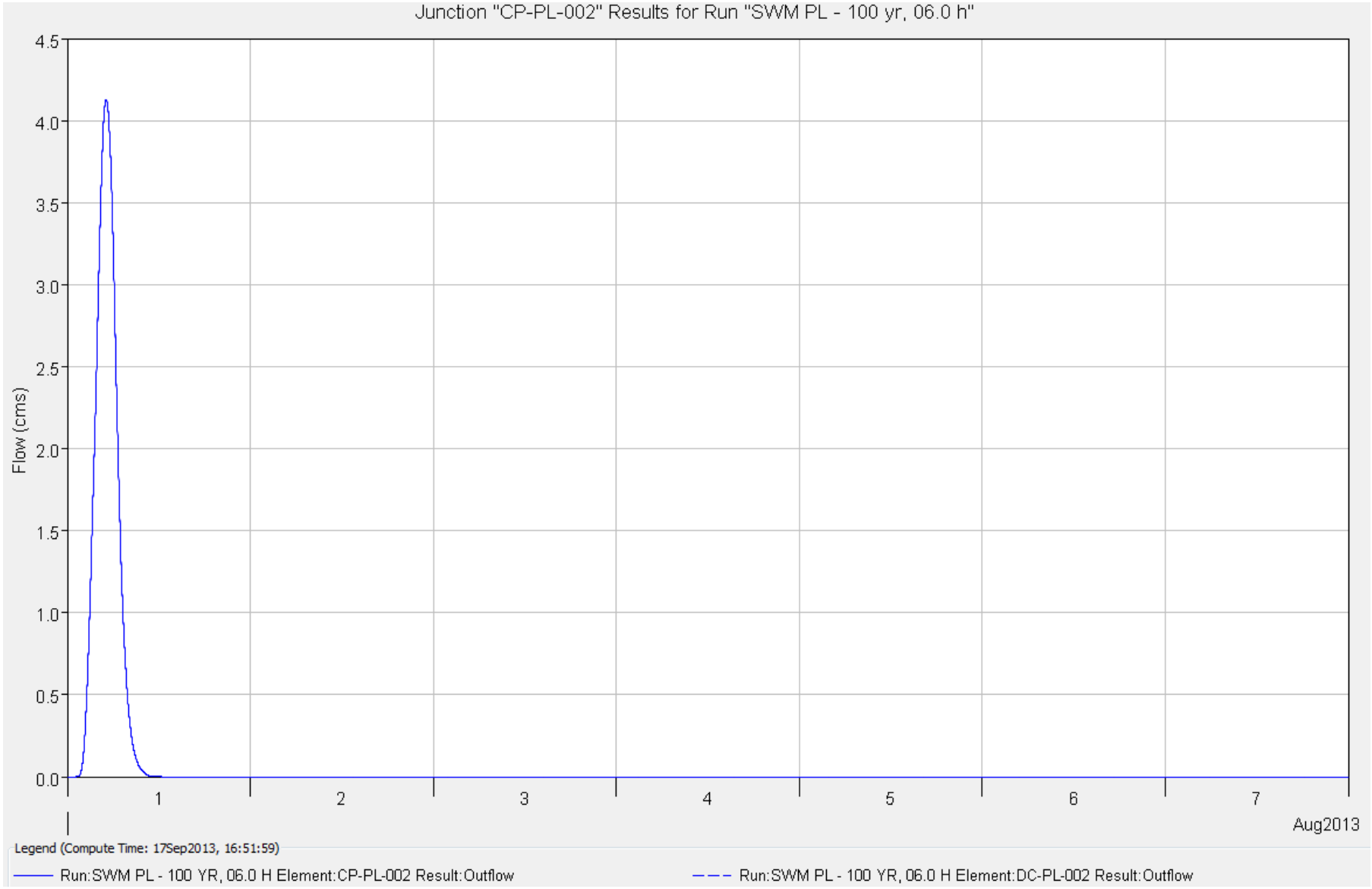

Junction "CP-EX-052" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-052 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-006 Result:Outflow

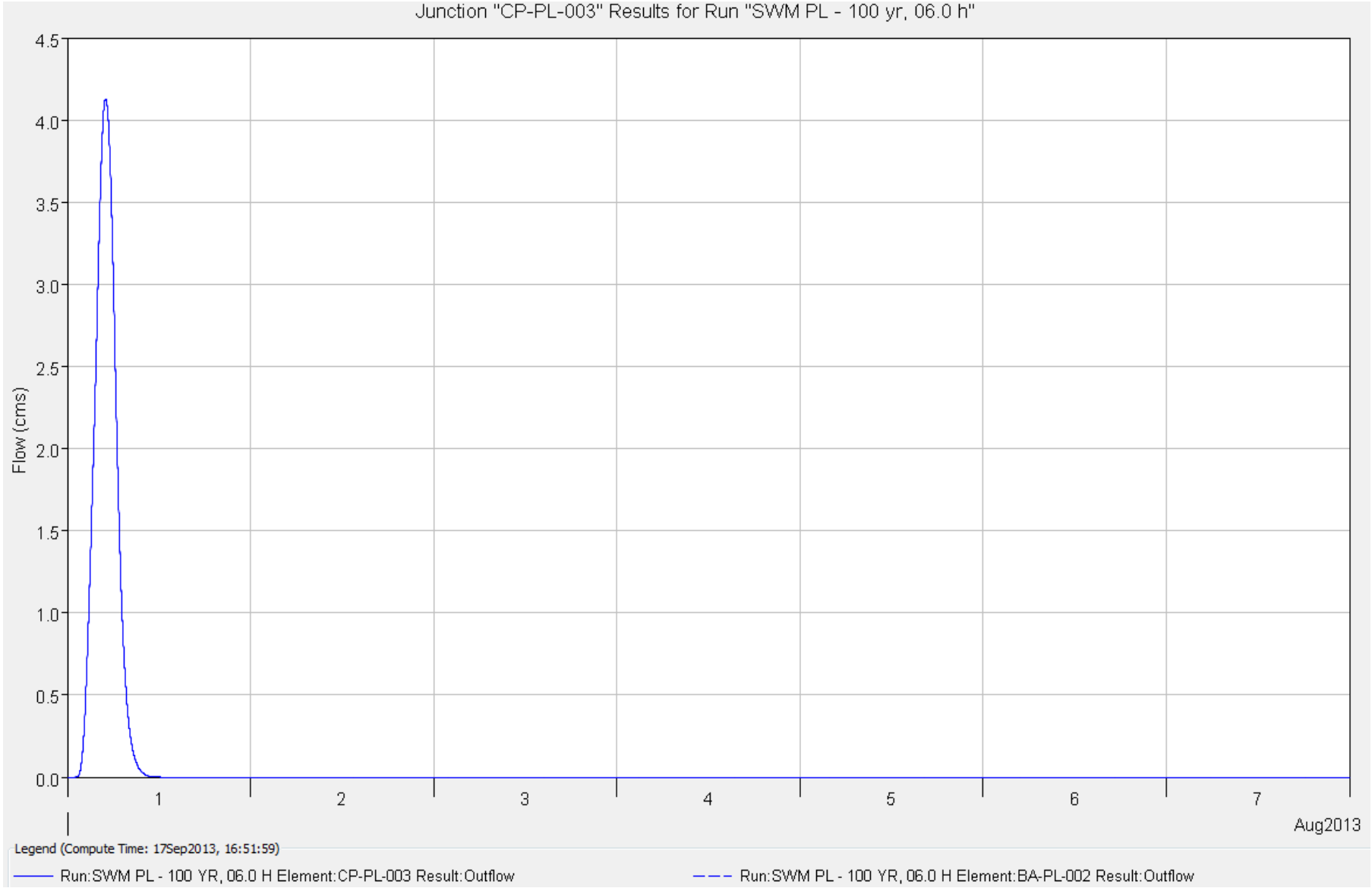

Junction "CP-EX-053" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:CP-EX-053 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:BA-EX-040 Result:Outflow

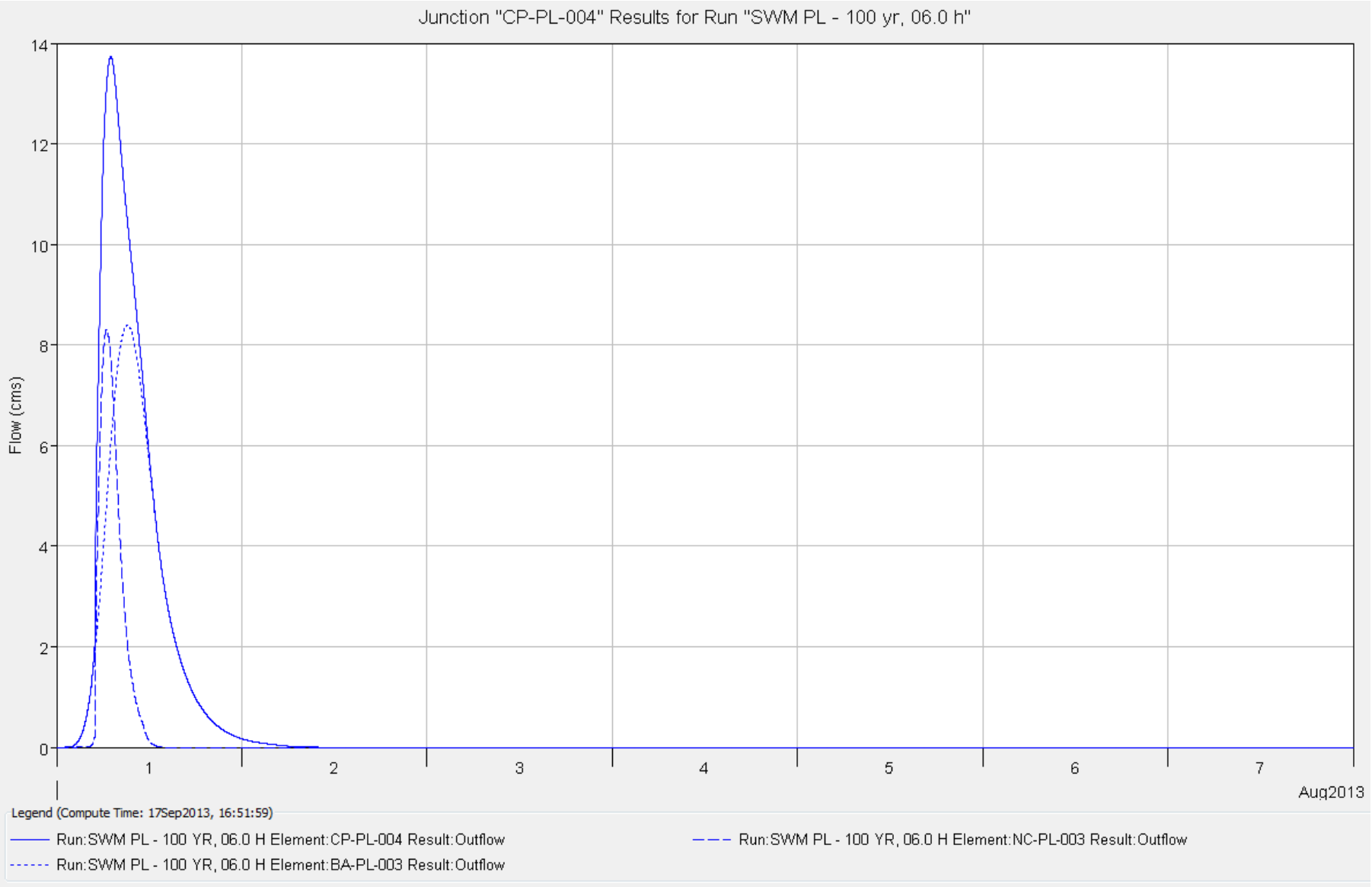

Sink "Chindwin River" Results for Run "SWM EX - 100 yr, 48 h"
120
100
80
60
40
20
-0
Flow (cms)
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 02Aug2013, 15:49:15)
Run:SWM EX - 100 YR, 48 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-011 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-001 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-004 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-007 Result:Outflow

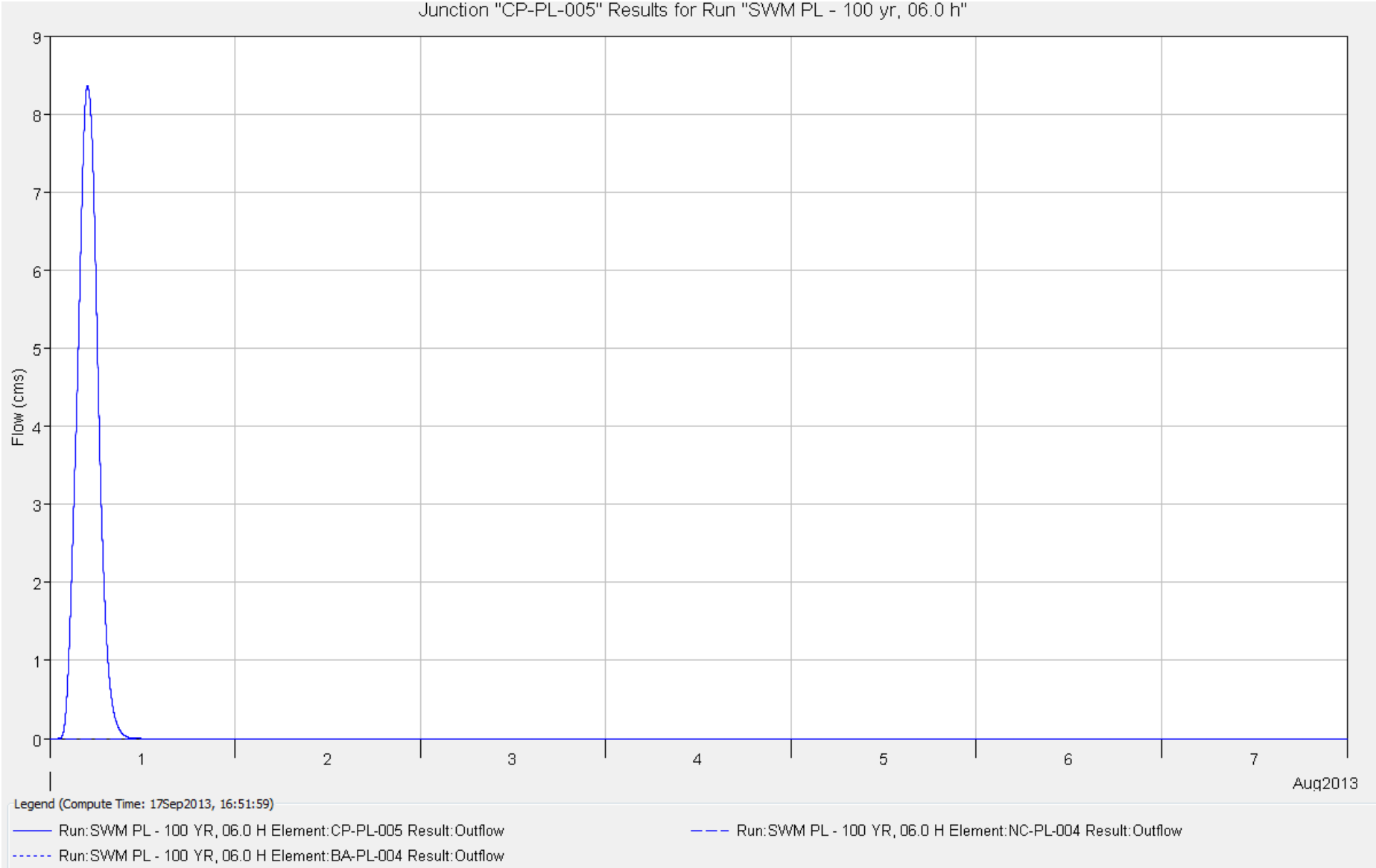

Sink "Yama Stream" Results for Run "SWM EX - 100 yr, 48 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 02Aug2013, 15:49:15)
Run:SWM EX - 100 YR, 48 H Element:YAMA STREAM Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-045 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-046 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-047 Result:Outflow
Run:SWM EX - 100 yr, 48 h Element:CP-EX-048 Result:Outflow

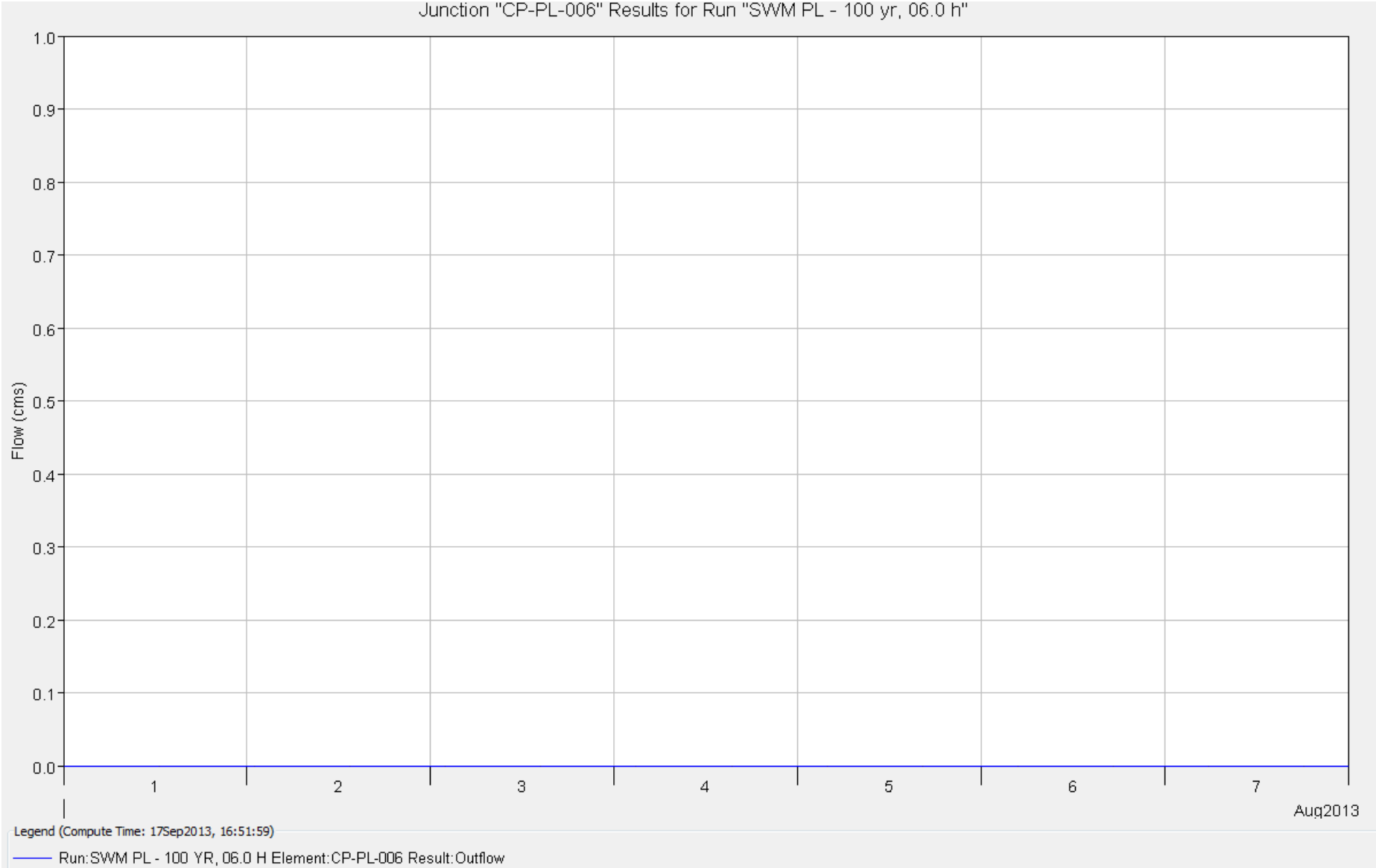

Junction "CP-PL-001" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-001 Result:Outflow

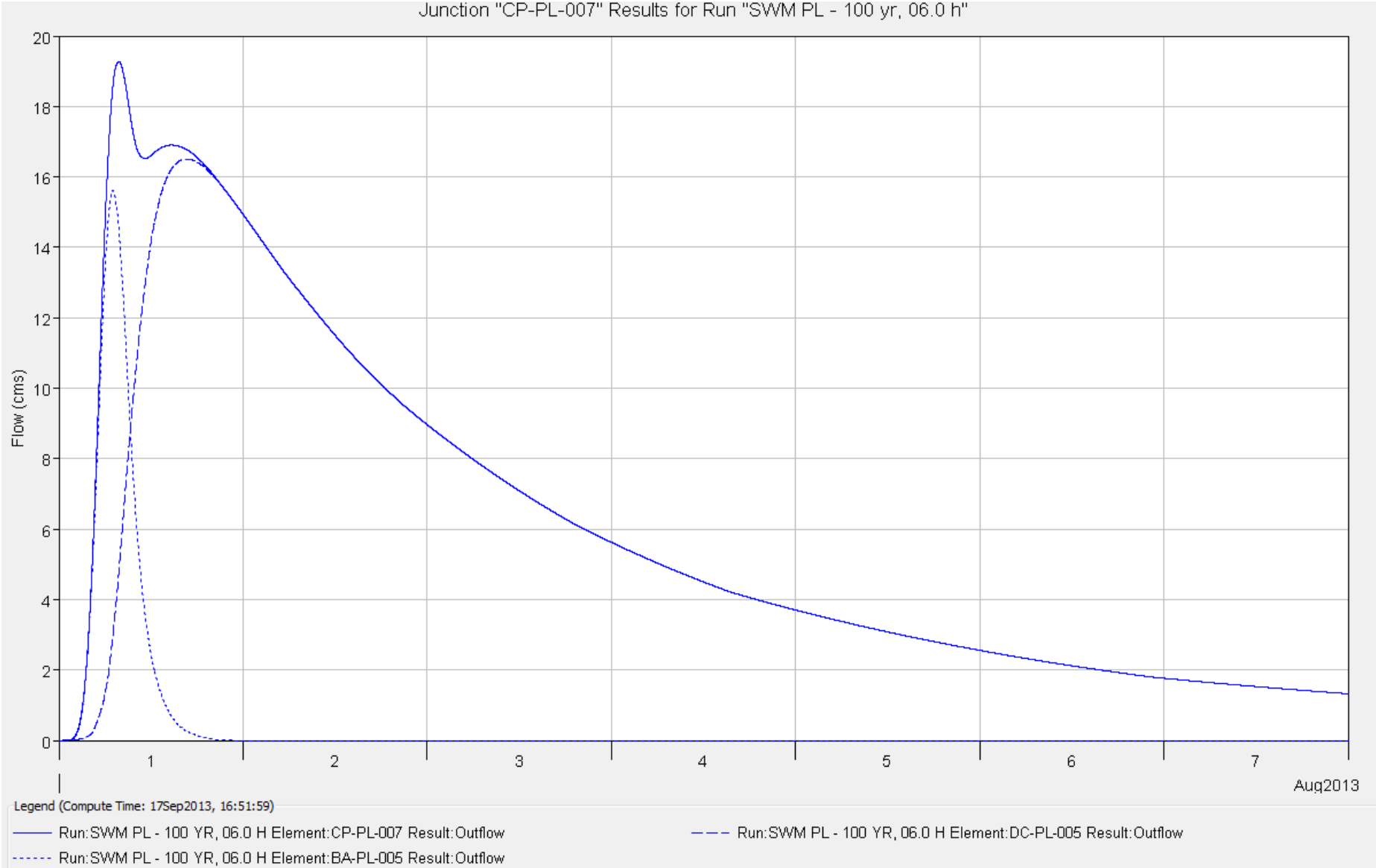

Junction "CP-PL-002" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-002 Result:Outflow

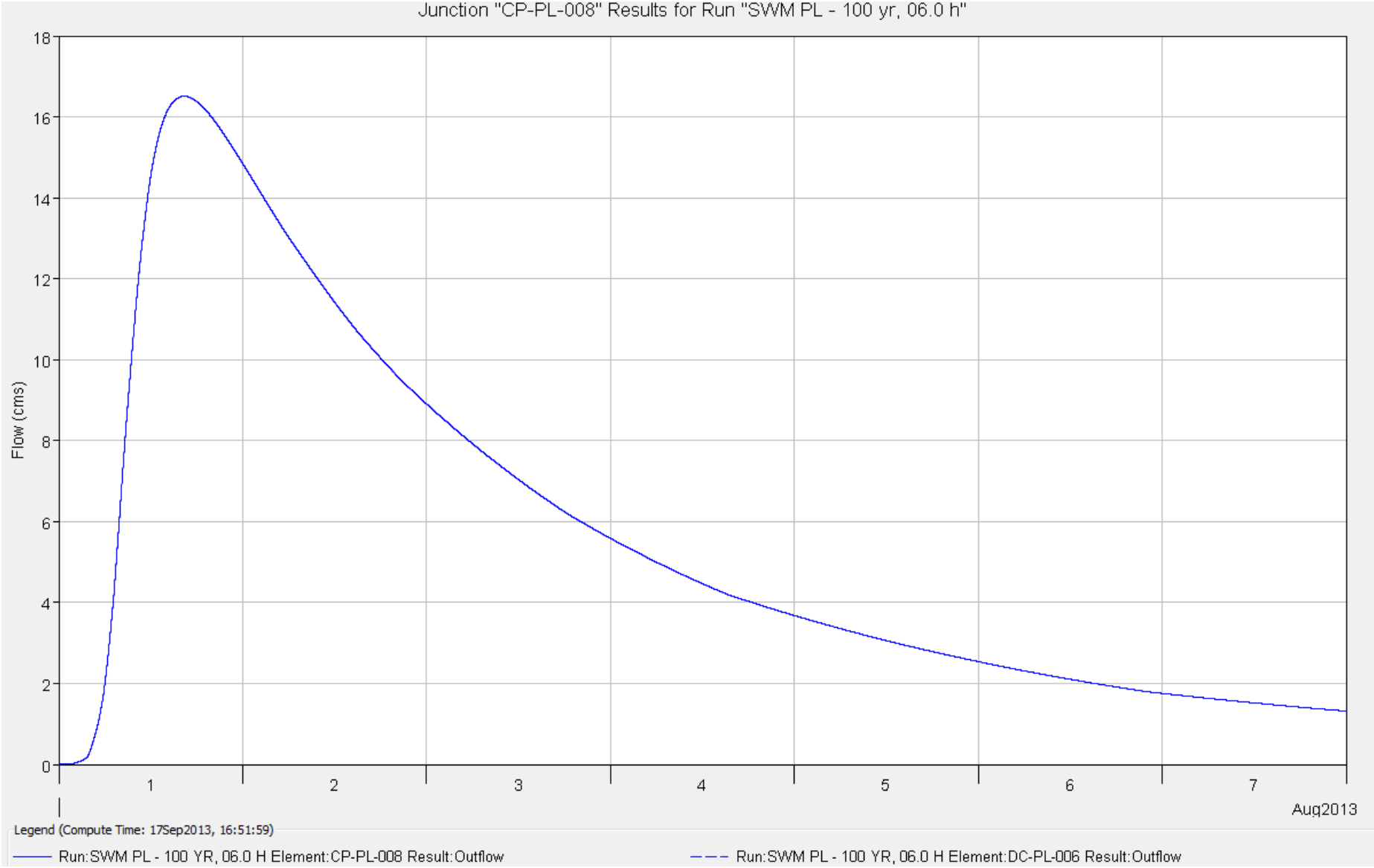

Junction "CP-PL-003" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-002 Result:Outflow

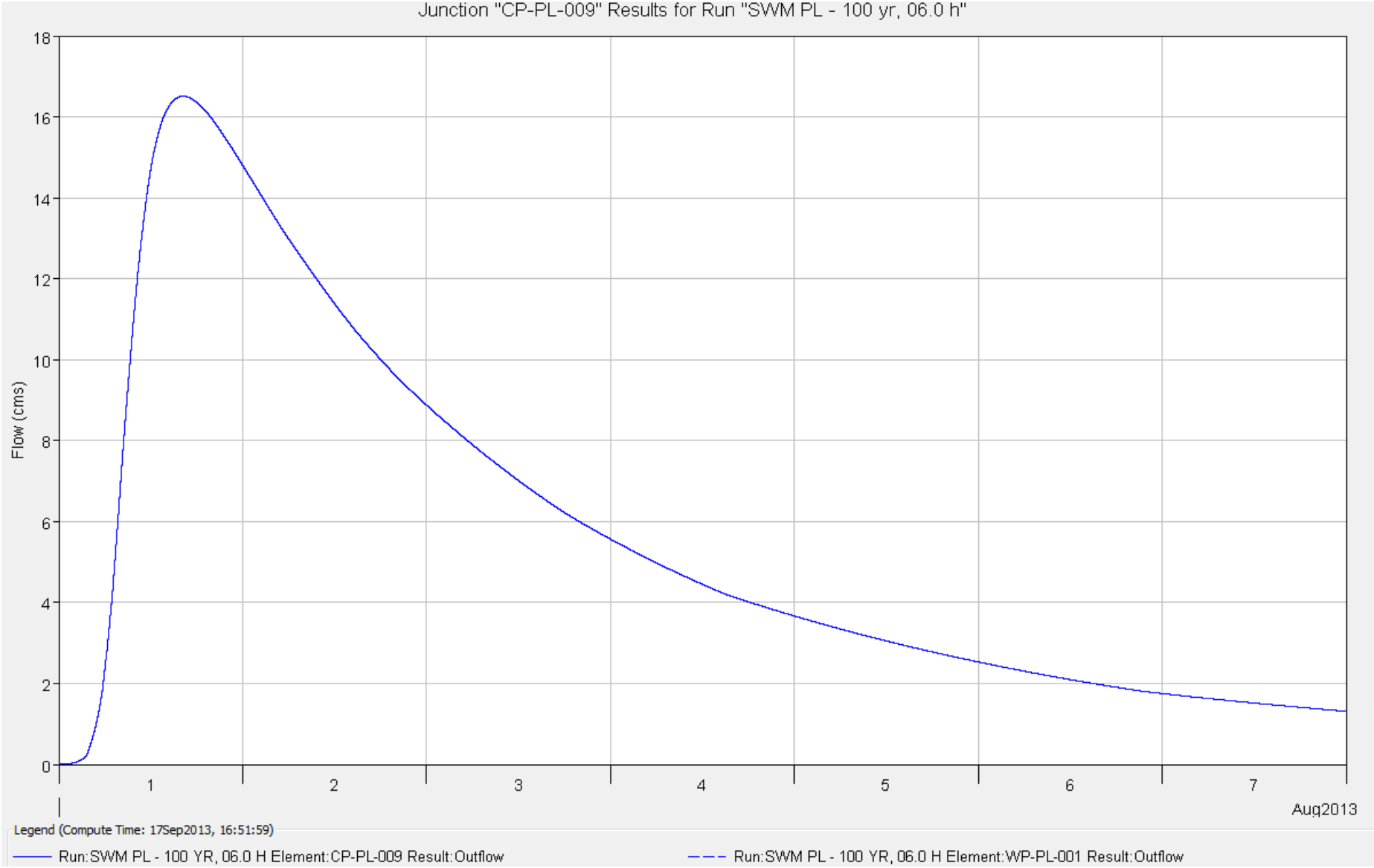

Junction "CP-PL-004" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-003 Result:Outflow

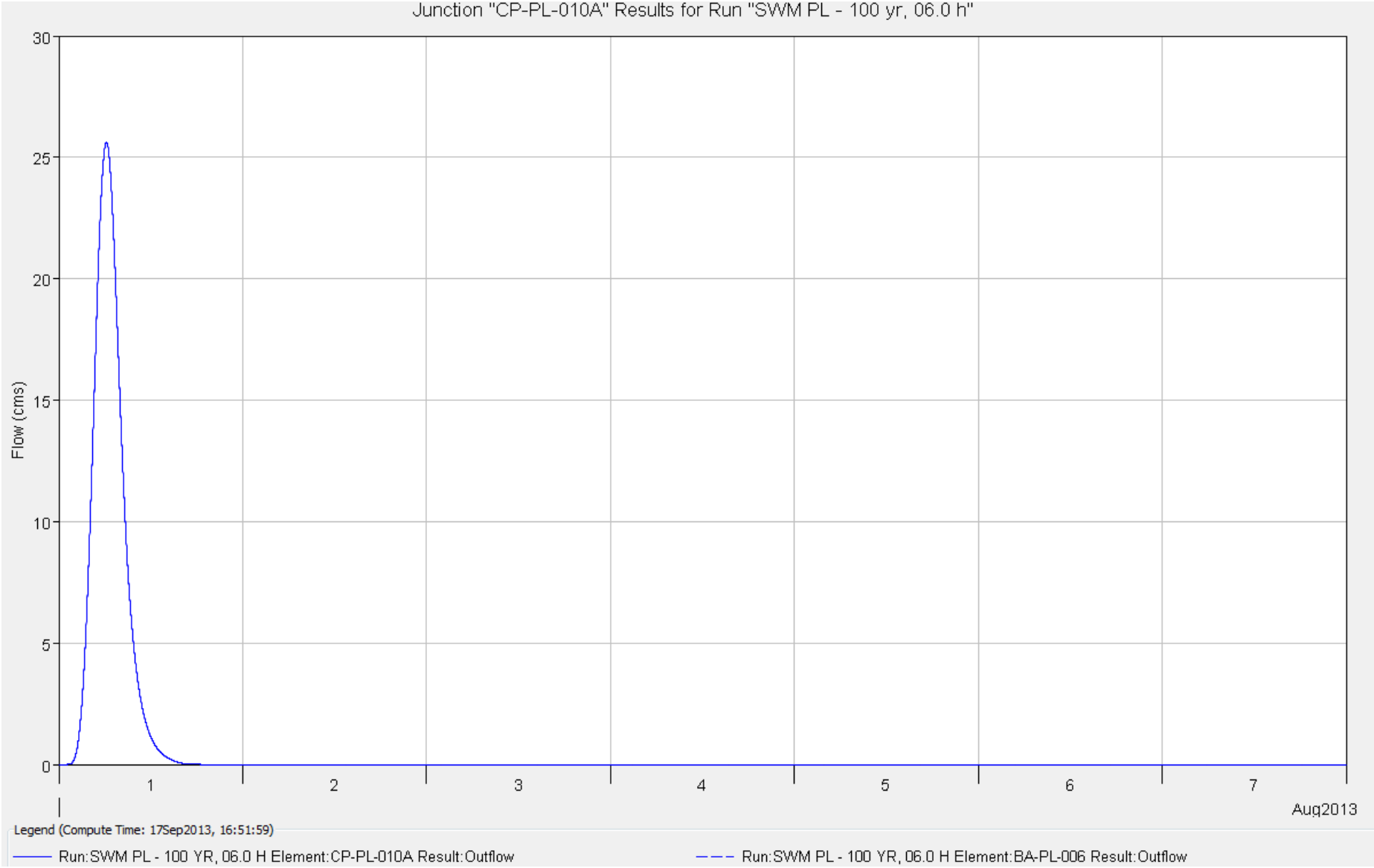

Junction "CP-PL-005" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-004 Result:Outflow

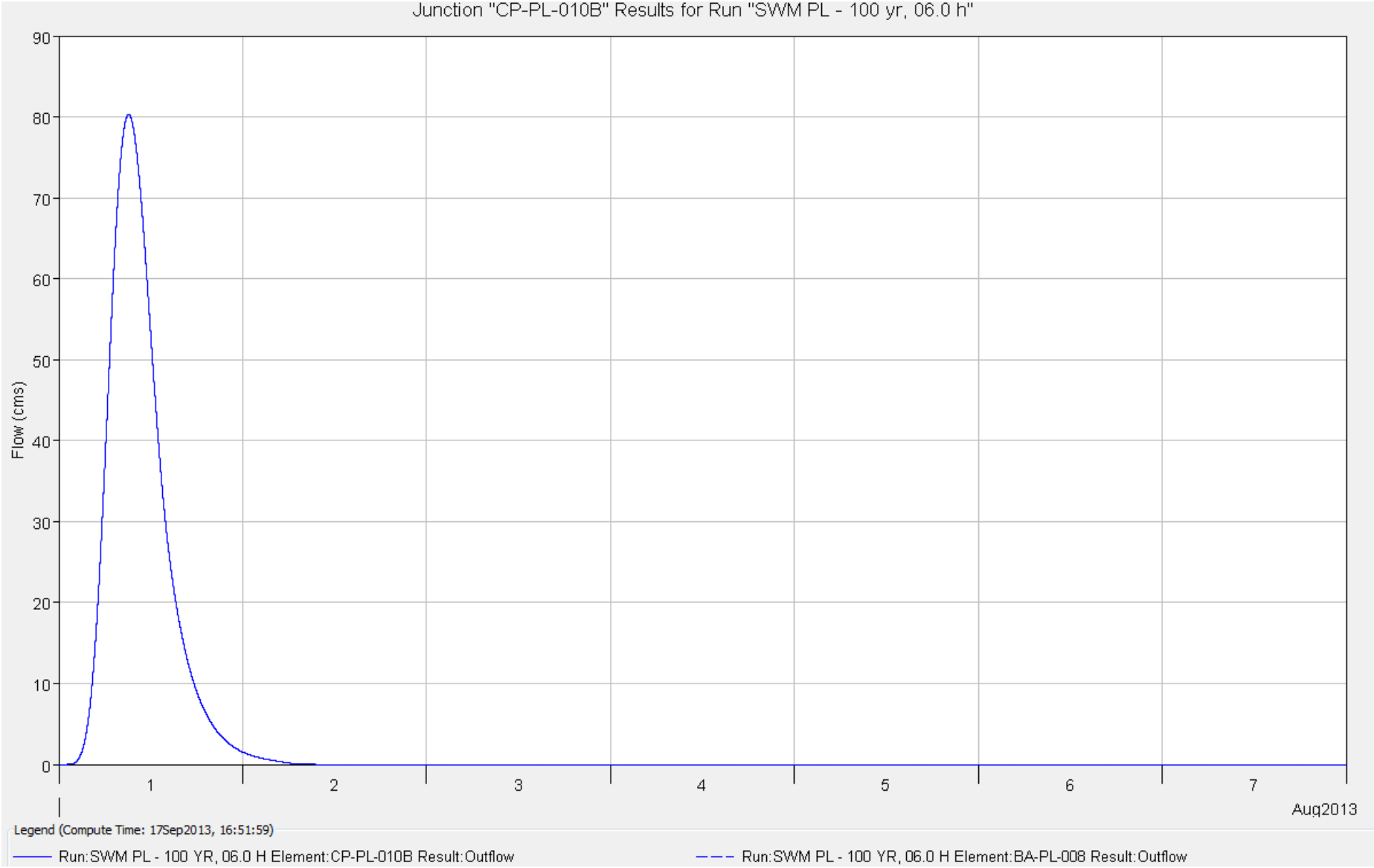

Junction "CP-PL-006" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-006 Result:Outflow

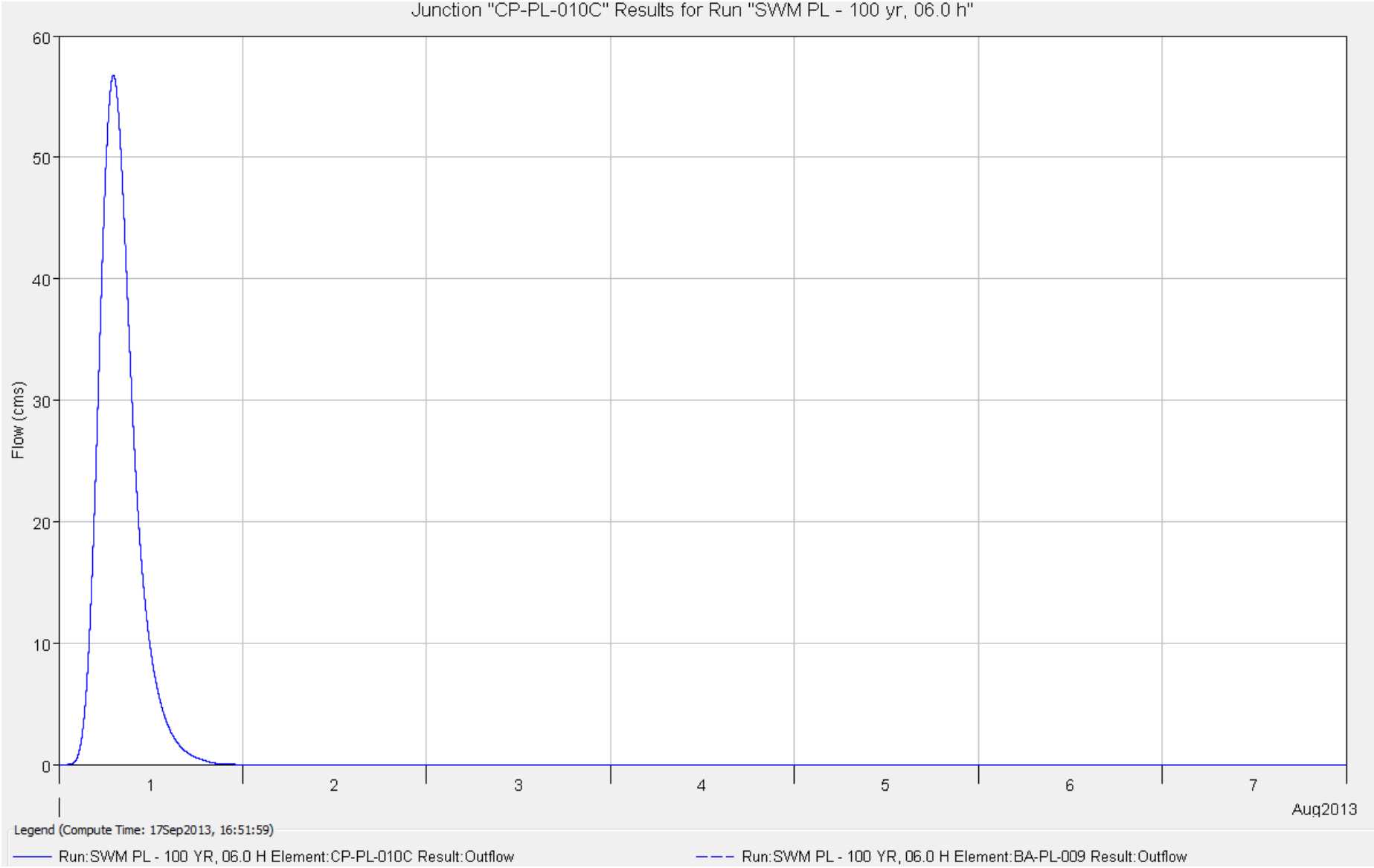

Junction "CP-PL-007" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-005 Result:Outflow

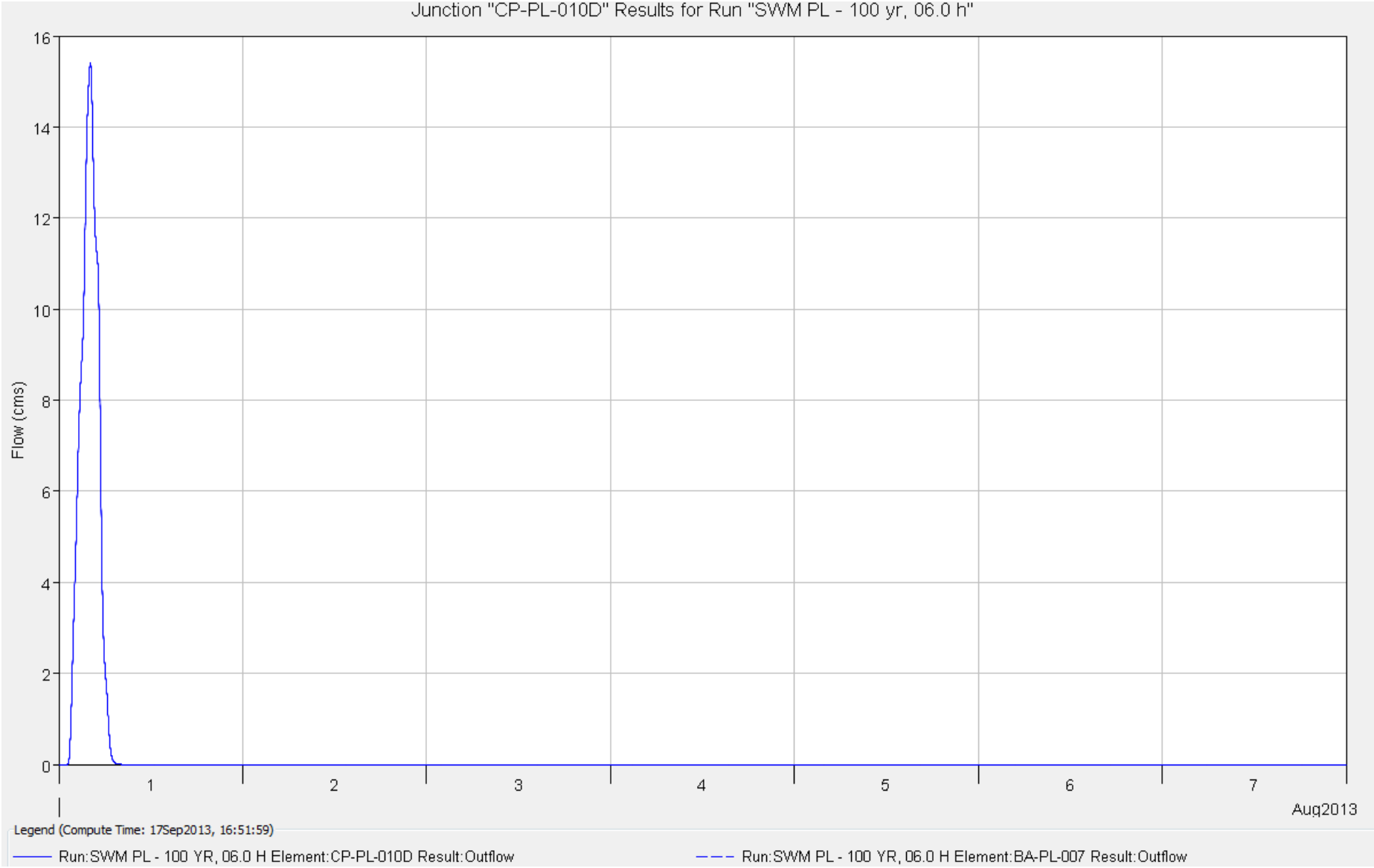

Junction "CP-PL-008" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-006 Result:Outflow

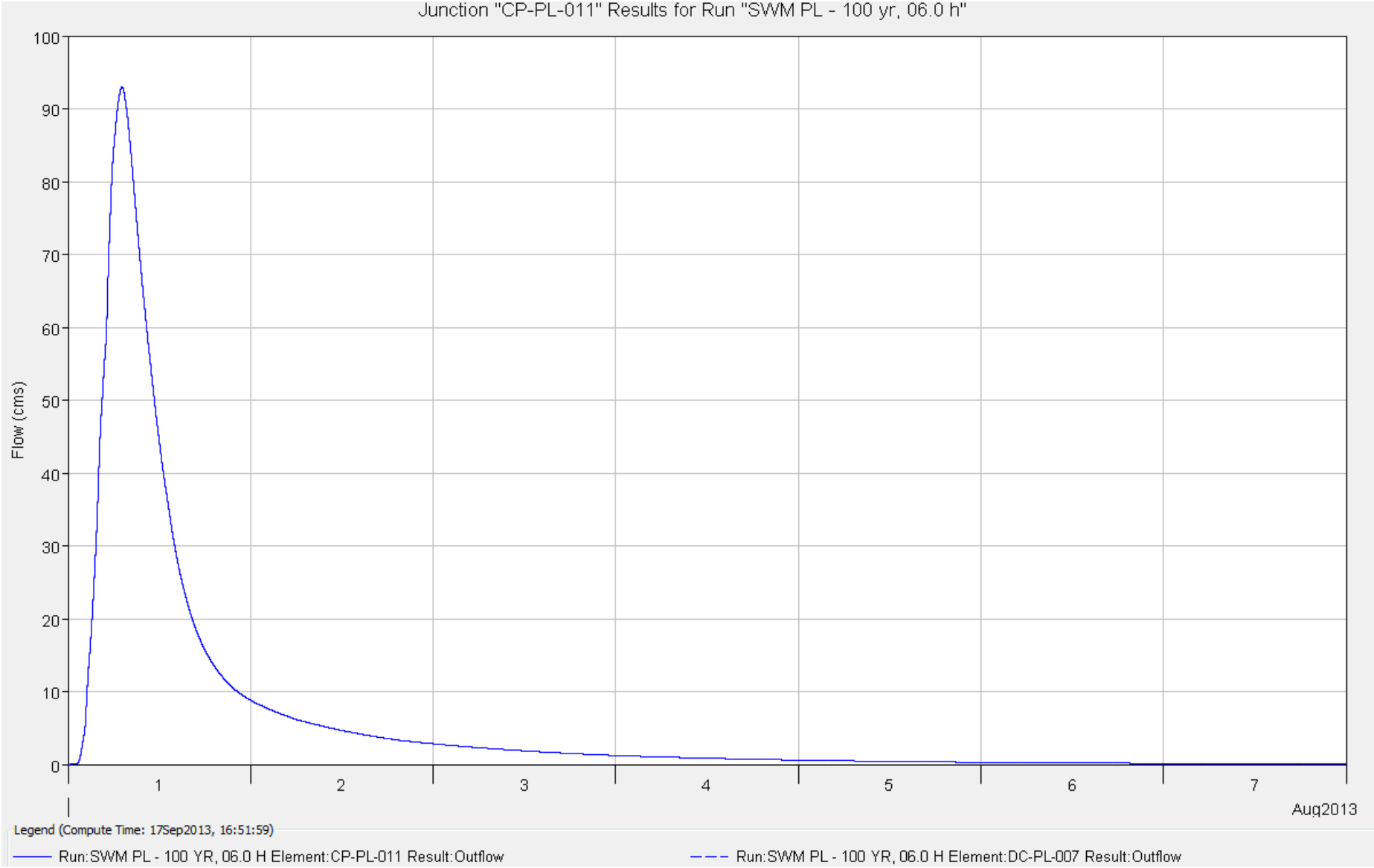

Junction "CP-PL-009" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Outflow

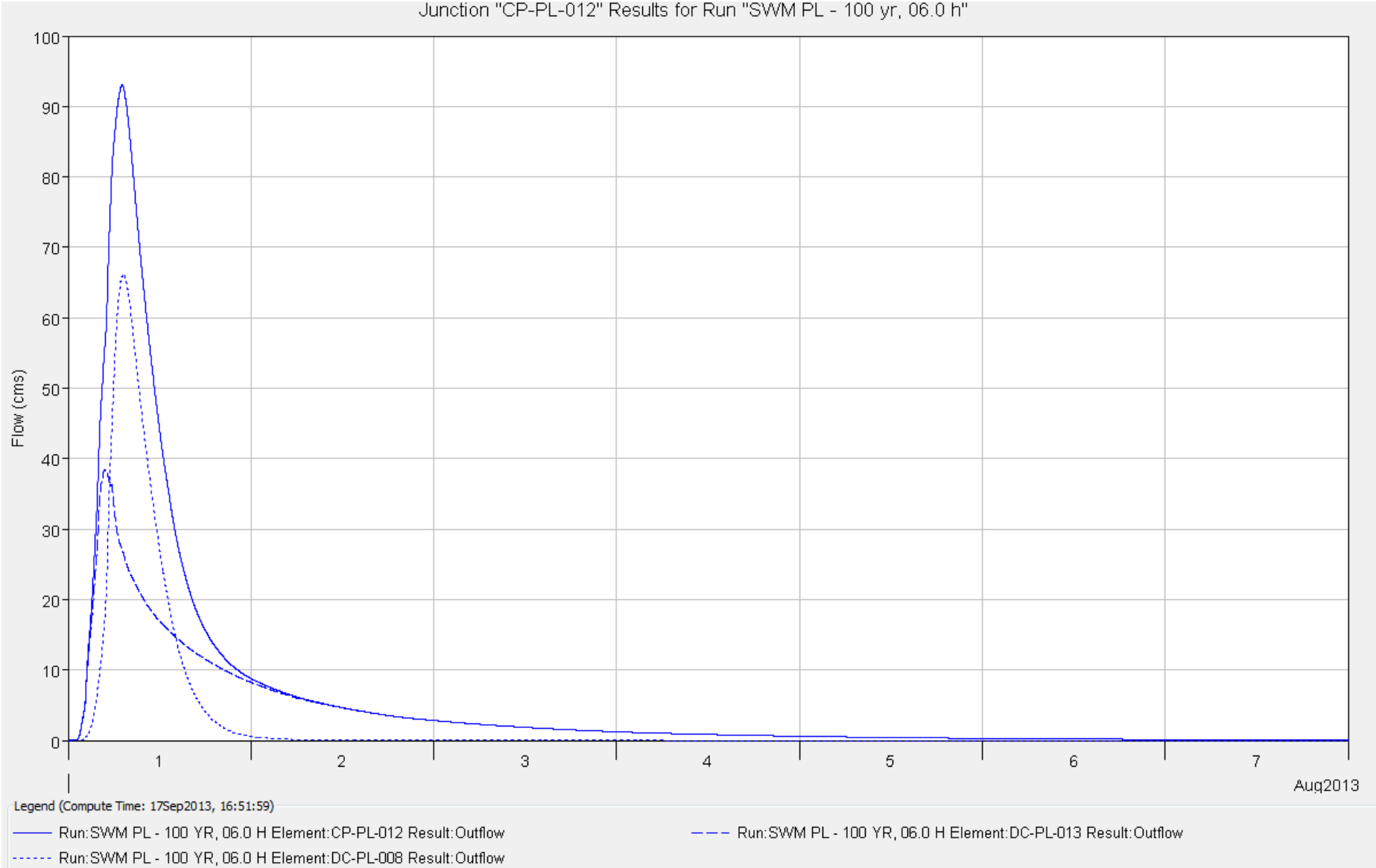

Junction "CP-PL-010A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-006 Result:Outflow

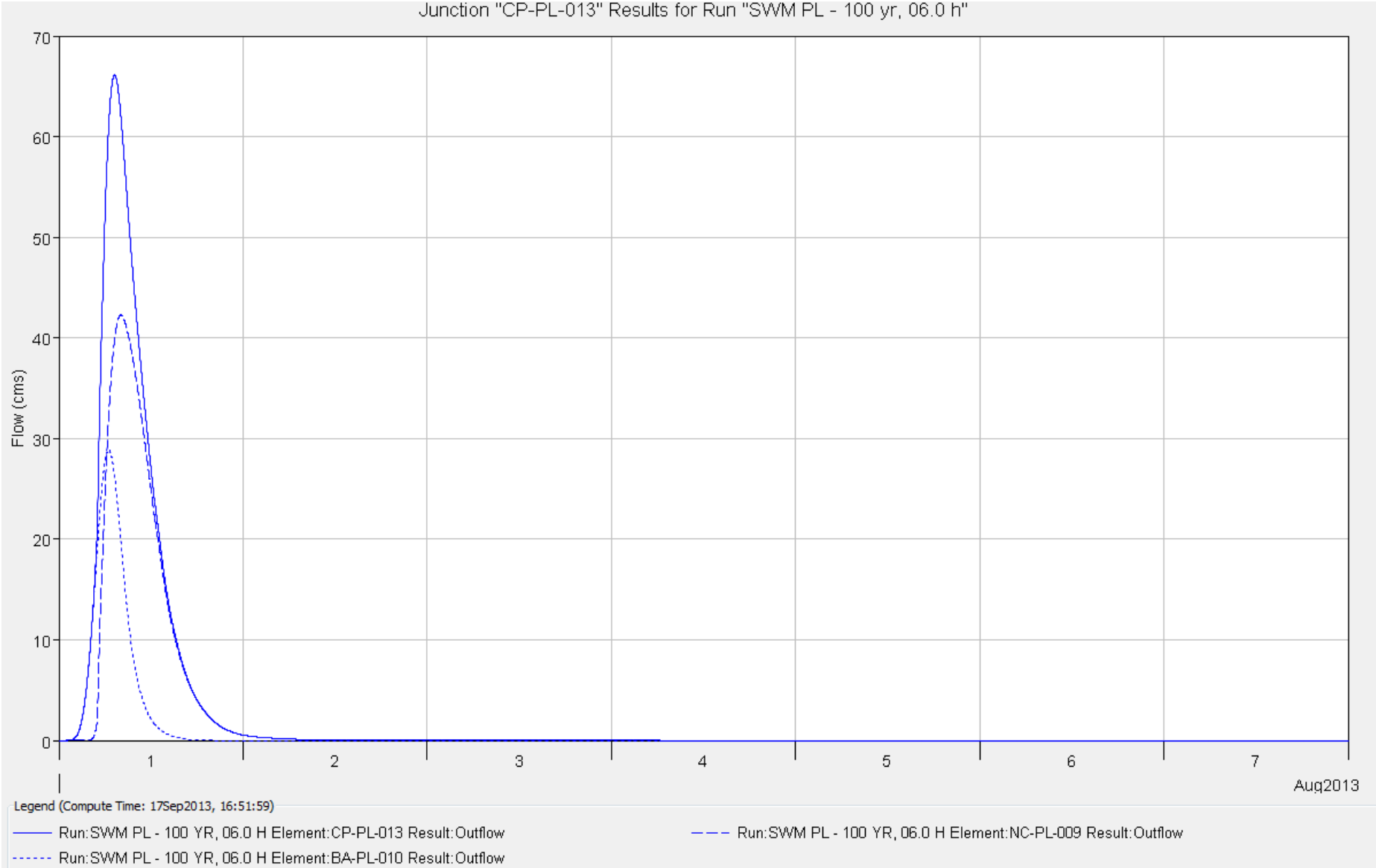

Junction "CP-PL-010B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-008 Result:Outflow

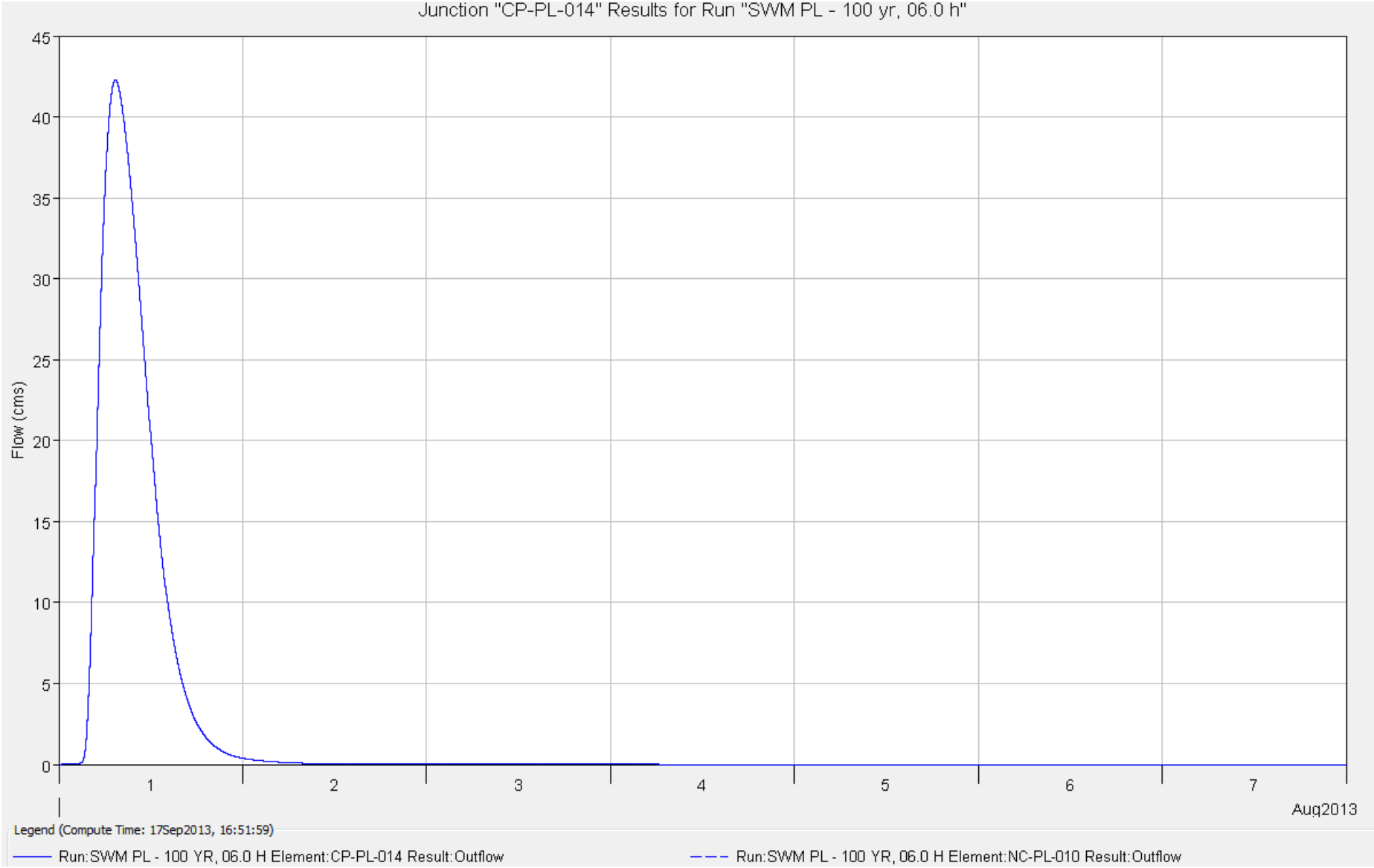

Junction "CP-PL-010C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-009 Result:Outflow

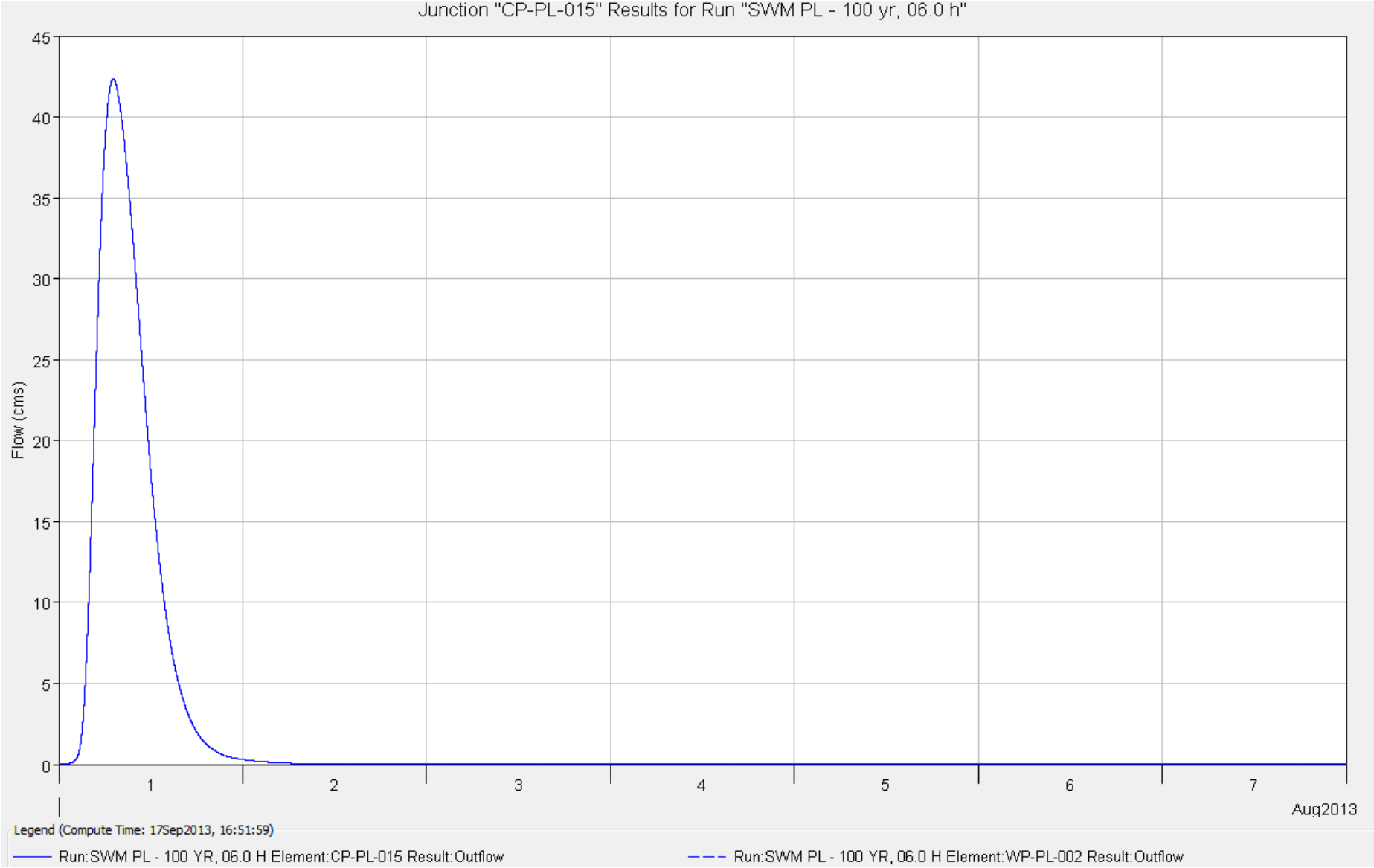

Junction "CP-PL-010D" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010D Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-007 Result:Outflow

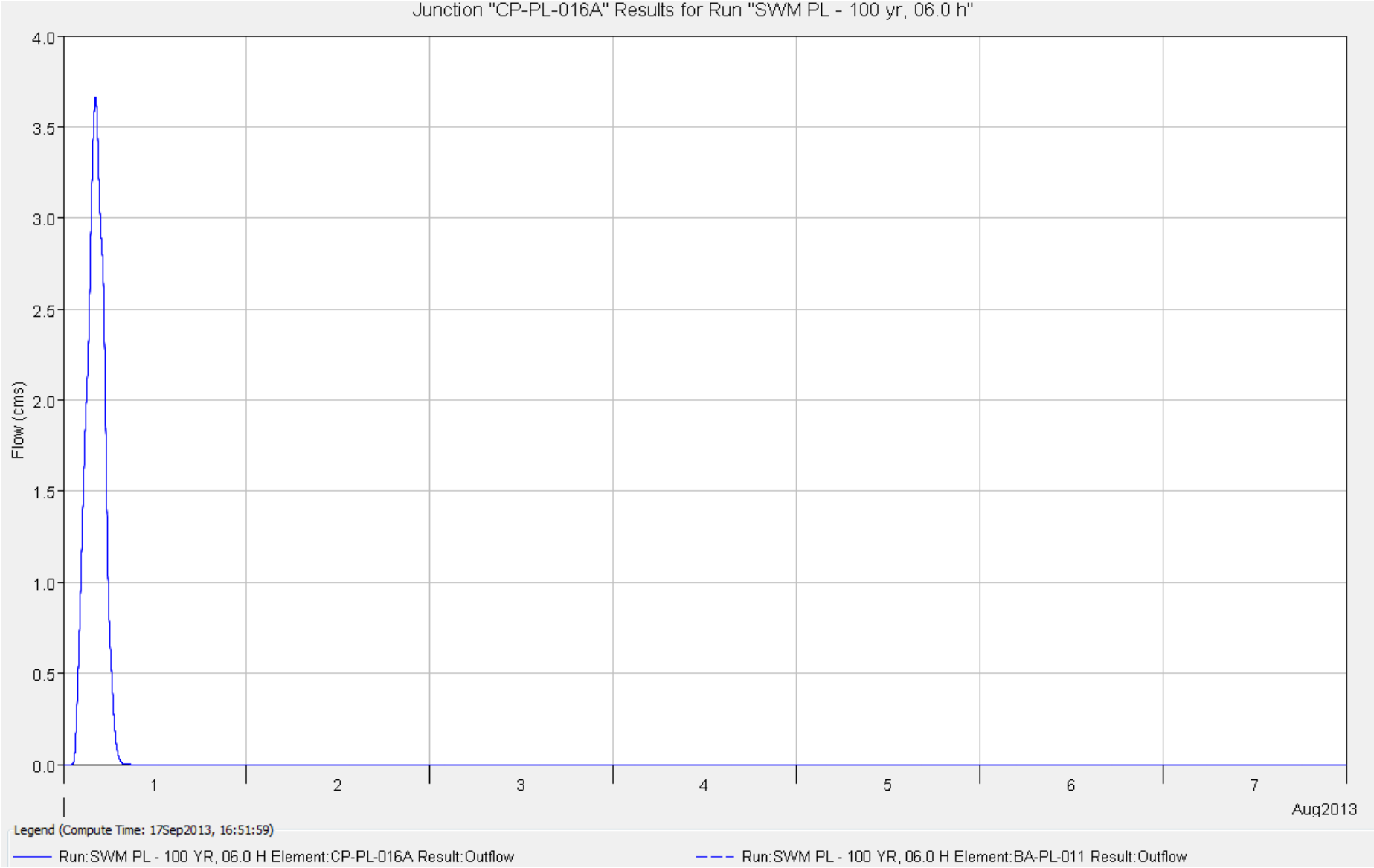

Junction "CP-PL-011" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-007 Result:Outflow

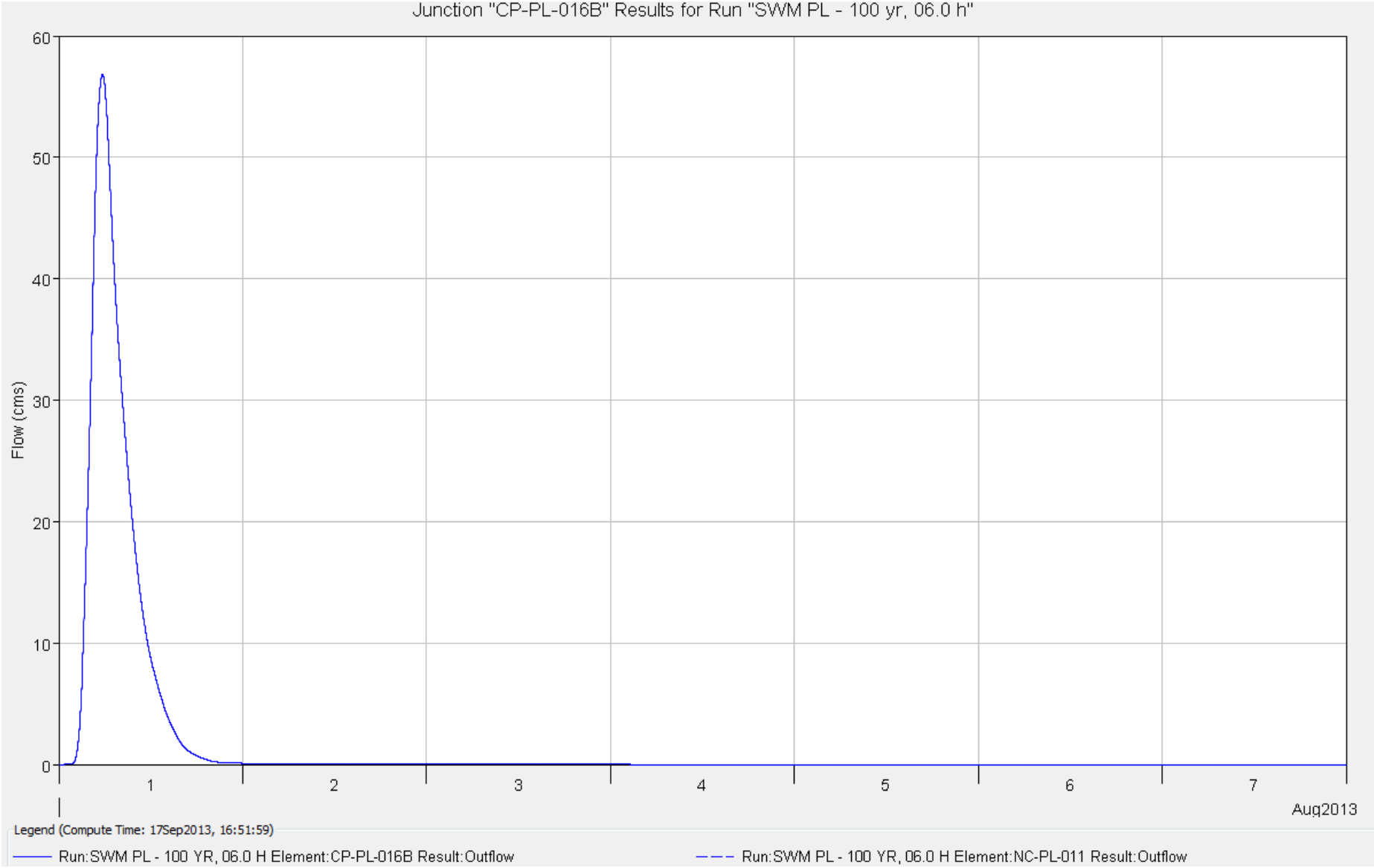

Junction "CP-PL-012" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-008 Result:Outflow

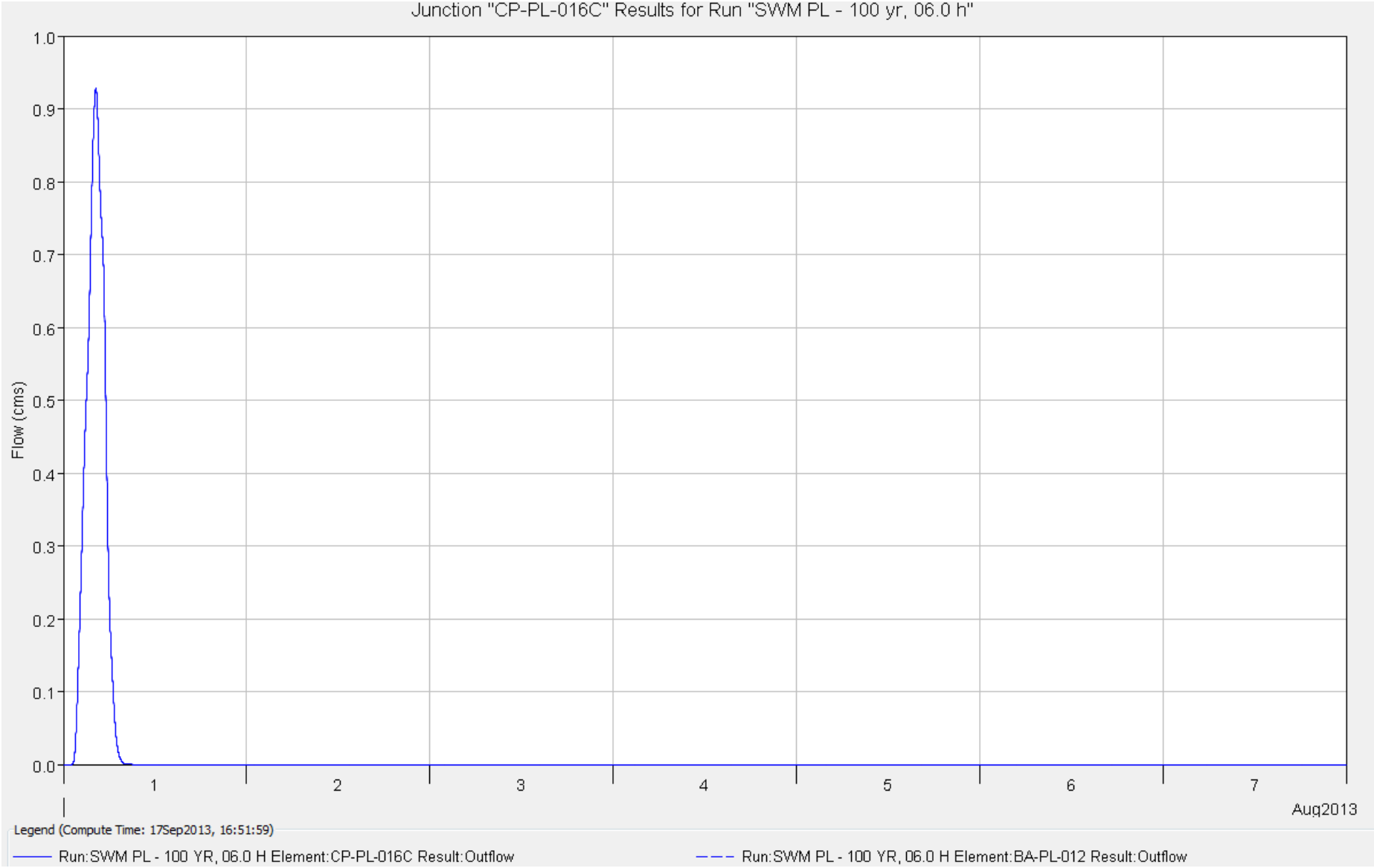

Junction "CP-PL-013" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-010 Result:Outflow

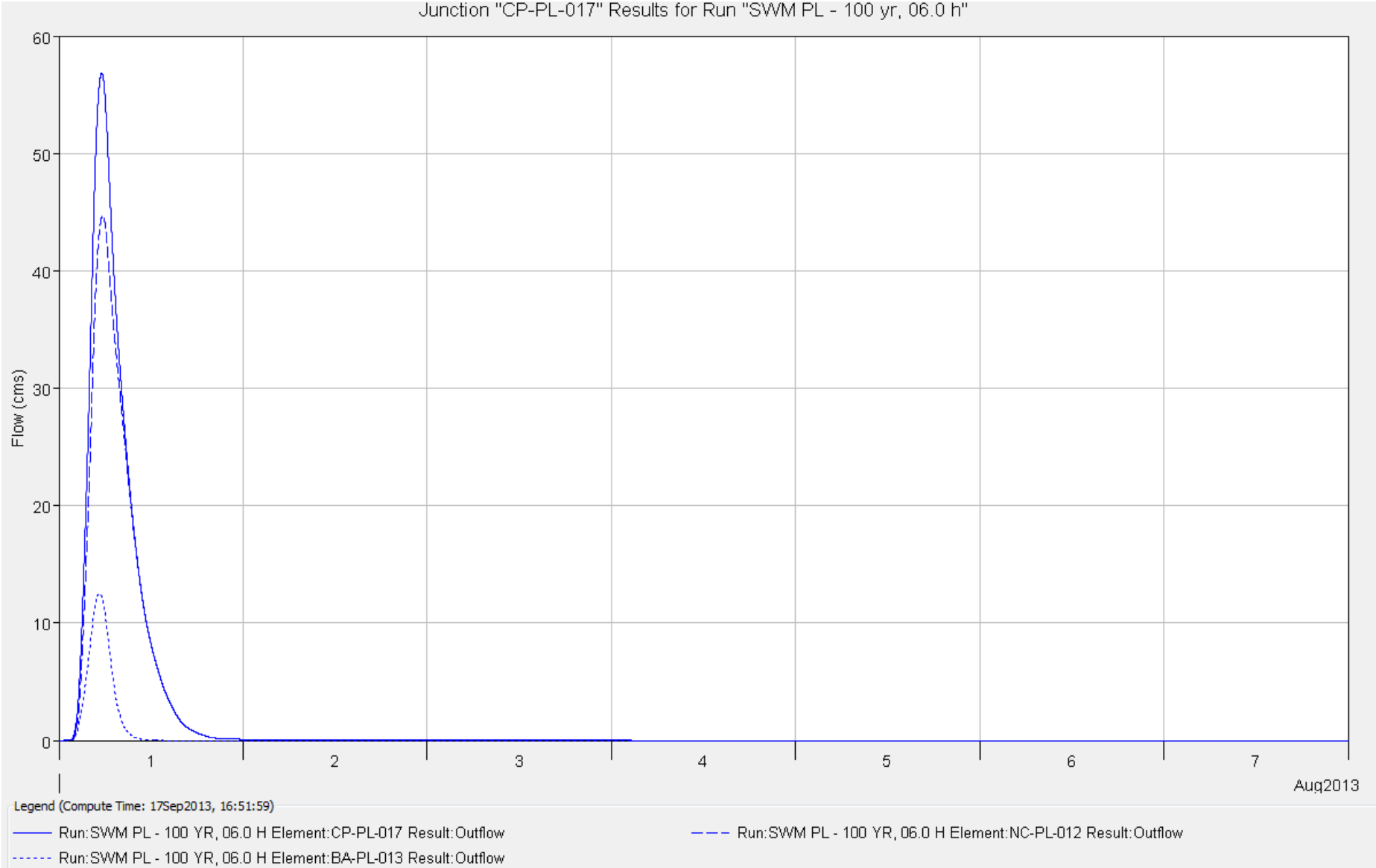

Junction "CP-PL-014" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-010 Result:Outflow

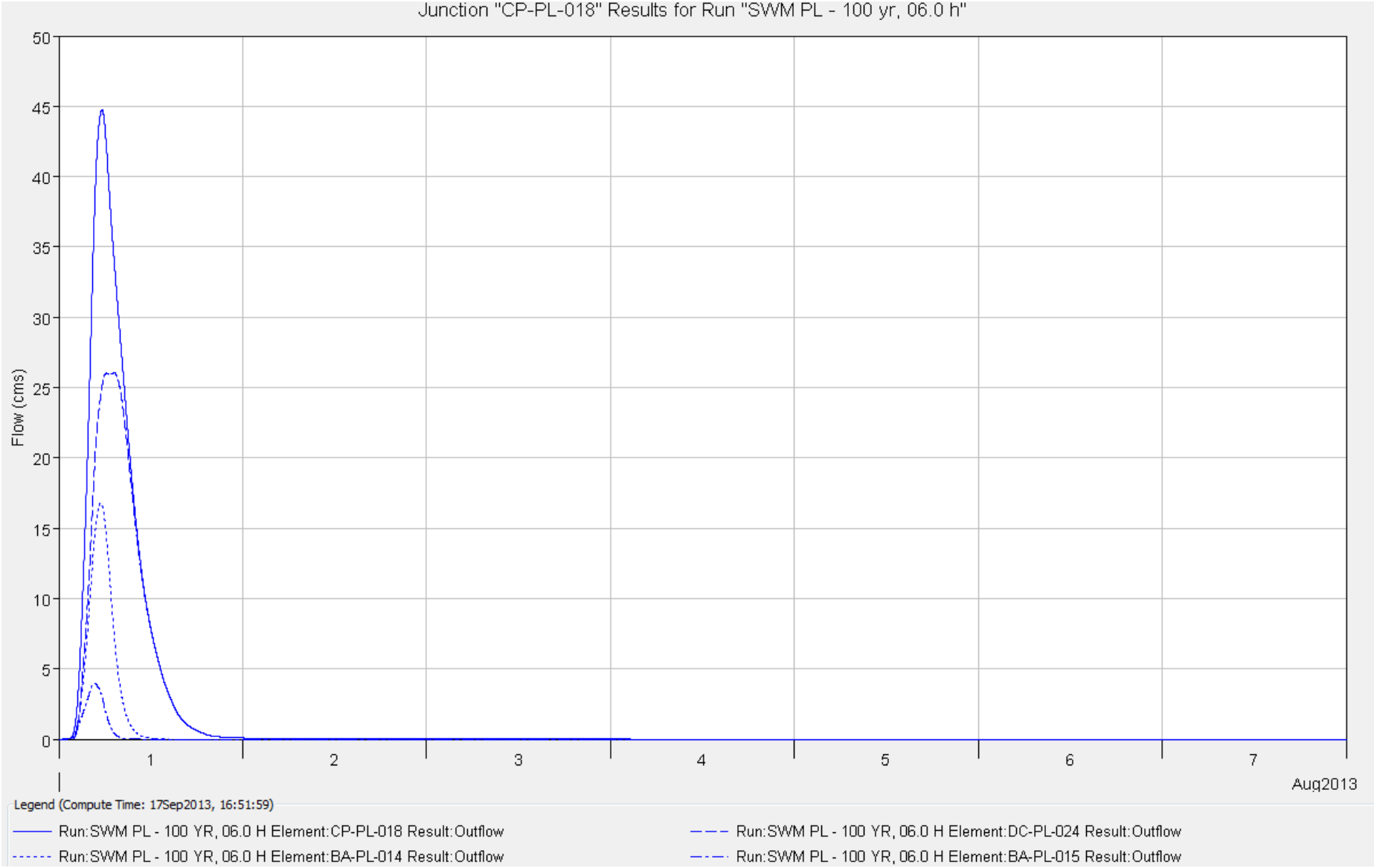

Junction "CP-PL-015" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Outflow

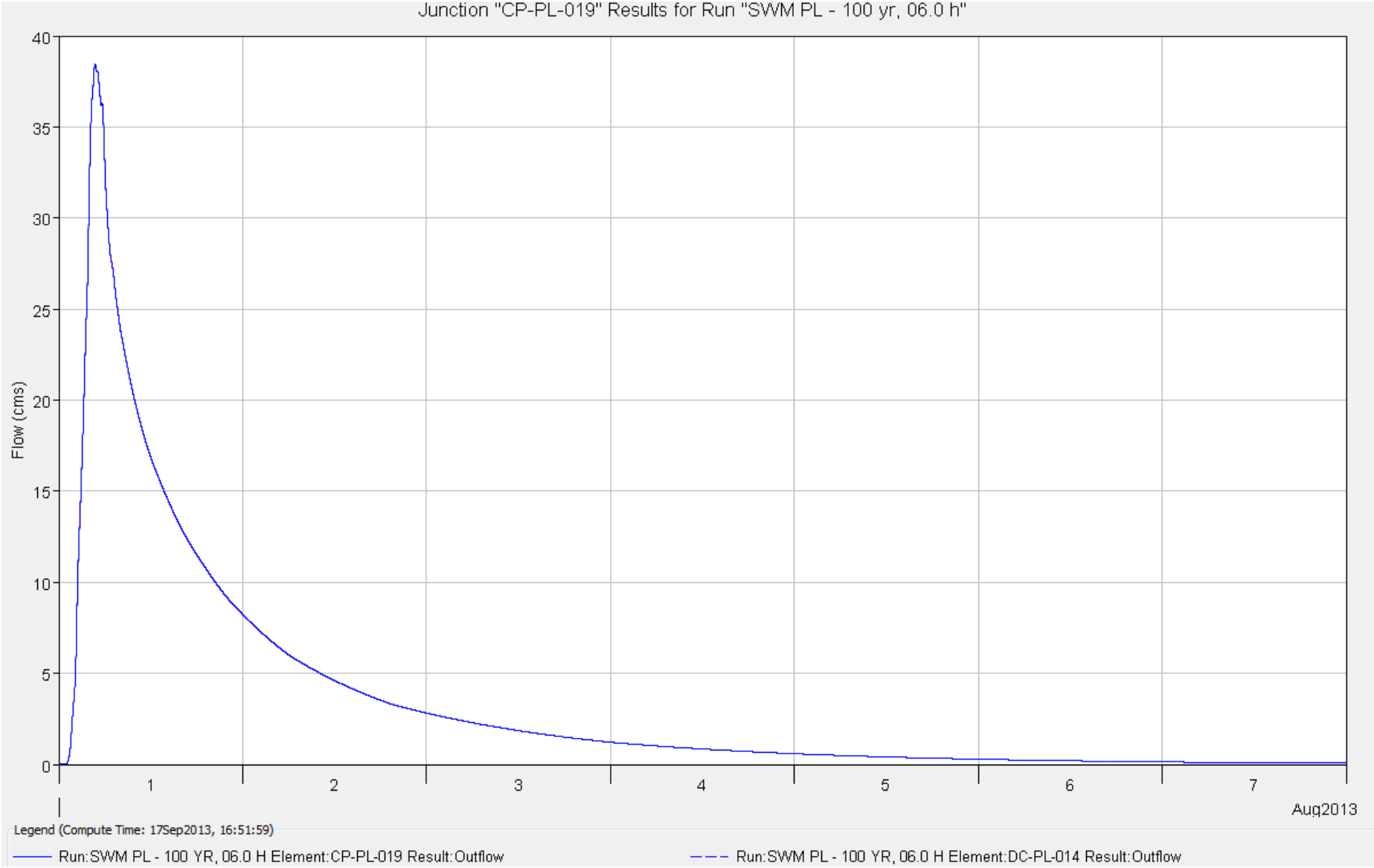

Junction "CP-PL-016A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-011 Result:Outflow

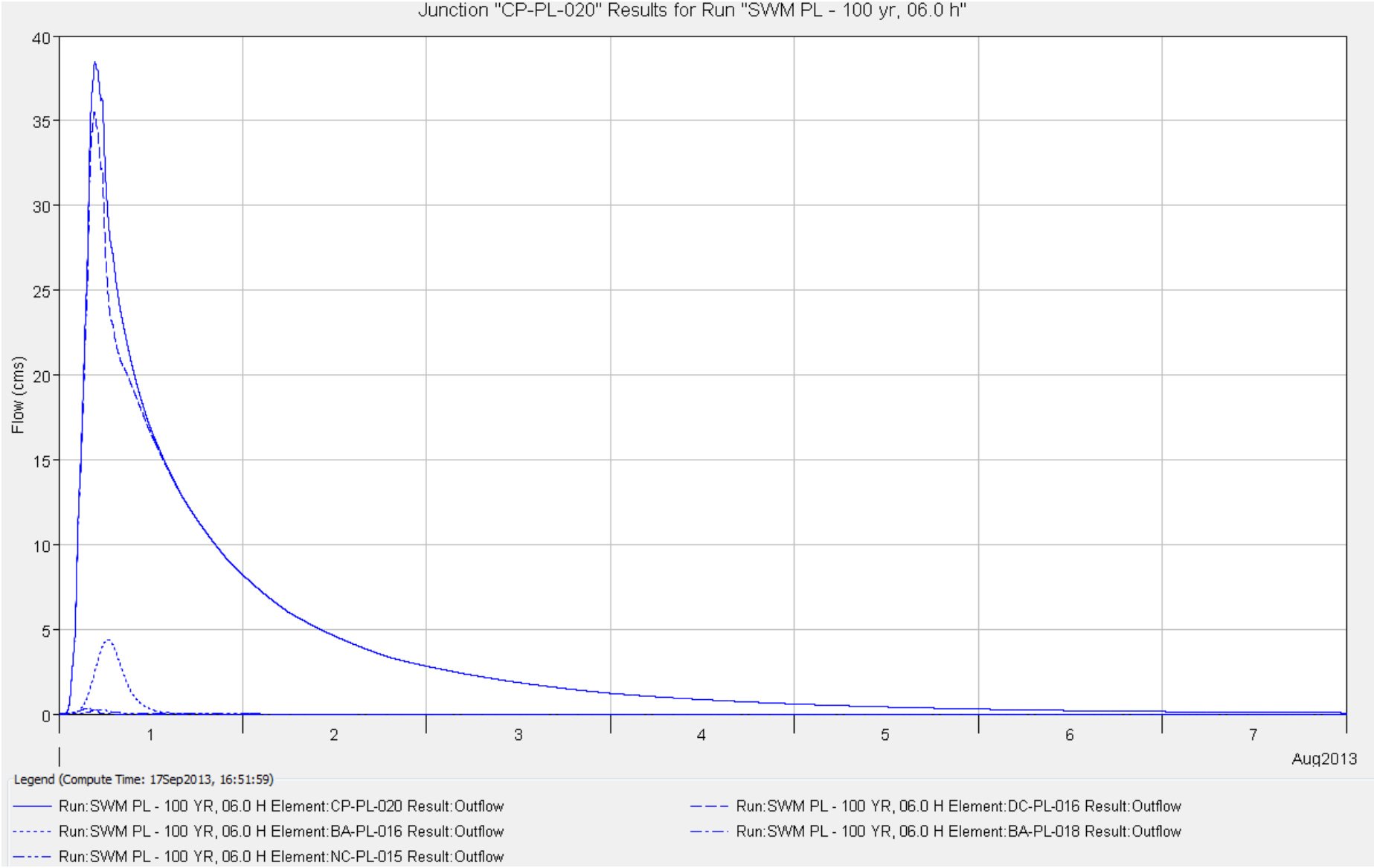

Junction "CP-PL-016B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-011 Result:Outflow

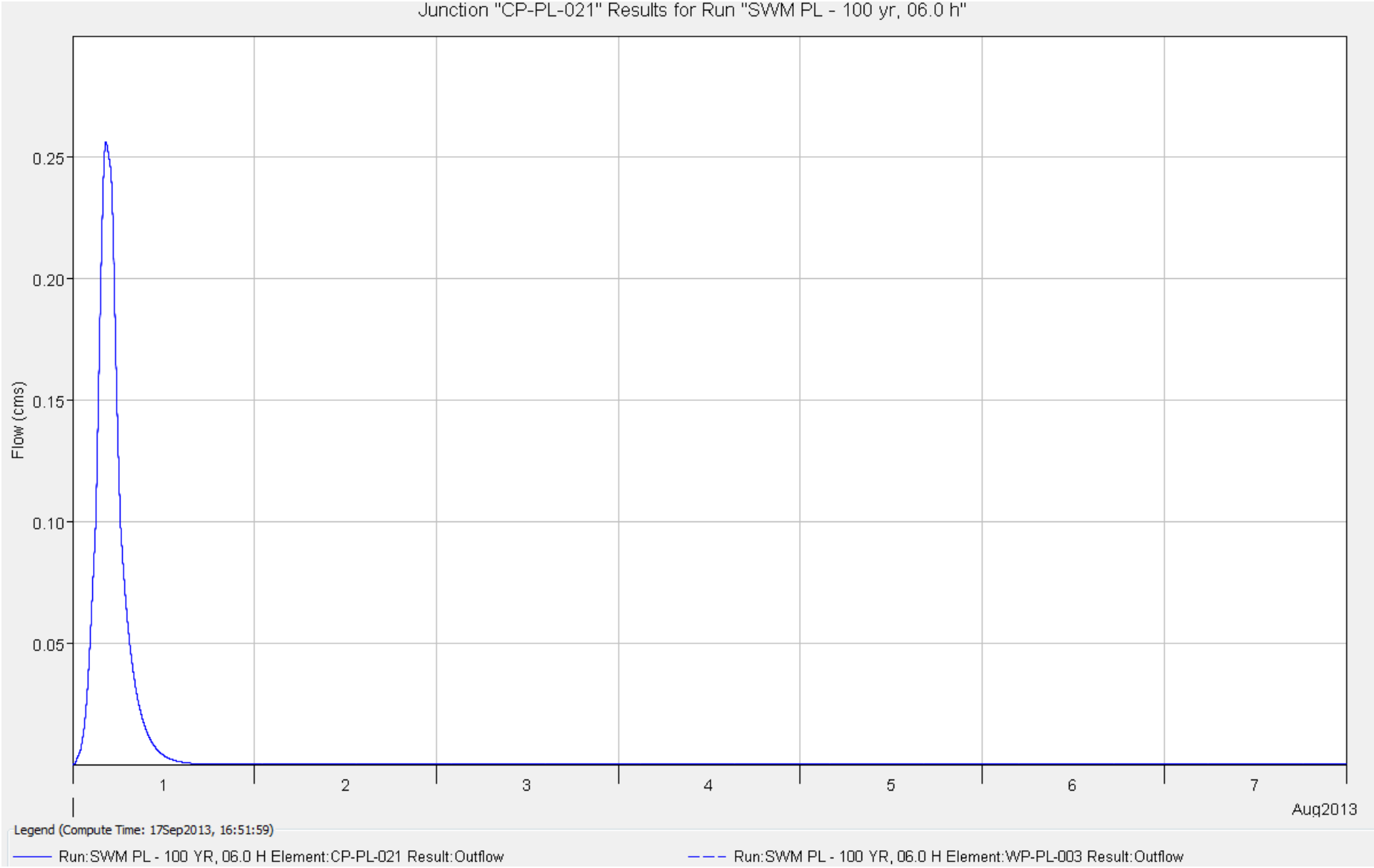

Junction "CP-PL-016C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-012 Result:Outflow

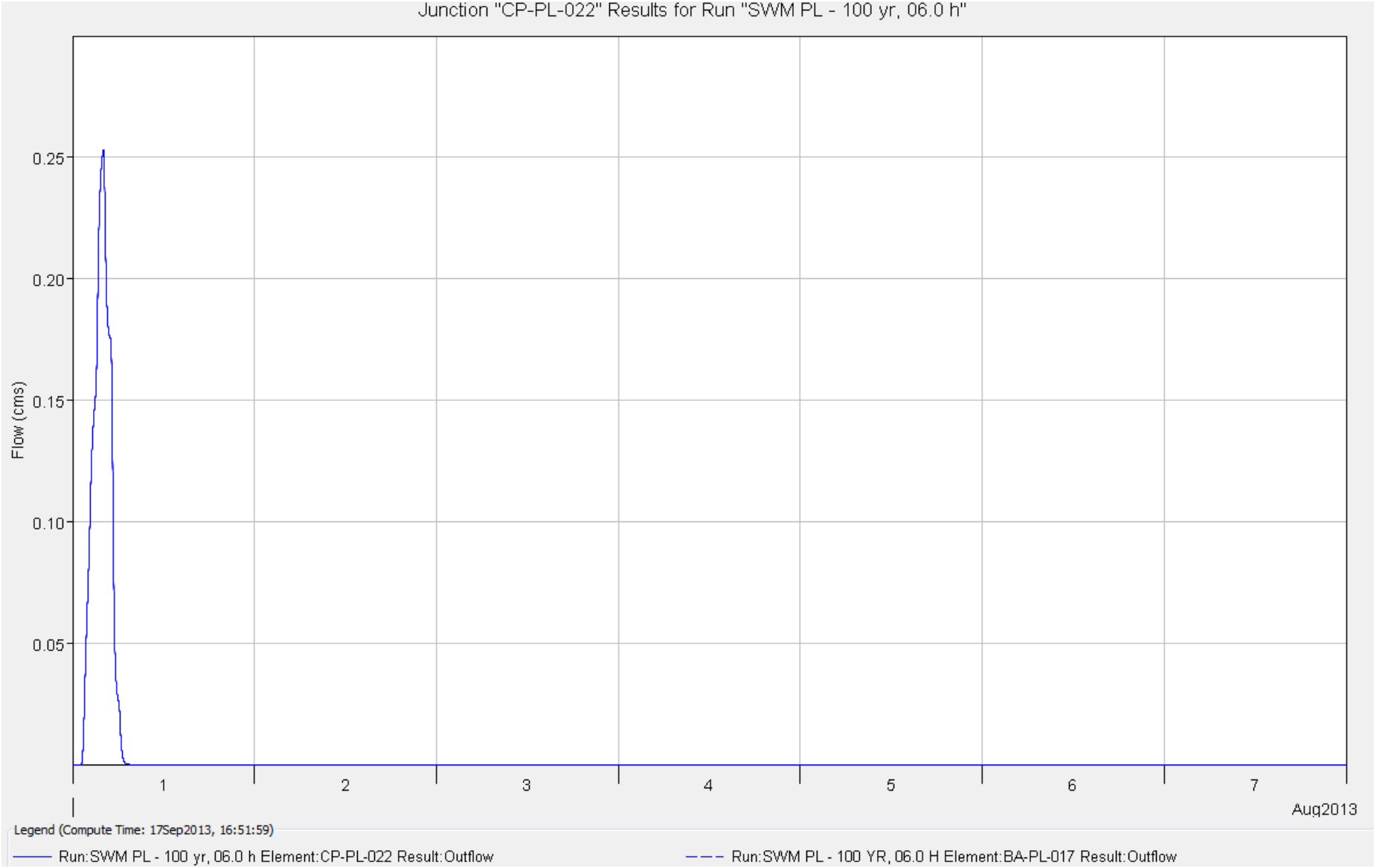

Junction "CP-PL-017" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-013 Result:Outflow

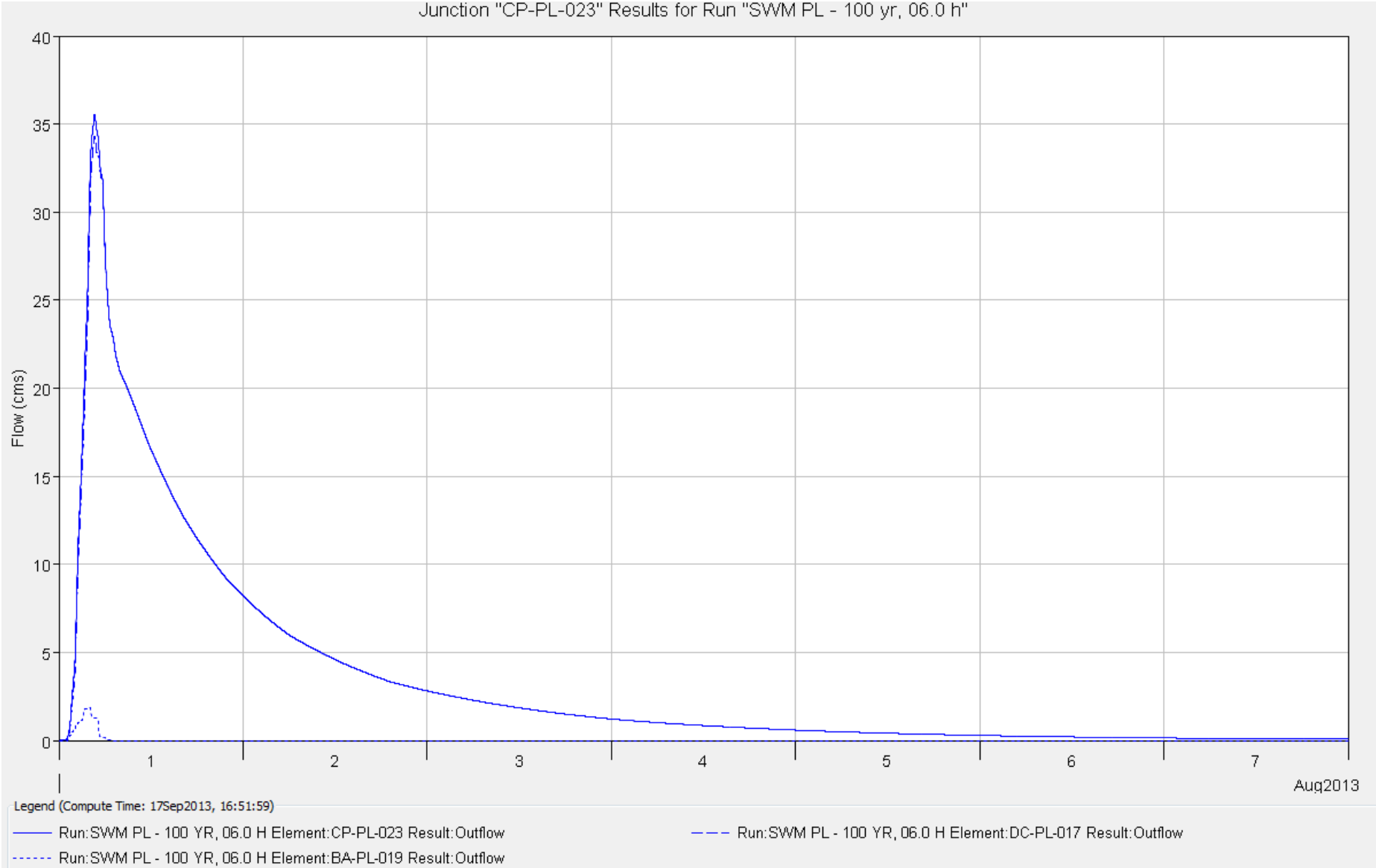

Junction "CP-PL-018" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-015 Result:Outflow

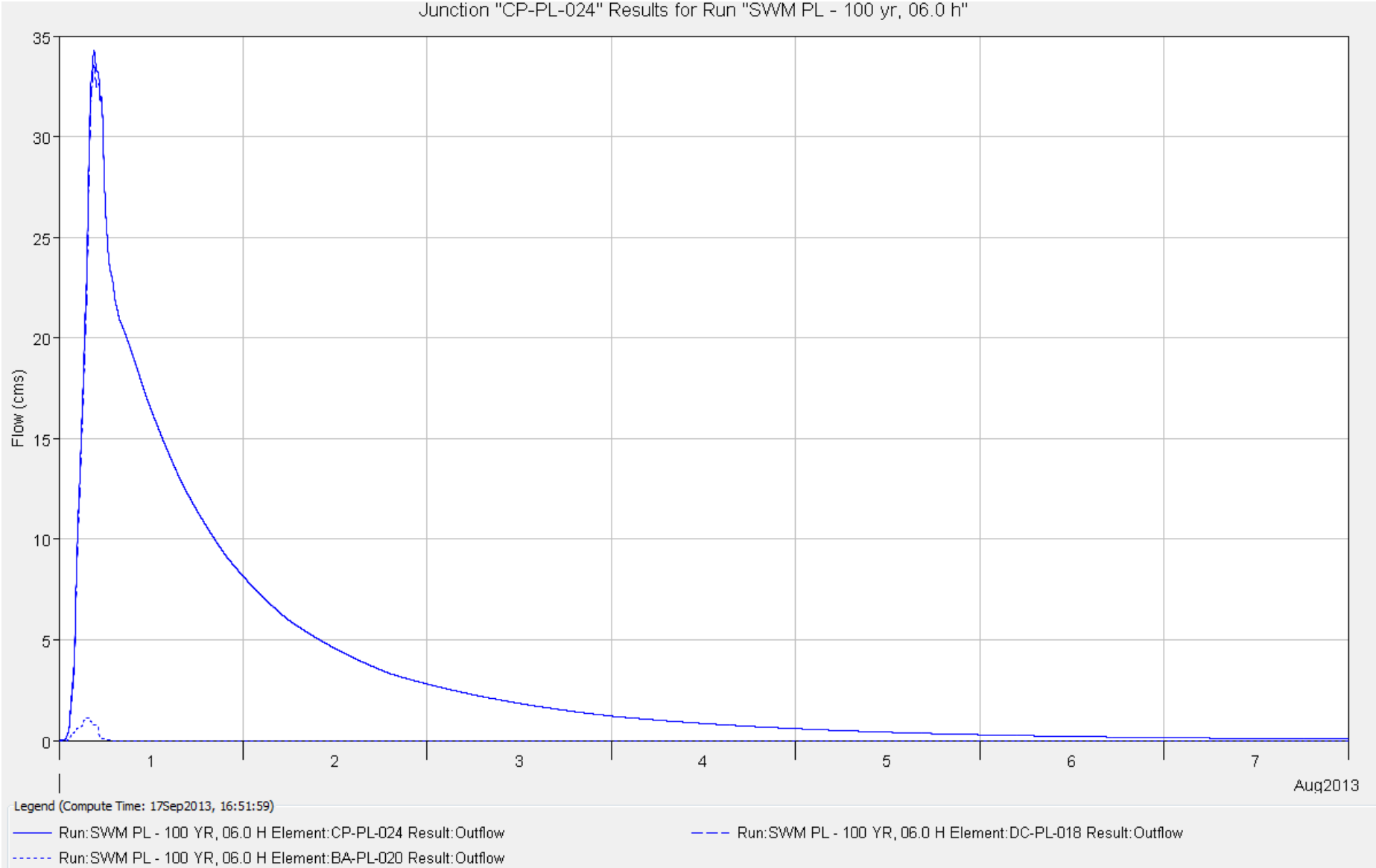

Junction "CP-PL-019" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-014 Result:Outflow

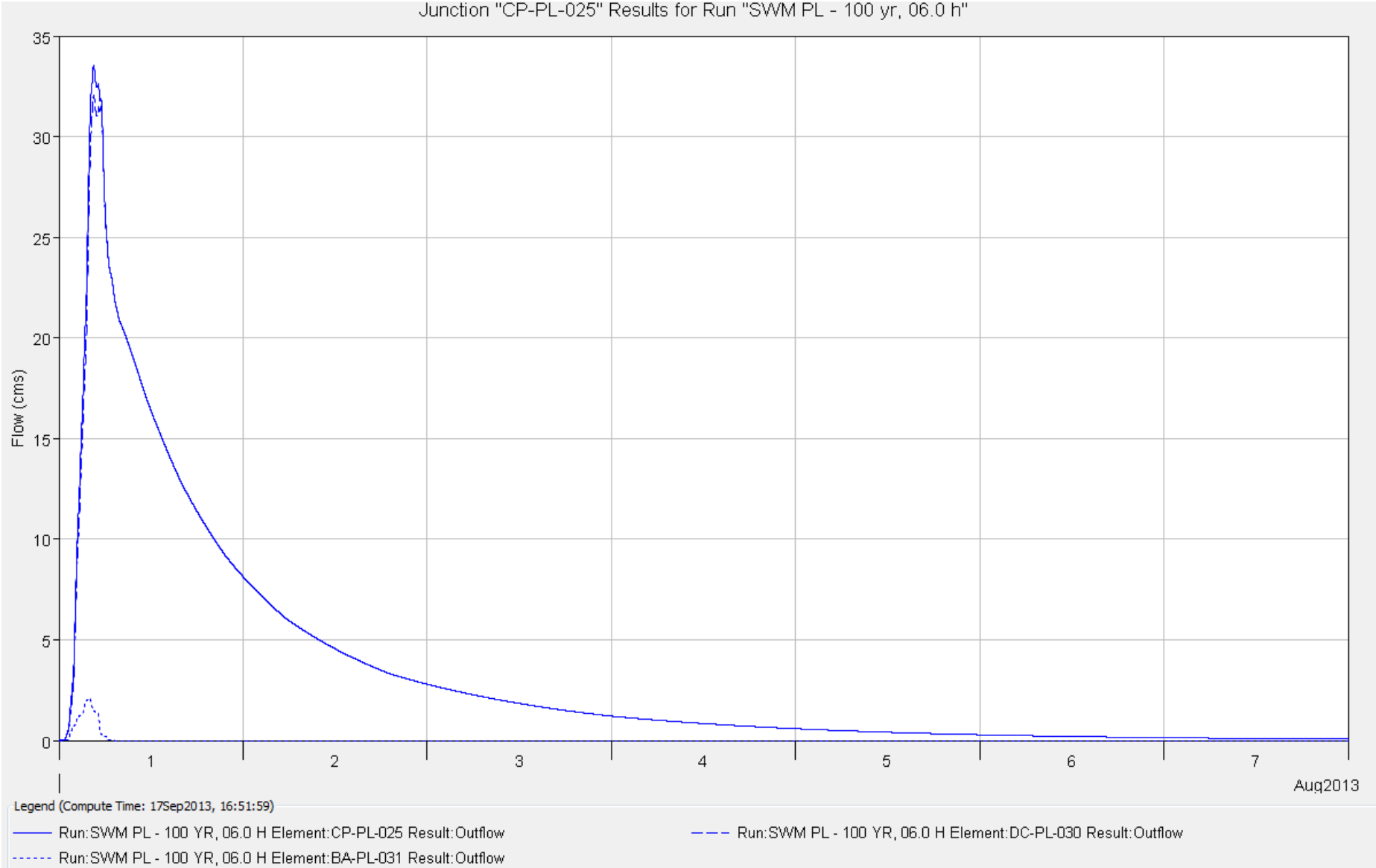

Junction "CP-PL-020" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-018 Result:Outflow

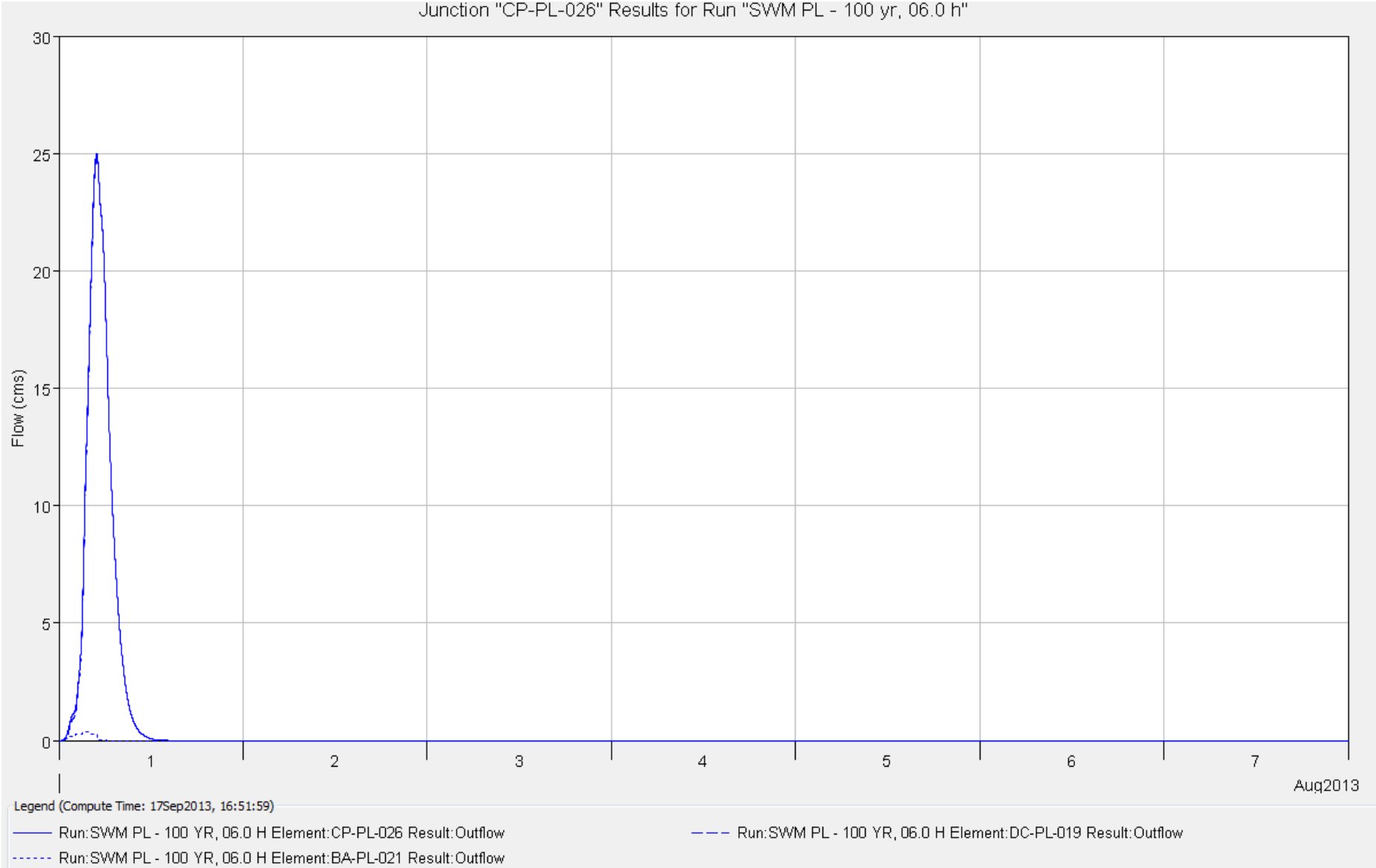

Junction "CP-PL-021" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0.25
0.20
0.15
0.10
0.05
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Outflow

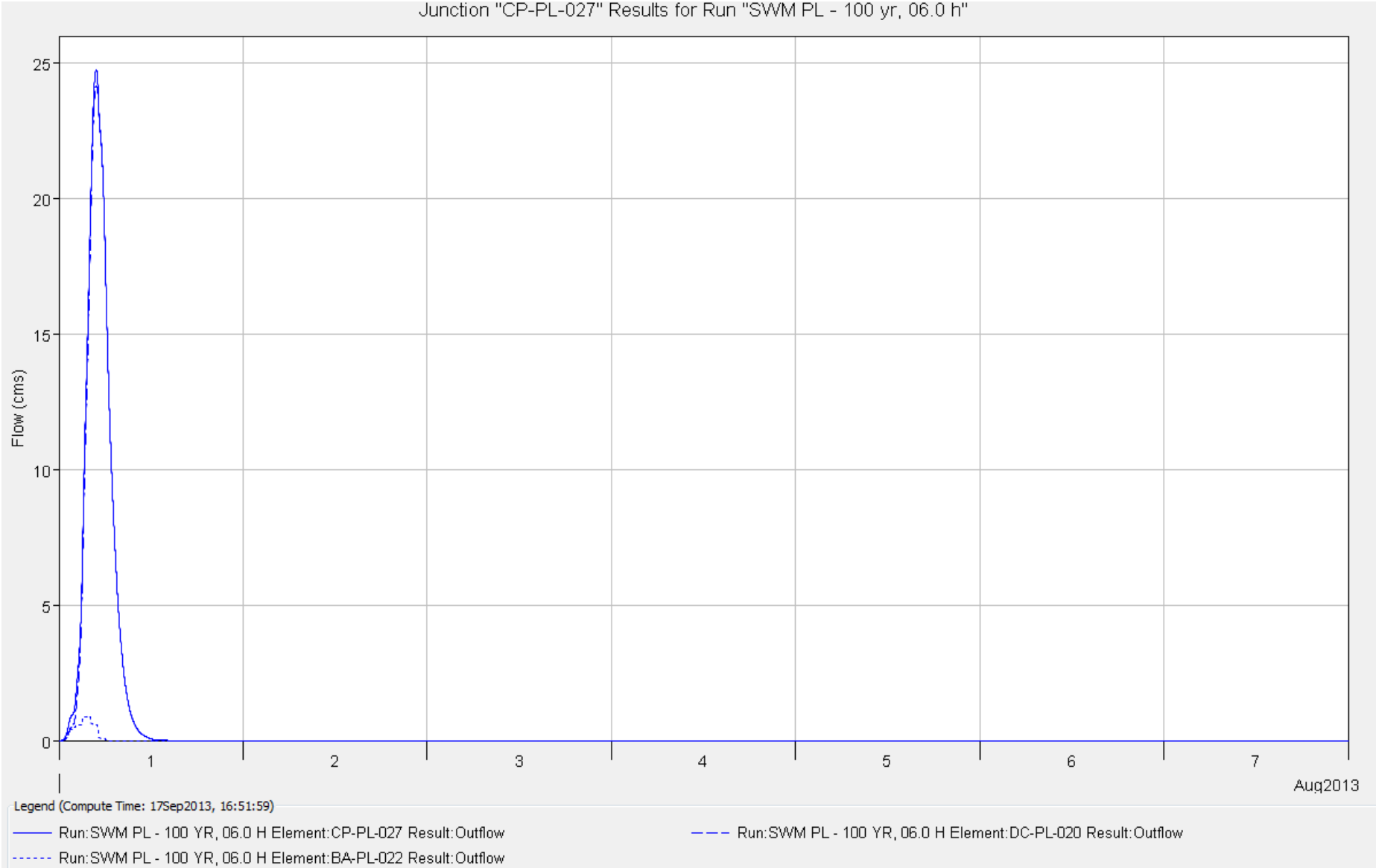

Junction "CP-PL-022" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0.25
0.20
0.15
0.10
0.05
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-017 Result:Outflow

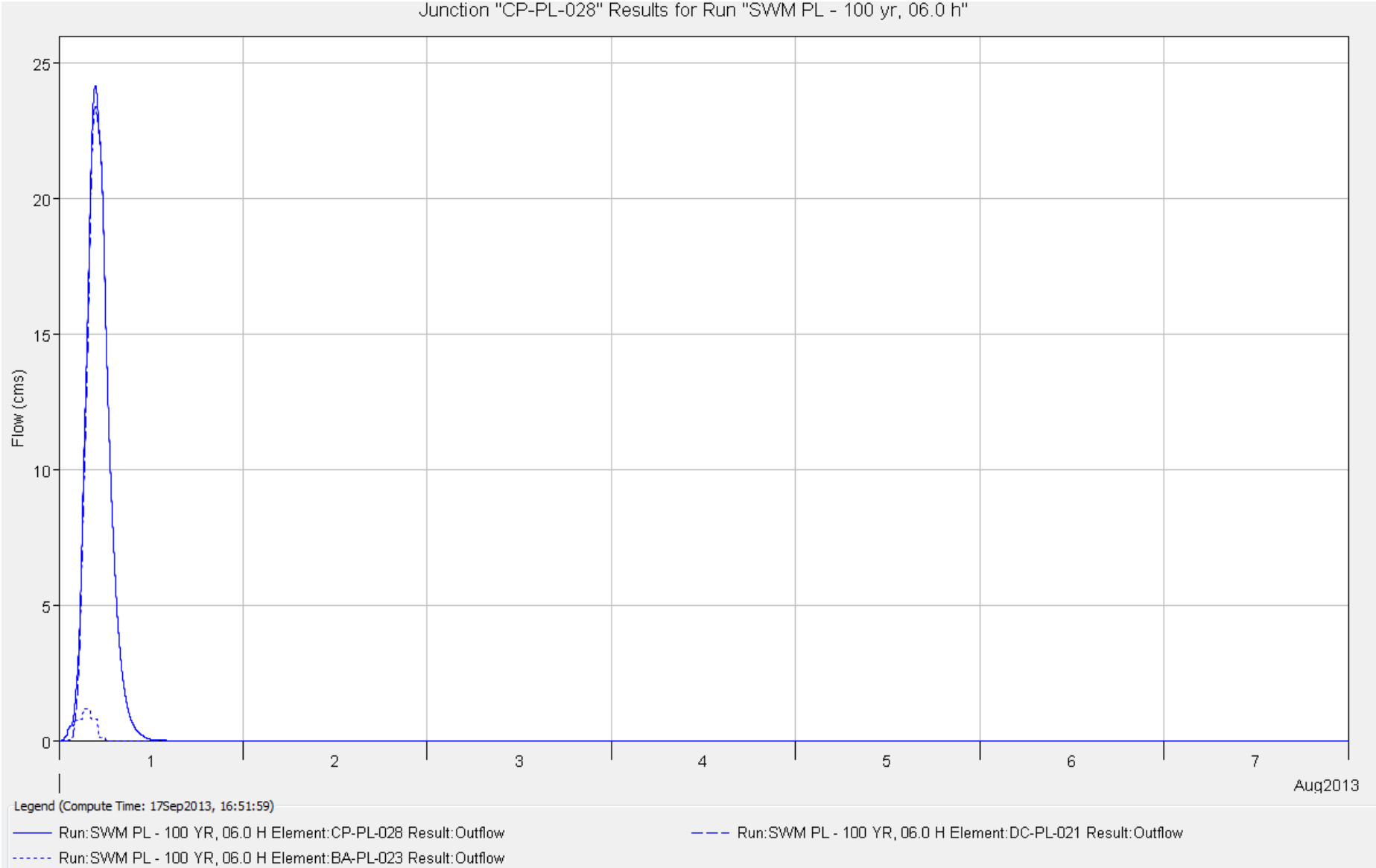

Junction "CP-PL-023" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-019 Result:Outflow

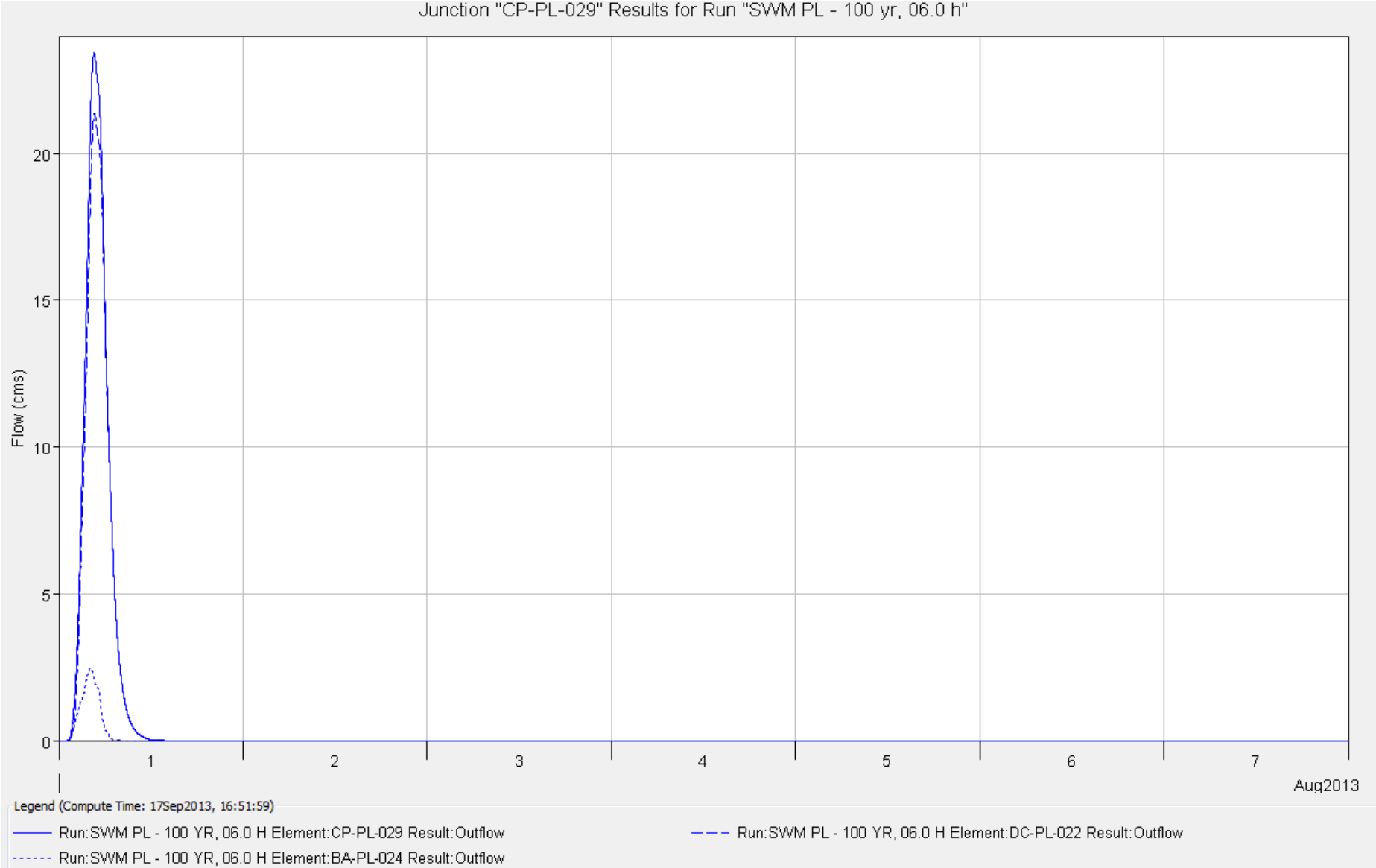

Junction "CP-PL-024" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-020 Result:Outflow

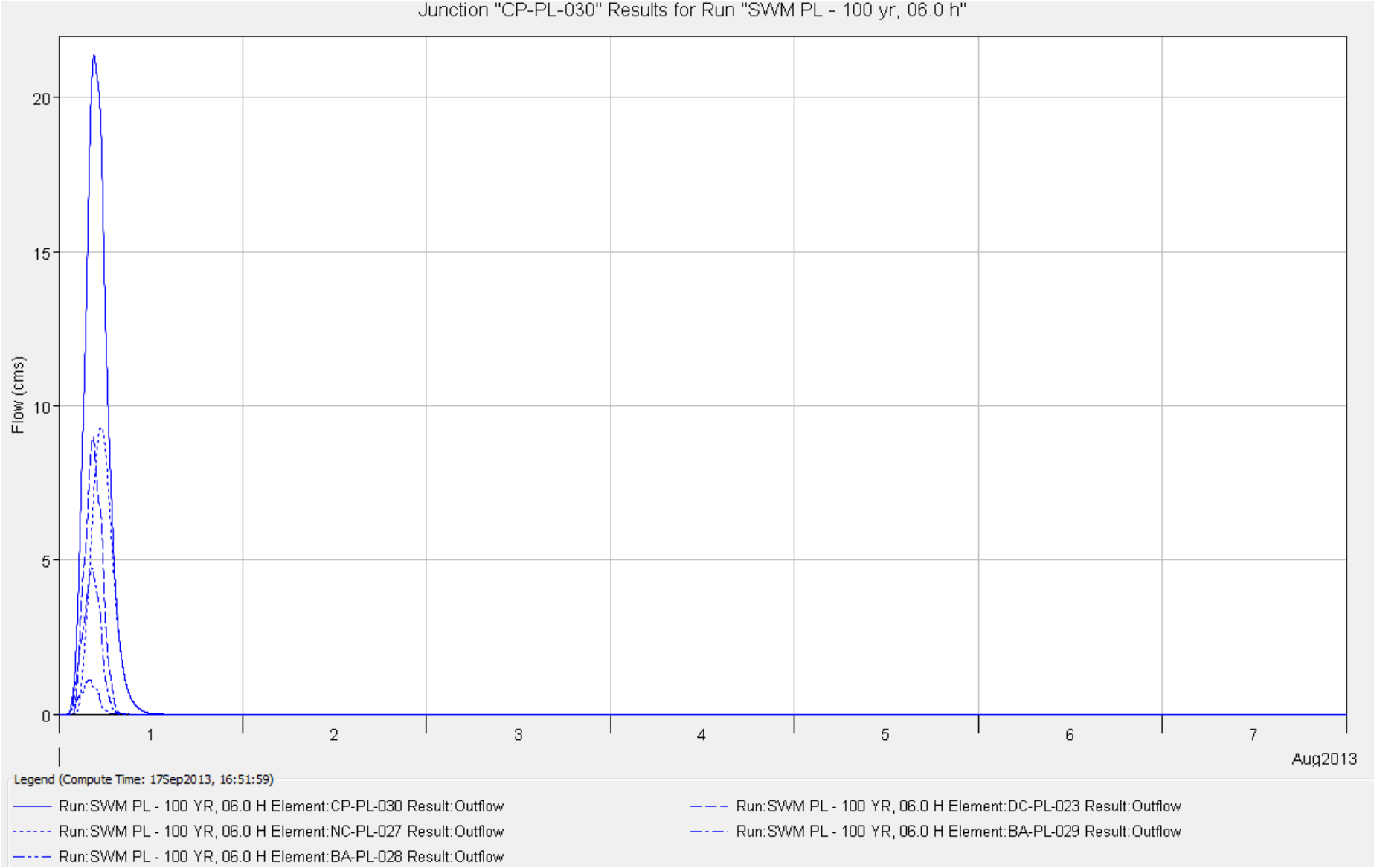

Junction "CP-PL-025" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-025 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-031 Result:Outflow

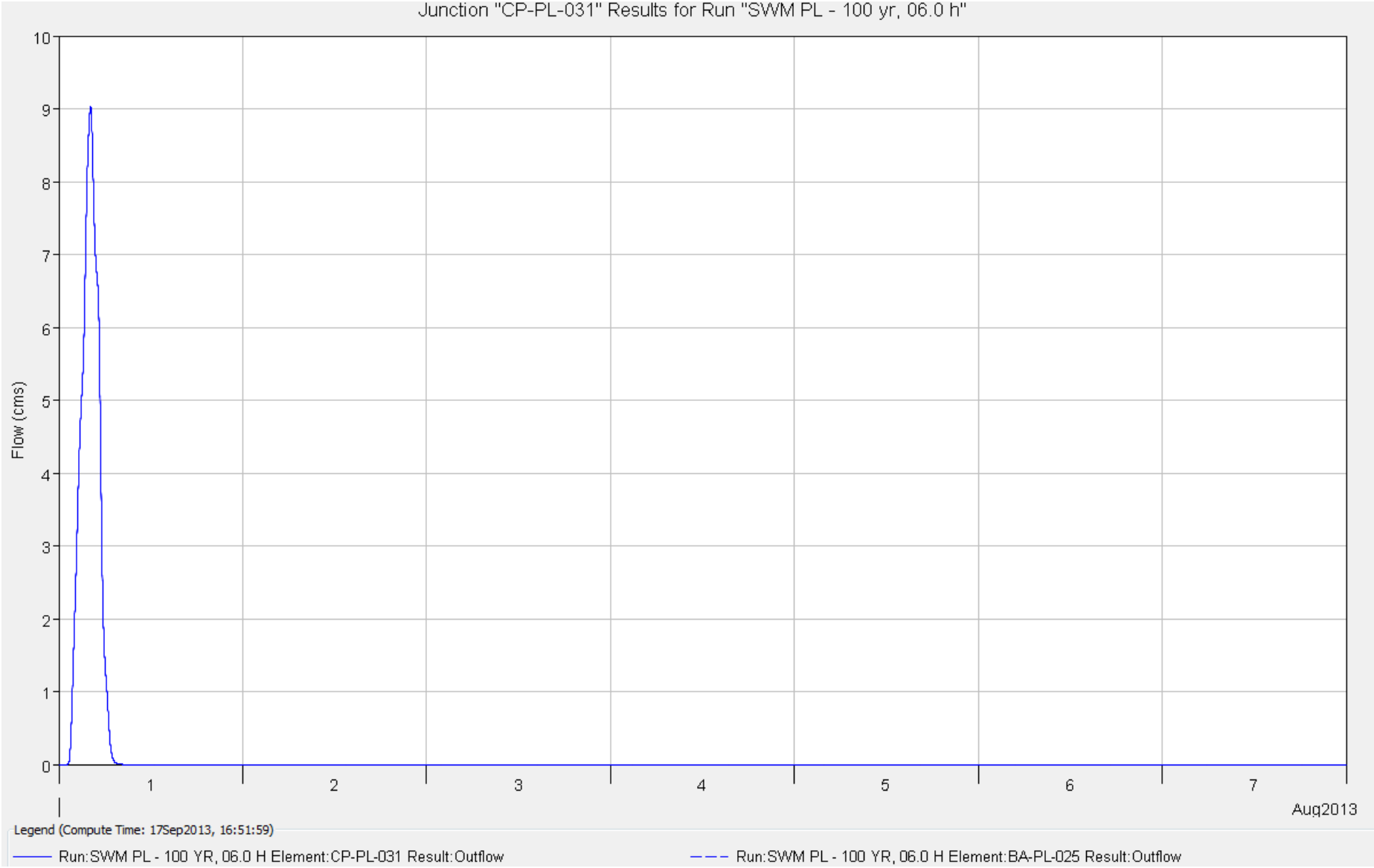

Junction "CP-PL-026" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-021 Result:Outflow

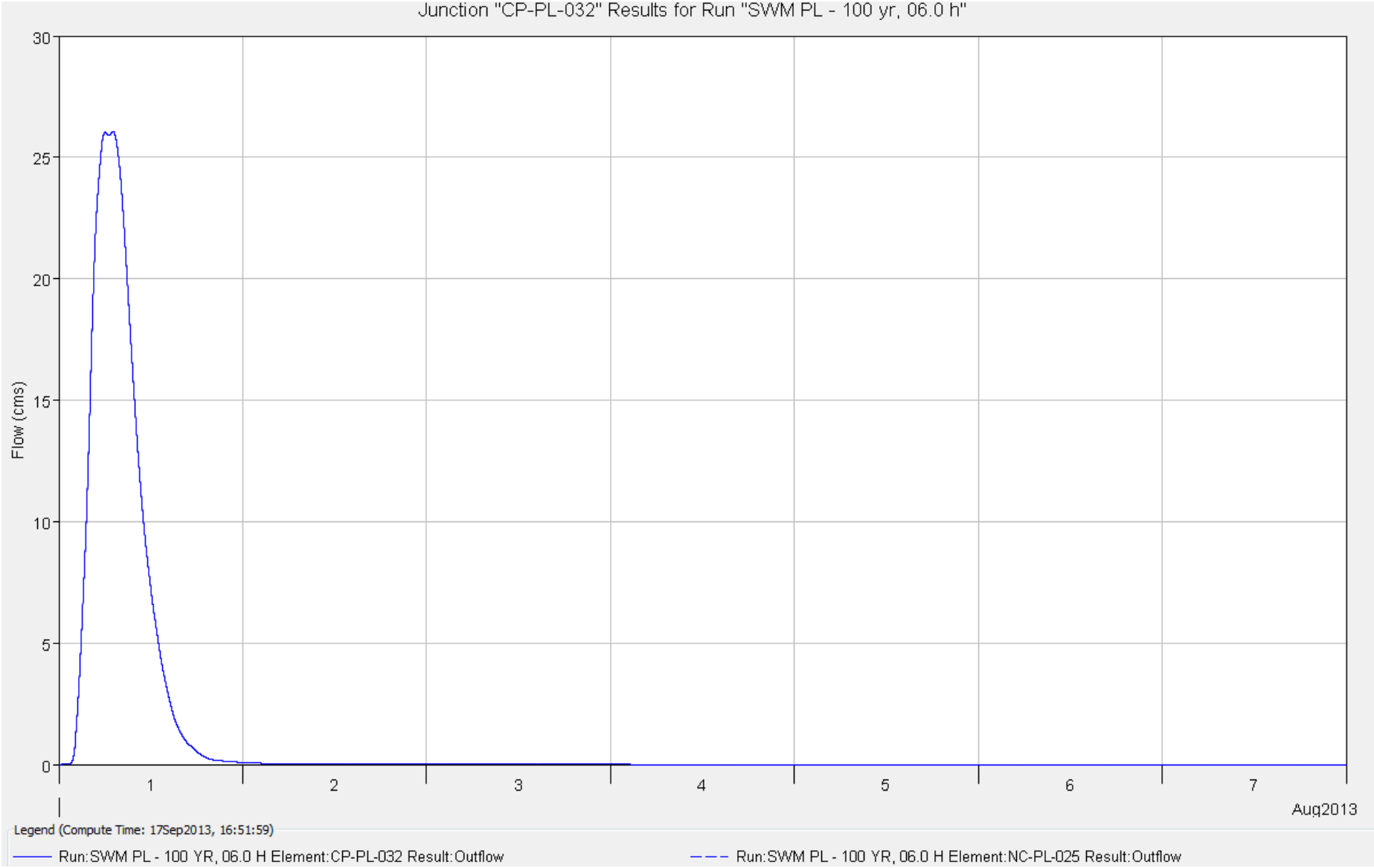

Junction "CP-PL-027" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-022 Result:Outflow

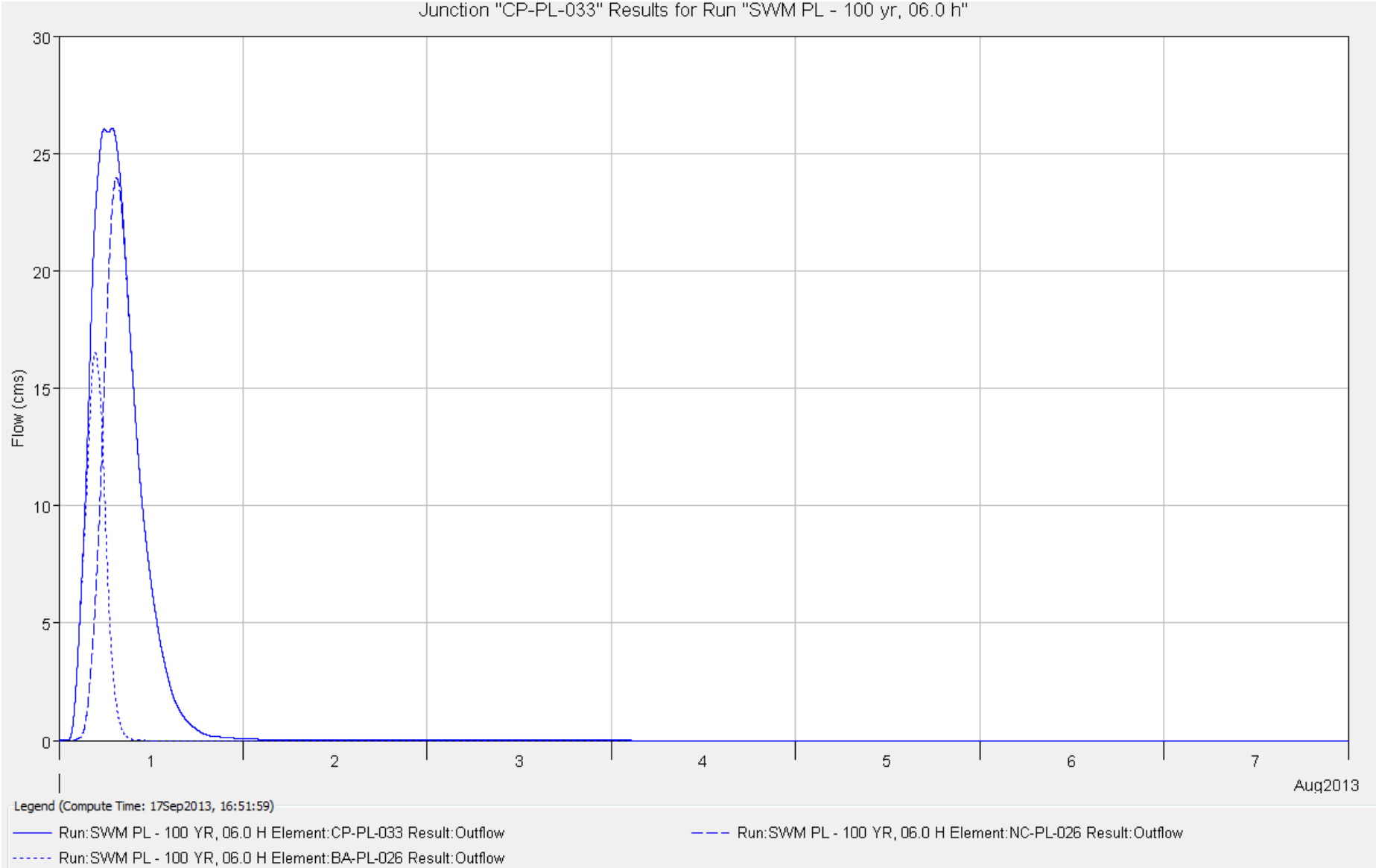

Junction "CP-PL-028" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-023 Result:Outflow

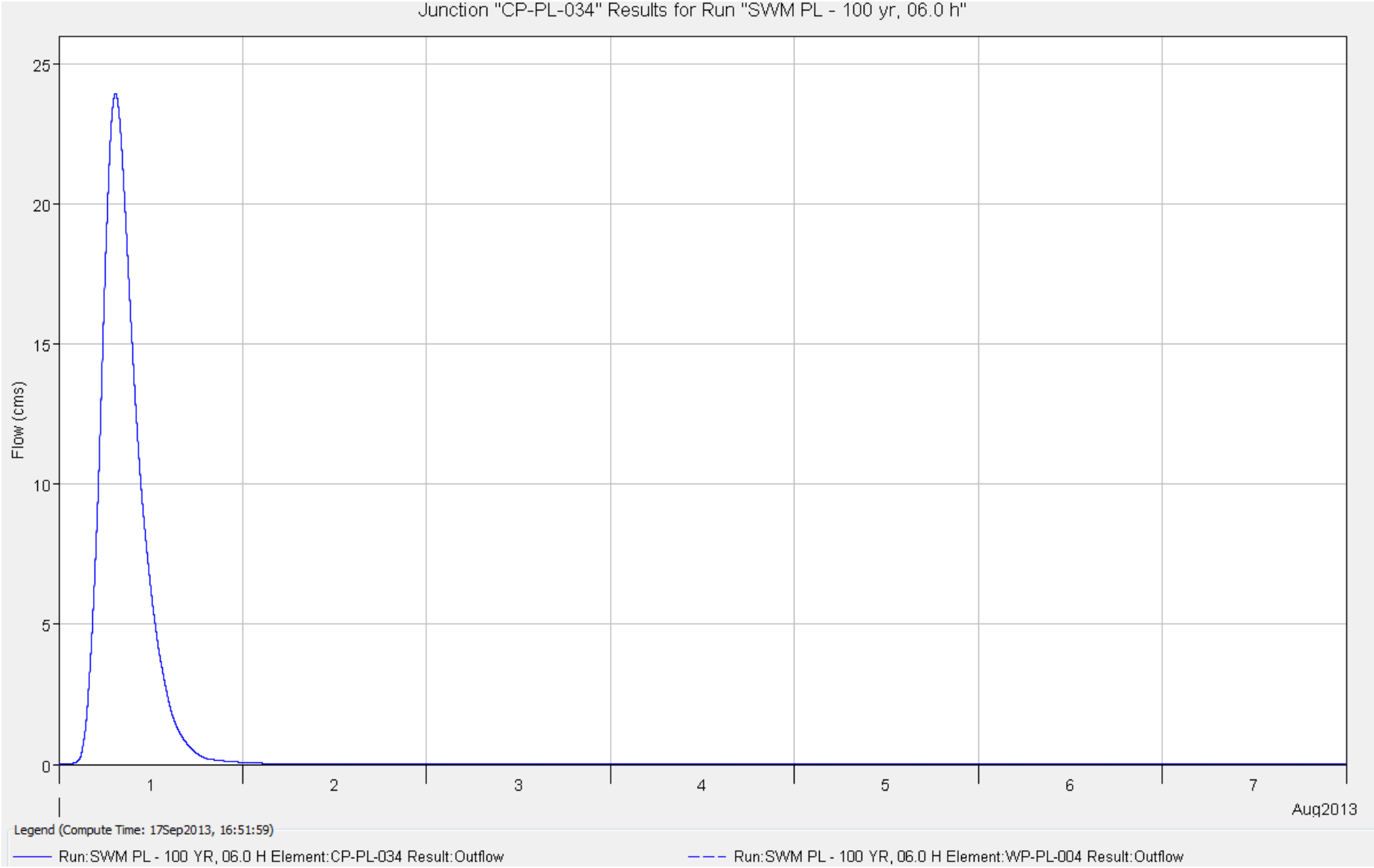

Junction "CP-PL-029" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-029 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-024 Result:Outflow

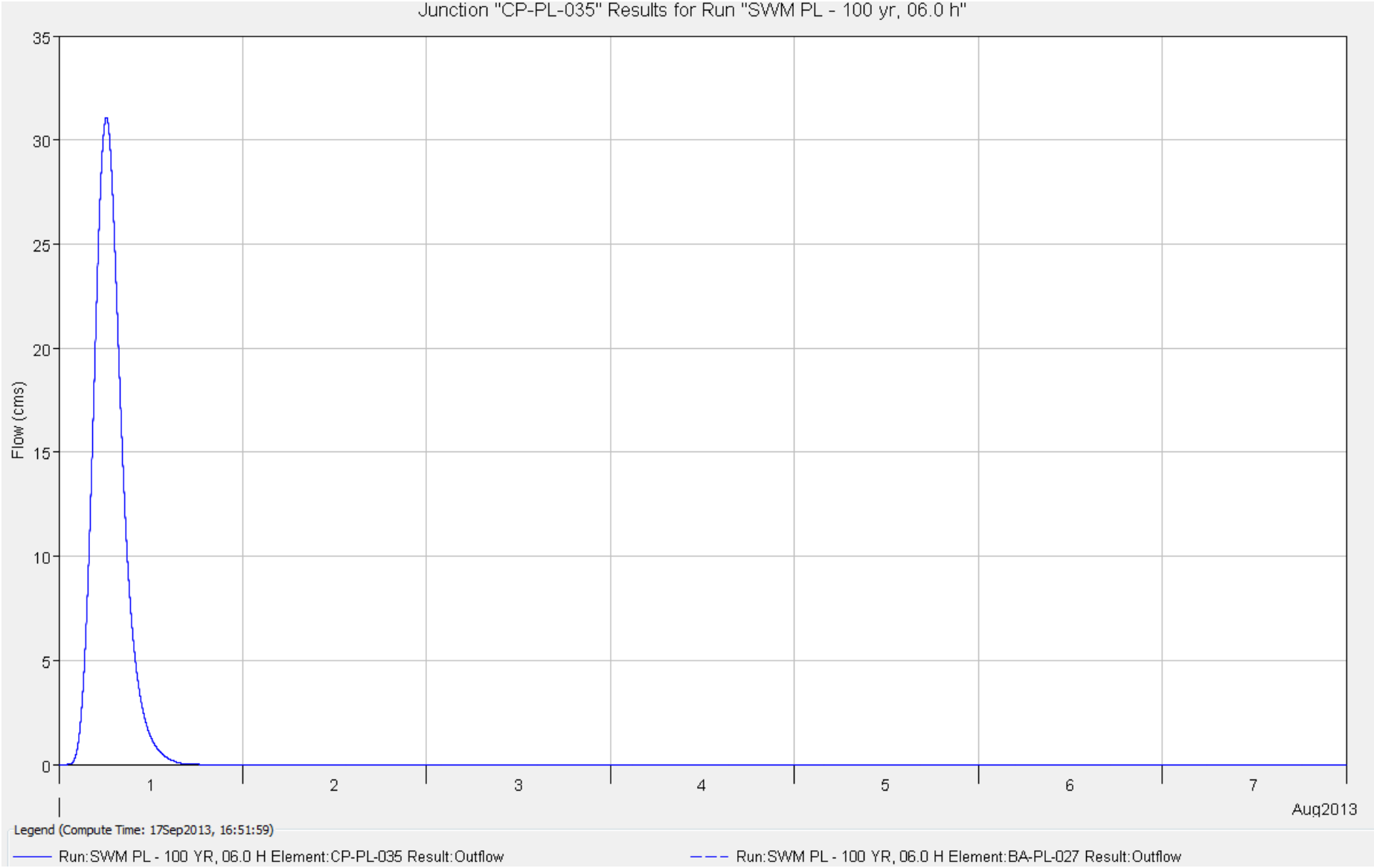

Junction "CP-PL-030" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-029 Result:Outflow

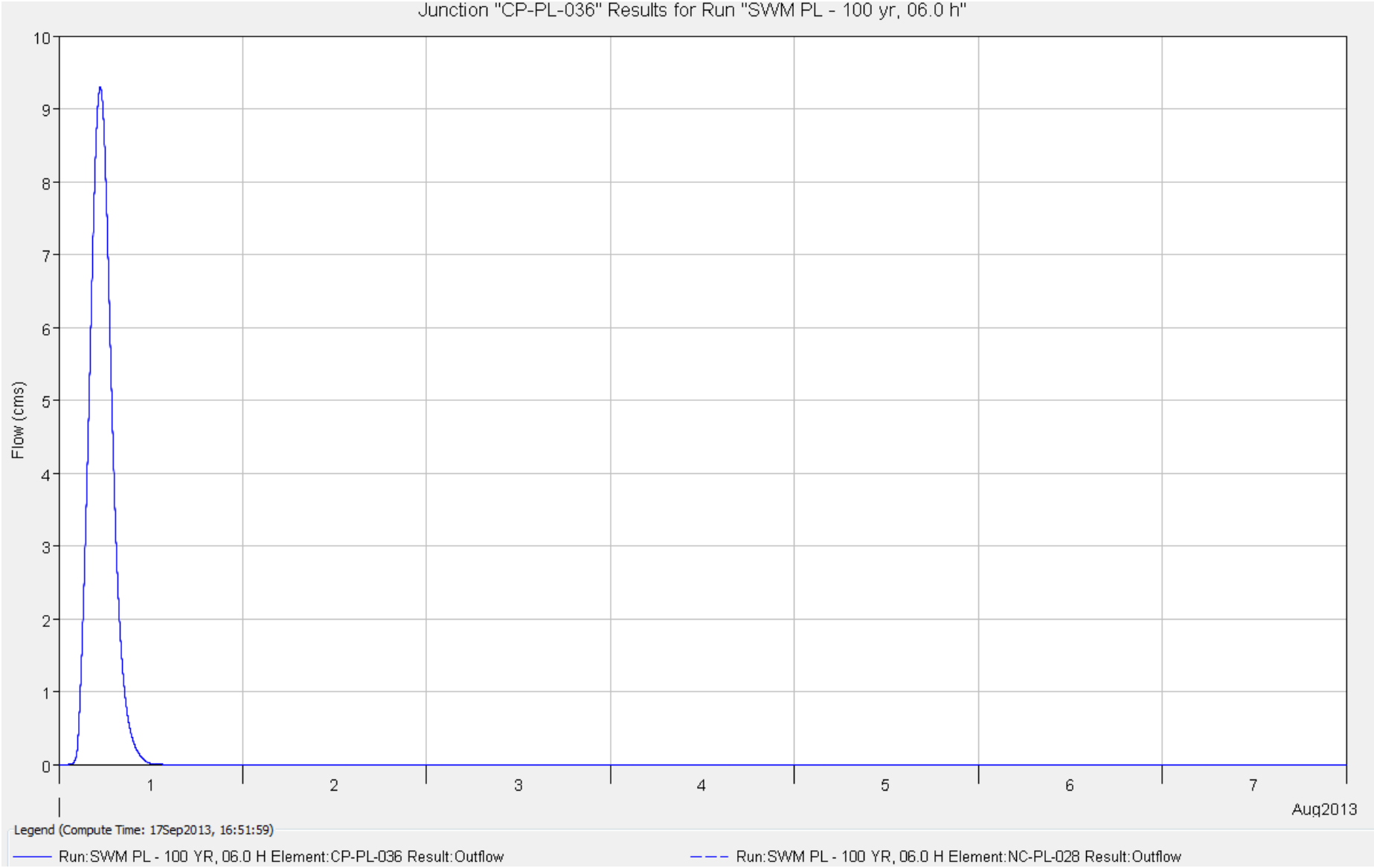

Junction "CP-PL-031" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-031 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-025 Result:Outflow

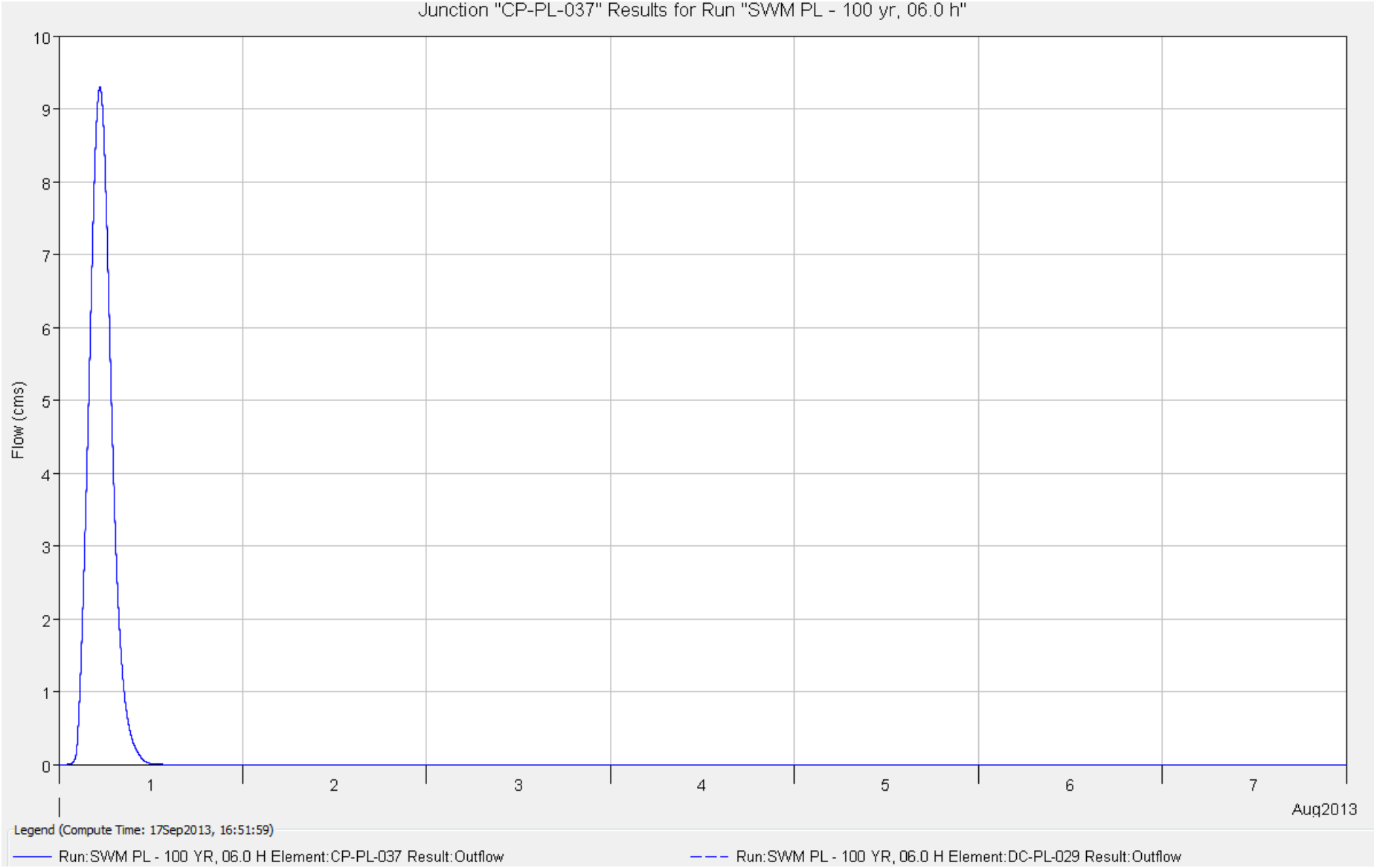

Junction "CP-PL-032" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-032 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-025 Result:Outflow

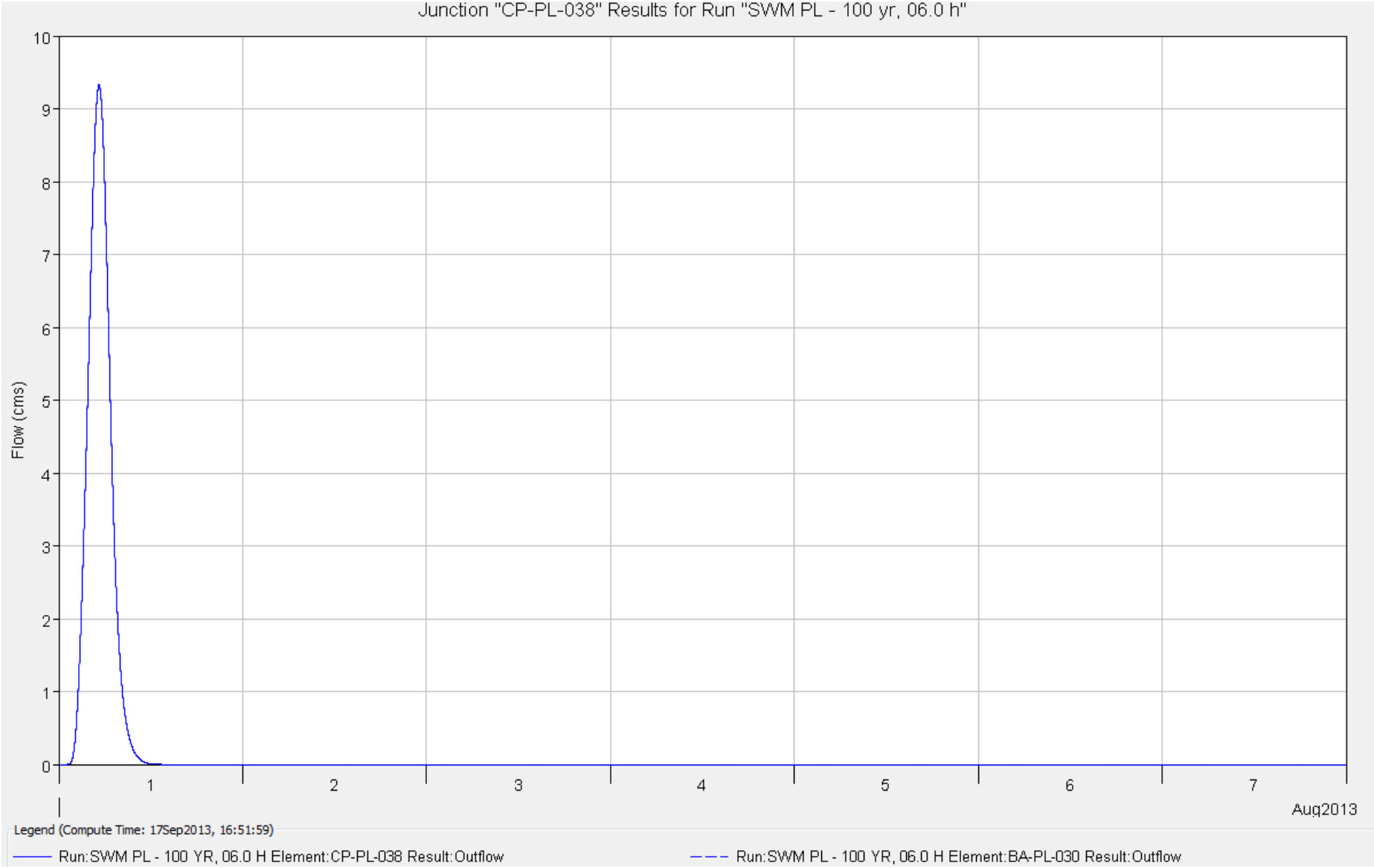

Junction "CP-PL-033" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-033 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-026 Result:Outflow

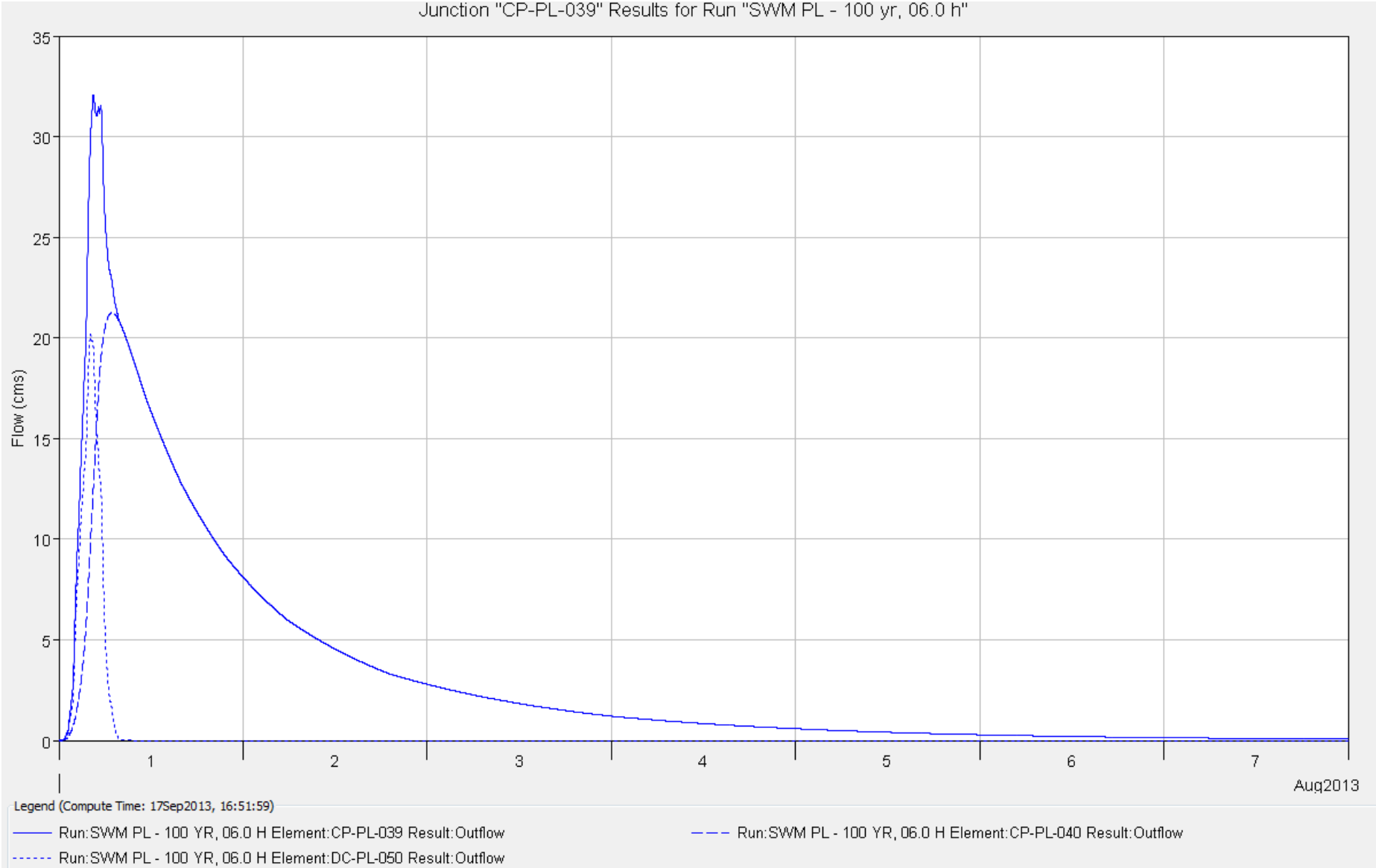

Junction "CP-PL-034" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Outflow

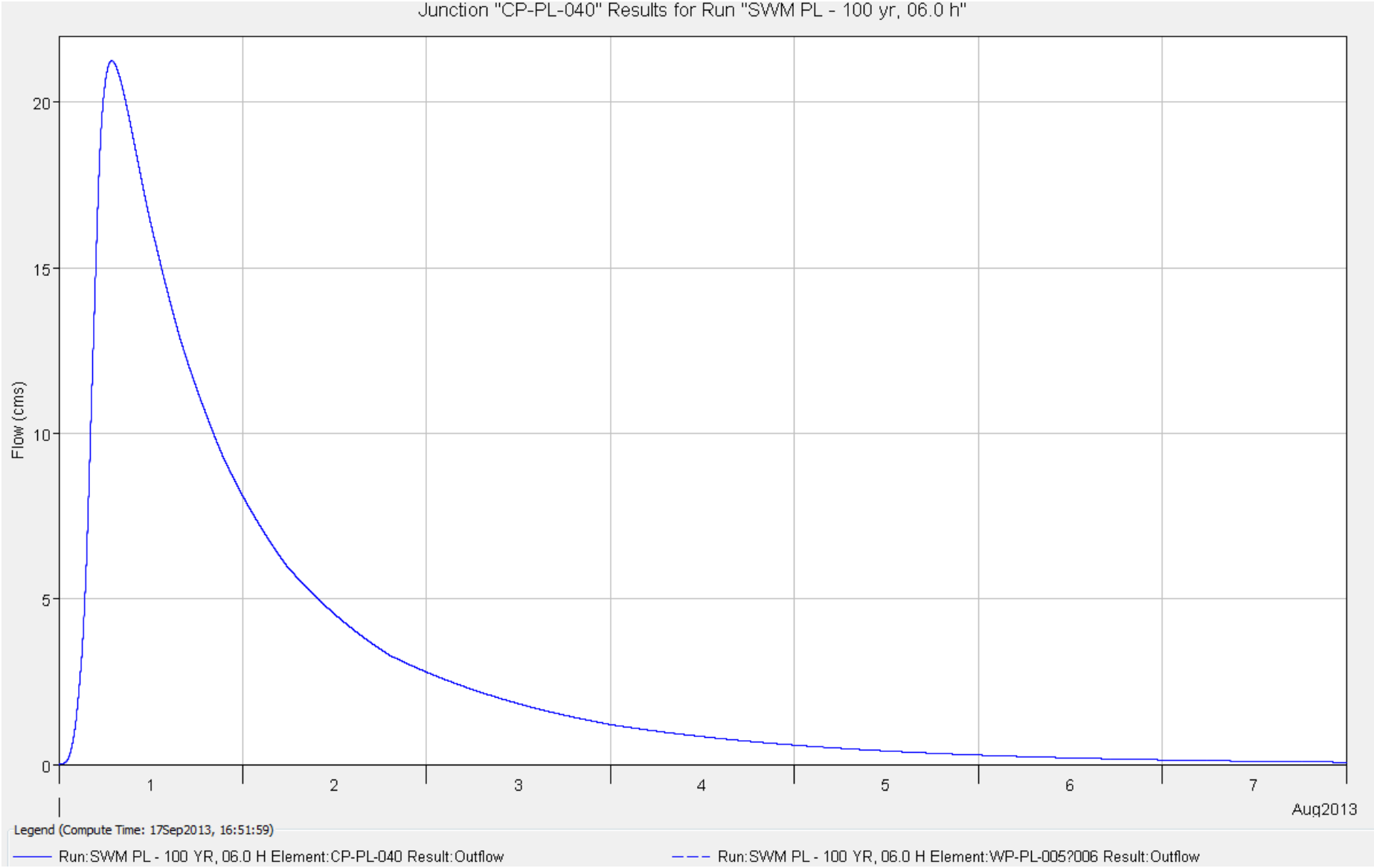

Junction "CP-PL-035" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-035 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-027 Result:Outflow

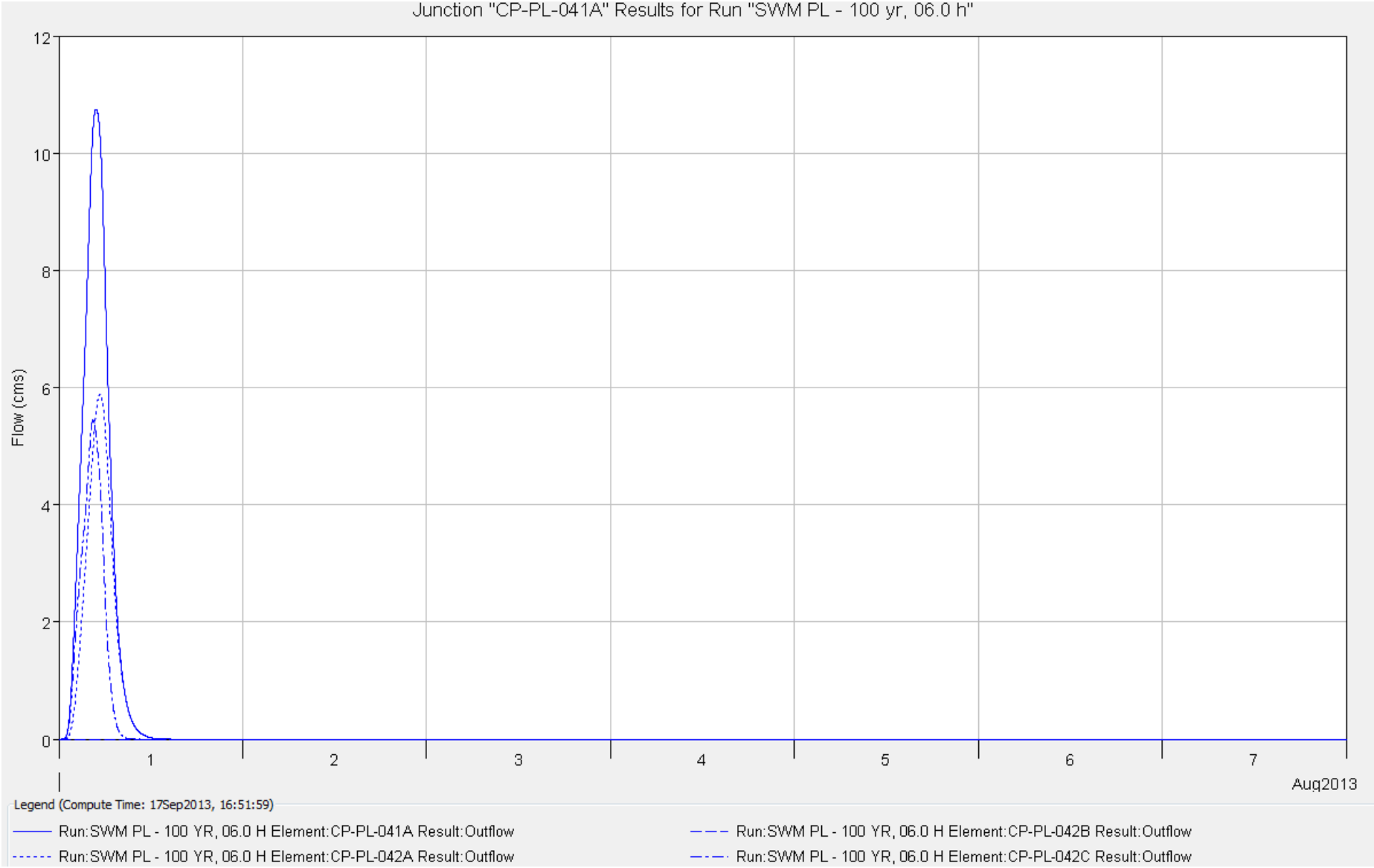

Junction "CP-PL-036" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-028 Result:Outflow

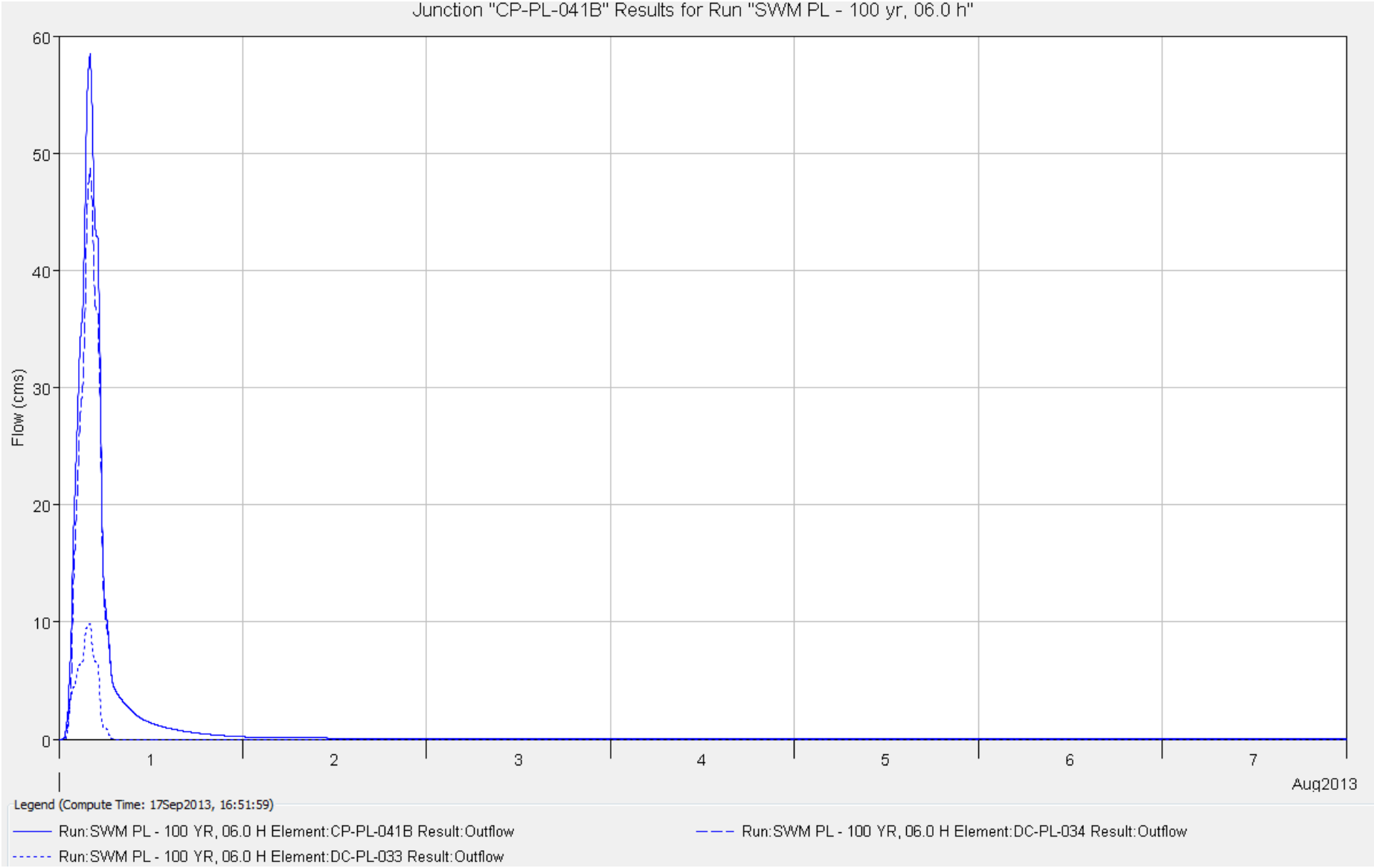

Junction "CP-PL-037" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-029 Result:Outflow

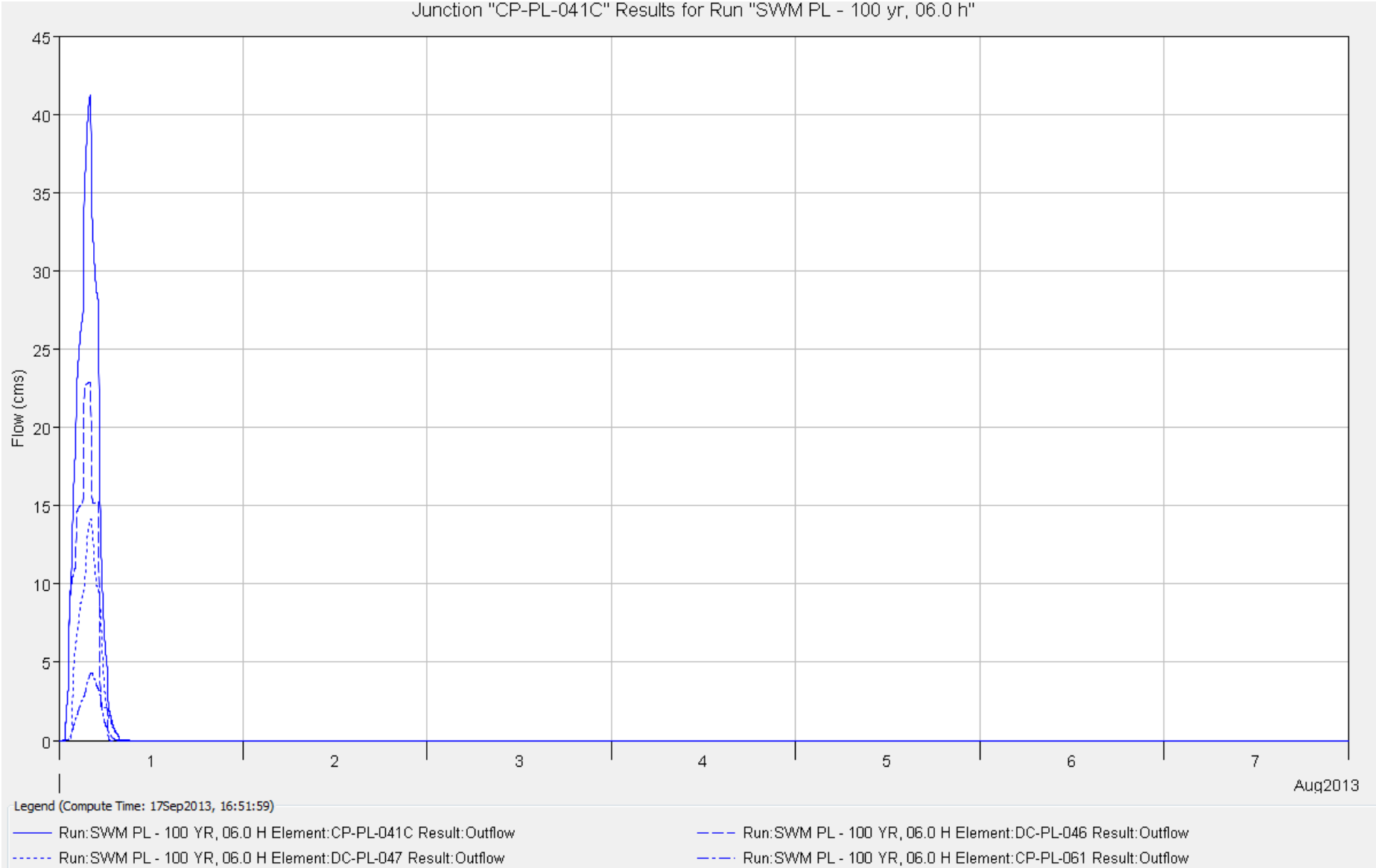

Junction "CP-PL-038" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-038 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-030 Result:Outflow

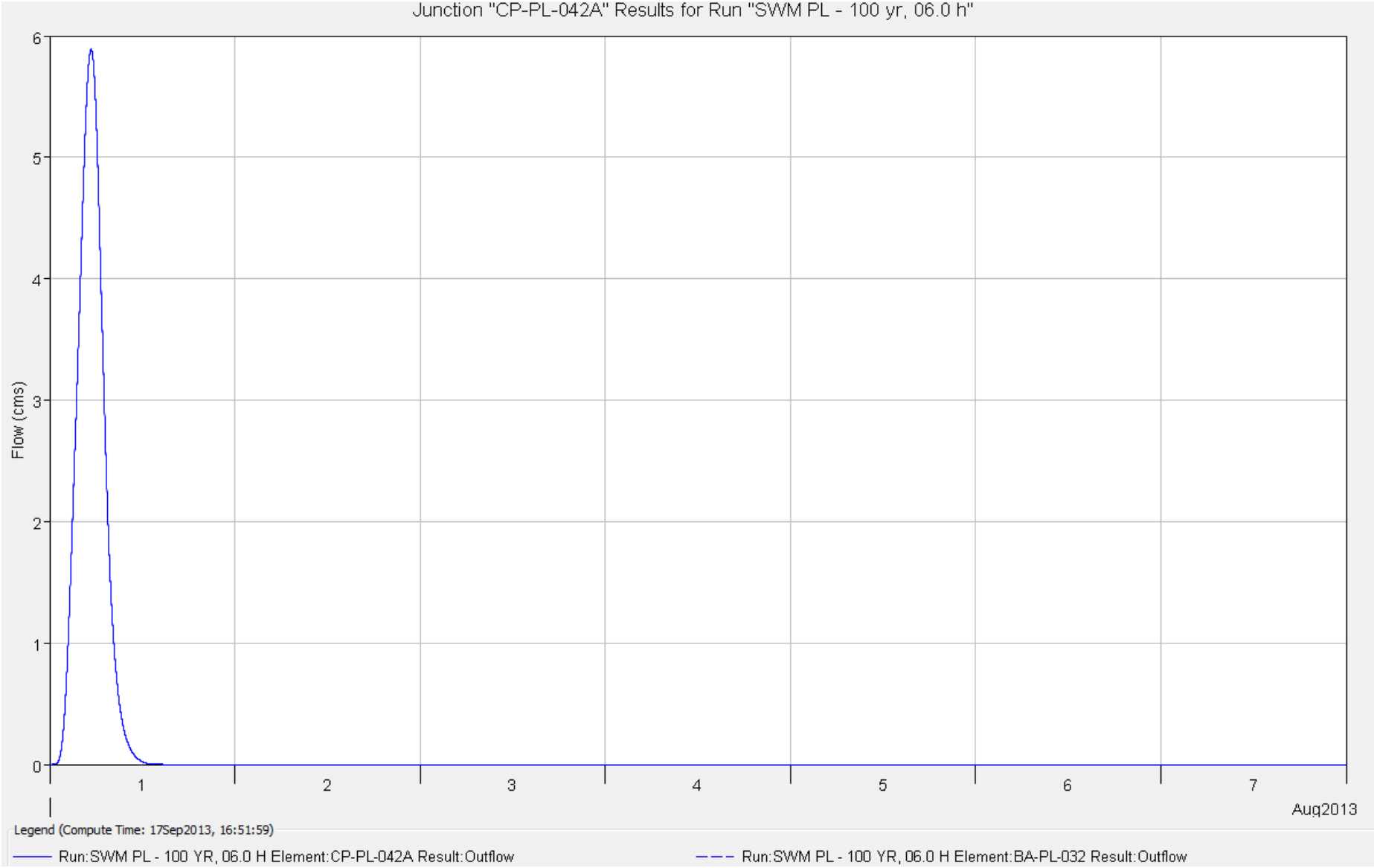

Junction "CP-PL-039" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-050 Result:Outflow

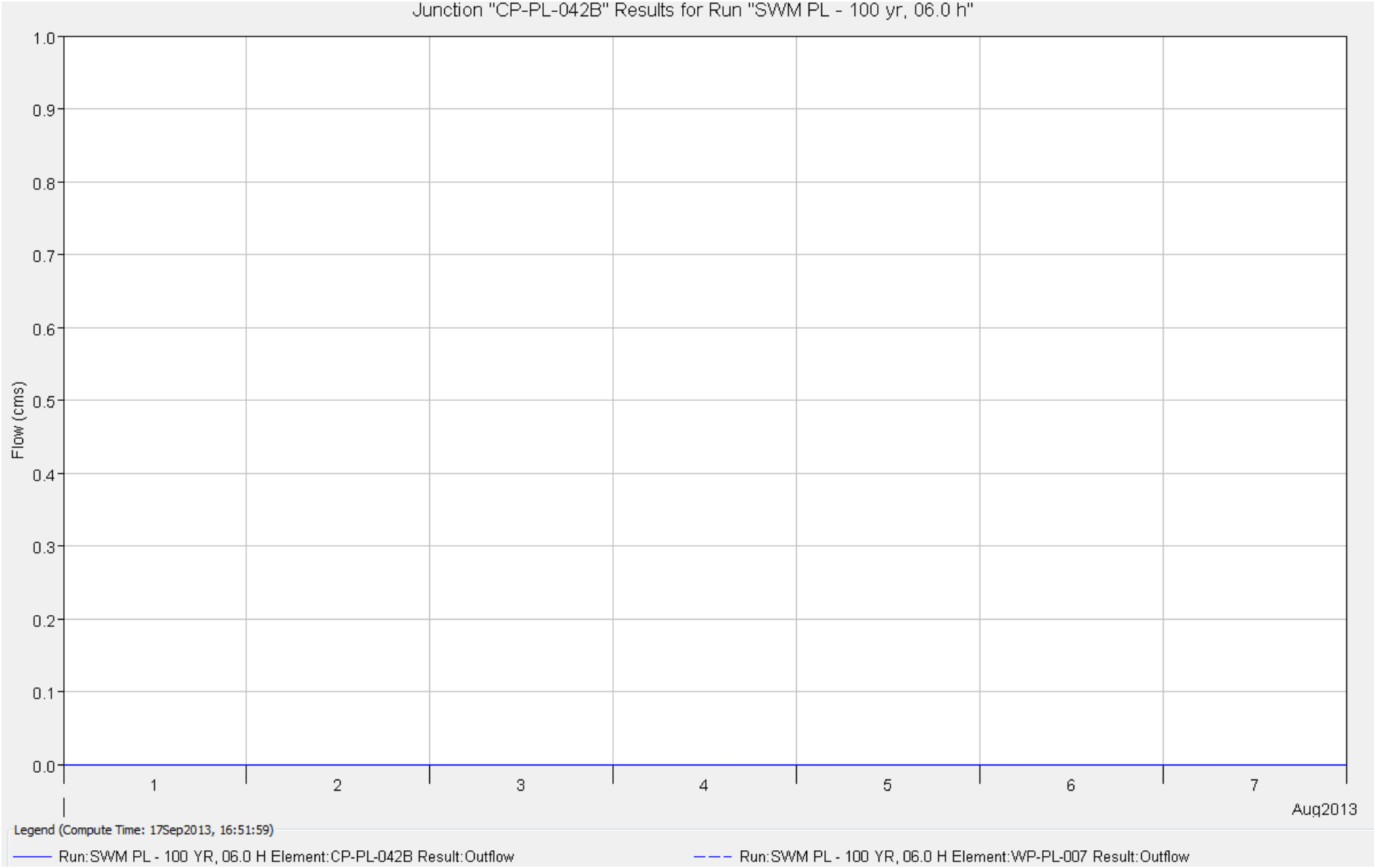

Junction "CP-PL-040" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Outflow

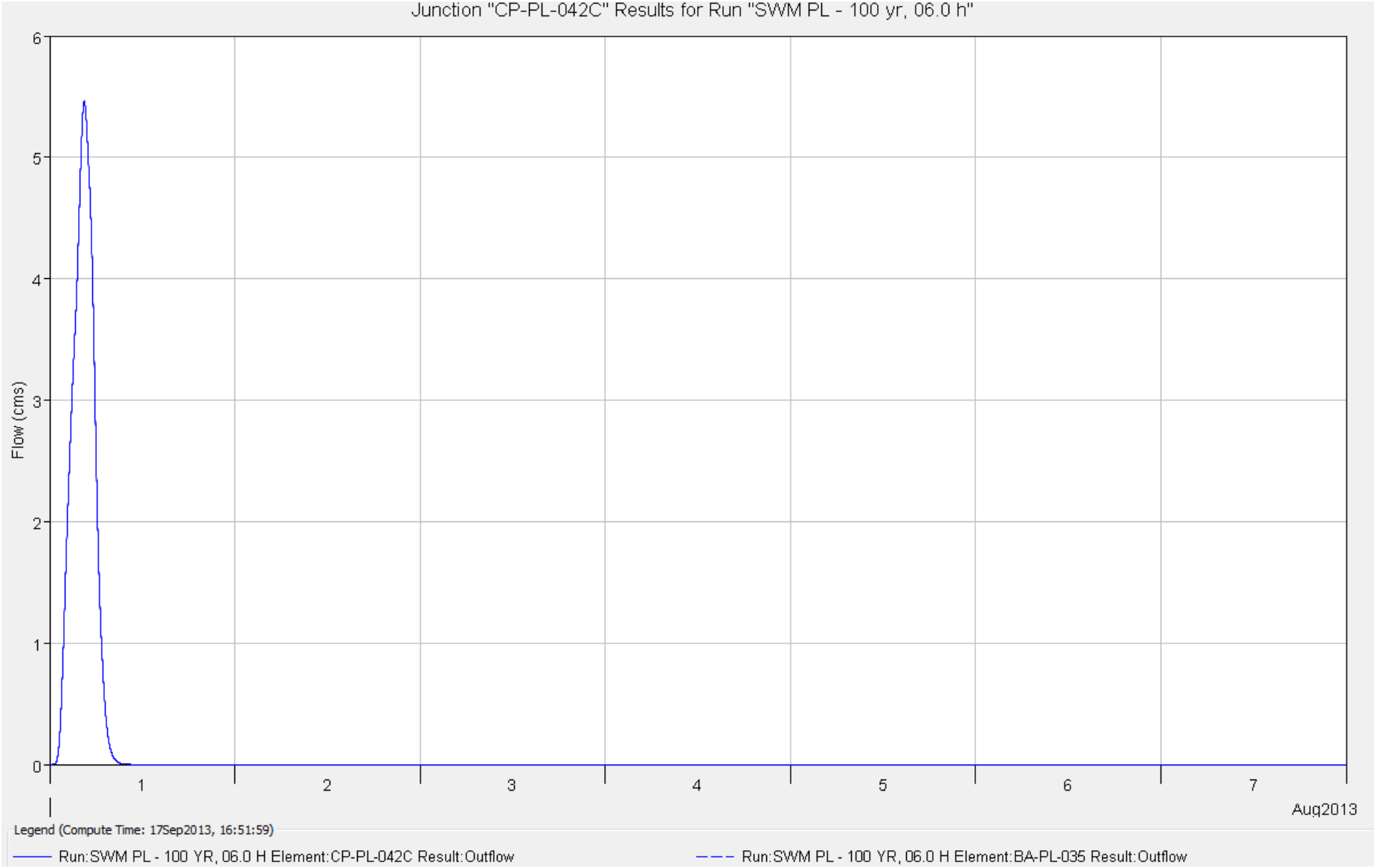

Junction "CP-PL-041A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042C Result:Outflow

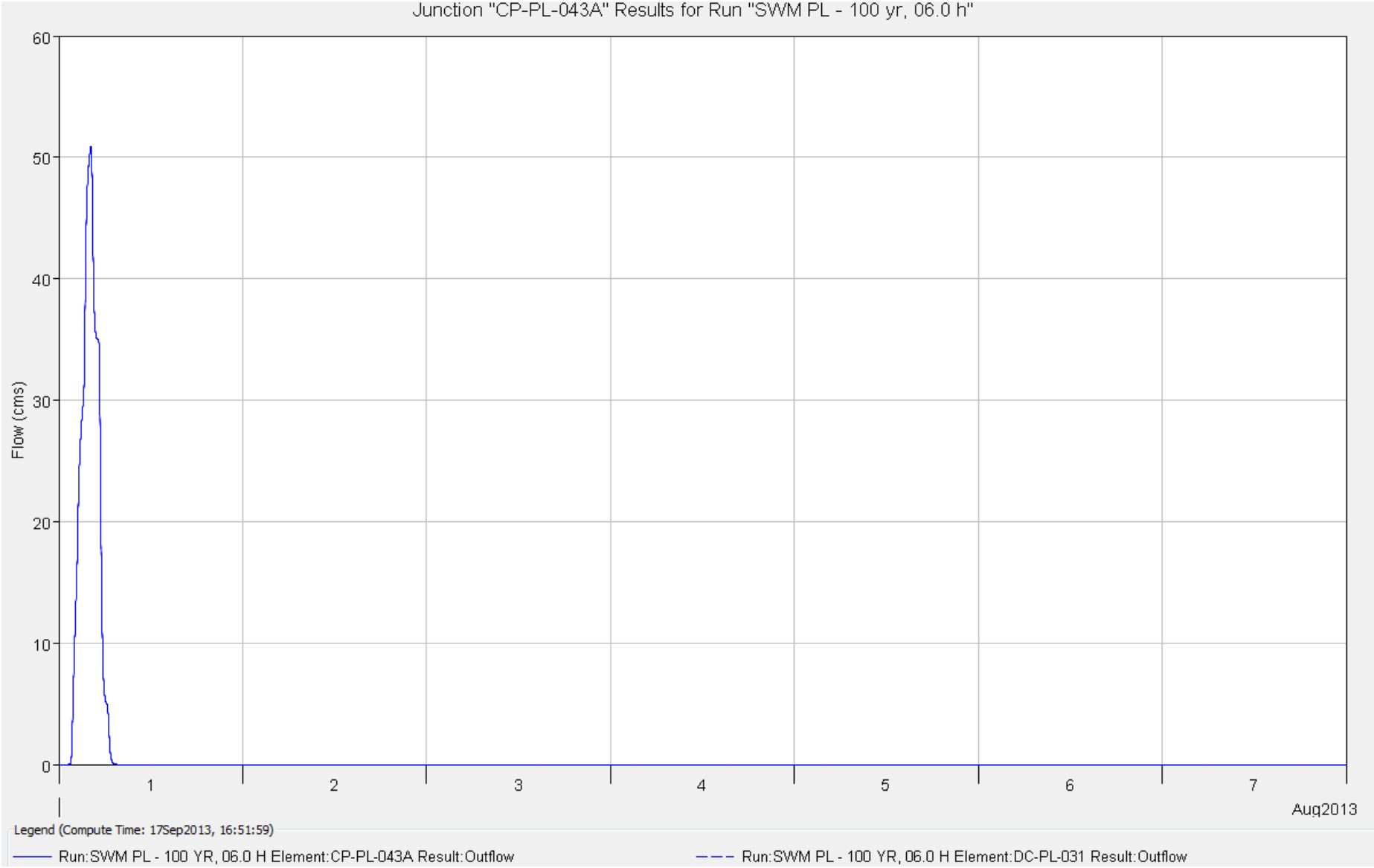

Junction "CP-PL-041B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-033 Result:Outflow

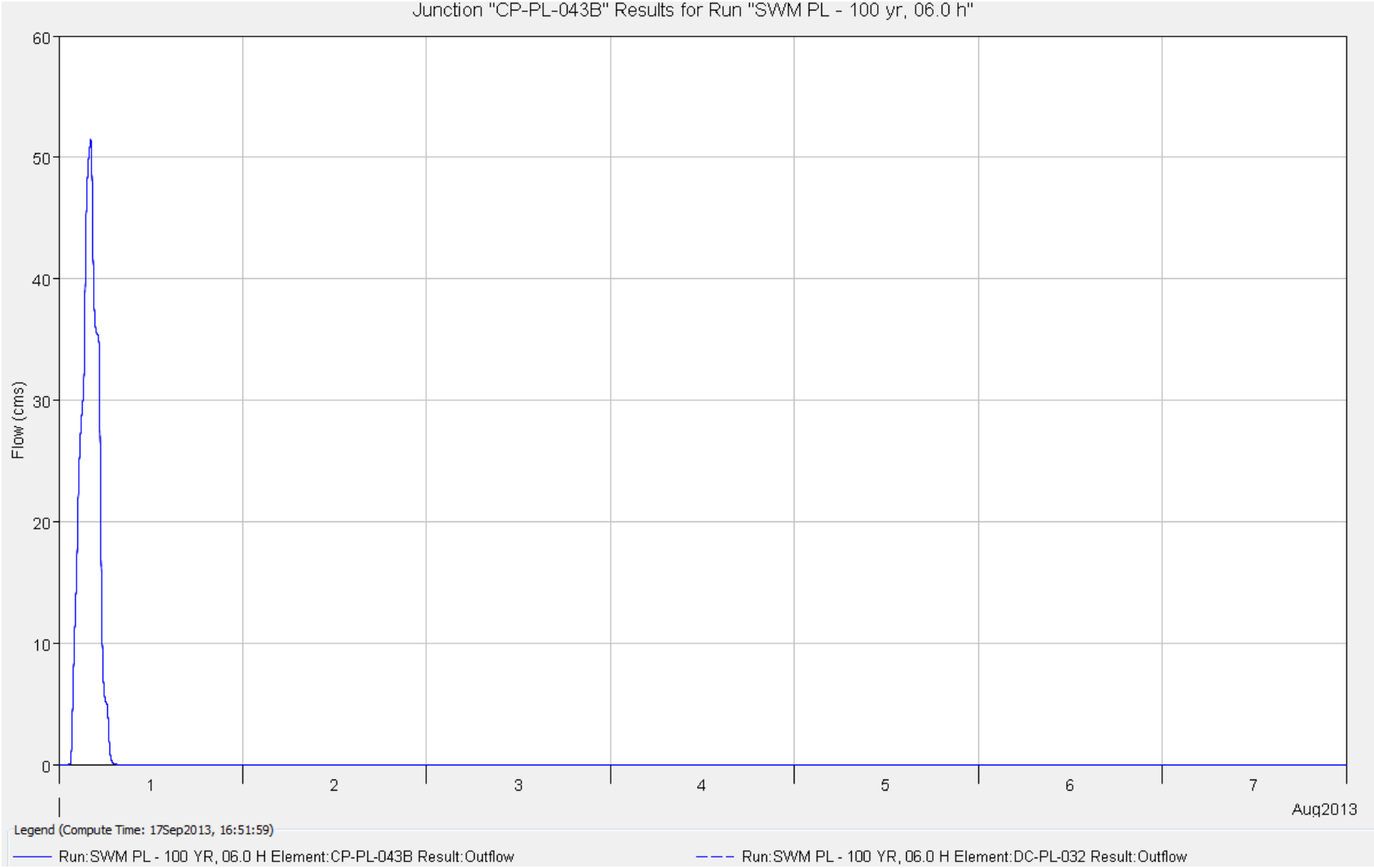

Junction "CP-PL-041C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-061 Result:Outflow

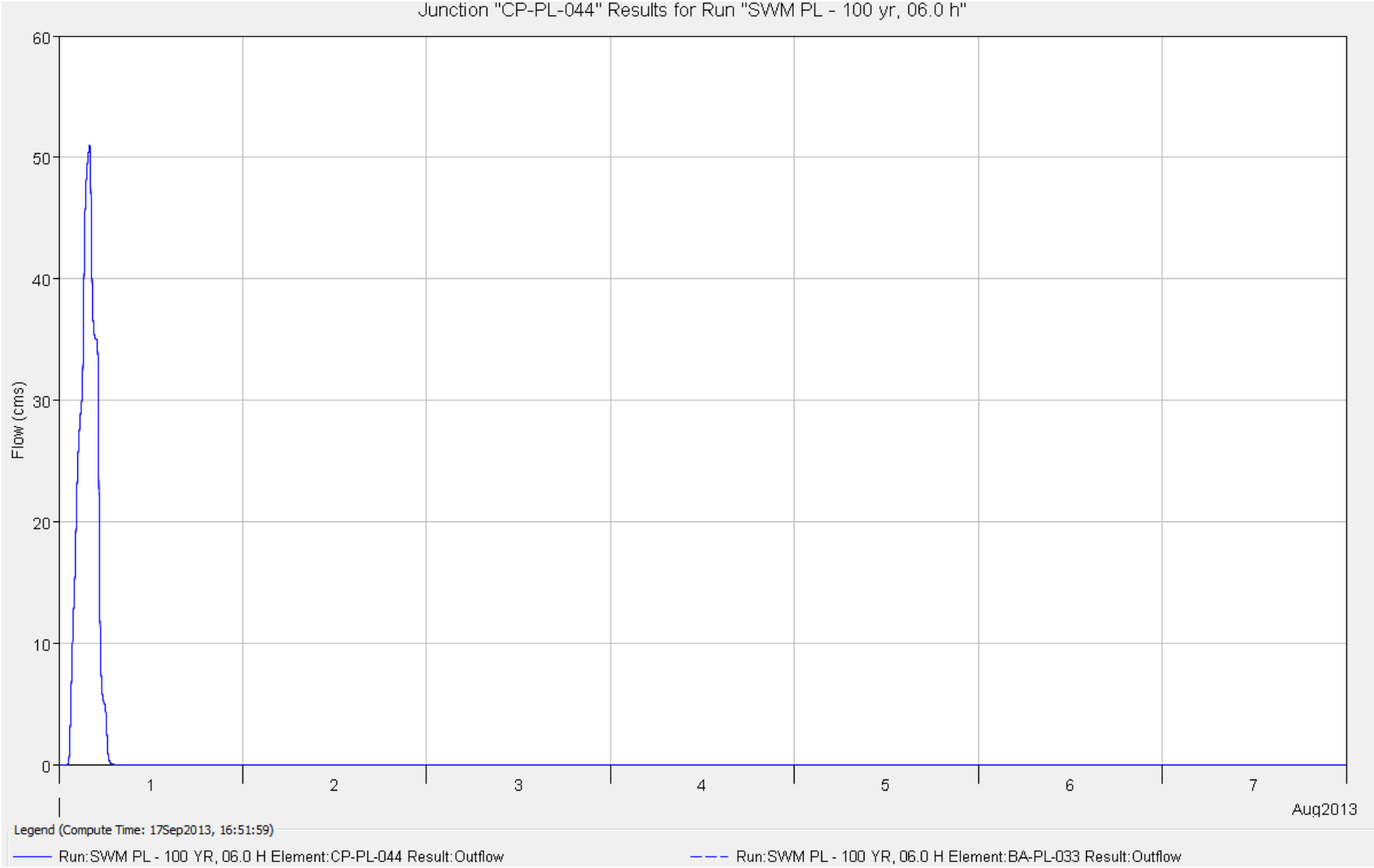

Junction "CP-PL-042A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-032 Result:Outflow

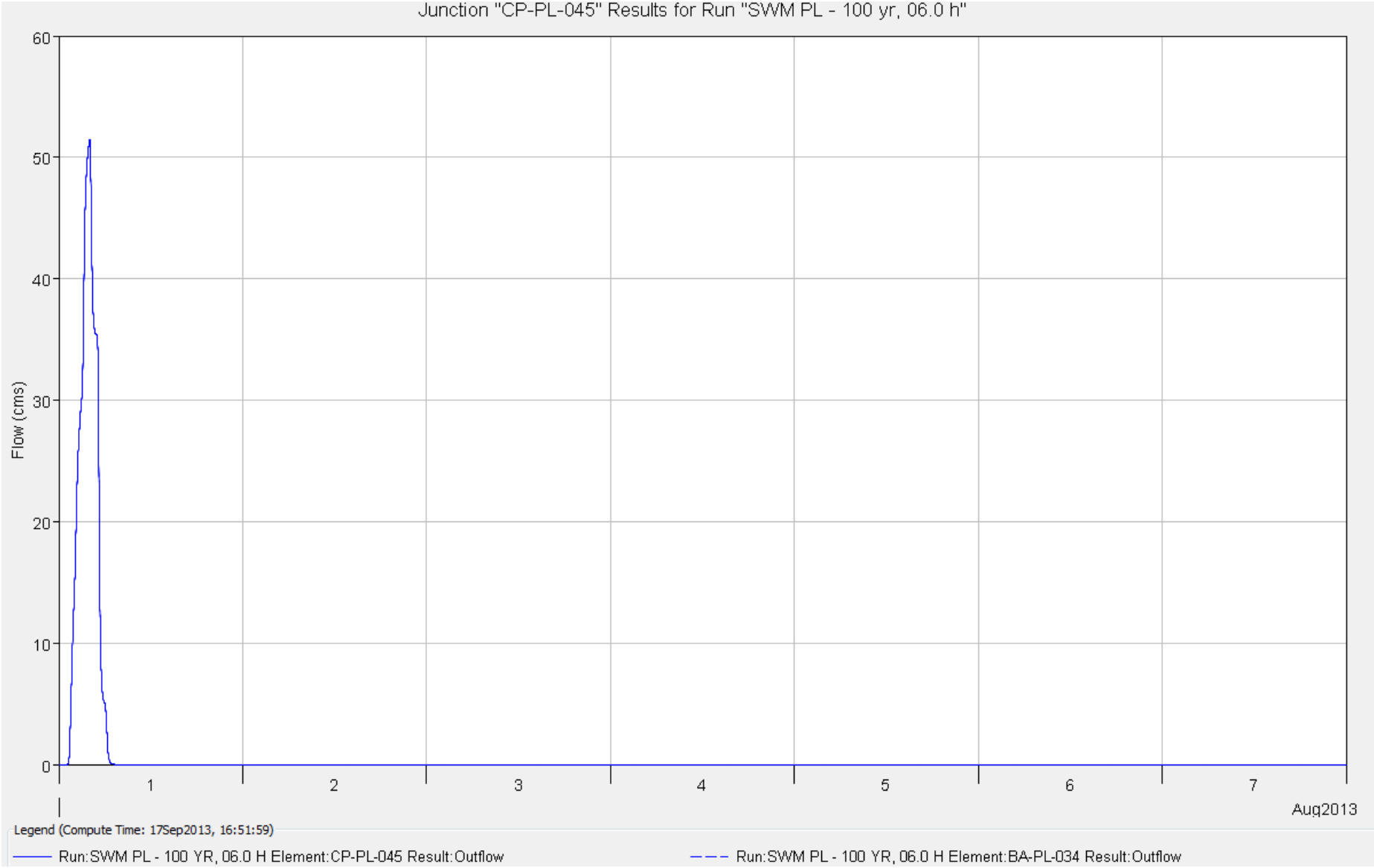

Junction "CP-PL-042B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Outflow

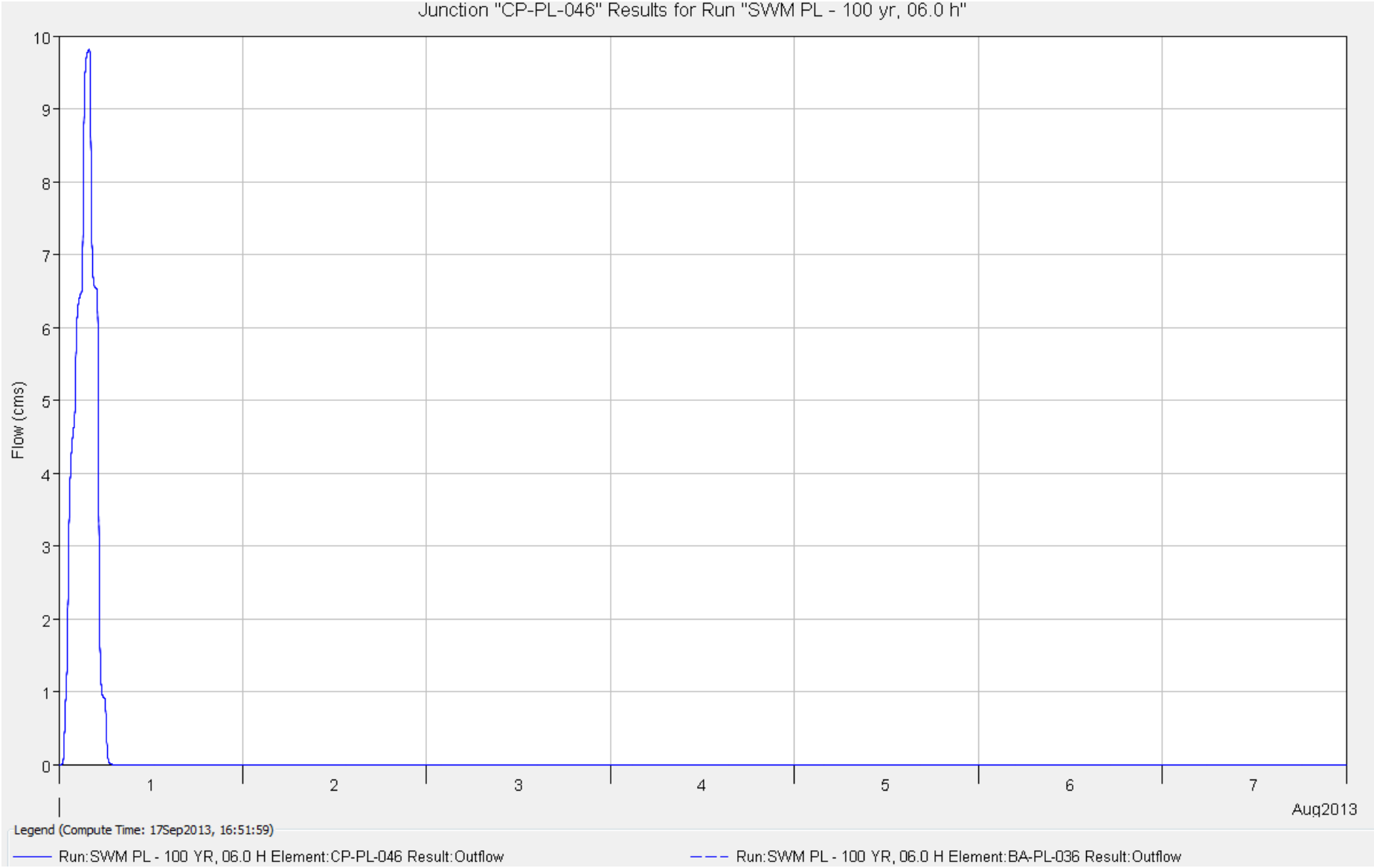

Junction "CP-PL-042C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-035 Result:Outflow

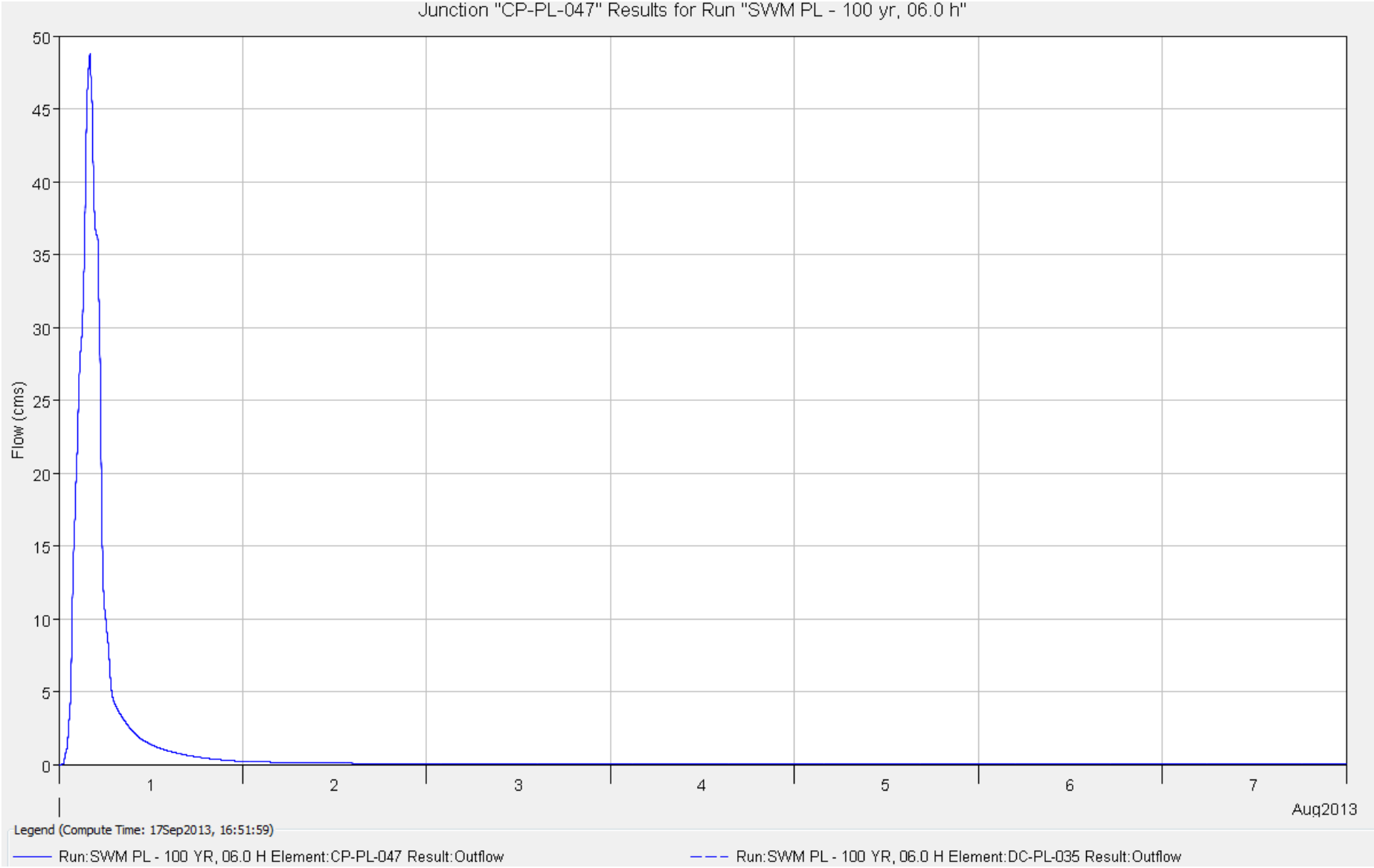

Junction "CP-PL-043A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-043A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-031 Result:Outflow

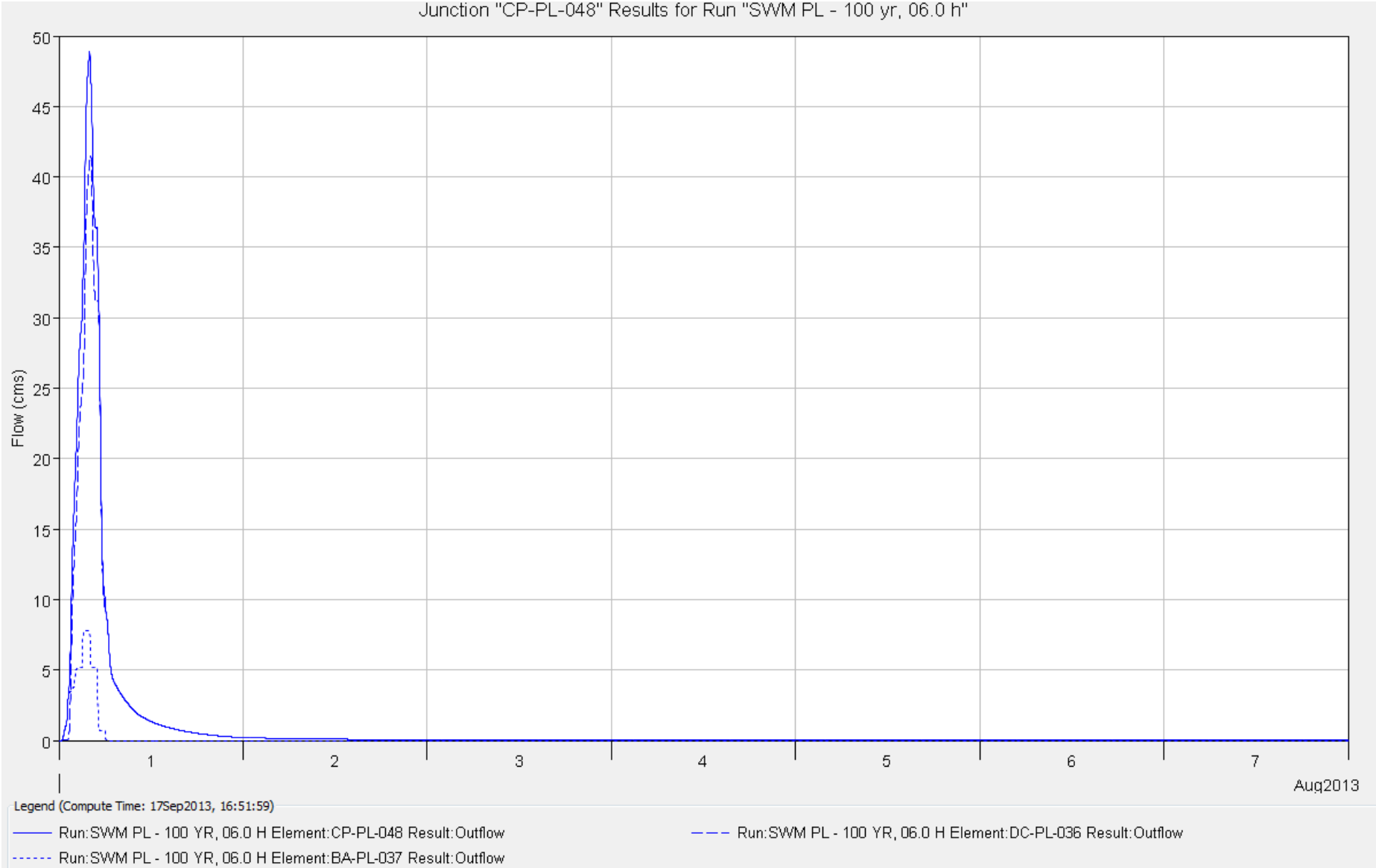

Junction "CP-PL-043B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-043B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-032 Result:Outflow

