VICTORIA GOLD CORPORATION
EAGLE GOLD PROJECT



FEASIBILITY WATER MANAGEMENT PLAN

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EXECUTIVE SUMMARY

The Eagle Gold Project is located in the Central Yukon Territory, approximately 400 km north of Whitehorse. The project is located in an area known as Dublin Gulch in the McQuesten River watershed and will operate for approximately 10 years from the start of active mining. The 92 million tonne mine will utilize conventional open pit mining techniques to extract ore for processing. The open pit is located on the south side of Dublin Gulch in an area that includes portions of three tributary gulches on the south side of Dublin Gulch. The ore will be crushed and placed in the Ann Gulch Heap Leach Facility, located across the valley to the north. Mined rock that does not contain economic ore or cannot be used for construction will be placed in one of two waste rock storage areas (Platinum Gulch or Eagle Pup Waste Rock Storage Areas).

The heap leach facility will be established by constructing a confining embankment at the toe of Ann Gulch. Once the embankment has been constructed, ore will be placed above the embankment and gold extraction will be achieved using cyanidation processes and carbon adsorption-desorption recovery. The cyanide solution will be prepared on site by mixing dry sodium cyanide with onsite make-up water. The cyanide solution will be kept in a closed heap leach circuit to ensure that the downstream environment is protected against cyanide discharge. The solution will be continuously re-circulated through the heap, until the recovery of gold is no longer economically viable.

The heap leach process will require make-up water at various times of the year. Collected mine-influenced runoff and water derived from open pit dewatering will provide the primary supply of make-up water. A well-engineered Water Management Plan (WMP) has been developed to ensure the use of mine-influenced water does not adversely affect downstream ecology. Understanding this, there are two water streams that must be managed:

- Mine-influenced water (MIW), referring to all water that comes into contact with mining activities or metallurgical processes – including neutral metal drainage and sediment-laden water.
- Non-contact water referring to any site water that does not come into contact with mining activities or metallurgical processes.

The general approach to managing non-contact water is fairly straight forward, involving isolation of disturbed or mined areas and safely diverting the water to downstream areas. At Eagle Gold the primary non-contact stream from upper Dublin Gulch will be conveyed by the Dublin Gulch Diversion Channel which will run around the toe of the heap leach facility, eventually discharging into Haggart Creek. Smaller diversion ditches will be used to isolate disturbed areas around the project site.

Process water requirements will be made up by harvesting storm water and diverting other MIW into the heap leach process ponds. This may be supplemented from groundwater wells, as needed. Excess water within the heap leach circuit will be treated prior to being returned to the environment.

The mitigation of MIW will depend on the nature of the source; however, the general management will typically involve characterization, interception, collection and an appropriate form of treatment. At the Eagle Gold Project, three classes of MIW are recognized as described below:

1. Sediment-laden water – collected water is directed to sediment control ponds (SCPs) that are sized to treat inflow events up to the 1 in 10 year storm water event and the ultimate capacity to safely contain storm inflows up to the 1 in 200 year storm water event.
2. Process water – excess process water from the heap leach process will be treated using an active detoxification facility, located within the mine water treatment plant (MWTP), to destroy any free cyanide, its complexes, and any other parameters of concern.
3. Metal leachate – low level neutral metal leaching is anticipated from the heap leached ore, waste rock, and possibly some rock exposures (i.e. the open pit), throughout the site. During active mining, this water will be collected and treated actively using the MWTP; however, during reclamation and closure passive treatment systems (anaerobic bioreactors and aerobic wetlands) may be constructed to address long term post-closure water quality. These facilities will be situated near point sources located around the site, possibly in the locations of the SCPs that were established during operations.

All treated water will be assessed to confirm water quality, prior to discharge into the downstream environment.

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SECTION 1.0 - INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Gold Project (the "Project") is a planned 92 million tonne open pit gold mining operation, located in the central Yukon Territory. The facility will operate using conventional open pit mining techniques to extract ore, which will be processed using cyanidation and carbon adsorption-desorption recovery (ADR) processes in the Ann Gulch heap leach facility (HLF). Mine rock that cannot be used for the construction of mine infrastructure will be deposited in waste rock storage areas (WRSA) located in strategic areas near the open pit.

Historically this site has been impacted by extensive placer mining in the Haggart Creek and Dublin Gulch watersheds. In the lower Dublin Gulch catchment the valley floor has been significantly re-worked. This has resulted in the re-routing of smaller streams within the system.

Planned infrastructure includes an open pit, Platinum Gulch WRSA, Eagle Pup WRSA, Ann Gulch HLF, Dublin Gulch diversion channel (DGDC), a mine water treatment plant (MWTP) and sediment control ponds (SCPs).

The MWTP will be constructed downstream of the HLF to treat excess process water and other collected mine influenced water (MIW). The MWTP will discharge treated water into Haggart Creek. SCPs will be used for MIW and non-contact water, before discharging into Haggart Creek.

This Water Management Plan (WMP) addresses the characterization and handling (collection, diversion, and distribution) of all waters within the Dublin Gulch and Eagle Creek watersheds. Waters are characterized as either MIW or non-contact water, based on the water's exposure to mining and exploration activities, and mineral processing.

The design of all water management facilities and components for the Project are based on the contents of the design basis developed by Knight Piésold Ltd. (Section 2.0) and Tetratech (Appendix A).

The WMP and all of its components are based upon the Feasibility Study Design of the Eagle Gold Project (Tetratech, 2012a) as known at the time of writing. Any changes to the design, layout, or schedule will have a direct impact on the content of the WMP. Should changes occur, this document should be reviewed and revised accordingly.

1.2 SITE LOCATION AND ACCESS

The Project is located in the central Yukon Territory, approximately 85 km by road north-northeast of Mayo or 400 km north of Whitehorse. From Whitehorse the Project is accessed by driving north on Highway 1 (Alaska Highway), then following Highway 2 (Klondike Highway) just outside of Whitehorse, until the junction at Stewart Crossing. From that point the route follows Highway 11 (Silver Trail) until an exit onto the South McQuesten Road, just outside of Mayo. The South McQuesten Road provides access to the Haggart Creek Road and eventually the Eagle Gold site.

Numerous access and exploratory roads have been constructed throughout the Dublin Gulch watershed. An old exploratory camp exists on the south side of Dublin Gulch creek near its confluence with Haggart Creek. The old camp still has existing facilities that continue to see use. A modern camp has been constructed directly across the valley from the old camp. The old camp has been replaced by a temporary modern camp located on the south side of the Lower Dublin Gulch Valley.

As site work advances it is likely that a number of new roads will be constructed and existing roads may be re-routed or decommissioned to accommodate site infrastructure and mining activities.

The main areas of concern for the Project and for this WMP are the Dublin Gulch, Eagle Creek and Haggart Creek watersheds. The project infrastructure itself will be situated within the Lower Dublin Gulch and Eagle Creek watersheds. Both Dublin Gulch and Eagle Creek drain into Haggart Creek.

1.3 SITE CONDITIONS

1.3.1 Overview

This document is based upon data collection and interpretation provided in the Eagle Gold Project Proposal Report (Stantec, June 2011), which includes a collection of documents summarizing baseline conditions for the Project. A brief summary of the baseline conditions is provided below.

1.3.2 Climate

The climate of the Project location is characterized as sub-arctic continental. Such climates typically experience moderate annual precipitation and a large temperature range. Summers tend to be short with occasionally high temperatures and periodic rain storms. Winters are long and cold with moderate snowfall. Snowfalls typically begin in October with the snowpack often persisting into mid-June at higher elevations. Average annual precipitation ranges from approximately 375 mm at the mouth of Dublin Gulch, to over 600 mm in the headwaters, with approximately 50% of the annual precipitation falling as snow. The proportion of snow generally increases with elevation.

1.3.3 Physiography

The Dublin Gulch watershed was not affected by the most recent glaciation, approximately 20,000 years ago; however, there is evidence that the area may have been affected by glaciation over 200,000 years ago. The effects of freeze-thaw phenomena, colluvial, alluvial, and fluvial processes have had the greatest effect on the physiography of the area in recent geological time.

The “gulches” that are common in the area were cirque formations (concave, amphitheatre-shaped erosional features that form at the head of valley glaciers) that have been affected by significant mass movement, leaving them with over-steepened slopes. There is little evidence of recent instabilities of this nature. However, some smaller landslide scarps are visible in Dublin and Olive Gulches.

The surficial geology of the area is characterized by weathered bedrock and colluvium, with morainal, fluvial, and glacio-fluvial material confined to the lower reaches of the gulches. The Dublin Gulch area has been significantly modified by placer mining activities, such that reworked placer material is common in Dublin Gulch and Haggart Creek. The steep terrain has limited the accumulation of organic material while the cold climate has limited vegetation growth; therefore, organic material comprises a very small fraction of the overall surficial material. There are few observed bedrock outcrops in the area.

Permafrost processes (including solifluction and nivation) is the dominant geomorphic process in the area, with notable permafrost concentrations south of the confluence between Dublin Gulch and Haggart Creek, the plateau to the east of the project footprint, and in a small area at the head of Ann Gulch. To a lesser extent, seepage and rapid mass movement processes also have a geomorphic effect on the site.

1.3.4 Surface Water Hydrology

The project area lies within the combined Dublin Gulch-Eagle Creek watershed, which is a sub-basin to the Haggart Creek Watershed. Haggart Creek flows southward into the South McQuesten River. Haggart Creek, downstream of the project area at Lynx Creek, has a catchment area of approximately 196 km^2 and a median basin elevation of 1076 m. Lynx Creek has a total catchment area of 98 km^2, which contributes over 50% of the drainage area to Haggart Creek at its confluence with Lynx Creek. Dublin Gulch has a total catchment area of 10.4 km^2 and a median basin elevation of 1249 m. Dublin Gulch is fed by the upper Dublin Gulch headwaters, Stewart Gulch, and Ann Gulch, which then drain into Haggart Creek, upstream of Eagle Creek. Due to past placer mining activities in the project area, the flow paths of some of the sub-basins within Dublin Gulch basin have been modified from their natural flow pathways. The Eagle Pup and Suttle Gulch basins now drain into Eagle Creek instead of Dublin Gulch. Eagle Creek is fed by Eagle Pup, Suttle Gulch, and Platinum Gulch, before running parallel to Haggart Creek and eventually joining it a few kilometres downstream.

1.4 SCOPE

This WMP, based on an evaluation of hydrometerological and hydrogeological conditions, has three functional components:

1. Operational water balance model (WBM)
2. Storm water management model (SWM), and

3. Erosion and sediment control plan (ESCP).

The WBM simulates the balance between the supply and demand of water, from construction through mining operations into closure, under a range of possible climate conditions. Each stage is simulated on a monthly basis to provide macro-scale operational guidance as to how the mine should operation with respect to water management. The quantitative results of the model are sufficient to make operational decisions with respect to how best to manage water resources based, on the availability or absence of water. Details of the WBM are contained in Appendix B.

The SWM simulates the ability of the site's water management infrastructure to contain, control and convey short duration extreme rainfall events (i.e. 1 in 10 year rain on snow, 1 in 100 year rainfall, or the Probable Maximum Precipitation). Water management facilities are designed with two specific operating modes: 1) service conditions which include all day-to-day operations and 2) ultimate limit conditions, which include provisions for safely handling extreme peak runoff events. Details of the SWM are contained in Appendix C.

Specific aspects of the WBM and the SWM as they relate to the operational WMP are described in Section 3.0 below.

The ESCP is a natural extension of the WMP, as the ability to control the generation, mobilization, and deposition of sediment is directly connected to the Proponent's ability to manage and control the flow of water around the site.

The functional components of the WMP are assessed at each of the following stages in the Project's life:

1. Construction
2. Operations
3. Active Closure and Reclamation, and
4. Post-Closure.

The primary emphasis has been placed on the construction and operational phases of the Project. The baseline conditions have been addressed in the Eagle Gold Project Proposal (Stantec, 2011) and the closure stages will be addressed in the Closure and Reclamation Plan for future permitting requirements.

The protection and preservation of water resources is a key objective for any mining development. The WMP provides mechanisms and procedures to ensure that the following water stewardship objectives are met:

- Promote the efficient use of water
- Avoid or minimize the contamination of clean streams and catchments
- Recognize and protect downstream beneficial uses of both surface and ground waters, and
- Upon completion of mining activities, the quality and quantity of water available to downstream and future users should not be compromised.

1.5 CLASSIFICATION OF WATER

For most mining developments there are two general streams of water – non-contact water and mine-influenced water (MIW). It is appropriate to subdivide MIW to address the ability to re-use MIW from particular sources. The classification of each stream of MIW at the Eagle Gold Project is summarized in Table 1.1 (Classification of Mine-Influenced Water).

SECTION 2.0 - DESIGN BASIS

2.1 DESIGN CRITERIA

A risk-based approach is used to select appropriate design storm events for specific water management facilities. This approach weighs the likelihood of failure, versus the consequence of failure, on a case-specific basis. Best practices generally dictate minimum prescriptive standards; however, facility-specific design basis criteria may be used, provided that the level of risk is acceptable to the Proponent and to the Approving Agencies. The design storm magnitudes applied to specific types of water management infrastructure are summarized in Table 2.1 (Water Management Design Criteria).

2.2 DESIGN STORM EVENTS

Design storm events are developed by assessing the annual recurrence of precipitation events of a given magnitude. These are generally derived from a data set of daily precipitation records by ranking the events and determining the relative probability of occurrence in a specific period of time (i.e. 1 in 2 year, 1 in 100 year, etc.). For this particular application, the design storms are expressed as millimetres of cumulative precipitation over a given area, in a period of 24 hours.

Design storm events are used as input parameters in most rainfall-runoff type storm water models (i.e. HEC-HMS, HydroCAD, TR-55). This is the approach that has been taken here.

The design storm events that were used to design appropriately-sized storm water management facilities are listed in Table 2.2 (Design Storm Events).

SECTION 3.0 - WATER MANAGEMENT PLAN

3.1 OVERVIEW

For the purposes of the Water Management Plan (WMP) the Project area has been subdivided into a number of hydrologic catchment units. Each unit is assessed individually and systematically managed to achieve the objectives described in Section 3.1.1.

These catchments include undisturbed areas (i.e. Upper Dublin Gulch) and areas containing mine infrastructure (heap leach area, WRSAs, open pit, etc.) or material storage. These areas are hydrologically divided such that any runoff generated in a given catchment remains in that catchment until it is collected and transferred into a separate catchment located downstream via a controlled drainage outlet, pumping system or conveyance channel.

The development of the primary mine infrastructure has a significant impact on surface water drainage. In many cases runoff generated in these areas must be captured and diverted to ensure safe operations. Water is also essential for the operation of the mine; therefore, some water must be sequestered to provide make up water to sustain mining activities and metallurgical processes.

The implementation of the water management strategies may differ at each stage of development; however, the intrinsic objectives and strategies are universally applicable to each stage of the mine's life.

This WMP is to be read in conjunction with Figures 3.1 to 3.6, which illustrate the flows of MIW and non-contact water over the entire project site, through each major phase of the mine's life.

3.1.1 Performance Objectives and Functional Requirements

The development of an effective water management plan requires a clear definition of the fundamental performance objectives and the sound selection of corresponding functional requirements.

The key objectives of the comprehensive site-wide water management plan consist of the following items:

1. Prevention and reduction of impacts to water quality reaching downstream areas.
2. Prevention and reduction of impacts to water quantity reaching downstream areas.
3. Prevention and reduction of erosion and sedimentation issues.
4. Provision of safe conveyance of water through the Project footprint.

The general functional requirements that achieve the specified performance objectives are listed in Table 3.1.

While closely linked to the WMP, measures for treating MIW - including metal-laden waters, domestic and industrial waste waters, and process water (with the exception of sediment-laden waters) are the domain of specialized water treatment processes that are beyond the scope of this plan. The MIW streams are identified in this plan and each stream will be directed to an appropriate treatment process that is tailored to treat the constituent contaminants.

3.1.2 Strategies

There are four keystone water management strategies that will be implemented through the development of the Eagle Gold Project:

1. Operational water management strategy
2. Storm water management strategy
3. Water conservation strategy, and
4. Erosion and sediment control strategy.

3.1.2.1 Operational Water Management Strategy

The operational water management strategy is an all-encompassing approach that integrates each of the other strategies, in order to ensure that the water management objectives for the Mine's development, operation and closure are achieved.

The operational strategy is manifested as a site-wide water balance. The water balance model is the primary measure by which the strategies presented herein are tested, evaluated, and confirmed. The water balance simulates the supply of and demand for water for each month in the life of the Mine (from construction through post-closure). The model integrates all on-site storm water management, mining, process and ancillary facilities that affect the flow, storage, use and treatment of all streams of water on site. The water balance is discussed in detail in Section 3.1.4, below.

The concept of water conservation is embedded in all aspects of the operational strategy. As the development of the Mine will require the disturbance of a large proportion of the Dublin Gulch watershed, the prevention of erosion and control of mobilized sediments is of critical importance to ensure the quality of water, both for operational water uses, as well as downstream environmental preservation.

The operational strategy focuses on minimizing water use and wastewater generation by reducing operational water losses along the process circuit and maximizing the re-use potential of each stream of MIW. The WMP presents an operational strategy based on the amount of water needed for operations (heap leach-make up water, camp water, and process water) and the fluctuating balance between water supply and demand. Pathways for all water streams need to be well-defined in order to adequately address operational questions – particularly with respect to daily operations, and extended drought or flood scenarios.

3.1.2.2 Storm Water Management Strategy

For the purposes of the water management plan (WMP) the Project area has been subdivided into a number of hydrologic catchment units. Each unit is assessed individually and systematically managed to achieve the objectives described below.

The catchments may be undisturbed areas (i.e. Upper Dublin Gulch) or areas containing mine infrastructure (heap leach area, WRSAs, open pit, etc.) or material storage (reclamation materials, overburden stockpiles). In general, these areas are hydrologically divided such that any runoff generated in a given catchment remains in that catchment until it is collected and transferred into a separate catchment located downstream, via a controlled drainage outlet, pumping system or conveyance channel.

The development of the primary mine infrastructure has a significant impact on surface water drainage. In many cases runoff generated in these areas must be captured and diverted to ensure safe operations. Water is an essential resource for the operation of the mine; therefore, some water must be harvested or sequestered to provide make up water to sustain mining and metallurgical processes.

The safe operation of the Mine's facilities is reliant on the ability of the storm water management infrastructure to effectively capture and retain runoff such that it may be routed to the HLF-process circuit, mine water treatment facilities, or safely discharged to the receiving environment. The storm water management strategies presented herein provide an overview of the operational regimes intended to safely capture, retain, and route peak flows generated during rainfall and snowmelt events of particular return periods.

Utilizing drainage controls (surface grading, interception ditches, diversion ditches) and impoundments that are appropriately designed to address the Mine's operational needs with the capacity to contain and attenuate upset storm water conditions, allows for safe operations, environmentally-sound collection and treatment of sediment-laden runoff and the ability to make use of stored runoff to sustain mine operations.

3.1.2.3 Water Conservation Strategy

Water conservation can reduce the demand for water resources. Mines are considered a temporary land use and the proper stewardship of water resources must be considered. By implementing a water conservation strategy the Mine is proactively protecting the interests of downstream users by limiting the amount of water that is impacted by mine site processes and facilities.

The Mine's processes will continue to re-use the water that is used to initially "seed" the process water circuit; however, over time, this quantity of water will be depleted as water is lost to entrapment within the heap leach facility, evaporation in the events ponds, through use as dust suppression, and in other mining activities. When water is added to the process circuit, this water is known as make-up water.

Water conservation can be achieved by any or all of the following means:

- Demand-side management:
  - Using mining and metallurgical processes that use less water
  - Minimizing water losses through conveyance, storage, and use, and
  - Preserving water quality (in general, the better the water quality the more effectively it may be used for the various water requirements around the site).
- Improved water treatment processes
- Wastewater reclamation – reconditioning wastewater streams for re-use, and
- Hydrologic awareness – by actively monitoring the inflows and outflows.

MIW may be recycled to maximize the use of water and reduce the demand for harvesting non-contact water sources (clean surface water or groundwater). These opportunities include the use of the following streams of water:

- Drill water recirculation
- Dust suppression – grey water (lightly used domestic water or harvested rain water) may be used for dust suppression; however, suspended solids should be removed (to prevent the blockage of pumps and spraying equipment), biological agents should be neutralized (as aerosol mists may be easily ingested by workers or wildlife), and nutrient levels should be low (to prevent fouling equipment)
- Process water – may be re-used provided that the chemical make-up of the water is compatible with the end use and suspended solids are well-managed, and
- Wash down water – oils and detergents typically build up as well as viral and bacterial micro-organisms.

The Project should take advantage of these opportunities wherever possible.

3.1.2.4 Sediment and Erosion Control Strategy

The sediment and erosion control strategy outlines measures to reduce erosion and sediment mobilization from disturbed areas. This will include hydro-seeding and re-vegetation, silt fencing, scarification and surface re-grading. If sediment cannot be prevented from mobilizing, measures to remove sediment from the system include ditch blocks, sediment traps, sediment control ponds, flocculants, and filter bags. During operation, sediment can be controlled by managing snow melt, isolating the truck wash area and appropriately designing all roads on site.

Details of the sediment and erosion control plan are summarized in Section 4.0, below.

3.1.3 Schedule

As described above, the Project will evolve through five discrete stages. Table 3.2 provides a general overview of the Project schedule.

The schedule has been developed, accounting for design methods, seasonal constraints, operational performance, and anticipated durations for specific activities such as reclamation and heap drain down. The WMP has been structured to be relatively flexible with respect to schedule; however, it is anticipated that the schedule will be revised as the Project advances. It is essential that the WMP be reviewed within the context of the most current mine development schedule.

3.2 Discussion of General Water Management Processes

3.2.1 Operational Water Balance Model

A site-wide operational water balance model (WBM) was created to simulate the availability and usage of water within the Project footprint. The water balance is a fundamental model of the supply and demand for water developed to simulate the ongoing water accounting on a month-by-month time step, from the initiation of mine operations through mine closure.

The GoldSim modelling platform was utilized to create the WBM in support of the Eagle Gold Feasibility Study. It provides the following advantages over simple deterministic models:

- It can operate either stochastically (utilizing uncertainties) or deterministically (using fixed input parameters) within the same model
- The platform has the ability to explicitly represent uncertainties that are inherent in water management systems
- It provides flexibility when modelling time-dependent conditions that vary throughout the life of mine, and
- It offers a graphical user interface that can provide more intuitive graphical representations of water management processes and their interrelationships.

The WBM is a stochastic, dynamic model that consists of a series of integrated containers which represent the water balance at the mine site (including the heap leach facility, fresh water diversions, the open pit, waste dumps, etc.), the climate conditions (precipitation, runoff, evaporation, and cold regions processes), operational conditions (ore/waste rock production rates, contact and non-contact waters), and regulatory compliance conditions.

GoldSim utilizes Monte Carlo simulation algorithms to translate uncertainties in model inputs into uncertainties in model outputs; therefore, the output of the probabilistic simulation is a *quantified probability*. The potential variability of climatic conditions was addressed by using a stochastic version of the water balance model, which utilizes a Monte Carlo type simulation to model monthly climate parameters as probability distributions, rather than mean values. The Monte Carlo simulations were run with 10,000 iterations, enabling nearly every conceivable combination of wet, dry and average months and years of precipitation to be considered. The model outputs a set of independent system realizations resulting in distributions of possible results for each month in each year, from which probabilities of occurrence were assessed.

Uncertainty is inherent to the climatic input parameters that are used to inform the WBM, which often means that fixing input parameters deterministically can yield unrealistic results. Understanding that input parameters have recognized predictable behaviour and a degree of randomness, and modelling the system as such, allows greater flexibility in focusing on the likelihood of a particular event occurring, rather than an exact magnitude of an event. The likelihood or probabilities of these parameters behaving a particular way can be attributed with a probability distribution based on historic behaviour and sound engineering judgement.

The results of the uncertainty analysis are then summarized by extracting relevant percentiles (i.e. the 10^{th} and 90^{th}) from output distributions.

3.2.2 Storm Water Management

Most on site storm water management infrastructure will be constructed prior to mine operations. It will be maintained and operated until the closure and reclamation stage has been reached. The major storm water infrastructure (ponds, fresh water diversions, etc.) is designed based on the full build-out mine configuration (i.e. maximum disturbed area) without progressive reclamation factored in. This is a conservative approach, as a lesser fraction of the overall site will be disturbed for much of the Mine's operating life. The intent is that these major water management structures will be established prior to operations without the need for relocation or modification.

Smaller water management facilities, such as minor surface water diversions and temporary works, will be deployed as required, when the major mine facilities (open pit, waste rock storage areas and heap leach facility) expand.

The general design basis for water management infrastructure is contained in Section 2.0 with specific memoranda for general site-wide water management, the Dublin Gulch diversion channel, and the heap leach facility.

The HydroCAD rainfall-runoff model (based upon the United States Department of Agriculture's Technical Release 55 (TR-55) model) was used to translate the design storm rainfall events into anticipated surface runoff. The model has many common elements with the original TR-55 model; however, it also includes the addition of more sophisticated hydraulic modelling functionality (i.e. pond inlet/outlet hydraulics, routing algorithms, and pond storage). The Type II SCS storm distribution was used to temporally-distribute the total rainfall accumulation over a 24 hour period while the Type II antecedent moisture content (AMC) was used to emulate average soil saturation conditions.

The Project area was subdivided into discrete sub-catchments, each attributed with appropriate model parameters (Curve Number, time of concentration, and drainage area) based on physical watershed characteristics. These parameters were calibrated using known precipitation and streamflow values collected as part of the hydrometric field program.

Hydraulic elements such as diversion ditches and detention ponds were included in the model to simulate the capability of the proposed infrastructure to safely capture and convey the runoff generated during peak storm events. An iterative approach was used to select and optimize the designs of the various fixed water management facilities (i.e. ponds and ditches). This approach was used to design appropriately-sized water management facilities to service the site from construction through closure.

Storm water runoff generated over disturbed ground surfaces tends to mobilize sediments when the erosive power of the runoff exceeds a soil's given resistance to movement, or soil stabilization methods fail to work as intended. For this reason, it is beneficial to integrate storm water management with erosion and sediment control protocols.

3.3 CONSTRUCTION PHASE WATER MANAGEMENT

The Construction phase will occur over the course of two years (Years -2 and -1). During this stage significant earthworks will be required to establish mine infrastructure, facilities and water management structures in all areas of the site.

Works will include, but are not limited to the following:

- Haul roads
- Dublin Gulch diversion channel
- Heap leach facility embankment
- Heap leach event ponds
- Long term sediment control / mine water ponds (Lower Dublin North and South ponds, Eagle Pup pond, and Platinum Gulch pond)
- Clearing, grubbing, and stripping of structural foundation areas, and
- Initial clearing, grubbing, and stripping of mine facilities (WRSAs, open pit area, heap leach pad, 100 day storage pad).

The construction schedule is dependent on the seasonal impacts of the weather in the Central Yukon and relies on the timely procurement of Quartz Mining License (Parts I and II) and Water Use License approvals. Part I of the Quartz Mining License allows for mining and earthwork activities that do not impact water courses.

3.3.1 Storm Water Management

Storm water will be managed through the use of temporary and permanent interceptor and diversion ditches, sedimentation ponds, and operational management to safely intercept, control, treat, and discharge waters passing through the Project footprint.

Long-term (i.e. life of mine) measures will be constructed concurrent with major site features such as access roads, perimeter ditching, and major sediment control ponds. Temporary features will be constructed on an as and when needed basis for short-term (<6 months) use only.

3.4 OPERATIONS PHASE WATER MANAGEMENT

The Operations phase of the Project is expected to run over the course of 9 years. Mine growth can be envisioned as three successive expansion phases throughout this period of time.

Phase I will see initial activities in the open pit, heap leach facility and waste rock deposition in both the Eagle Pup and Platinum Gulch WRSAs, terminating in Year 3. Phase II consists of continued expansion of the existing facilities leading to the ultimate capacity of the Platinum Gulch WRSA being achieved by the end of Year 6. Phase III experiences the full expansion of the Mine to encompass its maximum disturbed footprint, as the open pit, Eagle Pup WRSA, and the heap leach facility reach their maximum extents by the end of Year 9.

3.4.1 Water Balance

During operations, ore stacking on the heap and irrigation for leaching occurs for 250 days per year, with ore being stacked on the 100-day stockpile for the remaining 100 days of annual ore production (Tetratech, 2012b). The optimal water content for the leaching process is 13.3% while the ore mined from the Open pit is assumed to have a natural water content of 5.0%. Ore from the 100-day stockpile is assumed to have an increased water content of approximately 7.6%, due to direct precipitation inputs during its storage period (Tetratech, 2012b). A deficit condition is defined to exist when the heap requires makeup water to bring the stacked ore up to the optimal water content of 13.3%. Details of the water balance model including a schematic of the model and a summary table of input values are included in Appendix B. The results of the model during operations are summarized below.

The water balance results indicate the system (including mine site runoff collected in the Lower Dublin South Pond) is able to supply enough water to meet the process water requirements for the HLF throughout operations, with the exception of the months presented in Table B.4 and Table B.5 for the median and 90th percentile dry scenarios. During these months the HLF is in a deficit and will require additional makeup water from outside the system, such as pumping from groundwater wells. During other months excess site water that is not needed for makeup to the HLF is assumed to be sent for treatment. The range of possible monthly inflow volumes to the MWTP during operations, in terms of the median, 10th percentile (90th percentile dry), and 90th percentile values for unmanaged and optimized scenarios, respectively are presented in Figure B.2 and Figure B.3.

3.4.2 Storm Water Management

The majority of permanent storm water management infrastructure will be in place following the completion of the initial construction phase. This includes the Dublin Gulch diversion channel, all of the major pond structures and most local interceptor and diversion ditches required for operations. Some facilities (temporary works and expansion ditching) will come on line as large-footprint mining facilities such as the open pit and heap leach facilities, expand over the mine life.

The focus on utilizing harvested storm water to sustain mining operations allows the mine to limit its impact to the greater environment by re-using mine-influenced waters rather than obtaining make-up from external water sources.

The storm water management system is designed to intercept mine waters, route water to appropriate collection points via gravity drainage, and route waters to the process circuit, the mine water treatment plant, or directly to the environment as operational needs or water quality conditions dictate.

The operational rule set, shown on Figure 3.7, was developed to address the handling and use of all waters passing through the Project footprint. This concept has been integrated into the water balance model as a means of routing site waters to appropriate end processes or receptors.

3.5 CLOSURE AND RECLAMATION WATER MANAGEMENT

During the closure and reclamation phase there will be significant efforts to reclaim the site for sustainable land use beyond the life-of-mine. These reclamation efforts will employ a geomorphic design approach. This approach offers dynamic stability as opposed to relying on rigid, engineered systems to provide long to very-long term performance. The approach aims to replicate the stream morphology of natural, mature drainage systems with respect to zones of natural aggradation and degradation.

The designer employs foresight with respect to the geomorphic maturation process by integrating the anticipated future changes in channel migration, degradation, and aggradation into the built landscape. This approach also allows the designer to employ multiple lines of defence to ensure that the ultimate design intent is achieved.

The mine-disturbed landscape will be re-contoured to replicate a geomorphically-stable, mature landscape. The long term outcome will likely perform better than a rigid engineered system while achieving a more aesthetically pleasing landscape.

There are two stages within the closure and reclamation phase of the Project. The first stage of closure is termed the *active* phase. Within the active phase the following activities will occur:

- General reclamation of mine-disturbed landforms (Eagle Pup WRSA, 100-day storage facility, open pit) and decommissioning of on-site mechanical facilities and infrastructure.
- Supplemental gold recovery will occur at the heap leach facility until recovery is no longer effective or economic.
- Once gold recovery has ceased, the heap leach circuit will undergo detoxification and rinsing. This process will effectively destroy or eliminate residual cyanide within the heap leach facility while rinsing the pore space within the heap. At this point the process facilities (with the exception of the mine water treatment plant and detoxification facility) may be decommissioned.
- When the heap effluent quality has reached acceptable levels, the passive *drain down* process will commence and cover system construction will begin on the surface of the heap leach facility. This will also signify the point when the active mine water treatment facility may be decommissioned.

3.5.1 Water Balance

The closure phase commences at the end of Year 9 with the supplemental gold recovery phase for approximately one year (Year 10), followed by the rinse phase for approximately two years (Years 11 and 12). The heap is assumed to be at the optimal water content (13.3%) once ore stacking ceases at the end of Year 9, therefore no additional makeup water is required during the closure gold recovery phase. Once the rinse phase is completed, the heap drain down period commences, and continues for approximately 10 years (Years 13 to 23) during which time the water is allowed to drain freely from the heap, (Tetratech, 2011) as long as the MWTP capacity is not exceeded. The detailed assumptions of the closure water balance are included in Appendix B and results are summarized below.

The results on Figure B.2 indicate that for the unmanaged scenario there is a likelihood of excess inflow to the MWTP (resulting in a less than 10:1 dilution in Haggart Creek) occurring during the initial year gold recovery (Year 10) and the initial two years of the HLF drain down period (Year 12 to 14). The increased flow in Year 10 is due the net precipitation inputs to the heap exceeding the moisture losses to the ore, as ore production has ceased, creating a positive water balance in the heap. The increased flow in Year 12 is due to the initiation of drain down, in addition to the excess site water generated from the mine facilities (waste rock storage areas and Open Pit sump) that is assumed to require treatment, before being discharged to the environment, until passive treatment systems are in place. In the event that the cumulative inflows (HLF infiltration and other possible sources) to the MWTP would exceed the design capacity and/or result in a dilution ratio in Haggart Creek below the minimum allowed, the model simulates an optimized water management plan by recycling the excess discharge through the heap leach circuit including the events ponds, where it is temporarily held until there is sufficient capacity in the MWTP to treat it and/or sufficient flow in Haggart Creek to provide the required dilution. Figure B.3 illustrates the MWTP inflow/discharge with these constraints, in terms of 90th percentile and median values. Even under very wet conditions for the optimized scenario, the inflow is well below the MWTP design capacity, while achieving the specified dilution ratio in Haggart Creek.

3.5.2 Storm Water Management

Water from mine-disturbed areas will continue to be intercepted and routed to detention pond facilities as during operations; however, it is anticipated that runoff generation will be reduced once the landforms have been reclaimed. This is a result of reclamation activities that re-introduce soil and vegetation; in addition to this, the landform will be sculpted to promote sheet flow and infiltration rather than collecting surface water into engineered channels.

If effluent quality from either WRSA or the heap leach facility does not meet effluent discharge criteria in the near-term closure environment, then in line passive treatment systems (such as biochemical reactors, or permeable reactive barriers) may be constructed.

3.6 POST-CLOSURE WATER MANAGEMENT

The Post-Closure stage is assumed to commence once all mine operations facilities have been decommissioned and active closure activities have ceased. It is assumed that active mine water treatment will no longer be required, as seepage from the WRSAs and the HLF will have achieved an approximate steady-state geochemistry that is safe to discharge directly to the environment or is amenable to restoration via long-term passive rehabilitation measures (i.e. anaerobic biochemical reactors, engineered aerobic wetlands).

All road corridors (including running surfaces, ditch lines, and cross drainages) that are not required for post-closure field monitoring will have been reclaimed and allowed to vegetate naturally. Aids to re-vegetation may be considered on an as-needed basis.

3.6.1 Water Balance

The post-closure water balance has not been modelled as there will no longer be mining-related demands for water following active closure. It is assumed that a naturally-stable water balance will be restored and will not require human intervention to sustain itself.

3.6.2 Storm Water Management

Following closure and reclamation activities, it is anticipated that the post-closure site environment will be left in a geomorphically meta-stable condition. The site will be left to natural geomorphic processes to continuously shape drainage patterns that will continue to evolve in perpetuity without anthropogenic controls.

Should the closure and reclamation design objectives be achieved, the natural processes of stream aggradation and degradation will ultimately form a stable equilibrium. Storm water and snow melt provide the means by which the future landscape will be formed. Remnant landform features constructed during operations and active closure will tend to direct naturally-generated runoff along preferred flow paths as the site evolves over the long term.

SECTION 4.0 - EROSION AND SEDIMENT CONTROL

4.1 OVERVIEW

Surface water will be managed within the Project footprint such that sediment-laden runoff is eliminated or minimized, intercepted, and treated, prior to impacting downstream receiving waters or mine process facilities. The elimination of sediment-laden water depends on the effective isolation of easily-eroded, disturbed ground surfaces.

Isolation is achieved by implementing strategically placed interceptor ditches that collect overland flow combined with additional measures (i.e. leave strips and buffer zones), that reduce the quantity and erosive power of surface runoff.

Where the mobilization of sediments cannot be eliminated, measures will be implemented to reduce the quantity of runoff, then capture and route the contact water to locations where it may be treated via sedimentation or exfiltration. Given that zones of frozen ground may preclude exfiltration within portions of the Project footprint, it is likely that sedimentation using detention ponds will be the primary mechanism for the treatment of sediment-laden soils.

It is not anticipated that flocculants or other chemical additives that increase settling efficiency will be required; however, should unforeseen conditions necessitate such action, procedures will follow in accordance with the *Yukon Waters Act* (2003) guidelines for application and discharge.

Erosion management and sediment control during the initial construction phase will entail procedures that isolate disturbed areas and establish contact water collection ditches, construct sediment ponds, stabilize disturbed land surfaces to minimize erosion, and re-establish temporary vegetation covers. All contact water will be diverted to sediment ponds or exfiltration basins.

The following activities have the potential to result in increased erosion during construction:

- Vegetation clearing and topsoil stripping
- Stockpiling of topsoil, and
- Rough grading of construction areas.

Potential environmental hazards from these activities in the absence of planned mitigation measures include:

- Increased surface erosion from disturbed areas
- Increased sediment and pollutant load entering downstream water bodies, and
- Increased likelihood of mass instability on disturbed slopes.

The sediment and erosion control plan for the Project has been designed to address the potential environmental hazards listed above and to ensure effective management of clean surface water.

Sediment mobilization and erosion will be minimized by:

- Reducing exposure by isolating areas of land disturbance
- Installing water management and sediment controls prior to land disturbance

- Limiting the extent of the disturbance to the practical minimum
- Reducing water velocity across the ground, particularly on exposed surfaces and in areas where water concentrates
- Progressively rehabilitating disturbed land and constructing drainage controls to improve stability of rehabilitated land
- Protecting natural drainages and watercourses by constructing appropriate sediment control measures such as collection and diversion ditches, holding ponds, sediment traps and sediment basins
- Installing rock riprap, rock channel lining, sediment filters or other suitable measures on steep gradients, as required
- Restricting access to rehabilitated areas
- Constructing surface drainage control (e.g. collection ditches) to intercept surface runoff, and
- Constructing silt fences downslope of disturbed sites (where more permanent sediment control measures are not appropriate, or in combination with more permanent measures).

4.2 EROSION AND SEDIMENT CONTROL PLAN

The installation of temporary structural measures or “Industry Standard Practices” (ISPs) will provide erosion and sediment control during construction. All temporary sediment and erosion control features will require regular maintenance and inspection following each significant rainfall event. Temporary erosion and sediment control features will be reclaimed after achieving soil and sediment stabilization.

Experience and adaptive management are integral to the successful selection of the appropriate ISPs and the design and implementation of an overall erosion and sediment control plan. Erosion control ISPs will be implemented prior to and during construction to minimize erosion and sediment discharge into surrounding areas.

4.2.1 Erosion and Sediment Control During Construction

Erosion and sediment control features and protocols will be implemented on an as-required basis from initial construction through operations. Particular care will need to be taken with respect to the handling and management of ice-rich soils. BGC (2011, 2012) provides recommendations with respect to handling and storage of such materials.

Temporary erosion and sediment control features must be kept in serviceable order to ensure proper functionality.

4.2.2 Erosion and Sediment Control During Operations

By the commencement of operations, all of the fixed water management structures (Dublin Gulch diversion channel, operations ponds, and road side ditches) will be in place. The erosion and sediment control plan for this stage will require operational protocols to service and maintain these water management structures. Operations and maintenance protocols must be developed to ensure the functionality of these structures and systems at all times, to ensure the safe and environmentally sound operation of the site.

In addition to operations and maintenance, additional ground disturbances will occur as major features such as the open pit, waste rock storage areas and heap leach pad expand during active mining. These areas will require ongoing, temporary erosion and sediment control measures that will be implemented as and when required.

4.2.3 Erosion and Sediment Control During Closure

During the mine closure phase it is anticipated that most features on the site will be decommissioned and reclaimed. It is anticipated that the Closure and Reclamation Plan to be developed for the Project will address the operations and maintenance requirements as well as the erosion and sediment control protocols specific to achieving long term closure objectives.

4.3 EROSION AND SEDIMENT CONTROL FEATURES

Industry Standard Practices (ISPs) reduce erosion potential by stabilizing exposed soil or reducing surface runoff flow velocity. There are two general types of erosion control ISPs:

- Source control ISPs for the protection of exposed surfaces, and
- Conveyance ISPs for the control of runoff.

Typical ISPs that will be used at the Eagle Gold Project are identified below:

- Runoff collection ditches (contact water)
- Diversion ditches (non-contact water)
- Temporary sediment traps and sediment basins
- Surface roughening
- Silt fencing
- Temporary seeding
- Mulching, and
- Vegetative Buffer Zones.

Descriptions of the planned ISPs, their typical life spans and monitoring and maintenance requirements are provided below.

4.3.1 Runoff Interceptor Ditches

Runoff collection ditches intercept potentially sediment-laden runoff generated from ground surfaces that have been disturbed by construction. The ditches convey contact water to stabilized areas or other sediment control measures, where treatment may be facilitated.

General locations and conditions requiring collection ditches may include:

- Areas below disturbed existing slopes
- Areas at or near the perimeter of the construction area; preventing sediment-laden runoff from leaving the site, and
- Areas down gradient from disturbed areas prior to the establishment of soil stabilization measures.

Interceptor ditches are considered temporary measures. Once soils in the contributing catchments have been sufficiently re-vegetated, armoured, or otherwise stabilized the collection ditches may be decommissioned and reclaimed. All collection ditches will be sized to convey runoff generated by the 1 in 10 year return period storm of 24 hours duration. It is assumed that the contributing catchments are fully disturbed, yielding conservative results.

Interceptor ditches should be reviewed by operations staff following each major rainfall event throughout the construction and operations stages (as appropriate to the specific life of each ditch). Environmental management staff should ensure that ditch lining remains intact and excess sediment or debris is removed from ditch inverts and sediment traps. For vegetated ditch lines, any loss of vegetation should be restored as soon as practicable to maintain the functionality of the channel.

4.3.2 Diversion Ditches

Diversion ditches are similar to interceptor ditches with the exception that the source water supplying them is generated in undisturbed catchments (i.e. non-contact water). Properly located diversion ditches maximize the collection of non-contact runoff interception. Diversion ditches are an effective measure for isolating undisturbed upstream catchments from disturbed downstream catchments. Reducing the amount of runoff flowing on to disturbed catchments helps to minimize sediment mobilization.

The main design considerations are the volume and velocity of the water expected in the channel and the channel gradient. All diversion ditches will be designed to carry the 1 in 10 year storm event of 24 hours duration. Each diversion ditch will discharge through a stabilized outlet designed to dissipate the expected velocities without causing undesirable channel scour.

The ditches may require lining depending upon the design flow velocities and ambient soil conditions. Where fine grain soils have been exposed, appropriate erosion protection materials will be installed based on the estimated magnitude of flow and the flow velocity. Liner systems may consist of rock armour (riprap), HDPE liner, or vegetation lining. In-channel rock drop structures may also be used to reduce velocities in steep gradient channels.

Similar to collector ditches, diversion ditches should be monitored periodically to ensure functionality.

4.3.3 Temporary Sediment Traps

Sediment traps are temporary structures used to detain runoff from small drainage areas (less than 1 hectare). Sediment traps are sized to detain sediment-laden water for a period of time sufficient to promote the settlement of suspended sediments. They are generally installed downstream of relatively small drainage areas and in accessible areas that facilitate easy sediment removal and proper disposal.

Sediment-laden runoff from disturbed ground is conveyed to the trap via ditches, slope drains, or diversion dikes. Sediment traps are temporary measures, with nominal design lives of approximately six months. They are to be maintained until the catchments are permanently stabilized against erosion, by vegetation or other structural measures.

Temporary sediment traps will be constructed at the end of collection ditches to detain sediment-laden runoff long enough to allow the majority of the sediment to settle out. The sizes of the traps are primarily dependent on the size of the ditch supplying flows. The exact locations and final geometry of each trap will be field fit to integrate with locally-encountered conditions.

Sediment traps will be checked regularly for sediment accumulation. Traps that have accumulated sediment to one half of the wet storage will be cleaned out. Should a sediment trap become clogged by sediment or debris, the trap will be cleaned or replaced. Water from sediment traps may flow to exfiltration areas or other ISPs that will further improve the quality of the contact water.

4.3.4 Sediment Basins

Sediment basins are similar to sediment traps; however, they are built within ditch lines to reduce flow velocities and to provide a measure of sediment settlement and retention. Sediment basins are considered temporary measures; however, their life span is greatly extended by frequent monitoring and maintenance. Monitoring and maintenance of sediment basins should follow the frequency of ditch inspections.

4.3.5 Surface Roughening

Cut and fill slopes will be roughened with tracked machinery or by other means, to reduce runoff velocity, increase infiltration, reduce erosion, and to aid in the establishment of vegetative cover with seed. Roughening will typically be carried out by a tracked machine moving up and down the slope, creating undulations on the soil surface. This procedure is simple, inexpensive and provides immediate short-term erosion control for bare soil, where vegetative cover is not yet established. Compared to hard, compacted smooth surfaces a rough soil surface provides more favorable moisture conditions which will aid in seed germination.

4.3.6 Silt Fences

Silt fencing is a perimeter control used to intercept sheet flow runoff. Typical silt fencing is comprises a geotextile fabric anchored to posts driven into the ground. Silt fencing promotes sediment control by filtering water that passes through the fabric and increases short term detention time, allowing suspended sediments to settle.

Silt fences should be placed parallel to slope contours in order to maximize ponding efficiency. Barrier locations are informally chosen based on site features and conditions (e.g. soil types, terrain features, sensitive areas, etc.), design plans, existing and anticipated drainage courses, and other available erosion and sediment controls. Typical barrier sites are catch points beyond the toe of fill or on side slopes above waterways or drainage channels. Silt fences are not recommended for wide low-flow, low-velocity drainage ways, for concentrated flows, in continuous flow streams, for flow diversion, or as check dams. Silt fencing will be trenched to ensure that it is properly anchored.

All silt fences should be reviewed and maintained following major rainfall events. Proper installation and frequent maintenance is required for effective sediment control.

4.3.7 Temporary Seeding

Exposed slopes and other disturbed areas will be seeded to establish vegetative cover. Temporary seeding is intended to stabilize soil and reduce damage from wind and/or water until permanent stabilization is achieved or the area is re-graded and re-vegetated as part of final reclamation. Seeding is applicable to areas that are exposed and subject to erosion for more than 30 days. It is usually accompanied by surface preparation, fertilizer application, and mulch. Temporary seeding may be accomplished by hand or mechanical methods, or by hydraulic application (hydroseeding), which incorporates seed, water, fertilizer, and mulch into a homogeneous mixture (slurry) that is sprayed onto the soil.

A local seed supplier should be consulted to determine the optimal design mix for the region. The seed mix must be free of noxious weeds. Fertilizer additive may be required if nutrient-poor soils are encountered.

Seed mix may be applied by either broadcast seeding (at a rate of 25 kg/ha) or hydroseeding (at a rate of 75 kg/ha). These application rates will be monitored and modified as needed to achieve optimal results for the site.

All seeded areas will be assessed after the first major rainfall event following application and monthly thereafter, until vegetation is established. Where poor growth is noted, additional seed applications with fertilizer and mulch may be required.

4.3.8 Mulching

Mulching is the application of a uniform protective layer of straw, wood fiber, wood chips, or other acceptable material on, or incorporated into, the soil surface of a seeded area to allow for the immediate protection of the seed bed. The purpose of mulching is to protect the soil surface from the forces of raindrop impact and overland flow, foster the growth of vegetation, increase infiltration, reduce evaporation, insulate the soil, and suppress weed growth. Mulching also helps hold fertilizer, seed, and topsoil in place in the presence of wind, rain, and runoff, while reducing the need for watering.

Mulching may be utilized in areas that have been seeded either for temporary or permanent covers. There are two basic types of mulches: organic mulches and chemical mulches. Organic mulches may include straw, hay, wood fiber, wood chips and bark chips. This type of mulch is usually spread by hand or by machine (mulch blower) after seed, water, and fertilizer have been applied. Chemical mulches, also known as soil binders or tackifiers, are composed of a variety of synthetic materials, including emulsions or dispersions of vinyl compounds, rubber, asphalt, or plastics mixed with water. Chemical mulches are usually mixed with organic mulches as a tacking agent to aid in the stabilization process, and are not used as stand-alone mulch, except in cases where temporary dust and erosion control is required.

Hydroseeding, sometimes referred to as hydromulching, consists of mixing a tackifier, specified organic mulch, seed, water, and fertilizer together in a hydroslurry and spraying a layer of the mixture onto a surface or slope with hydraulic application equipment. The choice of materials for mulching should be based on soil conditions, season, type of vegetation, and the size of the area.

Vegetative buffer zones contain trees, shrubs and native grasses. They effectively spread runoff flows into sheet flow that allows increased settling and infiltration. Strips of undisturbed, original vegetation are the preferred form of buffer zone, since they can immediately filter sediment-laden runoff, infiltrate the runoff, and reduce storm runoff velocities.

4.3.9 Roadside Drainage and Cross Drainage

Haul roads will be built to the standards described by Tetratech (2012a). These guidelines provide requirements for design and implementation including construction techniques, road width, cut and fills slope angles, and horizontal and vertical control angles. These standards are defined in terms of stabilized road width and design speed.

Provided that the standards are adhered to during construction and operations, the road surface should be graded to positively shed water to stabilized ditches or swales, thereby preventing water accumulation on the road's running surface.

Roadside swales will be designed with the capacity to convey the 1 in 10 year storm of 24 hours duration. As a general guideline, these swales will achieve a minimum sustained grade of -0.5% to ensure drainage and to prevent standing water accumulation. Where steeper channels are required, check dams or drop structures may be installed. If high velocities are anticipated or erodible soils are encountered the ditches should be lined to prevent erosion. Ditch lining may consist of grass lining, riprap lining, or some other approved material or mechanical stabilization.

Culverts will be designed to convey the peak flow generated by the 1 in 100 year storm of 24 hour duration. All cross culverts should be installed with a skew within a normal range of 45 to 135 degrees to facilitate inlet pickup. Culvert grades should normally range between -1.0% to -2.2%; however, a gradient of -0.5% may be tolerated if there is minimal risk of sedimentation.

SECTION 5.0 - CLOSURE

This report has been prepared in support of the Eagle Gold Project, using the most current information made available to Knight Piésold Ltd. throughout the Feasibility Study process.

The Water Management Plan, encompassing the site-wide water balance, storm water management, and erosion and sediment control measures, addresses the key water management issues appropriate to a Feasibility-level of design. This report is sufficient to provide input to the capital and operating cost estimates of the National Instrument 43-101 document and Feasibility Study report (Tetratech, 2012).

Any changes to the general site layout, baseline hydrology, process requirements, or mining activities should be reviewed and this report should be updated or revised accordingly.

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SECTION 6.0 - REFERENCES

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SECTION 7.0 - CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.

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TABLE 1.1

VICTORIA GOLD CORPORATION
EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN
CLASSIFICATION OF MINE INFLUENCED WATER

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Classification[1]	Sources	Potential Contaminants	Treatment Requirements
Non-contact waters	Rain water, snowmelt, groundwater seepage		
Potable water	Treated groundwater/surface water	None	None
Contact waters also referred to as mine-influenced waters (MIW)	See below	See below	See below
Clean mine water	Undisturbed areas within the Project footprint	None	None
Sediment-laden water	Surface runoff from dirty areas (i.e. roads, laydown areas, stockpiles, etc.)	Suspended solids and/or other pollutants	Sediment removal
Neutral mine drainage (NMD)	Metal leachate that is generated at neutral pH as water flows through disturbed rock and ore	Metals, hardness	Active or passive water treatment
Acid mine drainage (AMD)	Acidic leachate that is generated by the oxidation of metals contained in disturbed rock (note that AMD is not anticipated at the Eagle Gold site and is presented here for completeness)	Not Applicable	Not Applicable
Process water	Pregnant/barren solution used in the heap leach gold recovery operations; wash water from the 100 Day Storage and conveyor alignment	Cyanide complexes, metals and metalloids; salinity; suspended solids	Full detoxification and metal removal
Wash down water	Vehicle and workshop wash down	Suspended sediment; hydrocarbons	Sediment removal (settling pond); oil-water separation
“Grey” water	Camp facilities (showers, wash basins, laundries, kitchens)	Solids; biological agents	Solids removal; possible disinfection (chlorine)
Domestic effluent (sewage)	Camp sanitary facilities	Fecal coliforms, biological agents	Solids removal; disinfection
Industrial effluent	Work shop facilities	Industrial agents – hydrocarbons, metals, etc.	Varies depending on source

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NOTES:

1. THESE CLASSIFICATIONS REPRESENT THE GENERAL STREAMS OF WATER OBSERVED AT MOST MINE SITES.

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TABLE 2.1

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN
WATER MANAGEMENT DESIGN CRITERIA

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Common Infrastructure Element	Design Element	Design Basis Criteria
Temporary diversion or interceptor ditches	Design storm event	1 in 10 year
	Minimum depth	300 mm
	Minimum grade	0.30%
	Maximum grade: unlined / lined	2% / 5%-10%
	Side slopes: unlined / lined or rock	2H:1V / 1H:1V
	Maximum velocity: unlined / lined	1.5 m/s / 4.0 m/s
Permanent diversion or interceptor ditches[1]	Design storm event	1 in 10 year
	Minimum depth	600 mm
	Minimum grade	0.30%
	Maximum grade: unlined / lined	2% / 5%-10%
	Side slopes: unlined / lined or rock	2H:1V / 1H:1V
	Maximum velocity: unlined / lined	1.5 m/s / 4.0 m/s
Culverts	Minimum diameter	600 mm
	Design storm event (areas < 1 ha)	1 in 10 year
	Design storm event (areas > 1 ha)	1 in 100 year
	Design storm events (at stream conveyances)	1 in 200 year
Temporary sediment control ponds[2]	Design storm event (capacity)	1 in 100 year
	Design storm event (sediment removal)	1 in 10 year
	Depth requirements:	
	Dead storage (sediment)	0.5 m
	Live storage (liquid)	1.5 m
	Minimum freeboard (200-year event)	0.5 m
Permanent sediment control ponds[2, 3]	Design storm event (capacity)	1 in 200 year
	Design storm event (sediment removal)	1 in 10 year
	Depth requirements:	
	Dead storage (sediment)	0.5 m
	Live storage (liquid)	1.5 m
	Minimum freeboard (200-year event)	0.5 m
	Dewatering (pumping capability)	Full dewater in 24 hours

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NOTES:

1. NOT INCLUDING THE DUBLIN GULCH DIVERSION CHANNEL AND FISH COMPENSATION WORKS.
2. SEDIMENT POND DESIGN BASIS DERIVED FROM "PROVINCE OF BRITISH COLUMBIA DRAFT GUIDANCE FOR ASSESSING THE DESIGN, SIZE AND OPERATION OF SEDIMENTATION PONDS USED IN MINING" (NOVEMBER 22, 1996).
3. THE DESIGN AND CONSTRUCTION OF SEDIMENT POND EMBANKMENTS IS GOVERNED BY THE CANADIAN DAM SAFETY GUIDELINES. ADDITIONAL APPROVALS ARE REQUIRED IF THE EMBANKMENT HEIGHT EXCEEDS 2.5 m FROM EMBANKMENT TOE TO CREST AND/OR STORAGE CAPACITIES EXCEED 30,000 m3. THESE APPROVALS ARE ALSO REQUIRED IF THE HAZARD CLASSIFICATION OF THE EMBANKMENT IS CONSIDERED HIGH WITH RESPECT TO THE CONSEQUENCE TO HUMAN LIFE, INFRASTRUCTURE OR THE ENVIRONMENT, AS A RESULT OF EMBANKMENT FAILURE.

0	17FEB'12	ISSUED WITH REPORT VA101-290/5-1	CA	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 2.2

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN
DESIGN STORM EVENTS

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Return Period (years)	Annual Probability of Exceedance	24-hour Duration Precipitation Depth (mm)	General Comments
2	0.5	31	
10	0.1	50	
100 (mean)	0.01	71	The 95th percentile (see Note 1, below) is used for the design of all permanent or critical water management infrastructure, with the exception of the heap leach facility spillway and events ponds.
100 (95th)		103	
200	0.005	79	
500	0.002	89	
PMP	<0.0004	200 (Spring), 256 (Summer)	Refer to Notes 2 and 3, below.

M:\1\01\00290\05\A\Report\1 - Water Management Plan\Rev 1\Tables\[Table 2.2_rev0 - Design Storm Events.xlsx]Tab2.1

NOTES:

1. THE 95TH PERCENTILE RAINFALL EVENT REFERS TO AN EVENT WHOSE PRECIPITATION IS GREATER THAN OR EQUAL TO 95% OF ALL 24 HOUR EVENTS, ON AN ANNUAL BASIS.
2. THE PMP WAS DERIVED USING STANDARD WORLD METEOROLOGICAL ORGANIZATION PROCEDURES (1986) / HERSHFIELD METHOD. THE PMP IS EFFECTIVELY THE LARGEST CONCEIVABLE STORM EVENT THAT COULD POSSIBLY IMPACT THE SITE. IN GENERAL IT IS SEEN TO HAVE A RETURN PERIOD OF APPROXIMATELY 1 IN 10,000 YEARS.
3. THE PMP VALUE OF 256 mm IS VALID FOR THE MONTHS OF JUNE THROUGH SEPTEMBER AS THIS IS THE PERIOD THAT EXPERIENCES THE MAJORITY OF EXTREME RAINFALL EVENTS. IT IS POSSIBLE THAT MORE EXTREME RUNOFF MAY BE PRODUCED BY A RAIN ON SNOW EVENT OCCURING IN THE SPRING. IN THIS SCENARIO, THE PMP IS ESTIMATED TO BE 200 mm. THIS VALUE SHOULD BE COMBINED WITH A MAXIMUM SNOWPACK VALUE FOR ESTIMATING THE PMF.
4. PRECIPITATION DEPTHS ASSUME A MEDIAN ELEVATION OF 1,000 M.

0	17FEB'12	ISSUED WITH REPORT VA101-290/5-1	CA	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE 3.1

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN
FUNCTIONAL REQUIREMENTS

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Area / Component	Functional Requirement	Timing
Open pit and waste landform	Install surface water diversion infrastructure around mines and waste landforms to maintain downstream flows.	Design and construction
	Design mine pits to be internally draining. Rainfall to be managed via sumps and potentially directly discharged to the environment.	Ongoing
Clearing and earthworks	Rehabilitate temporarily disturbed areas progressively.	Ongoing, closure
Linear infrastructure (roads, transmission lines)	Construct floodways on roads at depressions and at a maximum of 75 m intervals in sheet flow areas to maintain sheet flow regimes.	Design and construction
Surface discharge of open pit water	No discharge of open pit to surface water, except as a contingency measure during system failures or in exceptional circumstances when major maintenance is being undertaken on the injection system.	Operations
Flood management	Utilize risk-based design to select appropriate design criteria for the sizing and operation of water management infrastructure.	Design and construction
Storm water management	Keep clean and potentially contaminated storm water separate.	Operations
	Contain and appropriately treat potentially contaminated storm water prior to release to the environment.	Ongoing
Water use	Implement strategies to conserve water at all points within the Project footprint (process, domestic water, grey water re-use).	Operations
Mine closure	Implement geomorphic design to replicate a naturally-stable landform state post-closure.	Design and construction, closure

M:\1\01\00290\05\A\Report\1 - Water Management Plan\Rev 1\Tables\[Table 3.1_rev0 - Functional Requirements.xlsx]Tab3.1

NOTES:

1. FUNCTIONAL REQUIREMENTS BASED ON PAST EXPERIENCE IN DESIGNING, CONSTRUCTING, AND OPERATING MINE WATER MANAGEMENT FACILITIES.

0	14FEB'12	ISSUED WITH REPORT VA101-290/5-1	CA	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE 3.2

VICTORIA GOLD CORPORATION
EAGLE GOLD PROJECT

OVERALL PROJECT SCHEDULE

26/03/2012 15:36

Phase	Period	Description
Pre-Construction	Year -2 to -1	Initial site development, monitoring, equipment mobilization Lower Dublin south pond, Eagle Pup pond and Platinum Gulch pond constructed
Construction	Year -1 to 0	Warthworks, construction of all water related infrastructure Dublin Gulch diversion channel constructed
Phase I Operations	Year 0 to Year 3	Intial operation of mine, open pit, waste rock storage areas
Phase II Operations	Year 3 to Year 7	Expansion of heap, open pit, waste dumps
Phase III Operations	Year 7 to 9	Expansion to 96Mt, full build out complete Platinum Gulch WRSA reclamation occurs (Yr. 7)
Active Closure and Reclamation	Year 9 to Year 12	Supplemental gold recovery (Yr. 9-10) Rinse and detoxify heap leach facility, site reclamation
Passive Closure	Year 13 to 21	Heap draindown, annual monitoring
Post-Closure	Year 22+	Periodic monitoring of surface and groundwater

M:\1\01\00290\05\A\Report\1 - Water Management Plan\Rev 1\Tables\[Table 3.2_rev0 - Overall Project Schedule.xlsm]VA Table

NOTES:

1. SCHEDULE SUBJECT TO CHANGE.

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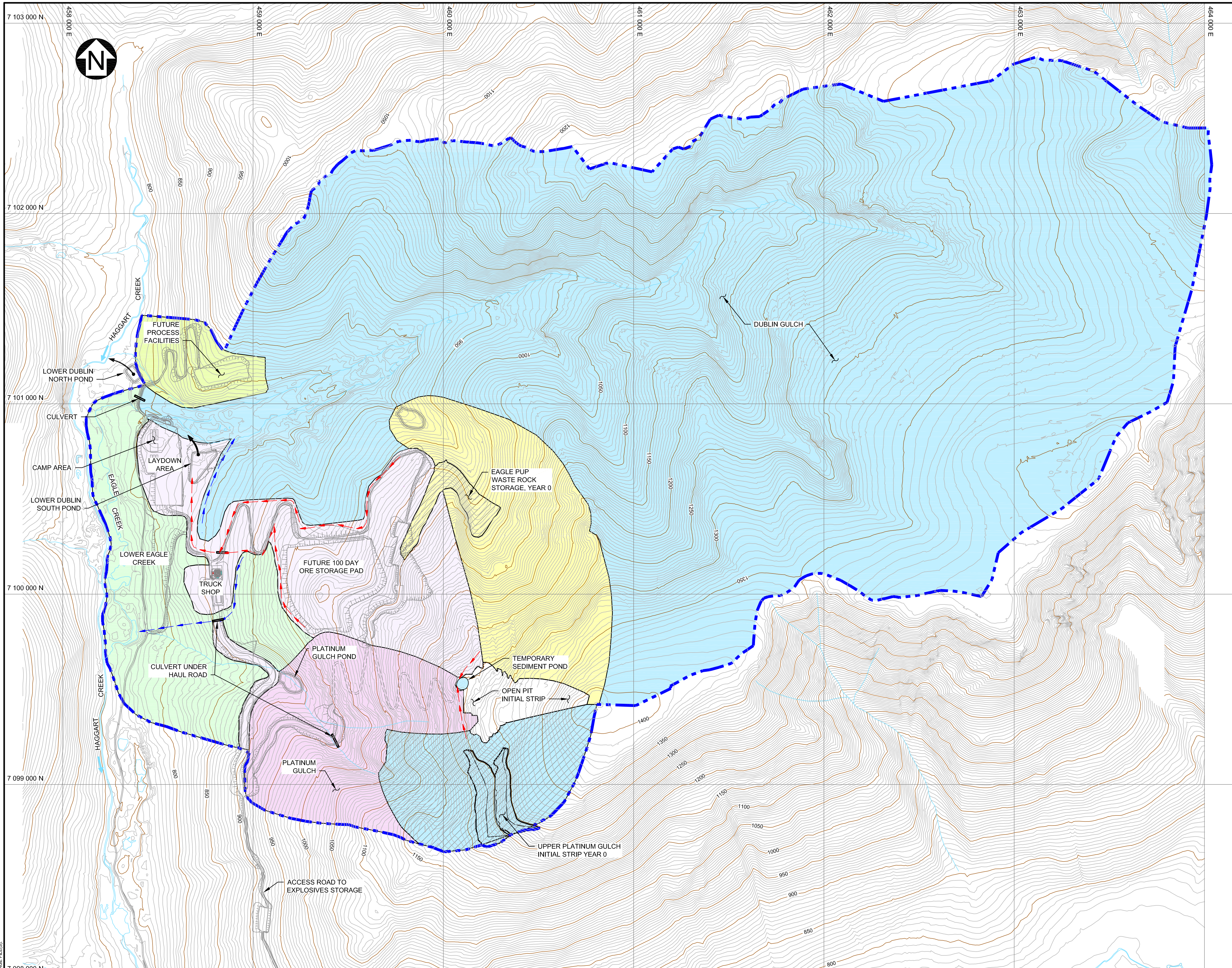

CATCHMENT AREAS	
DESCRIPTION	ha
DUBLIN GULCH	1070
OPEN PIT (INITIAL STRIP)	14
EAGLE PUP WRSA (INITIAL STRIP)	8
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	107
LOWER PLATINUM GULCH	79
PROCESS FACILITIES	39
LOWER EAGLE CREEK	96
UPPER PLATINUM GULCH	58
EAGLE PUP (UNDISTURBED)	133
TOTAL	1604

LEGEND:

SEDIMENT CONTROL POND

CONTACT WATER

SECONDARY ROUTING

CONTACT WATER DITCH

NON-CONTACT WATER

NON-CONTACT WATER DITCH

DRAINAGE DIVIDE

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN CONSTRUCTION PHASE YEAR -2

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-290/5	1

FIGURE 3.1 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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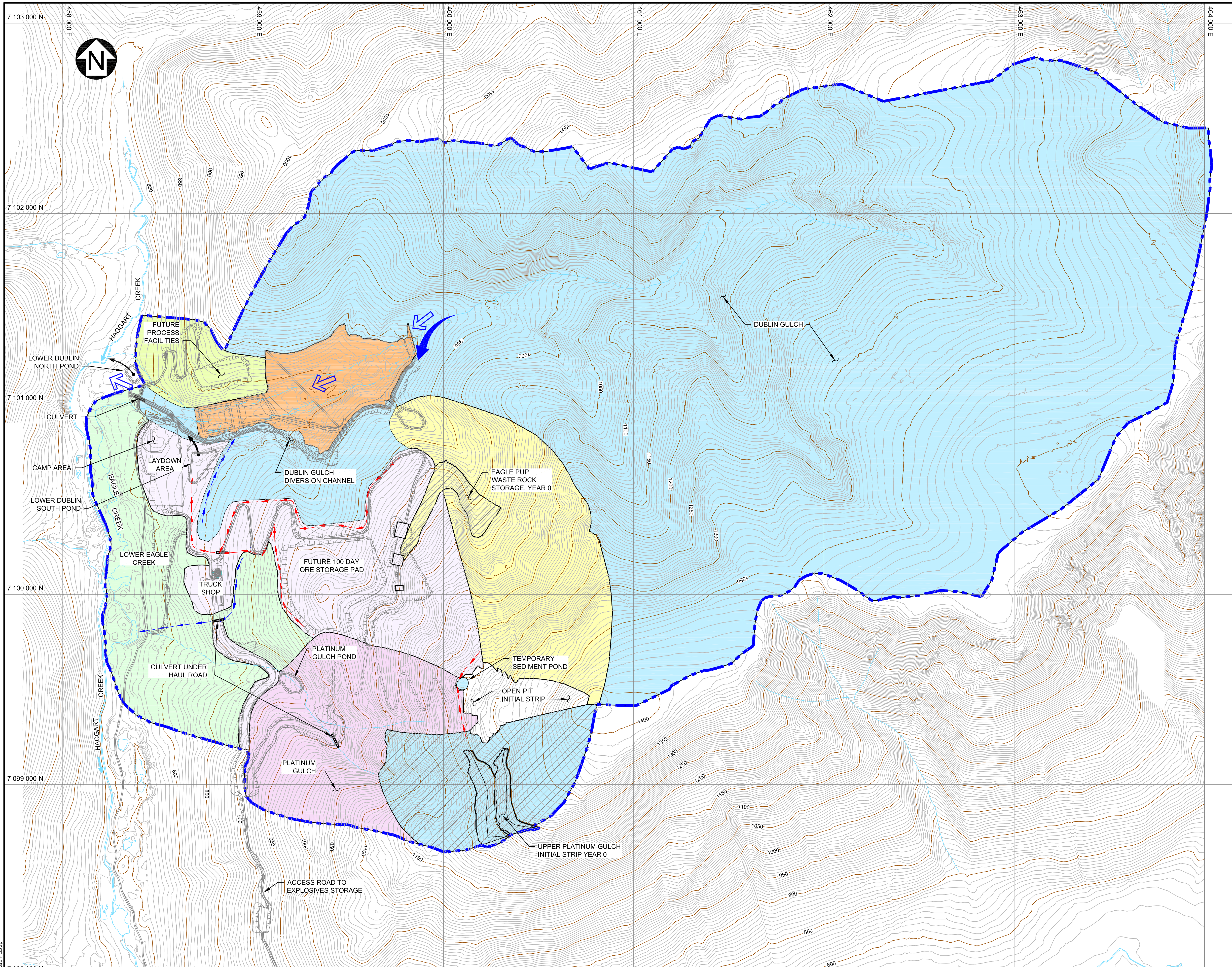

CATCHMENT AREAS	
DESCRIPTION	ha
DUBLIN GULCH	1034
OPEN PIT (INITIAL STRIP)	14
HEAP LEACH & EVENTS PONDS	38
EAGLE PUP WRSA (INITIAL STRIP)	8
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	107
LOWER PLATINUM GULCH	79
PROCESS FACILITIES	39
LOWER EAGLE CREEK	96
UPPER PLATINUM GULCH	58
EAGLE PUP (UNDISTURBED)	133
TOTAL	1604

LEGEND:

SEDIMENT CONTROL POND

CONTACT WATER

SECONDARY ROUTING

CONTACT WATER DITCH

NON-CONTACT WATER

NON-CONTACT WATER DITCH

DRAINAGE DIVIDE

DUBLIN GULCH FLOW DURING DIVERSION CHANNEL CONSTRUCTION

DUBLIN GULCH FLOW DURING DIVERSION HEAP EMBANKMENT CONSTRUCTION

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN CONSTRUCTION PHASE YEAR -1

Knight Piésold CONSULTING

P/A NO. VA101-290/5 | REF NO. 1

FIGURE 3.2 | REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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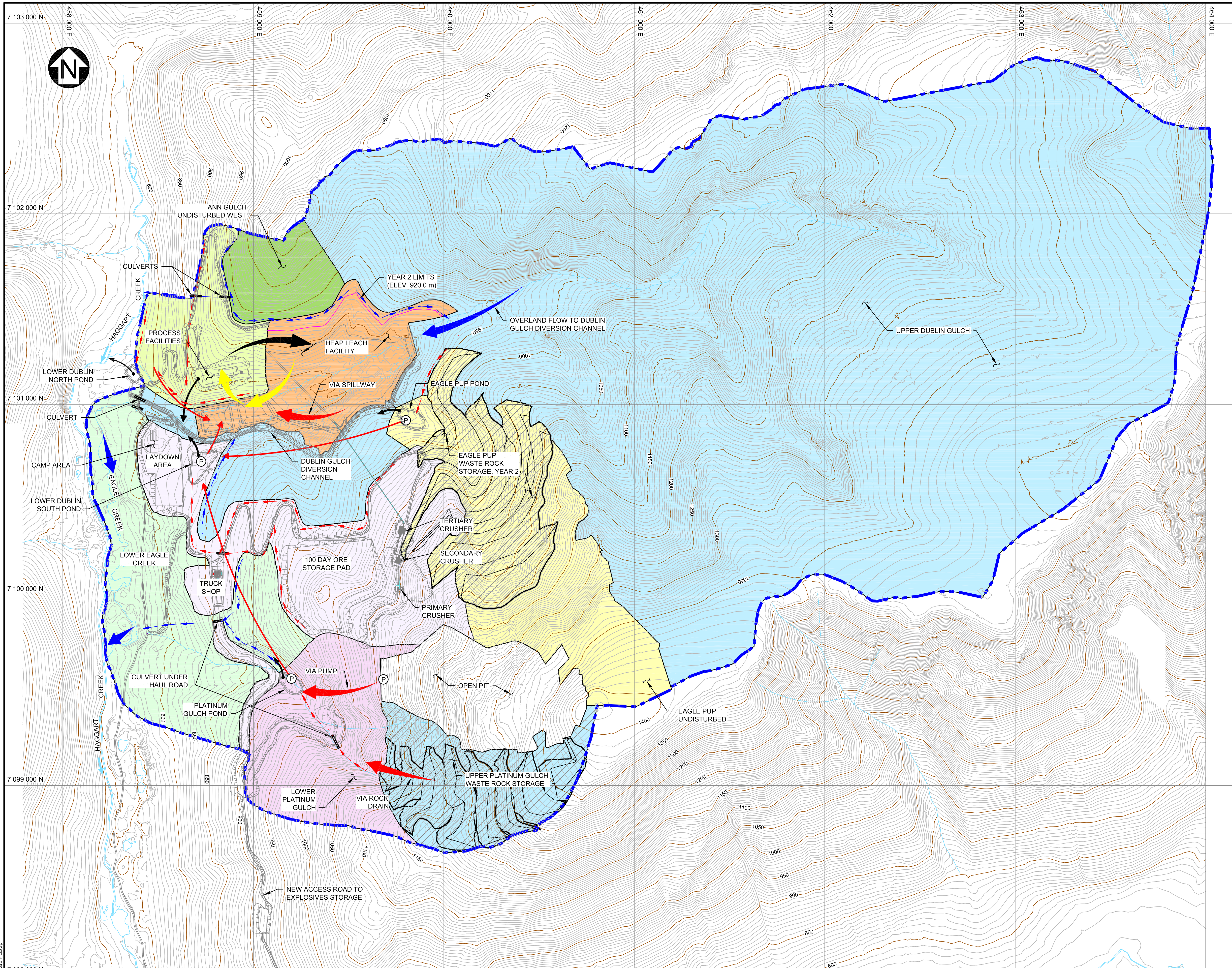

CATCHMENT AREAS	
DESCRIPTION	ha
UPPER DUBLIN GULCH (NON-CONTACT)	934
LOWER DUBLIN GULCH (NON-CONTACT)	46
OPEN PIT	49
HEAP LEACH & EVENTS PONDS	53
EAGLE PUP WRSA	61
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	106
LOWER PLATINUM GULCH	64
PROCESS FACILITIES	39
LOWER EAGLE CREEK	96
PLATINUM GULCH WRSA	54
EAGLE PUP	59
ANN GULCH UNDISTURBED WEST	24
TOTAL	1585

LEGEND:

SEDIMENT CONTROL POND

PUMP

CONTACT WATER

PRIMARY ROUTING

SECONDARY ROUTING

CONTACT WATER DITCH

NON-CONTACT WATER

PRIMARY ROUTING

NON-CONTACT WATER DITCH

TREATED WATER

TREATED WATER

PROCESS WATER

PREGNANT SOLUTION

BARREN SOLUTION

DRAINAGE DIVIDE

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN OPERATIONS: PHASE I YEAR 2

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-290/5	1

FIGURE 3.3 — REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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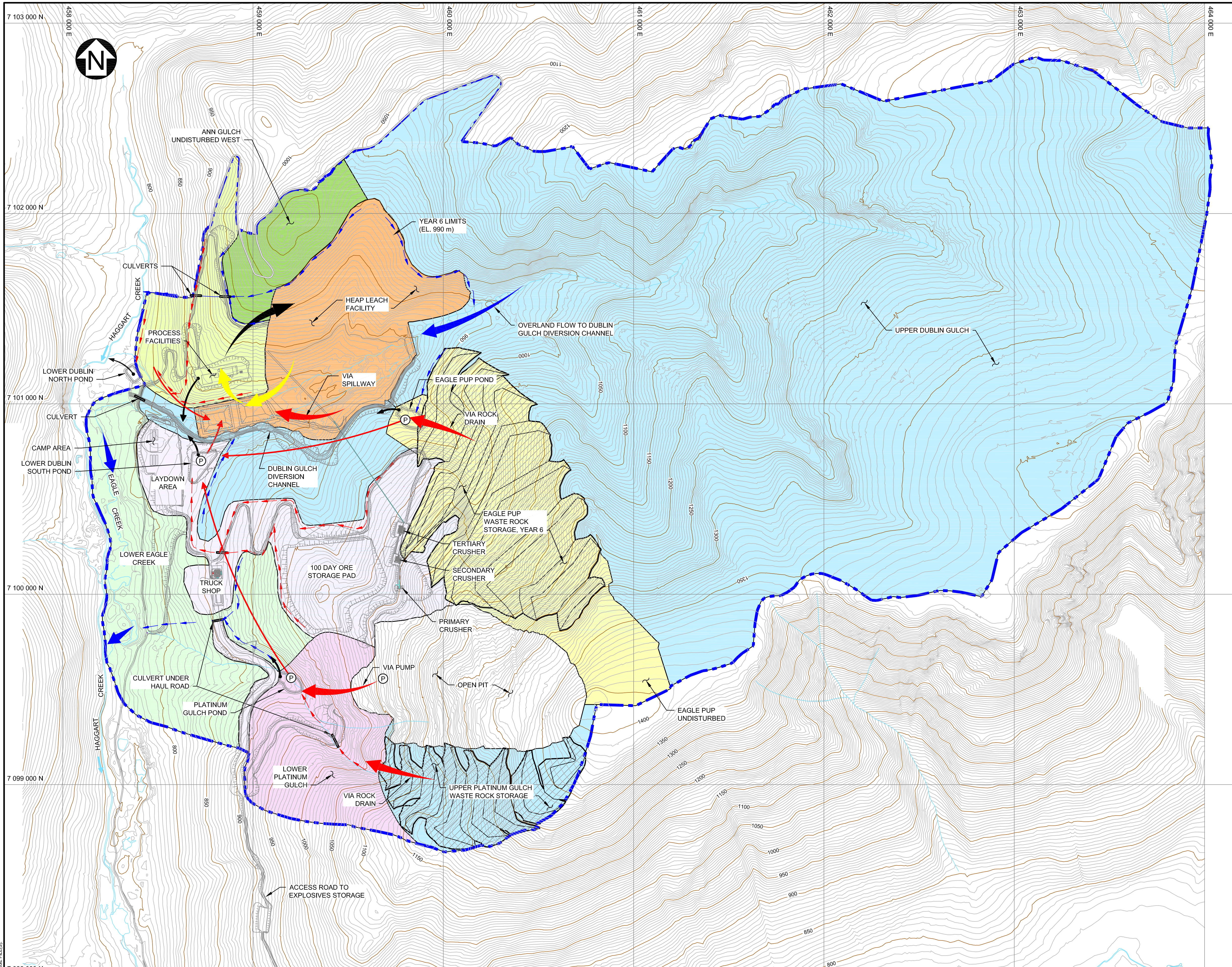

CATCHMENT AREAS	
DESCRIPTION	ha
UPPER DUBLIN GULCH (NON-CONTACT)	910
LOWER DUBLIN GULCH (NON-CONTACT)	46
OPEN PIT	71
HEAP LEACH & EVENTS PONDS	83
EAGLE PUP WRSA	94
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	95
LOWER PLATINUM GULCH	59
PROCESS FACILITIES	43
LOWER EAGLE CREEK	96
PLATINUM GULCH WRSA	48
EAGLE PUP	30
ANN GULCH UNDISTURBED WEST	29
TOTAL	1604

LEGEND:

SEDIMENT CONTROL POND

PUMP

CONTACT WATER
- PRIMARY ROUTING
- SECONDARY ROUTING
- CONTACT WATER DITCH

NON-CONTACT WATER
- PRIMARY ROUTING
- NON-CONTACT WATER DITCH

TREATED WATER
- TREATED WATER

PROCESS WATER
- PREGNANT SOLUTION
- BARREN SOLUTION

DRAINAGE DIVIDE

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN
OPERATIONS: PHASE II
YEAR 6

Knight Piésold CONSULTING

P/A NO. VA101-290/5 | REF NO. 1

FIGURE 3.4 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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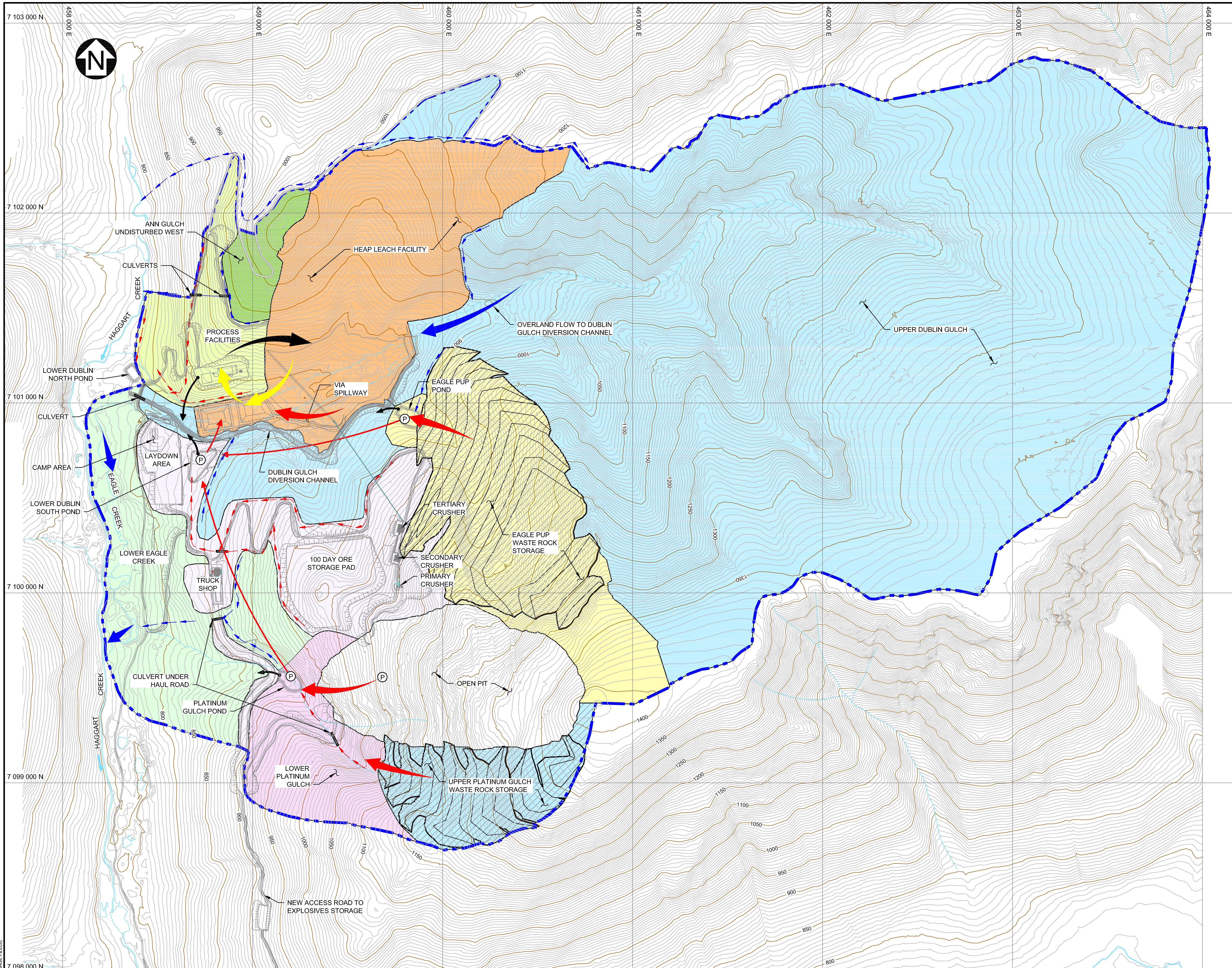

CATCHMENT AREAS	
DESCRIPTION	ha
UPPER DUBLIN GULCH (NON-CONTACT)	862
LOWER DUBLIN GULCH (NON-CONTACT)	46
OPEN PIT	81
HEAP LEACH & EVENTS PONDS	142
EAGLE PUP WRSA	98
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	93
LOWER PLATINUM GULCH	50
PROCESS FACILITIES	43
LOWER EAGLE CREEK	96
PLATINUM GULCH WRSA	47
EAGLE PUP	30
ANN GULCH UNDISTURBED WEST	16
TOTAL	1604

LEGEND:

SEDIMENT CONTROL POND

PUMP

CONTACT WATER

PRIMARY ROUTING

SECONDARY ROUTING

CONTACT WATER DITCH

NON-CONTACT WATER

PRIMARY ROUTING

NON-CONTACT WATER DITCH

TREATED WATER

TREATED WATER

PROCESS WATER

PREGNANT SOLUTION

BARREN SOLUTION

DRAINAGE DIVIDE

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN OPERATIONS: PHASE III YEAR 9

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P/A NO. VA101-290/5 | REF NO. 1

FIGURE 3.5 | REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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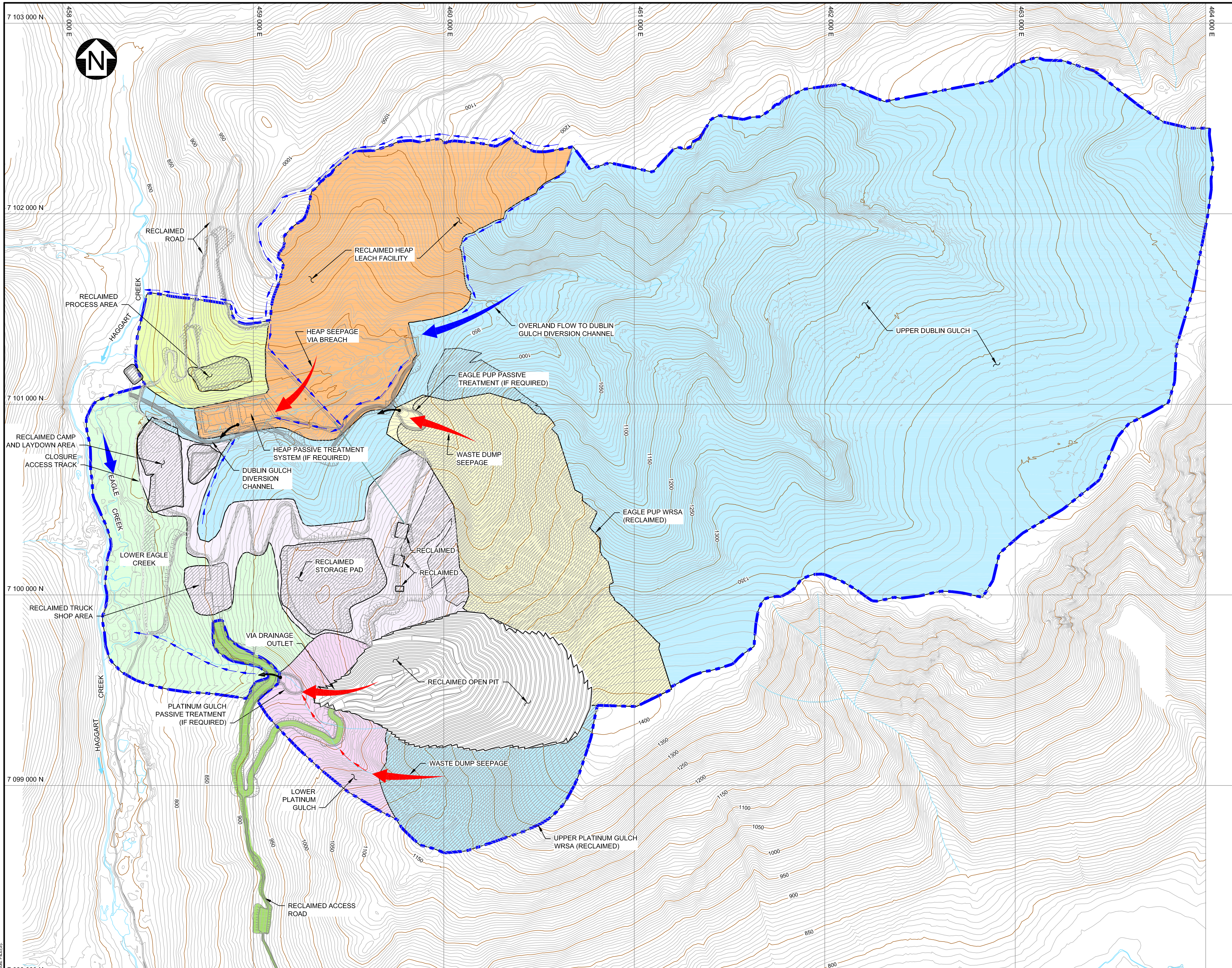

CATCHMENT AREAS	
DESCRIPTION	Ha
UPPER DUBLIN GULCH (NON-CONTACT)	858
LOWER DUBLIN GULCH (NON-CONTACT)	45
OPEN PIT	73
HEAP LEACH & EVENTS PONDS	143
EAGLE PUP WRSA	110
LAYDOWN, TRUCK STOP, ORE STORAGE & CRUSHING	101
LOWER PLATINUM GULCH	31
PROCESS FACILITIES	33
LOWER EAGLE CREEK	81
PLATINUM GULCH WRSA	48

LEGEND:

RECLAIM AREA
SEDIMENT CONTROL POND
PUMP

CONTACT WATER
PRIMARY ROUTING
CONTACT WATER DITCH

NON-CONTACT WATER
PRIMARY ROUTING
NON-CONTACT WATER DITCH

TREATED WATER
TREATED WATER

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 8.
2. CONTOUR INTERVAL IS 5 METRES.

SCALE A: 200 100 0 200 400 600 800 1000 m

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER MANAGEMENT PLAN POST CLOSURE

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P/A NO. VA101-290/5 | REF NO. 1

FIGURE 3.6 | REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
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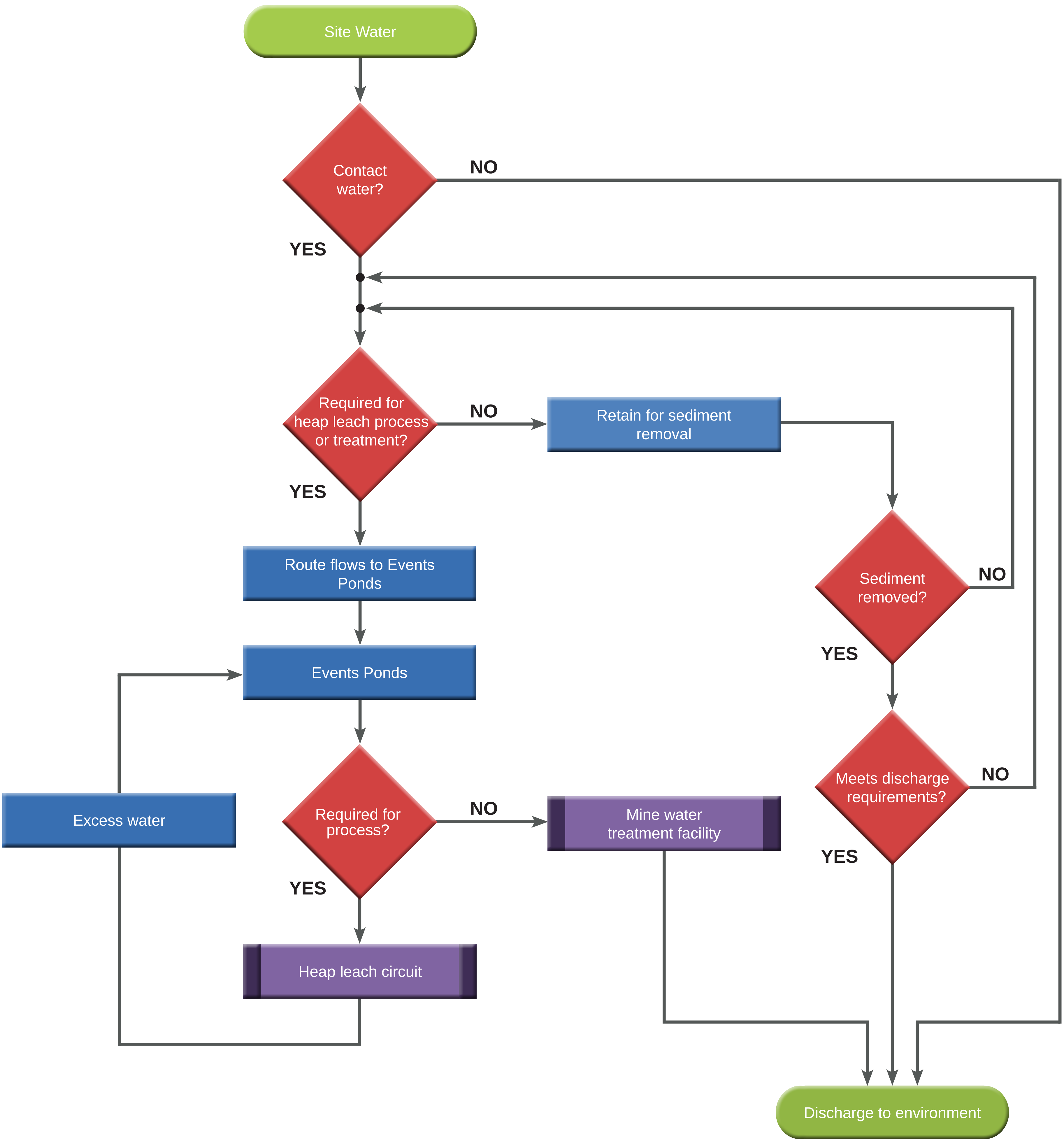

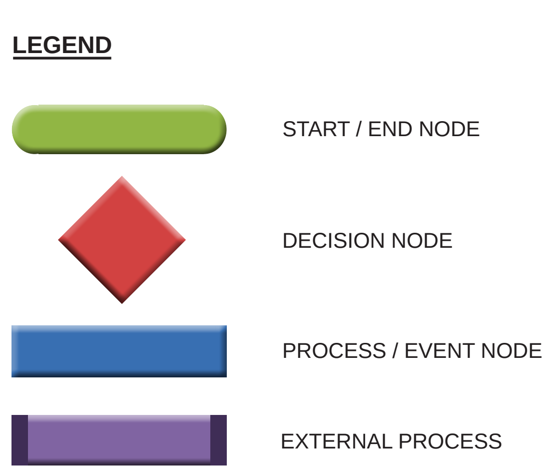

VICTORIA GOLD CORPORATION

EAGLE GOLD PROJECT

WATER MANAGEMENT
DECISION SUPPORT TOOL

Knight Piésold CONSULTING

P/A NO. VA101-290/5 | REF. NO. 1

FIGURE 3.7 | REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	06FEB'12	ISSUED WITH VA101-290/5-1	MP	CA	KJB

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APPENDIX A

DESIGN BASIS MEMORANDA

Knight Piésold CONSULTING

APPENDIX A1

DUBLIN GULCH DIVERSION CHANNEL DESIGN (TETRA TECH)

(Pages A1-1 to A1-54)

Tucson Office
3031 West Ina Road
Tucson, AZ 85741
Tel 520.297.7723 Fax 520.297.7724
www.tetratech.com

Technical Memorandum

To:	File	**From:**	Ronson Chee
Company:		**Date:**	December 23, 2011
Re:	Dublin Gulch Diversion Channel Design	**Doc #:**	114-320905X-5.3
CC:	Troy Meyer, P.E. (Tetra Tech)		

1.0 Introduction

This technical memorandum provides the hydrologic and hydraulic design information for the Dublin Gulch Diversion Channel (Channel) for the Eagle Gold Project. Construction of the Heap Leach Facility will encroach on the natural drainage of Dublin Gulch, this will necessitate diversion of Dublin Gulch around the Leaching Facilities (Heap Leach Pad, Confining Embankment, and Event Ponds). The diversion channel capacity and armoring is sized primarily for the 100-year, 24-hour storm event with adequate freeboard requirements. The channel will also have the capacity to convey the 500-year, 24-hour event without freeboard. Armoring will not be sized to accommodate the 500-year event.

In general, the Channel will redirect flow in Dublin Gulch to the south of the proposed Heap Leach Facility and will rejoin with Dublin Gulch prior to the existing natural junction with Haggart Creek. The Dublin Gulch Diversion Channel is a large structure, and will consist of the following major components:

- A turf reinforced armored “upper channel reach” with a slope of 1.0%.
- A series of concrete armored stepped “drop structures”. A drop structure consists of: an approach inlet channel (1.0% slope); a drop chute channel (50.0% slope), an energy dissipation pool (0.0% slope); and an outlet channel (1.0% slope).
- A turf reinforced armored “lower channel reach” with a slope of 1.0% with intermediate drop structures.

The Channel will receive the majority of its flow at the inlet (flow from Dublin Gulch), in addition, it will also intercept overland flow and run-on from Eagle Pup and Stuttle Gulch. The extents of the Dublin Gulch Diversion Channel is limited to immediately downstream of the Event Ponds. The remainder of the channel is subject to the final placement of facilities downstream and is to be completed by others as determined by Victoria Gold.

The design and armoring material presented in this memorandum is based on the available site geotechnical information. The design as presented is subject to change as more site geotechnical investigation is conducted.

2.0 Hydrologic Design Flows

Hydrologic peak flows for the 100-year, 24-hour and 500-year, 24-hour events were calculated by Knight Piesold (2011) and are summarized in Table 1 below.

Table 1. Dublin Gulch Diversion Channel Design Flows

Contributing Basin/Gulch	100-year, 24-hour Design Flow (m^3/s)	500-year, 24-hour Design Flow (m^3/s)
Dublin Gulch	8.5	10.3
Eagle Pup Gulch	1.5	4.9
Stuttle Gulch	0.6	2.6
Total Design Flow	**10.6**	**17.8**

For practical purposes the total design flow was used to size the entire length of the channel.

3.0 Channel Armoring Methodology and Calculations

The Dublin Gulch Diversion Channel was designed using the appropriate hydraulic equations for each component of the Channel. Vendor supplied software was used to perform the hydraulic calculations to compute flow depth and analyze the stability of the channel armoring.

3.1 Pyramat® Turf Reinforcement Mat Armoring

Pyramat® armoring was selected to armor the 1.0% slopes of the channel. Pyramat® by Propex Geosynthetics is a three-dimensional, woven polypropylene geotextile turf reinforcement mat. It allows vegetation to grow through the mat which increases its stability. Accordingly, two (2) channel conditions were analyzed to ensure that the Pyramat® armoring would be stable throughout all construction phases; an un-vegetated condition (short term recently constructed) and a fully vegetated condition (long term). Erosion Control Design Package (EC-DESIGN) 2003 was used to perform hydraulic calculations to ensure stability of the Pyramat® Armoring for all conditions. EC-DESIGN is a vendor supplied hydraulics program created by SI Geosolutions, Inc. and is created specifically to determine the stability of the Pyramat® turf reinforcement. The program has embedded shear strength and velocity calculations that determine the factory of safety (FS) of Pyramat® for various flow conditions and channel configurations. As recommended by the vendor, Propex Geosynthetics would need to verify calculations and evaluate site specific applicability of Pyramat® for the Channel. See Attachment B for product information.

The 1.0% portions of the Channel to be armored with Pyramat® will consist of the following from bottom to top:

- A prepared subgrade;

- A prepared seedbed and applied seeding; and
- Pyramat® Turf Reinforcement Mat.

3.1.1 Un-Vegetated Condition

The un-vegetated condition of the channel will govern the stability of the Pyramat® under peak flow conditions. A recently constructed channel using Pyramat® will allow the water to flow faster due to a smoother surface which increases the velocity and shear stress on the mat. For the un-vegetated condition a Manning's "n" roughness coefficient of 0.02 was used. This is the recommended minimum roughness coefficient according to Propex Geosynthetics. The stability analysis of the mat was conducted for the 100-year and 500-year events. The un-vegetated condition is a short lived condition. Construction procedures and scheduling will have to ensure that vegetation is established before channel is put into use. Detailed Calculations can be found in Attachment A.

3.1.2 Fully Vegetated Condition

The fully vegetated condition governs the depth of the channel. A higher vegetation growth in the channel will increase the Manning's "n" value which increases the flow depth in the channel. A fully vegetated condition increases the stability of the Pyramat®. It allows the Pyramat® to resist higher velocities and withstand higher shear stresses. The NRCS vegetated channel classification method which is embedded in the EC-Design software was used to estimate the vegetation condition in the channel. A vegetation retardance class of C was estimated (Mays, 200.

3.1.3 Pyramat Armoring Results

The calculated FS for velocity and shear stress stability using the EC-DESIGN software for the 100-year and 500-year events are presented in Table 2 below. A minimum FS of 1.5 is recommended for stability of the Pyramat®. Program output calculations can be found in Attachment A.

Table 2. Pyramat Stability Analysis Results

Channel Condition	Velocity FS		Shear Stress FS	
	100-year	500-year	100-year	500-year
Un-vegetated	1.0	0.9	2.4	1.8
Fully Vegetated	2.6	1.9	2.8	2.2

As shown, Pyramat® does not meet the required velocity FS for the un-vegetated condition for both storm events. For all other conditions and events the Pyramat® exceeds the recommended minimum FS. The stability analysis shows that the un-vegetated (recently constructed) condition is the most critical stage of the design. Thus, construction staging is critical to ensure that the Pyramat® is seeded and has adequate time to establish some vegetation. In order to determine the minimum vegetation threshold required for stability, an additional analysis was conducted using a vegetation retardance class of E, which is the lowest vegetation class established by the NRCS. A vegetation retardance class of E yields a velocity FS of 2.15 for the 100-year event and a velocity FS of 1.8 for the 500-year event. This shows that only a minimal amount of vegetation needs to be established to ensure stability of Pyramat® in the channel.

3.2 Armorflex® Articulated Concrete Block Armoring

Armorflex® Articulated Concrete Block was selected to armor the 50.0% slopes of the Drop Structure. Armorflex® by Armortech/Contech is a flexible matrix of concrete blocks that are laced longitudinally with steel revetment cables. The Armorflex® is an open cell concrete block that also allows for vegetation to be established. More specifically, the 70-T block class by Armortech was selected to as the armament material (see Attachment C for product information) which is suited for high velocity applications.

Appropriate installation is required for Armorflex armoring methods to be effective and is subject to the ground conditions encountered at the site. The proposed design and stability calculations will need to be verified by Contech to ensure stability in final design.

Armorflex® Design Software by Armortec Erosion Control Solution (Armortec, 2002) was used to perform hydraulic calculations to ensure stability of Armorflex®. Armorflex® Design Software is a vendor supplied program and is created specifically to determine the stability of Armorflex® in open channel flow. Embedded in the program are stability calculations that take into account the over-turning moments created by the moving water on a concrete block.

The armor on the 50.0% slopes will consist of the following from bottom to top:

- A prepared subgrade;
- A site specific geotextile;
- A minimum of 250 mm of angular drainage rock;
- A geogrid; and
- Armorflex® articulated concrete block

The calculated FS for overturning stability using the Armorflex® Design Software for the 100-year and 500-year events are presented in Table 3 below. A minimum FS of 1.5 is recommended for stability of the Armorflex®.

Table 3. Armorflex® Stability Analysis Results

Channel Armoring	FS	
	100-year	500-year
Armorflex® 70-T Block Type	1.5	1.1

As shown, the Armorflex® meets the required FS of 1.5 for the 100-year storm event but does not meet the required FS for the 500-year event. A FS of 1.1 suggests that the channel armoring may not necessarily result in failure, but may be subject to damage. Additional design features may be incorporated into the design to increase the FS such as; reducing the bed slope, reducing the channel sideslopes, and increasing the channel bottom width.

4.0 Channel Dimensions Results

4.1 Upper Channel Reach

The channel will primarily be in cut with the exception of a few fill areas. The upper channel reach will have the following dimensions.

- A bottom width of 4.0 m;
- A depth of 1.5 m;
- 2H:1V side-slopes; and
- A slope of 1.0%.

The upper channel reach will also receive overland flow along the length of the channel. At about mid-length of the upper reach, the channel will intercept flow from Eagle Pup basin. At the intersection with Eagle Pump the diversion channel will require additional armament where the Eagle pup flow enters the channel.

4.2 Drop Structure

The Drop Structure segment of the Channel is designed to facilitate the large elevation change across the site, and will be armored due to the steep slopes and high velocities in the channel. The Drop Structure will create various flow regimes due to the alternating slopes resulting in a complex water surface profile. The Drop Structure will require two types of armoring in order to effectively protect the Channel and dissipate the energy.

4.2.1 Inlet and Outlet Channel

The inlet and outlet channel portion of the drop structure will have the following dimensions:

- A bottom width that transitions from 4.0 m to 8.0 m;
- A depth that transitions from 1.5 m to 2.0 m;
- Side-slopes that range from 2H:1V to 3H:1V; and
- A slope of 1.0%.

4.2.2 Drop Chute

The drop chute portion of the Channel will have the following dimensions:

- A bottom width of 8.0 m;

- A depth of 2.0 m;
- 3H:1V side-slopes; and
- A slope of 50.0%.

4.2.3 Energy Dissipation Pool

Energy Dissipation Pools are used to reduce the energy gained within the water from the 50% slopes. Energy is reduced through a hydraulic jump, which will occur when there is an abrupt change in channel slope (from steep to shallow), and as the water changes from super critical flow to subcritical flow. Additionally, the jump must be fully dissipated, with the flow returning to subcritical prior to entering the outlet channel. The pools are designed such that the hydraulic jump calculated is retained within the pool and will have dissipated sufficient energy to return the flow back to the subcritical flow. Preliminary calculations were performed to determine the height and length of the jump which was used to determine the dimensions of the Energy Dissipation Pool to ensure that water does not “jump” out of the pool/channel.

The Energy Dissipation Pools will have the following dimensions:

- A bottom width of 8.0 m;
- A depth of 3.0 m;
- 3H:1V side-slopes; and
- A slope of 0.0%.

4.3 Lower Channel Reach

The lower channel reach is similar to the upper channel reach but will have two intermediate drop structures to account for abrupt elevation changes along the channel alignment. The channel will primarily be in cut with the exception of a few fill areas. The lower channel reach will ultimately discharge into Haggart Creek, however, this part of the channel was not designed. The lower channel reach will have the following dimensions.

- A bottom width of 4.0 m;
- A depth of 1.5 m;
- 2H:1V side-slopes; and
- A slope of 1.0%.

4.4 Channel Dimensions Design Summary

The calculated flow depths and channel dimensions are summarized in Table 4 below. The flow depths shown are for the vegetated condition which gives the deepest flow depth.

Table 4. Dublin Gulch Diversion Channel Summary

Diversion Channel Segment		Armoring	Channel Slope (%)	Bottom Width (m)	Side slope (H:V)	100-yr Flow Depth (m)	500-yr Flow Depth (m)	Channel Design Depth (m)
Upper Channel Reach		Pyramat®	1.0	4.0	2:1	1.02	1.30	1.5
Drop Structure	Inlet Channel	Pyramat®	1.0	[1]4.0 - 8.0	[2]2:1 – 3:1	[1]1.02 – 0.74	[1]1.3 – 0.94	[3]1.5 - 2.0
	Drop Chute	Armorflex®	50.0	8.0	3:1	0.59	0.86	2.0
	Energy Dissipation Pool	Armorflex®	0.0	8.0	3:1	[4]2.4	[4]2.7	3.0
	Outlet Channel	Pyramat®	1.0	[1]4.0 - 8.0	[2]2:1 – 3:1	[1]1.02 – 0.74	[1]1.3 – 0.94	[3]1.5 - 2.0
[4]Lower Channel Reach		Pyramat®	1.0	4.0	2:1	1.02	1.30	1.5

1) Channel transitions between a 4.0 m and 8.0 m bottom width.
2) Channel side-slope transitions between 2H:1V and 3H:1V.
3) Channel depth transition from 1.5 m to 2.0 m.
4) Flow depth in Energy Dissipation pool is estimated by adding the hydraulic jump depth to an assumed full pool depth of 1 m.

The final channel design depth shows that the channel depth accommodates the required flow depths for the 100-year and 500-year events. The final channel design depths were selected based on the 100-year, 24-hour flow depth in addition to a freeboard of 0.3 m and an estimated super elevation effect of water of 0.1 m. The channel depths for the drop chute and energy dissipation pools were increased to account for increases in flow depth cause by possible air entrainment and wave action effects. These effects were only estimated for this level of design.

5.0 Conclusion and Considerations

Except for small fill areas along the channel, the majority of the channel was designed to be in cut in order to minimize construction complications. Final design of the Dublin Gulch Diversion Channel will include finalizing and verifying with the suppliers the selection of artificial erosion protection and subgrade preparation for the specified armoring materials. This is highly dependent on soil conditions along the channel alignment.

Special construction considerations must be taken into account during construction of the diversion channel. The channel must be completed prior to construction of the Confining Embankment, Heap Leach Pad and Ponds. The entire channel must have adequate vegetation growth established prior to redirecting flows into the channel.

The final design of the channel is subject to further site investigation. The proposed armament materials and channel design are based on the available data, and additional data such as soil conditions and geology along the channel alignment are needed to finalize the design. Rock encountered along the alignment may eliminate the need for armament and can alter the geometry of the channel or drop structure design.

REFERENCES

Armortec Erosion Control Solutions (2002). *ArmorFlex Design Manual Abridged version 2002.*

Knight Piesold Ltd., Aurala, C*.* (2011). *Email Correspondence Subject: Eagle Gold Design Precipitation Events.* Email dated July 4, 2011.

Mays, Larry W. (2005). *Water Resources Engineering,* 2005 Edition, John Wiley & Sons, Inc., 2005, pgs. 85-139, 596-599.

ATTACHMENT A
ARMORING STABILITY AND HYDRAULIC CALCULATIONS

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/2/2012 11:44:44 AM

Project Name: DGDC - 100 year, 24-hour Event
Description:
City: **State:** **Units:** Metric
Notes:

Channel Design

Channel Name: 100yr-unvegetated **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	No
Vegetation Class	
Soil Filled	Yes

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	4
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	10.6
Flow Duration (hrs)	24
Avg. Velocity (m/s)	3.07

Channel Side Slopes

Left (H:1 V)	2
Right (H:1 V)	2

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 0.64

Lining Materials		Velocity (m/s)			Shear Stress (Pascals)			Pass	Quantity
		Computed	Maximum Allowed	Safety Factor	Computed	Maximum Allowed	Safety Factor		(SM)
Left	PYRAMAT	2.770	3.530	1.270	48.940	181.800	3.710	N	3,354.100
Bottom	PYRAMAT	3.420	3.530	1.030	74.680	181.800	2.430	N	4,000.000
Right	PYRAMAT	3.010	3.530	1.170	58.050	181.800	3.130	N	3,354.100

Calculation Results

Flow Depth (m)	0.640	**Left Wetted Perimeter (m)**	1.440
Flow Area (m)	3.390	**Bottom Wetted Perimeter (m)**	3.990
		Right Wetted Perimeter (m)	1.440
		Total Wetted Perimeter (m)	6.870
Hydraulic Radius (m)	0.490	**Avg. Velocity (m/s)**	3.070
Composite 'n'	0.0200	**Avg. Discharge (m^3/s)**	10.600

Channel Lining Material Costs

Channel Name: 100yr-unvegetated **Units:** Metric

Lining Materials		Estimated Cost per Square (m) Quantity *	Unit Cost	% Waste	Material Cost
Left	PYRAMAT	3354.1	0.00	0	0.00
Bottom	PYRAMAT	4000	0.00	0	0.00
Right	PYRAMAT	3354.1	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: 0.00

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: 0.00

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/2/2012 11:46:14 AM

Project Name: DGDC - 100 year, 24-hour Event
Description:
City: **State:** **Units:** Metric
Notes:

Channel Design

Channel Name: 100yr-vegetated **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	C
Soil Filled	No

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	4
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	10.6
Flow Duration (hrs)	24
Avg. Velocity (m/s)	1.7

Channel Side Slopes

Left (H:1 V)	2
Right (H:1 V)	2

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 1.02

Lining Materials		Velocity (m/s)			Shear Stress (Pascals)			Pass	Quantity
		Computed	Maximum Allowed	Safety Factor	Computed	Maximum Allowed	Safety Factor		(SM)
Left	PYRAMAT	1.540	4.800	3.120	79.210	333.070	4.200	Y	3,354.100
Bottom	PYRAMAT	1.880	4.800	2.550	118.830	333.070	2.800	Y	4,000.000
Right	PYRAMAT	1.670	4.800	2.870	93.970	333.070	3.540	Y	3,354.100

Calculation Results

Flow Depth (m)	1.020	**Left Wetted Perimeter (m)**	2.290
Flow Area (m)	6.180	**Bottom Wetted Perimeter (m)**	3.990
		Right Wetted Perimeter (m)	2.290
		Total Wetted Perimeter (m)	8.570
Hydraulic Radius (m)	0.720	**Avg. Velocity (m/s)**	1.700
Composite 'n'	0.0468	**Avg. Discharge (m^3/s)**	10.600

Channel Lining Material Costs

Channel Name: 100yr-vegetated **Units:** Metric

Lining Materials		Estimated Cost per Square (m)			
		Quantity *	Unit Cost	% Waste	Material Cost
Left	PYRAMAT	3354.1	0.00	0	0.00
Bottom	PYRAMAT	4000	0.00	0	0.00
Right	PYRAMAT	3354.1	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: 0.00

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: 0.00

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/3/2012 3:40:18 PM

Project Name: DGDC - 100 year, 24-hour Event
Description:
City: **State:** **Units:** Metric
Notes:

Channel Design

Channel Name: 100yr-vegetated-8m **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	C
Soil Filled	No

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	8
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	10.6
Flow Duration (hrs)	24
Avg. Velocity (m/s)	1.6

Channel Side Slopes

Left (H:1 V)	3
Right (H:1 V)	3

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 0.74

Lining Materials		Velocity (m/s)			Shear Stress (Pascals)			Pass	Quantity
		Computed	Maximum Allowed	Safety Factor	Computed	Maximum Allowed	Safety Factor		(SM)
Left	PYRAMAT	1.300	4.800	3.690	60.690	333.070	5.490	Y	4,743.420
Bottom	PYRAMAT	1.830	4.800	2.620	120.340	333.070	2.770	Y	8,000.000
Right	PYRAMAT	1.680	4.800	2.860	101.080	333.070	3.300	Y	4,743.420

Calculation Results

Flow Depth (m)	0.740	**Left Wetted Perimeter (m)**	2.330
Flow Area (m)	7.530	**Bottom Wetted Perimeter (m)**	8.000
		Right Wetted Perimeter (m)	2.330
		Total Wetted Perimeter (m)	12.660
Hydraulic Radius (m)	0.590	**Avg. Velocity (m/s)**	1.600
Composite 'n'	0.0500	**Avg. Discharge (m^3/s)**	10.600

Channel Lining Material Costs

Channel Name: 100yr-vegetated-8m **Units:** Metric

Lining Materials		Estimated Cost per Square (m)			
		Quantity *	**Unit Cost**	**% Waste**	**Material Cost**
Left	PYRAMAT	4743.42	0.00	0	0.00
Bottom	PYRAMAT	8000	0.00	0	0.00
Right	PYRAMAT	4743.42	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: **0.00**

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: **0.00**

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/2/2012 11:46:43 AM

Project Name: DGDC - 100 year, 24-hour Event

Description:

City: **State:** **Units:** Metric

Notes:

Channel Design

Channel Name: 500yr-unvegetated **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	No
Vegetation Class	
Soil Filled	Yes

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	4
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	17.8
Flow Duration (hrs)	24
Avg. Velocity (m/s)	3.59

Channel Side Slopes

Left (H:1 V)	2
Right (H:1 V)	2

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 0.85

Lining Materials		Velocity (m/s) Computed	Velocity (m/s) Maximum Allowed	Velocity (m/s) Safety Factor	Shear Stress (Pascals) Computed	Shear Stress (Pascals) Maximum Allowed	Shear Stress (Pascals) Safety Factor	Pass	Quantity (SM)
Left	PYRAMAT	3.240	3.530	1.090	65.440	181.800	2.780	N	3,354.100
Bottom	PYRAMAT	4.000	3.530	0.880	99.420	181.800	1.830	N	4,000.000
Right	PYRAMAT	3.530	3.530	1.000	77.630	181.800	2.340	N	3,354.100

Calculation Results

Flow Depth (m)	0.850	**Left Wetted Perimeter (m)**	1.910
Flow Area (m)	4.880	**Bottom Wetted Perimeter (m)**	4.000
		Right Wetted Perimeter (m)	1.910
		Total Wetted Perimeter (m)	7.820
Hydraulic Radius (m)	0.620	**Avg. Velocity (m/s)**	3.590
Composite 'n'	0.0200	**Avg. Discharge (m^3/s)**	17.800

Channel Lining Material Costs

Channel Name: 500yr-unvegetated **Units:** Metric

Lining Materials		Estimated Cost per Square (m)			
		Quantity *	**Unit Cost**	**% Waste**	**Material Cost**
Left	PYRAMAT	3354.1	0.00	0	0.00
Bottom	PYRAMAT	4000	0.00	0	0.00
Right	PYRAMAT	3354.1	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: **0.00**

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: **0.00**

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/2/2012 11:47:12 AM

Project Name: DGDC - 100 year, 24-hour Event
Description:
City: **State:** **Units:** Metric
Notes:

Channel Design

Channel Name: 500yr-vegetated **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	C
Soil Filled	No

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	4
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	17.8
Flow Duration (hrs)	24
Avg. Velocity (m/s)	2.06

Channel Side Slopes

Left (H:1 V)	2
Right (H:1 V)	2

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 1.3

Lining Materials		Velocity (m/s)			Shear Stress (Pascals)			Pass	Quantity
		Computed	Maximum Allowed	Safety Factor	Computed	Maximum Allowed	Safety Factor		(SM)
Left	PYRAMAT	1.880	4.800	2.550	103.460	333.070	3.220	Y	3,354.100
Bottom	PYRAMAT	2.270	4.800	2.110	151.280	333.070	2.200	Y	4,000.000
Right	PYRAMAT	2.040	4.800	2.350	122.740	333.070	2.710	Y	3,354.100

Calculation Results

Flow Depth (m)	1.300	**Left Wetted Perimeter (m)**	2.910
Flow Area (m)	8.590	**Bottom Wetted Perimeter (m)**	4.000
		Right Wetted Perimeter (m)	2.910
		Total Wetted Perimeter (m)	9.820
Hydraulic Radius (m)	0.870	**Avg. Velocity (m/s)**	2.060
Composite 'n'	0.0441	**Avg. Discharge (m^3/s)**	17.800

Channel Lining Material Costs

Channel Name: 500yr-vegetated **Units:** Metric

Lining Materials		Estimated Cost per Square (m)			
		Quantity *	Unit Cost	% Waste	Material Cost
Left	PYRAMAT	3354.1	0.00	0	0.00
Bottom	PYRAMAT	4000	0.00	0	0.00
Right	PYRAMAT	3354.1	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: 0.00

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: 0.00

ECDesign® 2003 Channel Analysis Report

Project Information

Last Update: 1/3/2012 3:41:02 PM

Project Name: DGDC - 100 year, 24-hour Event
Description:
City: **State:** **Units:** Metric
Notes:

Channel Design

Channel Name: 500yr-vegetated-8m **Units:** Metric **Design Life:** 1200 months

Design Criteria

Flow Rate (Q)

Vegetation and Soil

Vegetated	Yes
Vegetation Class	C
Soil Filled	No

Channel Geometry

Bed Slope (m/m)	0.01
Req. Freeboard (m)	
Channel Length (m)	1000
Bottom Width (m)	8
Channel Depth (m)	1.5

Flow/Velocity

Discharge (m^3/s)	17.8
Flow Duration (hrs)	24
Avg. Velocity (m/s)	1.99

Channel Side Slopes

Left (H:1 V)	3
Right (H:1 V)	3

Channel Bend true

Bend Radius (m)	33
Outside Bend	Right

Required Factor of Safety

1.5

Results

Avg. Flow Depth (m): 0.94

Lining Materials		Velocity (m/s)			Shear Stress (Pascals)			Pass	Quantity
		Computed	Maximum Allowed	Safety Factor	Computed	Maximum Allowed	Safety Factor		(SM)
Left	PYRAMAT	1.620	4.800	2.960	78.980	333.070	4.220	Y	4,743.420
Bottom	PYRAMAT	2.260	4.800	2.120	154.060	333.070	2.160	Y	8,000.000
Right	PYRAMAT	2.090	4.800	2.300	131.560	333.070	2.530	Y	4,743.420

Calculation Results

Flow Depth (m)	0.940	**Left Wetted Perimeter (m)**	2.980
Flow Area (m)	10.220	**Bottom Wetted Perimeter (m)**	8.010
		Right Wetted Perimeter (m)	2.980
		Total Wetted Perimeter (m)	13.970
Hydraulic Radius (m)	0.730	**Avg. Velocity (m/s)**	1.990
Composite 'n'	0.0466	**Avg. Discharge (m^3/s)**	17.800

Channel Lining Material Costs

Channel Name: 500yr-vegetated-8m **Units:** Metric

Lining Materials		Estimated Cost per Square (m)			
		Quantity *	Unit Cost	% Waste	Material Cost
Left	PYRAMAT	4743.42	0.00	0	0.00
Bottom	PYRAMAT	8000	0.00	0	0.00
Right	PYRAMAT	4743.42	0.00	0	0.00

* Quanities do not reflect seam overlaps

Total Material Cost: 0.00

Installation Costs

Description	Quantity	Unit Cost	Costs per (SM)

Total Installation Cost: 0.00

ARMORFLEX DESIGN REPORT

ArmorFlex Blocks by ARMORTEC Erosion Control Solutions

4301 Industrial Drive
Bowling Green, Kentucky 42101
Phone (270) 843-4659
Toll free (800) 305-0523
Fax (270) 783-8952

Design Report Printed from Armorflex Design Software
Report Type: Summary

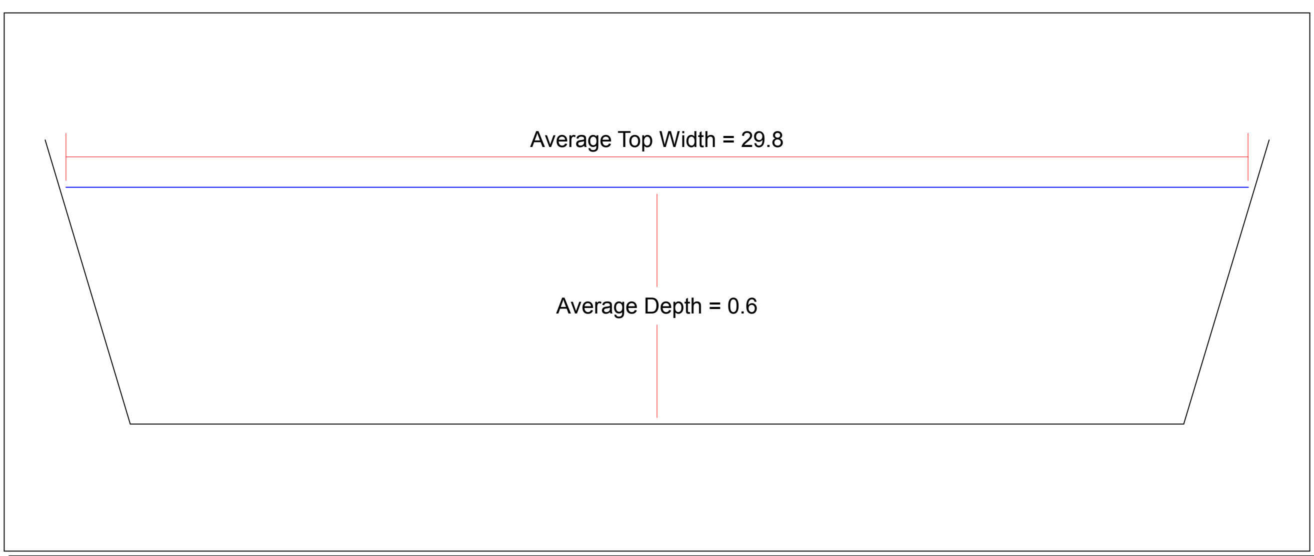
Company: Tetra Tech
Designer: Ronson Chee
Project No.: Project No. not supplied
Report Date: 1/2/2012

Client: Victoria Gold
Waterway: Dublin Gulch Diversion Channel
Location: Eagle Gold
Event: 100-year, 24-hour

Flow Scenario: Trapezoidal Channel
Block Cell Type: Open Cell Block
Block Taper Type: Tapered Block

Design Input for Factor of Safety Calculations

Left Side Slope (_H:1V) = 3
Right Side Slope (_H:1V) = 3
Channel Bottom Width (ft) = 26.248
Channel Bed Slope (ft/ft) = .5
Bend Coefficient = 1
Discharge (cfs) = 374
Projection Height (in.) = 0.2
Vertical Exageration for Plot = 10



Graphical Output of Normal Depth Calculations

Output from Factor of Safety Calculations

Block Type	n-Value	Depth (ft)	Velocity (ft/s)	Froude No.	Shear (psf)	Factor of Safety
40-T	0.031	0.59	22.66	5.2	16.44	1
50-T	0.031	0.59	22.66	5.2	16.44	1.2
60-T	0.031	0.59	22.66	5.2	16.44	1.3
70-T	0.031	0.59	22.66	5.2	16.44	1.5

ARMORFLEX DESIGN REPORT

ArmorFlex Blocks by ARMORTEC Erosion Control Solutions

4301 Industrial Drive
Bowling Green, Kentucky 42101
Phone (270) 843-4659
Toll free (800) 305-0523
Fax (270) 783-8952

Design Report Printed from Armorflex Design Software
Report Type: Summary

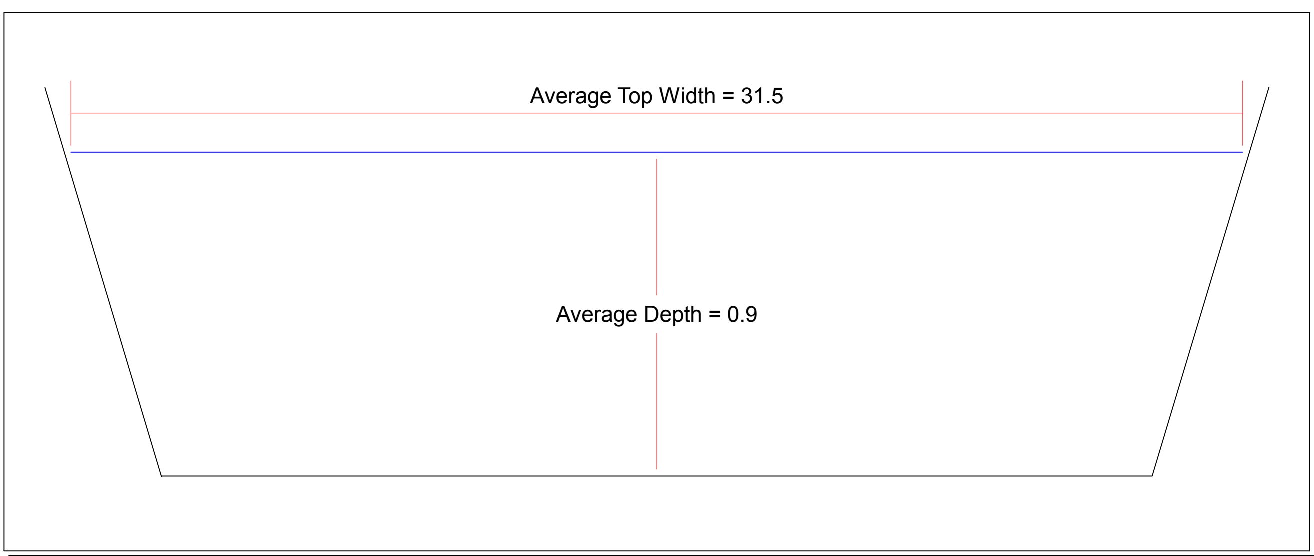
Company: Tetra Tech
Designer: Ronson Chee
Project No.: Project No. not supplied
Report Date: 1/2/2012

Client: Victoria Gold
Waterway: Dublin Gulch Diversion Channel
Location: Eagle Gold
Event: 500-year, 24-hour

Flow Scenario: Trapezoidal Channel
Block Cell Type: Open Cell Block
Block Taper Type: Tapered Block

Design Input for Factor of Safety Calculations

Left Side Slope (_H:1V) = 3
Right Side Slope (_H:1V) = 3
Channel Bottom Width (ft) = 26.3
Channel Bed Slope (ft/ft) = .5
Bend Coefficient = 1
Discharge (cfs) = 628
Projection Height (in.) = .2
Vertical Exageration for Plot = 10



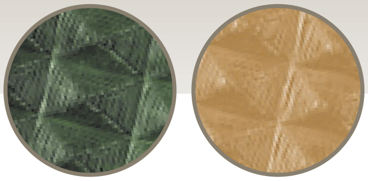
Graphical Output of Normal Depth Calculations

Output from Factor of Safety Calculations

Block Type	n-Value	Depth (ft)	Velocity (ft/s)	Froude No.	Shear (psf)	Factor of Safety
40-T	0.036	0.86	25.13	4.76	24.14	0.8
50-T	0.036	0.86	25.13	4.76	24.14	0.9
60-T	0.036	0.86	25.13	4.76	24.14	1
70-T	0.036	0.86	25.13	4.76	24.14	1.1

ATTACHMENT B
PYRAMAT TURF REINFORCEMENT MAT PRODUCT INFORMATION DATA SHEETS

PYRAMAT® HIGH PERFORMANCE TURF REINFORCEMENT MATS



Pyramat® High Performance Turf Reinforcement Mats (HPTRMs) feature our patented woven technology composed of a unique, three-dimensional matrix of polypropylene yarns. These yarns are designed in a uniform, dimensionally stable and homogenous configuration of pyramid-like structures, and they feature our patented X3® fiber technology specially created to lock soil in place. HPTRMs exhibit extremely high tensile strength as well as superior interlock and reinforcement capacity with both soil and root systems. They stand up to the toughest erosion applications where high loading and/or high survivability conditions are required, including maintenance access, steep slopes, arid and semi-arid environments, pipe inlets and outlets, structural backfills, utility cuts, potential traffic areas, abrasion, high-flow channels and/or areas where greater factors of safety are desired. Pyramat's superior characteristics provide a longer design life than our first and second generation standard TRMs, and meet the definition of HPTRM as defined by the U.S. EPA Storm Water Fact Sheet, "Turf Reinforcement Mats" (EPA 832-F-99-002) and FHWA FP-03 Specifications Section 713.8.

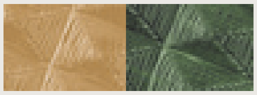
FEATURES & BENEFITS

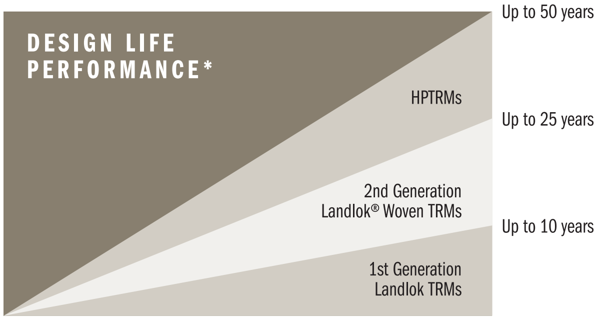
- A unique, patented matrix of pyramids formed with X3 fibers that gridlocks soil in place under unvegetated, partially vegetated and high-flow conditions
- Ideal for extended ultraviolet (UV) exposure, utility cuts, maintenance equipment traffic, pipe inlets and outlets and other high loadings
- X3 cross-sectional area for additional tensile strength, flexibility and seedling emergence
- Holds seed and soil in place on channels and slopes while vegetation grows
- Provides permanent reinforcement to enhance vegetation's natural ability to filter soil particles and prevent soil loss during storm events
- Promotes infiltration which leads to groundwater recharge
- Vegetation solution providing more pleasing aesthetics than conventional methods (i.e. rock riprap and concrete paving)
- Greater flexibility to maintain intimate contact with subgrade, resulting in rapid seedling emergence and minimal soil loss
- Can be used in arid and semi-arid environments
- Completely interconnected yarns that provide superior UV resistance throughout the HPTRM
- Meets requirement of 5 mm^2 or less mesh size to prevent wildlife entanglement in any sensitive habitats
- Superior product testing, performance and design life

Outperforms and is more cost-effective than conventional erosion control methods, including:

- Large rock riprap
- Grouted riprap
- Gabions
- Concrete paving
- Hard roadside shoulders
- Articulated concrete blocks
- Fabric formed revetments

PYRAMAT® HPTRMs PRODUCT FAMILY TABLE

PRODUCT		FUNCTIONAL LONGEVITY	COLOR	FIBER TYPE	# OF NETS	FP-03, SECTION 713 COMPLIANCE
	PYRAMAT®	PERMANENT	TAN OR GREEN	POLYPROPYLENE X3® FIBER TECHNOLOGY	0 (WOVEN)	EXCEEDS TYPE 5C



*Design life performance may vary depending upon field conditions and applications.

PYRAMAT® HIGH PERFORMANCE TURF REINFORCEMENT MATS

APPLICATION SUGGESTIONS FOR PYRAMAT® HPTRMs

	APPLICATION	FUNCTIONAL LONGEVITY	PRODUCT STYLE	INSTALLED COST[1]	ANCHOR SUGGESTIONS[2]
SLOPES	1H:1V OR STEEPER	PERMANENT	PYRAMAT®	\$12.00 - 18.00/yd² \$14.35 - 21.53/m²	2.5 ANCHORS/yd² 3 ANCHORS/m²
CHANNELS	SHEAR STRESS UP TO 15 lb/ft² (718 N/m²) VELOCITY UP TO 25 ft/sec (7.6 m/sec)				
BANKS	MODERATE WAVE ACTION = 1-2 ft (30 - 60 cm)				
CRITICAL STRUCTURES	PIPE INLETS & OUTLETS				

NOTES: 1. Installed cost estimates range from large to small projects according to material quantity. The estimates include material, seed, labor and equipment. Costs vary greatly in different regions of the country. 2. For anchor size and style, please see our HPTRM Installation Guidelines.

KEY PHYSICAL PROPERTIES OF PYRAMAT® HPTRMs

- Construction: Patented three-dimensional woven matrix makes it 10 times stronger than first generation TRMs, with performance unequaled in turf reinforcement.
- Tensile Strength: 4000 lb/ft (58.4 kN/m) tensile strength meets U.S. EPA definition of a High Performance Turf Reinforcement Mat.
- UV Resistance: Patented UV protection package provides superior resistance to the damaging effects of ultraviolet radiation.

