NJ WIND PORT PARCELS G & C1

STORMWATER MANAGEMENT REPORT

PREPARED FOR:

New Jersey Economic Development Authority

New Jersey Economic Development Authority (NJEDA)
36 West State Street
Trenton, New Jersey 08625

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Section 1 - Introduction and Project Description

The offshore wind (OSW) industry in the northeast of the United States (US) is a relatively new industry that is poised for significant growth and development. Multiple states have passed legislation mandating offshore wind power to be included in their energy portfolio. As a result, several power purchasing agreements (PPAs) have been awarded to various offshore wind developers. These new offshore wind farms will be commercial scale (over 300 MW). Additional northeastern states are in process to solicit and award additional PPAs. Due to the awarded power purchases and the pipeline of soon to be awarded work, significant infrastructure retrofits/enhancements will be required to prepare the region to support the offshore wind farm supply chain.

Offshore wind components are extremely large and require port facilities with significant laydown areas and high loading capacities. Due to the size and weight of the components, they are typically transported over water rather than overland. Currently, there are no manufacturing facilities in the northeast US capable of producing the required components; therefore, they will be imported from overseas manufacturers.

The New Jersey Economic Development Authority (NJEDA) is in the process of developing a marine terminal on land owned by Public Service Enterprise Group (PSEG) located directly to the north of the existing Hope Creek Nuclear Generating Station in Lower Alloways Creek, New Jersey. This development, the New Jersey Wind Port (NJWP), is being designed and constructed to serve as a wind turbine generation (WTG) port facility to service the offshore wind industry. WTG port facilities typically serve to import, stage, preassemble and loadout large components for the commercial-scale wind installation sites. These components consist of tower sections, nacelles, and blades. Other components such as transition pieces and monopiles may also be moved through these types of facilities. The marine facilities for this project are referred to as Site A, which is the subject of a separate report.

The NJWP will serve as an import, storage, pre-assembly and loadout facility for wind towers, nacelles, and blades to service the offshore wind market. The marshalling port to be located at Site A will have the potential to import and loadout the new GE Haliade-X 12 MW turbines as well as the associated towers and blades.

This report will address the proposed development of three separate areas: Site G, Site C1, and the electrical substation. The Site G facility will feature three main components: 1) a heavy haul road to connect Site G to Site A, 2) the nacelle manufacturing and assembly plant, and 3) laydown and testing area for the completed nacelles. The Site C1 area will provide additional laydown storage area for the expansion of Site A. The electrical substation will encompass the necessary electrical infrastructure to receive the high voltage transmission electricity and then distribute it to the remaining NJWP sites.

The proposed uses of the Site G and Site C1 areas as nacelle assembly plant and additional laydown areas to support Site A necessitates that the sites be capable of handling heavy surface loadings from self-propelled modular transporters (SPMTs) and OSW components.

The overarching goal of the storm drain collection system proposed for Sites C1 and G is to manage and treat the storm runoff from motor vehicle surfaces close to the area where it accumulates. This goal is achieved through the proper grading of the site to limit the size of proposed drainage basins and the use of green infrastructure (GI) manufactured treatment devices (MTDs) and non-GI MTDs installed locally in the proposed drainage basins on site. The treated stormwater and stormwater overflows will be conveyed through underground reinforced concrete pipes to either underground storage vaults for infiltration or discharged. The discharges for Site C1 will be connected to the outfall pipes of Site A that discharge directly to the Delaware River. Through Site G the stormwater will be discharged towards the adjacent wetlands to the north and the existing PSEG drainage ditch west of the site.

High mast lighting will be installed along the site perimeter. Power for lighting the nacelle laydown area and required building power will be supplied from the substation being provided for the development under a separate scope of work. Underground conduit and duct bank will be installed to create the power distribution network for the site. Infrastructure (e.g. empty conduit) only for telecommunication systems will also be installed.

Fire hydrants will be placed at the base of each light pole for ease in locating and to minimize site obstructions. Water supply to the site, both potable and fire water, will be provided by on-site storage tanks since tie-ins to the adjacent plant are not currently available. Tanks will be refilled by trucked in water. Sanitary sewage service will not be available from the adjacent plant. Temporary restroom facilities with pump-out shall be utilized and are assumed to be provided by the end user of the facility.

The finished surface of the laydown areas and the heavy haul road will be compacted dense graded aggregate. The aggregate will be imported from an offsite source. The site access roadway will have finished asphalt surface and the building parking lot will be a porous asphalt surface to facilitate drainage and stormwater treatment.

This Stormwater Management Report and permit package covers all of Site G, Site C1, and the electrical substation. The NJWP site location is shown in Figure 1-1 below. The limits of the Sites G, C1 and the substation are shown below in Figure 1-2 and described in more detail in Section 1.1.

1.1. Site Location and Project Overview

1.1.1. Existing Site Land Uses

This site is located directly adjacent to the existing Hope Creek Nuclear Generating Station in Lower Alloways Creek Township, in Salem County, New Jersey. Site G is bounded to the north and east by the NJDEP wetlands delineation line, and the south and west by the generating station. Site C1 is bounded by the Site A development to the west, the future Site B to the north, the confined disposal facility (CDF) C on the east, and the proposed heavy haul road of Site G to the south. Refer to Figure 1-1 below for the overall location map and Figure 1-2 for the aerial site photo. Photos of the existing site conditions from site visits are included in Appendix G.

Site G is currently occupied by the Hope Creek Nuclear Generating Station and most of the site is currently used as laydown area and parking. The western section of the site is currently occupied by the PSEG combo shop which is being relocated elsewhere on the Hope Creek site, and the eastern area of Site G is previously developed, unoccupied land overgrown by phragmites. The section of Site G where the electrical substation is proposed is located just south of the existing PSEG chiller plant on unoccupied land overgrown by phragmites. The current land use at Site C1 is dedicated to the existing PSEG security force target ranges and access to the nuclear dredging CDF.

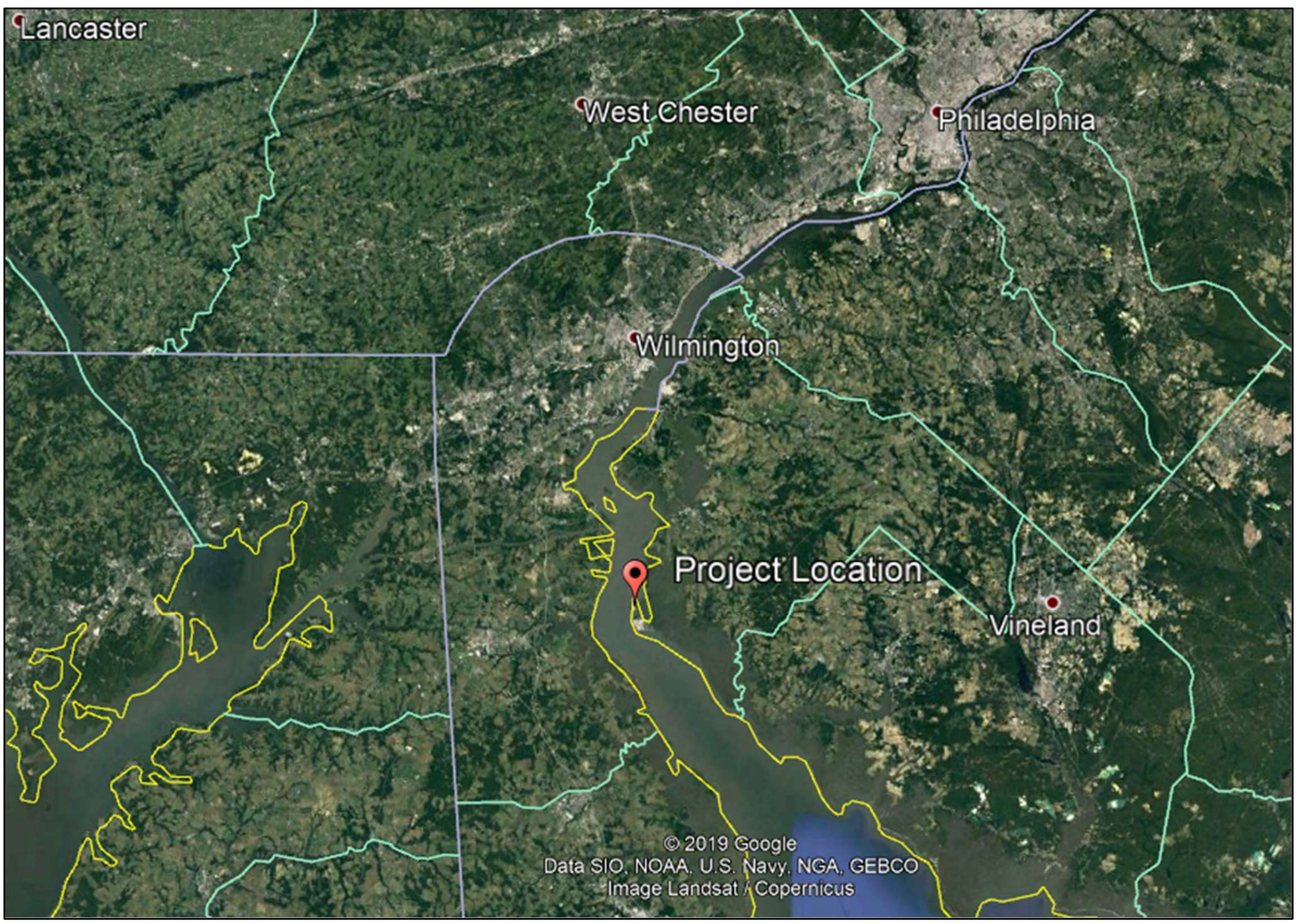


Figure 1-1 - Overall Location Map

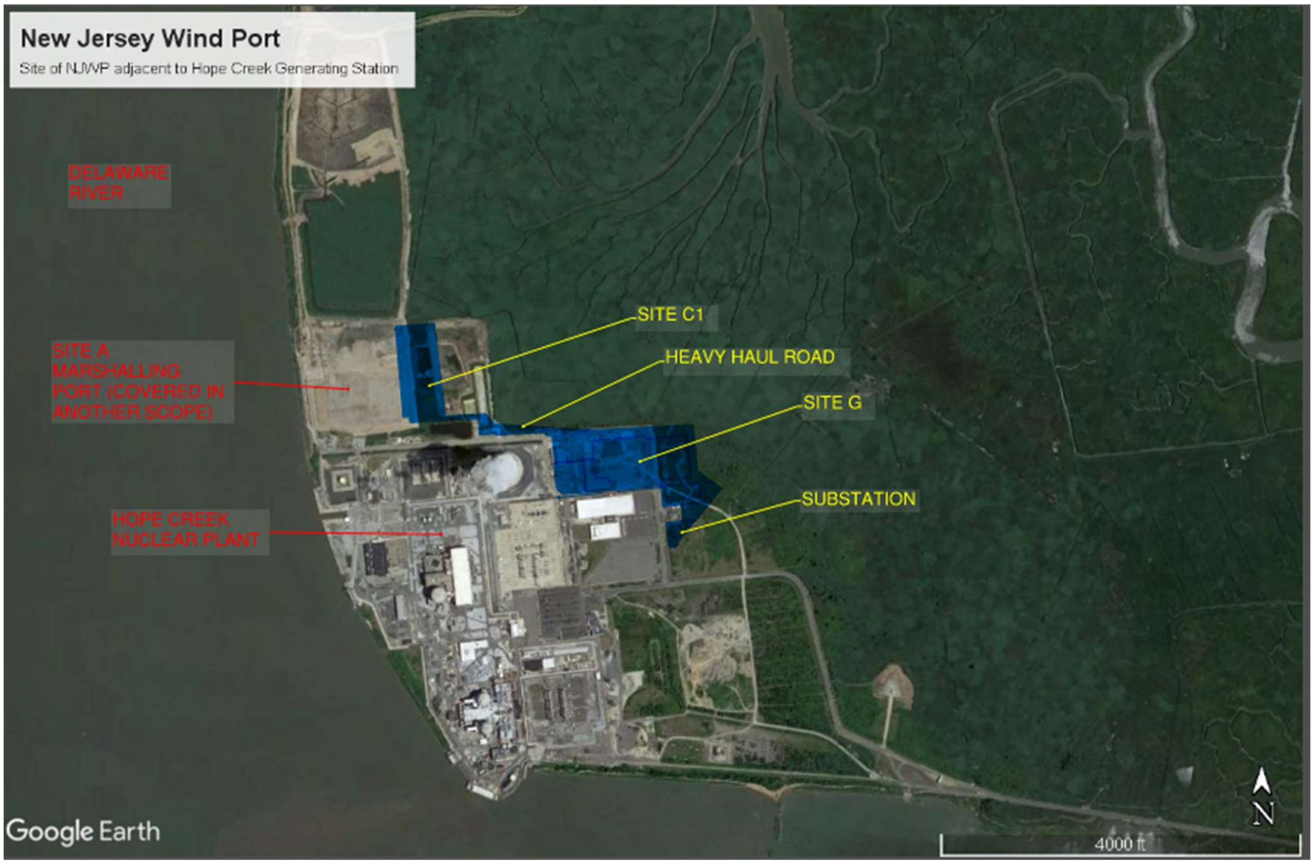


Figure 1-2 - Project Site Aerial

1.1.2. Proposed Site Conditions

Site G is currently being considered for use as a manufacturing and assembly plant for nacelles prior to loadout from the marshalling port at Site A. The vast majority of the site will be occupied by the proposed assembly and warehousing facility with its required access and supplementary office space. The additional area to the west of the site will be dedicated to laydown and testing area for the completed nacelles. The southeastern section of Site G is proposed as the Wind Port electrical substation. Site C1 is proposed as an extension of the Site A marshalling port for use as additional laydown area for the OSW components.

Outside of the building footprint, the site G layout will provide for as much open space as possible, while considering location of utility components such as high mast light poles, fire hydrants, storage tanks, etc. The topping surface in this area shall be compacted dense graded aggregate. The pavement surface around the building and along the access drive shall be asphalt, and the building parking lot will be porous asphalt. The Site C1 layout will provide as much additional open space to Site A as possible while accounting for additional high mast light poles, fire hydrants, and the POV access roadway. The pavement surface of Site C1 shall be dense graded aggregate.

The transport of OSW components will occur via self-propelled modular transporters (SPMT). An existing road utilized by PSE&G, called the Material Center Access Road, crosses the width of Site G at the edge of the existing paved/laydown area. This road will be rerouted to the southern and western limits of Site G just outside the limits of work.

The continuation of the Material Center Access Road leads from Site G to the berth area at Site A but does not have sufficient loading capacity for these transfers and would require crossing the existing LS Power lines, which would present additional challenges. Therefore, a newly constructed heavy haul road will be required to provide transport between Sites A and G. This proposed heavy haul road is contained within the scope of development of Site G and borders the southern perimeter of Site C1.

1.2. Site Zoning

According to the Township of Lower Alloways Zoning map, the site is listed in an existing "Industrial" Zoning District along with the adjacent properties. Consequently, the proposed wind port facility shall comply with the relevant permitted and condition use regulations (Section 5.15), as well as bulk and area regulations (Section 5.16) of the Land Development Ordinance for the Township of Lower Alloways Creek.

1.3. FEMA Flood Levels

According to the Flood Insurance Rate Map (FIRM) Numbers 34033C0256C and 34033C0257C, published by FEMA and made effective on June 16, 2016, the proposed Site G currently falls within the X zone, with some discrete areas shaded for inclusion within the 0.2% Annual chance flood hazard, which are defined as follows.

- Zone X: The areas of minimal flood hazard, which are the areas outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance flood (500-year).
- 0.2-percent-annual-chance flood: Areas of 0.2% annual chance flood, also termed 500-year.

In general, Site G is within an area of minimal flood risk.

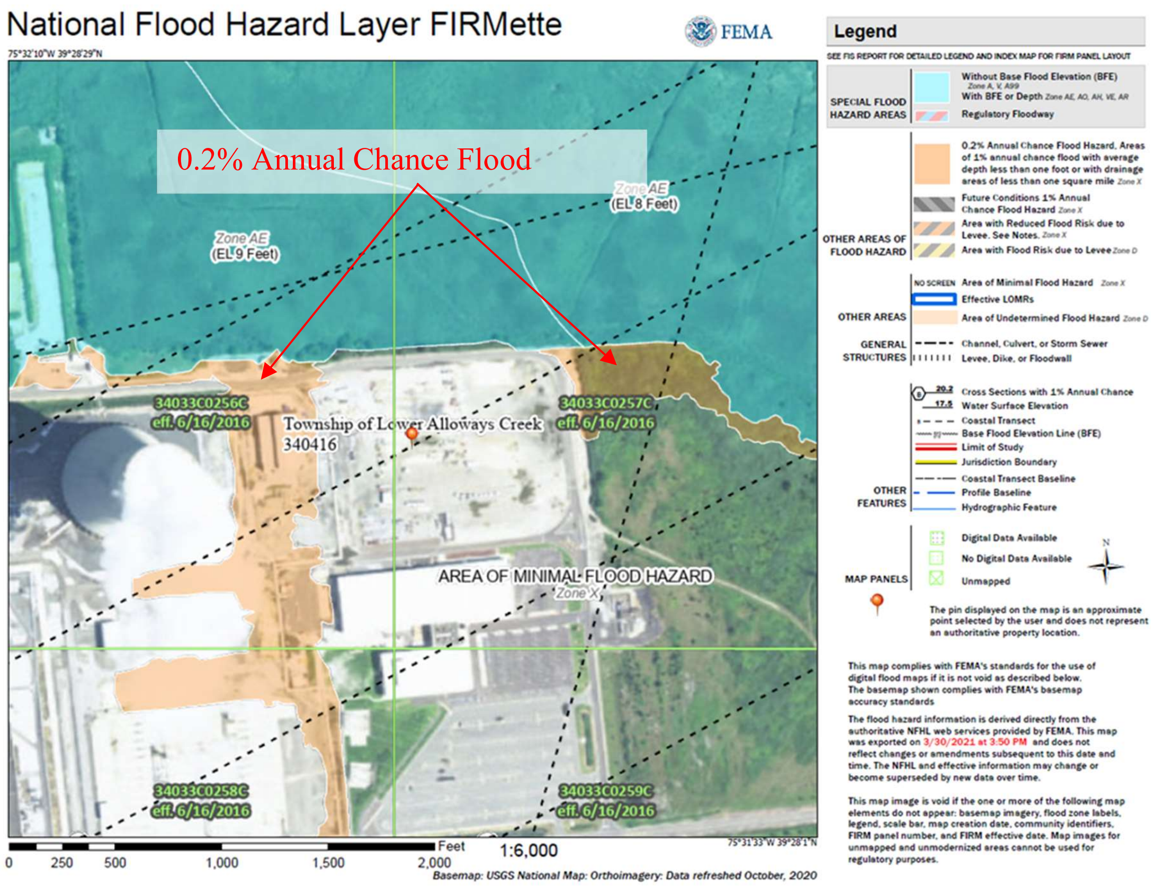


Figure 1-3 - Site G FEMA FIRMette Excerpt

According to the Flood Insurance Rate Map (FIRM) Number 34033C0256C, published by FEMA and made effective on June 16, 2016, the proposed heavy haul road will traverse areas designated as Zone AE, which is defined as follows:

- Zone AE (Site Base Flood Elevation – EL 9ft NAVD 88): Special flood hazard area designation by FEMA as having a 1 percent annual chance of flooding. This flood is also called the 100-year flood.

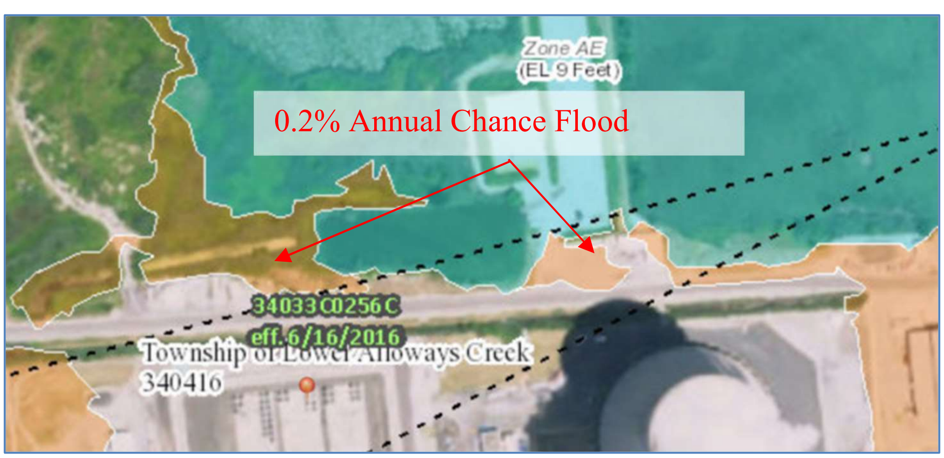


Figure 1-4 – Heavy Haul Road FIRMette

Site C1 is located entirely within the FEMA designated Zone AE with a base flood elevation of 9 feet (NAVD 88). This zone designation can be seen on FIRM Number 34033C0256C, published and made effective on June 16, 2016, and the FIRMette can be seen as Figure 1-5 below.

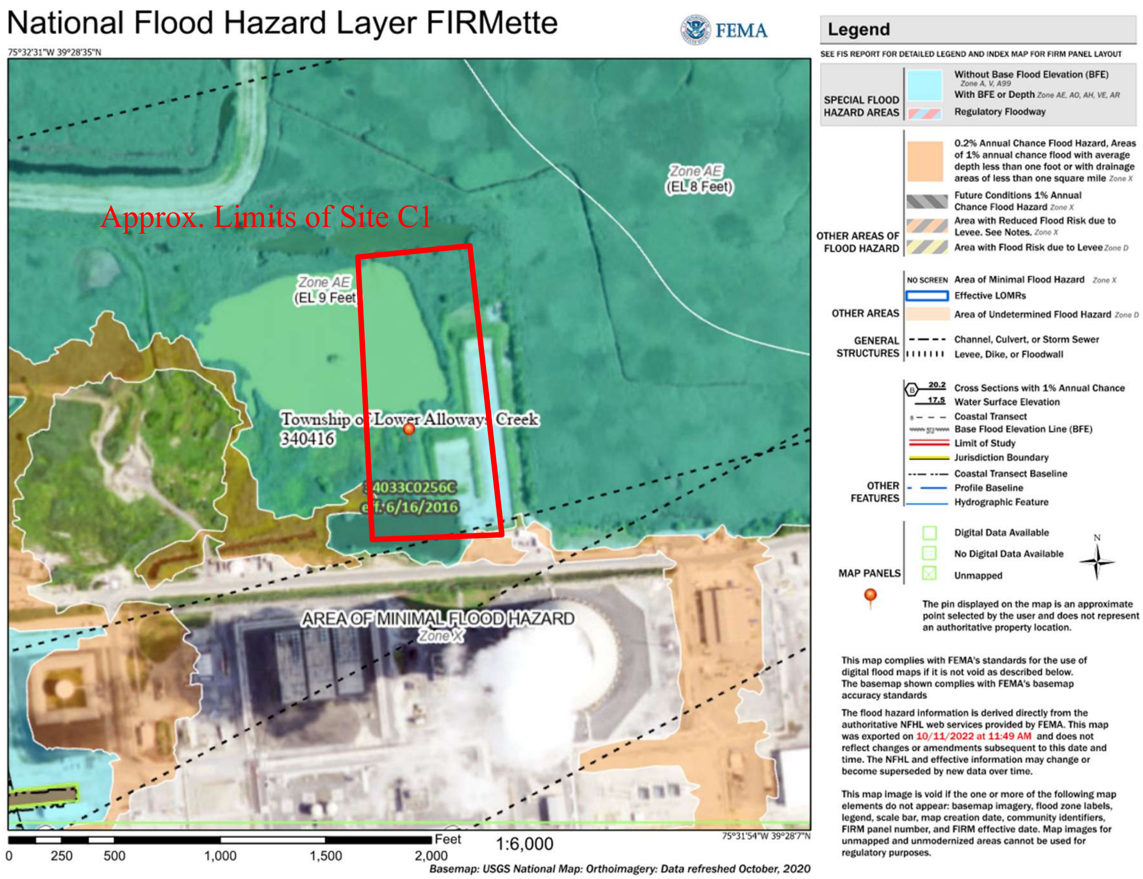


Figure 1-5 – Site C1 FIRMette

Section 2 -Proposed Stormwater Management Measures

All stormwater management plans, and stormwater control ordinances shall, according to the goals and requirements of NJDEP, be designed to:

- Reduce flood damage
- Minimize, to the extent practical, any increase in stormwater runoff from any new development
- Reduce soil erosion from any construction project
- Assure the adequacy of existing and proposed culverts and bridges, and other instream structures
- Maintain groundwater recharge
- Prevent, to the greatest extent feasible, an increase in nonpoint pollution
- Maintain the integrity of stream channels for their biological functions, as well as for drainage
- Minimize pollutants in stormwater runoff from new and existing development
- Protect public safety.

The proposed stormwater management system shall be designed to adequately collect, treat locally, and convey channelized runoff for sites G (+/- 35 acres) and C1 (+/-10 acres), and to satisfy all applicable NJDEP stormwater management requirements for major development. This shall be accomplished using structural and nonstructural stormwater management strategies. Proposed features include: cover stabilization practices, a stormwater collection and conveyance system, green infrastructure and manufactured treatment devices, and discharge control practices. Specific details pertinent to the design elements specified are as follows:

- The stormwater collection system shall be designed to manage the 25-yr, 24-hour storm event consistent with the NJDOT Roadway Drainage Design Manual Table 10-2 and the Township of Lower Alloways Creek Land Development Ordinance Section 4.30.B.2.
- Green infrastructure and Manufactured Treatment Devices (MTDs) shall be incorporated into the proposed system to remove total suspended solids and floating debris prior to discharge. The proposed system for Site G incorporates Contech StormFilters and Filterras capable of achieving an 80% TSS removal efficiency prior to discharge into the tidal channel that ends at the Delaware River. Grassed bioswales and porous asphalt have also been incorporated into the Site G stormwater management system in Site G where applicable. The proposed system for Site C1 utilizes the Jensen Stormvault GI MTDs as underground vaults to achieve the treatment requirement prior to discharging to the outfalls through Site A.
- The existing PSEG stormwater system currently drains through two sections of Site G. The open channel drainage through the eastern section of Site G will be captured and rerouted through buried reinforced concrete pipes that discharge to the adjacent wetlands to the north. The open channel drainage that runs east to west through the adjacent wetlands to the north will remain untouched and until it passes through a culvert to the existing PSEG drainage channel. Existing storm drainage passing through the existing Combo Shop lot will be demolished and removed, and the captured runoff from the south will be rerouted along the shifted Material Center Road to discharge in the PSEG drainage channel.
- To facilitate the green infrastructure localized treatment on Site G, four stormwater outfalls will discharge to the adjacent wetlands to the north. Each outfall will consist of a discharge pipe, a backflow preventer, and a riprap apron (for energy dissipation and scour protection). The full stormwater system will discharge to the tidally connected PSEG drainage channel to the west.

- Because Site C1 will function as an extension of Site A for the end user, the proposed stormwater management system will connect to the two outfall pipes of Site A that discharge directly to the Delaware River.

2.1. Design and Performance Standards for Stormwater Management Measures

NJDEP's objectives for stormwater management are directed at erosion control, groundwater recharge, storm water runoff quantity, and stormwater runoff quality. NJDEP supports and encourages use of non-structural stormwater management measures to satisfy design and performance standards; however, the most recent stormwater rule amendment, which took effect on March 2, 2021, requires the use of green infrastructure to meet these quantity, quality, and recharge design standards. Specifically in New Jersey, the Stormwater Management Rules at N.J.A.C. 7:8-1.2 define green infrastructure as "a stormwater management measure that manages stormwater close to its source by:

1. Treating stormwater runoff through infiltration into subsoil;
2. Treating stormwater runoff through filtration by vegetation or soil; or
3. Storing stormwater runoff for reuse."

There is a wide range of stormwater management measures that are used to address the impacts of development on groundwater, water quality and water quantity to meet the recently updated requirements of NJDEP guidelines. Applicable compliance standards for the new collection system are discussed below.

2.1.1. Erosion Control

The wind port facility will conform to the design and performance standards for erosion control established under the Soil Erosion and Sediment Control Act, NJSA 4:24-39 et eq. and implementing rules. Key structural elements of the Erosion and Sediment Control (ESC) plan include: installation of silt fencing, installation of stabilized construction entrances, use of crushed stone cover in equipment laydown and staging areas, and erosion control for temporary soil stockpiles. All structural ESCs shall be installed in accordance with applicable NJDEP recommended practices, as well as NJDEP's "Standards for Soil and Erosion Sediment Control," and operational prior to initial site disturbance and subsequent construction phasing. The proposed erosion and sediment control plans for the two phases of earthwork movement for Site G are included in Appendix E.

2.1.2. Groundwater Recharge

The groundwater recharge requirements outlined in NJAC 7:8 5.4, or use of infiltration practices for stormwater management at the site, would not be recommended for the following reasons:

- The site is in proximity to the tidal water of the Delaware River. As such, base flow discharge in the river is not at all influenced by local groundwater flow.
- The upper soil stratum at the site consists of very soft to medium stiff silty clays. These soils are unsuitable for infiltration. The thickness of fill after site development will vary but will generally be less than 5' and will be compacted through an extended period of surcharging.
- The saline environment of the Delaware River limits future development of groundwater wells or well field for either potable or industrial water supply purposes.

- Stormwater runoff could be subject to exposure to waste materials, industrial machinery and fuels, lubricants, or other industrial activities.
    - Per NJAC 7:8-5.4. (a).2.iii.(2), site stormwater exposed to "source material," i.e. any material(s) or machinery, located at an industrial facility, that is directly or indirectly related to process, manufacturing or other industrial activities, which could be a source of pollutants in any industrial stormwater discharge to groundwater, shall not be recharged.

Based on the above considerations, it has been evaluated that groundwater recharge shall not be considered as a principal stormwater management control measure for the wind port facility.

2.1.3. Stormwater Runoff Quantity Standards

In accordance with stormwater design standards established by the New Jersey Department of Transportation (NJDOT), the proposed stormwater management collection system for the wind port site shall be designed to safely manage runoff from the 25-year, 24-hour storm event (See Appendix A for design parameters and model), a flood recurrence level consistent with the NJDOT Roadway Drainage Design Manual Table 10-2 and the Township of Lower Alloways Creek Land Development Ordinance Article VI, Section 4.30.B.2. Water quantity control is not applicable to this site in accordance with the N.J.A.C. 7:8-5.6(b)4 due to the location of the site's point of discharge to the tidal zone of the Delaware Bay.

2.1.4. Stormwater Runoff Quality Standards

2.1.4.1. Total Suspended Solids Reduction

The project is subject to the NJDEP's stormwater quality standards for major development established in N.J.A.C. 7:8 where an 80% reduction in total suspended solids loading is required for new motor vehicle surfaces. This reduction must be achieved for the NJDEP's stormwater quality design storm of 1.25 inches of rainfall falling with a specific distribution over a 2-hour period. The amended stormwater rule establishes that the water quality treatment standards of 80% TSS reduction must be achieved through the implementation of approved green infrastructure techniques as detailed in the NJ BMP manual.

To achieve the mandatory water quality standard for Sites G and C1, multiple strategies are proposed to be implemented distributed throughout the site. Figure 2-1 demonstrates the applicable treatment technology for every proposed drainage area throughout Site G and C1. The techniques proposed for utilization around the site include GI-approved manufactured treatment devices (MTDs), pervious pavement, MTD's as pretreatment to infiltration, bioswales, and GI-approved MTD's as underground vault configurations. The green infrastructure solutions achieve the 80% TSS reduction required for all development proposed within the Sites G and C1; however, the GI MTD's proposed for Site C1 meet the 80% TSS reduction in a configuration not certified as green infrastructure according to the MTD certification. This non-GI configuration necessitates a petition for a green infrastructure requirement exemption for the Site C1.

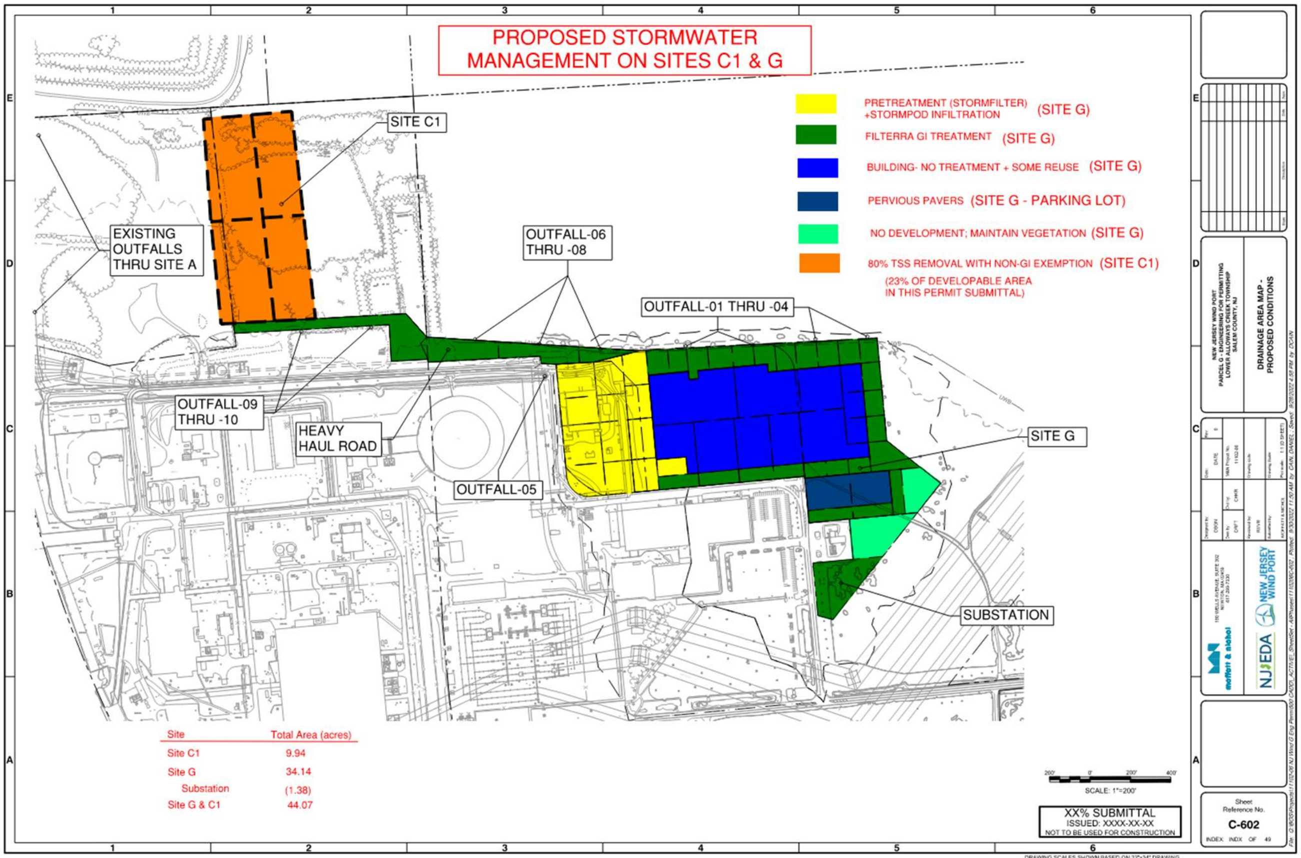


Figure 2-1 – Stormwater Treatment Measure Proposed for Sites C1 and G

2.1.4.2. Manufactured Treatment Device Certification

The manufactured treatment device (MTD) proposed for the OSW component laydown facility on the western half of Site G shall be the Stormwater Management StormFilter by Contech Engineered Solutions LLC. The StormFilter uses rechargeable, media-filled cartridges to absorb and retain pollutants from stormwater runoff including total suspended solids, hydrocarbons, nutrients, metals, and other common pollutants. The MTD proposed for the eastern half of Site G around the perimeter of the nacelle assembly building will be the Filterra Bioretention System (Filterra) by Contech Engineered Solutions LLC. The Filterra uses "physical, chemical, and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff." The MTD proposed for use within Site C1 will be the StormVault BioFiltration (StormVault) with Sierra Blend by Jensen Water Resources. The StormVault is a bioretention GI MTD that captures and removes pollutants from stormwater including total suspended solids, heavy metals, nutrients, gross solids, trash and debris, and petroleum hydrocarbons through its proprietary Sierra Blend bio-soil media.

N.J.A.C. 7:8-5.5(b) and 5.7(c) allows for the use of manufactured treatment devices for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by NJDEP. NJDEP has certified the use of both the StormFilter System and the Filterra Bioretention System by Contech Engineered Solutions LLC at a TSS removal rate of 80% when designed, operated, and maintained as stipulated by NJDEP in the terms of its certification. The NJDEP has also certified the use of the StormVault BioFiltration with Sierra

Blend by Jensen Water Resources when designed, operated, and maintained as stipulated in its certification letter; however, the proposed configuration of the StormVault as an underground vault with no infiltration does not meet the GI requirements of the certification. This imposes a need for a green infrastructure requirement exemption for the areas to use the StormVault in Site C1. Please refer to Appendix B for the MTDs certification and to Appendix C for the MTDs design, respectively.

2.1.5. Non-Structural Stormwater Management Controls

A Stormwater Pollution Prevention Plan (SWPPP), as required, will be developed prior to operation of the wind port site. The SWPPP will reflect the enhanced drainage, conveyance, and treatment systems for the site area, including routine inspection and maintenance practices. The SWPPP will also address material off-loading and storage practices for any oils (i.e. fuel oil, lubrication oil, etc.).

Section 3 - Stormwater Management System Design

3.1. Storm Drainage Design

The proposed stormwater management system for the wind port Sites G and C1 has been designed to comply with the applicable regulations of N.J.A.C. 7:8, the NJDOT Roadway Drainage Design Manual, and the Township of Lower Alloways Creek Land Development Ordinance Article VI, Section 4.30.B2. The NJDOT drainage regulations state in Table 10.2-C the design recurrence interval for this grade of stormwater management facility and network, which is 25-year storm events. In addition to compliance with the newly implemented green infrastructure rules of N.J.A.C., the design team accounted for the New Jersey extreme precipitation projections recently published by the NJDEP. The stormwater network was designed to account for the 25-year extreme precipitation event to accommodate projected additional flooding due to climate change and increase the facility's resilience.

The wind port site G has been divided into 64 total drainage areas to meet the drainage area limitations, manage the stormwater close to its source, and treat the stormwater locally through green infrastructure measures. The wind port site C1 has been divided into four drainage areas of approximately 2.5 acres each. Please refer to the drawing set included in Appendix E that details the proposed drainage areas of Sites G and C1. Appendix F demonstrates the proposed stormwater management system and all accompanying stormwater conveyance pipes.

Within Site C1, all stormwater runoff from each drainage area shall be intercepted by trench drains that are oriented in the north-south direction and parallel to the wharf in adjacent Parcel A, which will convey the flow into a storm drain network. Diversion structures set in line will direct peak runoff from the NJDEP 1.25-inch, 2-hour water quality storm to the underground storage structures upstream of the underground StormVault MTDs for treatment; larger storm events will bypass the MTD. Because the individual drainage areas are fully impervious, the underground storage shall provide attenuation for the peak storm flows that need to pass through the treatment MTD, which can at its proposed sizing can only handle maximum treatment flow rates of 0.606 cfs. The underground storage is sized based on the contributing area water quality design storm runoff volume. Therefore, the diversion structure provides the initial flow control towards the treatment train, then the outfall of the underground storage incorporates an outlet control structure to allow only up to the maximum treatment flow into the downstream MTD. The StormVault MTD is certified by the NJCAT to achieve the required 80% TSS removal efficiency for water quality treatment. The treated stormwater runoff from the MTDs and the larger storms will be conveyed to the Parcel A outfalls discharging through the wharf into the adjacent Delaware River.

Within Site G, the stormwater runoff from the heavy haul road shall be collected through the Filterra Bioretention systems configured with curb inlets and internal diversion structures. The internal diversion structures will allow the NJDEP water quality design storm (WQDS) flows to enter the bioretention cell and all larger storm events will be diverted downstream. The treated flows from the Filterra and the diverted flows will be conveyed downstream through grassed bioswales provided additional GI treatment prior to discharge to the existing PSEG stormwater pond and to the adjacent wetlands. The stormwater runoff within the western half of Site G that serves as the nacelle laydown area shall be collected through at grade catch basins. These catch basins will convey flow through an underground pipe network to diversion structures where the WQDS flows will be diverted to the pretreatment Stormfilter system housed within Stormpods underground storage structures. Storm events exceeding the 1.25-inch water quality design storm will be diverted downstream and bypass the pretreatment and underground storage. The pretreatment Stormfilter system will provide the 80% TSS reduction in water quality treatment prior to allowing the water quality flow to pass to another Stormpod underground storage facility where the WQDS volume will be allowed to infiltrate through the bottom of the structures. The Stormfilter pretreatment facility is sized by using HydroCAD and modeling the water quality peak flows. The Stormpod underground chambers shall be positioned such that the open bottom invert is at elevation +8.0, which is two feet above the seasonal high groundwater table elevation of +6.0' in the area. The Stormpod chambers were sized through HydroCAD modeling based on the water quality design storm volume of the contributing drainage area. The capacity to infiltrate this water quality design storm was confirmed by the approved NJDEP infiltration testing procedures which demonstrated infiltration values ranging from 5.5 to 15 inches per hour in this area of the site. Please refer to Appendix H, for the results from the infiltration testing performed on site by Pennoni in June 2022. By applying a factor of safety of two to the lowest infiltration test result of 5.5 inches per hour, the design infiltration rate for the chambers was determined to be 2.75 inches per hour. In order to comply with the Stormwater Management rules stated in N.J.A.C. 7:8-5.2(h) with regards to infiltration, the individual storage structures that facilitate infiltration were evaluated by the Hantush Method to determine all hydraulic impacts on the groundwater table underneath each structure. The results of the Hantush Method groundwater assessment are found in Appendix I, and they show that no groundwater mounding reaches the bottom invert of the infiltration chambers. By infiltrating the water quality storm, this stormwater management system complies with the green infrastructure guidelines. The diverted larger storm events will bypass the infiltration chambers and be conveyed to the discharge point at the existing PSEG drainage channel.

The eastern half of Site G around the perimeter of the nacelle assembly building shall utilize Filterra HC Bioretention systems configured with curb inlets and internal diversion structures. These Filterras will function in the same way as their counterparts along the heavy haul road, but the overflow and the treated stormwater shall be directed to small conveyance networks along the perimeter pavement around the building. The drainage areas were delineated around the assembly building to reach a maximum area of 0.30 acres, which was back-calculated as the maximum impervious area that a Filterra HC can treat as a single unit. As such, the Filterra placement was governed by the peak treatment flows from the independent drainage areas. The Filterra HC Biofiltration is certified by the NJCAT to achieve the required 80% TSS removal efficiency for water quality treatment. These conveyance networks will be sized to accommodate the stormwater runoff captured from the building rooflines and then carry the flows to the four proposed outfalls to the adjacent wetlands and drainage ditch to the north. In the southeast section of Site G, a proposed parking lot will be constructed to serve the nacelle assembly building and office. This proposed parking lot will be designed as porous asphalt to comply with the green infrastructure requirements, and due to poor infiltration in this area of the site, underdrains will be installed. These underdrains will be connected to the storm drain conveyance network that runs under the access road and around the perimeter of the building until discharging to the wetland to the north. Finally, the southernmost section of Site G is dedicated to the electrical substation. The site of the substation is graded such that all stormwater will be collected by a grassed bioswale running from south to north along the adjacent roadway. This bioswale is designed according to the NJ BMP Manual Chapter 9.5 to provide will provide 50% TSS reduction as pretreatment prior to discharging to a catch basin that sends the storm runoff under the access road. The flow then passes through a diversion structure which diverts larger storm events downstream yet allows the WQDS to flow directly to the Filterra HC Bioscape system configured online with a pipe inlet. The treated stormwater and overflow will meet downstream and be discharged to the existing PSEG storm network which is being rerouted through Site G.

Please refer to Appendix A for the full stormwater network XPSWMM modeling results where the stormwater system profiles demonstrate the hydraulic grade line (HGL) results for the model storm return periods. The stormwater system was designed with pipe sizes, materials and slopes that maintain the 25-year HGL below the allowable water elevation, which in this case is below the rim of the inlets and catch basins. This ensures that no flooding takes place during the 25-year extreme storm event, and minimal flooding occurs during larger storms like the 100-year event. Also included within the results are the water elevation versus time plots for the Stormpod infiltration systems, which demonstrate the full water quality storm infiltrating in under twenty-four hours and the water stages over time in the larger storm events.

3.1.1. Hydrologic and Hydraulic Analysis and Approach

The XP-SWMM software was utilized to model the proposed stormwater management network. The XP-SWMM software performs both hydrologic and hydraulic analysis for stormwater drainage systems. XP-SWMM uses the Tuflow calculation engine to run the dynamic wave equation for hydraulic routing. According to the XP-SWMM user guide:

Dynamic Wave routing solves the complete St. Venant flow equations and therefore produces the most accurate results. These equations consist of the continuity and momentum equations for conduits and a flow continuity equation at nodes.

Dynamic wave routing can account for channel storage, backwater, entrance/exit losses, flow reversal, and pressurized flow. Because it couples together the solution for both water levels at nodes and flow in conduits it can be applied to any general network layout, even those containing multiple downstream diversions and loops.

The hydrologic calculations were performed by the unit hydrograph NRCS method. The manufactured treatment devices (MTDs) were designed and sized appropriately using HydroCAD which uses a unit hydrograph for calculating peak runoff and volume storage of the devices.

Runoff volume, drainage collection system pipe sizing, and MTD sizing were determined using XP-SWMM and HydroCAD. The following assumptions were utilized for modeling the system.

1. Point Precipitation Frequency Estimates are sourced from NOAA Atlas 14, Volume 2, Version 3 (Location name: Salem, New Jersey, USA)
    a. 25-year, 24-hour SCS Type III design storm (6.25 inches – based on NOAA).
    b. 25-yr, 24-hour rainfall intensity (7.25 in/hr – based on NOAA).
2. Time of concentration (Tc) = 0.1 hour was utilized as the minimum for the sheet flow within drainage basins. All times of concentration were calculated using the NRCS TR-55 method.
3. For all developed areas, it was assumed 100% impervious area. There were two exceptions to this assumption:
    a. Surrounding the substation and Site G access roadway
    b. Bordering the heavy haul road
4. New Jersey Extreme Precipitation Projection tool was used to model additional extreme precipitation estimates for the 25-year return period (https://njprojectedprecipitationchanges.com/)
    a. 25-year, 24-hour design storm median projection (7.01 inches)

Please refer to Appendix A for full model input parameters and current design results.

Section 4 -Maintenance Procedures and Practices

Section 7:8-5.8 of the NJDEP stormwater management regulations outline requirements necessary to develop a maintenance plan for all proposed stormwater management measures incorporated into the design of a major development. Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure and can include repairs or replacement to the structure, and removal of debris. The maintenance plan shall contain specific preventative maintenance tasks and schedules, as well as cost estimates for sediment, debris, or trash removal. Please refer to Appendix D for manufacturer's detailed maintenance procedures as required by the NJDEP certification of the MTDs.

4.1. Responsibility

The facility manager shall be responsible for ensuring that the stormwater management system will be properly maintained. The facility manager shall ensure that all preventative and corrective maintenance tasks, including routine inspections, and shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the wind port site G1, including a record of all inspections and copies of all maintenance-related work orders. In addition, the person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan as needed.

4.2. Preventative and Corrective Maintenance Measures

Please refer to Appendix D for the approved maintenance manuals provided by the manufacturers. The primary purpose of the StormFilter is to screen and prevent pollutants and debris from discharging into protected waterway and periodically these pollutants must be removed to restore the filer to its full efficiency. Maintenance is recommended on an annual basis, with infrequent occurrences as a result of excessive sediment loading from site erosion or extreme storms. Regulatory requirements or a chemical spill can shift maintenance timing as well. The required frequency of maintenance may be adjusted as additional monitoring information becomes available during the inspection program but, ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual site. While the average maintenance lifecycle of the device is approximately 1-5 years, it is recommended that the site owner develop a database to properly manage inspection and maintenance programs.

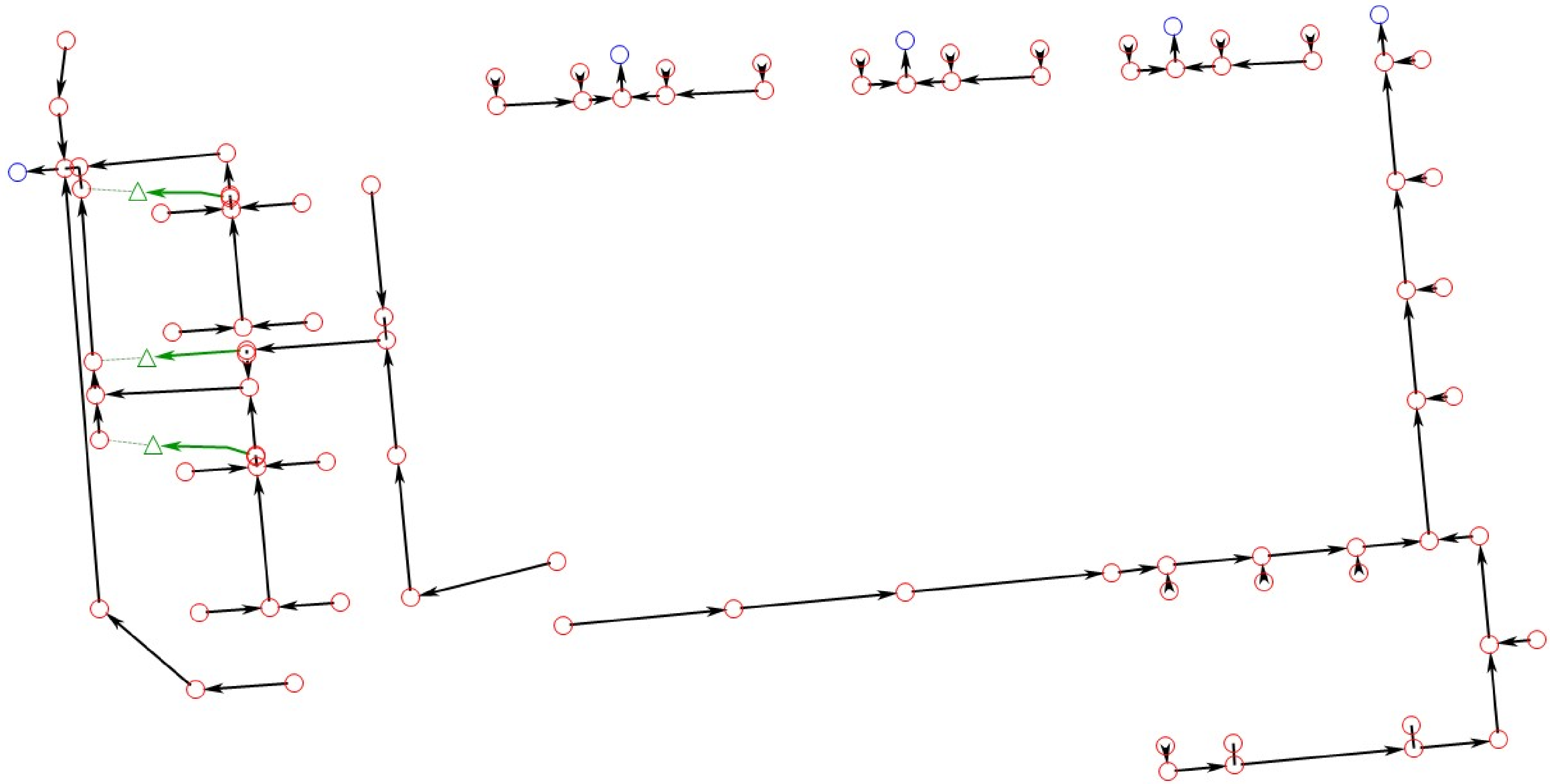
The initial step recommended for maintenance is to inspect the StormFilter vault to assess the condition of the filter cartridges. If the submerged cartridges are severely plugged (if pore space between media granules is absent), then the cartridges will need to be replaced. Prior to replacement, however, all cartridges shall be emptied onto the vault floor, and the empty shells returned to the manufacturer. It is recommended that cartridge replacement be done in dry weather.

Second, the level of visual sediment loading will need to be assessed. If the level of accumulation within the vault appears excessive (>4" on the vault floor), it is recommended that all accumulated material be removed from the vault and forebay via a vacuum truck. Prior to removal, samples of the accumulated sediment and media should be obtained to determine concentrations of any heavy metals and organic chemicals (such as petroleum products) and coordinate appropriate disposal requirements. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. This typically requires coordination with a local landfill for solid waste disposal. Liquid waste disposal may necessitate one of several options, including: a municipal vacuum truck decant facility; a local wastewater treatment plant; or on-site treatment and discharge.

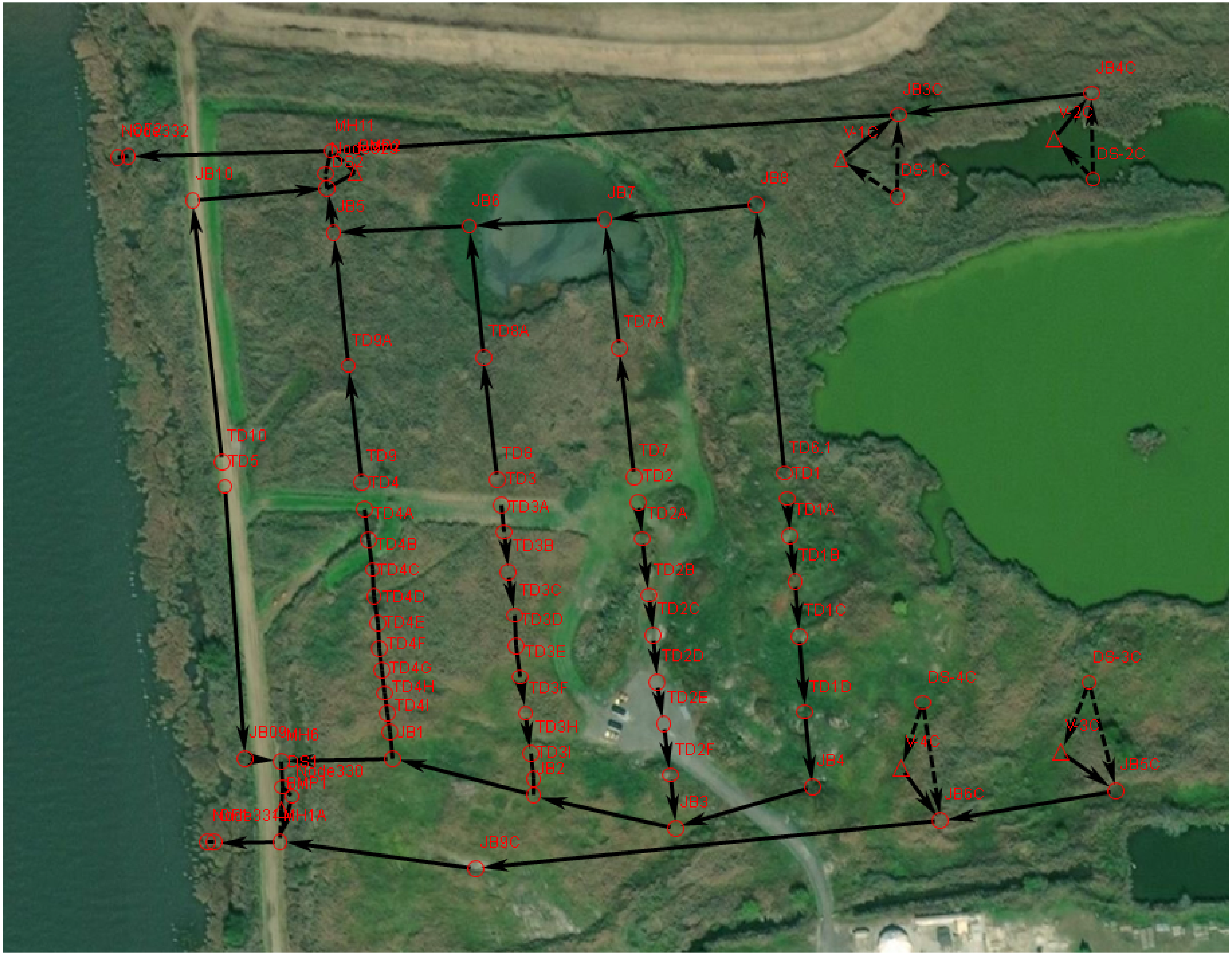
The Filterra HC systems function with internal bypass weirs and a special soil media mix and plants that provide biofiltration of the water quality design storm. With the purchase of the Filterra HC system, Contech includes the activation of the system and a one-year maintenance plan that includes up to two visits. Maintenance is recommended on an annual basis, with infrequent occurrences as a result of excessive sediment loading from site erosion or extreme storms. Regulatory requirements or a chemical spill can shift maintenance timing as well. The required frequency of maintenance may be adjusted as additional monitoring information becomes available during the inspection program but, ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual site. While the average maintenance lifecycle of the device is approximately 1-5 years, it is recommended that the site owner develop a database to properly manage inspection and maintenance programs. The maintenance plan for the Filterra HC was several initial requirements prior to activation of the system. The site landscaping must be fully stabilized in the area, final paving must be completed, and the curb inlet throat opening should measure at least four inches. The routine maintenance visits by Contech include debris removal, pretreatment mulch replacement, and a plant health evaluation. These routine maintenance procedures may be contracted through Contech after the first year or may become the responsibility of the site owner or operator.

Appendix A – XP-SWMM Model Parameters and Output

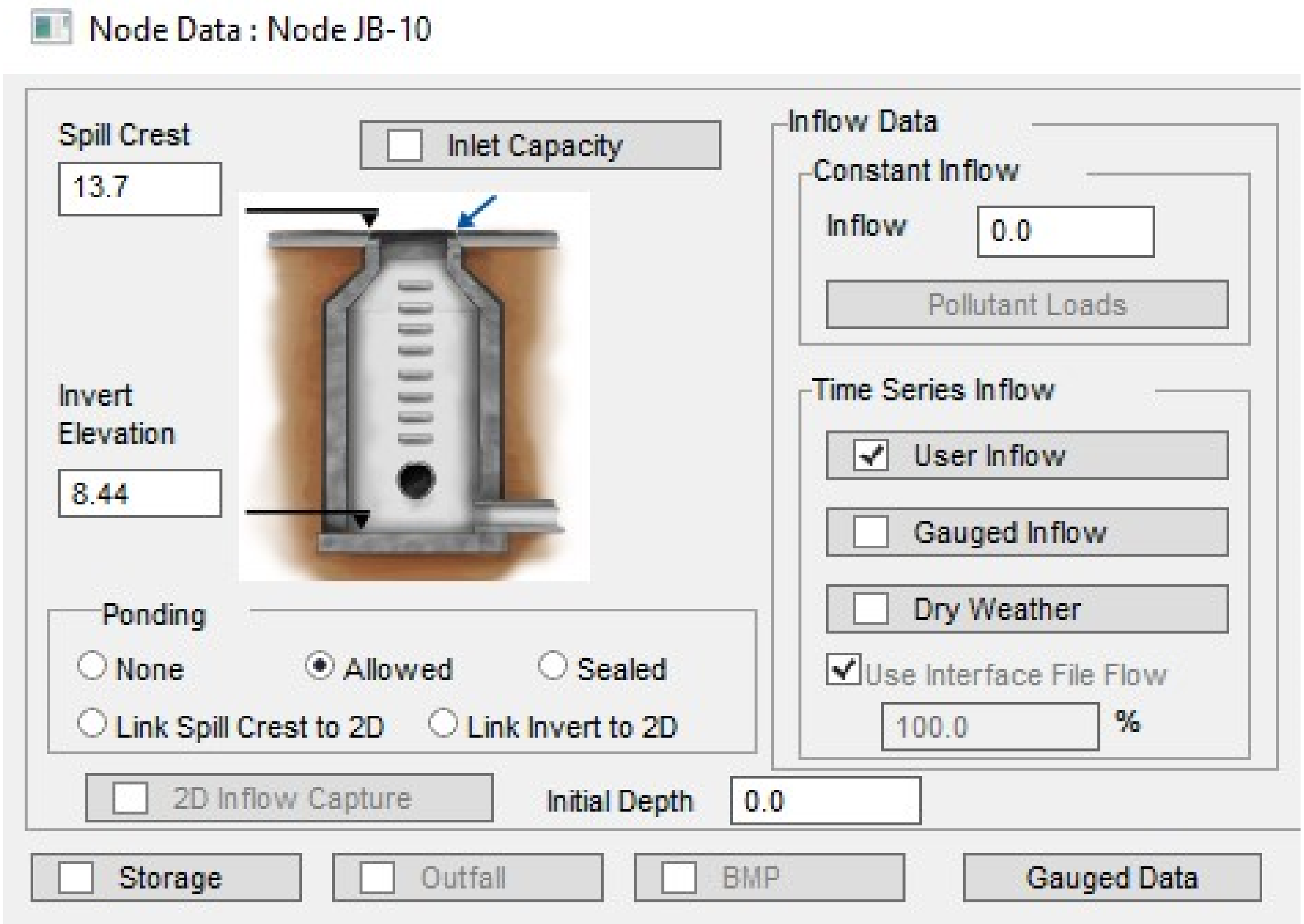
NEW JERSEY WIND PORT SITE G
XPSWMM MODEL LAYOUT

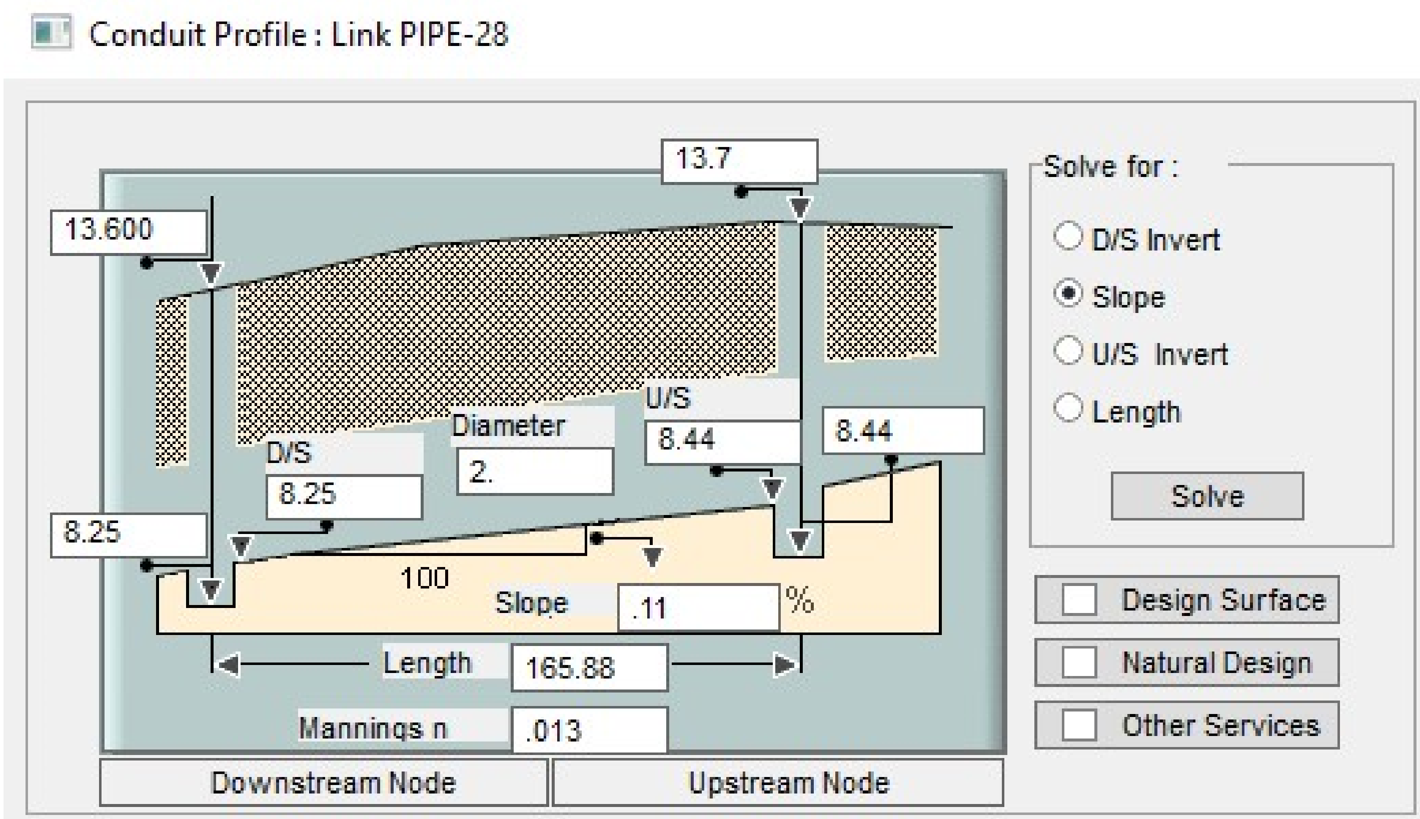


NEW JERSEY WIND PORT SITE C1
XPSWMM MODEL LAYOUT



EXAMPLES OF XPSWMM
NODE AND CONDUIT INPUT PARAMETERS





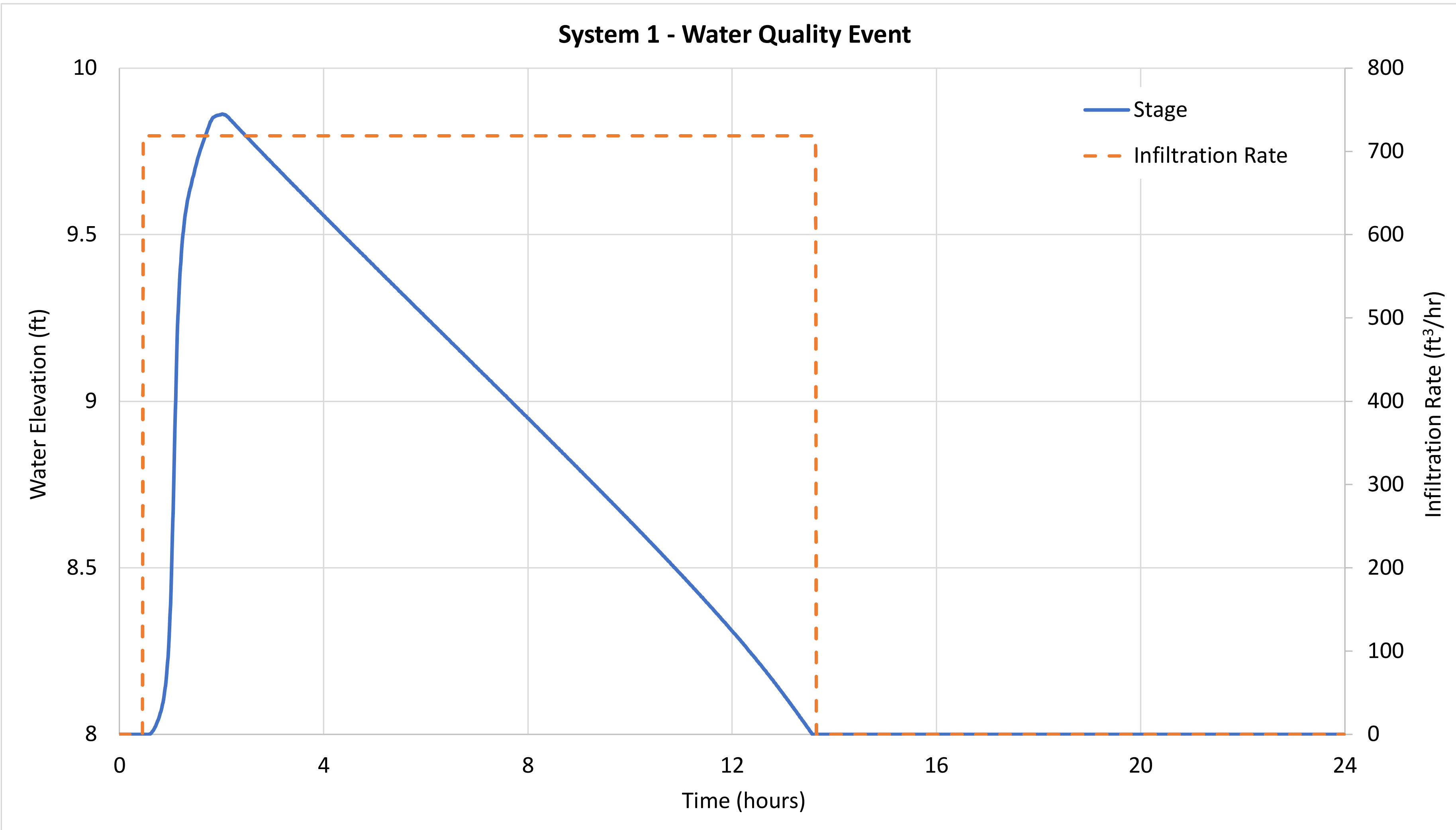
Name	Invert Elevation (ft)	Rim Elevation (ft)
DS-1	8.00	14.10
DS-2	8.00	14.09
DS-3	8.00	14.21
F-1	8.33	13.58
F-10	8.06	13.32
F-11	8.00	13.00
F-12	8.00	13.00
F-13	8.78	13.78
F-14	9.14	14.14
F-15	8.19	13.47
F-16	9.18	14.18
F-17	9.20	14.20
F-18	8.63	13.63
F-19	8.46	11.21
F-2	8.00	13.00
F-20	8.00	10.75
F-3	8.00	14.00
F-4	8.34	13.61
F-5	8.00	13.00
F-6	8.00	13.00
F-7	8.15	13.41
F-8	8.00	13.00
F-9	7.97	13.00
H-2	6.00	10.00
JB-07	7.50	13.80
JB-1	6.87	14.16
JB-10	8.44	13.70
JB-10A	8.25	13.60
JB-11	8.12	14.11
JB-12	8.27	13.50
JB-13	8.27	13.50
JB-14	8.15	13.40
JB-15	8.15	13.40
JB-16	6.31	14.09
JB-16A	7.21	14.08
JB-17	4.16	14.07
JB-18	8.40	13.40
JB-19	8.24	13.50
JB-2	6.72	14.19
JB-20	8.50	13.50
JB-21	8.50	13.50
JB-22	7.85	14.25
JB-23	3.15	14.07
JB-24	3.05	14.11

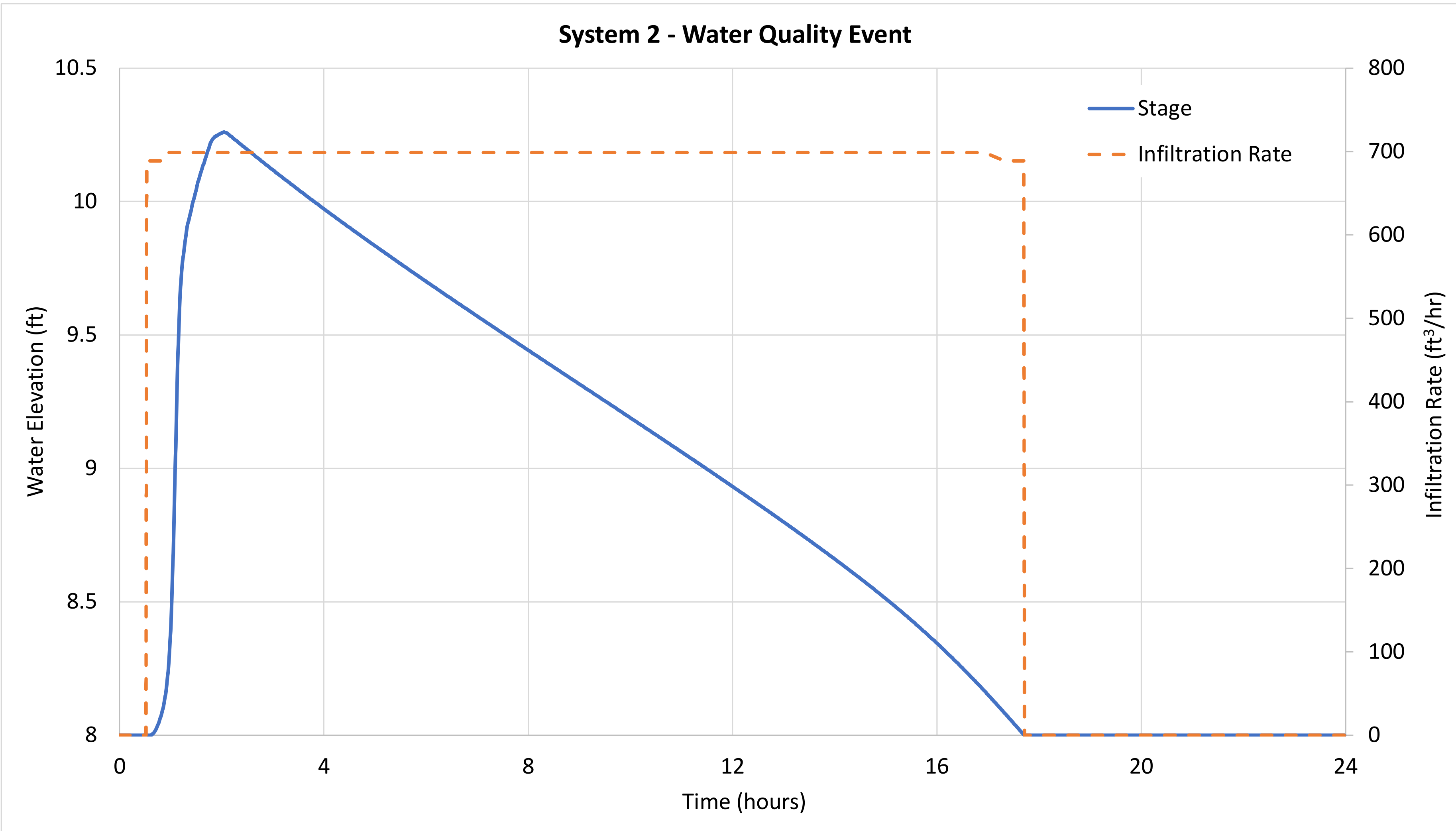
JB-25	0.97	12.11
JB-26	8.21	13.70
JB-27	8.45	13.70
JB-3	6.62	14.07
JB-4	4.66	13.21
JB-4A	4.60	13.95
JB-5	4.39	13.46
JB-6	5.30	11.87
JB-7A	6.77	13.31
JB-8	8.00	13.81
JB-9	8.52	13.81
JB-9A	8.65	13.90
MH-1	8.15	13.95
MH-10	7.88	13.87
MH-11	4.05	13.86
MH-12	4.19	14.16
MH-13	4.31	14.16
MH-14	4.44	14.16
MH-16	6.52	14.15
MH-17	6.31	14.15
MH-18	4.78	13.09
MH-19	5.04	12.72
MH-2	7.66	13.96
MH-20	5.19	11.77
MH-21	5.27	11.96
MH-22	6.73	13.90
MH-22-RN1	8.19	14.10
MH-23	8.03	14.10
MH-23A	5.43	14.09
MH-24	7.99	14.10
MH-25	8.03	14.17
MH-3	7.61	13.97
MH-4	8.16	13.98
MH-5	7.72	14.00
MH-6	7.46	13.95
MH-7	7.97	13.84
MH-8	7.72	13.85
MH-9	7.36	13.86
MH-W1	4.21	10.28
MH-W2	3.63	10.73
MH-W3	2.91	10.83
MH-W4	5.26	13.62
O-1	6.62	9.50
O-2	6.47	9.34
O-3	6.37	9.26
O-4	4.00	9.00
O-6	0.71	6.83

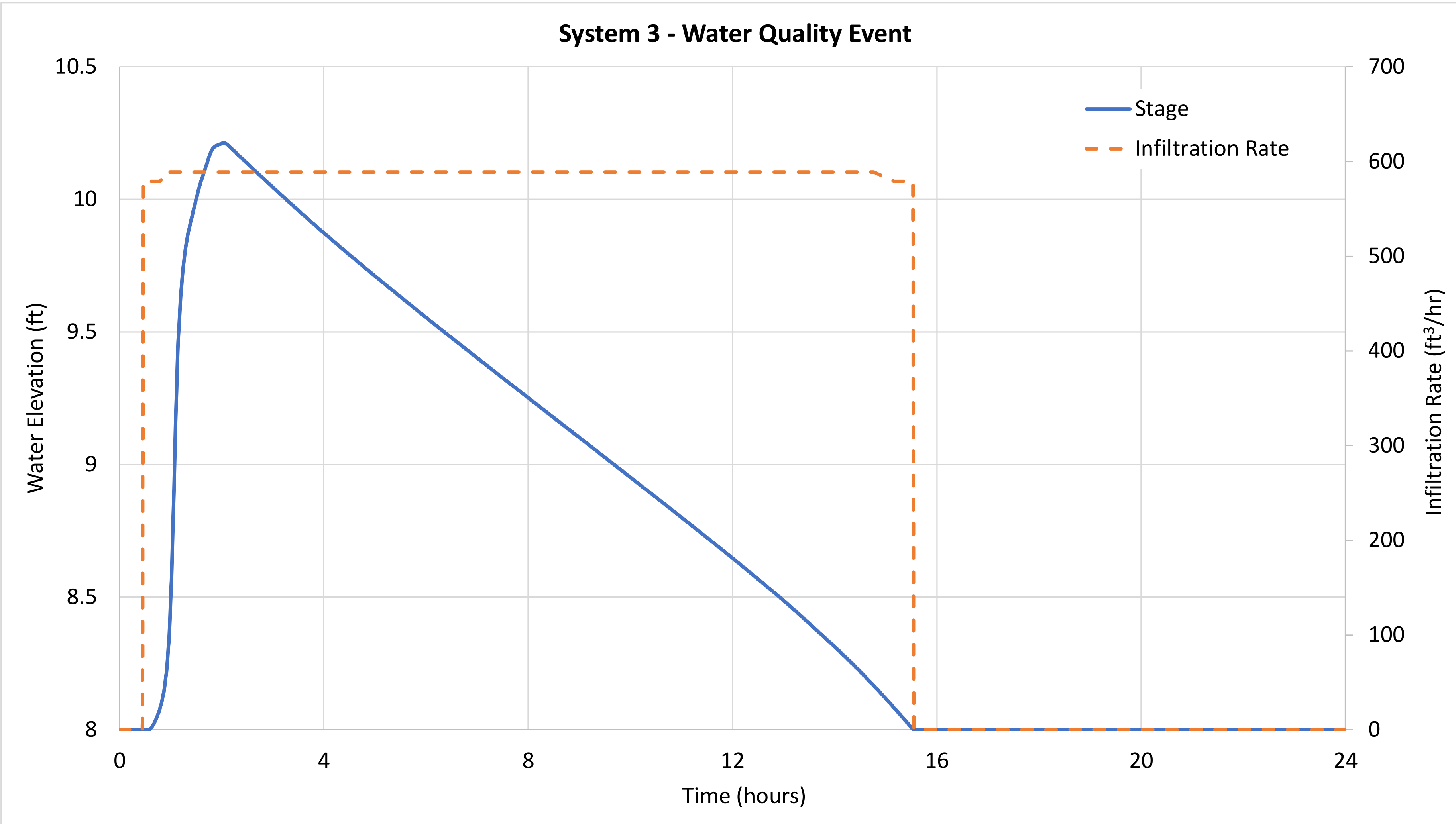
SYS1	8.00	14.00
SYS2	8.00	14.00
SYS4	8.00	13.80

Name	Upstream Node Name	Downstream Node Name	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Length (ft)	Diameter (ft)	Roughness	Conduit Slope (%)
CO-28	JB-4A	MH-14	4.61	4.44	165.9	5	0.013	0.10
CO-36	F-14	MH-14	9.14	8.90	47.0	2	0.013	0.51
CO-38	F-17	MH-17	9.20	9.05	30.0	2	0.013	0.50
CO-41	MH-20	MH-19	5.20	5.04	159.0	3.5	0.013	0.10
CO-47	F-19	MH-19	8.46	8.31	34.0	2	0.013	0.44
CO-5	F-3	MH-3	8.00	7.82	36.0	2	0.013	0.50
PIPE-1	JB-13	MH-22-RN1	8.27	8.19	82.0	2	0.013	0.10
PIPE-10	JB-23	JB-24	3.17	3.05	24.4	3.5	0.013	0.49
PIPE-11	WEIR-DS-1	JB-16	7.01	6.64	73.0	3.5	0.013	0.51
PIPE-110	WEIR-DS-2	JB-16	6.51	6.31	39.0	3.5	0.013	0.51
PIPE-112	JB-26	JB-11	8.21	8.17	36.0	2	0.013	0.11
PIPE-115	JB-16	MH-23A	6.32	5.43	177.6	3.5	0.013	0.50
PIPE-116	JB-16A	MH-23A	7.21	6.81	40.0	3.5	0.013	1.00
PIPE-117	MH-23A	JB-17	5.45	5.25	39.5	3.5	0.013	0.51
PIPE-126	JB-7A	MH-22	6.89	6.73	65.1	2	0.013	0.25
PIPE-13	JB-17	JB-23	4.16	3.15	201.8	3.5	0.013	0.50
PIPE-17	JB-12	MH-22-RN1	8.27	8.19	82.1	2	0.013	0.10
PIPE-18	JB-15	MH-23	8.15	8.05	81.8	2	0.013	0.12
PIPE-19	JB-14	MH-23	8.15	8.05	82.2	2	0.013	0.12
PIPE-2	MH-22-RN1	MH-23	8.19	8.03	164.0	2	0.013	0.10
PIPE-20	JB-19	MH-24	8.24	8.17	81.9	2	0.013	0.09
PIPE-21	MH-24	MH-25	8.17	8.03	138.5	2	0.013	0.10
PIPE-22	JB-18	MH-24	8.40	7.99	82.1	2	0.013	0.50
PIPE-23	JB-21	MH-25	8.50	8.09	82.3	2	0.013	0.50
PIPE-24	JB-20	MH-25	8.50	8.09	82.1	2	0.013	0.50
PIPE-25	JB-8	JB-07	8.00	7.50	200.0	2	0.013	0.25
PIPE-27	JB-9A	JB-10	8.65	8.44	174.2	2	0.013	0.12
PIPE-28	JB-10	JB-10A	8.44	8.25	165.9	2	0.013	0.12
PIPE-29	JB-9	JB-8	8.54	8.04	199.7	2	0.013	0.25
PIPE-3	MH-23	DS-1	8.04	8.00	12.4	2.5	0.013	0.32
PIPE-32	JB-11	DS-2	8.17	8.00	162.5	2	0.013	0.11
PIPE-33	JB-10A	JB-11	8.25	8.12	128.0	2	0.013	0.10
PIPE-34	JB-27	JB-26	8.45	8.21	199.0	2	0.013	0.12
PIPE-4	MH-25	DS-3	8.04	8.00	12.3	2	0.013	0.33
PIPE-40	MH-1	MH-2	8.16	7.66	100.5	2	0.013	0.50
PIPE-41	MH-2	JB-1	7.67	7.44	45.5	2	0.013	0.51
PIPE-42	JB-1	O-1	6.87	6.62	49.7	2.5	0.013	0.50
PIPE-43	MH-3	JB-1	7.62	7.36	51.7	2	0.013	0.50
PIPE-44	F-1	MH-1	8.33	8.15	36.0	2	0.013	0.50
PIPE-45	F-2	MH-2	8.00	7.82	36.0	2	0.013	0.50
PIPE-47	MH-5	JB-2	7.72	7.45	53.0	2	0.013	0.51
PIPE-48	JB-2	O-2	6.72	6.47	50.1	2.5	0.013	0.50
PIPE-49	MH-7	MH-6	7.98	7.46	104.2	2	0.013	0.50
PIPE-5	WEIR-DS-3	JB-22	8.01	7.85	52.0	2	0.013	0.31
PIPE-50	MH-6	JB-2	7.47	7.21	53.2	2	0.013	0.49
PIPE-51	F-5	MH-5	8.00	7.82	32.0	2	0.013	0.56
PIPE-52	F-6	MH-6	8.00	7.82	32.0	2	0.013	0.56
PIPE-53	F-7	MH-7	8.15	7.97	36.0	2	0.013	0.50
PIPE-54	MH-10	MH-9	7.89	7.36	105.5	2	0.013	0.50
PIPE-55	MH-9	JB-3	7.38	7.11	53.6	2	0.013	0.50
PIPE-56	JB-3	O-3	6.62	6.37	49.9	2.5	0.013	0.50
PIPE-57	MH-8	JB-3	7.72	7.46	52.3	2	0.013	0.50
PIPE-58	F-10	MH-10	8.06	7.88	36.0	2	0.013	0.50
PIPE-59	F-9	MH-9	7.98	7.82	31.5	2	0.013	0.51
PIPE-6	JB-22	JB-24	7.86	7.34	171.3	2	0.013	0.30
PIPE-60	F-8	MH-8	8.00	7.82	36.0	2	0.013	0.50
PIPE-61	MH-14	MH-13	4.44	4.31	127.7	5	0.013	0.10
PIPE-62	MH-13	MH-12	4.32	4.19	127.7	5	0.013	0.10
PIPE-63	MH-12	MH-11	4.19	4.05	138.3	5	0.013	0.10
PIPE-64	MH-11	O-4	4.06	4.00	55.7	5	0.013	0.11
PIPE-65	F-11	MH-11	8.00	7.76	47.0	2	0.013	0.51
PIPE-66	F-12	MH-12	8.00	7.76	47.0	2	0.013	0.51
PIPE-67	F-13	MH-13	8.78	8.54	47.0	2	0.013	0.51

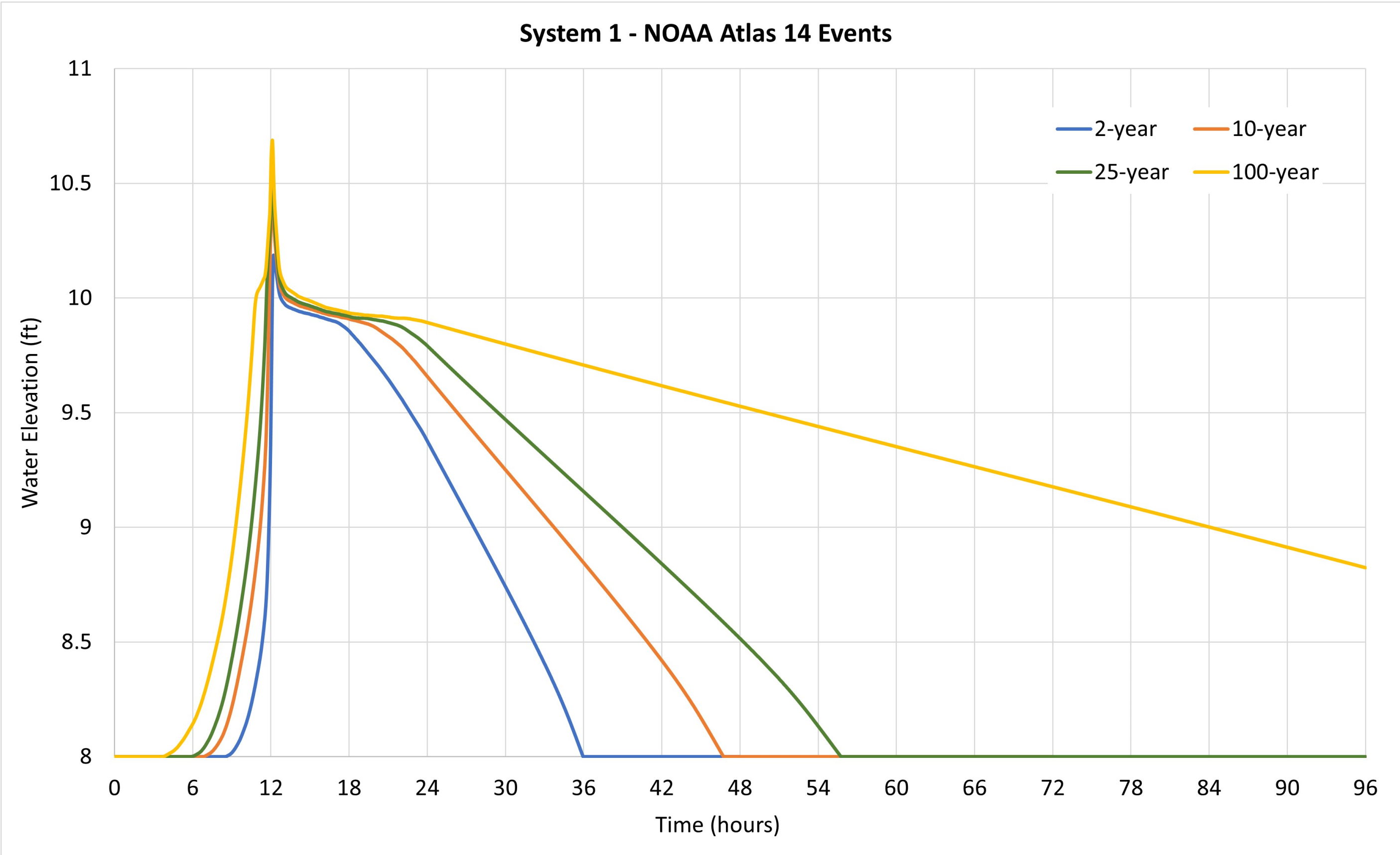
PIPE-69	MH-W1	MH-W2	4.21	3.63	115.5	2.5	0.013	0.50
PIPE-7	JB-24	JB-25	3.06	2.97	17.4	3.5	0.013	0.52
PIPE-70	MH-W2	MH-W3	3.64	2.91	146.0	2.5	0.013	0.50
PIPE-71	MH-W3	JB-25	2.92	0.97	513.7	3	0.013	0.38
PIPE-72	H-2	MH-W4	6.00	5.26	74.3	4	0.013	1.00
PIPE-73	MH-W4	JB-25	5.26	4.47	72.1	4	0.013	1.10
PIPE-74	F-4	MH-4	8.34	8.16	36.0	2	0.013	0.50
PIPE-75	MH-4	MH-3	8.17	7.61	112.5	2	0.013	0.50
PIPE-76	F-15	MH-22	8.19	8.02	34.0	2	0.013	0.50
PIPE-77	MH-22	MH-16	6.73	6.52	102.0	3	0.013	0.21
PIPE-78	MH-16	MH-17	6.53	6.31	109.7	3	0.013	0.20
PIPE-79	F-16	MH-16	9.18	9.03	29.9	2	0.013	0.50
PIPE-7-RN1	JB-25	O-6	0.98	0.71	55.5	5.5	0.013	0.49
PIPE-81	F-20	MH-20	8.00	7.85	34.0	2	0.013	0.44
PIPE-83	MH-19	JB-5	5.04	4.89	148.0	4	0.013	0.10
PIPE-84	JB-5	MH-18	4.89	4.78	111.4	4	0.013	0.10
PIPE-86	MH-18	JB-4	4.78	4.66	126.1	4	0.013	0.10
PIPE-87	MH-17	JB-4A	6.31	6.14	86.0	3	0.013	0.20
PIPE-89	F-18	MH-18	8.63	8.33	60.0	2	0.013	0.50
PIPE-90	JB-6	MH-21	5.30	5.27	34.0	3	0.013	0.09
PIPE-91	MH-21	MH-20	5.27	5.19	78.4	3	0.013	0.10
PIPE-94	JB-07	JB-7A	7.51	6.89	241.6	2	0.013	0.26
PIPE-96	JB-4	JB-4A	4.66	4.60	57.5	4.5	0.013	0.10
SYS1-IN	DS-3	SYS1	8.00	8.00	107.5	2	0.013	0.00
SYS2-IN	DS-1	SYS2	8.00	8.00	120.8	3.5	0.013	0.00
SYS4-IN	DS-2	SYS4	8.00	8.00	116.2	3.5	0.013	0.00

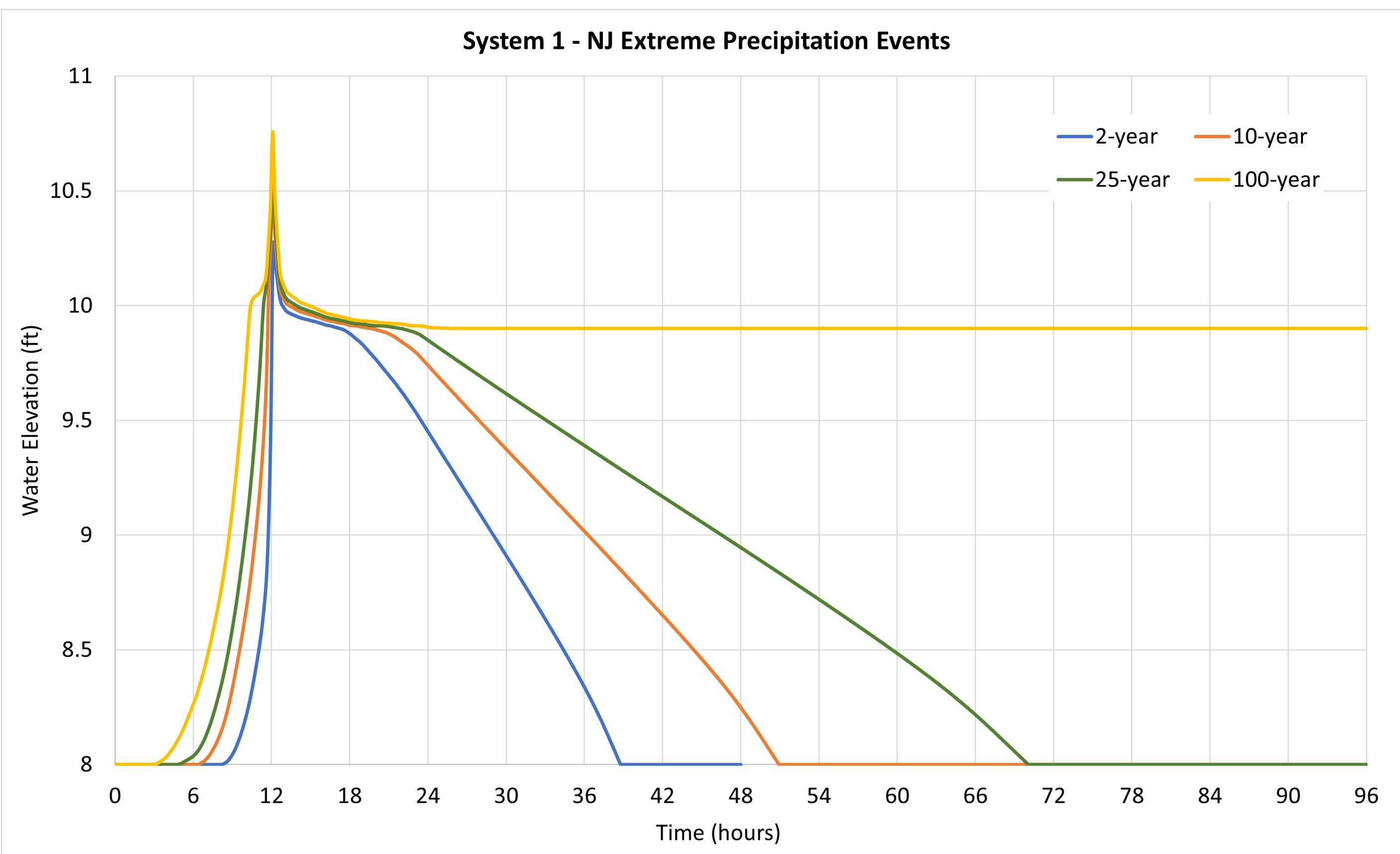

System 1 - Water Quality Event
Stage
Infiltration Rate
Water Elevation (ft)
Infiltration Rate (ft^3/hr)
Time (hours)
10
9.5
9
8.5
8
800
700
600
500
400
300
200
100
0
0
4
8
12
16
20
24