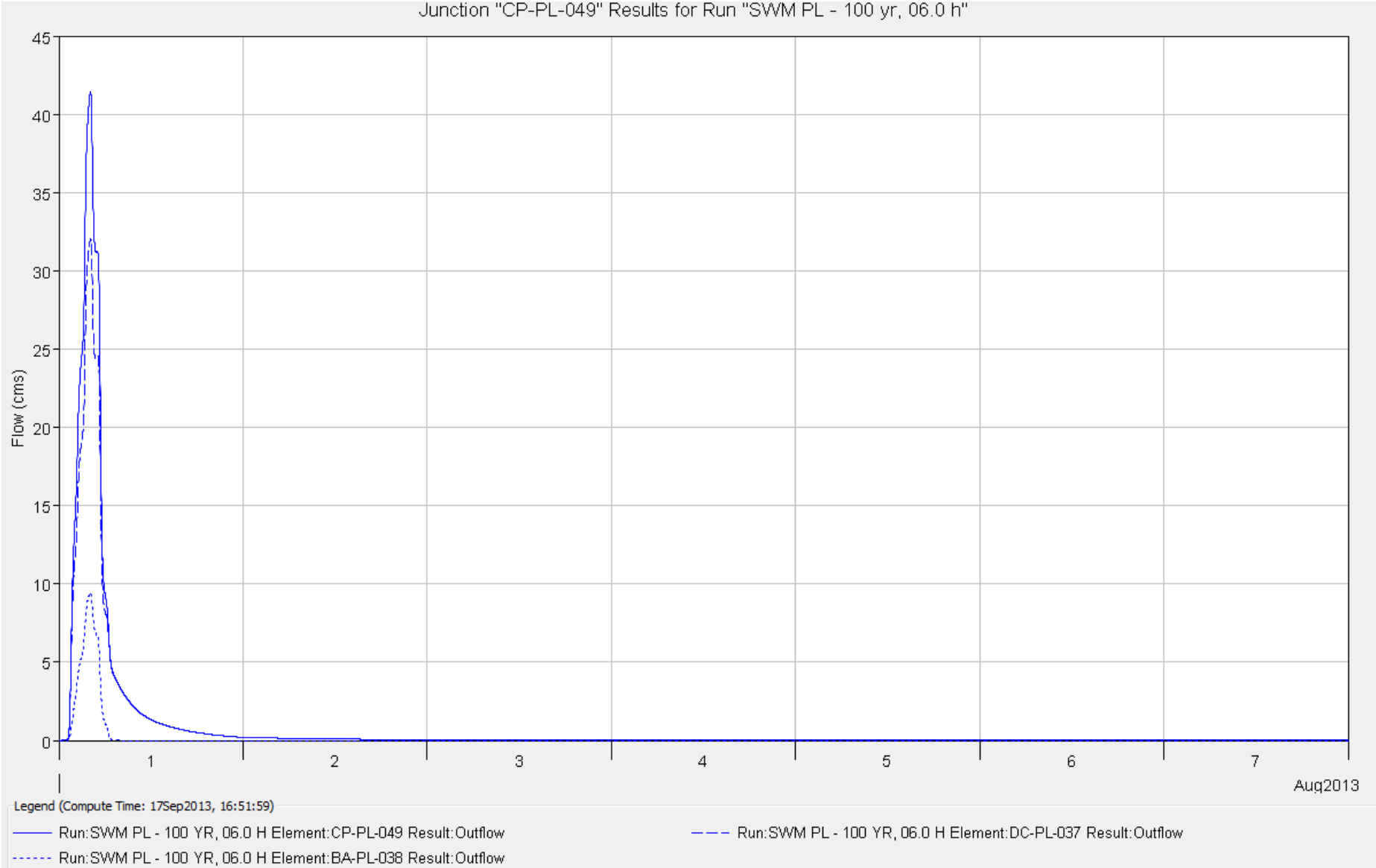

Junction "CP-PL-044" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-033 Result:Outflow

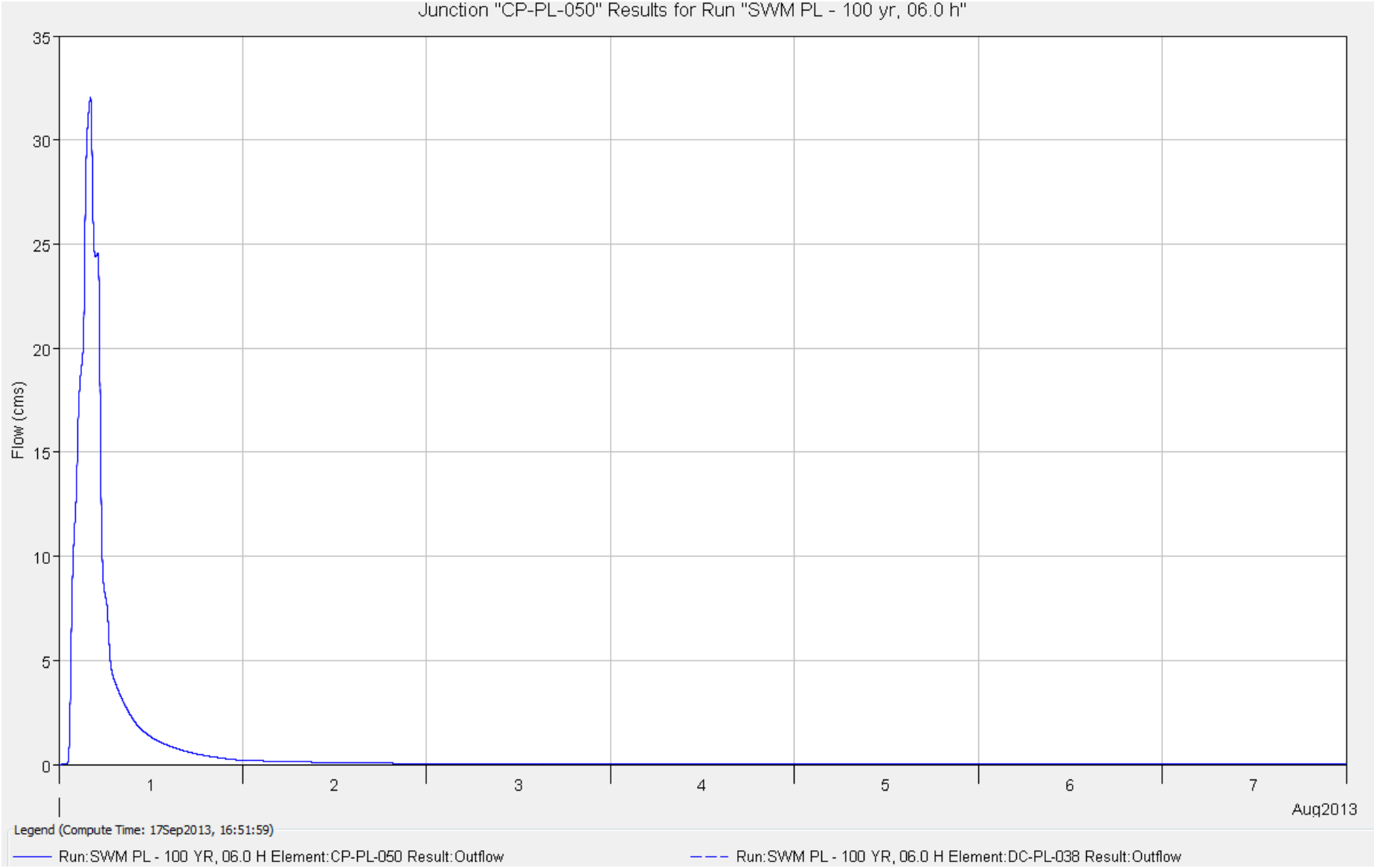

Junction "CP-PL-045" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-034 Result:Outflow

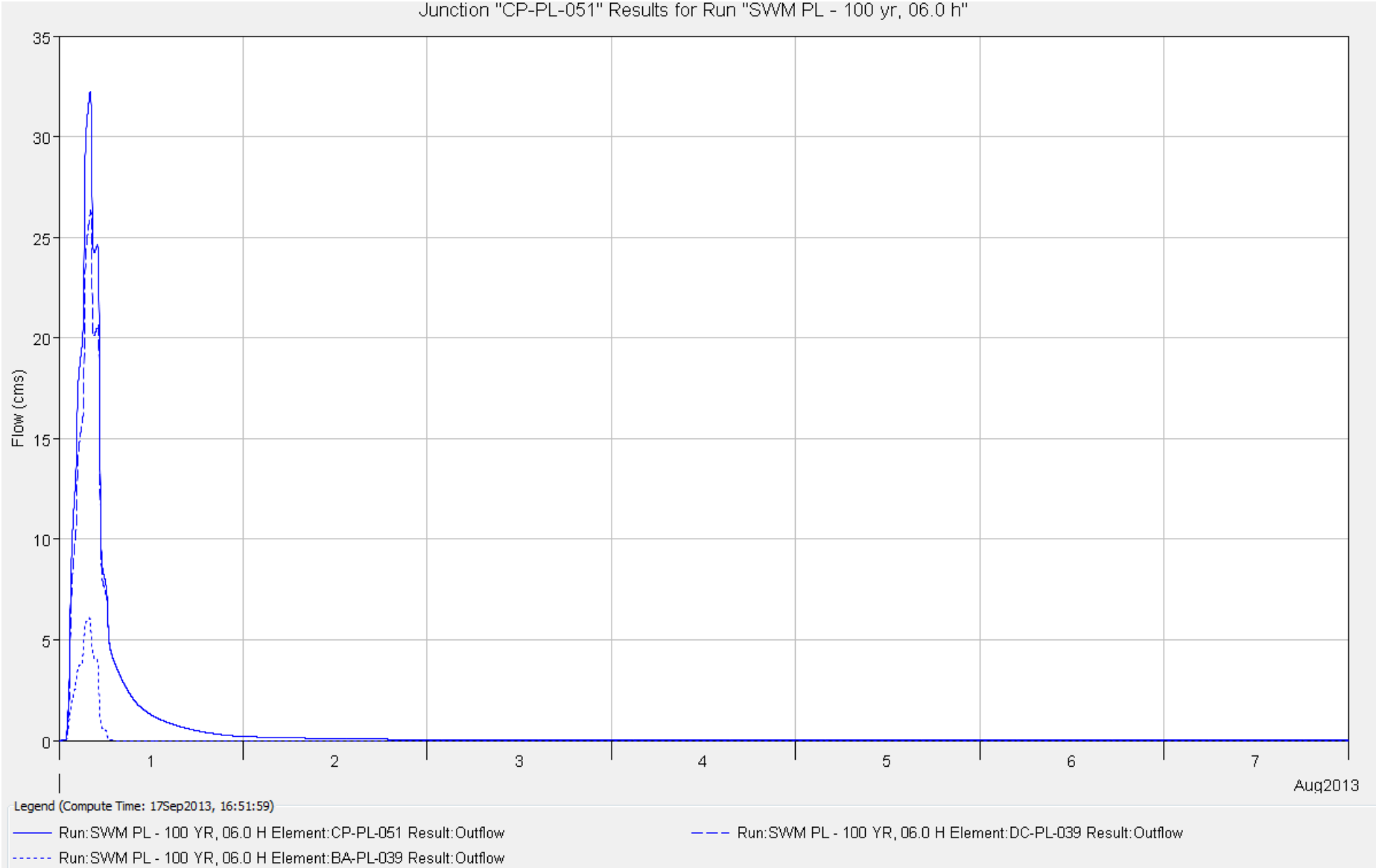

Junction "CP-PL-046" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-036 Result:Outflow

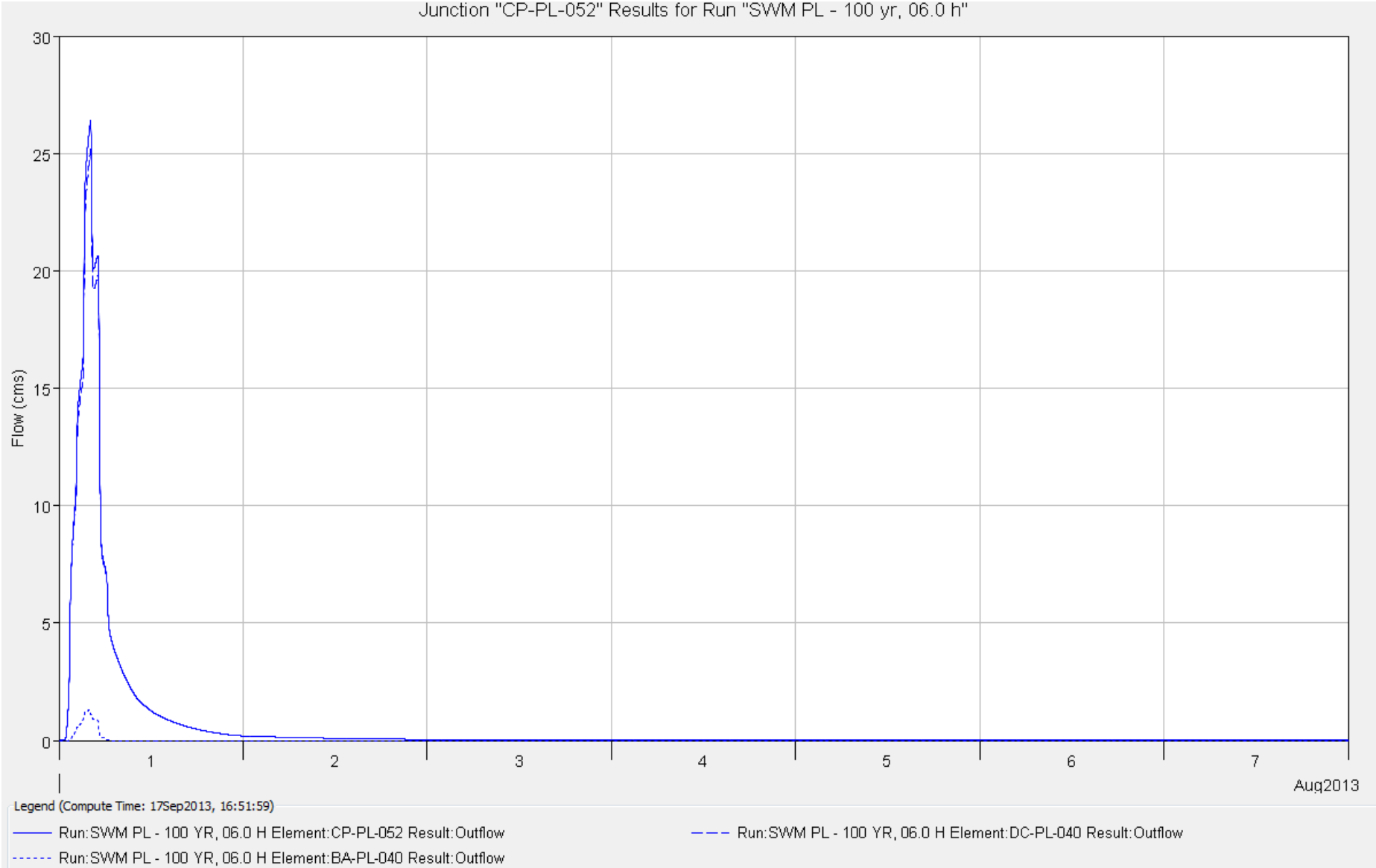

Junction "CP-PL-047" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-035 Result:Outflow

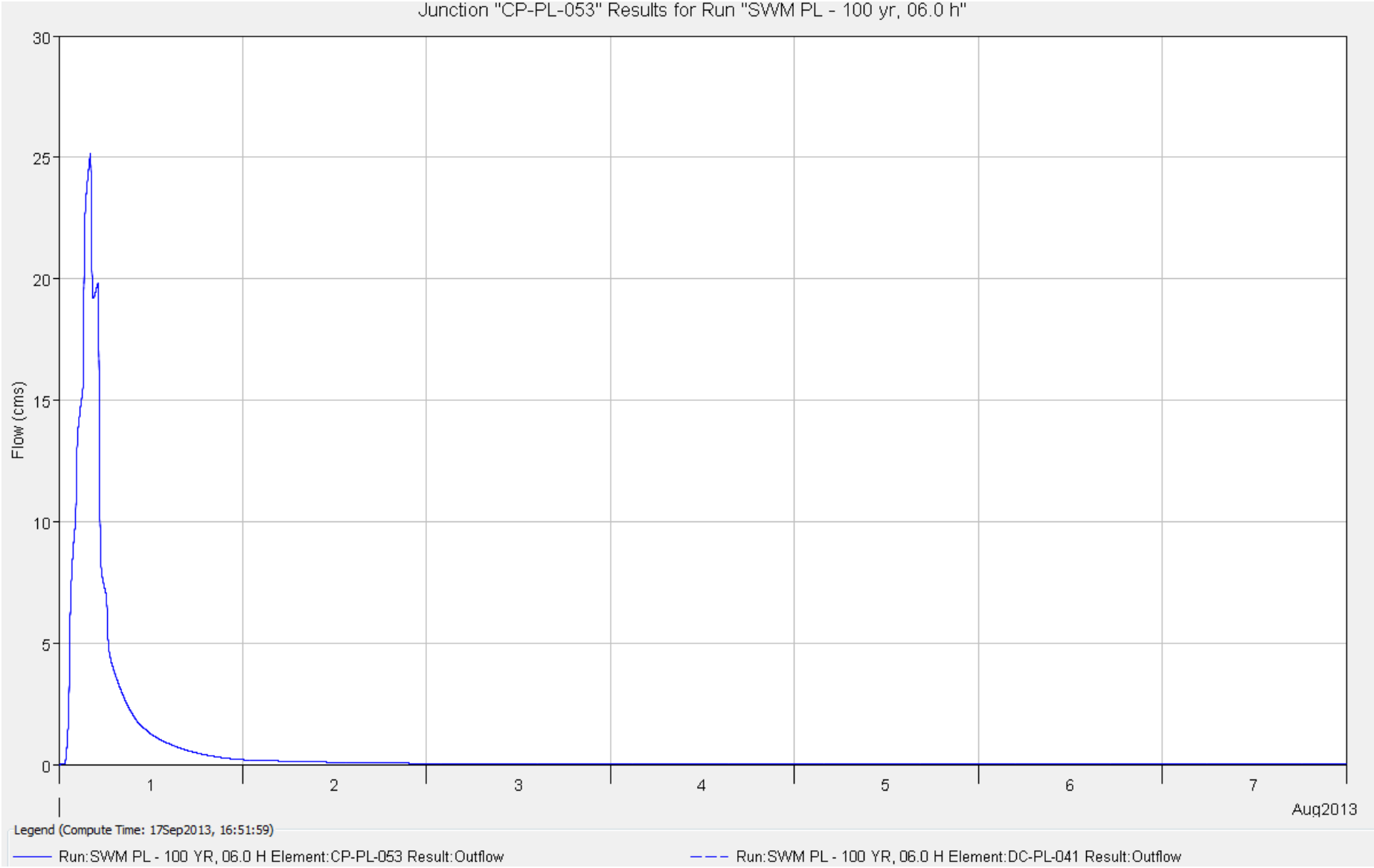

Junction "CP-PL-048" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-048 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-037 Result:Outflow

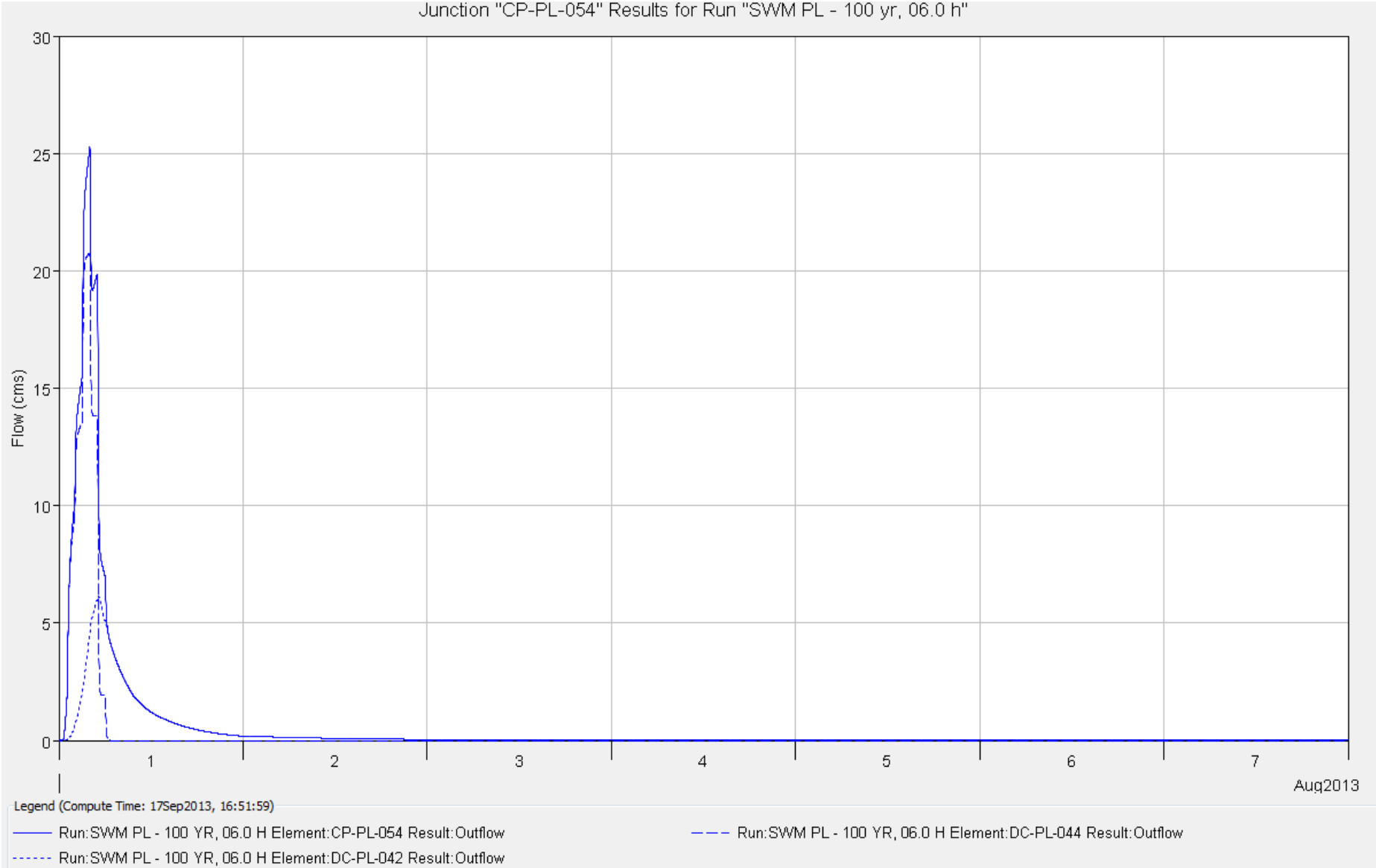

Junction "CP-PL-049" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-038 Result:Outflow

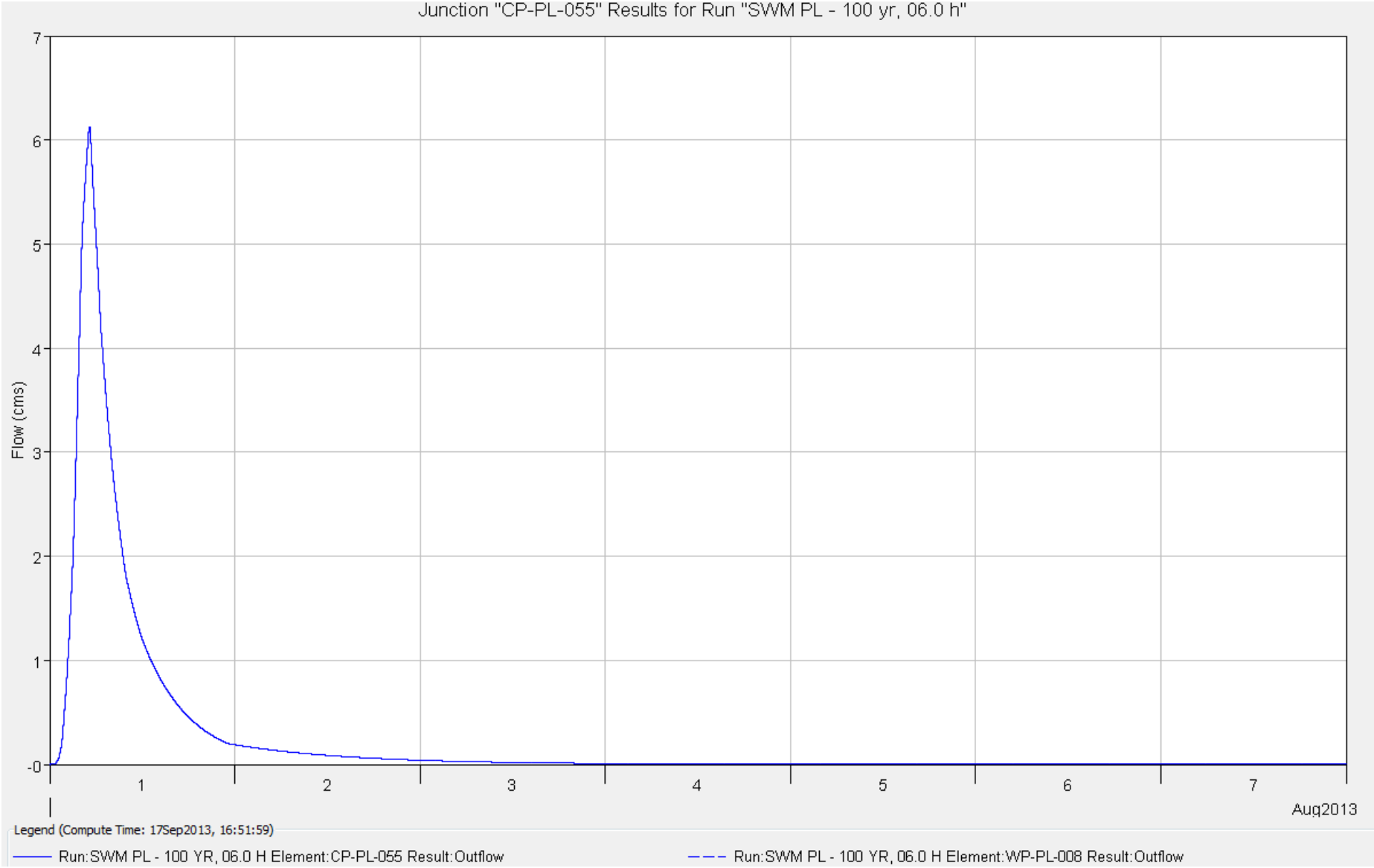

Junction "CP-PL-050" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-050 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-038 Result:Outflow

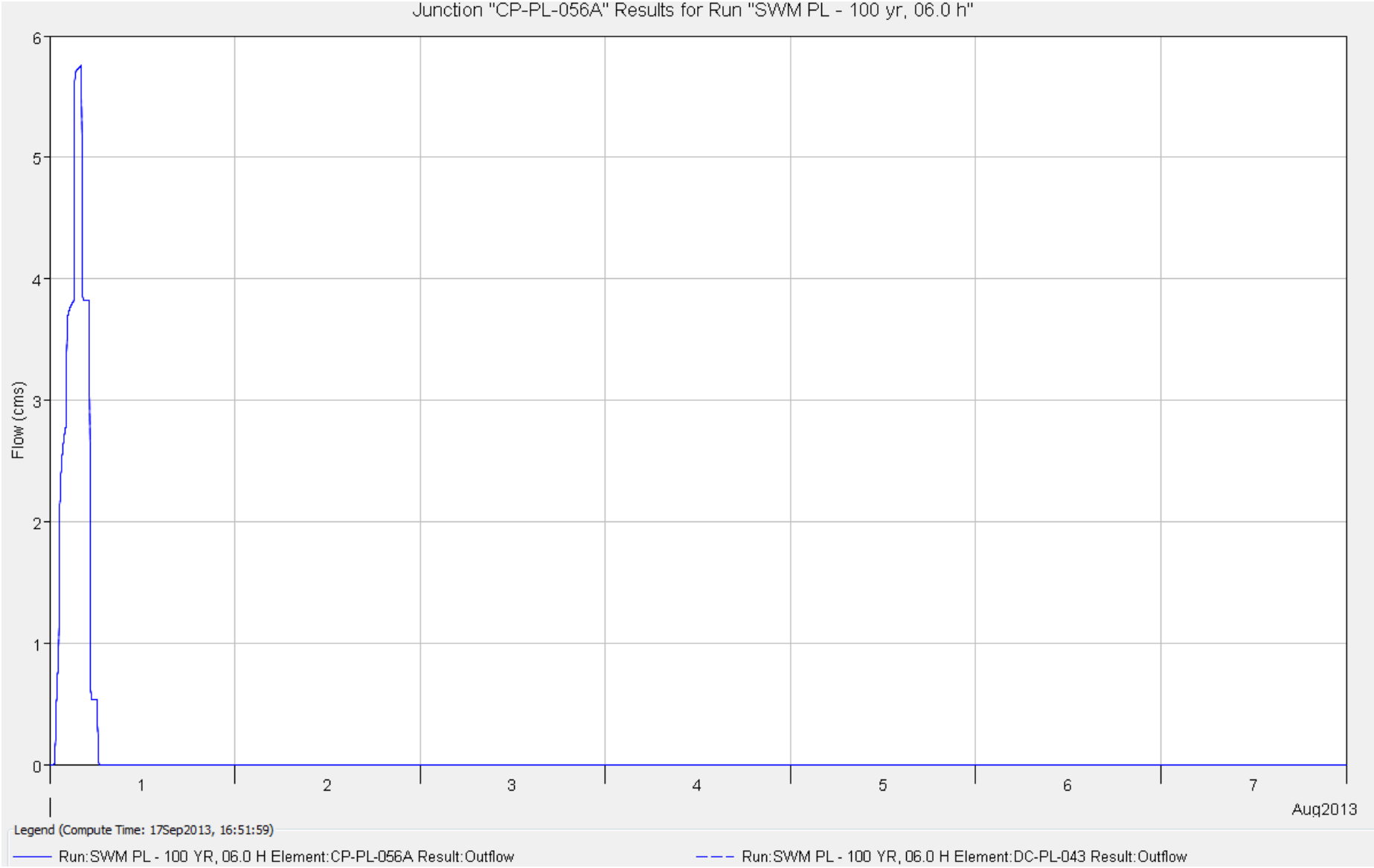

Junction "CP-PL-051" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-039 Result:Outflow

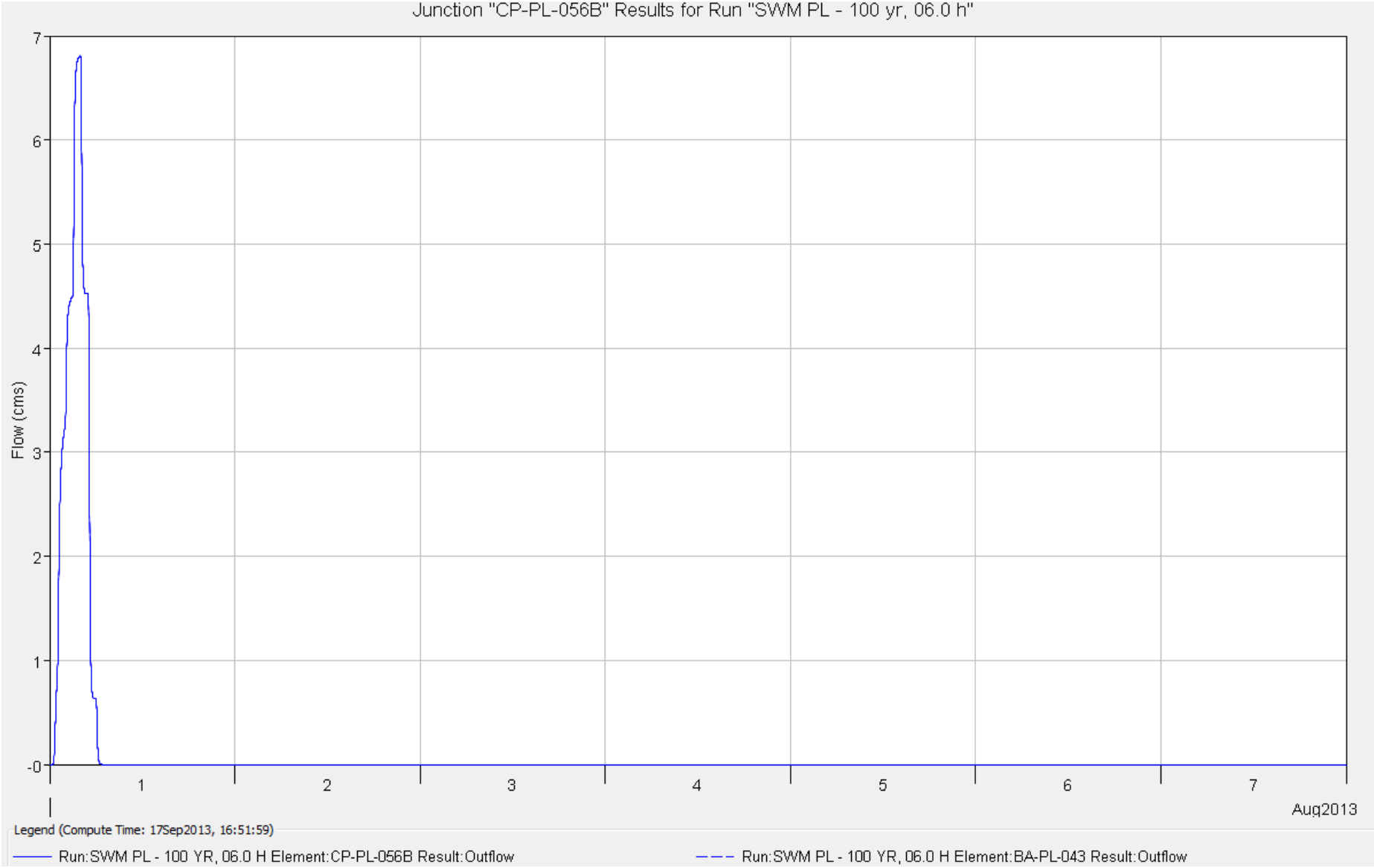

Junction "CP-PL-052" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-040 Result:Outflow

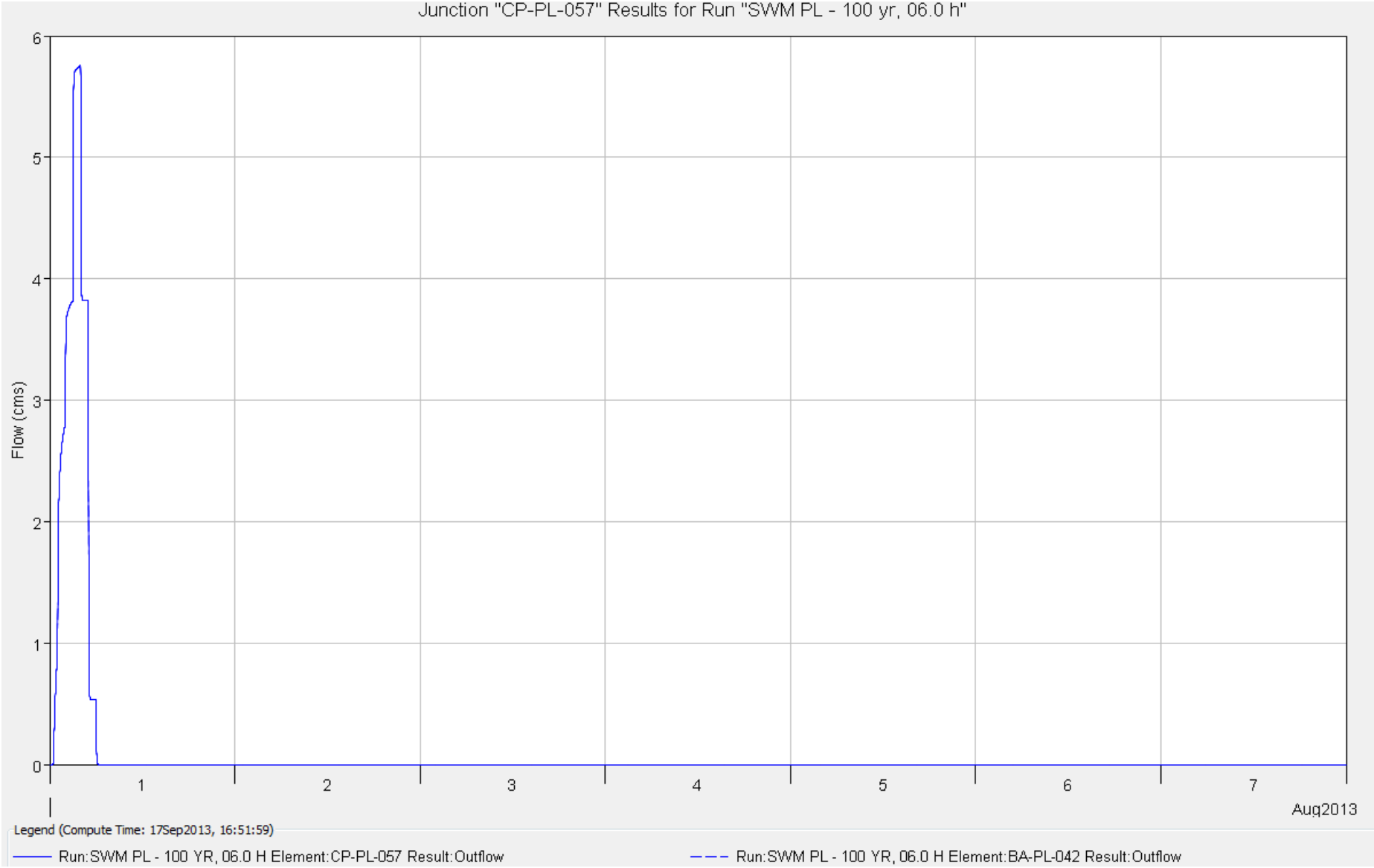

Junction "CP-PL-053" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-041 Result:Outflow

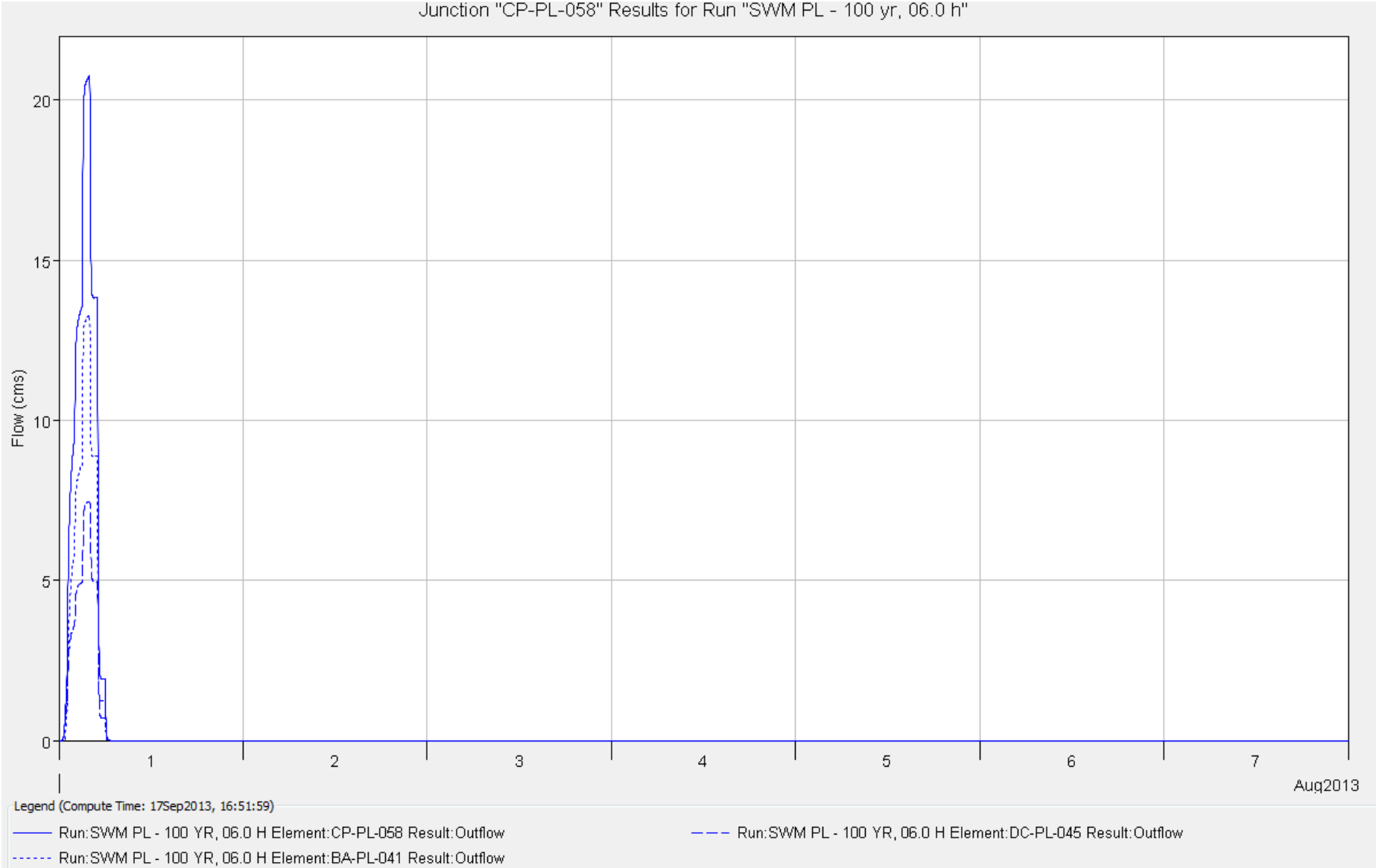

Junction "CP-PL-054" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-042 Result:Outflow

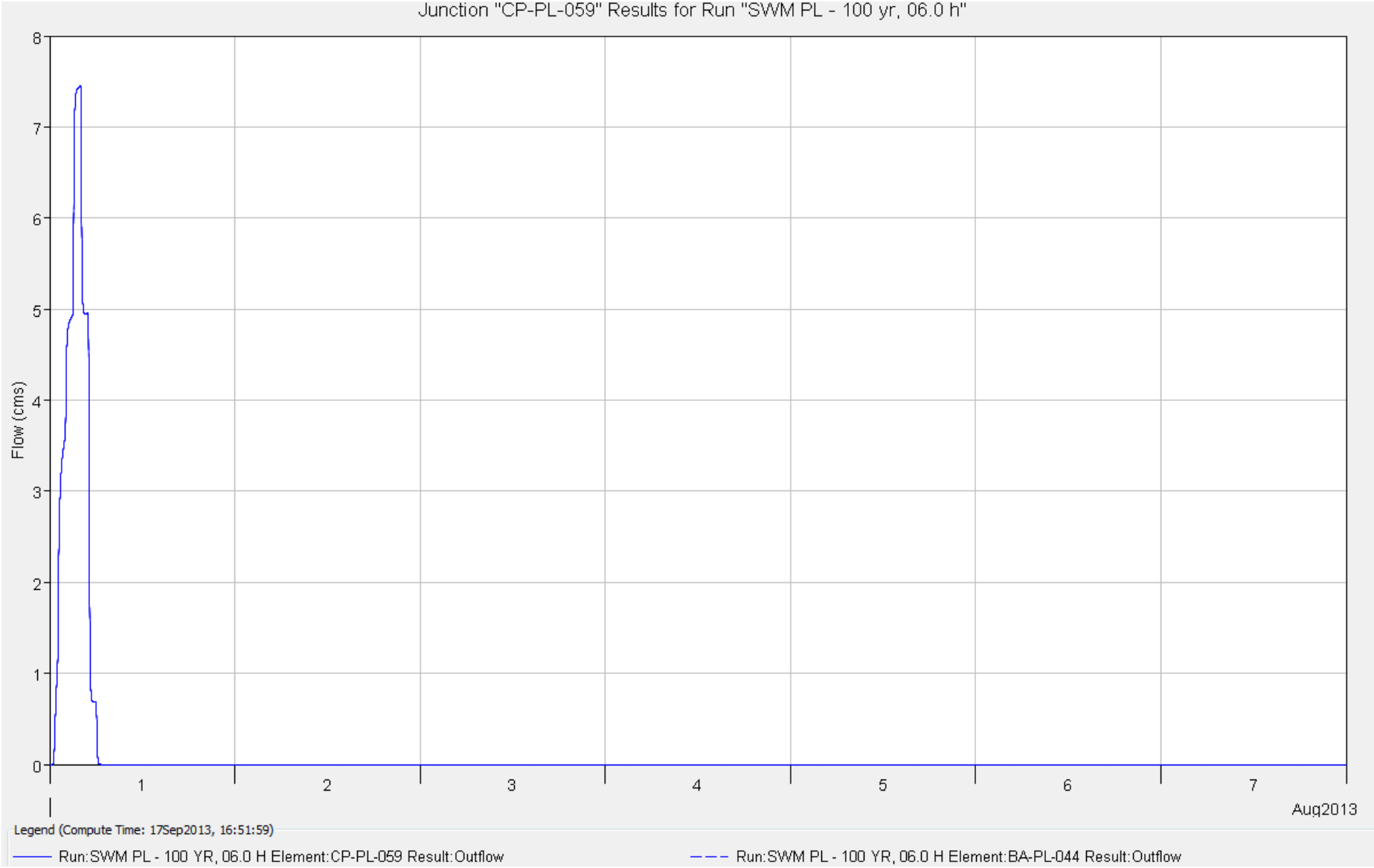

Junction "CP-PL-055" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Outflow

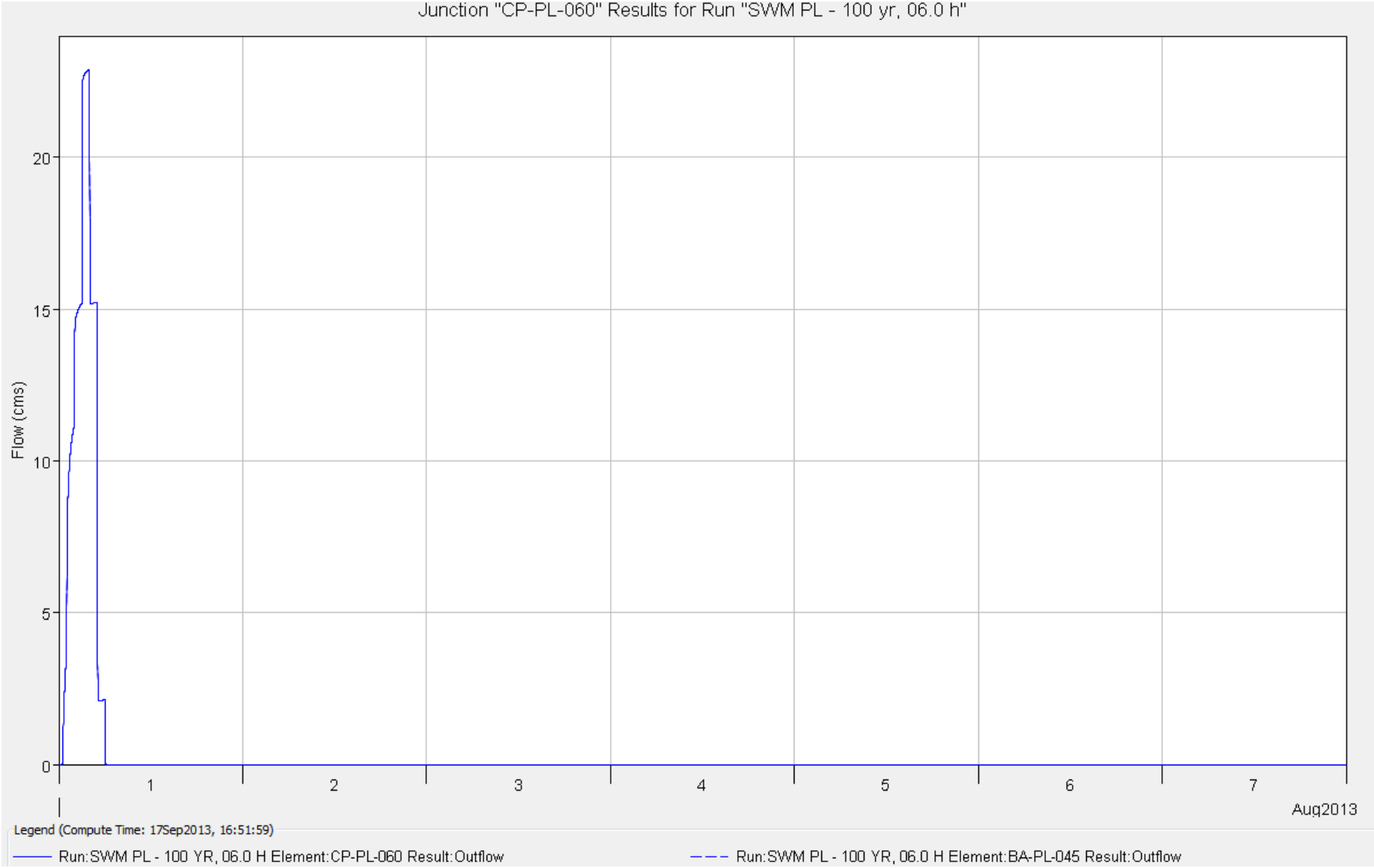

Junction "CP-PL-056A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-056A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-043 Result:Outflow

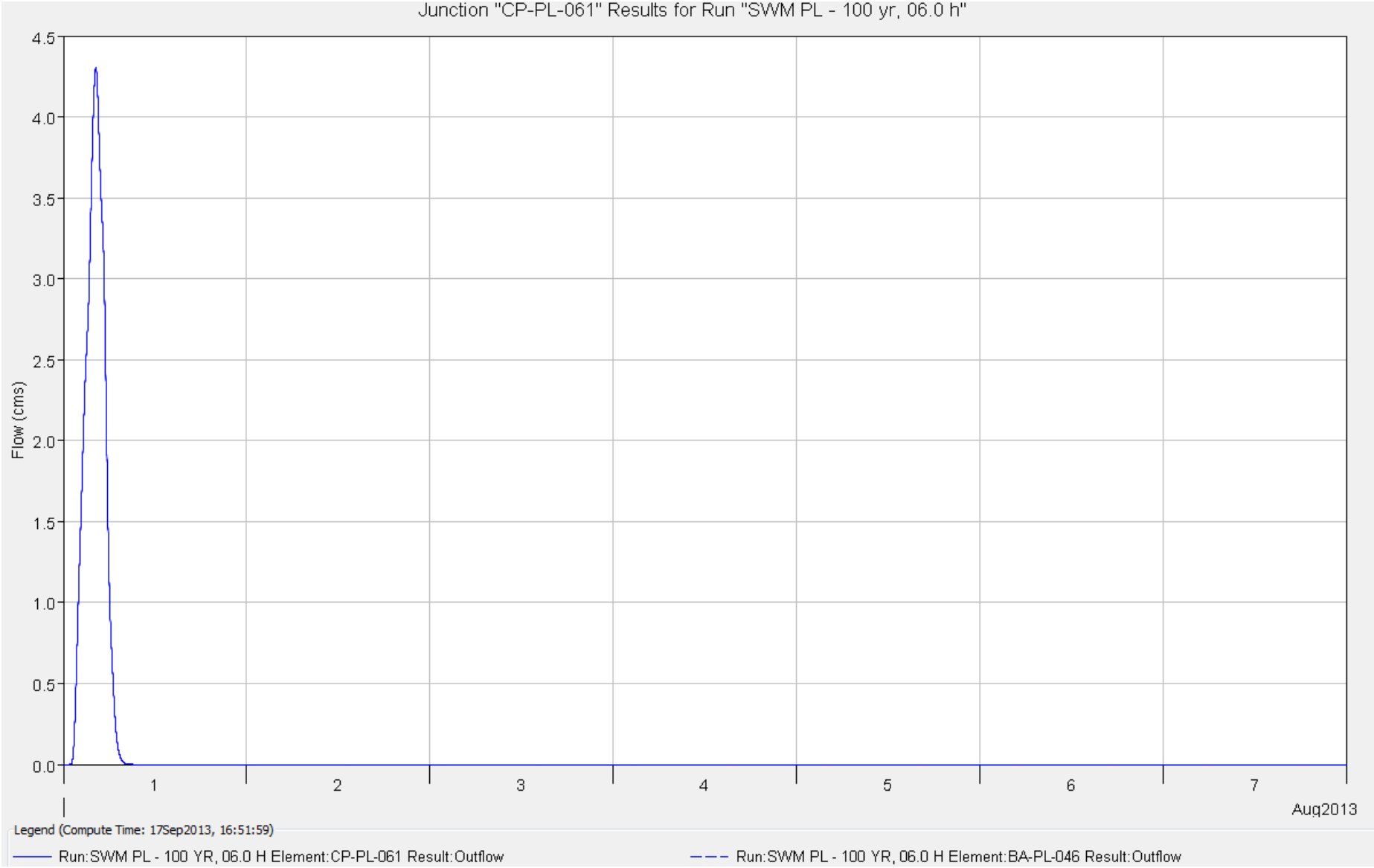

Junction "CP-PL-056B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
7
6
5
4
3
2
1
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-056B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-043 Result:Outflow

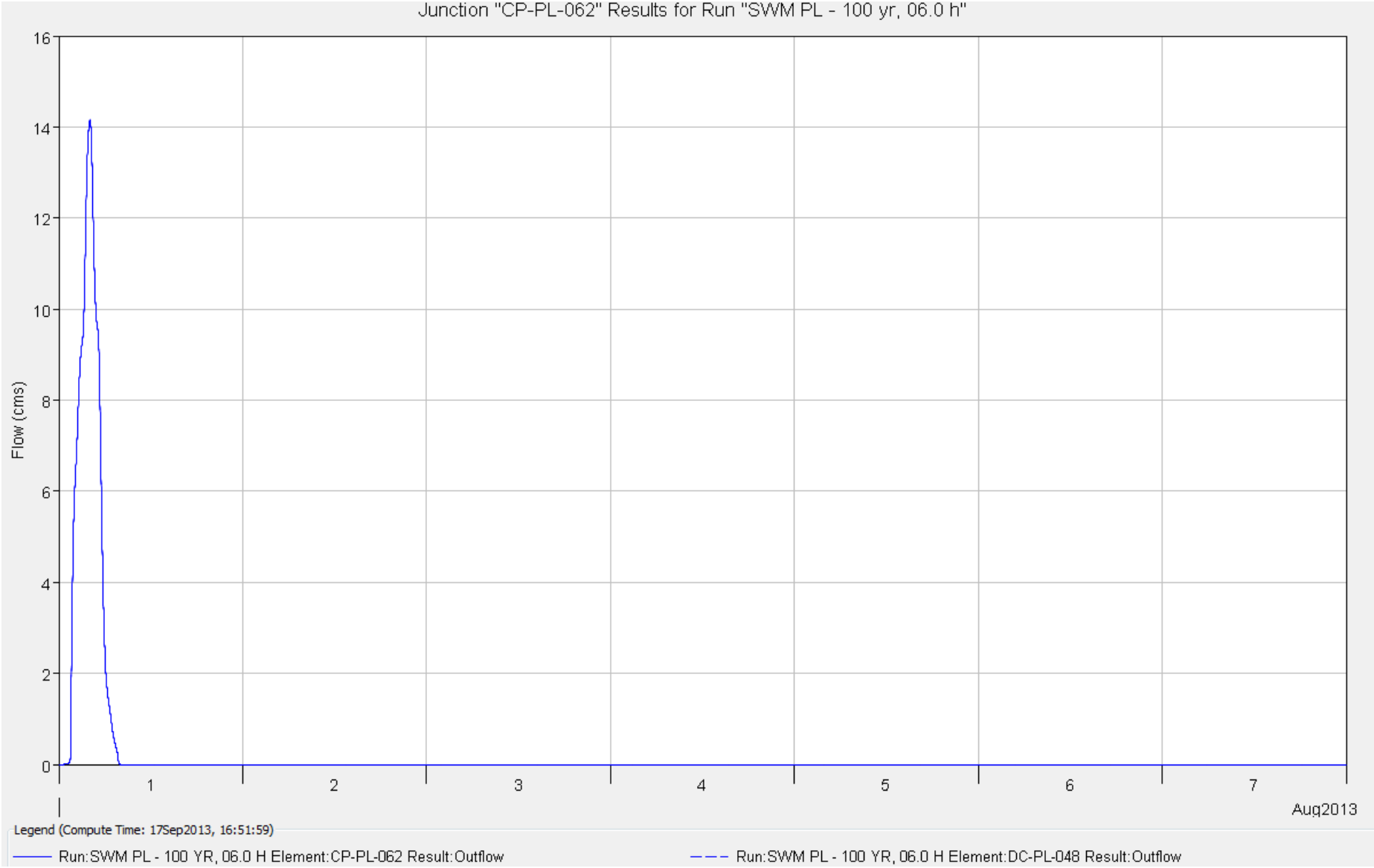

Junction "CP-PL-057" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-042 Result:Outflow

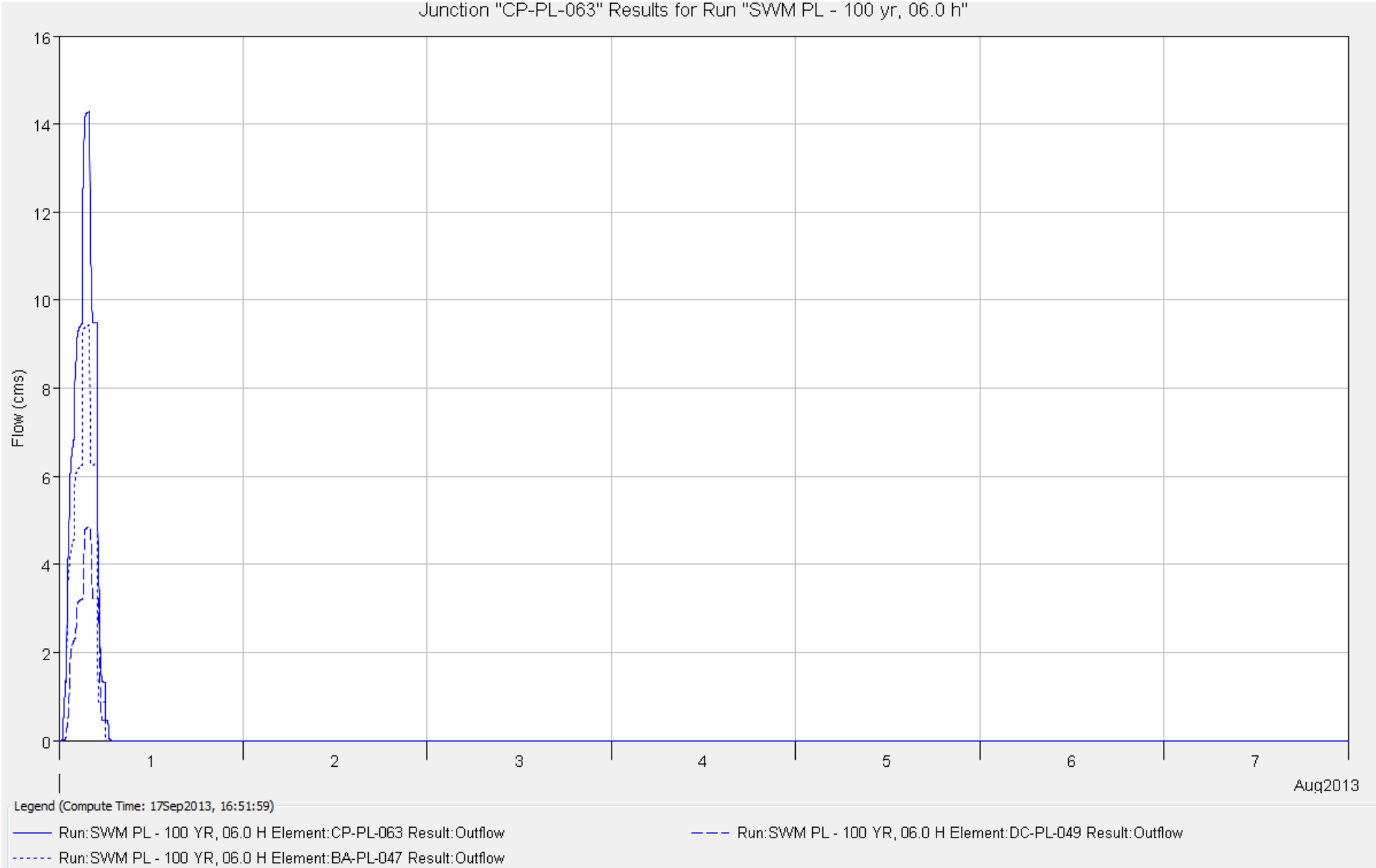

Junction "CP-PL-058" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-041 Result:Outflow

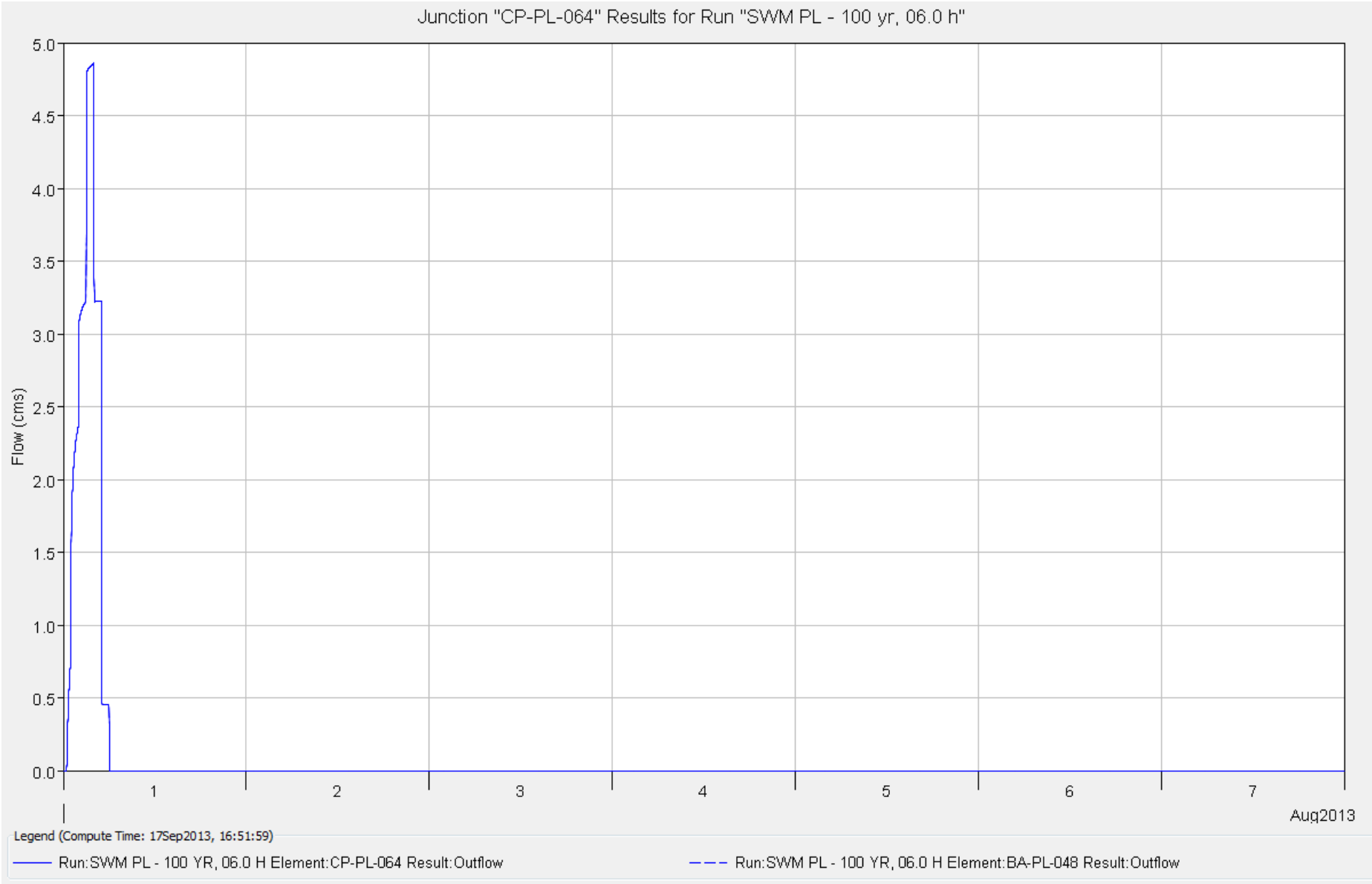

Junction "CP-PL-059" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-059 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-044 Result:Outflow


Junction "CP-PL-060" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-045 Result:Outflow

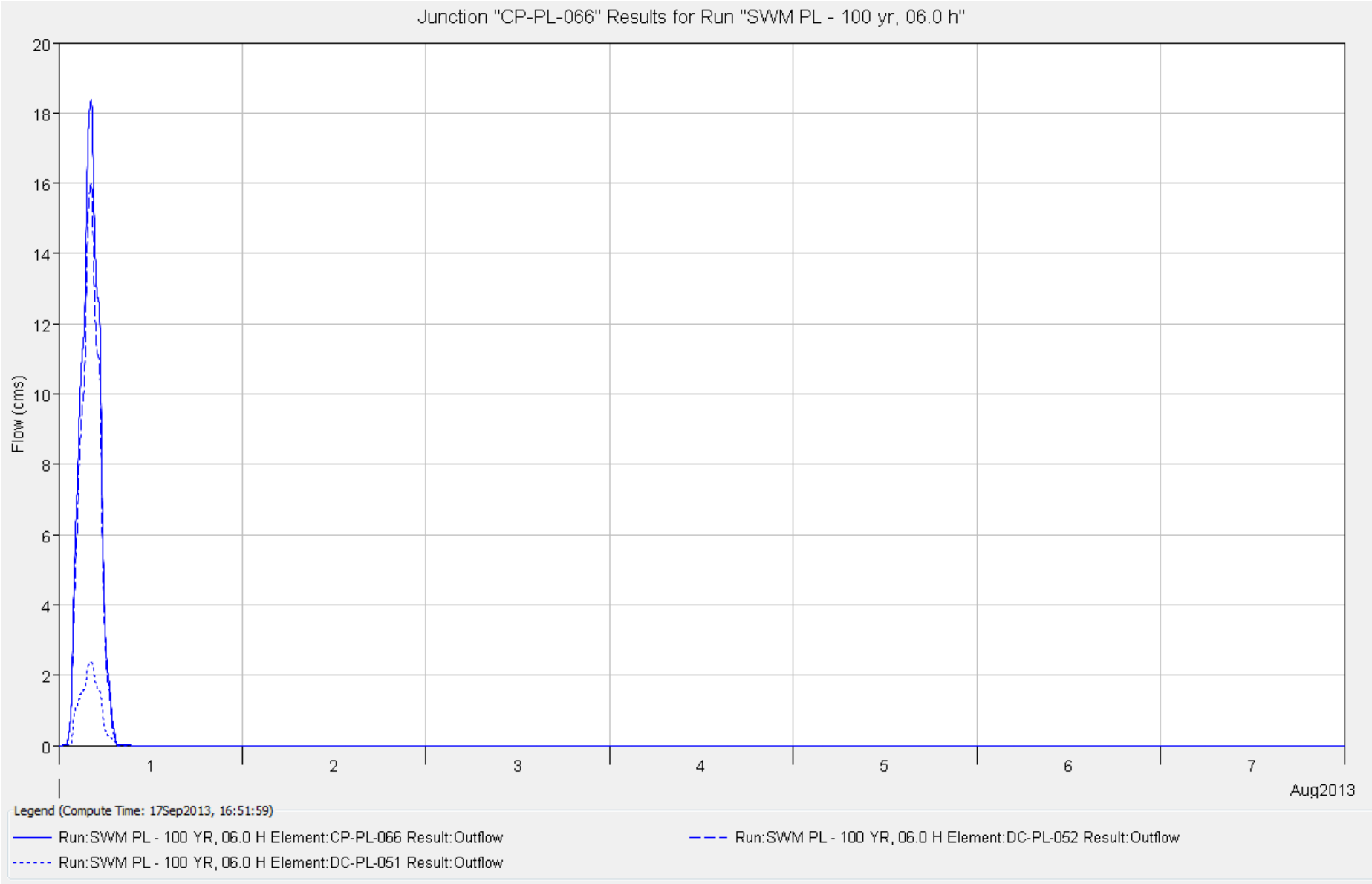

Junction "CP-PL-061" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-061 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-046 Result:Outflow

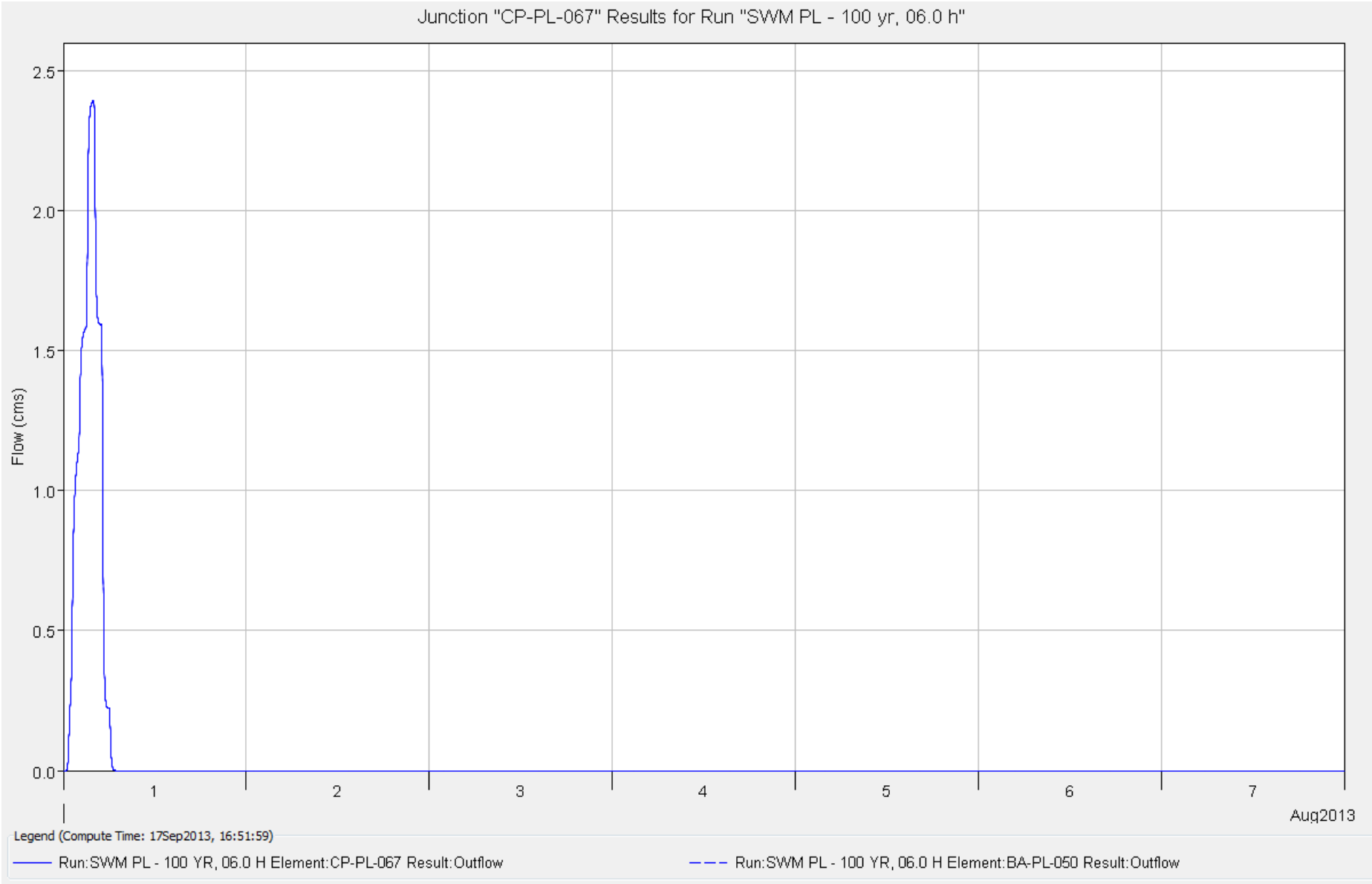

Junction "CP-PL-062" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-062 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-048 Result:Outflow

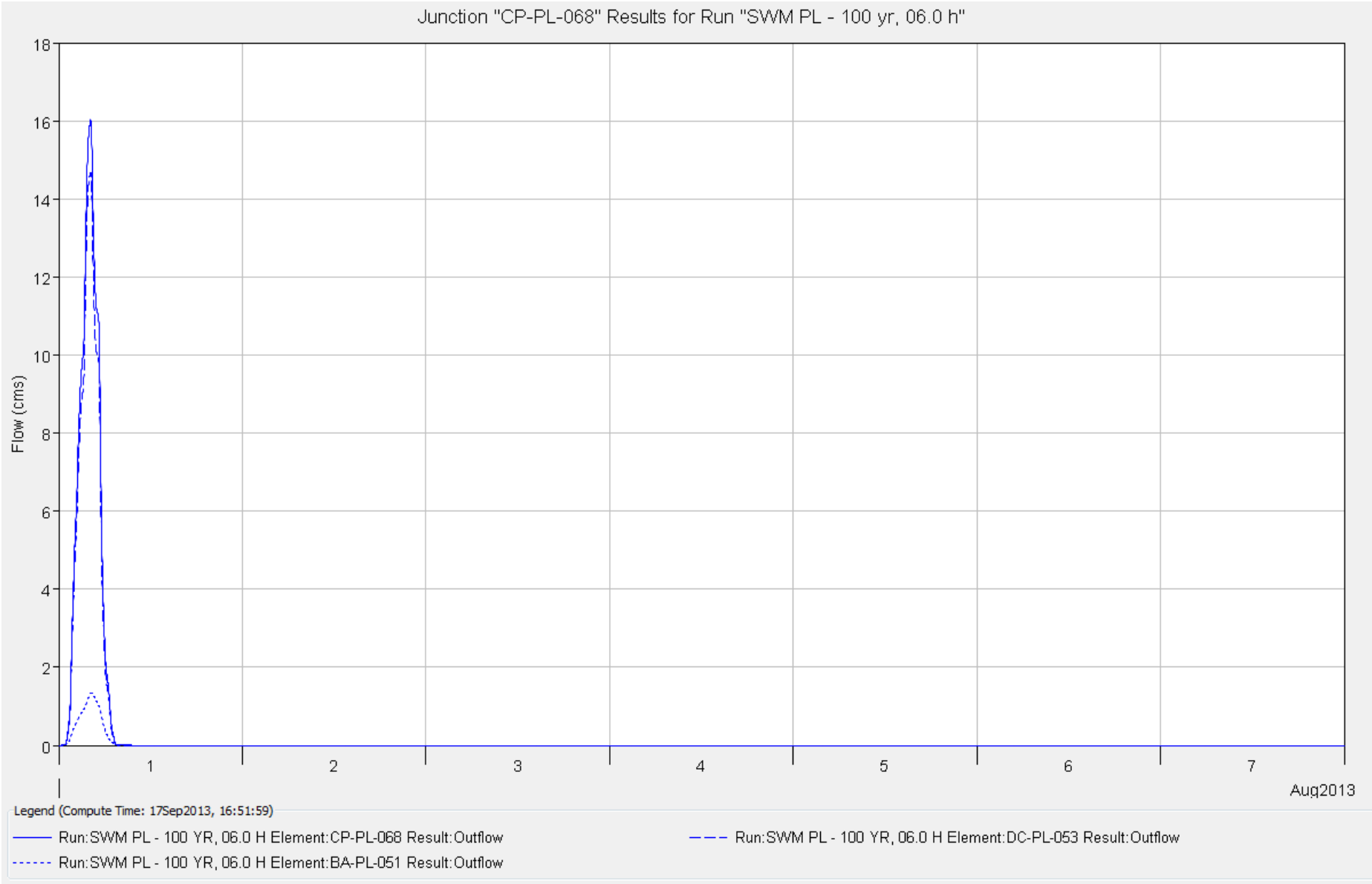

Junction "CP-PL-063" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-047 Result:Outflow

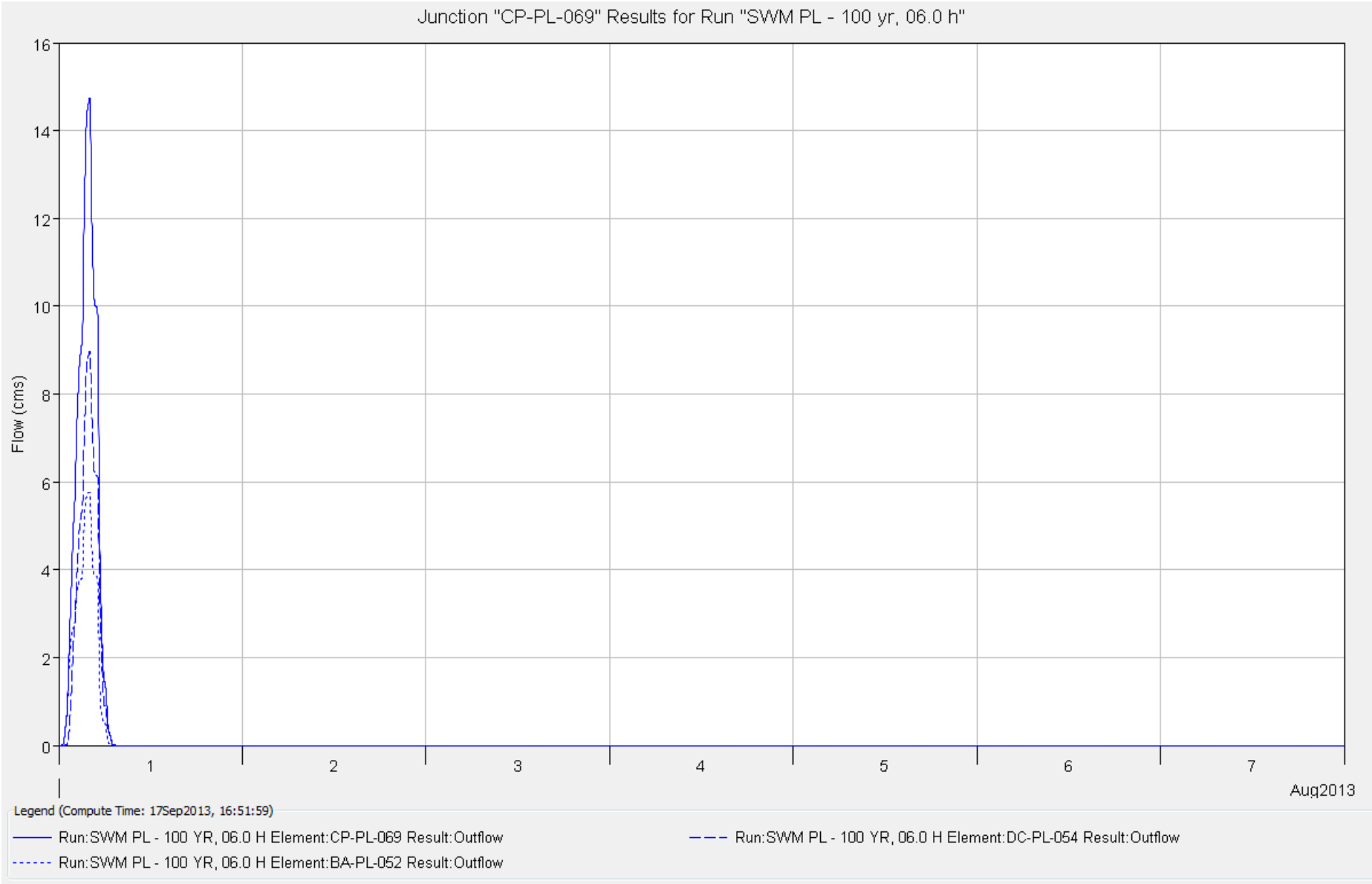

Junction "CP-PL-064" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-064 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-048 Result:Outflow

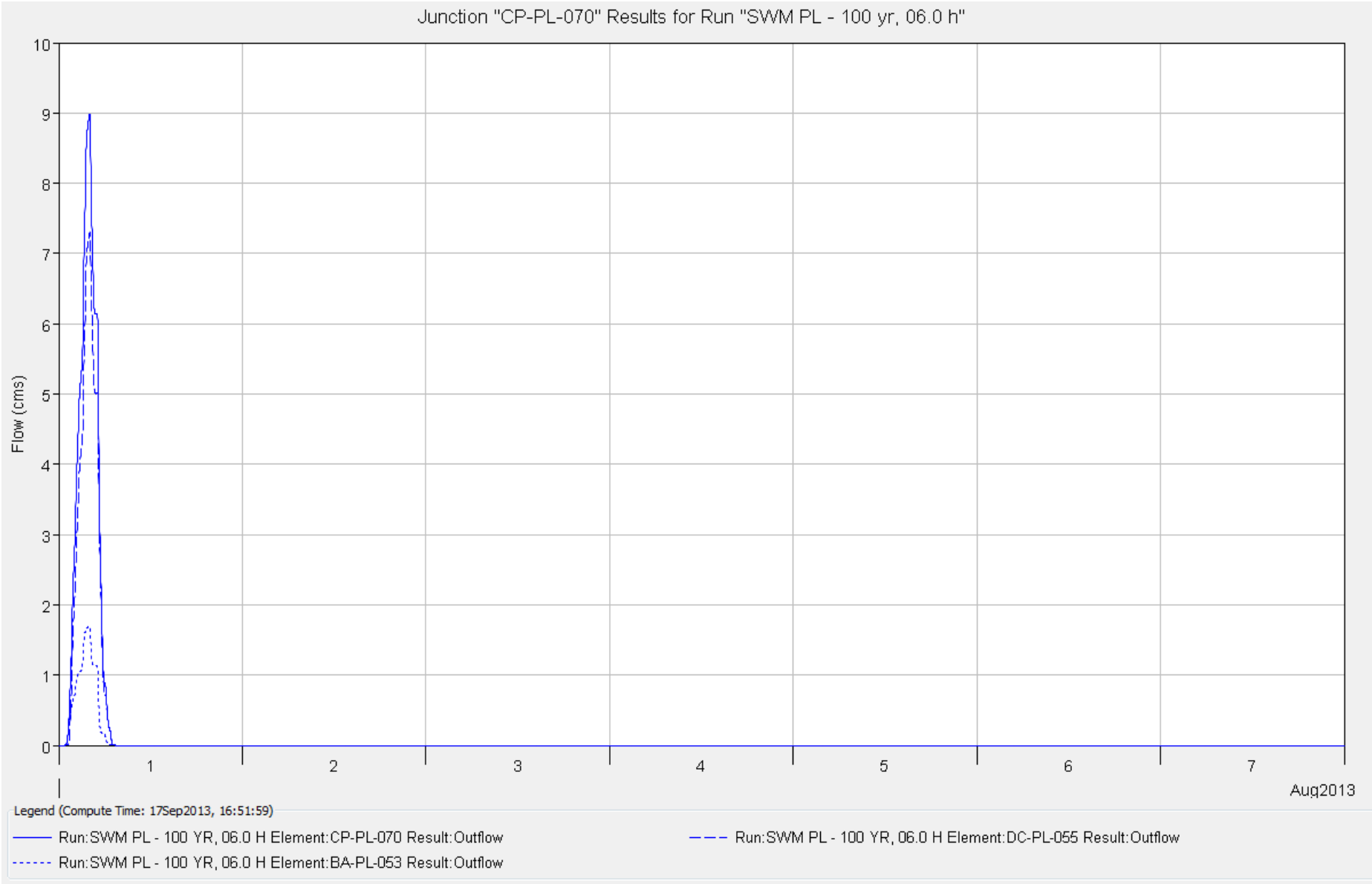

Junction "CP-PL-065" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-065 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-049 Result:Outflow

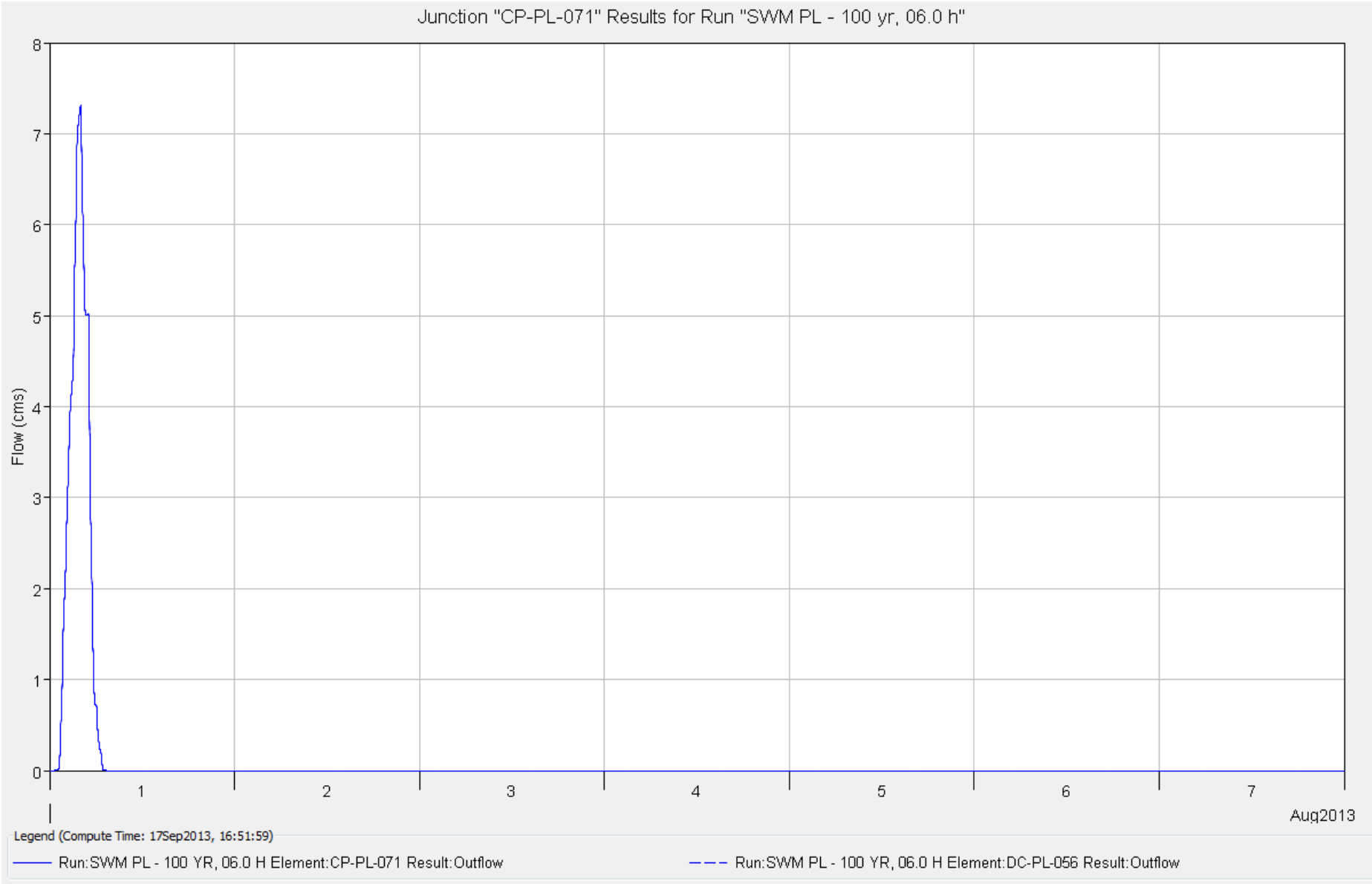

Junction "CP-PL-066" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-052 Result:Outflow

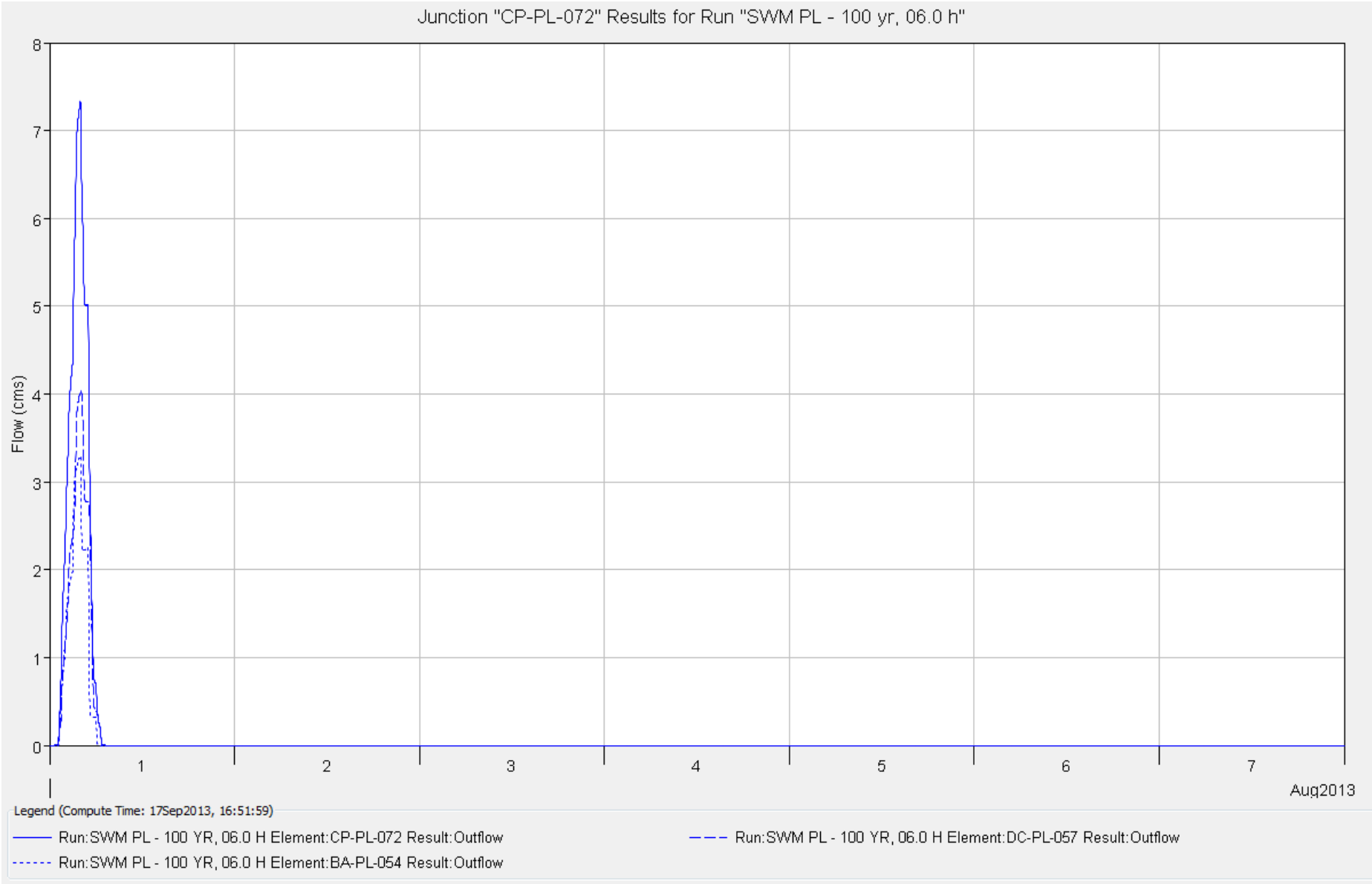

Junction "CP-PL-067" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-067 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-050 Result:Outflow


Junction "CP-PL-068" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-068 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-051 Result:Outflow

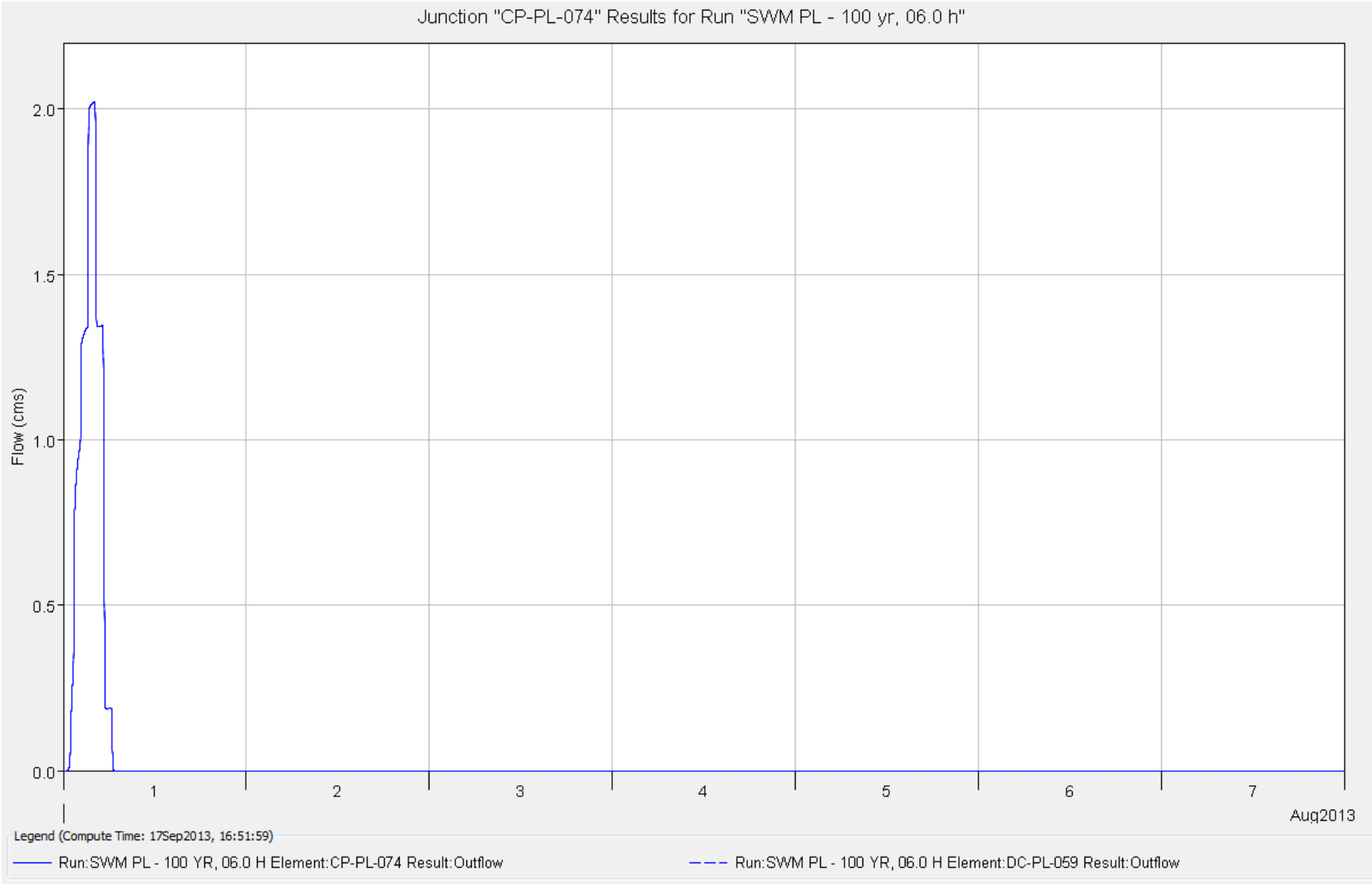

Junction "CP-PL-069" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-069 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-052 Result:Outflow

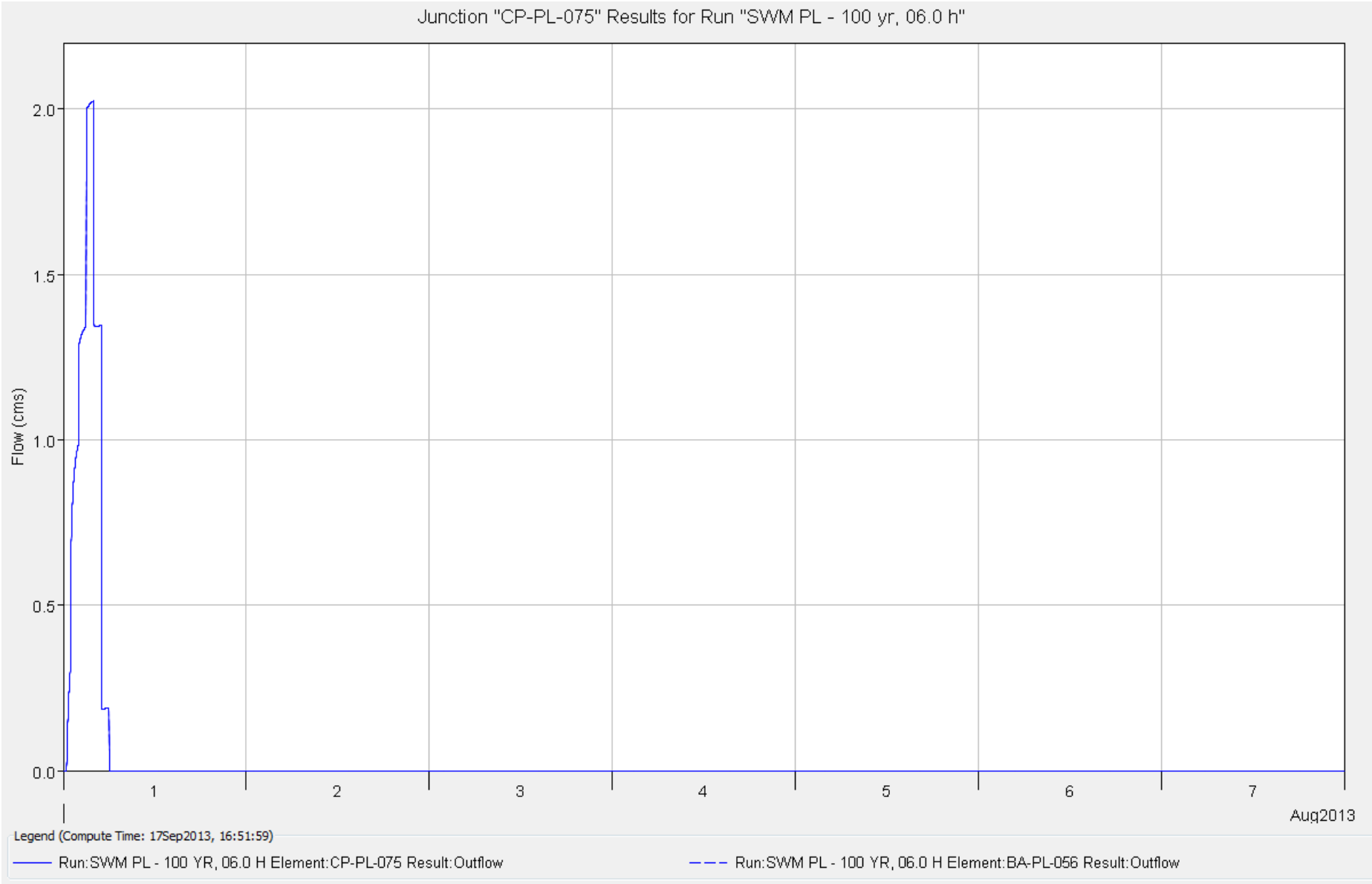

Junction "CP-PL-070" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-070 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-053 Result:Outflow

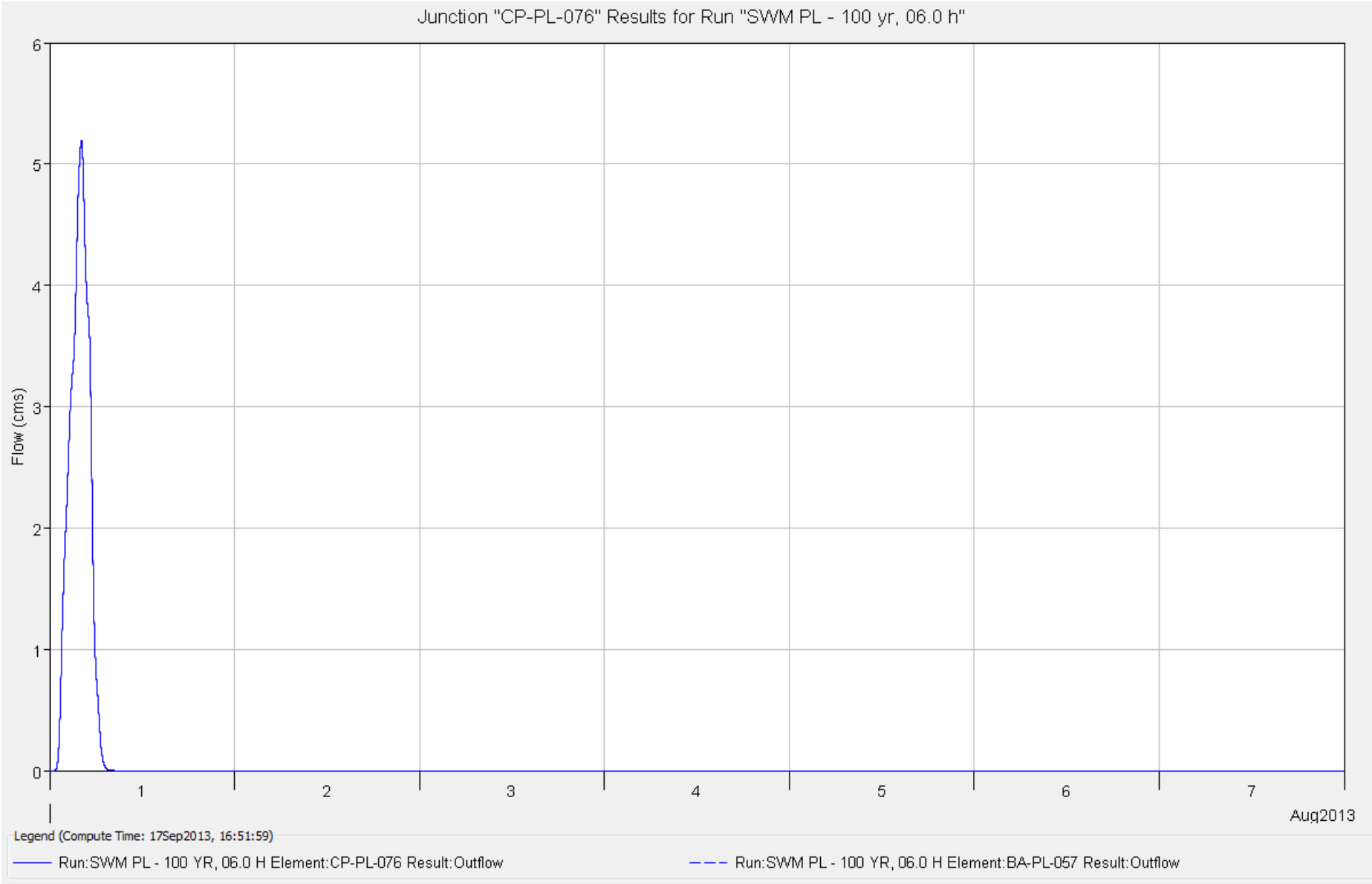

Junction "CP-PL-071" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-071 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-056 Result:Outflow

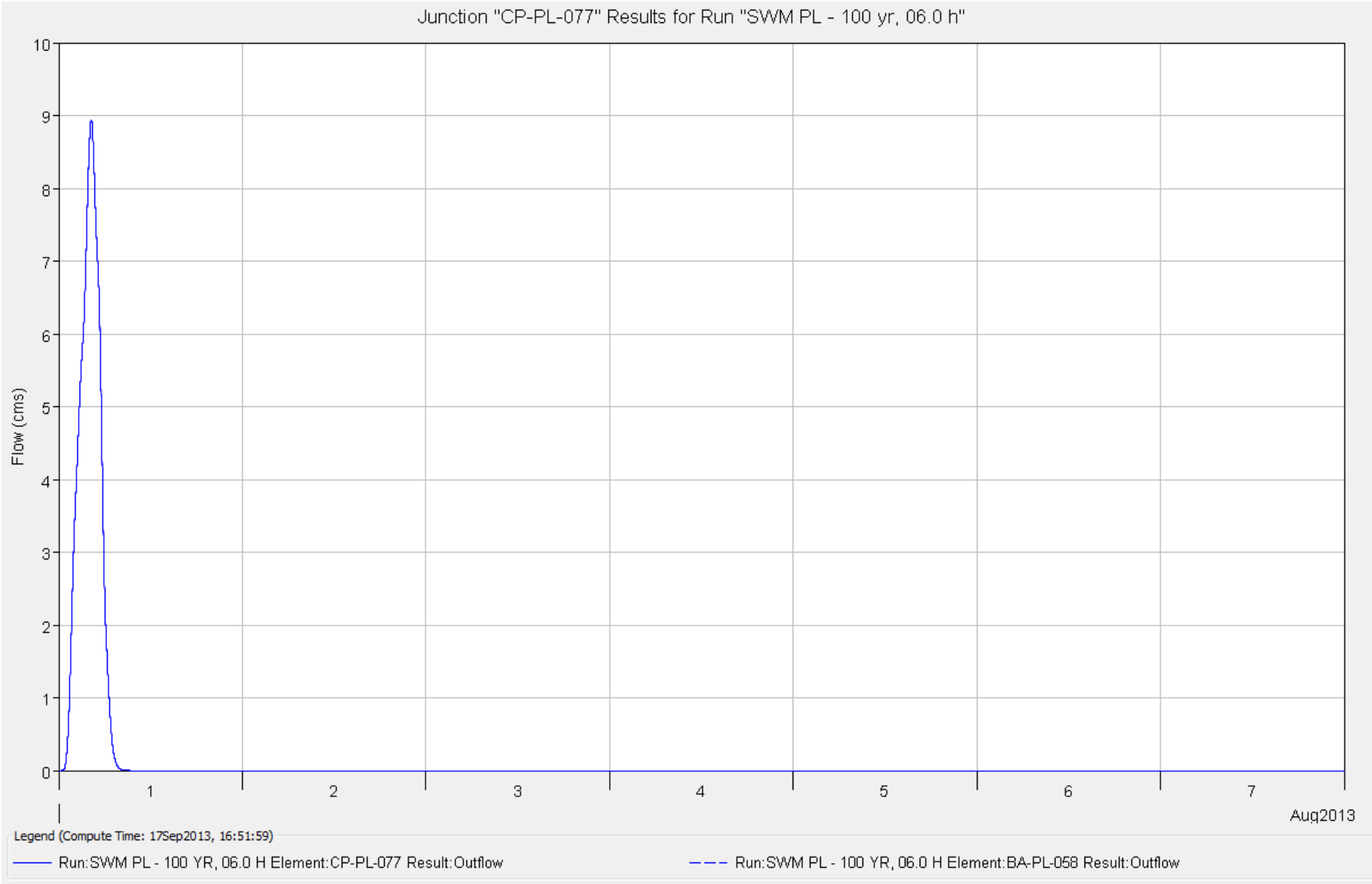

Junction "CP-PL-072" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-072 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-054 Result:Outflow

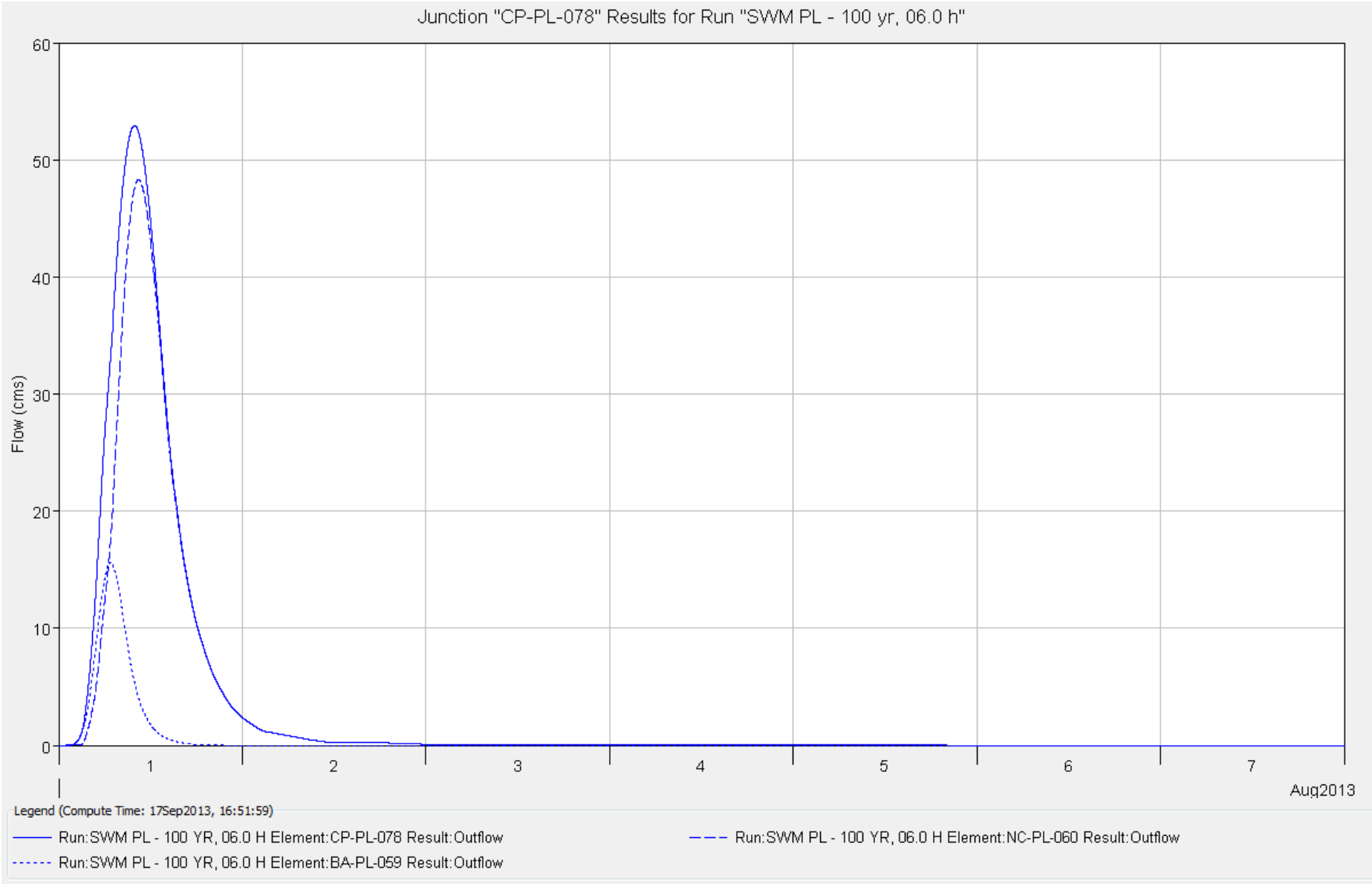

Junction "CP-PL-073" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-073 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-055 Result:Outflow

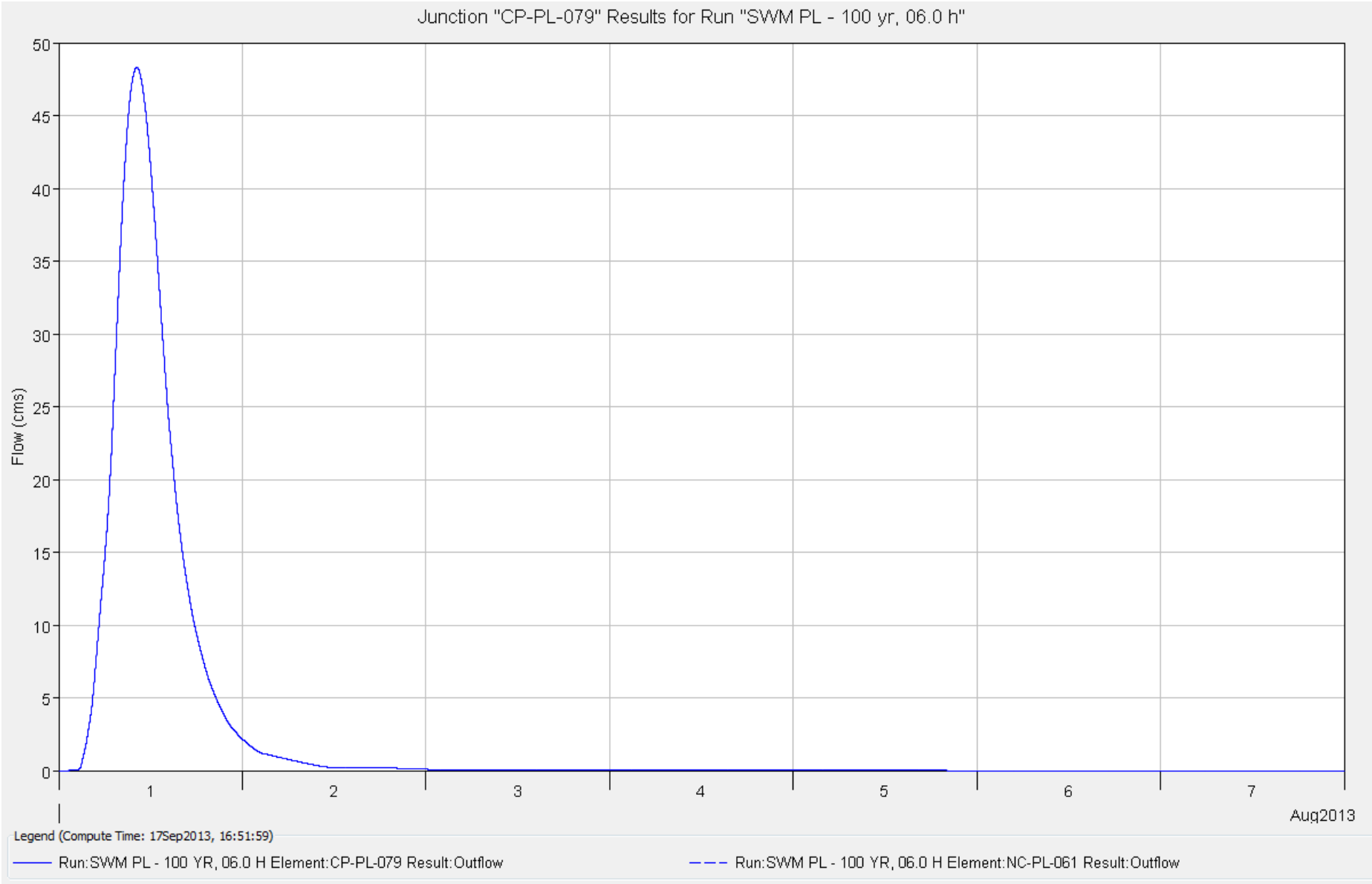

Junction "CP-PL-074" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-074 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-059 Result:Outflow

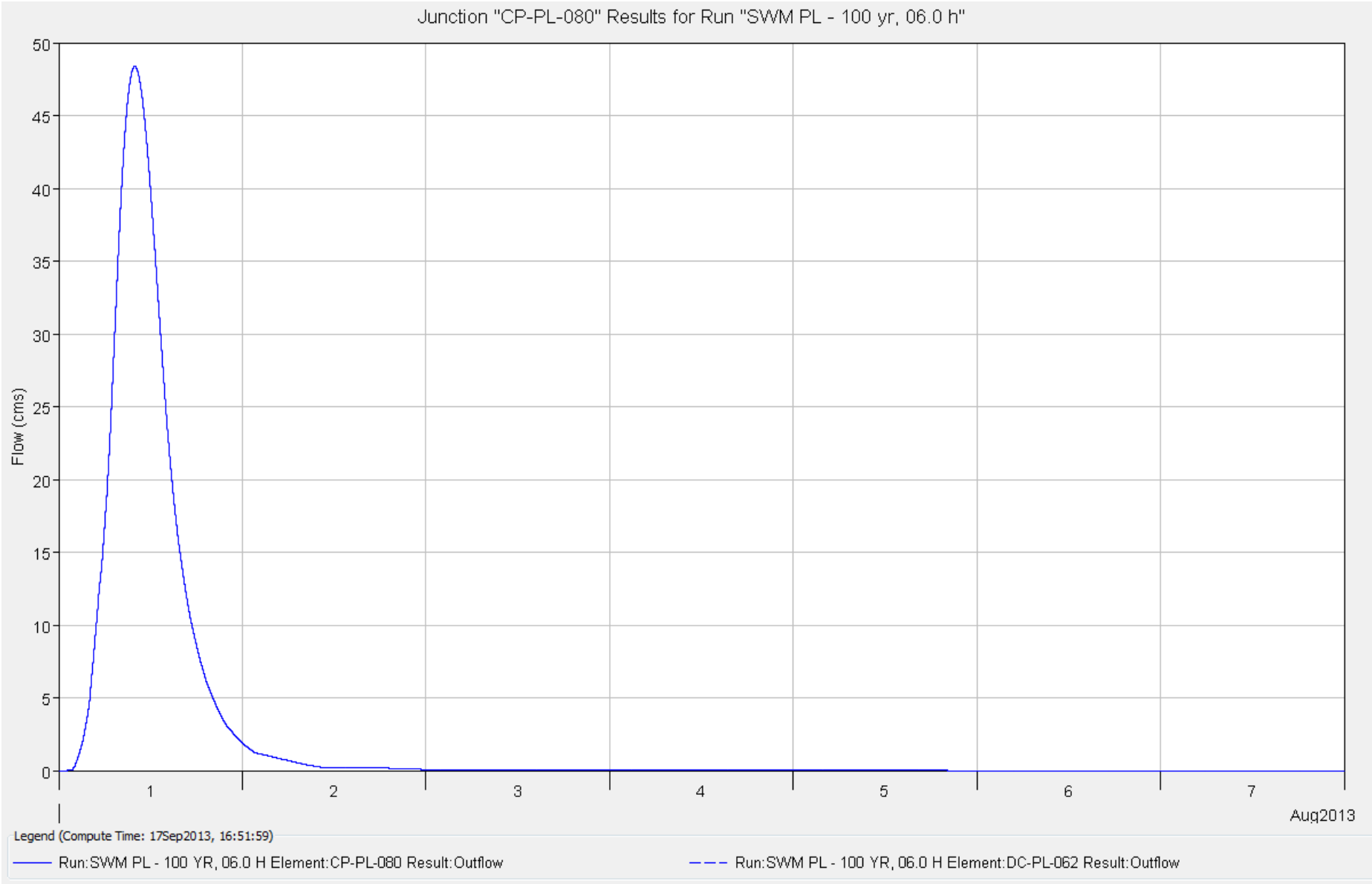

Junction "CP-PL-075" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-075 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-056 Result:Outflow

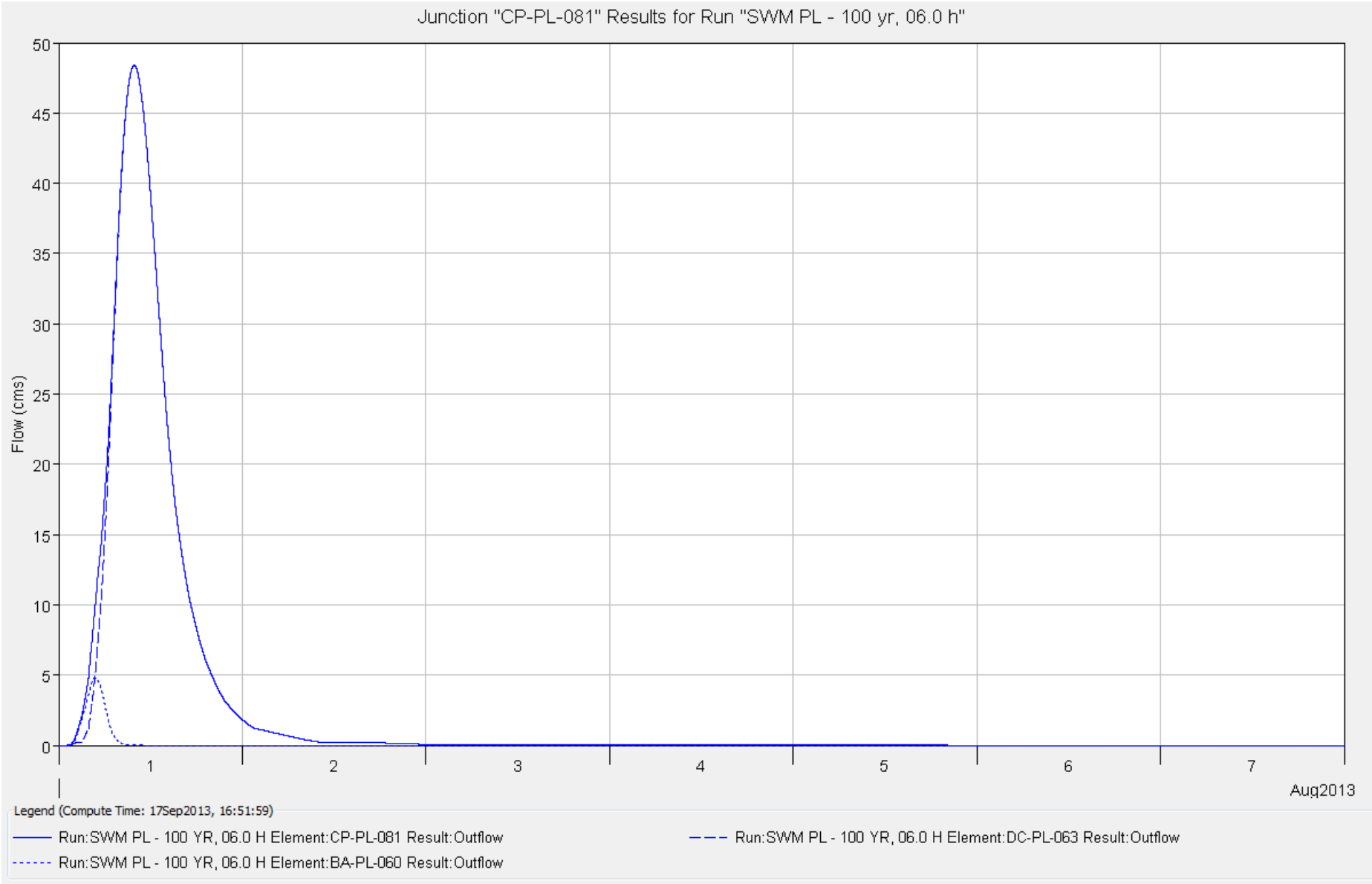

Junction "CP-PL-076" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-076 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-057 Result:Outflow

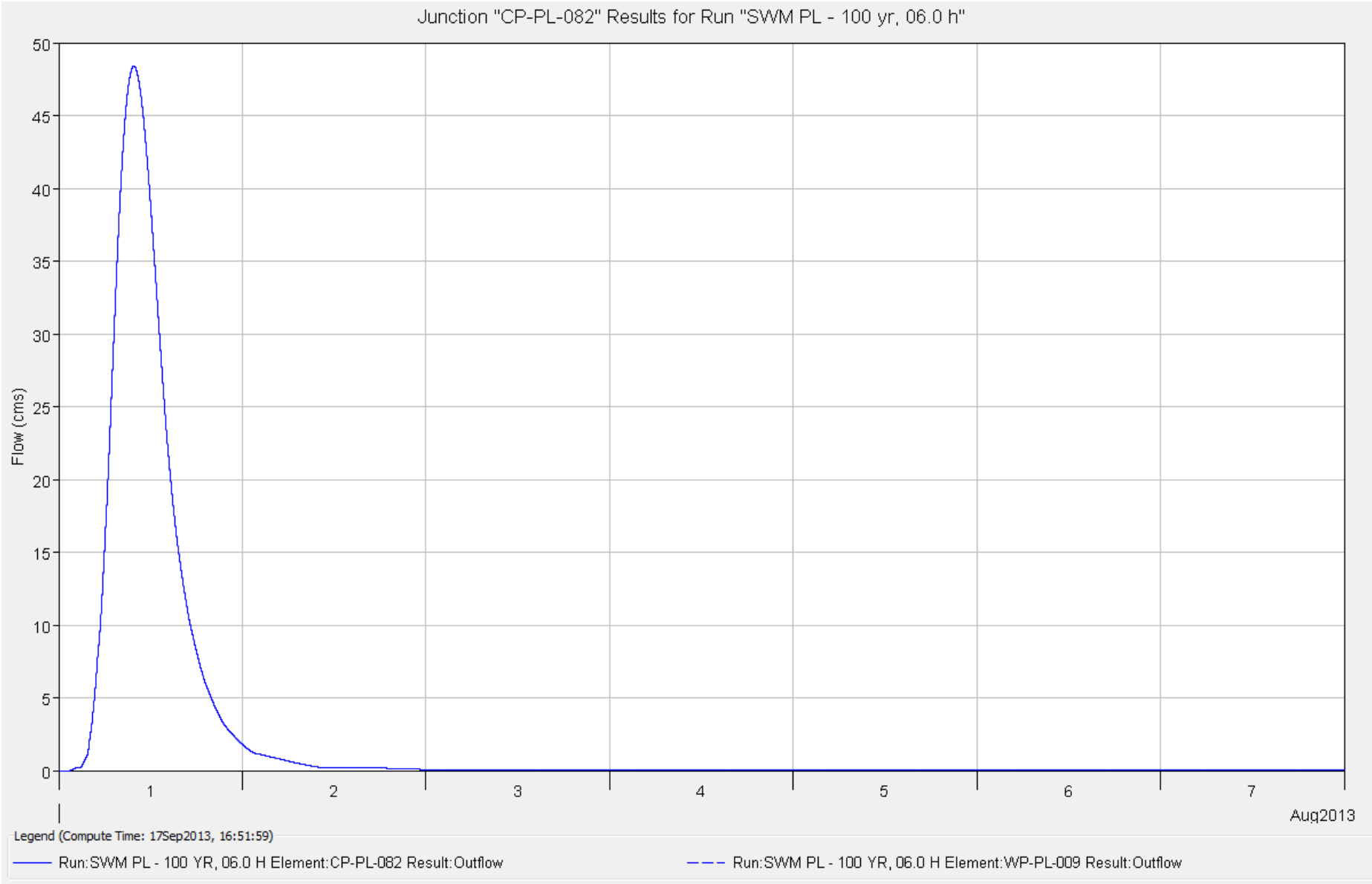

Junction "CP-PL-077" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-058 Result:Outflow

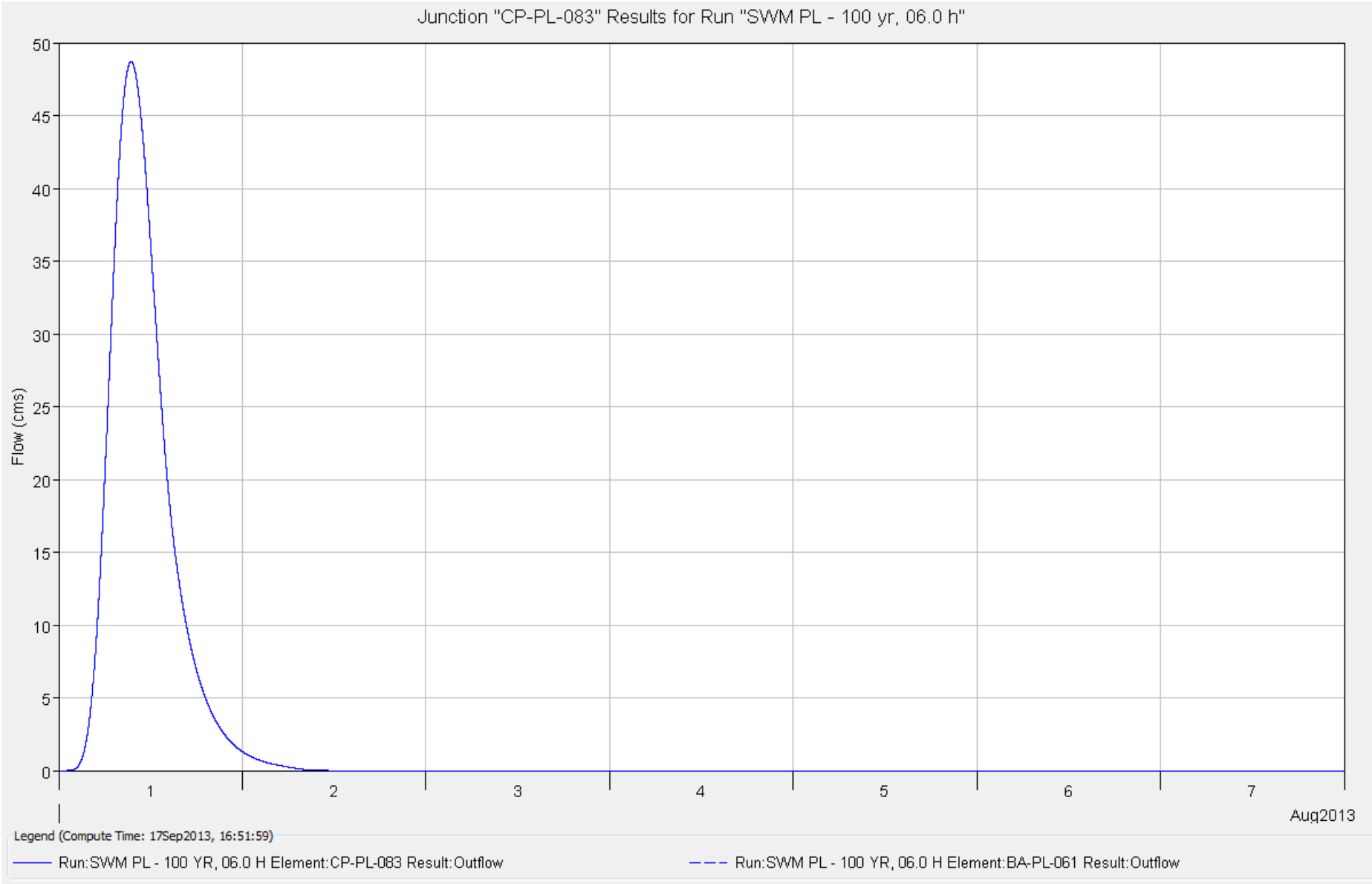

Junction "CP-PL-078" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-059 Result:Outflow

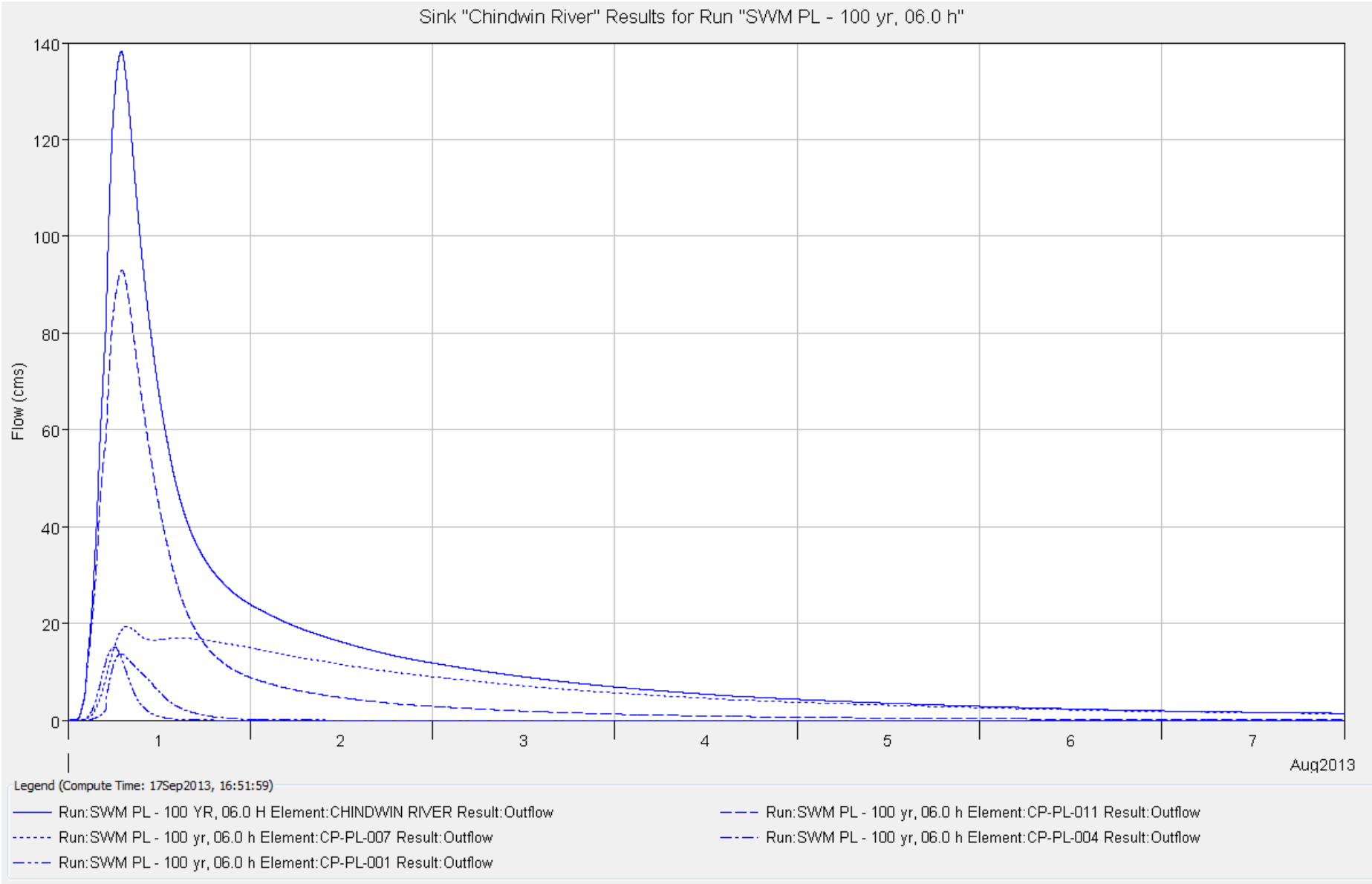

Junction "CP-PL-079" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-079 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-061 Result:Outflow

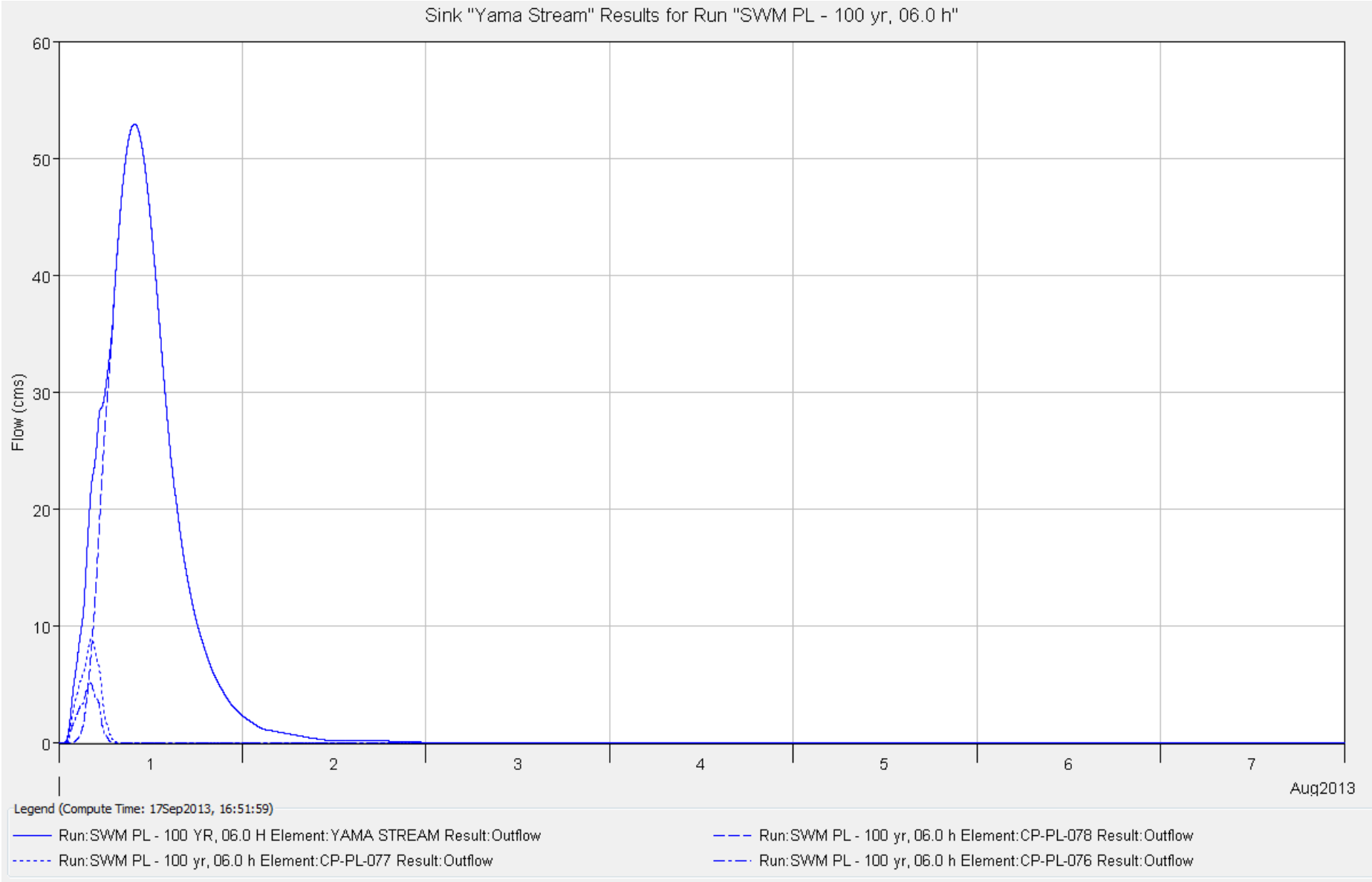

Junction "CP-PL-080" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-080 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-062 Result:Outflow

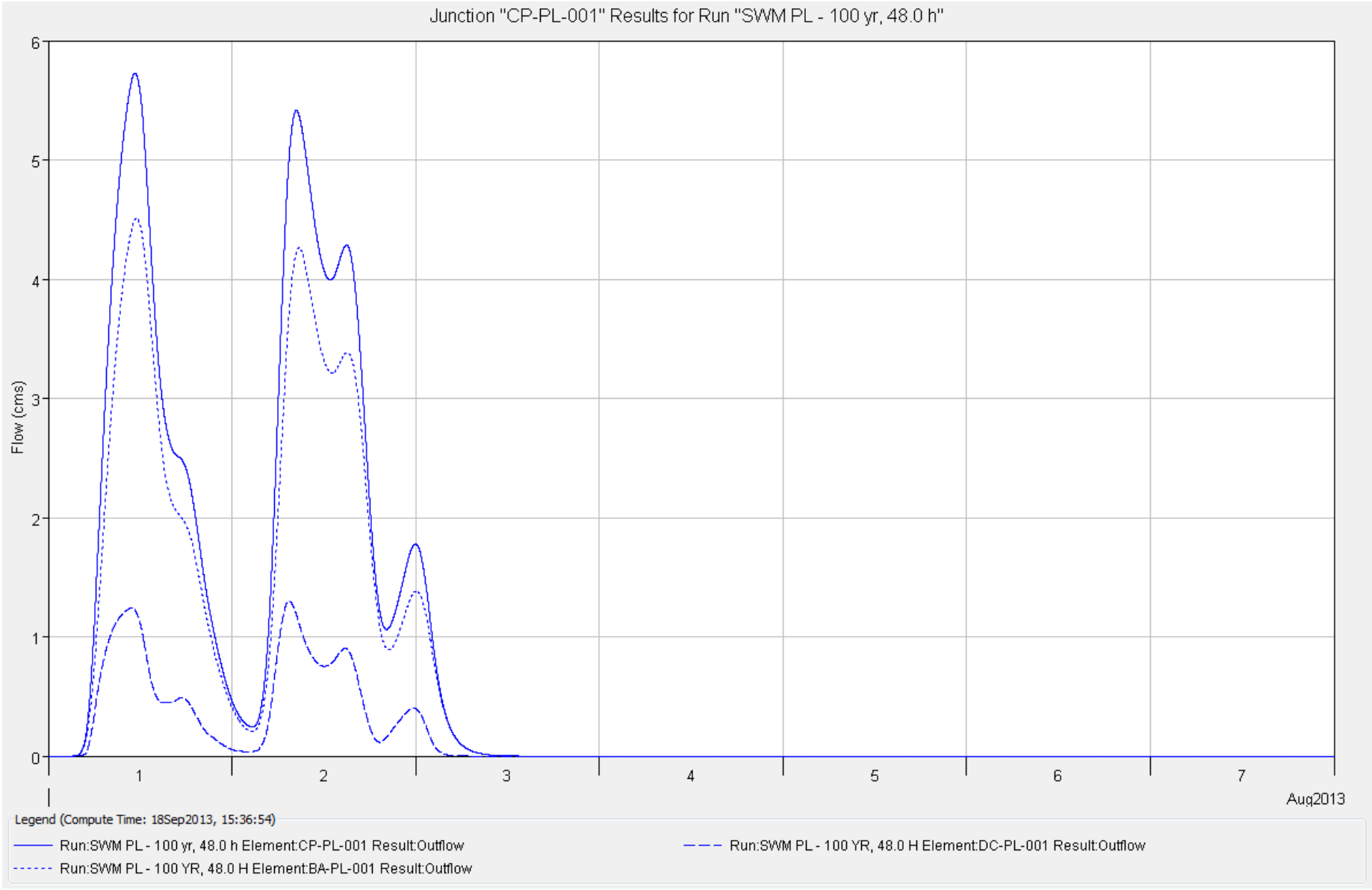

Junction "CP-PL-081" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-081 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-060 Result:Outflow

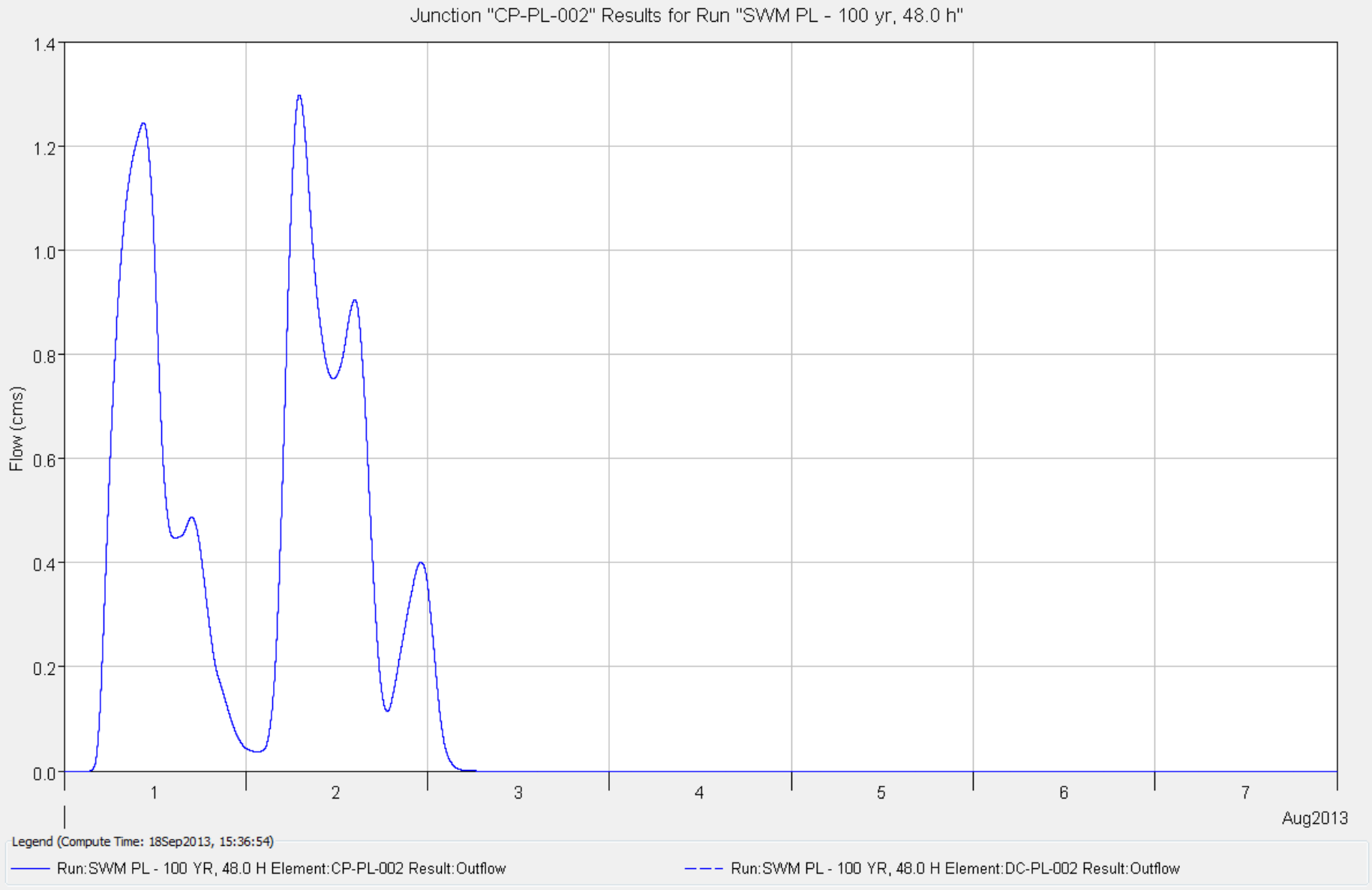

Junction "CP-PL-082" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-082 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Outflow

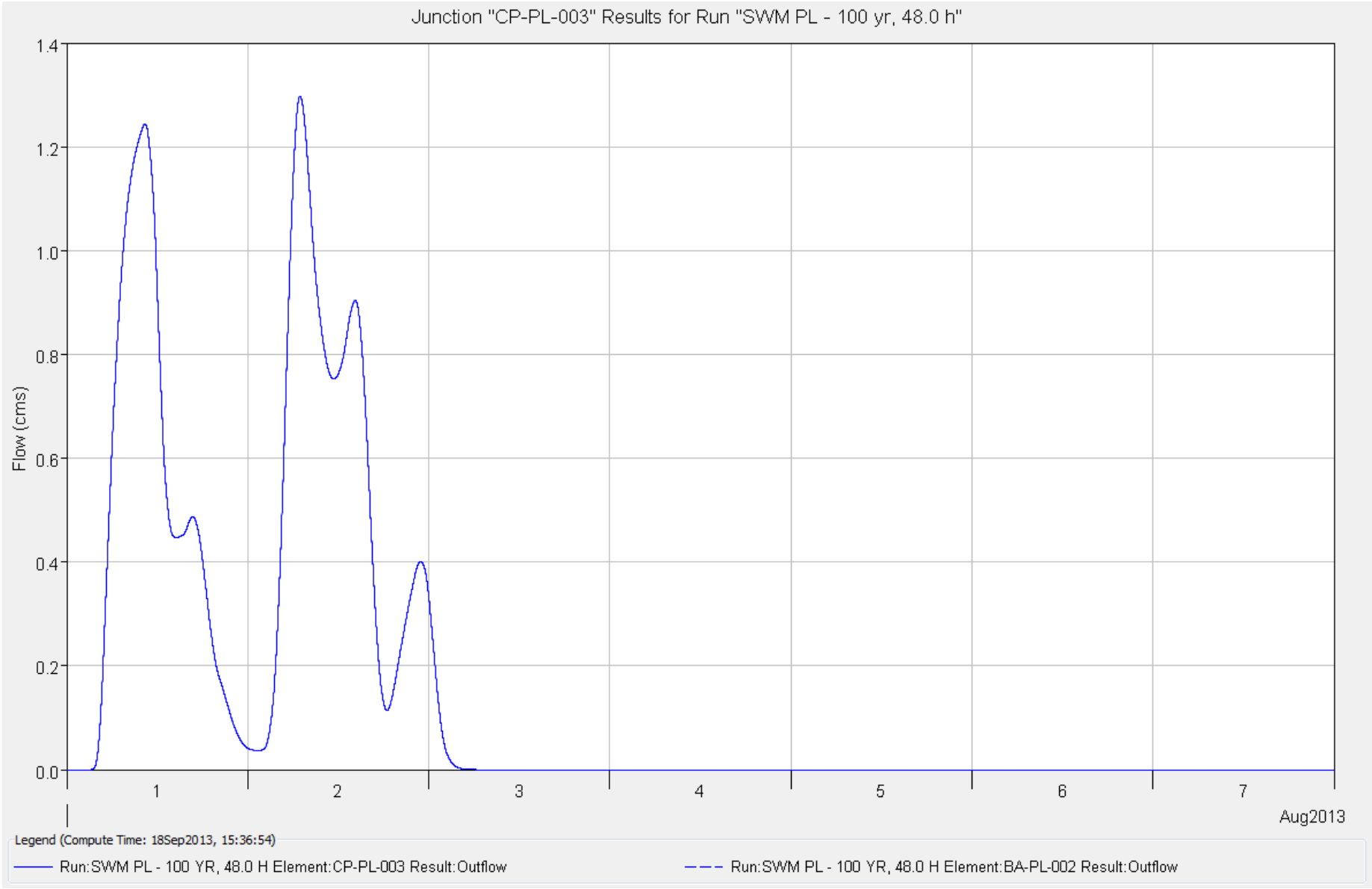

Junction "CP-PL-083" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-083 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-061 Result:Outflow

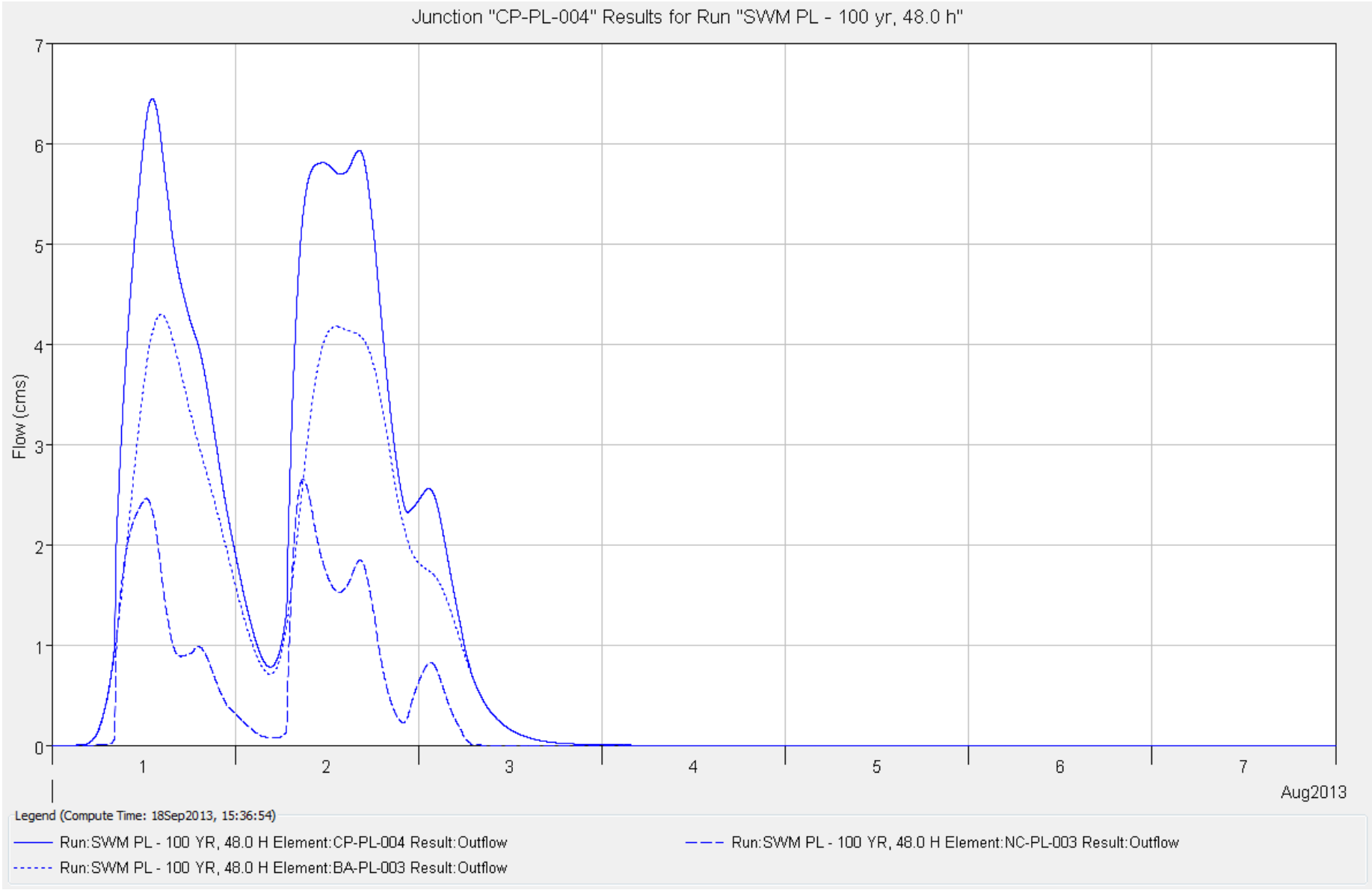

Sink "Chindwin River" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-004 Result:Outflow

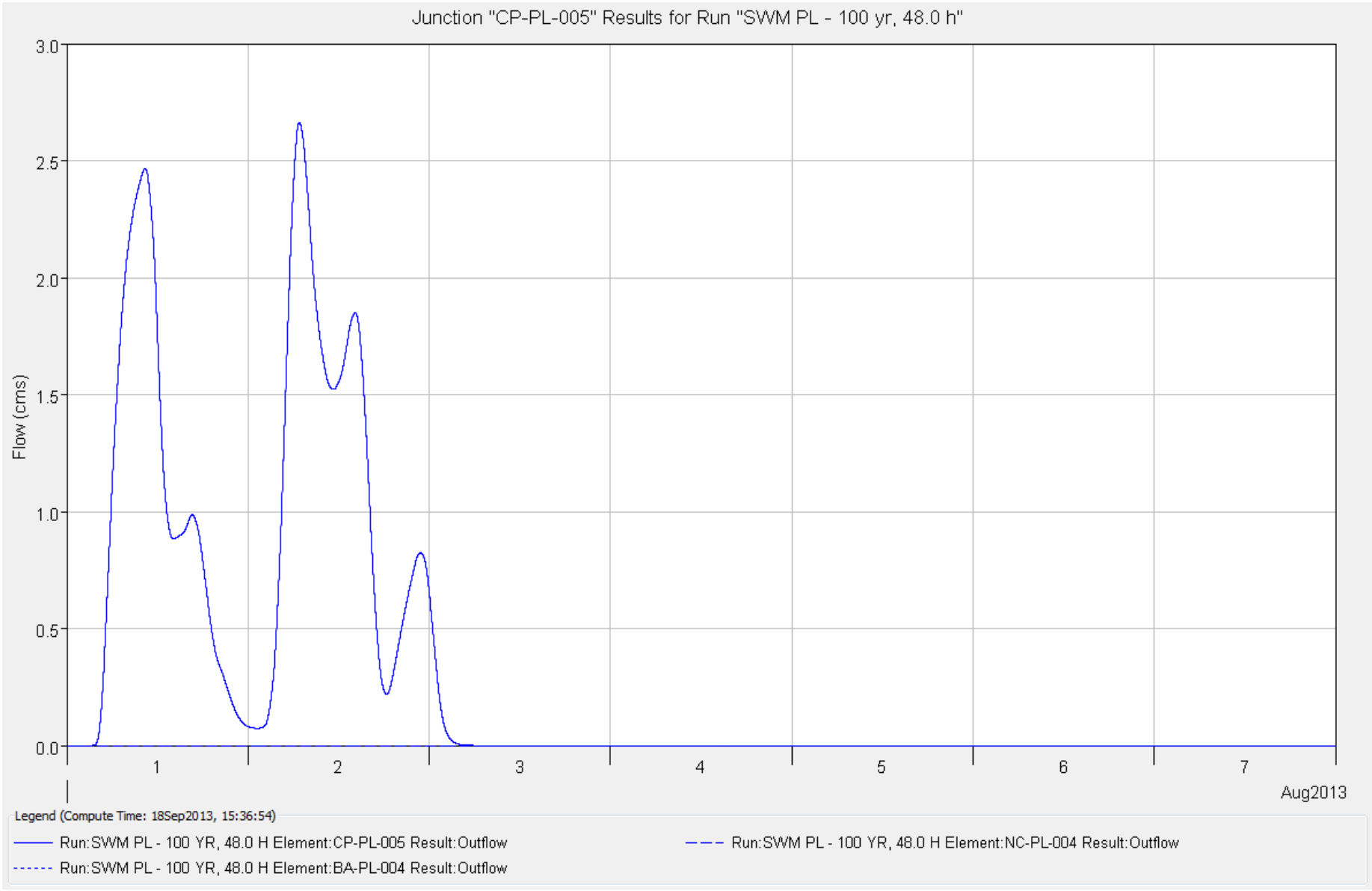

Sink "Yama Stream" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 17Sep2013, 16:51:59)
Run:SWM PL - 100 YR, 06.0 H Element:YAMA STREAM Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-076 Result:Outflow

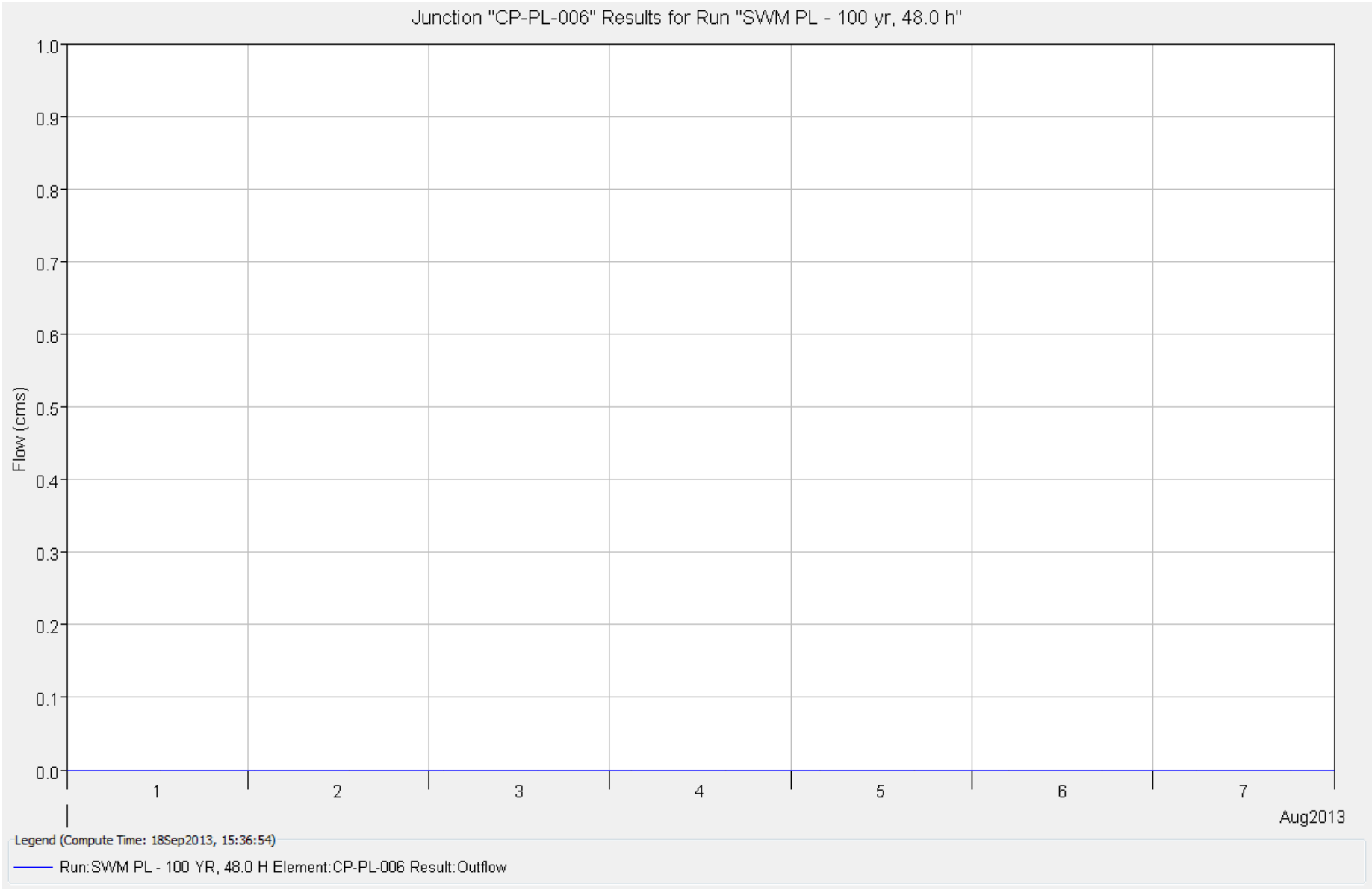

Junction "CP-PL-001" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-001 Result:Outflow

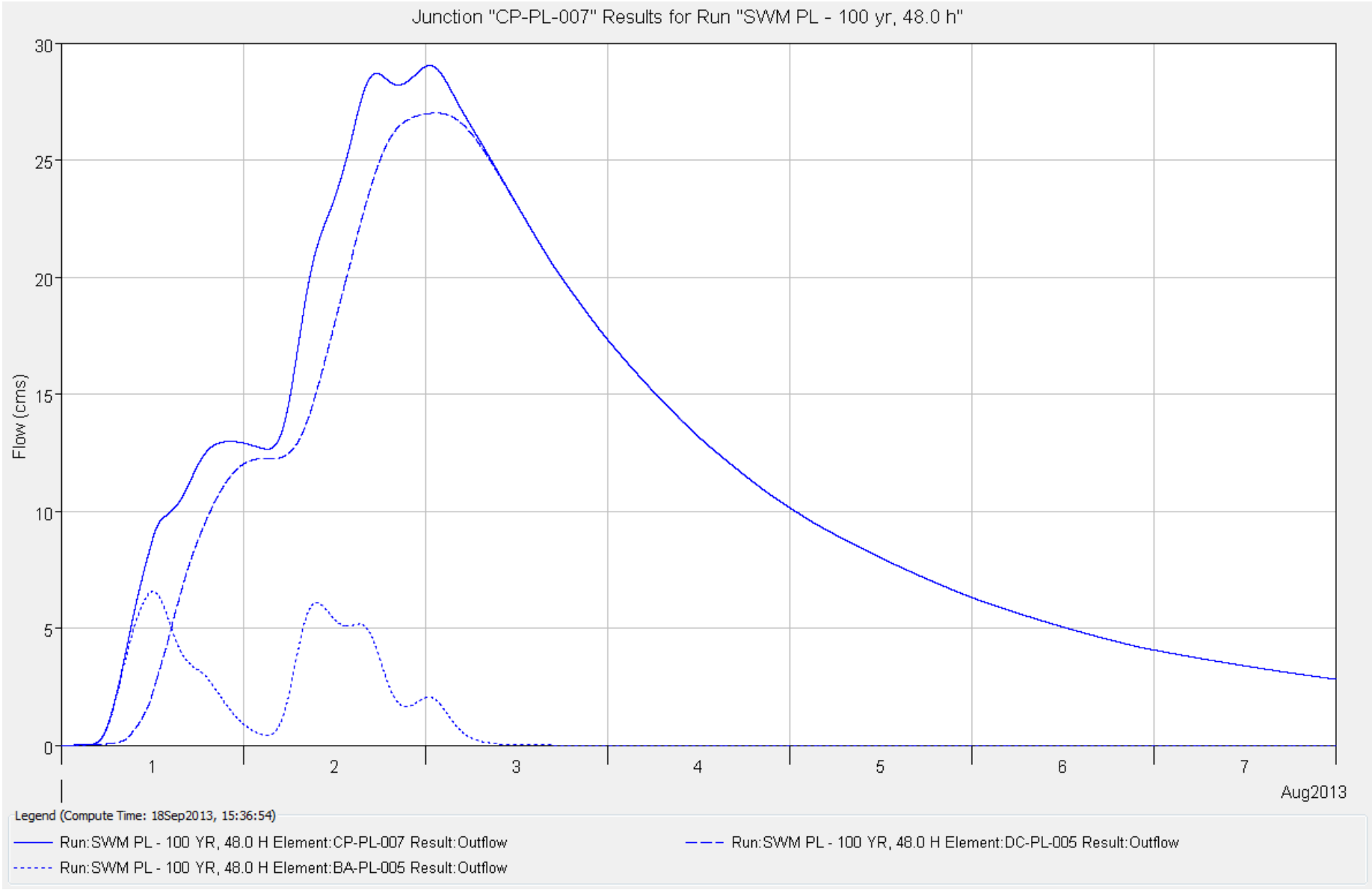

Junction "CP-PL-002" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-002 Result:Outflow

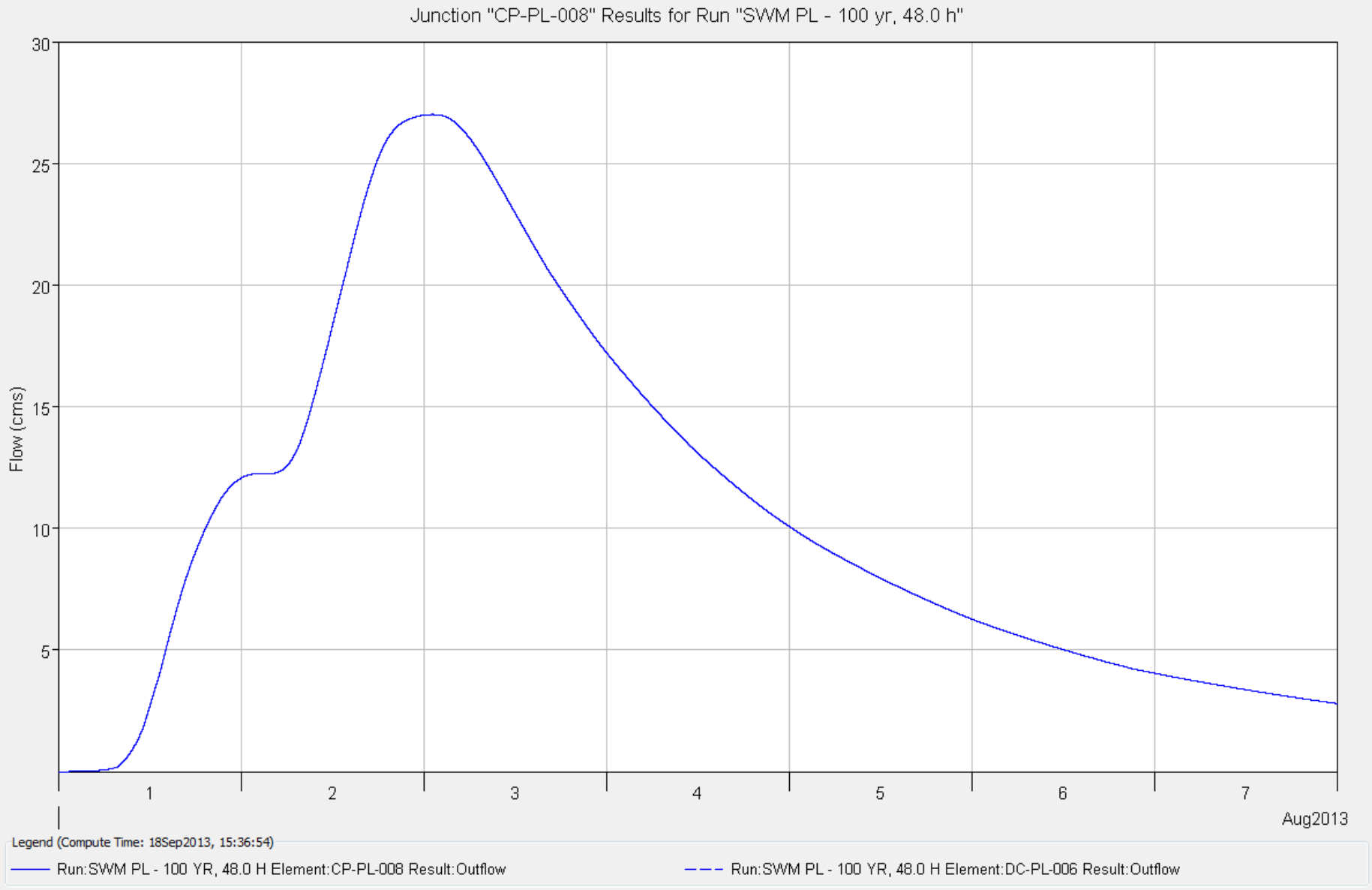

Junction "CP-PL-003" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-002 Result:Outflow

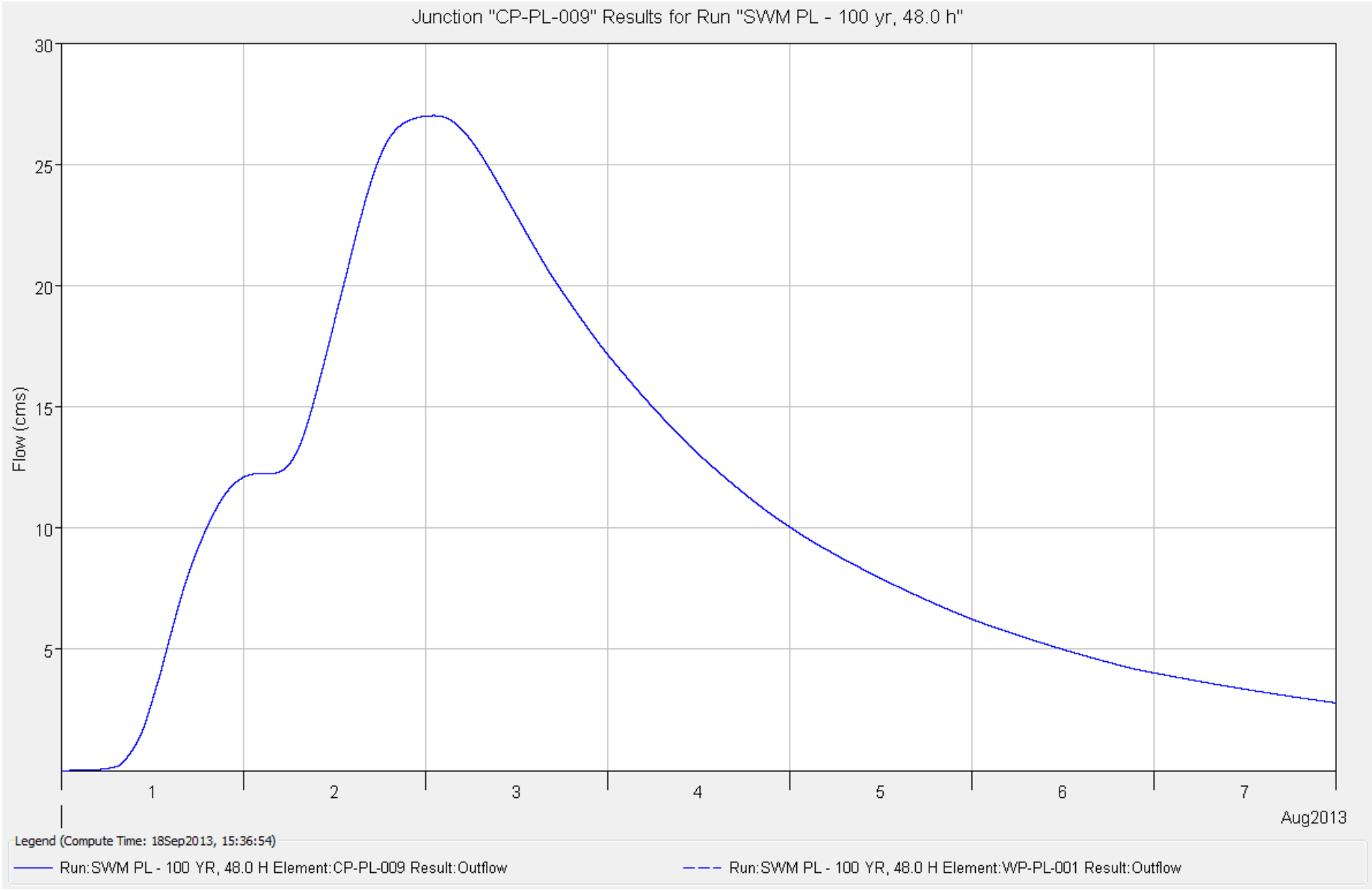

Junction "CP-PL-004" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-003 Result:Outflow

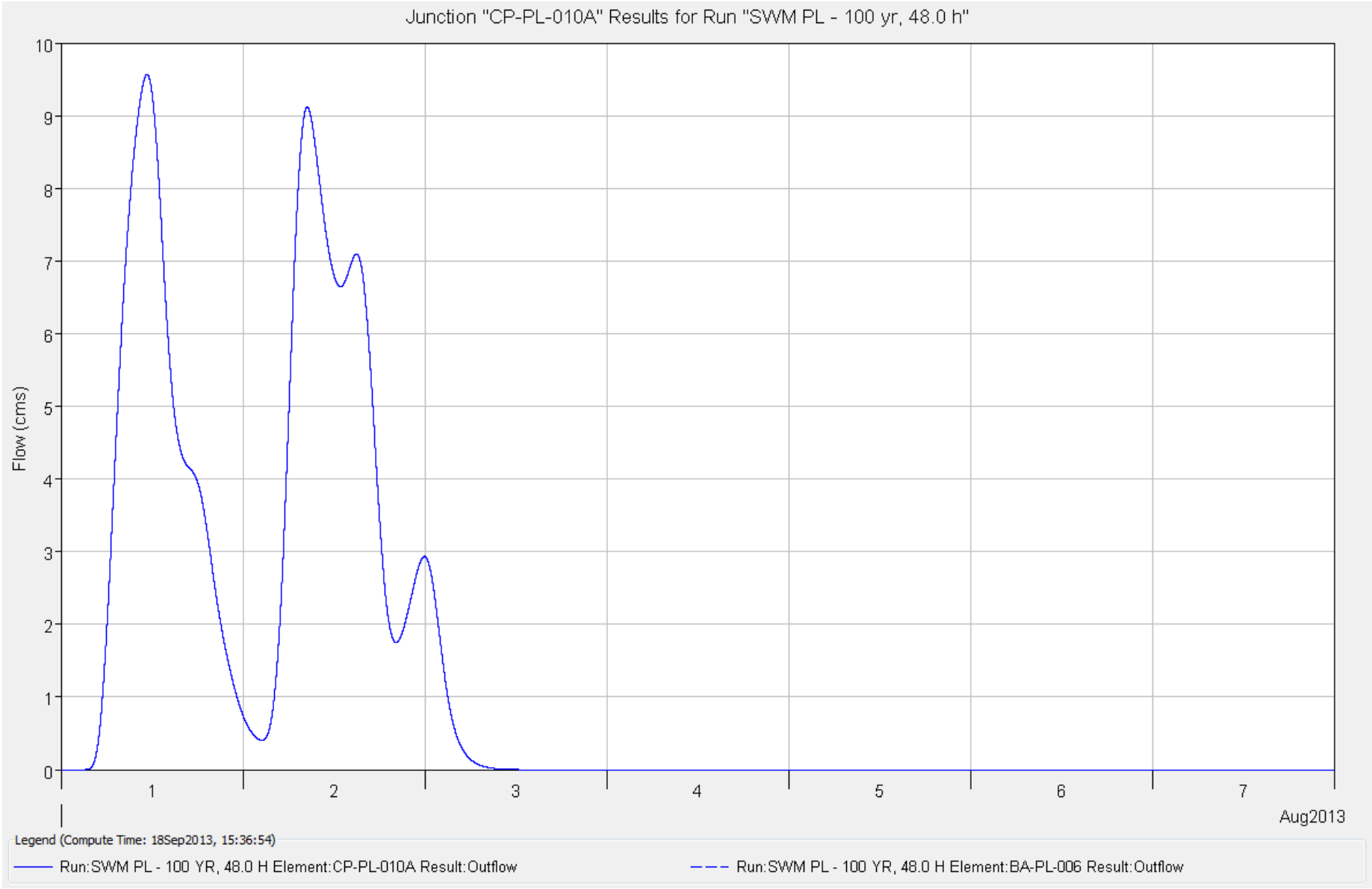

Junction "CP-PL-005" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-004 Result:Outflow

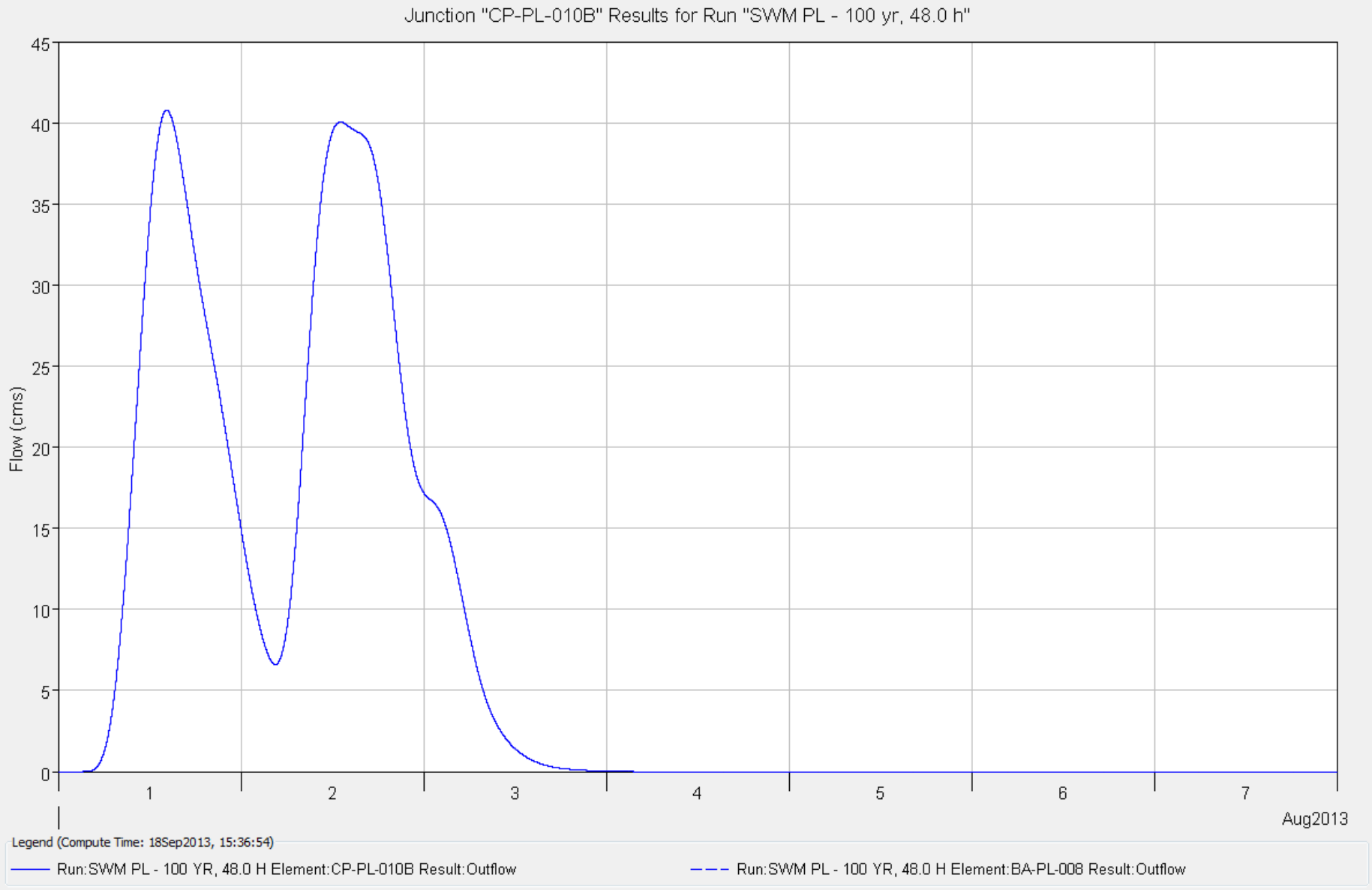

Junction "CP-PL-006" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-006 Result:Outflow

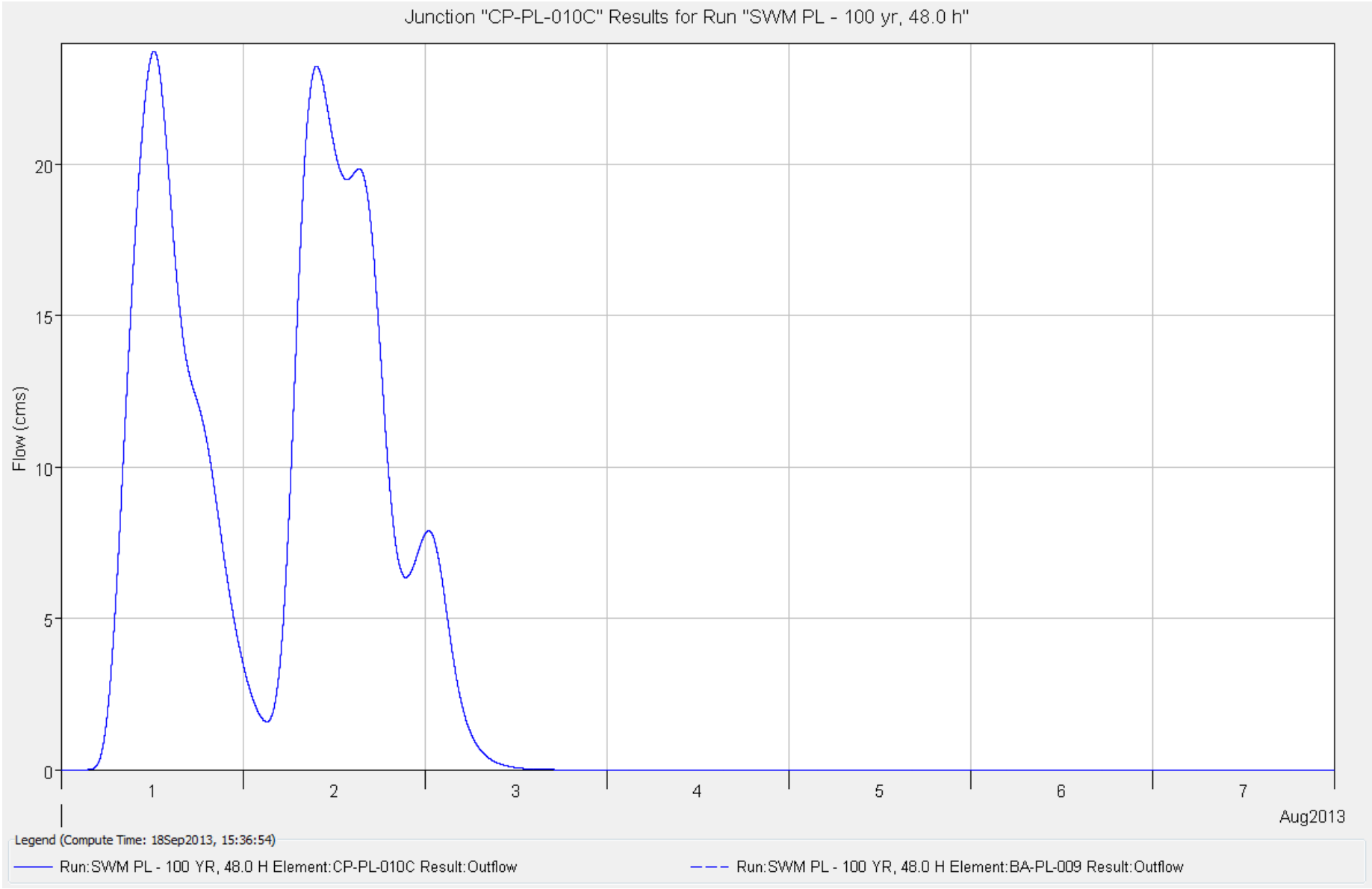

Junction "CP-PL-007" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-005 Result:Outflow

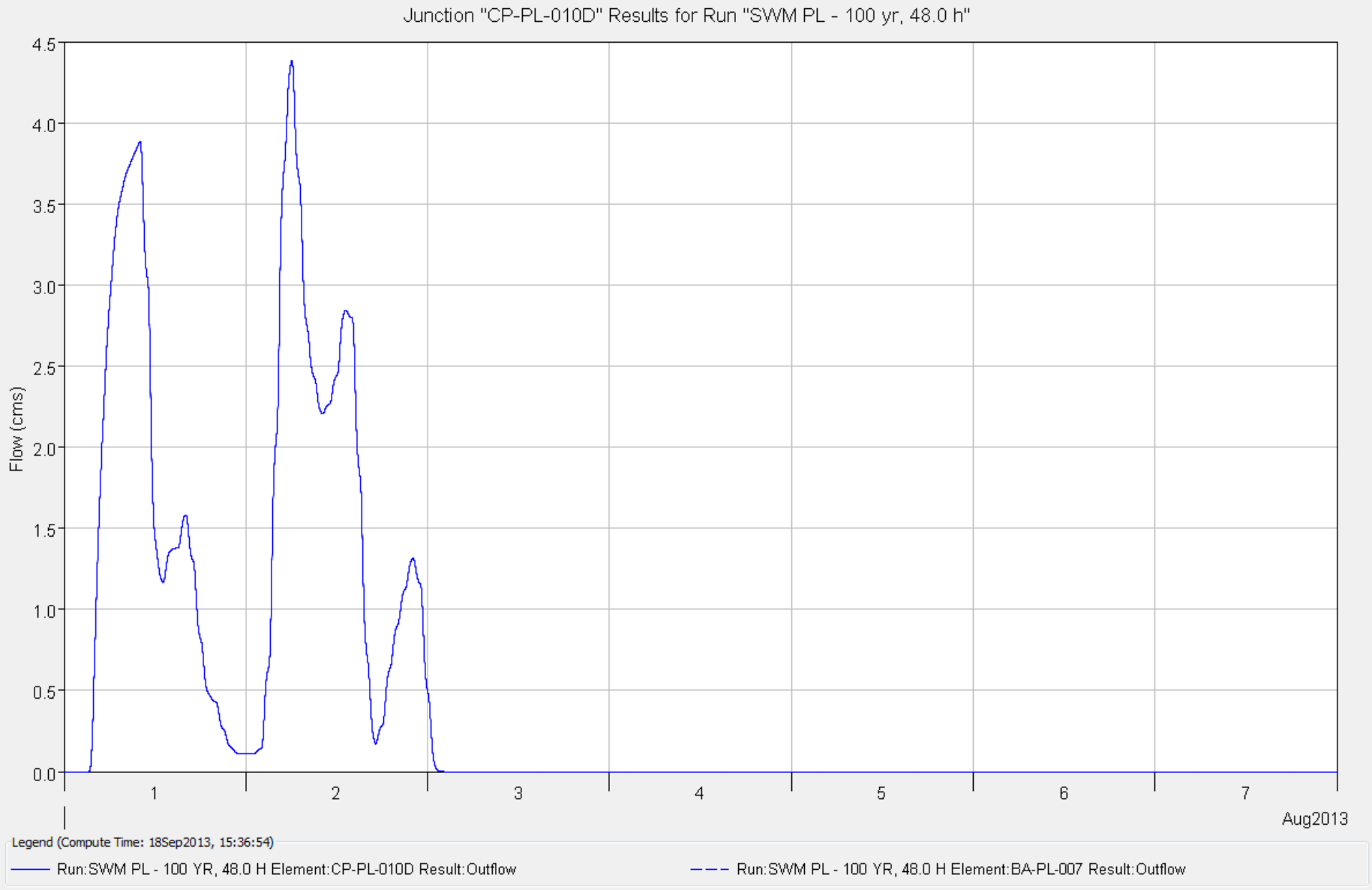

Junction "CP-PL-008" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-006 Result:Outflow

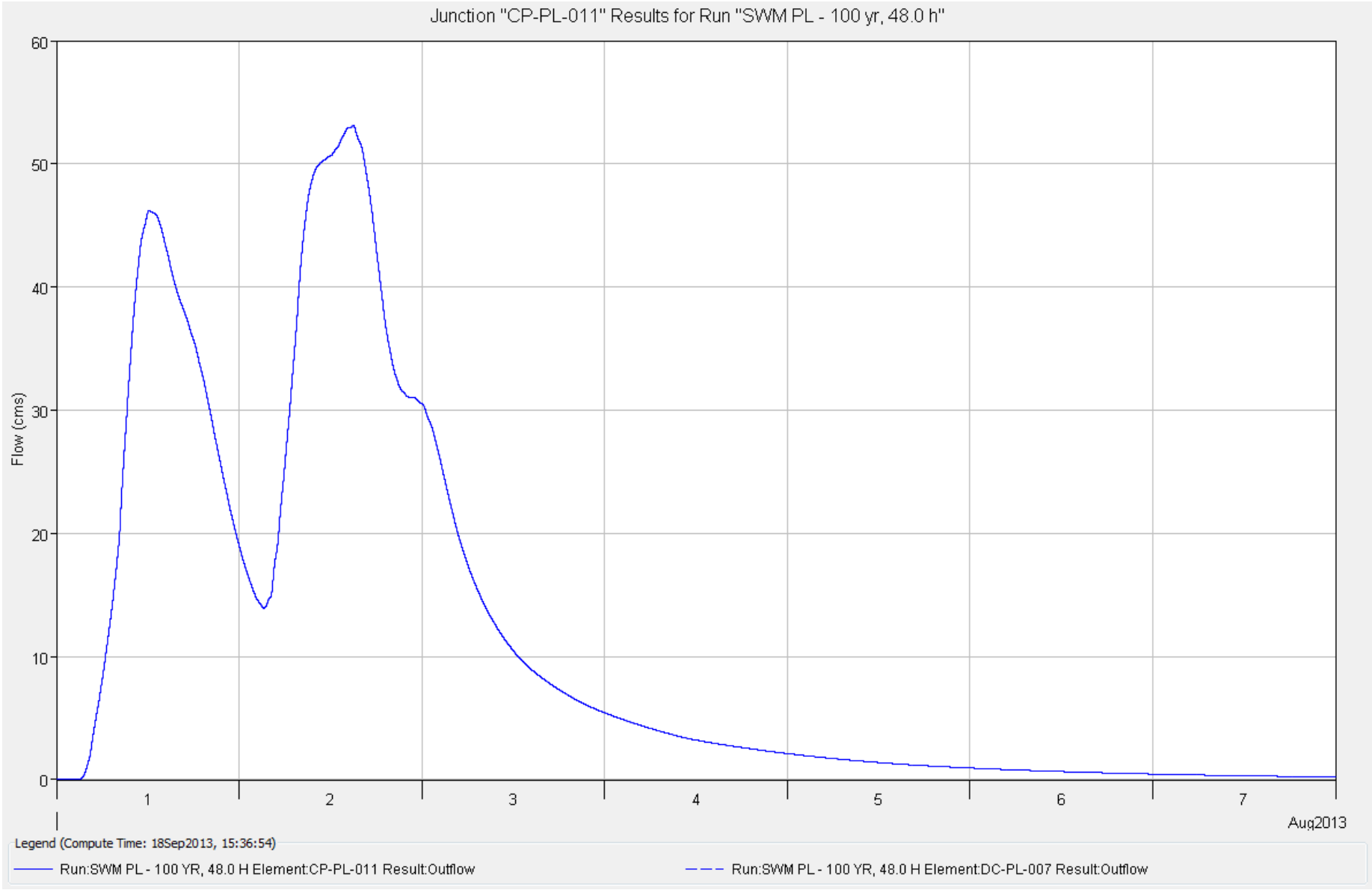

Junction "CP-PL-009" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Outflow

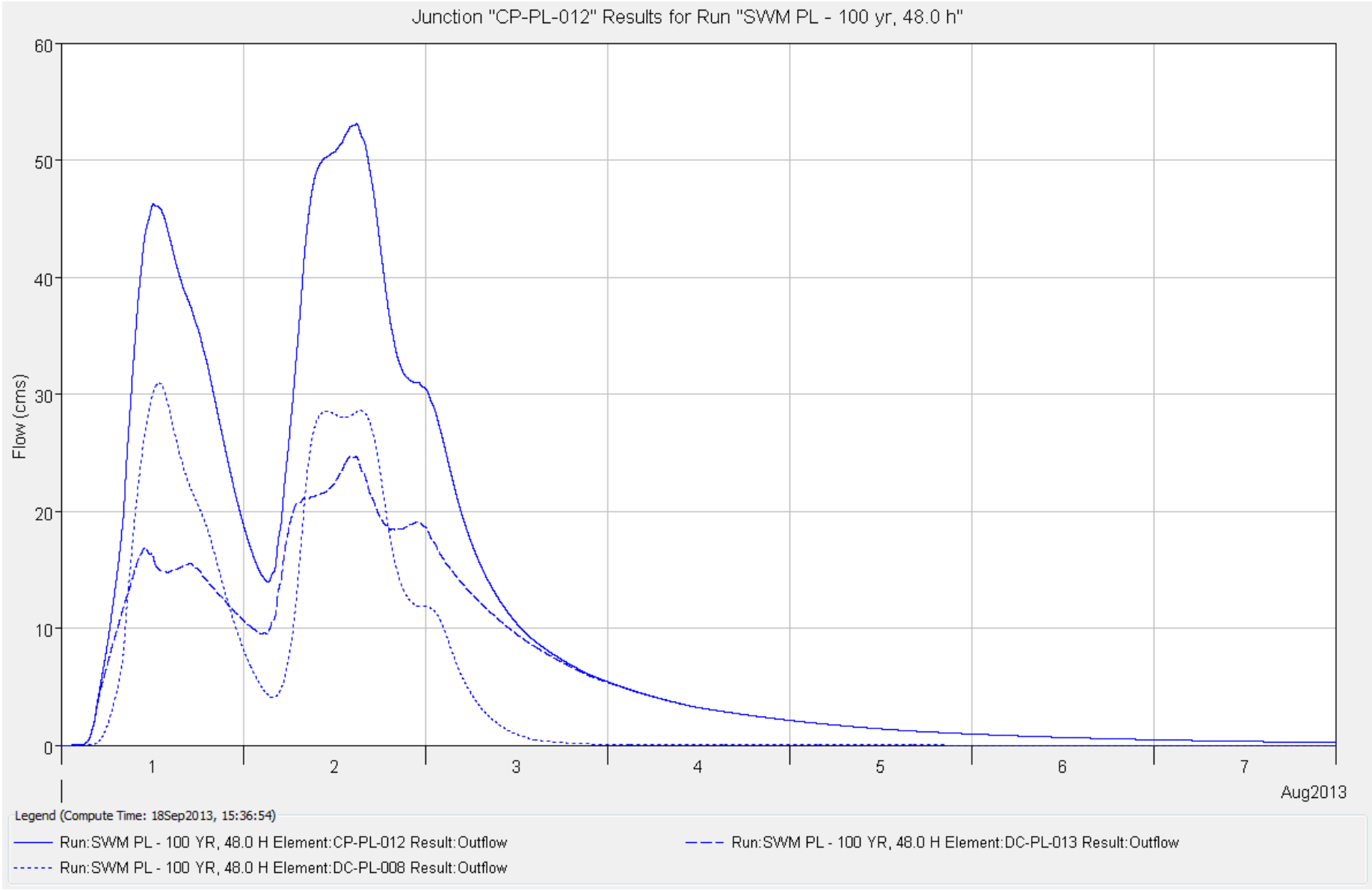

Junction "CP-PL-010A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-006 Result:Outflow

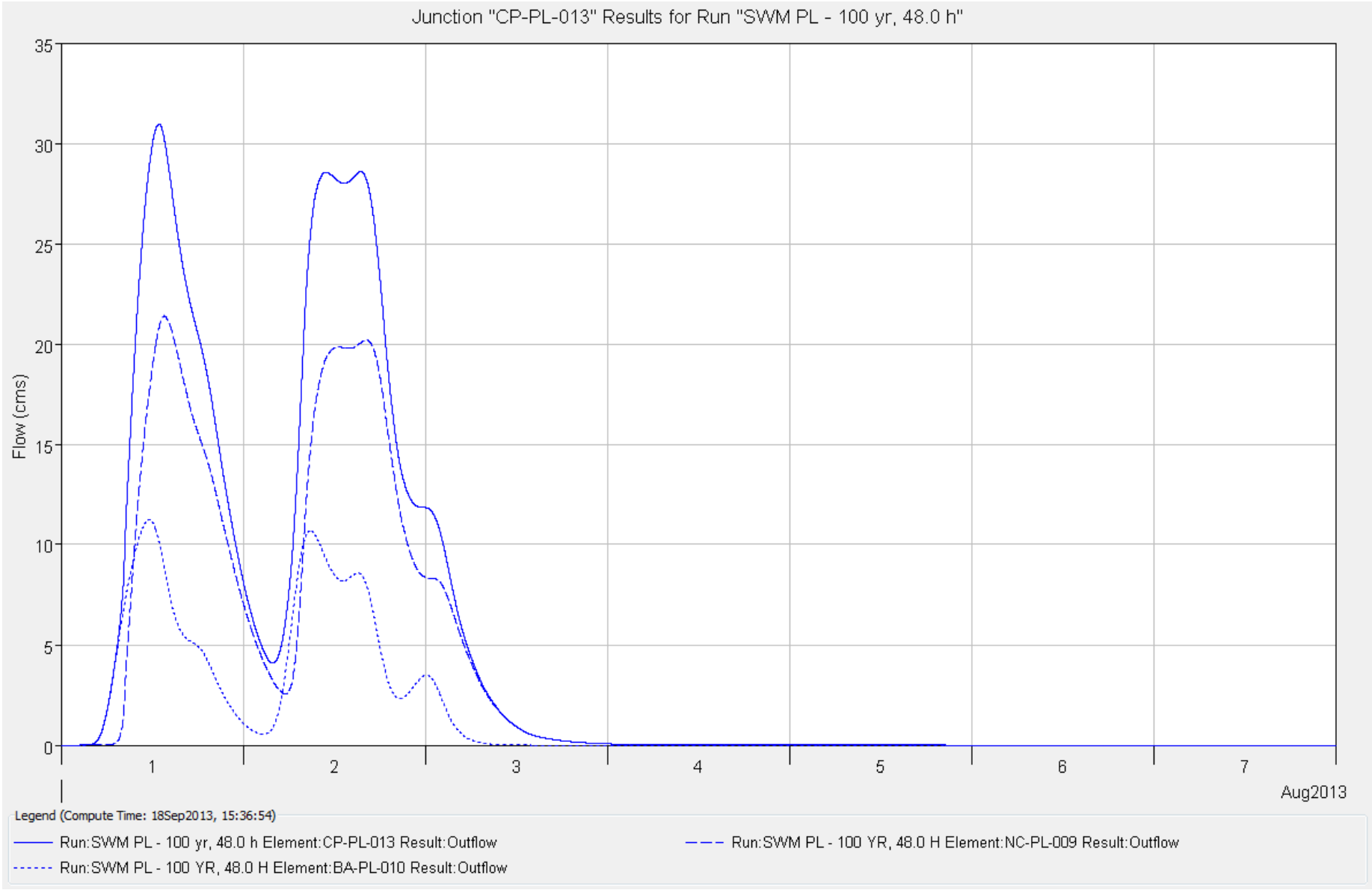

Junction "CP-PL-010B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-008 Result:Outflow

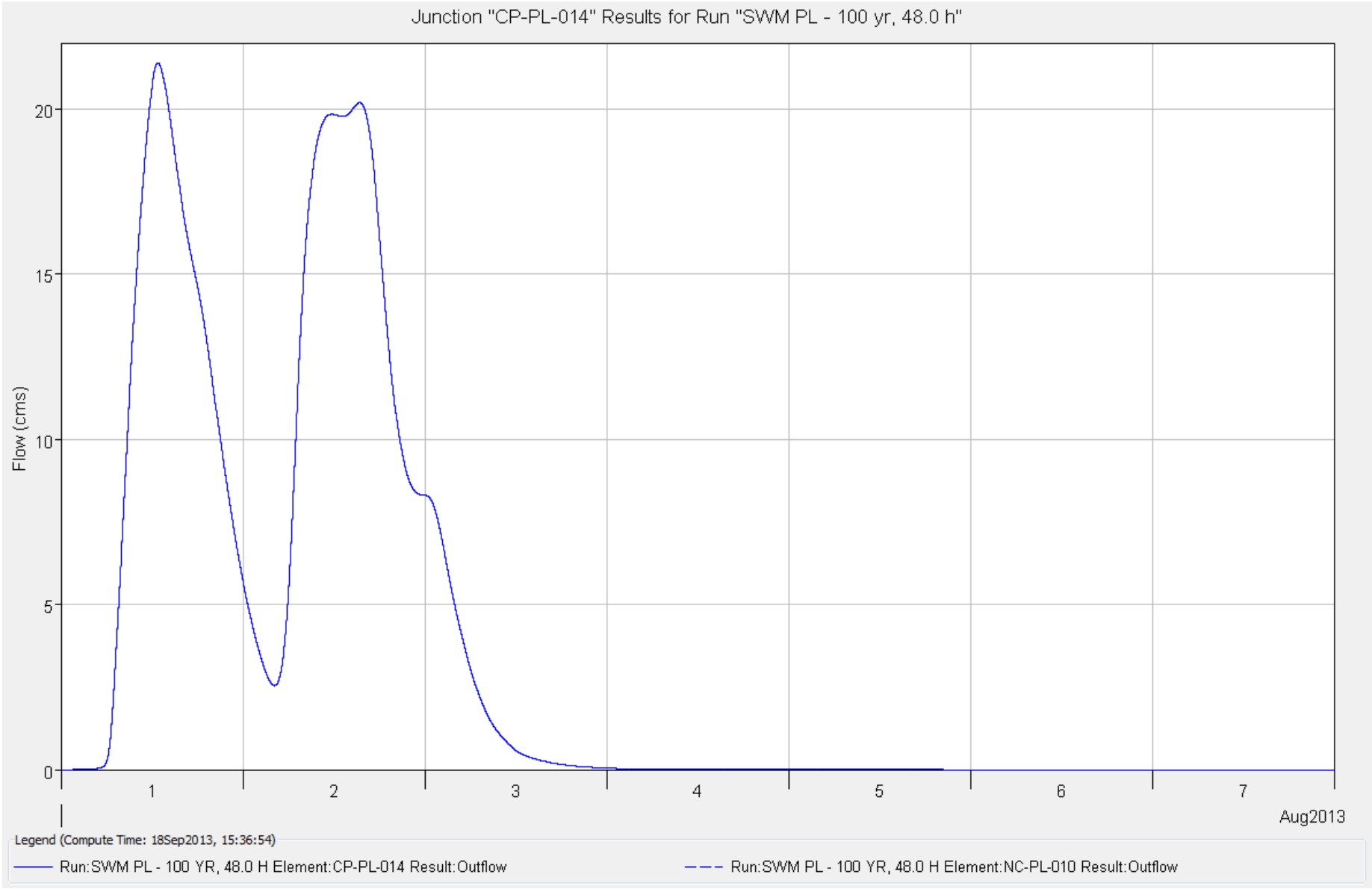

Junction "CP-PL-010C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-009 Result:Outflow

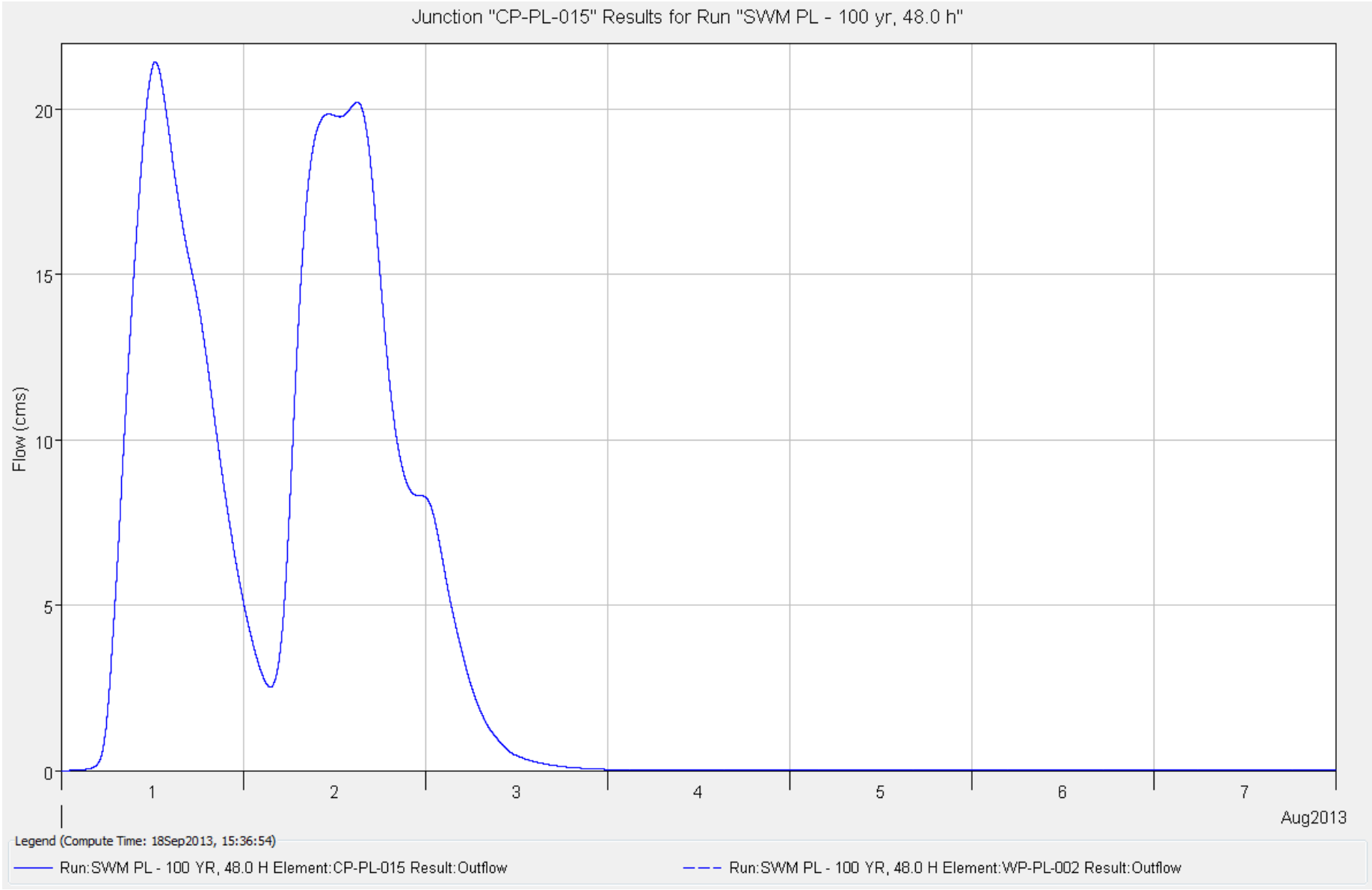

Junction "CP-PL-010D" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010D Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-007 Result:Outflow

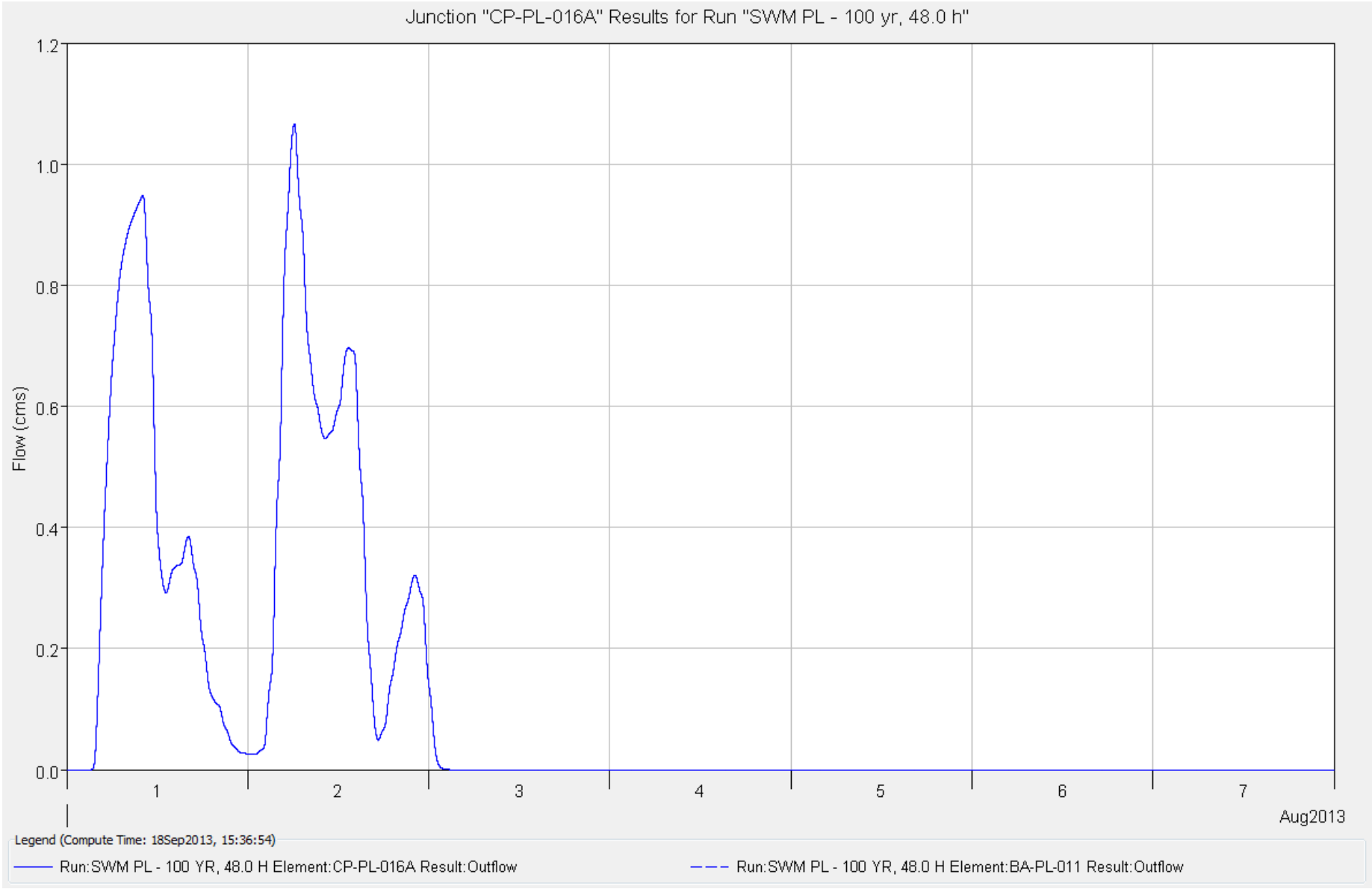

Junction "CP-PL-011" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-007 Result:Outflow

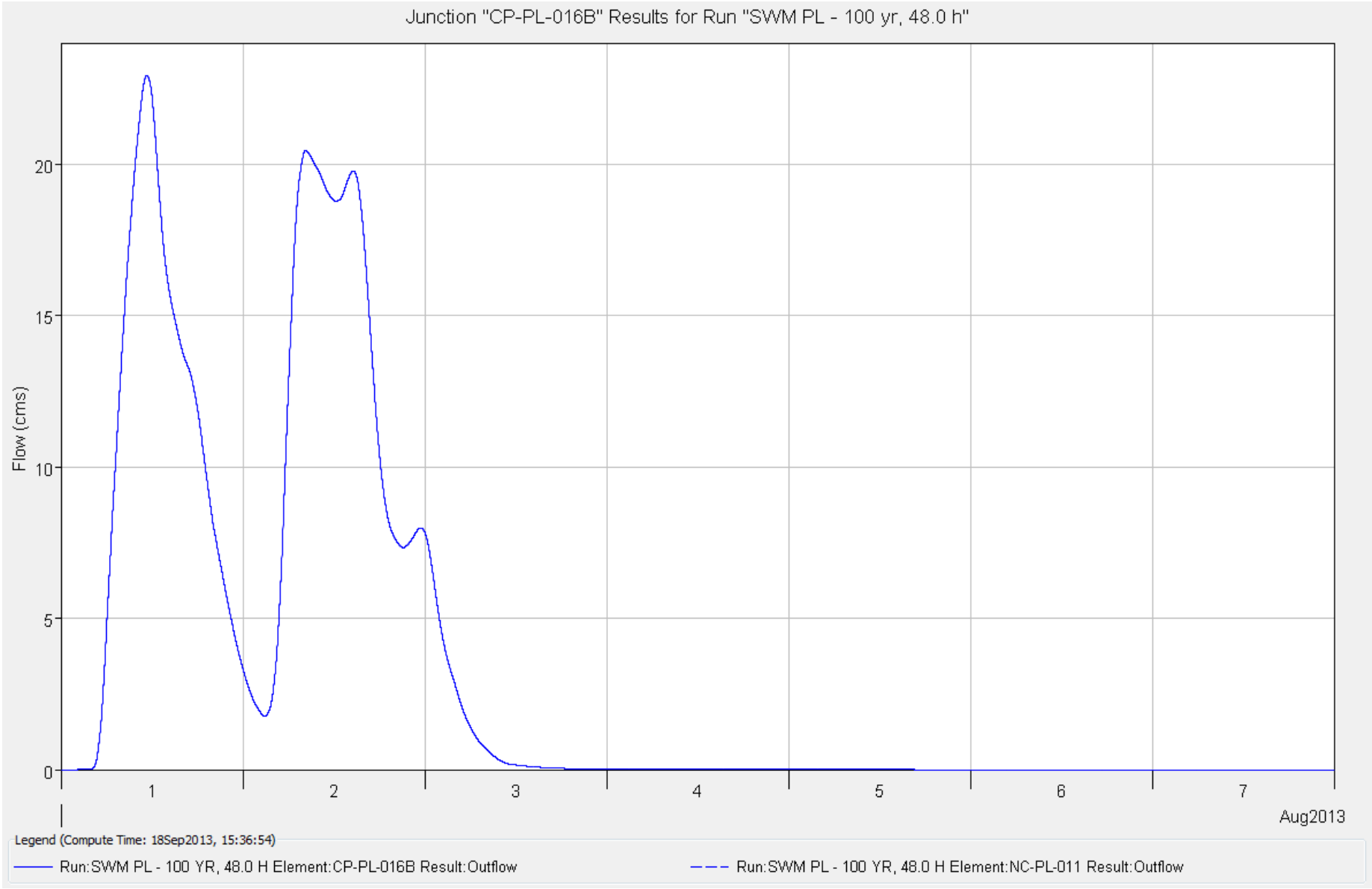

Junction "CP-PL-012" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-008 Result:Outflow

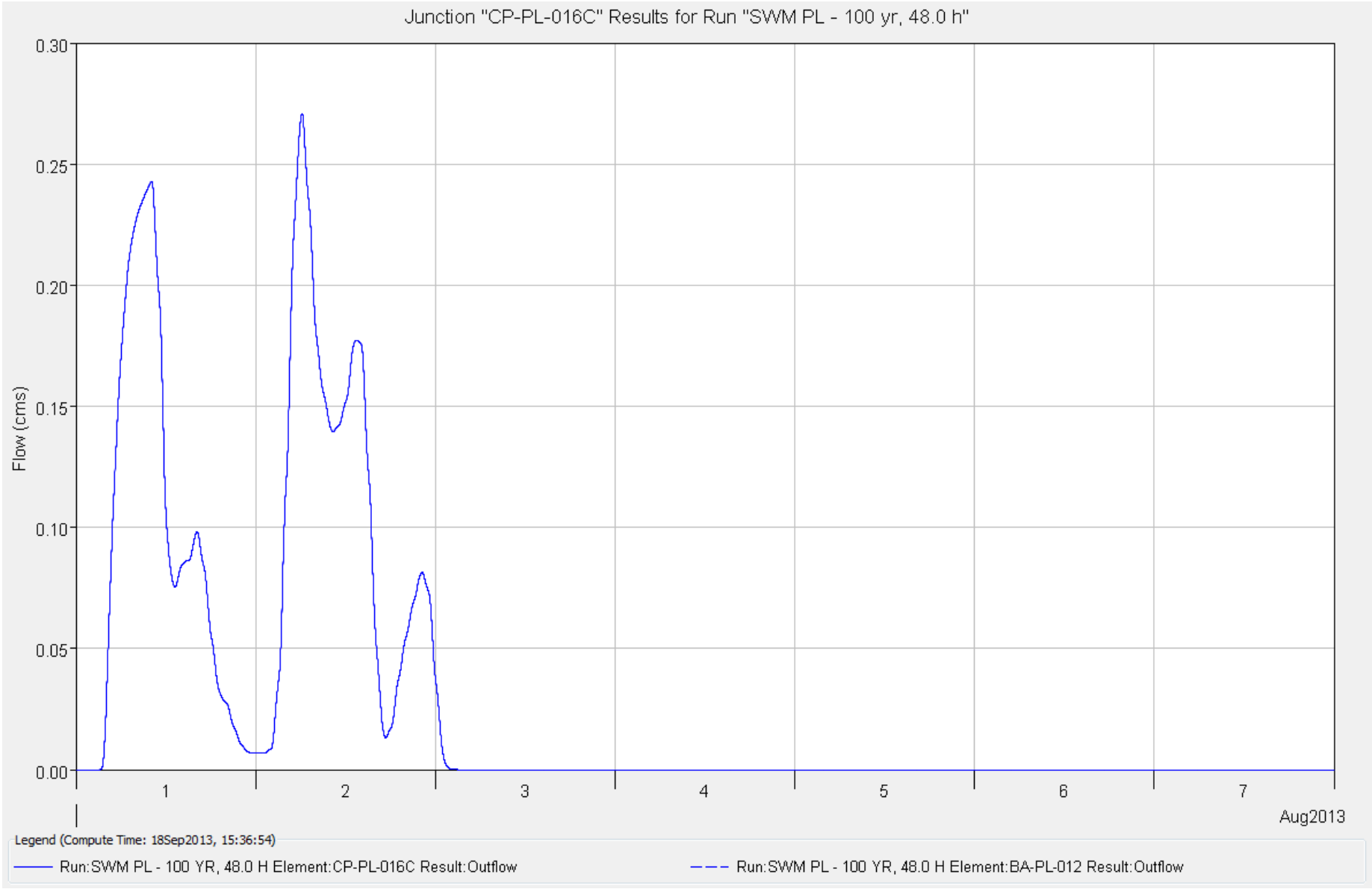

Junction "CP-PL-013" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-010 Result:Outflow