SEVEN STEPS FOR SUCCESSFUL TRM SELECTIONS*						
1 SELECT APPLICATIONS	2 DETERMINE FUNCTIONAL LONGEVITY	3 ANTICIPATE CLIMATE (ARID, SEMI-ARID, OR TEMPERATE)	4 UNDERSTAND TRADITIONAL SOLUTION	5 PREDICT NON-HYDRAULIC STRESSES (MAINTENANCE STRESSES)	6 KNOW VEGETATION TYPE	7 CALCULATE HYDRAULIC STRESSES

*See Propex Engineering Bulletins or EC-DESIGN® software for more information.

PYRAMAT® HPTRM PROPERTY TABLE[1] ENGLISH & METRIC VALUES

	PROPERTY	TEST METHOD	VALUE[2]	PYRAMAT®
PHYSICAL	MASS PER UNIT AREA	ASTM D-6566	MARV	13.5 oz/yd² 455 g/m²
	THICKNESS	ASTM D-6525	MARV	0.4 in 10.2 mm
	LIGHT PENETRATION	ASTM D-6567	TYPICAL	10%
	COLOR	VISUAL	–	GREEN, TAN
MECHANICAL	TENSILE STRENGTH	ASTM D-6818	MARV	4000 x 3000 lb/ft 58.4 x 43.8 kN/m
	TENSILE ELONGATION	ASTM D-6818	MaxARV	65%
	RESILIENCY	ASTM D-6524	MARV	80%
	FLEXIBILITY/STIFFNESS	ASTM D-6575	TYPICAL	0.534 in-lbs 615000 mg-cm
ENDURANCE	FUNCTIONAL LONGEVITY	OBSERVED	TYPICAL	PERMANENT
DURABILITY	UV RESISTANCE[4]	ASTM D-4355	MINIMUM	90% @ 6000 HOURS
PERFORMANCE	SEEDLING EMERGENCE[3]	ECTC DRAFT METHOD #4	TYPICAL	296%
PACKAGING	ROLL WIDTH	MEASURED	TYPICAL	8.5 ft 2.6 m
	ROLL LENGTH	MEASURED	TYPICAL	90 ft 27.4 m
	ROLL WEIGHT	CALCULATED	TYPICAL	76 lb 34 kg
	ROLL AREA	MEASURED	TYPICAL	85 yd² 71 m²

NOTES: 1. The listed property values are effective 06/2009 and are subject to change without notice. 2. MARV indicates Minimum Average Roll Value calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the reported value. Maximum Average Roll Values (MaxARV) is calculated as typical plus two standard deviations. 3. Calculated as percent increase in average plant biomass with tall fescue grass seed in sand 14 days after seeding versus a non-RECP protected control specimen. 4. All components must meet UV resistance values.

PYRAMAT® HPTRM PERFORMANCE VALUES ENGLISH & METRIC UNITS

MATERIAL	FUNCTIONAL LONGEVITY	SHORT-TERM MAXIMUM SHEAR STRESS AND VELOCITY						MANNING'S "n"		
		VEGETATED[5]		PARTIALLY[6]		UNVEGETATED[7]		0"-6"	6"-12"	12"-24"
PYRAMAT®	PERMANENT	15 lb/ft² 718 N/m²	25 ft/sec 7.6 m/sec	10 lb/ft² 478 N/m²	20 ft/sec 6.1 m/sec	6.0-8.0 lb/ft² 285-383 N/m²	15 ft/sec 4.6 m/sec	0.035	0.028	0.017

NOTES: 5. Maximum permissible shear stress has been obtained through fully vegetated (70% to 100% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. Achieved after 14 weeks of vegetative establishment versus the industry standard of two full growing seasons. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information. 6. Maximum permissible shear stress has been obtained through partially vegetated (30% to 70% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information. 7. Maximum permissible shear stress has been obtained through unvegetated (0% to 30% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.

For downloadable documents like construction specifications, installation guidelines, case studies and other technical information, please visit our web site at **geotextile.com.** These documents are available in easy-to-use Microsoft® Word format.

PROPEX® | THE ADVANTAGE CREATORS.™

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INSTALLATION GUIDELINES

FOR LANDLOK® TRMs AND PYRAMAT® HPTRMs

BEFORE YOU BEGIN

Thank you for purchasing high quality Landlok® Turf Reinforcement Mats (TRMs) and Pyramat® High Performance Turf Reinforcement Mats (HPTRMs) from Propex. We're committed to offering the best erosion control products in the industry.

It is important to follow these installation guidelines for a successful project. (Note: Construction shall be performed in accordance with the specific project bid documents, construction drawings, and specifications.) In addition, we suggest that a pre-installation meeting be held with the construction team and a representative from Propex. This meeting shall be scheduled by the contractor with at least two weeks notice. Also, Propex suggests that installation monitoring of our TRMs and HPTRMs be performed by a qualified independent third party.

SITE PREPARATION

- Grade and compact area of TRM/HPTRM installation as directed and approved by Engineer. Subgrade shall be uniform and smooth. Remove all rocks, clods, vegetation or other objects so the installed mat will have direct contact with soil surface.
- Prepare seedbed by loosening the top 2-3 in (50-75 mm) minimum of soil.
- Incorporate amendments such as lime and fertilizer and/or wet the soil, if needed.
- Do not mulch areas where mat is to be placed.

SEEDING

- Apply seed to soil surface before installing mat. Disturbed areas shall be reseeded.
- When soil filling, first install the mat, apply seed and then soil-fill per guidelines (see page 8).
- Consult project plans and/or specifications for seed types and application rates.

INSTALLATION ON STABLE SOIL SLOPES

- Excavate a 12 x 6 in (300 x 15 mm) minimum longitudinal anchor trench 2-3 ft (600-900 mm) over crest of slope (see Figure 2).
- Install top end of mat into trench and secure to bottom using suggested ground anchoring devices (see Tables 1 and 2 on page 7) spaced every 12 in (300 mm) minimum. Backfill and compact soil into trench (see Figure 2).
- Unroll mat down slope. Landlok® 1051 shall have the geotextile on bottom.
- Overlaps shall be 6 in (150 mm) minimum and anchored every 18 in (450 mm) minimum along the overlap. Secure using suggested ground anchoring devices shown in Table 1 for appropriate frequency and pattern. Overlaps are shingled away from prevailing winds (see Figure 1).
- Unroll mat in a manner to maintain direct contact with soil. Secure mat to ground surface using ground anchoring devices (see Table 1). Anchors shall be placed in accordance with the Anchor Pattern Guide on page 7.
- Excavate a 12 x 6 in (300 x 150 mm) key anchor trench at toe of slope (see Figure 3).
- Place bottom end of mat into key anchor trench at toe of slope and secure to bottom of trench using suggested ground anchoring devices (see Tables 1 and 2) spaced every 12 in (300 mm) minimum. Backfill and compact soil into trench (see Figure 3).
- If the potential for standing and/or flowing water exists at the toe of slope, the key anchor trench at the toe detail (see Figure 3) is not sufficient. Consult the project engineer for the appropriate detail.
- Irrigate as necessary to establish/maintain vegetation. Do not over-irrigate.

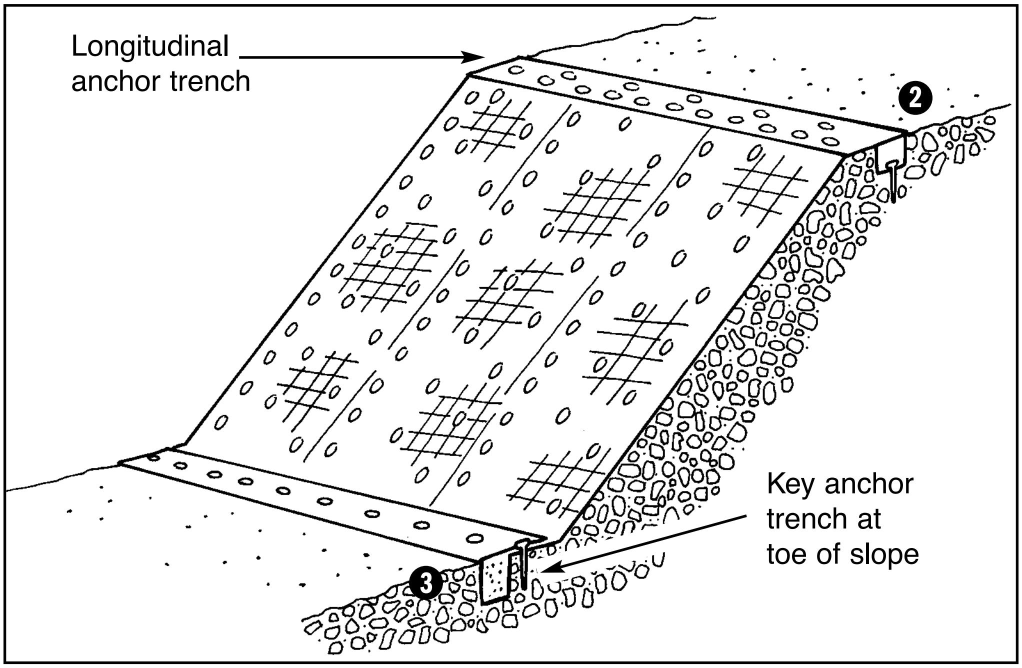


FIGURE 1

Installation of permanent turf reinforcement mat on slope

- Overlaps 6 in (150 mm) minimum
- Space anchors 18 in along overlaps down the slope
- Anchor pattern shall be in accordance with the "Anchor Pattern Guide" found on page 7

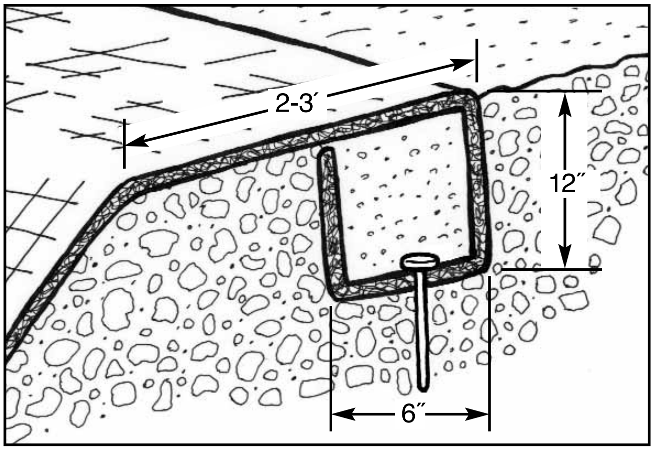


FIGURE 2

Longitudinal anchor trench at top of slope

· Space anchors 12 in (300 mm) along bottom of trench

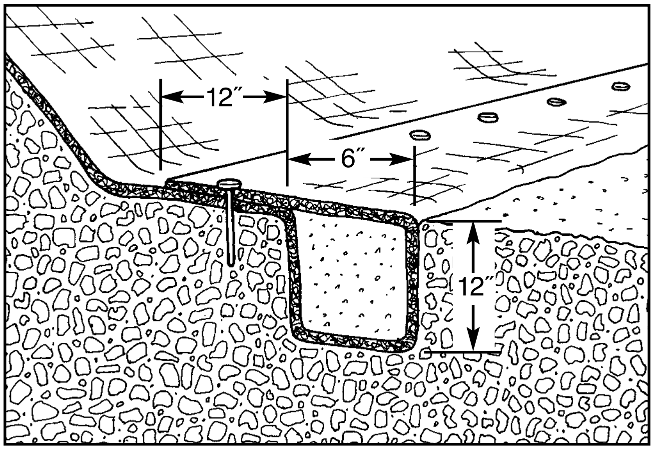


FIGURE 3

Key anchor trench at toe of slope

INSTALLATION IN STORM WATER CHANNELS

- Figure 4 shows general installation layout and details for TRMs and HPTRMs in storm water channels.
- Excavate an initial anchor trench 12 in (300 mm) minimum deep and 12 in (300 mm) minimum wide across the channel at downstream end of project (see Figure 5). Deeper initial anchor trench is needed in channels that have the potential for scour.
- Excavate longitudinal anchor trenches 12 in (300 mm) minimum deep and 6 in (150 mm) minimum wide along both sides of the installation to bury edges of mat (see Figure 6). The trench shall be located 2-3 ft (600-900 mm) over crest of slope.
- Place roll end into the initial anchor trench and secure with anchoring devices at 12 in (300 mm) minimum intervals (see Figure 5). Position adjacent rolls and secure in anchor trench in same manner. Backfill and compact soil into trench.
- Unroll mat in the upstream direction over the compacted trench.
- Continue installation as described above, overlapping adjacent rolls as follows:
  - Roll edge: 6 in (150 mm) minimum with upslope mat on top. Secure with one row of ground anchoring devices on 12 in (300 mm) minimum intervals (see Figure 7).
  - Roll end: 12 in (300 mm) minimum with upstream mat on top. Secure with two rows of ground anchoring devices staggered 12 in (300 mm) minimum apart on 12 in (300 mm) minimum intervals (see Figure 8).
- Fold and secure mat rolls snugly into intermittent check slots. Lay mat in the bottom and fold back against itself. Anchor through both layers of blanket or mat at 1 ft (300 mm) intervals then backfill and compact soil (Figure 9). Continue rolling upstream over the compacted slot to the next check slot or terminal anchor trench. Check slots are placed at 25 to 30 ft (7.6 to 9.1 m) intervals perpendicular to flow.

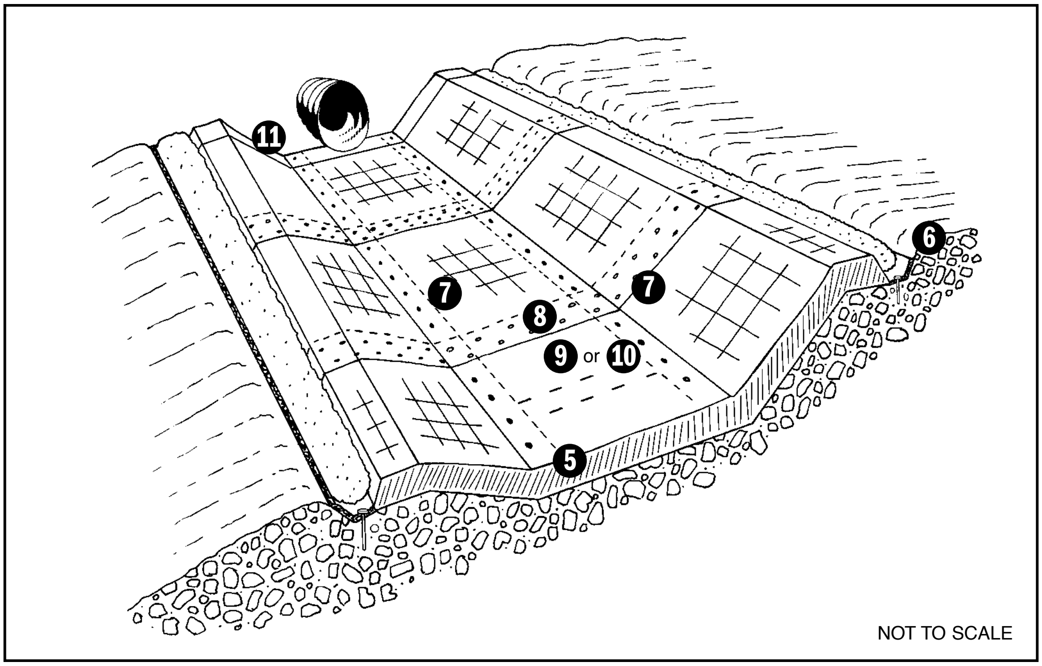


FIGURE 4 Installation of TRMs & HPTRMs in storm water channels

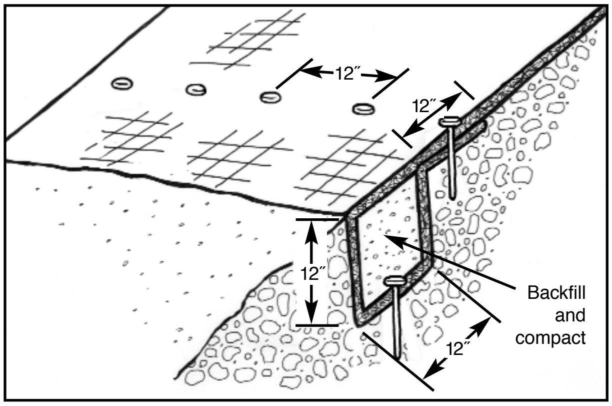


FIGURE 5 Initial anchor trench (downstream) detail

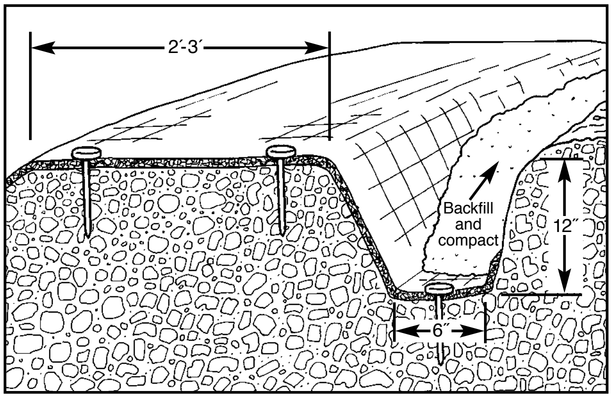


FIGURE 6 Longitudinal anchor trench detail (trapezoidal channel)

- An alternate method to the intermittent check slot is the simulated check slot. This method includes placing two staggered rows of anchors on 4 in (100 mm) centers at 30 ft (9.1 m) intervals (see Figure 10).
- Excavate terminal anchor trench 12 in wide x 12 in deep (300 x 300 mm) minimum across the channel at the upstream end of the project (see Figure 11). Deeper terminal anchor trench is needed in channels that have the potential for scour.
- Anchor, backfill and compact upstream end of mat in 12 x 12 in (300 x 300 mm) minimum terminal anchor trench (see Figure 11). Unroll mat in downstream direction over compacted trench with a minimum 2 ft (600 mm) lap. Secure with anchors in accordance with Figure 8.
- Secure mat using suggested ground anchoring devices (see Tables 1 and 2 on page 7) for appropriate frequency and pattern (see Anchor Pattern Guide on page 7).
- Seed and fill with soil for enhanced performance. See Soil Filling Section on page 8.
- When using Landlok® 1051, seed after installing mat and then fill with soil.
- Irrigate as necessary to establish/maintain vegetation. Do not over irrigate.

NOTE: If you encounter roll with factory overlap, install factory seam such that it shingles in the direction of the flow of water. Place anchoring devices in accordance with Figure 8 "Overlap at roll end" on page 5.

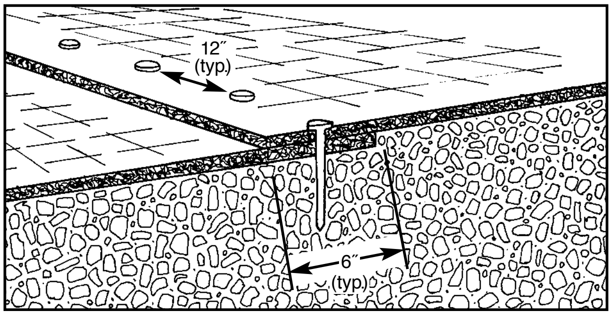


FIGURE 7 Overlap at roll edge

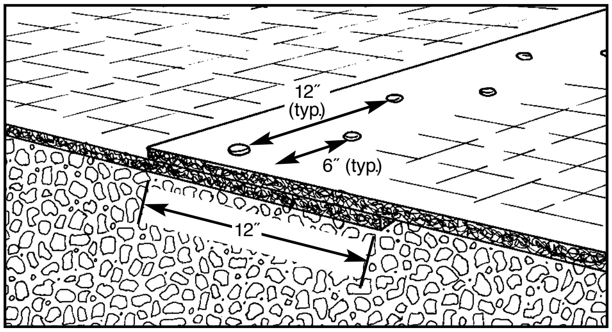


FIGURE 8 Overlap at roll end

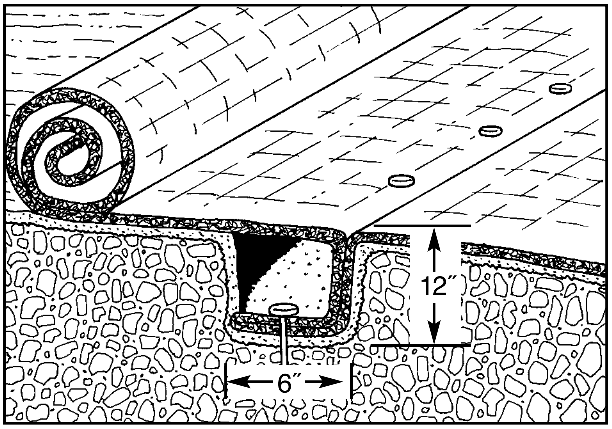


FIGURE 9 Intermittent check slot (channels)

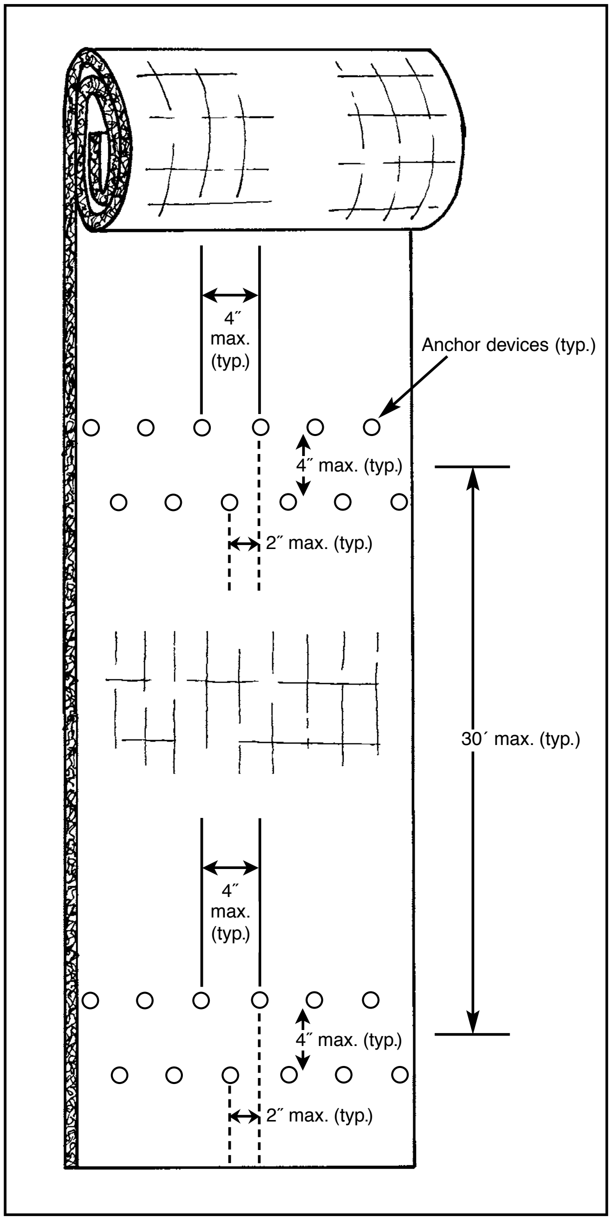


FIGURE 10 Simulated check slot

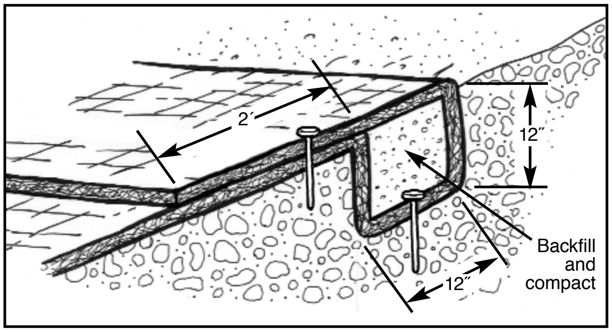


FIGURE 11 Terminal anchor trench (upstream) detail

SPECIAL TRANSITION GUIDELINES

- Rock Riprap
  - Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum at the transition between the mat and the rock riprap.
  - Place roll end into anchor trench and secure with suggested anchoring devices at 12 in (300 mm) minimum intervals. Position adjacent rolls and secure in anchor trench in same manner.
  - Backfill the anchor trench with rock riprap.
  - Place rock riprap as specified, extending approximately 3 ft (1 m) minimum beyond the anchor trench onto the mat.
- Concrete
  - Alternative 1: Concrete Apron
    - Place ready mixed concrete directly onto a 3 ft (0.9 m) wide minimum strip of mat.
  - Alternative 2: Concrete Backfill
    - Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum at the edge of the concrete structure.
    - Place roll end into anchor trench and secure with suggested anchoring devices at 12 in (300 mm) minimum intervals. Position adjacent rolls and secure in anchor trench in same manner.
    - Backfill trench with concrete slurry.
  - Alternative 3: Bolt to Structure (HPTRMs Only)
    - Cast threaded dowel in fresh ready mix concrete or install expanding bolt into cured concrete. Then affix HPTRM with washer (minimum 2 in or 50 mm diameter) or batten strip and bolt.
- Pipe Inlets/Outlets (HPTRMs Only)
  - Review the construction drawings and project specifications to evaluate the required area to be treated.
  - Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum above the pipe to bury end of HPTRM roll. The trench shall be located a minimum 2-3 ft (600-900 mm) above the pipe inlet/outlet.
  - Backfill and compact soil into trench.
  - Cut HPTRM to meet project requirements, slope length and pipe diameter.
  - Unroll HPTRM down the slope and secure around pipe circumference with ground anchoring devices spaced 6 in (150 mm) minimum. Also, the HPTRM can be secured around the pipe in a 12 x 12 in (300 x 300 mm) minimum trench filled with concrete slurry.

GROUND ANCHORING DEVICES

- Ground anchoring devices are used to secure the mat to the soil using the suggested anchor device (see Tables 1 and 2 on page 7) at a minimum frequency and pattern shown on the Anchor Pattern Guide on page 7.
- U-shaped wire staples or metal geotextile pins can be used to anchor mat to the ground surface. Wire staples should be a minimum thickness of 8 gauge (4.3 mm). Metal pins should be at least 0.20 in (5 mm) diameter steel with a 1 1/2 in (38 mm) steel washer at the head of the pin. Wire staples and metal pins should be driven flush to the soil surface. All anchors should be between 6-24 in (150-600 mm) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils. Heavier metal stakes may be required in rocky soils.

TABLE 1: SUGGESTED GROUND ANCHORING DEVICE SELECTION*

		DEGRADABLE STAKES	WIRE STAPLES	METAL PIN/WASHERS OR NAIL/WASHERS	PERCUSSION DRIVEN ANCHORS
PRODUCT	LANDLOK® ECBs	●	●		
	LANDLOK® TRMs		●	●	
	PYRAMAT®		●	●	●
APPLICATION	SLOPES	●	●	●	●
	BANKS			●	●
	CHANNELS		●	●	●

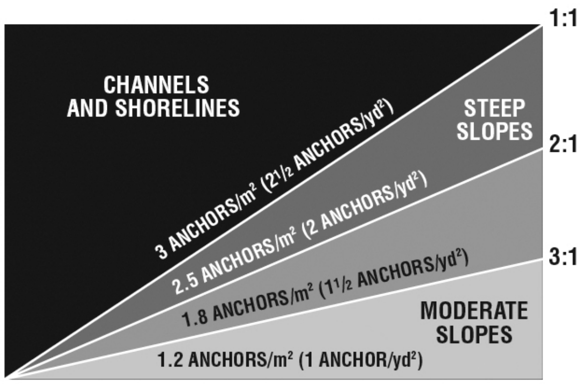
TABLE 2: SUGGESTED LENGTHS OF GROUND ANCHORING DEVICES*

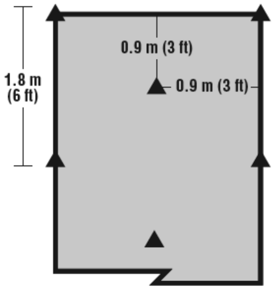
		6-INCH	12-INCH	18-INCH	24-INCH
SOIL TYPES	ROCKY	●			
	CLAYEY	●	●		
	SILTY		●	●	
	SANDY			●	●

*The performance of ground anchoring devices is highly dependent on numerous site/project specific variables. It is the sole responsibility of the project engineer and/or contractor to select the appropriate anchor type and length. Anchoring shall be selected to hold the mat in intimate contact with the soil subgrade and resist pullout in accordance with the project's design intent.

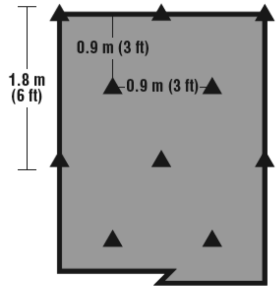
ANCHOR PATTERN GUIDE

- The shaded areas in the diagram provide anchor suggestions based on slope gradient and/or anticipated flow conditions. When the correct number of anchors has been determined, refer to the four illustrations below to establish anchor pattern. Increased anchoring may be required depending upon site conditions.

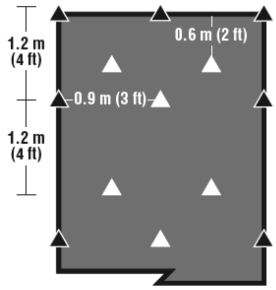




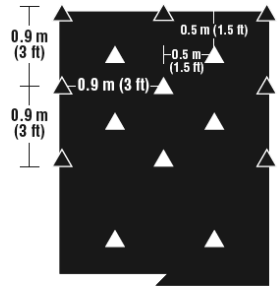
1.2 ANCHORS/m^2 (1 ANCHOR/yd^2)



1.8 ANCHORS/m^2 ($1\frac{1}{2}$ ANCHORS/yd^2)



2.5 ANCHORS/m^2 (2 ANCHORS/yd^2)



3 ANCHORS/m^2 ($2\frac{1}{2}$ ANCHORS/yd^2)

SOIL FILLING

- Soil filling is suggested for optimum performance.
- After seeding, spread and lightly rake ½-¾ in (12-19 mm) minimum of fine site soil or topsoil into the mat and completely fill the voids using backside of rake or other flat tool.
- If equipment must operate on the mat, make sure it is of the rubber-tired type. No tracked equipment or sharp turns are allowed on the mat.
- Avoid any traffic over the mat if loose or wet soil conditions exist.
- Smooth soil-fill in order to just expose the top netting of matrix. Do not place excessive soil above the mat.
- Broadcast additional seed and install a Landlok® ECB above the soil-filled mat (if desired).
- Hydraulically-applied mulch or seed may be used as an alternate to soil-fill on select applications. Consult manufacturer's technical representative for more information.
- Consult manufacturer's technical representative or local distributor for installation assistance, particularly if unique conditions apply (sandy soils and infertile environments).

MAINTENANCE

All slopes, channels, banks and other transition structures shall be maintained to assure the expected design life of the reinforced vegetated system. Here are a few tips that should prove helpful:

- Monitoring
  - Should be conducted semi-annually and after major storm events. This should include: observing the condition of the vegetation; testing the irrigation system; checking condition of all permanent erosion control systems; observing sediment and debris deposits that need removal.
- Vegetation
  - Repair and maintenance of various types of vegetation shall be consistent with their original design intent, including:
    - Grass/Turf Areas: applications shall be maintained for adequate cover and height.
    - Mowing: grasses shall be mowed according to normal maintenance schedules as determined by local jurisdictions or maintenance agreements; operations shall not start until vegetation achieves a minimum height of 6 in (150 mm); mower blades shall be greater than 6 in (150 mm) above the mat.
    - Unvegetated Areas: shall be re-seeded and soil-filled (if applicable).
- Sediment and Debris Deposits
  - Accumulation of sediment and debris can reduce the hydraulic capacity of channels, clog inlet and outlet structures and can damage existing vegetation. Sediment and debris removal is a vital part of system maintenance.
    - Removal: shall be done carefully to avoid damage. When excavation is within 12 in (300 mm) minimum of matting, removal shall be done by hand or with a visual "spotter." If equipment must operate on the mat, make sure it is of the rubber-tired type. No tracked equipment or sharp turns are allowed on the mat.
      - Alternatively, "stake chasers" or some other form of permanent visual markers can be utilized to provide a visual marker for maintenance activities.
- Damaged Sections
  - Missing or damaged sections of the matting should be replaced per the installation guidelines.
    - Repairing Rips or Holes: these should be patched with identical matting material. First, carefully cut out the damaged section with a knife. Then replace and compact soil to the elevation of the surrounding subgrade and plant seed. Cut a piece of replacement material a minimum of 12 in (300 mm) larger than the rip or tear. Use ties to attach the replacement material to the existing material. At overlaps, the upstream and upslope material should be on top. Secure the replacement material with ground anchoring devices spaced every 6 in (150 mm) around the circumference of the repair and at the frequency and spacing shown in the Anchor Pattern Guide on page 7. Seed and soil fill replacement area.

PROPEX | THE ADVANTAGE CREATORS.™
GEOSYNTHETICS

Propex Inc.
6025 Lee Highway, Suite 425
PO Box 22788
Chattanooga, TN 37422

PH: 423 899 0444
PH: 800 621 1273
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www.geotextile.com

PYRAMAT® high performance turf reinforcement mat (HPTRM) is a three-dimensional, lofty, woven polypropylene geotextile that is available in green or tan which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix is composed of polypropylene monofilament yarns ***featuring X3® technology*** woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, demonstrates superior UV resistance, and enhances seedling emergence.

PYRAMAT conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2000 certification. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

		MARV[2]	
PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
PHYSICAL			
Mass/Unit Area	ASTM D-6566	13.5 oz/yd²	457.7g/m²
Thickness	ASTM D-6525	0.4 in	10.2 mm
Light Penetration (% Passing)	ASTM D-6567	15% (Max)	15% (Max)
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength (Grab)	ASTM D-6818	4000 x 3000 lb/ft	58.4 x 43.8 kN/m
Elongation	ASTM D-6818	40 x 35%	40 x 35%
Resiliency	ASTM D-6524	80%	80%
Flexibility	ASTM D-6575	0.534 in-lb (avg)	29.6 mg-cm (avg)
ENDURANCE			
UV Resistance % Retained 6000 hrs	ASTM D-4355	90%	90%
UV Resistance % Retained 10000 hrs	ASTM D-4355	85%	85%
PERFORMANCE			
Velocity[3] (Fully Vegetated)	Large Scale	20 ft/sec	6.1 m/sec
Velocity[3] (65 – 70% Vegetated)	Large Scale	16 ft/sec	4.9 m/sec
Velocity[3] (20 – 30% Vegetated)	Large Scale	12 ft/sec	3.7 m/sec
Shear Stress[3] (Fully Vegetated)	Large Scale	16 lb/ft²	766 Pa
Shear Stress[3] (65 – 70% Vegetated)	Large Scale	12 lb/ft²	575 Pa
Shear Stress[3] (20 – 30% Vegetated)	Large Scale	5 lb/ft²	239 Pa
Manning's "n"[4] (Unvegetated)	Calculated	0.028	0.028
Seedling Emergence[4]	ECTC Draft Method #4	296%	296%
ROLL SIZES		8.5 ft x 90 ft	2.6 m x 27.4 m

NOTES:

1. The property values listed are effective 04/2011 and are subject to change without notice.
2. MARV indicates minimum average roll value calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the value reported.
3. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
4. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

GEOTEXTILE SYSTEMS BY PROPEX

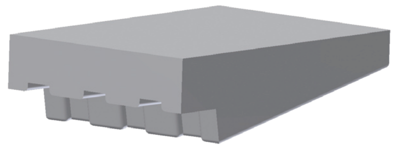
ENGINEERING EARTH
www.geotextile.com

Propex Operating Company, LLC · 6025 Lee Highway, Suite 425 · PO Box 22788 · Chattanooga, TN 37422
ph 423 899 0444 · ph 800 621 1273 · fax 423 899 7619

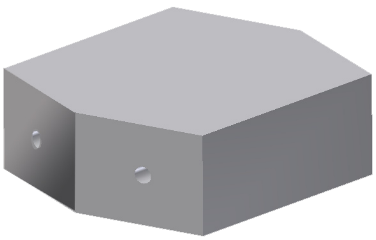
ATTACHMENT C
ARMORFLEX ARTICULATED CONCRETE BLOCK
PRODUCT INFORMATION
DATA SHEETS

CONTECH® CONSTRUCTION PRODUCTS INC.

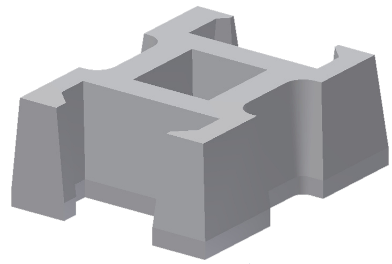
Armortec Product Details



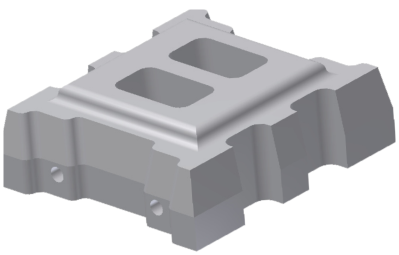
ArmorWedge®



ArmorRoad®

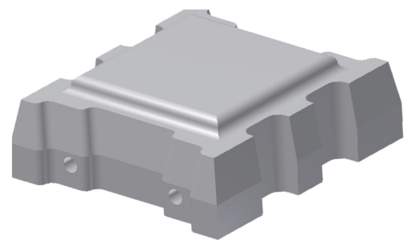


ArmorLoc®

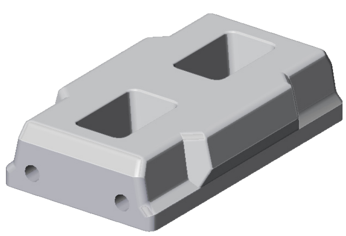


ArmorFlex® - Open Cell

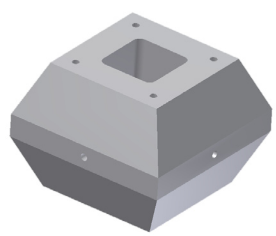
A-Jacks®



ArmorFlex® - Close Cell



ArmorStone®

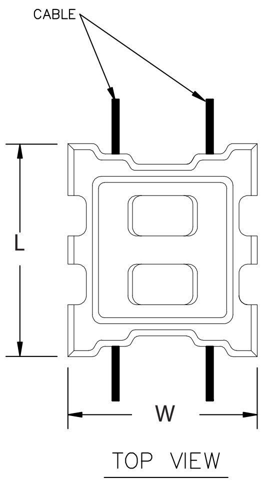


ArmorFlex® OS

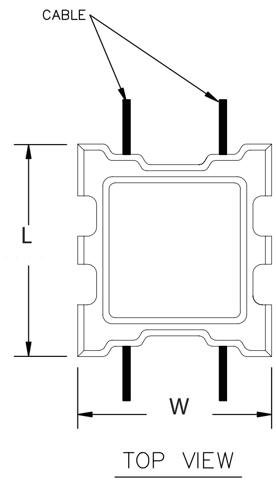
MANUFACTURING SPECIFICATION
ASTM D6684-04

ARMORTEC Erosion Control Solutions

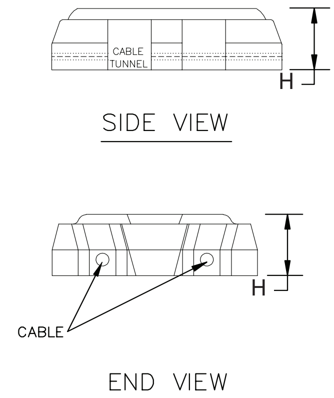
ArmorFlex® (not to scale)

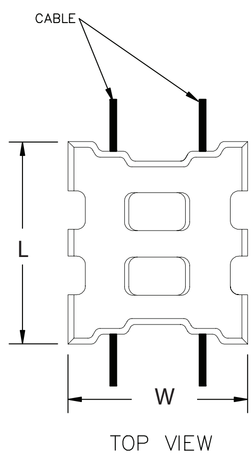


Open Cell Block

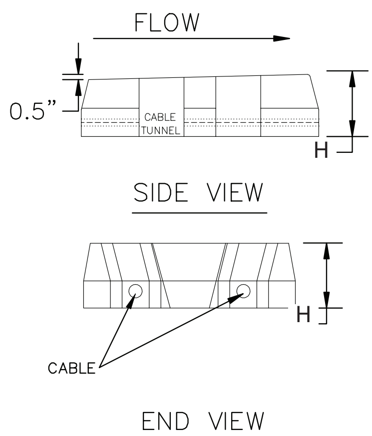


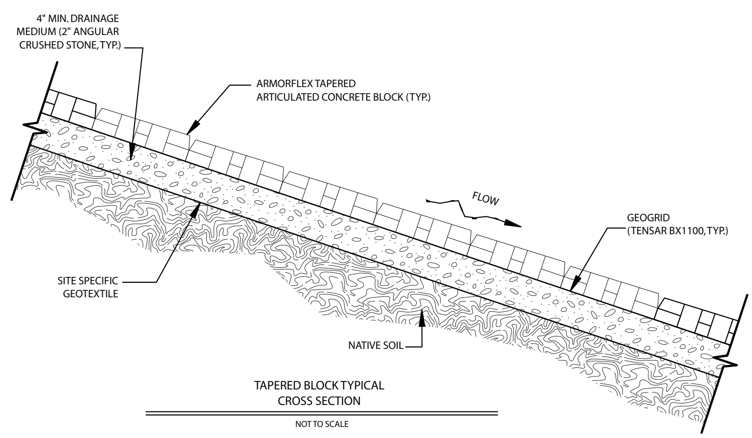
Close Cell Block



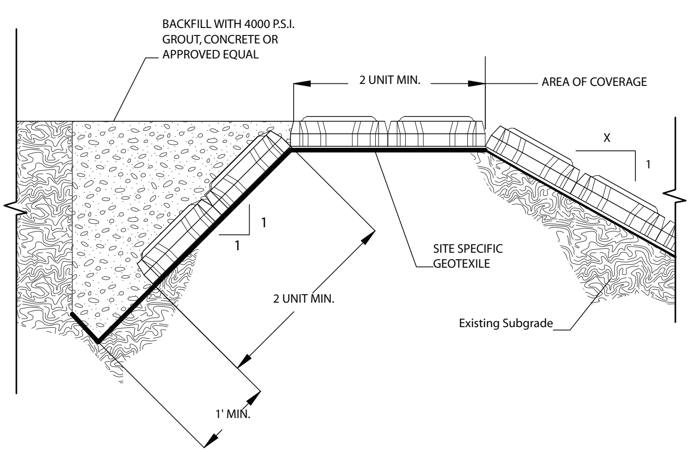


Tapered Series





Tapered Series - Cross Section

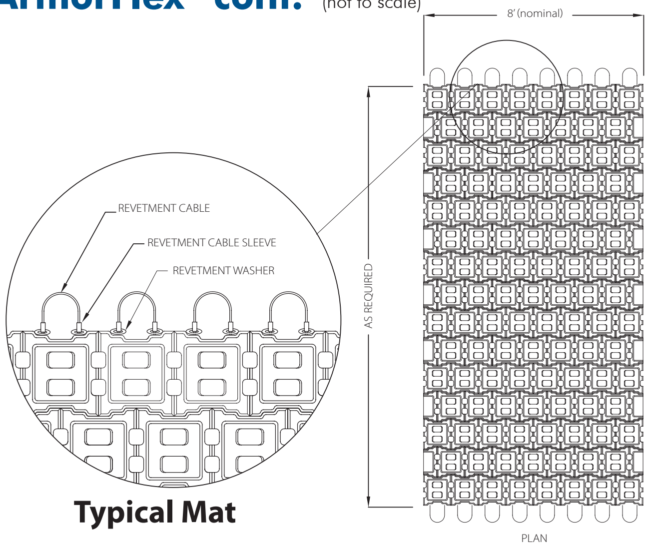


Top of Slope - Standard Detail

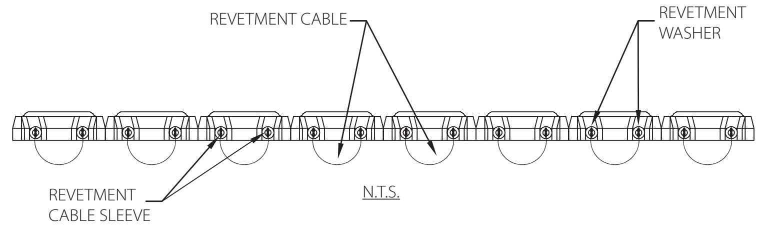
ArmorFlex Unit Specification

Concrete Block Class	Open/Closed Cell	Nominal Dimensions			Gross Area/ (sq. ft.)	Block Weight		Open Area %
		L	W	H		lbs	lbs/sq. ft.	
30s	Open	13.0	11.6	4.75	0.98	31-36	32-37	20
50s	Open	13.0	11.6	6.00	0.98	45-52	45-53	20
40	Open	17.4	15.5	4.75	1.77	62-71	35-40	20
50	Open	17.4	15.5	6.00	1.77	81-94	46-53	20
70	Open	17.4	15.5	8.50	1.77	120-138	68-78	20
40L	Open	17.4	23.6	4.75	2.58	90-106	35-41	20
70L	Open	17.4	23.6	8.50	2.58	173-201	67-78	20
45s	Closed	13.0	11.6	4.75	0.98	39-45	40-45	10
55s	Closed	13.0	11.6	6.00	0.98	53-61	54-62	10
45	Closed	17.4	15.5	4.75	1.77	78-89	43-50	10
55	Closed	17.4	15.5	6.00	1.77	94-108	53-61	10
85	Closed	17.4	15.5	8.50	1.77	145-167	82-98	10
45L	Closed	17.4	23.6	4.75	2.58	108-126	42-49	10
85L	Closed	17.4	23.6	8.50	2.58	209-243	81-94	10
High Velocity Application Block Classes								
40-T	Open	17.4	15.5	4.75	1.77	62-71	35-40	20
50-T	Open	17.4	15.5	6.00	1.77	81-94	46-53	20
70-T	Open	17.4	15.5	8.50	1.77	120-138	68-78	20

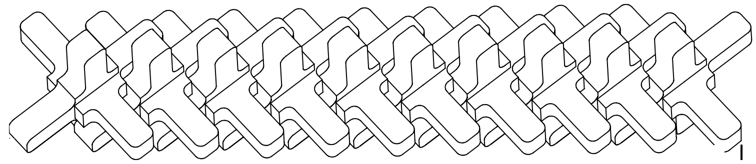
ArmorFlex® cont. (not to scale)



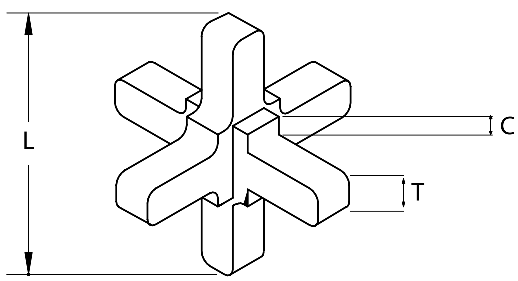
Typical Mat



A-Jacks® (not to scale)



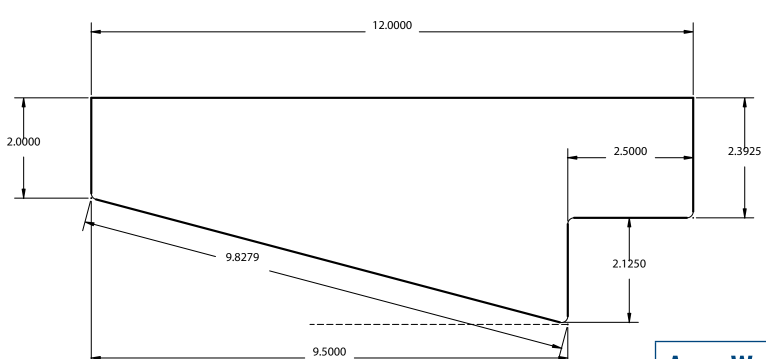
A-Jacks Placement Profile

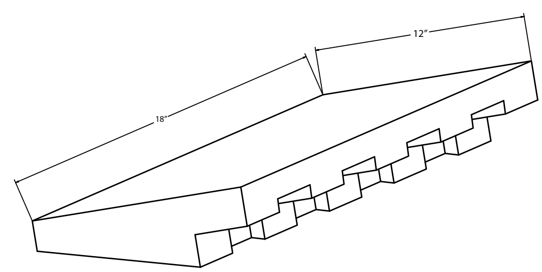


A-Jacks Unit

A-Jacks Unit Specification					
A-JACKS	L(IN)	T(IN)/H(IN)	C(IN)	VOL(FT^3)	WT (LBS)
AJ-24	24	4	1.84	0.56	78
AJ-48	48	7.36	3.68	4.49	629
AJ-72	72	11.04	5.52	15.14	2.120
AJ-96	96	14.72	7.396	35.87	5.022
AJ-120	120	18.40	9.20	70.69	9.699

ArmorWedge® (not to scale)

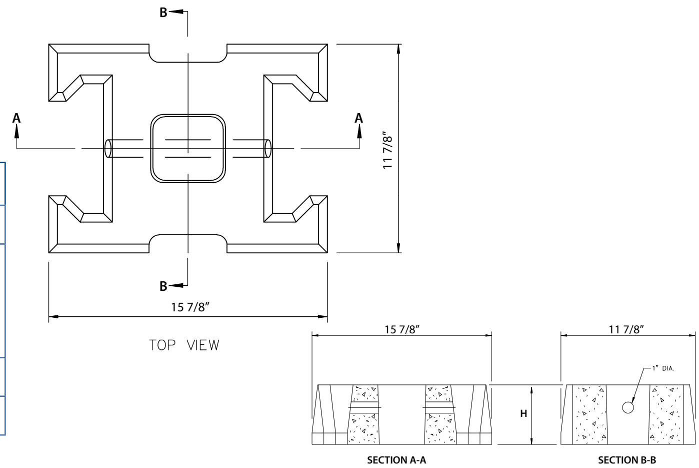




Side View - Typical Block

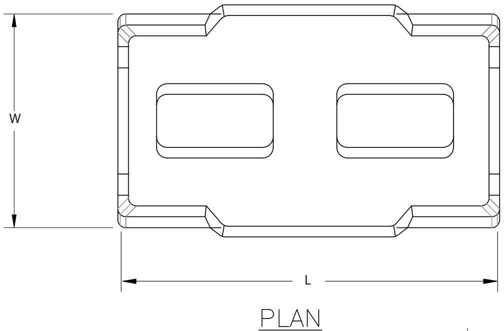
ArmorWedge Unit Specification					
UNIT DIMENSION	UNIT WEIGHT (LBS)	SYSTEM WEIGHT (LBS)	UNIT COVERAGE (SF)	COMPRESSIVE STRENGTH (PSI)	MAXIMUM ABSORPTION (LBS/FT^3)
12x18	40-52	36-40	1.1875	4000	12

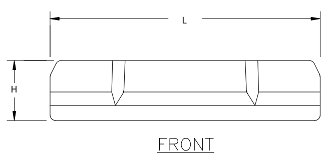
ArmorLoc® (not to scale)



ArmorLoc Unit Specification								
	TECHNICAL DATA			DIMENSIONS AND WEIGHTS				
BLOCK	Specific Weight lbs/ft^3	Compressive Strength psi	Max Absorption, Avg. of 3 units 10 lbs/ft^3	Thick-n2ess Inches (H)	Gross Area/ Grid ft^2	Weights/ Grid lbs	Weights/ Area lbs/ft^2	Open Area %
3510	130-150	4000 min	10	4	1.0	30-35	30-35	25
4511	130-150	4000 min	10	5.25	1.1	44-50	40-45	20

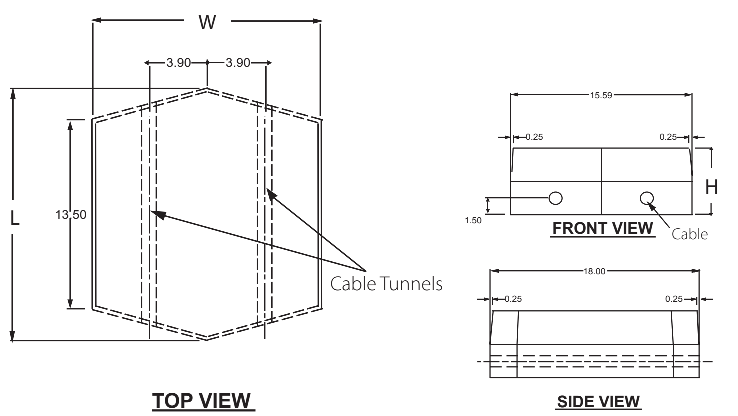
ArmorStone® (not to scale)





ArmorStone Unit Specification								
CONCRETE BLOCK CLASS		NOMINAL DIMENSIONS (IN.)			UNIT COVERAGE (SF)	BLOCK		OPEN AREA %
		L	W	H		UNIT WEIGHT LBS.	SYSTEMS WEIGHTS LBS./SF	
AS 40	Open	18.00	10.00	4.50	1.25	50-54	40-44	25
AS 55	Closed	18.00	10.00	4.50	1.25	61-66	49-53	5

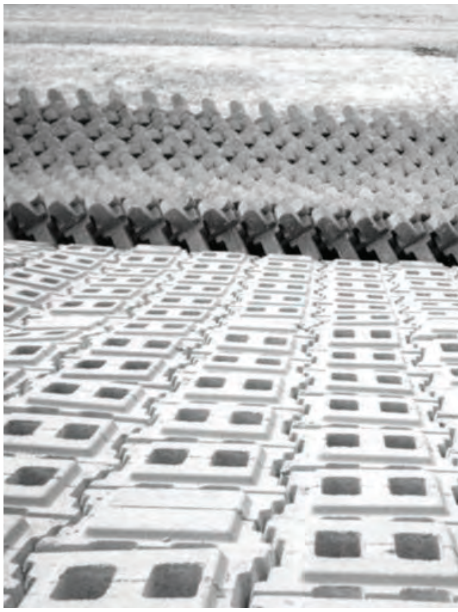
ArmorRoad® (not to scale)



ArmorRoad Unit Specification							
BLOCK	TYPE	L	W	H	SF COVERAGE PER UNIT	WEIGHT LBS PER UNIT	SF PER TRUCK LOAD
Mat	Closed	18.00	15.60	6.00	1.74	105-109	750
Individual	Closed	18.00	15.60	6.00	1.74	100-104	750

Armortec Minimum Physical Requirements per ASTM 06684-04					
MIN. DENSITY (IN AIR) LBS/FT^3		MIN. COMPRESSIVE STRENGTH PSI		MAX WATER ABSORPTION LBS/FT^3	
Ave. of 3 Units	Individual Unit	Ave. of 3 Units	Individual Unit	Ave. of 3 Units	Individual Unit
130	125	4,000	3,500	9.1	11.7

Engineered Hard Armor Solutions

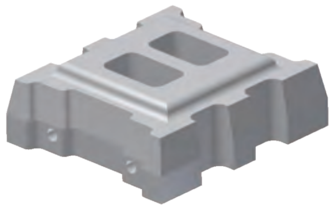


Channel Lining | Shoreline Protection | Dam & Spillway Protection | Levee Stabilization | Bridge Scour

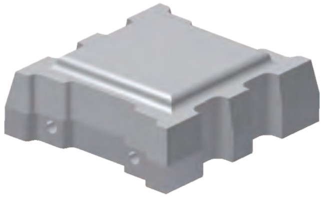
ArmorFlex: Articulating Concrete Block Mats

The industry leader since 1978, ArmorFlex® articulating concrete block (ACB) mats make a flexible matrix of concrete blocks with uniform size, shape and weight used for hard armor erosion control. ArmorFlex blocks have specific hydraulic capacities and are laced longitudinally with galvanized steel, stainless steel or polyester revetment cables which provide ease of handling and installation.

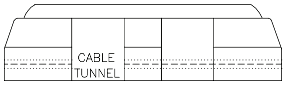
Open-Cell Block



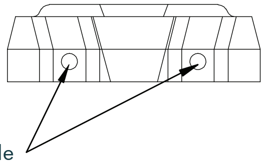
Closed-Cell Block



Side View



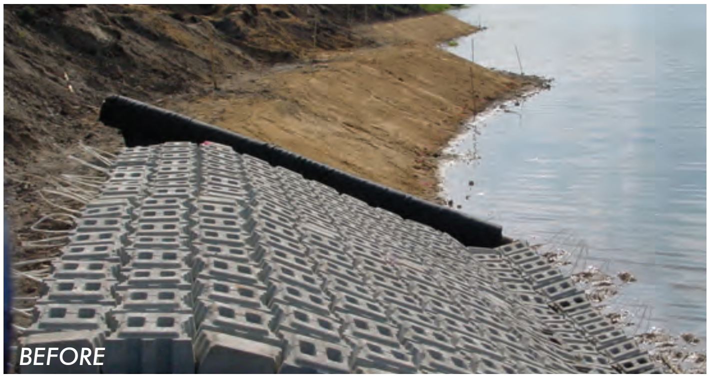
End View



Applications

- Channel Lining
- Shoreline Protection
- Boat Ramps & Access Roads
- Dam Overtopping Protection
- Pipeline & Cable Protection
- Bridge Abutment Protection
- Retention Basins
- Levee Stabilization
- Bridge Scour Protection

ArmorFlex has proven to be an aesthetic and functional alternative to dumped stone riprap, gabions, structural concrete and other hard armor erosion protection systems. ArmorFlex is easy to install and has a low life-cycle cost when compared to other permanent solutions. These two benefits can drastically reduce the cost to install and maintain the system. ArmorFlex mats are installed on a prepared subgrade utilizing conventional construction equipment and site-specific filter fabric. While both block types provide protection and stability, only the open-cell specifically offers the void space necessary for revegetation.



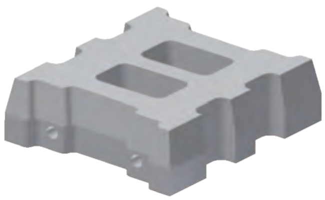
Research Proven Performance

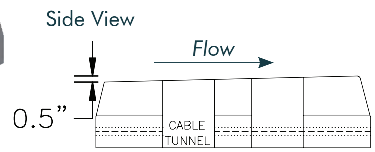
Armortec has carried out extensive research into wave and open channel flow conditions on ArmorFlex in the United States and the Netherlands. Design manuals and computer programs are available to assist in the proper ArmorFlex block selection for your hydraulic conditions.

Tapered Series

Armortec's unique Tapered Series ArmorFlex block design offers superior protection for embankment dams, spillways, high velocity channels and down chutes. The essential design component of ArmorFlex Tapered series is the 0.5 inch taper that virtually eliminates destabilizing impact flow forces, thereby providing a high factor of safety. The ArmorFlex Tapered block system has been successfully tested under hydraulic jump conditions at Colorado State University. Each Tapered series design incorporates a four inch rock drainage layer beneath the system.

Tapered-Cell Block





Block and A Half

The latest innovation in ACB technology is the ArmorFlex Block and a Half®. This new product introduction increases the factor of safety for the overall system while maintaining the ease of installation and overall benefits of the typical ArmorFlex systems.

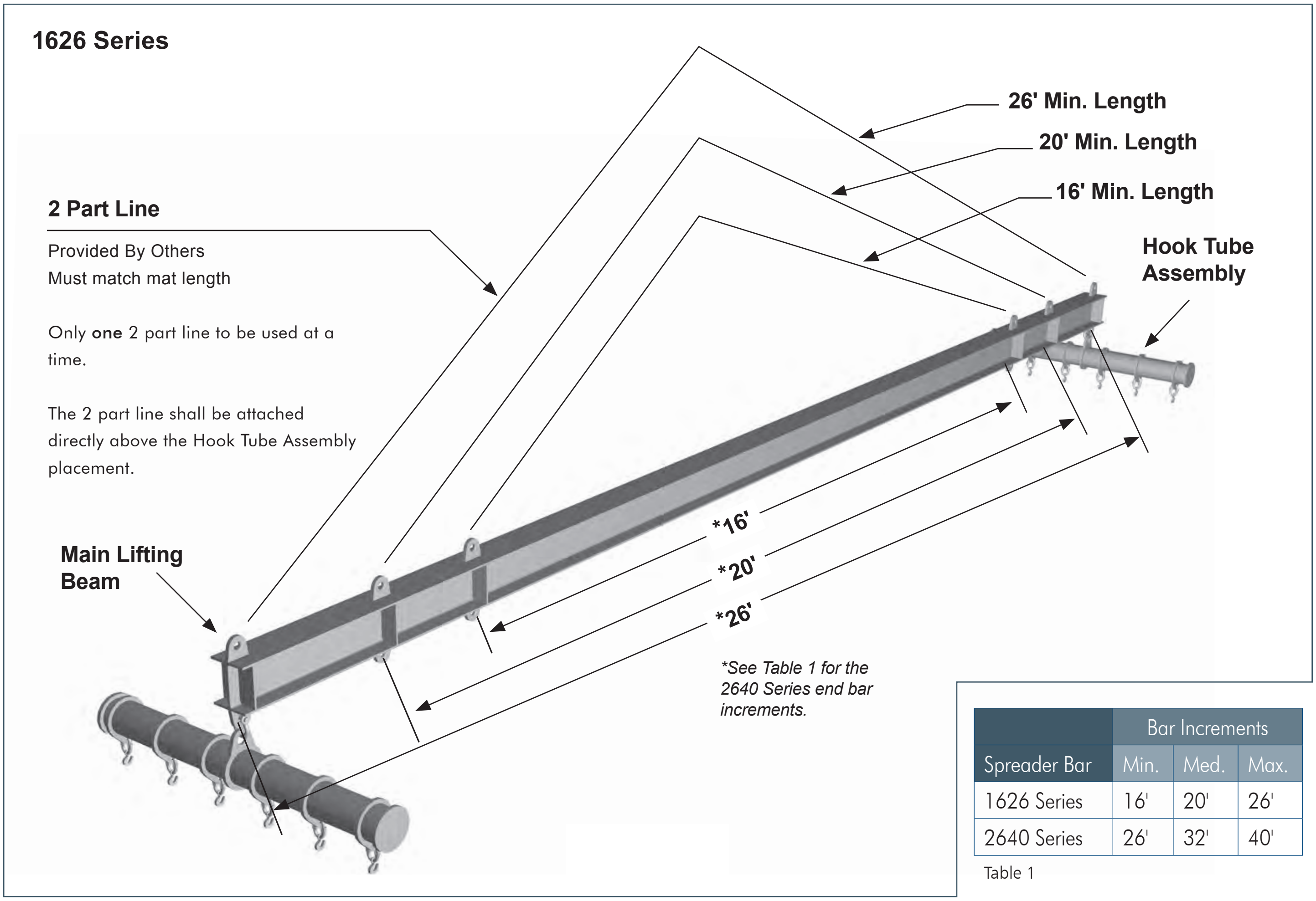
Block and A Half Block

ArmorFlex Design Software and Guidelines are available through the CONTECH website at www.contech-cpi.com

ArmorFlex: Installation

The proper installation of ArmorFlex ACB mats is important to achieving the intended hydraulic performance and maintaining stability against the erosive forces of flowing water. An ACB revetment system consists of a suitably prepared and compacted subgrade, a suitable site-specific filter fabric and properly sized ACB mattresses placed in "intimate contact" with the filter fabric and subgrade. Each individual site will vary, so it is important to follow the engineering project drawings as designed and sealed by a registered Professional Engineer; particularly as they relate to standard termination details. Please refer to the Armortec Installation Guide for further instructions on proper material handling.

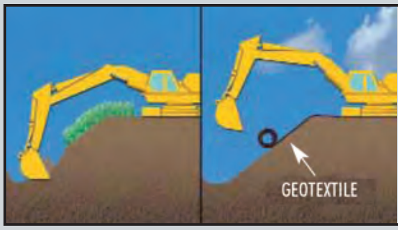
Spreader Bar Rigging Detail



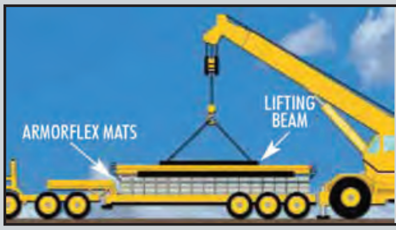
	Bar Increments		
Spreader Bar	Min.	Med.	Max.
1626 Series	16'	20'	26'
2640 Series	26'	32'	40'

Table 1

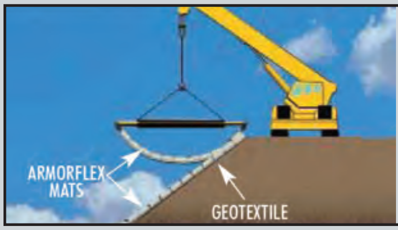
ArmorFlex: Installation



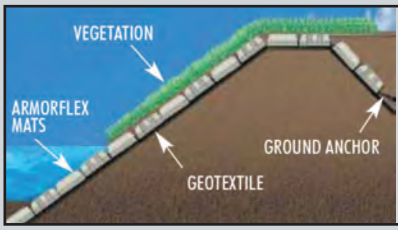
Step 1:
ArmorFlex arrives on-site as a system of factory-assembled mats. ArmorFlex is placed on a site specific geotextile which has been placed on a prepared subgrade using conventional construction equipment.



Step 2:
Mats are supplied on flat bed trailers. Mats can be handled with a spreader bar which can be rented from CONTECH.



Step 3:
Above normal waterline mats may be topsoiled and seeded to give a vegetated effect.



Step 4:
Proper toe trench requires a minimum of two rows of block buried below predicated soil depth. Tapered series block or mats subject to wave attack are required to have a bedding layer of crushed stone or gravel.

See Armortec Installation Guide for complete information on how to properly install ArmorFlex.

ArmorRoad

ArmorRoad® was developed in the field with input from contractors, construction managers and owners. The result is a flexible product that is efficient to install, aesthetically pleasing and able to withstand heavy traffic loads in harsh environments. ArmorRoad does not require the sand backfill typically required of standard pavers due to its unmatched durability with 8,000 PSI and 6" thickness. In addition, should a problem occur in the subgrade, ArmorRoad can be removed quickly and reinstalled.

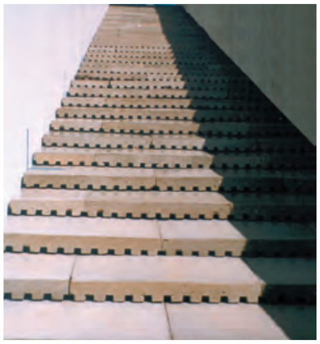
Applications

- Durable Driving Surface
- Temporary Road Application
- Heaving and Expanding Subgrade Condition

ArmorRoad Block

ArmorFlex Design Software and Guidelines are available through the CONTECH website at www.contech-cpi.com

ArmorWedge



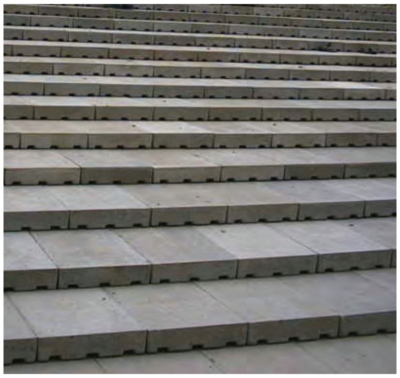
ArmorWedge® is a concrete step overlay protection system for embankment dams and spillways that are subject to high forces associated with overtopping flow. Researchers at Colorado State University assessed the stability of the blocks by comparing the downward (positive) forces of the block weight and the pressure of the flowing water to the uplift (negative) forces. The ArmorWedge system was tested up to and including the facility discharge capacity of 40 cf/s/ft. This discharge capacity had associated water velocities of 35 ft/sec and a shear stress of 22 lbs/sqft. Even at these levels the ArmorWedge system remained stable. An effective drainage system - allowing water to be removed from beneath the system - is essential to the design of the overlay.

The practicality of ArmorWedge lies in the cost effective ease of installation. This is particularly true for projects where the use of large machinery is deemed impractical due to confined, hard to reach jobsites or environmental impact on the surrounding area. ArmorWedge is typically installed by hand over site-specific filter fabric and subsequent drainage medium on a well compacted surface.

Applications

- Dam Overtopping
- High Velocity Channels
- Primary and Secondary Spillways

ArmorWedge Block



ArmorLoc

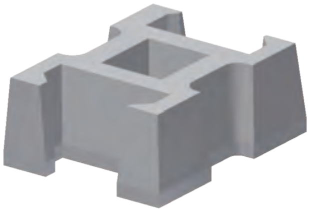
ArmorLoc® concrete interlocking blocks are specifically designed to control erosion. The ArmorLoc system provides easy and economical installation when equipment is not feasible or cannot be used due to confined or hard to reach areas. ArmorLoc is installed manually over site-specific filter fabric on a prepared surface. It improves the landscape and promotes drainage from the smallest erosion control job to the largest commercial project.

ArmorLoc is available in two sizes and weight classifications that provide excellent performance during light wave and open-channel flow conditions. The unique interlocking design of ArmorLoc keys each block into four adjacent blocks to hold it firmly in position and resist lateral movement.

Applications

- Retention Basins
- Shoreline Protection
- Drainage Ditch Lining
- Outfall Protection
- Bridge Abutment Protection

ArmorLoc Block



A-Jacks: Concrete Armor Units

A-Jacks® are high stability concrete armor units designed to interlock into a flexible, highly permeable matrix. A-Jacks can be installed either randomly or in a uniform pattern. The voids formed within the A-Jacks matrix provide approximately 40% open space in the uniform placement pattern. These voids provide habitat for fish and other marine life when applied as a reef, revetment or as a soil support system in river applications. In addition, the voids may be backfilled with suitable soils and planted with a variety of vegetation including grasses, shrubs and trees above the normal base flow.

A-Jacks Unit

Applications

- Drop Structures
- Weirs
- Energy Dissipation
- Bridge Scour Protection
- Streambank/Toe Stabilization

Streambank Applications

Streambank erosion often produces steep banks with little or no vegetation. These unprotected banks are even more susceptible to erosion due to over steepening, loss of ground cover, groundwater discharge and stream erosion at the base of the bank. A-Jacks concrete armor units provide an alternative which when used with bio stabilization technique, develops a cost-effective solution.

Bridge Scour Applications

The ability of the A-Jacks system to dissipate energy and resist the erosive forces of flowing water allows this system to protect channel boundaries from scour and erosion. Extensive laboratory research was performed on both model and full scale units in order to evaluate the hydraulic properties of the A-Jacks units. An A-Jacks Design Manual for the hydraulic design of open-channel conveyance ways and pier scour countermeasure is available upon request.

Energy Dissipation

A-Jacks ability to dissipate energy in channel, spillway or culvert outfall applications relies on the inherent roughness of the units. For A-Jacks, the design value for Manning's roughness coefficient is n=0.1. This value was determined from extensive full and quarter scale laboratory testing. The ability of A-Jacks to increase roughness creates a hydraulic jump when flow encounters the units. Creating the hydraulic jump effectively releases the energy associated with high velocity and/or steep embankment flow conditions. By releasing the energy, the erosive forces associated with the hydraulic jump are also greatly diminished. As the flow travels downstream through the A-Jacks matrix, the energy grade line slope continues to be reduced until the desired flow conditions are obtained downstream of the A-Jacks units.

CONTECH Construction Products Inc. provides site solutions for the civil engineering industry. CONTECH's portfolio includes bridges, drainage, retaining walls, sanitary sewer, stormwater, erosion control and soil stabilization products.

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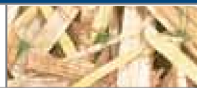
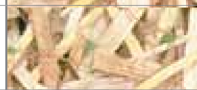
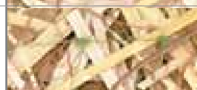
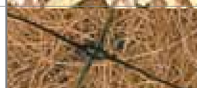
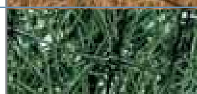
CONTECH CONSTRUCTION PRODUCTS INC.

Armortec 8/11 MC

RECYCLED PAPER

CONTECH CONSTRUCTION PRODUCTS INC.

EROSION CONTROL PRODUCT SELECTION GUIDE [1]

	PRODUCT		Functional Longevity	Slopes			Channels		Bank/Shoreline Stabilization		Culvert Outlets	Installed Costs[2] ($/SY)
				≤1:1[3]	≤2:1	≤3:1	Typical Velocity (ft/s)	Typical Shear Stress (lb/ft²)	Wave Potential	No Wave Potential		
TEMPORARY BLANKETS	**Landlok** (S1)		12 months			✔	5-6	2.0				1.00 to 1.75
TEMPORARY BLANKETS	**Landlok** (S2)		18 months			✔	5-6	1.5				1.25 to 1.75
TEMPORARY BLANKETS	**Landlok** (CS2)		24 months		✔		5-6	2.0				1.75 to 2.25
TEMPORARY BLANKETS	**Landlok** (C2)		36 months		✔ (≤1.5:1)		5-6	2.3				2.00 to 2.75
PERMANENT TURF REINFORCEMENT MATS	**Landlok 450**		Permanent	✔			8 to 18	2 to 10				6.00 to 8.00
PERMANENT TURF REINFORCEMENT MATS	**Landlok 300**		Permanent	✔			6 to 20	2 to 12		✔	✔	10.00 to 15.00
PERMANENT TURF REINFORCEMENT MATS	**Pyramat**		Permanent (up to 50 years)	✔			6 to 25	2 to 15		✔	✔	15.00 to 20.00
PERMANENT TURF REINFORCEMENT MATS	**ArmorMax** Anchored Reinforced System		Permanent (up to 50 years)	✔			6 to 25	2 to 18		✔	✔	20.00 to 25.00
HARD ARMOR	**Armorflex** ACB Revetment System		Permanent	✔			4" - 11 - 15 6" - 13 - 29 9" - 17 - 37	4" - 14 - 31 6" - 19 - 37 9" - 22 - 48	✔		✔	82.50 to 112.50 90.00 to 127.50 97.50 to 135.00
HARD ARMOR	**Armorloc** Hand Placed ACB Revetment System		Permanent	✔			4" - 10 6" - 12	4" - 8 6" - 11	✔		✔	52.50 to 82.50 75.00 to 97.50
HARD ARMOR	**A-Jacks**		Permanent	✔			24" - 22.0 48" - 31.1 72" - 38.1 96" - 44.0	24" - 38 48" - 76 72" - 114 96" - 152	✔		✔	30 to 45/ea. 375 to 525/ea. 900 to 1350/ea. 1650 to 2250/ea.
HARD ARMOR	**Gabions**		Permanent	✔			16	20	✔		✔	Basket:: 100 to 125/cy. Mattress:: 30 to 60/cy.

NOTES: 1. The above design recommendations should only be used as a "quick" reference tool for general project situations. Final selection of an appropriate product should be done by an experienced engineer and should consider site-specific parameters such as climate, soil, geometry, vegetation selection, irrigation, and installation conditions.
2. Installed cost estimates range from large to small projects according to material quantity. The estimates include E.C. material, seed, labor and equipment.
3. For slopes steeper than 2H:1V, mechanical anchoring should be investigated

APPENDIX A2

IN-HEAP POND AND EVENTS POND SIZING (TETRA TECH)

(Pages A2-1 to A2-16)

Tucson Office
3031 West Ina Road
Tucson, AZ 85741
Tel 520.297.7723 Fax 520.297.7724
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Technical Memorandum

To:	File	**From:**	Ronson Chee
Company:		**Date:**	February 9, 2012
Re:	In-Heap Pond, Spillway and Event Ponds Sizing	**Doc #:**	114-320905X-5.3
CC:	Troy Meyer, P.E. (Tetra Tech)		

1.0 Introduction

This technical memorandum explains the methodology and assumptions used in sizing the In-Heap Pond and Event Ponds associated with the Eagle Gold Heap Leach Facility (HLF). The In-Heap Pond is the storage volume created within the pore space of the ore, directly upstream of the Confining Embankment (Embankment). The In-Heap Pond will store solution within the pore space of the ore to facilitate maximum recovery of solution and allow for leaching operations during the winters' freezing temperatures. The Event Ponds, which consist of two (2) adjacent ponds located down gradient of the Heap Leach Facility and Embankment, will store solution and/or storm event runoff in excess of the capacity of the In-Heap Pond. The capacity of the In-Heap Pond is a function of the height of the Embankment and the porosity of the ore. Incoming flows in excess of the In-Heap Pond capacity will spill over the Embankment into the Event Ponds via the Heap Leach Facility Spillway (Spillway). Accordingly, this memorandum will determine the necessary height and volume requirements of the Confining Embankment, the design dimensions of the Spillway, and the volume requirements of the Event Ponds.

The construction timing and phasing of HLF will ultimately have an effect on the contributing areas and precipitation volumes reporting to the In-Heap Pond. As the Eagle Gold Project advances and more detailed phasing information becomes available, the HLF design can be optimized. The design as presented is based on the current information/design criteria available at the time and may be subject to change as the information/design criteria is updated.

The In-Heap Pond and the Event Ponds were sized to provide storage for leaching solution and selected precipitation events. Sizing the In-Heap Pond assumed that all precipitation that falls upstream of the Embankment and downstream of the Phase 1 temporary diversion channels contributes to the In-Heap Pond. The Phase 1 configuration of the HLF was selected as the critical scenario as it will experience the largest lined area with the smallest amount of ore on the pad (largest runoff potential). As the pad increases to Phases 2 and 3, the entire pad will become hydraulically connected by the liner, however, this will not have significant effects on the In-Heap Pond volume. The contributing areas of Phases 2 and 3 will have minimal effects on the In-Heap Pond storage volume because the ore height will increase as well, this will significantly attenuate the infiltration of precipitation events.

2.0 In-Heap Pond Volume Requirements

The In-Heap Pond volume requirements were determined assuming a combination of events were to occur simultaneously. This approach was taken to ensure adequate storage volume under the worst of conditions. Thus, the In-Heap Pond will provide containment storage for the following summation of events:

- Minimum Operational Volume – the minimum operational volume is the minimum amount of solution required in the pond to supply the gold recovery plant for 48 hours at a nominal rate of 2,770 m^3/hr. Thus, the minimum operational volume required for the In-Heap Pond is 132,960 m^3.

- Snowmelt Runoff Volume – the snowmelt runoff volume is the volume required for snowmelt runoff. The estimated maximum average snowpack depth is 164 mm (Wardrop, 2011a) which is assumed to contribute uniformly over the Phase 1 contributing area of 399,200 m^3. Thus, the snowmelt volume reporting to the In-Heap Pond is 65,469 m^3 which assumes direct runoff (no initial losses).

- Heap Draindown Volume – in the event of a power loss (pumps stop operating), pump malfunction, or pump maintenance, the pond must be able to accommodate the draindown from the Heap. For conservatism, the largest possible draindown rate over a 72-hour period was used. The largest possible draindown volume is the nominal application rate of 2,770 m^3/hr (Wardrop, 2012) multiplied by 72 hours which equates to 199,440 m^3. It is assumed that the mine will be able to restore/repair or supply backup pumps within the 72 hours to prevent larger draindown volumes from accumulating. Should larger draindown volumes accumulate, they can be conveyed into the Events Ponds via the Spillway.

- Freeboard – 1.0 m of freeboard below the ultimate Embankment crest is required. The 1.0 m of freeboard is added above the corresponding stage-storage volume that provides the required total volume.

The summation of the In-Heap Pond volume requirements are summarized in Table 1 below. The In-Heap Pond must provide 397,869 m^3 of solution storage capacity, excluding freeboard.

Table 1. In-Heap Pond Volume Requirements Summary

Volume Requirement	Volume (m^3)
Minimum Operational Volume	132,960
Snowmelt Runoff Volume	65,469
Heap Draindown Volume	199,440
Total	**397,869**

The solution storage capacity of the In-Heap Pond excludes the runoff volume generated from the 100-year, 24-hour rainfall event. If the 100-year, 24-hour rainfall event were to occur simultaneously with the events described above, flows would be routed to the Event Ponds through the Spillway. If the 100-year, 24-hour rainfall event were to occur under normal conditions (not simultaneously with the events described), the runoff can be stored in the In-Heap Pond.

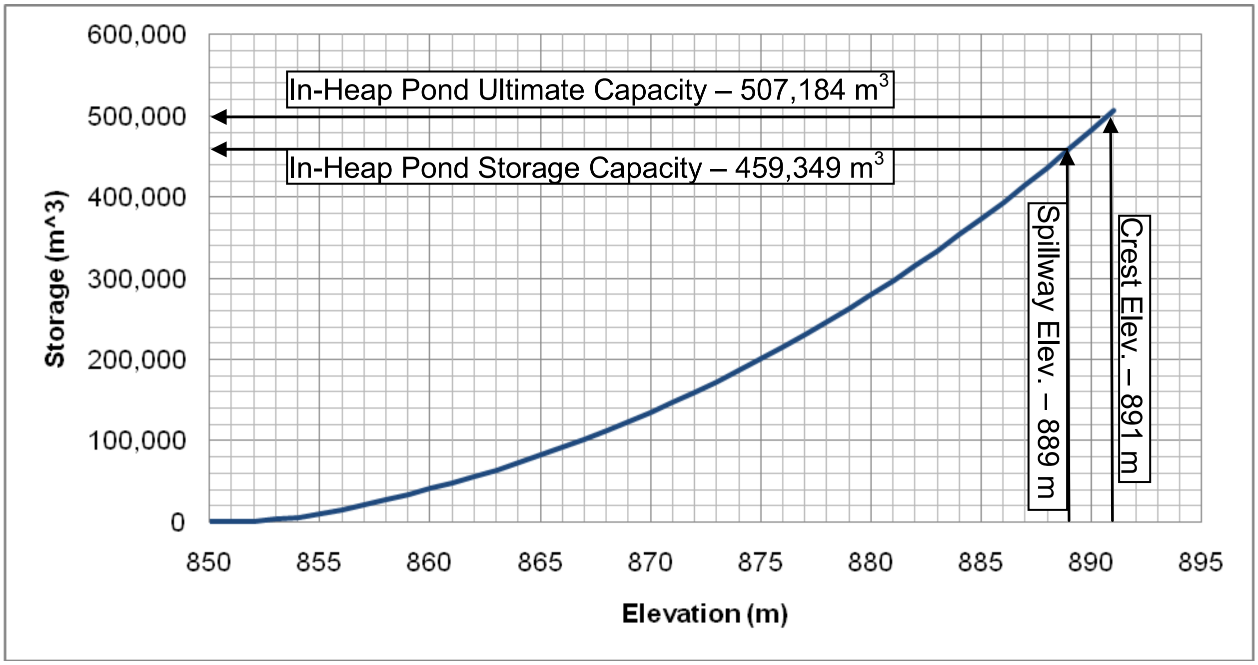
3.0 Confining Embankment Height

In order to determine the required ultimate Embankment height, a gross stage-storage curve based on the proposed Embankment and Heap Leach Pad grading was created. The actual net capacity (storage volume within the ore pore space) of the In-Heap Pond was determined by multiplying the gross storage volume by the ore storage solution factor of 0.1371 (0.1371 m^3 of solution/m^3 of ore). This factor was determined by assuming an initial ore moisture content of 5.0%, an ore bulk density of 1.8 tons/m^3, an ore specific gravity of 2.7, and an ore leaching moisture content of 13.3% (Wardrop, 2011b). Detailed calculations for derivation of the solution storage factor can be found in Attachment A.

The total required In-Heap Pond volume (397,869 m^3) was compared to the net stage-storage curve to obtain a corresponding elevation that will provide the necessary storage volume. Based on the net stage-storage curve for the In-Heap Pond, an elevation of 887 m (rounded to the next highest meter) will provide the required volume with an estimated net capacity of 414,652 m^3. To account for uncertainty in snowpack depth and snowmelt estimates, elevation 889 m was selected because it will provide an additional factor of safety to account for possible decreases in storage capacity. Decreases in storage capacity may also occur as a result of consolidation due to the loads from stacking as well as migration of fine particles into the pore space of the In-Heap Pond (i.e., agglomeration effects). However, these effects were not quantified for this level of design.

The final Embankment crest elevation will be at 891 m (2 m above the required elevation). The overflow spillway invert will be at elevation 889 m. The Spillway will be sized to allow up to 0.5 m of hydraulic head, allowing for 0.5 m of freeboard with respect to the crest of the Embankment. The ultimate storage capacity of the In-Heap Pond up to the final Embankment crest elevation (891 m) is estimated at 507,184 m^3. The In-Heap net stage-storage curve is presented in Figure 1 below (stage-storage calculations can be found in Attachment A). At its maximum, (downstream side of the embankment) the Embankment will have a height of approximately 63 m.

Figure 1. In-Heap Pond Stage-Storage – Net Volume



4.0 In-Heap Pond Spillway

The In-Heap Pond Spillway was designed in accordance with the Canadian Dam Association (CDA) guidelines for a "Very High" consequence dam. According to the CDA (2007) guidelines a dam classification of Very High suggests a design flood of 2/3 between the 1,000 year event and the Probable Maximum Flood (PMF). At this stage of the project, the 1,000 year rainfall event has not been firmly established for the site, thus, the design capacity for the spillway was increased to the full PMF. The PMF rainfall event for the Project site has been established by Knight Piesold (2011). According to the CDA, the PMF corresponds to an "Extreme" dam classification. As a result, the spillway capacity is conservatively estimated. Once the 1,000 year rainfall event has been established the spillway can be reduced to its required capacity.

The Spillway was sized to accommodate the PMF although the Event Ponds can only receive runoff volumes up to the 100 year, 24-hour event. The spillway's larger capacity was selected in order to eliminate the possibility of the Embankment being overtopped. Overtopping of the Embankment could compromise its stability resulting in Embankment failure. Failure of the Embankment would be an even more catastrophic event as it would result in a much larger volume of solution to be released. A higher capacity spillway will ensure that any flows in excess of the In-Heap Pond capacity can be routed downstream.

A worst case scenario was developed for calculating the largest peak flow to be experienced by the spillway. The scenario assumed that Phase 1 of the pad is constructed, Phases 2 and 3 are being cleared and grubbed for construction, and the pad is loaded with ore to elevation 889 m (roughly at the spillway invert - below the Embankment crest). The scenario also assumed that the ore is loaded to this elevation, and is completely saturated when the PMF occurs. The HLF temporary diversion channels (sized for the 100-year, 24-hour event) were assumed to have failed resulting in the entire upstream watershed contributing to the peak flow. Details of the hydrology calculations performed for sizing the Spillway are provided in the following sections.

4.1 Hydrology Methodology Overview

According to Knight Piesold (2011) the PMF can be modeled using a National Resource Conservation Service (NRCS) Type I curve with a 24-hour duration. Thus, the NRCS Method was selected to perform hydrologic calculations. The NRCS method described herein is based on two (2) components, the NRCS curve number approach (to determine initial losses and excess precipitation) and the unit hydrograph method (to derive the hydrograph resulting from excess rainfall).

The NRCS method was performed using the U.S. Army Corps of Engineer's Hydrologic Modeling System (HEC-HMS). HEC-HMS is a hydrologic modeling software package developed for general applications. HEC-HMS allows for the analysis of complex/integrated systems; i.e., multiple sub-basins, reservoir and channel routing, etc. Embedded in HEC-HMS are the NRCS method and unit hydrograph method.

4.2 Rainfall Distribution

The NRCS has developed synthetic hyetographs for the geographic U.S. for 24-hour storm events, called "type curves". The U.S. is divided into four (4) regions where specific "type curves" can be applied depending on the geographic location and on precipitation patterns. Since the project site is beyond the geographic borders of the U.S., the use of "type curves" in the Yukon Territory assumes that similar storm distribution patterns are prevalent at the project site. According to Knight Piesold (2011), a Type I curve is appropriate for the project site and can be used to model the PMF. A Type I storm is described as the Pacific maritime climate with wet winters and dry summers. According to Knight Peisold (2011), a PMF occurring from June to September was estimated to generate 256 mm of rainfall over a 24-hour period.

4.3 Rainfall Losses – Curve Number

The NRCS has developed a widely used curve number procedure for estimating runoff from storm events. The NRCS method incorporates this curve number procedure.

Rainfall initial losses depend primarily on soil characteristics and on land use (surface cover). The NRCS method uses a combination of soil conditions and land use to assign runoff factors (known as runoff curve numbers). Curve Numbers (CN) represent the runoff potential of a soil type (i.e., the higher the CN, the higher the runoff potential).

For practical purposes and due to the high likelihood of extreme rainfall events occurring during snowmelt, it was assumed that snowmelt has saturated the soil resulting in Antecedent Moisture Condition (AMC) III. AMC III increases the CN assuming a saturated soil condition. The worst case conditions were assumed in selecting the CN. It was assumed that the entire Heap Leach Pad has been cleared and grubbed (prior to construction of the pad) and the storm occurs. A CN of 86 was chosen to model this scenario, it corresponds with a hydrologic soil group of B and characterized as a "newly graded area" with no vegetation (Mays, 2005). Applying AMC III results in a CN of 93 which was used as input into the HEC-HMS model.

4.4 Rainfall Run-off Volume

The NRCS method determines rainfall runoff volume using the following relationship:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S}$$

Where:

Q = the accumulated runoff volume in millimeters (mm);

P = the accumulated precipitation in millimeters (mm);

S = the maximum soil water retention parameter ($S = \frac{1000}{CN} - 10$) in millimeters (mm); and

CN = the curve number.

The calculated PMF runoff volume for the watershed upstream of the Heap Embankment was estimated to be 302,000 m^3 (see Attachment B).

4.5 Time of Concentration / Lag Time

The time of concentration (T_c) used for the NRCS method was determined using an average of the T_c's as recommended by Coulson (1991). Two methods for calculating T_c were taken from the Manual of Operational Hydrology in British Columbia; one (1), the Hathaway formula, which a function of basin slope, roughness and stream length; and two (2), the T_c based on the area and steepness of the basin taken from a chart. The calculated T_c's were then converted to lag time which is defined by the NRCS method as 0.6*T_c. The average T_c value calculated was 33.6 minutes. This was used as input into the HEC-HMS model.

4.6 Spillway Peak Flow

The calculated peak flow for the PMF using HEC-HMS and the methods mentioned above is estimated to be 26.7 m^3/s. The summary of hydrology calculations can be found in Attachment B.

5.0 In-Heap Pond Spillway Hydraulics

Using the PMF peak flow calculated in the previous section, the flow capacity of the Spillway was estimated using two methods; the weir equation and Manning's equation for open channel flow.

5.1 Weir Equation

The spillway inlet capacity can be estimated using a weir equation as taken from Mays (2005) which is defined as:

$$Q = CLH^{3/2}$$

Where:

Q = the channel flow rate, in cubic meters per second (m^3/s);

C = the discharge coefficient (a conservative value of 3.0 was used);

L = the effective length of the crest, in meters (m); and

H = the head water on the crest, in meters (m).

Using a peak flow of 26.7 m^3/s, the selected dimensions to meet the required flows were a length of 5 m and a head water of 1.5 m. A spillway with a 2 m depth will allow a freeboard of 0.5 m.

5.2 Manning's Equation

The capacity of the shallowest sloping portion (inlet and outlet) of the Spillway was also estimated using Manning's Equation taken from Mays (2005):

$$Q = \frac{1}{n} AR^{2/3} S^{1/2}$$

Where:

Q = the channel flow rate, in cubic meters per second (m^3/s);

A = the cross sectional area of flow, in square meters (m^2);

R = the hydraulic radius of flow, in meters (m);

S = the longitudinal slope of the flow path for the channel, in millimeters over millimeters (m/m); and

n = Manning's roughness coefficient for the channel, (unitless).

Using the minimum slope on the spillway profile (0.5%), a roughness coefficient of 0.013 (concrete) and the rectangular dimensions calculated in Section 5.3, Manning's equation gives a flow depth of 1.15 m. This gives 0.85 m of freeboard in the Spillway.

5.3 Spillway Dimensions

Based on Spillway hydraulic calculations, the weir equation governs the Spillway dimensions. Thus, the Spillway will be rectangular with a width of 5.0 m and a depth of 2.0 m. The spillway will have an invert of 889 m. This configuration allows a 0.5 m of freeboard from the maximum anticipated water surface elevation to the crest of the Embankment.

6.0 Event Ponds Volume Requirements

The capacity of the Event Ponds are dependent on the events retained in the In-Heap Pond as described in section 2.0. The Event Ponds serve as an overflow containment area that provides additional storage in case the In-Heap Pond capacity is exceeded, or may also serve as a temporary storage area during ”wet” months when excess recycle water is available from leaching operations as determined in the heap leach facility water balance (Tetra Tech, 2012). The Event Ponds are sized to provide containment storage for the following:

- 100-year, 24-hour Rainfall – the Event Ponds will provide storage for the 100-year, 24-hour rainfall event. The 100-year, 24-hour rainfall event rainfall depth was estimated to be 103.2 mm (Knight Piesold, 2011) which is assumed to contribute entirely over the maximum contributing area (Phases 1, 2 and 3) of 1,281,000 m^3. Thus, the rainfall volume reporting to the Event Ponds is 132,200 m^3 which assumes direct runoff (i.e. no losses).

- Freeboard – 1.0 m of freeboard below the crest of the pond is required.

The Event Ponds must provide 132,200 m^3 of solution storage excluding freeboard. The configuration of the Event Ponds have a combined operational storage capacity of approximately 182,846 m^3 excluding freeboard. Event Pond 1 (closest to the Embankment) has a storage capacity of 92,153 m^3 and Event Pond 2 (farthest from the Embankment) has a storage capacity of 90,693 m^3. The combined ultimate storage capacity of the Event Ponds including 1.0 m of freeboard is 216,713 m^3. The stage-storage functions for both ponds are provided below (stage-storage calculations can be found in Attachment A).

7.0 Summary

The In-Heap Pond will provide a storage capacity of 459,349 m^3 at elevation 889m which also corresponds to the Spillway invert. The ultimate Confining Embankment crest elevation is 891m which corresponds to the ultimate storage capacity of 507,184 m^3. The Spillway is sized to accommodate the PMF peak flow with 0.5 m of dry freeboard from the Embankment crest, additionally. The Event Ponds have a combined storage capacity of 182,845 m^3 with 1.0 m of dry freeboard. The ultimate storage capacity of the Event Ponds is 216,713 m^3 (without any freeboard).

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Wardrop *(2011b). Process Design Criteria.* February 1, 2011.

Wardrop *(2012).* Process Flowsheet Drawings issued for revision on January 16, 2012.

ATTACHMENT A
IN-HEAP POND AND EVENT PONDS
STAGE-STORAGE CALCULATIONS

In-Heap Pond Ore Solution Storage Calculations

Equations:

$$\gamma_{dry} = \frac{\gamma_{bulk}}{1+w}$$

$$V = V_a + V_w + V_s = 1$$ assuming 1 m^3 of ore

$$W_w = wW_s$$

$$V_v = V_a + V_w$$

$$V_w = \frac{W_w}{\gamma_w}$$

$$n = \frac{V_v}{V}$$

$$V_s = \frac{W_s}{G_s \gamma_w}$$

$$Se = wG_s$$

$$V_a = 1 - V_s - V_w$$

Initial Conditions (Ore as Delivered)

Specific Gravity G_s =	2.7	
Density of Water (γ_w) =	1000	kg/m^3
Water Content as Delivered (w) =	5.00%	
Ore Density (γ_{bulk}) =	1,800	kg/m^3
Ore Density (γ_{dry}) =	1714.29	kg/m^3
Weight of Water (W_w) =	85.71	kg/m^3
Volume of Water (V_w) =	0.0857	m^3
Volume of Solids (V_s) =	0.6349	m^3
Volume of Air (V_a) =	0.2794	m^3/m^3 of ore
porosity (n) =	0.3651	
void ratio (e) =	0.5750	
Saturation (S) =	23.48%	

Leaching Conditions/Ore Solution Storage Capacity

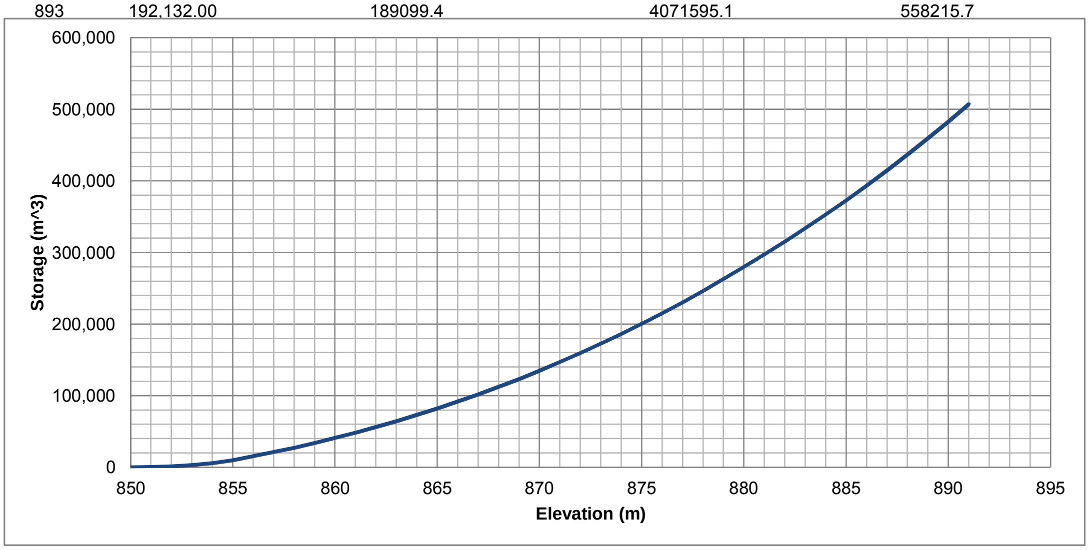
Water content (w) =	13.30%		
Weight of Water (W_w) =	228.00	kg/m^3	
Volume of Water (V_w) =	0.2280	m^3	
Volume of Solids (V_s) =	0.6349	m^3	
Volume of Air (V_a) =	**0.1371**	m^3/m^3 of ore	⟸ Ore Solution Storage Capacity at 13.3% initial water content
void ratio (e) =	0.5750	check - OK	(water required to bring to full saturation S=1)
Saturation (S) =	62.45%		

Ore properties provided by Wardrop (2011) in *Heap Leach Facility Design Criteria* , July, 2011

In-Heap Pond Stage-Storage

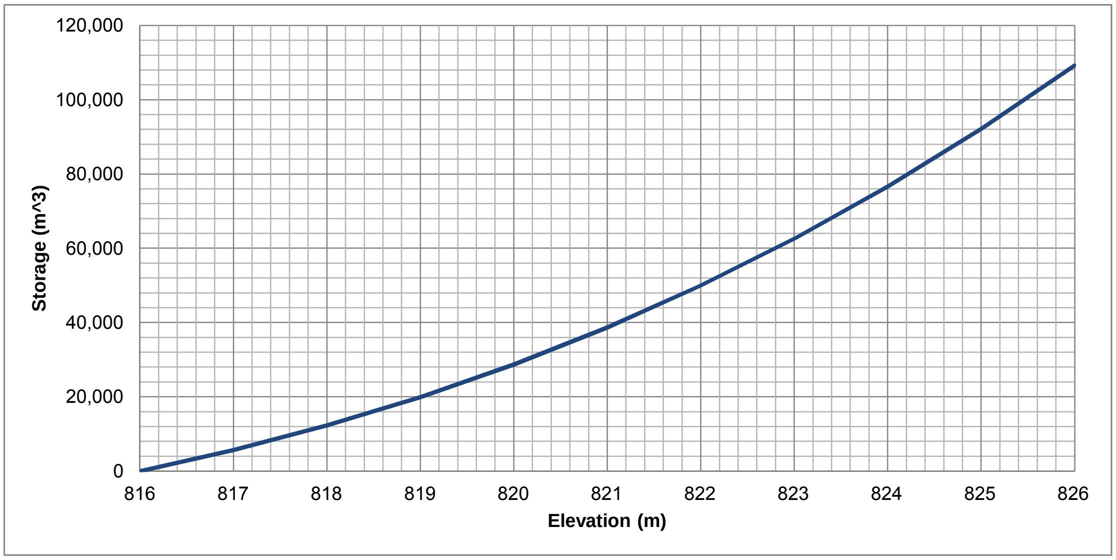
Elevation-Area Function

ELEV	AREA (m^2)	INCREMENTAL VOL (m^3)	GROSS TOTAL VOL (m^3)	NET TOTAL VOL (in Voids)
850	1,056.24	0.0	0.0	0.0
851	4,738.19	2897.2	2897.2	397.2
852	9,397.83	7068.0	9965.2	1366.2
853	15,328.82	12363.3	22328.6	3061.2
854	22,503.36	18916.1	41244.6	5654.6
855	38,575.42	30539.4	71784.0	9841.6
856	41,169.12	39872.3	111656.3	15308.1
857	43,839.58	42504.4	154160.7	21135.4
858	46,586.73	45213.2	199373.8	27334.1
859	49,410.57	47998.7	247372.5	33914.8
860	52,311.09	50860.8	298233.3	40887.8
861	55,313.72	53812.4	352045.7	48265.5
862	58,403.70	56858.7	408904.4	56060.8
863	61,581.05	59992.4	468896.8	64285.7
864	64,846.54	63213.8	532110.6	72952.4
865	68,197.83	66522.2	598632.8	82072.6
866	71,568.12	69883.0	668515.7	91653.5
867	75,031.01	73299.6	741815.3	101702.9
868	78,586.47	76808.7	818624.0	112233.4
869	82,234.53	80410.5	899034.5	123257.6
870	85,975.17	84104.9	983139.4	134788.4
871	89,810.77	87893.0	1071032.4	146838.5
872	93,728.77	91769.8	1162802.1	159420.2
873	97,720.13	95724.5	1258526.6	172544.0
874	101,783.00	99751.6	1358278.1	186219.9
875	105,918.84	103850.9	1462129.1	200457.9
876	109,749.78	107834.3	1569963.4	215242.0
877	113,636.79	111693.3	1681656.7	230555.1
878	117,580.75	115608.8	1797265.4	246405.1
879	121,580.35	119580.6	1916846.0	262799.6
880	125,635.81	123608.1	2040454.1	279746.3
881	129,695.04	127665.4	2168119.5	297249.2
882	133,802.01	131748.5	2299868.0	315311.9
883	137,957.84	135879.9	2435747.9	333941.0
884	142,162.46	140060.2	2575808.1	353143.3
885	146,784.74	144473.6	2720281.7	372950.6
886	152,066.10	149425.4	2869707.1	393436.8
887	157,424.23	154745.2	3024452.3	414652.4
888	162,975.38	160199.8	3184652.1	436615.8
889	168,653.13	165814.3	3350466.3	459348.9
890	174,488.42	171570.8	3522037.1	482871.3
891	180,181.02	177334.7	3699371.8	507183.9
892	186,066.74	183123.9	3882495.7	532290.2
893	192,132.00	189099.4	4071595.1	558215.7



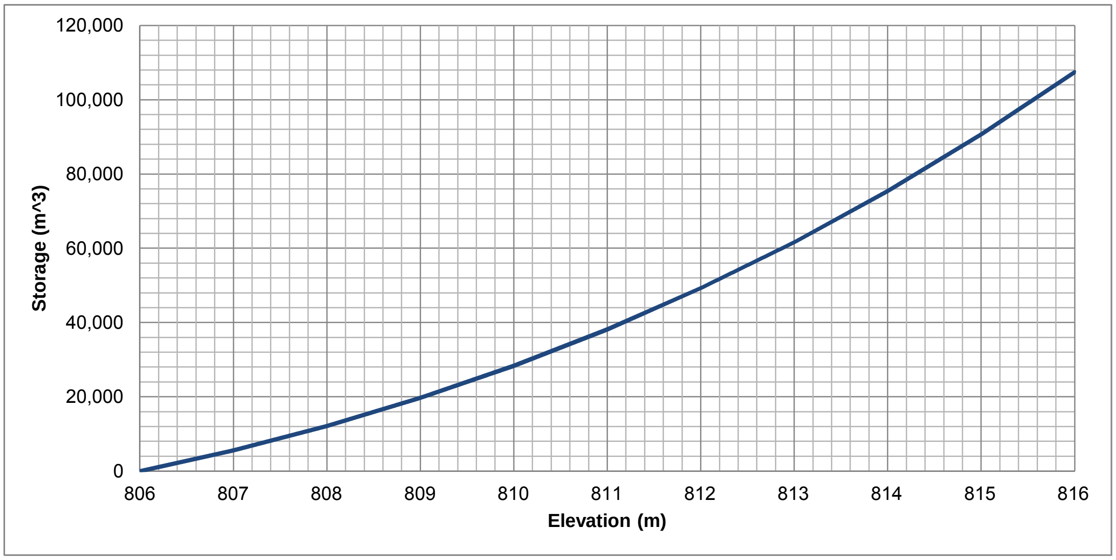
Event Pond 1 Stage-Storage

ELEV	AREA (m^2)	INCREMENTAL VOL (m^3)	TOTAL VOL (m^3)
816	5,173.41	0.0	0
817	6,111.88	5642.65	5643
818	7,124.70	6618.29	12261
819	8,211.88	7668.29	19929
820	9,373.41	8792.65	28722
821	10,609.30	9991.36	38713
822	11,919.55	11264.42	49978
823	13,304.15	12611.85	62590
824	14,763.11	14033.63	76623
825	16,296.42	15529.76	92153
826	17,904.09	17100.25	109253



Event Pond 2 Stage-Storage

ELEV	AREA (m^2)	INCREMENTAL VOL (m^3)	TOTAL VOL (m^3)
806	5,130.00	0.0	-
807	6,048.00	5589	5,589
808	7,038.00	6543	12,132
809	8,100.00	7569	19,701
810	9,234.00	8667	28,368
811	10,440.00	9837	38,205
812	11,718.00	11079	49,284
813	13,068.00	12393	61,677
814	14,490.00	13779	75,456
815	15,984.00	15237	90,693
816	17,550.00	16767	107,460



ATTACHMENT B
SPILLWAY SIZING HYDROLOGY
HEC-HMS RESULTS

TETRA TECH

Eagle Gold Hydrology Calculations Summary

Precipitation

P(100yr,24hr)=	103.20	mm	4.1	in
P(PMP, 24hr)=	256.0	mm	10.1	in

Hathaway Formula (roughness coefficient)

n= 0.3

Hydrology Calculations

	Watershed Data/HEC-HMS Input																			HEC-HMS Results			
			NRCS Parameters									Geometry			Time of Concentration/Lag Time								
	BASIN AREA		CN	CN(III)	S		Ia		Q(100,24)		Q(PMP,24)	Longest Watercourse		Average Watershed Slope	[1]NRCS T_{lag}	[2]Hathaway T_{lag}	[3]BCMOH T_{lag} Chart	[4]Kirpich	Tlag Avg	100-yr, 24 hr Volume	100-yr, 24-hr Peak Flow	PMP Volume	PMP Peak Flow
BASIN ID	(m^2)	(km^2)			(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(m)	(ft)	(%)	(min)	(min)	(min)	(min)	(min)	(1000 m^3)	(cms)	(1000 m^3)	(1000 m^3)
Ann Gulch / Spillway	1,281,018	1.28	86	93	18.0	1.628	3.596	0.326	84.375	2.603	235.622	1800	5906	19.2	14.7	24.1	43.2	7.1	22.3	108	9.9	302	26.7

Avg Tc **33.6**

Notes:
1) NRCS Lag time equation
2) Hathaway formula from BCMOH for small interior basins
3) Tc estimated from the British Columbia Manual of Operational Hydrology Figure 1. Steep Slope Time of Concentration p. 150
4) Kirpich formula small imperameable catchment from BCMOH

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APPENDIX B

OPERATIONAL WATER BALANCE MODEL

(Pages B-1 to B-15)

APPENDIX B

VICTORIA GOLD CORPORATION
EAGLE GOLD PROJECT

OPERATIONAL MONTHLY STOCHASTIC WATER BALANCE MODEL

1.1 GENERAL

A stochastic analysis was carried out on the monthly operational mine site water balance using the GoldSim© software package. The intent of the modelling was to estimate the magnitude and extent of any water surplus and/or deficit conditions for the heap leach facility and the associated excess mine site runoff requiring treatment, over a range of possible climatic conditions. The modelling timeline includes two years of pre-production (Year -1 to -2), 9 years of operation (Year 1 to 9) at a nominal ore production rate of 29,500 dry metric tonnes per day (tpd) and approximately 13 years of active closure (Year 10 to 22), during which time the heap leach facility goes through supplemental gold recovery, rinsing and draindown. The model is shown schematically on Figure B.1 and incorporates the following major project components:

- Open pit
- Eagle Pup waste rock storage area (WRSA)
- Platinum Gulch waste rock storage area (WRSA)
- 100-day ore stockpile
- Heap Leach Facility (HLF)
- Mine Water Treatment Plant (MWTP)
- Events Ponds
- Lower Dublin South Pond (LDSP), and
- Lower Dublin North Pond (LDNP).

The project schedule used for the water balance model is summarized in Table B.1. The calendar period presented in Table B.1 is arbitrary and was assumed only for the purpose of the water balance model and does not reflect the actual project scheduling. Model assumptions and parameters are discussed in the following sections and summarized in Table B.2, which also lists the relevant catchment areas for the mine facilities.

1.2 MODEL ASSUMPTIONS

1.2.1 Average Climatic Conditions

The base case monthly operational water balance model was developed using average estimated values for precipitation. The climate inputs, as well as the runoff coefficients for the undisturbed basins were based on the analyses completed by Stantec and included in the reports “Appendix 7: Eagle Gold Project – Environmental Baseline Report: 2010 Update for Climate”, (Stantec, 2011a) and “Appendix 21: Eagle Gold Project – Surface Water Balance Model Report”, (Stantec, 2011b).

The MAP for the project site was determined to be approximately 578 mm, for the median basin elevation of 1210 m of the Dublin Gulch catchment, with 61% of the annual precipitation falling as rain and the remainder as snow. Sublimation was estimated to be 20% of the monthly snowfall and the average snowmelt distribution for the project site was estimated to be 50% of the snowfall in October, then 10% in April, 80% in May and 10% in June of the maximum accumulated spring snowpack. The annual average long-term potential evapotranspiration for the project site was estimated to be 439 mm.

The downstream receiving waterbody in the model for the mine water treatment discharge was considered in Haggart Creek at W22, located upstream of Dublin Gulch. The baseline monthly surface water component of the streamflow at W22 was estimated based on applying a monthly runoff coefficient to the monthly rainfall plus snowmelt values defined by the operational model. The monthly runoff coefficients were based on the baseline model developed by Stantec (2011b):

Month	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Runoff Coefficient	0%	0%	0%	5%	17%	12%	11%	9%	12%	22%	0%	0%

The monthly baseflow component of the total streamflow at W22, assuming a contributing catchment area of approximately 67.3 km^2, from the Stantec (2011b) baseline model is as follows:

Month	*Unit Area baseflow flow (m/mon)*	*Monthly baseline flow (m^3/mon)*
Jan	0.0071	477,858
Feb	0.0052	349,981
Mar	0.0045	302,868
Apr	0.0038	255,755
May	0.017	1,144,168
Jun	0.019	1,278,776
Jul	0.0144	969,178
Aug	0.0186	1,251,854
Sep	0.0216	1,453,766
Oct	0.0224	1,507,610
Nov	0.016	1,076,864
Dec	0.0112	753,805

The total monthly streamflow distribution in Haggart Creek dictates the capacity of the system to dilute the MWTP discharge volume to the specified 10:1 dilution ratio. Haggart Creek experiences its highest flows in May due to snowmelt, with the high flows being maintained throughout June and July.

1.2.2 Stochastic Inputs

The potential variability of climatic conditions was addressed by using a stochastic version of the water balance model, which involved Monte Carlo type simulation techniques and the modelling of monthly climatic parameters as probability distributions, rather than simply as mean values. The year-to-year variability of monthly precipitation values was quantified using coefficient of variation (Cv) values, which were derived from regional datasets. Table B.3 lists the monthly Cv values for precipitation, along with the monthly mean and corresponding standard deviation values. The monthly mean and standard deviation values were used to develop monthly probability distributions, as required for a Monte Carlo simulation. The distributions of monthly precipitation were modelled assuming an underlying Gamma distribution.

1.2.3 Heap Leach Facility

1.2.3.1 Process Water Requirements

Process water requirements for the HLF were calculated based on the specified ore stacking rate and the water content of the ore from the Open pit and 100-day ore stockpile area. The ore production rate is 29,500 tpd for 350 days per year of mine life (Year 1 to 9), beginning in March of Year 1 and continuing to November of Year 9.

Ore will be stacked on the heap for 250 days per year (March to November), and for the remaining 100 days (November to February) will be stored on the 100-day stockpile. Beginning in Year 2, from March to November ore processed from the Open pit will be stacked on the heap pad at a rate of 29,500 tpd, as well as an additional 11,800 tpd will be moved from the 100-day ore stockpile; therefore, the total ore production rate during March to November, beginning in Year 2, will be 41,300 tpd. The first year of ore stacking on the heap will involve only the 29,500 tpd of ore mined from the Open pit.

The ore water content assumptions are as follows:

- Ore mined from Open pit – 0.09 m^3/m^3 ore
- Ore from 100-day stockpile – 0.135 m^3/m^3 ore
- HLF ore water content for optimal leaching – 0.23 m^3/m^3 ore

The ore stacking rate, ore water content and properties, and the heap and ore stockpile areas were based on the assumptions outlined in Tetratech’s technical memo “Eagle Gold Heap Leach Facility Water Balance – Revision 1” (Tetratech, 2012a).

The majority of the makeup water required for the HLF will be supplied by the mine site runoff from the WRSAs and Open pit sump dewatering. The volume of water required for makeup was estimated using the HLF water balance framework as outlined in Tetratech’s memo (2012a), but using the climate inputs as defined by the operational GoldSim model.

The primary inflows to the HLF are:

- Leachate solution application
- Infiltration from direct precipitation on the HLF, and
- Water content of the stacked ore.

The primary outflows from the HLF are:

- Recovered leachate solution
- Evaporation from the heap, and
- Evaporation from the leachate irrigation emitters.

The process water required by the HLF is assumed to be 100% of any deficit resulting from the calculation of outflows less inflows. Excess water in the heap system will be stored in the in-heap pond and/or Events ponds, which are located immediately downstream of the HLF. The leachate solution is assumed to be 100% recycled from the heap system (Tetratech, 2012a), and was therefore modelled as a closed loop that was not included in the operational water balance calculations.

1.2.3.2 In-Heap Pond and Events Ponds

The HLF in-heap pond is modelled with an assumed operating capacity of approximately 200,000 m^3, which includes the minimum operating volume and allowance for the snowmelt volume for the average maximum snowpack depth as outlined in the technical memo “In-Heap Pond, Spillway and Events Ponds Sizing” (Tetratech, 2012b). The in-heap pond functions to store excess leachate solution and water that may accumulate in the HLF during operations as a result of extreme precipitation events, based on the stochastic climate inputs.

The Events ponds were simulated with an assumed combined capacity of 182,845 m^3 (Tetratech, 2012b), and are used in the model to store makeup water required for the HLF, as determined by the HLF balance and calculation of the excess infiltration/runoff from the heap that exceeds the capacity of the in-heap pond. Excess water, above the normal operating capacity of the Events ponds is sent to the MWTP.

1.2.3.3 HLF Closure Draindown

In closure, the HLF draindown is assumed to commence in November of Year 12, based on end of the HLF operational schedule in November of Year 9 provided by Tetratech (2012a) and the two years of HLF closure (one year of supplemental gold recovery and one year of HLF rinsing). The draindown rate of residual leachate solution was based on the draindown curve provided by Tetratech in the technical memo “Seepage and Draindown Evaluation of the 66 Million Tonne Eagle Gold Project Heap Leach Facility” (Tetratech, November 2011). The calculated total volume of draindown for the 66 million tonne design (1.3 million m^3) was scaled up to approximately 1.9 million m^3 for the current heap facility design of 92 million tonnes. This provides a conservative assumption for the total draindown volume for the 92 million tonne facility and will be refined as more information becomes available. The draindown rate for the 92 million tonne heap assumed the same percentage of total draindown volume per month from the heap for the 10 years of simulated draindown as the 66 million tonne heap (Tetra Tech, November 2011).

1.2.4 Mine Site Collection Ponds

The storage capacities for the various ponds in the project area are summarized in Table B.2. The Eagle Pup and Platinum Gulch collection ponds are simulated as flow through ponds in the model, as these ponds will likely be pumped down during operations, with the pumped flow being directed to the LDSP and the Events ponds for makeup to the HLF, as needed. The Open pit sump volume will increase throughout operations, as the Open pit develops. The Open pit sump overflow will be directed to the

Platinum Gulch collection pond, then the LDSP. The LDSP is modelled with an operating capacity of 30,000 m^3, and excess water from this pond, above the storage capacity and/or water not needed as makeup, directed to the MWTP throughout operations. In closure, excess LDSP water will be sent to the MWTP until approximately Year 14 when the passive treatment systems are assumed to be operating and/or the water quality is acceptable to discharge to the Dublin Gulch Diversion Channel (DGDC).

1.2.5 Open Pit Groundwater Inflows

The water pumped from the Open pit sump includes pit wall runoff, water from the depressurization wells, and groundwater inflows. The water will be pumped to the PG collection pond for use as process water makeup to offset a potential deficit at the HLF.

The total groundwater inflows to the Open pit that are estimated for the water balance model are based on the groundwater inflows plus active depressurization and perimeter dewatering wells during operations, and groundwater inflows with no depressurization wells during closure (Stantec, June 2011). The total estimated groundwater inflows to the Open pit assumed in the model are:

Mine Life (year)	Total (m^3/day)
-1	**90.8**
-2	**172.8**
1	**115**
2	**299.8**
3	**66.2**
4	**428.9**
5	**77.8**
6	**400**
7	**45.9**
8	**38.1**
9	**38.1**
10 to 22	**41.7**

1.2.6 Operational Constraints

Operational rules were applied to the water balance in order to determine the design requirements (capacity and timing) for water management and treatment facilities. For the HLF and MWTP, the model utilized an optimized water management scenario to simulate the recycling of excess discharge from the HLF back to the HLF or Events ponds in that event that:

- The inflow in any month exceeds the design capacity of the MWTP of 600 m^3/hr.
- The ratio of potential discharge from the MWTP versus Haggart Creek flow is less than 1:10 (i.e. 1 part MWTP discharge to 10 parts Haggart Creek flow).

1.3 MODEL RESULTS

The model results were used to determine the likelihood of exceeding the design capacity of the MWTP and/or the dilution ratio in Haggart Creek while satisfying the process requirements of the HLF throughout operations.

1.3.1 Operations

The water balance results indicate that the mine water management system (including mine site runoff collected in the Lower Dublin South Pond) is able to supply enough water to meet the process water requirements for the HLF throughout operations, with the exception of the months presented in Table B.4 and Table B.5 for the median and 90th percentile dry scenarios. During these months, additional makeup water will be required from outside the system, such as that pumped from groundwater wells. Excess site water that is not needed for makeup to the HLF is assumed to be sent for treatment. Figure B.2 and Figure B.3 present the ranges of possible monthly inflow volumes to the MWTP during operations, in terms of the median, 10th percentile (90th percentile dry), and 90th percentile values, for unmanaged and optimized scenarios, respectively. The unmanaged case assumes that the operational water balance runs its course without intervention from the heap operators – this has a tendency to overload the MWTP during upset conditions where excess heap solution must be treated. The optimized case assumes that the heap operators have a measure of control over the quantity of water reporting to the MWTP – this control comes with the ability to re-circulate excess solution back through the heap. This allows the operators to regulate the quantity of flow passing to the MWTP.

1.3.2 Closure

Figure B.2 and Figure B.3 present the ranges of possible monthly inflow volumes to the MWTP in closure, in terms of the median, 10th percentile (90th percentile dry), and 90th percentile values, for unmanaged and optimized scenarios, respectively.

The results on Figure B.2 indicate that for the unmanaged scenario there is a likelihood of excess inflow to the MWTP (resulting in a less than 10:1 dilution in Haggart Creek) occurring during the initial year of gold recovery (Year 10) and the initial two years of the HLF draindown period (Years 12 to 14). The increased flow in Year 10 is due the net precipitation inputs to the heap exceeding the moisture losses to the ore, as ore production has ceased, creating a positive water balance in the heap. The increased flow in Year 12 is due to the initiation of draindown, in addition to the excess site water generated from the mine facilities (waste rock storage areas and Open Pit sump) that is assumed to require treatment before being discharged to the environment, up until passive treatment systems are in place. In the event that the cumulative inflows (HLF infiltration and other possible sources) to the MWTP exceed the design capacity and/or result in a dilution ratio in Haggart Creek below the minimum allowed, the model simulates an optimized water management plan by rerouting the excess discharge from the HLF back to the HLF or Events ponds, where it is temporarily held until there is sufficient capacity in the MWTP to treat it and/or sufficient flow in Haggart Creek to provide the required dilution.

Figure B.3 illustrates the MWTP inflow/discharge with these constraints, in terms of 90th percentile and median values. Even under very wet conditions for the optimized scenario, the inflow is well below the MWTP design capacity, while achieving the specified dilution ratio in Haggart Creek.

1.4 REFERENCES

Stantec (2011a). Appendix 7: Eagle Gold Project – Environmental Baseline Report: 2010 Update for Climate.

Stantec (2011b). Appendix 21: Eagle Gold Project – Surface Water Balance Model Report. June 2011.

Tetratech (2011). Seepage and Draindown Evaluation of the 66 Million Tonne Eagle Gold Project Heap Leach Facility. November 23, 2011.

Tetratech (2012a). Eagle Gold Heap Leach Facility Water Balance – Revision 1. February 1, 2012.

Tetratech (2012b). In-Heap Pond, Spillway and Events Ponds Sizing. February 9, 2012.

TABLE B.1

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

OPERATIONAL WATER BALANCE MODEL PROJECT SCHEDULE

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Calendar time	Mine Life (year)	Phase	Description	Notes
01/01/2011	-2	Construction	Pre-production - construction	Lower Dublin south pond complete - Mar 2012 Sediment control ponds (EP and PG) complete - Mar 2012 DGDC complete - Mar 2012
01/01/2012	-1	Construction	Pre-production - construction	
01/01/2013	1	Operations	Mine start-up	Phase 1 HLF footprint - Mar 2013 Mine start up - Mar 2013
01/01/2014	2	Operations		
01/01/2015	3	Operations		Phase 2 HLF footprint - Mar 2015
01/01/2016	4	Operations		
01/01/2017	5	Operations		
01/01/2018	6	Operations		
01/01/2019	7	Operations		Phase 3 HLF footprint - Mar 2019 PG WRSA cap - Mar 2019
01/01/2020	8	Operations		
01/01/2021	9	Operations/Closure	HLF Au recovery	End of operations - Nov 2021 Au recovery commences - Nov 2021
01/01/2022	10	Closure	HLF Au recovery/HLF Rinse	Au recovery complete - Nov 2022 HLF rinse commences - Nov 2022
01/01/2023	11	Closure	HLF rinse	
01/01/2024	12	Closure	HLF rinse/draindown	HLF draindown commences - Nov 2024 HLF cap - Nov 2024 EP WRSA cap - Nov 2024
01/01/2025	13	Closure	HLF draindown	
01/01/2026	14	Closure	HLF draindown	Collection pond (EP, PG, Lower Dublin south) discharge routed to passive treatment or DGDC - Nov 2026
01/01/2027	15	Closure	HLF draindown	
01/01/2028	16	Closure	HLF draindown	
01/01/2029	17	Closure	HLF draindown	
01/01/2030	18	Closure	HLF draindown	
01/01/2031	19	Closure	HLF draindown	
01/01/2032	20	Closure	HLF draindown	
01/01/2033	21	Closure	HLF draindown	
01/01/2034	22	Post-closure		Events ponds and MWTP decommissioned - Jan 2034 Reclaimed HLF runoff directed to Haggart Creek

M:\1\01\00290\05\A\Data\Task 300 - Surface Water Balance Model\Feasbility WBM\[Eagle Gold_WBM_FS Assumptions.xlsx]Table B.1

0	08FEB'12	ISSUED WITH REPORT VA101-290/5-1	ER	CA	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE B.2

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

FEASIBILITY WATER BALANCE INPUT PARAMETERS

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COMPONENT	UNITS	ASSUMPTION
General		
Ore Production	tpd	29,500
Mine Life (years)		8.75
Physical and Hydrometeorological		
Project Site Median Elevation	m	1,210
Mean Annual Precipitation	mm	577
Mean Annual Rainfall	mm	337
Mean Annual Snowfall	mm	240
Sublimation	%	20
Mean Annual Pond Evaporation	mm	439
Annual Evaporation (bare surface - Heap, Ore Stockpile)	mm	299
Runoff coefficient - facilities		
Waste Rock Storage Areas	-	0.8
Open Pit footprint	-	0.8
Laydown area, truck shop (disturbed)	-	0.8
Infiltration Rates		
Waste Rock Storage Areas	%	20
Heap Leach Facility during operations	%	100
Capped surfaces (closure)	%	10
Total Facilities Areas		
Eagle Pup WRSA (Phase I)	m^2	610,000
Eagle Pup WRSA (Phase II)	m^2	940,000
Eagle Pup WRSA (Phase III)	m^2	980,000
Platinum Gulch WRSA (Phase I)	m^2	410,000
Platinum Gulch WRSA (Phase II)	m^2	410,000
Platinum Gulch WRSA (Phase III)	m^2	410,000
HLF - (Phase I)	m^2	410,007
HLF - (Phase II)	m^2	940,920
HLF - (Phase III)	m^2	1,134,970
Open Pit (Phase I)	m^2	490,000
Open Pit (Phase II)	m^2	710,000
Open Pit (Phase III)	m^2	810,000
Pond capacities		
Eagle Pup Collection Pond	m^3	25,000
Platinum Gulch Collection Pond	m^3	41,000
Lower Dublin North Pond	m^3	10,500
Lower Dublin South Pond	m^3	30,000
HLF - Events Pond 1 (downstream)	m^3	90,693
HLF - Events Pond 2 (upstream)	m^3	92,153
HLF - Heap Pond (normal operating capacity)	m^3	200,000
Heap Leach Facility		
Water Demand		
Solution Application Rate	m^3/hr	2,770
Ore Moisture		
Initial moisture content	%	5
Leaching moisture content	%	13.3
Open Pit		
Drilling water requirements	m^3/day	49
Sump capacity (operations)	m^3	48,375
Sump capacity (closure)	m^3	249,793
Waste Rock Storage Areas		
Waste rock dry density	tonnes/m^3	2
Waste rock moisture content	%	2

M:\1\01\00290\05\A\Data\Task 300 - Surface Water Balance Model\Feasbility WBM\[Eagle Gold_WBM_FS Assumptions.xlsx]Assumptions

Notes:
1. THE OPEN PIT SUMP CAPACITY AND DRILLING WATER REQUIREMENTS WERE BASED ON THE STANTEC (2011b).
2. THE RUNOFF COEFFICIENTS SHOWN FOR THE MINE FACILITIES TAKE INTO ACCOUNT PRECIPITATION LOSSES DUE TO EVAPORATION.
3. THE INFILTRATION RATES SHOWN FOR THE MINE FACILITIES IS DEFINED AS THE RATIO OF NET PRECIPITATION THAT INFILTRATES THROUGH THE FACILITIES AND/OR COVER, WITH THE REMAINDER OF THE NET PRECIPITATION ASSUMED TO BE SURFACE RUNOFF.

0	18ARP'12	ISSUED WITH REPORT VA101-290/5-1	ER	CA	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE B.3

VICTORIA GOLD CORPORATION
EAGLE GOLD PROJECT

MONTHLY PRECIPITATION VALUES FOR WATER BALANCE MODELLING

26/03/2012 16:07

Location	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project site (elevation 1210 m)	Mean (mm)	24	19	25	22	32	91	105	77	68	48	34	33
	Coefficient of Variation (Cv)	0.79	0.70	0.83	0.92	0.49	0.46	0.46	0.49	0.47	0.56	0.50	0.60
	Standard Deviation (mm)	19	13	21	20	15	42	48	38	32	27	17	20

M:\1\01\00290\05\A\Data\Task 300 - Surface Water Balance Model\Feasbility WBM\[Eagle Gold_WBM_FS Assumptions.xlsx]Table B.3

NOTES:

1. COFFICIENT OF VARIATION = STANDARD DEVIATION/ MEAN
2. THE PRECIPITATION COFFICIENT OF VARIATION VALUES WERE BASED ON THE REGIONAL DATA AT MAYO A FOR THE PERIOD FROM 1925-2010.

0	15FEB'12	ISSUED WITH REPORT VA101-290/5-1	ER	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE B.4

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

HEAP LEACH FACILITY PROCESS WATER REQUIREMENTS
MEDIAN MAKEUP WATER DURING OPERATIONS

Print Apr/18/12 13:43:48

Mine Life (year)	Monthly Volume (m^3/mon)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	59,322	0	0	0	0	0	0	0	0
2	0	0	0	72,668	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0

M:\1\01\00290\05\A\Data\Task 300 - Surface Water Balance Model\Feasbility WBM\Results\[Eagle Gold WBM_FS16.xlsx]Table HLF makeup (3)

NOTES:

1. MINE OPERATIONS ASSUMED TO BEGIN MARCH OF YEAR 1.
2. HLF STACKING CEASES NOVEMBER OF YEAR 9.
3. THE SHADED PINK CELLS INDICATE THE AMOUNT OF PROCESS WATER REQUIRED BY THE HLF THAT CANNOT BE SUPPLIED BY THE MINE SITE SYSTEM.

0	18APR'12	ISSUED WITH REPORT VA101-290/5-1	ER	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

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TABLE B.5

VICTORIA GOLD CORP.
EAGLE GOLD PROJECT

HEAP LEACH FACILITY PROCESS WATER REQUIREMENTS
90th PERCENTILE DRY MAKEUP WATER DURING OPERATIONS

Print Apr/18/12 13:43:48

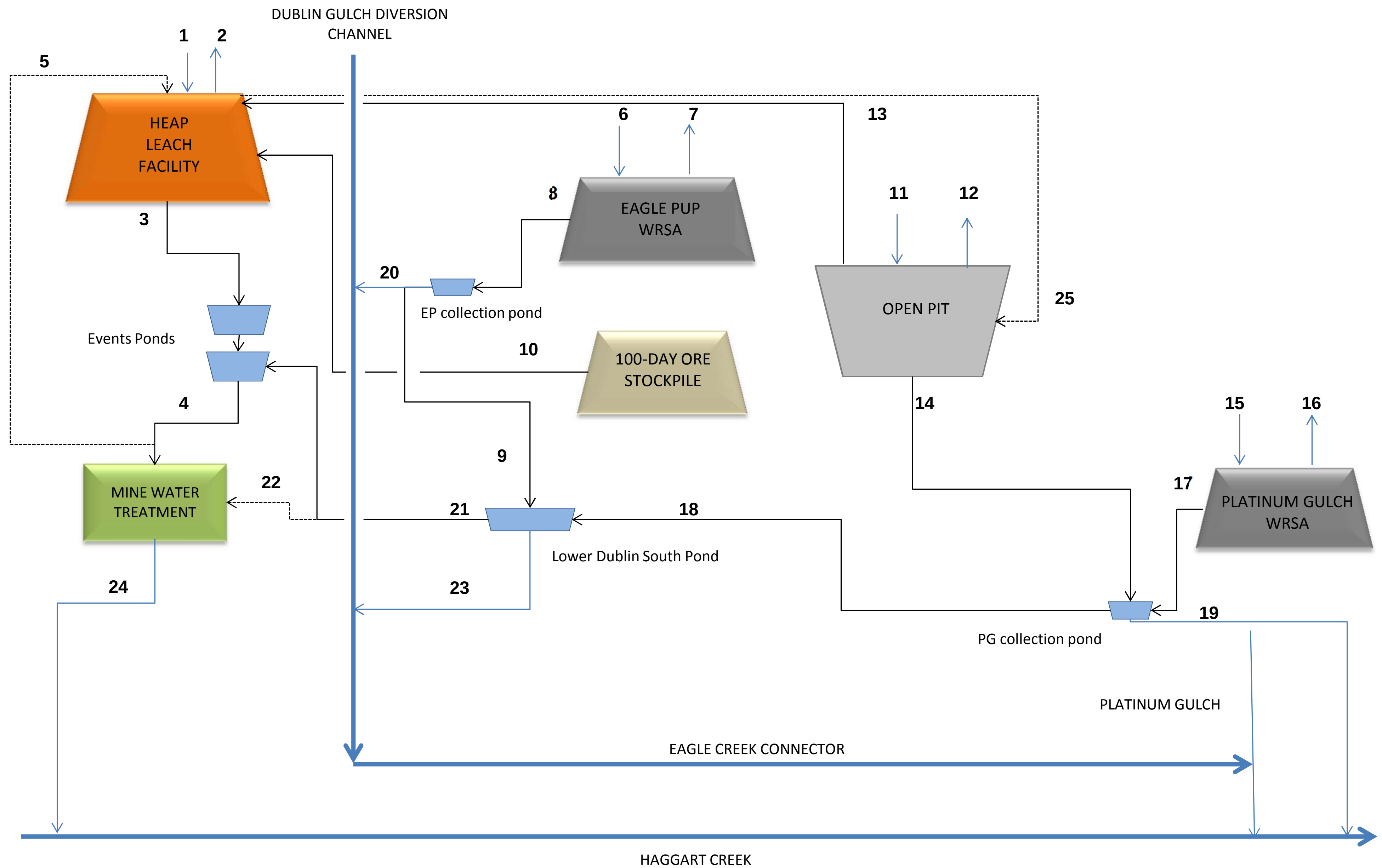
Mine Life (year)	Monthly Volume (m^3/mon)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	62,433	0	0	0	0	0	0	31,345	0
2	0	0	0	79,188	0	0	0	0	0	0	0	0
3	0	0	0	60,475	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0

M:\1\01\00290\05\A\Data\Task 300 - Surface Water Balance Model\Feasbility WBM\Results\[Eagle Gold WBM_FS16.xlsx]Table HLF makeup (2)

NOTES:

1. MINE OPERATIONS ASSUMED TO BEGIN MARCH OF YEAR 1.
2. HLF STACKING CEASES NOVEMBER OF YEAR 9.
3. THE SHADED PINK CELLS INDICATE THE AMOUNT OF PROCESS WATER REQUIRED BY THE HLF THAT CANNOT BE SUPPLIED BY THE MINE SITE SYSTEM.