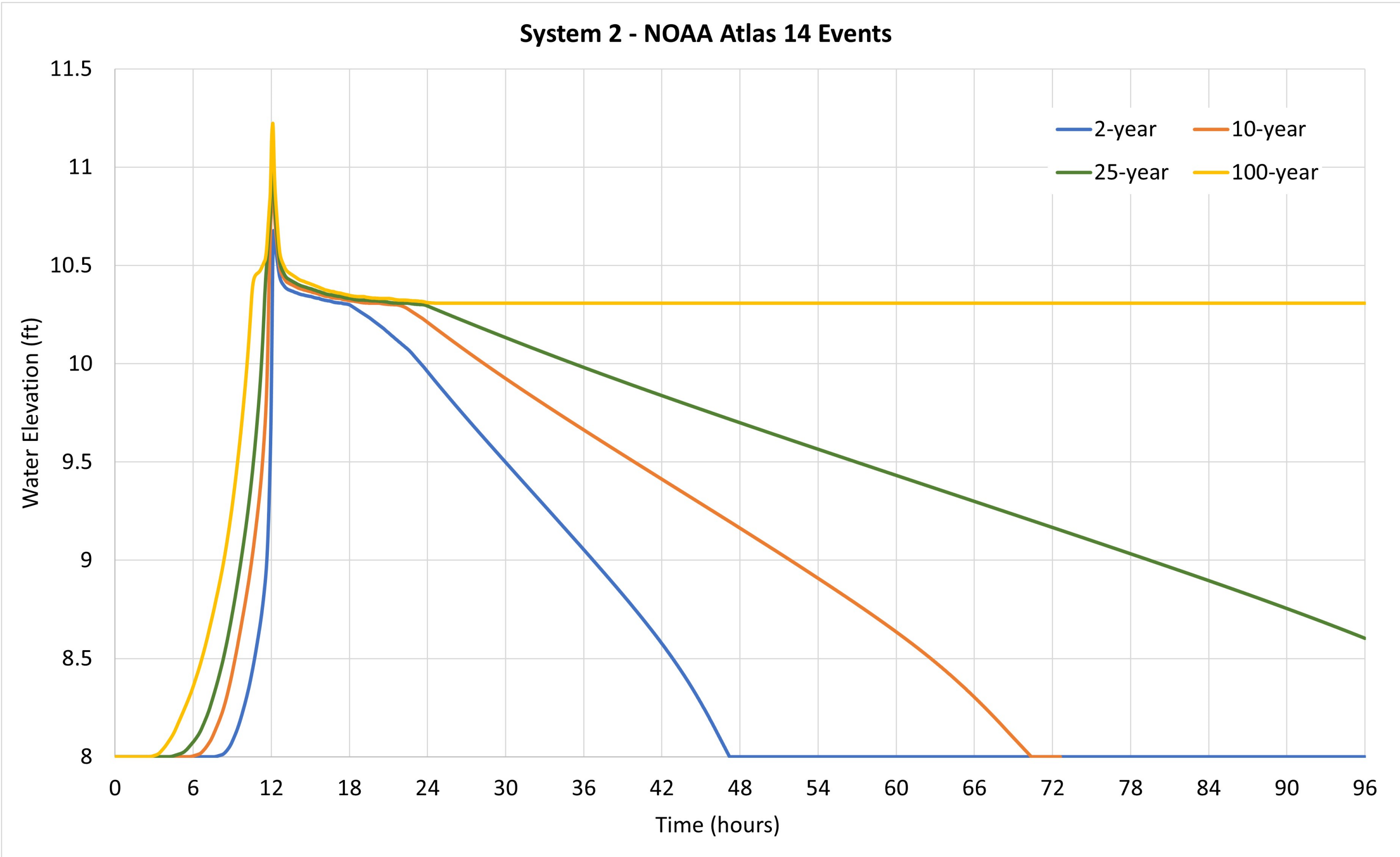

System 2 - Water Quality Event
Stage
Infiltration Rate
Water Elevation (ft)
10.5
10
9.5
9
8.5
8
Infiltration Rate (ft³/hr)
800
700
600
500
400
300
200
100
0
0
4
8
12
16
20
24
Time (hours)

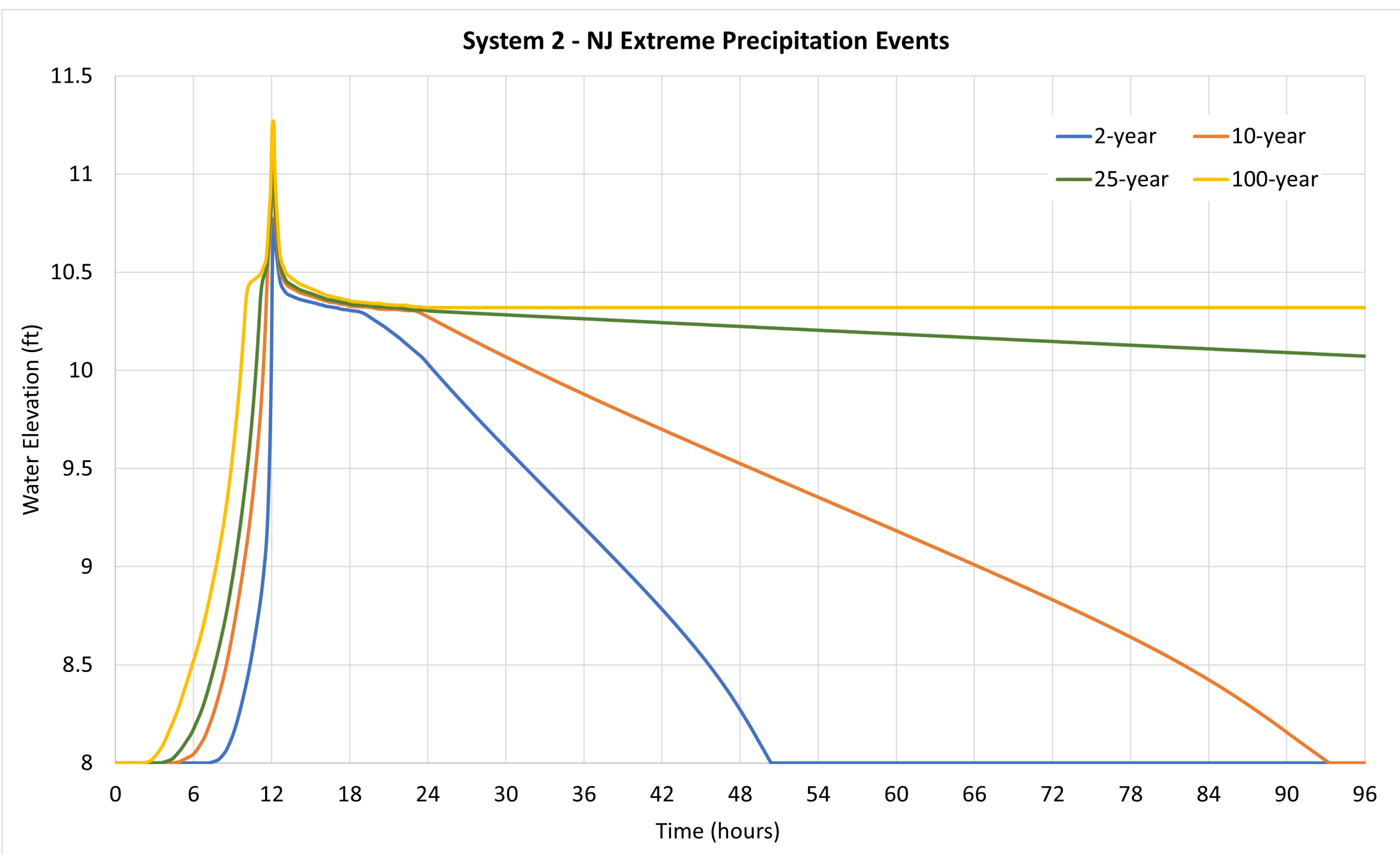

System 3 - Water Quality Event
Stage
Infiltration Rate
Water Elevation (ft)
10.5
10
9.5
9
8.5
8
700
600
500
400
300
200
100
0
Infiltration Rate (ft³/hr)
0
4
8
12
16
20
24
Time (hours)

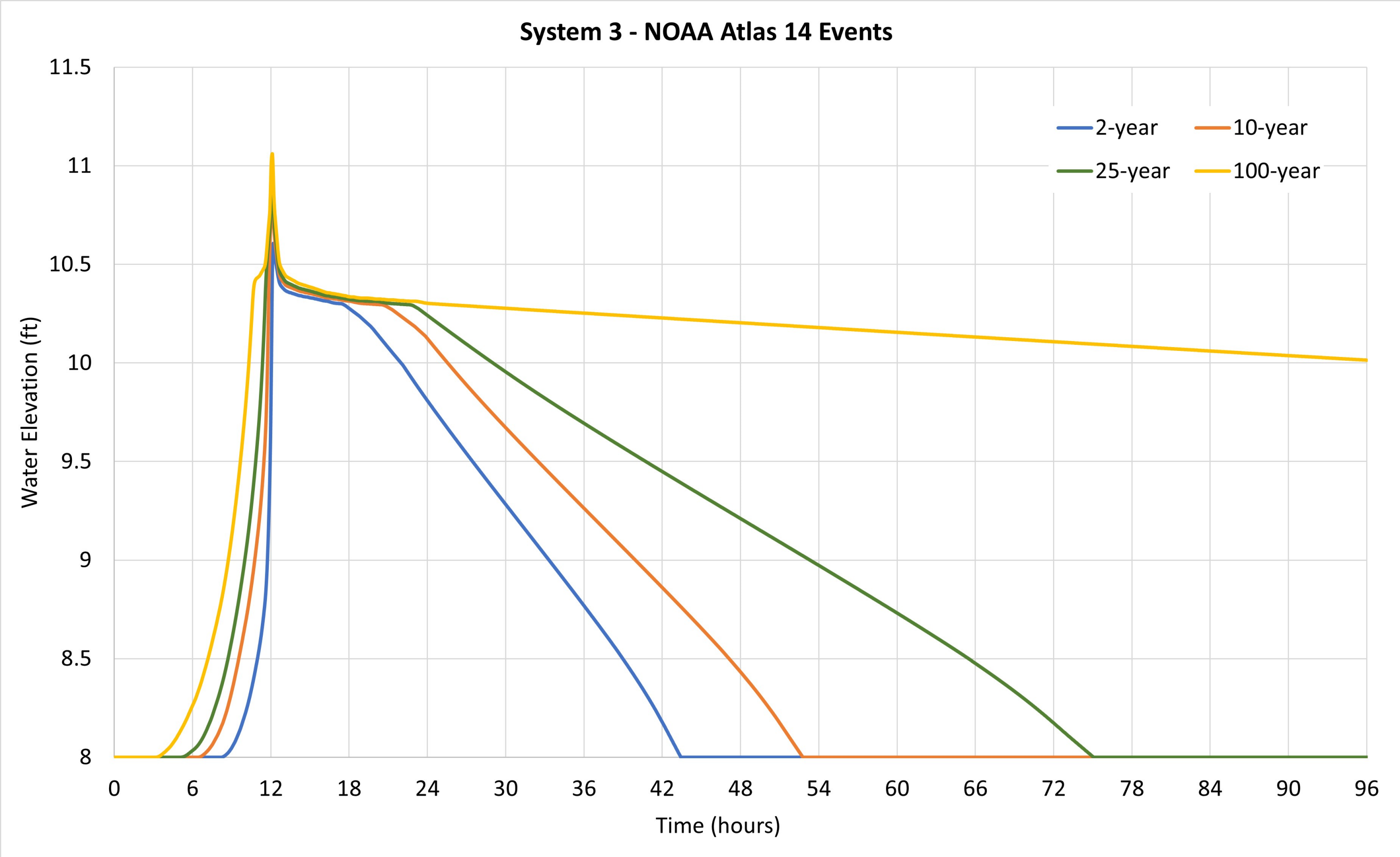
XPSWMM WATER SURFACE ELEVATION RESULTS FOR UNDERGROUND STORAGE SYSTEMS- PARCEL G

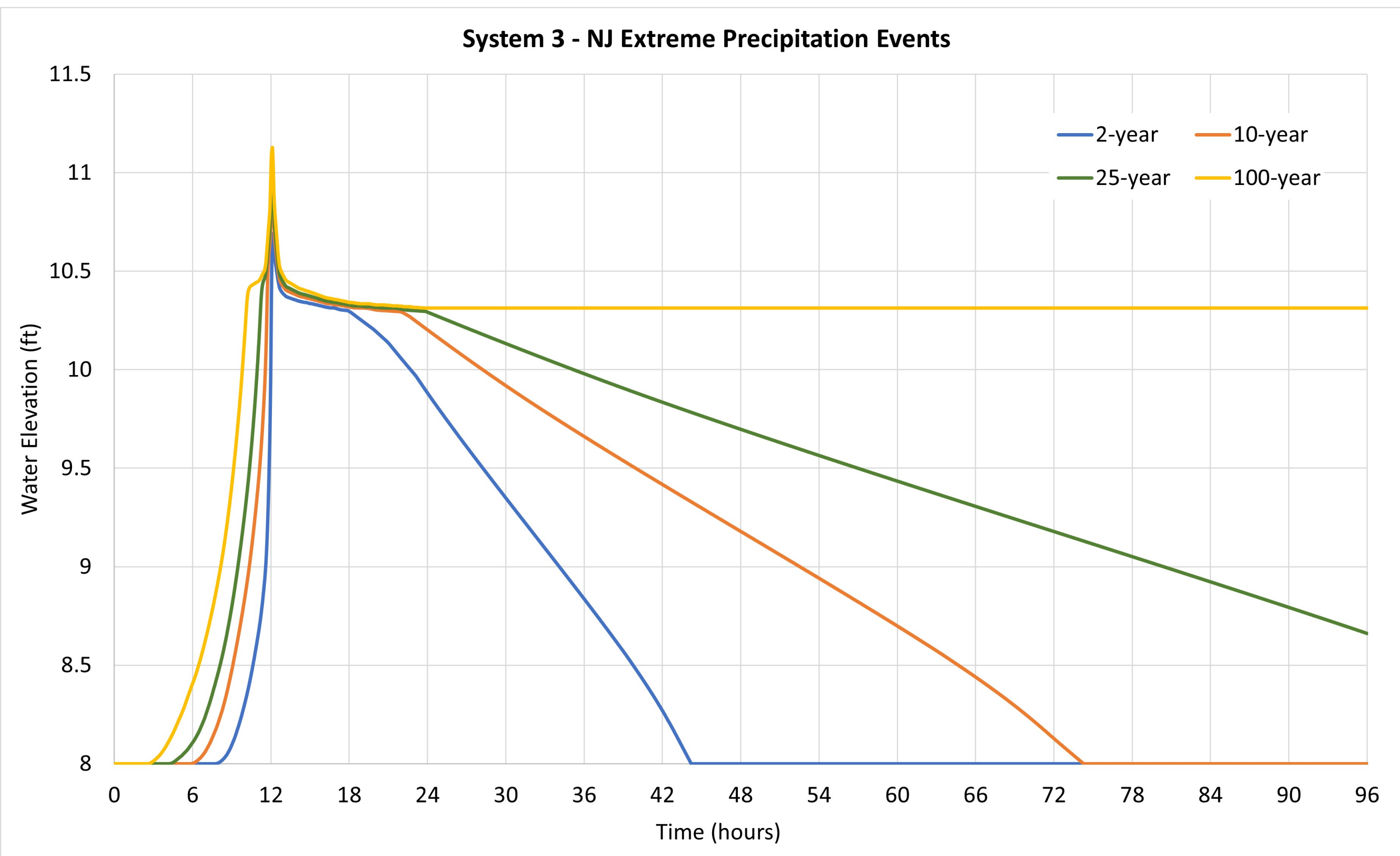




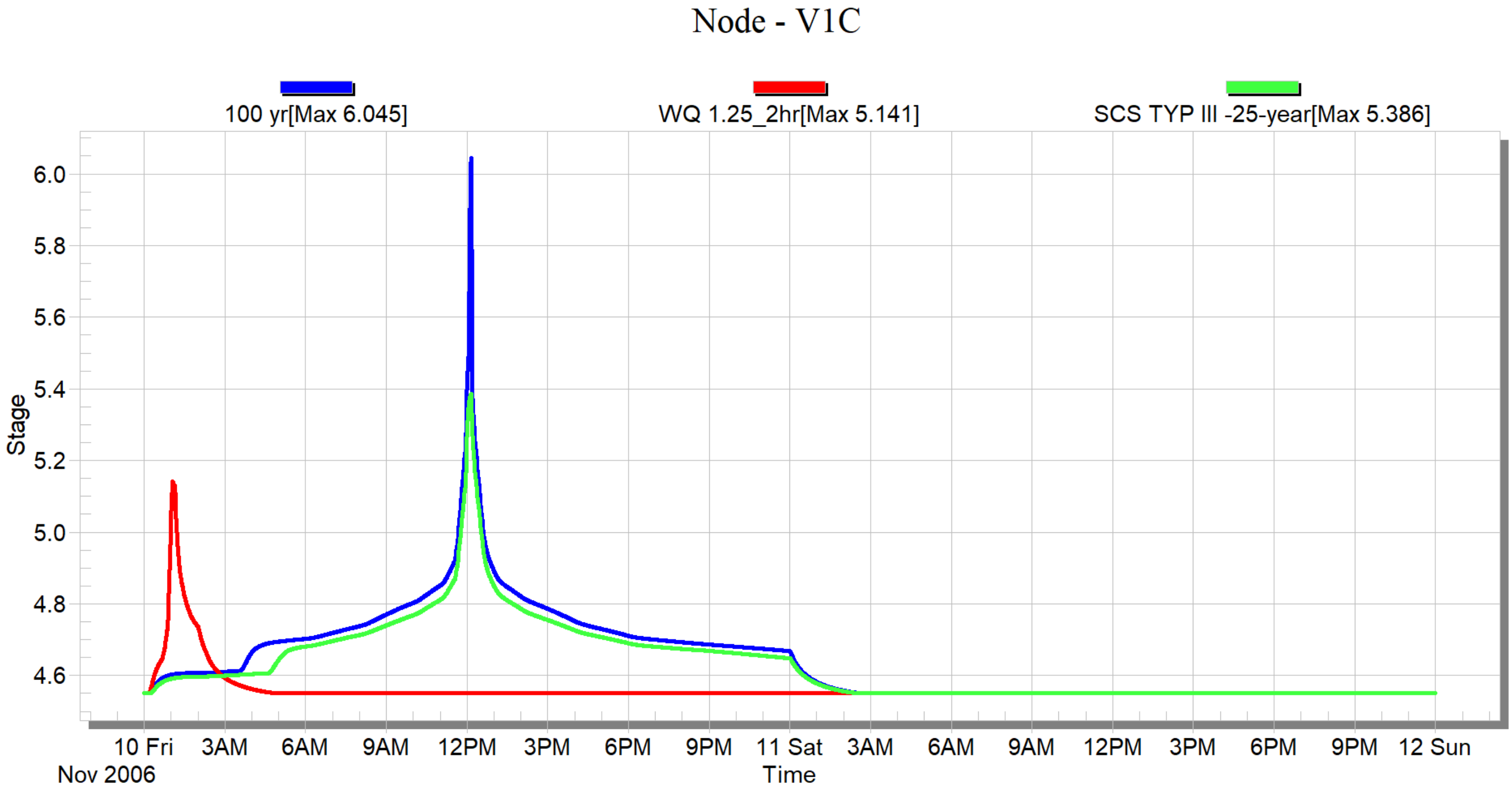

System 2 - NOAA Atlas 14 Events
Water Elevation (ft)
Time (hours)
2-year
10-year
25-year
100-year
11.5
11
10.5
10
9.5
9
8.5
8
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96

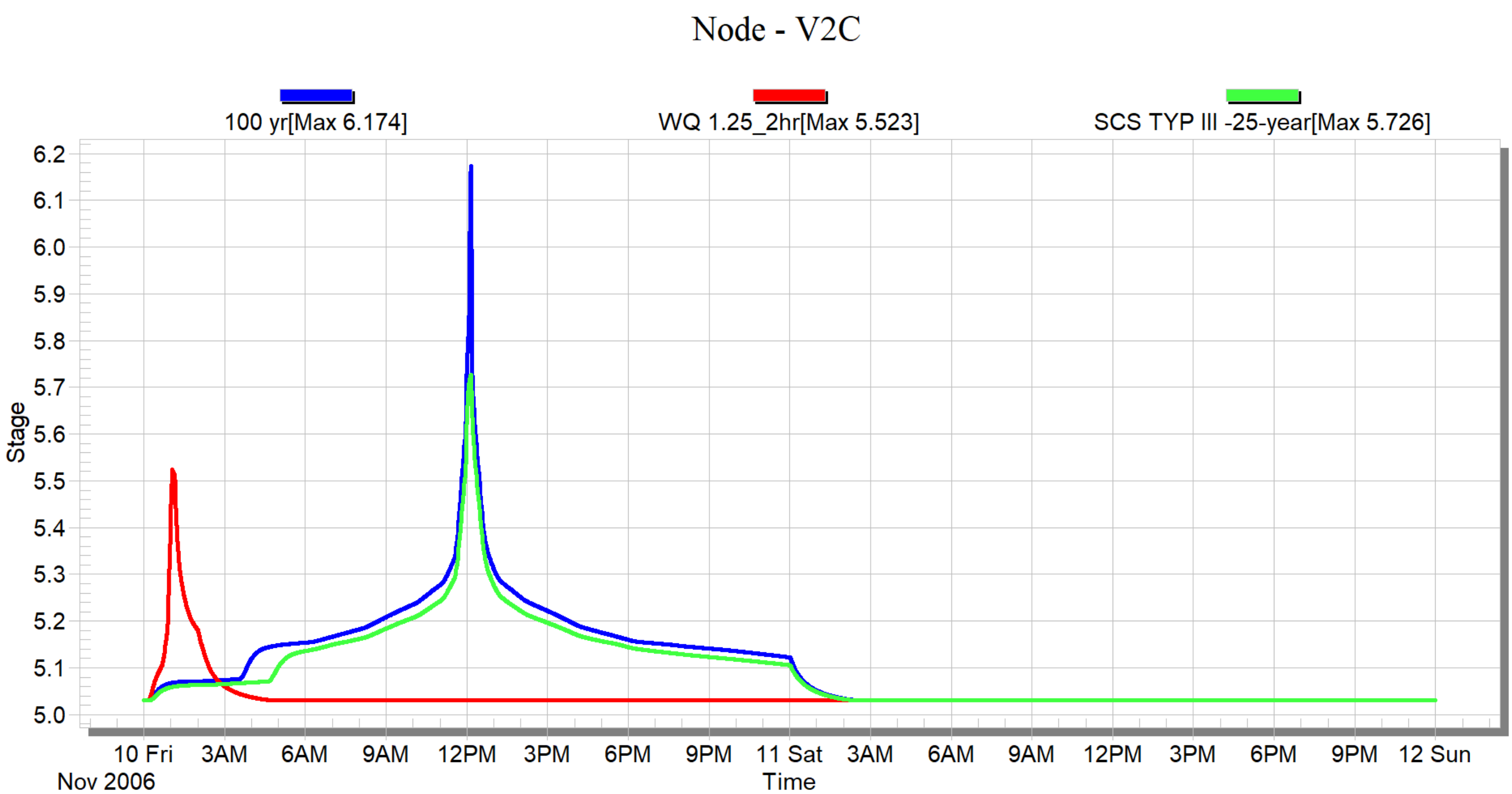

System 2 - NJ Extreme Precipitation Events
Water Elevation (ft)
Time (hours)
2-year
10-year
25-year
100-year
11.5
11
10.5
10
9.5
9
8.5
8
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96

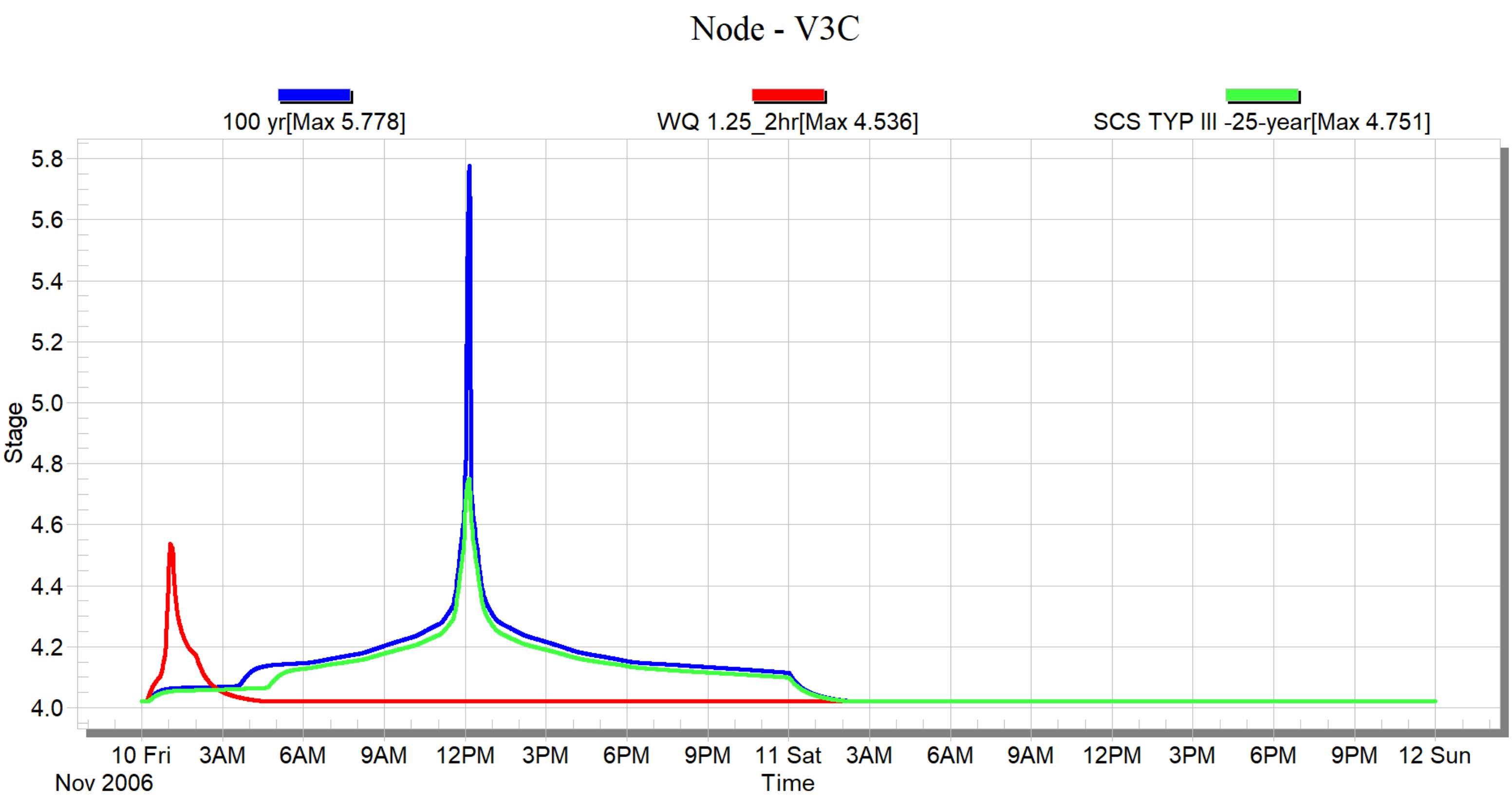

System 3 - NOAA Atlas 14 Events
11.5
11
10.5
10
9.5
9
8.5
8
Water Elevation (ft)
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96
Time (hours)
2-year
10-year
25-year
100-year


System 3 - NJ Extreme Precipitation Events
11.5
11
10.5
10
9.5
9
8.5
8
Water Elevation (ft)
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96
Time (hours)
2-year
10-year
25-year
100-year

XPSWMM WATER SURFACE ELEVATION RESULTS FOR UNDERGROUND STORAGE SYSTEMS- PARCEL C







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WQ 1.25_2hr[Max 4.536]
SCS TYP III -25-year[Max 4.751]
Stage
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5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
10 Fri
3AM
6AM
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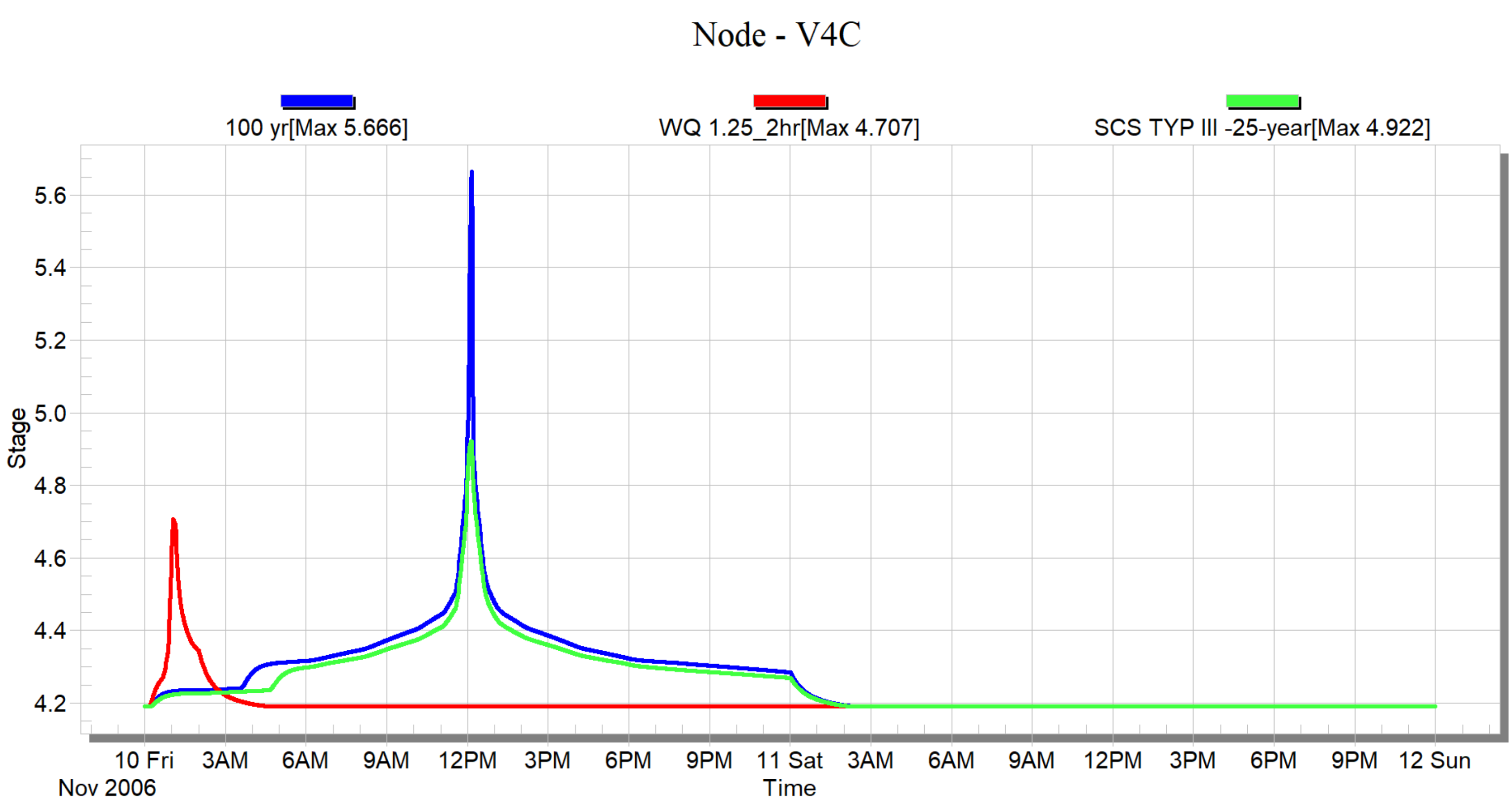
12 Sun
Nov 2006
Time



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WQ 1.25_2hr[Max 4.707]
SCS TYP III -25-year[Max 4.922]
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5.4
5.2
5.0
4.8
4.6
4.4
4.2
10 Fri
3AM
6AM
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11 Sat
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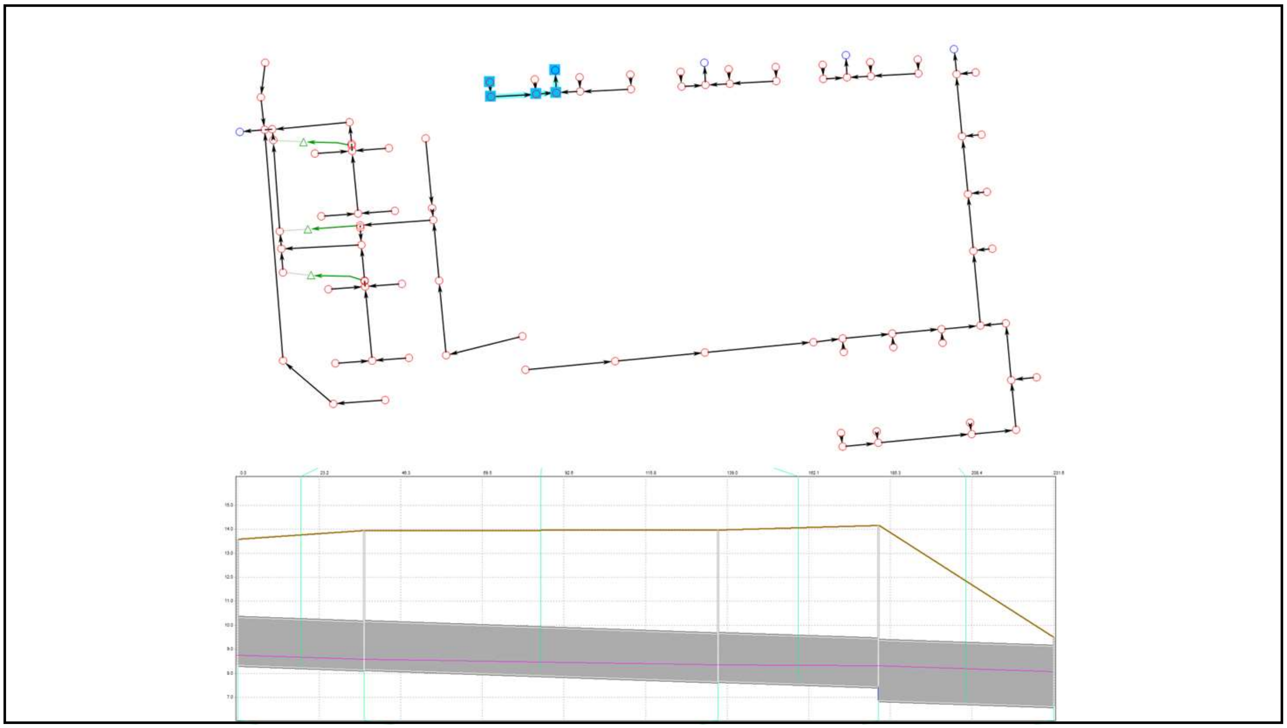
Time

XPSWMM STORM DRAIN PROFILES FOR 25-YEAR STORM FOR PARCEL G



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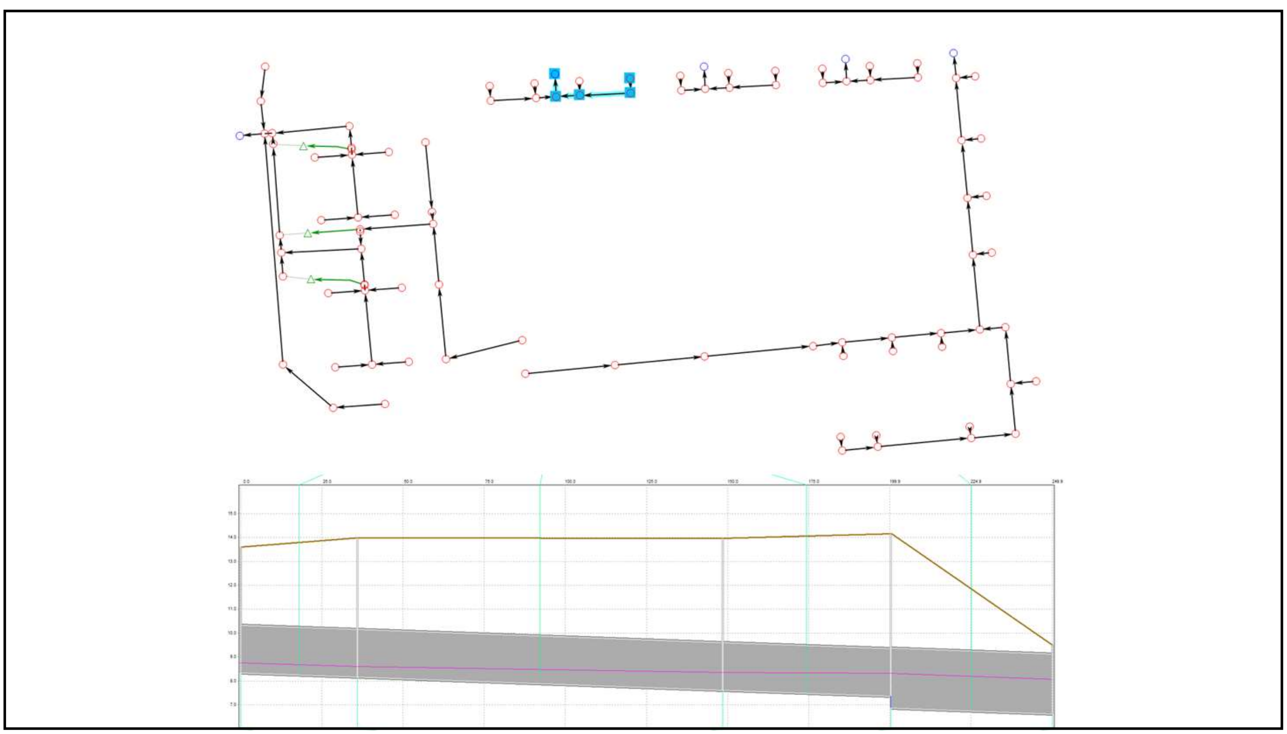

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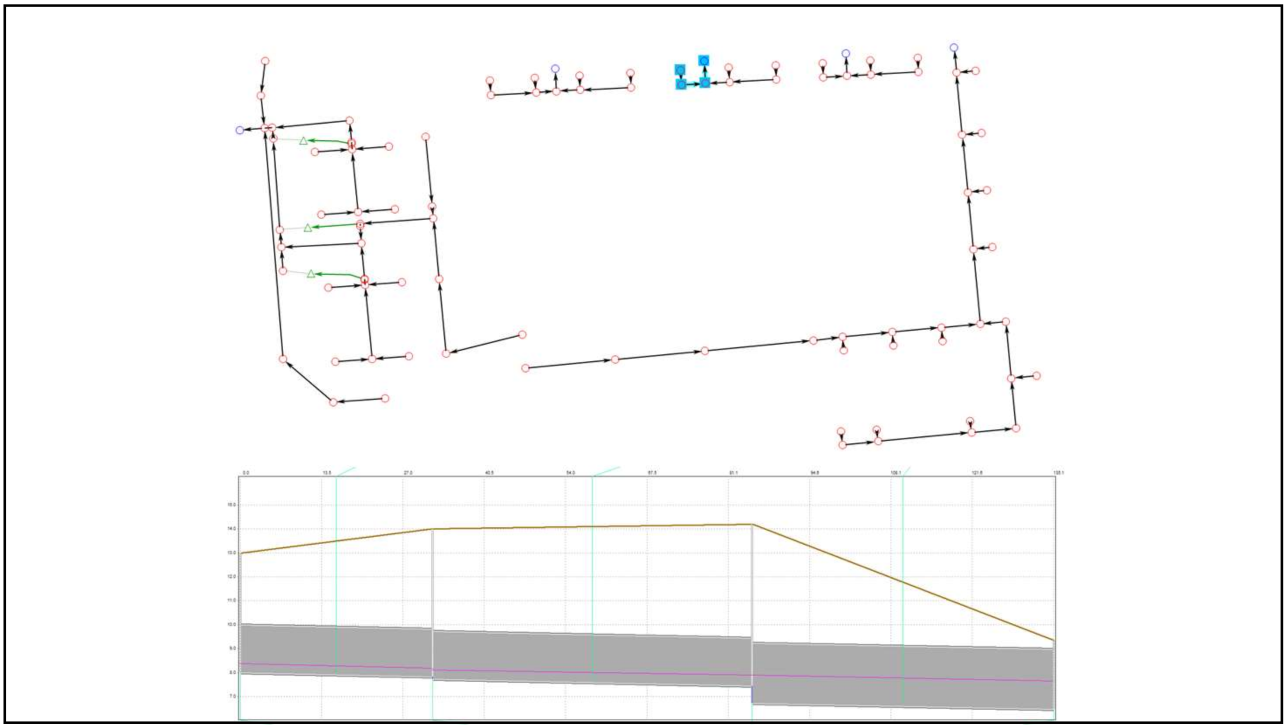

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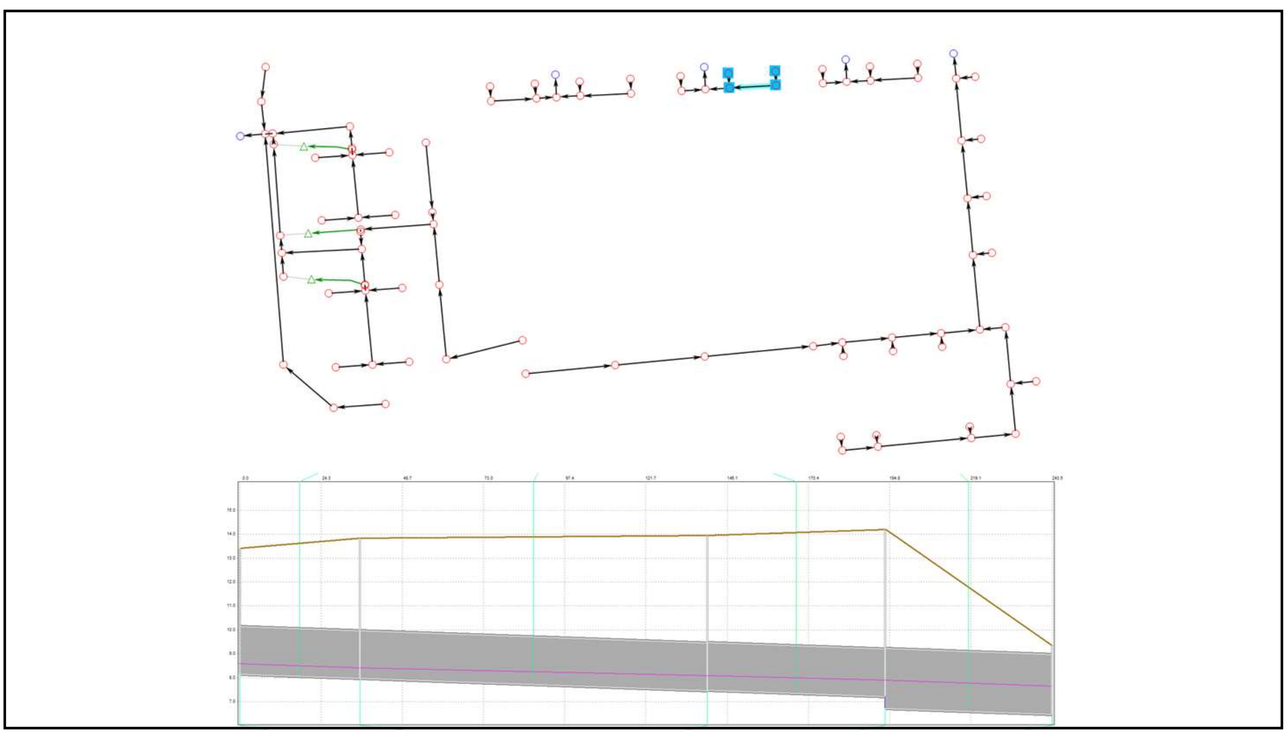

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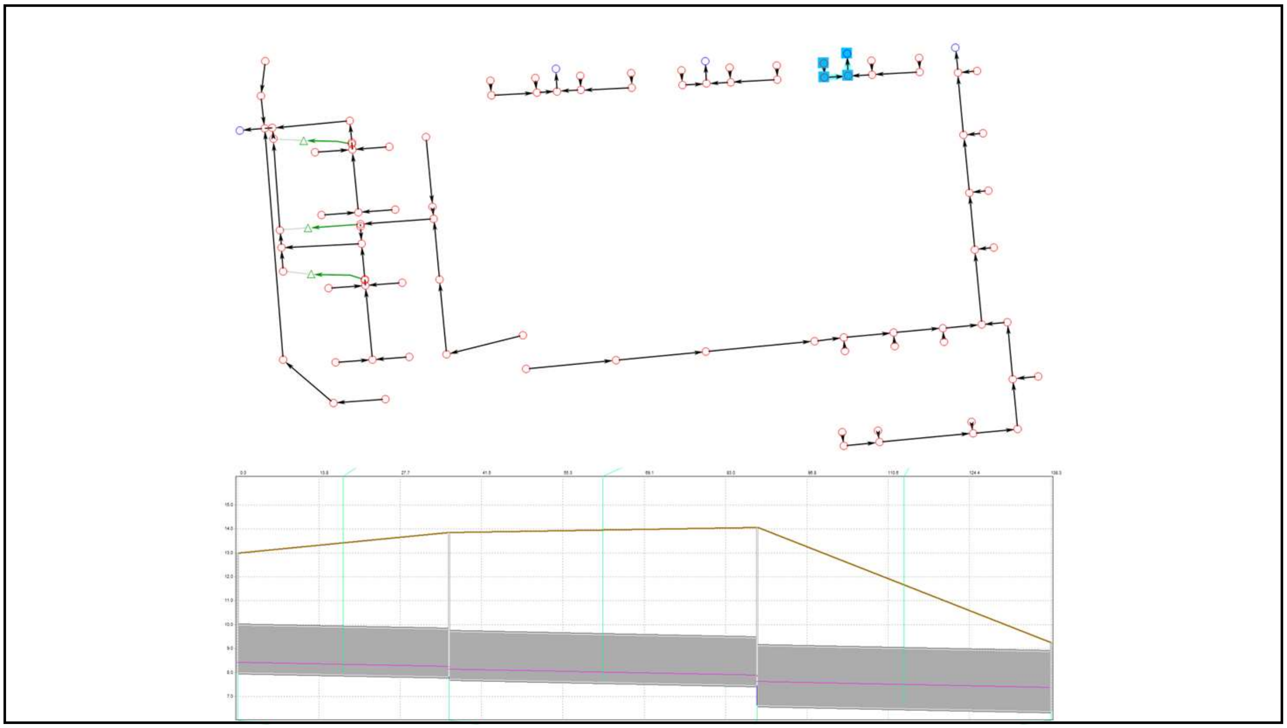

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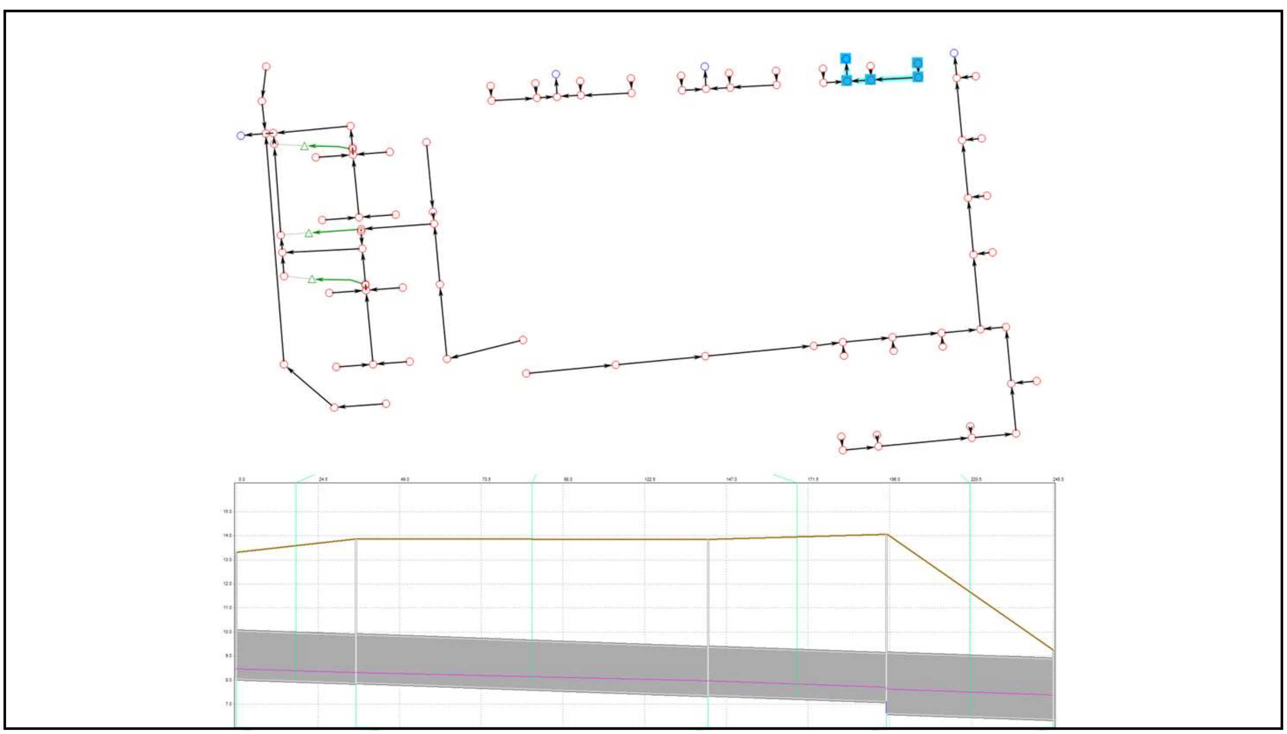

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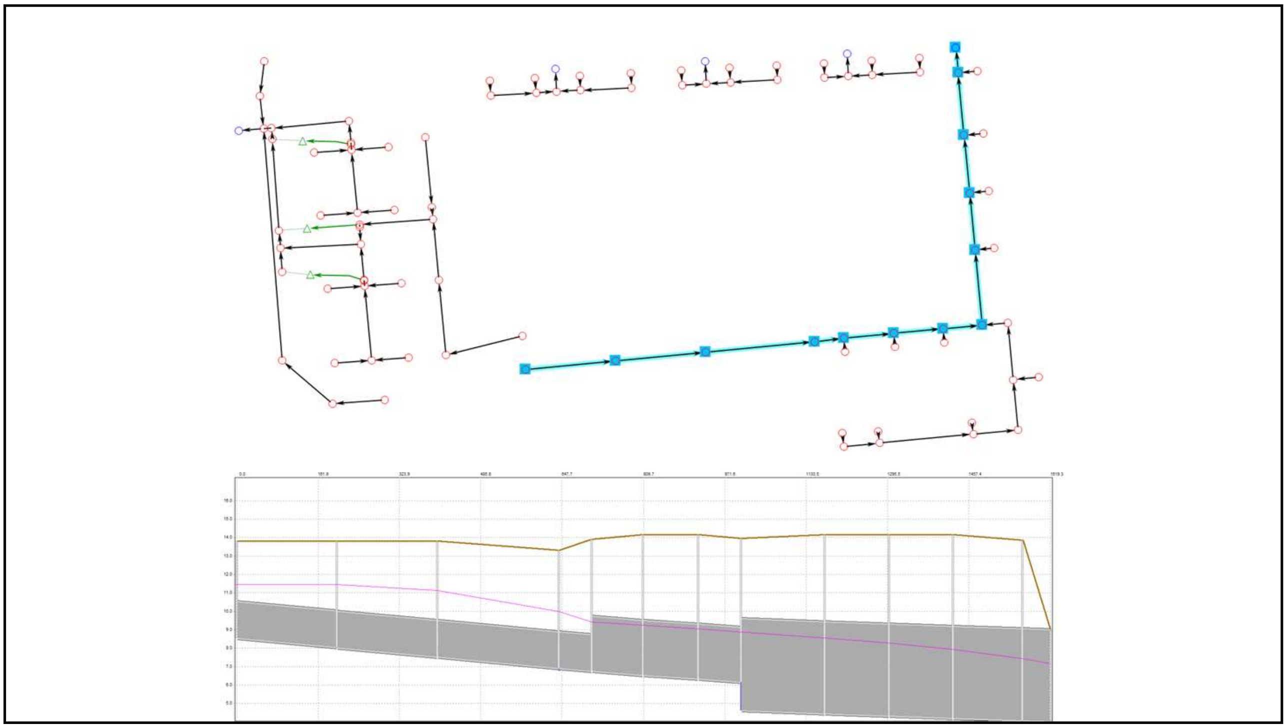

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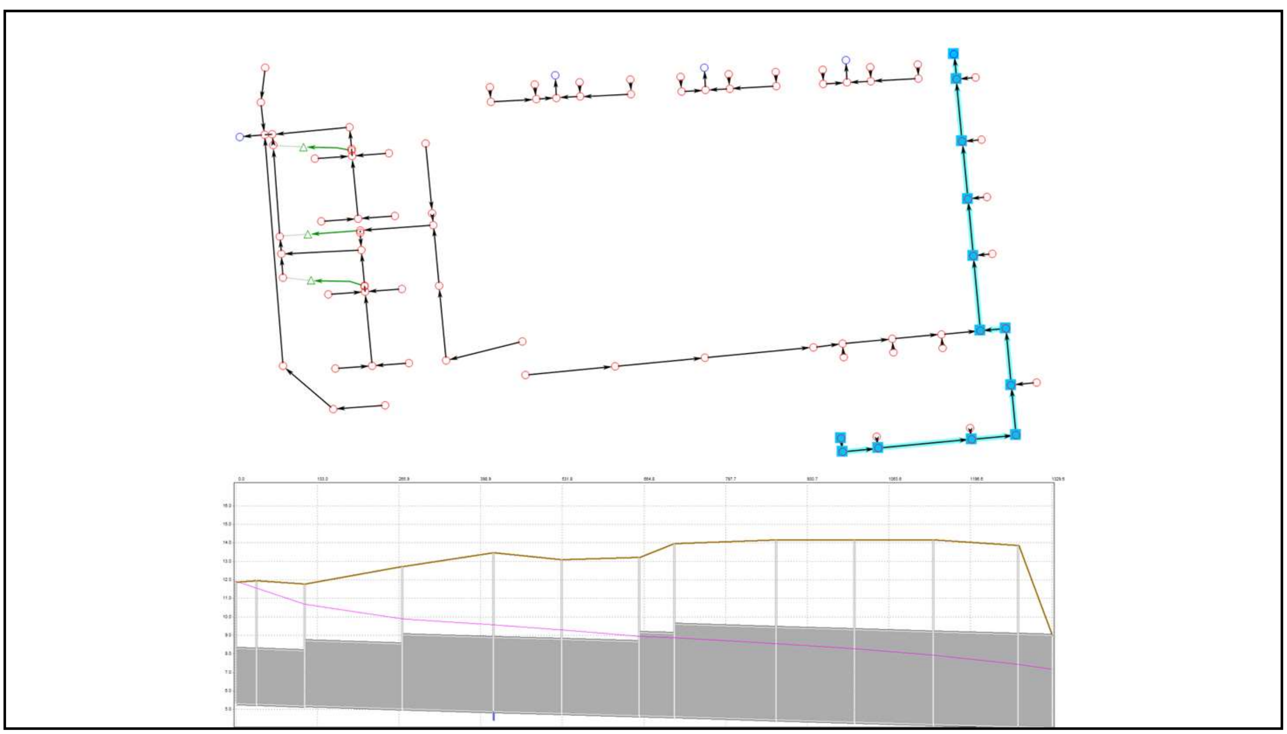

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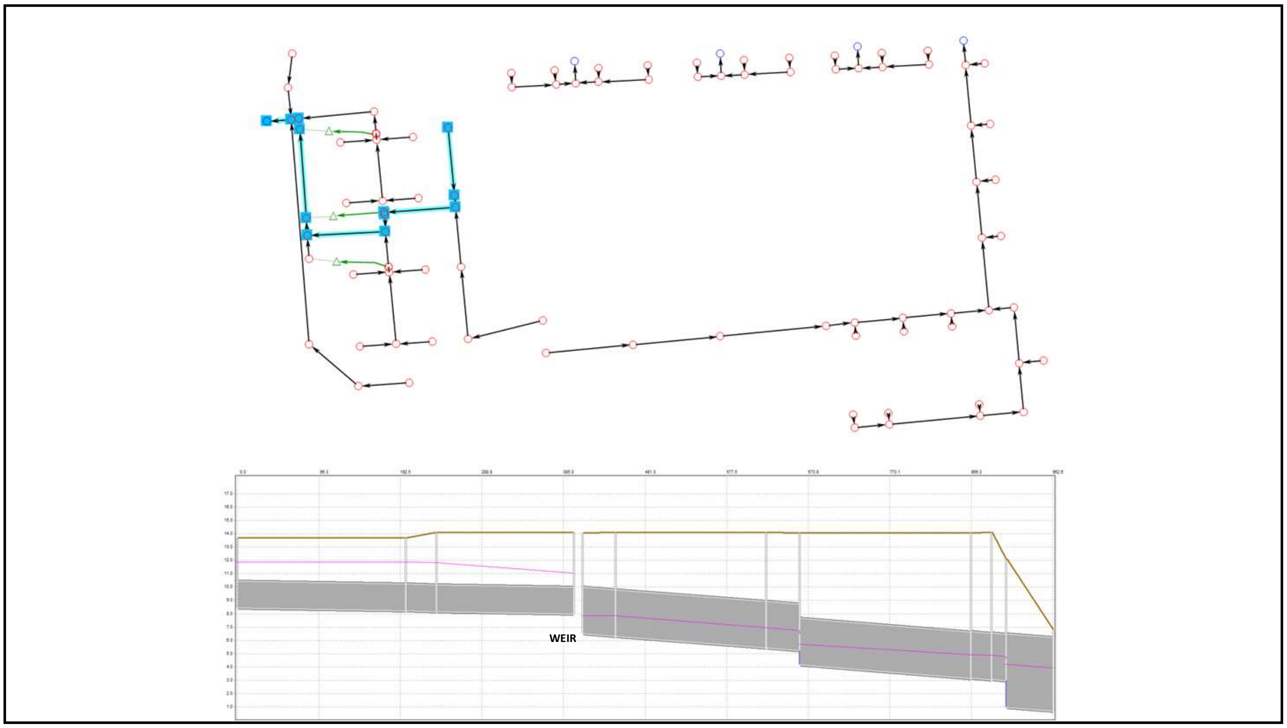

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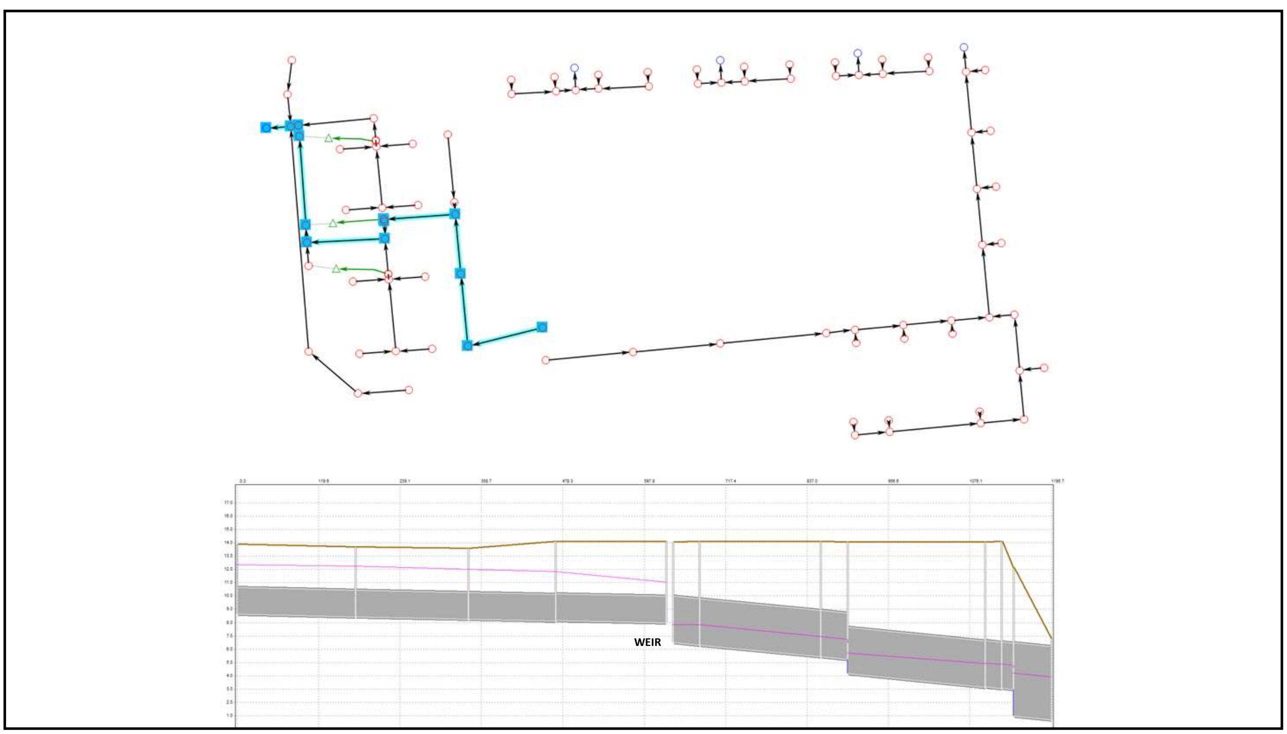

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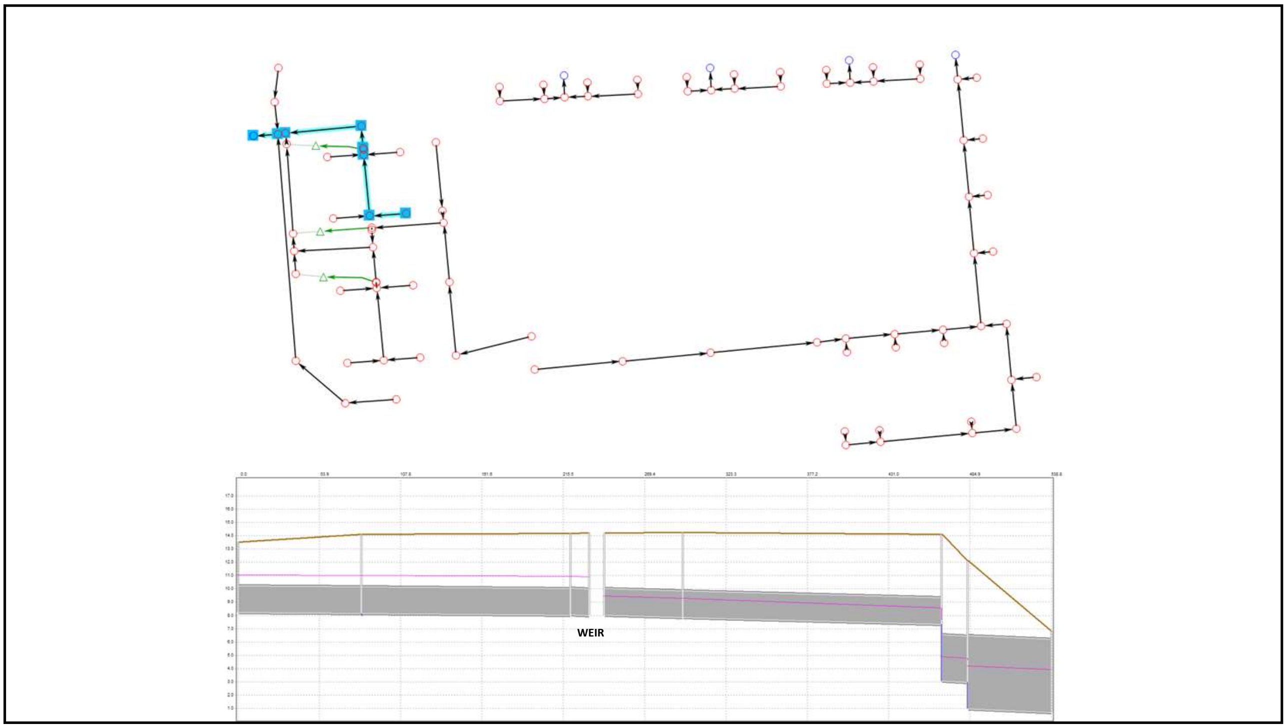

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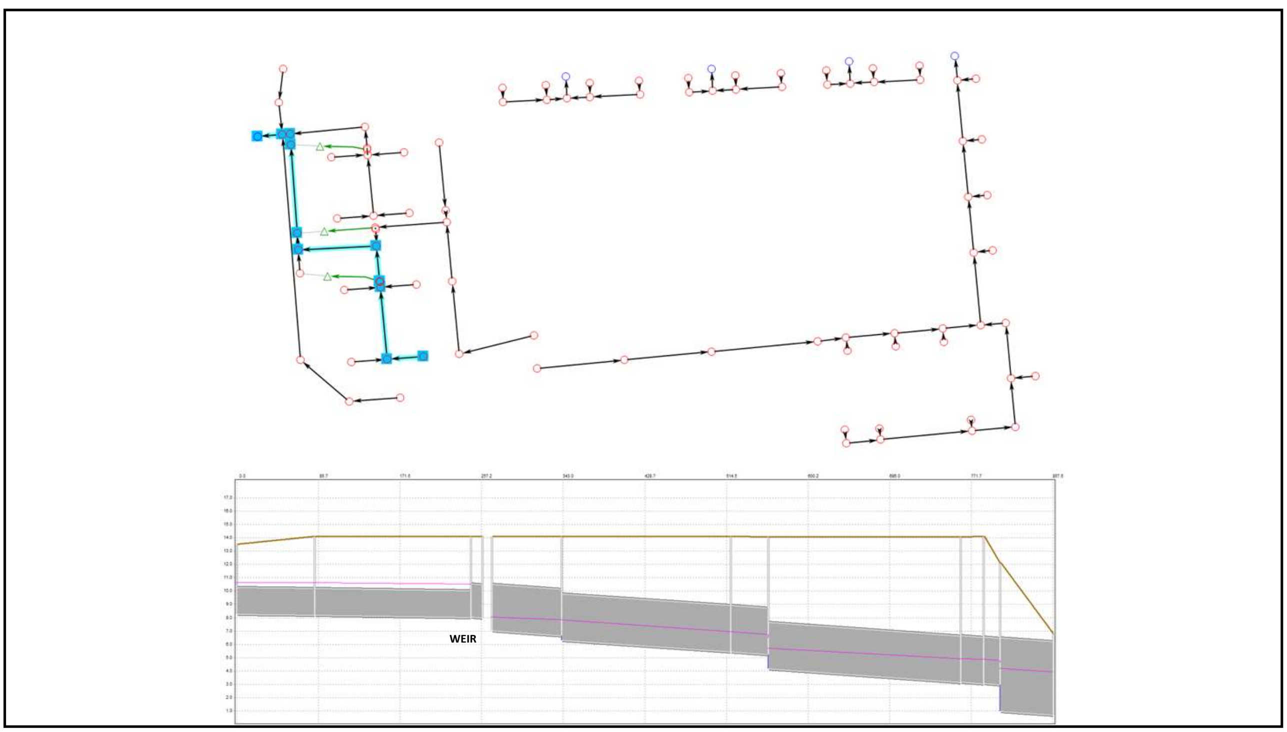

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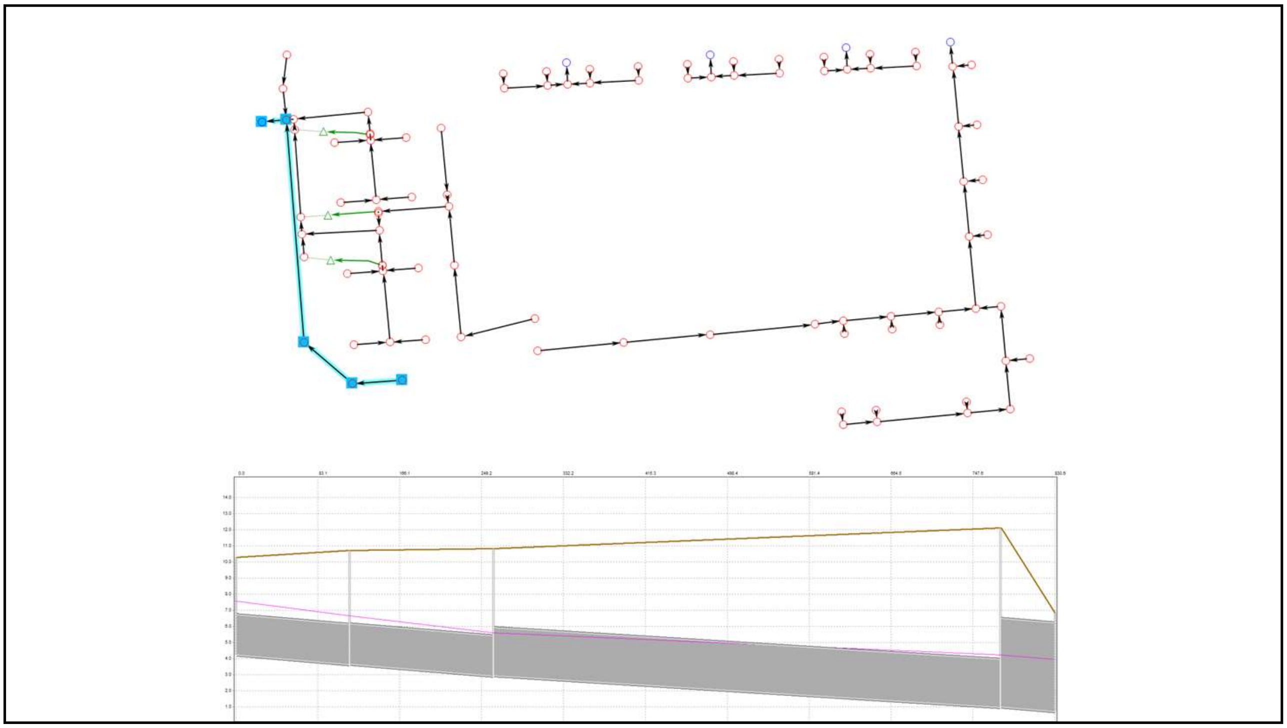

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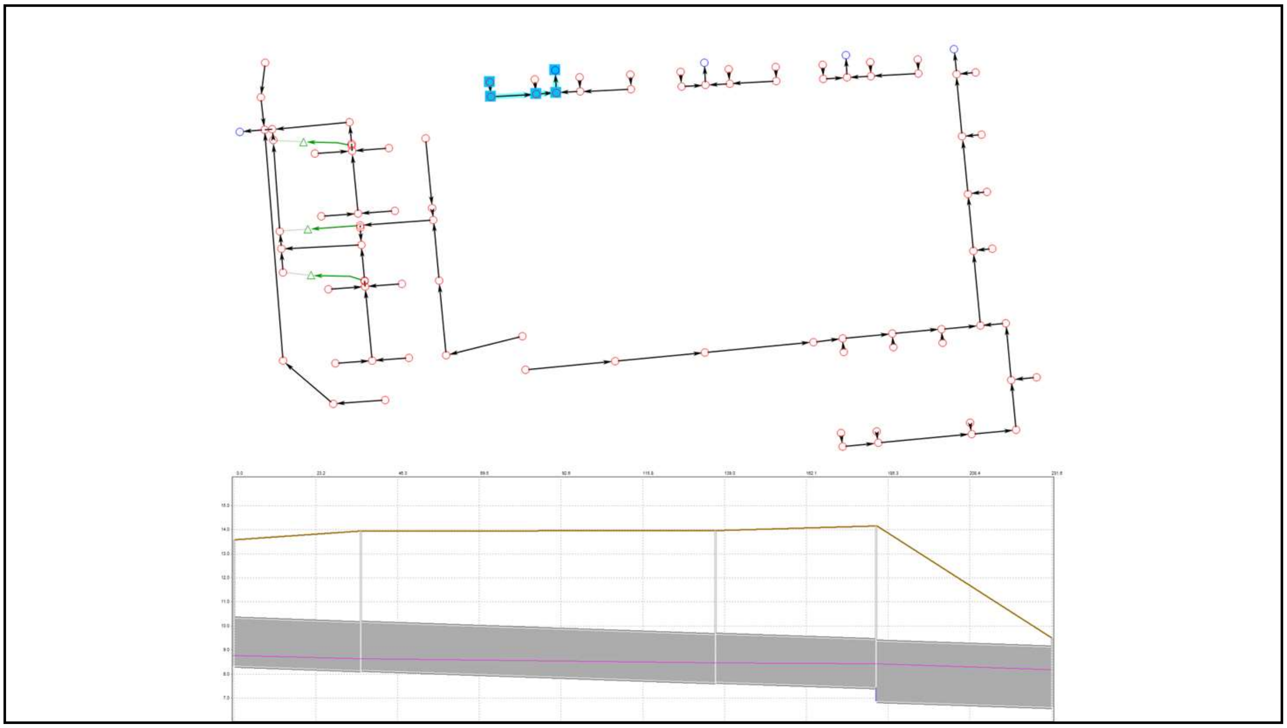
XPSWMM STORM DRAIN PROFILES FOR EXTREME 25-YEAR STORM PROJECTION FOR PARCEL G



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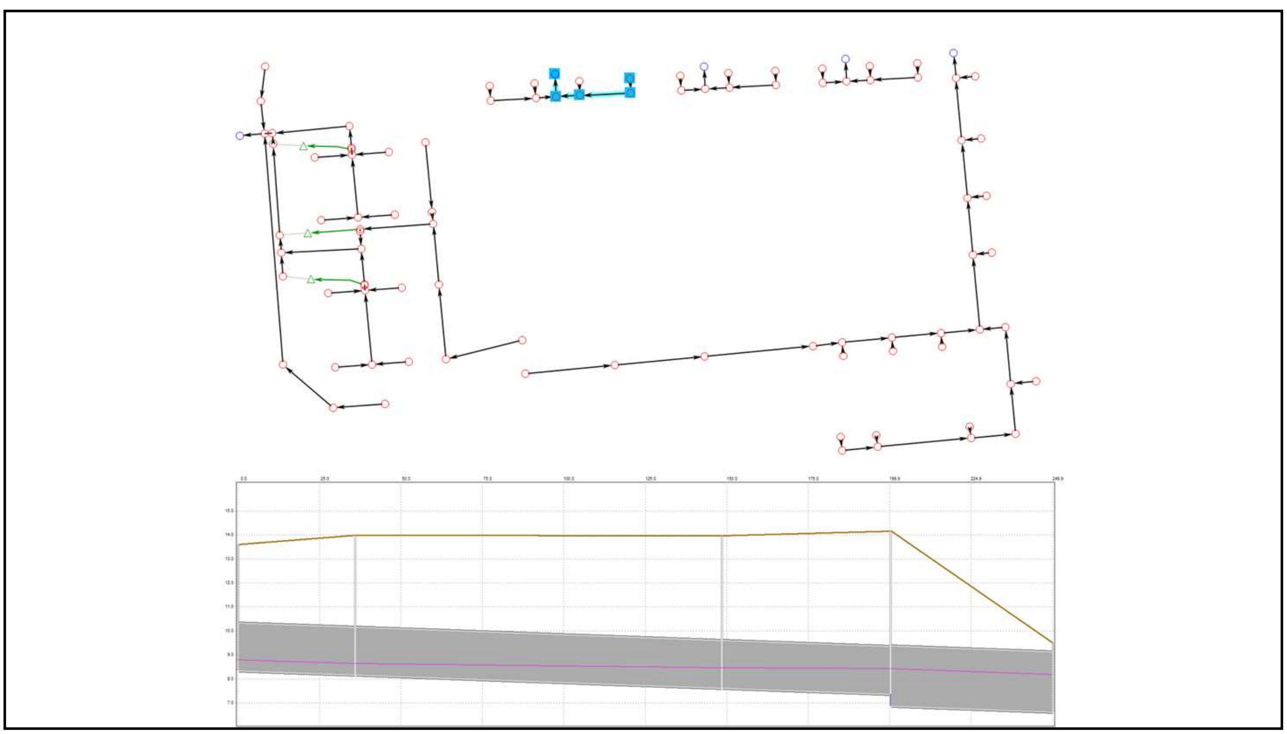

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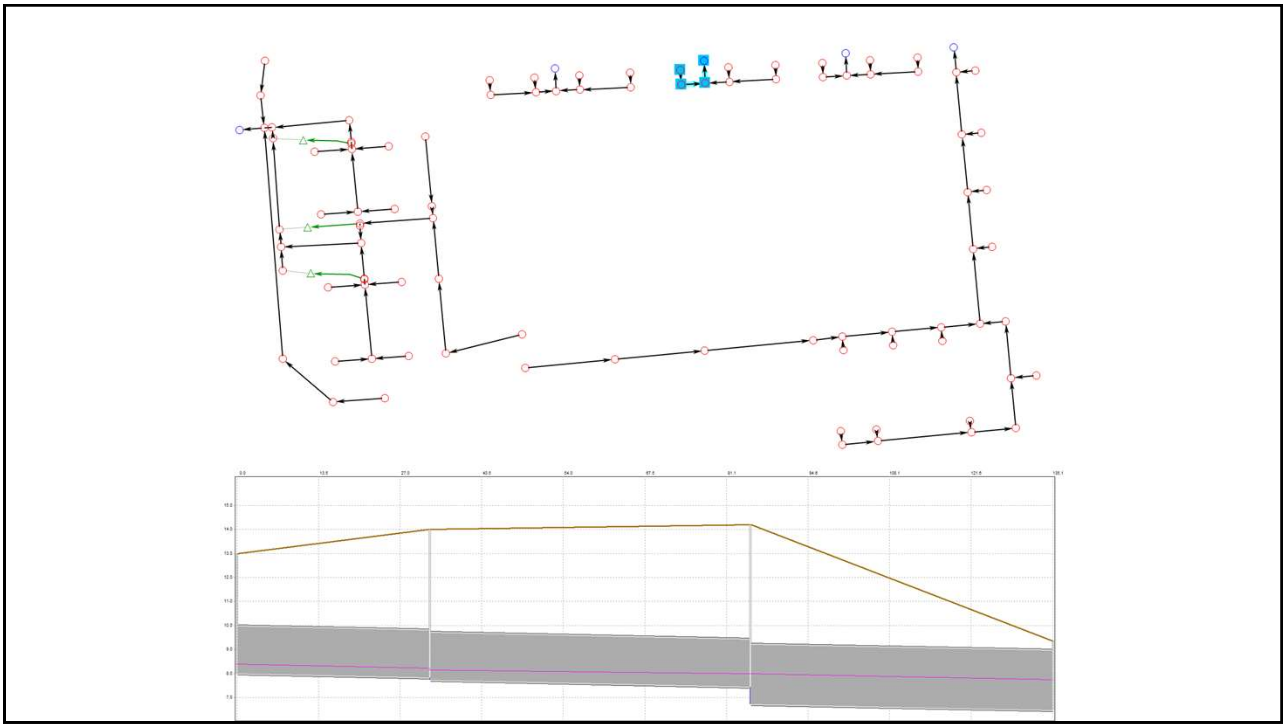

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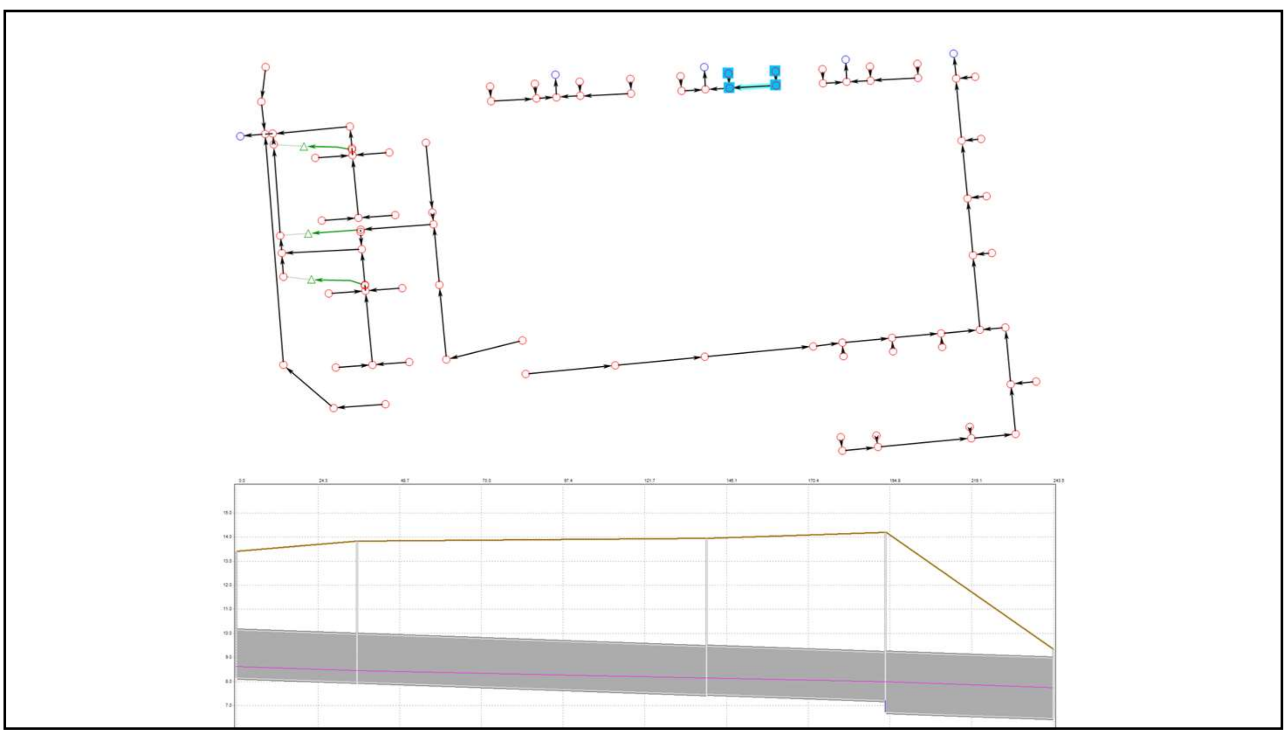

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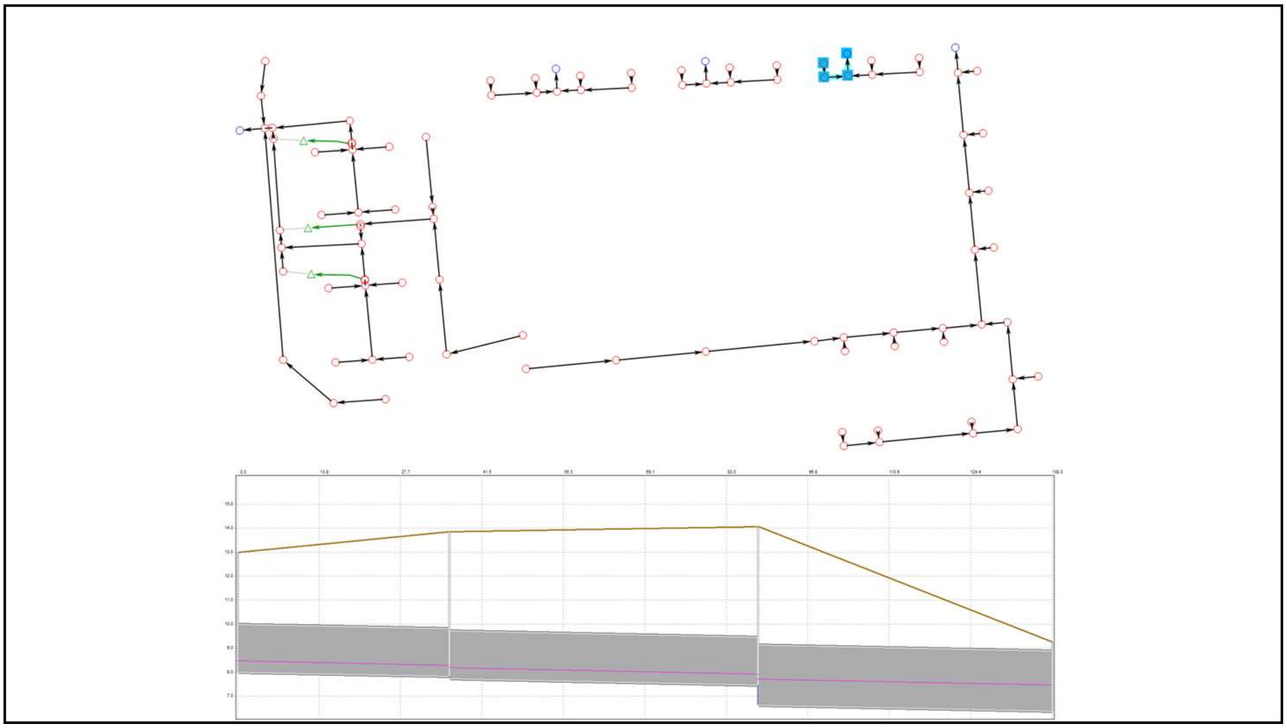

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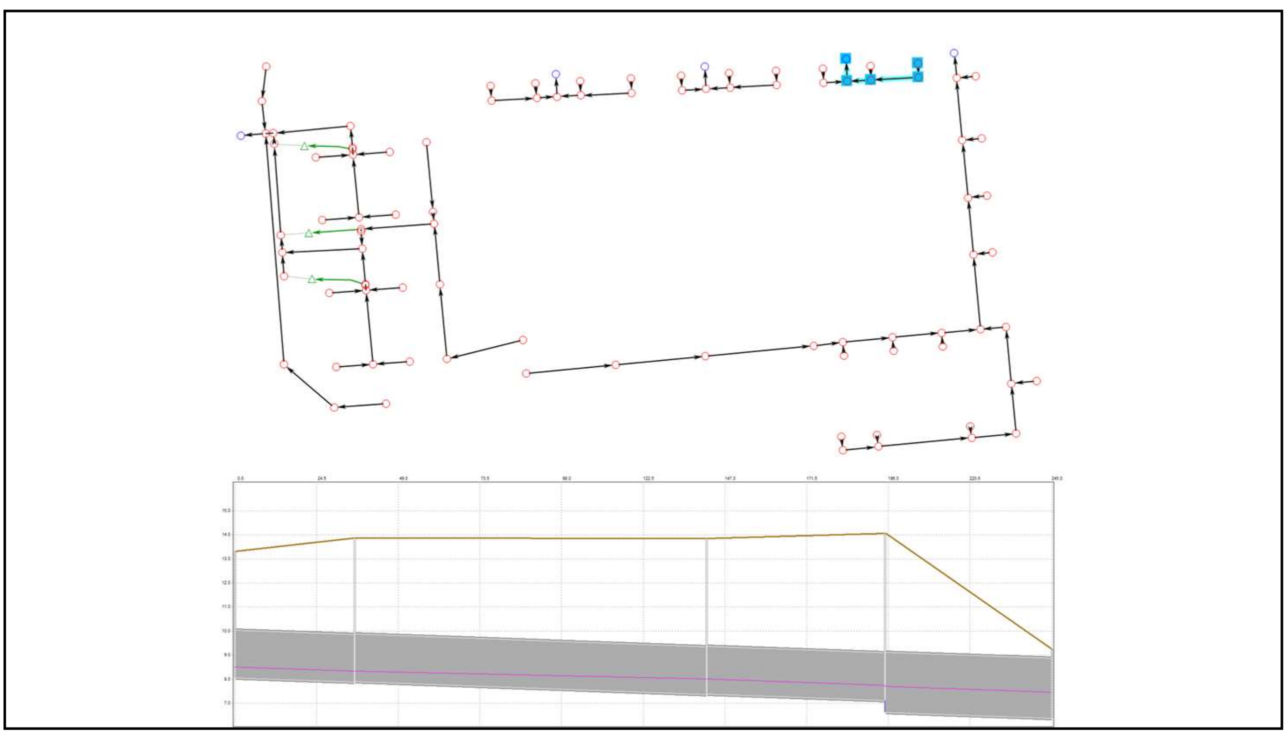

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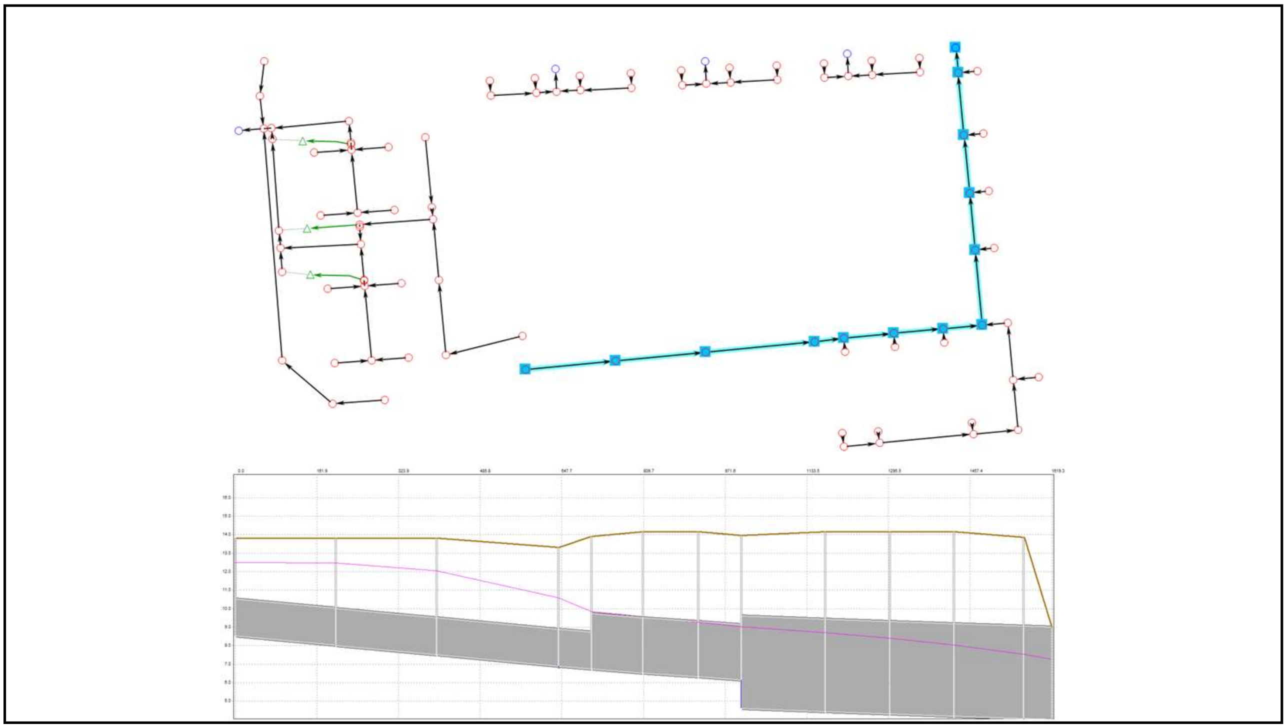

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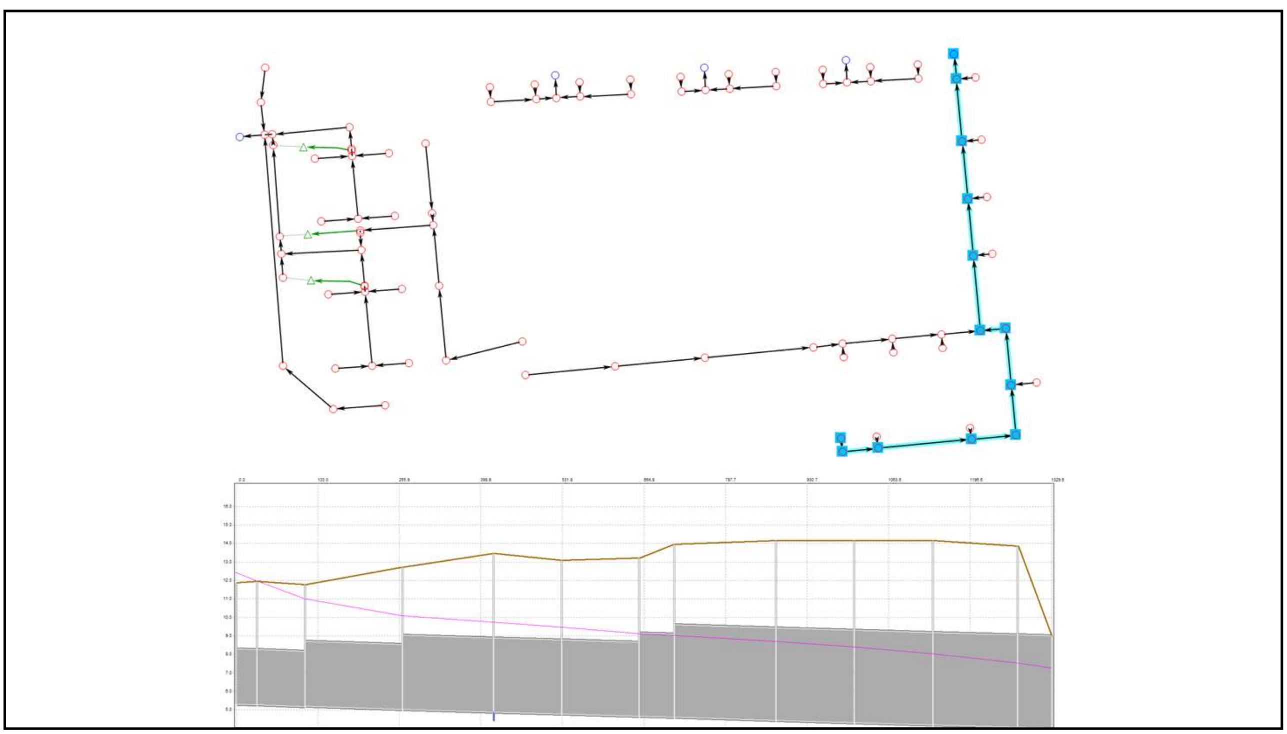

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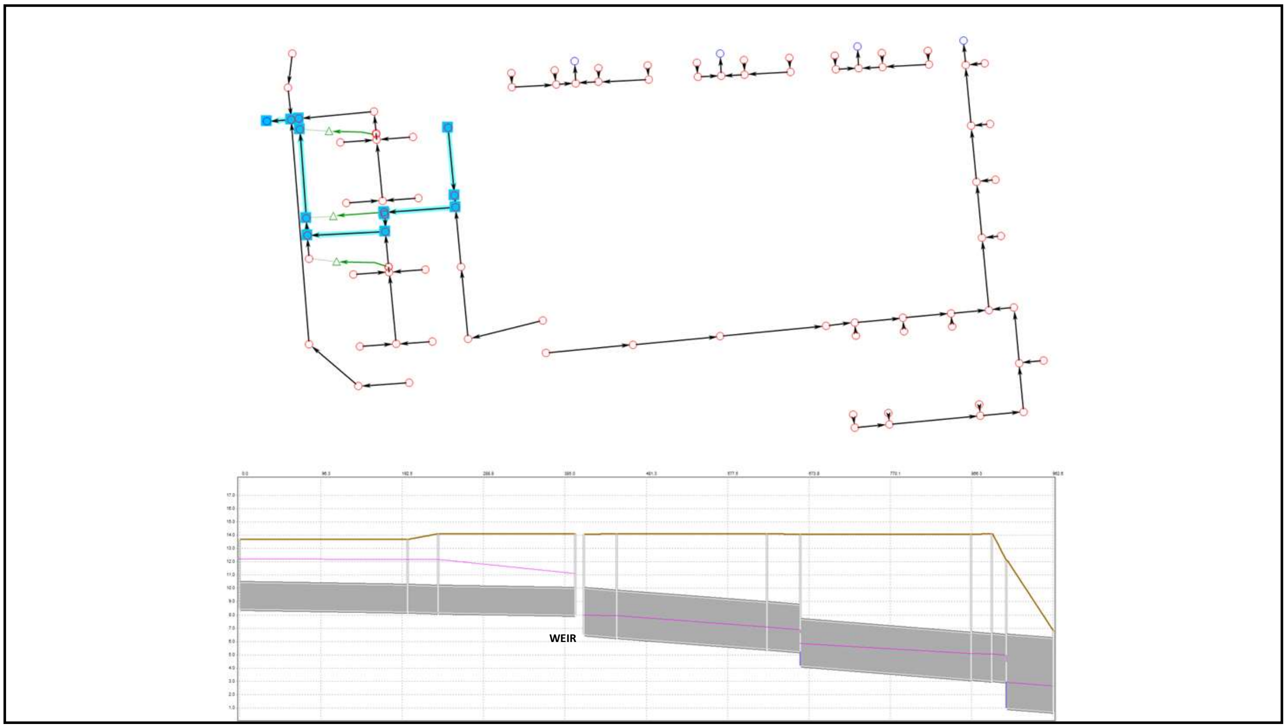

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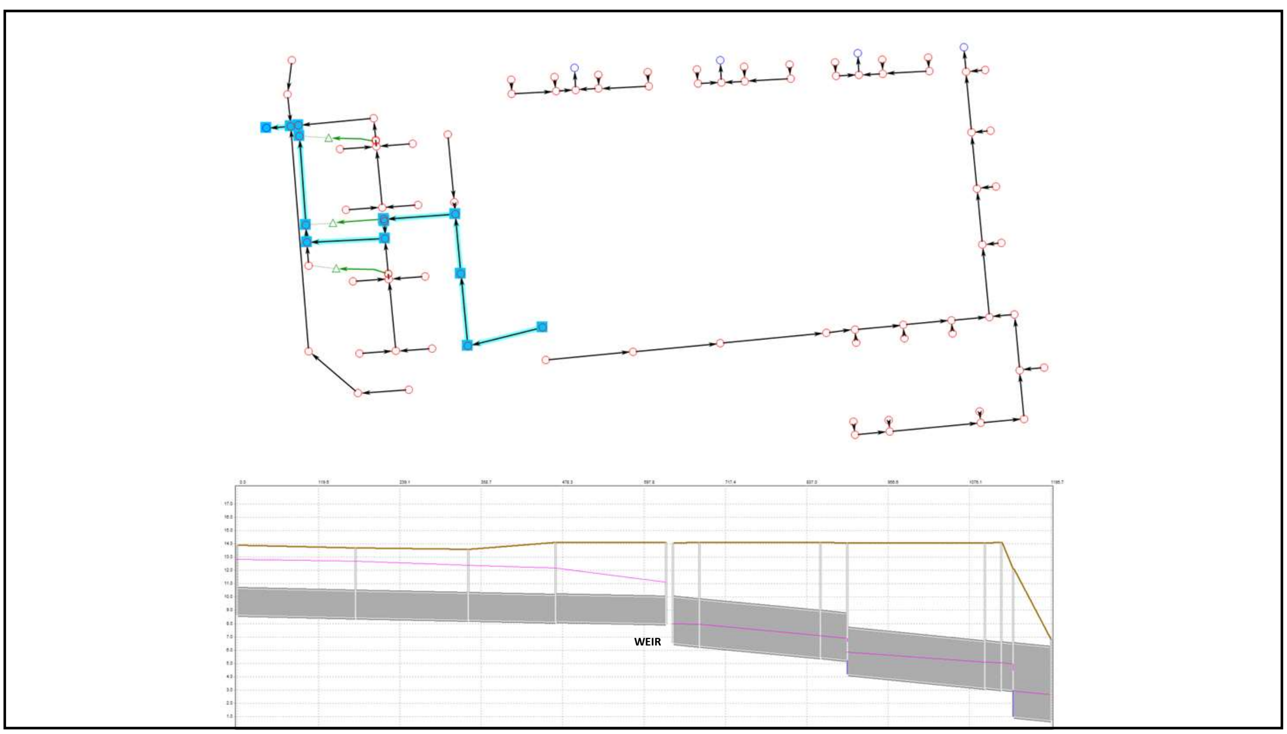

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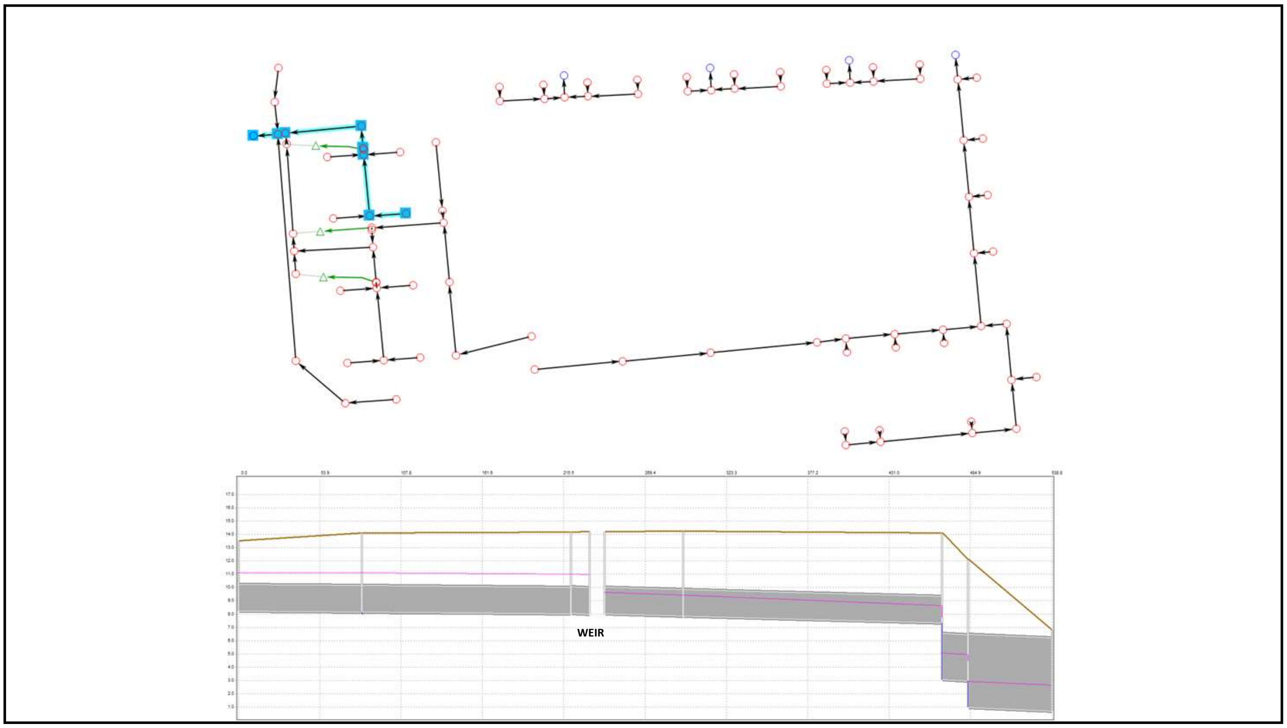

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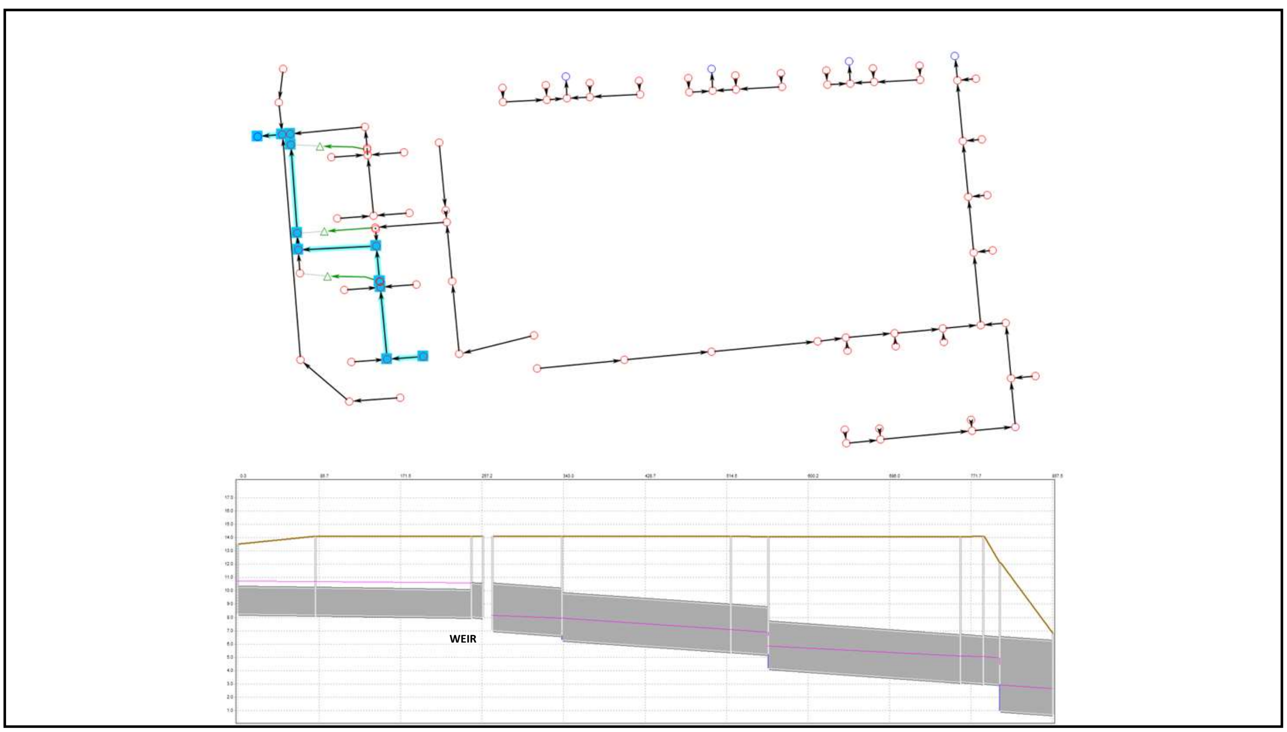

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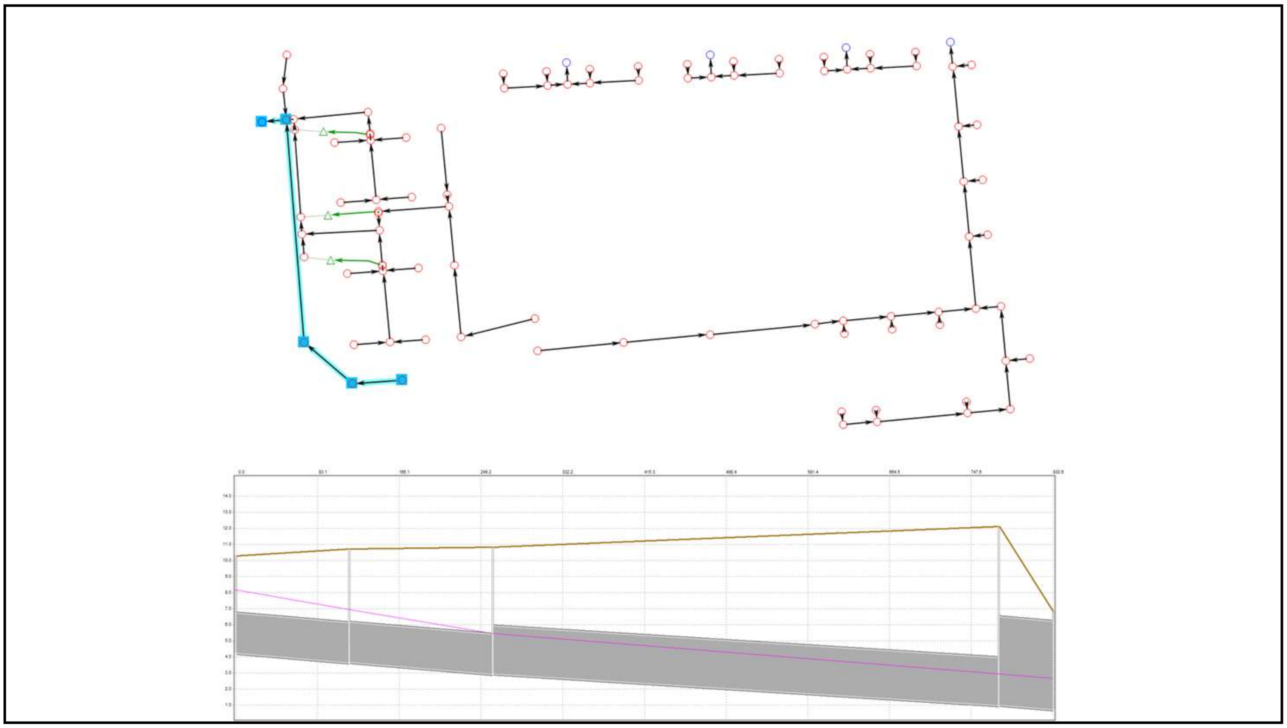

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Appendix B – NJDEP/NJCAT MTD Certification Letters

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER QUALITY
Bureau of Stormwater Permitting
401 East State Street
P.O. Box 420 Mail Code 401-02B
Trenton, NJ 08625-0420
Tel. (609) 633-7021 • Fax (609) 777-0432
www.nj.gov/dep/dwq/bnpc_home.htm

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

SHAWN M. LATOURETTE
Acting Commissioner

February 12, 2021

Derek M. Berg
Director – Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Lab Certification
Filterra® HC Bioretention System
Off-line Installation Approved

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the Filterra® HC Bioretention System (Filterra® HC.)