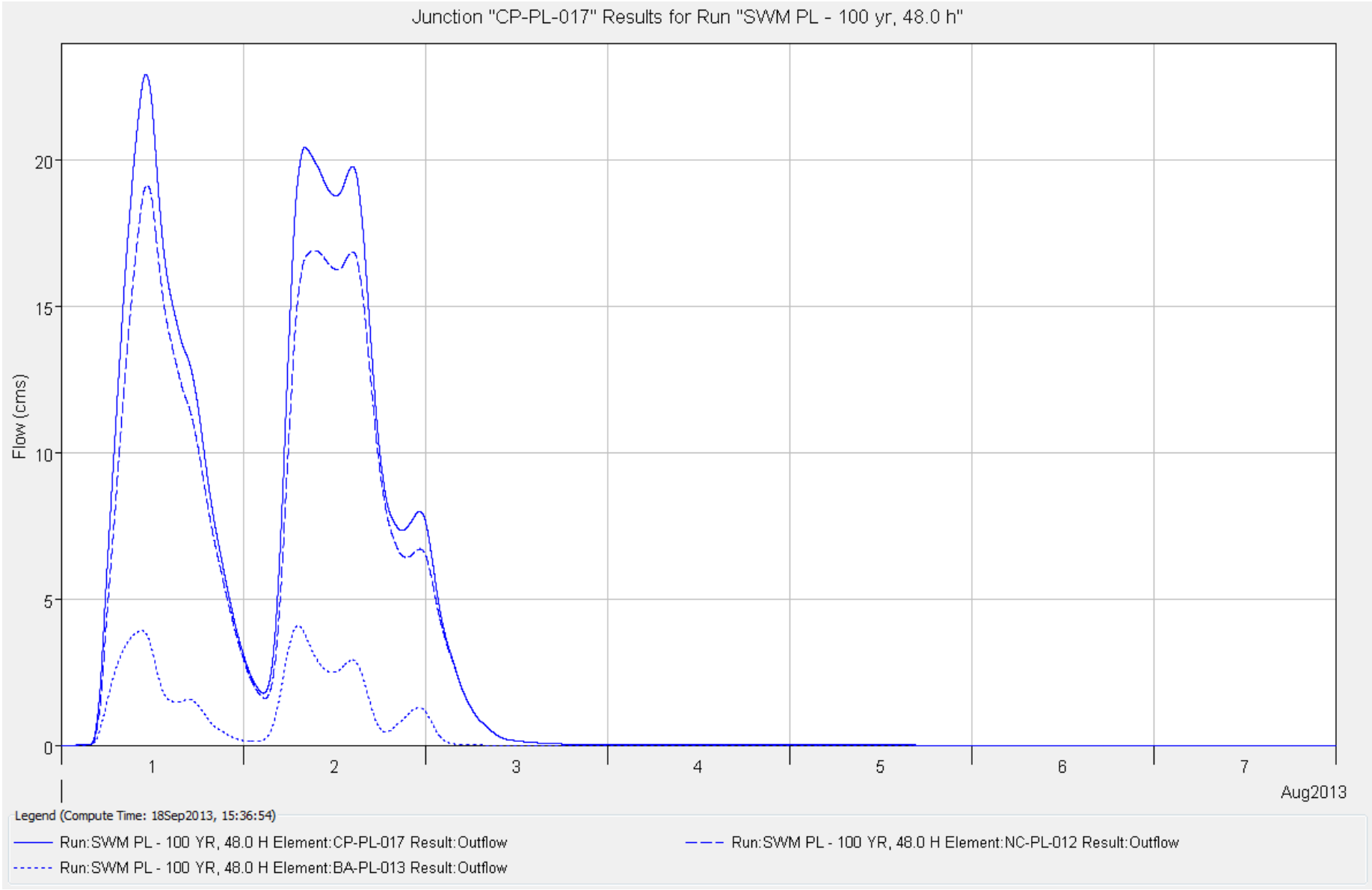

Junction "CP-PL-014" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-010 Result:Outflow

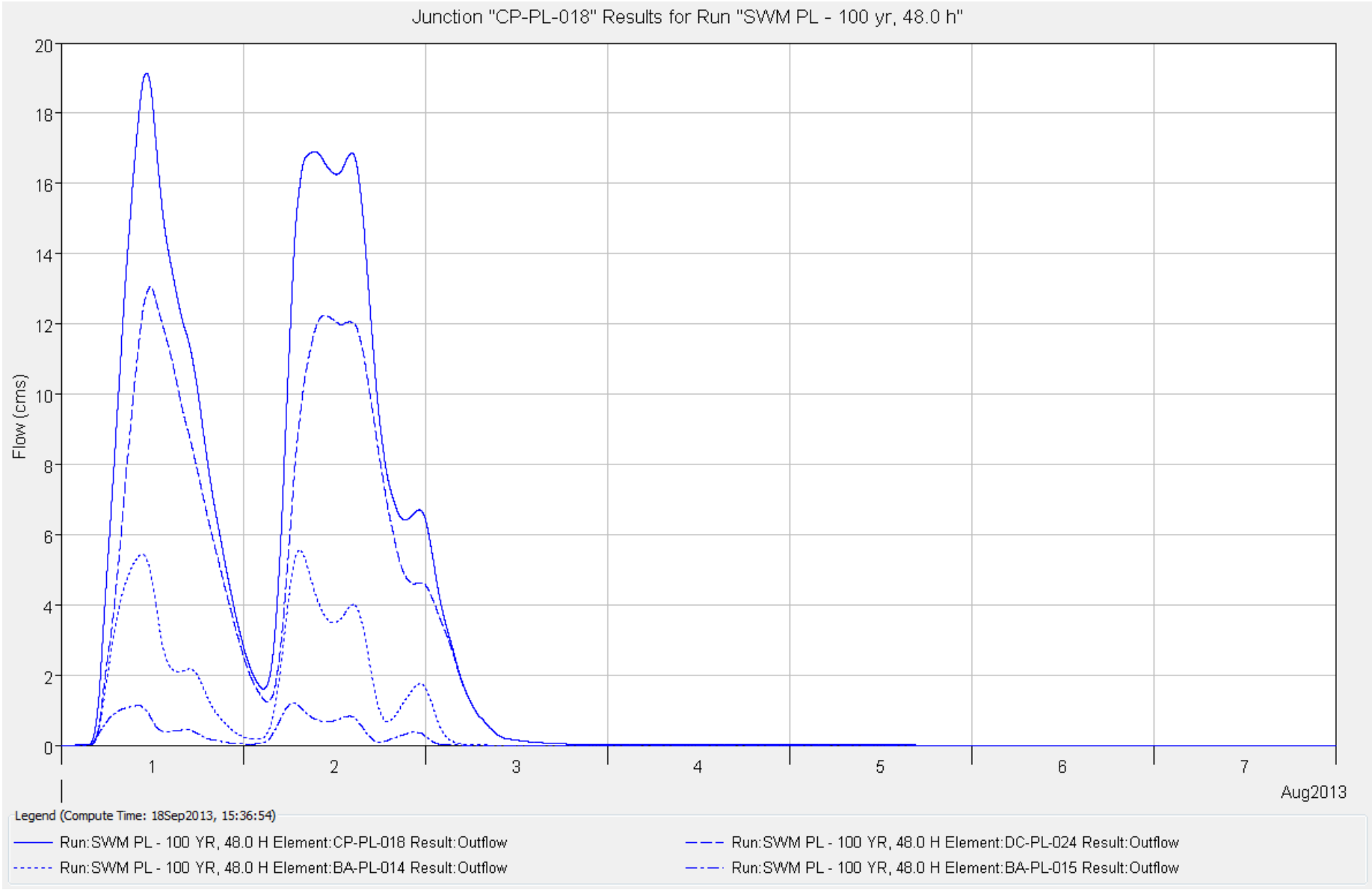

Junction "CP-PL-015" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Outflow

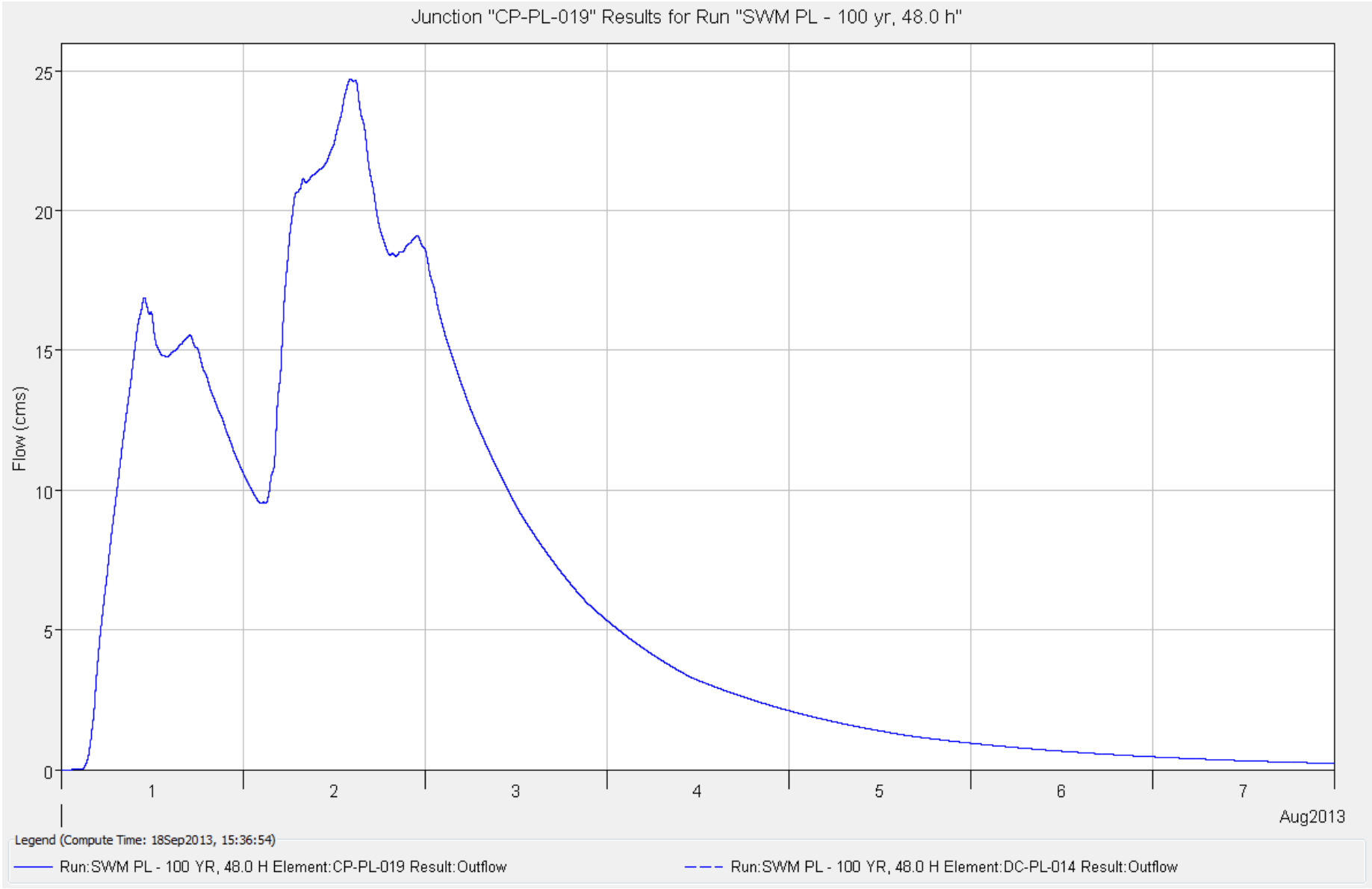

Junction "CP-PL-016A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-011 Result:Outflow

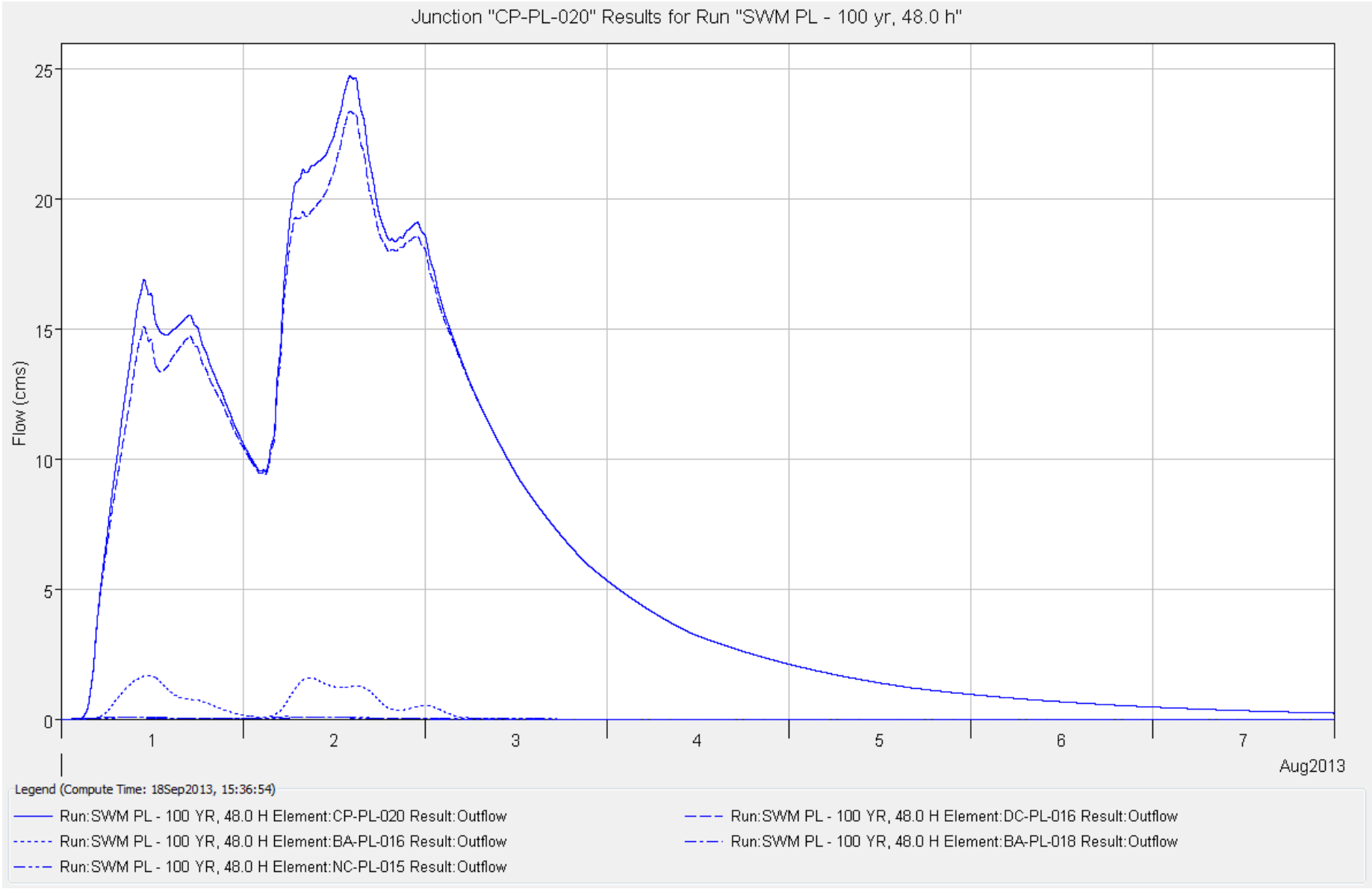

Junction "CP-PL-016B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-011 Result:Outflow

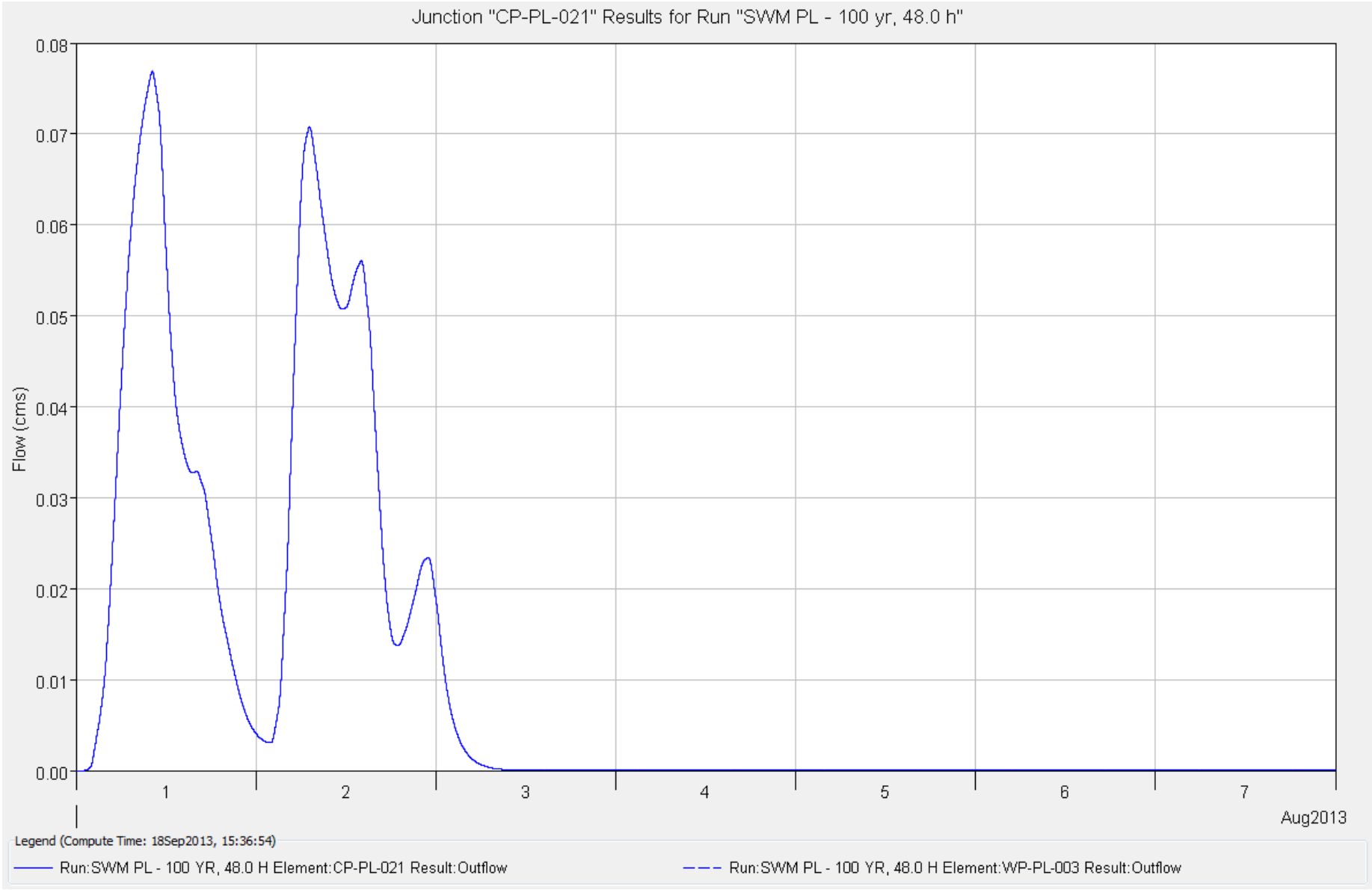

Junction "CP-PL-016C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-012 Result:Outflow

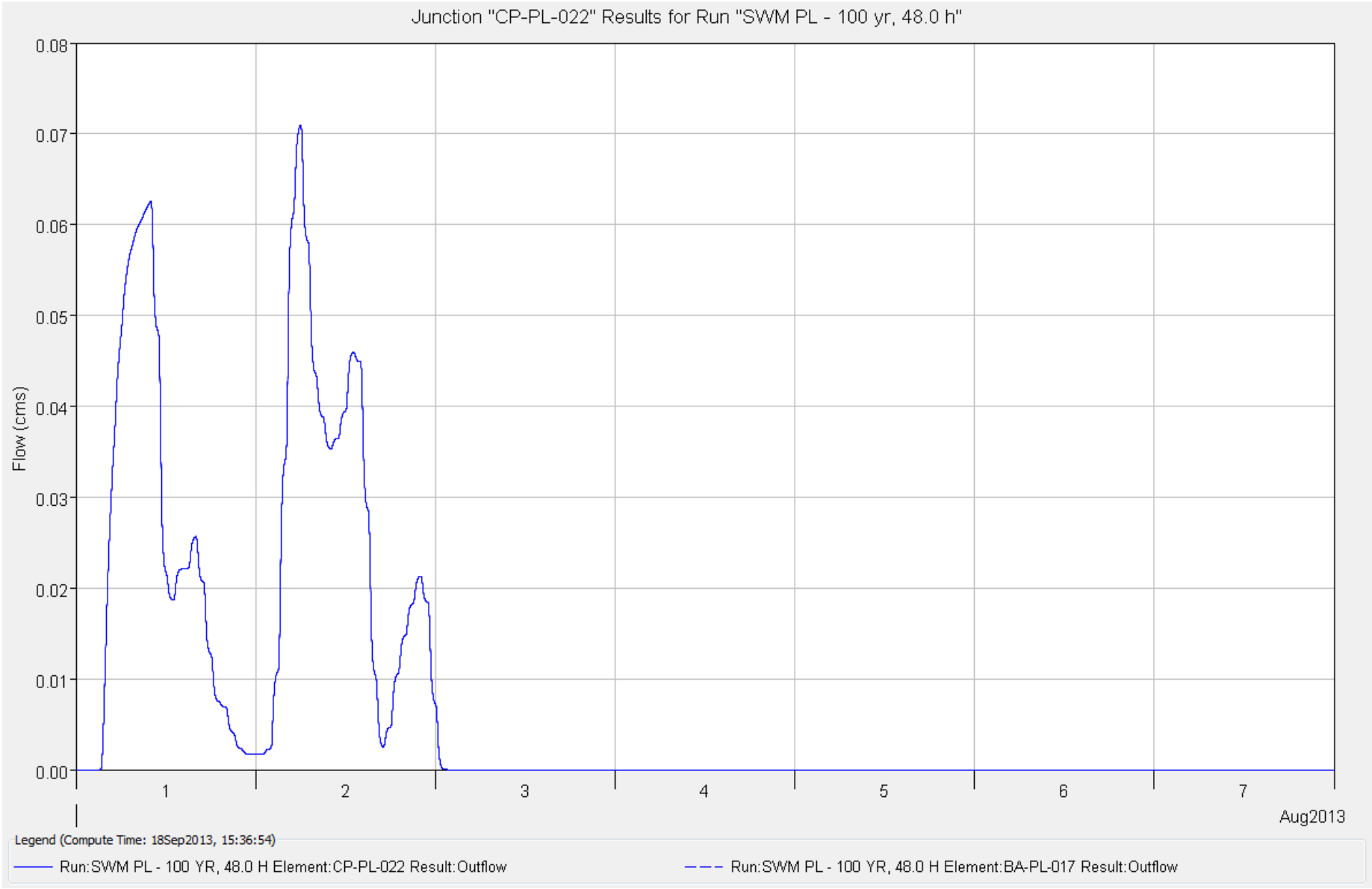

Junction "CP-PL-017" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-013 Result:Outflow

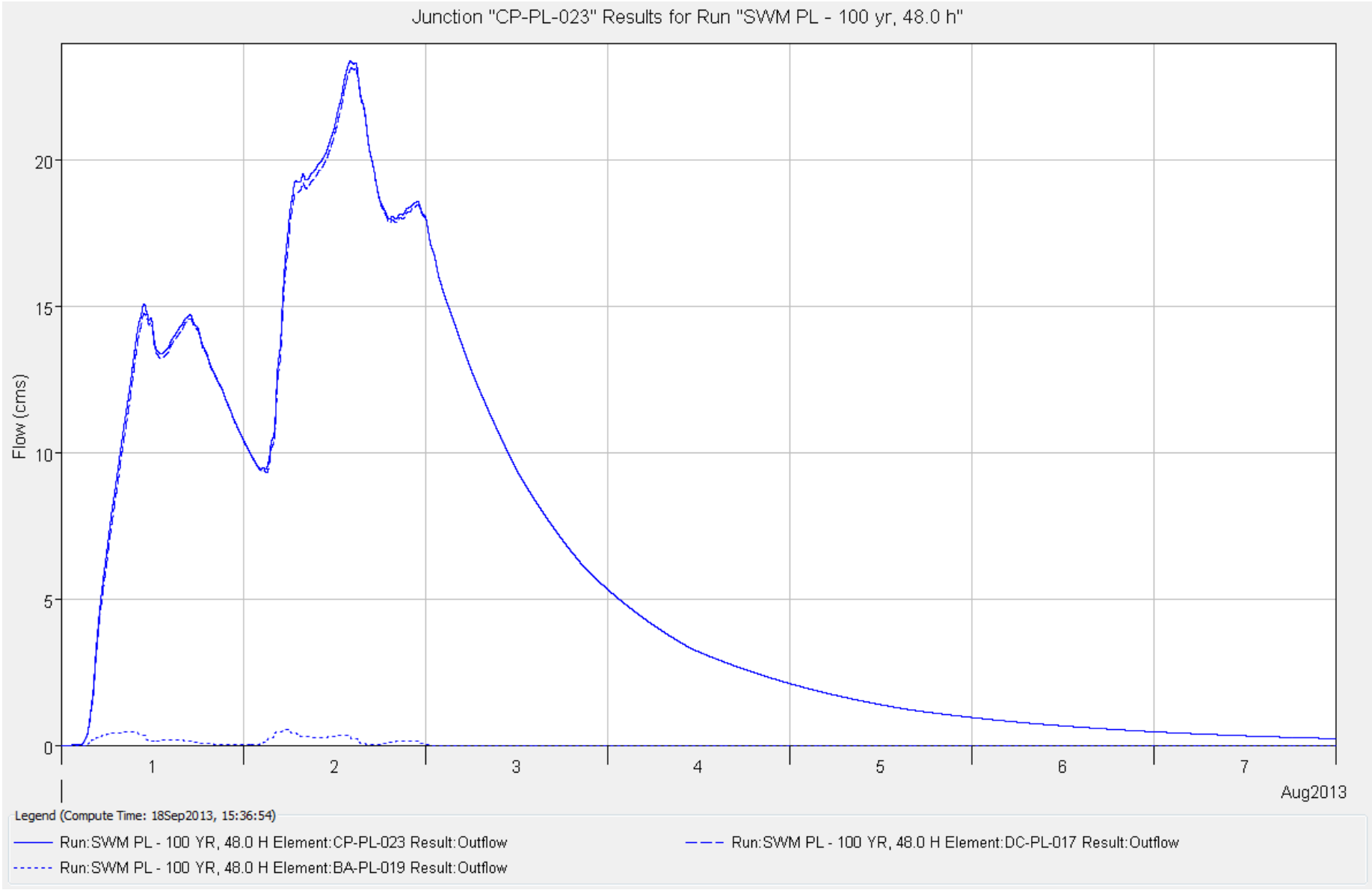

Junction "CP-PL-018" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-015 Result:Outflow

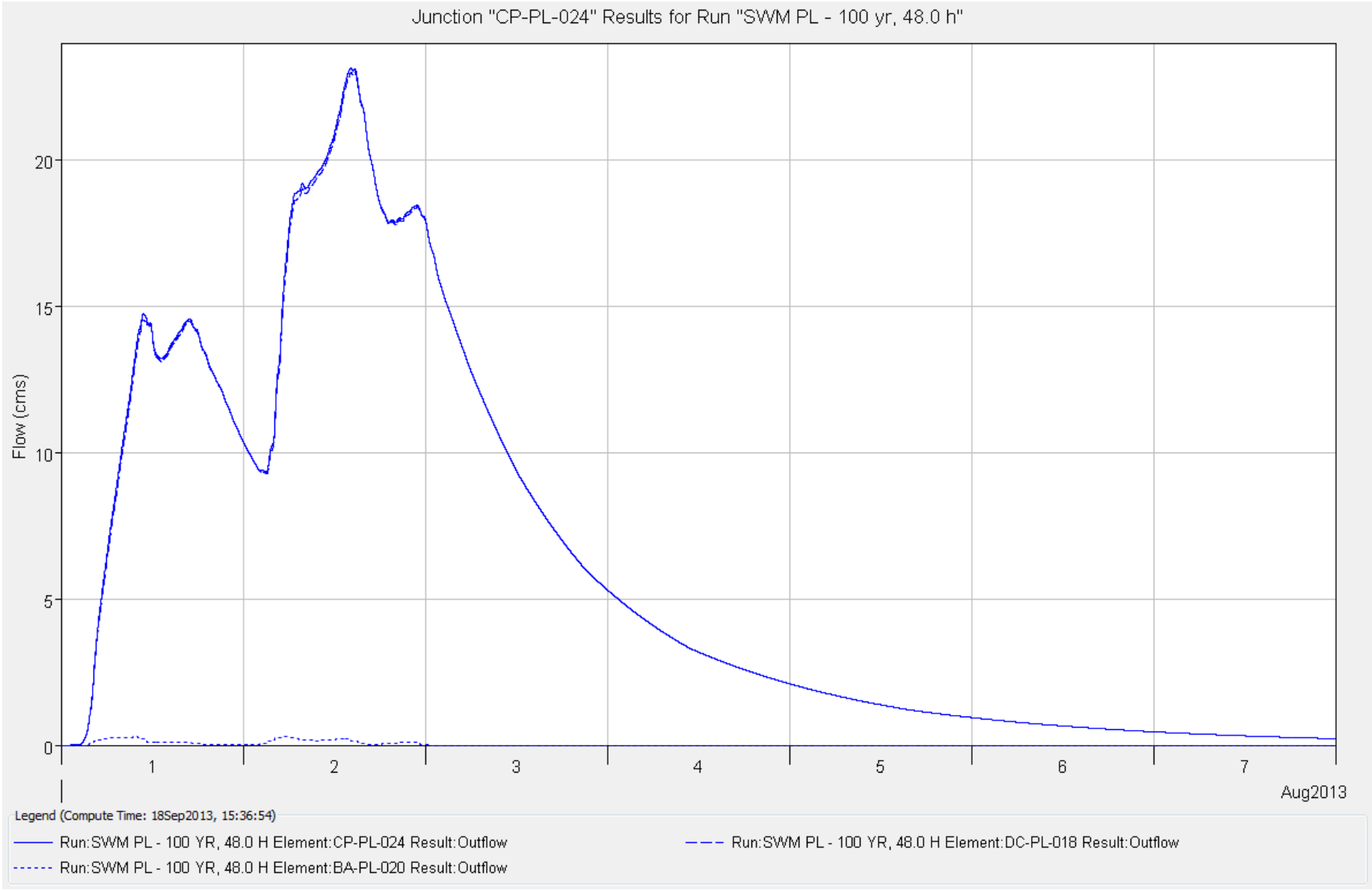

Junction "CP-PL-019" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-014 Result:Outflow

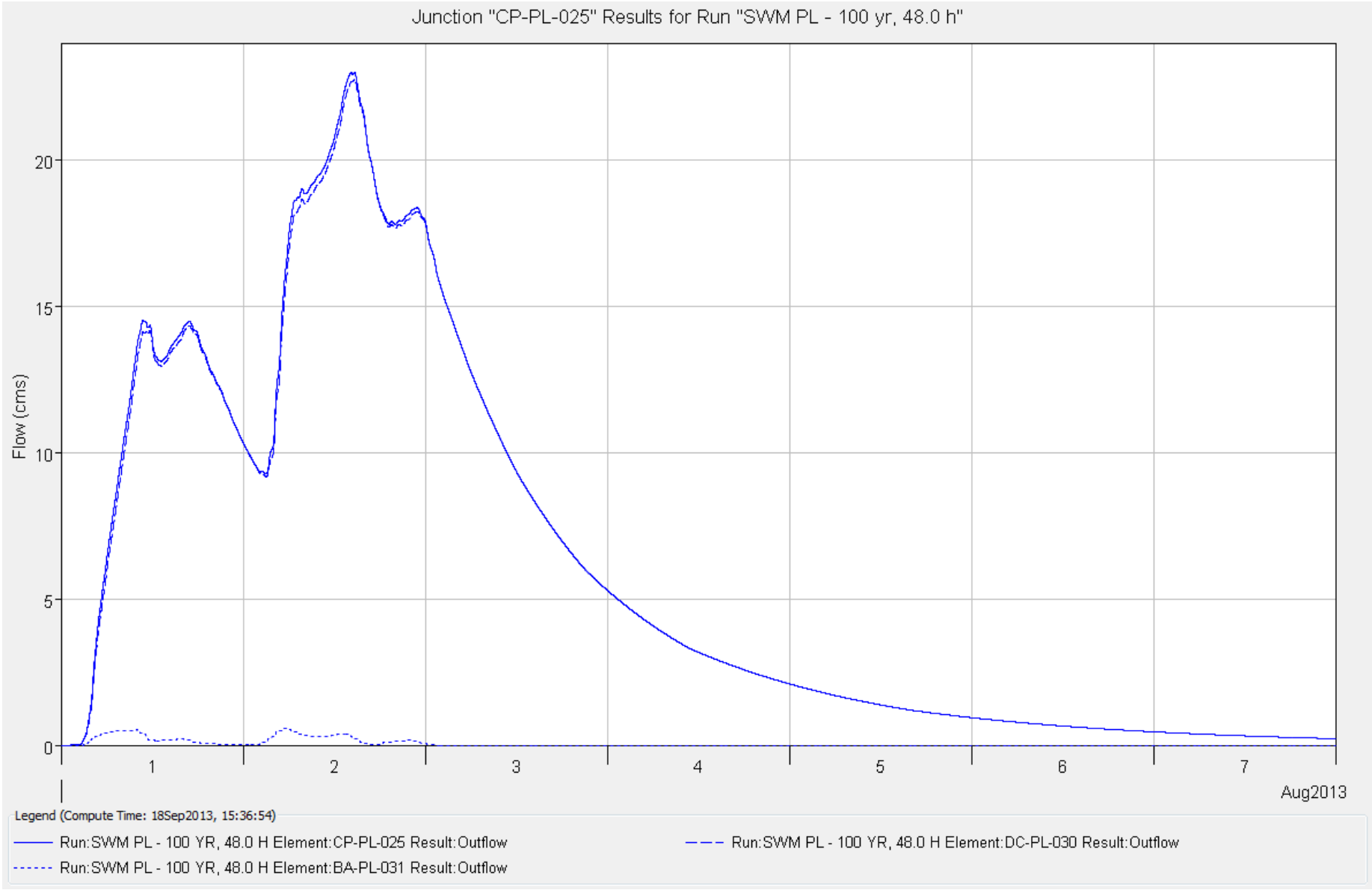

Junction "CP-PL-020" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-018 Result:Outflow

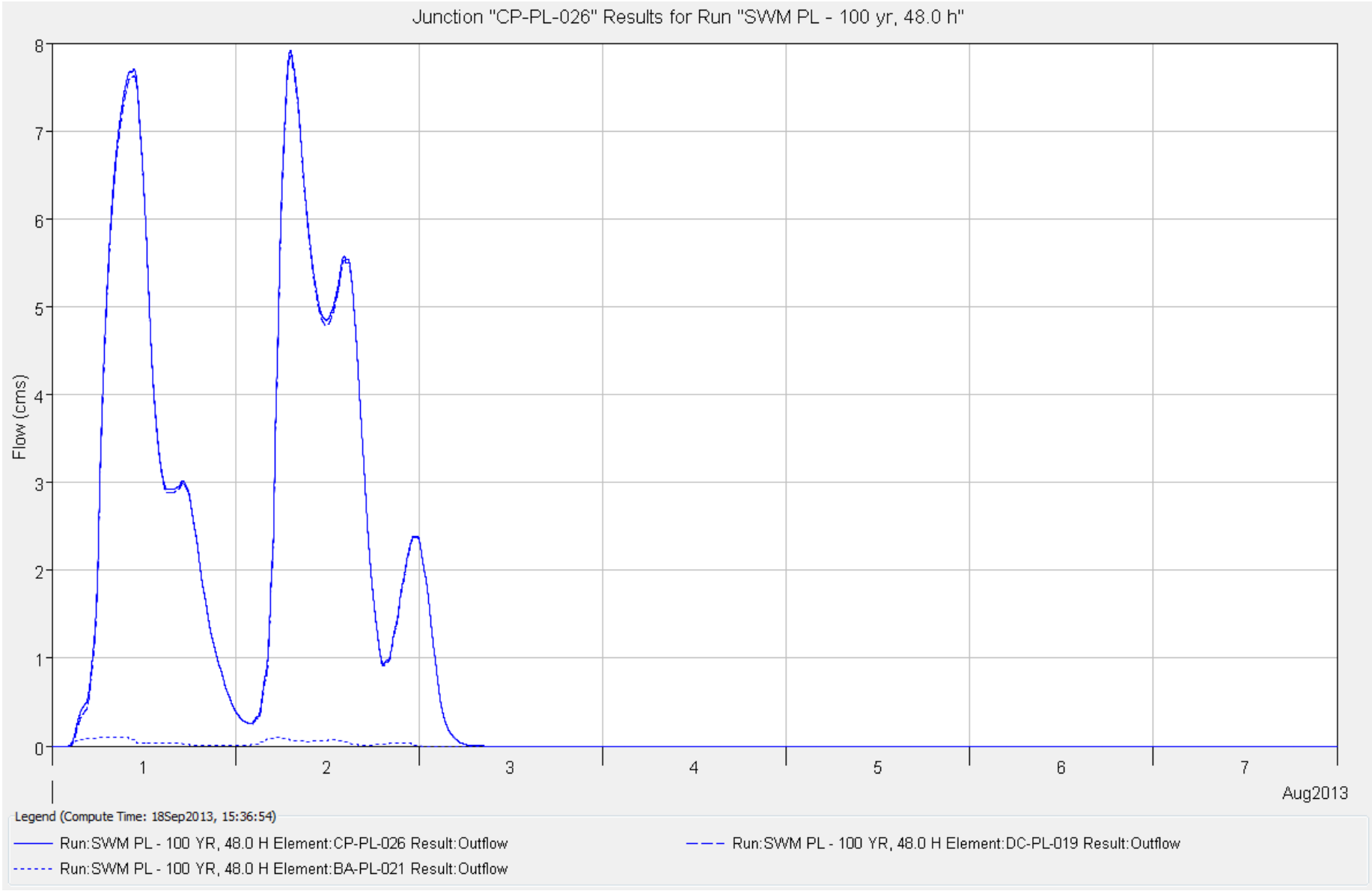

Junction "CP-PL-021" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Outflow

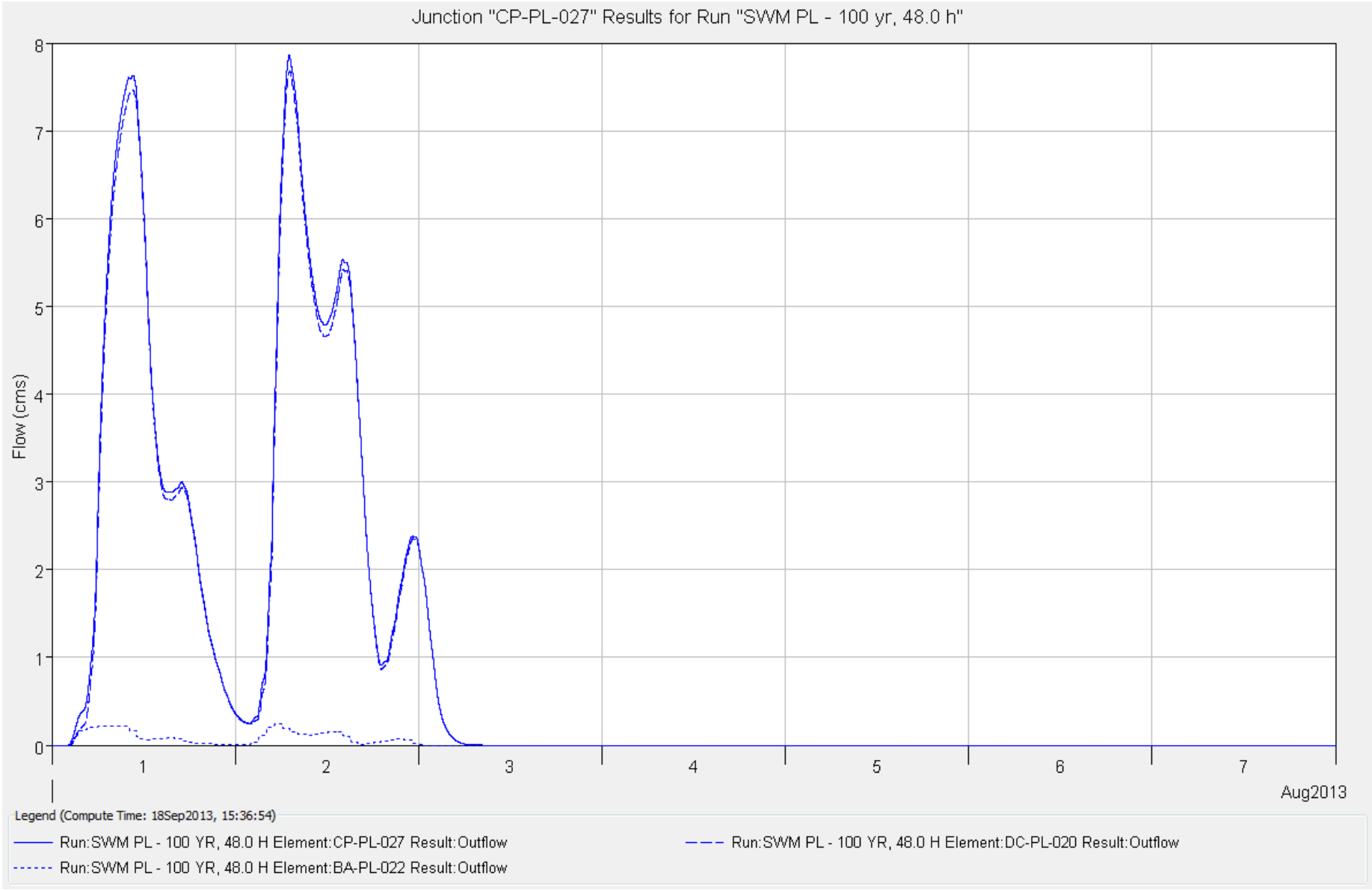

Junction "CP-PL-022" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-017 Result:Outflow

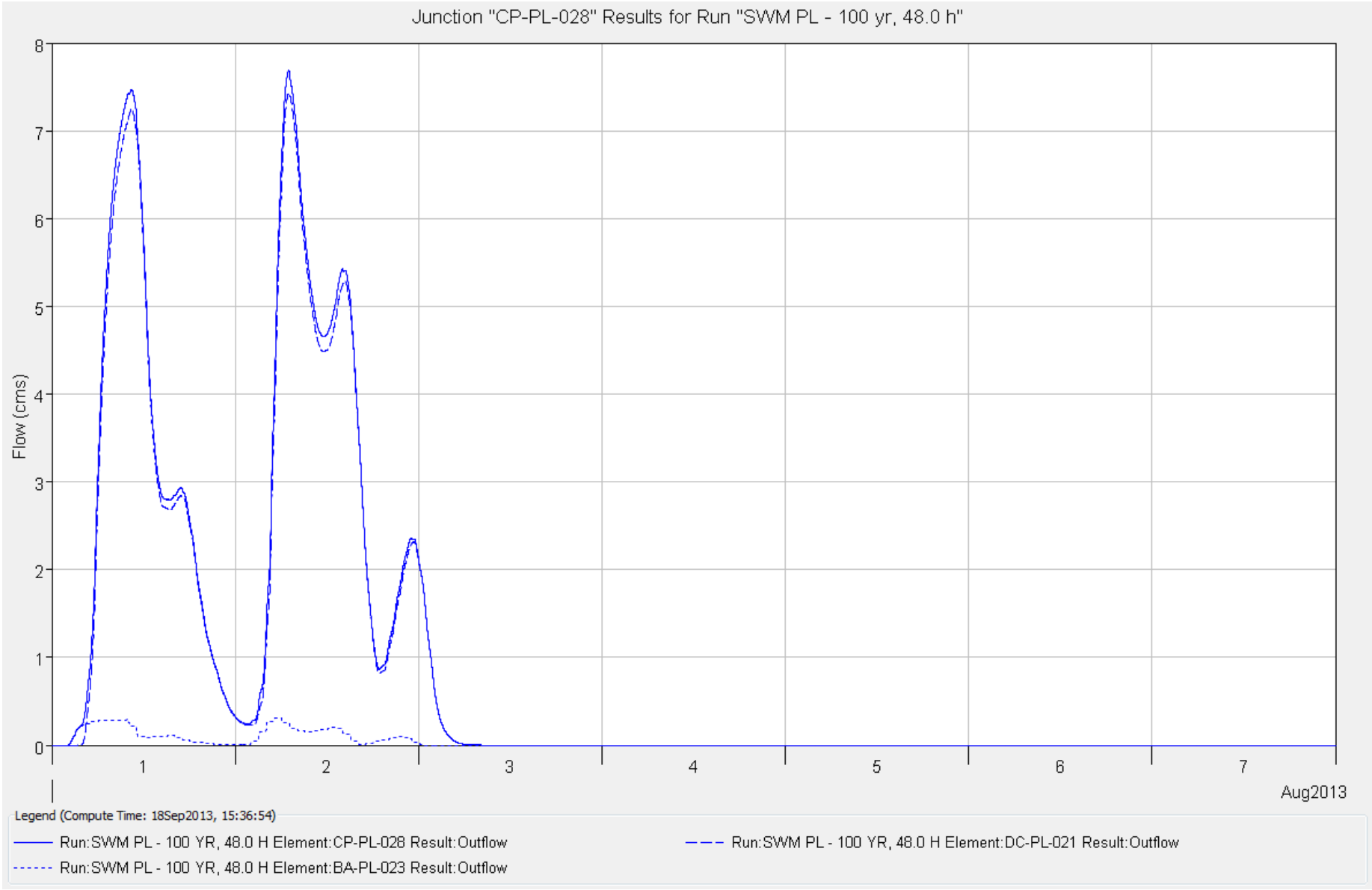

Junction "CP-PL-023" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-019 Result:Outflow

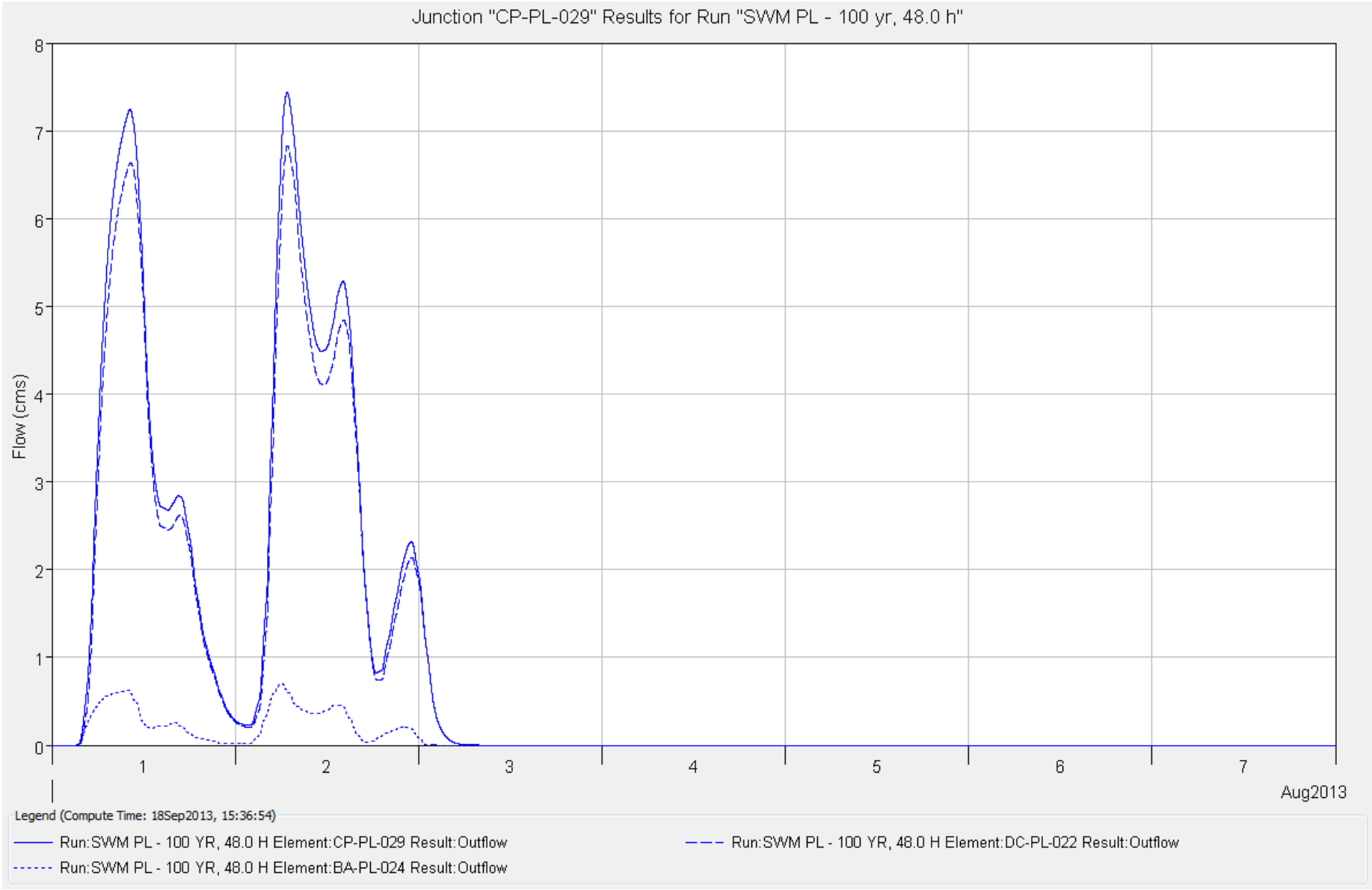

Junction "CP-PL-024" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-020 Result:Outflow

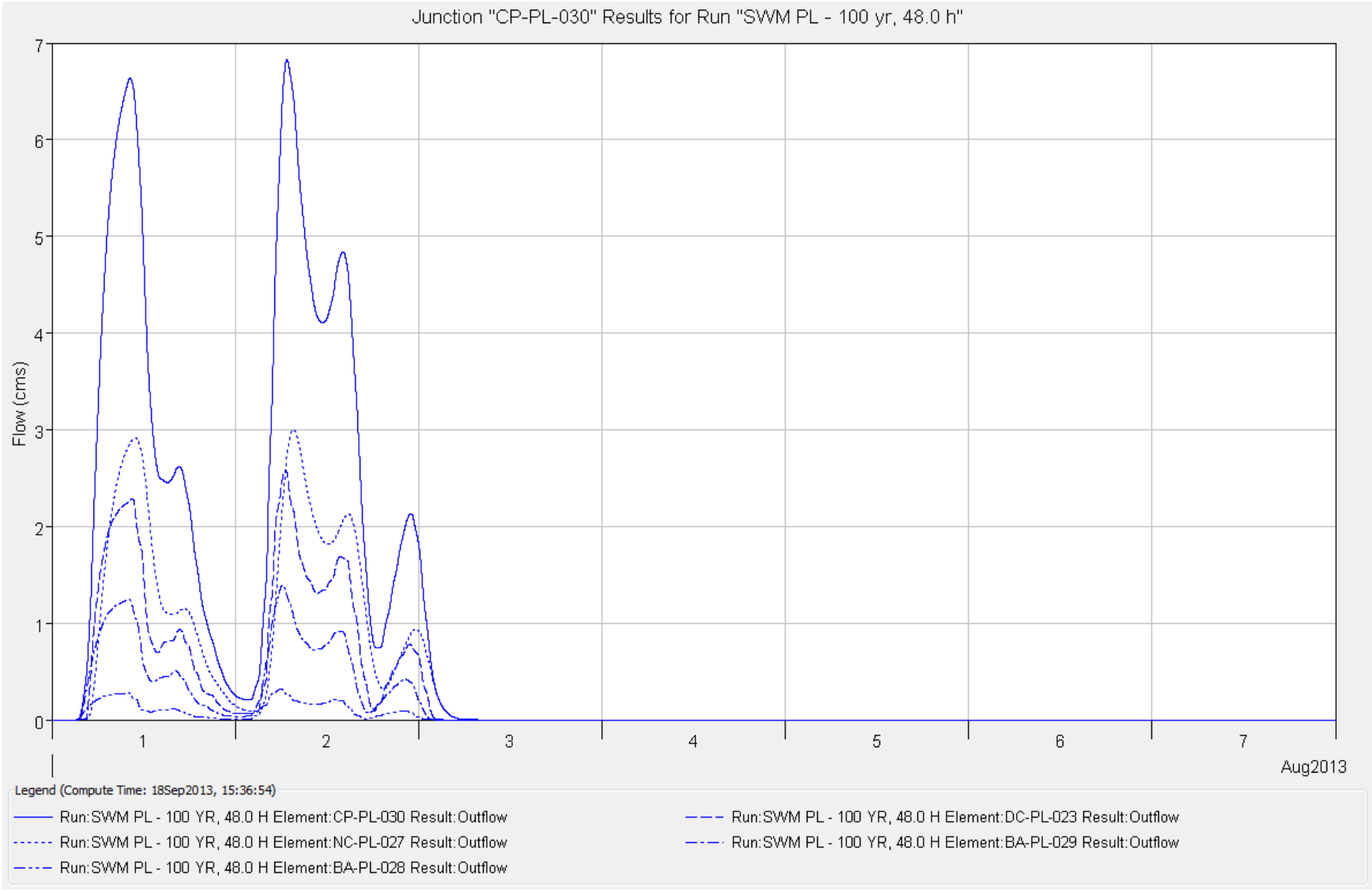

Junction "CP-PL-025" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-025 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-031 Result:Outflow

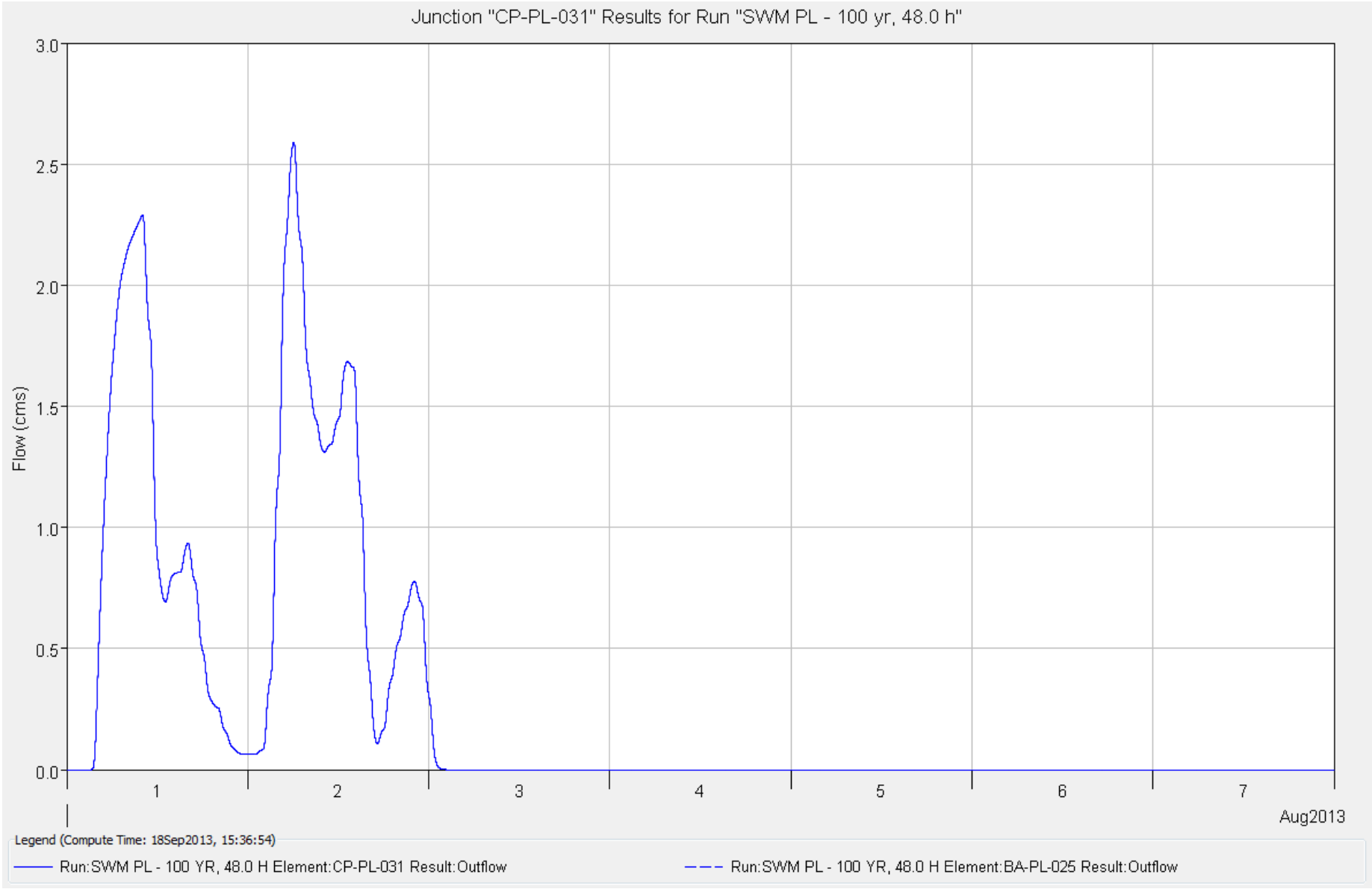

Junction "CP-PL-026" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-021 Result:Outflow

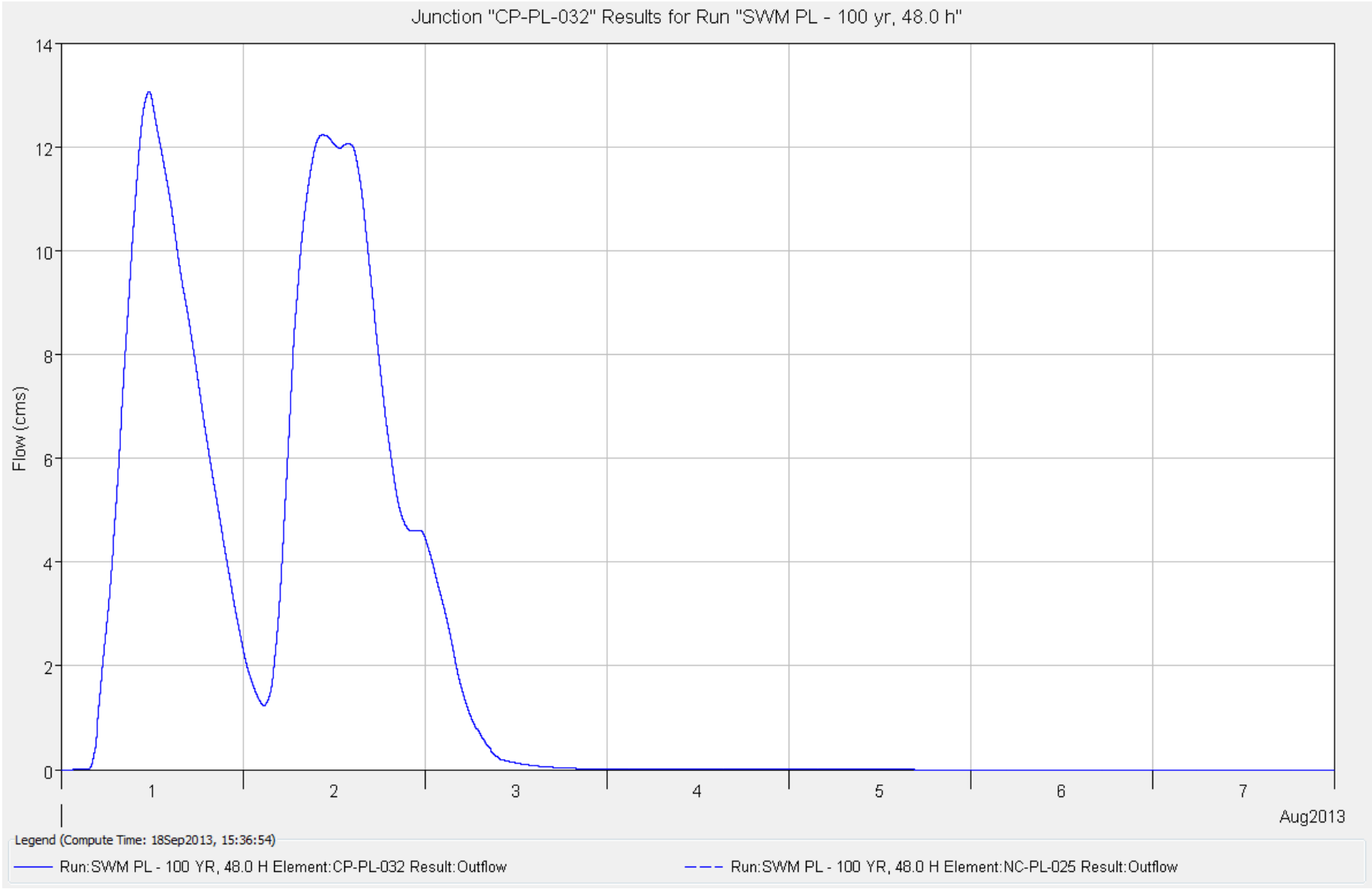

Junction "CP-PL-027" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-022 Result:Outflow

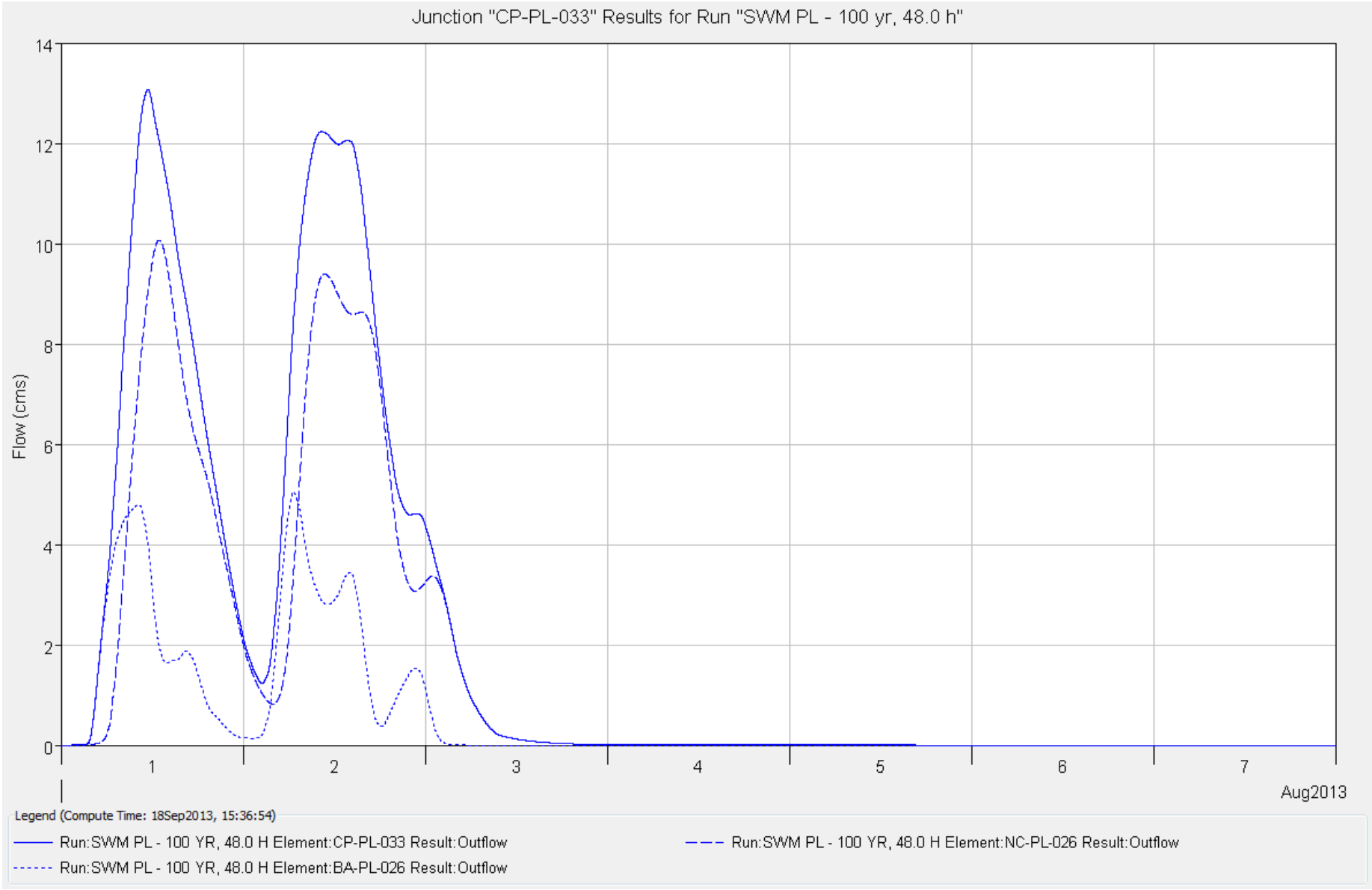

Junction "CP-PL-028" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-023 Result:Outflow

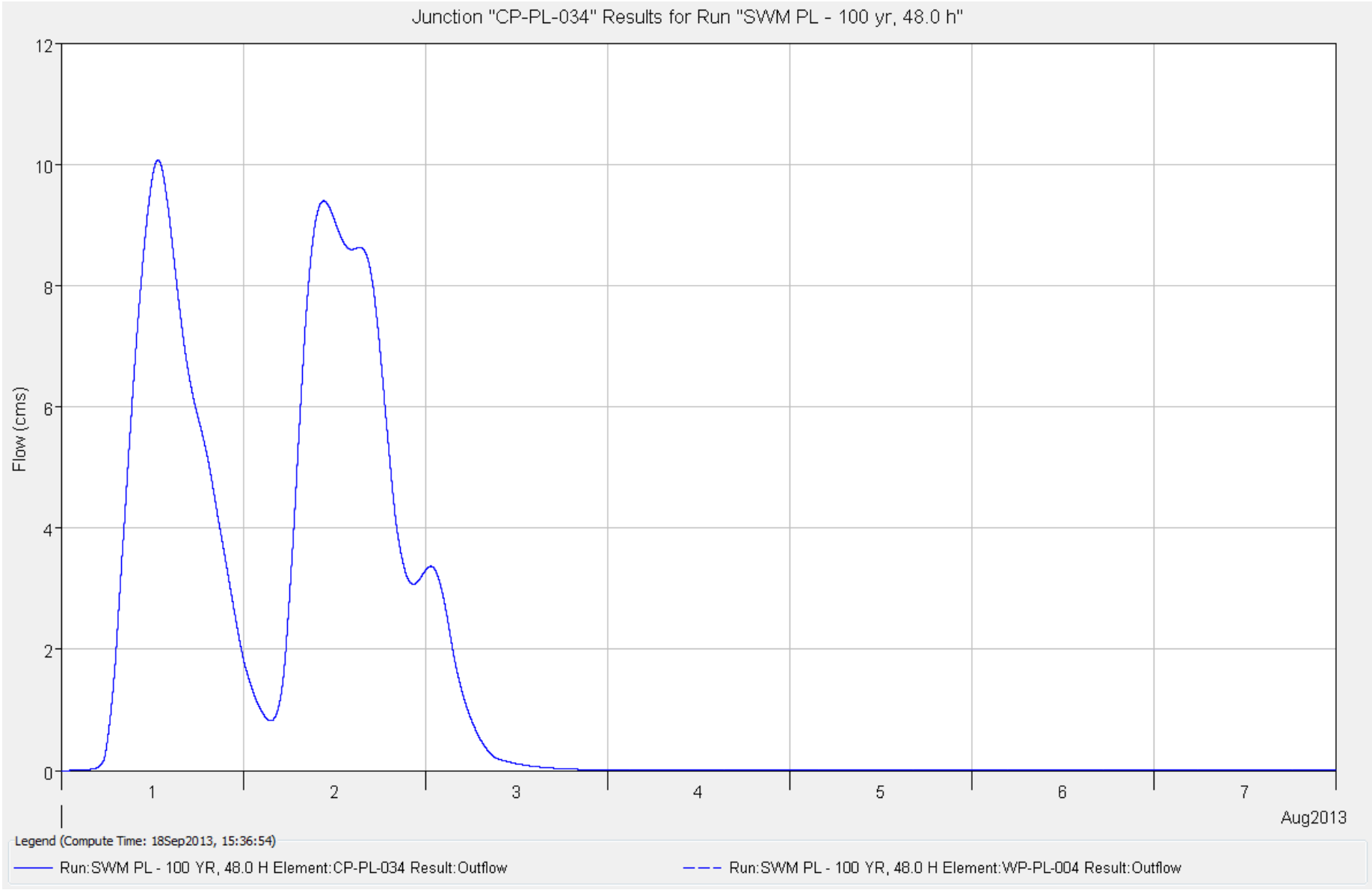

Junction "CP-PL-029" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-029 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-024 Result:Outflow

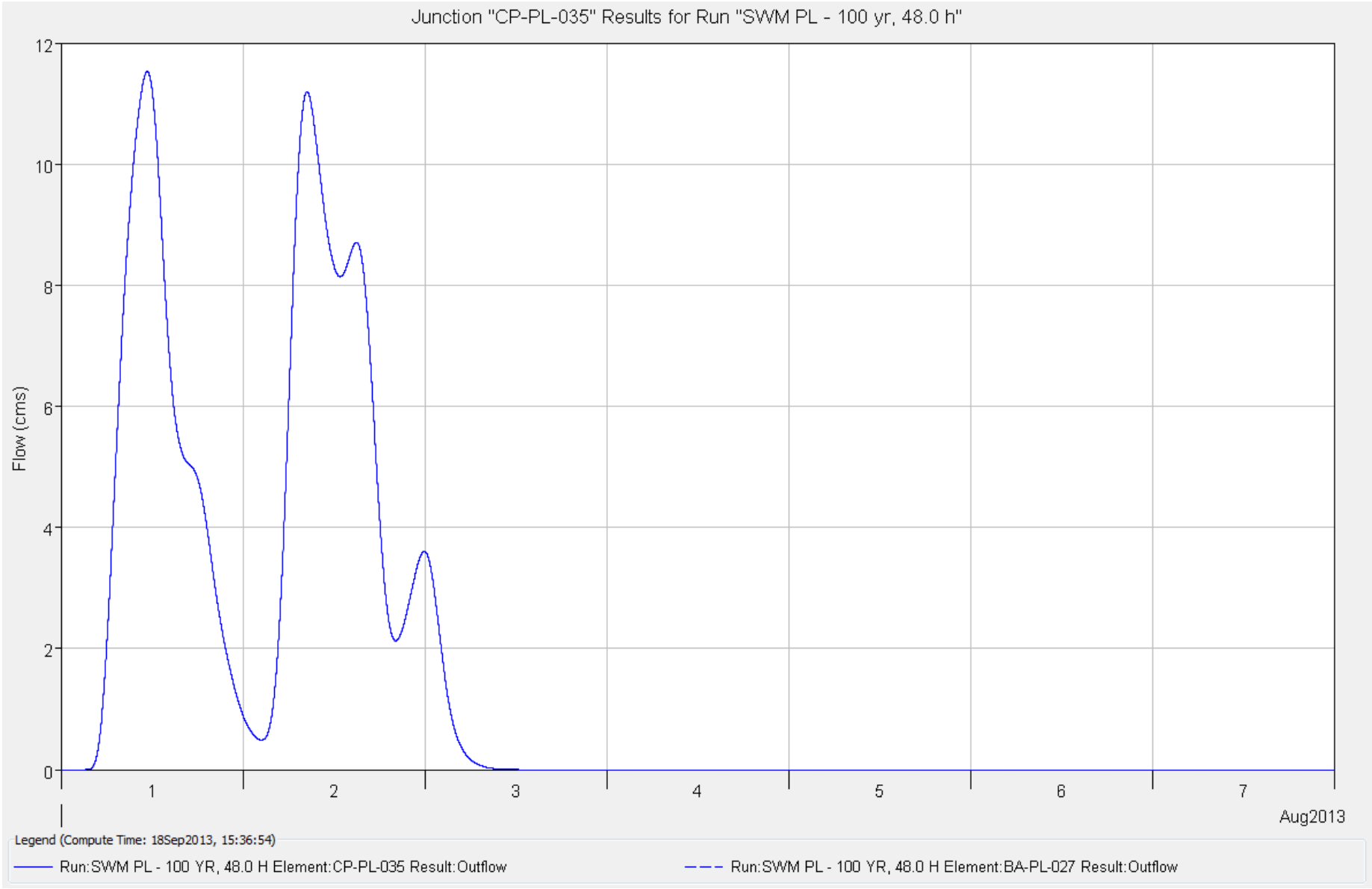

Junction "CP-PL-030" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-029 Result:Outflow

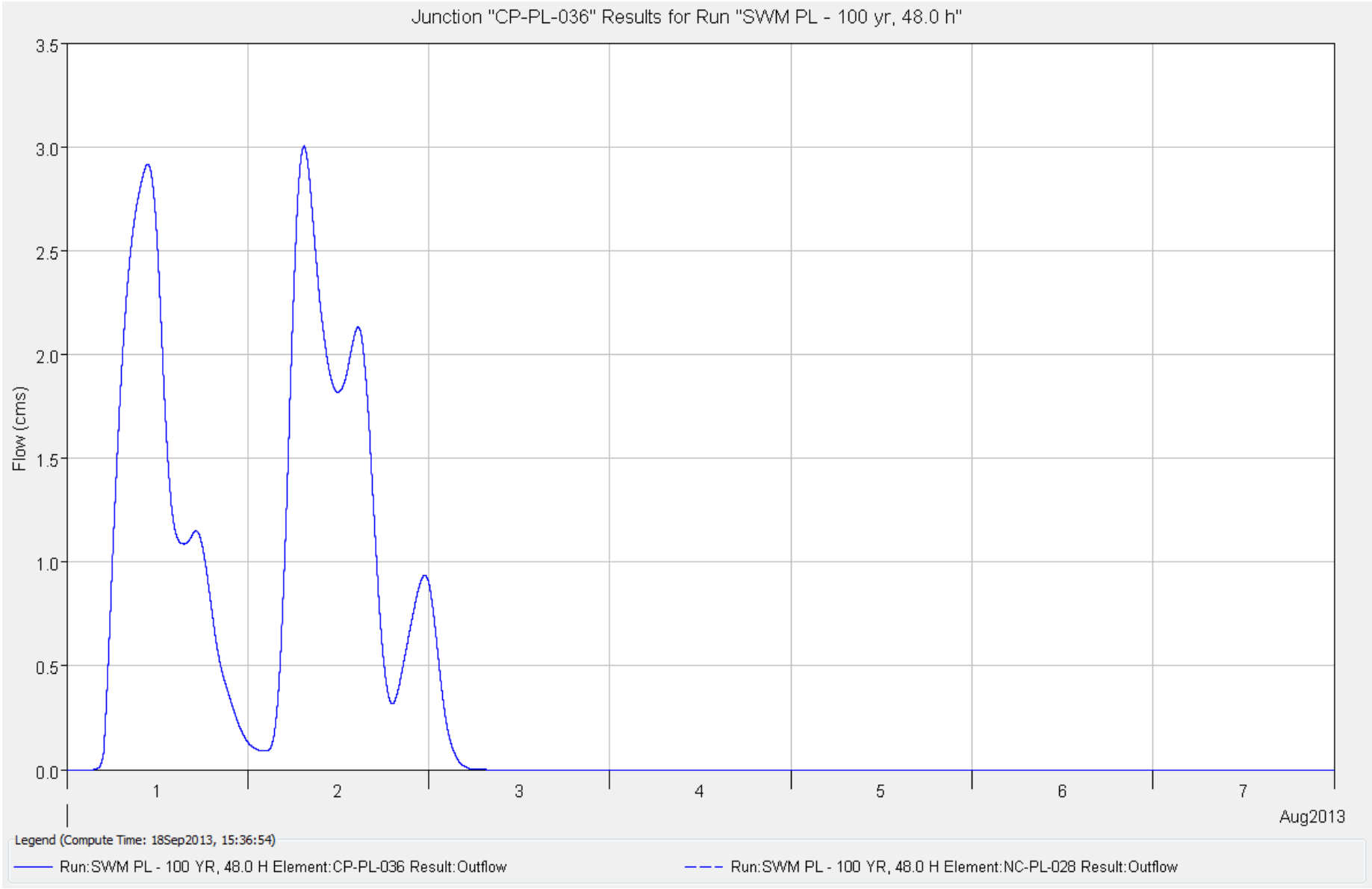

Junction "CP-PL-031" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-031 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-025 Result:Outflow

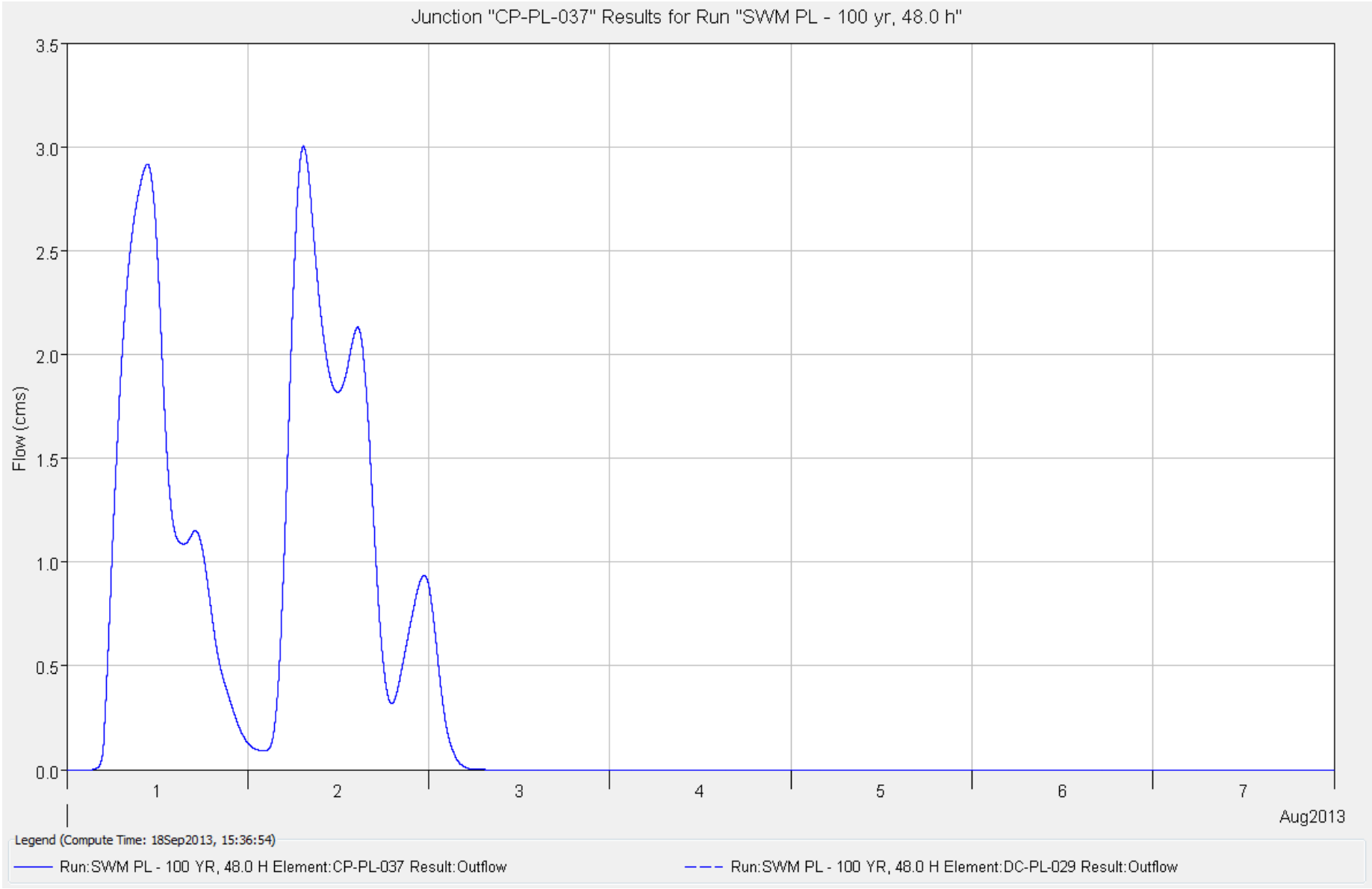

Junction "CP-PL-032" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-032 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-025 Result:Outflow

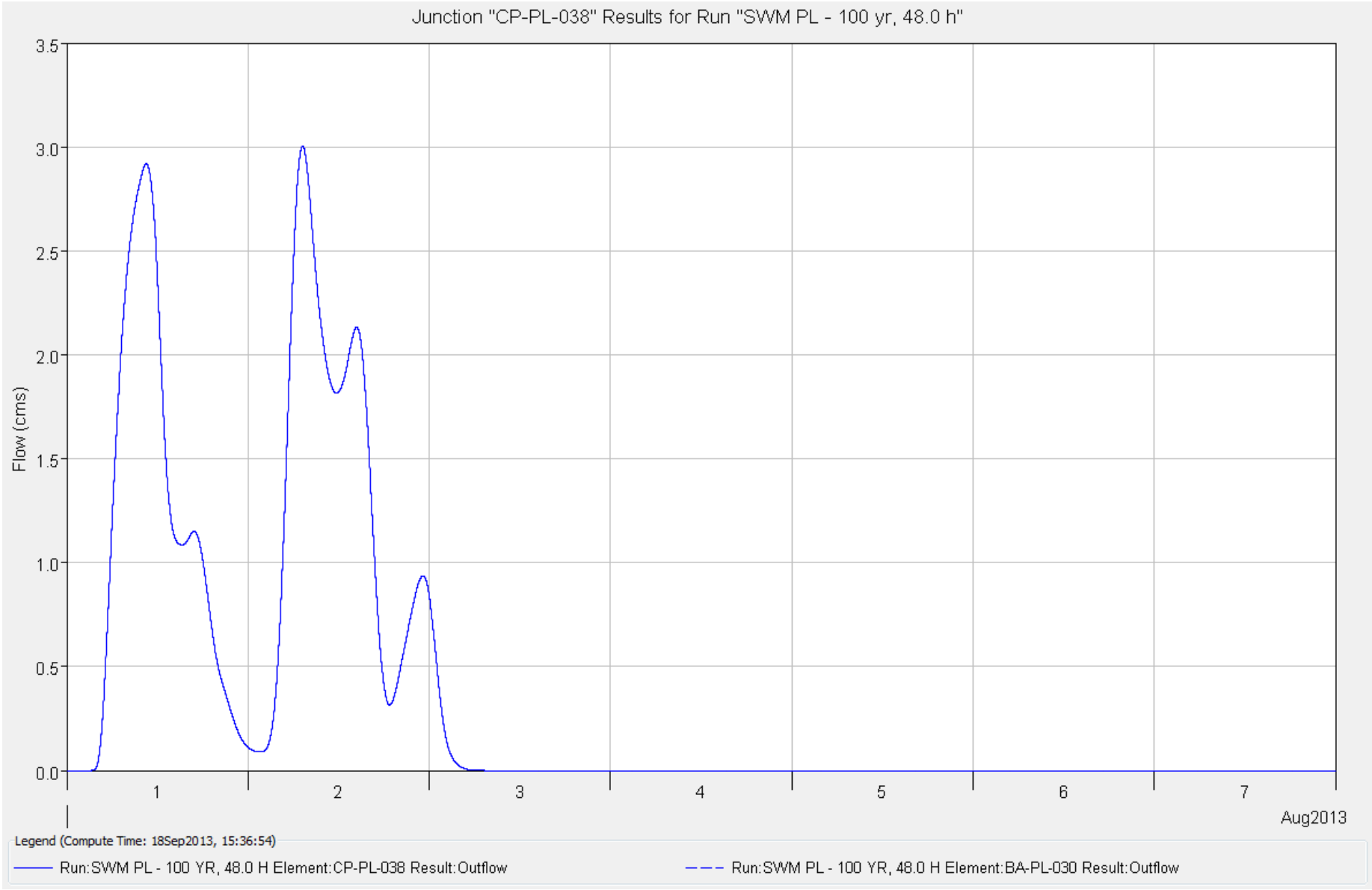

Junction "CP-PL-033" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-033 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-026 Result:Outflow

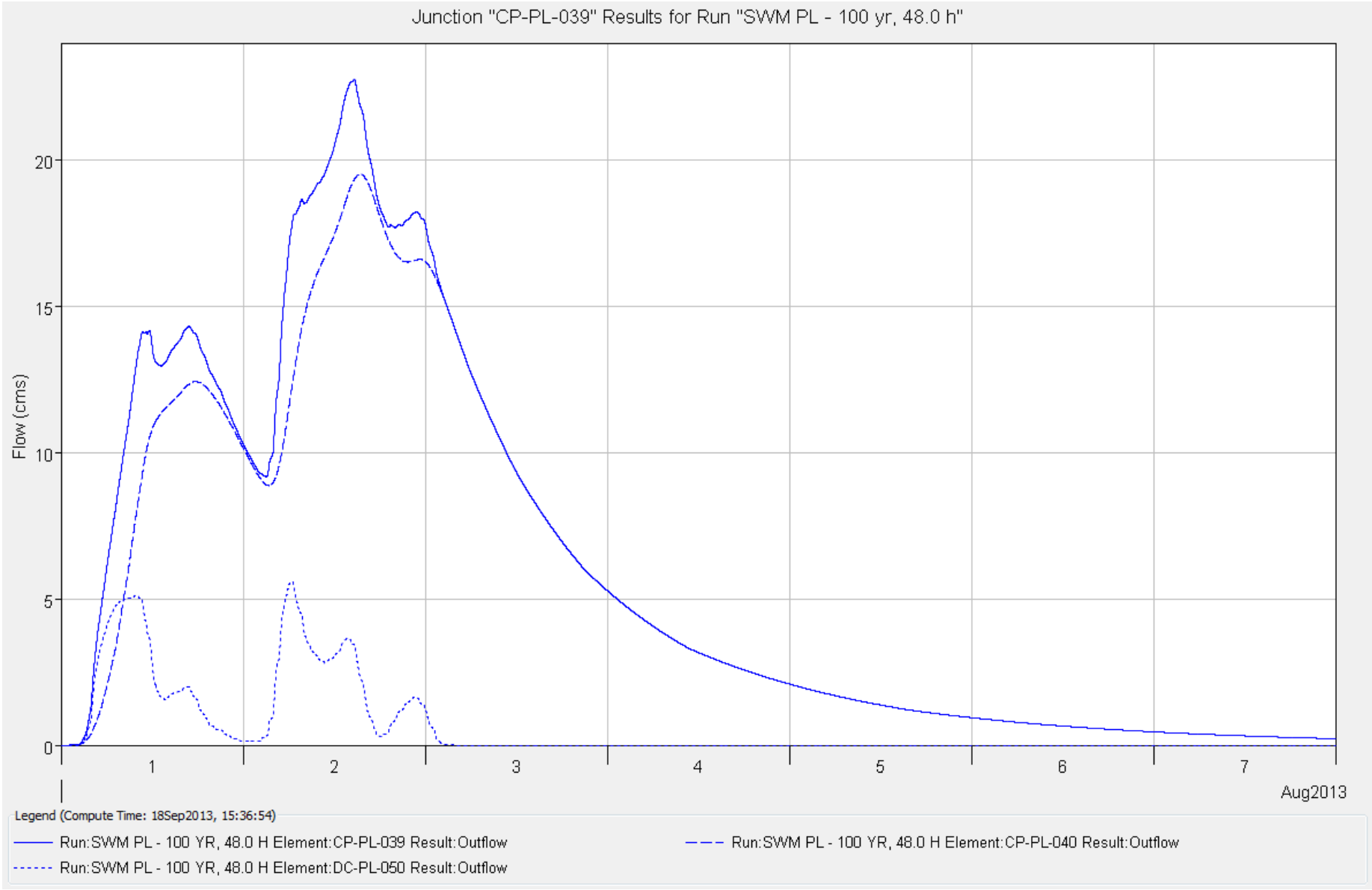

Junction "CP-PL-034" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Outflow

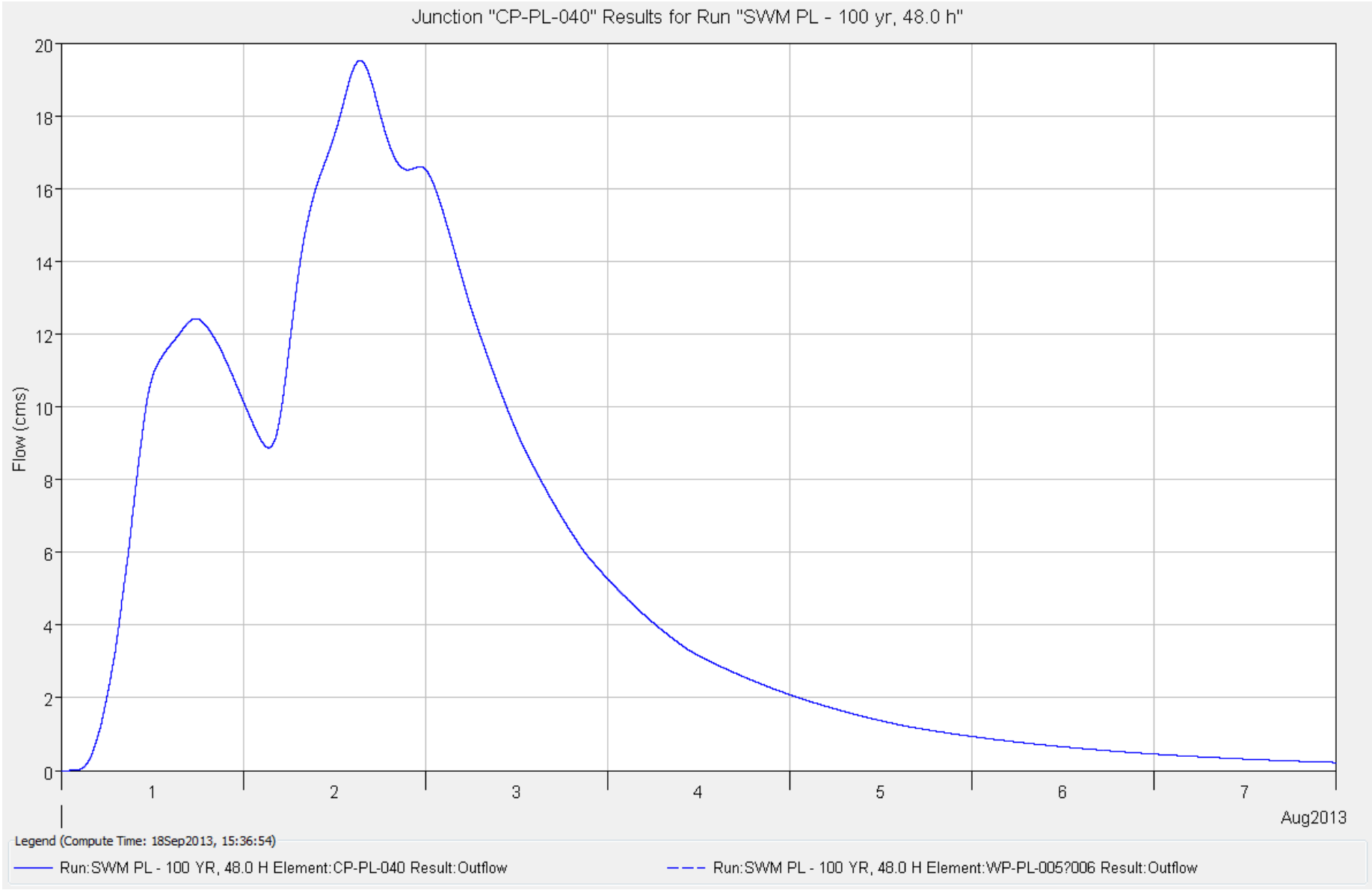

Junction "CP-PL-035" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-035 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-027 Result:Outflow

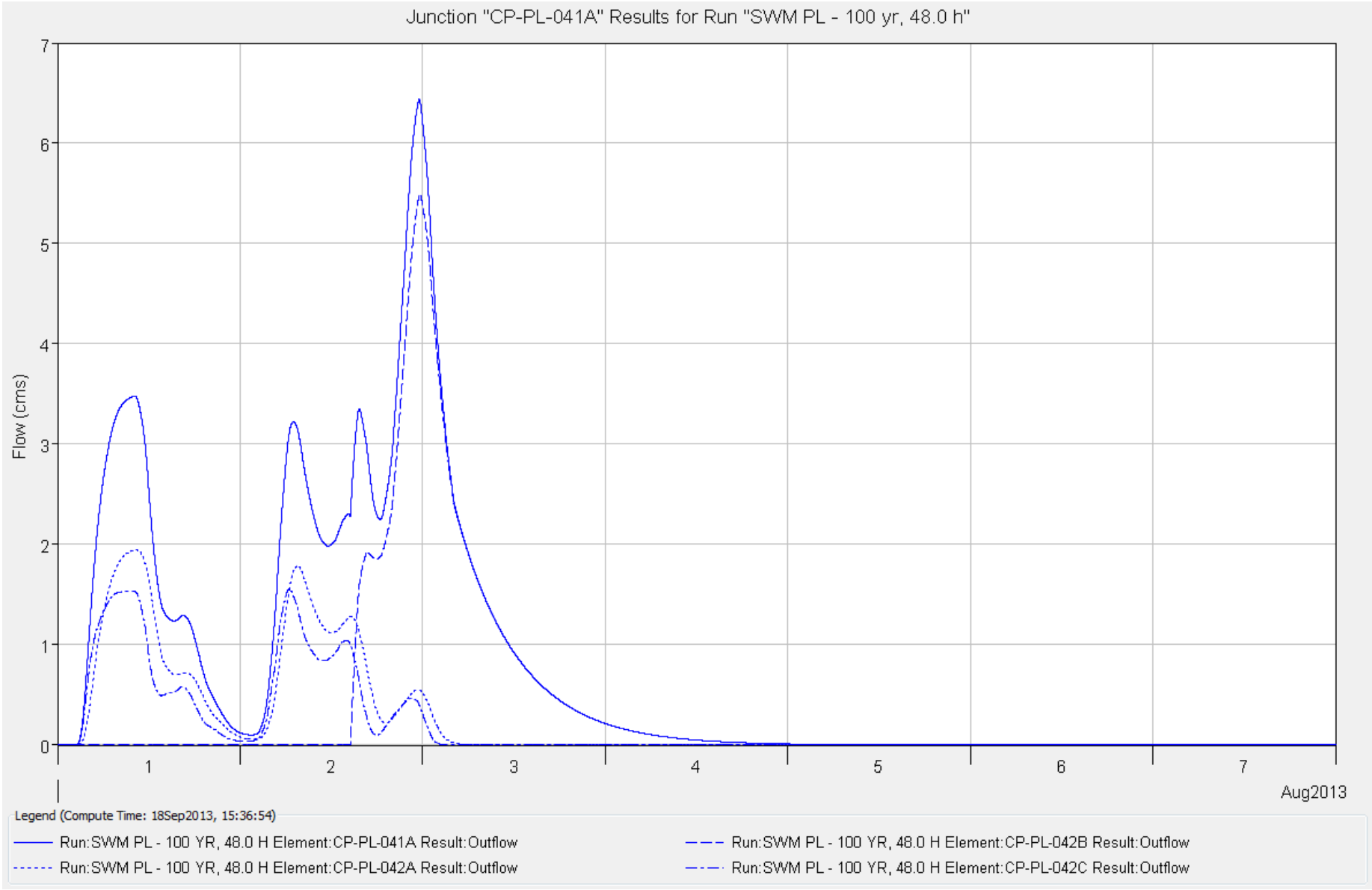

Junction "CP-PL-036" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-028 Result:Outflow

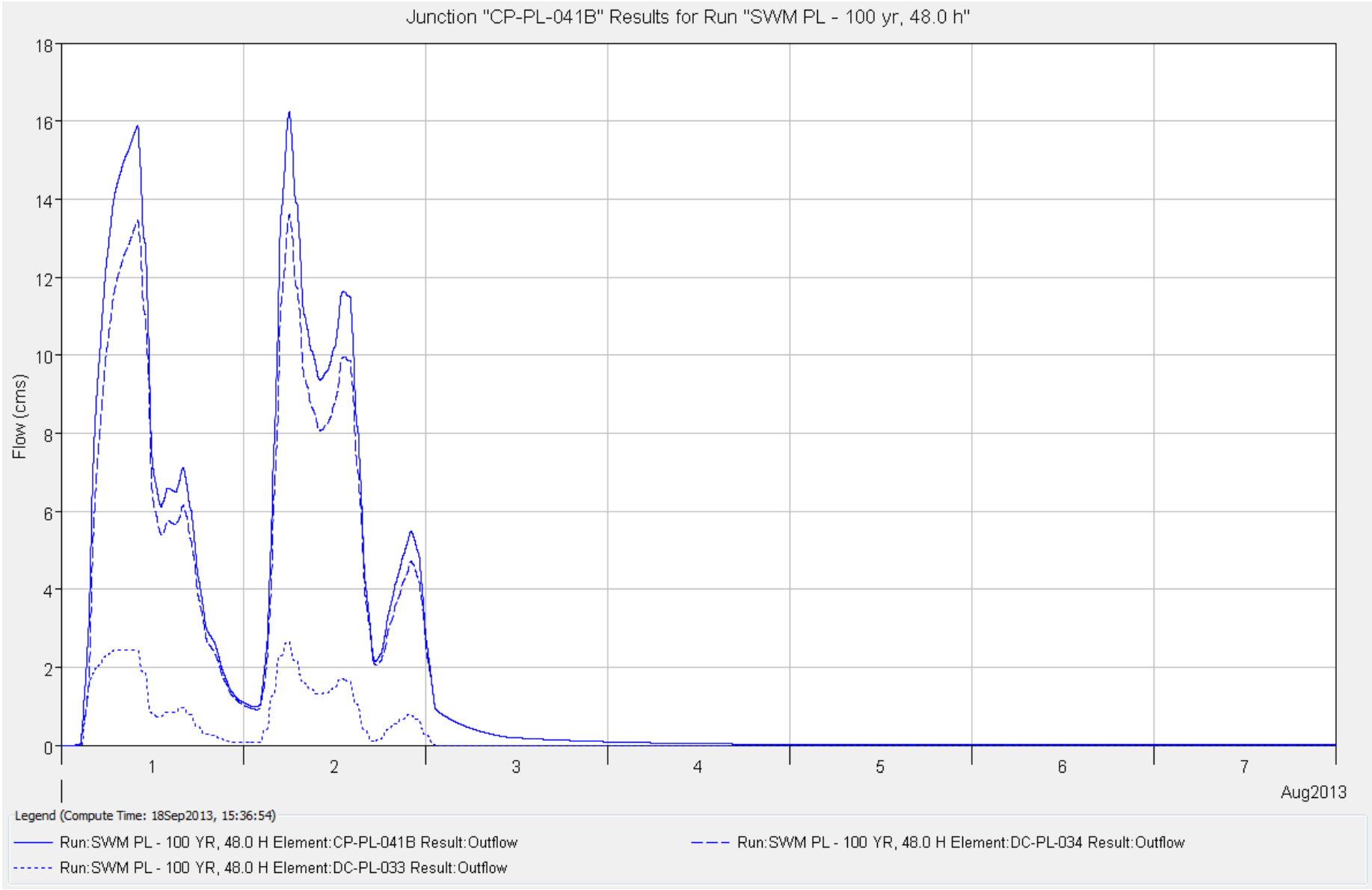

Junction "CP-PL-037" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-029 Result:Outflow

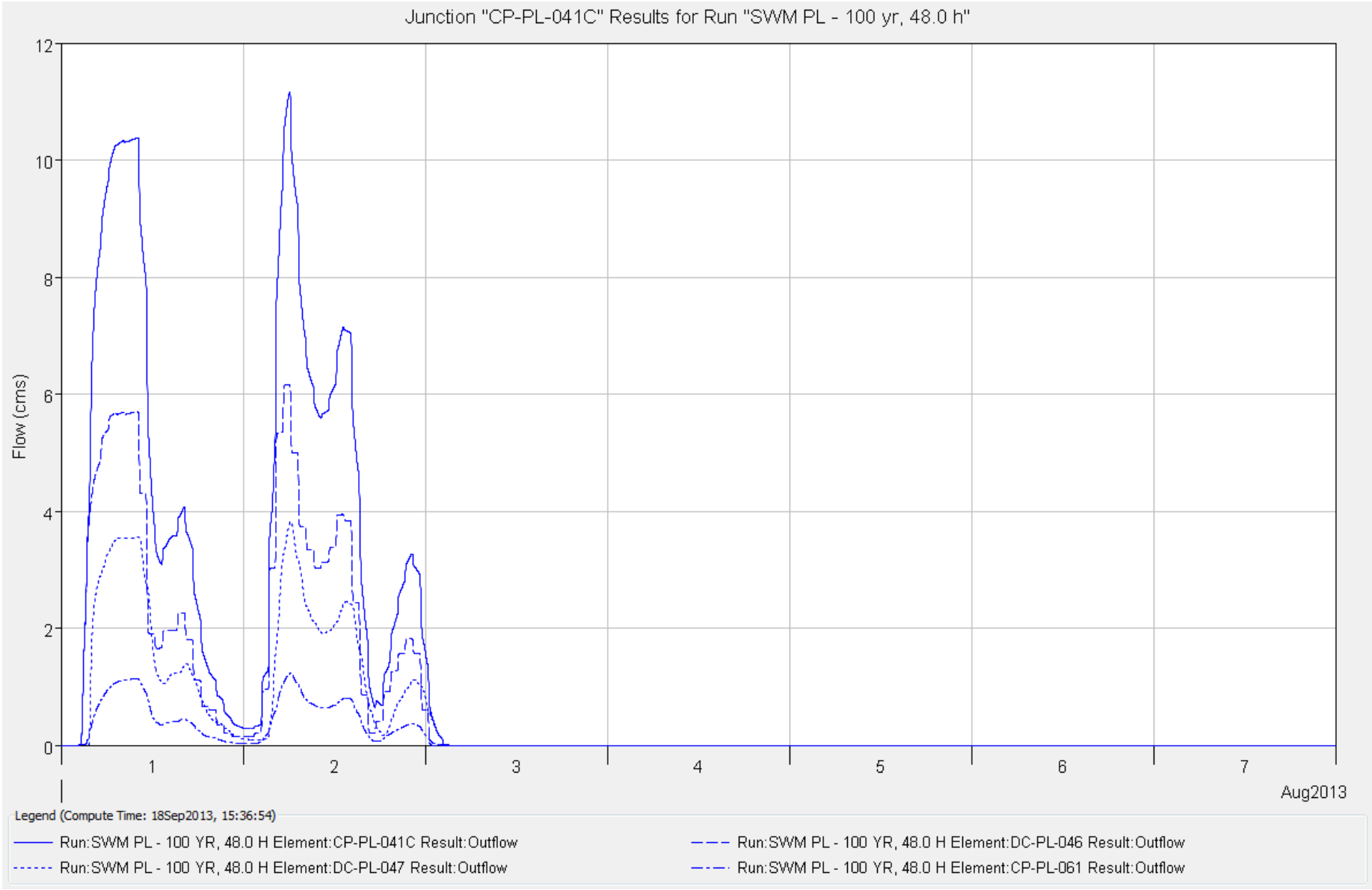

Junction "CP-PL-038" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-038 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-030 Result:Outflow

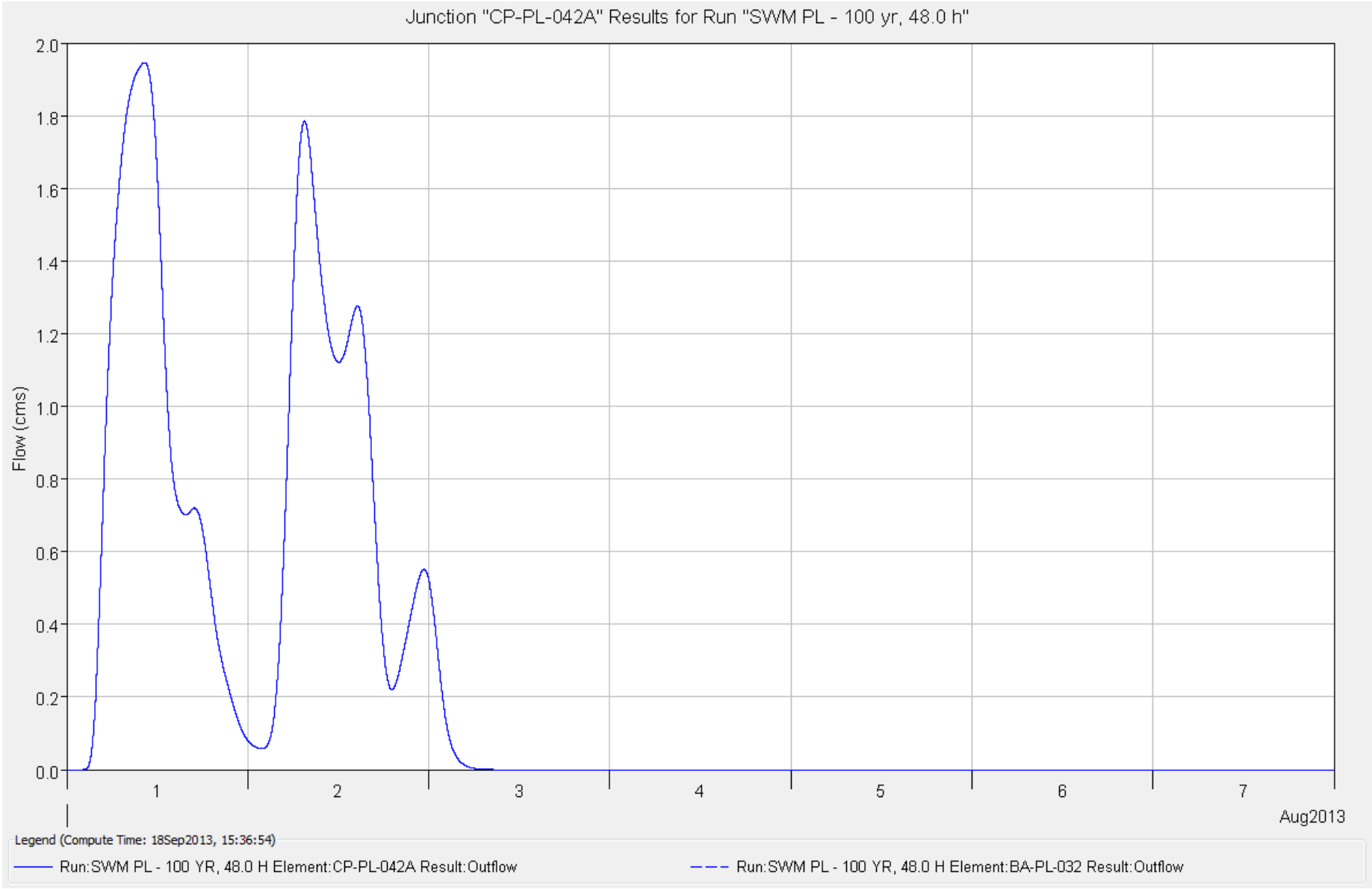

Junction "CP-PL-039" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-050 Result:Outflow

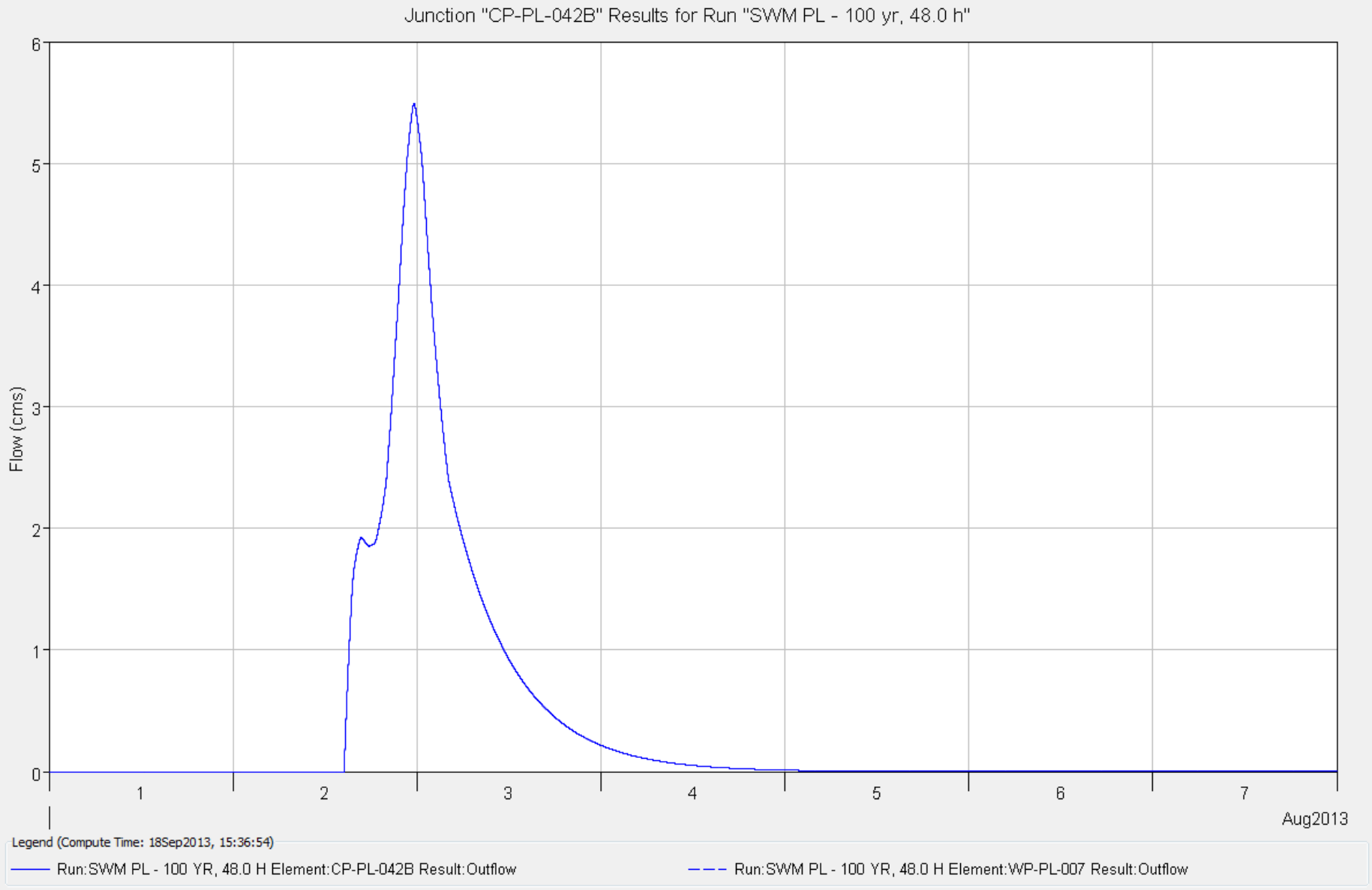

Junction "CP-PL-040" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Outflow

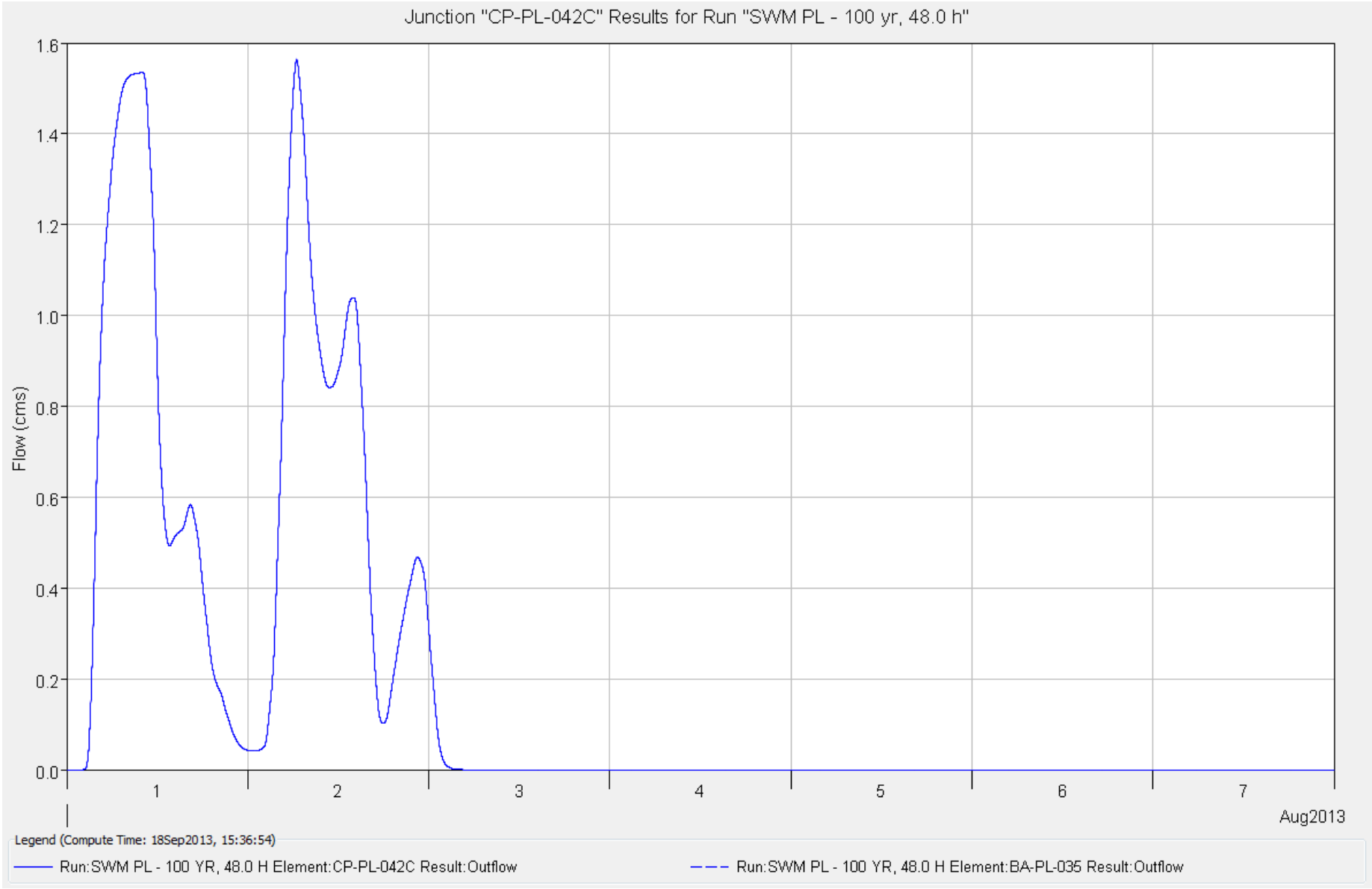

Junction "CP-PL-041A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042C Result:Outflow

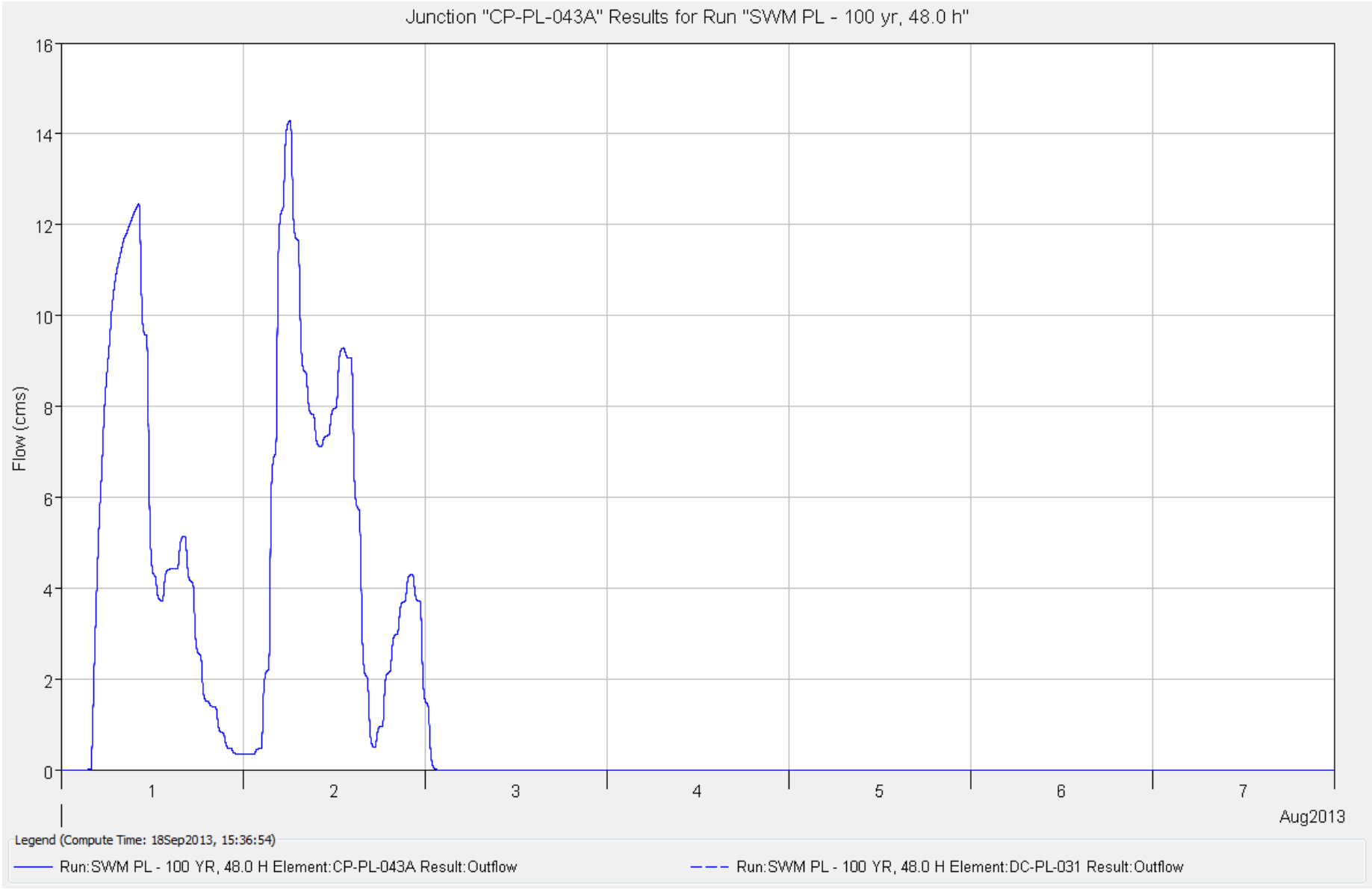

Junction "CP-PL-041B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-033 Result:Outflow

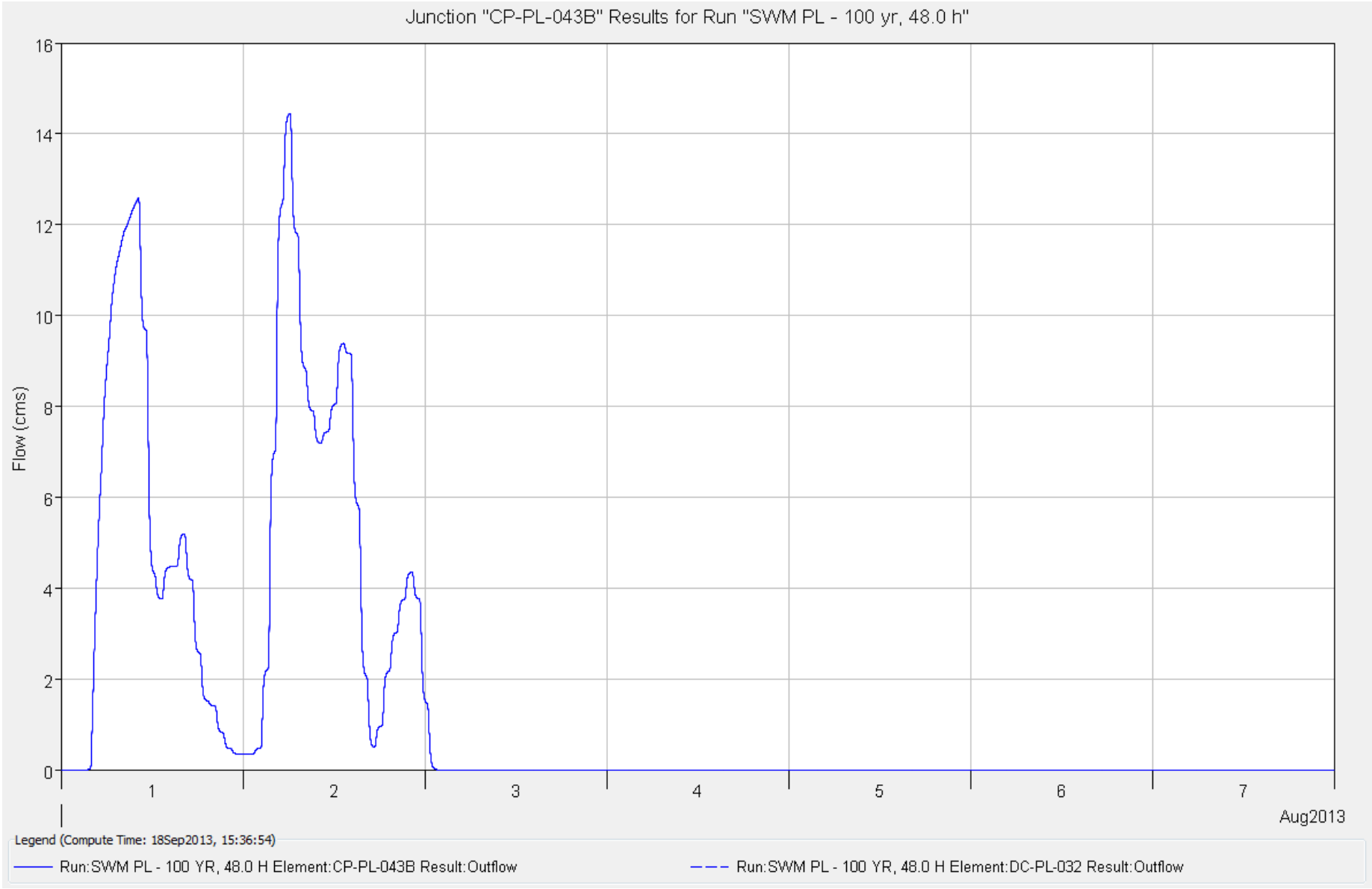

Junction "CP-PL-041C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-061 Result:Outflow

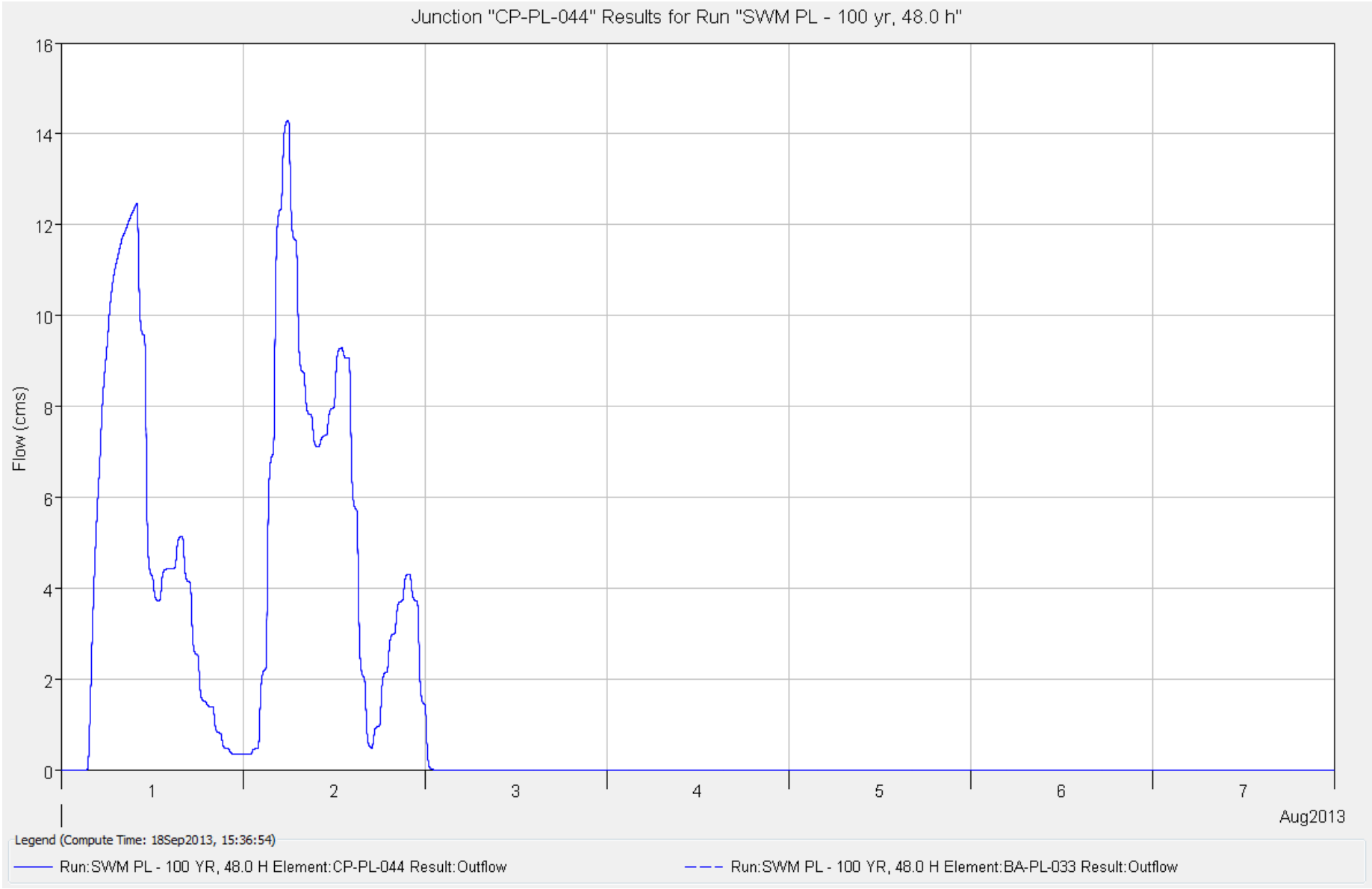

Junction "CP-PL-042A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-032 Result:Outflow

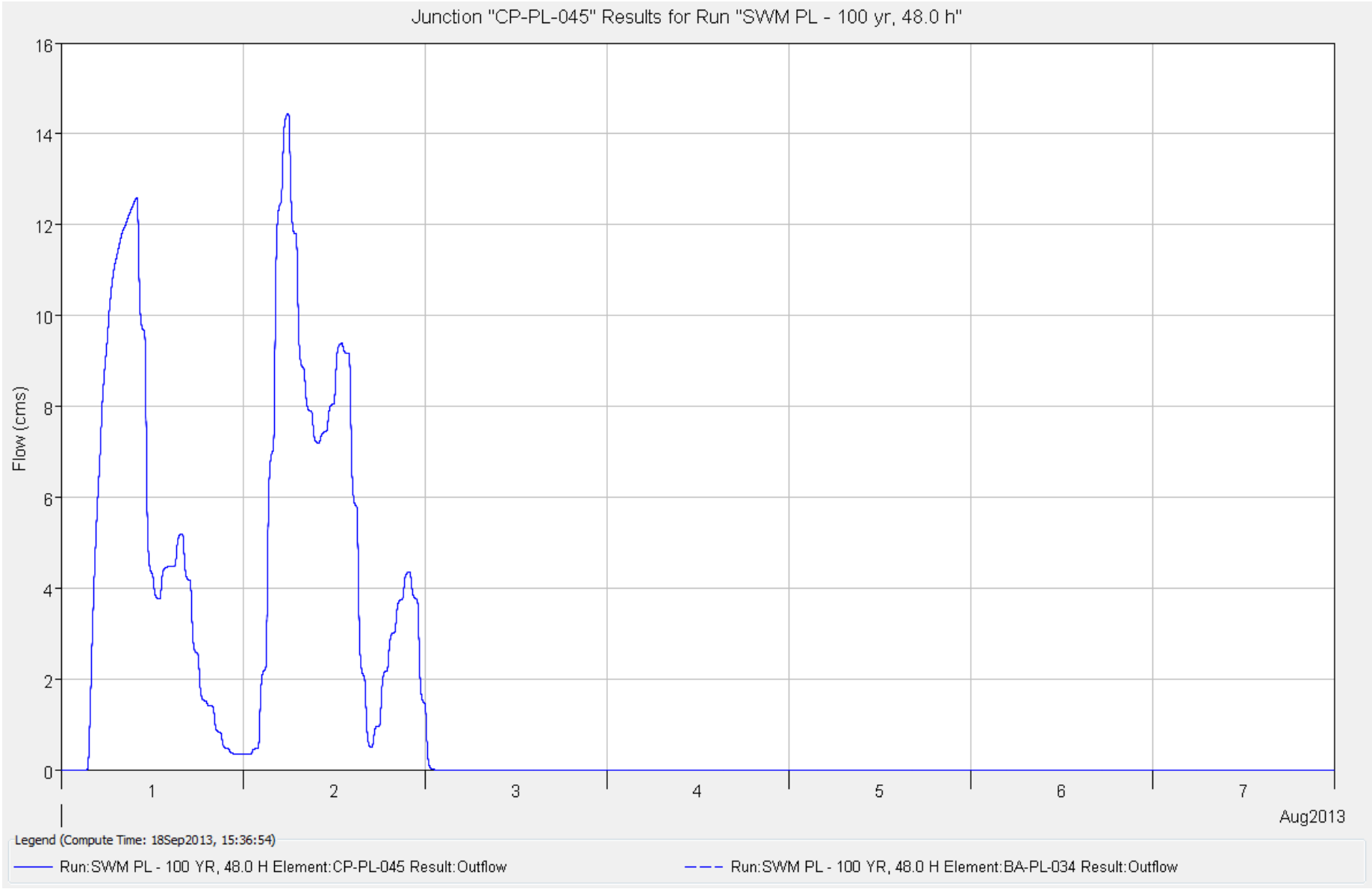

Junction "CP-PL-042B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Outflow

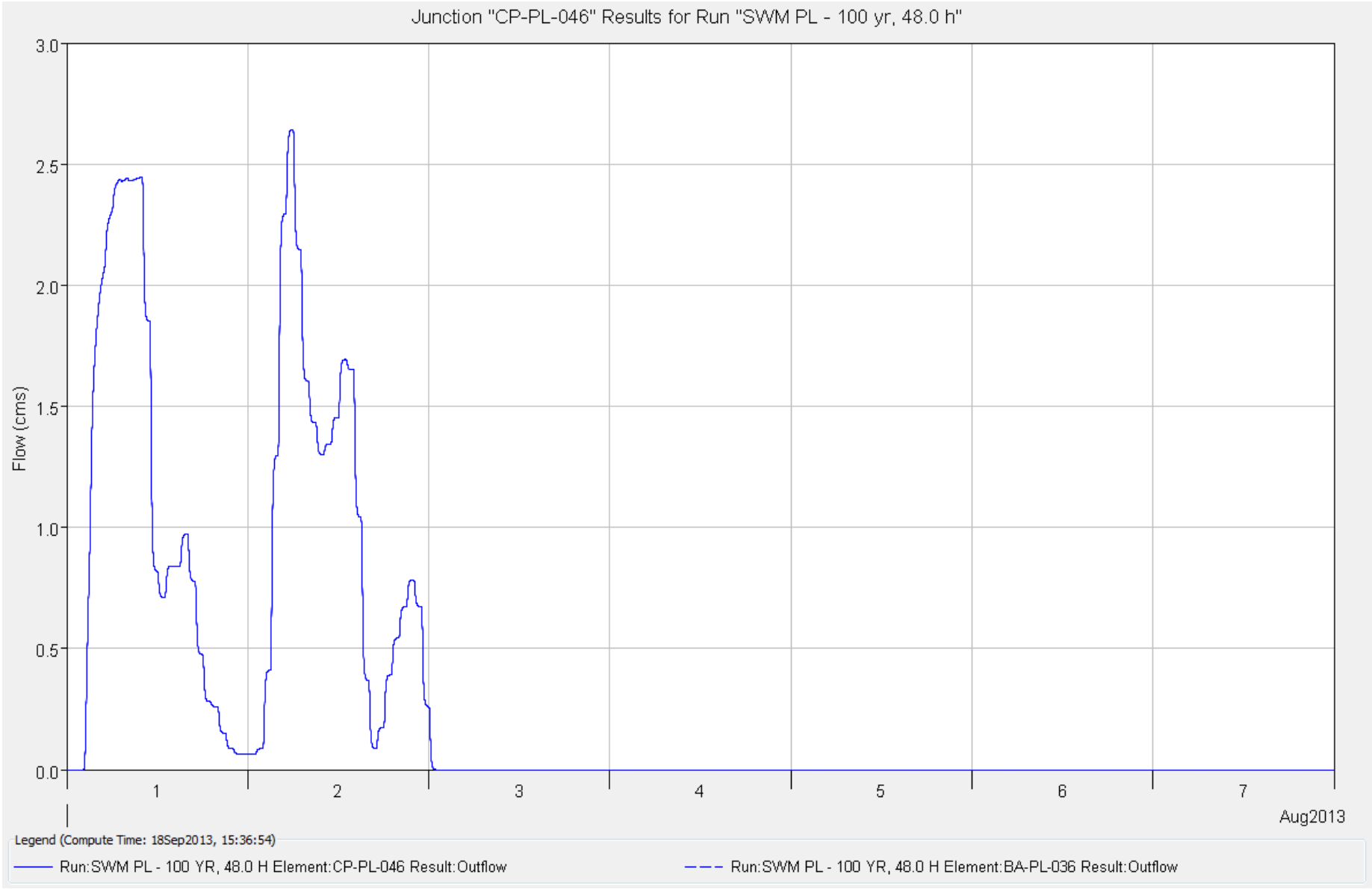

Junction "CP-PL-042C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-035 Result:Outflow

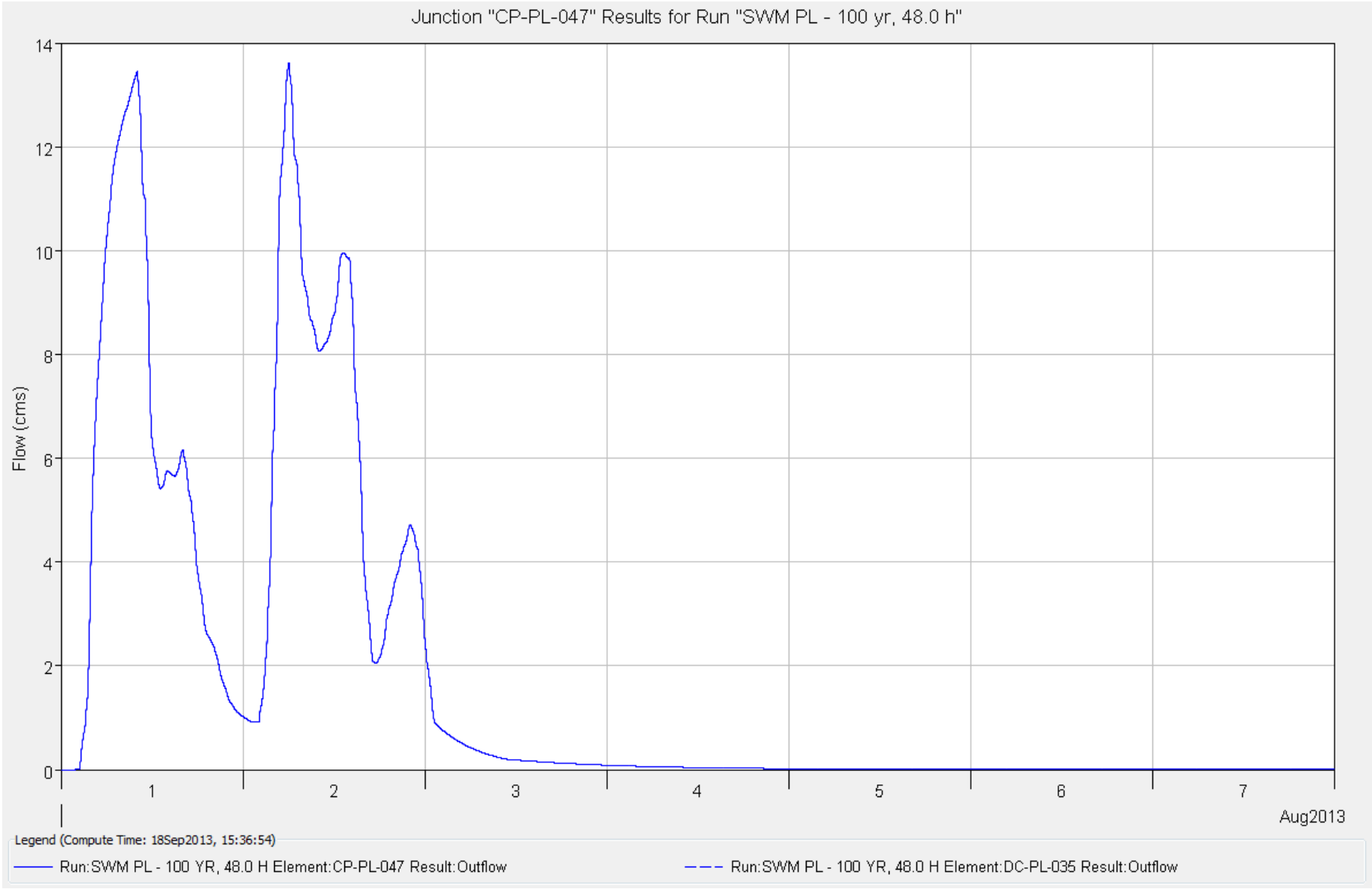

Junction "CP-PL-043A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-043A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-031 Result:Outflow

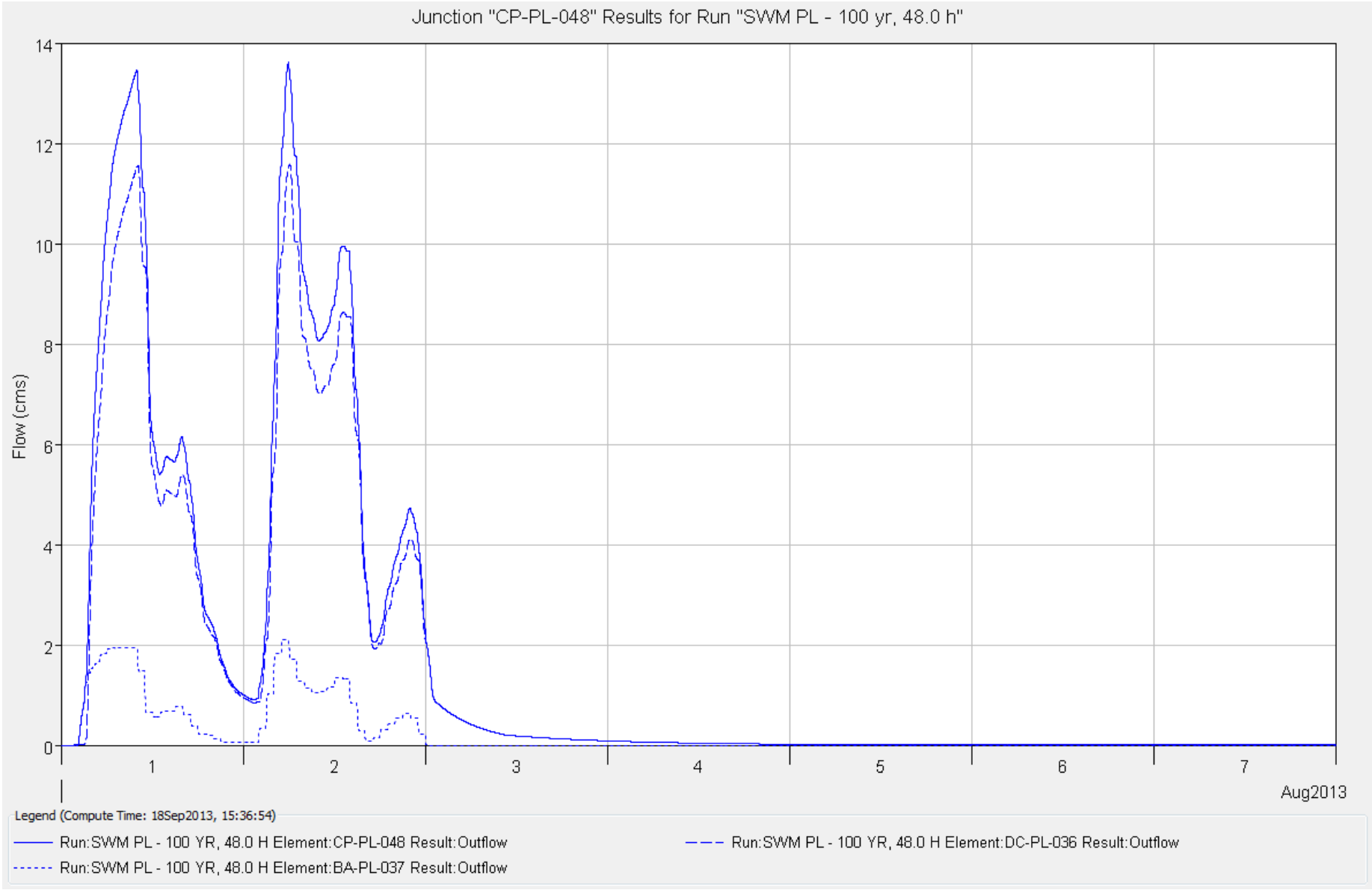

Junction "CP-PL-043B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-043B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-032 Result:Outflow

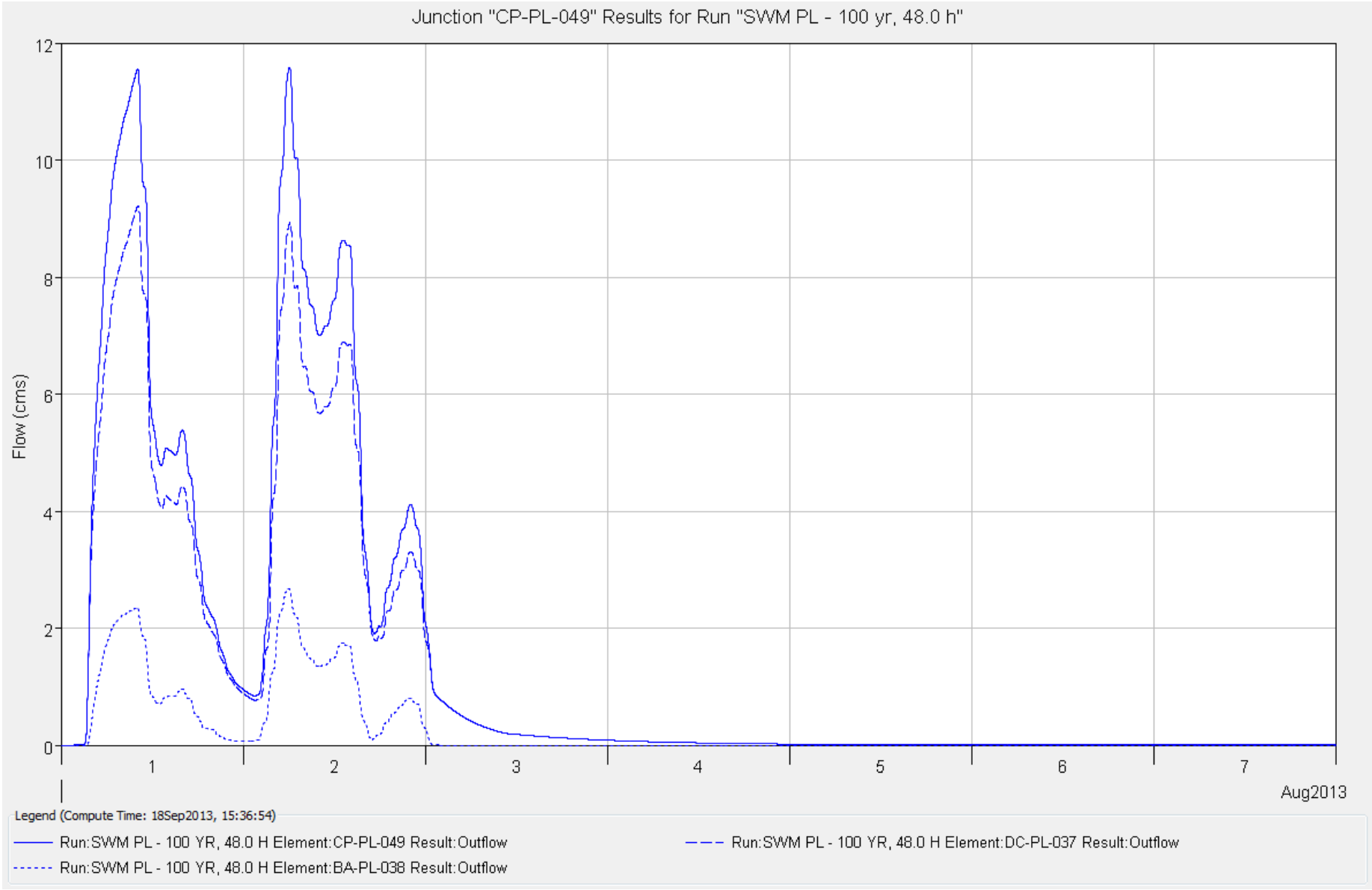

Junction "CP-PL-044" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-033 Result:Outflow

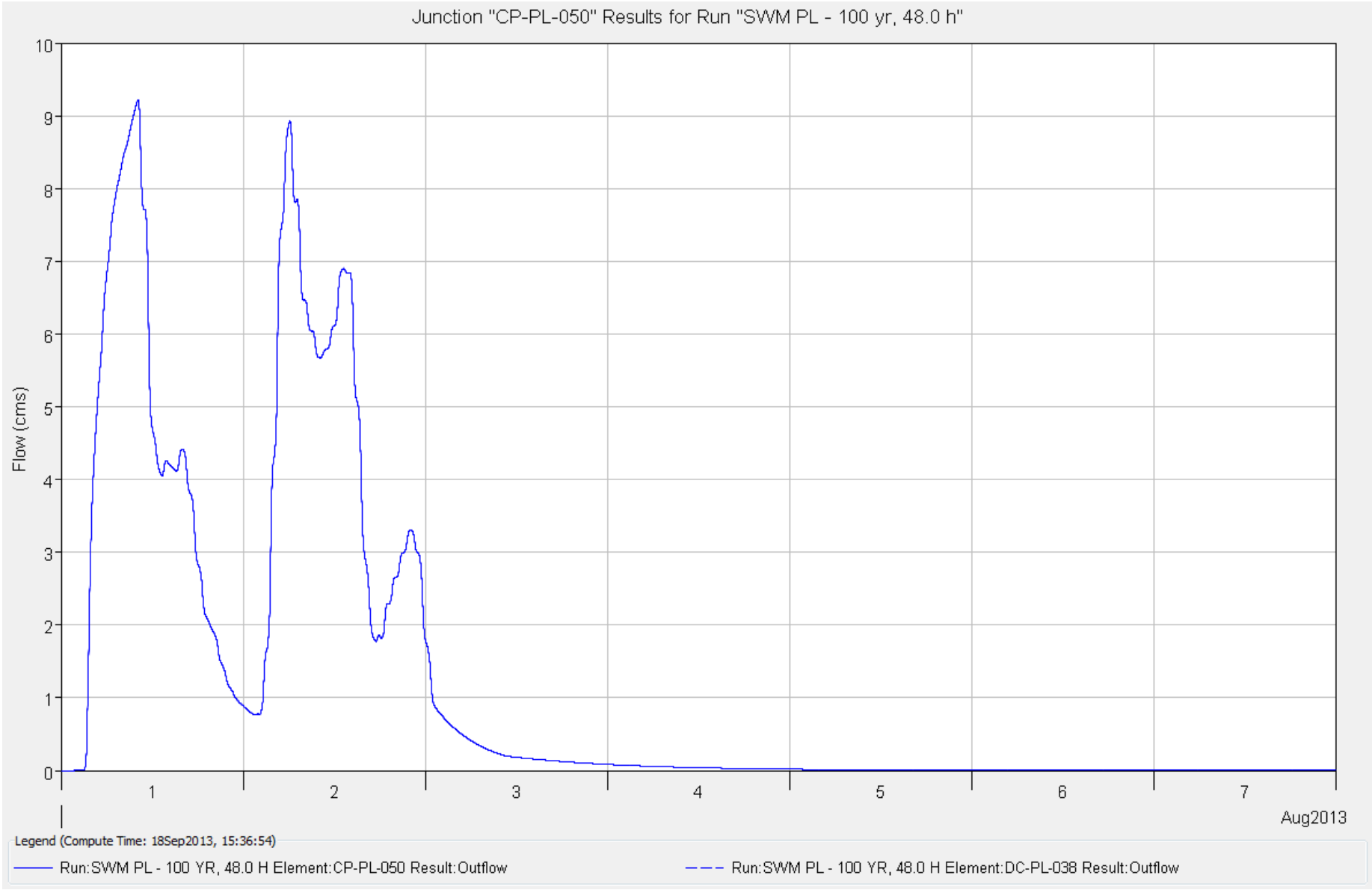

Junction "CP-PL-045" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-034 Result:Outflow

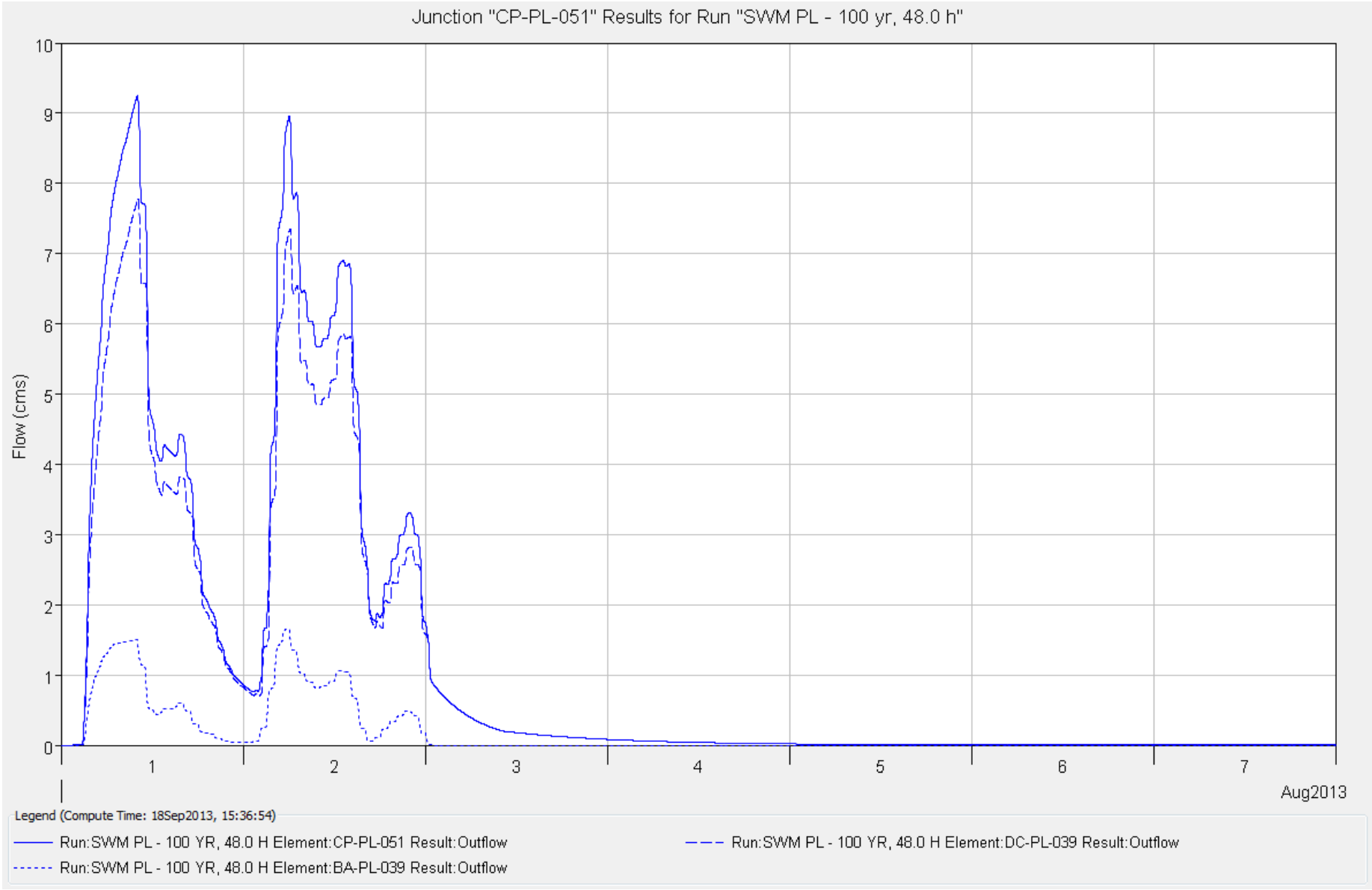

Junction "CP-PL-046" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-036 Result:Outflow

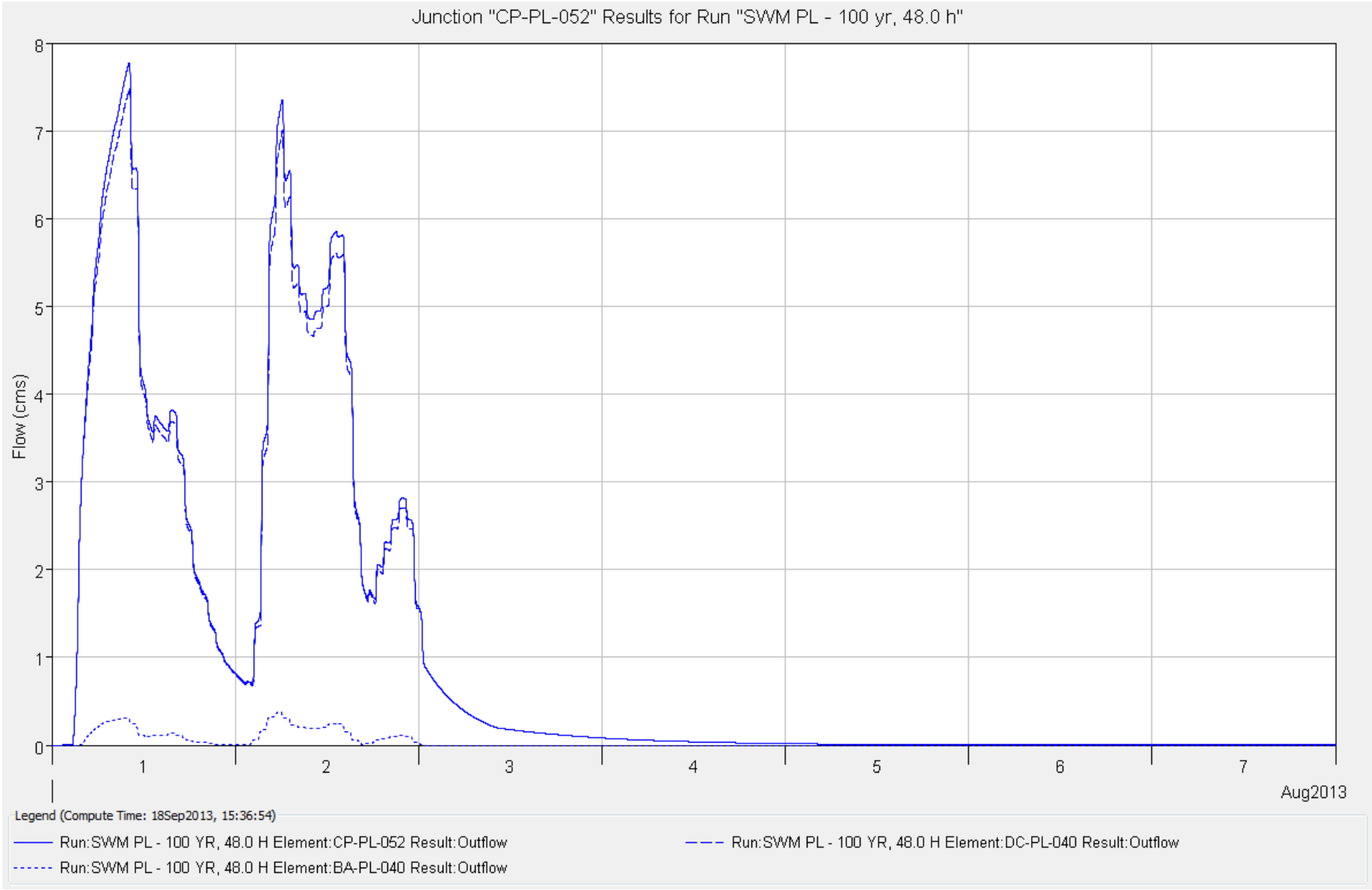

Junction "CP-PL-047" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-035 Result:Outflow

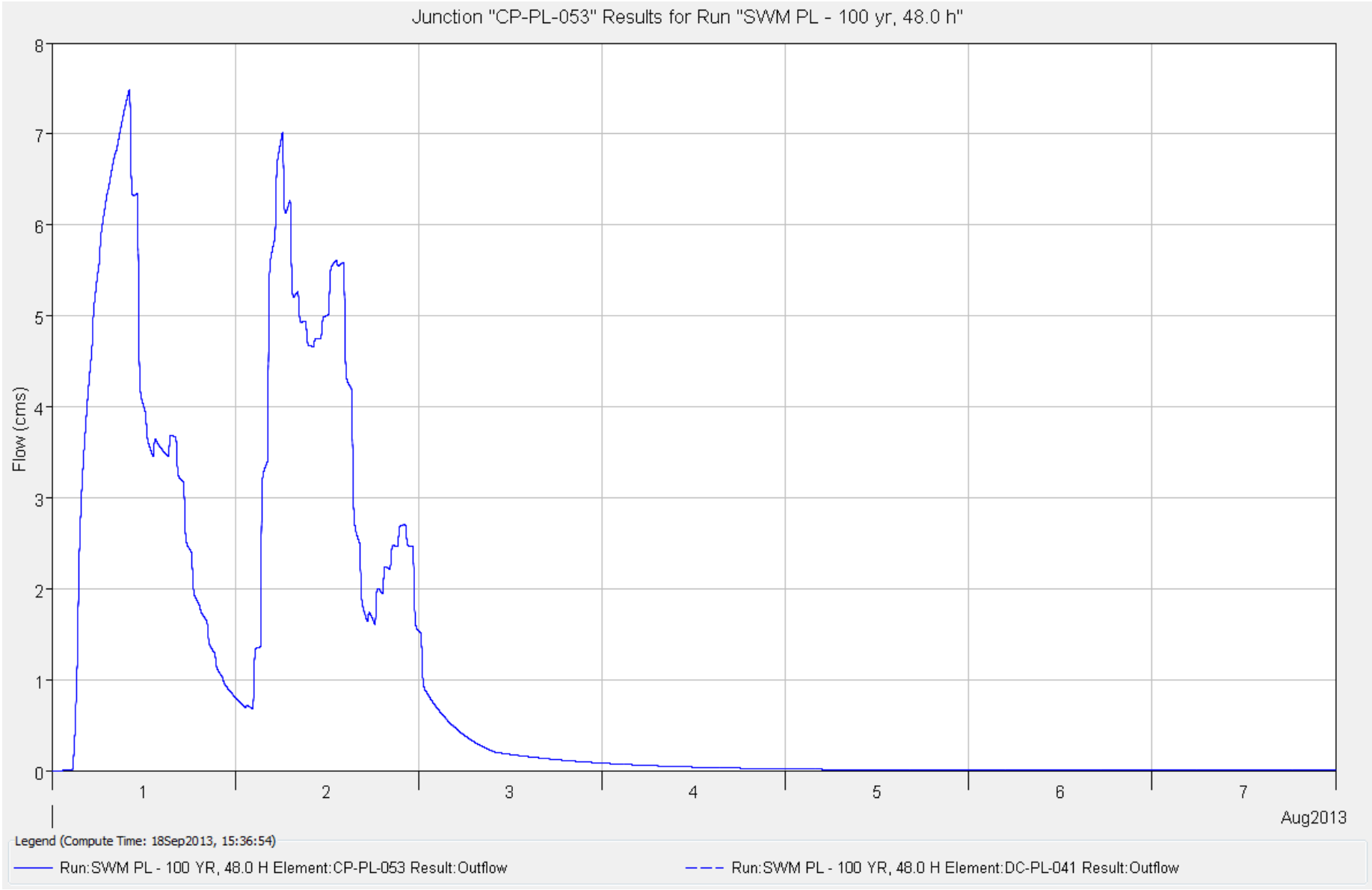

Junction "CP-PL-048" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-048 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-037 Result:Outflow

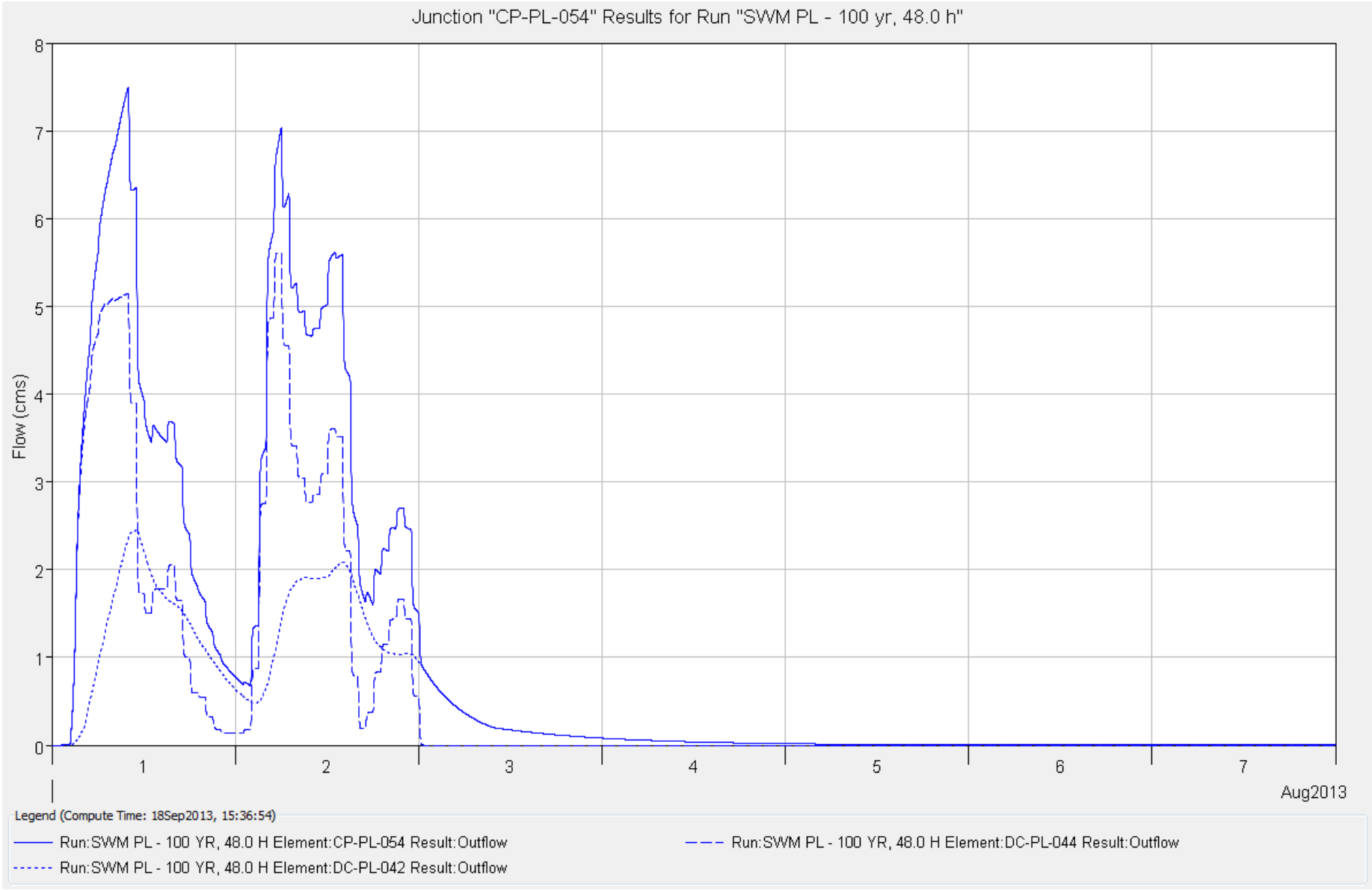

Junction "CP-PL-049" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-038 Result:Outflow

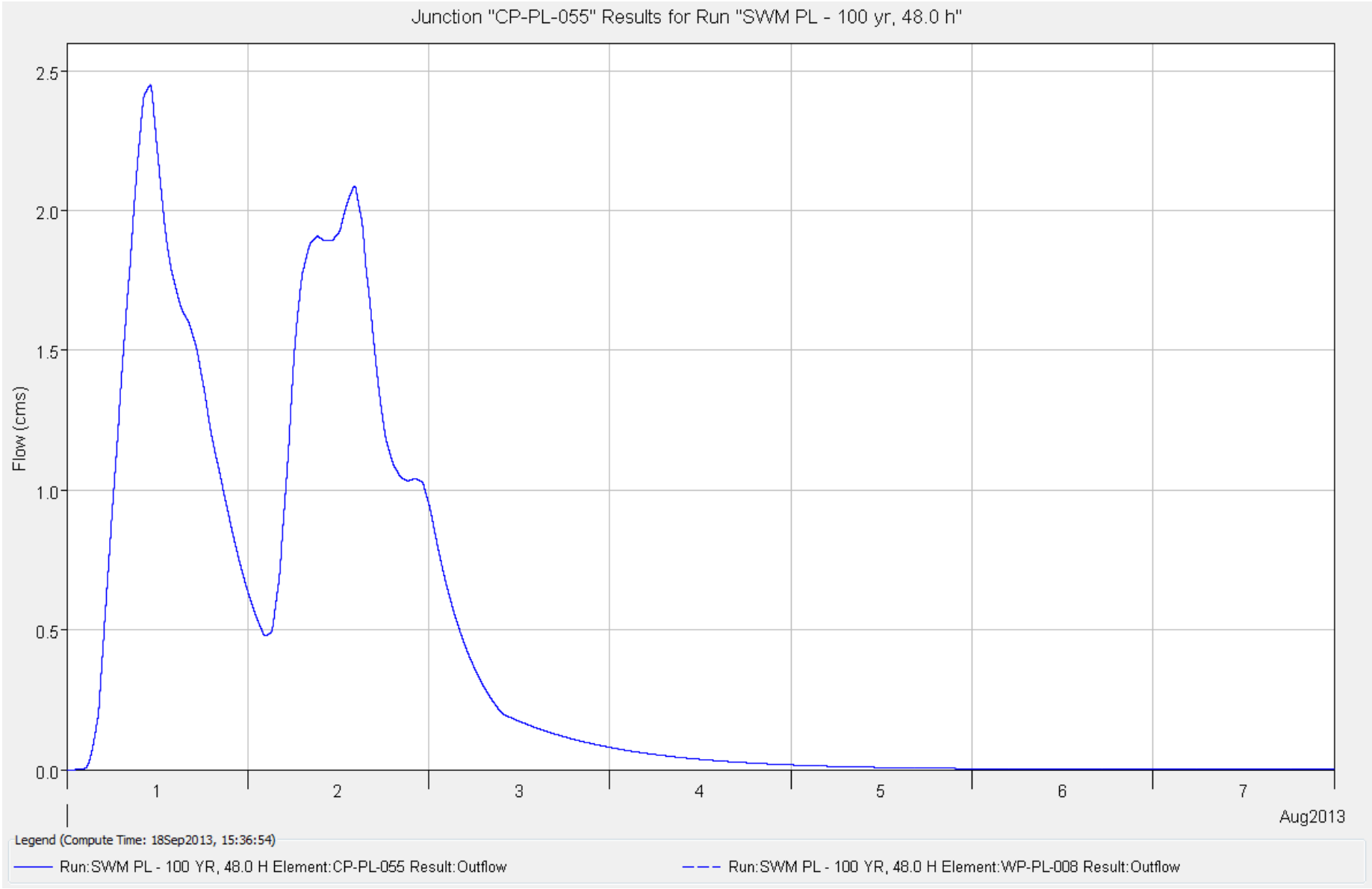

Junction "CP-PL-050" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-050 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-038 Result:Outflow

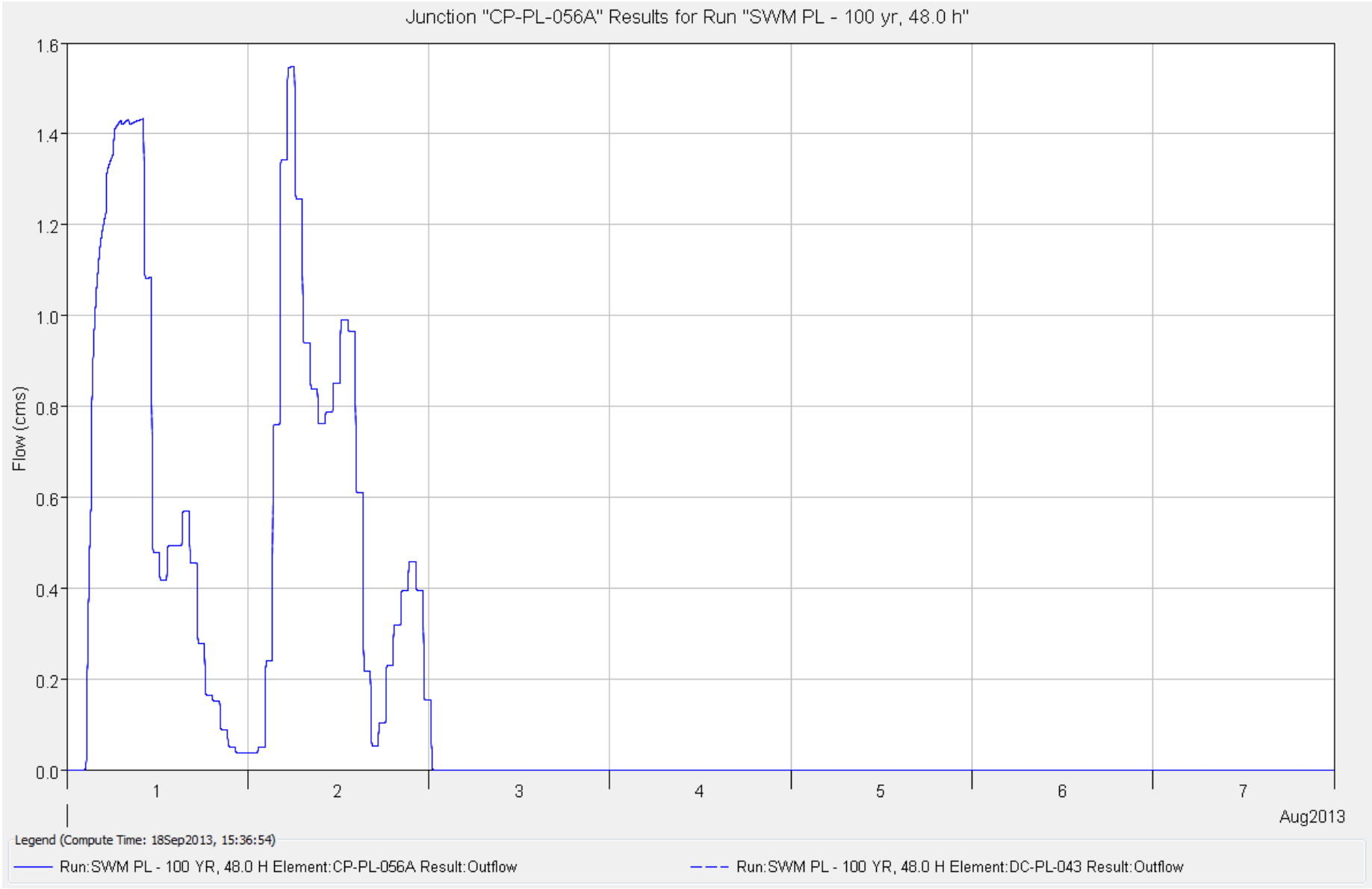

Junction "CP-PL-051" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-039 Result:Outflow

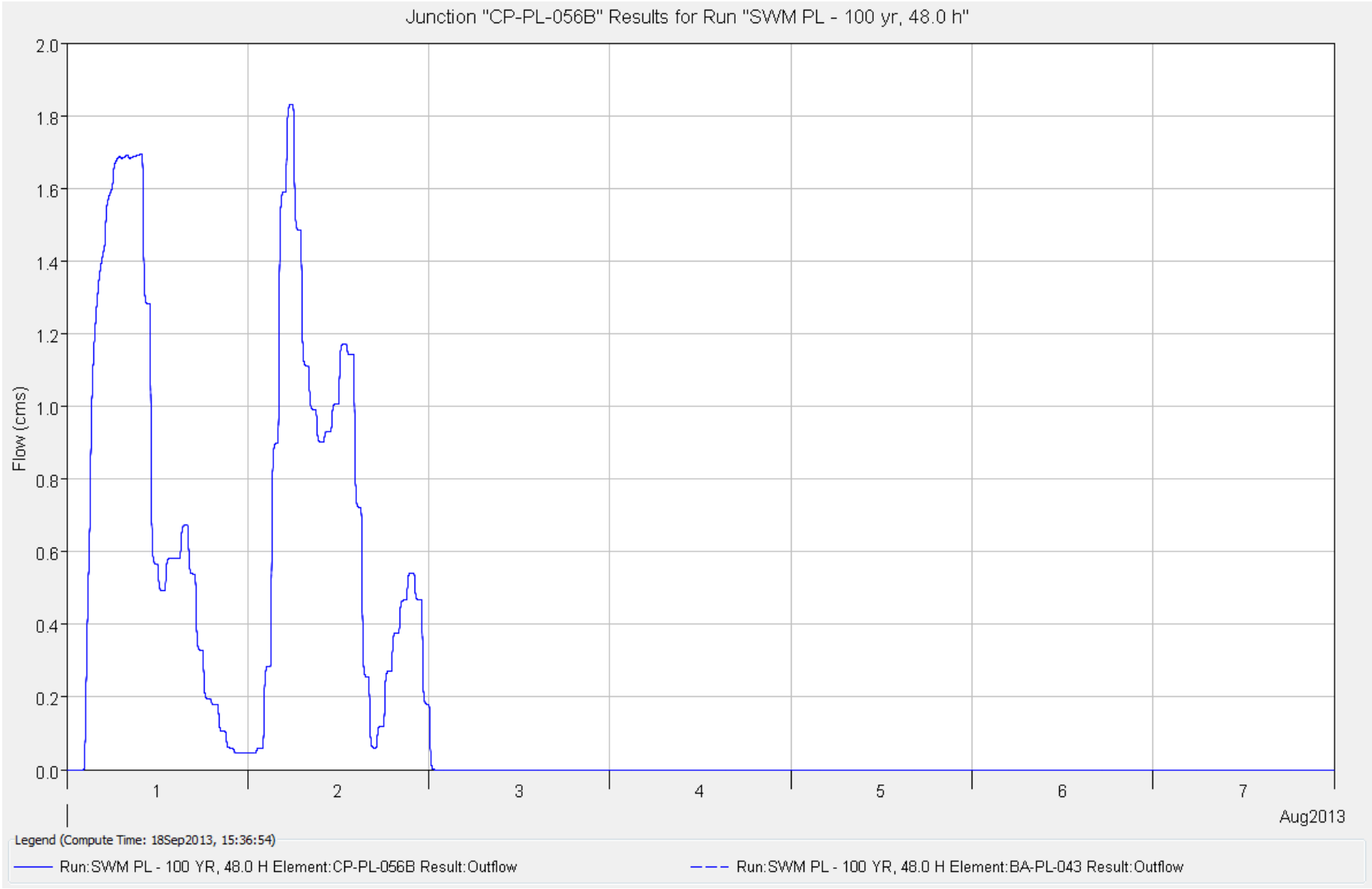

Junction "CP-PL-052" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-040 Result:Outflow

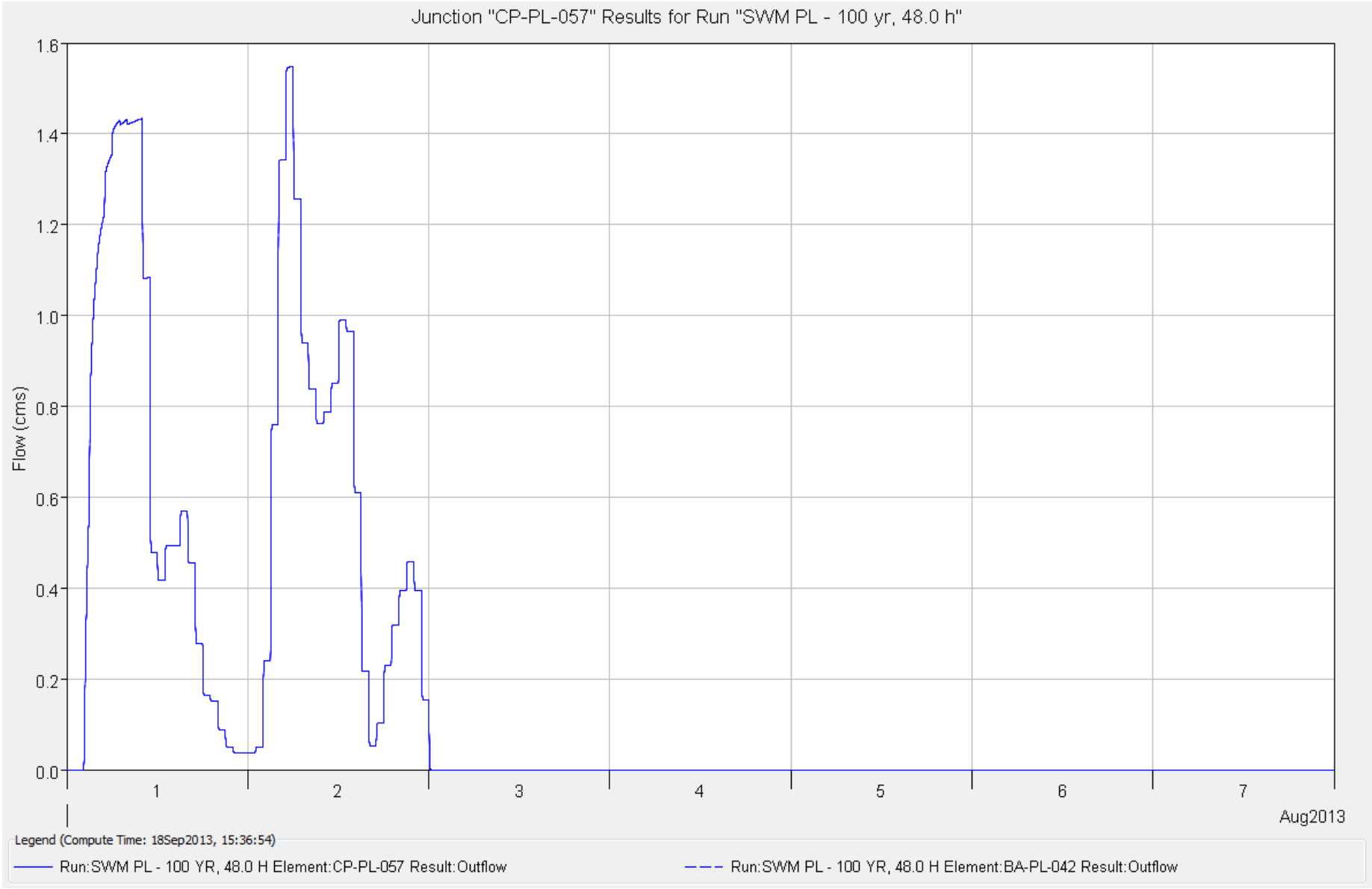

Junction "CP-PL-053" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-041 Result:Outflow

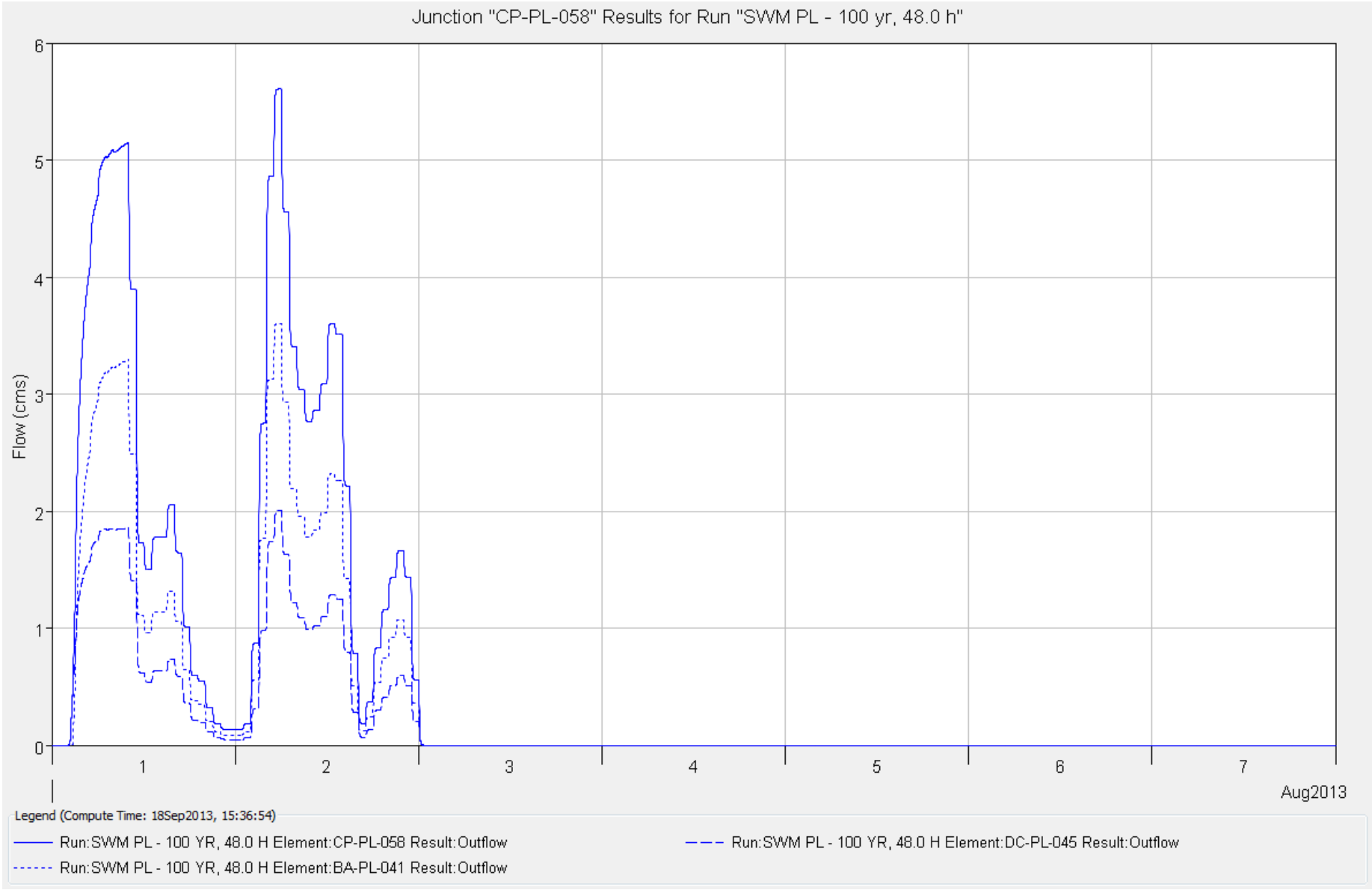

Junction "CP-PL-054" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-042 Result:Outflow

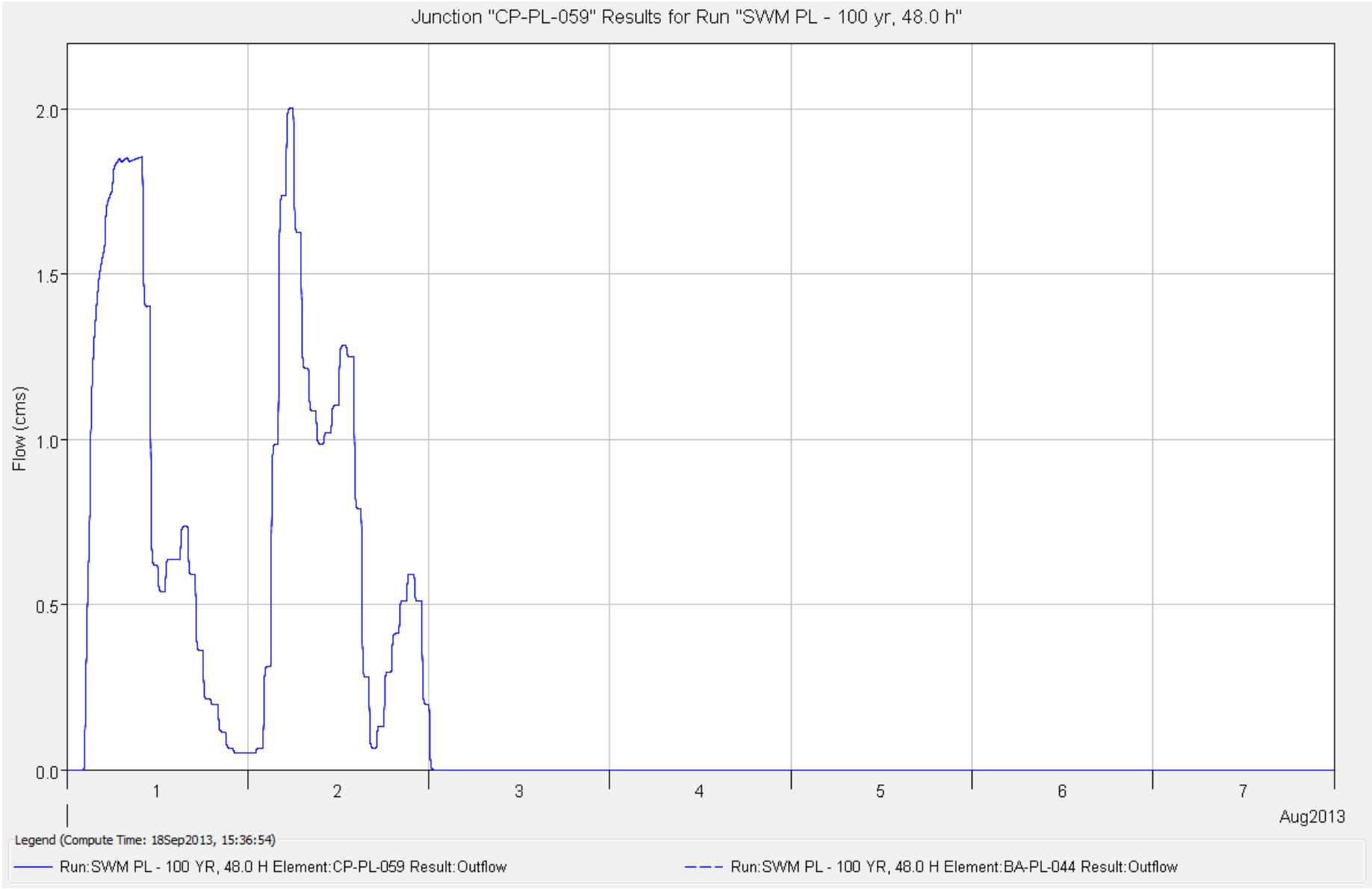

Junction "CP-PL-055" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Outflow

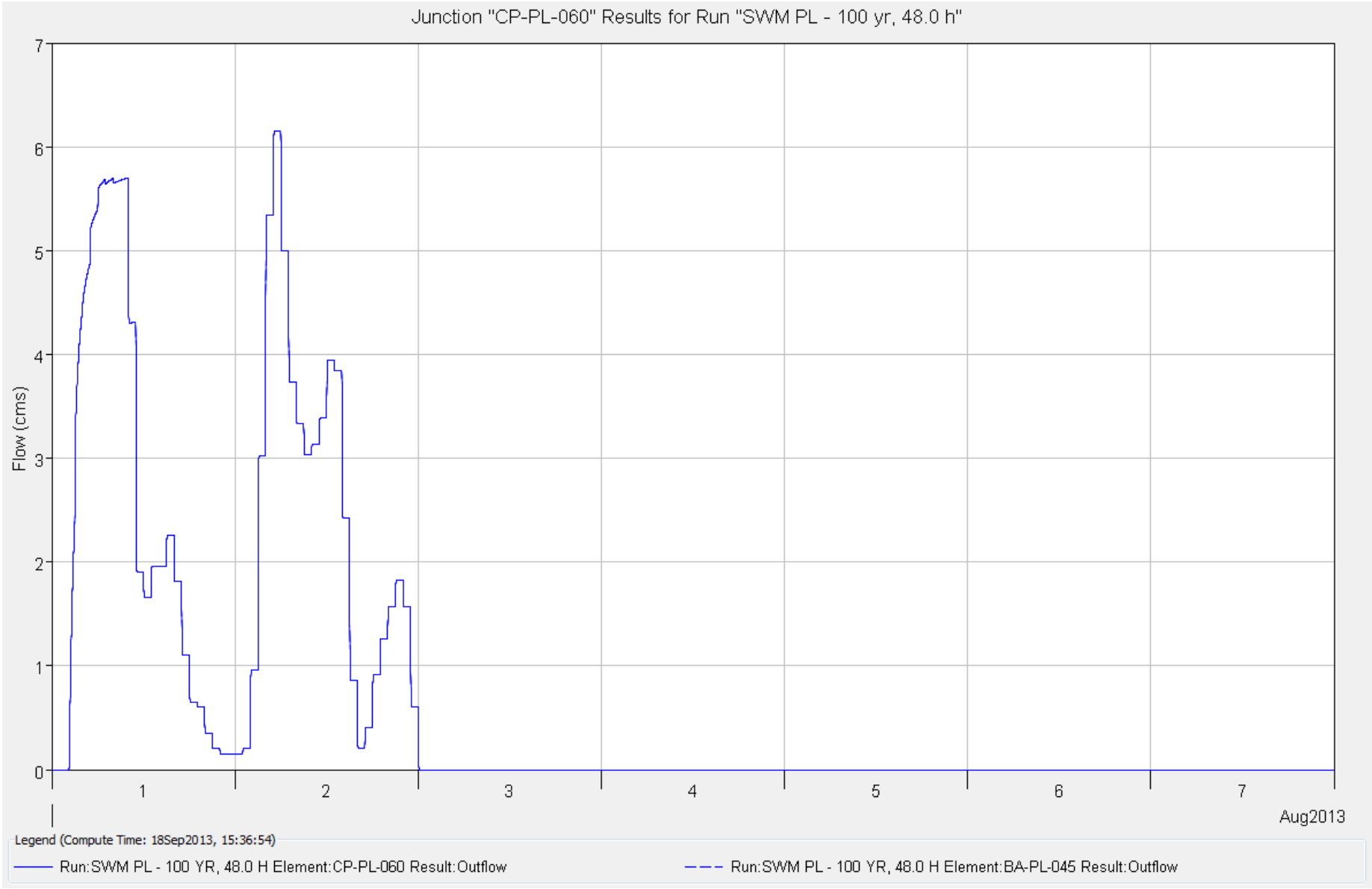

Junction "CP-PL-056A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-056A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-043 Result:Outflow

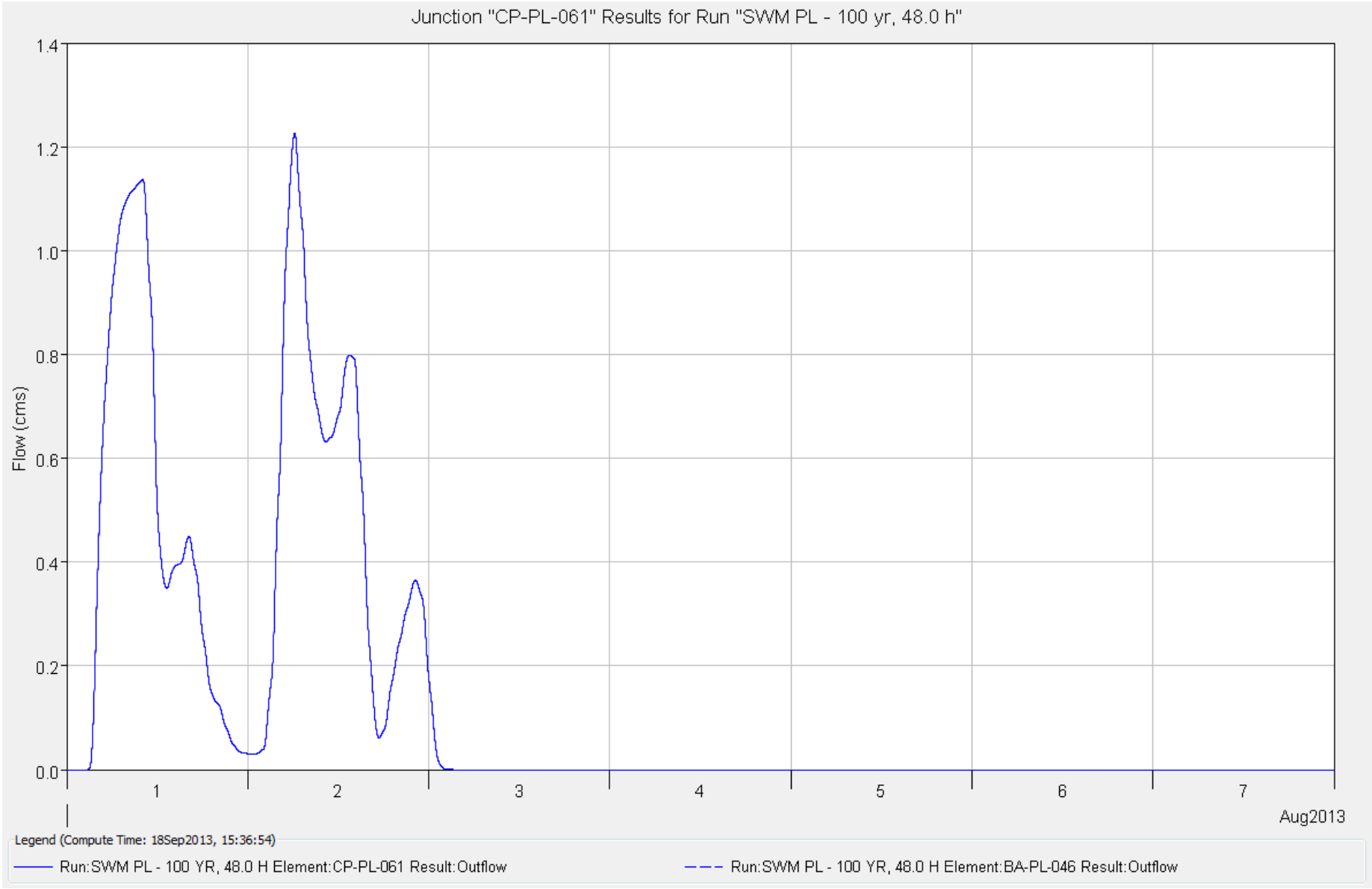

Junction "CP-PL-056B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-056B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-043 Result:Outflow

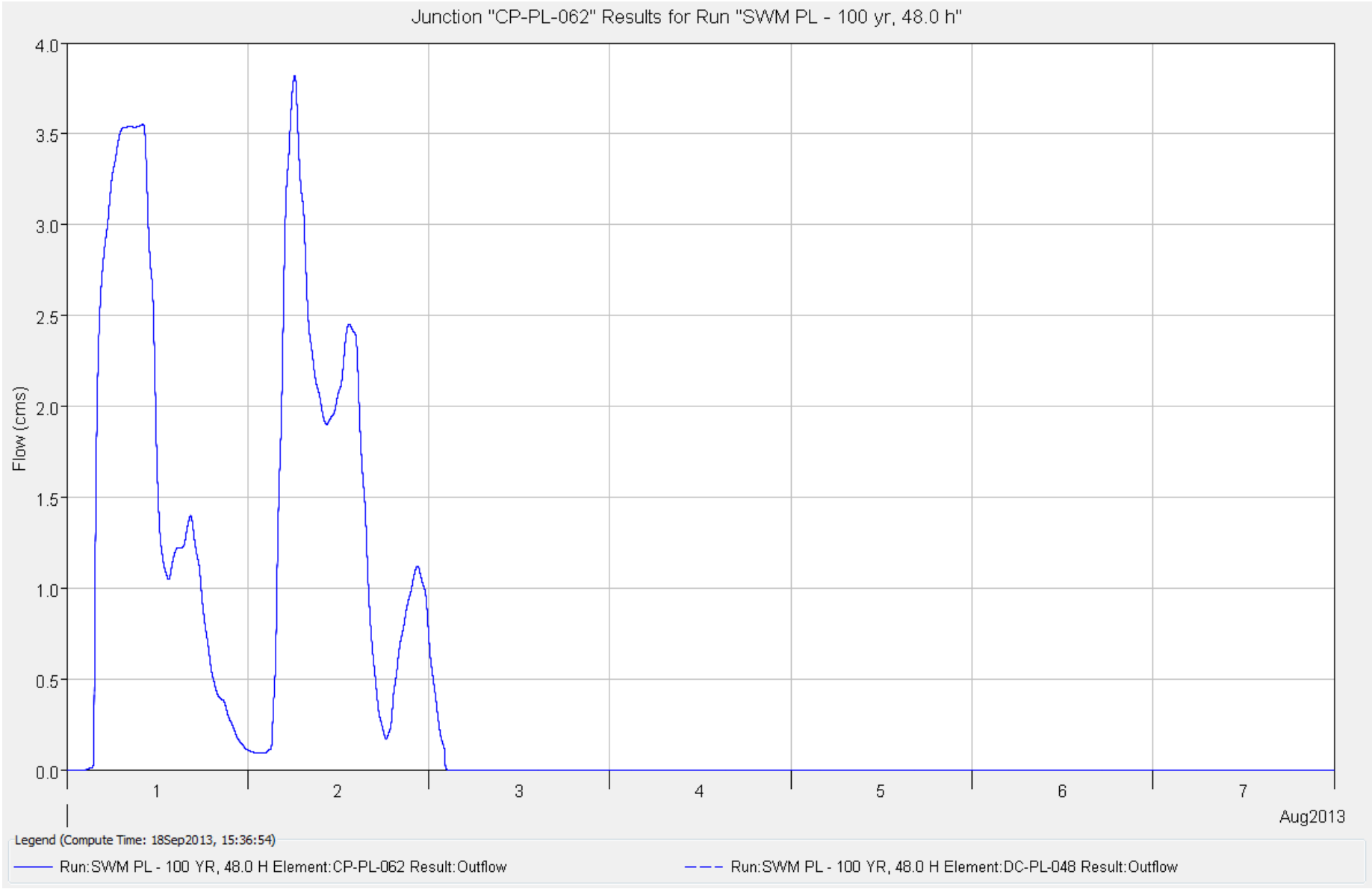

Junction "CP-PL-057" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-042 Result:Outflow

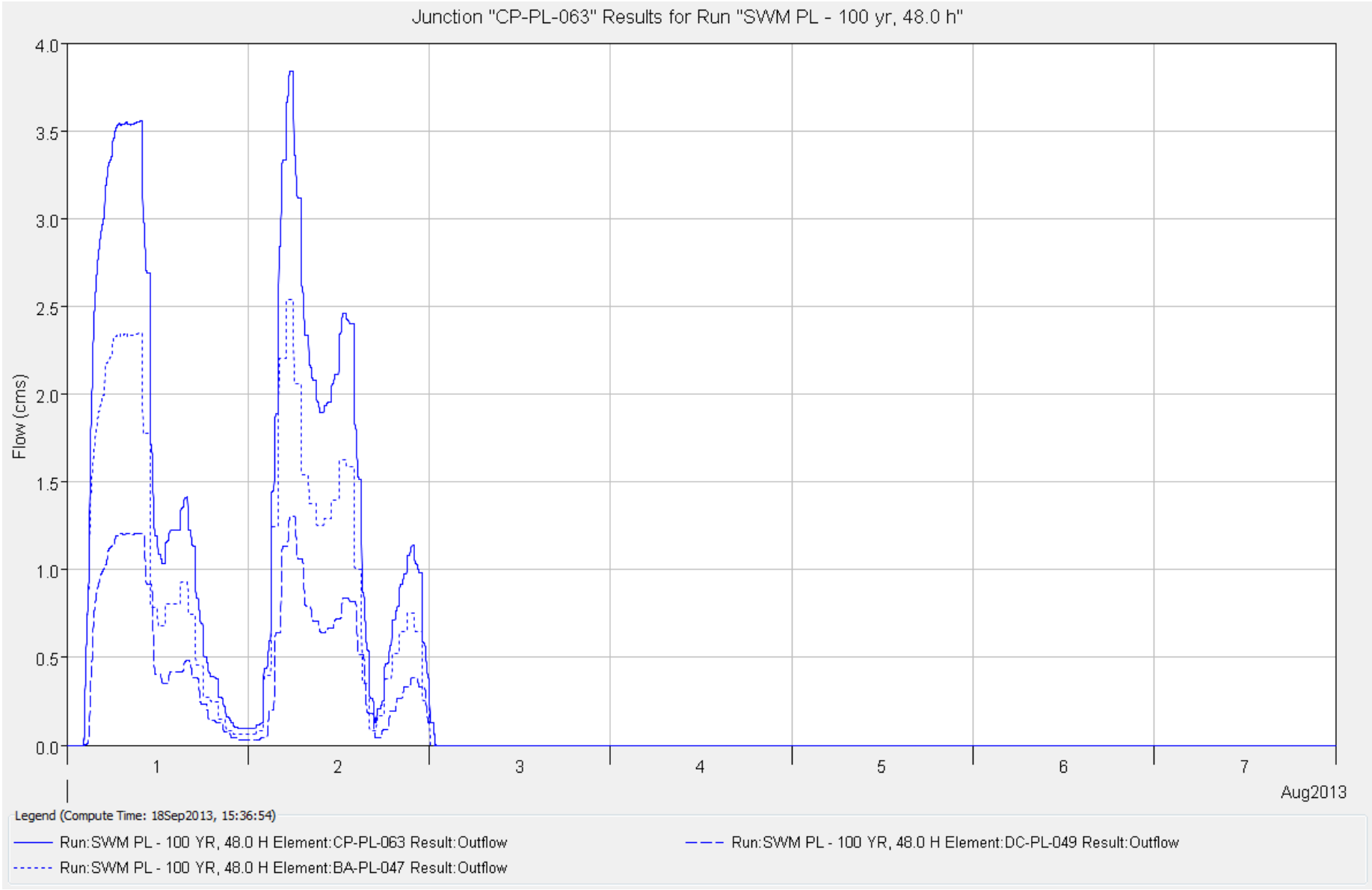

Junction "CP-PL-058" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-041 Result:Outflow

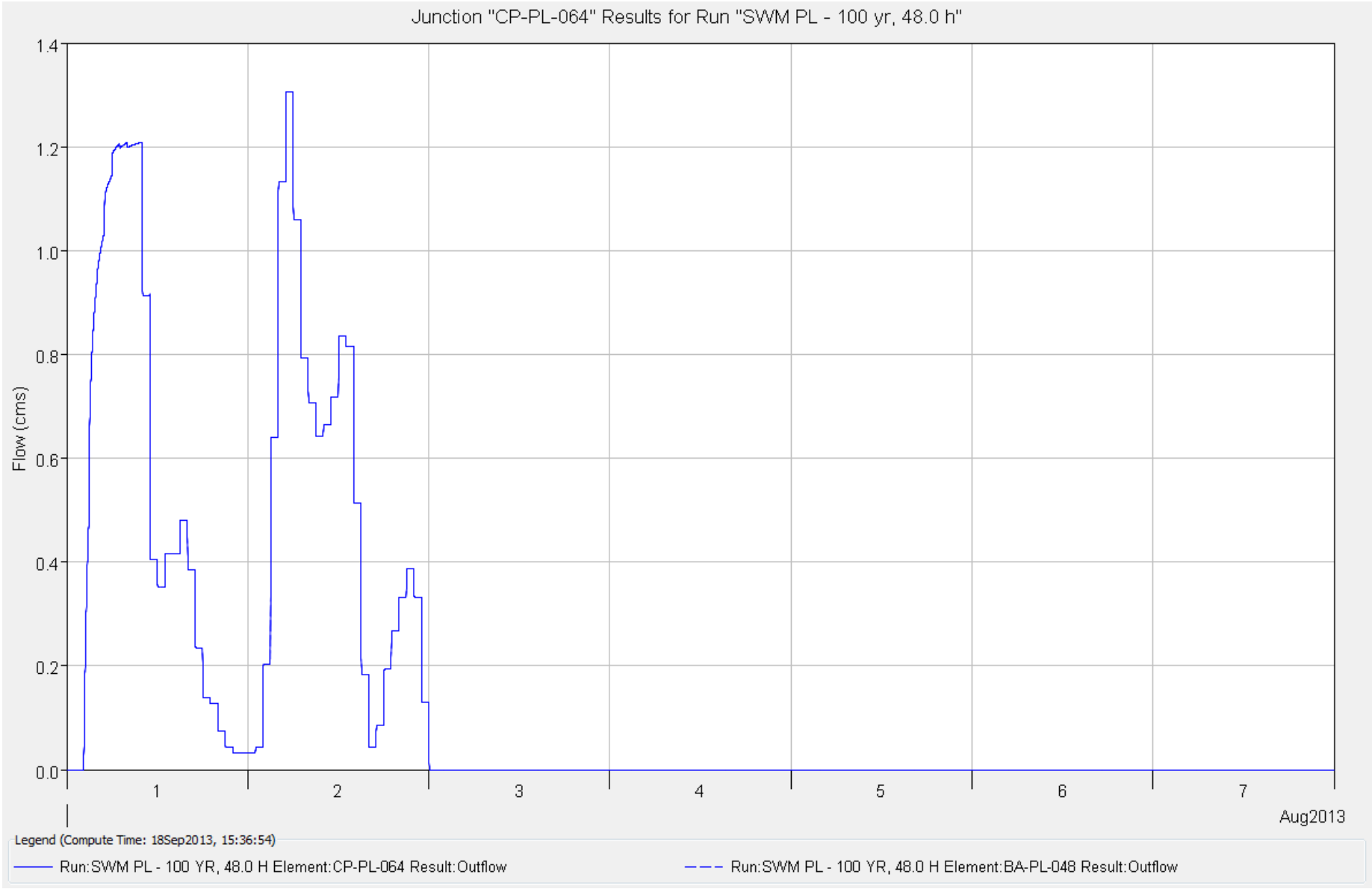

Junction "CP-PL-059" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-059 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-044 Result:Outflow

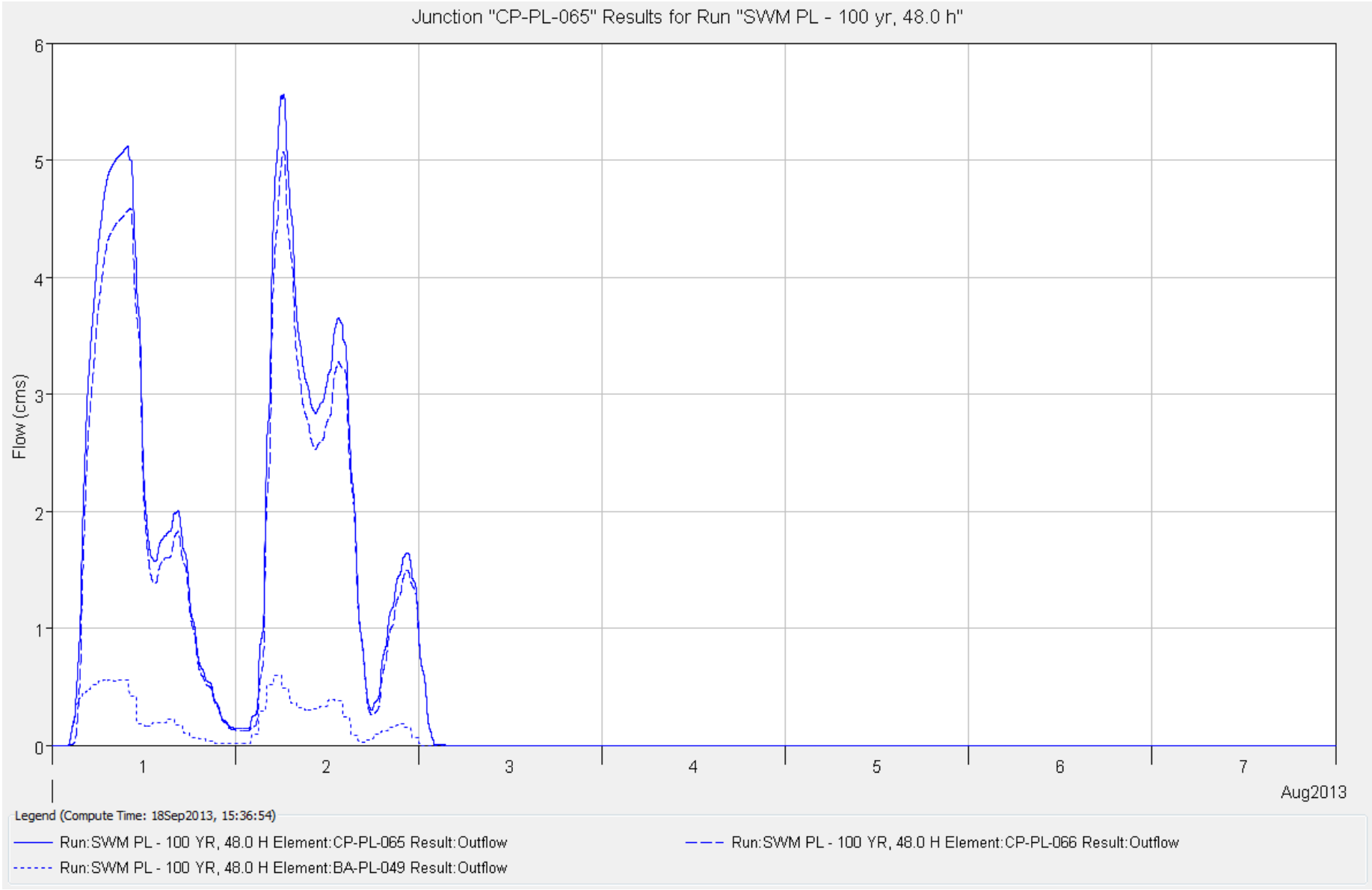

Junction "CP-PL-060" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-045 Result:Outflow

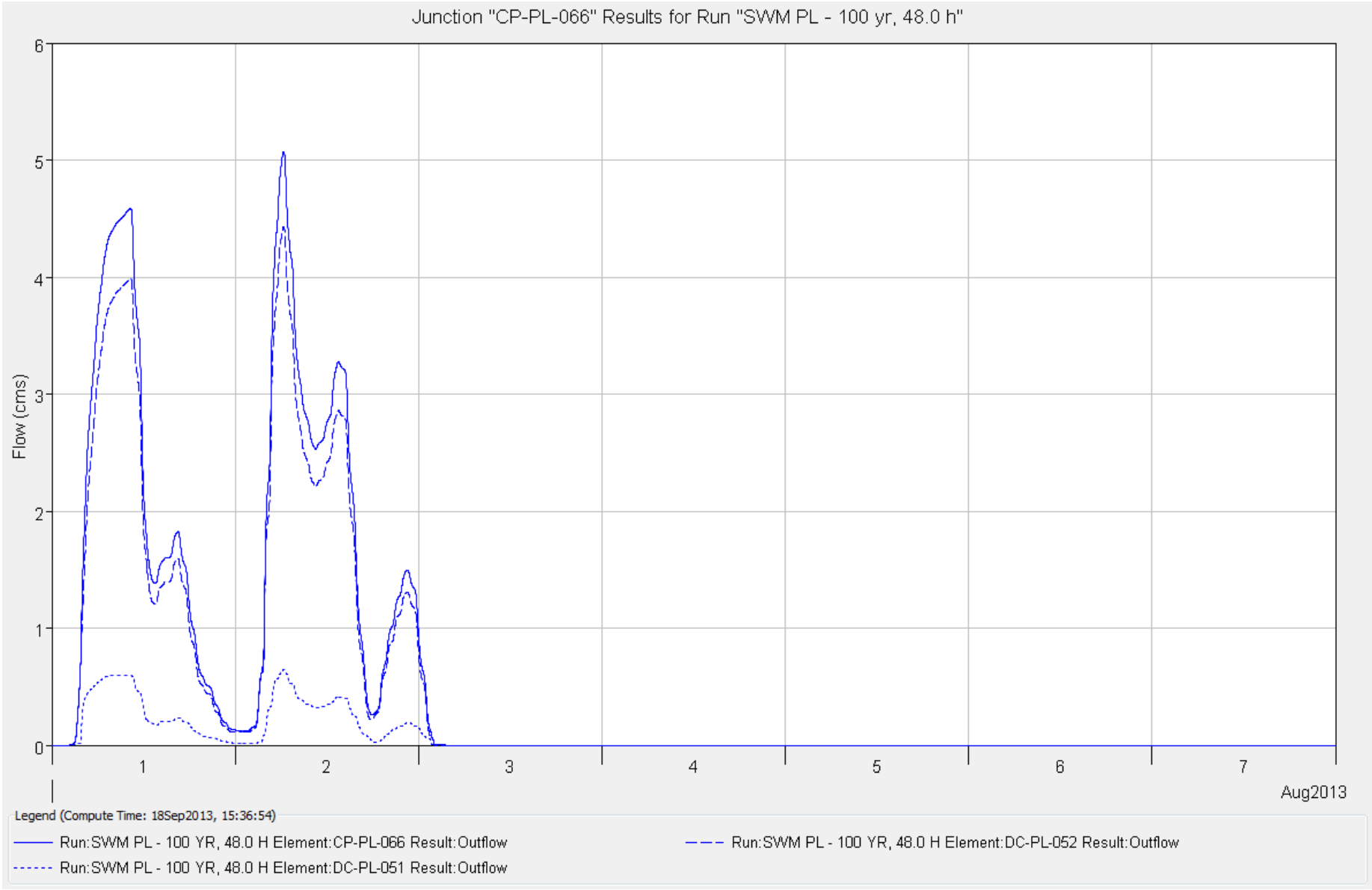

Junction "CP-PL-061" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-061 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-046 Result:Outflow