0	18APR'12	ISSUED WITH REPORT VA101-290/5-1	ER	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



Number	Description
1	HLF direct precipitation (rainfall + snowmelt)
2	HLF Evaporative losses
3	HLF excess runoff/infiltration to Events Ponds
4	Events Ponds overflow to MWTP
5	Optional recirculation of excess water to HLF (closure)
6	Eagle Pup WRSA direct precipitation and catchment runoff
7	Eagle Pup WRSA evaporative losses
8	Eagle Pup WRSA infiltration/runoff
9	Eagle Pup collection pond pumped to LDSP
10	Water in ore from 100-day stockpile
11	Open Pit direct precipitation
12	Open Pit evaporative losses
13	Water in ore from Open Pit
14	Open Pit sump dewatering to PG collection pond
15	Platinum Gulch direct precipitation and catchment runoff
16	Platinum Gulch evaporative losses
17	Platinum Gulch infiltration/runoff
18	Platinum Gulch collection pond pumped to LDSP
19	Platinum Gulch collection pond discharge to Haggart Creek (closure)
20	Eagle Pup collection pond discharge to DGDC (closure)
21	LDSP makeup water to Events Ponds (operations)
22	LDSP excess water to MWTP
23	LDSP discharge to DGDC (closure)
24	MWTP discharge to Haggart Creek
25	Optional routing to Open Pit in closure (if additional capacity required)

NOTES:

1. WATER BALANCE SCHEMATIC IS NOT DRAWN TO SCALE.
2. HLF = HEAP LEACH FACILITY
3. MWTP = MINE WATER TREATMENT PLANT
4. WRSA = WASTE ROCK STORAGE AREA
5. LDSP = LOWER DUBLIN SOUTH POND; LDNP = LOWER DUBLIN NORTH POND
6. PG = PLATINUM GULCH
7. EP = EAGLE PUP
8. DGDC = DUBLIN GULCH DIVERSION CHANNEL

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	16MAR'12	ISSUED WITH REPORT	ER	CA	KJB

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

WATER BALANCE SCHEMATIC

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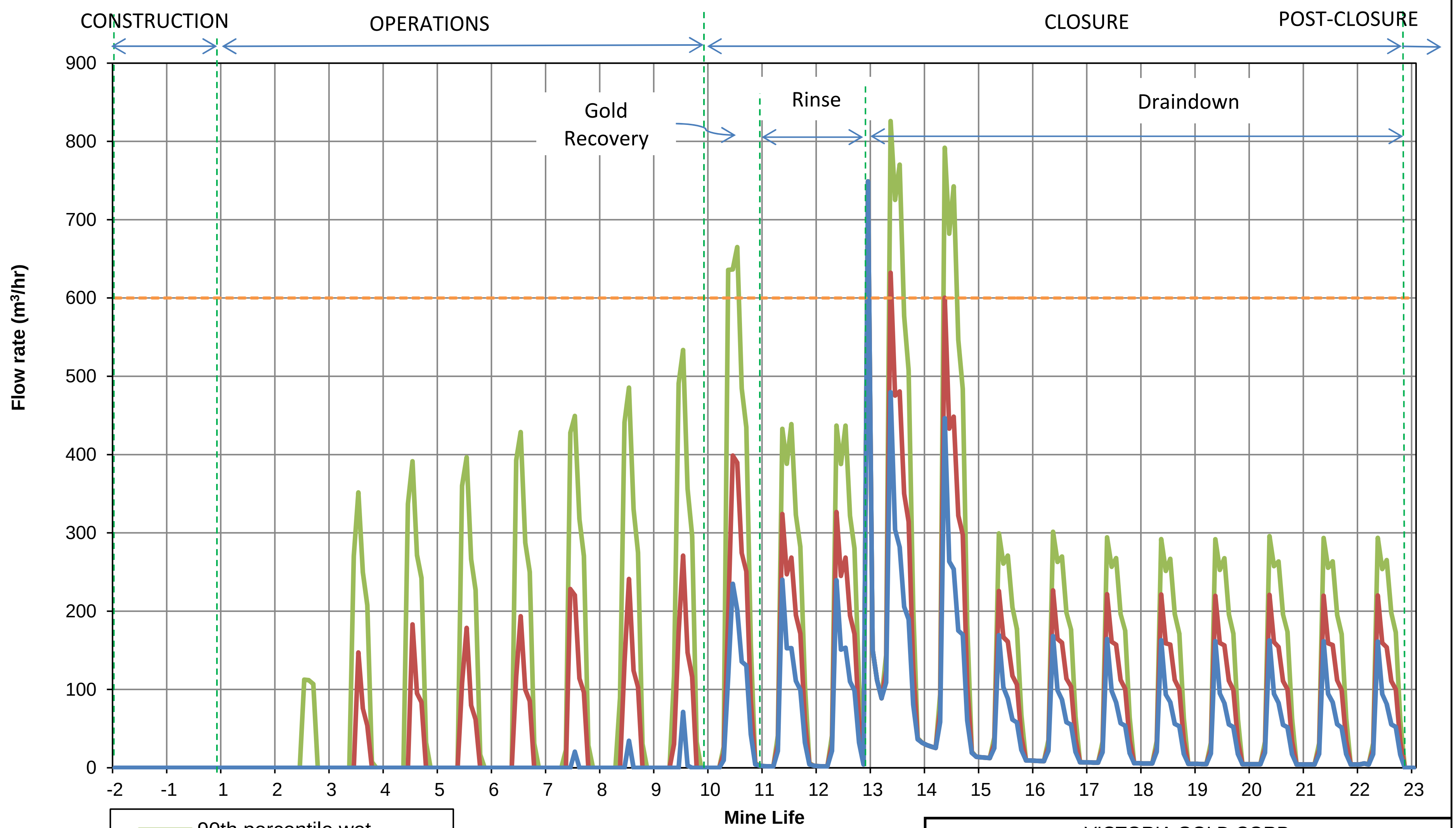
P/A NO. VA101-290/5

REF NO. 1

FIGURE B.1

REV 0



0	15FEB'12	ISSUED WITH REPORT	ER	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

UNMANAGED MONTHLY INFLOW TO THE MINE WATER TREATMENT PLANT

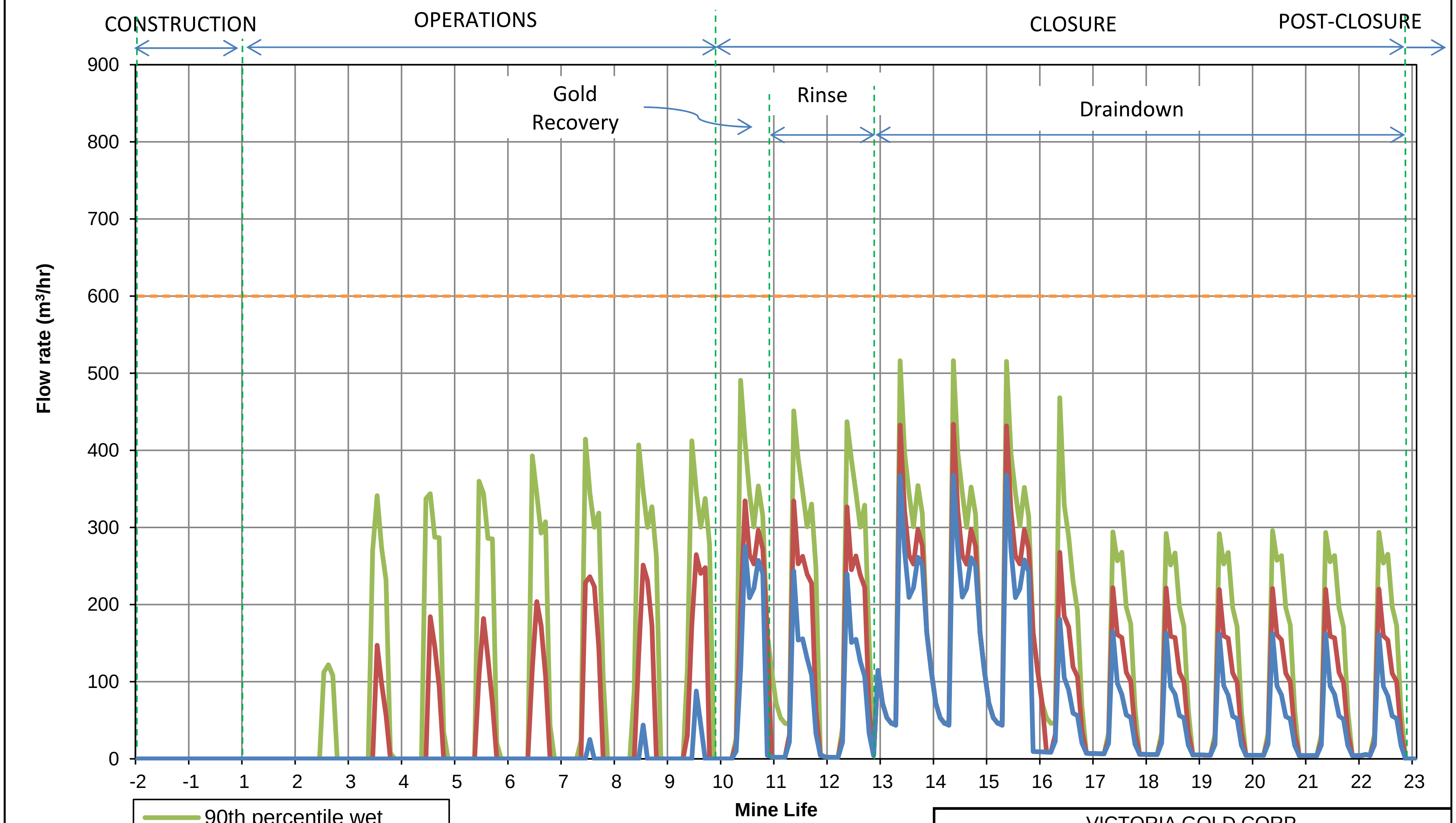
Knight Piésold CONSULTING

P/A NO. VA101-290/5

REF NO 1

FIGURE B.2

REV 0



0	15FEB`12	ISSUED WITH REPORT	ER	JGC	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

VICTORIA GOLD CORP.

EAGLE GOLD PROJECT

OPTIMIZED MONTHLY INFLOW TO THE MINE WATER TREATMENT PLANT

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P/A NO. VA101-290/5

REF NO 1

FIGURE B.3

REV 0

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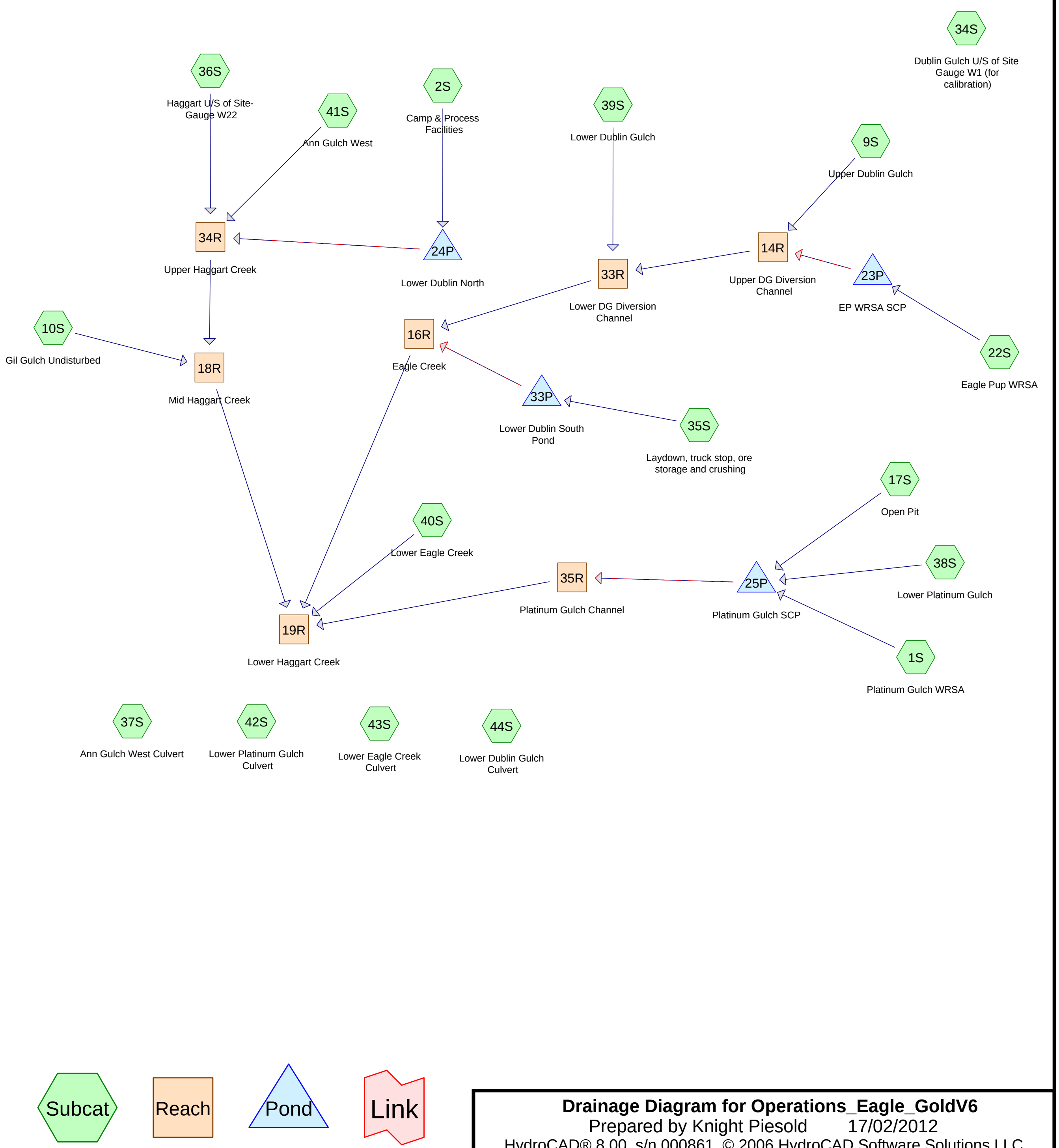
APPENDIX C

STORM WATER MANAGEMENT MODEL

(Pages C-1 to C-248)



Drainage Diagram for Operations_Eagle_GoldV6
Prepared by Knight Piesold 17/02/2012
HydroCAD® 8.00 s/n 000861 © 2006 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (hectares)	CN	Description (subcats)
8,073.8280	85	(10S,22S,34S,36S,37S,38S,39S,41S,42S,43S)
850.0000	85	Calibrated from runoff measurements (9S)
41.0000	85	Porous waste rock (1S)
96.0000	85	Some small disturbance (40S)
7.4000	90	Disturbed from Laydown area (44S)
132.0000	90	Highly disturbed (2S,35S)
81.0000	90	Highly disturbed, bare rock with benches (17S)
9,281.2280		

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=20 mm
Tc=100.0 min CN=85 Runoff=0.7709 m³/s 8.041 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=27 mm
Tc=45.0 min CN=90 Runoff=1.9087 m³/s 10.572 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=20 mm
Tc=210.0 min CN=85 Runoff=9.0275 m³/s 166.705 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=20 mm
Tc=127.0 min CN=85 Runoff=4.8545 m³/s 61.235 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=27 mm
Tc=65.0 min CN=90 Runoff=3.0327 m³/s 21.957 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=20 mm
Tc=81.0 min CN=85 Runoff=2.8082 m³/s 25.104 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=20 mm
Tc=187.0 min CN=85 Runoff=7.7908 m³/s 131.991 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and Runoff Area=93.0000 ha Runoff Depth=27 mm
Tc=69.0 min CN=90 Runoff=3.3290 m³/s 25.210 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>20 mm
Tc=591.0 min CN=85 Runoff=32.0492 m³/s 1,319.112 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=20 mm
Tc=47.0 min CN=85 Runoff=1.4107 m³/s 8.394 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=20 mm
Tc=54.0 min CN=85 Runoff=1.6710 m³/s 10.983 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=20 mm
Tc=49.0 min CN=85 Runoff=1.4719 m³/s 9.022 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=20 mm
Tc=71.0 min CN=85 Runoff=2.3344 m³/s 18.828 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=20 mm
Tc=26.0 min CN=85 Runoff=0.6456 m³/s 2.550 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=20 mm
Tc=54.0 min CN=85 Runoff=1.6979 m³/s 11.159 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=20 mm
Tc=29.0 min CN=85 Runoff=0.7350 m³/s 3.118 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=27 mm
Tc=20.0 min CN=90 Runoff=0.6107 m³/s 2.006 Ml

Reach 14R: Upper DG Diversion Cha Avg. Depth=0.34 m Max Vel=3.02 m/s Inflow=9.9520 m³/s 191.774 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=9.9304 m³/s 191.765 Ml

Reach 16R: Eagle Creek Avg. Depth=0.66 m Max Vel=1.37 m/s Inflow=10.7836 m³/s 225.930 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=10.7470 m³/s 225.886 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=3.98 m Max Vel=2.95 m/s Inflow=32.6457 m³/s 1,393.197 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=32.6394 m³/s 1,393.105 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.48 m Max Vel=3.58 m/s Inflow=36.0768 m³/s 1,678.783 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=36.0757 m³/s 1,678.762 Ml

Reach 33R: Lower DG Diversion Ch Avg. Depth=0.34 m Max Vel=3.04 m/s Inflow=10.0932 m³/s 200.787 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=10.0774 m³/s 200.770 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=4.22 m Max Vel=2.58 m/s Inflow=32.1916 m³/s 1,332.199 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=32.1402 m³/s 1,331.962 Ml

Reach 35R: Platinum Gulch Channel Avg. Depth=0.74 m Max Vel=2.32 m/s Inflow=3.4351 m³/s 40.968 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=3.3910 m³/s 40.964 Ml

Pond 23P: EP WRSA SCP Peak Elev=917.942 m Storage=31,247.7 m³ Inflow=2.8082 m³/s 25.104 Ml
Primary=0.3013 m³/s 18.831 Ml Secondary=0.7805 m³/s 6.238 Ml Outflow=1.0818 m³/s 25.069 Ml

Pond 24P: Lower Dublin North Peak Elev=791.096 m Storage=14,011.9 m³ Inflow=1.9087 m³/s 10.572 Ml
Primary=0.1455 m³/s 8.987 Ml Secondary=0.2231 m³/s 1.550 Ml Outflow=0.3686 m³/s 10.538 Ml

Pond 25P: Platinum Gulch SCP Peak Elev=903.251 m Storage=48,044.2 m³ Inflow=5.1655 m³/s 40.981 Ml
Primary=0.6518 m³/s 26.521 Ml Secondary=2.7832 m³/s 14.447 Ml Outflow=3.4351 m³/s 40.968 Ml

Pond 33P: Lower Dublin South P Peak Elev=832.090 m Storage=42,085.3 m³ Inflow=3.3290 m³/s 25.210 Ml
Primary=0.5781 m³/s 23.917 Ml Secondary=0.1978 m³/s 1.243 Ml Outflow=0.7759 m³/s 25.160 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 1,835.988 Ml Average Runoff Depth = 20 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

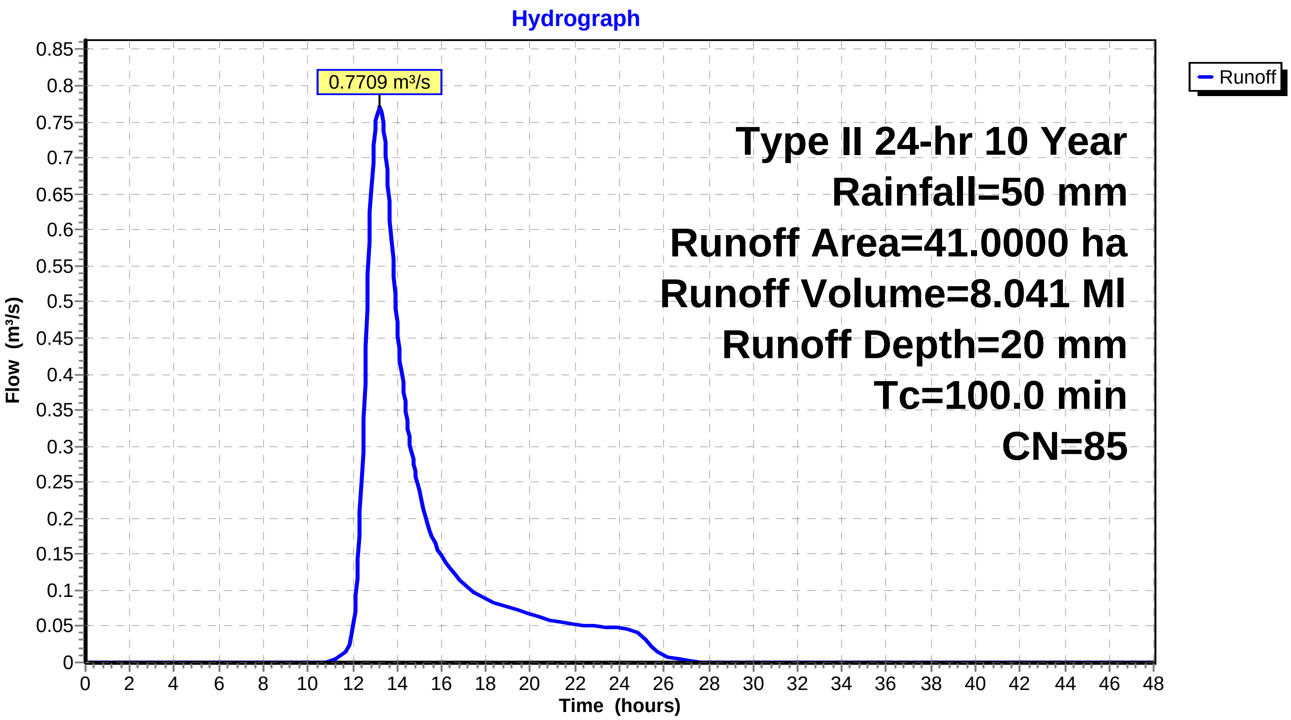
Runoff = 0.7709 m³/s @ 13.21 hrs, Volume= 8.041 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

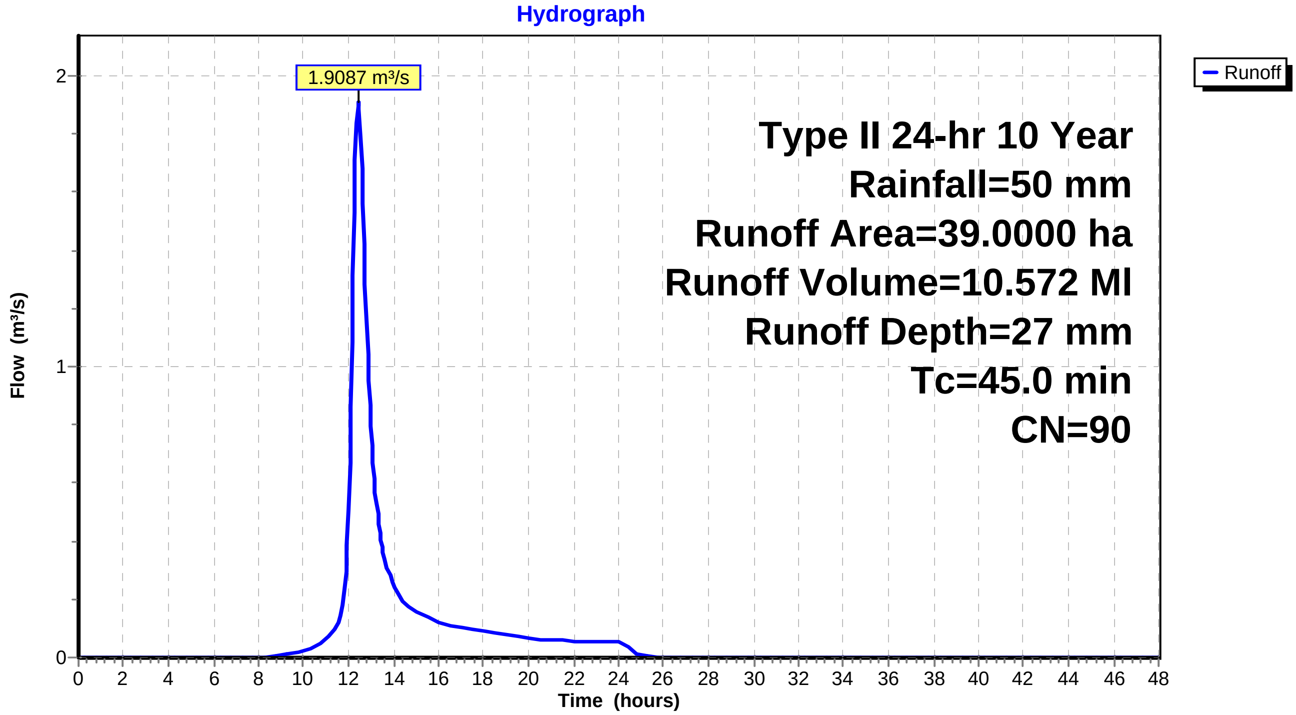
Runoff = 1.9087 m³/s @ 12.44 hrs, Volume= 10.572 Ml, Depth= 27 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

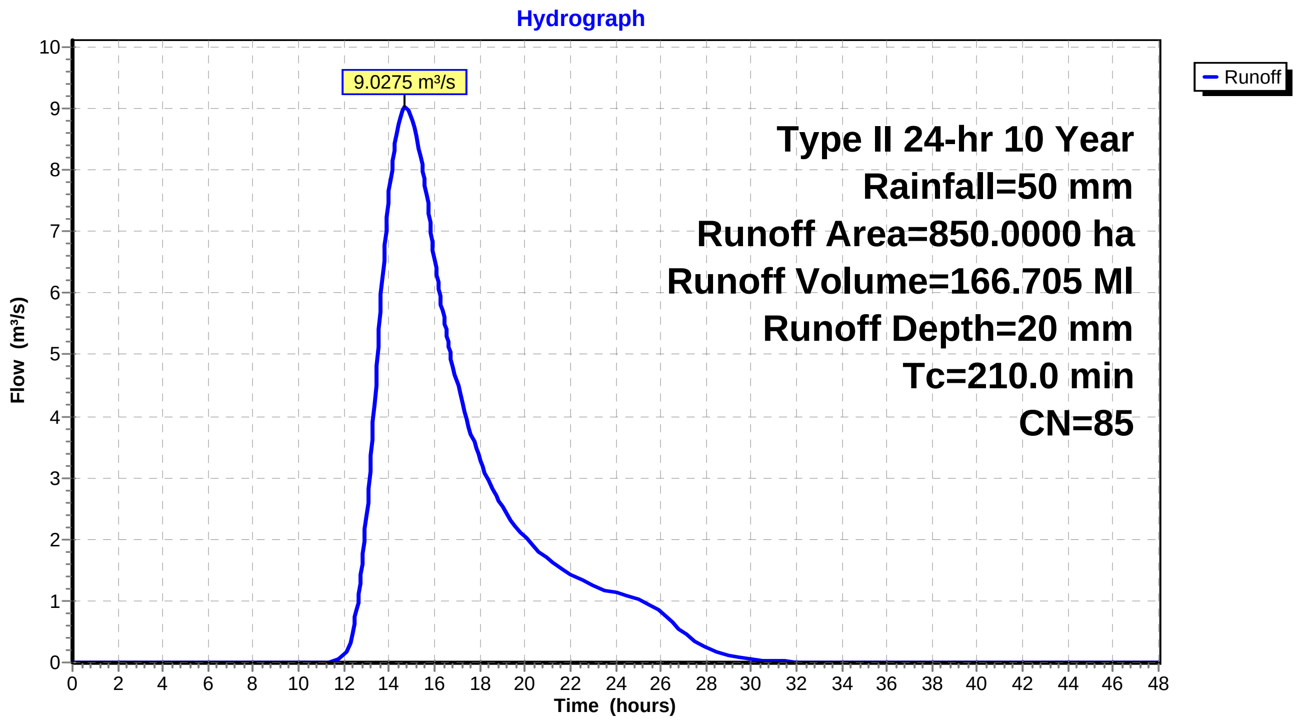
Runoff = 9.0275 m³/s @ 14.71 hrs, Volume= 166.705 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

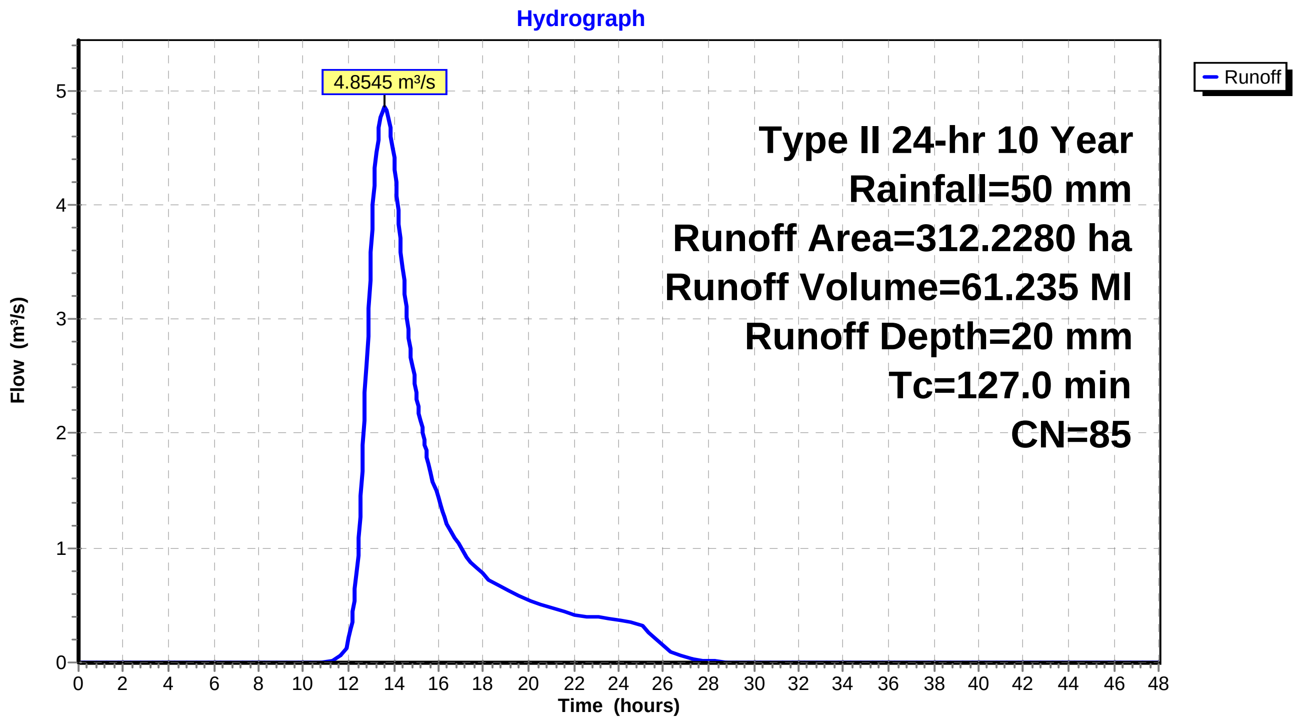
Runoff = 4.8545 m³/s @ 13.62 hrs, Volume= 61.235 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

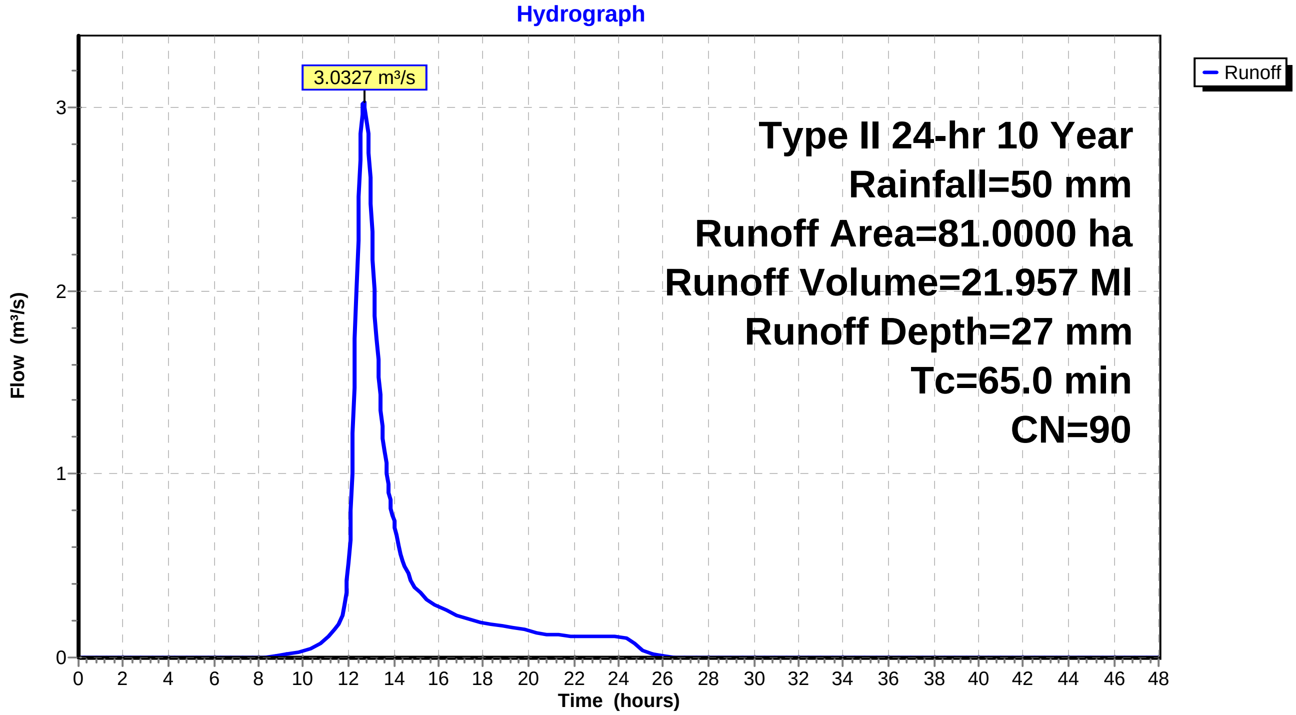
Runoff = 3.0327 m³/s @ 12.68 hrs, Volume= 21.957 Ml, Depth= 27 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

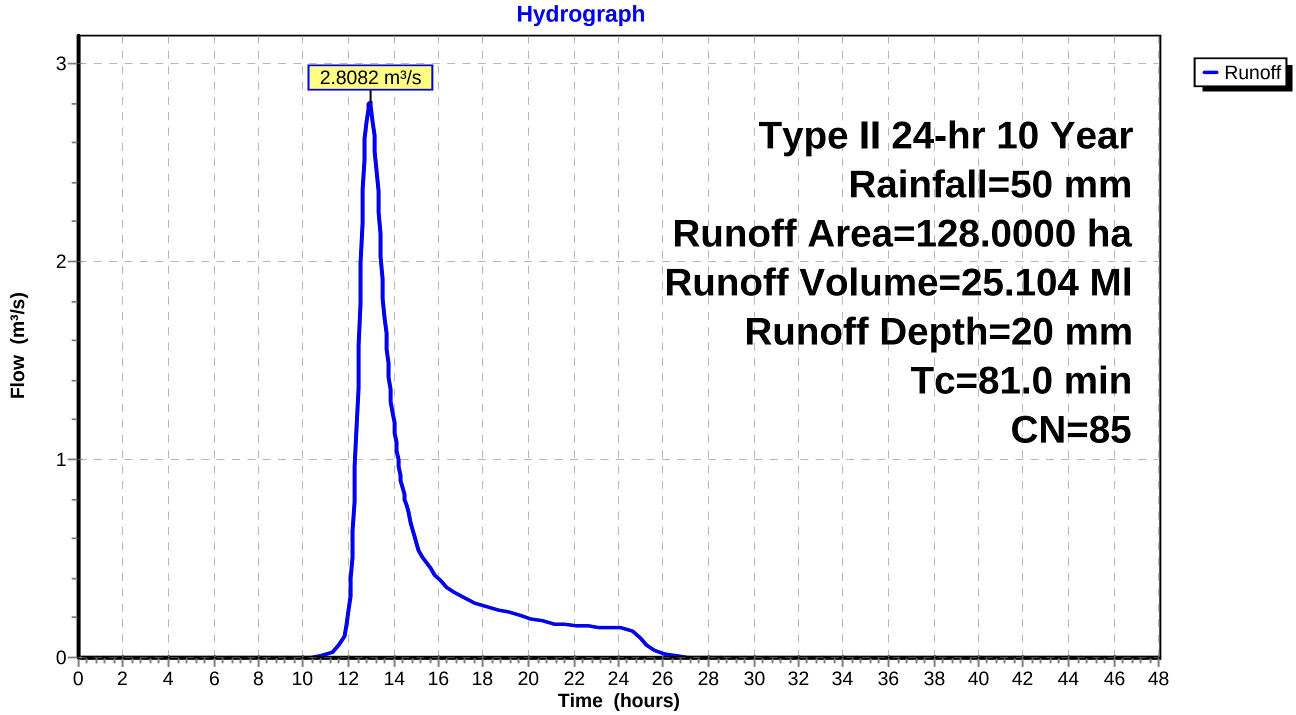
Runoff = 2.8082 m³/s @ 12.94 hrs, Volume= 25.104 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

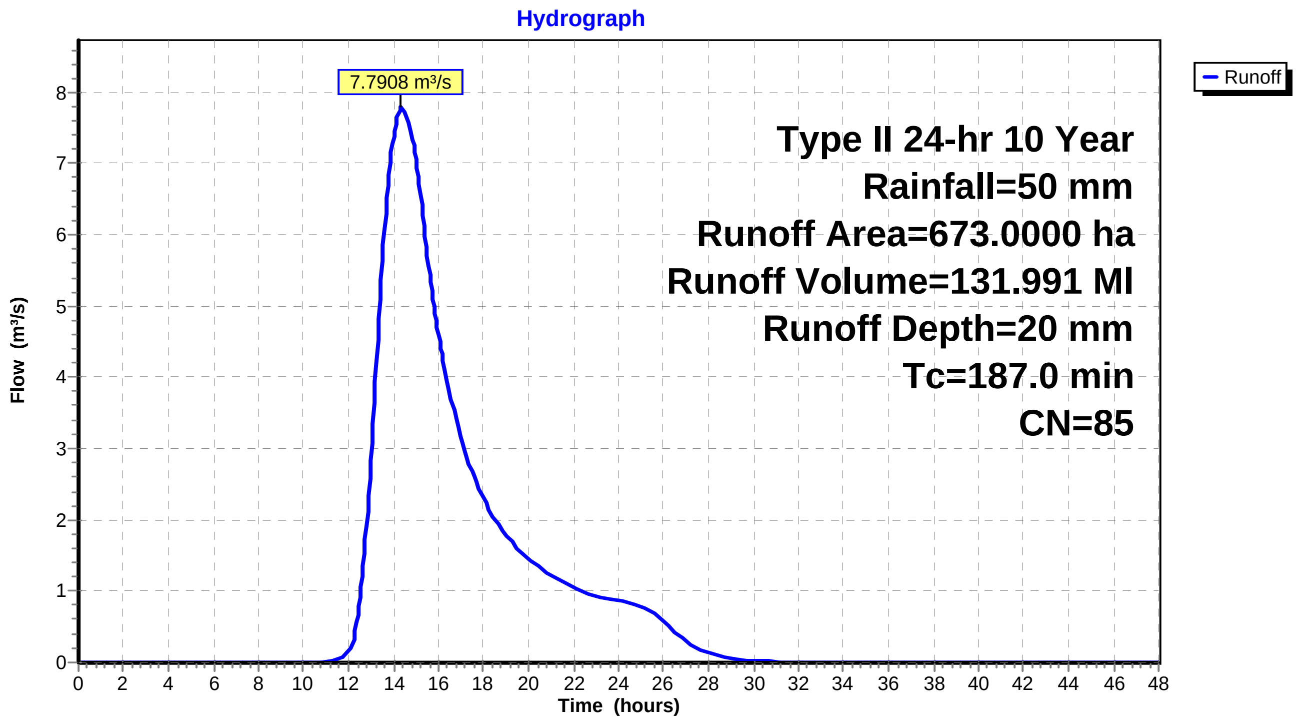
Runoff = 7.7908 m³/s @ 14.35 hrs, Volume= 131.991 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

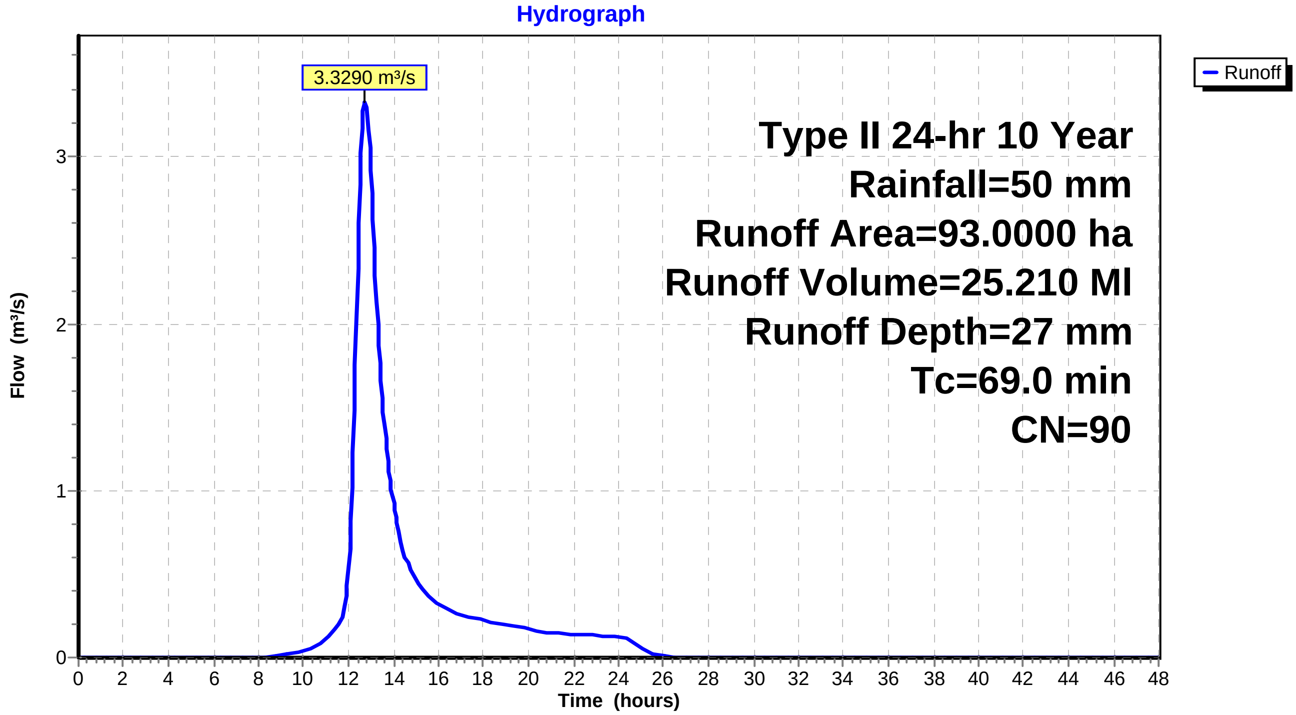
Runoff = 3.3290 m³/s @ 12.75 hrs, Volume= 25.210 Ml, Depth= 27 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

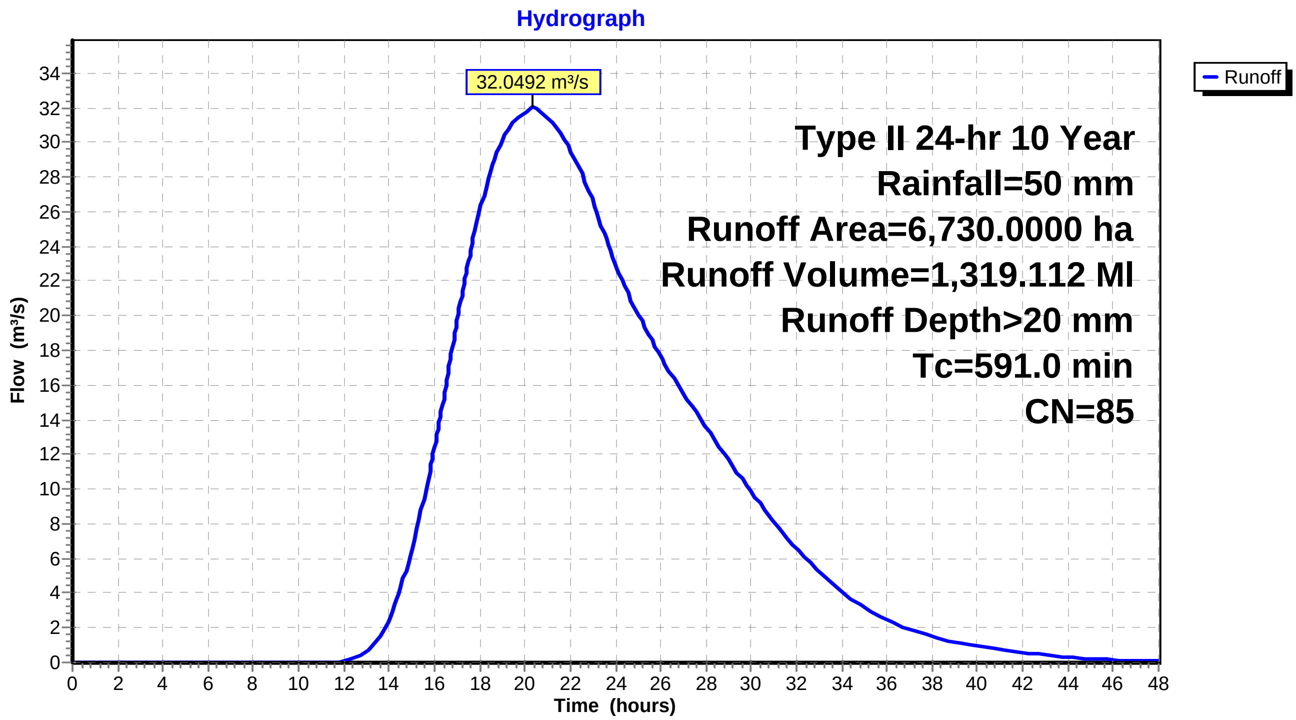
Runoff = 32.0492 m³/s @ 20.35 hrs, Volume= 1,319.112 Ml, Depth> 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

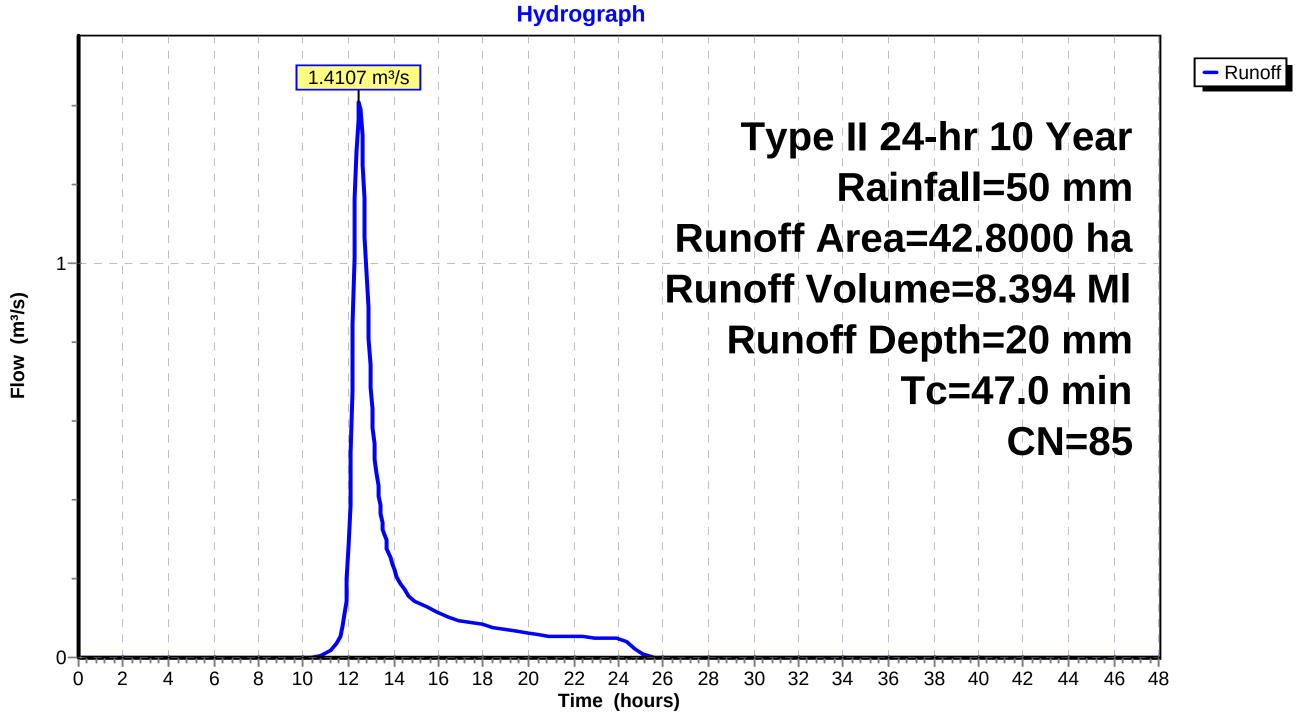
Runoff = 1.4107 m³/s @ 12.48 hrs, Volume= 8.394 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

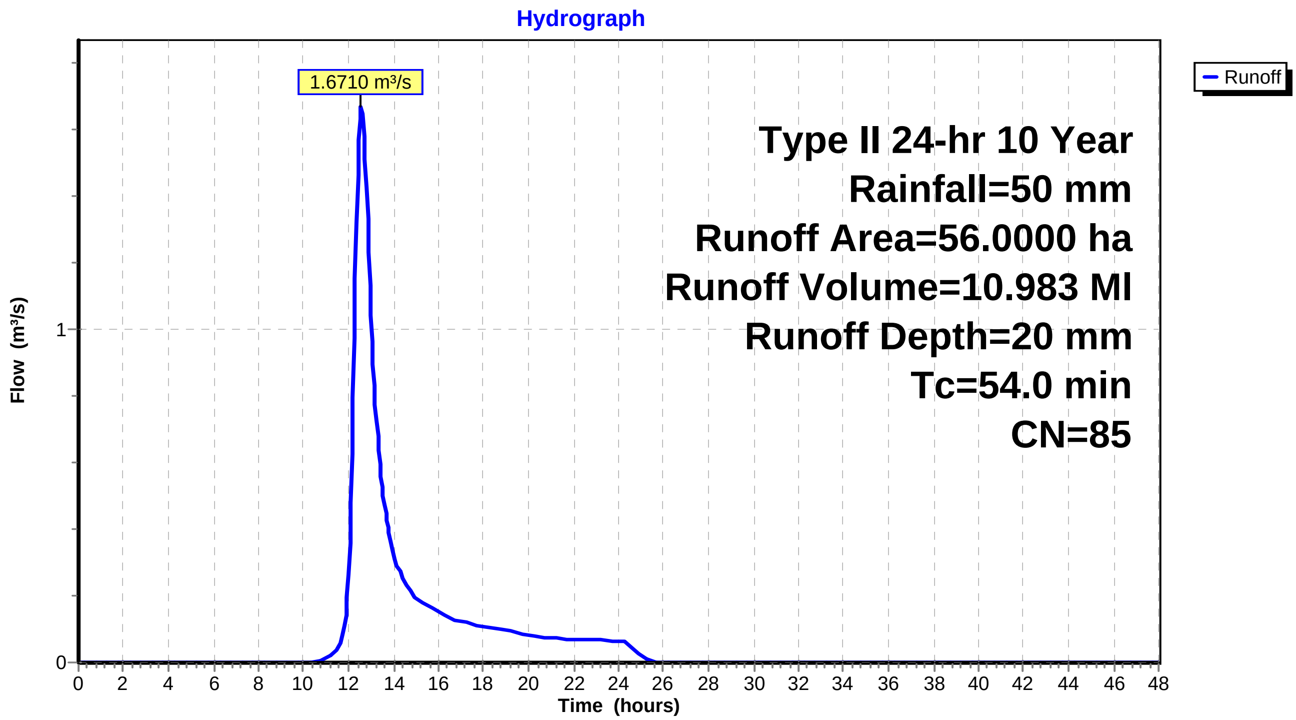
Runoff = 1.6710 m³/s @ 12.57 hrs, Volume= 10.983 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

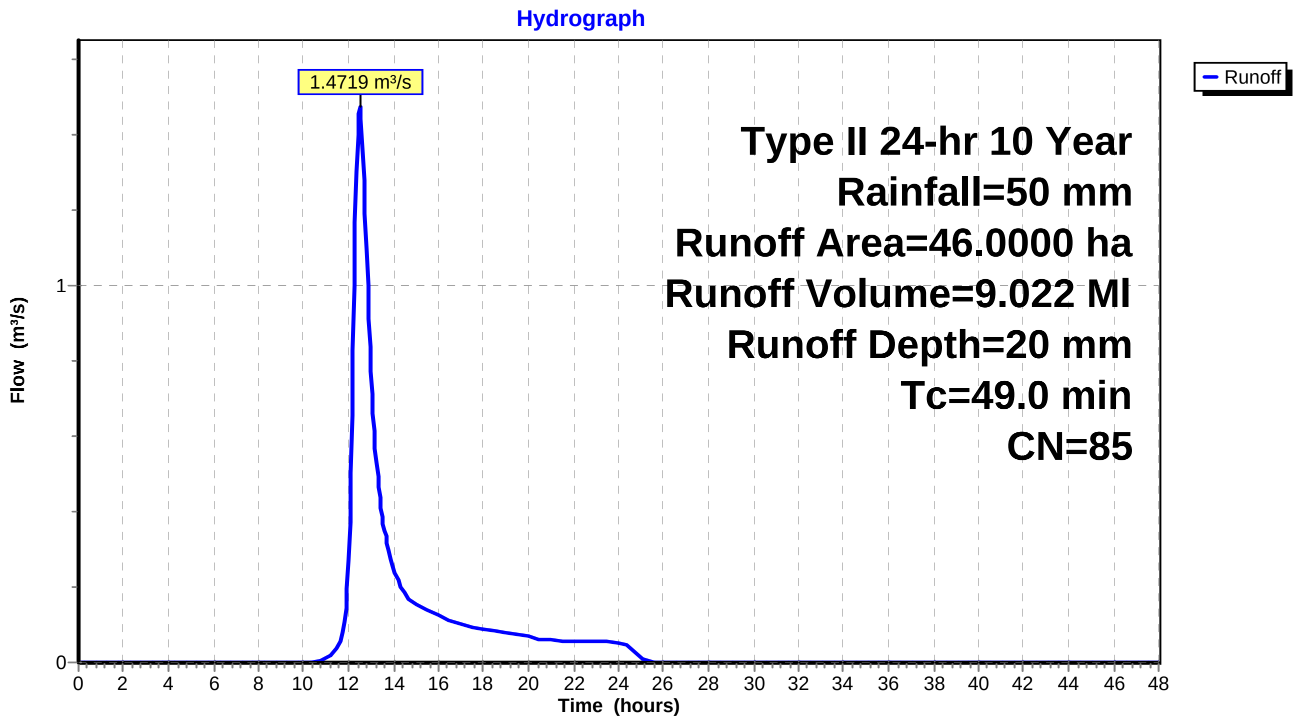
Runoff = 1.4719 m³/s @ 12.50 hrs, Volume= 9.022 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

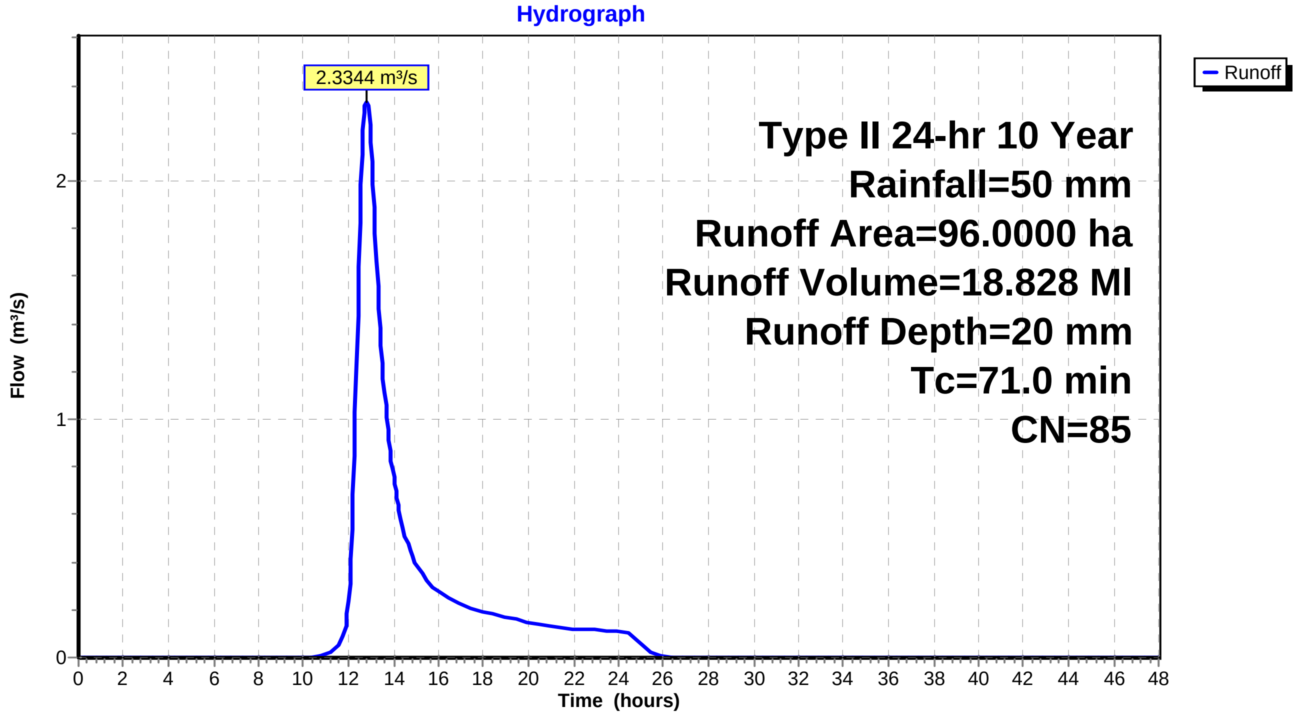
Runoff = 2.3344 m³/s @ 12.81 hrs, Volume= 18.828 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

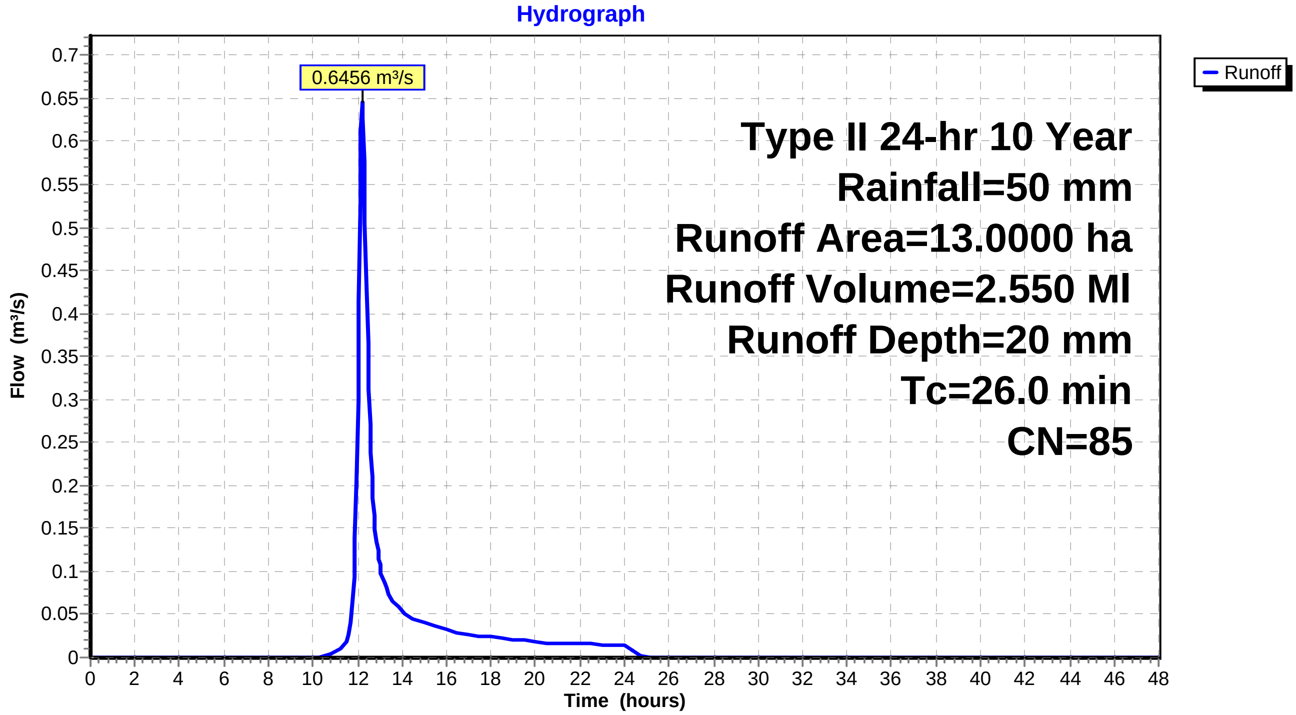
Runoff = 0.6456 m³/s @ 12.21 hrs, Volume= 2.550 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

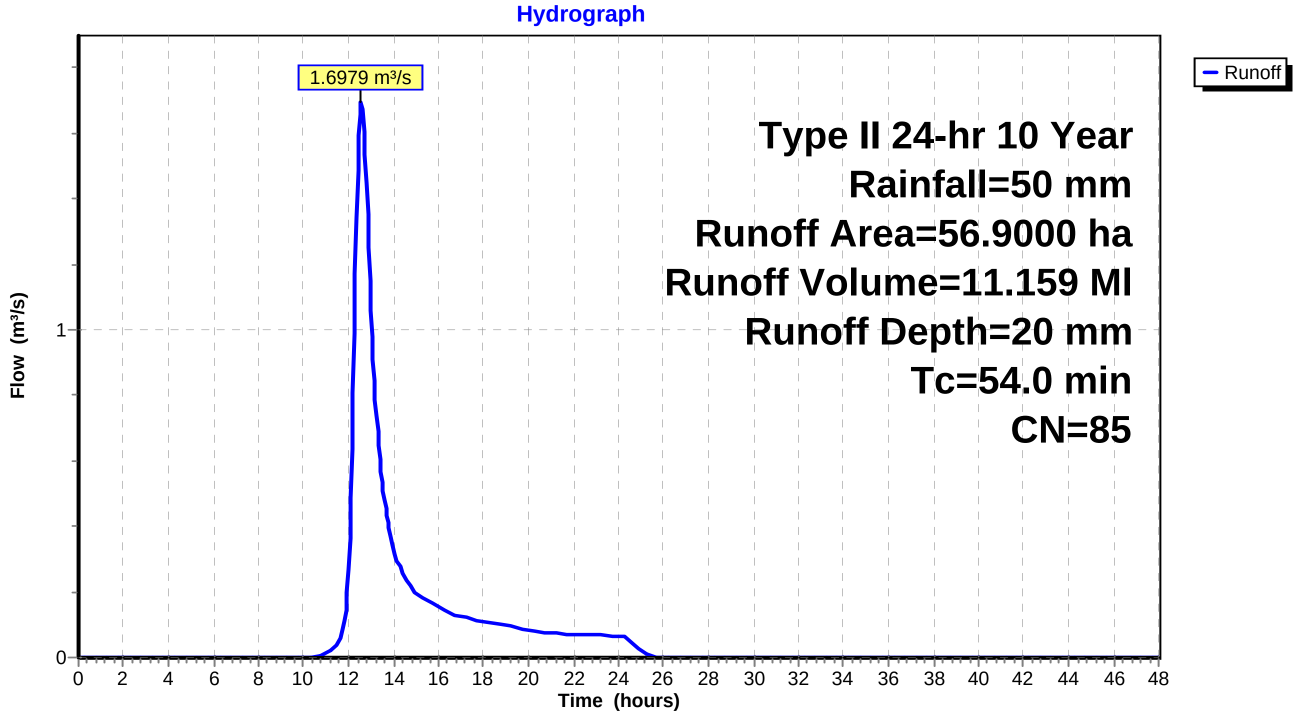
Runoff = 1.6979 m³/s @ 12.57 hrs, Volume= 11.159 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

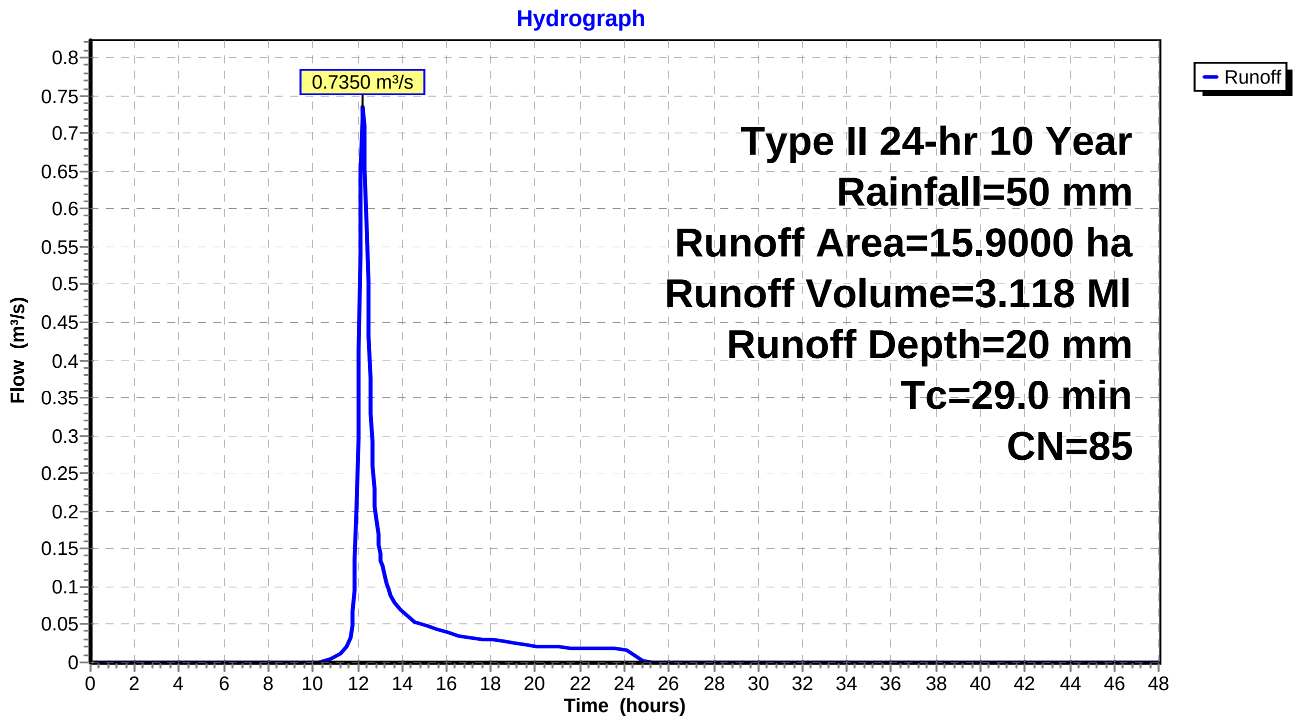
Runoff = 0.7350 m³/s @ 12.24 hrs, Volume= 3.118 Ml, Depth= 20 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

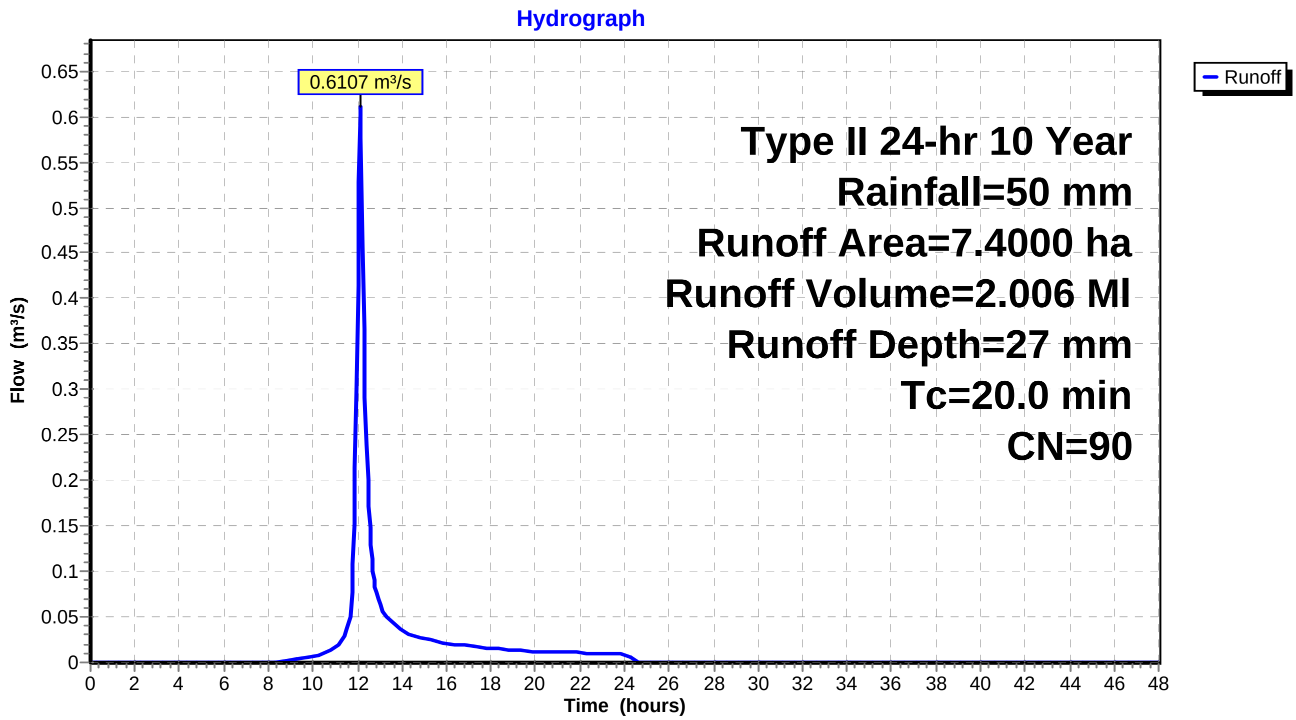
Runoff = 0.6107 m³/s @ 12.13 hrs, Volume= 2.006 Ml, Depth= 27 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Year Rainfall=50 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

Inflow Area = 978.0000 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 9.9520 m³/s @ 14.69 hrs, Volume= 191.774 Ml
Outflow = 9.9304 m³/s @ 14.80 hrs, Volume= 191.765 Ml, Atten= 0%, Lag= 6.4 min

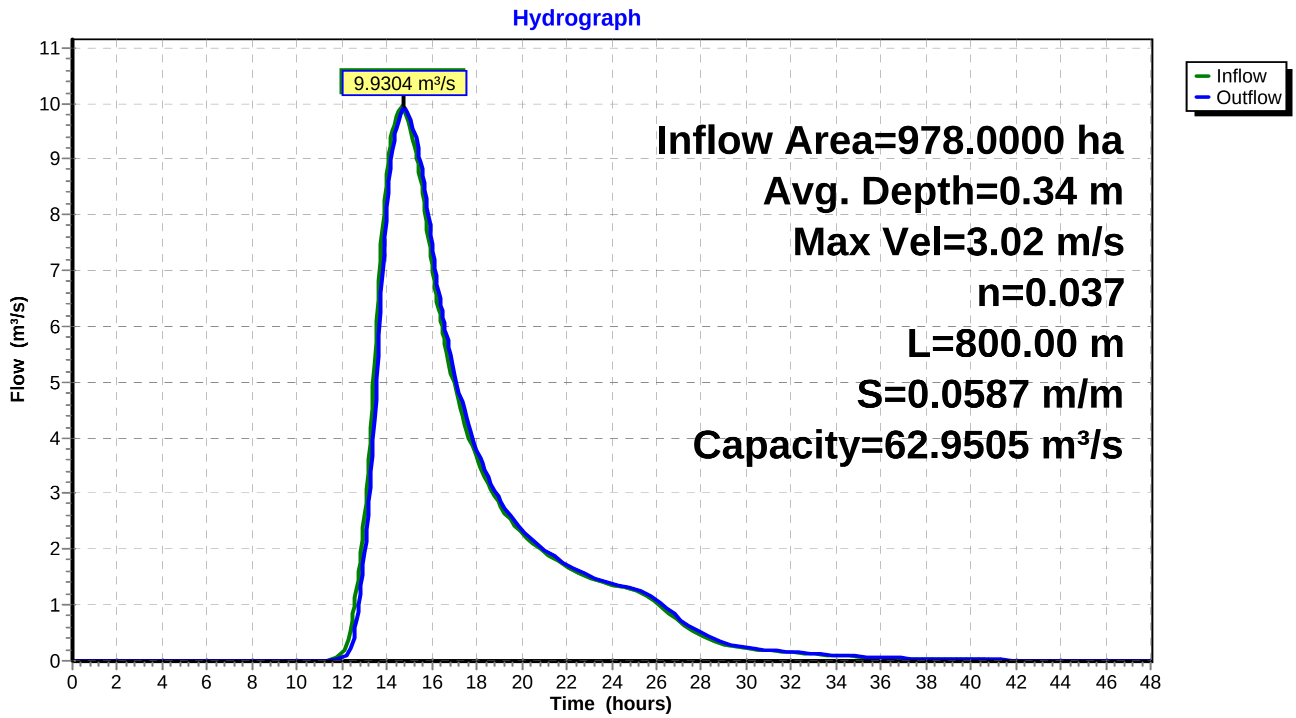
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.02 m/s, Min. Travel Time= 4.4 min
Avg. Velocity = 1.02 m/s, Avg. Travel Time= 13.1 min

Peak Storage= 2,632.7 m³ @ 14.73 hrs, Average Depth at Peak Storage= 0.34 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

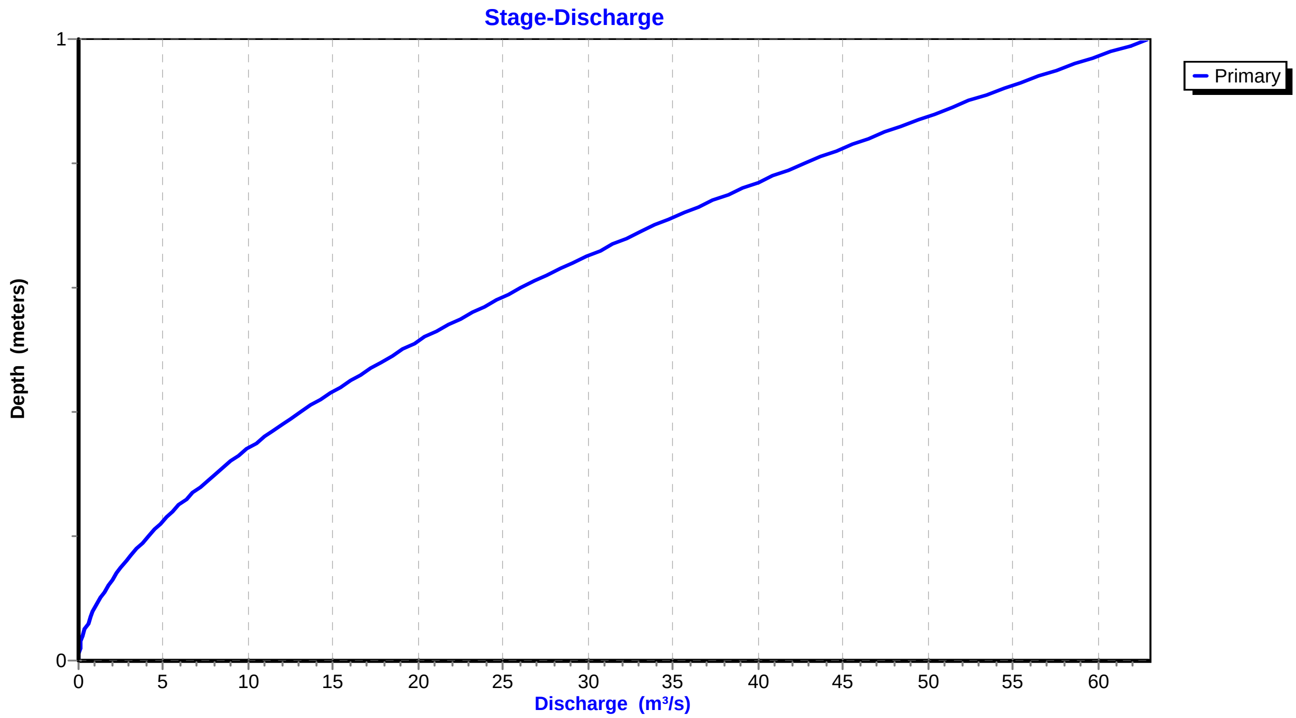
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

‡

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

Inflow Area = 1,117.0000 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 10.7836 m³/s @ 14.93 hrs, Volume= 225.930 Ml
Outflow = 10.7470 m³/s @ 15.18 hrs, Volume= 225.886 Ml, Atten= 0%, Lag= 15.4 min

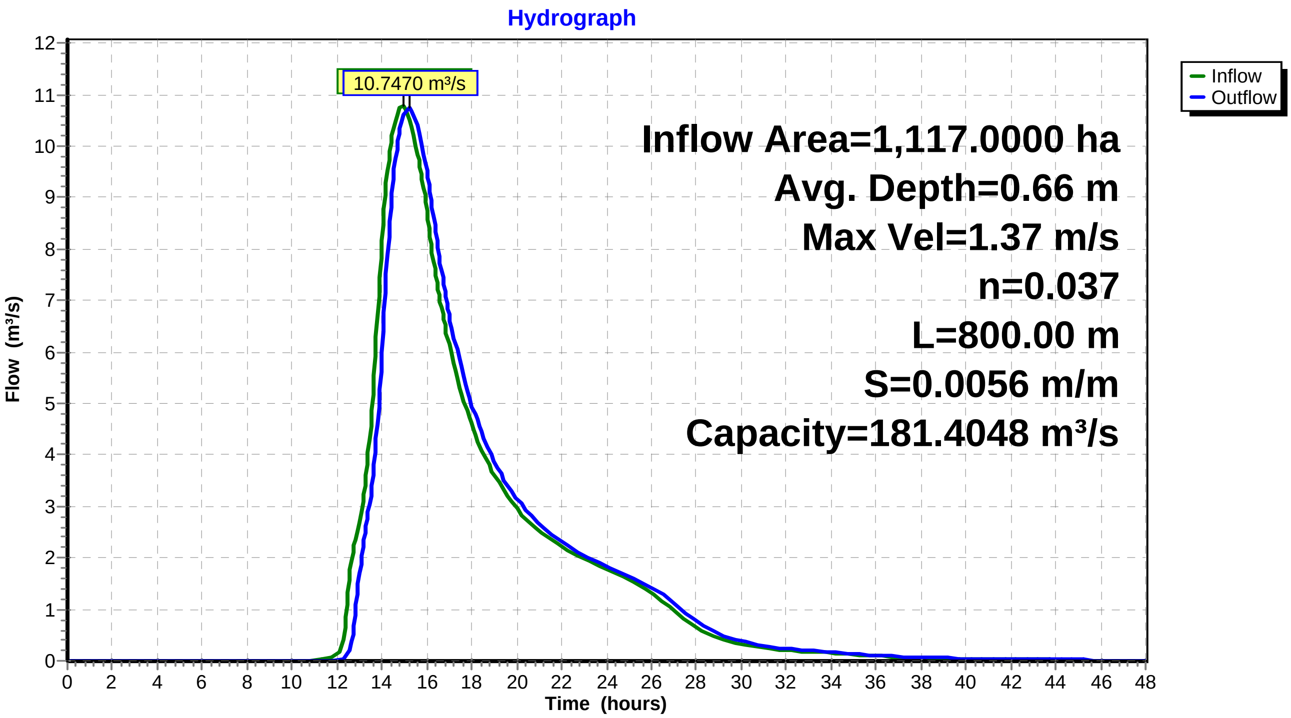
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.37 m/s, Min. Travel Time= 9.7 min
Avg. Velocity = 0.51 m/s, Avg. Travel Time= 26.3 min

Peak Storage= 6,281.3 m³ @ 15.02 hrs, Average Depth at Peak Storage= 0.66 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

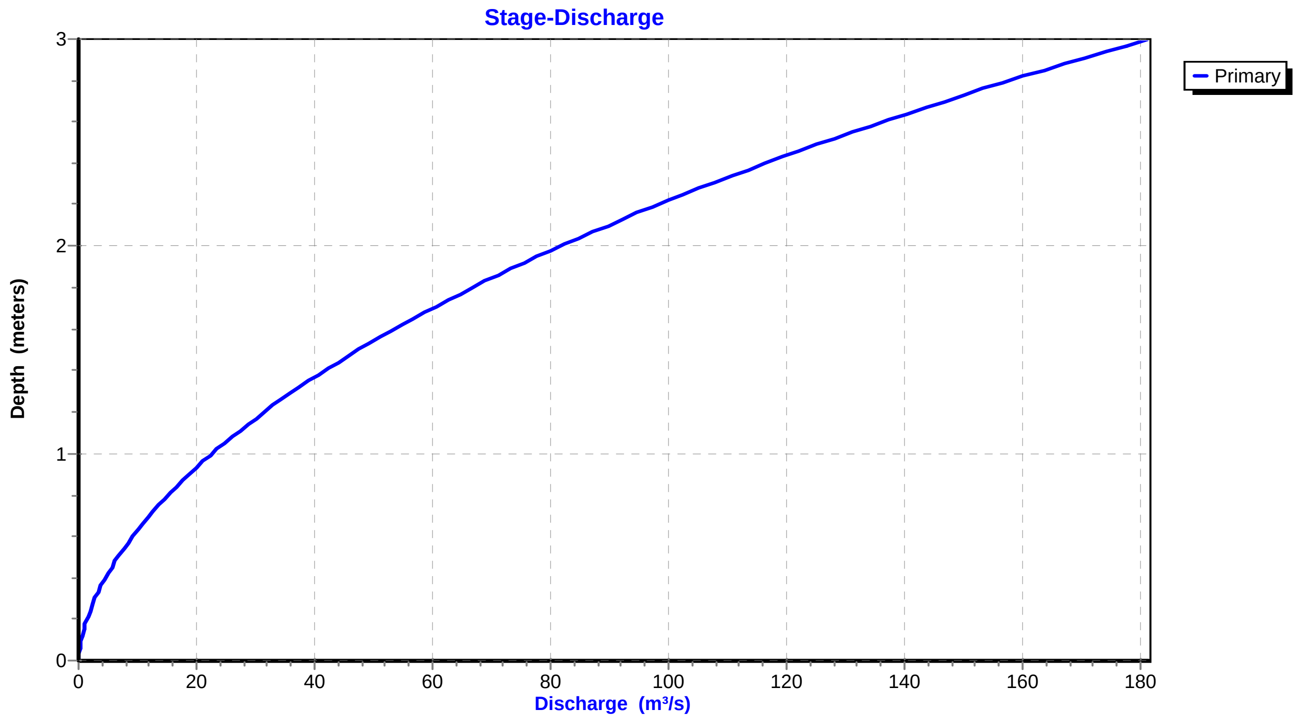
10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

‡

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



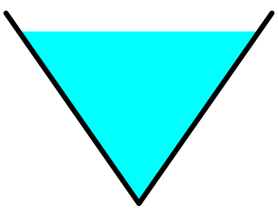
Reach 18R: Mid Haggart Creek

Inflow Area = 7,094.2280 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 32.6457 m³/s @ 20.55 hrs, Volume= 1,393.197 Ml
Outflow = 32.6394 m³/s @ 20.63 hrs, Volume= 1,393.105 Ml, Atten= 0%, Lag= 5.0 min

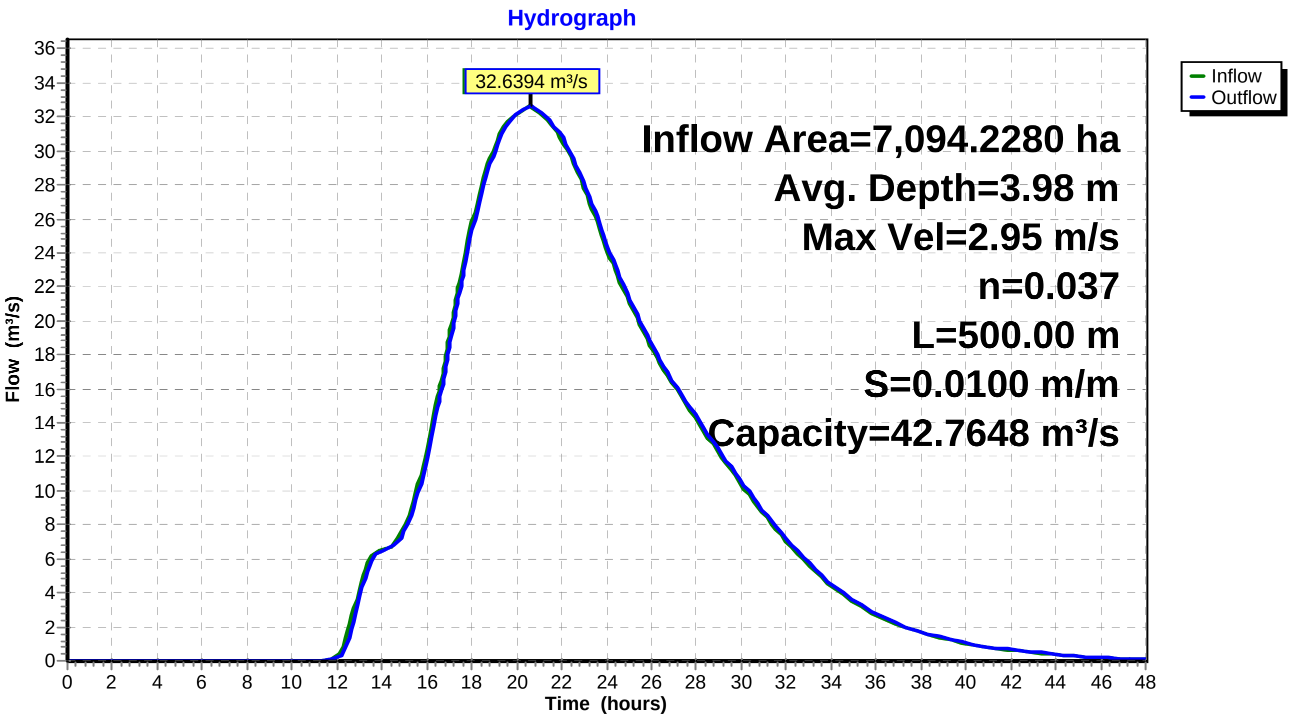
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.95 m/s, Min. Travel Time= 2.8 min
Avg. Velocity = 1.81 m/s, Avg. Travel Time= 4.6 min

Peak Storage= 5,533.0 m³ @ 20.58 hrs, Average Depth at Peak Storage= 3.98 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

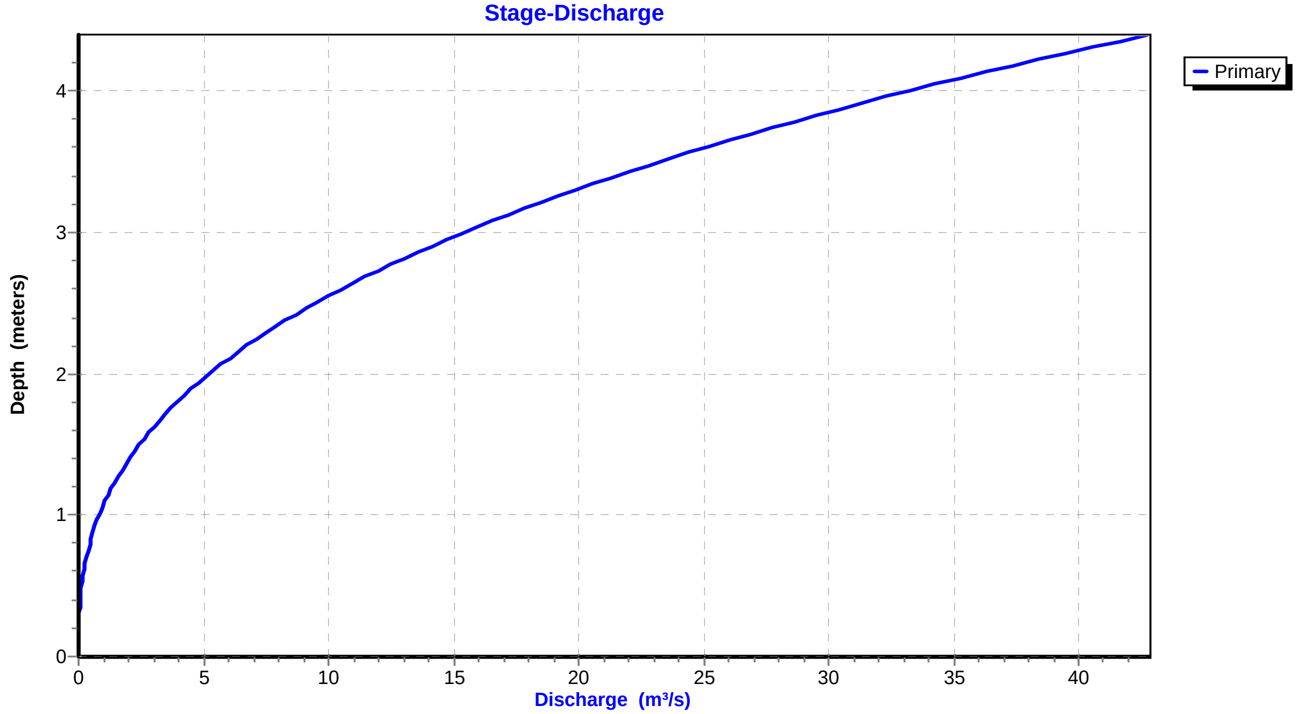
0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m



Reach 18R: Mid Haggart Creek



Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

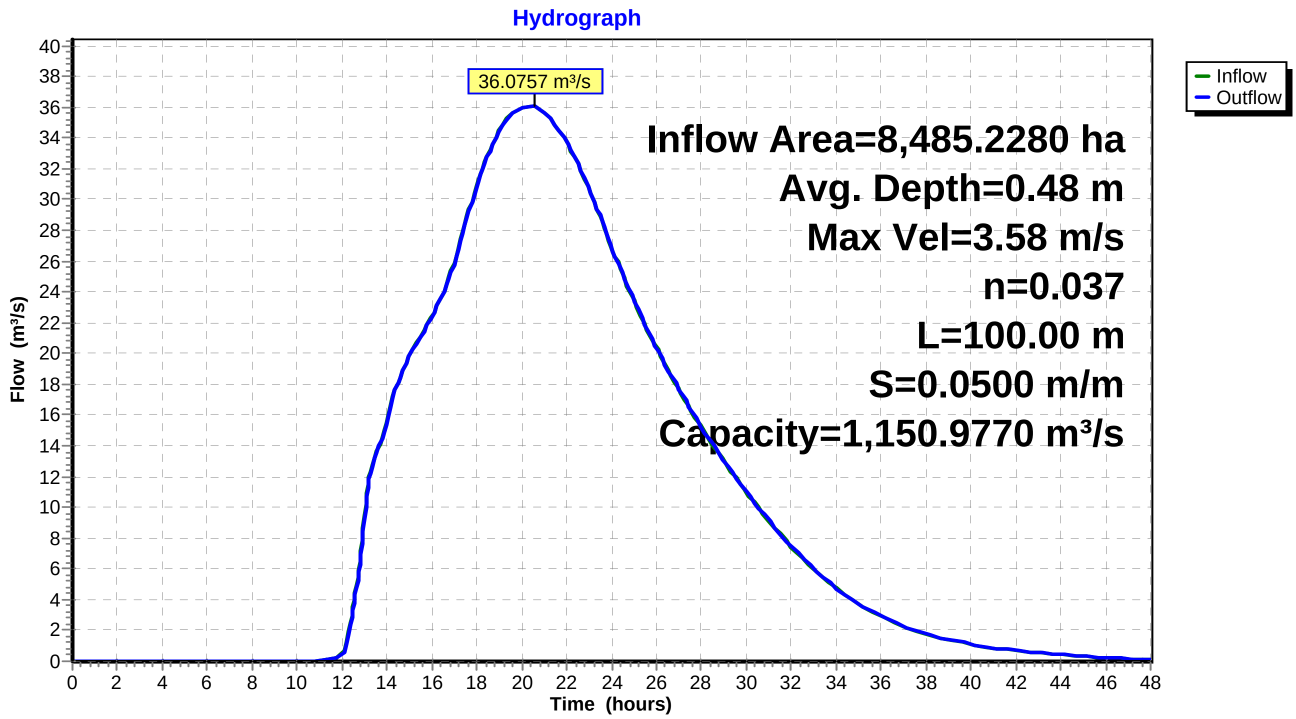
Inflow Area = 8,485.2280 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 36.0768 m³/s @ 20.56 hrs, Volume= 1,678.783 Ml
Outflow = 36.0757 m³/s @ 20.57 hrs, Volume= 1,678.762 Ml, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.58 m/s, Min. Travel Time= 0.5 min
Avg. Velocity = 1.95 m/s, Avg. Travel Time= 0.9 min

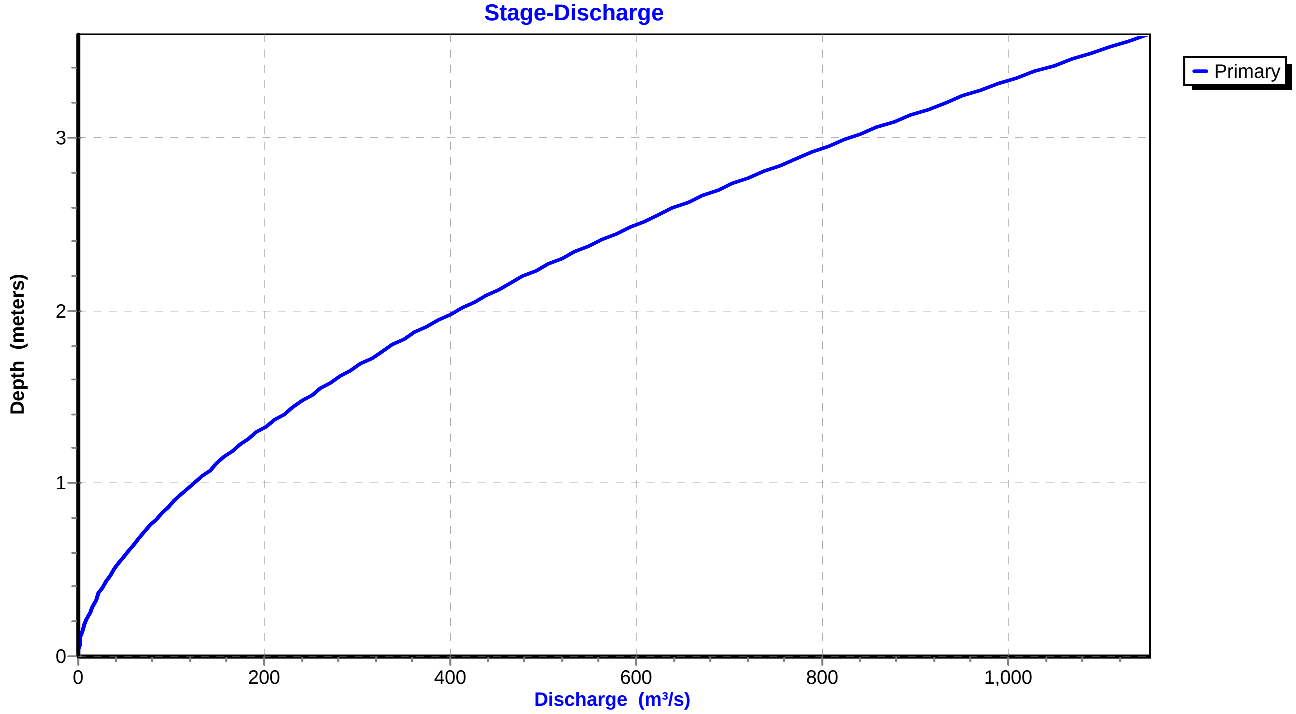
Peak Storage= 1,008.2 m³ @ 20.57 hrs, Average Depth at Peak Storage= 0.48 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 10.0932 m³/s @ 14.79 hrs, Volume= 200.787 Ml
Outflow = 10.0774 m³/s @ 14.95 hrs, Volume= 200.770 Ml, Atten= 0%, Lag= 9.2 min

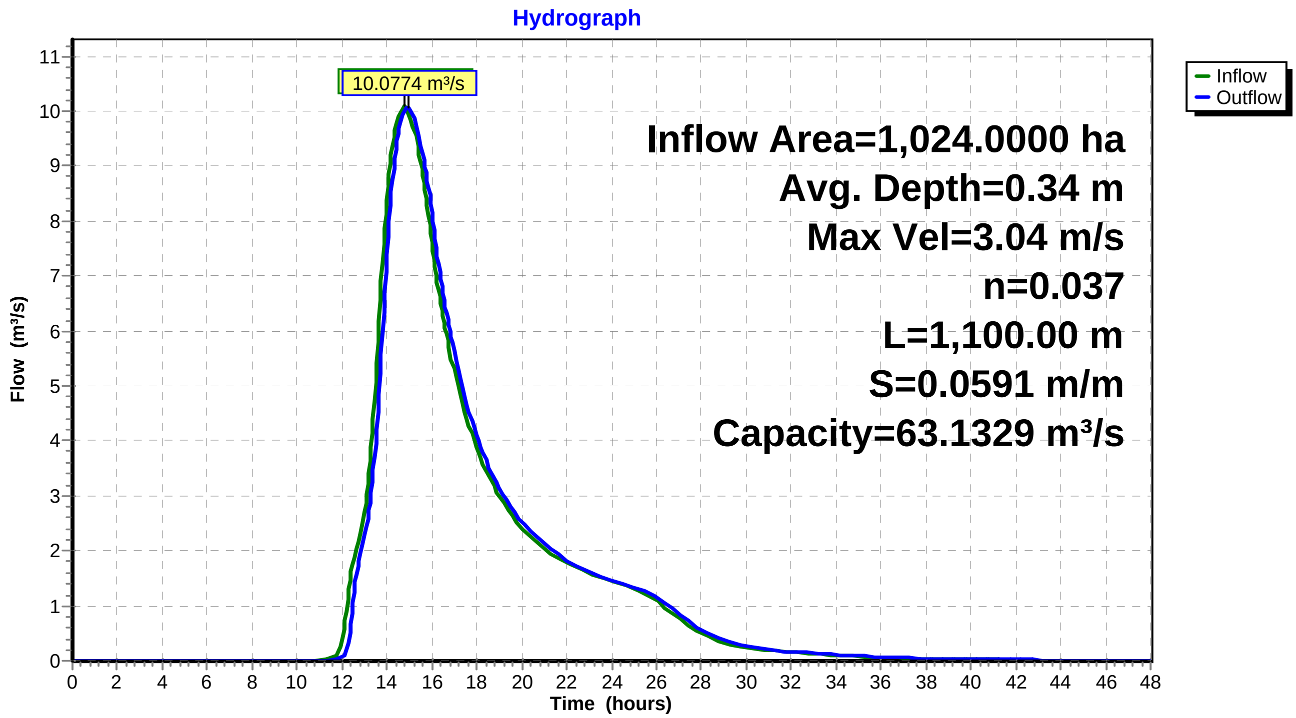
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.04 m/s, Min. Travel Time= 6.0 min
Avg. Velocity = 1.05 m/s, Avg. Travel Time= 17.5 min

Peak Storage= 3,646.1 m³ @ 14.84 hrs, Average Depth at Peak Storage= 0.34 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

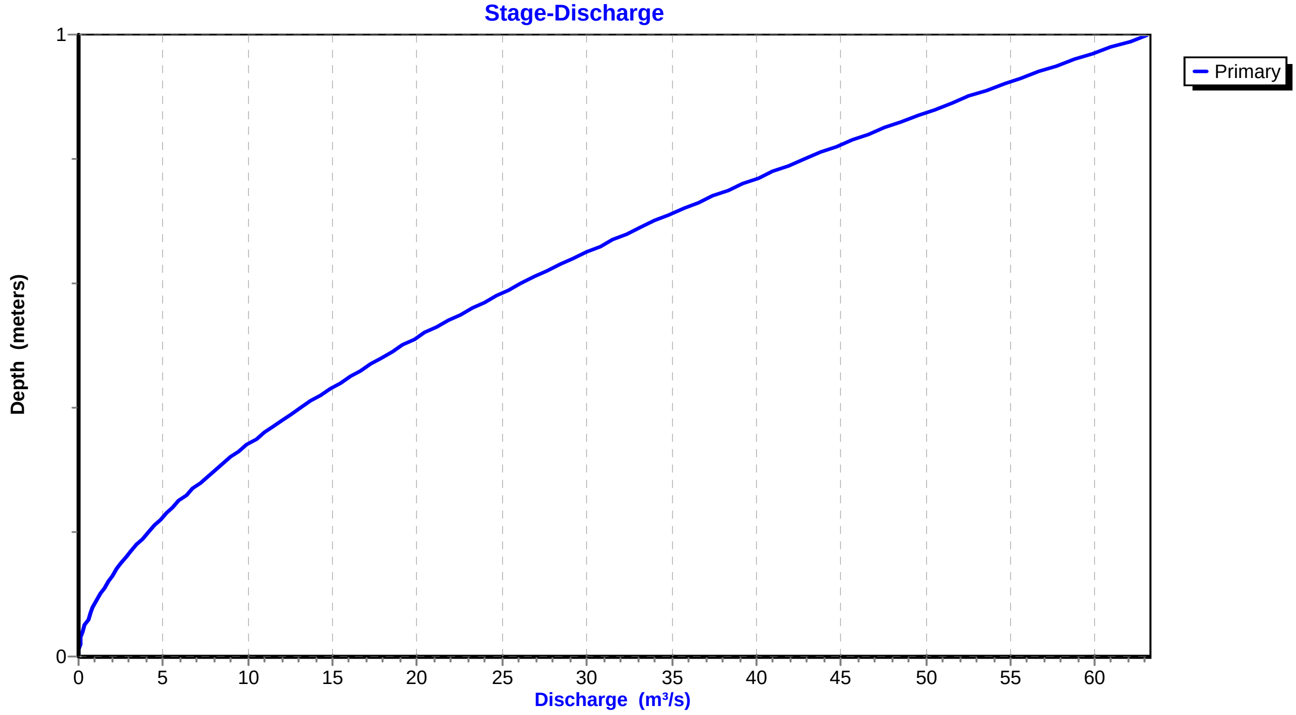
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



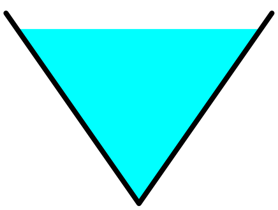
Reach 34R: Upper Haggart Creek

Inflow Area = 6,782.0000 ha, Inflow Depth > 20 mm for 10 Year event
Inflow = 32.1916 m³/s @ 20.35 hrs, Volume= 1,332.199 Ml
Outflow = 32.1402 m³/s @ 20.56 hrs, Volume= 1,331.962 Ml, Atten= 0%, Lag= 12.3 min

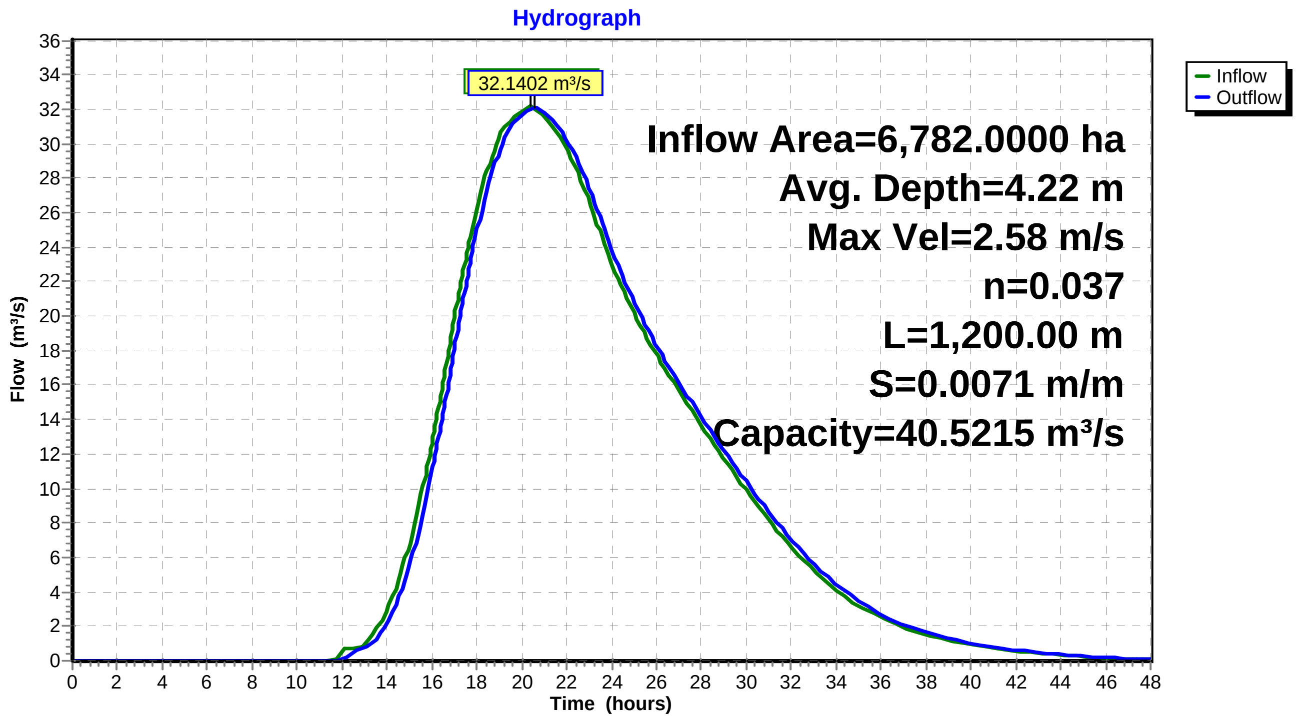
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.58 m/s, Min. Travel Time= 7.7 min
Avg. Velocity = 1.54 m/s, Avg. Travel Time= 13.0 min

Peak Storage= 14,939.6 m³ @ 20.42 hrs, Average Depth at Peak Storage= 4.22 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

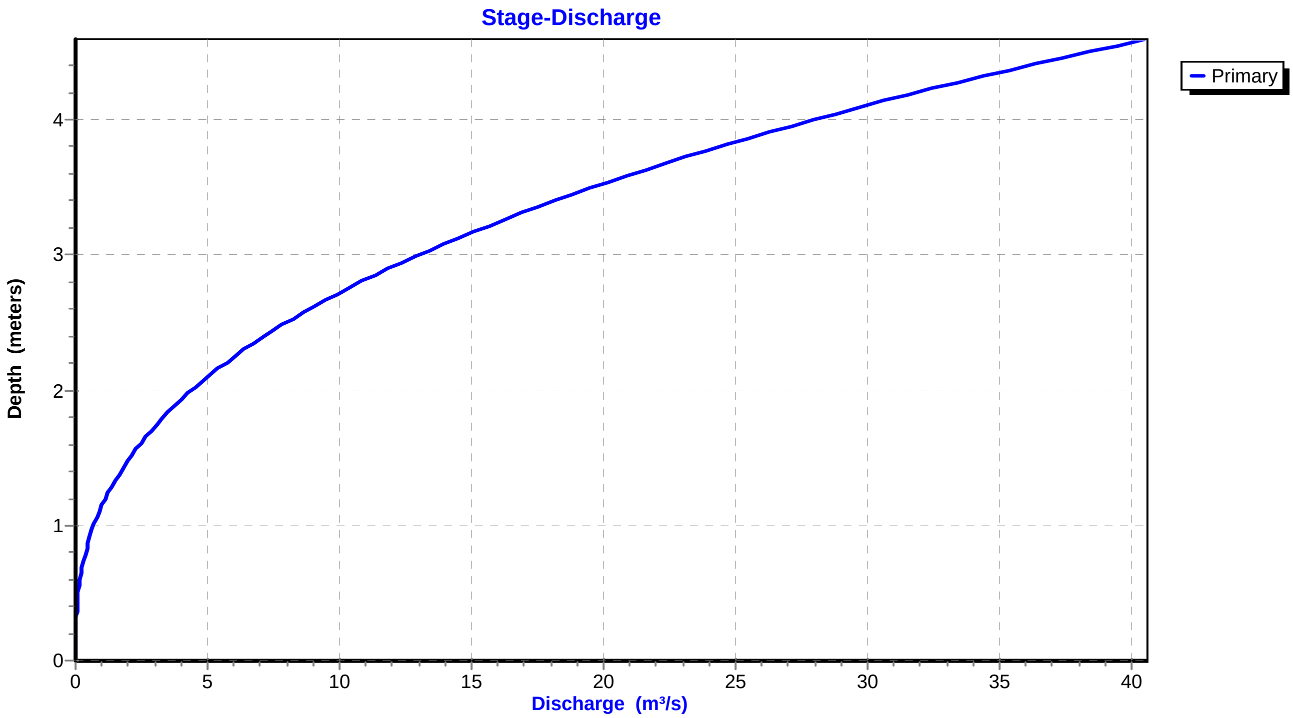
0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m



Reach 34R: Upper Haggart Creek



Reach 34R: Upper Haggart Creek



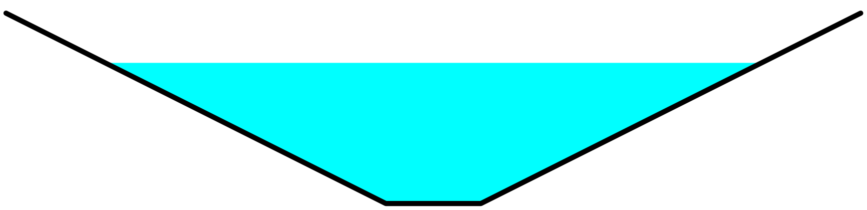
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 23 mm for 10 Year event
Inflow = 3.4351 m³/s @ 13.20 hrs, Volume= 40.968 Ml
Outflow = 3.3910 m³/s @ 13.37 hrs, Volume= 40.964 Ml, Atten= 1%, Lag= 10.3 min

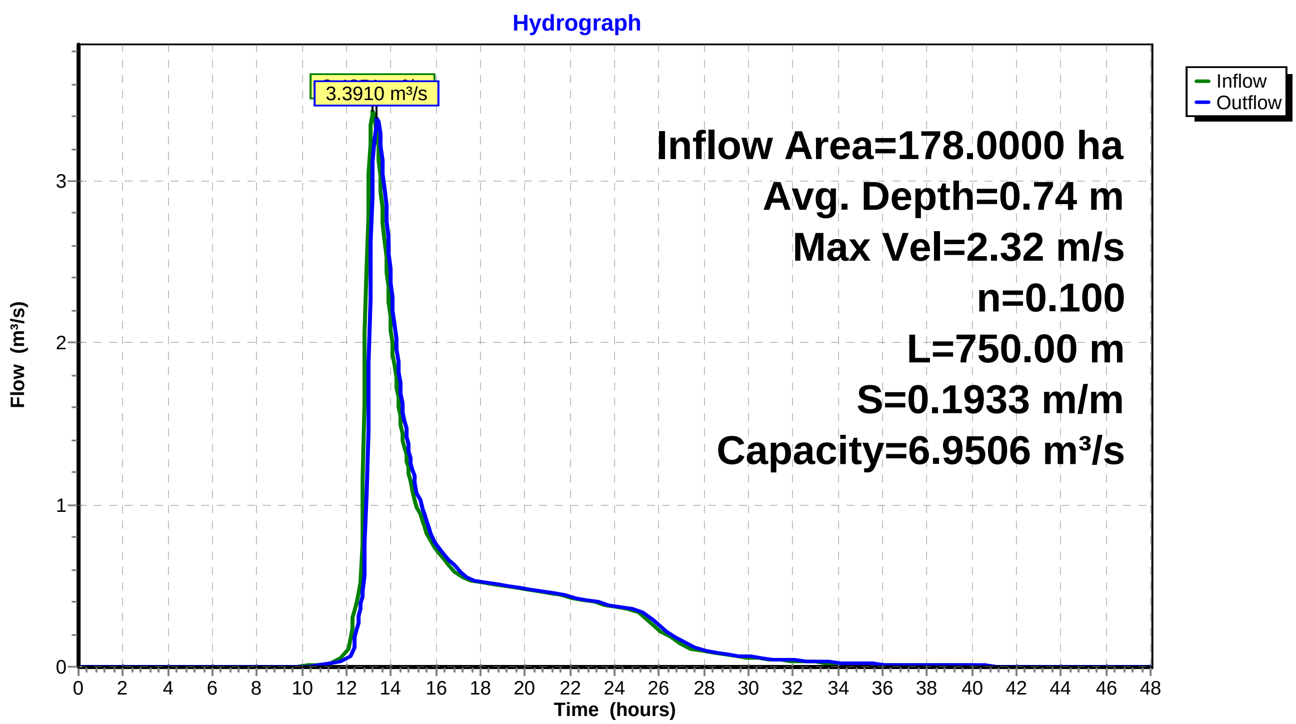
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.32 m/s, Min. Travel Time= 5.4 min
Avg. Velocity = 0.87 m/s, Avg. Travel Time= 14.4 min

Peak Storage= 1,095.4 m³ @ 13.28 hrs, Average Depth at Peak Storage= 0.74 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

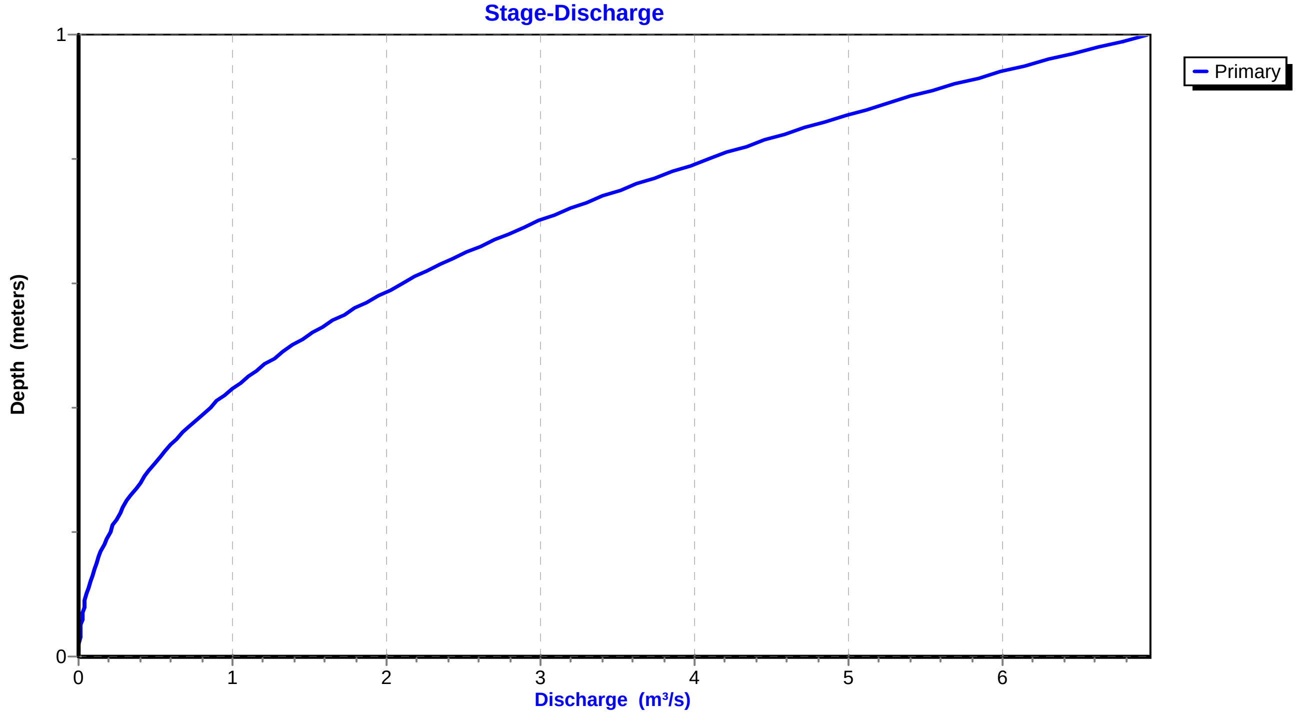
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 20 mm for 10 Year event
Inflow = 2.8082 m³/s @ 12.94 hrs, Volume= 25.104 Ml
Outflow = 1.0818 m³/s @ 14.11 hrs, Volume= 25.069 Ml, Atten= 61%, Lag= 70.3 min
Primary = 0.3013 m³/s @ 14.11 hrs, Volume= 18.831 Ml
Secondary = 0.7805 m³/s @ 14.11 hrs, Volume= 6.238 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 917.942 m @ 14.11 hrs Surf.Area= 17,196.8 m² Storage= 31,247.7 m³ (10,806.5 m³ above start)

Plug-Flow detention time= 1,196.6 min calculated for 4.628 Ml (18% of inflow)
Center-of-Mass det. time= 340.0 min (1,256.4 - 916.4)

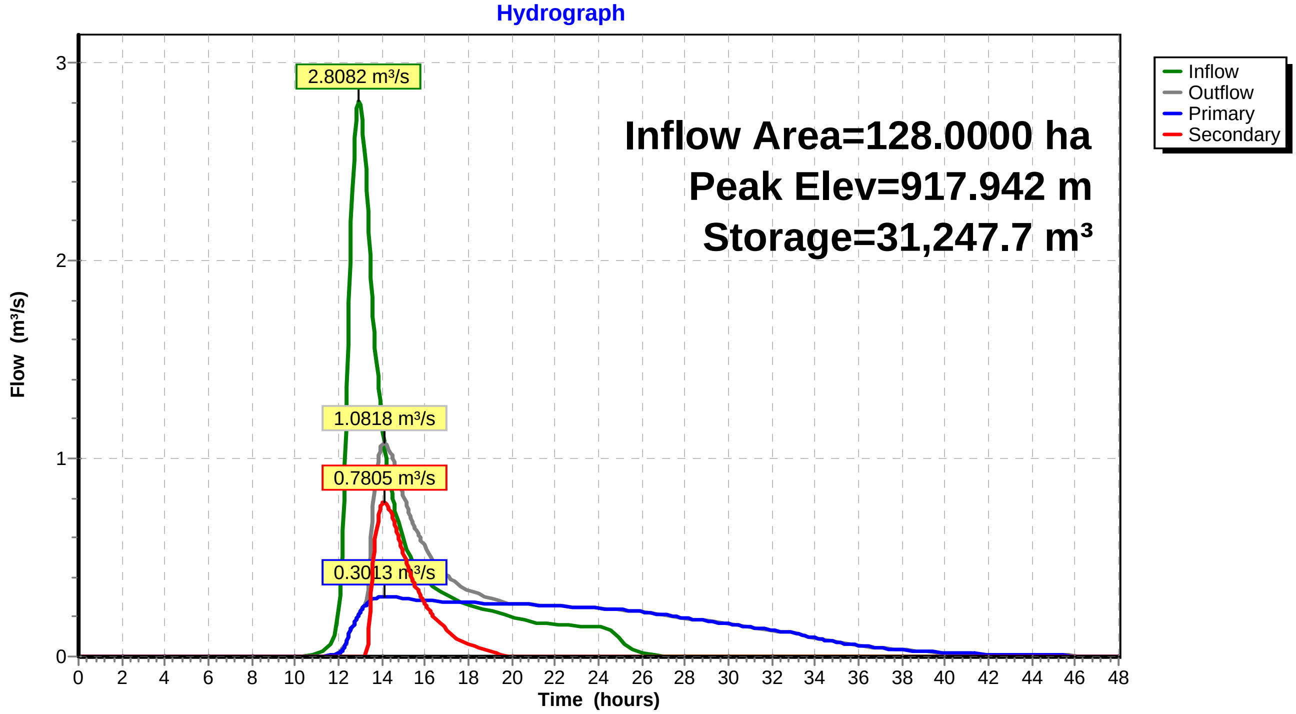
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

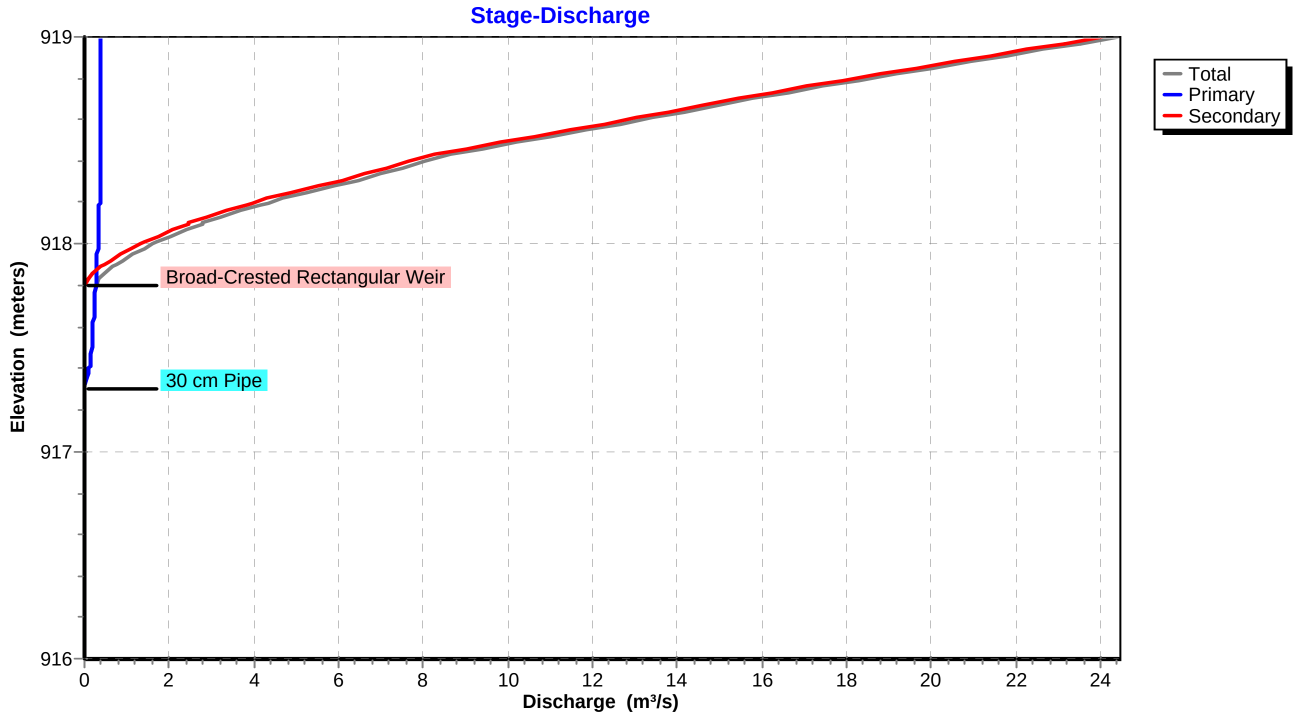
Primary OutFlow Max=0.3013 m³/s @ 14.11 hrs HW=917.942 m (Free Discharge)
└─**1=30 cm Pipe** (Custom Controls 0.3013 m³/s)

Secondary OutFlow Max=0.7777 m³/s @ 14.11 hrs HW=917.942 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.7777 m³/s @ 0.55 m/s)

Pond 23P: EP WRSA SCP



Pond 23P: EP WRSA SCP



Pond 24P: Lower Dublin North

Inflow Area =	39.0000 ha,	Inflow Depth = 27 mm	for 10 Year event	
Inflow =	1.9087 m³/s @	12.44 hrs, Volume=	10.572 Ml	
Outflow =	0.3686 m³/s @	13.53 hrs, Volume=	10.538 Ml,	Atten= 81%, Lag= 65.9 min
Primary =	0.1455 m³/s @	13.53 hrs, Volume=	8.987 Ml	
Secondary =	0.2231 m³/s @	13.53 hrs, Volume=	1.550 Ml	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 791.096 m @ 13.53 hrs Surf.Area= 9,572.9 m² Storage= 14,011.9 m³ (5,526.6 m³ above start)

Plug-Flow detention time= 1,243.6 min calculated for 2.053 Ml (19% of inflow)
Center-of-Mass det. time= 408.4 min (1,268.6 - 860.2)

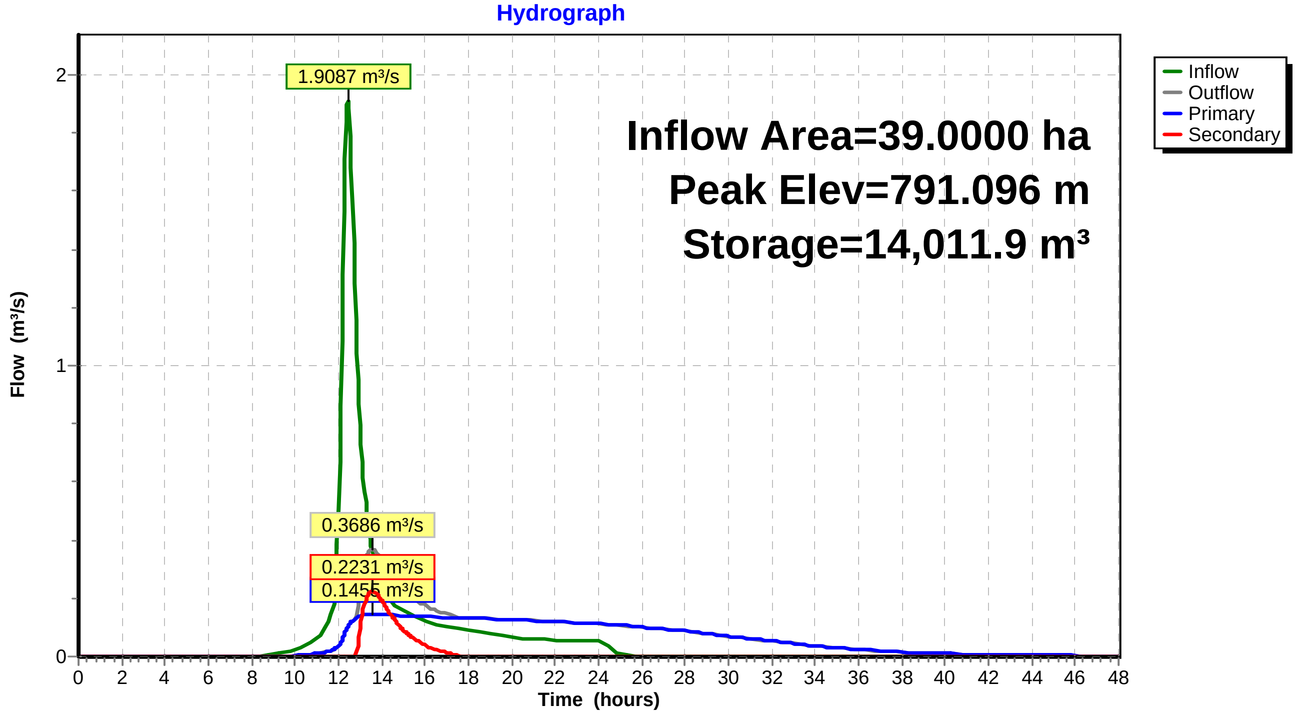
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

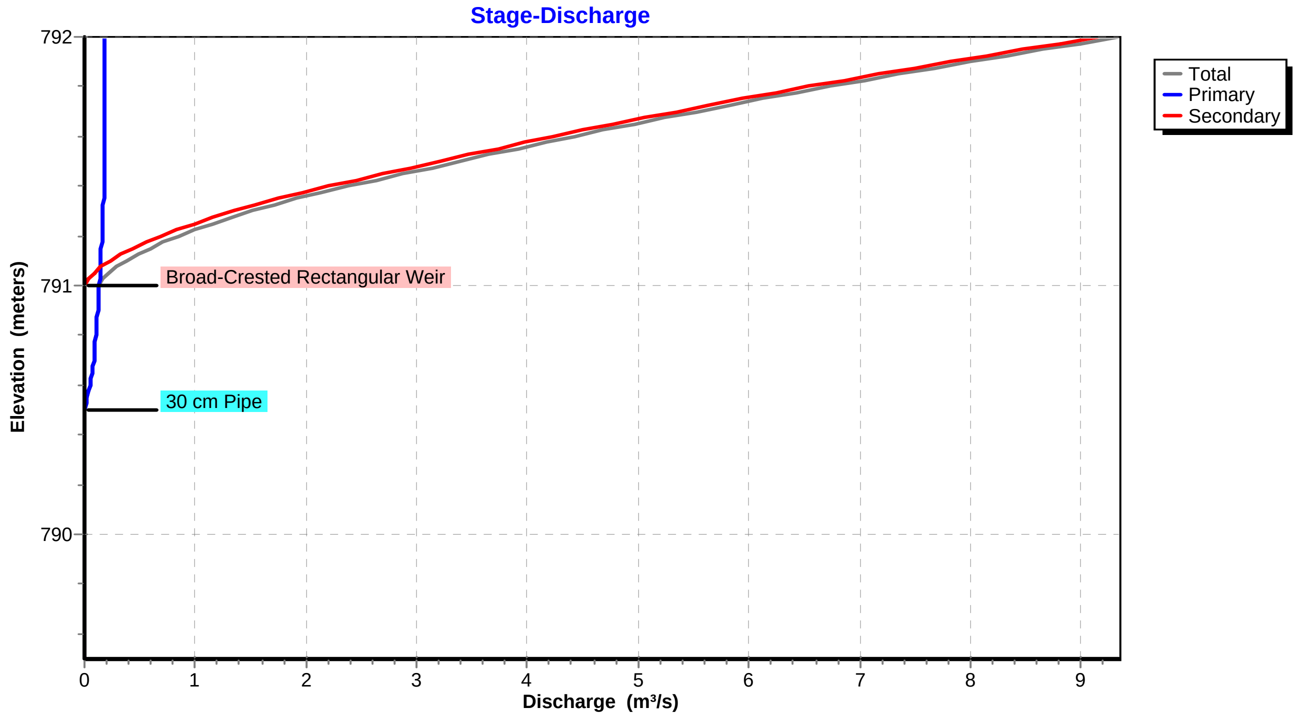
Primary OutFlow Max=0.1455 m³/s @ 13.53 hrs HW=791.096 m (Free Discharge)
└**1=30 cm Pipe** (Custom Controls 0.1455 m³/s)

Secondary OutFlow Max=0.2222 m³/s @ 13.53 hrs HW=791.096 m (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.2222 m³/s @ 0.46 m/s)

Pond 24P: Lower Dublin North



Pond 24P: Lower Dublin North



Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 23 mm for 10 Year event
Inflow = 5.1655 m³/s @ 12.67 hrs, Volume= 40.981 Ml
Outflow = 3.4351 m³/s @ 13.20 hrs, Volume= 40.968 Ml, Atten= 33%, Lag= 31.4 min
Primary = 0.6518 m³/s @ 13.20 hrs, Volume= 26.521 Ml
Secondary = 2.7832 m³/s @ 13.20 hrs, Volume= 14.447 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 903.251 m @ 13.20 hrs Surf.Area= 16,614.9 m² Storage= 48,044.2 m³ (12,148.4 m³ above start)

Plug-Flow detention time= 913.0 min calculated for 5.067 Ml (12% of inflow)
Center-of-Mass det. time= 153.3 min (1,046.2 - 892.9)

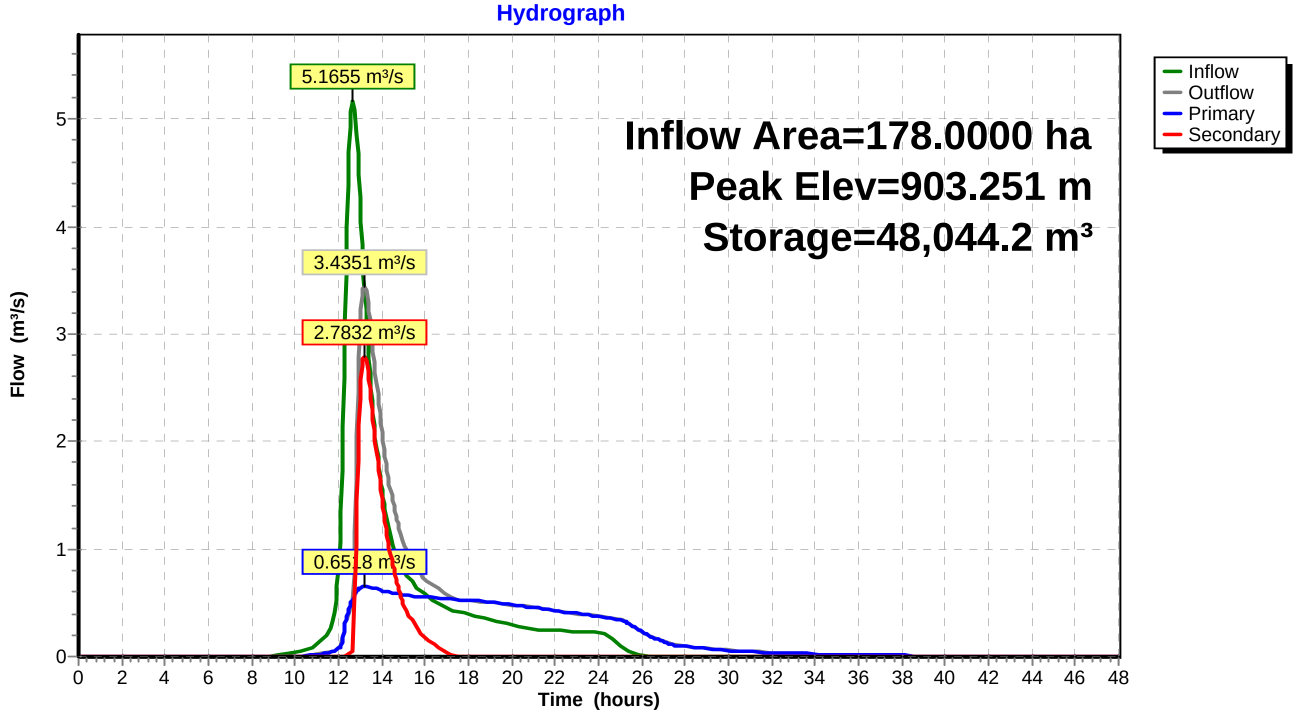
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