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated January 2021) for this device is published online at http://www.njcat.org/uploads/newDocs/NJCATFilterraTechnologyVerificationReportFinal._.pdf.

The NJDEP certifies the use of the Filterra® HC stormwater treatment unit by Contech Engineered Solutions LLC at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 3.12 gpm/ft^2 of effective filtration treatment area.

2. The Filterra® HC stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Filterra® HC. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://www.conteches.com/Portals/0/Documents/Maintenance%20Guides/Filterra%20HC%20OM%20Packet.pdf for any changes to the maintenance requirements.

6. For an MTD to be considered "green infrastructure" (GI) in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) treat stormwater runoff through infiltration into subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil; or (3) store stormwater runoff for reuse.

   The Filterra® HC filters stormwater runoff through an engineered biofiltration soil media and, thus, meets the definition of GI. Filterra® HC can be configured with or without a precast vault. Installations that will not include a precast vault will additionally need to comply the NJDEP Stormwater BMP Manual conditions regarding separation from the seasonal high water table and, if infiltration is proposed as an outlet, minimum vertical saturated hydraulic conductivity of the subsoil. Installations without a precast vault that do not rely on infiltration are required to maintain at least a one-foot separation from the seasonal high water table measured from the lowest point of the system. Installations without a precast vault that utilize infiltration are required to have the most hydraulically restrictive soil layer below the MTD meet the minimum tested vertical saturated hydraulic conductivity of one inch per hour and have at least two feet of separation from the seasonal high water table measured from the lowest point of the system.

7. Sizing Requirement:

The example below demonstrates the sizing procedure for the Filterra® HC:

Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using the Filterra® HC. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

The selection of the appropriate model of Filterra® HC is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

<u>Inflow Drainage Area Evaluation:</u>

The drainage area to the Filterra® HC in this example is 0.25 acres. Included in Table 1 below, all of the Filterra® HC models are designed with a maximum allowable drainage area greater than 0.25 acres. Specifically, the Filterra® HC with a 4'x4' media bay and a maximum allowable drainage area of 0.40 acres would be the smallest model able to treat runoff without exceeding the maximum allowable drainage area.

<u>Maximum Treatment Flow Rate (MTFR) Evaluation:</u>

The site runoff (Q) was based on the following:

time of concentration = 10 minutes
i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c = 0.99 (runoff coefficient for impervious)
Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

Given the site runoff is 0.79 cfs and based on the MTFR's listed in Table 1 below, the Filterra® HC with a 16'x8' media bay and an MTFR of 0.889 cfs would be the smallest model that could be used to treat the impervious area without exceeding the MTFR. If using more than one unit for treating runoff, the units should be configured such that the flowrate to each unit does not exceed the design MTFR for each unit and ensuring the entire 0.25 acre area is treated.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below:

Table 1. Filterra® HC MTFRs and Maximum Allowable Drainage Areas

	Available Filterra® Media Bay Sizes (feet)	Effective Filtration Treatment Area (ft^2)	Treatment Flow Rate (cfs)	Maximum Allowable Drainage Area (ac)
Standard Configuration Filterra and Filterra Biosape Vaults	4x4	16	0.111	0.40
	4x6 or 6x4	24	0.167	0.60
	4.5x7.83 or 7.83x4.5 (Nominal 4x8/8x4)	35.24	0.245	0.89
	6x6	36	0.250	0.91
	6x8 or 8x6	48	0.333	1.21
	6x10 or 10x6	60	0.417	1.51
	6x12 or 12x6	72	0.500	1.81
	7x13 or 13x7	91	0.632	2.29
	14x8	112	0.778	2.82
	16x8	128	0.889	3.22
	18x8	144	1.000	3.62
	20x8	160	1.111	4.03
	22x8	176	1.222	4.43
Peak Diversion Filterra Vaults	4x4	16	0.111	0.40
	4.5x5.83 (Nominal 4x6)	26.24	0.182	0.66
	6x4	24	0.167	0.60
	6x6	36	0.250	0.91
	6x8	48	0.333	1.21
	6x10 or 10x6	60	0.417	1.51
	7x10	70	0.486	1.76
	8x10.5	84	0.583	2.11
	8x12.5	100	0.694	2.52
	Custom and/or Filterra Bioscape	Media Area in ft^2	0.00694 * (Media Area in ft^2)	0.0252 * (Media Area in ft^2)

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact me at (609) 633-7021.

Sincerely,

Gabriel Mahon

Gabriel Mahon, Chief
Bureau of Stormwater Permitting

Attachment: Maintenance Plan
cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP – Water & Land Management
Nancy Kempel, NJDEP– BSTP
Keith Stampfel, NJDEP – DLRP
Dennis Contois, NJDEP – DLRP

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.

2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a StormFilter System.

   Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12” cartridges,
2. Three (3) 18” cartridges, or
3. Two (2) 27” cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:
time of concentration = 10 minutes
i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c=0.99 (runoff coefficient for impervious)
Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12” cartridges,
2. Twenty-four (24) 18” cartridges, or
3. Sixteen (16) 27” cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	**Filtration Surface Area (sq.ft)**	**MTFR[1] (GPM)**	**Mass Capture Capacity (lbs)**	**Maximum Allowable Inflow Area[2] (acres)**
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:
1. *MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.*
2. *Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.*

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

DIVISION OF WATERSHED PROTECTION AND RESTORATION
BUREAU OF NJPDES STORMWATER PERMITTING & WATER QUALITY MANAGEMENT
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
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www.njstormwater.org

SHAWN M. LATOURETTE
Commissioner

June 23, 2021

Walter Stein, P.E.
Jensen Water Resources
521 Dunn Circle
Sparks, NV 89431

Re: MTD Lab Certification
StormVault BioFiltration with Sierra Blend
Online Installation

TSS Removal Rate 80%

Dear Mr. Stein:

This revised certification letter supersedes the Department's prior certification dated May 5, 2020. This revision was completed as a result of a change to the company name (formerly Jensen Stormwater Systems), and the development of an updated maintenance manual. No other modifications were made to this certification.

The Stormwater Management rules under N.J.A.C. 7:8-5.2(f) and 5.2(j) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Jensen Water Resources (Jensen) has requested a Laboratory Certification for the StormVault Biofiltration with Sierra Blend ("SVBF") system.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated April 2020) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormVault Biofiltration with Sierra Blend stormwater treatment unit by Jensen at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2 gpm/ft^2 of effective filtration treatment area.

2. The SVBF stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 11.3 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the SVBF. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://www.jensenprecast.com/water-resources/product/biofiltration-systems/ for any changes to the maintenance requirements.

6. For an MTD to be considered "green infrastructure" in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) infiltrate into the subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil. The SVBF can be configured in two different manners, either as an open top planter box for shrubs, other smaller plants, or as a grated tree box; or it can be configured as an underground treatment vault fed by a subsurface inlet pipe. Any configuration that uses a bio-filtration media and can be configured "above ground" and incorporate a tree box, planter box, or shrubs, etc., would meet the GI definition. Any MTD with bio-filtration media that would be placed "below ground" as a vault without any vegetation can be considered GI (for NJ purposes) only if the device infiltrates the entire Water Quality Design Storm into the subsoil. Further, the below ground device (vault) would need to meet the NJDEP Stormwater BMP Manual conditions of having the soil below the MTD meet the minimum tested infiltration rate of one inch per hour, have at least two feet of separation from the seasonal high water table, and infiltrate into the subsoil.

7. Sizing Requirement:

   The example below demonstrates the sizing procedure for the SVBF:

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using an SVBF. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The selection of the appropriate model of SVBF is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the SVBF in this example is 0.25 acres. Based upon the information in Table 1 below, all of the SVBF models would be able to treat runoff without exceeding the maximum allowable drainage area.

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was based on the following:

time of concentration = 10 minutes
i = 3.2 in/hr (page 21, Fig. 5-10 of Chapter 5 of the NJ Stormwater BMP Manual)
c = 0.99 (runoff coefficient for impervious)
Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs (354.58 gpm)
(Note: 1 cfs = 448.83 gpm)

Given the site runoff is 0.79 cfs and based on Table 1 below, the minimum size unit to be used to treat the runoff without exceeding the MTFR is the Model SVBF 10 x 20.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below:

Table 1. StormVault BioFiltration with Sierra Blend (SVBF) Model MTFRs and Maximum Allowable Drainage Area.

Configuration	Dimensions (ft)	Media Surface Area (ft^2)	MTFR (cfs)[1]	Maximum Allowable Drainage Area (acres)
SVBF Unit	3 x 5	15.00	0.07	0.28
	4 x 4	16.00	0.07	0.30
	4 x 6.5	26.00	0.12	0.48
	4.5 x 8.5	38.25	0.17	0.71
	5 x 5	25.00	0.11	0.48
	5 x 10.5	52.50	0.23	0.97
	6 x 6	36.00	0.16	0.67
	6 x 8	48.00	0.21	0.89
	6 x 12	72.00	0.32	1.33
	6 x 15	90.00	0.40	1.67
	8 x 8	64.00	0.29	1.19
	8 x 10	80.00	0.36	1.48
	8 x 16	128.00	0.57	2.37
	10 x 20	200.00	0.89	3.70

Table 1. StormVault BioFiltration with Sierra Blend (SVBF) Model MTFRs and Maximum Allowable Drainage Area (continued)

Configuration	Dimensions (ft)	Media Surface Area (ft^2)	MTFR (cfs)[1]	Maximum Allowable Drainage Area (acres)
SVBF with Internal Bypass	3 x 5	14.91	0.07	0.28
	4 x 4	15.91	0.07	0.29
	4 x 6.5	25.91	0.12	0.48
	4.5 x 8.5	38.16	0.17	0.71
	5 x 5	24.91	0.11	0.46
	5 x 10.5	52.41	0.23	0.97
	6 x 6	35.80	0.16	0.66
	6 x 8	47.80	0.21	0.89
	6 x 12	71.80	0.32	1.33
	6 x 15	89.80	0.40	1.66
	8 x 8	63.80	0.28	1.18
	8 x 10	79.80	0.36	1.48
	8 x 16	127.80	0.57	2.37
	10 x 20	199.80	0.89	3.70

1. Calculated based on 2.0 gpm/ft^2 (0.004 cfs/ft^2) of effective filtration treatment area.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Anthony Robalik of my office at anthony.robalik@dep.nj.gov.

Sincerely,

Gabriel Mahon

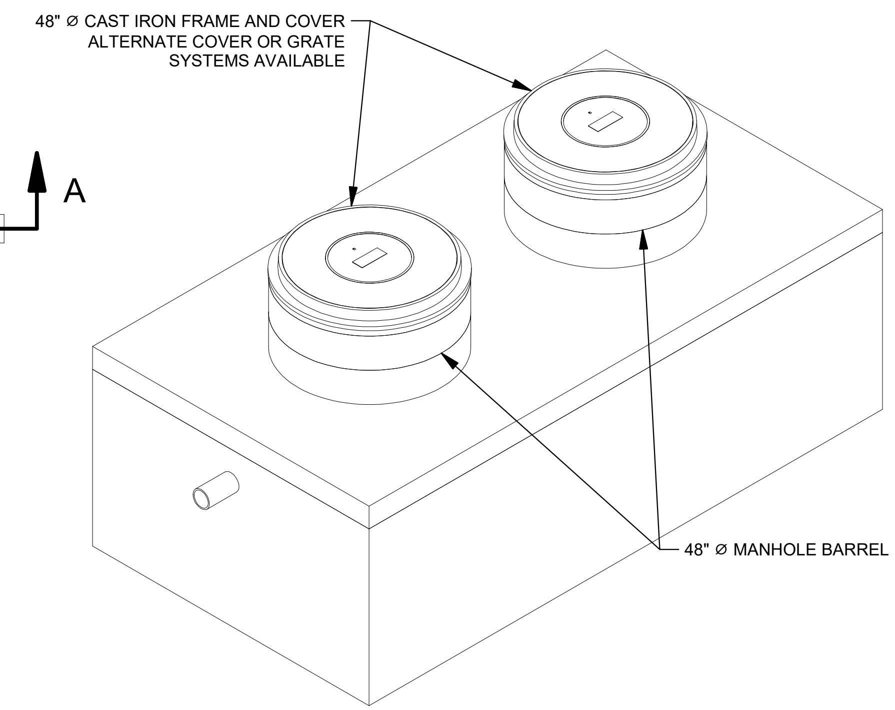
Gabriel Mahon, Chief
Bureau of NJPDES Stormwater Permitting & Water Quality Management
Division of Watershed Protection and Restoration
New Jersey Department of Environmental Protection

Attachment: Maintenance Plan

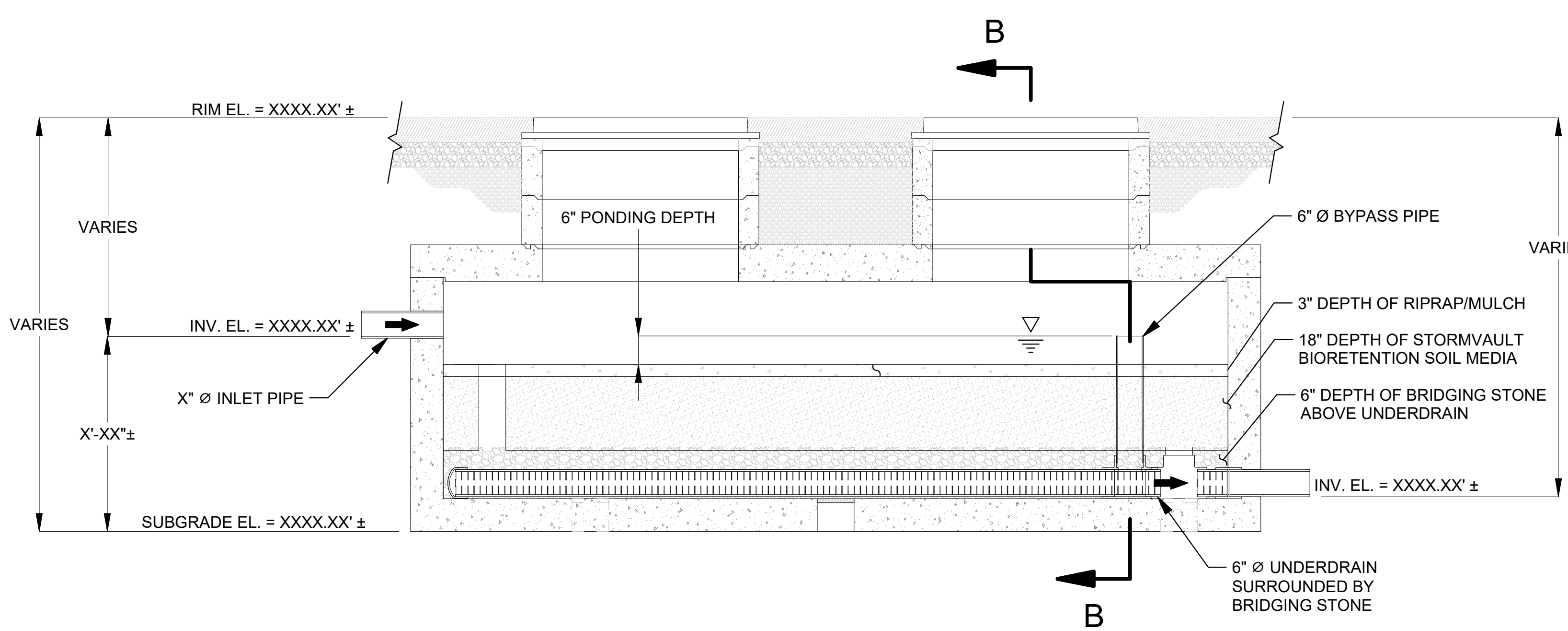
cc: Richard Magee, NJCAT

Appendix C – MTD HydroCAD Analysis and Drawings

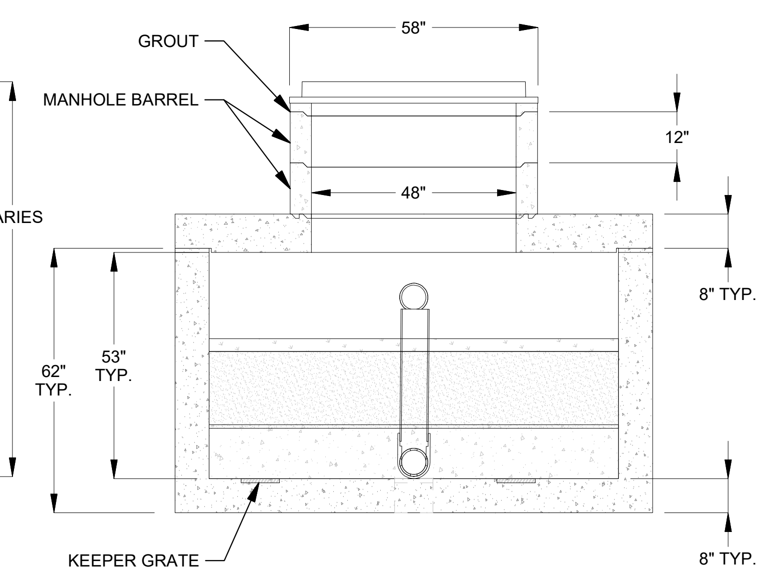
PLAN VIEW



ISOMETRIC VIEW



SECTION A-A



SECTION B-B

STORMVAULT BIOFILTRATION (SVBF)

CONFIGURATION: UNDERGROUND VAULT (-UV)

MODEL: SVBF-UV 8'4" X 16'4"

HYDRAULICS

WATER QUALITY DESIGN STORM (WQDS)	≤0.606-CFS
STORM DRAIN DESIGN CONVEYANCE FLOW	XX.X-CFS
RETURN REQUENCY / PERIOD OF PEAK DESIGN CONVEYANCE FLOW	XX-YRS

TREATMENT

BIO SOILS FILTRATION MEDIA	JENSEN'S *SIERRA BLEND* *
MODEL SVBF-UV 8'4"X16'4" MAXIMUM TREATMENT FLOW RATE (MTFR)	0.606-CFS
	272-GPM
BIO SOIL MEDIA UNITIZED TREATMENT FLUX RATE *HYDRAULIC SURFACE LOADING RATE (HSLR)*	193-(IN/HR)/FT^2
	2-GPM/FT^2

*THIS STORMVAULT BIOFILTRATION UNIT PROVIDES A MAXIMUM TREATMENT FLOW RATE (MTFR) EQUAL TO OR GREATER THAN THE PEAK FLOW FROM THE WATER QUALITY DESIGN STORM (WQDS) LISTED IN THE HYDRAULICS TABLE ABOVE.

1. THIS PROPRIETARY MANUFACTURED TREATMENT DEVICE (MTD), IS A CERTIFIED GREEN INFRASTRUCTURE (GI), BEST MANAGEMENT PRACTICE (BMP), BY THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJDEP).
2. THIS GI CERTIFIED MTD ACHIEVES 80% TSS REMOVAL EFFICIENCY ON A PARTICLE SIZE DISTRIBUTION (PSD), HAVING A d_{50} ≤ 48-MICRONS (μm). THIS PERFORMANCE HAS BEEN VERIFIED BY THE NEW JERSEY CORPORATION FOR ADVANCED TECHNOLOGY (NJCAT).
3. SIZING OF THIS SVBF IS BASED ON THE VERIFIED HYDRAULIC SURFACE LOADING RATE (HSLR), OF 2-GPM/FT^2 OF THE ENGINEERED "SIERRA BLEND" BIO SOIL MEDIA (BSM).
4. CAPTURED WATER QUALITY CONSTITUENTS:
   - TOTAL SUSPENDED SOLIDS (TSS)
   - PHOSPHORUS
   - TOTAL AND DISSOLVED COPPER
   - TOTAL AND DISSOLVED ZINC
   - OIL & GREASE
   - FECAL COLIFORM

DESIGN PARAMETERS

1. VEGETATION, FOUNDATION, SUBGRADE, AND BACKFILL TO BE DESIGNED BY OTHERS.
2. ***SVBF*** CAN READILY BE RECONFIGURED AS AN OPEN TOP SWALE SYSTEM TO RECEIVE SURFACE FLOW FROM ALL SIDES.
3. ***SVBF*** MAY BE DEPLOYED WITH UNFINISHED TOP OF WALLS TO BE POURED IN FIELD ALLOWING FOR CONSTRUCTION OF CONTINUOUS STREETSCAPE AND LANDSCAPE FEATURES.
4. INLETS THROUGH CURB CAN BE LOCATED ON ANY SIDE OF THE BOX AND THEIR DIMENSIONS VARY PER DESIGN.
5. GROUNDWATER ELEVATION IS ASSUMED TO BE BELOW THE BOTTOM OF PRECAST STRUCTURE. CONTACT JENSEN WATER RESOURCES FOR HIGH GROUNDWATER CONDITIONS.
6. STANDARD CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE READILY AVAILABLE. CONTACT JENSEN WATER RESOURCES FOR CUSTOM DESIGNS.
7. FOR COMPLETE DESIGN AND PRODUCT INFORMATION, CONTACT JENSEN WATER RESOURCES.

CONSTRUCTION & INSTALLATION NOTES

1. CONTRACTOR TO VERIFY ALL DIMENSIONS AND ELEVATIONS IN FIELD PRIOR TO INSTALLATION.
2. THE CONNECTION BETWEEN THE INTERNAL DRAIN PIPING OF THE ***SVBF*** SHALL BE WATERTIGHT.
3. CONTRACTOR MAY GROUT ALL PIPE PENETRATIONS IN PRECAST CONCRETE OPENINGS IN FIELD AS NECESSARY.
4. CONTRACTOR TO PROVIDE FIELD POUR OF CURB TO THE ELEVATIONS SHOWN ON THE SITE DRAWINGS AS NECESSARY.

MATERIALS

1. ALL DIMENSIONS ARE IN DECIMAL INCHES.
2. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH F'c = 4,000-psi AT 28-DAYS.
3. THE PORTLAND CEMENT USED IN THE PRECAST SECTION SHALL MEET THE REQUIREMENTS OF TYPE II/V HIGH SULFATE RESISTANT CEMENT IN ACCORDANCE WITH ASTM CLASS M C-150.
4. VAULT SECTIONS DESIGNED AND MANUFACTURED IN ACCORDANCE WITH ASTM C857 & C858
5. ALL PRECAST CONCRETE COMPONENTS TO BE MANUFACTURED IN A NPCA CERTIFIED PLANT.
6. IF REQUIRED, JENSEN WILL FURNISH VAULT WITH FLUID-APPLIED WATERPROOFING COATING AROUND ENTIRE INSIDE SURFACE OF ***SVBF***.
7. BRIDGING STONE SHALL BE 3/8" WASHED PEA GRAVEL OR 1/2" CLEAN ROUND ROCK.
8. ALL PVC PIPE SHALL CONFORM TO ASTM D 3034 (SDR-35) PIPE.
9. JENSEN WATER RESOURCES TO PROVIDE ALL MATERIALS AS SHOWN, UNLESS OTHERWISE NOTED.
10. ALL CONCRETE COMPONENT THICKNESSES, DIMENSIONS, AND JOINT ORIENTATIONS MAY VARY ACROSS JENSEN PRECAST'S MANUFACTURING FACILITIES.

SVBF-UV 8X16 NJCAT.idw

JENSEN WATER RESOURCES
521 DUNN CIRCLE, SPARKS, NV 89431
www.jensenwaterresources.com
(855) 468-5600

MODEL: STORMVAULT BIOFILTRATION UNDERGROUND VAULT MODEL: SVBF-UV 8'4"X16'4"	PROJECT: PROJECT NAME CITY, STATE			REV:
	PART NUMBER: SVBF-UV 8'4"X16'4"	DRAWN BY: T. Schmaling		SHEET: 1 OF 1
	CREATED: 6/4/2021	MODIFIED: 6/4/2021		

STORMCAPTURE®

Design Summary

PROJECT INFORMATION

PROJECT NAME: New Jersey Wind Port C1

PROJECT CITY: 30th Street Train Station

PROJECT STATE: Pennsylvania

COMPANY: Moffatt & Nichol

SITE TYPE: Industrial

SYSTEM DESIGN

System Type:
| Detention

Module Construction Type:
| Clamshell

Storage Volume Required (cf):
| 9800

Configured Storage Volume (cf):
| 10431

System Internal Height (ft):
| 6

Nominal Module Capacity (cf):
| 630

Required Number of Modules:
| 15

Module Designation:
| SC2 3-3

SITE DESIGN

System Invert Elevation (ft):
| 4.55

Top of Module Elevation (ft):
| 11.13

Maximum Rim Elevation (ft):
| 12.21

Depth of Cover (ft):
| 1.08

Minimum Inlet Elevation (ft):
| 6.62

Maximum Inlet Elevation (ft):
| 6.62

Minimum Outlet Elevation (ft):
| 4.55

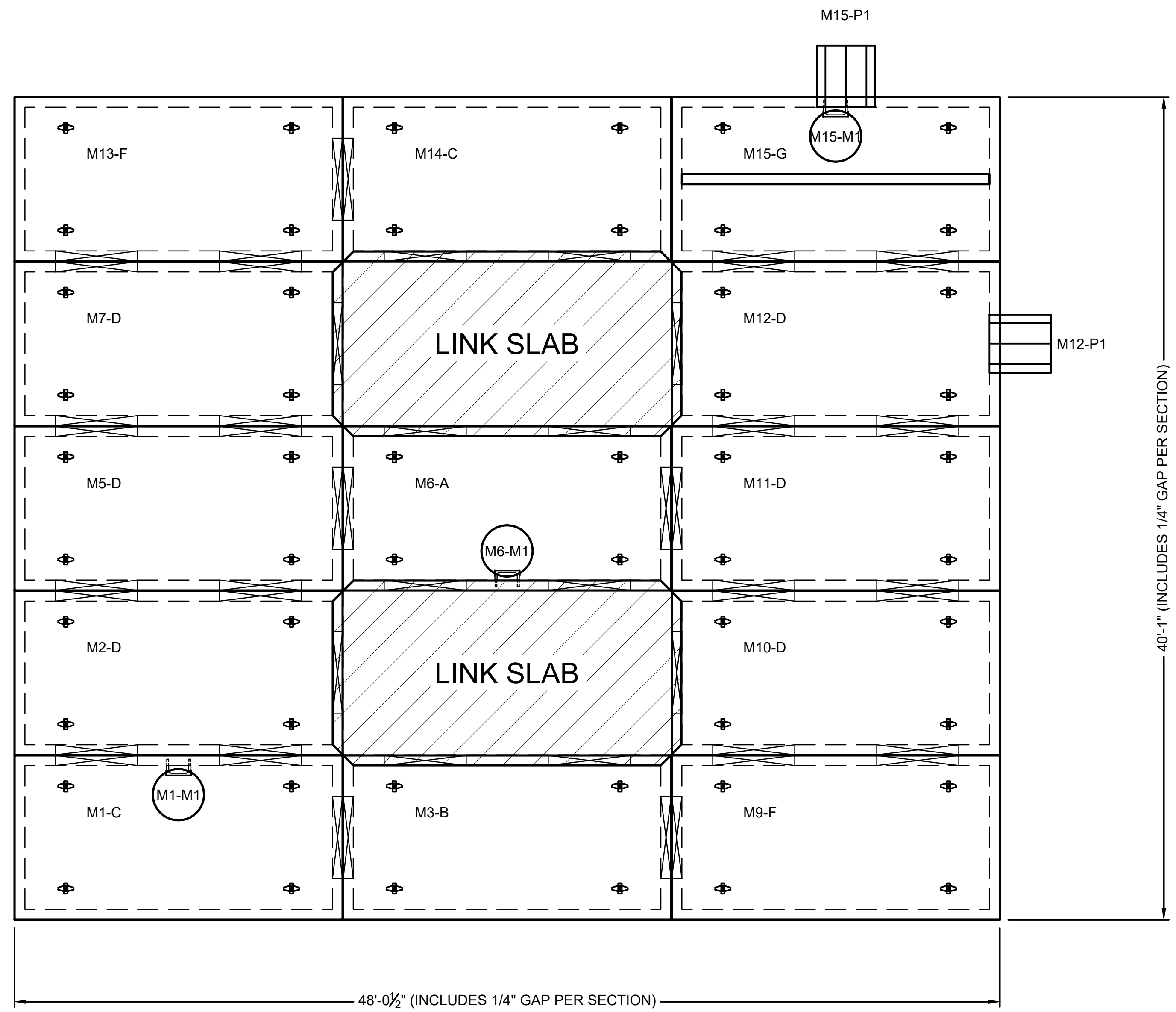
Maximum Outlet Elevation (ft):
| 4.55

Notes and Exceptions:
1. Additional design changes may be required for loading conditions over HS-20.
2. Additional design changes may be required for groundwater elevation above system invert.

MODULE NOTES		
TYPE	QUANTITY	HEIGHT
A	1	6.00'
B	1	6.00'
C	2	6.00'
D	6	6.00'
F	2	6.00'
G	1	6.00'
LINK SLAB	2	-
TOTAL	15	
VOLUME	10,431	CUBIC FEET

PIPE SCHEDULE		
PIPE	SIZE	INVERT
M12-P1	24" RCP	6.62'
M15-P1	24" RCP	4.55'

MANHOLE SCHEDULE		
MANHOLE	TYPE	RIM
M1-M1	30" DIA. F&C Steps	12.21'
M15-M1	30" DIA. F&C Steps	12.21'
M6-M1	30" DIA. F&C Steps	12.21'



PLAN VIEW
SCALE: 1/8" = 1'-0"

DESIGN NOTES

1. LIVE LOADING CRITERIA:
   A. AASHTO HS-20-44 DESIGN TRUCK (WITH IMPACT AT 0.50FT MINIMUM COVER)
   B. LATERAL LIVE LOAD SURCHARGE: 80 PSF (TO 8.00FT DEPTH)
   C. NO LATERAL SURCHARGE(S) FROM ANY ADJACENT BUILDINGS, WALLS, FOUNDATIONS, OR ANY ADDITIONAL SITE ELEMENTS.
2. SOIL LOADING CRITERIA:
   A. SOIL COVER DEPTH: 0.50FT (MIN.) - 5.00FT (MAX.)
   B. SOIL UNIT WEIGHT: 120 PCF
   C. ASSUMED WATER TABLE ELEVATION: BELOW BOTTOM OF PRECAST
   D. REQUIRED ALLOWABLE BEARING PRESSURE: 2,500 PSF
   E. EQUIVALENT LATERAL FLUID PRESSURE, ACTIVE: 45 PCF (DRAINED)
   F. EQUIVALENT LATERAL FLUID PRESSURE, AT-REST: 60 PCF (DRAINED)
   G. EQUIVALENT LATERAL FLUID PRESSURE, PASSIVE: 150 PCF (DRAINED)
   H. ASSUMED COEFFICIENT OF FRICTION: 0.40
   I. SEISMIC LATERAL EARTH PRESSURES: NOT APPLICABLE
3. STORMCAPTURE MODULE TYPE: DETENTION (WATERTIGHT).
4. CONCRETE (NORMALWEIGHT):
   A. MIN. 28-DAY COMPRESSIVE STRENGTH: 6,000 PSI
   B. CEMENT: ASTM C150
5. STEEL REINFORCEMENT: ASTM A615 / A706 (GRADE 60), ASTM A1064 (GRADE 80)
6. REFERENCE STANDARDS: ASTM C913 & C890, ACI 318-14

Detention/
Infiltration

REV	DESCRIPTION	DATE
	-	-

Oldcastle Infrastructure™
A CRH COMPANY
Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ® DETENTION SYSTEM
SYSTEM ID: 1
PLAN-N

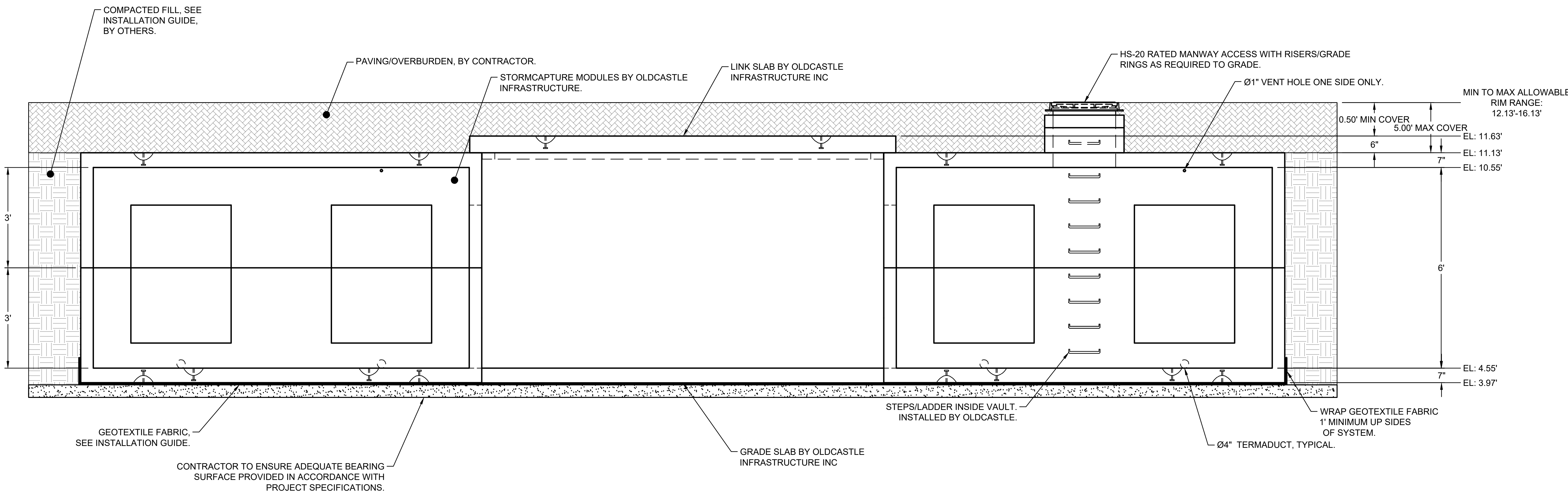
CUSTOMER: Moffatt & Nichol
JOB NAME: New Jersey Wind Port C1
JOB NUMBER: -

DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
10/30/2022	-	-	-	-	-

DRAWING NAME: SC2 3-3
SHEET: 1 OF 3

REVIEWING NOTES

1. THIS SYSTEM HAS BEEN DESIGNED PER THE DESIGN PARAMETERS SPECIFIED IN THE DESIGN NOTES. REVIEWING ENGINEER SHALL VERIFY THAT THESE PARAMETERS MEET OR EXCEED PROJECT SPECIFIC REQUIREMENTS. IF SITE CONDITIONS DIFFER FROM NOTED DESIGN PARAMETERS, REVIEWING ENGINEER SHALL NOTIFY OLDCASTLE FOR POTENTIAL REDESIGN AND/OR PRICING ADJUSTMENTS.
2. REVIEWING ENGINEER SHALL VERIFY ALL PIPE PENETRATION LOCATIONS, SIZES, AND INVERTS.
3. REVIEWING ENGINEER SHALL VERIFY ALL MANWAY ACCESS LOCATIONS AND RIM ELEVATIONS.
4. THIS SYSTEM IS DESIGNED FOR A GROUNDWATER TABLE ELEVATION PER DESIGN NOTE 2C. REVIEWING ENGINEER SHALL VERIFY THAT THE DESIGN GROUNDWATER ELEVATION MEETS OR EXCEEDS SITE CONDITION REQUIREMENTS. NOTIFY OLDCASTLE IF SITE CONDITIONS VARY FROM WHAT HAS BEEN SPECIFIED FOR POTENTIAL SYSTEM DESIGN CHANGES AND/OR PRICING ADJUSTMENTS.
5. STORMCAPTURE MODULES ARE NOT WATERTIGHT. IF A WATERTIGHT SOLUTION IS REQUIRED, CONTACT OLDCASTLE FOR RECOMMENDATIONS. THE WATERTIGHT APPLICATION TO BE PROVIDED AND IMPLEMENTED BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT THE SELECTED WATERTIGHT SOLUTION PERFORMS AS SPECIFIED BY THE MANUFACTURER.
6. DESIGN OF THE STORMCAPTURE PRECAST MODULE SYSTEM ASSUMES NO ADJACENT BUILDING(S), WALL(S), OR STRUCTURAL FOUNDATION(S) WITHIN A 1:1 INFLUENCE LINE FROM THE BOTTOM EDGE OF ANY SYSTEM MODULE. ANY SITE ELEMENTS BEYOND THIS ZONE OF INFLUENCE ARE ASSUMED TO HAVE NO IMPACT ON THE SYSTEM AND EXERT ZERO LATERAL SURCHARGE ONTO THE MODULES. THE CONTRACTOR SHALL VERIFY THAT ANY ADJACENT BUILDING(S), WALL(S), OR STRUCTURAL FOUNDATION(S) DO NOT LIE WITHIN THIS INFLUENCE ZONE OR DO NOT SURCHARGE THE PRECAST MODULES.
7. WRITTEN APPROVAL OF SUBMITTAL DRAWINGS ALONG WITH SIGNED PURCHASE ORDER REQUIRED FOR BEGINNING OF PRODUCT FABRICATION. ANY SYSTEM MODIFICATION POST-APPROVAL MAY RESULT IN CHANGE ORDER(S) AND/OR POTENTIAL DELIVERY DELAYS.
8. ALL SAND FILTER MEDIA, DRAIN ROCK AGGREGATE, PIPE, AND FITTINGS PROVIDED BY CONTRACTOR.



TYPICAL ELEVATION
NTS

NOTE:
TERMADUCT INSERTS TO BE KNOCKED OUT AT SPECIFIED LOCATIONS ONLY (BY OTHERS).

Detention/ Infiltration

REV	DESCRIPTION	DATE
	-	-

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Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ® DETENTION SYSTEM — SYSTEM ID: 1

CUSTOMER: Moffatt & Nichol

JOB NAME: New Jersey Wind Port C1 — JOB NUMBER: -

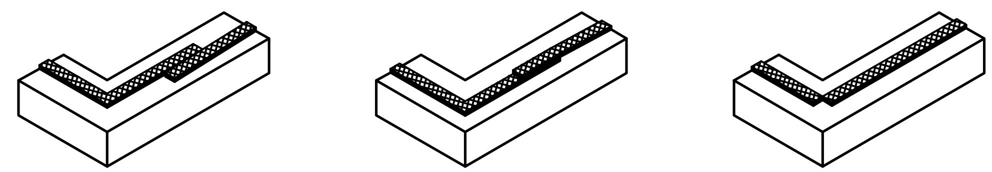
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
10/30/2022	-	-	-	-	-

DRAWING NAME: SC2 3-3 — SHEET: 2 OF 3

INSTALLATION NOTES

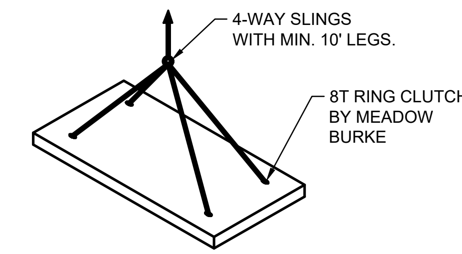
1. UNDERGROUND PRECAST CONCRETE SYSTEM INSTALLATION SHALL BE PER ASTM C891, "STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES" AND PER OLDCASTLE.
2. MODULE SUBBASE OR SUBGRADE SHALL BE LEVEL/SCREEDED AND COMPACTED ADEQUATELY FOR REQUIRED BEARING CAPACITY PER DESIGN NOTE 2D. CONTRACTOR AND/OR INSTALLING SUB-CONTRACTOR SHALL VERIFY THAT SOIL BEARING CONDITIONS MEET OR EXCEED DESIGN REQUIRED MINIMUMS PRIOR TO PLACEMENT AND INSTALLATION OF MODULES.
3. ANY CONSTRUCTION EQUIPMENT EXCEEDING NOTED DESIGN LOADING IS NOT PERMITTED OVER OR ADJACENT TO ANY MODULE WITHOUT FORMAL REVIEW AND WRITTEN APPROVAL BY OLDCASTLE ENGINEERING, ELSE PRODUCT WARRANTY MAY BE VOIDED. ANY DESIGN CONSTRAINT EXCEEDING THE DESIGN PARAMETERS NOTED ABOVE MAY REQUIRE CUSTOM STRUCTURAL DESIGN, SUBGRADE REVISIONS, AND/OR PRICING ADJUSTMENTS.
4. HEAVY VIBRATORY COMPACTION EQUIPMENT SHALL NOT BE OPERATED WITHIN 10 FEET OF MODULE EXTERIOR.
5. MINIMUM OF 0.50FT OF SOIL COVER REQUIRED FOR CONSTRUCTION EQUIPMENT OPERATION ON TOP OF SYSTEM. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND INSTALLING SUB-CONSTRACTOR TO ENSURE THAT NO MODULES ARE DAMAGED DURING CONSTRUCTION.
6. UNLESS NOTED OTHERWISE, ALL PIPE SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR MAY MODIFY AT RISK ANY OLDCASTLE PRODUCT(S) IN THE FIELD OR AFTER DELIVERY WITHOUT FORMAL REVIEW AND WRITTEN APPROVAL BY OLDCASTLE ENGINEERING. THE CONTRACTOR SHALL BE RESPOSIBLE FOR VERIFYING THAT ANY PRODUCT MODIFICATIONS DO NOT INVALIDATE THE PRODUCT WARRANTY.
8. MODULE PLACEMENT FIELD TOLERANCES SHALL NOT EXCEED 3/4" BETWEEN ADJACENT MODULES. IF MODULE GAP EXCEEDS 3/4", CONTRACTOR SHALL MAKE NECESSARY ADJUSTMENTS AND RESET MODULE(S) TO BRING WITHIN NOTED TOLERANCES.
9. CONTRACTOR IS RESPONSIBLE FOR PRODUCTS ONCE DELIVERED TO THE SITE. OLDCASTLE IS NOT RESPONSIBLE FOR OFFLOADING PRODUCTS, MAINTENANCE, AND INSTALLATION OF PRODUCTS ONCE THEY ARRIVE TO THE SITE.
10. CONTRACTOR SHALL INSTALL SYSTEM PER PROJECT WATERPROOFING AND SOILTIGHTNESS REQUIREMENTS. WATERPROOFING AND SOILTIGHTNESS INSTALLATION IS NOT BY OLDCASTLE AND OLDCASTLE WILL PROVIDE NO GUARANTEE FOR THIS COMPONENT OF SYSTEM INSTALLATION.

KEYWAYS MUST BE FREE OF DIRT, ROCKS, AND WATER. ROCKS AND DIRT PREVENT THE VAULT SECTIONS FROM SEATING AND SEALING PROPERLY. REMOVE ALL PROTECTIVE PAPER FROM RUBBER SEALANT MATERIAL. SPLICE RUBBER SEALANT MATERIAL WITH A "SIDE BY SIDE" JOINT, AWAY FROM CORNERS. CORNER SPLICING WILL NOT SEAL PROPERLY.



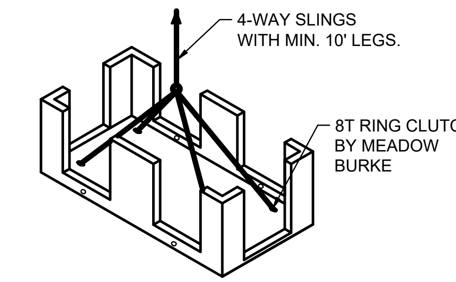
BUTYL RUBBER SEALANT (CONSEAL CS-102 OR EQUAL) PLACEMENT DETAIL

NTS



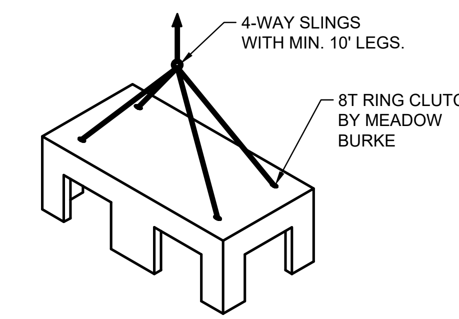
LINK SLAB LIFTING DETAIL

N.T.S.



BOTTOM MODULE LIFTING DETAIL

N.T.S.



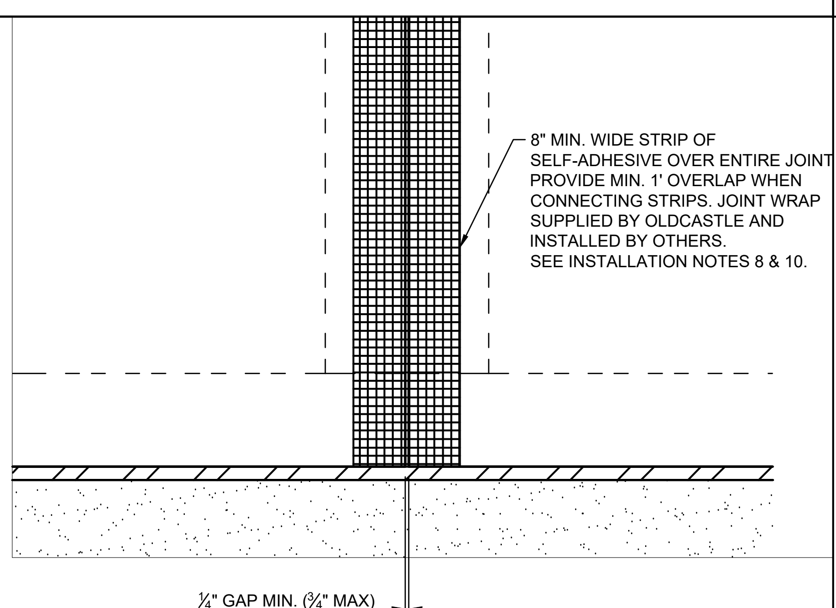
LIFTING DETAIL

N.T.S.

MAXIMUM EQUIPMENT OPERATING WEIGHT (OW) BY TRACK WIDTH				
TRACK WIDTH	12"	18"	24"	30"
MIN TRACK LENGTH	8'-0"	10'-0"	12'-0"	14'-0"
FILL DEPTH	OW (LBS)	OW (LBS)	OW (LBS)	OW (LBS)
0	35,000	45,000	52,500	54,500
1	35,000	45,000	56,000	60,500
2	35,000	45,000	56,000	64,000
3	76,000	78,500	83,500	88,000
4	94,000	100,000	106,000	113,000
5	100,000	116,000	132,000	149,000

NOTES:

1. IF CONSTRUCTION EQUIPMENT EXCEEDS THE ABOVE OPERATING WEIGHT LIMITS REFER TO INSTALLATION NOTE 3.
2. FOR WHEELED CONSTRUCTION EQUIPMENT LIMITS REFER TO INSTALLATION NOTE 3.
3. MINIMUM AXLE SPACING FOR ALL TRACK WIDTHS IS 6'-0".



MODULE JOINT DETAIL

SCALE: 1/2" = 1'-0"

Detention/ Infiltration

REV	DESCRIPTION	DATE
	-	-

Oldcastle Infrastructure™ A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

STORMCAPTURE ® DETENTION SYSTEM

SYSTEM ID: 1

CUSTOMER: Moffatt & Nichol

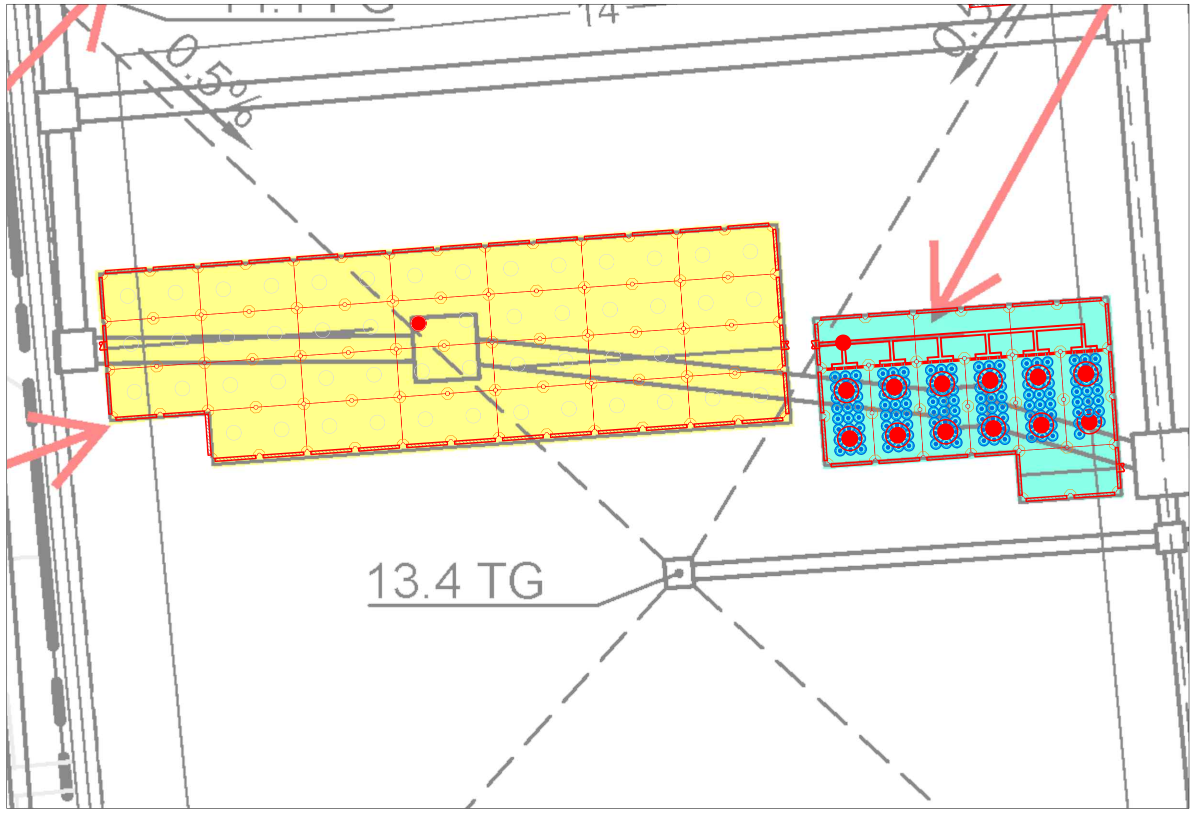
JOB NAME: New Jersey Wind Port C1

JOB NUMBER: -

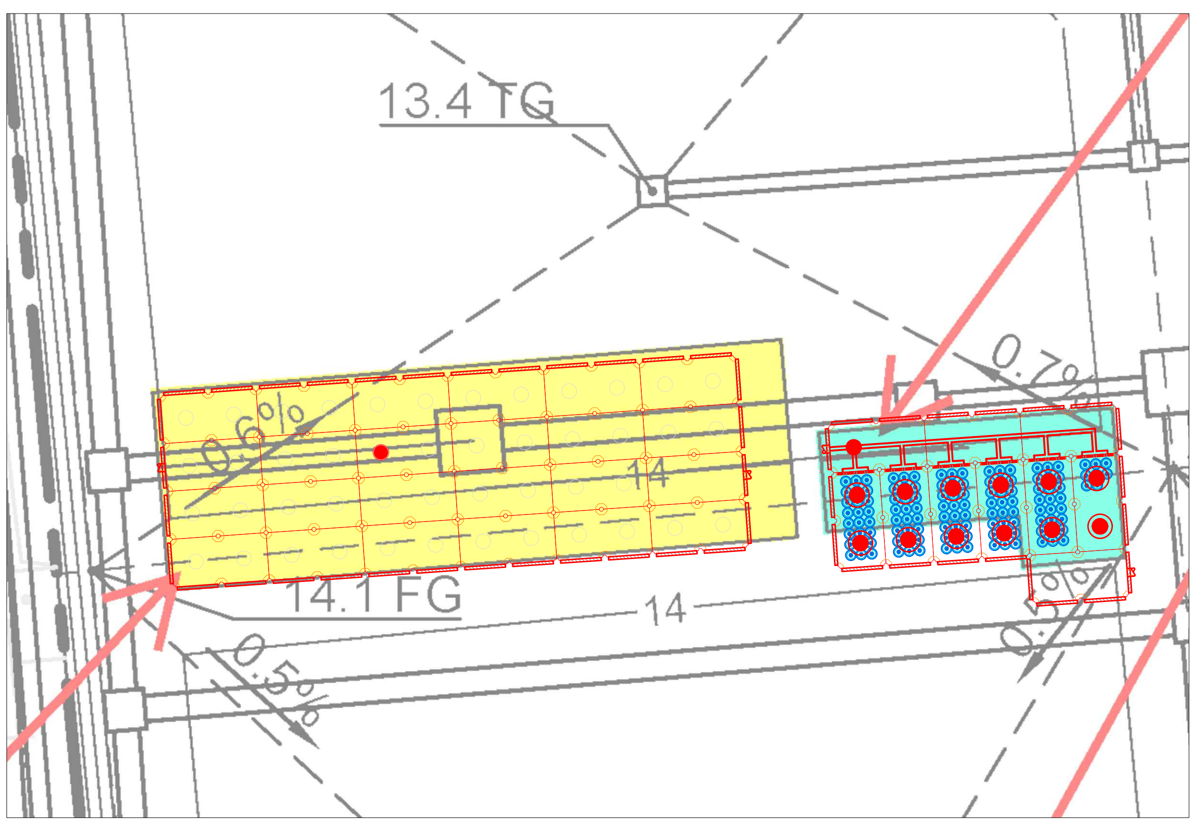
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
10/30/2022	-	-	-	-	-

DRAWING NAME: SC2 3-3

SHEET: 3 OF 3



SYSTEM 1



SYSTEM 2

SYSTEM 3

REVISIONS	
NO	DATE
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StormPod®
UNIVERSAL STORMWATER MANAGEMENT SYSTEM
By ROTONDO Environmental Solutions LLC
www.Rotondo-ES.com
US PATENT # 9580899 B2

CONTECH® ENGINEERED SOLUTIONS LLC
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800-338-1122 513-645-7000 513-645-7993 FAX

The Stormwater Management StormFilter®

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DRAWN BY: PAS	PROJECT: LO-PRO STORMPOD - STORMFILTER NEW JERSEY WIND PORT - PHASE 2 SALEM, NJ		
CHECKED BY: JAR			
DATE: 09/07/2022			
SCALE: NTS	CUSTOMER: ----	DWG. NO. L-1	
JOB NO.: ----		SHT.	

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NOTE: PRODUCTION WILL NOT COMMENCE UNTIL RECEIPT OF SIGNED APPROVED SHOP DRAWINGS.

PRECAST CONCRETE DESIGN SPECIFICATIONS:
- CONCRETE MINIMUM (28-DAY) COMPRESSIVE STRENGTH: 6,000 PSI
- REINFORCING DEFORMED BAR CONFORMING TO ASTM A615 (FY=60 KSI)
- REINFORCING WELDED WIRE CONFORMING TO ASTM A1064 (FY=80 KSI)
- STRUCTURAL REINFORCING FIBERS CONFORMING TO ASTM C1116
- DESIGN LIVE LOAD: 3.0 KSF UNIFORM LIVE LOAD W/ IMPACT
- DESIGN EARTH COVER: 1'-0" MIN. TO 5'-0" MAX.
- SOIL UNIT WEIGHT: 120 PCF
- GROUNDWATER TABLE ASSUMED TO BE AT OR BELOW INVERT OF STRUCTURE
- DESIGN CRITERIA IN ACCORDANCE TO AASHTO LRFD 8TH ED.

WATERTIGHT JOINT NOTES:
- STOMFILTER SYSTEMS TO BE WATERTIGHT
- INTERNAL CAULK JOINTS TO BE A CONTINUOUS SEAL THROUGHOUT EACH CHAMBER BY FILLING JOINTS WITH SIKAFLEX 2CNS OR 1A POLYURETHANE ELASTOMERIC SEALANT WITH SIKAFLEX PRIMER.
- JOINTS TO BE SEALED ON SITE BY THE SYSTEM MANUFACTURER.
- WATERTIGHTNESS OF SYSTEM IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER.

STRUCTURE CONSTRUCTION NOTES:
- TOP & BOTTOM SECTIONS TO BE BOLTED TOGETHER WITH (6) ¾"ø BOLTS TO HELP PREVENT DIFFERENTIAL SETTLEMENT.
- LATERAL INTERLOCKING TONGUE & GROOVES CAST INTO SIDES OF MODULES TO PROVIDE A LATERAL SHEAR CONNECTION BETWEEN MODULES TO PREVENT DIFFERENTIAL SETTLEMENT.
- LATERAL OPENINGS TO BE CAST IN AT PRECAST FACILITY.
- LATERAL PIPES TO EXTEND INTO THE STRUCTURE FLUSH WITH THE INSIDE WALL AND SEALED WITH GROUT. ANNULAR SPACE BETWEEN PIPE AND WALL OPENING TO BE SEALED WITH AN EXPANDABLE WATER-STOP AND AN APPROVED NON-SHRINK GROUT.
- LADDERS TO BE PROVIDED BY RES AND INSTALLED IN FIELD BY CONTRACTOR.
- MANHOLE ACCESS RISERS AND MANHOLE FRAMES & COVERS TO BE PROVIDED BY CONTECH, AND INSTALLED ON SITE BY THE CONTRACTOR.
- CONTRACTOR TO GROUT GRADE RINGS TO MATCH FINISHED GRADE.

DELIVERY
(Two modules per trailer)

HANDLING
(Base slab bolted to arch at factory)

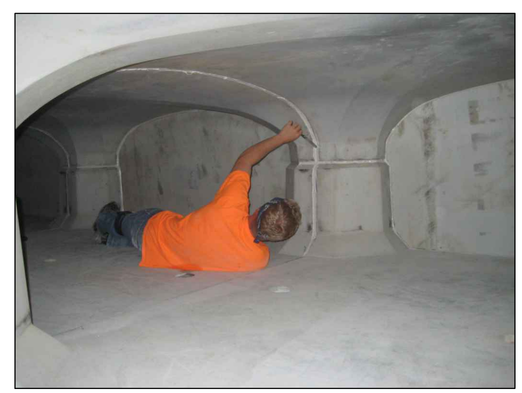
INSTALLATION

INSTALLED SYSTEM

INSIDE VIEW
(Smooth floor w/ no obstructions)

ENDWALL INSTALLATION

STORMPOD W/ CARTRIDGES (INSIDE VIEW)



SEALING JOINTS

WATERTIGHT JOINTS
(Tested to 17.25 psi hydrostatic pressure)

BACKFILL
(On-site soils around perimeter & #57 stone in aquifers)

REVISIONS	
NO	DATE
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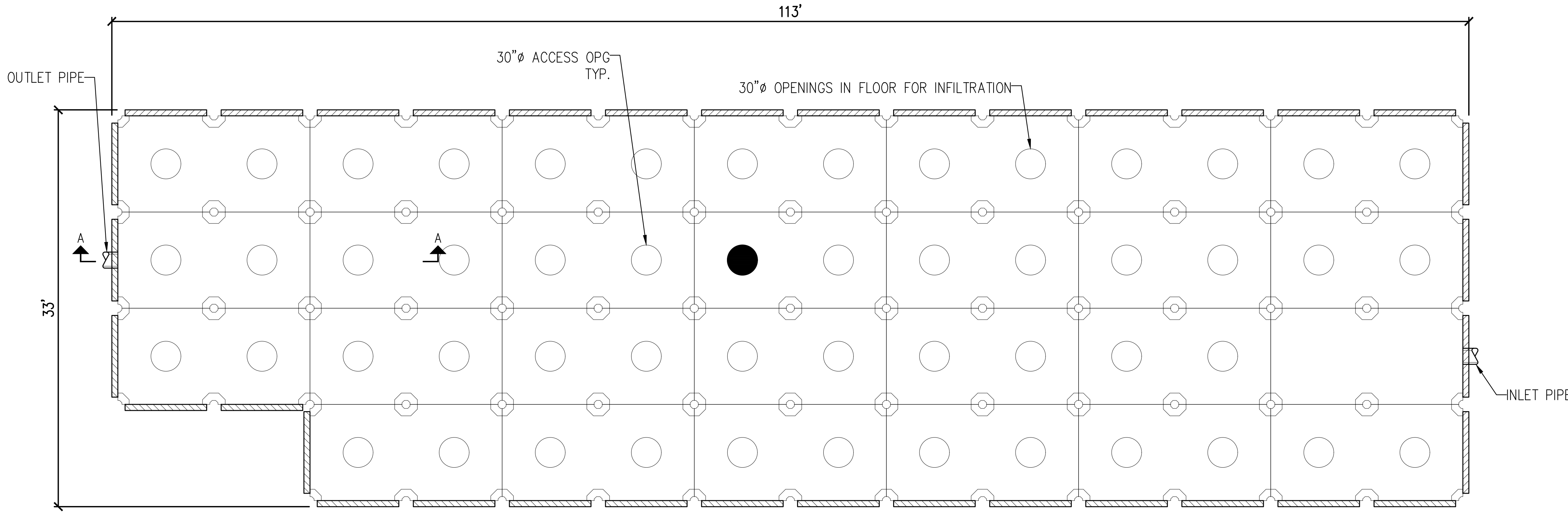
PROJECT:
LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

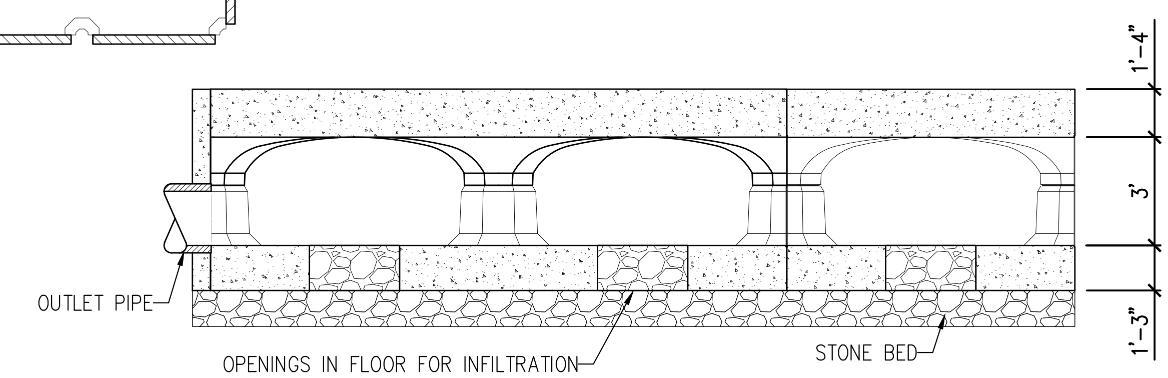
CUSTOMER: ----

DWG. NO. L-2

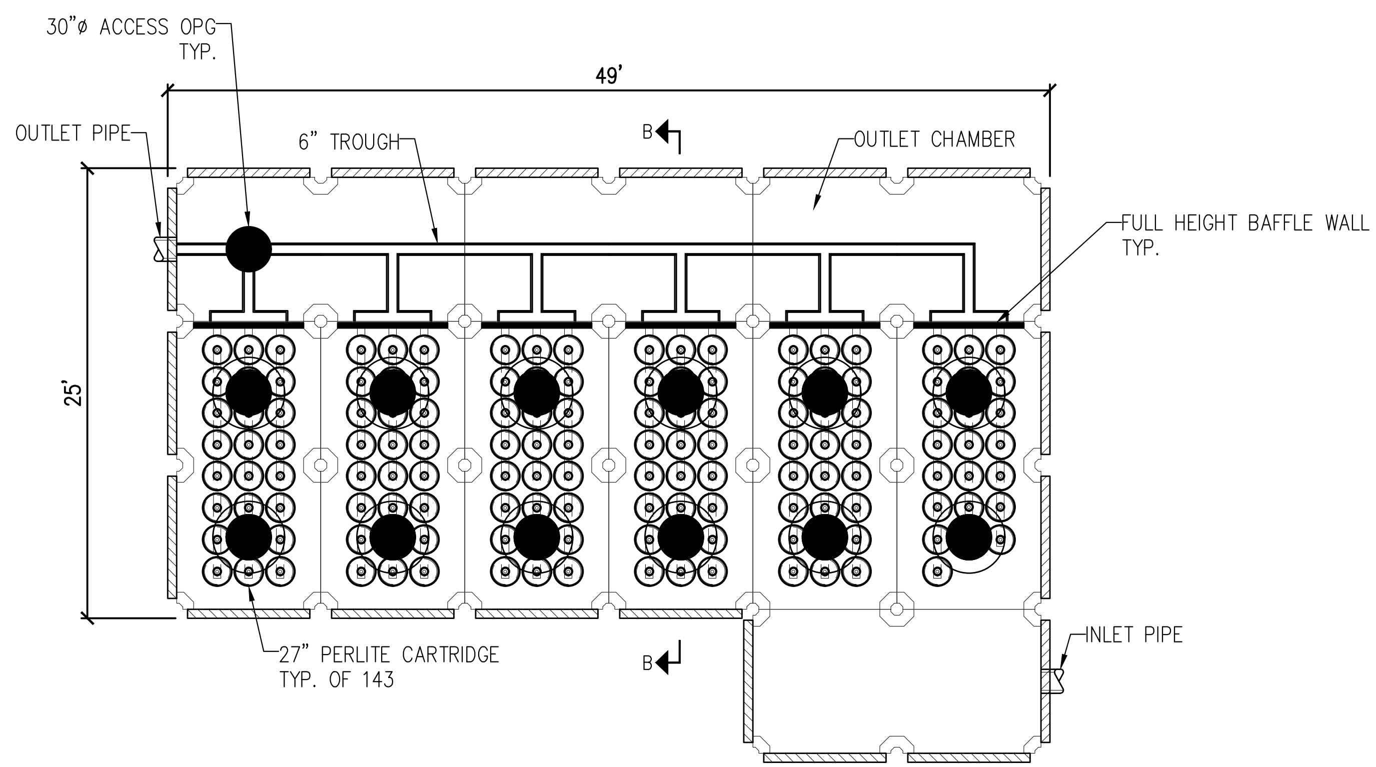
SHT.



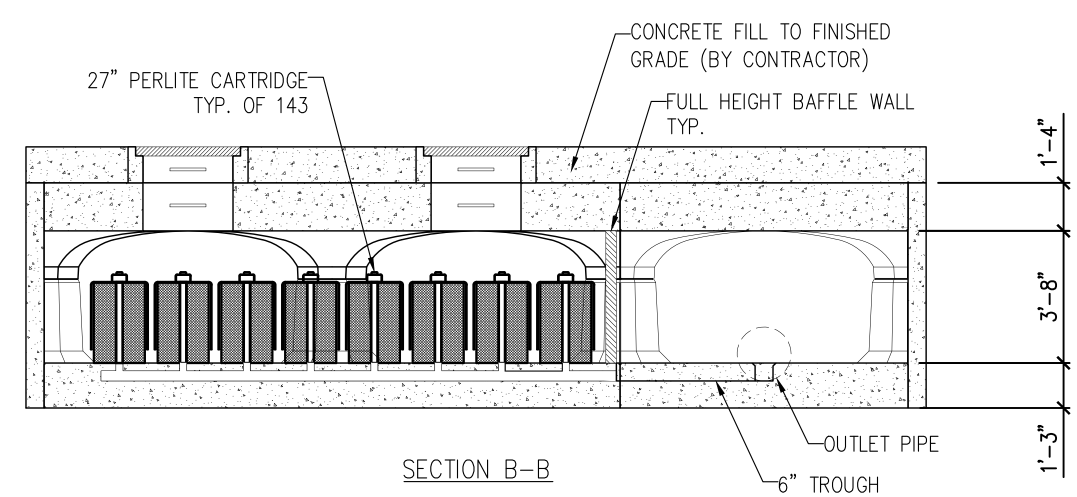
PLAN VIEW – 3-FT LO-PRO INFILTRATION



SECTION A–A



PLAN VIEW – 3-FT 8-INCH STORMPOD STORMFILTER



SECTION B–B

SYSTEM 1

REVISIONS	
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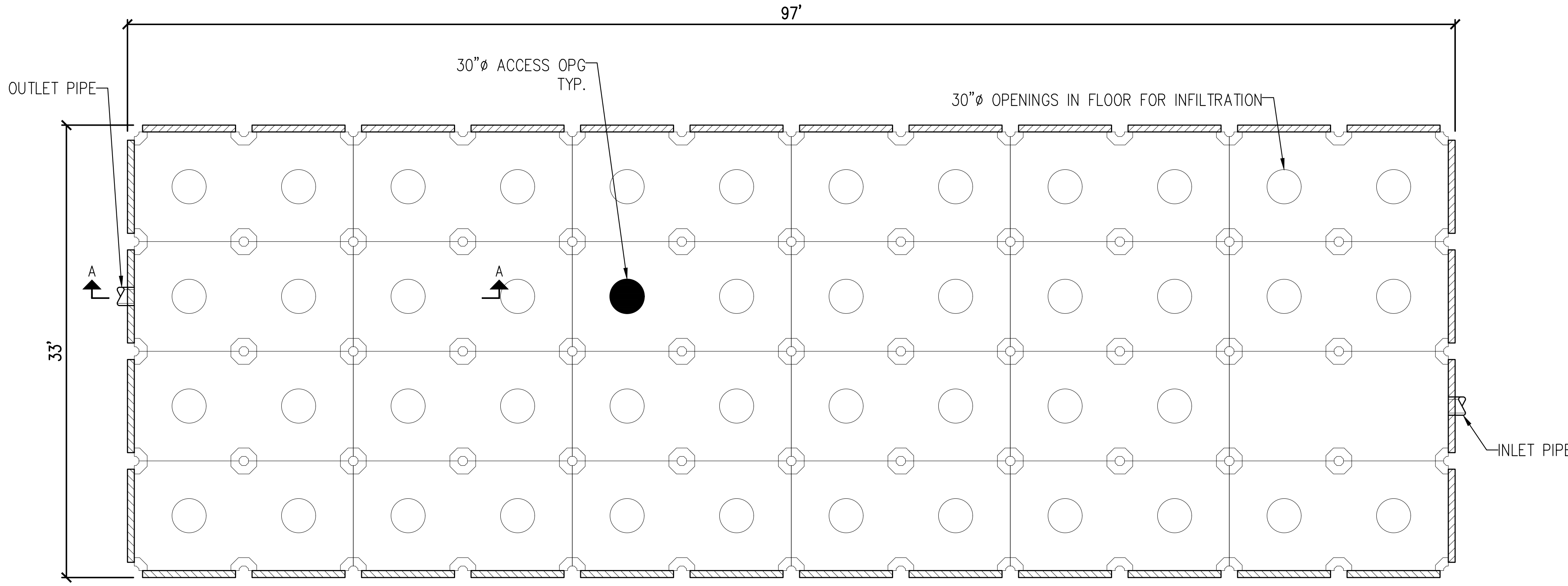
LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

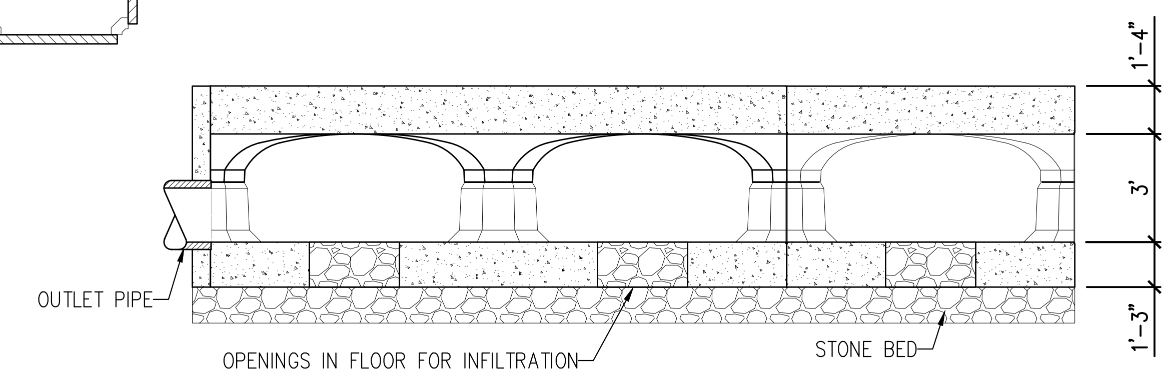
CUSTOMER:

DWG. NO.
L-3

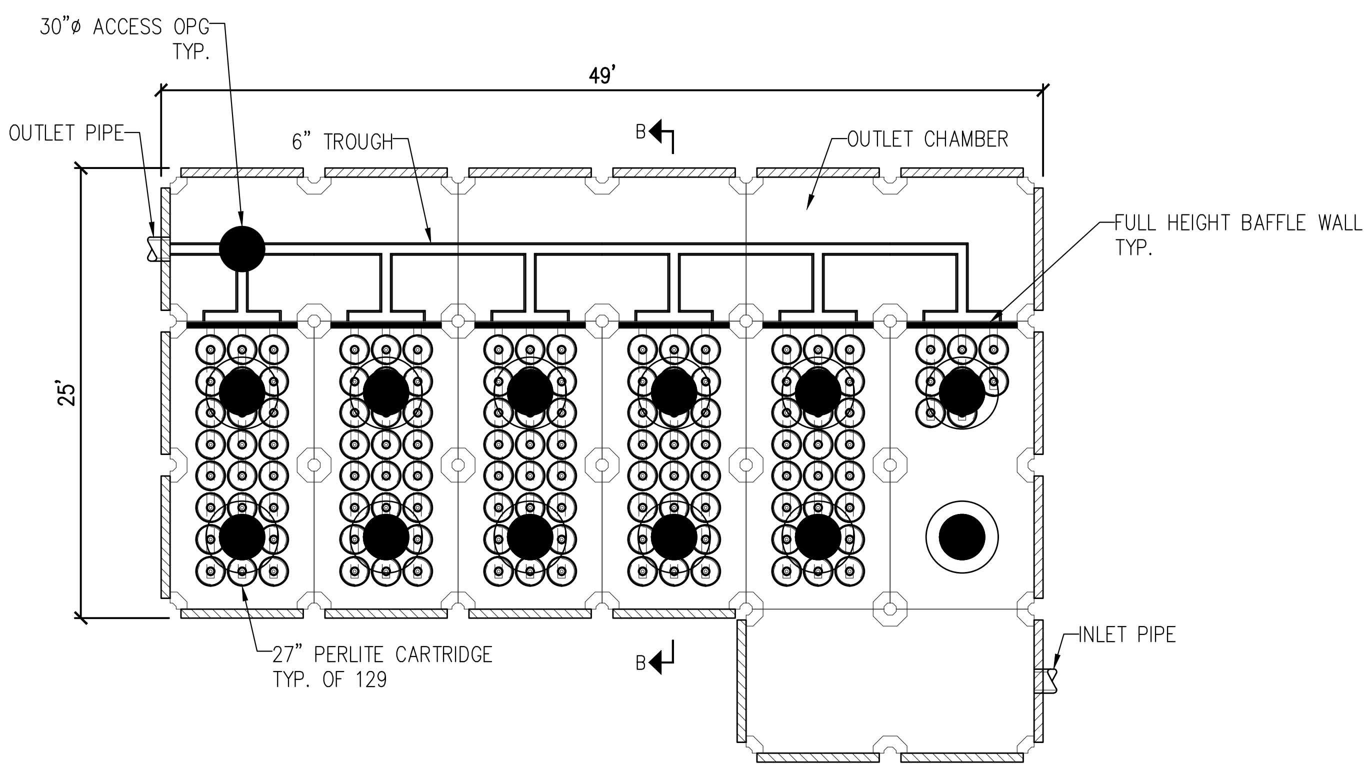
SHT.



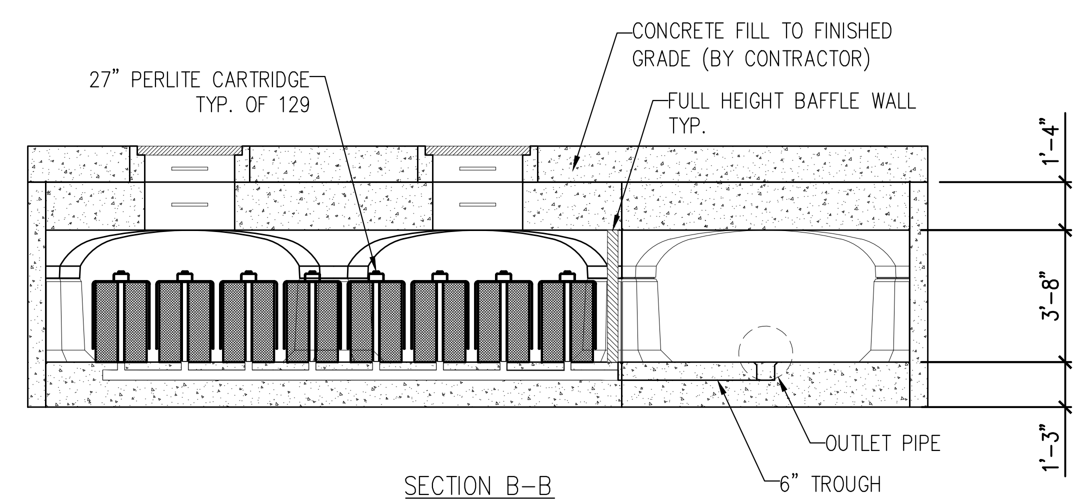
PLAN VIEW – 3-FT LO-PRO INFILTRATION



SECTION A–A



PLAN VIEW – 3-FT 8-INCH STORMPOD STORMFILTER



SECTION B–B

SYSTEM 2

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LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

CUSTOMER: ----

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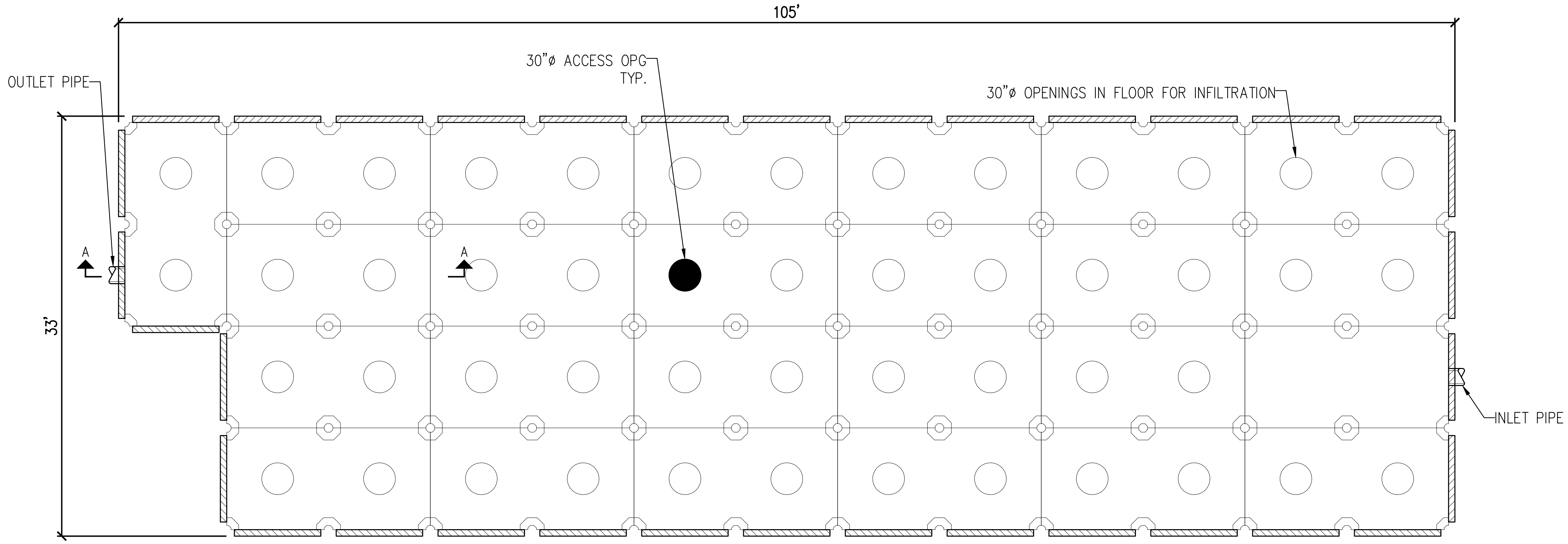
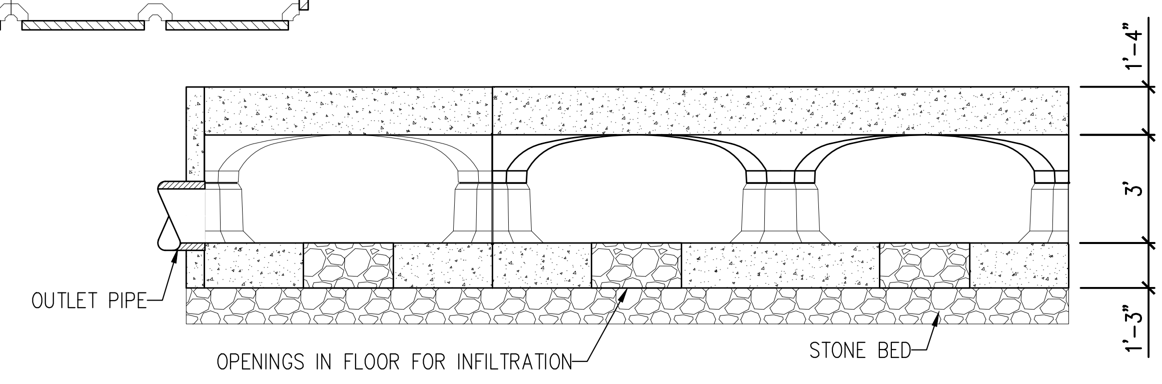
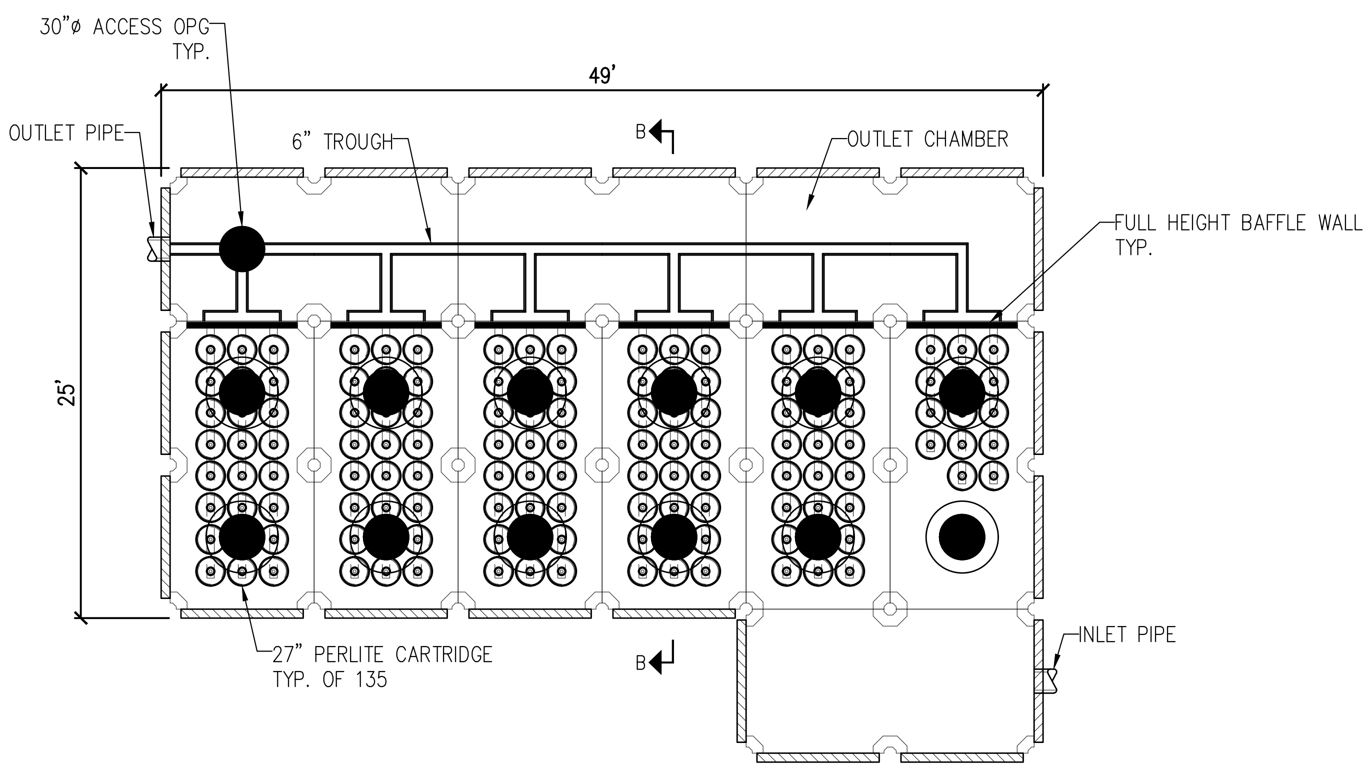
SHT.