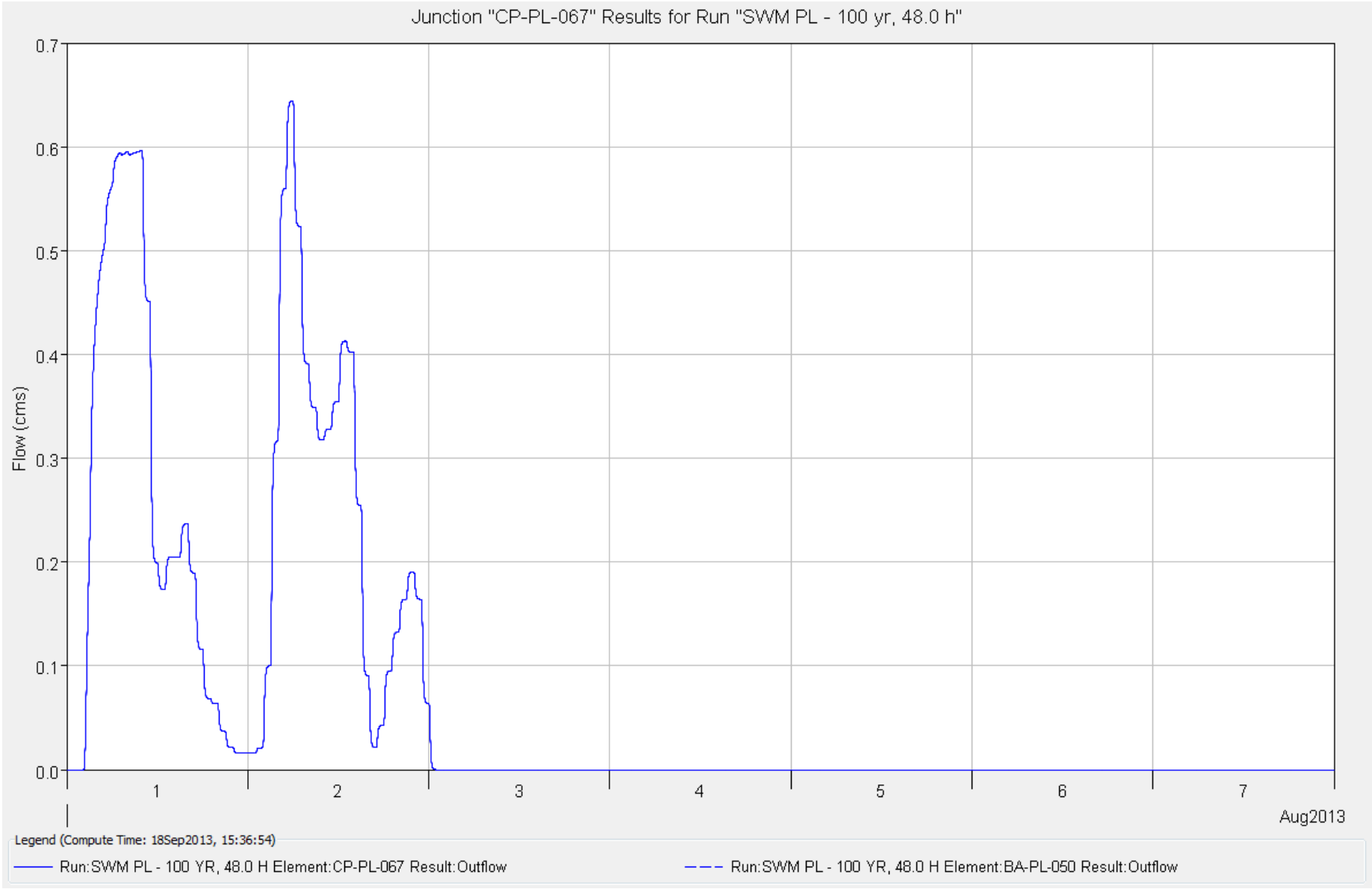

Junction "CP-PL-062" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-062 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-048 Result:Outflow

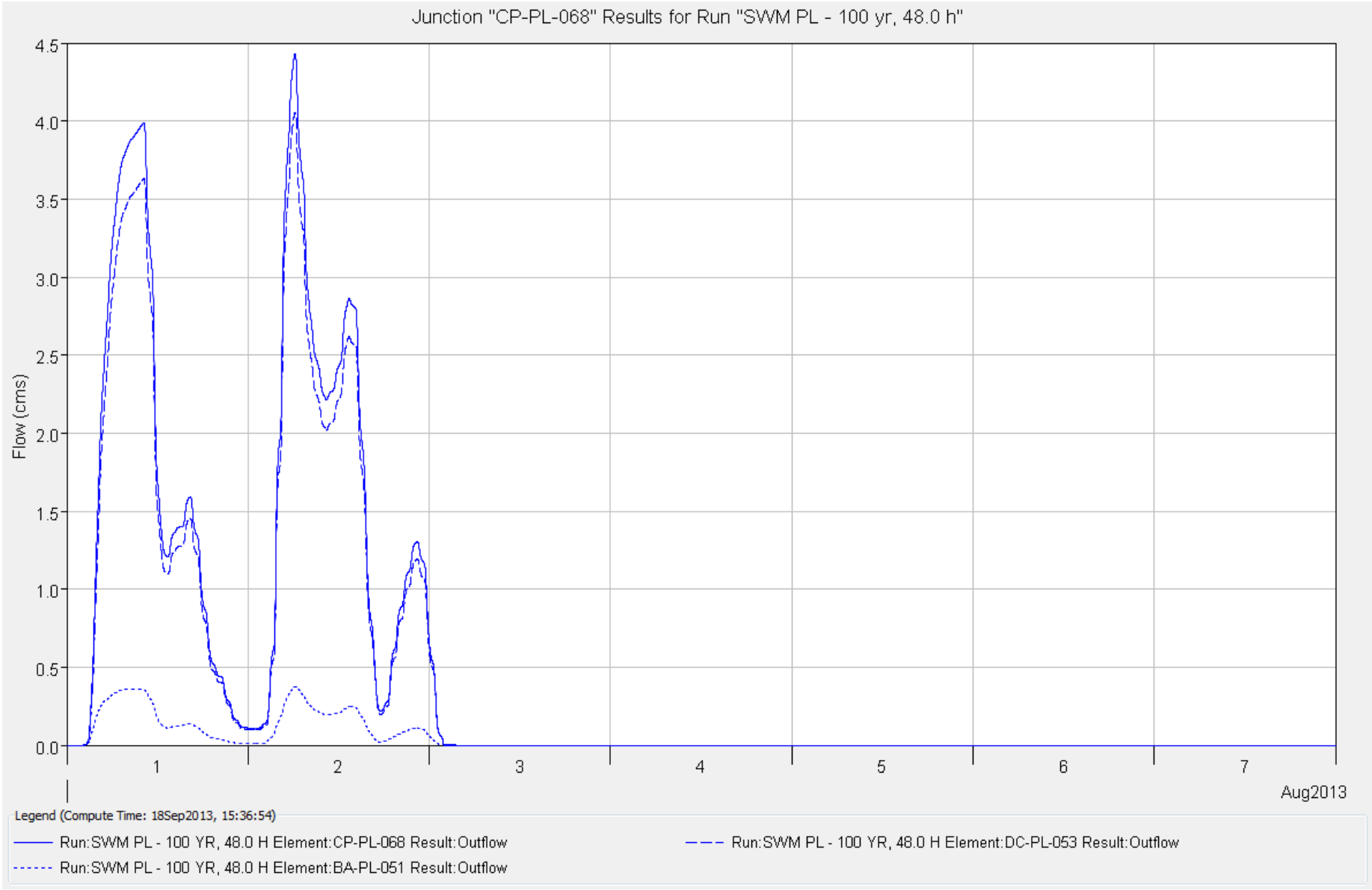

Junction "CP-PL-063" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-047 Result:Outflow

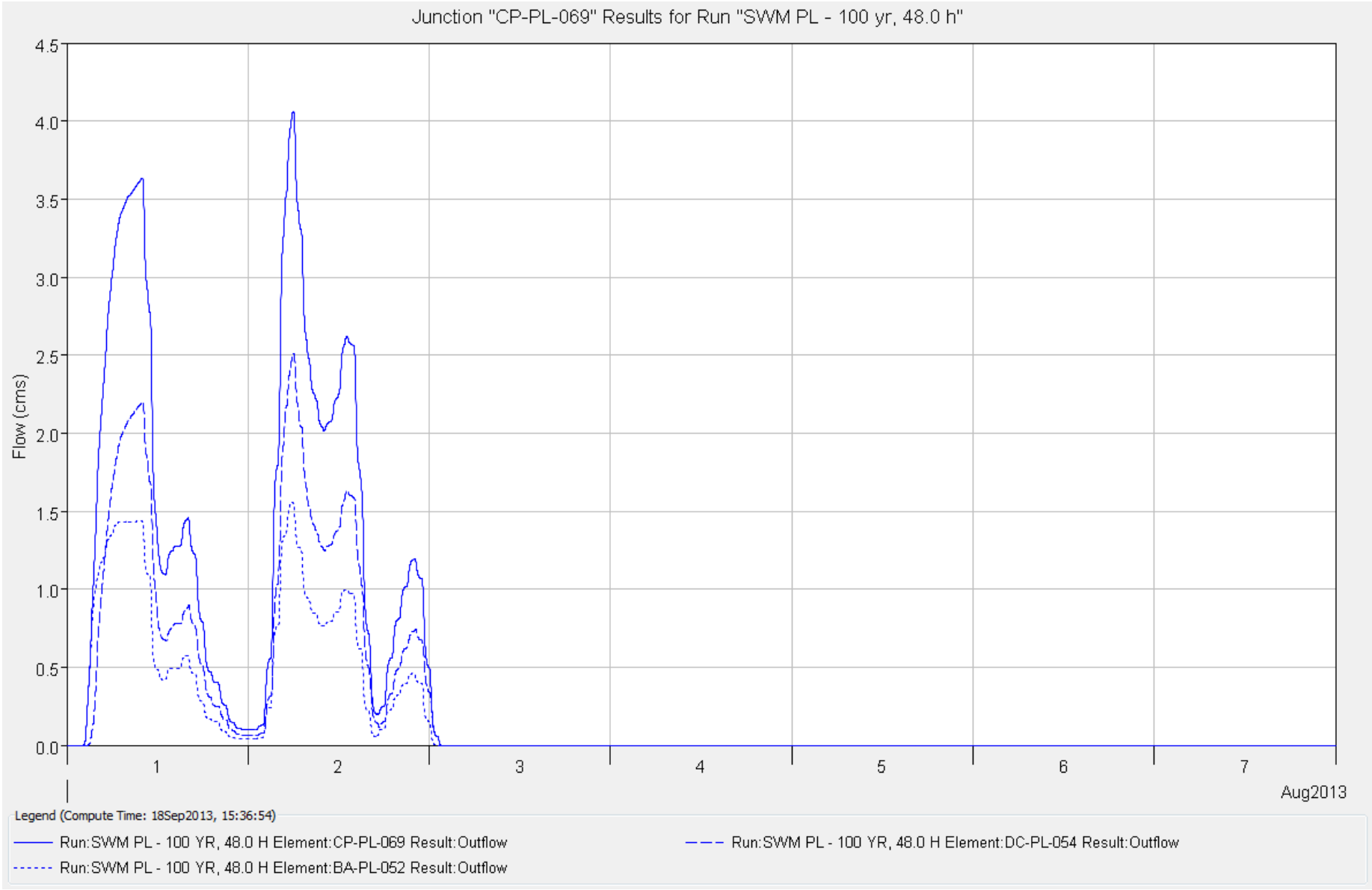

Junction "CP-PL-064" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-064 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-048 Result:Outflow

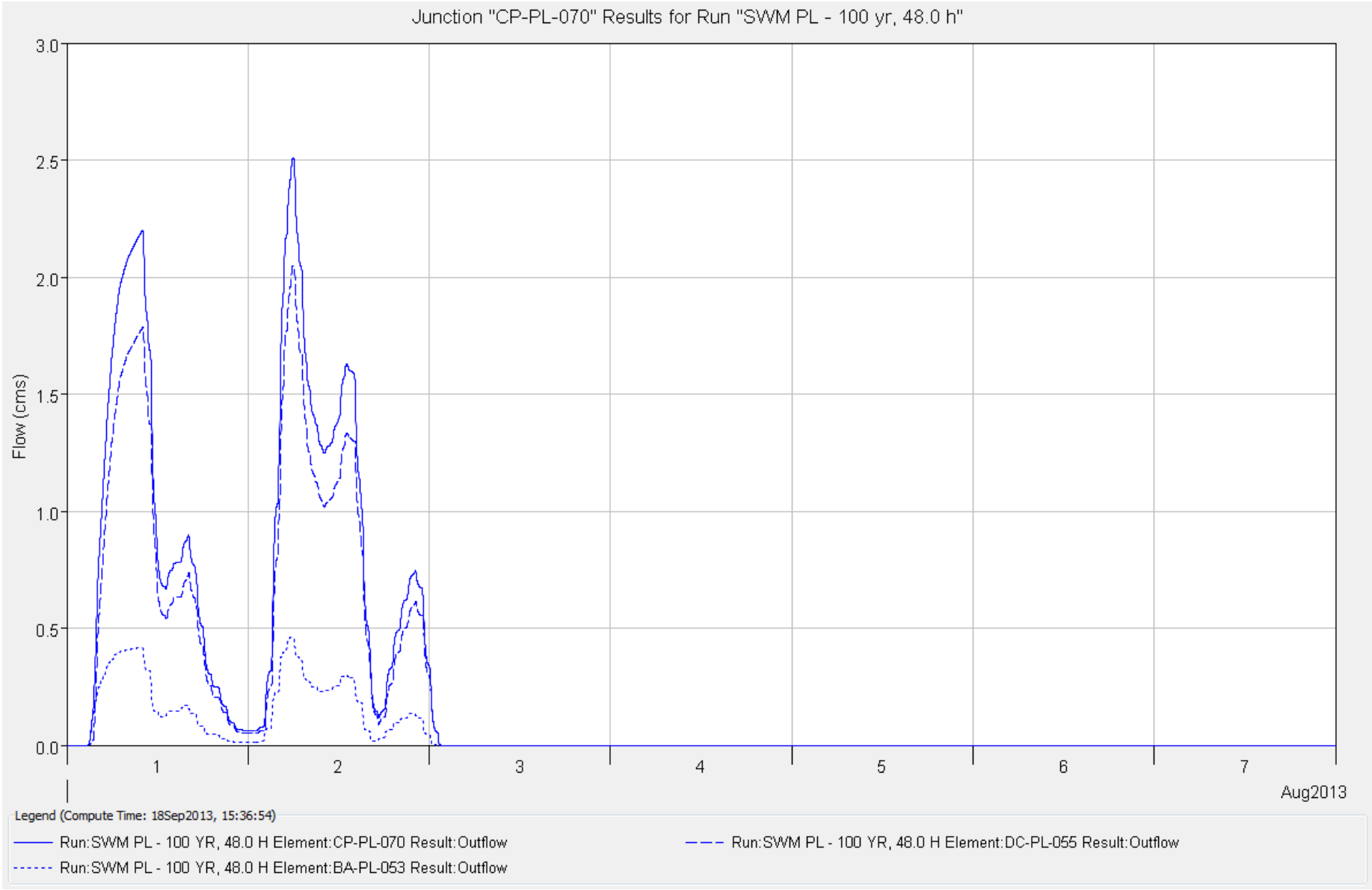

Junction "CP-PL-065" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-065 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-049 Result:Outflow

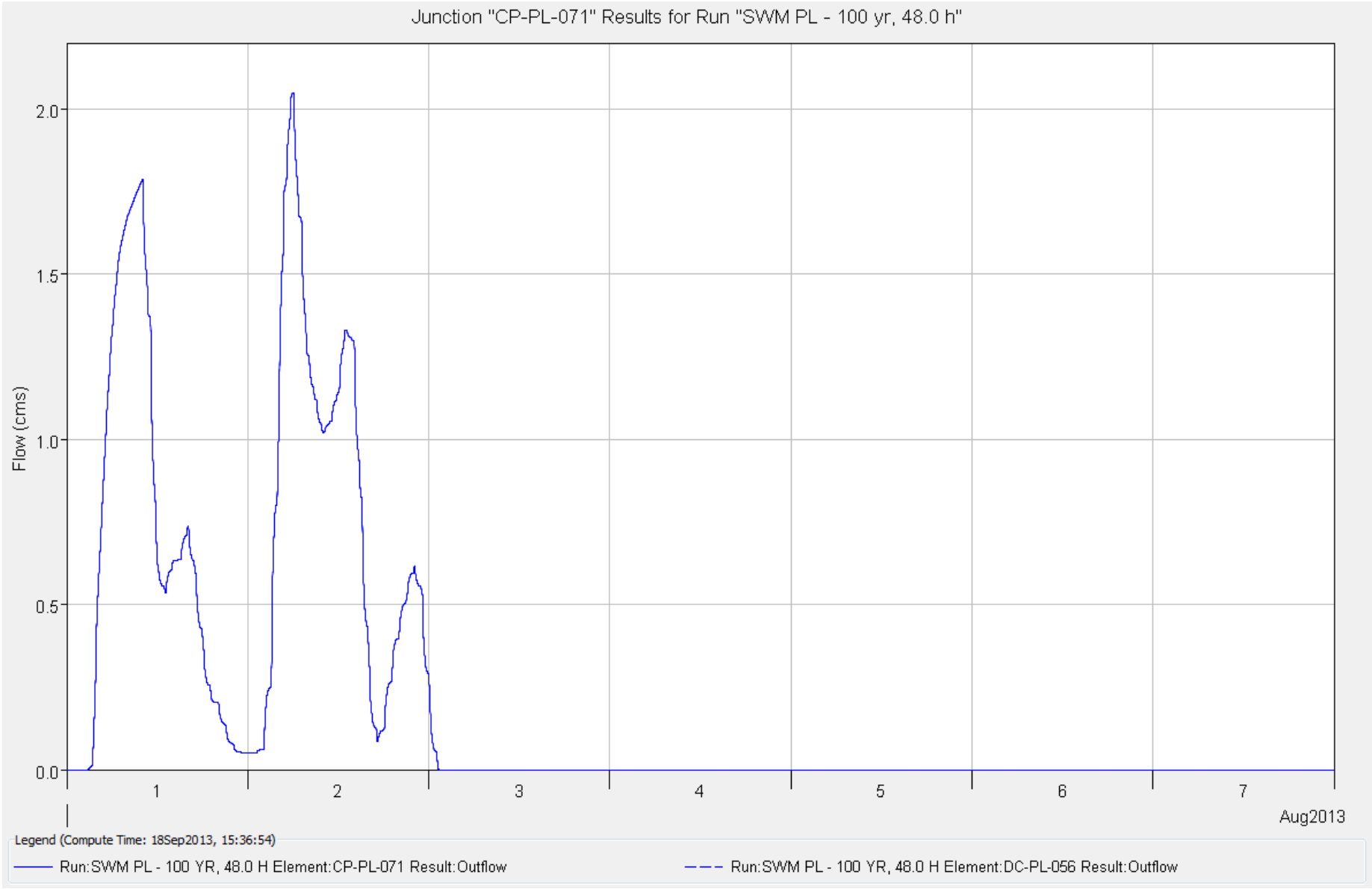

Junction "CP-PL-066" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-051 Result:Outflow

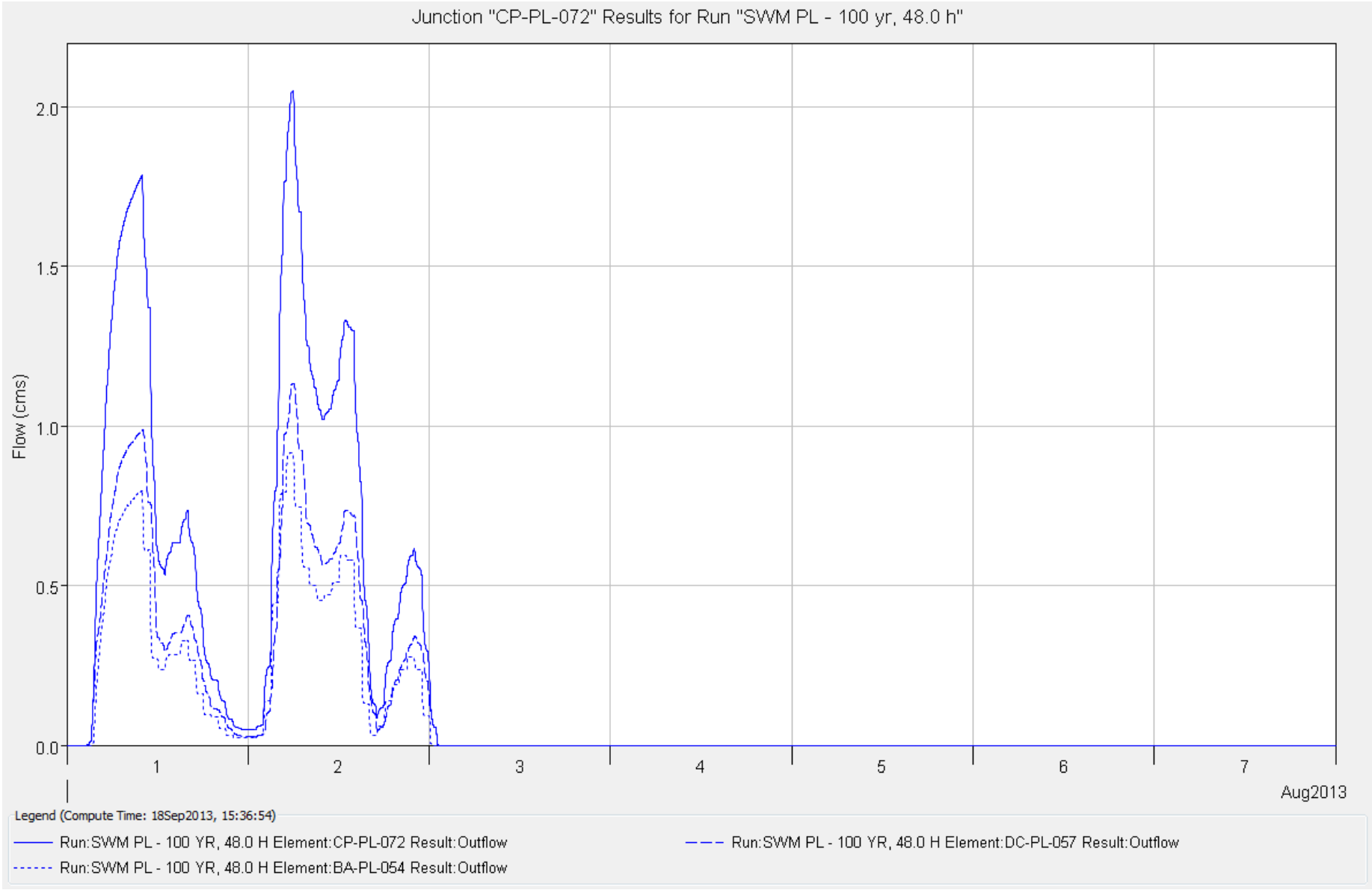

Junction "CP-PL-067" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-067 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-050 Result:Outflow

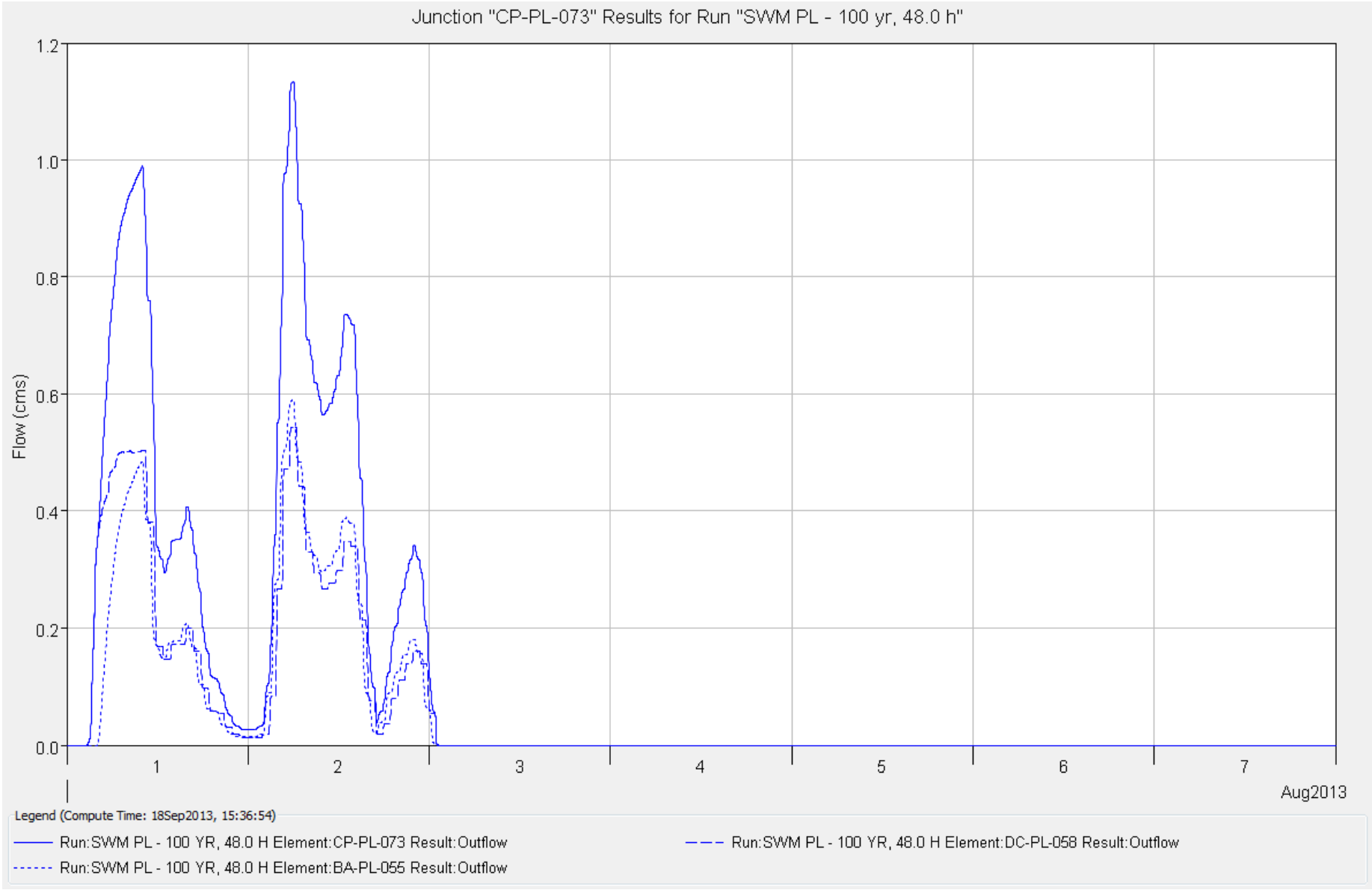

Junction "CP-PL-068" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-068 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-051 Result:Outflow

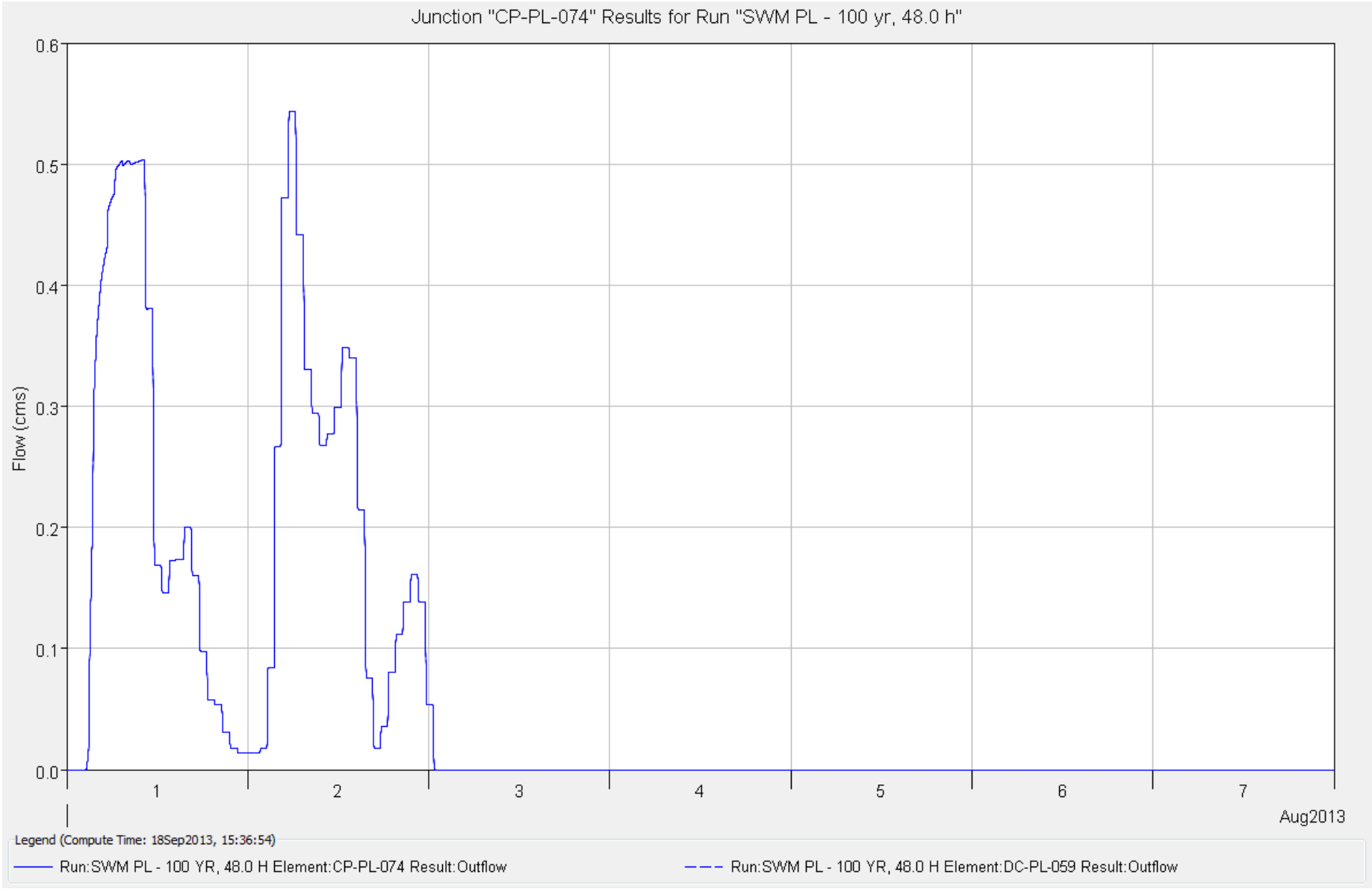

Junction "CP-PL-069" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-069 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-052 Result:Outflow

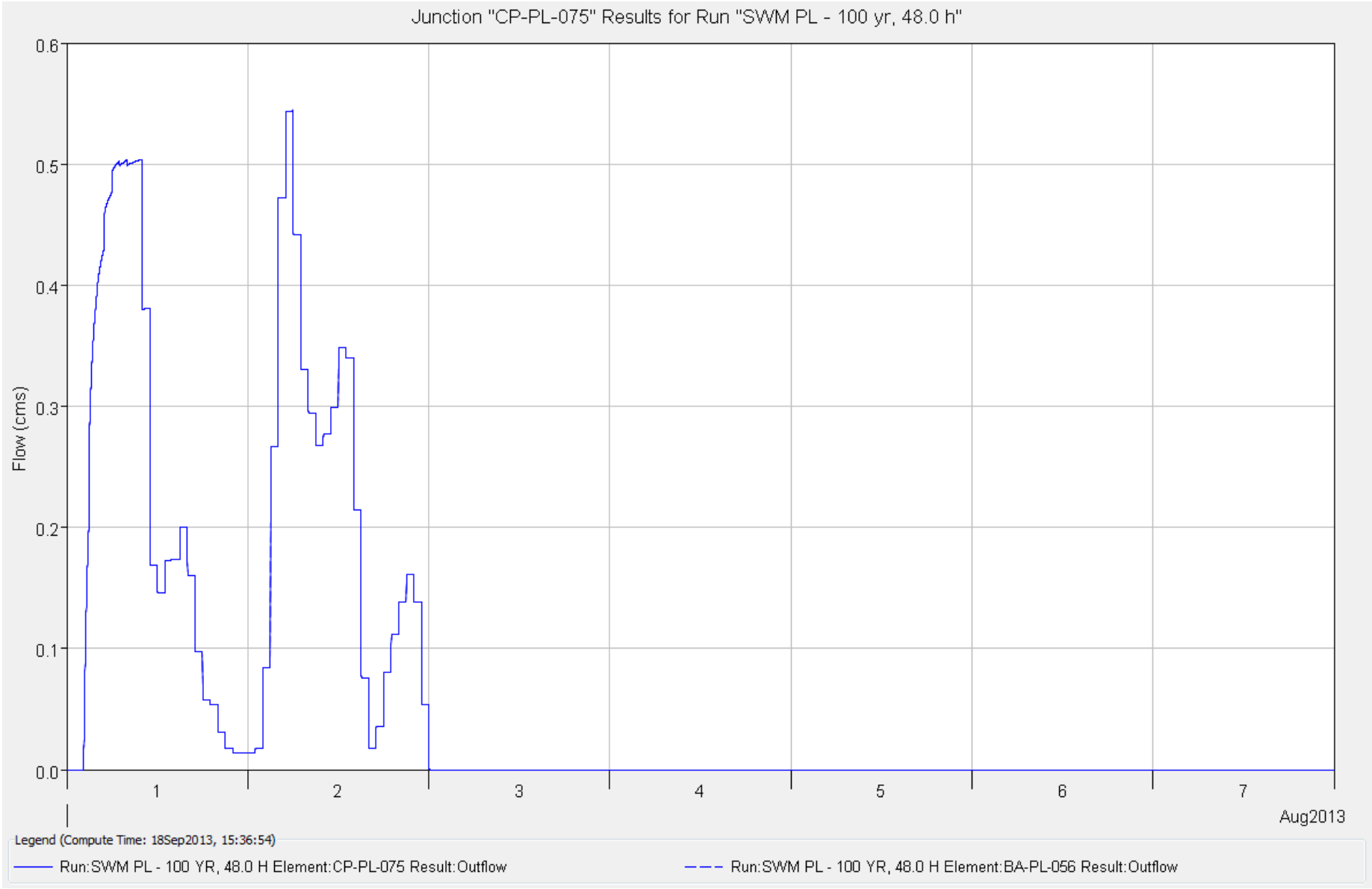

Junction "CP-PL-070" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-070 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-053 Result:Outflow

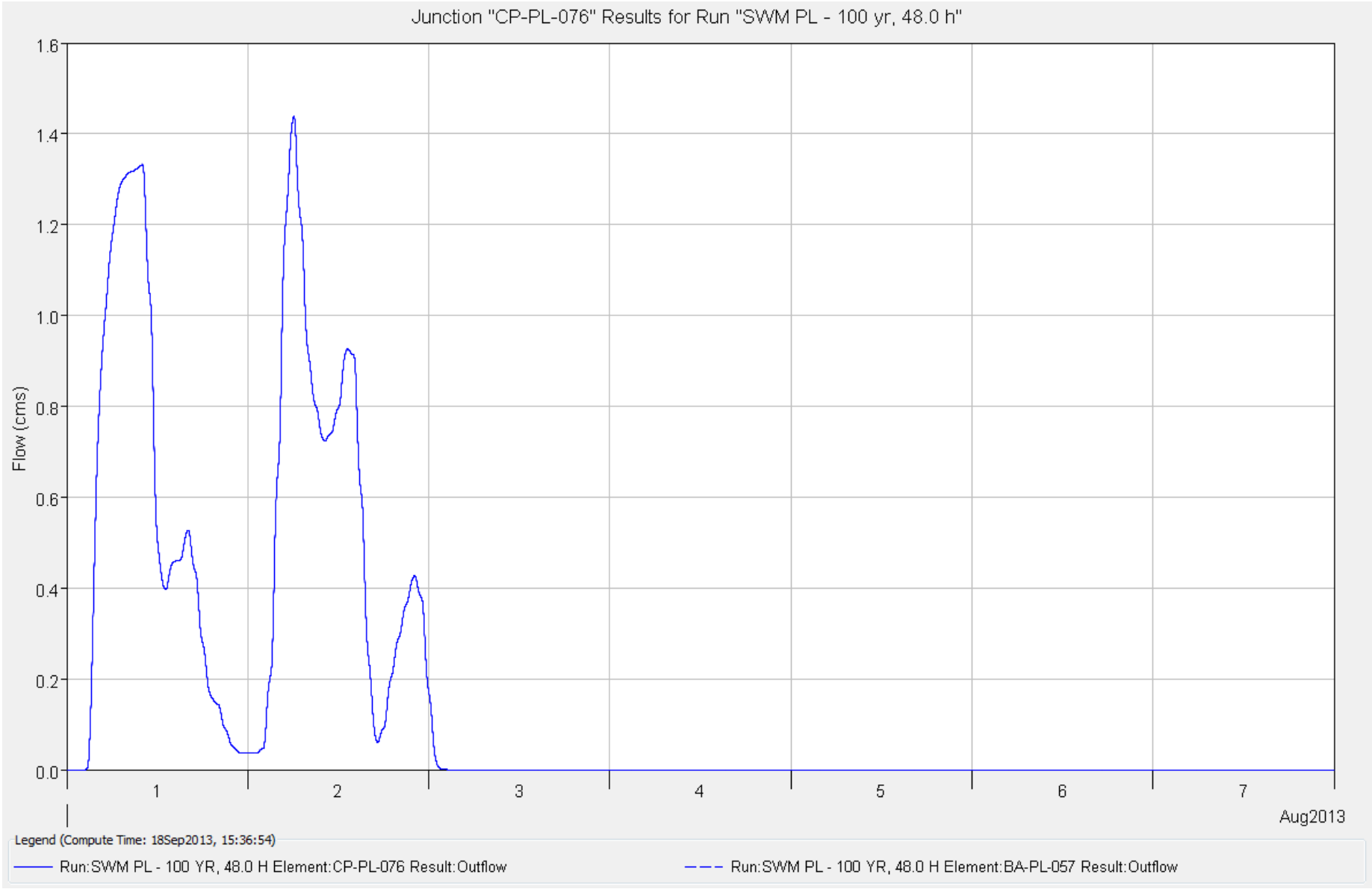

Junction "CP-PL-071" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-071 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-056 Result:Outflow

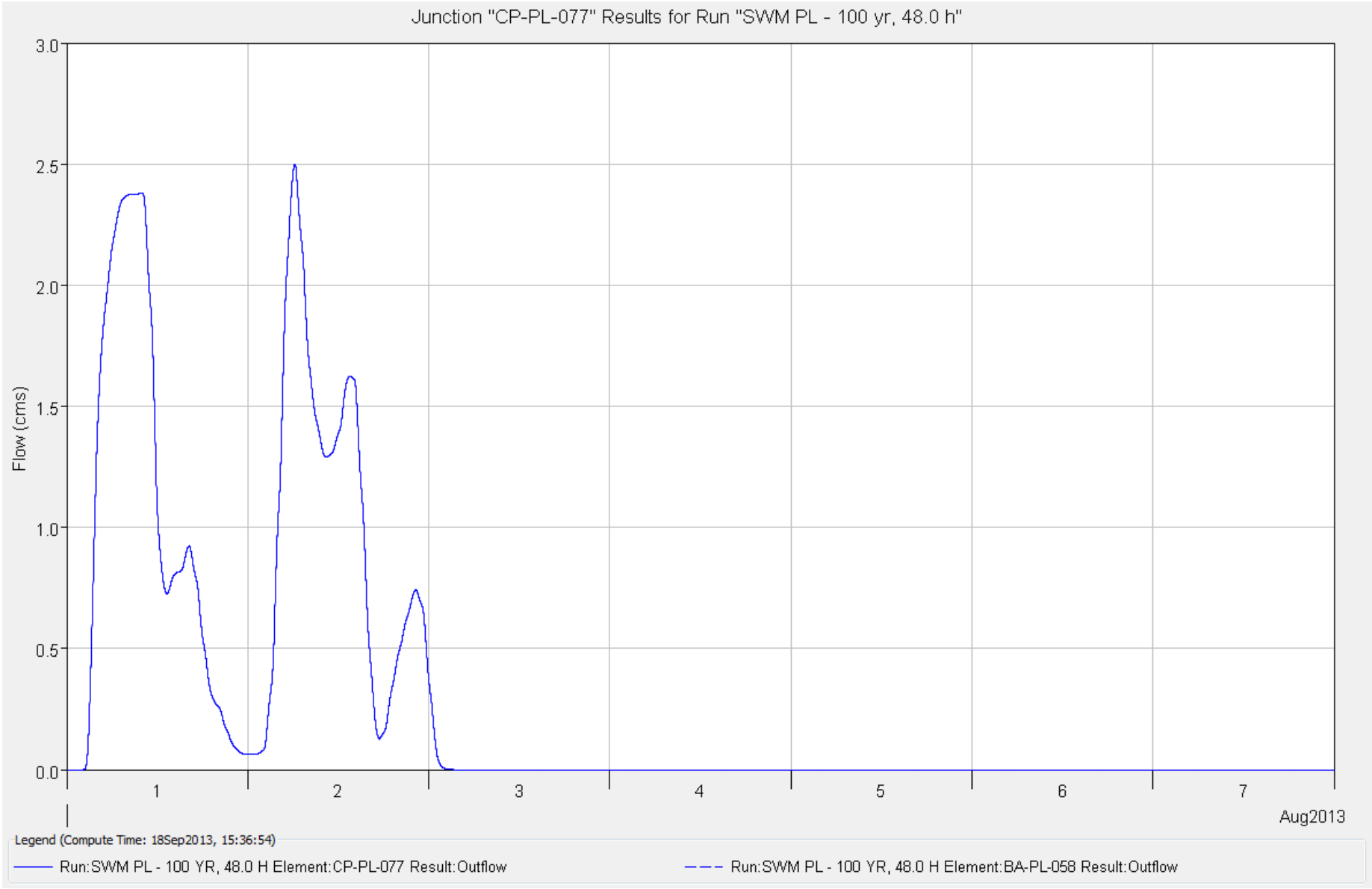

Junction "CP-PL-072" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-072 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-054 Result:Outflow

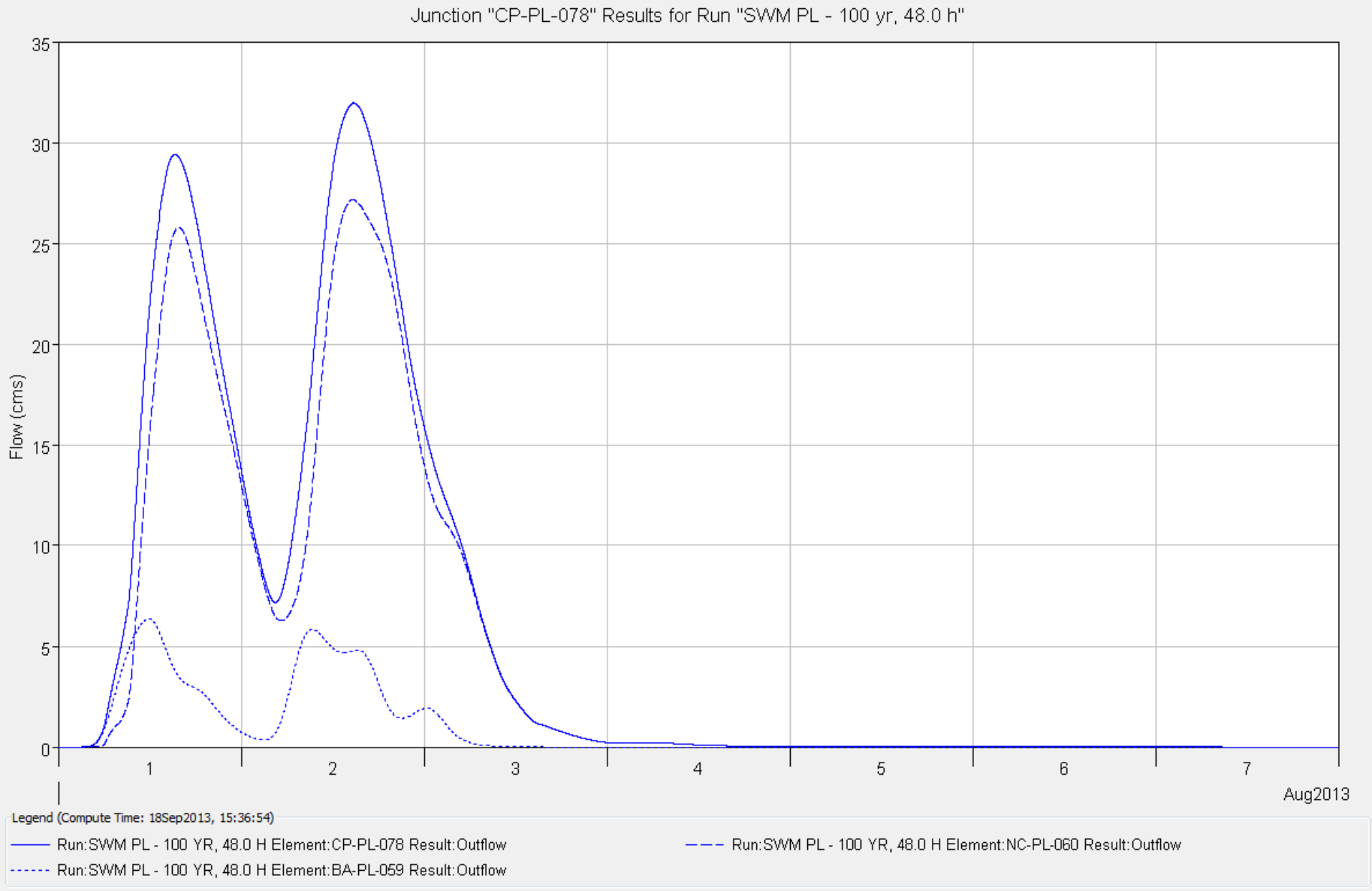

Junction "CP-PL-073" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-073 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-055 Result:Outflow

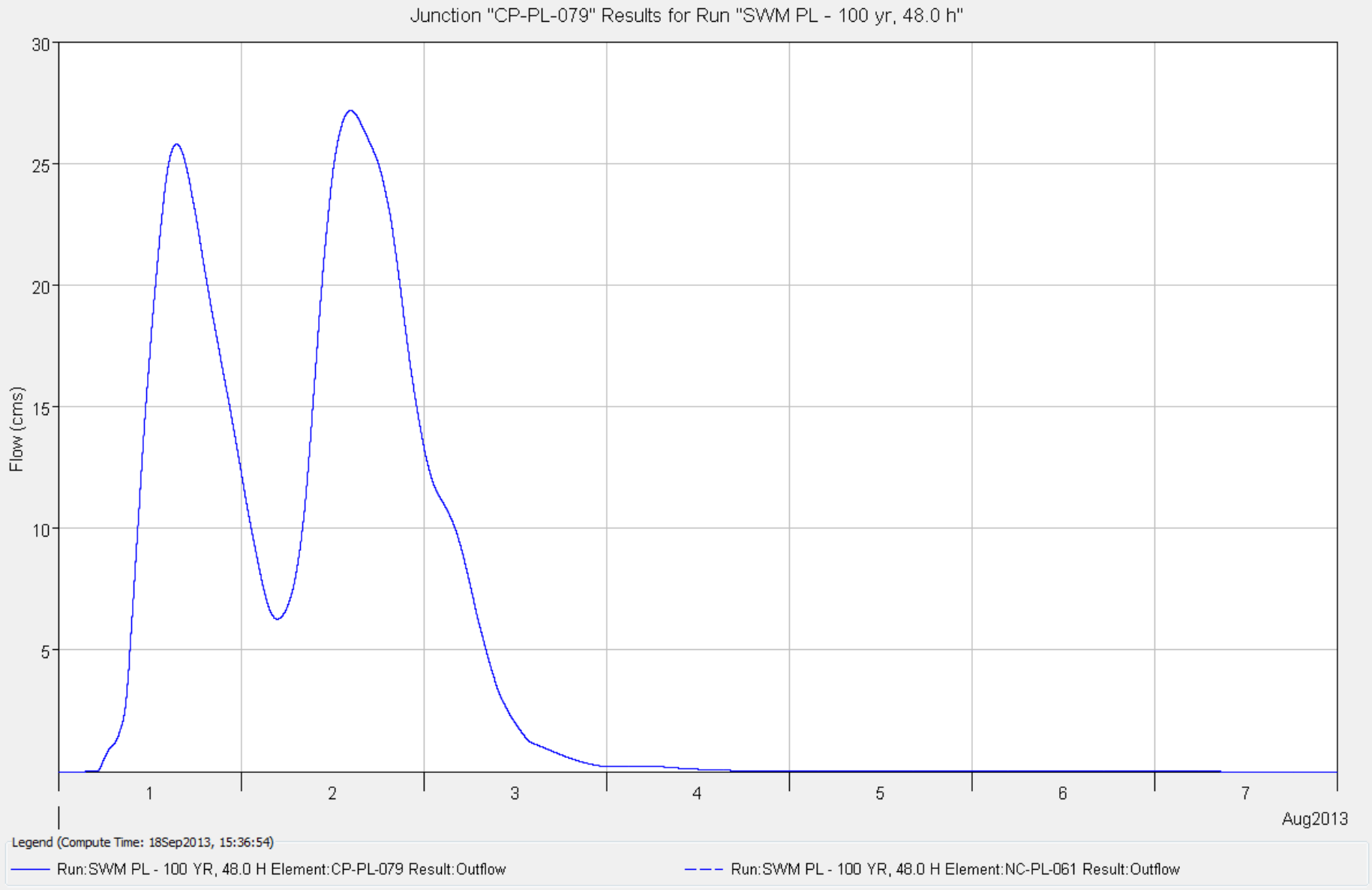

Junction "CP-PL-074" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-074 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-059 Result:Outflow

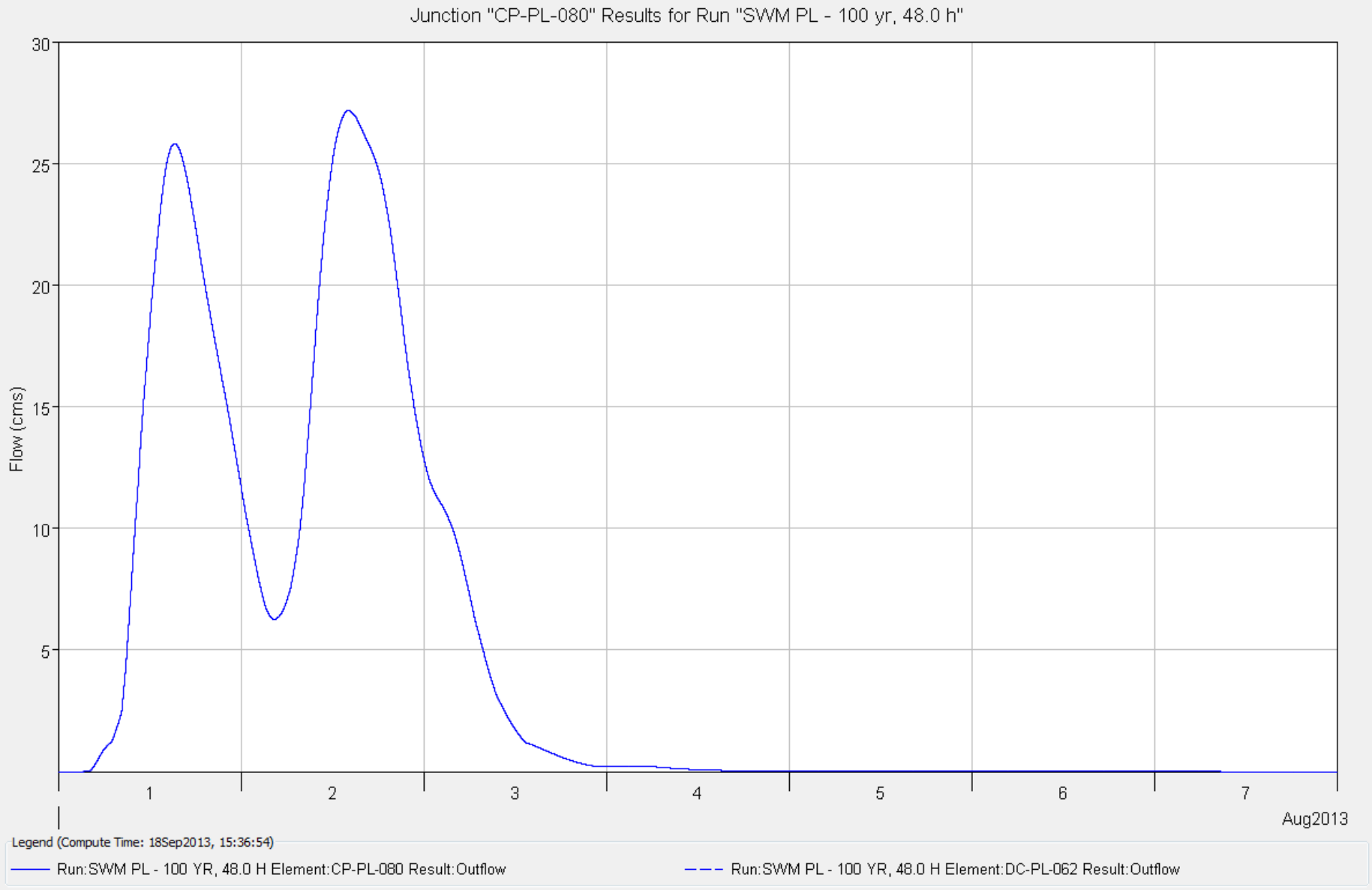

Junction "CP-PL-075" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-075 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-056 Result:Outflow

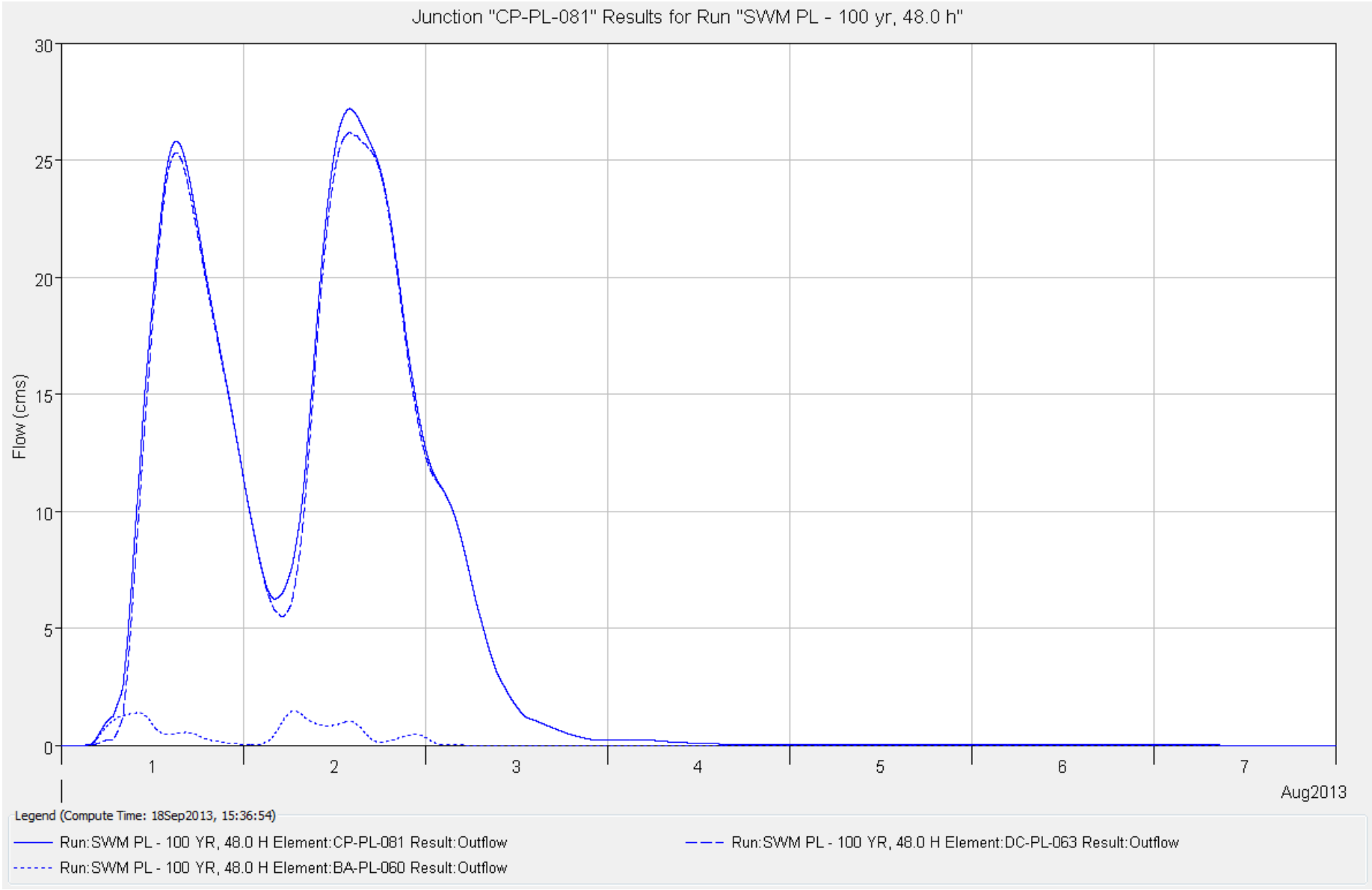

Junction "CP-PL-076" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-076 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-057 Result:Outflow

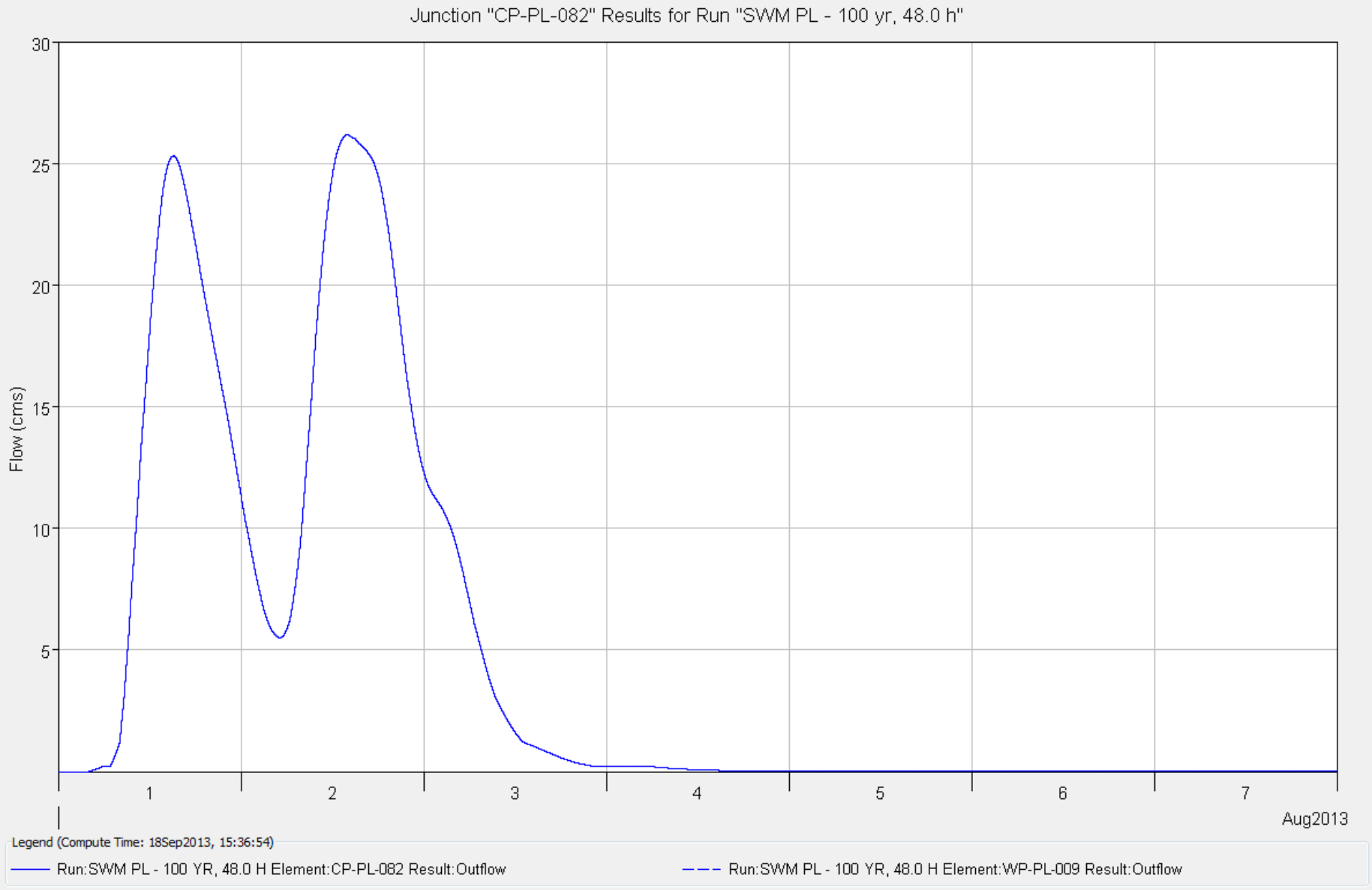

Junction "CP-PL-077" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-058 Result:Outflow

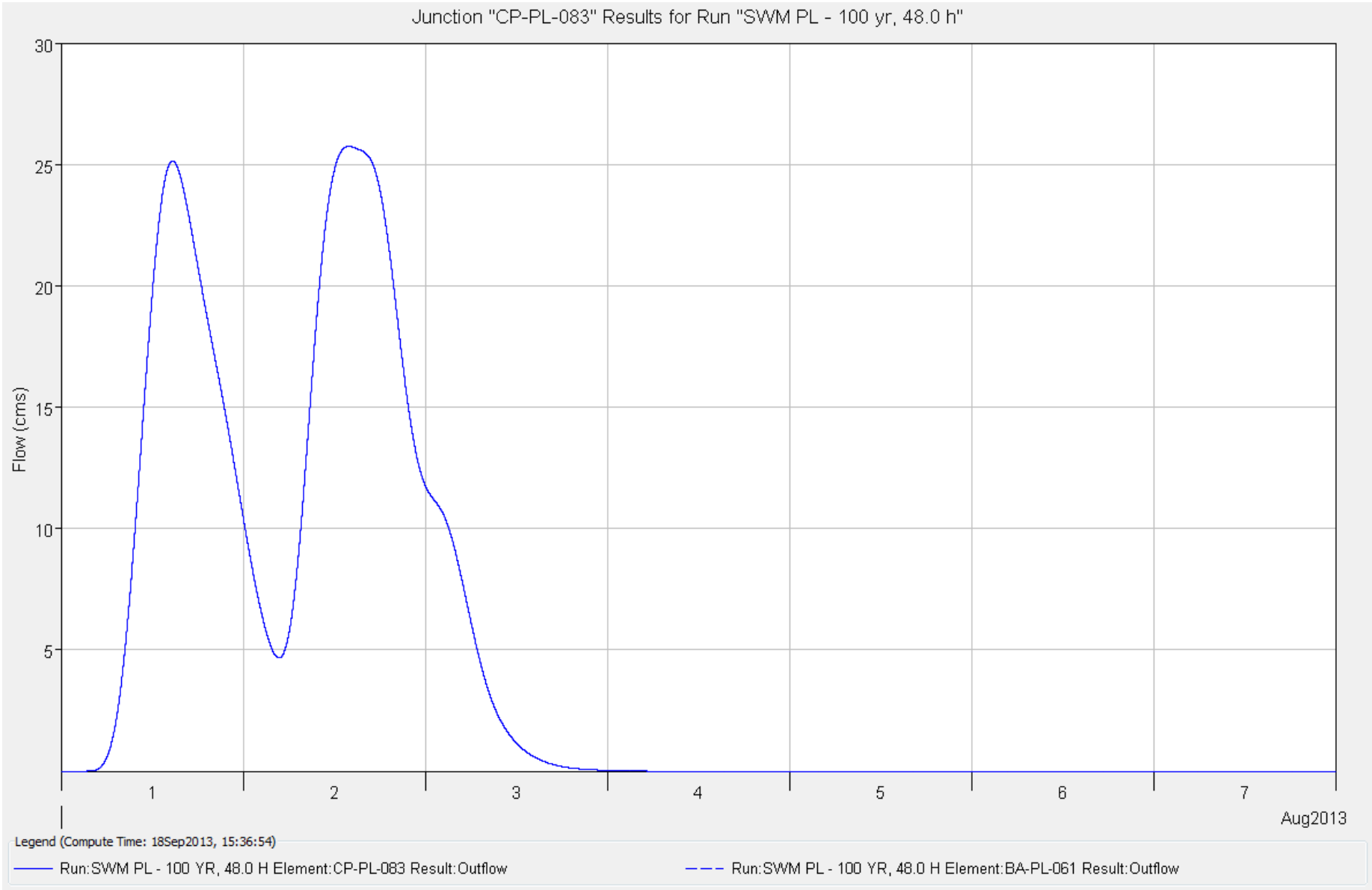

Junction "CP-PL-078" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-059 Result:Outflow

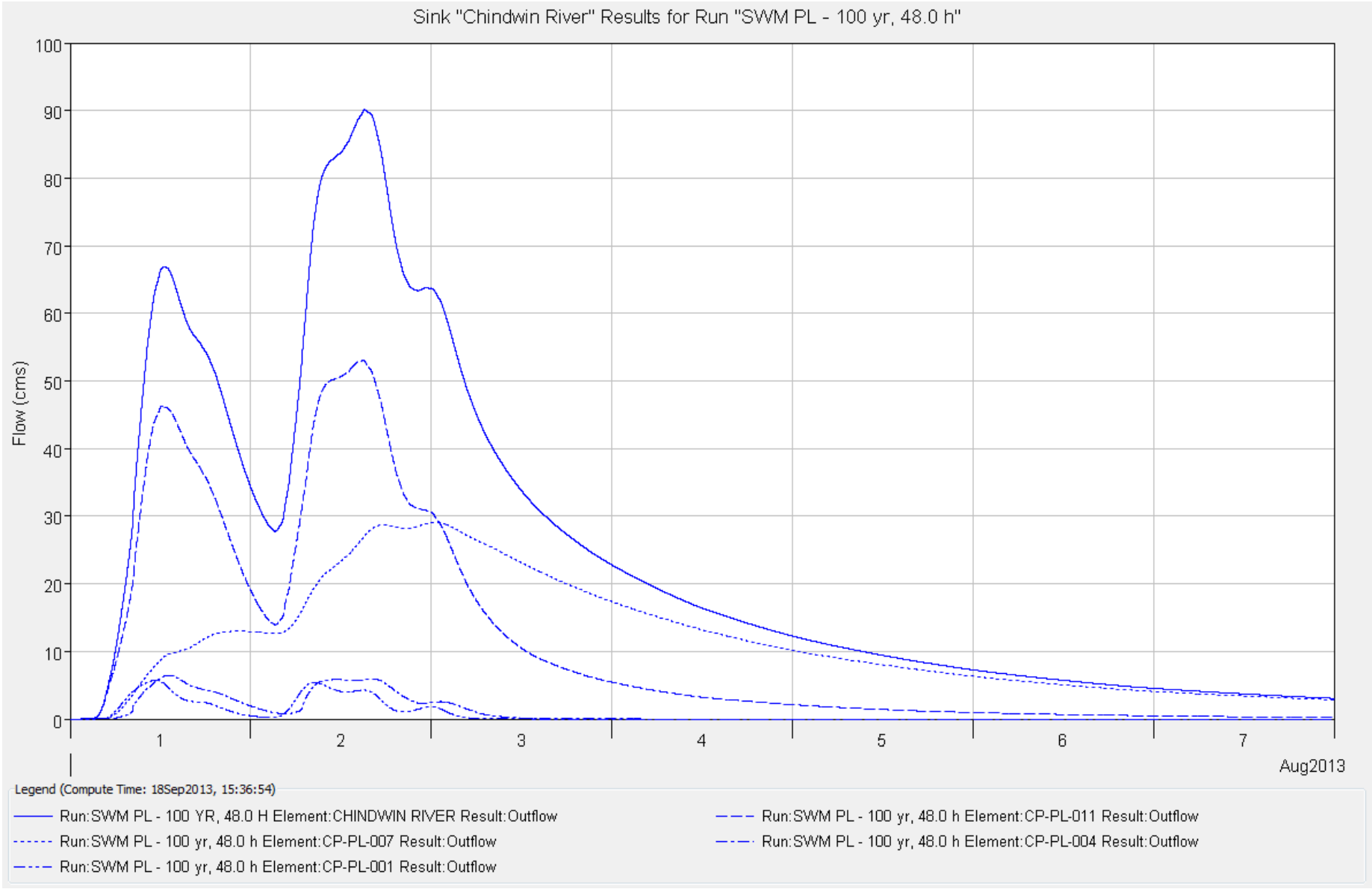

Junction "CP-PL-079" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-079 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-061 Result:Outflow

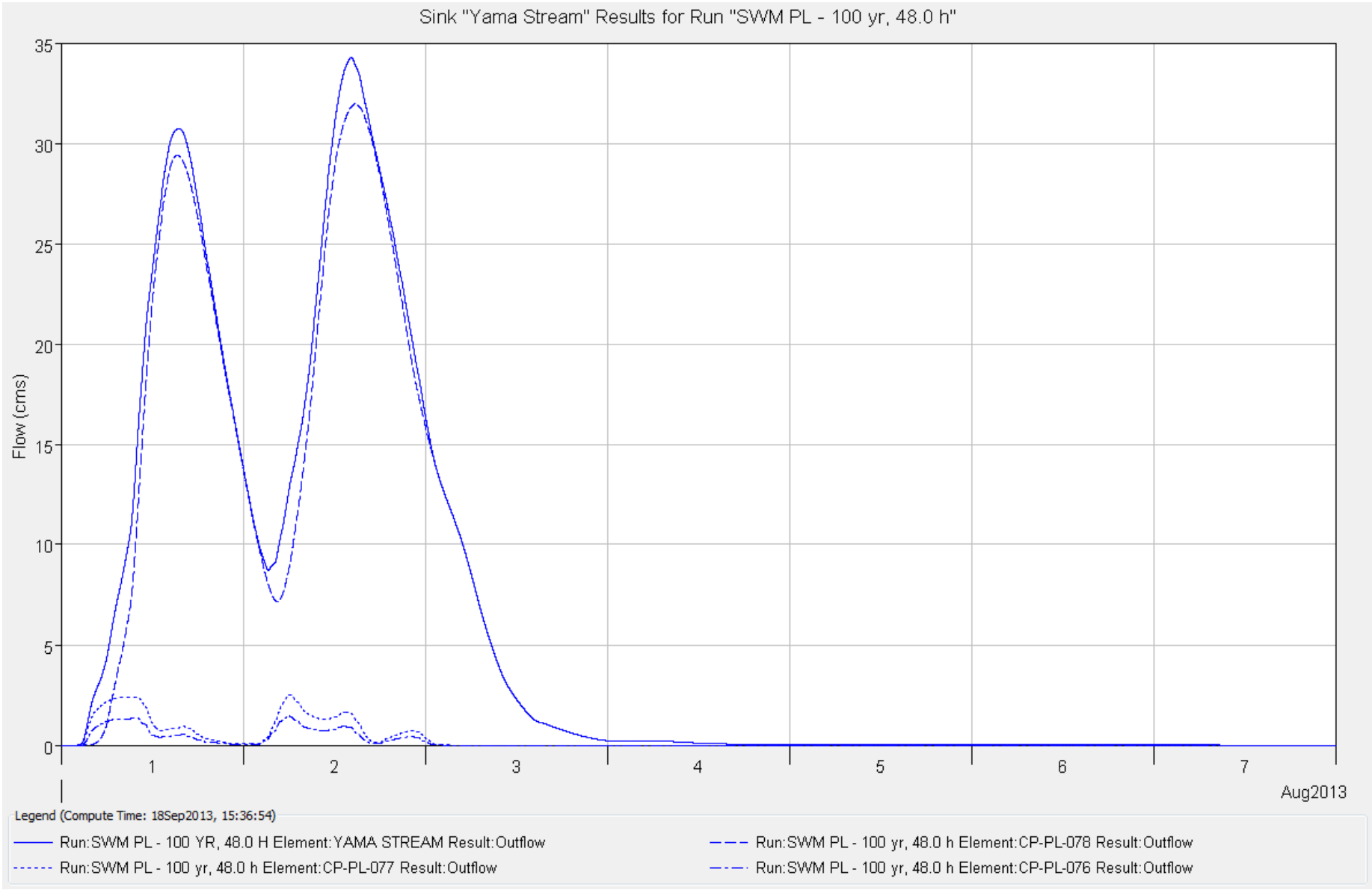

Junction "CP-PL-080" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-080 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-062 Result:Outflow

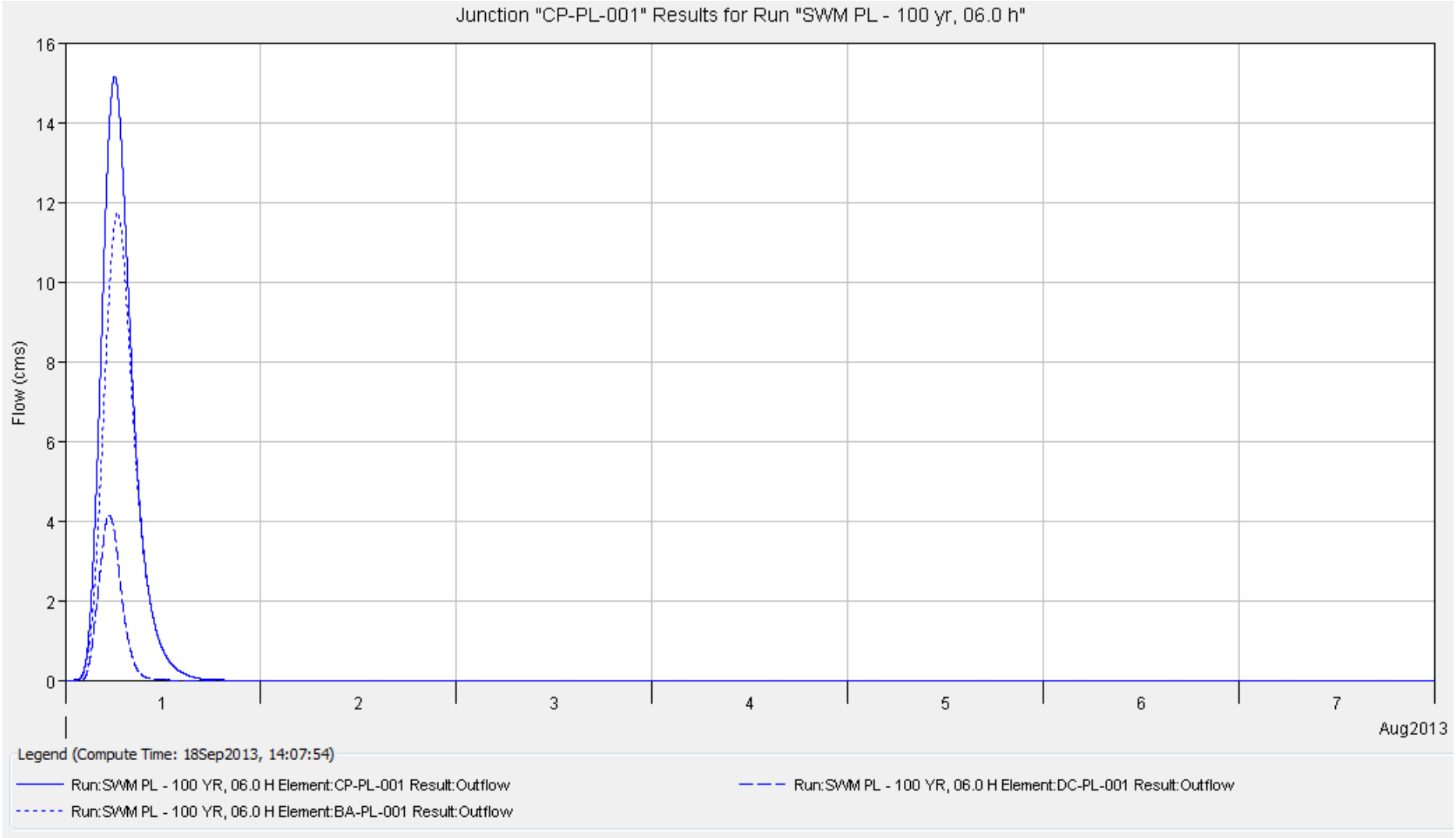

Junction "CP-PL-081" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-081 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-060 Result:Outflow

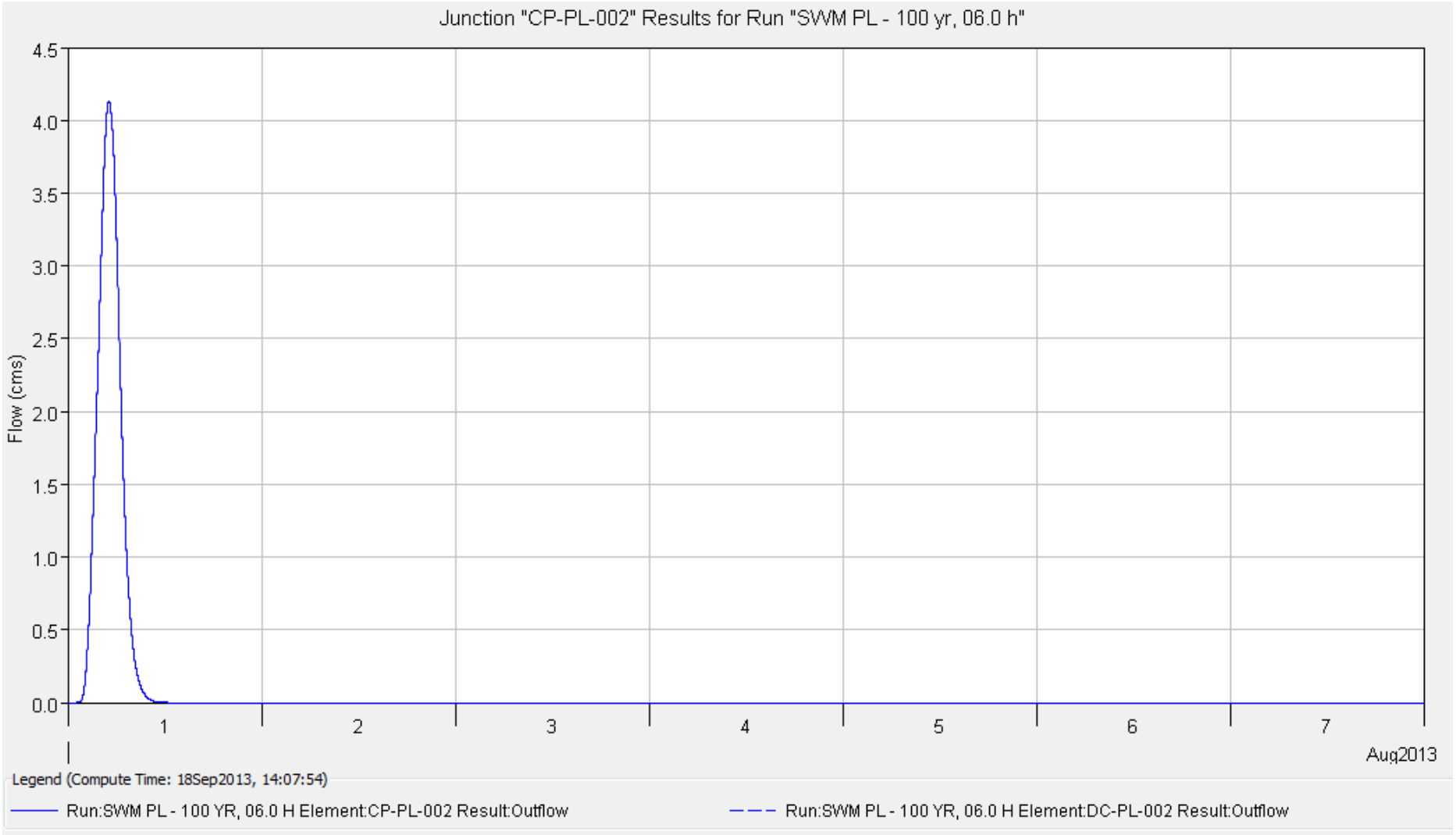

Junction "CP-PL-082" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-082 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Outflow

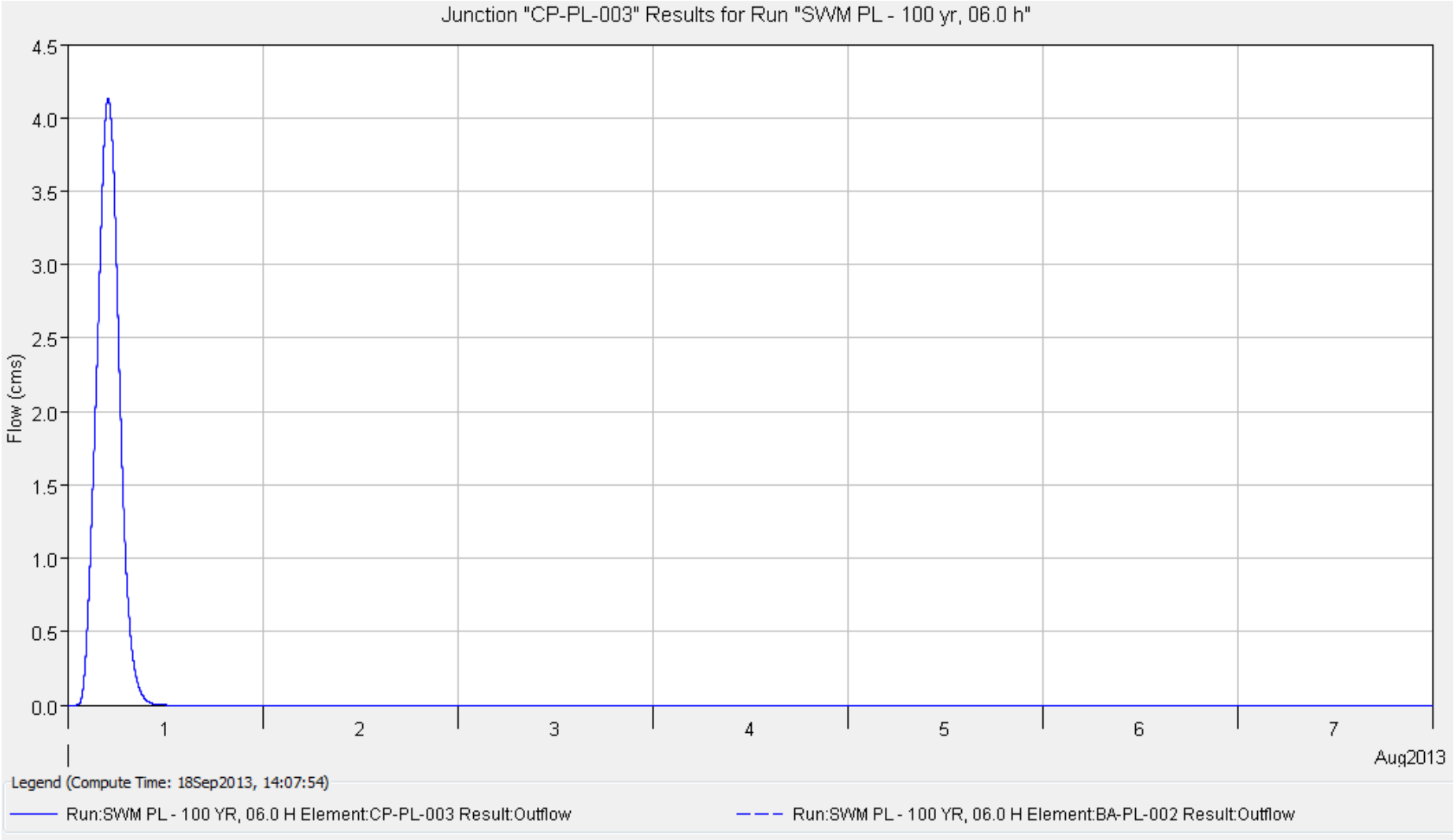

Junction "CP-PL-083" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-083 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-061 Result:Outflow

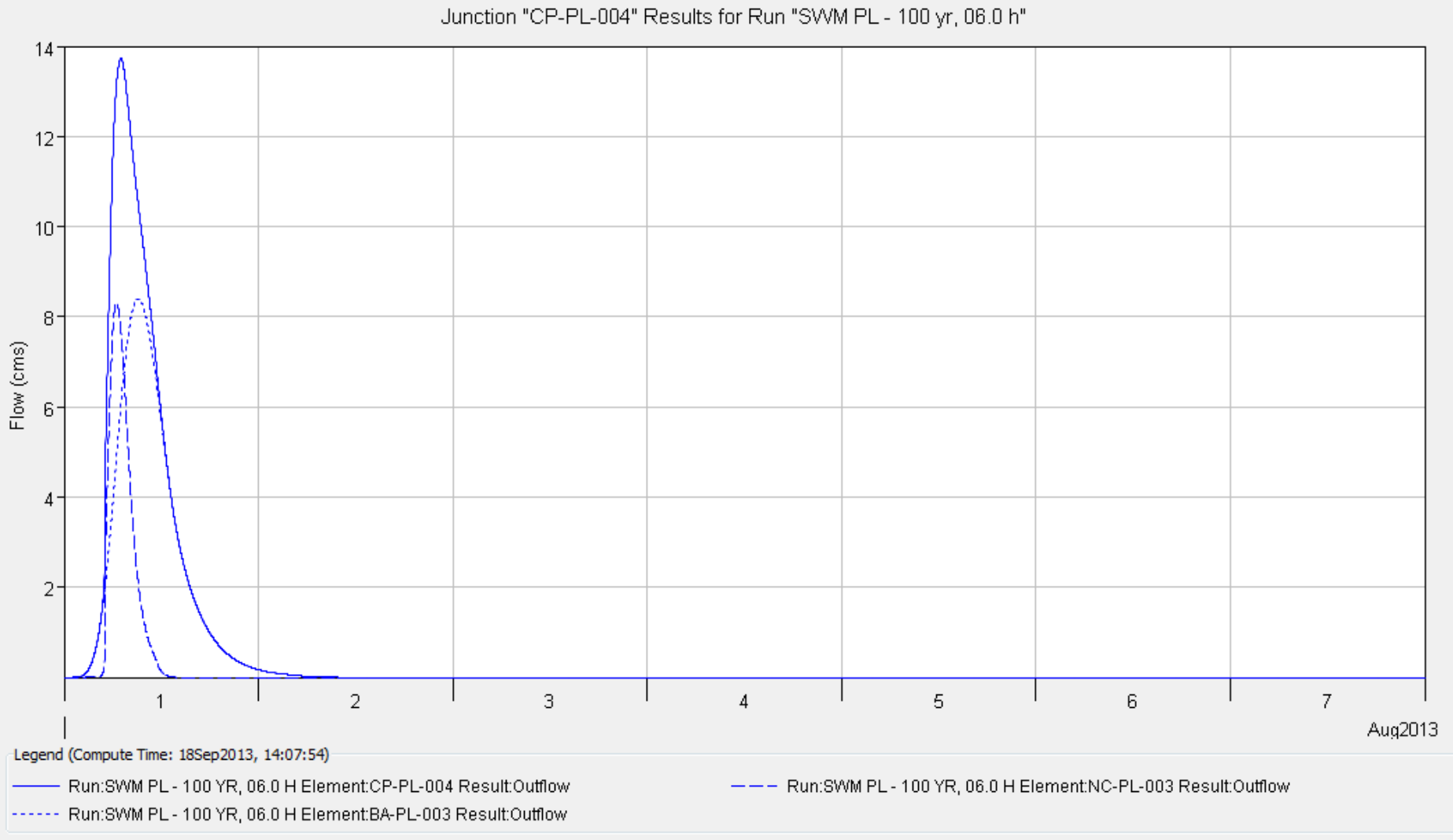

Sink "Chindwin River" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-004 Result:Outflow

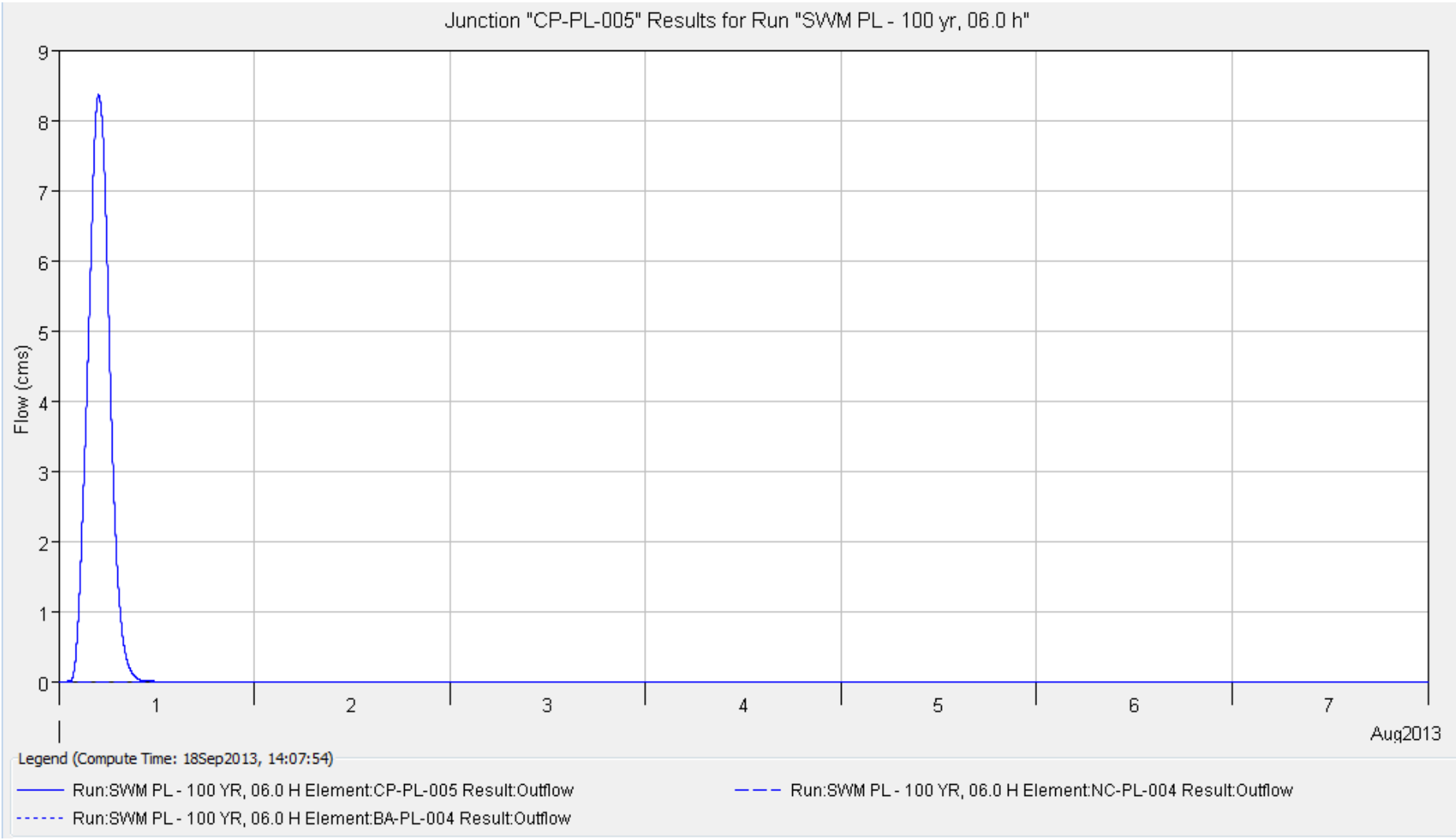

Sink "Yama Stream" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:YAMA STREAM Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-076 Result:Outflow


Junction "CP-PL-001" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-001 Result:Outflow

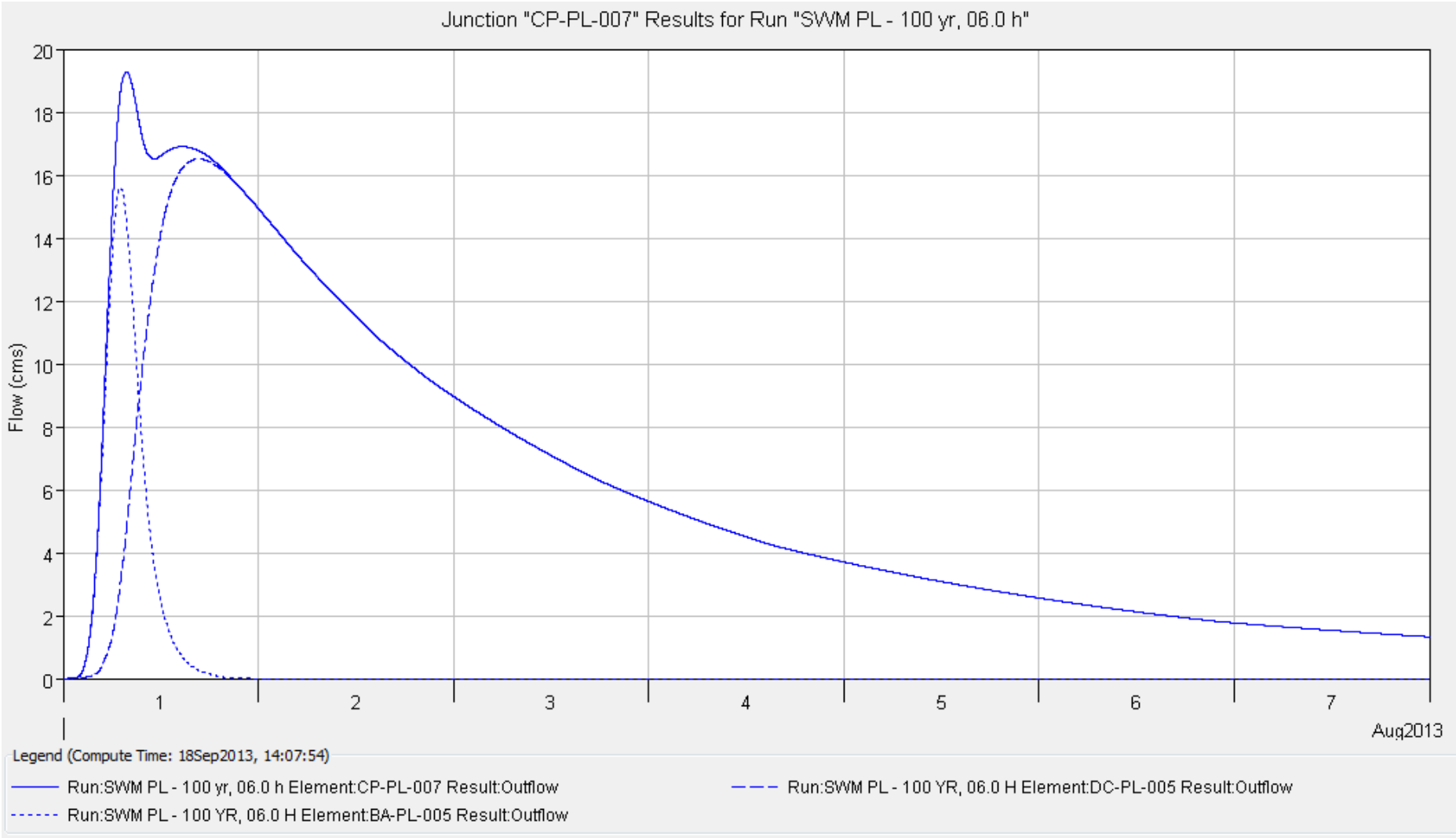

Junction "CP-PL-002" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-002 Result:Outflow

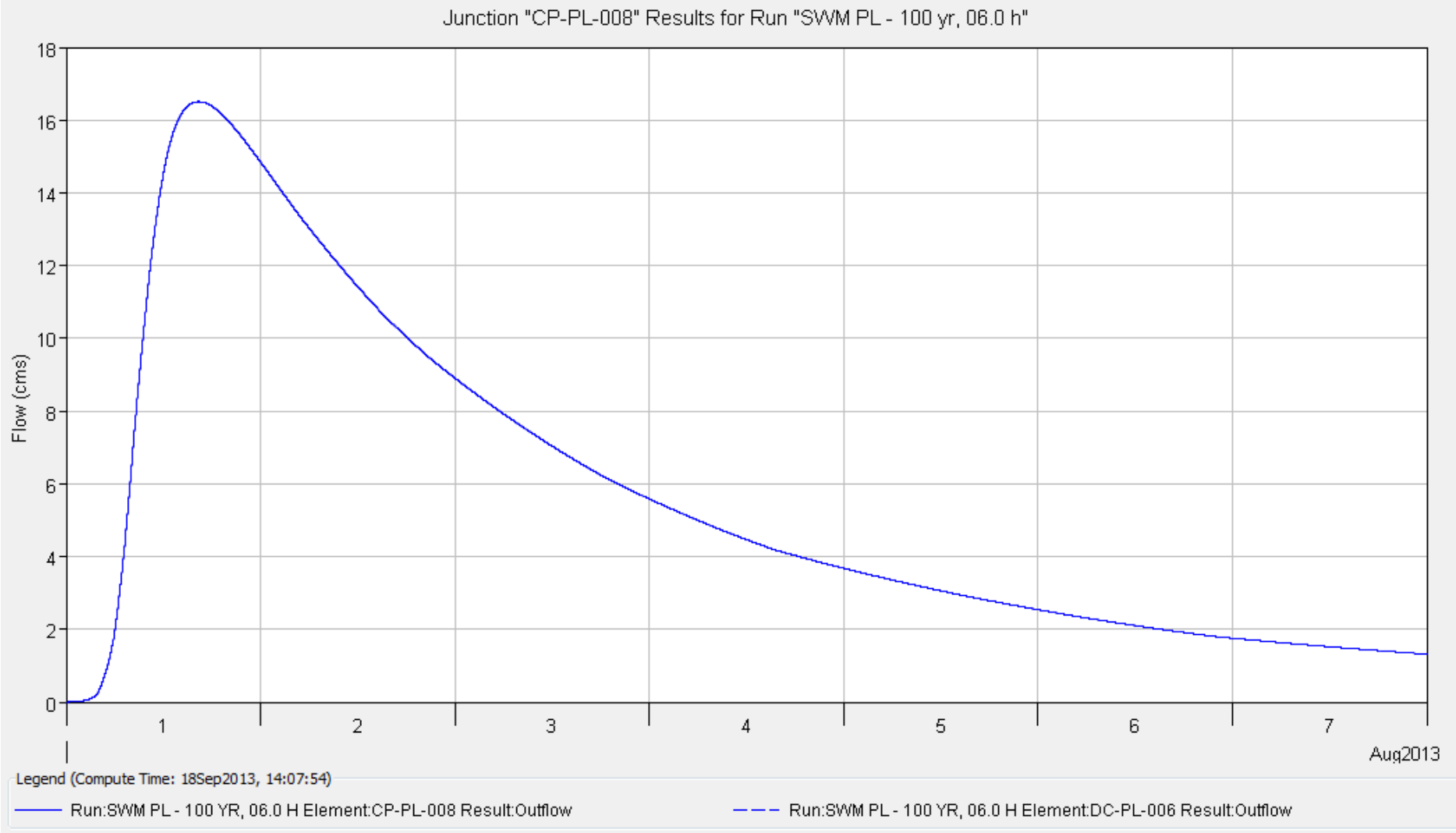

Junction "CP-PL-003" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-002 Result:Outflow

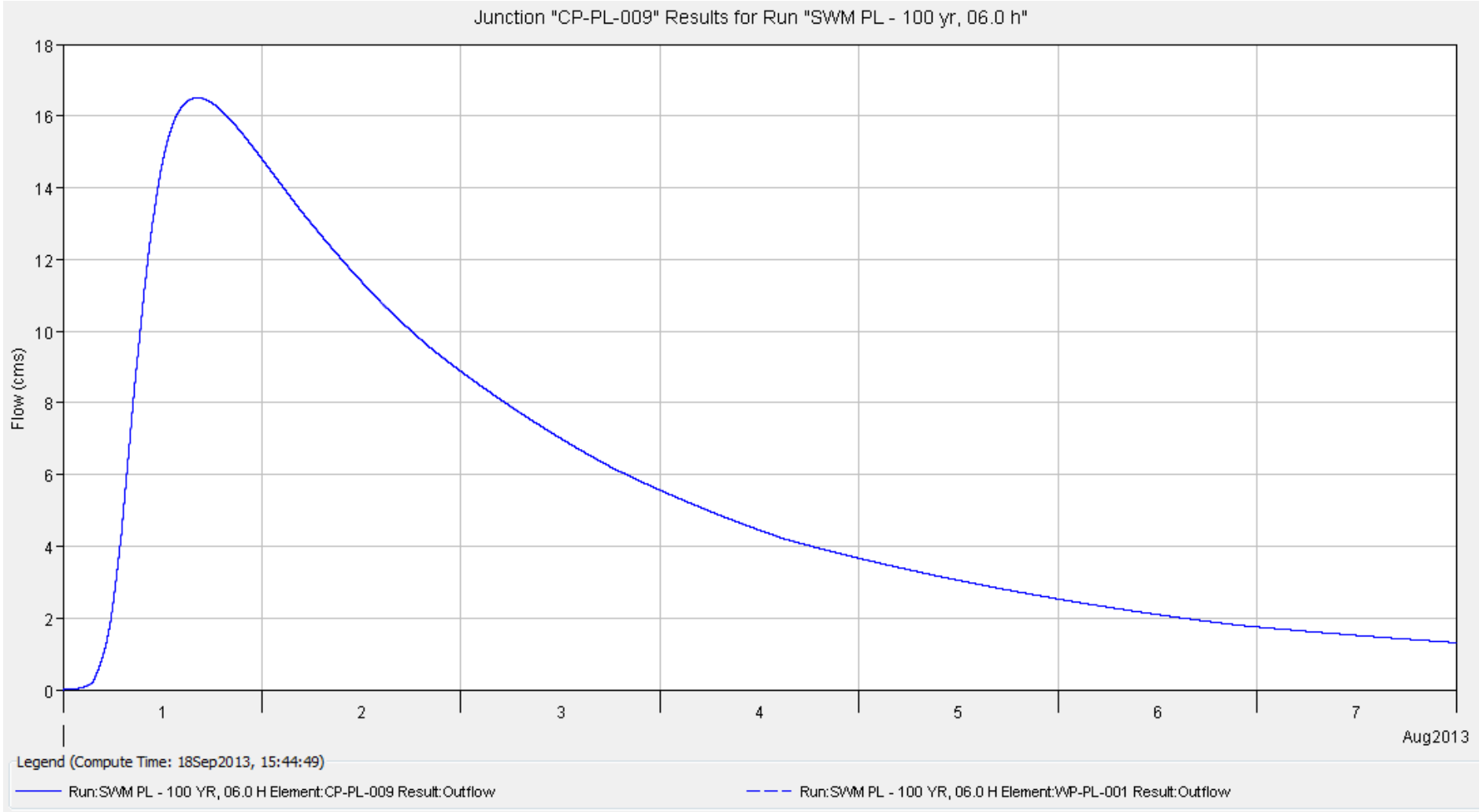

Junction "CP-PL-004" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
14
12
10
8
6
4
2
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-003 Result:Outflow

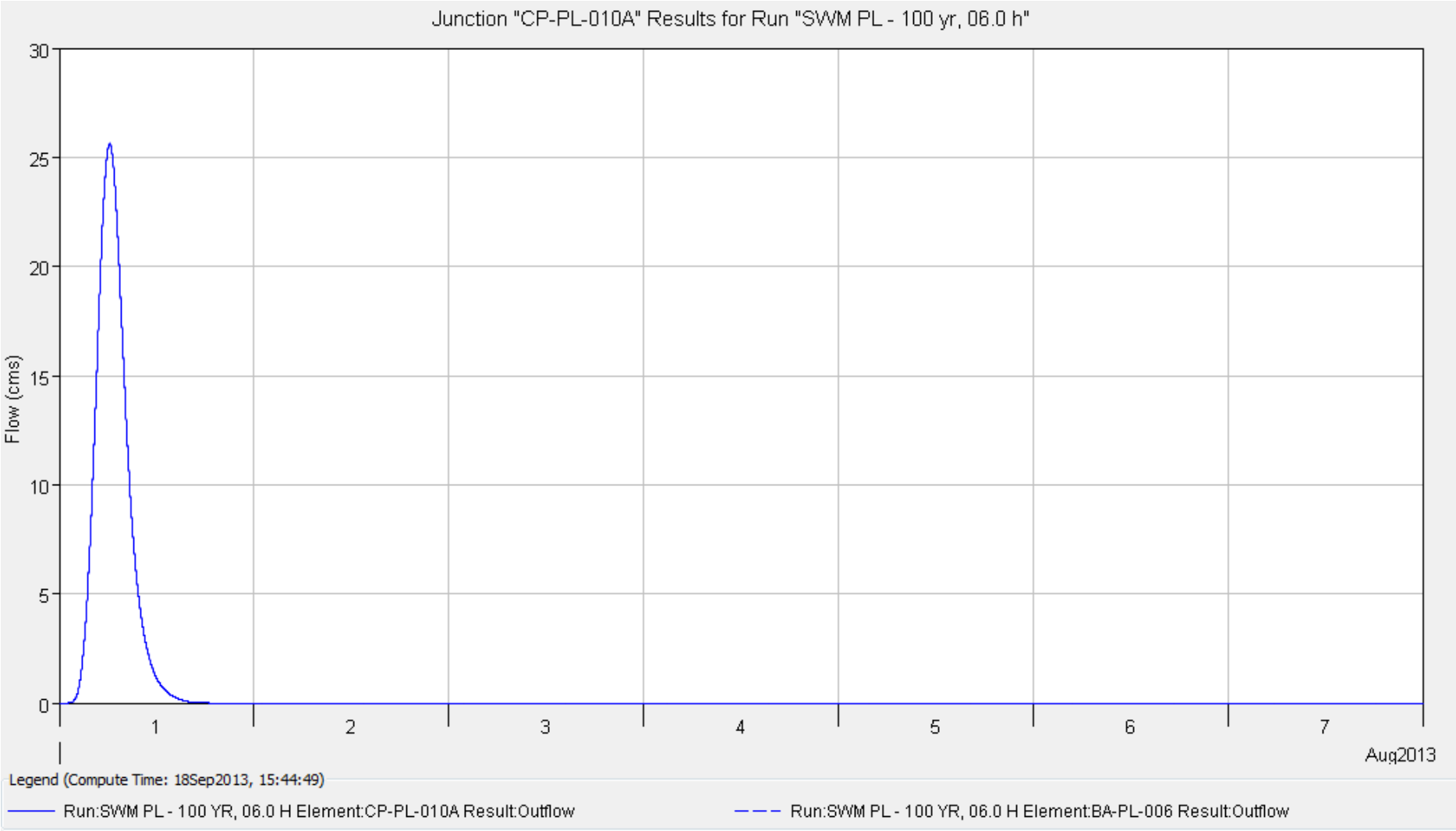

Junction "CP-PL-005" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-004 Result:Outflow

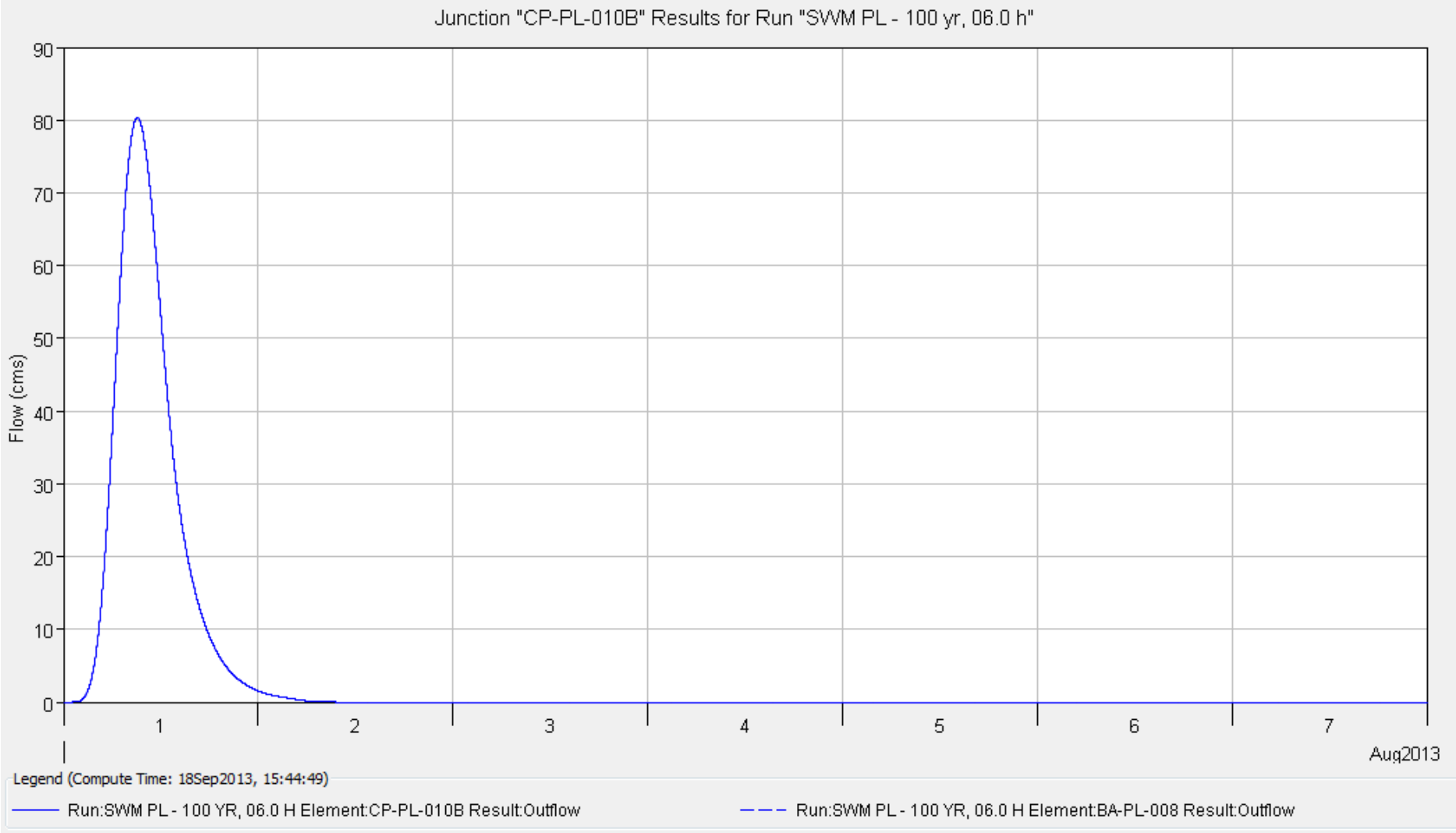

Junction "CP-PL-006" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-006 Result:Outflow

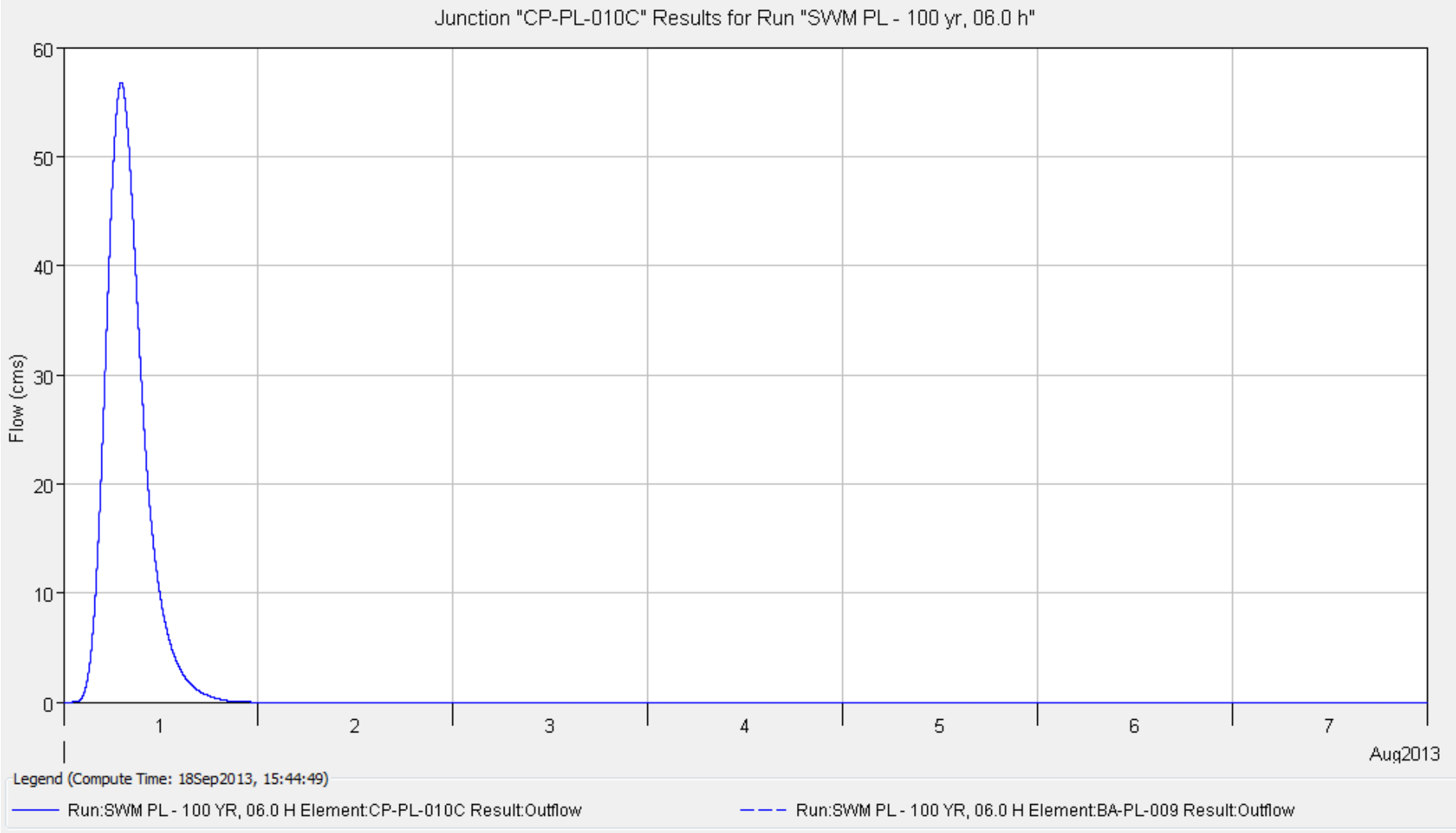

Junction "CP-PL-007" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-005 Result:Outflow

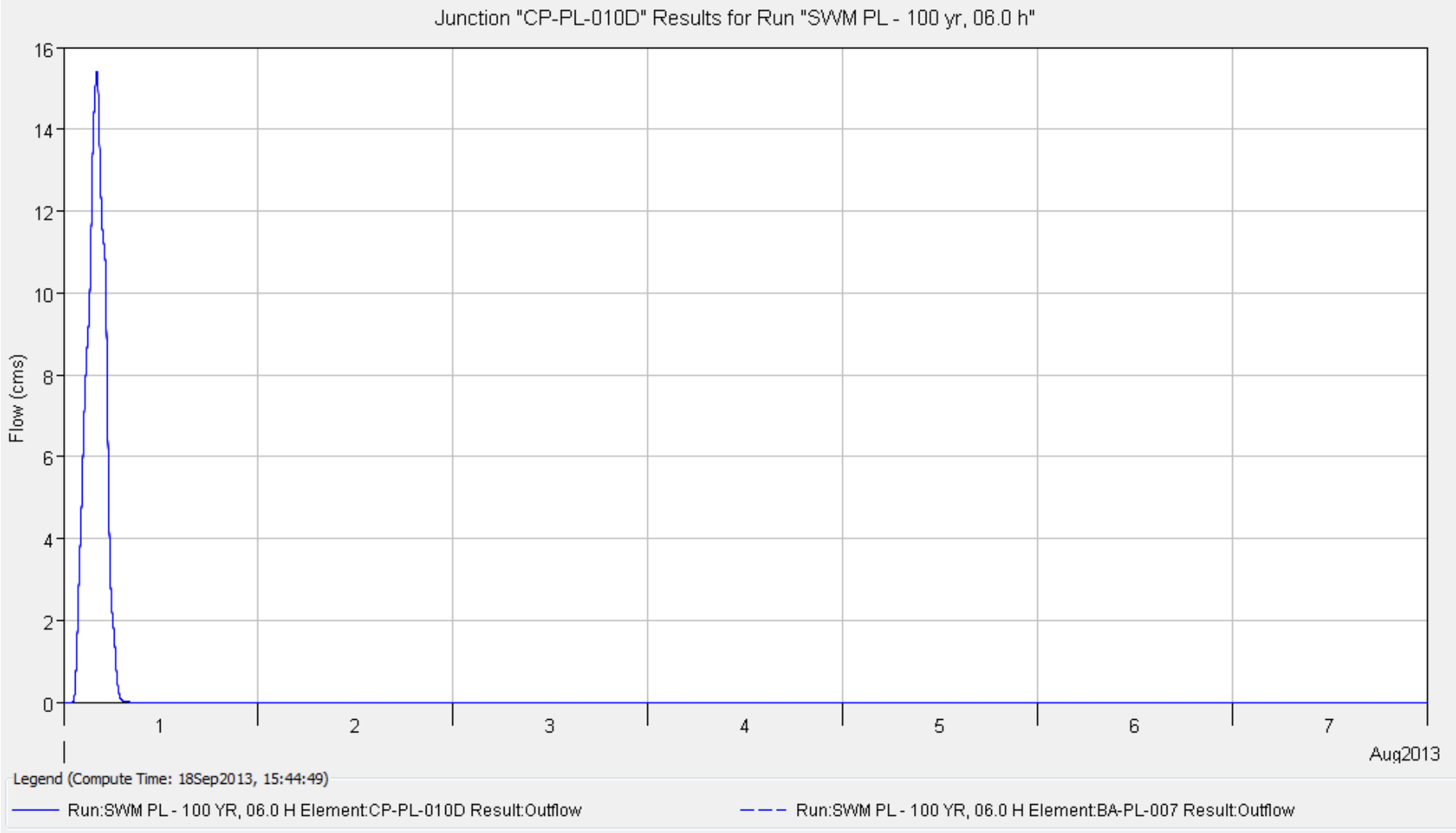

Junction "CP-PL-008" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 14:07:54)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-006 Result:Outflow

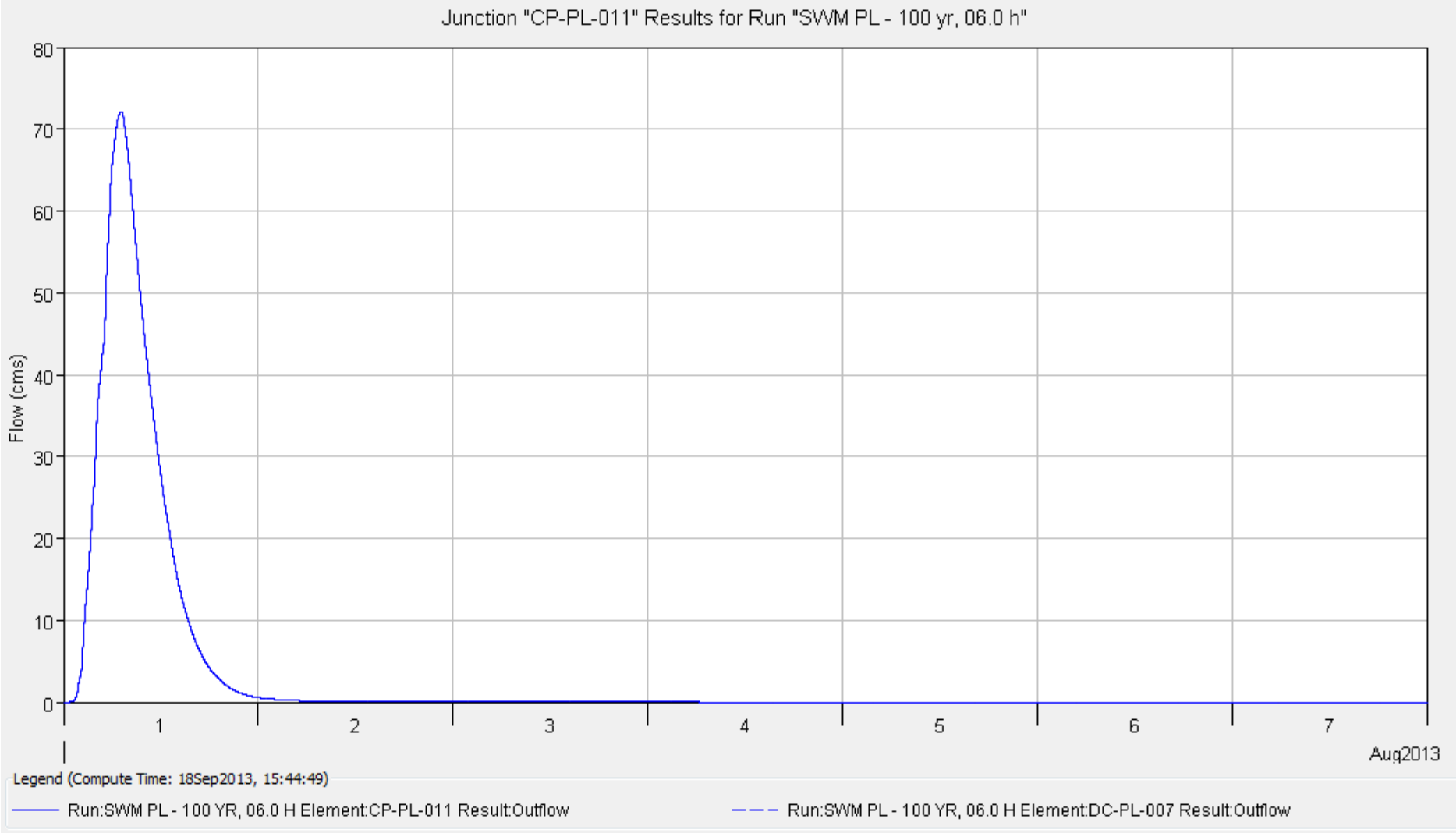

Junction "CP-PL-009" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Outflow

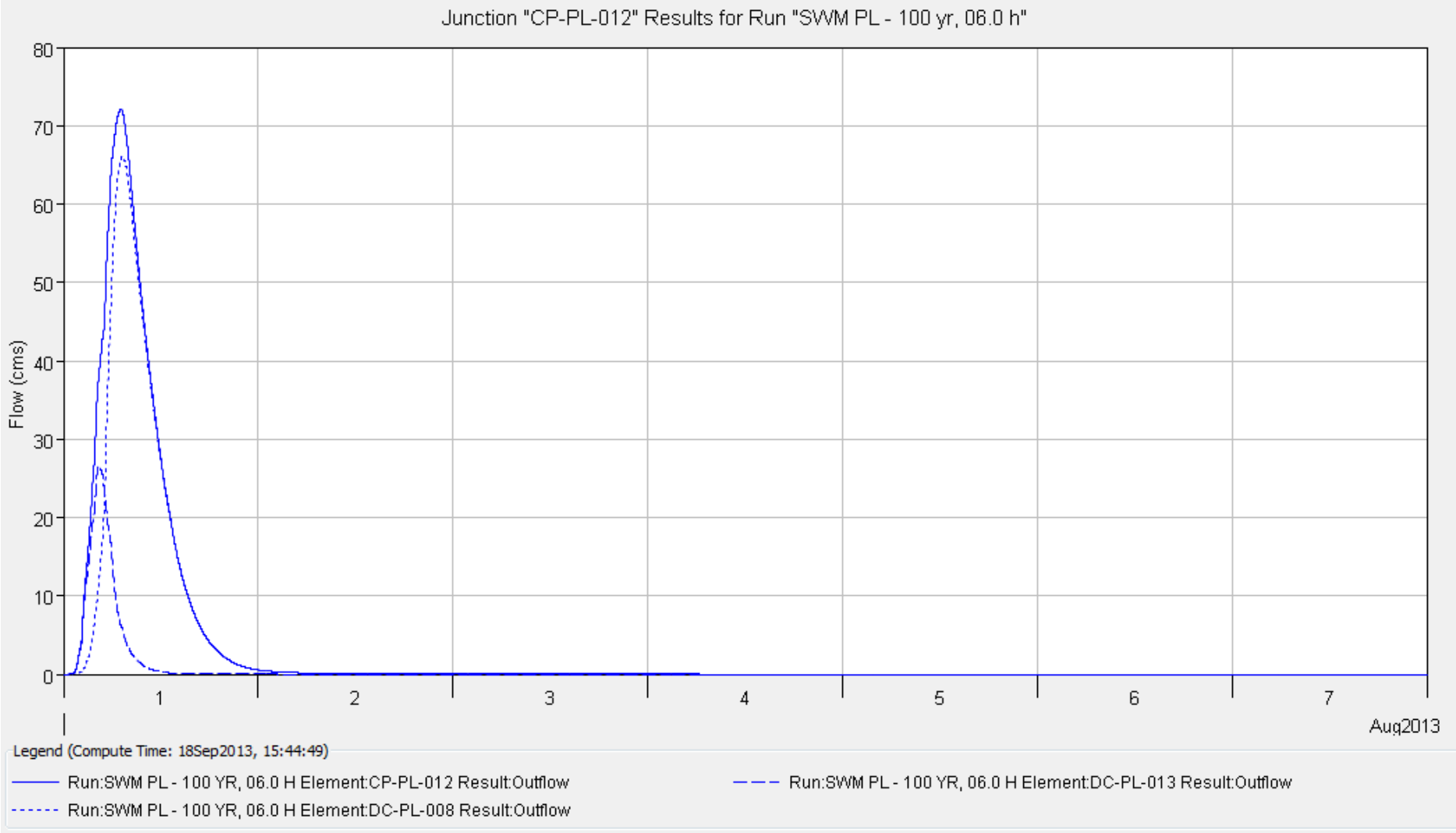

Junction "CP-PL-010A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-006 Result:Outflow

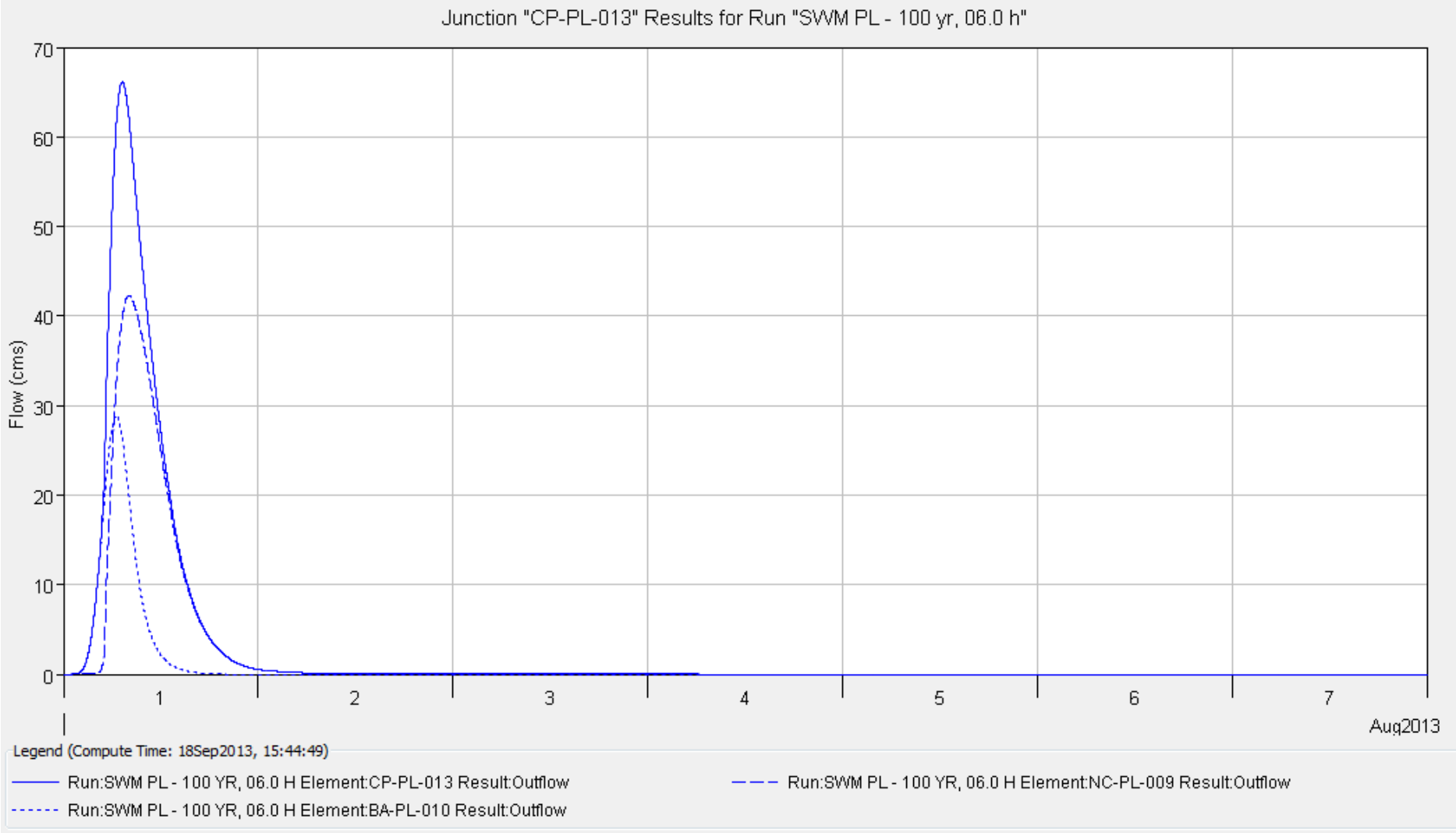

Junction "CP-PL-010B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-008 Result:Outflow

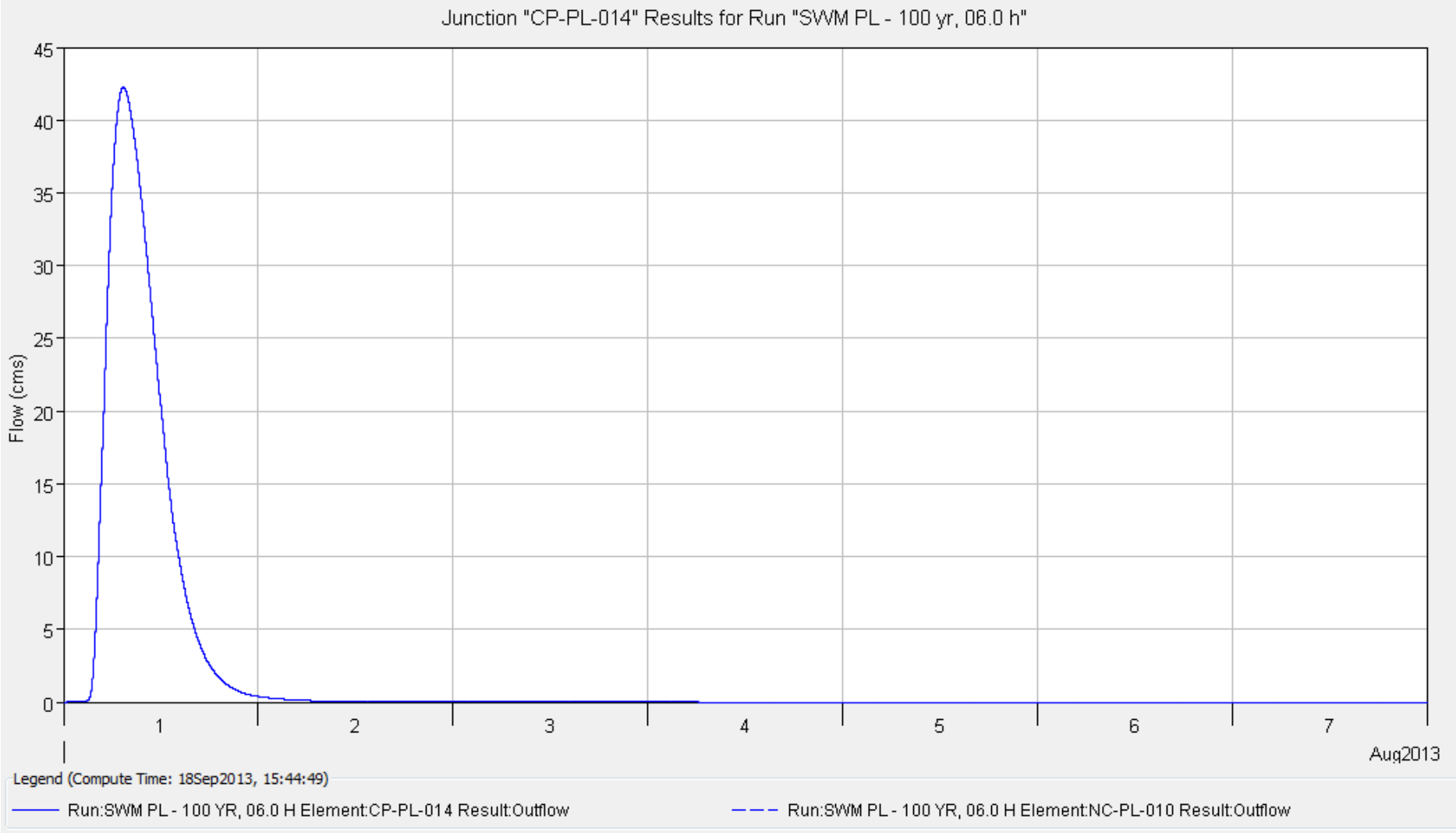

Junction "CP-PL-010C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-009 Result:Outflow

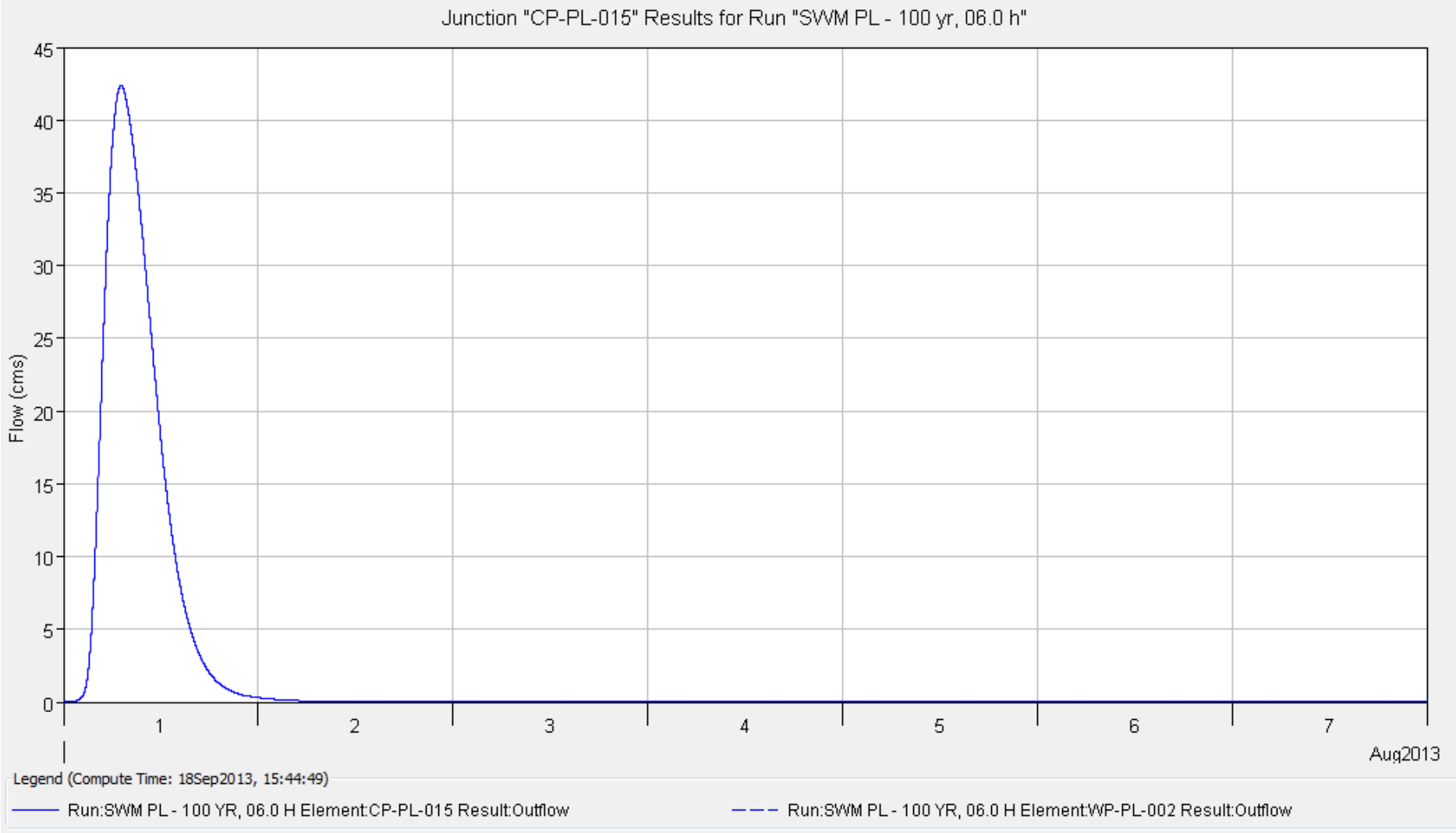

Junction "CP-PL-010D" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-010D Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-007 Result:Outflow

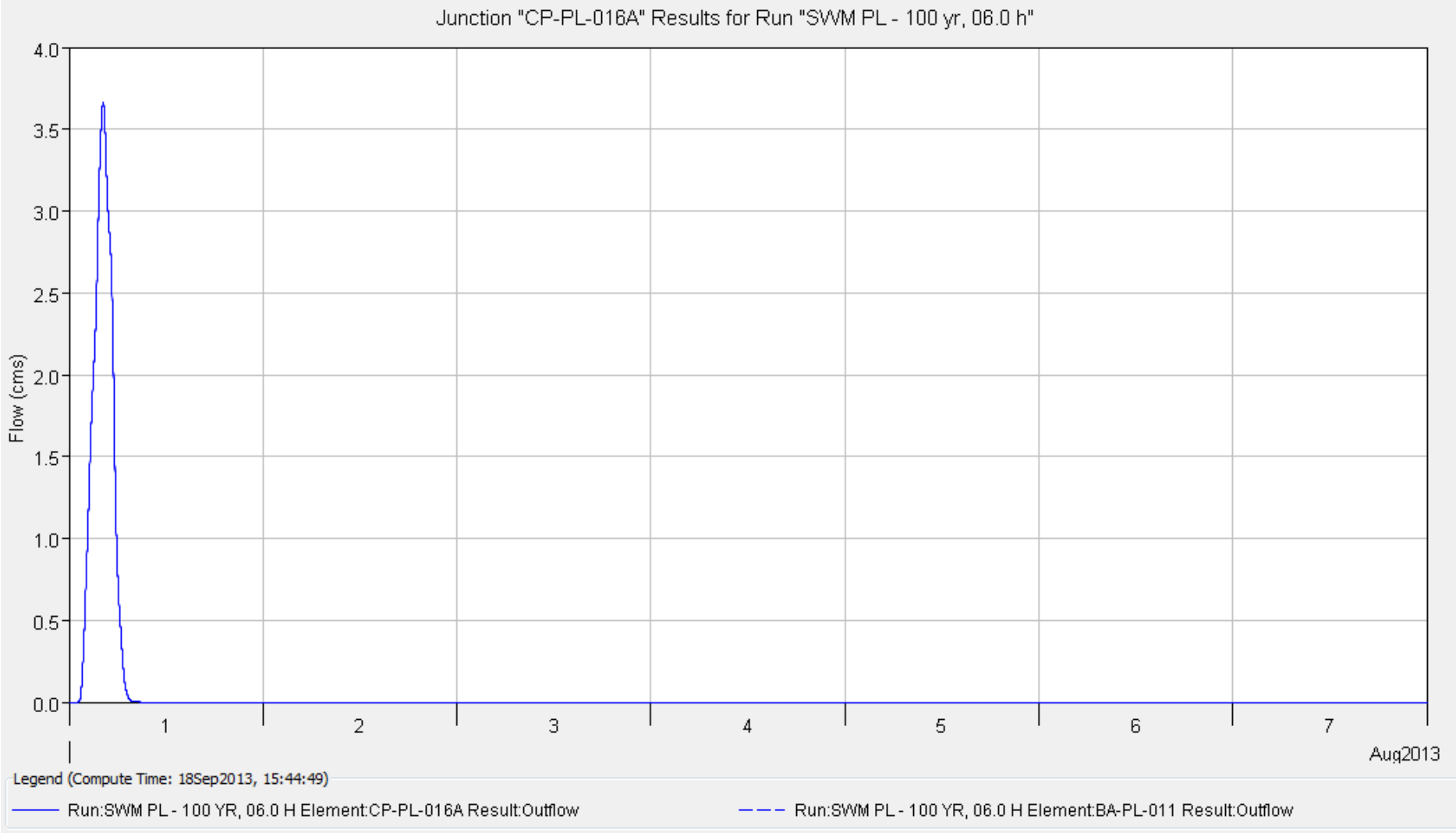

Junction "CP-PL-011" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-007 Result:Outflow

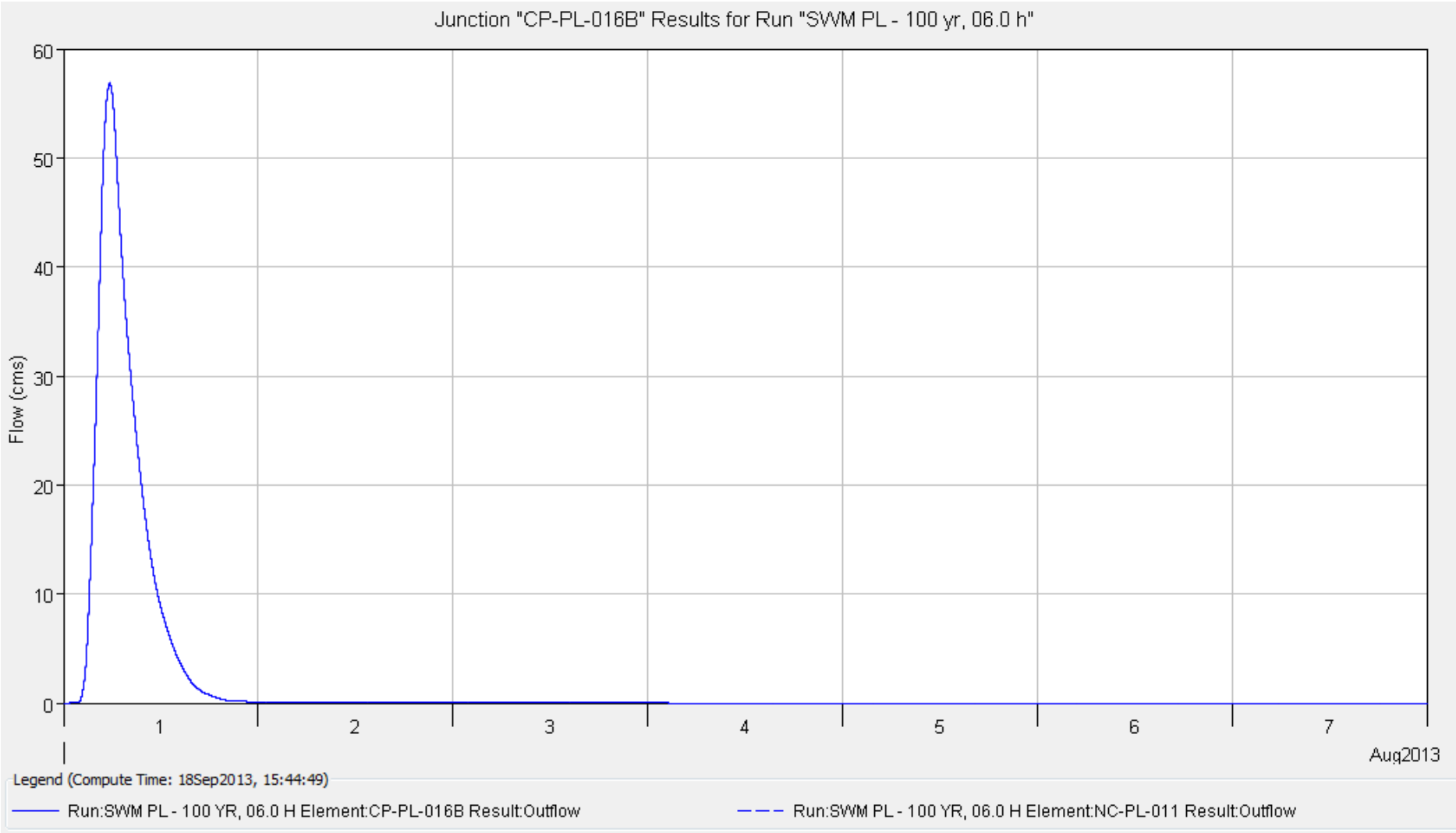

Junction "CP-PL-012" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-008 Result:Outflow

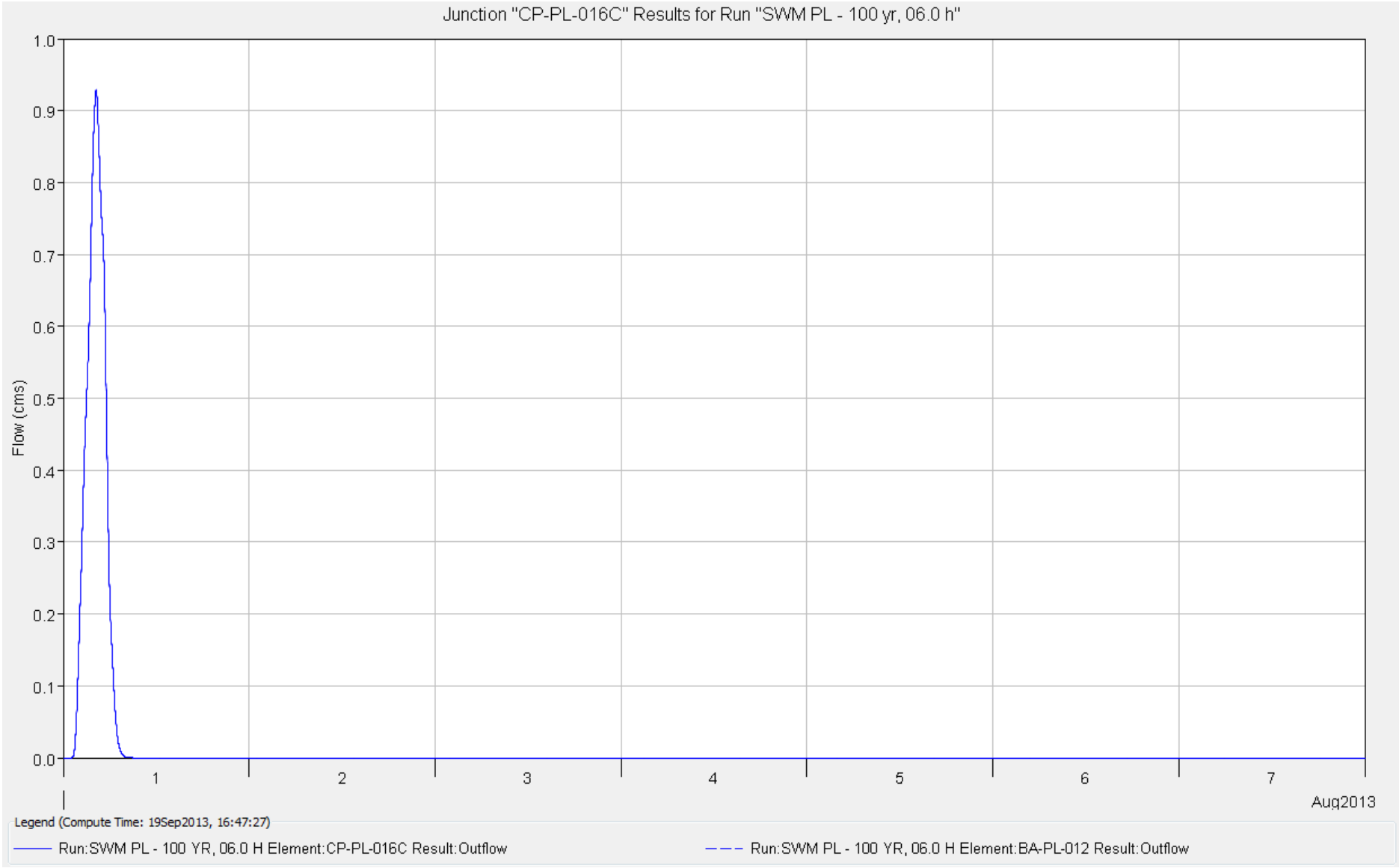

Junction "CP-PL-013" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-010 Result:Outflow

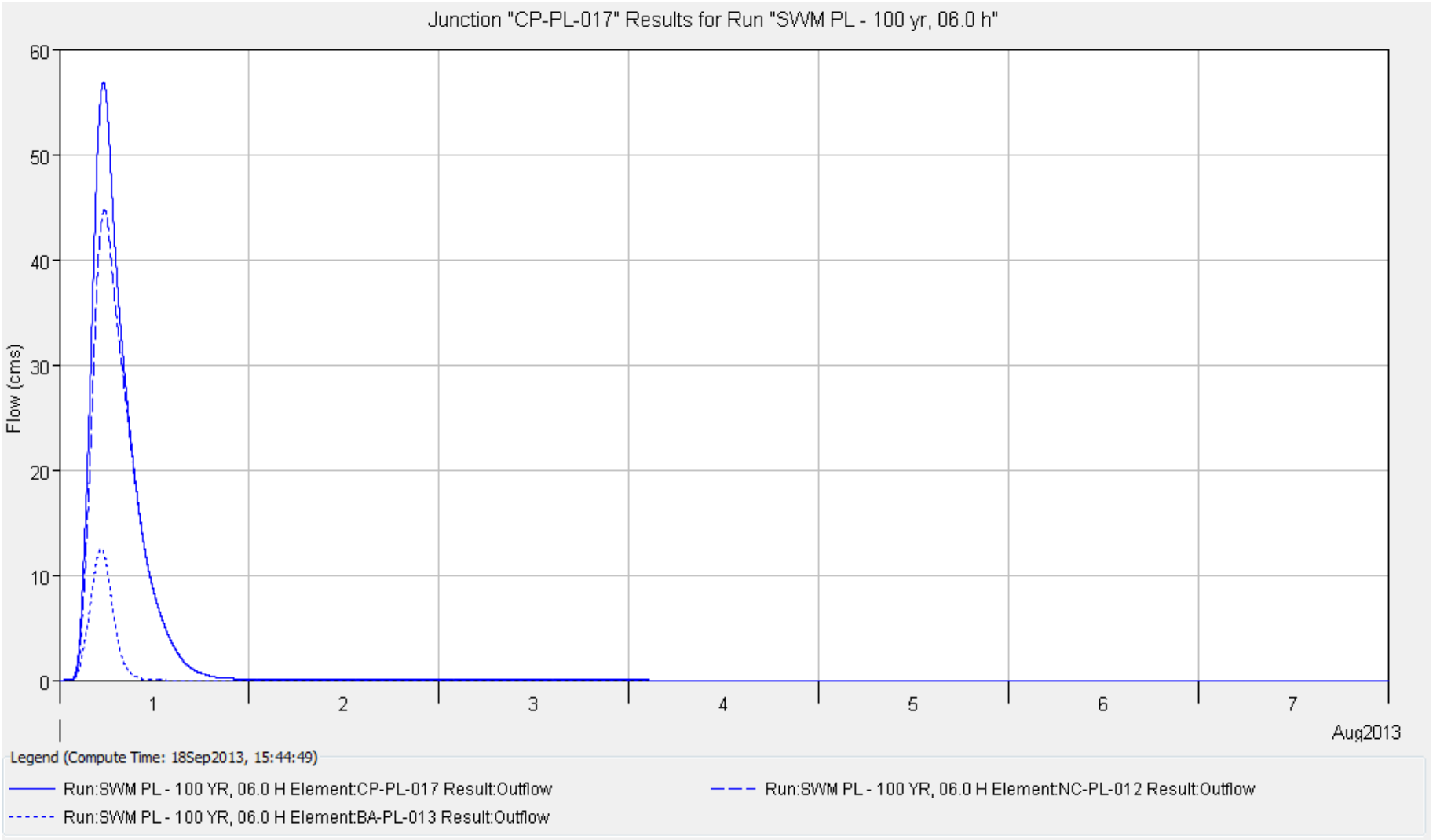

Junction "CP-PL-014" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-010 Result:Outflow

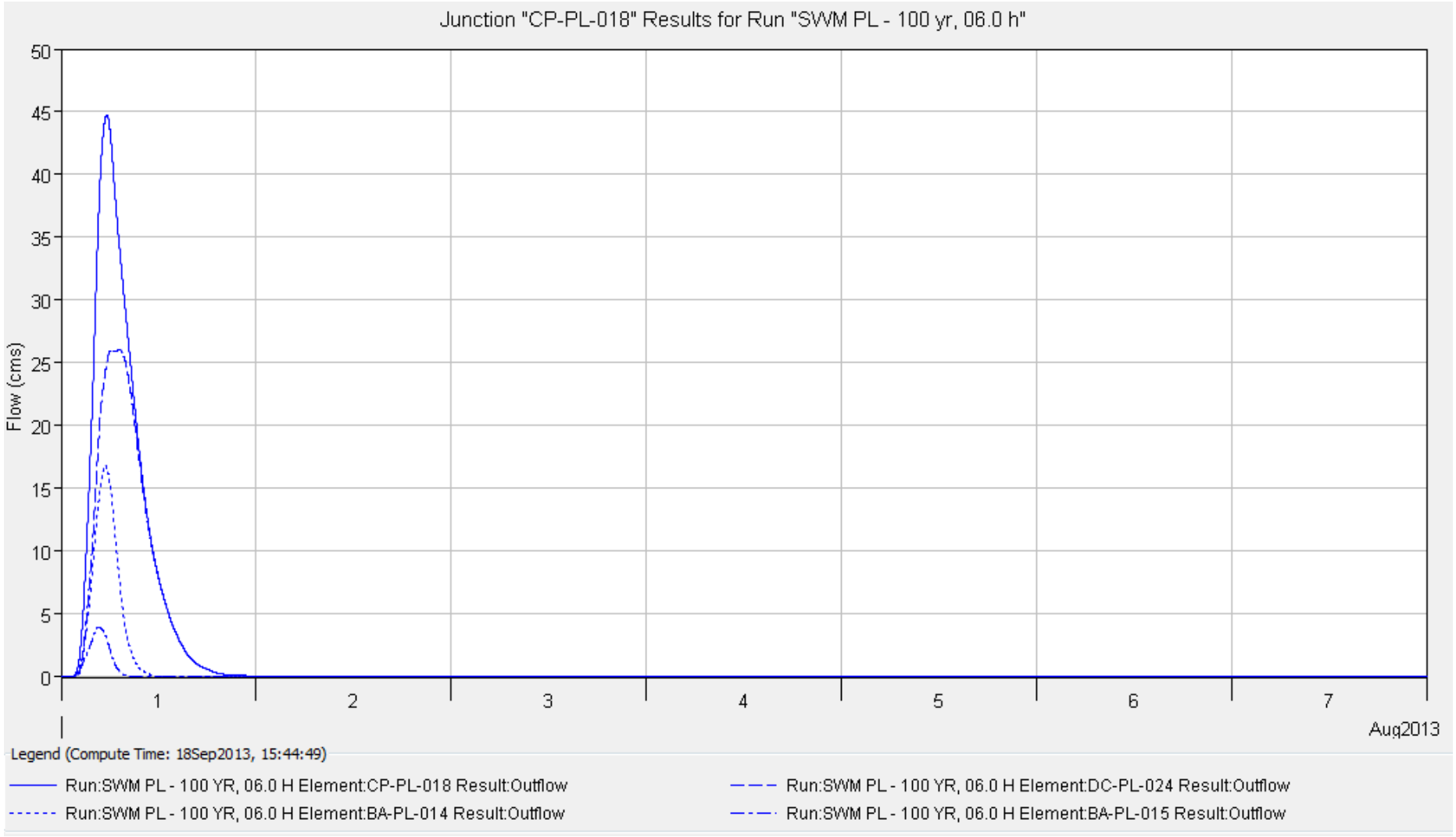

Junction "CP-PL-015" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Outflow

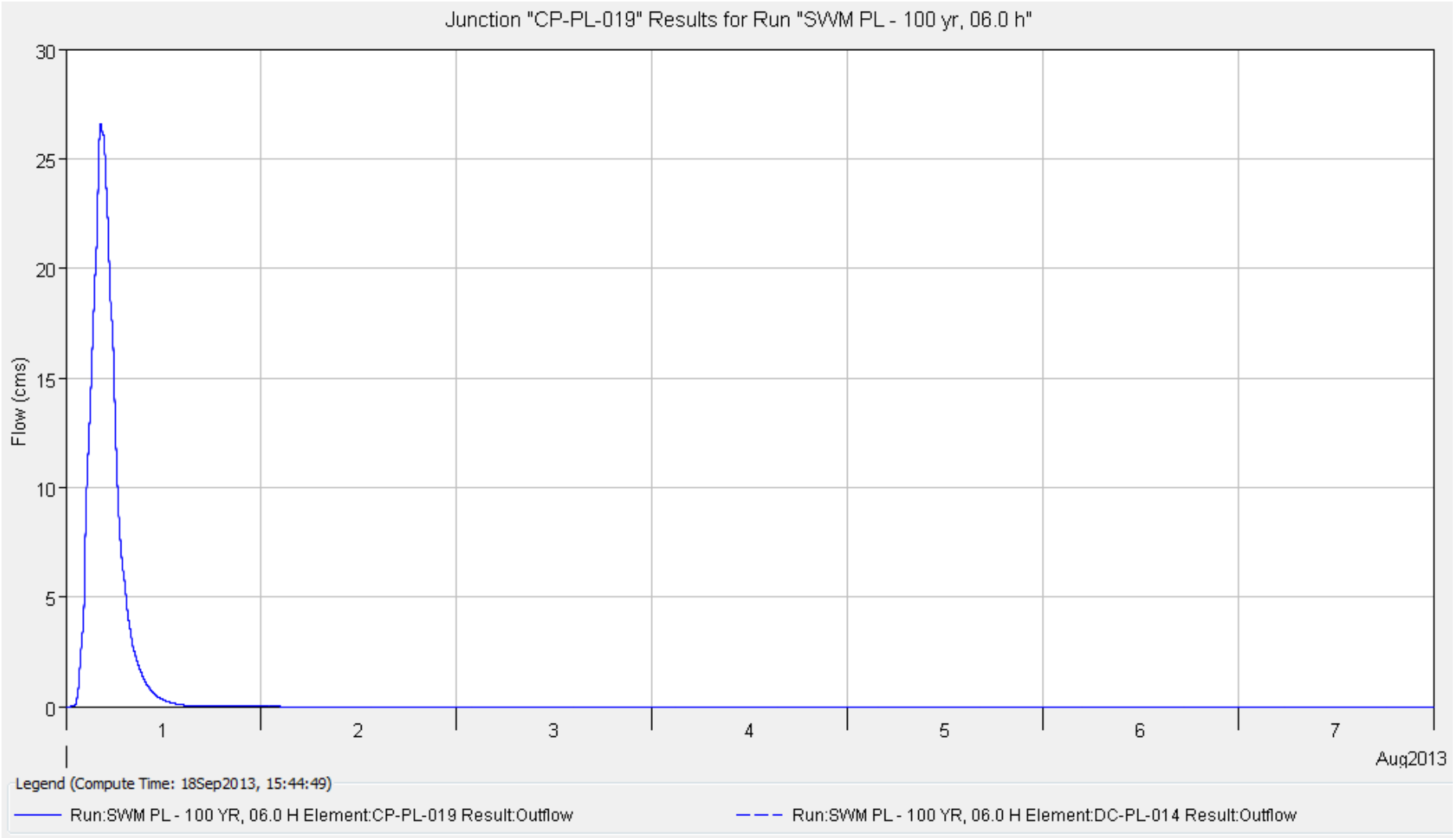

Junction "CP-PL-016A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-011 Result:Outflow

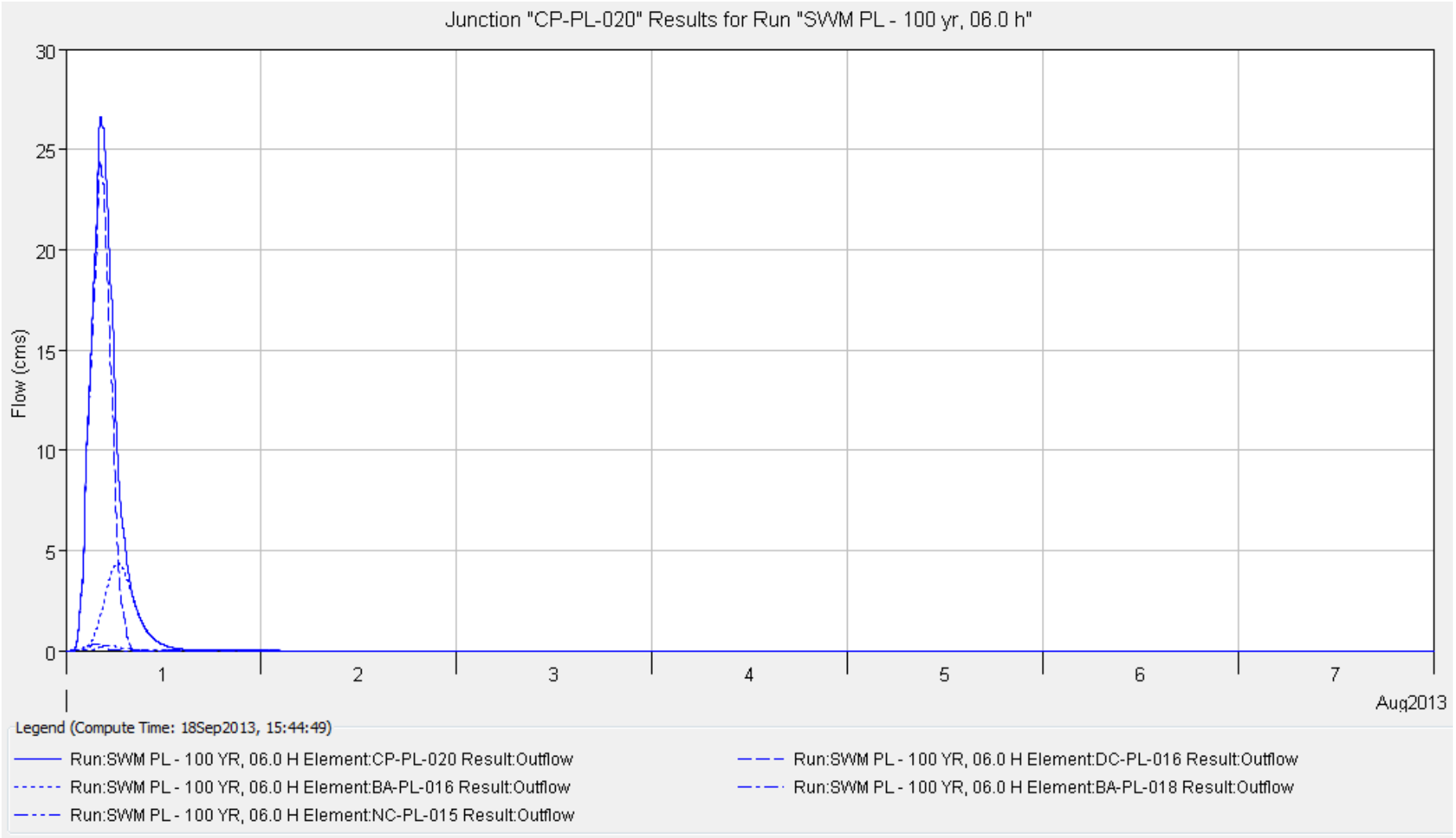

Junction "CP-PL-016B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-011 Result:Outflow

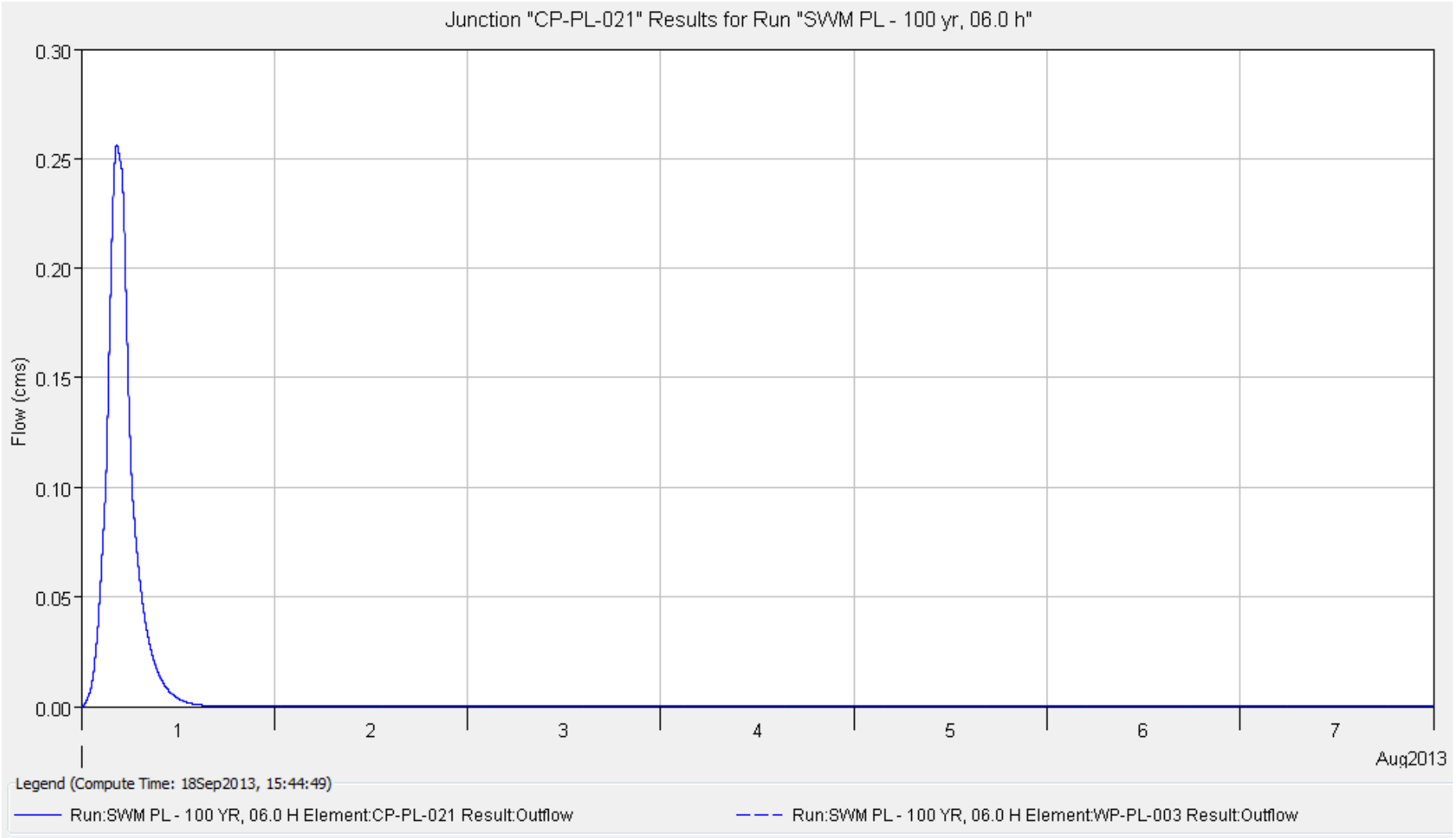

Junction "CP-PL-016C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-016C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-012 Result:Outflow

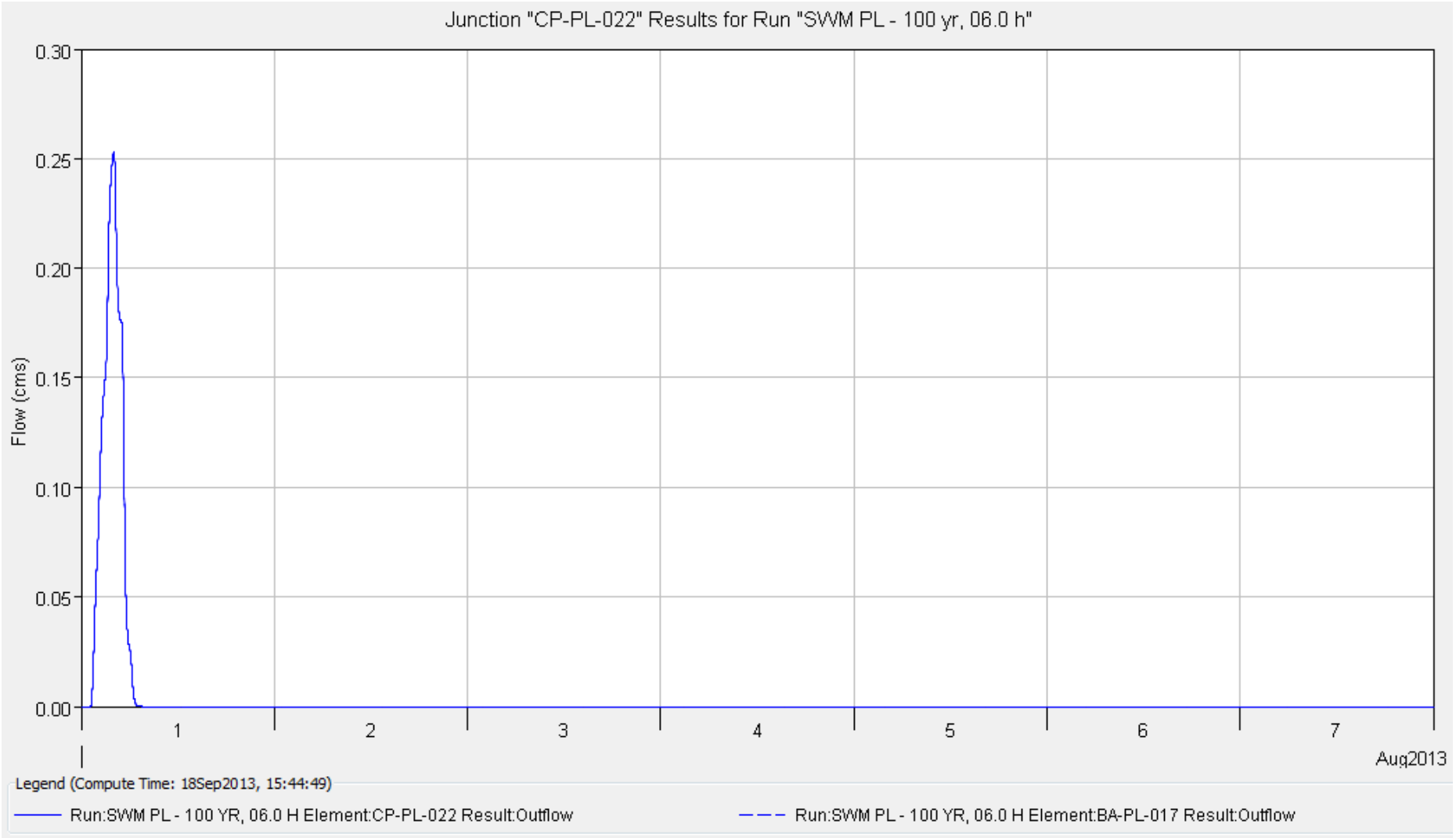

Junction "CP-PL-017" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-013 Result:Outflow

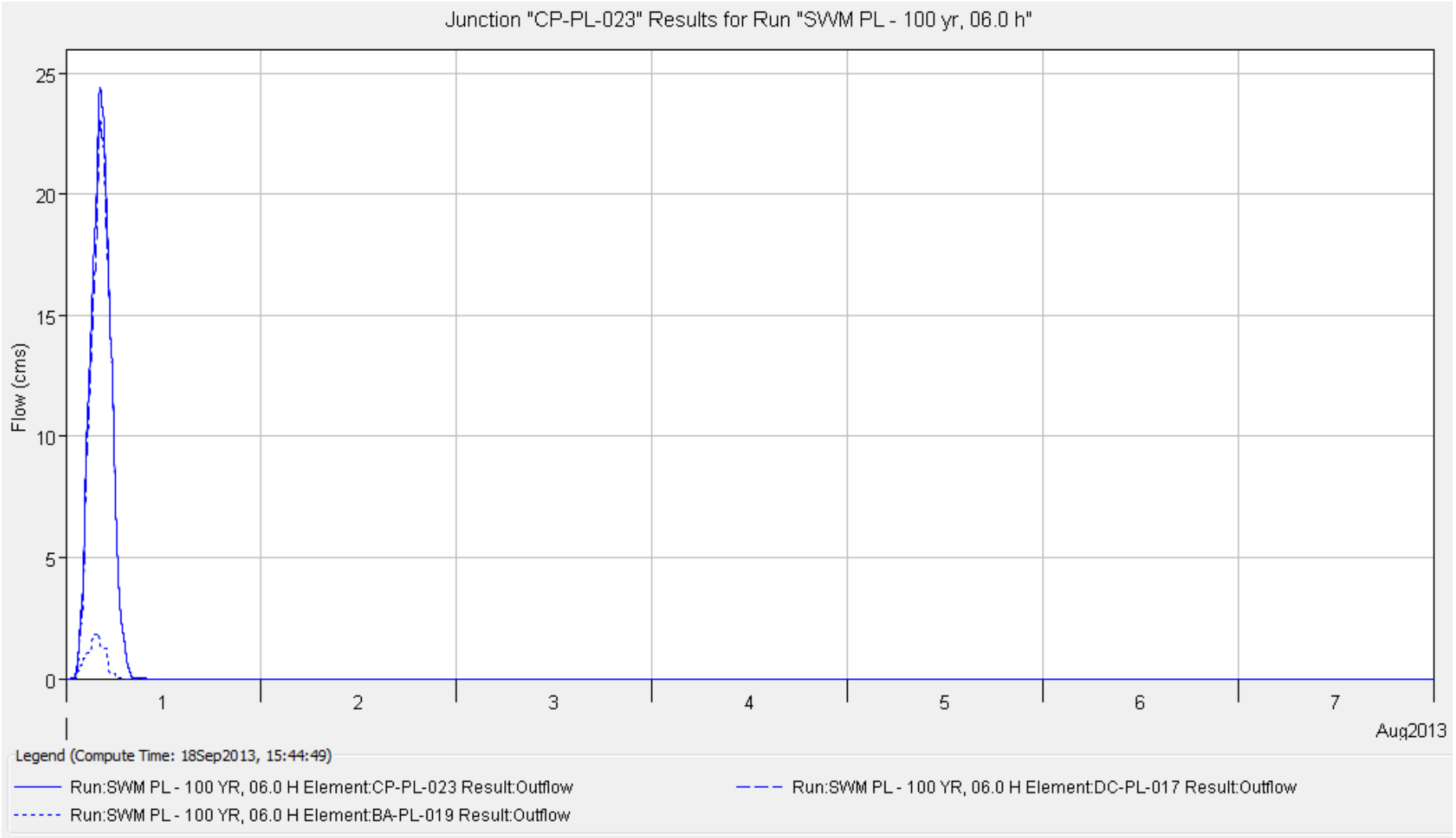

Junction "CP-PL-018" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-015 Result:Outflow

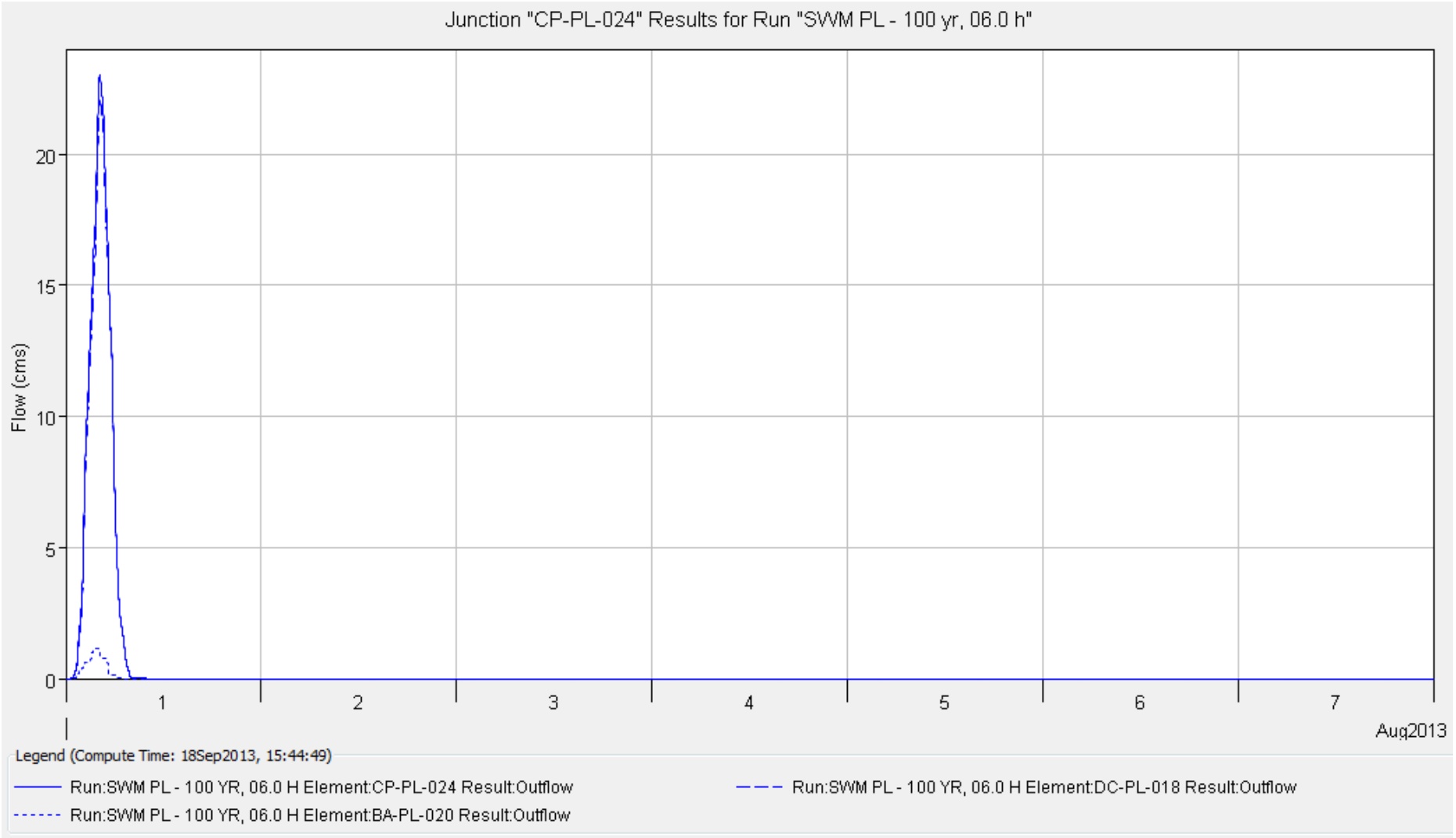

Junction "CP-PL-019" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-014 Result:Outflow

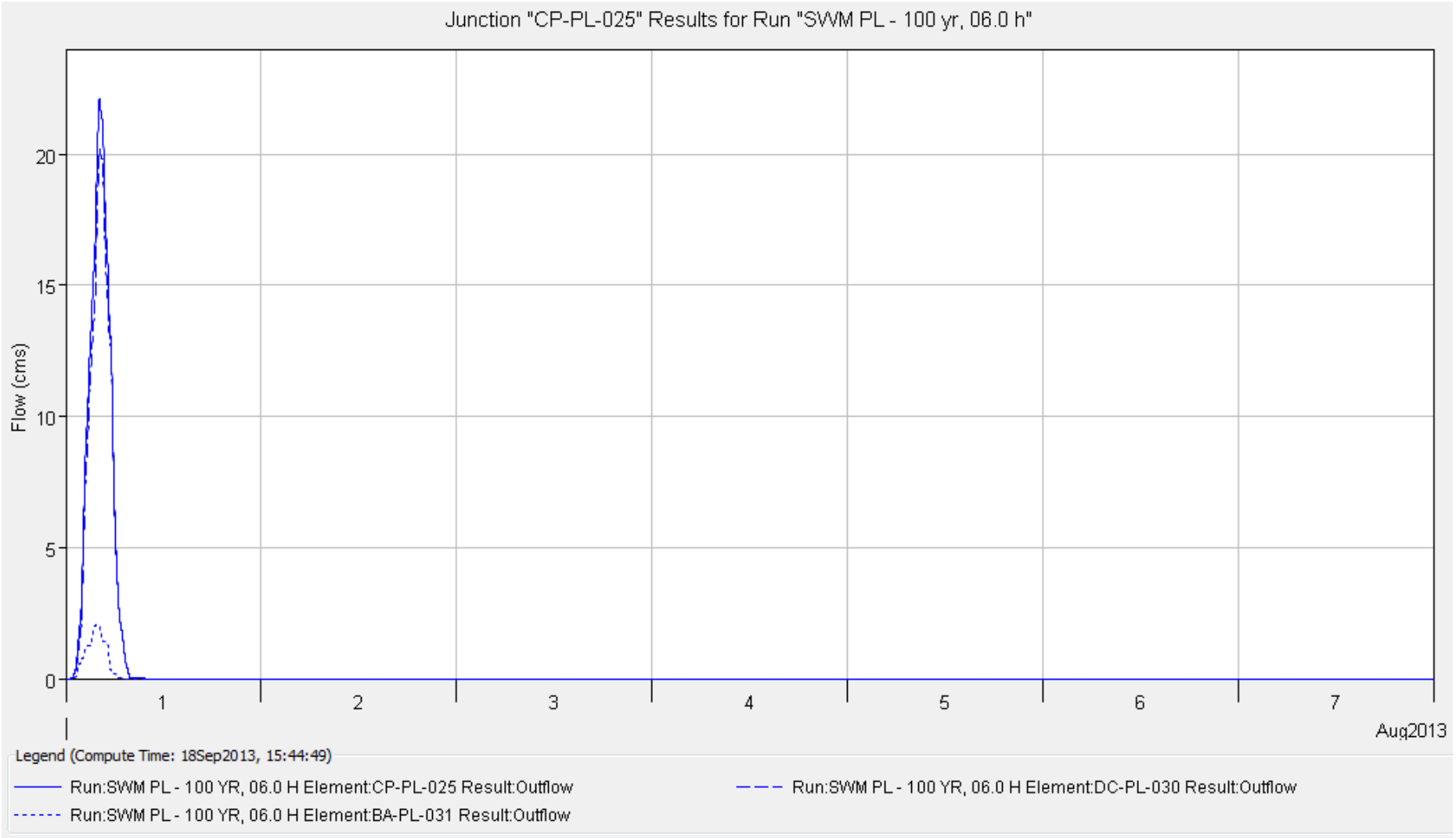

Junction "CP-PL-020" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-018 Result:Outflow

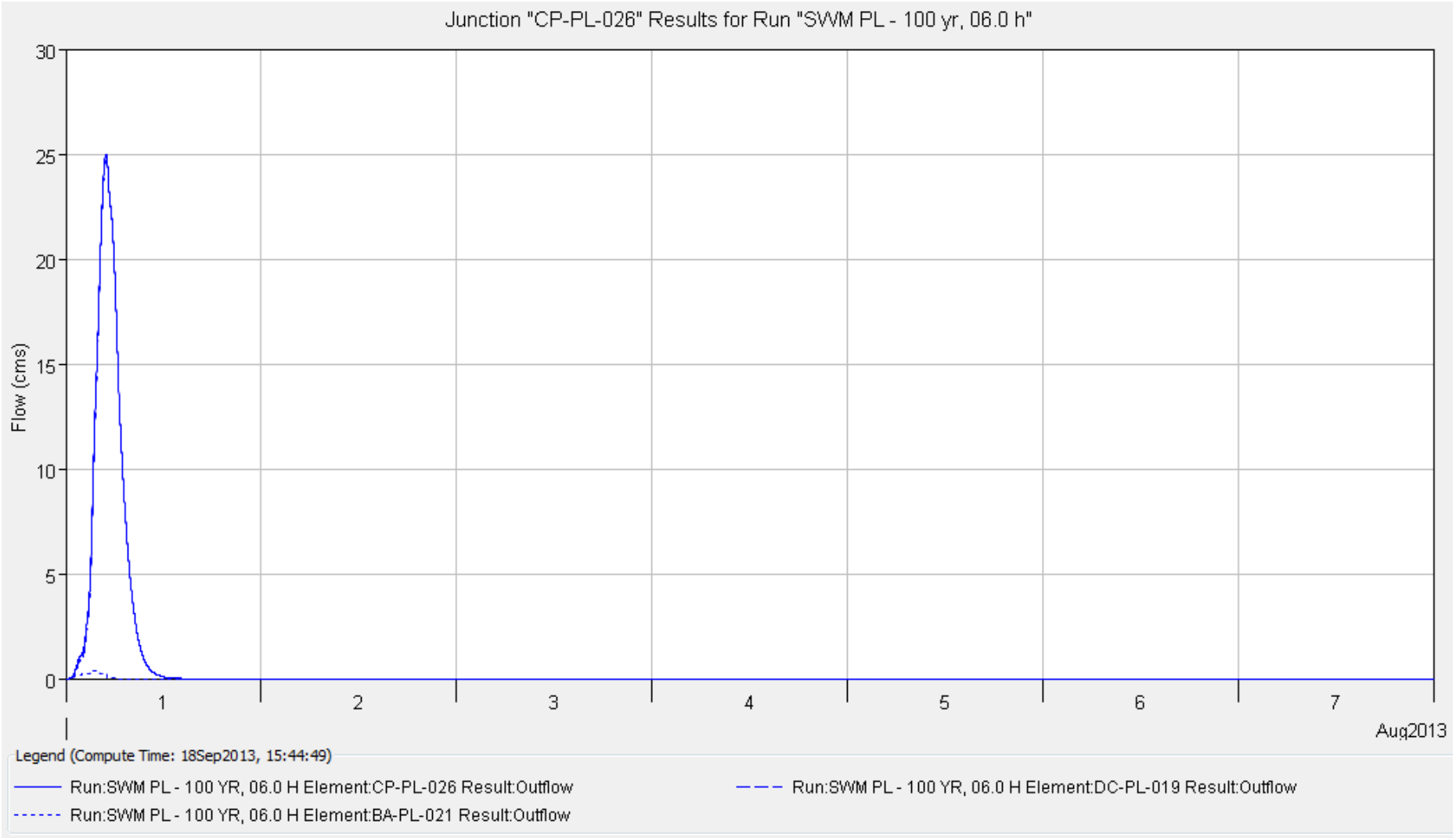

Junction "CP-PL-021" Results for Run "SWM PL - 100 yr, 06.0 h"
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Flow (cms)
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Outflow

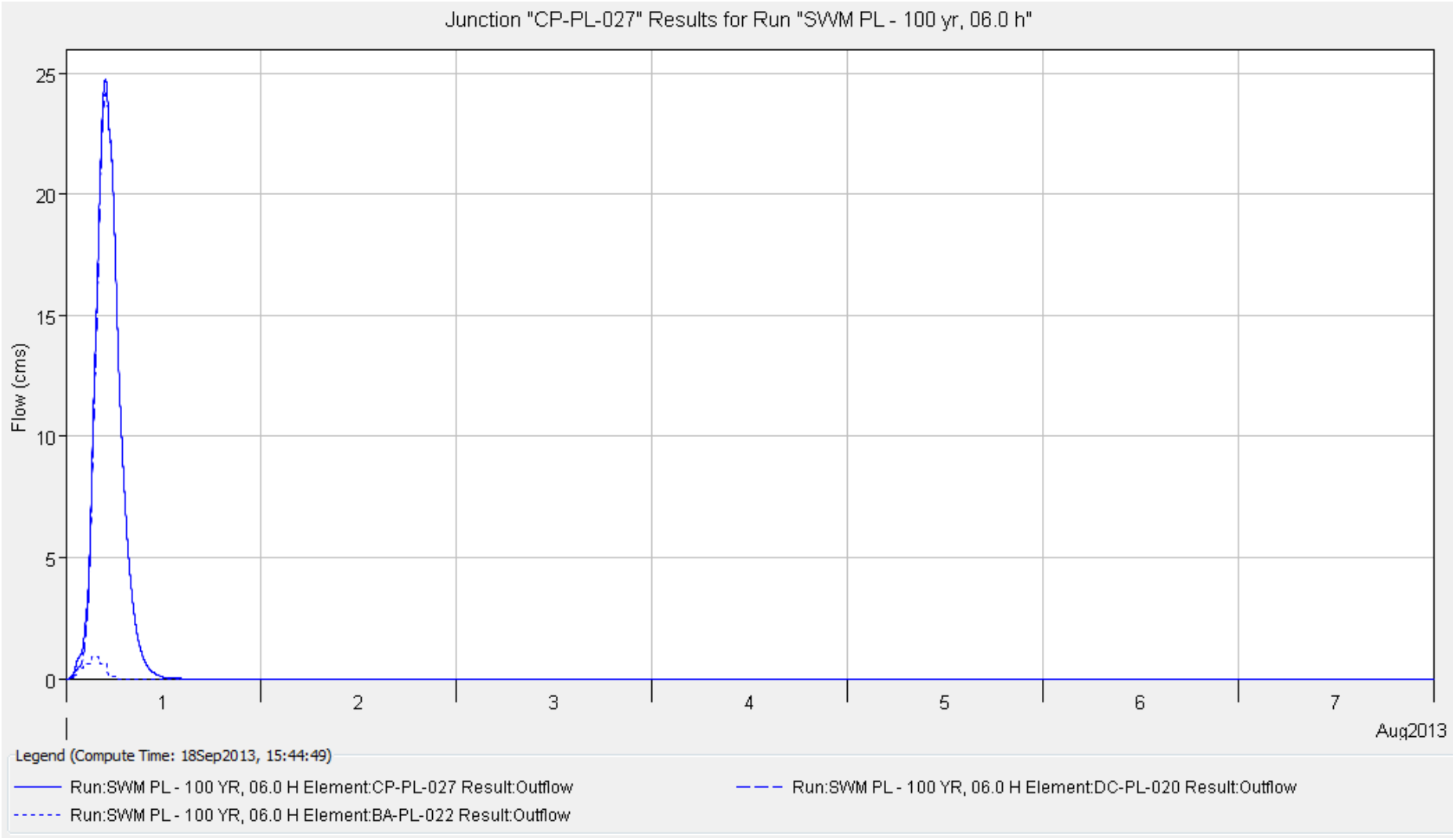

Junction "CP-PL-022" Results for Run "SWM PL - 100 yr, 06.0 h"
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Flow (cms)
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-017 Result:Outflow

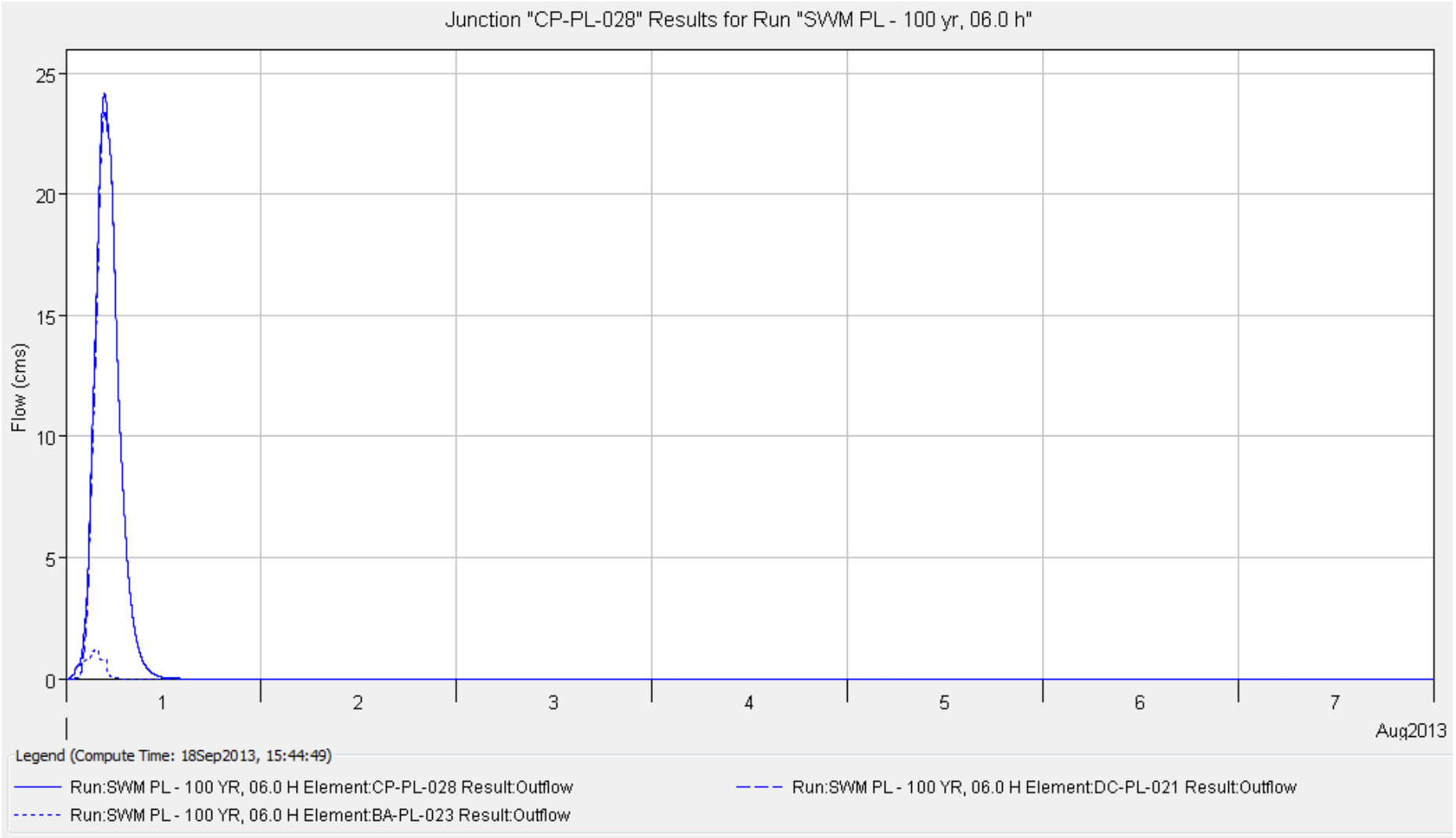

Junction "CP-PL-023" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-019 Result:Outflow

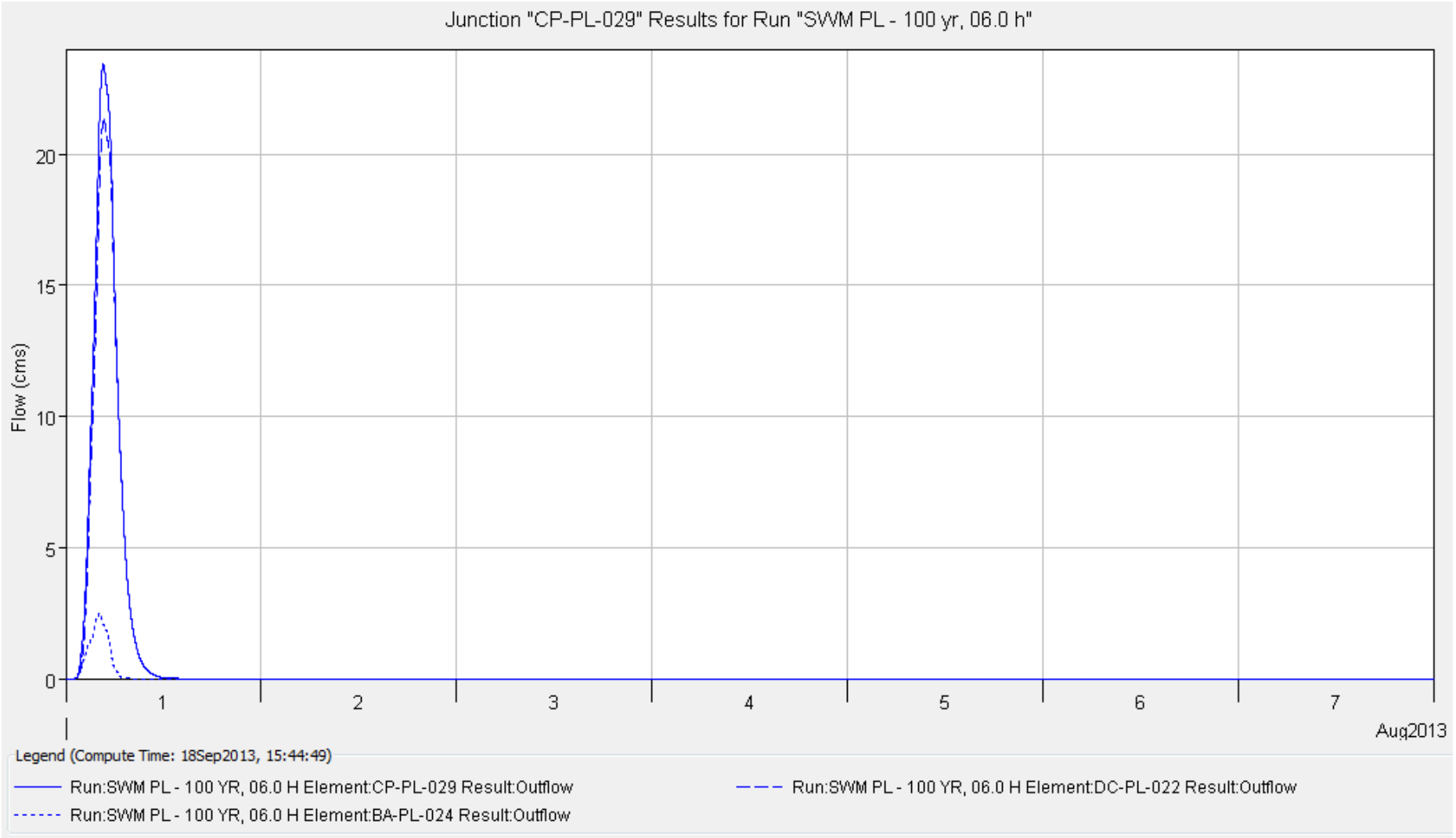

Junction "CP-PL-024" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-020 Result:Outflow

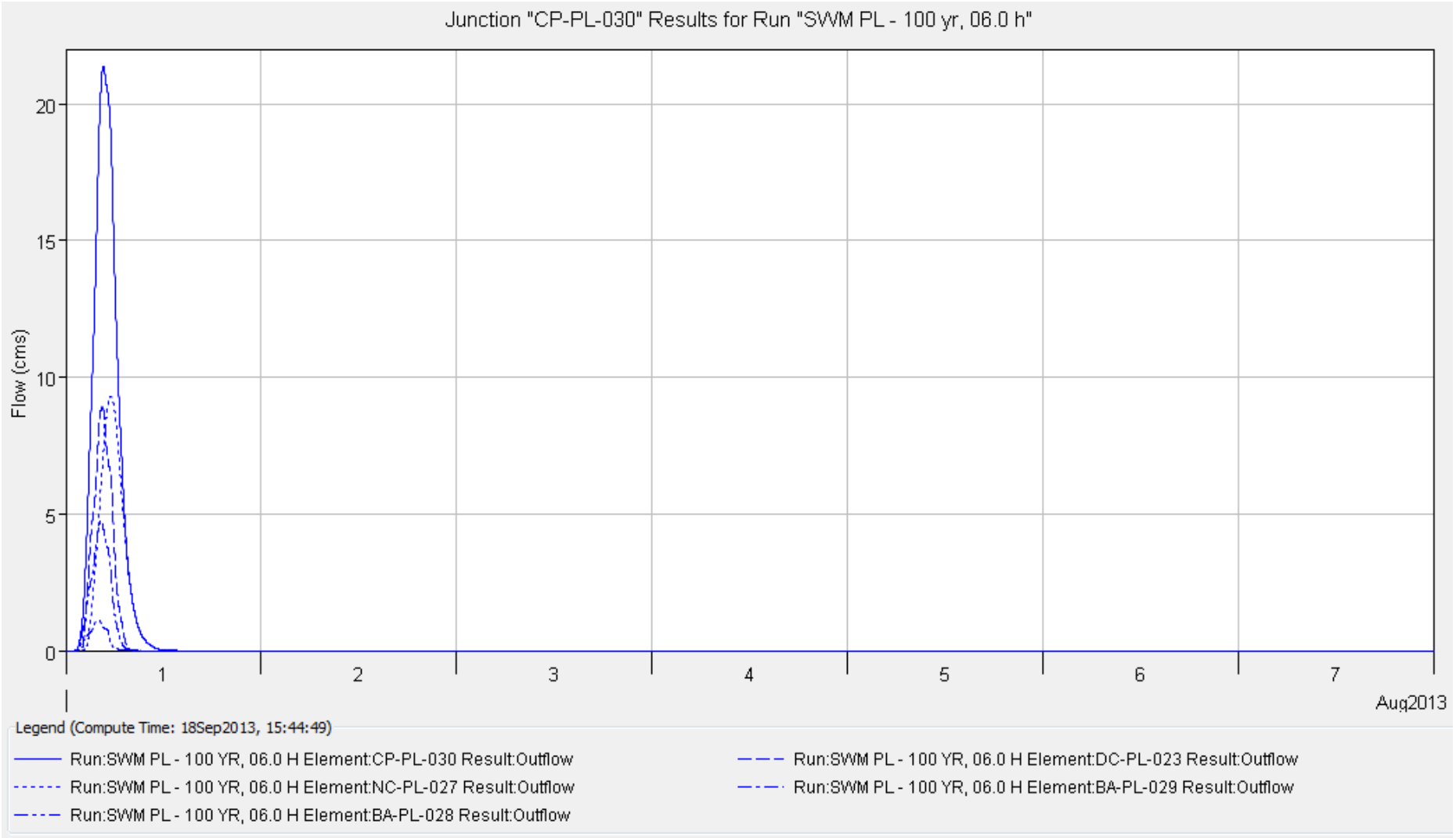

Junction "CP-PL-025" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-025 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-031 Result:Outflow

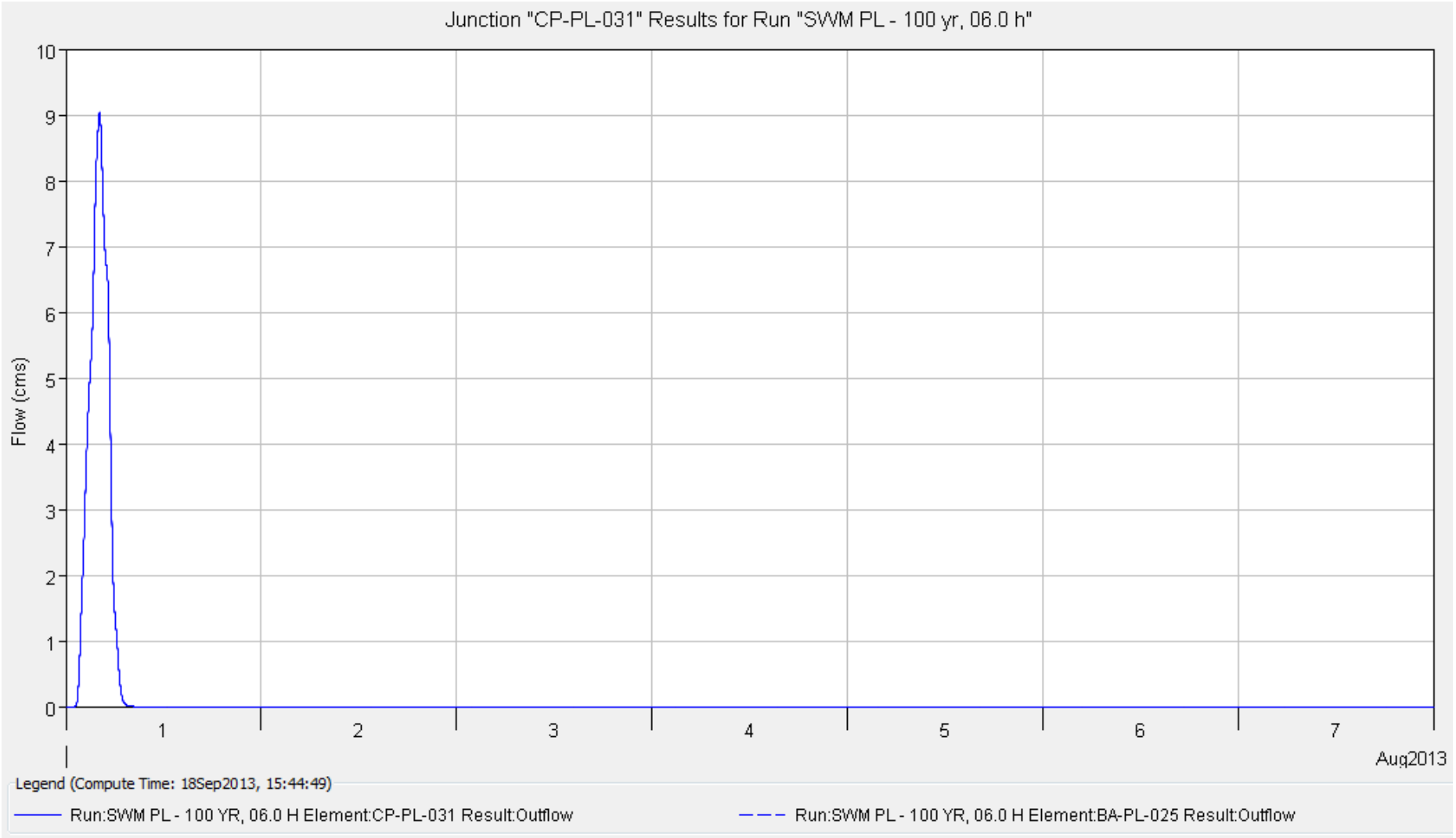

Junction "CP-PL-026" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-021 Result:Outflow

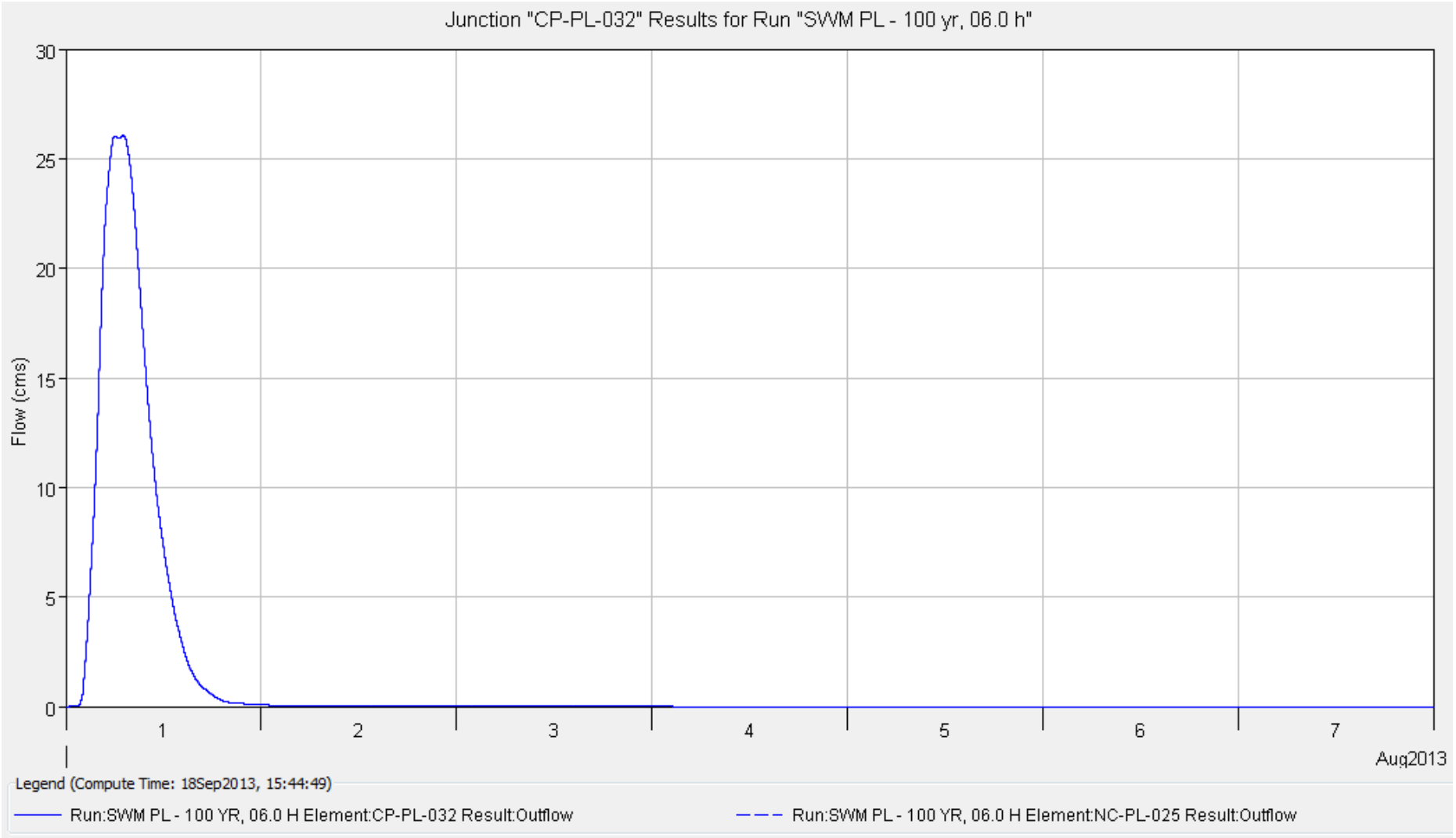

Junction "CP-PL-027" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-022 Result:Outflow

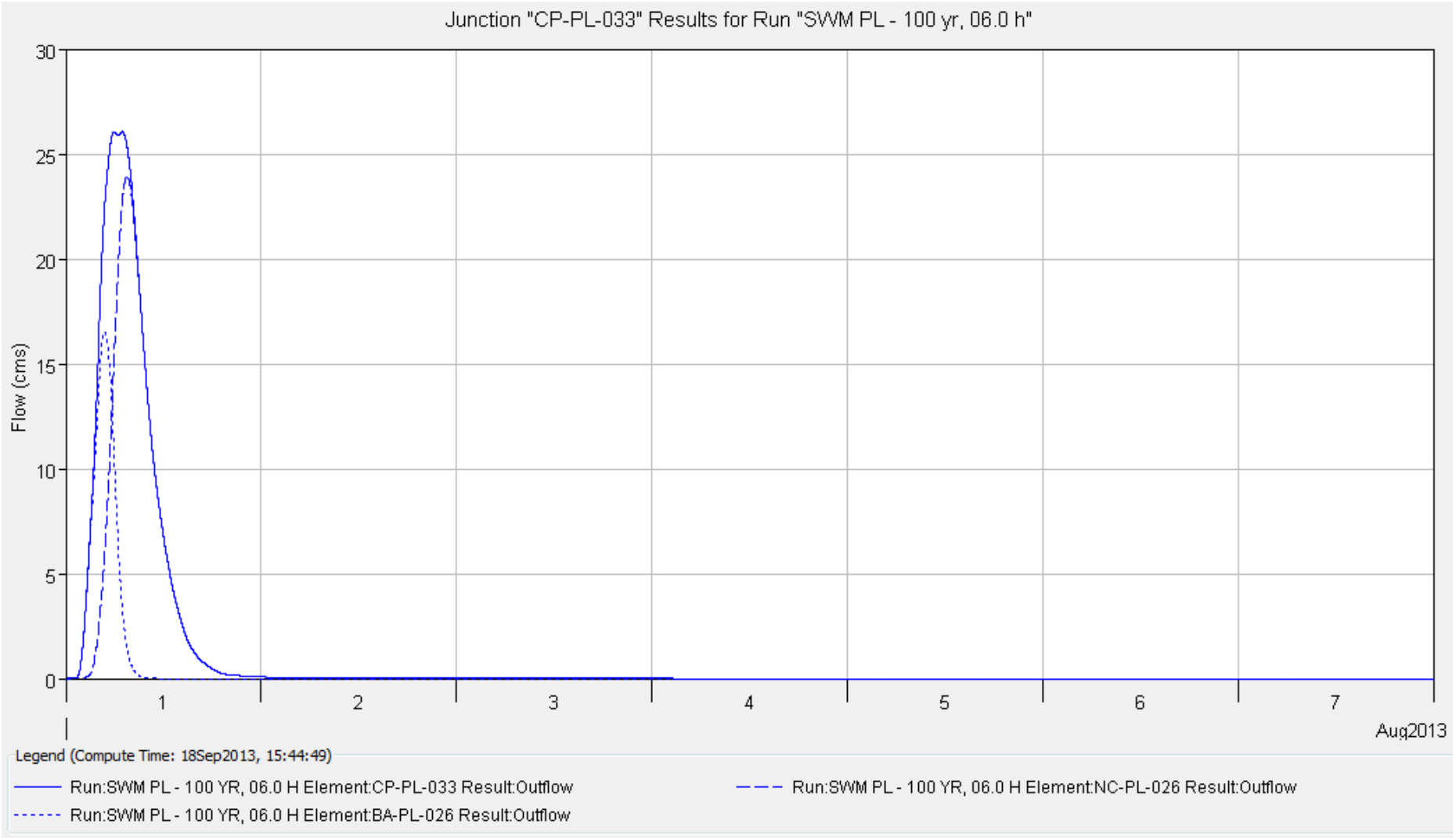

Junction "CP-PL-028" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-023 Result:Outflow

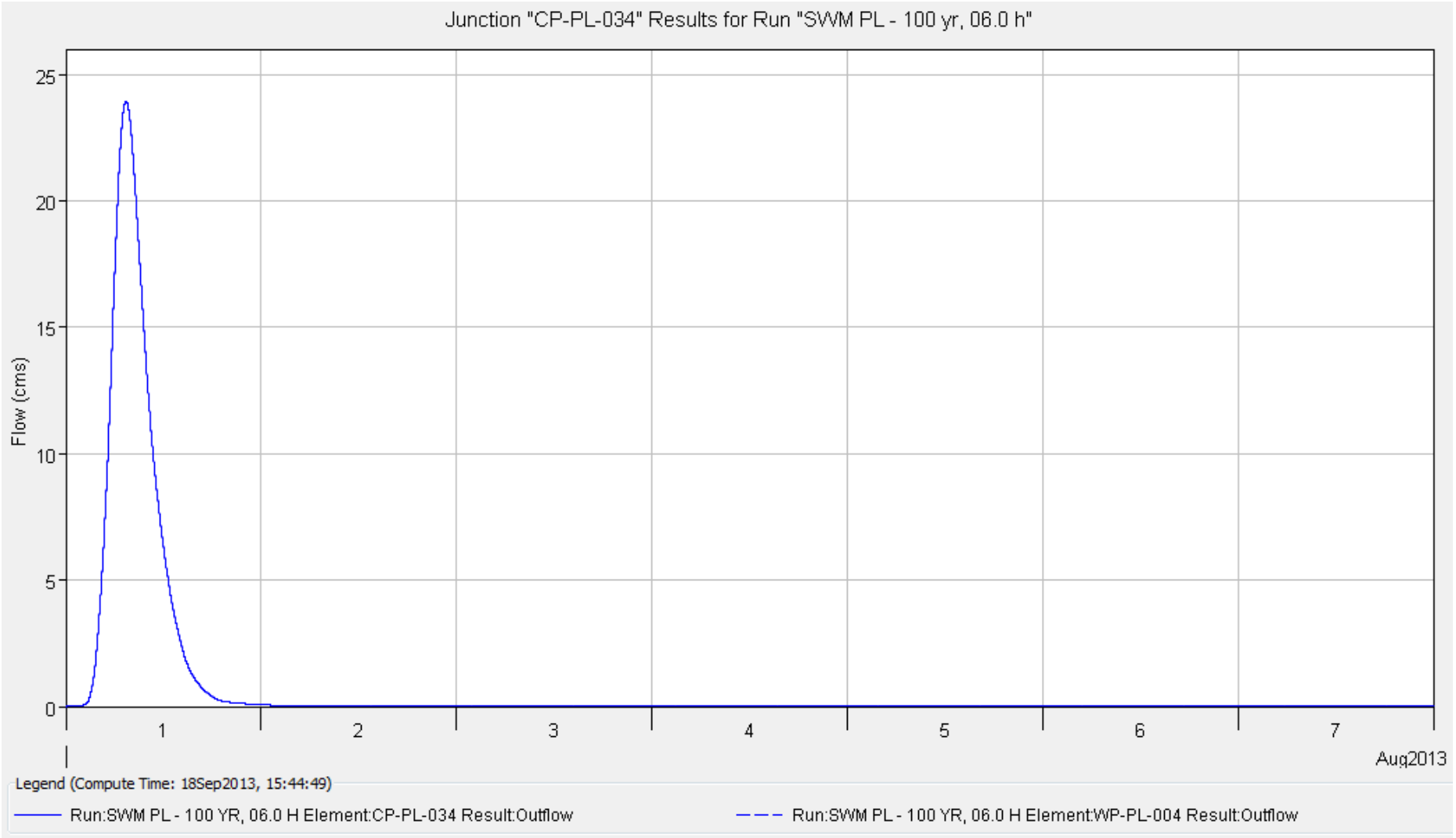

Junction "CP-PL-029" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
5
10
15
20
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-029 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-024 Result:Outflow