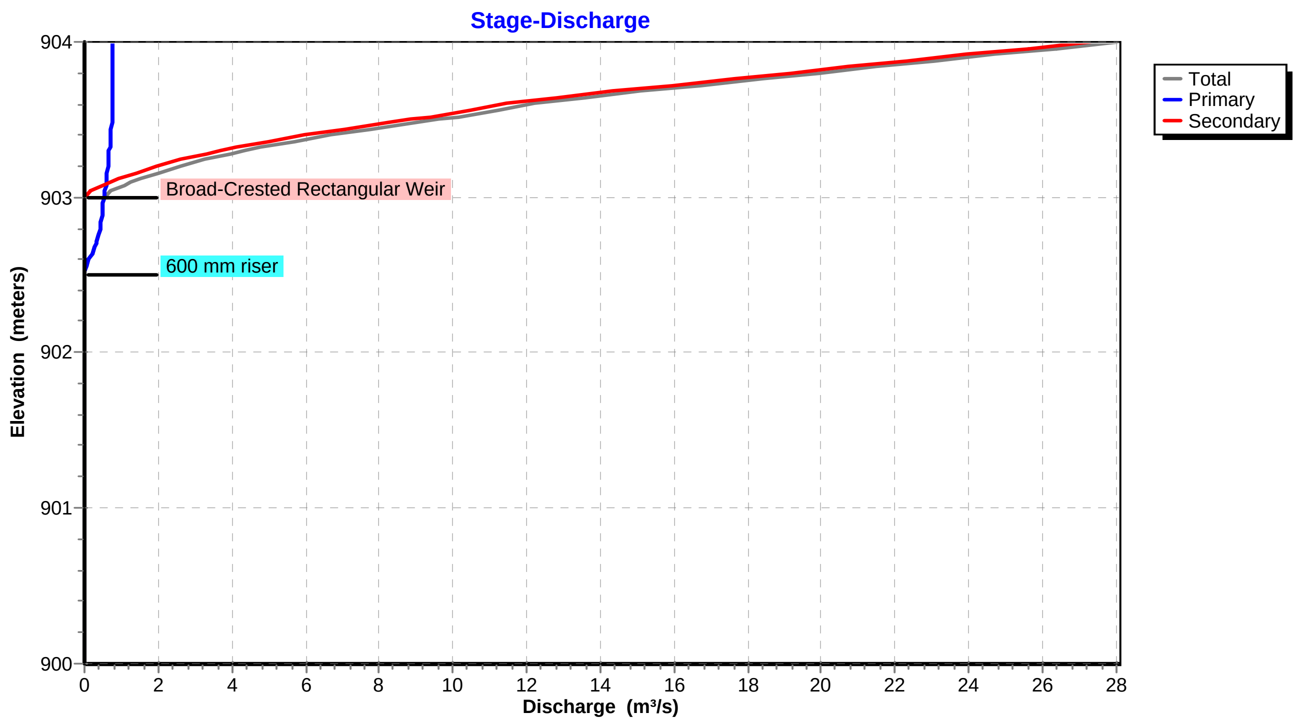
Primary OutFlow Max=0.6518 m³/s @ 13.20 hrs HW=903.251 m (Free Discharge)
└─**1=600 mm riser** (Custom Controls 0.6518 m³/s)

Secondary OutFlow Max=2.7747 m³/s @ 13.20 hrs HW=903.251 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.7747 m³/s @ 0.74 m/s)

Pond 25P: Platinum Gulch SCP



Pond 25P: Platinum Gulch SCP



Pond 33P: Lower Dublin South Pond

Inflow Area = 93.0000 ha, Inflow Depth = 27 mm for 10 Year event
Inflow = 3.3290 m³/s @ 12.75 hrs, Volume= 25.210 Ml
Outflow = 0.7759 m³/s @ 14.19 hrs, Volume= 25.160 Ml, Atten= 77%, Lag= 86.5 min
Primary = 0.5781 m³/s @ 14.19 hrs, Volume= 23.917 Ml
Secondary = 0.1978 m³/s @ 14.19 hrs, Volume= 1.243 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 832.090 m @ 14.19 hrs Surf.Area= 21,537.5 m² Storage= 42,085.3 m³ (12,479.8 m³ above start)

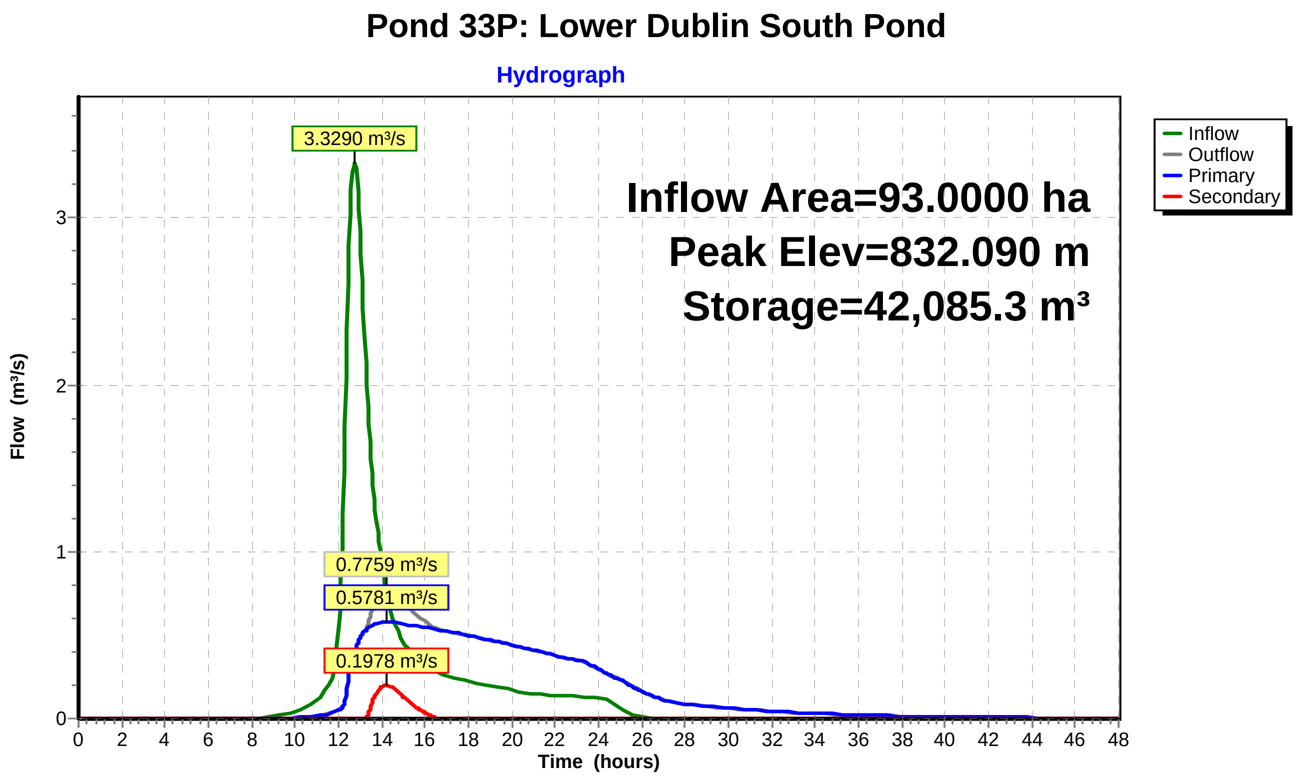
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 279.4 min (1,161.7 - 882.4)

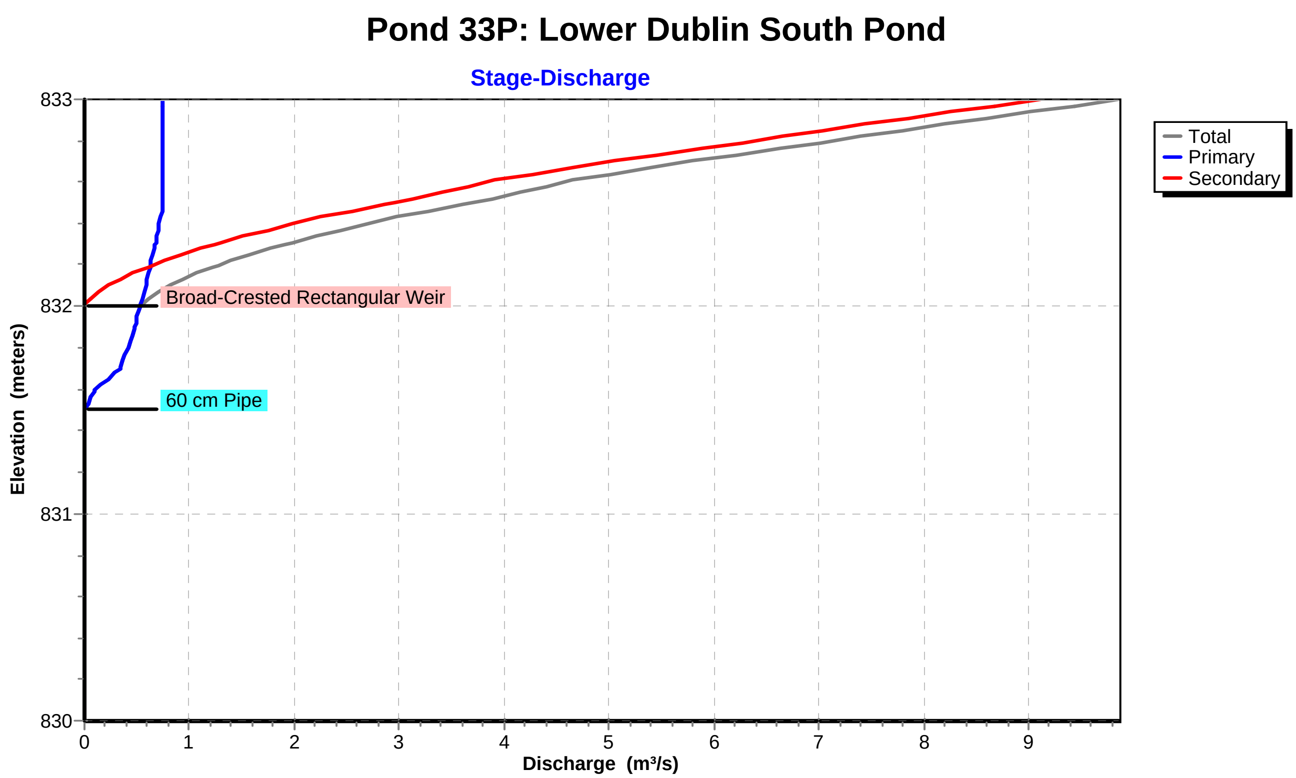
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

Primary OutFlow Max=0.5781 m³/s @ 14.19 hrs HW=832.090 m (Free Discharge)
└─**1=60 cm Pipe** (Custom Controls 0.5781 m³/s)

Secondary OutFlow Max=0.1958 m³/s @ 14.19 hrs HW=832.090 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.1958 m³/s @ 0.43 m/s)


Pond 33P: Lower Dublin South Pond
Hydrograph
3.3290 m³/s
0.7759 m³/s
0.5781 m³/s
0.1978 m³/s
Inflow Area=93.0000 ha
Peak Elev=832.090 m
Storage=42,085.3 m³
Inflow
Outflow
Primary
Secondary
Flow (m³/s)
Time (hours)


Pond 33P: Lower Dublin South Pond
Stage-Discharge
Broad-Crested Rectangular Weir
60 cm Pipe
Total
Primary
Secondary
Elevation (meters)
Discharge (m³/s)

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=36 mm
Tc=100.0 min CN=85 Runoff=1.4688 m³/s 14.766 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=46 mm
Tc=45.0 min CN=90 Runoff=3.2255 m³/s 17.802 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=36 mm
Tc=210.0 min CN=85 Runoff=17.1970 m³/s 306.116 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=36 mm
Tc=127.0 min CN=85 Runoff=9.2568 m³/s 112.445 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=46 mm
Tc=65.0 min CN=90 Runoff=5.1469 m³/s 36.972 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=36 mm
Tc=81.0 min CN=85 Runoff=5.3583 m³/s 46.097 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=36 mm
Tc=187.0 min CN=85 Runoff=14.8780 m³/s 242.372 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and Runoff Area=93.0000 ha Runoff Depth=46 mm
Tc=69.0 min CN=90 Runoff=5.6388 m³/s 42.450 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>36 mm
Tc=591.0 min CN=85 Runoff=59.8368 m³/s 2,422.424 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=36 mm
Tc=47.0 min CN=85 Runoff=2.6806 m³/s 15.414 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=36 mm
Tc=54.0 min CN=85 Runoff=3.1803 m³/s 20.168 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=36 mm
Tc=49.0 min CN=85 Runoff=2.7990 m³/s 16.566 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=36 mm
Tc=71.0 min CN=85 Runoff=4.4442 m³/s 34.573 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=36 mm
Tc=26.0 min CN=85 Runoff=1.2171 m³/s 4.682 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=36 mm
Tc=54.0 min CN=85 Runoff=3.2314 m³/s 20.492 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=36 mm
Tc=29.0 min CN=85 Runoff=1.3884 m³/s 5.726 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=46 mm
Tc=20.0 min CN=90 Runoff=1.0254 m³/s 3.378 Ml

Reach 14R: Upper DG Diversion Ch Avg. Depth=0.50 m Max Vel=3.81 m/s Inflow=18.9503 m³/s 352.158 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=18.9433 m³/s 352.144 Ml

Reach 16R: Eagle Creek Avg. Depth=0.95 m Max Vel=1.69 m/s Inflow=20.7911 m³/s 411.066 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=20.7626 m³/s 411.003 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=5.10 m Max Vel=3.41 m/s Inflow=60.7724 m³/s 2,556.967 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=60.7616 m³/s 2,556.838 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.69 m Max Vel=4.48 m/s Inflow=66.0955 m³/s 3,074.295 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=66.0949 m³/s 3,074.263 Ml

Reach 33R: Lower DG Diversion Ch Avg. Depth=0.50 m Max Vel=3.84 m/s Inflow=19.2351 m³/s 368.710 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=19.2254 m³/s 368.684 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=5.43 m Max Vel=2.97 m/s Inflow=59.9970 m³/s 2,444.858 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=59.9402 m³/s 2,444.523 Ml

Reach 35R: Platinum Gulch Channel Avg. Depth=1.06 m Max Vel=2.87 m/s Inflow=8.0024 m³/s 71.887 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=7.9028 m³/s 71.882 Ml

Pond 23P: EP WRSA SCP Peak Elev=918.162 m Storage=35,048.4 m³ Inflow=5.3583 m³/s 46.097 Ml
Primary=0.3483 m³/s 21.756 Ml Secondary=3.3634 m³/s 24.286 Ml Outflow=3.7117 m³/s 46.042 Ml

Pond 24P: Lower Dublin North Peak Elev=791.294 m Storage=15,930.9 m³ Inflow=3.2255 m³/s 17.802 Ml
Primary=0.1674 m³/s 10.433 Ml Secondary=1.3087 m³/s 7.318 Ml Outflow=1.4761 m³/s 17.751 Ml

Pond 25P: Platinum Gulch SCP Peak Elev=903.448 m Storage=51,336.2 m³ Inflow=9.2202 m³/s 71.906 Ml
Primary=0.7321 m³/s 32.713 Ml Secondary=7.2703 m³/s 39.173 Ml Outflow=8.0024 m³/s 71.887 Ml

Pond 33P: Lower Dublin South P Peak Elev=832.357 m Storage=47,880.5 m³ Inflow=5.6388 m³/s 42.450 Ml
Primary=0.6965 m³/s 30.120 Ml Secondary=1.6488 m³/s 12.262 Ml Outflow=2.3453 m³/s 42.382 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 3,362.442 Ml Average Runoff Depth = 36 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

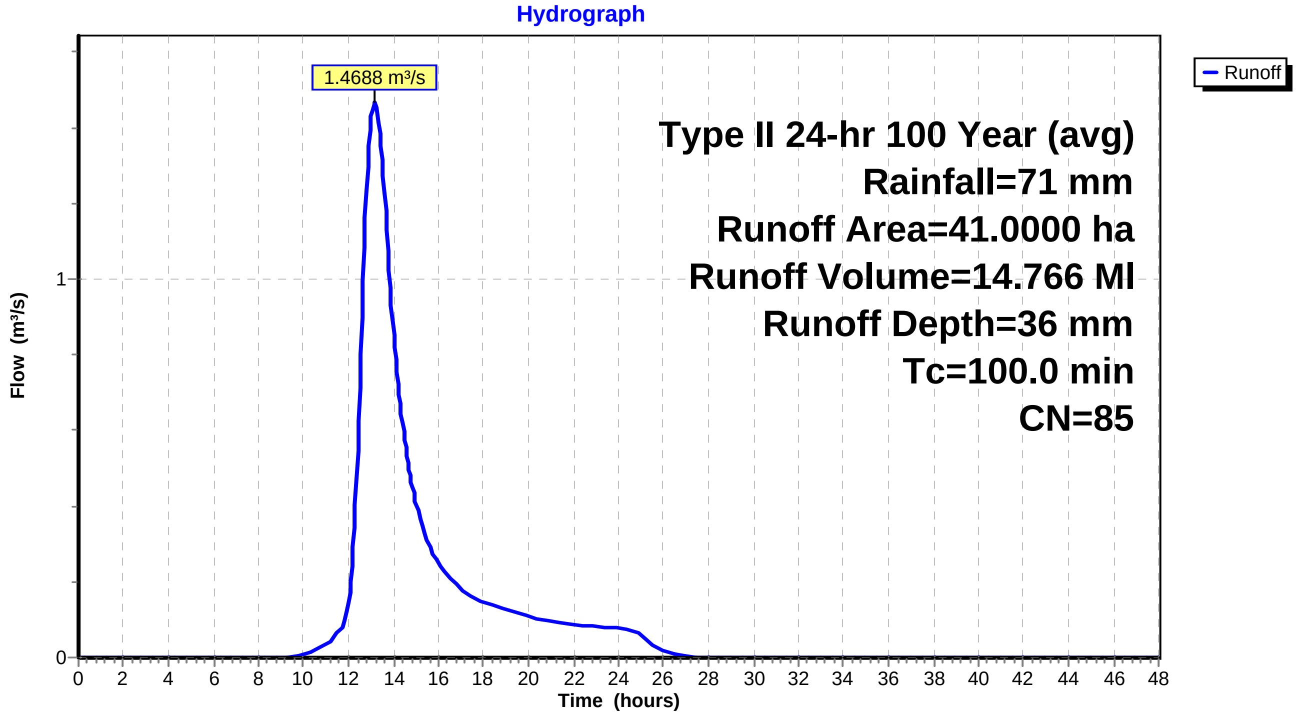
Runoff = 1.4688 m³/s @ 13.18 hrs, Volume= 14.766 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

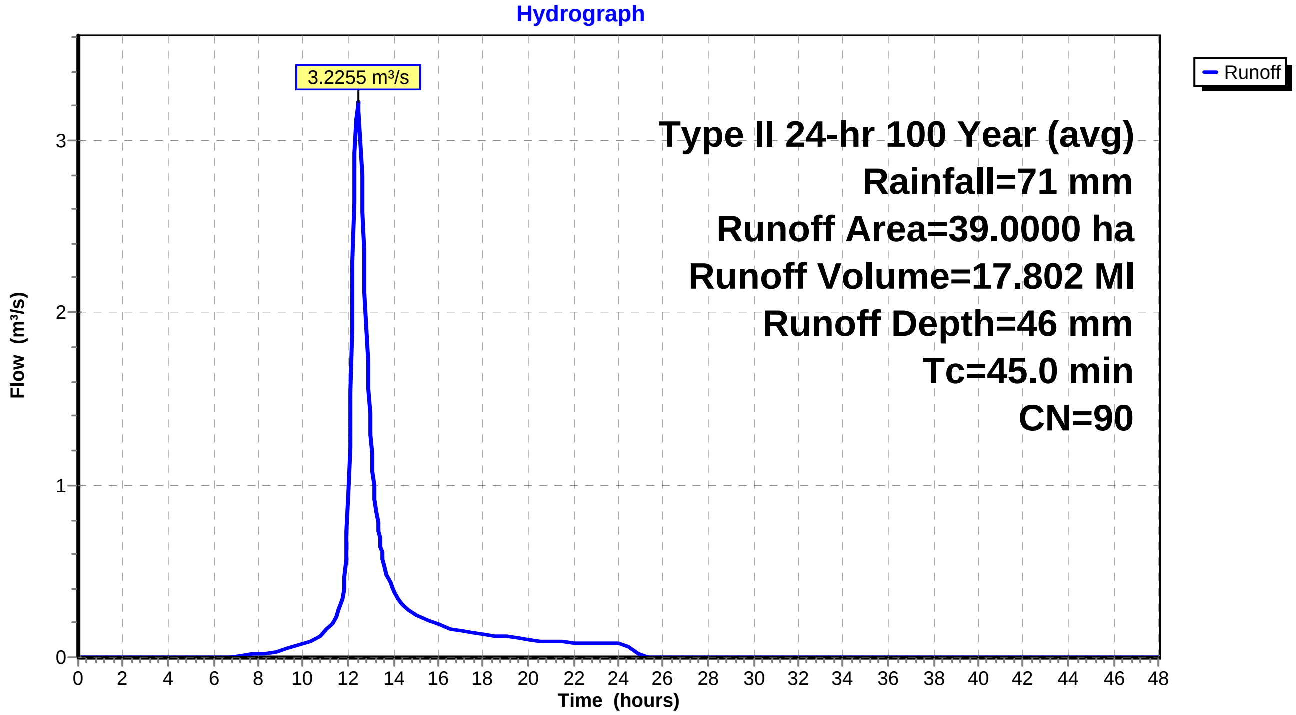
Runoff = 3.2255 m³/s @ 12.43 hrs, Volume= 17.802 Ml, Depth= 46 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

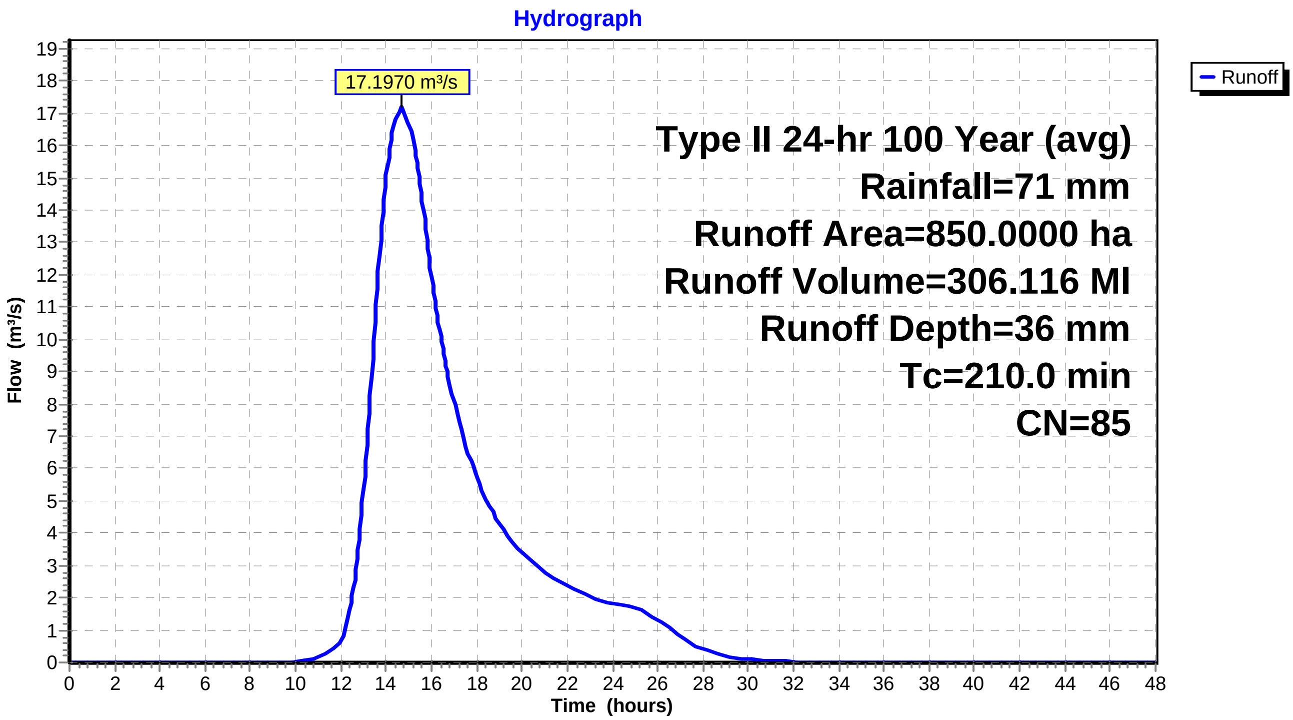
Runoff = 17.1970 m³/s @ 14.69 hrs, Volume= 306.116 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

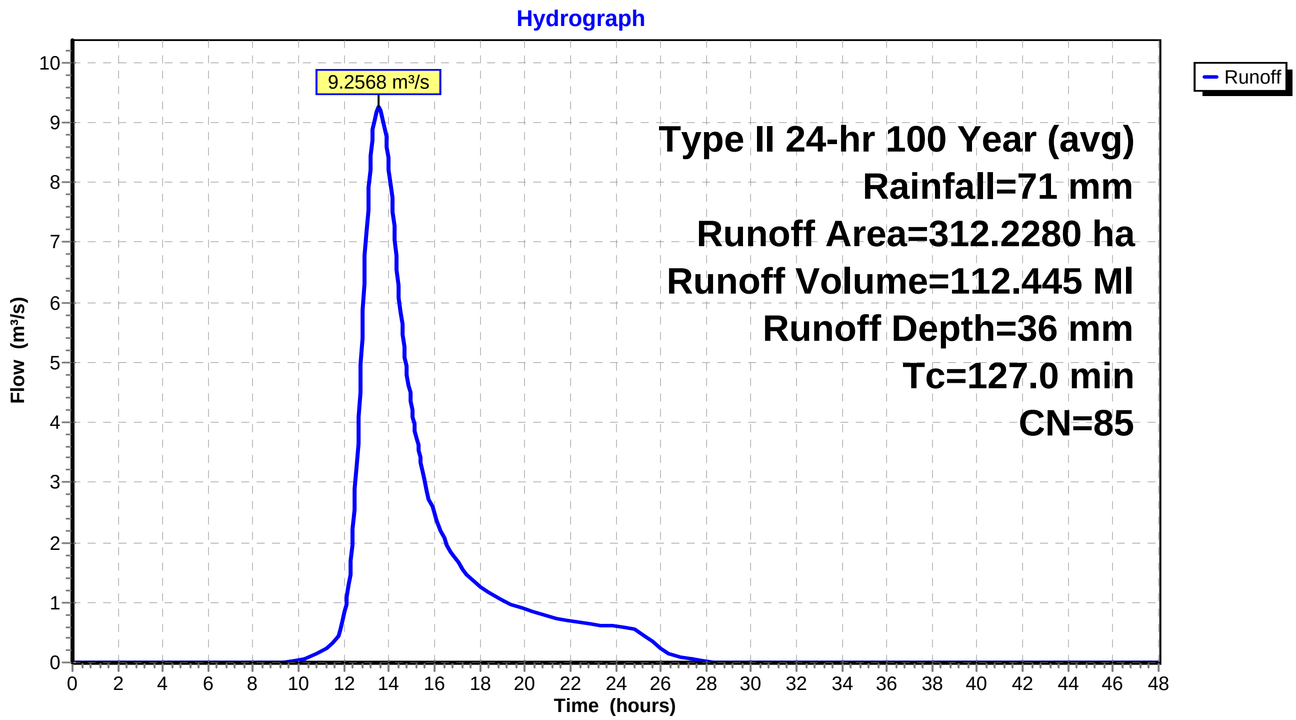
Runoff = 9.2568 m³/s @ 13.54 hrs, Volume= 112.445 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

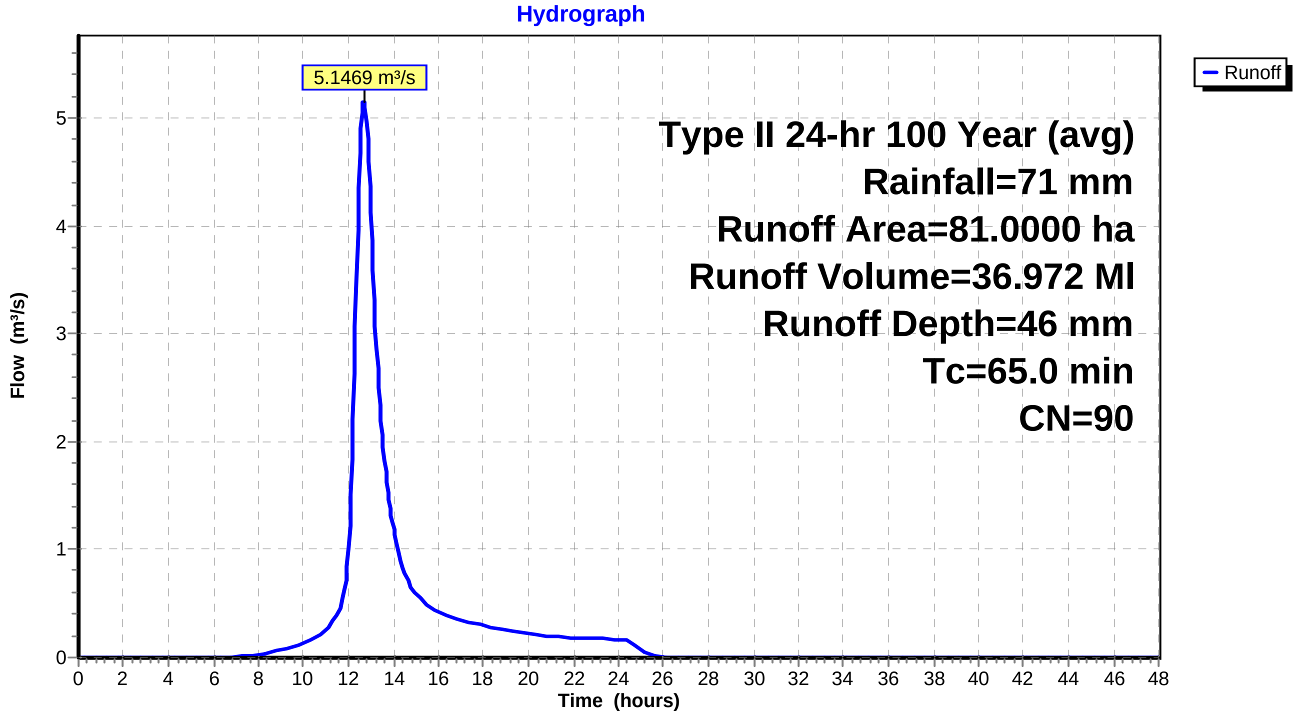
Runoff = 5.1469 m³/s @ 12.67 hrs, Volume= 36.972 Ml, Depth= 46 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

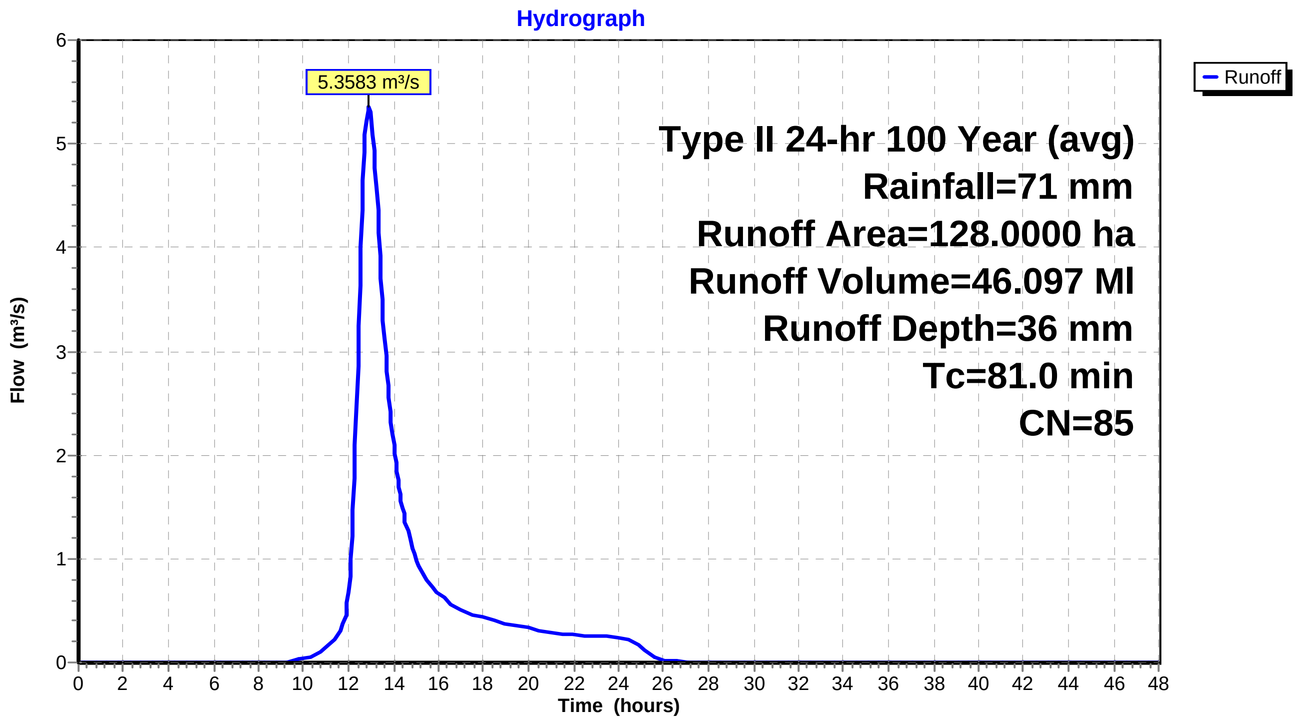
Runoff = 5.3583 m³/s @ 12.91 hrs, Volume= 46.097 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

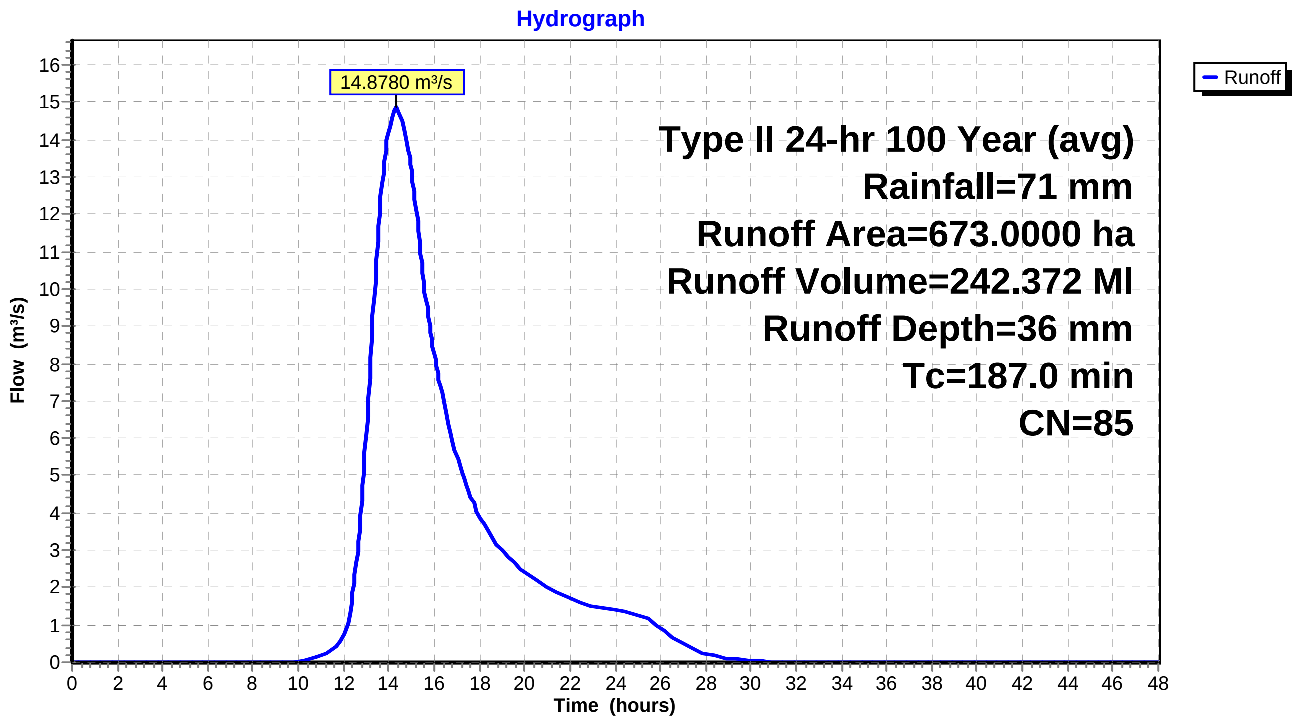
Runoff = 14.8780 m³/s @ 14.34 hrs, Volume= 242.372 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

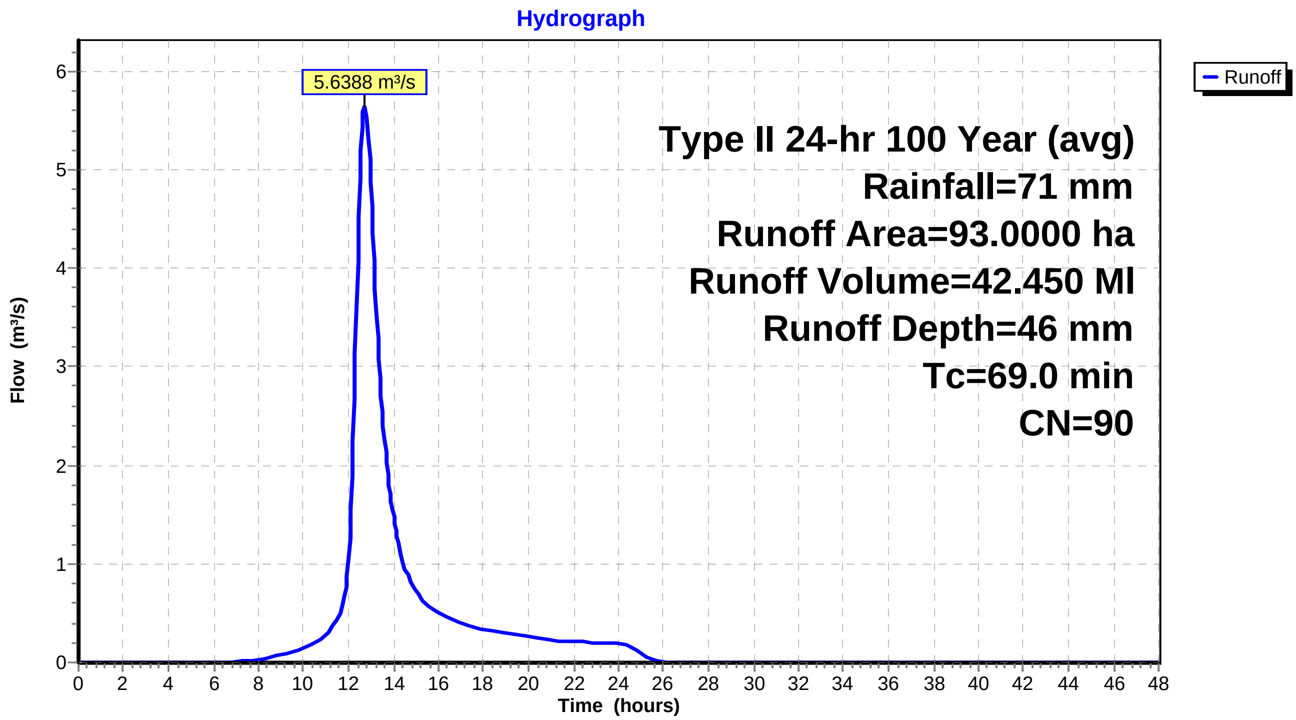
Runoff = 5.6388 m³/s @ 12.73 hrs, Volume= 42.450 Ml, Depth= 46 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m^3/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

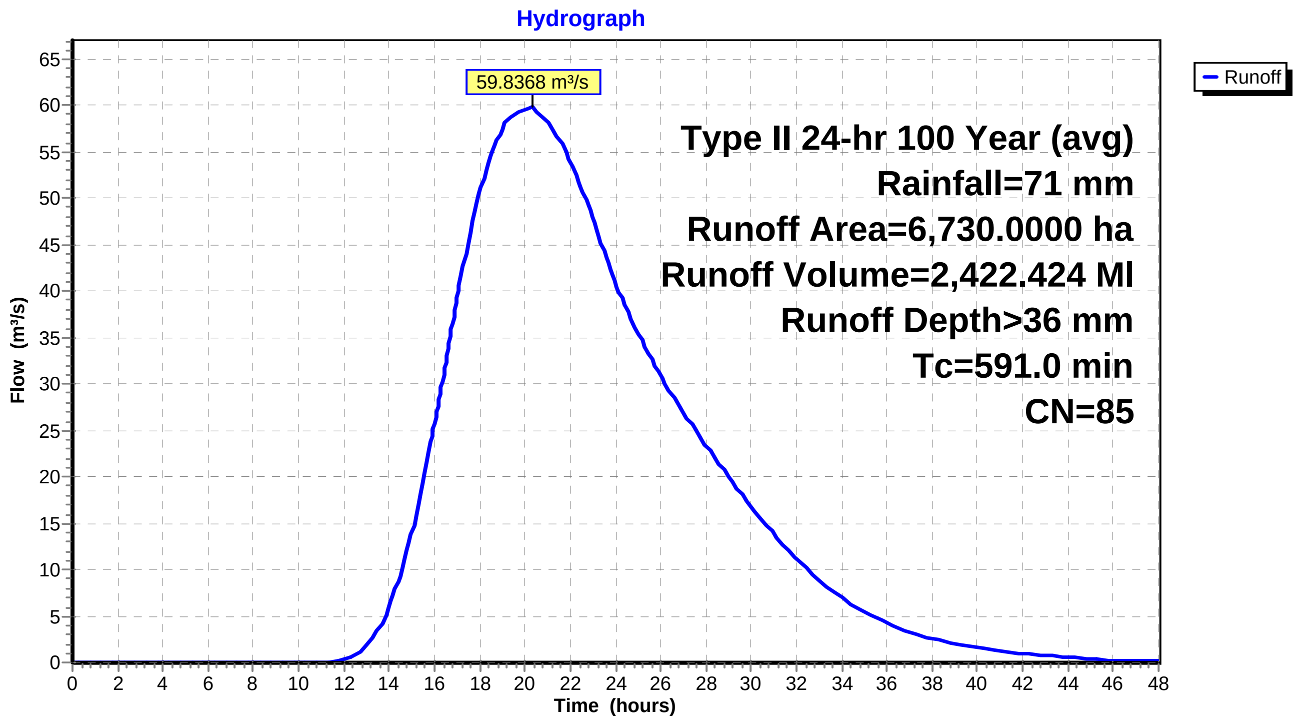
Runoff = 59.8368 m³/s @ 20.34 hrs, Volume= 2,422.424 Ml, Depth> 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

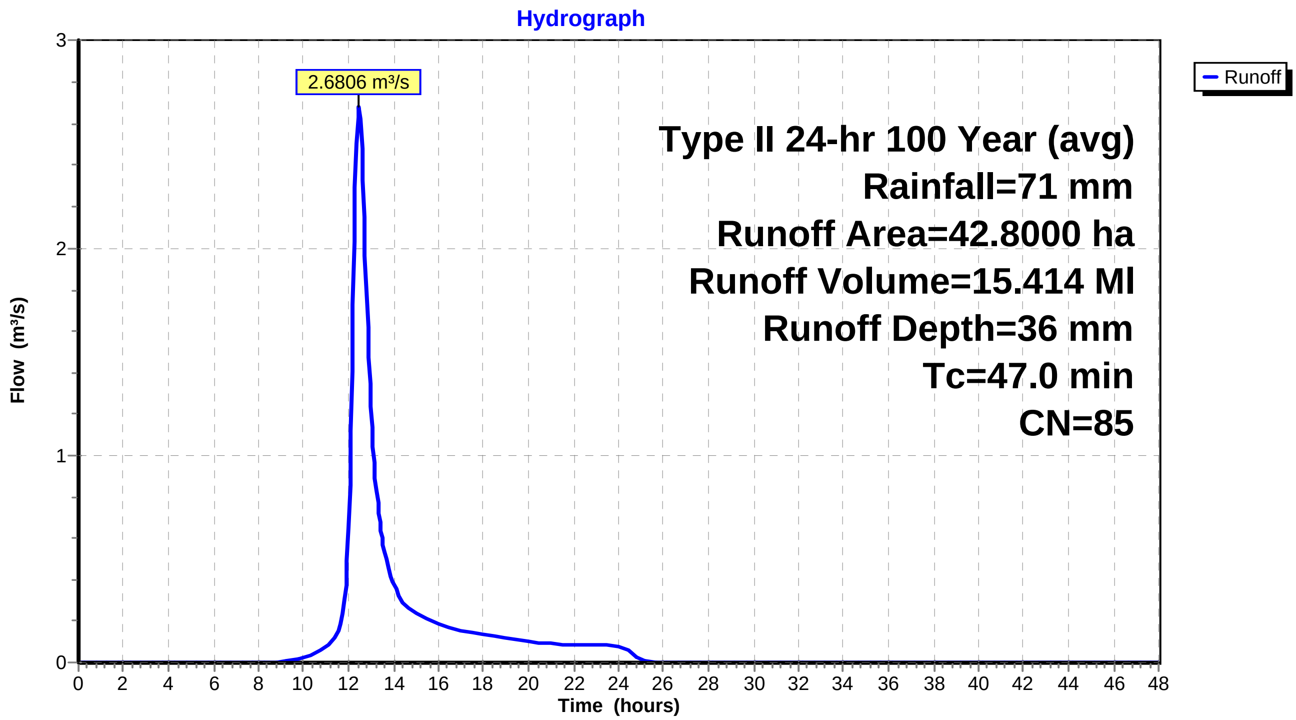
Runoff = 2.6806 m³/s @ 12.46 hrs, Volume= 15.414 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

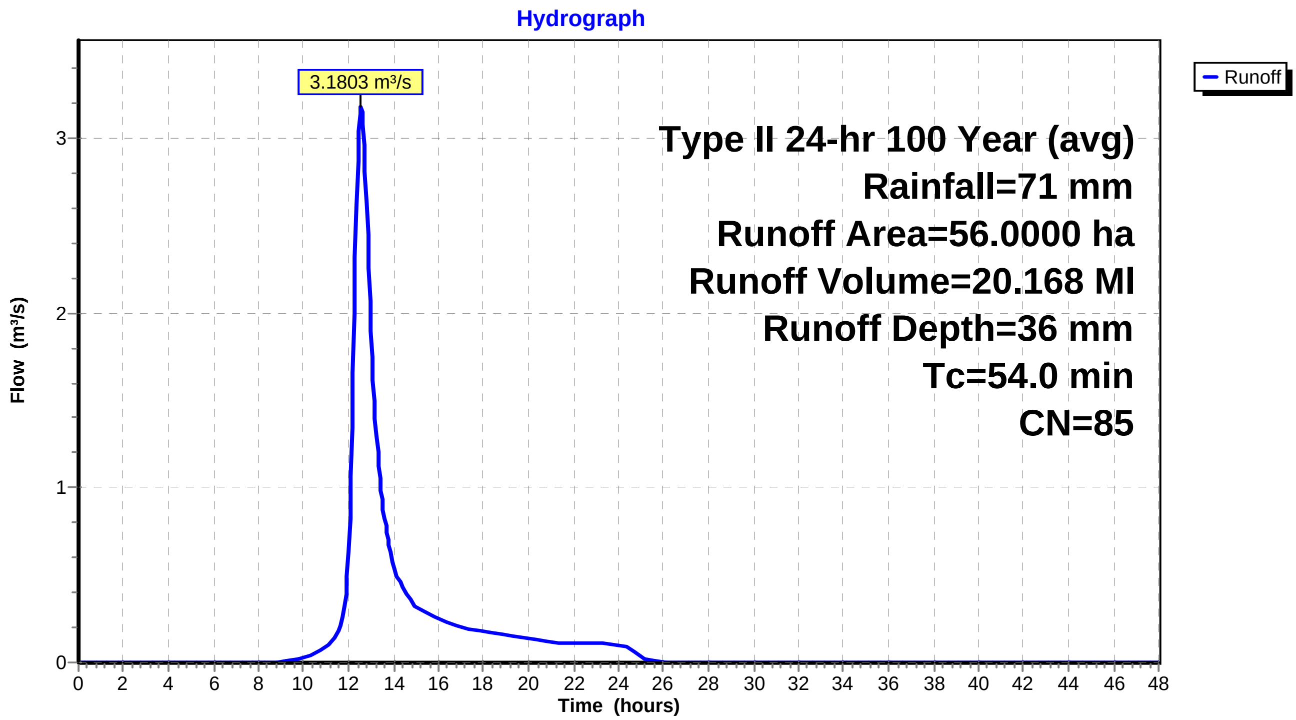
Runoff = 3.1803 m³/s @ 12.55 hrs, Volume= 20.168 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

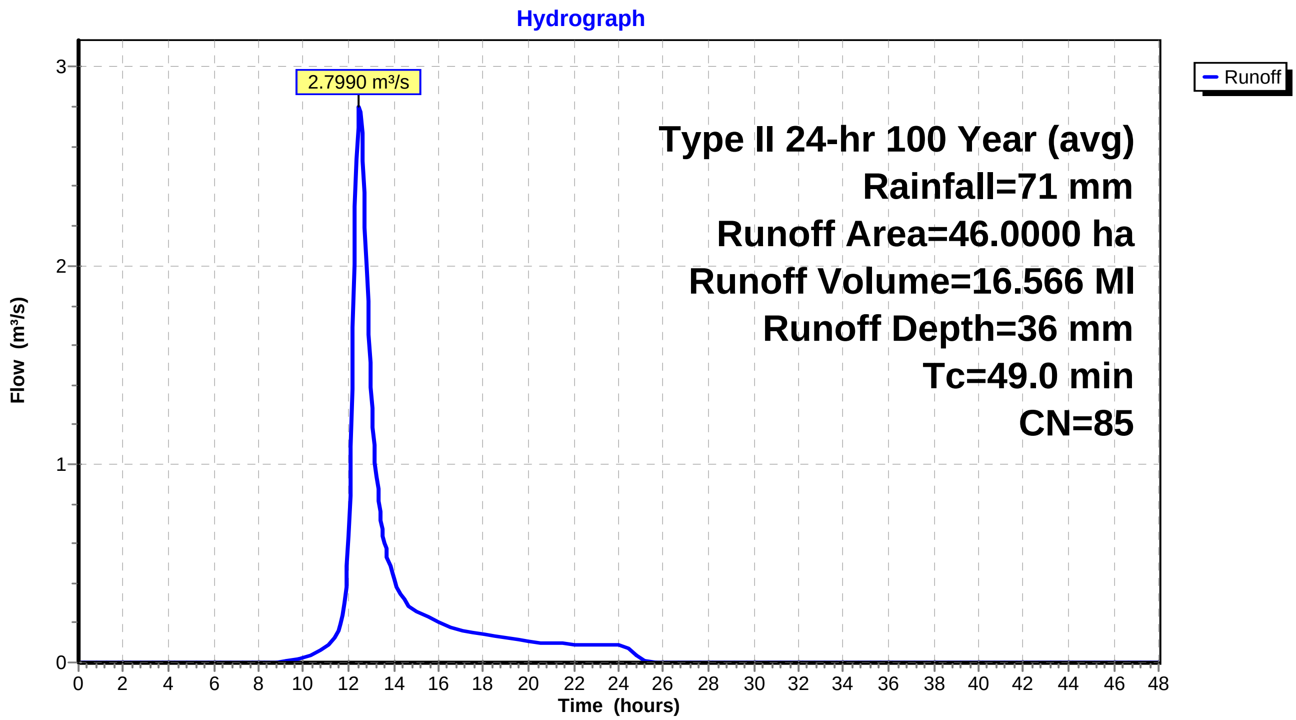
Runoff = 2.7990 m³/s @ 12.49 hrs, Volume= 16.566 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

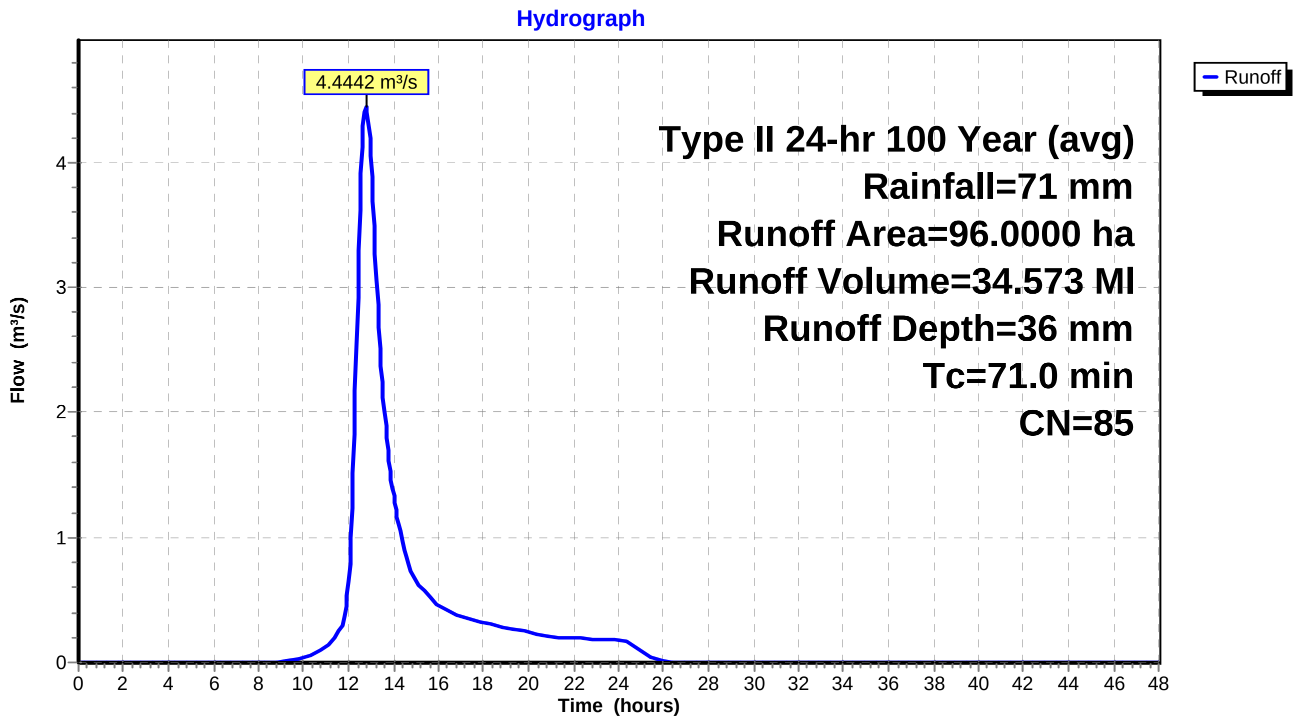
Runoff = 4.4442 m³/s @ 12.78 hrs, Volume= 34.573 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

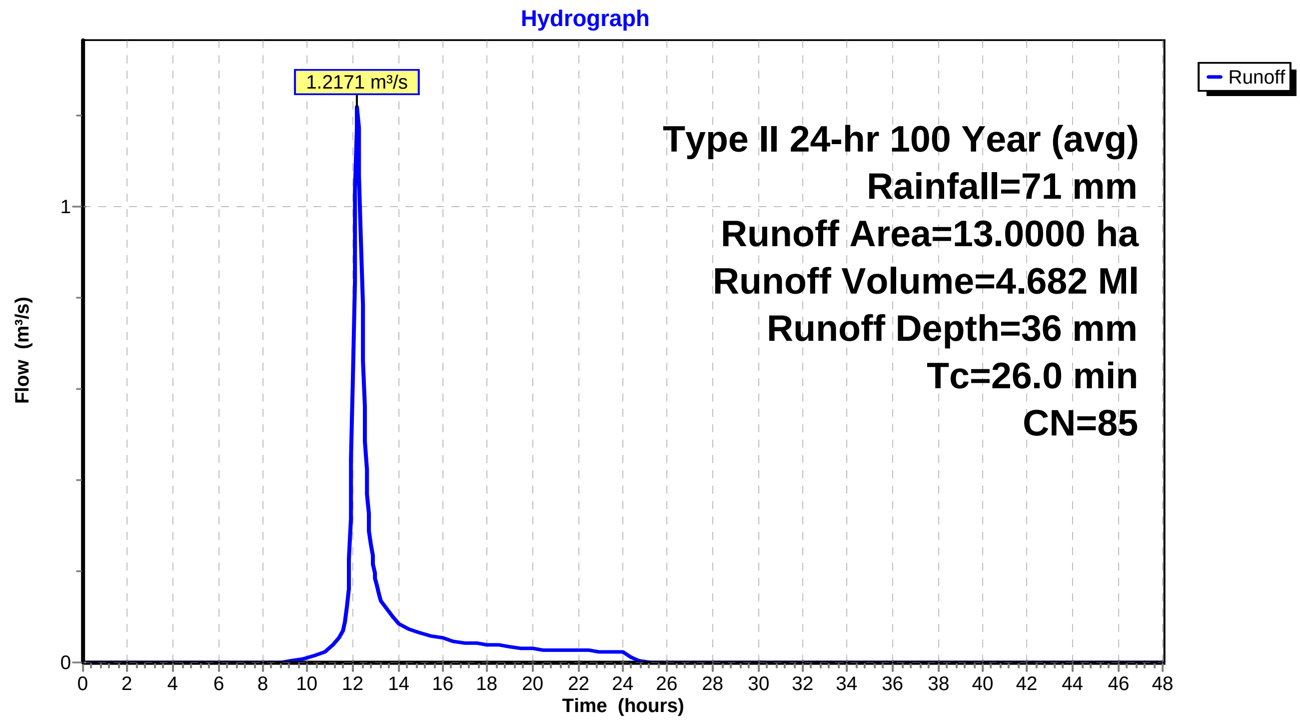
Runoff = 1.2171 m³/s @ 12.20 hrs, Volume= 4.682 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

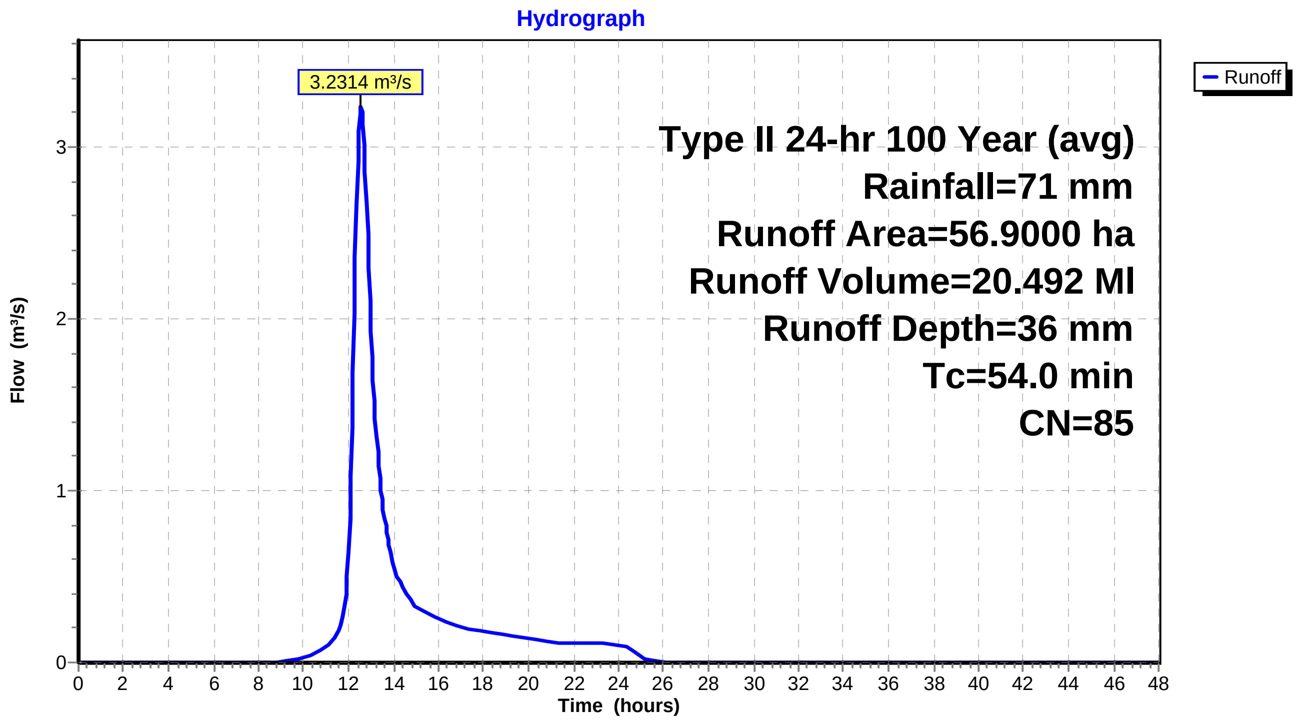
Runoff = 3.2314 m³/s @ 12.55 hrs, Volume= 20.492 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

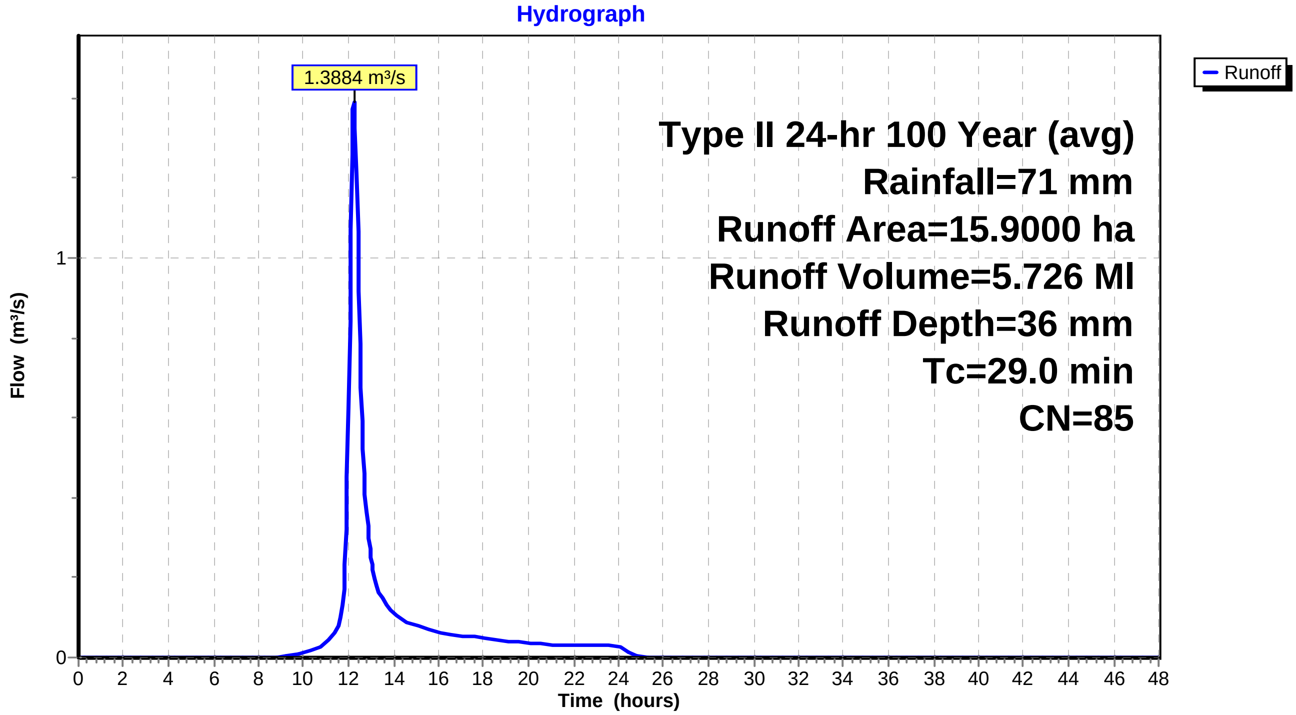
Runoff = 1.3884 m³/s @ 12.23 hrs, Volume= 5.726 Ml, Depth= 36 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

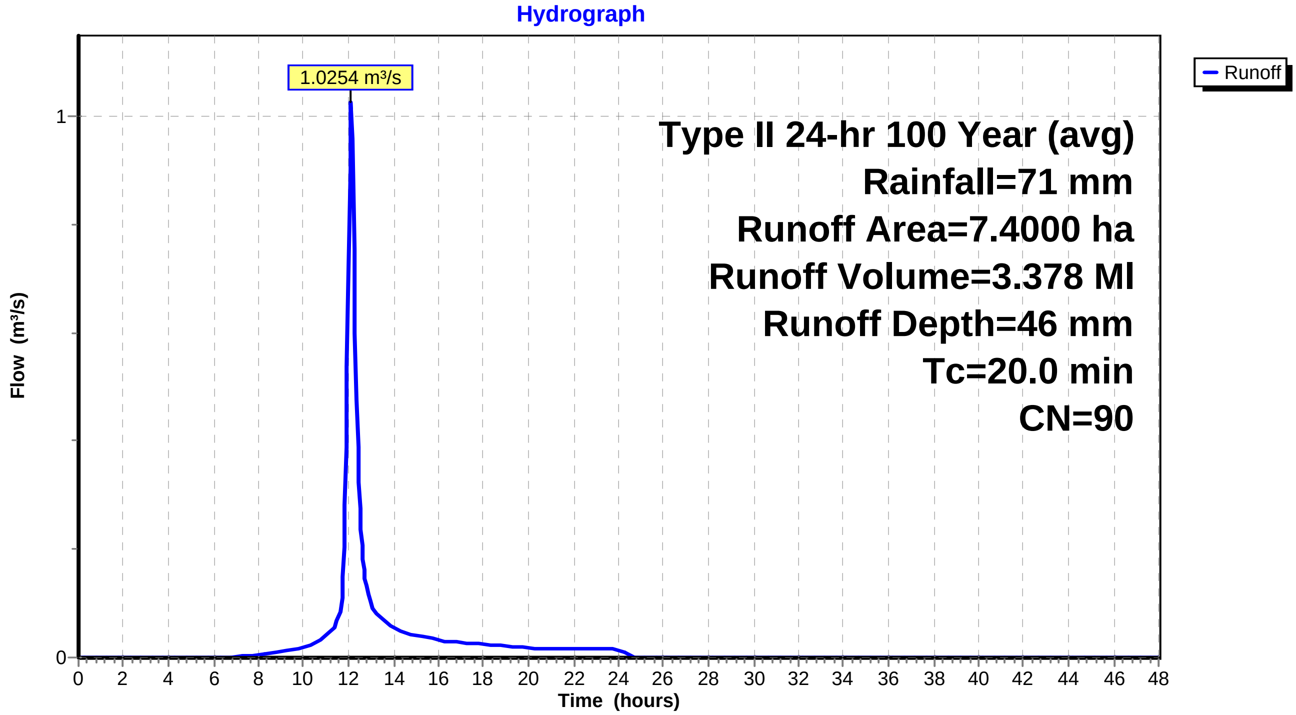
Runoff = 1.0254 m³/s @ 12.12 hrs, Volume= 3.378 Ml, Depth= 46 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Year (avg) Rainfall=71 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

Inflow Area = 978.0000 ha, Inflow Depth > 36 mm for 100 Year (avg) event
Inflow = 18.9503 m³/s @ 14.51 hrs, Volume= 352.158 Ml
Outflow = 18.9433 m³/s @ 14.62 hrs, Volume= 352.144 Ml, Atten= 0%, Lag= 6.8 min

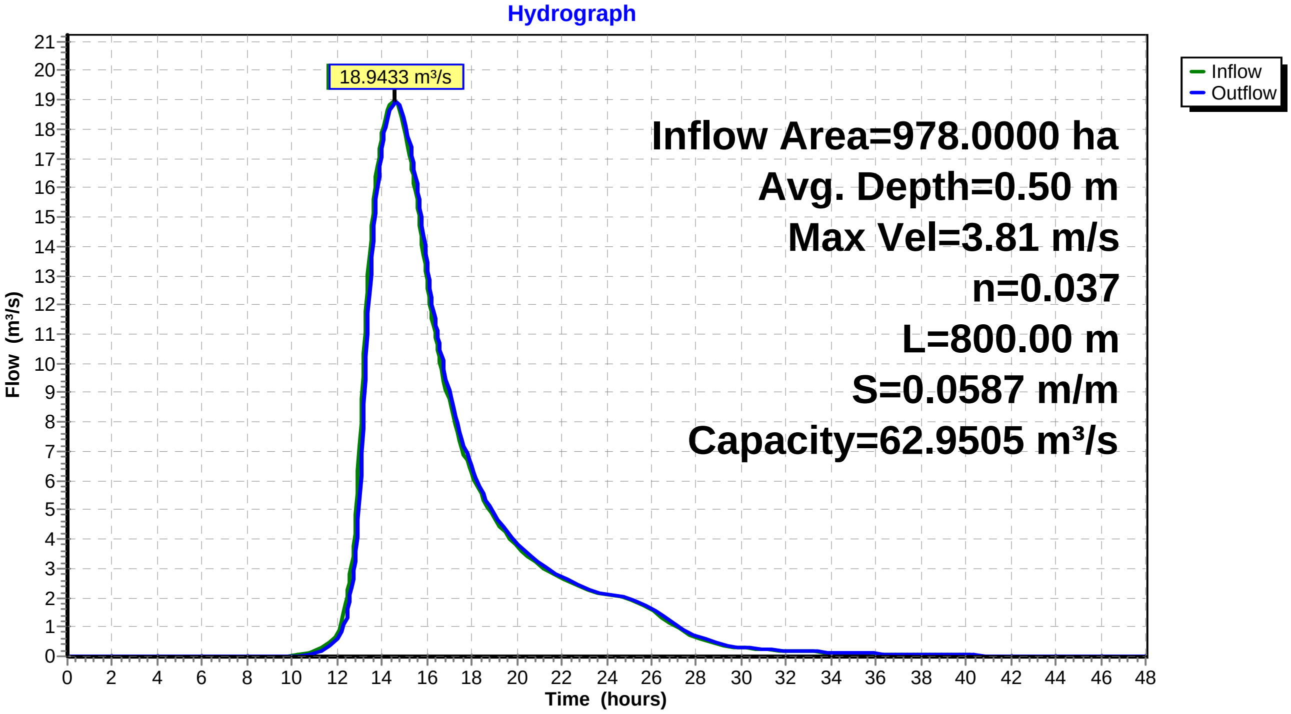
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.81 m/s, Min. Travel Time= 3.5 min
Avg. Velocity = 1.21 m/s, Avg. Travel Time= 11.0 min

Peak Storage= 3,979.9 m³ @ 14.56 hrs, Average Depth at Peak Storage= 0.50 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

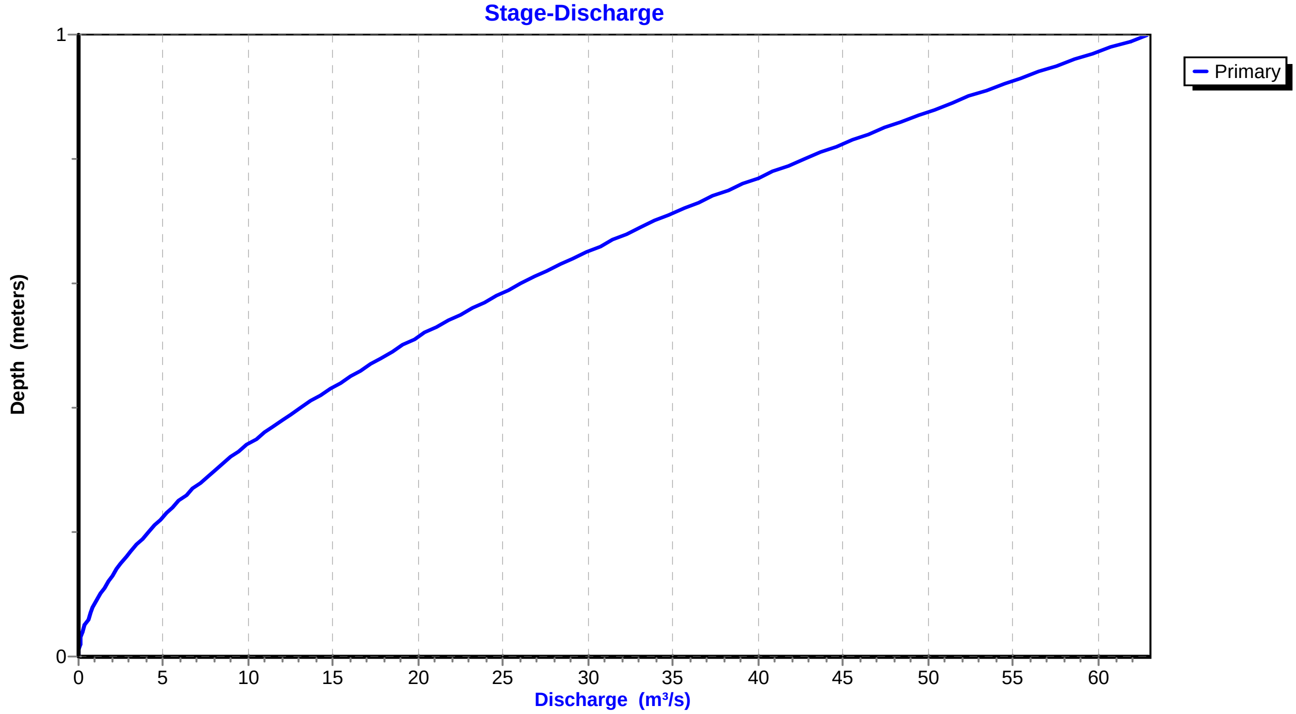
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

‡

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

Inflow Area = 1,117.0000 ha, Inflow Depth > 37 mm for 100 Year (avg) event
Inflow = 20.7911 m³/s @ 14.61 hrs, Volume= 411.066 Ml
Outflow = 20.7626 m³/s @ 14.84 hrs, Volume= 411.003 Ml, Atten= 0%, Lag= 14.1 min

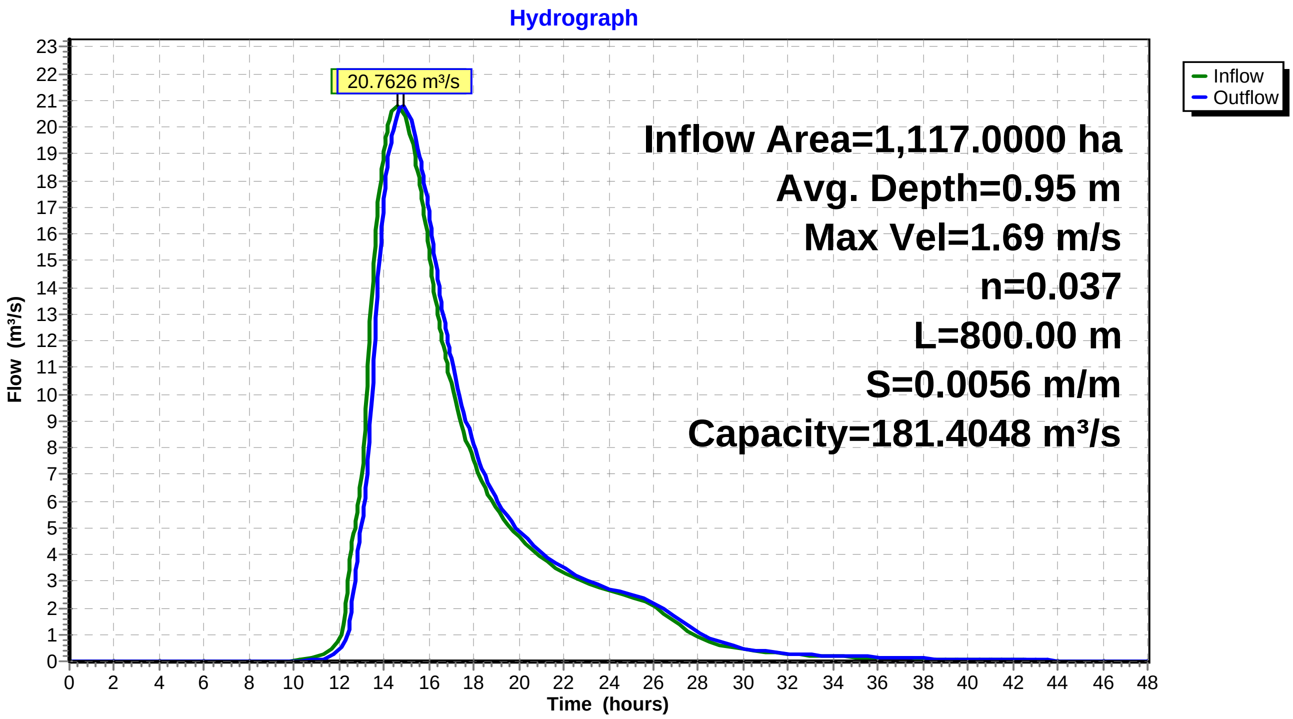
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.69 m/s, Min. Travel Time= 7.9 min
Avg. Velocity = 0.58 m/s, Avg. Travel Time= 22.9 min

Peak Storage= 9,801.1 m³ @ 14.71 hrs, Average Depth at Peak Storage= 0.95 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

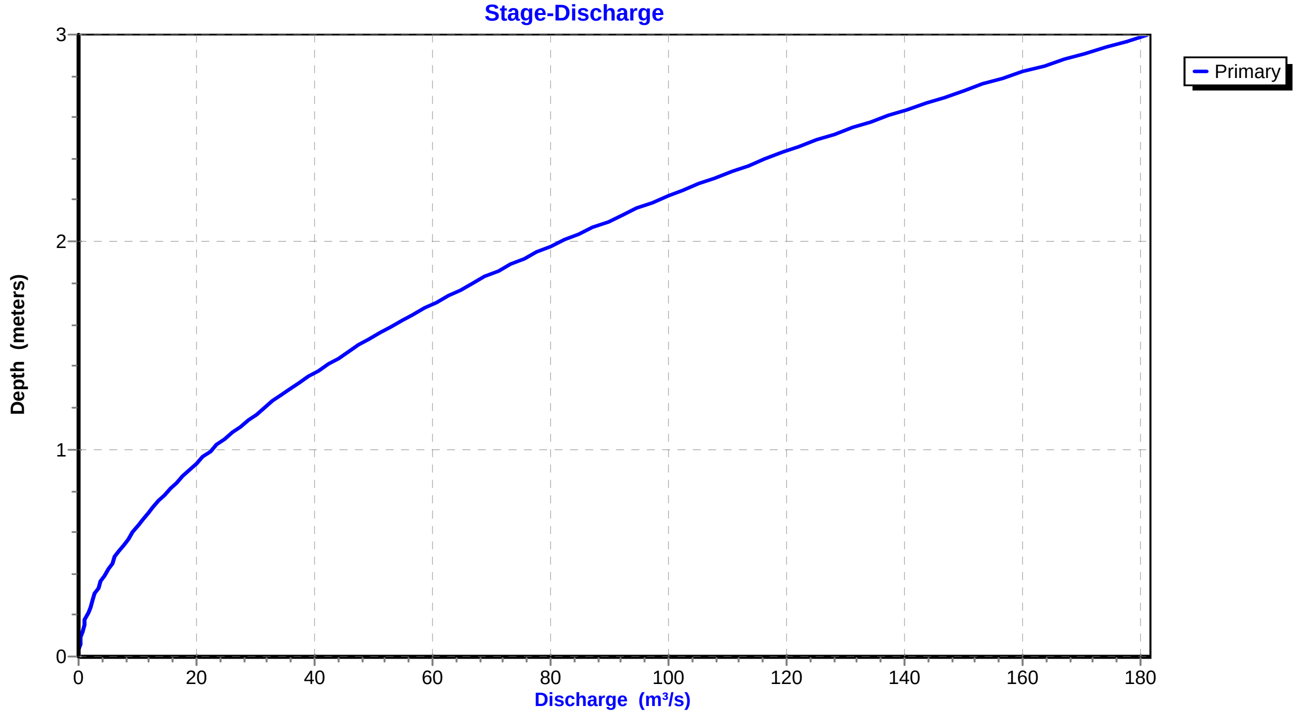
10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

‡

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



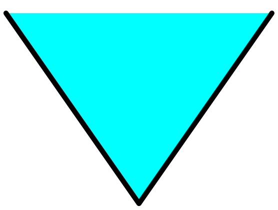
Reach 18R: Mid Haggart Creek

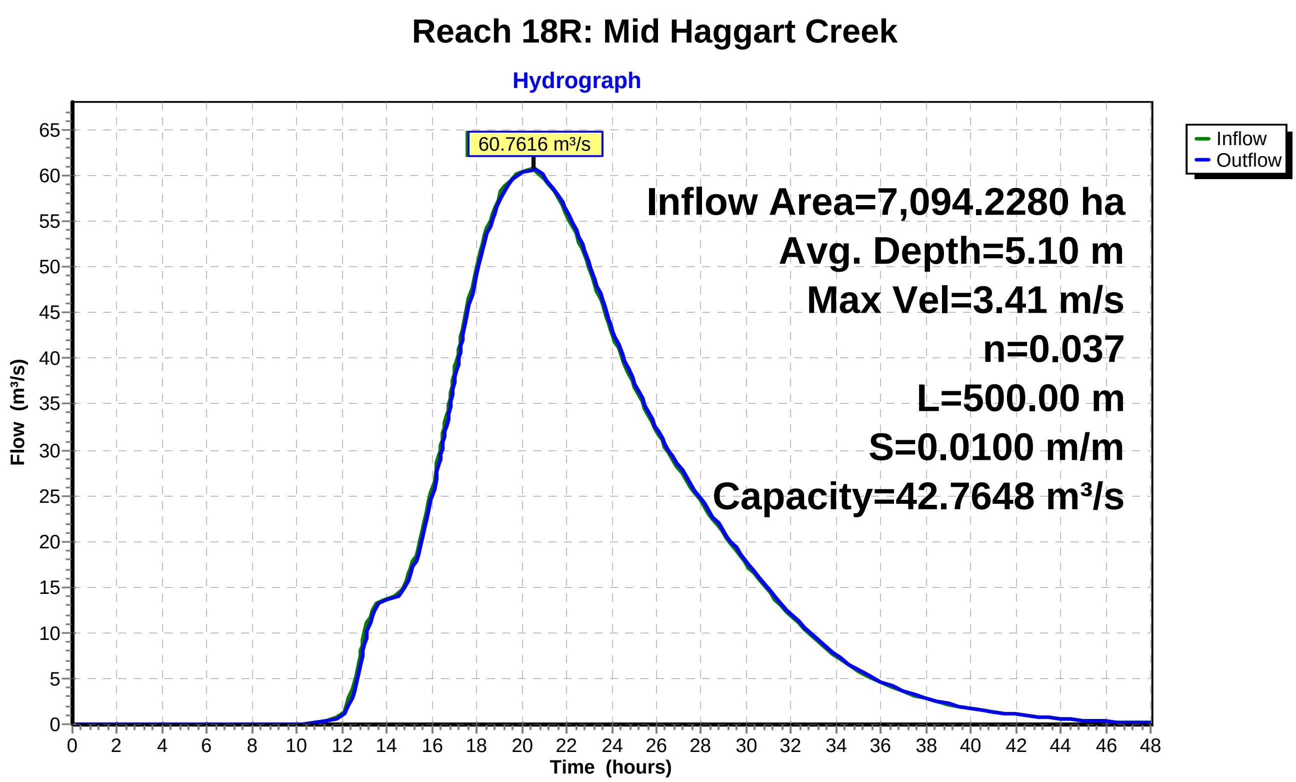
Inflow Area = 7,094.2280 ha, Inflow Depth > 36 mm for 100 Year (avg) event
Inflow = 60.7724 m³/s @ 20.48 hrs, Volume= 2,556.967 Ml
Outflow = 60.7616 m³/s @ 20.54 hrs, Volume= 2,556.838 Ml, Atten= 0%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.41 m/s, Min. Travel Time= 2.4 min
Avg. Velocity = 2.04 m/s, Avg. Travel Time= 4.1 min

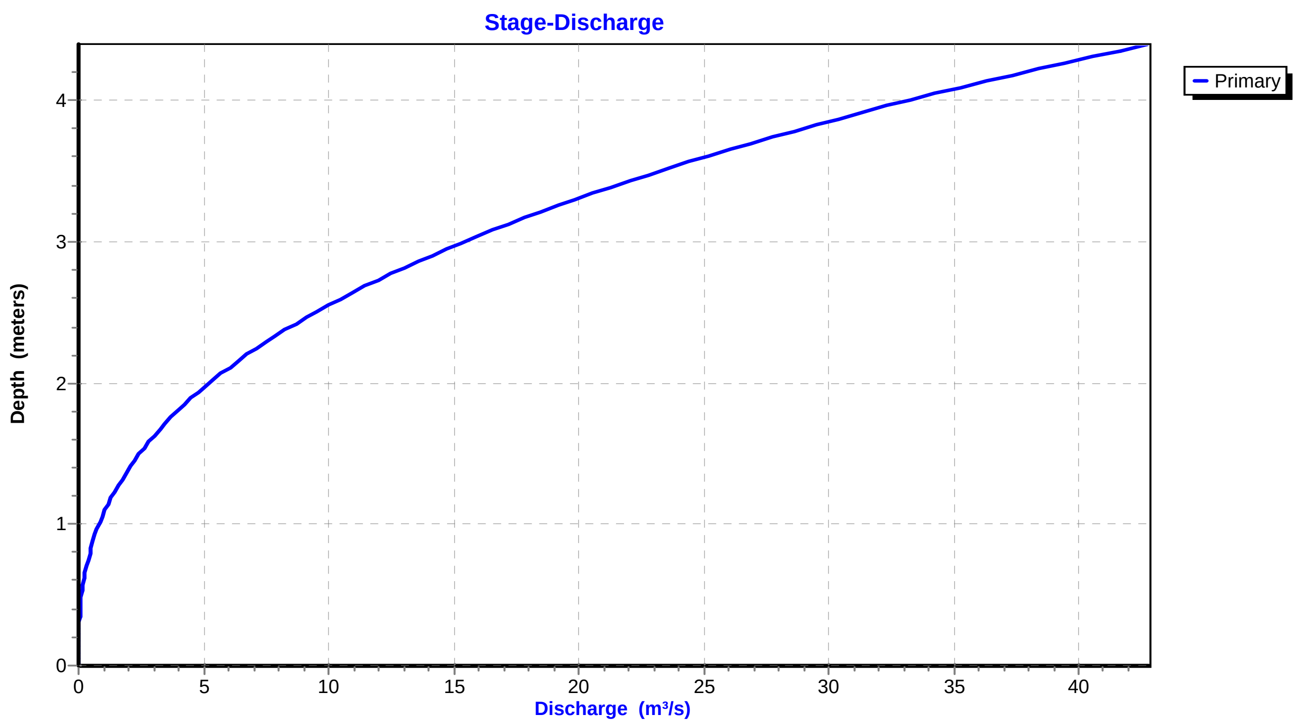
Peak Storage= 8,922.1 m³ @ 20.50 hrs, Average Depth at Peak Storage= 5.10 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m





Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

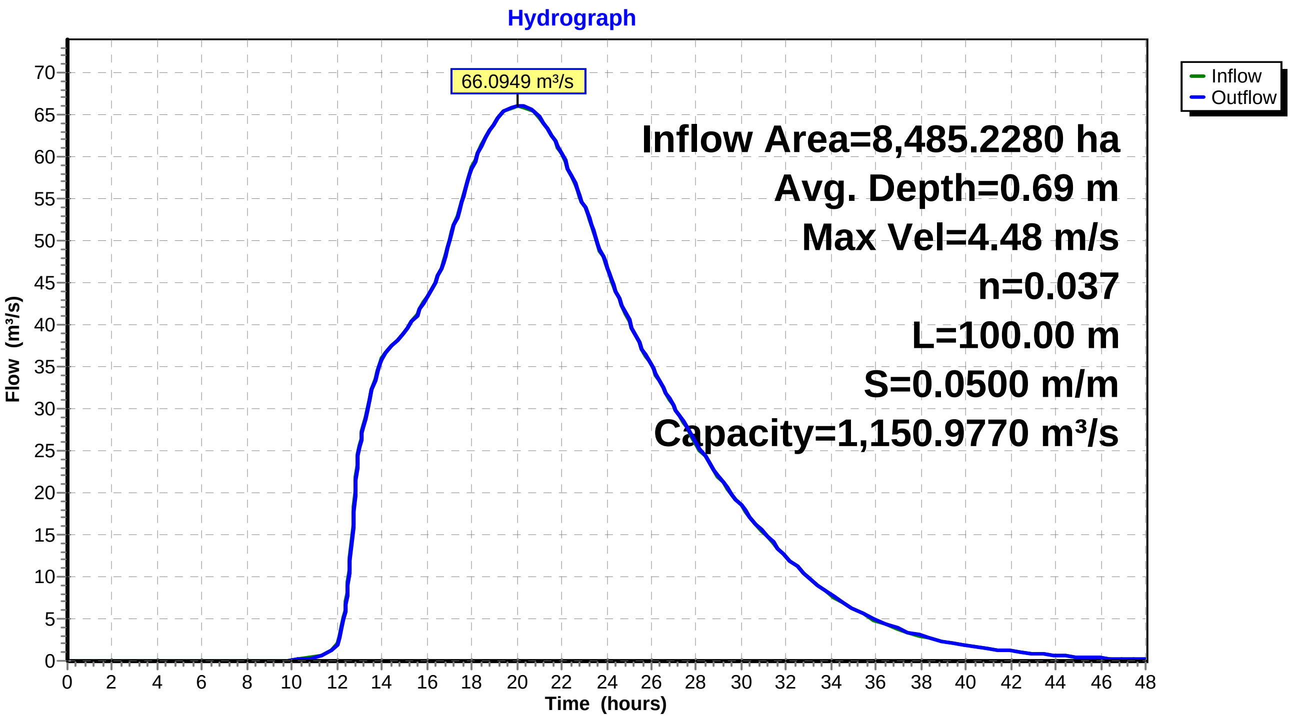
Inflow Area = 8,485.2280 ha, Inflow Depth > 36 mm for 100 Year (avg) event
Inflow = 66.0955 m³/s @ 20.00 hrs, Volume= 3,074.295 Ml
Outflow = 66.0949 m³/s @ 20.01 hrs, Volume= 3,074.263 Ml, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.48 m/s, Min. Travel Time= 0.4 min
Avg. Velocity = 2.34 m/s, Avg. Travel Time= 0.7 min

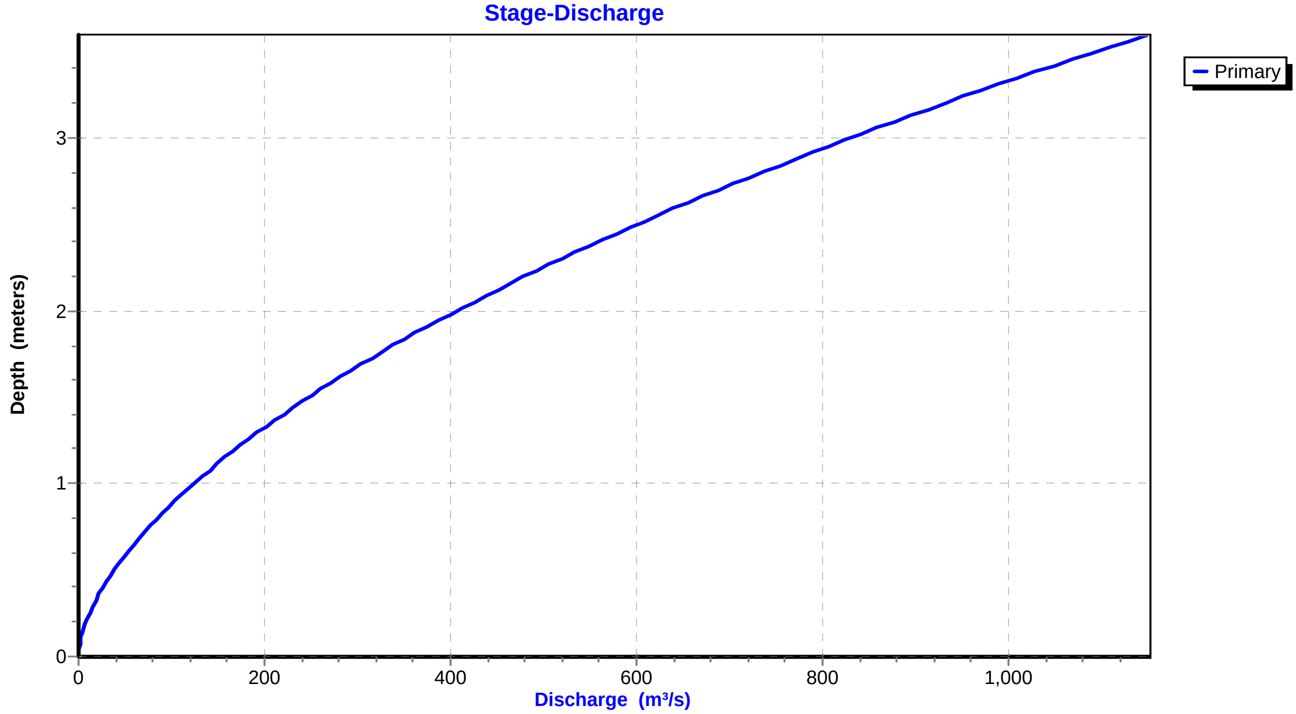
Peak Storage= 1,474.4 m³ @ 20.01 hrs, Average Depth at Peak Storage= 0.69 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 36 mm for 100 Year (avg) event
Inflow = 19.2351 m³/s @ 14.60 hrs, Volume= 368.710 Ml
Outflow = 19.2254 m³/s @ 14.74 hrs, Volume= 368.684 Ml, Atten= 0%, Lag= 8.8 min

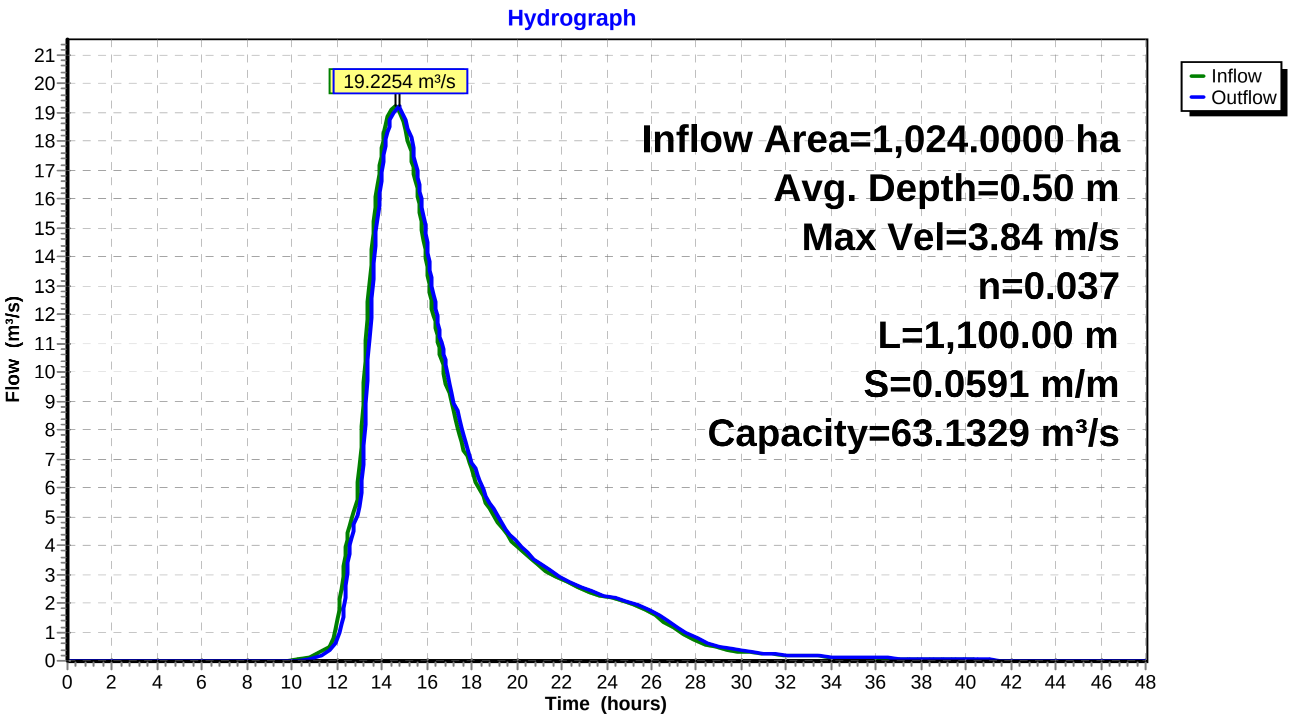
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.84 m/s, Min. Travel Time= 4.8 min
Avg. Velocity = 1.24 m/s, Avg. Travel Time= 14.8 min

Peak Storage= 5,514.8 m³ @ 14.66 hrs, Average Depth at Peak Storage= 0.50 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

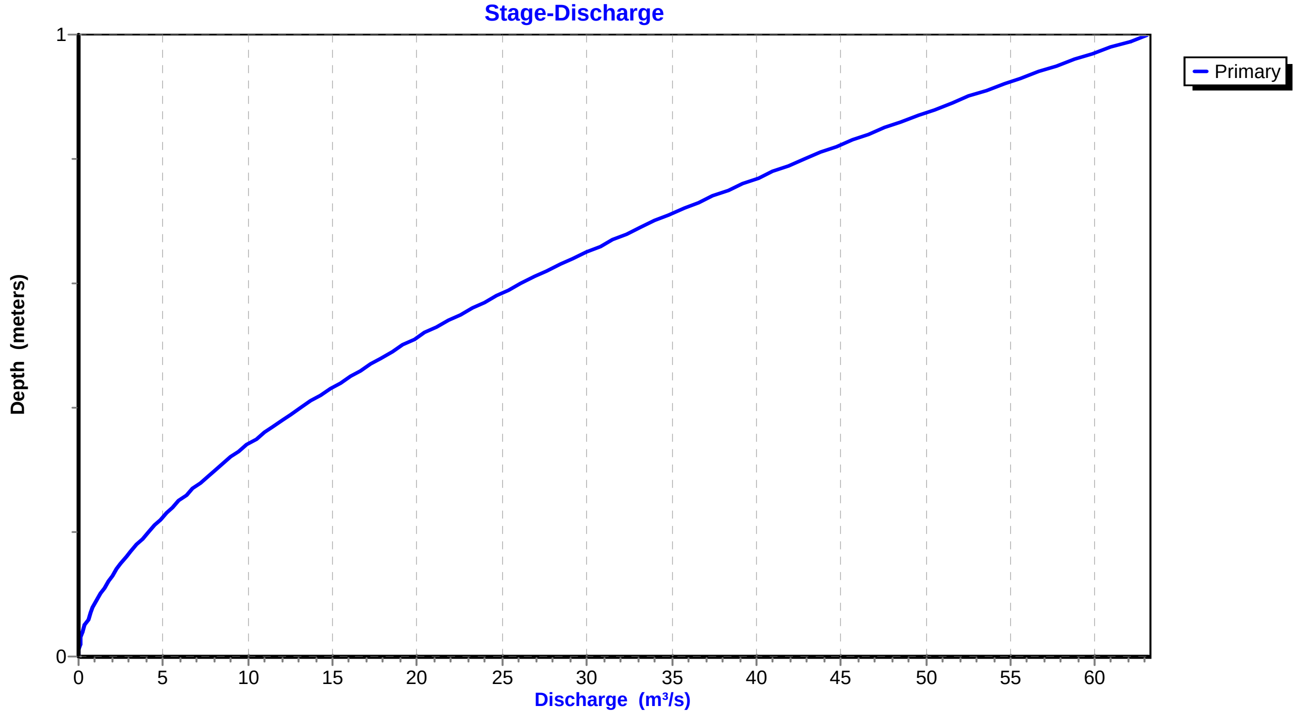
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



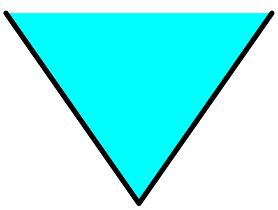
Reach 34R: Upper Haggart Creek

Inflow Area = 6,782.0000 ha, Inflow Depth > 36 mm for 100 Year (avg) event
Inflow = 59.9970 m³/s @ 20.34 hrs, Volume= 2,444.858 Ml
Outflow = 59.9402 m³/s @ 20.49 hrs, Volume= 2,444.523 Ml, Atten= 0%, Lag= 9.1 min

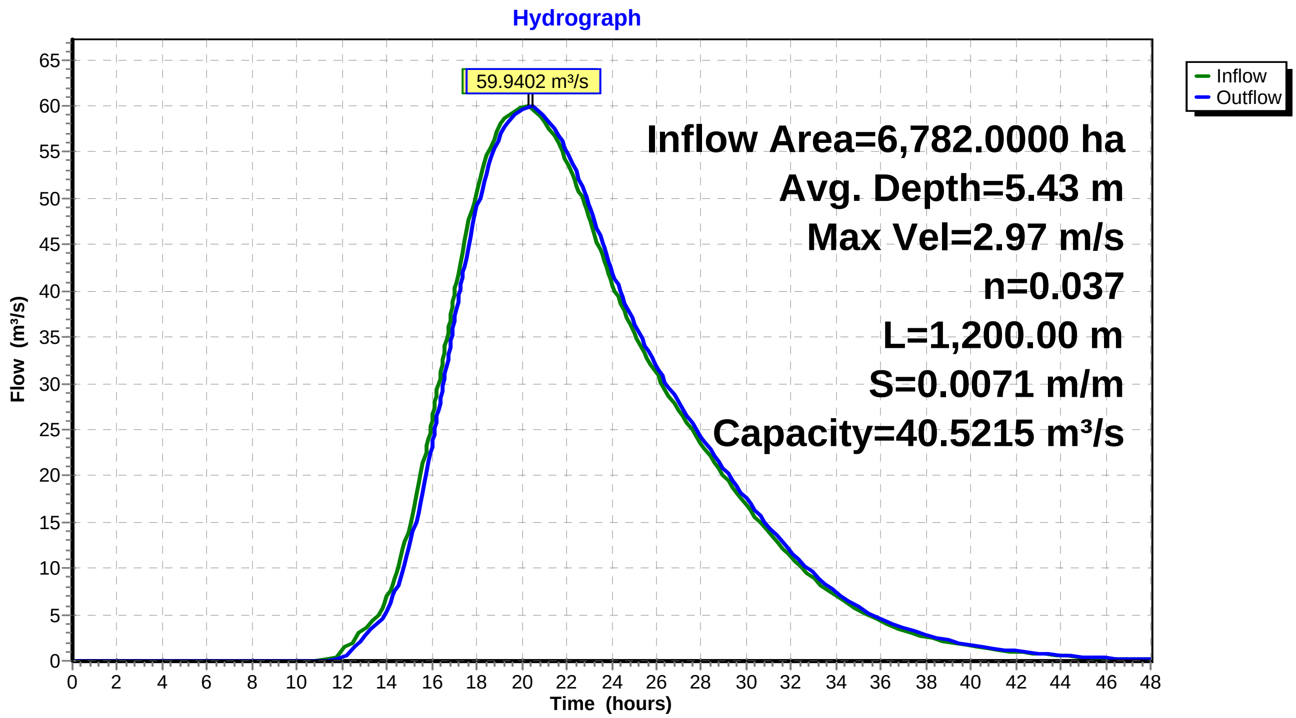
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.97 m/s, Min. Travel Time= 6.7 min
Avg. Velocity = 1.73 m/s, Avg. Travel Time= 11.6 min

Peak Storage= 24,185.4 m³ @ 20.38 hrs, Average Depth at Peak Storage= 5.43 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

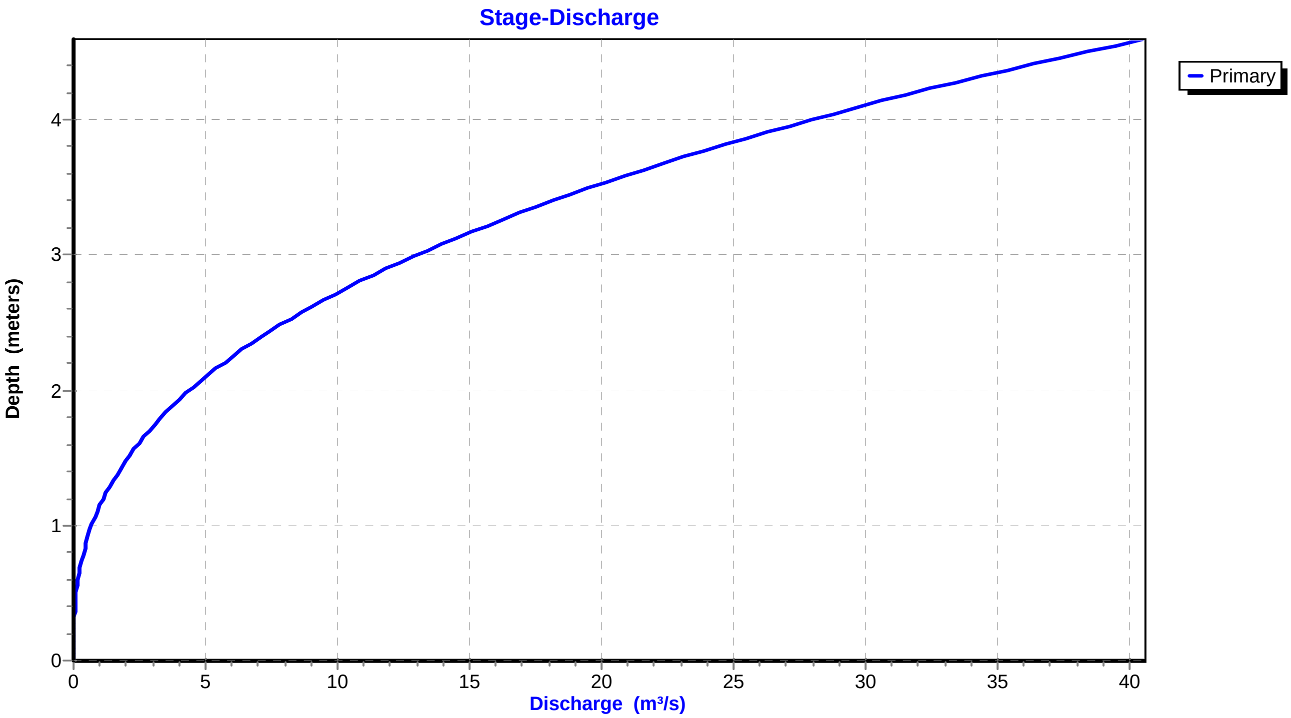
0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m



Reach 34R: Upper Haggart Creek



Reach 34R: Upper Haggart Creek



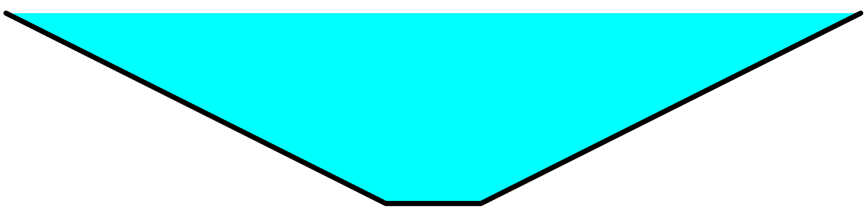
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 40 mm for 100 Year (avg) event
Inflow = 8.0024 m³/s @ 12.93 hrs, Volume= 71.887 Ml
Outflow = 7.9028 m³/s @ 13.07 hrs, Volume= 71.882 Ml, Atten= 1%, Lag= 8.3 min

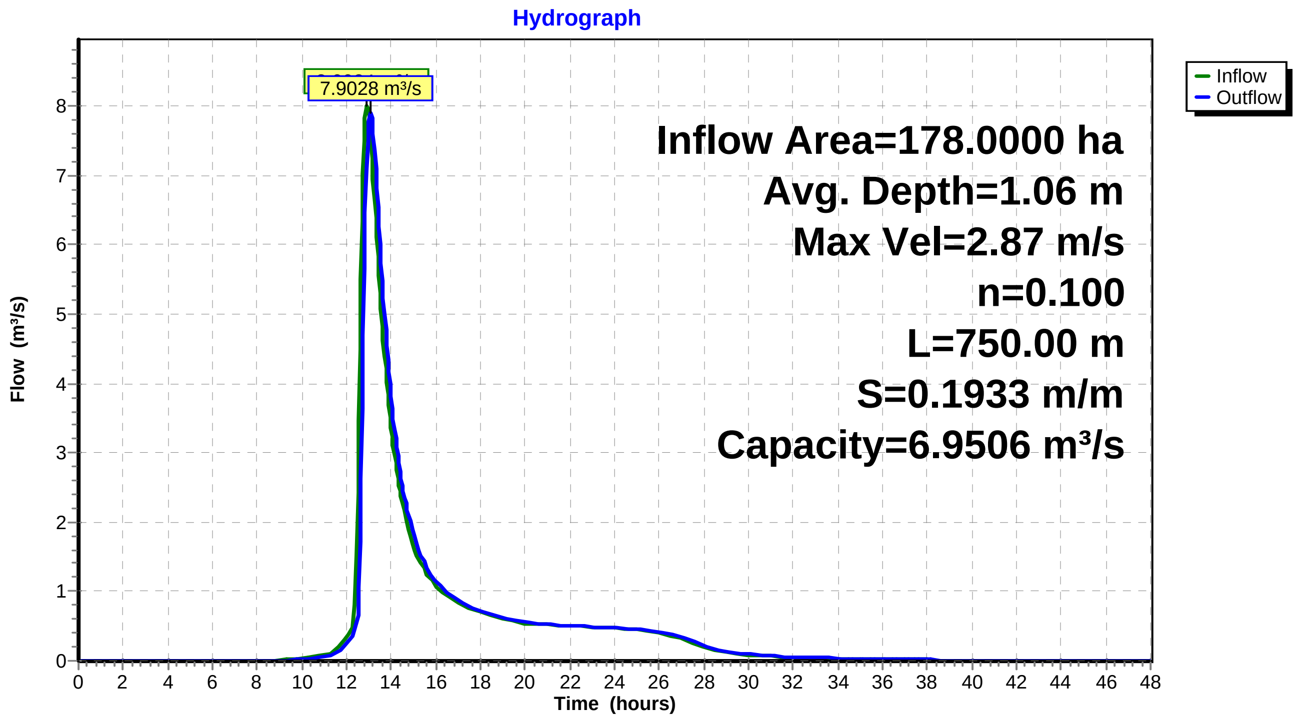
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.87 m/s, Min. Travel Time= 4.4 min
Avg. Velocity = 0.97 m/s, Avg. Travel Time= 12.9 min

Peak Storage= 2,070.7 m³ @ 13.00 hrs, Average Depth at Peak Storage= 1.06 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

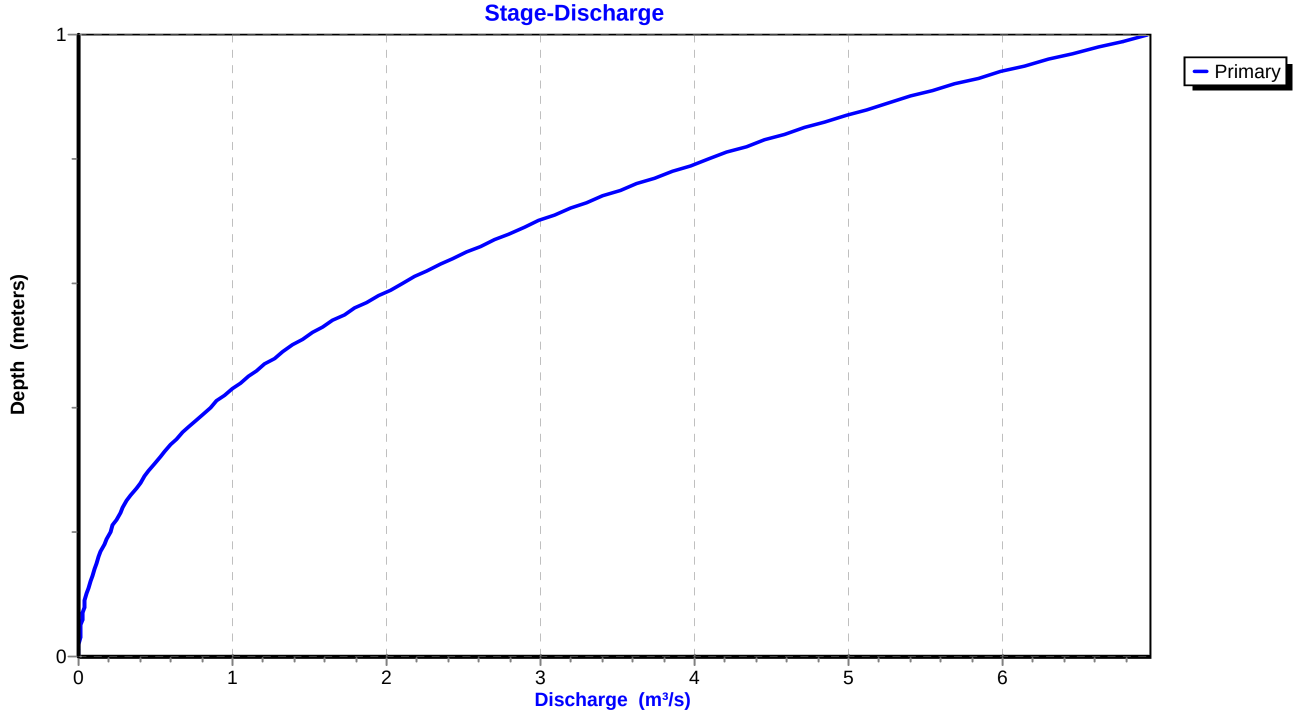
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 36 mm for 100 Year (avg) event
Inflow = 5.3583 m³/s @ 12.91 hrs, Volume= 46.097 Ml
Outflow = 3.7117 m³/s @ 13.45 hrs, Volume= 46.042 Ml, Atten= 31%, Lag= 32.7 min
Primary = 0.3483 m³/s @ 13.45 hrs, Volume= 21.756 Ml
Secondary = 3.3634 m³/s @ 13.45 hrs, Volume= 24.286 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 918.162 m @ 13.45 hrs Surf.Area= 17,452.6 m² Storage= 35,048.4 m³ (14,607.2 m³ above start)

Plug-Flow detention time= 588.7 min calculated for 25.574 Ml (55% of inflow)
Center-of-Mass det. time= 227.1 min (1,125.8 - 898.8)

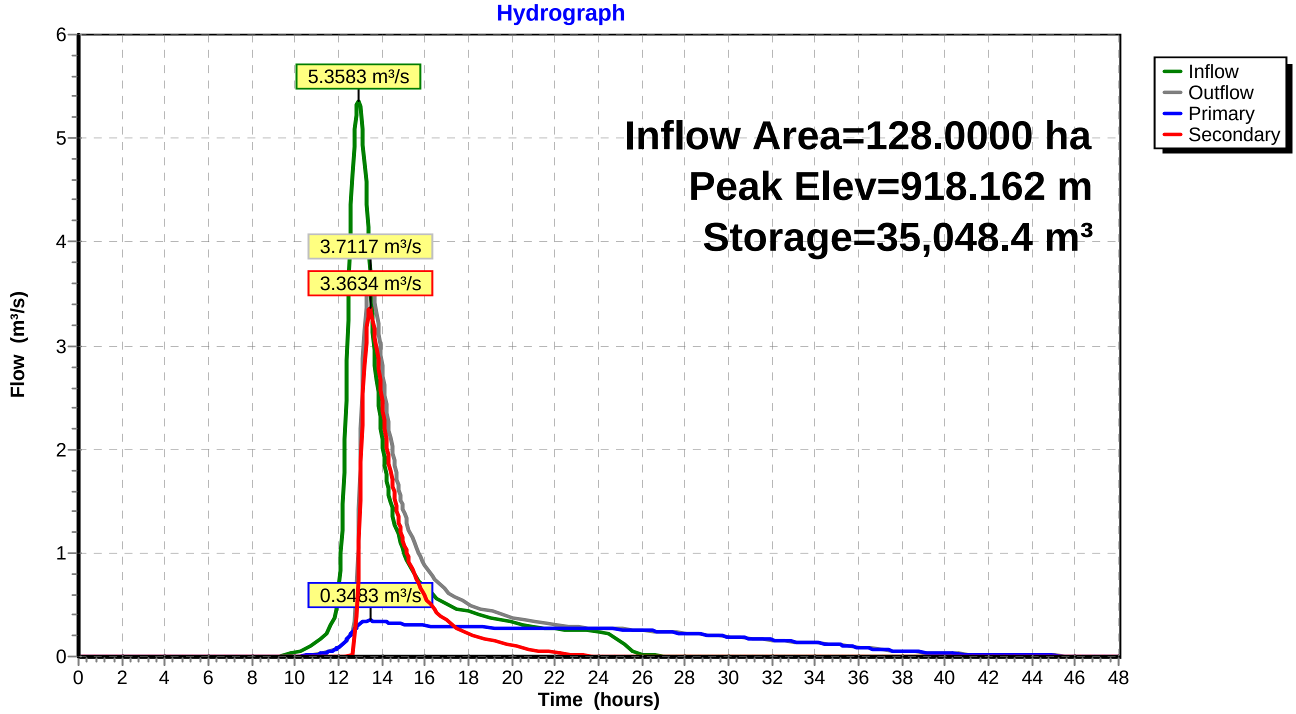
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

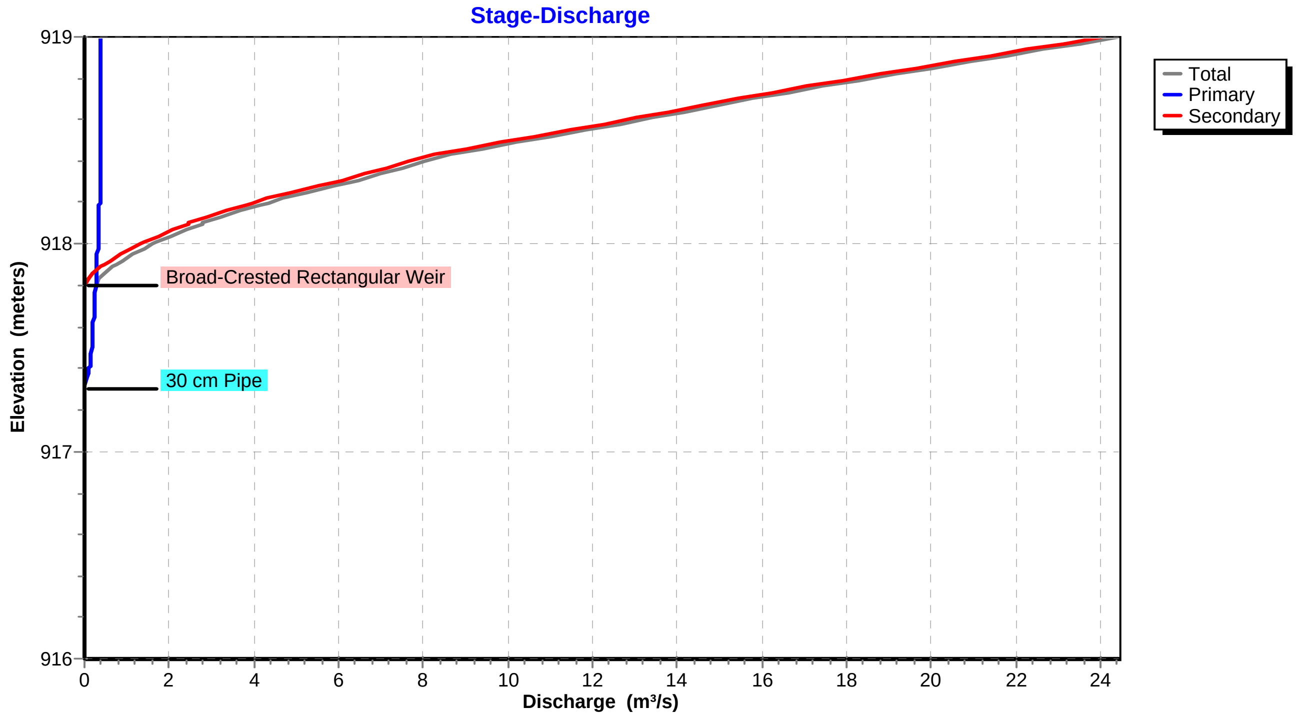
Primary OutFlow Max=0.3483 m³/s @ 13.45 hrs HW=918.162 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.3483 m³/s)

Secondary OutFlow Max=3.3625 m³/s @ 13.45 hrs HW=918.162 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.3625 m³/s @ 0.93 m/s)

Pond 23P: EP WRSA SCP



Pond 23P: EP WRSA SCP



Pond 24P: Lower Dublin North

Inflow Area =	39.0000 ha,	Inflow Depth = 46 mm	for	100 Year (avg) event
Inflow =	3.2255 m³/s @	12.43 hrs, Volume=		17.802 Ml
Outflow =	1.4761 m³/s @	12.93 hrs, Volume=		17.751 Ml, Atten= 54%, Lag= 30.1 min
Primary =	0.1674 m³/s @	12.93 hrs, Volume=		10.433 Ml
Secondary =	1.3087 m³/s @	12.93 hrs, Volume=		7.318 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 791.294 m @ 12.93 hrs Surf.Area= 9,774.1 m² Storage= 15,930.9 m³ (7,445.5 m³ above start)

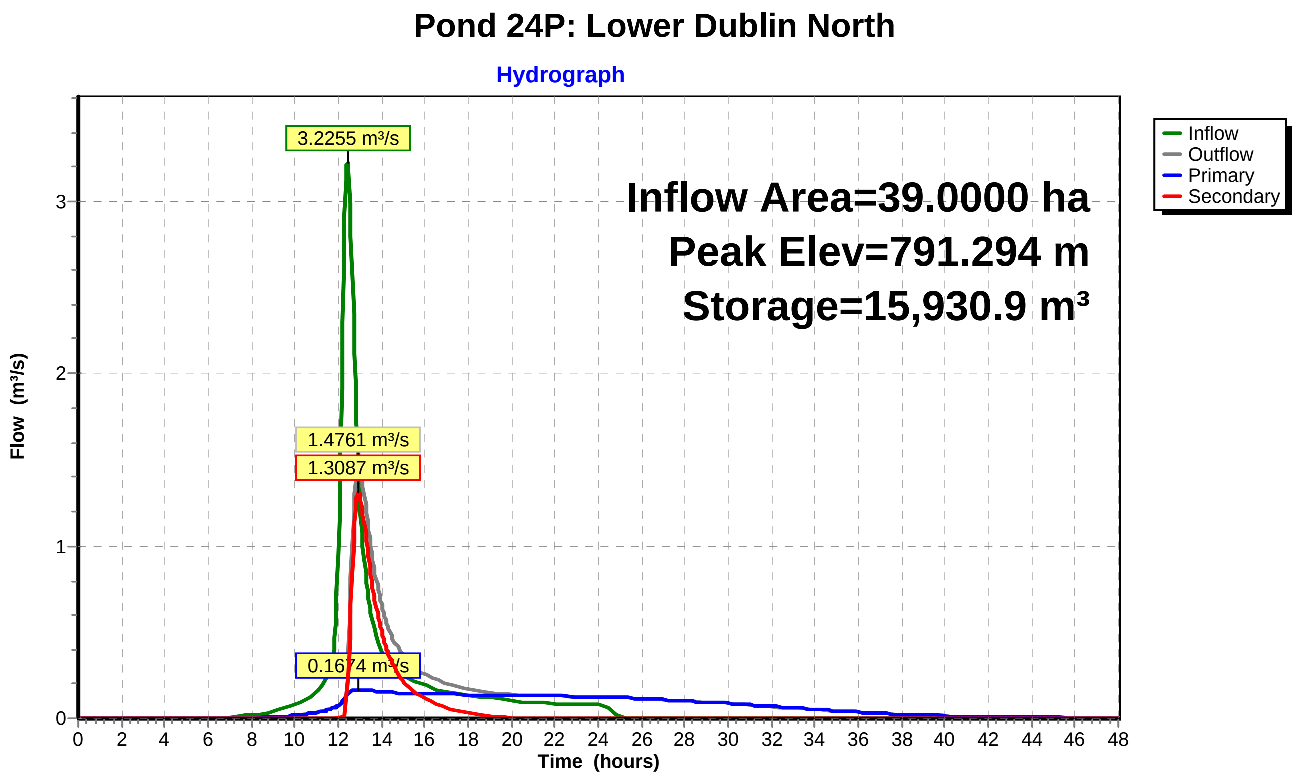
Plug-Flow detention time= 718.0 min calculated for 9.256 Ml (52% of inflow)
Center-of-Mass det. time= 295.5 min (1,140.8 - 845.3)

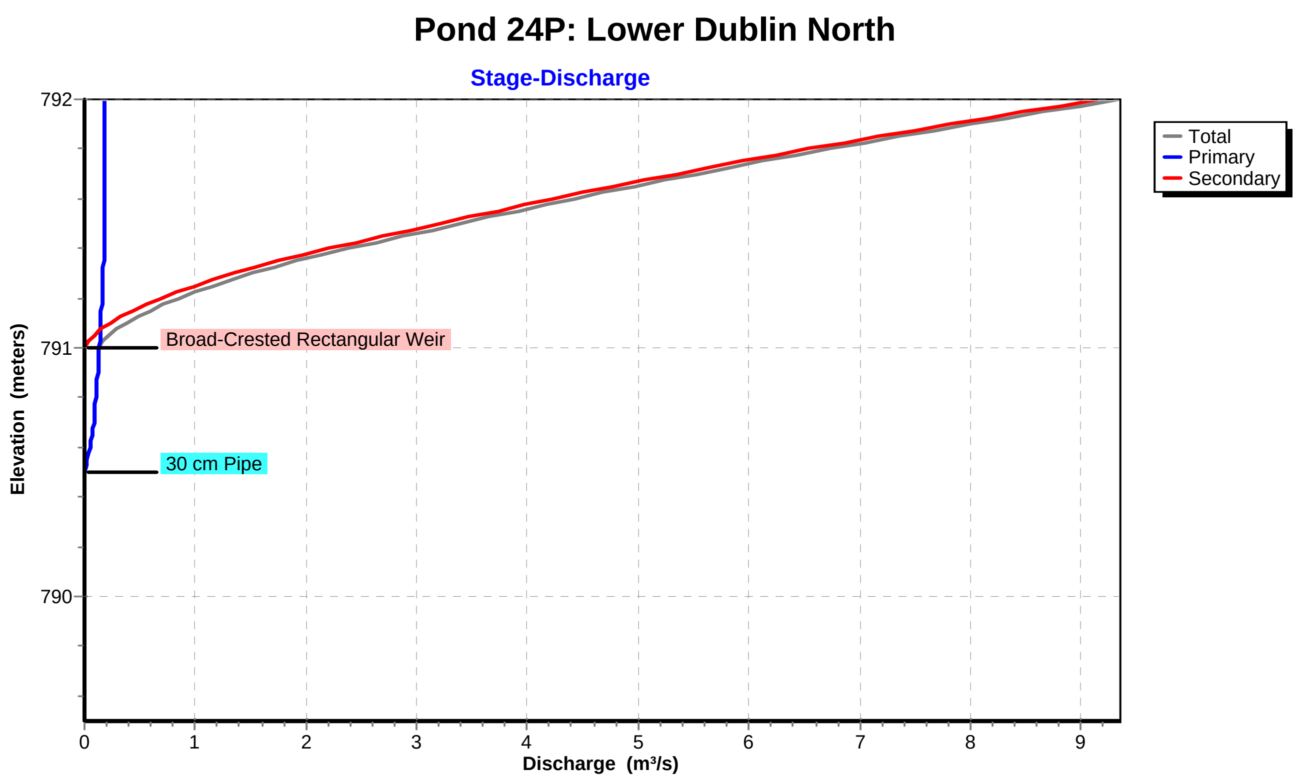
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

Primary OutFlow Max=0.1673 m³/s @ 12.93 hrs HW=791.294 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.1673 m³/s)

Secondary OutFlow Max=1.3055 m³/s @ 12.93 hrs HW=791.294 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.3055 m³/s @ 0.89 m/s)


Pond 24P: Lower Dublin North
Hydrograph
3.2255 m³/s
1.4761 m³/s
1.3087 m³/s
0.1674 m³/s
Inflow Area=39.0000 ha
Peak Elev=791.294 m
Storage=15,930.9 m³
Inflow
Outflow
Primary
Secondary
Flow (m³/s)
Time (hours)


Pond 24P: Lower Dublin North
Stage-Discharge
Total
Primary
Secondary
Broad-Crested Rectangular Weir
30 cm Pipe
Elevation (meters)
Discharge (m³/s)

Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 40 mm for 100 Year (avg) event
Inflow = 9.2202 m³/s @ 12.66 hrs, Volume= 71.906 Ml
Outflow = 8.0024 m³/s @ 12.93 hrs, Volume= 71.887 Ml, Atten= 13%, Lag= 16.2 min
Primary = 0.7321 m³/s @ 12.93 hrs, Volume= 32.713 Ml
Secondary = 7.2703 m³/s @ 12.93 hrs, Volume= 39.173 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 903.448 m @ 12.93 hrs Surf.Area= 16,844.6 m² Storage= 51,336.2 m³ (15,440.3 m³ above start)

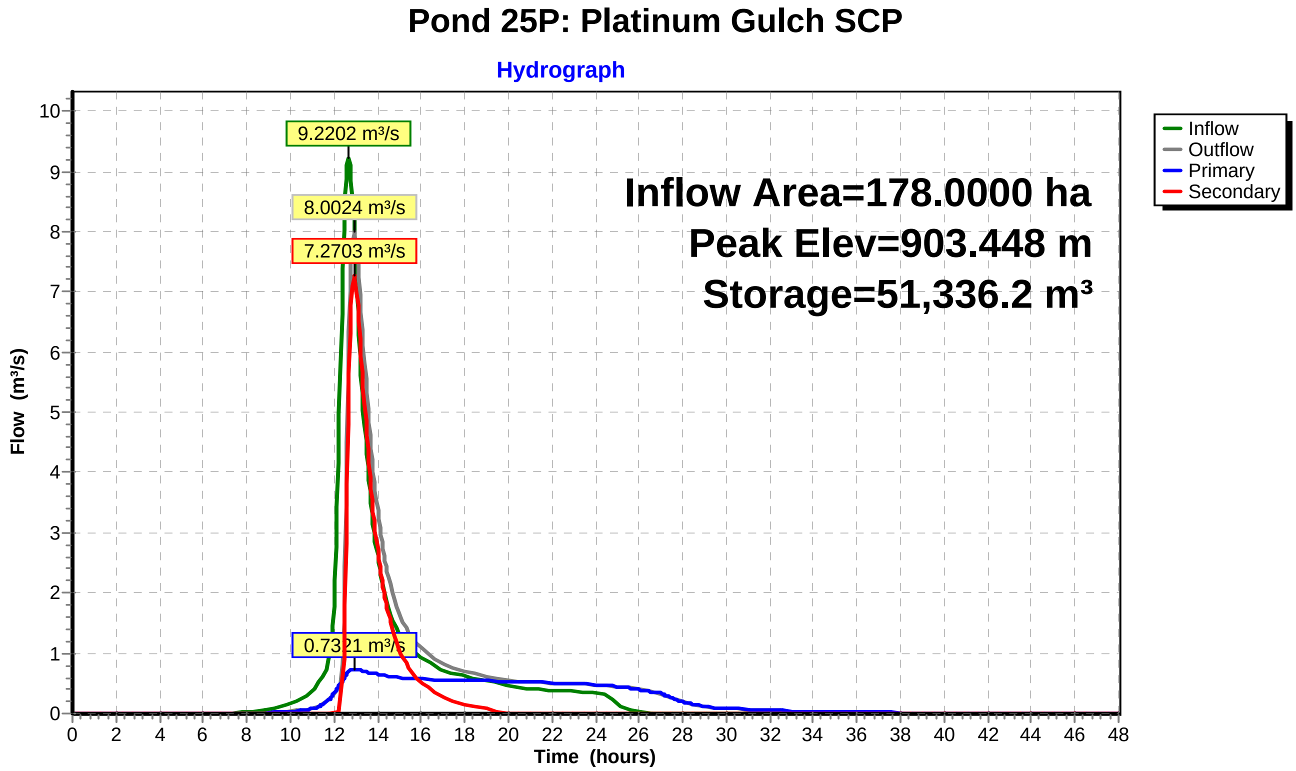
Plug-Flow detention time= 442.4 min calculated for 35.991 Ml (50% of inflow)
Center-of-Mass det. time= 114.7 min (992.1 - 877.4)

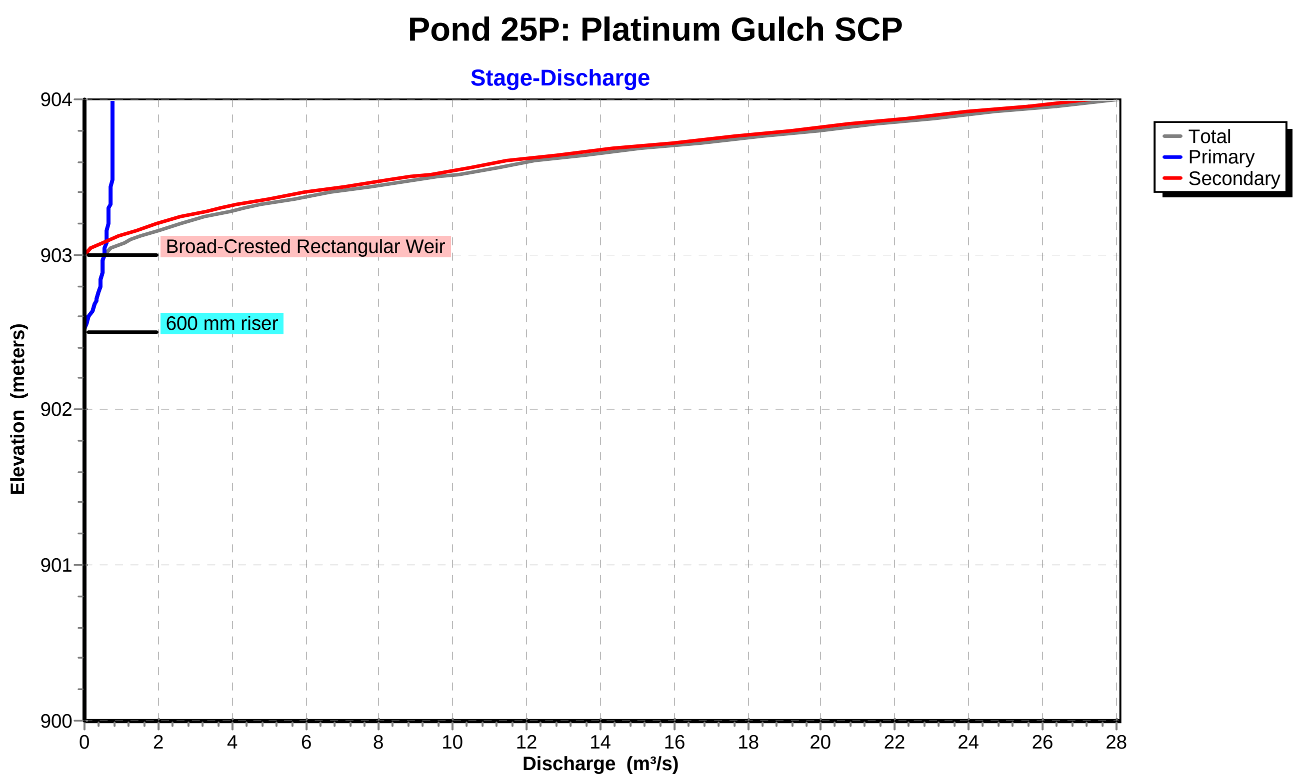
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

Primary OutFlow Max=0.7319 m³/s @ 12.93 hrs HW=903.447 m (Free Discharge)
└─**1=600 mm riser** (Custom Controls 0.7319 m³/s)