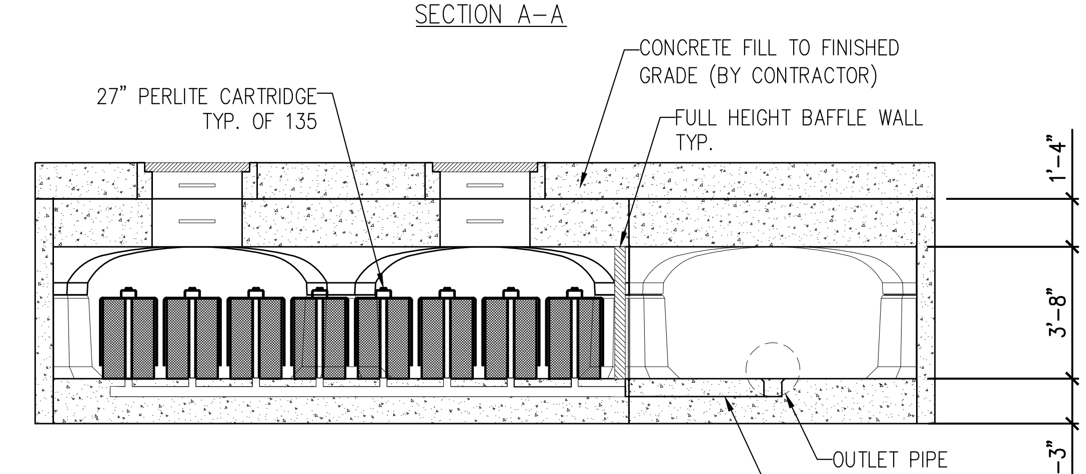
PLAN VIEW – 3-FT LO-PRO INFILTRATION



SECTION A–A



PLAN VIEW – 3-FT 8-INCH STORMPOD STORMFILTER



SECTION B–B

SYSTEM 3

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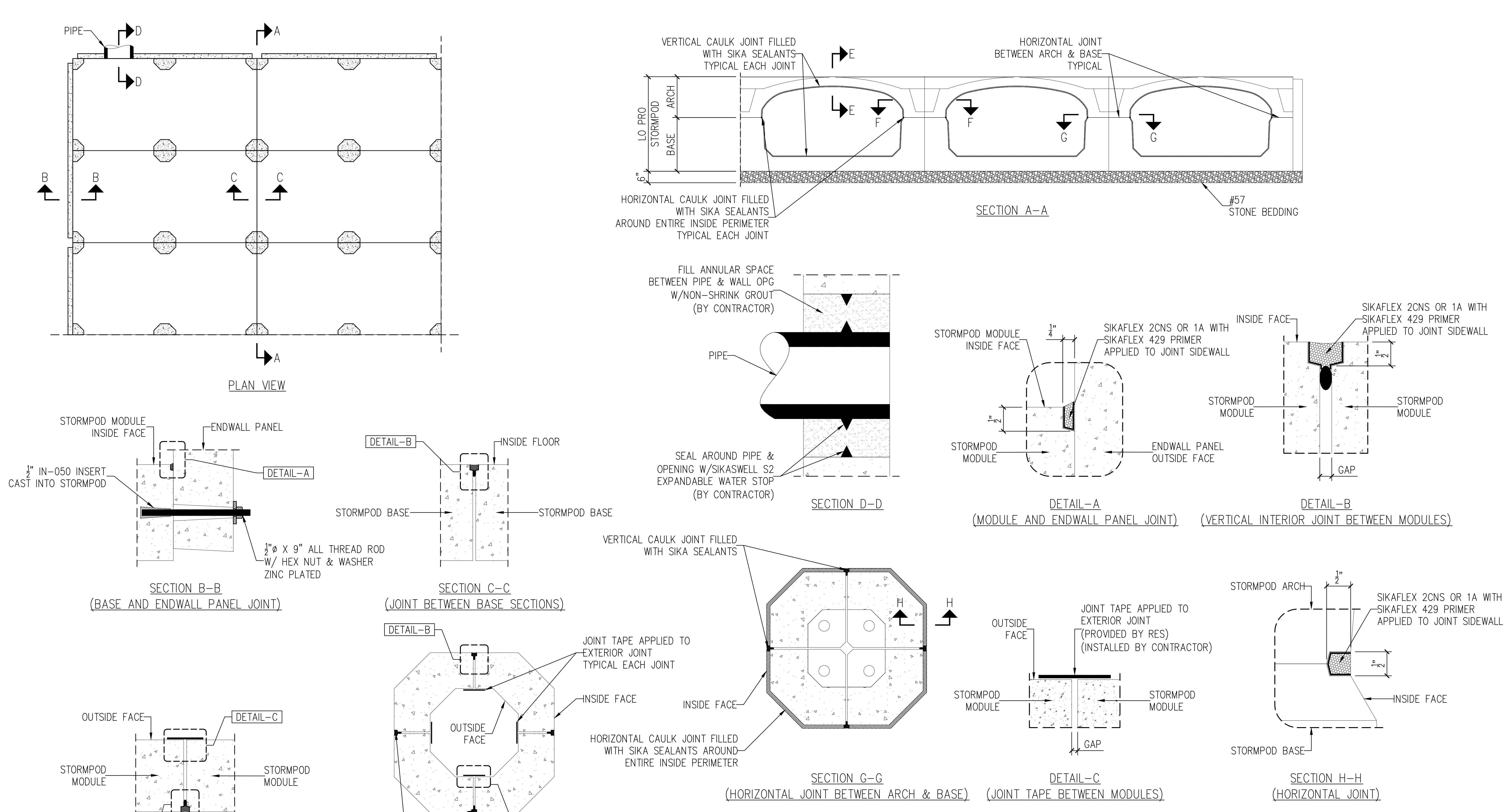
LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

CUSTOMER:

DWG. NO. L-5

SHT.



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NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

CUSTOMER: ----

DWG. NO. L-6

SHT.

SPECIFICATIONS FOR THE INSTALLATION & BACKFILLING OF THE STORMPOD LO-PRO DETENTION SYSTEM

1.0 DESCRIPTION

THIS WORK CONSISTS OF CONSTRUCTING AN UNDERGROUND STORMPOD LO-PRO STORMWATER FACILITY IN ACCORDANCE WITH THESE SPECIFICATIONS AND IN CONFORMITY WITH THE LINES, GRADES, DESIGN AND DIMENSIONS SHOWN ON THE PLANS OR AS ESTABLISHED BY THE PROJECT ENGINEER.

2.0 EQUIPMENT/TOOLS

2.1 EQUIPMENT/TOOLS PROVIDED BY ROTONDO

- LIFTING HARDWARE (I.E. FIXTURES THAT CONNECT TO THE PRODUCT).

2.2 EQUIPMENT/TOOLS PROVIDED BY CONTRACTOR

- CRANE/EXCAVATOR
- 4-HOOK CABLE OR CHAIN FOR HANDLING PRECAST ELEMENTS IN GOOD CONDITION AND PROPER CAPACITY
- (3) 1.5-TON (MIN.) CAPACITY RATCHET LEVER CHAIN HOIST (SEE PHOTO)
- (2) 5' LONG PRY BARS
- A TRANSIT OR LASER LEVEL WITH ROD
- A CARPENTER'S LEVEL 6 FOOT MINIMUM LENGTH
- A SURVEYOR'S TAPE MEASURE 100 FOOT MINIMUM LENGTH
- WRENCH AND SOCKET SET TO TIGHTEN BOLTED CONNECTIONS WHEN REQUIRED

3.0 MATERIALS

3.1 NON-WOVEN FILTER FABRIC – NOT REQUIRED FOR LO-PRO SYSTEM

3.2 ACCESS MATERIALS

- ACCESS HATCH – A 4-FT X 4-FT H 20 DOUBLE LEAF, GALVANIZED STEEL HATCH AS MANUFACTURED BY INWESCO, INC. OR APPROVED EQUAL.
- MANHOLE FRAME & COVER – H 20 CAST-IRON MANHOLE FRAMES AND COVERS AS SUPPLIED BY CAPITOL FOUNDRY OR APPROVED EQUAL.
- LADDERS – HOT-DIPPED GALVANIZED STEEL MANHOLE LADDERS AS MANUFACTURED BY INWESCO, INC. MODEL I-3400 OR APPROVED EQUAL.
- MANHOLE STEPS – COPOLYMER POLYPROPYLENE STEEL REINFORCED MANHOLE STEPS AS SUPPLIED BY MA INDUSTRIES MODEL PS1-PF OR APPROVED EQUAL.

4.0 INSTALLATION PREPARATION

TO ENSURE CORRECT INSTALLATION OF THE PRECAST STORMPOD SYSTEM, CARE AND CAUTION MUST BE EXERCISED IN PREPARING THE STONE BEDDING THAT GOES BENEATH THE STRUCTURE. EXERCISING SPECIAL CARE WILL FACILITATE THE RAPID INSTALLATION OF THE PRECAST COMPONENTS.

4.1 SUBGRADE

- SUBGRADE SOILS IN THE PLANNED STRUCTURE AREA SHOULD BE EXAMINED BY THE SITE SOILS ENGINEER. IN THE EVENT THAT ANY YIELDING MATERIALS ARE ENCOUNTERED, THOSE SUBGRADE SOILS SHOULD EITHER BE THOROUGHLY DENSIFIED IN PLACE OR UNDERCUT TO FIRM GROUND AND REPLACED WITH CONTROLLED, COMPACTED FILL TO FINAL SUBGRADE ELEVATIONS.
- THE SITE SOILS ENGINEER SHALL CERTIFY THAT THE SUBGRADE BEARING CAPACITY MEETS OR EXCEEDS THE APPLIED BEARING PRESSURES FROM THE STRUCTURE.

4.2 STONE BEDDING

- BEDDING MATERIAL SHALL BE #57 STONE.
- A 6 INCH MINIMUM LAYER OF THE SPECIFIED AGGREGATE SHALL BE PLACED AND LEVELED ON TOP OF THE PREPARED SUBGRADE UNDER THE ENTIRE STRUCTURE.
- BEDDING SHALL BE LIGHTLY AND UNIFORMLY COMPACTED.
- THE STONE BED SHALL BE LEVELED IN ACCORDANCE WITH GRADES SHOWN ON THE PLANS. WHEN CHECKED WITH A TRANSIT/LASER LEVEL, THE ELEVATION SHALL NOT VARY MORE THAN 1/4 INCH (+/-) FROM THE SPECIFIED ELEVATION.

5.0 INSTALLATION OF PRECAST SYSTEM

ROTONDO ENVIRONMENTAL SOLUTIONS SHALL HAVE A QUALIFIED TECHNICIAN ON SITE DURING THE INSTALLATION PROCESS TO INSURE THAT THE PRECAST SECTIONS ARE INSTALLED PER MANUFACTURER'S REQUIREMENTS. ROTONDO SHALL PROVIDE CERTIFICATION THAT THE PRECAST CONCRETE ELEMENTS ARE INSTALLED IN ACCORDANCE WITH THE APPROVED PLANS AND TO MANUFACTURER'S REQUIREMENTS. ROTONDO IS NOT RESPONSIBLE FOR THE LOCATION OR ELEVATION OF THE STRUCTURE OR FOR PROVIDING CERTIFICATION FOR THE SUBGRADE OR BACKFILL PROCESS. A LICENSED SOILS ENGINEER SHALL BE RESPONSIBLE FOR THE CERTIFICATION THAT THE SUBGRADE AND STRUCTURE BEDDING AS WELL AS THE BACKFILL PROCESS AND MATERIALS MEET THE REQUIRED SPECIFICATIONS.

TO ENSURE A QUALITY ASSEMBLY OF THE PRECAST STORMPOD SYSTEM, THE INSTALLATION OF PERIMETER AND INTERIOR ELEMENTS SHOULD BE INSTALLED SIMULTANEOUSLY WHILE MONITORING ELEVATIONS, ALIGNMENT AND MINIMIZING GAPS IN JOINTS. IT IS IMPORTANT TO START AT ONE POINT AND MIGRATE ACROSS THE SYSTEM DRAWING ALL SECTIONS INWARD.

5.1 PLACEMENT OF POD ASSEMBLIES

- EACH STORMPOD ASSEMBLY CONSISTS OF AN ARCH SECTION ATTACHED TO A SINGLE PRECAST FLOOR SLAB. THE ARCH SECTION IS ATTACHED TO THE PRECAST FLOOR SLAB AT THE PRECAST FACILITY PRIOR TO DELIVERY TO THE JOBSITE.
- IDENTIFY THE CRITICAL BENCH MARK LOCATION TO BEGIN THE INSTALLATION OF PRECAST ELEMENTS. TYPICALLY, THIS LOCATION WOULD BE AT THE OUTLET OR ANOTHER CRITICAL POINT WHERE GROWTH AND ALIGNMENT ARE A CONCERN.
- TO ENSURE CORRECT INSTALLATION OF THE PRECAST STORMPOD SYSTEM, THE OUTER PERIMETER BARREL SHOULD BE MARKED USING A PRE-PLACED STRING-LINE PLACED AT THE TOP OF THE STONE BED OFFSET ALONG THE SIDE OF THE ARCH BARREL. SECURE STRING-LINE WITH WOOD STAKES PLACED AT EACH END OF THE BARREL WITH THE TOP OF THE STAKE SET TO APPROXIMATELY 3 INCHES ABOVE THE REQUIRED BED ELEVATION. FASTEN THE STRING-LINE TO THE STAKE BY STAPLING TO THE TOP OF THE STAKE.
- TO ESTABLISH PROPER EXTERIOR WALL ALIGNMENT FOR THE STRUCTURE, START INSTALLING PERIMETER POD SECTIONS IN EITHER DIRECTION UNTIL PROPER ALIGNMENT AND GROWTH HAS BEEN CONFIRMED. MEASURE FROM OFFSET STRING LINE TO MONITOR ALIGNMENT. ELEVATIONS AND LEVELNESS MUST ALSO BE MONITORED AND ADJUSTED AT ALL TIMES WHEN INSTALLING POD UNITS.

- WHEN INSTALLING THE POD UNITS, REMOVE ENOUGH STONE WHERE SECTIONS ARE DRAWN TOGETHER WHICH MAY PREVENT SECTIONS FROM TOUCHING. EACH SECTION MUST THEN BE DRAWN TOGETHER TIGHT, USING THE 1.5-TON RATCHET LEVER CHAIN HOISTS, TO MINIMIZE GAPS AND ENGAGE THE ALIGNMENT TONGUE AND GROOVES. VERIFY THE INVERT ELEVATIONS AT EACH JOINT AND FOLLOW THE LEVELING PROCEDURES IN PREVIOUS STEP.
- ONCE ACCEPTABLE, REPEAT THE PREVIOUS STEPS MIGRATING ACROSS THE SYSTEM TO ONE COMMON POINT.

- INSTALL ENDWALL PANELS BY BOLTING ONTO END OF STORMPOD MODULE.
- ONCE PRECAST ELEMENTS HAVE BEEN INSTALLED, WRAP EXTERIOR VERTICAL JOINTS WITH JOINT TAPE MATERIAL. THIS MATERIAL IS USED TO PREVENT FINES FROM PASSING THROUGH AND PROVIDE A SILT-TIGHT JOINT.

- IF THE SYSTEM IS REQUIRED TO BE WATER-TIGHT, ONCE THE PRECAST ELEMENTS HAVE BEEN INSTALLED, MAKE SURE ALL INTERIOR JOINT SURFACES ARE CLEAN AND FREE FROM DIRT/DEBRIS. STARTING WITH THE BOTTOM SECTION JOINTS, APPLY A CONTINUOUS UNIFORM BEAD OF SIKAFLEX 2CNS POLYURETHANE ELEASTOMERIC SEALANT.
- SYSTEM JOINTS TO BE SEALED AND MADE WATERTIGHT BY MANUFACTURER.

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SCALE: NTS
JOB NO.: ----

PROJECT: LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

CUSTOMER: ----

DWG. NO. L-7

SHT.

6.0 BACKFILL

A LICENSED SOILS ENGINEER SHALL BE RESPONSIBLE FOR THE CERTIFICATION THAT THE SUBGRADE AND STRUCTURE BEDDING AS WELL AS THE BACKFILL PROCESS AND MATERIALS MEET THE REQUIRED SPECIFICATIONS.

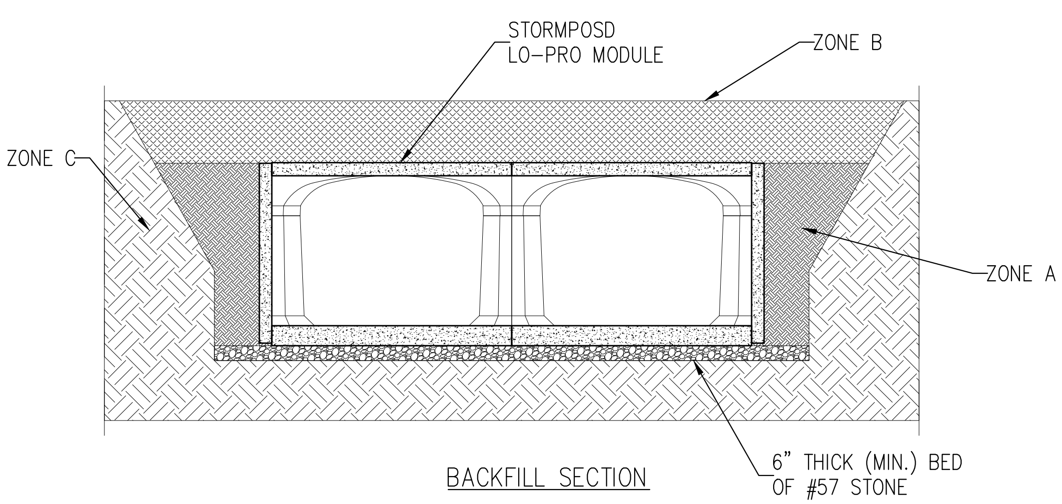
6.1 DO NOT PERFORM BACKFILLING DURING WET OR FREEZING WEATHER.

6.2 NO BACKFILL SHALL BE PLACED AGAINST ANY STRUCTURAL ELEMENTS UNTIL THE BACKFILL MATERIAL HAS BEEN APPROVED BY THE SITE SOILS ENGINEER.

6.3 CONSTRUCTION VEHICLES HEAVIER THAN A CATERPILLAR D-4 ARE NOT ALLOWED OVER THE STRUCTURE WHEN BACKFILL DEPTH IS LESS THAN 2 FEET OVER THE STRUCTURE CROWN. LIGHTWEIGHT DOZERS MAY BE OPERATED OVER UNITS HAVING 2 FEET OF COMPACTED COVER, BUT HEAVY EARTH MOVING EQUIPMENT (LARGER THAN A CAT D-4 DOZER WEIGHING IN EXCESS OF 12 TONS AND HAVING TRACK PRESSURES OF 8 PSI OR GREATER) SHALL REQUIRE A MINIMUM OF 4 FEET OF COVER. IN NO CASE SHALL EQUIPMENT OPERATING IN EXCESS OF THE DESIGN LOAD HL-93 BE PERMITTED OVER THE STRUCTURE UNLESS APPROVED BY ROTONDO ENVIRONMENTAL SOLUTION'S ENGINEER.

6.4 BACKFILL ZONES
- ZONE A – FILL THAT IS DIRECTLY AGAINST THE STRUCTURE AROUND THE OUTSIDE PERIMETER OF THE STRUCTURE.
- ZONE B – FILL THAT IS PLACED DIRECTLY OVER THE TOP OF THE STRUCTURE
- ZONE C – CONSTRUCTED EMBANKMENT OR OVERFILL

6.5 REQUIRED BACKFILL PROPERTIES
- ZONE A – GENERALLY, SOILS SHALL BE REASONABLY FREE OF ORGANIC MATTER, AND FREE OF STONES LARGER THAN 3-INCHES IN DIAMETER NEAR CONCRETE SURFACES.
- ZONE B – GENERALLY, SOILS SHALL BE REASONABLY FREE OF ORGANIC MATTER, AND FREE OF STONES LARGER THAN 3-INCHES IN DIAMETER NEAR CONCRETE SURFACES.
- ZONE C –SHALL BE REGULAR BACKFILL MATERIAL.
- IN-SITU SOIL – NATURAL GROUND IS TO BE SUFFICIENTLY STABLE TO ALLOW EFFECTIVE SUPPORT TO THE PRECAST CONCRETE STRUCTURE.



BACKFILL SECTION

6.6 BACKFILL SEQUENCE
- PHASE 1 – BACKFILL ZONE A TO TOP OF STRUCTURE AROUND THE ENTIRE PERIMETER OF STRUCTURE TO THE DIMENSIONS SHOWN.
- PHASE 2 – BACKFILL ZONE B ON TOP OF THE STRUCTURE TO THE DIMENSION SHOWN.

6.7 PLACING AND COMPACTING BACKFILL AROUND STRUCTURE – ZONE A
- DUMPING OF BACKFILL MATERIAL IS NOT ALLOWED ANY NEARER THAN 3 FT FROM THE SIDE OF THE STRUCTURE.
- THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING 6 INCHES IN THICKNESS, LOOSE MEASUREMENT. THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL AROUND THE PERIMETER OF THE STRUCTURE MUST NOT EXCEED 2 FEET.
- EACH LAYER SHALL BE COMPACTED WITHIN A TOLERANCE OF OMC (OPTIMUM MOISTURE CONTENT) TO OMC+2 POINTS TO A DENSITY OF AT LEAST 95% OF THE THEORETICAL DENSITY.
- EACH LAYER SHALL BE COMPACTED BY ROLLING, TAMPING WITH MECHANICAL RAMMERS OR PNEUMATIC BACKFILL TAMPERS, OR HAND TAMPING WITH HEAVY METAL TAMPERS WITH A FACE OF AT LEAST 25 SQUARE INCHES. IF VIBRATORY ROLLERS ARE USED IN THE BACKFILL OPERATIONS, VIBRATORY MOTORS SHALL NOT BE ACTIVATED UNTIL AT LEAST 4 FEET OF BACKFILL HAS BEEN PLACED AND COMPACTED OVER THE TOP OF THE STRUCTURE.

6.8 PLACING AND COMPACTING BACKFILL ON TOP OF STRUCTURE – ZONE B
- DUMPING BACKFILL MATERIAL IS NOT ALLOWED ON TOP OF THE STRUCTURE. BACKFILL MATERIAL SHALL BE DUMPED NO CLOSER THAN 3 FEET FROM THE OUTSIDE PERIMETER OF THE STRUCTURE AND SPREAD ACROSS THE TOP OF THE STRUCTURE USING LIGHT EQUIPMENT SUCH AS A LIGHT DOZER OR BOBCAT.
- THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING 6 INCHES THICKNESS, LOOSE MEASUREMENT.
- EACH LAYER SHALL BE COMPACTED WITHIN A TOLERANCE OF OMC (OPTIMUM MOISTURE CONTENT) TO OMC+2 POINTS TO A DENSITY OF AT LEAST 95% OF THE THEORETICAL DENSITY.
- EACH LAYER MATERIAL SHALL BE COMPACTED BY ROLLING, TAMPING WITH MECHANICAL RAMMERS OR PNEUMATIC BACKFILL TAMPERS, OR HAND TAMPING WITH HEAVY METAL TAMPERS WITH A FACE OF AT LEAST 25 SQUARE INCHES. IF VIBRATORY ROLLERS ARE USED IN THE BACKFILL OPERATIONS, VIBRATORY MOTORS SHALL NOT BE ACTIVATED UNTIL AT LEAST 4 FEET OF BACKFILL HAS BEEN PLACED AND COMPACTED OVER THE TOP OF THE STRUCTURE.

REVISIONS	
NO	DATE
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StormPod®
UNIVERSAL STORMWATER MANAGEMENT SYSTEM
by ROTONDO
www.Rotondo-ES.com
US PATENT # 9580899 B2

DRAWN BY:	PAS
CHECKED BY:	JAR
DATE:	09/07/2022
SCALE:	NTS
JOB NO.:	----

PROJECT:
LO-PRO STORMPOD - STORMFILTER
NEW JERSEY WIND PORT - PHASE 2
SALEM, NJ

CUSTOMER: ----

DWG. NO. L-8

SHT.

CONTECH ENGINEERED SOLUTIONS

filterra

NJWP Substation
10/23/22

Sizing Basis:
Filterra High Capacity biofiltration system has received final certification from the NJDEP for 80% TSS removal. Per the NJDEP, Filterra HC is considered a Green Infrastructure (GI) MTD. The sizing for the Filterra HC system under NJDEP regulations is based on the methodology outlined in Chapter 5 of the NJDEP BMP Manual. The NRCS method is utilized to determine a water quality flow rate for the drainage area in question. To validate the sizing, the parameters below were assumed.

Design Parameters:
Design Storm = NJDEP Water Quality Design Storm (1.25-inch/2-hour storm event)
Filterra HC Media Flow Rate = 300 inches/hour
Allowable Ponding in Filterra = 9”

Design Summary:
Utilizing NRCS Method and HydroCAD software, a hydrograph can be derived to represent the design storm. As seen in the provided HydroCAD report, the WQ flow is routed to an appropriately sized Filterra unit. Since the Filterra system can provide up to 9” of ponding, some flow attenuation is possible. The Filterra system is able to accommodate a portion of the water quality volume in the head space above the media and release it at the system’s NJDEP certified maximum treatment flow rate.

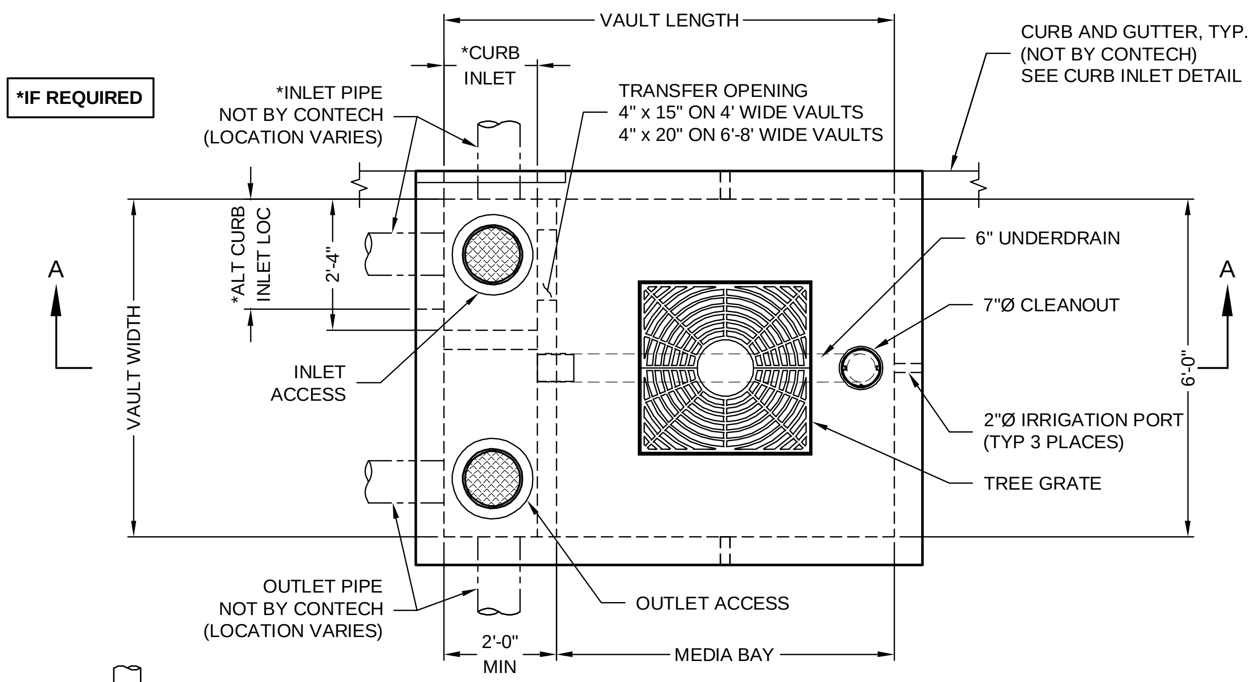
Drainage Area ID	Impervious Drainage Area (ac)	Filterra HC Model Analyzed
1	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
2	0.25	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
3	0.31	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
4	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
5	0.25	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
6	0.28	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
7	0.31	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
8	0.32	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
9	0.31	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
10	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
11	0.25	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
12	0.29	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
13	0.27	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
14	0.29	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
15	0.19	6'x10' Peak Diversion Filterra HC (6'x12' vault)
16	0.19	6'x10' Peak Diversion Filterra HC (6'x12' vault)
17	0.25	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
18	0.31	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
19	0.27	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
20	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
23	0.32	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
26	0.23	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
27	0.26	8'x10.5' Peak Diversion Filterra HC (8'x14' vault)
28	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
29	0.30	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
54	0.15	14’x8’ Standard Offline Filterra HC
55	0.17	

56	0.14	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
57	0.14	
58	0.14	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
59	0.15	
60	0.17	8'x12.5' Peak Diversion Filterra HC (8'x16' vault)
61	0.14	
62	0.14	6'x8' Peak Diversion Filterra HC (6'x10' vault)
63	0.20	7'x10' Peak Diversion Filterra HC (7'x13' vault)
Substation Area	0.59	14'x8' Offline Filterra HC Bioscape vault

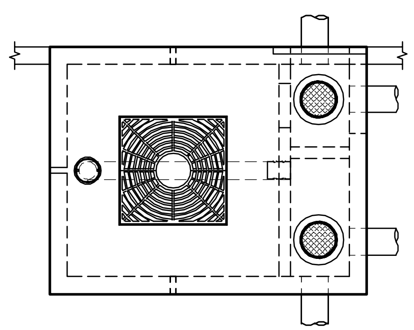
Thank you for the opportunity to present this to you and your client. Please do not hesitate to contact me should you have any additional questions.

Sincerely,

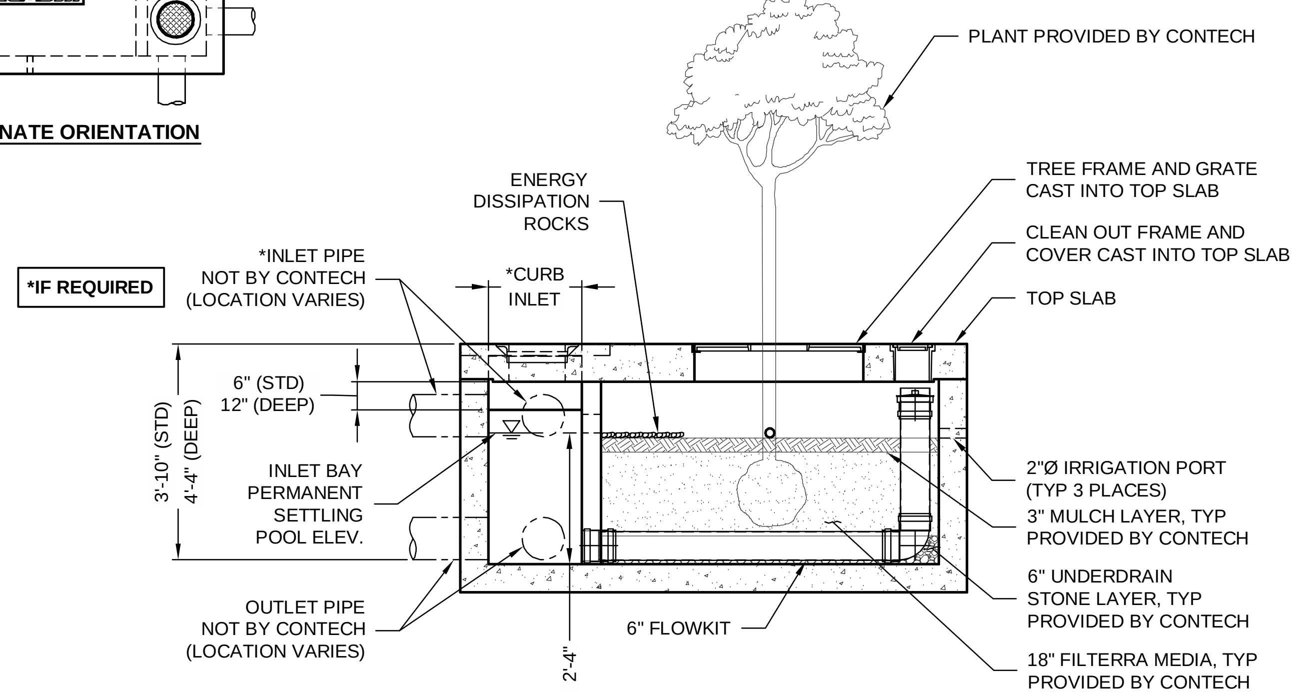
Taylor Murdock
Stormwater Design Engineer
Contech Engineered Solutions, LLC.



PLAN VIEW



ALTERNATE ORIENTATION



SECTION A-A
(STANDARD DEPTH SHOWN)

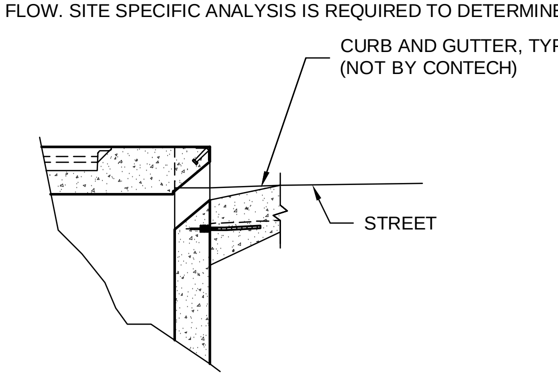
FTPD-HC STANDARD HEIGHT CONFIGURATION

DESIGNATION (OPTIONS: -P, -T, -PT)	DESIGNATION (OPTIONS: -P, -T, -PT)	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR LENGTH/ MAX CURB OPENING	*MAX BYPASS FLOW (CFS)	INLET/ OUTLET ACCESS DIA	TREE GRATE QTY & SIZE
FTPD0404-HC	ALL	4 x 4	4 x 6	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0406-HC	N/A DE, MD, NJ, PA, VA, WV	4 x 6	4 x 8	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD045058-HC	DE, MD, NJ, PA, VA, WV ONLY	4.5 x 5.83	4.5 x 7.83	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0604-HC	ALL	6 x 4	6 x 6	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0606-HC	ALL	6 x 6	6 x 8	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0608-HC	ALL	6 x 8	6 x 10	1'-8"	1.4	12"/12"	(1) 4' x 4'
FTPD0610-HC	ALL	6 x 10	6 x 12	1'-8"	1.4	12"/12"	(1) 4' x 4'
FTPD0710-HC	ALL	7 x 10	7 x 13	2'-6"	2.1	24"/24"	(1) 4' x 4'
FTPD08105-HC	ALL	8 x 10.5	8 x 14	3'-0"	2.5	24"/24"	(1) 4' x 4'
FTPD08125-HC	N/A OR, WA	8 x 12.5	8 x 16	3'-0"	2.5	24"/24"	(2) 4' x 4'
FTPD09115-HC	OR, WA ONLY	9 x 11.5	9 x 15	3'-0"	2.5	24"/24"	(2) 4' x 4'
N/A = NOT AVAILABLE							

FTPD-D-HC DEEP OPTION CONFIGURATION

DESIGNATION (OPTIONS: -P, -T, -PT)	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR LENGTH/ MAX CURB OPENING	*MAX BYPASS FLOW (CFS)	INLET/ OUTLET ACCESS DIA	TREE GRATE QTY & SIZE
FTPD0404-D-HC	ALL	4 x 4	4 x 6	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0406-D-HC	N/A DE, MD, NJ, PA, VA, WV	4 x 6	4 x 8	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD045058-D-HC	DE, MD, NJ, PA, VA, WV ONLY	4.5 x 5.83	4.5 x 7.83	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0604-D-HC	ALL	6 x 4	6 x 6	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0606-D-HC	ALL	6 x 6	6 x 8	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0608-D-HC	ALL	6 x 8	6 x 10	1'-8"	4.6	12"/12"	(1) 4' x 4'
FTPD0610-D-HC	ALL	6 x 10	6 x 12	1'-8"	4.6	12"/12"	(1) 4' x 4'
FTPD0710-D-HC	ALL	7 x 10	7 x 13	2'-6"	6.8	24"/24"	(1) 4' x 4'
FTPD08105-D-HC	ALL	8 x 10.5	8 x 14	3'-0"	8.2	24"/24"	(1) 4' x 4'
FTPD08125-D-HC	N/A OR, WA	8 x 12.5	8 x 16	3'-0"	8.2	24"/24"	(2) 4' x 4'
FTPD09115-D-HC	OR, WA ONLY	9 x 11.5	9 x 15	3'-0"	2.5	24"/24"	(2) 4' x 4'
N/A = NOT AVAILABLE							

*MAX BYPASS FLOW IS INTERNAL WEIR FLOW. SITE SPECIFIC ANALYSIS IS REQUIRED TO DETERMINE CURB INLET FLOW CAPACITY



CURB INLET DETAIL

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING UPON OUTLET LOCATION.

filterra

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,277,274; 6,569,321; 7,625,485; 7,425,261; 7,833,412; RELATED FOREIGN PATENTS.

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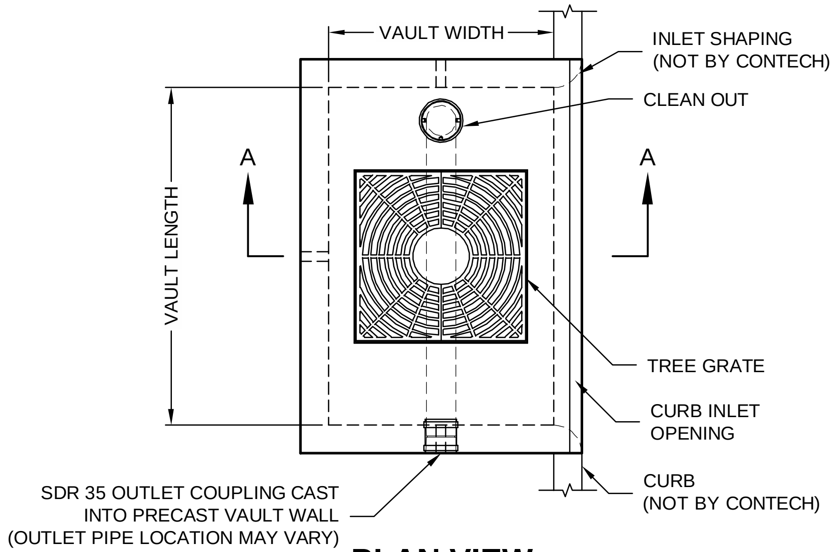
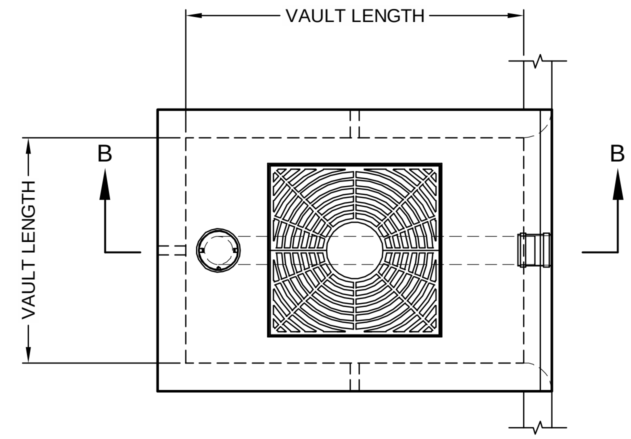
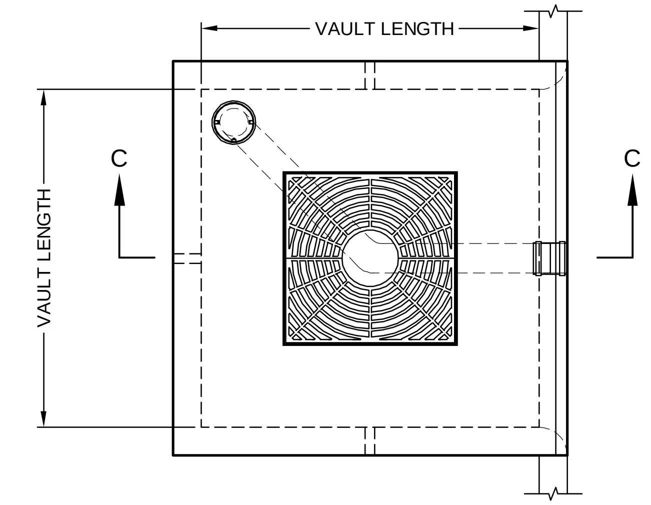
800-338-1122 513-645-7000 513-645-7993 FAX

FILTERRA HC PEAK DIVERSION (FTPD-HC) CONFIGURATION DETAIL

I:\STORMWATER\COMMOPS\54 FILTERRA\40 STANDARD DRAWINGS\FT-HC - FILTERRA HC (NEW JERSEY ONLY)\FTPD-HC - FILTERRA PEAK DIVERSION CONFIG DTL.DWG 9/8/2022 11:36 AM



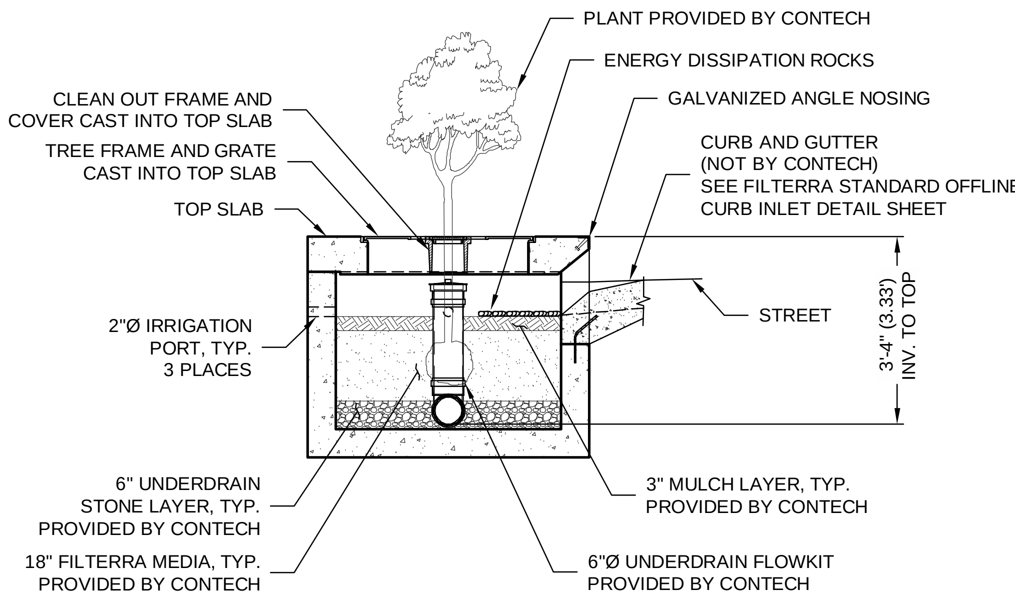




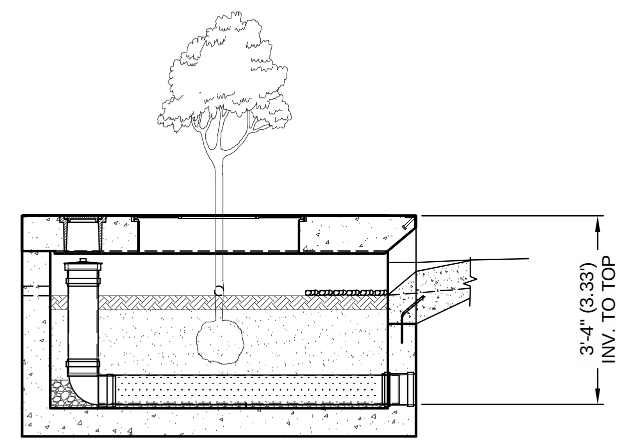
PLAN VIEW

PLAN VIEW

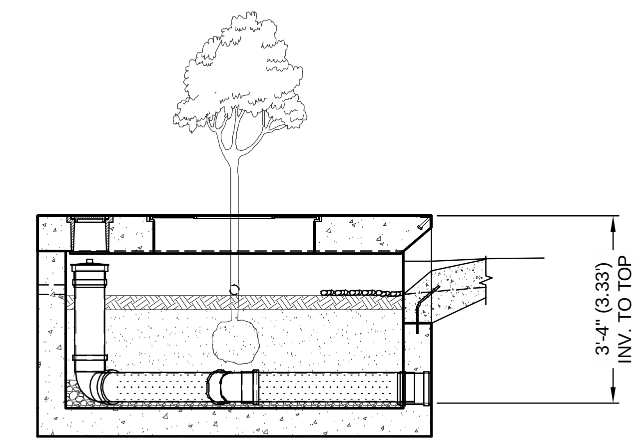
PLAN VIEW



SECTION A-A



SECTION B-B



SECTION C-C

FT-HC LONG SIDE INLET CONFIGURATION

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	OUTLET PIPE DIA	TREE GRATE QTY & SIZE
FT0604-HC	ALL	6 x 4	6 x 4	6" SDR 35	(1) 3' x 3'
FT078045-HC	DE, MD, NJ, PA, VA, WV ONLY	7.83 x 4.5	7.83 x 4.5	6" SDR 35	(1) 3' x 3'
FT0804-HC	N/A DE, MD, NJ, PA, VA, WV	8 x 4	8 x 4	6" SDR 35	(1) 3' x 3'
FT0806-HC	ALL	8 x 6	8 x 6	6" SDR 35	(1) 4' x 4'
FT1006-HC	ALL	10 x 6	10 x 6	6" SDR 35	(1) 4' x 4'
FT1206-HC	ALL	12 x 6	12 x 6	6" SDR 35	(2) 4' x 4'
FT1307-HC	ALL	13 x 7	13 x 7	6" SDR 35	(2) 4' x 4'
FT1408-HC	CALL CONTECH	14 x 8	14 x 8	6" SDR 35	(2) 4' x 4'
FT1509-HC	CALL CONTECH	15 x 9	15 x 9	6" SDR 35	(2) 4' x 4'
FT1608-HC	CALL CONTECH	16 x 8	16 x 8	6" SDR 35	(2) 4' x 4'
FT1808-HC	CALL CONTECH	18 x 8	18 x 8	6" SDR 35	(2) 4' x 4'
FT2008-HC	CALL CONTECH	20 x 8	20 x 8	6" SDR 35	(3) 4' x 4'
FT2208-HC	CALL CONTECH	22 x 8	22 x 8	6" SDR 35	(3) 4' x 4'

N/A = NOT AVAILABLE

FT-HC SHORT SIDE INLET CONFIGURATION

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	OUTLET PIPE DIA	TREE GRATE QTY & SIZE
FT0406-HC	ALL	4 x 6	4 x 6	6" SDR 35	(1) 3' x 3'
FT0408-HC	N/A DE, MD, NJ, PA, VA, WV	4 x 8	4 x 8	6" SDR 35	(1) 3' x 3'
FT045078-HC	DE, MD, NJ, PA, VA, WV ONLY	4.5 x 7.83	4.5 x 7.83	6" SDR 35	(1) 3' x 3'
FT0608-HC	ALL	6 x 8	6 x 8	6" SDR 35	(1) 4' x 4'
FT0610-HC	ALL	6 x 10	6 x 10	6" SDR 35	(1) 4' x 4'
FT0612-HC	ALL	6 x 12	6 x 12	6" SDR 35	(2) 4' x 4'
FT0713-HC	ALL	7 x 13	7 x 13	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

FT-HC SQUARE INLET CONFIGURATION

DESIGNATION	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	OUTLET PIPE DIA	TREE GRATE QTY & SIZE
FT0404-HC	ALL	4 x 4	4 x 4	6" SDR 35	(1) 3' x 3'
FT0606-HC	ALL	6 x 6	6 x 6	6" SDR 35	(1) 3' x 3'

N/A = NOT AVAILABLE

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING UPON OUTLET LOCATION.

filterra®

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,277,274; 6,569,321; 7,625,485; 7,425,261; 7,833,412; RELATED FOREIGN PATENTS.

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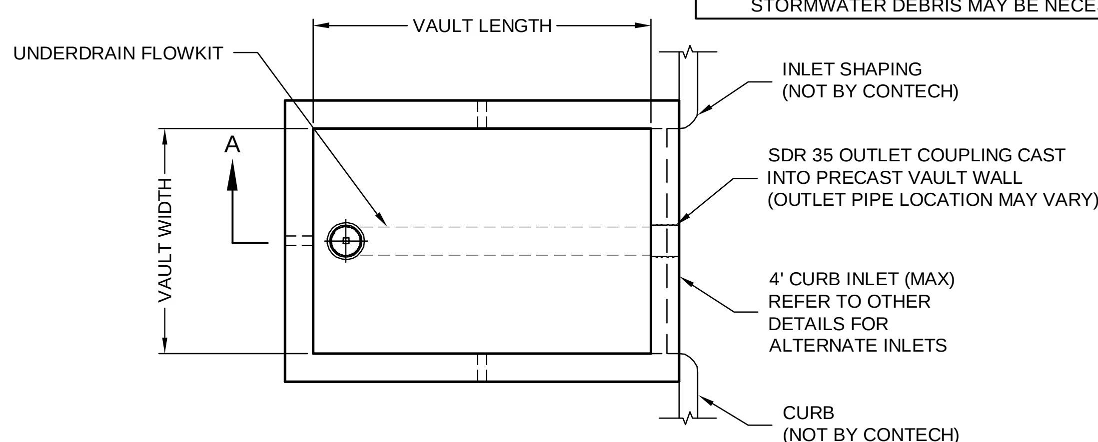
FILTERRA HC OFFLINE (FT-HC)
CONFIGURATION DETAIL

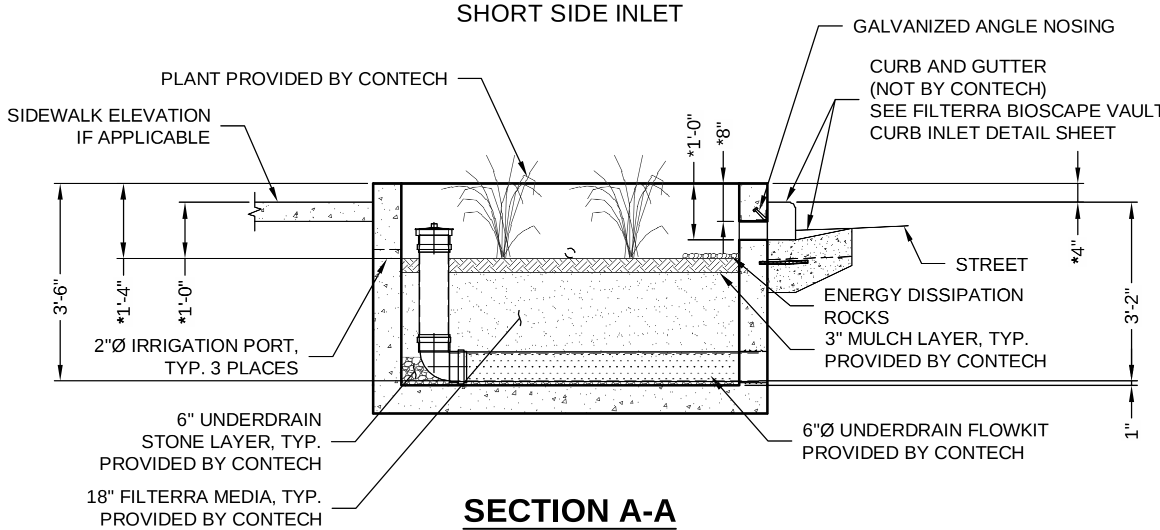
DIMENSIONS PRECEDED BY " * " ARE CRITICAL AND MAY NOT BE MODIFIED WITHOUT CONSULTING CONTECH

AS WITH ALL OPEN TOP BIORETENTION SYSTEMS, FILTERRA BIOSCAPE IS OPEN TO THE ATMOSPHERE WITH A MEDIA SURFACE RECESSED BELOW FINISHED GRADE. CONTRACTOR OR OWNER IS RESPONSIBLE FOR PROVIDING ANY REQUIRED SAFETY MEASURES AROUND SYSTEM PERIMETER. TO MAINTAIN AESTHETICS, REMOVAL OF HEAVY STORMWATER DEBRIS MAY BE NECESSARY BETWEEN REGULAR FILTERRA SYSTEM MAINTENANCE EVENTS.



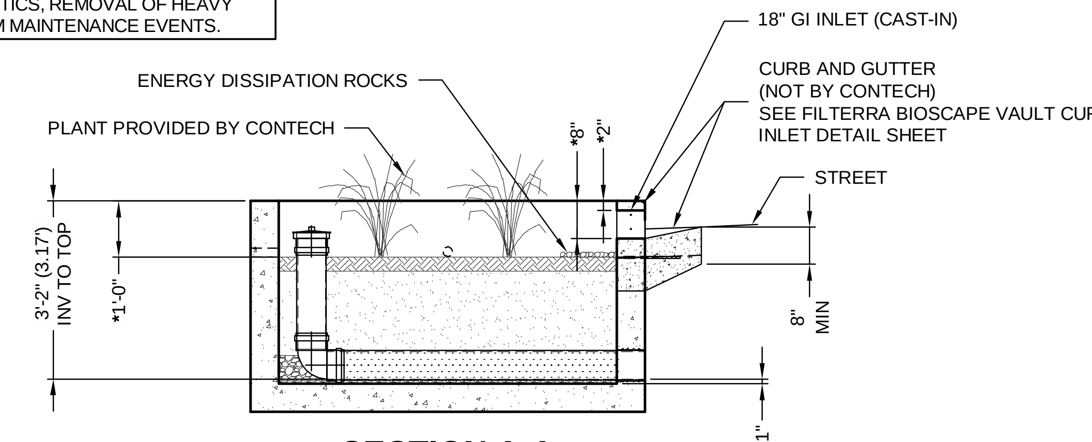
PLAN VIEW

SHORT SIDE INLET



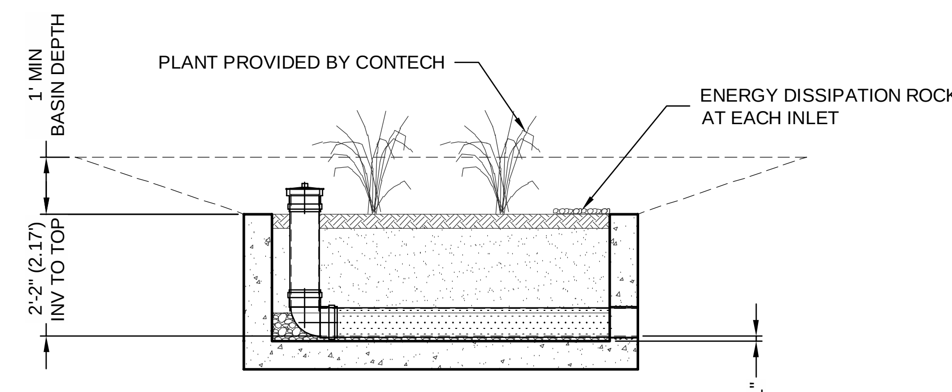
SECTION A-A

SLOTTED THROAT INLET



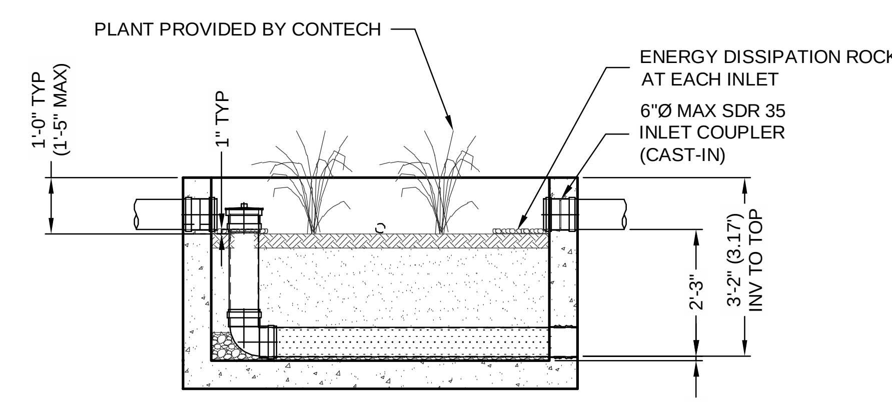
SECTION A-A

GREEN INFRASTRUCTURE INLET - TOP FLUSH WITH TOP OF CURB, NOT INTENDED FOR SIDEWALK APPLICATIONS



SECTION A-A

BASIN - CURB INLET OR PIPE INLETS OPTIONAL



SECTION A-A

PIPE INLET

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING ON VAULT SIZE.

FTBSV-HC CONFIGURATION

(OPTIONS: BASIN "-B", GREEN INFR. INLET "-I", PIPE INLET "-P", SLOTTED THROAT INLET "-T")

MEDIA BAY SIZE	VAULT SIZE (L x W)	LONG SIDE INLET DESIGNATION	SHORT SIDE INLET DESIGNATION	AVAILABILITY	OUTLET PIPE DIA	MIN. NO. OF INLET PIPES (-P ONLY)
4 x 4	4 x 4	FTBSV0404-HC	FTBSV0404-HC	ALL	6" SDR 35	1
6 x 4	6 x 4	FTBSV0604-HC	FTBSV0406-HC	ALL	6" SDR 35	1
7.83 x 4.5	7.83 x 4.5	FTBSV078045-HC	FTBSV045078-HC	DE,MD,NJ,PA,VA,WV ONLY	6" SDR 35	1
8 x 4	8 x 4	FTBSV0804-HC	FTBSV0408-HC	N/A DE,MD,NJ,PA,VA,WV	6" SDR 35	1
6 x 6	6 x 6	FTBSV0606-HC	FTBSV0606-HC	ALL	6" SDR 35	1
8 x 6	8 x 6	FTBSV0806-HC	FTBSV0608-HC	ALL	6" SDR 35	1
10 x 6	10 x 6	FTBSV1006-HC	FTBSV0610-HC	ALL	6" SDR 35	2
12 x 6	12 x 6	FTBSV1206-HC	FTBSV0612-HC	ALL	6" SDR 35	2
13 x 7	13 x 7	FTBSV1307-HC	FTBSV0713-HC	ALL	6" SDR 35	2
14 x 8	14 x 8	FTBSV1408-HC†	N/A	ALL	6" SDR 35	3
16 x 8	16 x 8	FTBSV1608-HC†	N/A	N/A OR,WA	6" SDR 35	3
15 x 9	15 x 9	FTBSV1509-HC†	N/A	OR,WA ONLY	6" SDR 35	3
18 x 8	18 x 8	FTBSV1808-HC†	N/A	CALL CONTECH	6" SDR 35	3
20 x 8	20 x 8	FTBSV2008-HC†	N/A	CALL CONTECH	6" SDR 35	4
22 x 8	22 x 8	FTBSV2208-HC†	N/A	CALL CONTECH	6" SDR 35	4

†UTILIZES (2) CURB OPENINGS WITH MIN 1' SPACING

N/A = NOT AVAILABLE

filterra

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,277,274; 6,569,321; 7,625,485; 7,425,261; 7,833,412; RELATED FOREIGN PATENTS.

CONTECH®
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FILTERRA HC BIOSCAPE VAULT STANDARD OFFLINE (FTBSV-HC) CONFIGURATION DETAIL

I:\STORMWATER\COMMOPS\54 FILTERRA\40 STANDARD DRAWINGS\FT-HC - FILTERRA HC (NEW JERSEY ONLY)\FTBSV-HC - FILTERRA BIOSCAPE VAULT OFFLINE CONFIG DTL.DWG 9/8/2022 11:20 AM

Summary for Subcatchment 1S: DA 1

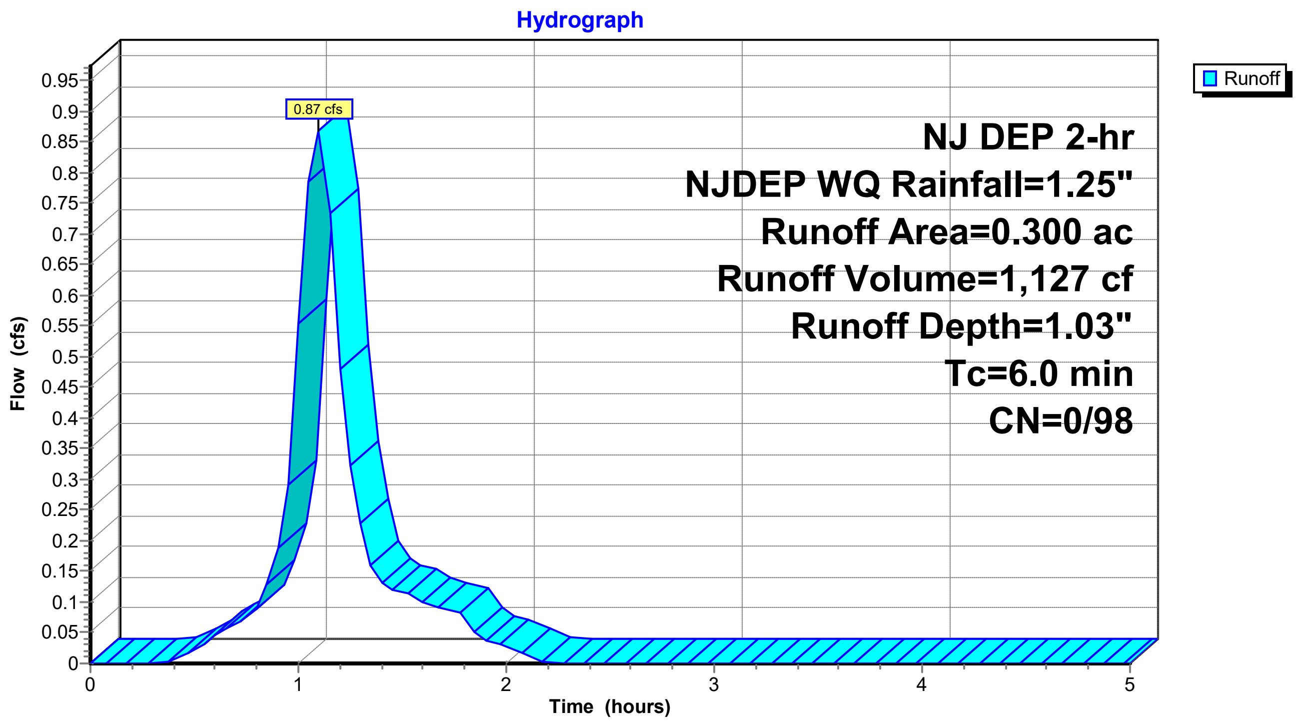
Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 1P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: DA 1



Summary for Pond 1P: Filterra 8x12.5

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 951 cf, Atten= 20%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 951 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

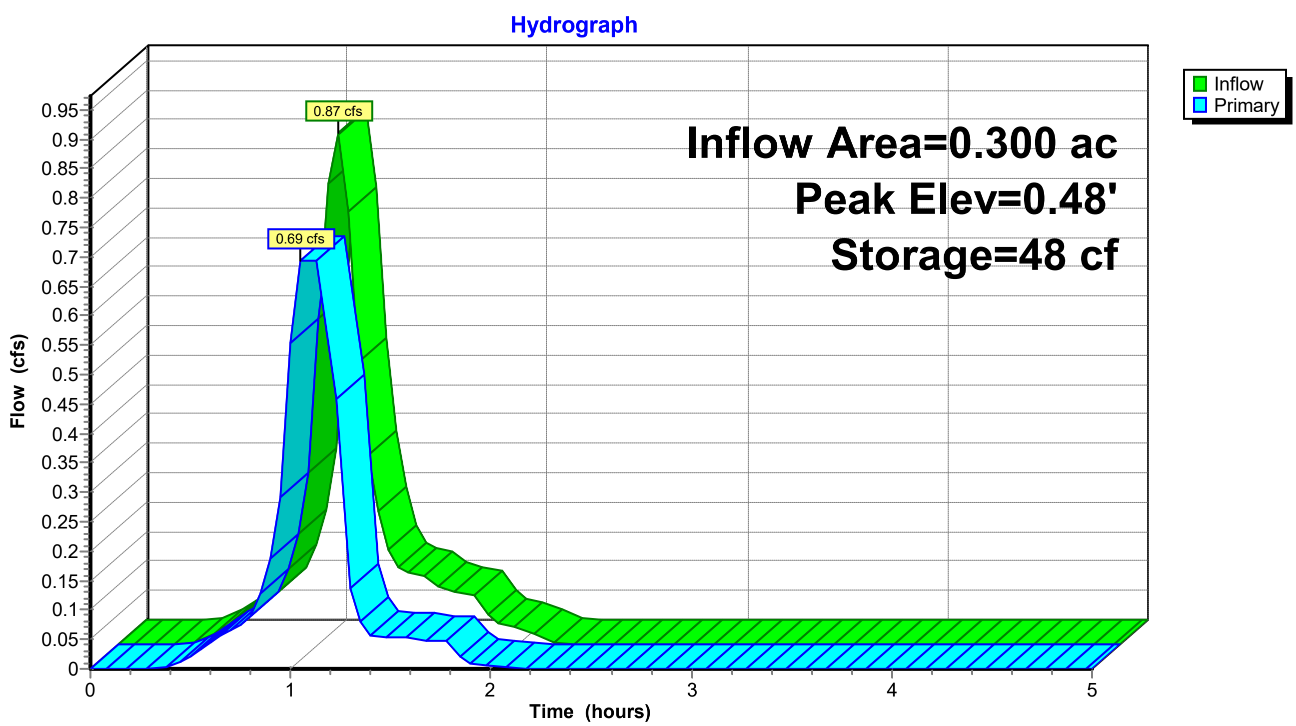
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 1P: Filterra 8x12.5



Summary for Subcatchment 2S: DA 2

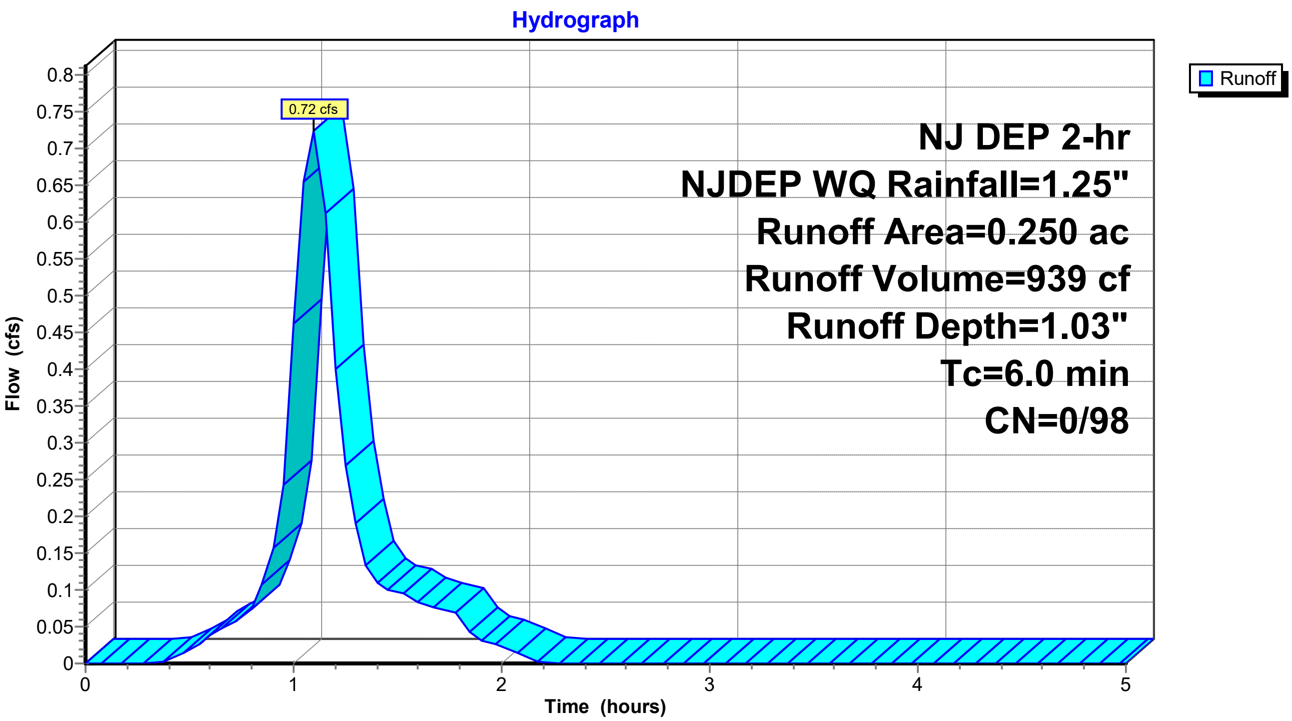
Runoff = 0.72 cfs @ 1.09 hrs, Volume= 939 cf, Depth= 1.03"
Routed to Pond 2P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.250	98	
	0.250	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: DA 2



Summary for Pond 2P: Filterra 8x10.5

Inflow Area =	0.250 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event		
Inflow =	0.72 cfs @	1.09 hrs,	Volume=	939 cf	
Outflow =	0.58 cfs @	1.05 hrs,	Volume=	701 cf,	Atten= 19%, Lag= 0.0 min
Primary =	0.58 cfs @	1.05 hrs,	Volume=	701 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.45' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 38 cf

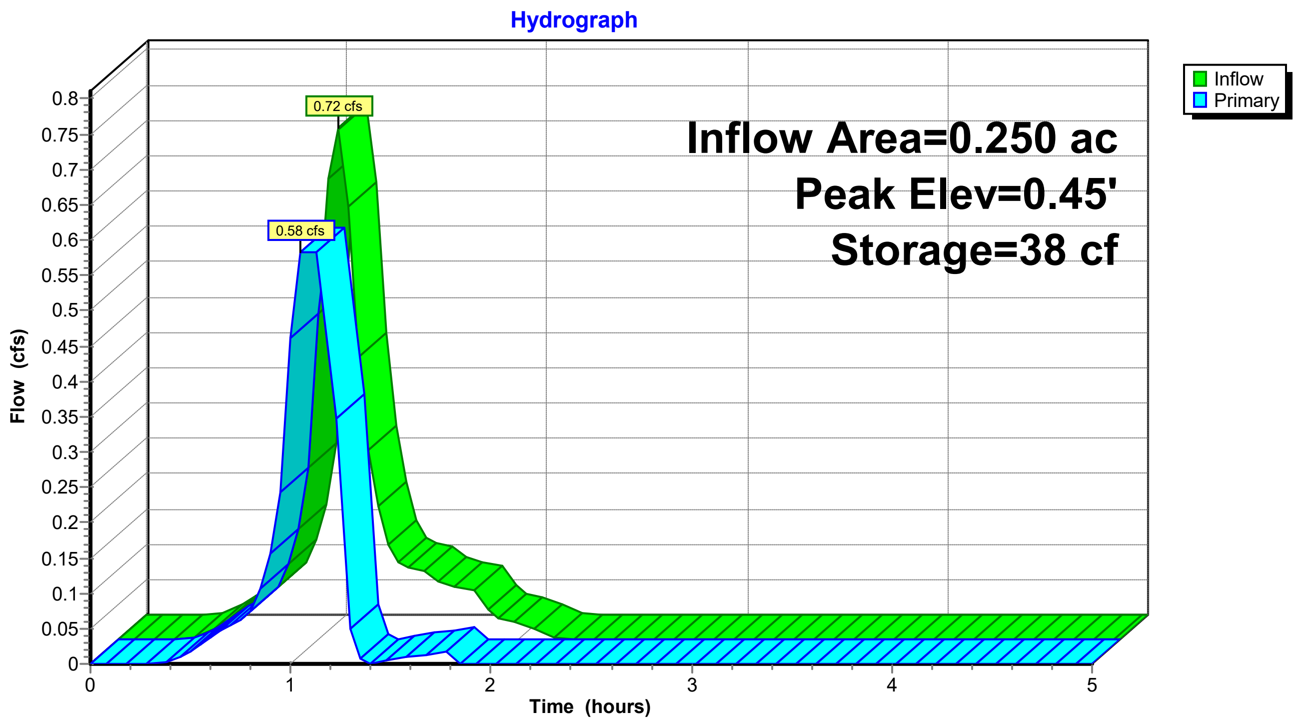
Plug-Flow detention time= 1.2 min calculated for 701 cf (75% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 2P: Filterra 8x10.5



Summary for Subcatchment 3S: DA 3

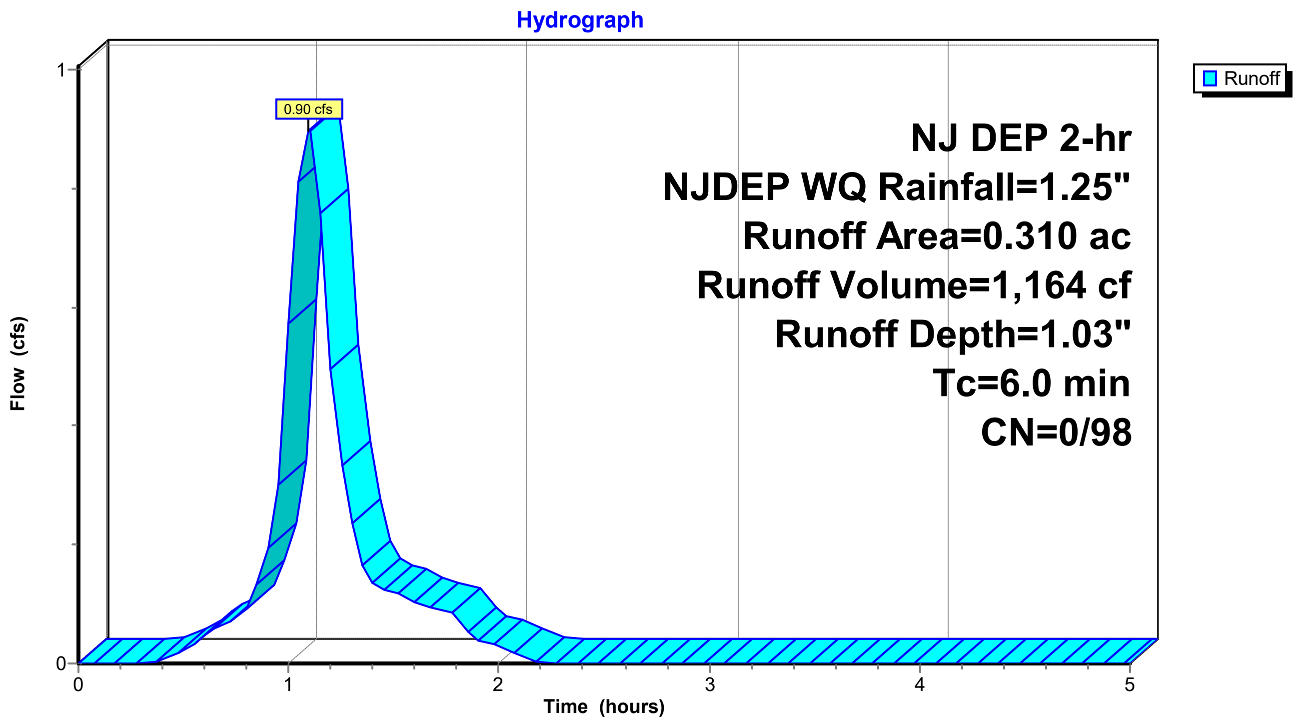
Runoff = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf, Depth= 1.03"
Routed to Pond 3P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.310	98	
	0.310	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3S: DA 3



Summary for Pond 3P: Filterra 8x12.5

Inflow Area = 0.310 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf, Atten= 23%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.59' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 59 cf

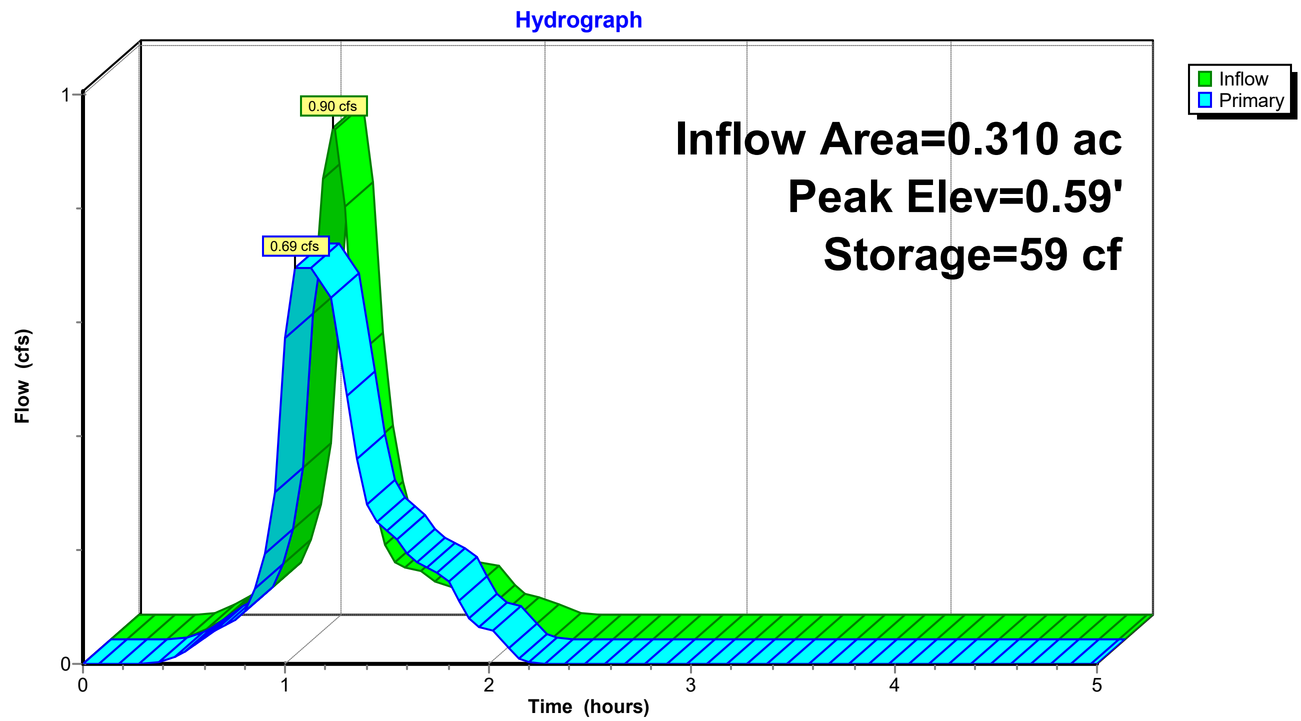
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 3P: Filterra 8x12.5



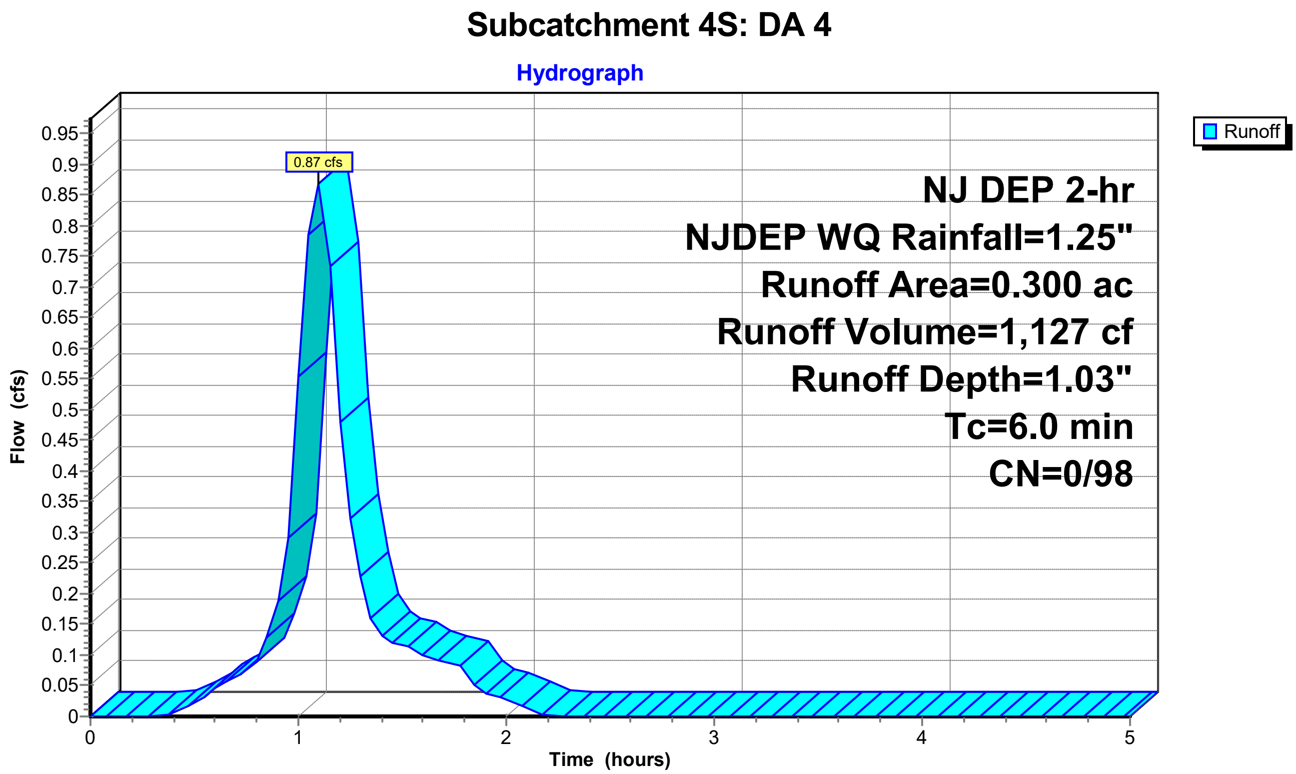
Summary for Subcatchment 4S: DA 4

Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 4P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**



Summary for Pond 4P: Filterra 8x12.5

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 951 cf, Atten= 20%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 951 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

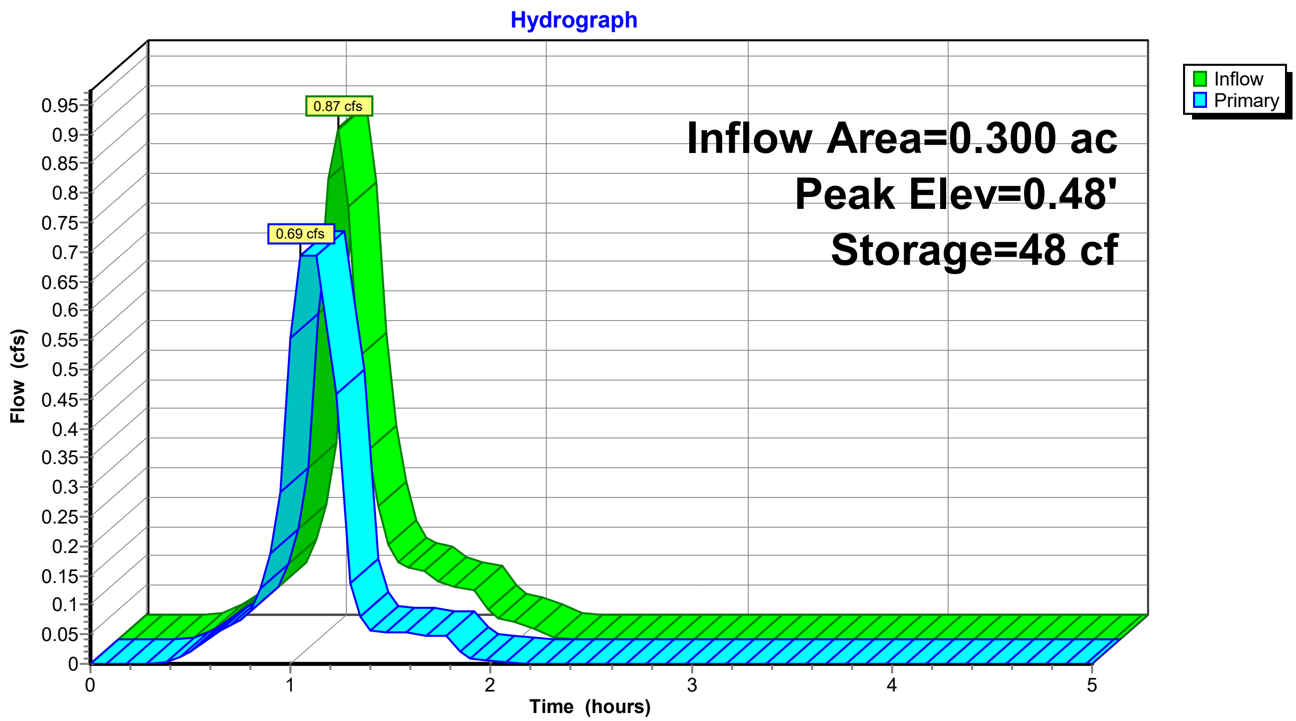
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 4P: Filterra 8x12.5



Summary for Subcatchment 5S: DA 5

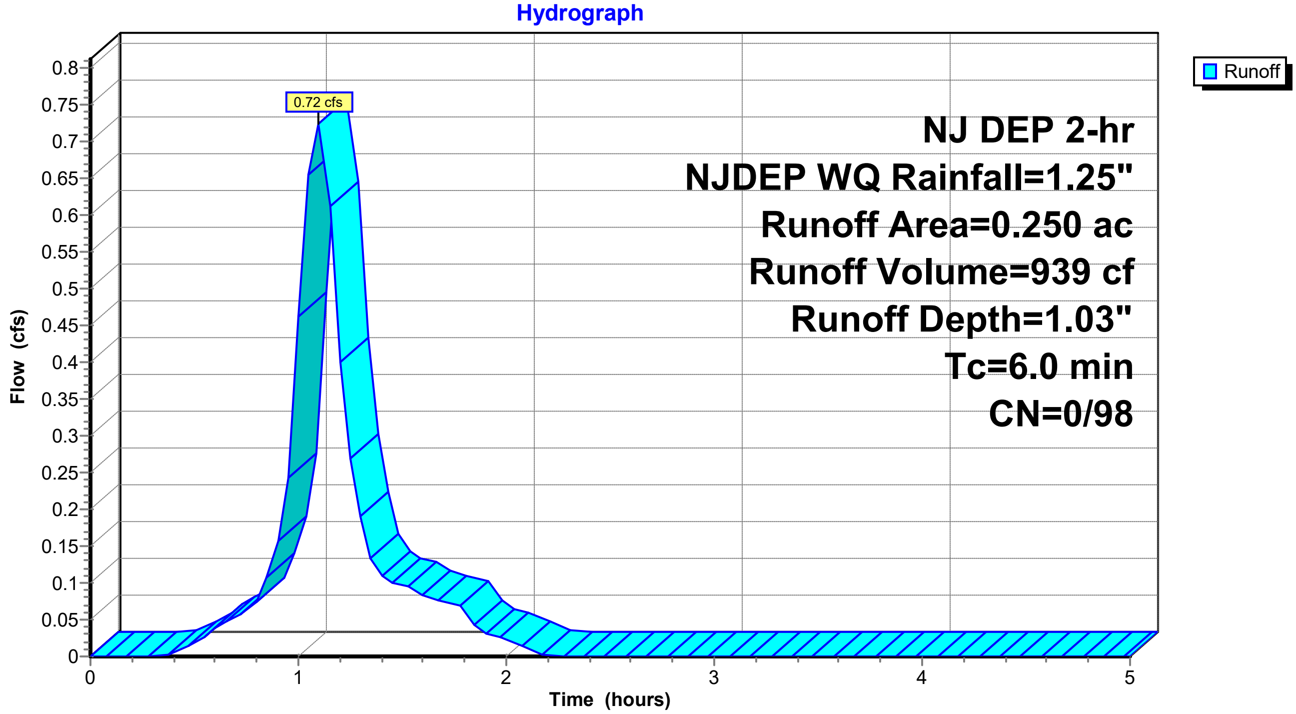
Runoff = 0.72 cfs @ 1.09 hrs, Volume= 939 cf, Depth= 1.03"
Routed to Pond 5P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.250	98	
	0.250	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 5S: DA 5



Summary for Pond 5P: Filterra 8x10.5

Inflow Area = 0.250 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.72 cfs @ 1.09 hrs, Volume= 939 cf
Outflow = 0.58 cfs @ 1.05 hrs, Volume= 701 cf, Atten= 19%, Lag= 0.0 min
Primary = 0.58 cfs @ 1.05 hrs, Volume= 701 cf

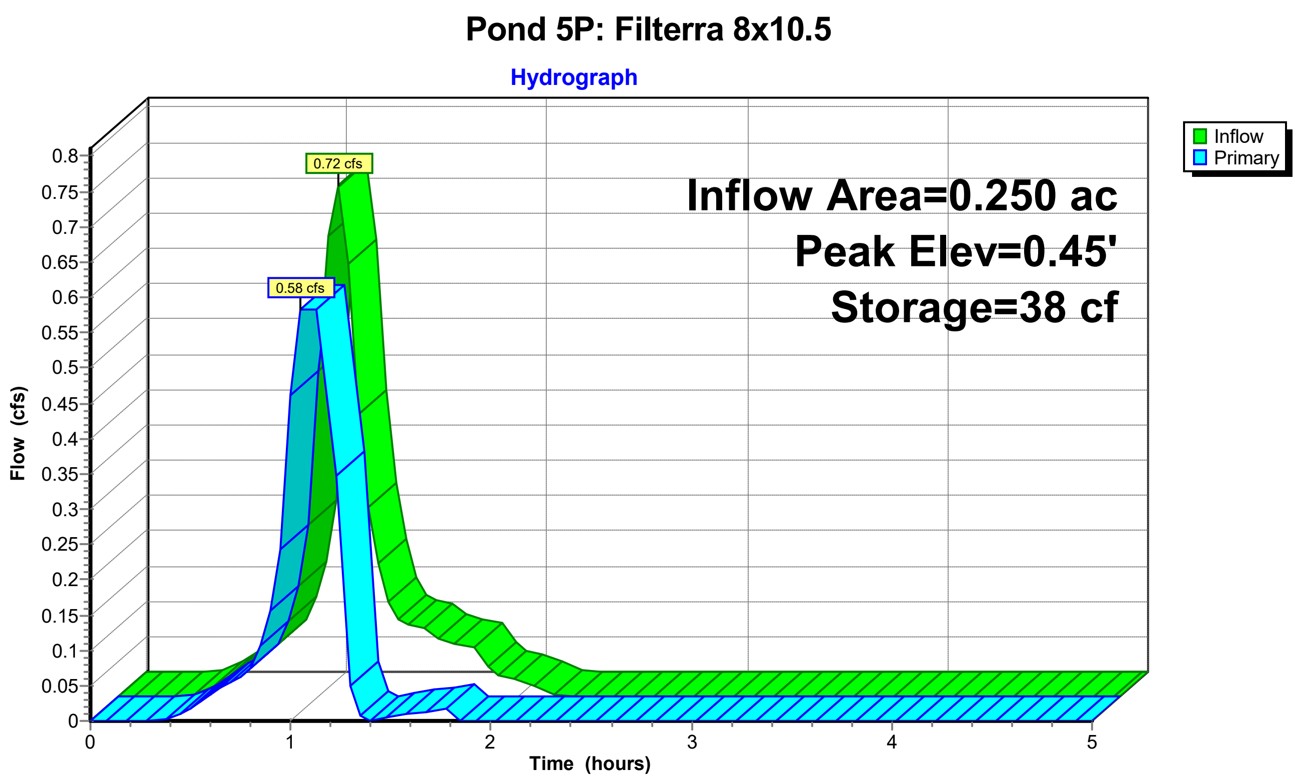
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.45' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 38 cf

Plug-Flow detention time= 1.2 min calculated for 701 cf (75% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)



Summary for Subcatchment 6S: DA 6

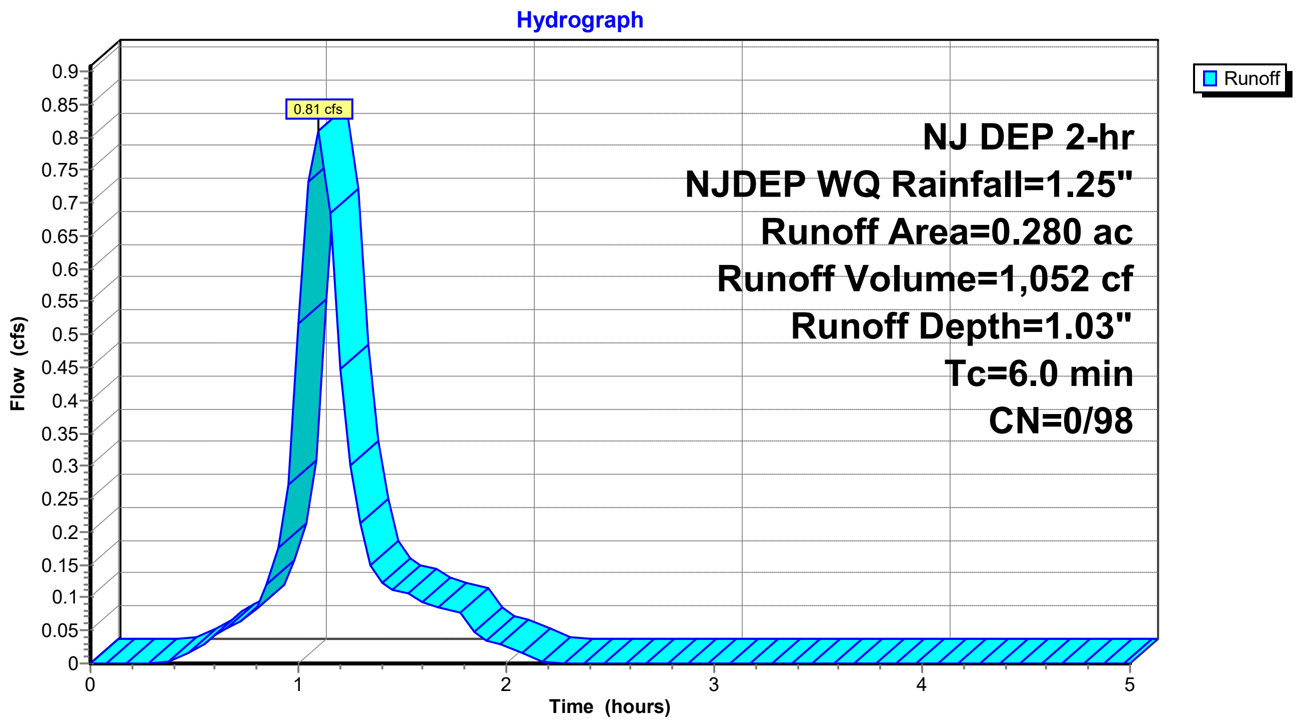
Runoff = 0.81 cfs @ 1.09 hrs, Volume= 1,052 cf, Depth= 1.03"
Routed to Pond 6P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.280	98	
	0.280	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6S: DA 6



Summary for Pond 6P: Filterra 8x12.5

Inflow Area = 0.280 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.81 cfs @ 1.09 hrs, Volume= 1,052 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,338 cf, Atten= 14%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,338 cf

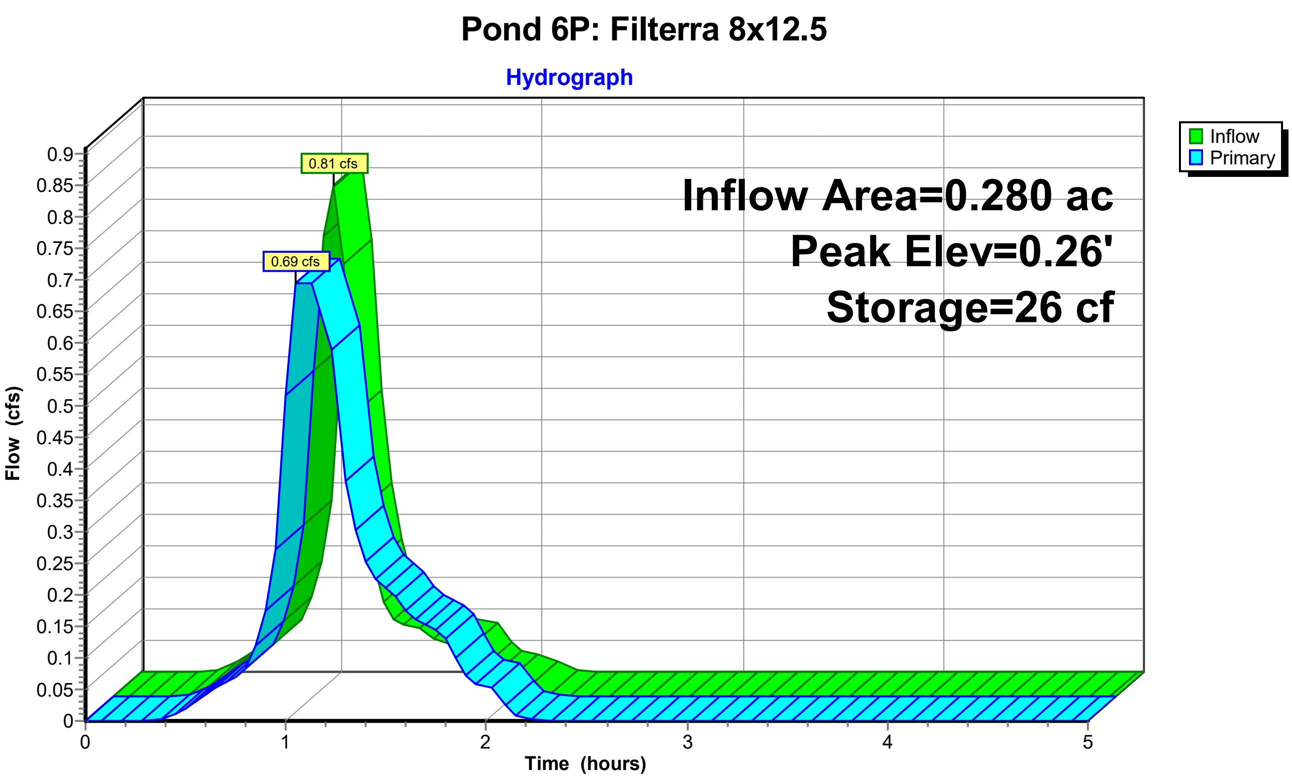
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.26' @ 1.14 hrs Surf.Area= 0.002 ac Storage= 26 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.4 min (74.7 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)