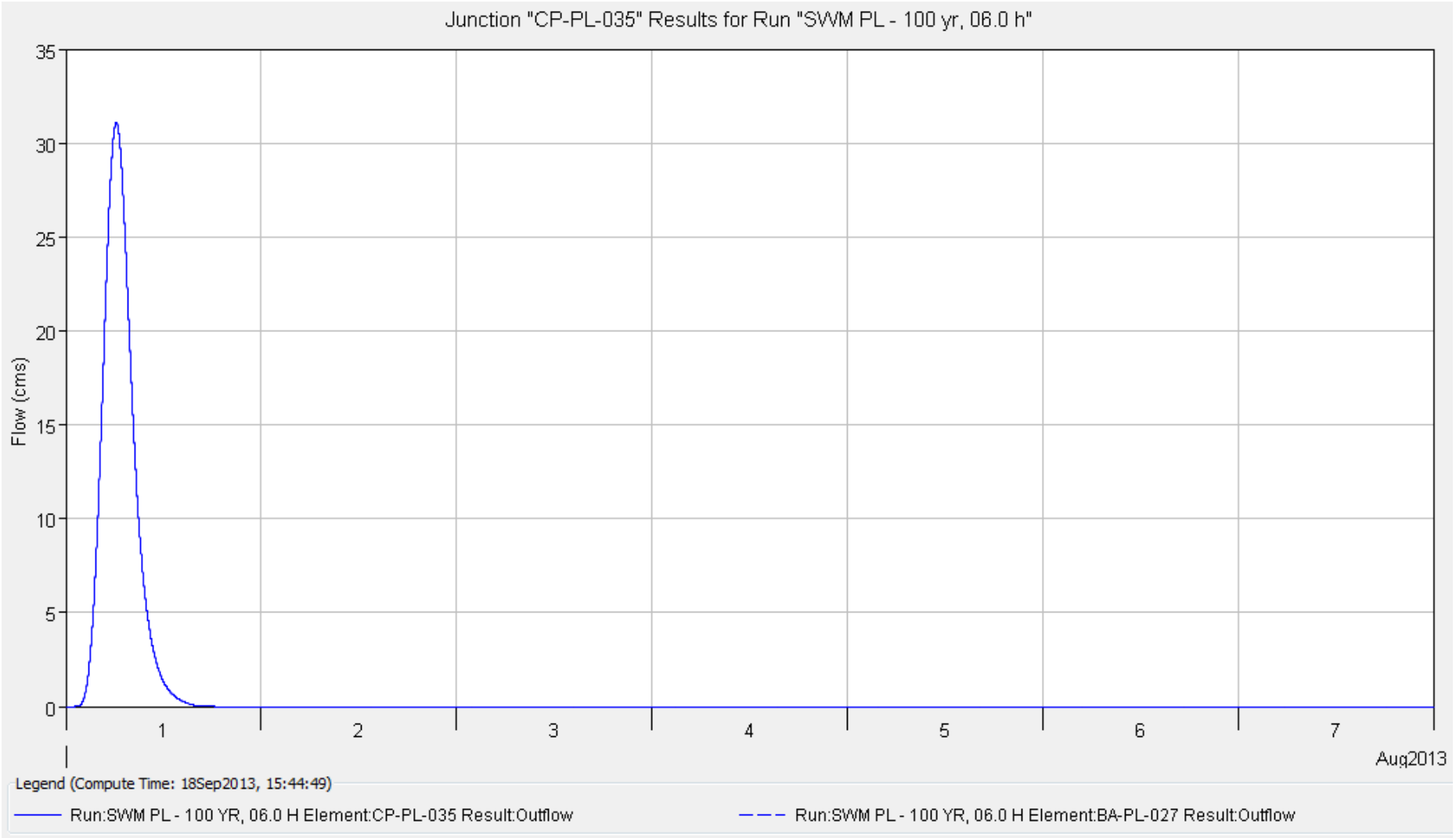

Junction "CP-PL-030" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-029 Result:Outflow

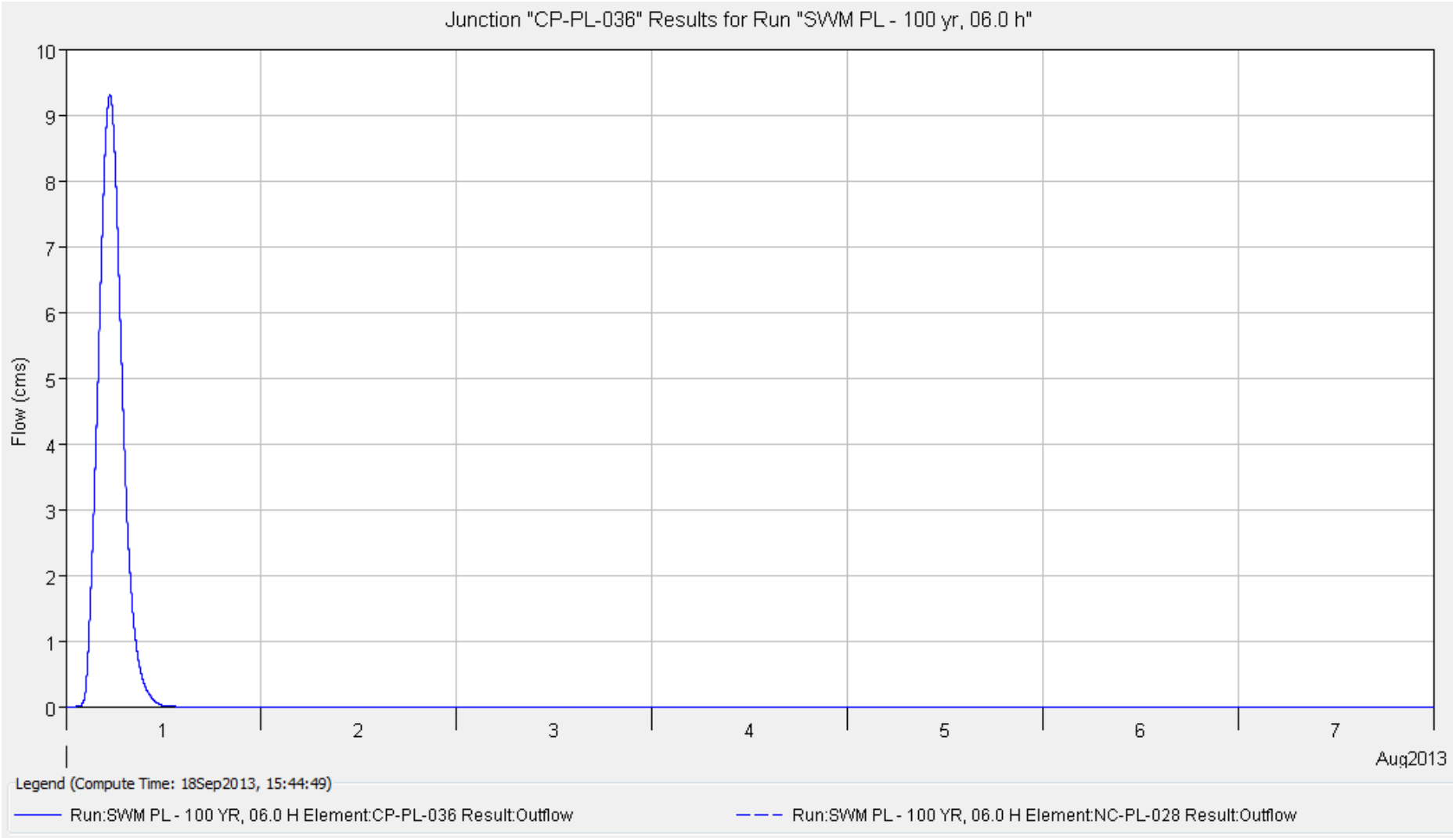

Junction "CP-PL-031" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-031 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-025 Result:Outflow

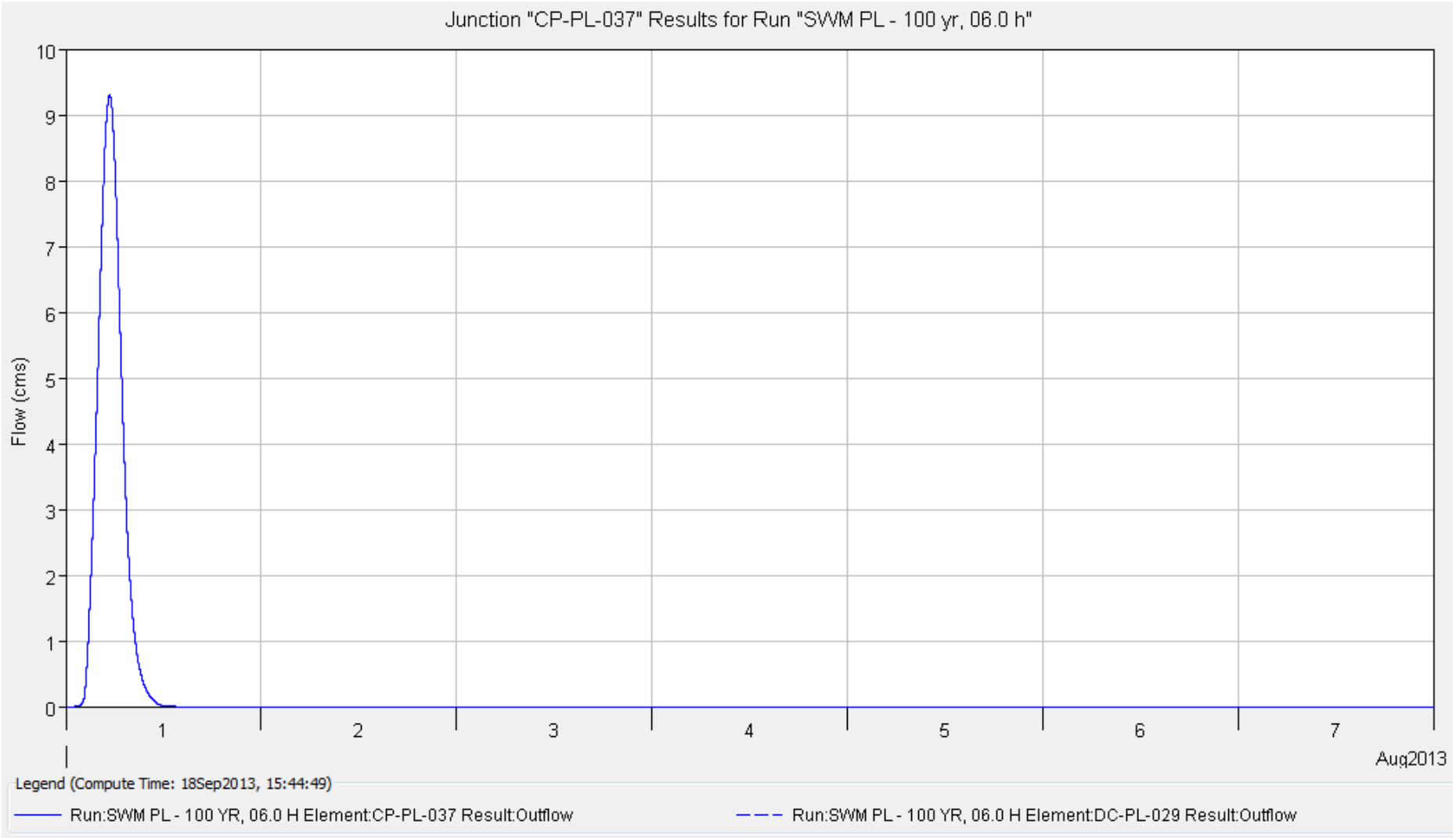

Junction "CP-PL-032" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-032 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-025 Result:Outflow

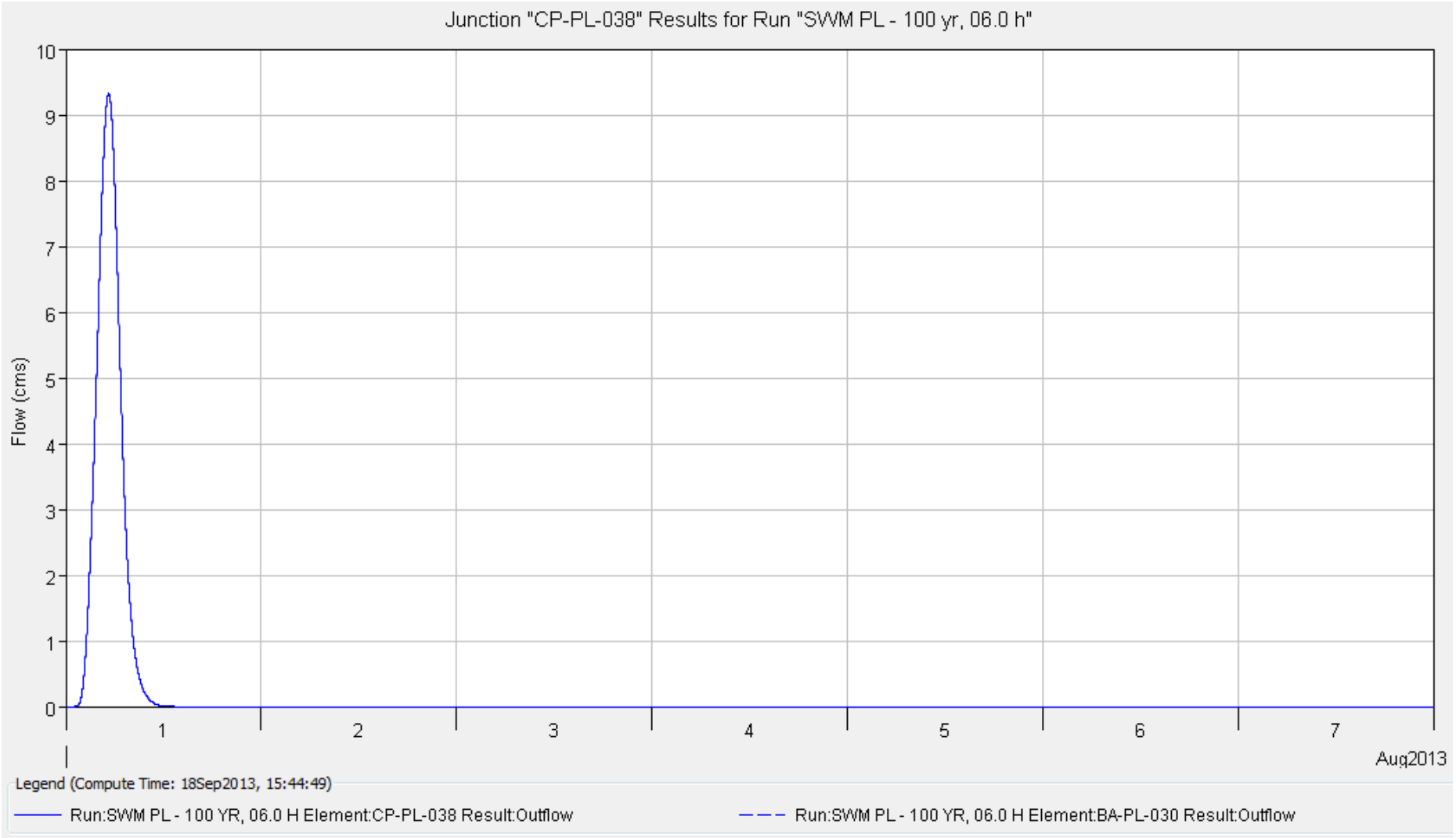

Junction "CP-PL-033" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-033 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-026 Result:Outflow

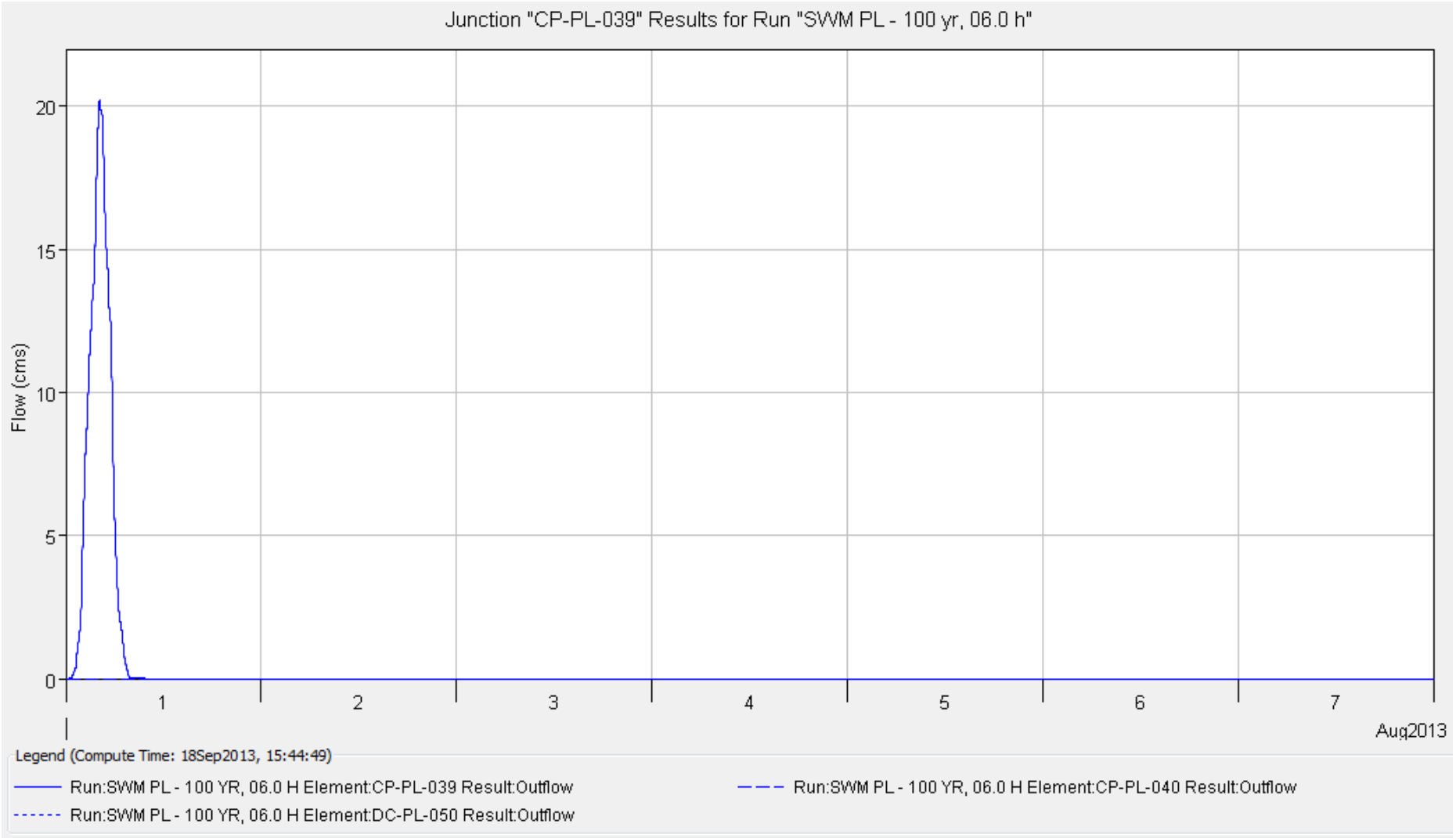

Junction "CP-PL-034" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Outflow

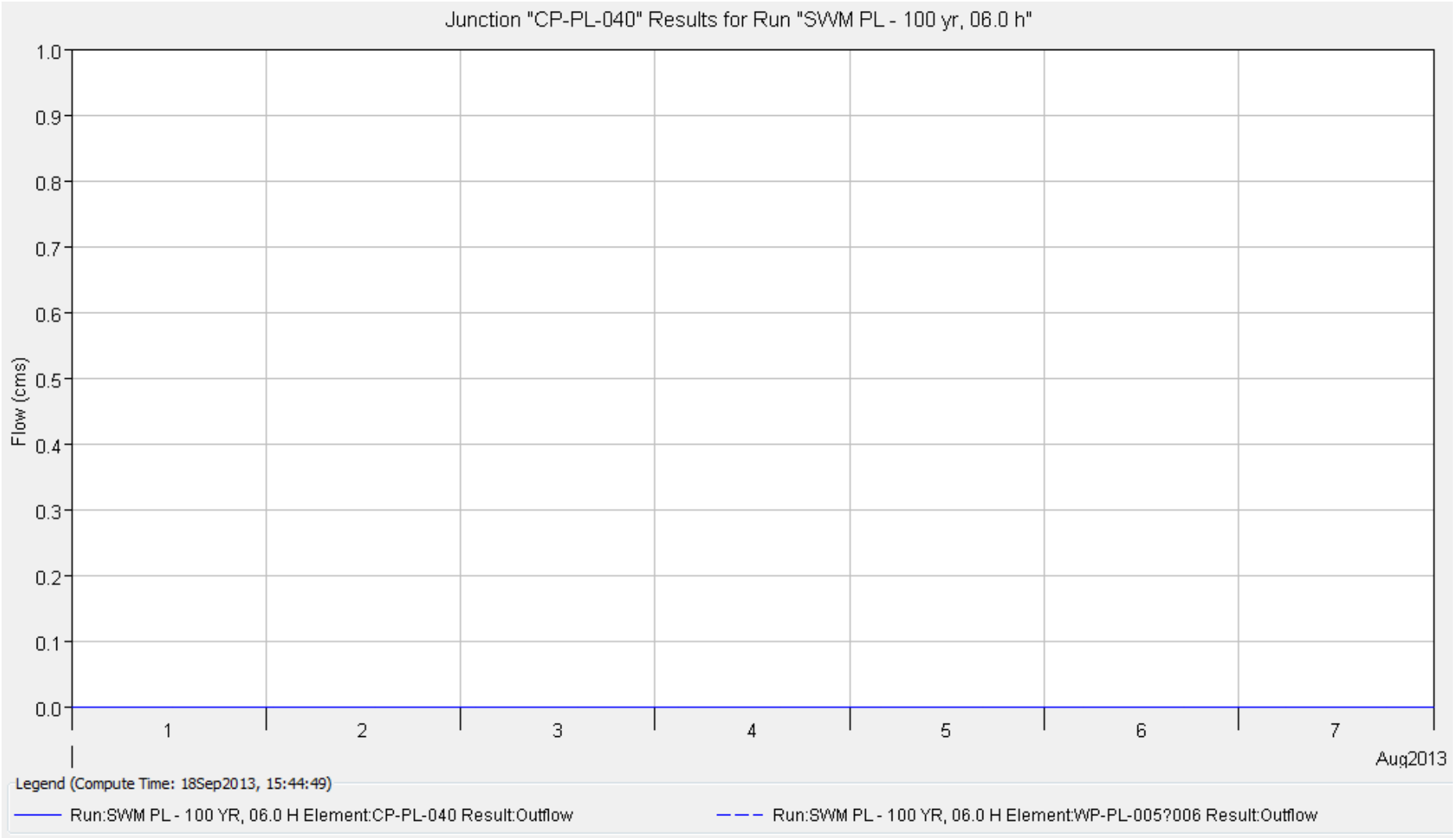

Junction "CP-PL-035" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-035 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-027 Result:Outflow

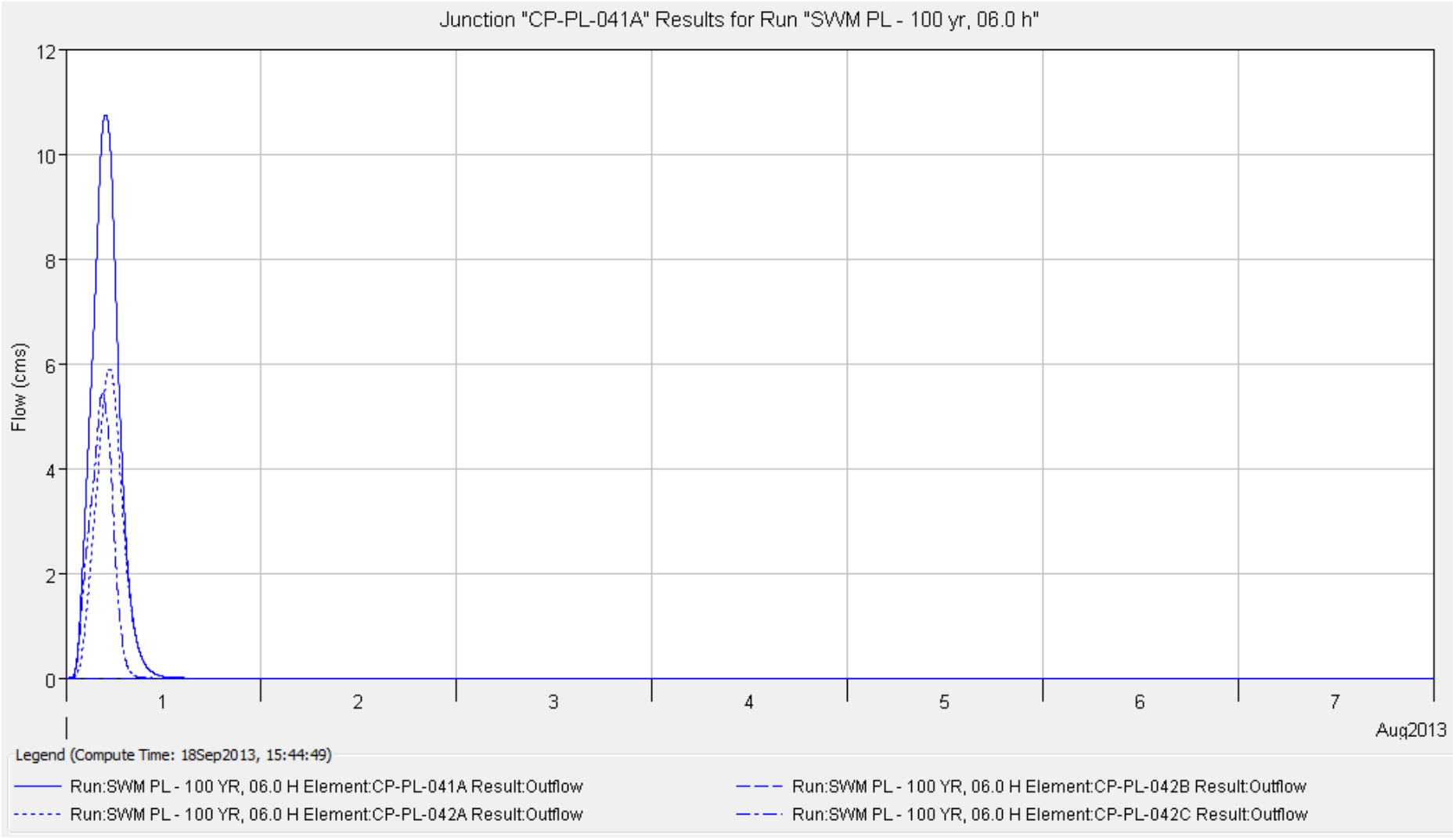

Junction "CP-PL-036" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-028 Result:Outflow

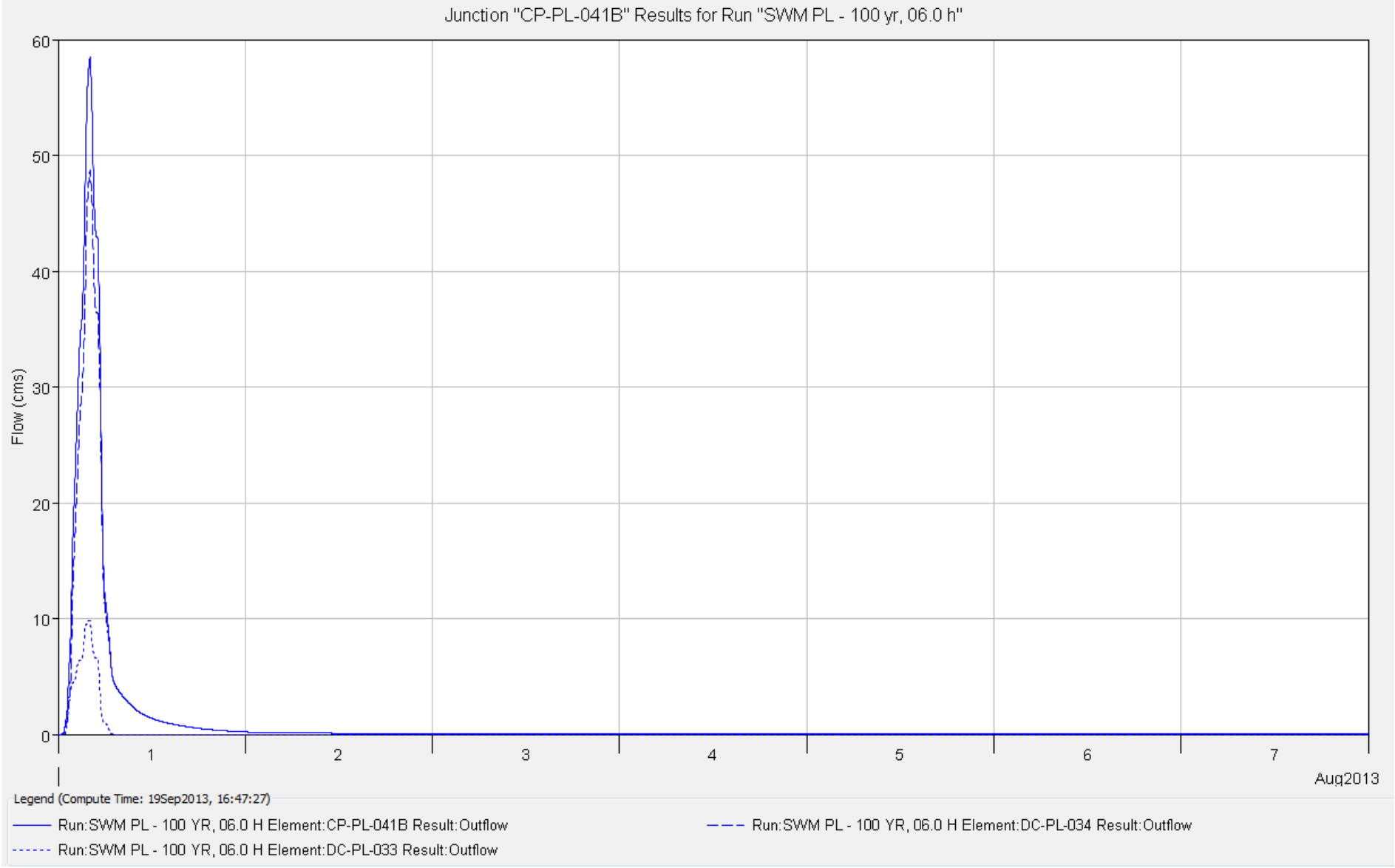

Junction "CP-PL-037" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-029 Result:Outflow


Junction "CP-PL-038" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-038 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-030 Result:Outflow

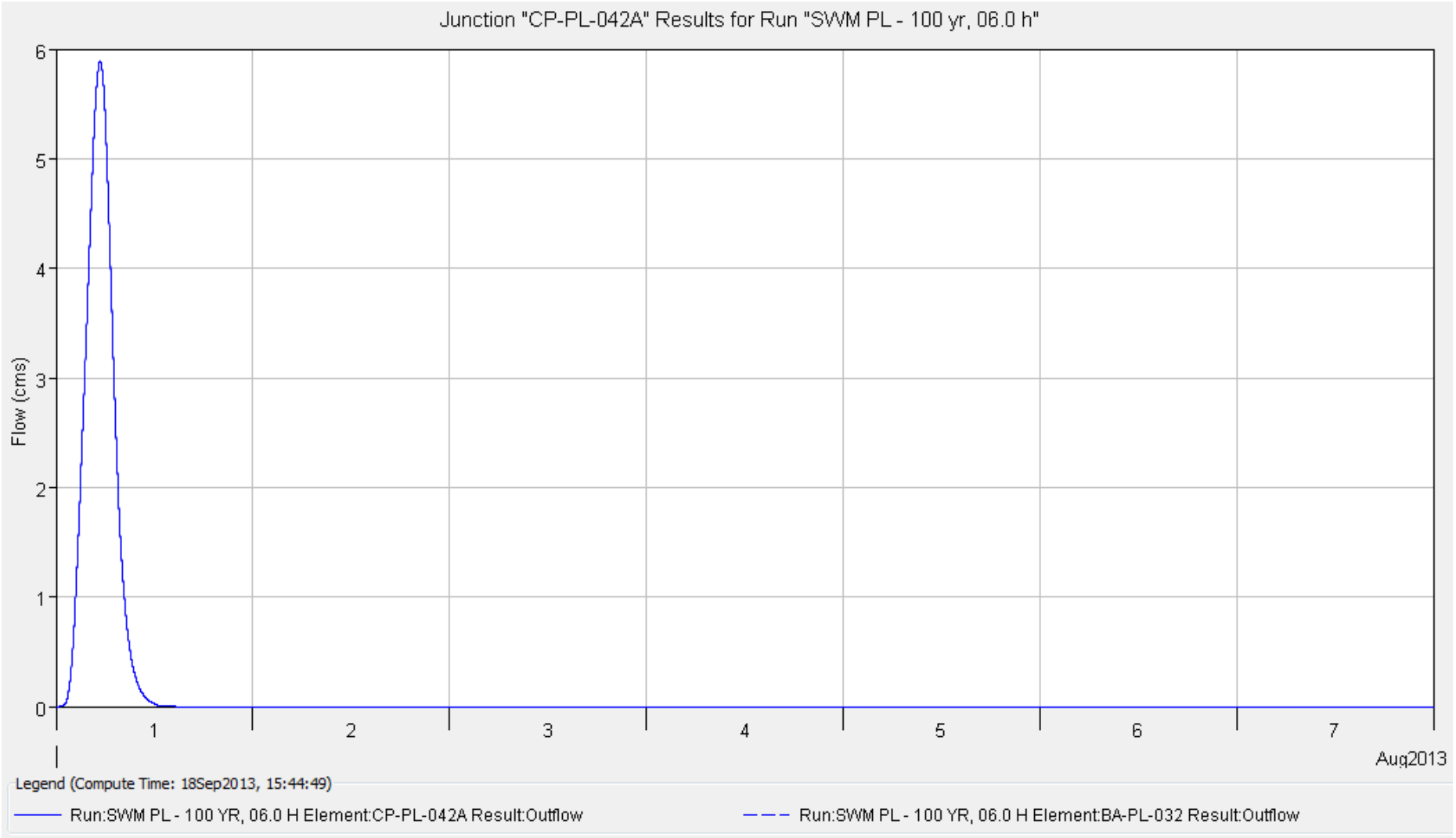

Junction "CP-PL-039" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-050 Result:Outflow

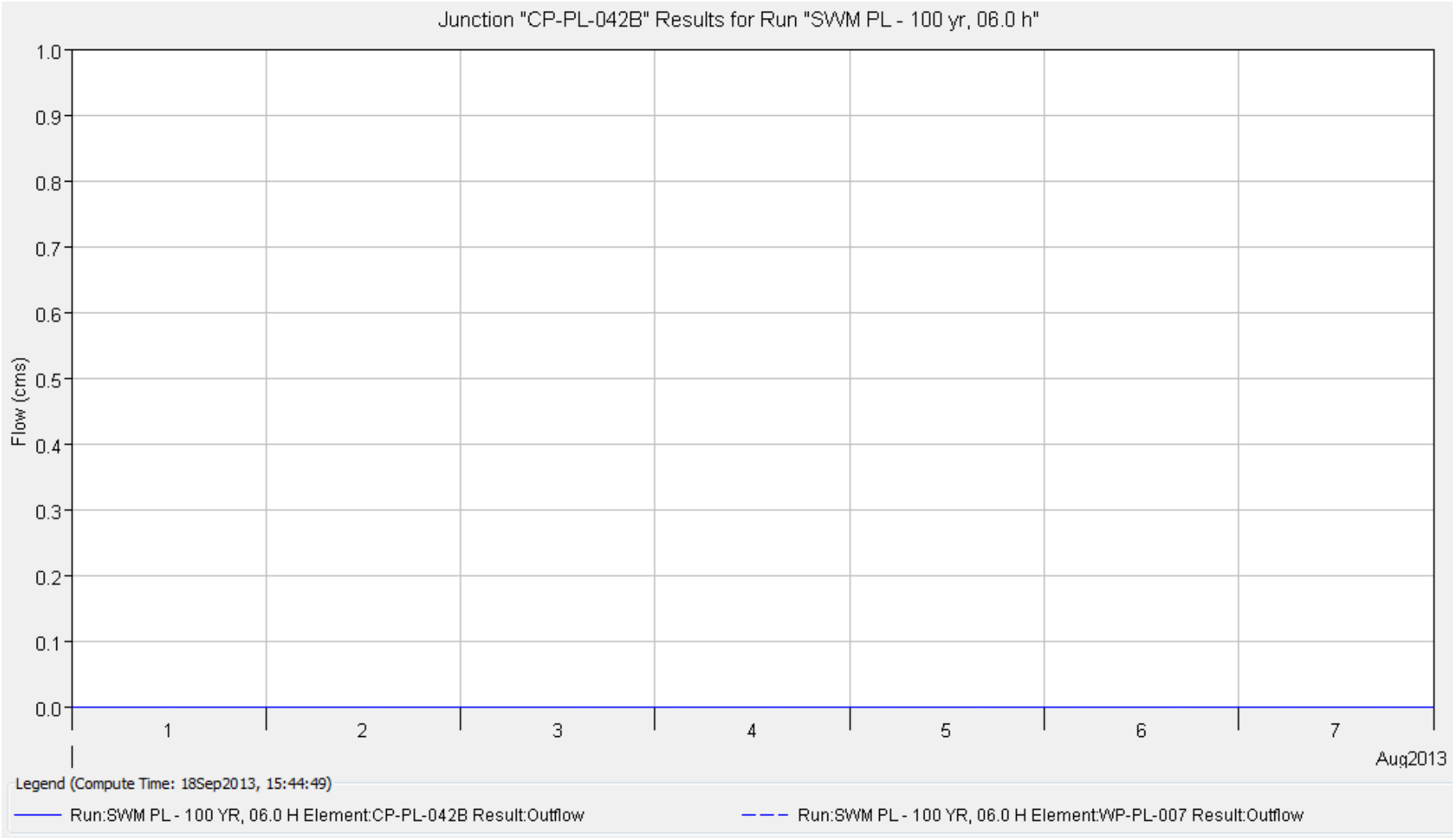

Junction "CP-PL-040" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Outflow

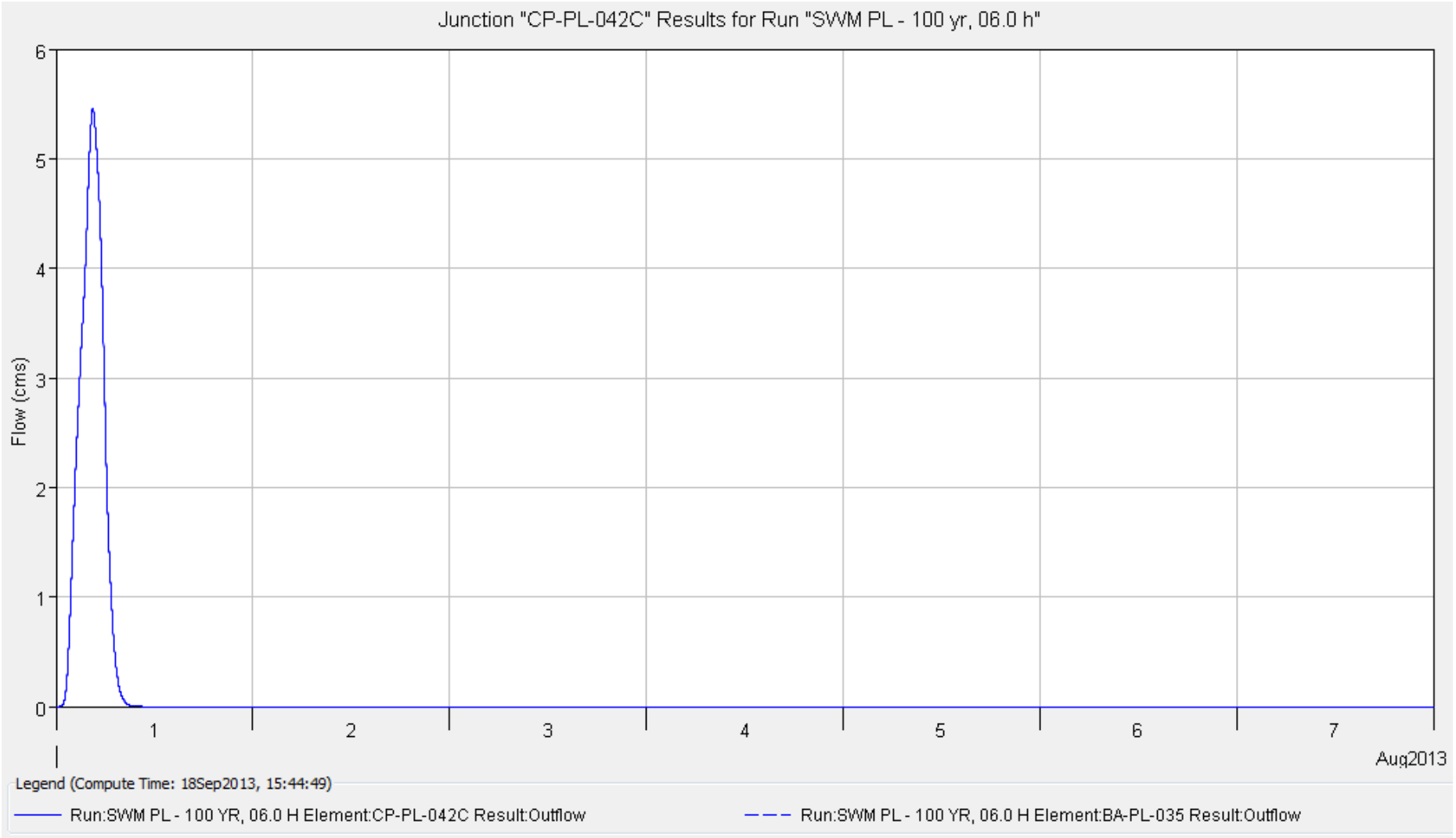

Junction "CP-PL-041A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042C Result:Outflow

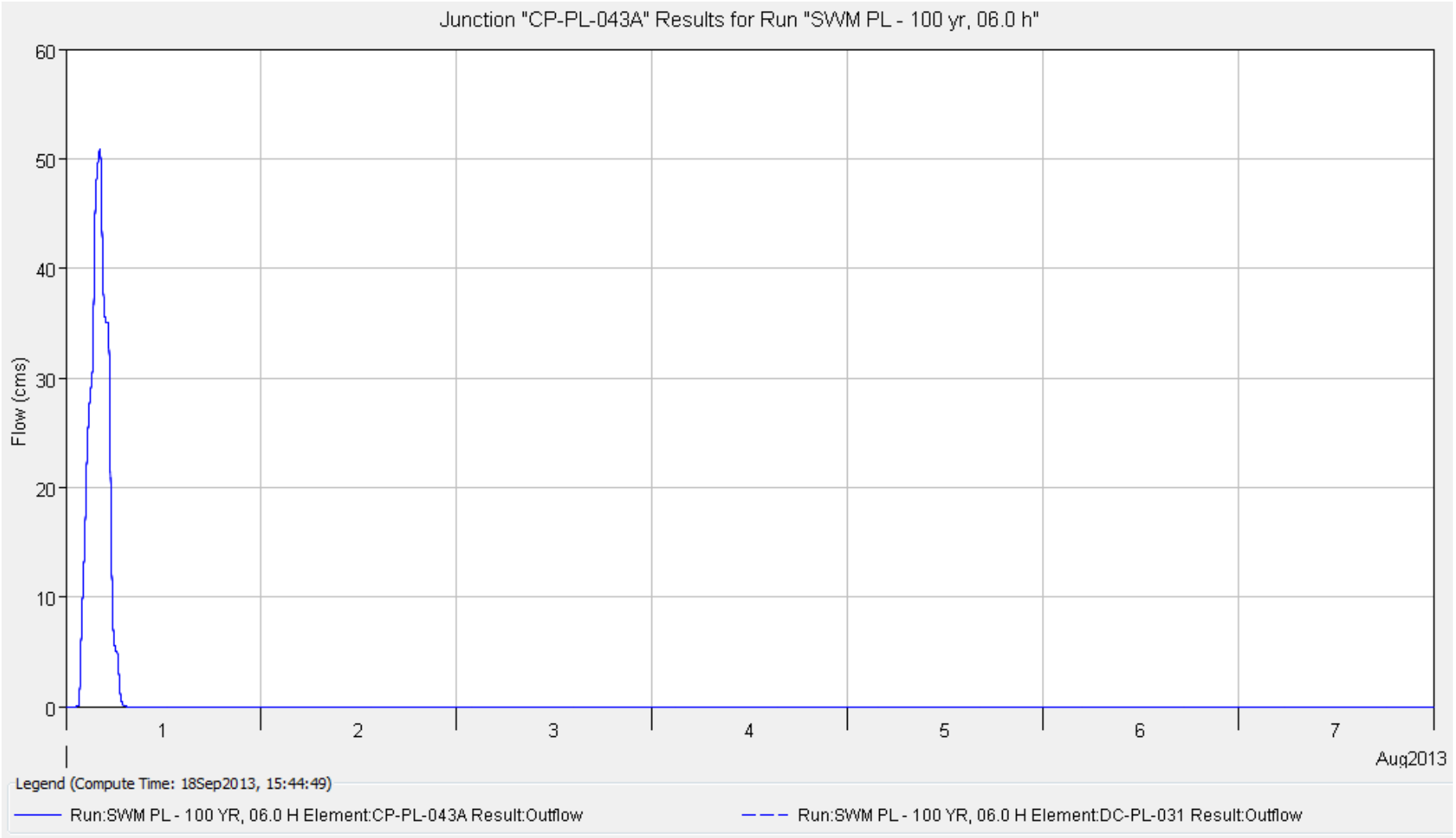

Junction "CP-PL-041B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-033 Result:Outflow

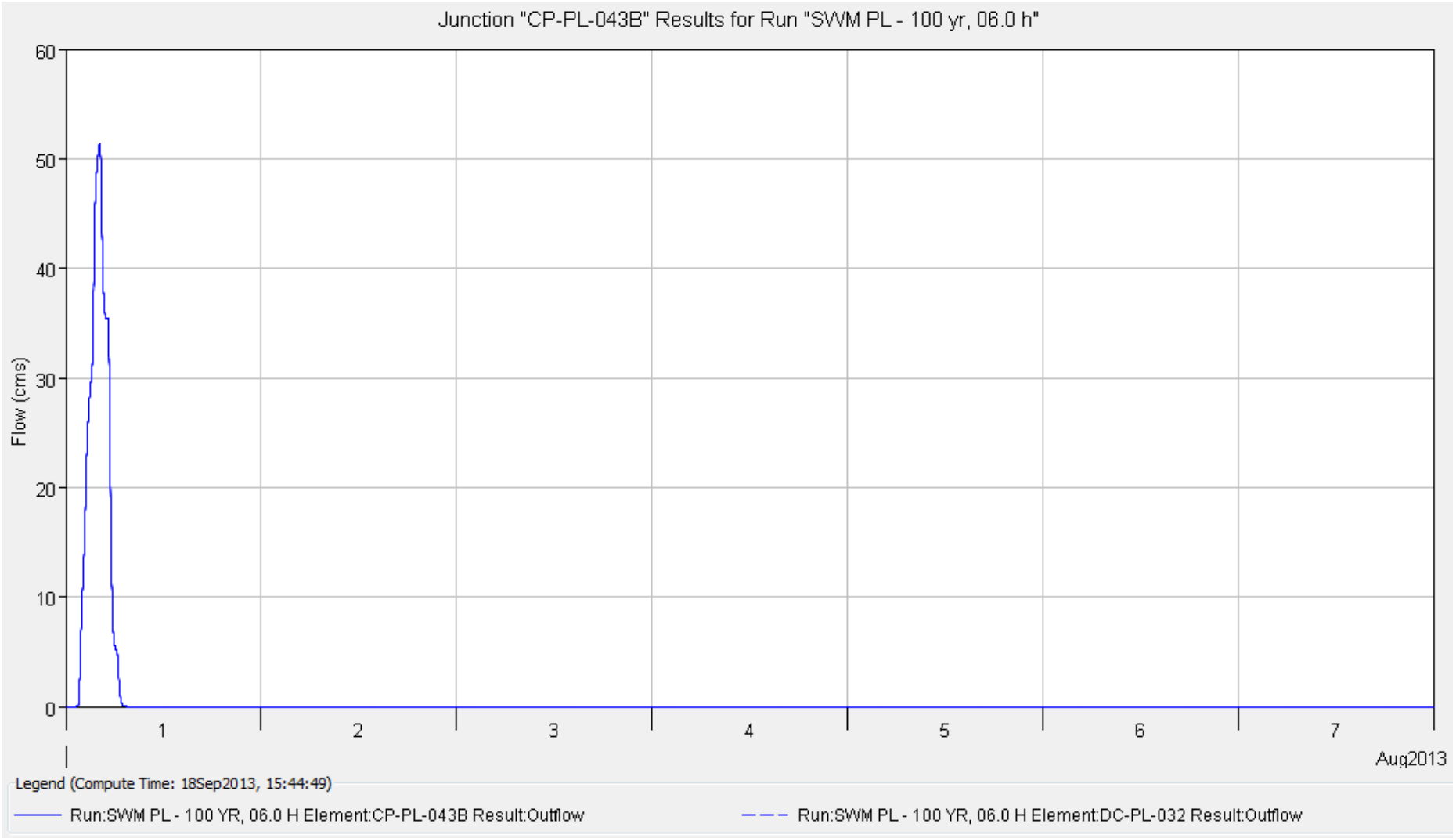

Junction "CP-PL-041C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-041C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-061 Result:Outflow

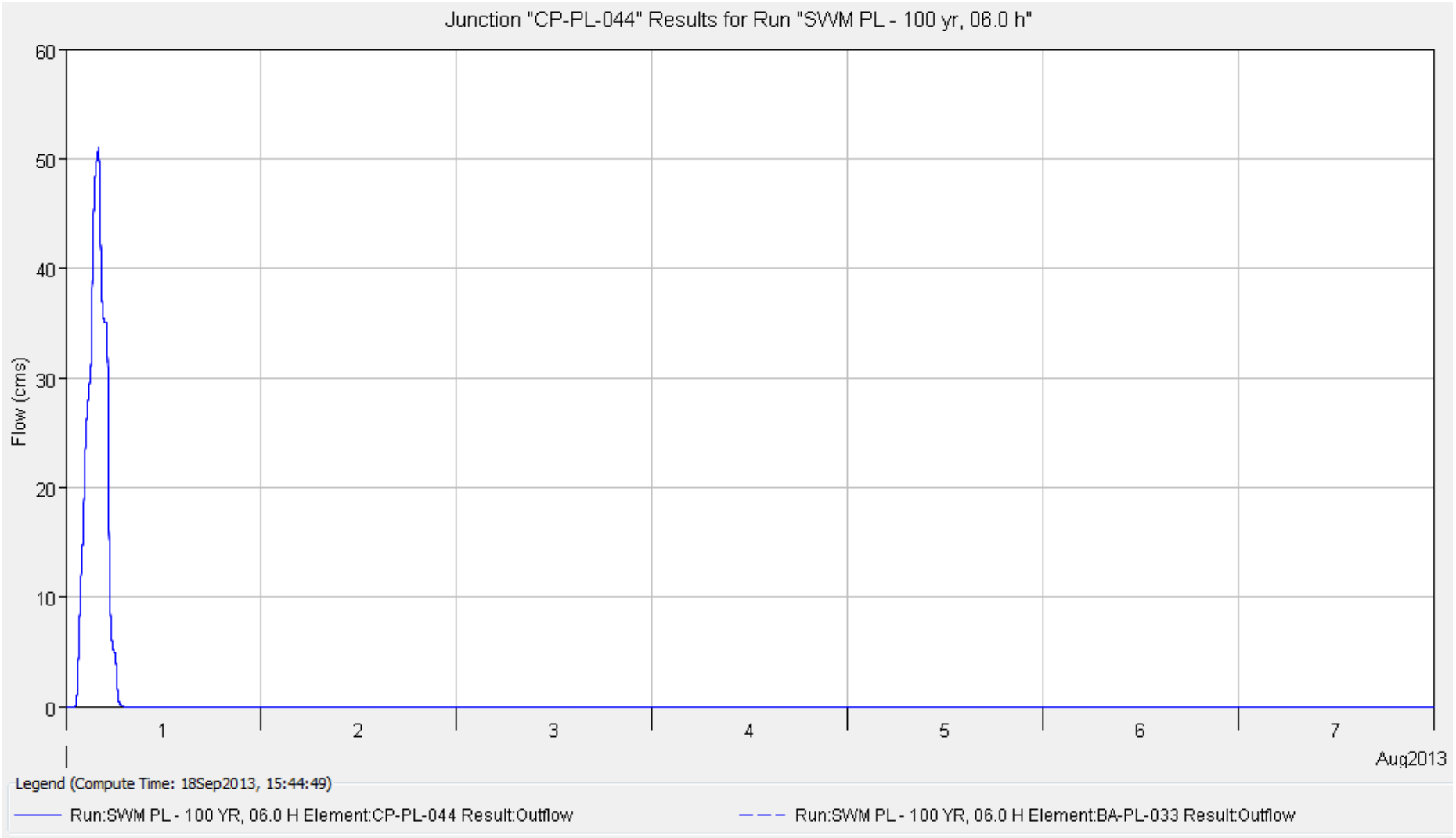

Junction "CP-PL-042A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-032 Result:Outflow

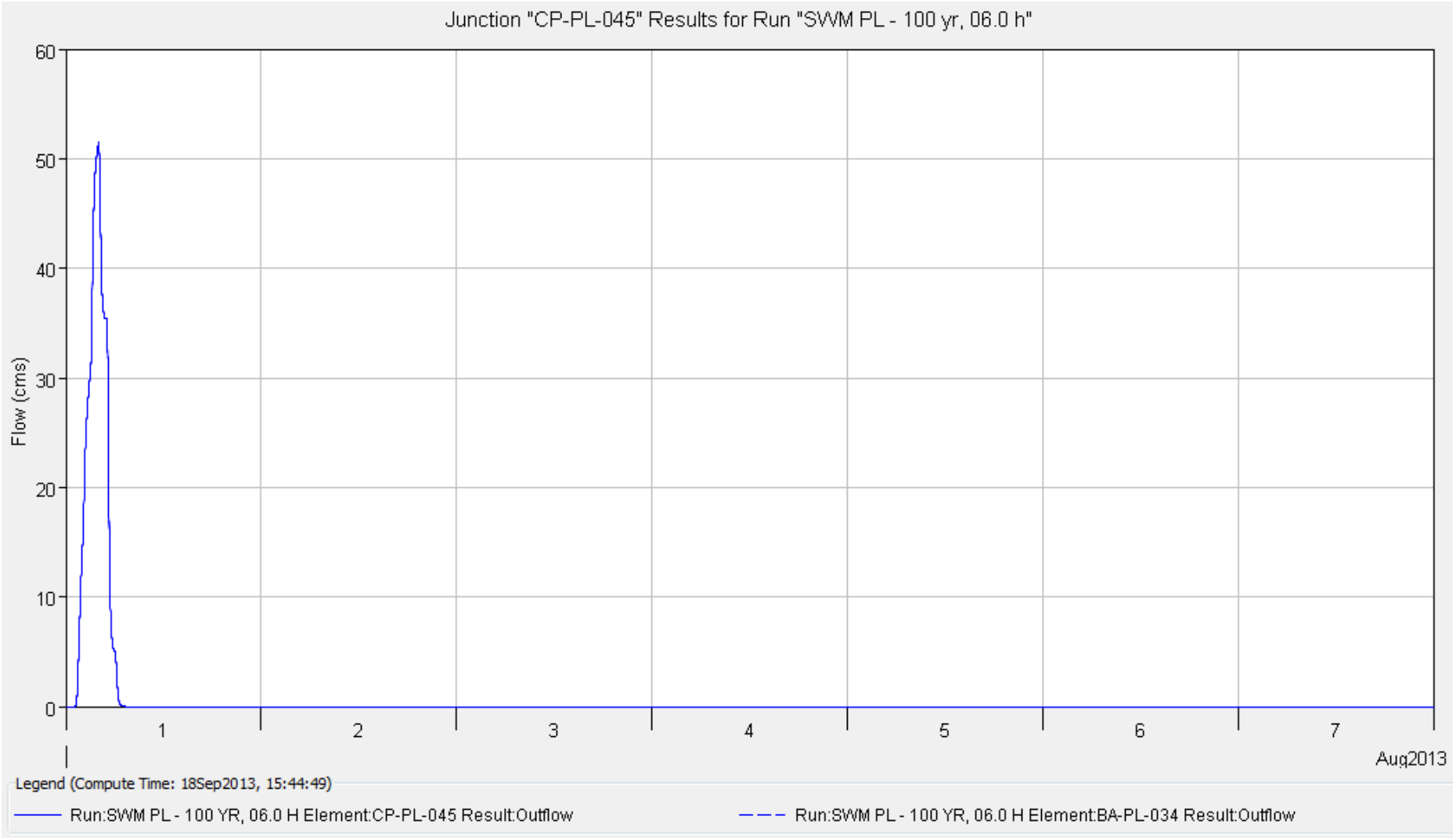

Junction "CP-PL-042B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Outflow

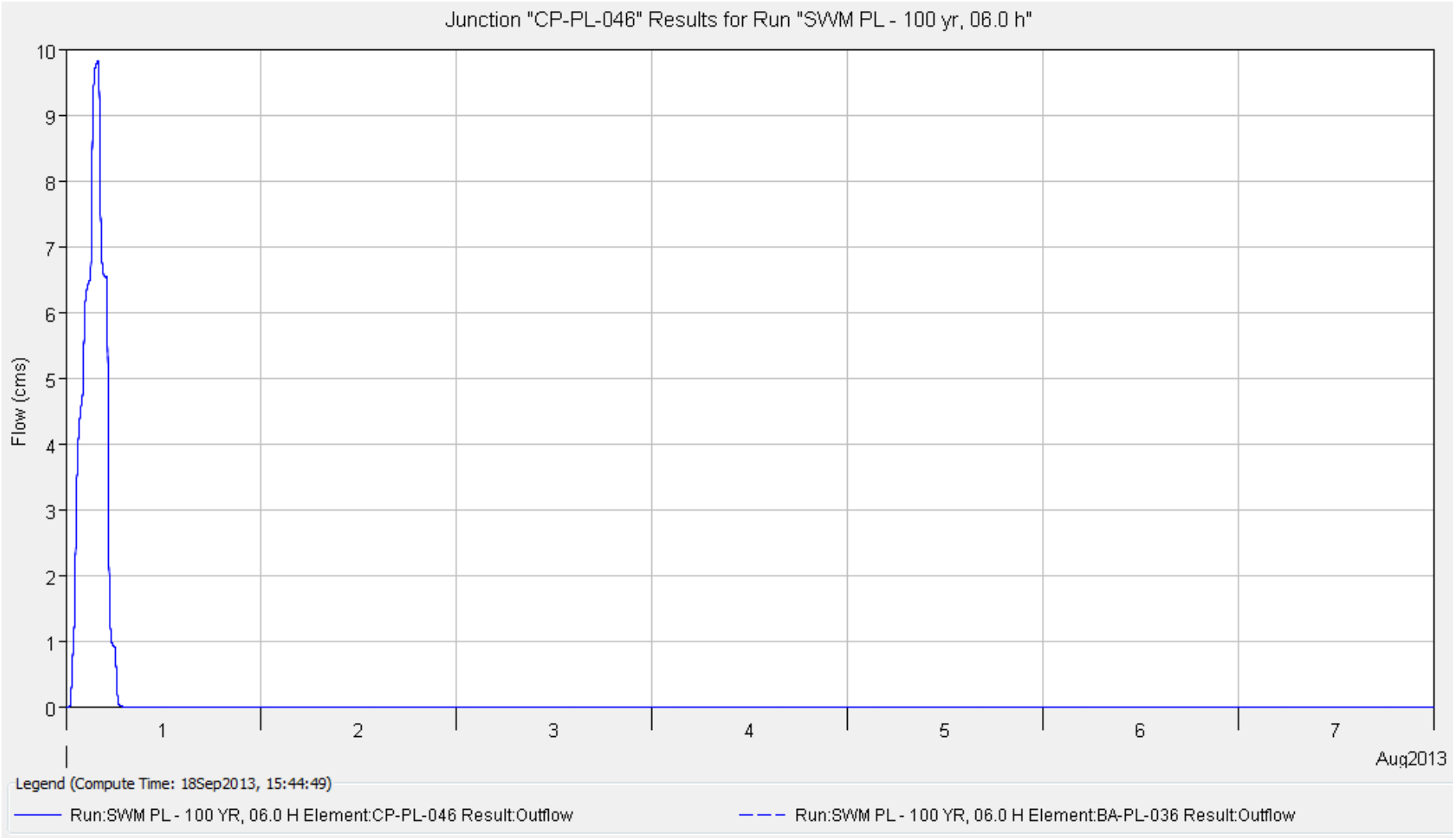

Junction "CP-PL-042C" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-042C Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-035 Result:Outflow

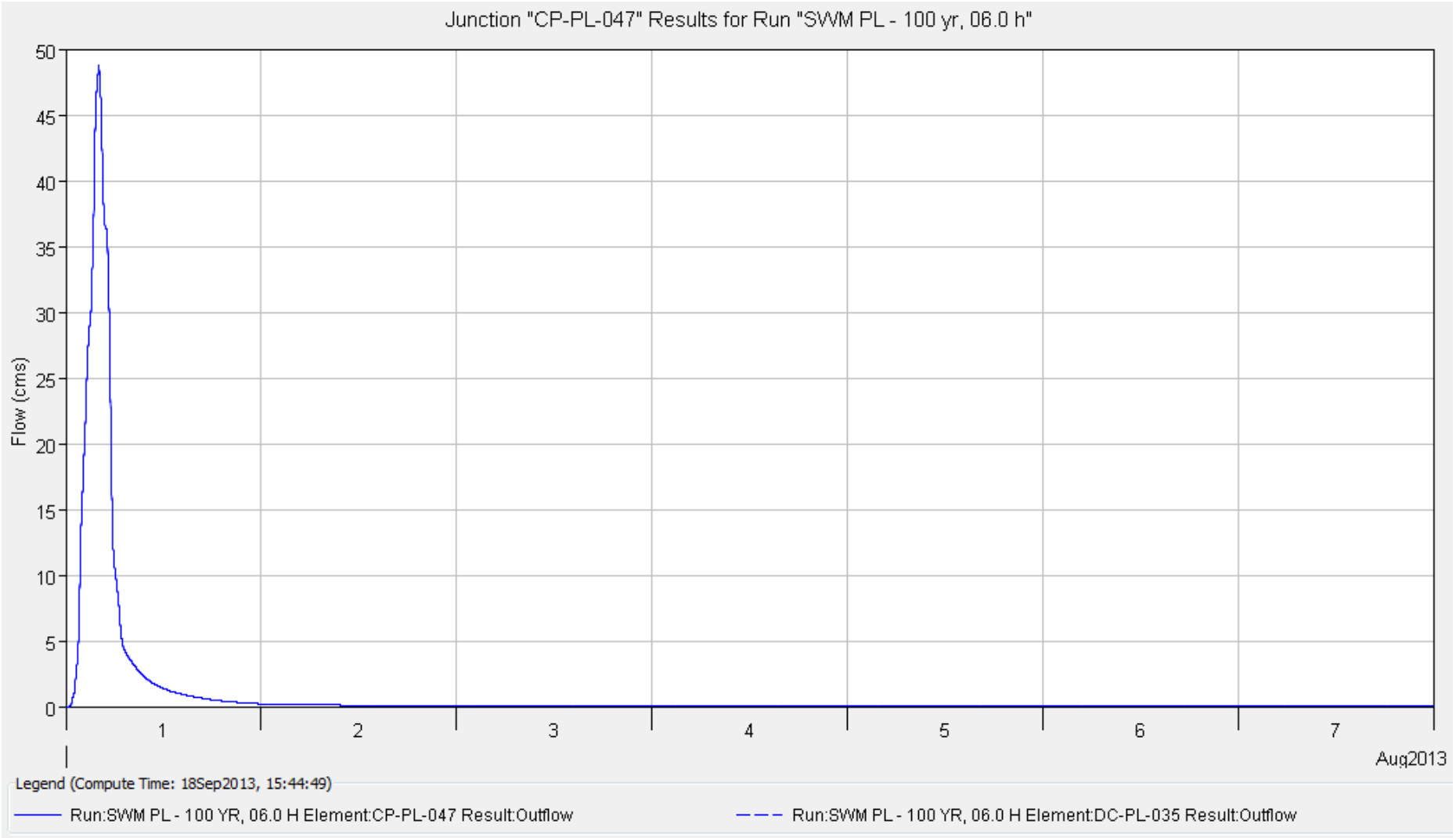

Junction "CP-PL-043A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-043A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-031 Result:Outflow

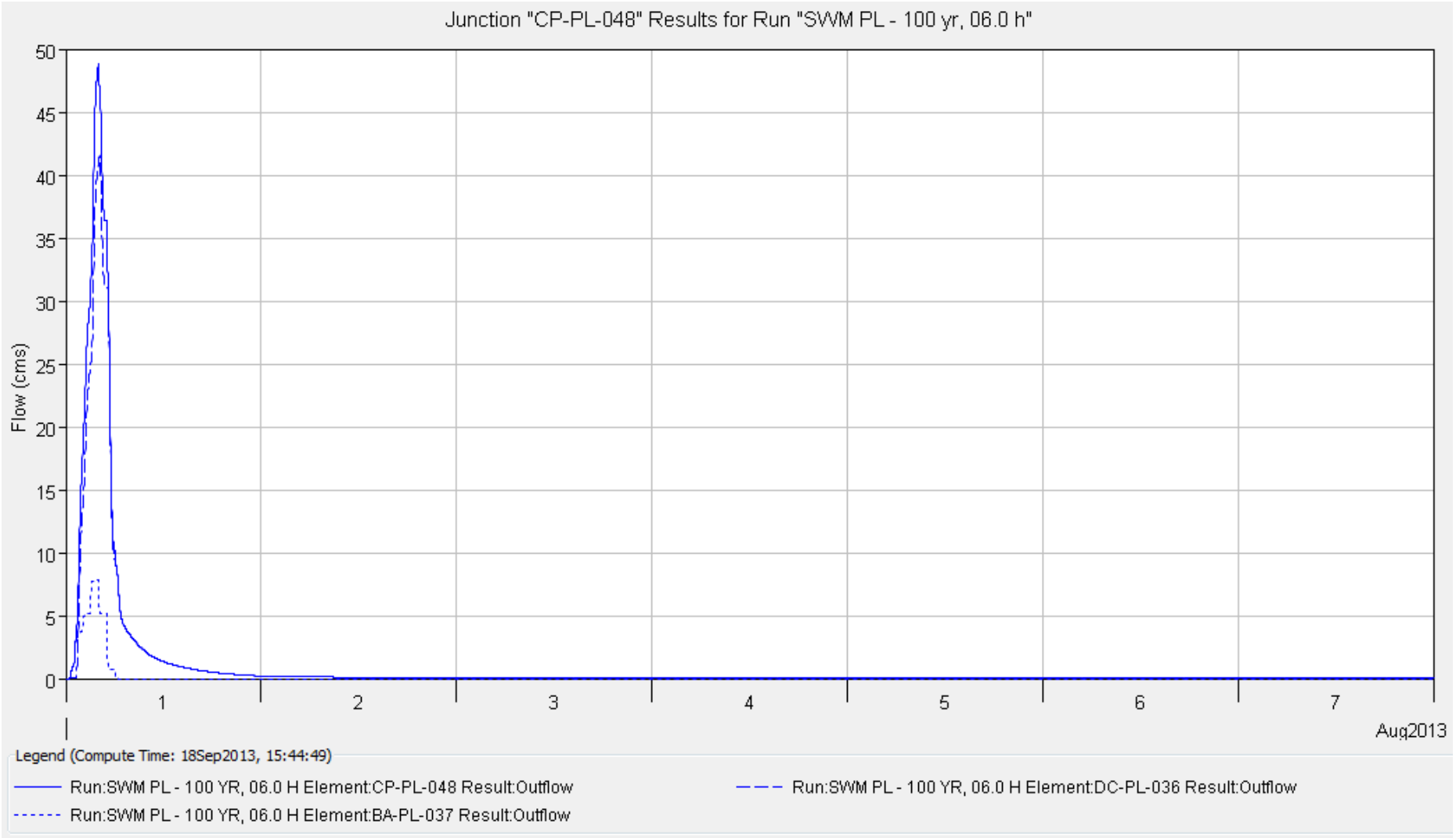

Junction "CP-PL-043B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-043B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-032 Result:Outflow

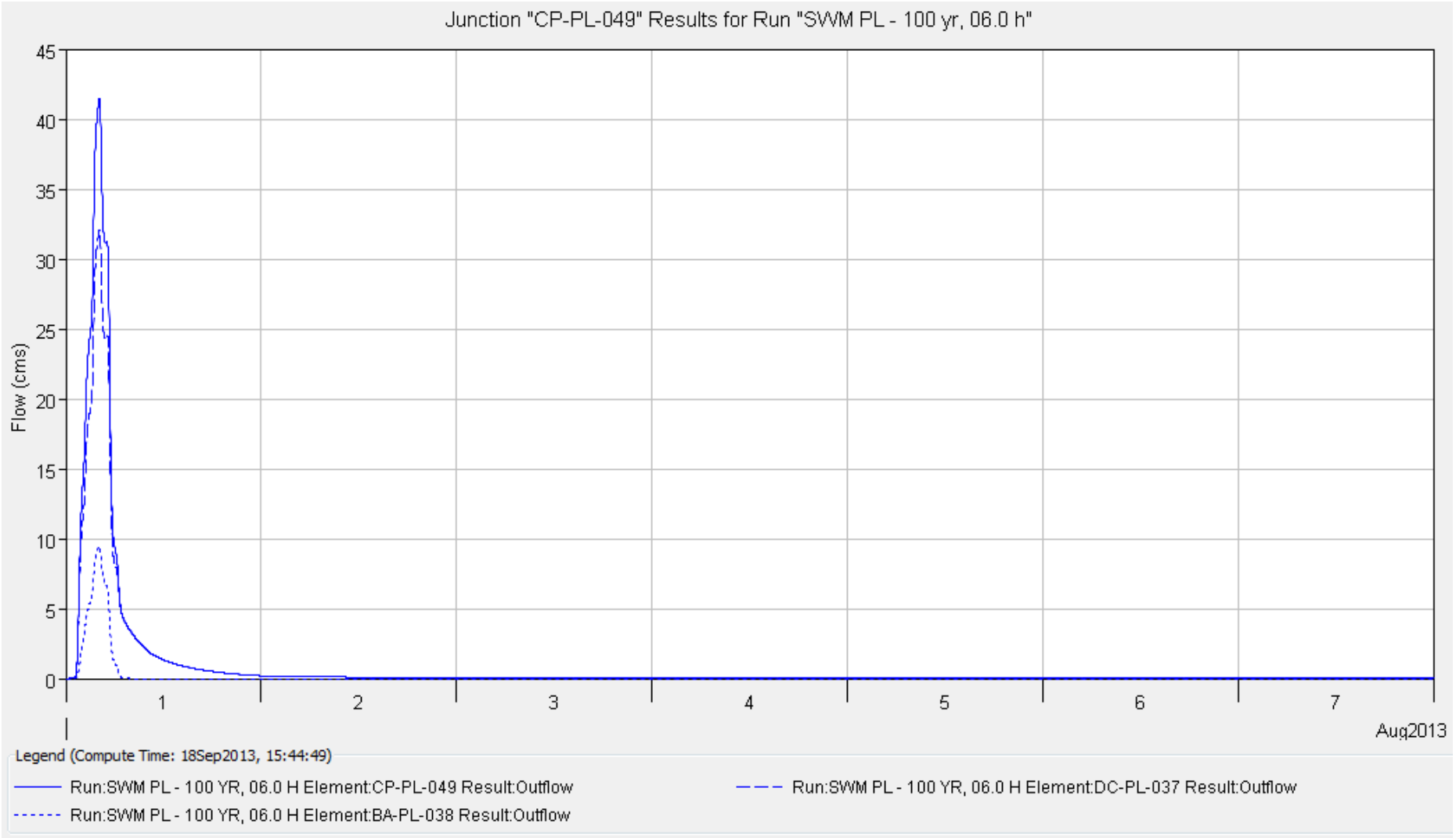

Junction "CP-PL-044" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-033 Result:Outflow

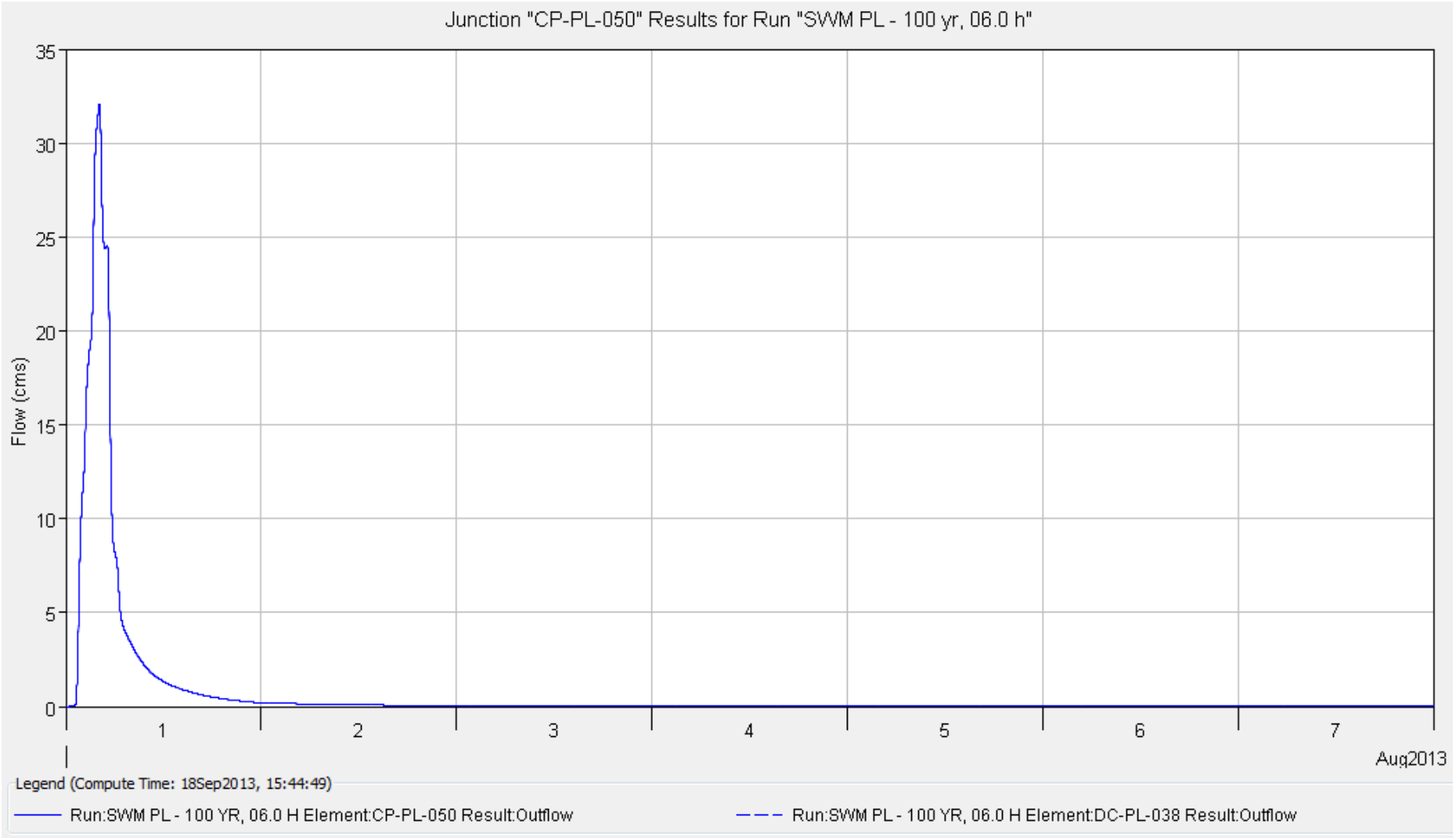

Junction "CP-PL-045" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-034 Result:Outflow

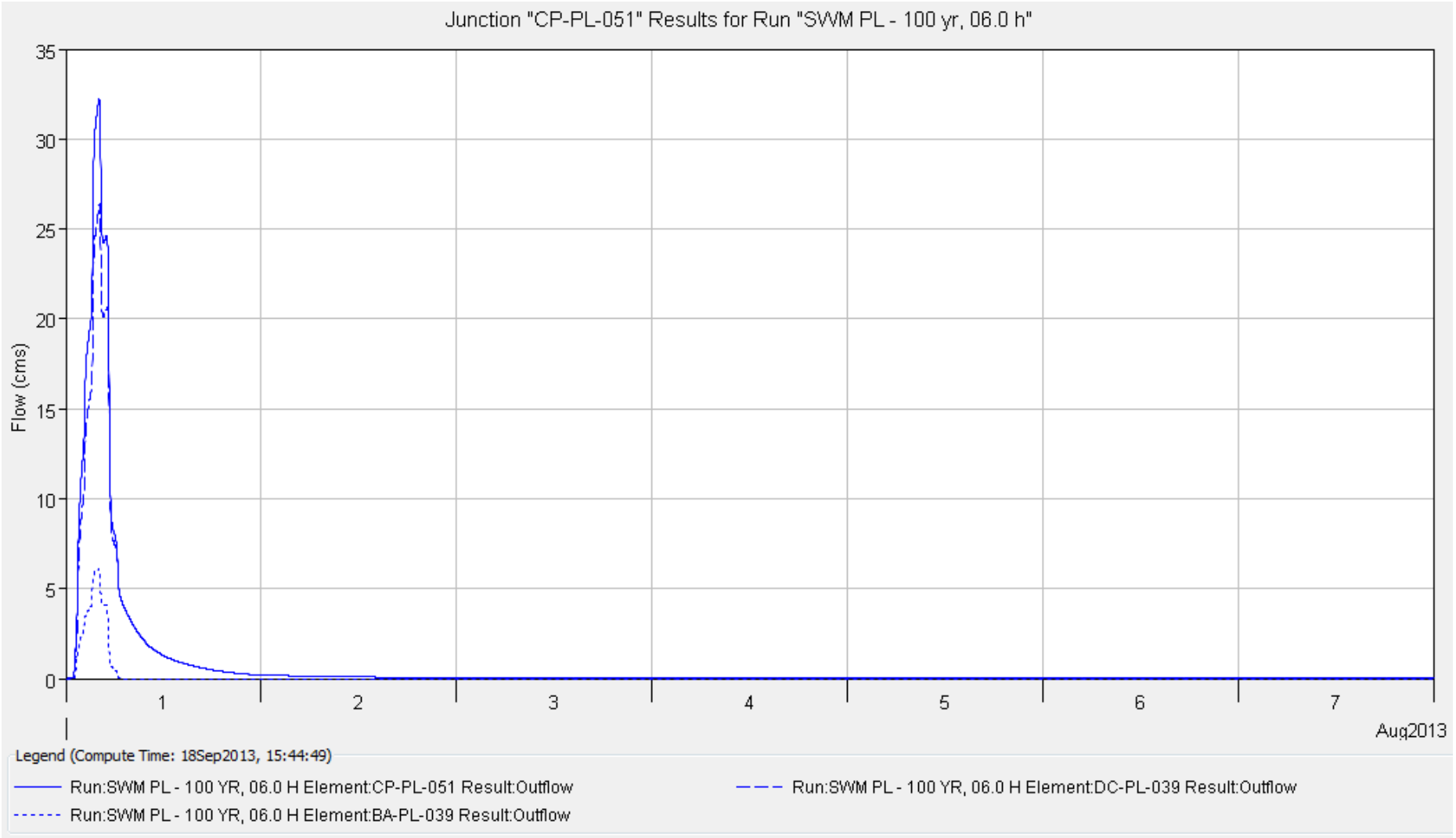

Junction "CP-PL-046" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-036 Result:Outflow

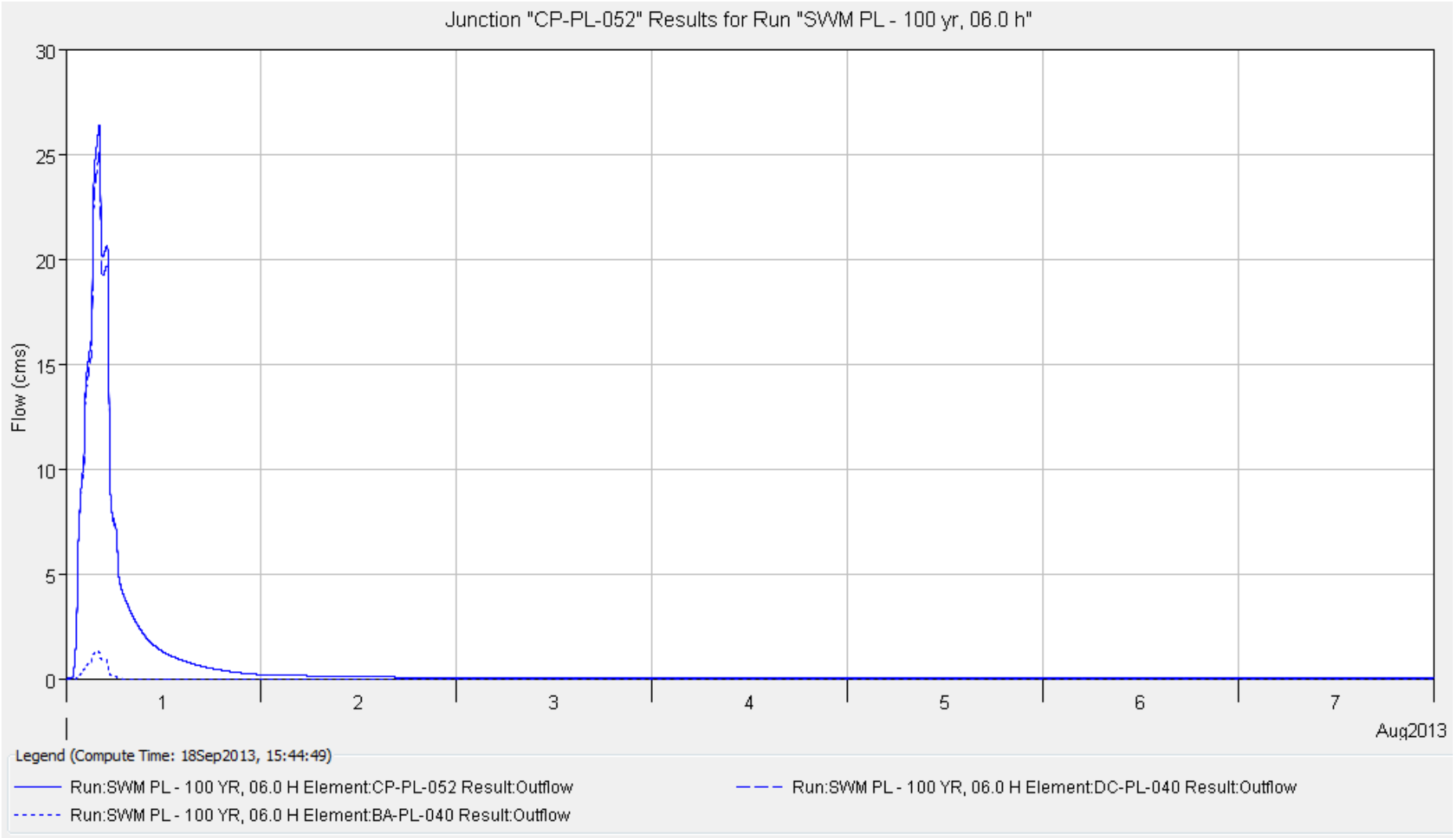

Junction "CP-PL-047" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-035 Result:Outflow

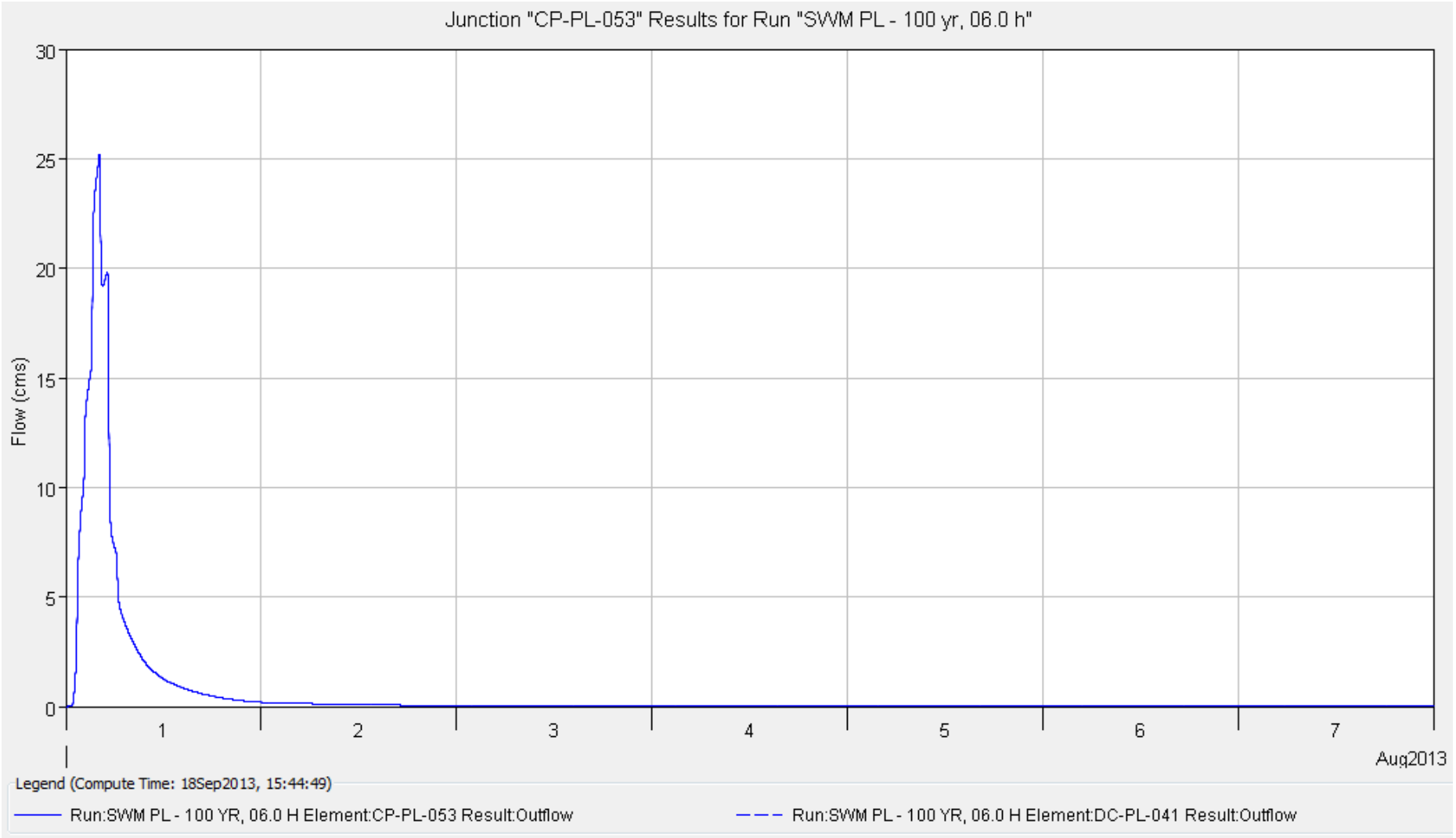

Junction "CP-PL-048" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-048 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-037 Result:Outflow

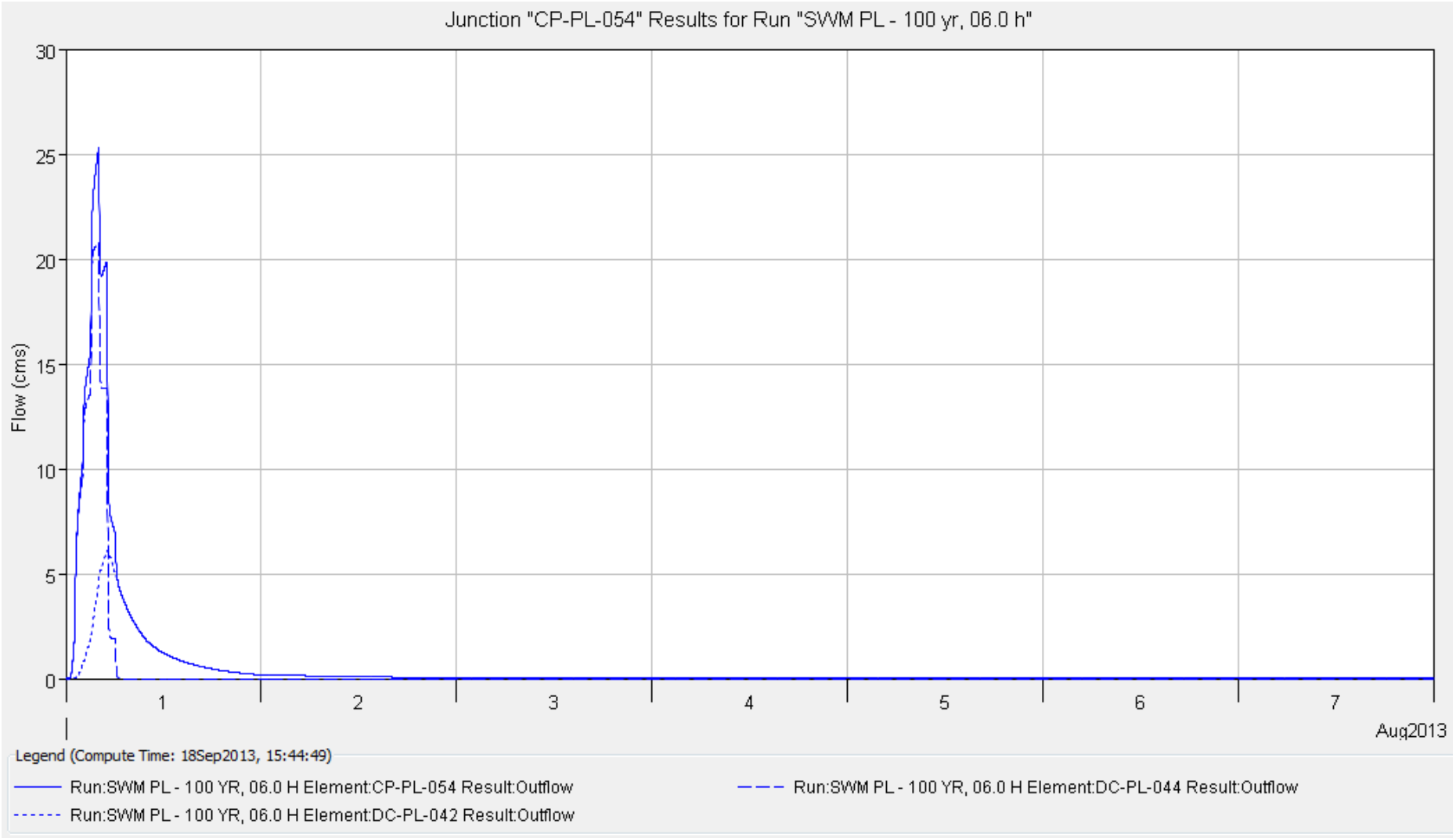

Junction "CP-PL-049" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-038 Result:Outflow

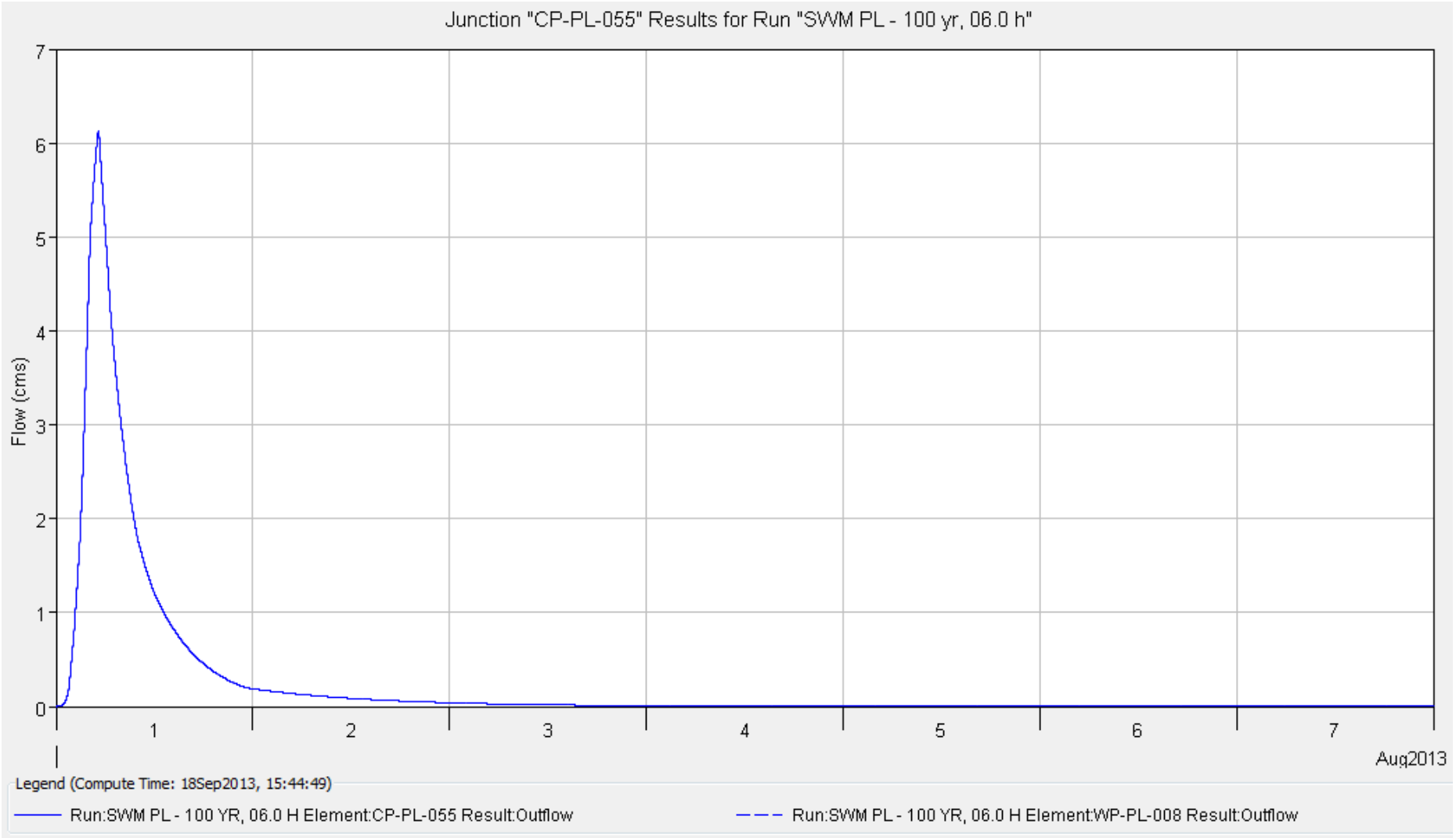

Junction "CP-PL-050" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-050 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-038 Result:Outflow

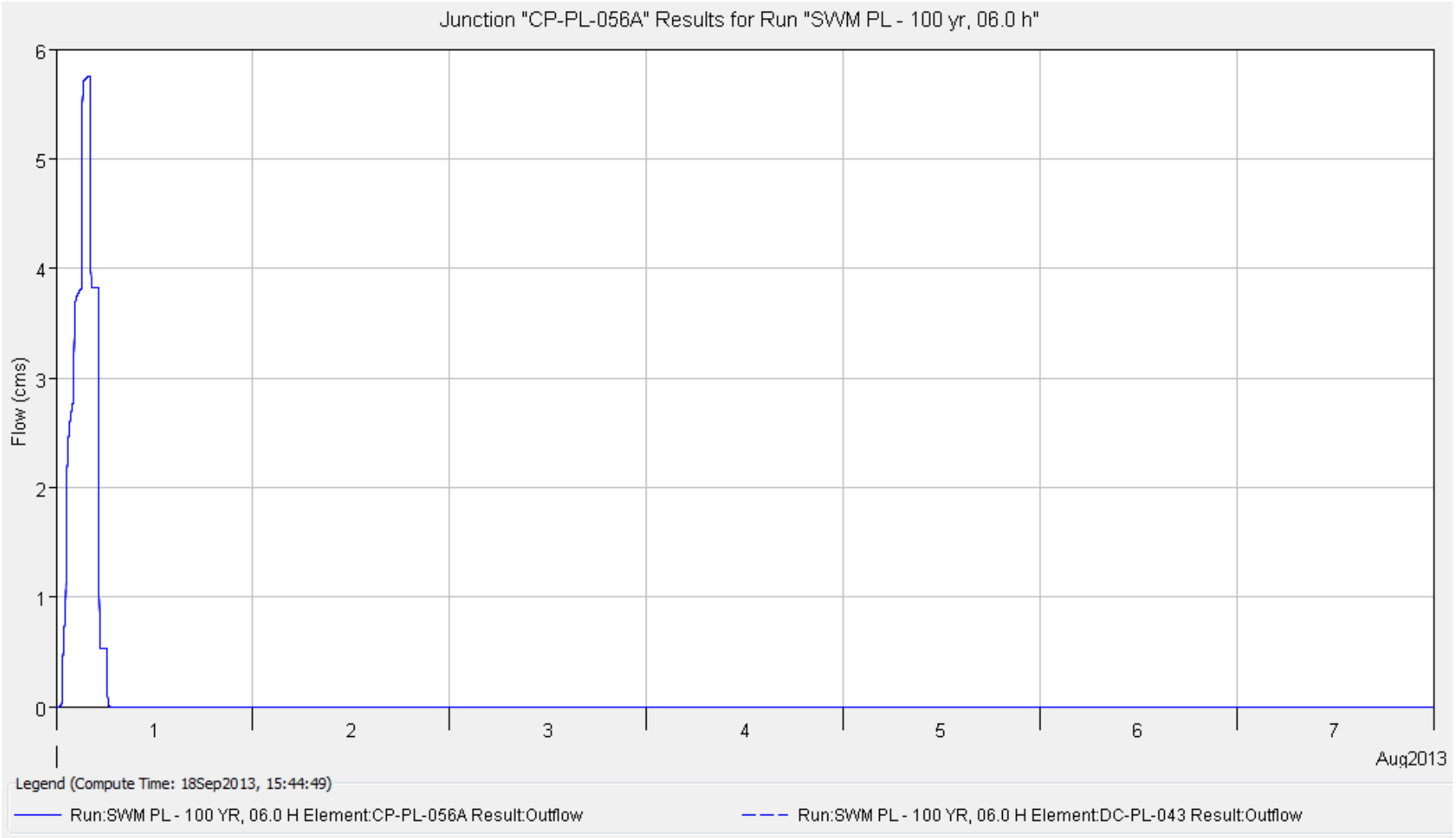

Junction "CP-PL-051" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-039 Result:Outflow

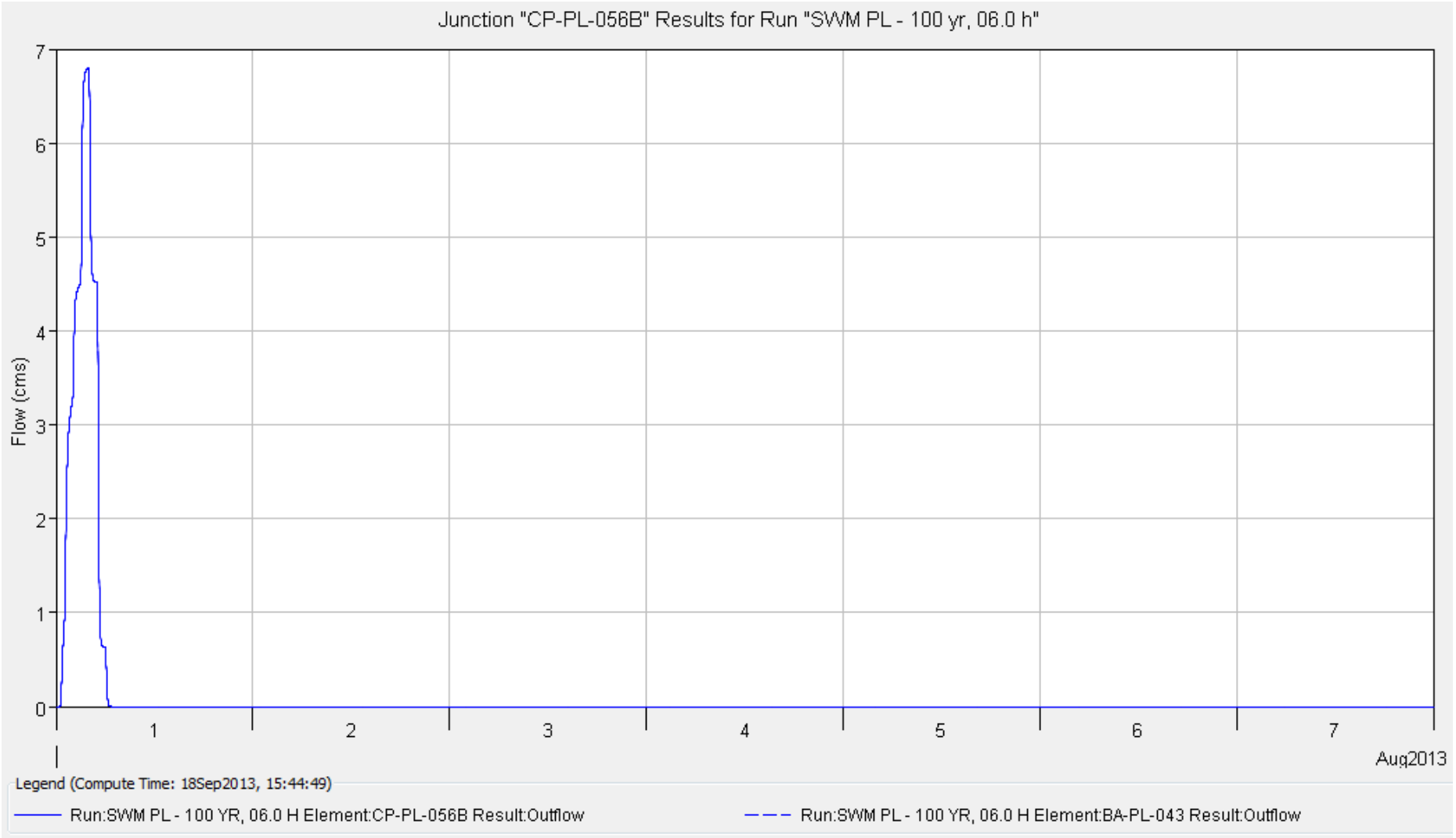

Junction "CP-PL-052" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-040 Result:Outflow

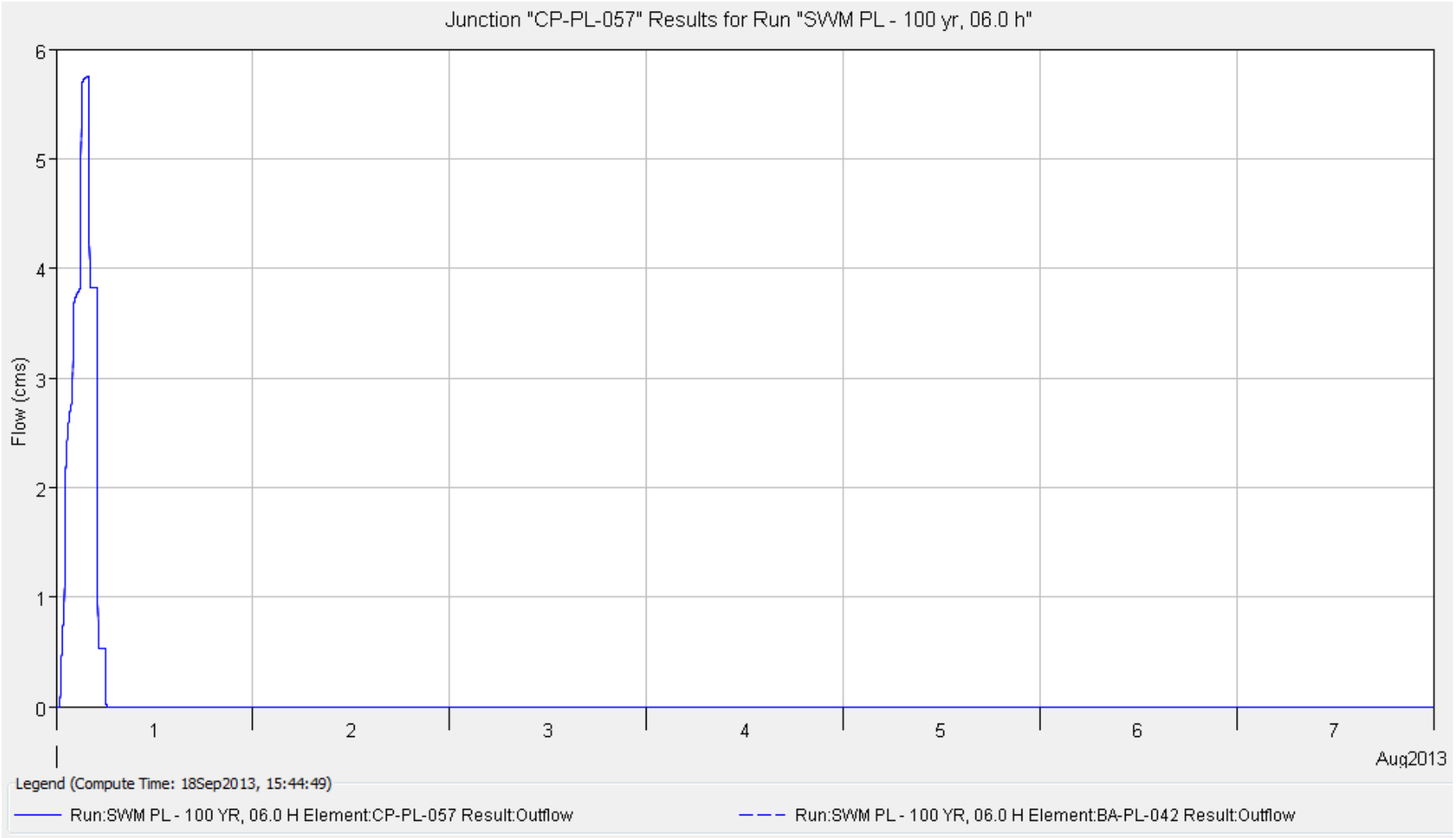

Junction "CP-PL-053" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-041 Result:Outflow

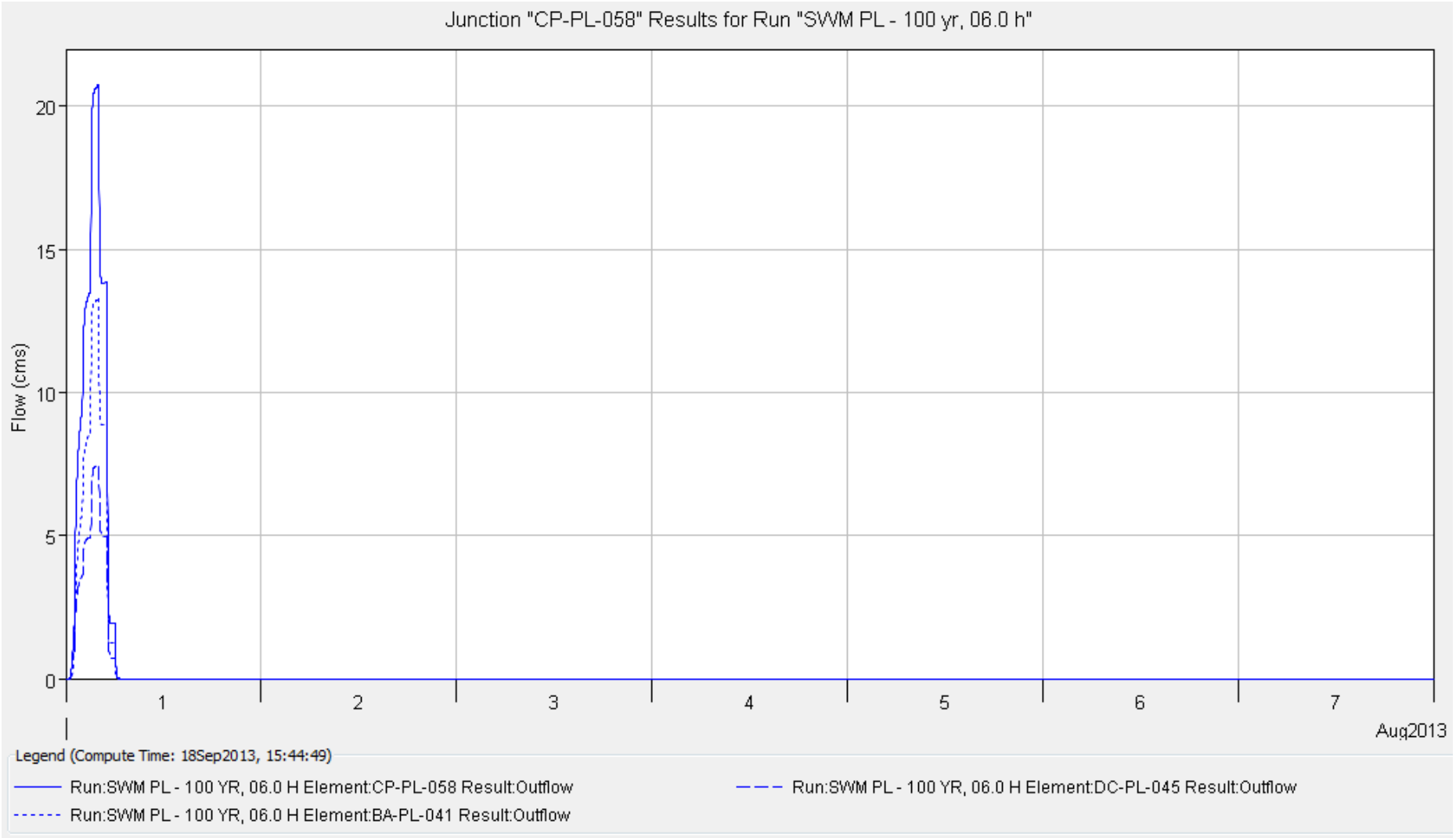

Junction "CP-PL-054" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-042 Result:Outflow

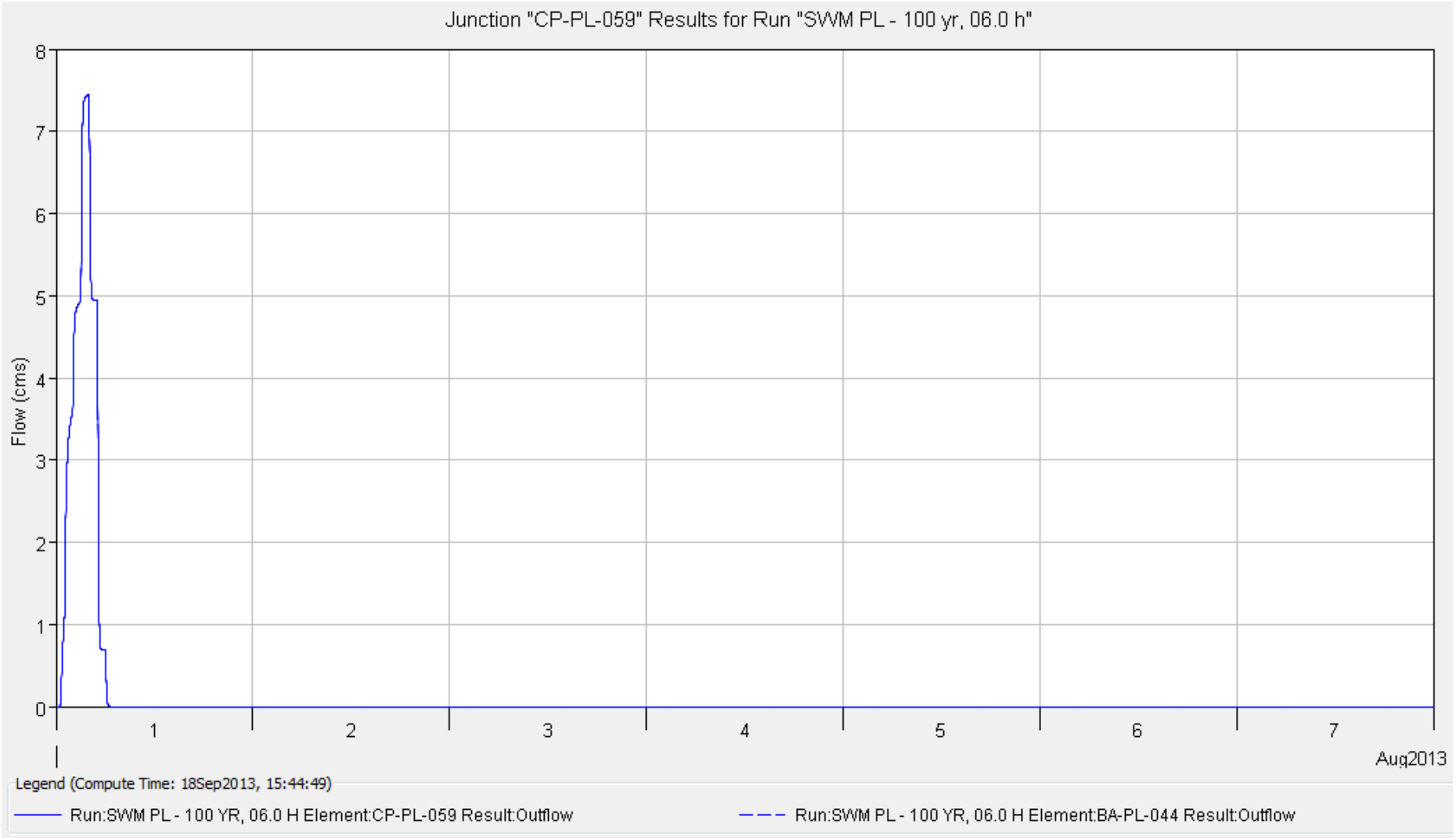

Junction "CP-PL-055" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Outflow

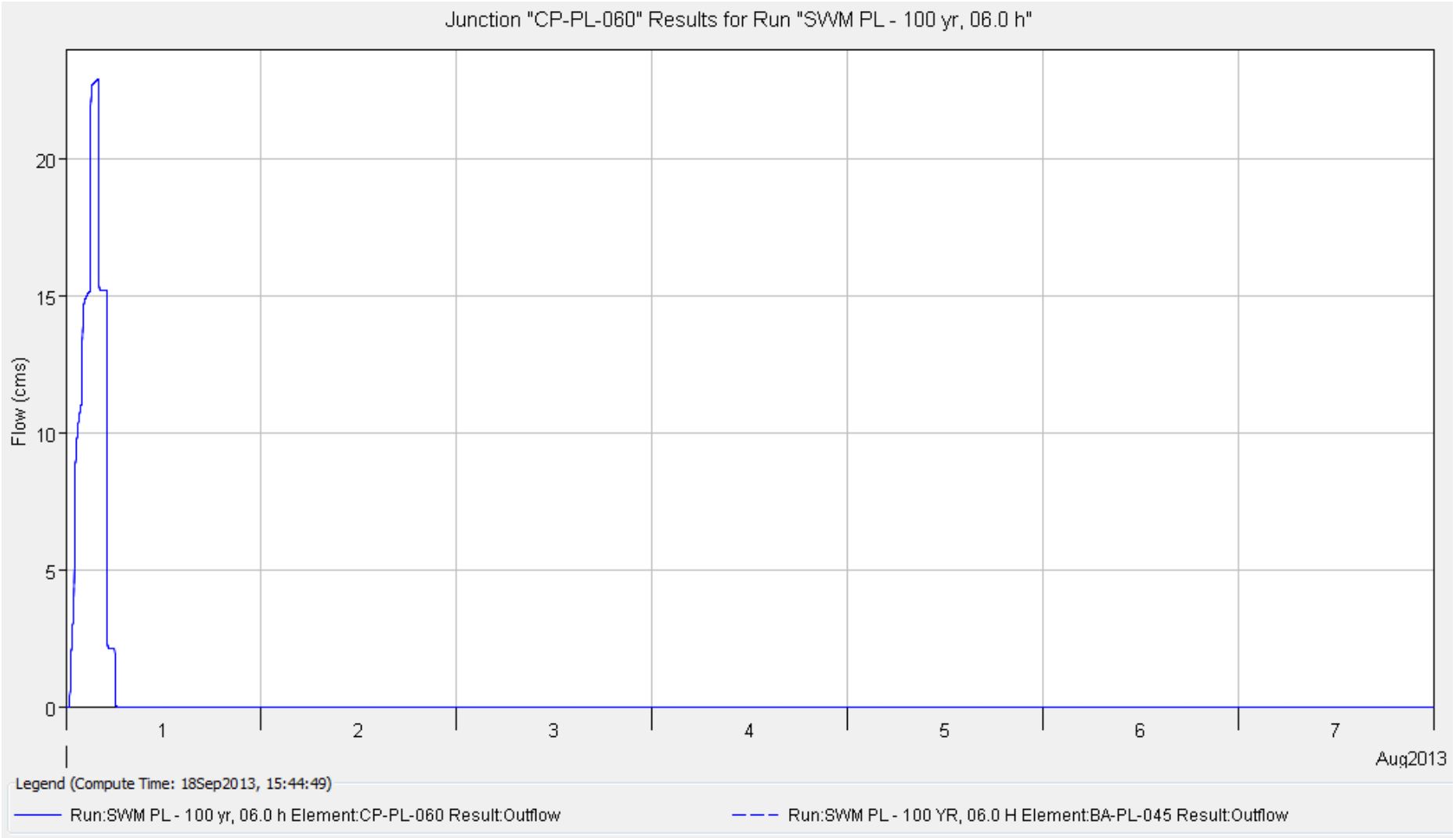

Junction "CP-PL-056A" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-056A Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-043 Result:Outflow

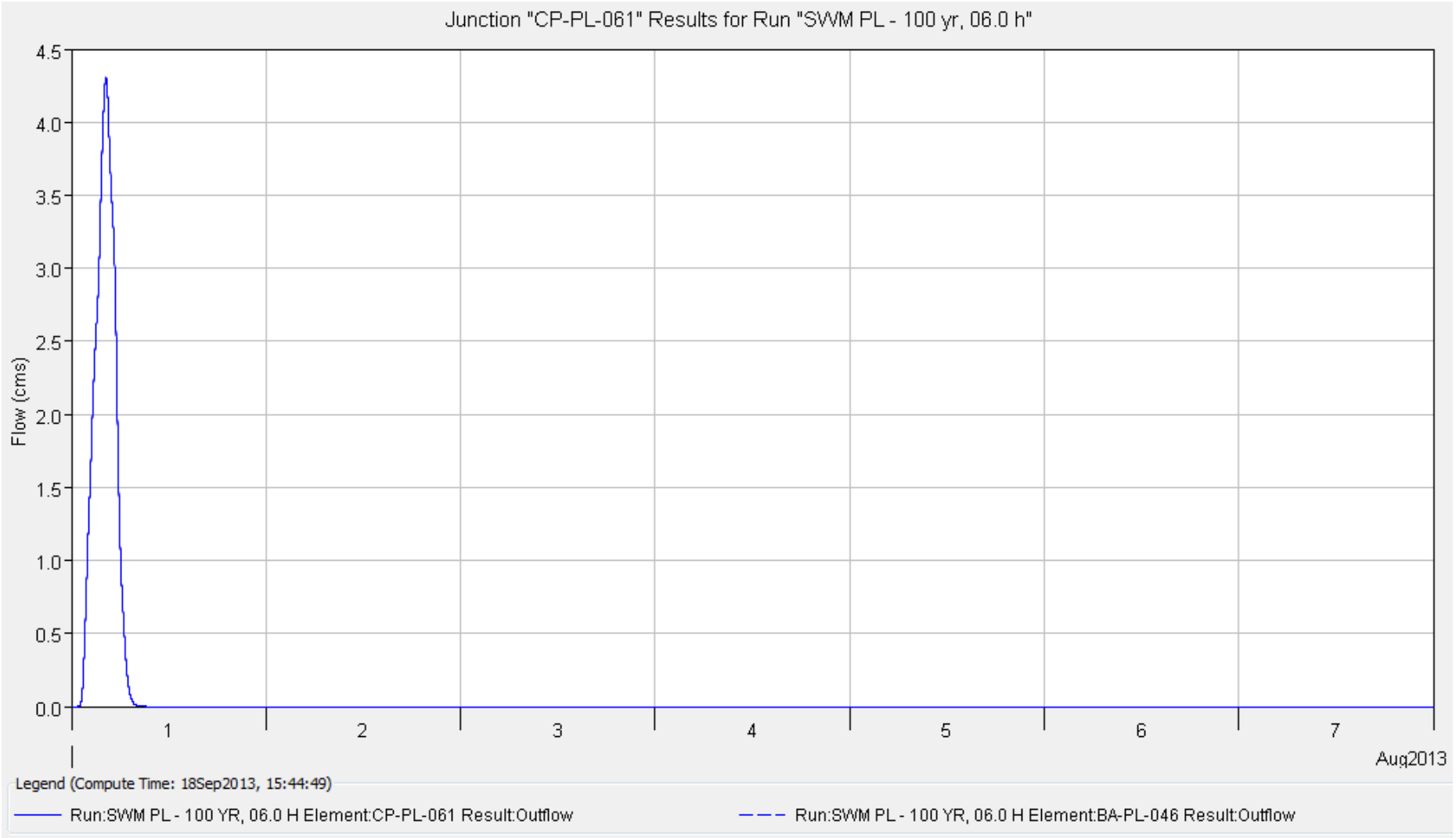

Junction "CP-PL-056B" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-056B Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-043 Result:Outflow

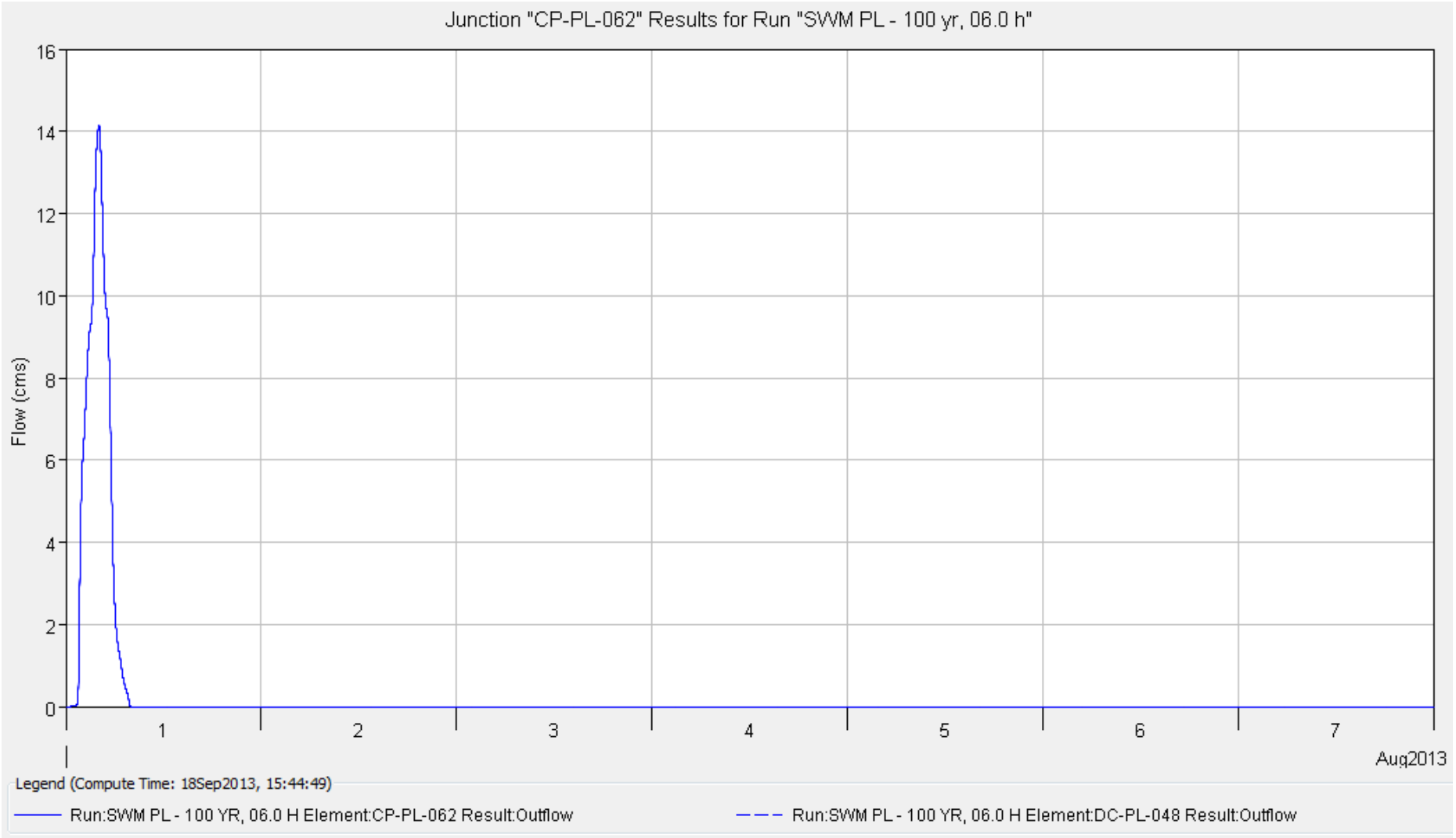

Junction "CP-PL-057" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-042 Result:Outflow

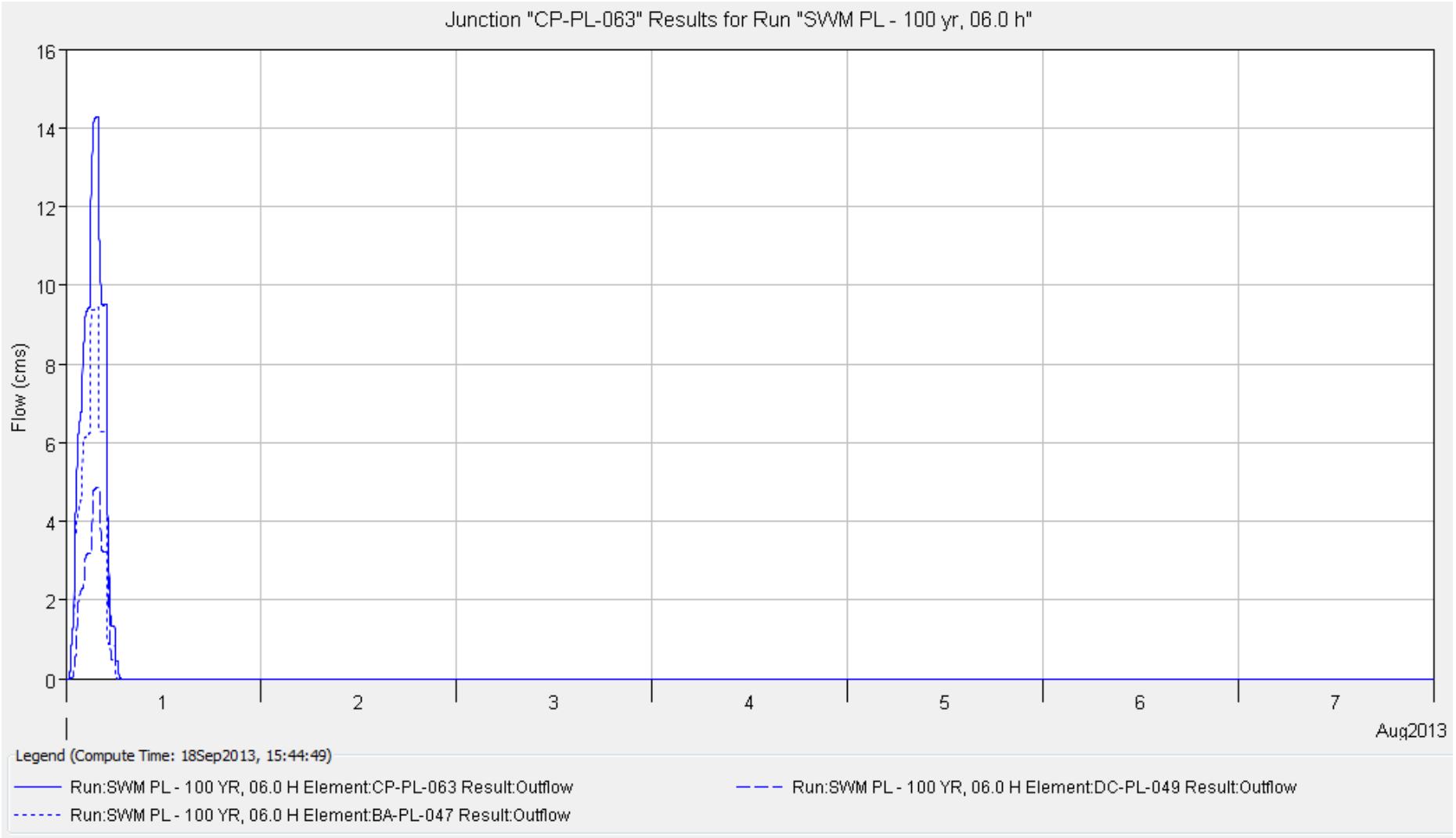

Junction "CP-PL-058" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-041 Result:Outflow

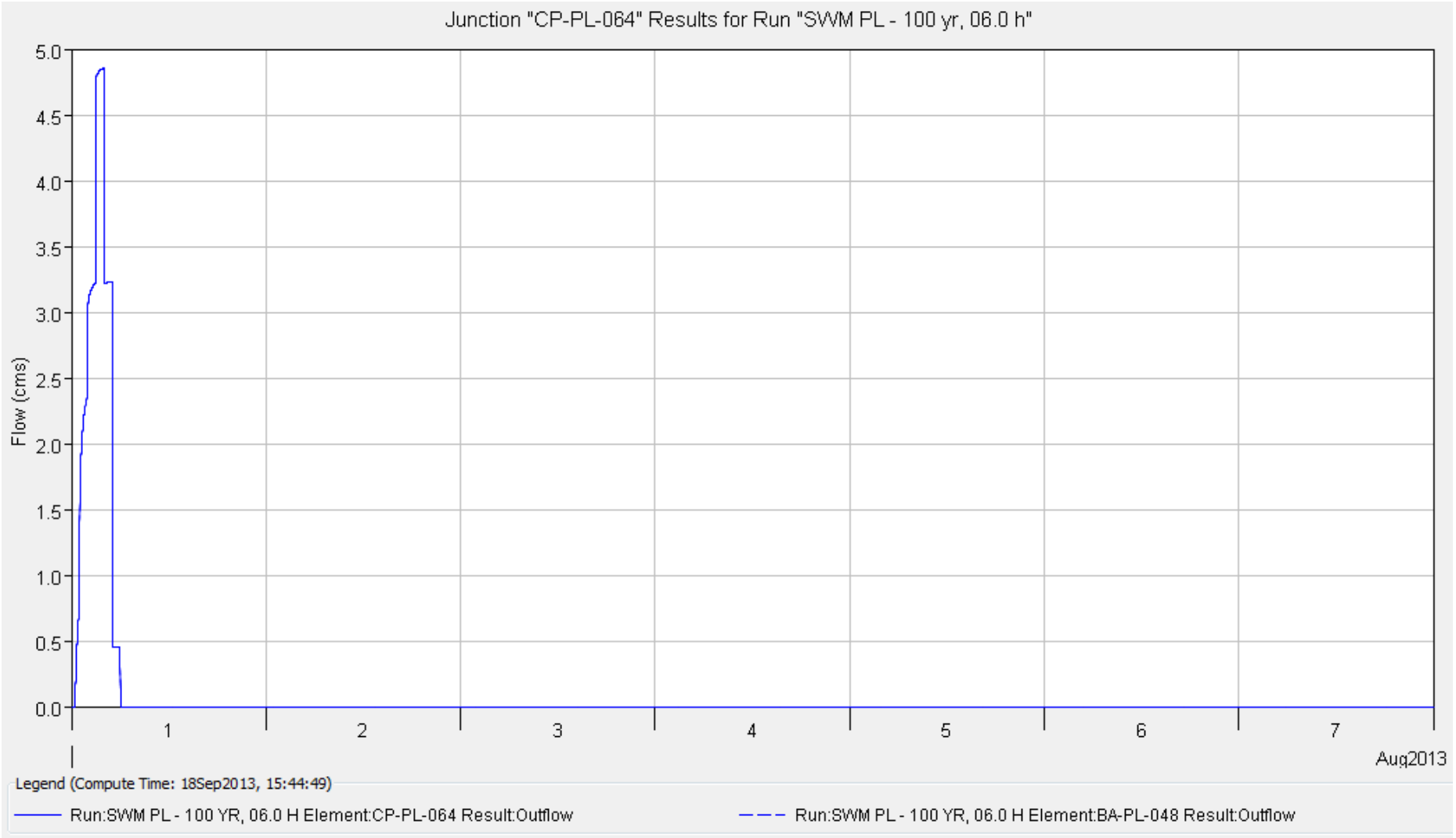

Junction "CP-PL-059" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-059 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-044 Result:Outflow

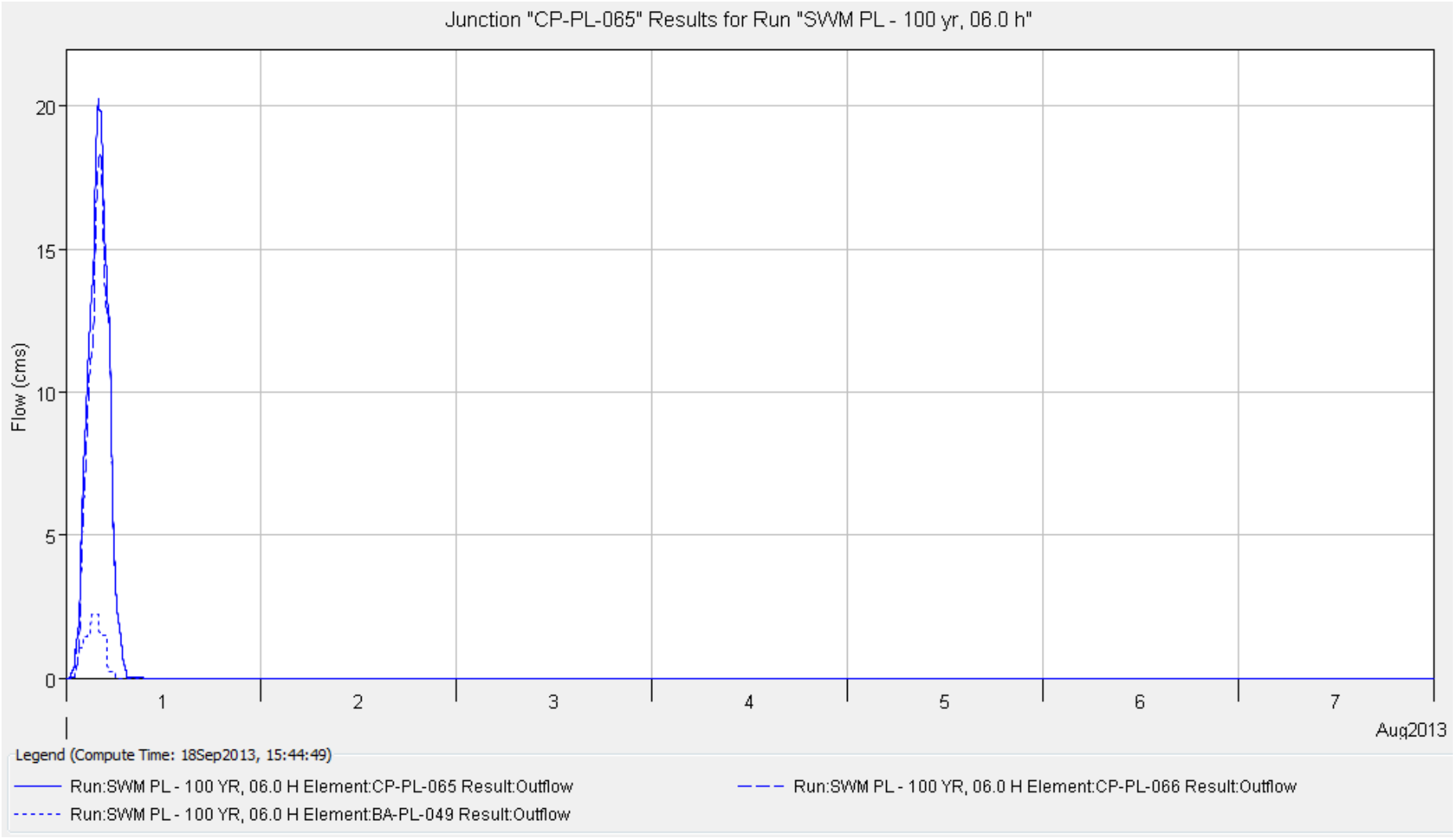

Junction "CP-PL-060" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-045 Result:Outflow

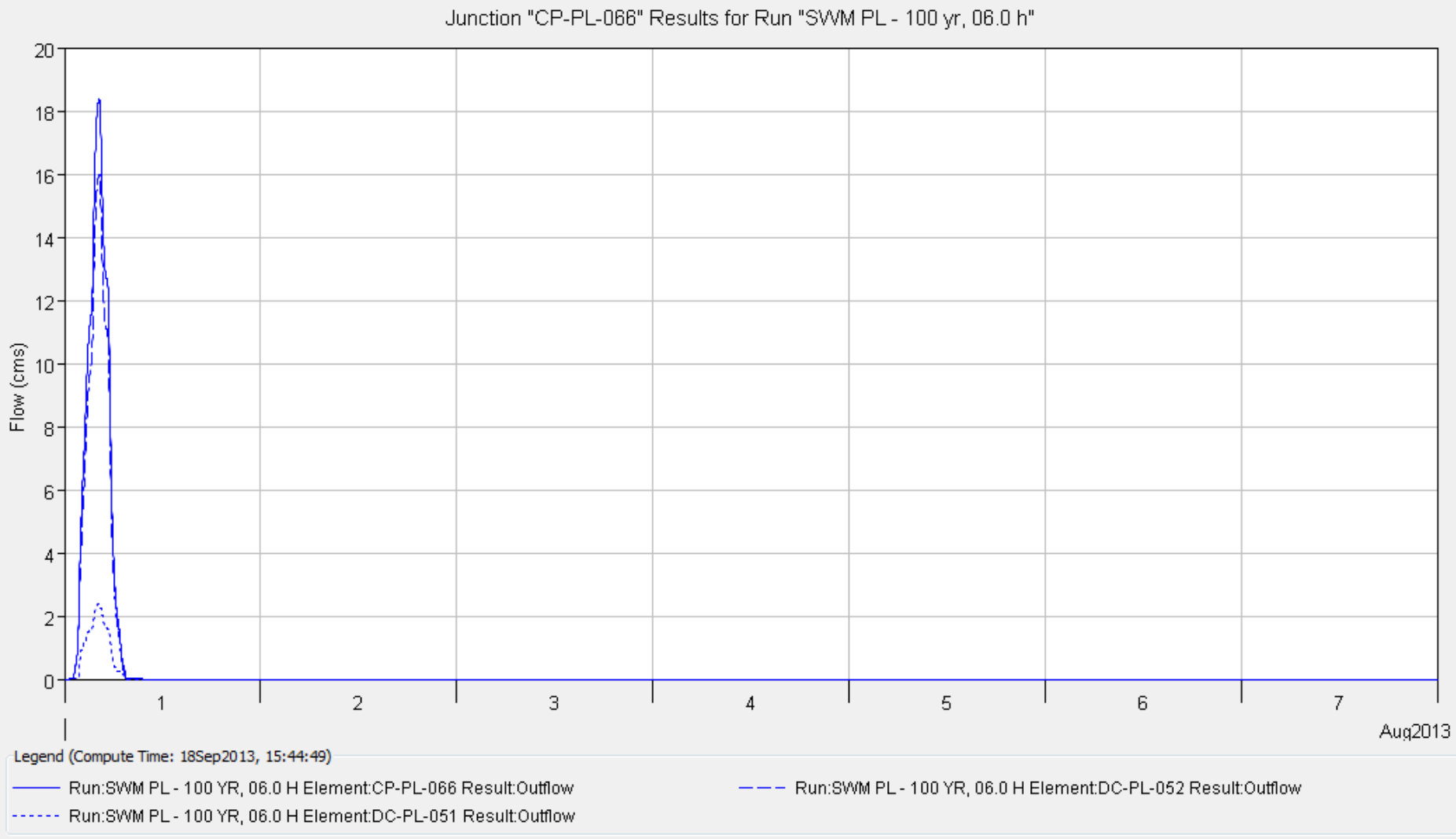

Junction "CP-PL-061" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-061 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-046 Result:Outflow

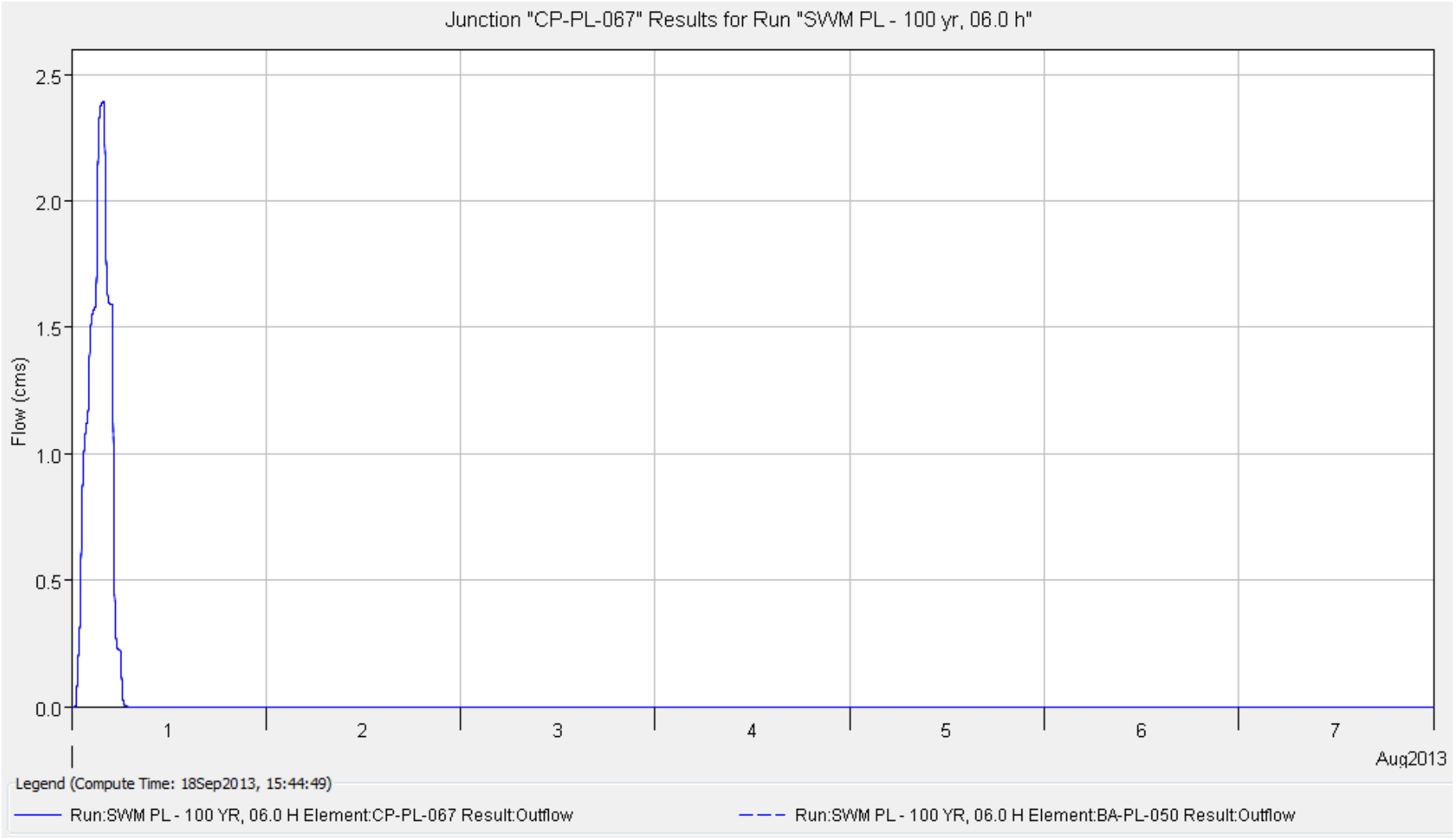

Junction "CP-PL-062" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-062 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-048 Result:Outflow

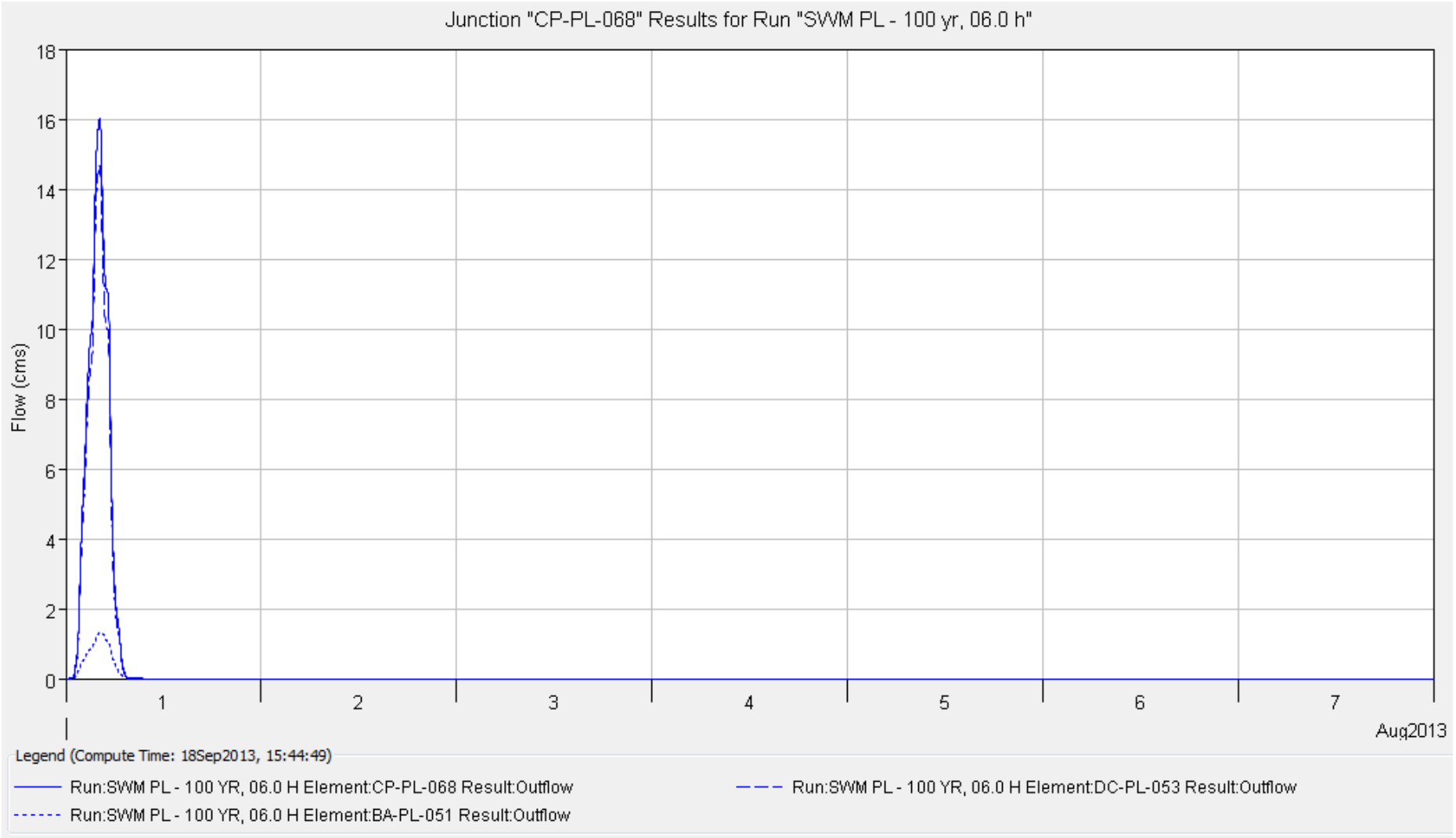

Junction "CP-PL-063" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-047 Result:Outflow

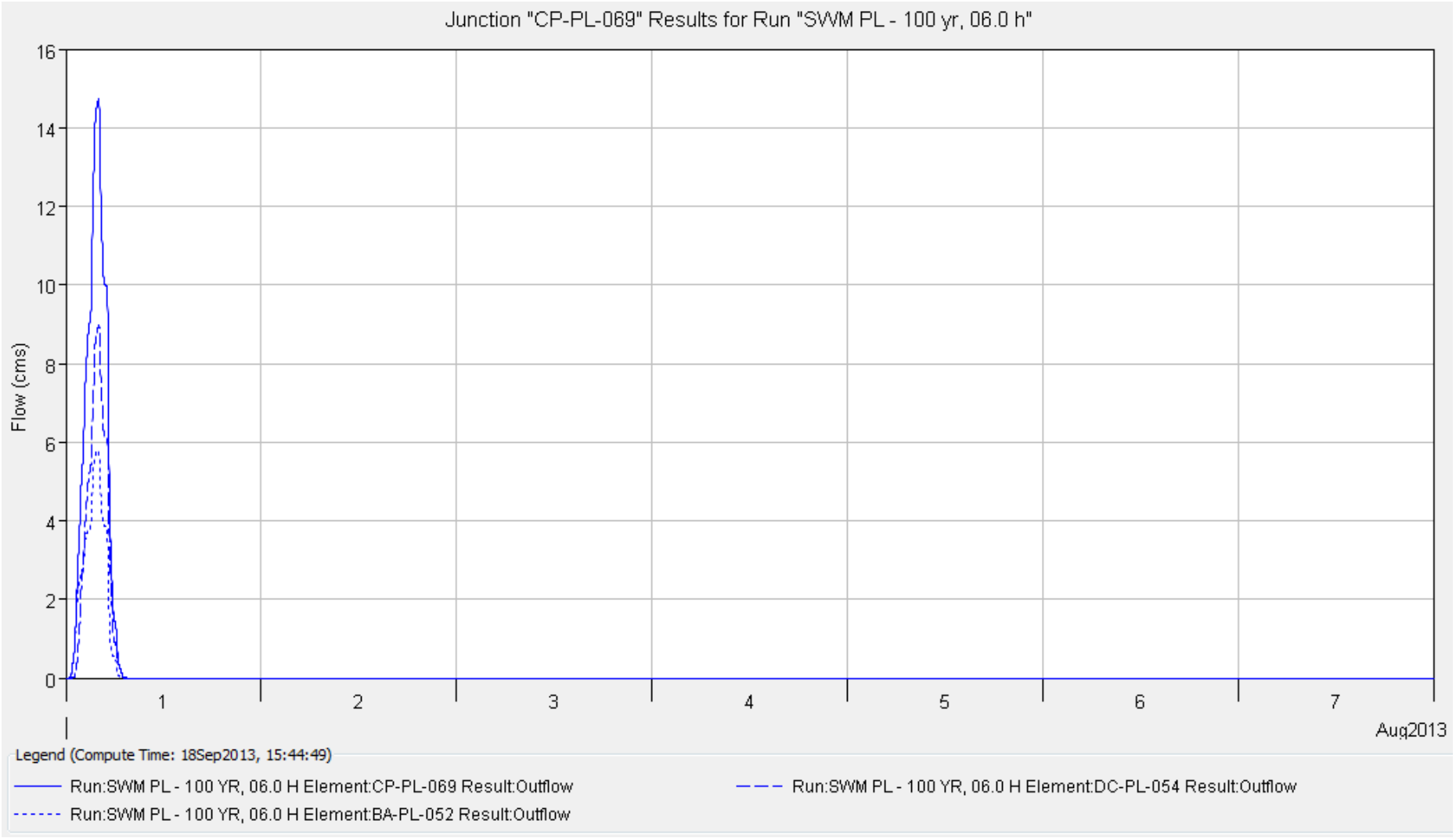

Junction "CP-PL-064" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-064 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-048 Result:Outflow

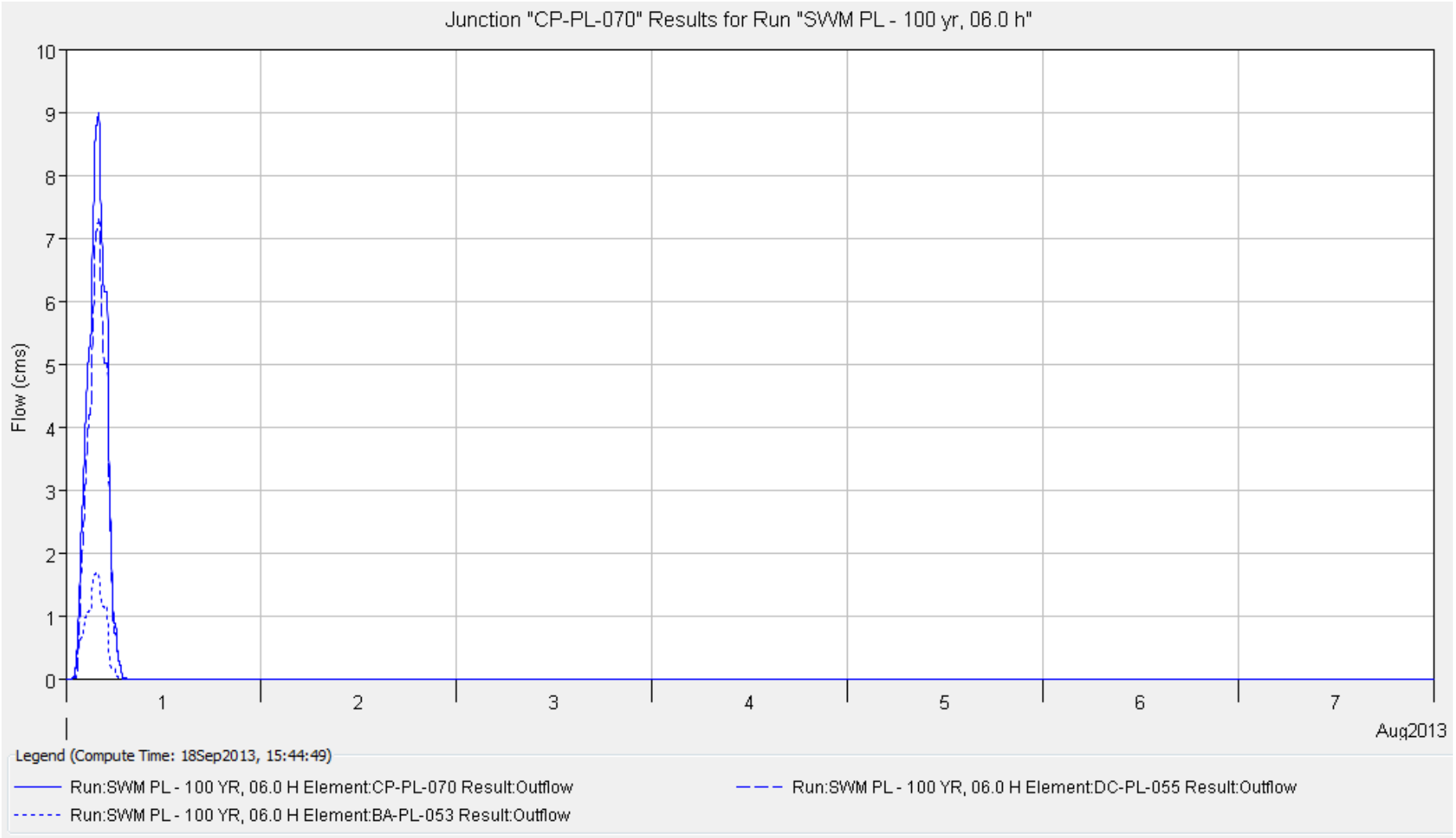

Junction "CP-PL-065" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-065 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-049 Result:Outflow

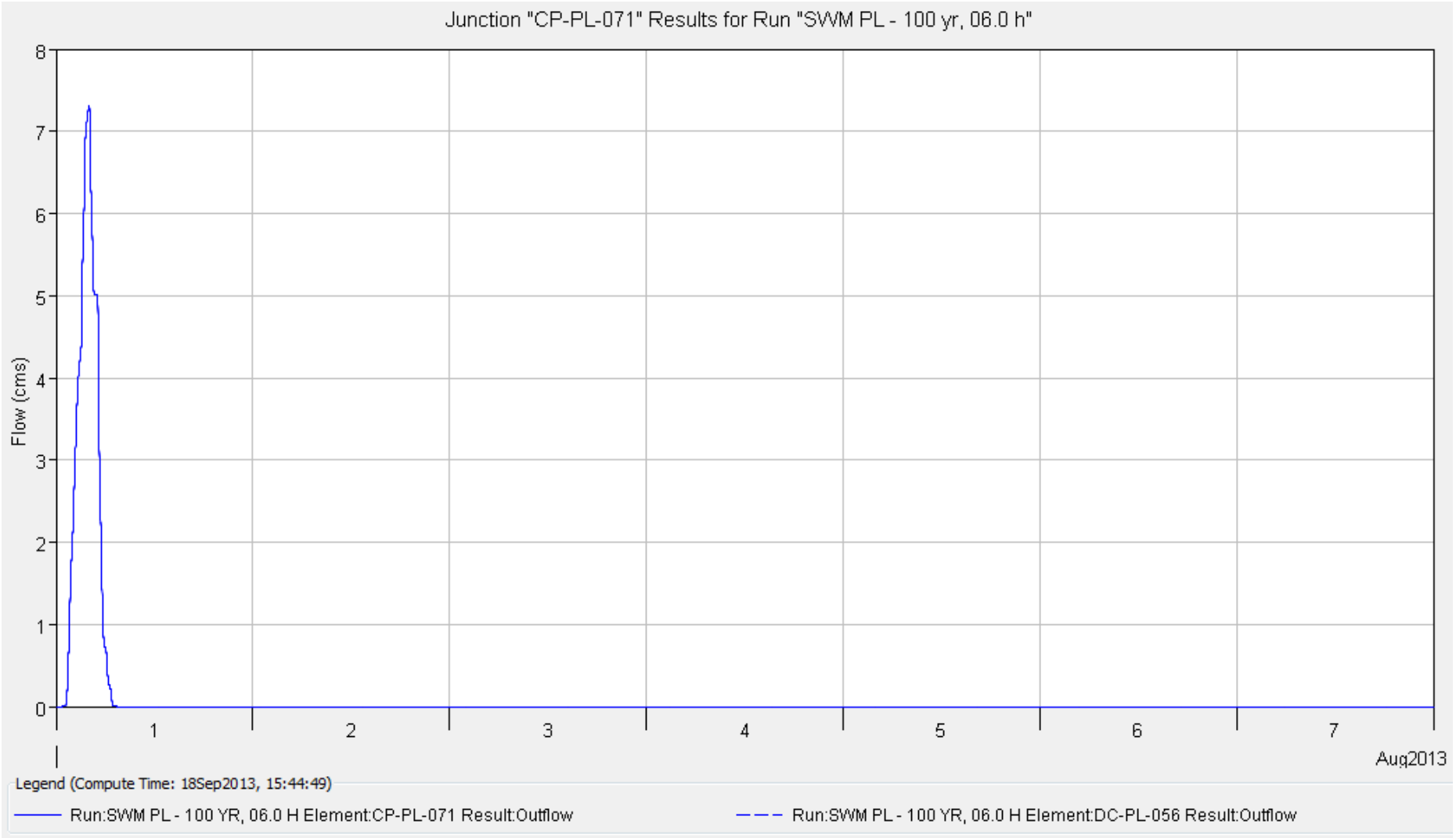

Junction "CP-PL-066" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-051 Result:Outflow

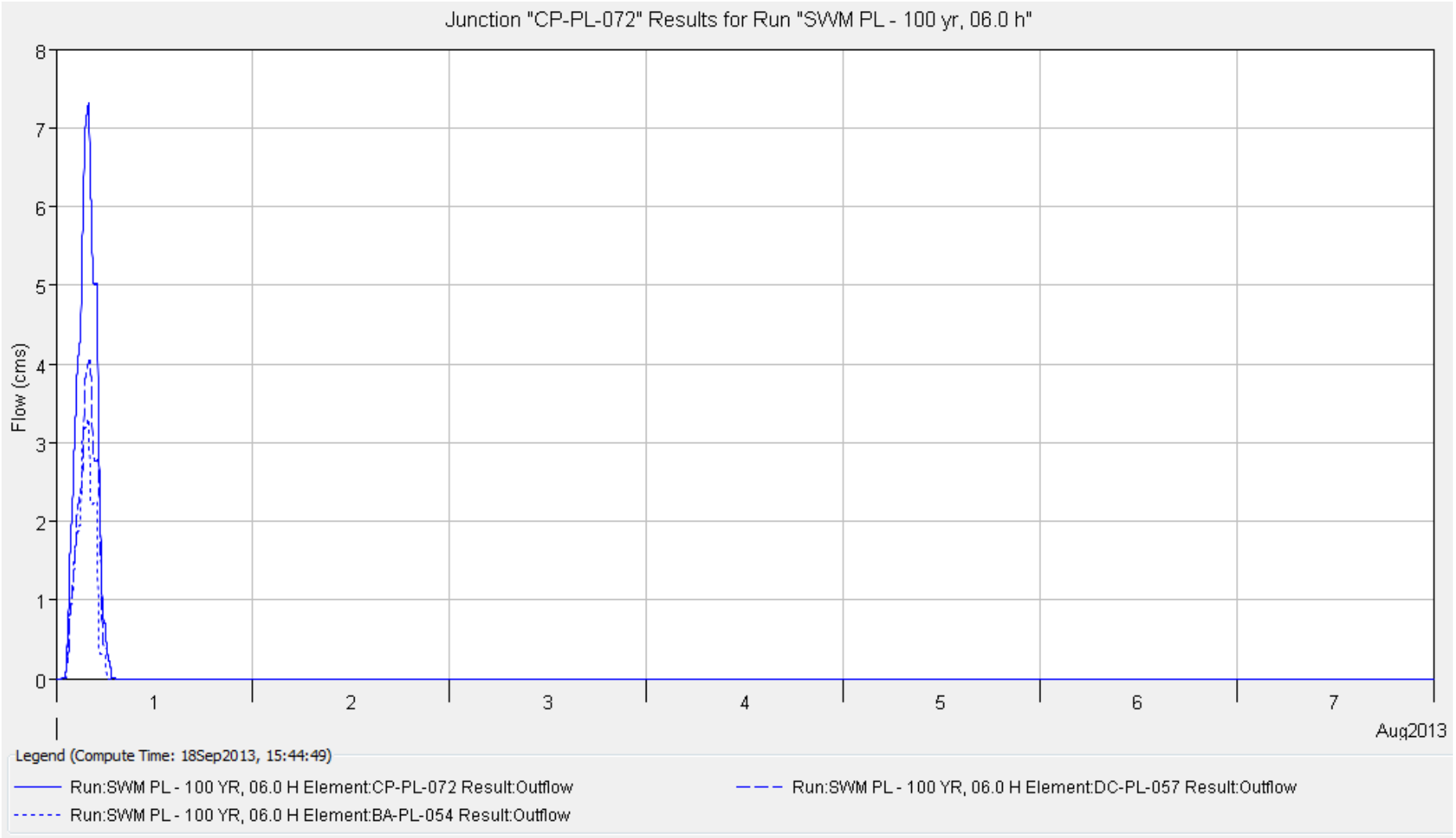

Junction "CP-PL-067" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-067 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-050 Result:Outflow

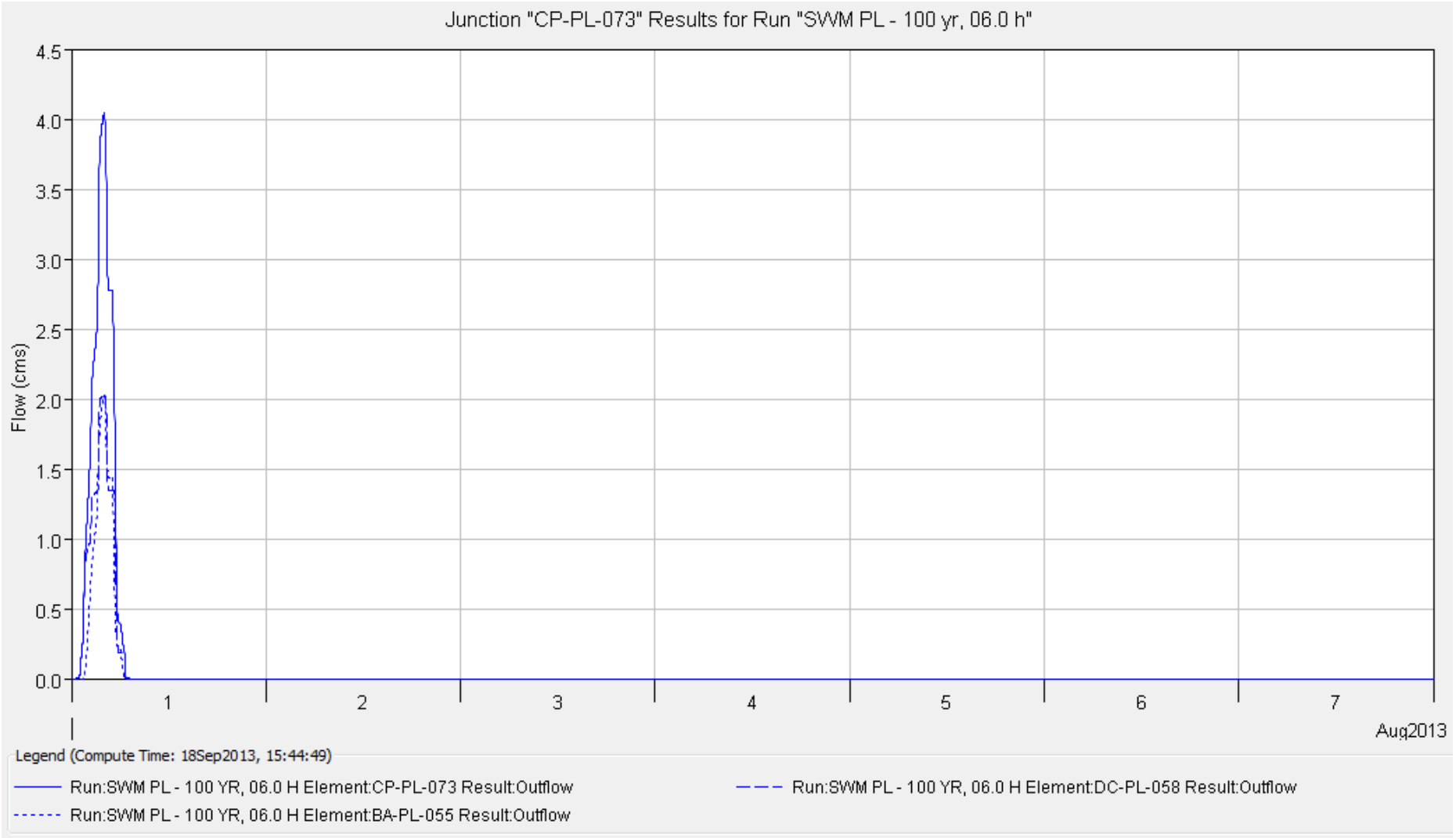

Junction "CP-PL-068" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-068 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-051 Result:Outflow

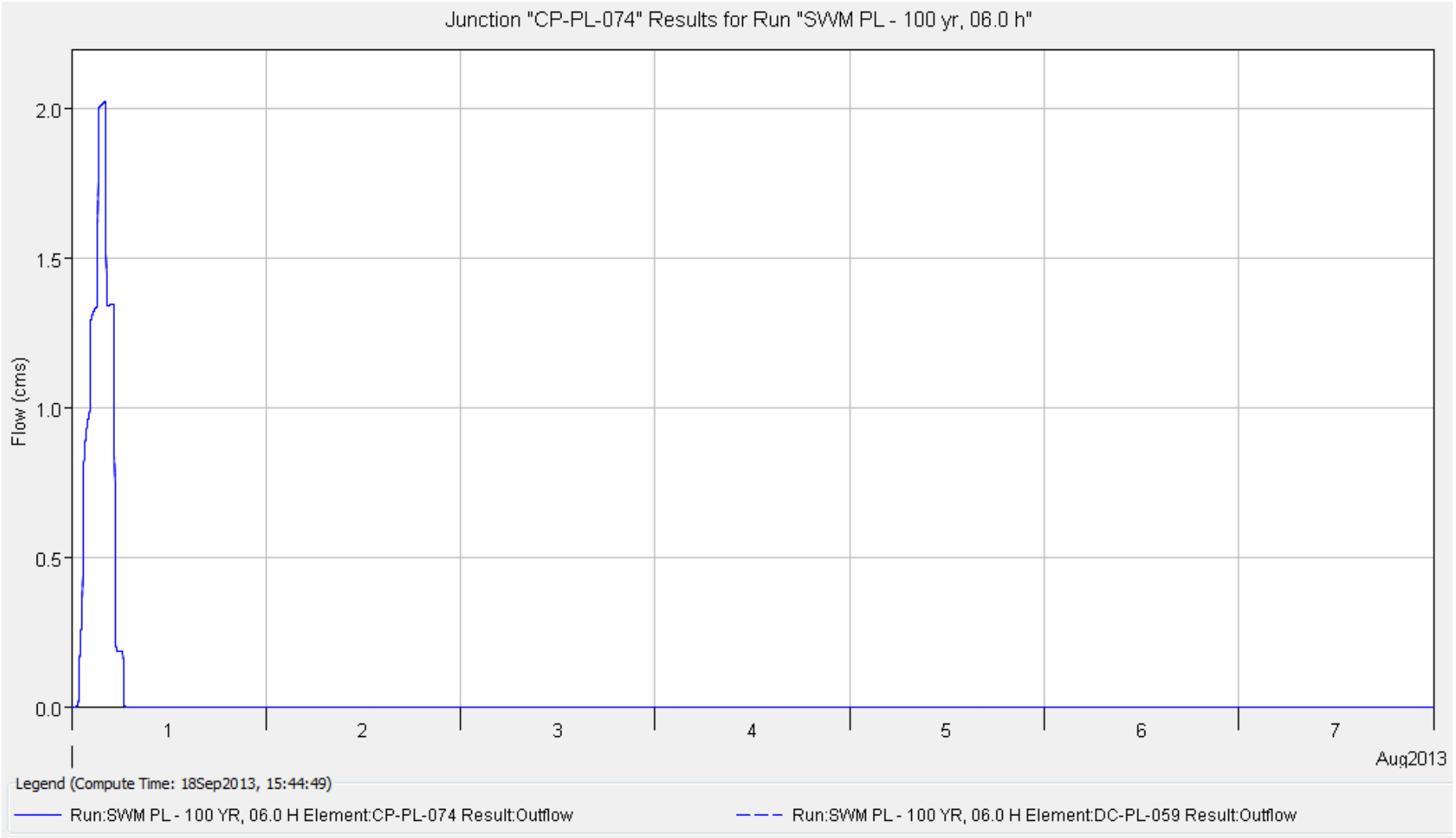

Junction "CP-PL-069" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-069 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-052 Result:Outflow

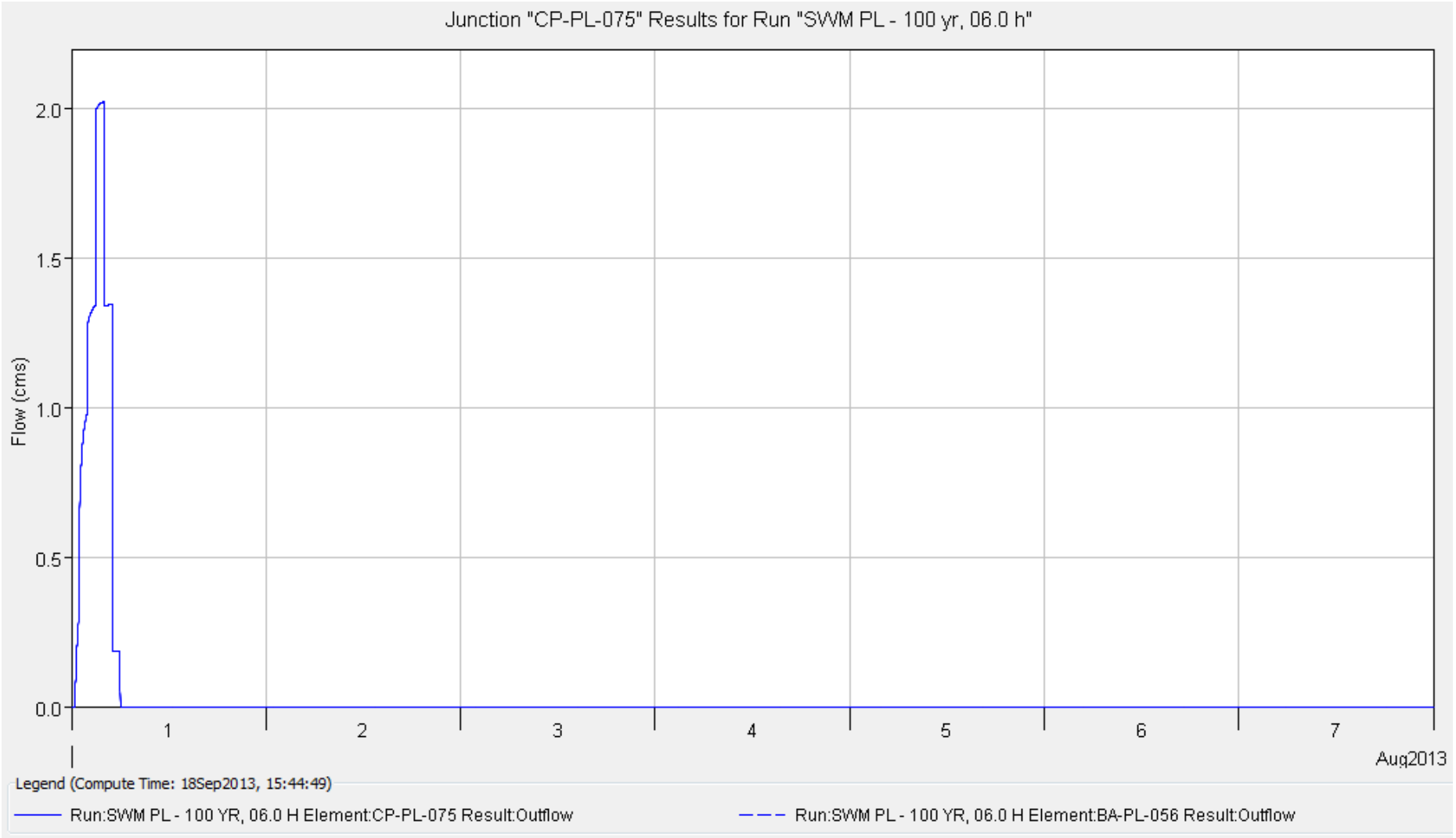

Junction "CP-PL-070" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-070 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-053 Result:Outflow

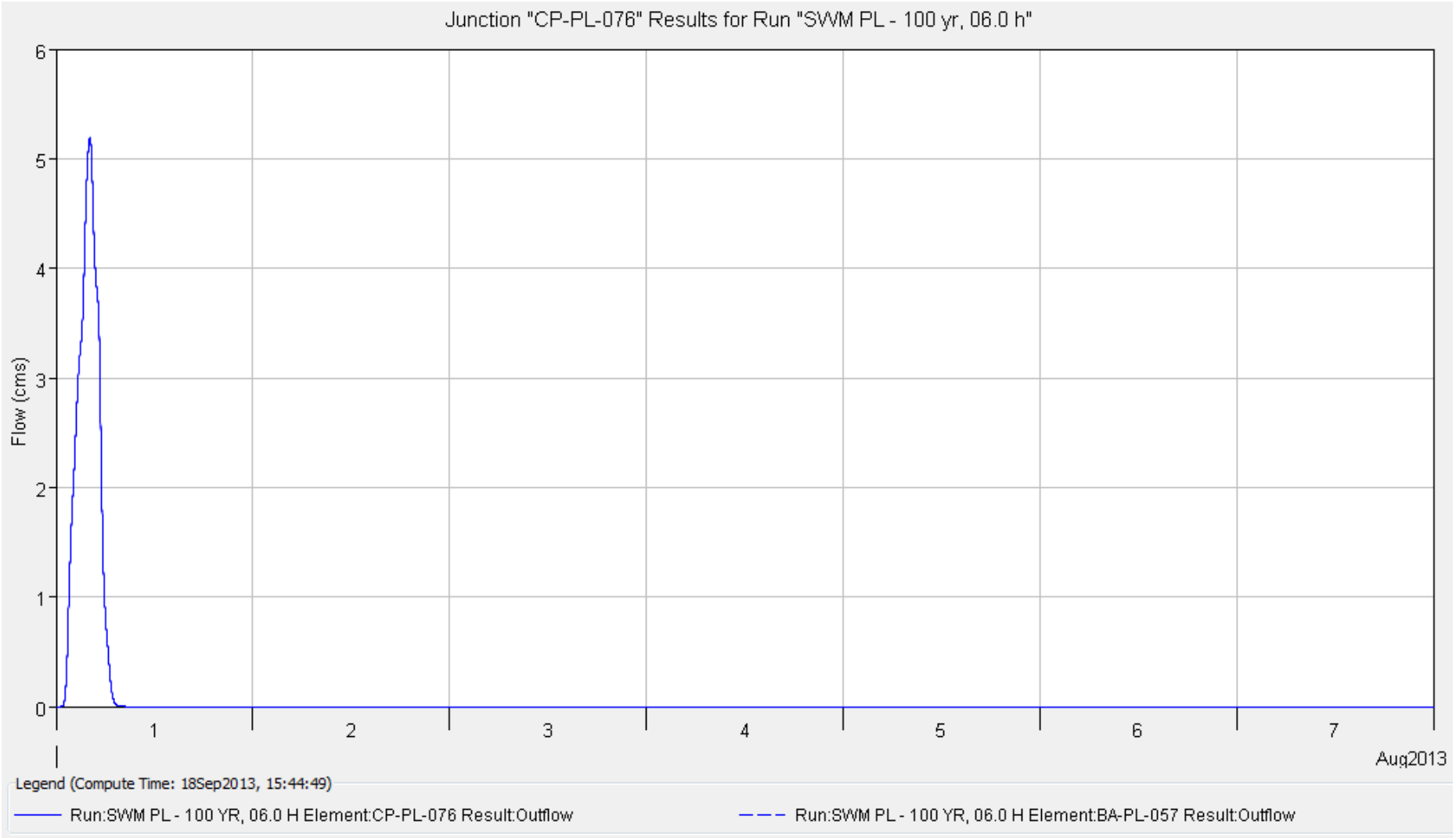

Junction "CP-PL-071" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-071 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-056 Result:Outflow

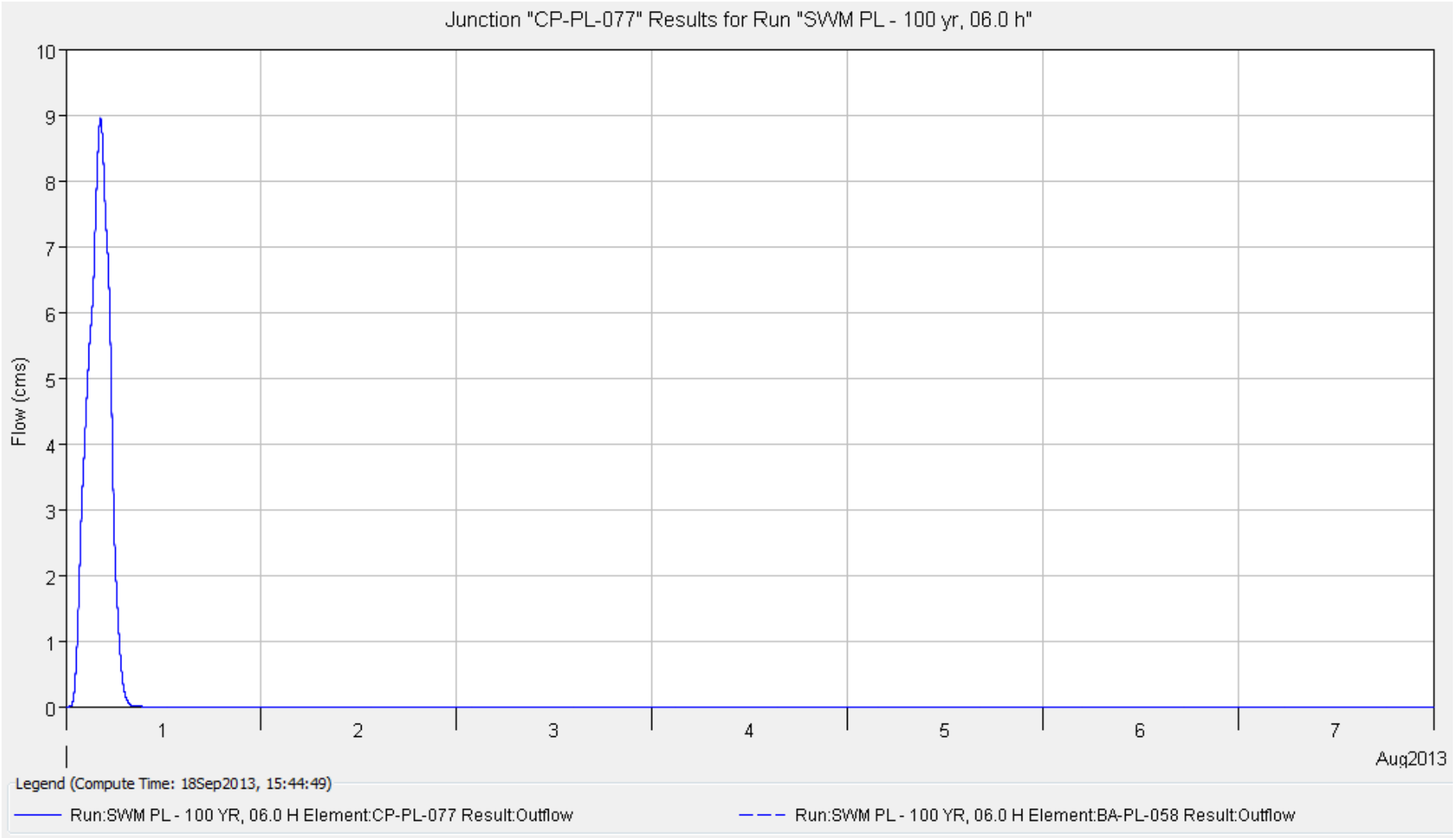

Junction "CP-PL-072" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-072 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-054 Result:Outflow

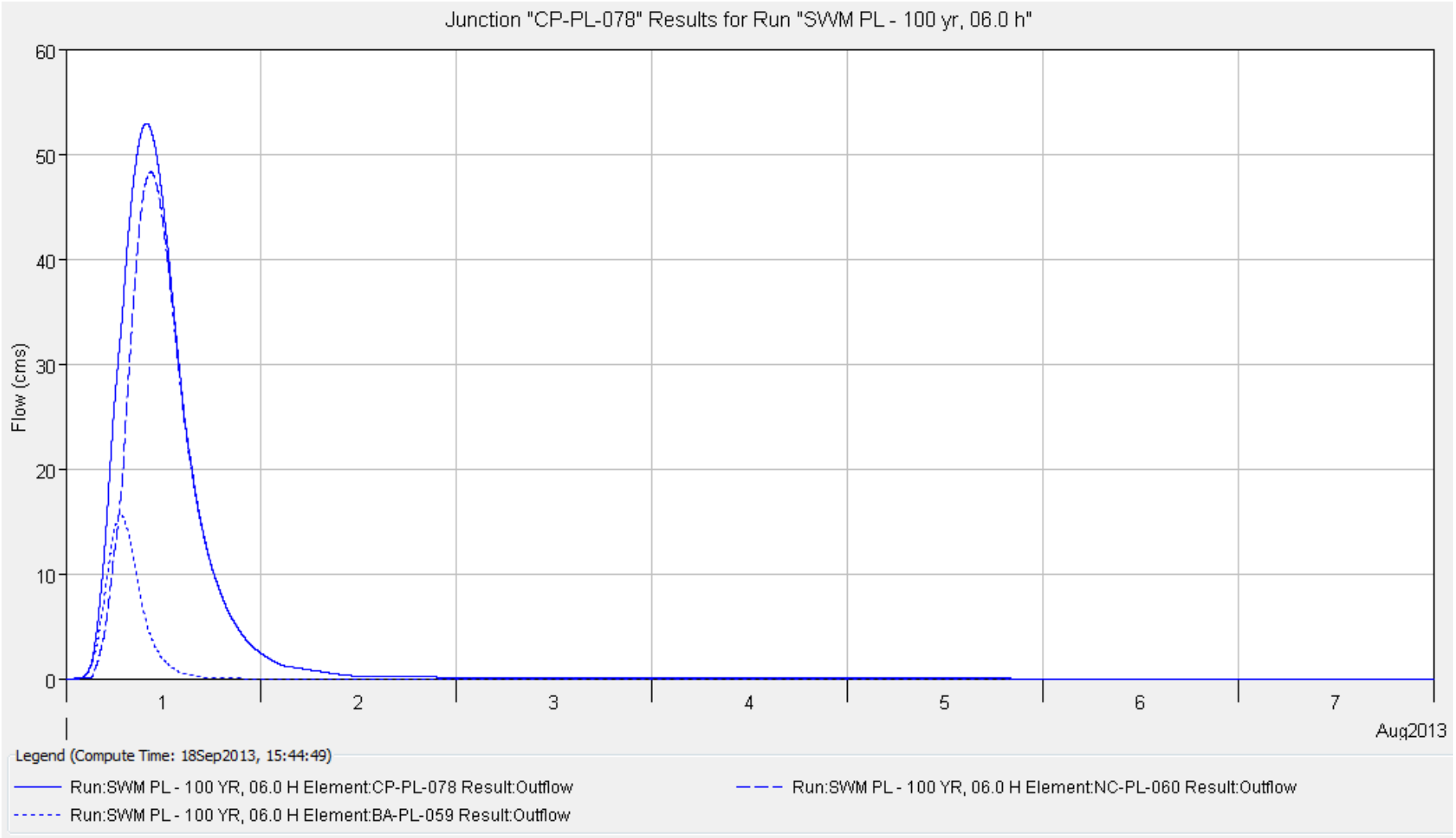

Junction "CP-PL-073" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-073 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-055 Result:Outflow

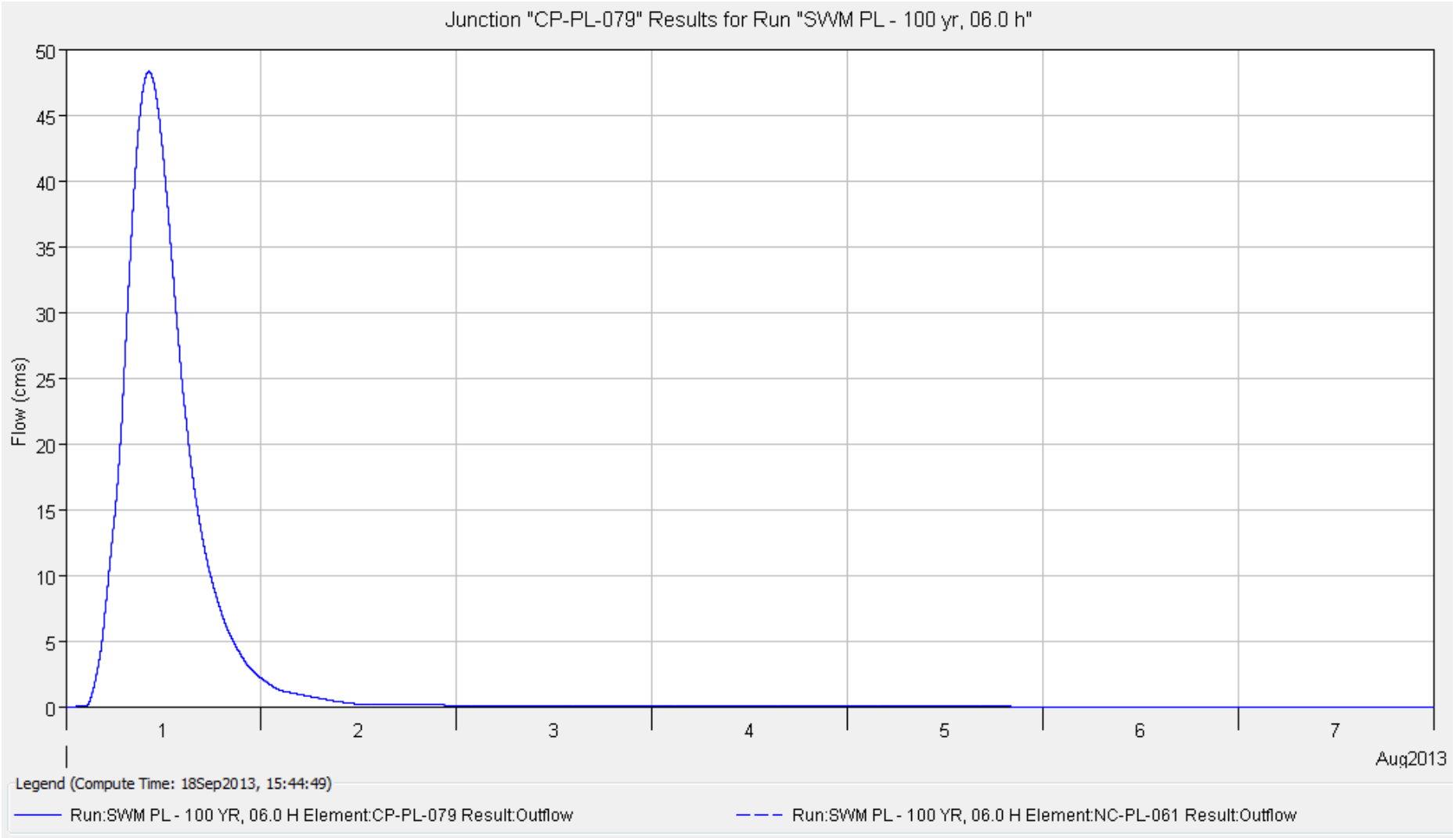

Junction "CP-PL-074" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-074 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-059 Result:Outflow

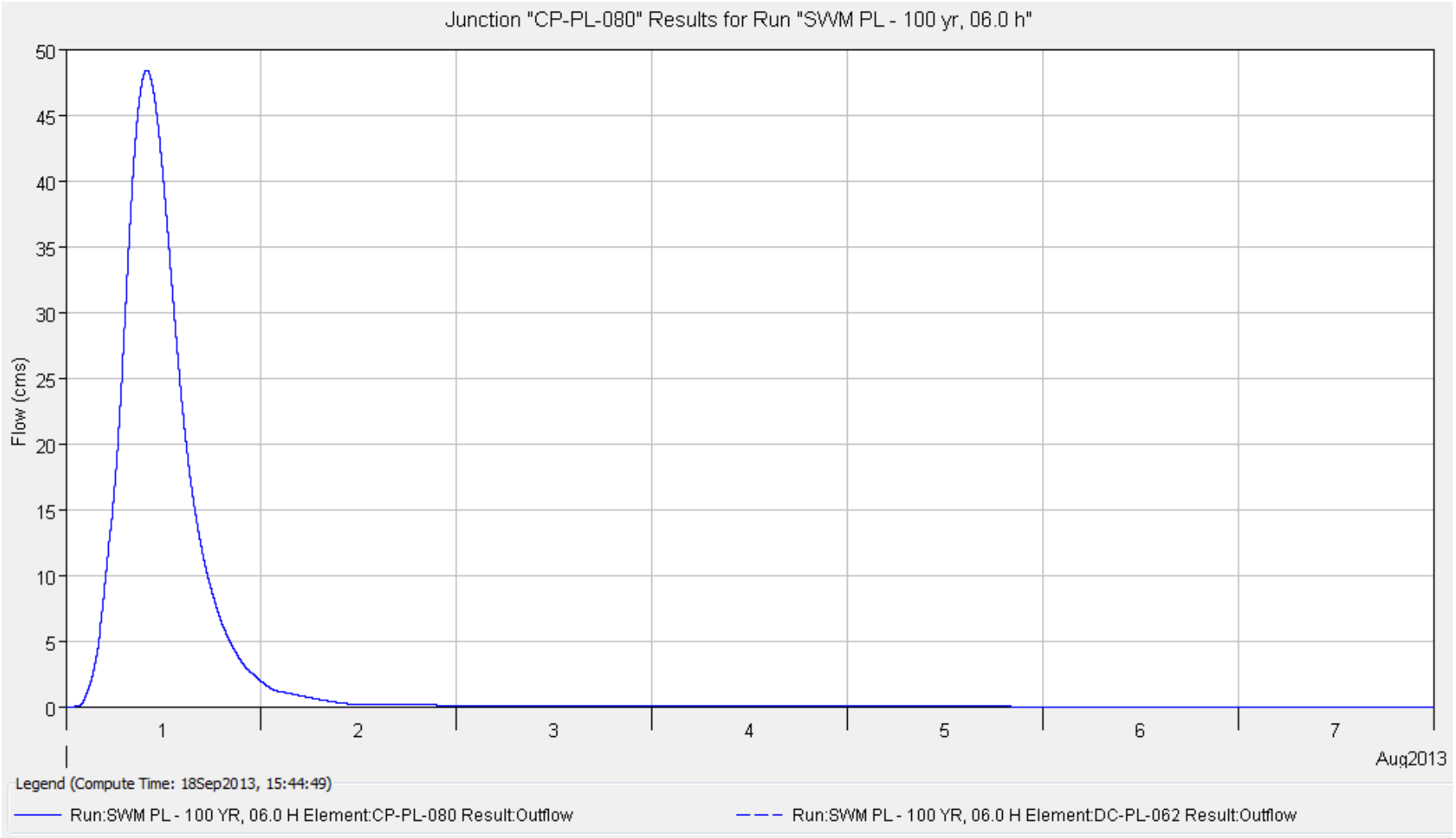

Junction "CP-PL-075" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-075 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-056 Result:Outflow

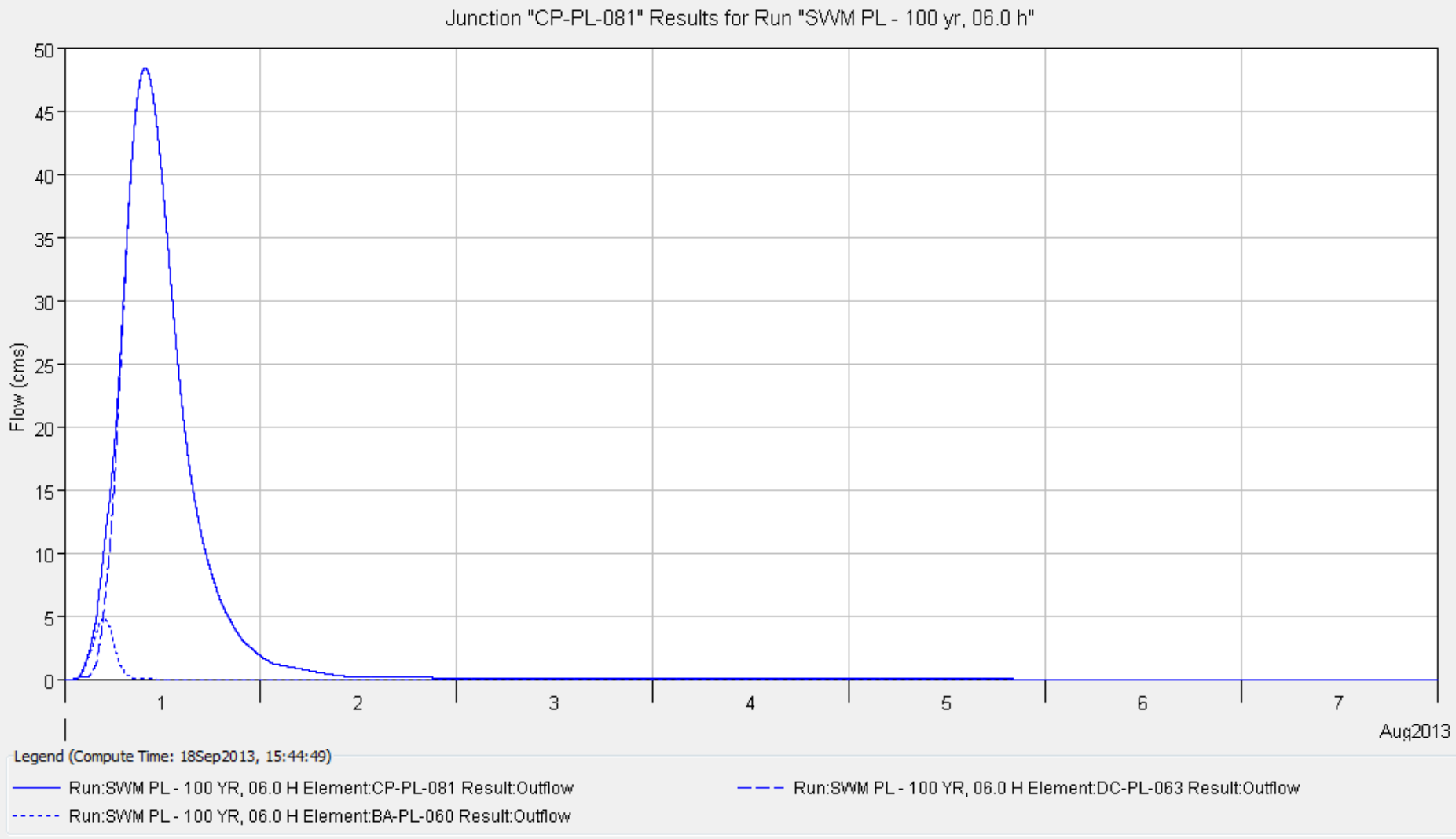

Junction "CP-PL-076" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-076 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-057 Result:Outflow

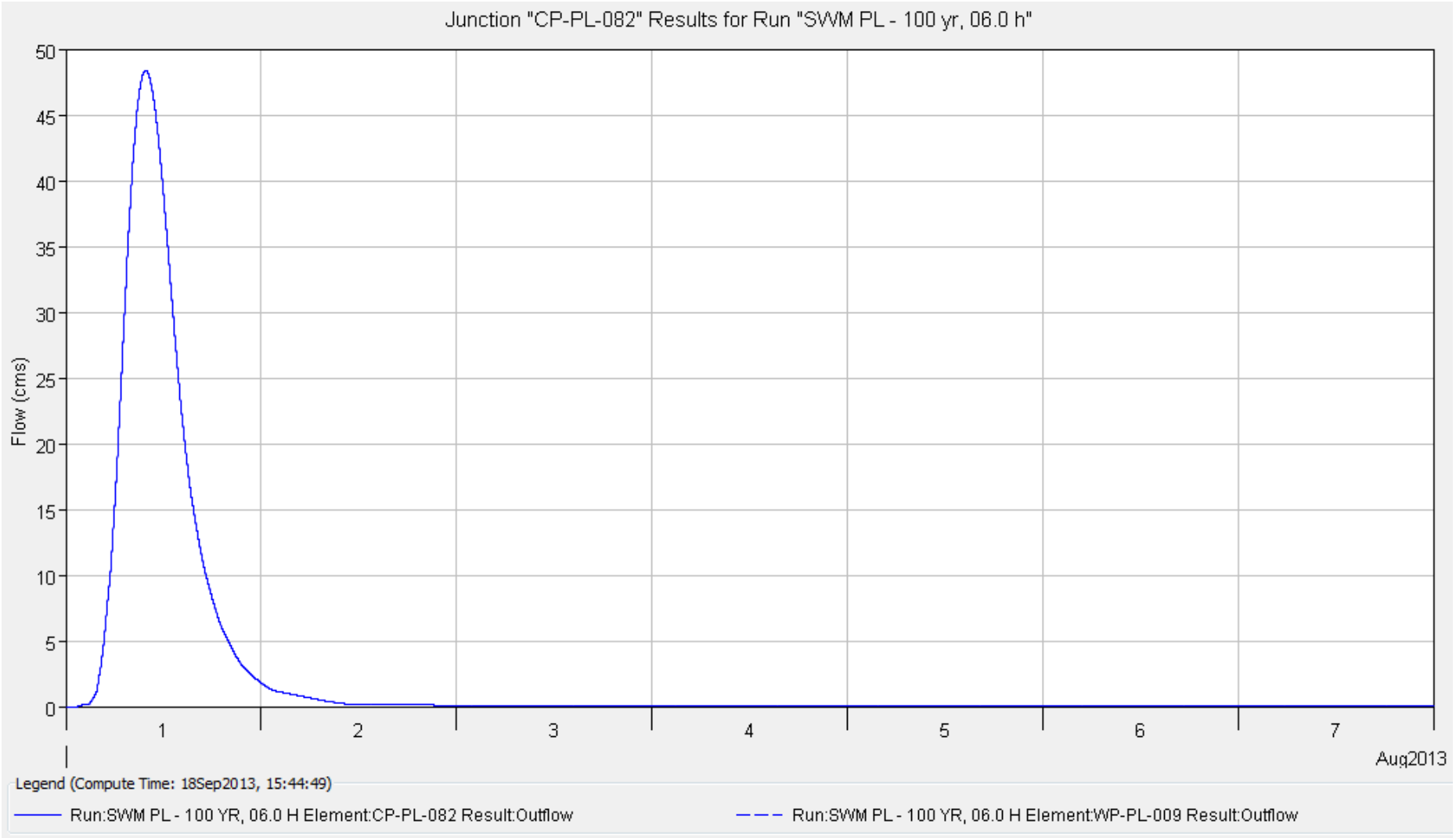

Junction "CP-PL-077" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-058 Result:Outflow

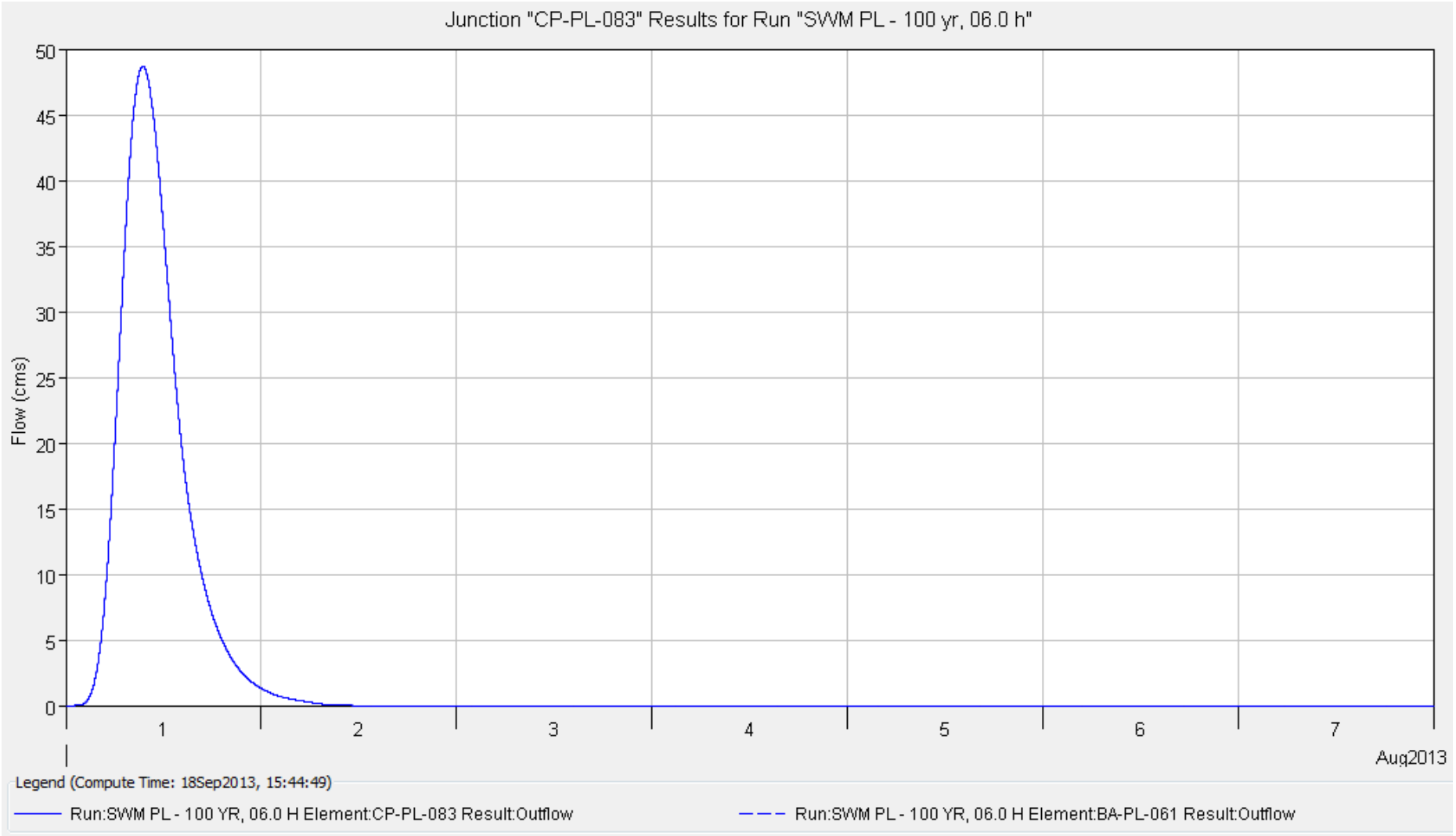

Junction "CP-PL-078" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-059 Result:Outflow

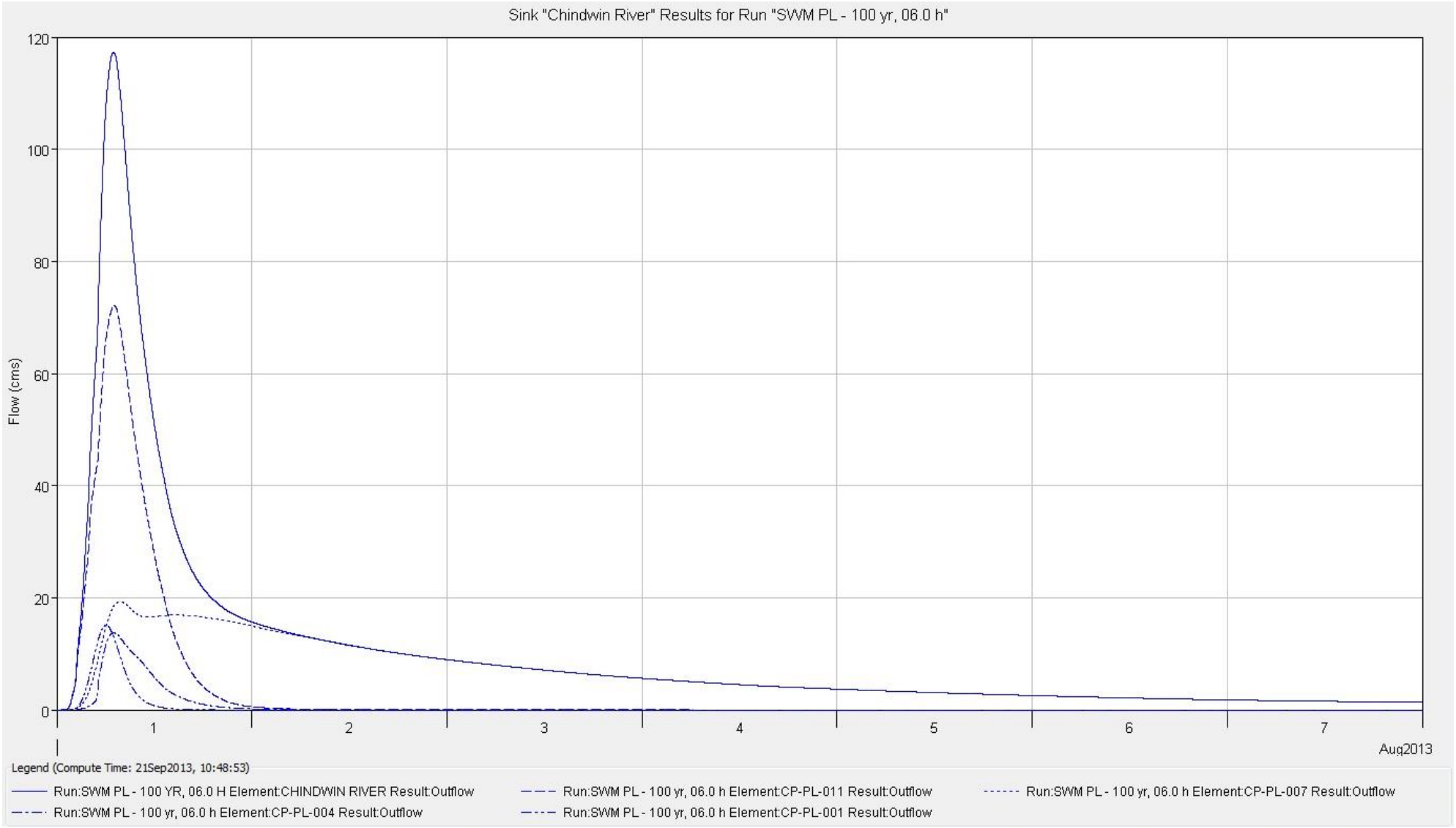

Junction "CP-PL-079" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-079 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:NC-PL-061 Result:Outflow

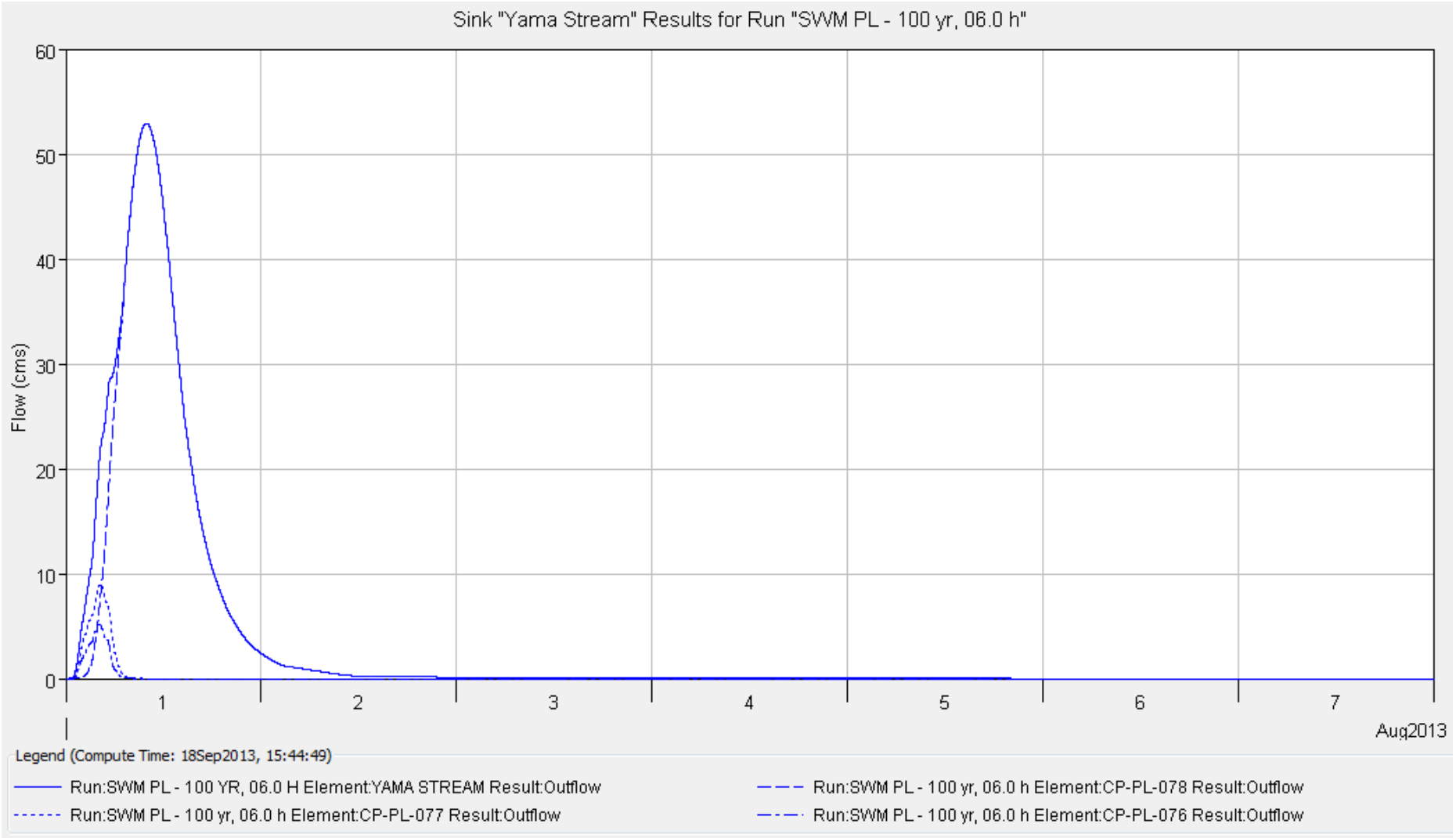

Junction "CP-PL-080" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-080 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-062 Result:Outflow