Secondary OutFlow Max=7.2492 m³/s @ 12.93 hrs HW=903.447 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 7.2492 m³/s @ 1.08 m/s)


Pond 25P: Platinum Gulch SCP
Hydrograph
Inflow
Outflow
Primary
Secondary
Inflow Area=178.0000 ha
Peak Elev=903.448 m
Storage=51,336.2 m³
9.2202 m³/s
8.0024 m³/s
7.2703 m³/s
0.7321 m³/s
Flow (m³/s)
Time (hours)


Pond 25P: Platinum Gulch SCP
Stage-Discharge
Total
Primary
Secondary
Broad-Crested Rectangular Weir
600 mm riser
Elevation (meters)
Discharge (m³/s)

Pond 33P: Lower Dublin South Pond

Inflow Area =	93.0000 ha,	Inflow Depth = 46 mm	for	100 Year (avg) event	
Inflow =	5.6388 m³/s @	12.73 hrs,	Volume=	42.450 Ml	
Outflow =	2.3453 m³/s @	13.57 hrs,	Volume=	42.382 Ml,	Atten= 58%, Lag= 50.4 min
Primary =	0.6965 m³/s @	13.57 hrs,	Volume=	30.120 Ml	
Secondary =	1.6488 m³/s @	13.57 hrs,	Volume=	12.262 Ml	

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 832.357 m @ 13.57 hrs Surf.Area= 21,903.4 m² Storage= 47,880.5 m³ (18,275.0 m³ above start)

Plug-Flow detention time= 791.7 min calculated for 12.763 Ml (30% of inflow)
Center-of-Mass det. time= 228.5 min (1,096.0 - 867.5)

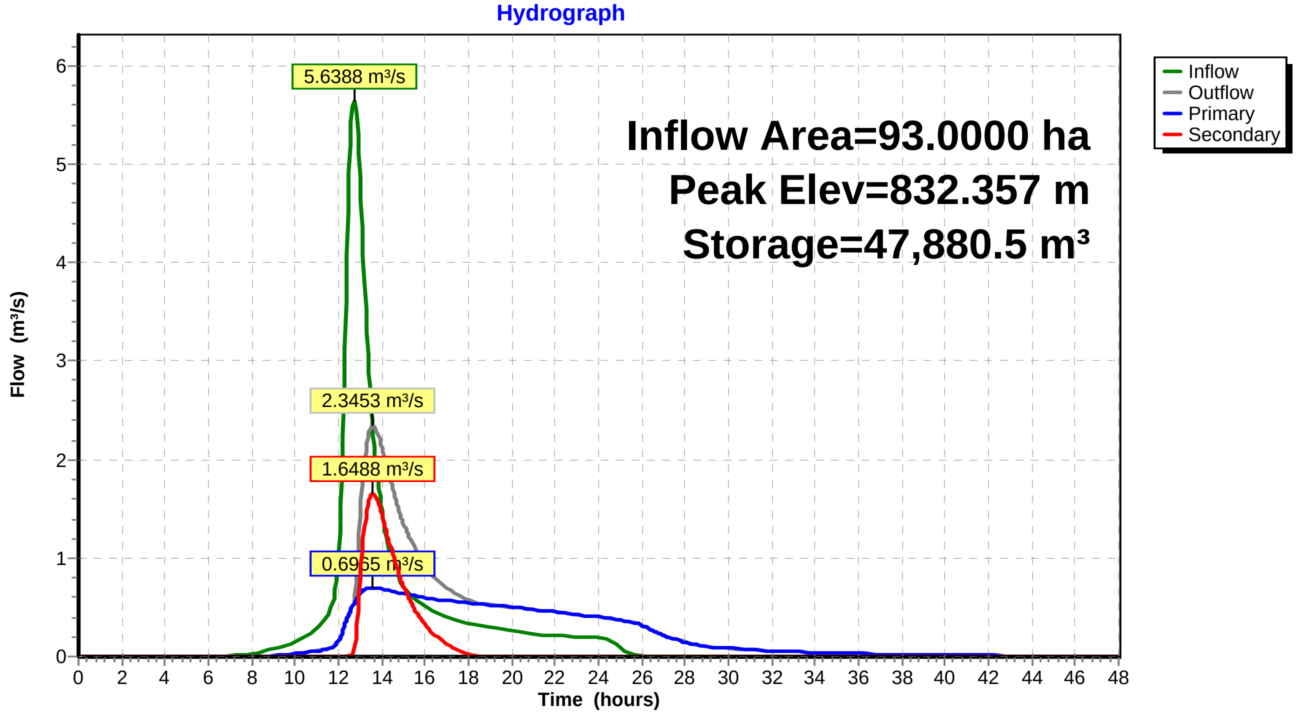
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

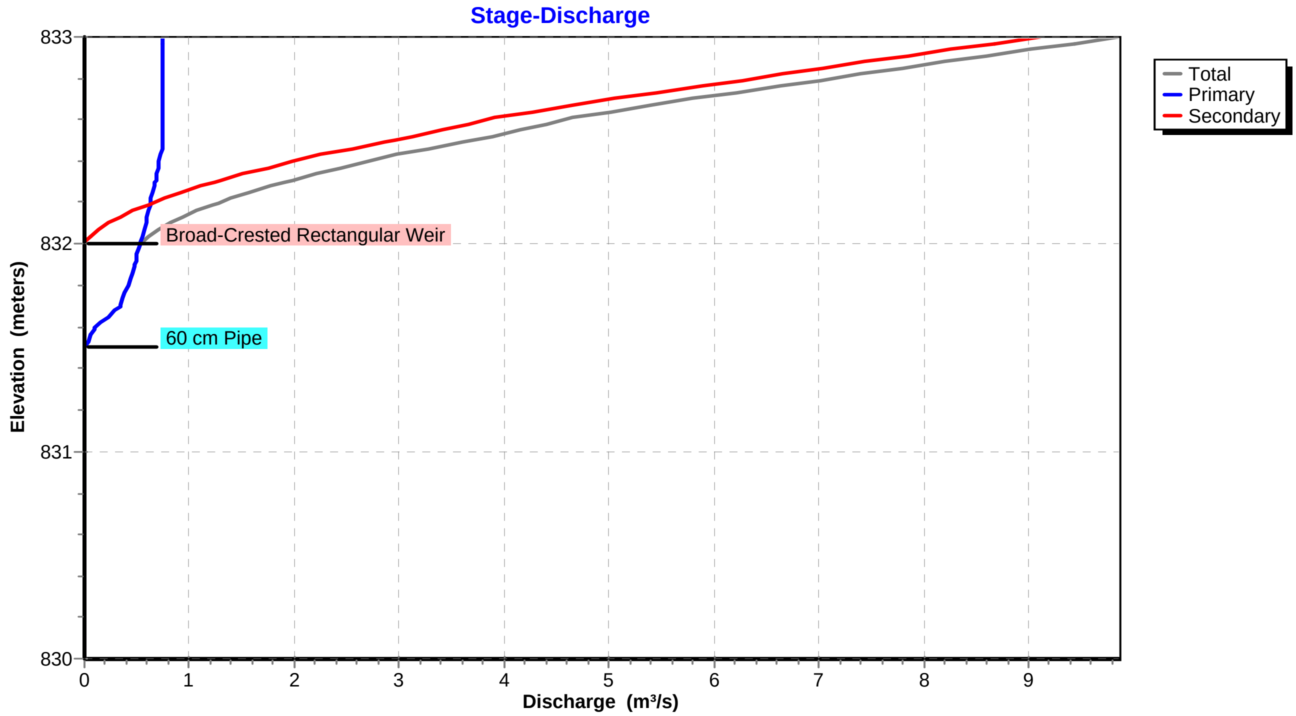
Primary OutFlow Max=0.6964 m³/s @ 13.57 hrs HW=832.357 m (Free Discharge)
↑—**1=60 cm Pipe** (Custom Controls 0.6964 m³/s)

Secondary OutFlow Max=1.6462 m³/s @ 13.57 hrs HW=832.357 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.6462 m³/s @ 0.92 m/s)

Pond 33P: Lower Dublin South Pond



Pond 33P: Lower Dublin South Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=43 mm
Tc=100.0 min CN=85 Runoff=1.7513 m³/s 17.509 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=53 mm
Tc=45.0 min CN=90 Runoff=3.7377 m³/s 20.660 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=43 mm
Tc=210.0 min CN=85 Runoff=20.5152 m³/s 362.985 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=43 mm
Tc=127.0 min CN=85 Runoff=11.0419 m³/s 133.334 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=53 mm
Tc=65.0 min CN=90 Runoff=5.9691 m³/s 42.909 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=43 mm
Tc=81.0 min CN=85 Runoff=6.3908 m³/s 54.661 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=43 mm
Tc=187.0 min CN=85 Runoff=17.7567 m³/s 287.399 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and Runoff Area=93.0000 ha Runoff Depth=53 mm
Tc=69.0 min CN=90 Runoff=6.5393 m³/s 49.266 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>43 mm
Tc=591.0 min CN=85 Runoff=71.1470 m³/s 2,872.502 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=43 mm
Tc=47.0 min CN=85 Runoff=3.1938 m³/s 18.277 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=43 mm
Tc=54.0 min CN=85 Runoff=3.7905 m³/s 23.914 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=43 mm
Tc=49.0 min CN=85 Runoff=3.3357 m³/s 19.644 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=43 mm
Tc=71.0 min CN=85 Runoff=5.2992 m³/s 40.996 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=43 mm
Tc=26.0 min CN=85 Runoff=1.4473 m³/s 5.552 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=43 mm
Tc=54.0 min CN=85 Runoff=3.8514 m³/s 24.299 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=43 mm
Tc=29.0 min CN=85 Runoff=1.6519 m³/s 6.790 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=53 mm
Tc=20.0 min CN=90 Runoff=1.1858 m³/s 3.920 Ml

Reach 14R: Upper DG Diversion Ch Avg. Depth=0.55 m Max Vel=4.05 m/s Inflow=22.5639 m³/s 417.586 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=22.5537 m³/s 417.571 Ml

Reach 16R: Eagle Creek Avg. Depth=1.05 m Max Vel=1.79 m/s Inflow=24.7481 m³/s 486.380 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=24.7151 m³/s 486.312 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=5.55 m Max Vel=3.51 m/s Inflow=72.2264 m³/s 3,031.621 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=72.2165 m³/s 3,031.479 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.76 m Max Vel=4.77 m/s Inflow=78.4124 m³/s 3,643.093 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=78.4113 m³/s 3,643.056 Ml

Reach 33R: Lower DG Diversion Ch Avg. Depth=0.56 m Max Vel=4.08 m/s Inflow=22.8991 m³/s 437.215 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=22.8841 m³/s 437.187 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=5.92 m Max Vel=3.06 m/s Inflow=71.3212 m³/s 2,898.658 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=71.2679 m³/s 2,898.287 Ml

Reach 35R: Platinum Gulch Channel Avg. Depth=1.16 m Max Vel=2.99 m/s Inflow=9.7509 m³/s 84.311 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=9.6507 m³/s 84.306 Ml

Pond 23P: EP WRSA SCP Peak Elev=918.230 m Storage=36,247.9 m³ Inflow=6.3908 m³/s 54.661 Ml
Primary=0.3620 m³/s 22.444 Ml Secondary=4.5112 m³/s 32.157 Ml Outflow=4.8732 m³/s 54.601 Ml

Pond 24P: Lower Dublin North Peak Elev=791.359 m Storage=16,563.2 m³ Inflow=3.7377 m³/s 20.660 Ml
Primary=0.1739 m³/s 10.871 Ml Secondary=1.8231 m³/s 9.733 Ml Outflow=1.9970 m³/s 20.605 Ml

Pond 25P: Platinum Gulch SCP Peak Elev=903.505 m Storage=52,310.9 m³ Inflow=10.8301 m³/s 84.332 Ml
Primary=0.7520 m³/s 34.636 Ml Secondary=8.9989 m³/s 49.675 Ml Outflow=9.7509 m³/s 84.311 Ml

Pond 33P: Lower Dublin South P Peak Elev=832.442 m Storage=49,749.2 m³ Inflow=6.5393 m³/s 49.266 Ml
Primary=0.7301 m³/s 31.952 Ml Secondary=2.3710 m³/s 17.241 Ml Outflow=3.1011 m³/s 49.193 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 3,984.616 Ml Average Runoff Depth = 43 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

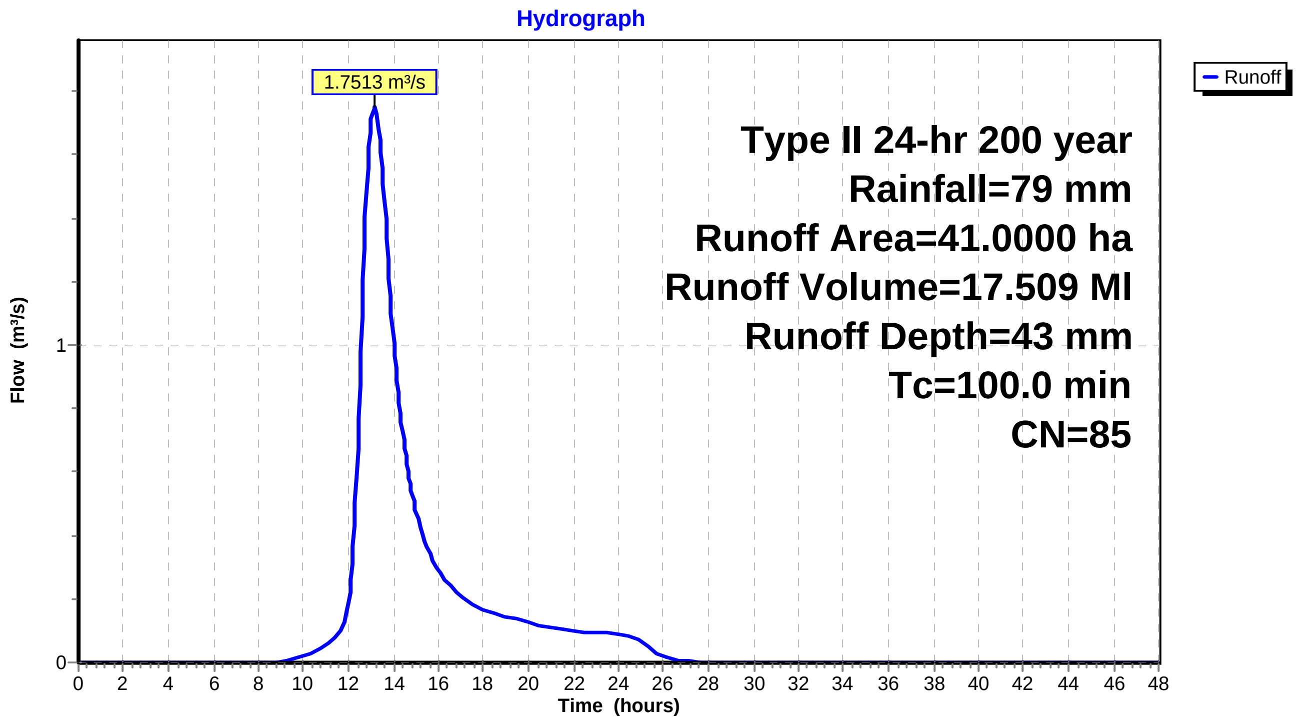
Runoff = 1.7513 m³/s @ 13.18 hrs, Volume= 17.509 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

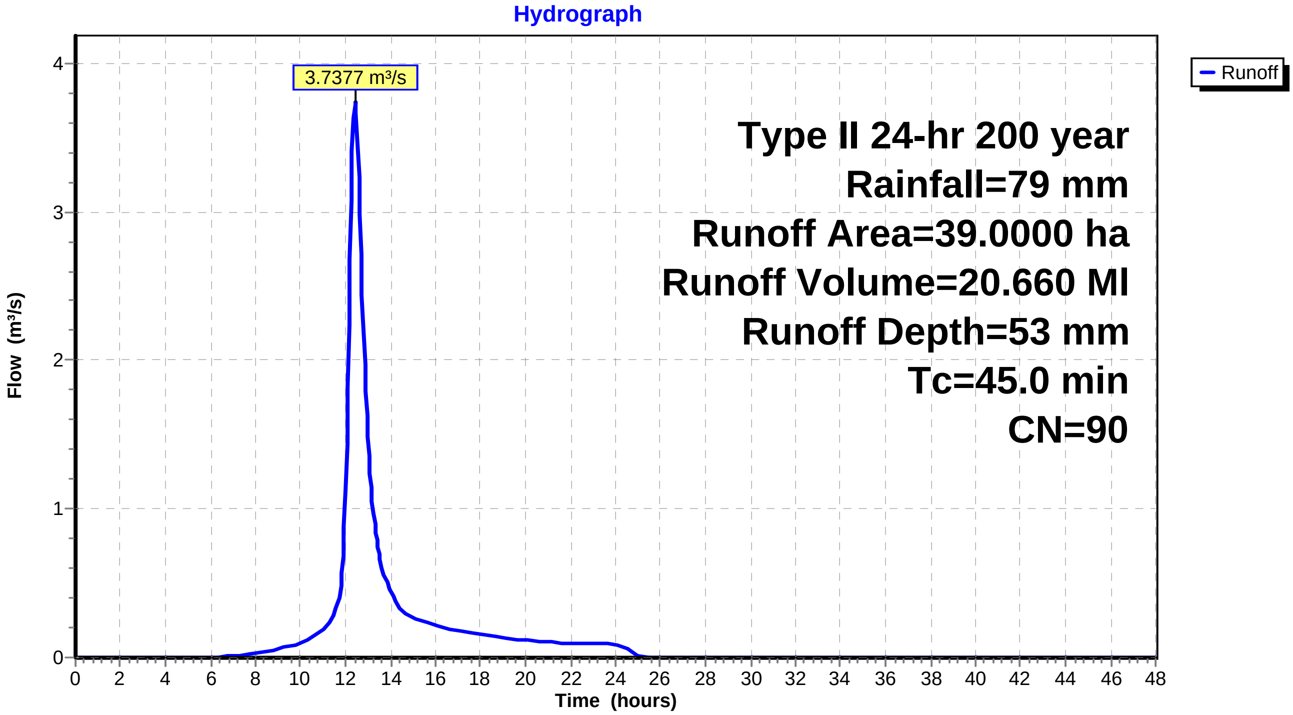
Runoff = 3.7377 m³/s @ 12.43 hrs, Volume= 20.660 Ml, Depth= 53 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

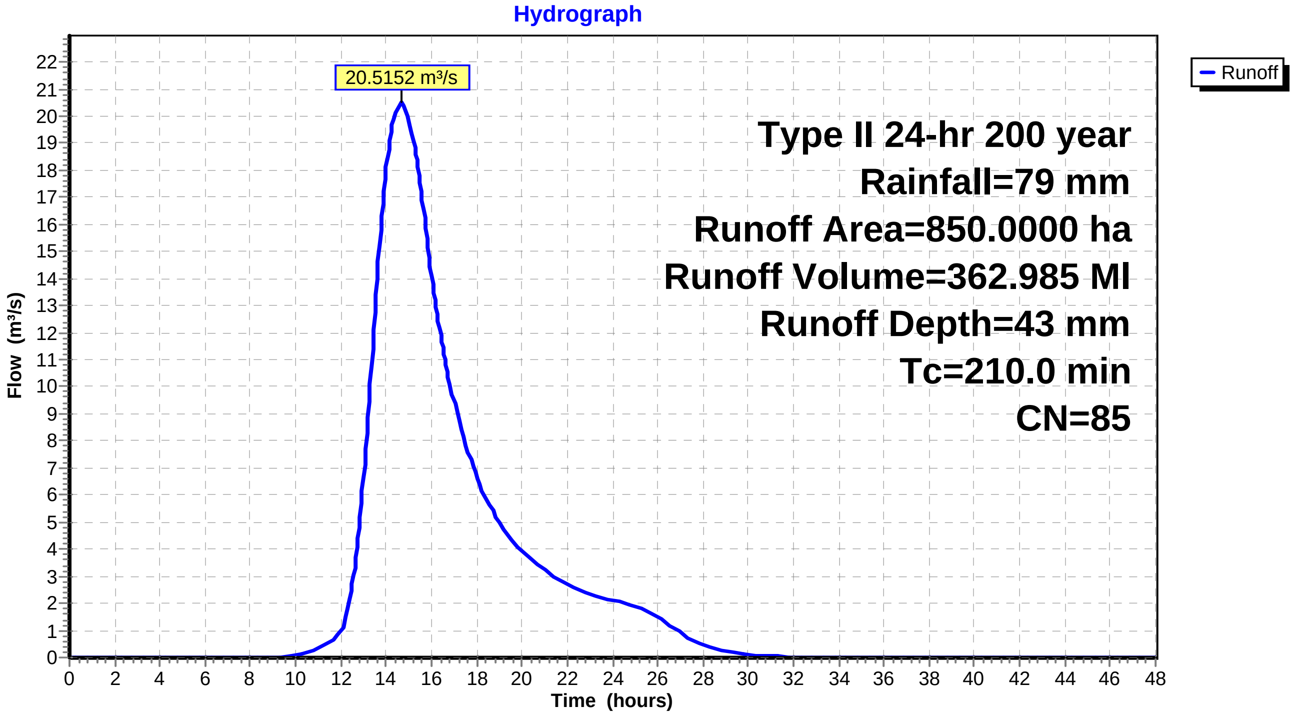
Runoff = 20.5152 m³/s @ 14.69 hrs, Volume= 362.985 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

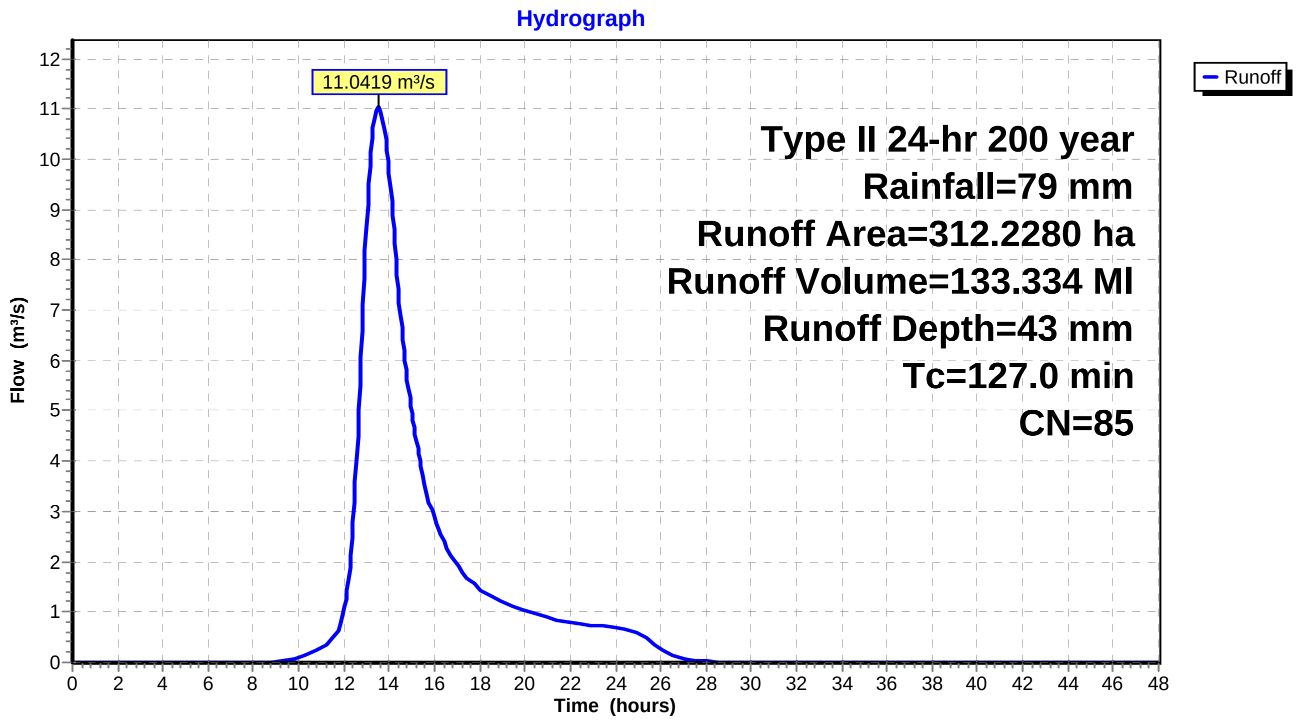
Runoff = 11.0419 m³/s @ 13.53 hrs, Volume= 133.334 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

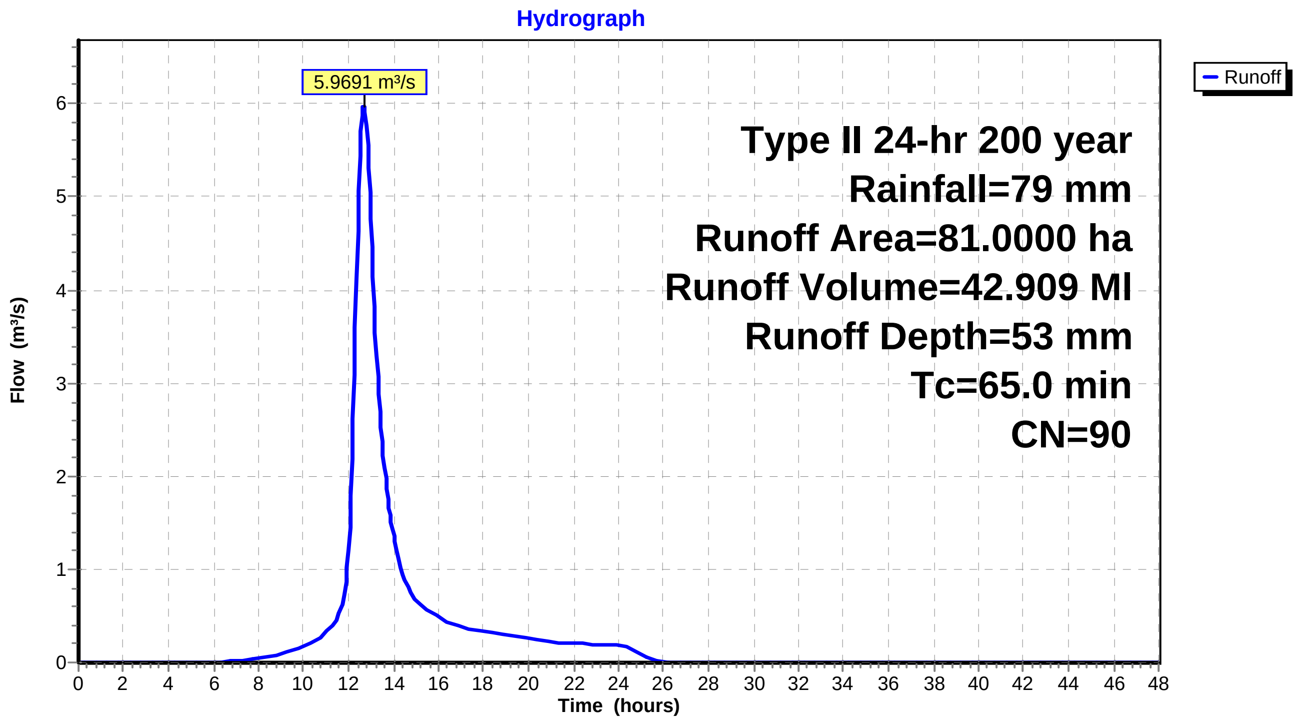
Runoff = 5.9691 m³/s @ 12.67 hrs, Volume= 42.909 Ml, Depth= 53 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

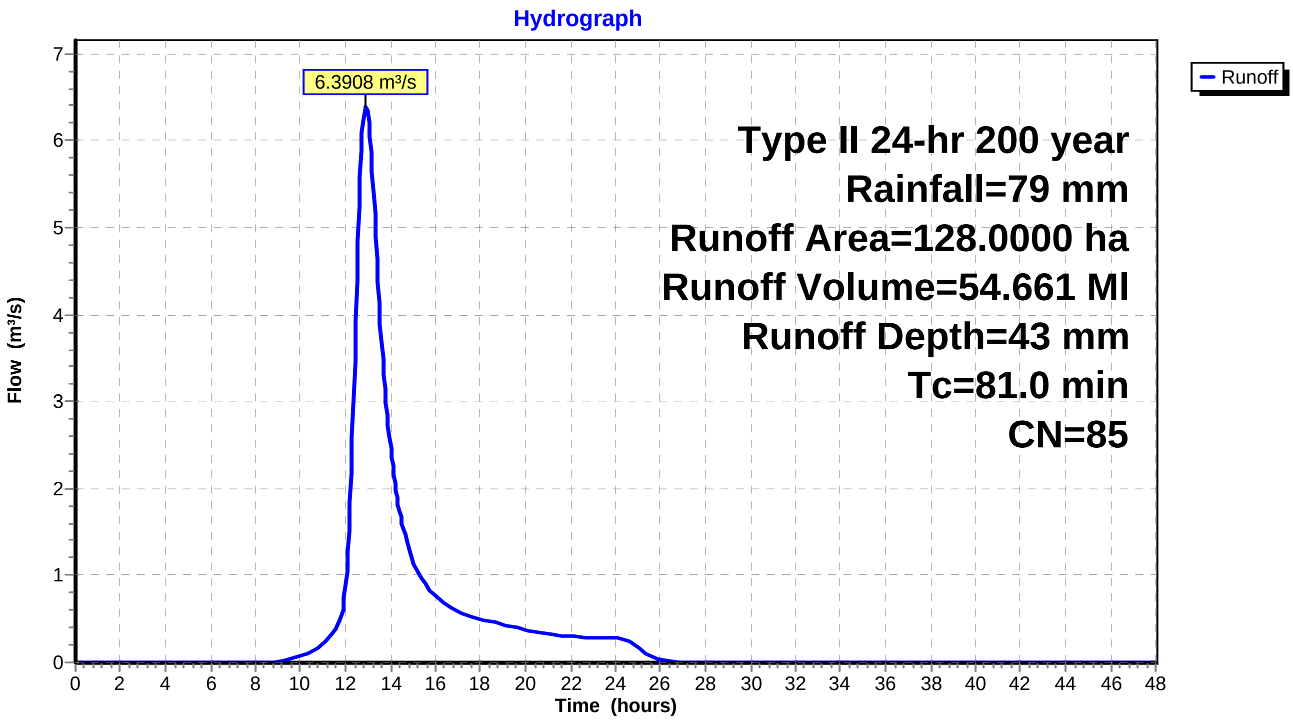
Runoff = 6.3908 m³/s @ 12.90 hrs, Volume= 54.661 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

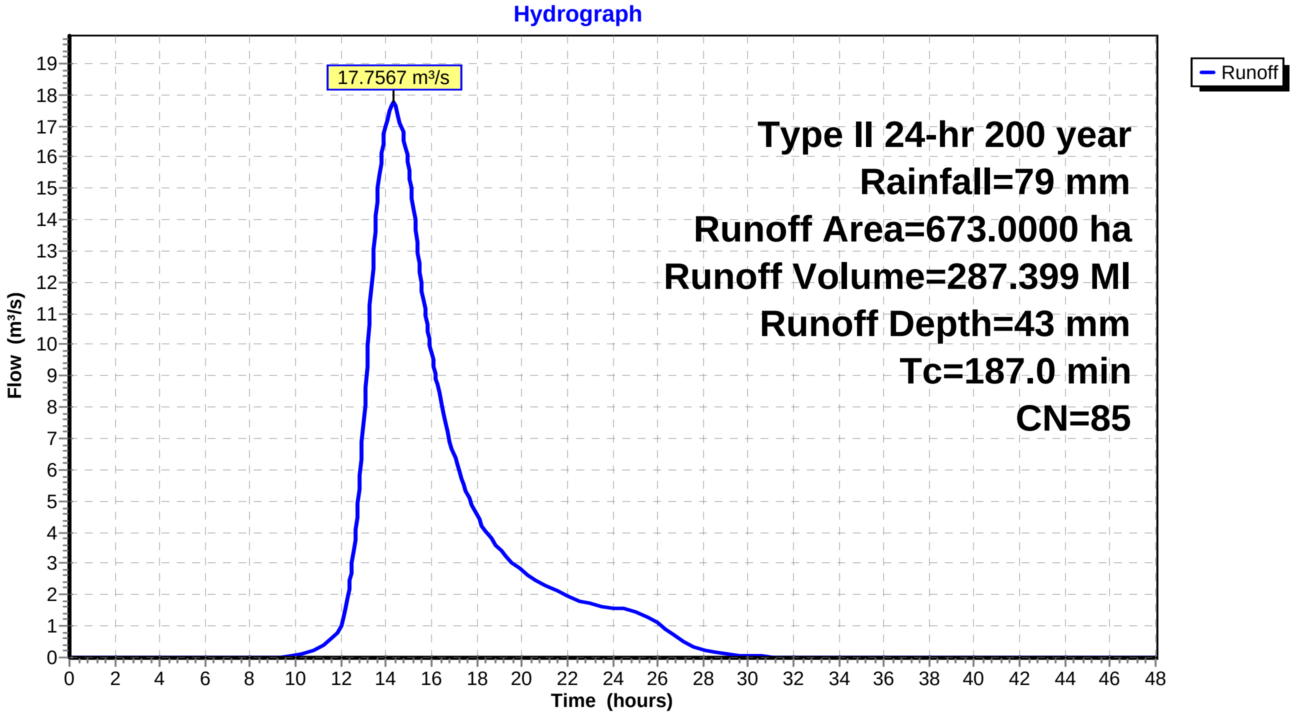
Runoff = 17.7567 m³/s @ 14.33 hrs, Volume= 287.399 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

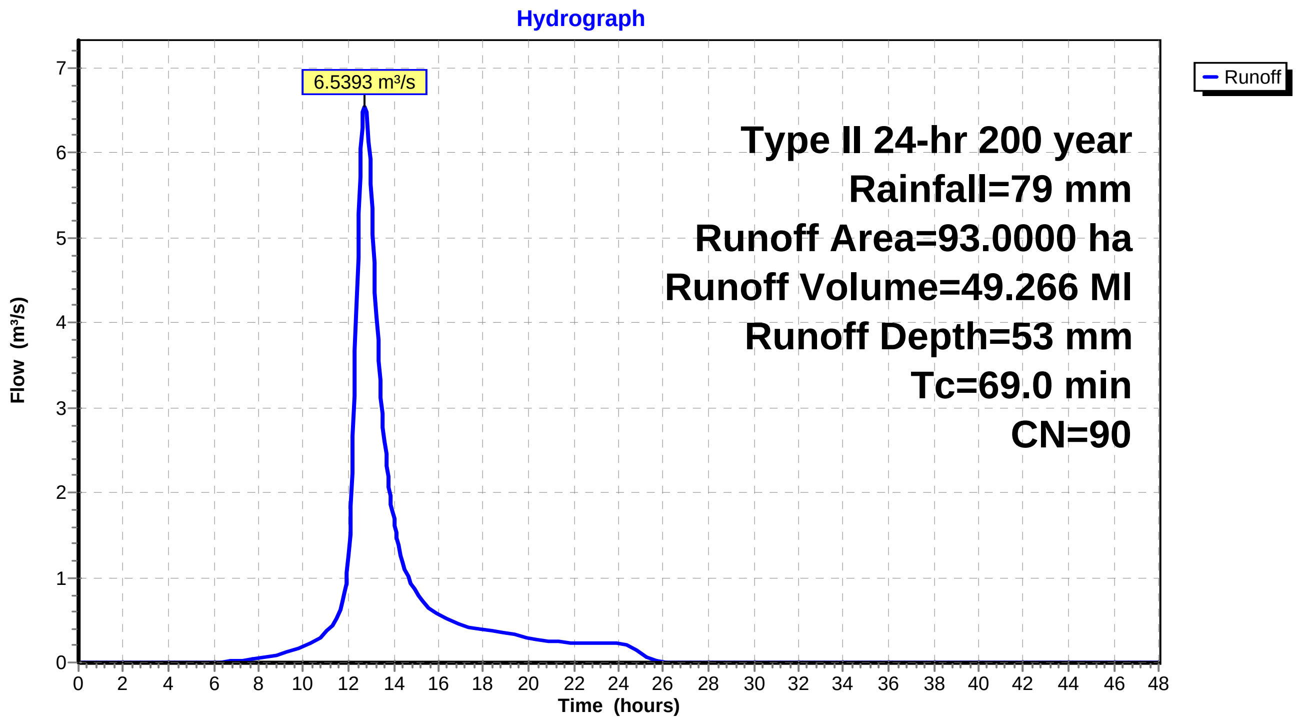
Runoff = 6.5393 m³/s @ 12.73 hrs, Volume= 49.266 Ml, Depth= 53 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

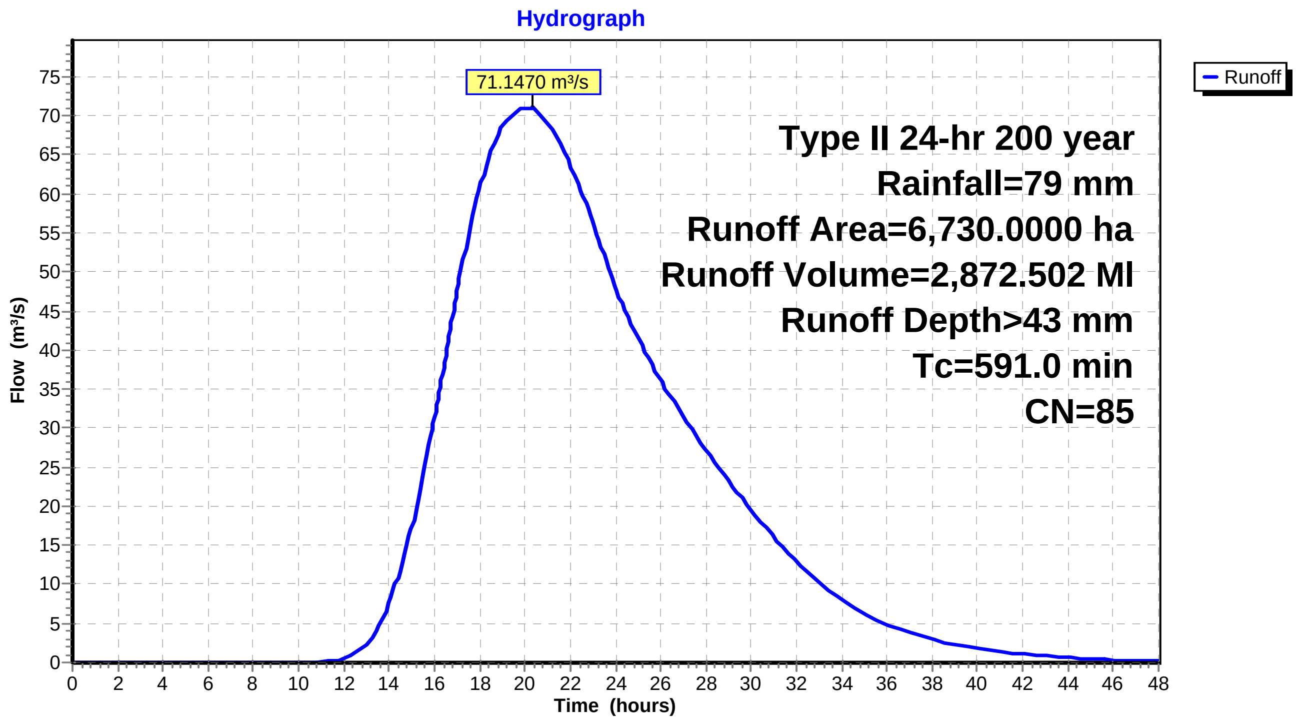
Runoff = 71.1470 m³/s @ 20.33 hrs, Volume= 2,872.502 Ml, Depth> 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

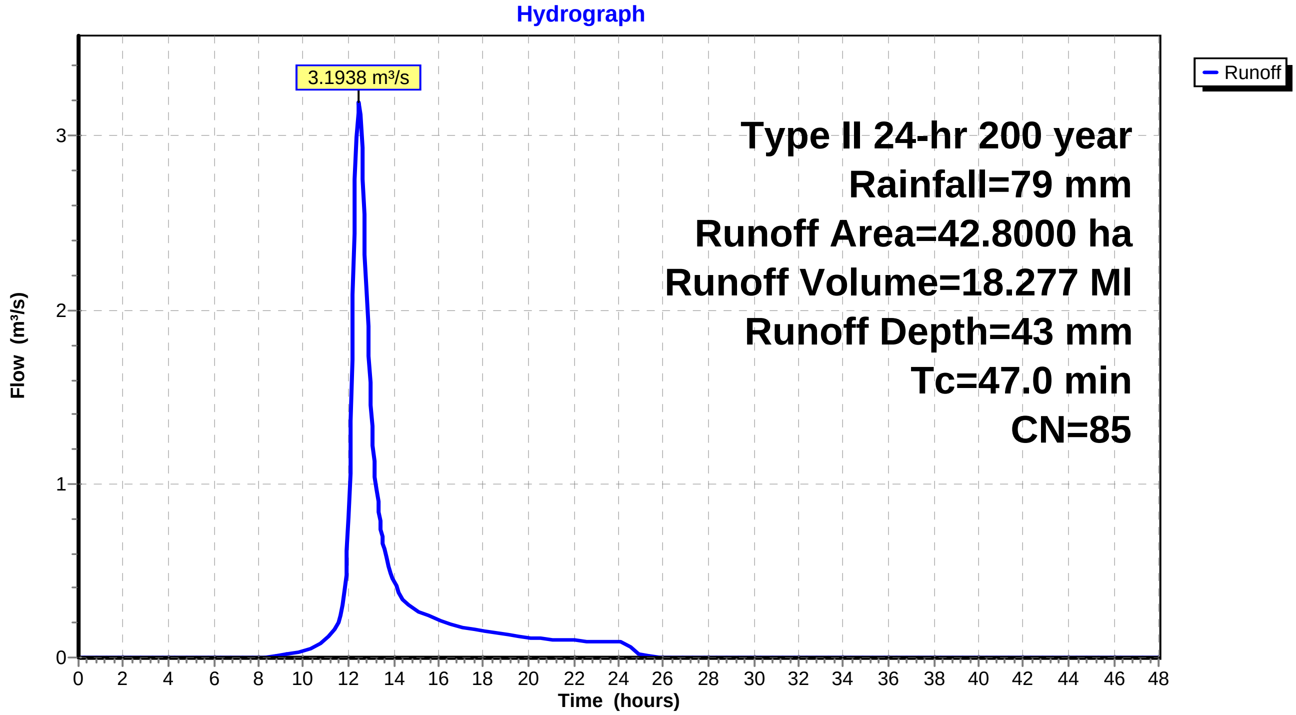
Runoff = 3.1938 m³/s @ 12.46 hrs, Volume= 18.277 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

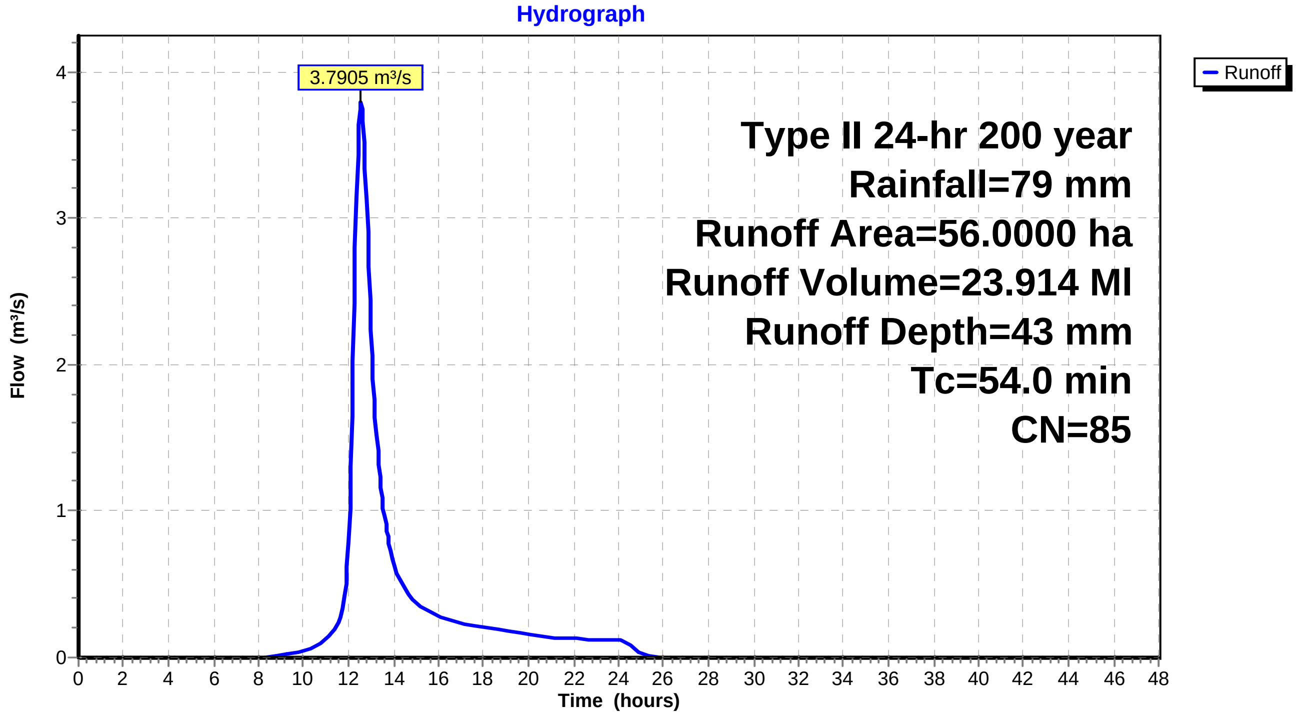
Runoff = 3.7905 m³/s @ 12.55 hrs, Volume= 23.914 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

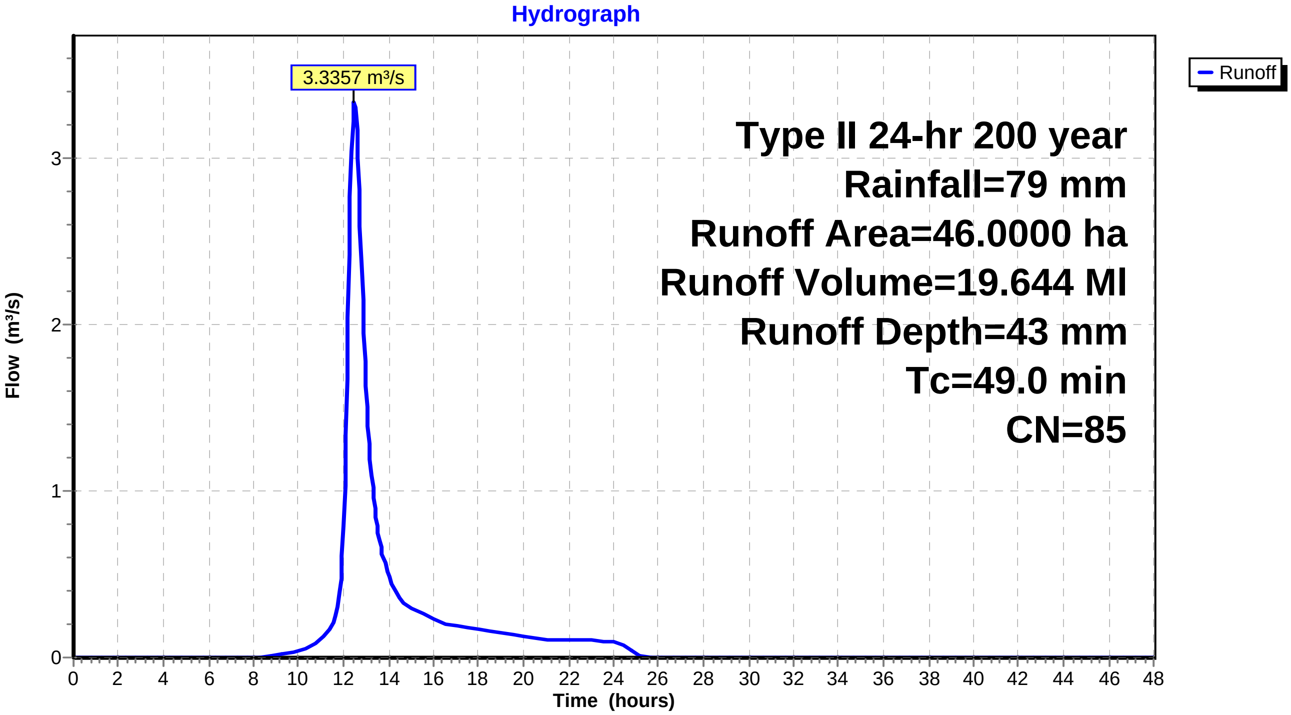
Runoff = 3.3357 m³/s @ 12.48 hrs, Volume= 19.644 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

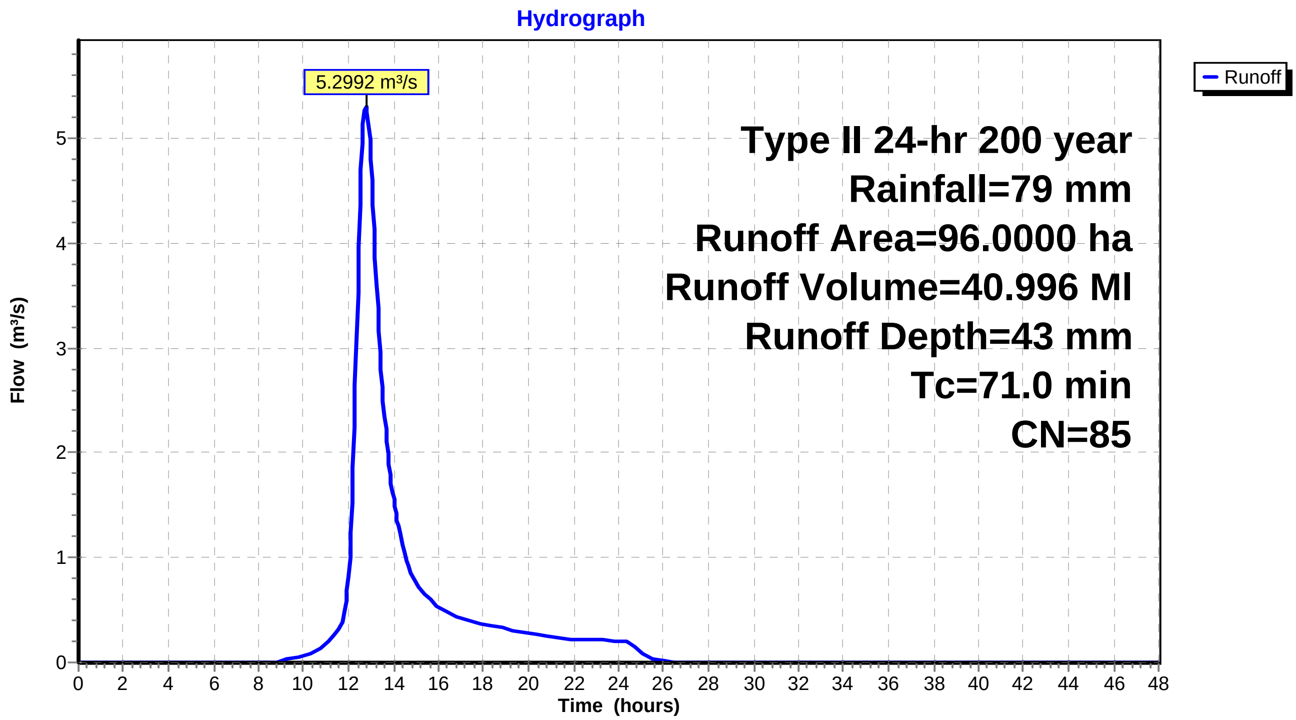
Runoff = 5.2992 m³/s @ 12.77 hrs, Volume= 40.996 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

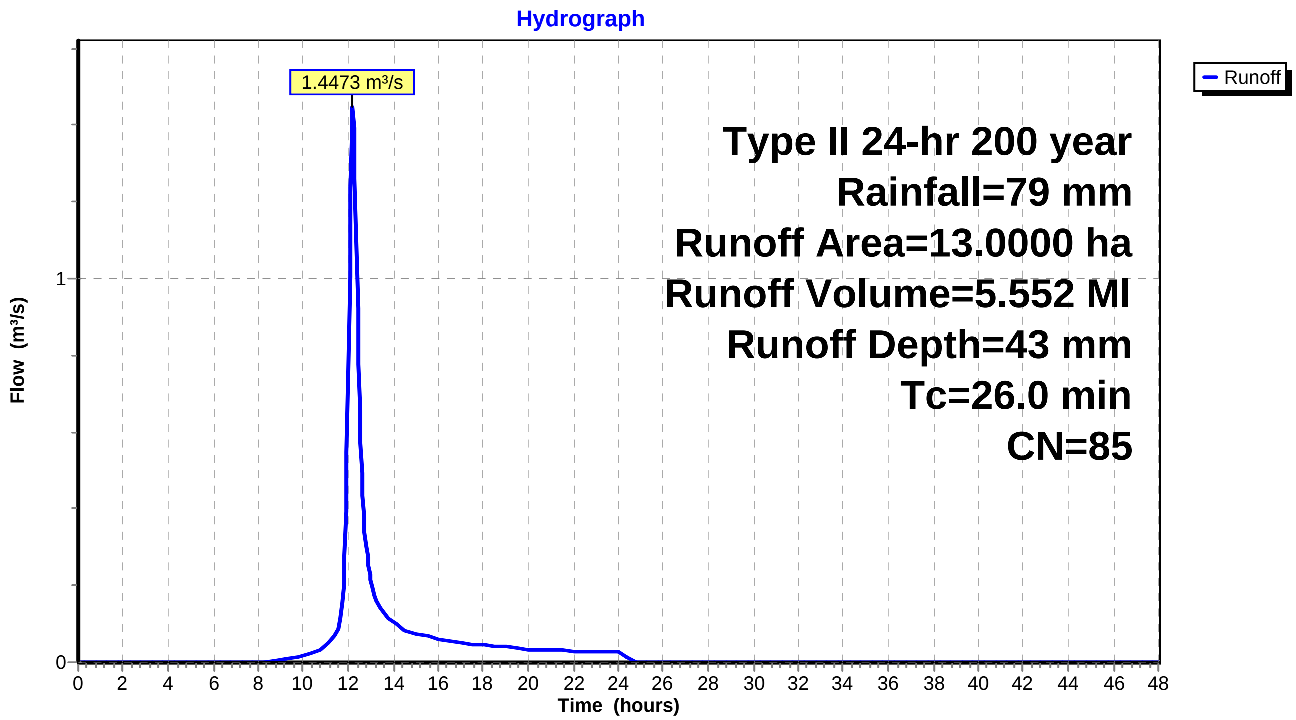
Runoff = 1.4473 m³/s @ 12.20 hrs, Volume= 5.552 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

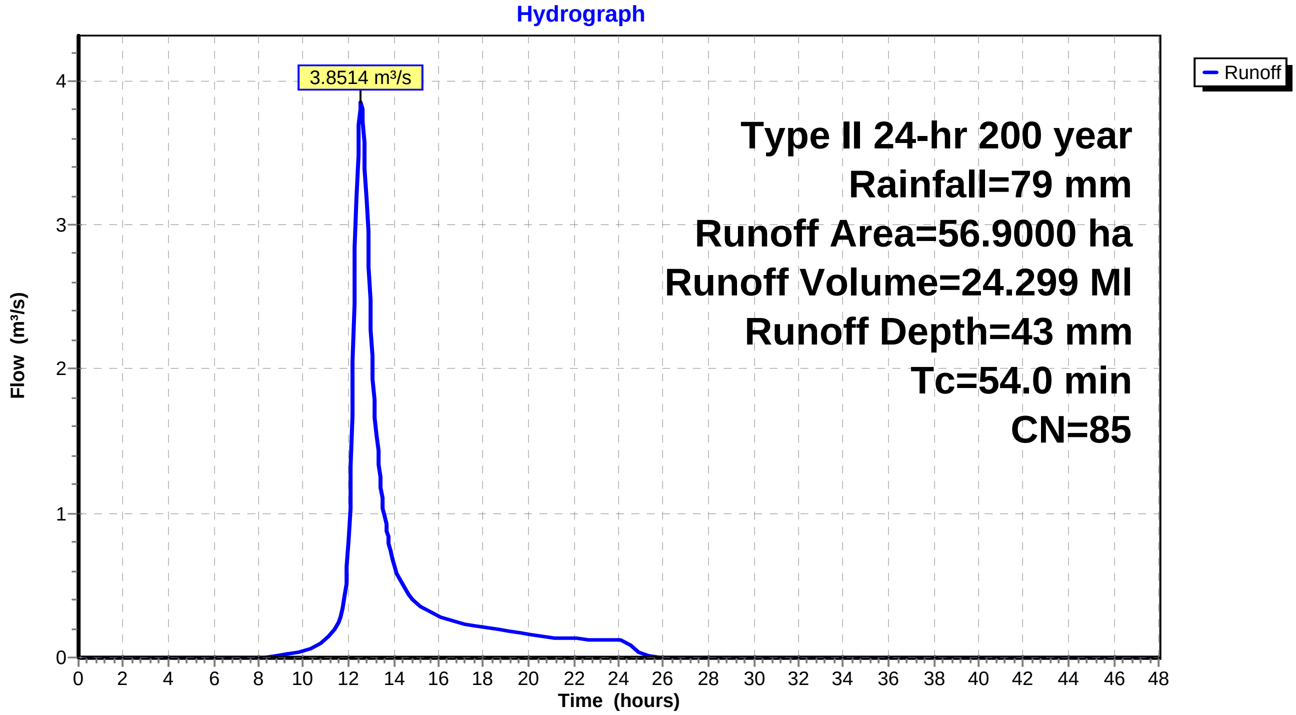
Runoff = 3.8514 m³/s @ 12.55 hrs, Volume= 24.299 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

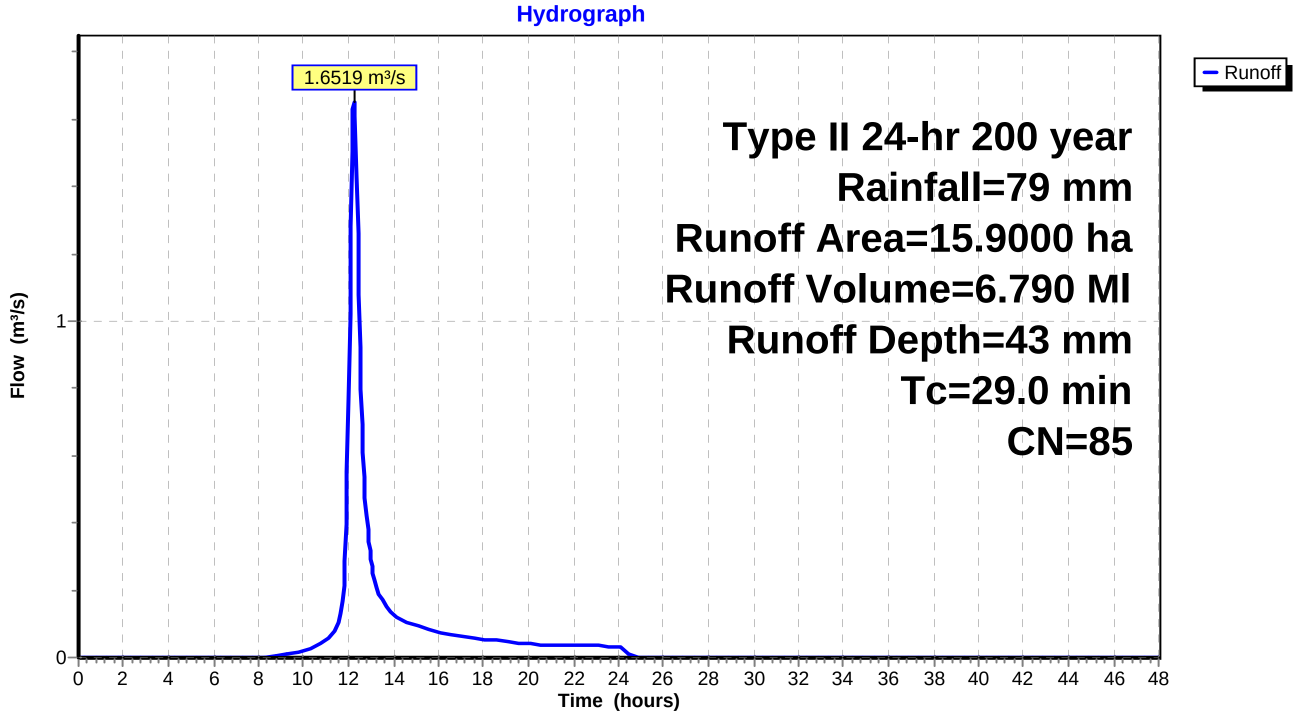
Runoff = 1.6519 m³/s @ 12.23 hrs, Volume= 6.790 Ml, Depth= 43 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

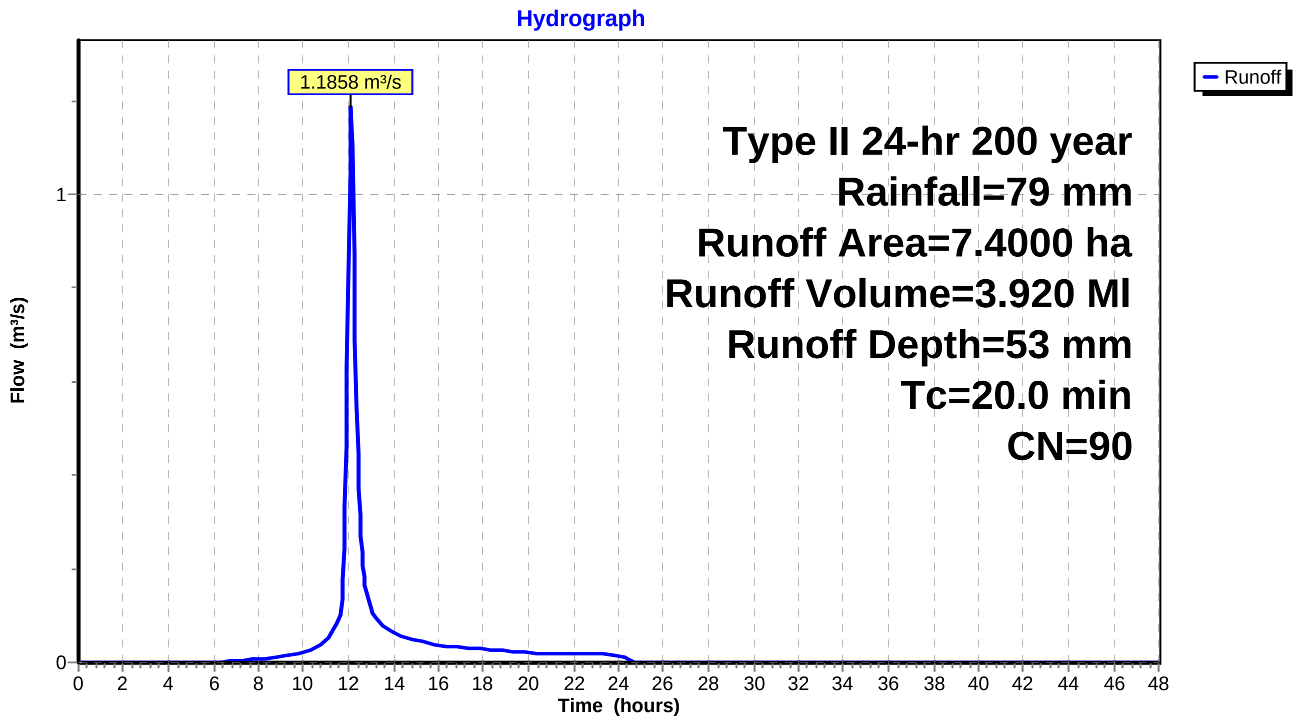
Runoff = 1.1858 m³/s @ 12.12 hrs, Volume= 3.920 Ml, Depth= 53 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 200 year Rainfall=79 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

Inflow Area = 978.0000 ha, Inflow Depth > 43 mm for 200 year event
Inflow = 22.5639 m³/s @ 14.48 hrs, Volume= 417.586 Ml
Outflow = 22.5537 m³/s @ 14.58 hrs, Volume= 417.571 Ml, Atten= 0%, Lag= 5.8 min

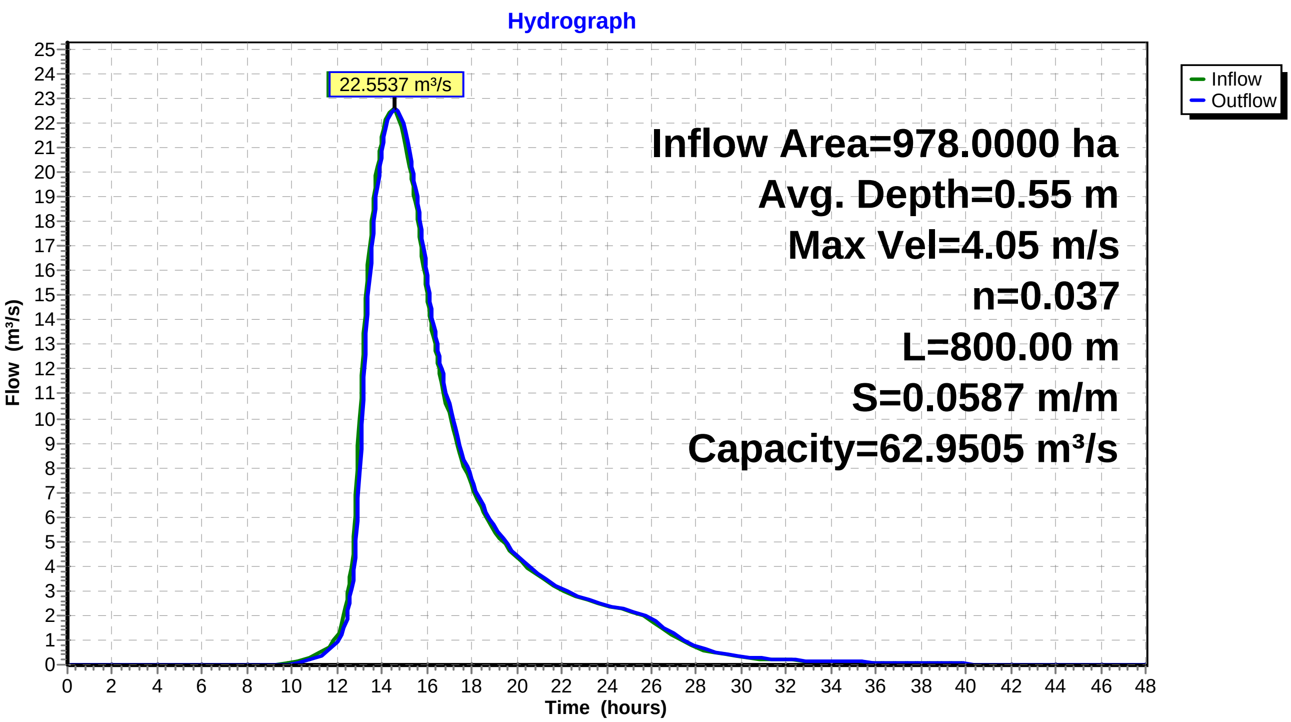
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.05 m/s, Min. Travel Time= 3.3 min
Avg. Velocity = 1.27 m/s, Avg. Travel Time= 10.5 min

Peak Storage= 4,457.0 m³ @ 14.52 hrs, Average Depth at Peak Storage= 0.55 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

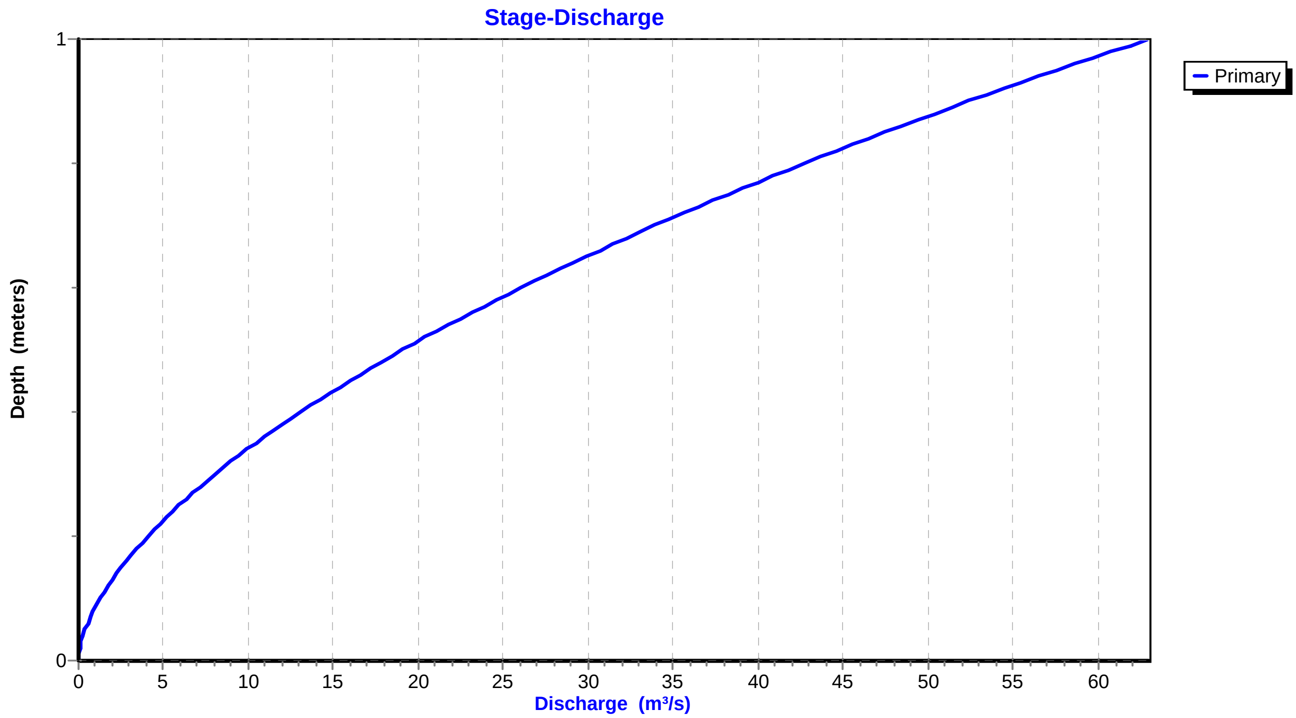
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

‡

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

Inflow Area = 1,117.0000 ha, Inflow Depth > 44 mm for 200 year event
Inflow = 24.7481 m³/s @ 14.53 hrs, Volume= 486.380 Ml
Outflow = 24.7151 m³/s @ 14.77 hrs, Volume= 486.312 Ml, Atten= 0%, Lag= 14.7 min

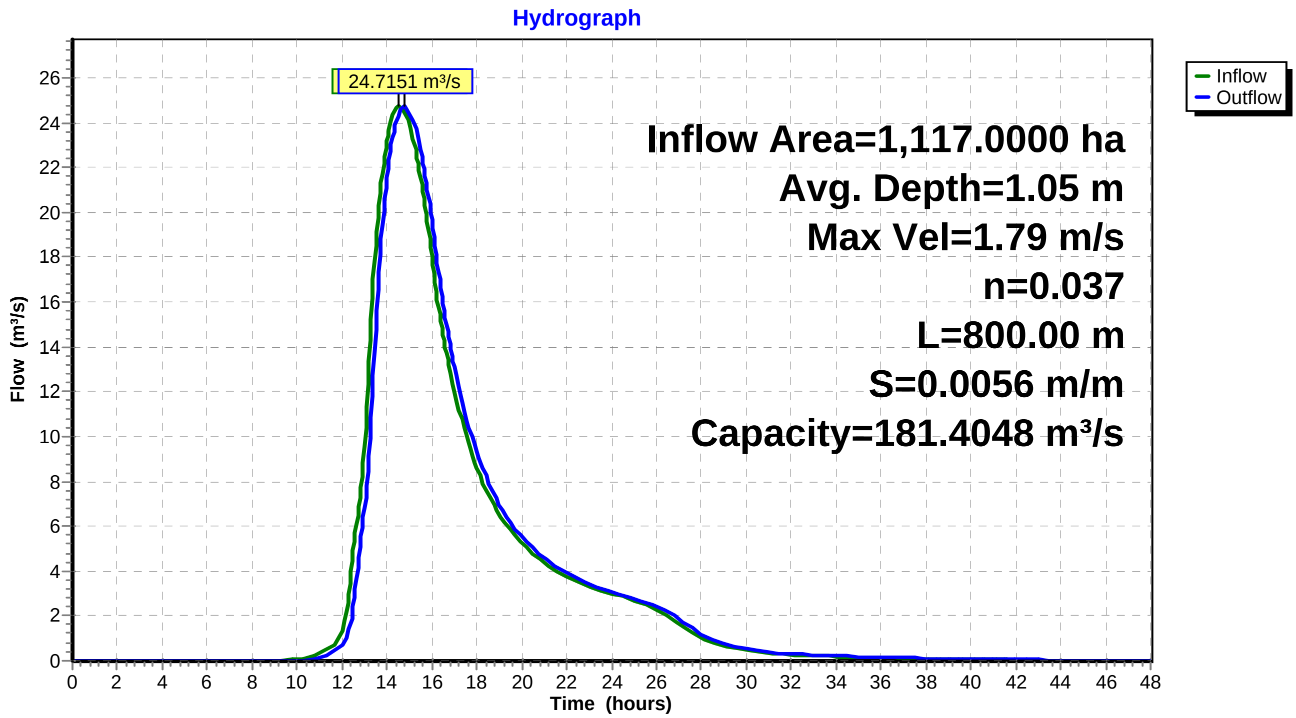
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.79 m/s, Min. Travel Time= 7.4 min
Avg. Velocity = 0.61 m/s, Avg. Travel Time= 21.9 min

Peak Storage= 11,047.1 m³ @ 14.65 hrs, Average Depth at Peak Storage= 1.05 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

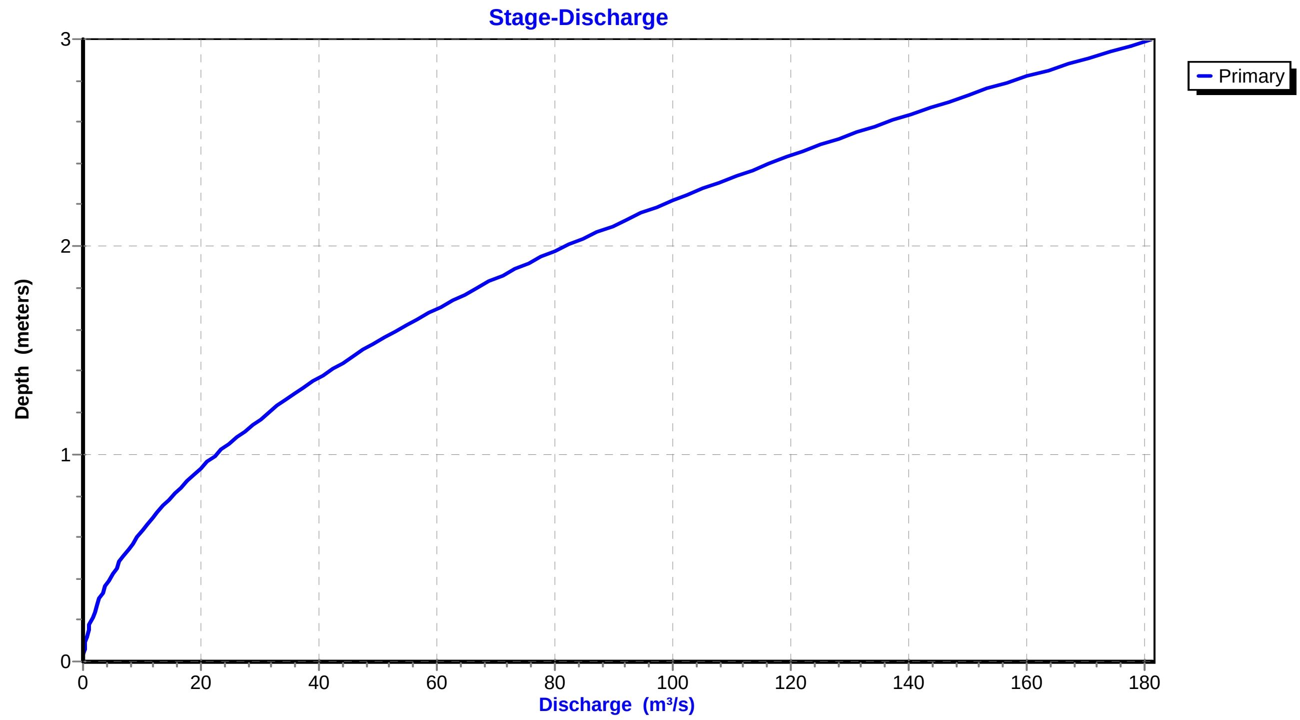
10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

‡

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



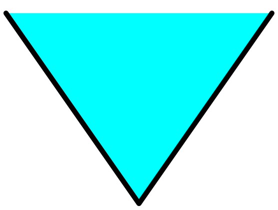
Reach 18R: Mid Haggart Creek

Inflow Area = 7,094.2280 ha, Inflow Depth > 43 mm for 200 year event
Inflow = 72.2264 m³/s @ 20.46 hrs, Volume= 3,031.621 Ml
Outflow = 72.2165 m³/s @ 20.52 hrs, Volume= 3,031.479 Ml, Atten= 0%, Lag= 3.8 min

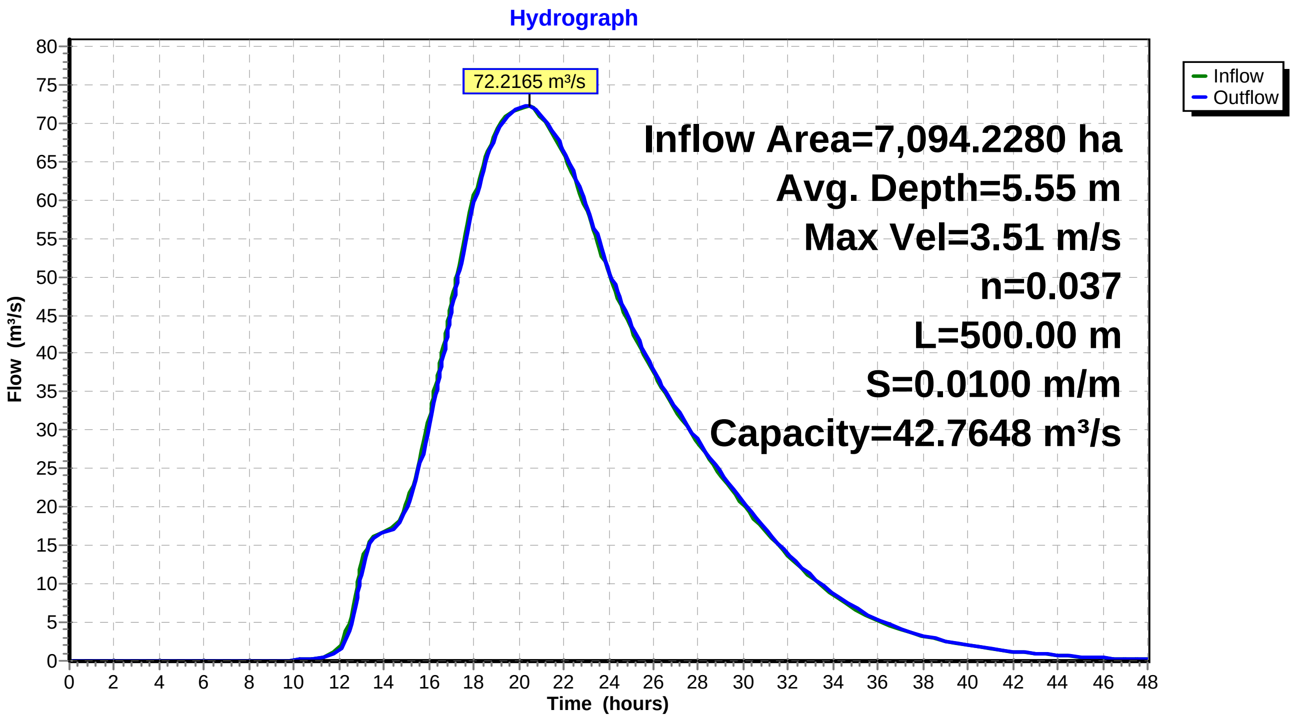
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.51 m/s, Min. Travel Time= 2.4 min
Avg. Velocity = 2.11 m/s, Avg. Travel Time= 4.0 min

Peak Storage= 10,288.3 m³ @ 20.48 hrs, Average Depth at Peak Storage= 5.55 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

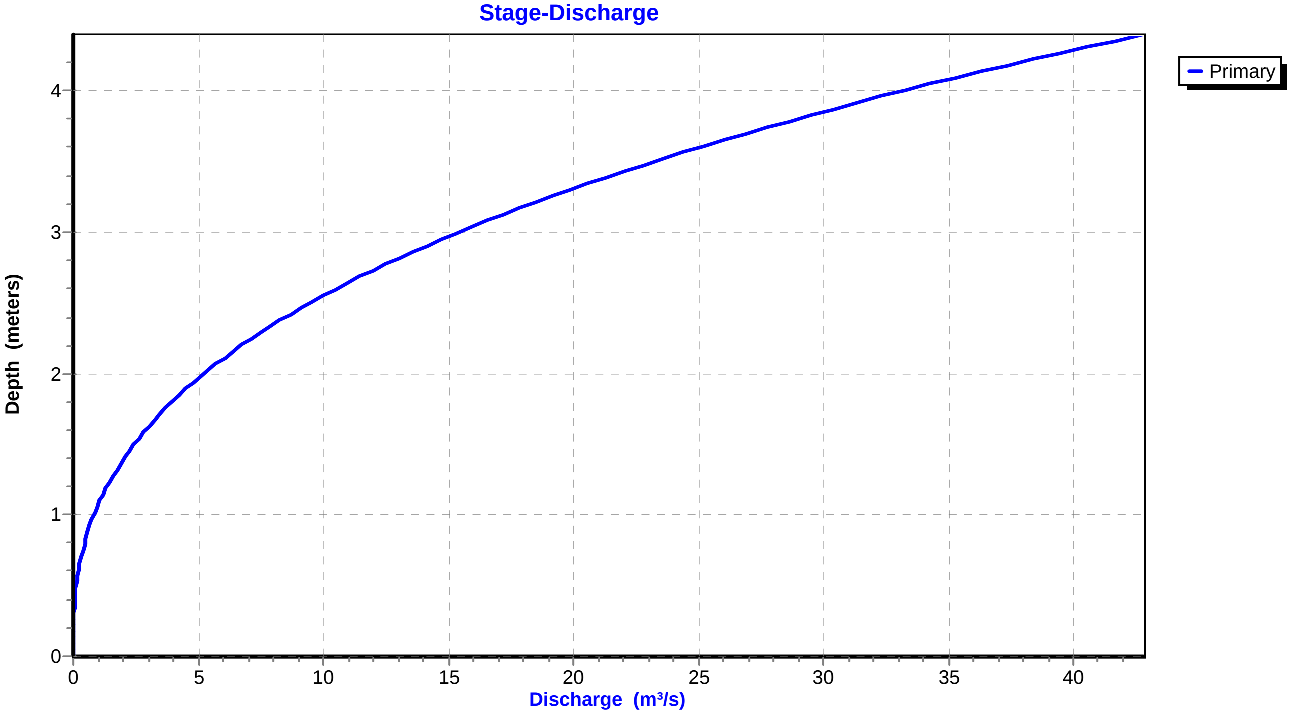
0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m



Reach 18R: Mid Haggart Creek



Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

Inflow Area = 8,485.2280 ha, Inflow Depth > 43 mm for 200 year event
Inflow = 78.4124 m³/s @ 19.96 hrs, Volume= 3,643.093 Ml
Outflow = 78.4113 m³/s @ 19.97 hrs, Volume= 3,643.056 Ml, Atten= 0%, Lag= 0.6 min

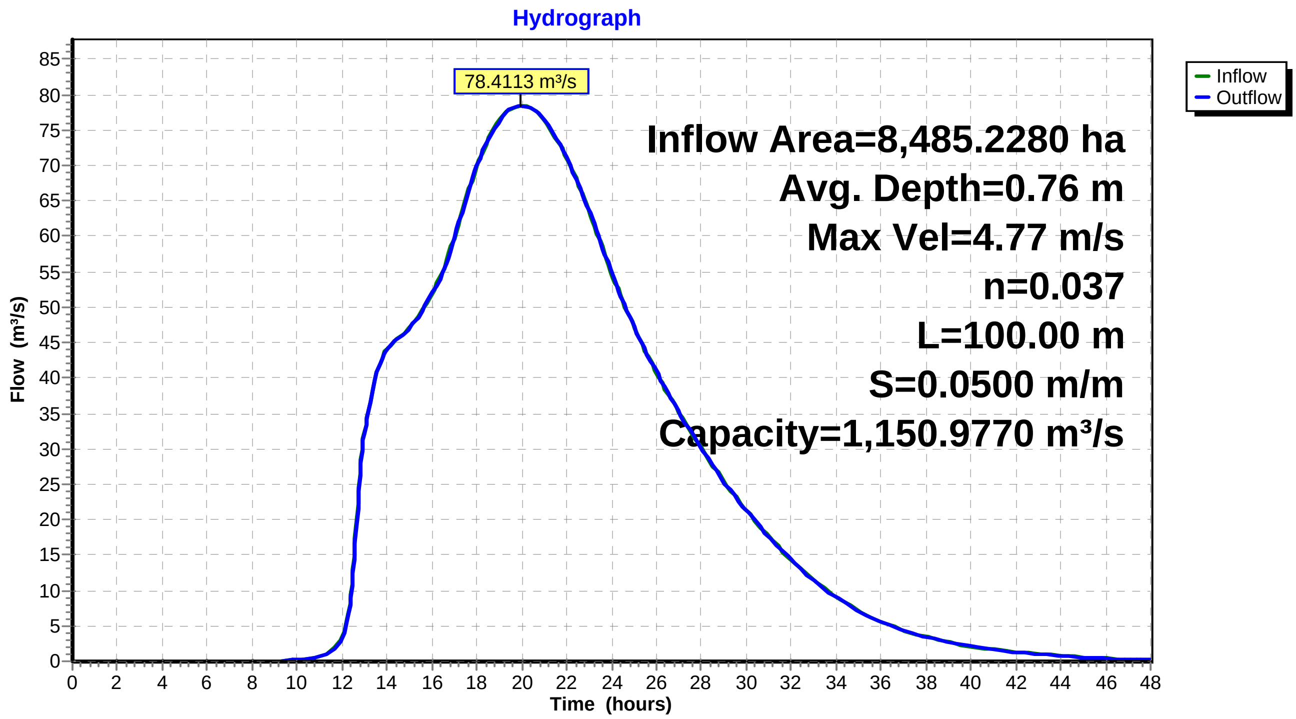
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.77 m/s, Min. Travel Time= 0.3 min
Avg. Velocity = 2.47 m/s, Avg. Travel Time= 0.7 min

Peak Storage= 1,642.9 m³ @ 19.97 hrs, Average Depth at Peak Storage= 0.76 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

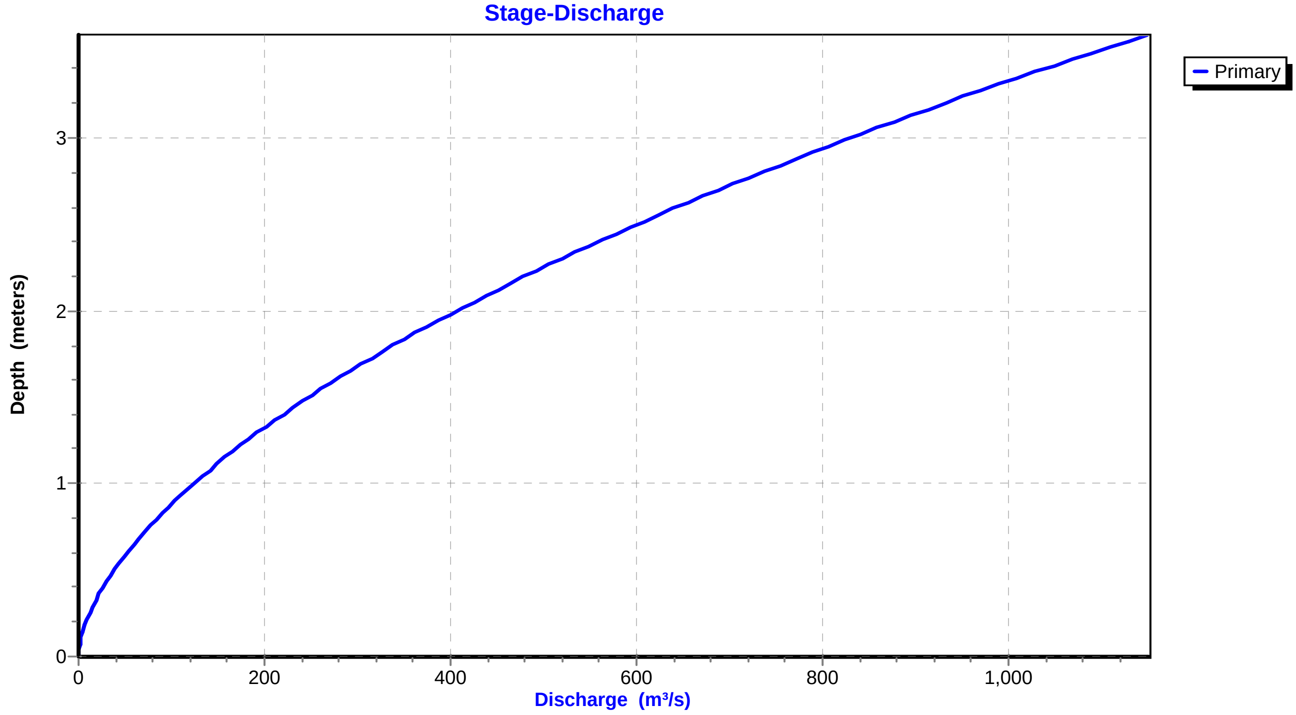
20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

‡

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 43 mm for 200 year event
Inflow = 22.8991 m³/s @ 14.56 hrs, Volume= 437.215 Ml
Outflow = 22.8841 m³/s @ 14.69 hrs, Volume= 437.187 Ml, Atten= 0%, Lag= 7.8 min

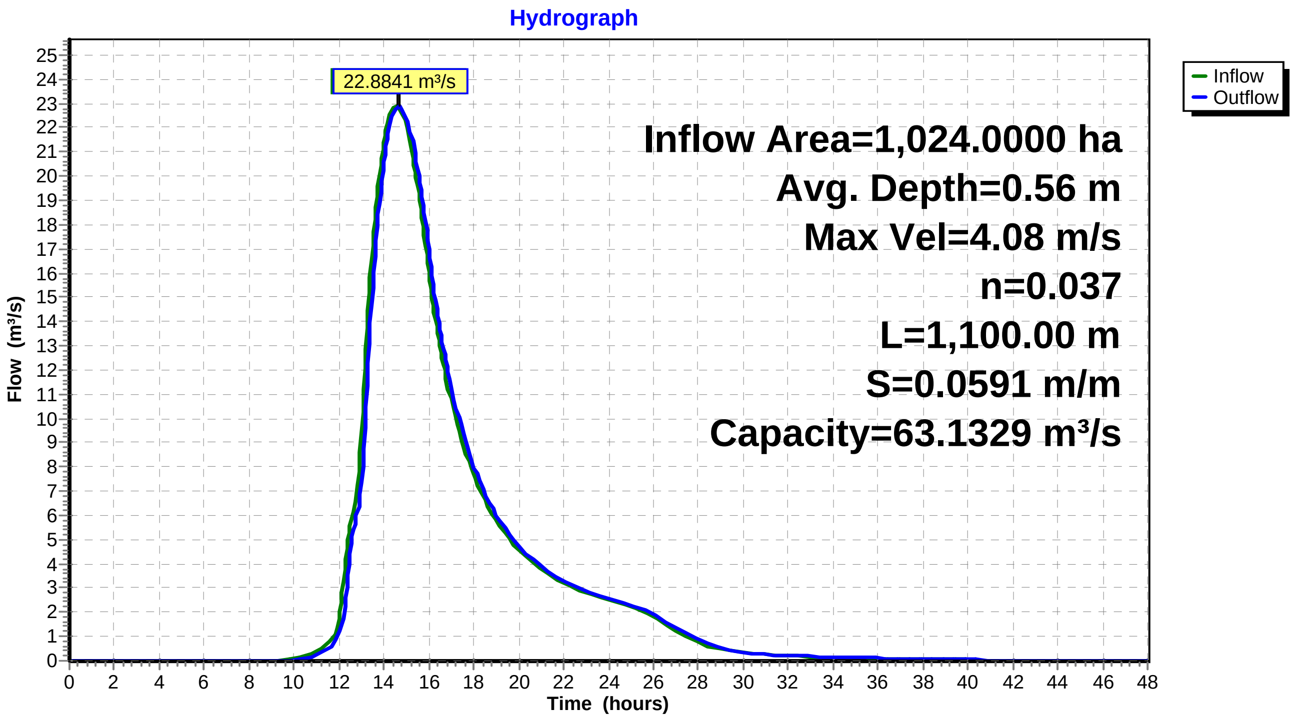
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.08 m/s, Min. Travel Time= 4.5 min
Avg. Velocity = 1.30 m/s, Avg. Travel Time= 14.1 min

Peak Storage= 6,174.8 m³ @ 14.62 hrs, Average Depth at Peak Storage= 0.56 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

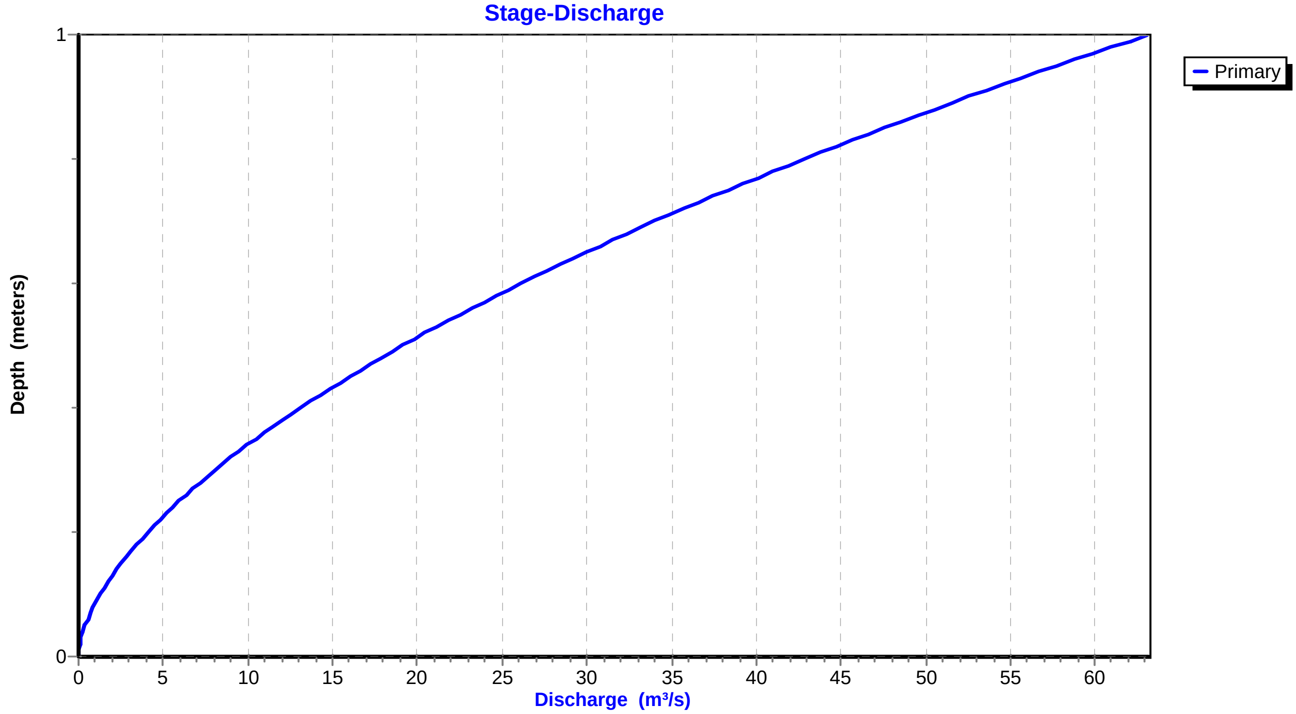
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



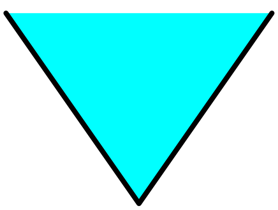
Reach 34R: Upper Haggart Creek

Inflow Area = 6,782.0000 ha, Inflow Depth > 43 mm for 200 year event
Inflow = 71.3212 m³/s @ 20.33 hrs, Volume= 2,898.658 Ml
Outflow = 71.2679 m³/s @ 20.47 hrs, Volume= 2,898.287 Ml, Atten= 0%, Lag= 8.3 min

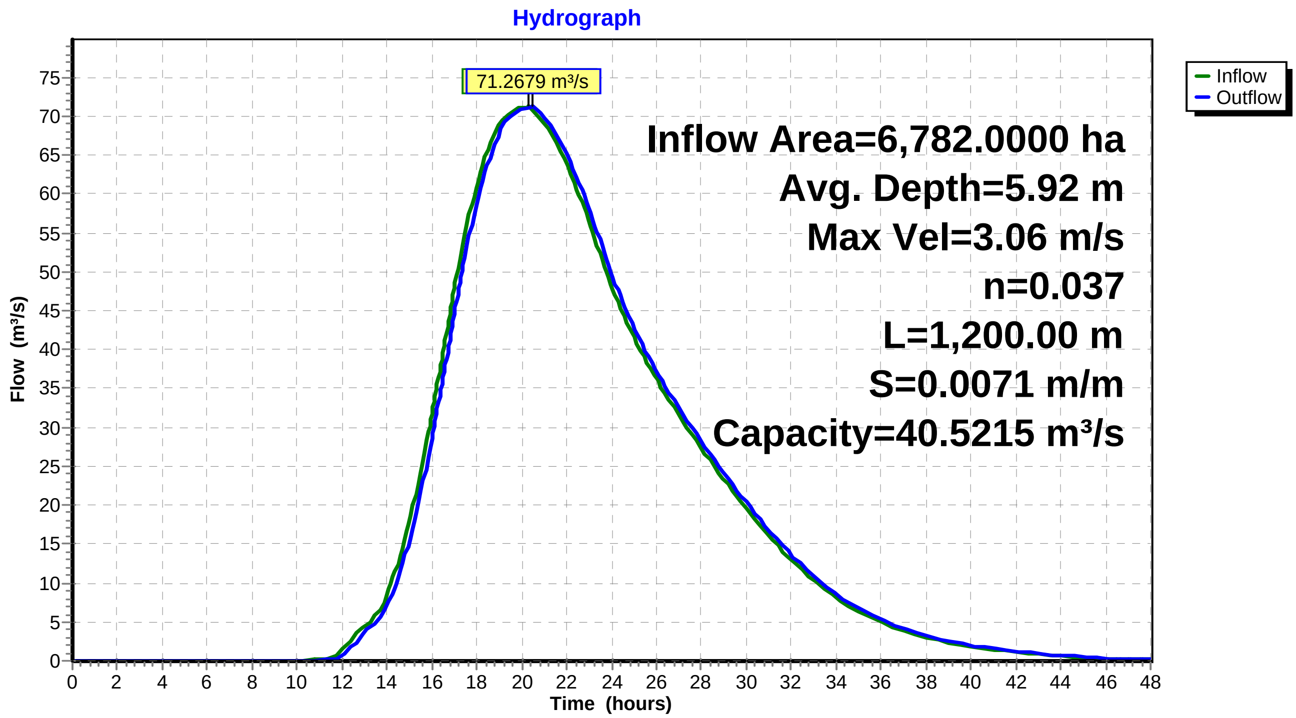
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.06 m/s, Min. Travel Time= 6.5 min
Avg. Velocity = 1.78 m/s, Avg. Travel Time= 11.2 min

Peak Storage= 27,924.2 m³ @ 20.36 hrs, Average Depth at Peak Storage= 5.92 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

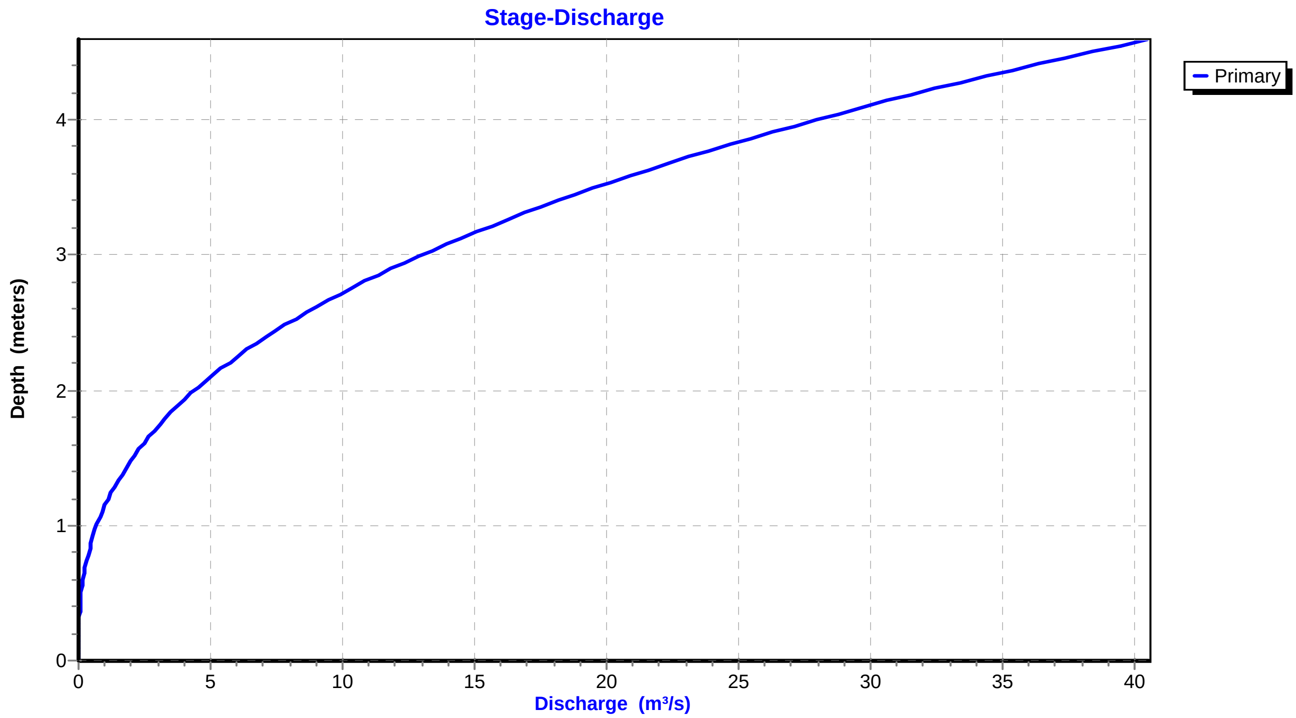
0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m



Reach 34R: Upper Haggart Creek



Reach 34R: Upper Haggart Creek



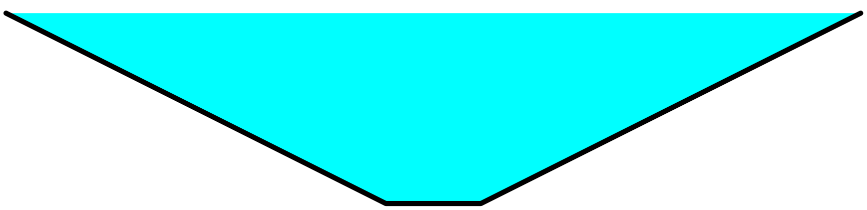
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 47 mm for 200 year event
Inflow = 9.7509 m³/s @ 12.88 hrs, Volume= 84.311 Ml
Outflow = 9.6507 m³/s @ 13.02 hrs, Volume= 84.306 Ml, Atten= 1%, Lag= 8.1 min

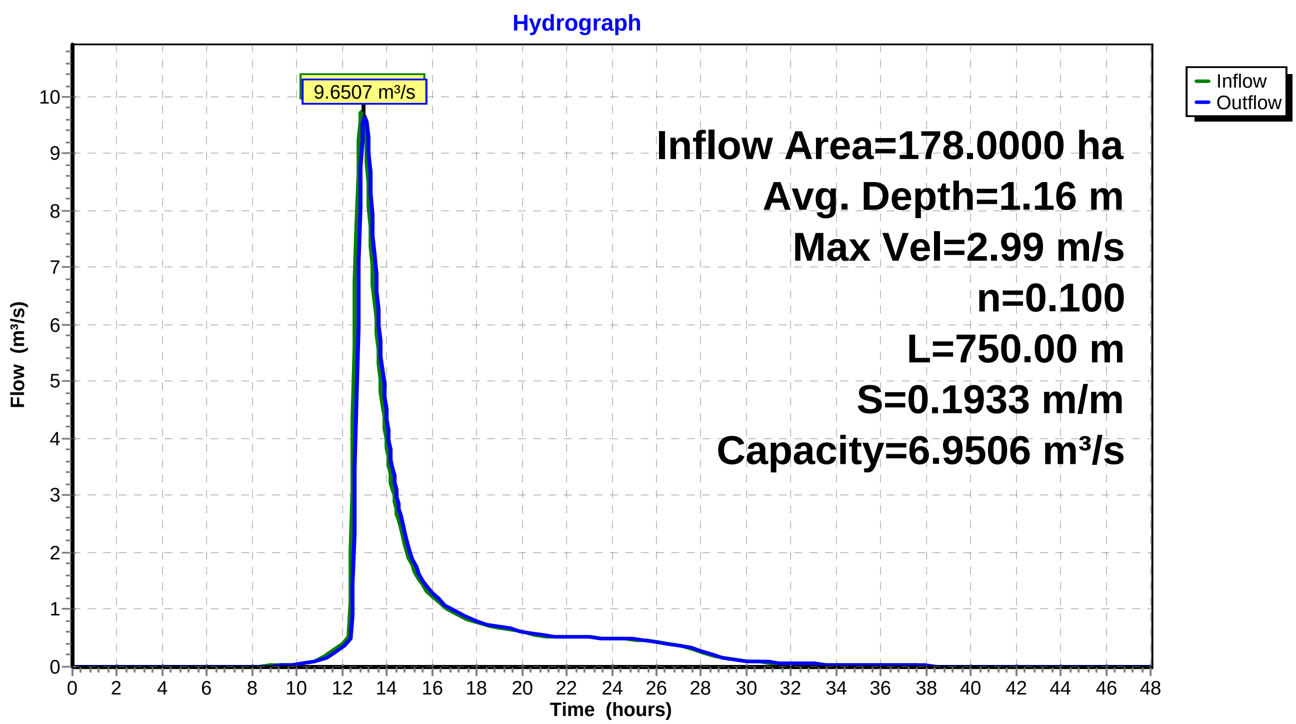
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.99 m/s, Min. Travel Time= 4.2 min
Avg. Velocity = 1.00 m/s, Avg. Travel Time= 12.5 min

Peak Storage= 2,425.5 m³ @ 12.95 hrs, Average Depth at Peak Storage= 1.16 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

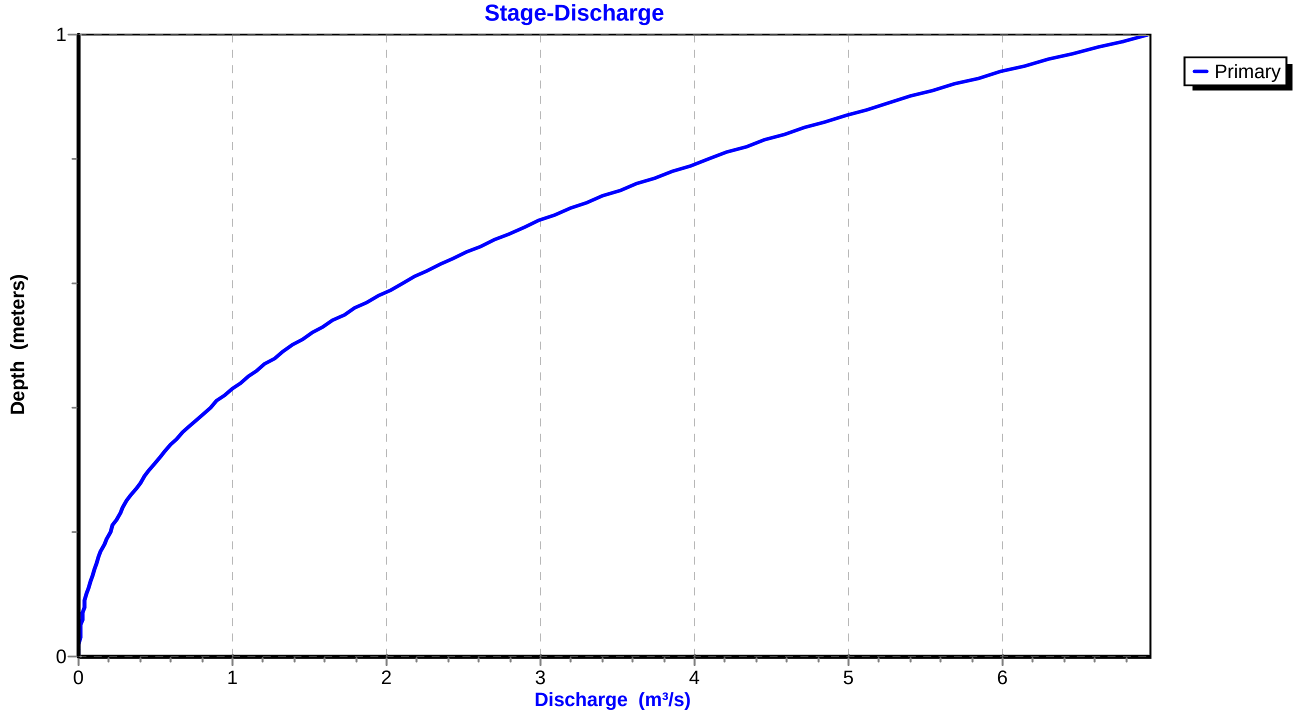
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 43 mm for 200 year event
Inflow = 6.3908 m³/s @ 12.90 hrs, Volume= 54.661 Ml
Outflow = 4.8732 m³/s @ 13.36 hrs, Volume= 54.601 Ml, Atten= 24%, Lag= 27.5 min
Primary = 0.3620 m³/s @ 13.36 hrs, Volume= 22.444 Ml
Secondary = 4.5112 m³/s @ 13.36 hrs, Volume= 32.157 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 918.230 m @ 13.36 hrs Surf.Area= 17,532.8 m² Storage= 36,247.9 m³ (15,806.7 m³ above start)

Plug-Flow detention time= 487.0 min calculated for 34.160 Ml (62% of inflow)
Center-of-Mass det. time= 200.1 min (1,094.0 - 893.9)

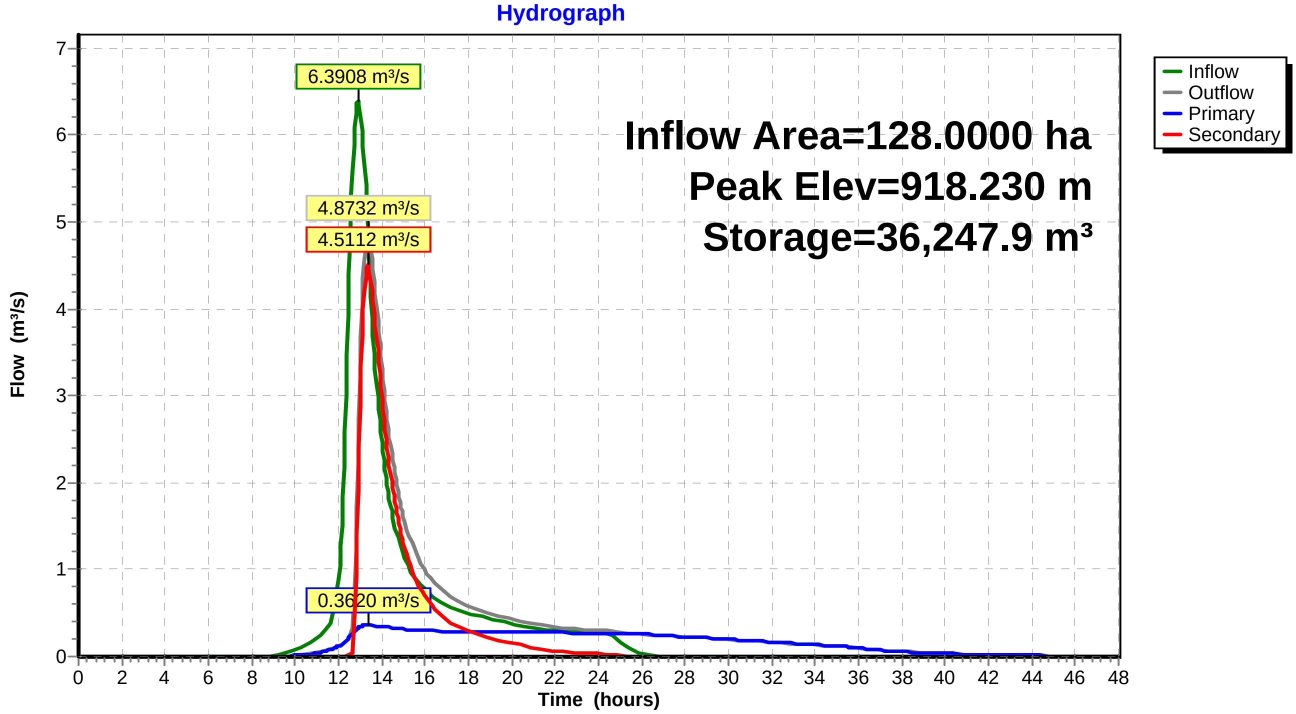
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

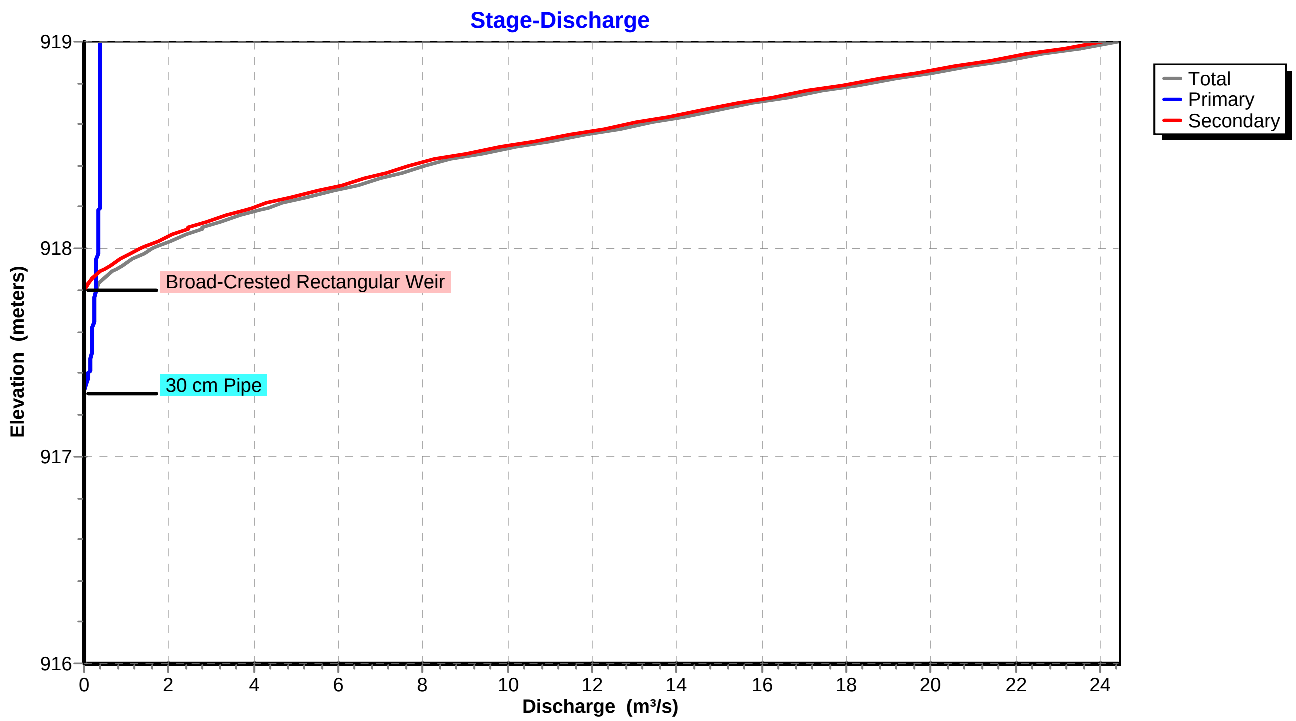
Primary OutFlow Max=0.3620 m³/s @ 13.36 hrs HW=918.230 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.3620 m³/s)

Secondary OutFlow Max=4.4949 m³/s @ 13.36 hrs HW=918.230 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.4949 m³/s @ 1.05 m/s)

Pond 23P: EP WRSA SCP



Pond 23P: EP WRSA SCP



Pond 24P: Lower Dublin North

Inflow Area = 39.0000 ha, Inflow Depth = 53 mm for 200 year event
Inflow = 3.7377 m³/s @ 12.43 hrs, Volume= 20.660 Ml
Outflow = 1.9970 m³/s @ 12.85 hrs, Volume= 20.605 Ml, Atten= 47%, Lag= 25.4 min
Primary = 0.1739 m³/s @ 12.85 hrs, Volume= 10.871 Ml
Secondary = 1.8231 m³/s @ 12.85 hrs, Volume= 9.733 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 791.359 m @ 12.85 hrs Surf.Area= 9,839.7 m² Storage= 16,563.2 m³ (8,077.9 m³ above start)

Plug-Flow detention time= 609.3 min calculated for 12.119 Ml (59% of inflow)
Center-of-Mass det. time= 268.2 min (1,109.2 - 841.1)

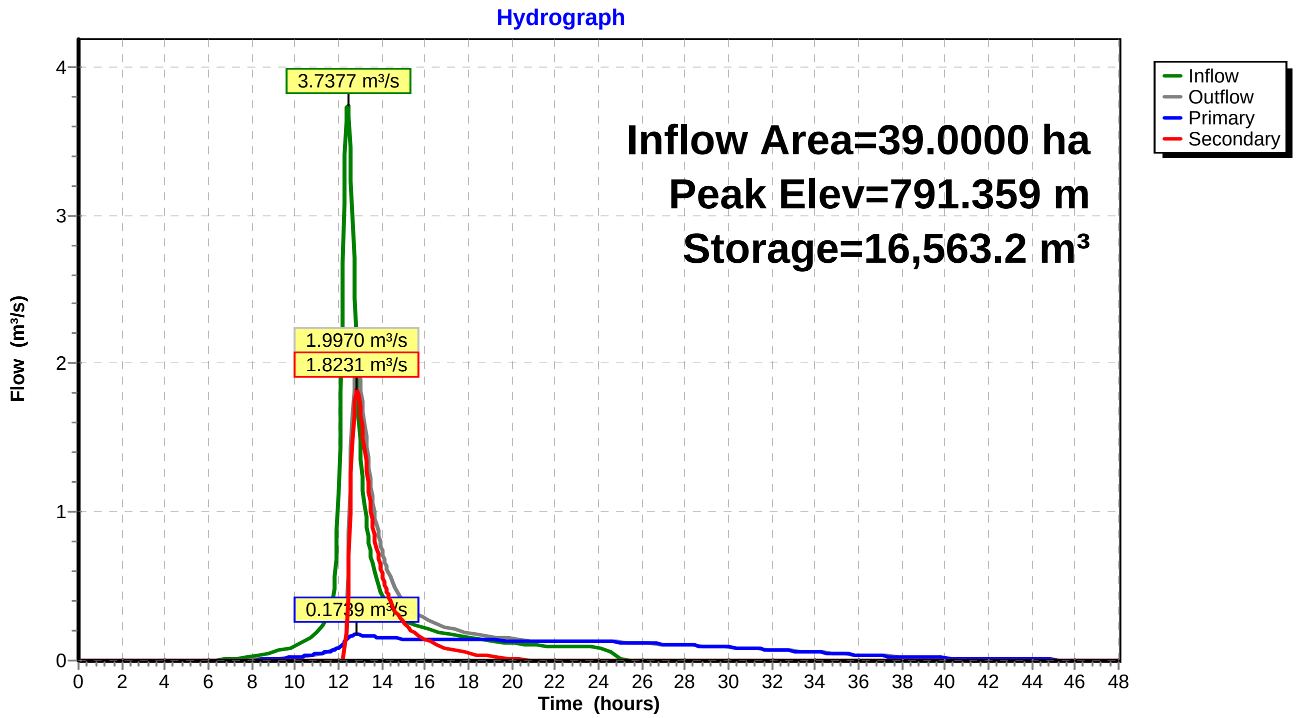
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

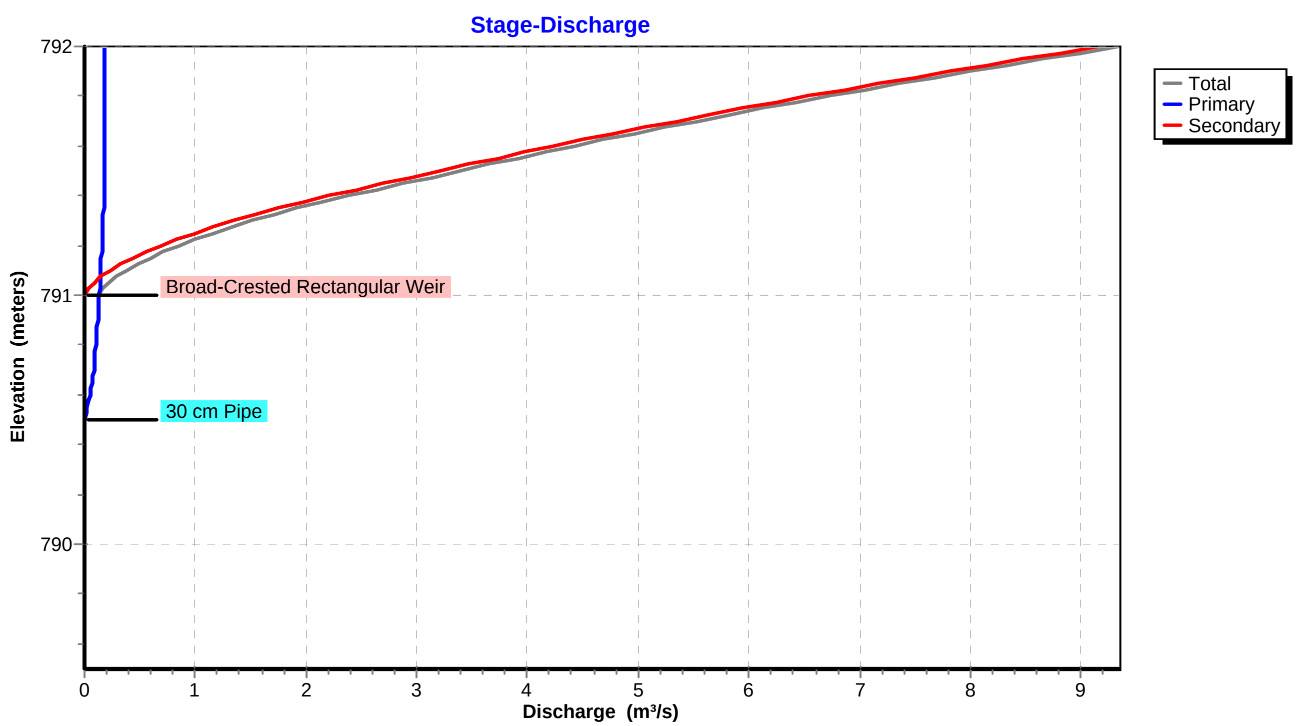
Primary OutFlow Max=0.1739 m³/s @ 12.85 hrs HW=791.359 m (Free Discharge)
└─**1=30 cm Pipe** (Custom Controls 0.1739 m³/s)

Secondary OutFlow Max=1.8200 m³/s @ 12.85 hrs HW=791.359 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.8200 m³/s @ 1.01 m/s)

Pond 24P: Lower Dublin North



Pond 24P: Lower Dublin North



Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 47 mm for 200 year event
Inflow = 10.8301 m³/s @ 12.66 hrs, Volume= 84.332 Ml
Outflow = 9.7509 m³/s @ 12.88 hrs, Volume= 84.311 Ml, Atten= 10%, Lag= 13.6 min
Primary = 0.7520 m³/s @ 12.85 hrs, Volume= 34.636 Ml
Secondary = 8.9989 m³/s @ 12.88 hrs, Volume= 49.675 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 903.505 m @ 12.88 hrs Surf.Area= 16,912.2 m² Storage= 52,310.9 m³ (16,415.1 m³ above start)

Plug-Flow detention time= 373.1 min calculated for 48.415 Ml (57% of inflow)
Center-of-Mass det. time= 105.0 min (978.0 - 873.0)

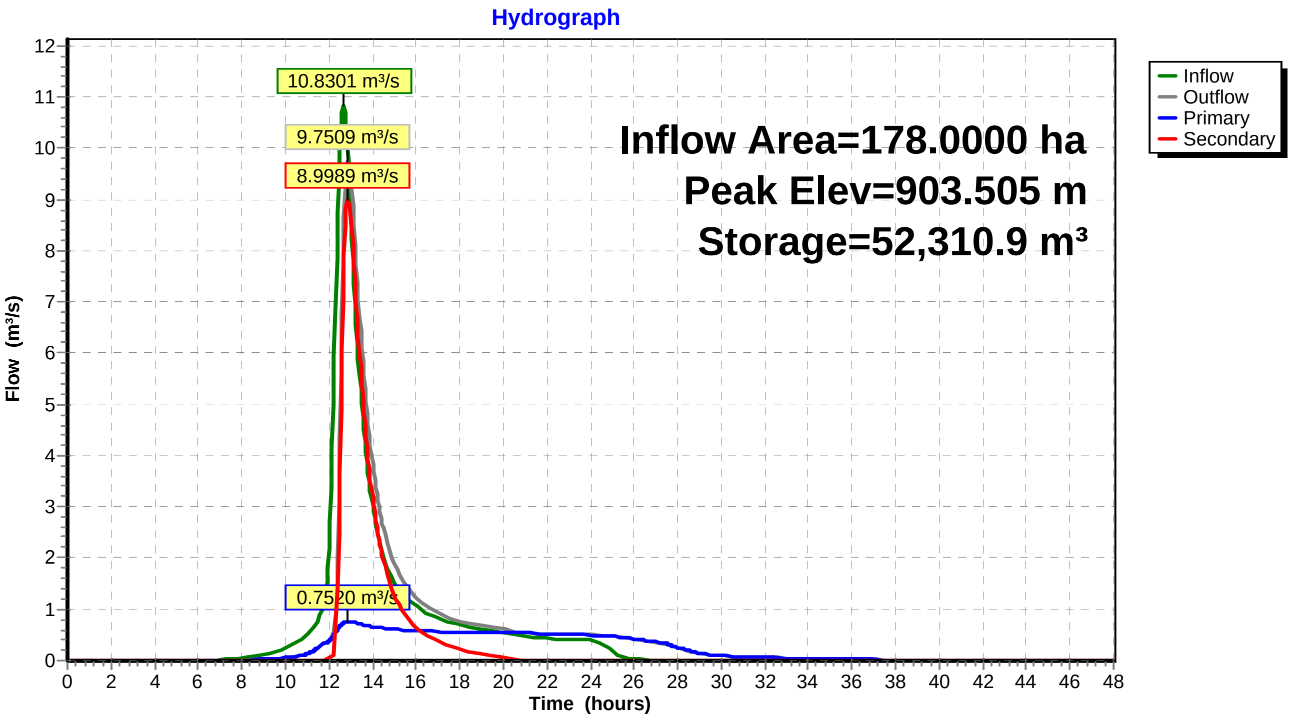
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

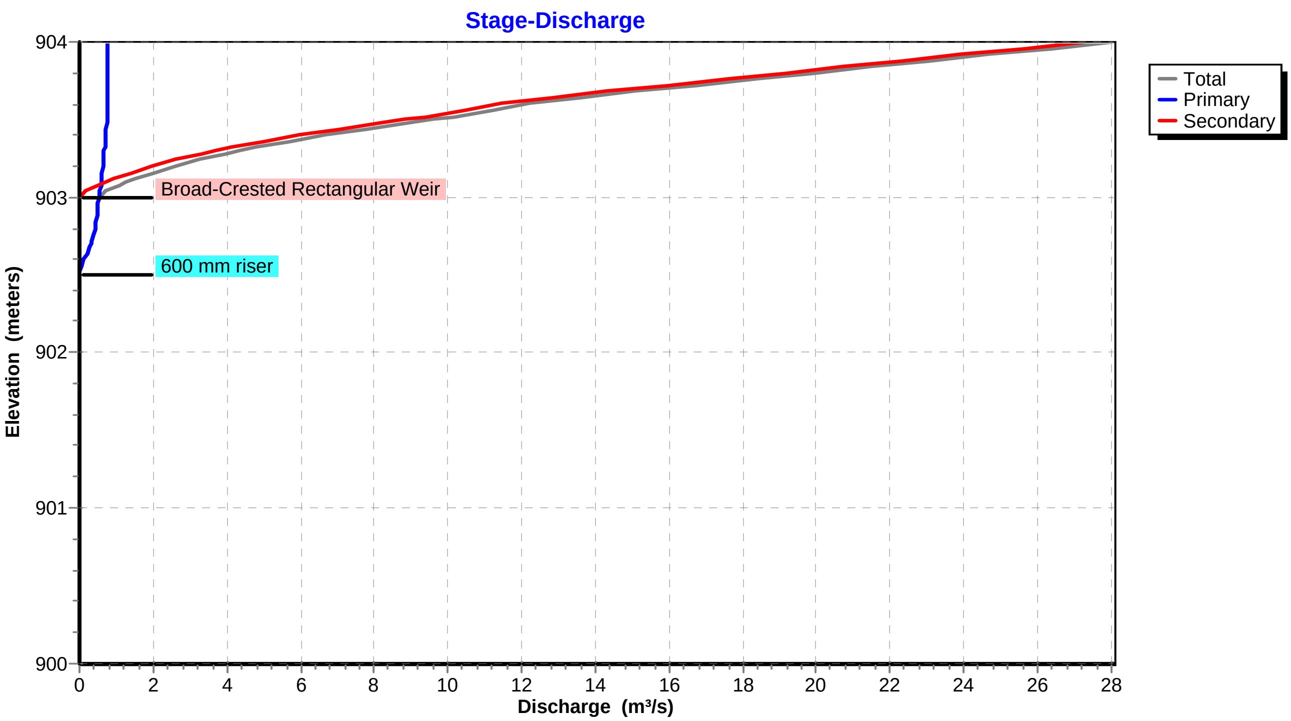
Primary OutFlow Max=0.7520 m³/s @ 12.85 hrs HW=903.504 m (Free Discharge)
↑—**1=600 mm riser** (Custom Controls 0.7520 m³/s)

Secondary OutFlow Max=8.9863 m³/s @ 12.88 hrs HW=903.505 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 8.9863 m³/s @ 1.19 m/s)

Pond 25P: Platinum Gulch SCP



Pond 25P: Platinum Gulch SCP



Pond 33P: Lower Dublin South Pond

Inflow Area = 93.0000 ha, Inflow Depth = 53 mm for 200 year event
Inflow = 6.5393 m³/s @ 12.73 hrs, Volume= 49.266 Ml
Outflow = 3.1011 m³/s @ 13.46 hrs, Volume= 49.193 Ml, Atten= 53%, Lag= 43.8 min
Primary = 0.7301 m³/s @ 13.46 hrs, Volume= 31.952 Ml
Secondary = 2.3710 m³/s @ 13.46 hrs, Volume= 17.241 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 832.442 m @ 13.46 hrs Surf.Area= 22,020.5 m² Storage= 49,749.2 m³ (20,143.7 m³ above start)

Plug-Flow detention time= 673.5 min calculated for 19.587 Ml (40% of inflow)
Center-of-Mass det. time= 213.1 min (1,076.4 - 863.3)

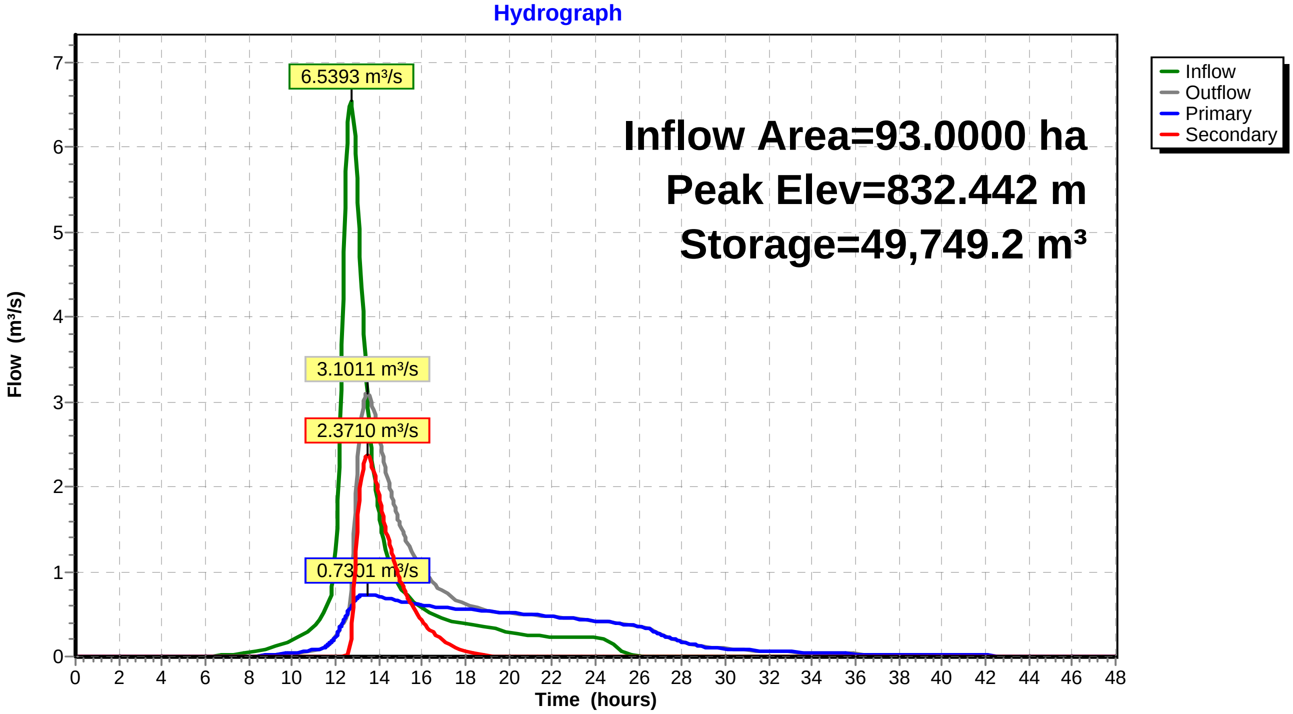
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