Summary for Subcatchment 7S: DA 7

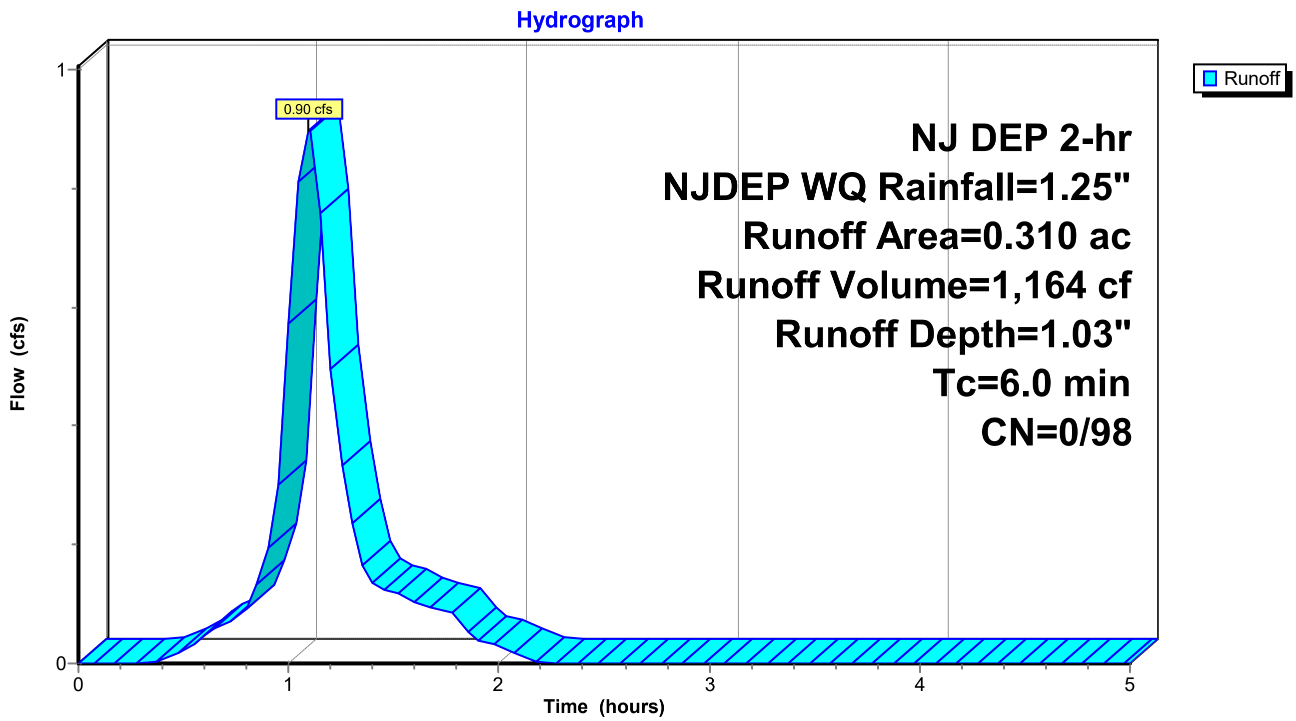
Runoff = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf, Depth= 1.03"
Routed to Pond 7P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.310	98	
	0.310	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 7S: DA 7



Summary for Pond 7P: Filterra 8x12.5

Inflow Area = 0.310 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf, Atten= 23%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.59' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 59 cf

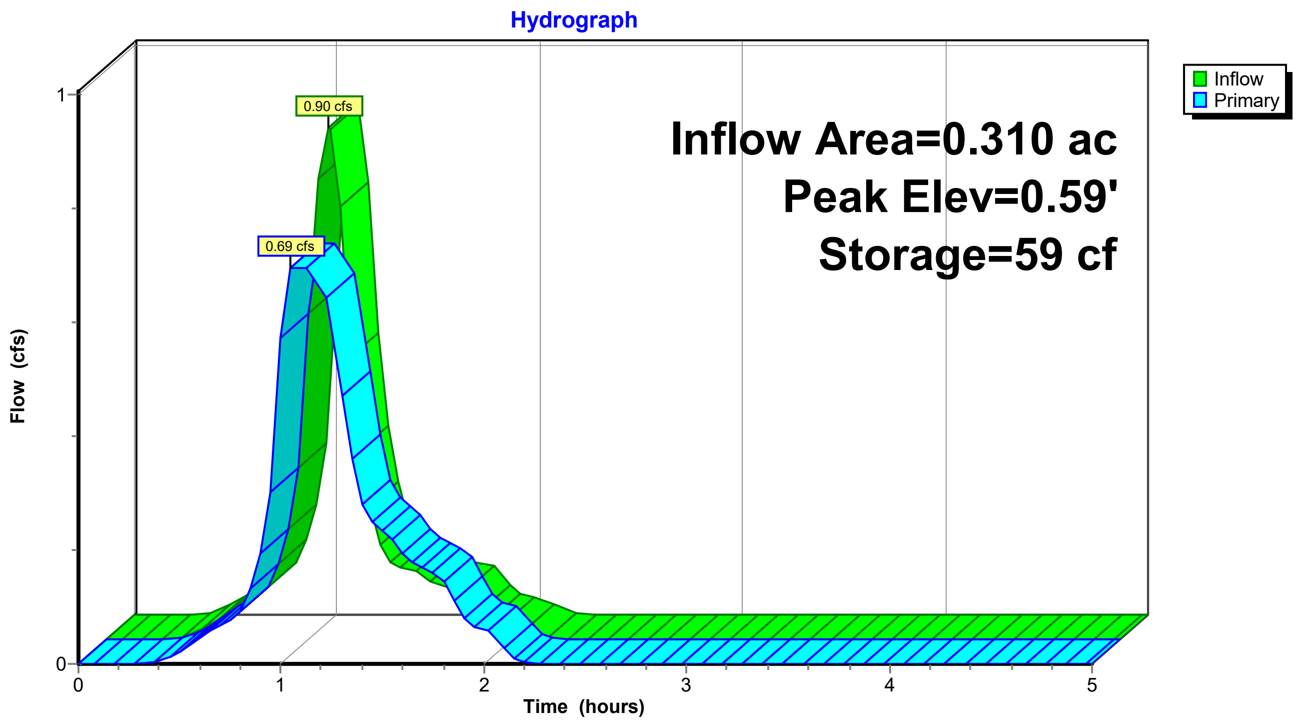
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 7P: Filterra 8x12.5



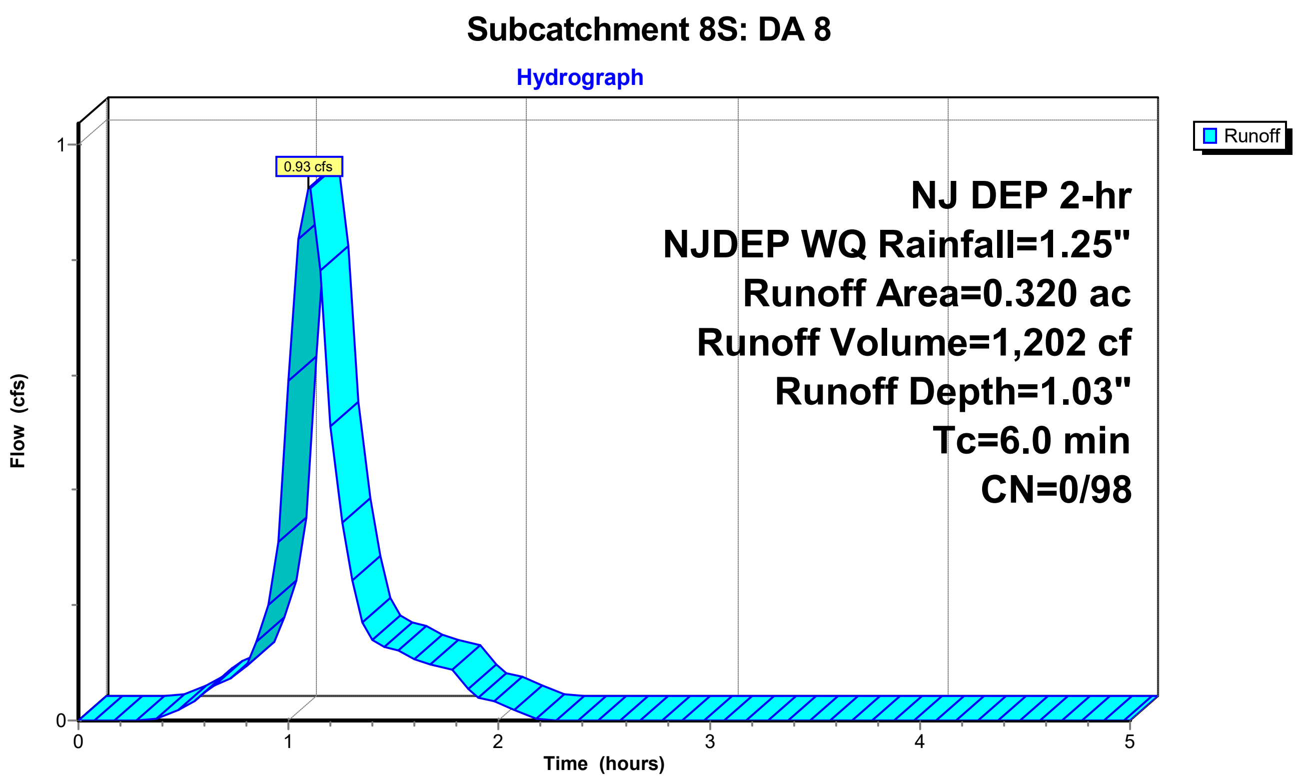
Summary for Subcatchment 8S: DA 8

Runoff = 0.93 cfs @ 1.09 hrs, Volume= 1,202 cf, Depth= 1.03"
Routed to Pond 8P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.320	98	
	0.320	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**



Summary for Pond 8P: Filterra 8x12.5

Inflow Area = 0.320 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.93 cfs @ 1.09 hrs, Volume= 1,202 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,272 cf, Atten= 25%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,272 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.72' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 72 cf

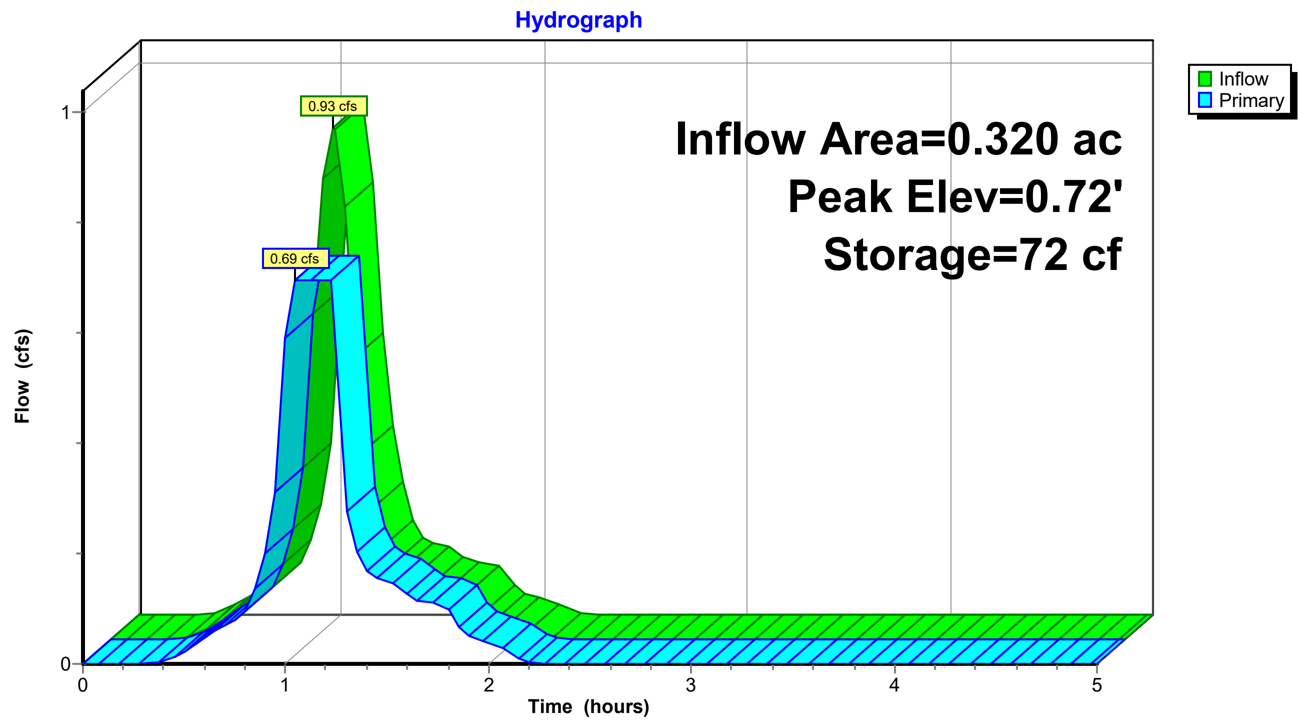
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.8 min (72.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.09' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 8P: Filterra 8x12.5



Summary for Subcatchment 9S: DA 9

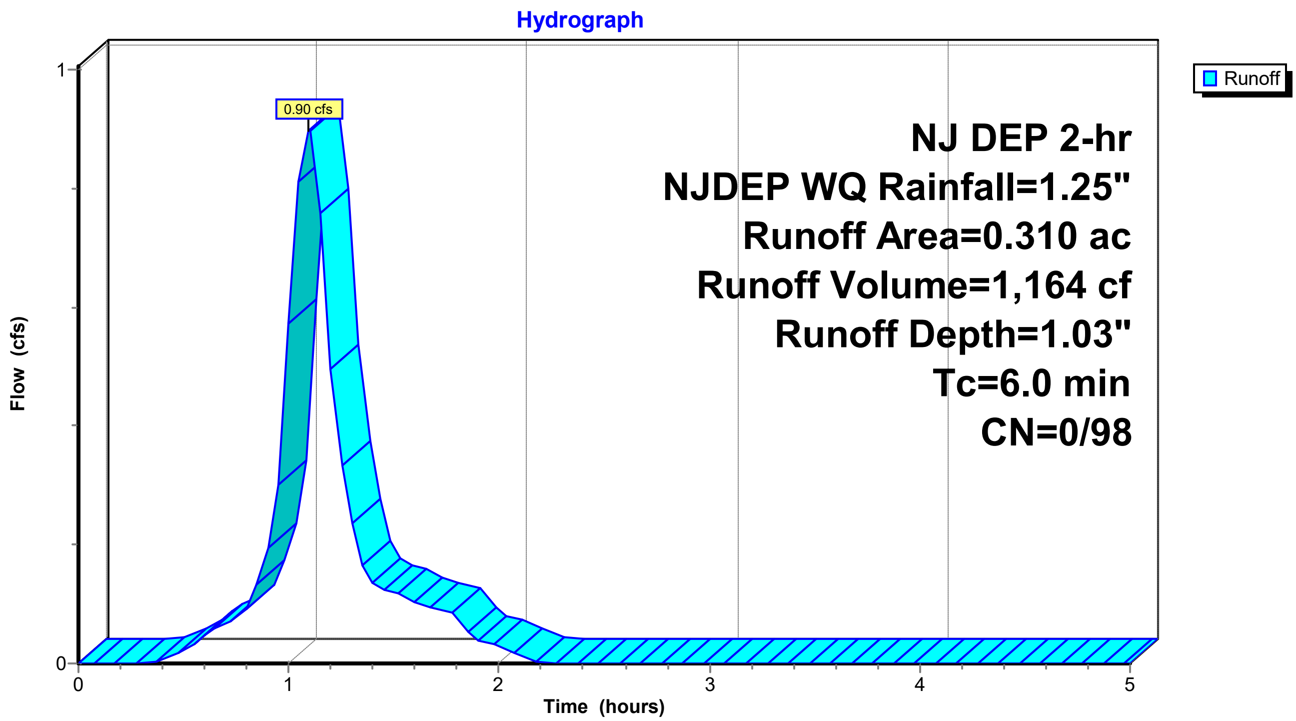
Runoff = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf, Depth= 1.03"
Routed to Pond 9P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.310	98	
	0.310	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 9S: DA 9



Summary for Pond 9P: Filterra 8x12.5

Inflow Area =	0.310 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event		
Inflow =	0.90 cfs @	1.09 hrs,	Volume=	1,164 cf	
Outflow =	0.69 cfs @	1.05 hrs,	Volume=	1,451 cf,	Atten= 23%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs,	Volume=	1,451 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.59' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 59 cf

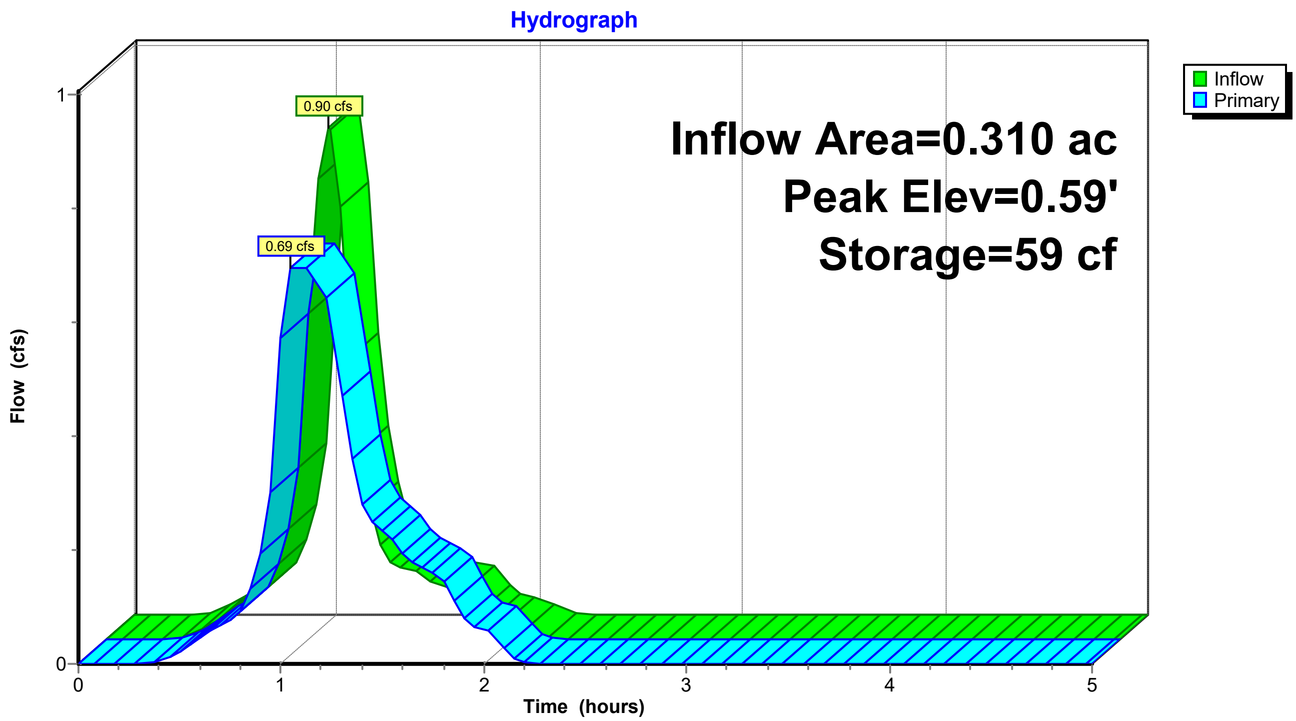
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 9P: Filterra 8x12.5



Summary for Subcatchment 10S: DA 10

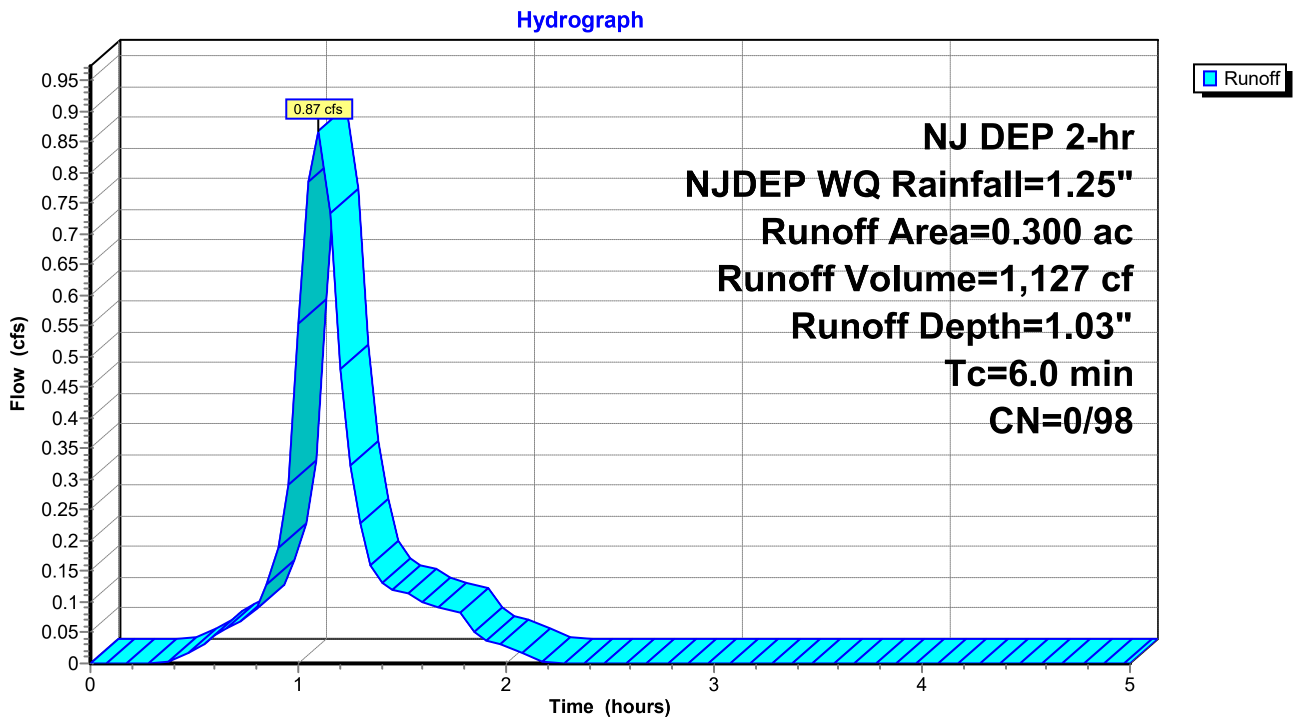
Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 10P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 10S: DA 10



Summary for Pond 10P: Filterra 8x12.5

Inflow Area =	0.300 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event		
Inflow =	0.87 cfs @	1.09 hrs,	Volume=	1,127 cf	
Outflow =	0.69 cfs @	1.05 hrs,	Volume=	951 cf,	Atten= 20%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs,	Volume=	951 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

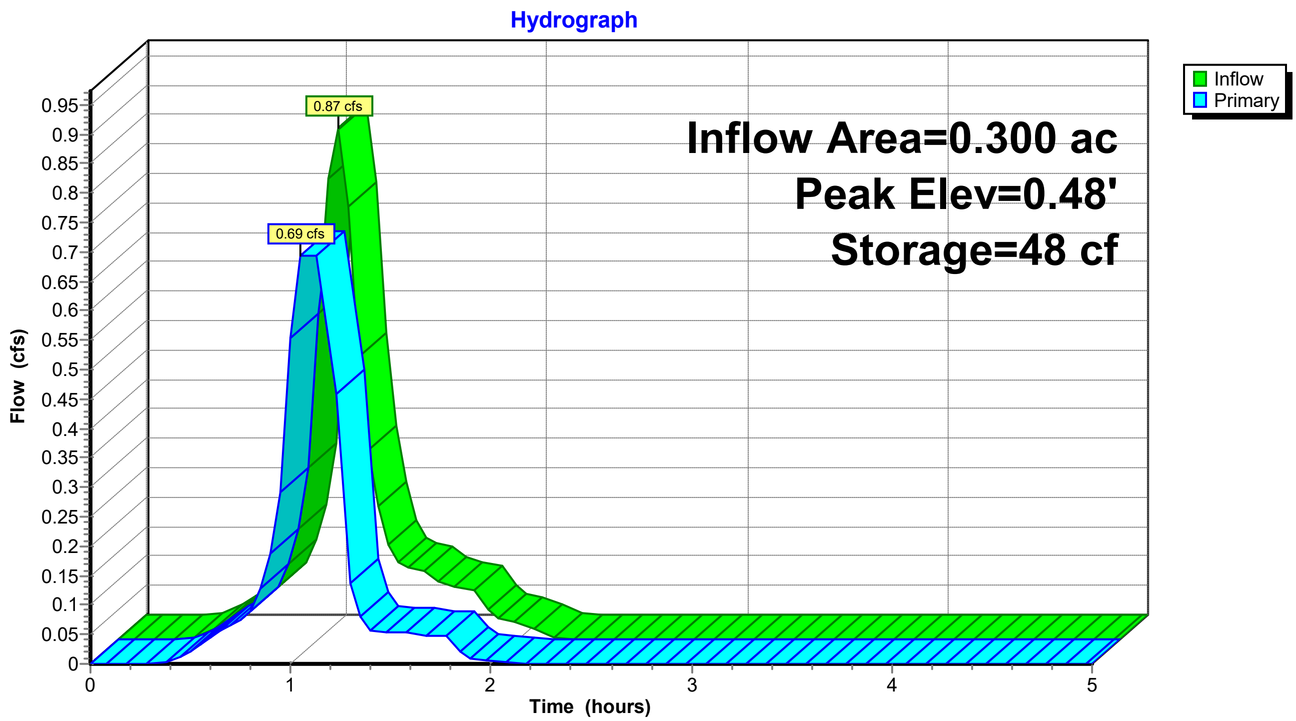
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 10P: Filterra 8x12.5



Summary for Subcatchment 11S: DA 11

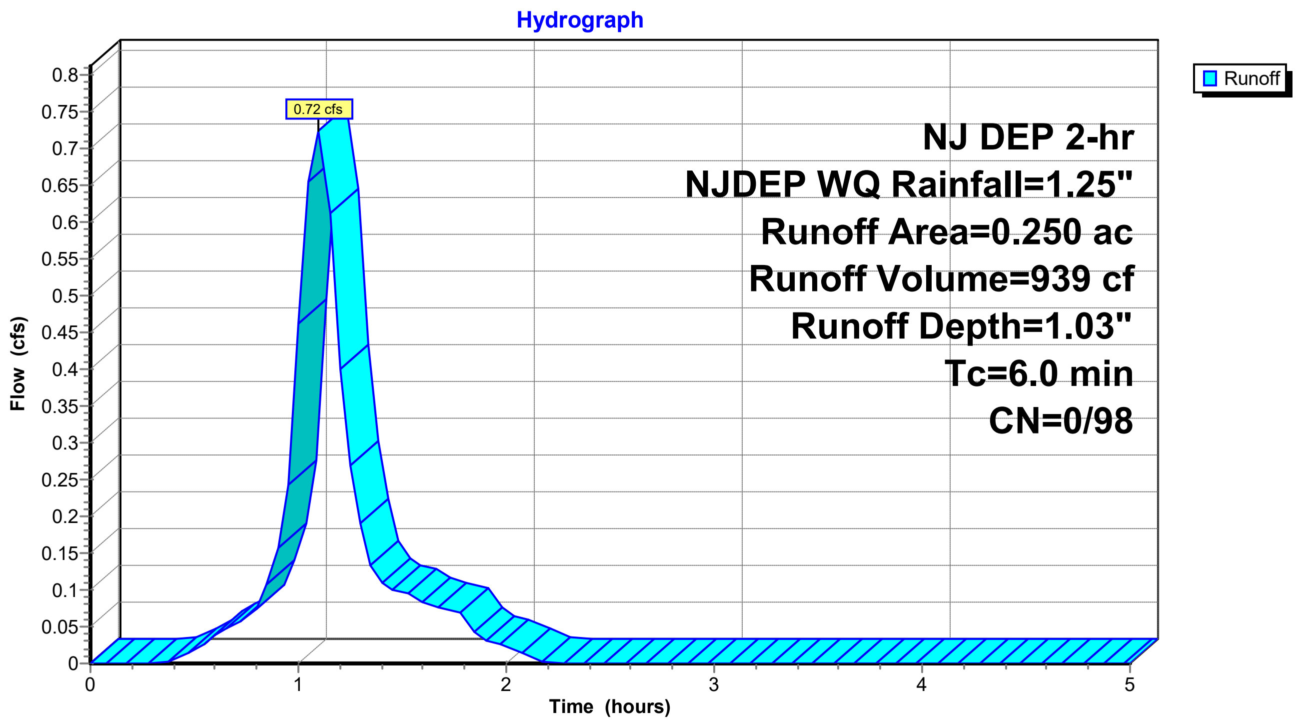
Runoff = 0.72 cfs @ 1.09 hrs, Volume= 939 cf, Depth= 1.03"
Routed to Pond 11P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.250	98	
	0.250	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 11S: DA 11



Summary for Pond 11P: Filterra 8x10.5

Inflow Area =	0.250 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.72 cfs @	1.09 hrs, Volume=	939 cf	
Outflow =	0.58 cfs @	1.05 hrs, Volume=	701 cf,	Atten= 19%, Lag= 0.0 min
Primary =	0.58 cfs @	1.05 hrs, Volume=	701 cf	

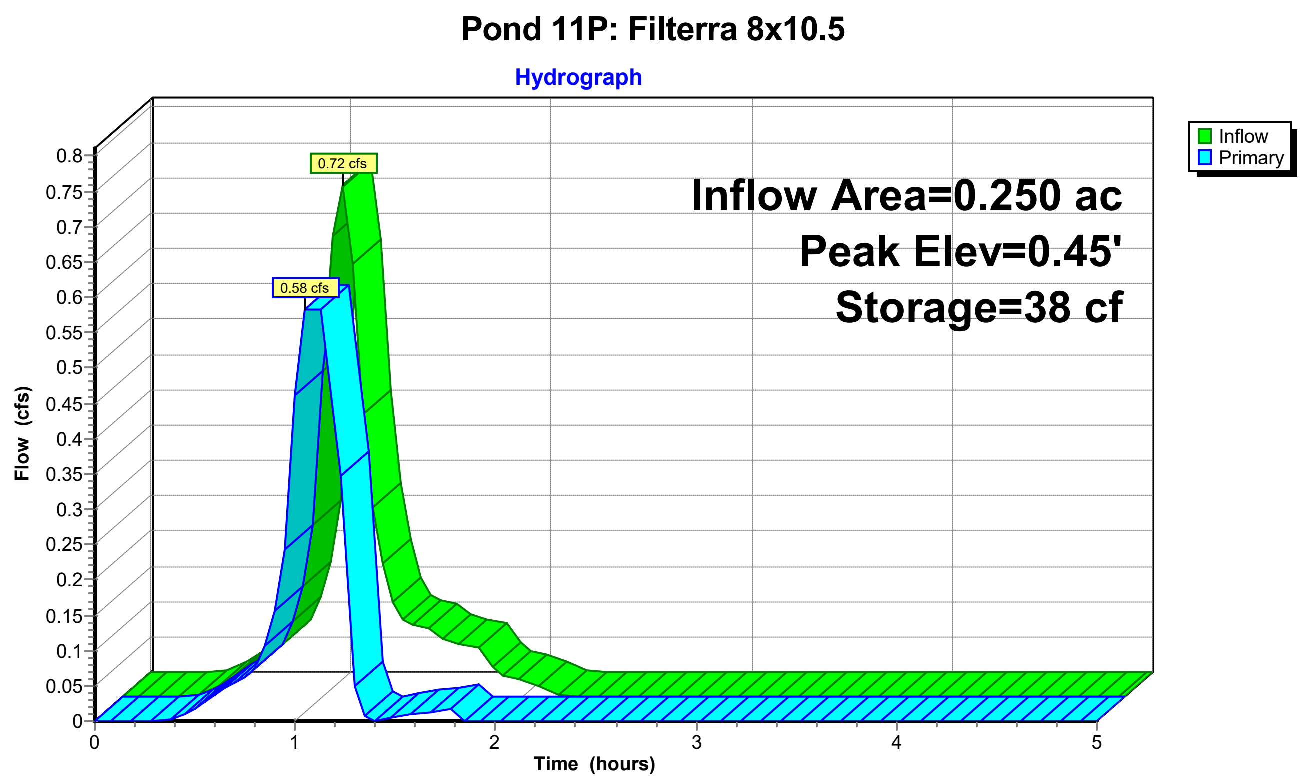
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.45' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 38 cf

Plug-Flow detention time= 1.2 min calculated for 701 cf (75% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)



Summary for Subcatchment 12S: DA 12

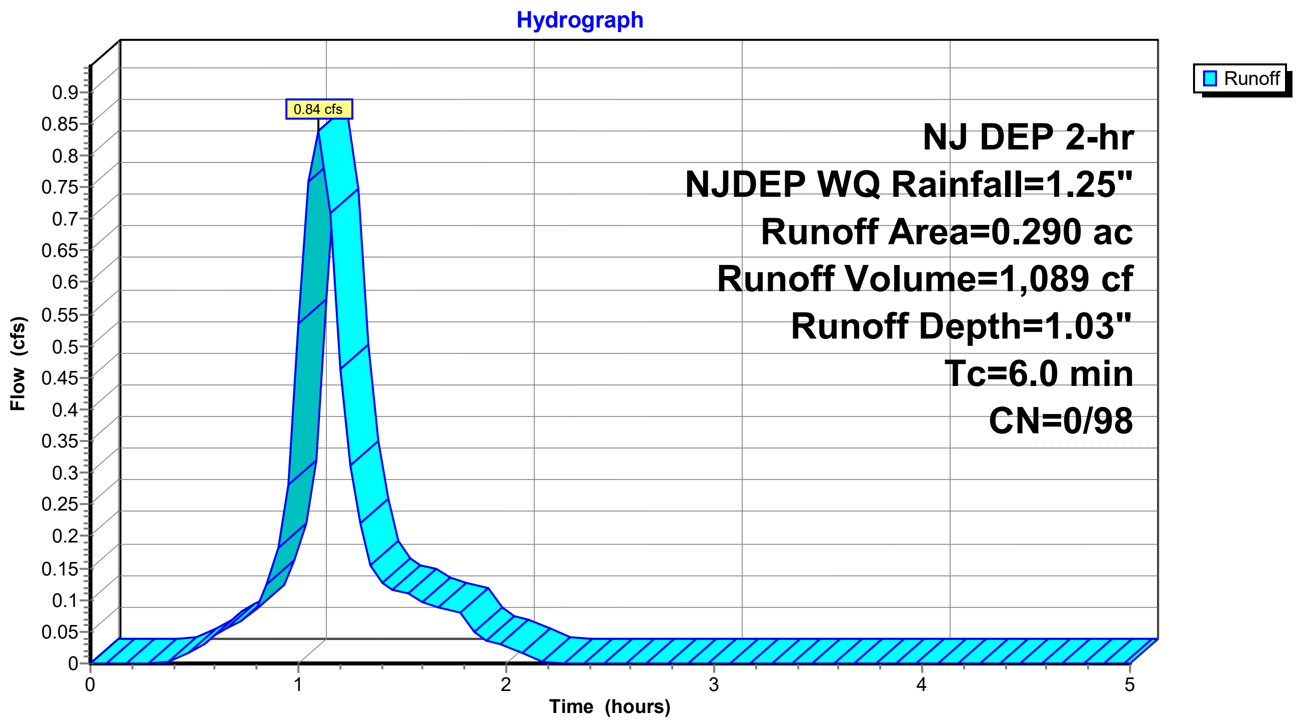
Runoff = 0.84 cfs @ 1.09 hrs, Volume= 1,089 cf, Depth= 1.03"
Routed to Pond 12P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.290	98	
	0.290	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 12S: DA 12



Summary for Pond 12P: Filterra 8x12.5

Inflow Area =		0.290 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.84 cfs @	1.09 hrs,	Volume=	1,089 cf	
Outflow =	0.69 cfs @	1.05 hrs,	Volume=	883 cf,	Atten= 17%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs,	Volume=	883 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.37' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 37 cf

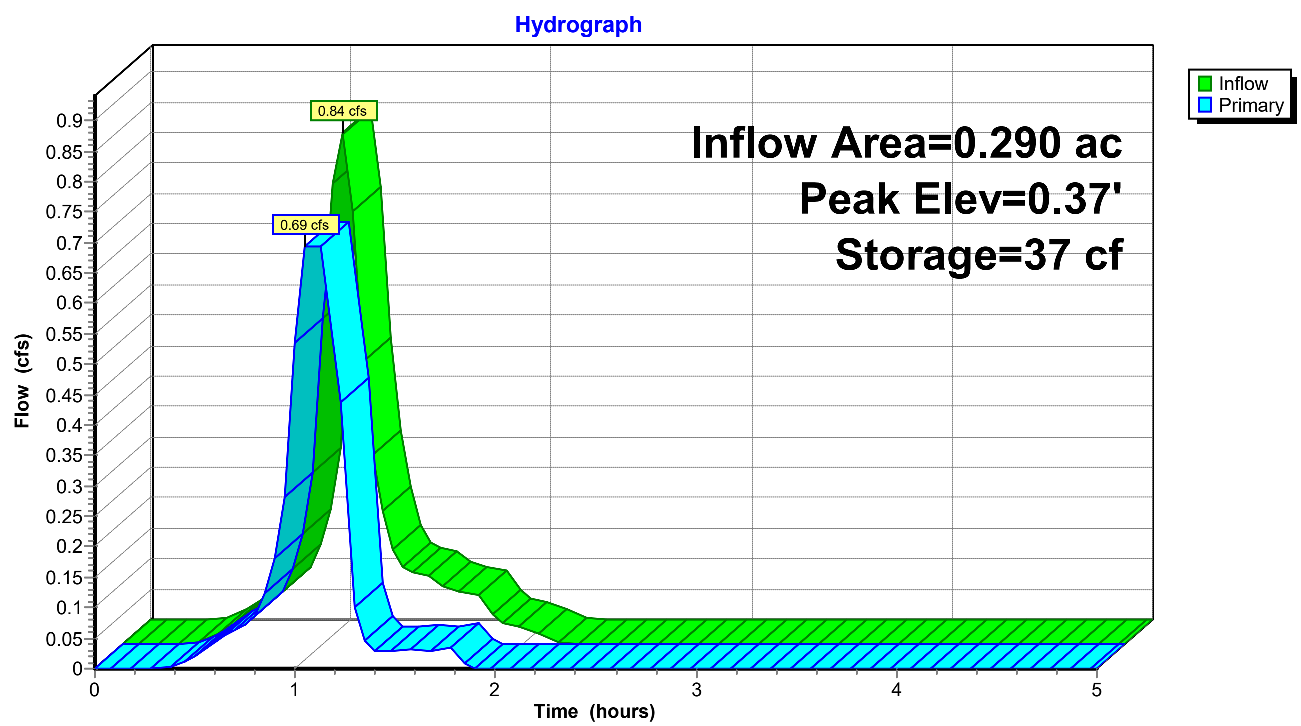
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 12P: Filterra 8x12.5



Summary for Subcatchment 13S: DA 13

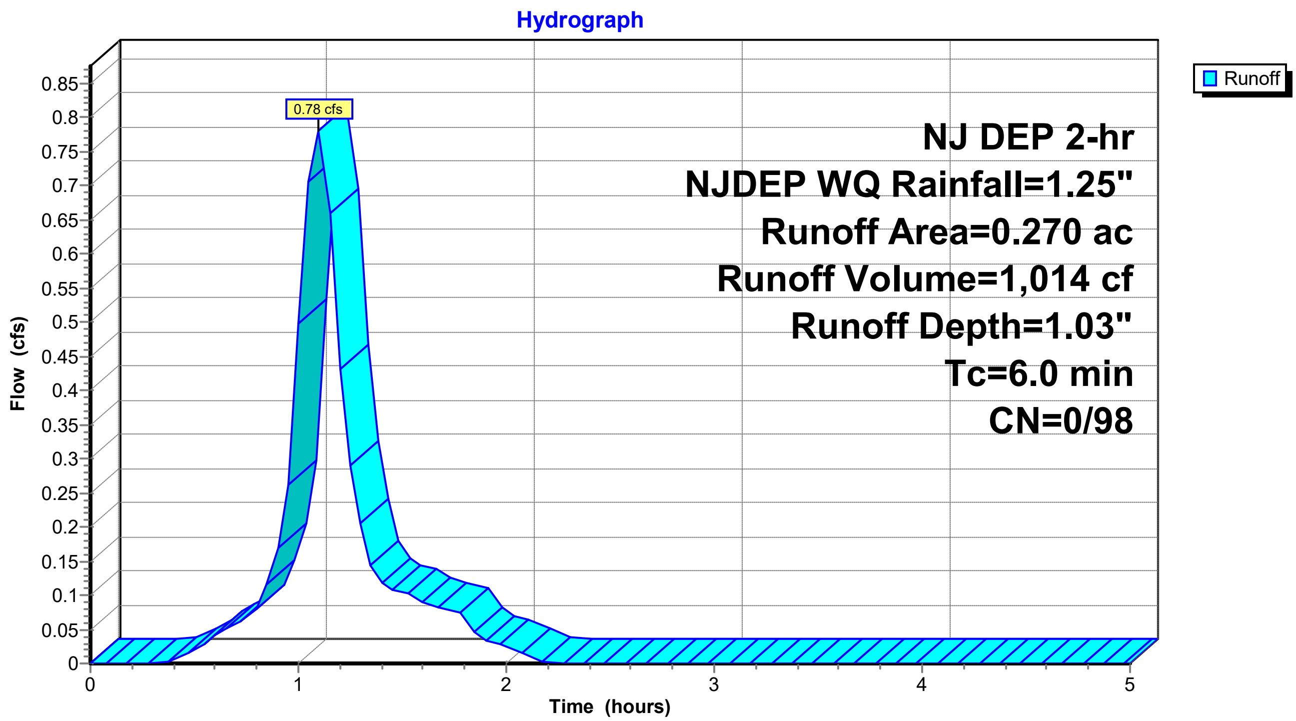
Runoff = 0.78 cfs @ 1.09 hrs, Volume= 1,014 cf, Depth= 1.03"
Routed to Pond 13P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.270	98	
	0.270	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 13S: DA 13



Summary for Pond 13P: Filterra 8x10.5

Inflow Area =		0.270 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.78 cfs @	1.09 hrs, Volume=	1,014 cf		
Outflow =	0.58 cfs @	1.05 hrs, Volume=	992 cf,	Atten= 25%,	Lag= 0.0 min
Primary =	0.58 cfs @	1.05 hrs, Volume=	992 cf		

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.74' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 62 cf

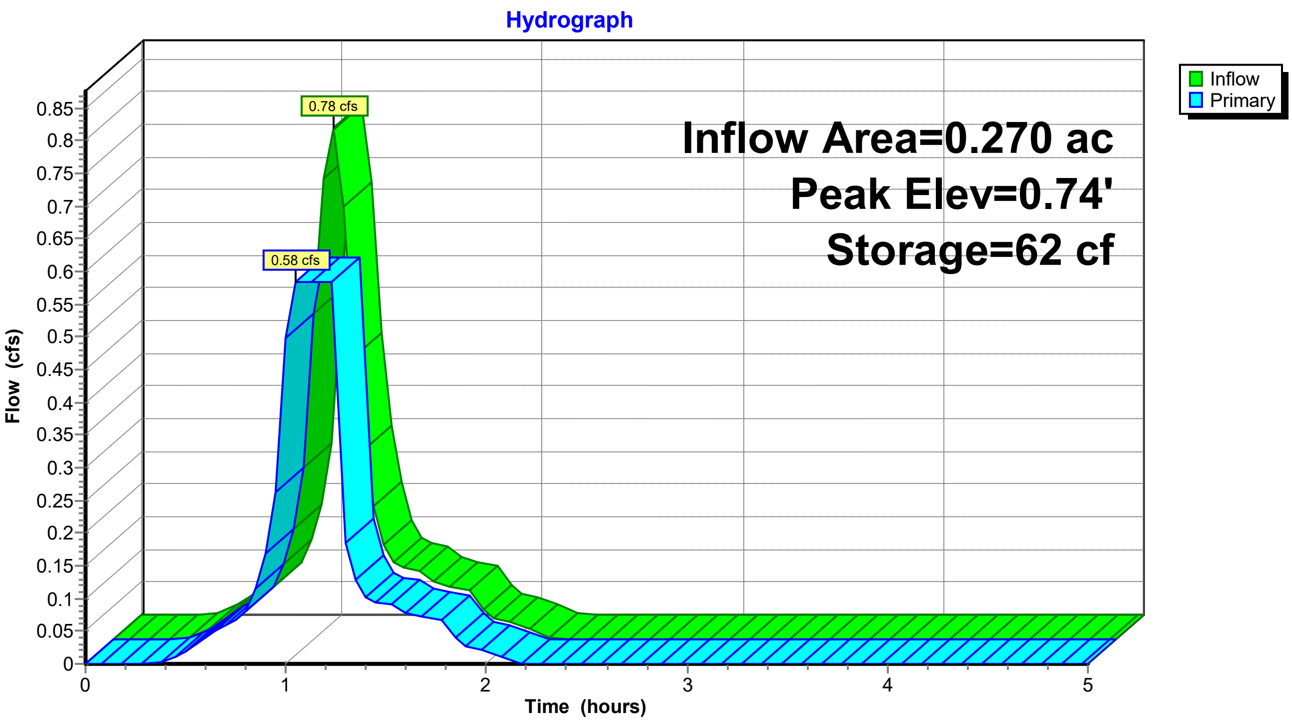
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.09' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 13P: Filterra 8x10.5



Summary for Subcatchment 14S: DA 14

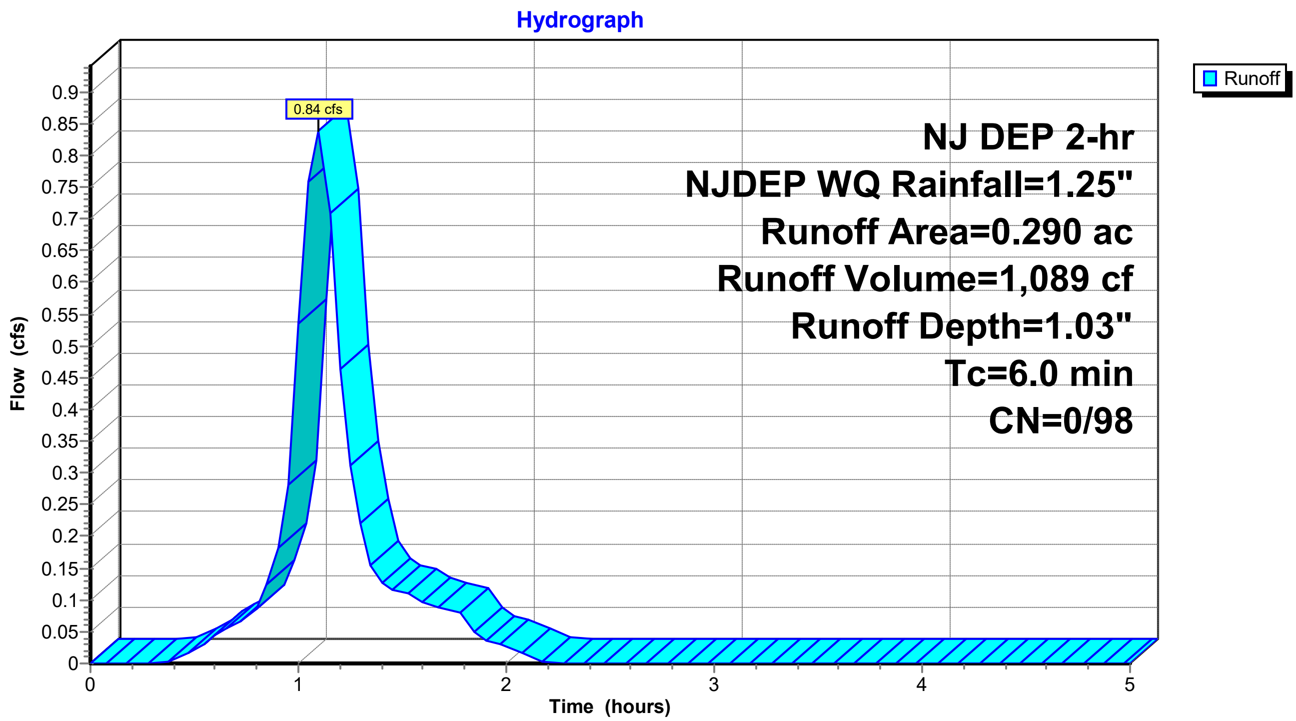
Runoff = 0.84 cfs @ 1.09 hrs, Volume= 1,089 cf, Depth= 1.03"
Routed to Pond 14P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.290	98	
	0.290	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 14S: DA 14



Summary for Pond 14P: Filterra 8x12.5

Inflow Area = 0.290 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.84 cfs @ 1.09 hrs, Volume= 1,089 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 883 cf, Atten= 17%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 883 cf

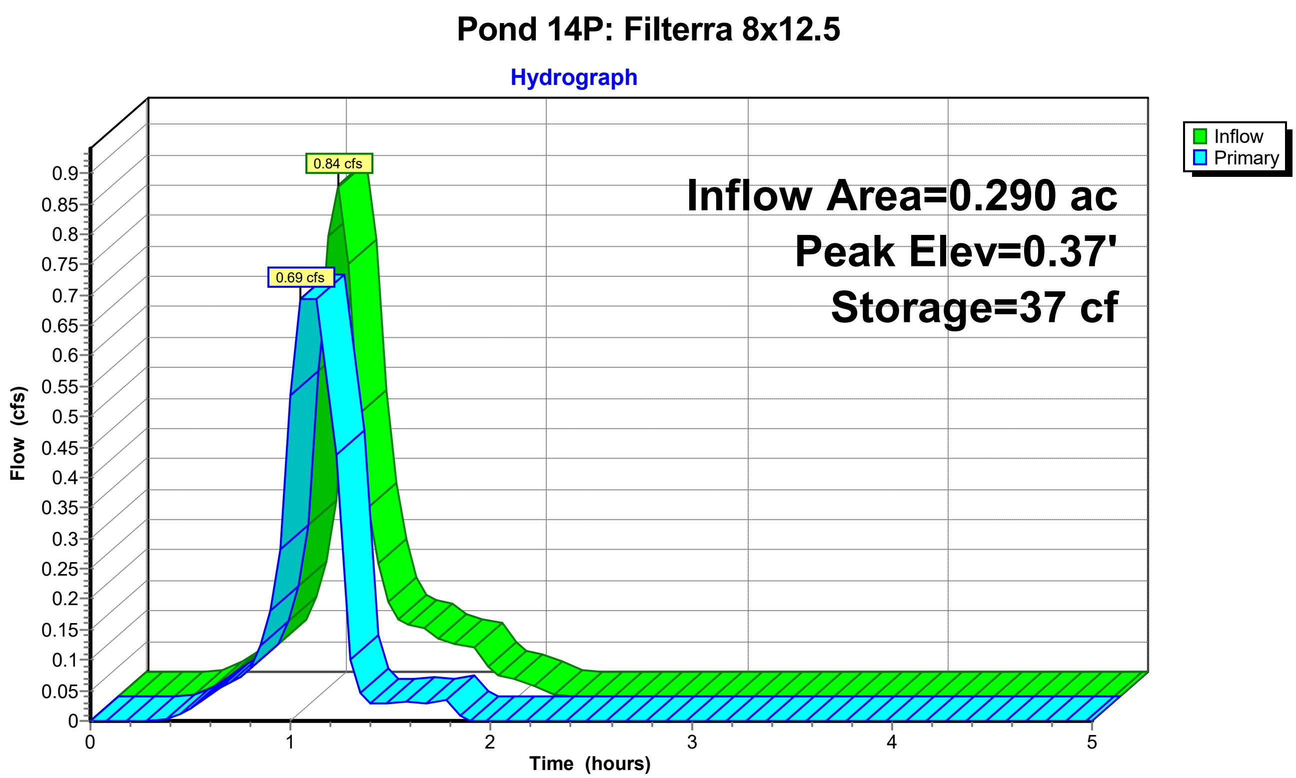
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.37' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 37 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)



Summary for Subcatchment 15S: DA 15

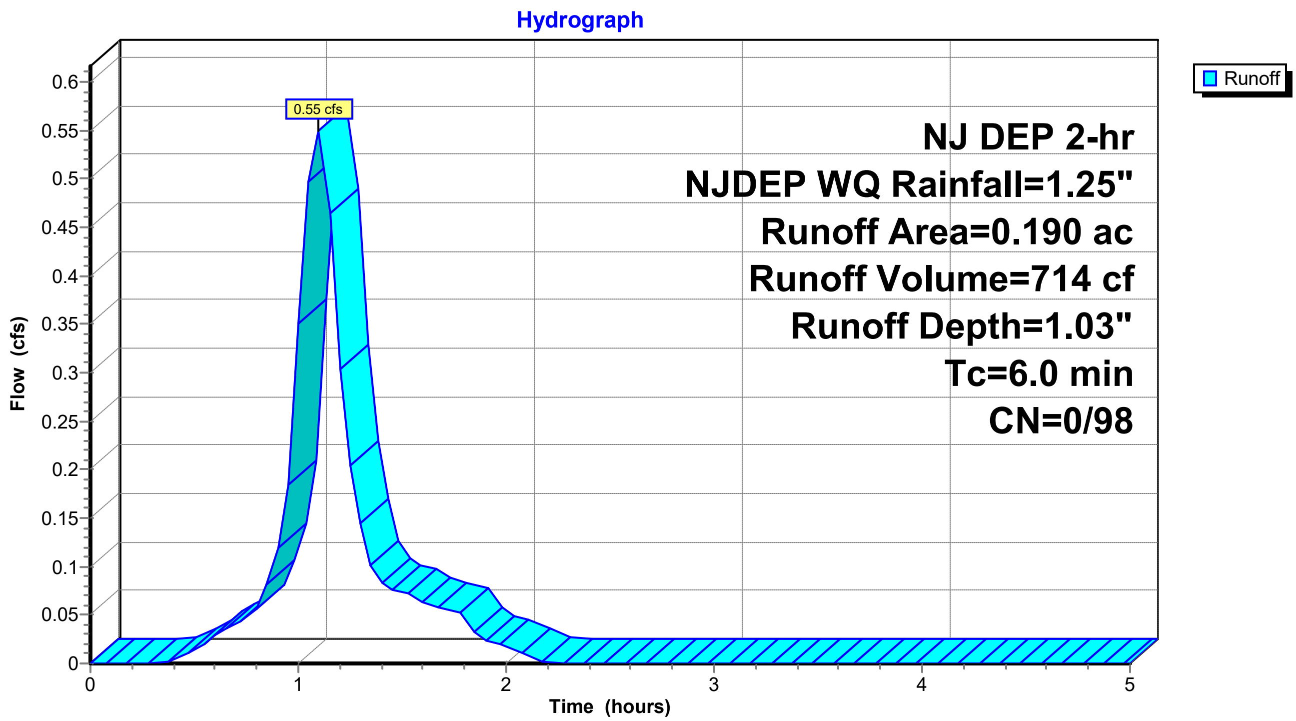
Runoff = 0.55 cfs @ 1.09 hrs, Volume= 714 cf, Depth= 1.03"
Routed to Pond 15P : Filterra 6x10

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.190	98	
	0.190	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 15S: DA 15



Summary for Pond 15P: Filterra 6x10

Inflow Area = 0.190 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.55 cfs @ 1.09 hrs, Volume= 714 cf
Outflow = 0.42 cfs @ 1.05 hrs, Volume= 879 cf, Atten= 24%, Lag= 0.0 min
Primary = 0.42 cfs @ 1.05 hrs, Volume= 879 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.68' @ 1.16 hrs Surf.Area= 0.001 ac Storage= 41 cf

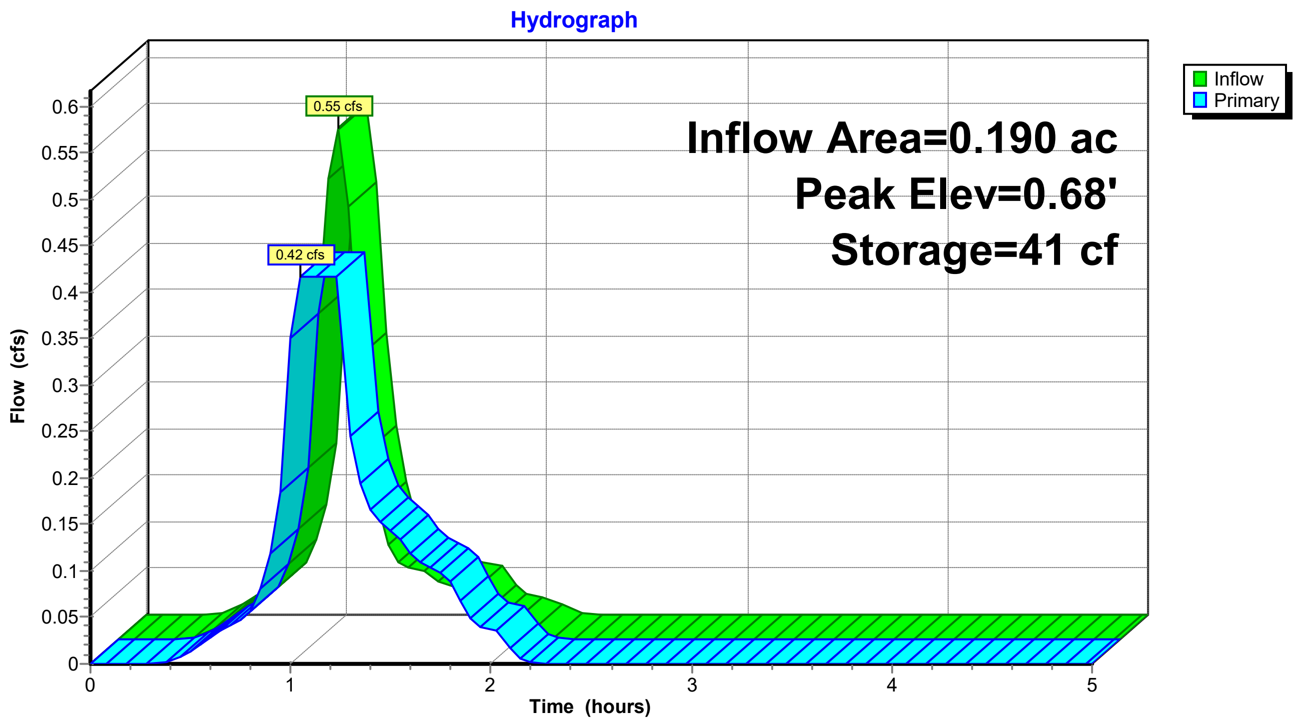
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	45 cf	**6.00'W x 10.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.42 cfs @ 1.05 hrs HW=0.08' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.42 cfs @ 0.01 fps)

Pond 15P: Filterra 6x10



Summary for Subcatchment 16S: DA 16

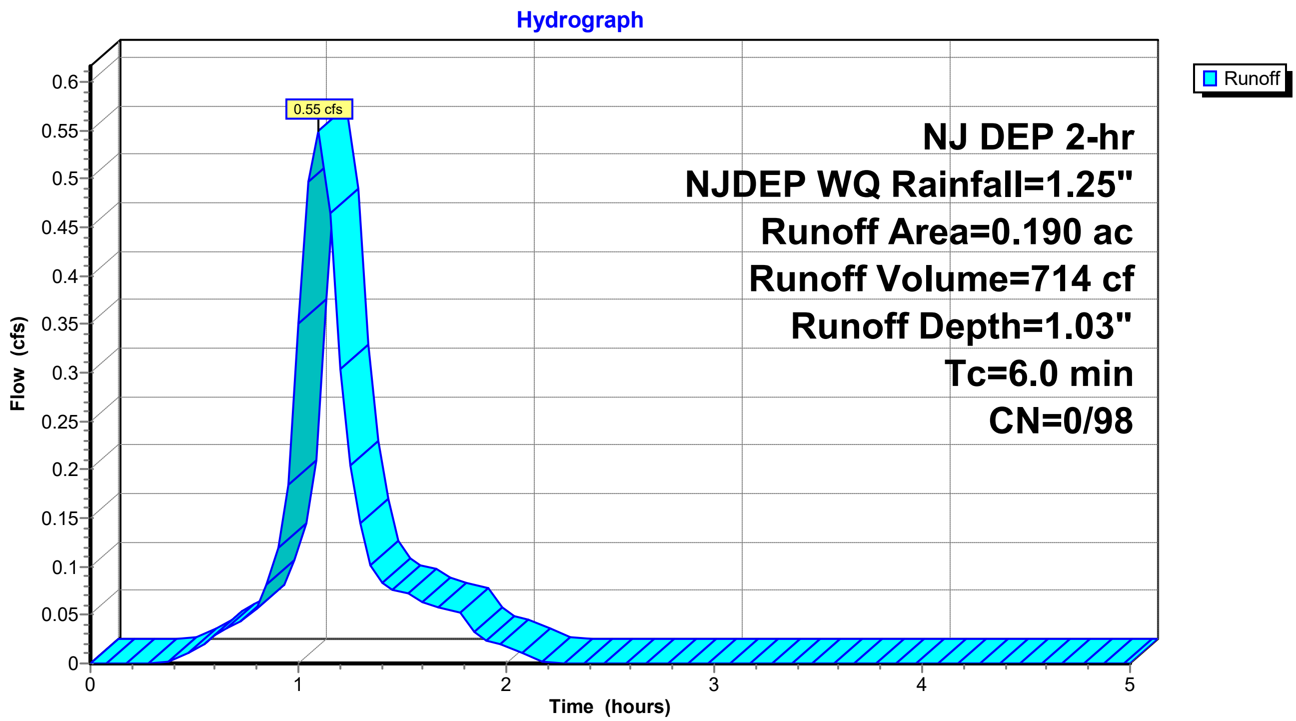
Runoff = 0.55 cfs @ 1.09 hrs, Volume= 714 cf, Depth= 1.03"
Routed to Pond 16P : Filterra 6x10

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.190	98	
	0.190	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 16S: DA 16



Summary for Pond 16P: Filterra 6x10

Inflow Area = 0.190 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.55 cfs @ 1.09 hrs, Volume= 714 cf
Outflow = 0.42 cfs @ 1.05 hrs, Volume= 879 cf, Atten= 24%, Lag= 0.0 min
Primary = 0.42 cfs @ 1.05 hrs, Volume= 879 cf

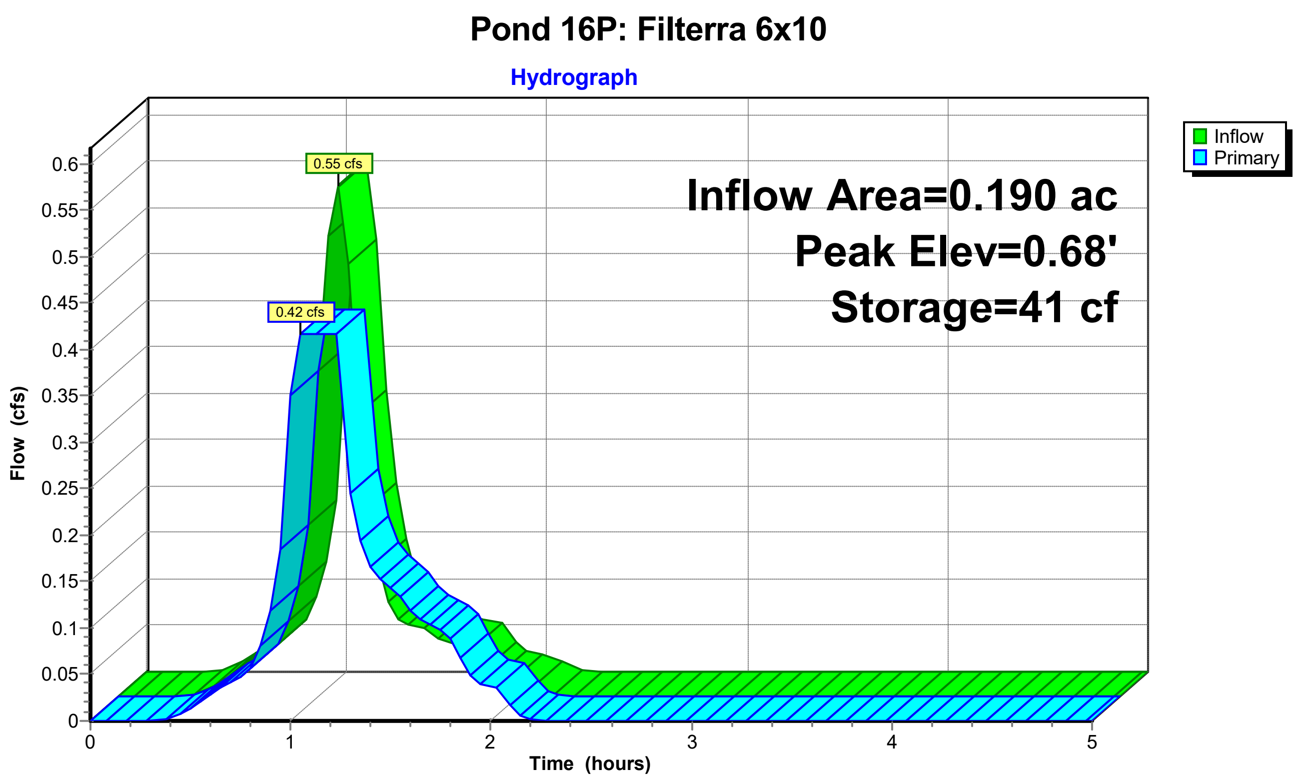
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.68' @ 1.16 hrs Surf.Area= 0.001 ac Storage= 41 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	45 cf	**6.00'W x 10.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.42 cfs @ 1.05 hrs HW=0.08' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.42 cfs @ 0.01 fps)



Summary for Subcatchment 17S: DA 17

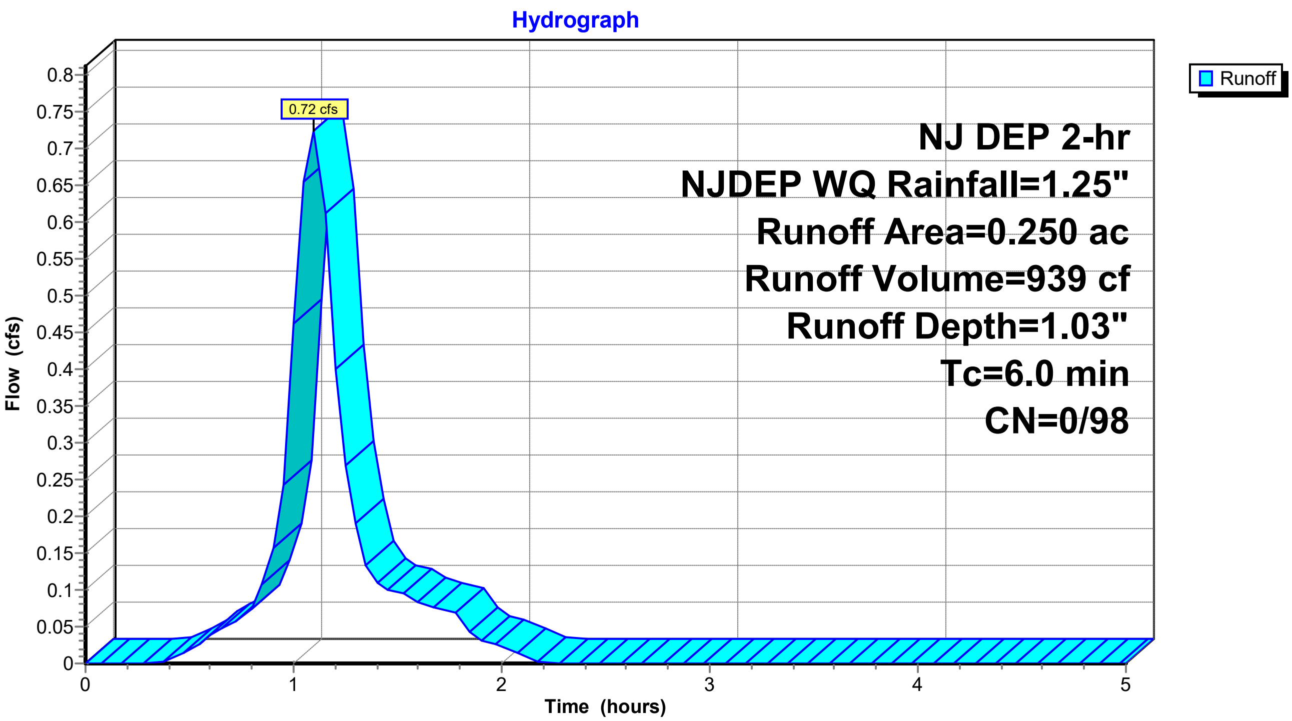
Runoff = 0.72 cfs @ 1.09 hrs, Volume= 939 cf, Depth= 1.03"
Routed to Pond 17P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.250	98	
	0.250	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 17S: DA 17



Summary for Pond 17P: Filterra 8x10.5

Inflow Area = 0.250 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.72 cfs @ 1.09 hrs, Volume= 939 cf
Outflow = 0.58 cfs @ 1.05 hrs, Volume= 701 cf, Atten= 19%, Lag= 0.0 min
Primary = 0.58 cfs @ 1.05 hrs, Volume= 701 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.45' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 38 cf

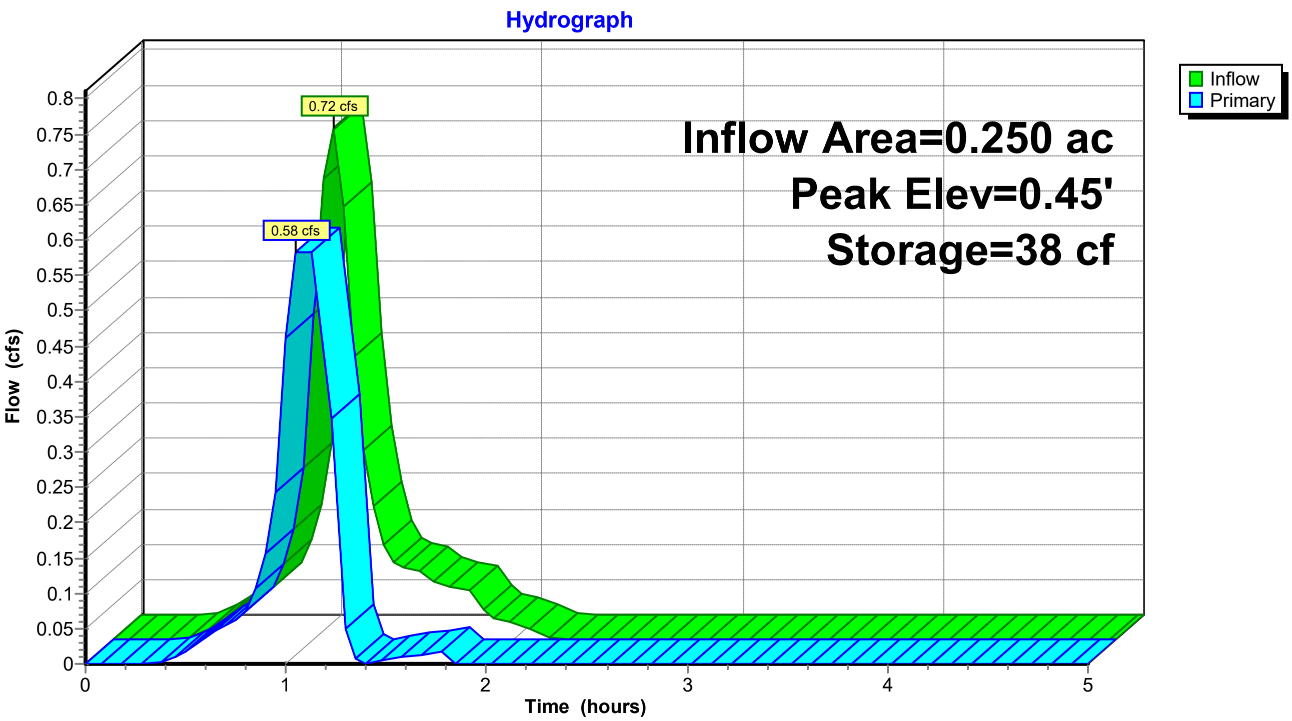
Plug-Flow detention time= 1.2 min calculated for 701 cf (75% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 17P: Filterra 8x10.5



Summary for Subcatchment 18S: DA 18

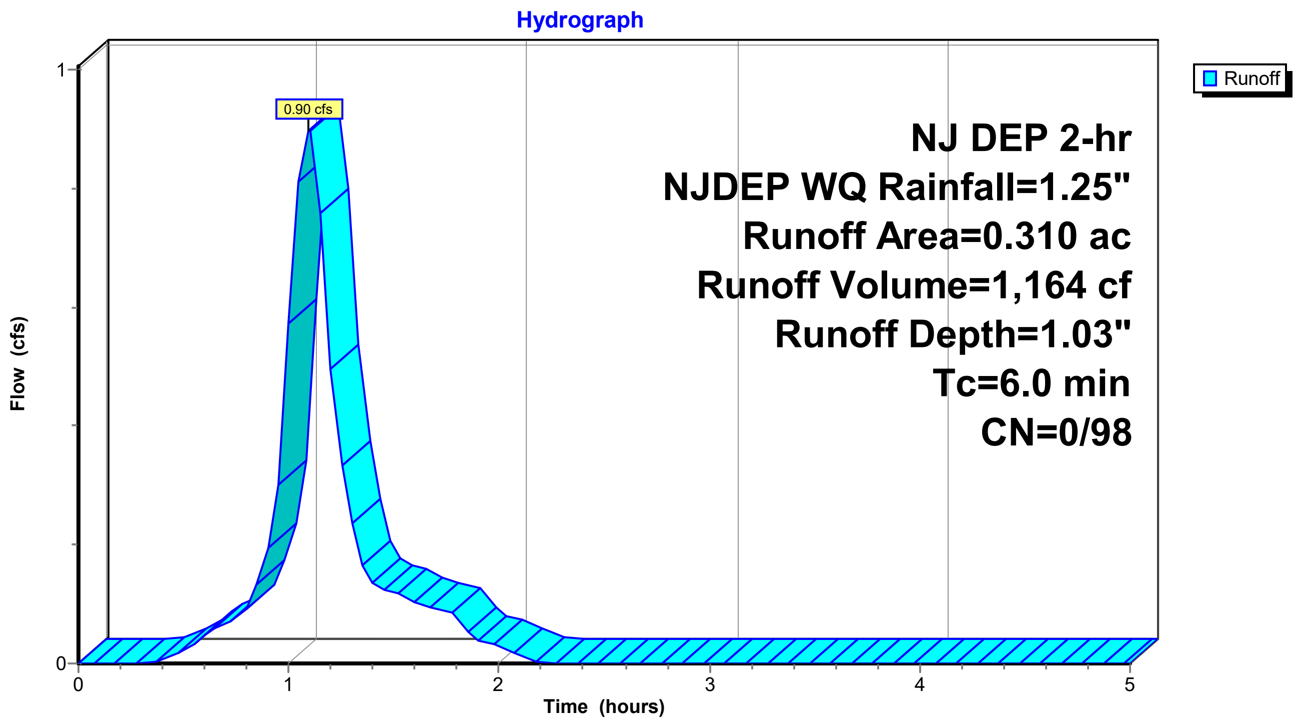
Runoff = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf, Depth= 1.03"
Routed to Pond 18P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.310	98	
	0.310	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 18S: DA 18



Summary for Pond 18P: Filterra 8x12.5

Inflow Area = 0.310 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf, Atten= 23%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.59' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 59 cf

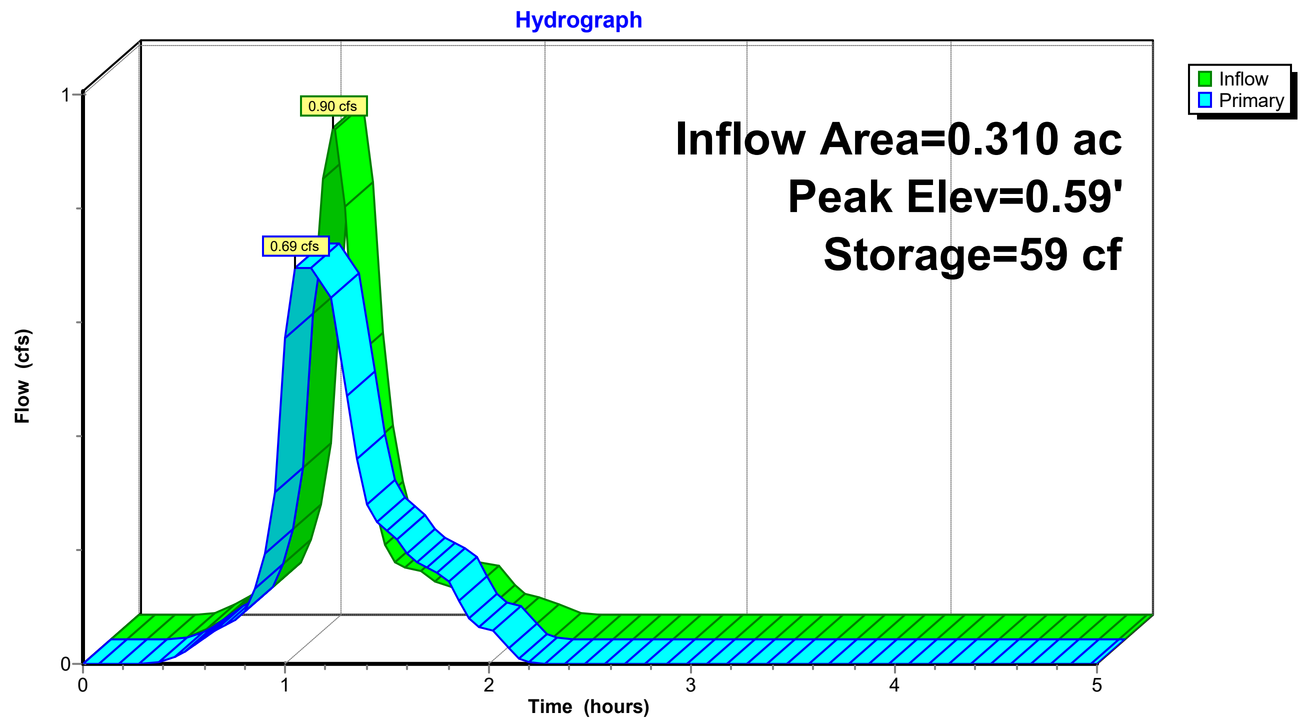
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 18P: Filterra 8x12.5



Summary for Subcatchment 19S: DA 19

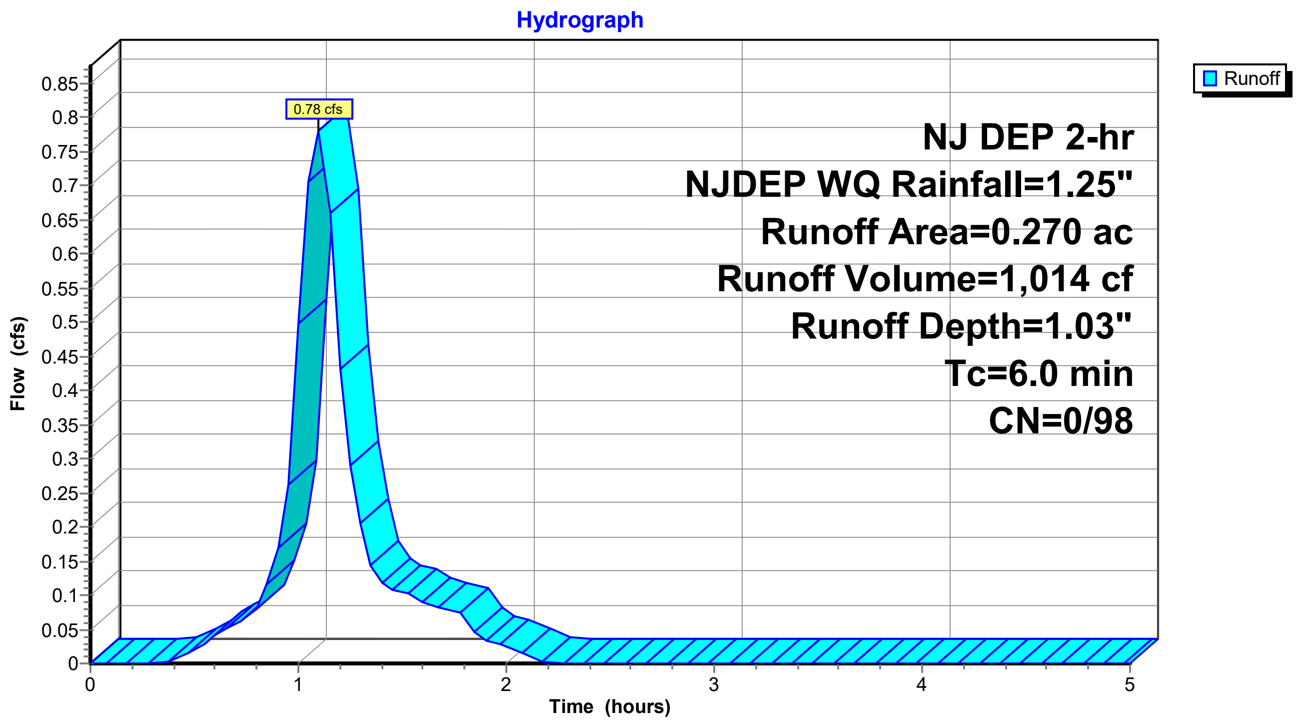
Runoff = 0.78 cfs @ 1.09 hrs, Volume= 1,014 cf, Depth= 1.03"
Routed to Pond 19P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.270	98	
	0.270	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 19S: DA 19



Summary for Pond 19P: Filterra 8x10.5

Inflow Area = 0.270 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.78 cfs @ 1.09 hrs, Volume= 1,014 cf
Outflow = 0.58 cfs @ 1.05 hrs, Volume= 992 cf, Atten= 25%, Lag= 0.0 min
Primary = 0.58 cfs @ 1.05 hrs, Volume= 992 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.74' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 62 cf

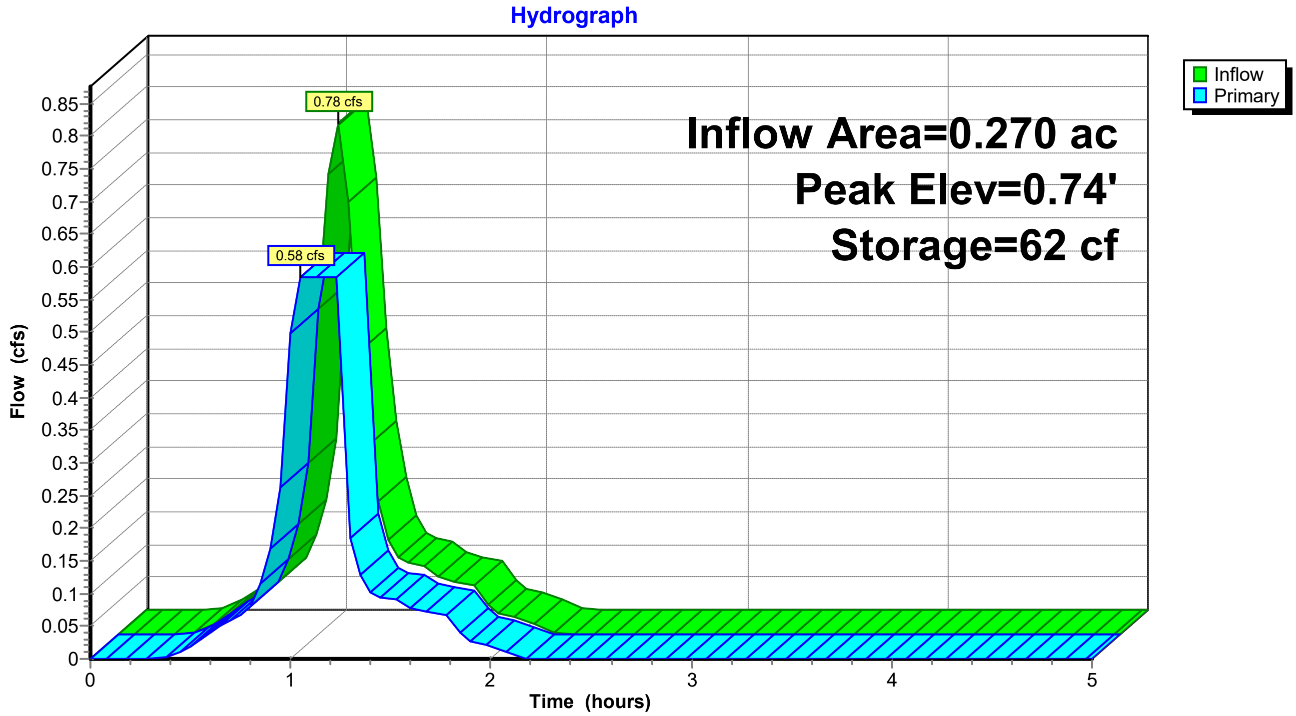
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.09' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 19P: Filterra 8x10.5



Summary for Subcatchment 20S: DA 20

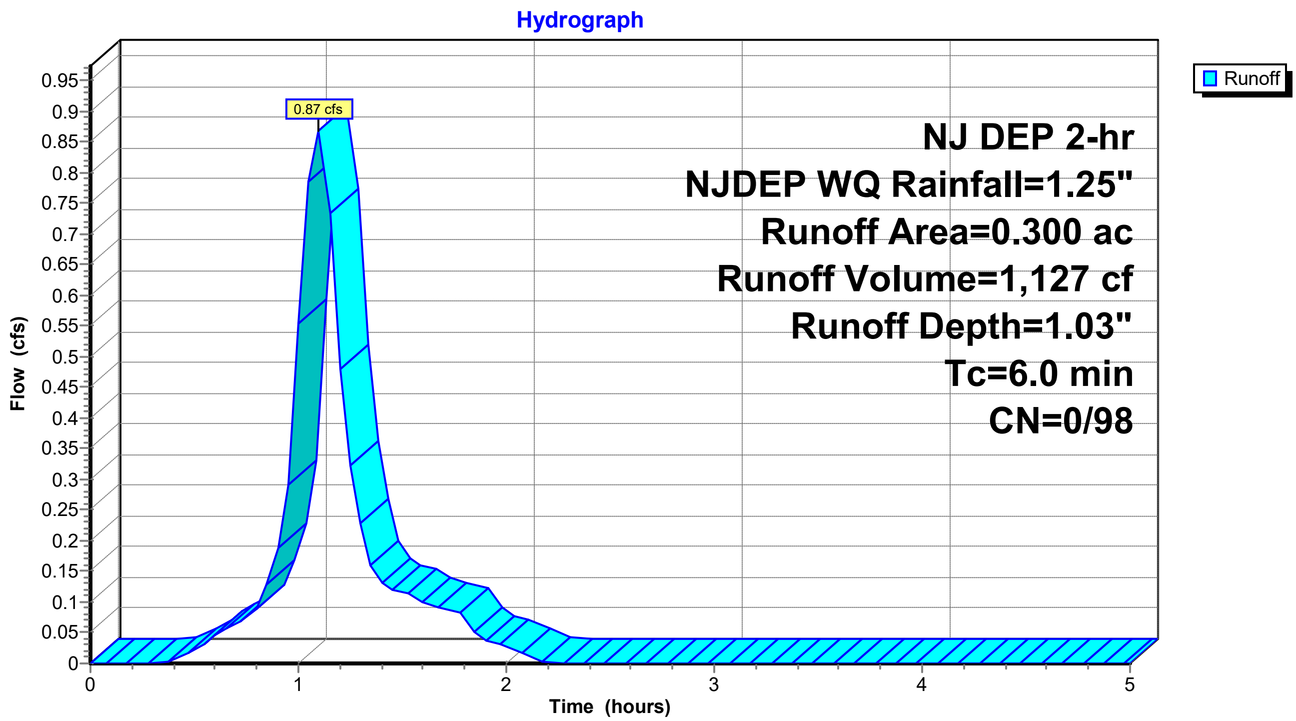
Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 20P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 20S: DA 20



Summary for Pond 20P: Filterra 8x12.5

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 951 cf, Atten= 20%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 951 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

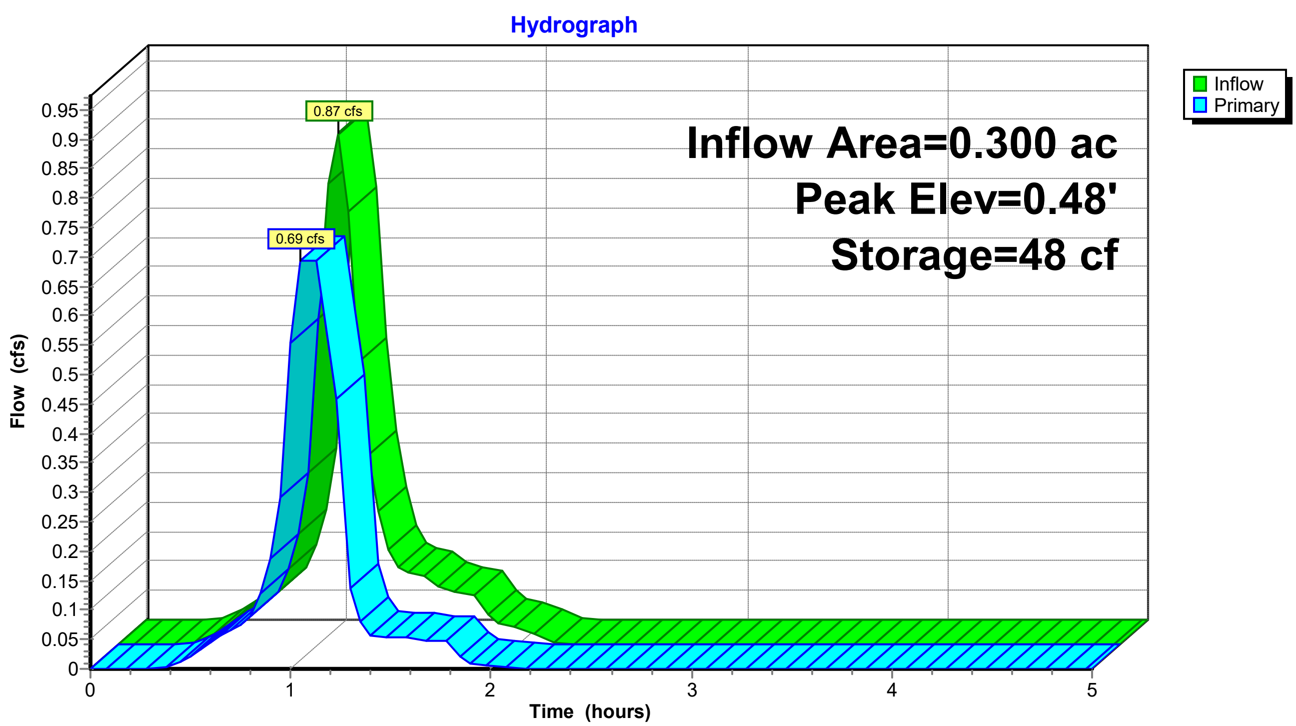
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 20P: Filterra 8x12.5



Summary for Subcatchment 23S: DA 23

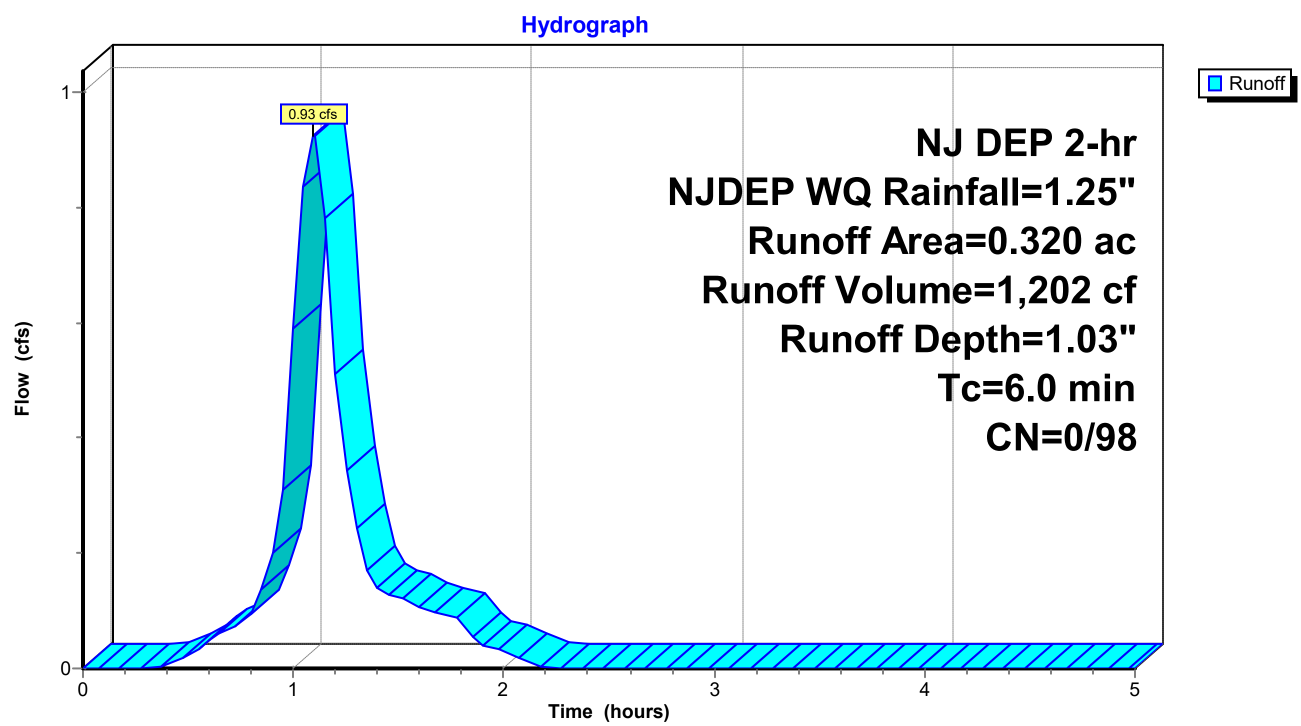
Runoff = 0.93 cfs @ 1.09 hrs, Volume= 1,202 cf, Depth= 1.03"
Routed to Pond 23P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.320	98	
	0.320	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 23S: DA 23



Summary for Pond 23P: Filterra 8x12.5

Inflow Area = 0.320 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.93 cfs @ 1.09 hrs, Volume= 1,202 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,272 cf, Atten= 25%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,272 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.72' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 72 cf