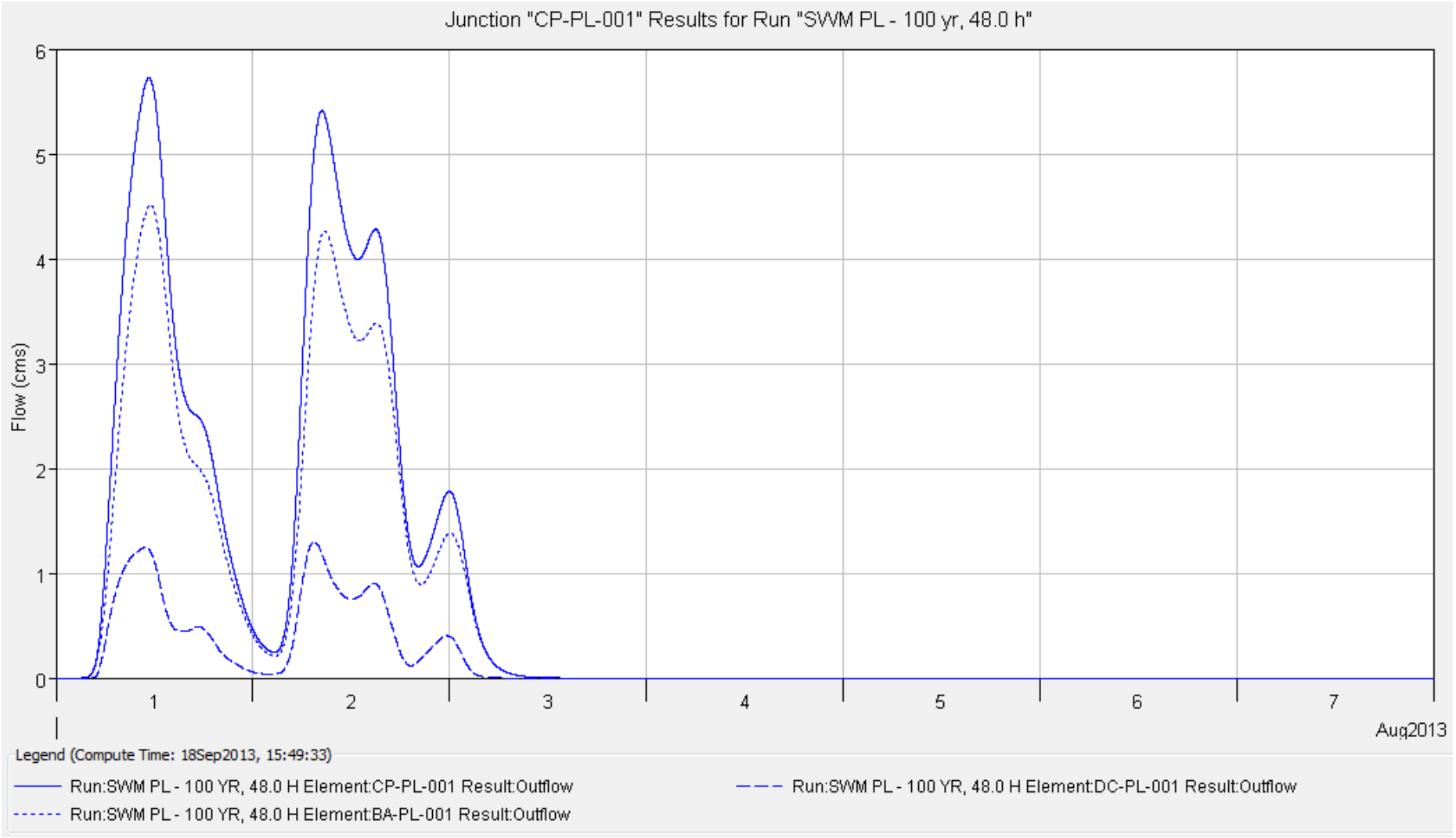

Junction "CP-PL-081" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-081 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:DC-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-060 Result:Outflow

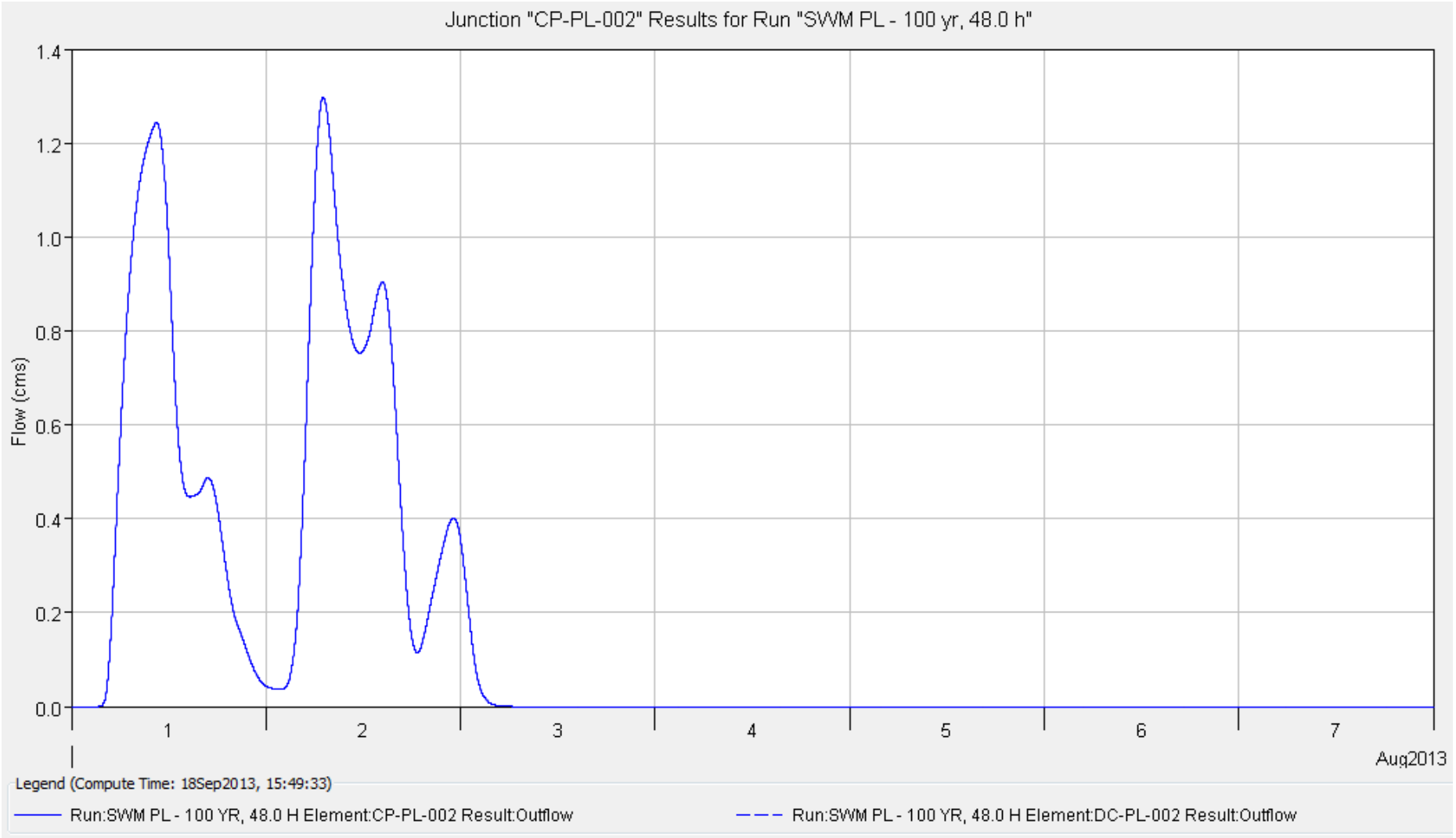

Junction "CP-PL-082" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-082 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Outflow

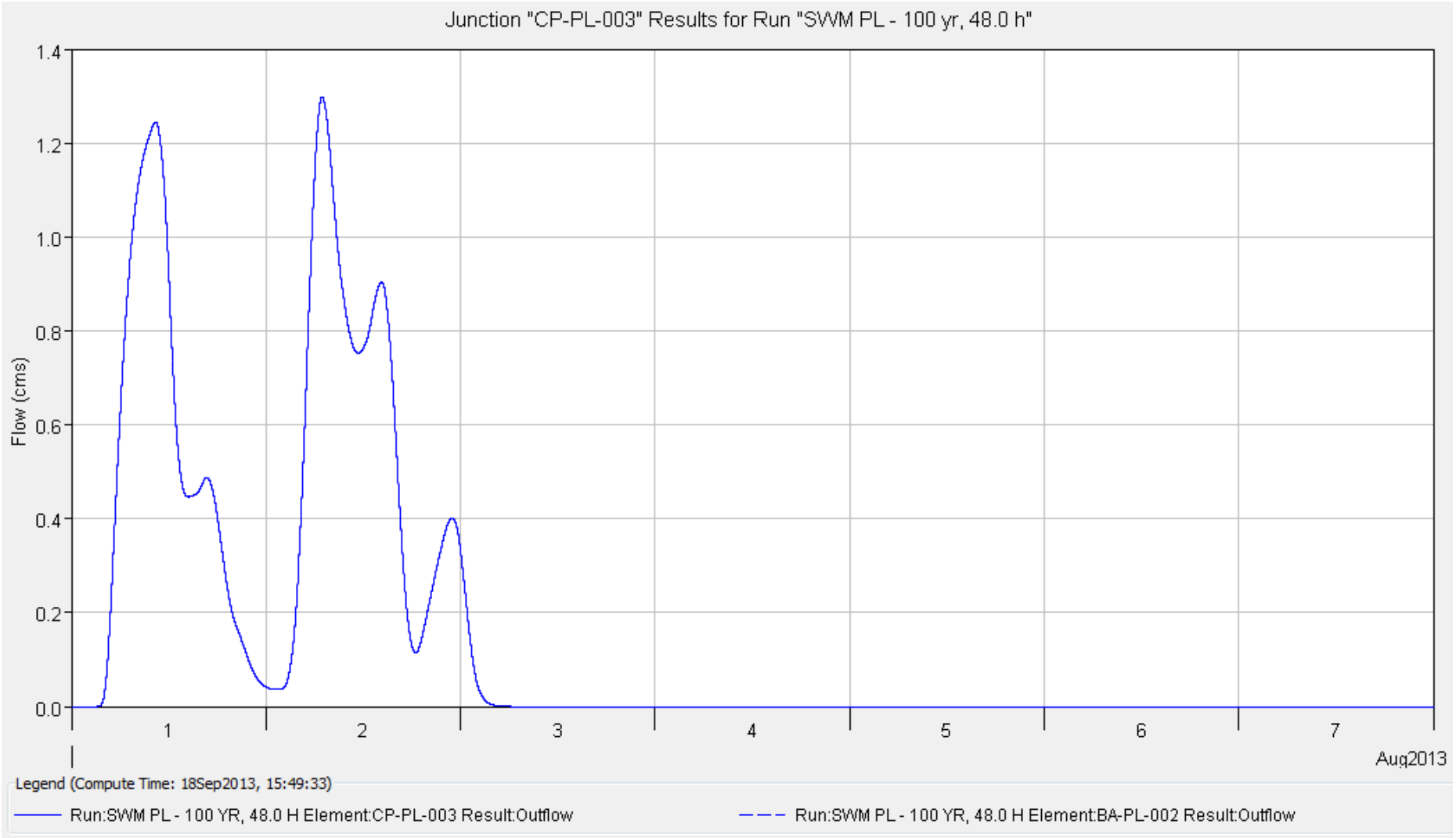

Junction "CP-PL-083" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:CP-PL-083 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:BA-PL-061 Result:Outflow

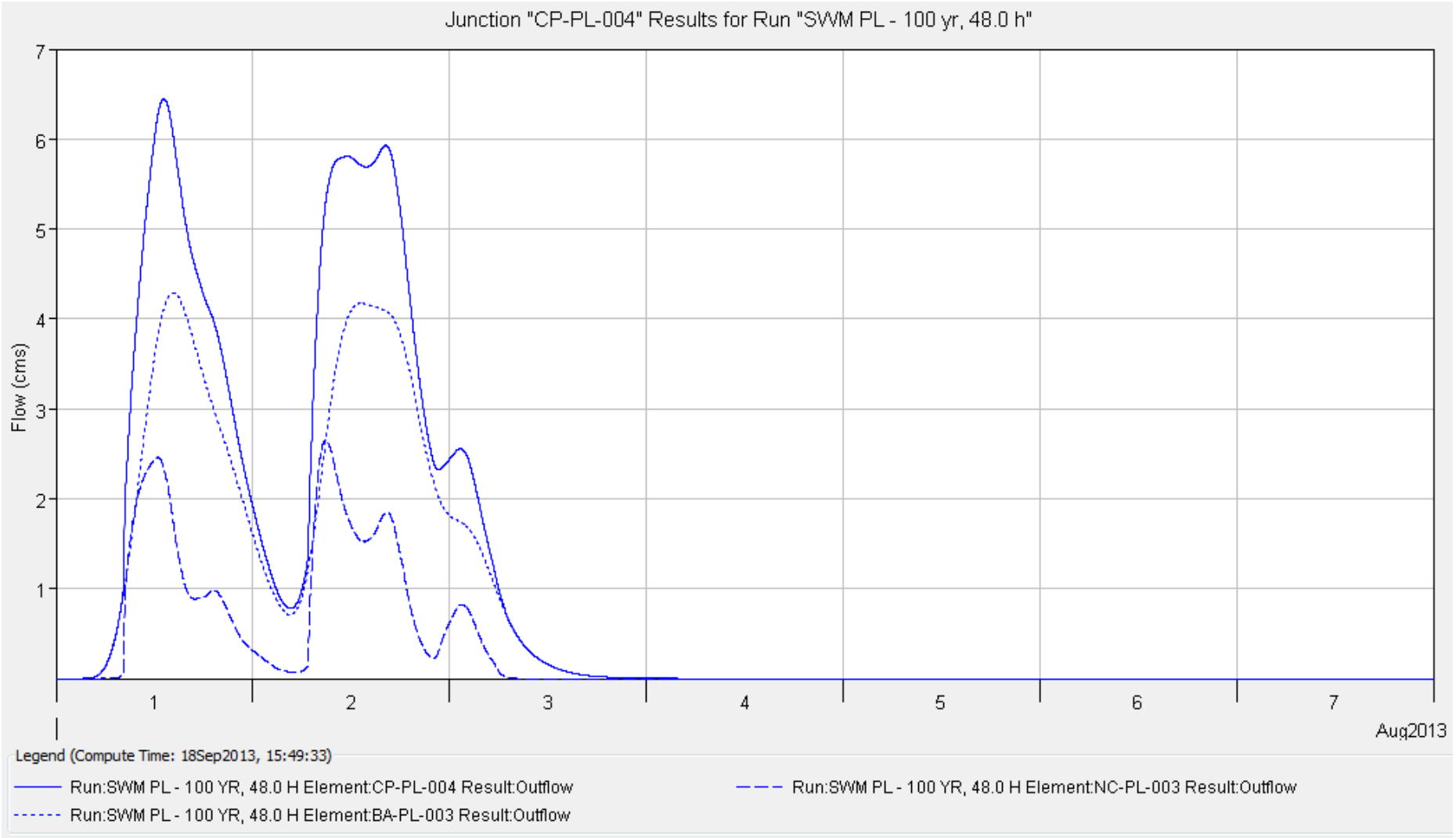

Sink "Chindwin River" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 21Sep2013, 10:48:53)
Run:SWM PL - 100 YR, 06.0 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-004 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-001 Result:Outflow

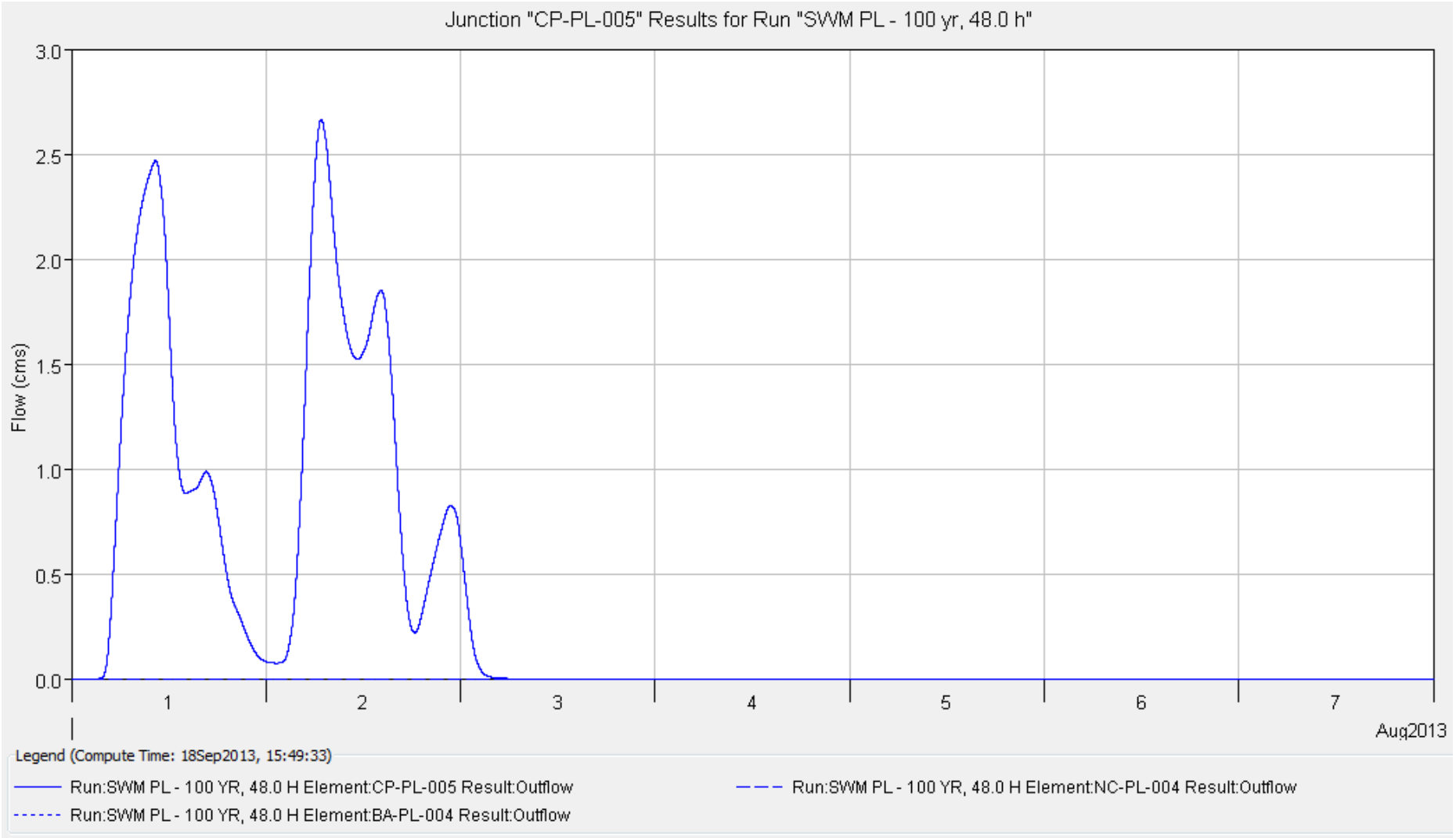

Sink "Yama Stream" Results for Run "SWM PL - 100 yr, 06.0 h"
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:44:49)
Run:SWM PL - 100 YR, 06.0 H Element:YAMA STREAM Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:CP-PL-076 Result:Outflow

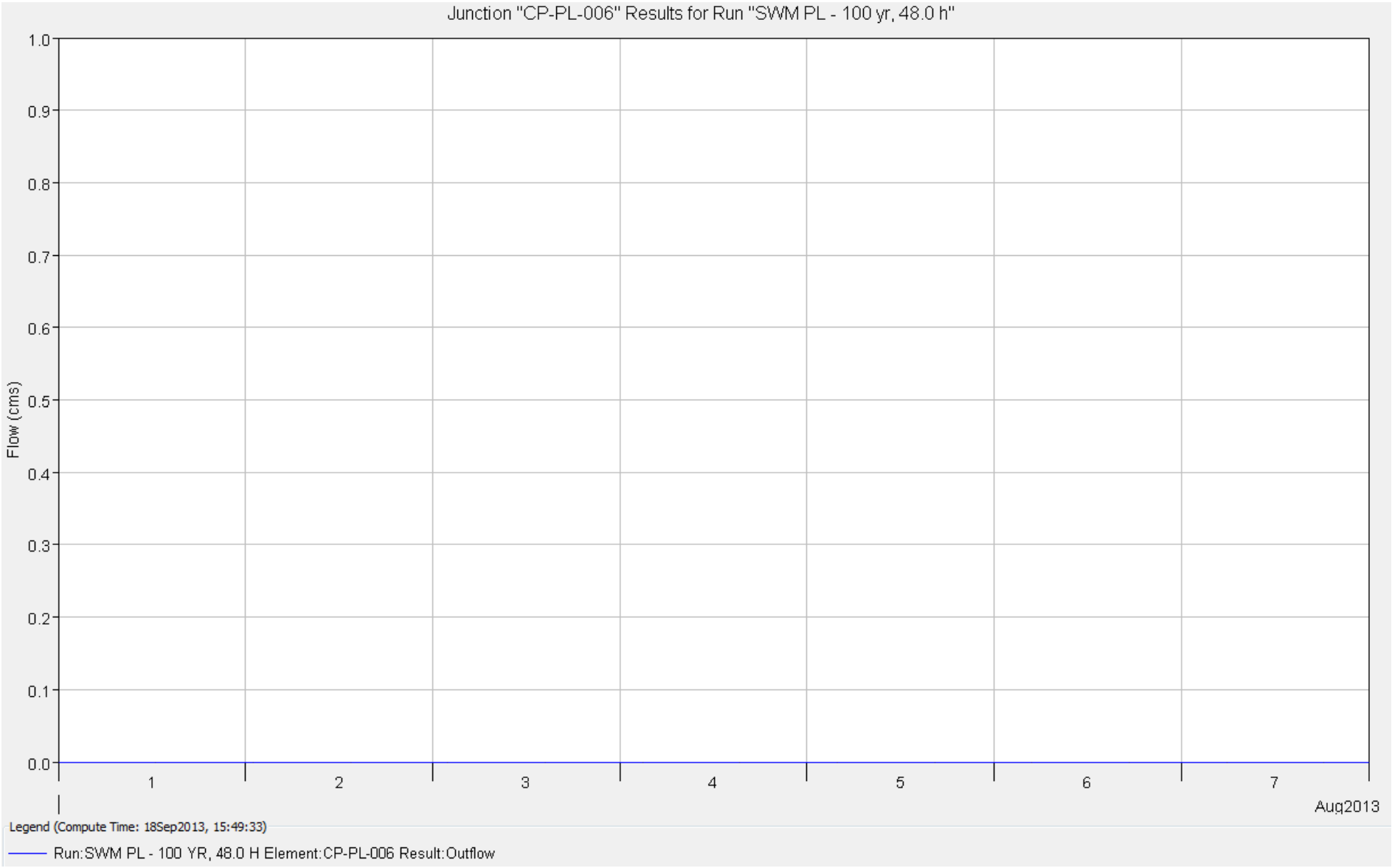

Junction "CP-PL-001" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-001 Result:Outflow

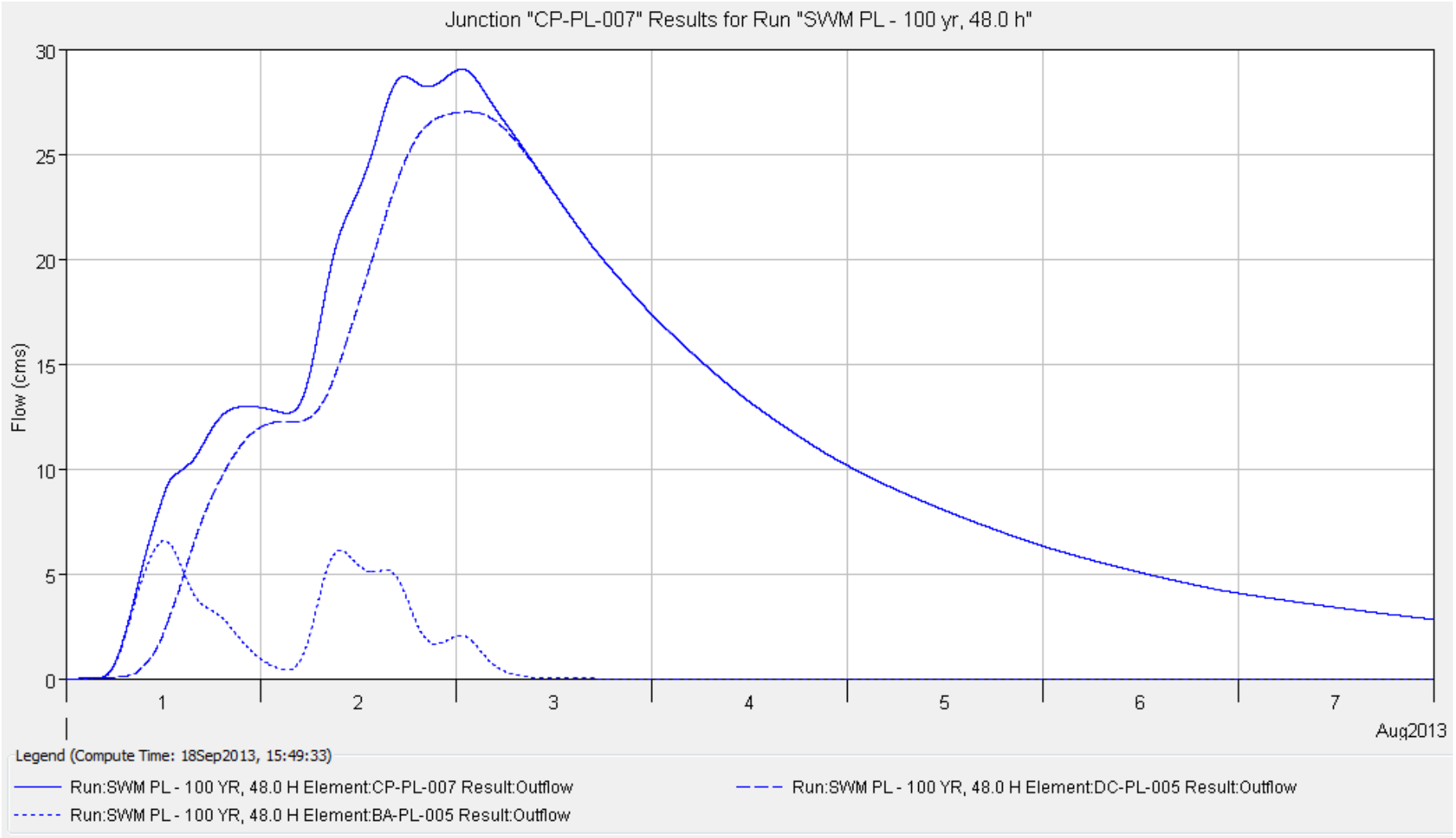

Junction "CP-PL-002" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-002 Result:Outflow

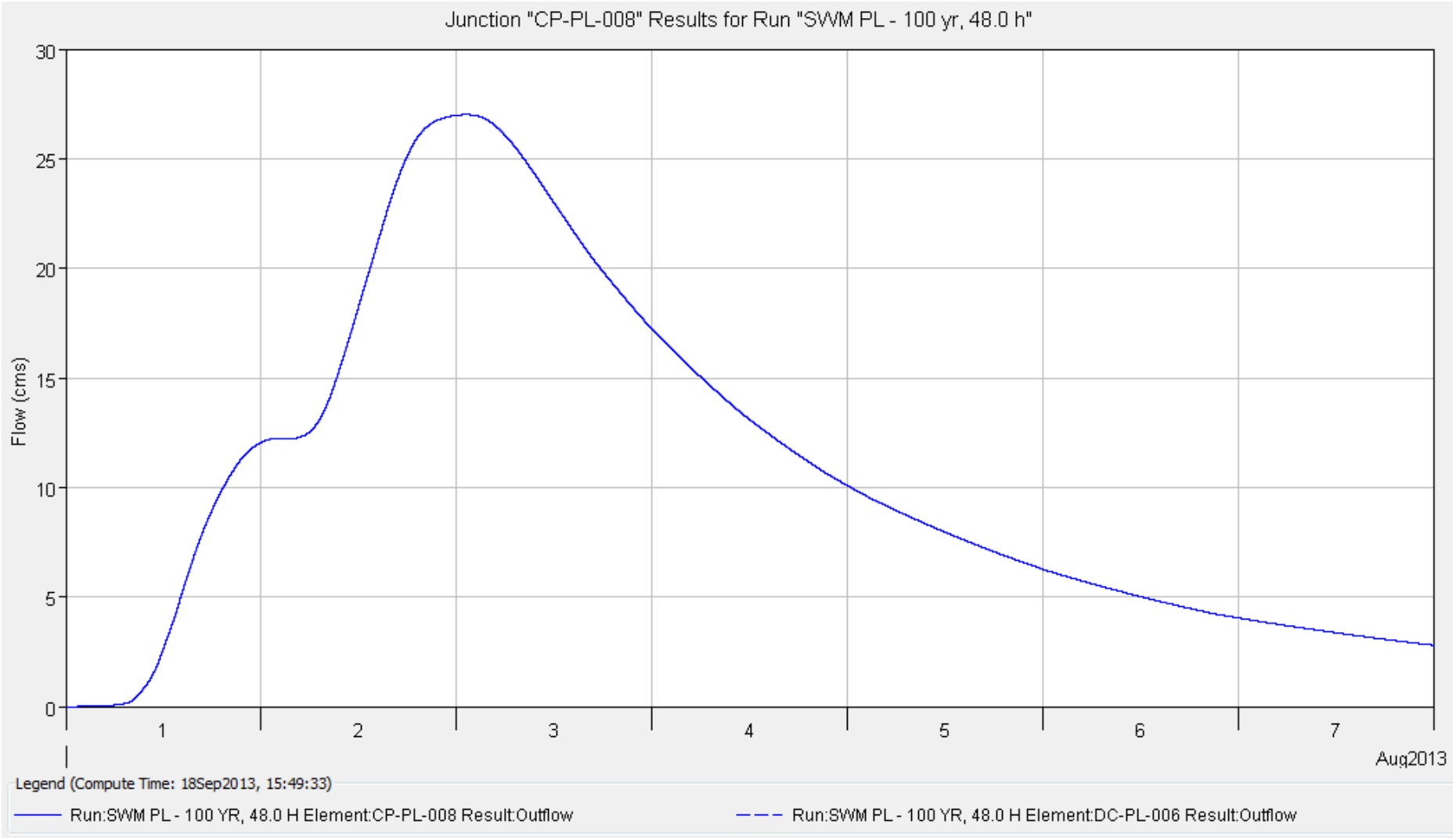

Junction "CP-PL-003" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-002 Result:Outflow

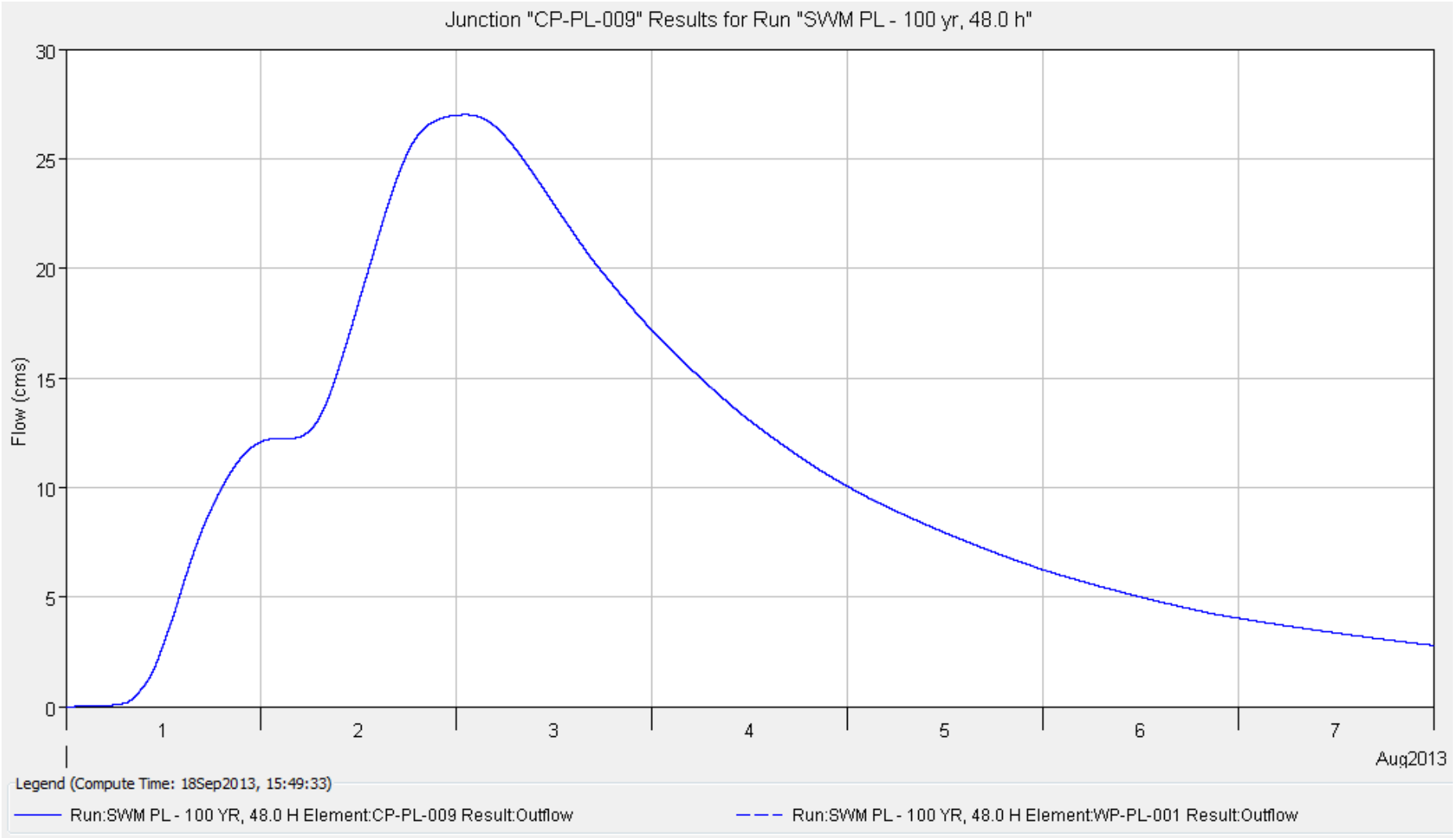

Junction "CP-PL-004" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-003 Result:Outflow

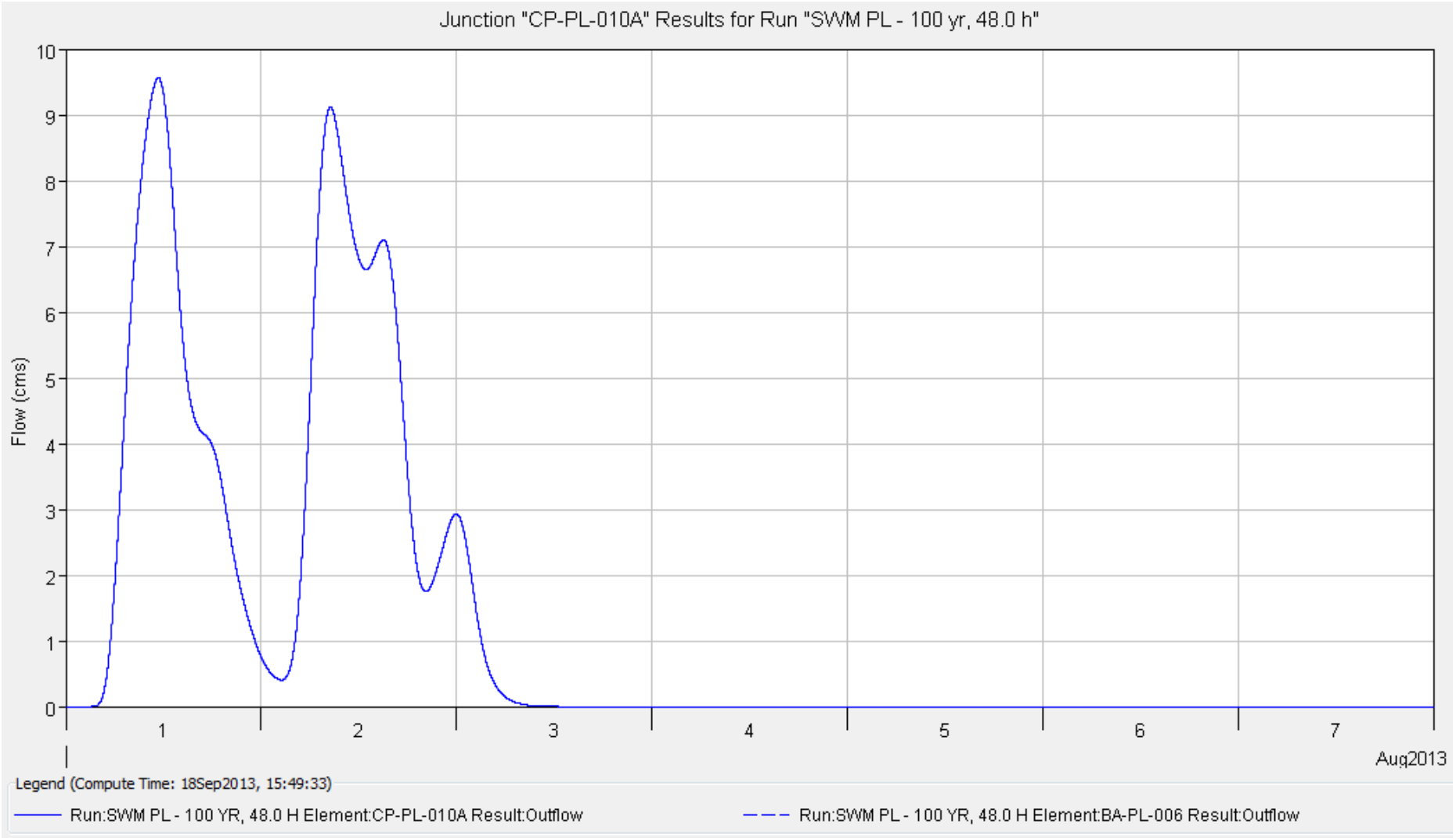

Junction "CP-PL-005" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-004 Result:Outflow

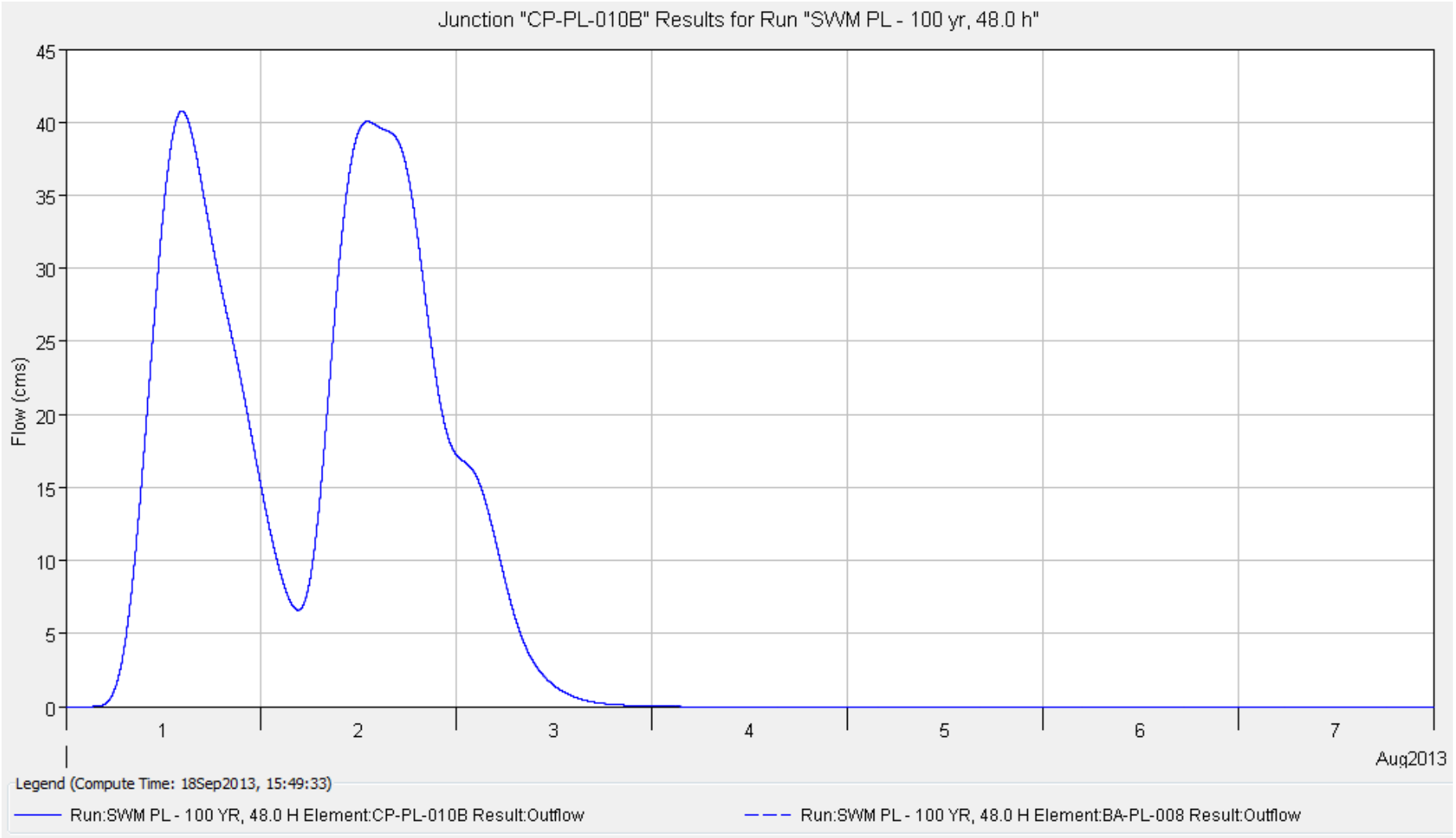

Junction "CP-PL-006" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-006 Result:Outflow

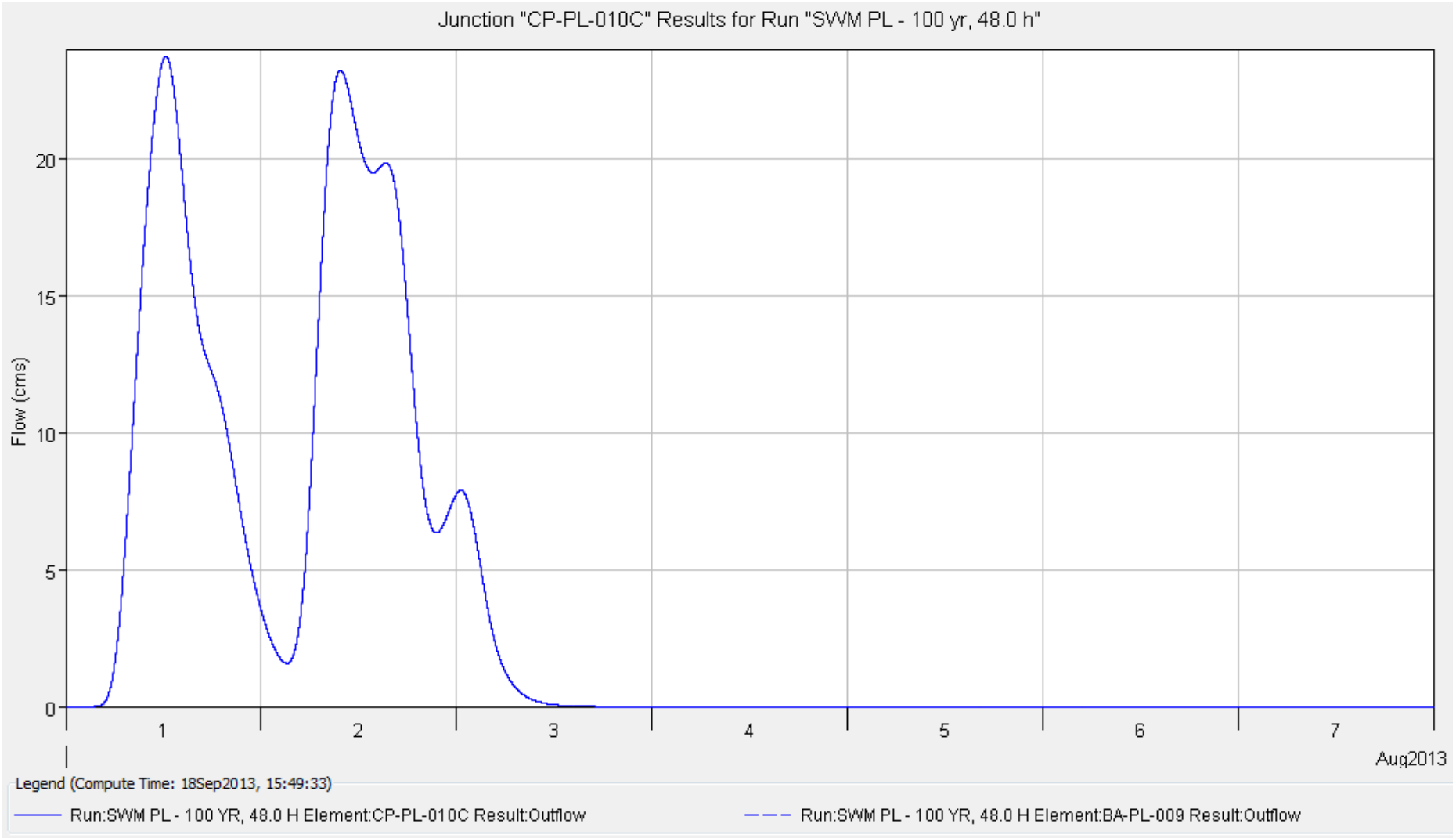

Junction "CP-PL-007" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-005 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-005 Result:Outflow

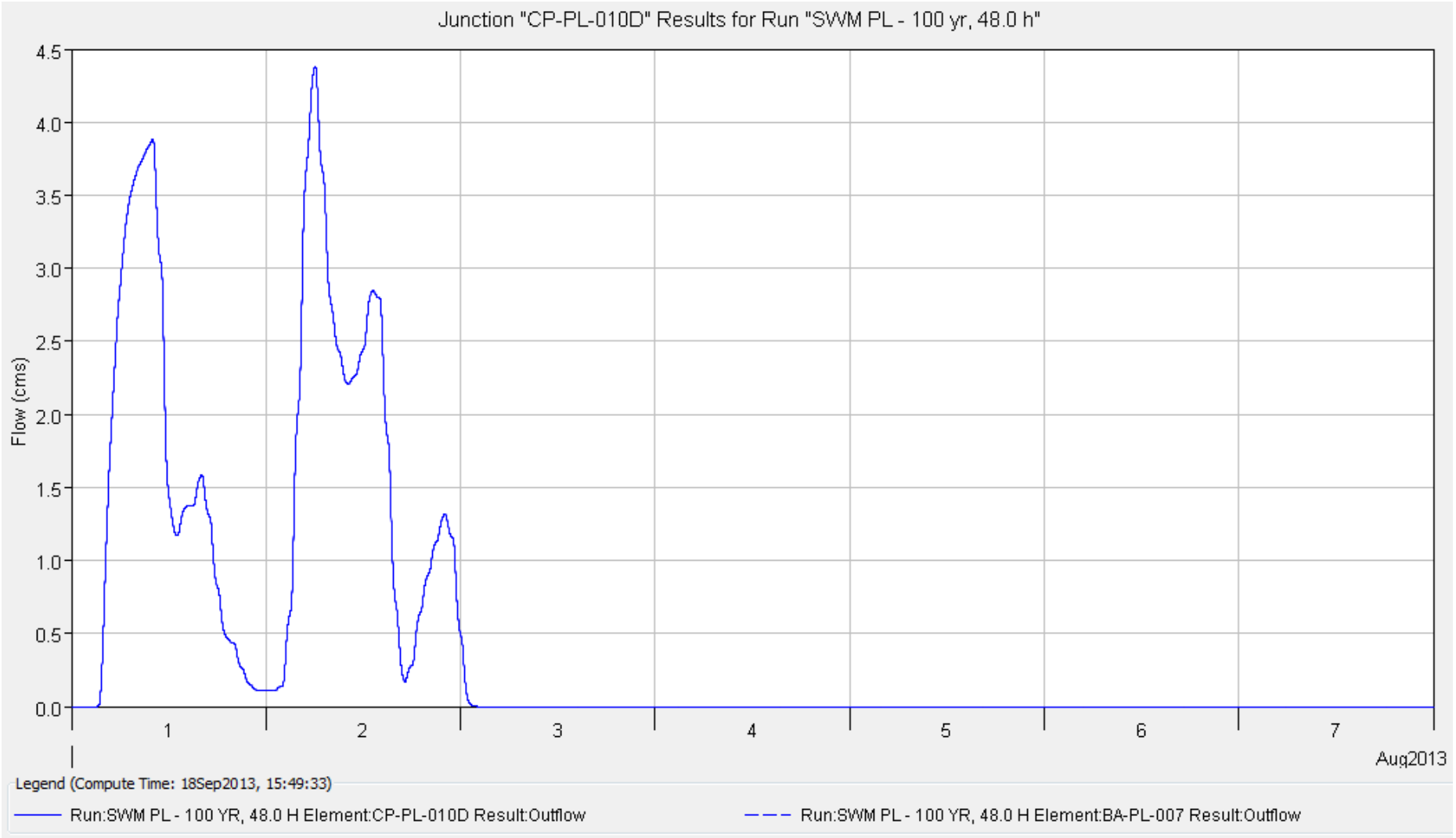

Junction "CP-PL-008" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-006 Result:Outflow

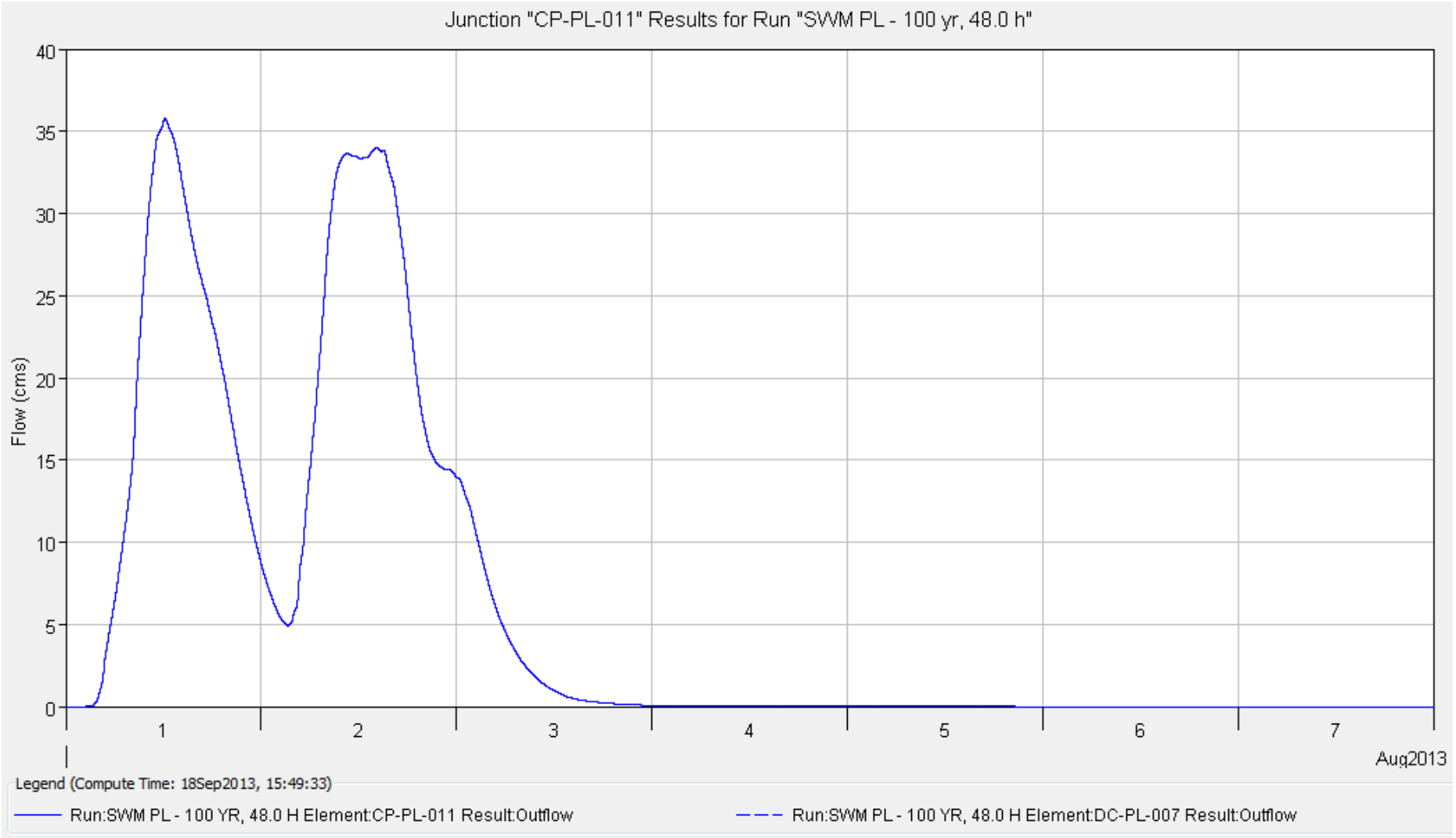

Junction "CP-PL-009" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Outflow

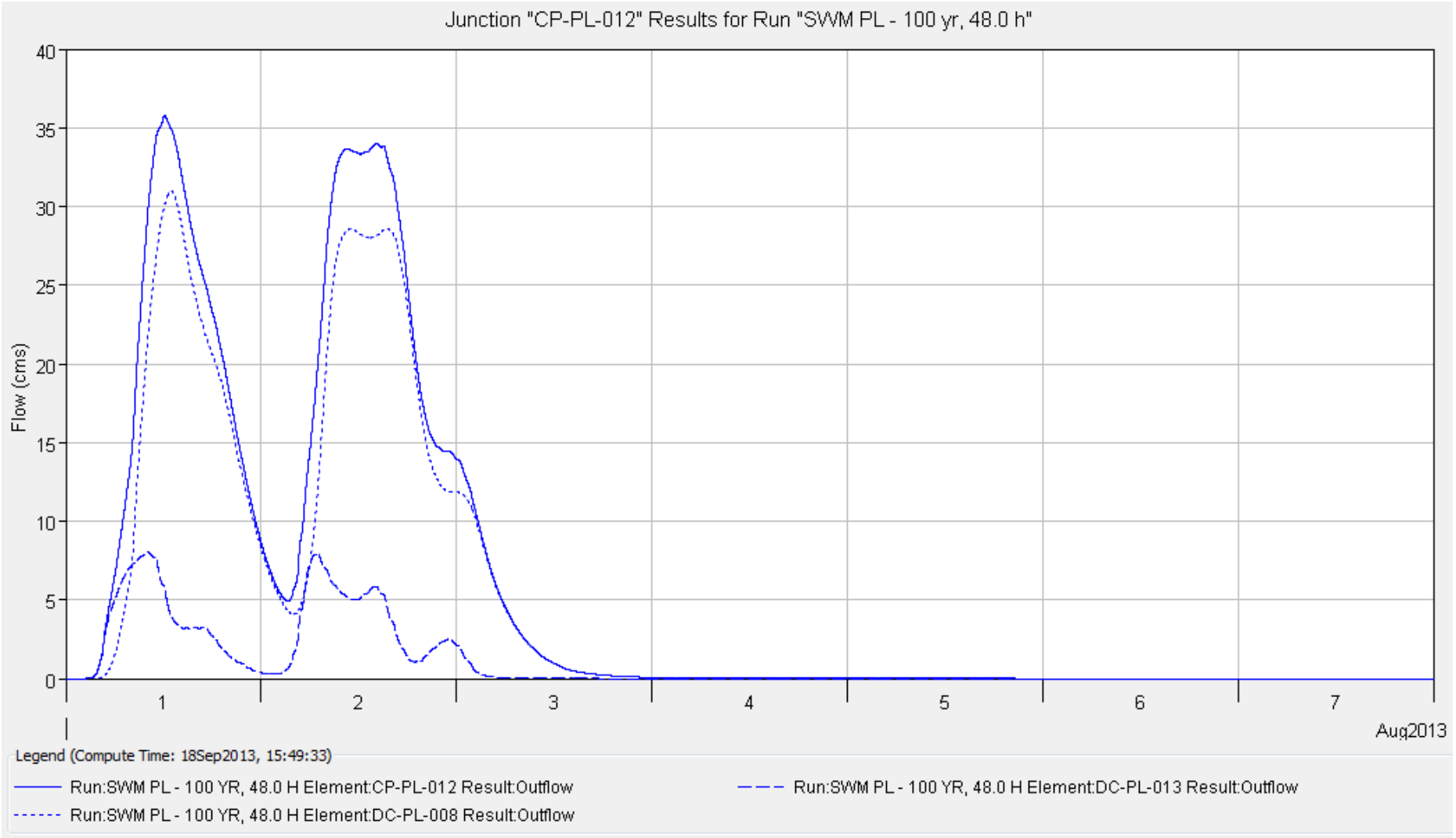

Junction "CP-PL-010A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-006 Result:Outflow

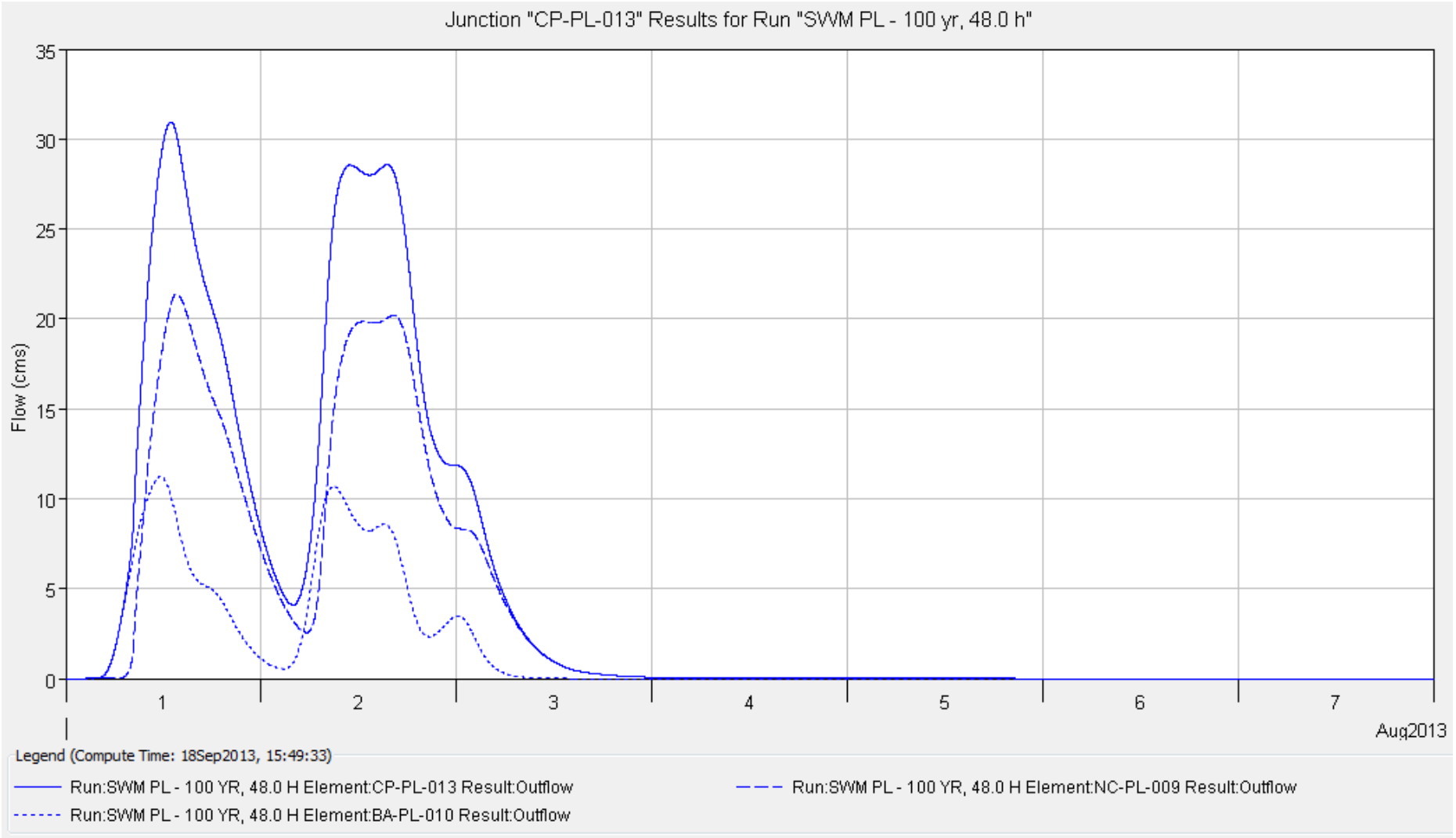

Junction "CP-PL-010B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-008 Result:Outflow

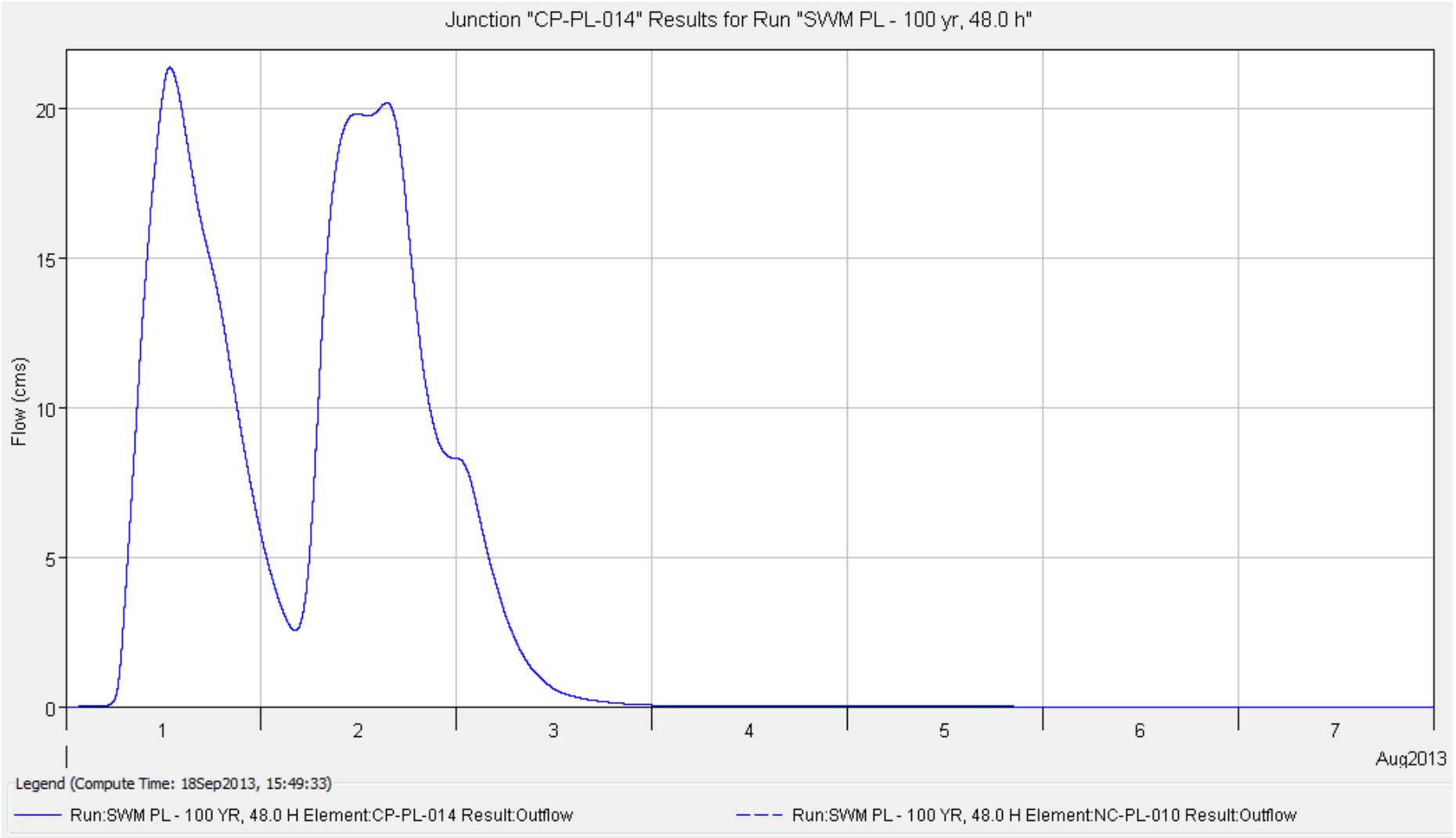

Junction "CP-PL-010C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-009 Result:Outflow

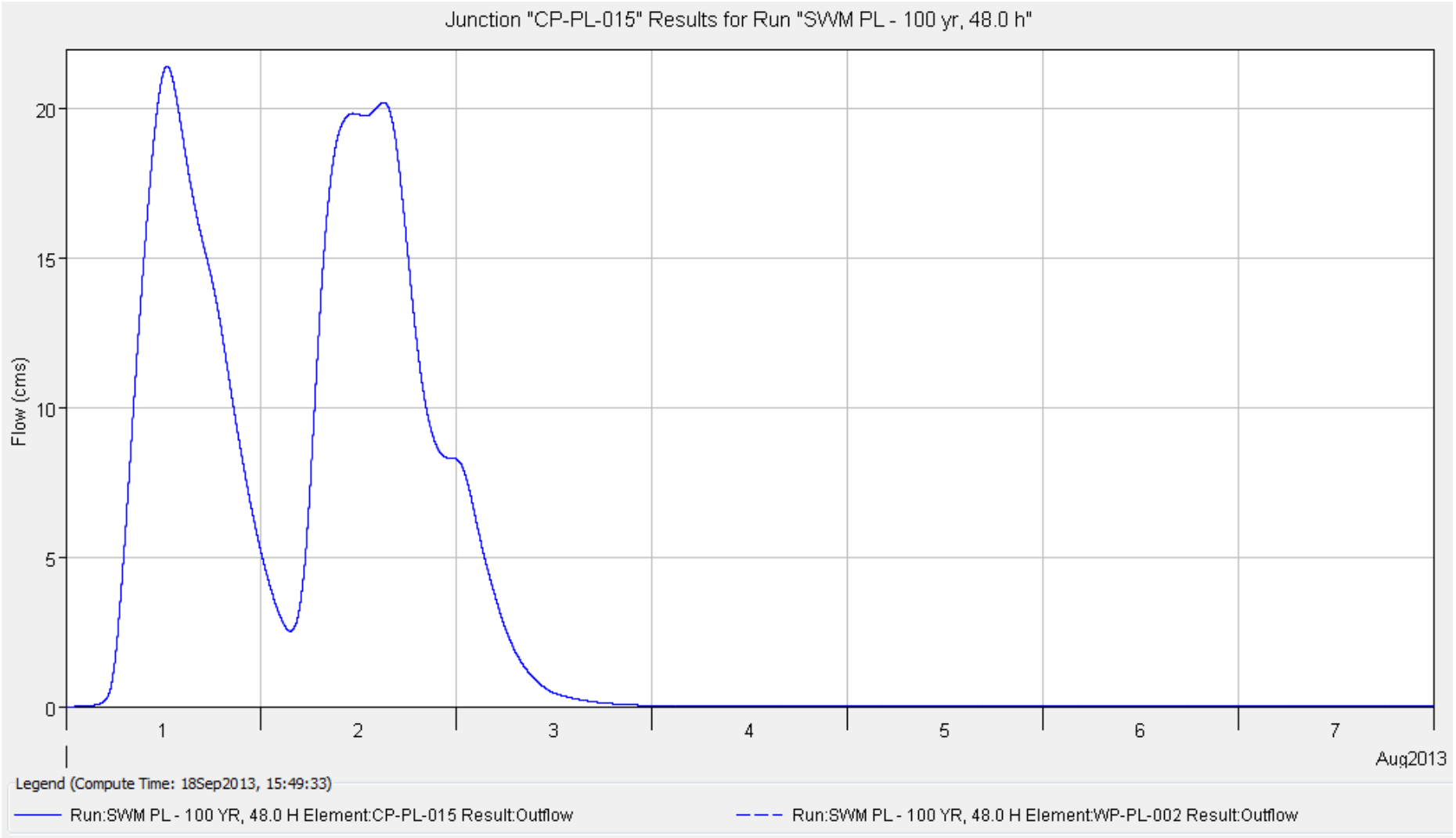

Junction "CP-PL-010D" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-010D Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-007 Result:Outflow

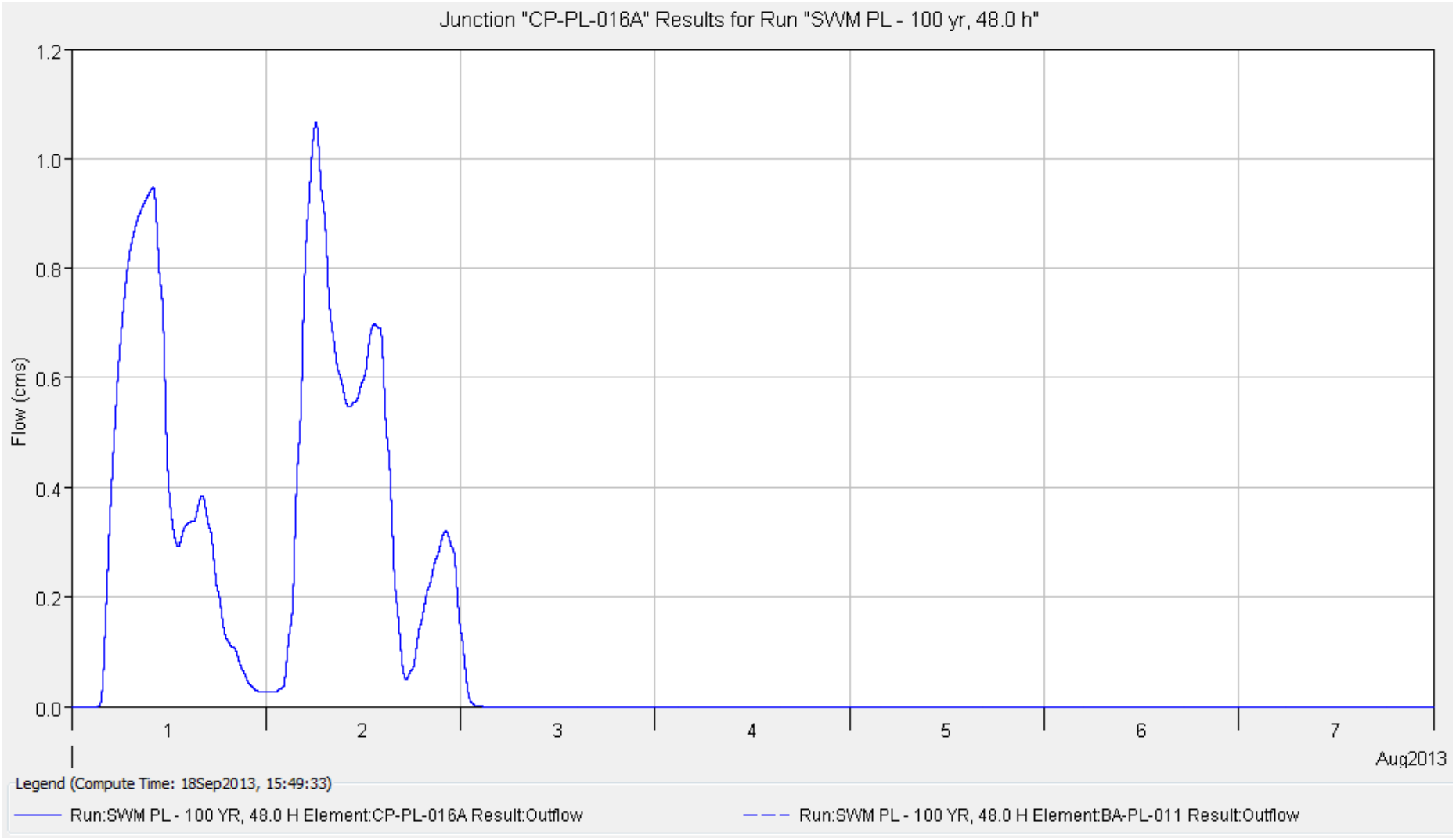

Junction "CP-PL-011" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-007 Result:Outflow

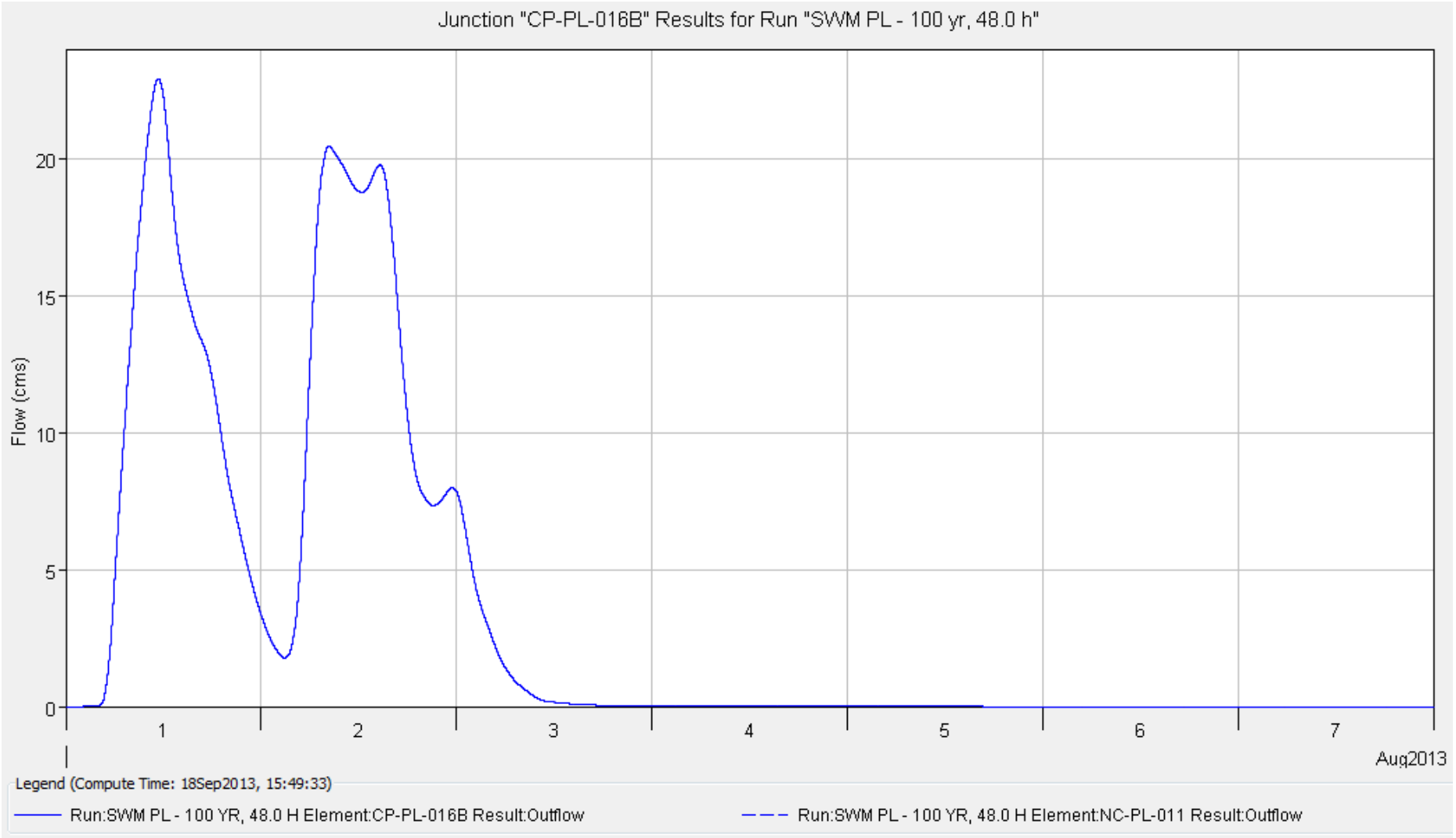

Junction "CP-PL-012" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-008 Result:Outflow

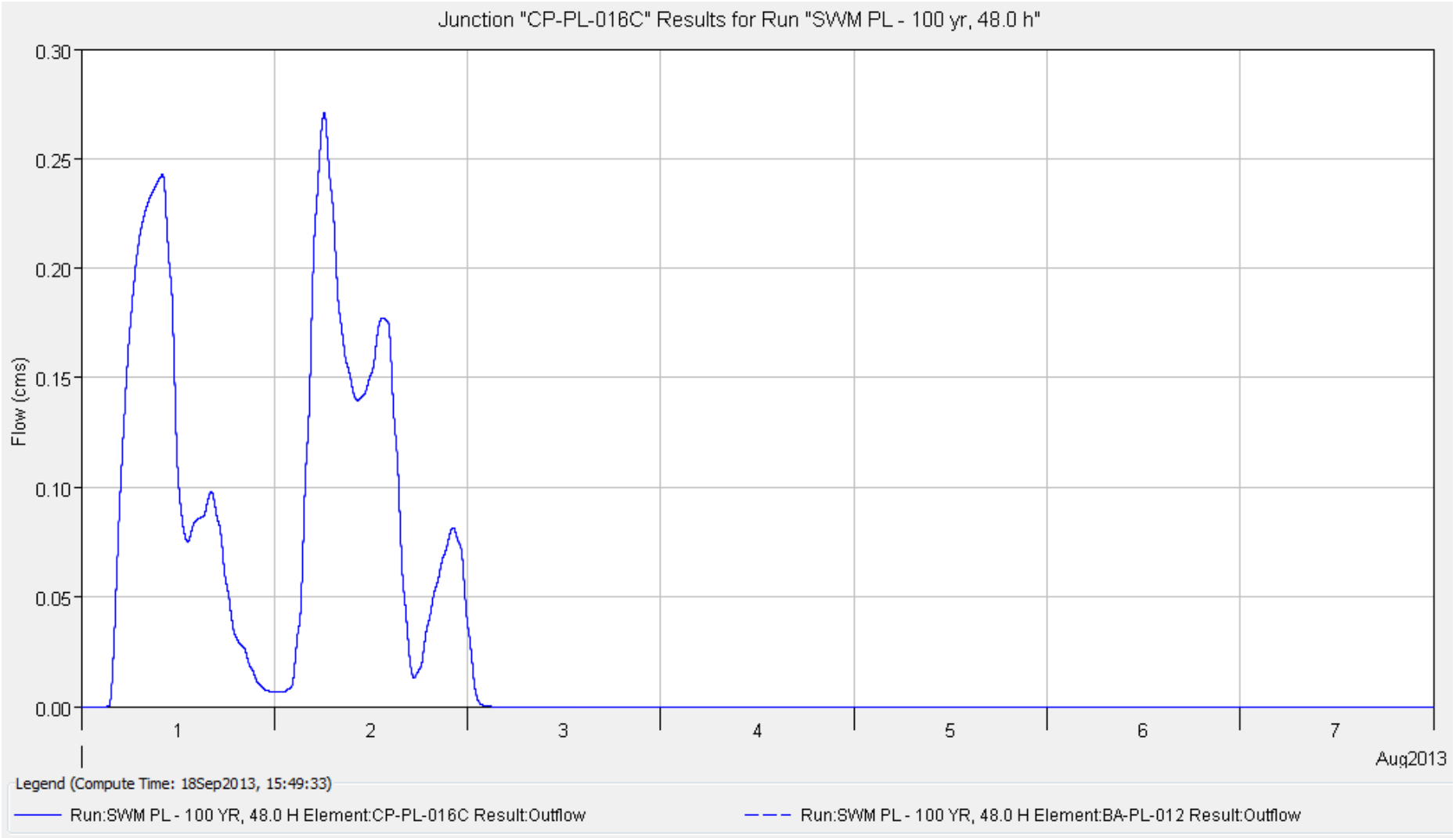

Junction "CP-PL-013" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-013 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-010 Result:Outflow

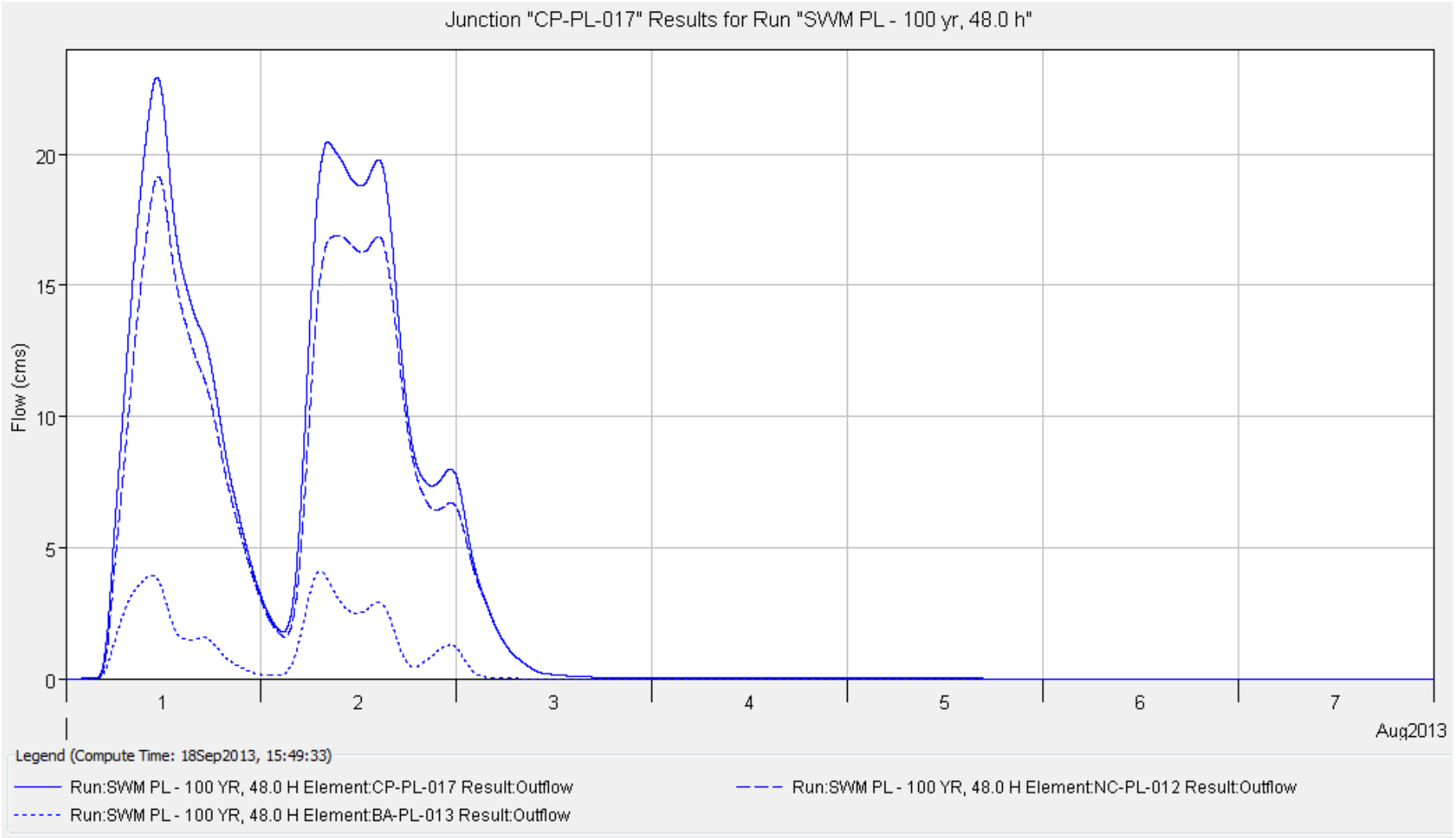

Junction "CP-PL-014" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-010 Result:Outflow

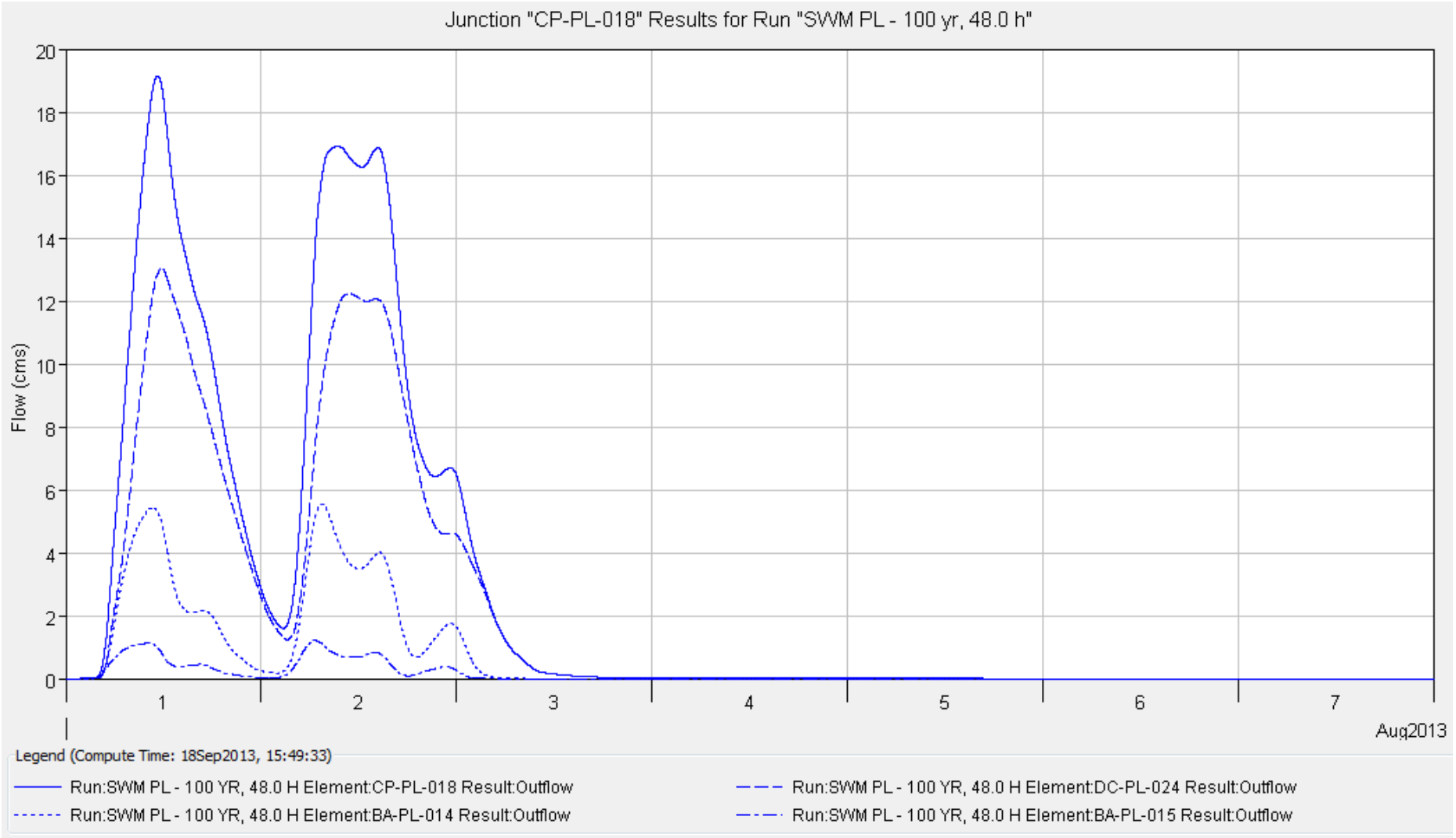

Junction "CP-PL-015" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Outflow

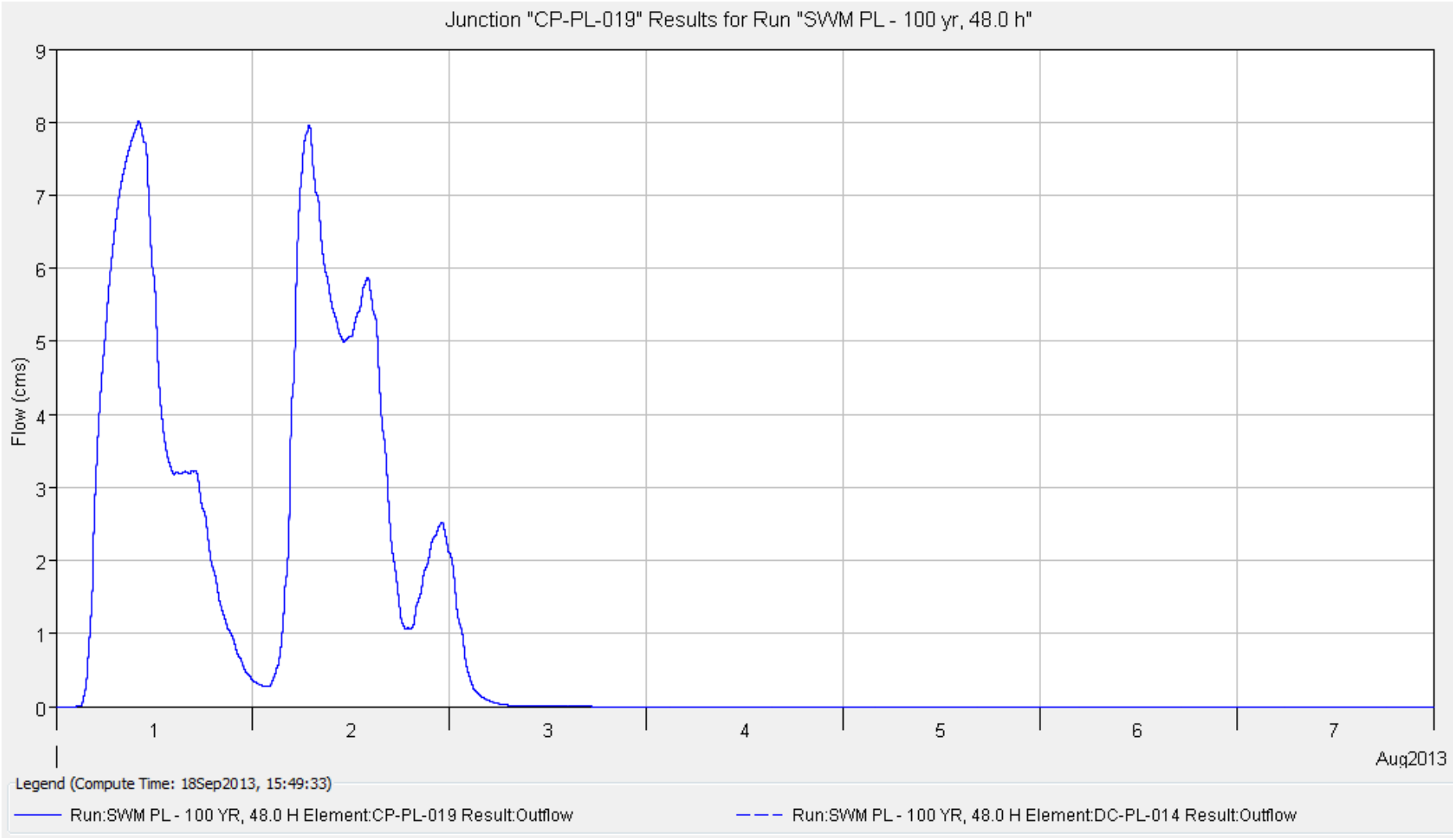

Junction "CP-PL-016A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-011 Result:Outflow

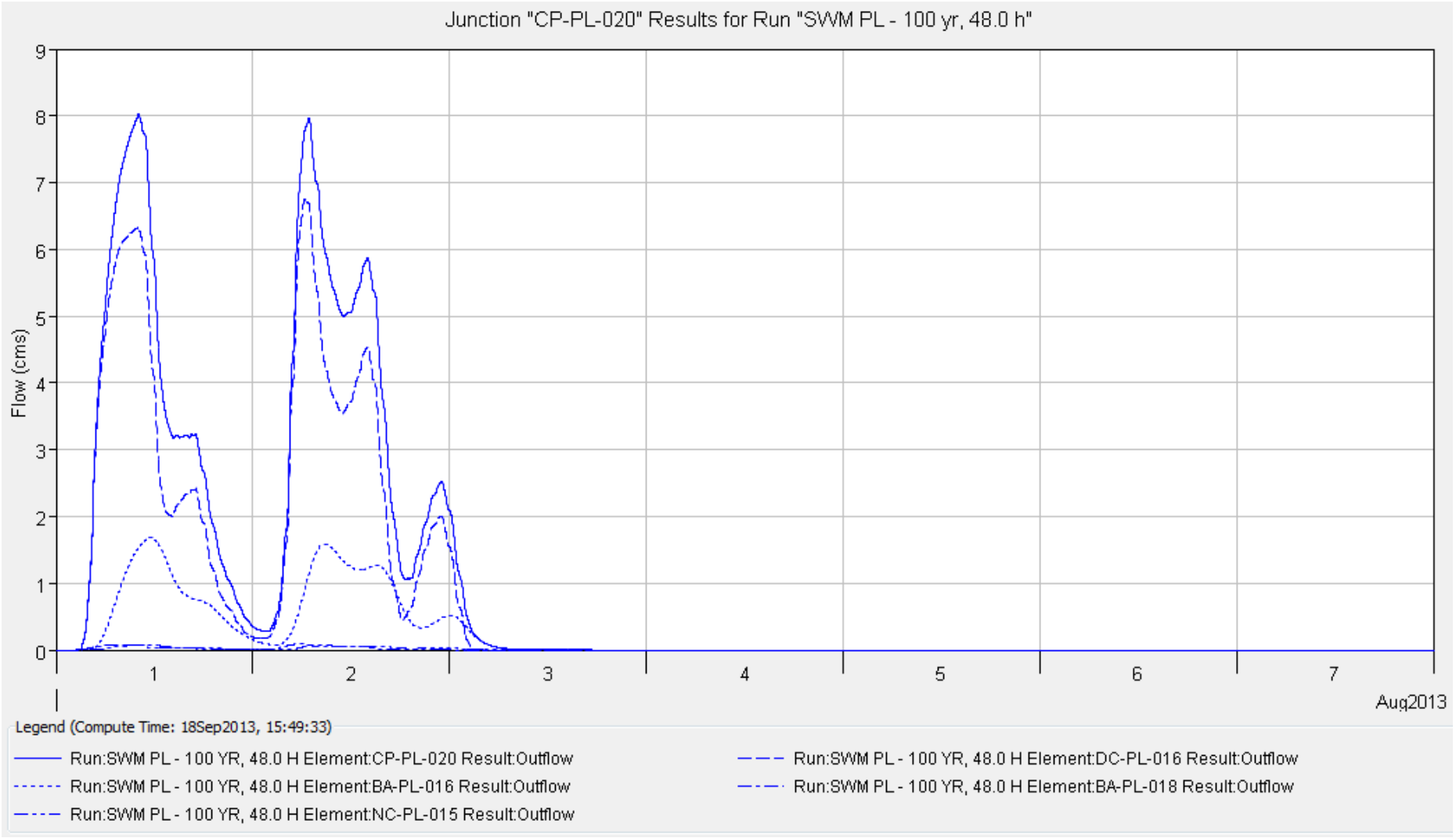

Junction "CP-PL-016B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-011 Result:Outflow

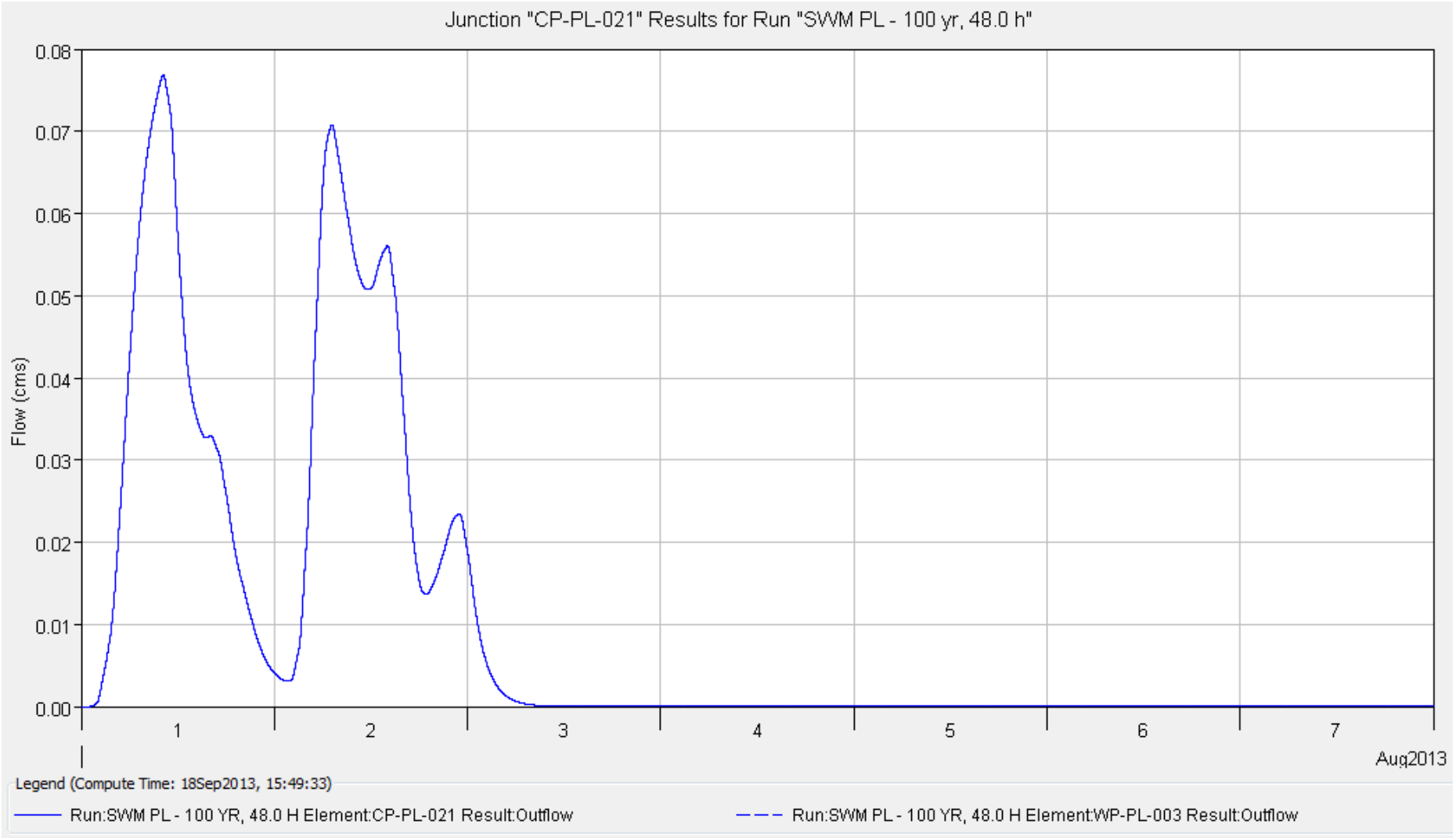

Junction "CP-PL-016C" Results for Run "SWM PL - 100 yr, 48.0 h"
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Flow (cms)
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-016C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-012 Result:Outflow

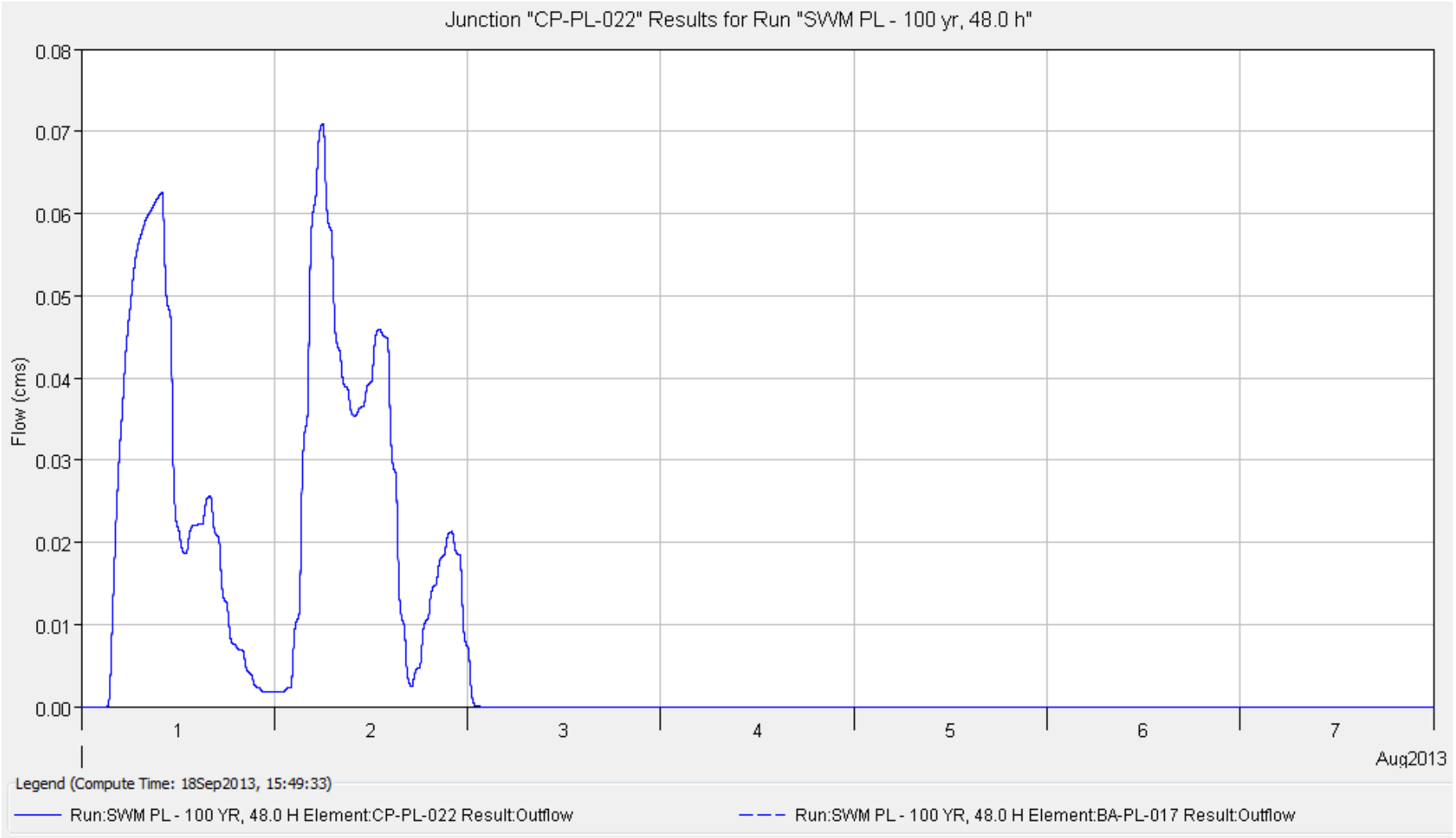

Junction "CP-PL-017" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-012 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-013 Result:Outflow

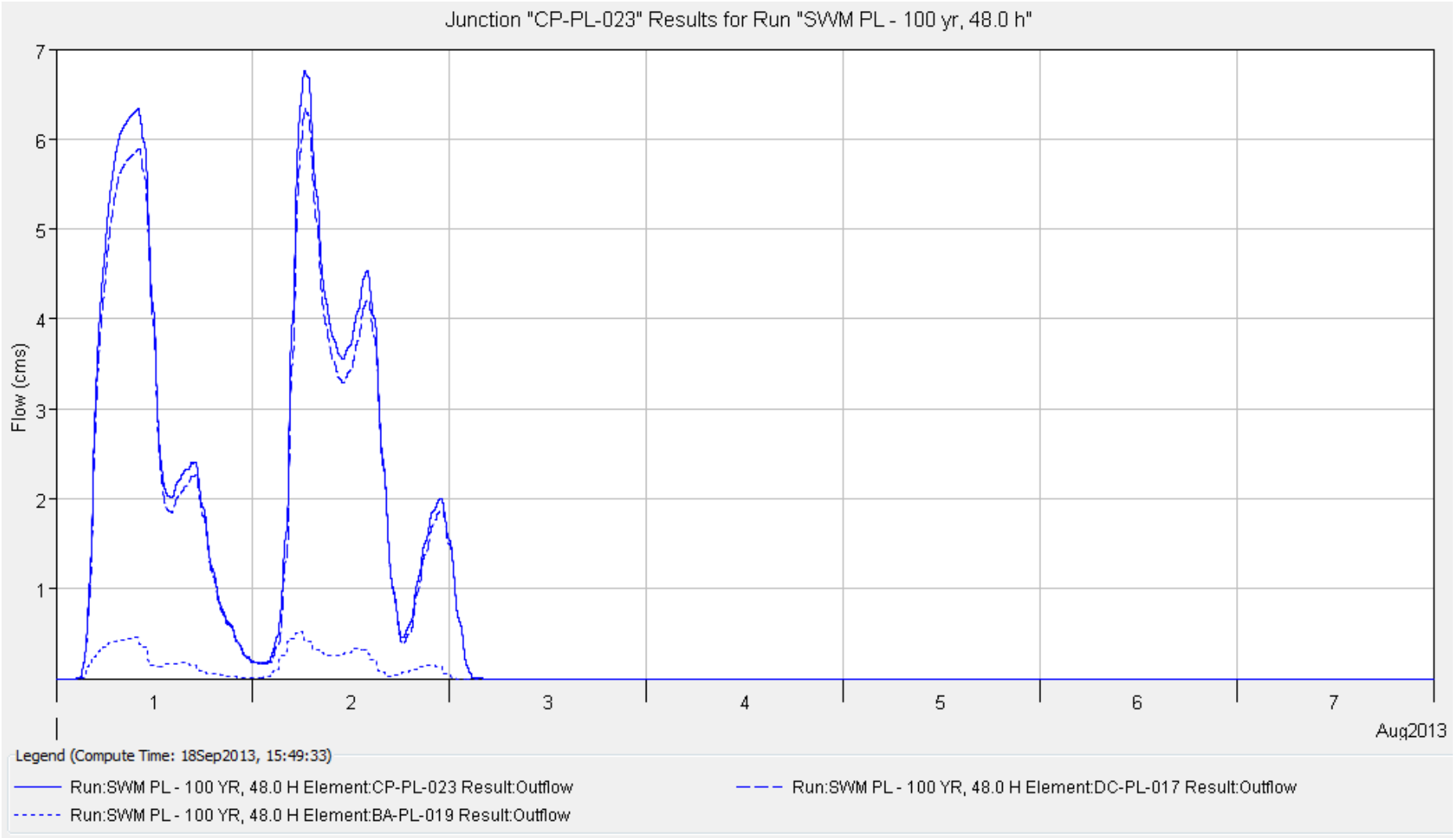

Junction "CP-PL-018" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-014 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-015 Result:Outflow

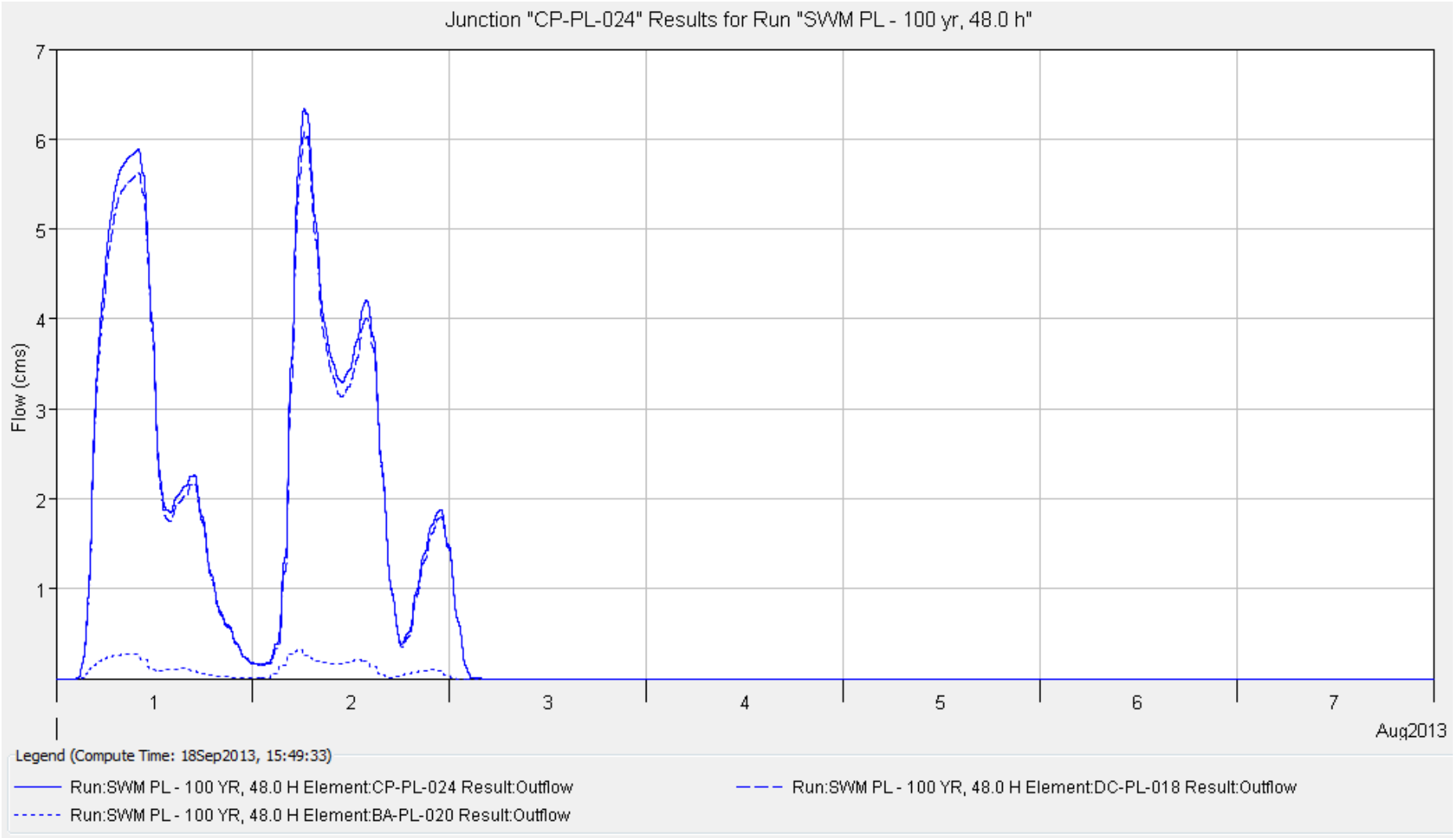

Junction "CP-PL-019" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-014 Result:Outflow

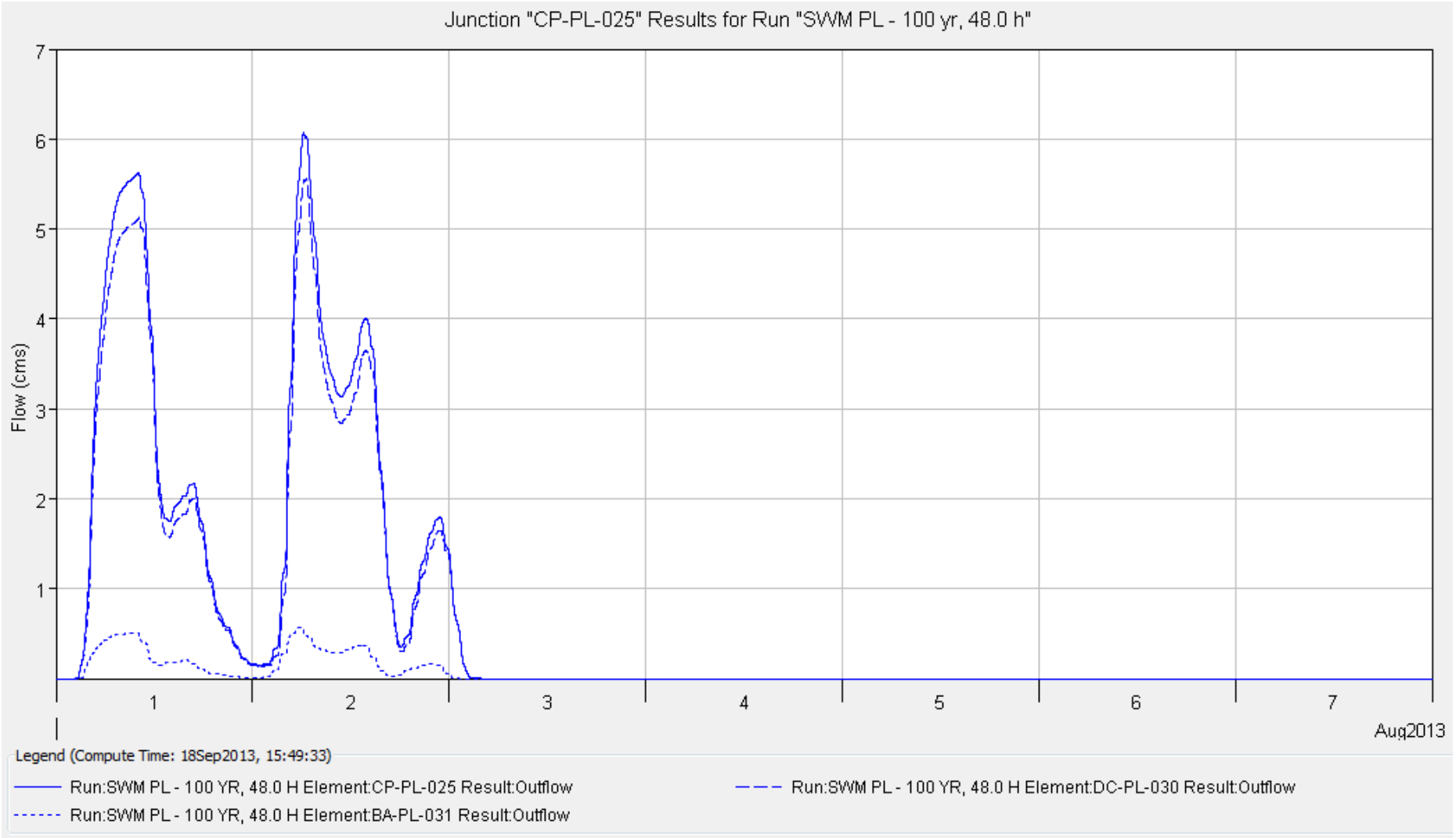

Junction "CP-PL-020" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-015 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-016 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-018 Result:Outflow

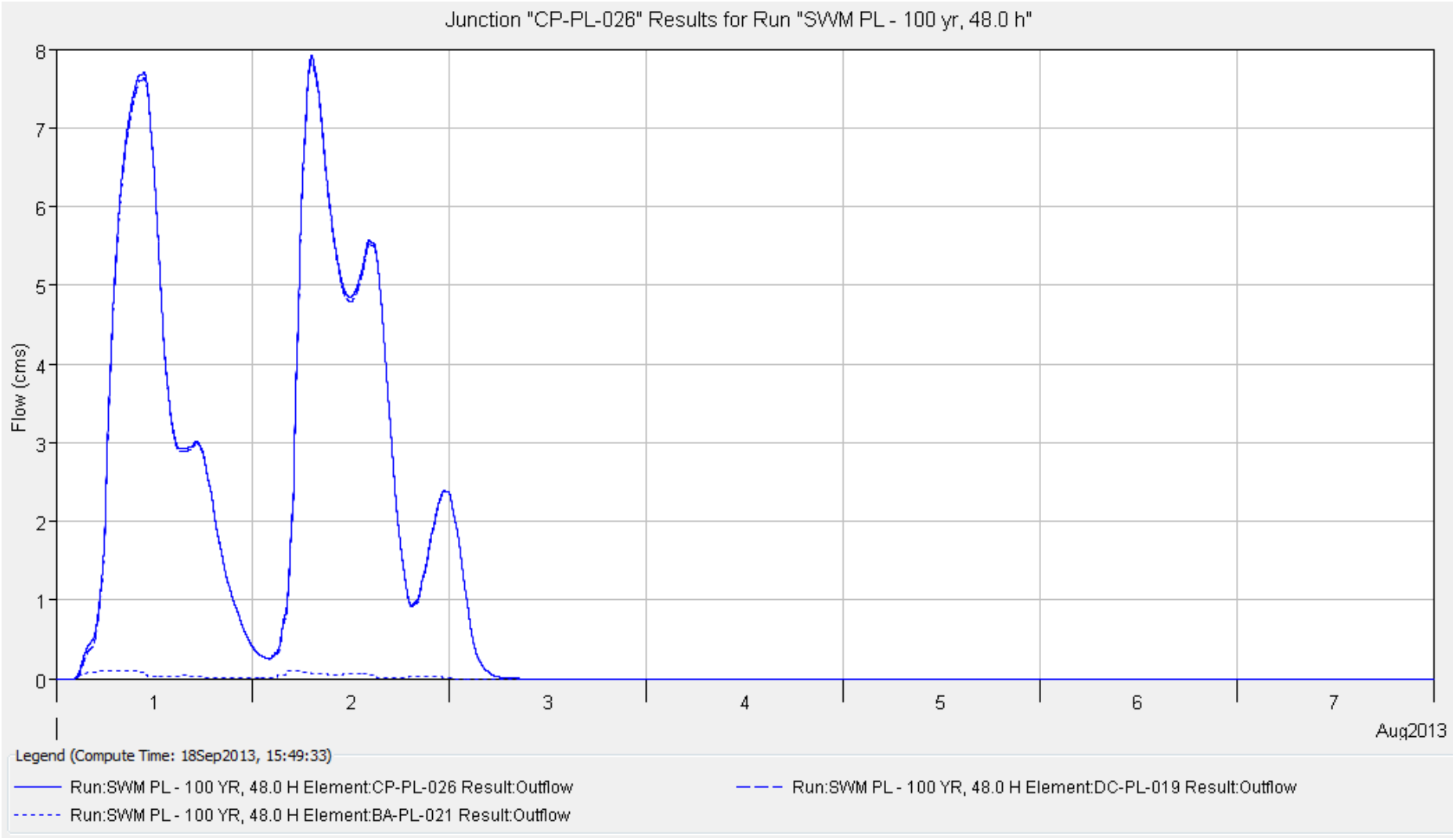

Junction "CP-PL-021" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Outflow

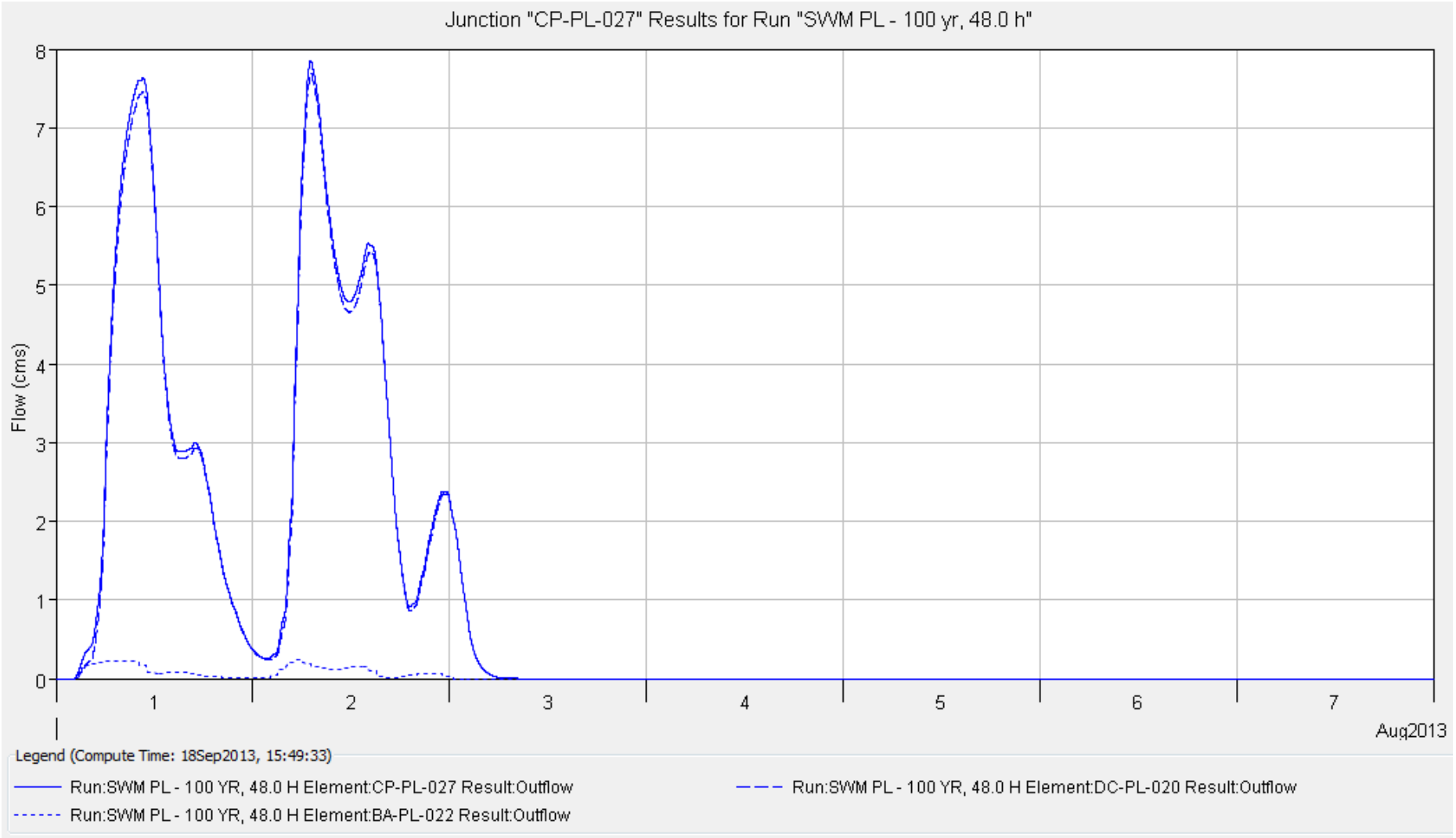

Junction "CP-PL-022" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-017 Result:Outflow

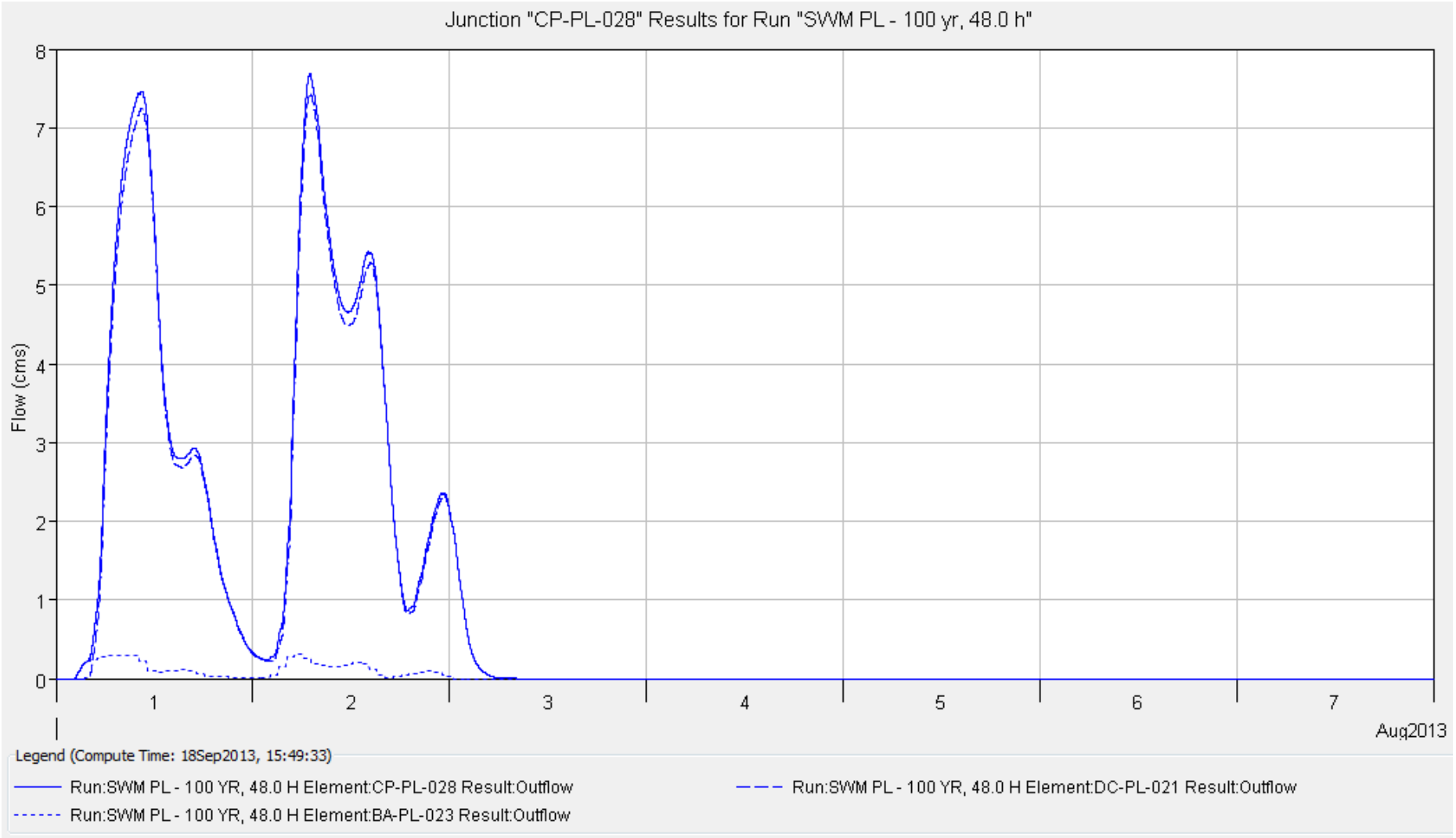

Junction "CP-PL-023" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-017 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-019 Result:Outflow

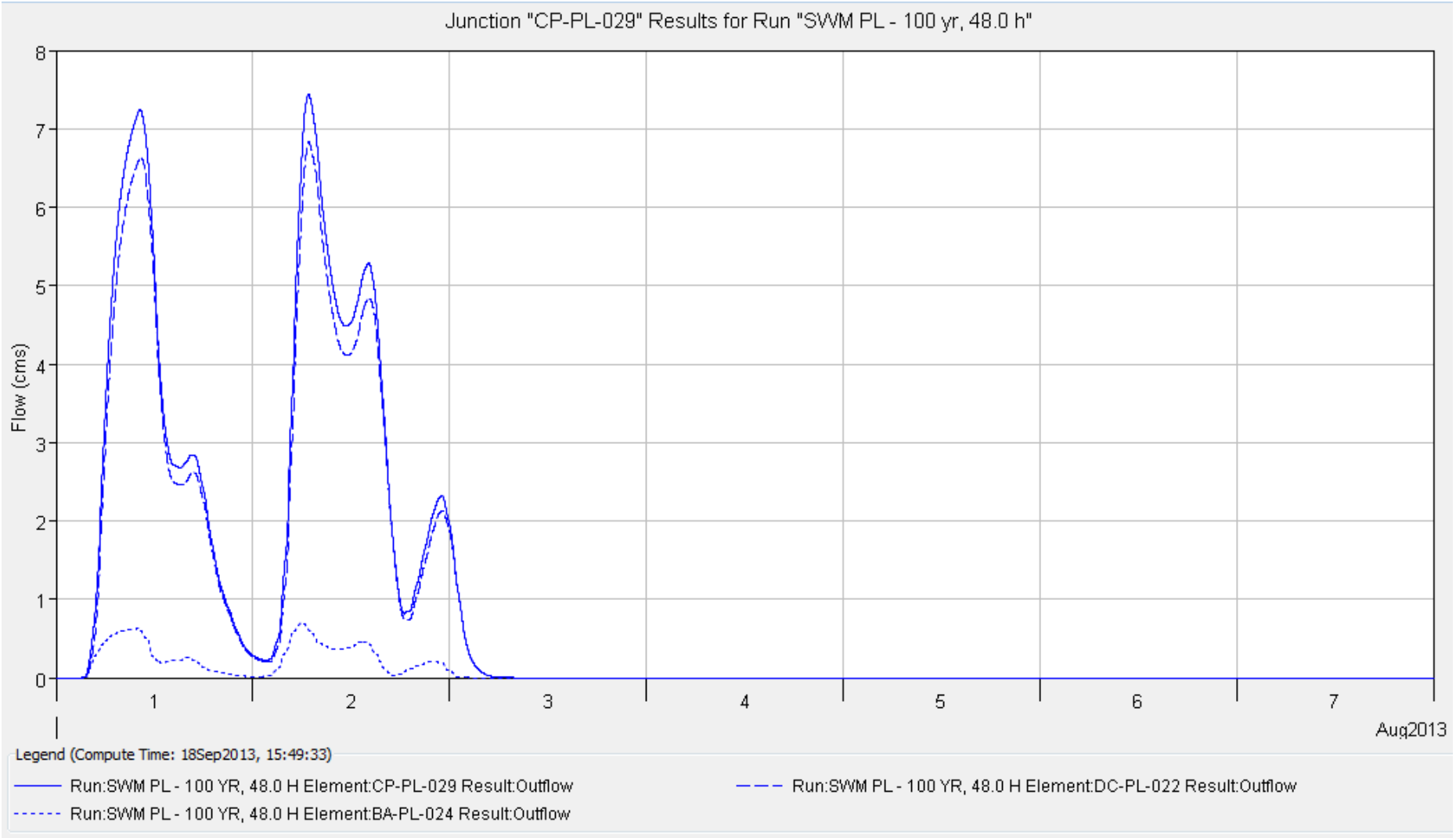

Junction "CP-PL-024" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-024 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-018 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-020 Result:Outflow

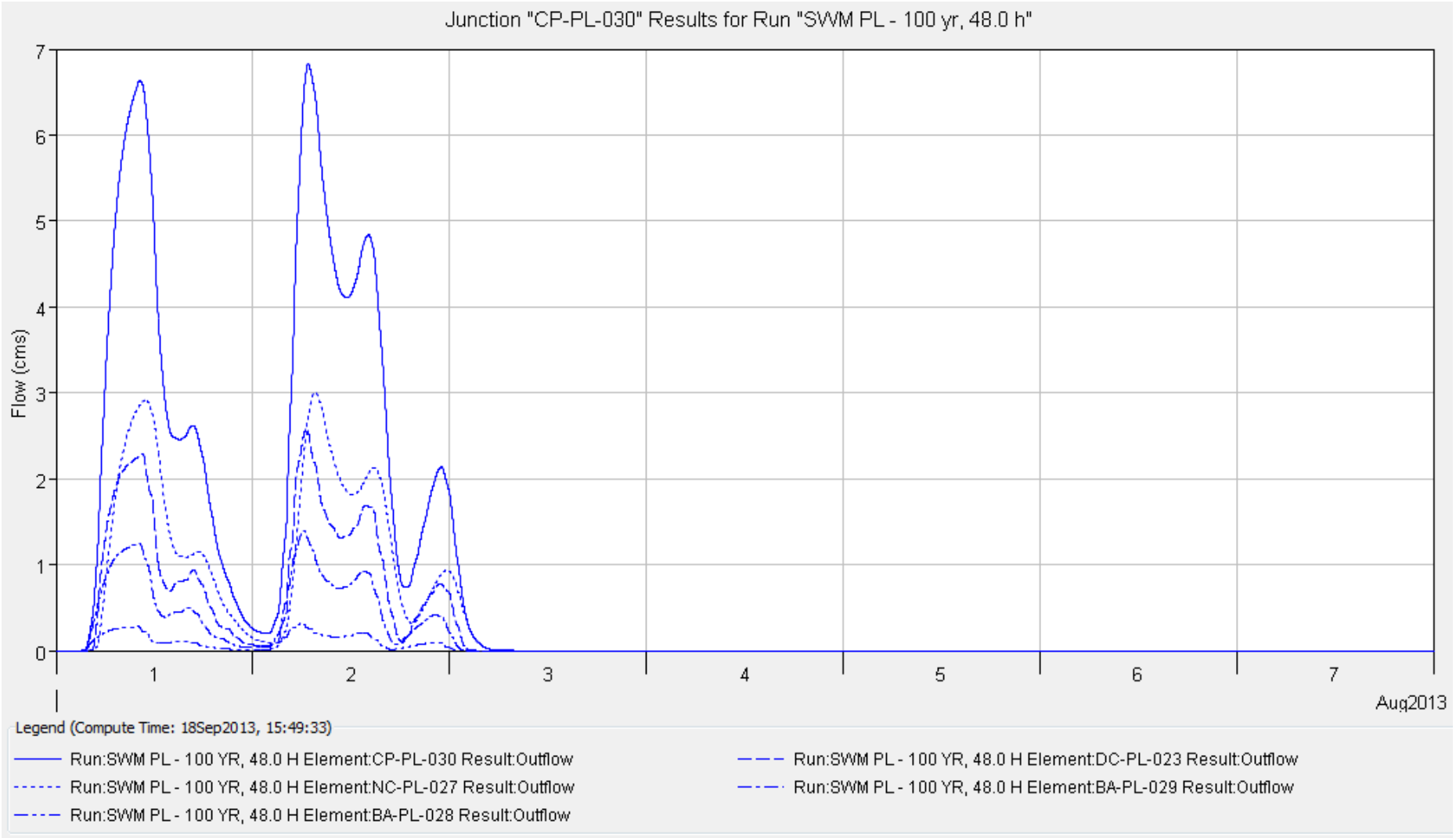

Junction "CP-PL-025" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-025 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-031 Result:Outflow

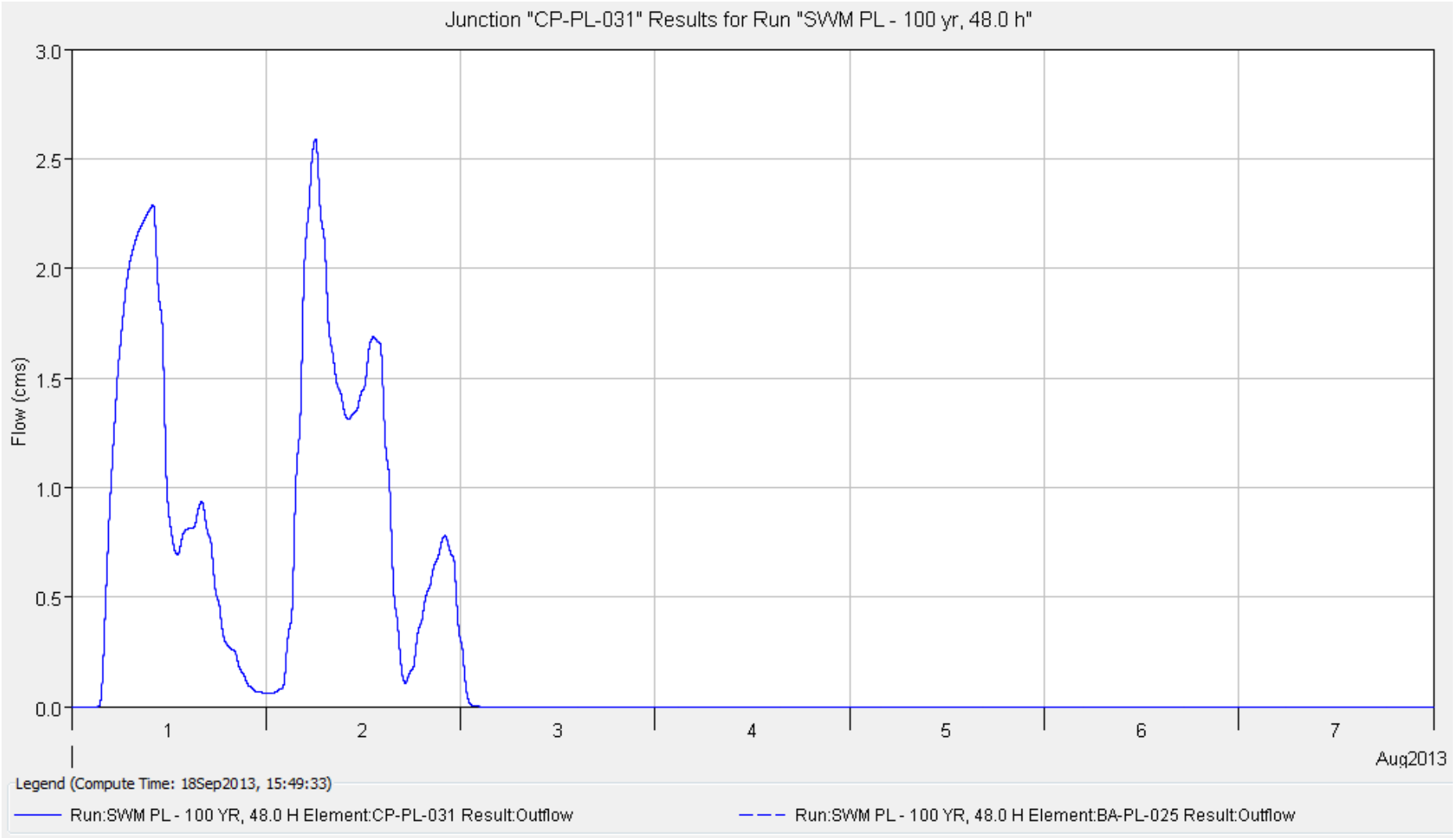

Junction "CP-PL-026" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-019 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-021 Result:Outflow

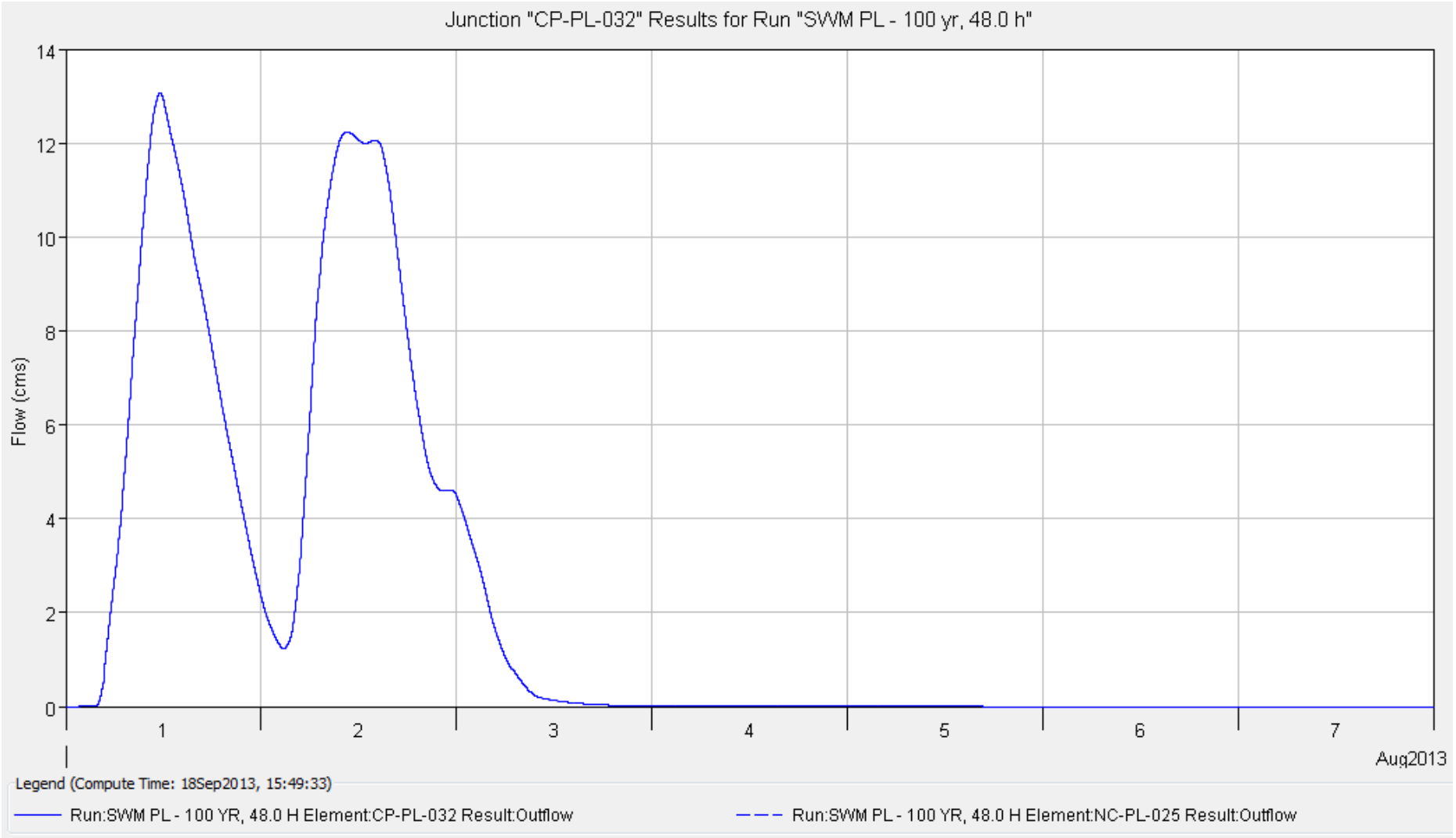

Junction "CP-PL-027" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-020 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-022 Result:Outflow

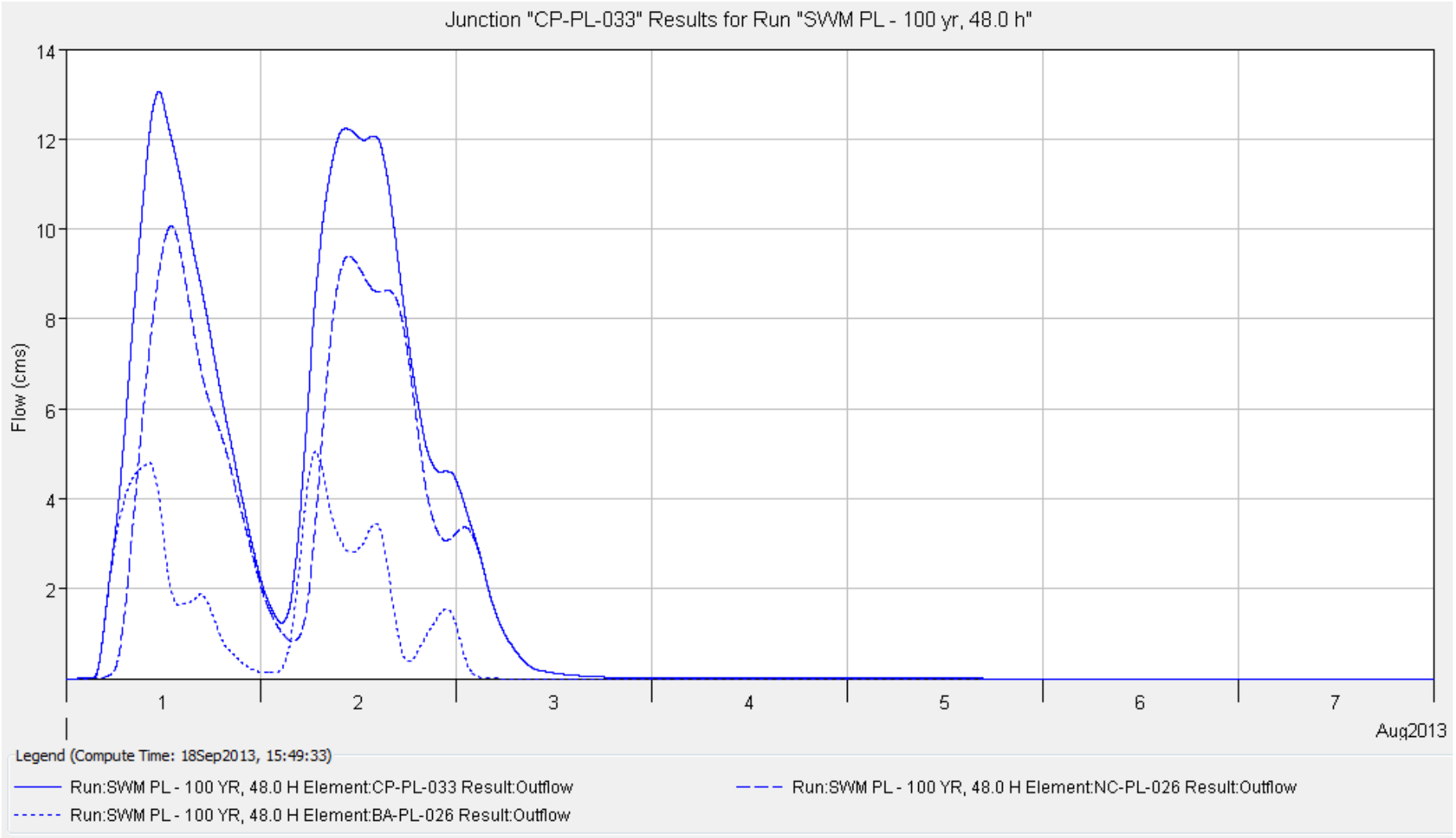

Junction "CP-PL-028" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-021 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-023 Result:Outflow

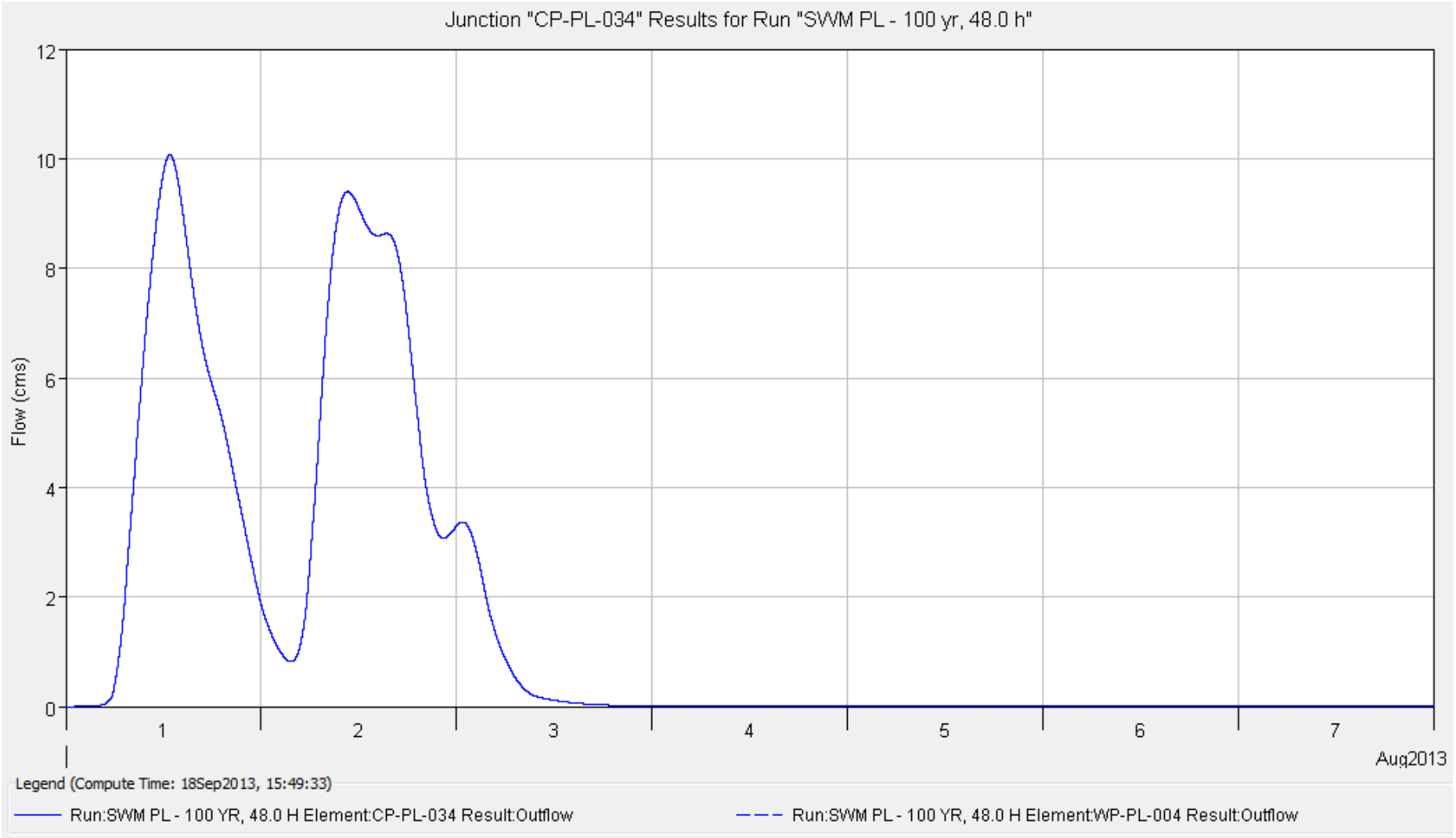

Junction "CP-PL-029" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-029 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-022 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-024 Result:Outflow

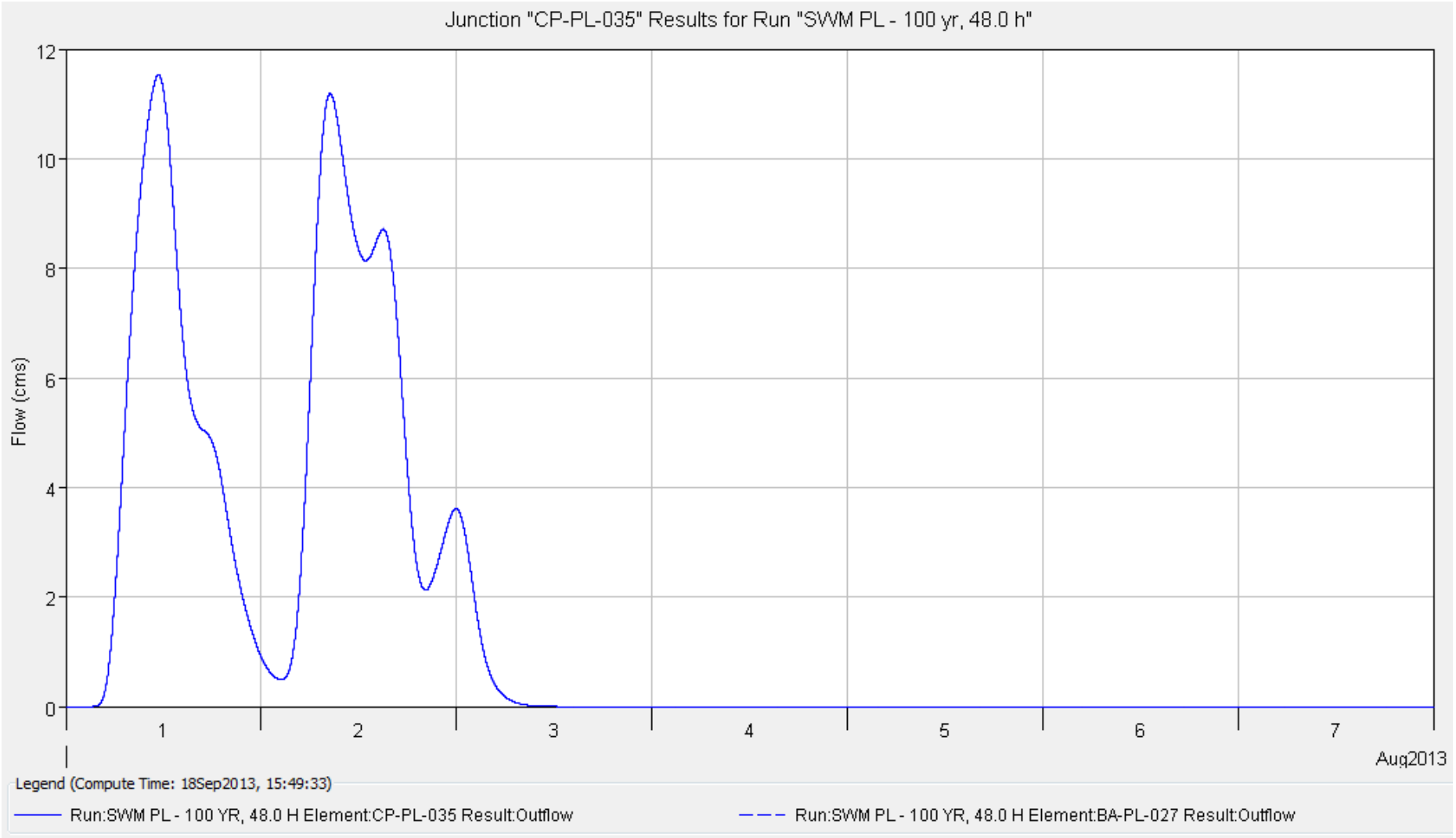

Junction "CP-PL-030" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-030 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-027 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-028 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-023 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-029 Result:Outflow

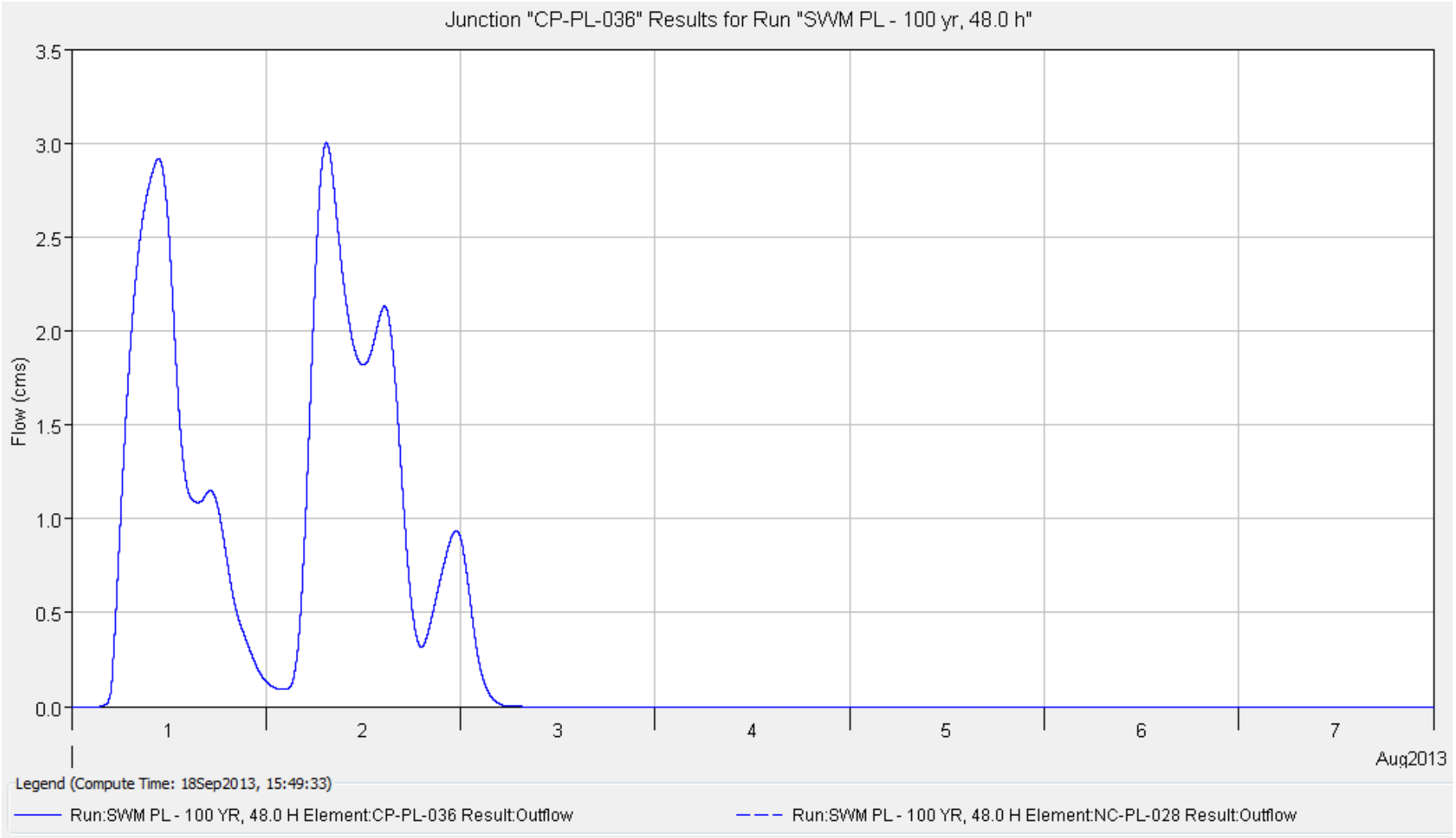

Junction "CP-PL-031" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-031 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-025 Result:Outflow

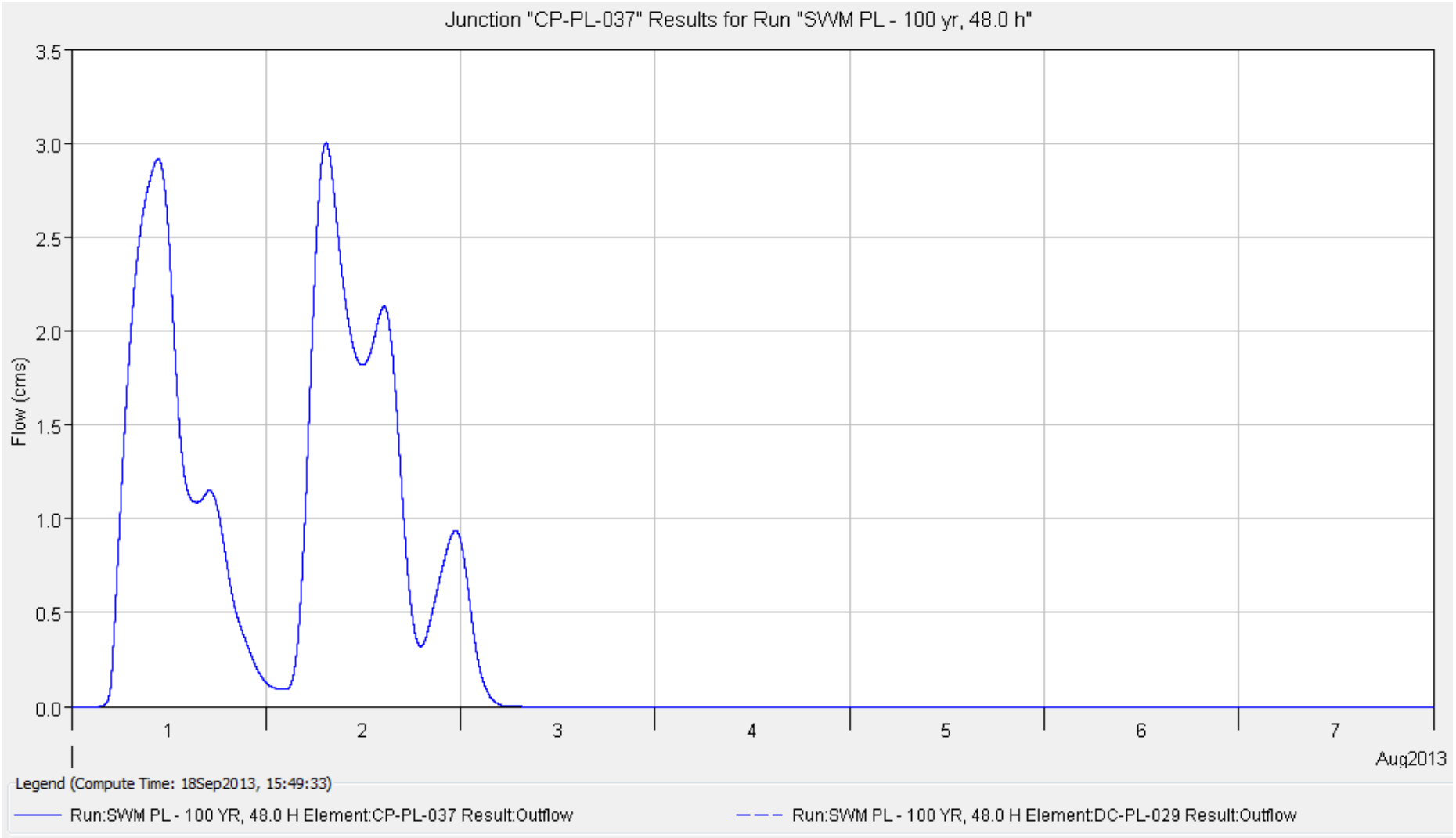

Junction "CP-PL-032" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-032 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-025 Result:Outflow

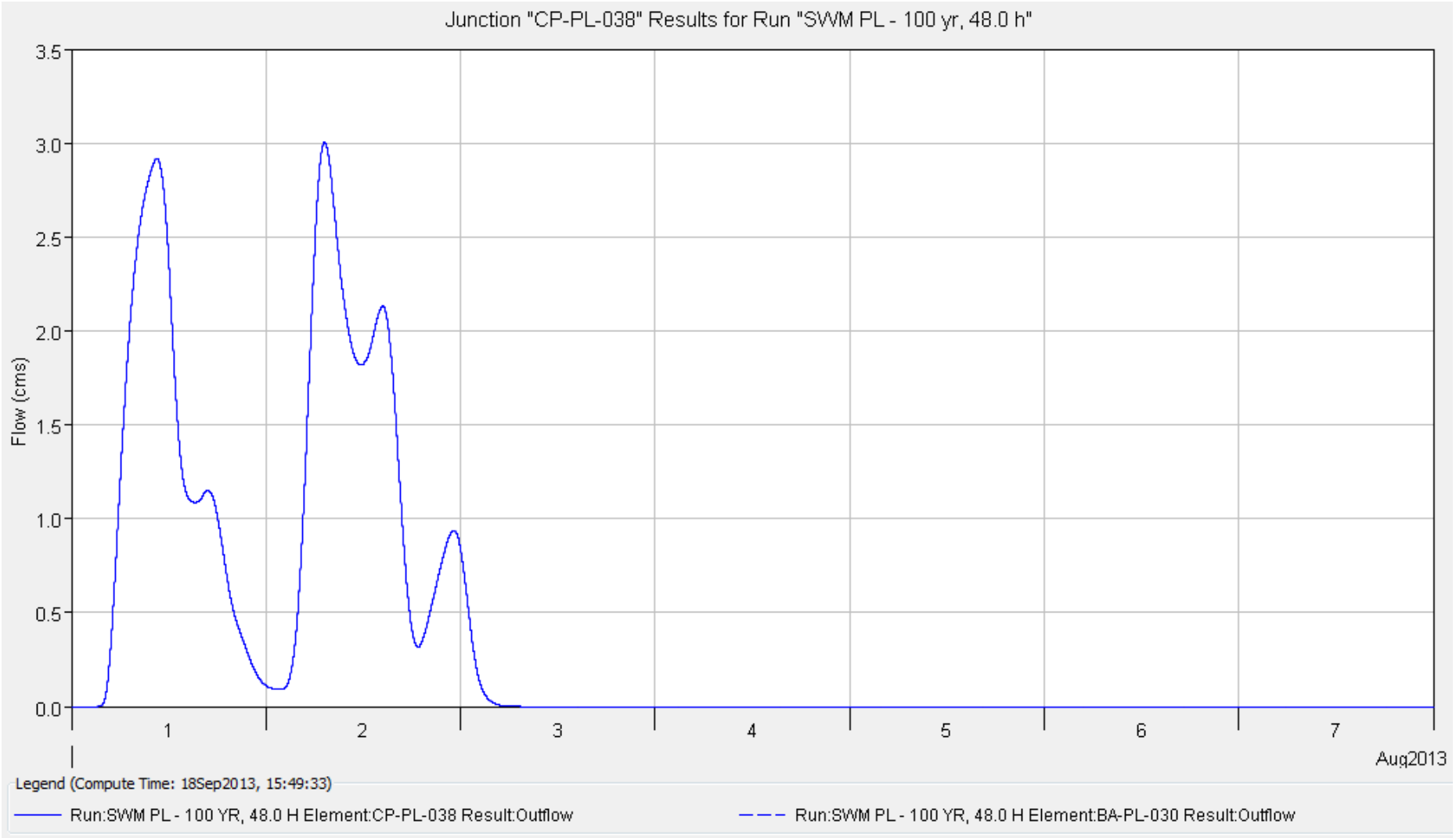

Junction "CP-PL-033" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-033 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-026 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-026 Result:Outflow

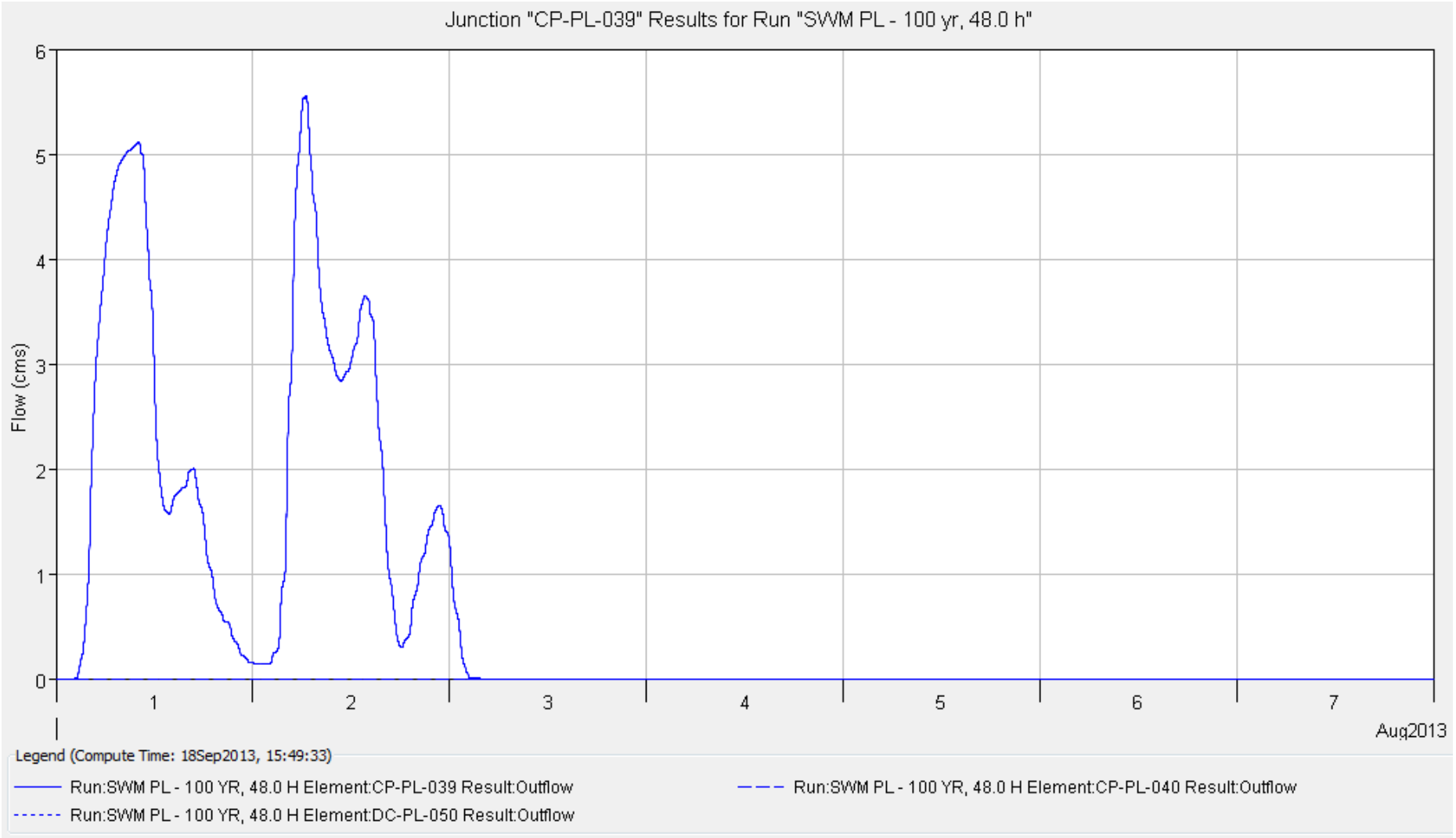

Junction "CP-PL-034" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Outflow

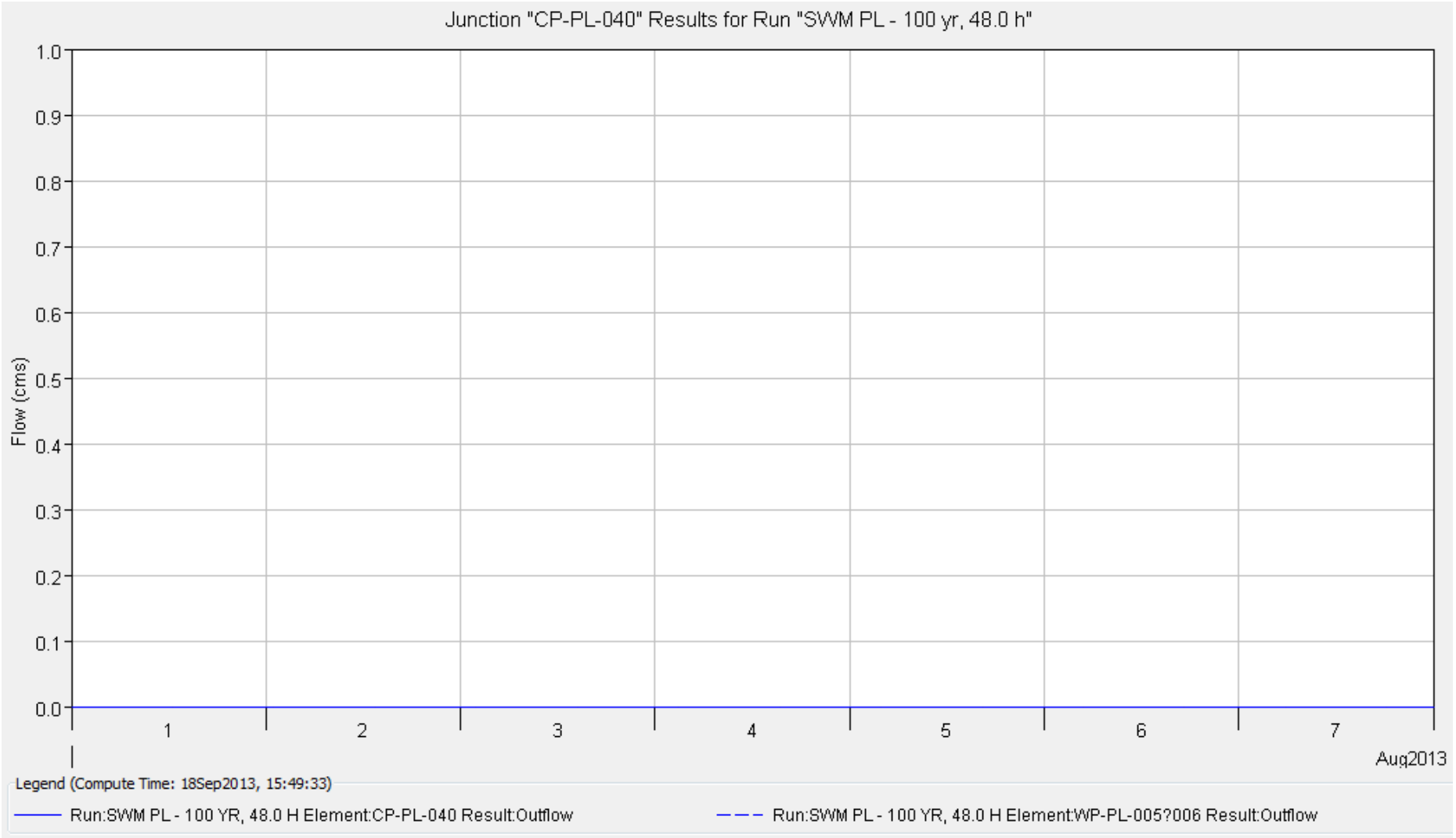

Junction "CP-PL-035" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-035 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-027 Result:Outflow

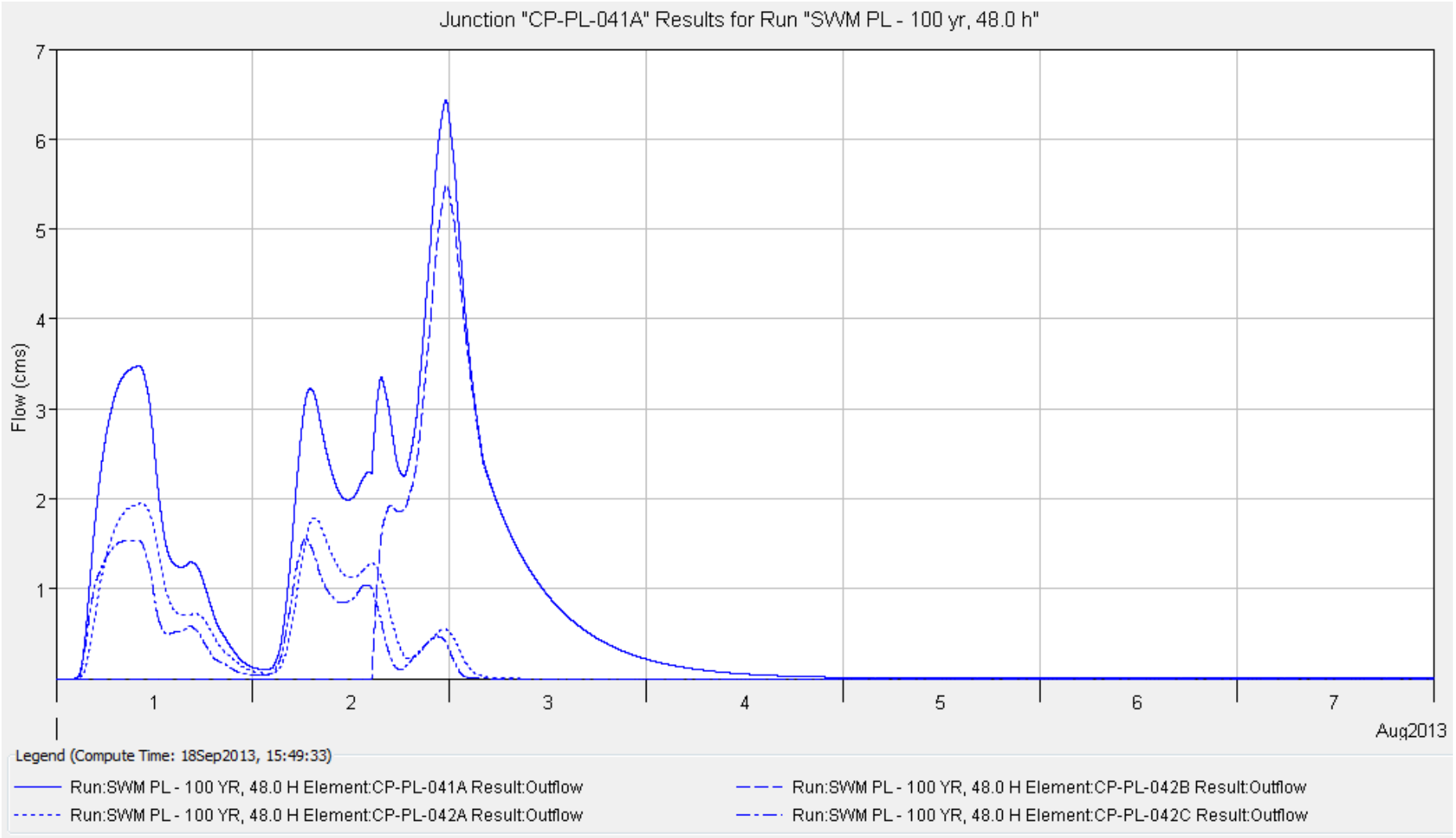

Junction "CP-PL-036" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-028 Result:Outflow

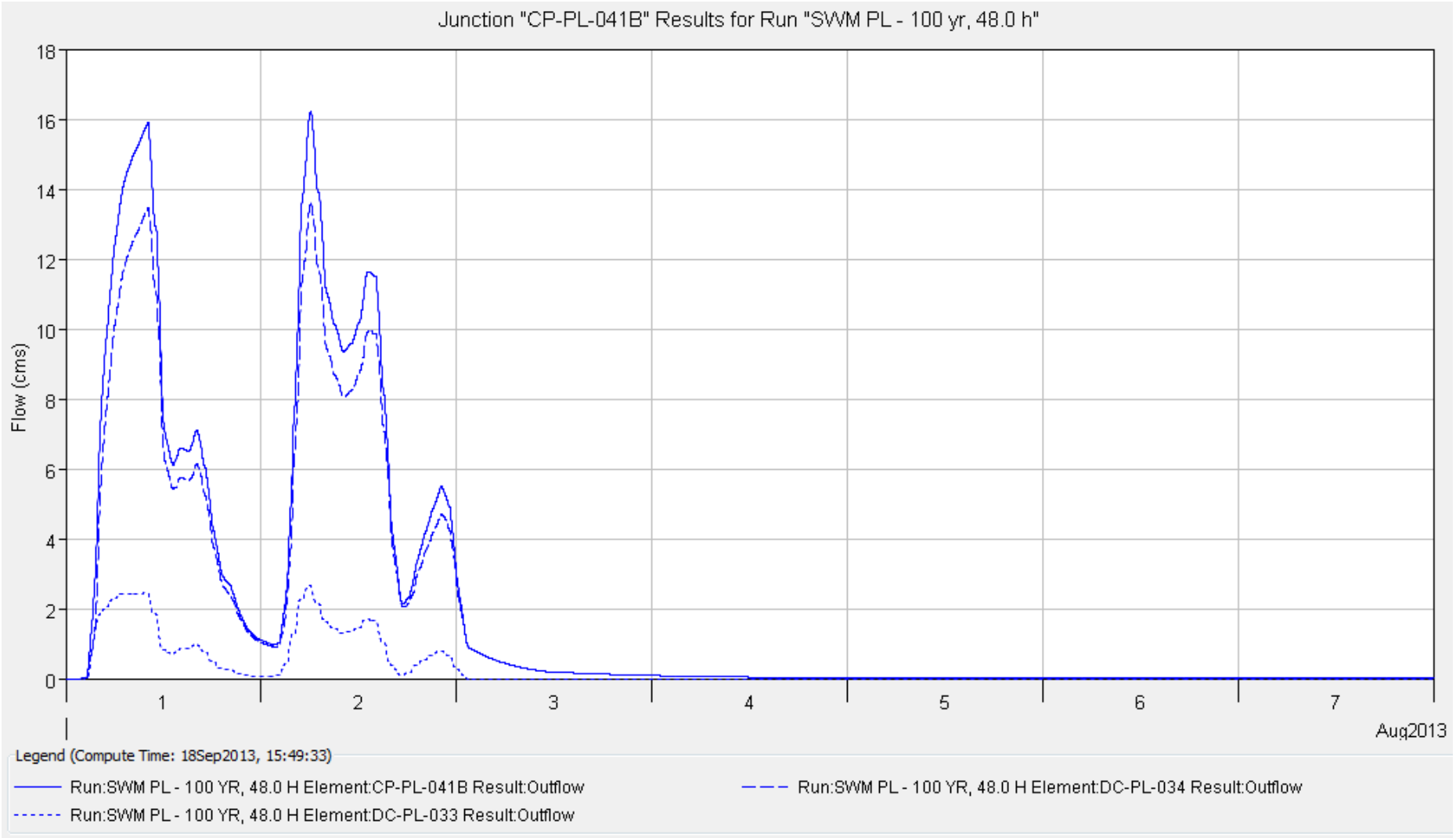

Junction "CP-PL-037" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-029 Result:Outflow

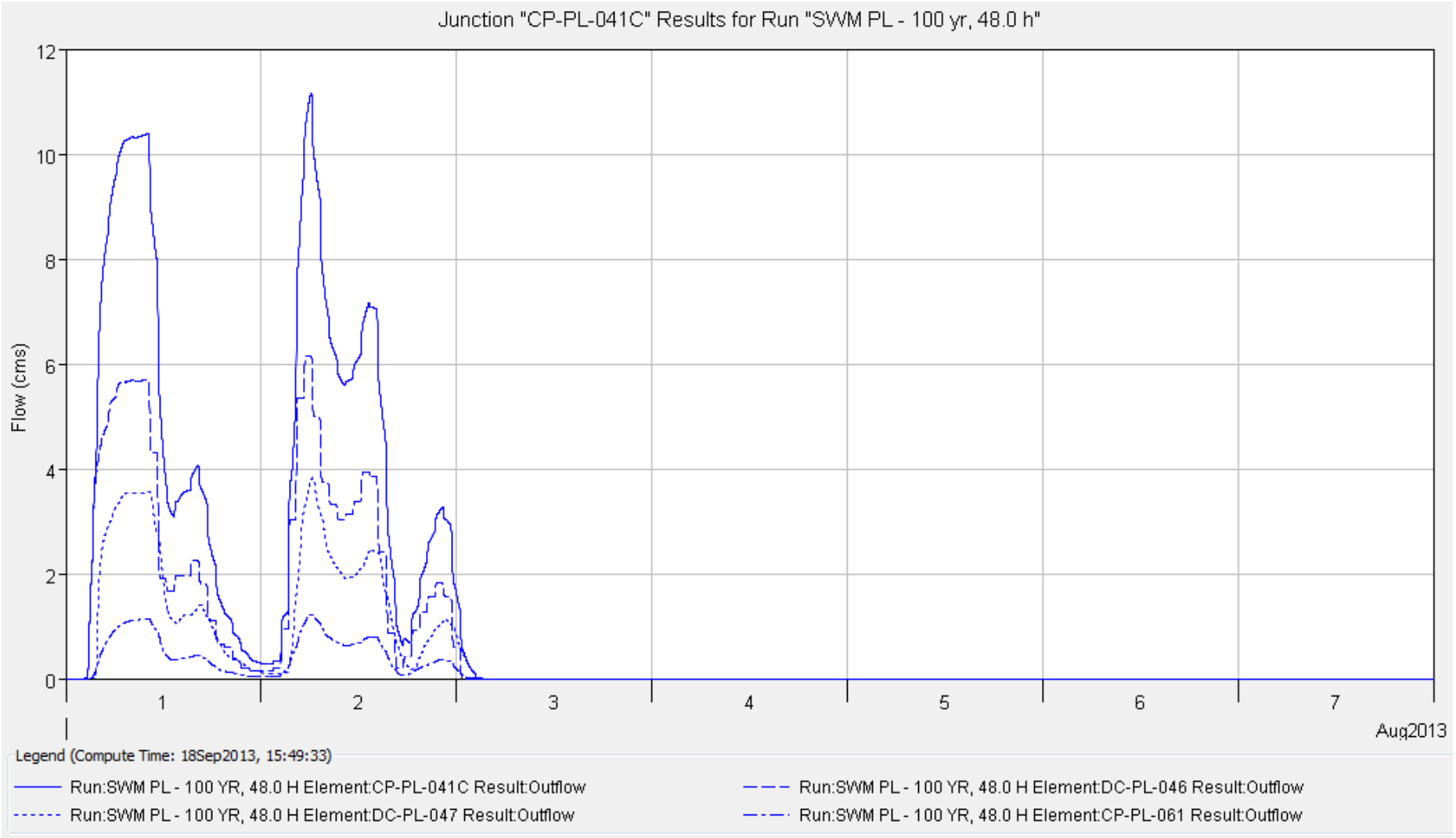

Junction "CP-PL-038" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-038 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-030 Result:Outflow

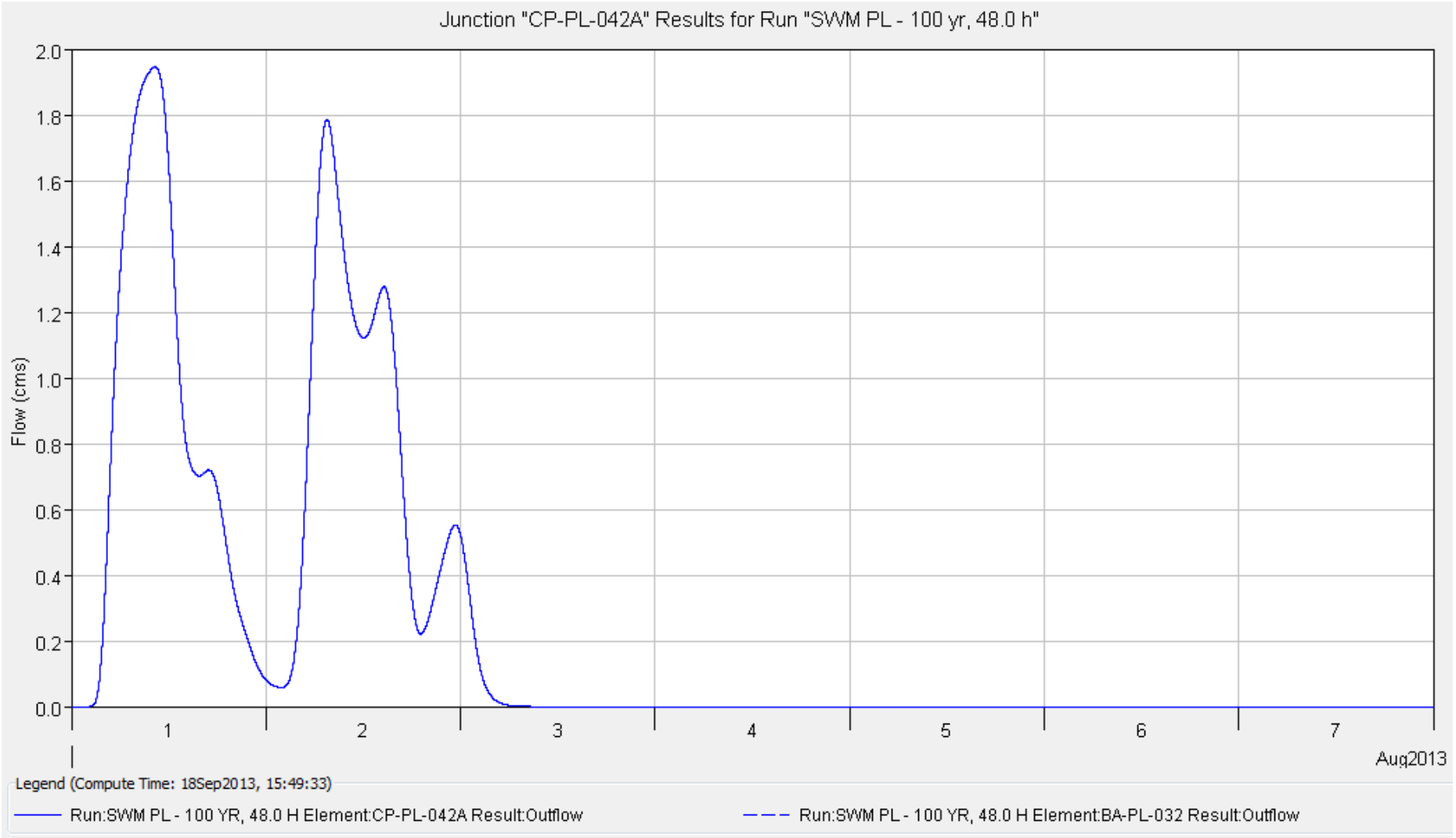

Junction "CP-PL-039" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-050 Result:Outflow

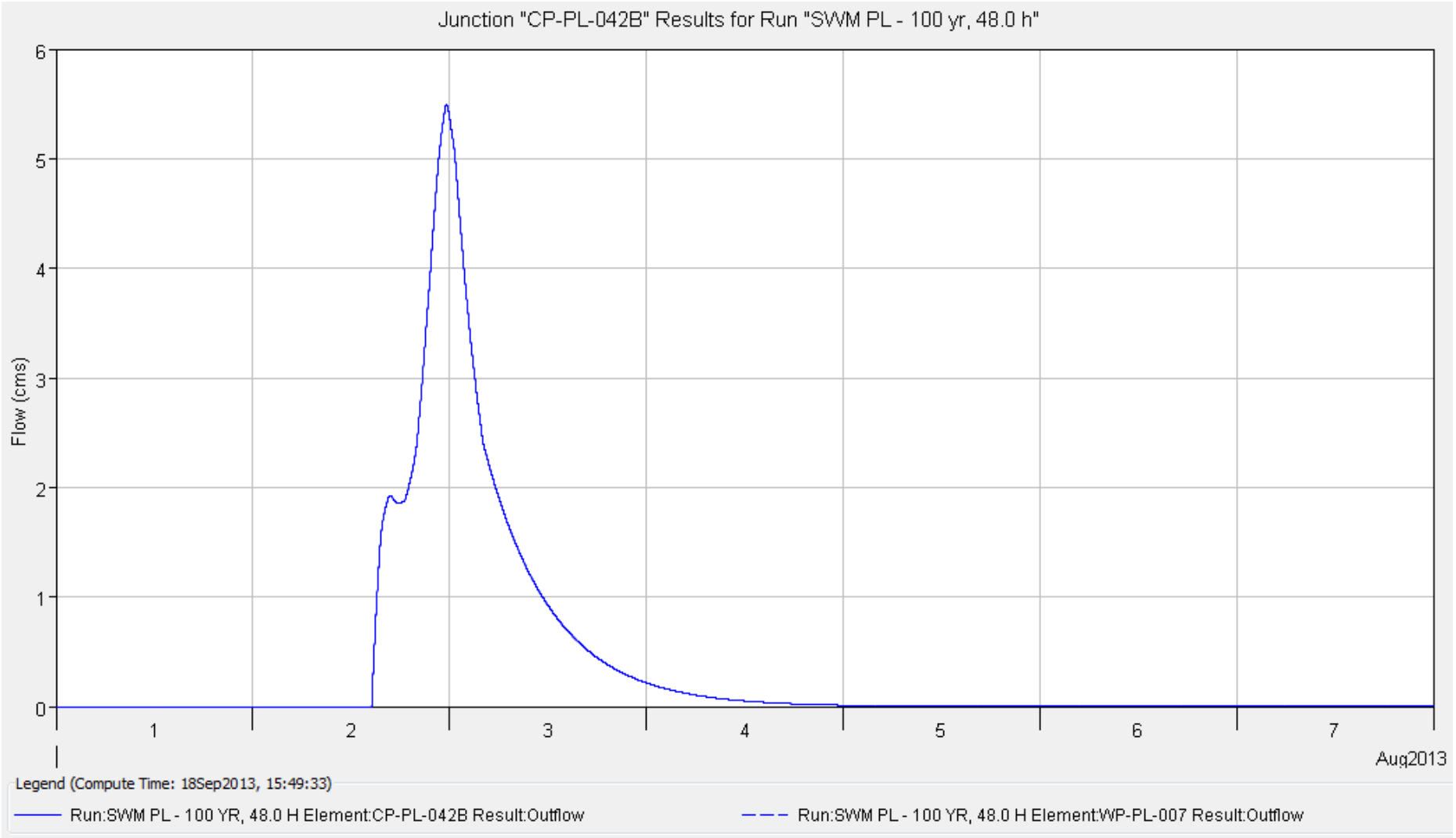

Junction "CP-PL-040" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Outflow

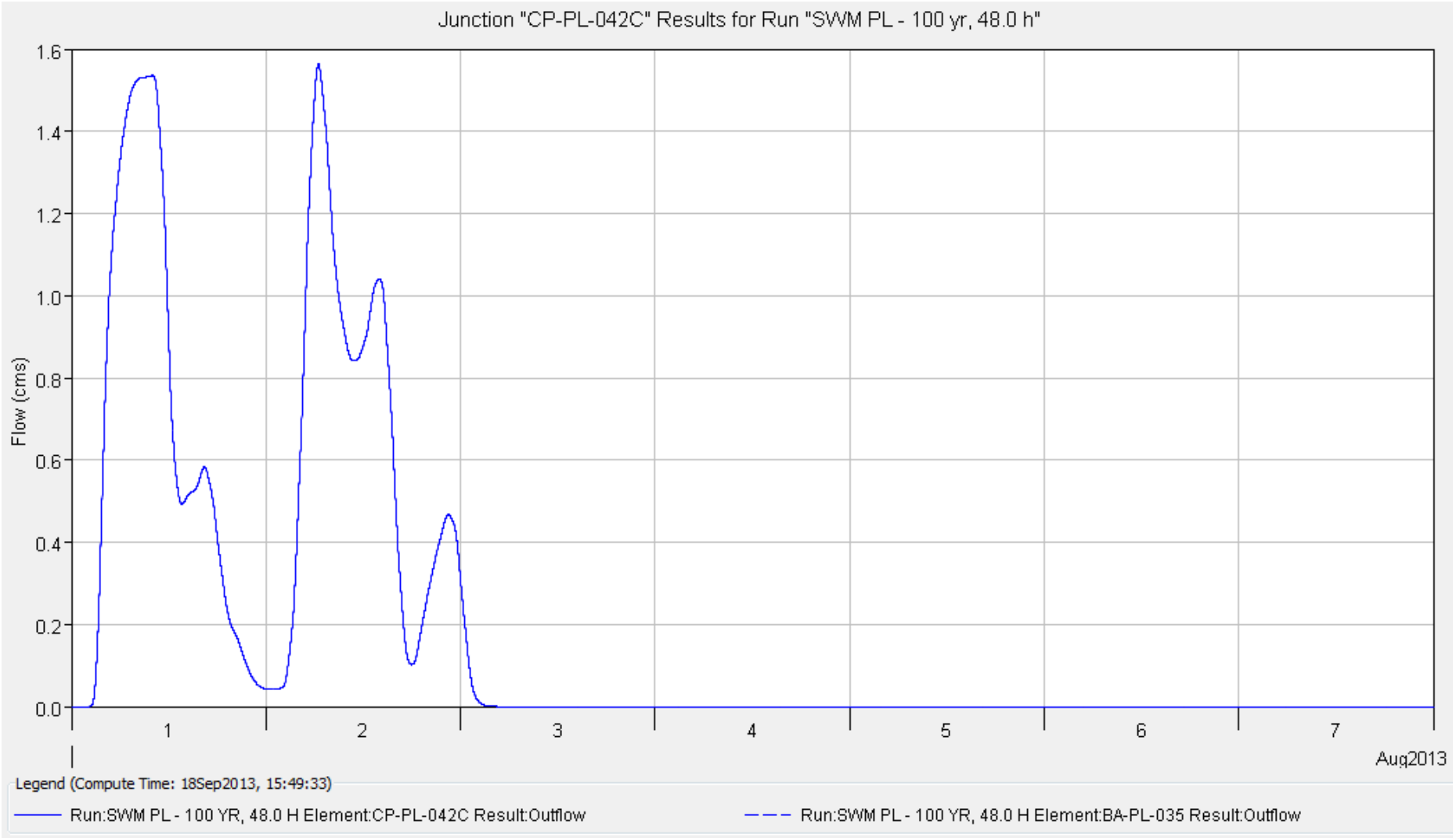

Junction "CP-PL-041A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042C Result:Outflow

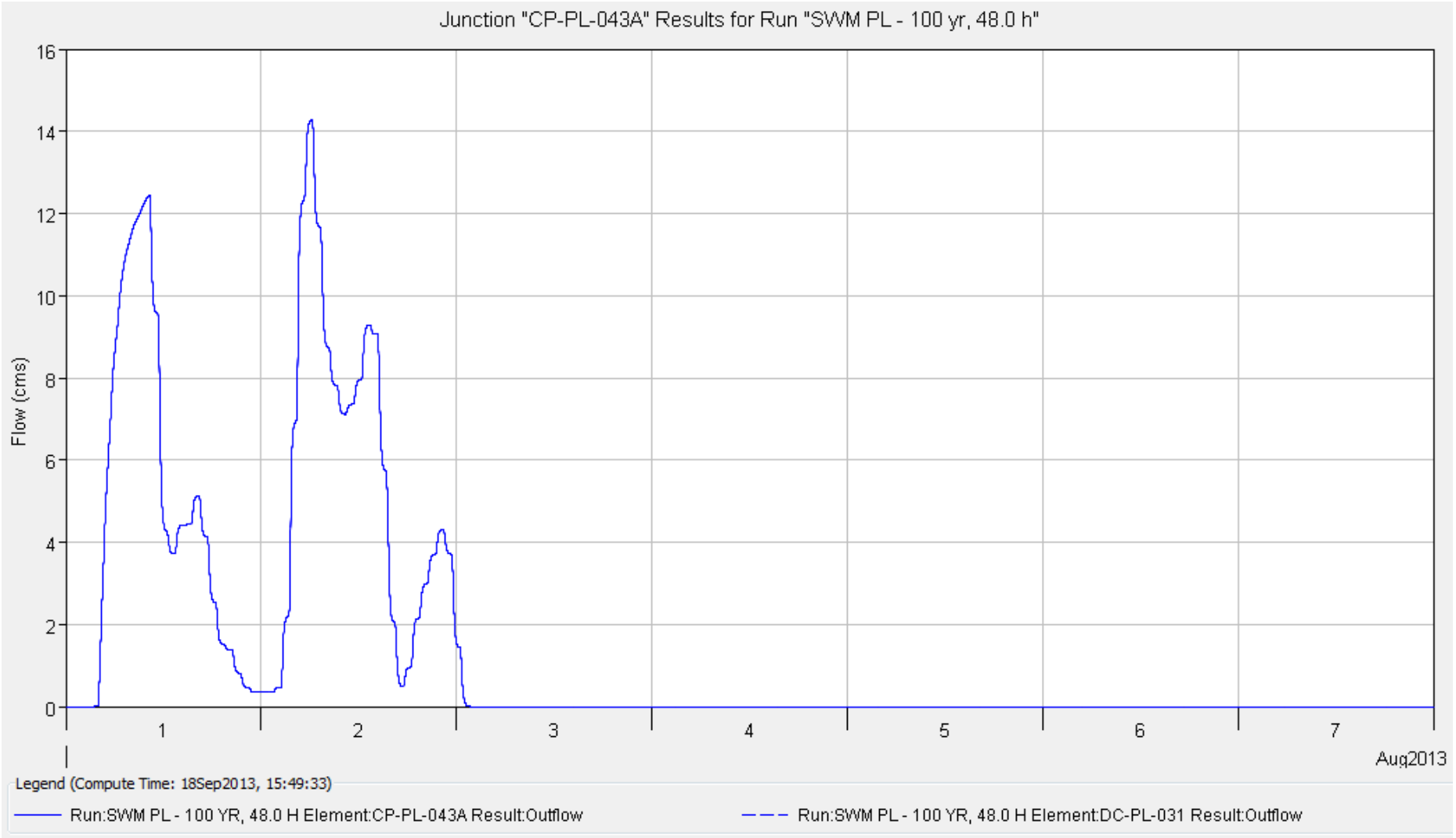

Junction "CP-PL-041B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-034 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-033 Result:Outflow

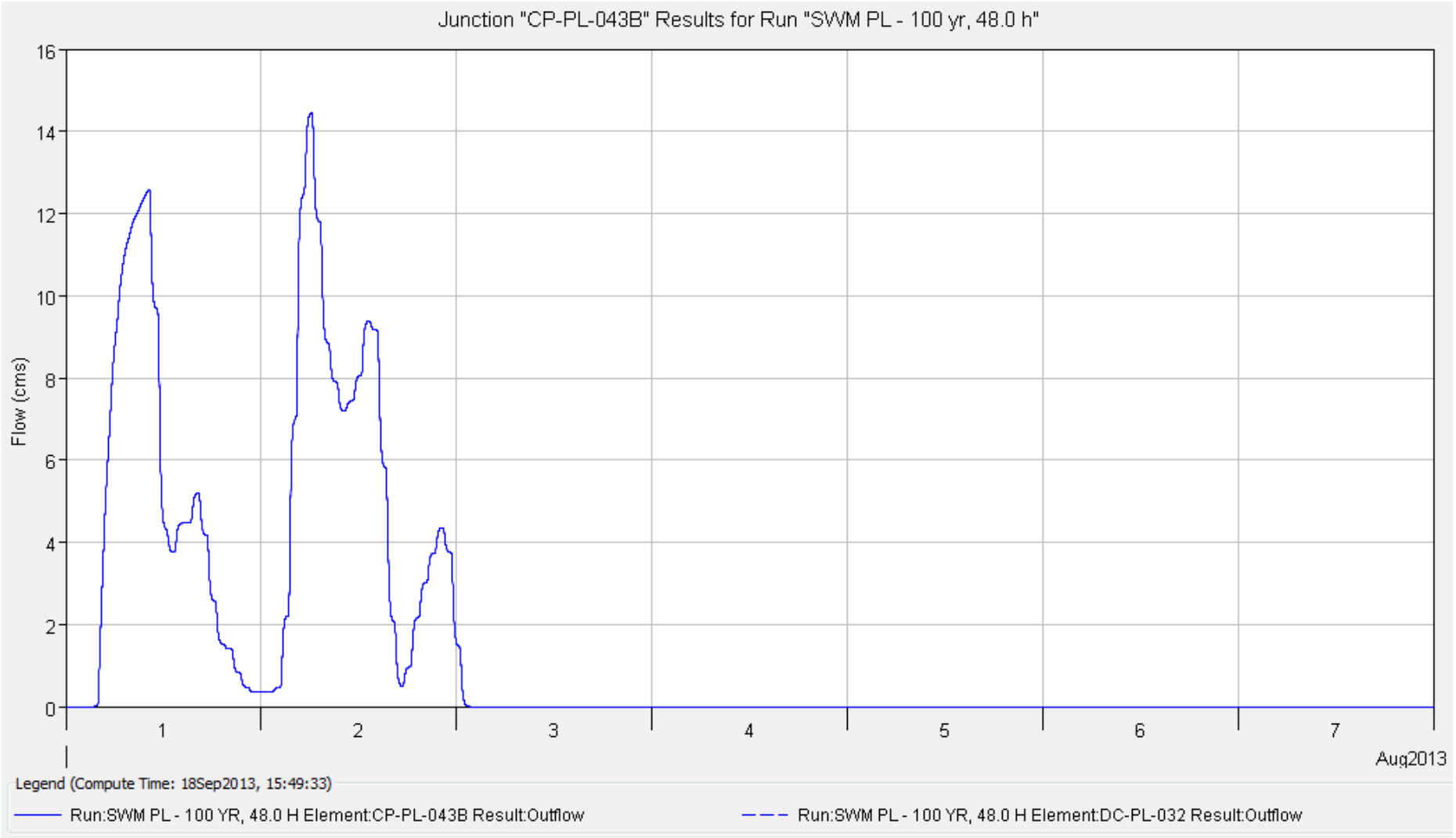

Junction "CP-PL-041C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-041C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-061 Result:Outflow

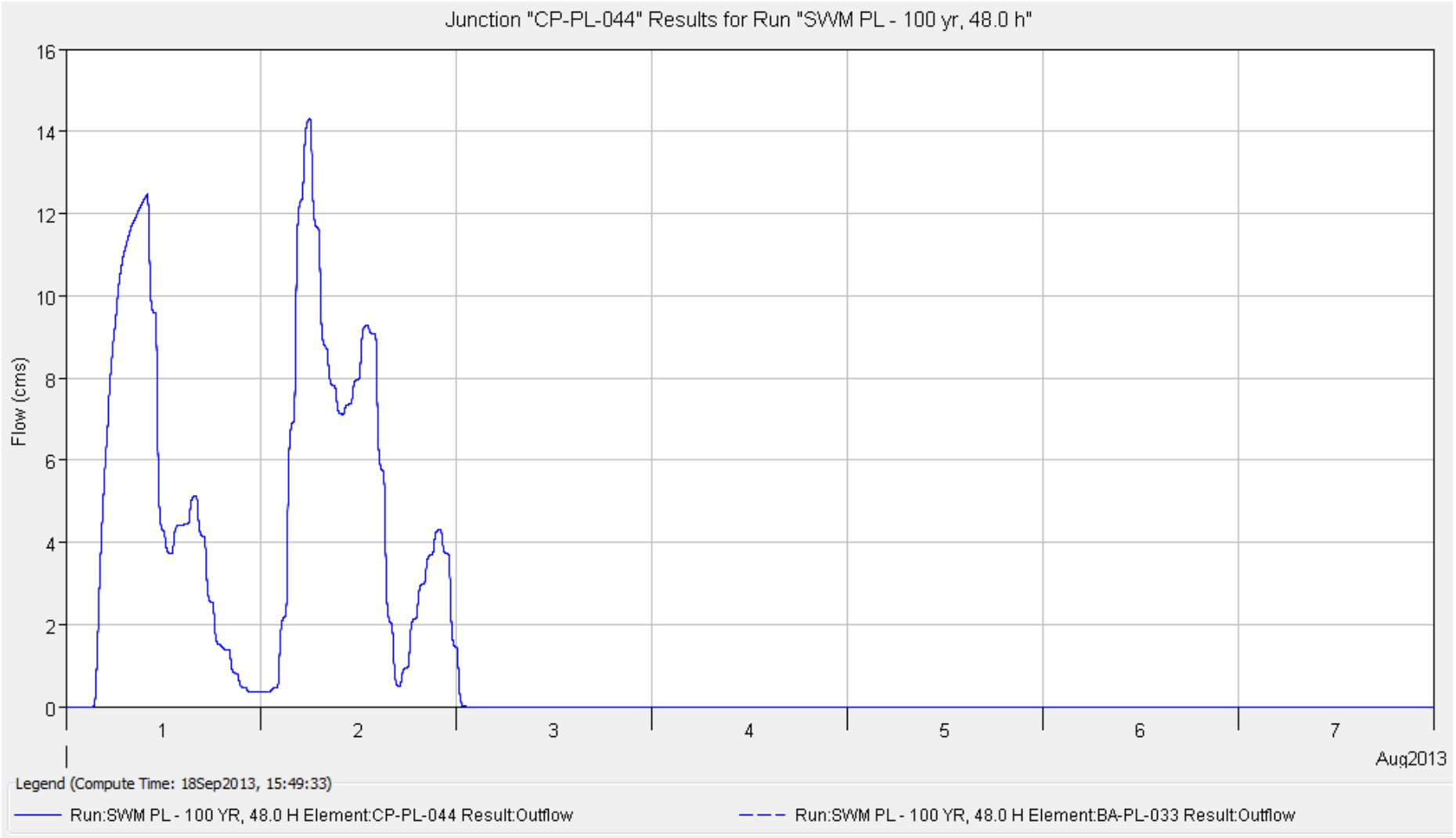

Junction "CP-PL-042A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-032 Result:Outflow

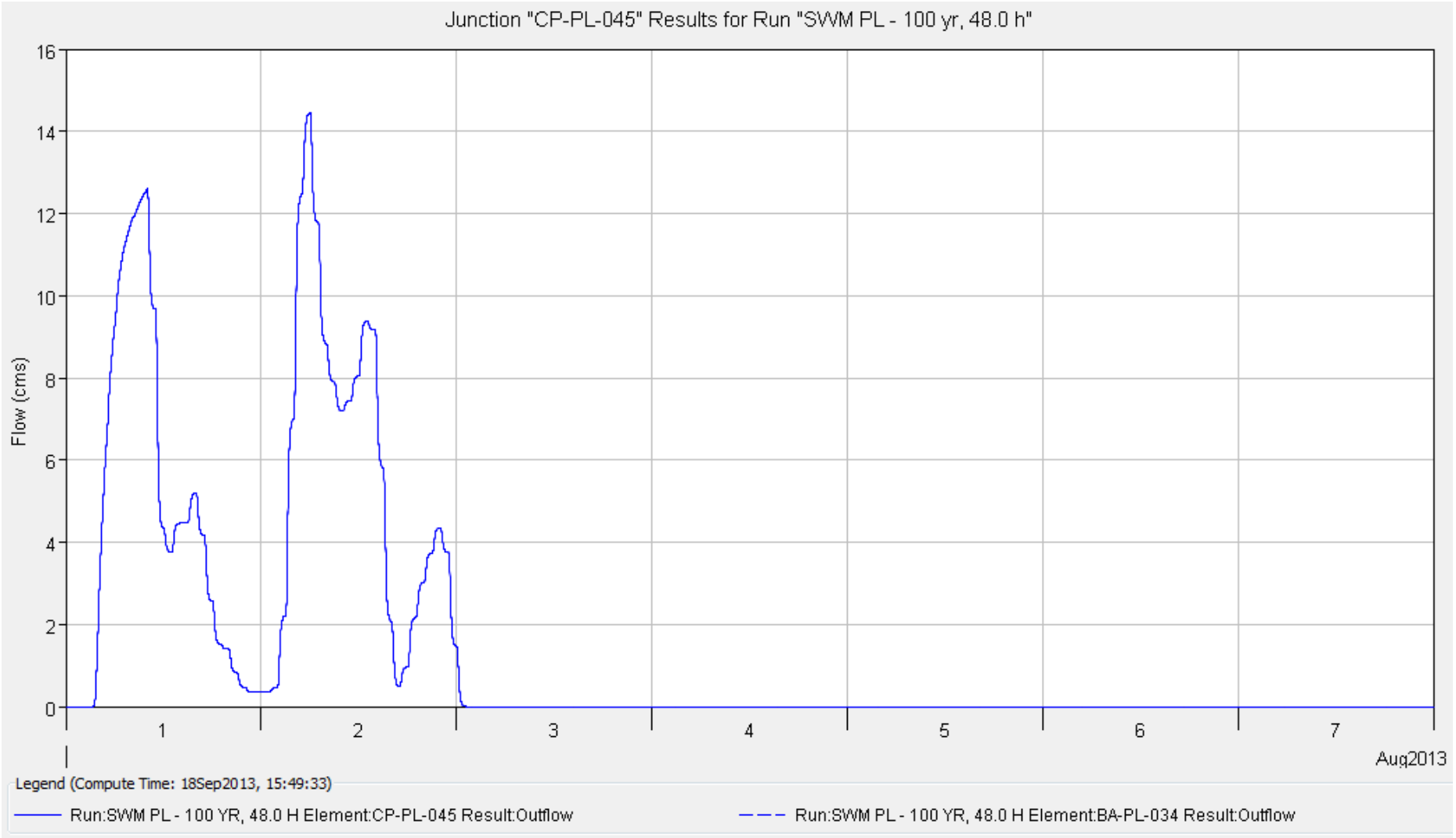

Junction "CP-PL-042B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Outflow

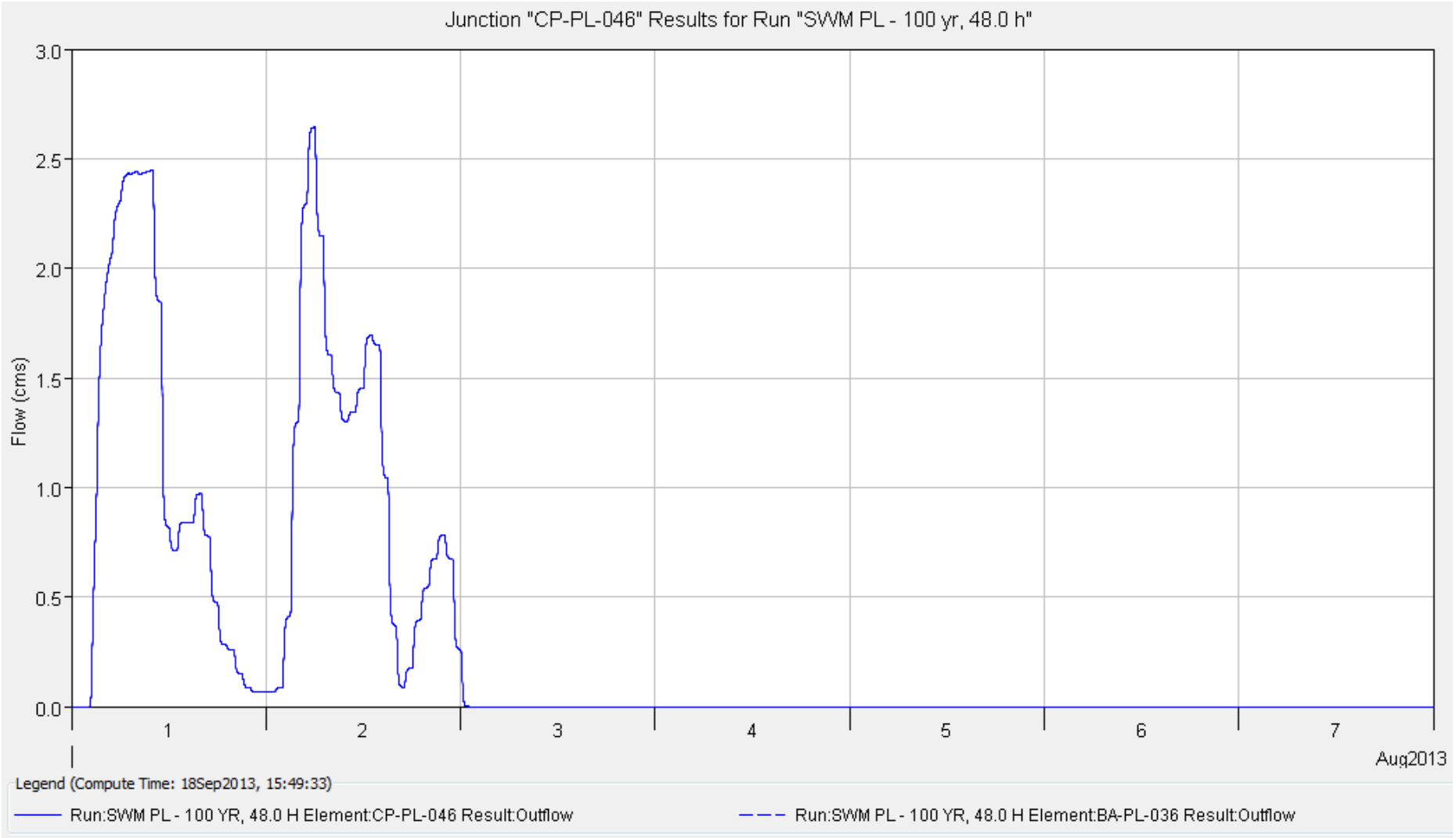

Junction "CP-PL-042C" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-042C Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-035 Result:Outflow

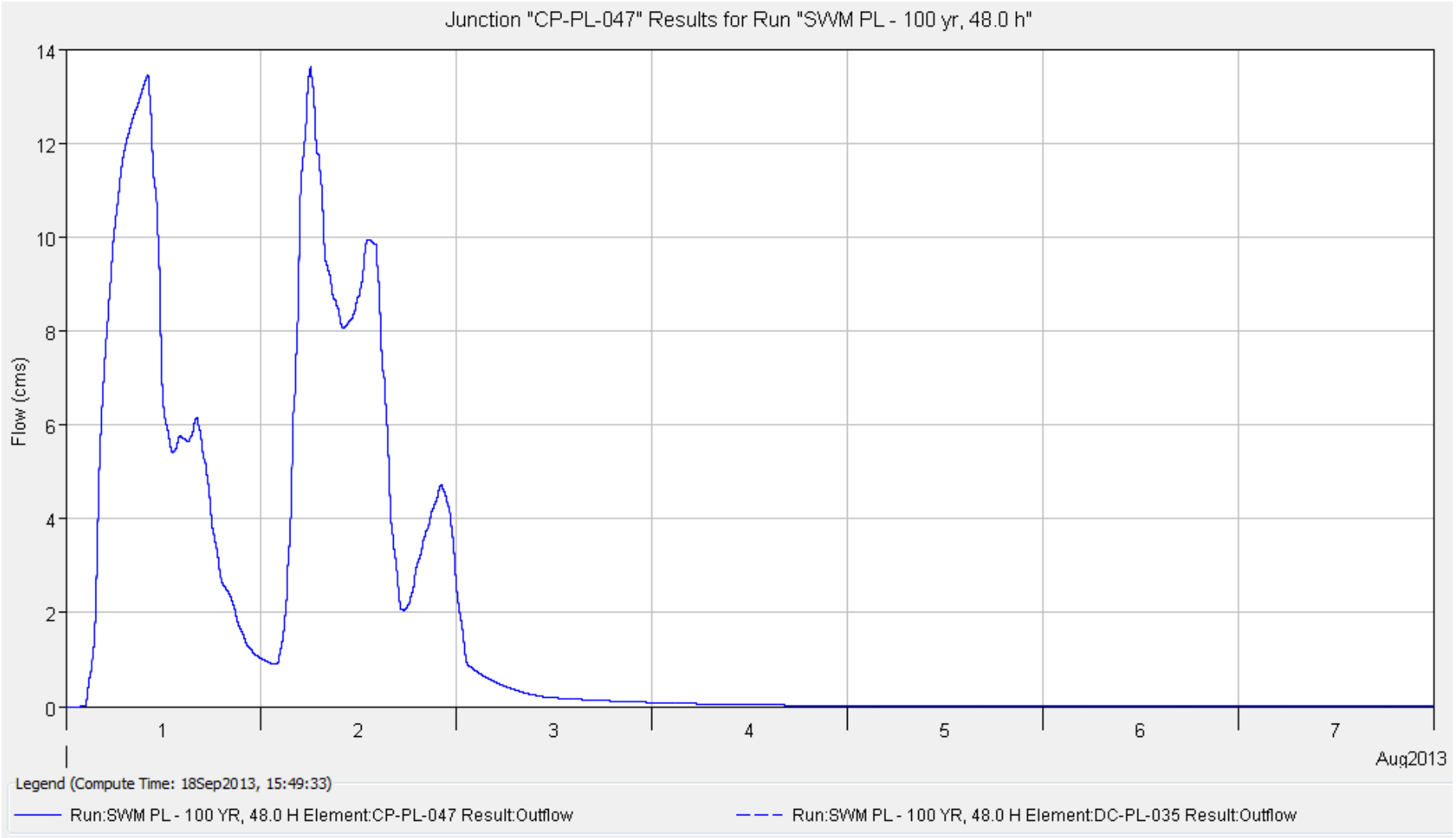

Junction "CP-PL-043A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-043A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-031 Result:Outflow