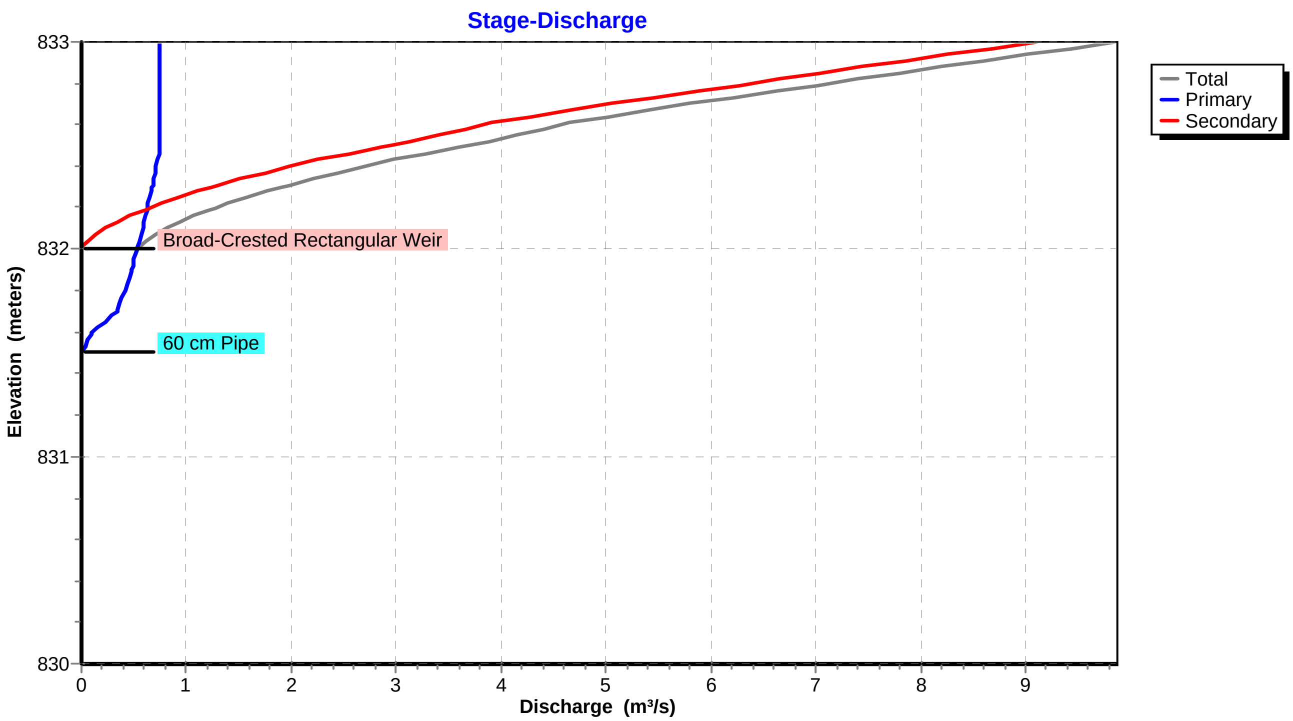
Primary OutFlow Max=0.7301 m³/s @ 13.46 hrs HW=832.442 m (Free Discharge)
└─**1=60 cm Pipe** (Custom Controls 0.7301 m³/s)

Secondary OutFlow Max=2.3677 m³/s @ 13.46 hrs HW=832.442 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.3677 m³/s @ 1.07 m/s)

Pond 33P: Lower Dublin South Pond



Pond 33P: Lower Dublin South Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=51 mm
Tc=100.0 min CN=85 Runoff=2.1124 m³/s 21.034 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=62 mm
Tc=45.0 min CN=90 Runoff=4.3794 m³/s 24.286 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=51 mm
Tc=210.0 min CN=85 Runoff=24.7619 m³/s 436.077 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=51 mm
Tc=127.0 min CN=85 Runoff=13.3204 m³/s 160.183 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=62 mm
Tc=65.0 min CN=90 Runoff=7.0030 m³/s 50.440 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=51 mm
Tc=81.0 min CN=85 Runoff=7.7108 m³/s 65.668 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=51 mm
Tc=187.0 min CN=85 Runoff=21.4410 m³/s 345.270 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and Runoff Area=93.0000 ha Runoff Depth=62 mm
Tc=69.0 min CN=90 Runoff=7.6723 m³/s 57.913 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>51 mm
Tc=591.0 min CN=85 Runoff=85.6433 m³/s 3,450.980 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=51 mm
Tc=47.0 min CN=85 Runoff=3.8492 m³/s 21.958 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=51 mm
Tc=54.0 min CN=85 Runoff=4.5698 m³/s 28.730 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=51 mm
Tc=49.0 min CN=85 Runoff=4.0212 m³/s 23.599 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=51 mm
Tc=71.0 min CN=85 Runoff=6.3920 m³/s 49.251 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=51 mm
Tc=26.0 min CN=85 Runoff=1.7409 m³/s 6.669 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=51 mm
Tc=54.0 min CN=85 Runoff=4.6432 m³/s 29.191 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=51 mm
Tc=29.0 min CN=85 Runoff=1.9880 m³/s 8.157 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=62 mm
Tc=20.0 min CN=90 Runoff=1.3870 m³/s 4.608 Ml

Reach 14R: Upper DG Diversion Ch Avg. Depth=0.61 m Max Vel=4.32 m/s Inflow=27.1717 m³/s 501.681 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=27.1598 m³/s 501.665 Ml

Reach 16R: Eagle Creek Avg. Depth=1.16 m Max Vel=1.90 m/s Inflow=29.7852 m³/s 583.066 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=29.7325 m³/s 582.994 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=6.12 m Max Vel=3.61 m/s Inflow=86.9149 m³/s 3,641.644 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=86.9081 m³/s 3,641.484 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.85 m Max Vel=5.10 m/s Inflow=94.1927 m³/s 4,373.905 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=94.1916 m³/s 4,373.863 Ml

Reach 33R: Lower DG Diversion Ch Avg. Depth=0.62 m Max Vel=4.35 m/s Inflow=27.5650 m³/s 525.264 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=27.5485 m³/s 525.234 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=6.54 m Max Vel=3.15 m/s Inflow=85.8166 m³/s 3,481.874 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=85.7979 m³/s 3,481.461 Ml

Reach 35R: Platinum Gulch Chann Avg. Depth=1.28 m Max Vel=3.09 m/s Inflow=11.7449 m³/s 100.181 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=11.6424 m³/s 100.175 Ml

Pond 23P: EP WRSA SCP Peak Elev=918.304 m Storage=37,551.6 m³ Inflow=7.7108 m³/s 65.668 Ml
Primary=0.3760 m³/s 23.207 Ml Secondary=5.9823 m³/s 42.397 Ml Outflow=6.3583 m³/s 65.604 Ml

Pond 24P: Lower Dublin North Peak Elev=791.432 m Storage=17,283.7 m³ Inflow=4.3794 m³/s 24.286 Ml
Primary=0.1812 m³/s 11.356 Ml Secondary=2.5152 m³/s 12.868 Ml Outflow=2.6964 m³/s 24.224 Ml

Pond 25P: Platinum Gulch SC Peak Elev=903.581 m Storage=53,596.0 m³ Inflow=12.8711 m³/s 100.204 Ml
Primary=0.7520 m³/s 36.744 Ml Secondary=10.9929 m³/s 63.436 Ml Outflow=11.7449 m³/s 100.181 Ml

Pond 33P: Lower Dublin South P Peak Elev=832.541 m Storage=51,919.9 m³ Inflow=7.6723 m³/s 57.913 Ml
Primary=0.7520 m³/s 34.053 Ml Secondary=3.3194 m³/s 23.779 Ml Outflow=4.0714 m³/s 57.832 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 4,784.015 Ml Average Runoff Depth = 52 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

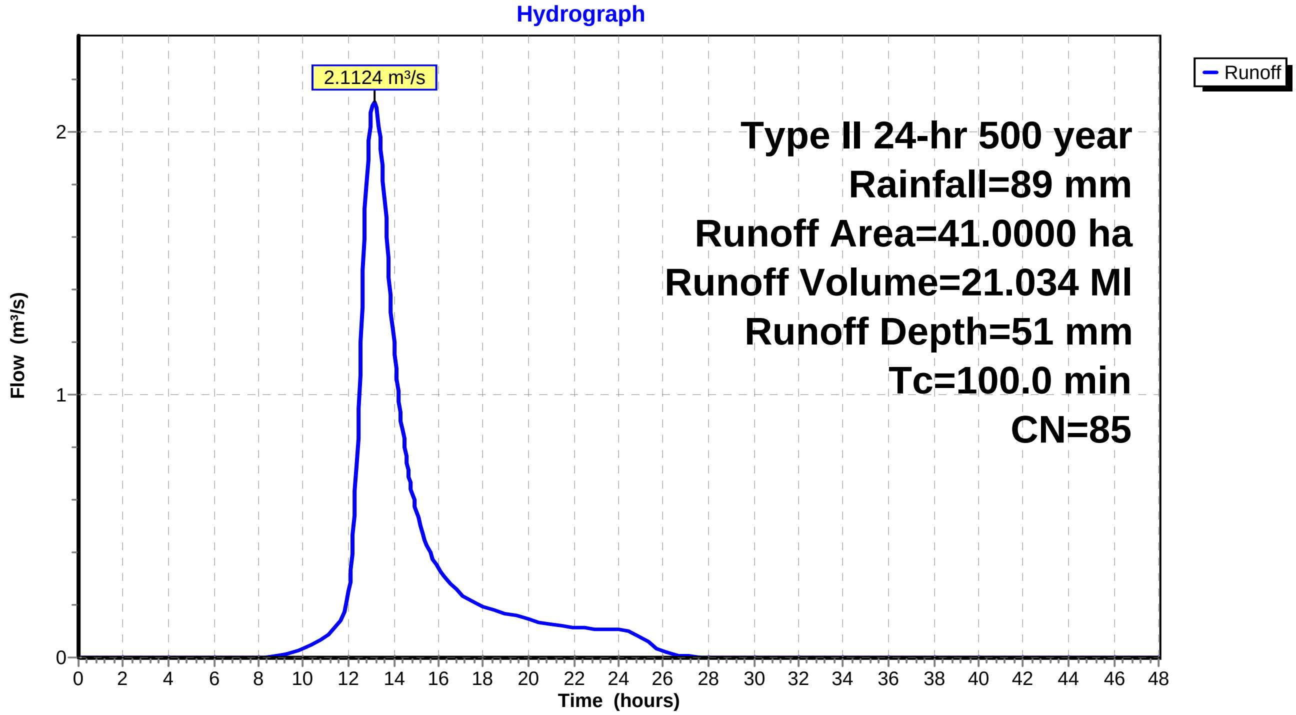
Runoff = 2.1124 m³/s @ 13.18 hrs, Volume= 21.034 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

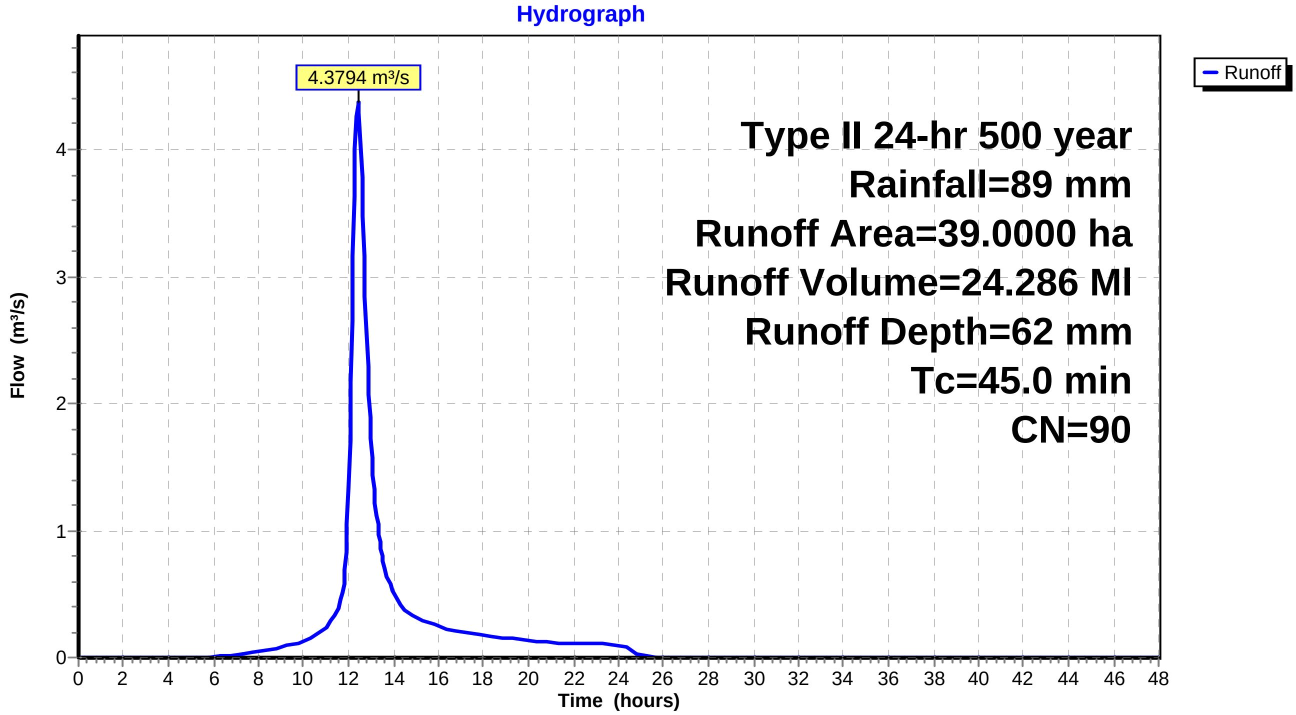
Runoff = 4.3794 m³/s @ 12.42 hrs, Volume= 24.286 Ml, Depth= 62 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

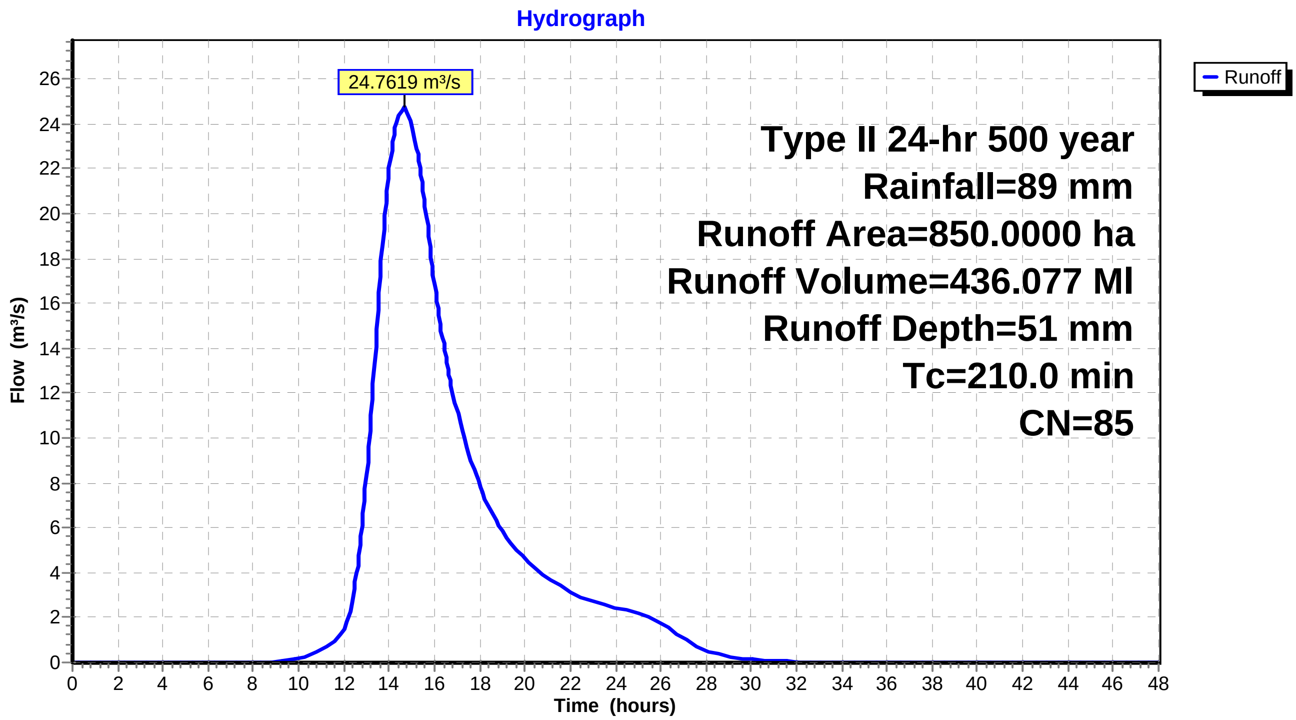
Runoff = 24.7619 m³/s @ 14.69 hrs, Volume= 436.077 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

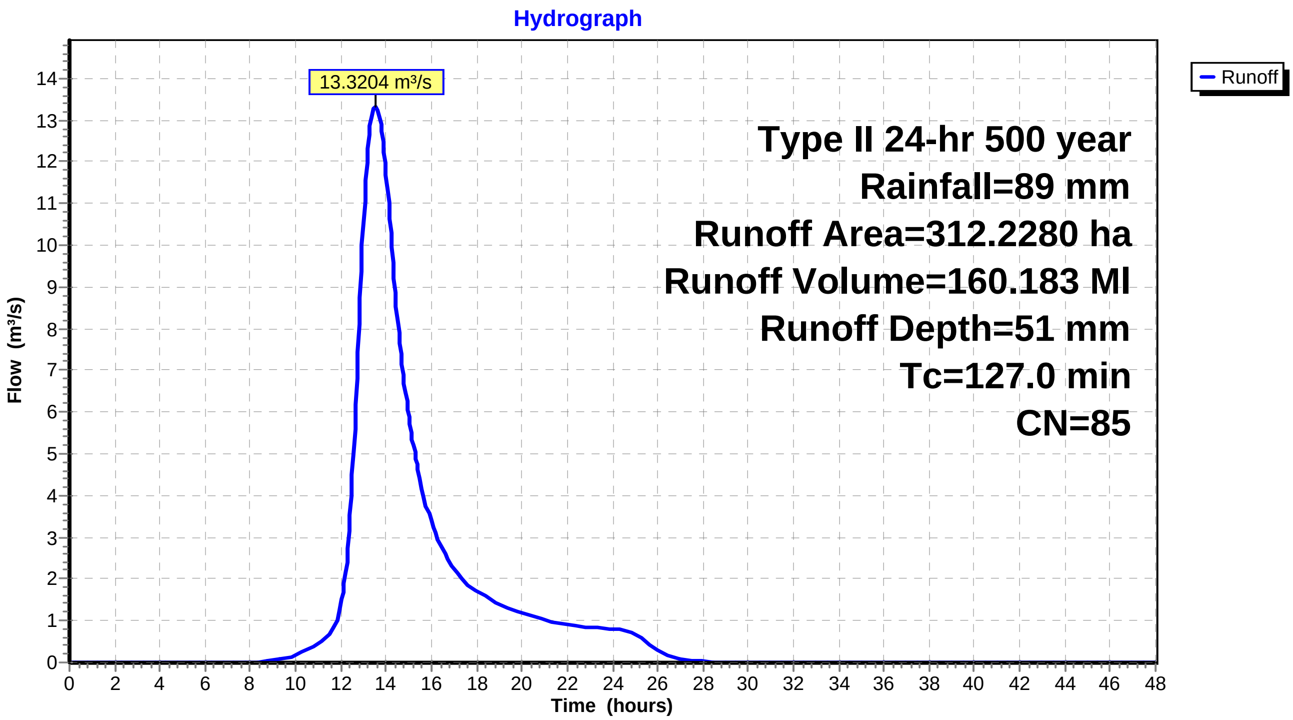
Runoff = 13.3204 m³/s @ 13.52 hrs, Volume= 160.183 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

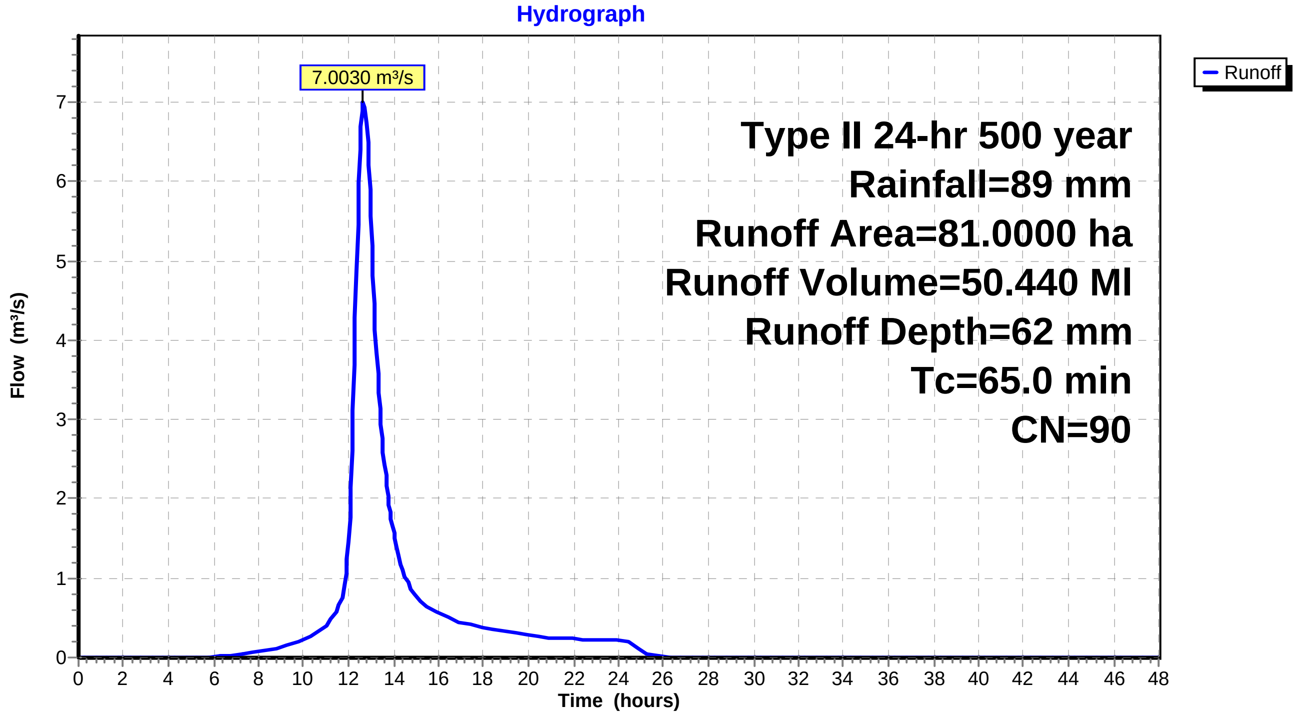
Runoff = 7.0030 m³/s @ 12.67 hrs, Volume= 50.440 Ml, Depth= 62 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

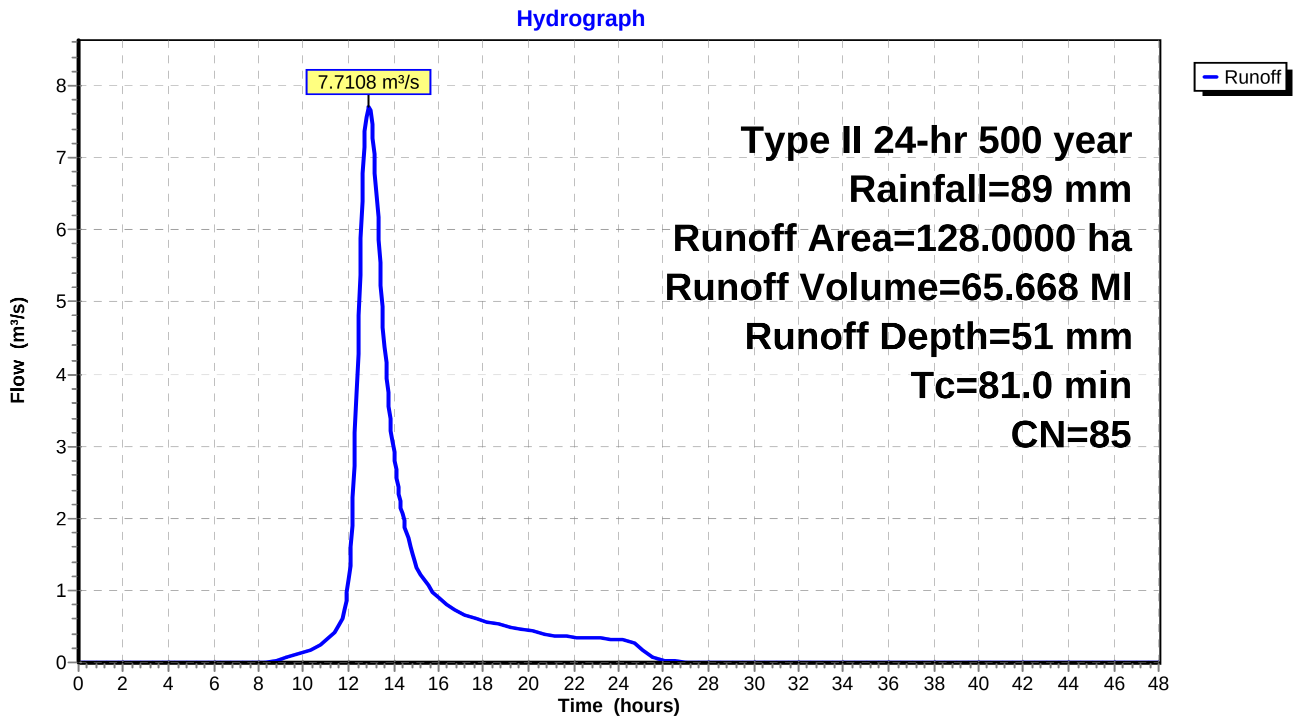
Runoff = 7.7108 m³/s @ 12.89 hrs, Volume= 65.668 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

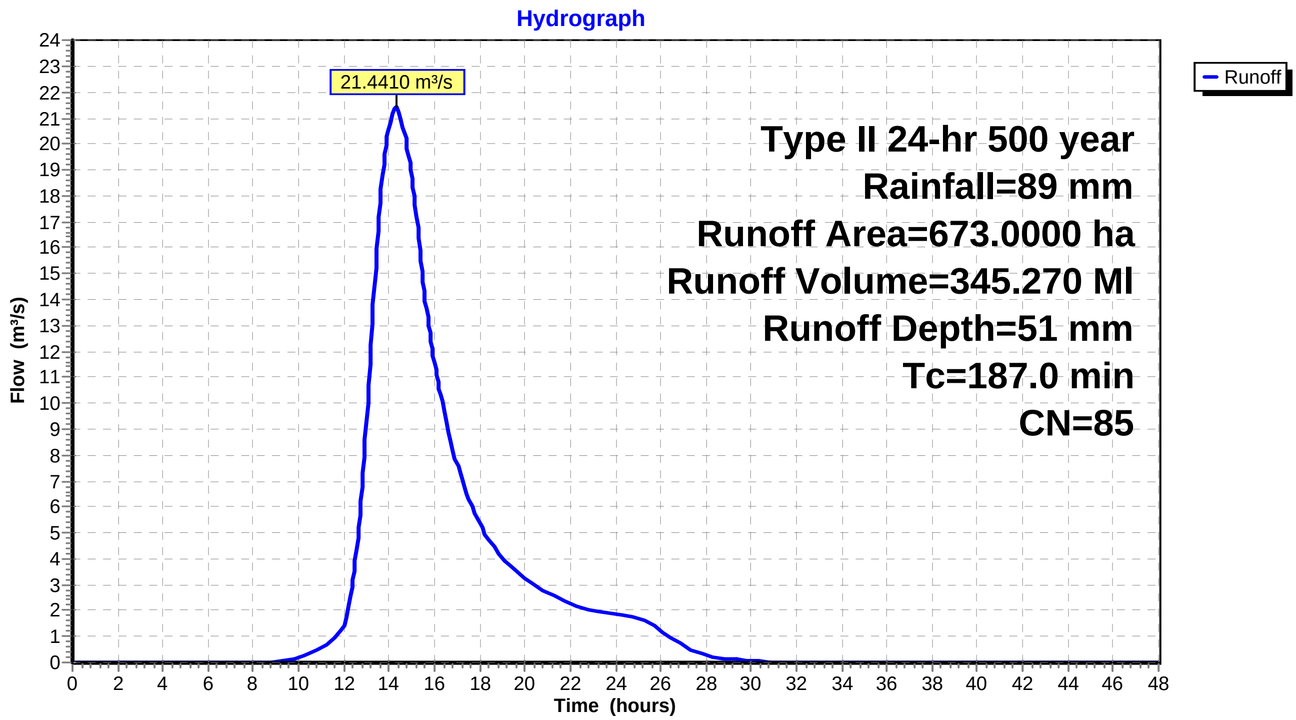
Runoff = 21.4410 m³/s @ 14.33 hrs, Volume= 345.270 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

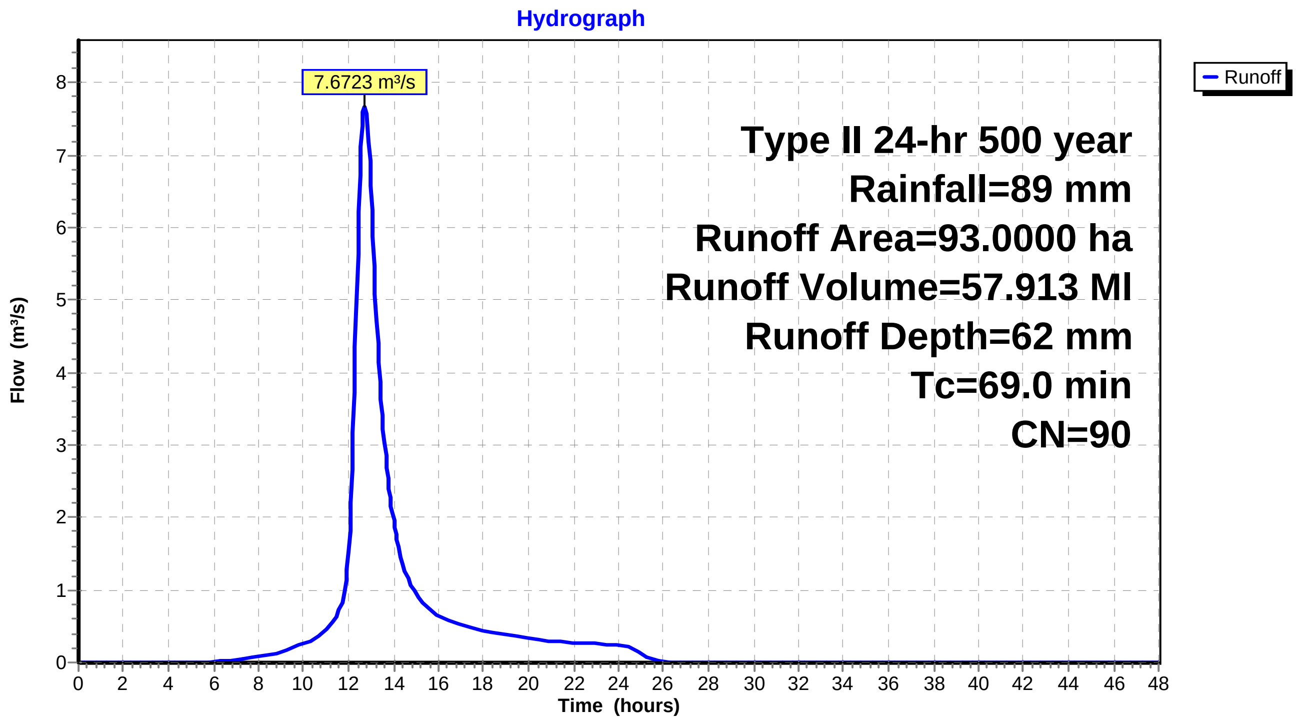
Runoff = 7.6723 m³/s @ 12.72 hrs, Volume= 57.913 Ml, Depth= 62 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

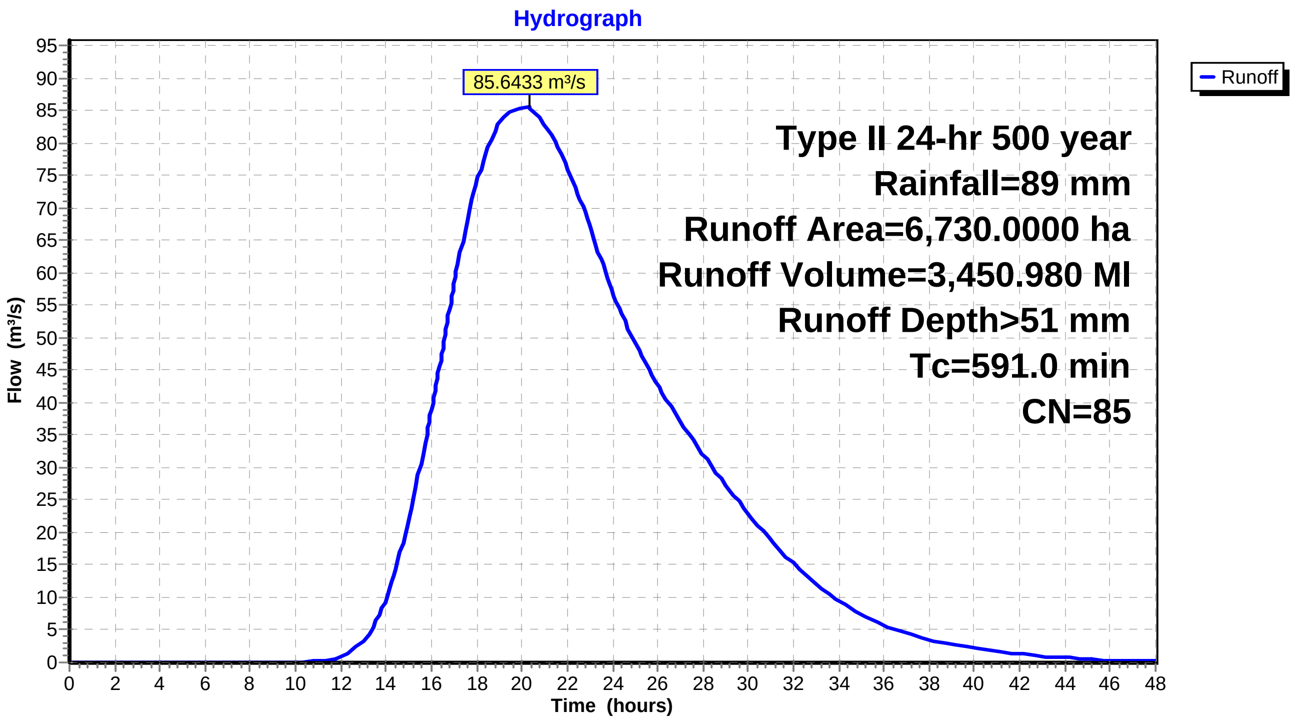
Runoff = 85.6433 m³/s @ 20.33 hrs, Volume= 3,450.980 Ml, Depth> 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

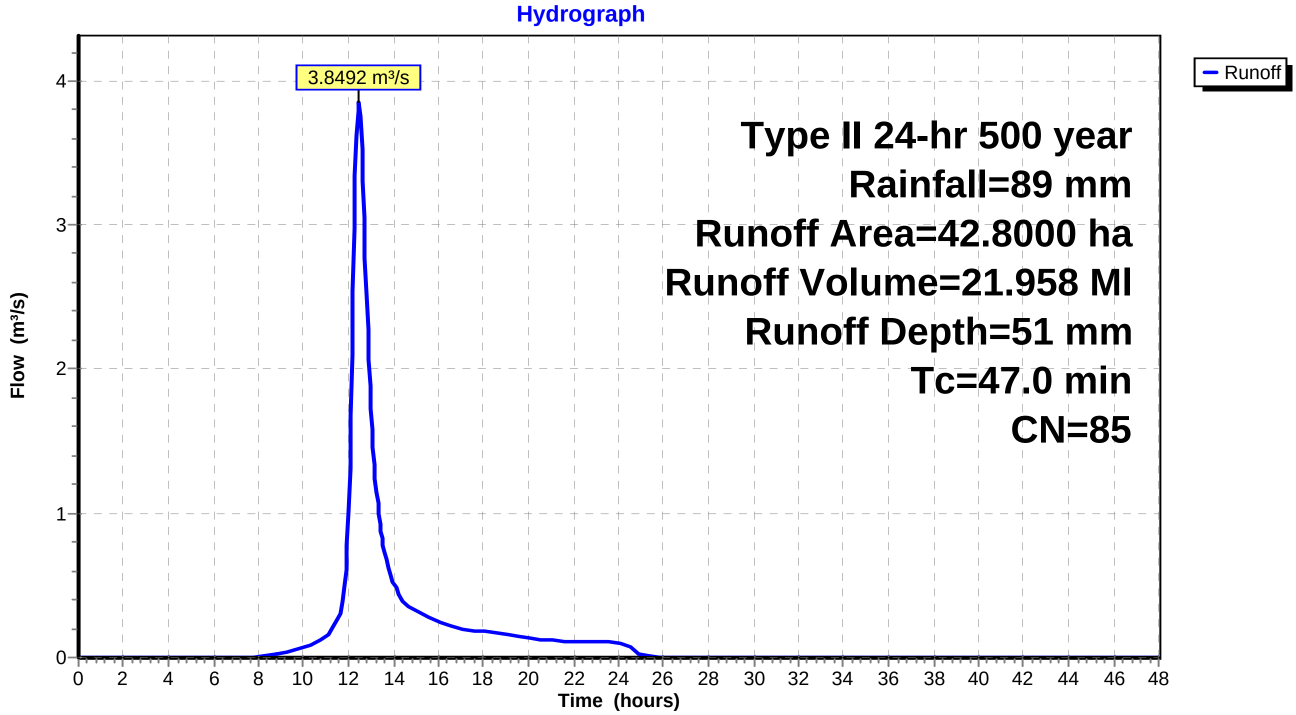
Runoff = 3.8492 m³/s @ 12.46 hrs, Volume= 21.958 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

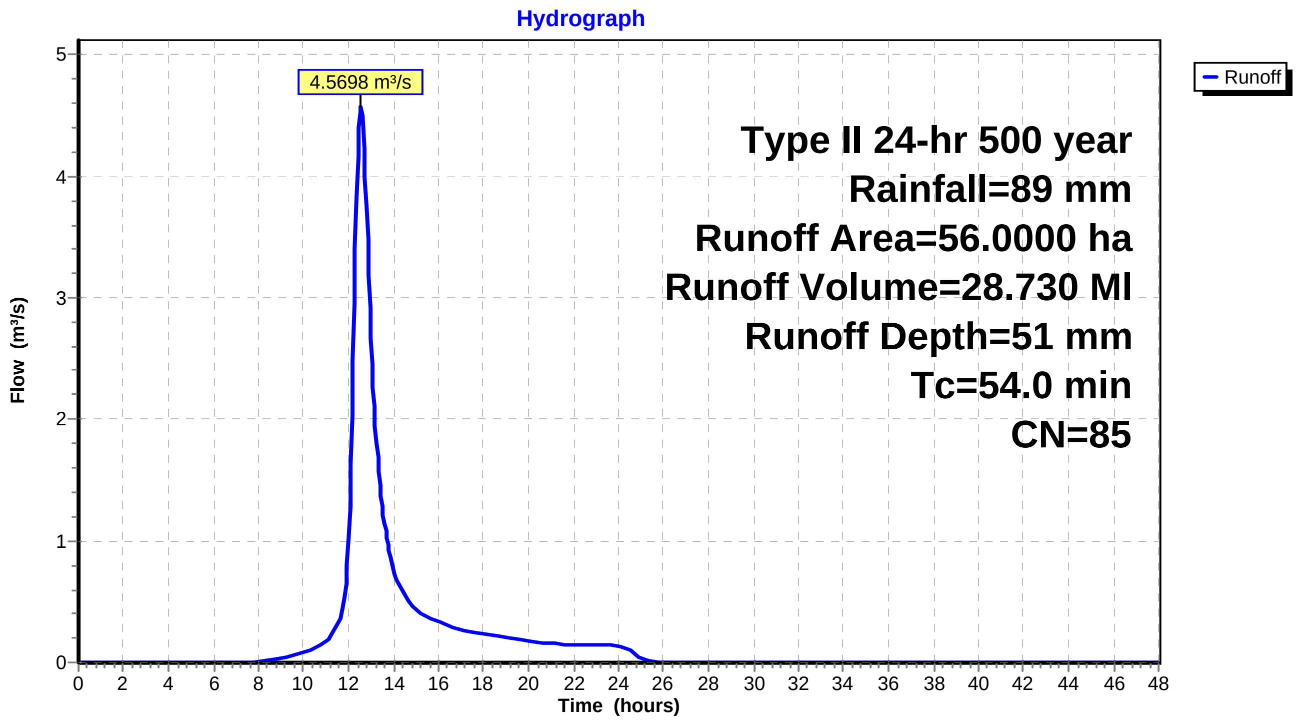
Runoff = 4.5698 m³/s @ 12.55 hrs, Volume= 28.730 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

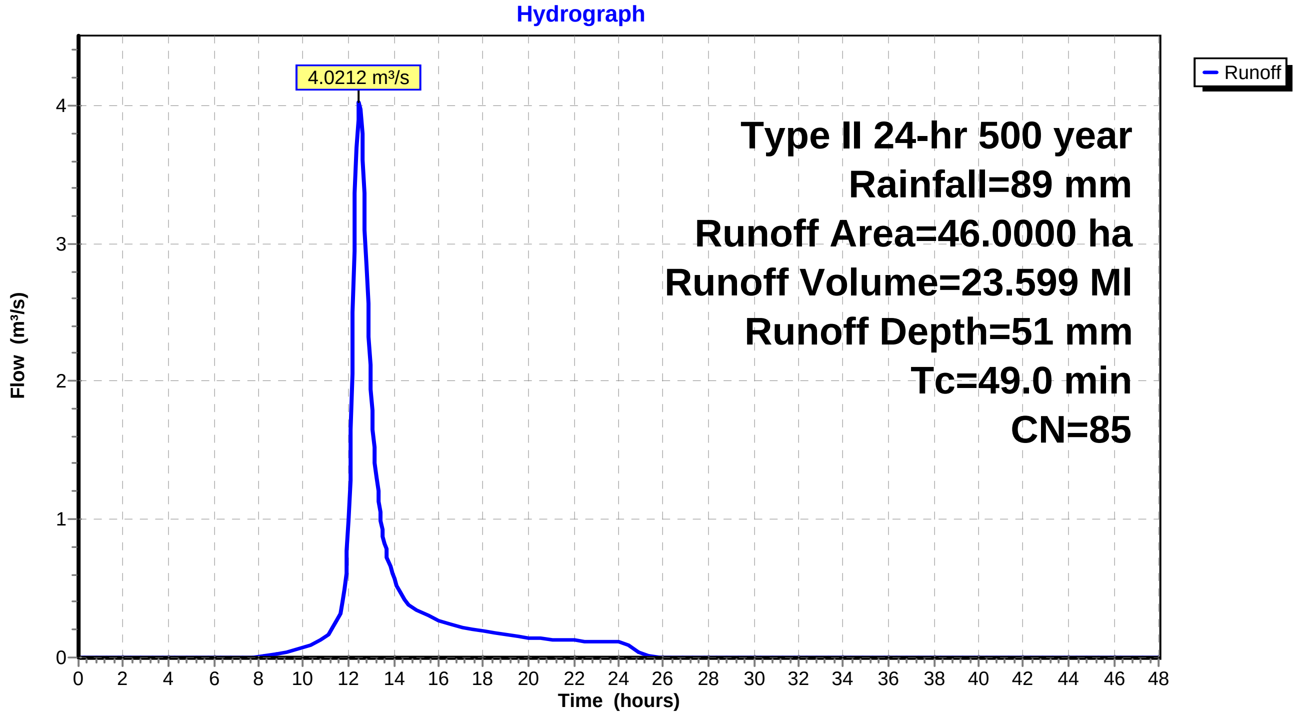
Runoff = 4.0212 m³/s @ 12.48 hrs, Volume= 23.599 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

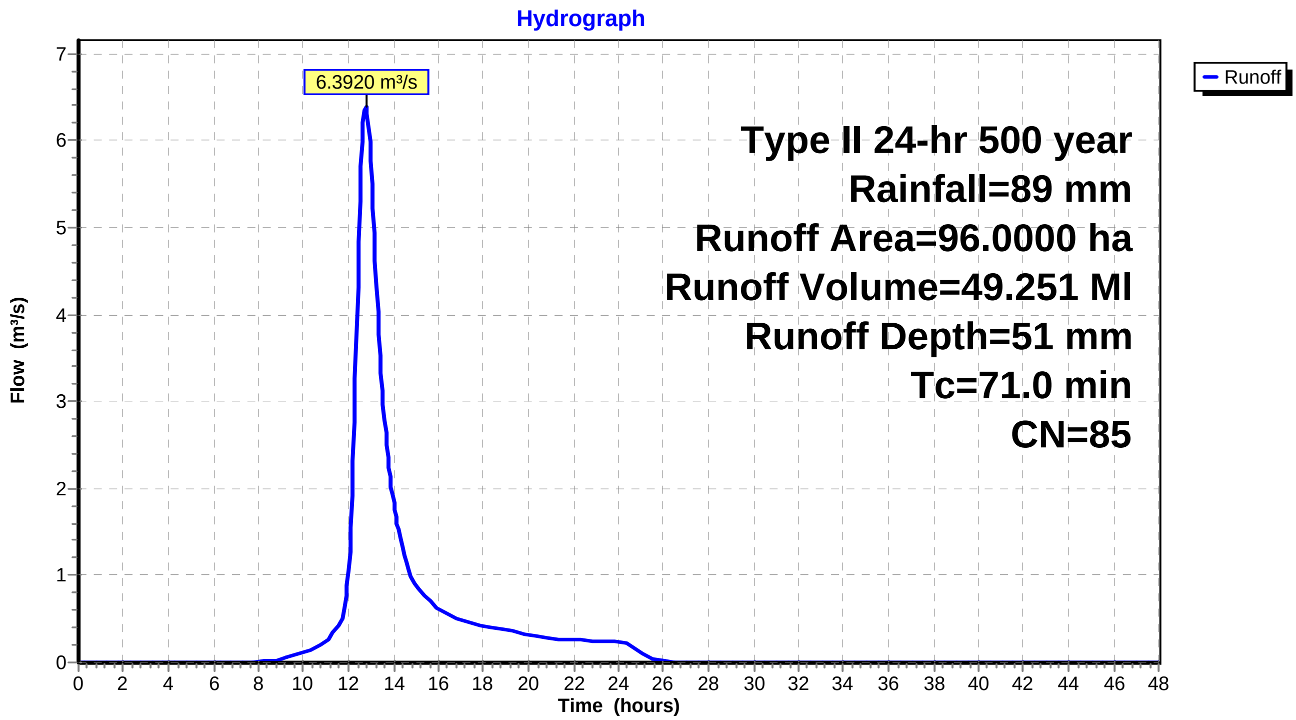
Runoff = 6.3920 m³/s @ 12.76 hrs, Volume= 49.251 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

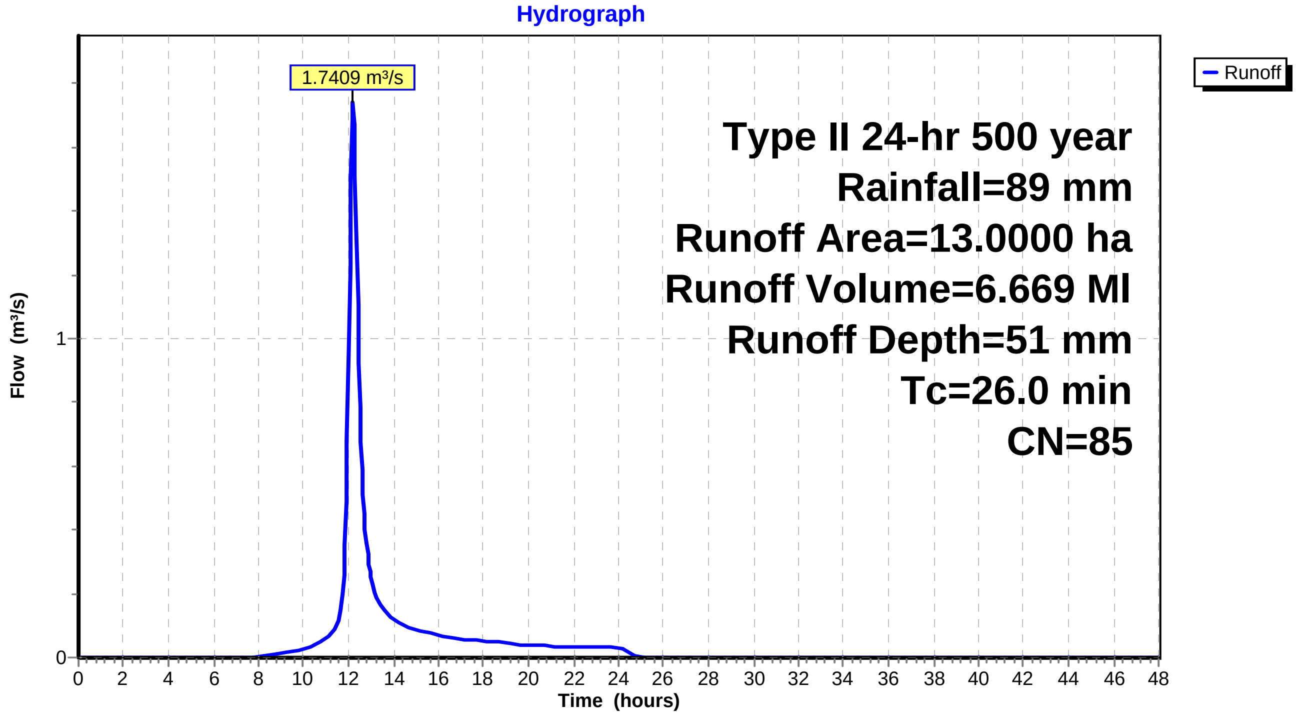
Runoff = 1.7409 m³/s @ 12.20 hrs, Volume= 6.669 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

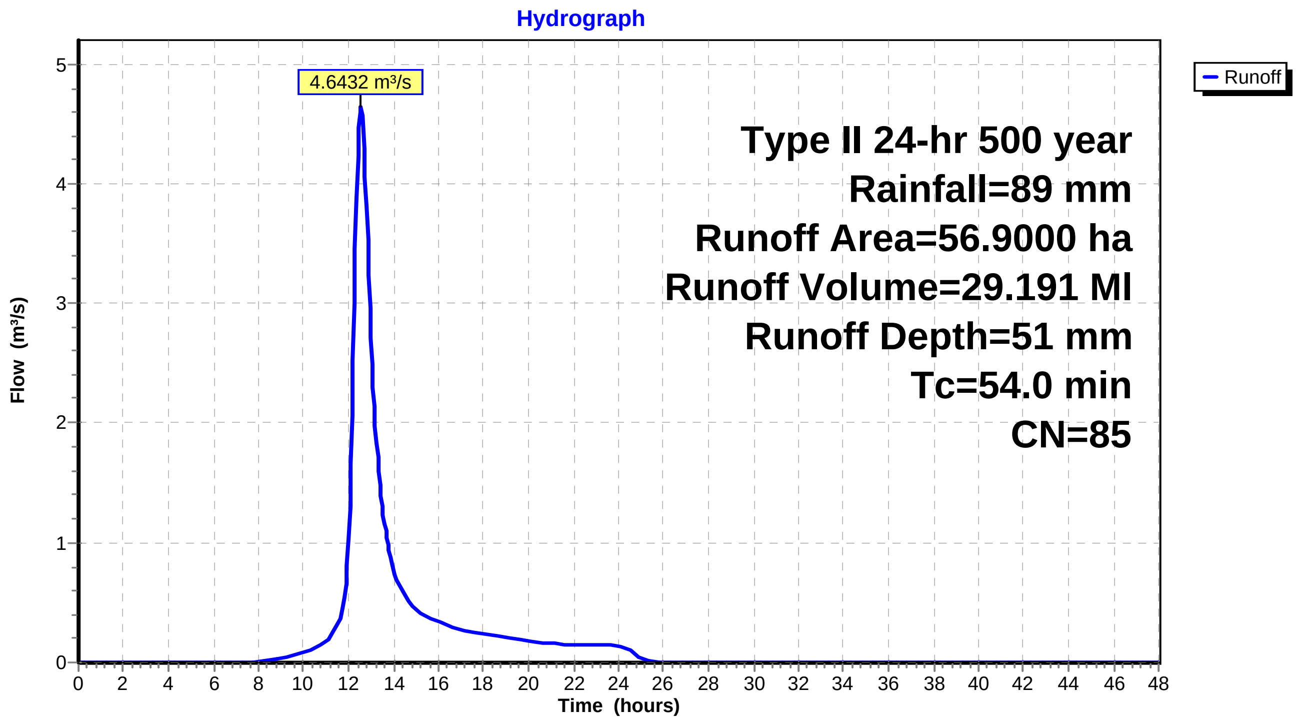
Runoff = 4.6432 m³/s @ 12.55 hrs, Volume= 29.191 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

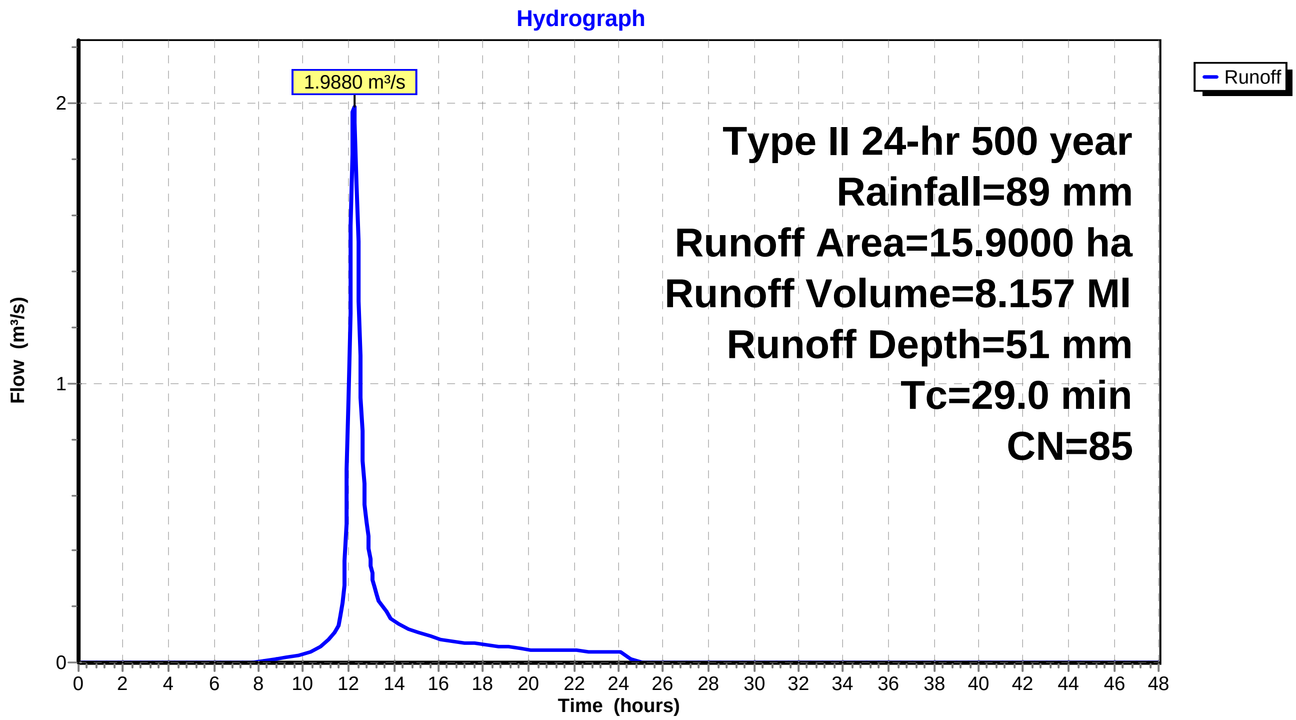
Runoff = 1.9880 m³/s @ 12.23 hrs, Volume= 8.157 Ml, Depth= 51 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

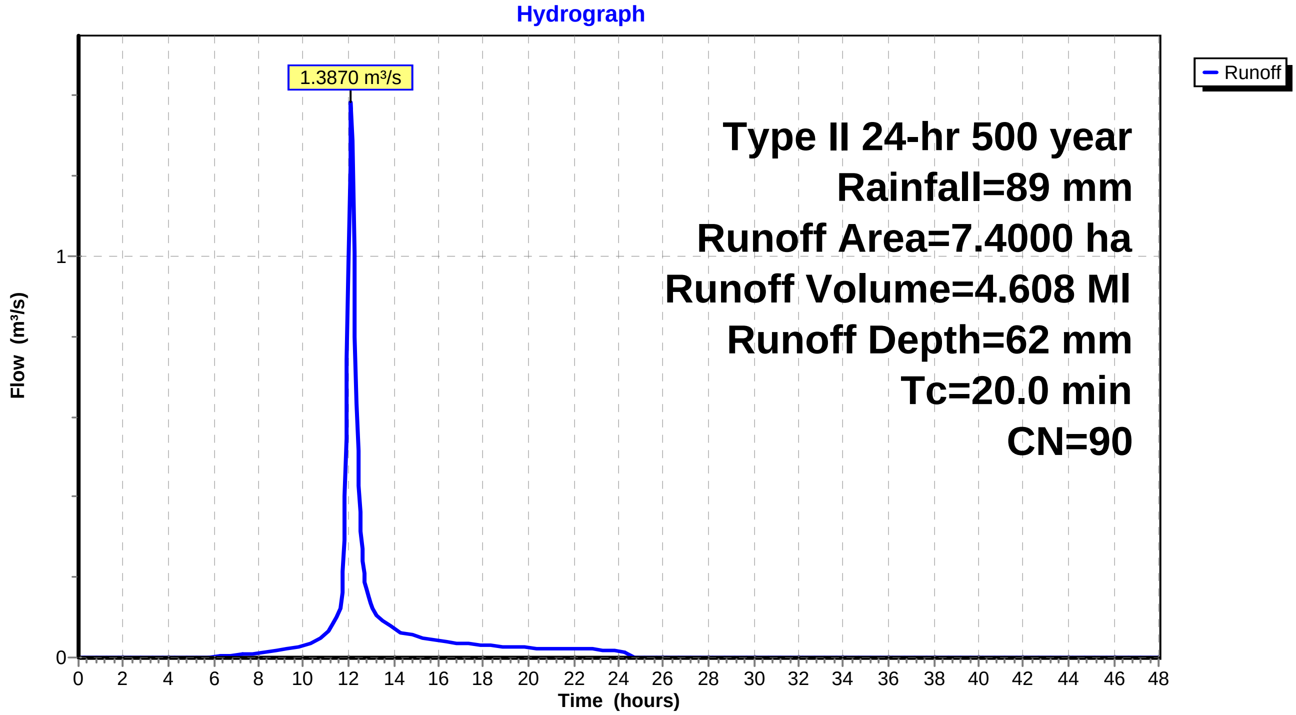
Runoff = 1.3870 m³/s @ 12.12 hrs, Volume= 4.608 Ml, Depth= 62 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 500 year Rainfall=89 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

Inflow Area = 978.0000 ha, Inflow Depth > 51 mm for 500 year event
Inflow = 27.1717 m³/s @ 14.47 hrs, Volume= 501.681 Ml
Outflow = 27.1598 m³/s @ 14.56 hrs, Volume= 501.665 Ml, Atten= 0%, Lag= 5.4 min

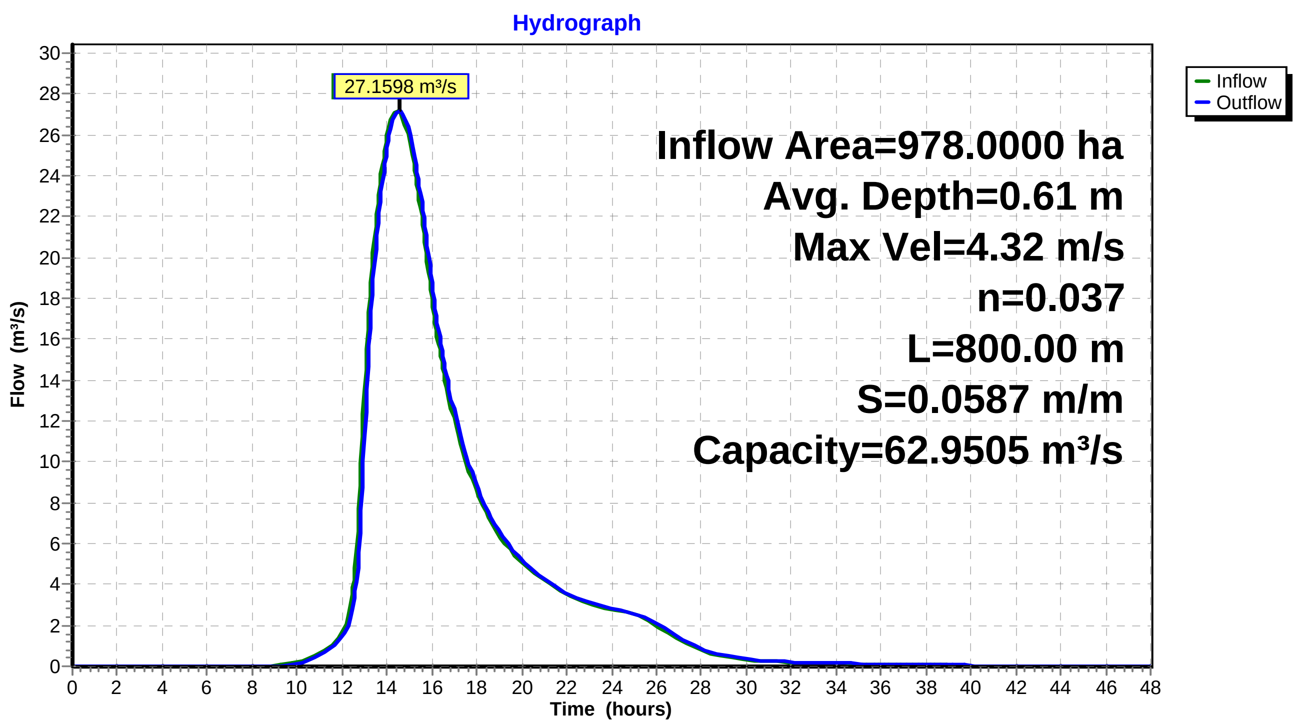
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.32 m/s, Min. Travel Time= 3.1 min
Avg. Velocity = 1.33 m/s, Avg. Travel Time= 10.0 min

Peak Storage= 5,031.2 m³ @ 14.51 hrs, Average Depth at Peak Storage= 0.61 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

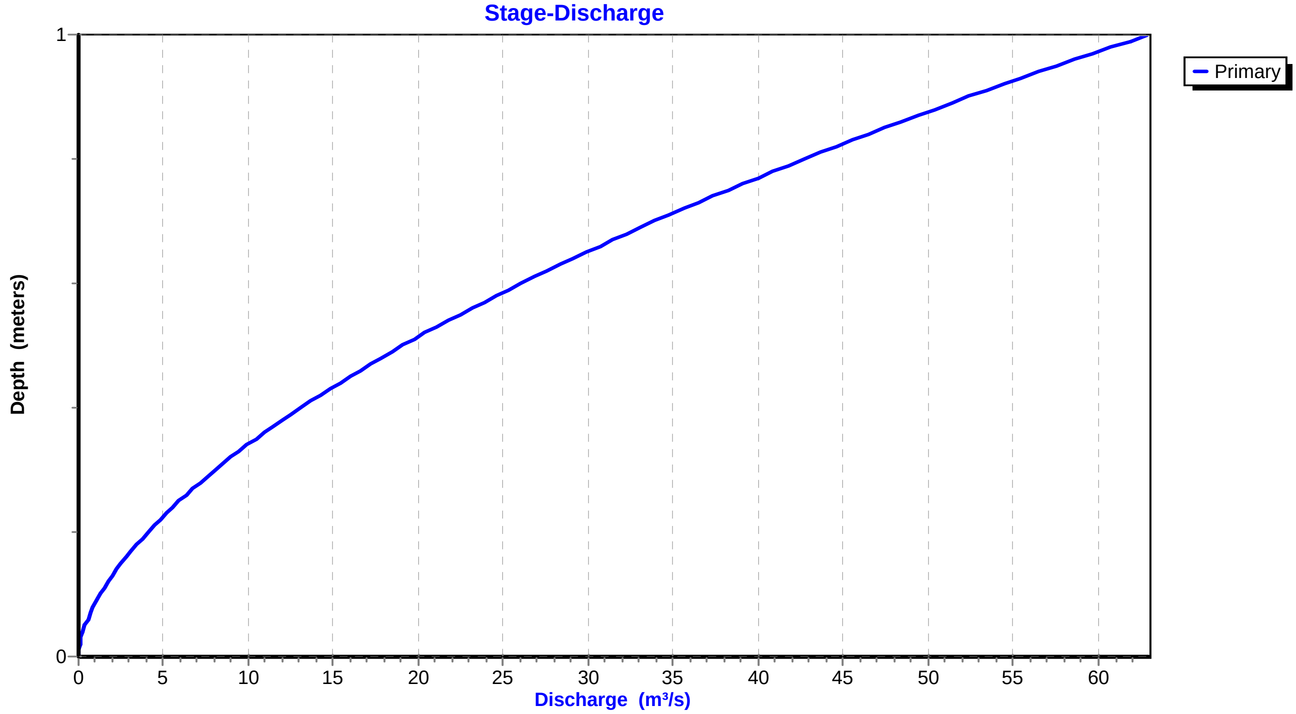
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

‡

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

Inflow Area = 1,117.0000 ha, Inflow Depth > 52 mm for 500 year event
Inflow = 29.7852 m³/s @ 14.47 hrs, Volume= 583.066 Ml
Outflow = 29.7325 m³/s @ 14.70 hrs, Volume= 582.994 Ml, Atten= 0%, Lag= 13.6 min

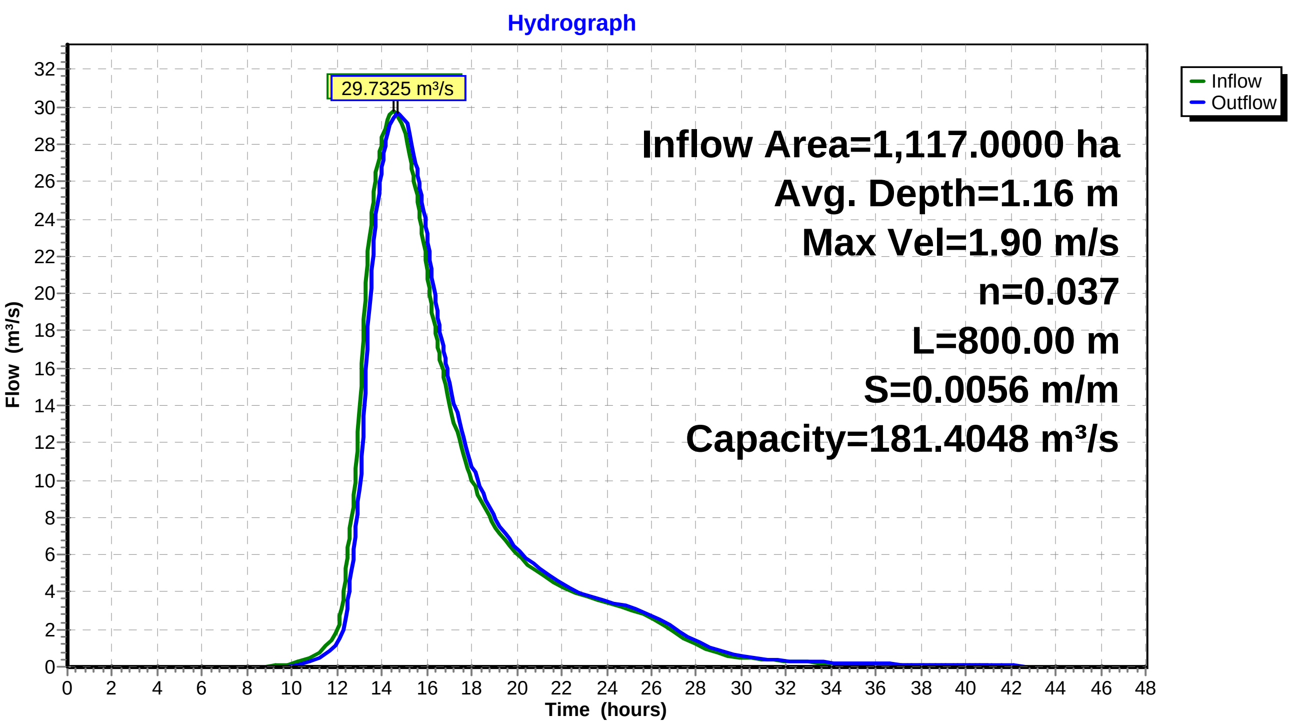
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 m/s, Min. Travel Time= 7.0 min
Avg. Velocity = 0.64 m/s, Avg. Travel Time= 20.9 min

Peak Storage= 12,551.7 m³ @ 14.58 hrs, Average Depth at Peak Storage= 1.16 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

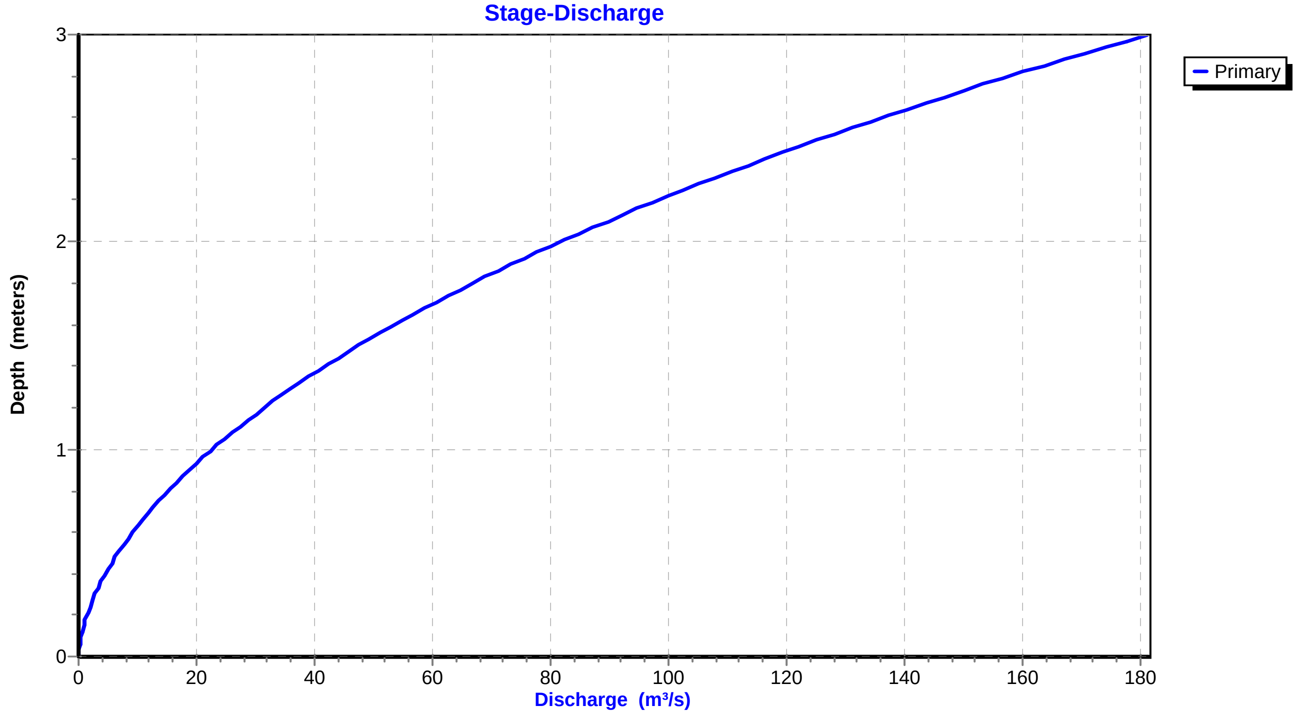
10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

‡

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



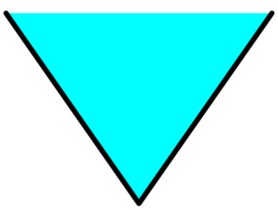
Reach 18R: Mid Haggart Creek

Inflow Area = 7,094.2280 ha, Inflow Depth > 51 mm for 500 year event
Inflow = 86.9149 m³/s @ 20.43 hrs, Volume= 3,641.644 Ml
Outflow = 86.9081 m³/s @ 20.48 hrs, Volume= 3,641.484 Ml, Atten= 0%, Lag= 2.9 min

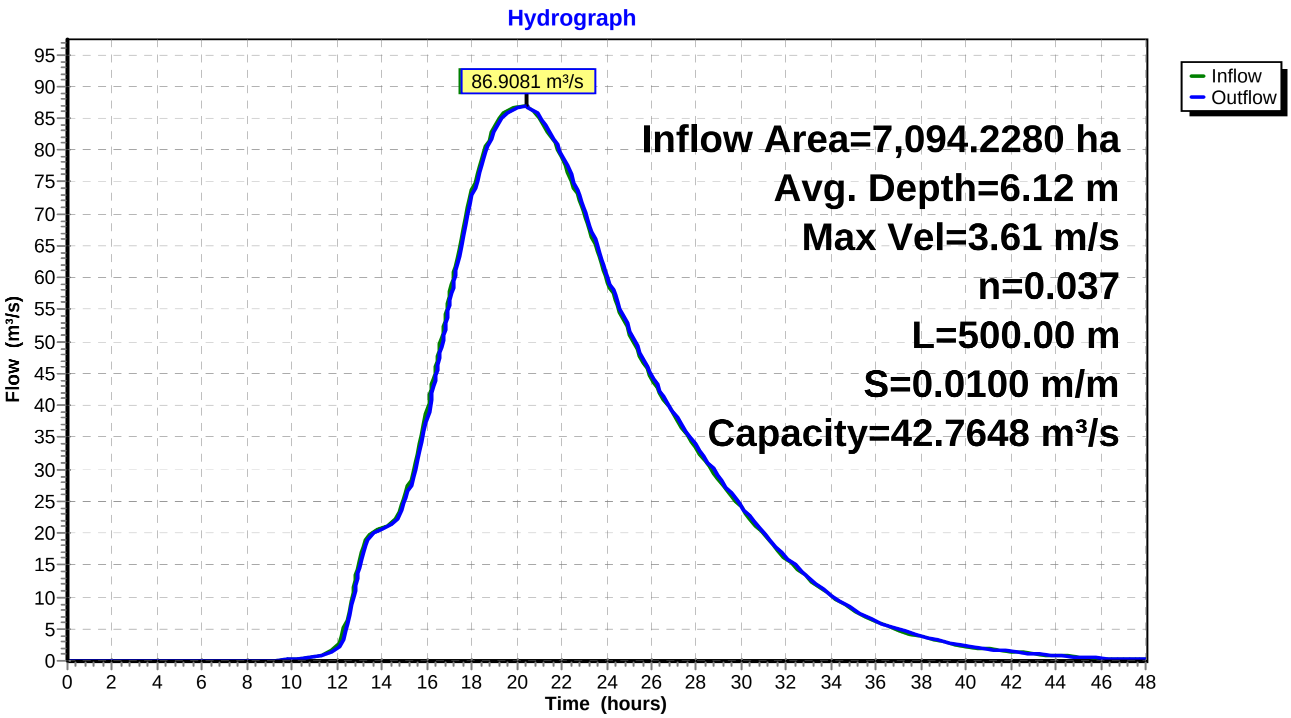
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 m/s, Min. Travel Time= 2.3 min
Avg. Velocity = 2.18 m/s, Avg. Travel Time= 3.8 min

Peak Storage= 12,039.4 m³ @ 20.45 hrs, Average Depth at Peak Storage= 6.12 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

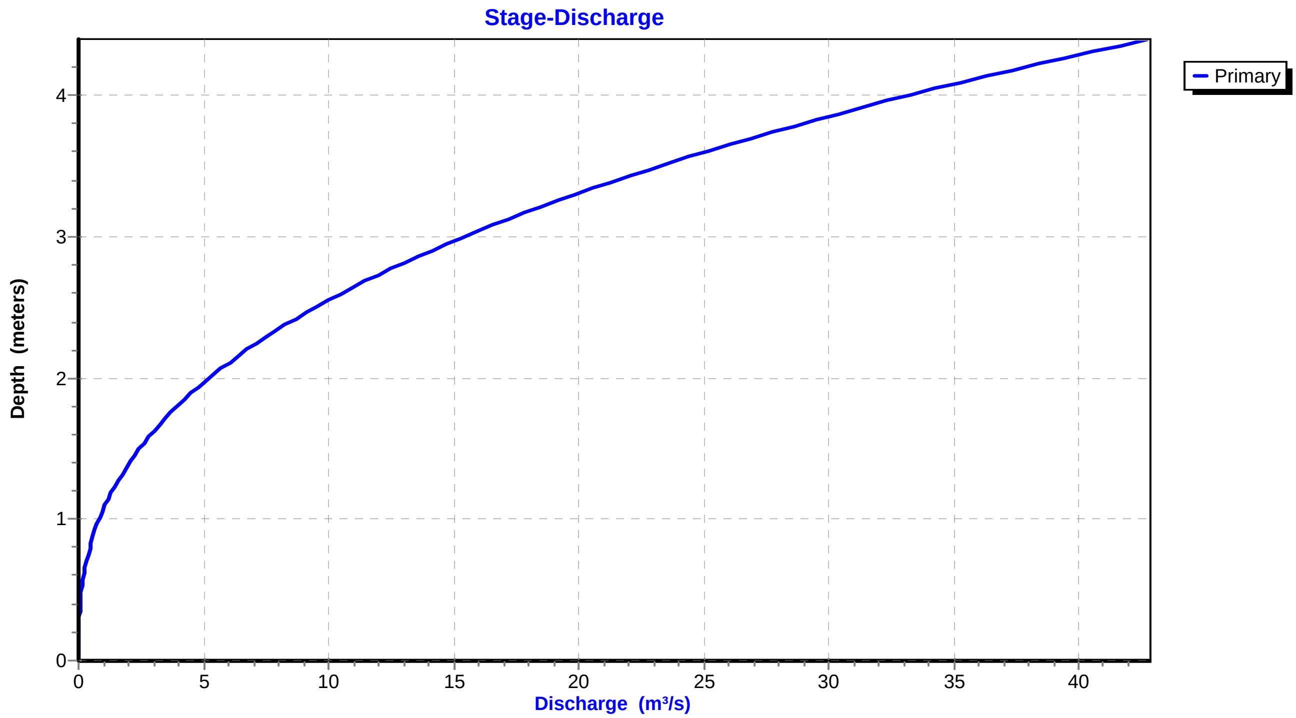
0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m



Reach 18R: Mid Haggart Creek



Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

Inflow Area = 8,485.2280 ha, Inflow Depth > 52 mm for 500 year event
Inflow = 94.1927 m³/s @ 19.93 hrs, Volume= 4,373.905 Ml
Outflow = 94.1916 m³/s @ 19.94 hrs, Volume= 4,373.863 Ml, Atten= 0%, Lag= 0.5 min

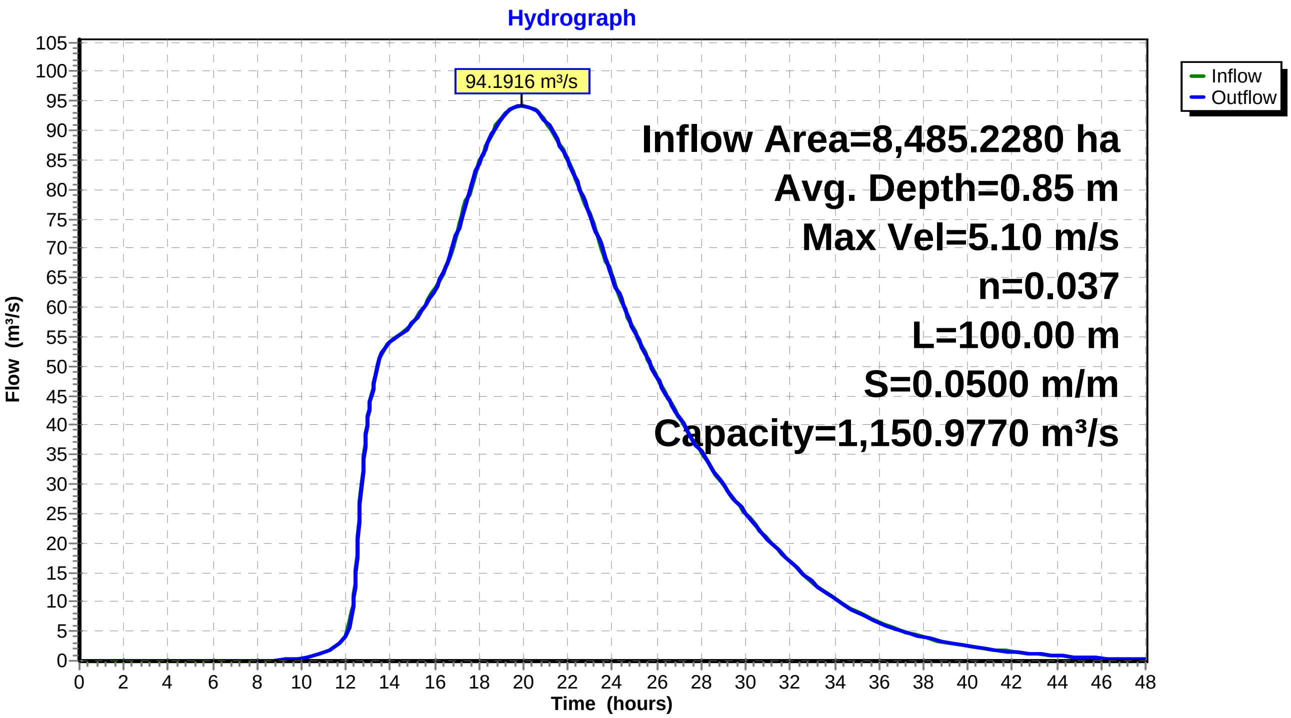
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.10 m/s, Min. Travel Time= 0.3 min
Avg. Velocity = 2.61 m/s, Avg. Travel Time= 0.6 min

Peak Storage= 1,846.1 m³ @ 19.93 hrs, Average Depth at Peak Storage= 0.85 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

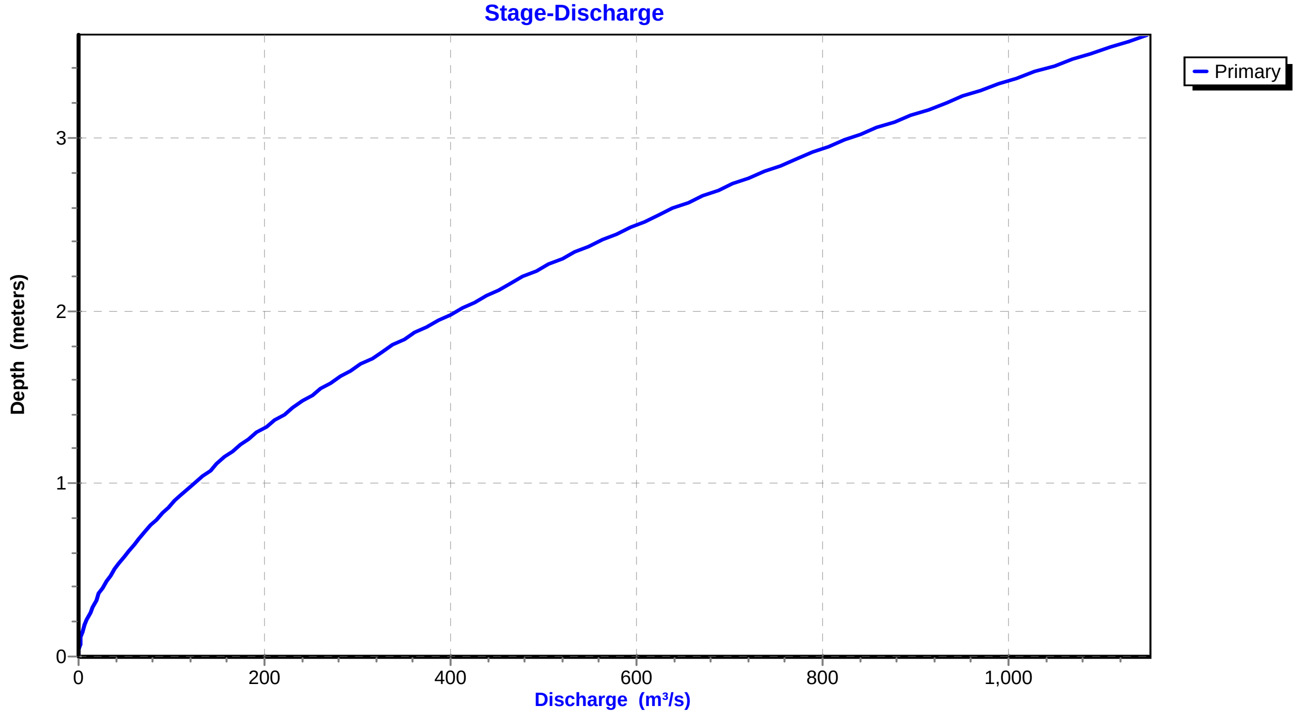
20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

‡

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 51 mm for 500 year event
Inflow = 27.5650 m³/s @ 14.55 hrs, Volume= 525.264 Ml
Outflow = 27.5485 m³/s @ 14.66 hrs, Volume= 525.234 Ml, Atten= 0%, Lag= 6.6 min

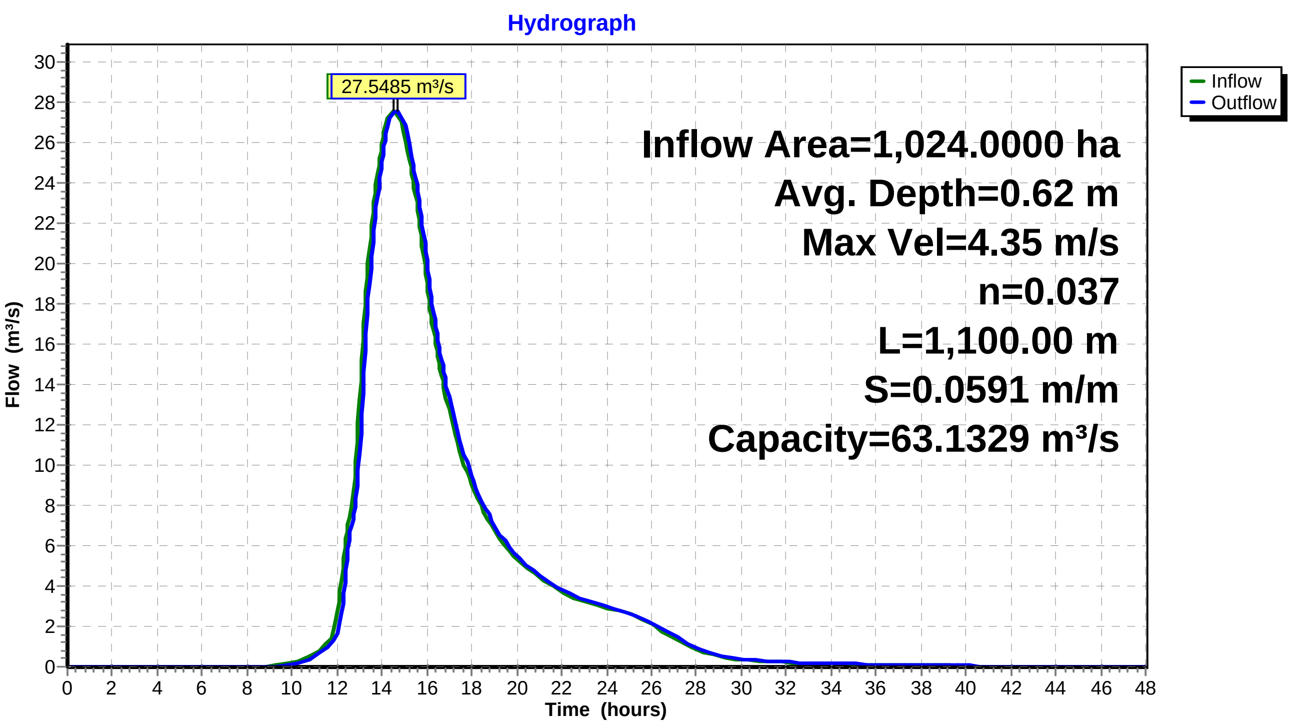
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.35 m/s, Min. Travel Time= 4.2 min
Avg. Velocity = 1.36 m/s, Avg. Travel Time= 13.4 min

Peak Storage= 6,969.8 m³ @ 14.59 hrs, Average Depth at Peak Storage= 0.62 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

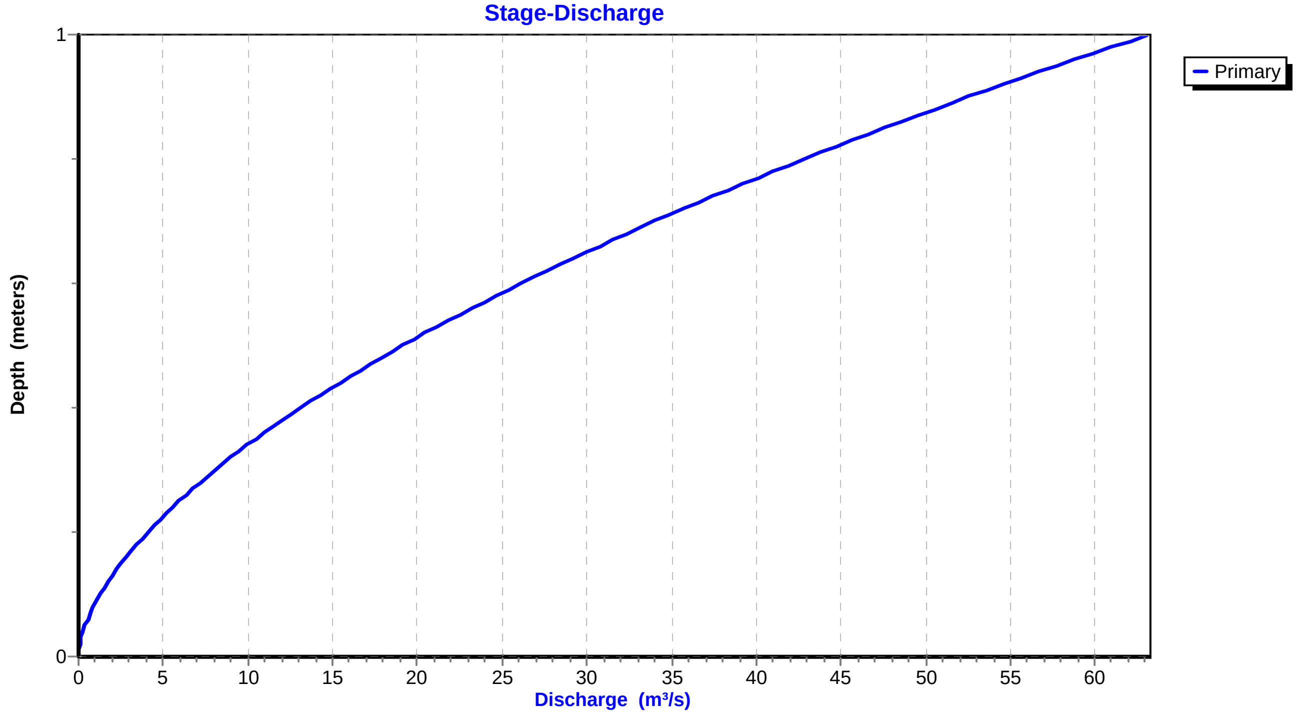
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



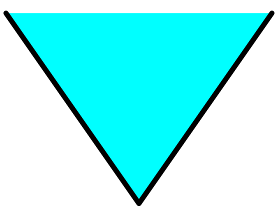
Reach 34R: Upper Haggart Creek

Inflow Area = 6,782.0000 ha, Inflow Depth > 51 mm for 500 year event
Inflow = 85.8166 m³/s @ 20.35 hrs, Volume= 3,481.874 Ml
Outflow = 85.7979 m³/s @ 20.44 hrs, Volume= 3,481.461 Ml, Atten= 0%, Lag= 5.6 min

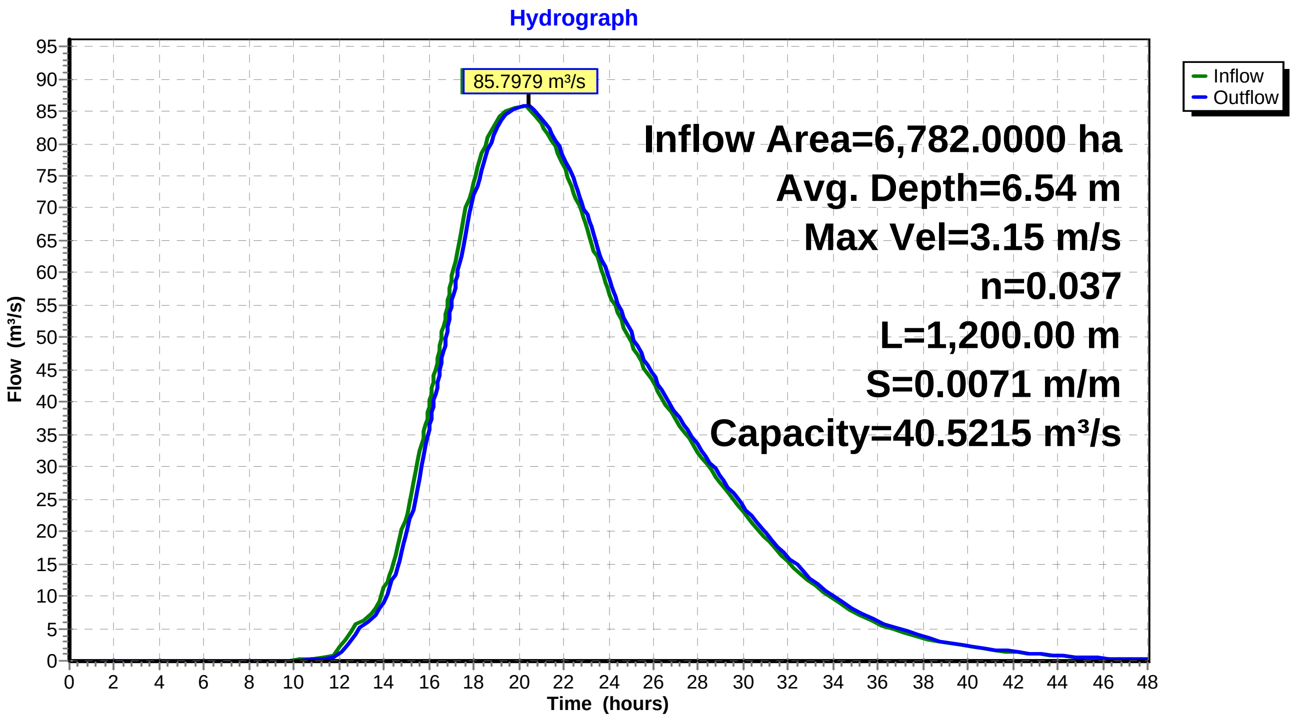
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.15 m/s, Min. Travel Time= 6.4 min
Avg. Velocity = 1.84 m/s, Avg. Travel Time= 10.9 min

Peak Storage= 32,719.9 m³ @ 20.34 hrs, Average Depth at Peak Storage= 6.54 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

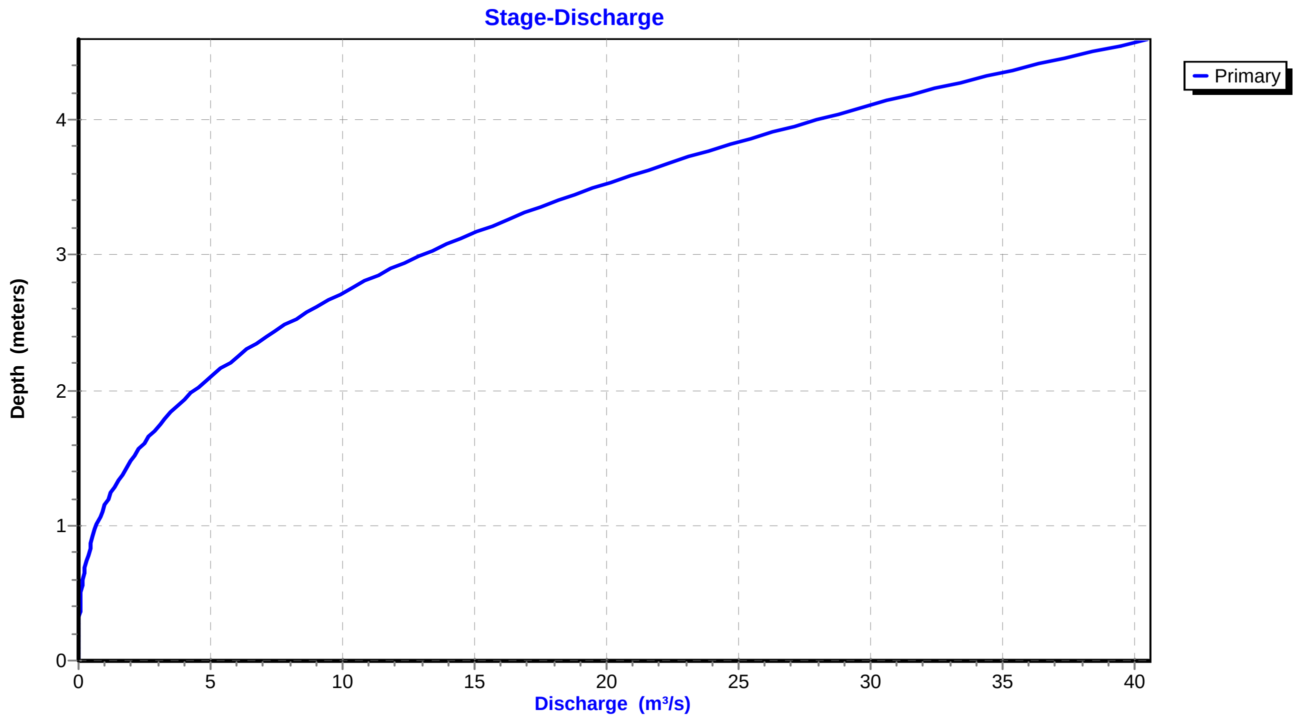
0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m



Reach 34R: Upper Haggart Creek



Reach 34R: Upper Haggart Creek



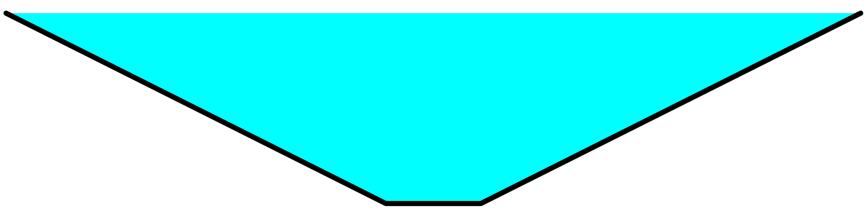
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 56 mm for 500 year event
Inflow = 11.7449 m³/s @ 12.86 hrs, Volume= 100.181 Ml
Outflow = 11.6424 m³/s @ 12.99 hrs, Volume= 100.175 Ml, Atten= 1%, Lag= 7.8 min

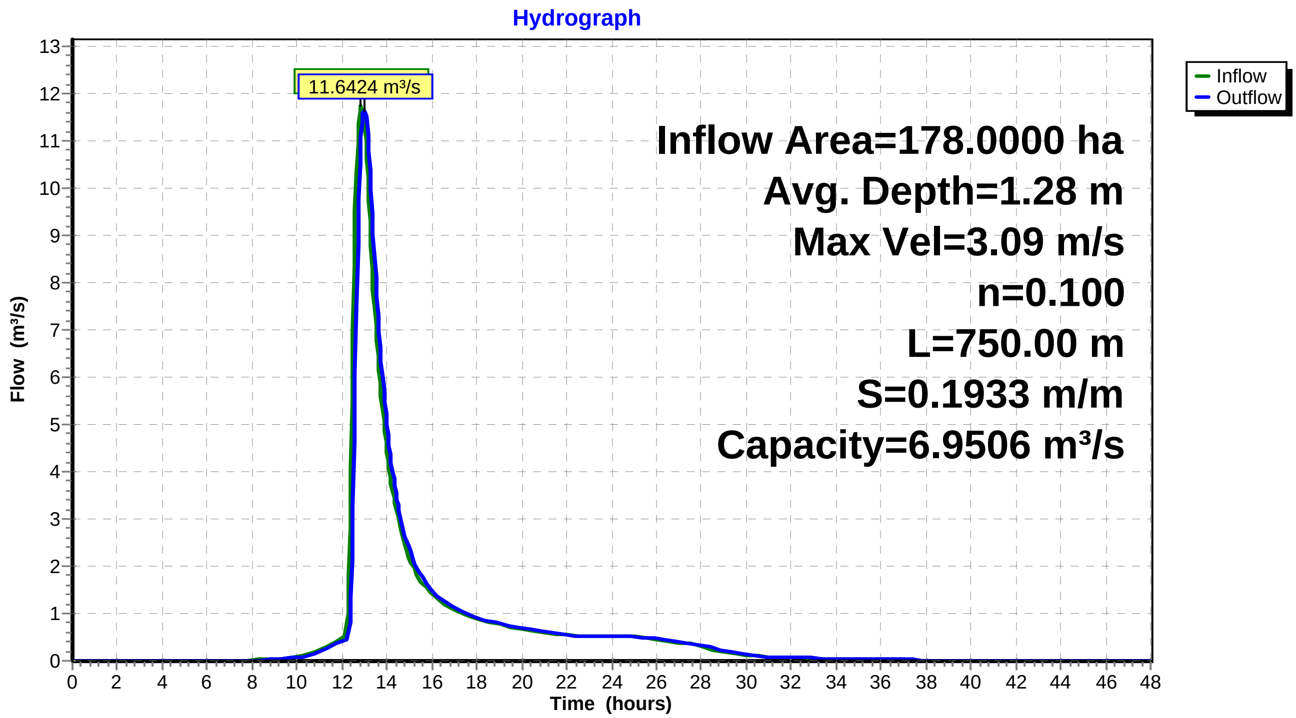
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.09 m/s, Min. Travel Time= 4.0 min
Avg. Velocity = 1.04 m/s, Avg. Travel Time= 12.1 min

Peak Storage= 2,830.2 m³ @ 12.92 hrs, Average Depth at Peak Storage= 1.28 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

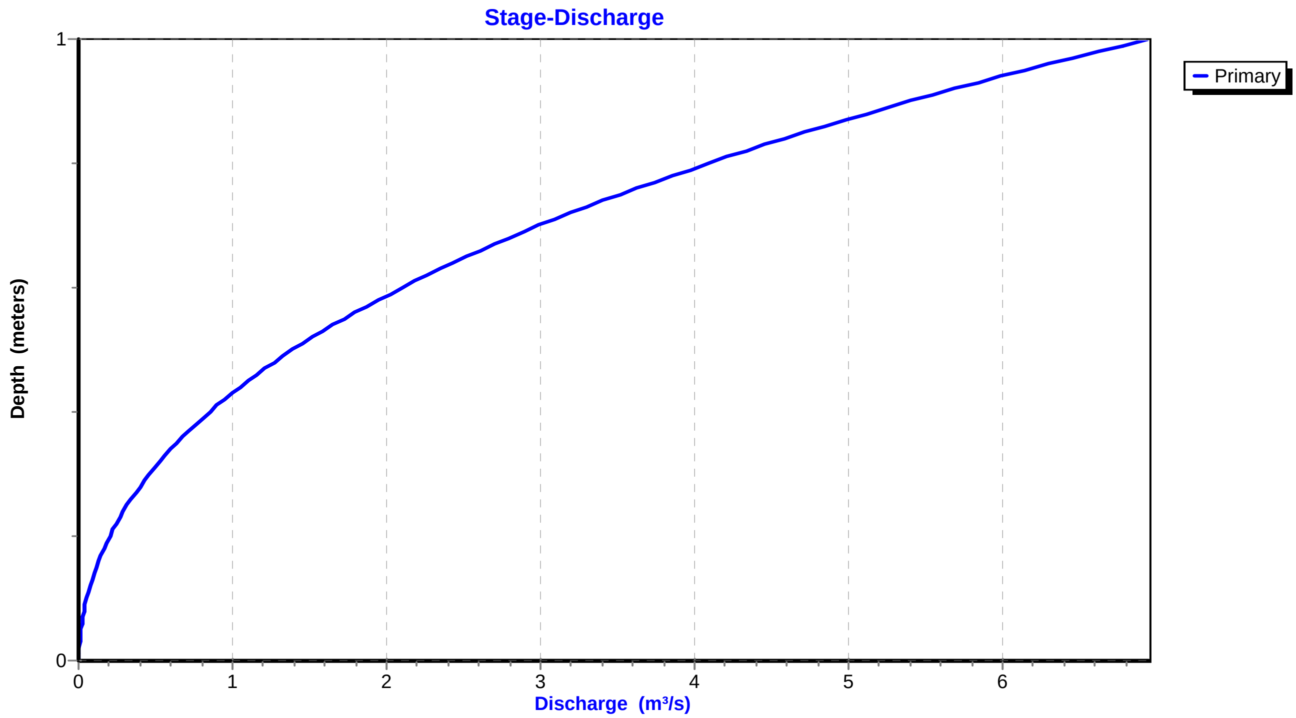
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 51 mm for 500 year event
Inflow = 7.7108 m³/s @ 12.89 hrs, Volume= 65.668 Ml
Outflow = 6.3583 m³/s @ 13.27 hrs, Volume= 65.604 Ml, Atten= 18%, Lag= 22.8 min
Primary = 0.3760 m³/s @ 13.20 hrs, Volume= 23.207 Ml
Secondary = 5.9823 m³/s @ 13.27 hrs, Volume= 42.397 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 918.304 m @ 13.27 hrs Surf.Area= 17,619.8 m² Storage= 37,551.6 m³ (17,110.4 m³ above start)

Plug-Flow detention time= 401.3 min calculated for 45.116 Ml (69% of inflow)
Center-of-Mass det. time= 174.4 min (1,063.1 - 888.7)

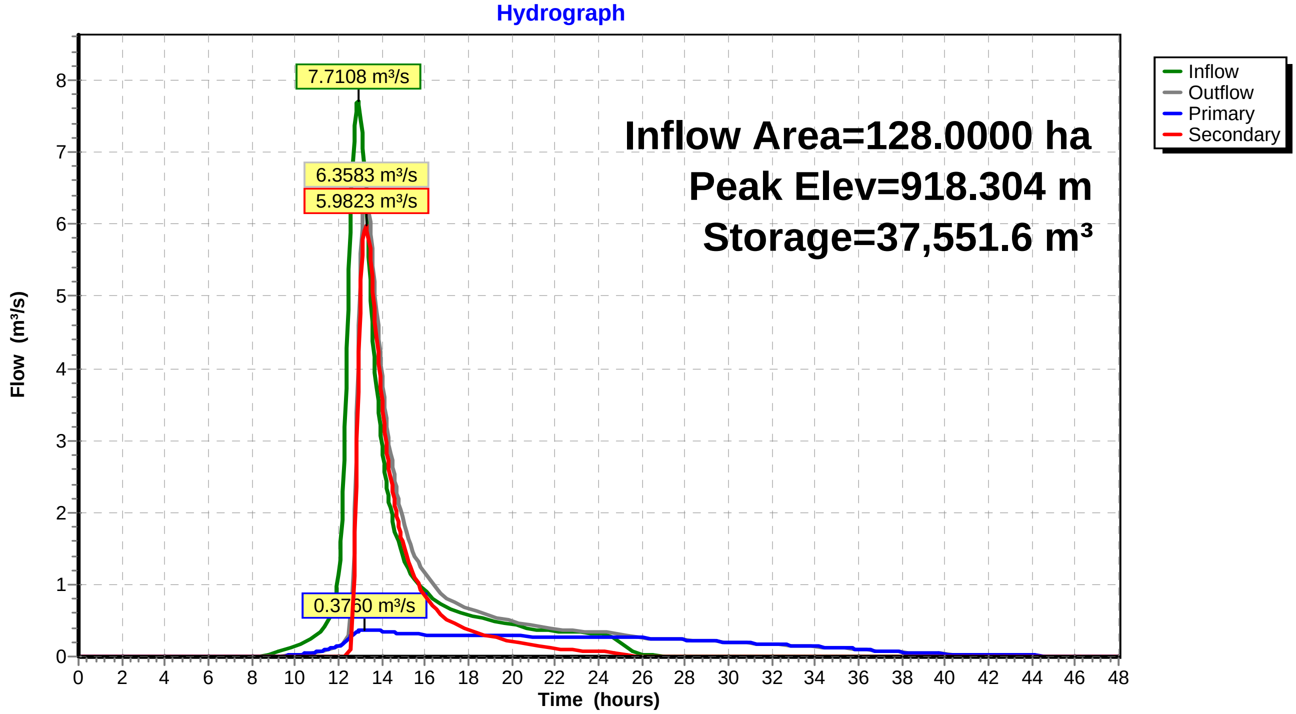
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

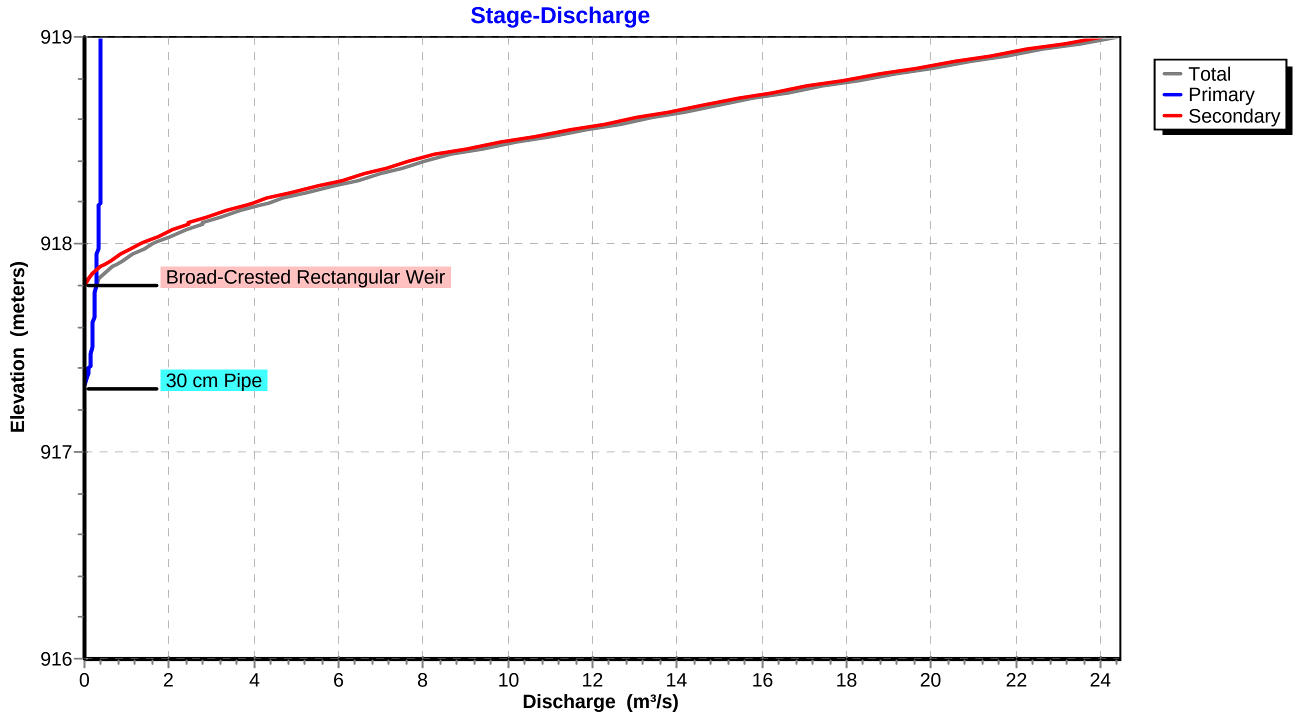
Primary OutFlow Max=0.3760 m³/s @ 13.20 hrs HW=918.301 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.3760 m³/s)

Secondary OutFlow Max=5.9747 m³/s @ 13.27 hrs HW=918.304 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 5.9747 m³/s @ 1.19 m/s)

Pond 23P: EP WRSA SCP



Pond 23P: EP WRSA SCP



Pond 24P: Lower Dublin North

Inflow Area = 39.0000 ha, Inflow Depth = 62 mm for 500 year event
Inflow = 4.3794 m³/s @ 12.42 hrs, Volume= 24.286 Ml
Outflow = 2.6964 m³/s @ 12.78 hrs, Volume= 24.224 Ml, Atten= 38%, Lag= 21.2 min
Primary = 0.1812 m³/s @ 12.78 hrs, Volume= 11.356 Ml
Secondary = 2.5152 m³/s @ 12.78 hrs, Volume= 12.868 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 791.432 m @ 12.78 hrs Surf.Area= 9,914.2 m² Storage= 17,283.7 m³ (8,798.4 m³ above start)

Plug-Flow detention time= 513.1 min calculated for 15.723 Ml (65% of inflow)
Center-of-Mass det. time= 240.9 min (1,077.4 - 836.5)

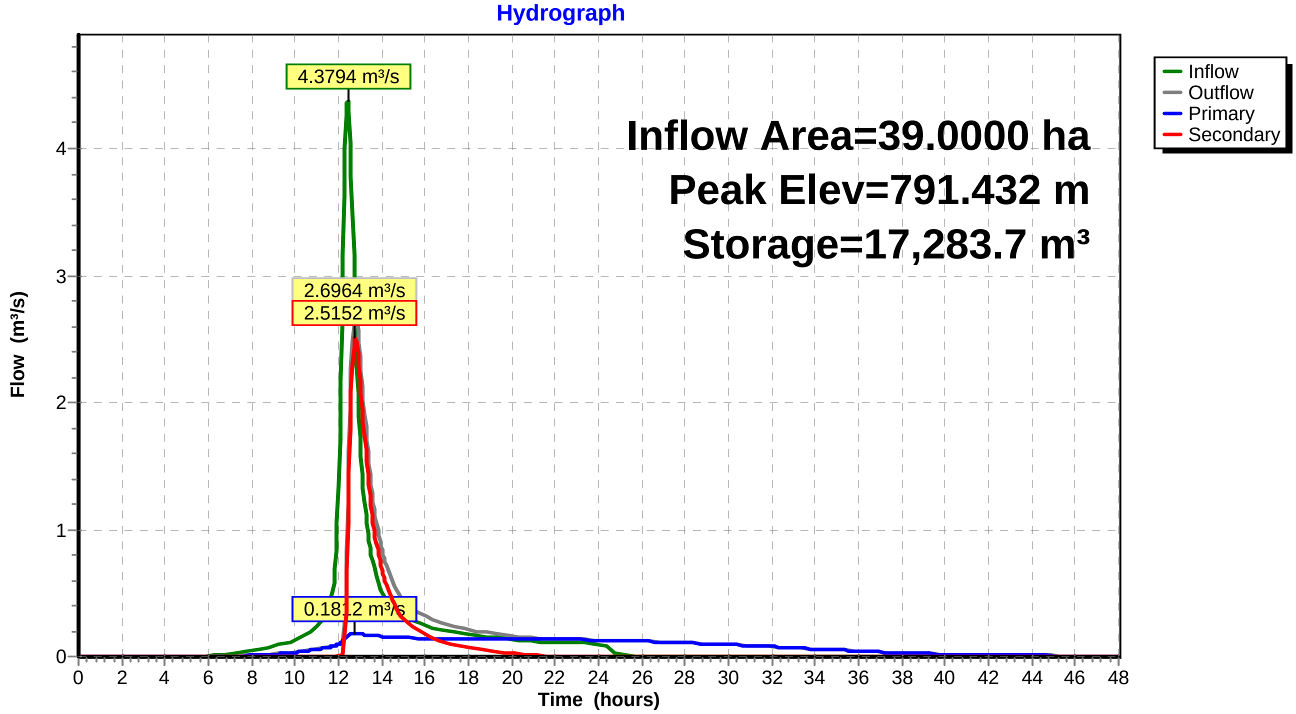
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

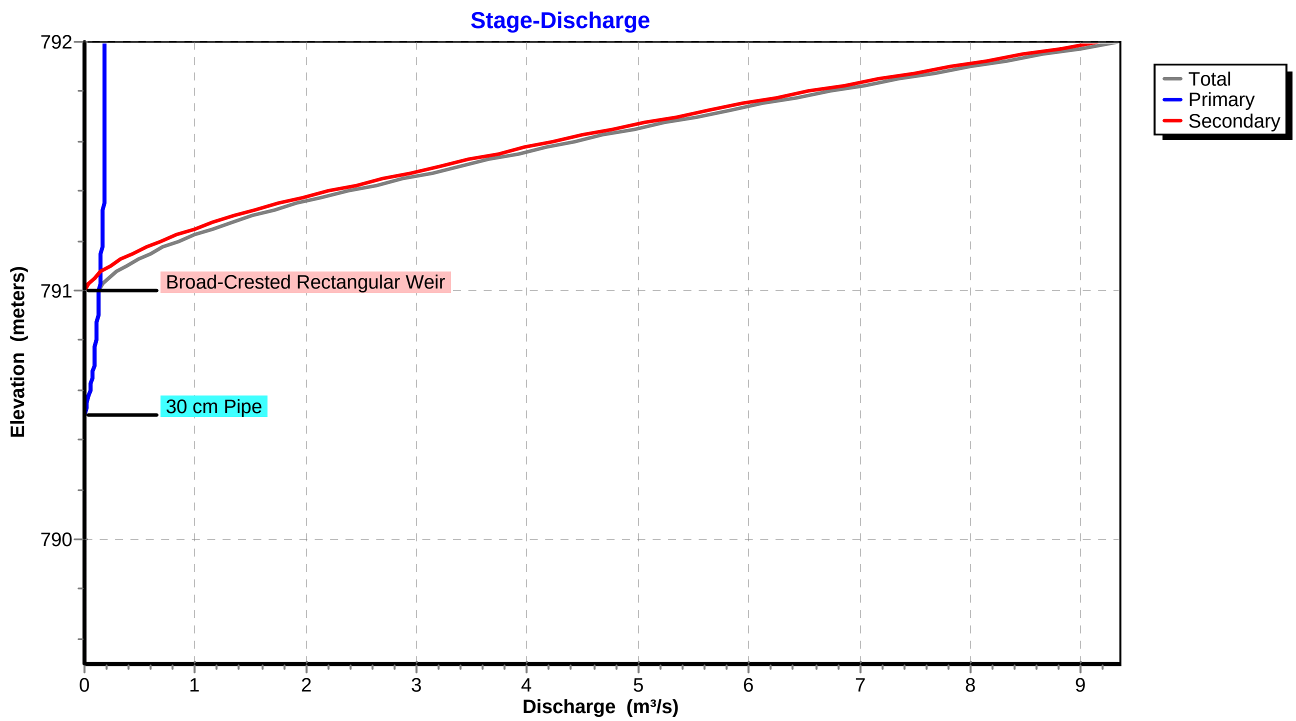
Primary OutFlow Max=0.1811 m³/s @ 12.78 hrs HW=791.431 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.1811 m³/s)

Secondary OutFlow Max=2.5097 m³/s @ 12.78 hrs HW=791.431 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.5097 m³/s @ 1.16 m/s)

Pond 24P: Lower Dublin North



Pond 24P: Lower Dublin North



Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 56 mm for 500 year event
Inflow = 12.8711 m³/s @ 12.66 hrs, Volume= 100.204 Ml
Outflow = 11.7449 m³/s @ 12.86 hrs, Volume= 100.181 Ml, Atten= 9%, Lag= 12.5 min
Primary = 0.7520 m³/s @ 12.65 hrs, Volume= 36.744 Ml
Secondary = 10.9929 m³/s @ 12.86 hrs, Volume= 63.436 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 903.581 m @ 12.86 hrs Surf.Area= 17,001.1 m² Storage= 53,596.0 m³ (17,700.2 m³ above start)

Plug-Flow detention time= 314.7 min calculated for 64.218 Ml (64% of inflow)
Center-of-Mass det. time= 95.2 min (963.4 - 868.2)

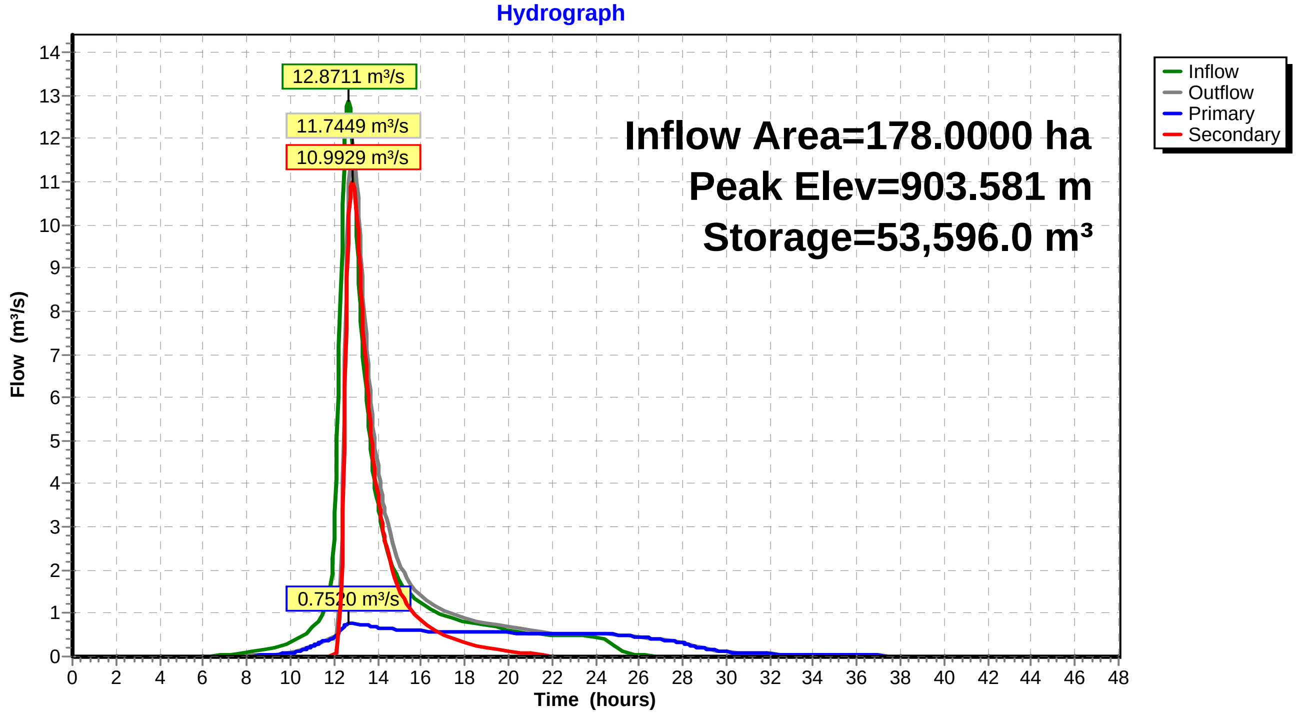
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

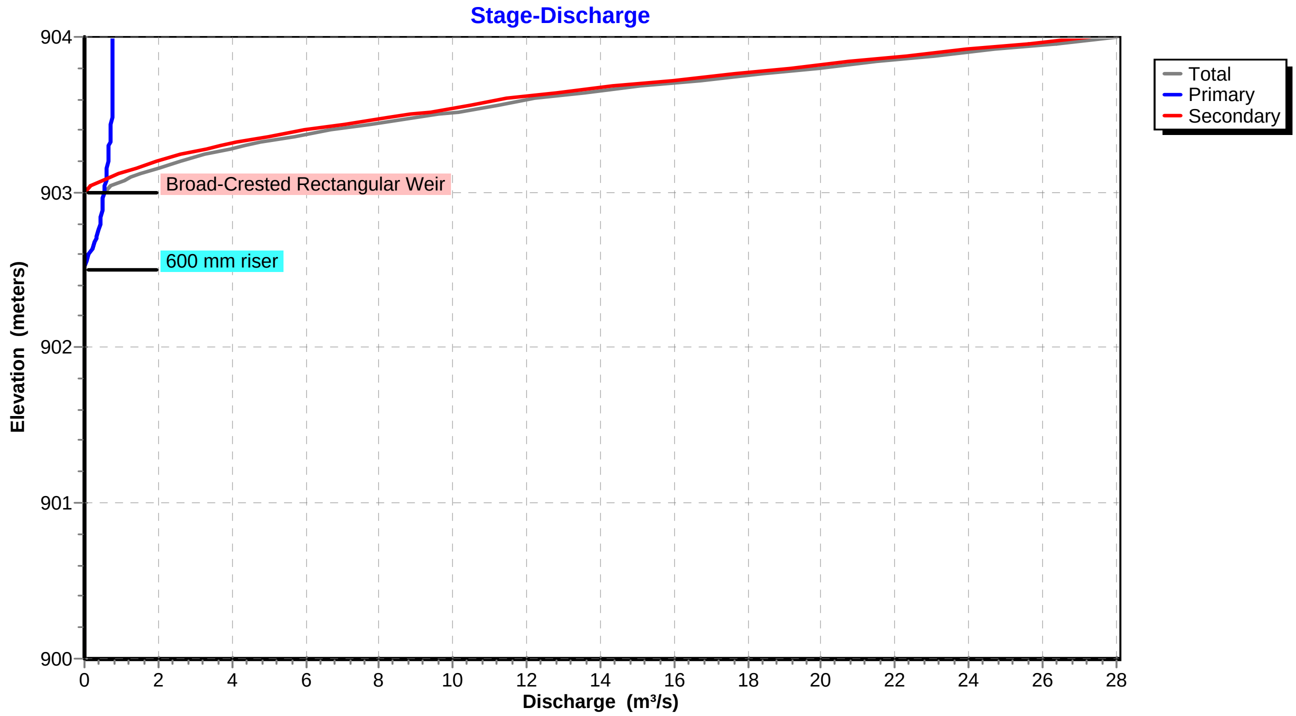
Primary OutFlow Max=0.7520 m³/s @ 12.65 hrs HW=903.528 m (Free Discharge)
↑—**1=600 mm riser** (Custom Controls 0.7520 m³/s)

Secondary OutFlow Max=10.9780 m³/s @ 12.86 hrs HW=903.581 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 10.9780 m³/s @ 1.26 m/s)

Pond 25P: Platinum Gulch SCP



Pond 25P: Platinum Gulch SCP



Pond 33P: Lower Dublin South Pond

Inflow Area = 93.0000 ha, Inflow Depth = 62 mm for 500 year event
Inflow = 7.6723 m³/s @ 12.72 hrs, Volume= 57.913 Ml
Outflow = 4.0714 m³/s @ 13.36 hrs, Volume= 57.832 Ml, Atten= 47%, Lag= 38.4 min
Primary = 0.7520 m³/s @ 13.10 hrs, Volume= 34.053 Ml
Secondary = 3.3194 m³/s @ 13.36 hrs, Volume= 23.779 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 832.541 m @ 13.36 hrs Surf.Area= 22,156.1 m² Storage= 51,919.9 m³ (22,314.4 m³ above start)

Plug-Flow detention time= 563.9 min calculated for 28.197 Ml (49% of inflow)
Center-of-Mass det. time= 197.1 min (1,055.8 - 858.7)

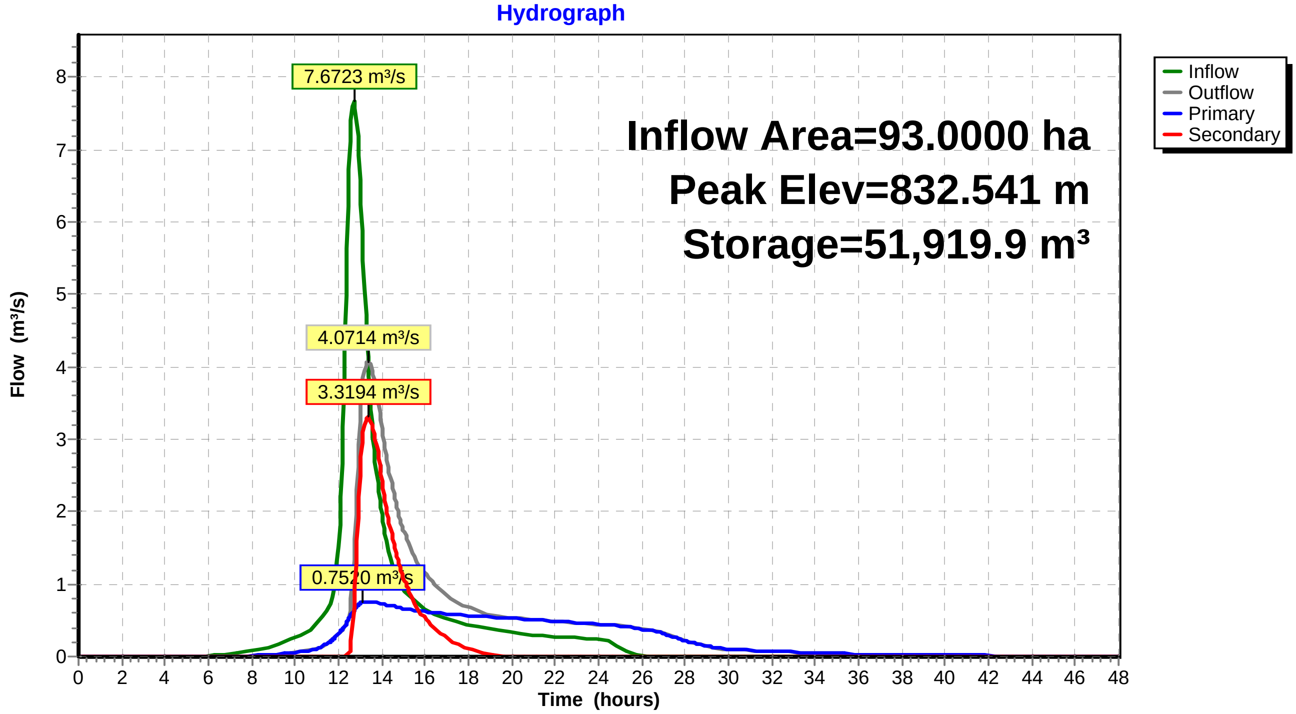
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

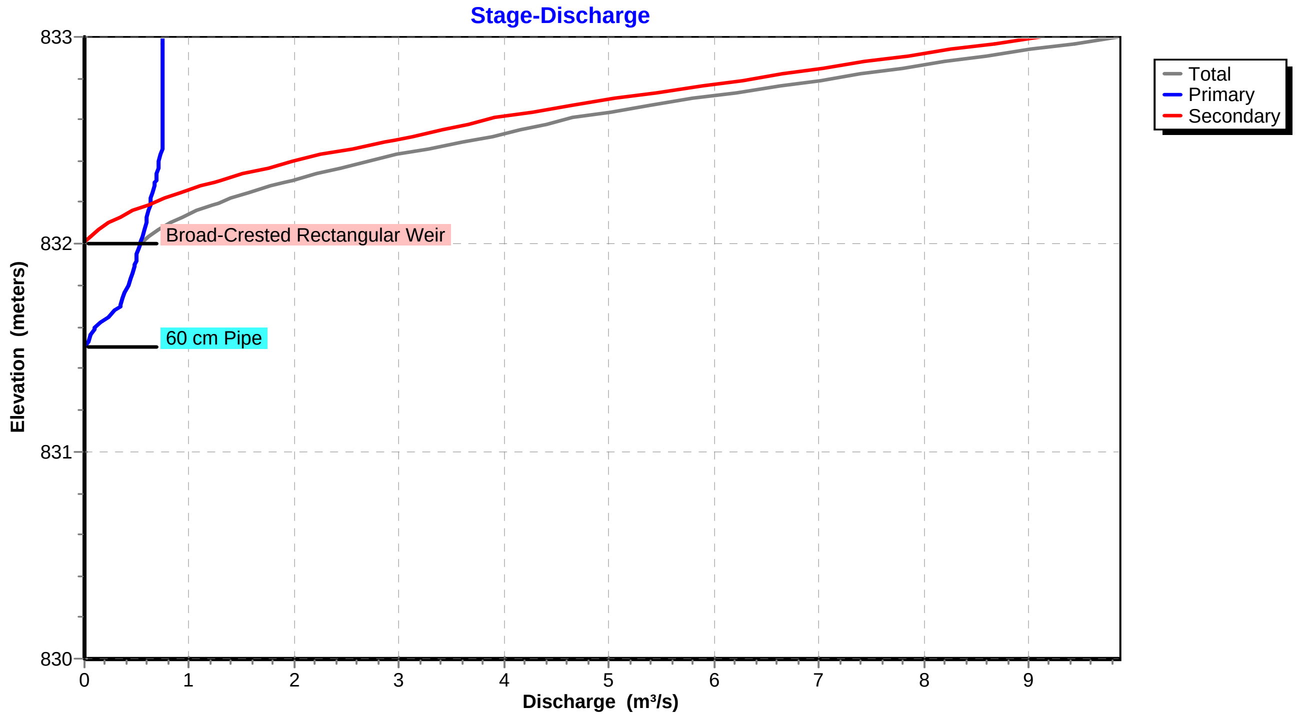
Primary OutFlow Max=0.7520 m³/s @ 13.10 hrs HW=832.500 m (Free Discharge)
↑—**1=60 cm Pipe** (Custom Controls 0.7520 m³/s)

Secondary OutFlow Max=3.3173 m³/s @ 13.36 hrs HW=832.540 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.3173 m³/s @ 1.23 m/s)