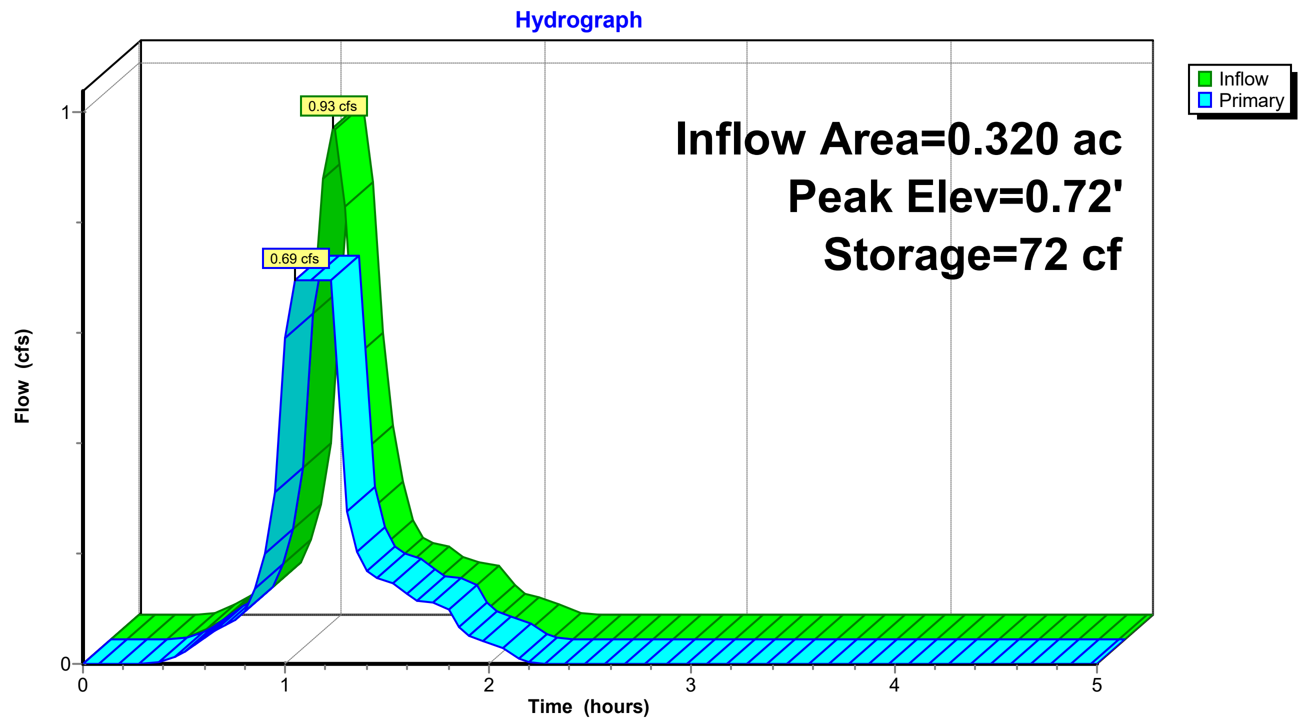
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.8 min (72.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.09' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 23P: Filterra 8x12.5



Summary for Subcatchment 26S: DA 26

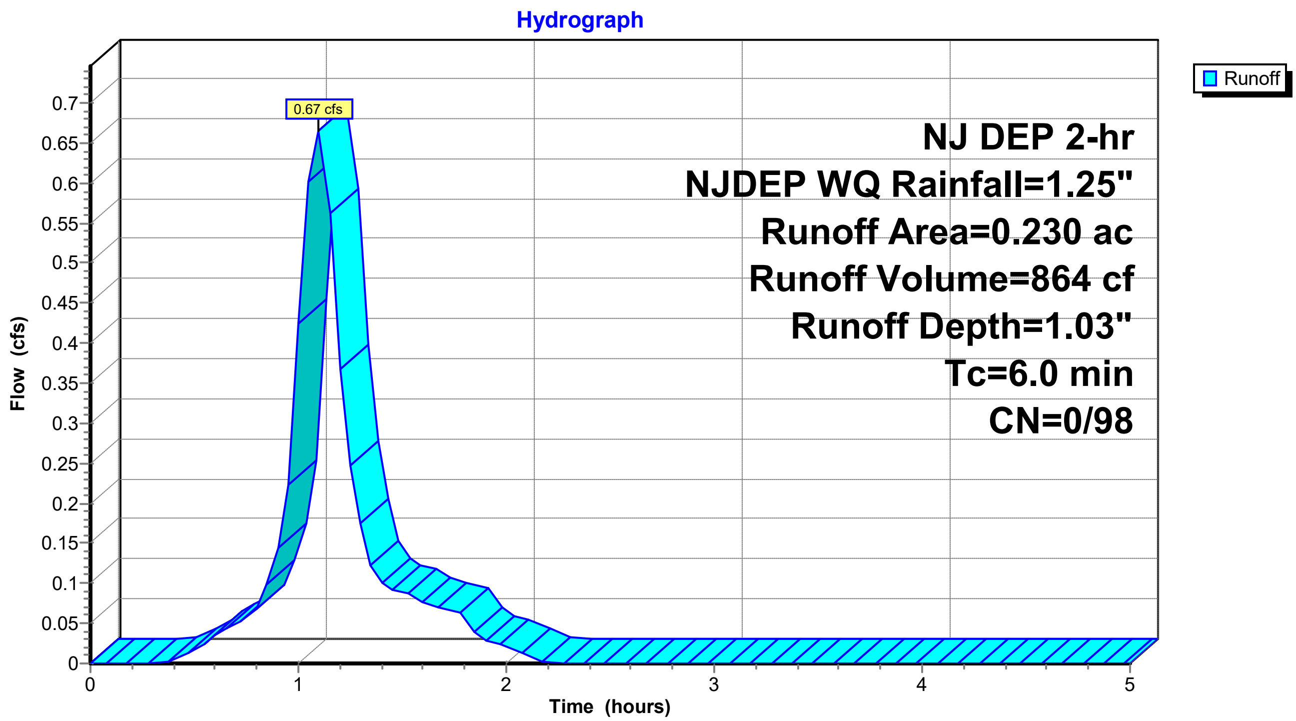
Runoff = 0.67 cfs @ 1.09 hrs, Volume= 864 cf, Depth= 1.03"
Routed to Pond 26P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.230	98	
	0.230	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 26S: DA 26



Summary for Pond 26P: Filterra 8x10.5

Inflow Area = 0.230 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.67 cfs @ 1.09 hrs, Volume= 864 cf
Outflow = 0.58 cfs @ 1.05 hrs, Volume= 990 cf, Atten= 12%, Lag= 0.0 min
Primary = 0.58 cfs @ 1.05 hrs, Volume= 990 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.20' @ 1.14 hrs Surf.Area= 0.002 ac Storage= 16 cf

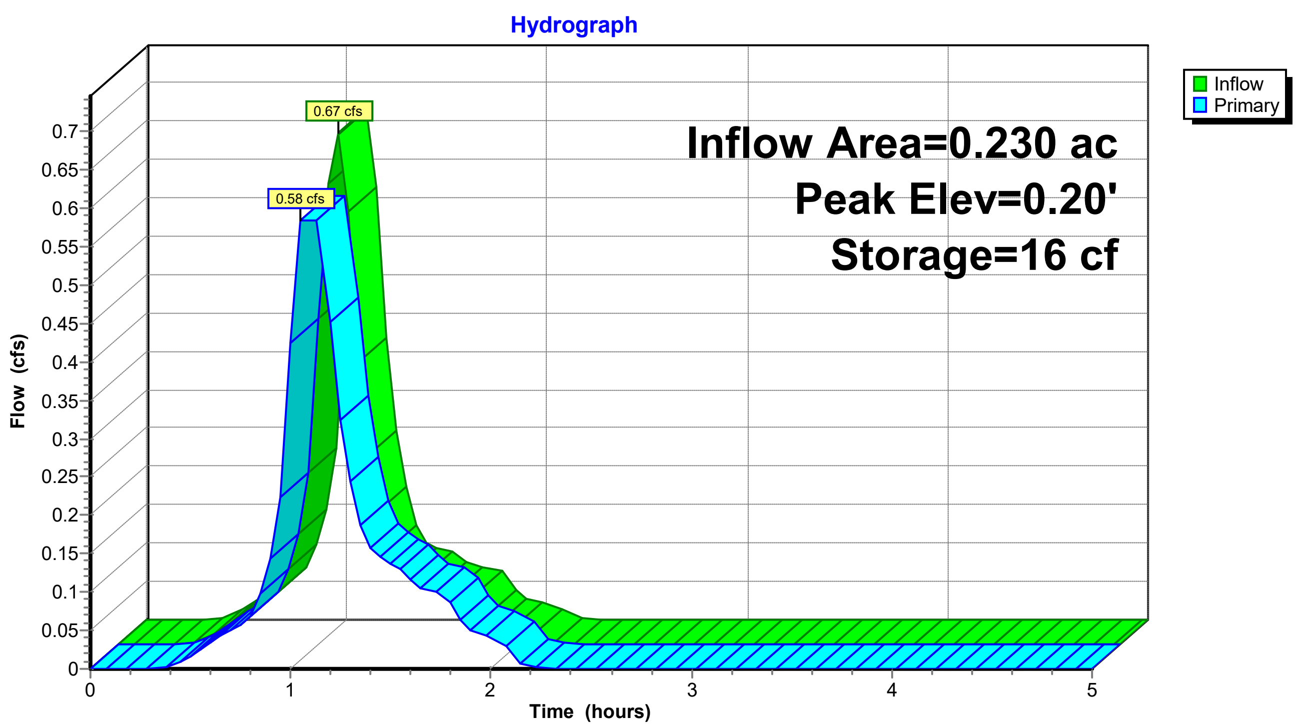
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.0 min (73.3 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 26P: Filterra 8x10.5



Summary for Subcatchment 27S: DA 27

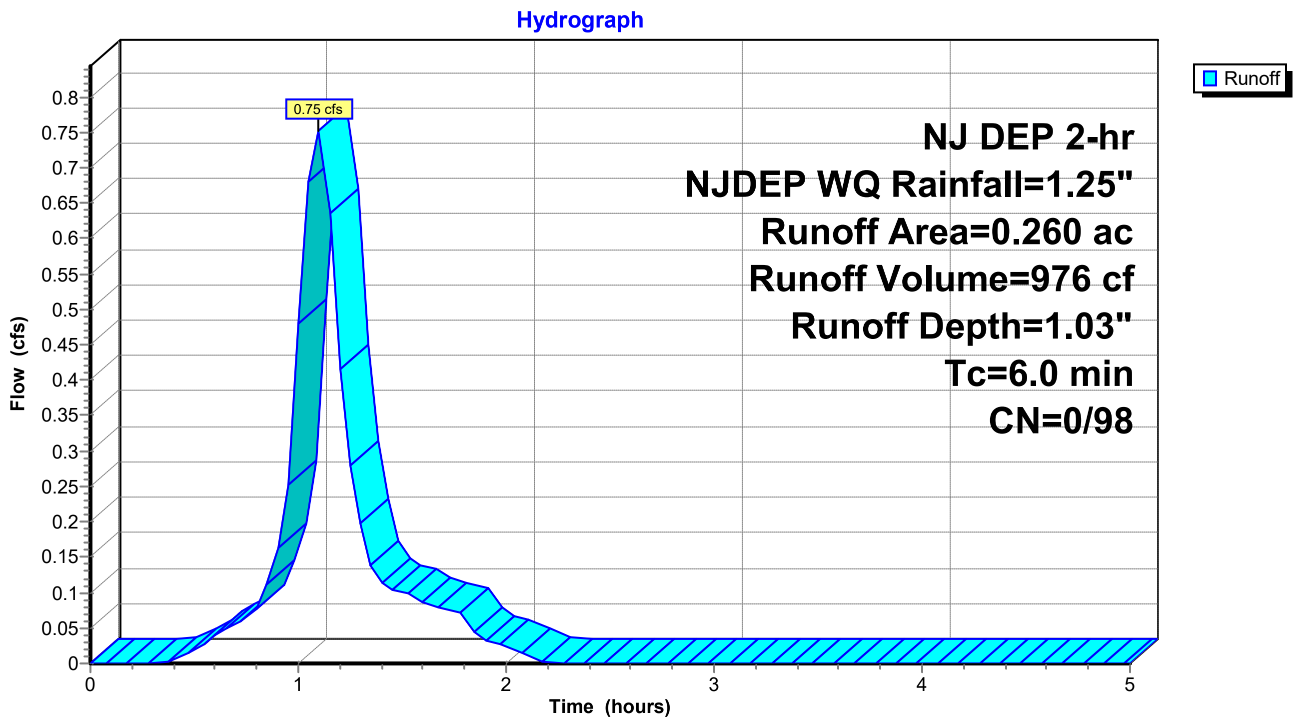
Runoff = 0.75 cfs @ 1.09 hrs, Volume= 976 cf, Depth= 1.03"
Routed to Pond 27P : Filterra 8x10.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.260	98	
	0.260	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 27S: DA 27



Summary for Pond 27P: Filterra 8x10.5

Inflow Area = 0.260 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.75 cfs @ 1.09 hrs, Volume= 976 cf
Outflow = 0.58 cfs @ 1.05 hrs, Volume= 1,212 cf, Atten= 23%, Lag= 0.0 min
Primary = 0.58 cfs @ 1.05 hrs, Volume= 1,212 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.58' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 49 cf

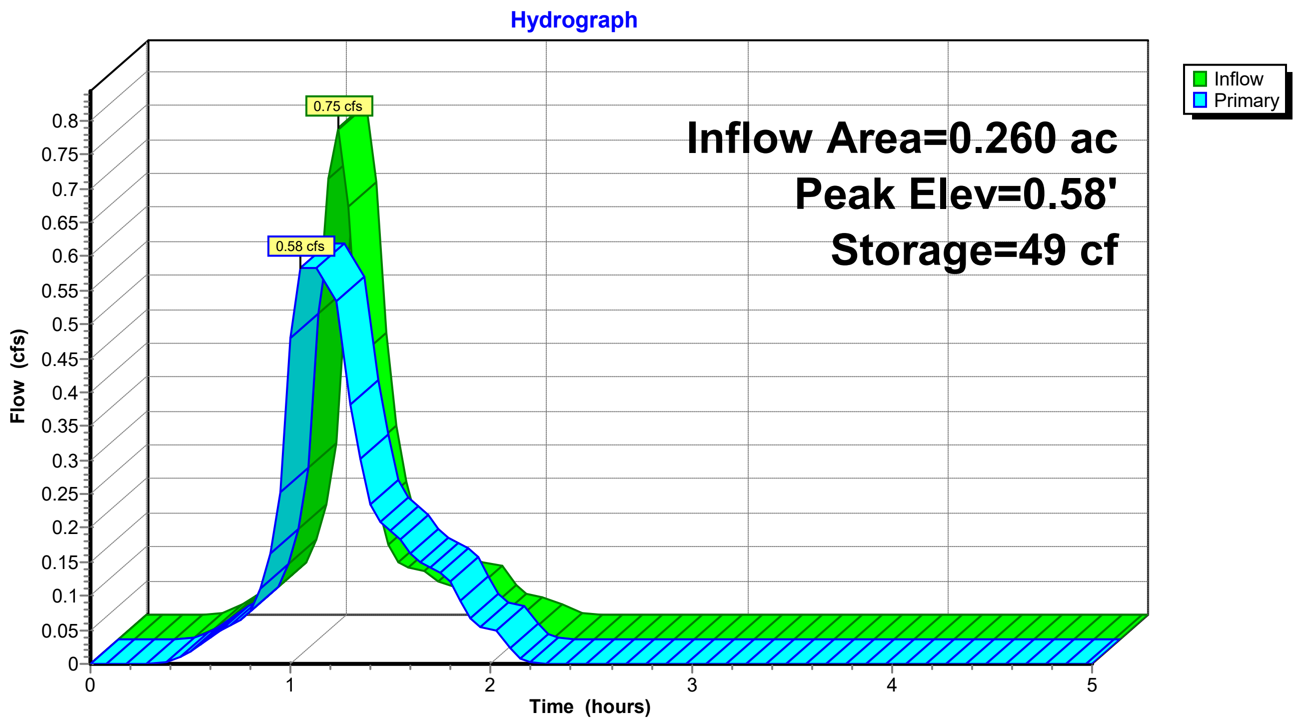
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	63 cf	**8.00'W x 10.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.58 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.58 cfs @ 0.01 fps)

Pond 27P: Filterra 8x10.5



Summary for Subcatchment 28S: DA 28

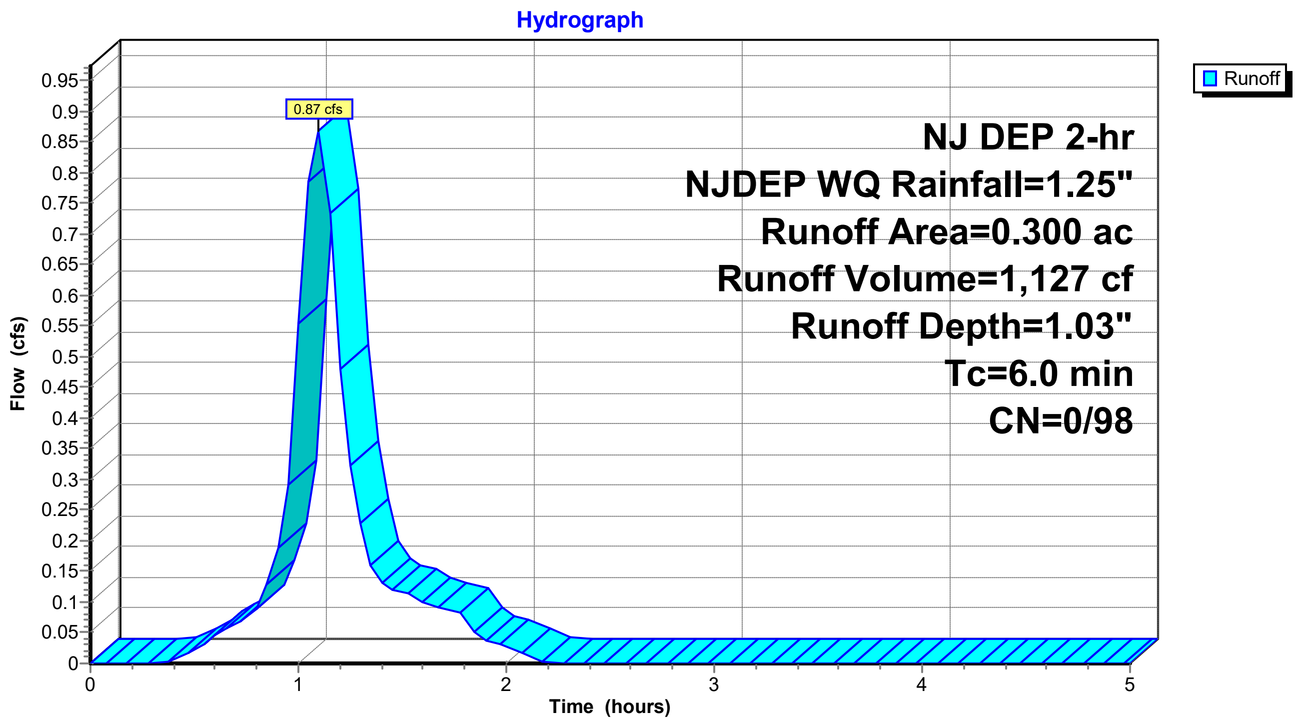
Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 28P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 28S: DA 28



Summary for Pond 28P: Filterra 8x12.5

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 951 cf, Atten= 20%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 951 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

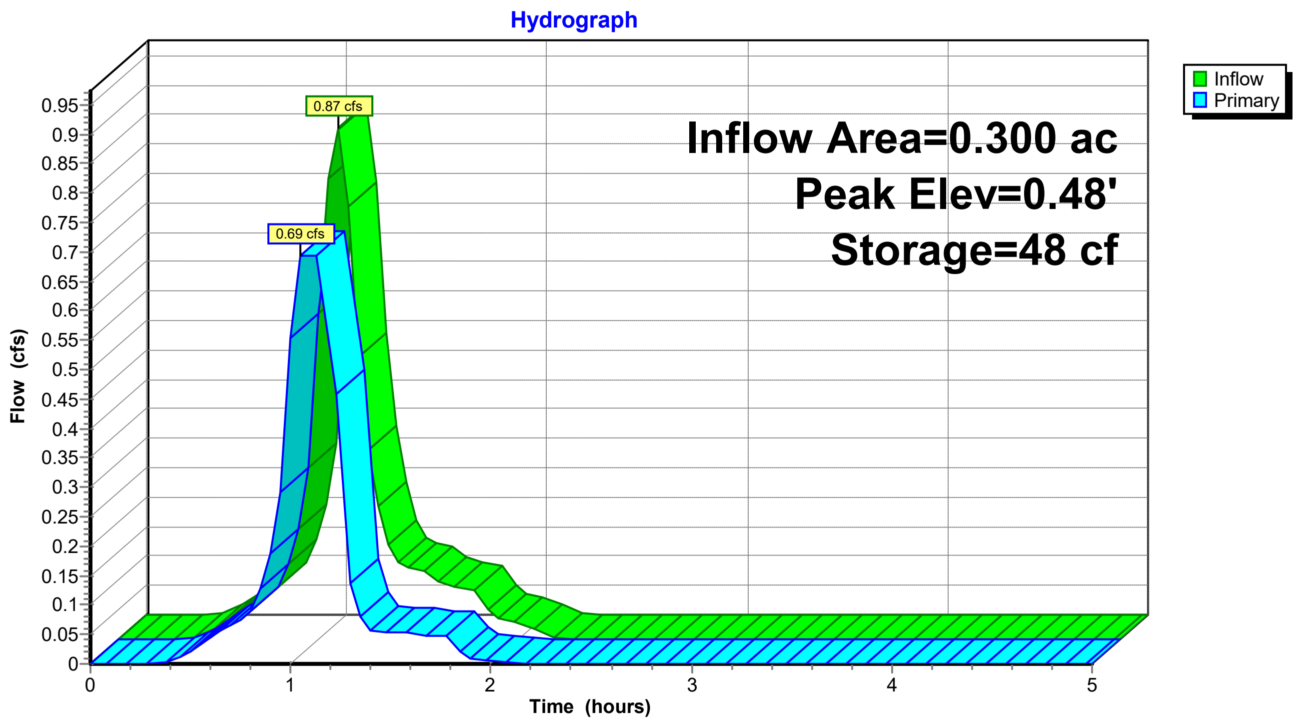
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 28P: Filterra 8x12.5



Summary for Subcatchment 29S: DA 29

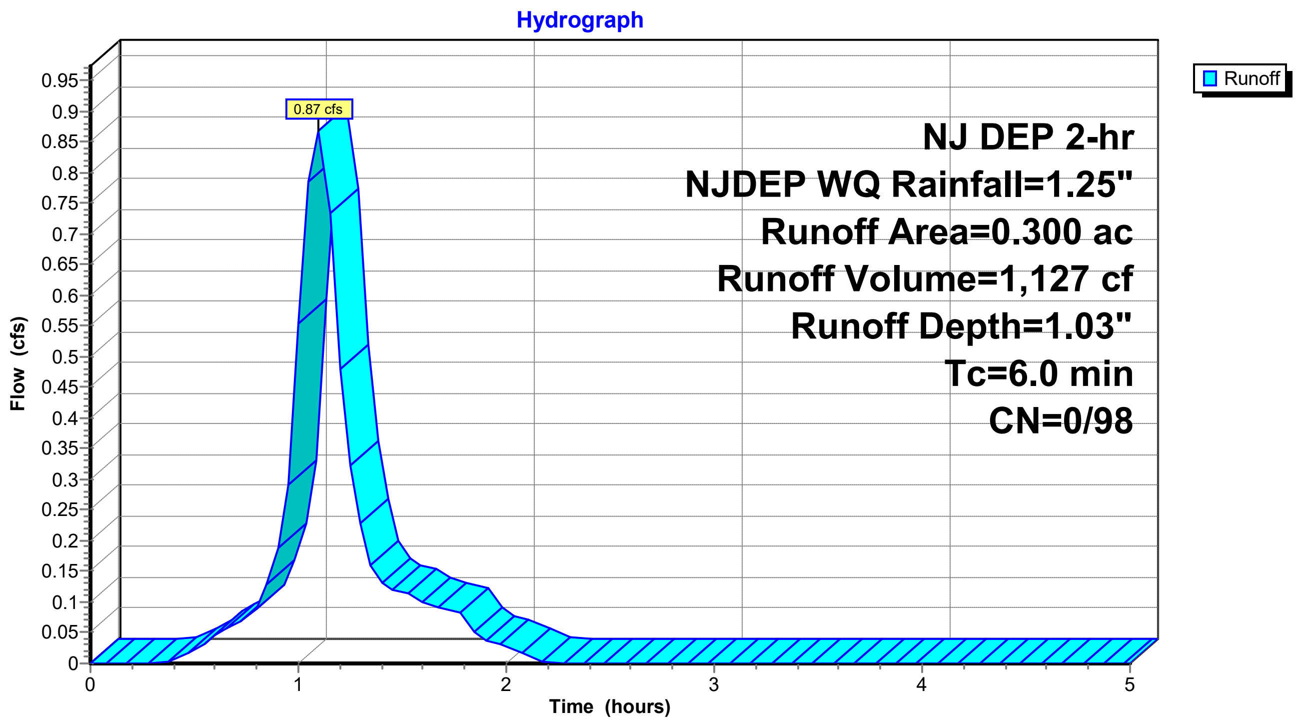
Runoff = 0.87 cfs @ 1.09 hrs, Volume= 1,127 cf, Depth= 1.03"
Routed to Pond 29P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.300	98	
	0.300	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 29S: DA 29



Summary for Pond 29P: Filterra 8x12.5

Inflow Area =	0.300 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.87 cfs @	1.09 hrs, Volume=	1,127 cf	
Outflow =	0.69 cfs @	1.05 hrs, Volume=	951 cf,	Atten= 20%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs, Volume=	951 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.48' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 48 cf

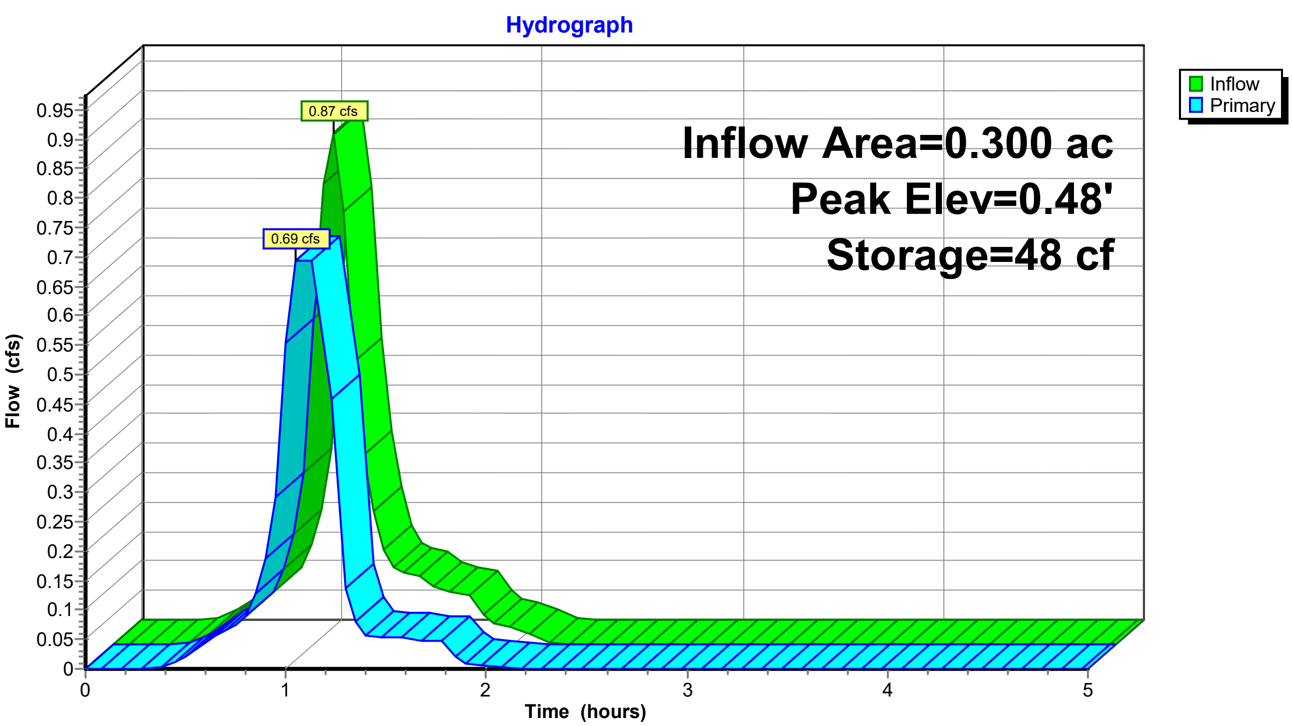
Plug-Flow detention time= 2.2 min calculated for 951 cf (84% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 29P: Filterra 8x12.5



Summary for Subcatchment 54S: DA 54

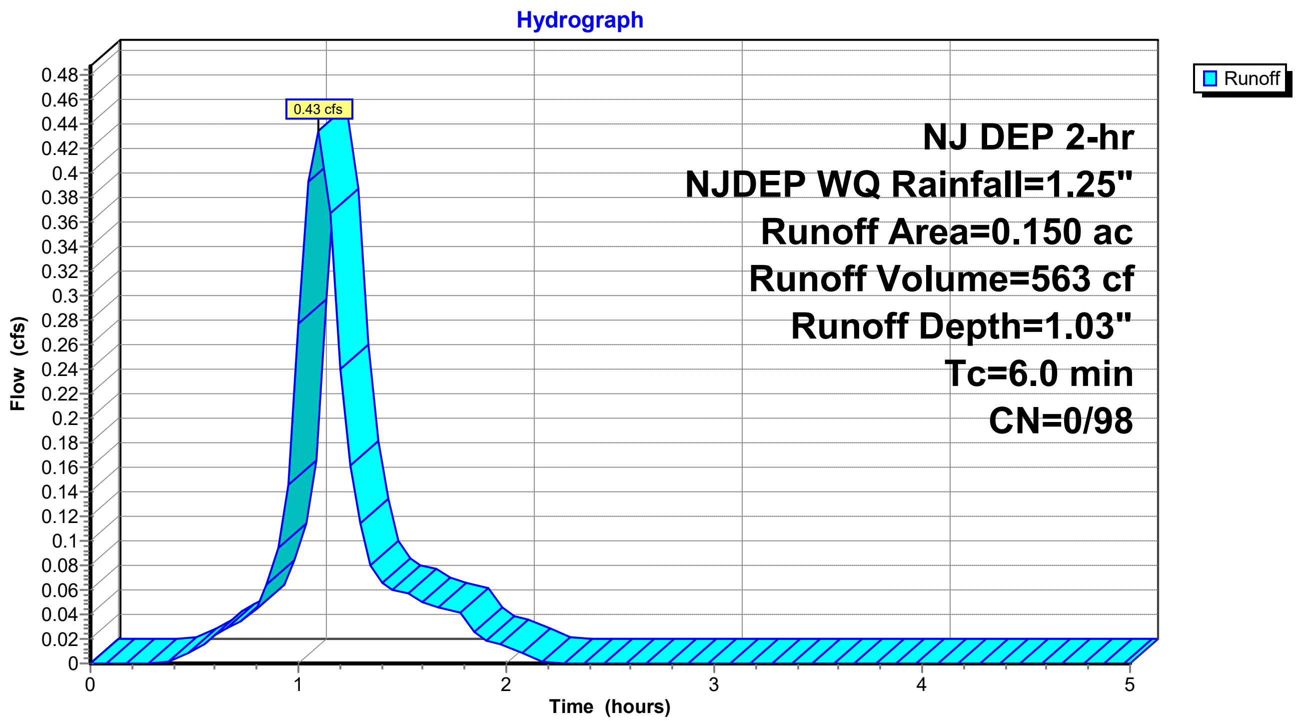
Runoff = 0.43 cfs @ 1.09 hrs, Volume= 563 cf, Depth= 1.03"
Routed to Pond 54P : Filterra 14x8

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.150	98	
	0.150	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 54S: DA 54



Summary for Subcatchment 55S: DA 55

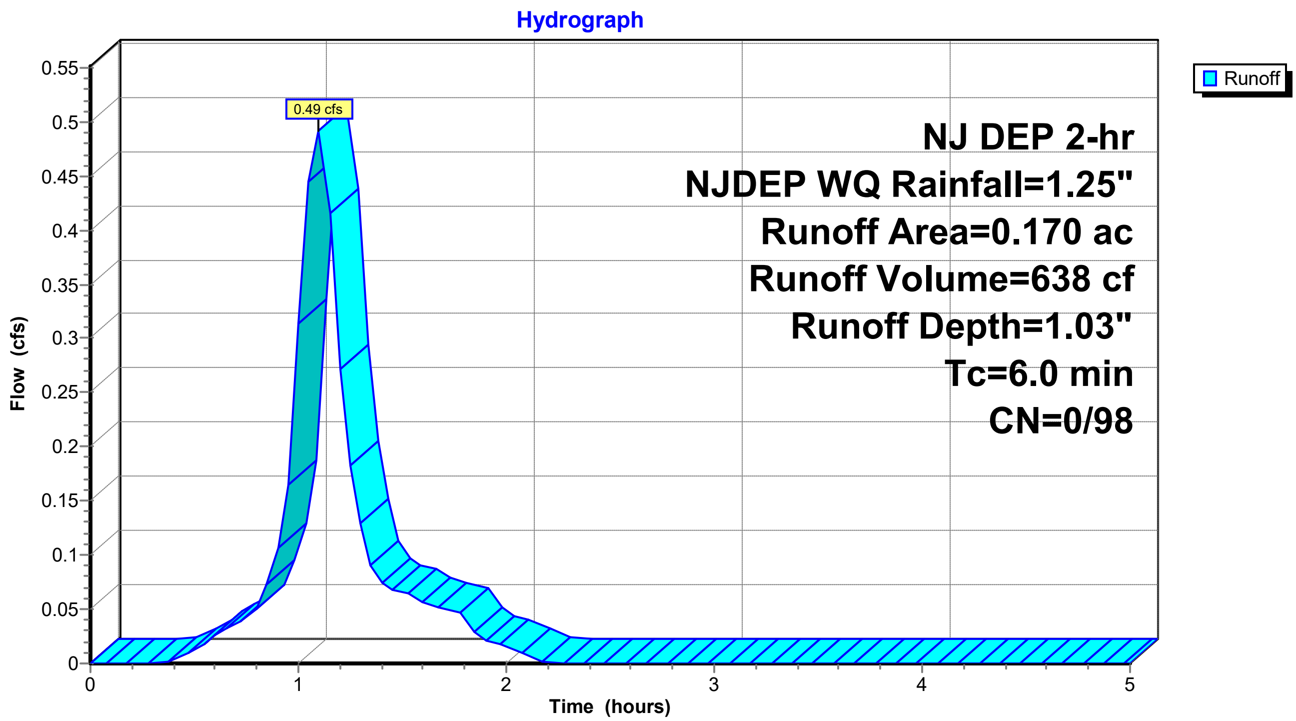
Runoff = 0.49 cfs @ 1.09 hrs, Volume= 638 cf, Depth= 1.03"
Routed to Pond 54P : Filterra 14x8

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.170	98	
	0.170	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 55S: DA 55



Summary for Pond 54P: Filterra 14x8

Inflow Area =		0.320 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.93 cfs @	1.09 hrs,	Volume=	1,202 cf	
Outflow =	0.78 cfs @	1.05 hrs,	Volume=	1,220 cf,	Atten= 16%, Lag= 0.0 min
Primary =	0.78 cfs @	1.05 hrs,	Volume=	1,220 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.32' @ 1.14 hrs Surf.Area= 0.003 ac Storage= 36 cf

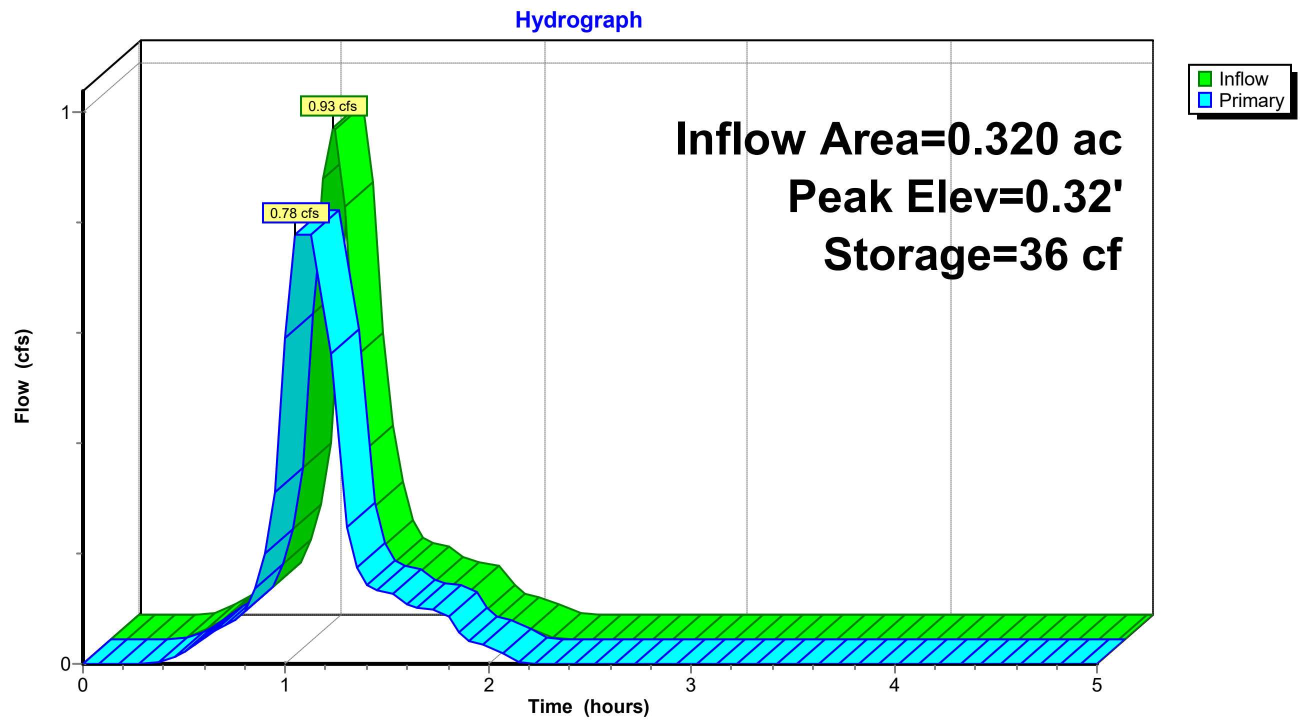
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.4 min (70.7 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	84 cf	**14.00'W x 8.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.78 cfs @ 1.05 hrs HW=0.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.78 cfs @ 0.01 fps)

Pond 54P: Filterra 14x8



Summary for Subcatchment 56S: DA 56

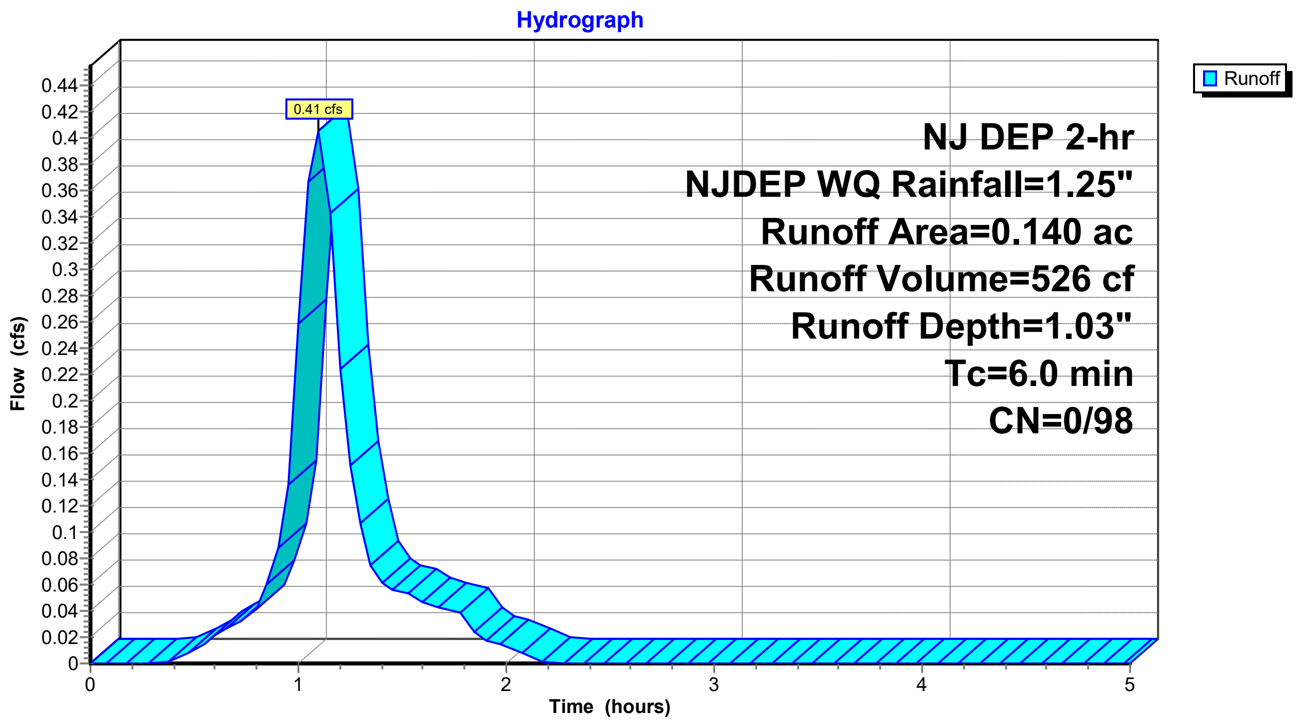
Runoff = 0.41 cfs @ 1.09 hrs, Volume= 526 cf, Depth= 1.03"
Routed to Pond 56P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.140	98	
	0.140	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 56S: DA 56



Summary for Subcatchment 57S: DA 57

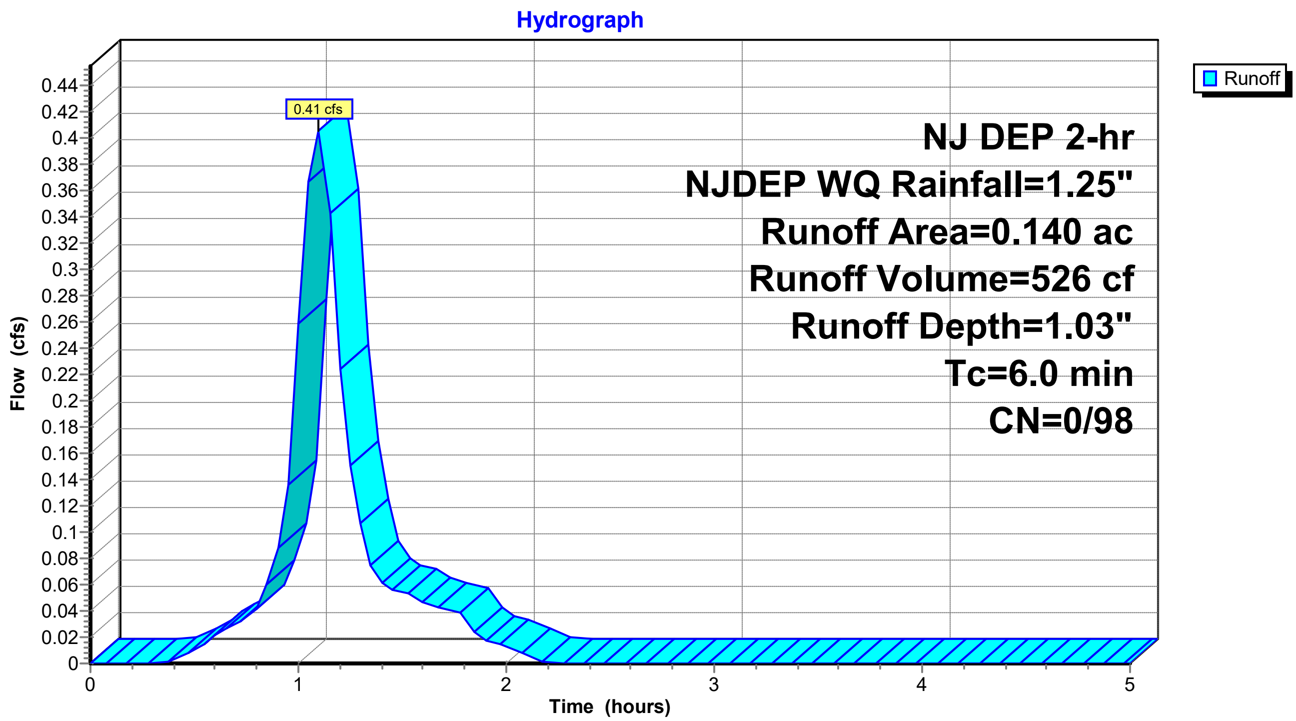
Runoff = 0.41 cfs @ 1.09 hrs, Volume= 526 cf, Depth= 1.03"
Routed to Pond 56P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.140	98	
	0.140	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 57S: DA 57



Summary for Pond 56P: Filterra 8x12.5

Inflow Area =	0.280 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event		
Inflow =	0.81 cfs @	1.09 hrs,	Volume=	1,052 cf	
Outflow =	0.69 cfs @	1.05 hrs,	Volume=	1,338 cf,	Atten= 14%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs,	Volume=	1,338 cf	

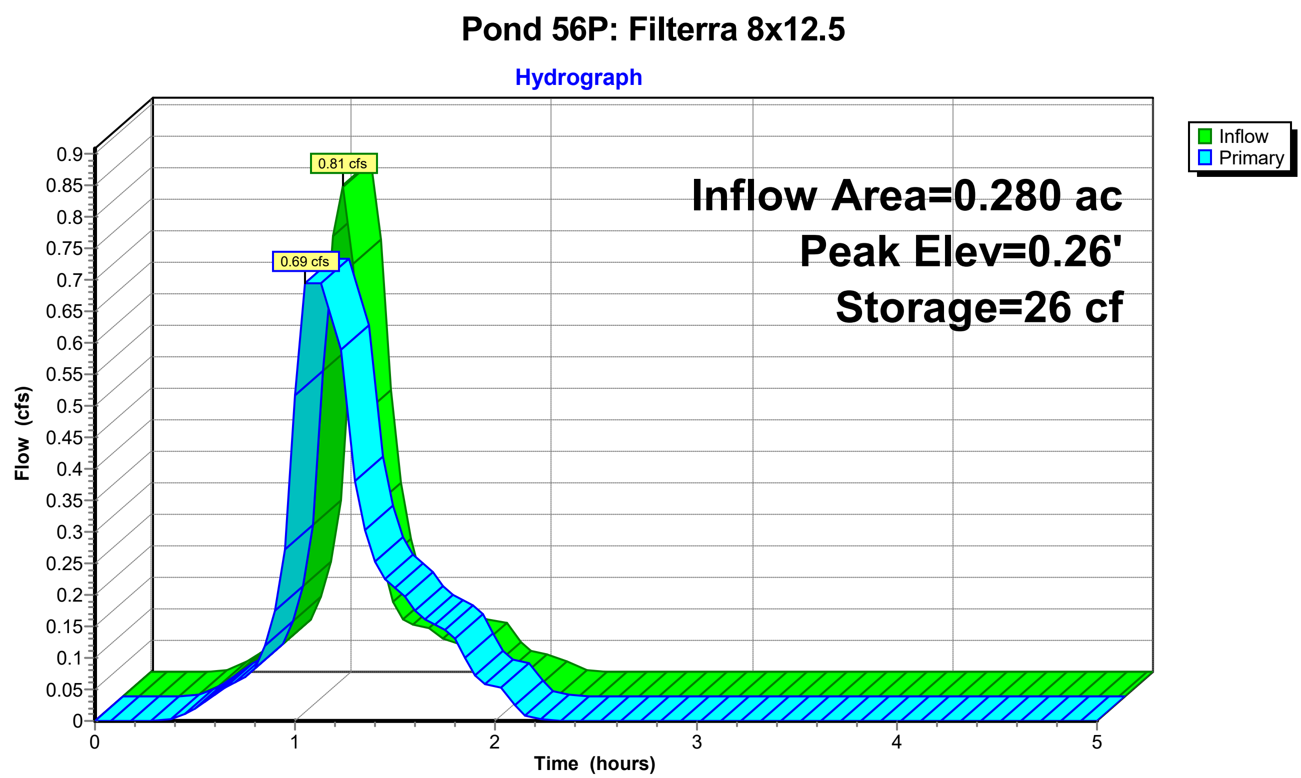
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.26' @ 1.14 hrs Surf.Area= 0.002 ac Storage= 26 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.4 min (74.7 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)



Summary for Subcatchment 58S: DA 58

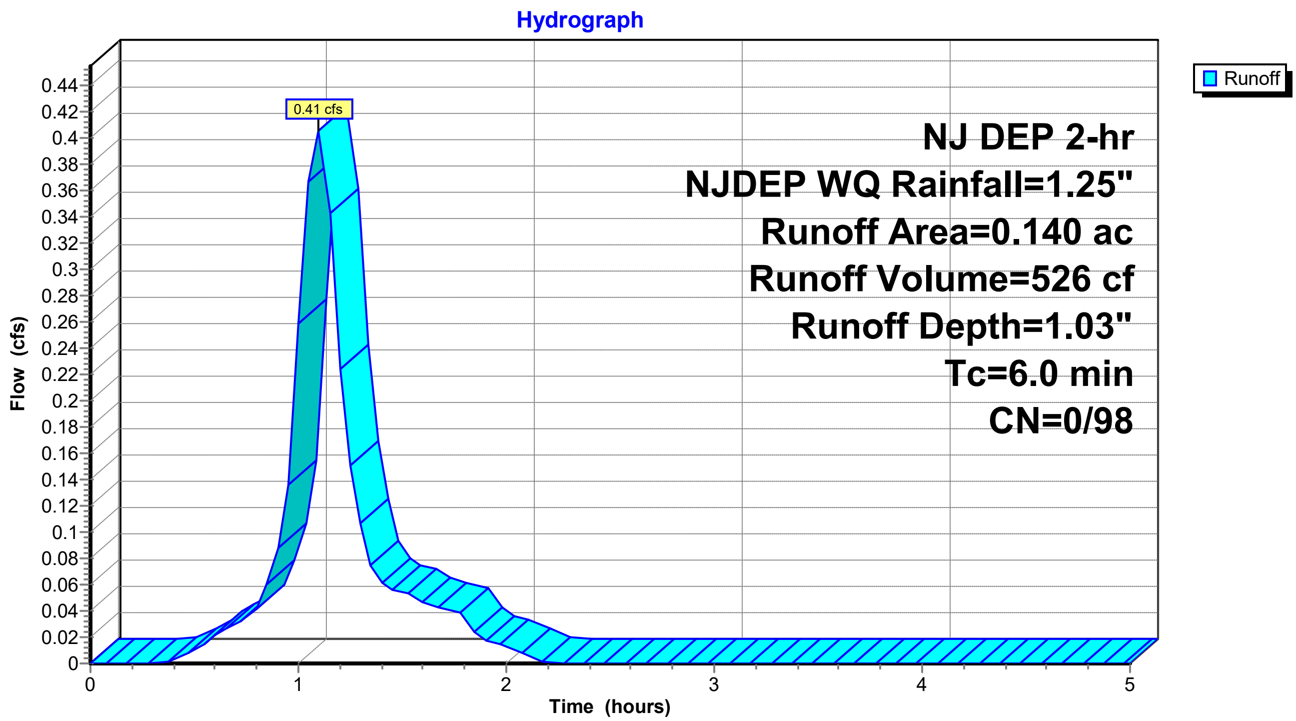
Runoff = 0.41 cfs @ 1.09 hrs, Volume= 526 cf, Depth= 1.03"
Routed to Pond 58P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.140	98	
	0.140	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 58S: DA 58



Summary for Subcatchment 59S: DA 59

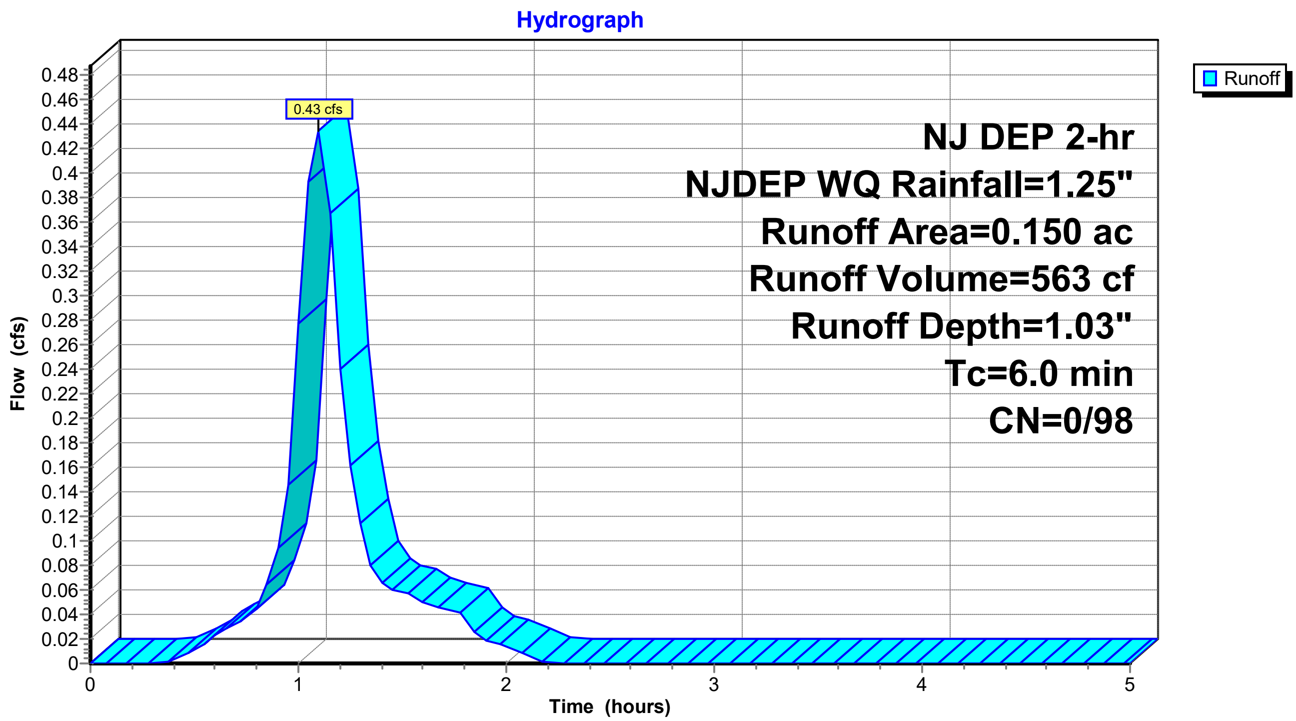
Runoff = 0.43 cfs @ 1.09 hrs, Volume= 563 cf, Depth= 1.03"
Routed to Pond 58P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.150	98	
	0.150	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 59S: DA 59



Summary for Pond 58P: Filterra 8x12.5

Inflow Area =		0.290 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.84 cfs @	1.09 hrs,	Volume=	1,089 cf	
Outflow =	0.69 cfs @	1.05 hrs,	Volume=	883 cf,	Atten= 17%, Lag= 0.0 min
Primary =	0.69 cfs @	1.05 hrs,	Volume=	883 cf	

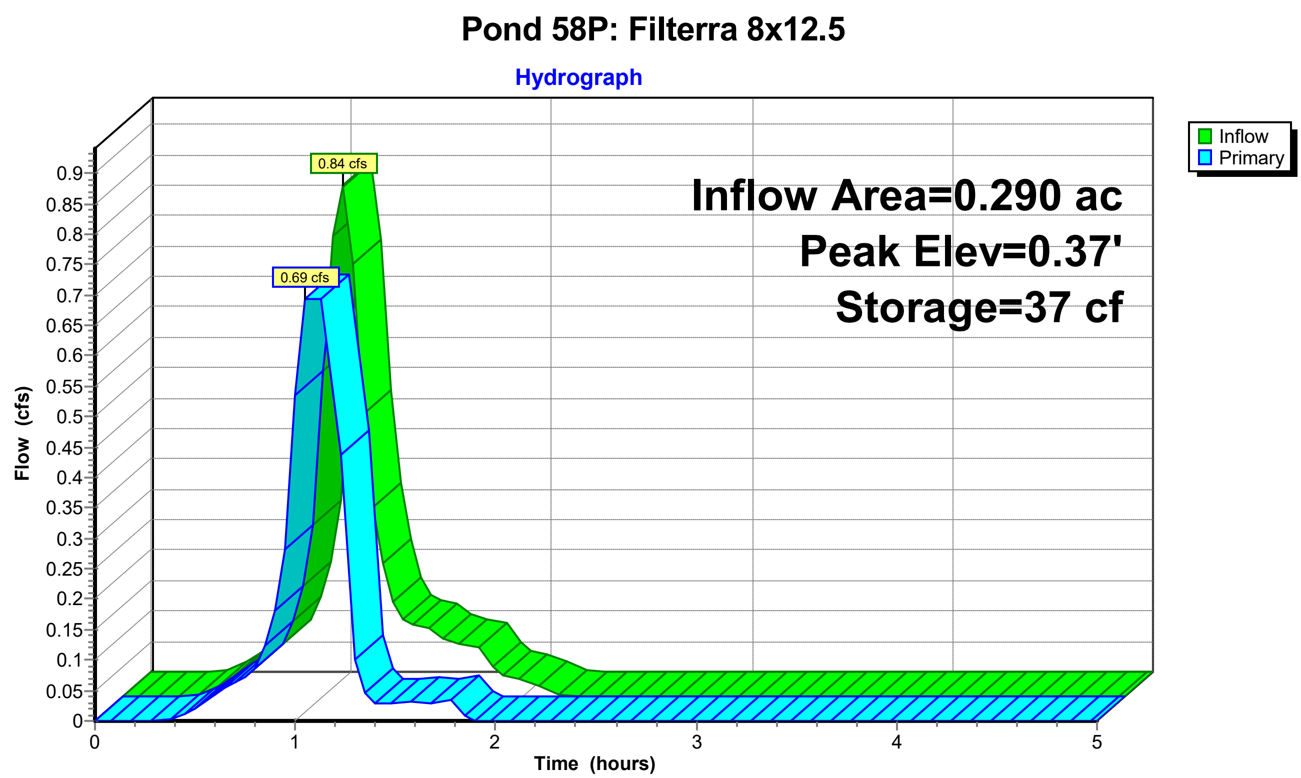
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.37' @ 1.15 hrs Surf.Area= 0.002 ac Storage= 37 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)



Summary for Subcatchment 60S: DA 60

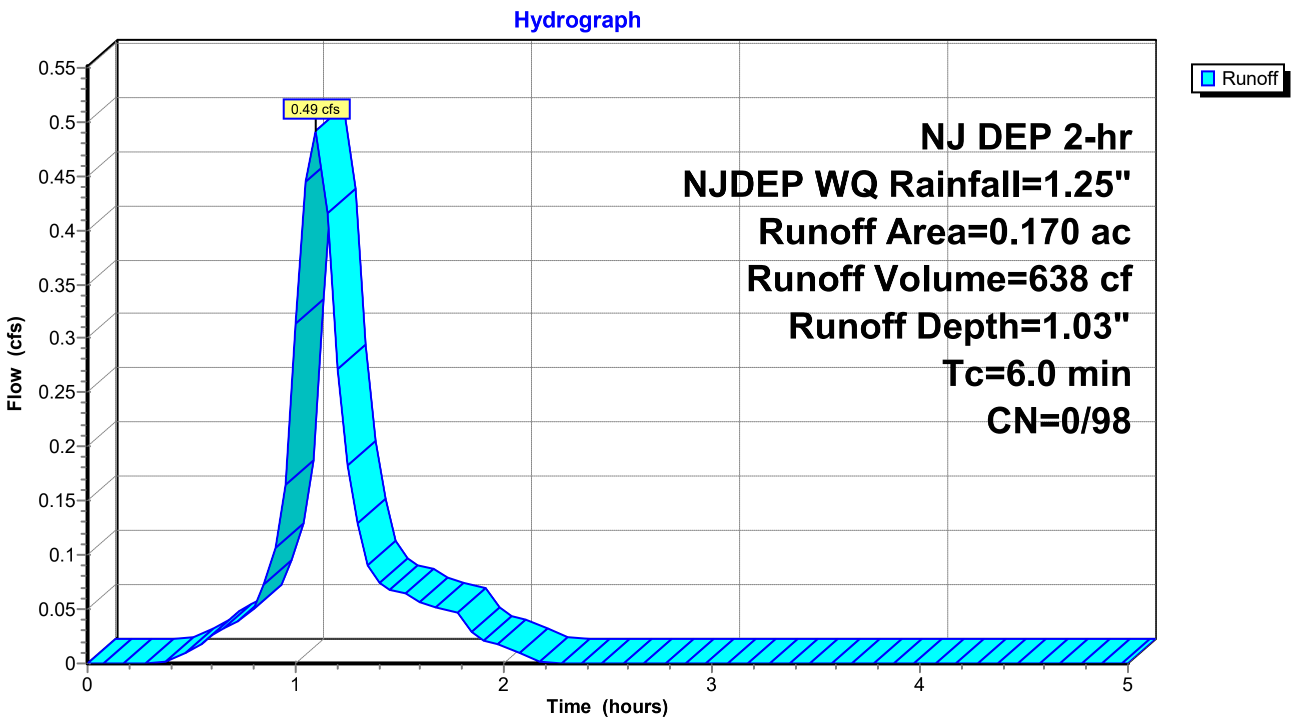
Runoff = 0.49 cfs @ 1.09 hrs, Volume= 638 cf, Depth= 1.03"
Routed to Pond 60P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.170	98	
	0.170	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 60S: DA 60



Summary for Subcatchment 61S: DA 61

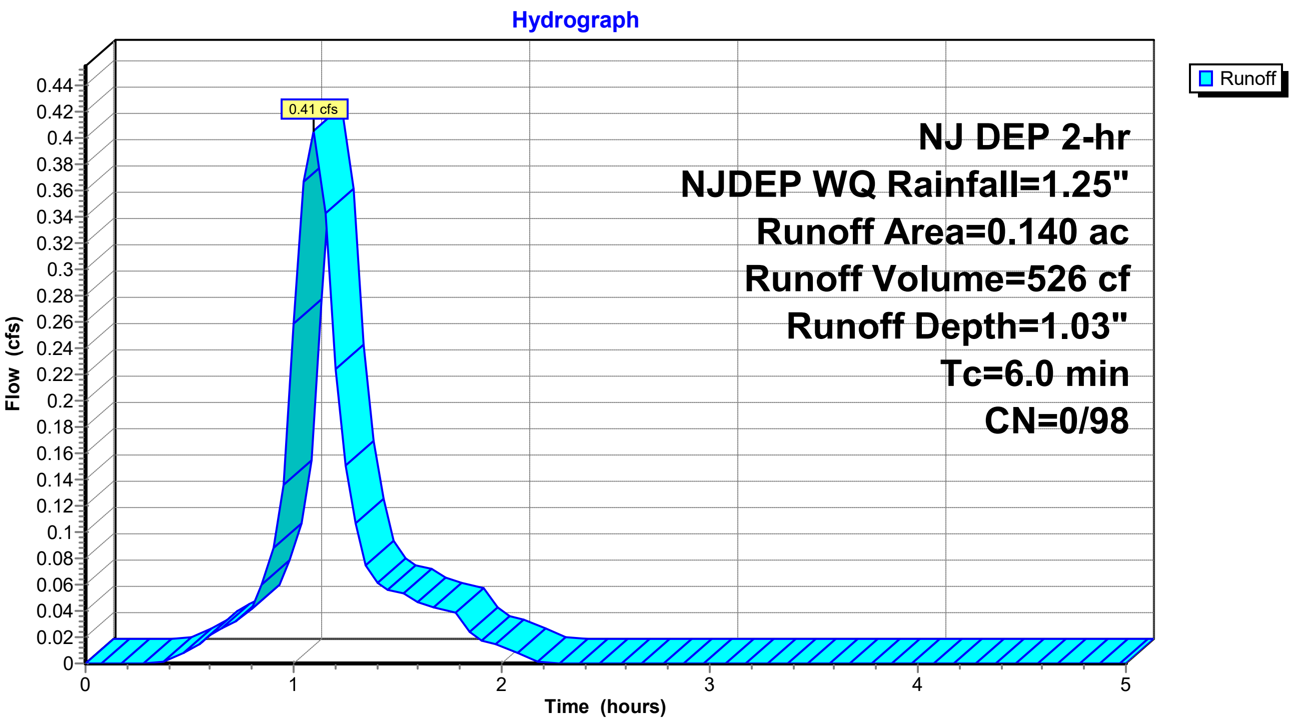
Runoff = 0.41 cfs @ 1.09 hrs, Volume= 526 cf, Depth= 1.03"
Routed to Pond 60P : Filterra 8x12.5

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.140	98	
	0.140	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 61S: DA 61



Summary for Pond 60P: Filterra 8x12.5

Inflow Area = 0.310 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.90 cfs @ 1.09 hrs, Volume= 1,164 cf
Outflow = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf, Atten= 23%, Lag= 0.0 min
Primary = 0.69 cfs @ 1.05 hrs, Volume= 1,451 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.59' @ 1.16 hrs Surf.Area= 0.002 ac Storage= 59 cf

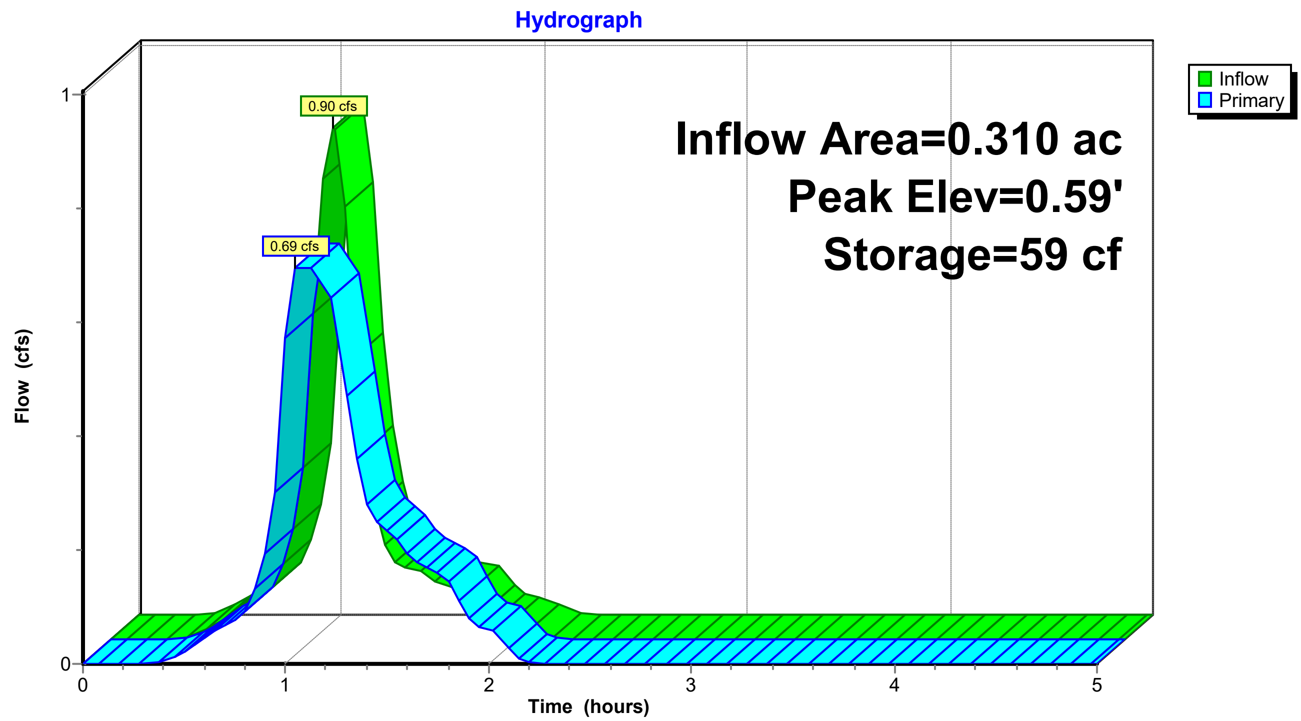
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (75.0 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	75 cf	**8.00'W x 12.50'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.69 cfs @ 1.05 hrs HW=0.06' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.69 cfs @ 0.01 fps)

Pond 60P: Filterra 8x12.5



Summary for Subcatchment 62S: DA 62

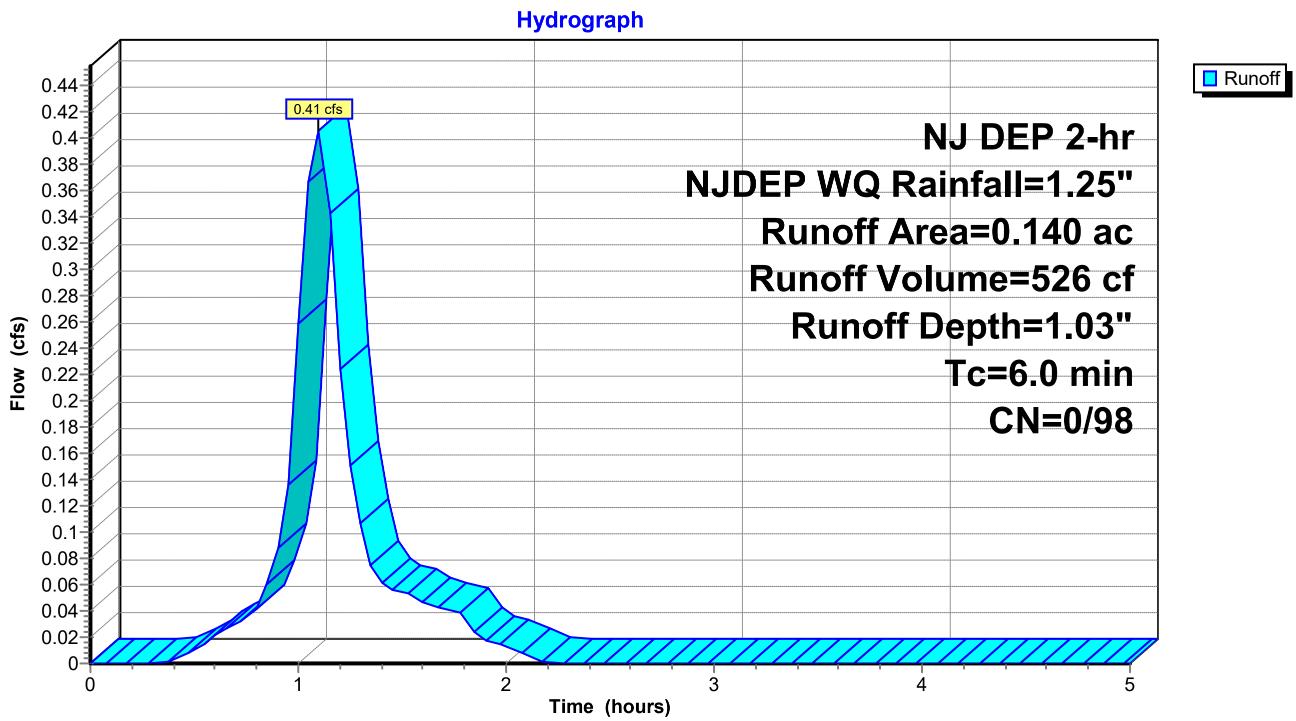
Runoff = 0.41 cfs @ 1.09 hrs, Volume= 526 cf, Depth= 1.03"
Routed to Pond 62P : Filterra 6x8

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.140	98	
	0.140	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 62S: DA 62



Summary for Pond 62P: Filterra 6x8

Inflow Area = 0.140 ac,100.00% Impervious, Inflow Depth = 1.03" for NJDEP WQ event
Inflow = 0.41 cfs @ 1.09 hrs, Volume= 526 cf
Outflow = 0.33 cfs @ 1.05 hrs, Volume= 396 cf, Atten= 18%, Lag= 0.0 min
Primary = 0.33 cfs @ 1.05 hrs, Volume= 396 cf

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.38' @ 1.15 hrs Surf.Area= 0.001 ac Storage= 18 cf

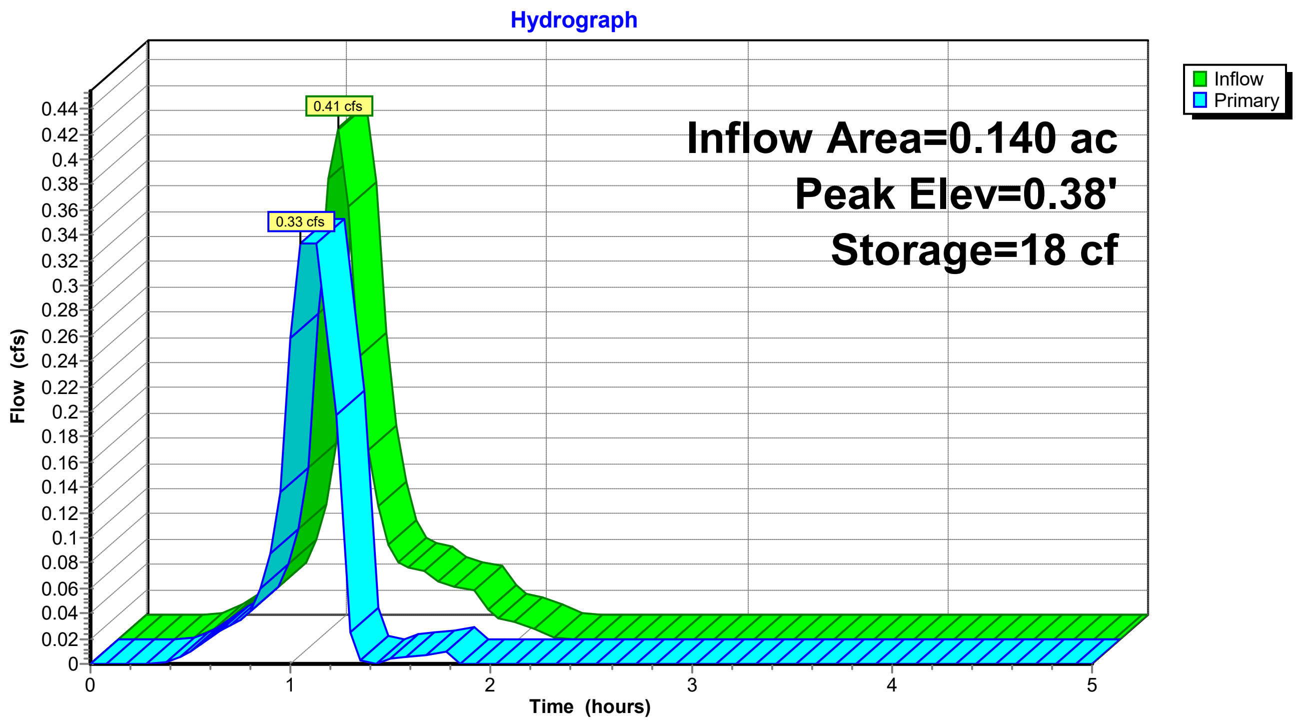
Plug-Flow detention time= 1.1 min calculated for 396 cf (75% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	36 cf	**6.00'W x 8.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.33 cfs @ 1.05 hrs HW=0.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.33 cfs @ 0.01 fps)

Pond 62P: Filterra 6x8



Summary for Subcatchment 63S: DA 63

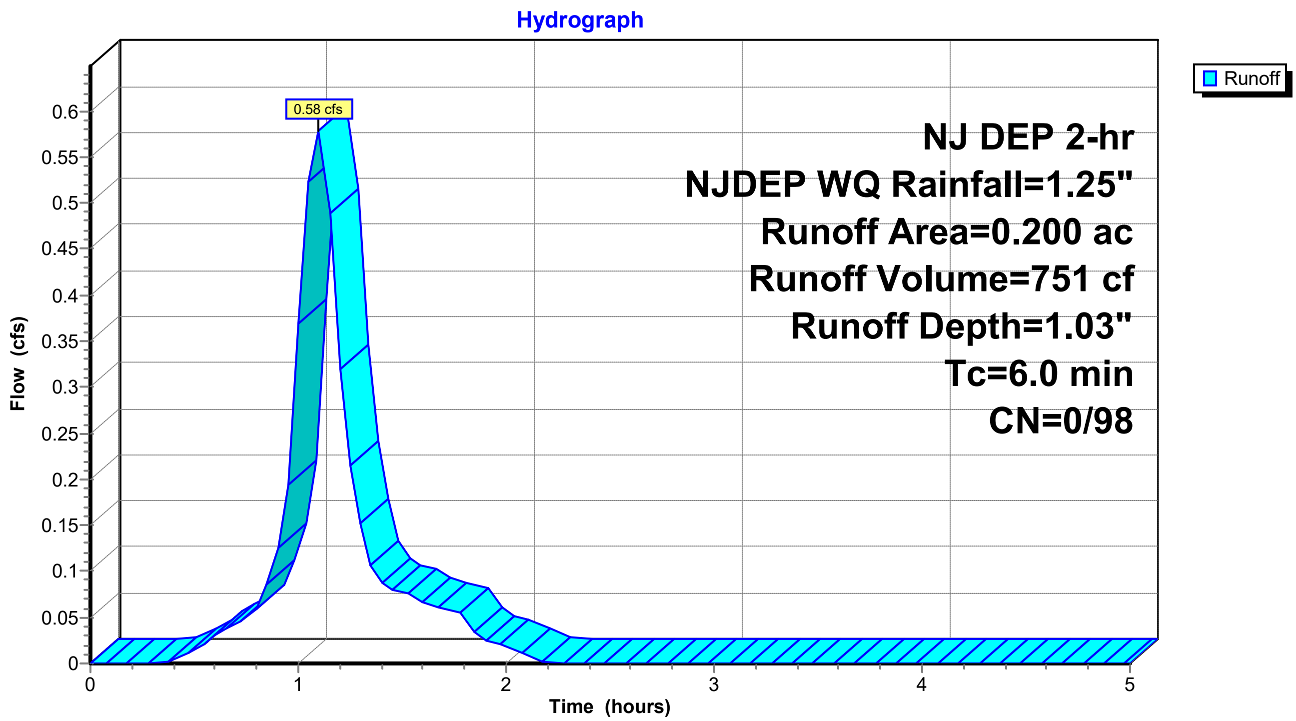
Runoff = 0.58 cfs @ 1.09 hrs, Volume= 751 cf, Depth= 1.03"
Routed to Pond 63P : Filterra 7x10

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.200	98	
	0.200	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 63S: DA 63



Summary for Pond 63P: Filterra 7x10

Inflow Area =	0.200 ac,100.00% Impervious,	Inflow Depth = 1.03"	for NJDEP WQ event	
Inflow =	0.58 cfs @	1.09 hrs, Volume=	751 cf	
Outflow =	0.49 cfs @	1.05 hrs, Volume=	762 cf,	Atten= 16%, Lag= 0.0 min
Primary =	0.49 cfs @	1.05 hrs, Volume=	762 cf	

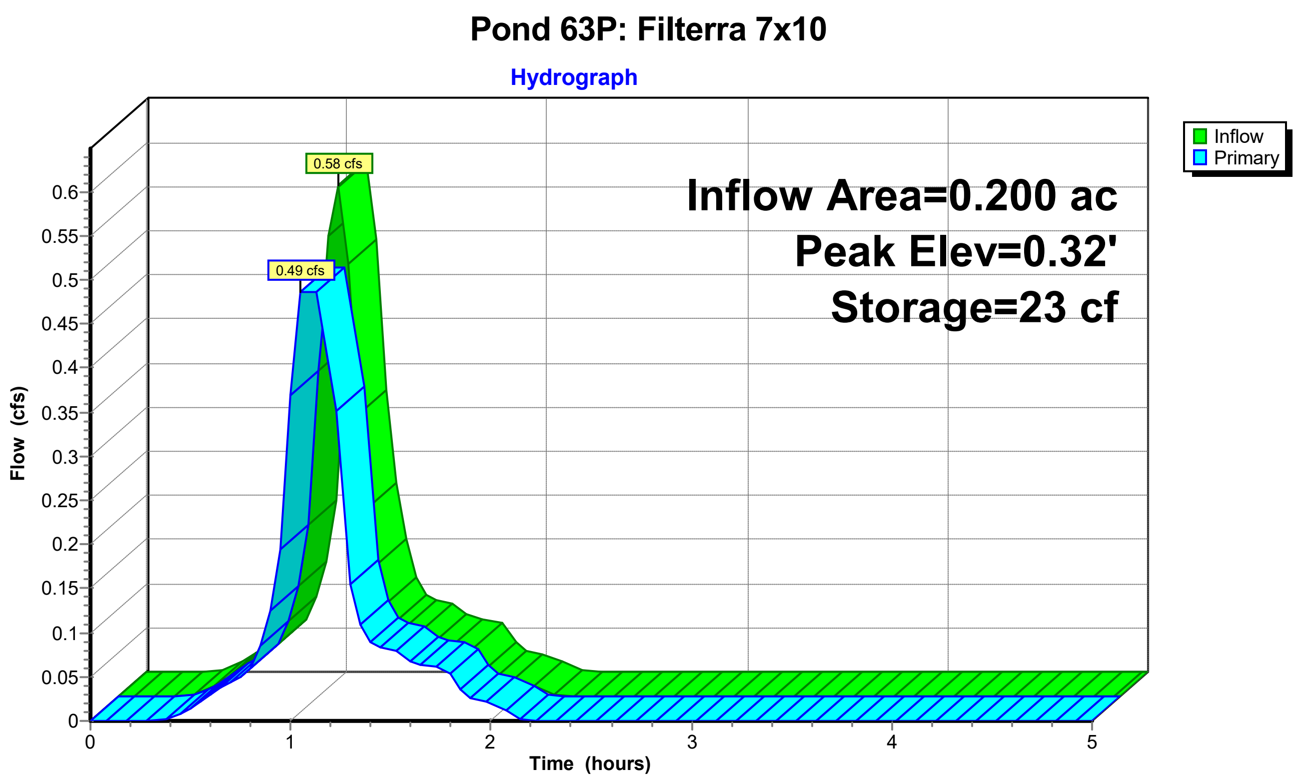
Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.32' @ 1.14 hrs Surf.Area= 0.002 ac Storage= 23 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.4 min (70.7 - 70.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	53 cf	**7.00'W x 10.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.49 cfs @ 1.05 hrs HW=0.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.49 cfs @ 0.01 fps)



Summary for Subcatchment 64S: substation DA

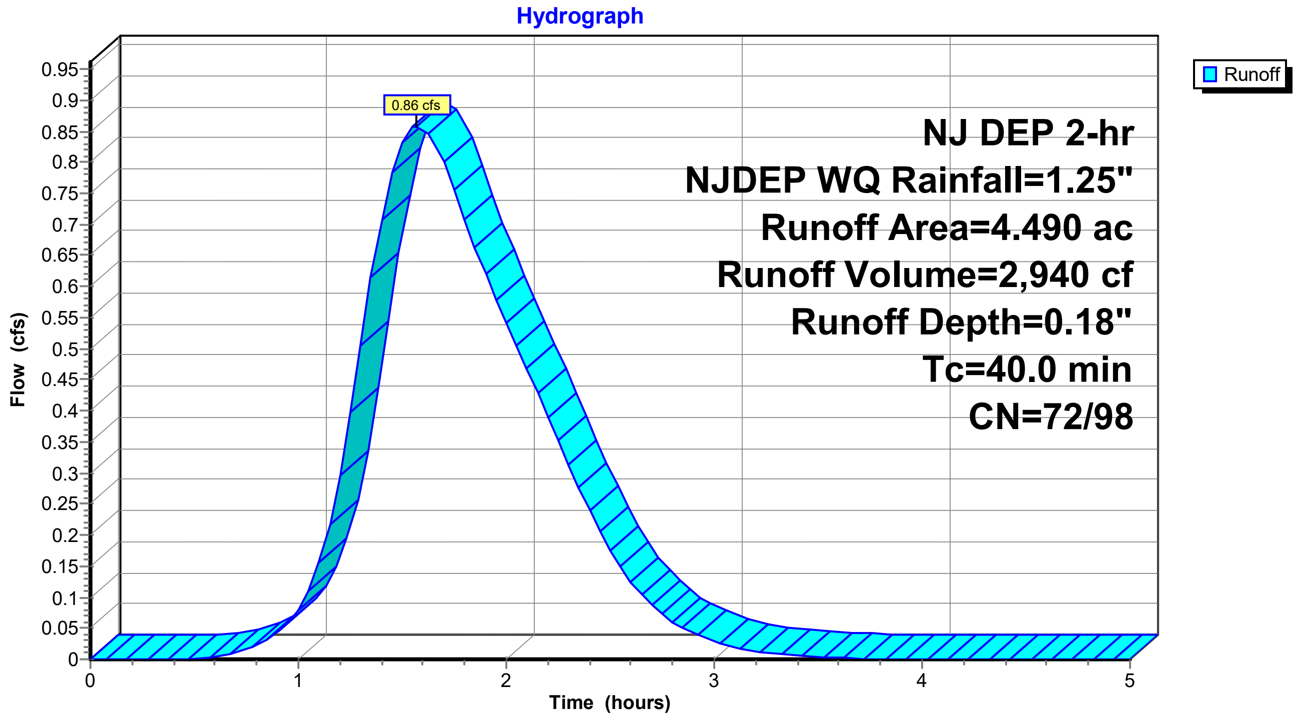
Runoff = 0.86 cfs @ 1.57 hrs, Volume= 2,940 cf, Depth= 0.18"
Routed to Pond 64P : Filterra 14x8

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-5.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.590	98	
*	3.900	72	
	4.490	75	Weighted Average
	3.900	72	86.86% Pervious Area
	0.590	98	13.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry,**

Subcatchment 64S: substation DA



Summary for Pond 64P: Filterra 14x8

Inflow Area =		4.490 ac,	13.14% Impervious,	Inflow Depth = 0.18"	for NJDEP WQ event
Inflow =	0.86 cfs @	1.57 hrs,	Volume=	2,940 cf	
Outflow =	0.78 cfs @	1.45 hrs,	Volume=	3,173 cf,	Atten= 9%, Lag= 0.0 min
Primary =	0.78 cfs @	1.45 hrs,	Volume=	3,173 cf	

Routing by Stor-Ind method, Time Span= 0.00-5.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.47' @ 1.73 hrs Surf.Area= 0.003 ac Storage= 53 cf

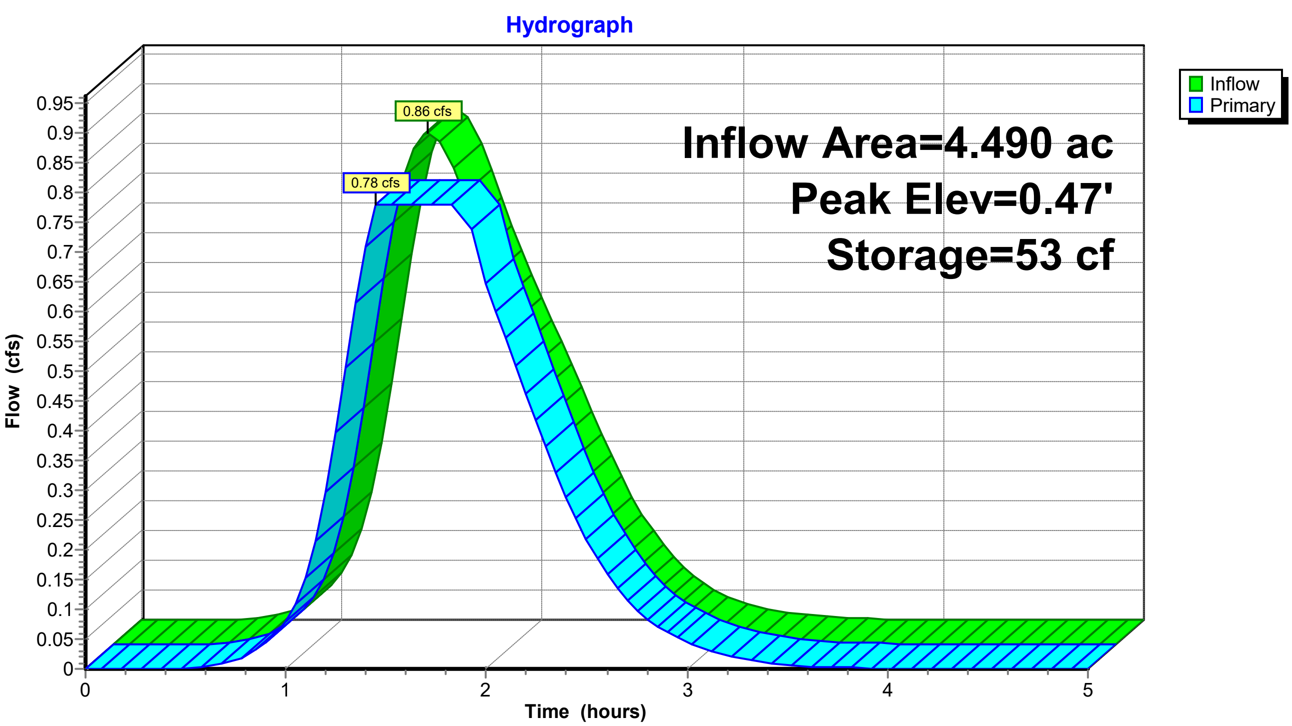
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.8 min (109.5 - 106.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	84 cf	**14.00'W x 8.00'L x 0.75'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**300.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.78 cfs @ 1.45 hrs HW=0.01' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.78 cfs @ 0.01 fps)

Pond 64P: Filterra 14x8



Appendix D –Manufacturer's Recommended Maintenance Procedures

Filterra HC Owner's Manual

filterra®

Bioretention Systems

CONTECH®
ENGINEERED SOLUTIONS

Table of Contents

Introduction

Thank you for your purchase of the Filterra® HC Bioretention System. Filterra HC is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra HC system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra HC system.

Included with your purchase is Activation of the Filterra HC system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

Each project presents different scopes for the use of Filterra HC systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra HC box sizing (per local regulations) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra HC units as shown in approved plans. A comprehensive installation manual covering all Filterra configurations is available at www.ContechES.com.

Activation Overview

Activation of the Filterra HC system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra HC systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra HC systems.

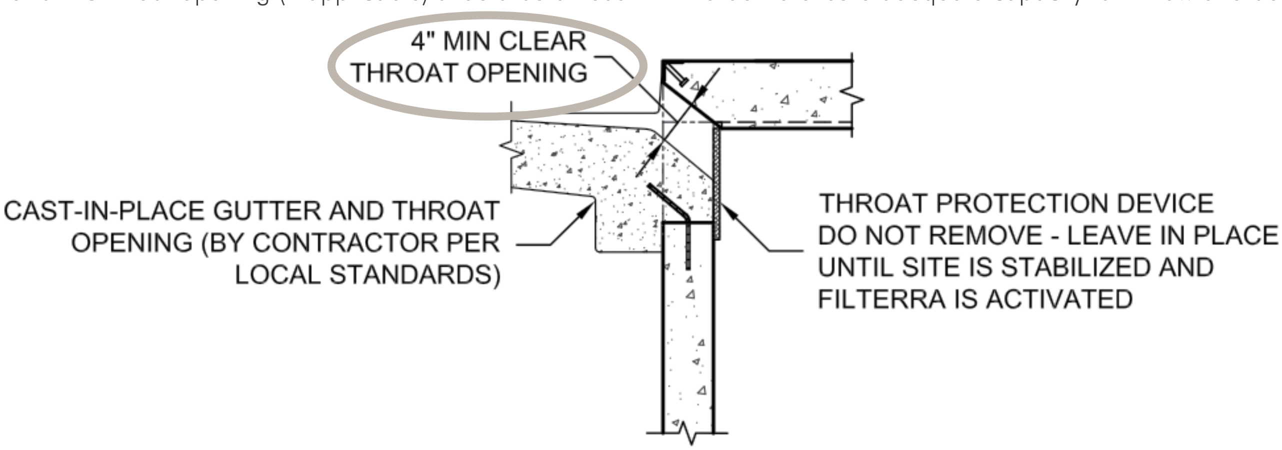
Minimum Requirements

The minimum requirements for Filterra HC Activation are as follows:

1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.

2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra HC system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra HC system.

3. Filterra HC throat opening (if applicable) should be at least 4″ in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra HC Plant Selection Overview

Plant Lists are available on the Contech website highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra HC system. Plants installed in the Filterra HC system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra HC system.

The "Planting Requirements for Filterra HC Systems" document is included as an appendix and discusses proper selection and care of the plants within Filterra HC systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra HC system's warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra HC system or runoff protection devices
- Removal of any Filterra HC system components
- Failure to prevent construction related runoff from entering the Filterra HC system
- Failure to properly store and protect any Filterra HC components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

Routine maintenance is included by the manufacturer on all Filterra HC systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra HC systems also contain diversion bypass or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan the media in the Filterra HC system.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra HC is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The Filterra HC system is also subjected to various materials entering the inlet, including trash, silt, leaves, etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra HC system flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

If the system is not maintained on regular intervals, is subject to a catastrophic spill or other event, or subject to unusual pollutant loading, full media bed replacement could be required. Please contact Contech for further evaluation if you feel this may be necessary.

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency;

e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.

Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra HC (where the cleaned runoff drains to, such as drop inlet) and block off the inlet of the Filterra HC. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra HC and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation & pruning or replacement as necessary
6. Clean area around Filterra HC
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working near traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media for the Filterra HC system, available from the Supplier.

	Available Filterra® HC Media Bay Sizes (feet)	Filter Surface Area (ft^2)	Mulch Volume at 3" Depth (ft^2)	# of 2 ft^2 Mulch Bags
Standard Configuration Filterra and Filterra Biosape Vaults	4x4	16	4	2
	4x6 or 6x4	24	6	3
	4.5x7.83 or 7.83x4.5 (Nominal 4x8/8x4)	35.24	9	5
	6x6	36	9	5
	6x8 or 8x6	48	12	6
	6x10 or 10x6	60	15	8
	6x12 or 12x6	72	18	9
	7x13 or 13x7	91	23	12
	14x8	112	28	14
	16x8	128	32	16
	18x8	144	36	18
	20x8	160	40	20
	22x8	176	44	22
Peak Diversion Filterra Vaults	4x4	16	4	2
	4.5x5.83 or 5.83x4.5 (Nominal 4x6/6x4)	26.24	7	4
	6x6	36	9	5
	6x8	48	12	6
	6x10 or 10x6	60	15	8
	7x10	70	18	9
	8x10.5	84	21	11
	8x12.5	100	25	13
	Custom and/or Filterra Bioscape	Media Area in ft^2	0.25 x (Media Area in ft^2)	0.125 x (Media Area in ft^2)

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.

1. Inspection of Filterra HC and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).

2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra HC box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	________

- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	________
Inches of Media Added	________

4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3”.
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra HC inlet to allow for entry of trash during a storm event.
- Replace Filterra HC grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.

5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant’s health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	____________________ (ft)
Width at Widest Point	____________________ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no

6. Clean area around Filterra HC

- Clean area around unit and remove all refuse to be disposed of appropriately.

7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra HC.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra HC HC.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra HC.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.

Maintenance is ideally to be performed twice annually.

Filterra HC Inspection & Maintenance Log

Filterra HC System Size/Model: ____________________ Location: ____________________________________

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3"*	*Lowe's Premium Brown Mulch*	*4'*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

Appendix 1 – Filterra® Activation Checklist

CONTECH ENGINEERED SOLUTIONS

Project Name:______________________________ Company:______________________________

Site Contact Name: ______________________________ Site Contact Phone/Email: ____________________

Site Owner/End User Name:____________________ Site Owner/End User Phone/Email: ____________________

Preferred Activation Date: ______________________________(provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

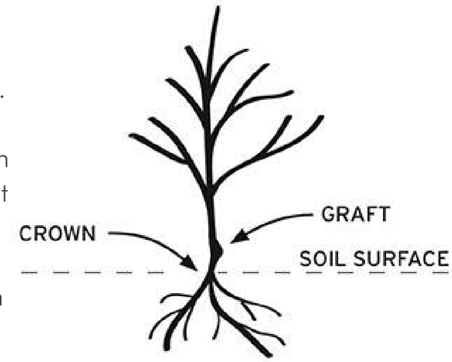
NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra HC systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

______________________________ ____________________

Signature Date

Appendix 2 – Planting Requirements for Filterra® HC Systems

Plant Material Selection



- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra HC systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra HC systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25-30 feet.
- A 7-15 gallon container size shall be used.
- For precast Filterra HC systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some of the faster growing species, or species known to produce basal sprouts

Plant Installation

- During transport protect the plant leaves from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that has been meeting Contech Engineered Solutions' mulch specifications can be used in the Filterra HC system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

- Each Filterra HC system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra HC plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore, irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore, if dry periods exceed 3 weeks, irrigation may be required. It is also important to recognize that plants which are exposed to windy areas and reflected heat from paved surfaces may need more frequent irrigation. Long term care should develop a history which is more site specific.

** Five gallons per square yard approximates 1 inch of water. Therefore, for a 6' by 6' Filterra HC approximately 20-60 gallons of water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five-gallon bucket to estimate the applied water flow rate then calculate the time needed to irrigate the Filterra HC system. For example, if the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6' by 6' filter.