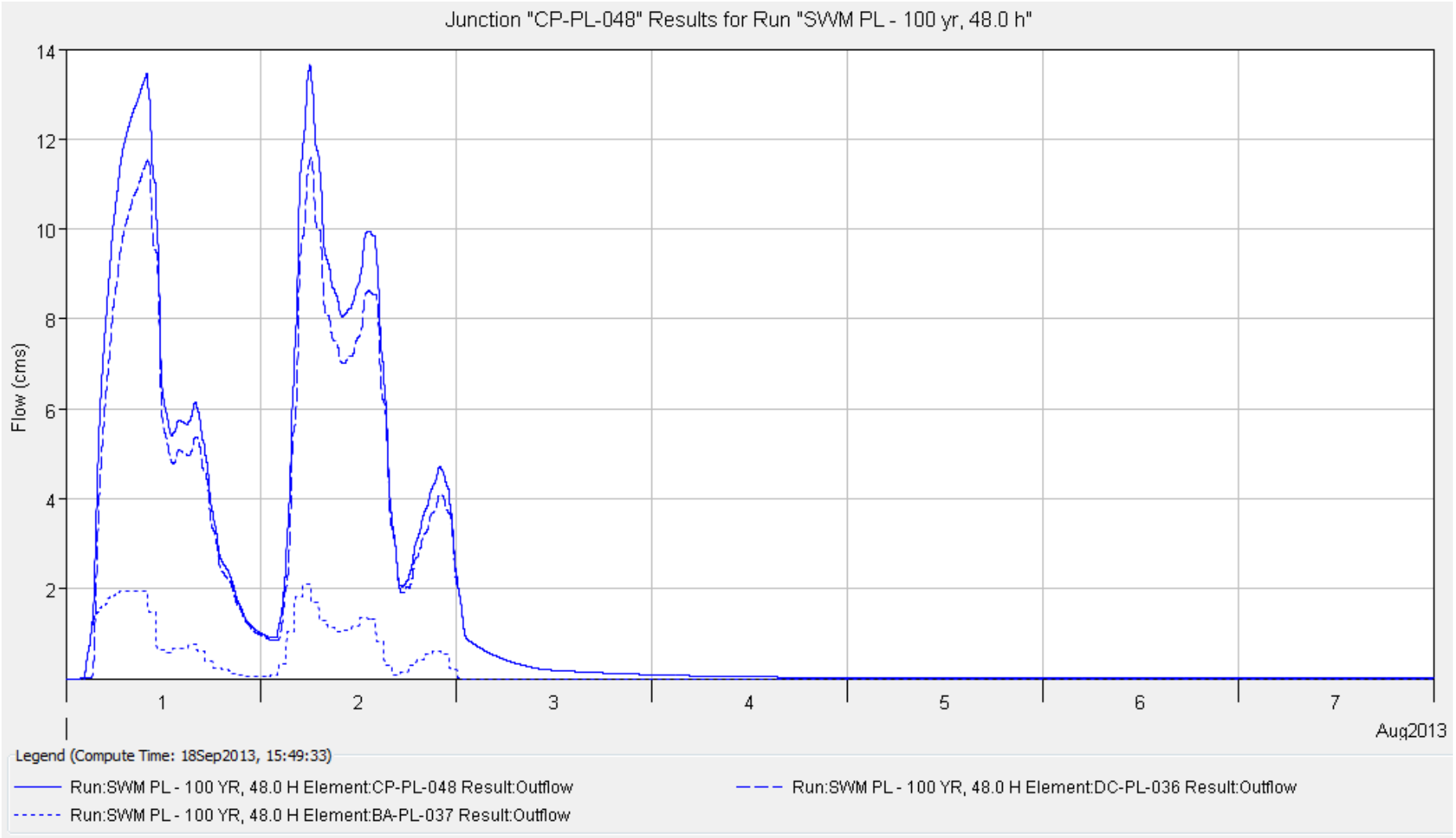

Junction "CP-PL-043B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-043B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-032 Result:Outflow

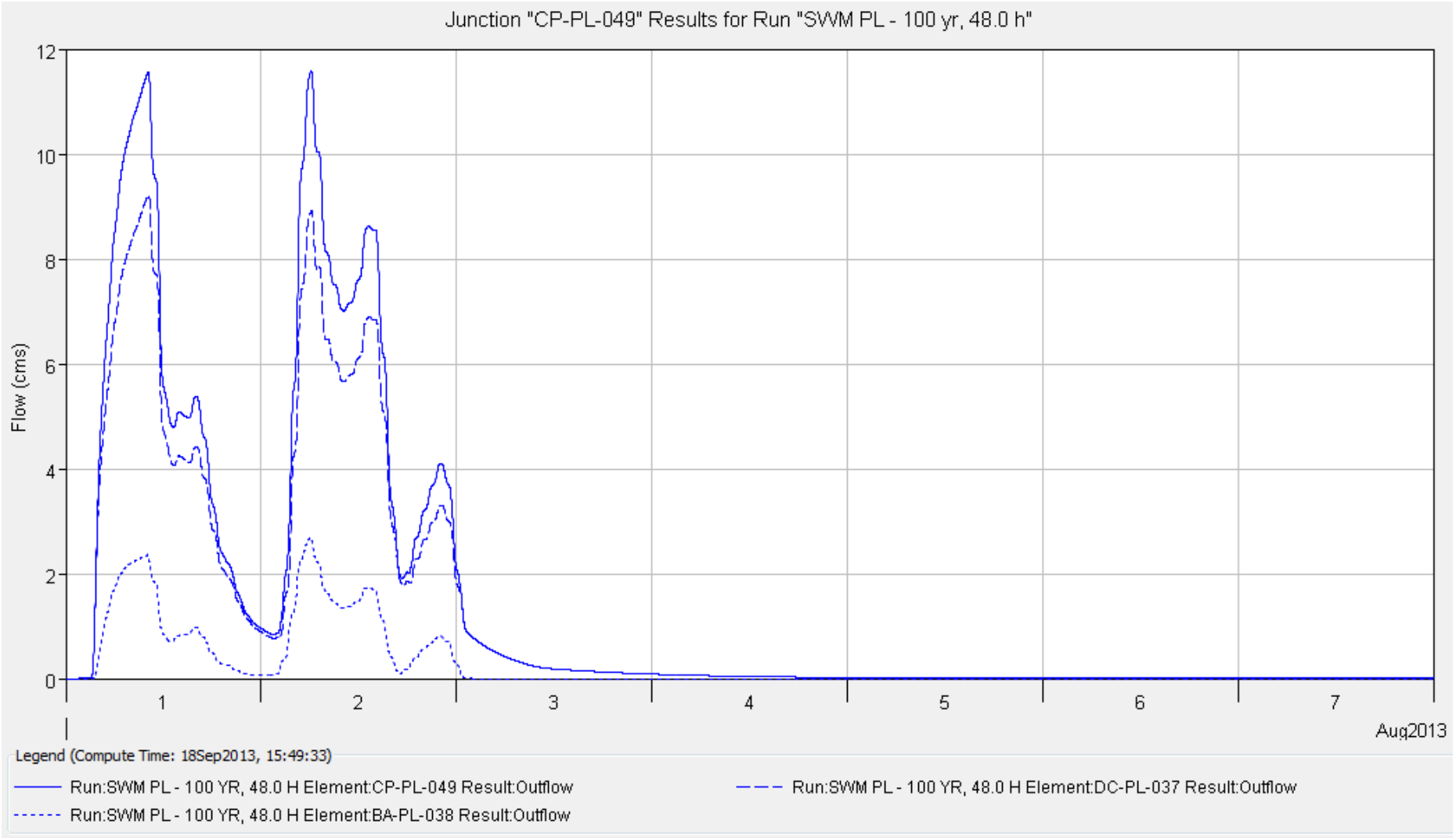

Junction "CP-PL-044" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-033 Result:Outflow

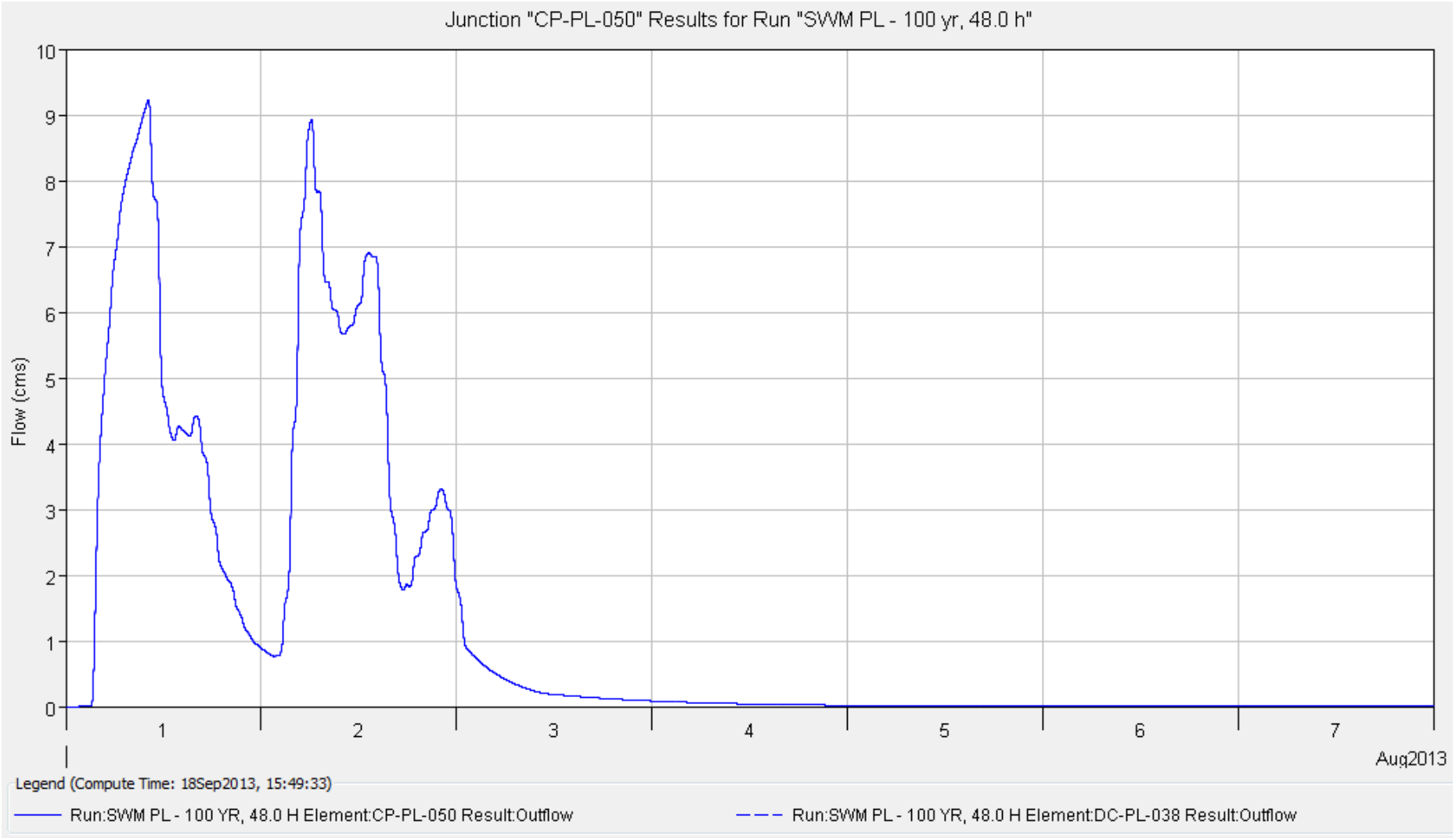

Junction "CP-PL-045" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-034 Result:Outflow

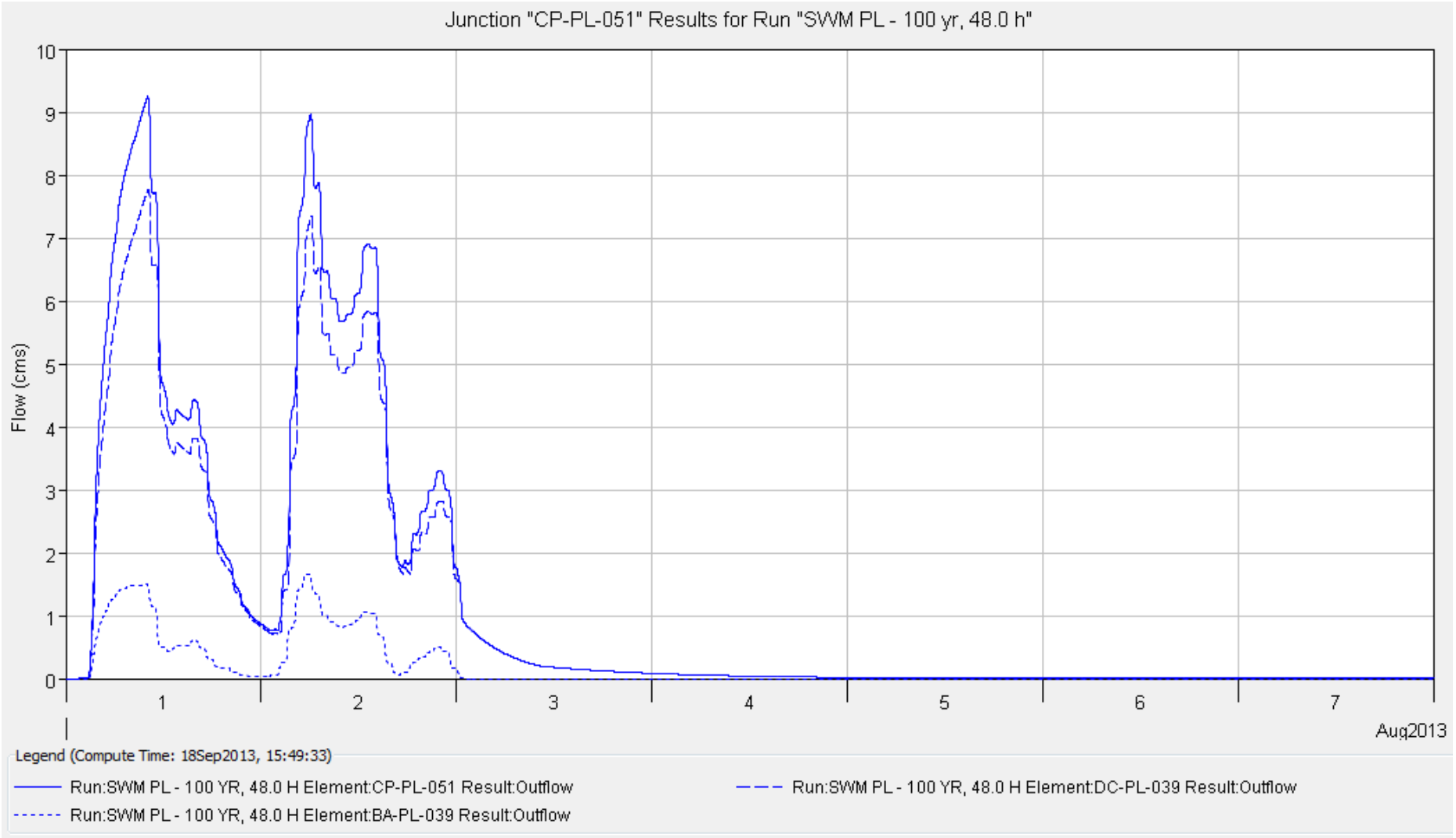

Junction "CP-PL-046" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-046 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-036 Result:Outflow

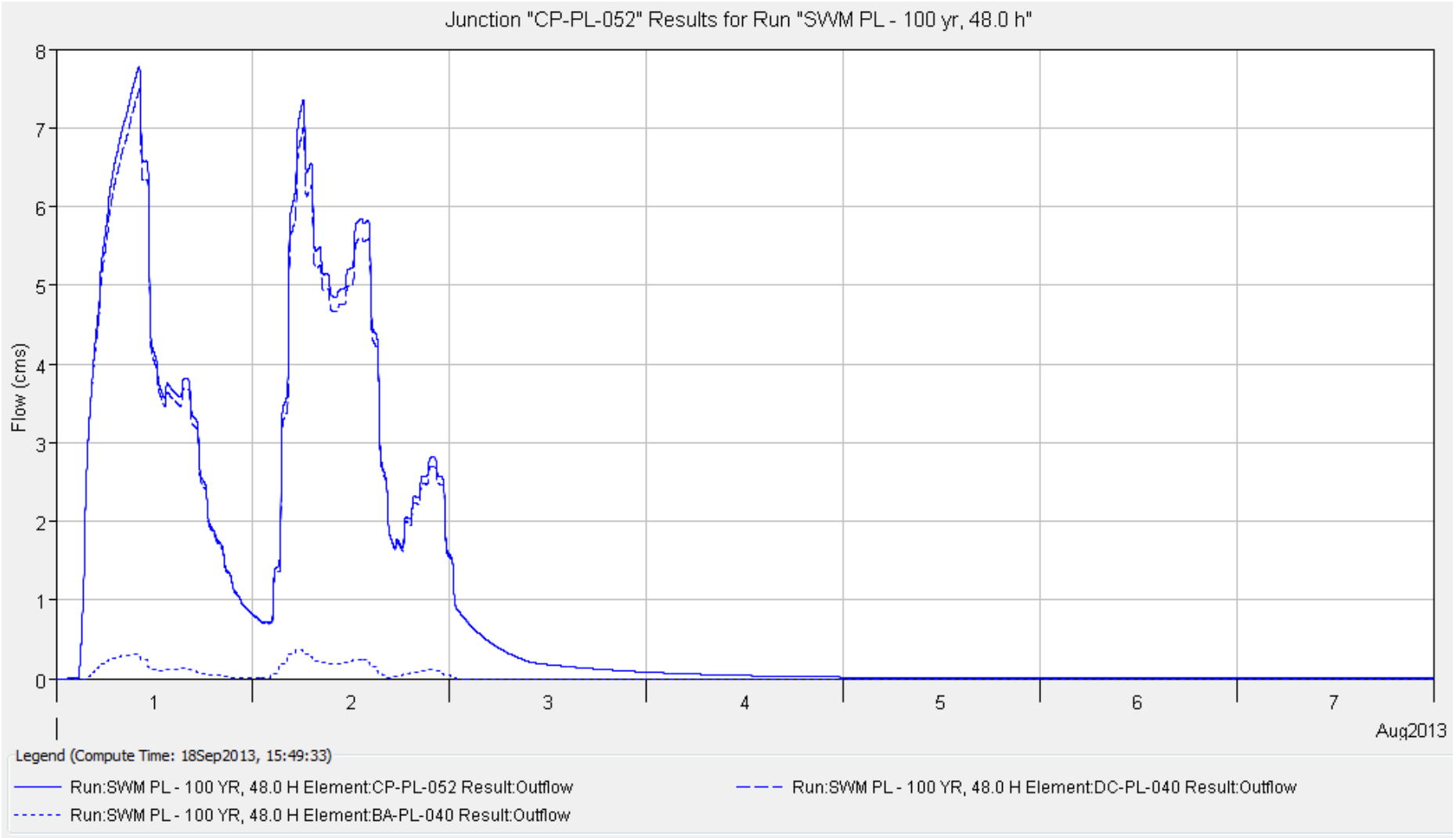

Junction "CP-PL-047" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-047 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-035 Result:Outflow

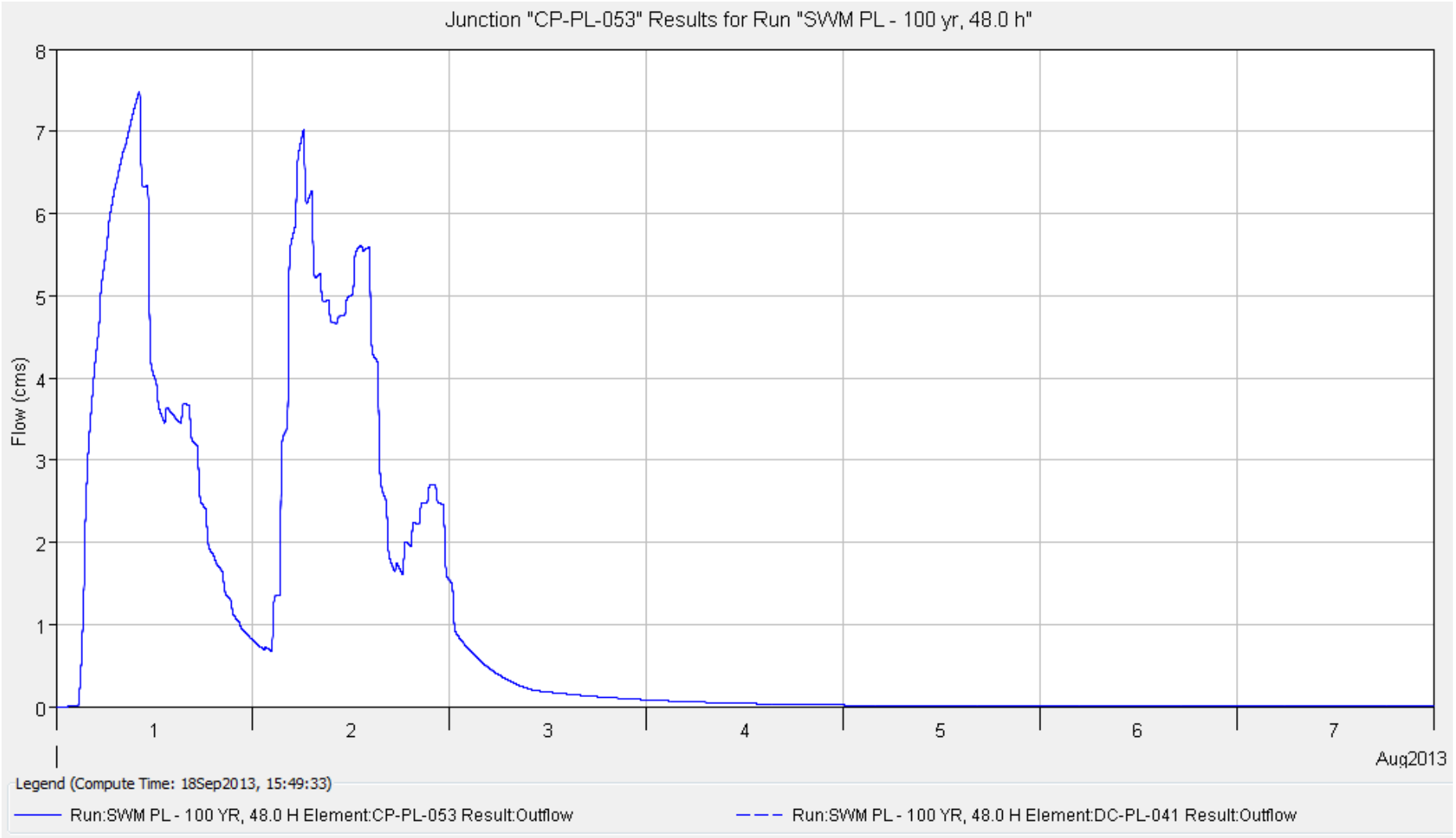

Junction "CP-PL-048" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
14
12
10
8
6
4
2
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-048 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-036 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-037 Result:Outflow

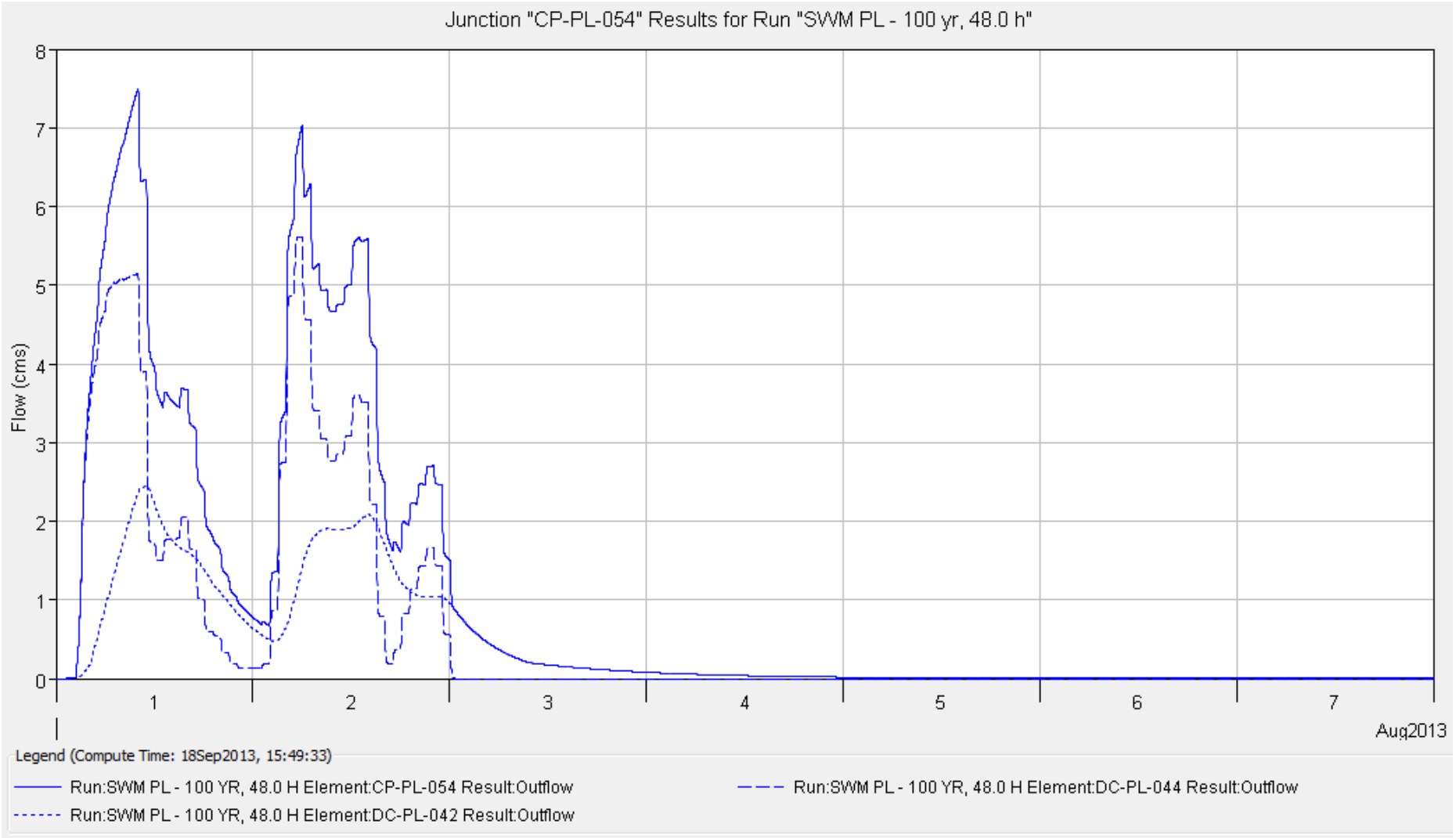

Junction "CP-PL-049" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-037 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-038 Result:Outflow

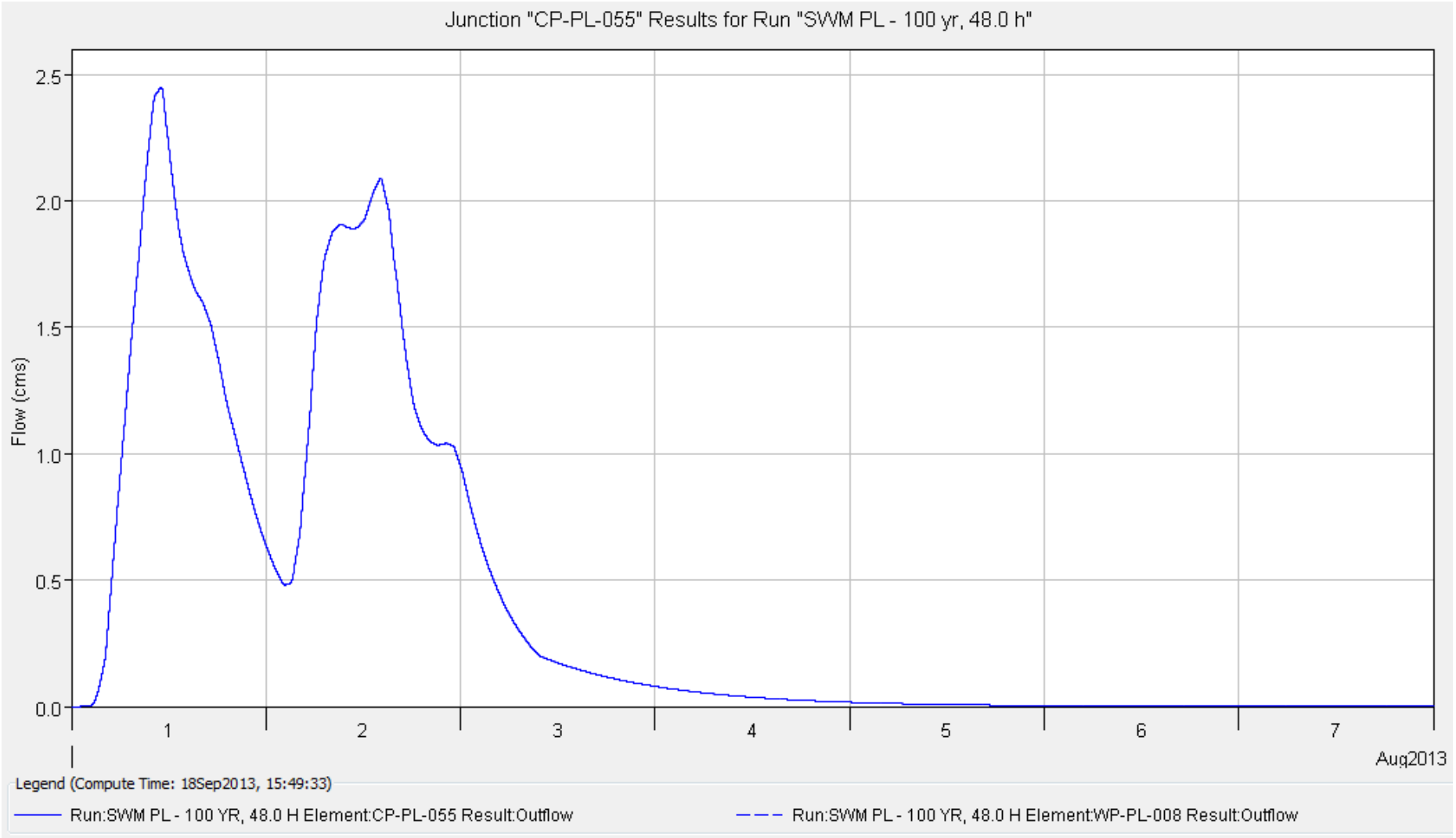

Junction "CP-PL-050" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-050 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-038 Result:Outflow

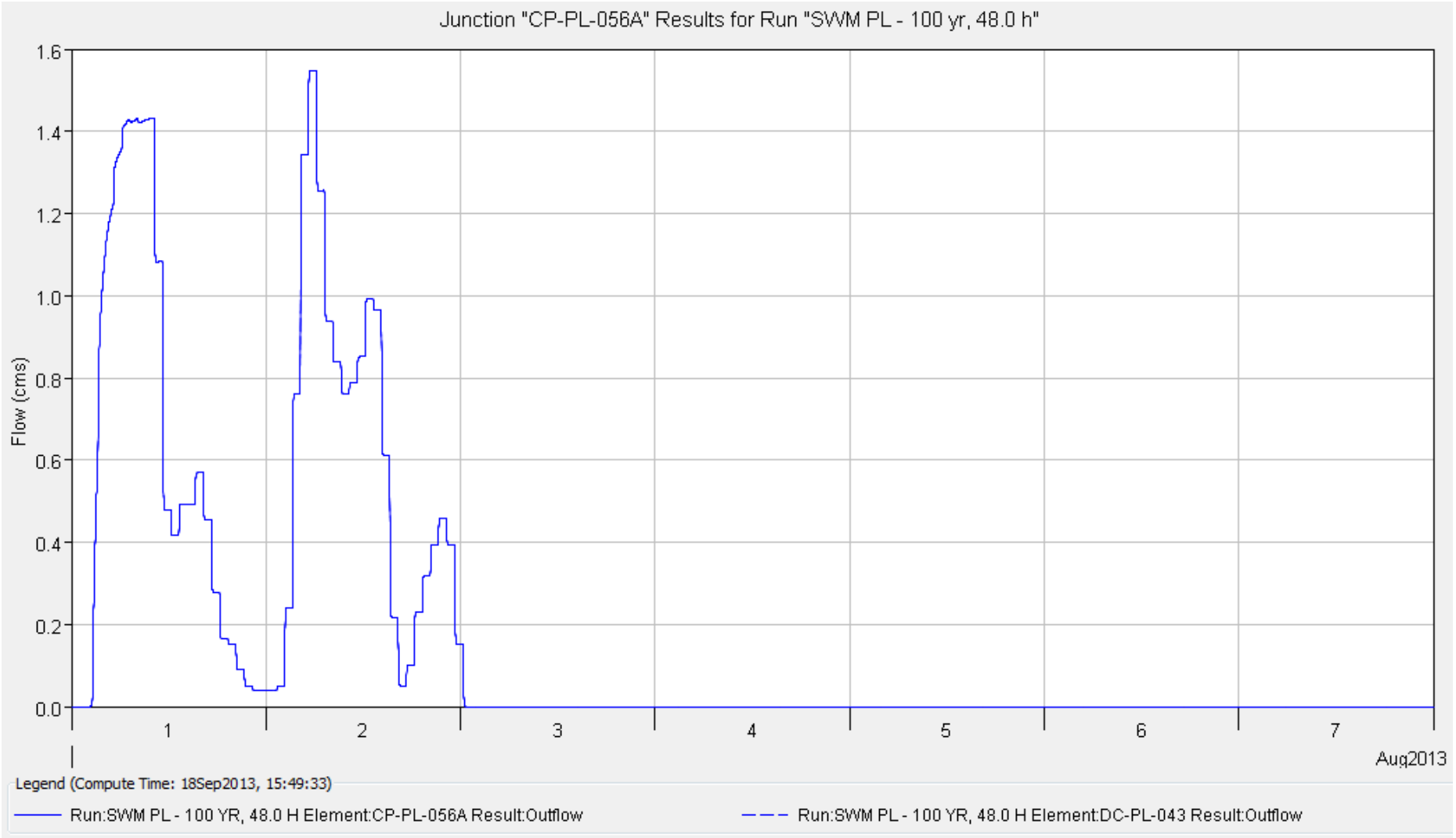

Junction "CP-PL-051" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-039 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-039 Result:Outflow

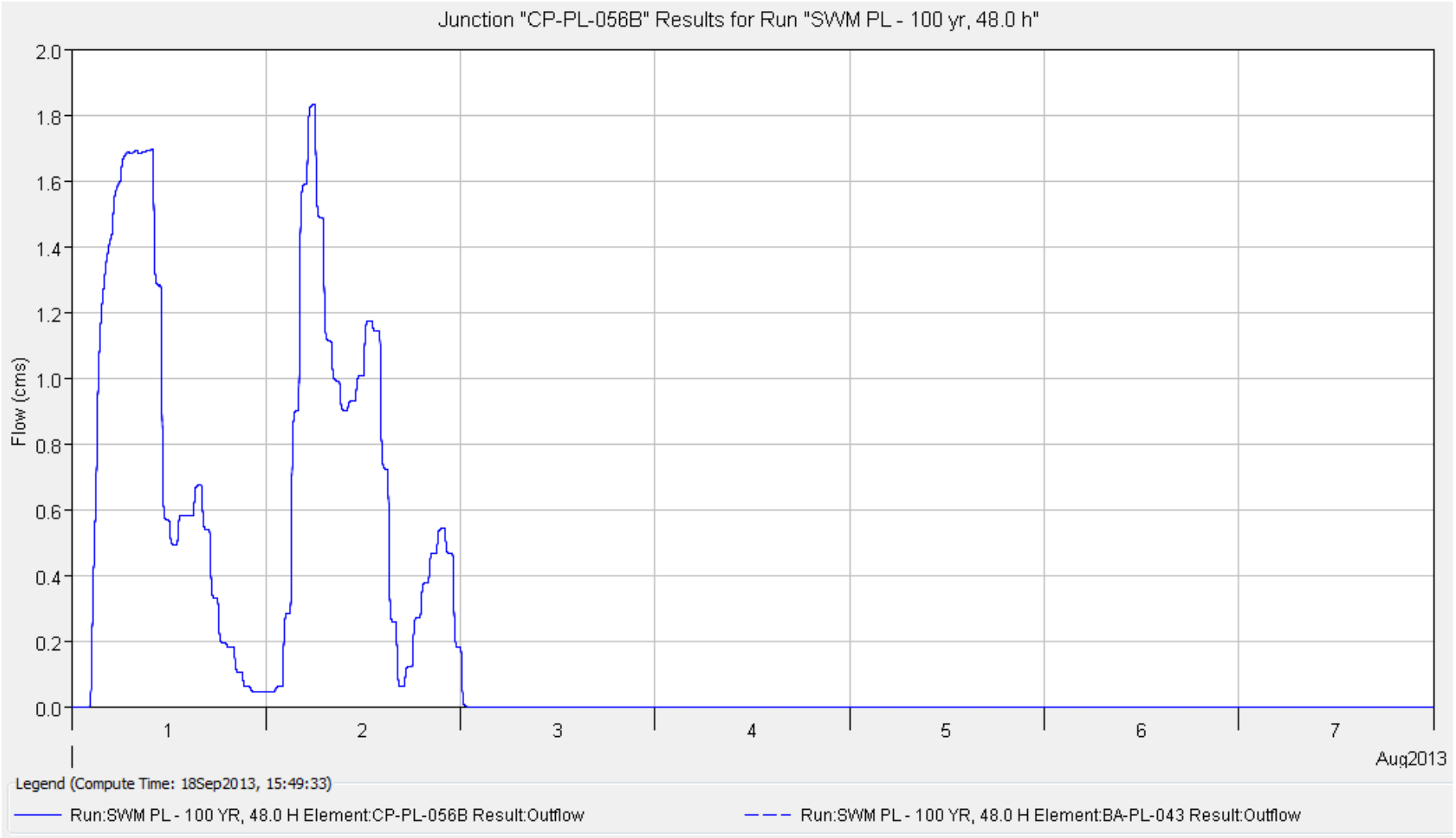

Junction "CP-PL-052" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-052 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-040 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-040 Result:Outflow

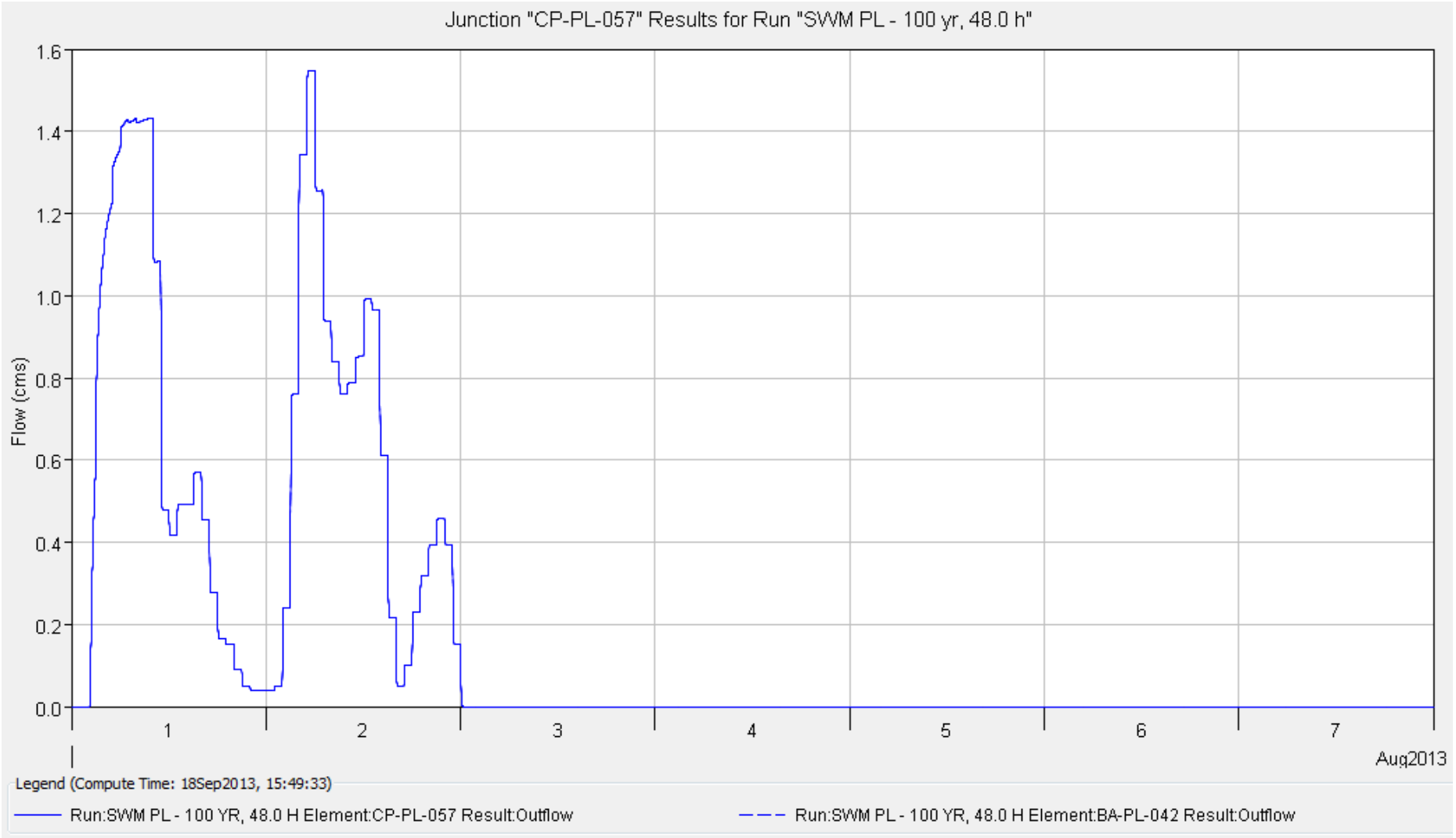

Junction "CP-PL-053" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-041 Result:Outflow

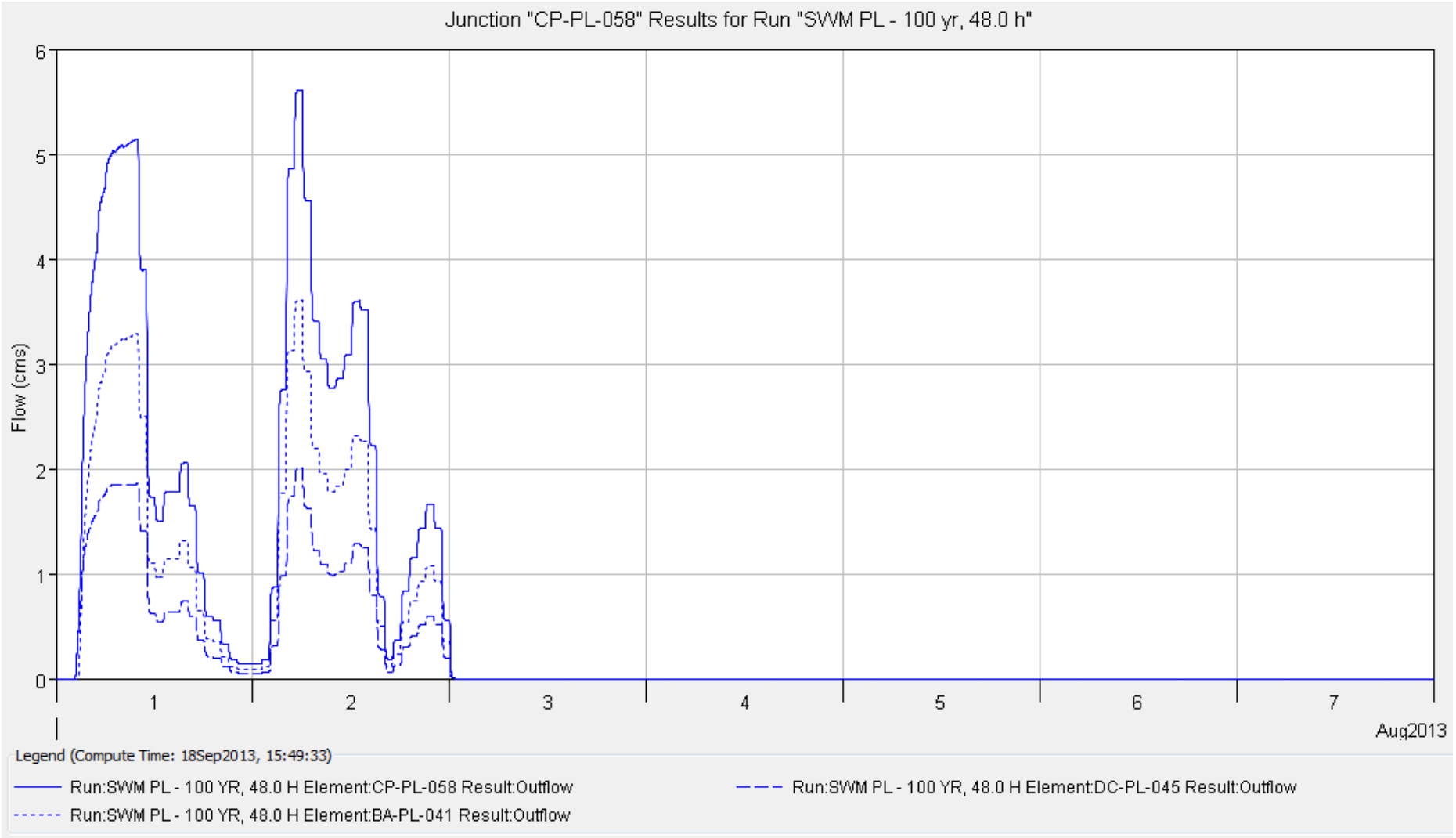

Junction "CP-PL-054" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-044 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-042 Result:Outflow

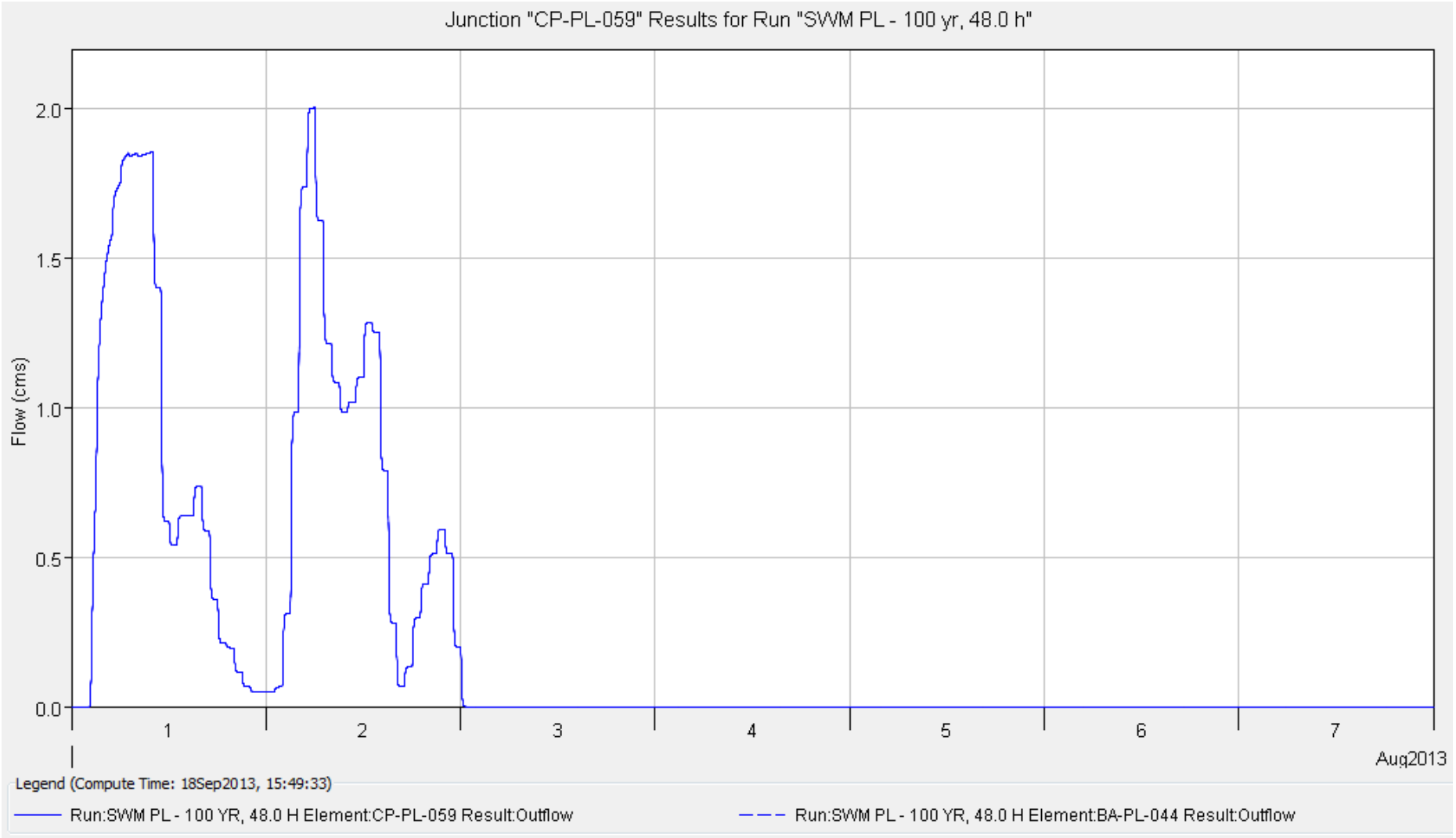

Junction "CP-PL-055" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Outflow

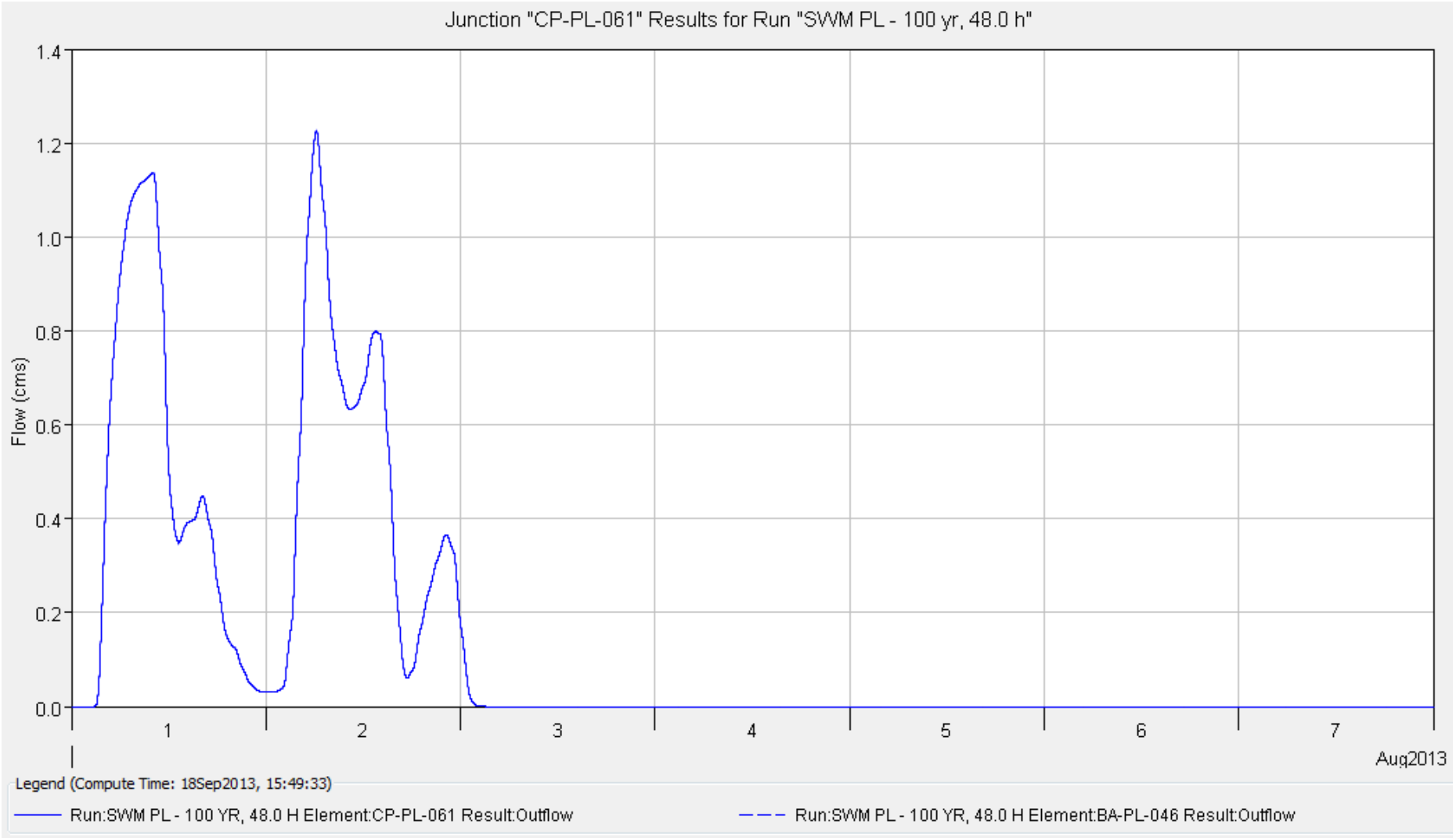

Junction "CP-PL-056A" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-056A Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-043 Result:Outflow

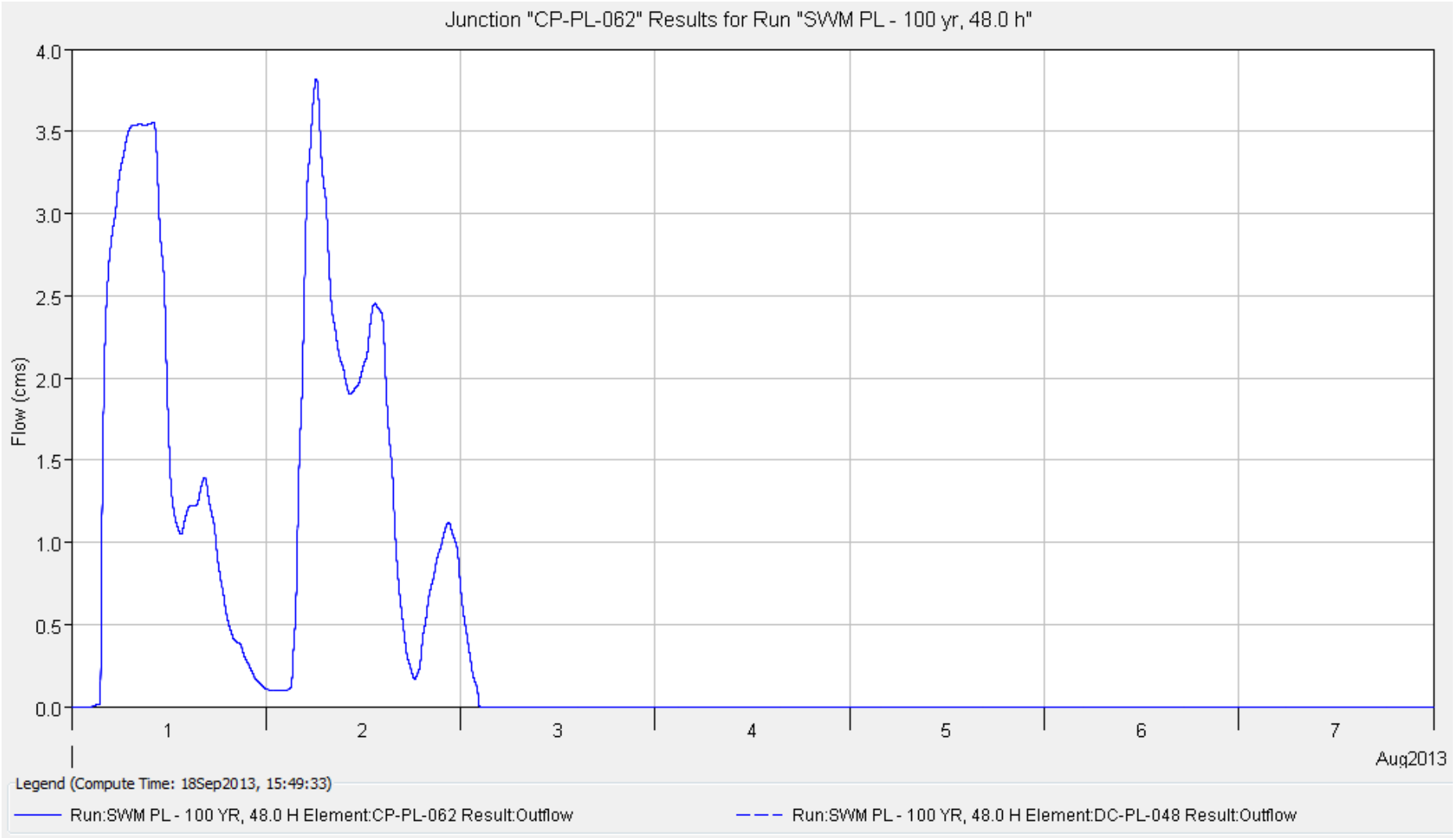

Junction "CP-PL-056B" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-056B Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-043 Result:Outflow

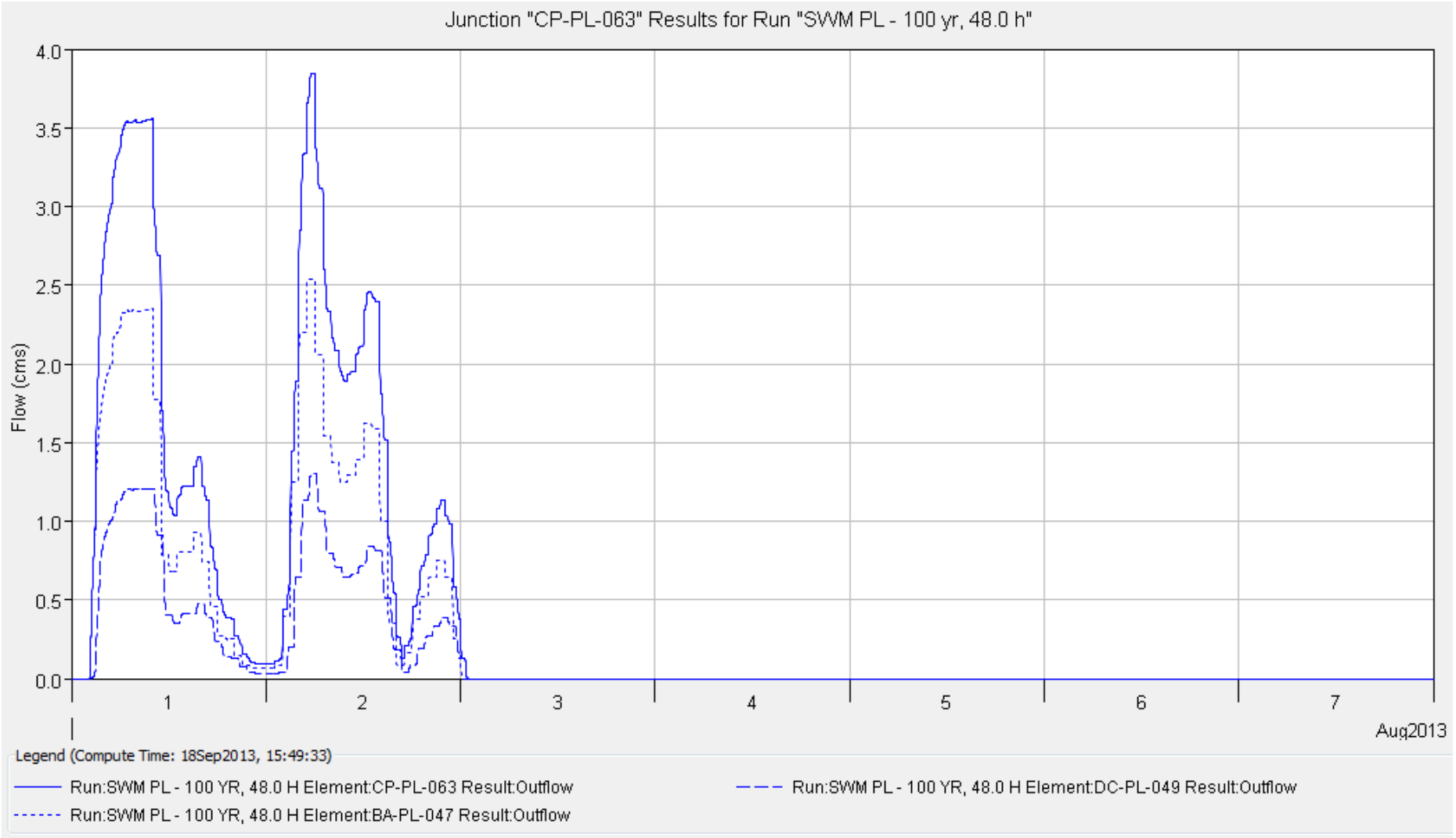

Junction "CP-PL-057" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-042 Result:Outflow

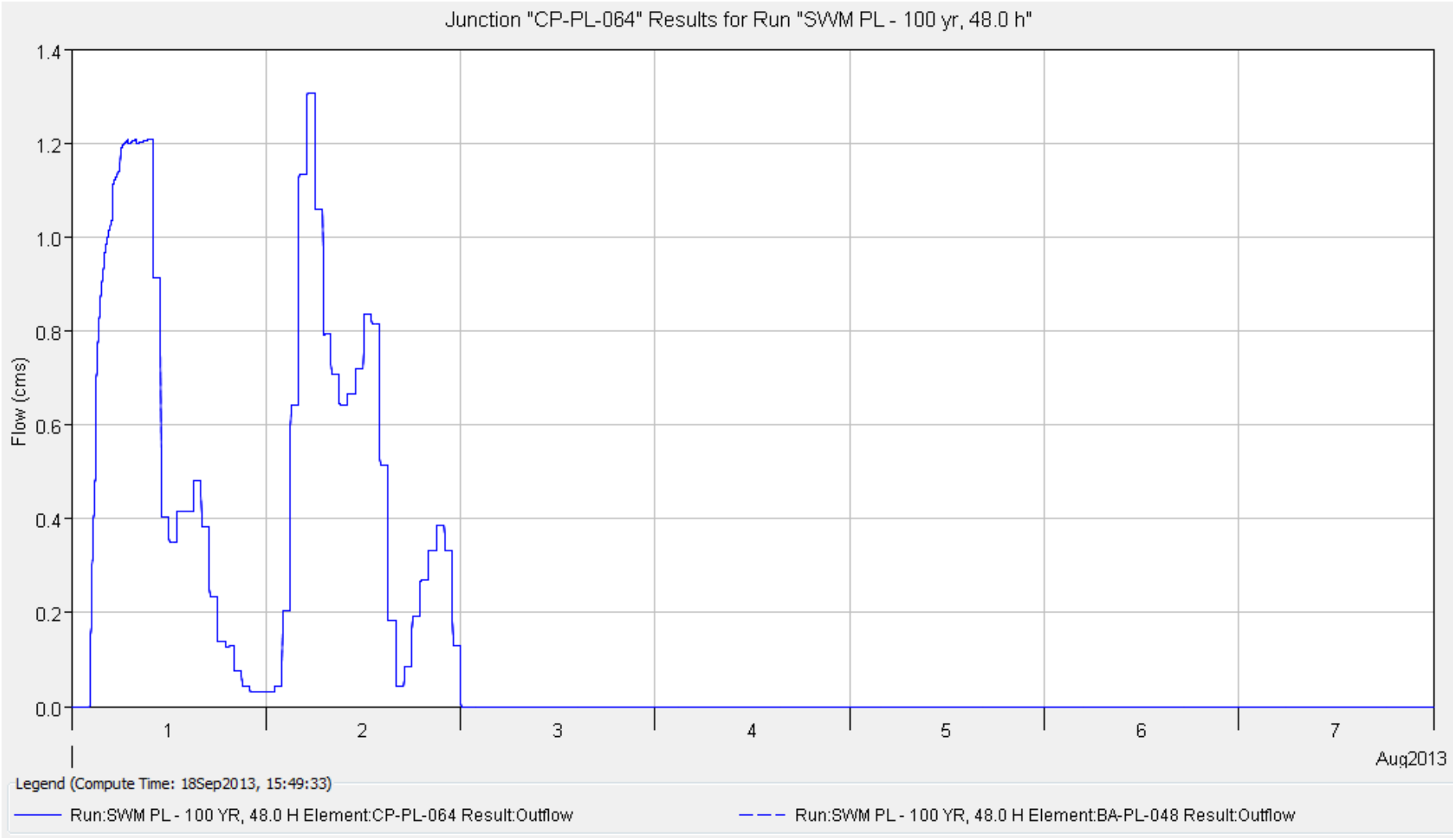

Junction "CP-PL-058" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-045 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-041 Result:Outflow

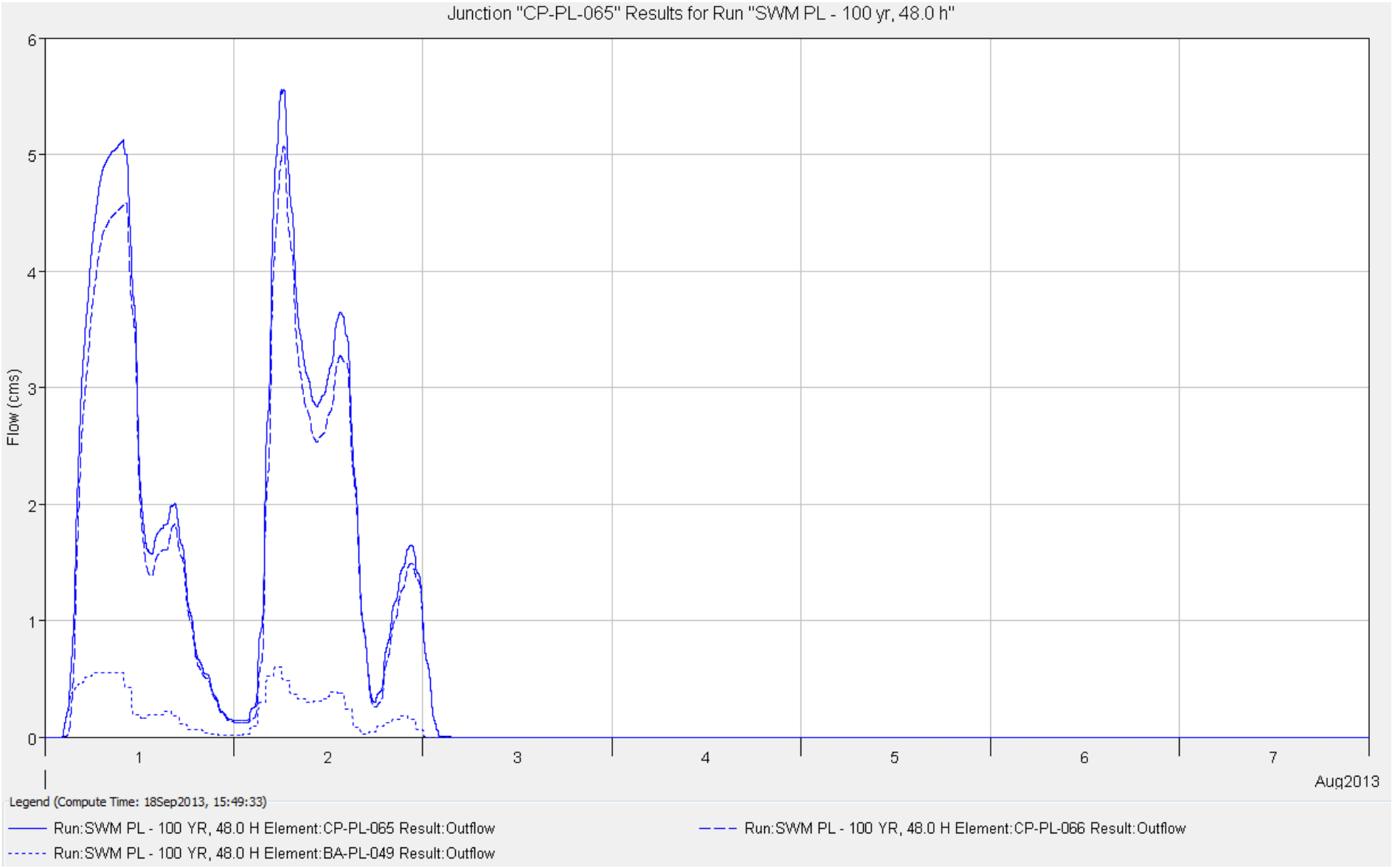

Junction "CP-PL-059" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-059 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-044 Result:Outflow

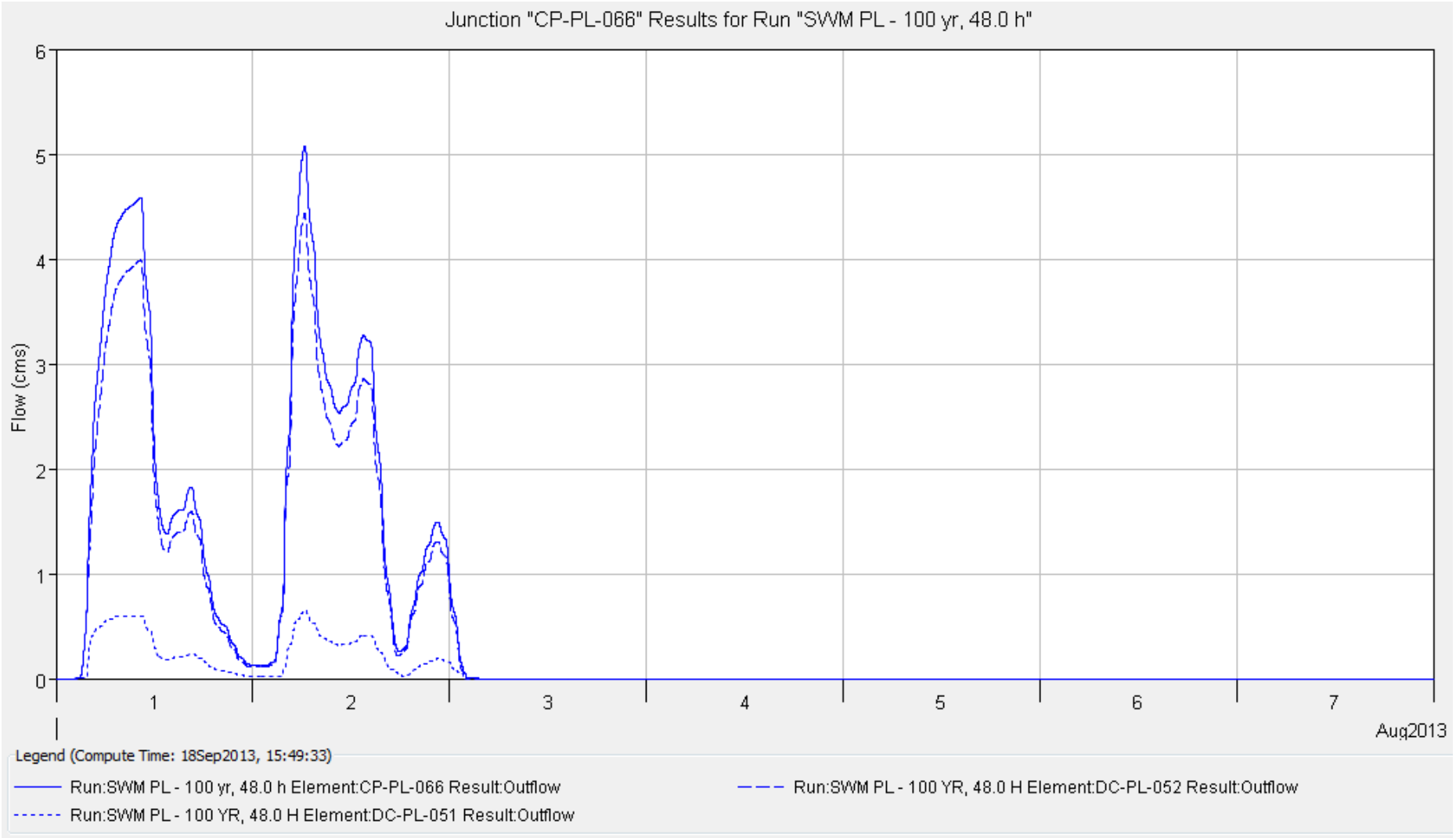

Junction "CP-PL-061" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-061 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-046 Result:Outflow

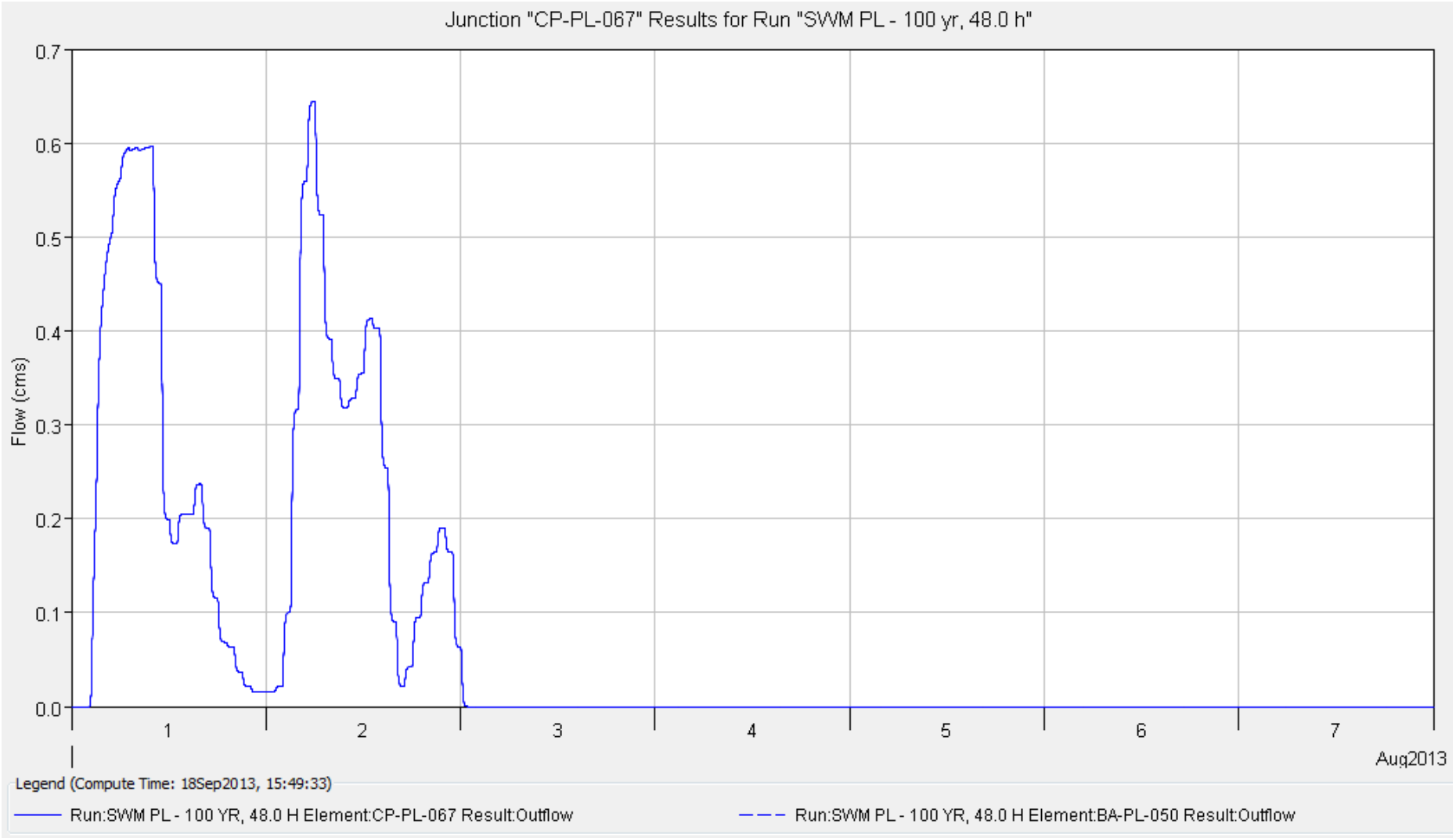

Junction "CP-PL-062" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-062 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-048 Result:Outflow

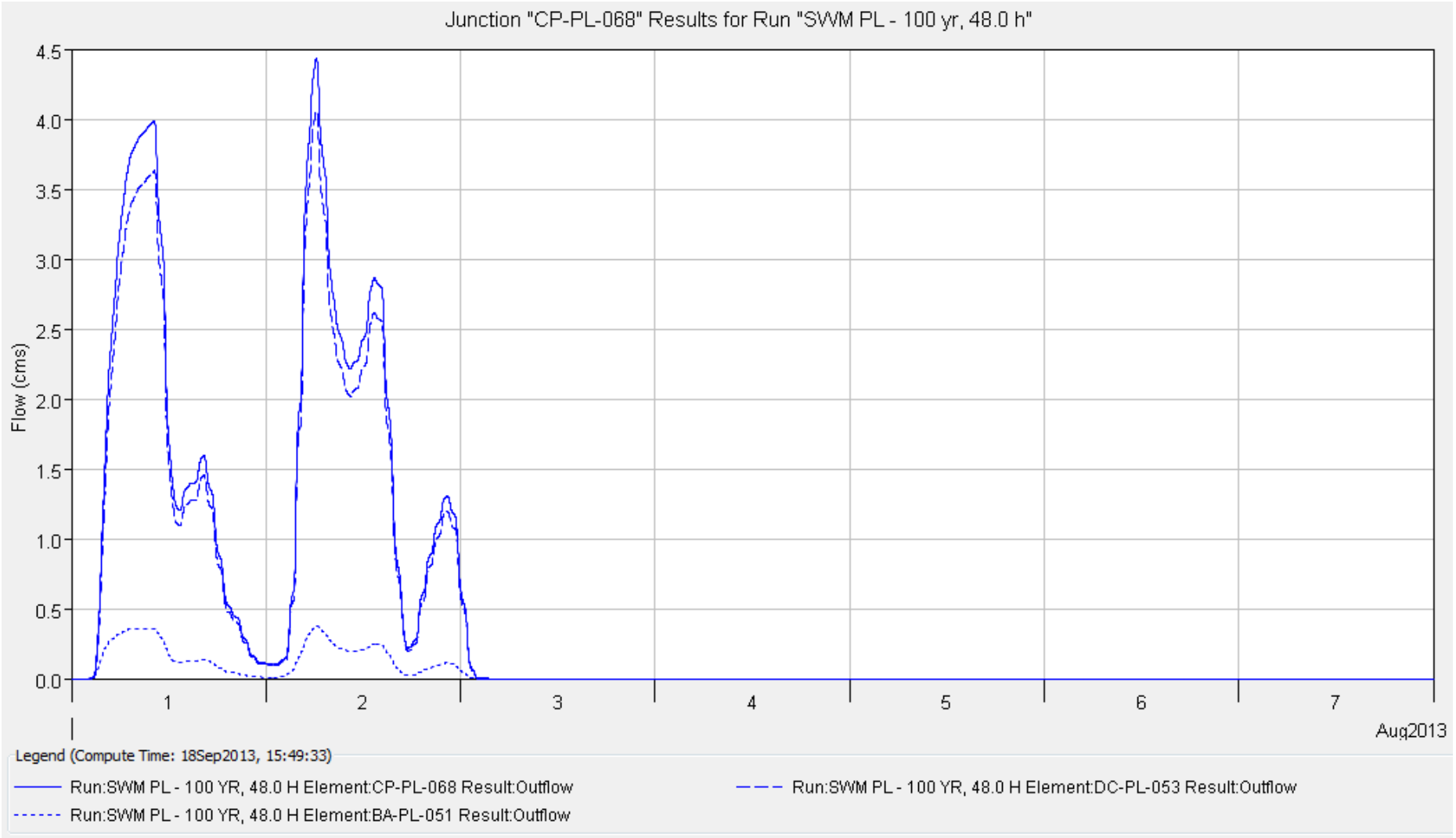

Junction "CP-PL-063" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-049 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-047 Result:Outflow

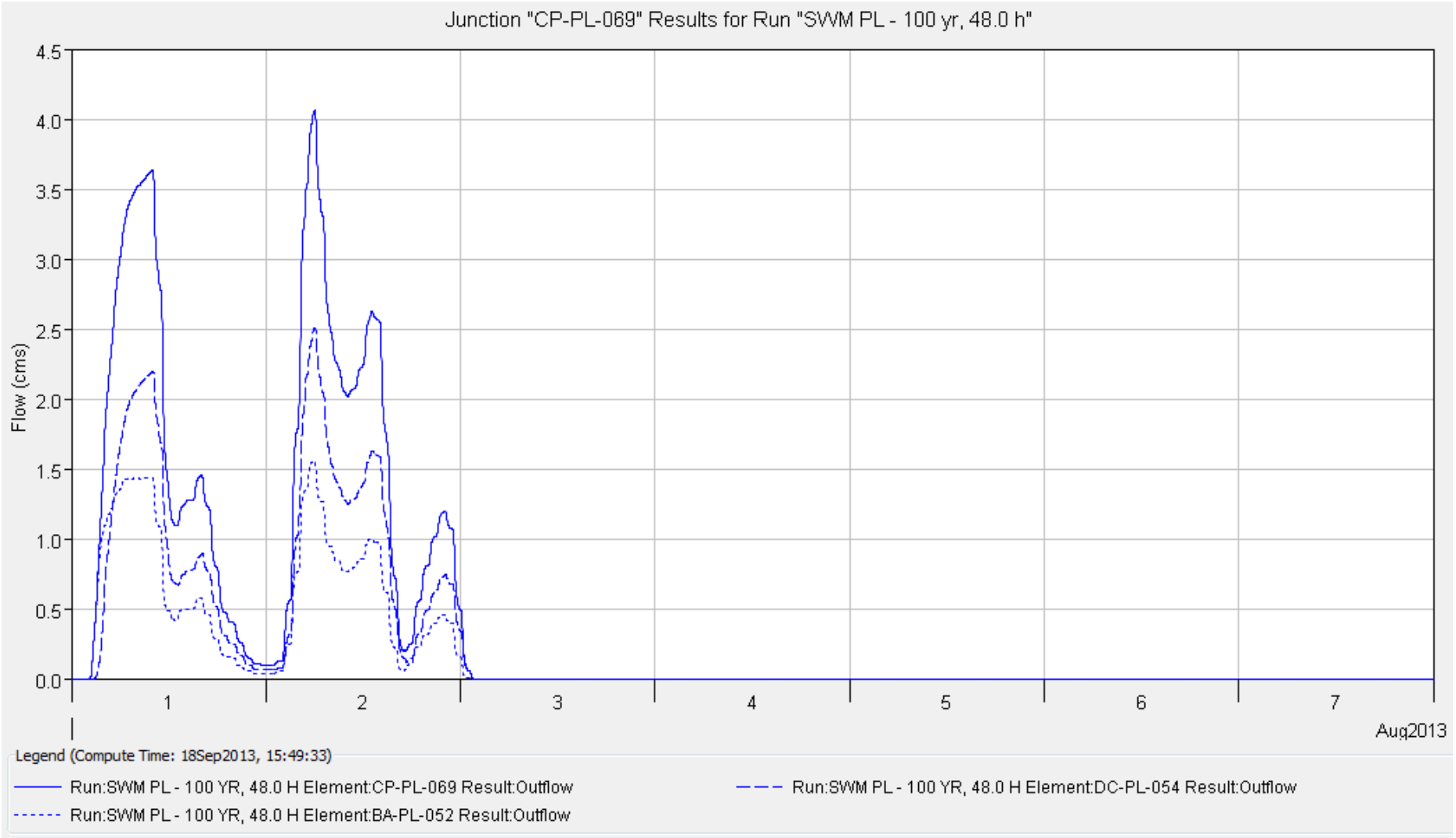

Junction "CP-PL-064" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-064 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-048 Result:Outflow

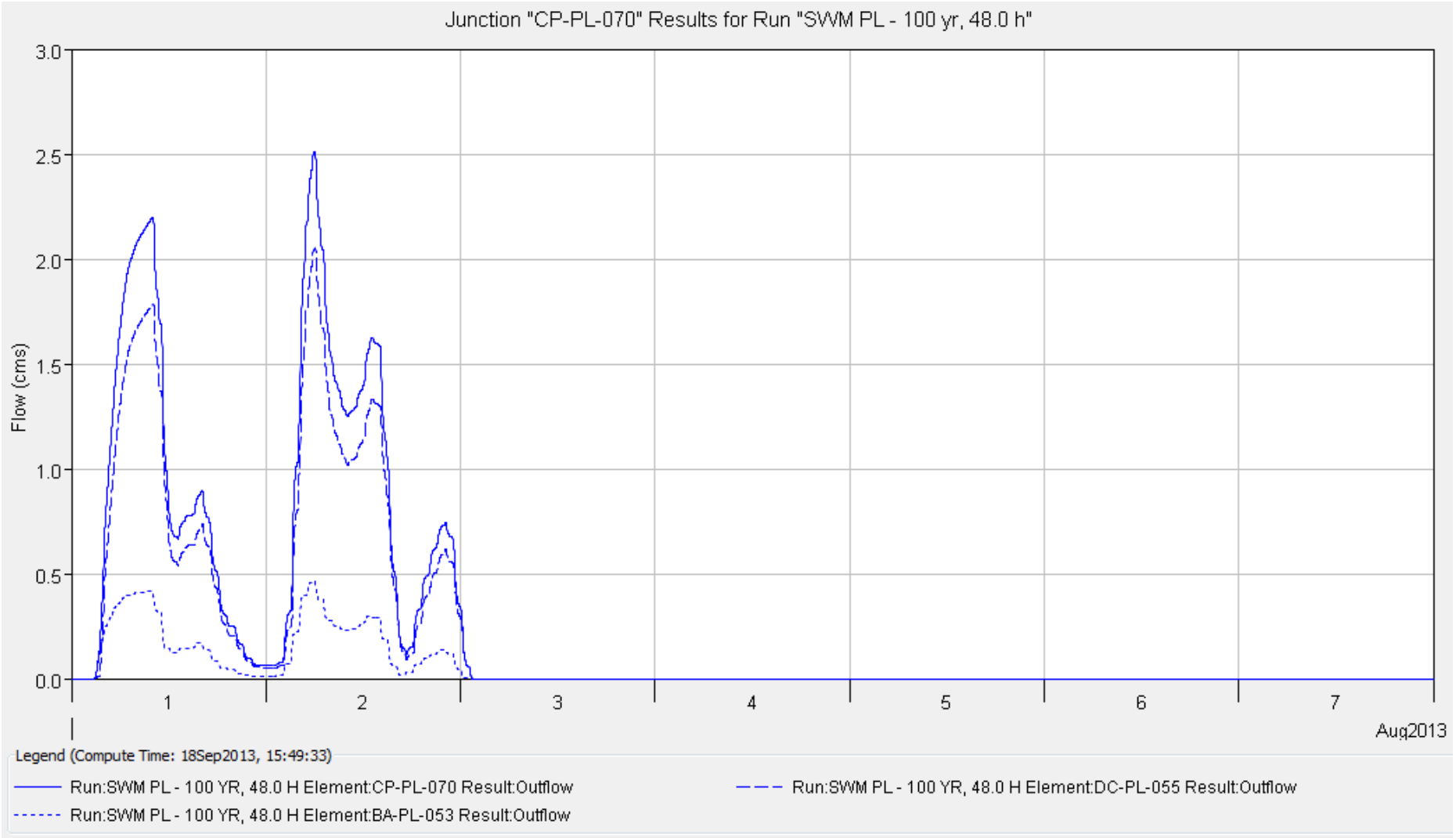

Junction "CP-PL-065" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-065 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-049 Result:Outflow

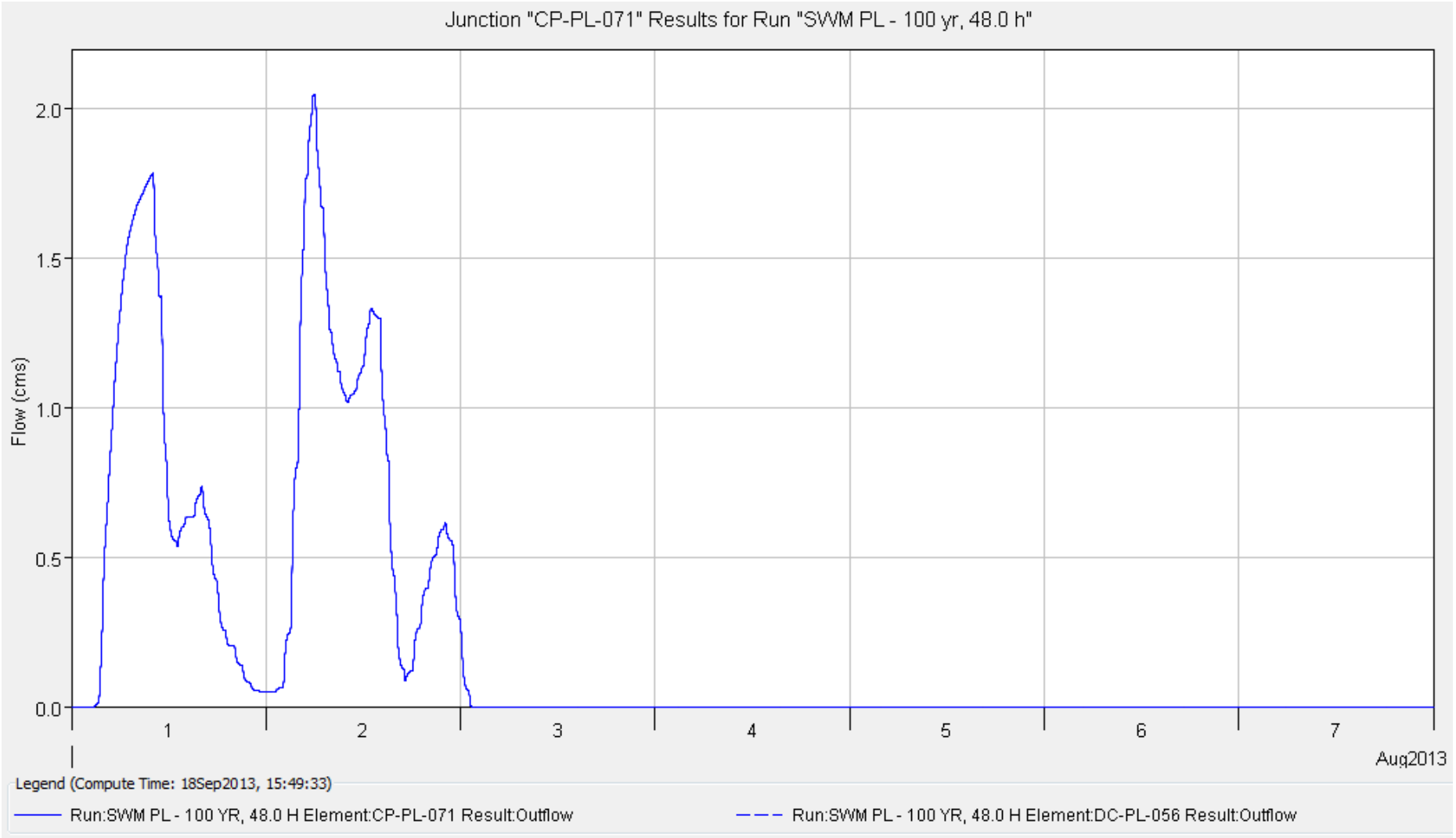

Junction "CP-PL-066" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0
1
2
3
4
5
6
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-066 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-051 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-052 Result:Outflow

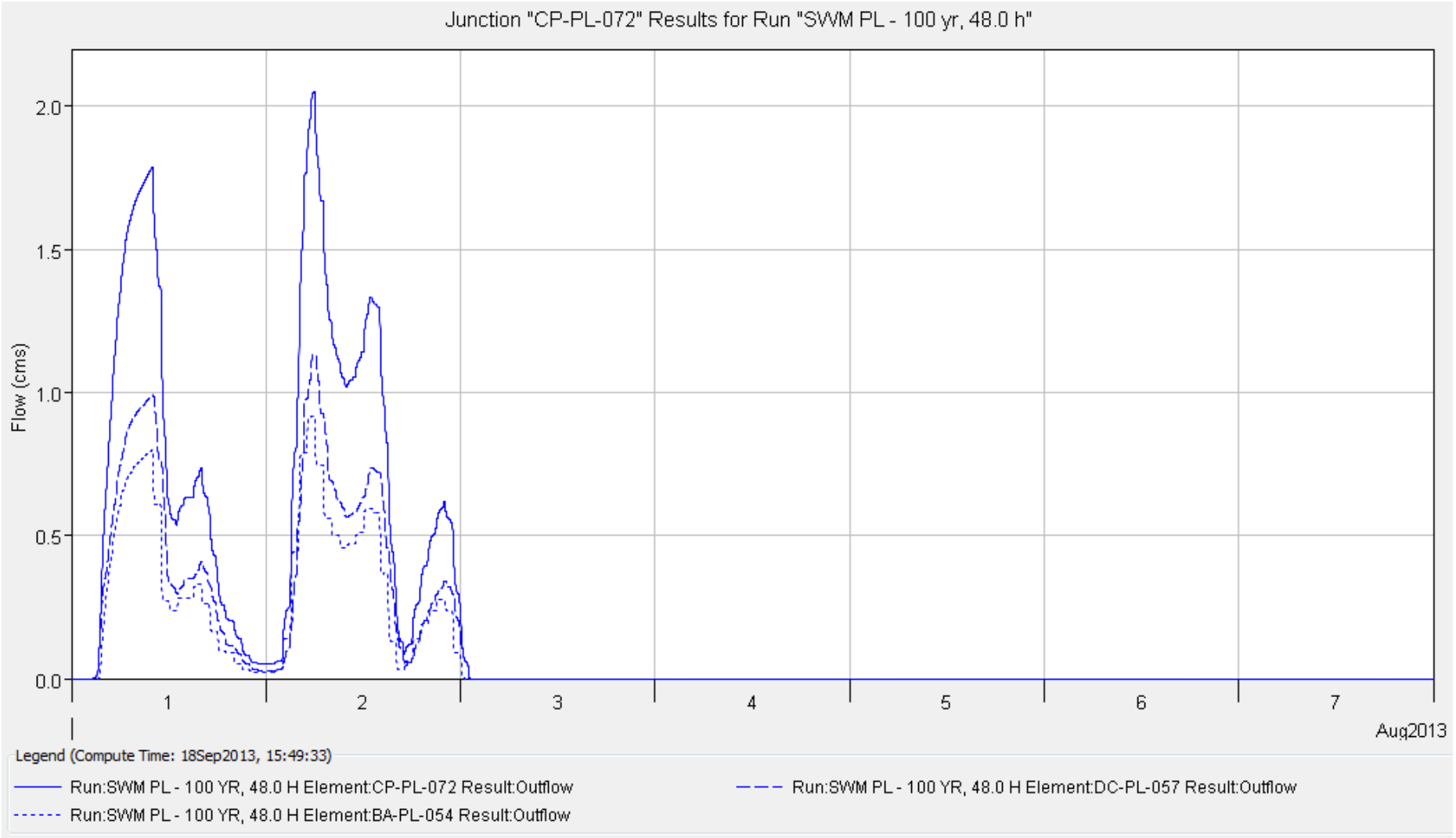

Junction "CP-PL-067" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-067 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-050 Result:Outflow

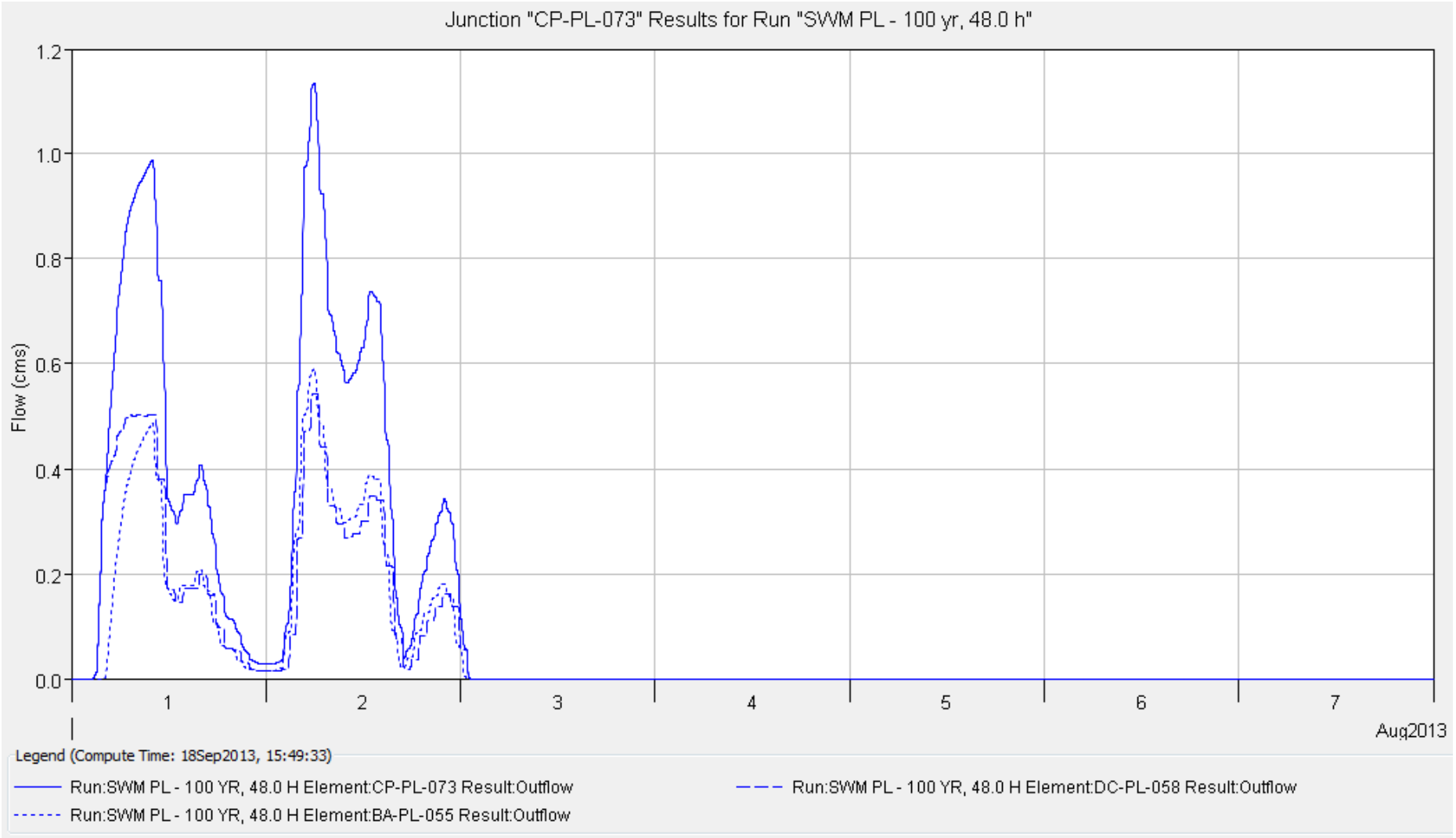

Junction "CP-PL-068" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-068 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-053 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-051 Result:Outflow

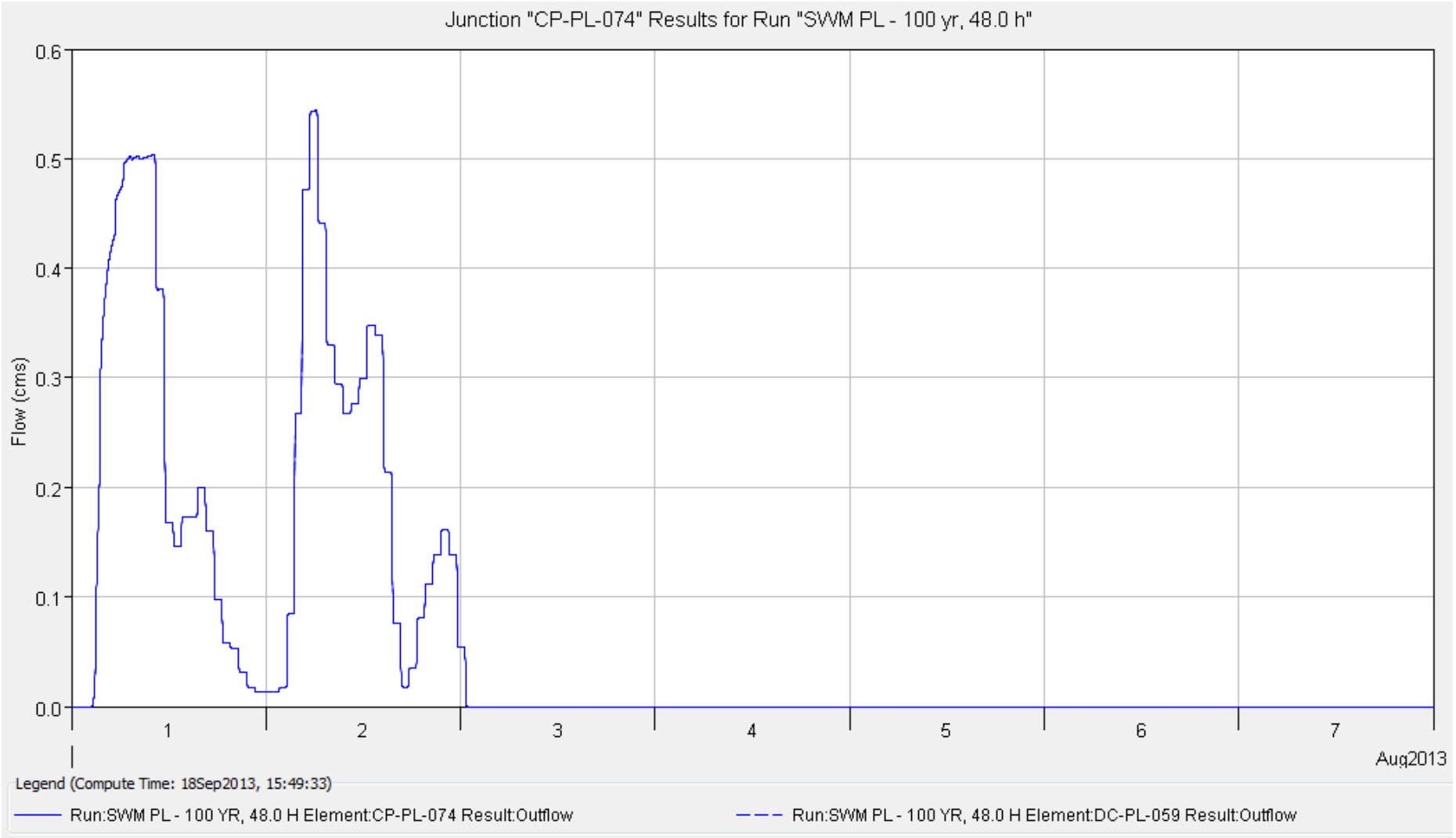

Junction "CP-PL-069" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-069 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-054 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-052 Result:Outflow

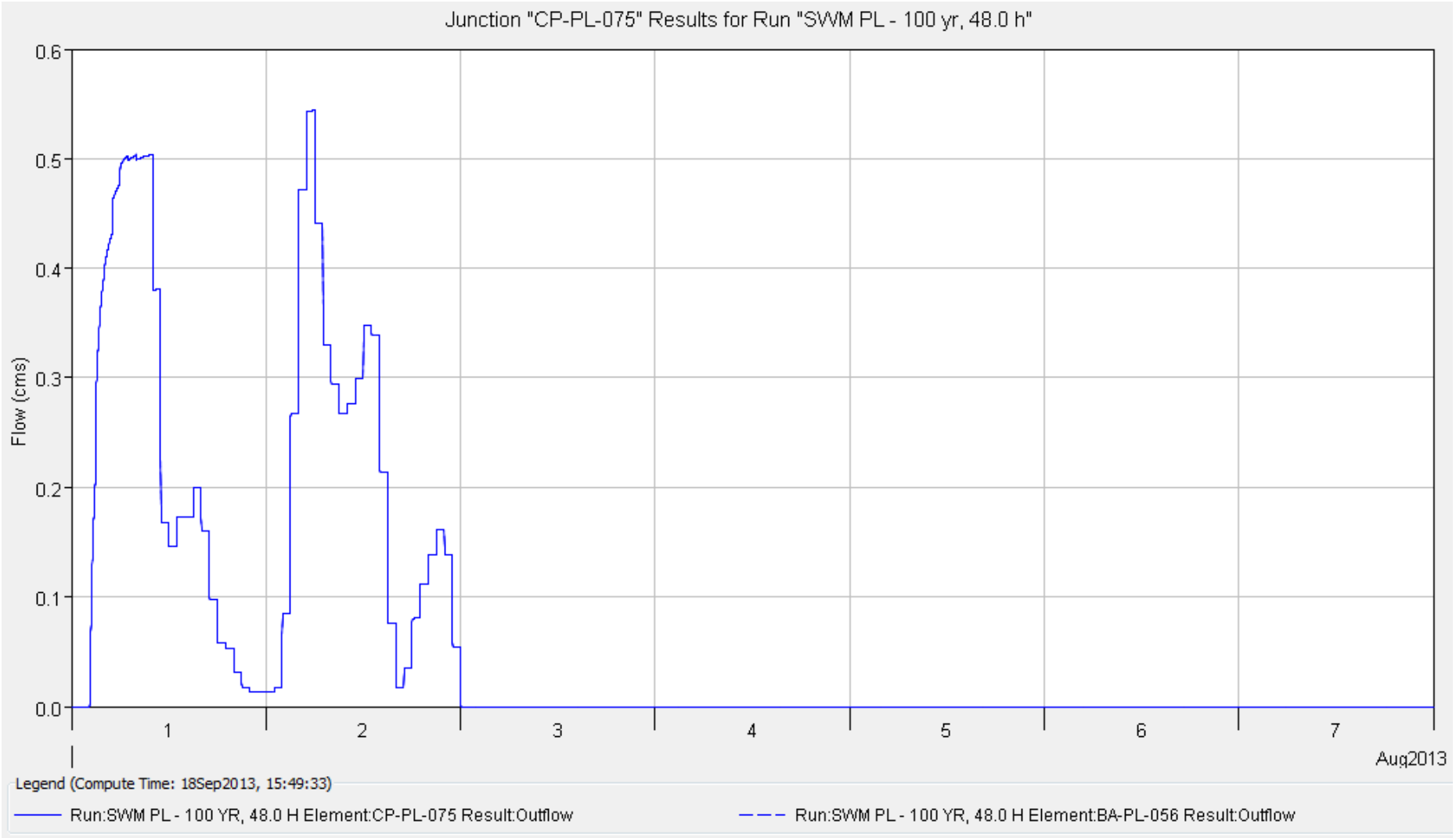

Junction "CP-PL-070" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-070 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-055 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-053 Result:Outflow

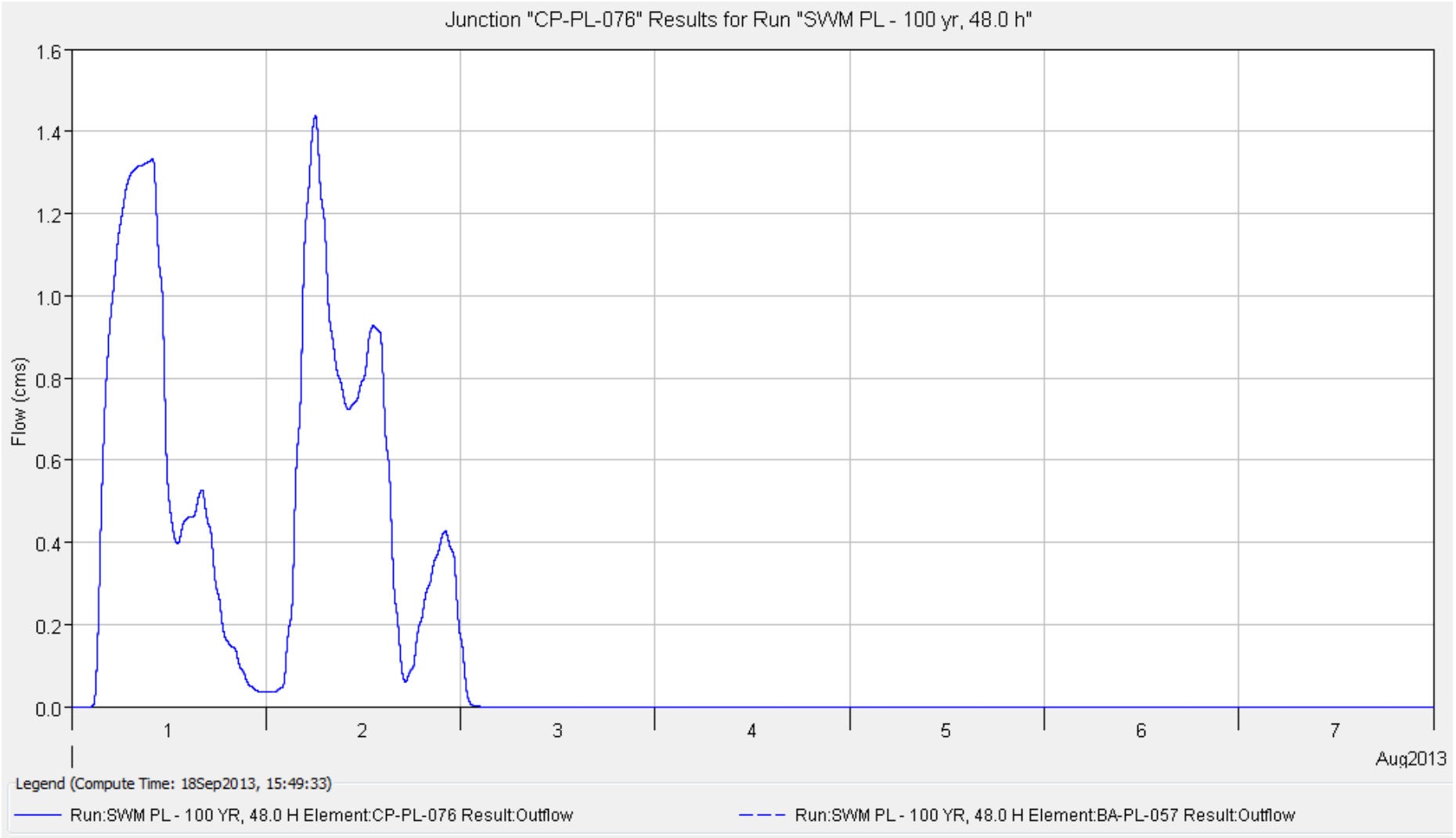

Junction "CP-PL-071" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-071 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-056 Result:Outflow

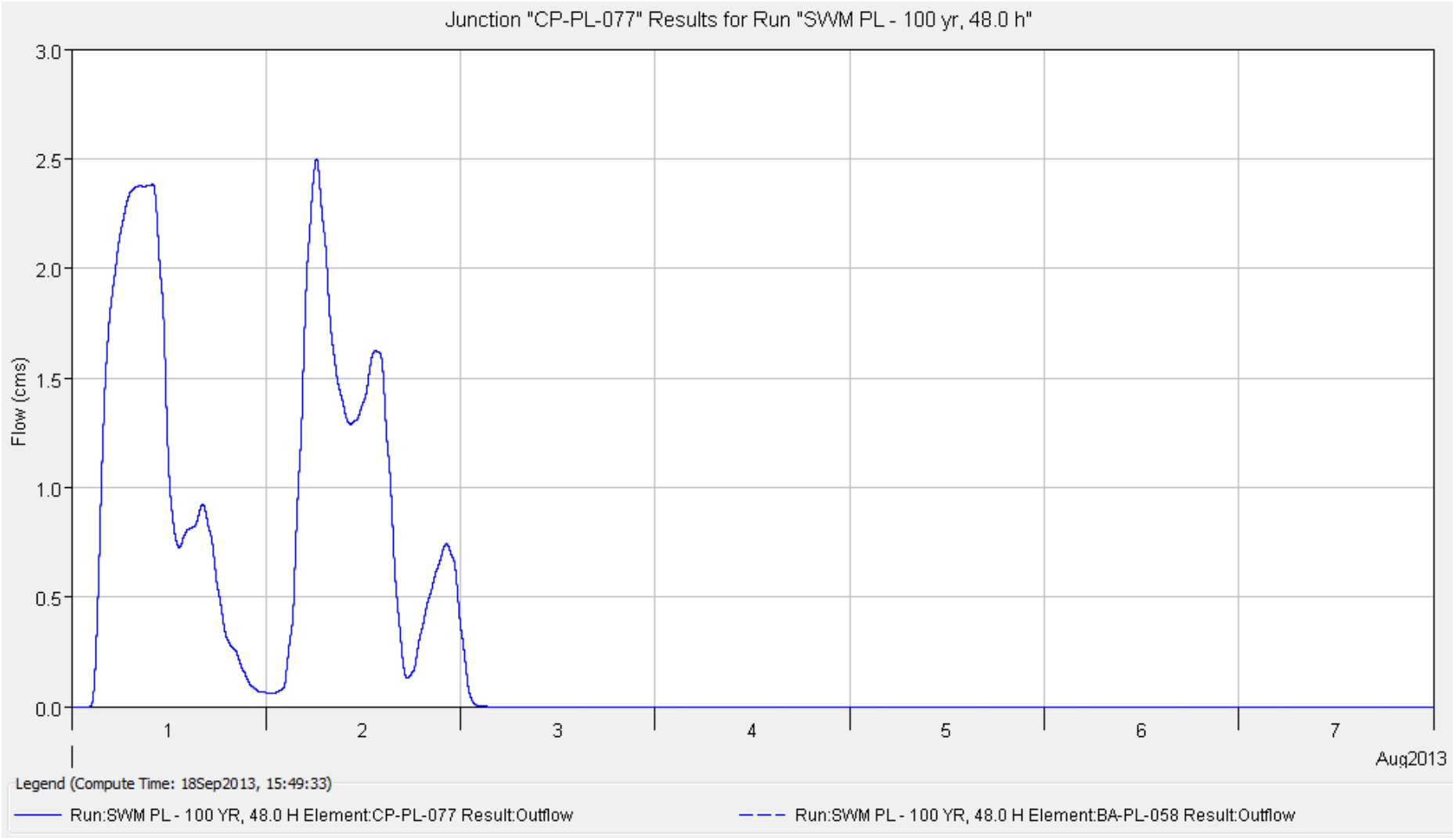

Junction "CP-PL-072" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-072 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-057 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-054 Result:Outflow

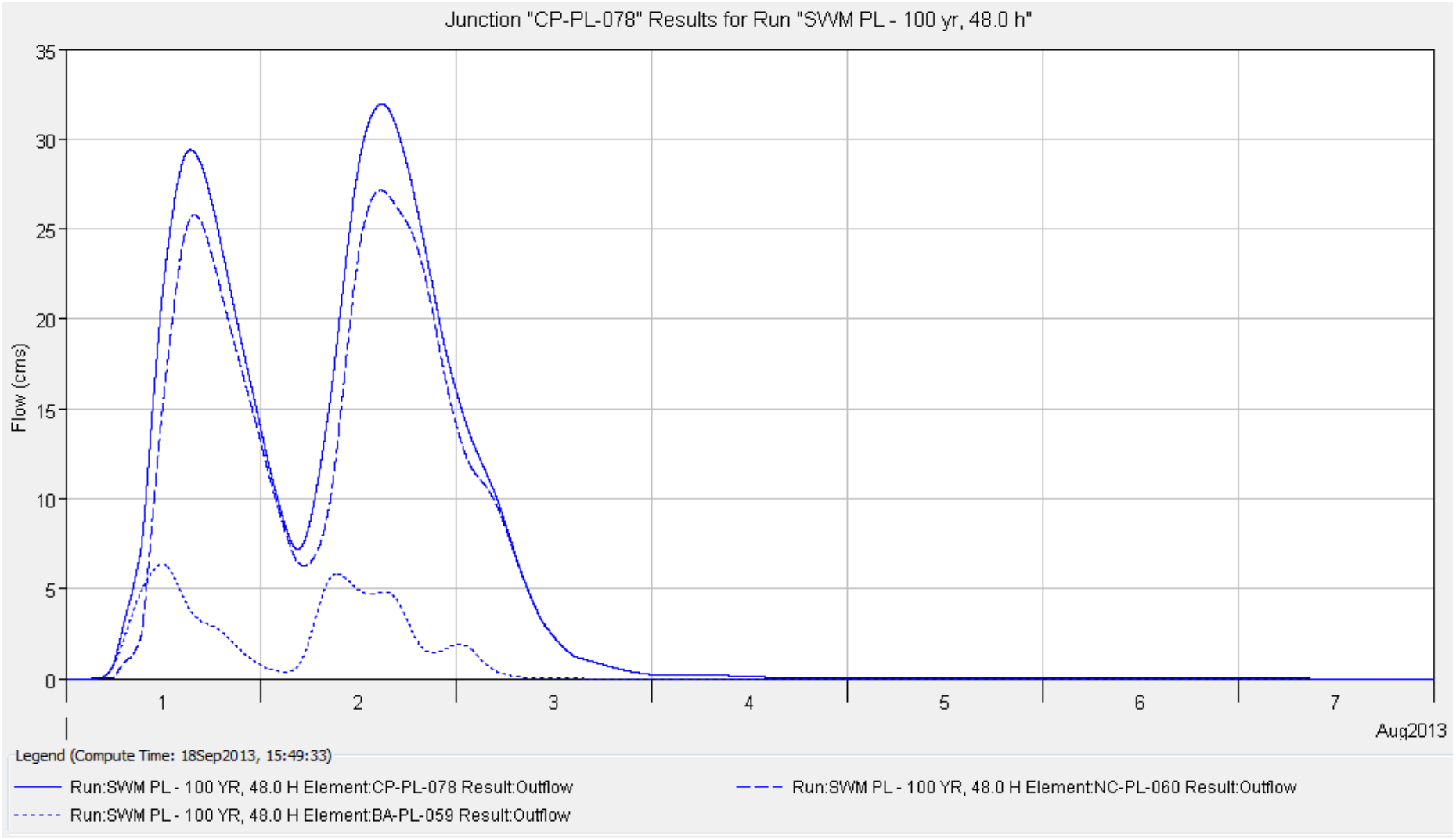

Junction "CP-PL-073" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-073 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-058 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-055 Result:Outflow

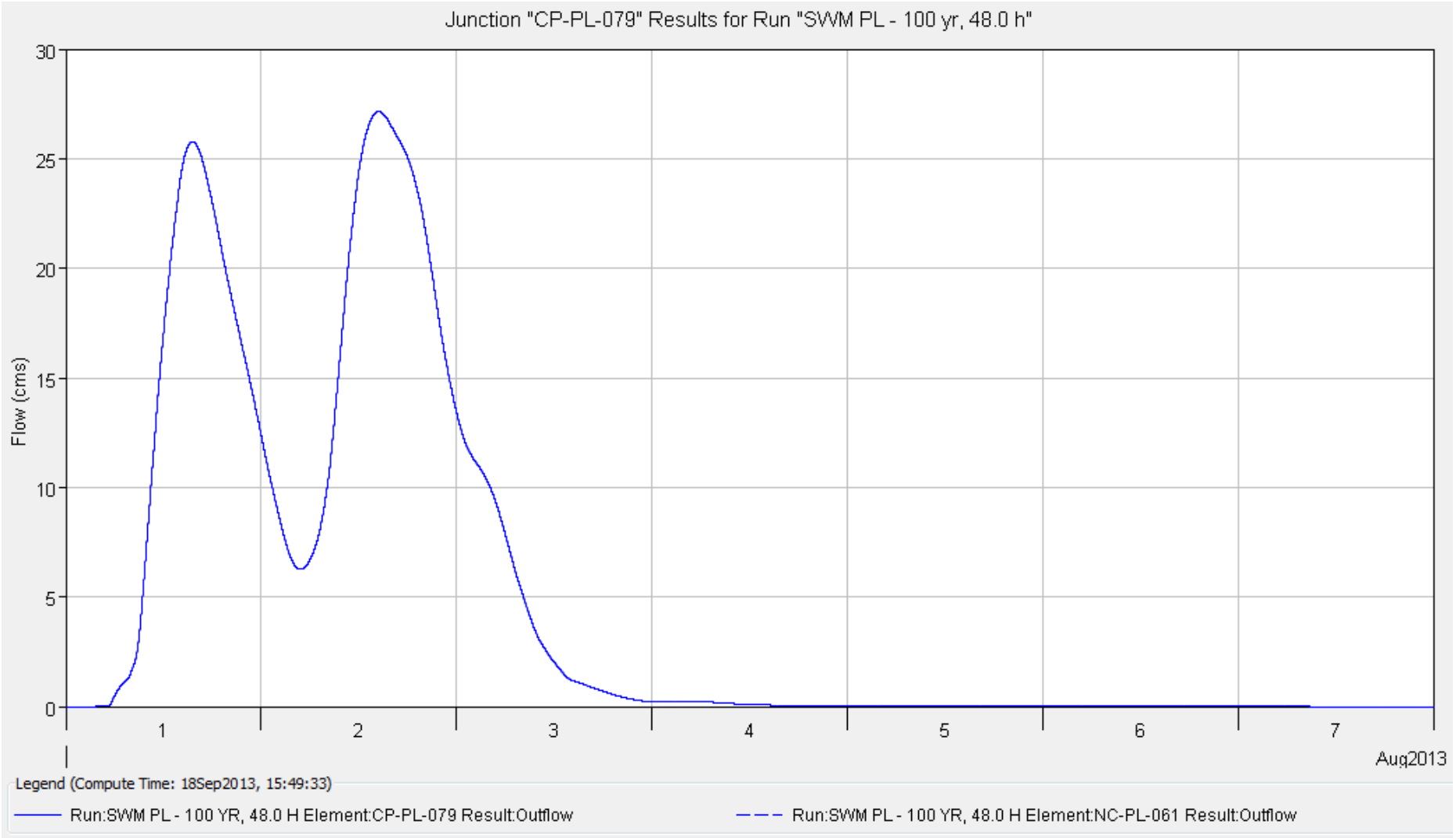

Junction "CP-PL-074" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-074 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-059 Result:Outflow

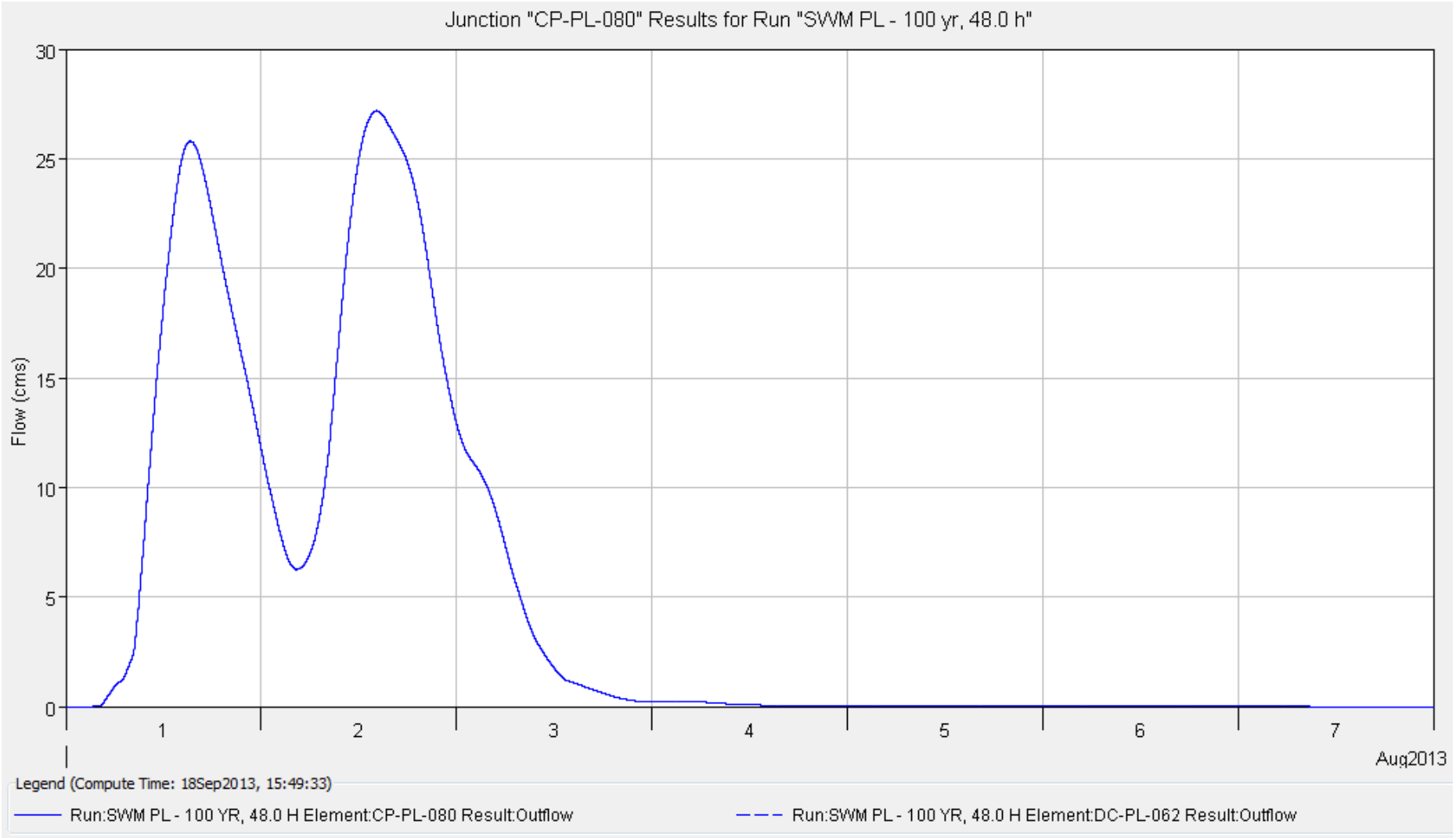

Junction "CP-PL-075" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-075 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-056 Result:Outflow

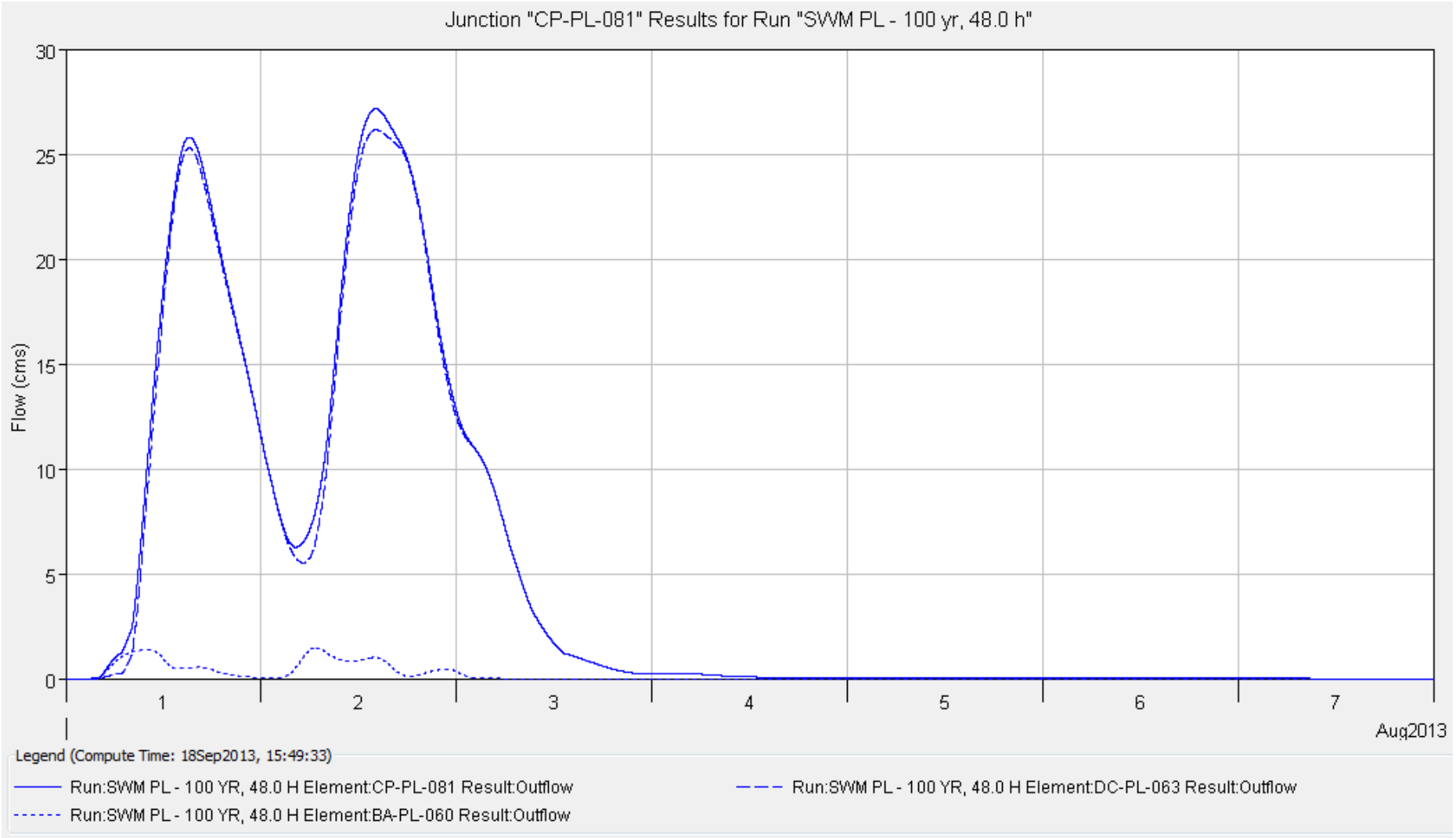

Junction "CP-PL-076" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-076 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-057 Result:Outflow

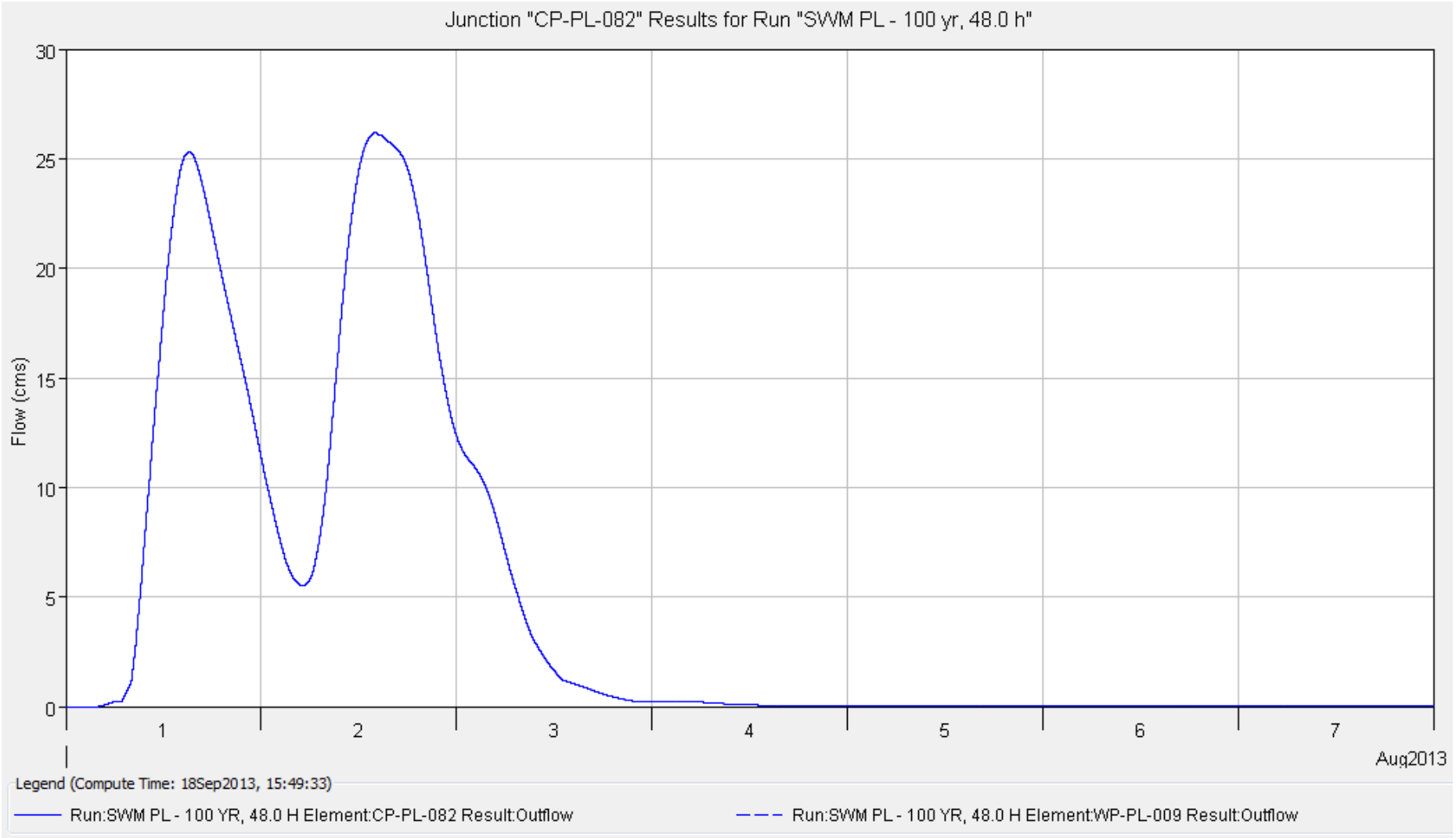

Junction "CP-PL-077" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-058 Result:Outflow

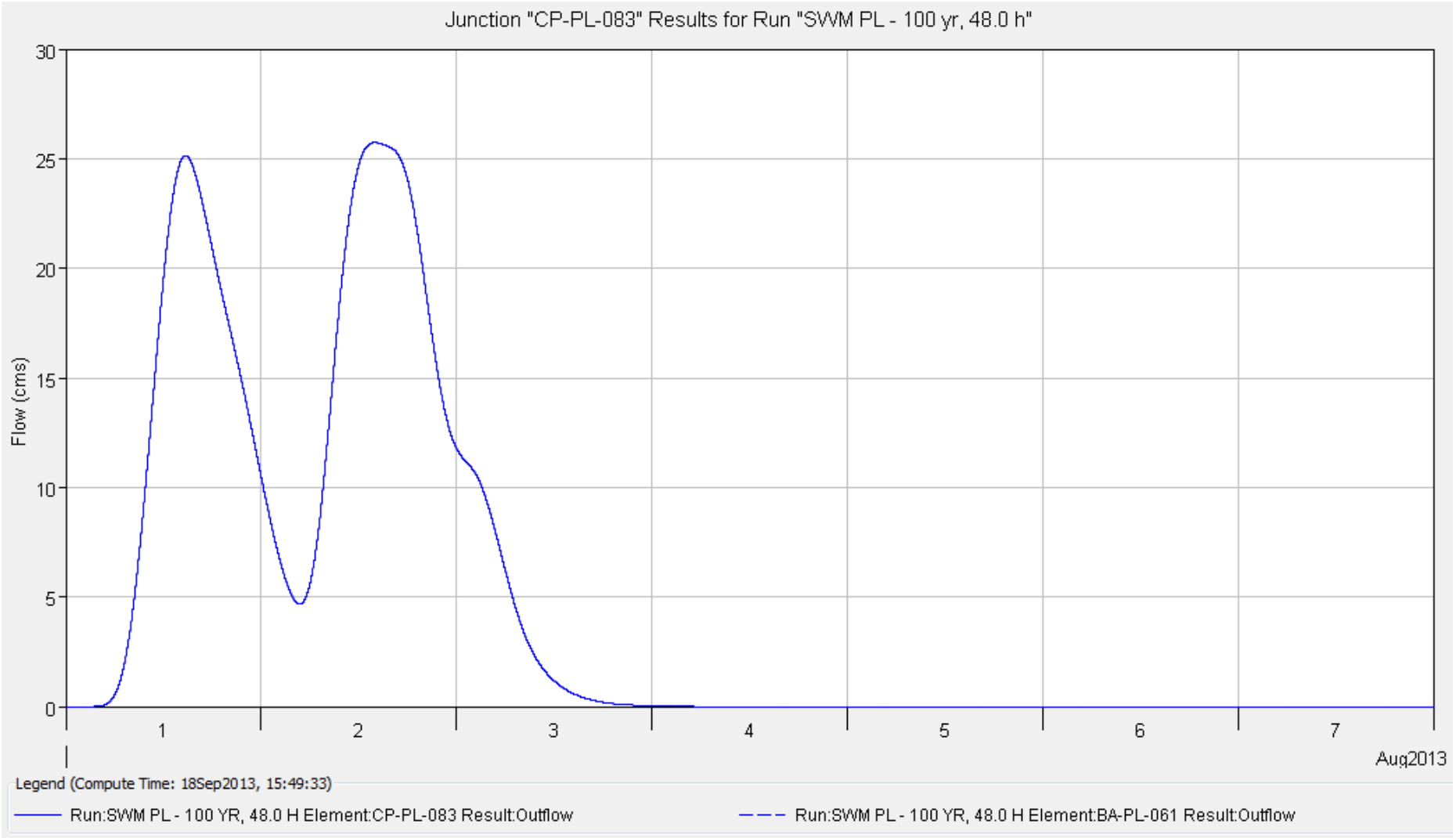

Junction "CP-PL-078" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-060 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-059 Result:Outflow

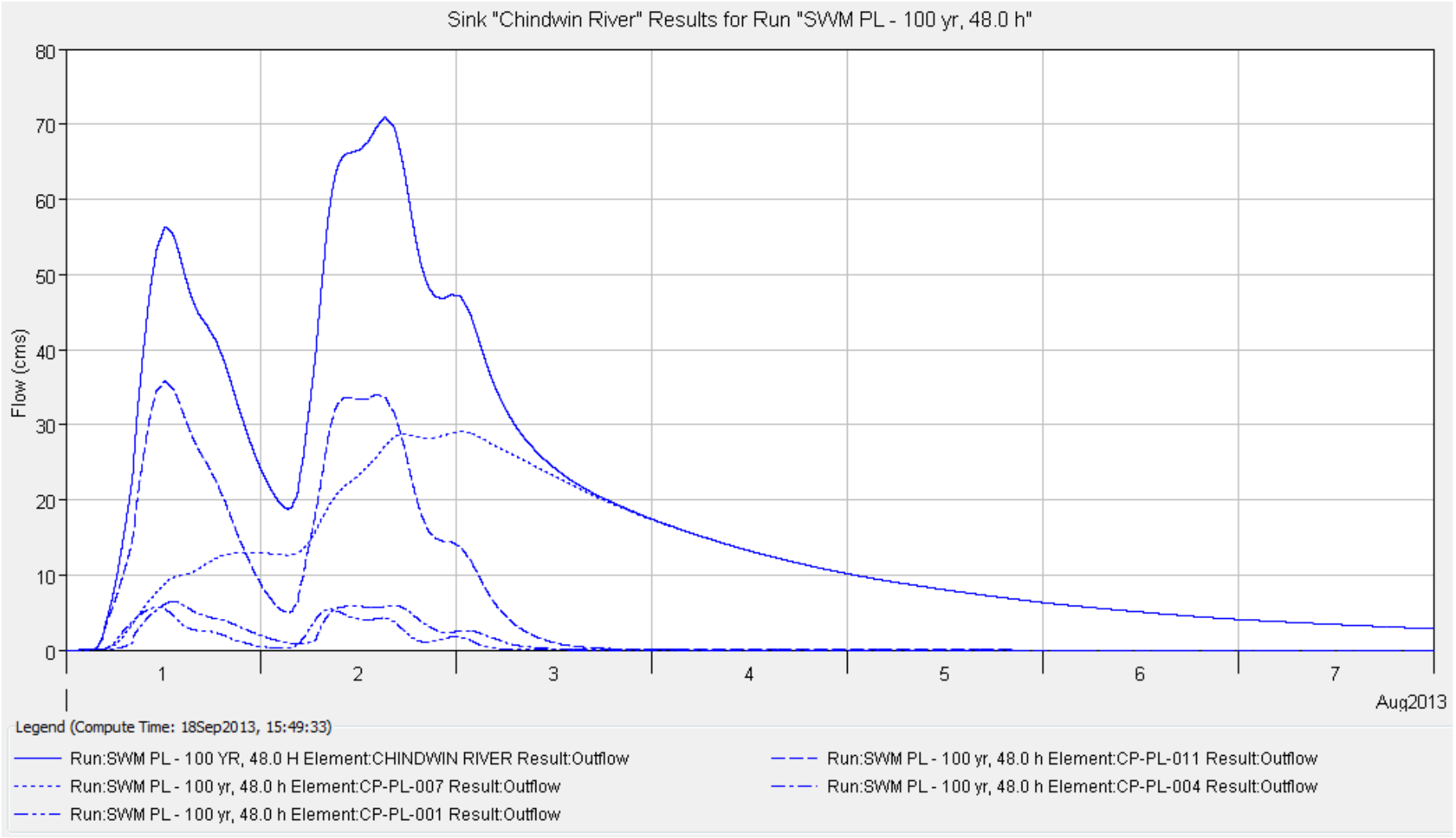

Junction "CP-PL-079" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-079 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:NC-PL-061 Result:Outflow

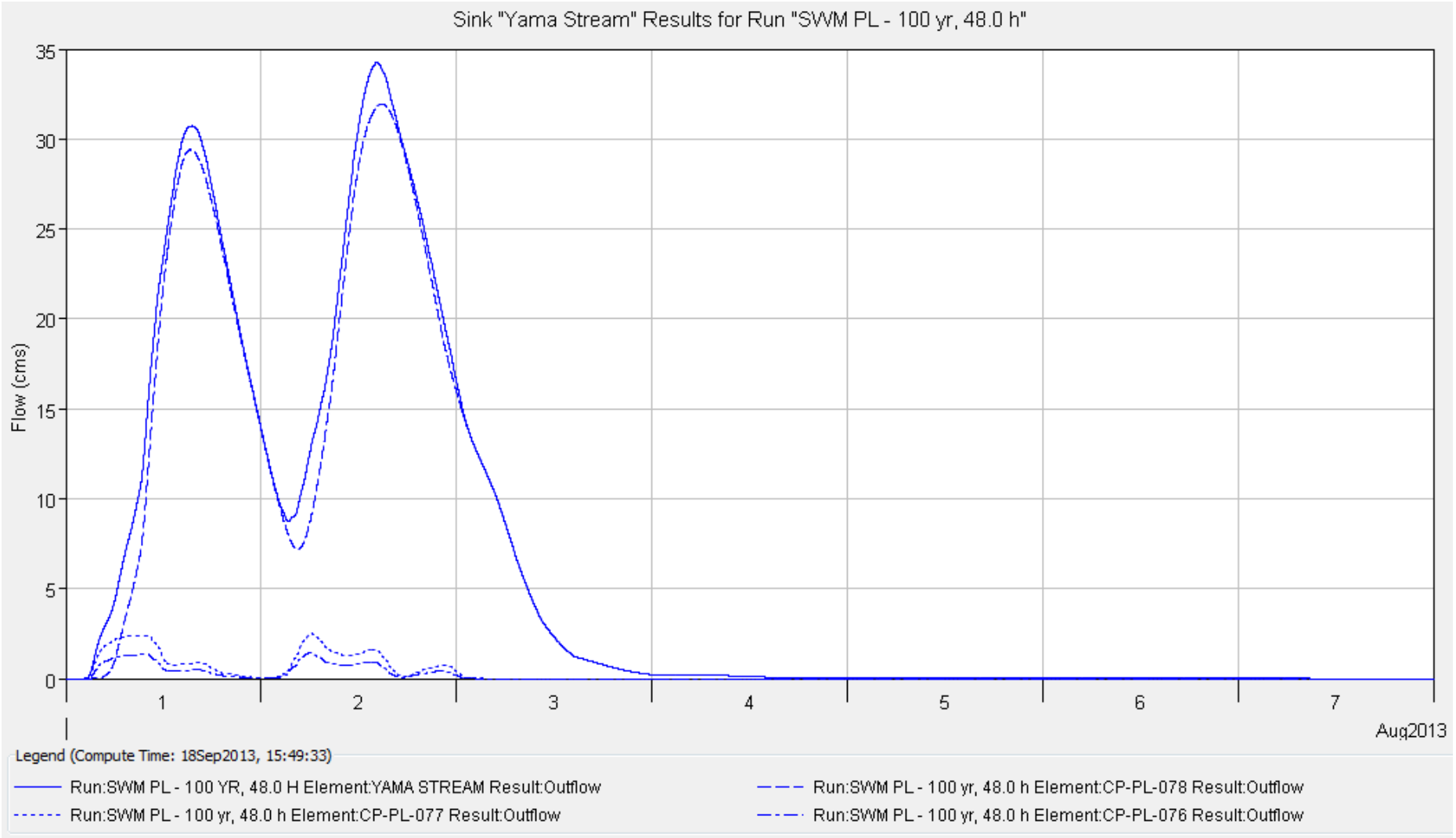

Junction "CP-PL-080" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-080 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-062 Result:Outflow

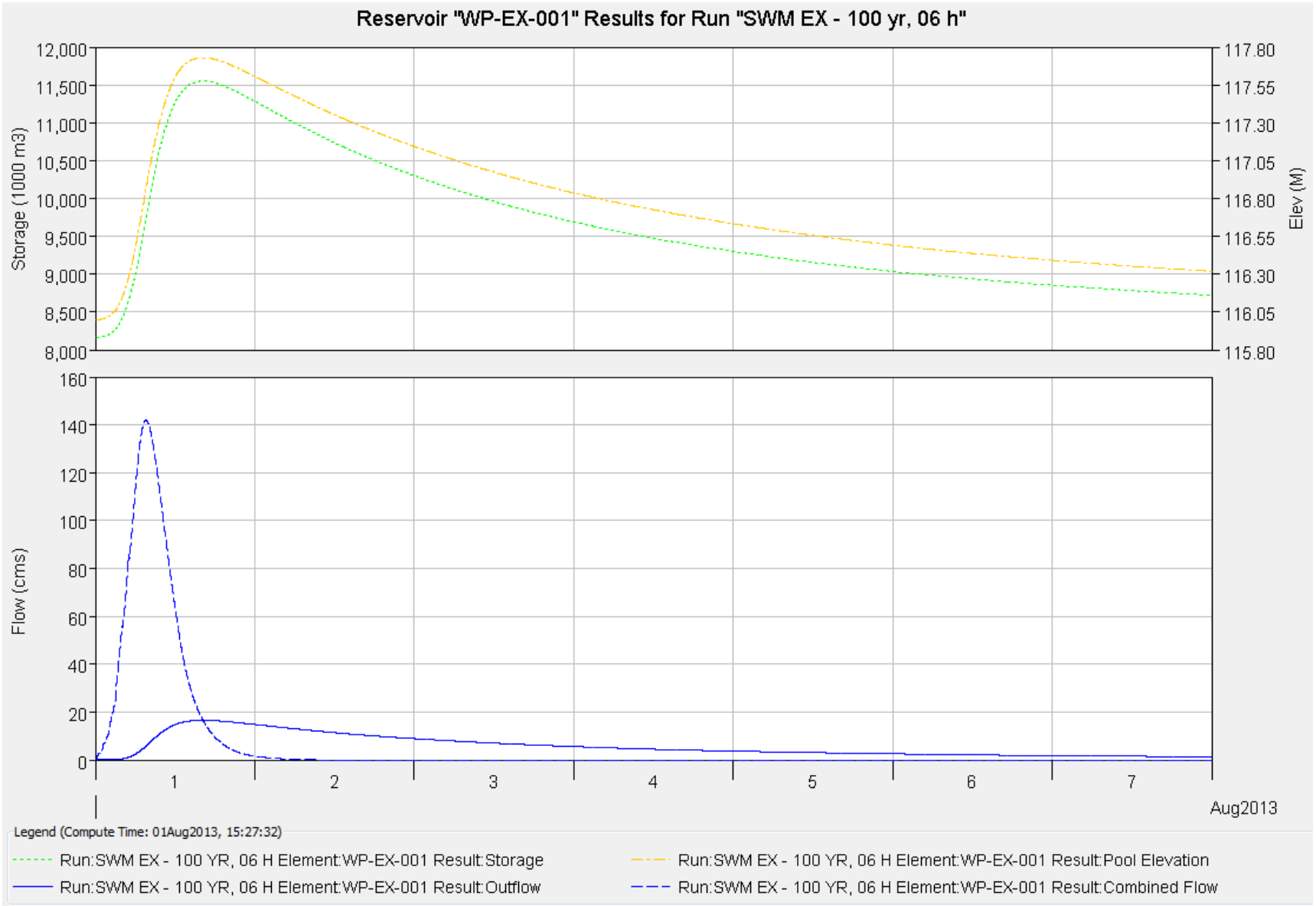

Junction "CP-PL-081" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-081 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:DC-PL-063 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-060 Result:Outflow

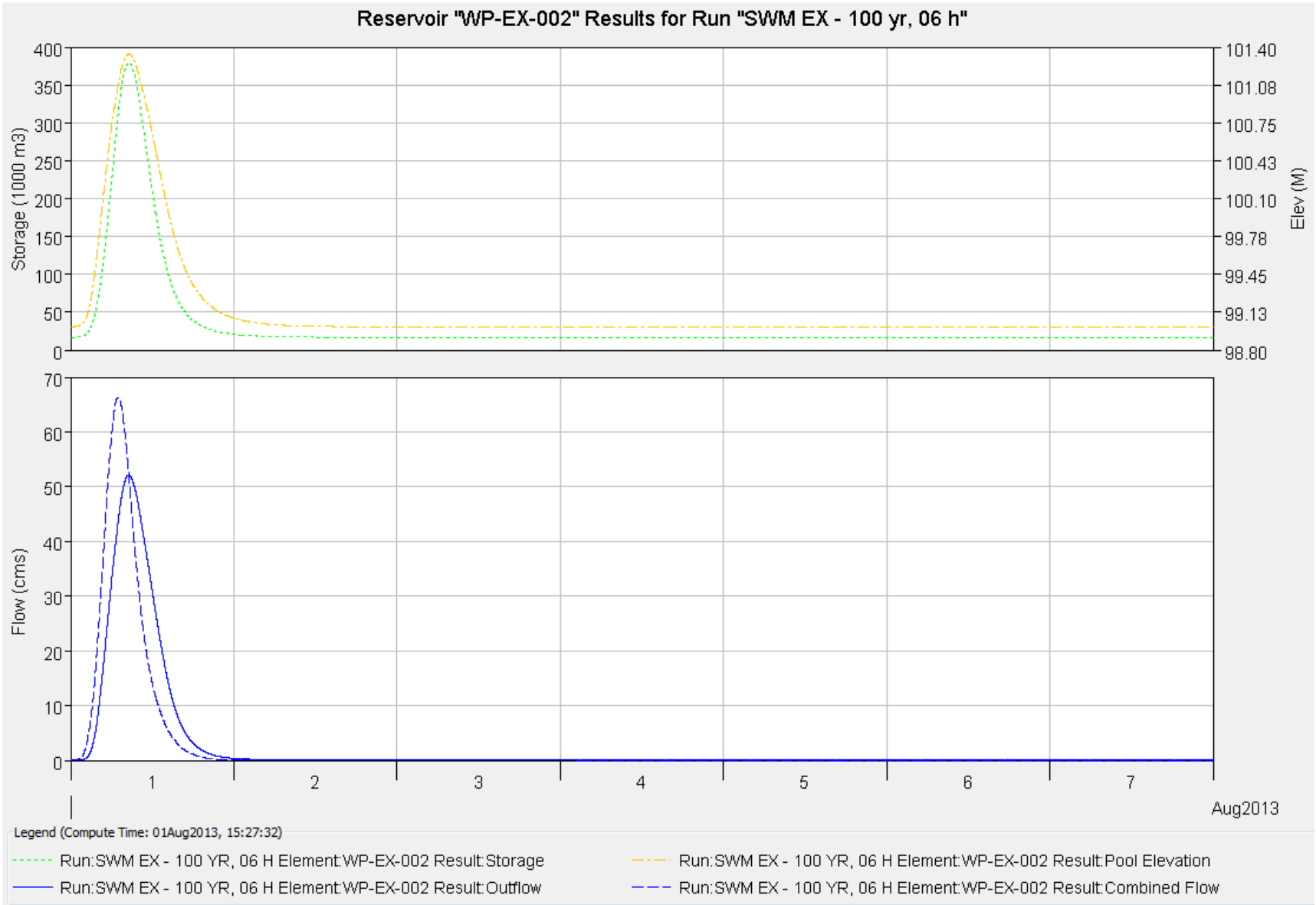

Junction "CP-PL-082" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-082 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Outflow

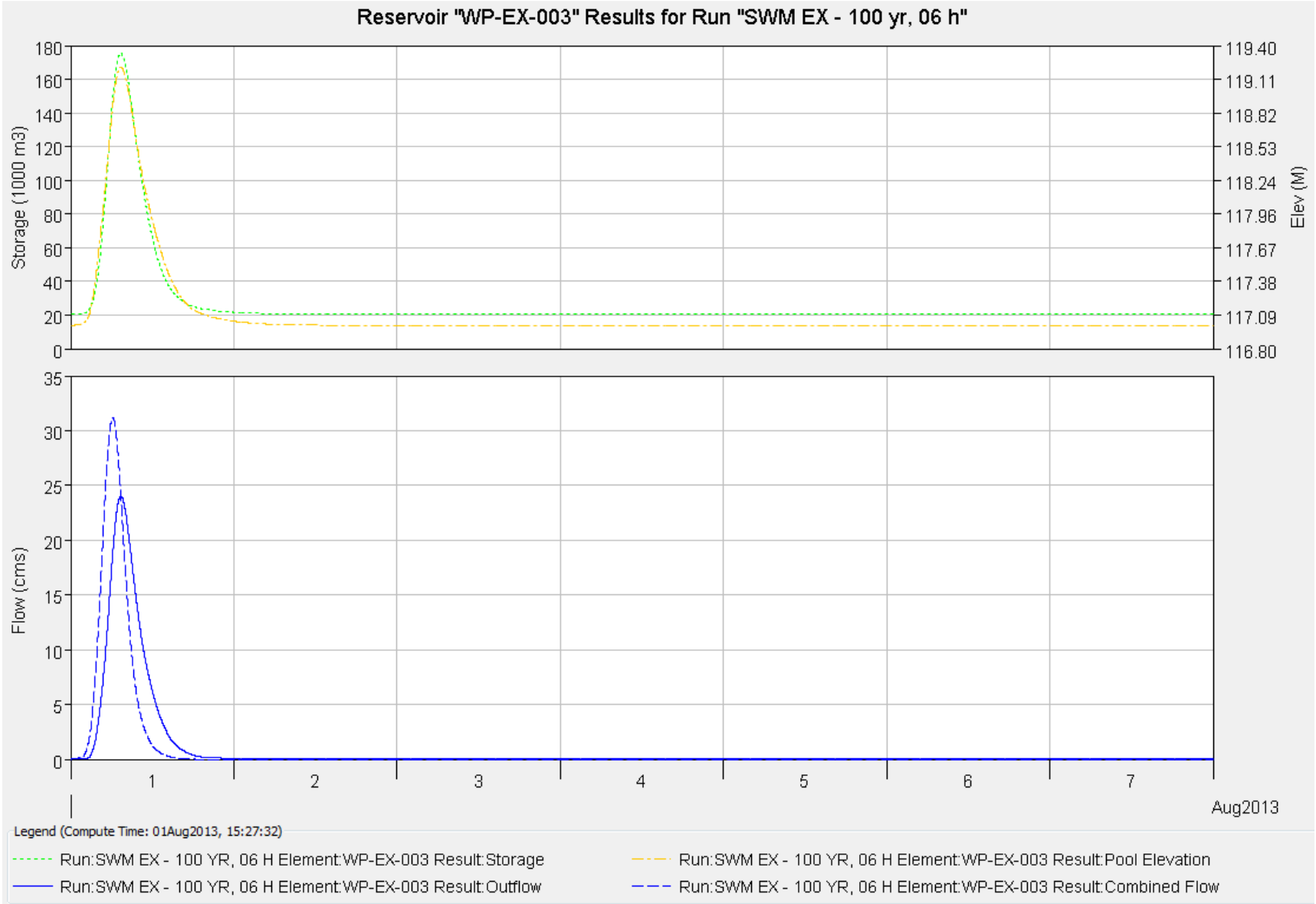

Junction "CP-PL-083" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CP-PL-083 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:BA-PL-061 Result:Outflow

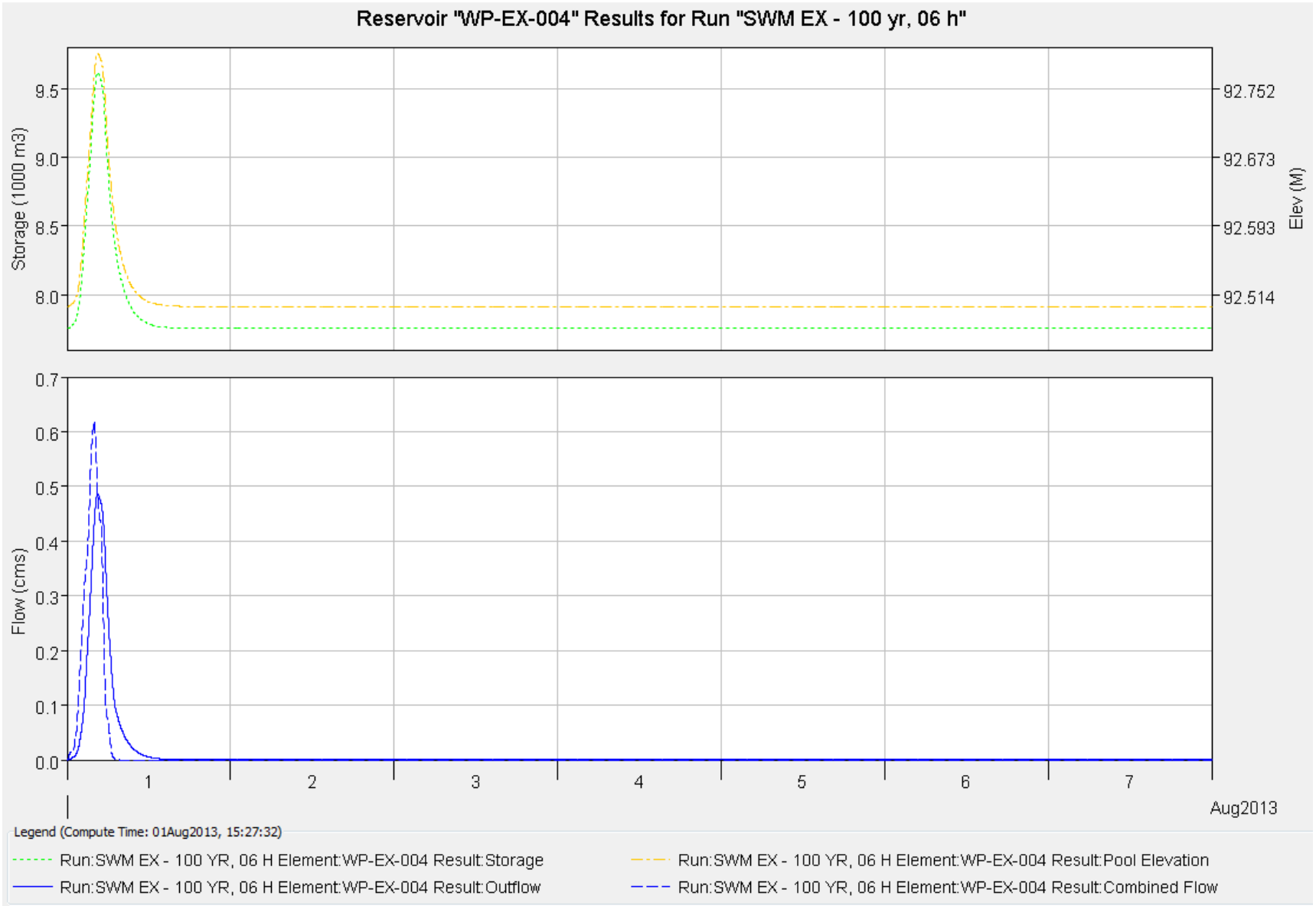

Sink "Chindwin River" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:CHINDWIN RIVER Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-007 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-001 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-011 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-004 Result:Outflow

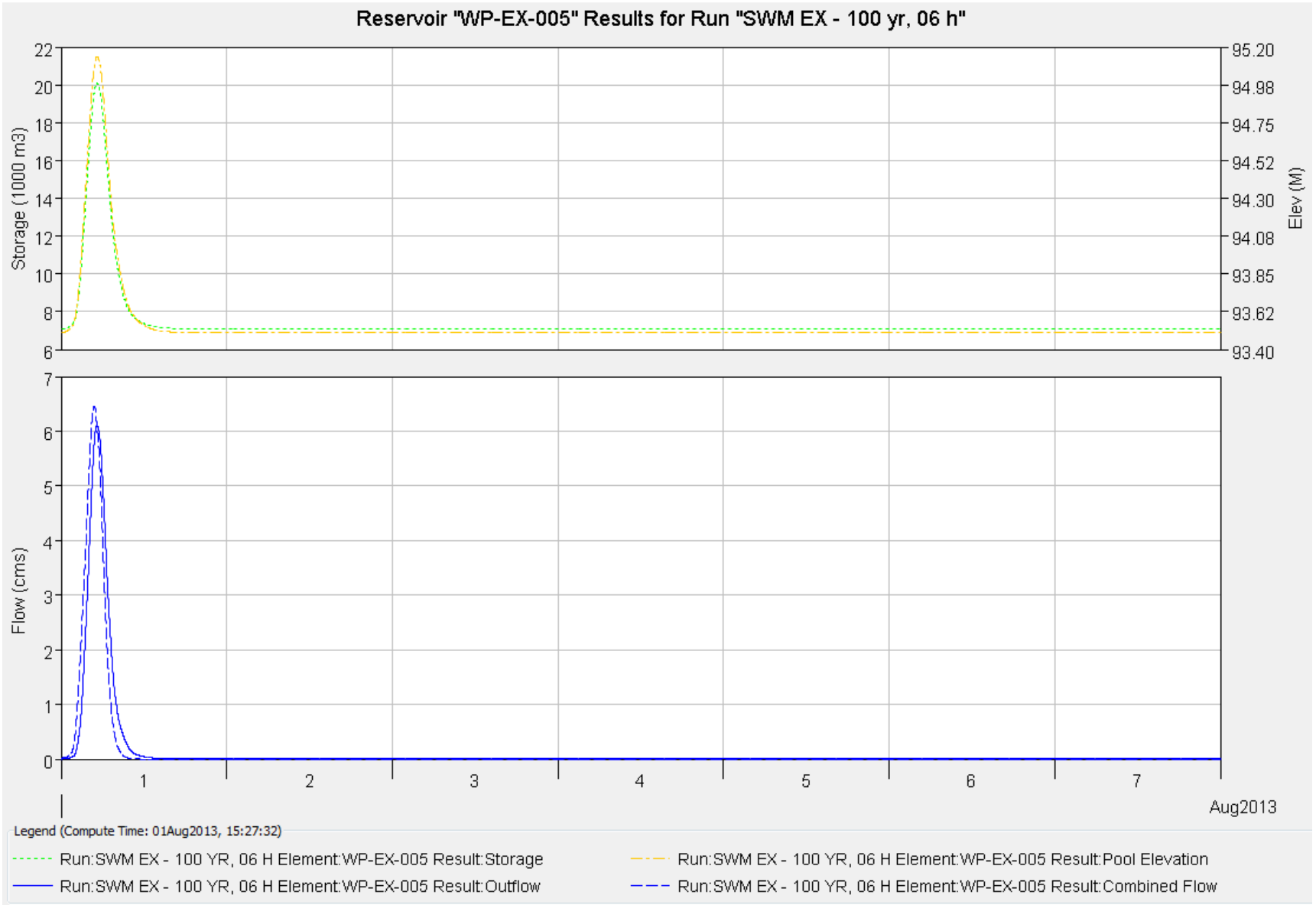

Sink "Yama Stream" Results for Run "SWM PL - 100 yr, 48.0 h"
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:YAMA STREAM Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-078 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-077 Result:Outflow
Run:SWM PL - 100 yr, 48.0 h Element:CP-PL-076 Result:Outflow

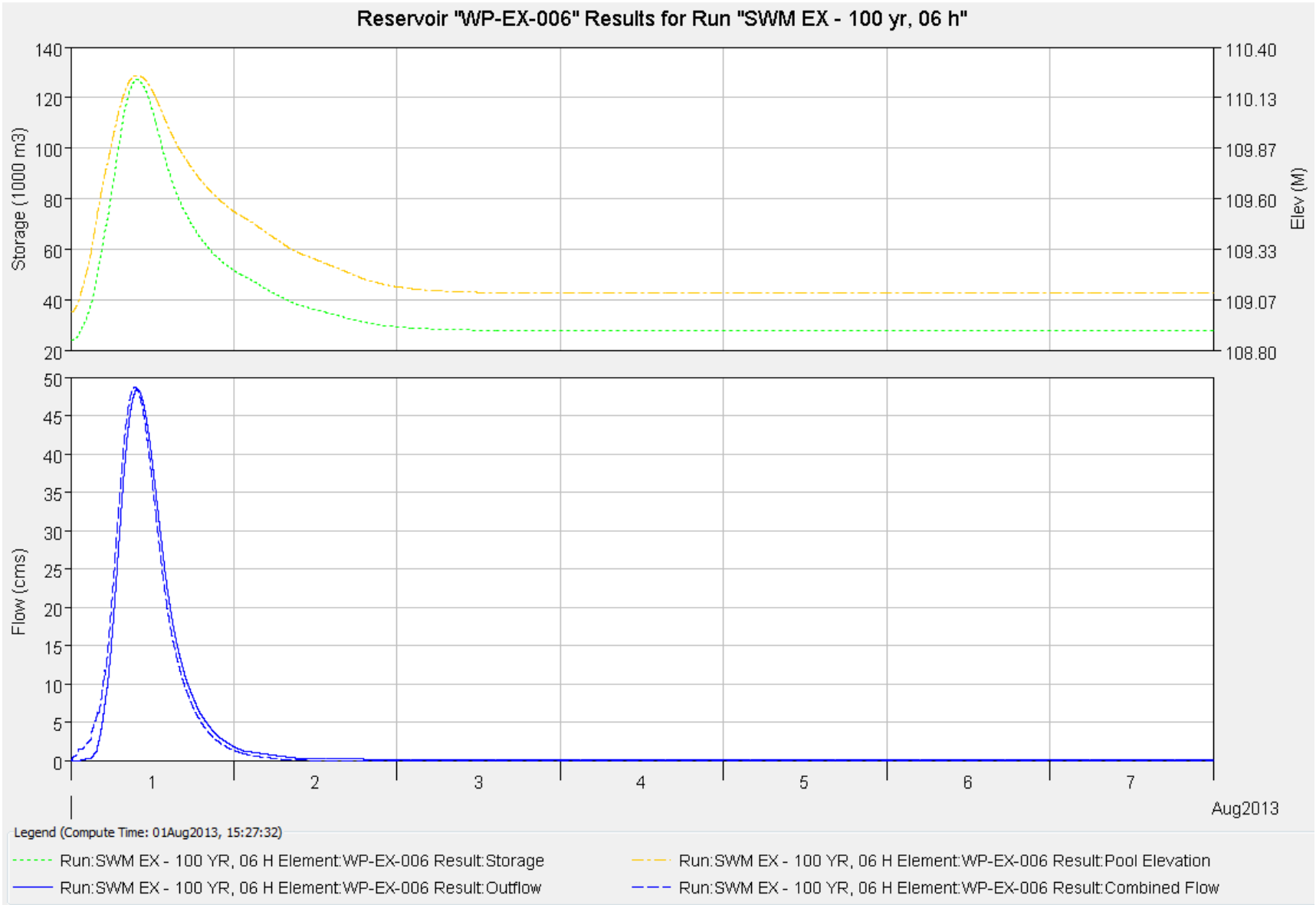

Reservoir "WP-EX-001" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
Elev (M)
12,000
11,500
11,000
10,500
10,000
9,500
9,000
8,500
8,000
117.80
117.55
117.30
117.05
116.80
116.55
116.30
116.05
115.80
Flow (cms)
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-001 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-001 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-001 Result:Combined Flow

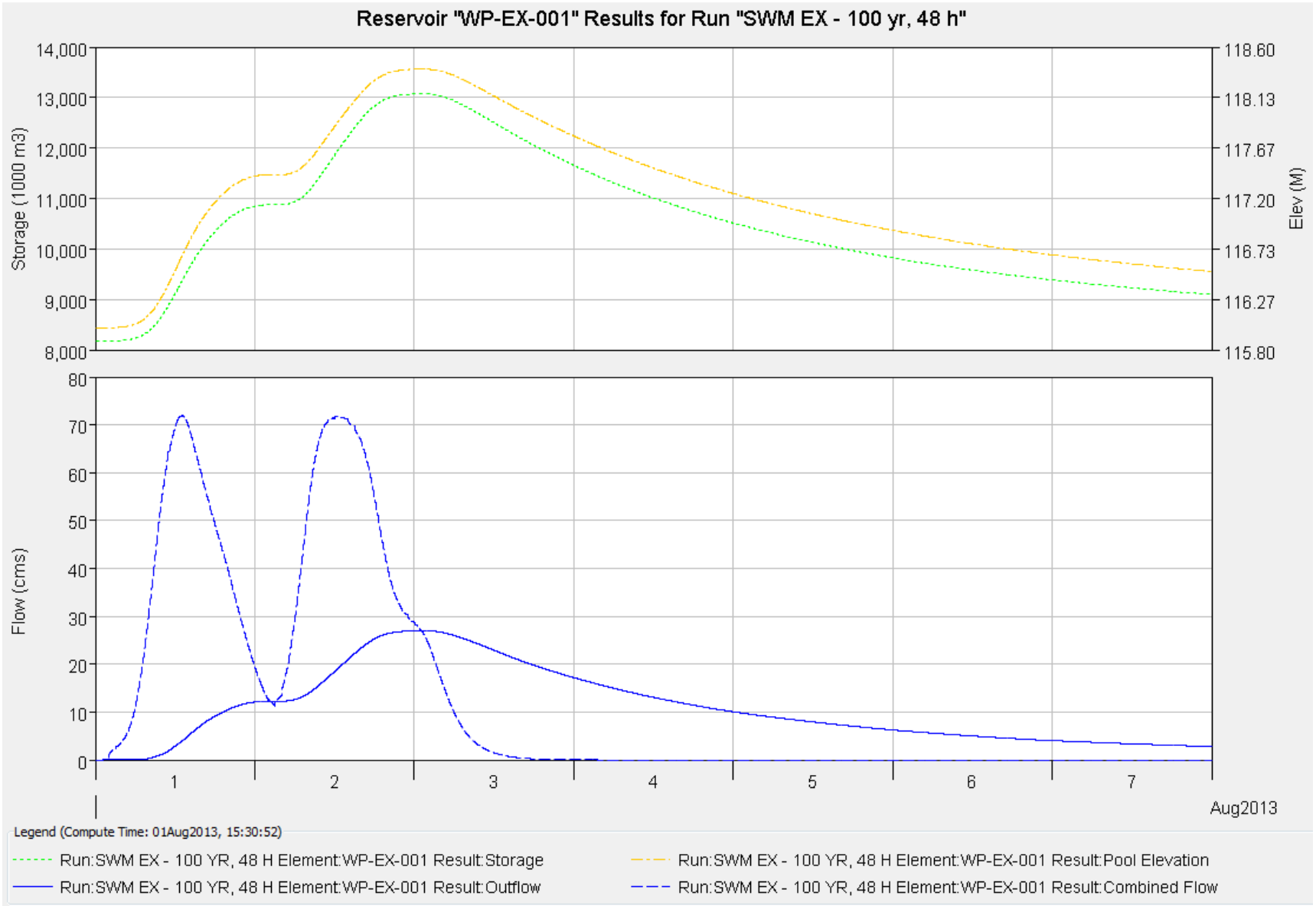

Reservoir "WP-EX-002" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
Elev (M)
400
350
300
250
200
150
100
50
0
101.40
101.08
100.75
100.43
100.10
99.78
99.45
99.13
98.80
Flow (cms)
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-002 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-002 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-002 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-002 Result:Combined Flow

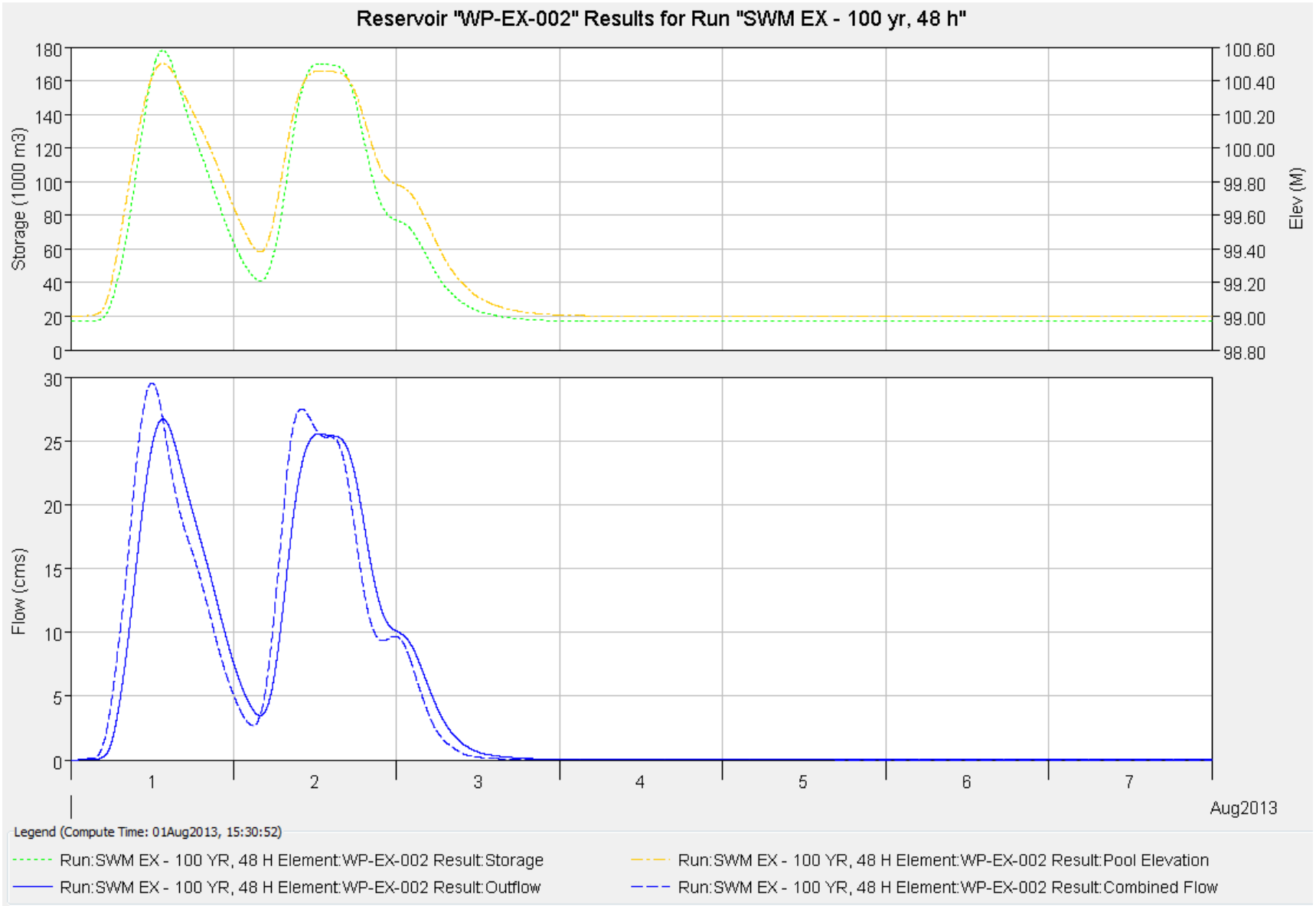

Reservoir "WP-EX-003" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
Elev (M)
180
160
140
120
100
80
60
40
20
0
119.40
119.11
118.82
118.53
118.24
117.96
117.67
117.38
117.09
116.80
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-003 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-003 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-003 Result:Combined Flow

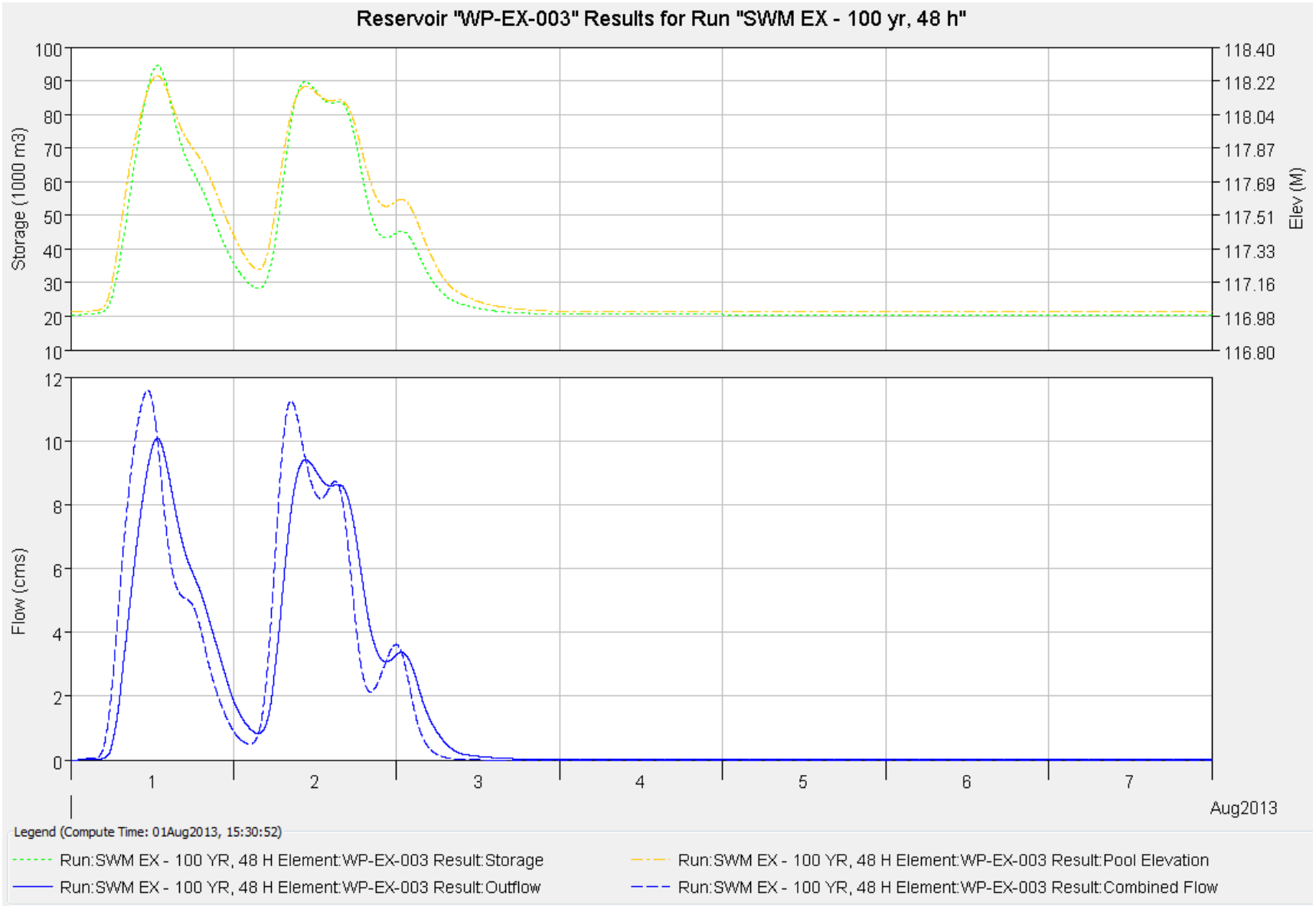

Reservoir "WP-EX-004" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
9.5
9.0
8.5
8.0
92.752
92.673
92.593
92.514
Elev (M)
Flow (cms)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-004 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-004 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-004 Result:Combined Flow

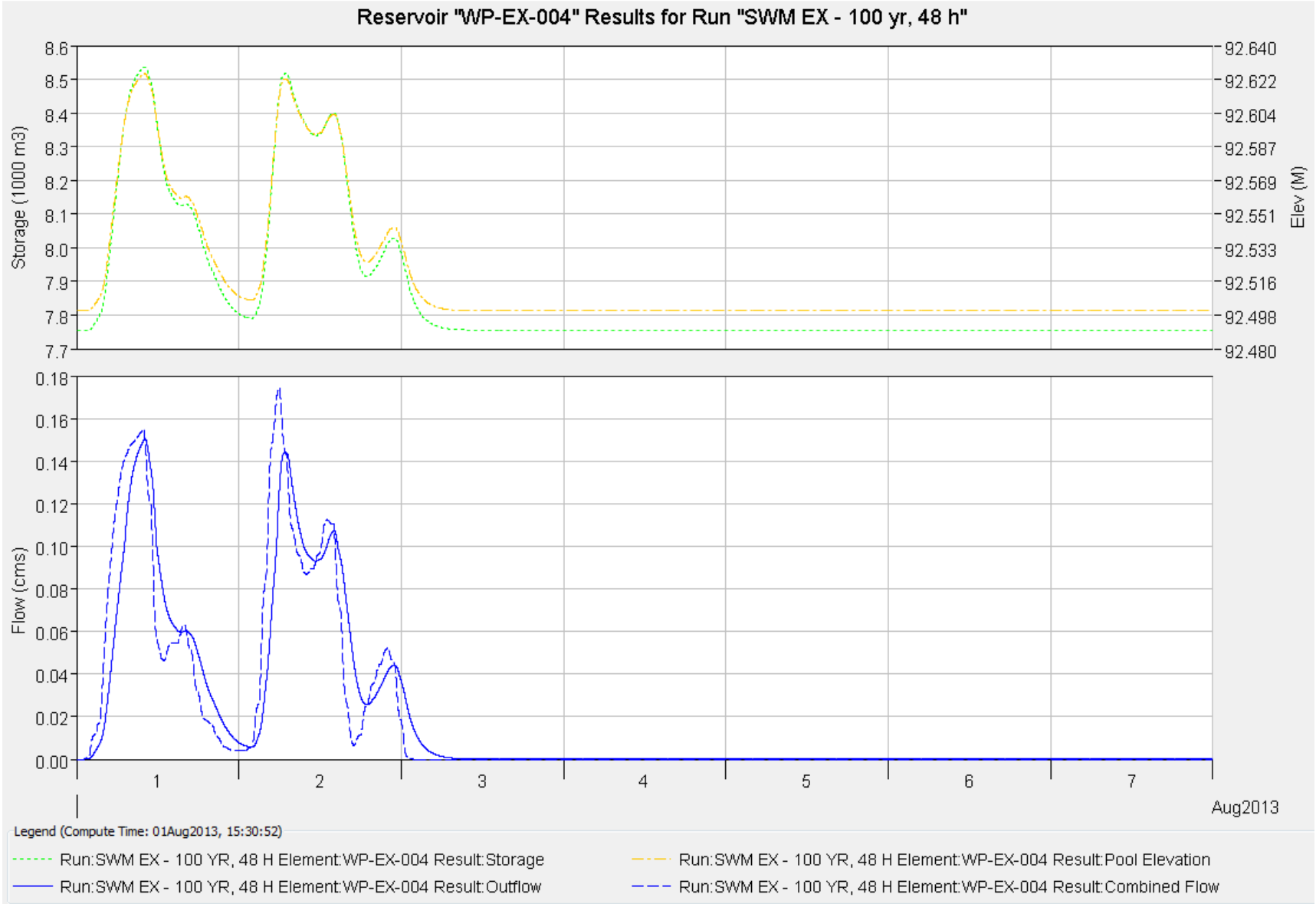

Reservoir "WP-EX-005" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
22
20
18
16
14
12
10
8
6
95.20
94.98
94.75
94.52
94.30
94.08
93.85
93.62
93.40
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-005 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-005 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-005 Result:Combined Flow

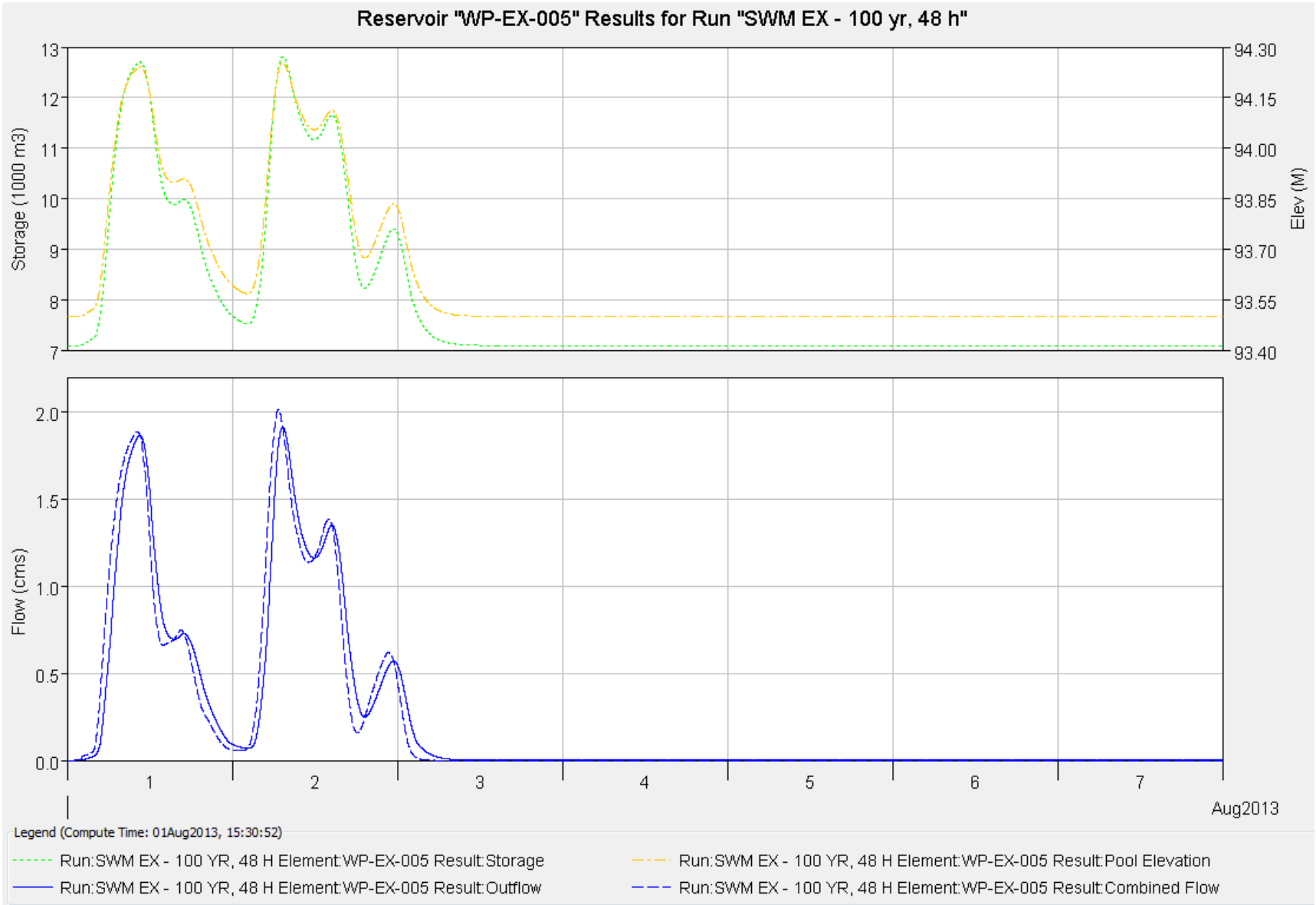

Reservoir "WP-EX-006" Results for Run "SWM EX - 100 yr, 06 h"
Storage (1000 m3)
Elev (M)
140
120
100
80
60
40
20
110.40
110.13
109.87
109.60
109.33
109.07
108.80
Flow (cms)
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:27:32)
Run:SWM EX - 100 YR, 06 H Element:WP-EX-006 Result:Storage
Run:SWM EX - 100 YR, 06 H Element:WP-EX-006 Result:Pool Elevation
Run:SWM EX - 100 YR, 06 H Element:WP-EX-006 Result:Outflow
Run:SWM EX - 100 YR, 06 H Element:WP-EX-006 Result:Combined Flow

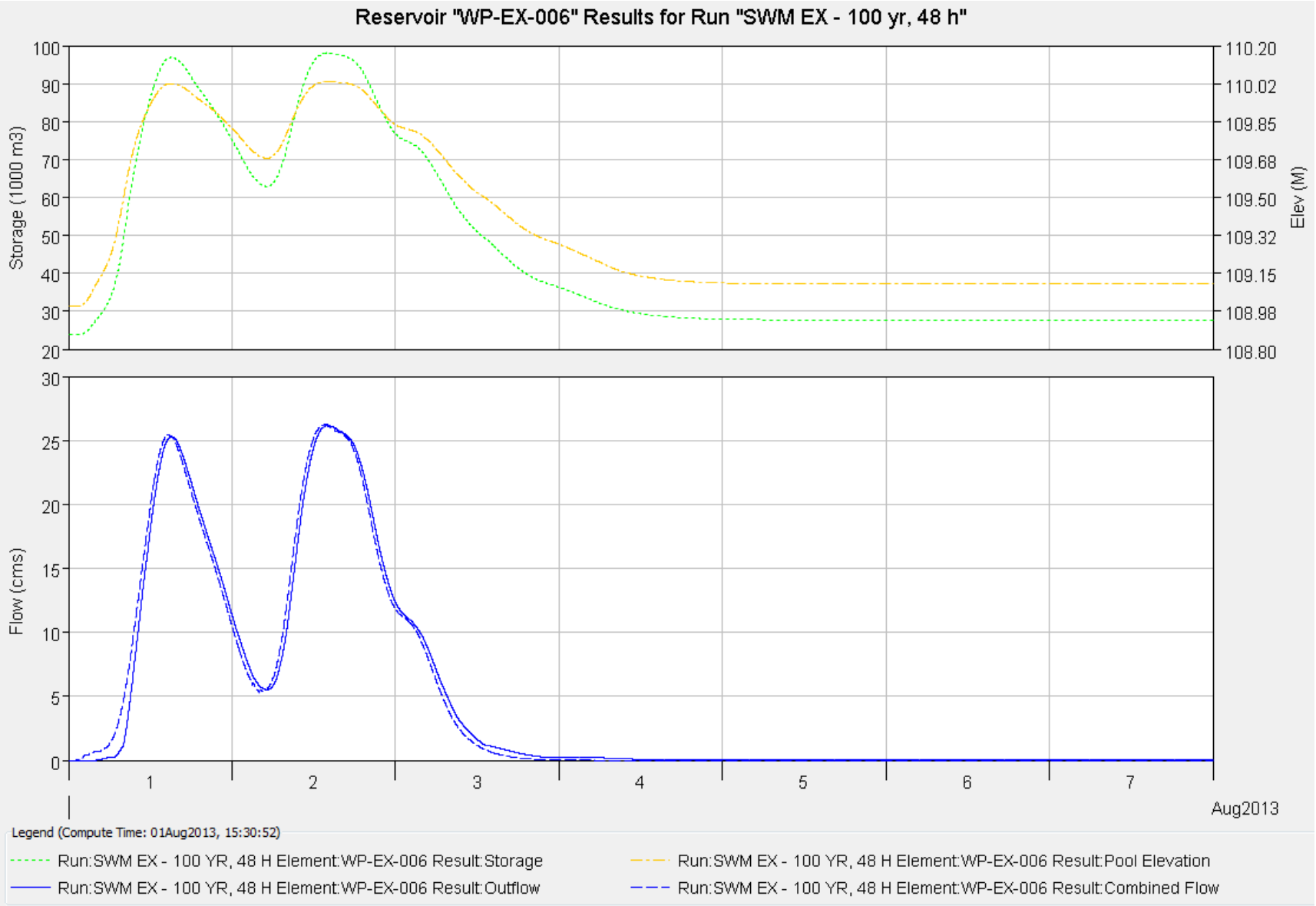

Reservoir "WP-EX-001" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
14,000
13,000
12,000
11,000
10,000
9,000
8,000
Elev (M)
118.60
118.13
117.67
117.20
116.73
116.27
115.80
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-001 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-001 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-001 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-001 Result:Combined Flow

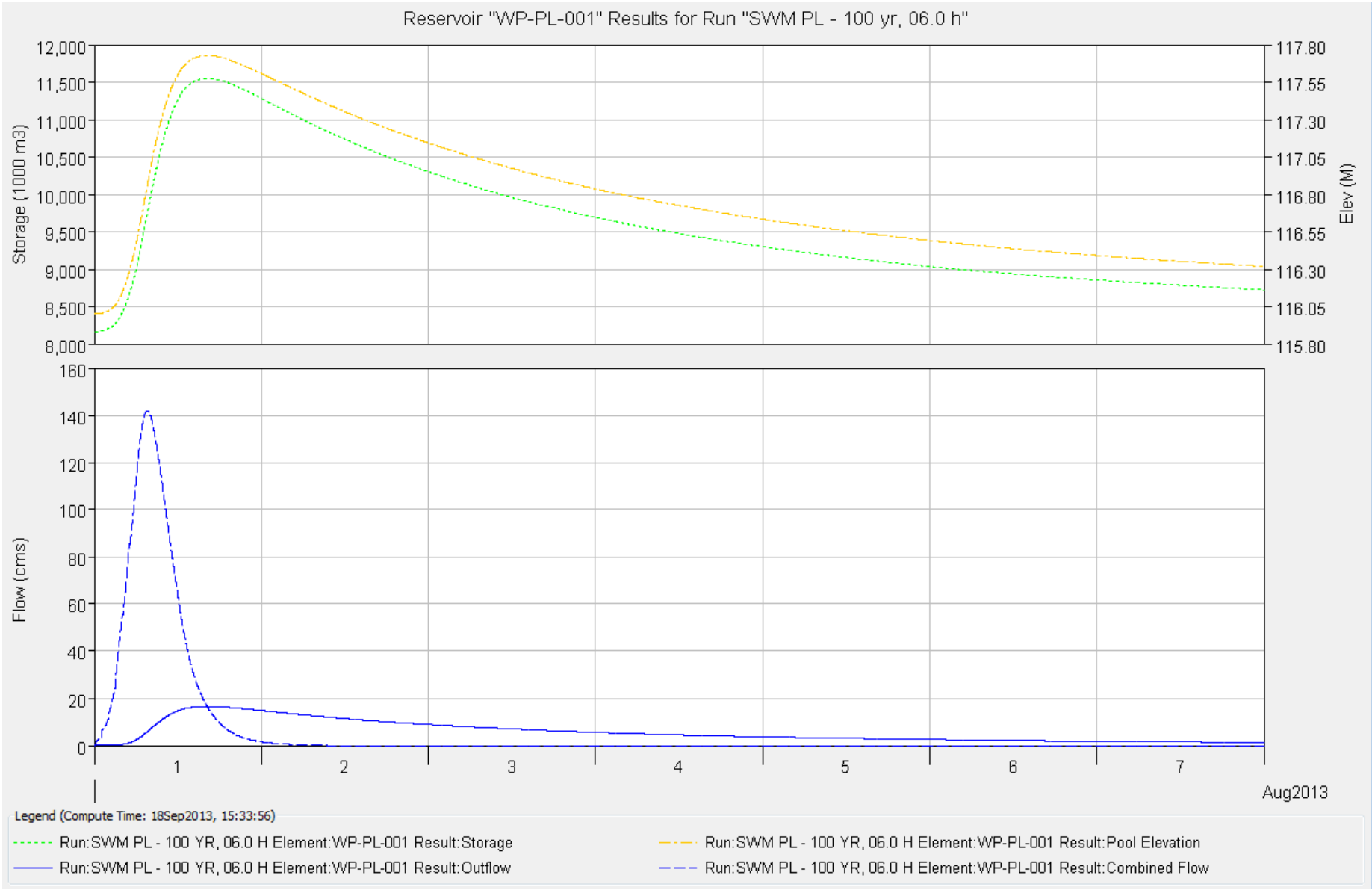

Reservoir "WP-EX-002" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-002 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-002 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-002 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-002 Result:Combined Flow

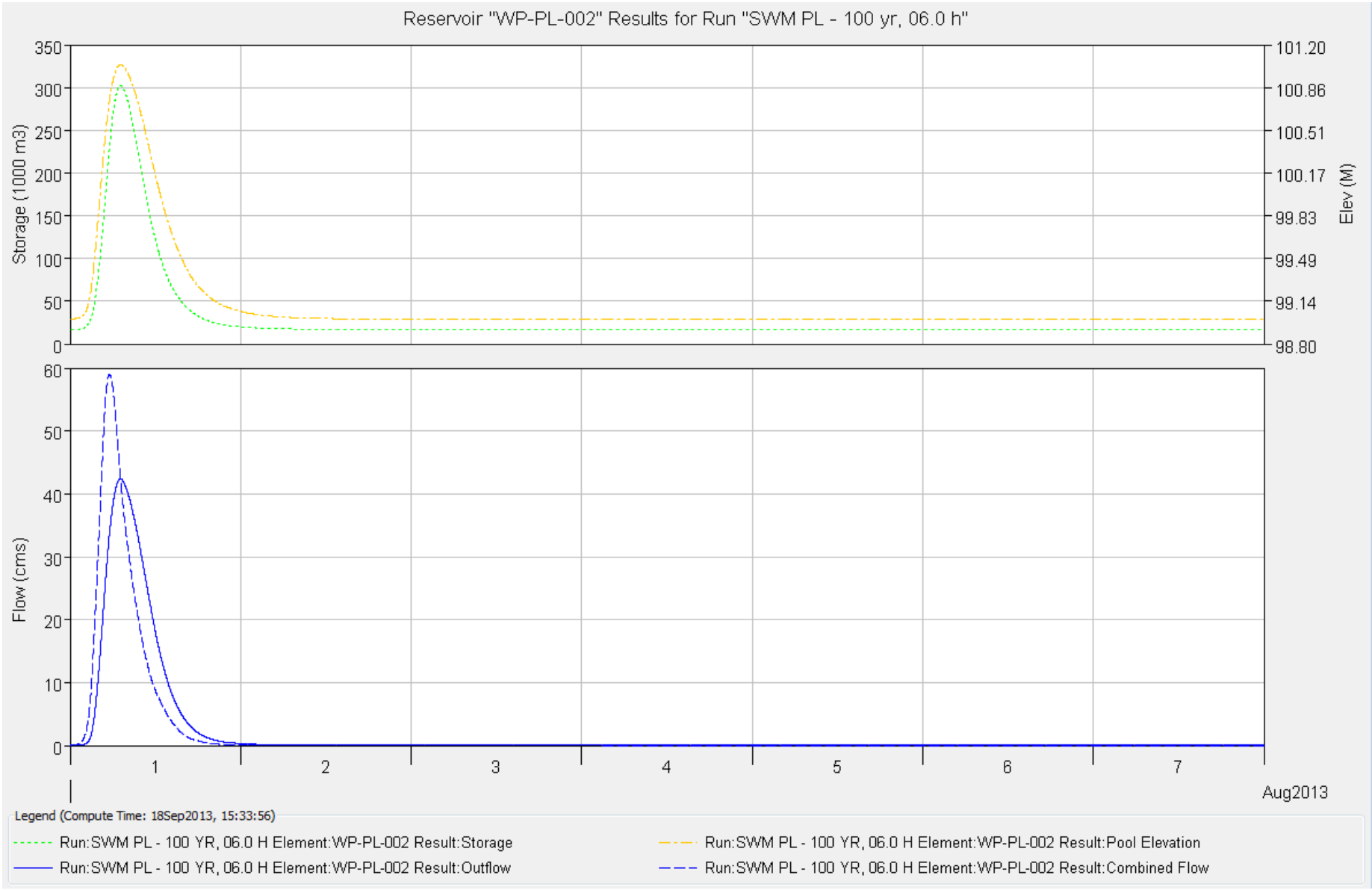

Reservoir "WP-EX-003" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
Elev (M)
100
90
80
70
60
50
40
30
20
10
118.40
118.22
118.04
117.87
117.69
117.51
117.33
117.16
116.98
116.80
Flow (cms)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-003 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-003 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-003 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-003 Result:Combined Flow

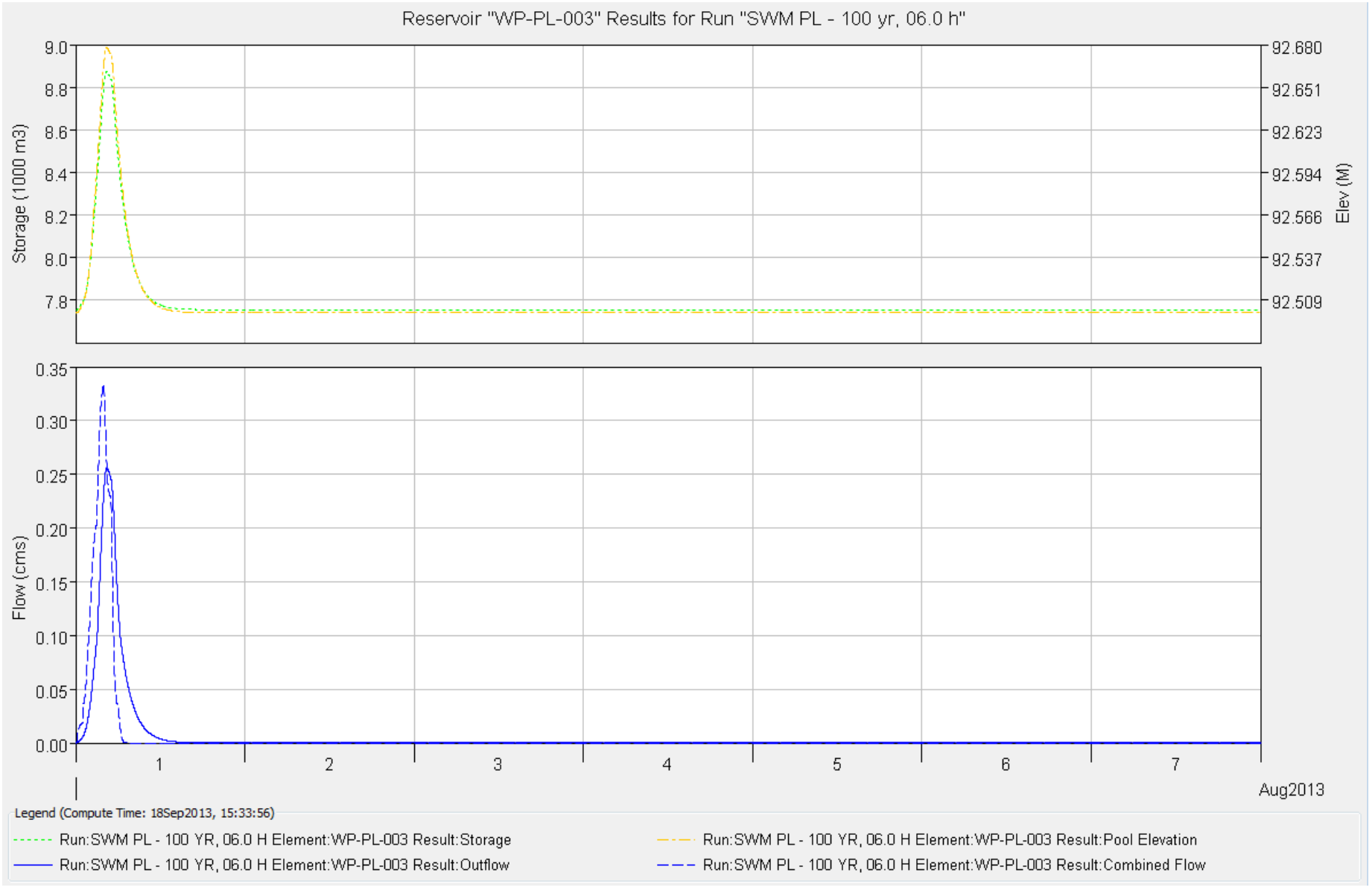

Reservoir "WP-EX-004" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
8.6
8.5
8.4
8.3
8.2
8.1
8.0
7.9
7.8
7.7
Elev (M)
92.640
92.622
92.604
92.587
92.569
92.551
92.533
92.516
92.498
92.480
Flow (cms)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-004 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-004 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-004 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-004 Result:Combined Flow

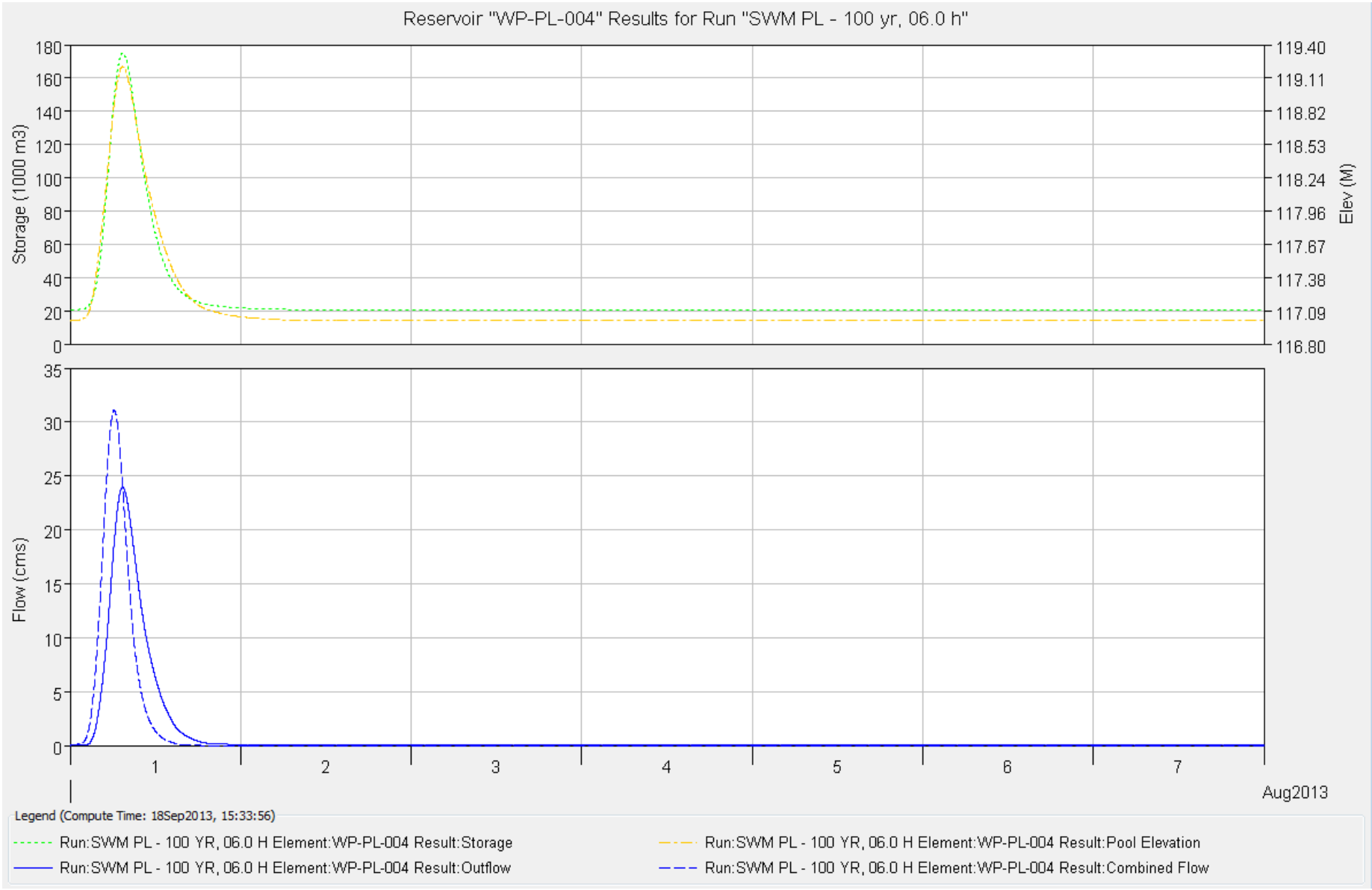

Reservoir "WP-EX-005" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
Elev (M)
13
12
11
10
9
8
7
94.30
94.15
94.00
93.85
93.70
93.55
93.40
Flow (cms)
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-005 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-005 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-005 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-005 Result:Combined Flow

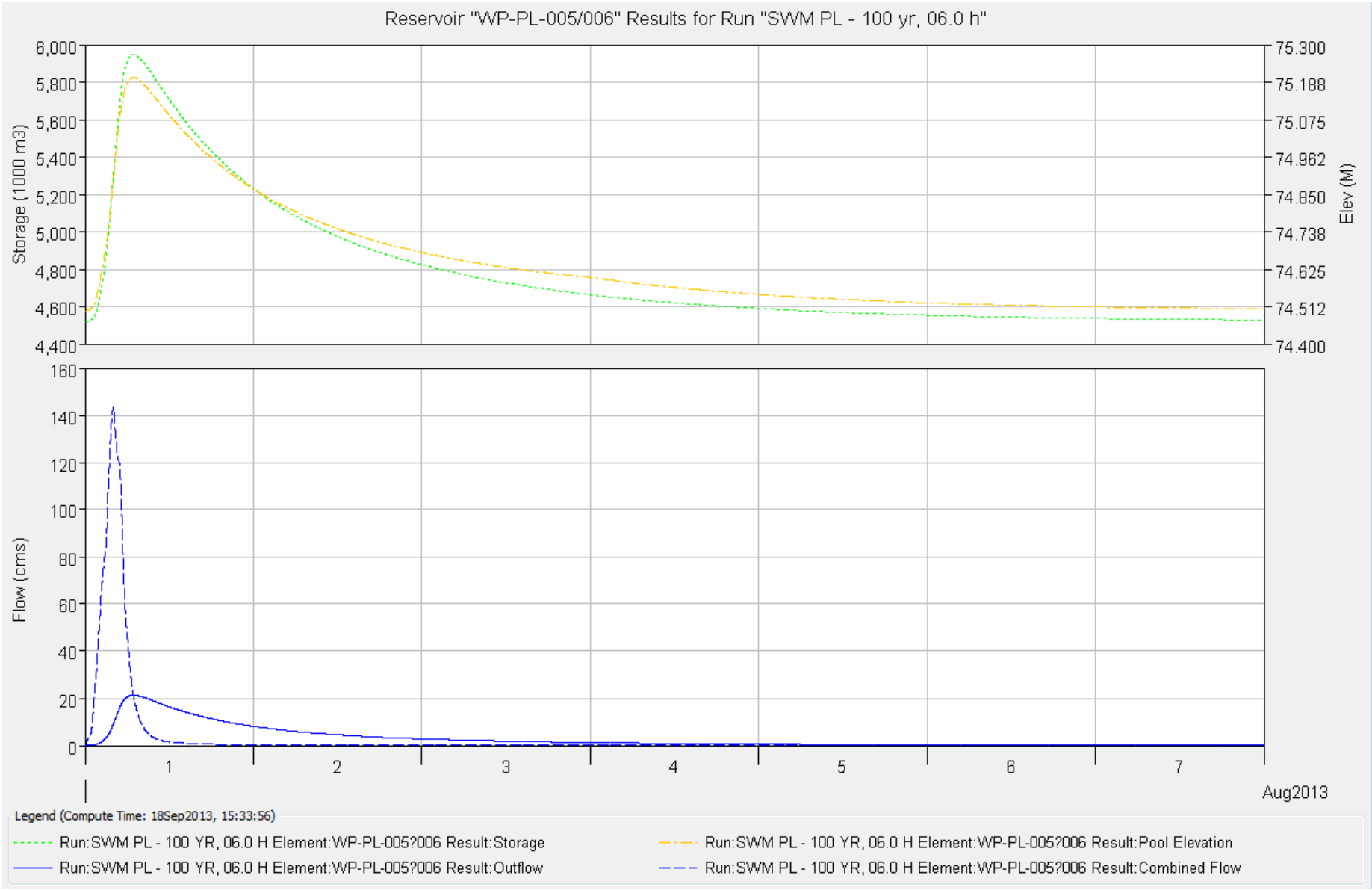

Reservoir "WP-EX-006" Results for Run "SWM EX - 100 yr, 48 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
100
90
80
70
60
50
40
30
20
110.20
110.02
109.85
109.68
109.50
109.32
109.15
108.98
108.80
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 01Aug2013, 15:30:52)
Run:SWM EX - 100 YR, 48 H Element:WP-EX-006 Result:Storage
Run:SWM EX - 100 YR, 48 H Element:WP-EX-006 Result:Pool Elevation
Run:SWM EX - 100 YR, 48 H Element:WP-EX-006 Result:Outflow
Run:SWM EX - 100 YR, 48 H Element:WP-EX-006 Result:Combined Flow

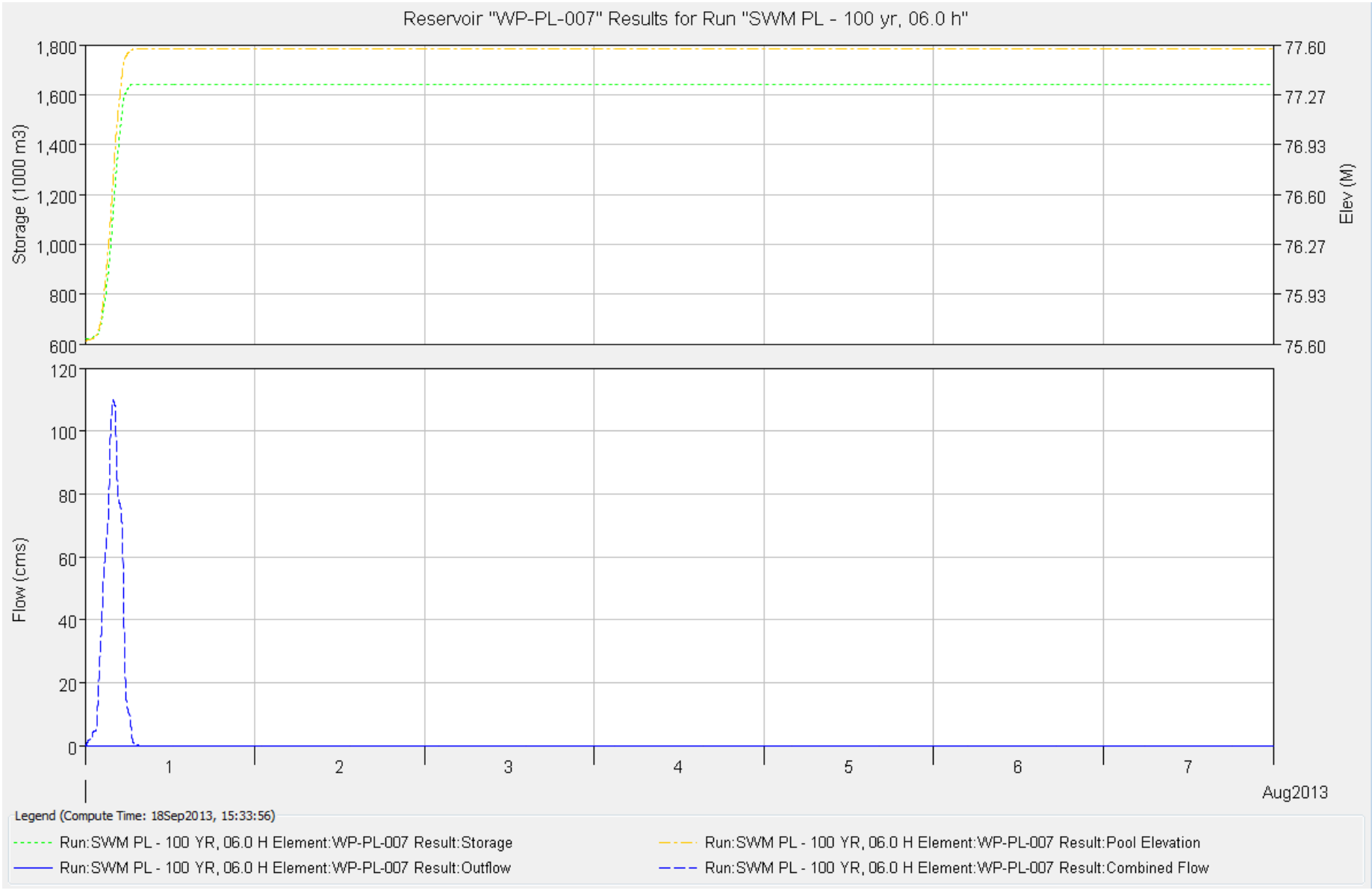

Reservoir "WP-PL-001" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
12,000
11,500
11,000
10,500
10,000
9,500
9,000
8,500
8,000
117.80
117.55
117.30
117.05
116.80
116.55
116.30
116.05
115.80
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Combined Flow