Pond 33P: Lower Dublin South Pond



Pond 33P: Lower Dublin South Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=2 mm
Tc=100.0 min CN=85 Runoff=0.0529 m³/s 0.894 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=5 mm
Tc=45.0 min CN=90 Runoff=0.2857 m³/s 1.888 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=2 mm
Tc=210.0 min CN=85 Runoff=0.7077 m³/s 18.531 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=2 mm
Tc=127.0 min CN=85 Runoff=0.3573 m³/s 6.807 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=5 mm
Tc=65.0 min CN=90 Runoff=0.4544 m³/s 3.921 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=2 mm
Tc=81.0 min CN=85 Runoff=0.1906 m³/s 2.791 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=2 mm
Tc=187.0 min CN=85 Runoff=0.5959 m³/s 14.672 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and c Runoff Area=93.0000 ha Runoff Depth=5 mm
Tc=69.0 min CN=90 Runoff=0.4983 m³/s 4.501 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>2 mm
Tc=591.0 min CN=85 Runoff=3.1569 m³/s 146.568 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=2 mm
Tc=47.0 min CN=85 Runoff=0.0886 m³/s 0.933 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=2 mm
Tc=54.0 min CN=85 Runoff=0.1064 m³/s 1.221 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=2 mm
Tc=49.0 min CN=85 Runoff=0.0926 m³/s 1.003 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=2 mm
Tc=71.0 min CN=85 Runoff=0.1538 m³/s 2.093 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=2 mm
Tc=26.0 min CN=85 Runoff=0.0392 m³/s 0.283 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=2 mm
Tc=54.0 min CN=85 Runoff=0.1081 m³/s 1.240 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=2 mm
Tc=29.0 min CN=85 Runoff=0.0446 m³/s 0.347 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=5 mm
Tc=20.0 min CN=90 Runoff=0.0959 m³/s 0.358 Ml

Reach 14R: Upper DG Diversion Cha Avg. Depth=0.07 m Max Vel=1.14 m/s Inflow=0.7728 m³/s 21.320 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=0.7714 m³/s 21.320 Ml

Reach 16R: Eagle Creek Avg. Depth=0.15 m Max Vel=0.56 m/s Inflow=0.8881 m³/s 26.806 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=0.8785 m³/s 26.798 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=1.68 m Max Vel=1.66 m/s Inflow=3.2598 m³/s 155.470 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=3.2592 m³/s 155.441 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.12 m Max Vel=1.51 m/s Inflow=3.8013 m³/s 190.360 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=3.8013 m³/s 190.355 Ml

Reach 33R: Lower DG Diversion Cha Avg. Depth=0.07 m Max Vel=1.15 m/s Inflow=0.7936 m³/s 22.322 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=0.7901 m³/s 22.322 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=1.77 m Max Vel=1.45 m/s Inflow=3.1867 m³/s 148.736 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=3.1814 m³/s 148.663 Ml

Reach 35R: Platinum Gulch Channel Avg. Depth=0.19 m Max Vel=1.09 m/s Inflow=0.1846 m³/s 6.031 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=0.1840 m³/s 6.029 Ml

Pond 23P: EP WRSA SCP Peak Elev=917.356 m Storage=21,360.3 m³ Inflow=0.1906 m³/s 2.791 Ml
Primary=0.0658 m³/s 2.789 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0658 m³/s 2.789 Ml

Pond 24P: Lower Dublin North Peak Elev=790.591 m Storage=9,302.9 m³ Inflow=0.2857 m³/s 1.888 Ml
Primary=0.0471 m³/s 1.885 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0471 m³/s 1.885 Ml

Pond 25P: Platinum Gulch SCP Peak Elev=902.635 m Storage=38,032.7 m³ Inflow=0.5915 m³/s 6.035 Ml
Primary=0.1846 m³/s 6.031 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.1846 m³/s 6.031 Ml

Pond 33P: Lower Dublin South Po Peak Elev=831.597 m Storage=31,620.8 m³ Inflow=0.4983 m³/s 4.501 Ml
Primary=0.0998 m³/s 4.484 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0998 m³/s 4.484 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 208.050 Ml Average Runoff Depth = 2 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

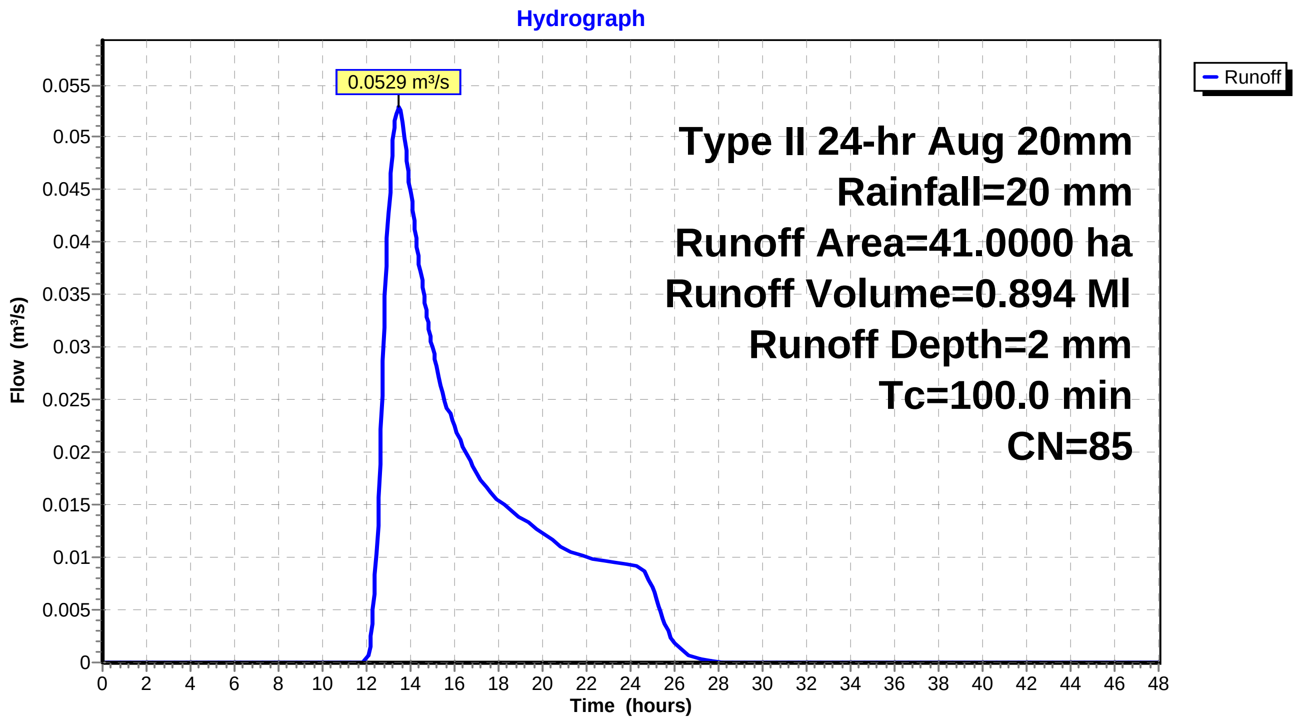
Runoff = 0.0529 m³/s @ 13.47 hrs, Volume= 0.894 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

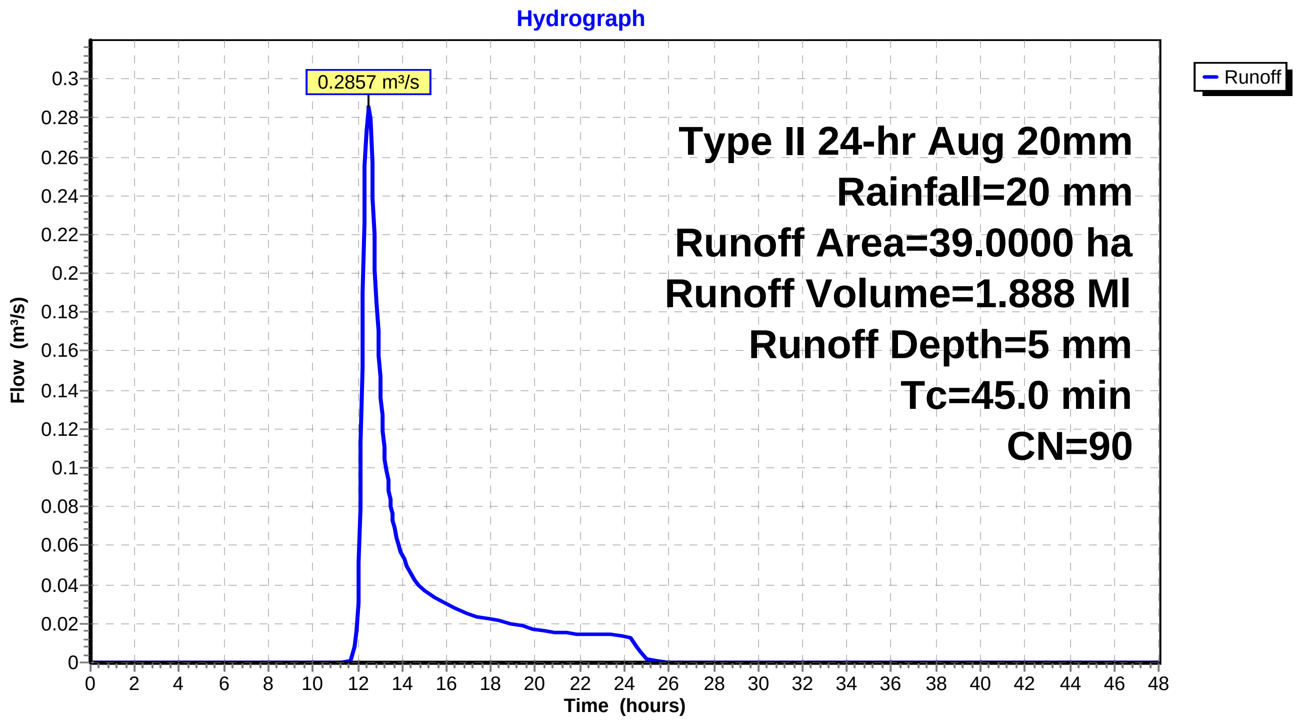
Runoff = 0.2857 m³/s @ 12.49 hrs, Volume= 1.888 Ml, Depth= 5 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

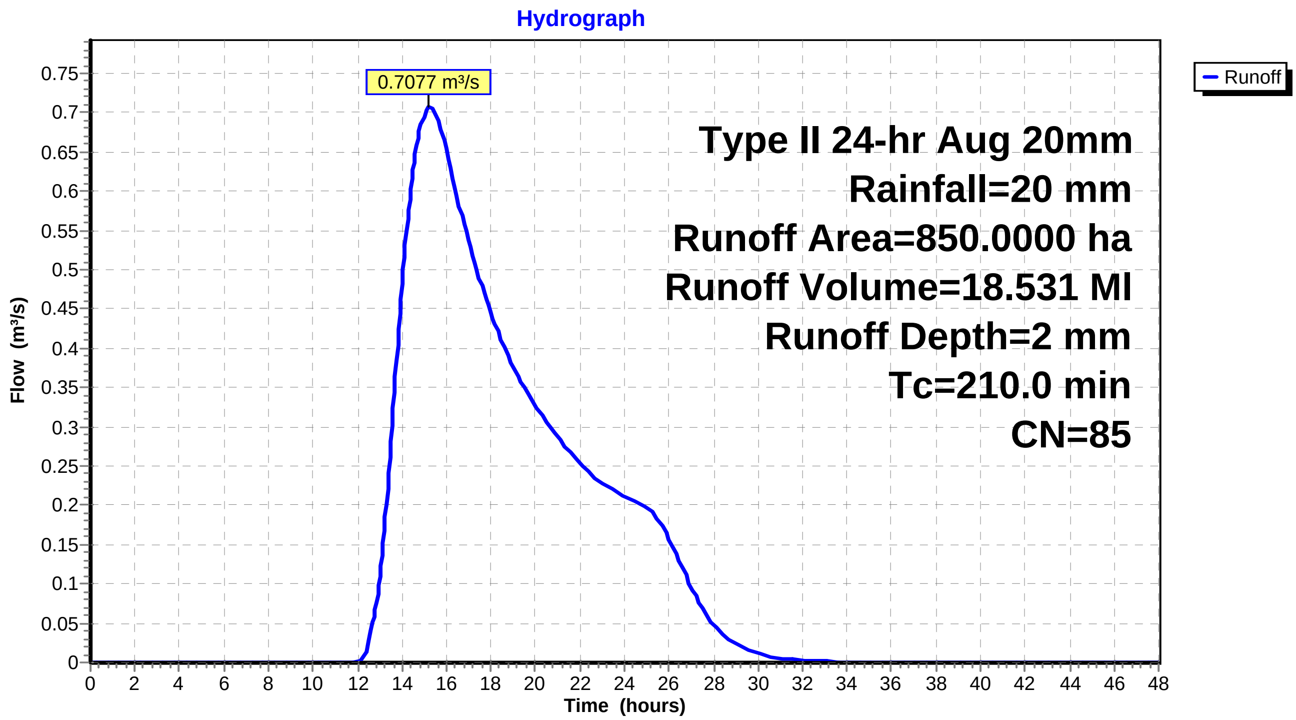
Runoff = 0.7077 m³/s @ 15.20 hrs, Volume= 18.531 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

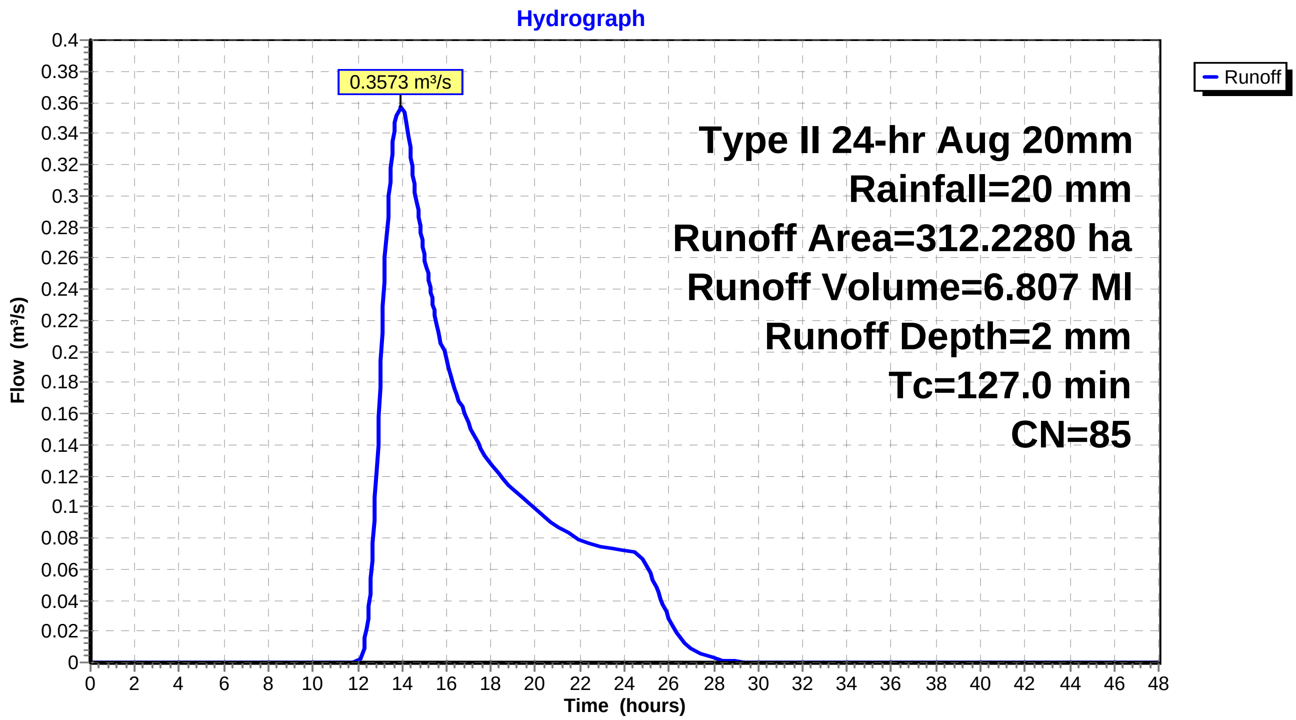
Runoff = 0.3573 m³/s @ 13.96 hrs, Volume= 6.807 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

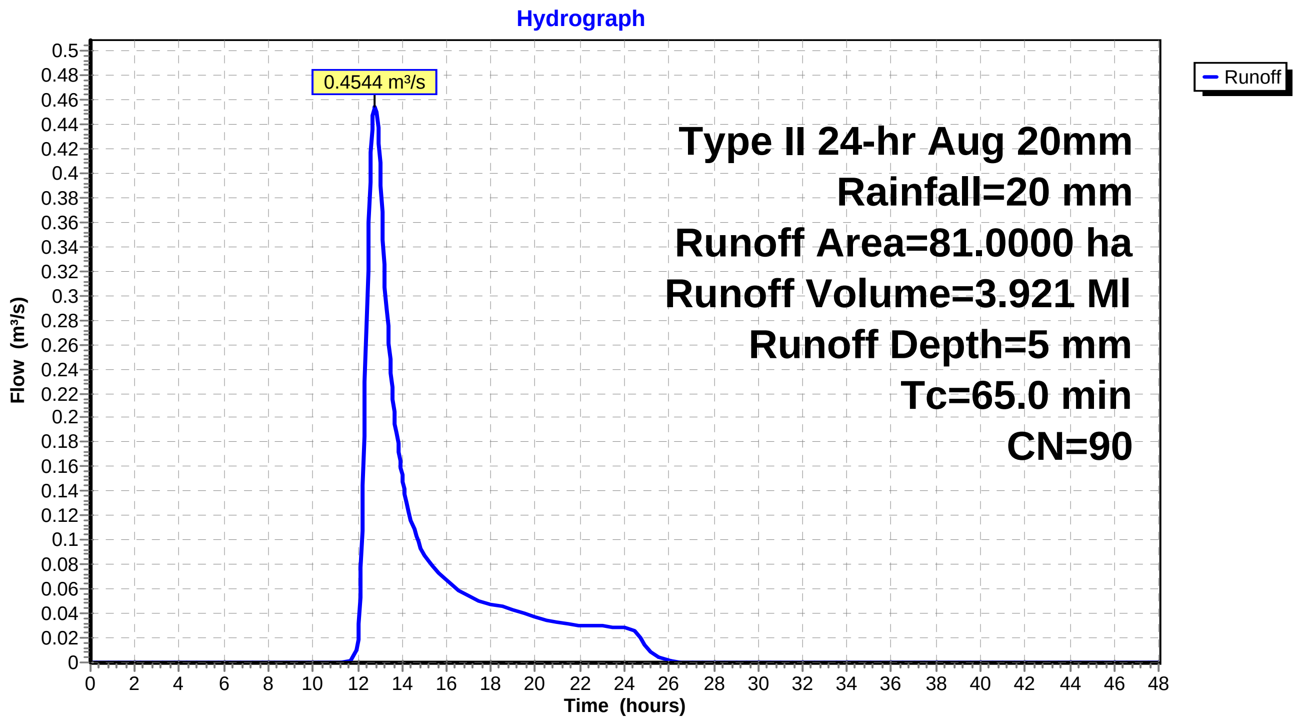
Runoff = 0.4544 m³/s @ 12.78 hrs, Volume= 3.921 Ml, Depth= 5 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

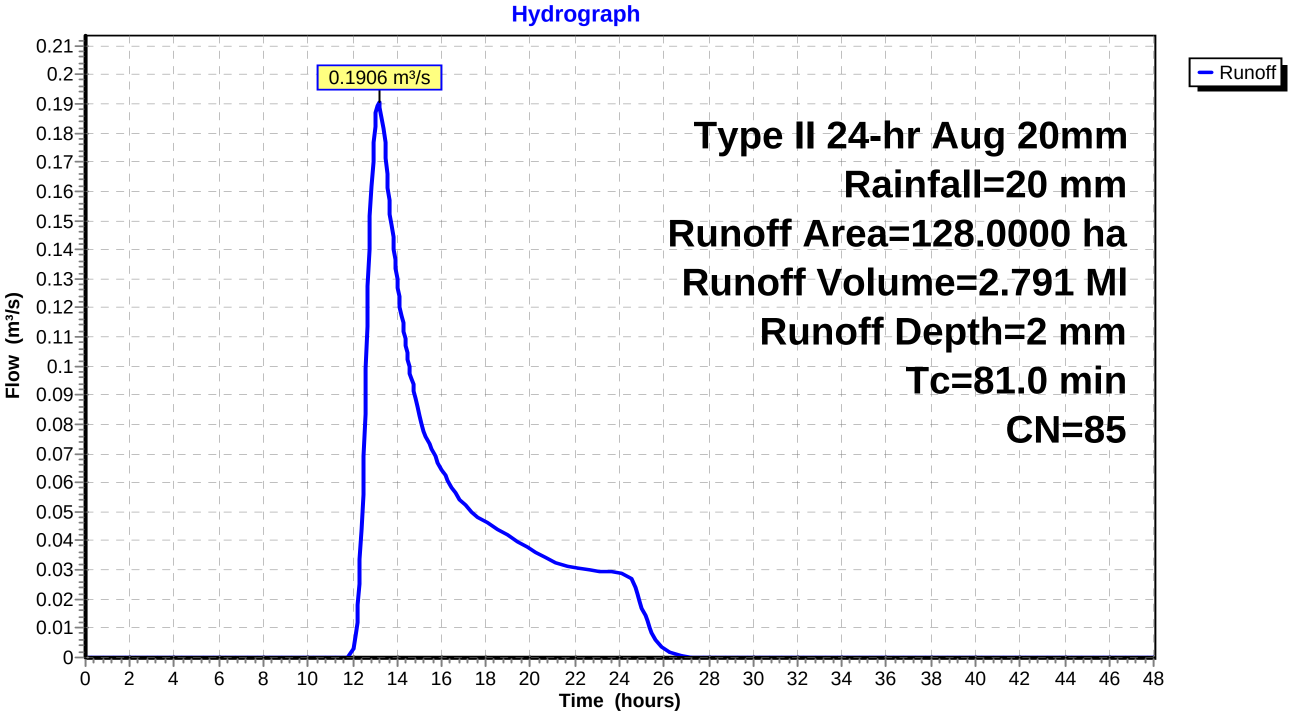
Runoff = 0.1906 m³/s @ 13.19 hrs, Volume= 2.791 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

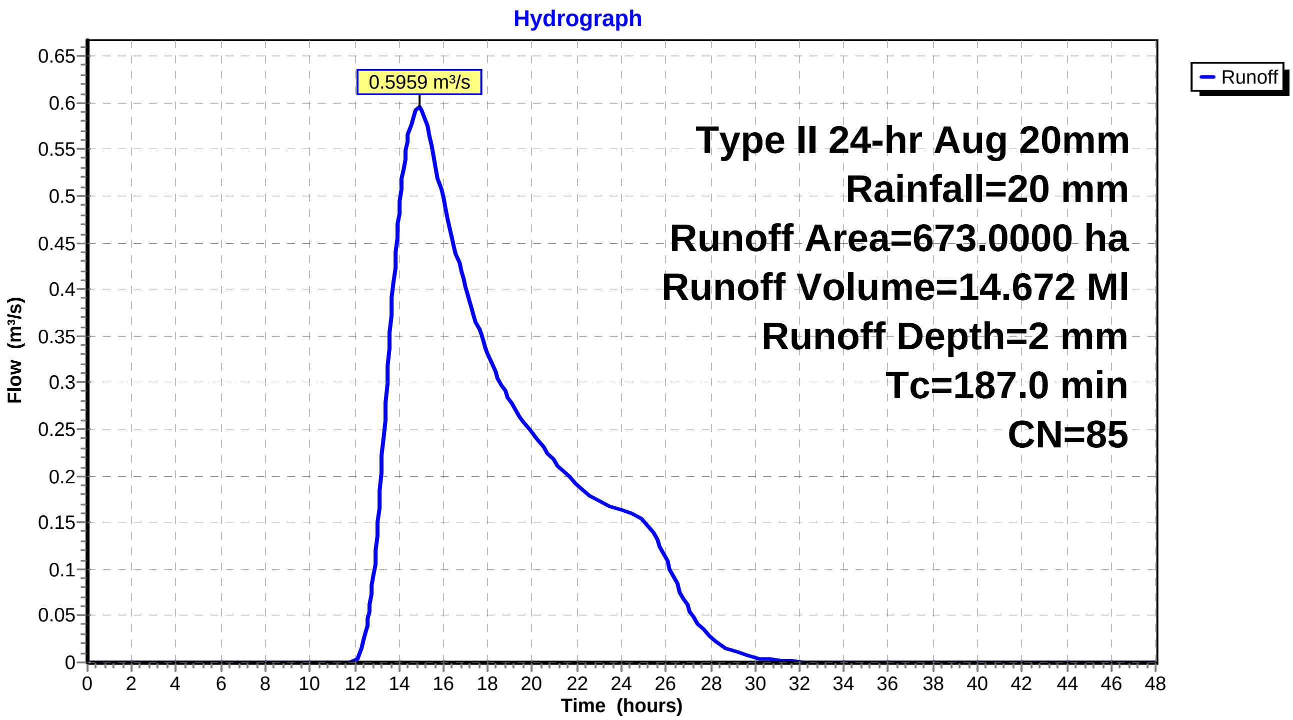
Runoff = 0.5959 m³/s @ 14.93 hrs, Volume= 14.672 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

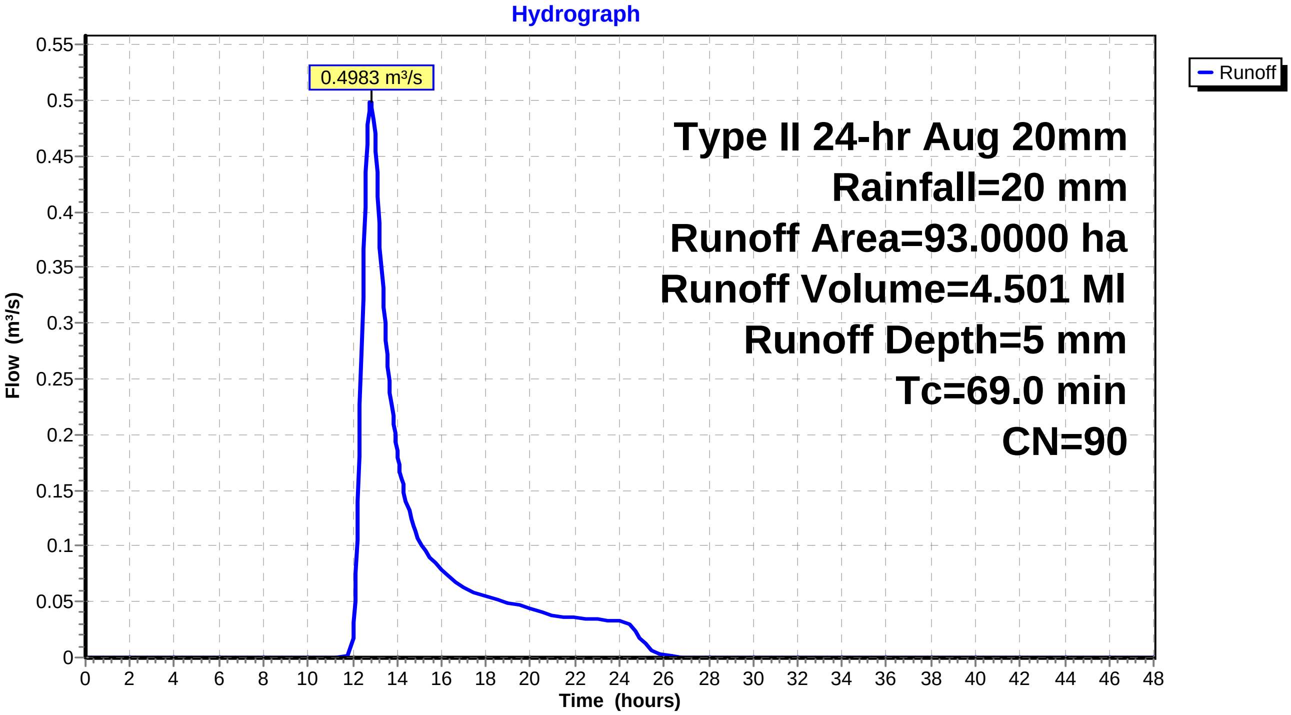
Runoff = 0.4983 m³/s @ 12.82 hrs, Volume= 4.501 Ml, Depth= 5 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

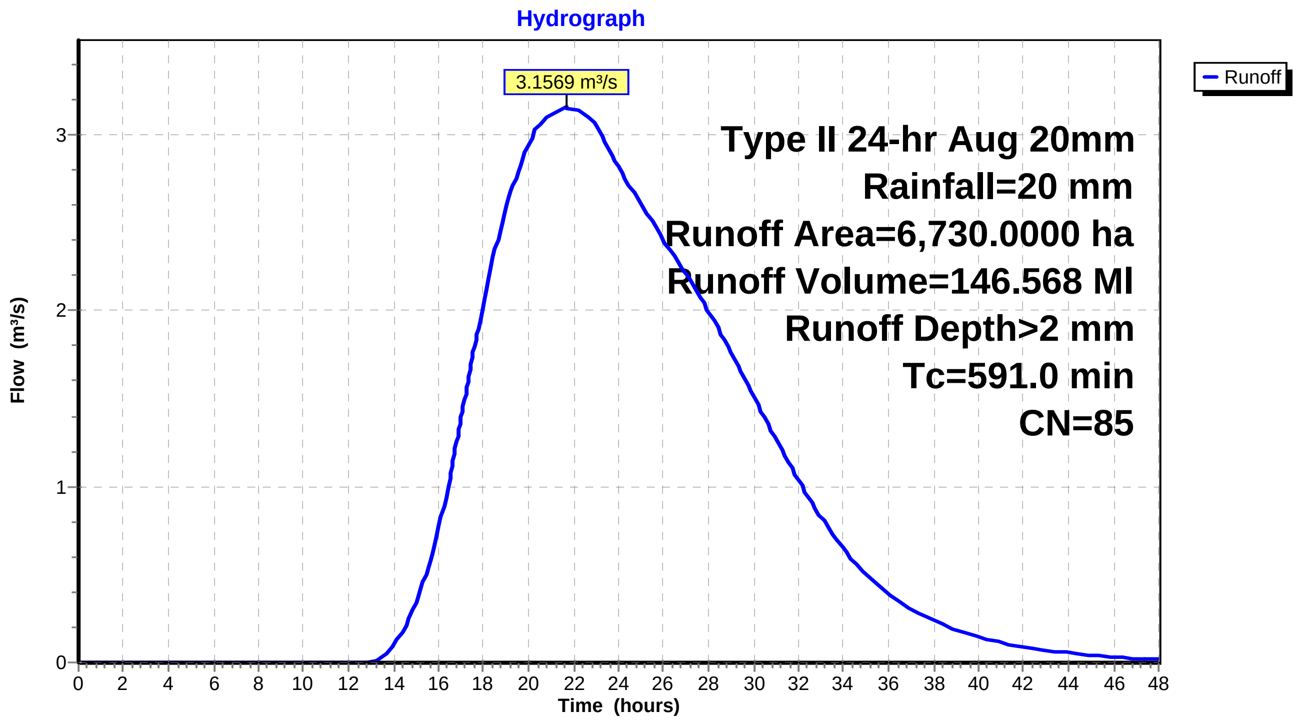
Runoff = 3.1569 m³/s @ 21.68 hrs, Volume= 146.568 Ml, Depth> 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

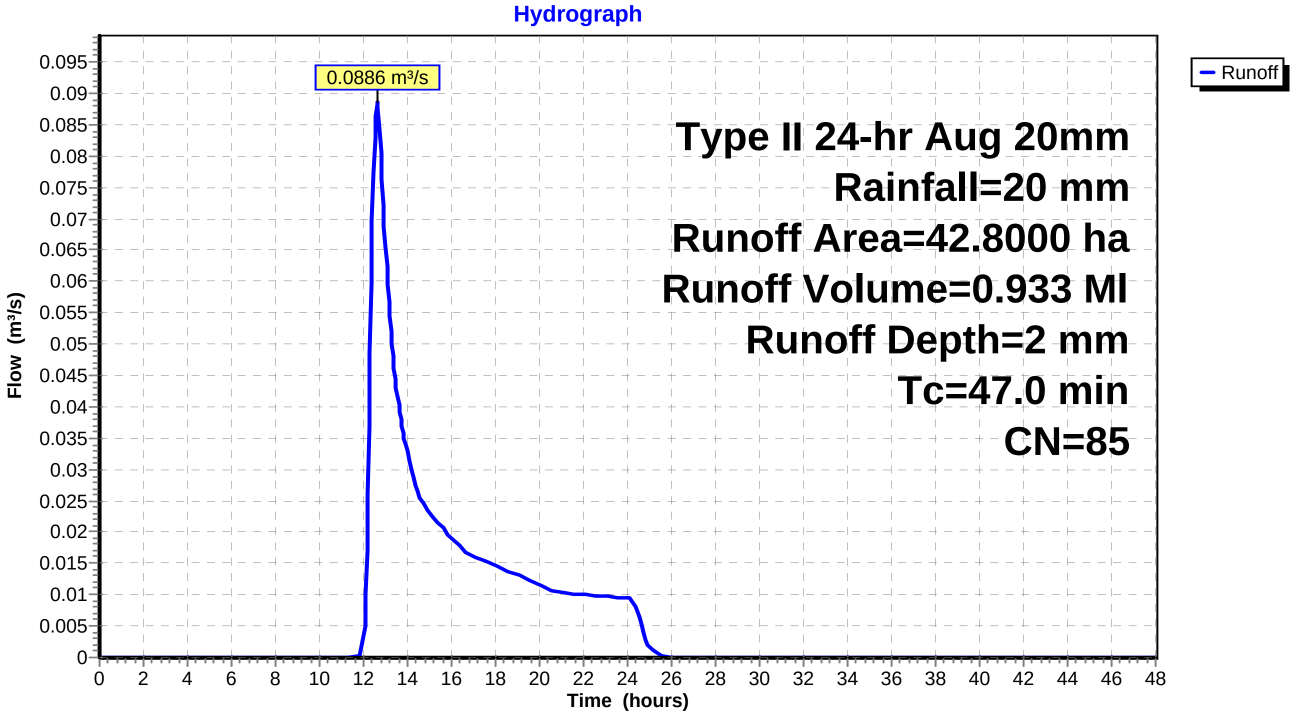
Runoff = 0.0886 m³/s @ 12.62 hrs, Volume= 0.933 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

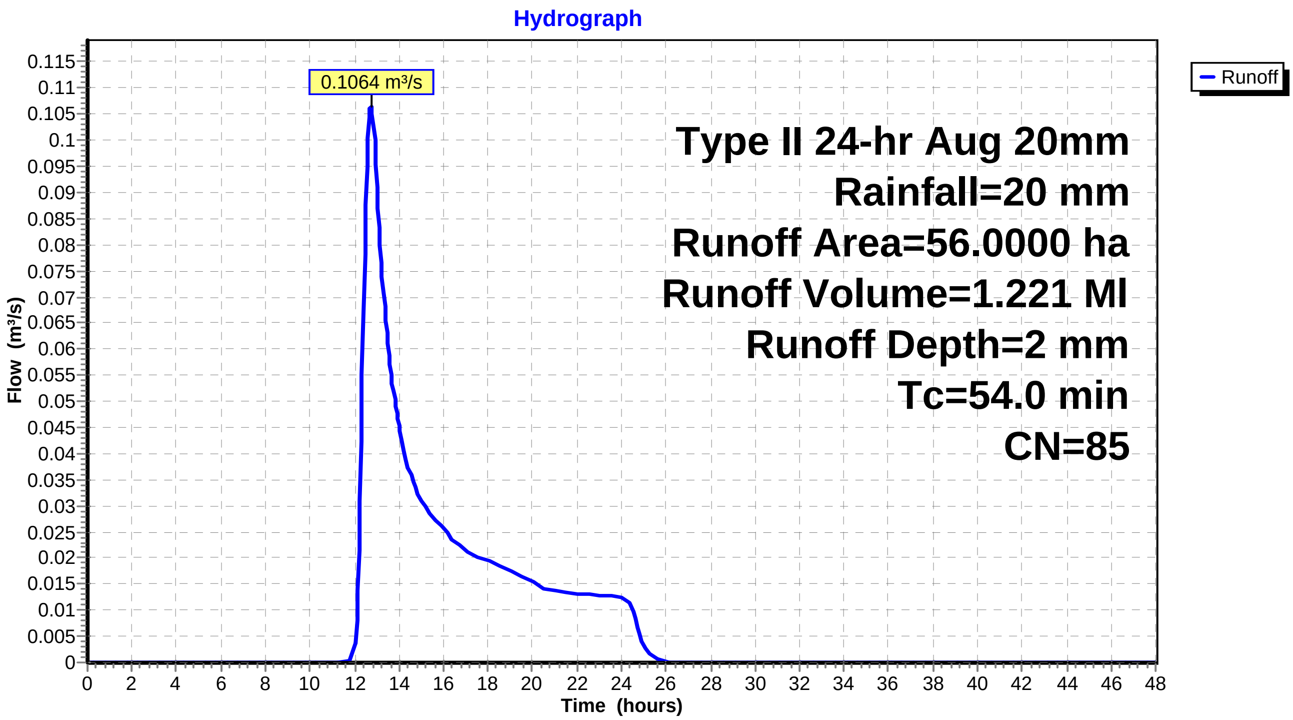
Runoff = 0.1064 m³/s @ 12.74 hrs, Volume= 1.221 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

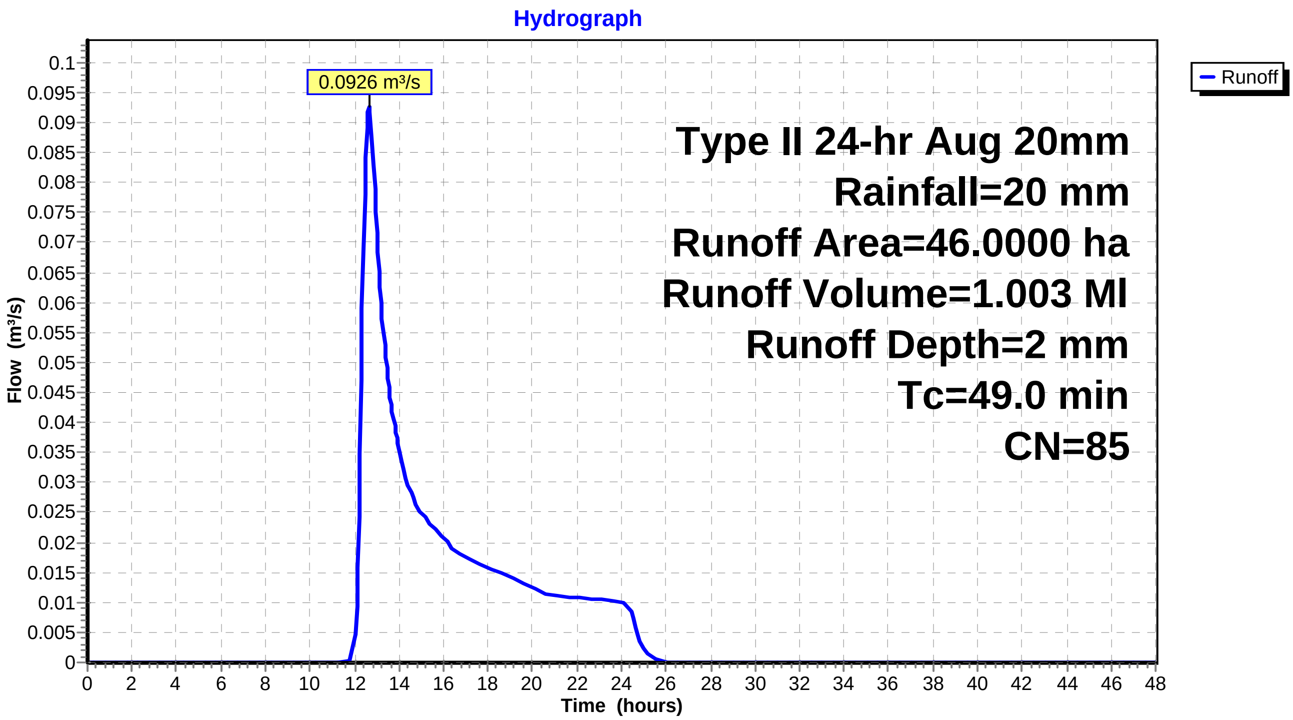
Runoff = 0.0926 m³/s @ 12.66 hrs, Volume= 1.003 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

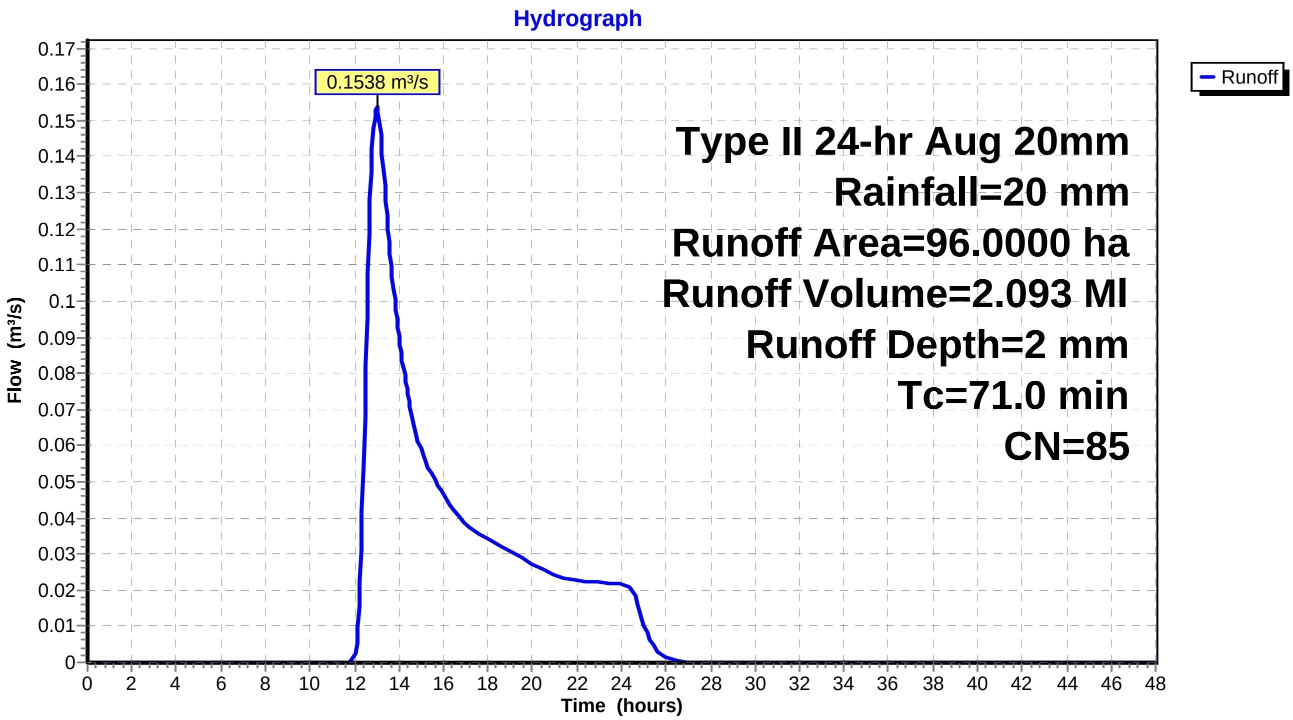
Runoff = 0.1538 m³/s @ 13.01 hrs, Volume= 2.093 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

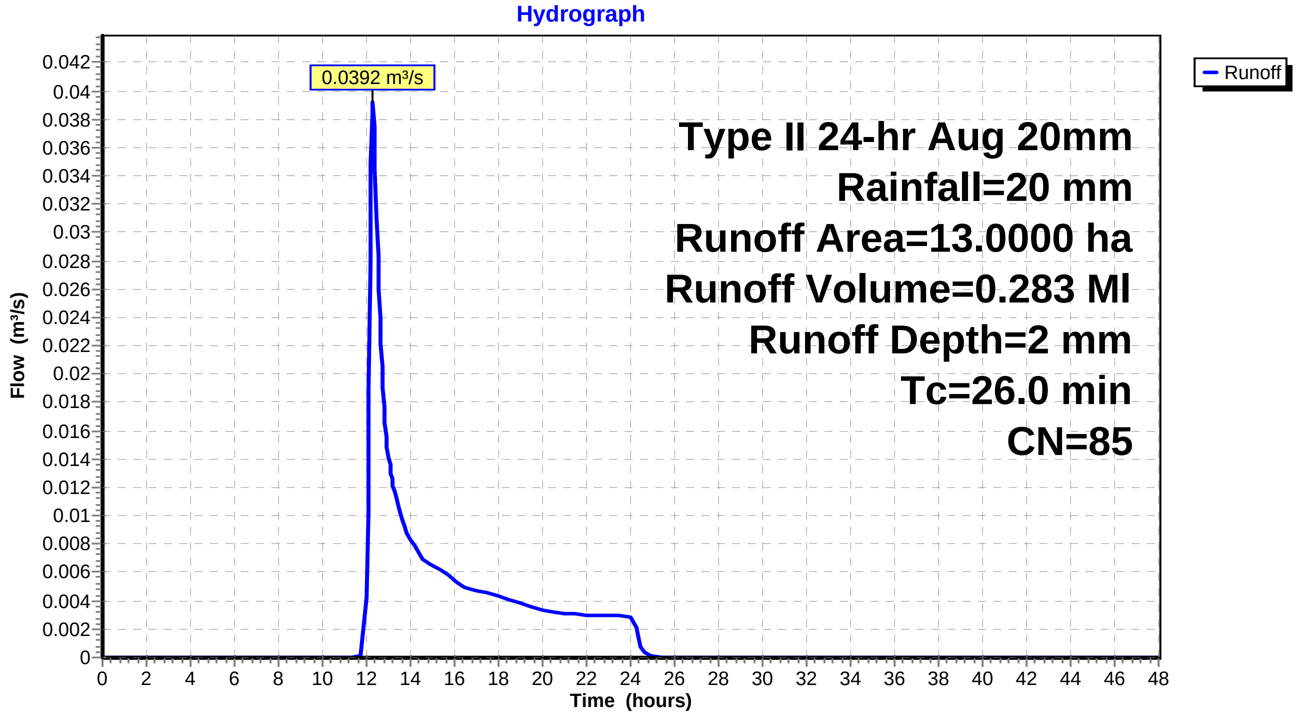
Runoff = 0.0392 m³/s @ 12.29 hrs, Volume= 0.283 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

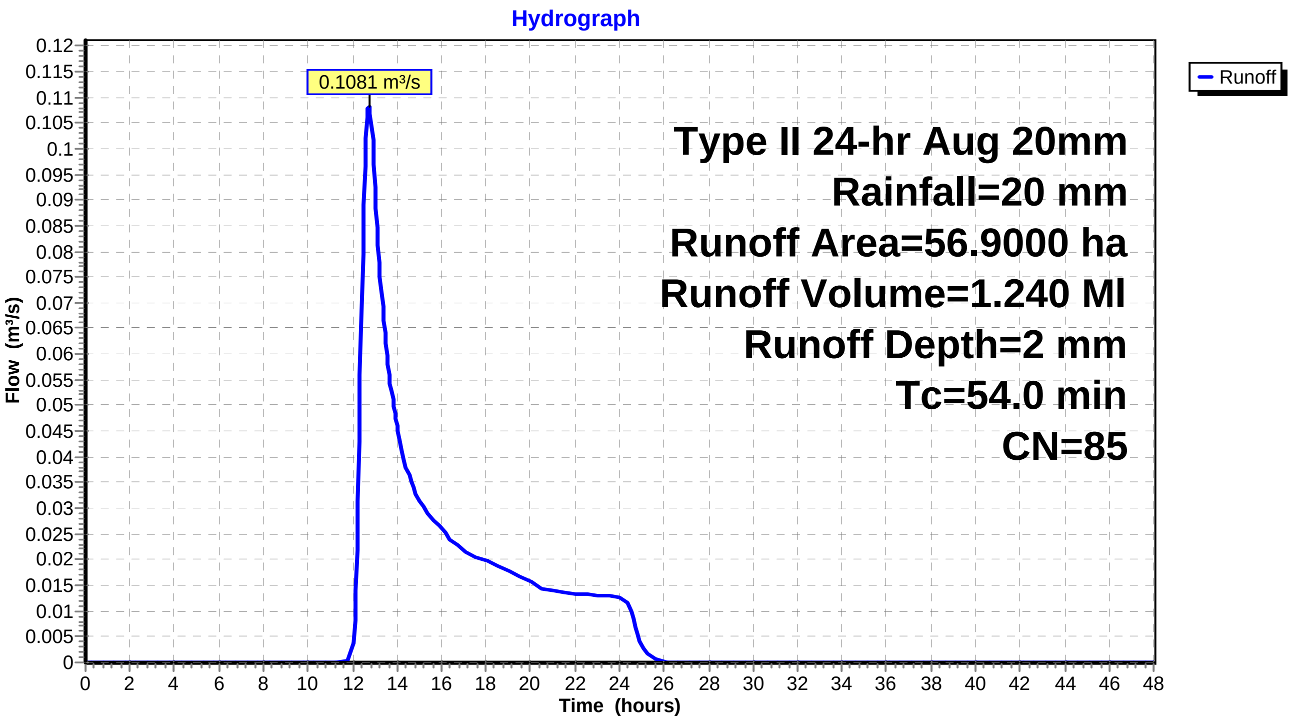
Runoff = 0.1081 m³/s @ 12.74 hrs, Volume= 1.240 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

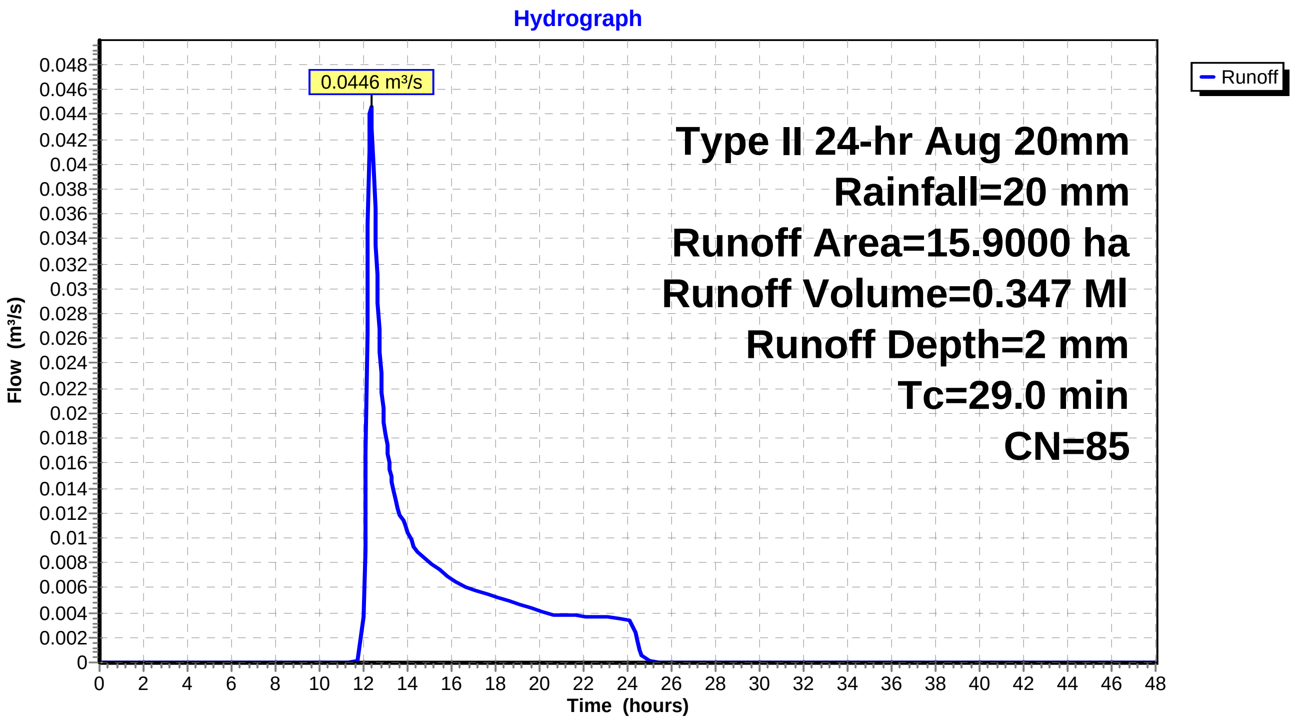
Runoff = 0.0446 m³/s @ 12.34 hrs, Volume= 0.347 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

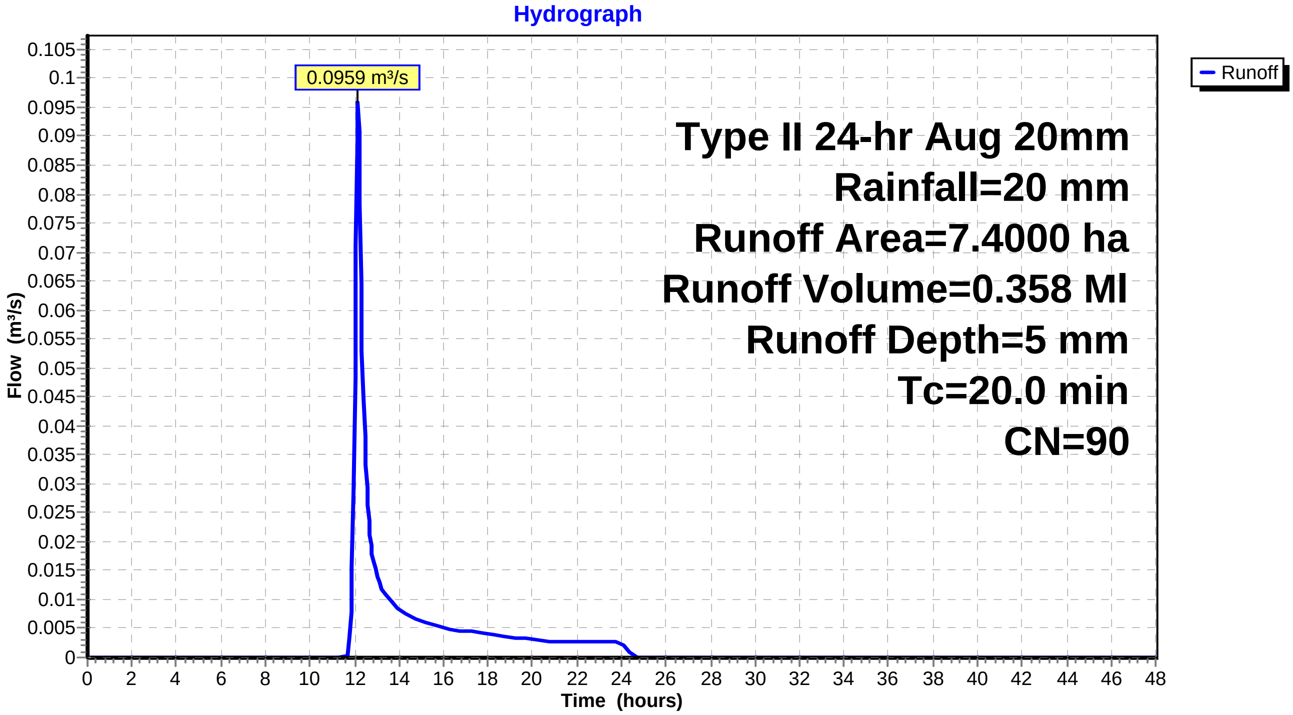
Runoff = 0.0959 m³/s @ 12.15 hrs, Volume= 0.358 Ml, Depth= 5 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Aug 20mm Rainfall=20 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

Inflow Area = 978.0000 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 0.7728 m³/s @ 15.34 hrs, Volume= 21.320 Ml
Outflow = 0.7714 m³/s @ 15.62 hrs, Volume= 21.320 Ml, Atten= 0%, Lag= 16.8 min

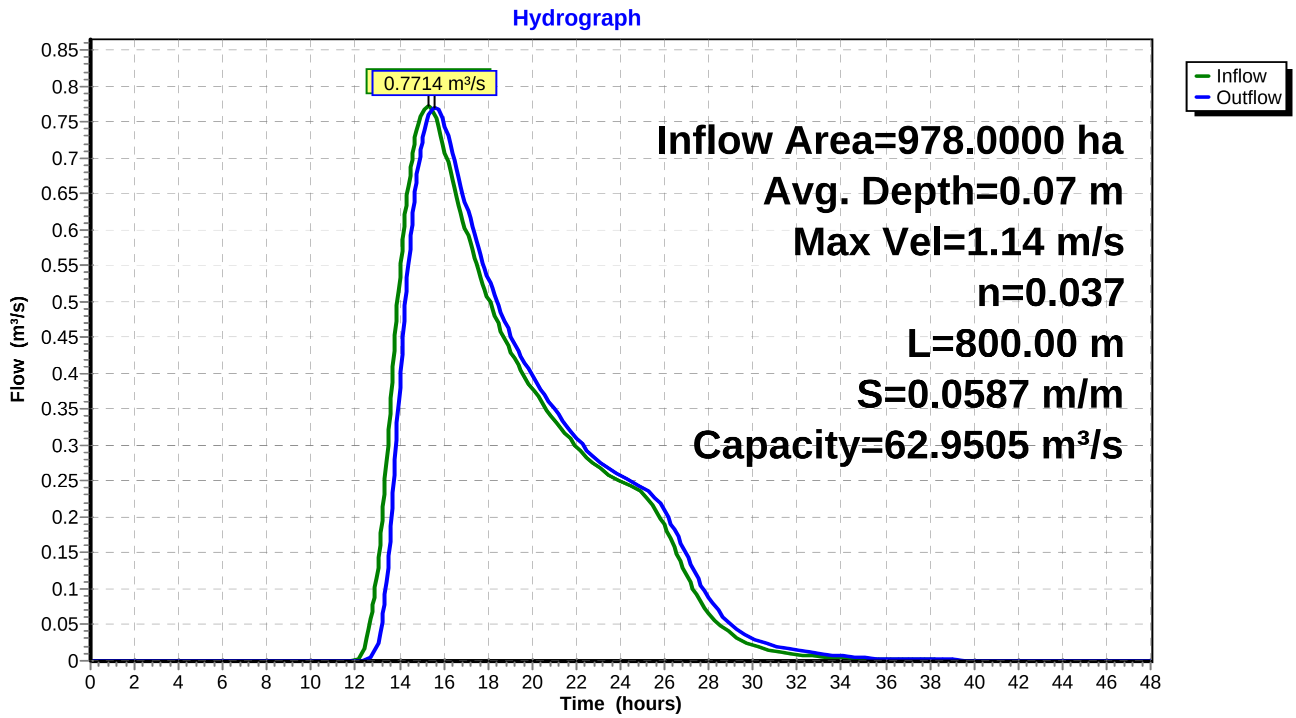
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.14 m/s, Min. Travel Time= 11.7 min
Avg. Velocity = 0.53 m/s, Avg. Travel Time= 25.1 min

Peak Storage= 540.8 m³ @ 15.43 hrs, Average Depth at Peak Storage= 0.07 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

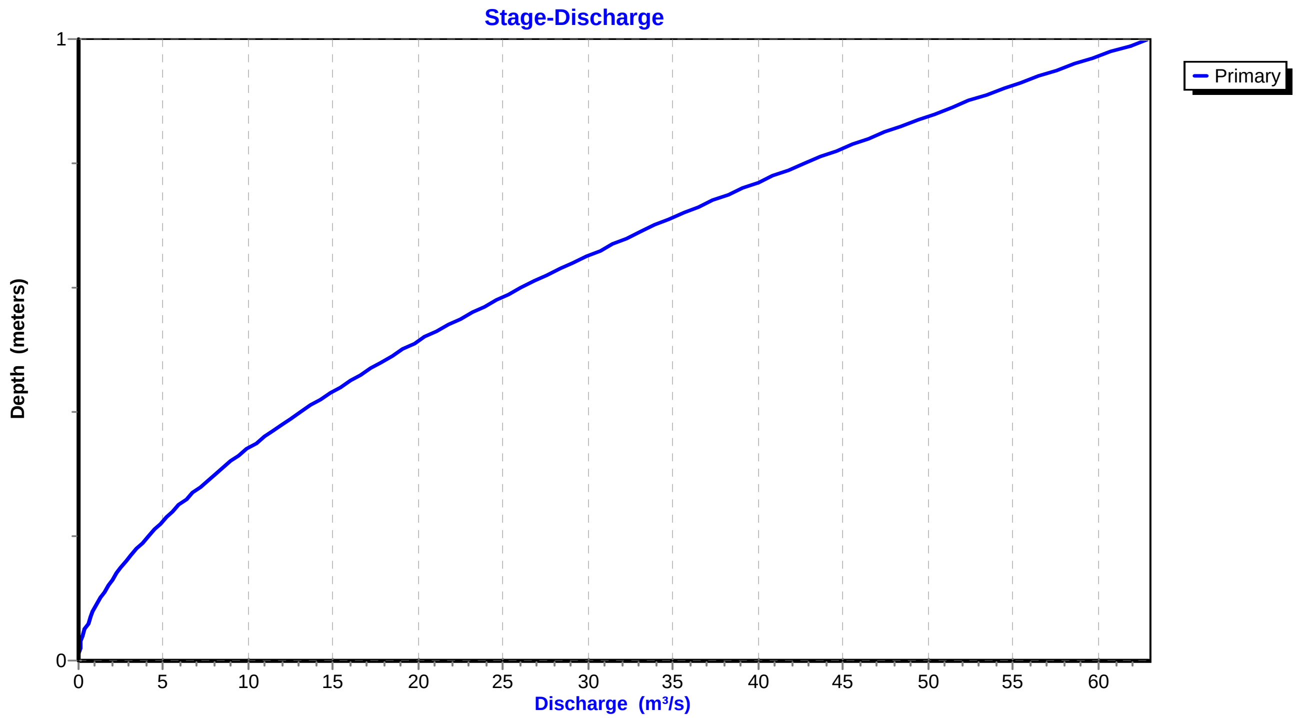
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

‡

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

Inflow Area = 1,117.0000 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 0.8881 m³/s @ 16.02 hrs, Volume= 26.806 Ml
Outflow = 0.8785 m³/s @ 16.69 hrs, Volume= 26.798 Ml, Atten= 1%, Lag= 40.2 min

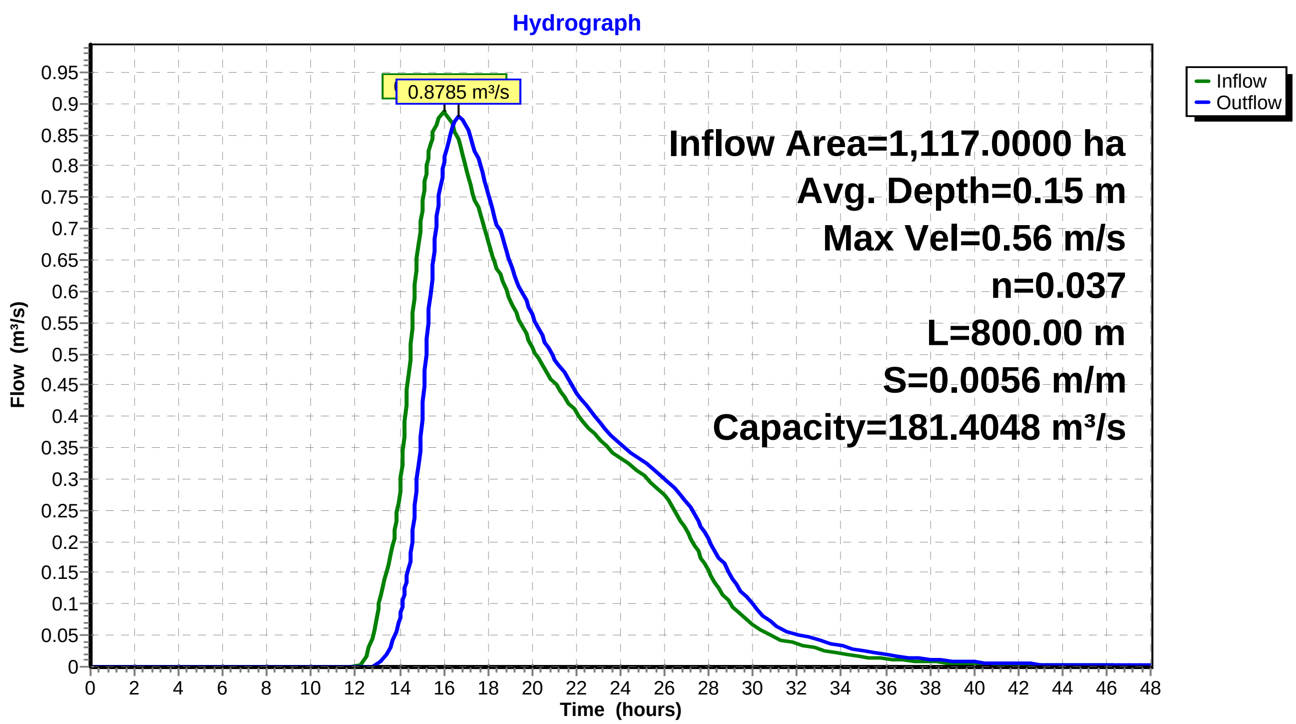
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.56 m/s, Min. Travel Time= 23.9 min
Avg. Velocity = 0.29 m/s, Avg. Travel Time= 45.4 min

Peak Storage= 1,261.6 m³ @ 16.29 hrs, Average Depth at Peak Storage= 0.15 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

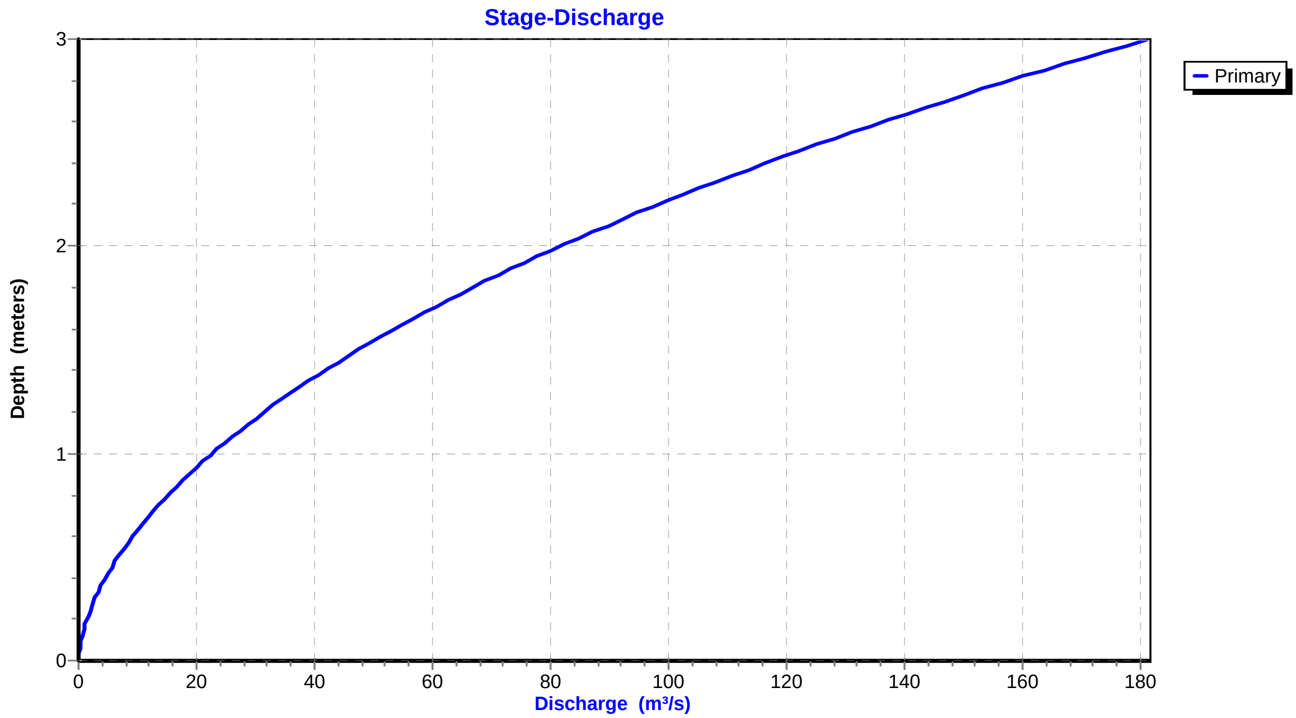
10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

‡

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



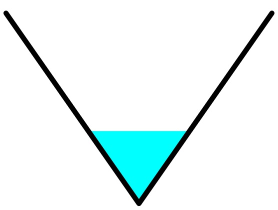
Reach 18R: Mid Haggart Creek

Inflow Area = 7,094.2280 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 3.2598 m³/s @ 22.04 hrs, Volume= 155.470 Ml
Outflow = 3.2592 m³/s @ 22.20 hrs, Volume= 155.441 Ml, Atten= 0%, Lag= 9.2 min

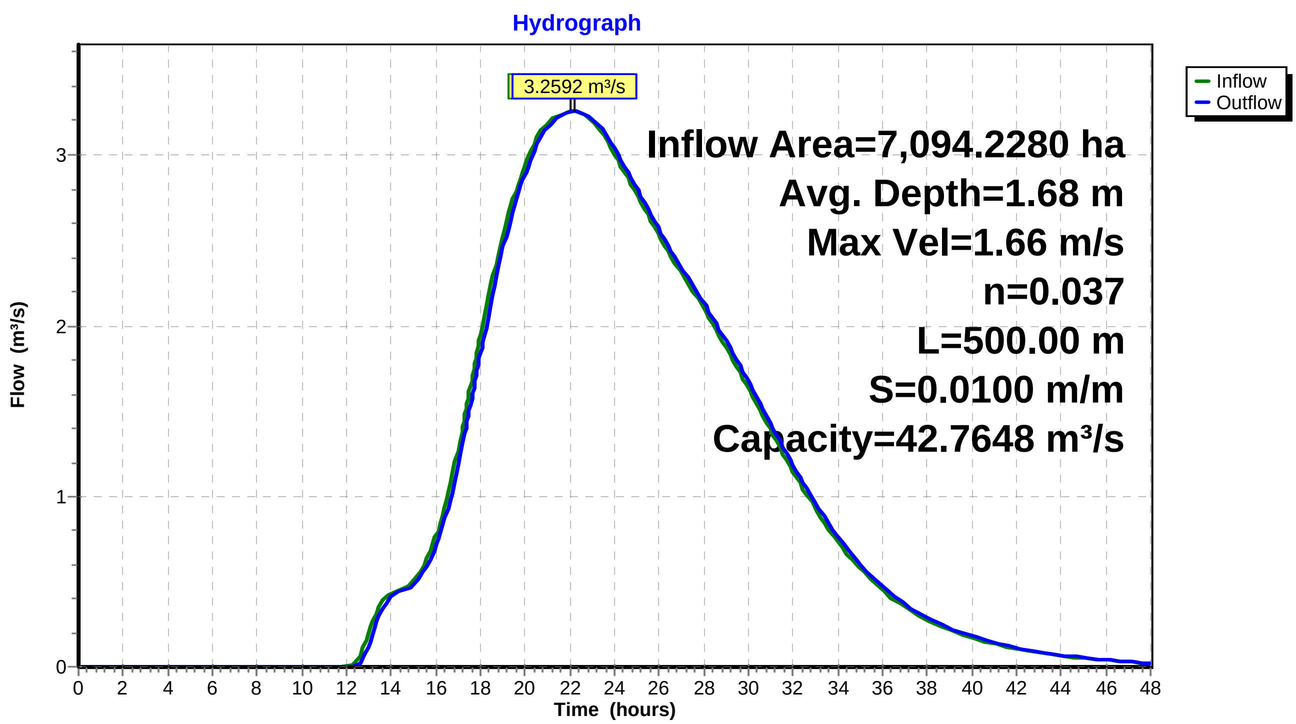
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.66 m/s, Min. Travel Time= 5.0 min
Avg. Velocity = 1.13 m/s, Avg. Travel Time= 7.4 min

Peak Storage= 982.8 m³ @ 22.11 hrs, Average Depth at Peak Storage= 1.68 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

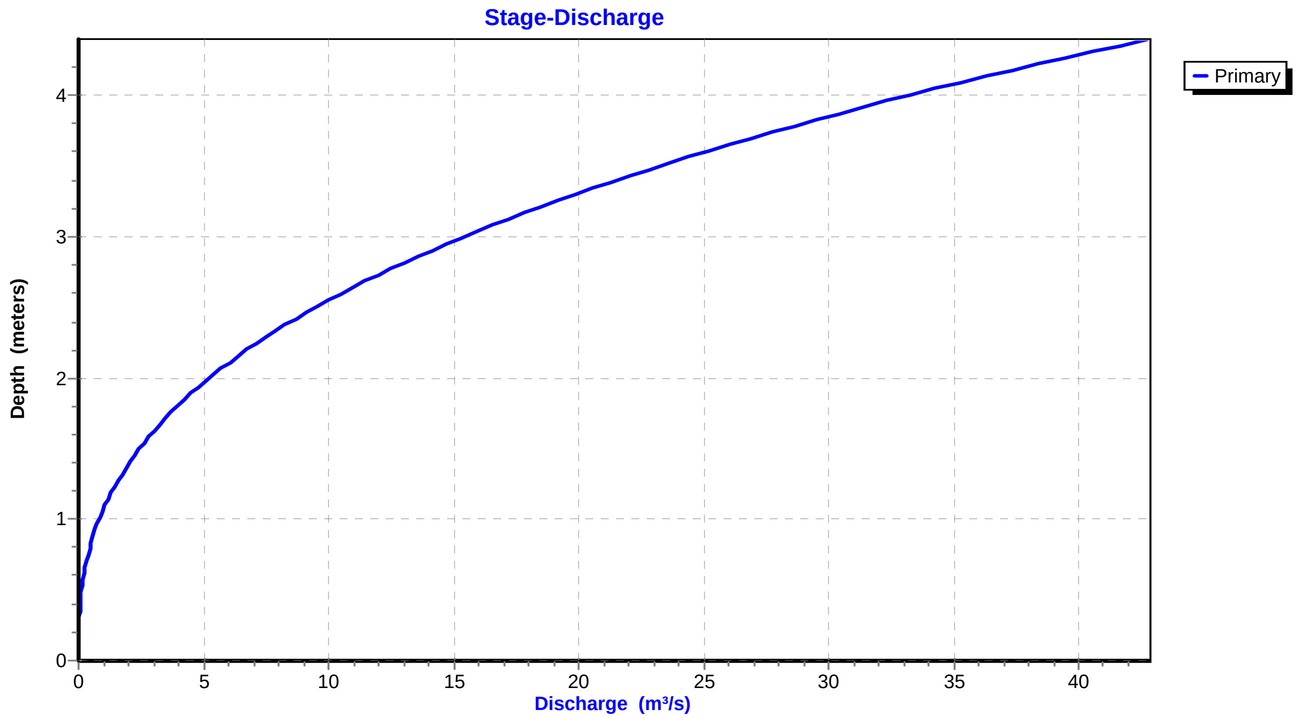
0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m



Reach 18R: Mid Haggart Creek



Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

Inflow Area = 8,485.2280 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 3.8013 m³/s @ 21.71 hrs, Volume= 190.360 Ml
Outflow = 3.8013 m³/s @ 21.74 hrs, Volume= 190.355 Ml, Atten= 0%, Lag= 2.0 min

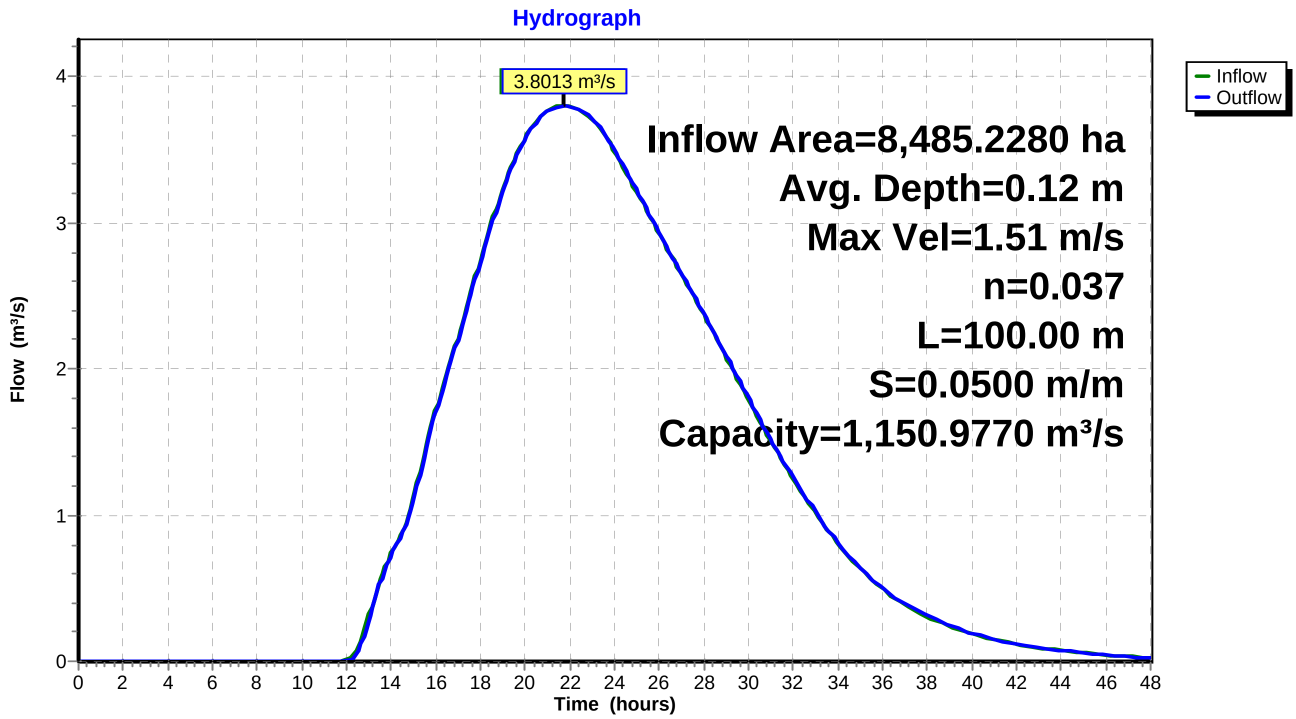
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.51 m/s, Min. Travel Time= 1.1 min
Avg. Velocity = 0.99 m/s, Avg. Travel Time= 1.7 min

Peak Storage= 252.0 m³ @ 21.72 hrs, Average Depth at Peak Storage= 0.12 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

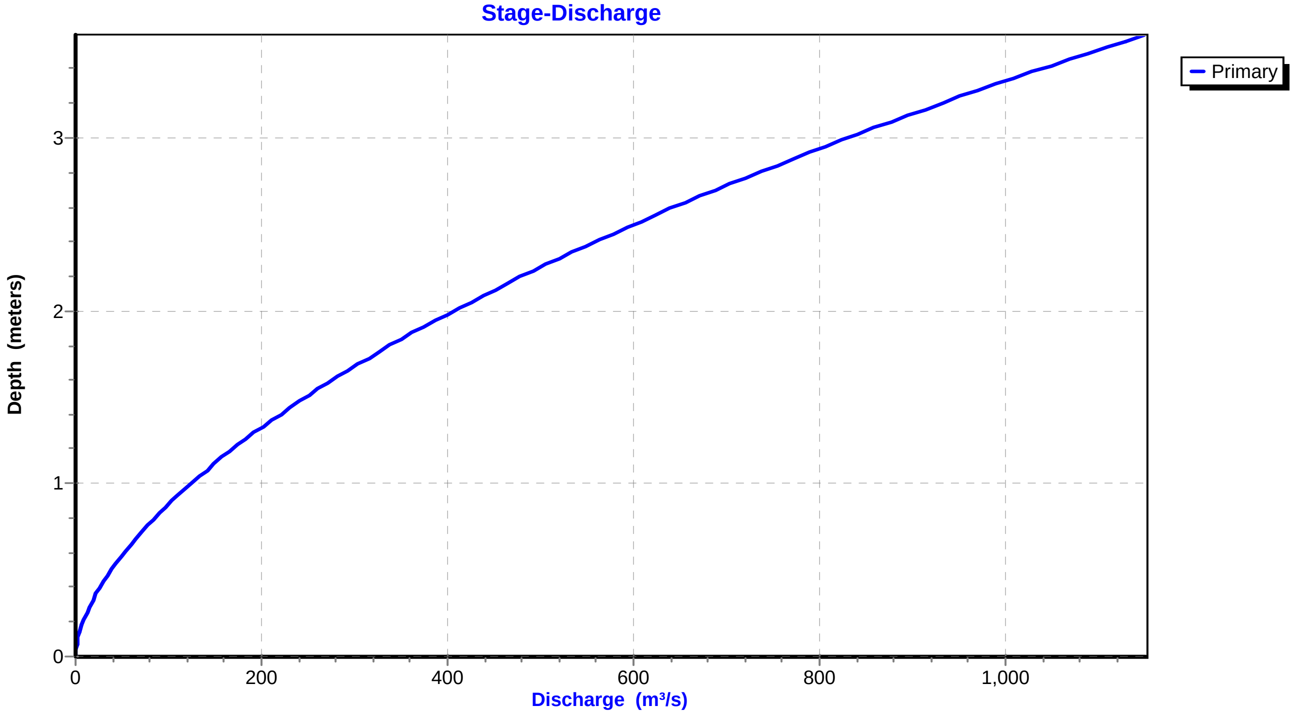
20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

‡

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 0.7936 m³/s @ 15.61 hrs, Volume= 22.322 Ml
Outflow = 0.7901 m³/s @ 16.03 hrs, Volume= 22.322 Ml, Atten= 0%, Lag= 25.3 min

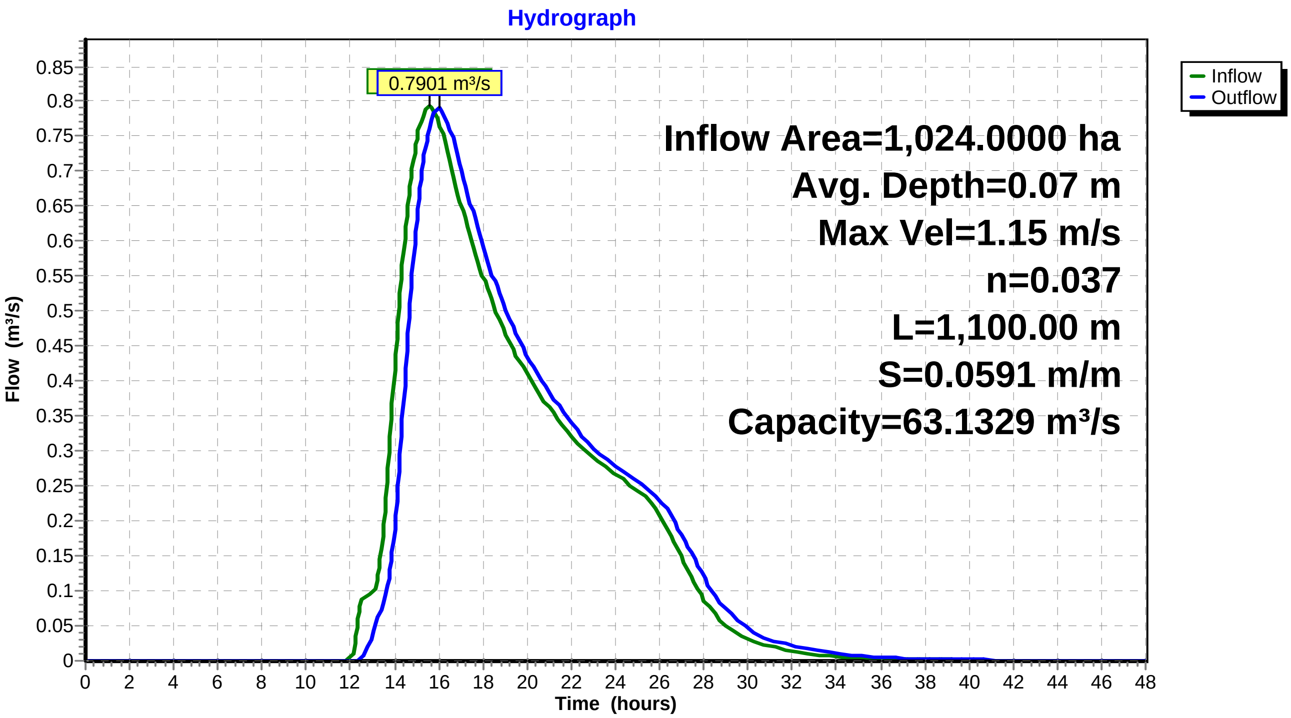
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.15 m/s, Min. Travel Time= 15.9 min
Avg. Velocity = 0.54 m/s, Avg. Travel Time= 33.9 min

Peak Storage= 753.2 m³ @ 15.77 hrs, Average Depth at Peak Storage= 0.07 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

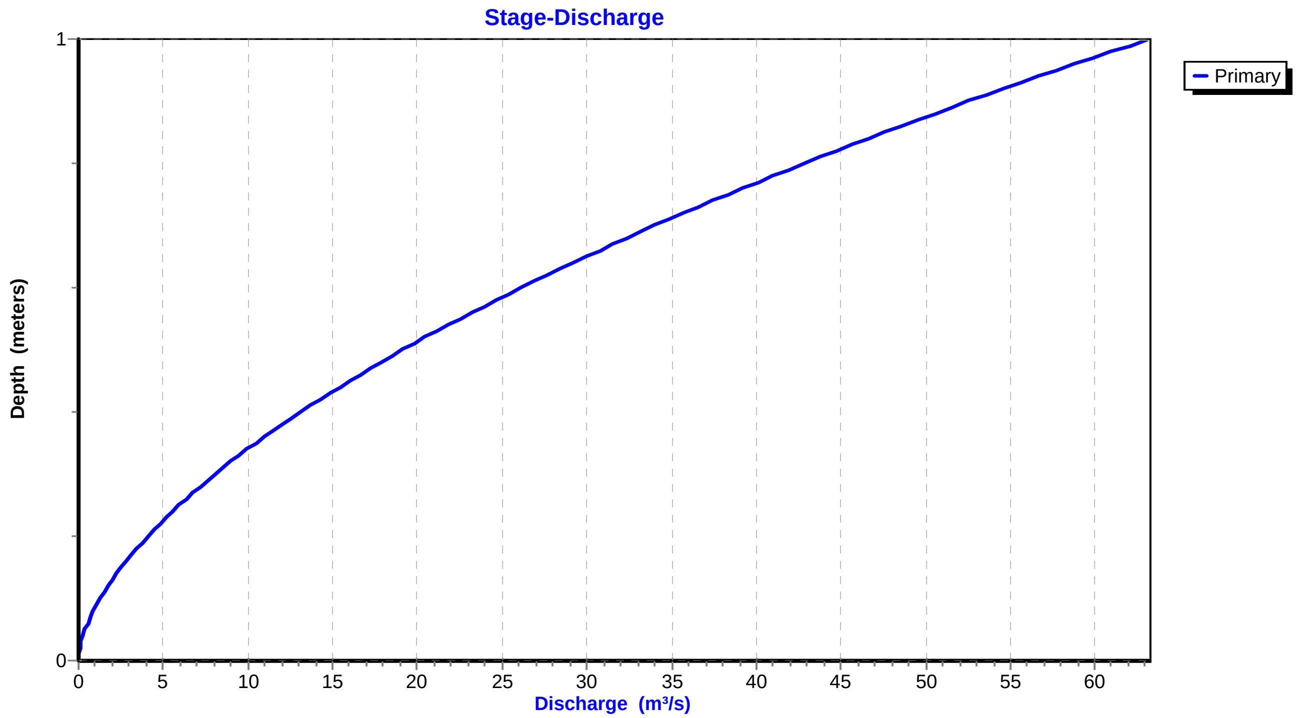
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



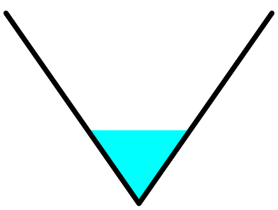
Reach 34R: Upper Haggart Creek

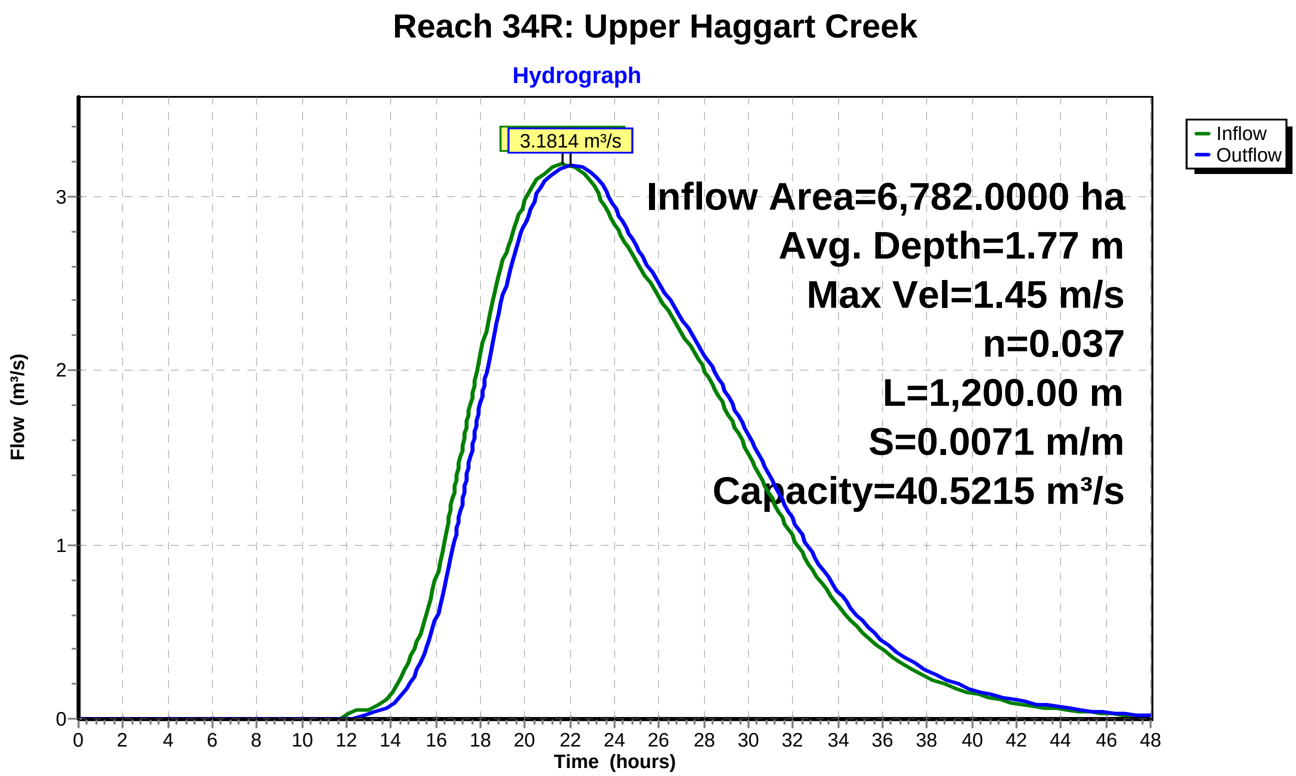
Inflow Area = 6,782.0000 ha, Inflow Depth > 2 mm for Aug 20mm event
Inflow = 3.1867 m³/s @ 21.68 hrs, Volume= 148.736 Ml
Outflow = 3.1814 m³/s @ 22.06 hrs, Volume= 148.663 Ml, Atten= 0%, Lag= 23.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.45 m/s, Min. Travel Time= 13.8 min
Avg. Velocity = 0.97 m/s, Avg. Travel Time= 20.7 min

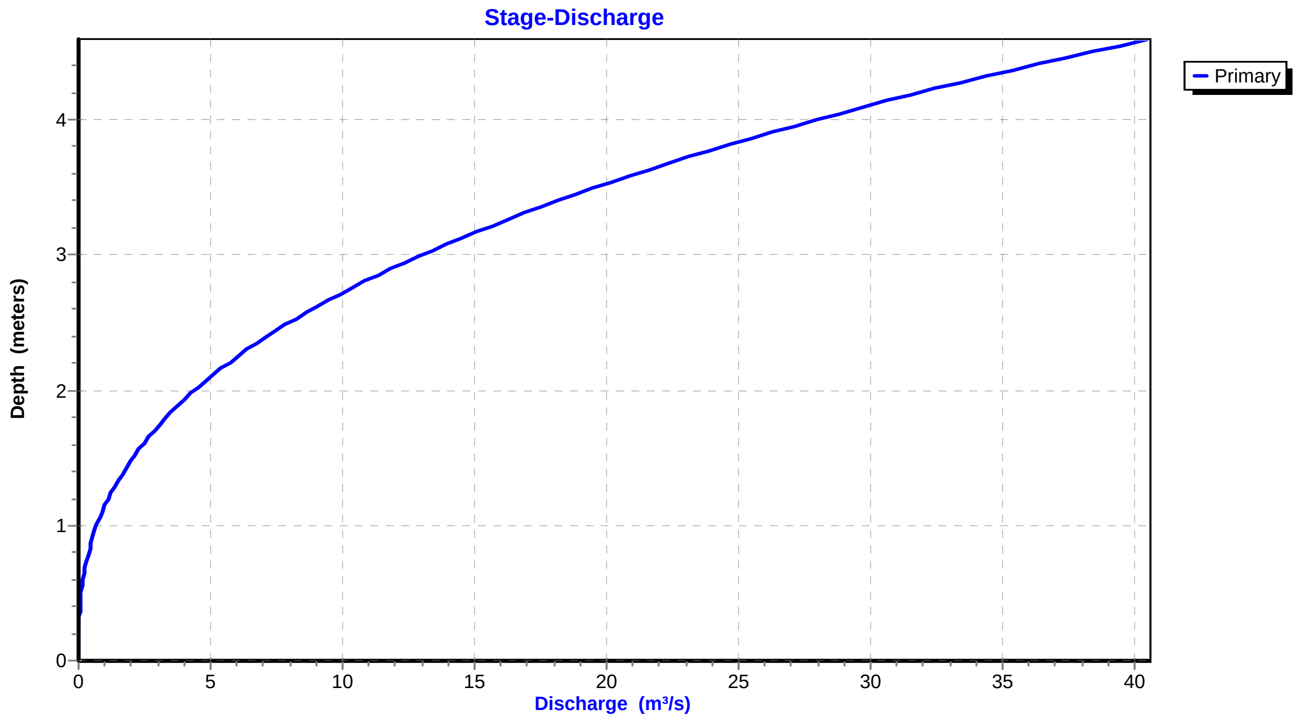
Peak Storage= 2,636.0 m³ @ 21.83 hrs, Average Depth at Peak Storage= 1.77 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m





Reach 34R: Upper Haggart Creek



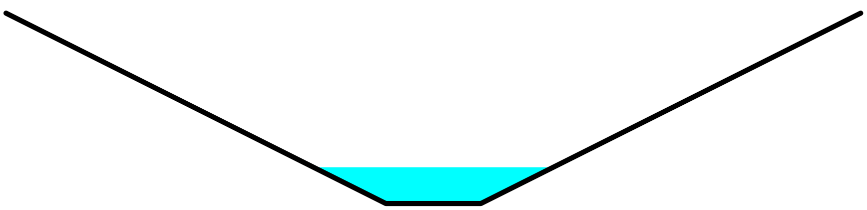
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 3 mm for Aug 20mm event
Inflow = 0.1846 m³/s @ 14.49 hrs, Volume= 6.031 Ml
Outflow = 0.1840 m³/s @ 14.84 hrs, Volume= 6.029 Ml, Atten= 0%, Lag= 20.8 min

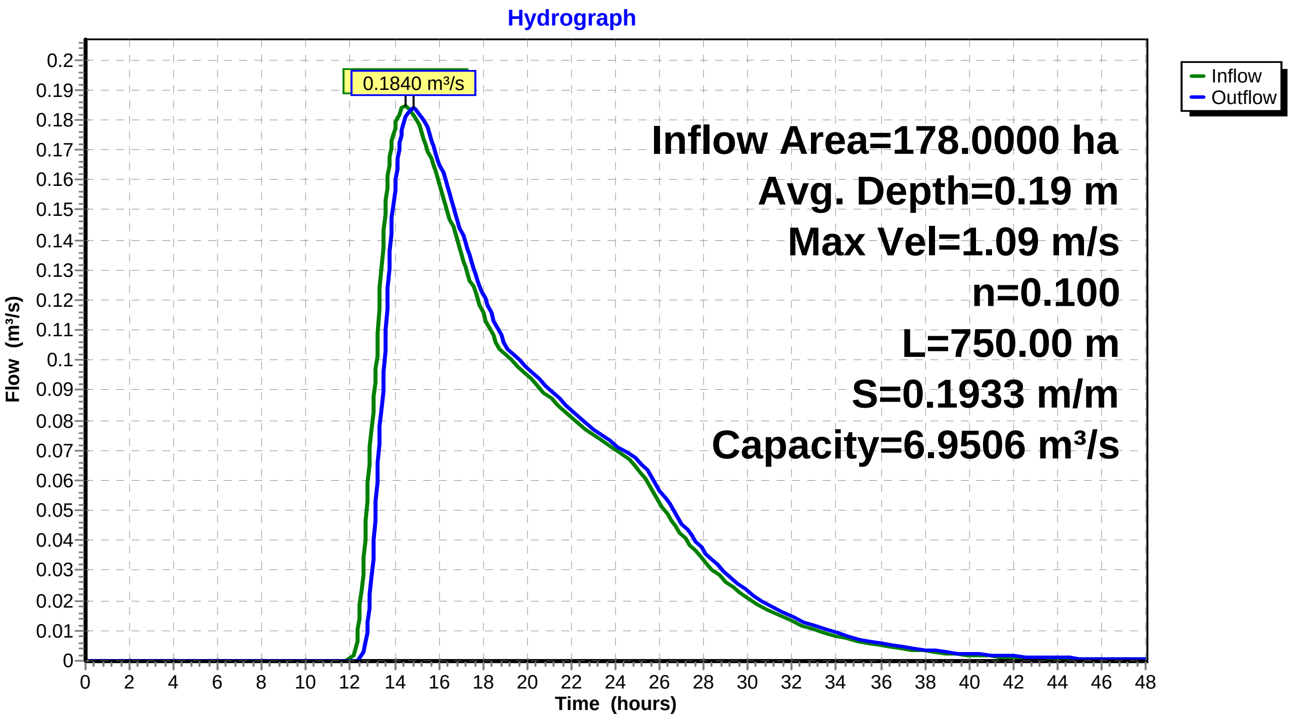
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.09 m/s, Min. Travel Time= 11.4 min
Avg. Velocity = 0.59 m/s, Avg. Travel Time= 21.3 min

Peak Storage= 126.1 m³ @ 14.65 hrs, Average Depth at Peak Storage= 0.19 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

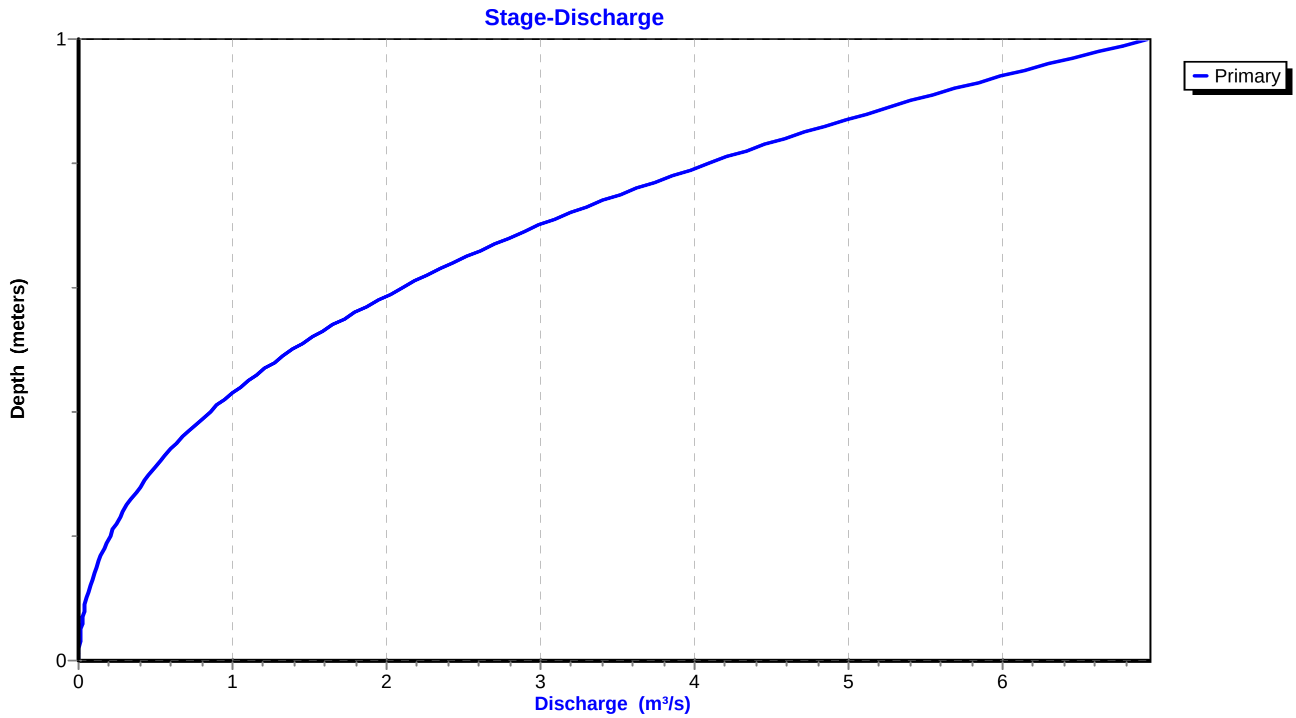
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 2 mm for Aug 20mm event
Inflow = 0.1906 m³/s @ 13.19 hrs, Volume= 2.791 Ml
Outflow = 0.0658 m³/s @ 15.92 hrs, Volume= 2.789 Ml, Atten= 65%, Lag= 163.8 min
Primary = 0.0658 m³/s @ 15.92 hrs, Volume= 2.789 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 917.356 m @ 15.92 hrs Surf.Area= 16,520.7 m² Storage= 21,360.3 m³ (919.1 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 231.8 min (1,232.4 - 1,000.5)

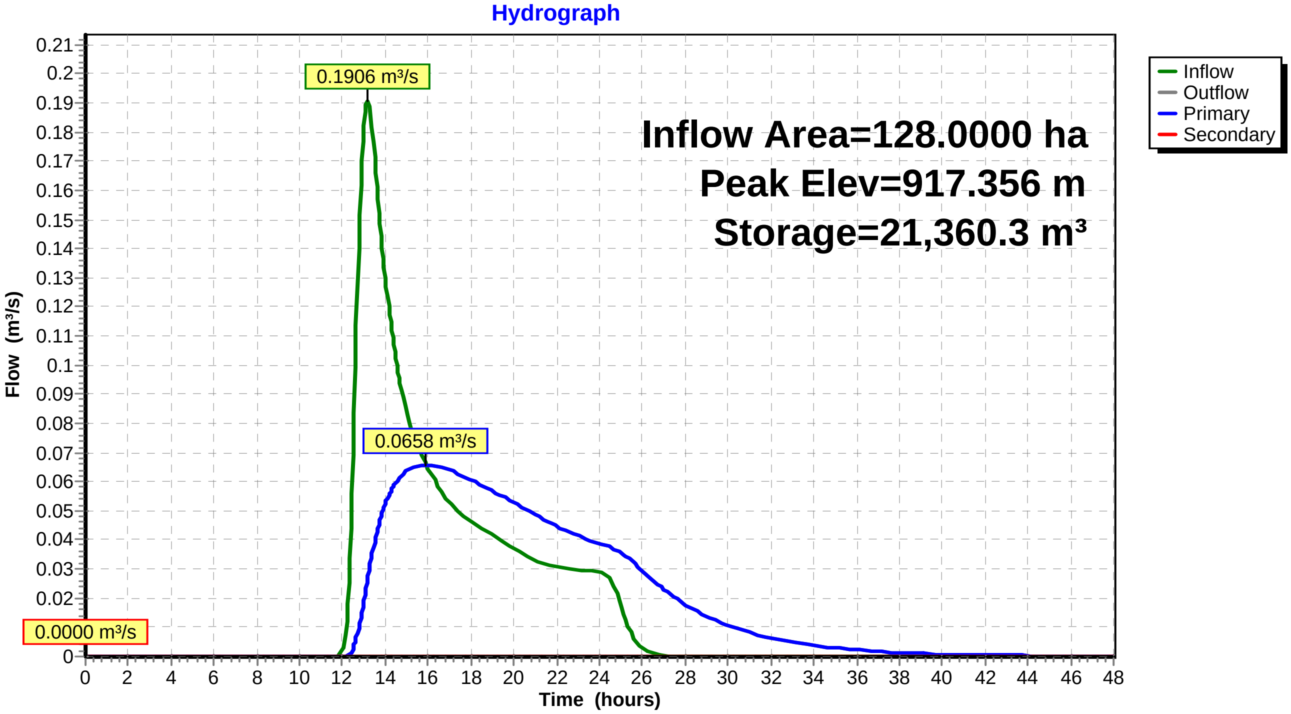
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

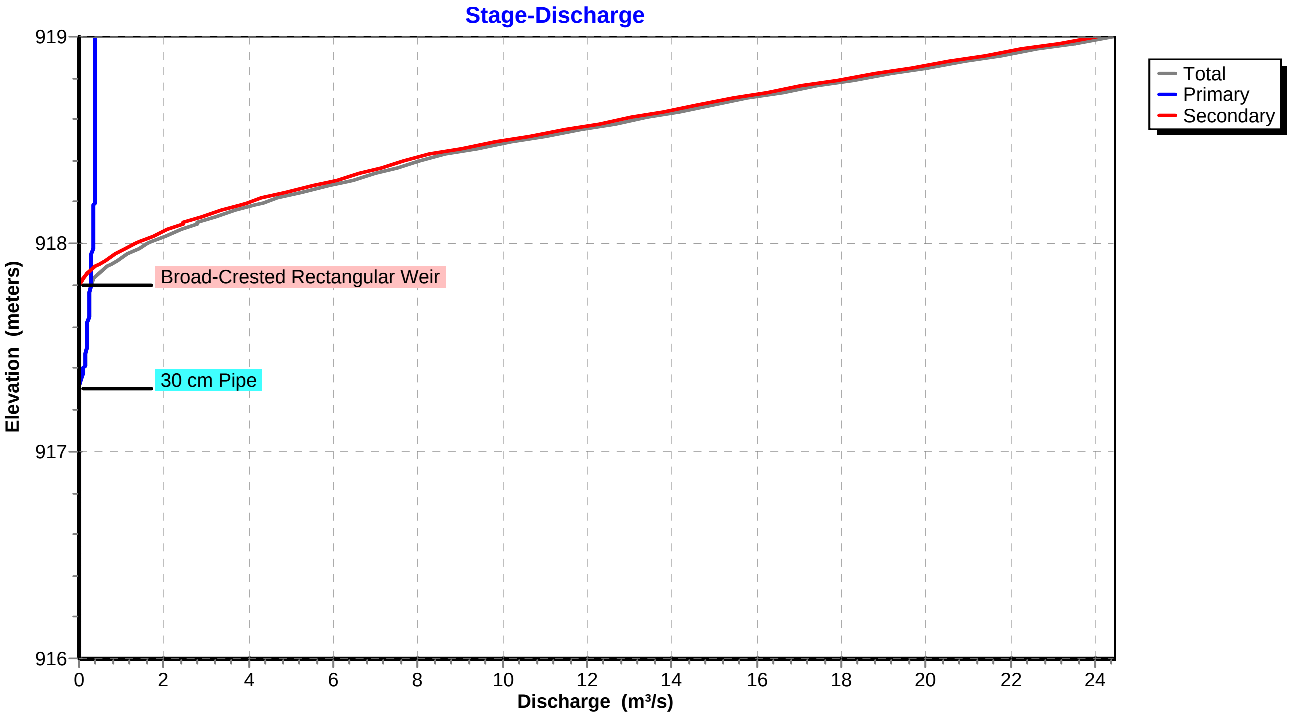
Primary OutFlow Max=0.0658 m³/s @ 15.92 hrs HW=917.356 m (Free Discharge)
└─**1=30 cm Pipe** (Custom Controls 0.0658 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=917.300 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 23P: EP WRSA SCP



Pond 23P: EP WRSA SCP



Pond 24P: Lower Dublin North

Inflow Area = 39.0000 ha, Inflow Depth = 5 mm for Aug 20mm event
Inflow = 0.2857 m³/s @ 12.49 hrs, Volume= 1.888 Ml
Outflow = 0.0471 m³/s @ 14.30 hrs, Volume= 1.885 Ml, Atten= 84%, Lag= 108.8 min
Primary = 0.0471 m³/s @ 14.30 hrs, Volume= 1.885 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 790.591 m @ 14.30 hrs Surf.Area= 9,066.0 m² Storage= 9,302.9 m³ (817.6 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 285.8 min (1,198.7 - 912.9)

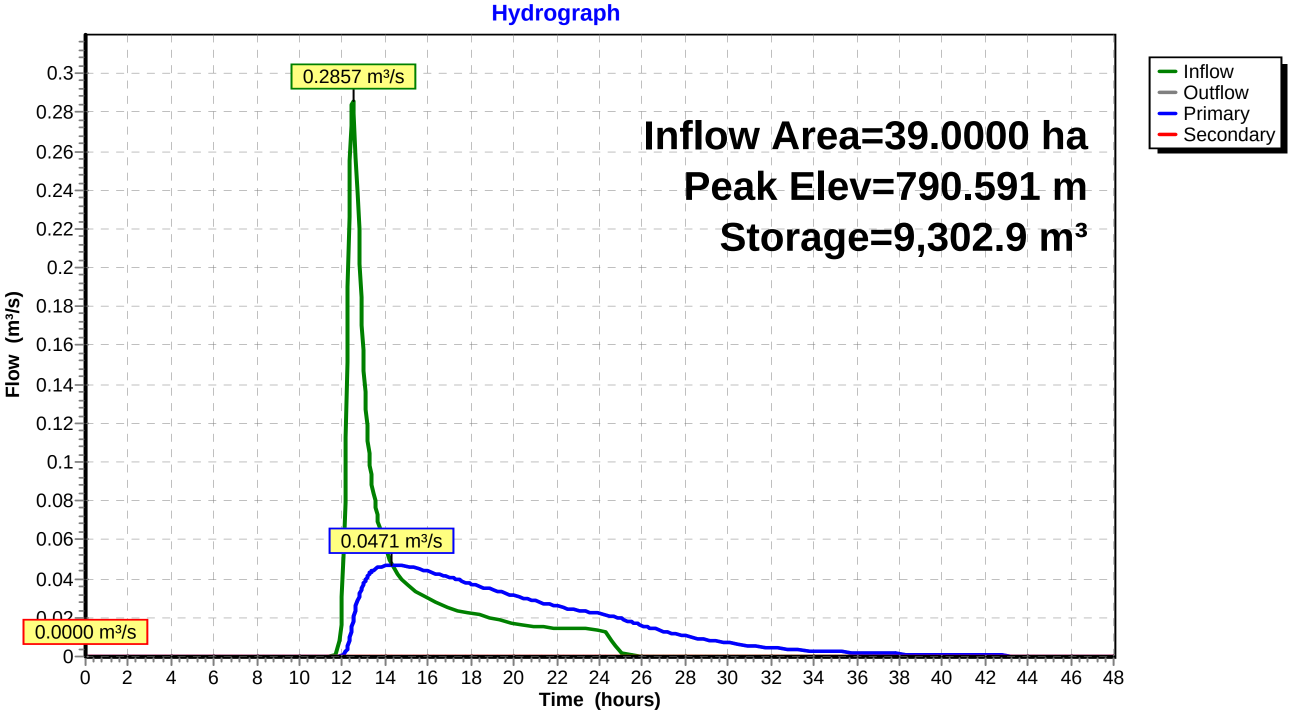
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

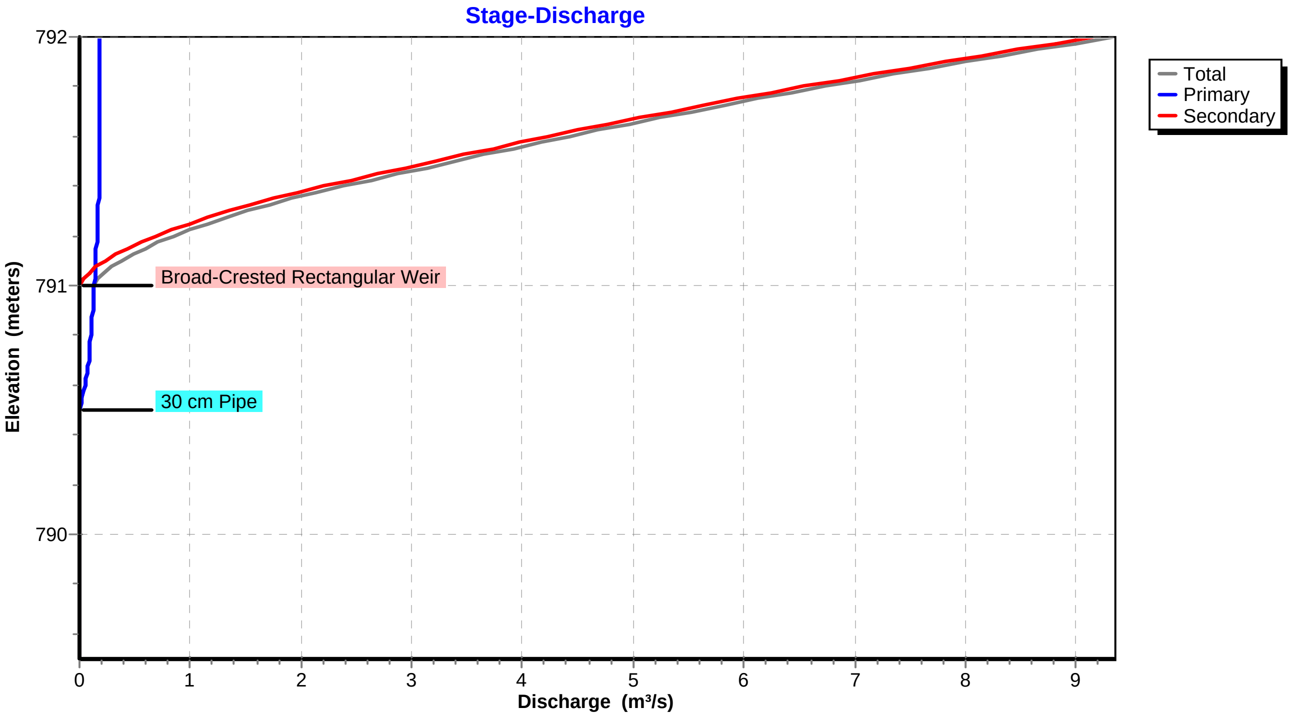
Primary OutFlow Max=0.0471 m³/s @ 14.30 hrs HW=790.591 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.0471 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=790.500 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 24P: Lower Dublin North



Pond 24P: Lower Dublin North



Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 3 mm for Aug 20mm event
Inflow = 0.5915 m³/s @ 12.79 hrs, Volume= 6.035 Ml
Outflow = 0.1846 m³/s @ 14.49 hrs, Volume= 6.031 Ml, Atten= 69%, Lag= 101.7 min
Primary = 0.1846 m³/s @ 14.49 hrs, Volume= 6.031 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 902.635 m @ 14.49 hrs Surf.Area= 15,904.2 m² Storage= 38,032.7 m³ (2,136.9 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 232.6 min (1,185.7 - 953.1)

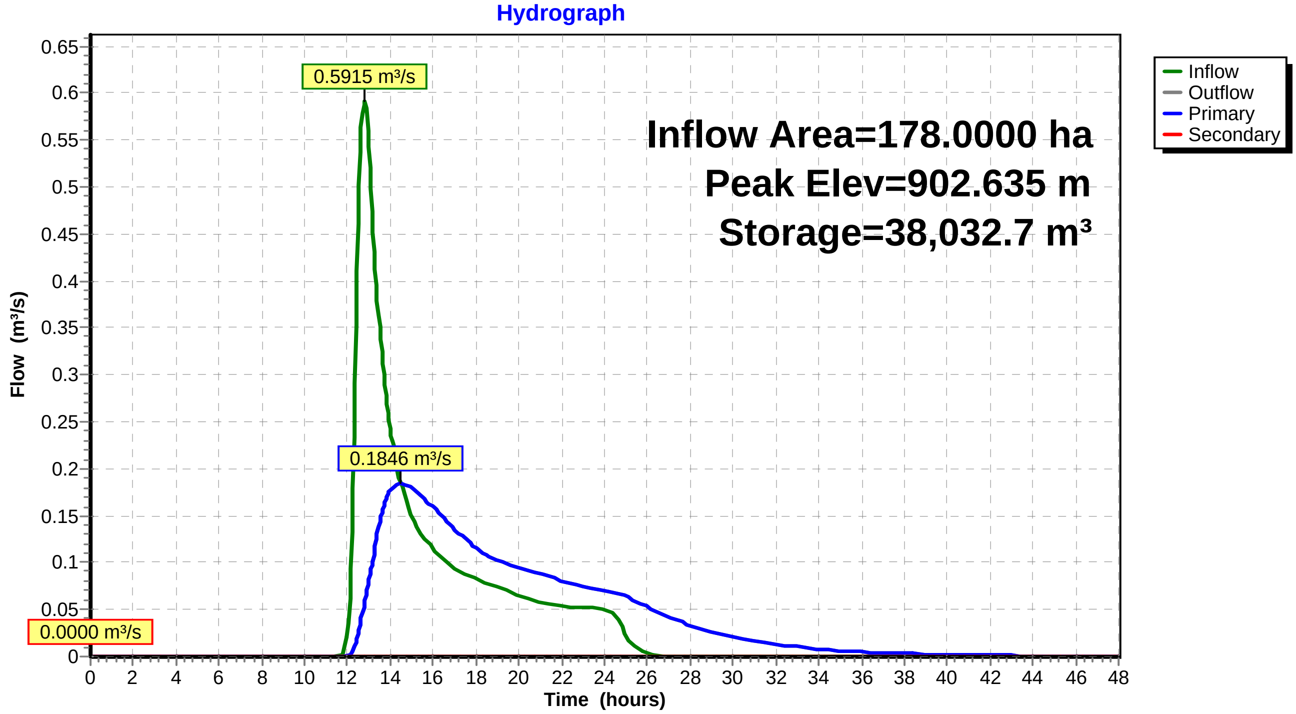
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

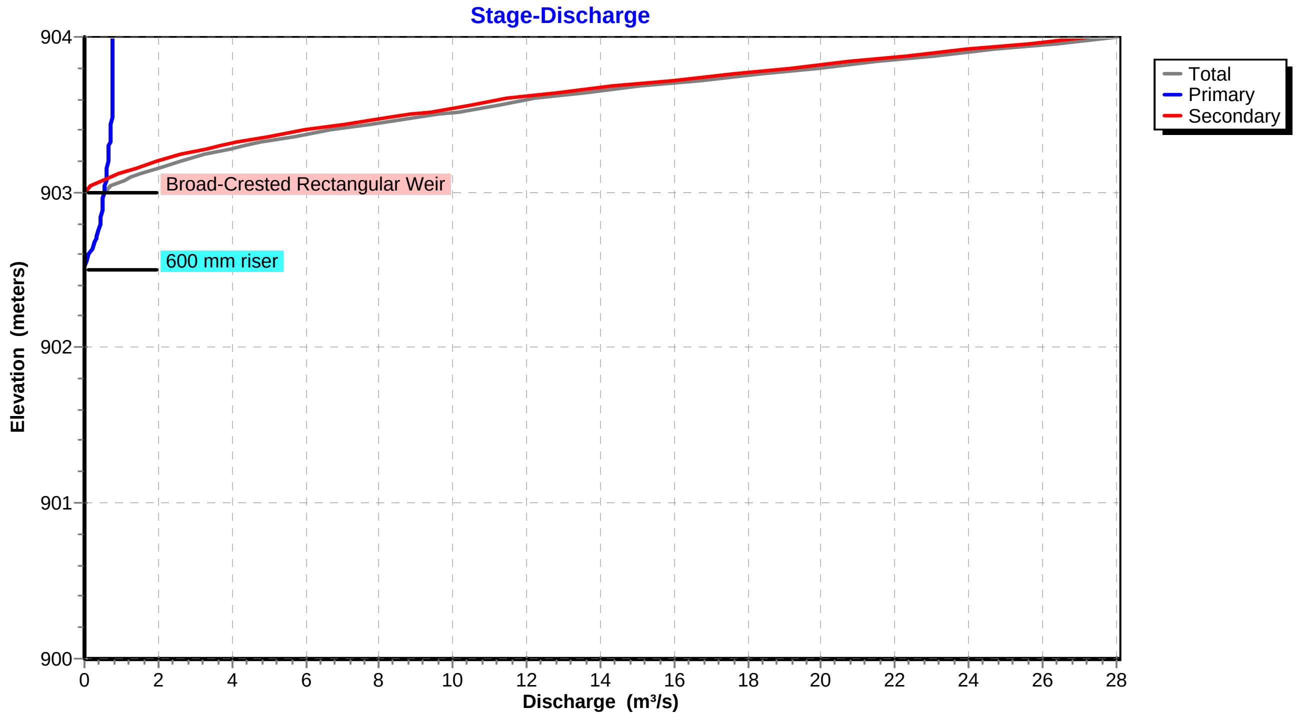
Primary OutFlow Max=0.1846 m³/s @ 14.49 hrs HW=902.635 m (Free Discharge)
↑—**1=600 mm riser** (Custom Controls 0.1846 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=902.500 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 25P: Platinum Gulch SCP



Pond 25P: Platinum Gulch SCP



Pond 33P: Lower Dublin South Pond

Inflow Area = 93.0000 ha, Inflow Depth = 5 mm for Aug 20mm event
Inflow = 0.4983 m³/s @ 12.82 hrs, Volume= 4.501 Ml
Outflow = 0.0998 m³/s @ 15.13 hrs, Volume= 4.484 Ml, Atten= 80%, Lag= 138.8 min
Primary = 0.0998 m³/s @ 15.13 hrs, Volume= 4.484 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 831.597 m @ 15.13 hrs Surf.Area= 20,866.8 m² Storage= 31,620.8 m³ (2,015.3 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 328.8 min (1,263.9 - 935.1)

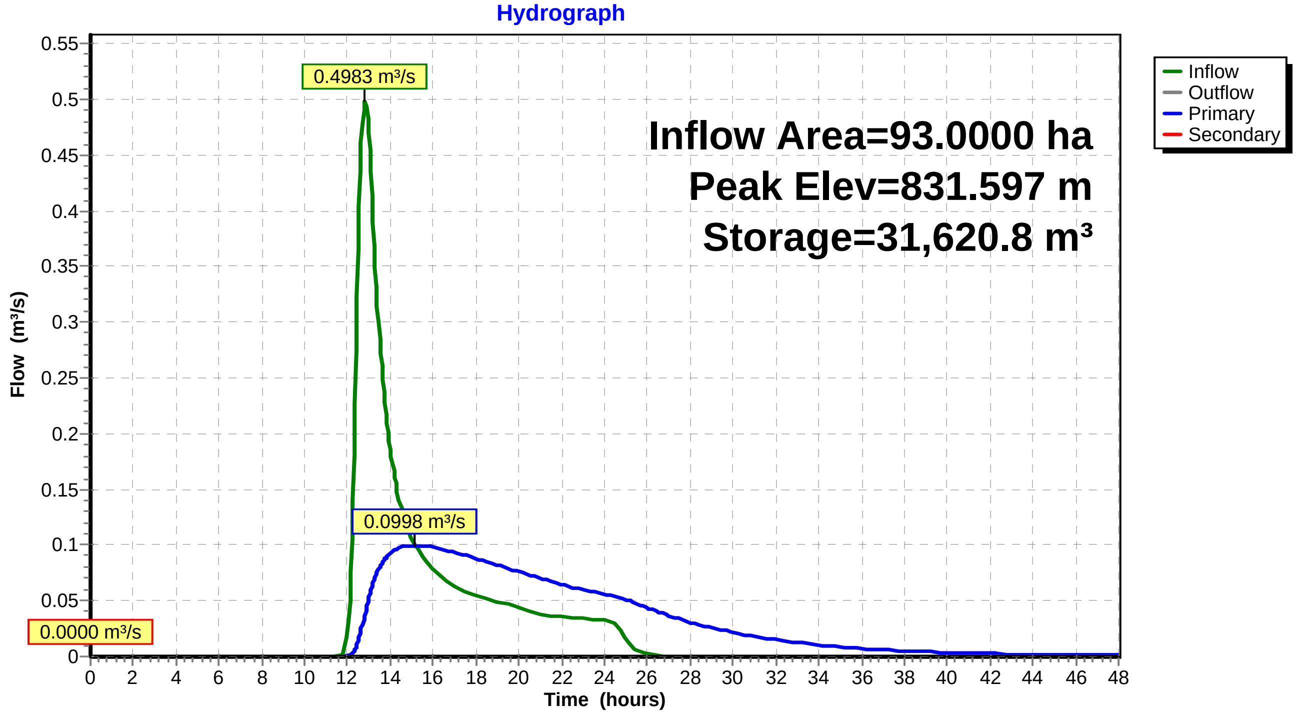
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

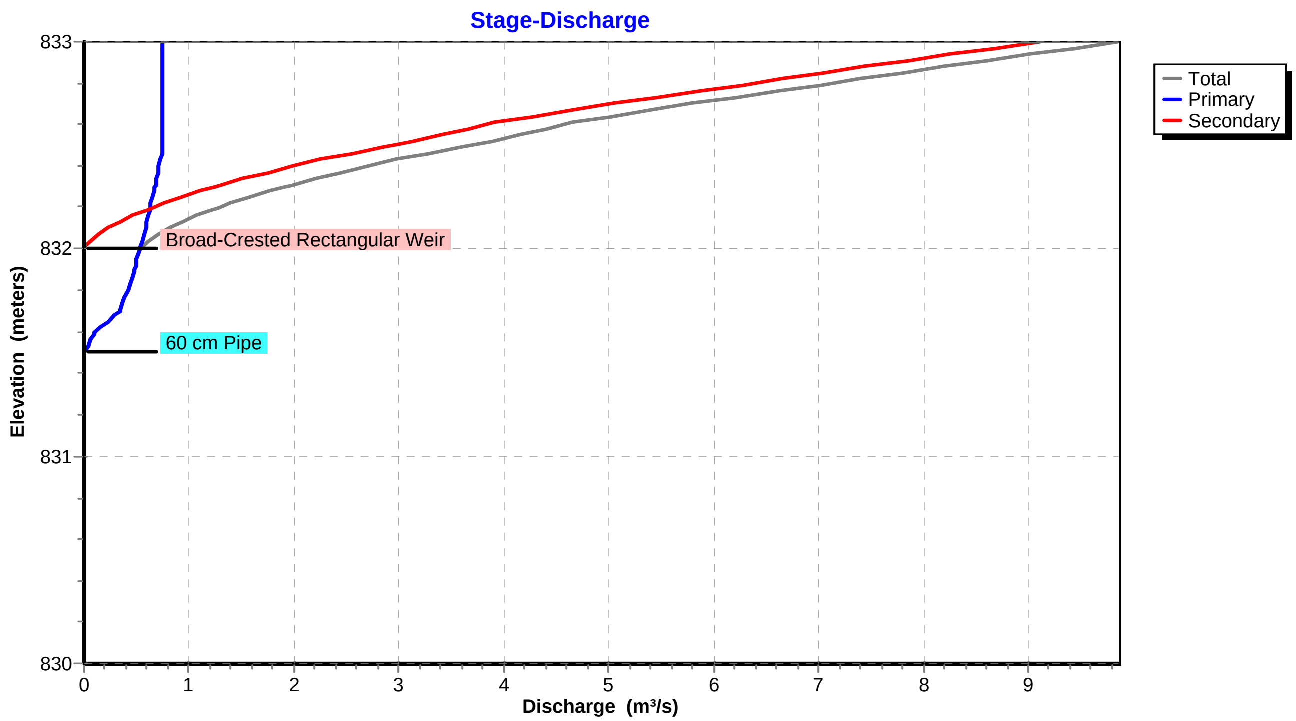
Primary OutFlow Max=0.0998 m³/s @ 15.13 hrs HW=831.597 m (Free Discharge)
↑—**1=60 cm Pipe** (Custom Controls 0.0998 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=831.500 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 33P: Lower Dublin South Pond



Pond 33P: Lower Dublin South Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Platinum Gulch WRSA Runoff Area=41.0000 ha Runoff Depth=2 mm
Tc=100.0 min CN=85 Runoff=0.0318 m³/s 0.621 Ml

Subcatchment 2S: Camp & Process Facilities Runoff Area=39.0000 ha Runoff Depth=4 mm
Tc=45.0 min CN=90 Runoff=0.2089 m³/s 1.467 Ml

Subcatchment 9S: Upper Dublin Gulch Runoff Area=850.0000 ha Runoff Depth=2 mm
Tc=210.0 min CN=85 Runoff=0.4508 m³/s 12.884 Ml

Subcatchment 10S: Gil Gulch Undisturbed Runoff Area=312.2280 ha Runoff Depth=2 mm
Tc=127.0 min CN=85 Runoff=0.2197 m³/s 4.733 Ml

Subcatchment 17S: Open Pit Runoff Area=81.0000 ha Runoff Depth=4 mm
Tc=65.0 min CN=90 Runoff=0.3334 m³/s 3.047 Ml

Subcatchment 22S: Eagle Pup WRSA Runoff Area=128.0000 ha Runoff Depth=2 mm
Tc=81.0 min CN=85 Runoff=0.1138 m³/s 1.940 Ml

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (f Runoff Area=673.0000 ha Runoff Depth=2 mm
Tc=187.0 min CN=85 Runoff=0.3767 m³/s 10.201 Ml

Subcatchment 35S: Laydown, truck stop, ore storage and c Runoff Area=93.0000 ha Runoff Depth=4 mm
Tc=69.0 min CN=90 Runoff=0.3646 m³/s 3.499 Ml

Subcatchment 36S: Haggart U/S of Site- Gauge W22 Runoff Area=6,730.0000 ha Runoff Depth>2 mm
Tc=591.0 min CN=85 Runoff=2.1346 m³/s 101.892 Ml

Subcatchment 37S: Ann Gulch West Culvert Runoff Area=42.8000 ha Runoff Depth=2 mm
Tc=47.0 min CN=85 Runoff=0.0504 m³/s 0.649 Ml

Subcatchment 38S: Lower Platinum Gulch Runoff Area=56.0000 ha Runoff Depth=2 mm
Tc=54.0 min CN=85 Runoff=0.0614 m³/s 0.849 Ml

Subcatchment 39S: Lower Dublin Gulch Runoff Area=46.0000 ha Runoff Depth=2 mm
Tc=49.0 min CN=85 Runoff=0.0529 m³/s 0.697 Ml

Subcatchment 40S: Lower Eagle Creek Runoff Area=96.0000 ha Runoff Depth=2 mm
Tc=71.0 min CN=85 Runoff=0.0899 m³/s 1.455 Ml

Subcatchment 41S: Ann Gulch West Runoff Area=13.0000 ha Runoff Depth=2 mm
Tc=26.0 min CN=85 Runoff=0.0211 m³/s 0.197 Ml

Subcatchment 42S: Lower Platinum Gulch Culvert Runoff Area=56.9000 ha Runoff Depth=2 mm
Tc=54.0 min CN=85 Runoff=0.0624 m³/s 0.862 Ml

Subcatchment 43S: Lower Eagle Creek Culvert Runoff Area=15.9000 ha Runoff Depth=2 mm
Tc=29.0 min CN=85 Runoff=0.0243 m³/s 0.241 Ml

Subcatchment 44S: Lower Dublin Gulch Culvert Runoff Area=7.4000 ha Runoff Depth=4 mm
Tc=20.0 min CN=90 Runoff=0.0705 m³/s 0.278 Ml

Reach 14R: Upper DG Diversion Cha Avg. Depth=0.06 m Max Vel=0.96 m/s Inflow=0.4928 m³/s 14.823 Ml
n=0.037 L=800.00 m S=0.0587 m/m Capacity=62.9505 m³/s Outflow=0.4915 m³/s 14.823 Ml

Reach 16R: Eagle Creek Avg. Depth=0.12 m Max Vel=0.47 m/s Inflow=0.5780 m³/s 19.004 Ml
n=0.037 L=800.00 m S=0.0056 m/m Capacity=181.4048 m³/s Outflow=0.5695 m³/s 18.998 Ml

Reach 18R: Mid Haggart Creek Avg. Depth=1.45 m Max Vel=1.51 m/s Inflow=2.2139 m³/s 108.226 Ml
n=0.037 L=500.00 m S=0.0100 m/m Capacity=42.7648 m³/s Outflow=2.2136 m³/s 108.201 Ml

Reach 19R: Lower Haggart Creek Avg. Depth=0.10 m Max Vel=1.30 m/s Inflow=2.6227 m³/s 133.167 Ml
n=0.037 L=100.00 m S=0.0500 m/m Capacity=1,150.9770 m³/s Outflow=2.6226 m³/s 133.162 Ml

Reach 33R: Lower DG Diversion Cha Avg. Depth=0.06 m Max Vel=0.97 m/s Inflow=0.5073 m³/s 15.520 Ml
n=0.037 L=1,100.00 m S=0.0591 m/m Capacity=63.1329 m³/s Outflow=0.5040 m³/s 15.519 Ml

Reach 34R: Upper Haggart Creek Avg. Depth=1.53 m Max Vel=1.31 m/s Inflow=2.1570 m³/s 103.555 Ml
n=0.037 L=1,200.00 m S=0.0071 m/m Capacity=40.5215 m³/s Outflow=2.1555 m³/s 103.493 Ml

Reach 35R: Platinum Gulch Channel Avg. Depth=0.15 m Max Vel=0.96 m/s Inflow=0.1125 m³/s 4.514 Ml
n=0.100 L=750.00 m S=0.1933 m/m Capacity=6.9506 m³/s Outflow=0.1122 m³/s 4.512 Ml

Pond 23P: EP WRSA SCP Peak Elev=917.337 m Storage=21,048.5 m³ Inflow=0.1138 m³/s 1.940 Ml
Primary=0.0435 m³/s 1.939 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0435 m³/s 1.939 Ml

Pond 24P: Lower Dublin North Peak Elev=790.568 m Storage=9,099.8 m³ Inflow=0.2089 m³/s 1.467 Ml
Primary=0.0355 m³/s 1.465 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0355 m³/s 1.465 Ml

Pond 25P: Platinum Gulch SCP Peak Elev=902.604 m Storage=37,540.9 m³ Inflow=0.4120 m³/s 4.518 Ml
Primary=0.1125 m³/s 4.514 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.1125 m³/s 4.514 Ml

Pond 33P: Lower Dublin South Po Peak Elev=831.573 m Storage=31,128.0 m³ Inflow=0.3646 m³/s 3.499 Ml
Primary=0.0754 m³/s 3.485 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0754 m³/s 3.485 Ml

Total Runoff Area = 9,281.2280 ha Runoff Volume = 145.514 Ml Average Runoff Depth = 2 mm
100.00% Pervious Area = 9,281.2280 ha 0.00% Impervious Area = 0.0000 ha