Notes

filterra®
Bioretention Systems

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StormFilter Inspection and Maintenance Procedures

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: Personnel:

Location: ________________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: ____ Date: ____________

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Estimated Flow from Drainage Pipes (if available): ____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: ____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: ____

☐ Minor Structural Repairs: ____

☐ Drainage Area Report ____

Excessive Oil Loading: Yes ☐ No ☐ Source: ____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ____

Items Needing Further Work: ____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

____

____

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____

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: ______________________ Personnel: ____

Location: ______________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: ____

____

____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): ____

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: ______________________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ______________________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ______________________________

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: ______________________________

Replace Cartridges: Yes ☐ No ☐ Details: ______________________________

Sediment Removed: Yes ☐ No ☐ Details: ______________________________

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: ______________________________

Residuals (debris, sediment) Disposal Methods: ____

Notes:

____

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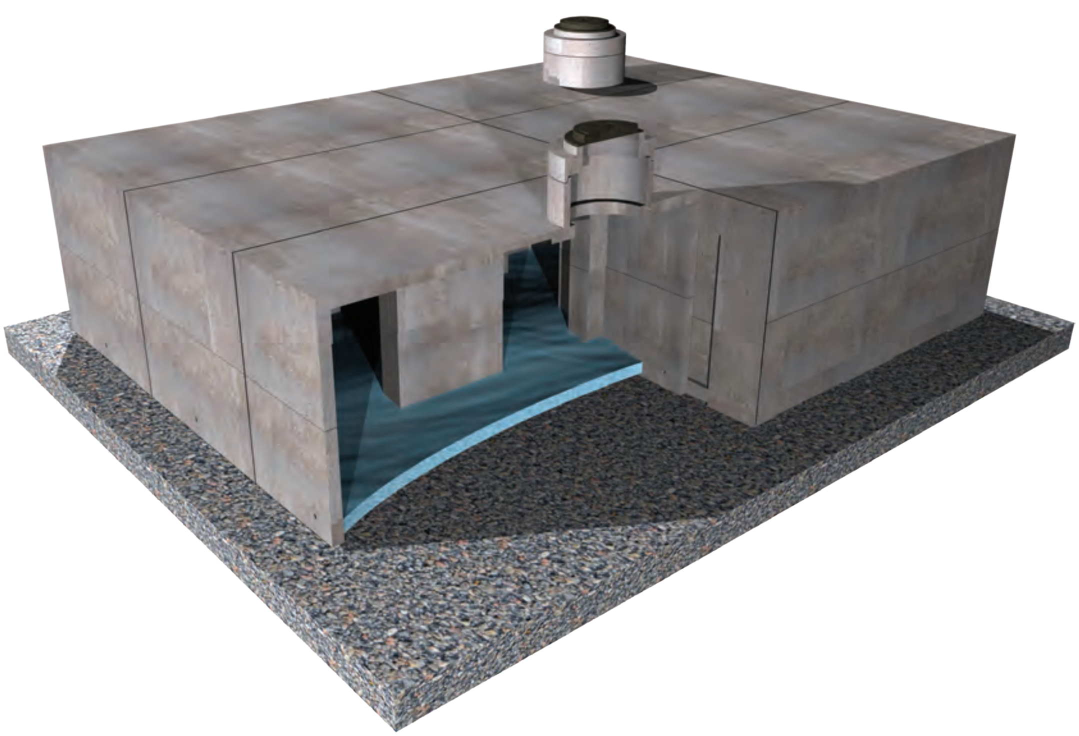
STORMCAPTURE®

Inspection and Maintenance Guide



Water

Description

The StormCapture® system is an underground, modular, structural precast concrete storage system for stormwater detention, retention, infiltration, harvesting and reuse, and water quality volume storage. The system's modular design utilizes multiple standard precast concrete units with inside dimensions of 7 feet by 15 feet (outside dimensions of 8 feet by 16 feet) to form an underground storage system. The inside height of the StormCapture system can range from 2 feet to 14 feet. This modular design provides limitless configuration options for site-specific layouts.

StormCapture components can be provided as either open-bottom modules to promote infiltration or closed-bottom modules for detention. In some cases, StormCapture modules can be placed in a checkerboard configuration for an even more efficient design. A Link Slab, with a footprint of 9 feet by 17 feet, is then used to bridge each space without a module.

The standard StormCapture design incorporates lateral and longitudinal passageways between modules to accommodate internal stormwater conveyance throughout the system. These passageways may be classified as either a "window configuration" with standard 12-inch tall sediment baffles extending up from the floor of the module to the bottom of the window, or a "doorway configuration" without the sediment baffles. The function and drainage rate of a StormCapture system depends on site-specific conditions and requirements.

Stormwater typically enters the StormCapture system through an inlet pipe. Grated inlets can also be used for direct discharge into the system. The StormCapture system is rated for H-20 traffic loading with limited cover. Higher load requirements can also be accommodated. In addition, StormCapture systems are typically equipped with a limited number of maintenance modules that provide access to the system for ongoing inspection and maintenance.

Function

The StormCapture system is primarily used to manage water quantity by temporarily storing stormwater runoff from impervious surfaces to prevent flooding, slow down the rate at which stormwater leaves the site, and reduce receiving stream erosion. In addition, the StormCapture system can be used to capture stormwater runoff for water quality treatment. Regardless of how the StormCapture system is used, some sedimentation may occur in the modules during the time water is stored.

Configurations

The configuration of the StormCapture systems may vary, depending on the water quality and/or quantity requirements of the site. StormCapture configurations for detention, retention/infiltration, and retention/harvesting are described below.

Detention

StormCapture Detention systems are designed with a closed bottom to detain stormwater runoff for controlled discharge from the site. This design may incorporate a dead storage sump and a permanent pool of water if the outlet pipe is higher than the floor elevation. Discharge from the system is typically controlled by an outlet orifice and/or outlet weir to regulate the rate of stormwater leaving the system. StormCapture Detention systems are typically designed with silt-tight joints, however when conditions exist that require a StormCapture system to be watertight, the system may be wrapped in a continuous, impermeable geomembrane liner. If the StormCapture Detention system includes Link Slabs, a liner must be used to detain water since the chambers under each Link Slab have no floor slab. In this case, care must be taken by maintenance personnel not to damage the exposed liner beneath each Link Slab.

Retention/Infiltration

StormCapture Retention/Infiltration systems are designed with an open bottom to allow for the retention of stormwater onsite through infiltration into the base rock and surrounding soils. For infiltration systems, the configuration of the base of the StormCapture system may vary, depending on the needs of the site and the height of the system. Some systems may use modules that have fully open bottoms with no concrete floor, while other systems may use modules that incorporate floor openings in the base of each module. These are typically 24-inch by 24-inch openings. For open-bottom systems, concrete splash pads may be installed below inlet grate openings and pipe inlets to prevent erosion of base rock. A StormCapture Infiltration system may have an elevated discharge pipe for peak overflow.

Retention/Harvesting

StormCapture Retention/Harvesting systems are similar to detention systems using closed-bottom modules, but stormwater is typically retained onsite for an extended period of time and later reused for non-potable applications or irrigation. For rainwater harvesting systems, an impermeable geomembrane liner is typically installed around the modules to provide a water-tight system.

Inspection and Maintenance Overview

State and local regulations typically require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Inspections should be used to evaluate the conditions of the system. Based on these inspections, maintenance needs can be determined. Maintenance needs vary by site and system. Using this Inspection & Maintenance Guide, qualified maintenance personnel should be able to provide a recommendation for maintenance needs. Requirements may range from minor activities such as removing trash, debris or pipe blockages to more substantial activities such as vacuuming and removal of sediment and/or non-draining water. Long-term maintenance is important to the operation of the system since it prevents excessive pollutant buildup that may limit system performance by reducing the operating capacity and increasing the potential for scouring of pollutants during periods of high flow.

Only authorized personnel shall inspect and/or enter a StormCapture system. Personnel must be properly trained and equipped before entering any underground or confined space structure. Training includes familiarity with and adherence to any and all local, state and federal regulations governing confined space access and the operation, inspection, and maintenance of underground structures.

Inspection and Maintenance Frequency

The StormCapture system should be inspected on a regular basis, typically twice per year, and maintained as required. The maintenance frequency will be driven by the amount of runoff and pollutant loading encountered by a given system. Local jurisdictions may also dictate inspection and maintenance frequencies.

Inspection Equipment

The following equipment is helpful when conducting StormCapture inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Measuring stick or sludge sampler
- Long-handled net (optional)

Inspection Procedures

A typical StormCapture system provides strategically placed access points that may be used for inspection. StormCapture inspections are usually conducted visually from the ground surface, without entering the unit. This typically limits inspection to the assessment of sediment depth, water drain down, and general condition of the modules and components, but a more detailed assessment of structural condition may be conducted during a maintenance event.

To complete an inspection, safety measures including traffic control should be deployed before the access covers are removed. Once the covers have been removed, the following items should be inspected and recorded (see form provided at the end of this document) to determine whether maintenance is required:

- Observe inlet and outlet pipe penetrations for blockage or obstruction.
- If possible, observe internal components like baffles, flow control weirs or orifices, and steps or ladders to determine whether they are broken, missing, or possibly obstructed.
- Observe, quantify, and record the sediment depths within the modules.
- Retrieve as much floating trash as possible with a long-handled net. If a significant amount of trash remains, make a note in the Inspection & Maintenance Log.
- For infiltration systems, local regulations may require monitoring of the system to ensure drain down is occurring within the required permit time period (typically 24 to 72 hours). If this is the case, refer to local regulations for proper inspection procedure.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during the inspection:

- Inlet or outlet piping is blocked or obstructed.
- Internal components are broken, missing, or obstructed.
- Accumulation of more than six inches of sediment on the system floor or in the sump, if applicable.
- Significant accumulation of floating trash and debris that cannot be retrieved with a net.
- The system has not drained completely after it hasn't rained for one to three days, or the drain down does not meet permit requirements.
- Any hazardous material is observed or reported.

Maintenance Equipment

The following equipment is helpful when conducting StormCapture maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Vacuum truck

Maintenance Procedures

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is usually required to maintain the StormCapture. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Once safety measures such as traffic control have been deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove trash and debris using an extension on the end of the boom hose of the vacuum truck. Continue using the vacuum truck to completely remove accumulated sediment. Some jetting may be necessary to fully evacuate sediment from the system floor or sump. Jetting is acceptable in systems with solid concrete floors or base slabs (referred to as closed-bottom systems). However, jetting is not recommended for open-bottom systems with a gravel foundation since it may cause bedding displacement, undermining of the foundation, or internal disturbance.
- All material removed from the system during maintenance must be disposed of in accordance with local regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.
- Inspect inlet and outlet pipe penetrations for cracking and other signs of movement that may cause leakage.
- Inspect the concrete splash pads (applicable for open-bottom systems only) for proper function and placement.
- Inspect the system for movement of modules. There should be less than 3/4-inch spacing between modules.
- Inspect the general interior condition of modules for concrete cracking or deterioration. If the system consists of horizontal joints as part of the modules, inspect those joints for leakage, displacement or deterioration.

Be sure to securely replace all access covers, as appropriate, following inspection and/or maintenance. If the StormCapture modules or any of the system components show significant signs of cracking, spalling, or deterioration or if there is evidence of excessive differential settlement between modules, contact Oldcastle Infrastructure at **800-579-8819.**

StormCapture
Inspection & Maintenance Log

Refer to as-built records for details about system size and location onsite

Location ____

System Configuration: Inspection Date ______________

☐ Detention ☐ Infiltration ☐ Retention/Harvesting

Inlet or Outlet Blockage or Obstruction ☐ Yes ☐ No	**Notes:**
Condition of Internal Components ☐ Good ☐ Damaged ☐ Missing	**Notes:**
Sediment Depth Observed ☐ Inches of Sediment: ________	**Notes:**
Trash and Debris Accumulation ☐ Significant ☐ Not Significant	**Notes:**
Drain Down Observations ☐ Appropriate Time Frame ☐ Inappropriate Time Frame	**Notes:**

Maintenance Requirements

☐ **Yes - Schedule Maintenance** ☐ **No - Inspect Again in ______ Months**

StormVault Biofiltration

(SVBF)

OPERATION & MAINTENANCE MANUAL

Prepared For
Project Name:
Project Location:
Date:

Table of Contents

PROJECT INFORMATION
FOR
STORMVAULT BIOFILTRATION (SVBF) UNITS

Project:

Location:

Subject:

SWTU: **STORMVAULT BIOFILTRATION (SVBF*)* UNITS**

Model: **SVBFXX-XX**

INTRODUCTION

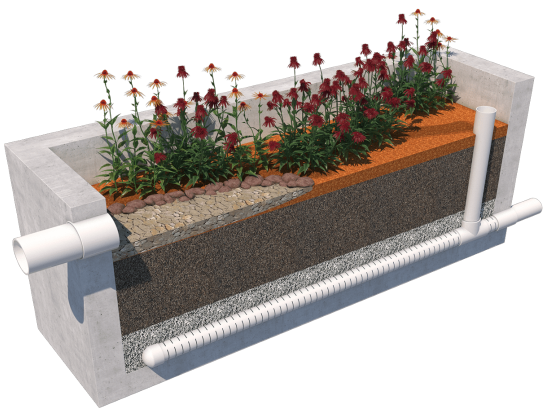
The ***StormVault BioFiltration*** (***SVBF***) stormwater treatment unit (SWTU), is a bioretention manufactured treatment device (MTD) designed for the treatment of stormwater runoff. Using the proprietary ***Sierra Blend*** engineered bio-soil media, the ***SVBF*** captures and removes pollutants from stormwater including total suspended solids, heavy metals, nutrients, gross solids, trash and debris, and petroleum hydrocarbons. Many of these pollutants are regulated by local, state, and/or federal government(s) who limit the allowable level of pollutants in stormwater runoff discharging from a site. Due to the high hydraulic surface loading rate capacity of the ***Sierra Blend*** bio-soil media, the ***SVBF*** system is able to treat more stormwater in a smaller footprint than conventional bioretention systems.

DEPLOYMENT CONFIGURATIONS

The ***SVBF*** comes in many standard sizes and is available in several different deployment configurations. Depending on the deployment configuration, units may have additional parts or chambers that will need to be inspected and maintained. In addition to the standard model featuring only the treatment chamber, other deployment configurations may include an inlet and outlet chamber separated by a high-flow bypass weir, as well as an underground vault model without vegetation. However, inspection and maintenance across all deployment configurations should remain consistent and generally follow the same procedures.

The ***SVBF*** unit consists of a precast concrete vault layered with 3-inches of plant stabilization mulch/media, 18-inches of the ***Sierra Blend*** bio-soil media, and 6-inches of bridging stone above the underdrain piping, with an internal or external high-flow bypass. Different deployment configurations of the unit are available to better serve the requirements and needs of a specific site. Deployment configurations include a planter box with an open top more suited for shrubs and grasses to better mimic a natural swale, a tree box with or without a grated curb inlet, a tree well consisting of an adjacent tree well with open bottom to promote mature tree root growth, and an underground vault with a subsurface inlet pipe. All of these deployment configurations can be deployed with block-outs in the bottom of the vault to promote infiltration and groundwater recharge.

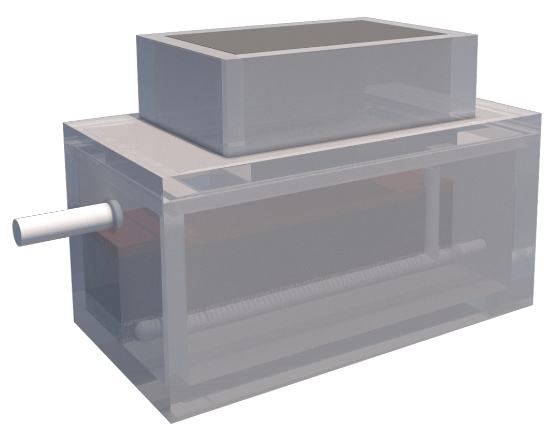
The following illustrations depict the various possible deployment configurations of the ***SVBF*** unit.



Planter Box Model

Tree Box Model

Tree Well Model



Underground Vault Model

OPERATIONS

The ***SVBF*** unit is a non-mechanical, self-operating system that will function anytime there is flow within the drainage system. The plant stabilization mulch/media, the ***Sierra Blend*** bio-soil media, and the bridging stone are arranged in layers within the chamber with stormwater gravity flowing downward through these layers. The plant stabilization mulch/media layer consists of hardwood mulch and/or large stone riprap and serves as pretreatment, removing the trash, debris, and large sediment while increasing moisture retention, erosion control, and flow dissipation across the treatment chamber. The ***Sierra Blend*** bio-soil media treats the stormwater, removing fine and suspended sediment, heavy metals, and nutrients. The bridging stone, the gravel base beneath the ***Sierra Blend*** bio-soil media bed ensures even drainage. Treated stormwater enters an underdrain pipe, infiltrates into the ground, or splits between both.

A system bypass allows the ***SVBF*** unit to continue to operate in high-flow situations without washing out or scouring the pollutants already trapped in the system. After the water quality treatment flow depth is reached, excess flow spills over a bypass weir or overflow pipe and is directly discharged along with treated flows. Flows greater than the water quality treatment flow rate of a unit will cause ponding within the unit.

An external bypass consists of a separate catch basin or other external bypass structure located further downstream from the unit.

INSPECTION

NEW INSTALLATIONS – Jensen recommends a visual inspection of the unit every 6-months or for every 10-inches of rainfall, whichever comes first, but regular inspections during the first two to three years of operation will help to establish a site-specific frequency for future inspections and maintenance. During these regular inspections, light maintenance procedures such as clearing out trash and debris caught in the plant stabilization mulch/media and inlet grates or tending to vegetation can be completed. Clearing out trash and debris will prevent obstructions to the inlets and ensure the unit is operating at its maximum capacity. It is recommended to inspect the system after each major storm event during the first several months of the rainy season.

ONGOING OPERATION – The system should be routinely inspected to ensure that all grates and drains are free of blockage. After several storm events, inspections should look for signs of erosion of or accumulation of sediment in the plant stabilization mulch/media layer. If the plant stabilization mulch/media has been displaced due to flows and the ***Sierra Blend*** bio-soil media layer is visible, or heavy accumulation of sediment is apparent in the plant stabilization mulch/media layer, the steps outlined in the maintenance section should be followed to ensure that the ***SVBF*** unit is able to continue to operate at maximum capacity.

Use the attached Inspection & Maintenance Log in Appendix A, to help determine whether maintenance is needed.

Inspection Equipment

The following is a list of equipment for the simple and effective inspection of ***SVBF*** systems:

- Appropriate clothing (pants and shoes, gloves, safety vest, hard hat, etc.)
- Traffic control equipment (Traffic cones, signage, etc.)
- Manhole hook or crowbar
- Inspection & Maintenance Log or other recording method
- Flashlight
- Tape measure
- Trash grabber
- Shovel, rake, and broom
- Pruners
- Trash can/bag.

Inspection Procedure

All necessary pre-inspection steps including traffic control or pedestrian detours must be carried out. Access to underground, closed top ***SVBF*** units can be reached through the access hatch, grate or manhole frame and cover. When access has been safely established the following inspection procedure should begin:

- Record the date, time, and inspector on the day of inspection as well as the job location and model designation
- Observe and record the level of the scum line if any
- Clean off a section of the scum line on the side wall
- Inspections of the internal components can, in most cases, be accomplished through observations from the ground surface
- Check the inlet structures for any unwanted objects or obstructions and remove them
- Record and photograph any observations in the provided inspection form

- Observe the inside of the ***SVBF*** for trash, debris, or displacement of the plant stabilization mulch/media and ***Sierra Blend*** bio-soil media layers

- Observe the SVBF for "light", "medium", or "heavy" sediment loading within the plant stabilization mulch/media layer

    - For "light" loading, the sediment is difficult to distinguish amongst the plant stabilization mulch/media with the plant stabilization mulch/media appearing new

    - For "medium" loading, the sediment is apparent and may be concentrated in some areas, but the probing of the plant stabilization mulch/media reveals lighter loads beneath the first inch of plant stabilization mulch/media

    - For "heavy" loads, sediment is apparent across the entire top layer as well as beneath the first inch of plant stabilization mulch/media

- Finalize the inspection report with the designated manager to determine required maintenance

- It must be noted that closed top ***SVBF*** units may be considered confined space environments and only properly trained personnel possessing the necessary safety equipment should enter the unit to perform maintenance and/or inspection in adherence with the requirements of a confined space entry permit.

MAINTENANCE

The schedule for the maintenance of the ***SVBF*** unit should be established based on the results of the routine inspections outlined in the previous section.

Maintenance Equipment

In addition to the equipment necessary for inspection, the following equipment is recommended for performing maintenance on the ***SVBF*** unit:

- Traffic control equipment (Traffic cones, signage, etc.)

- Vactor truck as necessary.

Maintenance Indicators

From observations noted during previous inspections, the following items may be indications that the ***SVBF*** unit needs maintenance:

- The visual presence of a scum line on the wall above the plant stabilization mulch/media layer that is higher than the crest of the bypass weir or overflow pipe is a general indicator that the filter bed has operated in bypass mode and the ***Sierra Blend*** bio-soil media may be plugged
- Damage to the concrete structure
- Damaged or missing grates
- Obstruction of the curb inlet or inlet rack
- Water stagnation in the biofiltration chamber more than a full day after a rainfall event
- Invasive vegetation growth
- Excessive trash and debris, especially plastics
- Heavy sediment load present in the plant stabilization mulch/media or top of ***Sierra Blend*** bio-soil media
- Excessive erosion of the plant stabilization mulch/media or ***Sierra Blend*** bio-soil media.

Maintenance Procedure

Cleanout of the ***SVBF*** unit at the end of a wet season is recommended to ensure captured trash, debris, sediment, and invasive vegetation do not compromise the unit's functionality or harm plant housed in it.

The following maintenance activities should be performed during each service:

- Inspection of treatment system and housing structure
- Removal of any material or debris blocking flow into and through the unit
- Removal of trash and debris from plant stabilization mulch/media and visible flow paths
- Raking or replacement of plant stabilization mulch/media layer
    - ***Sierra Blend*** bio-soil media replacement should only be necessary after an oil or chemical spill clean-up or when the filter has become totally occluded with fines or possibly biofouling
- If vegetation is planted:
    - Pruning of vegetation
    - Replacement with new vegetation if current vegetation is in poor health for aesthetic purposes

- Ensure irrigation system is functional
- Disposal of any trash or debris collected.

If the ***Sierra Blend*** bio-soil media appears plugged due to the presence of a prominent scum line on the vault wall above the crest of the bypass:

- Remove the plant stabilization mulch/media layer, which should be replaced if necessary
- Rake the top of the ***Sierra Blend*** bio-soil media in ¼ to ½-inch depth passes until the original ***Sierra Blend*** bio-soil media is observed and to break any cementitious crust that may have formed
- Again, remember to clean off a section of the scum line on the side wall as an operational reset for future indicator measurements

If operations continue to appear to be in bypass condition:

- Replace any ***Sierra Blend*** bio-soil media that was removed and replace plant stabilization mulch/media
- Again, remember to clean off a section of the scum line on the side wall

If bypass events still appear to continue:

- Remove ***Sierra Blend*** bio-soil media as necessary until no more incoming sediment is observed within this media, exposing the underdrain pipe if necessary and replace all ***Sierra Blend*** bio-soil media if necessary
- Wash or replace the underdrain bridging stone layer
- Clean and place new ***Sierra Blend*** bio-soil media and plant stabilization mulch/media.

Replacement of the ***Sierra Blend*** bio-soil media is done either with hand tools or a mini excavator.

CLEANOUT AND DISPOSAL

Cleanout of the unit primarily involves the removal of trash and sediment from the unit. Trash and debris can be removed from the curb inlet, inlet rack, and the biofiltration chamber manually with tools such as rakes, shovels, brooms or by Vactor trucks if required.

- Disposal of material from the ***SVBF*** unit should be in accordance with the local municipality's requirements. Typically, the removed solids can be disposed of in a similar fashion as those materials collected from sump catch basins or manholes

- If any of the unit's parts previously mentioned under the inspection section are damaged or missing, or ***Sierra Blend*** bio-soil media is needed for replacement, please contact Jensen Water Resources

  Jensen Water Resources
  521 Dunn Circle
  Sparks, NV 89431
  Toll Free: (877) 649-0095
  Fax: (775) 440-2013

RECORDS OF OPERATION AND MAINTANACE

The owner shall maintain annual records of the operation and maintenance of the ***SVBF*** unit to document the effective maintenance of this important component of a site's stormwater management program.

The attached Inspection & Maintenance Log in Appendix A, is suggested and should be retained for a minimum period of three years.

Appendix A

Inspection & Maintenance Log

StormVault BioFiltration (SVBF)
ANNUAL RECORD OF OPERATION AND MAINTENANCE

OWNER ______________________________

ADDRESS ______________________________

OWNER'S REPRESENTATIVE ______________________ **PHONE** ______________

SVBF MODEL DESIGNATION ______________________ **DATE** ______________

SITE LOCATION ______________________________

INSPECTIONS:

DATE & INSPECTOR	SCUM LINE LEVEL	INLET AND OUTLET INTEGRITY	STANDING WATER/ TRASH AND DEBRIS	MULCH AND EROSION	CONDITION OF VEGETATION	OBSERVATIONS OF FUNCTION

CLEANOUT:

DATE	SCUM LINE LEVEL	TRASH AND DEBRIS REMOVAL	MULCH MEDIA REPLACED (Y/N)	VEGETATION PRUNED REPLACED (Y/N)	METHOD OF DISPOSAL OF MULCH, MEDIA, TRASH AND DEBRIS, AND VEGETATION	OBSERVATIONS OF FUNCTION

MAINTENANCE:

DATE OF INSPECTION AND OBSERVATIONS: ______________________________

____

CERTIFICATION: ____________________ **TITLE:** __________ **DATE:** ____________________

Appendix E – Storm Drain System Drainage Areas and Erosion and Sediment Control Plans for Sequence of Construction

STORM DRAIN DRAINAGE AREA TABLE

DA ID	DA(AC)	C	Q_{25}(CFS)
1	0.7140	0.90	4.66
2	1.4670	0.90	9.57
3	0.8230	0.90	5.37
4	0.0750	0.90	0.49
5	0.9400	0.90	6.13
6	2.3720	0.90	15.48
7	2.3420	0.90	15.28
8	0.2730	0.90	1.78
9	0.4100	0.90	2.68
10	5.1580	0.90	33.66
11	0.5240	0.90	3.42
12	0.2670	0.90	1.74
13	2.2000	0.90	14.36
14	0.7510	0.90	4.90
15	0.2240	0.90	1.46
16	1.3250	0.90	8.65
17	0.6940	0.90	4.53
18	0.3970	0.90	2.59
19	1.4500	0.90	9.46
20	0.5800	0.90	3.78
22	0.4740	0.90	3.09
23	0.4400	0.90	2.87
24	0.9720	0.90	6.34
25	4.5490	0.90	29.68
26	0.5280	0.90	3.45
27	1.5570	0.90	10.16
28	18.8450	0.90	122.96
29	10.5260	0.90	68.68
30	7.0500	0.90	46.00
31	2.4210	0.90	15.80

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

DRAINAGE AREA MAP - EXISTING CONDITIONS

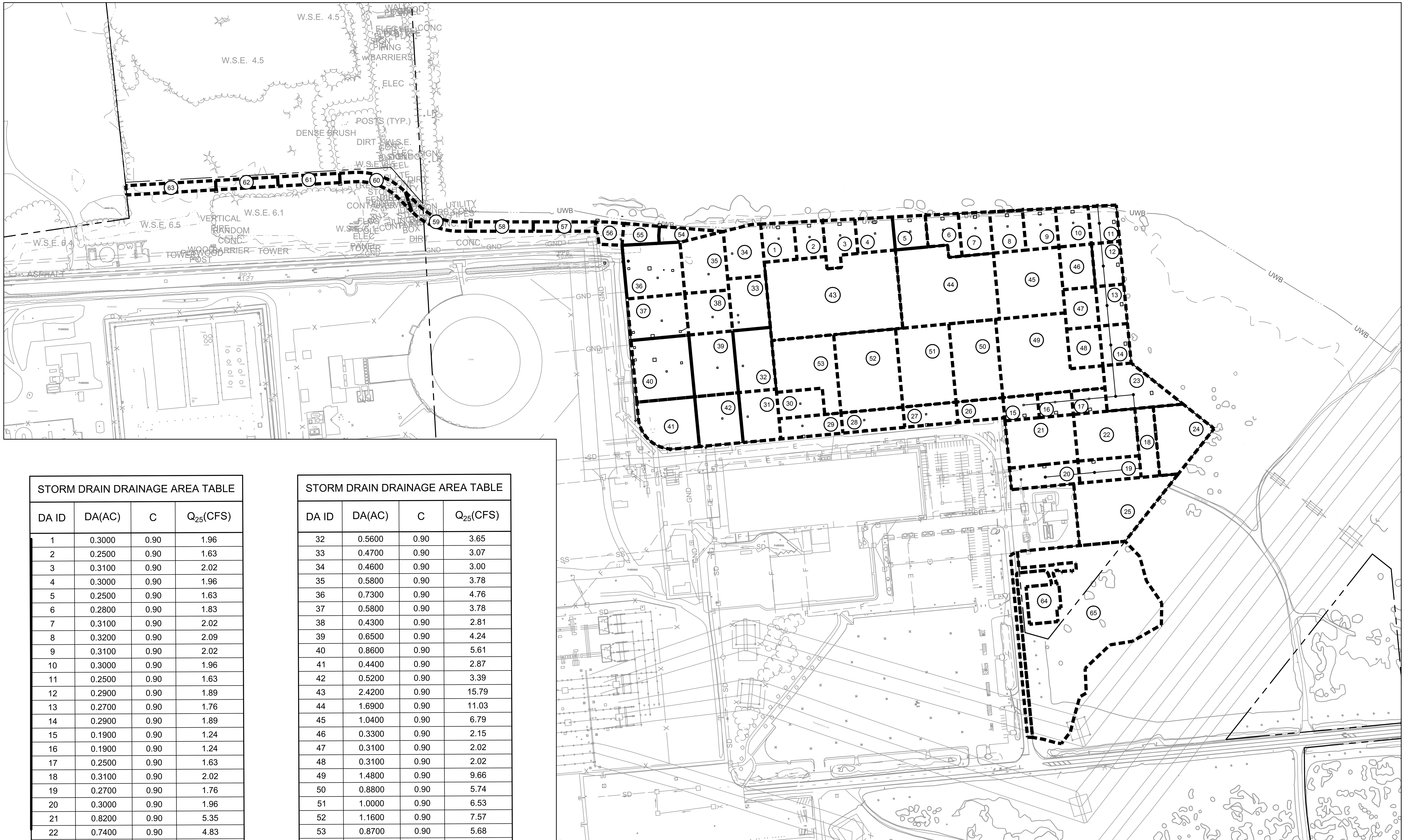
moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

NJEDA — NEW JERSEY WIND PORT

Date: 2022-11-04 | M&N Project No. 11102-06 | Rev. 0
Designed by: DSGN | Dwn by: DRFT | Ckd by: CHKR
Reviewed by: REVR | Submitted by: MOFFATT & NICHOL
Plot scale: 1:1 (D SHEET)

Sheet Reference No.
C-601
INDEX: 65 OF 79

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



STORM DRAIN DRAINAGE AREA TABLE

DA ID	DA(AC)	C	Q_{25}(CFS)
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2	0.2500	0.90	1.63
3	0.3100	0.90	2.02
4	0.3000	0.90	1.96
5	0.2500	0.90	1.63
6	0.2800	0.90	1.83
7	0.3100	0.90	2.02
8	0.3200	0.90	2.09
9	0.3100	0.90	2.02
10	0.3000	0.90	1.96
11	0.2500	0.90	1.63
12	0.2900	0.90	1.89
13	0.2700	0.90	1.76
14	0.2900	0.90	1.89
15	0.1900	0.90	1.24
16	0.1900	0.90	1.24
17	0.2500	0.90	1.63
18	0.3100	0.90	2.02
19	0.2700	0.90	1.76
20	0.3000	0.90	1.96
21	0.8200	0.90	5.35
22	0.7400	0.90	4.83
23	0.3200	0.90	2.09
24	0.8300	0.20	1.20
25	1.1200	0.20	1.62
26	0.2300	0.90	1.50
27	0.2600	0.90	1.70
28	0.3000	0.90	1.96
29	0.3000	0.90	1.96
30	0.2900	0.90	1.89
31	0.4500	0.90	2.94

STORM DRAIN DRAINAGE AREA TABLE

DA ID	DA(AC)	C	Q_{25}(CFS)
32	0.5600	0.90	3.65
33	0.4700	0.90	3.07
34	0.4600	0.90	3.00
35	0.5800	0.90	3.78
36	0.7300	0.90	4.76
37	0.5800	0.90	3.78
38	0.4300	0.90	2.81
39	0.6500	0.90	4.24
40	0.8600	0.90	5.61
41	0.4400	0.90	2.87
42	0.5200	0.90	3.39
43	2.4200	0.90	15.79
44	1.6900	0.90	11.03
45	1.0400	0.90	6.79
46	0.3300	0.90	2.15
47	0.3100	0.90	2.02
48	0.3100	0.90	2.02
49	1.4800	0.90	9.66
50	0.8800	0.90	5.74
51	1.0000	0.90	6.53
52	1.1600	0.90	7.57
53	0.8700	0.90	5.68
54	0.1500	0.90	0.98
55	0.1700	0.90	1.11
56	0.1400	0.90	0.91
57	0.1400	0.90	0.91
58	0.1400	0.90	0.91
59	0.1500	0.90	0.98
60	0.1700	0.90	1.11
61	0.1400	0.90	0.91
62	0.1400	0.90	0.91
63	0.2000	0.90	1.31

160' 0' 160' 320'
SCALE: 1"=160'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

NJEDA
NEW JERSEY WIND PORT

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

DRAINAGE AREA MAP - PROPOSED CONDITIONS

Designed by: DSGN	Rev. 0
Dwn by: DRFT	Date: 2022-11-04
Ckd by: CHKR	M&N Project No. 11102-06
Reviewed by: REVR	Drawing code:
Submitted by: MOFFATT & NICHOL	Drawing Scale: Plot scale: 1:1 (D SHEET)

Sheet Reference No.
C-602

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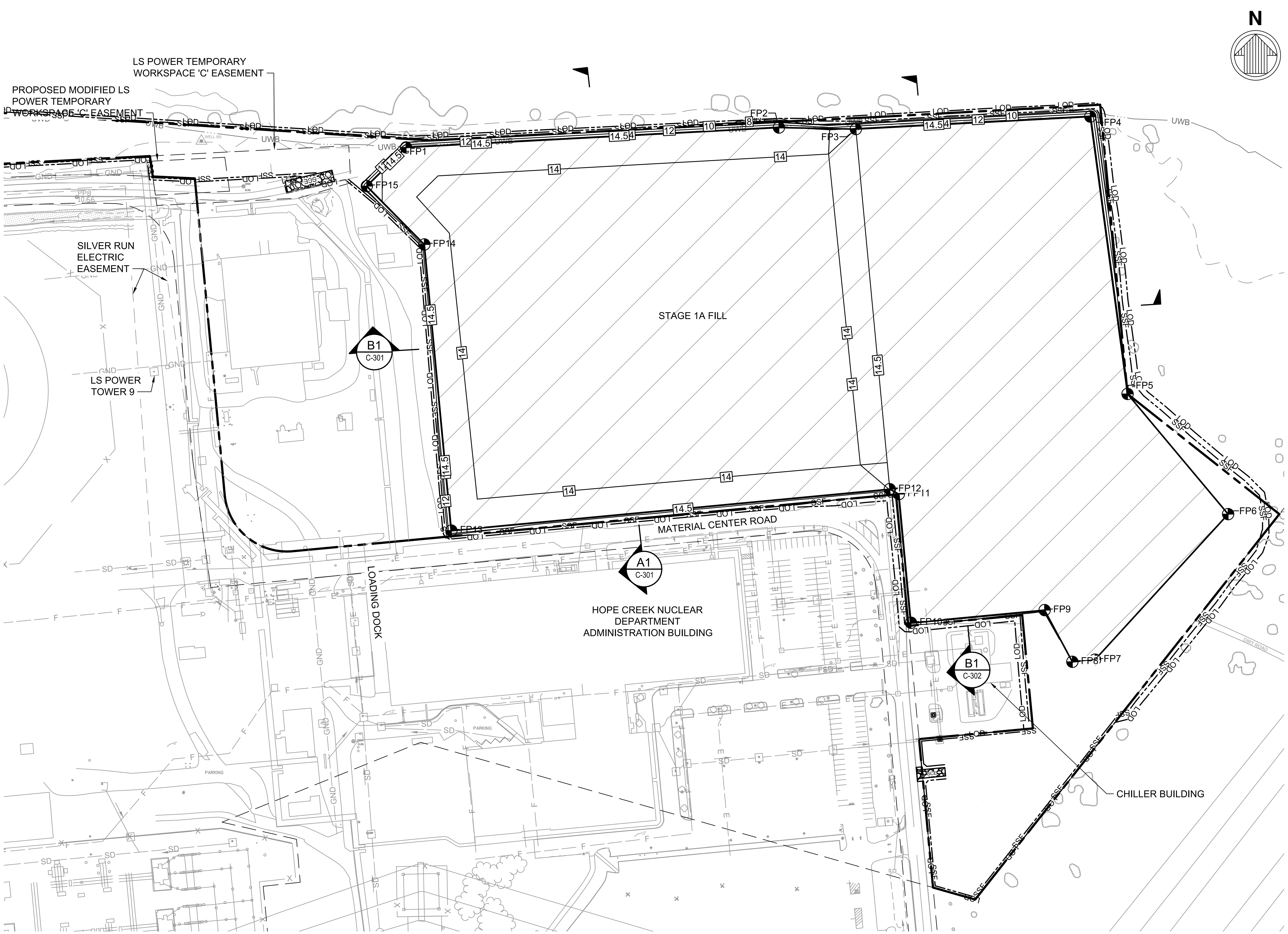

NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.

LEGEND

- TOP OF INITIAL FILL WORKING POINT
- STAGE 1A INITIAL FILL
- LIMIT OF DISTURBANCE
- SUPER SILT FENCE
- STABILIZED CONSTRUCTION ENTRANCE
- SILT FENCE ON PAVEMENT
- INLET PROTECTION
- INITIAL FILL CONTOUR

INITIAL FILL WORKING POINTS

POINT #	NORTHING	EASTING
FP1	234125.65	200834.64
FP2	234160.65	201489.79
FP3	234157.86	201624.96
FP4	234179.87	202036.98
FP5	233692.34	202102.45
FP6	233481.11	202279.20
FP7	233225.26	202045.26
FP8	233221.50	202005.44
FP9	233312.33	201956.69
FP10	233290.18	201721.87
FP11	233516.36	201700.54
FP12	233524.90	201684.66
FP13	233452.23	200914.22
FP14	233955.15	200866.77
FP15	234057.70	200765.70

100' 0' 100' 200'
SCALE: 1"=100'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - INITIAL FILL AND ESC STAGE 1A

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NEWTON, MA 02459
617-299-7330

NJEDA NEW JERSEY WIND PORT

Designed by: DC | Drn by: HR | Ckd by: LC | Reviewed by: TJS | Submitted by: MOFFATT & NICHOL
Date: 2022-11-04 | M&N Project No. 11102-06 | Drawing code: | Drawing Scale: | Plot scale: 1:1 (D SHEET)

Sheet Reference No.
C-106
INDEX: 15 OF 79

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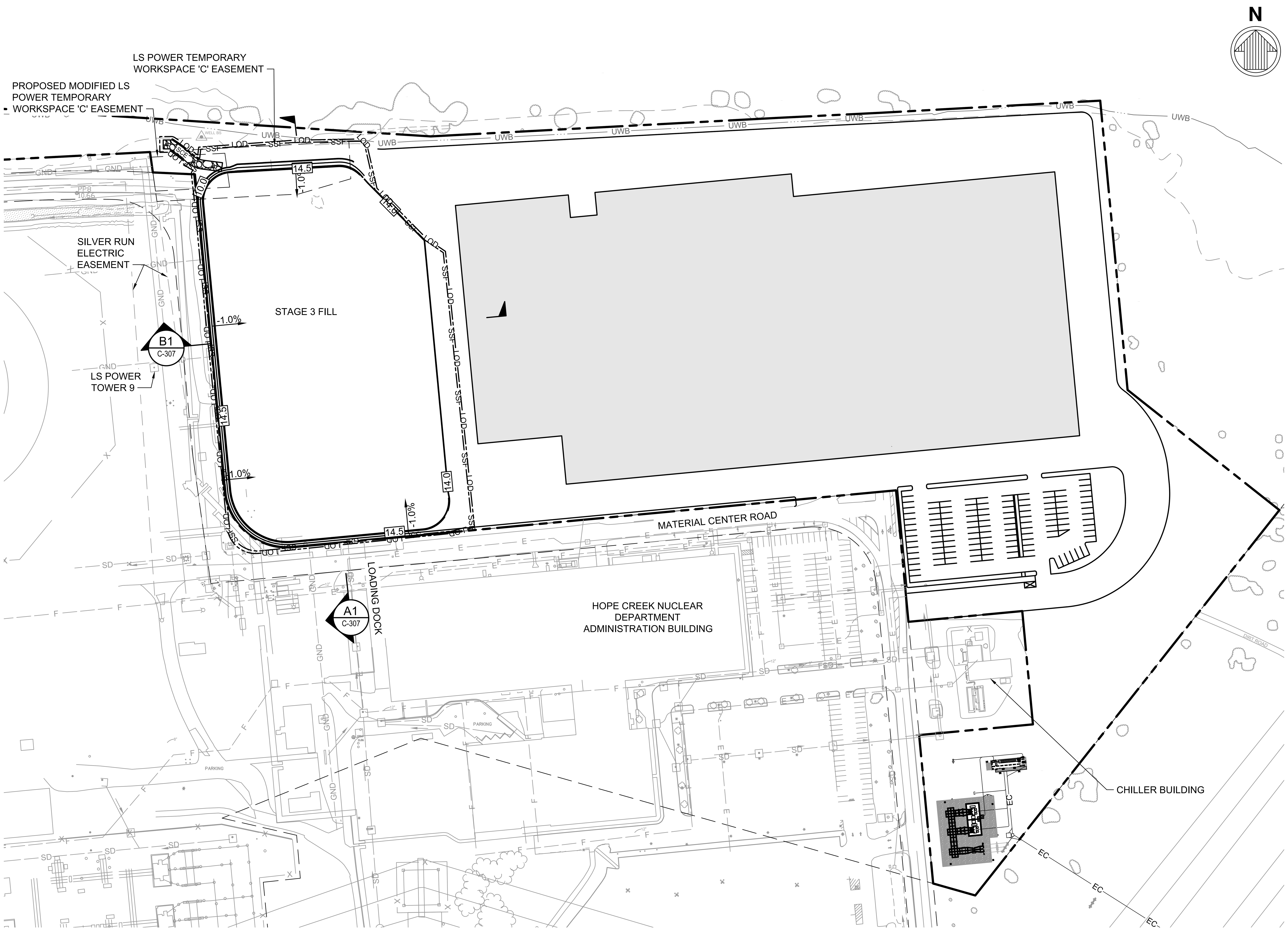

NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.

LEGEND

LOD	LIMIT OF DISTURBANCE
SSF	SUPER SILT FENCE
SCE	STABILIZED CONSTRUCTION ENTRANCE
SFP	SILT FENCE ON PAVEMENT

100' 0' 100' 200'
SCALE: 1"=100'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

Mark	Description	Date	Appr.	

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - INITIAL FILL AND ESC
STAGE 3

Designed by: DC		Date: 2022-11-04	Rev.
Dwn by: HR	Ckd by: LC	M&N Project No. 11102-06	
Reviewed by: TJS		Drawing code:	
Submitted by: MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)	

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NEWTON, MA 02459
617-299-7330

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NEW JERSEY WIND PORT

Sheet
Reference No.
C-110
INDEX: 19 OF 79

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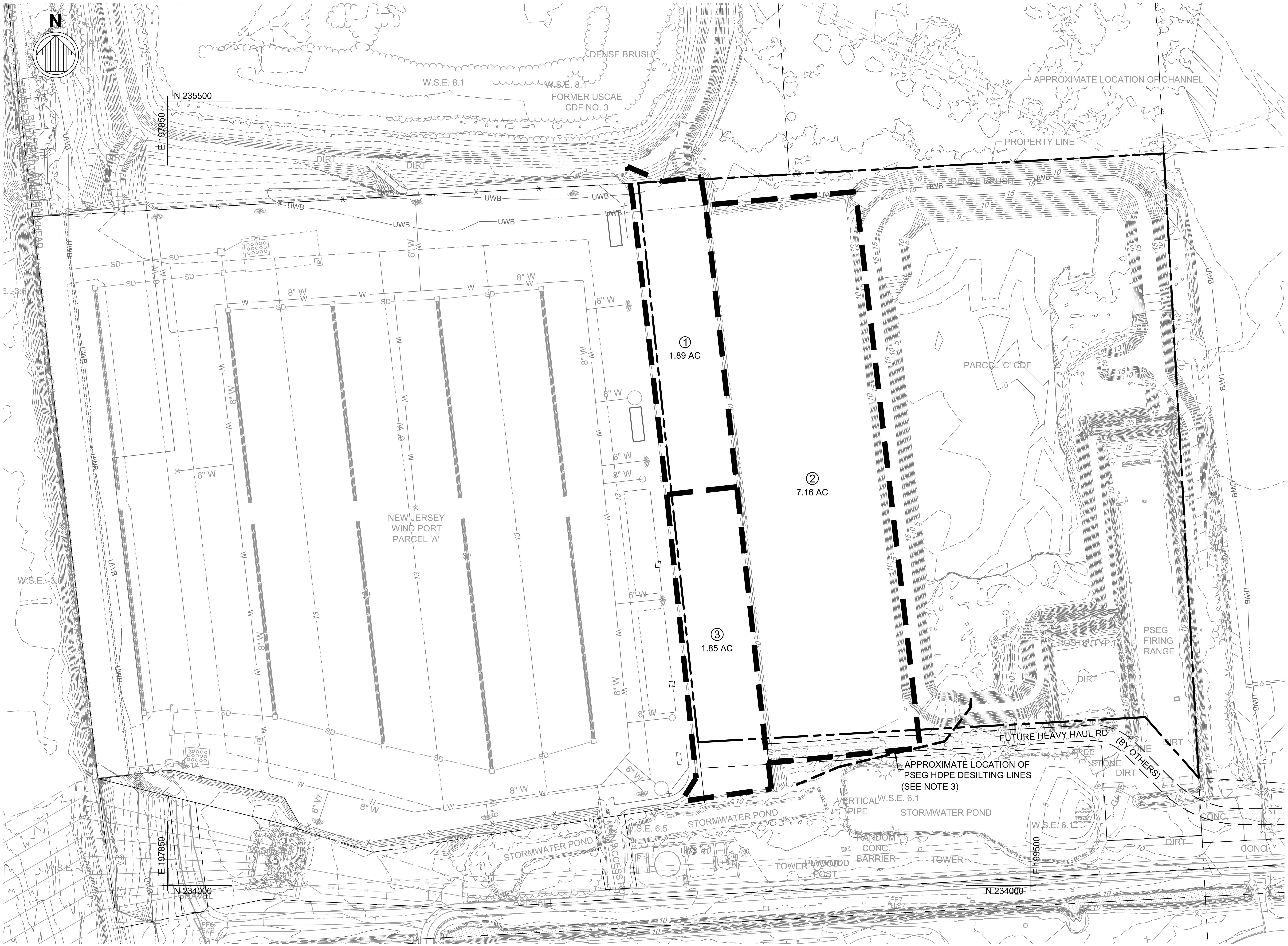

A1
C-601

DRAINAGE AREA MAP - EXISTING CONDITIONS

SCALE: 1" = 100'

NOTES:

1. FOR GENERAL NOTES AND SEQUENCE OF CONSTRUCTION, SEE SHEET G-002
2. FOR LEGEND AND ABBREVIATION, SEE SHEET G-003
3. APPROXIMATE LOCATION OF 8" AND 12" PSEG DESILTING LINES. THESE LINES SHALL NOT BE DAMAGED OR DISTURBED.

LEGEND

DRAINAGE AREA LIMITS

100' 0' 100' 200'

SCALE: 1"=100'

PERMIT SET
ISSUED: 2022-11-04
NOT TO BE USED FOR CONSTRUCTION

Mark	Description	Date	Appr.

NEW JERSEY WIND PORT
PARCEL C ACCELERATION (C1)
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

DRAINAGE AREA MAP - EXISTING CONDITIONS

Designed by: TJS	Date: 2022-11-04	Rev.	
Dwn by: HR	Ckd by: LC	M&N Project No. 11102-19	
Reviewed by: FCG	Drawing code:		
Submitted by: FERNANDO GONZALEZ CHANA MOFFATT & NICHOL	Drawing Scale:	Plot scale: 1:1 (D SHEET)	

moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

NJEDA
NEW JERSEY WIND PORT

SEAL

Sheet Reference No.
C-601

INDEX: 24 OF 32

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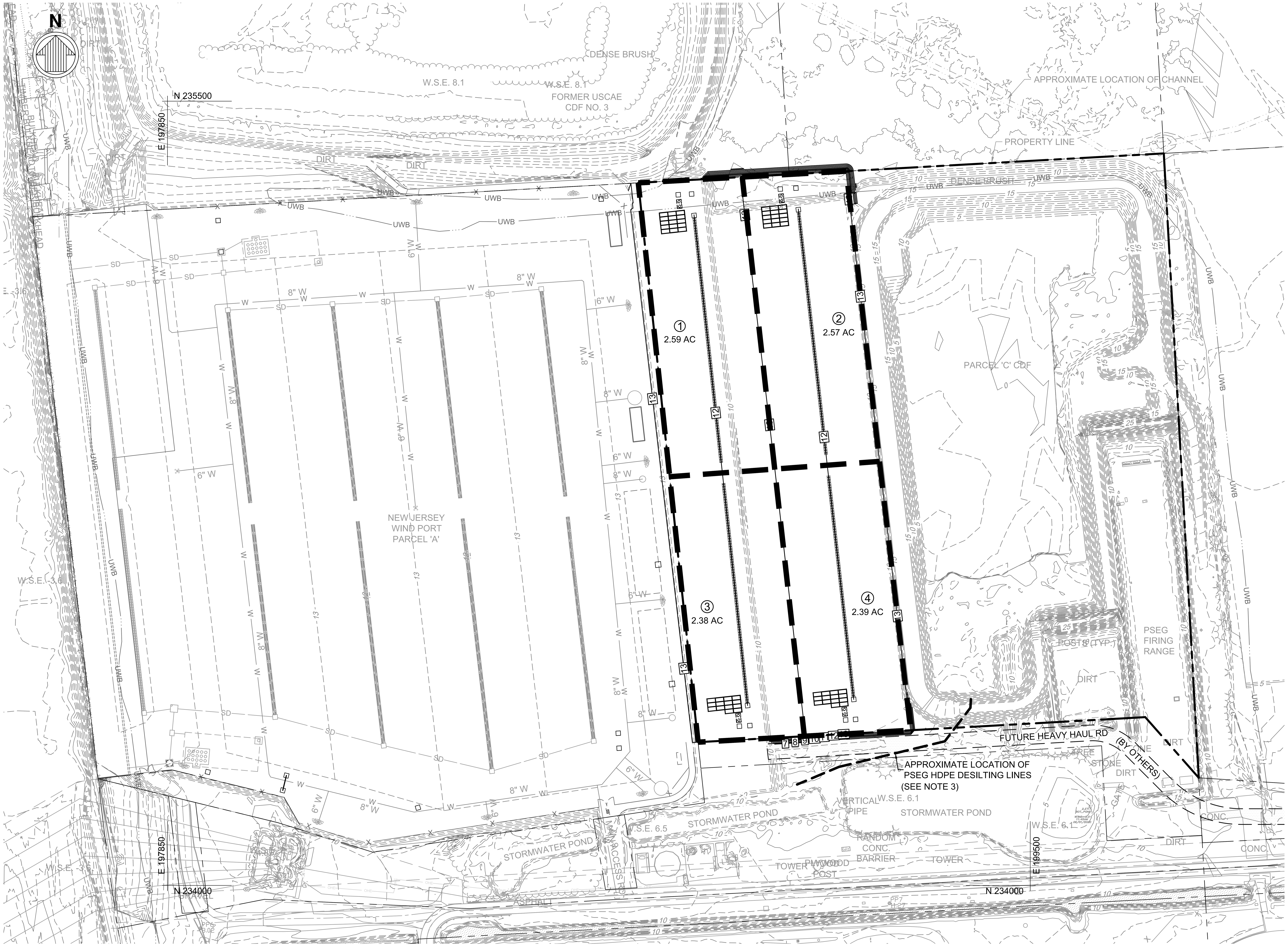
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



A1 C-602 DRAINAGE AREA MAP - PROPOSED CONDITIONS

SCALE: 1" = 100'

NOTES:

1. FOR GENERAL NOTES AND SEQUENCE OF CONSTRUCTION, SEE SHEET G-002
2. FOR LEGEND AND ABBREVIATION, SEE SHEET G-003
3. APPROXIMATE LOCATION OF 8" AND 12" PSEG DESILTING LINES. THESE LINES SHALL NOT BE DAMAGED OR DISTURBED.

LEGEND

DRAINAGE AREA LIMITS

100' 0' 100' 200'

SCALE: 1"=100'

PERMIT SET
ISSUED: 2022-11-04
NOT TO BE USED FOR CONSTRUCTION

Mark	Description	Date	Appr

NEW JERSEY WIND PORT
PARCEL C ACCELERATION (C1)
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

DRAINAGE AREA MAP - PROPOSED CONDITIONS

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NJEDA NEW JERSEY WIND PORT

Designed by: TJS		Date: 2022-11-04	Rev.
Dwn by: HR	Ckd by: LC	M&N Project No. 11102-19	
Reviewed by: FCG		Drawing code:	
Submitted by: FERNANDO GONZALEZ CHANA MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)	

SEAL

Sheet Reference No.
C-602
INDEX: 25 OF 32

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

A1 C-102 **PLAN - INITIAL FILL AND ESC**
SCALE: 1" = 100'

NOTES:

1. FOR GENERAL NOTES AND SEQUENCE OF CONSTRUCTION, SEE SHEET G-002
2. FOR LEGEND AND ABBREVIATION, SEE SHEET G-003
3. APPROXIMATE LOCATION OF 8" AND 12" PSEG DESILTING LINES. THESE LINES SHALL NOT BE DAMAGED OR DISTURBED.

LEGEND

- PARCEL 'C' ACCELERATED
- SSF — SUPER SILT FENCE
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- FP# — INITIAL FILL WORKING POINT
- WP# — BASELINE WORKING POINT

INITIAL FILL WORKING POINT

POINT #	NORTHING	EASTING
FP1	235350.54	198870.65
FP2	235343.84	198751.06
FP3	235468.92	198874.08
FP4	235483.48	199133.93
FP5	234270.30	199274.36
FP6	234247.72	199002.12

BASELINE OF CONSTRUCTION WORKING POINT

POINT #	NORTHING	EASTING
WP1	234155.66	198830.11
WP2	235340.58	198692.74

100' 0' 100' 200'
SCALE: 1"=100'

PERMIT SET
ISSUED: 2022-11-04
NOT TO BE USED FOR CONSTRUCTION

NEW JERSEY WIND PORT
PARCEL C ACCELERATION (C1)
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - INITIAL FILL AND ESC

Designed by: TJS | Drwn by: HR | Chk'd by: LC | Date: 2022-11-04 | Rev.
M&N Project No. 11102-19
Drawing code:
Reviewed by: FCG
Submitted by: FERNANDO GONZALEZ CHAMA, MOFFATT & NICHOL
Drawing Scale: 1:1 (D SHEET)
Plot scale:

moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

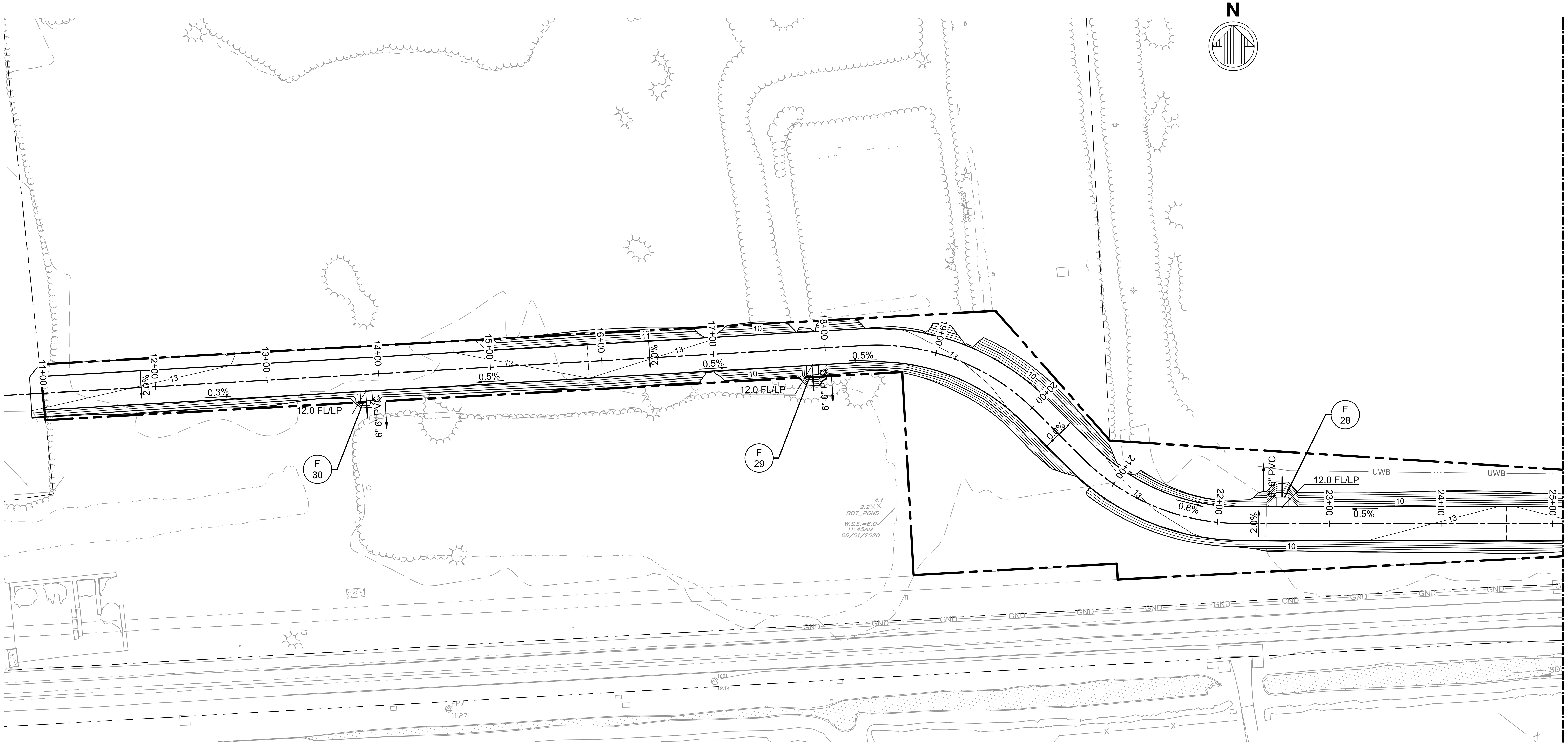
NJEDA
NEW JERSEY WIND PORT

SEAL

Sheet Reference No.
C-102
INDEX: 7 OF 32

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

Appendix F – Final Storm Drainage Site Layout



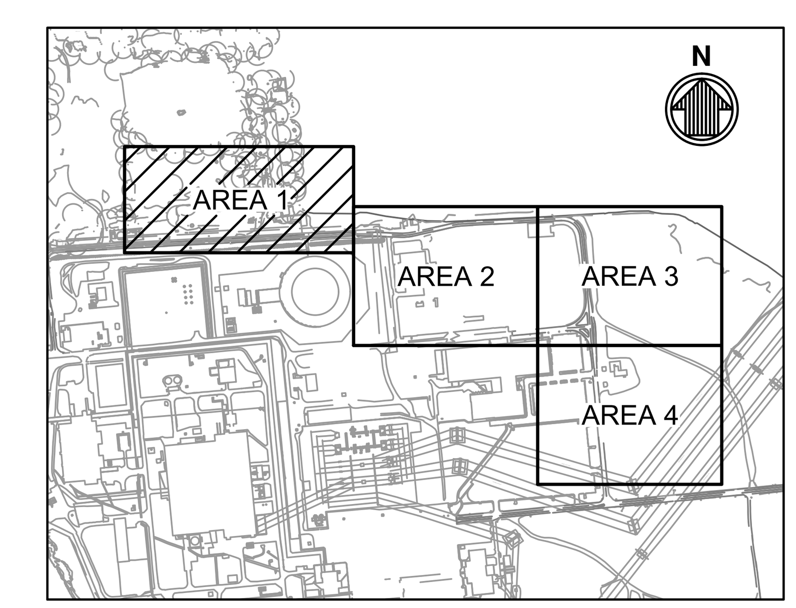
NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.
3. FOR STORM DRAIN SIZE, MATERIAL, AND SLOPE, SEE STORM DRAIN PROFILES ON SHEETS C-202 THROUGH C-209.

LEGEND

F # — STRUCTURE TYPE / STRUCTURE NUMBER

F — FILTERRA HC BIOFILTRATION UNIT (SEE SHEET C-509)



50' 0' 50' 100'

SCALE: 1"=50'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - SITE GRADING AND DRAINAGE (1 OF 4)

Designed by: DC	Date: 2022-11-04	Rev.
Dwn by: HR	Ckd by: LC	M&N Project No. 11102-06
Reviewed by: TJS		Drawing code:
Submitted by: MOFFATT & NICHOL		Drawing Scale: Plot scale: 1:1 (D SHEET)

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NEWTON, MA 02459
617-299-7330

NJEDA
NEW JERSEY WIND PORT

Sheet Reference No.
C-114
INDEX: 23 OF 79

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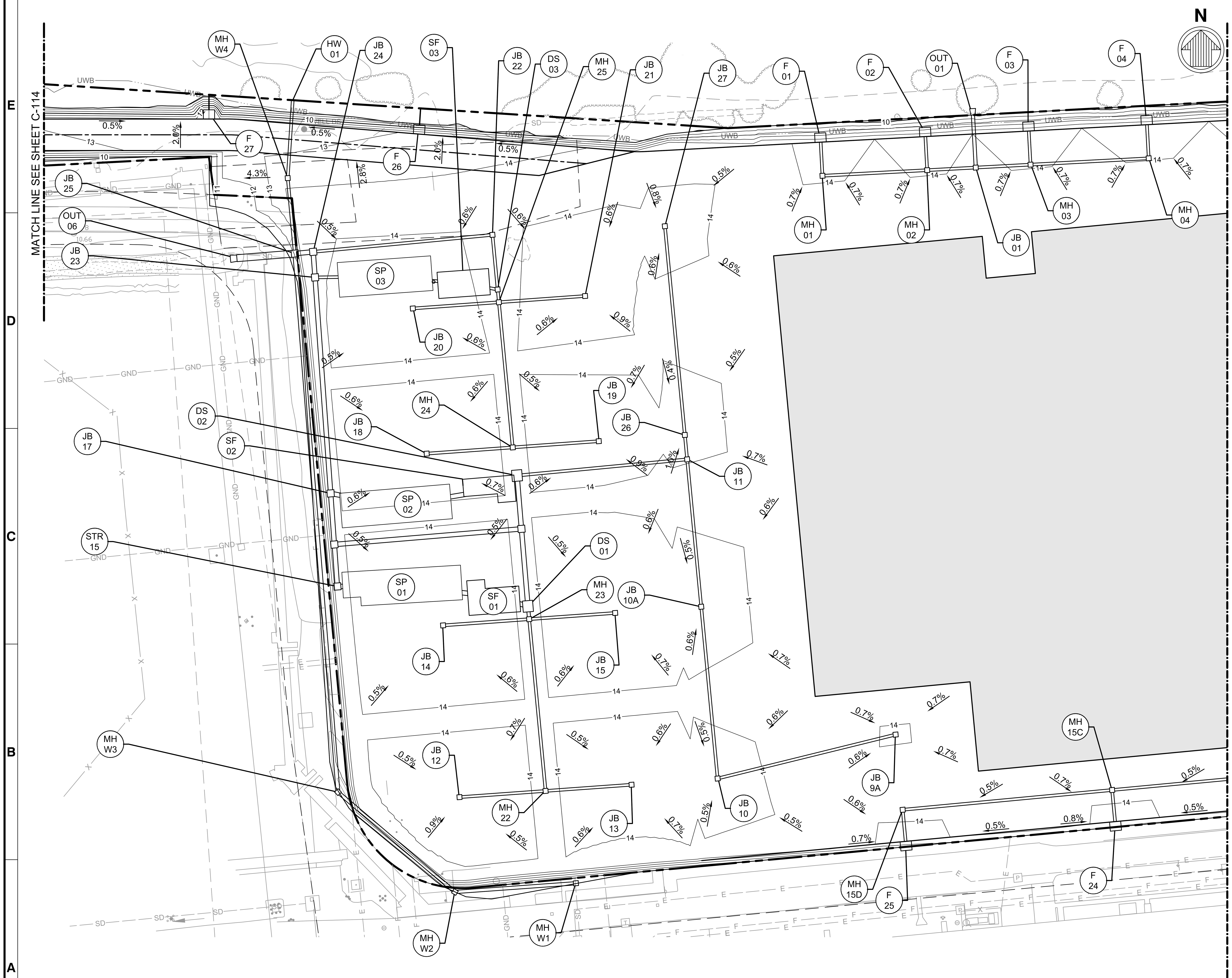
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



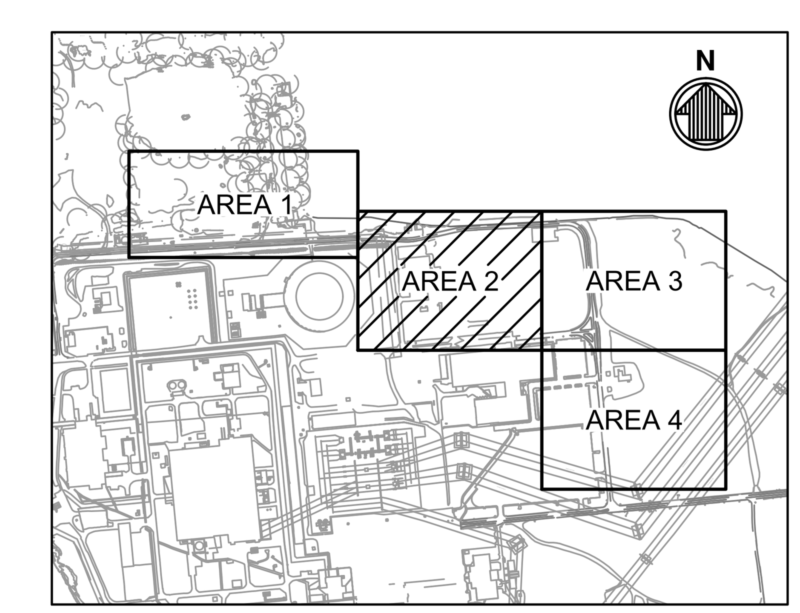
NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.
3. FOR STORM DRAIN SIZE, MATERIAL, AND SLOPE, SEE STORM DRAIN PROFILES ON SHEETS C-202 THROUGH C-209.

LEGEND

F # — STRUCTURE TYPE / STRUCTURE NUMBER

F	FILTERRA HC BIOFILTRATION UNIT (SEE SHEET C-509)
SF	STORMFILTER PRETREATMENT UNIT (SEE SHEETS C-506-C-508)
SP	STORMPOD INFILTRATION VAULT (SEE SHEETS C-506-C-508)
MH	STORMWATER MANHOLE (SEE SHEET C-504)
JB	JUNCTION BOX (SEE SHEET C-502)
DS	DIVERSION STRUCTURE (SEE SHEET C-503)
OUT	OUTFALL STRUCTURE
HW	HEADWALL STRUCTURE



50' 0' 50' 100'

SCALE: 1"=50'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - SITE GRADING AND DRAINAGE (2 OF 4)

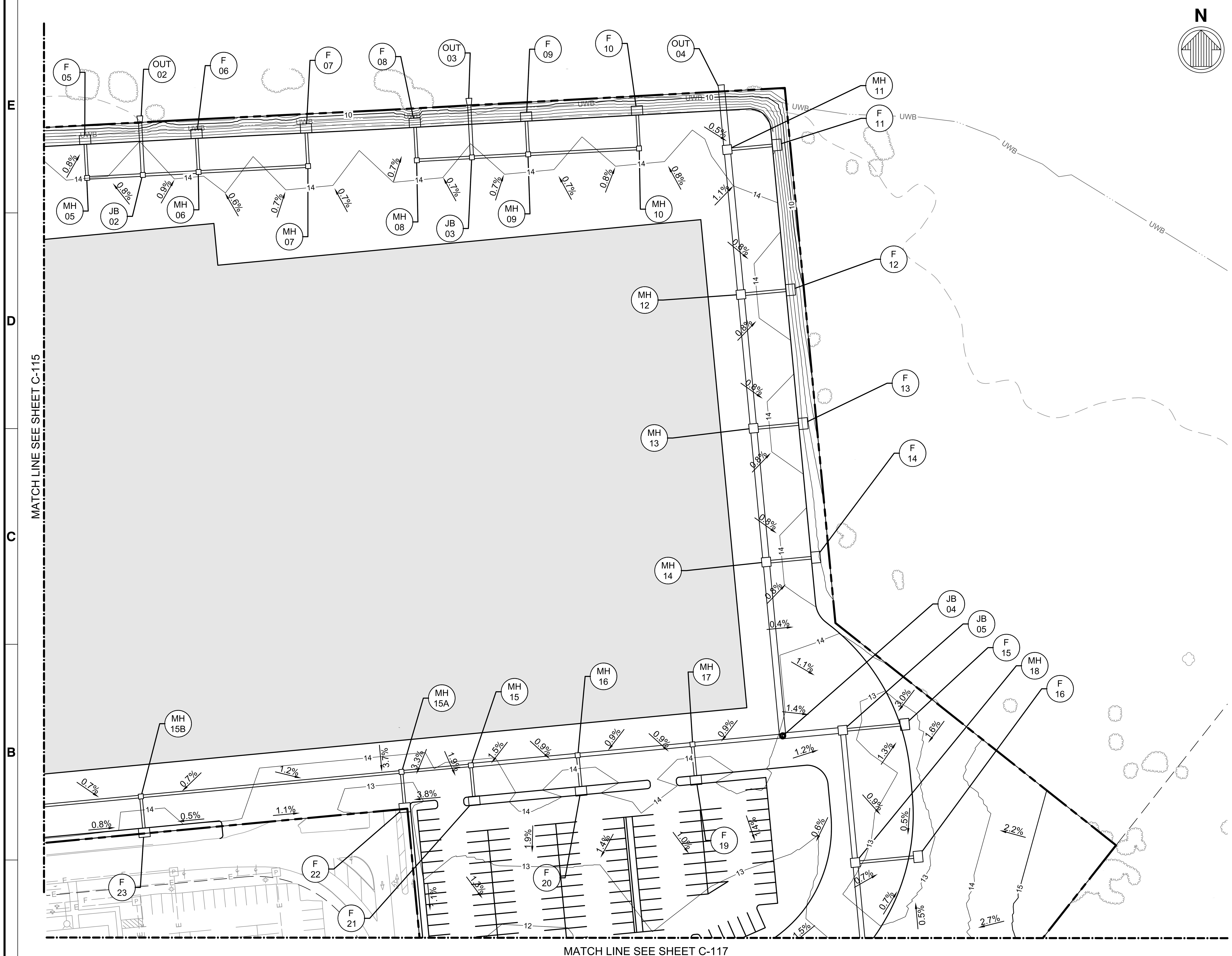
moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

NJEDA — NEW JERSEY WIND PORT

Designed by: DC	Date: 2022-11-04	Rev.	
Dwn by: HR	Ckd by: LC	M&N Project No. 11102-06	
Reviewed by: TJS	Drawing code:		
Submitted by: MOFFATT & NICHOL	Drawing Scale:	Plot scale: 1:1 (D SHEET)	

Sheet Reference No.
C-115
INDEX: 24 OF 79

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



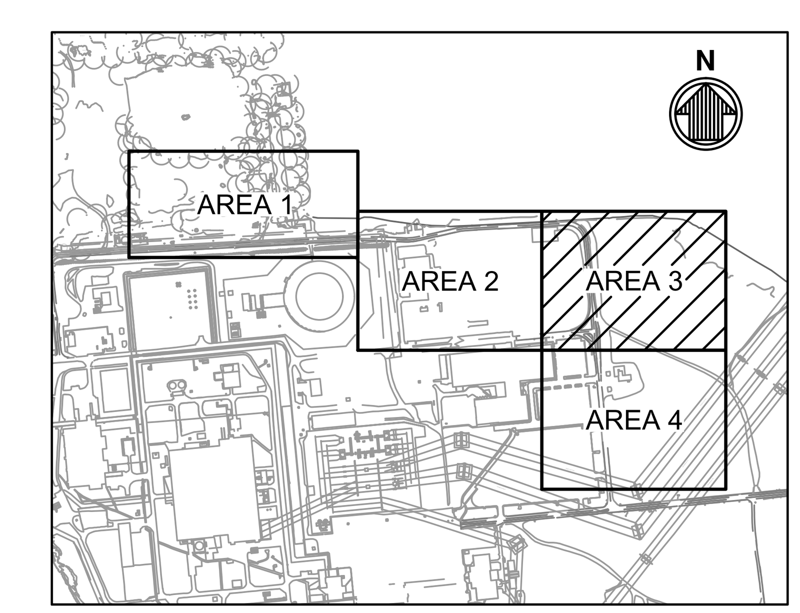
NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.
3. FOR STORM DRAIN SIZE, MATERIAL, AND SLOPE, SEE STORM DRAIN PROFILES ON SHEETS C-202 THROUGH C-209.

LEGEND

F # — STRUCTURE TYPE / STRUCTURE NUMBER

F	FILTERRA HC BIOFILTRATION UNIT (SEE SHEET C-509)
SF	STORMFILTER PRETREATMENT UNIT (SEE SHEETS C-506-C-508)
SP	STORMPOD INFILTRATION VAULT (SEE SHEETS C-506-C-508)
MH	STORMWATER MANHOLE (SEE SHEET C-504)
JB	JUNCTION BOX (SEE SHEET C-502)
DS	DIVERSION STRUCTURE (SEE SHEET C-503)
OUT	OUTFALL STRUCTURE
HW	HEADWALL STRUCTURE



50' 0' 50' 100'

SCALE: 1"=50'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - SITE GRADING AND DRAINAGE (3 OF 4)

Designed by: DC	Date: 2022-11-04
Dwn by: HR	Ckd by: LC
M&N Project No. 11102-06	Rev.
Reviewed by: TJS	Drawing code:
Submitted by: MOFFATT & NICHOL	Drawing Scale:
Plot scale: 1:1 (D SHEET)	

moffatt & nichol
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NEWTON, MA 02459
617-299-7330

NJEDA NEW JERSEY WIND PORT

Mark | Description | Date | Appr

Sheet Reference No.
C-116

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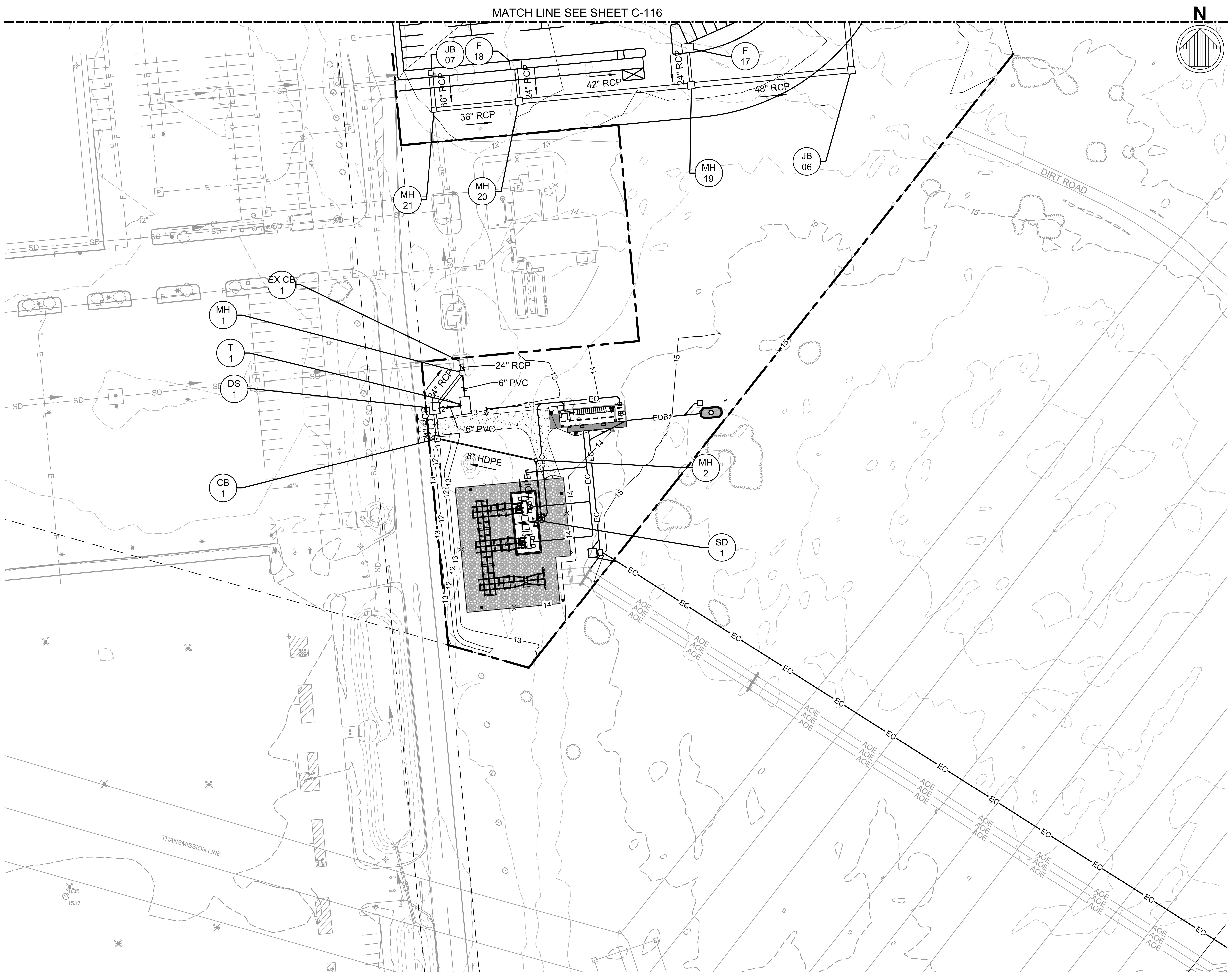
DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

MATCH LINE SEE SHEET C-116



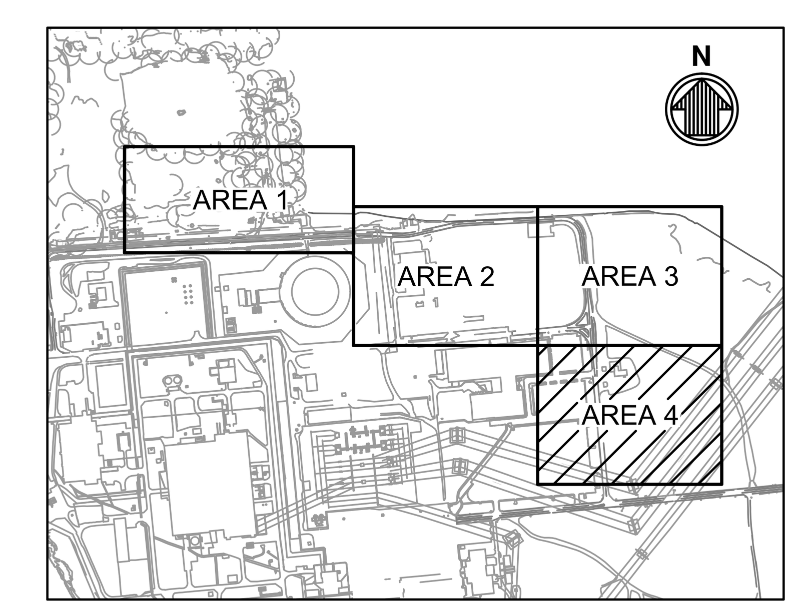
NOTES

1. FOR GENERAL NOTES, SEE SHEET G-002.
2. FOR LEGEND AND ABBREVIATIONS, SEE SHEET G-003.
3. FOR STORM DRAIN SIZE, MATERIAL, AND SLOPE, SEE STORM DRAIN PROFILES ON SHEETS C-202 THROUGH C-209.

LEGEND

F # — STRUCTURE TYPE / STRUCTURE NUMBER

F	FILTERRA HC BIOFILTRATION UNIT (SEE SHEET C-509)
SF	STORMFILTER PRETREATMENT UNIT (SEE SHEETS C-506-C-508)
SP	STORMPOD INFILTRATION VAULT (SEE SHEETS C-506-C-508)
MH	STORMWATER MANHOLE (SEE SHEET C-504)
JB	JUNCTION BOX (SEE SHEET C-502)
DS	DIVERSION STRUCTURE (SEE SHEET C-503)
OUT	OUTFALL STRUCTURE
HW	HEADWALL STRUCTURE



50' 0' 50' 100'

SCALE: 1"=50'

PRELIMINARY DESIGN
ISSUED: FOR PERMITTING
ISSUED: NOVEMBER 04, 2022

NEW JERSEY WIND PORT
PARCEL G - ENGINEERING FOR PERMITTING
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - SITE GRADING AND DRAINAGE (4 OF 4)

Designed by: DC	Date: 2022-11-04	Rev.
Dwn by: HR	Chd by: LC	M&N Project No. 11102-06
Reviewed by: TJS	Drawing code:	
Submitted by: MOFFATT & NICHOL	Plot scale: 1:1 (D SHEET)	Drawing Scale:

moffatt & nichol
180 WELLS AVENUE, SUITE 302
NEWTON, MA 02459
617-299-7330

NJEDA
NEW JERSEY WIND PORT

Mark	Description	Date	Appr

Sheet Reference No.
C-117
INDEX: 26 OF 79

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

A1 C-106 PLAN - SITE GRADING AND DRAINAGE
SCALE: 1" = 100'

NOTES:

1. FOR GENERAL NOTES AND SEQUENCE OF CONSTRUCTION, SEE SHEET G-002
2. FOR LEGEND AND ABBREVIATION, SEE SHEET G-003
3. APPROXIMATE LOCATION OF 8" AND 12" PSEG DESILTING LINES. THESE LINES SHALL NOT BE DAMAGED OR DISTURBED.
4. CONVEYANCE OF TREATED STORMWATER FROM PARCEL 'C' ACCELERATED THROUGH PARCEL 'A' WILL NEED TO BE INCLUDED AS PART OF THE ONGOING PARCEL 'A' CONSTRUCTION.
5. BMP'S 1-4C SHALL BE THE STORMVAULT BIOFILTRATION 8X16' VAULT CONFIGURATIONS BY JENSEN WATER RESOURCES AS SPECIFIED IN DETAIL SHEET CG501 OR EQUIVALENT. SHALL BE CONFIRMED BY THE ENGINEER.
6. V-1C-4C SHALL BE THE STORMCAPTURE 8X16' MODULE BY OLDCASTLE AS SPECIFIED IN DETAIL SHEET CG502 OR EQUIVALENT. SHALL BE CONFIRMED BY THE ENGINEER. THE CONFIGURATION OF MODULES SHALL BE AS SHOWN IN THE DETAIL AND AS FOLLOWS:
   - V-1C: 15 MODULES
   - V-2C: 15 MODULES
   - V-3C: 14 MODULES
   - V-4C: 14 MODULES

LEGEND

- PARCEL 'C' ACCELERATED
- SSF — SUPER SILT FENCE
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- FG# — FINISHED GRADE WORKING POINT

FINISHED GRADE WORKING POINTS

POINT #	NORTHING	EASTING
FG1	235343.0	198736.3
FG2	235366.1	199147.5
FG3	234296.8	199271.3
FG4	234273.4	198853.8

100' 0' 100' 200'
SCALE: 1"=100'

PERMIT SET
ISSUED: 2022-11-04
NOT TO BE USED FOR CONSTRUCTION

NEW JERSEY WIND PORT
PARCEL C ACCELERATION (C1)
LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY, NJ

PLAN - SITE GRADING AND DRAINAGE

Date: 2022-11-04 | Rev.
M&N Project No. 11102-19
Drawing code:
Drawing Scale:
Plot scale: 1:1 (D SHEET)
Designed by: TJS
Dwn by: HR | Ckd by: LC
Reviewed by: FCG
Submitted by: FERNANDO GONZALEZ CHANA, MOFFATT & NICHOL

moffatt & nichol
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NEWTON, MA 02459
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NJEDA | NEW JERSEY WIND PORT

SEAL

Sheet Reference No.
C-106
INDEX: 11 OF 32

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DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

Appendix G – Site Photos

Figure G-1 - Site Photo, Taken at Site G looking North

Figure G-2 - Site Photo, Taken at Site G looking South.

Figure G-3 - Site Photo, Taken at Site G Looking East.

Figure G-4 - Site Photo, Taken at Site G Looking West.

Appendix H – Pennoni Site Soils Investigation Report

Geotechnical Data Report

New Jersey Wind Port – Parcel G
Artificial Island – Hope Creek Site – Block 26, Lot 5
Lower Alloways Creek Township, Salem County, NJ

MOFNI 22003

PREPARED FOR:
Moffatt & Nichol
2929 Arch Street, Suite 1700
Philadelphia, PA 19104

PREPARED BY:
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

August 12, 2022

TABLE OF CONTENTS

SECTION **PAGE NUMBER**

ATTACHMENTS:

1. INTRODUCTION

Pennoni Associates Inc. (Pennoni) is pleased to submit this data report summarizing our geotechnical engineering services performed for the referenced project located within the area referred to as "Parcel G" for the New Jersey Wind Port project as indicated in the attached Site Location Sketch, SL-1. The general purpose of our services was to perform localized clearing, limited subsurface utility locating, test pit excavations, infiltration testing, geotechnical laboratory testing, and preparation of a geotechnical data report. These services were performed in general accordance with Pennoni's revised proposal dated April 14, 2022 and subsequent Moffatt & Nichol (M&N) Subconsultant Agreement dated May 27, 2022.

The field exploration consisted of subsurface utility location performed at each field-testing location, twenty-two (22) test pit excavations and infiltration testing performed at each test pit location, and one additional test pit excavation performed for groundwater observations.

To assist with the performance of our services, we were provided with the following documents:

- A geotechnical report titled, "Subsurface Evaluation: Area G & SPMT Corridor New Jersey Wind Port," prepared by Duffield Associate, LLC, dated January 2021;
- A subdivision plan containing block and lot numbering for the area of intertest titled, "Salem Hope Creek," prepared by PSEG Services Corporation, dated March 31, 2021;
- A test pit and infiltration testing location plan for Parcel G with topographic contour grading information titled, "Plan – Overall Site Grading and Drainage," Sheet Number CG101, prepared by Moffatt & Nichol, dated September 30, 2021 (stamped "Preliminary Design Issued for Permitting"); and
- A test pit and infiltration testing location plan for the proposed substation area with topographic contour grading information titled, "Plan – Proposed Geotechnical Exploration," Sheet Number FIG. 1, prepared by Moffatt & Nichol, dated March 11, 2022 (stamped 60% Submittal).

We understand that M&N is working with the New Jersey Economic Development Authority (NJEDA) within Parcel G for a proposed manufacturing building with associated stormwater management facilities and paved parking areas, a heavy haul road connecting parcels A and G, and a substation for the New Jersey Wind Port. As this project is in the conceptual phase, a preliminary site layout was available indicating building and stormwater management facilities footprints, but no invert elevations for the stormwater management facilities were available at the time of our field exploration. The work area for the geotechnical field exploration generally consists of a gravel graded lot with a structure in the northwestern and western portions of the site and phragmite covered open areas in the northeastern and eastern portion of the site. A paved bituminous concrete road separates the gravel lot area and the phragmite covered open area. The site is bordered by phragmite covered open areas to the north and east and PSE&G nuclear power plant to the south and west with the Delaware River further west. The general topography at the project site is relatively flat with downward western sloping direction towards Delaware River with elevations at the project site ranging from approximately 15 feet to 9 feet (NAVD88, project datum).

Work was performed in accordance with our M&N approved Geotechnical Field Exploration Site Specific Work Plan titled, "New Jersey Wind Port – Parcel G: Artificial Island – Hope Creek Site, Block 26, Lot 5" prepared by Pennoni, with a latest revision date of June 1, 2022. A PSE&G Excavation Permit was obtained by M&N for the performance of the test pit excavations.

2. FIELD EXPLORATION PROGRAM

The field exploration program was performed from June 8, 2022 to June 17, 2022 and consisted of localized clearing to facilitate subsurface utility locating efforts, limited subsurface utility locating, test pit excavations, and the performance of infiltration testing. Pennoni subcontracted the services of Bloodhound LLC to perform the subsurface utility locate and R.E. Pierson Construction Co., Inc. to perform the localized clearing and test pit excavation operations. Subsurface utility locate services were performed on June 8 and June 10, 2022. A total of 22 test pit excavations were performed from June 9, 2022 to June 17, 2022 to depths ranging from approximately 10 to 20 feet below existing grade (approximate existing grade elevations ranging from 9.0 to 15.0 feet) to observe subsurface soil conditions and facilitate infiltration testing within the proposed bioretention facilities at the project site. Test pit/infiltration testing locations were established by M&N. Existing surface elevations were estimated by Pennoni based on topographic contour grading lines provided on the above referenced drawing sheets provided by M&N.

The testing locations were established in the field by Pennoni utilizing a cellular phone with GPS capabilities based on the coordinates provided by M&N presented in the below table.

Table 1: Test Pit Excavation Coordinates

	New Jersey SPCS NAD83 Projected Coordinates (US Survey Feet)	
Test Pit Designation	**Northing**	**Easting**
TP-01	233069.43	201764.38
TP-02	233075.38	201824.11
TP-03	232978.63	201756.28
TP-04	232853.78	201768.06
TP-05	233696.26	200887.14
TP-06	233715.04	201086.26
TP-07	233526.68	200903.14
TP-08	233545.46	201102.26
TP-09	234148.71	201845.35
TP-10	233947.84	201765.83
TP-11	233969.93	201962.60
TP-12	233784.08	201782.10
TP-13	233801.74	201981.60
TP-14	233617.89	201798.61
TP-15	233635.40	201996.44
TP-16	233451.70	201815.13
TP-17	233481.04	202145.21
TP-18	233269.88	202028.85
TP-19	233997.07	200539.09
TP-20	234004.28	200638.83
TP-21	233677.48	200688.03
TP-22	233507.90	200704.03
TP-23 *	232920.24	201761.59
(*) – Test pit TP-23 was selected and established in the field by Pennoni as an additional test pit excavation to be performed for additional subsurface soil and groundwater observations.		

Prior to the infiltration testing, the test pits were extended a minimum of 8 feet below the anticipated infiltration testing elevation (as provided by M&N prior to field exploration and corresponding to two feet above encountered groundwater) to identify if potential limiting zones such as groundwater table (GWT), seasonal high-water table (SHWT), observed seepage, and/or hardpan were present, as well as confirm the uniformity of subsoil conditions. After establishing the subsurface conditions were suitable for testing and confirming infiltration testing elevations with M&N, the infiltration test locations were offset approximately 10 feet laterally and the infiltration tests were set at the respective test elevation. The infiltration tests were performed using a sing-ring infiltration device in general accordance with the New Jersey Stormwater Best Management Practices (BMP) Manual, Chapter 12: Soil Testing Criteria, Section 3: Soil Hydraulic Conductivity Testing, Subsection A5: Single Ring Infiltration Test (April 2022).

An additional test pit, labelled TP-23, was elected to be performed by Pennoni and approved by M&N for further observations of subsurface soil and groundwater observations. The test pit was left open for an approximate half working day duration (approximately 4-hours) to observe groundwater conditions over an elapsed period of time.

Upon completion of the test pits and infiltration testing, the excavated soils were placed in the excavation in lifts and “tamped” with the bucket of the excavator to generally match the existing grade. Photos of the project site prior to our departure from the site were distributed via electronic mail to M&N on June 17, 2022.

The test pit excavations were performed by our subcontractor, RE Pierson utilizing a tracked CAT-315 excavator. Our Theodore A. Thomson, PE directed the field work and Jacquie Kelley, EIT observed the field exploration operations. Testing locations are indicated the attached Field-Testing Location Sketches, SK-1 and SK-2. Test pit logs are attached herein.

3. GEOTECHNICAL LABORATORY TESTING PROGRAM

Following conclusion of the test pit excavation operations, the soil samples were returned to Pennoni’s laboratory for visual classification and testing. The geotechnical laboratory program consisted of the following:

- Moisture Content (ASTM D2216) 22 tests
- Particle Size Distribution w/ Hydrometer (ASTM D6913/D7928) 22 tests
- Atterberg Limits (ASTM 4318) 12 tests
- USDA Soil Classification 22 tests

Samples for testing were selected by Pennoni and approved by M&N prior to the performance of the testing. Results of the laboratory testing are attached herein.

4. SUBSURFACE CHARACTERISTICS

4.1 GEOLOGY

The project site is located within the Atlantic Coastal Plain Physiographic Province of New Jersey, which is characterized by relatively loose and unconsolidated sedimentary materials. Based on review of a geologic map titled, “Geology of the Canton and Taylors Bridge Quadrangles – Salem and Cumberland Counties, New Jersey,” Open File Map Series OFM 92, prepared by Scott D. Stanford in cooperation with the United States Geological Survey, dated 2011 the upper 200 feet of the general project site is estimated to comprise of the following soil types in descending order from the ground surface:

Table 3: Geology at Project Site[1]

Soil Map Unit	General Description	Thickness (feet)
Artificial Fill	Gray to brown sand, silt, gravel, clay with debris. Material deposited in this area from to form Artificial Island and surrounding areas.	Up to 15 – 30 feet thick
Dredge Soils (afd)	Gray to brown fine sand, silt, clay, some to little medium to coarse sand and gravel, with varied amounts of organics and mica. Material deposited in this area from dredging operations to form Artificial Island and surrounding areas.	Up to 40 feet thick
Salt-Marsh and Estuarine Deposits (Qm)	Peat, clay, silt, fine sand with some medium sand and fine gravel. Alluvial deposits in tidal areas (marshes, wetlands, flat, channels).	Up to 100 feet thick
Cape May Formation, Units 3 through 1 (Qcm3, Qcm2/2f, Qcm1)	Yellow to various shades of brown to light gray becoming reddish very fine to fine silty sand becoming coarser as the formation transitions from Units Qcm3 to Qcm2/2f to Qcm1 of the Cape May Formation due to weathering. The formations have varying quantities of gravel and cobbles. A fine-grained primary constituent of dark gray silt to sandy/clayey silt (Qcm2f) was observed locally at the Salem Nuclear Plant underlying Unit Qcm3.	Each unit up to 30 – 40 feet thick
Vincentown Formation (Tvt)	Olive to light gray to brown medium-sized quartz sand. Within the upper 20 to 30 feet of the formation silty clay may be present.	Up to 90 feet thick
Hornerstown Formation (Tht)	Olive to green to black clay (referred to as “marl”) with some fine to medium sand and mica.	Up to 20 – 25 feet thick
Navesink Formation (Kns)	Olive to green to black clay to sandy clay with shells and medium sand (referred to as “marl”).	Up to 20 – 25 feet thick
Mount Laurel Formation (Kml)	Olive to gray to black medium sand (referred to as “salt-and-pepper sand”). This formation is reportedly the stratum for most domestic water wells in this general area.	Up to 90 – 100 feet thick
NOTE: [1] A portion of the geologic map titled, “Geology of the Canton and Taylors Bridge Quadrangles – Salem and Cumberland Counties, New Jersey,” Open File Map Series OFM 92 and cross section contained within the map are attached herein (SK-3 and SK-4) within the general area of the project site.		

The field exploration was performed within the area referred to as “Parcel G” (referenced in the geologic cross-section provided in SK-4) where artificial fill and/or dredged materials appear to have been placed previously during initial construction of the area.