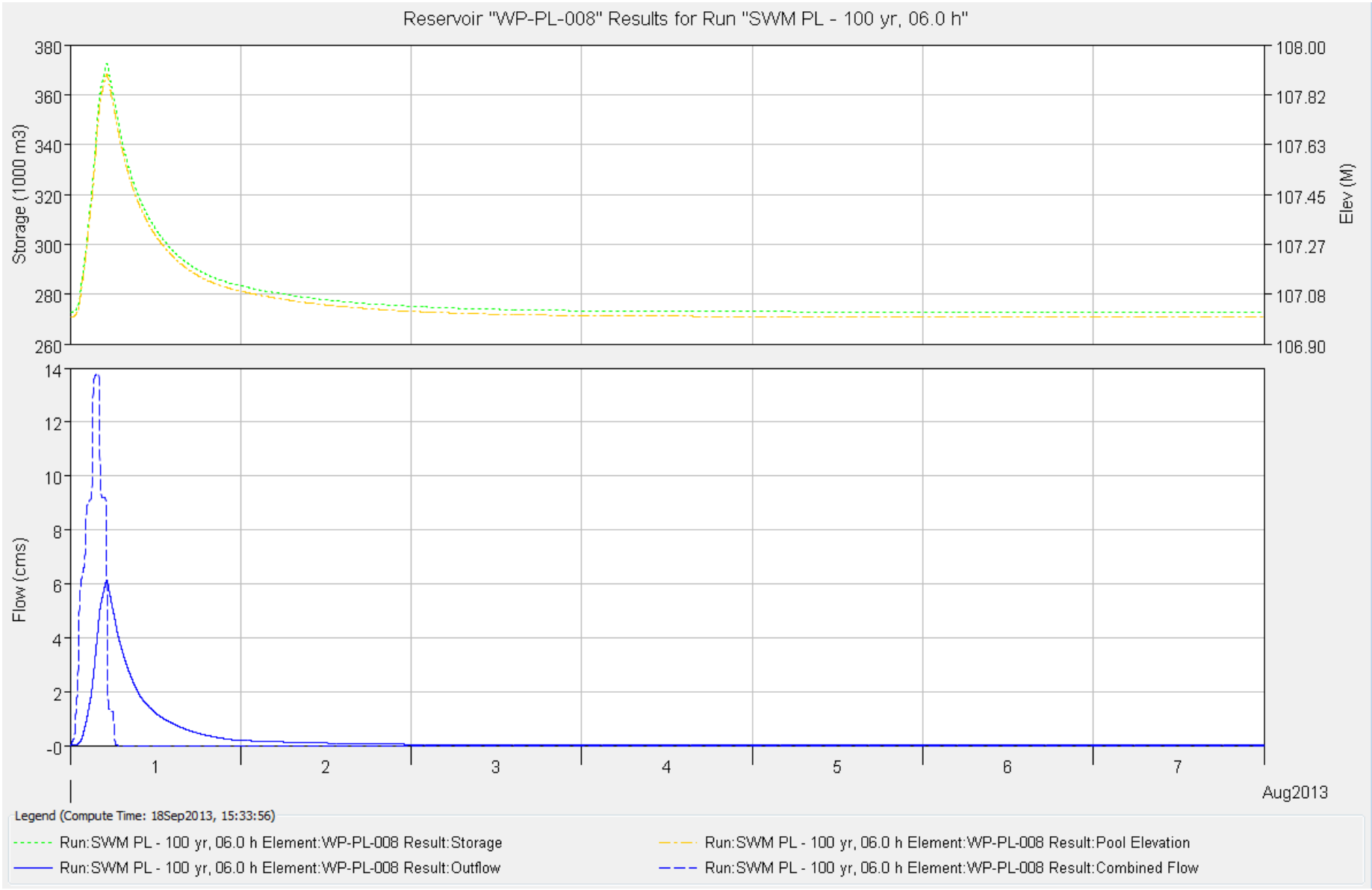

Reservoir "WP-PL-002" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
350
300
250
200
150
100
50
0
101.20
100.86
100.51
100.17
99.83
99.49
99.14
98.80
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Combined Flow

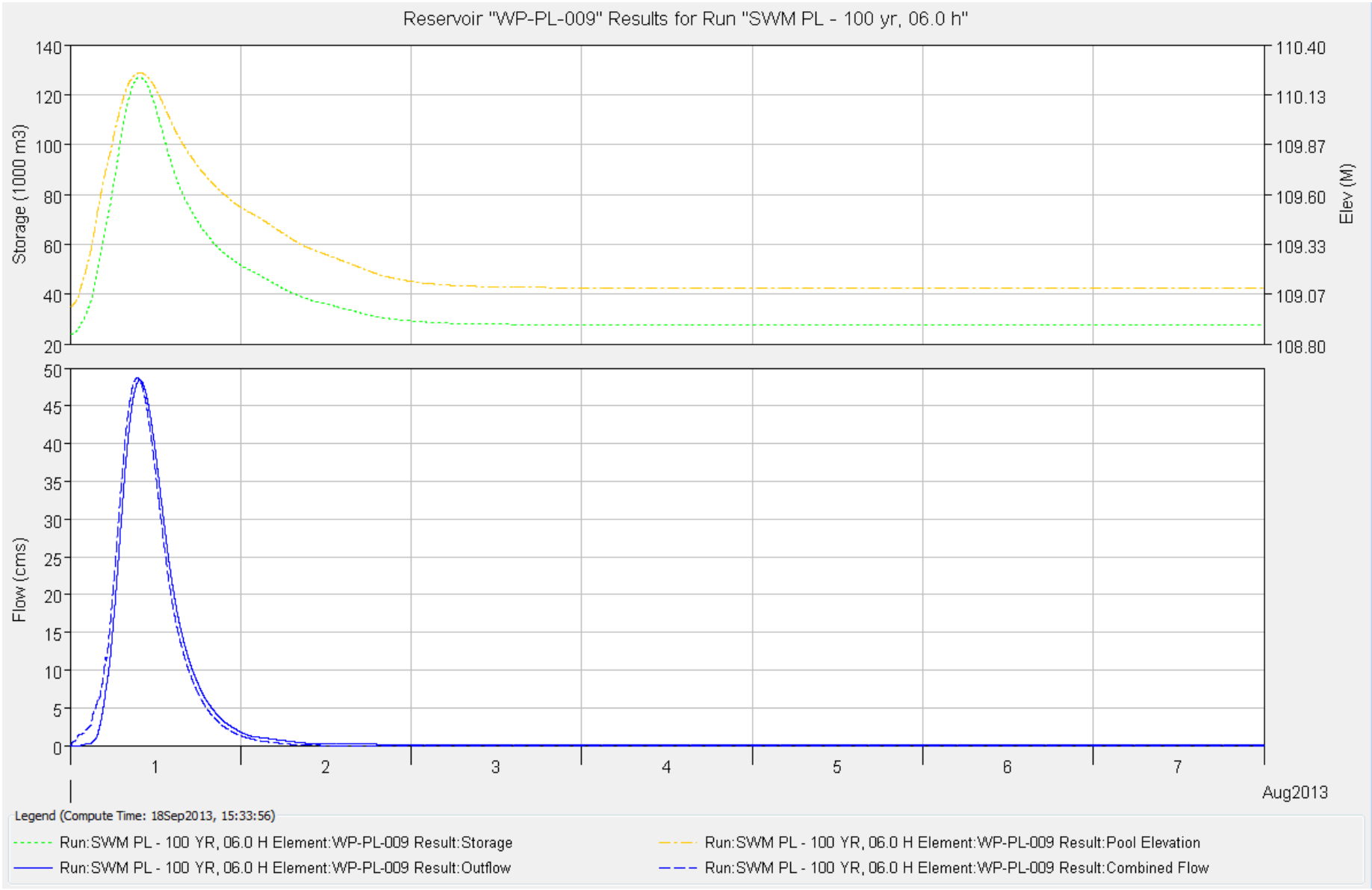

Reservoir "WP-PL-003" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
9.0
8.8
8.6
8.4
8.2
8.0
7.8
Elev (M)
92.680
92.651
92.623
92.594
92.566
92.537
92.509
Flow (cms)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Combined Flow

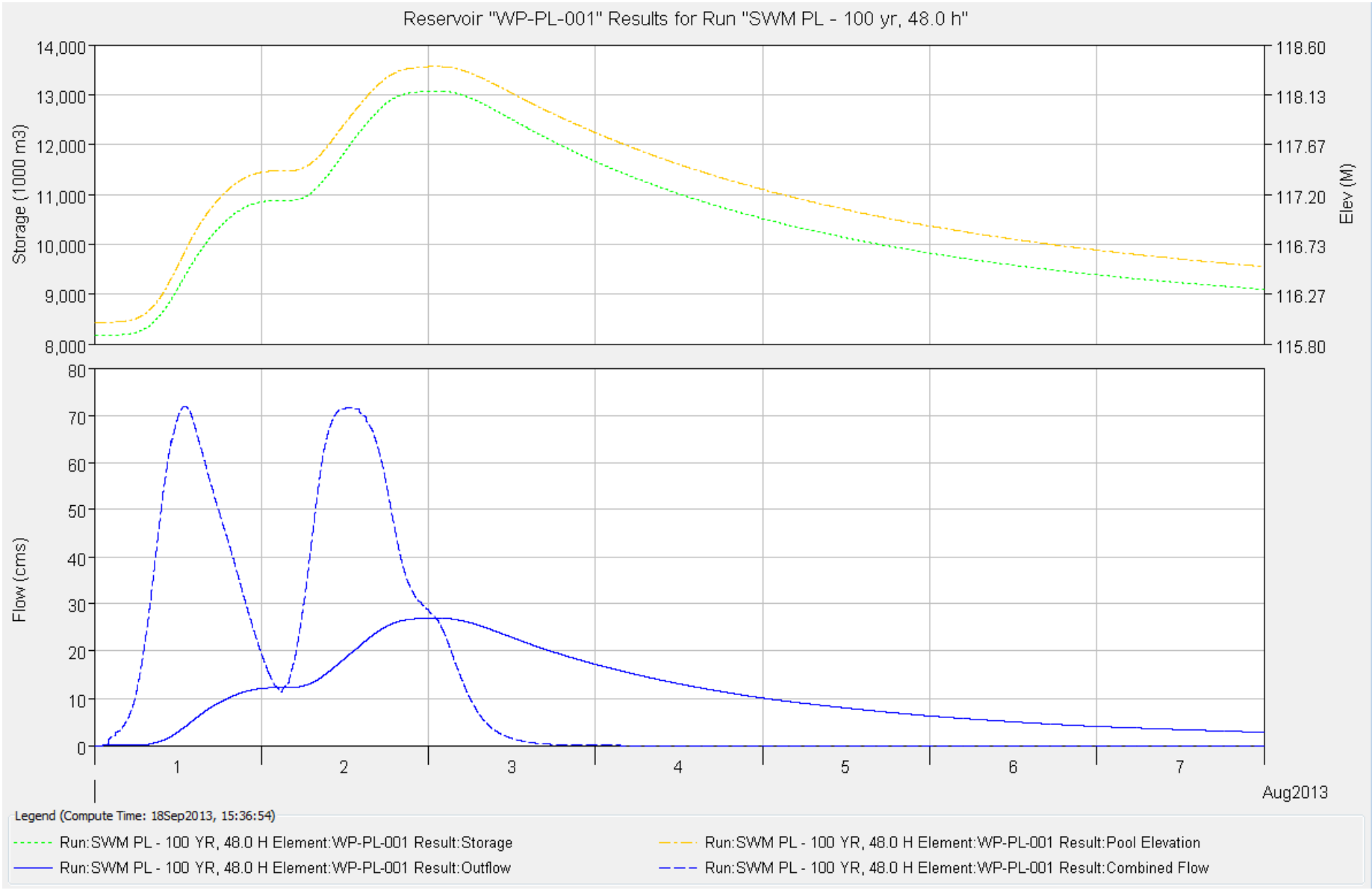

Reservoir "WP-PL-004" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
180
160
140
120
100
80
60
40
20
0
119.40
119.11
118.82
118.53
118.24
117.96
117.67
117.38
117.09
116.80
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Combined Flow

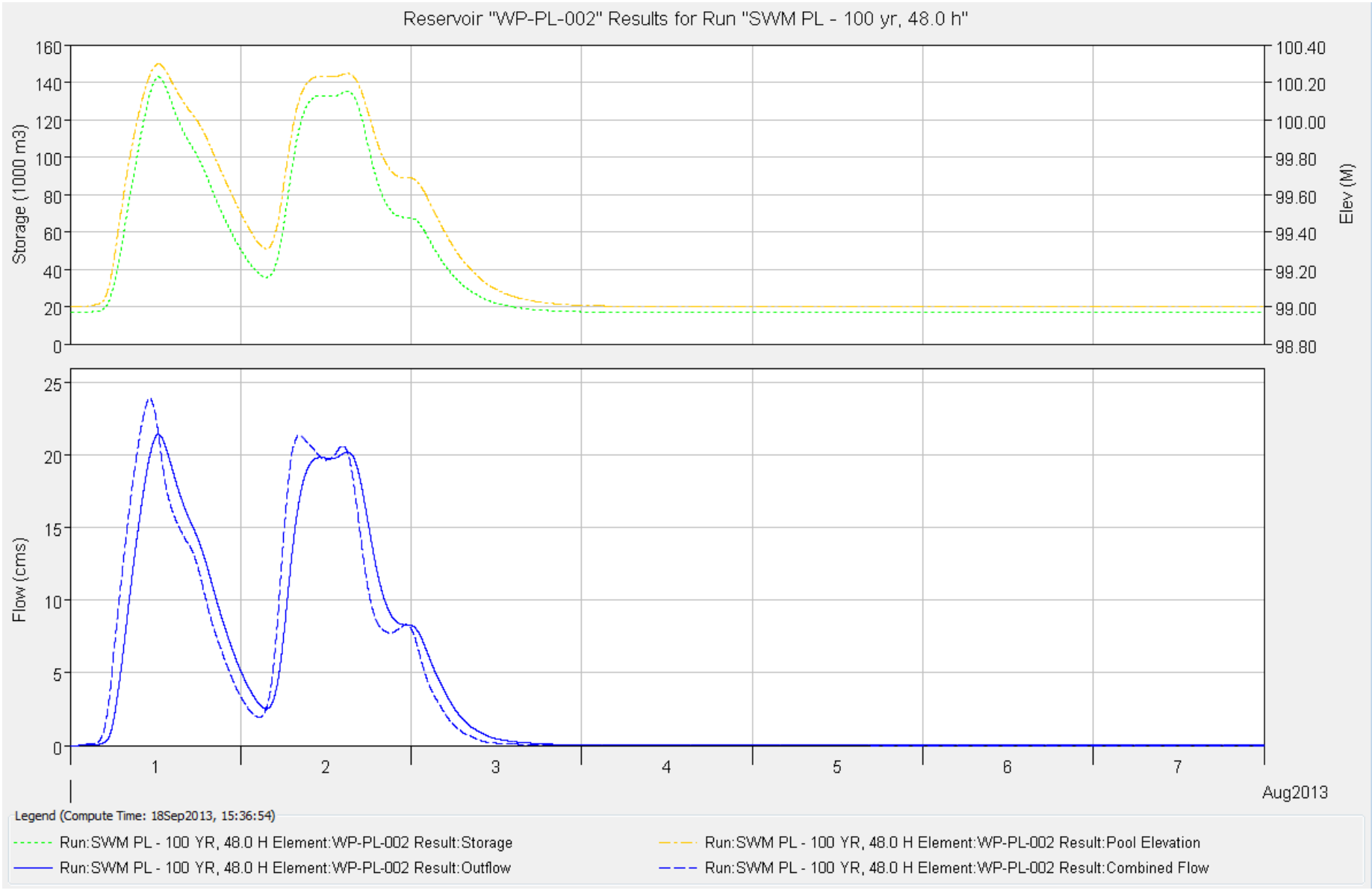

Reservoir "WP-PL-005/006" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
6,000
5,800
5,600
5,400
5,200
5,000
4,800
4,600
4,400
Elev (M)
75.300
75.188
75.075
74.962
74.850
74.738
74.625
74.512
74.400
Flow (cms)
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Combined Flow

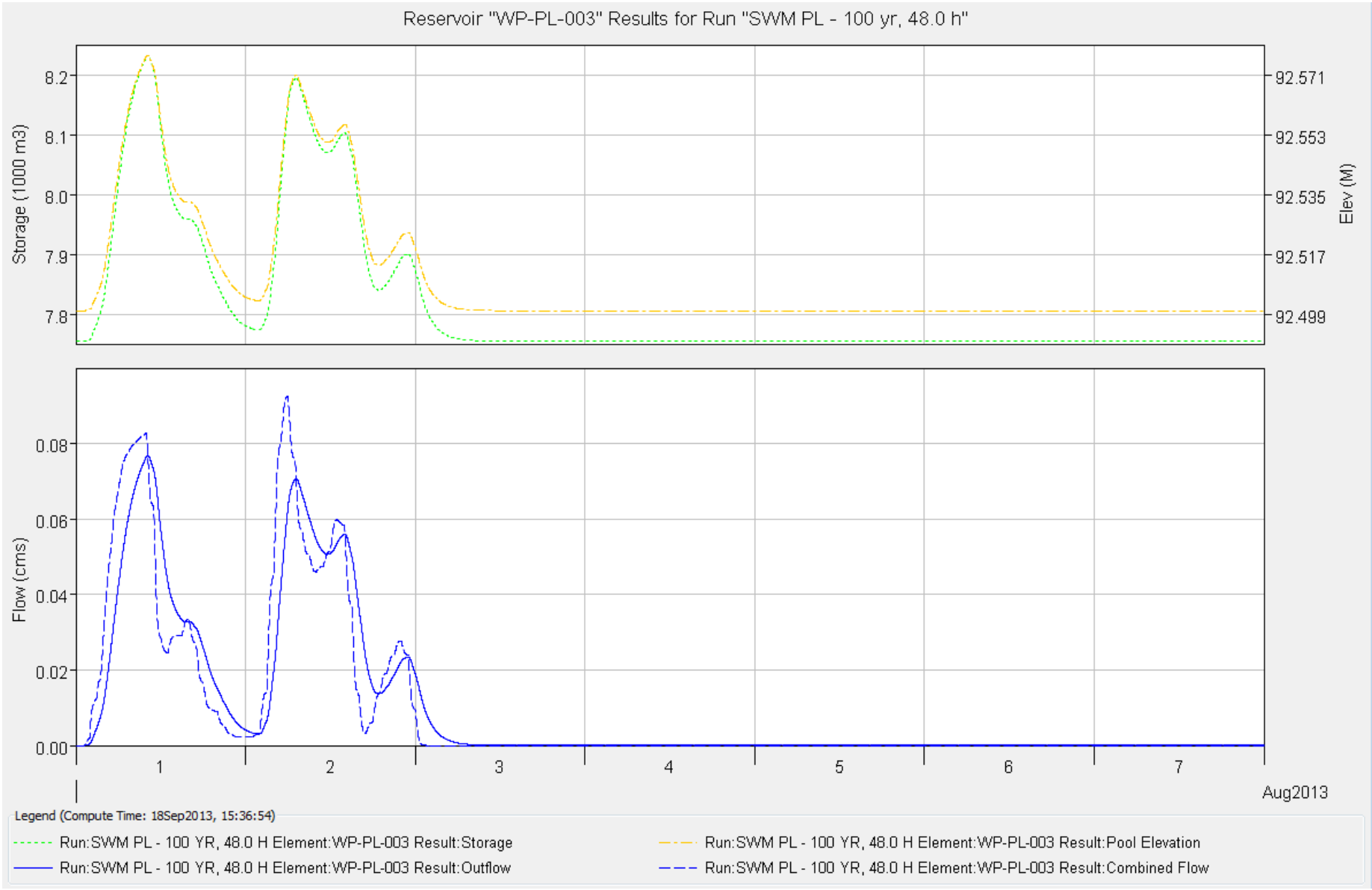

Reservoir "WP-PL-007" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
1,800
1,600
1,400
1,200
1,000
800
600
Elev (M)
77.60
77.27
76.93
76.60
76.27
75.93
75.60
Flow (cms)
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Combined Flow

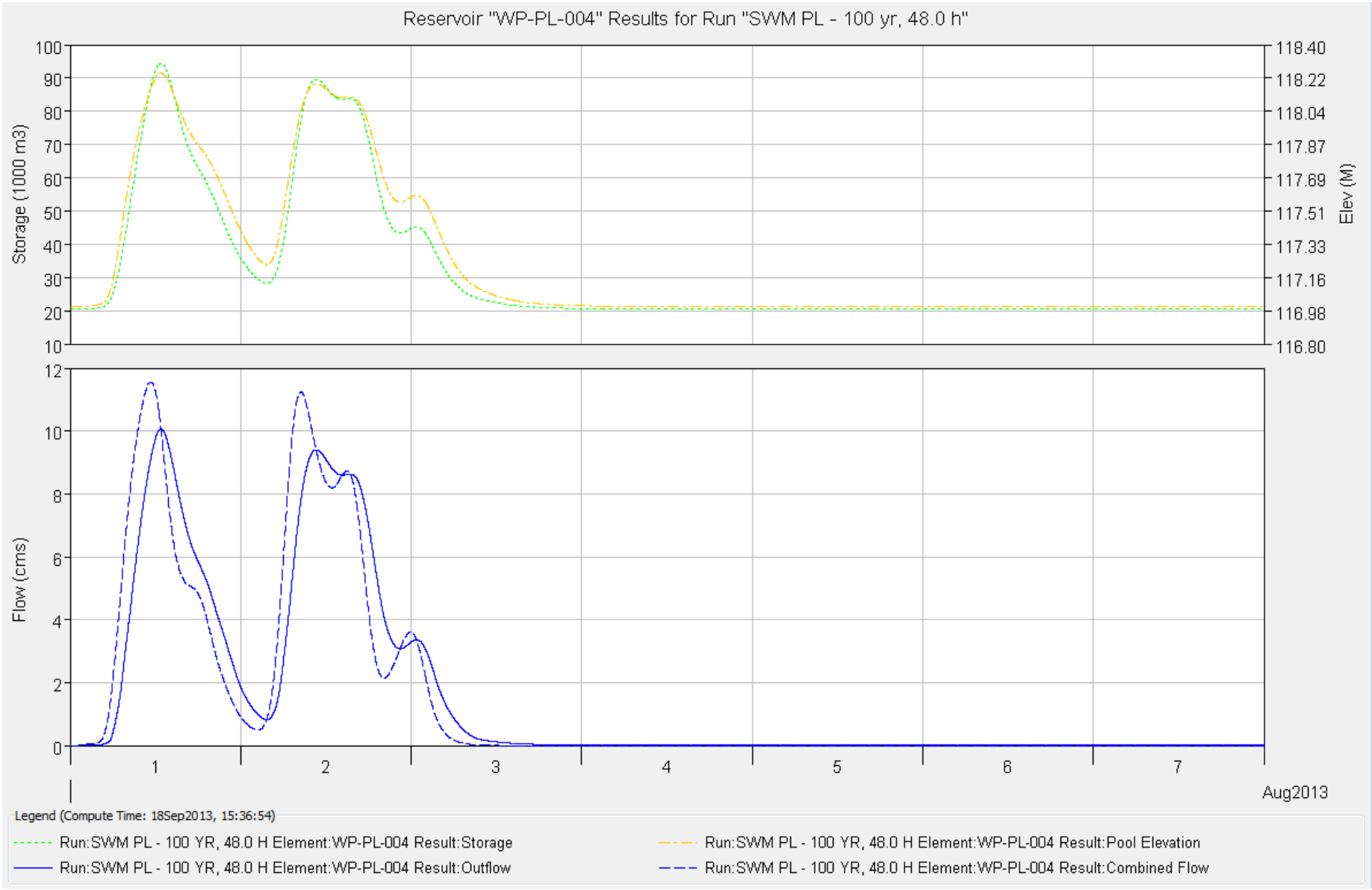

Reservoir "WP-PL-008" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
380
360
340
320
300
280
260
Elev (M)
108.00
107.82
107.63
107.45
107.27
107.08
106.90
Flow (cms)
14
12
10
8
6
4
2
-0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 yr, 06.0 h Element:WP-PL-008 Result:Storage
Run:SWM PL - 100 yr, 06.0 h Element:WP-PL-008 Result:Pool Elevation
Run:SWM PL - 100 yr, 06.0 h Element:WP-PL-008 Result:Outflow
Run:SWM PL - 100 yr, 06.0 h Element:WP-PL-008 Result:Combined Flow

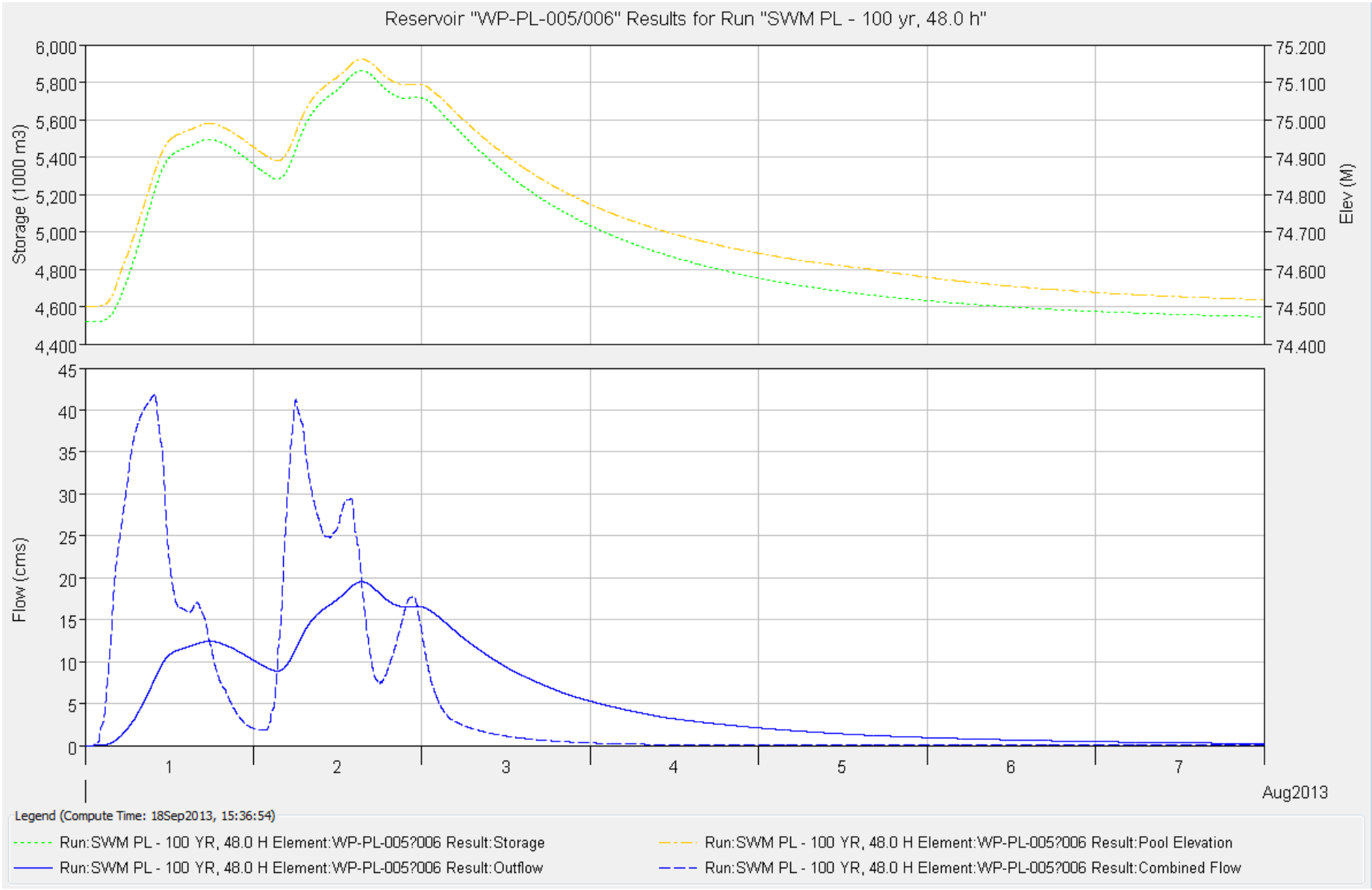

Reservoir "WP-PL-009" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
140
120
100
80
60
40
20
110.40
110.13
109.87
109.60
109.33
109.07
108.80
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:33:56)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Combined Flow

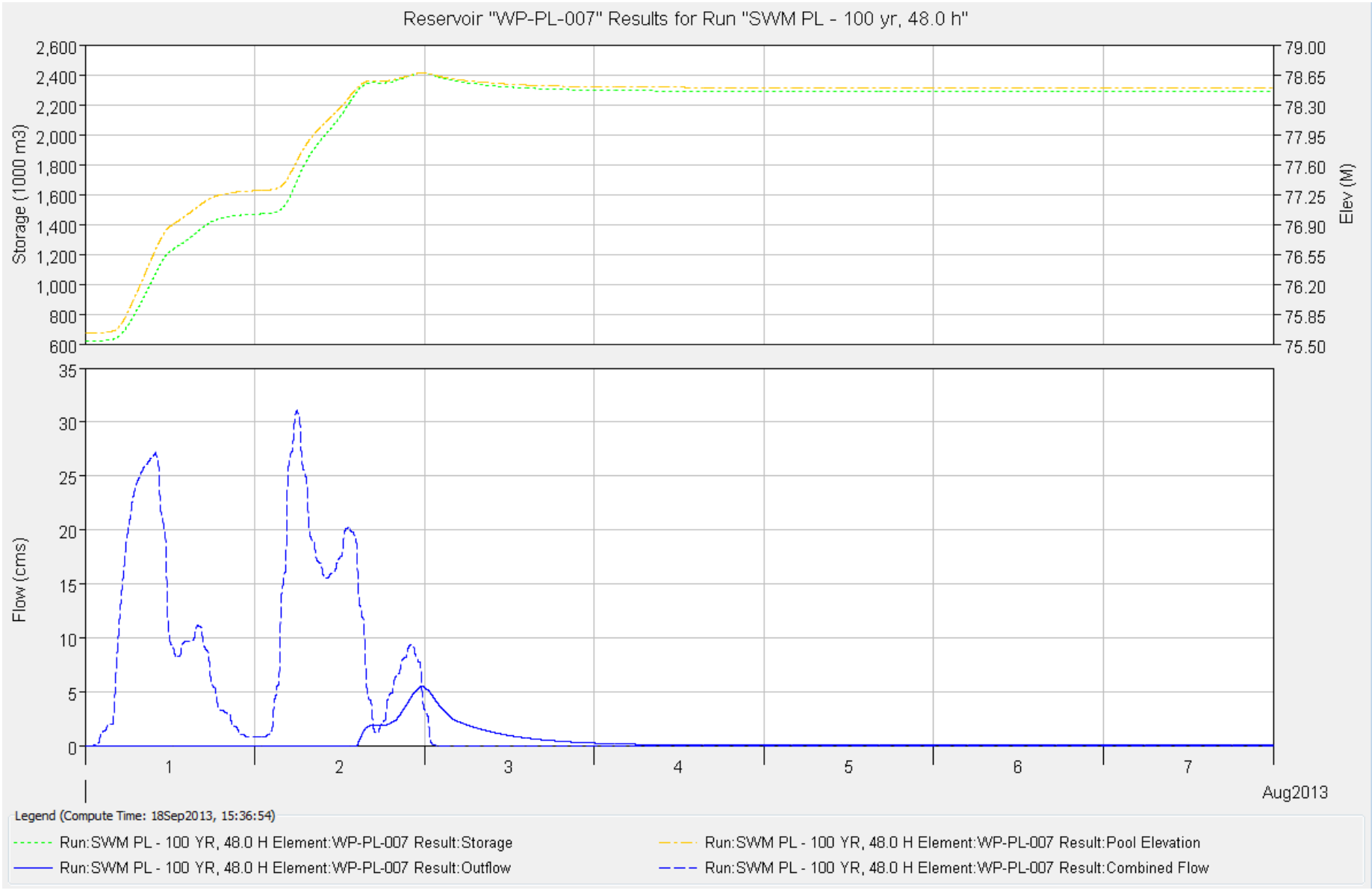

Reservoir "WP-PL-001" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
14,000
13,000
12,000
11,000
10,000
9,000
8,000
118.60
118.13
117.67
117.20
116.73
116.27
115.80
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Combined Flow

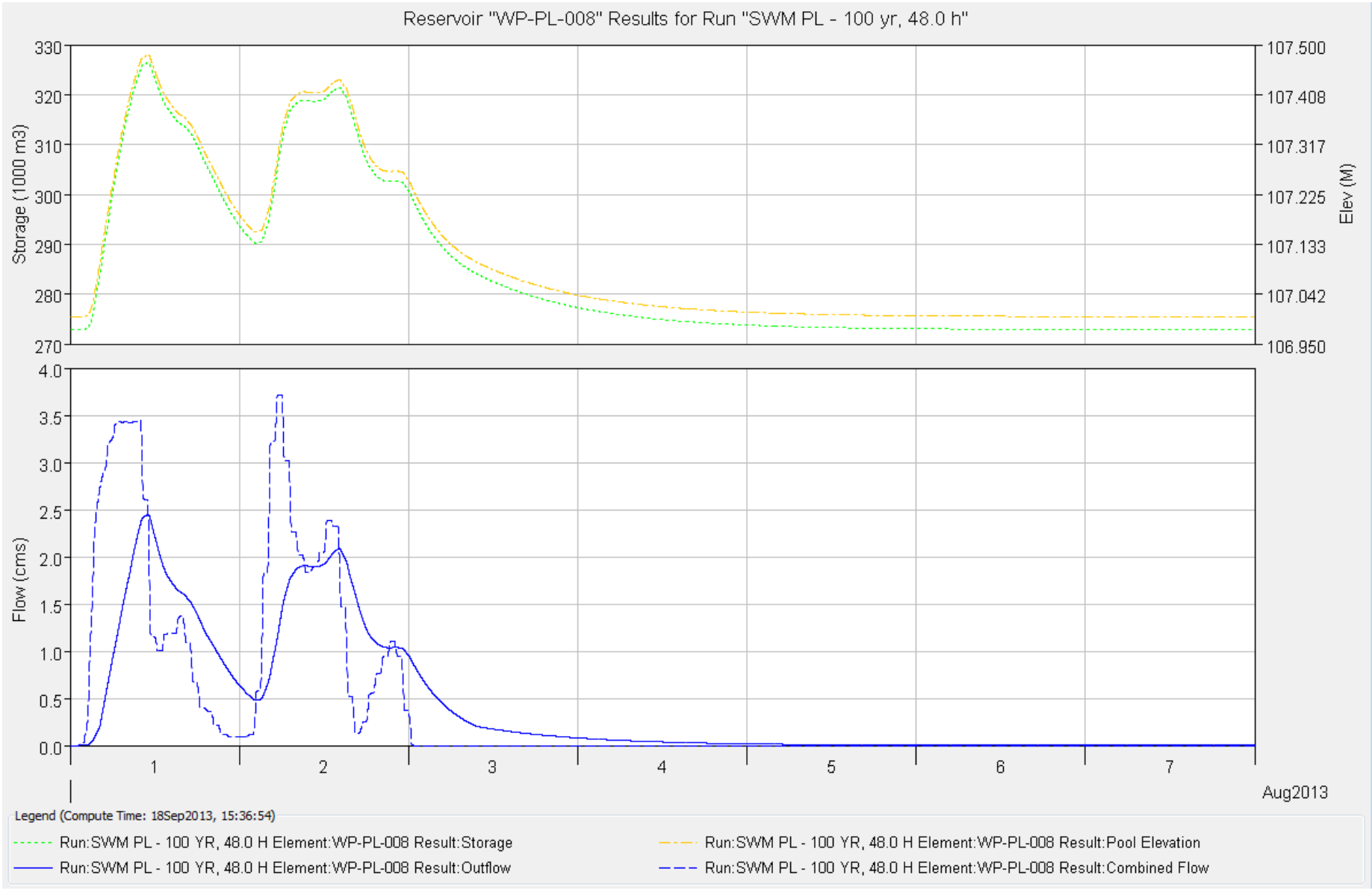

Reservoir "WP-PL-002" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Combined Flow

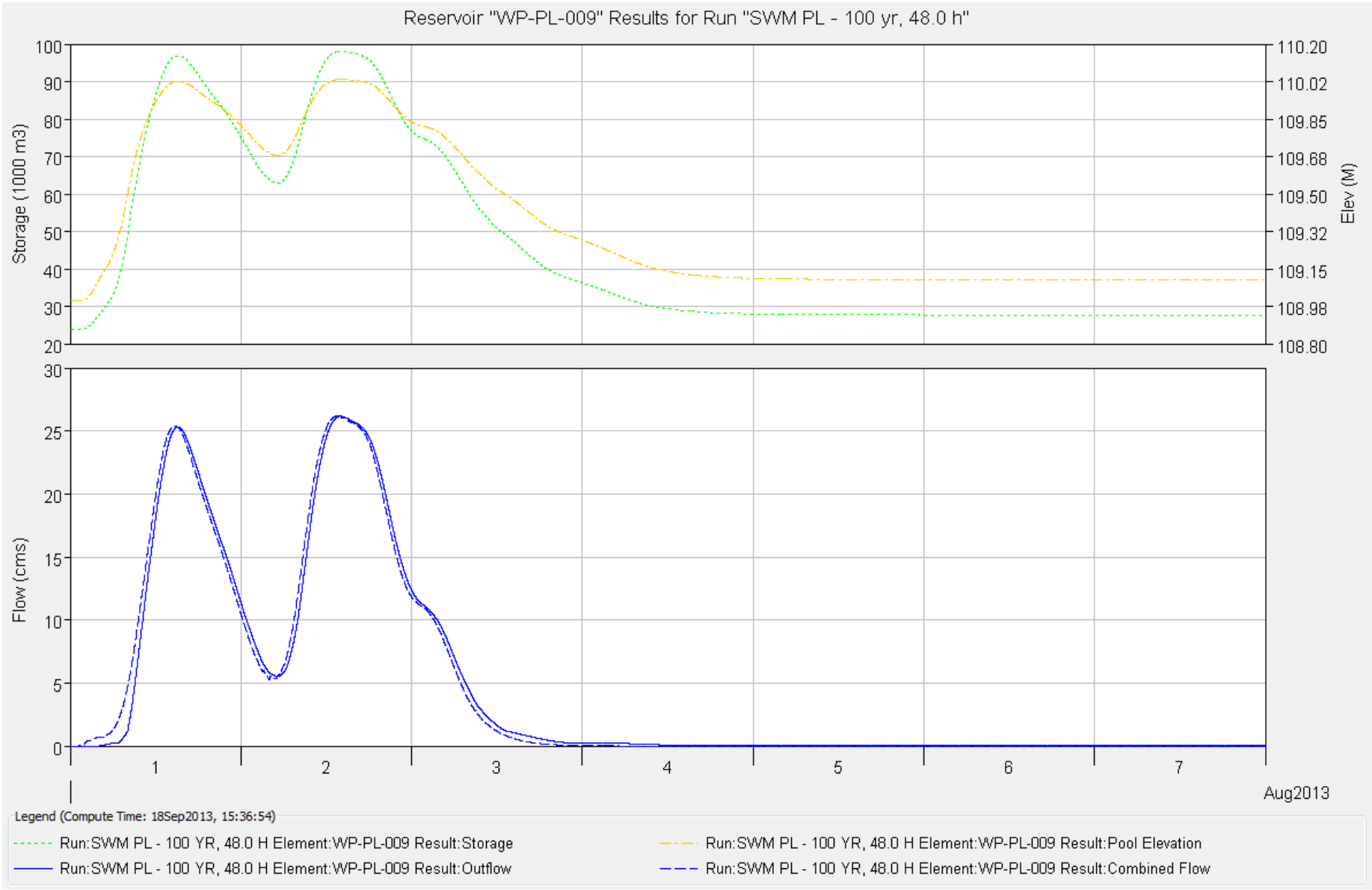

Reservoir "WP-PL-003" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
8.2
8.1
8.0
7.9
7.8
92.571
92.553
92.535
92.517
92.499
Elev (M)
Flow (cms)
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Combined Flow

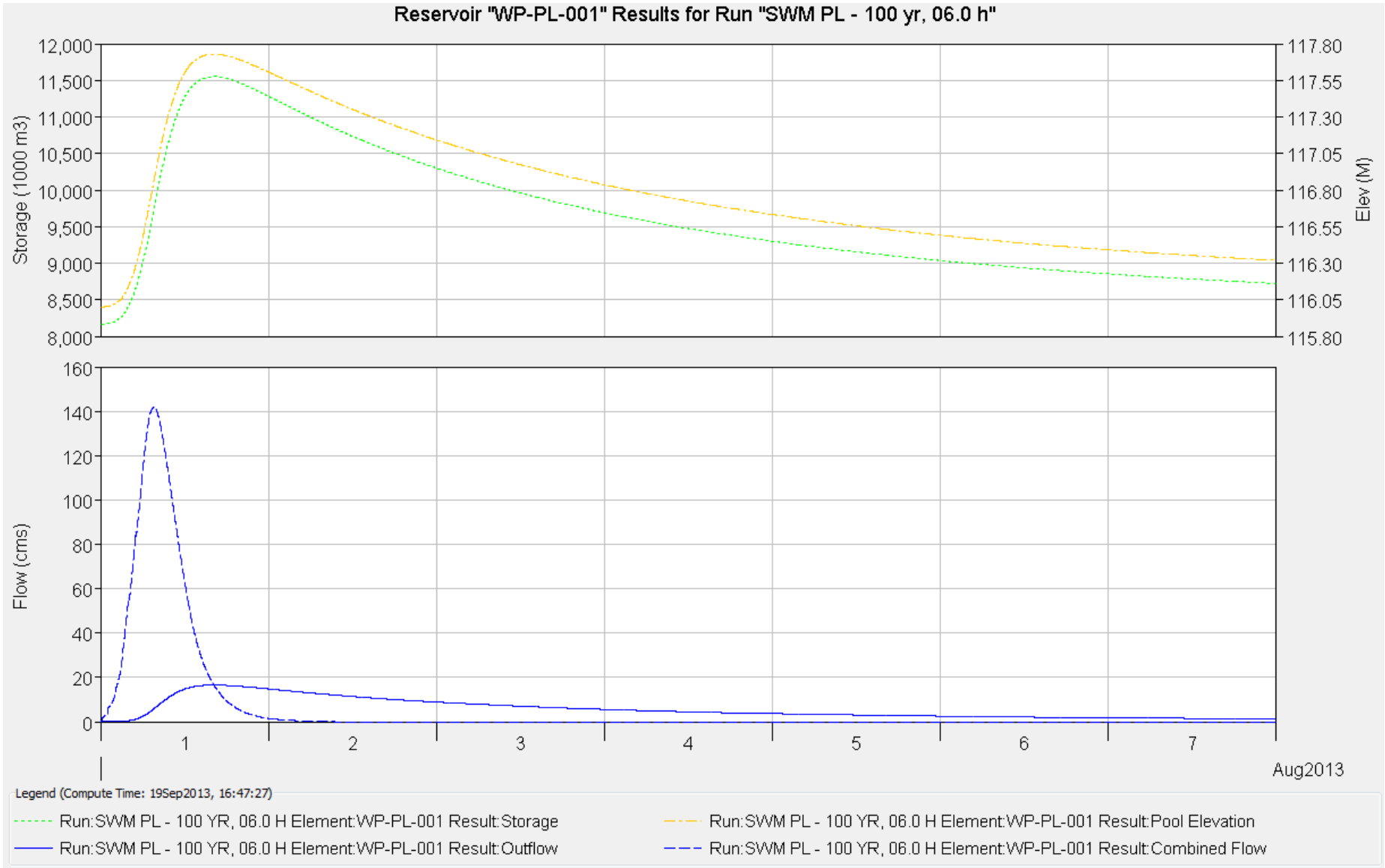

Reservoir "WP-PL-004" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
100
90
80
70
60
50
40
30
20
10
118.40
118.22
118.04
117.87
117.69
117.51
117.33
117.16
116.98
116.80
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Combined Flow

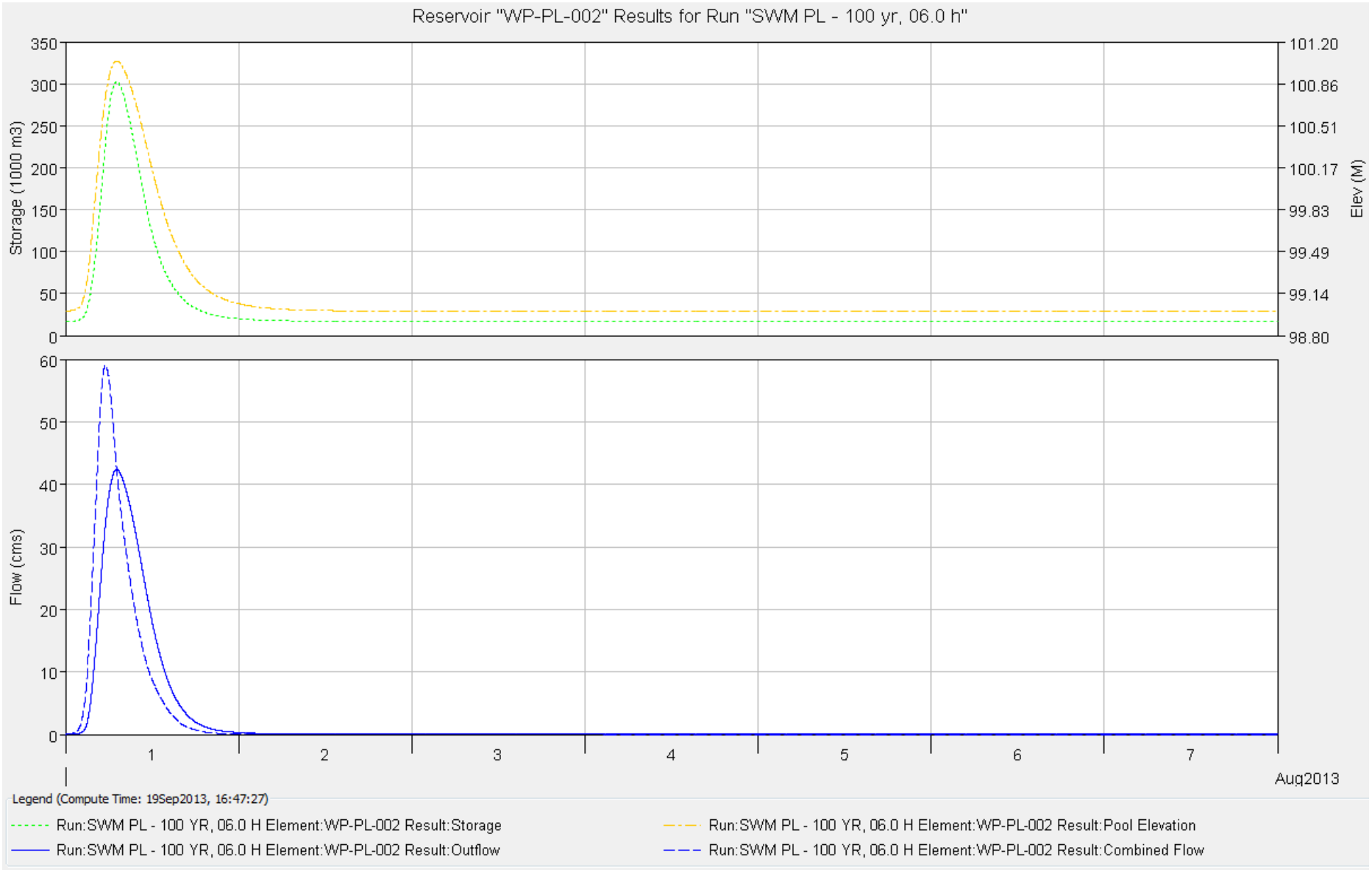

Reservoir "WP-PL-005/006" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
6,000
5,800
5,600
5,400
5,200
5,000
4,800
4,600
4,400
Elev (M)
75.200
75.100
75.000
74.900
74.800
74.700
74.600
74.500
74.400
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Combined Flow

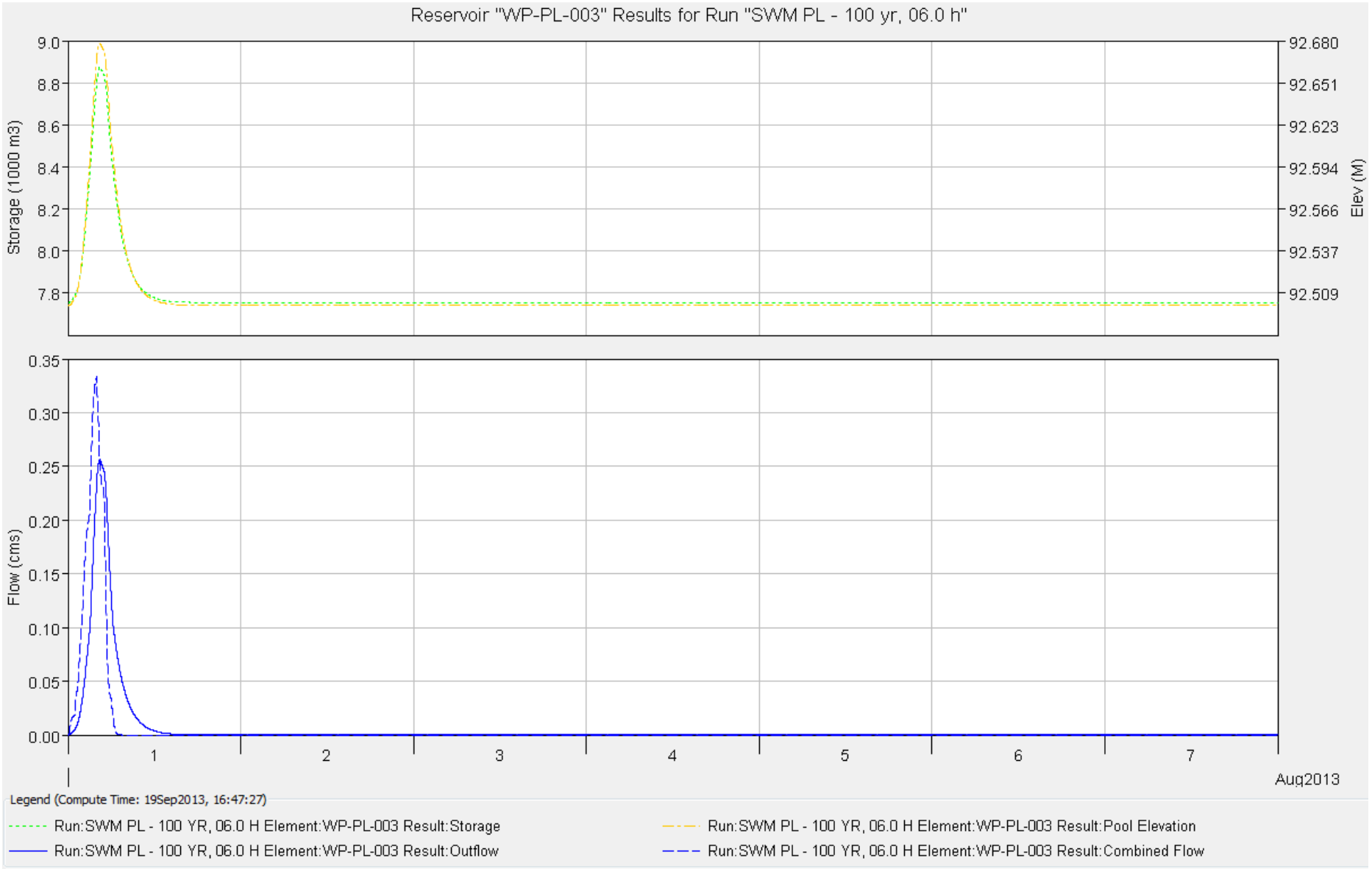

Reservoir "WP-PL-007" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
79.00
78.65
78.30
77.95
77.60
77.25
76.90
76.55
76.20
75.85
75.50
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Combined Flow


Reservoir "WP-PL-008" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
330
320
310
300
290
280
270
Elev (M)
107.500
107.408
107.317
107.225
107.133
107.042
106.950
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Combined Flow

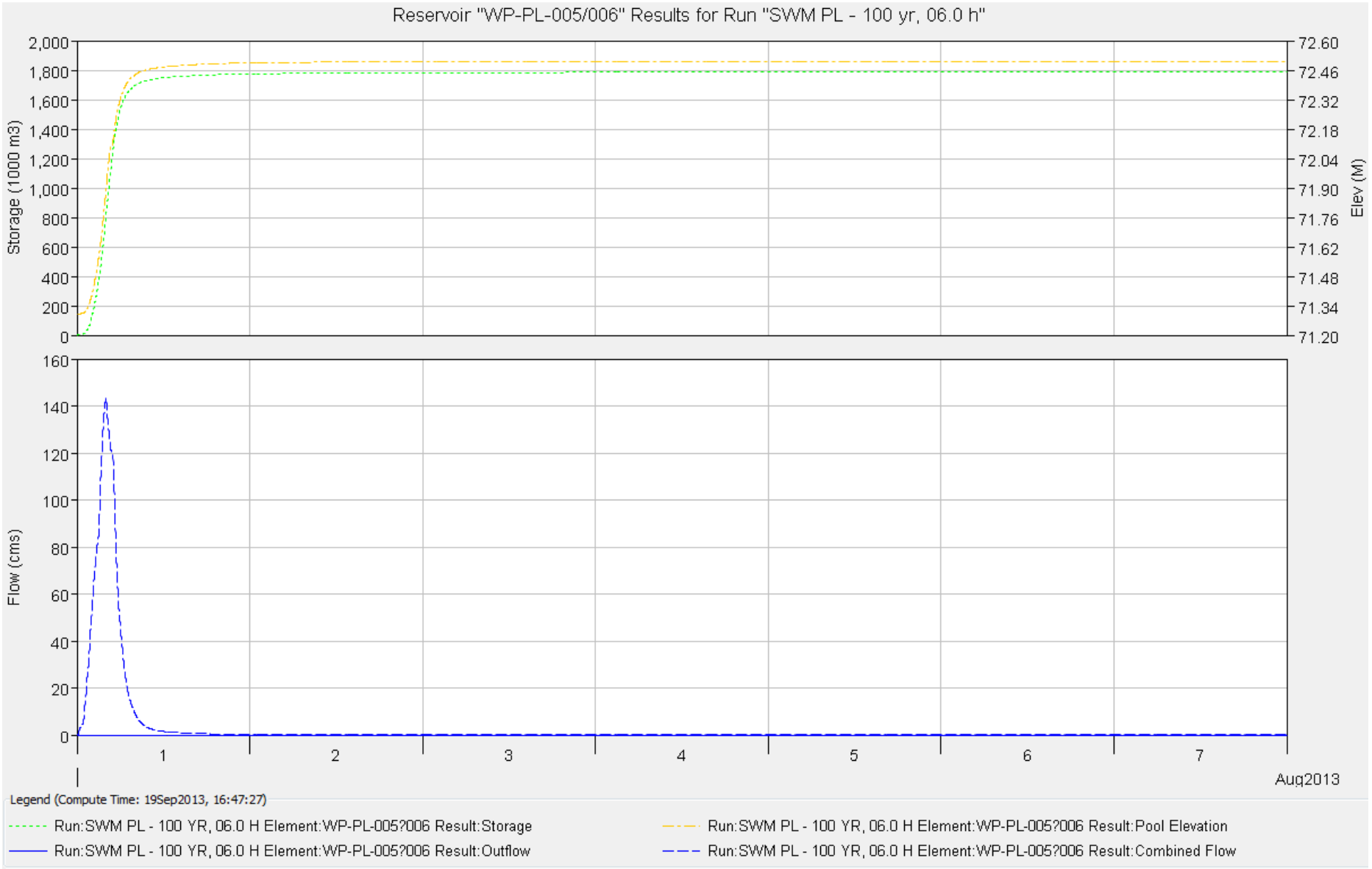

Reservoir "WP-PL-009" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
100
90
80
70
60
50
40
30
20
110.20
110.02
109.85
109.68
109.50
109.32
109.15
108.98
108.80
Flow (cms)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:36:54)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Combined Flow


Reservoir "WP-PL-001" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
12,000
11,500
11,000
10,500
10,000
9,500
9,000
8,500
8,000
Elev (M)
117.80
117.55
117.30
117.05
116.80
116.55
116.30
116.05
115.80
Flow (cms)
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-001 Result:Combined Flow

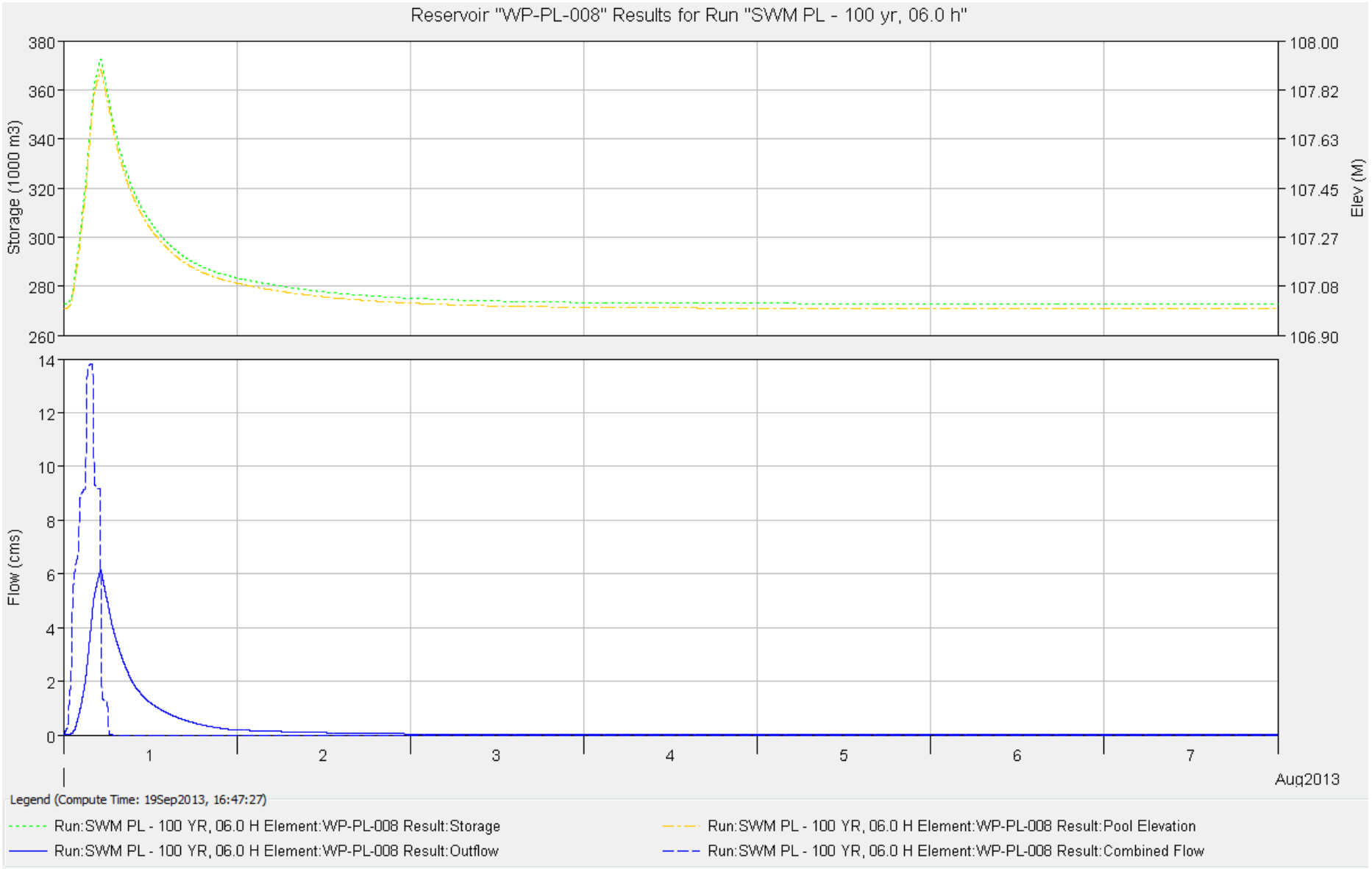

Reservoir "WP-PL-002" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
350
300
250
200
150
100
50
0
101.20
100.86
100.51
100.17
99.83
99.49
99.14
98.80
Flow (cms)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-002 Result:Combined Flow

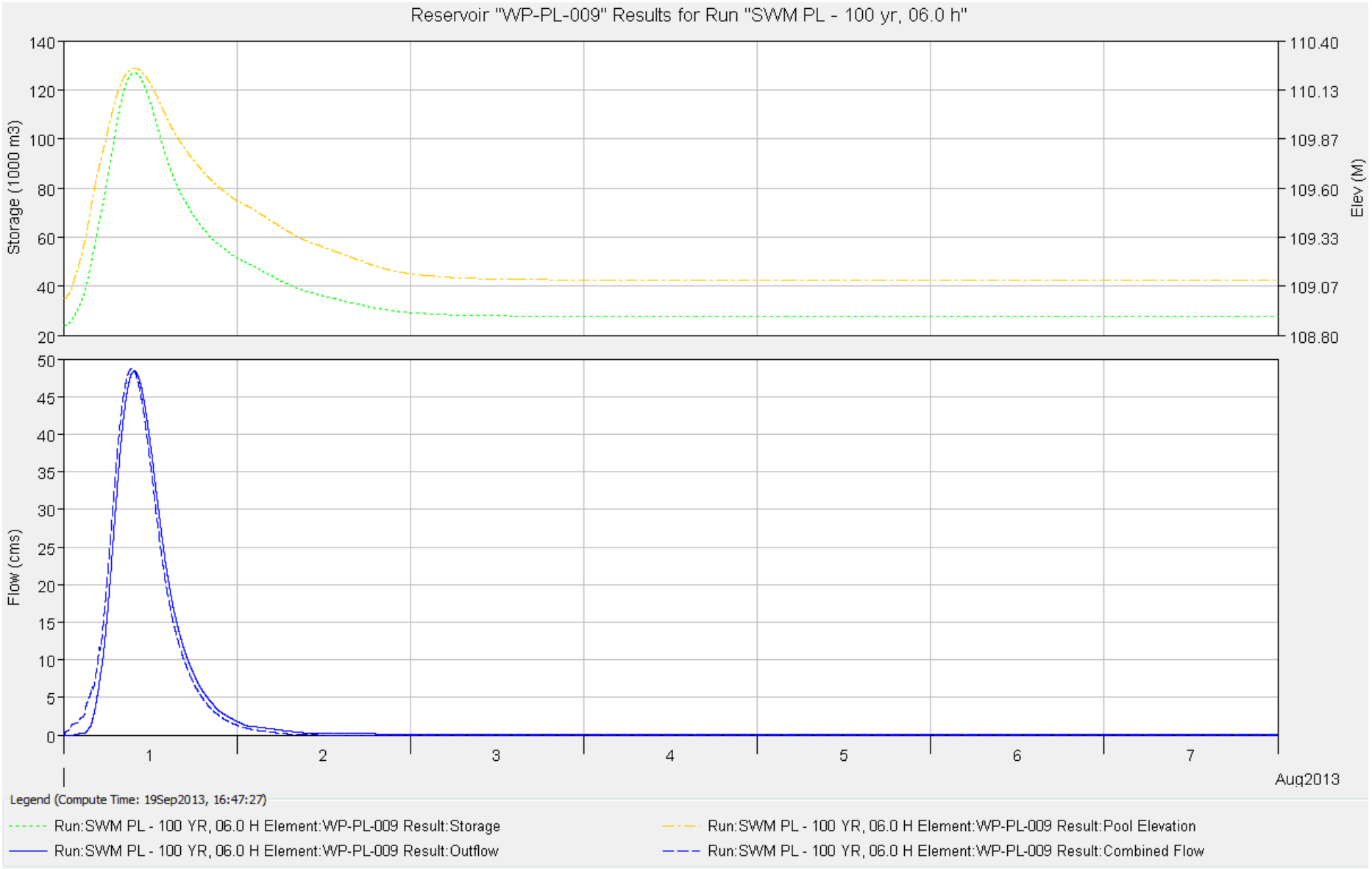

Reservoir "WP-PL-003" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
9.0
8.8
8.6
8.4
8.2
8.0
7.8
Elev (M)
92.680
92.651
92.623
92.594
92.566
92.537
92.509
Flow (cms)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-003 Result:Combined Flow

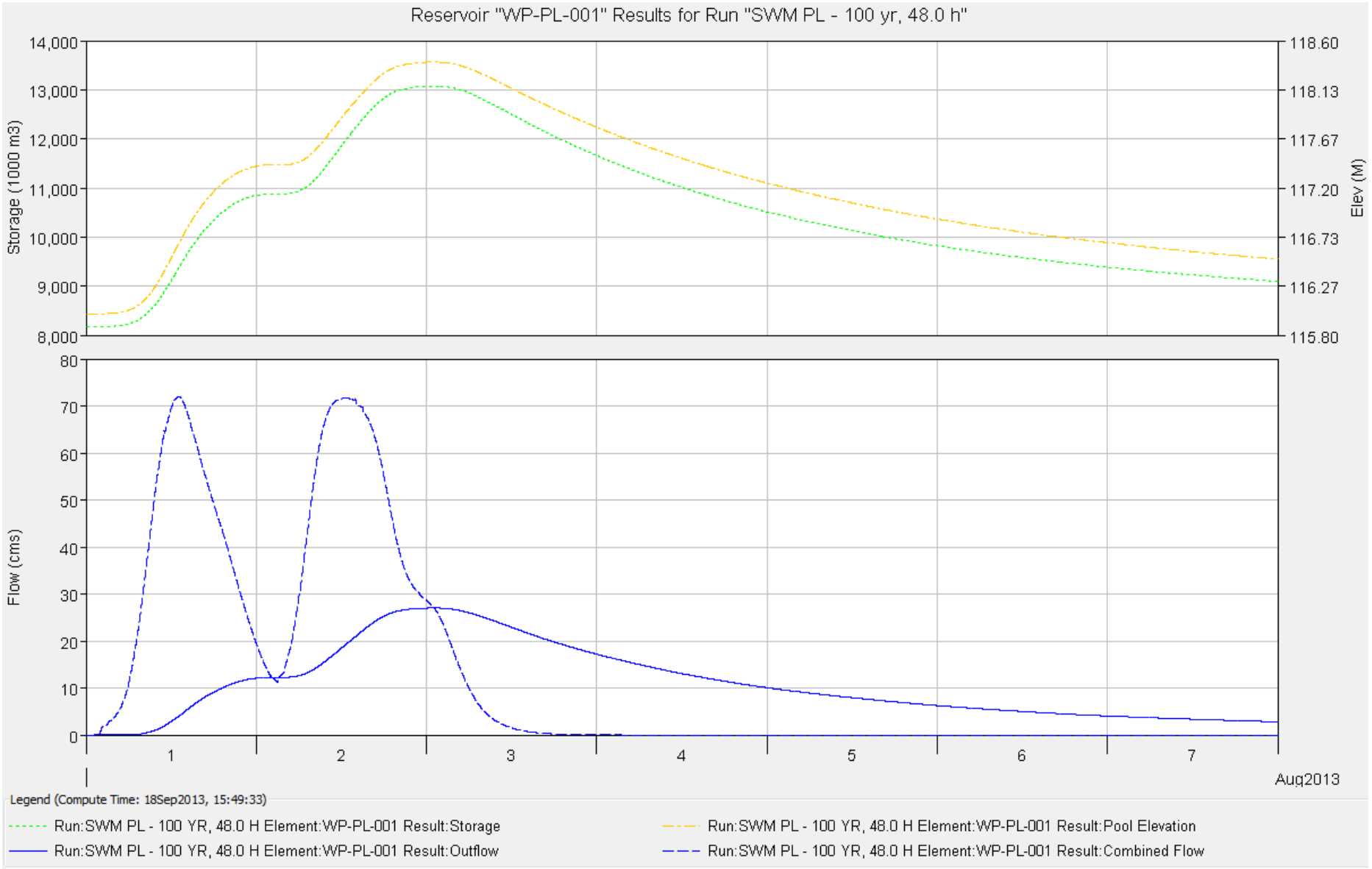

Reservoir "WP-PL-004" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
180
160
140
120
100
80
60
40
20
0
119.40
119.11
118.82
118.53
118.24
117.96
117.67
117.38
117.09
116.80
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-004 Result:Combined Flow

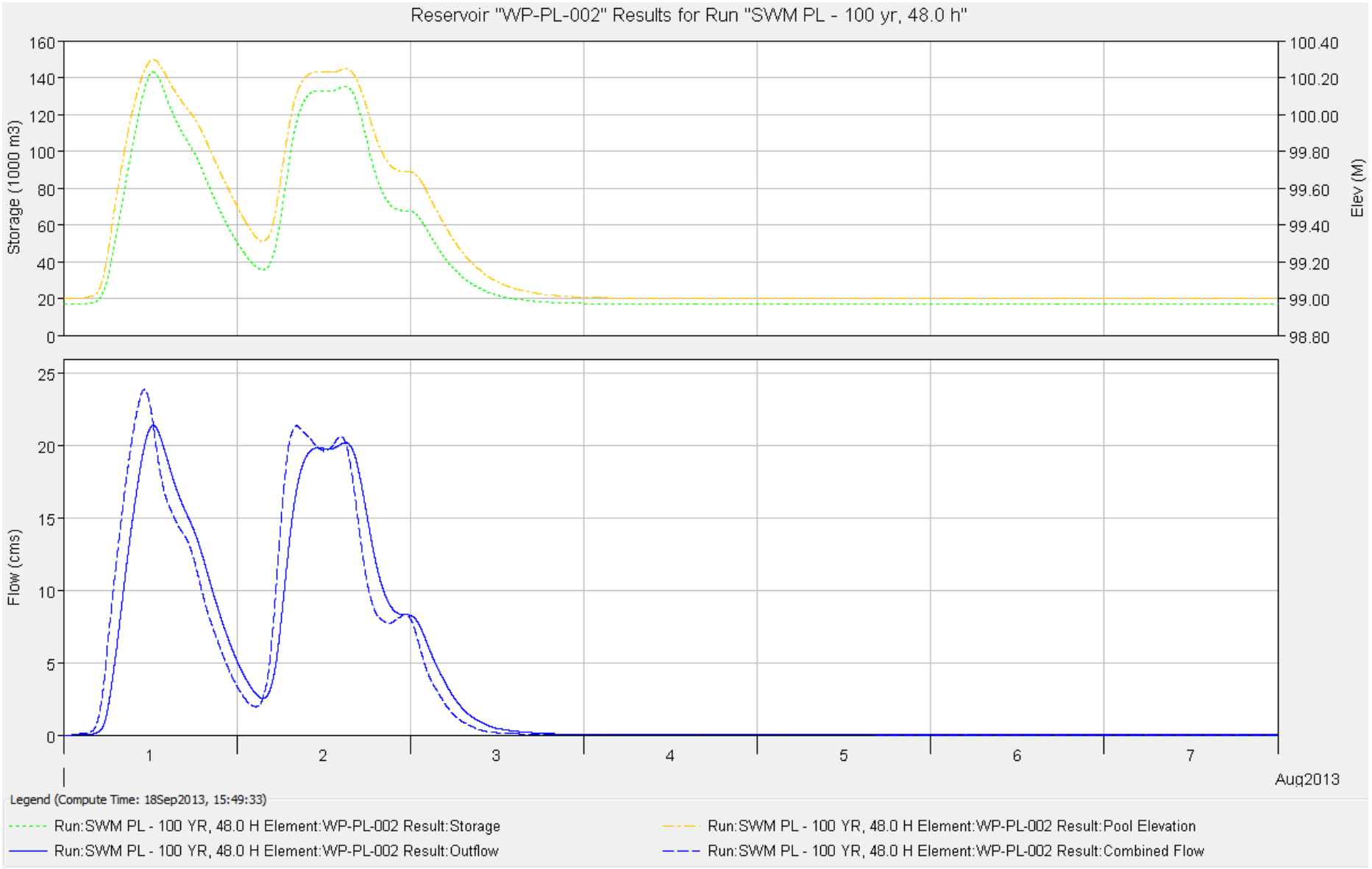

Reservoir "WP-PL-005/006" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
72.60
72.46
72.32
72.18
72.04
71.90
71.76
71.62
71.48
71.34
71.20
Flow (cms)
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-005?006 Result:Combined Flow

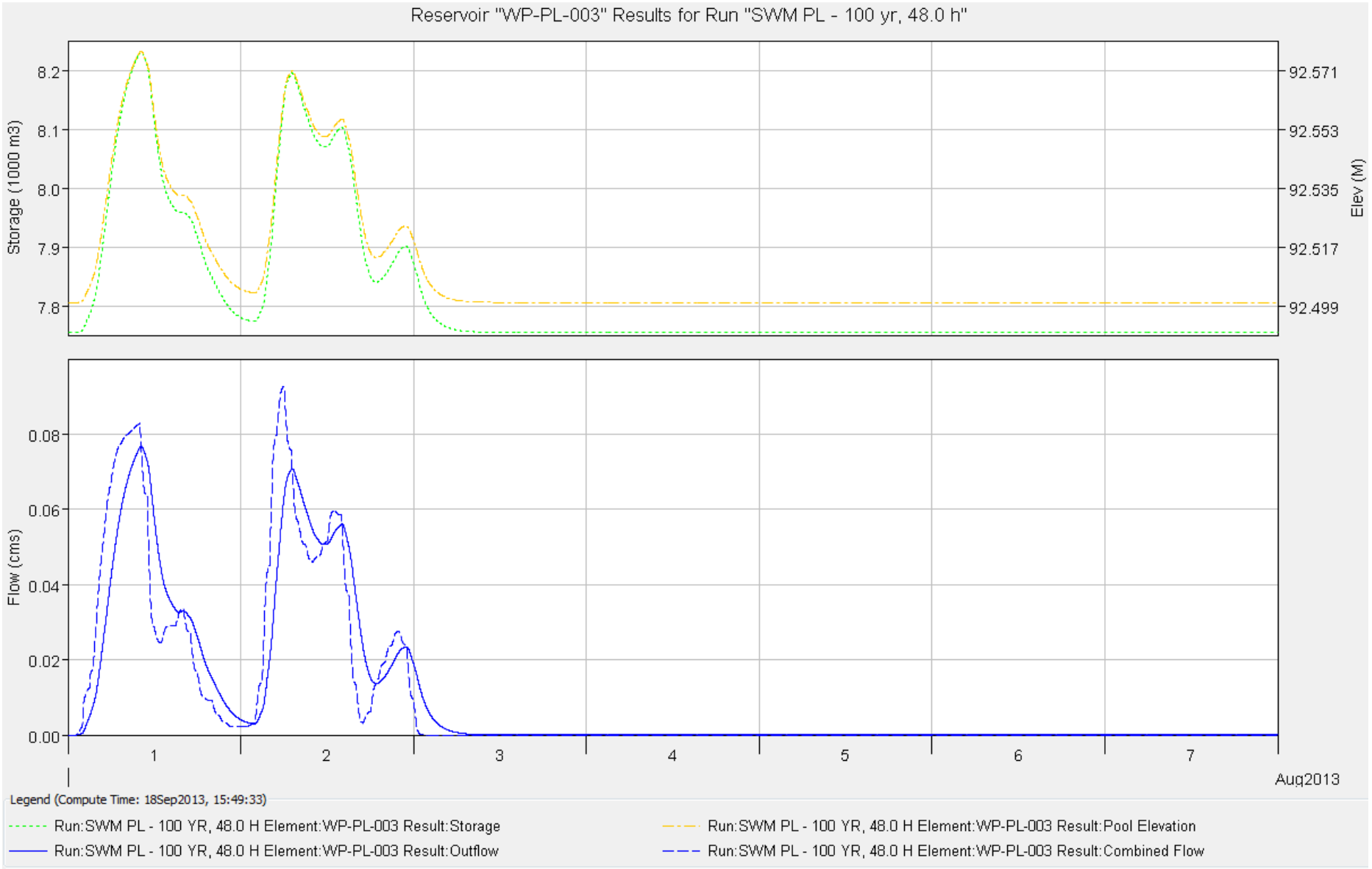

Reservoir "WP-PL-007" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
1,800
1,600
1,400
1,200
1,000
800
600
Elev (M)
77.60
77.27
76.93
76.60
76.27
75.93
75.60
Flow (cms)
120
100
80
60
40
20
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-007 Result:Combined Flow

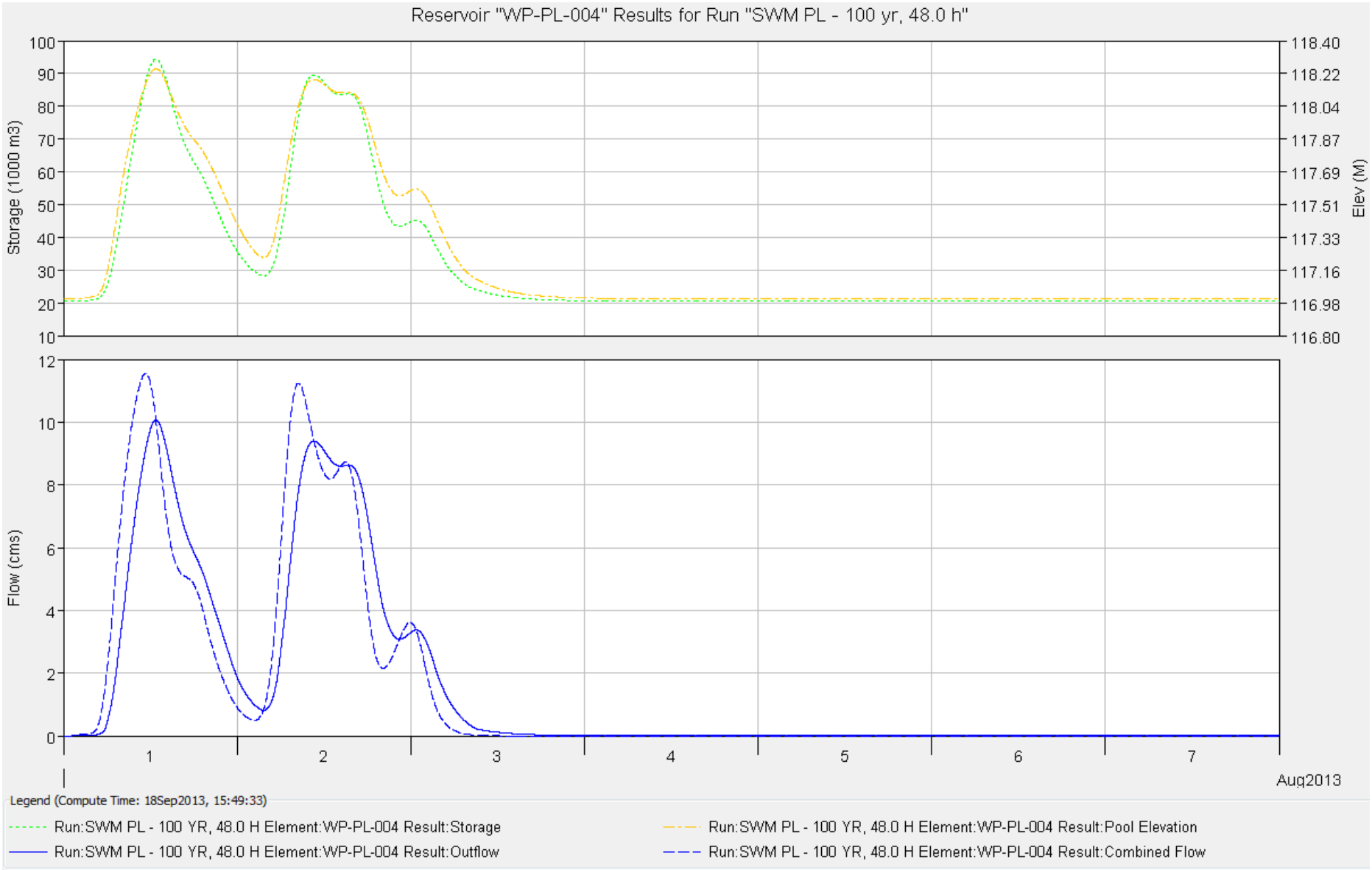

Reservoir "WP-PL-008" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
380
360
340
320
300
280
260
108.00
107.82
107.63
107.45
107.27
107.08
106.90
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-008 Result:Combined Flow

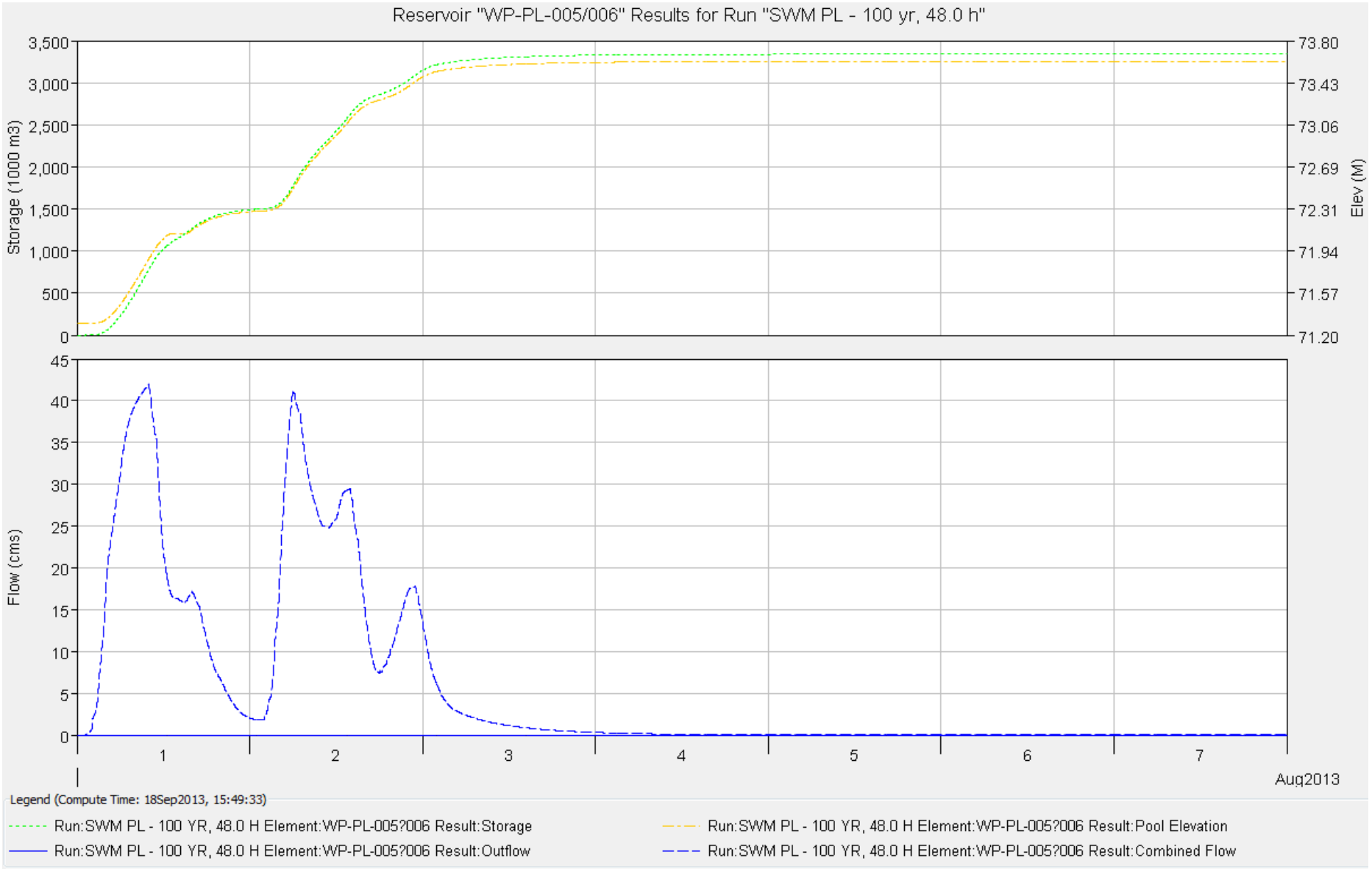

Reservoir "WP-PL-009" Results for Run "SWM PL - 100 yr, 06.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
140
120
100
80
60
40
20
110.40
110.13
109.87
109.60
109.33
109.07
108.80
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 19Sep2013, 16:47:27)
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Storage
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Pool Elevation
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 06.0 H Element:WP-PL-009 Result:Combined Flow

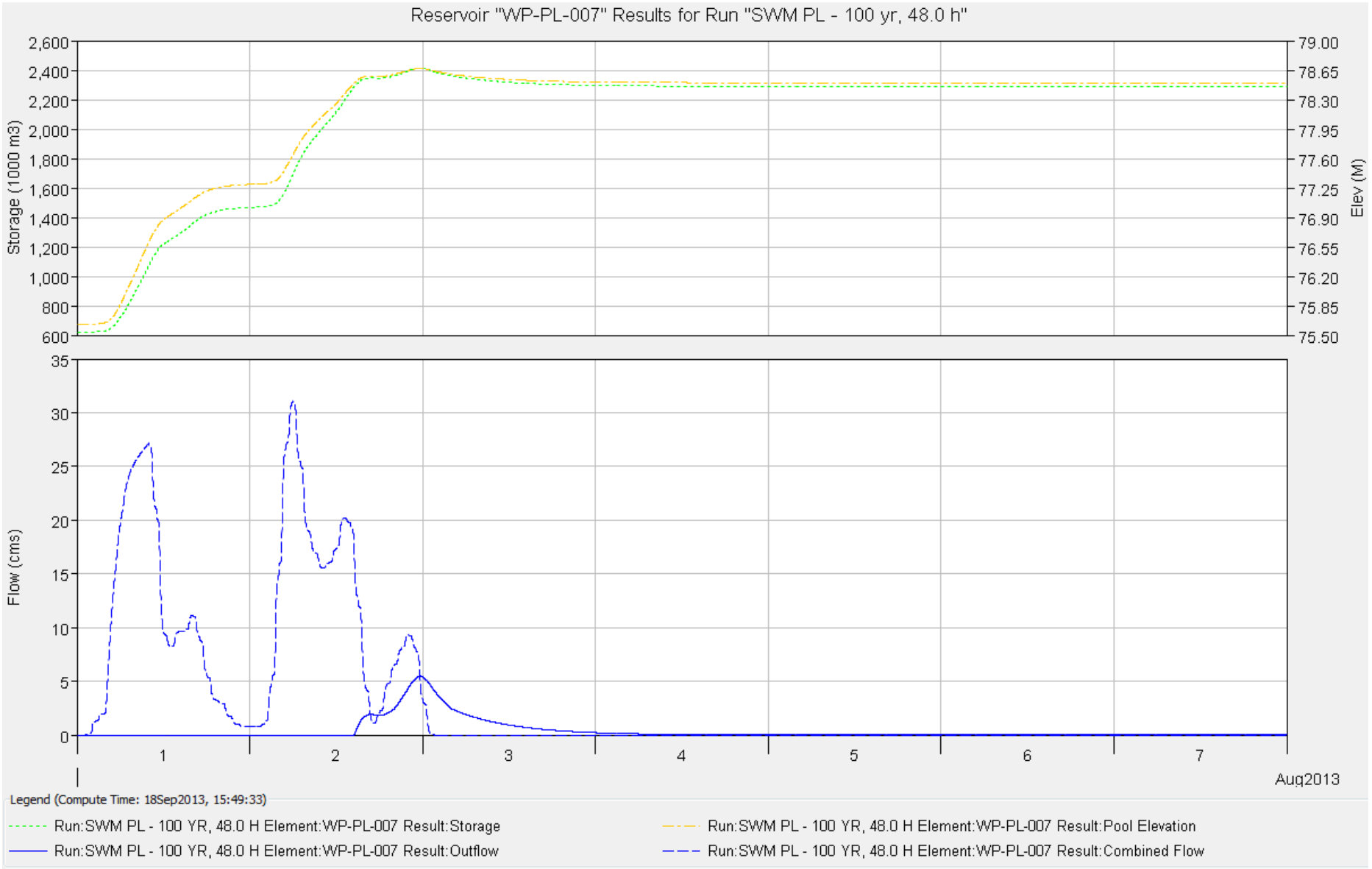

Reservoir "WP-PL-001" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
14,000
13,000
12,000
11,000
10,000
9,000
8,000
118.60
118.13
117.67
117.20
116.73
116.27
115.80
Flow (cms)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-001 Result:Combined Flow

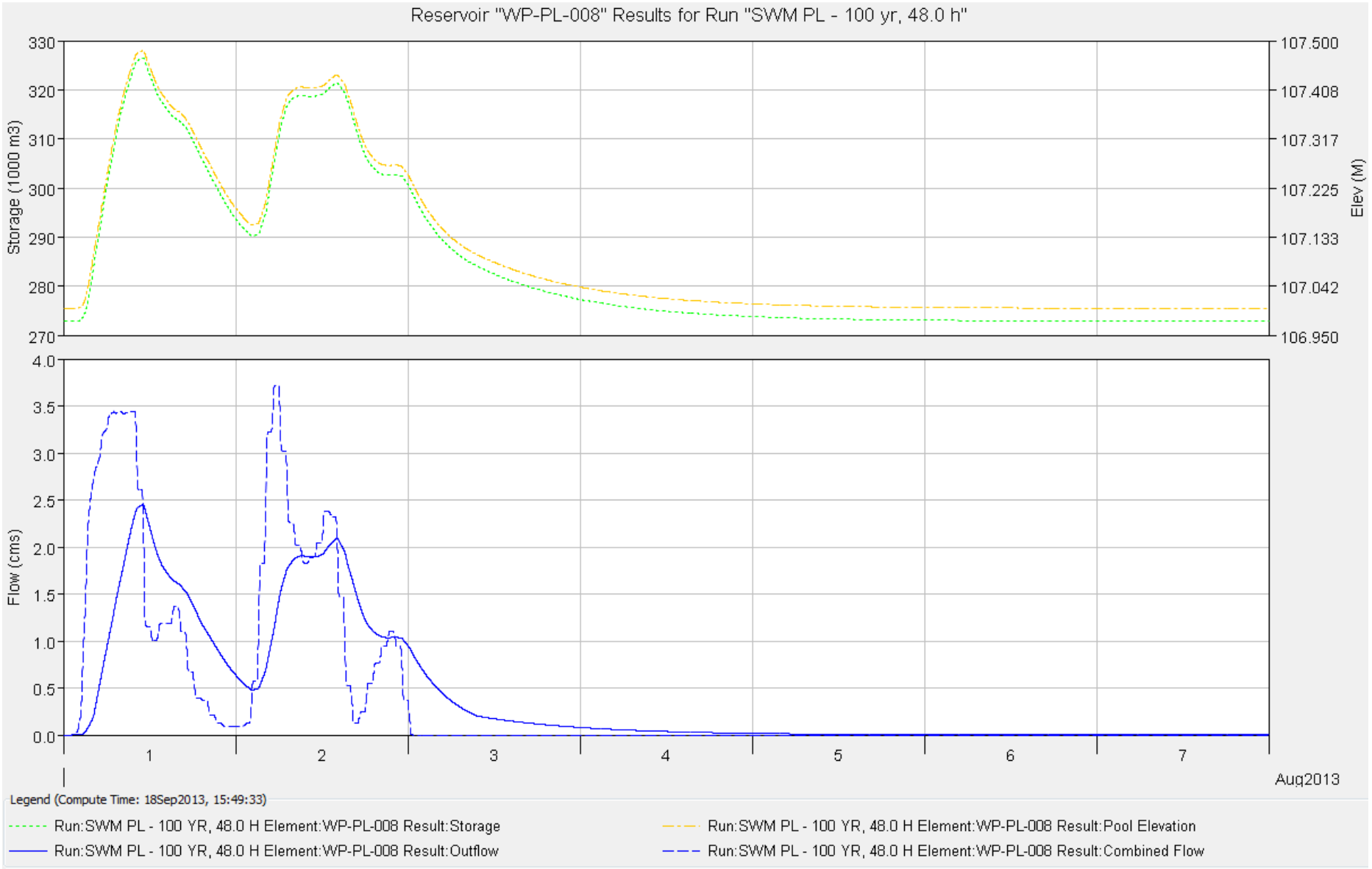

Reservoir "WP-PL-002" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
160
140
120
100
80
60
40
20
0
100.40
100.20
100.00
99.80
99.60
99.40
99.20
99.00
98.80
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-002 Result:Combined Flow

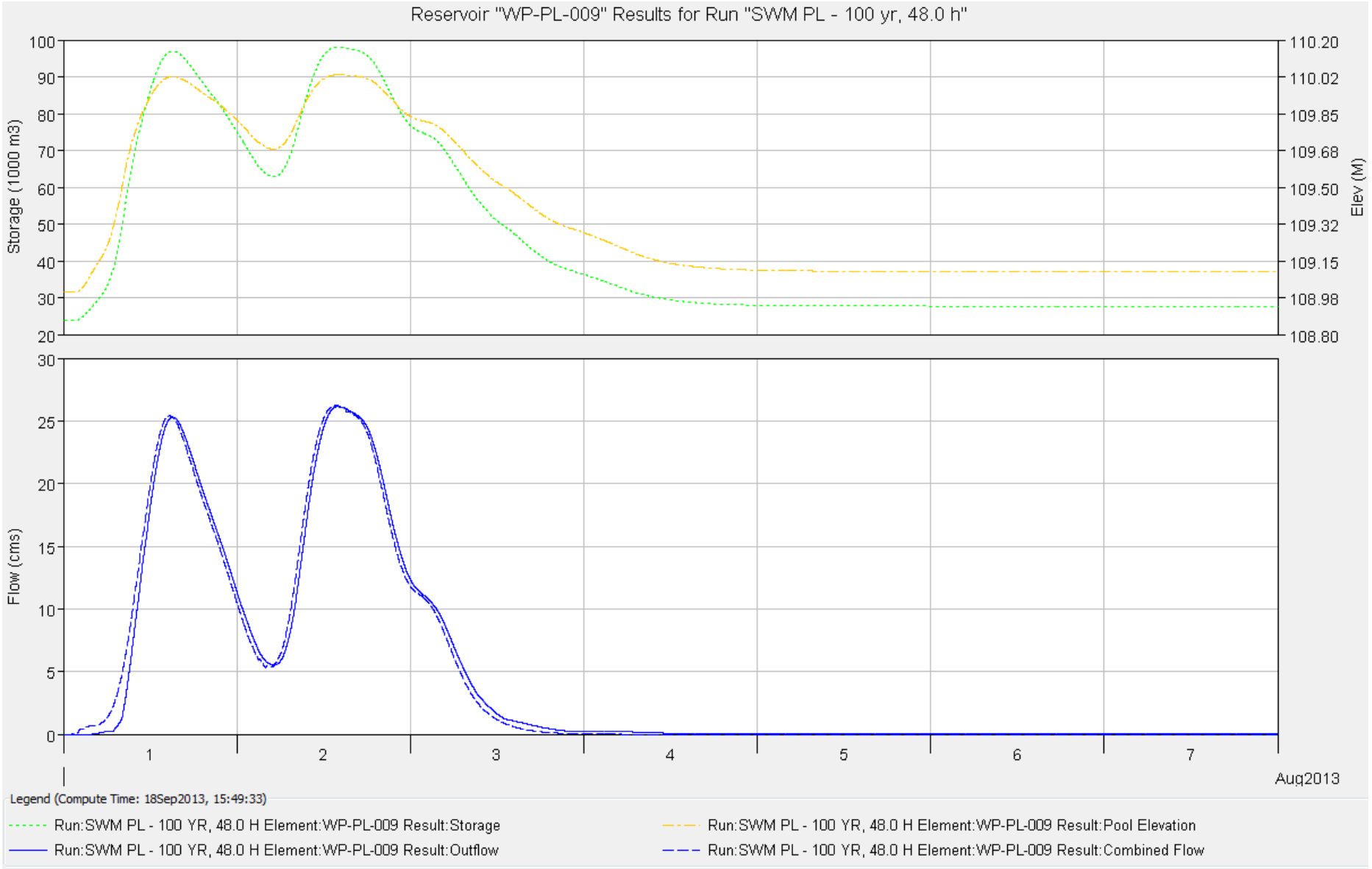

Reservoir "WP-PL-003" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
8.2
8.1
8.0
7.9
7.8
92.571
92.553
92.535
92.517
92.499
Elev (M)
Flow (cms)
0.08
0.06
0.04
0.02
0.00
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-003 Result:Combined Flow

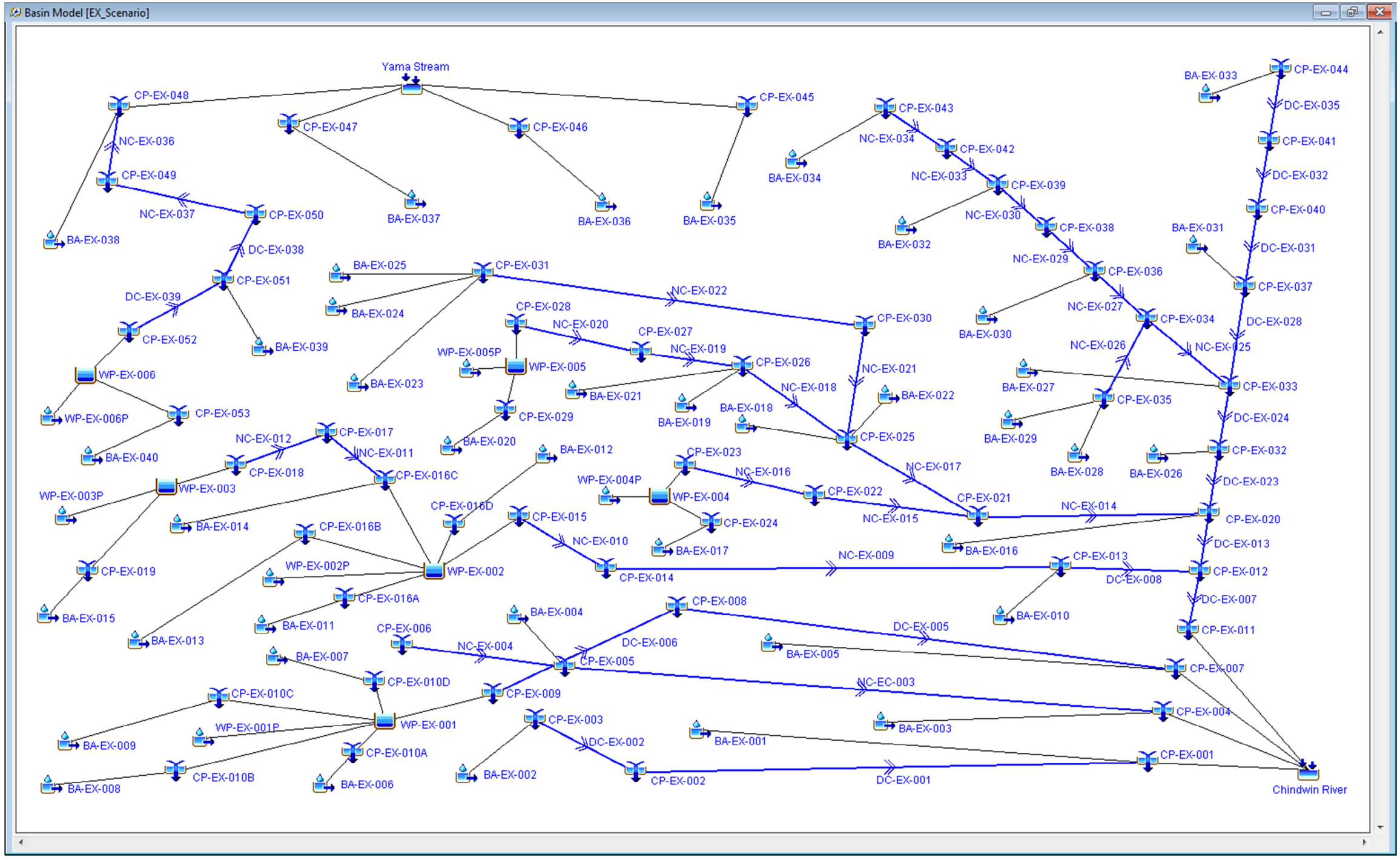

Reservoir "WP-PL-004" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
100
90
80
70
60
50
40
30
20
10
118.40
118.22
118.04
117.87
117.69
117.51
117.33
117.16
116.98
116.80
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-004 Result:Combined Flow

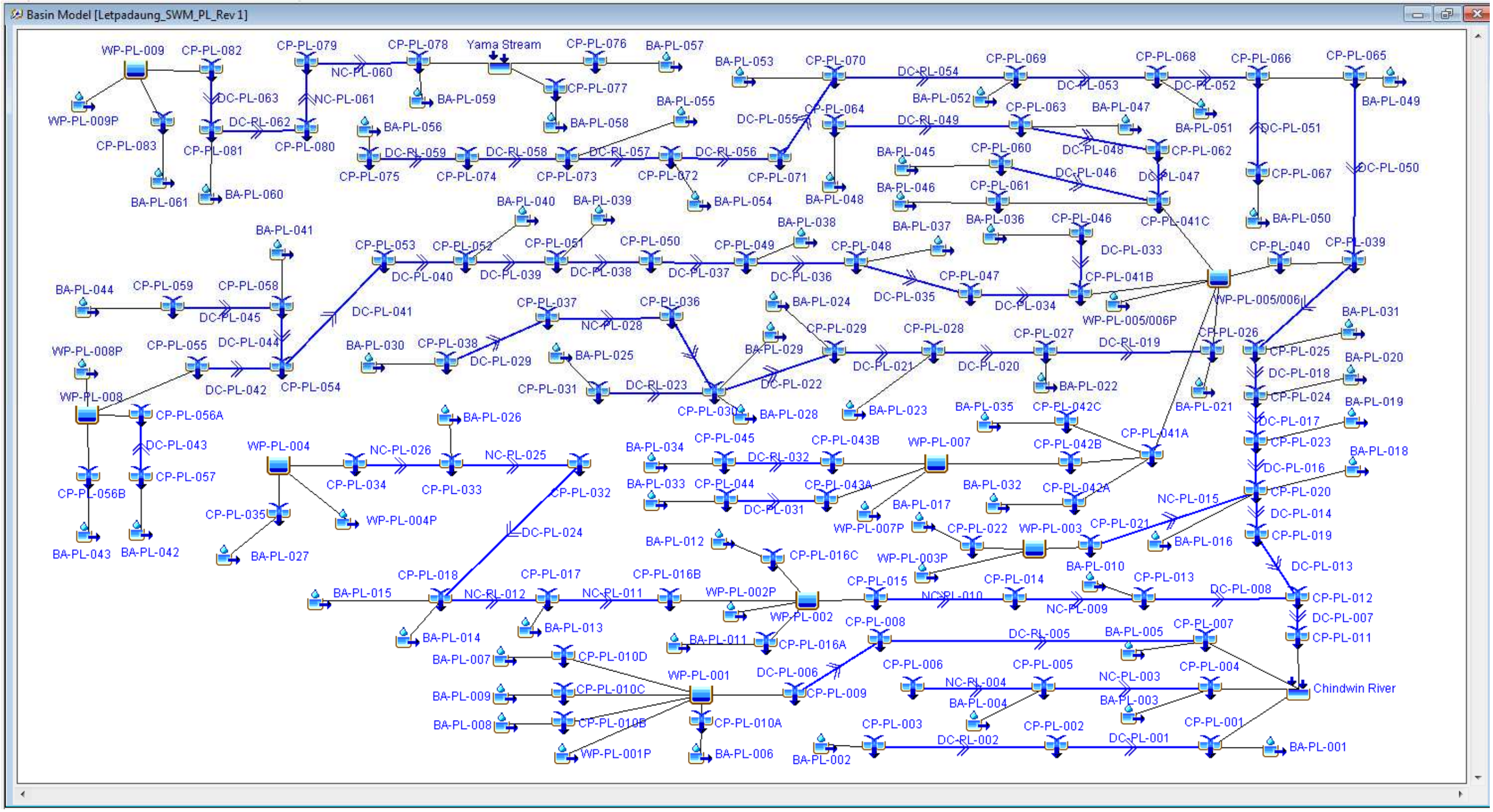

Reservoir "WP-PL-005/006" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Elev (M)
73.80
73.43
73.06
72.69
72.31
71.94
71.57
71.20
Flow (cms)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-005?006 Result:Combined Flow


Reservoir "WP-PL-007" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
79.00
78.65
78.30
77.95
77.60
77.25
76.90
76.55
76.20
75.85
75.50
Flow (cms)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-007 Result:Combined Flow


Reservoir "WP-PL-008" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
330
320
310
300
290
280
270
Elev (M)
107.500
107.408
107.317
107.225
107.133
107.042
106.950
Flow (cms)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-008 Result:Combined Flow


Reservoir "WP-PL-009" Results for Run "SWM PL - 100 yr, 48.0 h"
Storage (1000 m3)
Elev (M)
Flow (cms)
100
90
80
70
60
50
40
30
20
110.20
110.02
109.85
109.68
109.50
109.32
109.15
108.98
108.80
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Aug2013
Legend (Compute Time: 18Sep2013, 15:49:33)
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Storage
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Pool Elevation
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Outflow
Run:SWM PL - 100 YR, 48.0 H Element:WP-PL-009 Result:Combined Flow


Basin Model [EX_Scenario]
Yama Stream
CP-EX-048
CP-EX-047
CP-EX-046
CP-EX-045
NC-EX-036
CP-EX-049
NC-EX-037
CP-EX-050
BA-EX-037
BA-EX-036
BA-EX-035
BA-EX-038
DC-EX-038
CP-EX-051
DC-EX-039
CP-EX-052
BA-EX-039
WP-EX-006
WP-EX-006P
CP-EX-053
BA-EX-040
NC-EX-012
CP-EX-017
CP-EX-018
NC-EX-011
CP-EX-016C
WP-EX-003
WP-EX-003P
BA-EX-014
CP-EX-019
BA-EX-015
CP-EX-016B
WP-EX-002P
CP-EX-016A
BA-EX-011
BA-EX-013
BA-EX-025
CP-EX-031
BA-EX-024
NC-EX-022
CP-EX-028
NC-EX-020
CP-EX-027
NC-EX-019
WP-EX-005P
WP-EX-005
CP-EX-026
BA-EX-023
BA-EX-021
BA-EX-019
BA-EX-018
NC-EX-018
CP-EX-029
BA-EX-020
CP-EX-016D
CP-EX-015
NC-EX-010
WP-EX-002
CP-EX-014
BA-EX-012
CP-EX-023
NC-EX-016
WP-EX-004P
WP-EX-004
CP-EX-022
CP-EX-024
BA-EX-017
NC-EX-015
CP-EX-030
NC-EX-021
BA-EX-022
CP-EX-025
NC-EX-017
CP-EX-021
NC-EX-009
CP-EX-013
DC-EX-008
BA-EX-010
BA-EX-016
NC-EX-014
CP-EX-020
DC-EX-013
CP-EX-012
DC-EX-007
CP-EX-011
CP-EX-008
DC-EX-005
BA-EX-005
DC-EX-006
CP-EX-005
NC-EX-004
CP-EX-006
BA-EX-004
BA-EX-007
CP-EX-010D
CP-EX-009
CP-EX-010C
WP-EX-001P
WP-EX-001
BA-EX-009
CP-EX-010B
BA-EX-008
CP-EX-010A
BA-EX-006
CP-EX-003
DC-EX-002
BA-EX-002
CP-EX-002
NC-EC-003
BA-EX-001
BA-EX-003
CP-EX-007
CP-EX-004
CP-EX-001
DC-EX-001
Chindwin River
BA-EX-033
CP-EX-044
DC-EX-035
CP-EX-041
DC-EX-032
CP-EX-040
BA-EX-031
DC-EX-031
CP-EX-037
DC-EX-028
NC-EX-025
CP-EX-033
DC-EX-024
CP-EX-032
DC-EX-023
CP-EX-043
NC-EX-034
CP-EX-042
BA-EX-034
NC-EX-033
CP-EX-039
NC-EX-030
CP-EX-038
BA-EX-032
NC-EX-029
CP-EX-036
BA-EX-030
NC-EX-027
CP-EX-034
NC-EX-026
BA-EX-027
CP-EX-035
BA-EX-029
BA-EX-028
BA-EX-026


Basin Model [Letpadaung_SWM_PL_Rev 1]
WP-PL-009
CP-PL-082
CP-PL-079
CP-PL-078
Yama Stream
CP-PL-076
BA-PL-057
NC-PL-060
BA-PL-059
CP-PL-077
WP-PL-009P
DC-PL-063
NC-PL-061
BA-PL-058
DC-PL-062
BA-PL-056
BA-PL-055
CP-PL-083
CP-PL-081
CP-PL-080
DC-PL-059
DC-PL-058
DC-PL-057
DC-PL-056
CP-PL-075
CP-PL-074
CP-PL-073
CP-PL-072
CP-PL-071
BA-PL-061
BA-PL-060
BA-PL-054
BA-PL-053
CP-PL-070
DC-PL-054
CP-PL-069
CP-PL-068
CP-PL-066
CP-PL-065
DC-PL-055
CP-PL-064
DC-PL-053
DC-PL-052
BA-PL-049
BA-PL-052
CP-PL-063
BA-PL-047
DC-PL-049
BA-PL-051
DC-PL-051
BA-PL-048
BA-PL-045
CP-PL-060
DC-PL-048
CP-PL-062
DC-PL-050
DC-PL-046
DC-PL-047
CP-PL-067
BA-PL-046
CP-PL-061
BA-PL-036
CP-PL-046
CP-PL-041C
BA-PL-050
BA-PL-040
BA-PL-039
BA-PL-038
BA-PL-037
CP-PL-040
CP-PL-039
BA-PL-041
CP-PL-053
CP-PL-052
CP-PL-051
CP-PL-050
CP-PL-049
CP-PL-048
DC-PL-033
DC-PL-040
DC-PL-039
DC-PL-038
DC-PL-037
DC-PL-036
DC-PL-035
CP-PL-047
CP-PL-041B
BA-PL-044
CP-PL-059
CP-PL-058
DC-PL-034
WP-PL-005/006P
WP-PL-005/006U
DC-PL-045
DC-PL-041
BA-PL-024
BA-PL-031
CP-PL-037
CP-PL-036
CP-PL-029
CP-PL-028
CP-PL-027
CP-PL-026
NC-PL-028
DC-PL-019
WP-PL-008P
CP-PL-055
DC-PL-044
BA-PL-030
CP-PL-038
DC-PL-029
BA-PL-025
BA-PL-029
DC-PL-021
DC-PL-020
CP-PL-025
BA-PL-020
DC-PL-018
WP-PL-008
DC-PL-042
CP-PL-054
CP-PL-031
DC-PL-023
DC-PL-022
BA-PL-022
CP-PL-024
CP-PL-056A
CP-PL-030
BA-PL-028
BA-PL-023
BA-PL-035
CP-PL-042C
BA-PL-021
BA-PL-019
DC-PL-017
DC-PL-043
BA-PL-026
CP-PL-045
CP-PL-043B
WP-PL-007
CP-PL-041A
CP-PL-023
BA-PL-018
WP-PL-004
NC-PL-026
NC-PL-025
BA-PL-034
DC-PL-032
CP-PL-042B
DC-PL-016
CP-PL-057
CP-PL-033
CP-PL-032
BA-PL-033
CP-PL-044
CP-PL-043A
BA-PL-032
CP-PL-042A
CP-PL-020
CP-PL-056B
CP-PL-034
NC-PL-015
CP-PL-035
WP-PL-004P
DC-PL-031
BA-PL-017
DC-PL-014
WP-PL-007P
CP-PL-022
WP-PL-003
CP-PL-021
CP-PL-019
BA-PL-043
BA-PL-042
BA-PL-027
DC-PL-024
BA-PL-016
BA-PL-012
CP-PL-016C
WP-PL-003P
DC-PL-013
CP-PL-018
CP-PL-017
CP-PL-016B
CP-PL-015
CP-PL-014
CP-PL-013
BA-PL-010
BA-PL-015
NC-PL-012
NC-PL-011
WP-PL-002P
NC-PL-010
DC-PL-008
CP-PL-012
NC-PL-009
WP-PL-002
DC-PL-007
BA-PL-013
CP-PL-008
CP-PL-011
BA-PL-014
BA-PL-011
CP-PL-016A
DC-PL-005
BA-PL-005
CP-PL-007
BA-PL-007
CP-PL-010D
CP-PL-006
CP-PL-005
CP-PL-004
WP-PL-001
DC-PL-006
NC-PL-004
NC-PL-003
Chindwin River
BA-PL-009
CP-PL-010C
CP-PL-009
BA-PL-004
BA-PL-003
BA-PL-008
CP-PL-010B
CP-PL-010A
CP-PL-003
CP-PL-002
CP-PL-001
DC-PL-002
DC-PL-001
WP-PL-001P
BA-PL-006
BA-PL-002
BA-PL-001

APPENDIX L

Conceptual Closure Plan

Knight Piésold CONSULTING

MYANMAR WANBAO MINING COPPER LTD
LETPADAUNG COPPER PROJECT





CONCEPTUAL CLOSURE PLAN

PREPARED FOR:

Myanmar Wanbao Mining Copper Limited (MWMCL)
70(I) Bo Chien Street
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LETPADAUNG COPPER PROJECT

CONCEPTUAL CLOSURE PLAN

KP Report No. PE701-00022/04

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EXECUTIVE SUMMARY

The Letpadaung Copper Project site is located near Monywa in the Salingyi Township, approximately 600 km north-northwest of Yangon in Myanmar. It is planned that approximately 1 Bt of ore will be extracted at a rate of 30 Mtpa over a 30 year mine life. The copper will be extracted from the ore using a heap leach pad system with recovery of the copper from the leachate solution.

Knight Piésold (KP) was appointed by Myanmar Wanbao Mining Copper Ltd (MWMCL) to undertake an Environmental and Social Impact Assessment (ESIA) for the scheme as well as complete initial design work for the facility.

As part of the design development to aid preparation of the ESIA, a concept closure plan for the site has been developed which addresses closure and rehabilitation of the following areas:

- Open Pit
- Waste Dumps
- Heap Leach Pads
- Plant, Equipment and Infrastructure
- Process and Stormwater Ponds
- Accommodation Camps

The Mine Closure Management Plan:

- Outlines the regulatory and good practice standards with regards to mine closure (both national and international standards) with which Letpadaung will comply;
- Defines Letpadaung objectives and procedures to guide Letpadaung management and contractors;
- Defines mitigation programmes to manage and minimise adverse impacts;
- Identifies the opportunities for trials to research methods for achieving closure criteria; and
- Defines monitoring and reporting procedures.

In developing the concept closure plan reference has been made to Myanmar regulations as well as international standards, guidelines and best practice including IFC Guidelines, Chinese standards, European Commission 'Best Available Techniques' and Western Australian guidelines.

Letpaduang's short-term closure and reclamation objectives (during construction and operations) can be summarised as follows:

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- Progressively reclaim disturbed areas as soon as they are no longer active;
- Minimise the risk and impact of wind and water erosion and sediment transportation;
- Stabilise slopes;
- Restore drainage; and
- Cover ground to prevent soil drifting/dust.

The long-term closure and reclamation objectives are to:

- Reclaim the land to a condition where long-term environmental degradation does not take place;
- Reduce care and maintenance requirements;
- Restore the natural drainage patterns as far as practicable to the original conditions;
- For areas which cannot be restored to the original conditions, rehabilitate the areas to create landforms which are physically and chemically stable in the long-term, and where possible, are in keeping with the prevailing topography in the area;
- Prevent physical or chemical pollutants from entering and subsequently degrading the downstream environment - including surface and ground waters;
- Develop the site to achieve the long term land use goals developed in consultation with the community and government;
- Reclaim/rehabilitate the land to a condition where safety risks and environmental associated with the mine to the public are minimised;
- Restore the local environment to a natural, balanced ecosystem typical of the area, or leave it in such a state so as to encourage and enable the natural rehabilitation and/or reintroduction of a biologically diverse, stable environment.
- Seek to establish flora and fauna communities which are dynamic and resilient to disturbance from external influences (such as rain, wind, drought, harvesting, for example);
- Reclaim the land to a condition where local communities can use the site without inheriting significant future liability;
- To the extent practical, create an aesthetically pleasing environment;
- Ensure public health and safety is protected;
- Minimise adverse socio-economic impacts and provide positive social-economic benefits;

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- Agree success/completion criteria with relevant stakeholders. Monitor achievement against those criteria and report results to the stakeholders;
- Ensure at all stages of operations there are adequate and readily available funds to implement the closure plan.

In order to develop the closure plan from the concept level to detailed design stage, a number of consultations and studies will be undertaken during the mine operation to refine the plan. These are likely to include:

- Consultation with the local population to determine preferred final land use options;
- Consultation with government to establish final land use parameters;
- Rehabilitation trials to assess most appropriate resoiling and revegetation strategies for each key area on the site.
- Ongoing investigation and reviews of available rehabilitation materials and new technologies to improve rehabilitation outcomes.

The Conceptual Closure Plan presented here allows integration with the design concepts and ensures that the design and operation of the site are compatible with the closure plan. After commissioning a Detailed Closure Plan will be developed.

An outline closure land-use plan has been developed for the site. On closure the open pit will remain as a void with a permanent pit lake. The remaining areas will be rehabilitated to one of four land-use categories, namely:

i. Scrub/grazing
ii. Agriculture
iii. Pond or wetland areas
iv. Landfill

Progressive rehabilitation will be undertaken wherever possible. All equipment and infrastructure will be removed from site unless there is a beneficial use to the community such as buildings or roads.

Due to the potential for long-term environmental pollution, both the waste dumps and heap leach pads are to be covered with low or very low permeability capping systems to reduce infiltration.

Surface water run-off and leachate from waste dumps and heap leach pads will be controlled via a surface water management system that separates clean from potentially contaminated

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water, provides settling areas to reduce suspended load prior to discharge, and allows treatment of water which doesn't reach the necessary standards before release from the site.

Some materials arising from clearance of the site will have a commercial use and value. These may include generators, pumps and pre-fabricated buildings. Where possible these will be removed from site and either sold or reused elsewhere. Any materials which cannot be handled in this manner are considered wastes for the purposes of this closure plan.

If it is possible to reuse a waste either on site or for a different application in the local community then this should be adopted. Possible options include using old plastic pipework for fencing or corrugated metal sheeting as roofing on community buildings.

Where the wastes cannot be reused, attempts will be made to recycle those materials through off-site merchants and processing facilities. Types of waste that could be recycled include crushed concrete which can be used as aggregate and steelwork that can be sold as scrap metal.

If the waste cannot be reused or recycled then it should be disposed of in an appropriately-constructed landfill facility. It is intended that two landfills will be constructed on the site so that wastes are contained within the site boundary. One facility will accept inert/non-hazardous waste whilst the other will be a hazardous waste landfill.

As the Closure Plan is developed during the mine life, a set of completion criteria for rehabilitation, which are consistent with overall site closure objectives, will be determined and agreed with the regulator and relevant stakeholders. Through long-term monitoring of the site, it will be demonstrated that the development of rehabilitated areas is consistent with completion criteria.

Closure costs will be developed concurrent with the Closure Plan and financial provision will be made to ensure that adequate funds are available for final closure.

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1. INTRODUCTION

The Letpadaung Copper Project site is located near Monywa in the Salingyi Township, approximately 600 km north-northwest of Yangon in Myanmar. It is planned that approximately 1 Bt of ore will be extracted at a rate of 30 Mtpa over a 30 year mine life. The copper will be extracted from the ore using a heap leach pad system with recovery of the copper from the leachate solution.

Knight Piésold (KP) was appointed by Myanmar Wanbao Mining Copper Ltd (MWMCL) to undertake an Environmental and Social Impact Assessment (ESIA) for the scheme as well as complete initial design work for the facility.

As part of the design development to aid preparation of the ESIA, a closure plan for the site needs to be developed.

Closure and rehabilitation of the following areas will be required:

- Open Pit.
- Waste Dumps.
- Heap Leach Pads.
- Plant, Equipment and Infrastructure.
- Process and Stormwater Ponds.
- Accommodation Camps.

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This report presents the concept closure plan for the whole site.

The Mine Closure Management Plan:

- Outlines the regulatory and good practice standards with regards to mine closure (both national and international standards) with which Letpadaung will comply;
- Defines Letpadaung objectives and procedures to guide Letpadaung management and contractors;
- Defines mitigation programmes to manage and minimise adverse impacts;
- Identifies the opportunities for trials to research methods for achieving closure criteria; and
- Defines monitoring and reporting procedures.

The Mine Closure Management Plan will cover the full range of closure events which include:

- Unexpected mine closure (either temporary or permanent);
- Progressive rehabilitation through the life of the mine; and
- Permanent closure.

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2. MYANMAR REGULATORY REQUIREMENTS

2.1 EXISTING ENVIRONMENTAL LEGISLATION

Though Myanmar does have some legislation related to protecting people and the environment, the country lacks the necessary adequate administrative and legal structures, standards, safeguards and political will to enforce such provisions. In addition, while Myanmar is party to several international treaties such as the Convention on Biological Diversity (CBD), in the past, Myanmar has not incorporated the provisions contained in these agreements into domestic law. For example, national laws did not require specific environmental and social impact assessments (ESIA) or public participation by local communities in the decision-making processes of large-scale development projects. However, to address the environmental expectations of the laws described below, an ESIA would be required to establish the mechanisms for preventing such actions from occurring. There are no specific laws that comprehensively regulate pollution, no standards to adequately protect biodiversity, develop resettlement plans, or provide compensation. There are, however, the 1995 Community Forest Instructions (CFI), the March 2012 Environmental Conservation Law, the November 2012 Foreign Investment Law, Rules and Notification by Myanmar Investment Commission (2013), Rules of the Conservation of Water Resources and Rivers Law (2013) and the Land Acquisition Act that, if systematically enforced, would improve environmental protection and the land-based rights of local populations. Myanmar became a party to the CBD in 1994. Article 14(1)(a) of the Convention requires an EIA and Article 8(j) mandates indigenous participation where there is a significant impact on biodiversity. Section 54 of the 2012 Foreign Investment Law provides that “If any provision of this Law is contrary with any matter of the International Treaty and Agreement adopted by the Republic of the Union of Myanmar, the matters contained in the International Treaty and Agreement shall be abided by.

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2.2 THE ENVIRONMENTAL CONSERVATION LAW 2012 (ECL)

2.2.1 Objectives

The ECL, the landmark law specifically dedicated to address environmental conservation, was enacted:

a) to implement the national environmental policy;

b) to lay down basic principles and provide guidance to systematically integrate environmental conservation matters with the sustainable development works;

c) to build a healthy and clean environment and to conserve natural and cultural heritage for the benefit of current and future generations;

d) to restore the deteriorating and disappearing ecosystem to the fullest extent possible;

e) to enable to manage and implement for the decrease and loss of natural resources and for enabling the benefits of sustainable use;

f) to enable promotion of public awareness and cooperation in the matters of environmental conservation;

g) to enable promotion of international, regional, and bilateral cooperation in the matters of environmental conservation; and

h) to co-operate with the government departments and organisations, international organisations, non-governmental organisations and private individuals on environmental conservation matters.[1]

2.2.2 Current Position

Though the ECL paves the way for the use of EIA and/or SIA in evaluation of issuing a prior permission for prescribed businesses, the prior permission scheme itself is discretionary and there is currently no basis in the law for the Ministry to determine whether or not to issue a permit, and whether to impose environmental compliance conditions on the user. Also, some of the Ministry of Environmental Conservation and Forestry's (MOECAF) broad powers granted under the law require the approval of the Union Government and the Environmental Conservation Council (ECC) but without the clear power and basis of the approval.

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There are no regulatory guidelines and rules specified to enable the ECL to be operable in practice: such as setting the environmental quality standards, emission standards, and classes of hazardous waste and substances. In addition, there is a need to cover the non-point sources of pollution that is not discussed in the ECL.

The ECL provides for integration with sectoral policies and co-ordination amongst the Ministries and departments.[2] It is expected that the Environmental Conservation Rules (ECR) of the ECL which is underway would provide regulatory guidelines to implement the ECL.

2.2.3 Obligations of Business Owners and Occupiers

The polluter at source has obligations to clean, discharge, dispose, or keep pollutants in accordance with the prescribed standards[3].

[1] ECL Section 3
[2] ECL Section 18
[3] ECL Section 14

The owner or occupier of business activities, materials or places that are source of the pollution must install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If this is not possible, it must be arranged to dispose the wastes in accordance with environmentally sound methods[4].

The individuals or organisations carrying on the businesses in the industrial zones, or special economic zones or businesses set by the government ministries have responsibilities to contribute either in cash or in kind and carry out the management of pollutants and environmental conservations including the treatment of wastes collectively[5]; must give the fees for the usage and expenses incurred in connection with management of environmental conservation by the relevant industrial zones, special economic zones and business organisations[6]; and must comply with the environmental conservation directives published by the relevant industrial zone, special economic zone or the business organisations[7].

2.3 FOREIGN INVESTMENT LAW 2012 (FIL)

The FIL, in its Basic Principles, states that the investment shall be allowed based upon principles including "protection and conservation of the environment"[8].

The duties of the investor requires the carrying out of business in a manner not to cause environmental pollution or damage in accord with existing laws in respect of investment business[9].

2.4 NOTIFICATION OF MIC 1/2013

The list of Economic Activities under Prohibition includes:

- Installation of Factory in Myanmar utilizing of the imported wastes
- Manufacturing of hazardous material which are not in compliance with the Environmental and Conservation Law, Rules and Procedures promulgated from time to time.
- Activities which may emit hazardous chemicals, minerals, rays, noise, particles etc., and may cause earth/water/air pollution which affect public health.
- Exploitation of minerals including gold in the revering and water way.

[4] ECL Section15
[5] ECL Section 16(a)
[6] ECL Section 16(b)
[7] ECL Section 16(c)
[8] Fill Clause 8(l)
[9] Fill Clause 17(h)

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The list of Economic Activities Permitted with Specific Conditions includes at No (3) includes Economics activities which required Environmental Impact Assessment.

Exploration and production of minerals, manufacturing of iron, steel and minerals and operation in cultural heritage, archaeological and prominent geographical symbolical sites, etc., all require that it will be allowed subject to the need for Environmental Impact and Social Impact, or Environmental Impact, alone being carried out for initial study of environment.

Clause 37 of the Rules of the FIL states “In order to scrutinize accepted proposals sector by sector, a Proposal Review Group, composed of high ranking officers from the Environmental Conservation Department, is to be formed to perform preliminary scrutiny.

Section 47 states that the Commission shall scrutinise investment proposals in the following manners:

- Scrutinising remarks from the Ministry of Environmental Protection and Forestry on the protection measures of social and environmental impact.

Notification No 1/2013 of MIC dated 29th January, 2013 List of Economic Activities requiring environmental impact assessments:

- Exploration and production of minerals – Depending upon the business activity, to avoid environmental and social impacts, or to minimise environmental and social impacts, it will be allowed only after conducting initial study and assessment upon environmental and social impacts.

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2.5 MINES LAW (1994) (MML) AND ASSOCIATED MINES RULES

The Mines Law (1994) aims to protect the environment from mining operations that may be detrimental to conservation of environmental quality.

Section (3) of the Mine Law states the objectives as follows:

- To carry out for the development of conservation, utilisation and research works of mineral resources;
- To protect the environmental conservation works that may have detrimental effects due to mining operations.

Under duties of the holder of Permit, it is stated that the holder of permit shall comply with the rules prescribed under this Law in respect of the following matters:

- Making provisions for safety and the prevention of accidents in a mine and their implementation;

- Making and implementation of plans relating to the welfare, health, sanitation and discipline of personnel and workers in a mine;
- Making provisions for the environmental conservation works that may have detrimental effects due to mining operation;
- Reporting of accidents, loss of life and bodily injury received due to such accidents in the mine; and
- Submission to the inspection of the Chief Inspector and inspectors[10].

Rules 69 to 73 govern the rights of utilisation of land and water for mineral production which includes the provisions of the responsibility of the mineral permit holder so that there is no pollution of the environment due to the use of land and water.

The holder of a mineral exploration permit or a mineral production permit must backfill or otherwise make safe bore holes, excavations, surface of land damaged during the course of underground mining operations to the satisfaction of the Ministry or the Department. The holder must also establish forest plantations or pay compensation to the Ministry of Forestry, if trees were cut and cleared for mineral exploration or mineral production within a forest land or in a land area covered with forests.

In disposing of liquids, wastes, tailings and fumes which have resulted from mineral production, the holder of a mineral production permit must undertake laboratory tests as may be necessary for the prevention of pollution of water, air and land in the environment and for the safety of living beings. If toxic materials are found in the waste products, which are harmful to living beings, degradation shall be made by chemical means and systematic disposal shall be made only when it is assured that there is no danger.

The holder of a permit for mineral production within an area under the Ministry's administrative control or which does not lie within the Mineral Reserve Area or Gemstone Tract, shall carry out such production only after co-ordinating and receiving agreement from the individual or organisation having the right of cultivation, right of possession, right of use and occupancy, beneficial enjoyment, right of succession or transfer of the said land[11].

Chapter XXI of the Myanmar Mining Rules (MMR) describes "making provisions to prevent detrimental effects due to mining operations on the environmental conservation works". The requirements include:

[10] MML Section 13
[11] MML Section 14

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- Backfilling or making safe bore holes, excavations or surface of the land damaged during the course of underground mining[12]; and
- Undertaking laboratory tests, as necessary, to prevent pollution of water, air and land[13].

2.6 ENVIRONMENTAL POLICIES

A national environmental policy was drafted by the NCEA in 1994. The National Environment Policy is as follows:

"To establish sound environment policies, utilisation of water, land, forests, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation, the Government of the Union of Myanmar hereby adopts the following policy: The wealth of the nation is its people, its cultural heritage, its environment and its natural resources."

The objective of Myanmar's environmental policy is aimed at achieving harmony and balance between people, the environment, heritage and natural resources through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has the sovereign right to utilise its natural resources in accordance with its environmental policies; but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations. It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations.

The development of the environmental policy was followed by the drafting of 'Myanmar Agenda 21' in 1997, which follows a UN framework for a multi-pronged approach to sustainable development. The Myanmar Agenda 21 recognises the need for Environmental Impact Assessments. Myanmar, in its Agenda 21, calls for integrated management of natural resources and provides a blueprint for achieving sustainable development.

The ECL provides more institutional space to regulate environmental quality and conduct EIA's and SIA's for infrastructure and investment projects funded by the government and private sector.

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[12] MML Section 105
[13] MML Section 106

2.7 MYANMAR INVESTMENT COMMISSION (MIC)

The MIC issued a Notification on 30 June 1994 on Protection of Environment stating that:

1. The Myanmar Investment Commission, at its meeting 8/94 held on 17 June 1994 has resolved that all projects established with the permission of the Commission shall be responsible for the preservation of the environment at and around the area of the project site. The enterprises are entirely responsible that they shall be able to control pollution or air, water and land, and other environmental degradation, and that they can keep the project site environmentally friendly.
2. Consequently, it is hereby notified that treatment plant, industrial waste water treatment plant and other pollution control procedures should be promptly implemented and abide with the sanitary and hygienic rules and regulations set by the authorities concerned.
3. In the future proposals that are to be submitted to the Commission, either under the Union of Myanmar Foreign Investment Law or the Myanmar Citizens Investment Law, shall incorporate the provision in their contracts that they shall undertake proper sewage and industrial wastewater treatment systems and other environmental control systems. The system so used shall be in accordance with the rules and regulations specified by the respective development committees and local authorities.

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3. INTERNATIONAL GUIDELINES AND STANDARDS

3.1 GENERAL

In addition to adherence with applicable local legal obligations, Letpadaung is committed to conducting project mine closure and reclamation activities in line with international good practices. Relevant standards and guidelines consulted during the development of the Letpadaung Concept Closure Plan are outlined below.

3.2 INTERNATIONAL FINANCE CORPORATION GUIDELINES

3.2.1 General

The International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines relevant to the Letpadaung project comprise general environmental guidelines as well as mining-specific guidelines.

3.2.2 Environmental

IFC EHS General Environmental Guidelines[14] include a number of sections relevant to closure and rehabilitation of the site. These sections include:

- Waste Water and Ambient Water Quality.
- Waste Management.

Relevant best practice recommendations from these guidelines include:

- Plan and implement the segregation of liquid effluents in order to limit the volume of water requiring specialized treatment.
- Assess compliance of wastewater discharges with the applicable discharge standards.
- Establish waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences.
- Where waste cannot be recovered or reused, it should be treated, destroyed, and disposed of in an environmentally sound manner.
- Where offsite disposal in not possible, facilities should be constructed that will provide for the environmental sound long-term storage of wastes on-site.

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[14] Environmental Health & Safety Guidelines: Environmental, International Finance Corporation

3.2.3 Mining

IFC EHS Guidelines for Mining[15] include the following best practice recommendations for mine closure:

- The Mine Reclamation and Closure Plan should incorporate both physical rehabilitation and socio-economic considerations.
- Preparation of a Mine Reclamation and Closure Plan in draft form prior to the start of production with annual updates during the mine life.
- Finalise the plan during the last five years of forecasted operations.
- The Mine Reclamation and Closure Plan will be designed so that:
  - Future public health and safety are not compromised;
  - The after-use of the site is beneficial and sustainable to the affected communities in the long term; and
  - Adverse socio-economic impacts are minimised and socio-economic benefits are maximised.

The Mine Reclamation and Closure Plan will clearly identify allocated and sustainable funding sources to implement closure at any stage in the mine life including the provision for early or temporary closure. Funding should be by either cash accrual or a financial guarantee.

Closure and post closure plans will include appropriate aftercare and continued monitoring of the site, pollutant emissions, and related potential impacts. The duration of post closure monitoring will be defined on a risk basis. However, site conditions typically require a minimum period of five years after closure or longer.

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3.3 CHINESE STANDARDS

In preparing this closure plan, reference has been made to the Code for Waste Dump Design of Nonferrous Metal Mines[16]. The standard is assumed to apply to waste dumps and heap leach pads as well as application of general principles to overall site closure. Amongst others, it requires that:

- The reclamation plan for the waste dump be prepared at the same time as the waste disposal plan;

[15] IFC (2007). Environmental Health & Safety Guidelines for Mining, International Finance Corporation, 10 December 2007

[16] Code for Waste Dump Design of Nonferrous Metal Mines (2007). National Standard of the People's Republic of China, GB 504421-2007. Implemented 01 October 2007.

- The final landform be in keeping with the local natural environment with vegetation coverage no less than the original coverage;
- The end land use of arable or agricultural land be the main priority;
- Slopes be slackened appropriately for stability, development and utilisation of the site;
- Reclamation be completed within three years of completion of waste disposal (one year for engineering and two years for habitat/vegetation establishment);
- The design shall include measures to prevent waste residue, dust and water pollution influencing the environment; and
- Waste dumps containing heavy metals, sulfides or other toxic soluble waste shall have waterproof and leakproof measures to prevent release of contaminants to the environment.

3.4 EUROPEAN COMMISSION BEST AVAILABLE TECHNIQUES (BAT)

The European Commission Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities (January 2009) provides details of current good practice relating to waste rock management. Recommendations relevant to the Letpadaung project include:

- The site should be designed for closure. This implies that the closure of the site is taken into account in the feasibility study of a new mine site and is then continuously monitored and updated during the life cycle of the mine.
- Closure costs are included in the assessment of alternatives.
- Facilities are designed to facilitate premature closure if necessary.
- After-care design should minimise the need for active management.
- Life-cycle management: A reduction of the risk of any failures can be assisted by a commitment of the operator to the adequate and rigorous application of appropriate available engineering techniques for the design, operation and closure of tailings and waste rock management facilities over the entire period of their operating life. Some tools elemental to good engineering are the establishment of an environmental baseline, the characterisation of tailings and waste-rock, the use of dam safety manuals and audits, as well as applying planning for closure from the outset.
- Upon closure, ARD generating .waste-rock heaps should be covered with engineered dry covers that aim to prevent ARD generation.

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- Progressive restoration/revegetation: Heaps and dams are often restored/revegetated during operation. Amongst other advantages, this allows a shorter closure period.
- Development of a monitoring plan that includes inspections and audits.

3.5 WESTERN AUSTRALIA MINE CLOSURE GUIDELINES

The Guidelines for Preparing Mine Closure Plans, produced by the Government of Western Australia (June 2011) provide further good practice guidance. Recommendations include:

- At all stages, from the project approval stage onwards, the Mine Closure Plan should demonstrate that ecologically sustainable mine closure can be achieved consistent with agreed post-mining outcomes and land uses, and without unacceptable liability.
- Planning for mine closure should be fully integrated in the life of mine planning, and should start as early as possible and continue through to final closure and relinquishment. For new projects, closure planning should start in the project feasibility stage (before project approvals).
- Mine closure plans must be site-specific. Generic “off-the-shelf” closure plans will not be acceptable.
- Closure planning should be risk-based taking into account results of materials characterisation, data on the local environmental and climatic conditions, and consideration of potential impacts through contaminant pathways and environmental receptors.
- Consultation should take place between proponents and stakeholders which should include acknowledging and responding to stakeholder’s concerns. Information from consultation is central to closure planning and risk management.
- Post-mining land uses should be identified and agreed upon through consultation before approval of new projects. This should take into account the operational life span of the project, and should include consideration of opportunities to improve management outcomes of the wider environmental setting and landscape, and possibilities for multiple land uses. For existing mining projects, post-mining land uses should be agreed as soon as practicable.
- Characterisation of materials needs to be carried out prior to project approval to a sufficient level of detail to develop a workable closure plan. This is fundamental to effective closure planning. Characterisation of materials should

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include the identification of materials with potential to produce acid, metalliferous or saline drainage, dispersive materials, fibrous and asbestiform materials, and radioactive materials, as well as benign materials intended for use in mine rehabilitation activities.

- Closure planning should be based on adaptive management. Closure plans should identify relevant experience and research, and how lessons learned from these are to be applied.
- Closure plans should demonstrate that appropriate systems for closure performance monitoring and maintenance, and for record keeping and management are in place.

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4. CLOSURE CONSIDERATIONS

4.1 DEFINITIONS

For the purposes of this closure plan, the following terminology has been adopted:

CLOSURE – Life of mine process which culminates in tenement relinquishment. It includes decommissioning and rehabilitation.

DECOMMISSIONING – The process that begins near, or at, the cessation of mineral production and ends with the removal of all unwanted infrastructure and services.

REHABILITATION – The return of disturbed land to a stable, productive, and self-sustaining condition.

RELINQUISHMENT – Formal approval by the regulating authority that completion criteria have been achieved.

4.2 CLOSURE PRINCIPLES

Current good mining practice suggests that mine planning should be undertaken with mine closure at the forefront of consideration. Some key principles and elements related to mine closure include:

- Integrate sustainable development considerations within the corporate decision-making process,
- Plan, design, operate and close operations that enhance sustainable development;
- Implement risk management strategies based on valid data and sound science,
- Consult with interested and affected parties in the identification, assessment and management of all social, health, safety, environmental and economic impacts associated with closure activities, and
- Inform potentially affected parties of significant risks from mining, minerals and metals operations and of the measures that will be taken to manage potential closure risks effectively;
- Seek continual improvement in environmental performance,
  - Assess the positive, negative, indirect and cumulative impacts of new projects from exploration through closure,
  - Rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses, and
  - Design and plan all operations so that adequate resources are available to meet closure requirements of operations;

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- Contribute to the social, economic and institutional development of the communities in which the project operates,
- Contribute to community development from project development through closure in collaboration with host communities and their representatives; and,
- Implement effective and transparent engagement, communications and independently verified reporting arrangements with stakeholders.

4.3 SHORT-TERM OBJECTIVES

Letpaduang's short-term closure and reclamation objectives (during construction and operations) can be summarised as follows:

- Progressively reclaim disturbed areas as soon as they are no longer active;
- Minimise the risk and impact of wind and water erosion and sediment transportation;
- Stabilise slopes;
- Restore drainage; and
- Cover ground to prevent soil drifting/dust.

4.4 LONG-TERM OBJECTIVES

The long-term closure and reclamation objectives are to:

- Reclaim the land to a condition where long-term environmental degradation does not take place;
- Reduce care and maintenance requirements;
- Restore the natural drainage patterns as far as practicable to the original conditions;
- For areas which cannot be restored to the original conditions, rehabilitate the areas to create landforms which are physically and chemically stable in the long-term, and where possible, are in keeping with the prevailing topography in the area;
- Prevent physical or chemical pollutants from entering and subsequently degrading the downstream environment - including surface and ground waters;
- Develop the site to achieve the long term land use goals developed in consultation with the community and government;
- Reclaim/rehabilitate the land to a condition where safety risks and environmental associated with the mine to the public are minimised;

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- Restore the local environment to a natural, balanced ecosystem typical of the area, or leave it in such a state so as to encourage and enable the natural rehabilitation and/or reintroduction of a biologically diverse, stable environment.
- Seek to establish flora and fauna communities which are dynamic and resilient to disturbance from external influences (such as rain, wind, drought, harvesting, for example);
- Reclaim the land to a condition where local communities can use the site without inheriting significant future liability;
- To the extent practical, create an aesthetically pleasing environment;
- Ensure public health and safety is protected;
- Minimise adverse socio-economic impacts and provide positive social-economic benefits;
- Agree success/completion criteria with relevant stakeholders. Monitor achievement against those criteria and report results to the stakeholders;
- Ensure at all stages of operations there are adequate and readily available funds to implement the closure plan.

As part of the closure plans, a set of rehabilitation standards will be developed and agreed with the relevant authorities, which when achieved will demonstrate successful rehabilitation. They will be inclusive of legislative requirement, recognitions of final land use requirement and quantified through consultation with relevant stakeholders.

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4.5 SOCIAL CONSIDERATIONS

During development of the closure plan, consideration should be given to the impact that the scheme will have on the local population. Issues to be addressed include (DITR, 2006b):

- Ensuring future public health and safety of the community is not compromised;
- An early and effective communication strategy should be established and the community engaged throughout the life of the operation, including through decommissioning and closure;
- Community development should include strategies for sustaining the socio-economic state of the community without the support of the mine;
- Develop capacity to maintain certain infrastructure services and facilities for future community or local government ownership or as part of arising business development opportunities;

- Provide appropriate skills transfer and employment opportunities through the development of local business enterprises;
- Community development should be driven by the needs of the community with the aim of contributing to the building of the long-term strength of community viability; and
- Develop the formal and informal processes, systems, structures and relationships within the community that actively supports the capacity of current and future generations to create a range of healthy and liveable communities.

It should be noted that consultations have not yet commenced but will be undertaken in later stages of the feasibility design. The concept closure plan presented here provides an engineered solution for land use that has been adopted on similar schemes elsewhere. Refinement of the design will be completed following the consultation process.

4.6 PRE-CLOSURE STUDIES AND CONSULTATIONS

In order to develop the closure plan from the concept level to detailed design stage, a number of consultations and studies will be undertaken during the mine operation to refine the plan. These are likely to include:

- Consultation with the local population to determine preferred final land use options;
- Consultation with government to establish final land use parameters;
- Rehabilitation trials to assess most appropriate resoiling and revegetation strategies for each key area on the site.
- Ongoing investigation and reviews of available rehabilitation materials and new technologies to improve rehabilitation outcomes.

4.7 DEVELOPMENT OF THE CLOSURE PLAN

A dynamic rehabilitation plan will be developed which has the flexibility to evolve as results from investigations, research, on-site trials and detailed mine planning become available. The development schedule for the closure plan will consist of the following stages:

1. The Conceptual Closure Plan will be prepared during the design stage (this report). This will allow integration with the design concepts and ensure that the design and operation of the site are compatible with the closure plan.
2. After commissioning the Detailed Closure Plan will be developed which incorporates the following:

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a) A closure plan for each specific area / type of facility and structure on site.

b) Rehabilitation completion standards for approval with the regulators.

c) Testing program for assessment of short term and long term physical and chemical stability of waste dump and heap leach materials.

d) Rehabilitation trials to assess the viability of the closure concept plan.

e) Progressive rehabilitation plans for areas of the site which are no longer required for the ongoing operation.

3. During mine operation the closure plan will be updated every five years based on the results of the testwork programme and the changes in the operation and mine planning.

4. A minimum of five years before closure of the mine, a Final Closure Plan will be developed and approved with the regulators.

Key activities that will be undertaken to develop the Plan include:

- **Options workshops**: to identify closure options and develop a strategy to identify and develop the preferred closure option taking into account social, environmental and economic implications;
- **Risk assessment workshops**: to identify risks associated with the preferred closure option(s) and to develop a mitigation programme to manage risks to acceptable levels;
- **Closure cost estimation**: to develop an estimate of mine closure costs, including the construction, demobilisation, demolition, removal and remediation of all plant facilities as well as all other ongoing remediation activities.

An outline of the level of detail to be included in the closure plan in relation to the time before closure works commence is provided in Table 4.1 (Government of WA Guidelines for Closure Plans).

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Table 4.1: Anticipated level of closure detail

Life of Mine	Post-mining Land use	Identification and Management of Key Environmental Issues	Closure Outcomes	Closure Costing	Closure Implementation and Monitoring Plans
Long term (25+ years)	Provisional targets unless agreed to by all key stakeholders as being final	High risk components completed	Indicative except for high risk operations	Indicative	Preliminary except for high risk operations
Medium term (10 to 25 years)	Well advanced	Completed	Well advanced	Increased accuracy	Well advanced
Short term (Up to 10 years)	Well advanced to Completed	Completed	Well advanced to Completed	Accurate	Completed
Existing operations	Determined on a case by case basis depending on mine life and risk	Completed	Determined on a case by case basis depending on mine life and risk	Determined on a case by case basis depending on mine life and risk	Determined on a case by case basis depending on mine life and risk

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5. CONCEPTUAL CLOSURE DESIGN

5.1 OVERVIEW

The following sections describe the conceptual design for the key physical elements of the mine site. The closure concepts for each component are based on the best engineering interpretation of the data available currently with verification of the assumptions to be part of the ongoing closure plan testing program.

A closure land-use plan is provided as Figure 5.1 which shows the principal mine areas and proposed final land-uses.

5.2 TOPSOIL RECOVERY

As part of the site clearance and preparation prior to construction of the mine, topsoil and other suitable subsoils will be recovered from all areas to be disturbed with sufficient volume recovery to ensure effective rehabilitation of the site on closure. The soils will be stockpiled at various locations around the site and will be protected throughout the mine life. The recovery and storage of the soils will conserve valuable nutrients and enhance the future viability of native seed and micro-organisms. As such efficient recovery and management of the resource is critical to rehabilitation.

Initial assessments of ground conditions suggest that some 7 Mm^3 of topsoil and subsoil can be recovered from the disturbed footprint of the mine with an average thickness of 400 mm. The stockpiles will have a maximum height of 4 m which is a balance between optimising storage volumes whilst trying to maintain low stockpile heights which assists with preserving viability of the soils. Preliminary stockpile locations are shown on Figure 5.1.

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5.3 OPEN PIT

5.3.1 General

The key factor in closure of the open pit is the maintenance of the safety of the public and the environment.

The key risks are:

- Steep sloping side walls of the pit;
- Collapse of sides and creation of zones of instability; and
- Accumulation of water in the pit which will generally be of poor water quality due to acid rock drainage and accumulation of metals and salts in the water associated with evaporation and/or changes in water chemistry.

The closure design will ensure that the risk of harm to humans, fauna or domestic animals is reduced as far as reasonably practicable. Measures will also be included to reduce the likelihood of contamination of groundwater or surface water by the mine pit after closure.

5.3.2 Post-Closure Land-Use

The mine pit will be partially backfilled during the later stages of operation as waste rock from one section of the pit is placed in other sections where resources have been fully exploited. It is not practical to completely backfill the pit and a void will be left on completion of mining operations.

Due to the potential for acid generation in the pit walls and waste rock within the pit, it is proposed that the pit be flooded to reduce oxygen exposure to the potentially reactive rock.

The mine pit area will not have a post-closure use other than to act as a sump for potentially contaminated contact surface run-off from the site. Some non-contaminated water from the waste dump areas may also be routed to the pit in order to maintain pit lake levels sufficiently high to reduce acid generation in the base of the pit.

5.3.3 Decommissioning and Reclamation

On closure, all equipment will be removed from the Open Pit and any areas with a high risk of ongoing instability will be backfilled and/or re-profiled. Access to the pit will be blocked at the access ramps.

The dewatering system will be decommissioned and the Open Pit will be allowed to fill with inflows from direct rainfall, runoff from pit walls, groundwater inflows, and surface water inflows from the upslope catchment areas which will include potentially contaminated contact water from the waste dumps.

An abandonment bund wall, constructed of NAF mine waste to a minimum height of 2 m, will be constructed around the full pit perimeter outside of the area of potential future instability in order to restrict access to the pit. Warnings signs will also be installed.

5.3.4 Water Management

The pit lake will be managed through a combination of adjusting surface run-off inflows and evaporation areas to ensure acid-generating materials are continuously below the waterline and not subject to oxidation whilst also maintaining the pit lake water levels below the pit rim baseline groundwater level to reduce seepage to local groundwater.

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Surface water discharges from the Open Pit will be prevented in perpetuity unless the water is demonstrated to be consistently of a suitable quality for release.

Pit Lake water quality will be monitored after closure, and any requirements for passive or active water treatment of Pit Lake inflows will be determined according to water use objectives.

5.4 WASTE ROCK DUMPS

5.4.1 General

The waste rock dumps (WRDs) will be constructed during operations to provide structures which are safe and stable whilst also providing landforms that are appropriate for rehabilitation and the final land use. Due to the significant quantities of PAF waste that will be produced from the pit, the dumps will be constructed to encapsulate the PAF waste concurrent with mining and also allow progressive rehabilitation of the dumps.

It is noted that geochemistry evaluations have not yet been fully completed and therefore the concepts presented herewith are based on the available data which suggest a significant potential for acid generation and metals leaching.

5.4.2 Post-Closure Land-Use

Whilst there will be a large area of revegetated land on closure, the elevation of the WRDs compared to the surrounding topography combined with minimal flat areas and low rainfall experienced in the area are unlikely to make the WRDs suitable as agricultural land. Some grazing of livestock may occur but large scale farming is not expected. The current intent is to revegetate the landforms to prevent erosion of the soil and thereby ensure long-term protection of the cover system.

5.4.3 Decommissioning and Reclamation

The waste rock dumps will be constructed as a series of lifts with seven metre wide benches every 12.5 m of height gain. The external walls of the waste dumps will have local slopes of 1V:2.5H and overall angles of 1V:2.9H. Some reprofiling may be required to reduce slope angles to enable effective rehabilitation and for the slopes to be grazed by animals. This will be confirmed during detailed design. The outer walls will be finished with a cover system (described below).

The top of the waste rock dump will be shaped to shed water to drainage channels located on the final top surface that direct flows to drop drains. The benches of the waste rock dump will be graded to direct water also to the drop drains. The drop drains will be lined with heavy fresh benign NAF rock with drain stop boards constructed every five metres down the slope to control the flow speed of the water down the slope. At

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the base of each drop drain an energy dissipater and sediment trap with the capacity to hold runoff from a 1 in 10 year storm of 1 hour duration will be constructed to control flows and contain runoff prior to release to the general site surface water management system.

After all the batter slopes have been covered, they should be seeded/planted with a mixture of local grass seed and the seeds or plants of shrubs and trees local to the area.

The rehabilitation of waste rock dump batters should occur progressively during the mining process, after each berm is established and the outer walls shaped, to enable the success of the rehabilitation techniques to be reviewed and refined. This will allow a fully developed and assured method of revegetation and batter treatment, as well as drainage structures, to be developed and minimise the level of maintenance required after closure works are complete.

5.4.4 Cover System

Cover systems are an integral design component for the successful reclamation and closure of the Project. At the surface of the cover system, direct precipitation will either run off the cover, be removed through evapotranspiration or infiltrate into the active zone. Water that infiltrates is typically stored in the active zone and can exfiltrate to the surface and evaporate. A portion of the water that infiltrates can also percolate into the underlying waste, which is intended to be reduced by the placement of the cover system. The objectives of the cover systems considered for the Project include:

- Physical stabilization to provide dust and erosion control, particularly wind and water erosion of waste materials, and to act as a barrier to prevent direct contact of the waste by flora and fauna
- Chemical stabilization through control of oxygen or water ingress; and contaminant release control through reduced infiltration, and
- Meeting land use objectives and other societal values by providing a growth medium for establishment of sustainable vegetation; and reclaiming the area for post-closure land uses.

A combination of cover system efficiency and saturation conditions can help to reduce oxygen ingress and the subsequent oxidization of waste materials which typically results in ARD production.

The proposed cover system concept aims to maximize use of the climate, cover material characteristics, cover material availability, hydrogeologic setting and waste

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material physical properties to minimize potential effects related to the waste material chemical properties.

In consideration of the anticipated chemistry of the waste rock combined with the varying proximity of the waste materials to watercourses that are used for domestic, drinking, irrigation and livestock watering uses, a low Infiltration cover system (50-90 % reduction of net infiltration) is proposed for the WRDs in order to reduce the risk of acid generation in the waste dumps and the associated release of low-pH leachate to the environment. Release of solubilised heavy metals will also be reduced.

A low permeability layer with a saturated hydraulic conductivity of less than or equal to 1×10^{-8} m/s would be required to construct a cover system capable of reducing net infiltration to approximately 50 to 90% of the infiltration rate expected for a bare surface. Considering the characteristics and availability of materials on site, the cover system would be constructed from a minimum 1 m thick compacted low permeability soil layer, overlain by a 2 m thick gravelly store and release layer, and finished with a re-vegetated subsoil/topsoil layer some 400 mm thick comprising 250 mm of subsoil over which 150 mm of topsoil is place. A typical section through the cover system is provided on Figure 5.2.

Additionally, prior to placement of the cover system, some localised grading may be required to promote positive surface drainage thereby minimizing the likelihood of standing water and saturation of the materials in the cover system. Sloped areas must be protected from surface erosion through re-vegetation and development of drainage structures, to reduce infiltration and to prevent breakthrough of flow into the underlying tailings.

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It is anticipated that the low permeability materials and the store and release layer will be sourced from overburden strip from the mine pit during operations. Alternatively borrow areas may need to be established if insufficient material is available locally and/or mine scheduling isn't compatible with the waste dump construction.

5.4.5 Water Management

A surface water management system will be progressively established concurrent to waste dump development. Major flowpaths are shown on Figure 5.1. Provision is made in the design for separate systems to manage non-contaminated contact water and potentially contaminated contact water. Non-contaminated contact water will be suitable for release into watercourses downstream of the site following basic settling to reduce suspended sediment loads. Potentially contaminated contact water will be directed initially to the mine pit dewatering system and, once the pit is

decommissioned, the water will flow to the pit lake to prevent release of the potentially-contaminated water to the wider environment.

Runoff and drainage water from the waste dumps will be analysed during the closure phase to determine the water quality characteristics. It is anticipated that the surface runoff water quality will be similar to baseline runoff once the surfaces are re-vegetated, while seepage from the waste rock may be of poorer quality. If water treatment is found to be necessary, a suitably designed passive water treatment wetland system will be designed to enable improvement of water quality to be undertaken prior to release into the environment.

5.4.6 Rehabilitation

The construction of the closure cover system will provide a landform suitable for revegetation with native plants. Seeding and planting across the finished surface will provide long-term erosion protection.

5.5 HEAP LEACH PADS

5.5.1 General

The heap leach pads (HLPs) will contain acid-generating material as well as residual acidity from the leaching process. The HLPs must be closed and rehabilitated in such a way that the waste is not exposed to the environment and that infiltration of water is reduced to a level where long-term leachate generation is negligible.

The HLPs should also be reshaped to provide landforms that are stable in the long-term and do not pose a hazard to personnel undertaking rehabilitation or the local population post-closure.

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5.5.2 Post-Closure Land-Use

Whilst there will be a large area of revegetated land on closure, the elevation of the HLPs compared to the surrounding topography combined with the low rainfall experienced in the area are unlikely to make the HLPs suitable as agricultural land. Some grazing of livestock may occur but large scale farming is not expected. The current intent is to revegetate the landforms to prevent erosion of the soil and thereby ensure long-term protection of the cover system.

5.5.3 Decommissioning and Reclamation

Once all viable resource has been recovered from the HLPs, the pads are to be flushed with fresh water to reduce the amount of free acid in the heaps.

The principal aspects of the outline HLP closure are:

- Perimeter slopes to be reshaped to a grade that ensures long-term stability and that is appropriate for machinery to safely operate during the rehabilitation and future maintenance works.
- Surplus material is to be placed as fill between HLP 1 and 2 to infill the valley and create a single large landform for rehabilitation.
- Final top surface to be reshaped to provide positive drainage to the closure surface water management system.
- Placement of an appropriate cover system to reduce infiltration into the HLPs and provide a growing medium suitable for rehabilitation.
- Revegetation of the closure surface.

The reshaping and filling exercise is illustrated on Figure 5.3.

5.5.4 Cover System

In consideration of the anticipated chemistry of the HLP material on closure, combined with the varying proximity of the waste materials to watercourses that are used for domestic, drinking, irrigation and livestock watering uses very low infiltration cover systems (>90 % reduction of net infiltration) are proposed for the HLPs. Reducing infiltration into the heaps will reduce further acid generation and quantities of leachate produced.

A very low permeability layer with a saturated hydraulic conductivity of less than or equal to 1×10^{-9} m/s would be required to construct a cover system capable of reducing net infiltration to greater than 90% of the infiltration rate to be expected for a bare waste rock surface.

The main elements of the cover will be:

- Low permeability soil (1 m thick) or synthetic liner to prevent ingress of water;
- Protective fill layer (0.6 to 1.5 m thick depending on liner system adopted) which may also act as ‘store and release’ capping;
- Topsoil to allow revegetation (approximately 400 mm).

The cover options are illustrated in Figure 5.2. Studies into the most appropriate cover system shall be undertaken during the operational phase of the mine. Considerations in the studies will include availability of suitable fill materials.

5.5.5 Water Management

The HLPs should be reshaped to positively drain all run-off to perimeter channels that convey the non-contaminated contact water to the site surface water management system with subsequent release in to watercourses downstream of the site.

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Any leachate generated from the heaps will be routed into a closed (potentially-contaminated contact water) system for treatment prior to release. During initial drawdown, the leachate will be passed through the process plant to ensure that the water quality is suitable for discharge. Once the drawdown phase is complete and leachate quantity and quality have reduced to manageable levels, leachate will be passed through passive treatment systems to render the water suitable for release.

The passive treatment systems will be developed during operations when leachate chemistry is better understood. Possible options, which may be combined, include sediment control, wetlands, or limestone-filled 'polishing' channels.

5.5.6 Rehabilitation

The construction of the closure cover system will provide a landform suitable for revegetation with grasses and small native plants. Seeding and planting across the finished surface will provide long-term erosion protection.

5.6 PLANT, EQUIPMENT AND INFRASTRUCTURE

5.6.1 General

All plant, equipment and infrastructure on the site shall be recovered, removed and re-used wherever possible. The primary objective is to ensure the site is safe and does not generate hazards for the community.

As a general rule, where facilities are of no use to the community:

- All structures shall be removed;
- All waste shall be buried at least three metres below a finished surface;
- Concrete should be broken up and buried;
- All batters should be flattened to at least a 1V:4H slope for public safety;
- All areas should be ripped, scarified, topsoiled and then seeded to encourage a vegetated cover, unless otherwise agreed with the local community.

5.6.2 Post-Closure Land-Use

Buildings on the site should be made available to the local community, if they have no value and cannot be economically removed and re-used elsewhere. Such opportunities can assist communities to adjust the socio-economic effects of closure and allow the development of new enterprises and provision of alternative local employment.

Where practicable, areas that are rehabilitated will be returned to the pre-mine land use. Discussions may be held with regulatory agencies and stakeholders to determine

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the potential to create small water storage structures to improve water availability for post-closure land use in agriculture and livestock rearing.

The future of any water supply bores associated with the project should be discussed with local authorities and the community. The presence of a water supply may provide much needed infrastructure to the community as well as providing commercial and industrial opportunities which are not currently available, due to the cost of establishing such facilities. Transfer of these assets to the community may also offset some of the socio-economic losses that arise due to closure of the mine.

5.6.3 Decommissioning and Reclamation

All process tanks, pipes and water lines should be flushed free of any solids or residual fluids prior to removal. Materials that constituted these facilities should be recovered for reuse or recycling or otherwise buried at least three (3) metres deep within the site. Opportunities for burial may arise in some of the process water ponds to be closed.

All fixed and mobile equipment with marketable value will be removed from site and sold. Equipment that cannot be sold or is deemed to be hazardous will be disposed of in an appropriate manner.

Fuels and lubricants will be required during the closure phase. Additional fuels will only be provided on an as-needed basis to reduce the materials remaining on site. Fuels remaining at the end of the active closure phase will be returned to the original supplier or possibly sold to a third party user. Fuel storage tanks and associated pipework should be recovered for reuse or recycling or otherwise be disposed of as hazardous waste.

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Unused explosives and detonation devices stored on site will be checked for condition and either returned to the supplier for credit, shipped to another third party user, or destroyed through appropriate procedures. In all cases the explosives will be handled, transported and disposed of in compliance with the appropriate legislation. The explosives magazines will be returned to the supplier or to a third party.

During the initial closure stage, power generation requirements will be reduced and only those generators required for on-going activities will remain operational. Excess generators will be removed from the power plant and poles and distribution lines will be salvaged or buried in a landfill. At the end of the closure phase when the mine no longer has any power requirements, the remaining generators will be removed from the site and the remaining poles distribution lines will be salvaged or buried in the landfill.

Roads required for access during the rehabilitation phase and for post-closure monitoring and maintenance will be left in place. After these roads are no longer

required for Project use, they will be left in place for use by local communities. Site roads not needed for the closure works will be broken up, resoiled and re-vegetated unless the local communities would prefer that the roads are left in place.

Where buildings and structures are to be removed, they should be demolished with reusable or recyclable waste removed from site. Rubble and other inert waste can be buried in designated locations at least three (3) metres below final ground surface. Any contaminated soils will be treated and disposed of appropriately. Hazardous waste is to be disposed of in an on-site hazardous waste facility.

Reuse of items, such as HDPE pipe, should be considered as part of the closure plan. HDPE pipe, for example, can be used as fence posts for barricading areas with public safety issues or used as posts for fencing associated with local cropping and grazing activities.

5.6.4 Water Management

Following demolition, the disturbed areas will be shaped to prevent ponding of water and to provide positive drainage into the site surface water management system.

5.6.5 Waste Management

Reusable or recyclable waste should be removed from site. Non-hazardous waste can be buried in designated disposal areas with a minimum of three metres of cover. Any hazardous waste should be encapsulated in a purpose-built facility within the site boundary for permanent storage.

5.6.6 Rehabilitation

Disturbed areas will be reshaped for drainage, topsoil applied and will then be re-vegetated using grass and shrub species native to the region to encourage vegetation to re-establish in the area.

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5.7 PROCESS AND WASTE WATER PONDS

5.7.1 General

There are a number of ponds located to the east and south east of the site. These include HLP stormwater ponds, process water ponds and surface water stormwater ponds. It is proposed that these ponds be used on closure for treatment of run-off and storage of wastes.

5.7.2 Post-Closure Land-Use

Uses of the former ponds include:

- Settling ponds for uncontaminated surface run-off water to reduce sediment loads prior to discharge off site.

- Wetlands and/or polishing ponds for the passive treatment of water with low levels of contamination prior to discharge.
- HDPE-lined ponds to be utilised for the construction of a hazardous waste landfill to store decommission wastes.

Any pond areas not required for the above uses should be infilled and returned to agricultural use.

5.7.3 Decommissioning and Reclamation

Process and waste water ponds shall be completely drained until only residual solids/sludge are present.

Once drained, any residual sludge is to be sampled and tested. Sludges which are considered 'hazardous' should be disposed of in the site hazardous waste landfill. Inert or non-hazardous wastes will either be disposed of in an appropriate storage area or, if physical and chemical characteristics are suitable, be used as fill in the reclamation process.

The pond base will then be prepared according to the final end use. Any HDPE liner, or similar, where not required will be removed and disposed of. Clay liners for ponds will be retained unless the area is to be used for agriculture in which case the liner will be ripped prior to backfilling to promote through drainage.

Where ponds are to be retained as ponds or wetlands, hydraulic control structures will be built to control flows in and out as well as retained water levels.

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5.7.4 Water Management

The former pond areas will be used to manage run-off water from the site with collection channels routed to the pond areas. Hydraulic control structures will be constructed as necessary to maintain or prevent ponding of water.

5.7.5 Waste Management

Non-hazardous waste can be buried in designated disposal areas with a minimum of three metres of cover. Any hazardous waste should be encapsulated in a purpose-built facility within the site boundary for permanent storage.

5.7.6 Rehabilitation

Disturbed areas will be reshaped where necessary for drainage, topsoil applied and will then be re-vegetated. Wetland areas will either be re-vegetated with reed beds or, if water chemistry is acceptable, be provided to the local community as rice paddies. Areas designated for agriculture should be handed over to the local community to vegetate.

5.8 SURFACE WATER MANAGEMENT

5.8.1 Routing

At closure, contaminated mine contact water will continue to be allowed to drain to the open pit, and non-contaminated water will be directed to the surrounding natural aquatic environment. Diversion and collection ditches that are no longer required will be decommissioned (backfilled) and re-vegetated. In general, collection ponds accepting non-contact water will be reclaimed through re-vegetation and allowed to collect and store water for use by the local communities. Collection ponds accepting mine contact water will not be decommissioned directly after closure, and will continue to function to direct mine-contact water into the Pit.

The operational surface water management system will be adjusted to convey flows generated by the closure land forms and land uses.

It is envisaged that the majority of run-off generated post closure will be uncontaminated and will only require settlement to reduce suspended loads prior to discharge. It is the intention that as much water as possible is returned to the surrounding environment. However there is provision in the design to direct some of the run-off water to the open pit. A pit lake will need to be maintained to reduce acid generation in the pit walls and buried waste. If the detailed hydrogeological modelling, and/or experience on site, shows that recharge of the pit lake is insufficient to maintain appropriate water levels then run-off from Waste Rock Dump 1 can be directed to the pit.

An outline design for surface water routing is provided on Figure 5.1.

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5.8.2 Chemistry

It is envisaged that during initial stages of HLP drawdown, a substantial volume of contaminated leachate will still be produced by the heaps. The process plant, potentially with adaptions, will be used to treat this water until concentrations reach a level where other, less onerous, treatment options can be successfully adopted.

Runoff collected in the collection ponds will be analysed in the closure phase to determine if water quality characteristics meet applicable standards. It is anticipated that the surface runoff water quality will be similar to baseline runoff once the surfaces are re-vegetated. When water quality meets acceptable standards, the mine contact collection ponds will be backfilled and re-vegetated.

Where surface run-off and/or leachate from areas such as the waste rock dumps and heap leach pads is not suitable for release then treatment systems should be implemented.

The first level of treatment is sedimentation through sedimentation ponds or wetland areas to reduce the suspended load. In many cases this is likely to be sufficient to improve the water to meet the relevant release criteria.

Water treatment methods used to eliminate or reduce acidity and heavy metals precipitation from impacted waters can be grouped into two types: (1) active and (2) passive treatment:

Active treatment involves neutralising acid-polluted waters with alkaline chemicals. However, the chemicals can be expensive and the treatment facility is expensive to construct and operate.

Passive treatment involves the construction of a treatment system that employs naturally occurring chemical and biological reactions that aid acid rock drainage treatment and which require little maintenance. Passive control measures include anoxic drains, limestone rock channels, alkaline recharges of groundwater, and the diversion of drainage through man-made wetlands or other settling structures.

There is also a possibility to combine active and passive treatment techniques (e.g. liming and constructed wetlands)

An evaluation of water chemistry, potential environmental impacts, and whether or not water treatment will be required will be undertaken as part of the ongoing closure planning during the mine life. If necessary the design will be updated to include additional water treatment.

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5.9 WASTE MANAGEMENT

5.9.1 Waste Streams

Some materials arising from clearance of the site will have a commercial use and value. These may include generators, pumps and pre-fabricated buildings. Where possible these will be removed from site and either sold or reused elsewhere. Any materials which cannot be handled in this manner are considered wastes for the purposes of this closure plan.

Waste generated by the decommissioning and rehabilitation of the site will be one of three different categories of waste:

Inert Waste. This is waste which is neither chemically or biologically reactive and will not decompose. It includes concrete, bricks and uncontaminated sediment/sludge from stormwater ponds.

Non-Hazardous Waste. This is waste which is not inert but does not have properties that pose a substantial threat to public health or the environment (and therefore

classifies as hazardous waste). Types of waste will include plastic liner, plastic pipes, metals, and timber.

Hazardous Waste. This is waste that poses substantial or potential threats to public health or the environment by exhibiting one or four of the following properties:

i. Ignitability
ii. Reactivity
iii. Corrosivity
iv. Toxicity

Hazardous wastes are likely to include fuels, oils, contaminated soils and sludges, and components of equipment and machinery.

5.9.2 Hierarchy of Waste Management

Waste generated from the decommissioning activities will be managed to reduce the environmental impact. MWMCL will seek to treat the wastes in the following order of priorities:

i. Reuse
ii. Recycle
iii. Dispose

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If it is possible to reuse a waste either on site or for a different application in the local community then this should be adopted. Possible options include using old plastic pipework for fencing or corrugated metal sheeting as roofing on community buildings.

Where the wastes cannot be reused, attempts will be made to recycle those materials through off-site merchants and processing facilities. Types of waste that could be recycled include crushed concrete which can be used as aggregate and steelwork that can be sold as scrap metal.

If the waste cannot be reused or recycled then it should be disposed of in an appropriately-constructed landfill facility. It is intended that landfills will be constructed on the site so that wastes are contained within the site boundary. Disposal options are discussed in more detail below.

5.9.3 Disposal Options

Two landfill facilities will be constructed to handle decommissioning wastes. An inert and non-hazardous facility will be constructed on the western side of Waste Rock Dump No. 3. The facility will be constructed in cells to separate different types of waste

and also to reduce the exposed tip head to a manageable size. The waste will be regularly covered with a soil cover to reduce dust generation. On completion the whole landfill will be capped with a 1 m thick low permeability soil cover, 2 m of store and release fill and finished with topsoil. The cover will be shaped to shed water.

The HDPE-lined base of the HLP stormwater pond will form the basis of the hazardous waste landfill. After draining and de-sludging, the HDPE liner will be inspected and repaired if necessary. Intermediate bund walls will be constructed to provide cells for different waste types, a leachate collection system will be installed and a second HDPE liner placed to provide double containment of the wastes.

As waste is placed, daily cover will be applied to reduce dust and minimise the risk of release of hazardous material to the environment. The landfill cover will comprise a very low permeability (HDPE or similar) cover to reduce infiltration and associated soil and topsoil cover. The landfill area will be revegetated with grass, fenced to restrict access and signage erected to warn the local population of the hazard.

Monitoring of the landfills will form part of the overall site monitoring programme with maintenance undertaken as necessary. It is envisaged that satisfactory closure and handover of the landfills will be one of the closure criteria adopted.

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6. SOCIO-ECONOMIC INITIATIVES AT CLOSURE

The Mine Closure Management Plan will set out:

- Initiatives with local communities;
- Broader economic initiatives; and
- Plans to maximise local and regional opportunities at closure.

These initiatives will be developed during the mine life in consultation with the relevant stakeholders and local communities.

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7. CLOSURE SCHEDULE

A detailed Closure Schedule will be developed during the mine life to manage the various stages of decommissioning and rehabilitation. The following summary schedule highlights the key areas of work anticipated:

Period	Activity
Yr 1 to 20	Stage 1 Mining Ongoing recovery of topsoil and rehabilitation materials from the disturbed footprint with construction and progressive rehabilitation of WRDs 1 to 3. Heap Leach Pads 1 and 2 in operation.
Yr 21 to 30	Stage 2 Mining Completion of WRD rehabilitation (Yr 23). Mine waste deposited in-pit. HLP 3 in operation.
Yr 31 to 35	Decommissioning and Rehabilitation Decommissioning of pit and ore recovery/processing infrastructure. Flushing of HLPs, installation of cover system and rehabilitation. Removal of copper recovery plant and conversion of waste water ponds to closure land-use.
Yr 36 to 40	Monitoring and Maintenance Ongoing performance monitoring of the site. Relinquishment of lease when closure criteria are achieved.

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8. PROGRESSIVE CLOSURE AND REHABILITATION

Progressive restoration/revegetation during operation has the following advantages:

- Costs are spread over a longer period and may be recovered from mining revenues.
- Closure activities can be integrated into the daily operational activities of the mine.
- A shorter closure implementation period will result.
- Monitoring programmes are integrated into routine environmental management
- Techniques can be trialled and refined in localised areas with successful techniques can be incorporated into the final closure plan.
- Potential for better rehabilitation outcomes through the use of recently disturbed topsoil.
- Adverse environmental effects such as dust generation and contamination are minimised.
- The amount of time required for monitoring and maintenance post mine life is reduced.

The closure plan will be developed to enable progressive rehabilitation during the mine life. The principal focus will be rehabilitation of the waste rock dumps as capping and revegetation can be implemented throughout the WRD development. Because of in-pit disposal in Stage 2 of the mining plan, no further waste is to be placed in the dumps after about Year 20 allowing ample time to fully close the dumps during the operational period of the open pit.

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9. CARE AND MAINTENANCE PLAN

Whilst design of the closure landforms will seek to reduce care and maintenance requirements, there will be ongoing aftercare liabilities for a number of years. A care and maintenance plan will be developed as part of the Closure Plan to ensure that closure objectives are achieved and so that efficient and relatively rapid rehabilitation can take place.

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10. POST-CLOSURE MONITORING

As the Closure Plan is developed during the mine life, a set of completion criteria for rehabilitation, which are consistent with overall site closure objectives, will be determined and agreed with the regulator and relevant stakeholders. Through long-term monitoring of the site, it will be demonstrated that the development of rehabilitated areas is consistent with completion criteria.

The Monitoring Plan will include as a minimum:

- Physical stability monitoring:
  - Open pit and subsidence area;
  - Mine site and disturbed areas;
  - Waste rock dumps;
  - Heap leach pad;
  - Site security features.
- Chemical stability:
  - Open pit and subsidence area;
  - Mine site and disturbed areas;
  - Waste rock dumps; and
  - Heap leach pad.
- Water Quality:
  - Pit lake
  - Surface run-off
  - Leachate generation.
- Environmental impacts and anticipated mitigation, management measures and associated monitoring;
- Expected maintenance requirements;
- Monitoring of community initiatives;
- Monitoring of community health and safety;
- Monitoring of socio-economic activities; and
- Land resettlement, use and management.

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11. PROVISIONS FOR EARLY OR TEMPORARY CLOSURE

Mining operations may be forced to close prematurely (referred to as *early* closure) or on care and maintenance (referred to as *temporary* closure).

In the event of *early* closure, the closure process should be accelerated. Immediate review of the pre-existing Mine Closure Plan to include a detailed Decommissioning Plan would be undertaken.

If a *temporary* closure is imminent, a detailed Care and Maintenance Plan would be prepared and implemented, based on the pre-existing Mine Closure Plan. The Care and Maintenance Plan would demonstrate that on-going environmental obligations will be met during the period of temporary closure.

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12. RISKS AND OPPORTUNITIES

12.1 RISKS

In preparing this concept closure plan a number of risks were identified. As the closure plan is developed over the mine life these risks will be mitigated where possible. Potential risks at the current time include:

i. Insufficient topsoil and subsoil recovered from disturbed areas, and stored appropriately, for adequate rehabilitation of the disturbed areas.

ii. Insufficient low permeability soil sources on site for WRD liner system.

iii. Insufficient NAF waste and/or borrow sources within the site area for adequate cover depth to WRDs and HLPs.

iv. Restricted footprints for WRDs and HLPs resulting in steep slopes that are difficult and expensive to cover and revegetate.

v. Lack of agreement of closure objectives and end land-use between the operator, regulatory authorities and other relevant stakeholders.

vi. Difficult to manage acid and metals generation from WRDs and HLPs and thereby ensure protection of the downstream environment.

vii. Ongoing liabilities for MWMCL in regards to treatment of run-off prior to discharge if chemical concentrations in surface water remain higher than release criteria.

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12.2 OPPORTUNITIES

With the development of the closure plan during the mine life, operational designs can be adapted to reduce the work required to close the site thereby saving time and cost on closure. Potential opportunities to be explored include:

i. Optimising HLP design, potentially through use of the valleys between the heaps, to reduce footprint, increase leaching efficient and adopt closure batter angles for operational purposes.

ii. Optimise HLP stacking and leaching to exhaust cells and allow progressive rehabilitation rather than operating all the HLPs simultaneously until closure.

iii. Optimise WRD design to adopt closure batter angles for operational purposes and reduce the volume of earthworks needed to achieve the necessary profiles on closure.

13. CLOSURE COSTS AND FUNDING PROVISION

13.1 GENERAL

Closure costs will be accounted for in line with the corporate accounting practices. Letpadaung will estimate mine closure costs throughout the operational life of the Project and will accrue mine closure cost provisions on an annual basis. This will ensure that the accrued closure provision meets the costs of a planned closure event, whether permanent or otherwise, at such time as it occurs. In the event of temporary and/or unplanned mine closure, Letpadaung will develop and agree with the applicable Myanmar regulatory authorities a care and maintenance regime, the costs for which would be covered by Letpadaung's own cash reserves and cash flows.

The closure cost estimate, as reported in the Project financial statements, will be updated annually during the operational life to reflect known developments, including scope changes, the effect of a further year's inflation, exchange rate differentials and new regulatory requirements. Closure cost estimation procedures will ensure that identified post-closure costs, whether ongoing or one-off, are realistically estimated and incorporated into the estimate.

Progressive rehabilitation will be built into operations plans and budgets and will also be subject to annual planning, budgeting and permitting.

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13.2 COST PROVISIONS FOR FINAL MINE CLOSURE

Letpadaung's approach to the estimation and management of costs related to the final closure of the Letpadaung copper mine at the end of the operational mine life comprises the following:

- A provision for mine closure costs on Letpadaung's balance sheet to be determined in accordance with International Financial Reporting Standards including appropriate actuarial assumptions;
- A Letpadaung commitment to review, monitor and update mine closure plans and costs on a yearly basis (Annual Mine Closure Assessment¨). The Annual Mine Closure Assessment will provide (i) an ongoing estimated date of closure (Mine Closure Date) (ii) an update of the estimated cost of mine closure (Mine Closure Cost¨) and (iii) as presented further below an assessment of the date by which Letpadaung will start setting aside cash contributions against the Mine Closure Cost (Closure Contribution Date);
  - The Closure Contribution Date will be the earlier of (i) 7 years before the Mine Closure Date and (ii) the date on which Letpadaung forecasts

aggregate post finance cash flows from such date to the Mine Closure Date falls below twice the Mine Closure Costs; and

- From the Closure Contribution Date, Letpadaung will commit to making cash contributions in priority to shareholder dividend payments ensuring that a dedicated mine closure reserve account is funded by the Mine Closure Date in an amount equal to the Mine Closure Cost by making equal annual cash contributions (the determination of which will take account of interest on the funds in the mine closure reserve account). To the extent that cash flow in any year is insufficient to meet the required annual contribution, any shortfall shall be made up in the following year. The cash contribution shall also be adjusted to reflect any change to the Mine Closure Cost.

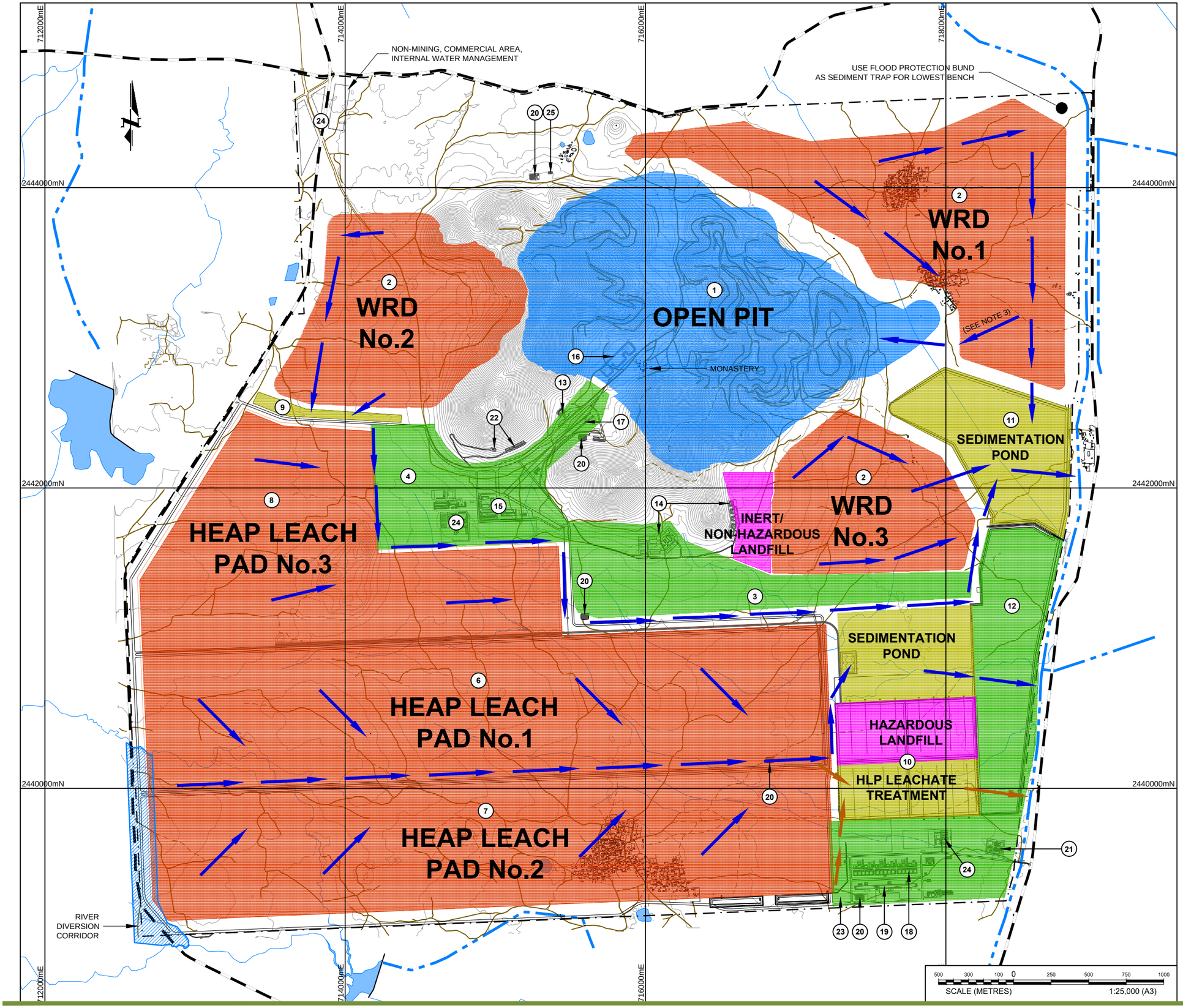
13.3 TEMPORARY/ UNPLANNED MINE CLOSURE

Letpadaung will give a commitment to comply with an agreed care and maintenance regime if there is an unplanned closure of the mine at any time. From a financial perspective, it is expected that there will be sufficient cash within Letpadaung (e.g. from cash balances and payments received on sales made before closure) not only to cover care and maintenance obligations but also, together with proceeds from the sale of Letpadaung's realisable assets, to meet any closure costs. Letpadaung will ensure that any spending on care and maintenance and closure costs is prioritised, ahead of other costs, in the event of an unplanned closure.

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FIGURES

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LEGEND:

- EXISTING CANAL
- EXISTING MAIN ROAD (SEALED)
- EXISTING ROAD/TRACK (UNSEALED)
- LEASE BOUNDARY
- RIVER DIVERSION CORRIDOR
- CLOSURE SURFACE WATER FLOWS
- CLOSURE HLP LEACHATE POLISHING

LAND USE LEGEND:

- PIT AND PIT LAKE
- SCRUB/GRAZING
- LANDFILL (FENCED OFF GRASS COVER)
- PONDS (INITIALLY - MAY BECOME AGRICULTURAL USE OVER TIME)
- AGRICULTURAL USE

NOTES:

1. ALL COORDINATES SHOWN IN UTM (WGS84) ZONE 46.
2. 5m CONTOUR INTERVALS SHOWN.
3. IF REQUIRED TO MAINTAIN OPEN PIT LAKE LEVELS, SURFACE WATER RUN-OFF FROM WRD No.1 TO BE DIRECTED INTO THE PIT.

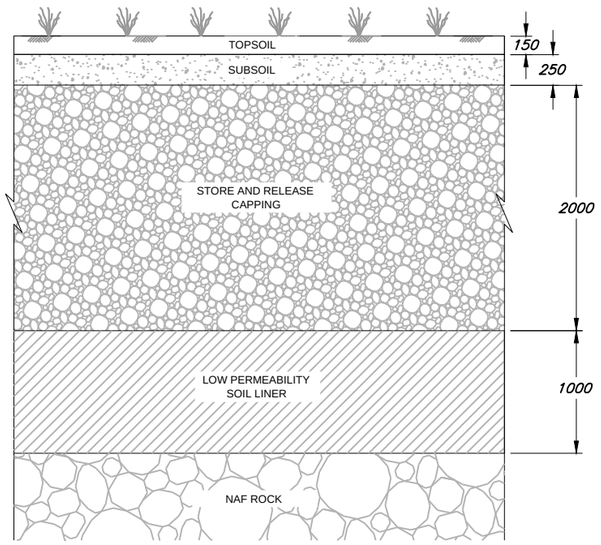
KEY:

1. PIT
2. WASTE DUMP
3. TOPSOIL STOCKPILE
4. LOW GRADE ORE STOCKPILE
5. RESERVE ORE STOCKPILE
6. HEAP LEACH PAD No.1
7. HEAP LEACH PAD No.2
8. HEAP LEACH PAD No.3
9. WASTE WATER COLLECTION POND - CLAY
10. HEAP LEACH STORM WATER POND - HDPE
11. WASTE WATER RESERVOIR (NORTH) - CLAY
12. WASTE WATER RESERVOIR (SOUTH) - CLAY
13. FUEL STATION
14. EXPLOSIVES AREA
15. OFFICES/ WAREHOUSES/ MAINTENANCE AREA
16. MOBILE CRUSHER FOR QUARRY
17. CONVEYOR FOUNDATIONS
18. EXTRACTION PLANT
19. ELECTROWINNING PLANT
20. 33Kv SUBSTATION
21. 230kV SUBSTATION
22. WATER PURIFICATION AREA
23. ACID STORAGE AREA
24. STAFF ACCOMMODATION
25. 2Mw DIESEL POWER STATION

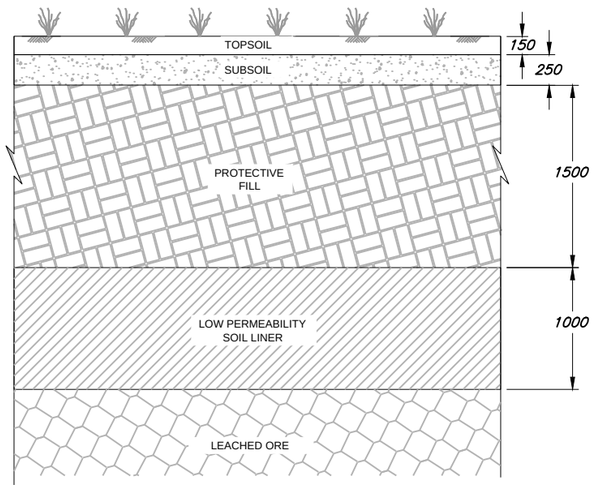
Knight Piésold CONSULTING

LETPADUANG PROJECT
CONCEPT CLOSURE PLAN
LAND-USE AND SURFACE WATER MANAGEMENT

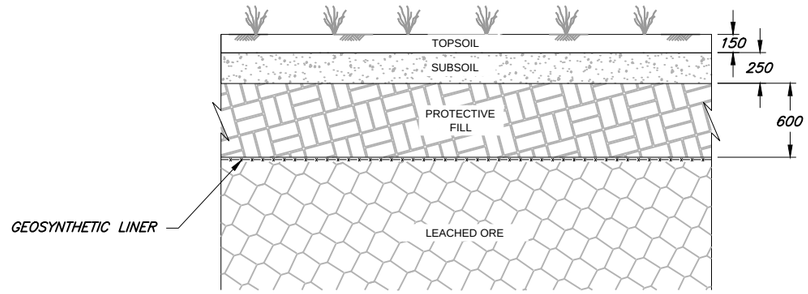
Ref: PE701-00022/20
Figure 5.1



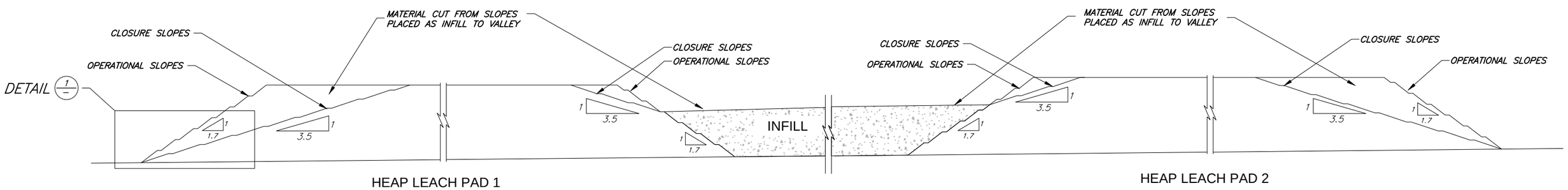
WASTE ROCK DUMPS



HEAP LEACH PADS
(LOW PERMEABILITY SOIL LINER)

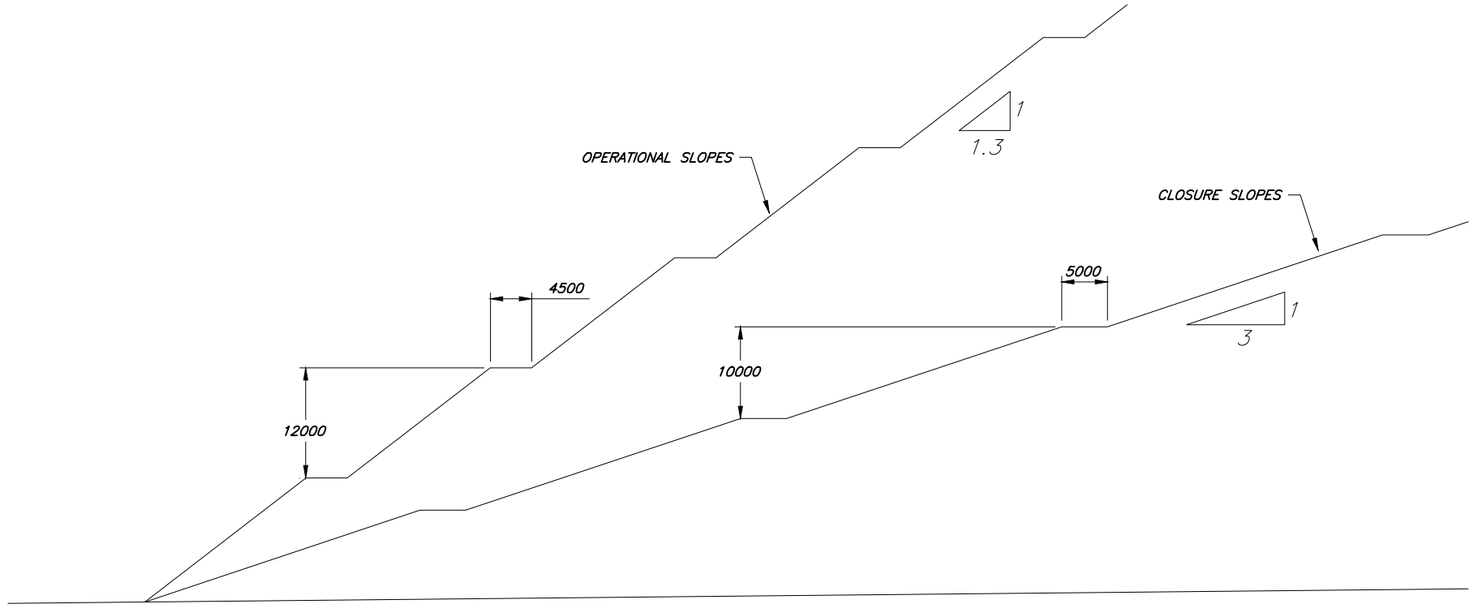


HEAPS LEACH PADS
(GEOSYNTHETIC LINER)



HEAP LEACH PAD 1

HEAP LEACH PAD 2



DETAIL 1 BATTER PROFILE
SCALE N.T.S.

APPENDIX K

Air Quality, Noise and Vibration Modeling

Knight Piésold CONSULTING

MYANMAR WANBAO COPPER MINING LIMITED
LETPADAUNG PROJECT





AIR QUALITY, NOISE AND VIBRATION MODELING LETPADAUNG PROJECT

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LETPADAUNG COPPER PROJECT

AIR QUALITY, NOISE AND VIBRATION MODELING

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KP Job No. LI201-00239/05

CONTRACT

PROPOSAL APPROVED PEL-0225-2013

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Maximun 24 hour mean concentrations for PM_{10} impacts during dry-cold, dry-hot and wet seasons

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1. INTRODUCTION

The Letpadaung Copper Project is located at Letpadaung in the Sagaing Division and is part of a larger project known as the Monywa Copper Project, which is developing the Sabetaung & Kyisintaung (S&K) deposits within the Monywa Copper Geological Complex. Myanmar Wanbao Mining Copper Limited (MWMCL), which will be responsible for the complete development of the Letpadaung deposit, has adopted the Environmental and Social assessments reviewed by AATA International Inc. in 1996.

As part of the Environmental Impact Assessment (EIA) of the Letpadaung Project, particulate matter dispersion as well as noise and vibration propagation have been modelled, which has allowed quantifying impacts caused by the project within the environmental baseline area. This area has been delimited in coordination with Knight Piésold Pty. Ltd and comprises the sites of the noise, vibration and air quality sampling stations.

The input information used for estimating particulate matter, noise and vibration emissions, and specific for this project was provided by the company Myanmar Wanbao Mining Copper Limited in coordination with Knight Piésold Pty. Ltd (Knight Piésold Australia). In terms of methodology, the computer programs used for modelling air quality dispersion (particulate matter) as well as noise and vibration propagation were AERMOD View, version 8.2, and SoundPLAN, version 7.2; which allowed a quantification of impacts produced by project activities during the construction and operation phases.

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2. OBJECTIVES

The specific objectives of this study are presented below:

- To prepare an inventory of particulate matter, noise and vibration emissions produced by the project's construction and operation phases.
- To quantify impacts on air quality caused by the project's construction and operation phases; this is to be achieved by modelling particulate matter dispersion (PM_{10}).
- To quantify impacts on noise and vibration quality induced by activities to be executed during the project's construction and operation phases; this is to be accomplished by modelling noise and vibrations.

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3. LETPADAUNG PROJECT DESCRIPTION

The Letpadaung Project is located 5.3 km from the city of Monywa, on the western bank of the Chindwin River and south of the Yama Stream, a Chindwin tributary. The company Myanmar Wanbao Mining Copper Limited (MWMCL) is responsible for developing the project. This project is part of the Monywa Copper Project, which is developing the Sabetaung and Kyisintaung copper deposits, located 6 km northwest from the Letpadaung deposit.

The project's construction phase will include the execution of all activities required for the operation, as well as the construction and operation of complementary facilities. Construction activities will take place during the day; these activities consist of earthworks, land grading, facility construction, facility assembly, drilling and blasting, excavations, materials transportation, consumables transportation, and road improvement.

The project's operation phase is the one during which copper ore exploitation, processing and dressing take place. Figure 1 shows the location of the project and the facilities considered during year 5 of the mining plan, which include the execution of an open pit, waste rock dumps, crushing facilities, pump station, conveyor belt, and heap leach piles. During this phase, typical operation activities and improvements are considered, which will ensure their normal execution through implementation of mitigation measures for dust and noise control, in order to comply with MWMCL's environmental standards. According to information provided by the company Knight Piésold Pty. Ltd in coordination with MWMCL, Table 1 presents the project-related production of copper ore concentrate and waste rock throughout the first 10 years.

Table 1: Letpadaung Project Mining Plan

Mining plan	Material handling (1)		
	Ore	Waste rock	Total
Year 1	27,600	41,400	69,000
Year 2	27,000	42,000	69,000
Year 3	28,000	41,000	69,000
Year 4	33,000	36,000	69,000
Year 5	30,000	39,000	69,000
Year 6	32,000	37,000	69,000
Year 7	30,000	39,000	69,000
Year 8	30,100	39,200	69,300
Year 9	30,700	38,700	69,400
Year 10	30,200	38,800	69,000

Source: MWMCL
Note :(1) Units in kt (kiloton)

4. METHODOLOGY

4.1 NOISE AND AIR QUALITY BACKGROUND

This section provides a brief summary of results obtained through air and noise quality samplings, which were executed as part of the Environmental Baseline section of the Letpadaung Copper Project's Environmental and Social Impact Assessment (ESIA), performed by the company Knight Piésold Pty.

4.1.1 Air Quality Baseline

In order to characterize environmental baseline conditions for Letpadaung Project's EIA, 8 air quality stations were sampled during the dry and wet season of 2013. The samplings comprised measurements of particulate matter (PM_{10} and $PM_{2.5}$) and gases (SO_2, NO_2 and CO), which were determined with an Environmental Perimeter Air Monitoring Station (EPAS – Haz-Scanner) equipment.

Based on results shown in Table 2, it was determined that background concentrations for PM_{10} vary between 7.1 and 20 µg/m^3, depending on each air quality station's location.

The measurement lasted 24 hours; this period presents continuous hourly records measured at a height of 3 m above ground level, a height that was chosen in order to obtain values that represent the human exposure level. Figure 1 shows the location of air quality sampling stations.

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Table 2: Summary of pollutant concentration - Air quality baseline

Pollutant (µg/m^3)		Season (2013)	Sampling period	Points of air quality sampling								AQS according to WHO (µg/m^3)			
				Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	IT-1	IT-2	IT-3	AQG
Particulate matter	Small particles less than 10 micrometers - PM_{10}	Dry	24 hour average	14.3	12.7	11.4	17.6	22.3	9.5	19.2	10.4	150	100	75	50
		Wet	24 hour average	8.3	2.7	4.2	11.0	17.7	4.7	10.8	4.4	150	100	75	50
		Average	**24 hour average**	**11.3**	**7.7**	**7.8**	**14.3**	**20.0**	**7.1**	**15.0**	**7.4**	150	100	75	50
	Fine particles less than 2,5 micrometers - $PM_{2,5}$	Dry	24 hour average	11.0	8.5	8.2	11.1	14.2	8.5	11.3	7.8	75	50	37,5	25
		Wet	24 hour average	6.0	1.7	2.4	5.6	8.8	2.6	5.2	2.6	75	50	37,5	25
		Average	**24 hour average**	**8.5**	**5.1**	**5.3**	**8.4**	**11.5**	**5.5**	**8.3**	**5.2**	75	50	37,5	25
	Inhalable coarse particles - $PM_{10\text{-}2.5}$	Dry	24 hour average	3.3	4.15	3.2	6.5	8.1	1	7.9	2.6	-	-	-	-
		Wet	24 hour average	2.3	1.0	1.8	5.3	8.9	2.1	5.6	1.8	-	-	-	-
		Average	**24 hour average**	**2.8**	**2.6**	**2.5**	**5.9**	**8.5**	**1.6**	**6.8**	**2.2**	-	-	-	-
Gases	Carbone monoxide - CO	Dry	Maximum 8 hour mean	0.3	0.3	0.4	0.4	0.5	0.4	0.4	0.4	-	-	-	10 000
		Wet	Maximum 8 hour mean	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	10 000
		Average	**Maximum 8 hour mean**	**0.3**	**0.3**	**0.4**	**0.4**	**0.5**	**0.4**	**0.4**	**0.4**	-	-	-	10 000
	Nitrogen dioxide - NO_2	Dry	1 hour average	28.1	25.2	32.7	28.7	23.1	20.7	9.7	14.6	-	-	-	200
		Wet	1 hour average	26.0	24.1	34.8	29.3	22.0	19.7	9.5	13.2	-	-	-	200
		Average	**1 hour average**	**27.1**	**24.7**	**33.7**	**29.0**	**22.6**	**20.2**	**9.6**	**13.9**	-	-	-	200
	Sulphur dioxide - SO_2	Dry	24 hour average	2.6	2.3	2.5	2.4	3.0	2.5	2.5	2.5	125	50	-	20
		Wet	24 hour average	2.5	2.4	2.5	2.4	2.5	2.5	2.5	2.5	125	50	-	20
		Average	**24 hour average**	**2.6**	**2.4**	**2.5**	**2.4**	**2.8**	**2.5**	**2.5**	**2.5**	125	50	-	20

Elaborated by Knight Piésold.

Source: MWMCL

Notes:

"AQS": Air Quality Standards.

"WHO": World Health Organization.

"AQG": Air Quality Guideline.

"IT": Interim Target. According to Vahlsing, C., & Smith, K. R. (2011) developing countries, with higher levels of air pollution, could select an interim target level achievable based on their own air quality management infrastructure, and progress towards the AQG value.

Pollutant concentrations greater than Air quality Standards:

IT-1

IT-2

IT-3

AQG

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According to information provided by the company Knight Piésold Pty. Ltd, results obtained during measurements at the 8 air quality stations (Table 2) present particulate matter (PM_{10} and $PM_{2.5}$) and gas (CO, NO_2 and SO_2) concentrations that do not exceed air quality standards established by World Health Organization (WHO). Furthermore, measurement results for meteorological parameters were also obtained during air quality samplings, which are shown in Table 3.

Table 3: Meteorological conditions during air quality sampling

Parameters	Season (2013)	
	Dry	Wet
Temperature	31ºC	26ºC
Relative humidity	56%	86%
Wind speed	10 km/hr	10 km/hr
Wind direction	104º (ESE)	106º (ESE)

Source: MWMCL

4.1.2 Noise Quality Baseline

For the purpose of characterizing the environmental baseline conditions of the Letpadaung Project's EIA, 10 noise stations were sampled during the dry and wet seasons of 2013, whose locations are shown in Figure 1. Based on information provided and shown in Table 4, noise equivalent values have been determined per period (daytime and night-time); consequently, during the dry season, noise levels for the daytime period varied between 41.3 and 46.6 dB(A), while they varied between 41.5 and 46.3 dB(A) for the night-time period. It is important to point out that, except for the value determined for Station 3 during the night-time period, the remaining recorded values do not exceed international noise standards established by the IFC (2007).

On the other hand, values exceeding IFC standards were recorded during the wet season. These values range from 59.9 to 85.5 dB (A) during the daytime period, and from 66.7 to 74.6 dB(A) during the night-time period.

The criterion considered for assessing the results obtained at sampling stations close to vehicle traffic and built-up areas was the one established by the OECD (Organisation for Economic Cooperation and Development). This standard considers a value below 65 dB(A) to be an acceptable noise level for the daytime period, and a value below 55 dB(A) to be acceptable for the night-time period.

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Table 4: Noise quality baseline around area of Letpadaung Project

Period	Time	Noise level measured in $L_{Aeq(1h)}$ dB(A)																			
		Dry season										Wet season									
		Nº Stations										Nº Stations									
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Daytime	07:00-08:00	45.7	47.7	43.7	45.7	43.7	44.5	46.5	41.2	39.4	40.3	65.0	73.0	61.0	49.1	82.0	65.0	97.0	74.0	61.0	55.0
	08:00-09:00	41.5	44.3	44.3	44.7	41.3	46.6	46.6	41.6	40.7	41.7	67.0	76.0	56.0	49.1	74.0	69.0	78.0	75.0	56.0	55.0
	09:00-10:00	43.2	43.5	45.1	50.5	42.4	42.4	48.4	45.4	47.8	43.8	74.0	79.0	61.0	73.0	71.0	61.0	70.0	72.0	58.0	50.0
	10:00-11:00	45.1	40.1	43.1	48.1	48.1	46.1	47.1	42.1	45.3	45.3	67.0	78.0	62.0	62.0	63.0	64.0	53.0	68.0	56.0	44.1
	11:00-12:00	45.1	42.9	42.9	45.9	44.7	44.7	44.7	44.7	44.7	41.3	71.0	73.0	62.0	61.0	68.0	65.0	67.0	61.0	78.0	46.1
	12:00-13:00	38.7	41.8	44.8	45.8	45.8	45.8	45.8	44.8	42.8	42.8	67.0	71.0	55.0	53.0	84.0	67.0	61.0	62.0	71.0	37.6
	13:00-14:00	40.1	40.6	45.6	46.6	46.6	46.5	46.5	41.5	41.5	42.1	67.0	69.0	55.0	54.0	75.0	68.0	73.0	65.0	67.0	54.0
	14:00-15:00	41.2	43.5	42.5	42.5	42.5	42.5	42.5	42.5	39.5	39.5	69.0	71.0	52.0	50.1	64.0	61.0	74.0	66.0	62.0	53.0
	15:00-16:00	45.6	44.2	47.2	45.2	45.2	40.3	40.3	40.3	40.3	39.4	65.0	70.0	44.0	74.0	74.0	67.0	62.0	61.0	60.0	68.0
	16:00-17:00	39.5	39.2	44.0	47.5	43.8	43.8	43.8	39.8	39.8	40.6	64.0	74.0	47.0	69.4	60.0	56.0	54.0	64.0	58.0	59.0
	17:00-18:00	39.0	41.7	45.7	47.7	42.3	42.3	47.3	42.3	39.0	39.0	66.0	65.0	46.0	66.2	53.1	47.5	81.0	53.0	63.0	60.0
	18:00-19:00	40.5	39.8	43.8	43.8	40.8	41.8	41.8	41.8	41.8	41.8	56.2	55.1	54.0	61.0	60.0	44.4	54.0	43.6	51.0	64.0
	19:00-20:00	38.0	40.9	43.9	47.9	39.3	37.8	38.7	38.7	38.7	38.7	66.0	47.4	56.0	62.4	58.0	45.9	51.1	42.6	58.0	61.0
	20:00-21:00	39.4	42.5	47.5	43.5	36.5	41.2	41.2	41.2	41.2	38.1	51.6	46.8	68.0	61.8	50.2	43.4	43.2	49.1	39.2	59.0
	21:00-22:00	37.5	41.3	43.1	47.1	42.1	42.1	38.1	38.1	38.1	36.8	58.1	61.0	59.0	62.1	58.0	45.8	48.3	41.4	38.4	60.0
	LAeq-Daytime	**42.2**	**42.8**	**44.7**	**46.6**	**43.9**	**43.8**	**45.0**	**42.2**	**42.3**	**41.3**	**67.5**	**72.9**	**59.9**	**66.5**	**75.4**	**63.8**	**85.5**	**67.9**	**67.8**	**60.0**
	Noise Level Guidelines [(1)]	**65**	**65**	**55**	**55**	**65**	**55**	**55**	**55**	**55**	**55**	**65**	**65**	**55**	**55**	**65**	**55**	**55**	**55**	**55**	**55**
Night-time	22:00-23:00	38.5	41.5	42.5	43.6	47.5	47.5	44.5	41.5	41.5	39.4	64.0	70.0	76.0	59.0	47.6	63.0	42.7	42.8	38.7	76.0
	23:00-24:00	40.3	39.8	45.8	45.8	45.8	45.8	45.8	38.8	38.8	38.8	64.9	67.0	56.0	68.0	63.0	66.0	44.9	45.4	60.0	56.0
	24:00-01:00	40.5	43.9	43.9	43.9	43.9	43.9	43.9	43.1	43.1	40.5	69.0	68.0	58.0	66.0	69.0	62.0	56.0	63.0	61.0	63.0
	01:00-02:00	41.2	42.9	42.9	42.9	42.9	41.7	47.7	41.7	41.7	37.9	75.0	69.0	63.0	74.0	61.0	64.0	58.0	60.0	68.0	51.0
	02:00-03:00	46.7	43.3	43.3	43.3	43.3	43.3	43.3	43.3	44.3	44.3	69.0	70.0	67.0	74.0	60.0	81.0	58.0	65.0	71.0	67.0
	03:00-04:00	39.8	41.6	39.6	45.6	42.6	42.6	42.6	42.6	42.6	42.6	73.0	70.0	57.0	82.0	69.0	72.0	77.0	62.0	72.0	56.0
	04:00-05:00	42.7	41.1	45.1	42.7	45.1	43.5	43.5	43.5	43.5	43.5	74.0	46.8	56.0	75.0	62.0	74.0	76.0	63.0	49.1	58.0
	05:00-06:00	43.7	43.2	49.2	45.2	45.2	45.2	38.2	38.2	38.2	38.2	72.0	70.0	63.0	69.0	73.0	73.2	77.0	75.0	53.1	62.0
	06:00-07:00	41.7	42.5	51.5	41.5	42.5	42.8	42.8	42.8	42.8	42.8	67.0	70.0	67.0	63.0	42.8	74.1	73.0	74.0	69.0	62.0
	LAeq-Night time	**42.4**	**42.4**	**46.3**	**44.0**	**44.6**	**44.4**	**44.2**	**42.0**	**42.2**	**41.5**	**71.2**	**68.9**	**67.9**	**74.6**	**66.7**	**74.0**	**72.5**	**68.7**	**67.0**	**67.6**
	Noise Level Guidelines [(1)]	**55**	**55**	**45**	**45**	**55**	**45**	**45**	**45**	**45**	**45**	**55**	**55**	**45**	**45**	**55**	**45**	**45**	**45**	**45**	**45**

Prepared by Knight Piésold.

Source: MWMCL

Notes:

[(1)] Noise Level Guidelines according to IFC (2007). Noise impacts should not exceed the levels or result in a maximum increase in background levels of 3 dB at the nearest location off-site.

Noise level guidelines according to WHO (1999):

Receptor	Daytime / Night-time	Noise exceedance
Residential (IFC criteria)	55 / 45	
Residential close to highway (OECD criteria)	65 / 55	

Furthermore, the samplings also provided measurement results for meteorological parameters, which are shown in Table 5.

Table 5: Meteorological conditions during noise quality sampling

Season (2013)	Station	Parameters			
		Temperature ºC	Relative humidity (%)	Wind speed (m/s)	Wind direction
Dry	1	29-31	41-63	2.5-3.3	167 (S)
	2	29-31	40-64	2.6-3.5	178 (S)
	3	26-42	41-63	2.5-3.4	158 (S)
	4	25-42	41-63	2.4-3.8	169 (S)
	5	26-45	41-60	2.8-3.9	175 (S)
	6	23-40	40-61	2.3-3.5	164 (S)
	7	23-38	40-65	2.3-3.5	165 (S)
	8	23-37	40-68	2.3-3.5	172 (S)
	9	23-41	40-66	2.5-3.6	164 (S)
	10	24-41	41-67	2.6-3.8	172 (S)
Wet	1	29.9-30.4	36-93	0.5-3.3	177 (S)
	2	30.4-31.1	40-91	0.6-3.5	174 (S)
	3	34.8-41.7	41-83	0.5-3.4	168 (S)
	4	34.8-41.9	41-83	0.4-3.8	175 (S)
	5	34.8-42.4	41-90	0.8-3.9	176 (S)
	6	35.8-44.6	40-81	0.3-3.5	168 (S)
	7	37.6-39.4	40-85	0.3-3.5	167 (S)
	8	35.3-37.8	40-90	0.3-3.5	173 (S)
	9	35.1-36.9	40-96	0.5-3.6	166 (S)
	10	37.4-41	41-87	0.6-3.8	177 (S)

Source: MWMCL

4.1.3 Vibration Quality Baseline

Vibration measurements conducted within the project's environmental baseline area were recorded in mm/s and are given in Table 6.

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Table 6: Vibration levels around Letpadaung Project area

Location	Vibration levels (mm/s)						Safe level according to DIN 4150-3 (mm/s)[1]		
	Hot dry season			Wet season			MSB	RB	IB
	Mean	Max	Min	Mean	Max	Min			
Station 1	0.371	1.400	0.000	0.360	1.500	0.000	3	5	20
Station 2	0.510	3.000	0.100	0.515	3.000	0.100	3	5	20
Station 3	1.383	4.800	0.400	1.410	5.900	0.400	3	5	20
Station 4	0.298	0.800	0.100	0.294	0.700	0.100	3	5	20
Station 5	0.229	1.200	0.100	0.225	1.200	0.100	3	5	20
Station 6	0.958	4.500	0.200	0.990	4.500	0.200	3	5	20
Station 7	0.360	1.500	0.000	0.373	1.500	0.000	3	5	20
Station 8	0.329	1.400	0.100	0.338	1.500	0.100	3	5	20
Station 9	0.279	1.300	0.100	0.271	1.200	0.100	3	5	20
Station 10	0.233	1.100	0.100	0.223	1.200	0.100	3	5	20

Prepared by Knight Piésold.
Source: MWMCL
Notes:
(1) Safe level for frequency less than 10 Hz
(2) MSB = More sensitive buildings
(3) RB = Residential buildings
(4) IB = Industrial buildings. Commercial, Industrial or Similar
Legend:

x	Values greater than MSB standard
x	Values greater than RB standard
x	Values greater than IB standard

In order to assess the mean records obtained at stations close to roads (stations 1, 2, 3 and 5), it has been considered to compare them to standards established by the Federal Transit Administration (FTA) of the U.S. Department of Transit. Based on mean vibration level records, expressed in mm/s, the velocity level was determined in $Lv_{ref\ 1\ \mu inches}$ (VdB) units. The velocity level (L_V) is defined as (FTA, 2006):

$$RMS\ Velocity\ Level = Lv_{ref1:\frac{micro\ in.}{sec}} = 20 \times \log\left(\frac{v}{v_{ref}}\right)$$

Where Lv is in VdB, v is the RMS (Root Mean Square) of velocity amplitude, and v_{ref} is the reference velocity amplitude.

Table 7: General assessment of vibration levels recorded close to roads

Location	Vibration levels in VdB ref 1 micro inch/sec		General assessment according to FTA(1)		
	Season		Category		
	Hot dry	Wet	C1(2)	C2(3)	C3(4)
Station 1	**83.3**	**83.0**	65	72	75
Station 2	**86.1**	**86.1**	65	72	75
Station 3	**94.7**	**94.9**	65	72	75
Station 5	**79.1**	**78.9**	65	72	75

Prepared by Knight Piésold.
Notes:
(1) Standard values for frequent events are defined as more than 70 vibration events of the same source per day (FTA, 2006). Most rapid transit projects fall into this category.
(2) C1 = Category 1. Buildings where vibration would interfere with interior operations
(3) C2 = Category 2. Residences and buildings where people normally sleep
(4) C3 = Category 3. Institutional land use, mainly during daytime
Legend:

x	Values greater than C1 standard
x	Values greater than C2 standard
x	Values greater than C3 standard

According to results shown in Table 7, vibrations are clearly felt by inhabitants who are close to the referred stations. According to FTA criteria (2006), the area close to these stations is suitable for dwellings that present resistant structures rather than for sensitive buildings.

4.2 METEOROLOGICAL INFORMATION

In order to model air quality dispersion (AERMOD View v. 8.2) and noise propagation (Sound PLAN v. 7.2), weather data generated by the MM5 model[1] has been used. This model contains hourly ground-level and vertical data. This data comprises the period from January 2010 to December 2012 and is representative for an area of 144 km^2 (MM5 model grid area), which is where the Letpadaung Project lies. The information generated by the MM5 model is based on global reanalysis climate data provided by the National Center for Environmental Protection (NCEP). This information has a resolution of 2.5 degrees for the entire planet, with records for every 6 hours. Table 8 shows the characteristics of information generated by the MM5 model.

[1]Developed by Pennsylvania State University (PSU) and National Center for Atmospheric Research (NCAR). MM5 meteorological model is a limited-area, non-hydrostatic, terrain-following sigma-coordinate model designed to simulate or predict mesoscale atmospheric circulation.

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