Subcatchment 1S: Platinum Gulch WRSA

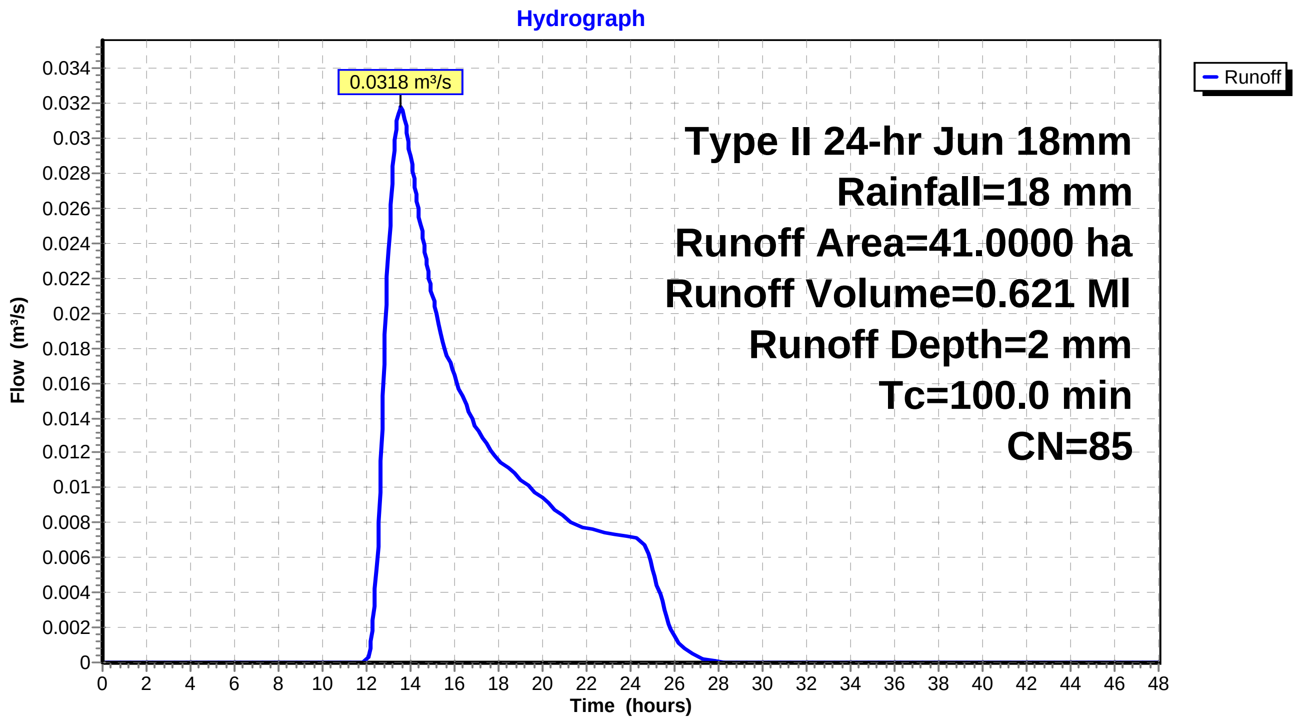
Runoff = 0.0318 m³/s @ 13.57 hrs, Volume= 0.621 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
41.0000	85	Porous waste rock
41.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m^3/s)	Description
100.0					**Direct Entry, BCMOE**

Subcatchment 1S: Platinum Gulch WRSA



Subcatchment 2S: Camp & Process Facilities

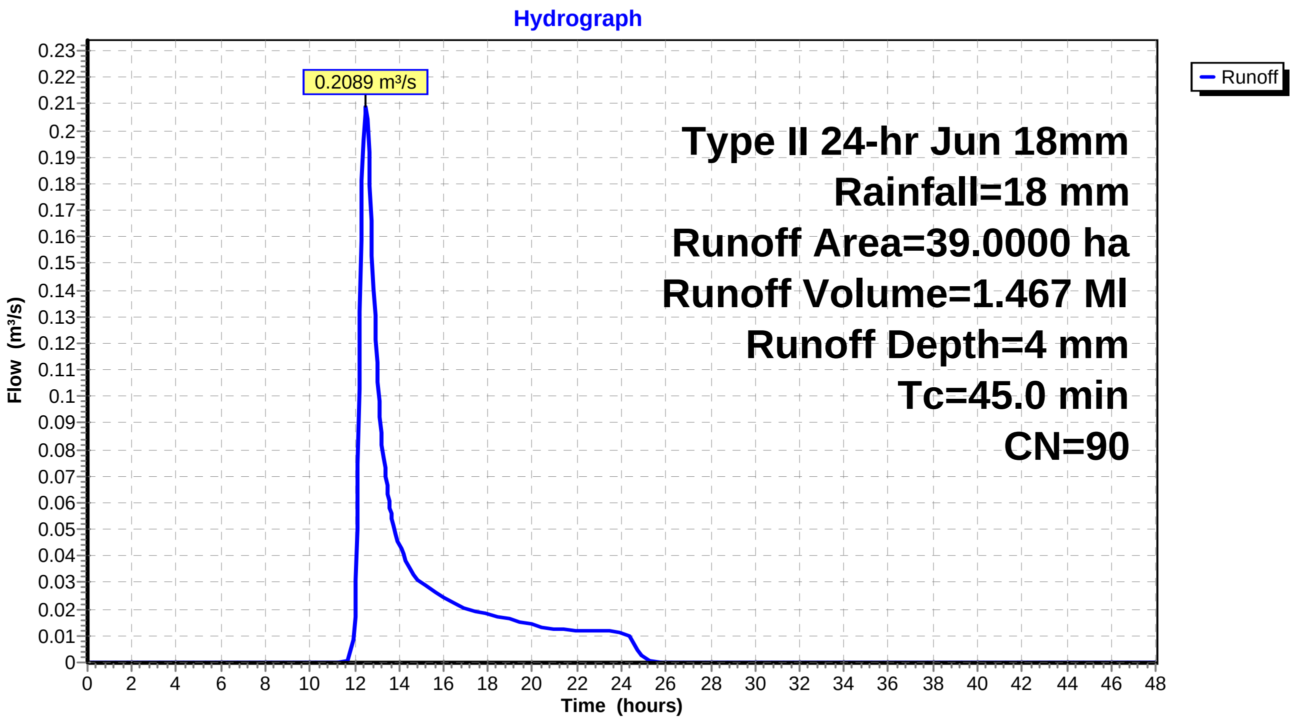
Runoff = 0.2089 m³/s @ 12.51 hrs, Volume= 1.467 Ml, Depth= 4 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
39.0000	90	Highly disturbed
39.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
45.0					**Direct Entry, BCMOE >10%**

Subcatchment 2S: Camp & Process Facilities



Subcatchment 9S: Upper Dublin Gulch

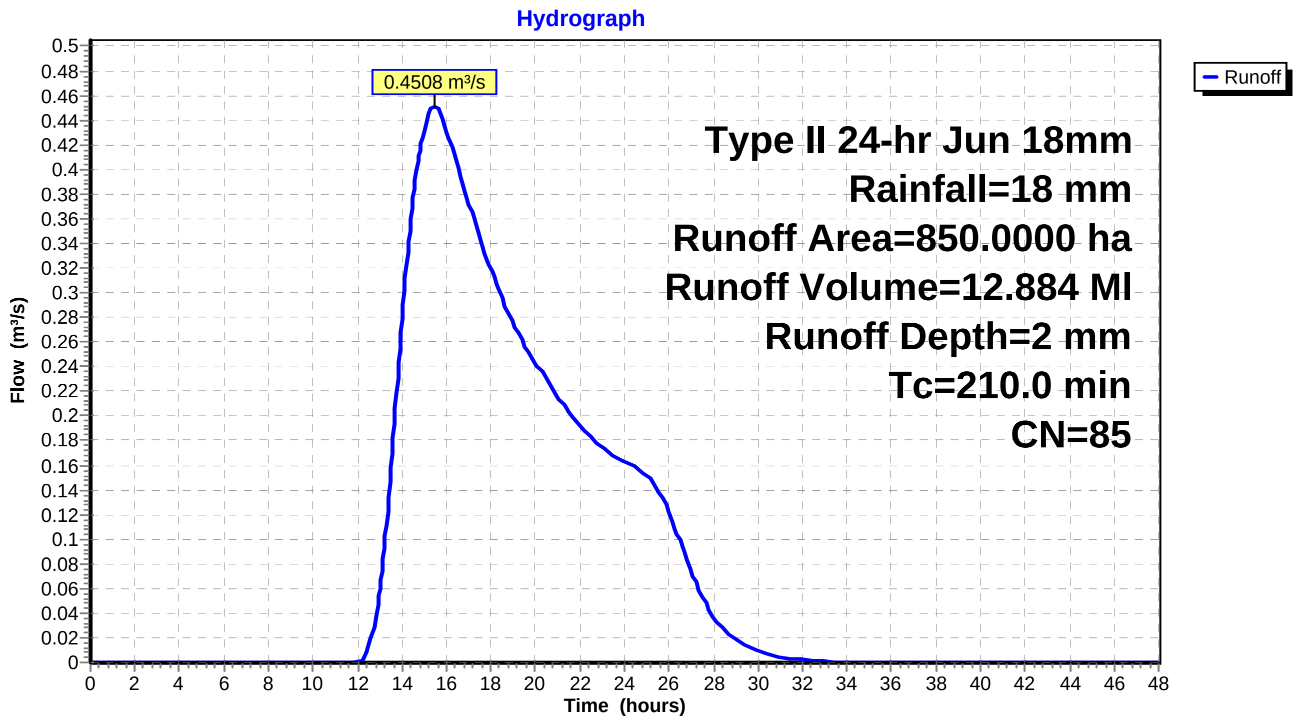
Runoff = 0.4508 m³/s @ 15.42 hrs, Volume= 12.884 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
850.0000	85	Calibrated from runoff measurements
850.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
210.0					**Direct Entry, BCMOE>10%**

Subcatchment 9S: Upper Dublin Gulch



Subcatchment 10S: Gil Gulch Undisturbed

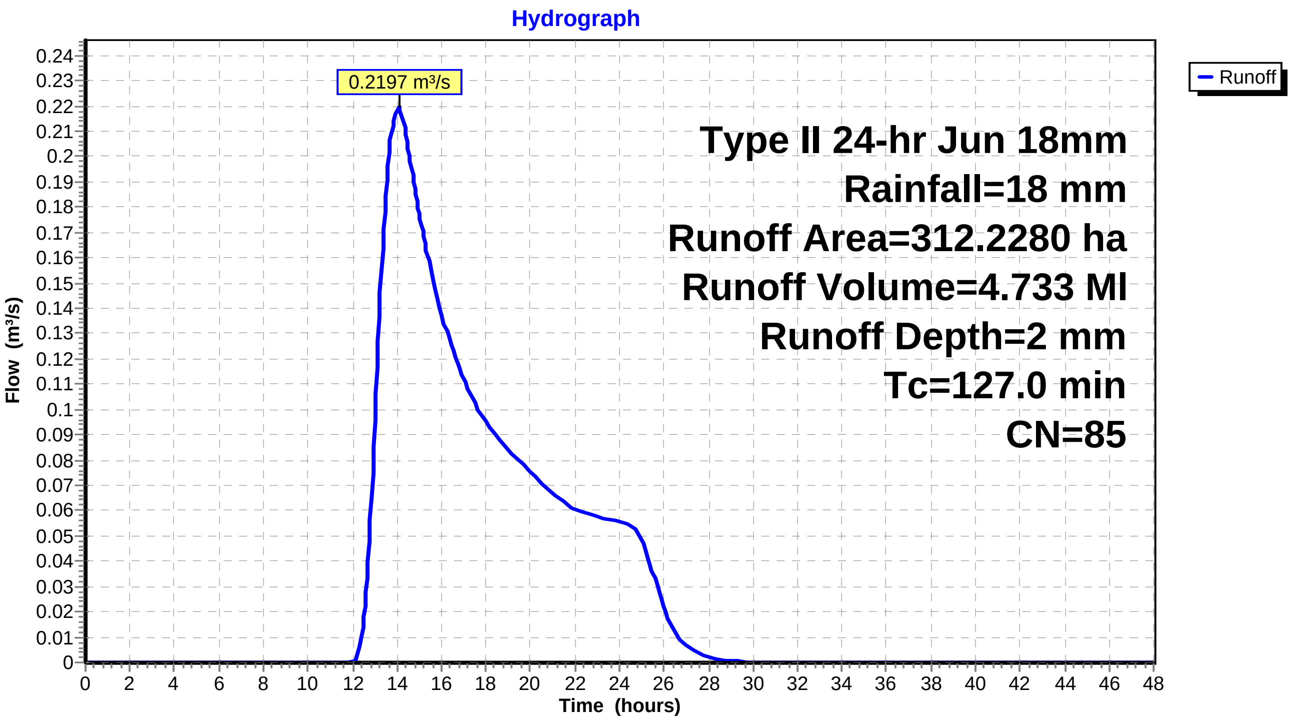
Runoff = 0.2197 m³/s @ 14.09 hrs, Volume= 4.733 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
312.2280	85	
312.2280		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
127.0					**Direct Entry, BCMOE >10%**

Subcatchment 10S: Gil Gulch Undisturbed



Subcatchment 17S: Open Pit

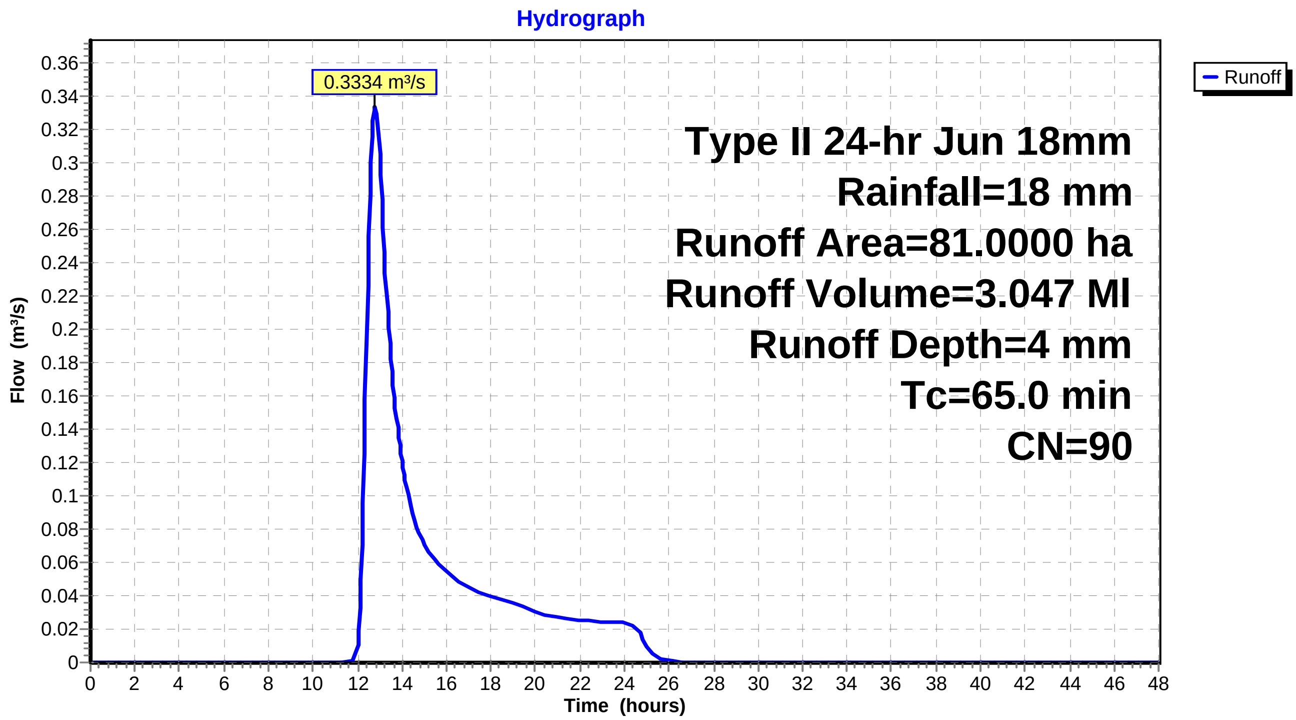
Runoff = 0.3334 m³/s @ 12.80 hrs, Volume= 3.047 Ml, Depth= 4 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
81.0000	90	Highly disturbed, bare rock with benches
81.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
65.0					**Direct Entry, BCMOE**

Subcatchment 17S: Open Pit



Subcatchment 22S: Eagle Pup WRSA

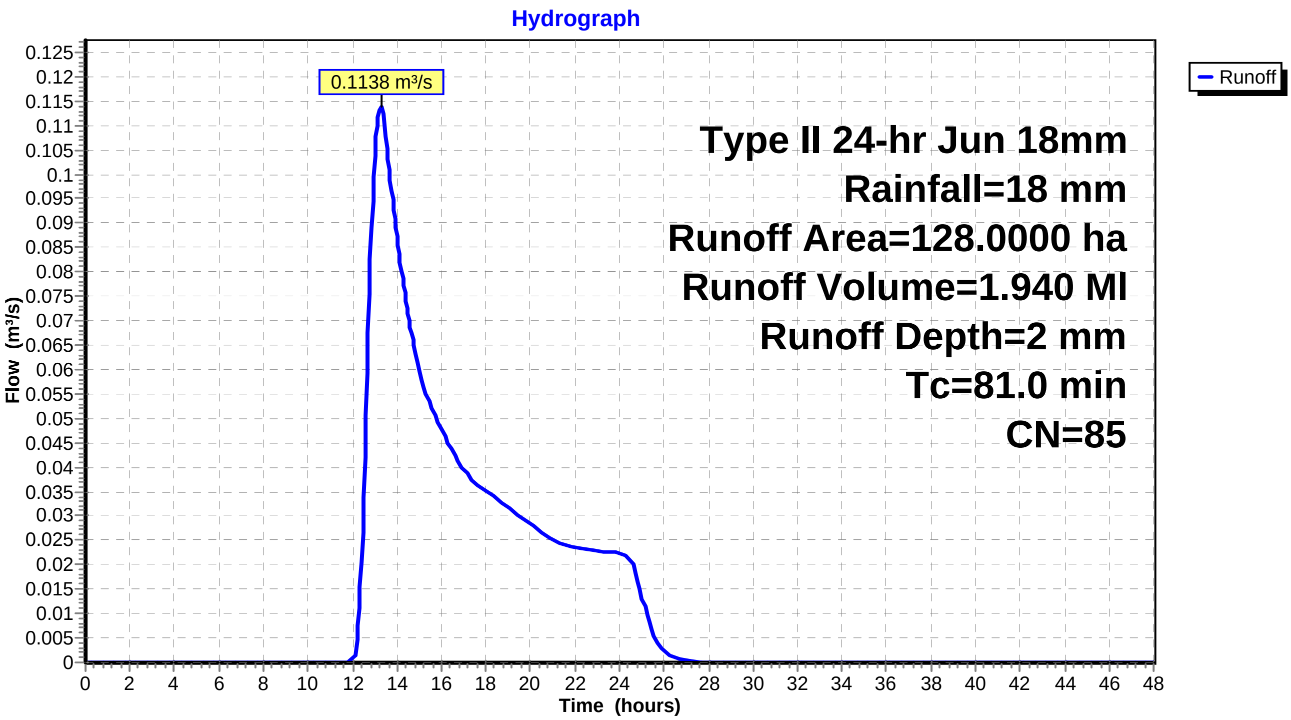
Runoff = 0.1138 m³/s @ 13.27 hrs, Volume= 1.940 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
128.0000	85	
128.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
81.0					**Direct Entry, Estimated long duration for runoff through waste**

Subcatchment 22S: Eagle Pup WRSA



Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)

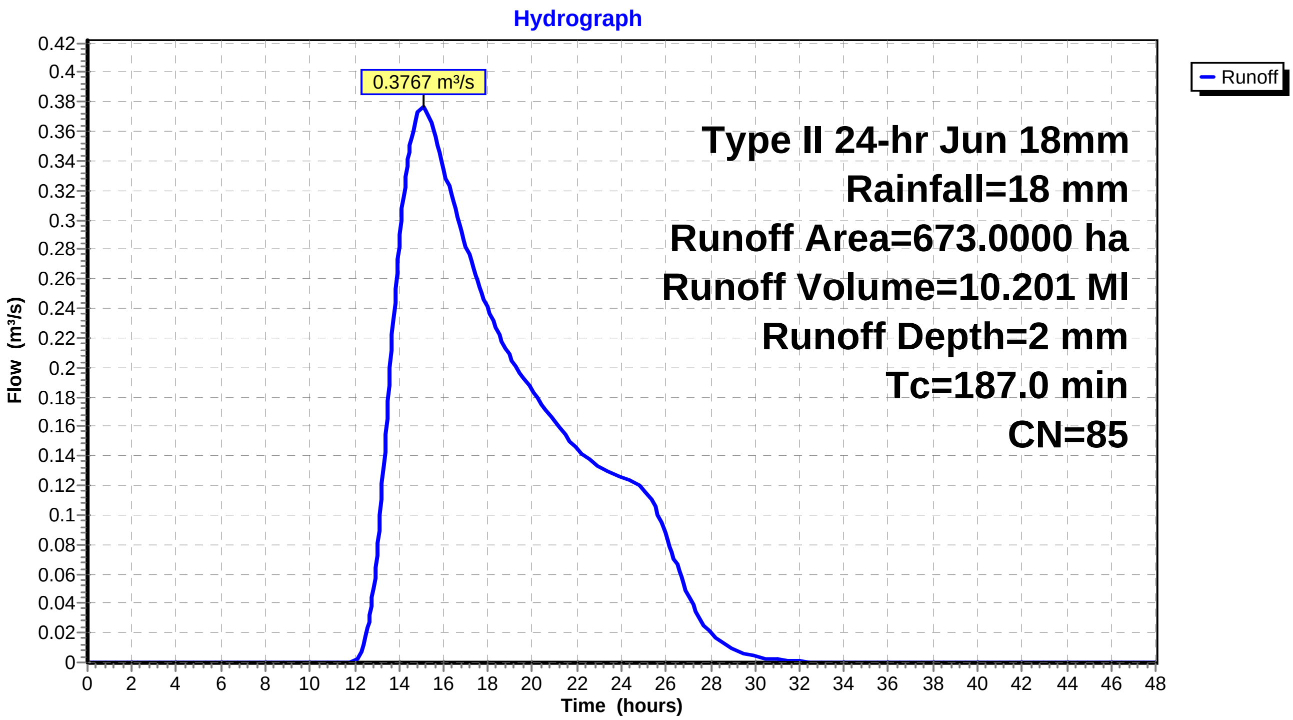
Runoff = 0.3767 m³/s @ 15.13 hrs, Volume= 10.201 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
673.0000	85	
673.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
187.0					**Direct Entry, Coulson Equation for >0.1 slope catchment**

Subcatchment 34S: Dublin Gulch U/S of Site Gauge W1 (for calibration)



Subcatchment 35S: Laydown, truck stop, ore storage and crushing

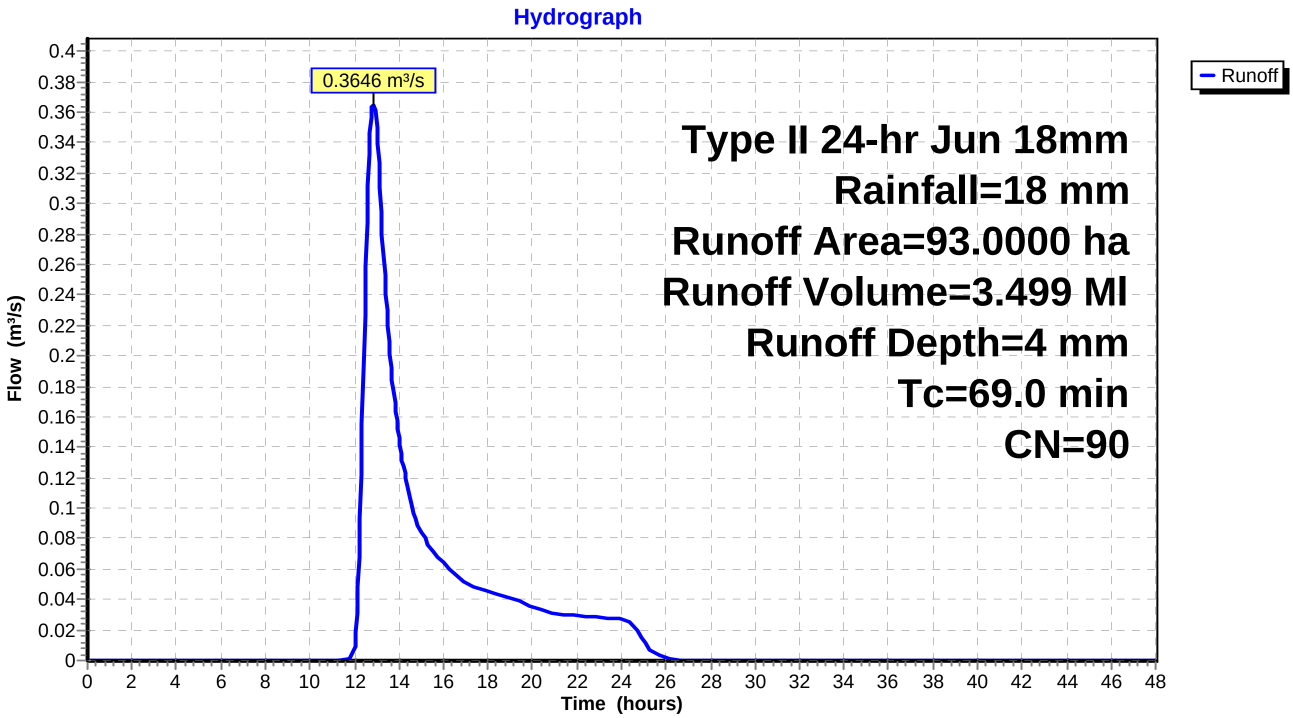
Runoff = 0.3646 m³/s @ 12.84 hrs, Volume= 3.499 Ml, Depth= 4 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
93.0000	90	Highly disturbed
93.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
69.0					**Direct Entry, BCMOE**

Subcatchment 35S: Laydown, truck stop, ore storage and crushing



Subcatchment 36S: Haggart U/S of Site- Gauge W22

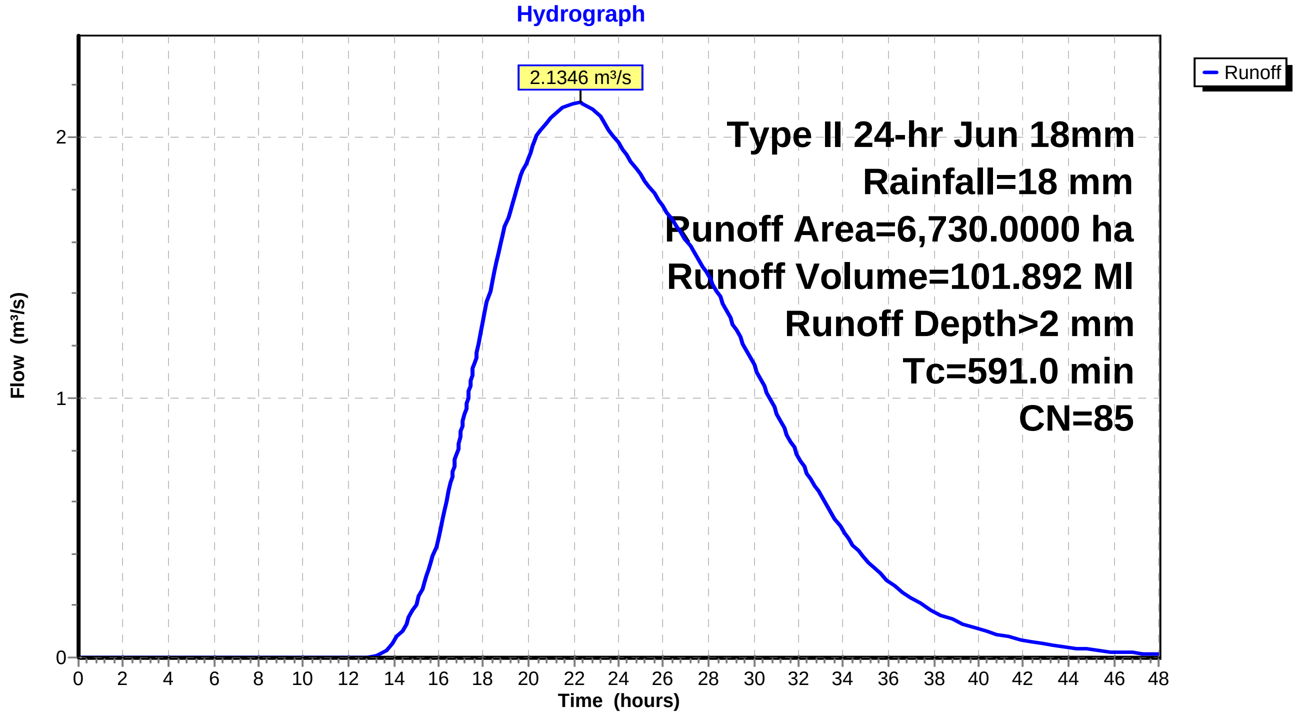
Runoff = 2.1346 m³/s @ 22.29 hrs, Volume= 101.892 Ml, Depth> 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
6,730.0000	85	
6,730.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
591.0					**Direct Entry, BCMOE**

Subcatchment 36S: Haggart U/S of Site- Gauge W22



Subcatchment 37S: Ann Gulch West Culvert

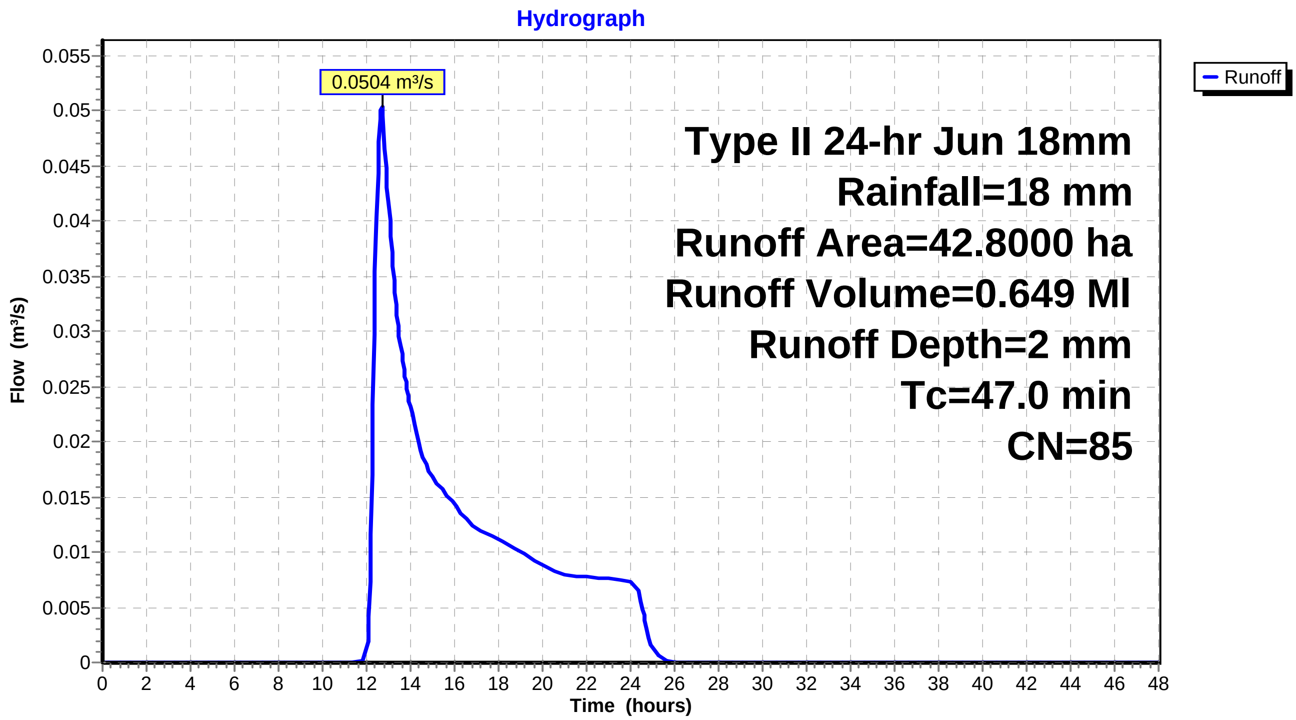
Runoff = 0.0504 m³/s @ 12.69 hrs, Volume= 0.649 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
42.8000	85	
42.8000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
47.0					**Direct Entry,**

Subcatchment 37S: Ann Gulch West Culvert



Subcatchment 38S: Lower Platinum Gulch

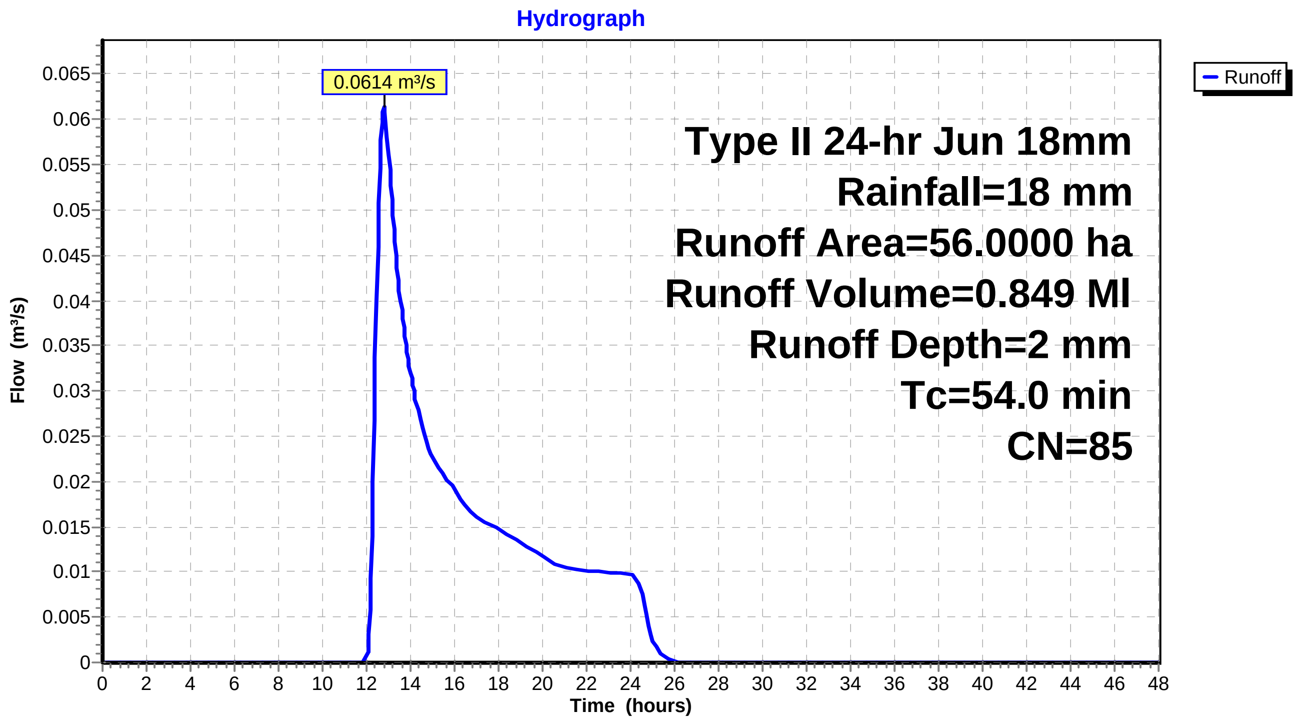
Runoff = 0.0614 m³/s @ 12.81 hrs, Volume= 0.849 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
56.0000	85	
56.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry, BCMOE**

Subcatchment 38S: Lower Platinum Gulch



Subcatchment 39S: Lower Dublin Gulch

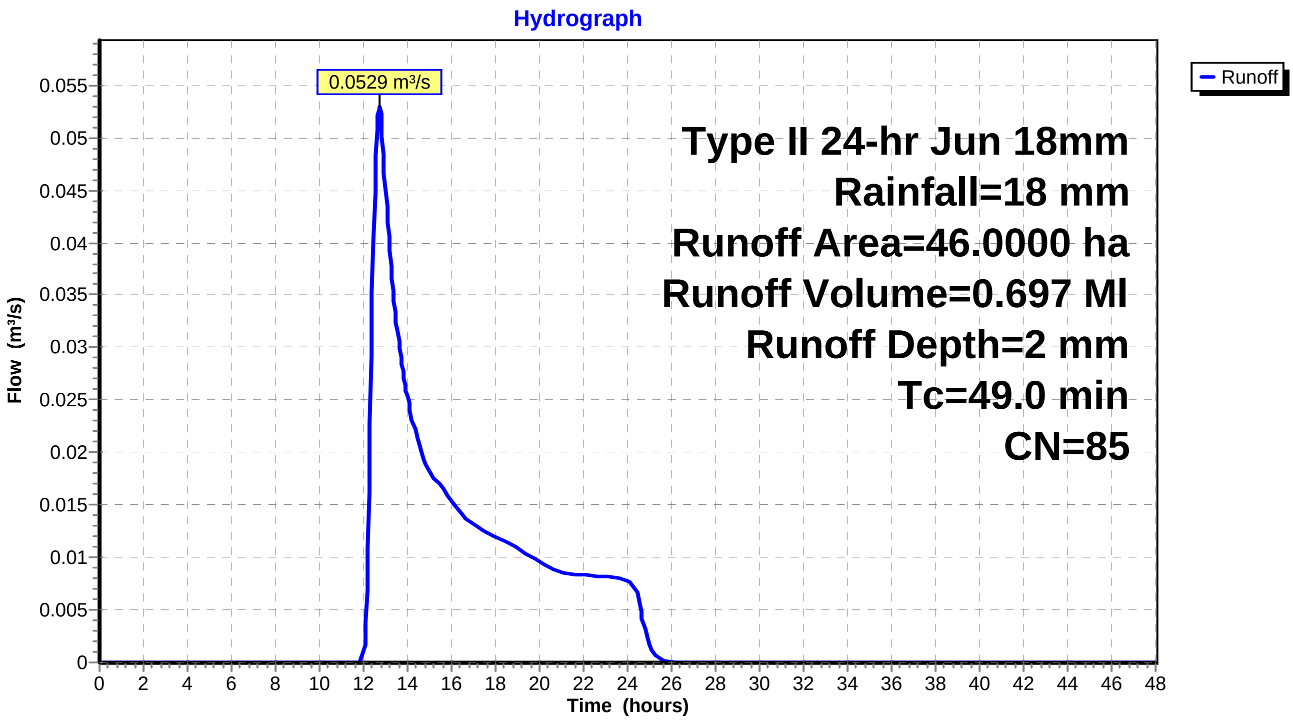
Runoff = 0.0529 m³/s @ 12.72 hrs, Volume= 0.697 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
46.0000	85	
46.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
49.0					**Direct Entry, BCMOE**

Subcatchment 39S: Lower Dublin Gulch



Subcatchment 40S: Lower Eagle Creek

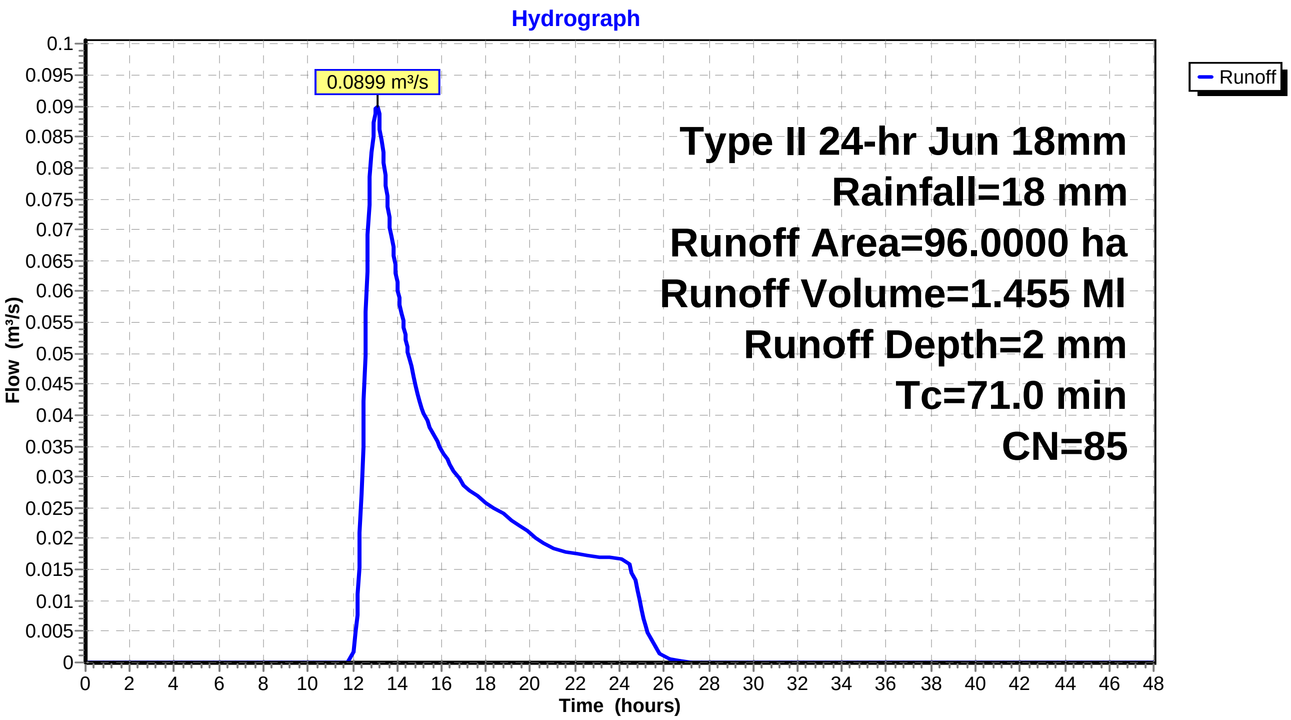
Runoff = 0.0899 m³/s @ 13.09 hrs, Volume= 1.455 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
96.0000	85	Some small disturbance
96.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
71.0					**Direct Entry, BCMOE (Slope>0.10)**

Subcatchment 40S: Lower Eagle Creek



Subcatchment 41S: Ann Gulch West

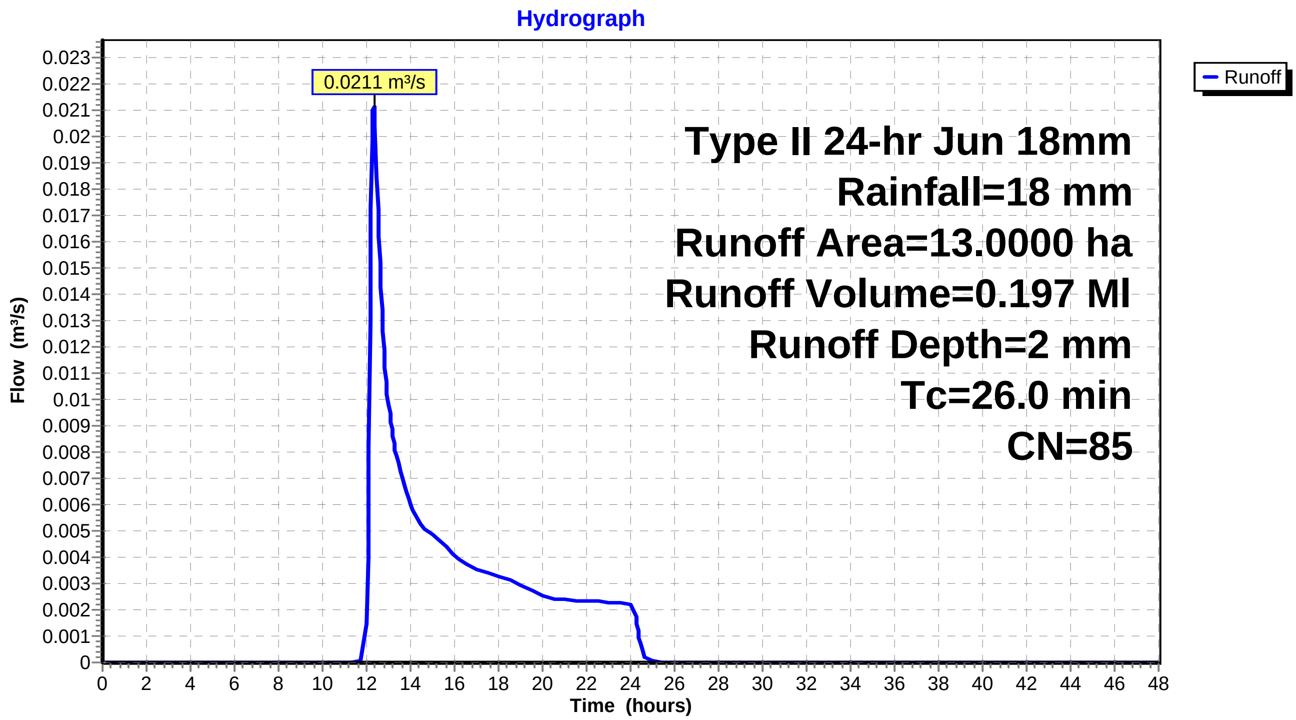
Runoff = 0.0211 m³/s @ 12.32 hrs, Volume= 0.197 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
13.0000	85	
13.0000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
26.0					**Direct Entry,**

Subcatchment 41S: Ann Gulch West



Subcatchment 42S: Lower Platinum Gulch Culvert

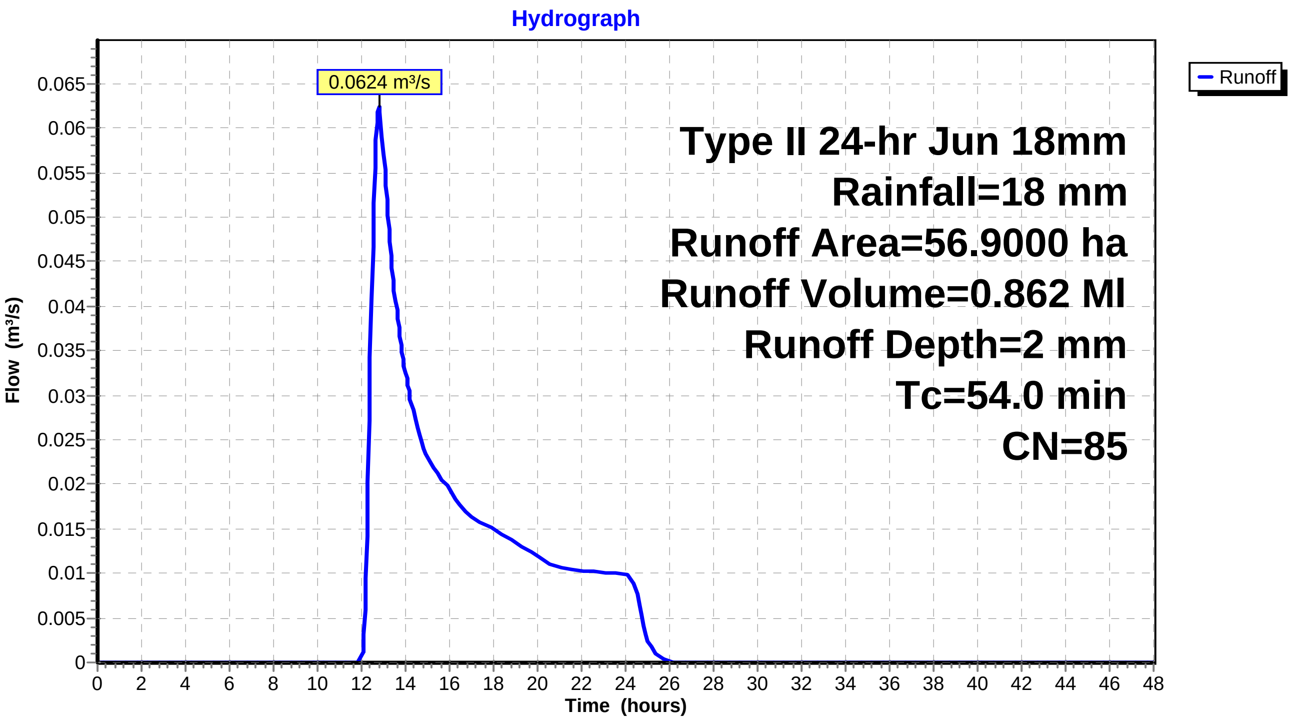
Runoff = 0.0624 m³/s @ 12.81 hrs, Volume= 0.862 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
56.9000	85	
56.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
54.0					**Direct Entry,**

Subcatchment 42S: Lower Platinum Gulch Culvert



Subcatchment 43S: Lower Eagle Creek Culvert

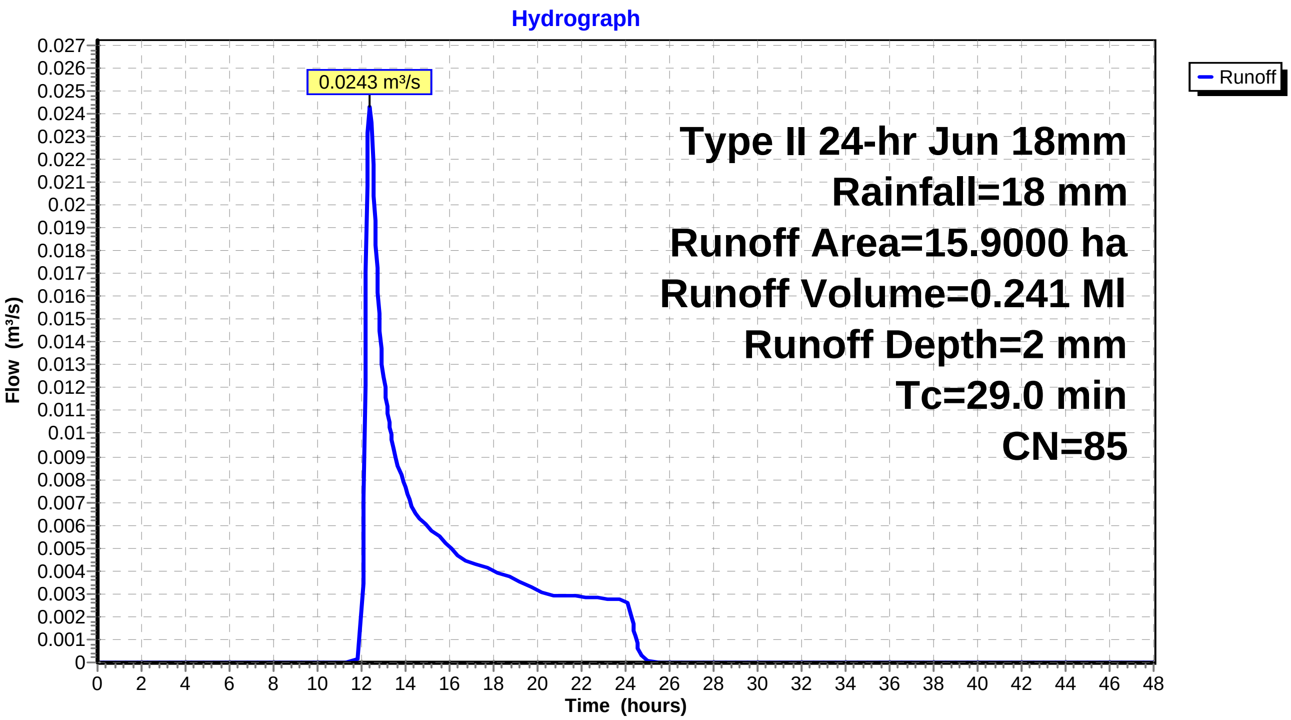
Runoff = 0.0243 m³/s @ 12.37 hrs, Volume= 0.241 Ml, Depth= 2 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
15.9000	85	
15.9000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
29.0					**Direct Entry,**

Subcatchment 43S: Lower Eagle Creek Culvert



Subcatchment 44S: Lower Dublin Gulch Culvert

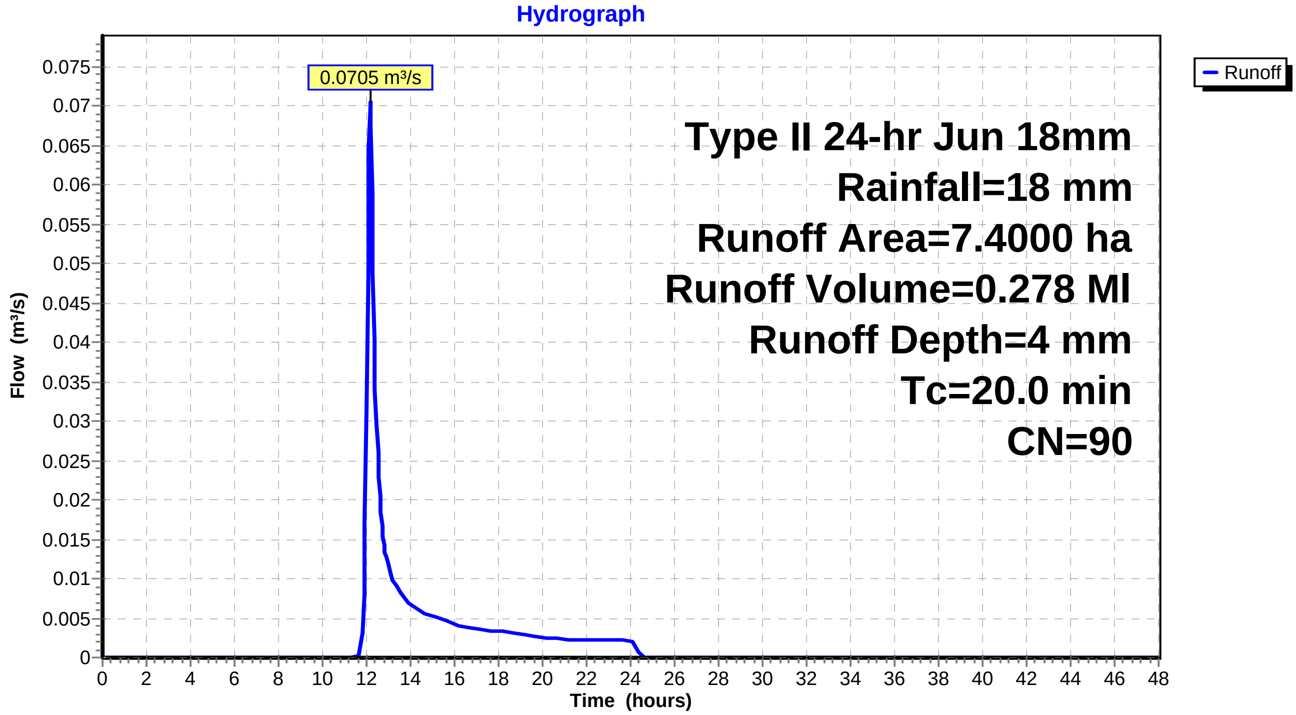
Runoff = 0.0705 m³/s @ 12.16 hrs, Volume= 0.278 Ml, Depth= 4 mm

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr Jun 18mm Rainfall=18 mm

Area (ha)	CN	Description
7.4000	90	Disturbed from Laydown area
7.4000		Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment 44S: Lower Dublin Gulch Culvert



Reach 14R: Upper DG Diversion Channel

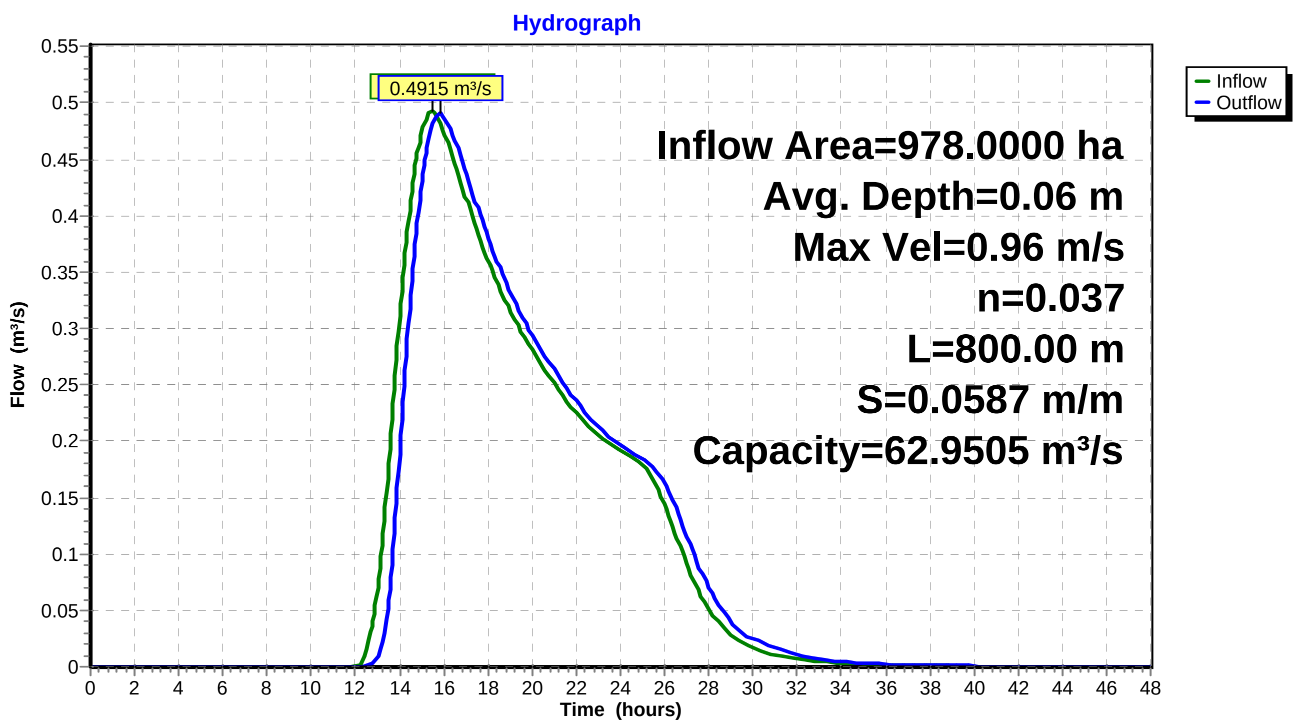
Inflow Area = 978.0000 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 0.4928 m³/s @ 15.46 hrs, Volume= 14.823 Ml
Outflow = 0.4915 m³/s @ 15.88 hrs, Volume= 14.823 Ml, Atten= 0%, Lag= 25.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.96 m/s, Min. Travel Time= 13.9 min
Avg. Velocity = 0.48 m/s, Avg. Travel Time= 27.5 min

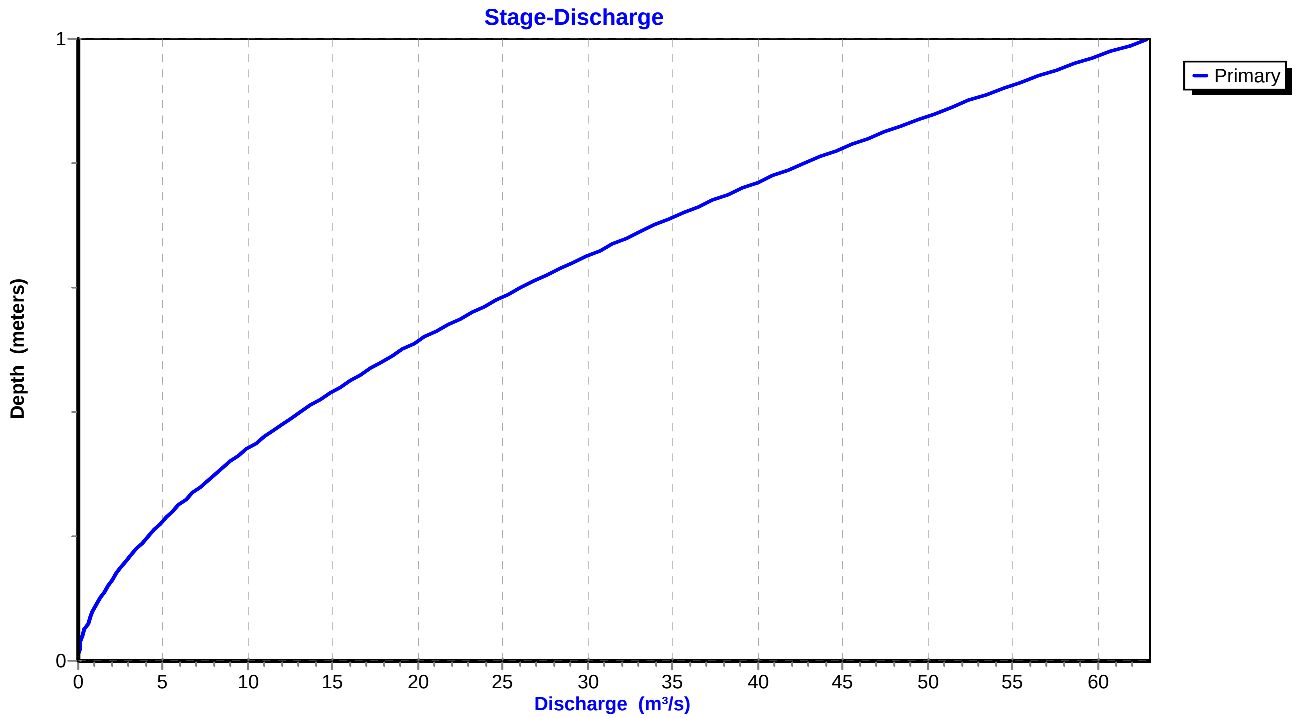
Peak Storage= 410.9 m³ @ 15.65 hrs, Average Depth at Peak Storage= 0.06 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 62.9505 m³/s

9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 800.00 m Slope= 0.0587 m/m
Inlet Invert= 902.000 m, Outlet Invert= 855.000 m

Reach 14R: Upper DG Diversion Channel



Reach 14R: Upper DG Diversion Channel



Reach 16R: Eagle Creek

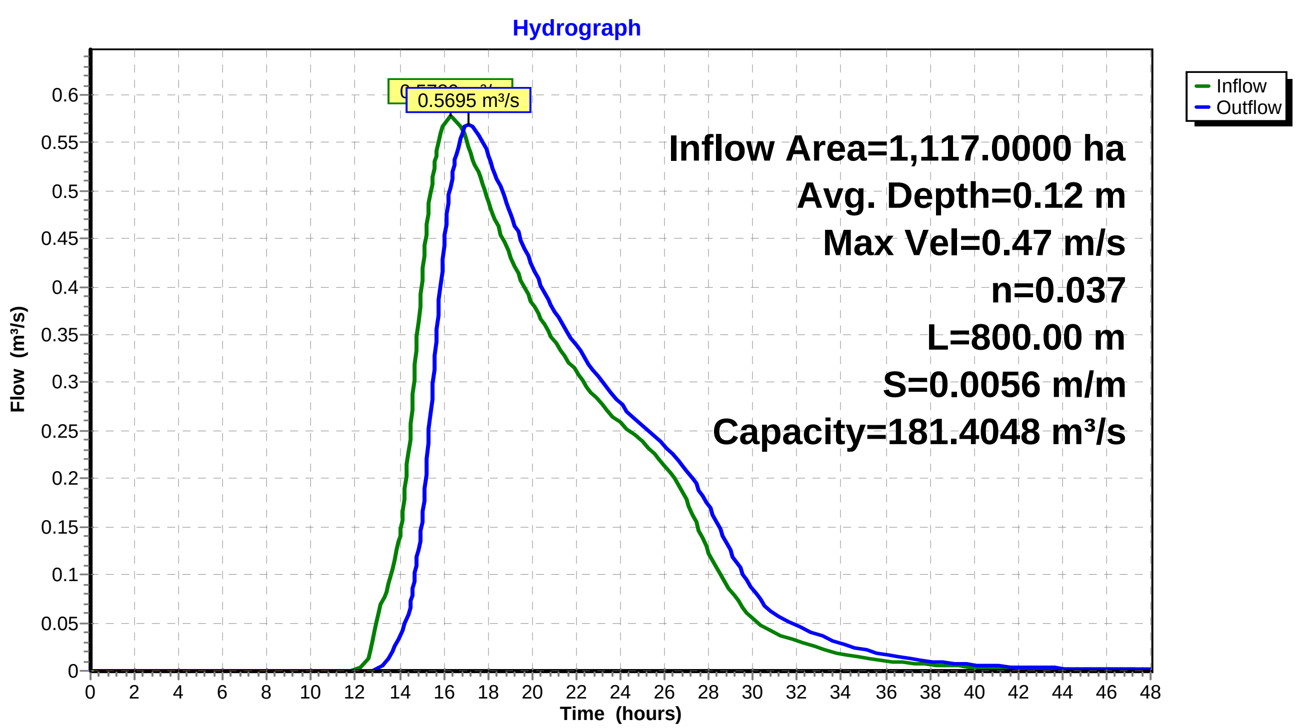
Inflow Area = 1,117.0000 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 0.5780 m³/s @ 16.34 hrs, Volume= 19.004 Ml
Outflow = 0.5695 m³/s @ 17.16 hrs, Volume= 18.998 Ml, Atten= 1%, Lag= 49.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.47 m/s, Min. Travel Time= 28.2 min
Avg. Velocity = 0.27 m/s, Avg. Travel Time= 49.2 min

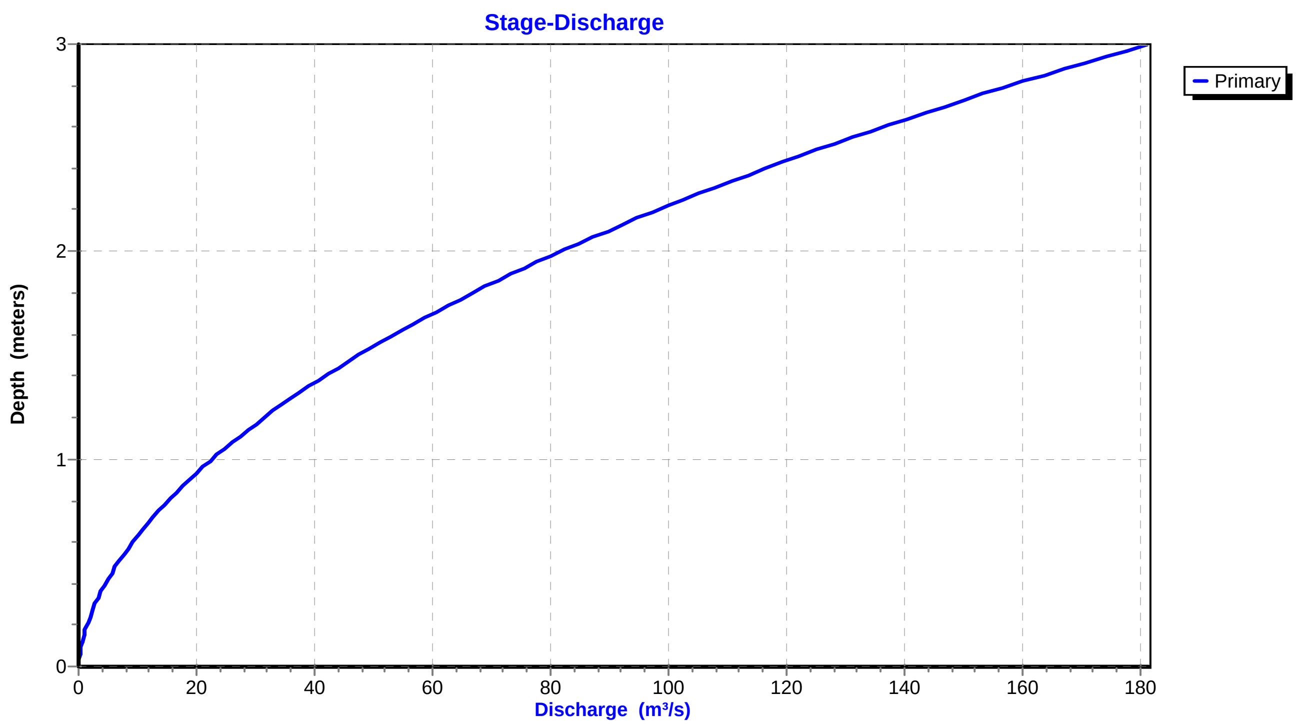
Peak Storage= 963.0 m³ @ 16.69 hrs, Average Depth at Peak Storage= 0.12 m
Bank-Full Depth= 3.000 m, Capacity at Bank-Full= 181.4048 m³/s

10.00 m x 3.00 m deep channel, n= 0.037
Side Slope Z-value= 3.0 m/m Top Width= 28.00 m
Length= 800.00 m Slope= 0.0056 m/m
Inlet Invert= 789.500 m, Outlet Invert= 785.000 m

Reach 16R: Eagle Creek



Reach 16R: Eagle Creek



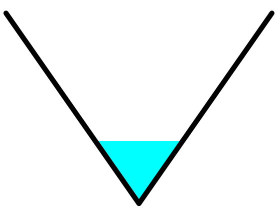
Reach 18R: Mid Haggart Creek

Inflow Area = 7,094.2280 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 2.2139 m³/s @ 22.60 hrs, Volume= 108.226 Ml
Outflow = 2.2136 m³/s @ 22.74 hrs, Volume= 108.201 Ml, Atten= 0%, Lag= 8.5 min

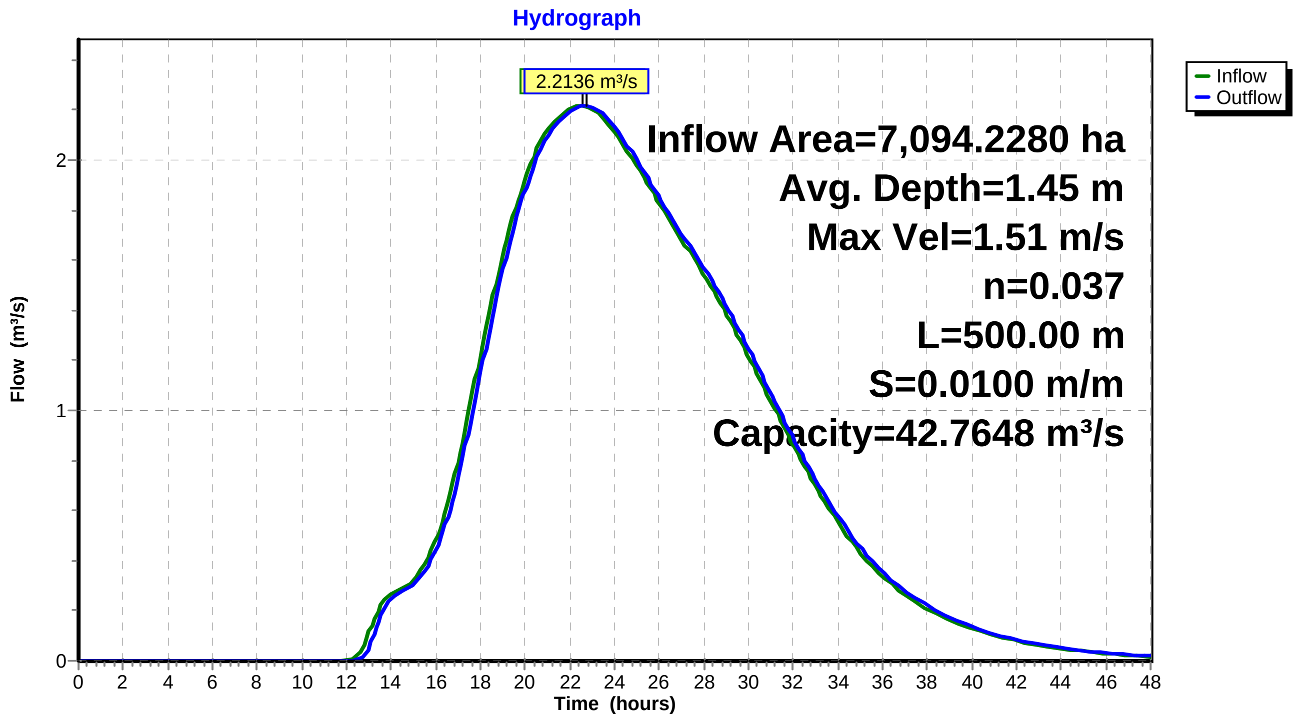
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.51 m/s, Min. Travel Time= 5.5 min
Avg. Velocity = 1.04 m/s, Avg. Travel Time= 8.0 min

Peak Storage= 735.3 m³ @ 22.65 hrs, Average Depth at Peak Storage= 1.45 m
Bank-Full Depth= 4.400 m, Capacity at Bank-Full= 42.7648 m³/s

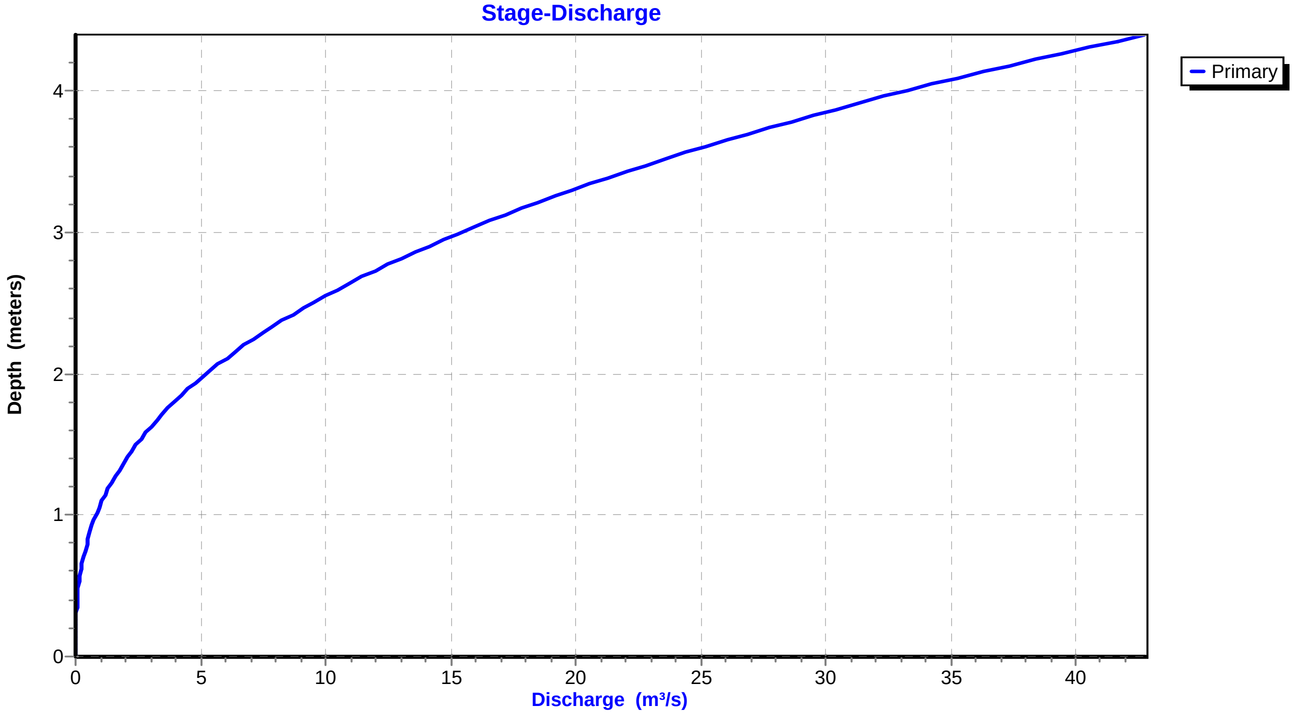
0.00 m x 4.40 m deep channel, n= 0.037 rock lined
Side Slope Z-value= 0.7 m/m Top Width= 6.16 m
Length= 500.00 m Slope= 0.0100 m/m
Inlet Invert= 805.000 m, Outlet Invert= 800.000 m



Reach 18R: Mid Haggart Creek



Reach 18R: Mid Haggart Creek



Reach 19R: Lower Haggart Creek

Inflow Area = 8,485.2280 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 2.6227 m³/s @ 22.22 hrs, Volume= 133.167 Ml
Outflow = 2.6226 m³/s @ 22.25 hrs, Volume= 133.162 Ml, Atten= 0%, Lag= 2.2 min

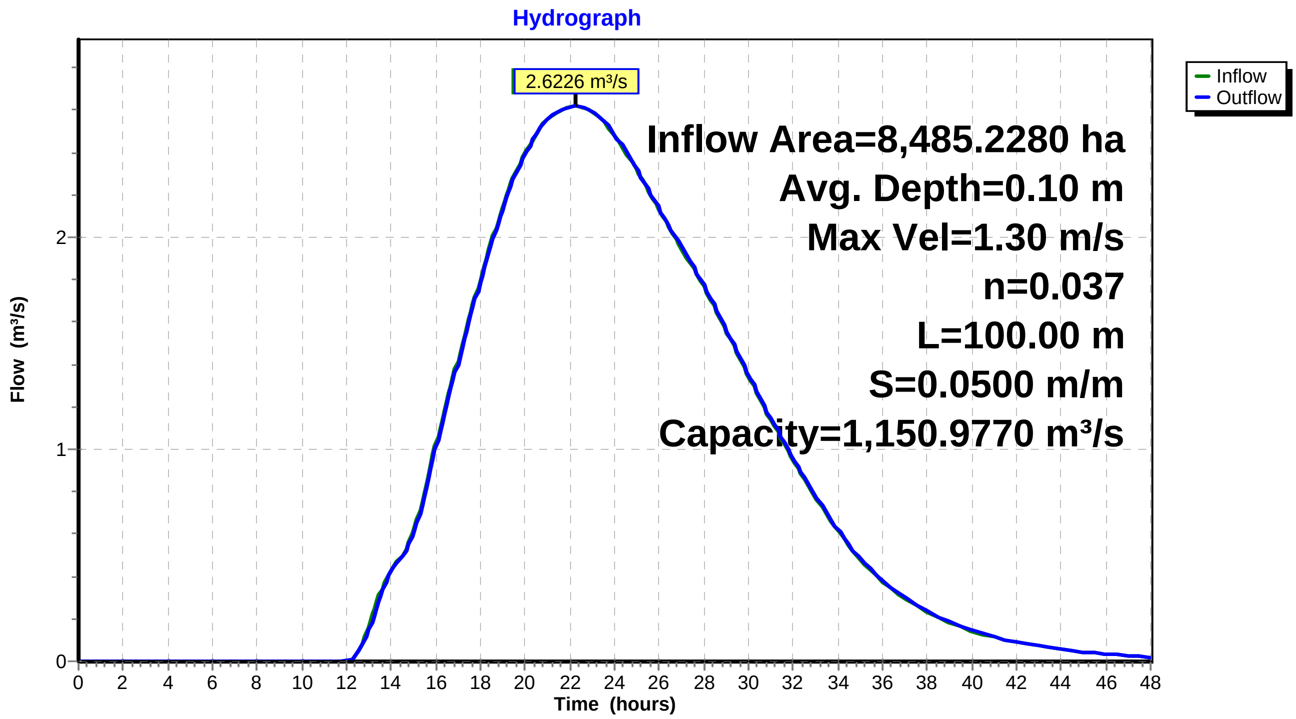
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.30 m/s, Min. Travel Time= 1.3 min
Avg. Velocity = 0.90 m/s, Avg. Travel Time= 1.9 min

Peak Storage= 201.1 m³ @ 22.23 hrs, Average Depth at Peak Storage= 0.10 m
Bank-Full Depth= 3.600 m, Capacity at Bank-Full= 1,150.9770 m³/s

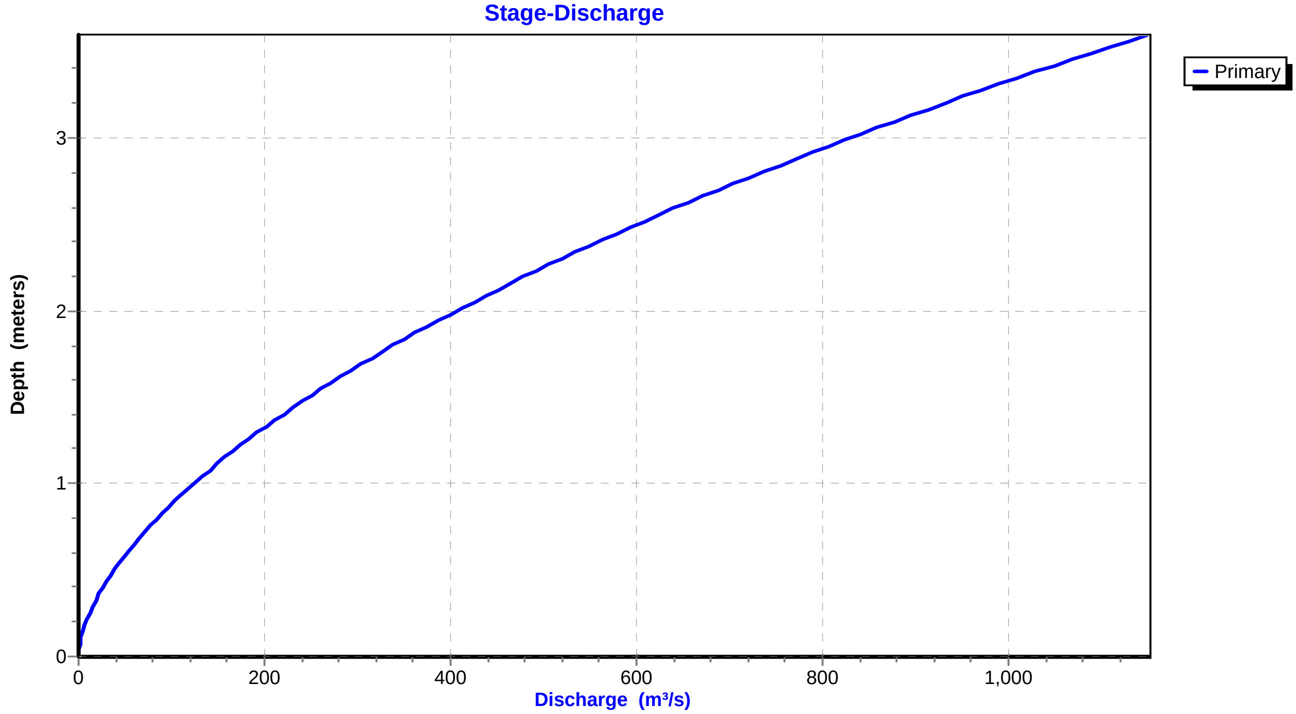
20.00 m x 3.60 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 34.40 m
Length= 100.00 m Slope= 0.0500 m/m
Inlet Invert= 785.000 m, Outlet Invert= 780.000 m

‡

Reach 19R: Lower Haggart Creek



Reach 19R: Lower Haggart Creek



Reach 33R: Lower DG Diversion Channel

Inflow Area = 1,024.0000 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 0.5073 m³/s @ 15.86 hrs, Volume= 15.520 Ml
Outflow = 0.5040 m³/s @ 16.36 hrs, Volume= 15.519 Ml, Atten= 1%, Lag= 29.7 min

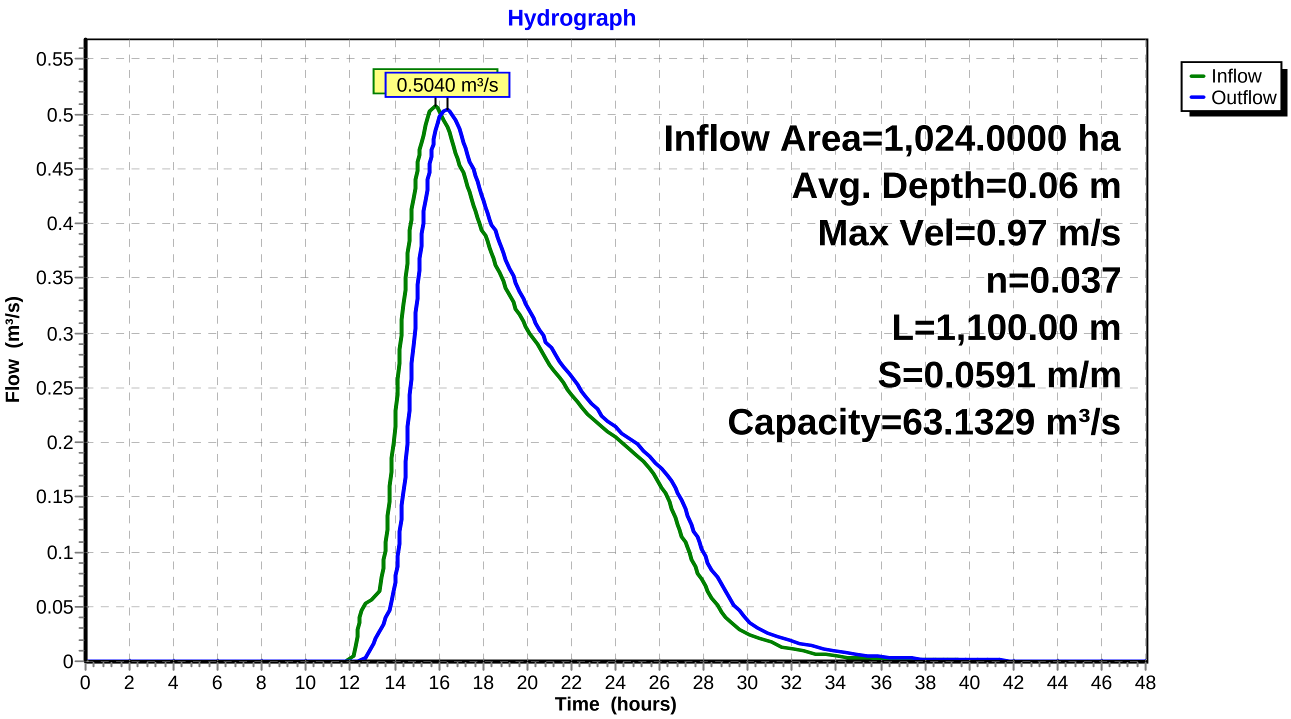
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.97 m/s, Min. Travel Time= 18.9 min
Avg. Velocity = 0.49 m/s, Avg. Travel Time= 37.3 min

Peak Storage= 572.8 m³ @ 16.04 hrs, Average Depth at Peak Storage= 0.06 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 63.1329 m³/s

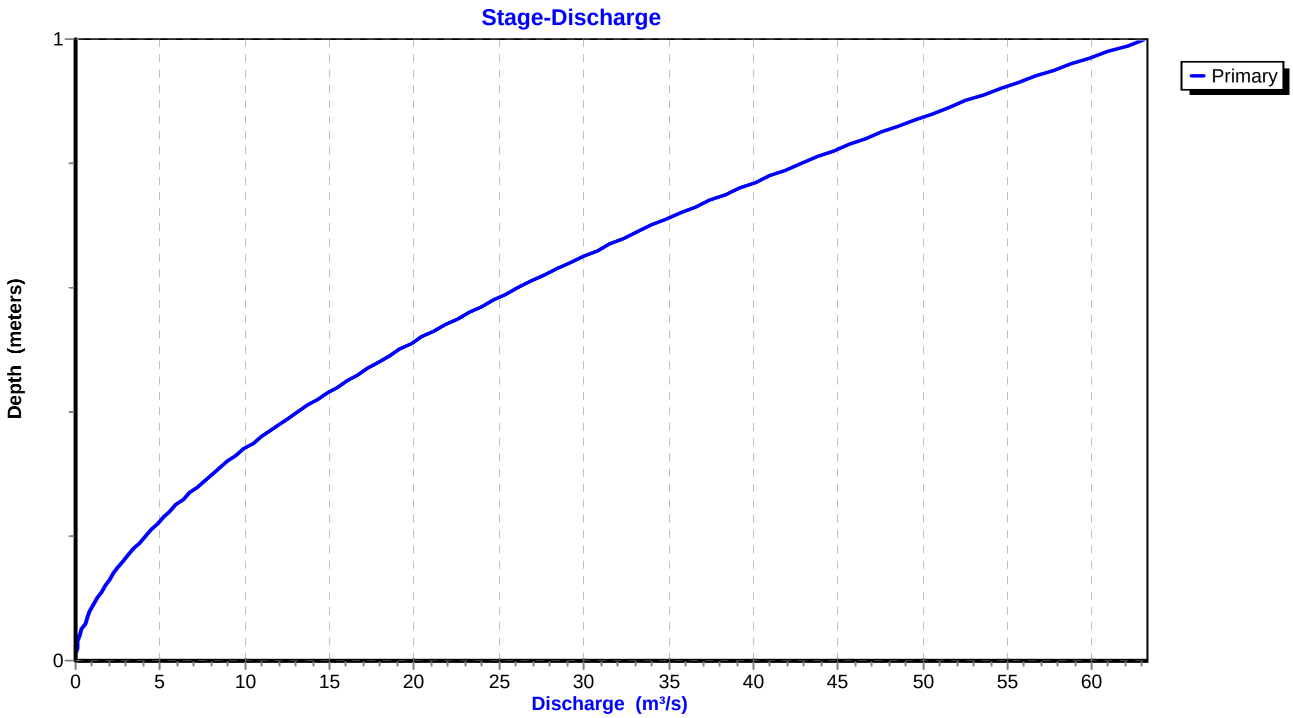
9.00 m x 1.00 m deep channel, n= 0.037
Side Slope Z-value= 2.0 m/m Top Width= 13.00 m
Length= 1,100.00 m Slope= 0.0591 m/m
Inlet Invert= 855.000 m, Outlet Invert= 790.000 m

‡

Reach 33R: Lower DG Diversion Channel



Reach 33R: Lower DG Diversion Channel



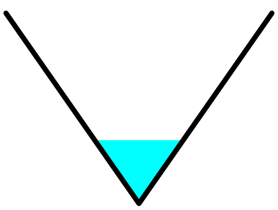
Reach 34R: Upper Haggart Creek

Inflow Area = 6,782.0000 ha, Inflow Depth > 2 mm for Jun 18mm event
Inflow = 2.1570 m³/s @ 22.29 hrs, Volume= 103.555 Ml
Outflow = 2.1555 m³/s @ 22.61 hrs, Volume= 103.493 Ml, Atten= 0%, Lag= 19.4 min

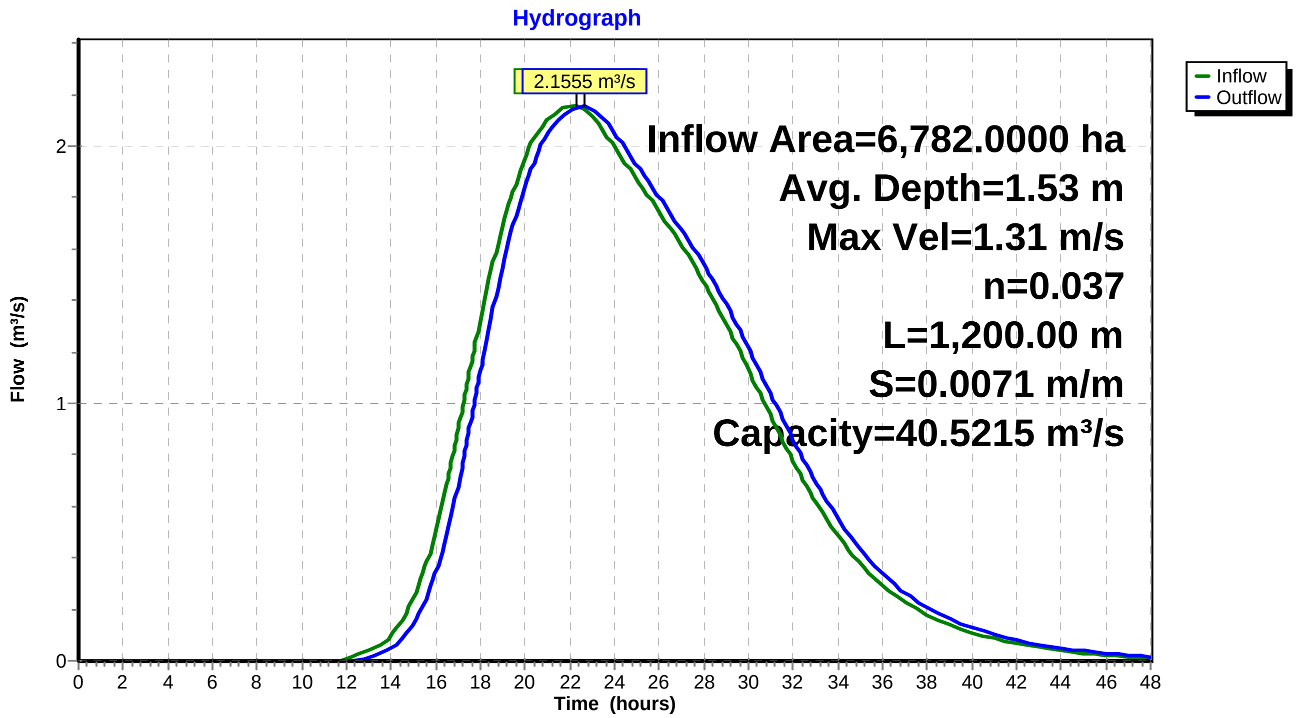
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.31 m/s, Min. Travel Time= 15.2 min
Avg. Velocity = 0.89 m/s, Avg. Travel Time= 22.5 min

Peak Storage= 1,968.5 m³ @ 22.36 hrs, Average Depth at Peak Storage= 1.53 m
Bank-Full Depth= 4.600 m, Capacity at Bank-Full= 40.5215 m³/s

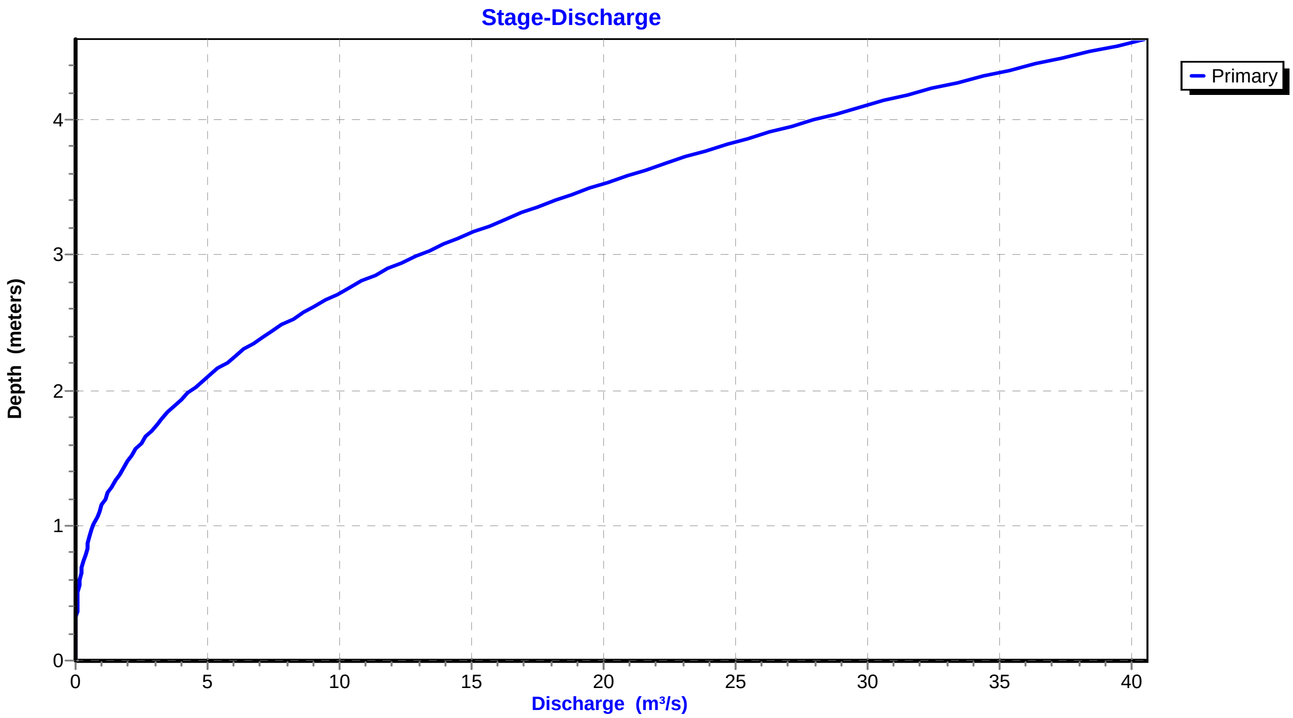
0.00 m x 4.60 m deep channel, n= 0.037
Side Slope Z-value= 0.7 m/m Top Width= 6.44 m
Length= 1,200.00 m Slope= 0.0071 m/m
Inlet Invert= 813.500 m, Outlet Invert= 805.000 m



Reach 34R: Upper Haggart Creek



Reach 34R: Upper Haggart Creek



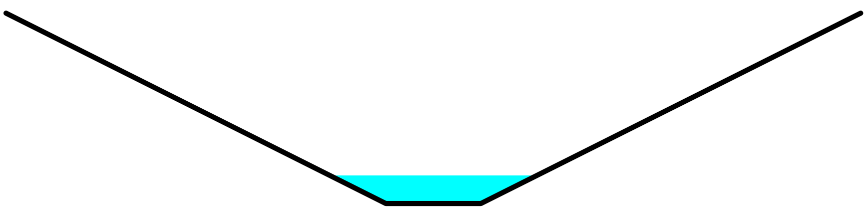
Reach 35R: Platinum Gulch Channel

Inflow Area = 178.0000 ha, Inflow Depth > 3 mm for Jun 18mm event
Inflow = 0.1125 m³/s @ 15.07 hrs, Volume= 4.514 Ml
Outflow = 0.1122 m³/s @ 15.47 hrs, Volume= 4.512 Ml, Atten= 0%, Lag= 23.9 min

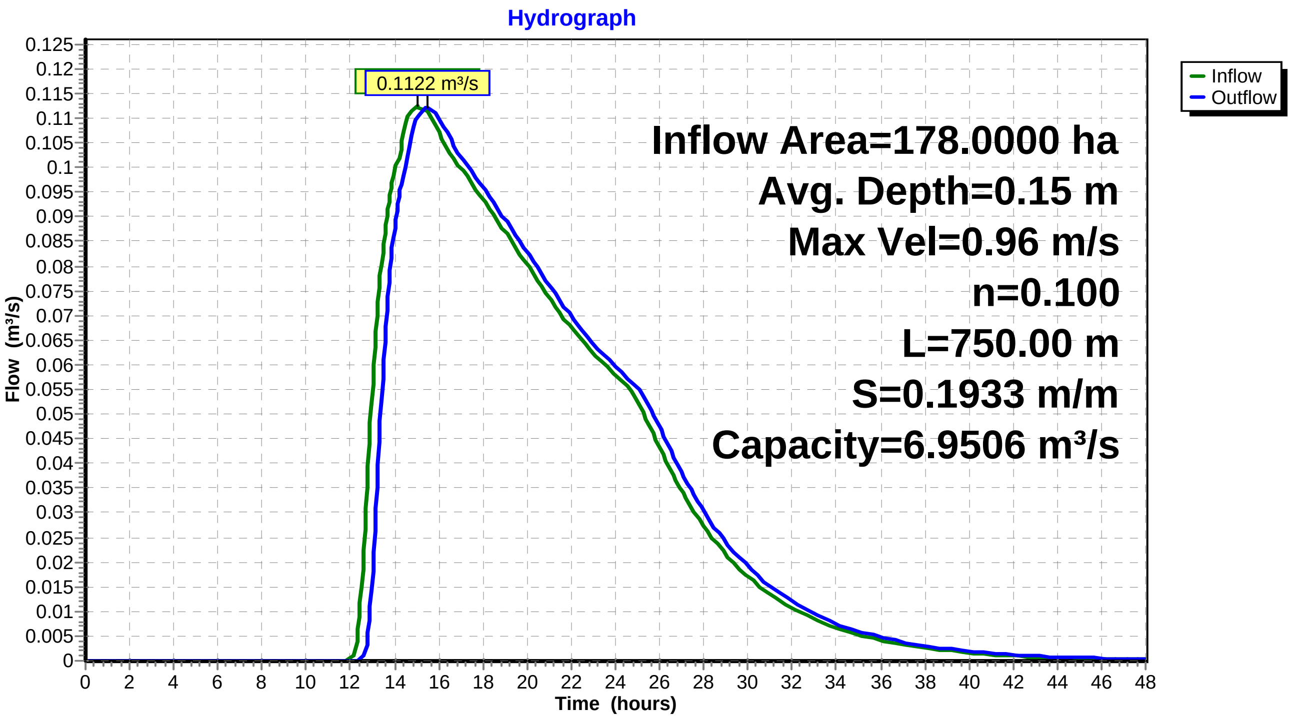
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.96 m/s, Min. Travel Time= 13.1 min
Avg. Velocity = 0.55 m/s, Avg. Travel Time= 22.9 min

Peak Storage= 88.1 m³ @ 15.25 hrs, Average Depth at Peak Storage= 0.15 m
Bank-Full Depth= 1.000 m, Capacity at Bank-Full= 6.9506 m³/s

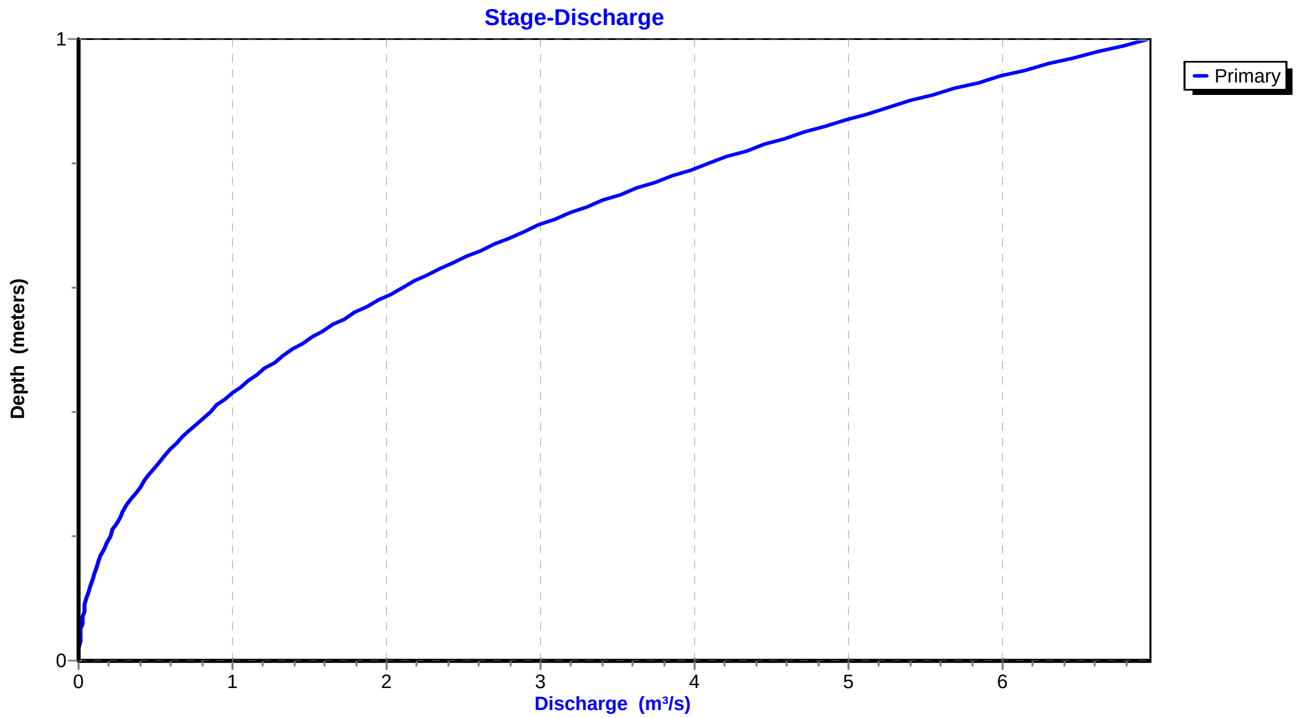
0.50 m x 1.00 m deep channel, n= 0.100
Side Slope Z-value= 2.0 m/m Top Width= 4.50 m
Length= 750.00 m Slope= 0.1933 m/m
Inlet Invert= 900.000 m, Outlet Invert= 755.000 m



Reach 35R: Platinum Gulch Channel



Reach 35R: Platinum Gulch Channel



Pond 23P: EP WRSA SCP

Inflow Area = 128.0000 ha, Inflow Depth = 2 mm for Jun 18mm event
Inflow = 0.1138 m³/s @ 13.27 hrs, Volume= 1.940 Ml
Outflow = 0.0435 m³/s @ 16.47 hrs, Volume= 1.939 Ml, Atten= 62%, Lag= 191.6 min
Primary = 0.0435 m³/s @ 16.47 hrs, Volume= 1.939 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 917.300 m Surf.Area= 16,457.0 m² Storage= 20,441.2 m³
Peak Elev= 917.337 m @ 16.47 hrs Surf.Area= 16,499.1 m² Storage= 21,048.5 m³ (607.3 m³ above start)

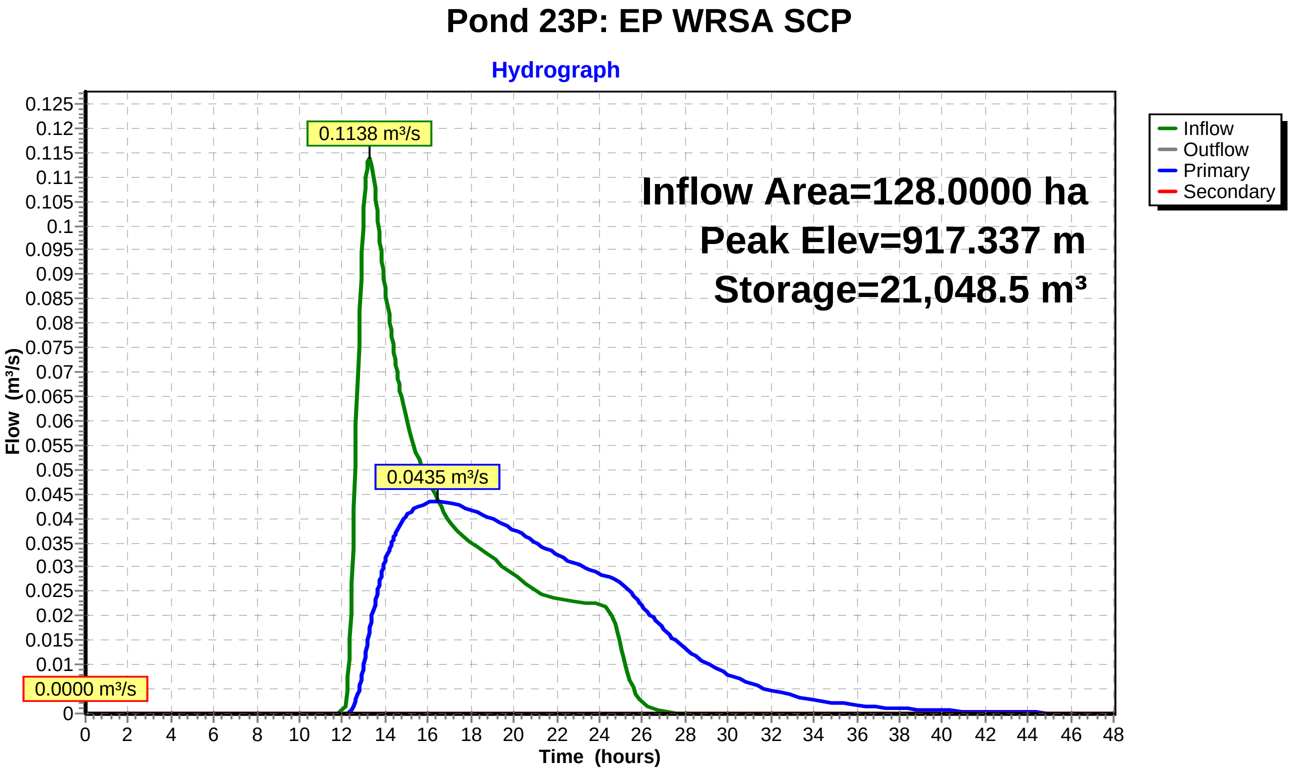
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 231.7 min (1,252.2 - 1,020.5)

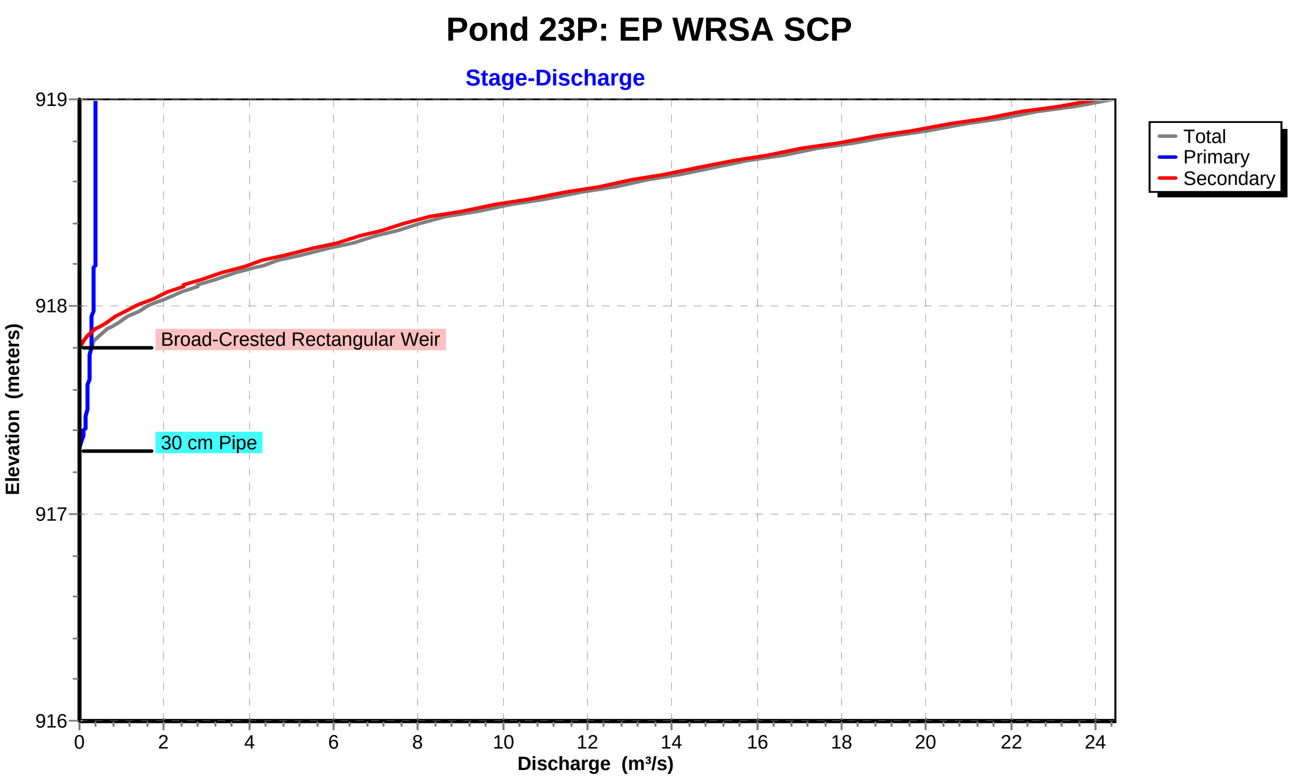
Volume	Invert	Avail.Storage	Storage Description
#1	916.000 m	50,094.0 m³	**75.00 mW x 200.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	917.300 m	**30 cm Pipe X 2.00** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05900 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	917.800 m	**10.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

Primary OutFlow Max=0.0435 m³/s @ 16.47 hrs HW=917.337 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.0435 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=917.300 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)


Pond 23P: EP WRSA SCP
Hydrograph
0.1138 m³/s
0.0435 m³/s
0.0000 m³/s
Inflow
Outflow
Primary
Secondary
Inflow Area=128.0000 ha
Peak Elev=917.337 m
Storage=21,048.5 m³
Flow (m³/s)
Time (hours)


Pond 23P: EP WRSA SCP
Stage-Discharge
Total
Primary
Secondary
Broad-Crested Rectangular Weir
30 cm Pipe
Elevation (meters)
Discharge (m³/s)

Pond 24P: Lower Dublin North

Inflow Area = 39.0000 ha, Inflow Depth = 4 mm for Jun 18mm event
Inflow = 0.2089 m³/s @ 12.51 hrs, Volume= 1.467 Ml
Outflow = 0.0355 m³/s @ 14.45 hrs, Volume= 1.465 Ml, Atten= 83%, Lag= 116.3 min
Primary = 0.0355 m³/s @ 14.45 hrs, Volume= 1.465 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 790.500 m Surf.Area= 8,976.0 m² Storage= 8,485.3 m³
Peak Elev= 790.568 m @ 14.45 hrs Surf.Area= 9,043.7 m² Storage= 9,099.8 m³ (614.5 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 285.5 min (1,207.6 - 922.2)

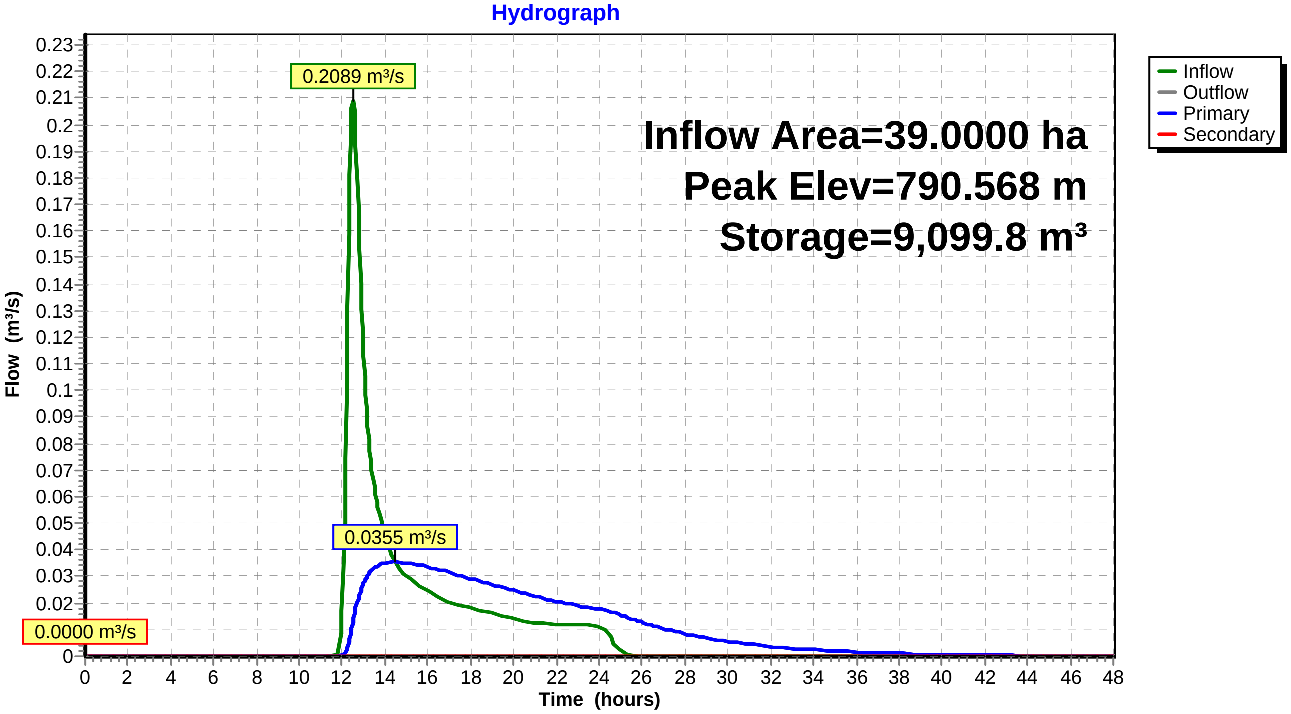
Volume	Invert	Avail.Storage	Storage Description
#1	789.500 m	23,083.3 m³	**40.00 mW x 200.00 mL x 2.50 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	790.500 m	**30 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.05200 0.08400 0.10300 0.11900 0.13300 0.14600 0.15700 0.16800 0.17800 0.18800
#2	Secondary	791.000 m	**5.00 m long x 0.30 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 Coef. (Metric) 1.49 1.50 1.52 1.58 1.65 1.70 1.77 1.81 1.83 1.82 1.83

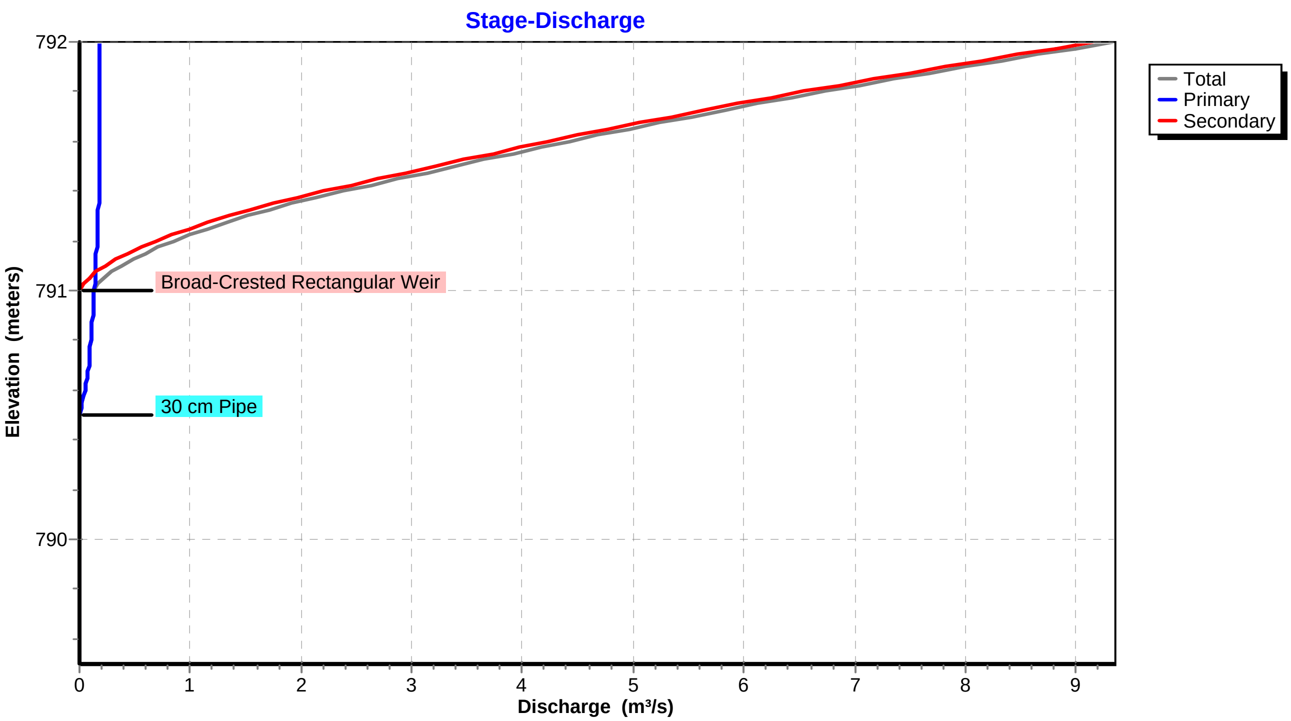
Primary OutFlow Max=0.0355 m³/s @ 14.45 hrs HW=790.568 m (Free Discharge)
↑—**1=30 cm Pipe** (Custom Controls 0.0355 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=790.500 m (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 24P: Lower Dublin North



Pond 24P: Lower Dublin North



Pond 25P: Platinum Gulch SCP

Inflow Area = 178.0000 ha, Inflow Depth = 3 mm for Jun 18mm event
Inflow = 0.4120 m³/s @ 12.81 hrs, Volume= 4.518 Ml
Outflow = 0.1125 m³/s @ 15.07 hrs, Volume= 4.514 Ml, Atten= 73%, Lag= 135.5 min
Primary = 0.1125 m³/s @ 15.07 hrs, Volume= 4.514 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 902.500 m Surf.Area= 15,750.0 m² Storage= 35,895.8 m³
Peak Elev= 902.604 m @ 15.07 hrs Surf.Area= 15,868.8 m² Storage= 37,540.9 m³ (1,645.1 m³ above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 252.4 min (1,216.7 - 964.3)

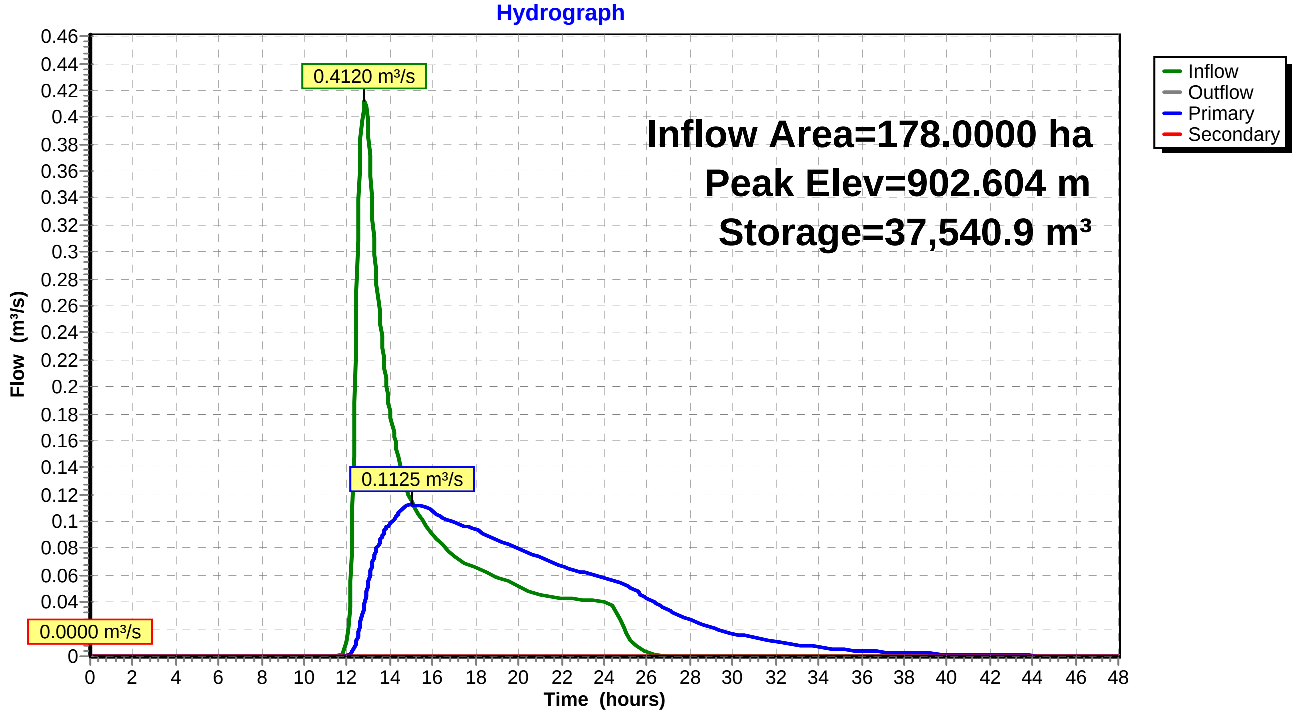
Volume	Invert	Avail.Storage	Storage Description
#1	900.000 m	60,821.3 m³	**65.00 mW x 200.00 mL x 4.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	902.500 m	**600 mm riser** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	903.000 m	**15.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

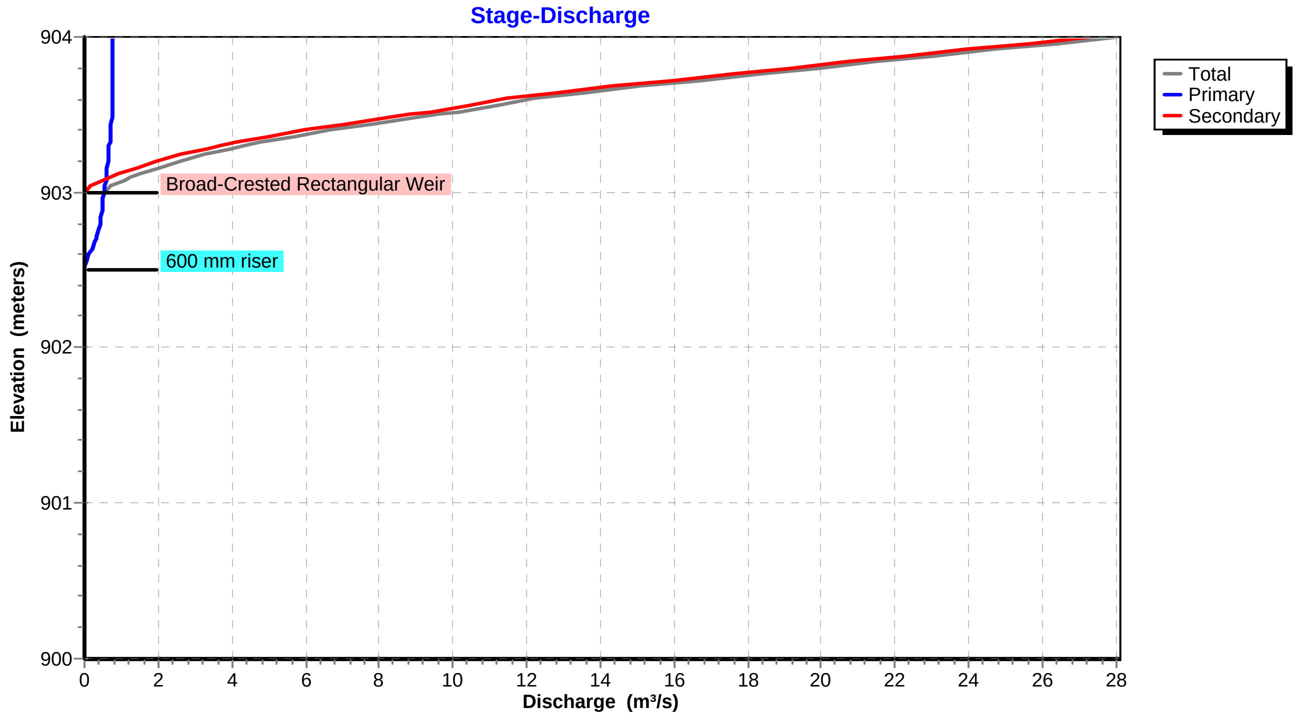
Primary OutFlow Max=0.1125 m³/s @ 15.07 hrs HW=902.604 m (Free Discharge)
└─**1=600 mm riser** (Custom Controls 0.1125 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=902.500 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)

Pond 25P: Platinum Gulch SCP



Pond 25P: Platinum Gulch SCP



Pond 33P: Lower Dublin South Pond

Inflow Area = 93.0000 ha, Inflow Depth = 4 mm for Jun 18mm event
Inflow = 0.3646 m³/s @ 12.84 hrs, Volume= 3.499 Ml
Outflow = 0.0754 m³/s @ 15.35 hrs, Volume= 3.485 Ml, Atten= 79%, Lag= 150.6 min
Primary = 0.0754 m³/s @ 15.35 hrs, Volume= 3.485 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 831.500 m Surf.Area= 20,736.0 m² Storage= 29,605.5 m³
Peak Elev= 831.573 m @ 15.35 hrs Surf.Area= 20,834.8 m² Storage= 31,128.0 m³ (1,522.5 m³ above start)

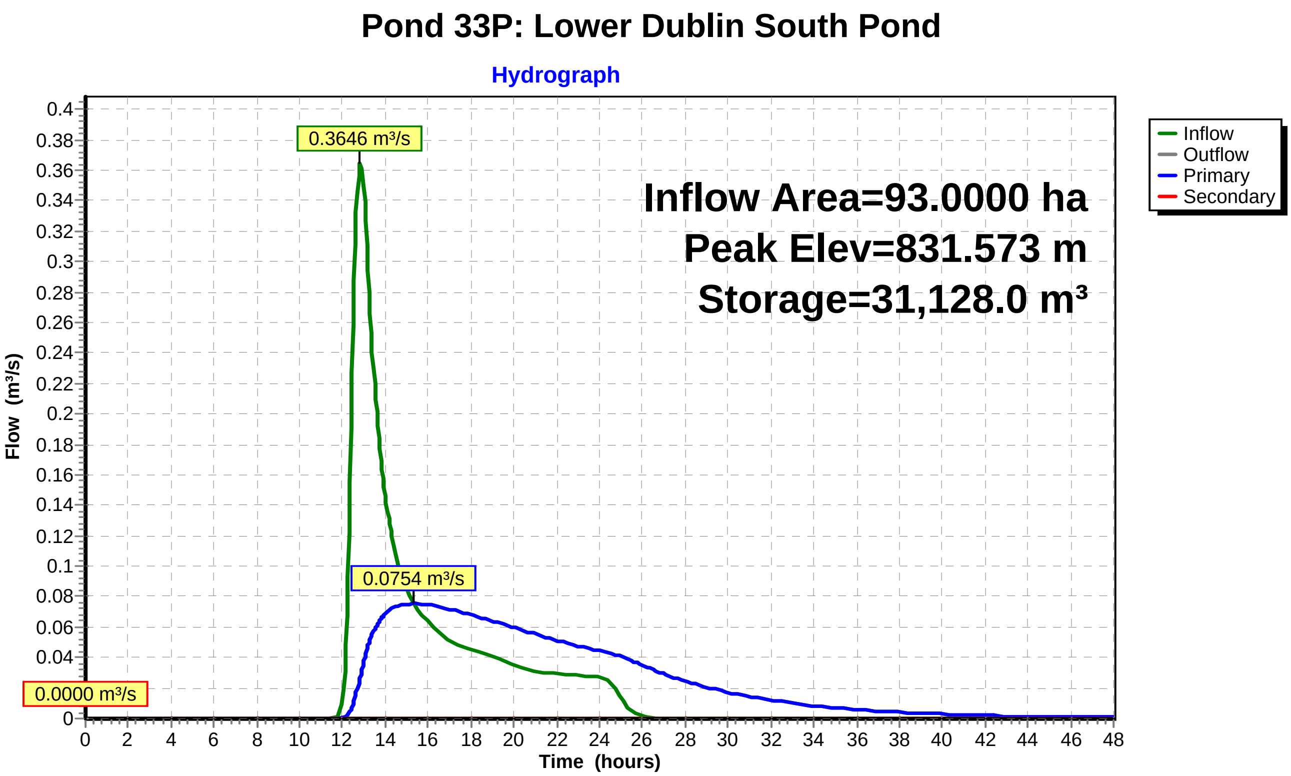
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 328.5 min (1,272.8 - 944.3)

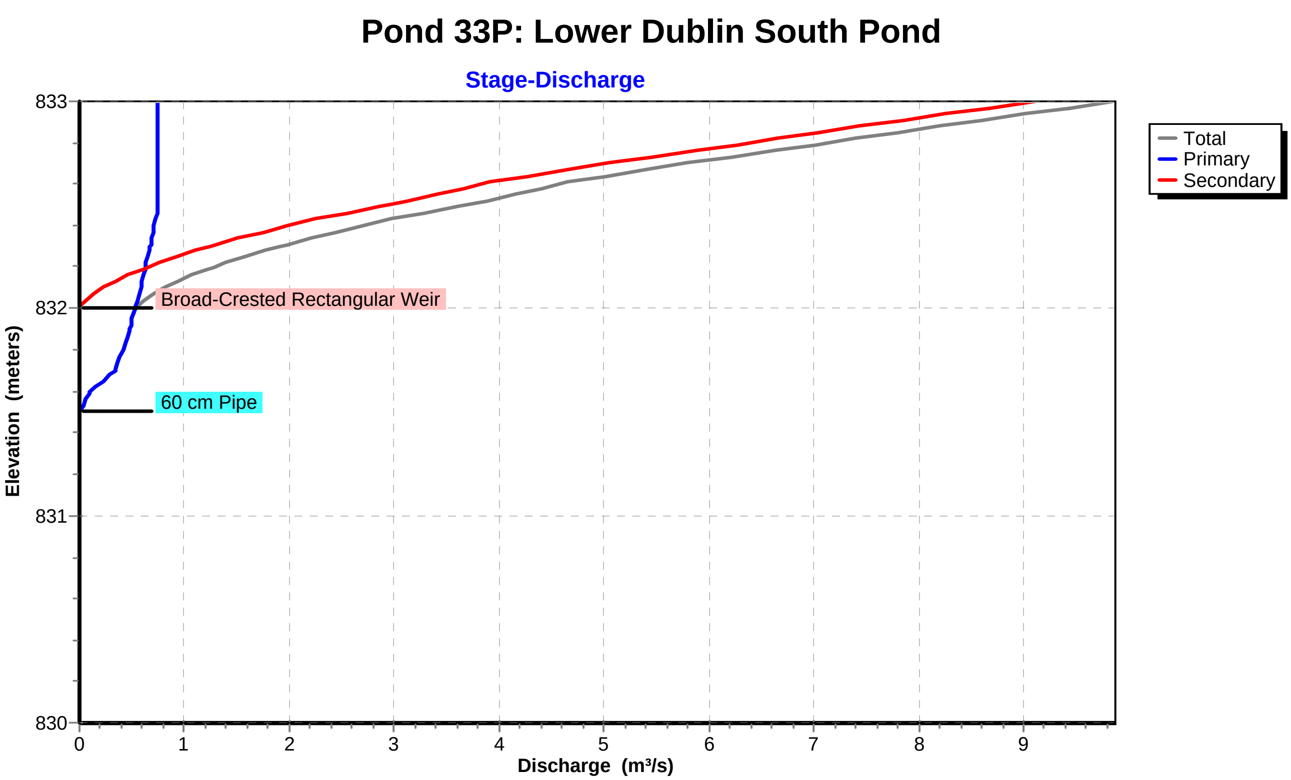
Volume	Invert	Avail.Storage	Storage Description
#1	830.000 m	62,244.0 m³	**75.00 mW x 250.00 mL x 3.00 mH Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	831.500 m	**60 cm Pipe** Head (meters) 0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000 Disch. (m³/s) 0.00000 0.10300 0.33600 0.41200 0.47600 0.53200 0.58300 0.63000 0.67300 0.71400 0.75200
#2	Secondary	832.000 m	**5.00 m long x 0.50 m breadth Broad-Crested Rectangular Weir** Head (meters) 0.061 0.122 0.183 0.244 0.305 0.366 0.427 0.488 0.549 0.610 0.762 0.914 1.067 Coef. (Metric) 1.43 1.45 1.45 1.47 1.50 1.55 1.59 1.67 1.67 1.64 1.78 1.81 1.83

Primary OutFlow Max=0.0754 m³/s @ 15.35 hrs HW=831.573 m (Free Discharge)
└─**1=60 cm Pipe** (Custom Controls 0.0754 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=831.500 m (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.0000 m³/s)


Pond 33P: Lower Dublin South Pond
Hydrograph
0.3646 m³/s
0.0754 m³/s
0.0000 m³/s
Inflow Area=93.0000 ha
Peak Elev=831.573 m
Storage=31,128.0 m³
Inflow
Outflow
Primary
Secondary
Flow (m³/s)
Time (hours)


Pond 33P: Lower Dublin South Pond
Stage-Discharge
Broad-Crested Rectangular Weir
60 cm Pipe
Total
Primary
Secondary
Elevation (meters)
Discharge (m³/s)