According to USDA Web Soil Survey mapping, the project site consists primarily of Udorthents, dredged fine material (UddfB), and Urban Land (UR). The Udorthents dredged fine material generally consists of fine-loamy dredge spoils transported by human activity. The Udorthents is noted to as hydrologic soil group C with moderately low to moderately high capacity to transmit water (0.06 to 0.20 inches per hour). The anticipated depth to water table is estimated at more than 80 inches below the ground surface and the depth to a restrictive feature generally exceeds 80 inches. Urban Land generally consists of surface material covered by pavement, concrete, buildings, and other structures underlain by disturbed or natural soil material. The USDA report does not comment on the hydrologic soil group, the ability of the material to transmit water, and on the depth to groundwater or restrictive feature. Approximate ground surface elevations were not provided in the mapping report prepared by the USDA. The USDA report for this site is attached to this report. The subsurface soils and groundwater observations encountered during our field exploration are generally similar to those provided in the USDA Web Soil Survey.

4.2 SUBSURFACE STRATIGRAPHY

Subsurface stratigraphy encountered within Parcel G generally consists of either surficial layer of topsoil (Stratum T) or a surficial layer of graded aggregate base course (Stratum P). Strata T and P are typically underlain by apparent fill material generally consisting of silty loam gravel to gravelly sand to loamy sand with trace construction debris (Stratum F). Stratum F is typically underlain by interbedded stratums of loam to loamy sand to sand (Stratum A) and clay to clay loam (Stratum B). A layer of silt loam (Stratum C) was observed localized at test pit location TP-16 underlaying Stratum A and was not fully penetrated. Stratum A was not encountered at test pit locations TP-1, TP-2, TP-9 through TP-12, TP-18, and TP-21. Stratum B was not encountered at test pit locations TP-3 through TP-5, TP-7, TP-16, and TP-17. Test pit excavations were terminated at depths ranging from 10 to 20 feet below existing grades (approximate existing grade elevations ranging from 9.0 to 15.0 feet).

Historic subsurface information was also reviewed from the above-referenced Duffield Associates' report. The previously performed SPT locations were located in the northwest and northern potions of Parcel G and generally consisted of a surficial layer of fill consisting of sand with occasional construction debris. The fill was generally underlain by silts and clays with interlayered sands to depths of 40 to 70 feet below grade. Medium dense to dense sands and gravels were generally observed underlying these strata at approximate elevations of -30 to -60 feet (NAVD88) and the test borings appeared to terminate in this stratum. The near surface subsurface stratigraphy of the previously performed geotechnical field exploration performed adjacent to Parcel G generally appears similar to that of the current Pennoni field exploration.

4.3 GROUNDWATER

Groundwater observations were made in each test pit location. Evidence of groundwater was observed at depths ranging from 5 to 17.5 feet below existing grades (groundwater elevations corresponding to Elev. -4 to 8 feet). Apparent water seepage through the sidewalls of the excavations were observed during our field exploration in the following test pits: TP-1, TP-3, TP-4, TP-12, TP-13, and TP-21, potentially influenced by precipitation events and generally not interpreted as natural groundwater table. Other indicators of limiting zones, e.g., hardpan, bedrock, perched water, as defined by the NJ BMP Manual (April 2022) were not observed.

One test pit location, TP-23, was elected to be performed and left open over a half working day duration (approximately 4-hour period) to facilitate groundwater observations. Groundwater was encountered during the initial excavation at a depth of 7.5 feet below existing grade (Elev. 5.5 feet). Prior to backfilling, groundwater observations were observed to be at a depth of 7.5 feet below existing grade (Elev. 5.5 feet). Water seepage from the sidewalls of excavation was initially observed at 4 feet below existing grades, however prior to backfilling no seepage was generally observed.

Groundwater observations are for the times and locations noted and may not be indicative of seasonal and daily fluctuations in groundwater levels, as well as tidal fluctuations due to the project site's close proximity to the Delaware River.

Table 4: Estimated Groundwater Elevations Based on Test Pit Excavations

Test Pit Designation	Ex. Surface Elevation, ft 1,2,3	GWT Depth, ft 4	GWT Elevation, ft 1,2,3, 4	Observed Seepage Depth, ft5	Observed Seepage Elevation, ft 1,2,3,5
TP-01	12.0	6.5	5.5	4.5	7.5
TP-02	13.0	5.0	8.0	NE	NE
TP-03	13.0	6.5	6.5	3.0	10.0
TP-04	12.8	6.0	6.8	2.5	10.3
TP-05	12.5	5.0	7.5	NE	NE
TP-06	13.0	8.5	4.5	NE	NE
TP-07	11.0	13.0	-2.0	NE	NE
TP-08	13.0	15.0	-2.0	NE	NE
TP-09	9.0	4.0	5.0	NE	NE
TP-10	10.5	13.0	-2.5	NE	NE
TP-11	10.5	15.5	-5.0	NE	NE
TP-12	13.0	11.0	2.0	5.0	8.0
TP-13	14.0	15.0	-1.0	10.0	4.0
TP-14	14.0	17.5	-3.5	NE	NE
TP-15	15.0	15	0.0	NE	NE
TP-16	13.0	10.0	3.0	NE	NE
TP-17	16.0	16.0	0.0	NE	NE
TP-18	14.0	8.5	5.5	NE	NE
TP-19	9.5	4.0	5.5	NE	NE
TP-20	10.0	5.0	5.0	NE	NE
TP-21	11.0	15.0	-4.0	5.0	6.0
TP-22	10.0	14.0	-4.0	NE	NE
TP-23 (start of day)	13.0	7.5	5.5	4	9.0
TP-23 (end of day)	13.0	7.5	5.5	NE	NE

NOTES:
(1) SURFACE ELEVATIONS FOR TEST PIT LOCATIONS TP-1 THROUGH TP-4 AND TP-23 WERE APPROXIMATED BASED ON A DRAWING TITLED, "PLAN – PROPOSED GEOTECHNICAL EXPLORATION," SHEET NO. FIG.1, PREPARED BY M&N, DATED MARCH 11, 2022;
(2) SURFACE ELEVATIONS FOR TEST PIT LOCATIONS TP-5 THROUGH TP-22 WERE APPROXIMATED BASED ON A DRAWING TITLED, "PLAN – OVERALL SITE GRADING AND DRAINAGE," SHEET NO. CG101, PREPARED BY M&N, DATED SEPTEMBER 30, 2021;
(3) VERTICAL DATUM IS NAVD88;
(4) GWT – GROUNDWATER TABLE;
(5) NE - NOT ENCOUNTERED; AND
(6) DIMENSIONS AND MEASUREMENTS ARE APPROXIMATIONS.

Historic groundwater information was also reviewed from the above-referenced Duffield Associates' report. Groundwater was indicated to be encountered during drilling at depths ranging from 2 to 15 feet below existing ground surfaces (groundwater elevations corresponding to Elev. -4 to 11 feet). Historic groundwater readings generally appeared similar to that of our field exploration.

5. INFILTRATION TESTING RESULTS

Infiltration tests were performed using a sing-ring infiltration device in general accordance with the New Jersey Stormwater BMP Manual, Chapter 12: Soil Testing Criteria, Section 3: Soil Hydraulic Conductivity Testing, Subsection A5: Single Ring Infiltration Test (April 2022). Infiltration testing depths were established as directed by M&N. Detailed infiltration testing results for each respective test are attached to this report. A brief summary of our findings for the infiltration testing program is presented in Table 5 below.

Table 5: Summary of Findings

Test Pit Location/Infil. Number	Ex. Surface Elevation (Elev.)[1,2,3]	GWT Elevation (Elev.)[1,2,3,4]	Limiting Zone Type[4,5]	Limiting Zone Elevation (Elev.)[1,2,3]	Infiltration Test Elevation (Elev.)[1,2,3]	Stratum of Soil Tested	OFIR (in./hr)[6]	Calculated HC (in./hr)[7,8]
TP-1/INF-1	12.0	4.5	SP	7.5	9.5	F	16.0	5.50
TP-2/INF-2	13.0	8.0	GWT	8.0	10.0	F	0.88	0.30
TP-3/INF-3	13.0	10.0	SP	10.0	8.5	A	0.13	0.04
TP-4/INF-4	12.8	10.3	SP	10.3	8.8	A	0.25	0.10
TP-5/INF-5	12.5	7.5	GWT	7.5	9.5	A	0.63	0.20
TP-6/INF-6	13.0	4.5	GWT	4.5	8.0	A	0.13	0.04
TP-7/INF-7	11.0	-2.0	GWT	-2.0	9.0	A	15.2	5.20
TP-8/INF-8	13.0	-2.0	GWT	-2.0	8.0	A	0.13	0.04
TP-9/INF-9	9.0	5.0	GWT	5.0	8.0	F	0.38	0.10
TP-10/INF-10	10.5	-2.5	GWT	-2.5	8.0	F	0.13	0.04
TP-11/INF-11	10.5	-5.0	GWT	-5.0	9.0	F	0.25	0.10
TP-12/INF-12	13.0	8.0	SP	8.0	10.0	F	0.13	0.04
TP-13/INF-13	14.0	4.0	SP	4.0	6.0	A	0.88	0.30
TP-14/INF-14	14.0	-3.5	GWT	-3.5	8.0	A	0.50	0.20
TP-15/INF-15	15.0	0.0	GWT	0.0	8.0	A	0.13	0.04
TP-16/INF-16	13.0	3.0	GWT	3.0	5.0	C	0.25	0.10
TP-17/INF-17	16.0	0.0	GWT	0.0	6.0	A	0.13	0.04
TP-18/INF-18	14.0	5.5	GWT	5.5	7.5	F	4.50	1.50
TP-19/INF-19	9.5	5.5	GWT	5.5	8.0	F	15.30	5.20
TP-20/INF-20	10.0	5.0	GWT	5.0	8.0	F	7.20	2.40
TP-21/INF-21	11.0	6.0	SP	6.0	8.0	F	5.60	1.90
TP-22/INF-22	10.0	-4.0	GWT	-4.0	8.0	F	17.00	5.80

NOTES:
(1) SURFACE ELEVATIONS FOR TEST PIT LOCATIONS TP-1 THROUGH TP-4 AND TP-23 WERE APPROXIMATED BASED ON A DRAWING TITLED, "PLAN – PROPOSED GEOTECHNICAL EXPLORATION," SHEET NO. FIG.1, PREPARED BY M&N, DATED MARCH 11, 2022;
(2) SURFACE ELEVATIONS FOR TEST PIT LOCATIONS TP-5 THROUGH TP-22 WERE APPROXIMATED BASED ON A DRAWING TITLED, "PLAN – OVERALL SITE GRADING AND DRAINAGE," SHEET NO. CG101, PREPARED BY M&N, DATED SEPTEMBER 30, 2021;
(3) VERTICAL DATUM IS NAVD88;
(4) GWT – GROUNDWATER TABLE;
(5) SP – SEEPAGE;
(6) OFIR – OBSERVED FIELD INFILTRATION RATE;
(7) HC – HYDRAULIC CONDUCTIVTY;
(8) CALCULATED HC IS EQUAL TO 0.34239 MULTIPLIED BY THE OFIR PER THE NJ BMP MANUAL (APRIL 2022); AND
(9) DIMENSIONS AND MEASUREMENTS ARE APPROXIMATIONS.

6. LIMITATIONS

This work has been done in accordance with our authorized scope of work and in accordance with generally accepted professional practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project described herein; any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problems that may result from misinterpretation or misunderstanding of this report or failure to comply with our recommendations.

We trust that the information presented in this report is what you require at this time and we thank you for the opportunity to assist you with this project. If you have any questions, or if you need any further assistance with this project, please contact this office at your earliest convenience.

Sincerely,

PENNONI ASSOCIATES INC.

Steven J. Corcoran, PE (DE)
Project Geotechnical Engineer

Theodore A. Thomson, Jr., PhD, PE, DGE, LEED AP
Geotechnical Division Manager/Associate Vice President

Site Location Sketch

NOTES:
(1) THIS SKETCH WAS ADAPTED BY PENNONI FROM A GOOGLE EARTH AERIAL IMAGE DATED OCTOBER 16, 2020.
(2) APPROXIMATE SITE LOCATION OUTLINED IN RED.

Pennoni

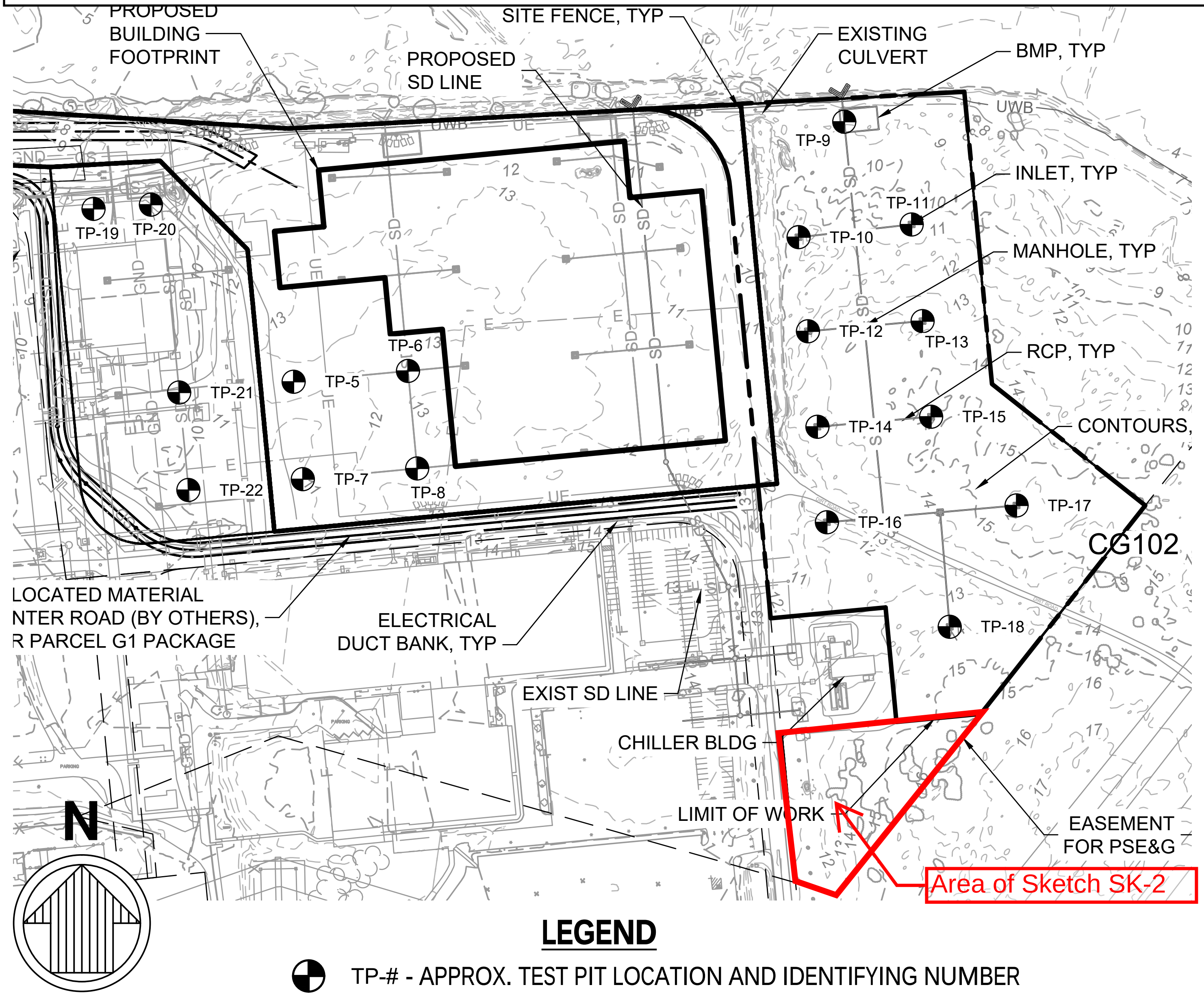
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

DRAWN BY: SJC	SCALE: AS SHOWN	DATE: 08/12/2022
CHECKED BY: TAT	FIGURE No. SL-1	
PROJECT No: MOFNI22003		

NJ WIND PORT - PARCEL G - LOWER ALLOWAYS CREEK TWP, SALEM COUNTY, NJ

Field Testing Location Sketch

Note: This figure is adapted from a revised drawing titled "Plan - Overall Site Grading and Drainage," developed by Moffatt & Nichol and stamped "Issued for Permitting," dated September 30, 2021, distributed to Pennoni on June 1, 2022.



LEGEND

TP-# - APPROX. TEST PIT LOCATION AND IDENTIFYING NUMBER

Pennoni

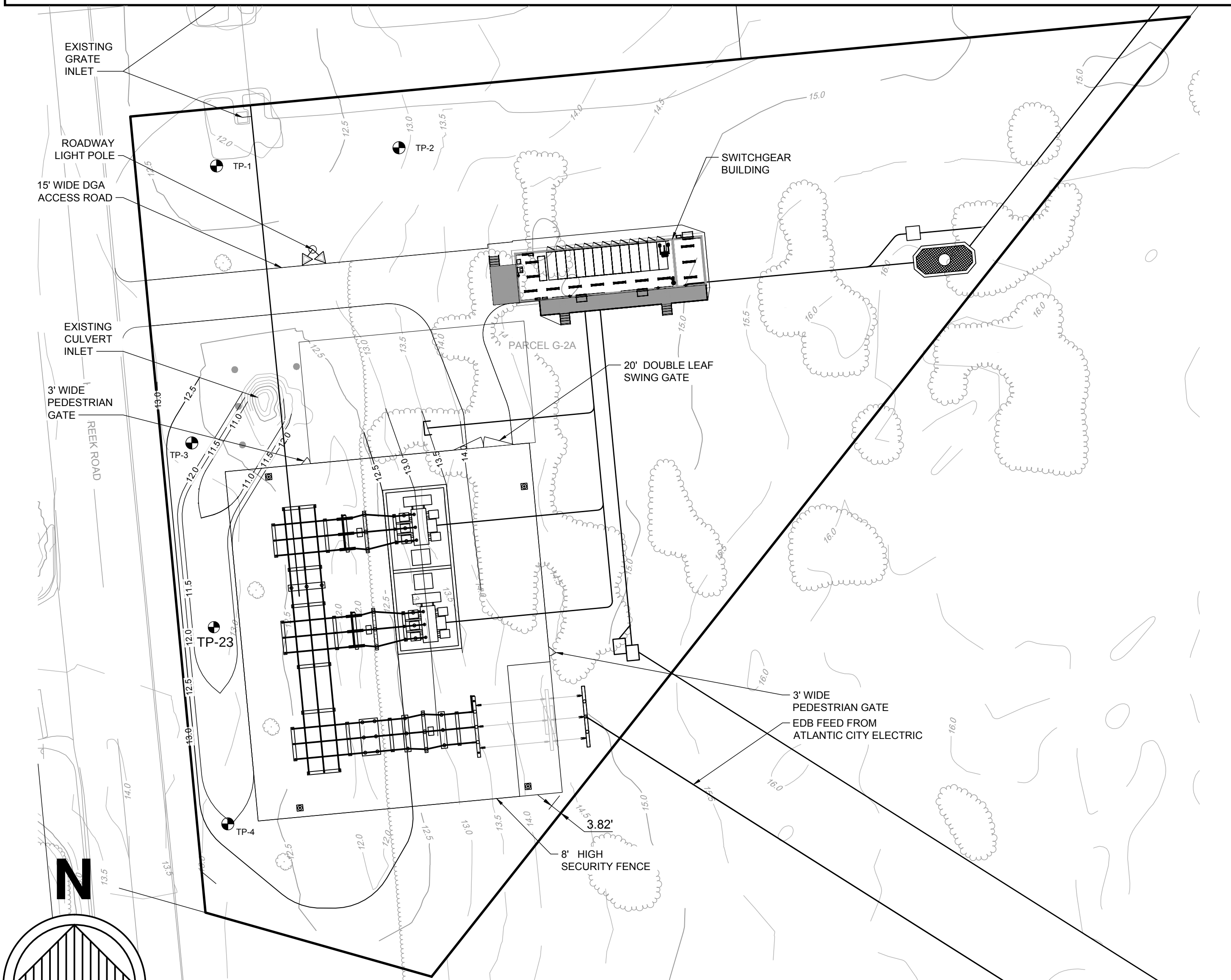
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

DRAWN BY:	SCALE:	DATE:
SJC	NTS	08/12/2022
CHECKED BY: TAT	FIGURE No.	
PROJECT No: MOFNI22003	SK-1	

NJ WIND PORT - PARCEL G - LOWER ALLOWAYS CREEK TWP, SALEM COUNTY, NJ

Field Testing Location Sketch

Note: This figure is adapted from a drawing titled "Plan - Proposed Geotechnical Exploration," developed by Moffatt & Nichol and stamped "60% Submittal ," dated March 11, 2022.



LEGEND

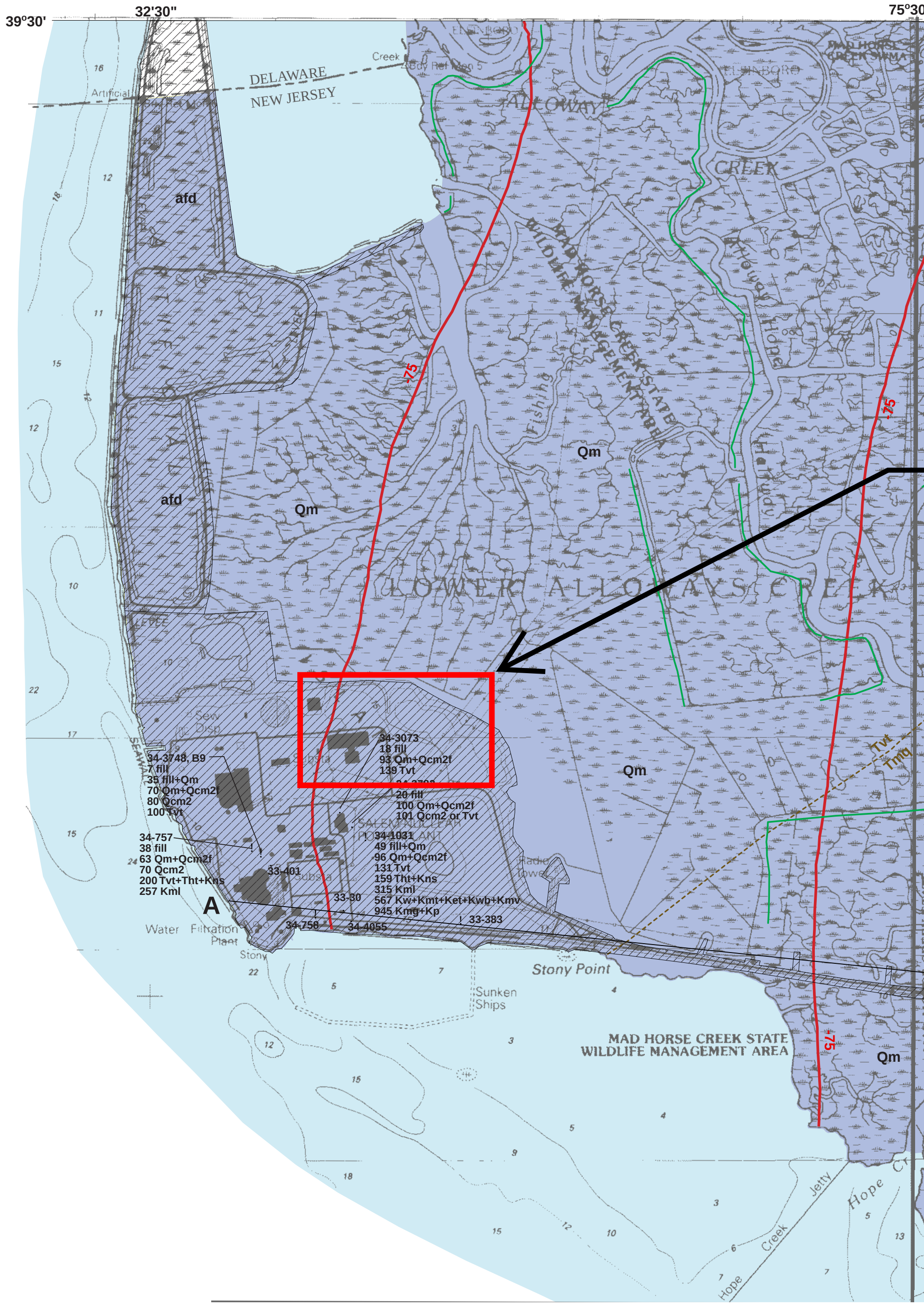
TP-# - APPROX. TEST PIT LOCATION AND IDENTIFYING NUMBER

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

DRAWN BY:	SCALE:	DATE:
SJC	NTS	08/12/2022
CHECKED BY:	FIGURE No.	
TAT		
PROJECT No:	SK-2	
MOFNI22003		

NJ WIND PORT - PARCEL G - LOWER ALLOWAYS CREEK TWP, SALEM COUNTY, NJ

GEOLOGIC MAP SKETCH



APPROXIMATE PARCEL G SITE LOCATION IN RED.

NOTES:
(1) THIS SKETCH WAS ADAPTED BY PENNONI FROM A GEOLOGIC MAP TITLED, "GEOLOGY OF CANTON AND TAYLORS BRIDGE QUADRANGLES - SALEM AND CUMBERLAND COUNTIES, NEW JERSEY," PREPARED IN COOPERATION WITH USGS, DATED 2011.
(2) APPROXIMATE SITE LOCATIONS OUTLINED IN RED.

Pennoni

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

DRAWN BY: SJC

CHECKED BY: TAT

PROJECT No: MOFNI 22003

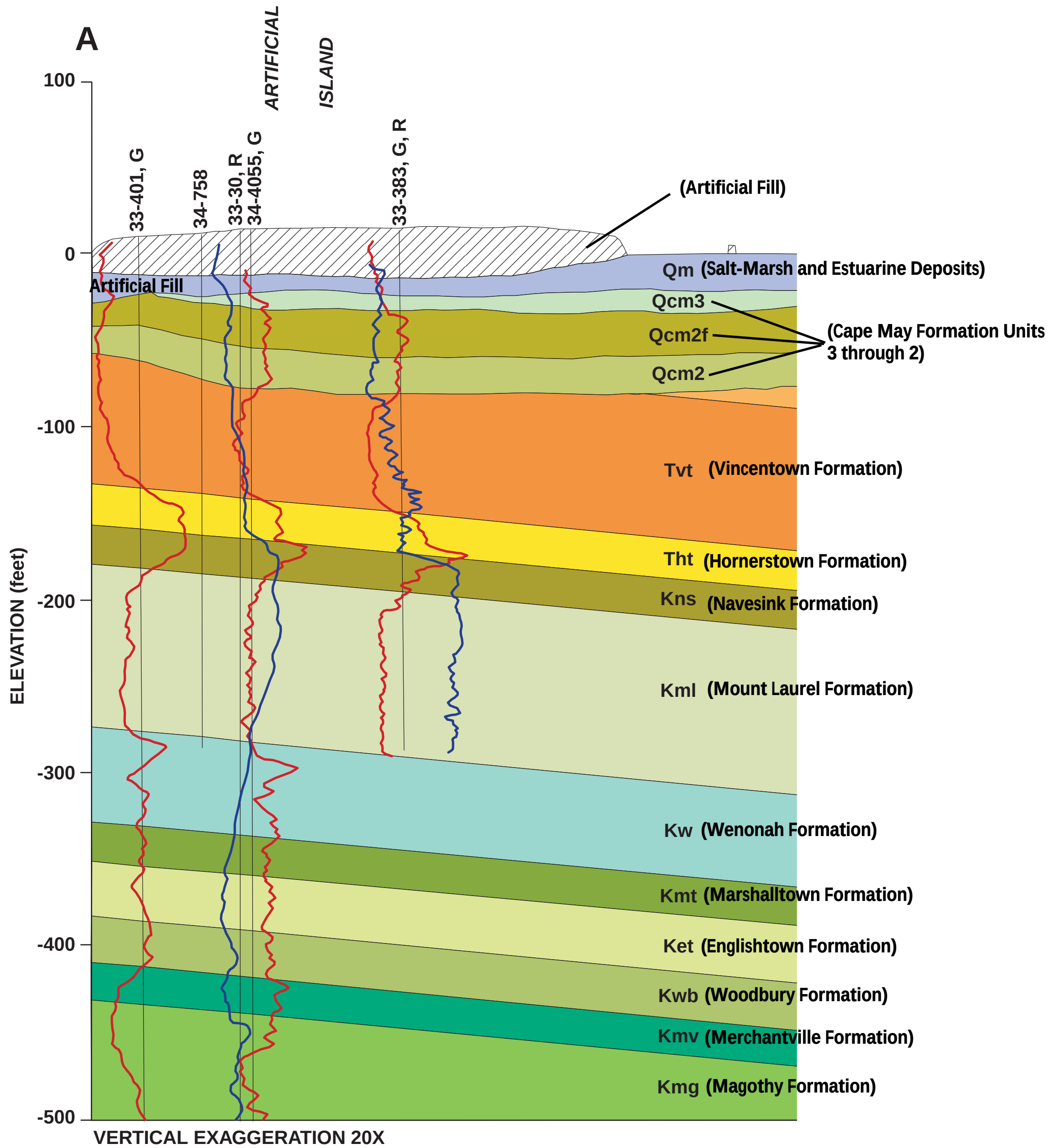
SCALE: AS SHOWN

DATE: 08/12/2022

Figure No. SK-3

NJ WIND PORT - PARCEL G - LOWER ALLOWAYS CREEK TWP, SALEM COUNTY NJ

GEOLOGIC CROSS-SECTION SKETCH



NOTES:

(1) THIS SKETCH WAS ADAPTED BY PENNONI FROM A GEOLOGIC MAP TITLED, "GEOLOGY OF CANTON AND TAYLORS BRIDGE QUADRANGLES - SALEM AND CUMBERLAND COUNTIES, NEW JERSEY," PREPARED BY SCOTT STANFORD IN COOPERATION WITH USGS, DATED 2011.

Pennoni

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DRAWN BY:	SCALE:	DATE:
SB	AS SHOWN	08/12/2022
CHECKED BY: SJC	Figure No.	
PROJECT No: MOFNI 21002	SK-4	

NJ WIND PORT - PARCEL G - LOWER ALLOWAYS CREEK TWP., SALEM COUNTY, NJ

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Salem County, New Jersey

MOFNI22003-06.20.2022-NRCS
Web Soil Survey

June 20, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:3,670 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 150, 300, 600, 900

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Salem County, New Jersey
Survey Area Data: Version 18, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 9, 2020—Jun 13, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UddfB	Udorthents, dredged fine material, 0 to 8 percent slopes	10.9	25.2%
UR	Urban land	32.3	74.8%
Totals for Area of Interest		**43.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Salem County, New Jersey

UddfB—Udorthents, dredged fine material, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 4k49
Elevation: 0 to 170 feet
Mean annual precipitation: 28 to 59 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 161 to 231 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, dredged fine materials, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Dredged Fine Materials

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy material transported by human activity; fine-loamy dredge spoils

Typical profile

A - 0 to 12 inches: loam
C - 12 to 80 inches: clay

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Water

Percent of map unit: 5 percent

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

UR—Urban land

Map Unit Setting

National map unit symbol: 4k4c
Elevation: 0 to 170 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 5 percent
Landform: Low hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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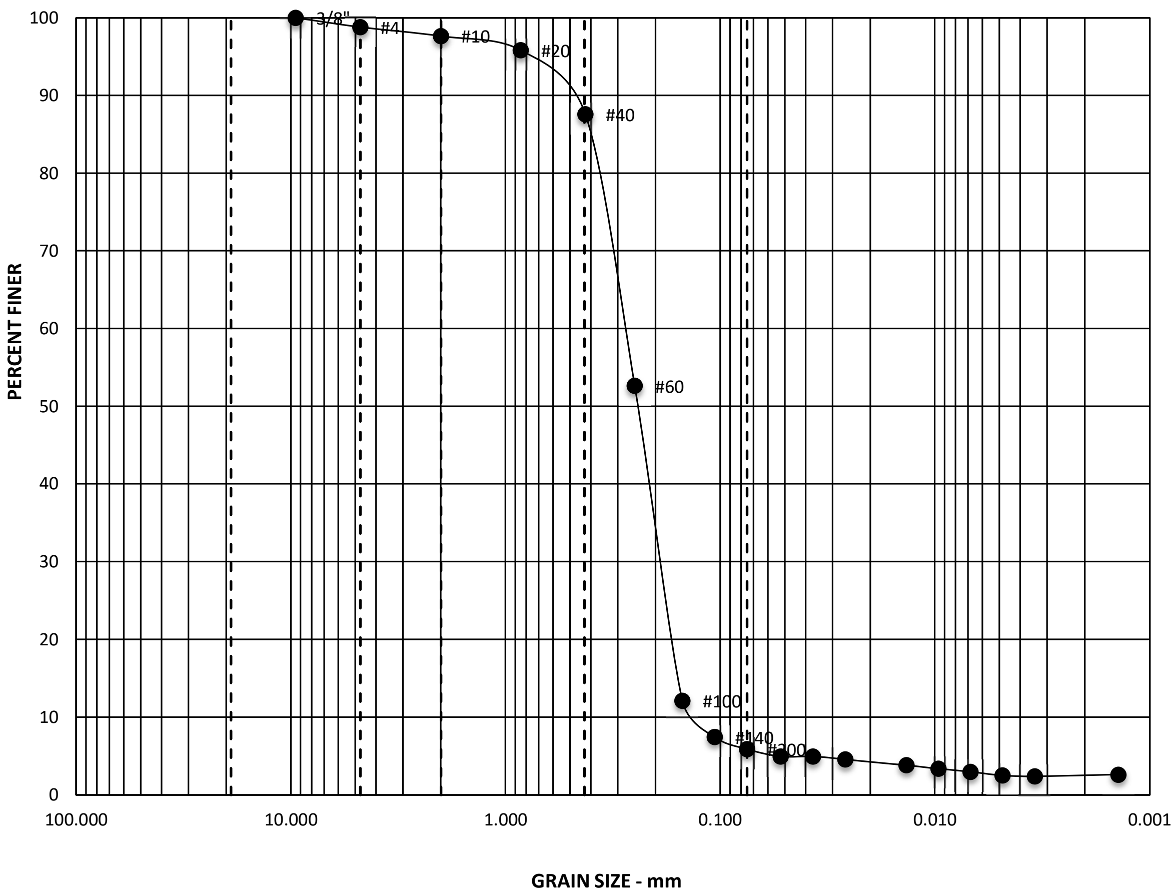
SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	USDA CLASSIFICATION *(BASED ON PARTICLE SIZE LESS THAN NO. 10 SIEVE)*	GRAIN SIZE DISTRIBUTION			PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC						COMPACTION DATA		
				GRAVEL %	SAND %	SILT/CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		MOISTURE CONTENT w %	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	VOID RATIO (e)	SPECIFIC GRAVITY (G) (*) ASSUMED	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED
TP-01	GS-2	1.5-4.5	SAND	2	93	3 / 2	NV	NP	NP	NV	14.8					2.7				
TP-02	GS-2	2.5-6.5	SANDY LOAM	21	61	11 / 7					16.3					2.7				
TP-03	GS-3	3.0-6.5	SANDY LOAM	7	58	20 / 15	22	16	6	1.1	22.7					2.6				
TP-04	GS-2	2.5-10	SANDY LOAM	3	52	28 / 17	29	17	12	0.5	23.0					2.6				
TP-05	GS-2	1.5-6	SANDY LOAM	8	72	12 / 8	NV	NP	NP	NV	17.3					2.7				
TP-06	GS-3	4.5-7.5	SANDY LOAM	8	53	23 / 16	31	18	13	0.4	23.2					2.6				
TP-07	GS-2	2.5-5.0	LOAM	8	48	26 / 18	35	19	16	0.3	23.2					2.6				
TP-08	GS-2	2.5-5.0	SANDY LOAM	18	48	21 / 13	34	20	14	0.2	23.3					2.6				
TP-09	GS-1	1.0-6.0	SANDY LOAM	7	66	16 / 11					17.2					2.6				
TP-10	GS-1	1.2-6.5	SANDY LOAM	9	55	22 / 14					14.3					2.6				
TP-11	GS-1	0.8-5.8	SANDY LOAM	9	54	22 / 15	27	16	11	0.4	19.7					2.6				
TP-12	GS-1	0.9-5.5	SANDY CLAY LOAM	11	48	23 / 18					24.0					2.6				
TP-13	GS-2	3.5-11.0	SANDY LOAM	19	56	12 / 13					17.2					2.6				
TP-14	GS-2	5.0-12.0	SANDY LOAM	17	54	17/ 12	29	17	12	0.1	18.1					2.6				
TP-15	GS-2	5.0-12.0	SANDY LOAM	8	54	24 / 14	34	19	15	0.2	22.6					2.6				
TP-16	GS-3	4.5-14.0	SILT LOAM	0	31	54 / 16	91	33	58	0.7	75.6					2.5				
TP-17	GS-2	6.5-18.0	SANDY LOAM	14	58	16 / 12	22	15	7	-0.4	12.1					2.6				
TP-18	GS-1	0.8-9.0	LOAMY SAND	73	23	3 / 1					4.5					2.7				
TP-19	GS-1	0.5-4.5	SAND	38	59	2 / 1					11.3					2.7				
TP-20	GS-1	0.5-3.0	SAND	57	41	1 / 1					11.7					2.7				
TP-21	GS-2	2.5-5.0	LOAMY SAND	12	77	5 / 6					12.5					2.7				
TP-22	GS-1	1.0-3.5	SAND	70	28	1 / 1					8.8					2.7				

PENNONI ASSOCIATES INC.	DRAWN BY: SJC	DATE: 7/29/2022	PROJECT: **NJ Wind Port - Parcel G**
	CHECKED BY: TAT	DATE: 7/29/2022	LOCATION: **Salem County, NJ**

Particle Size Distribution Report



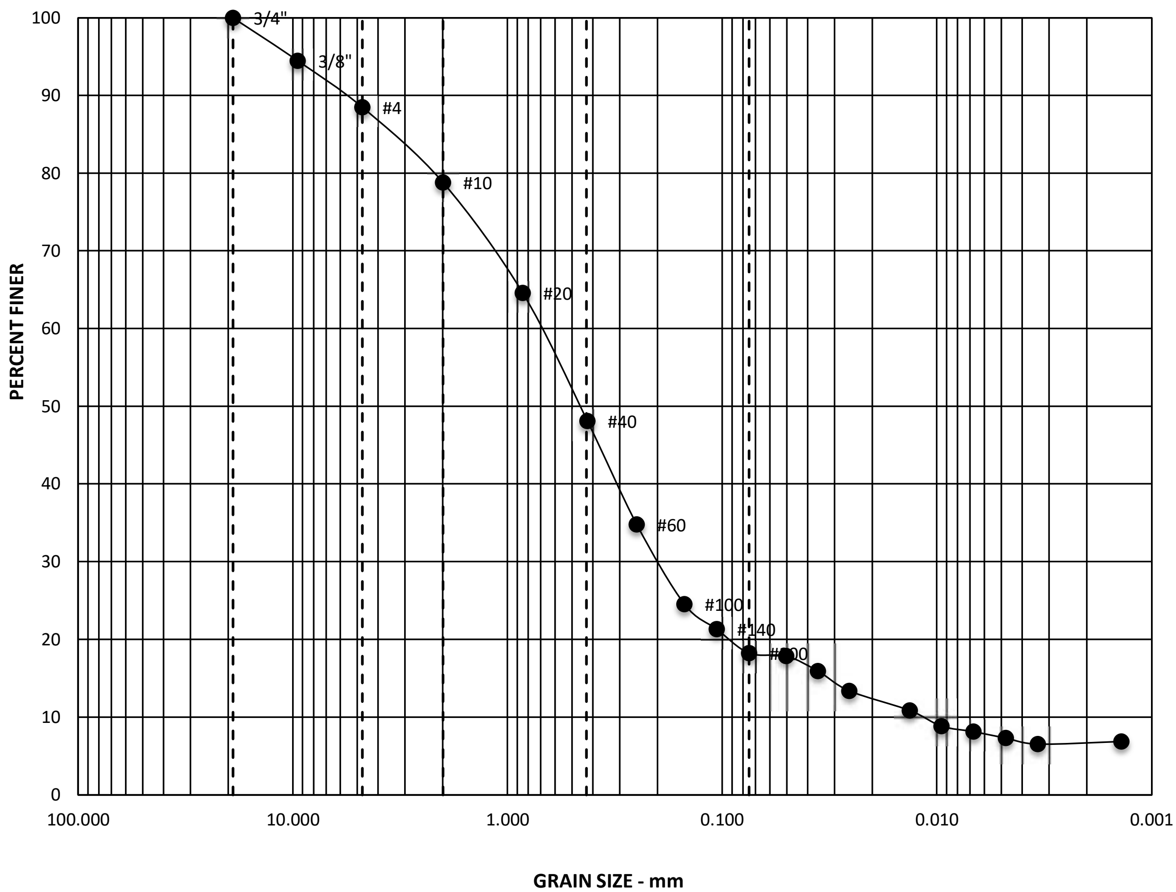
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
2.3	92.8	2.5	2.4	14.8

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
4.9	2.4	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-01
Sample:	GS-2
Depth (ft):	1.5-4.5
Lab No.	10-199487-1
Figure	S-1

Particle Size Distribution Report



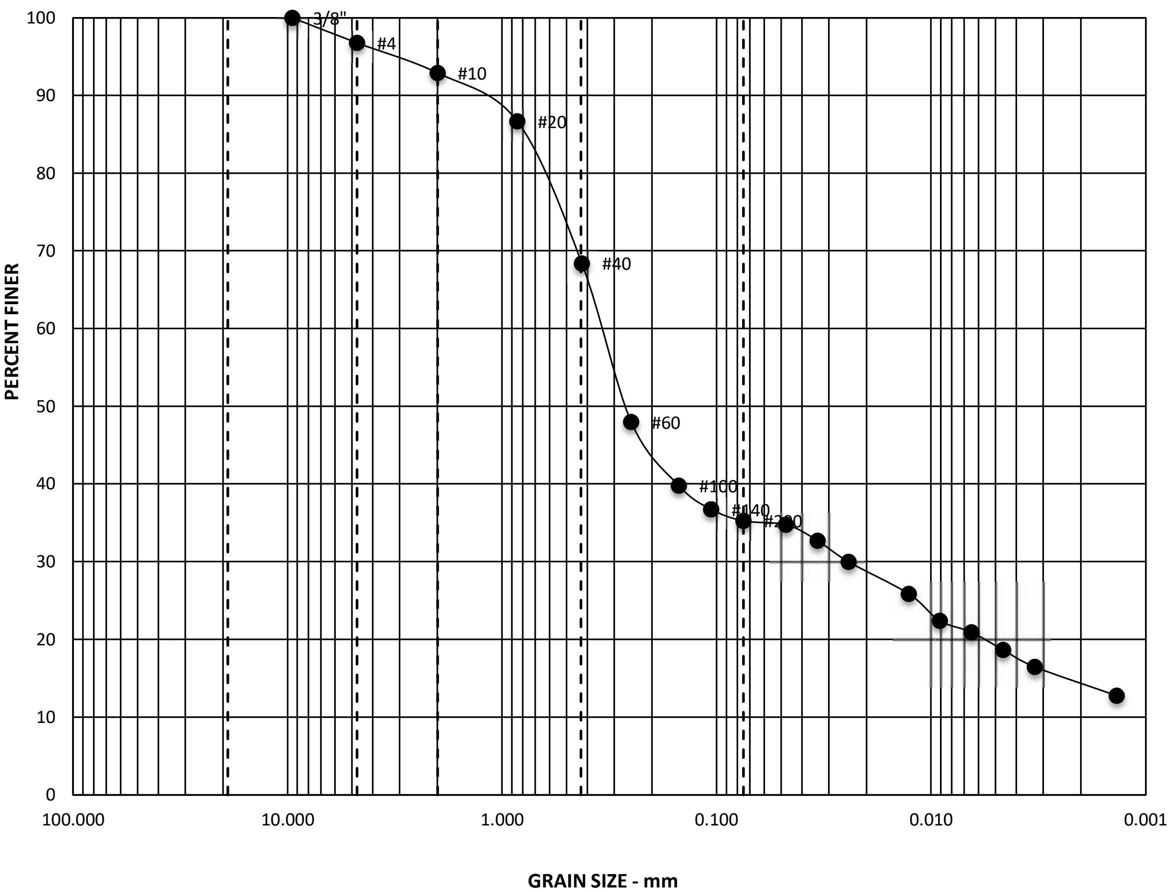
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
21.2	61.0	11.3	6.5	16.3

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
17.8	6.5	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-02
Sample:	GS-2
Depth (ft):	2.5-6.5
Lab No.	10-199487-2
Figure	S-2

Particle Size Distribution Report



USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
7.1	58.1	20.2	14.6	22.7

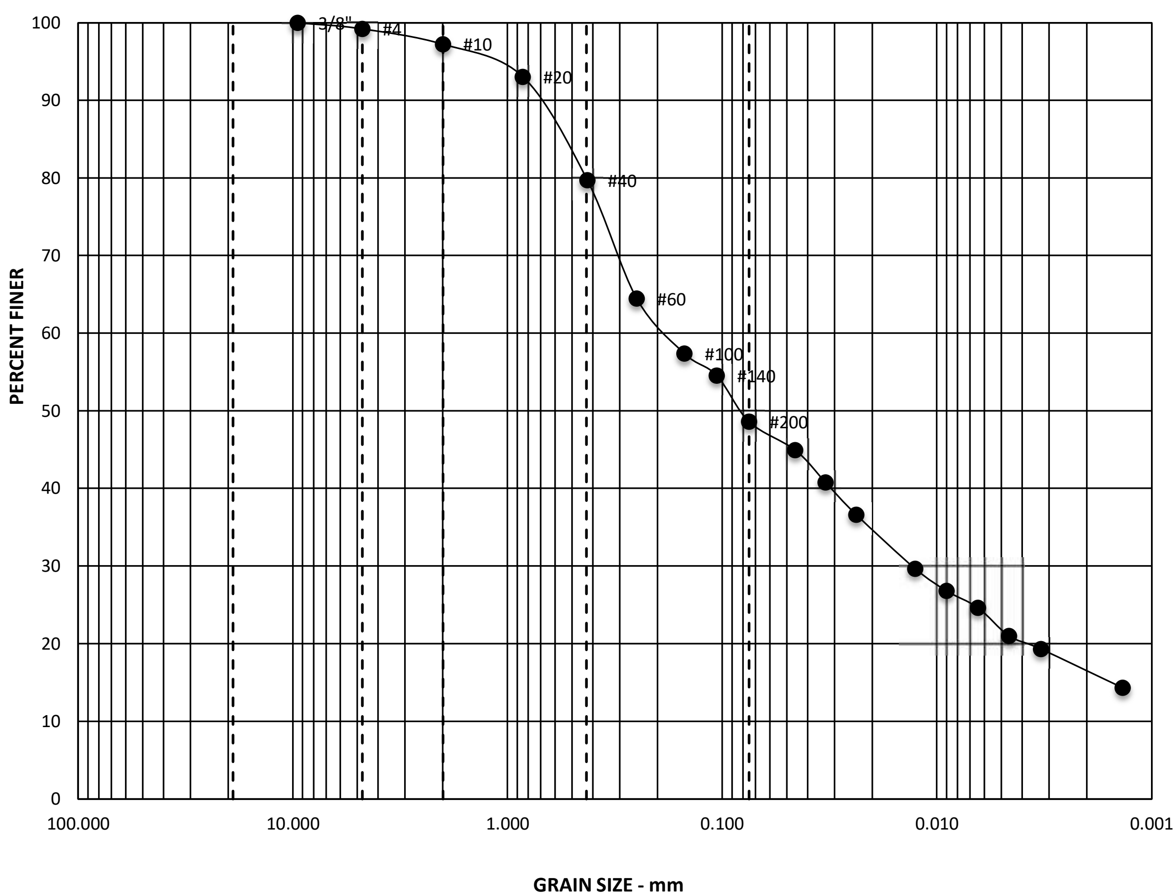
% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
34.8	14.6	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-03
Sample:	GS-3
Depth (ft):	3.0-6.5
Lab No.	10-199487-3

Figure S-3

Particle Size Distribution Report



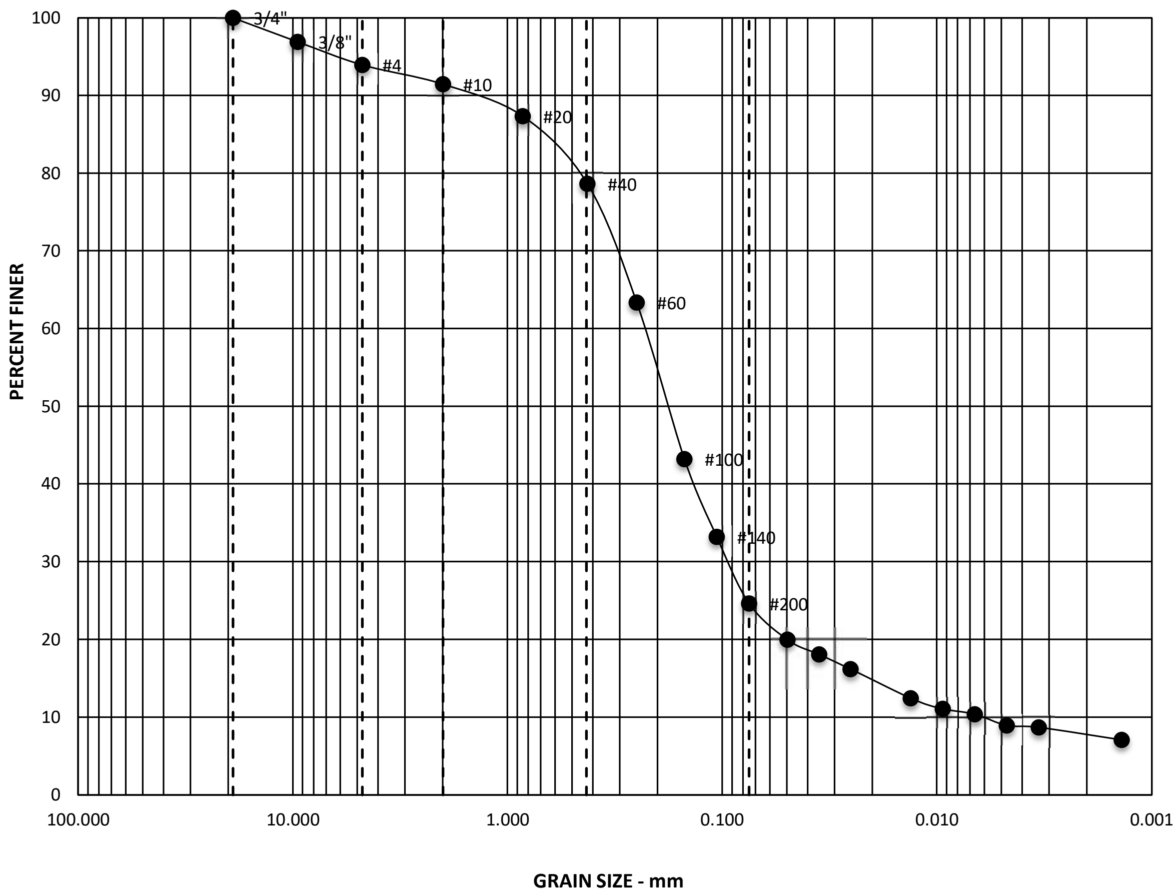
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
2.8	52.3	28.1	16.8	23.0

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
44.9	16.8	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-04
Sample:	GS-2
Depth (ft):	2.5-10.0
Lab No.	10-199487-4
Figure	S-4

Particle Size Distribution Report



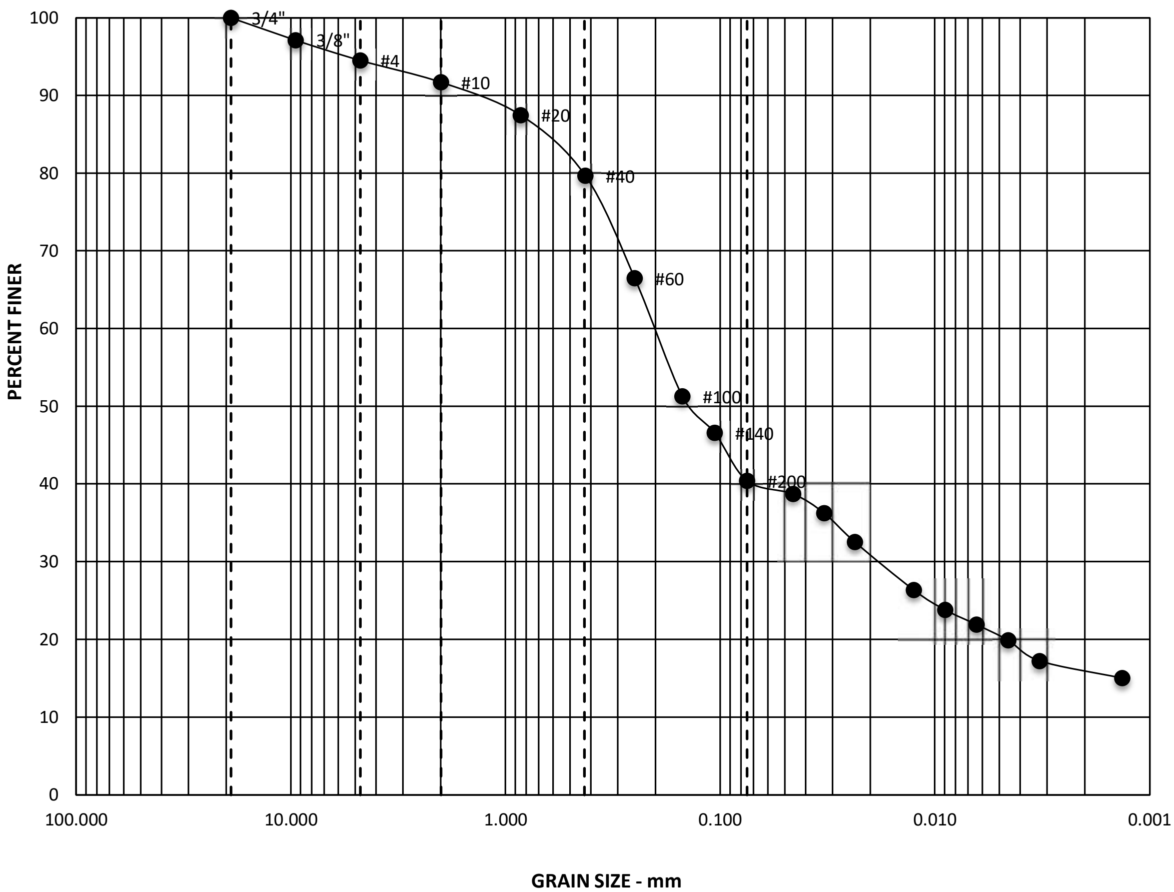
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
8.5	71.5	12.1	7.9	17.3

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
20.0	7.9	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-05
Sample:	GS-2
Depth (ft):	1.5-6.0
Lab No.	10-199487-5
Figure	S-5

Particle Size Distribution Report



USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
8.3	53.0	22.6	16.1	23.2

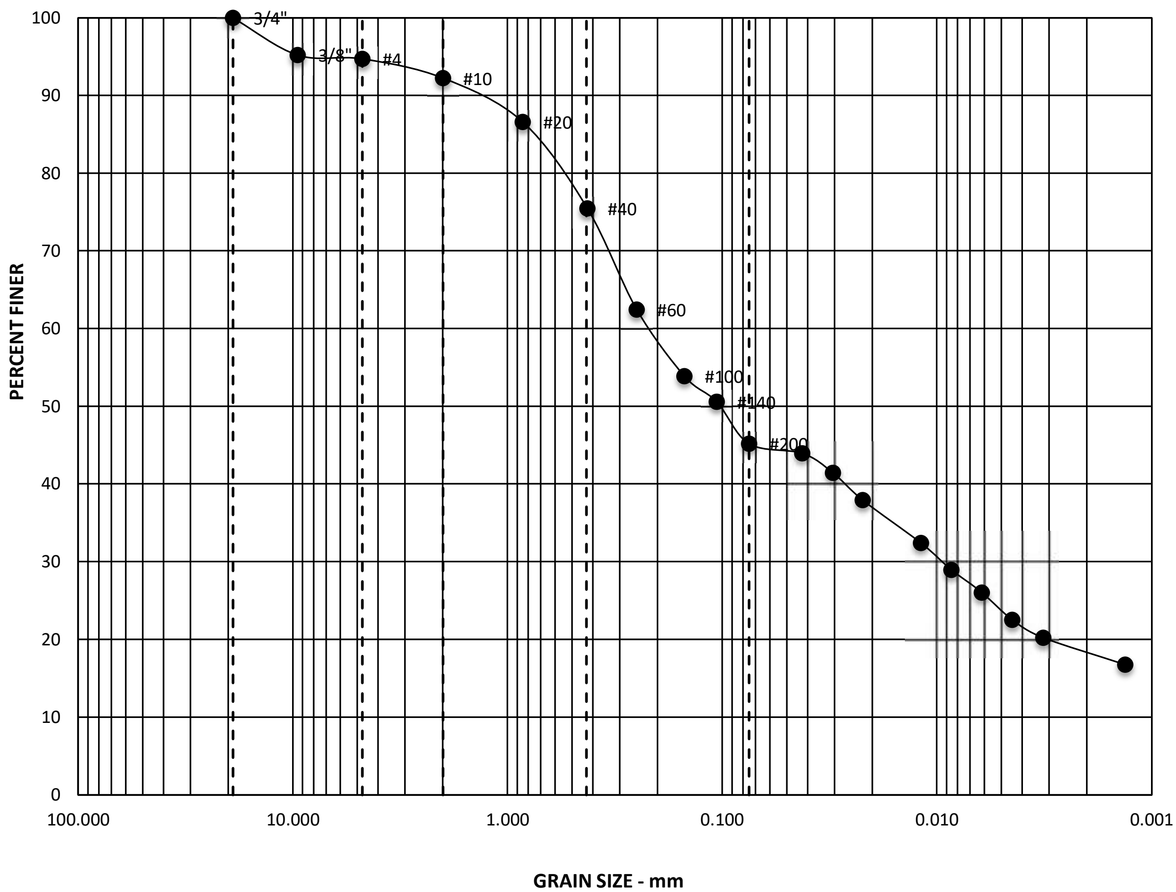
% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
38.7	16.1	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-06
Sample:	GS-3
Depth (ft):	4.5-7.5
Lab No.	10-199487-6

Figure S-6

Particle Size Distribution Report



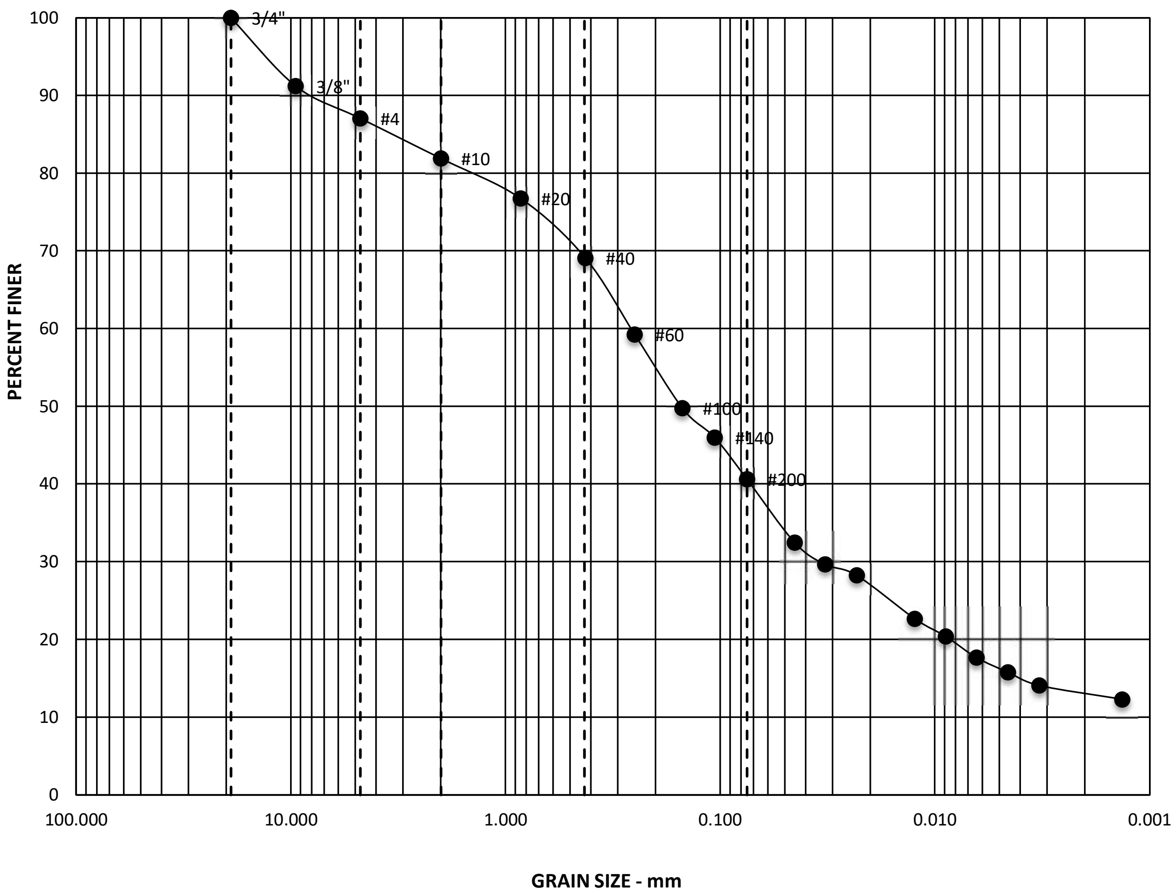
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
7.8	48.2	25.5	18.5	23.2

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
44.0	18.5	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-07
Sample:	GS-2
Depth (ft):	2.5-5.0
Lab No.	10-199487-7
Figure	S-7

Particle Size Distribution Report



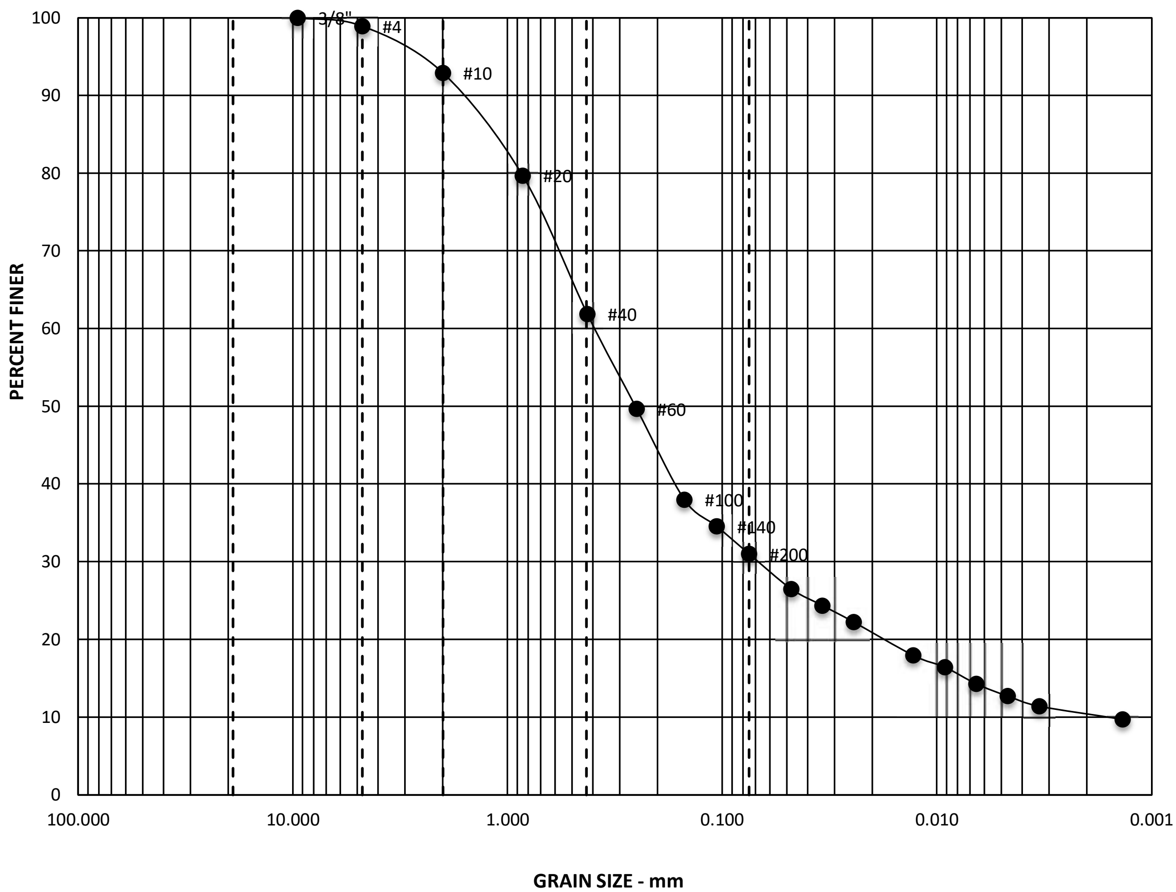
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
18.1	47.8	21.3	12.8	23.3

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
34.1	12.8	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-08
Sample:	GS-2
Depth (ft):	2.5-5.0
Lab No.	10-199487-8
Figure	S-8

Particle Size Distribution Report



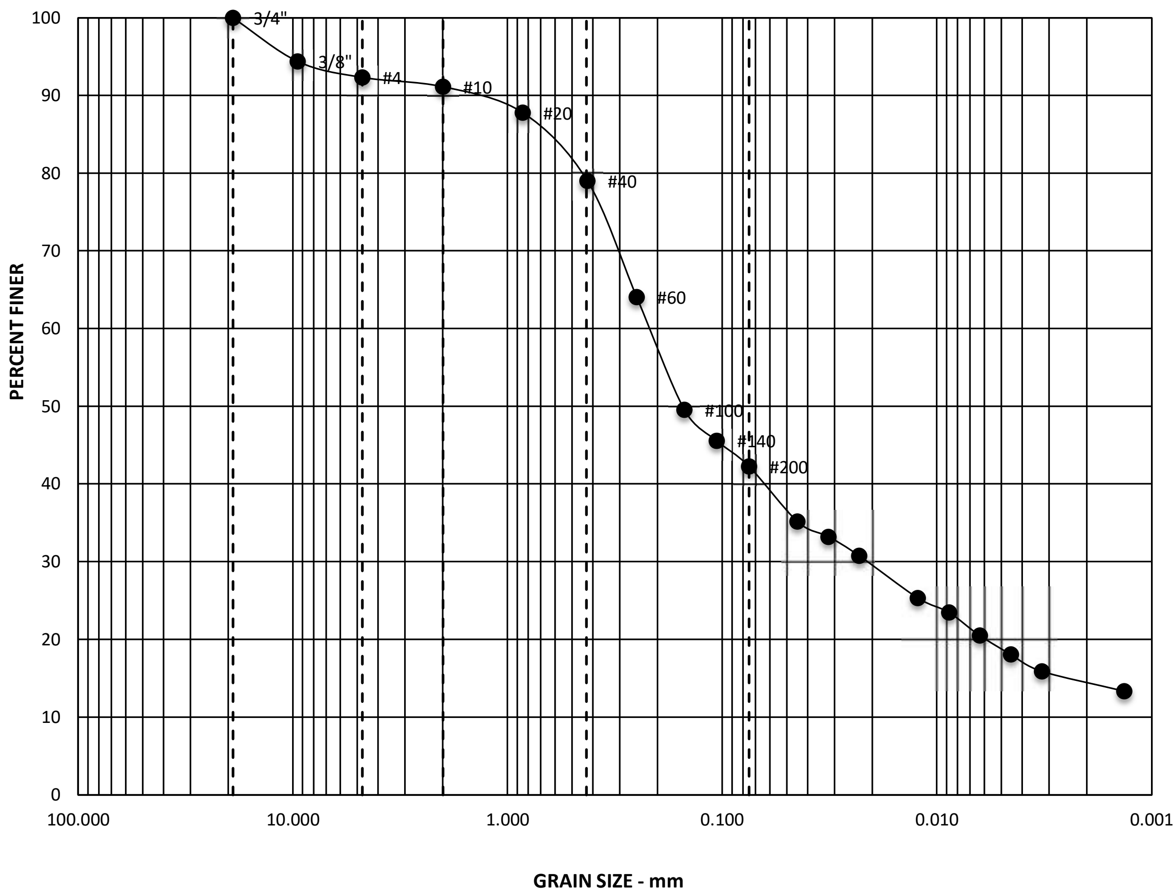
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
7.1	66.4	15.9	10.6	17.2

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
26.5	10.6	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-09
Sample:	GS-1
Depth (ft):	1-6
Lab No.	10-199487-9
	Figure S-9

Particle Size Distribution Report



USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
8.9	55.9	20.6	14.6	14.3

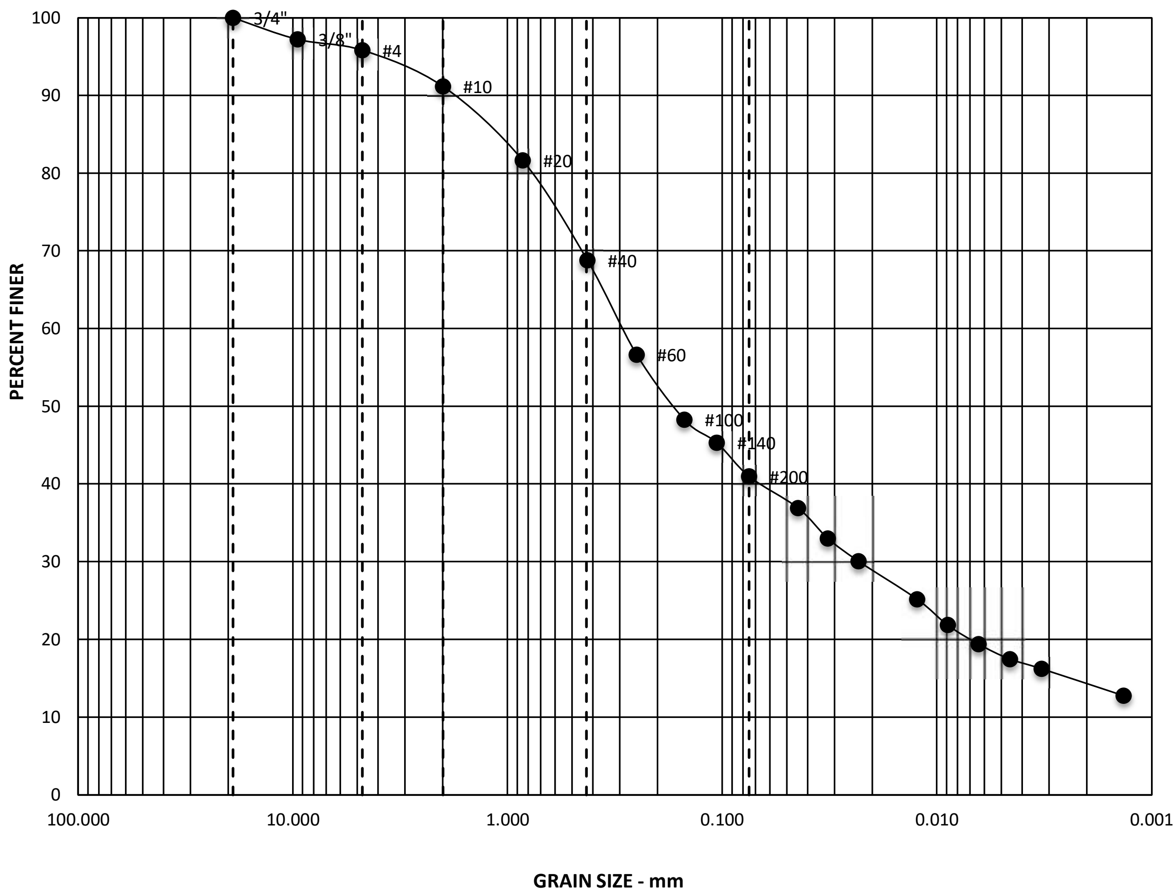
% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
35.2	14.6	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-10
Sample:	GS-1
Depth (ft):	1.2-6.5
Lab No.	10-199487-10

Figure S-10

Particle Size Distribution Report



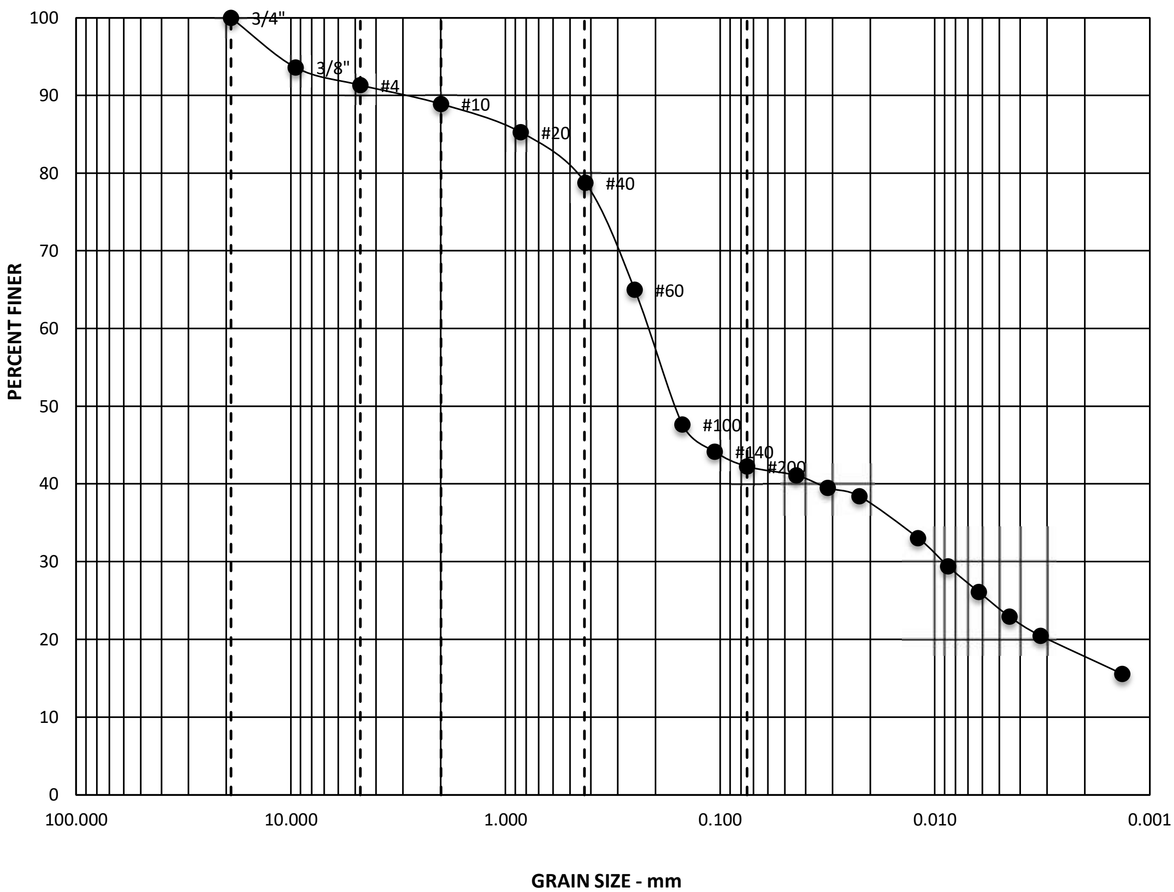
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
8.8	54.3	22.4	14.5	19.7

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
36.9	14.5	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-11
Sample:	GS-1
Depth (ft):	0.8-5.8
Lab No.	10-199487-11
	Figure S-11

Particle Size Distribution Report



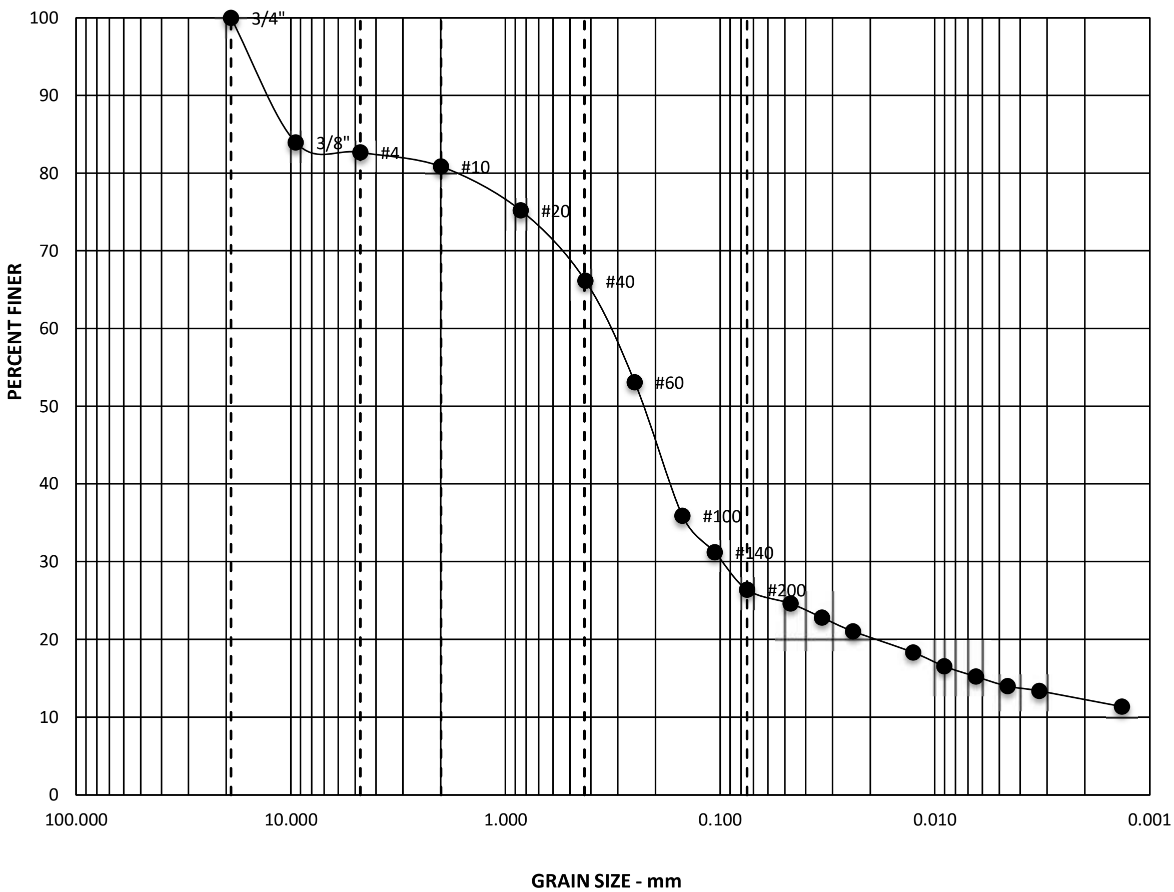
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
11.1	47.8	23.1	18.0	24.0

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
41.1	18.0	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-12
Sample:	GS-1
Depth (ft):	0.9-5.5
Lab No.	10-199487-12
Figure	S-12

Particle Size Distribution Report



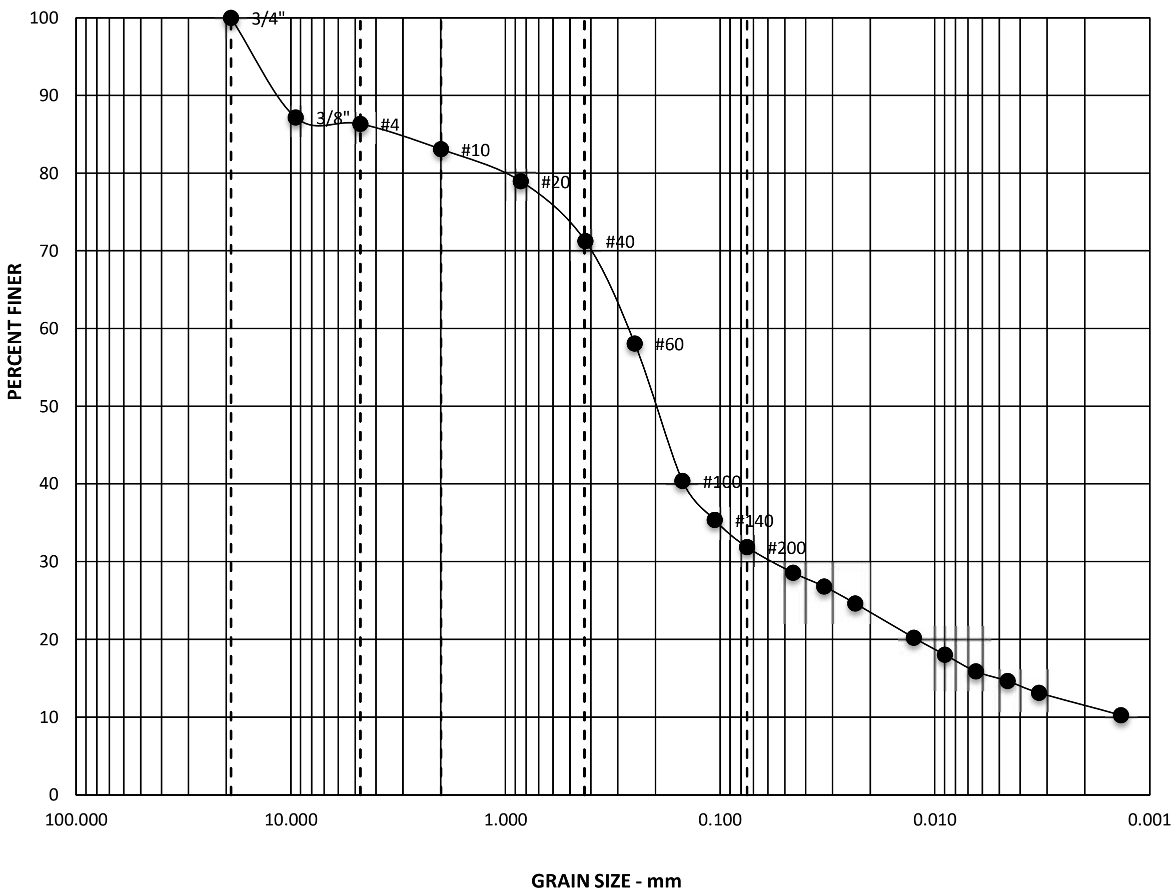
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
19.1	56.3	12.3	12.3	17.2

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
24.6	12.3	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-13
Sample:	GS-2
Depth (ft):	3.5-11
Lab No.	10-199487-13
Figure	S-13

Particle Size Distribution Report



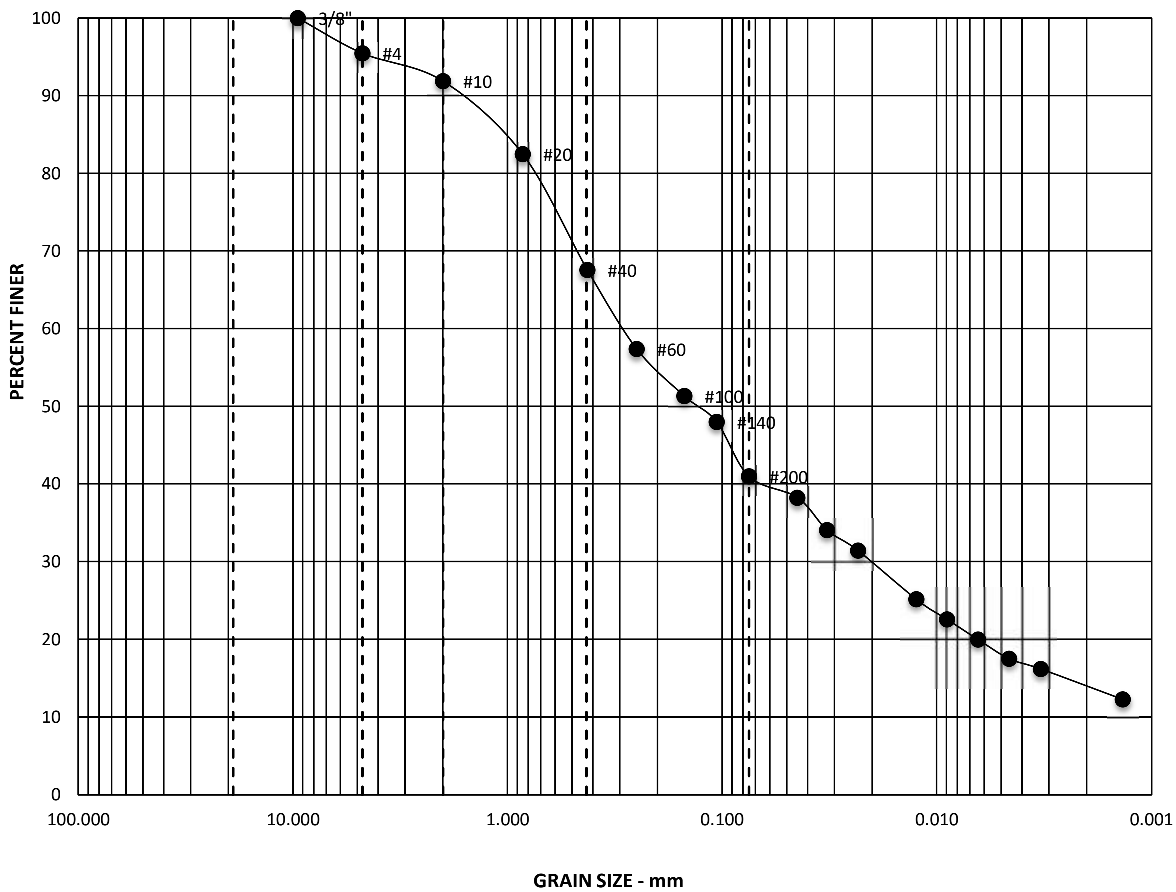
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
16.9	54.5	16.9	11.7	18.1

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
28.6	11.7	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-14
Sample:	GS-2
Depth (ft):	5-13
Lab No.	10-199487-14
Figure	S-14

Particle Size Distribution Report



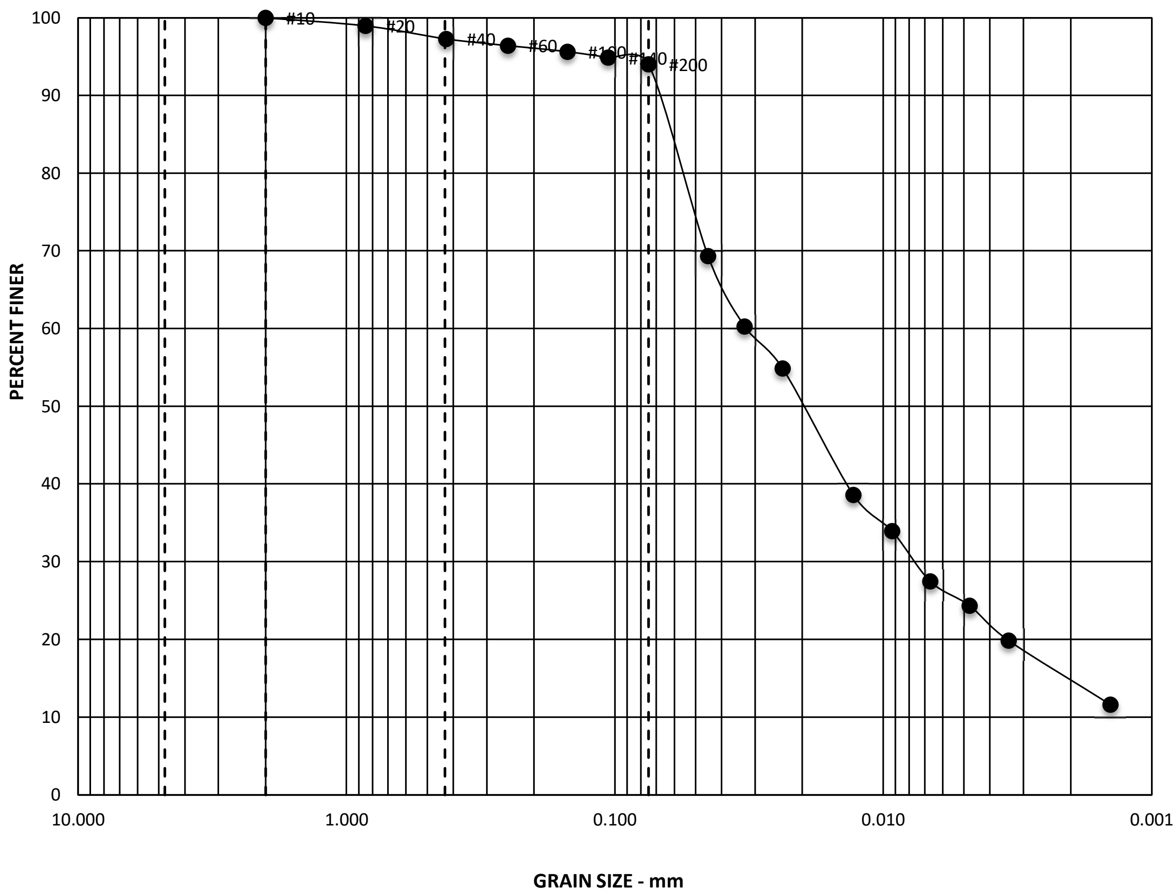
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
8.1	53.6	24.0	14.3	22.6

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
38.3	14.3	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-15
Sample:	GS-2
Depth (ft):	5-12
Lab No.	10-199487-15
	Figure S-15

Particle Size Distribution Report



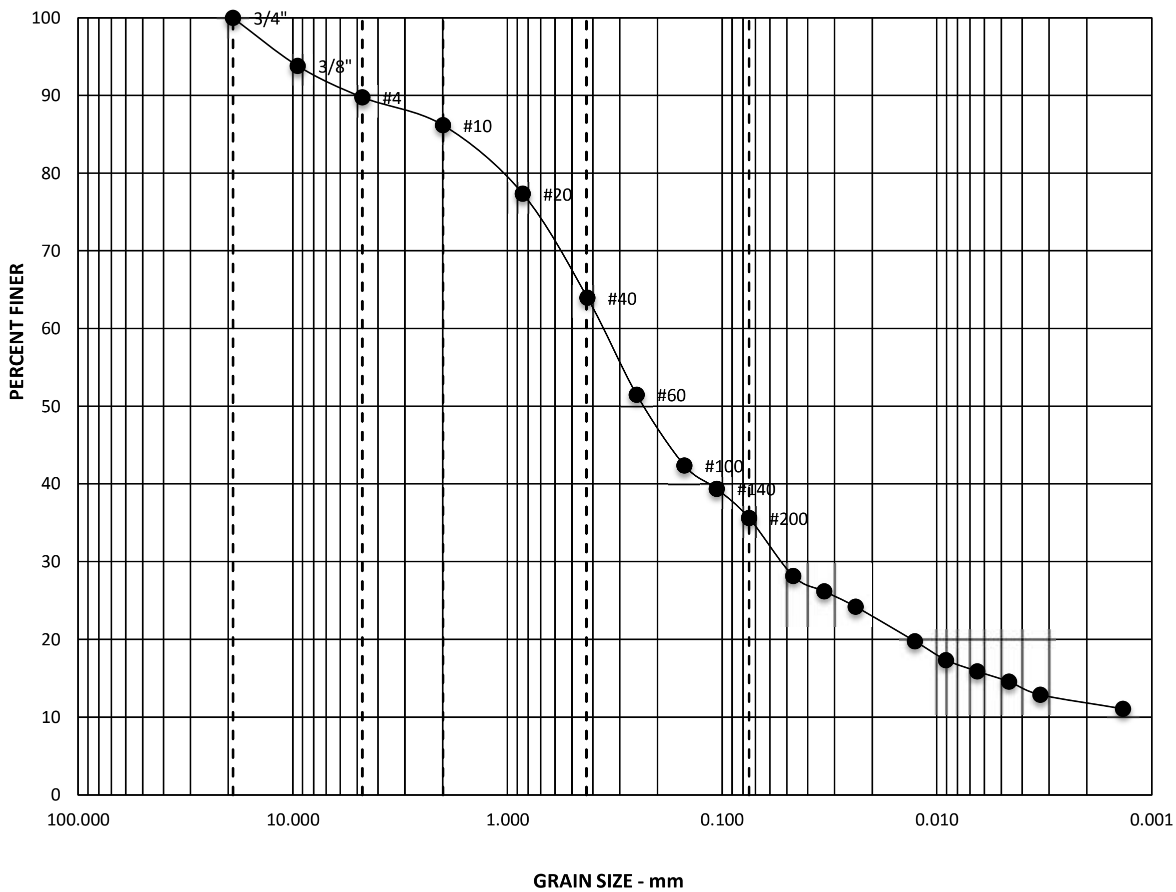
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
0	30.7	53.6	15.7	75.6

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
69.3	15.7	2.5

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-16
Sample:	GS-3
Depth (ft):	4.5-14
Lab No.	10-199487-16
Figure	S-16

Particle Size Distribution Report



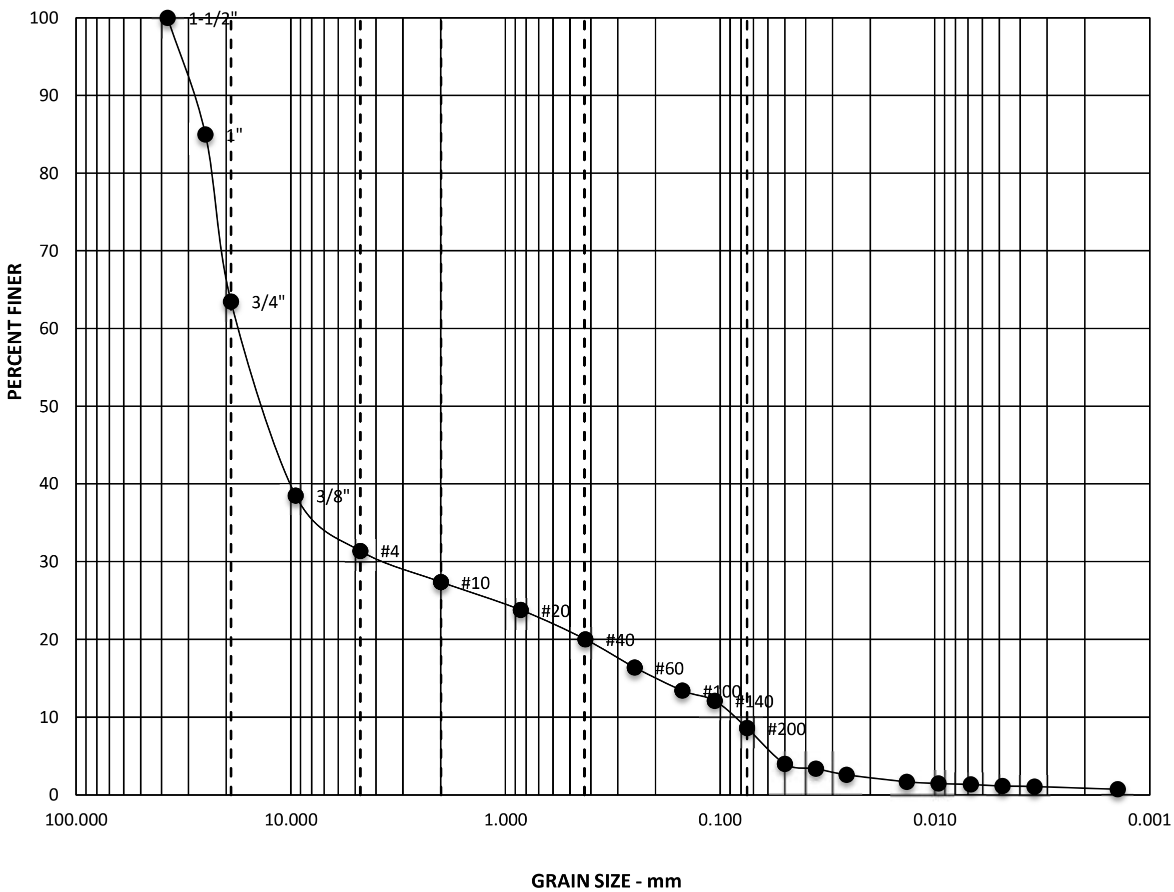
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
13.8	58.0	16.2	12.0	12.1

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
28.2	12.0	2.6

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-17
Sample:	GS-2
Depth (ft):	6.5-18
Lab No.	10-199487-17
	Figure S-17

Particle Size Distribution Report



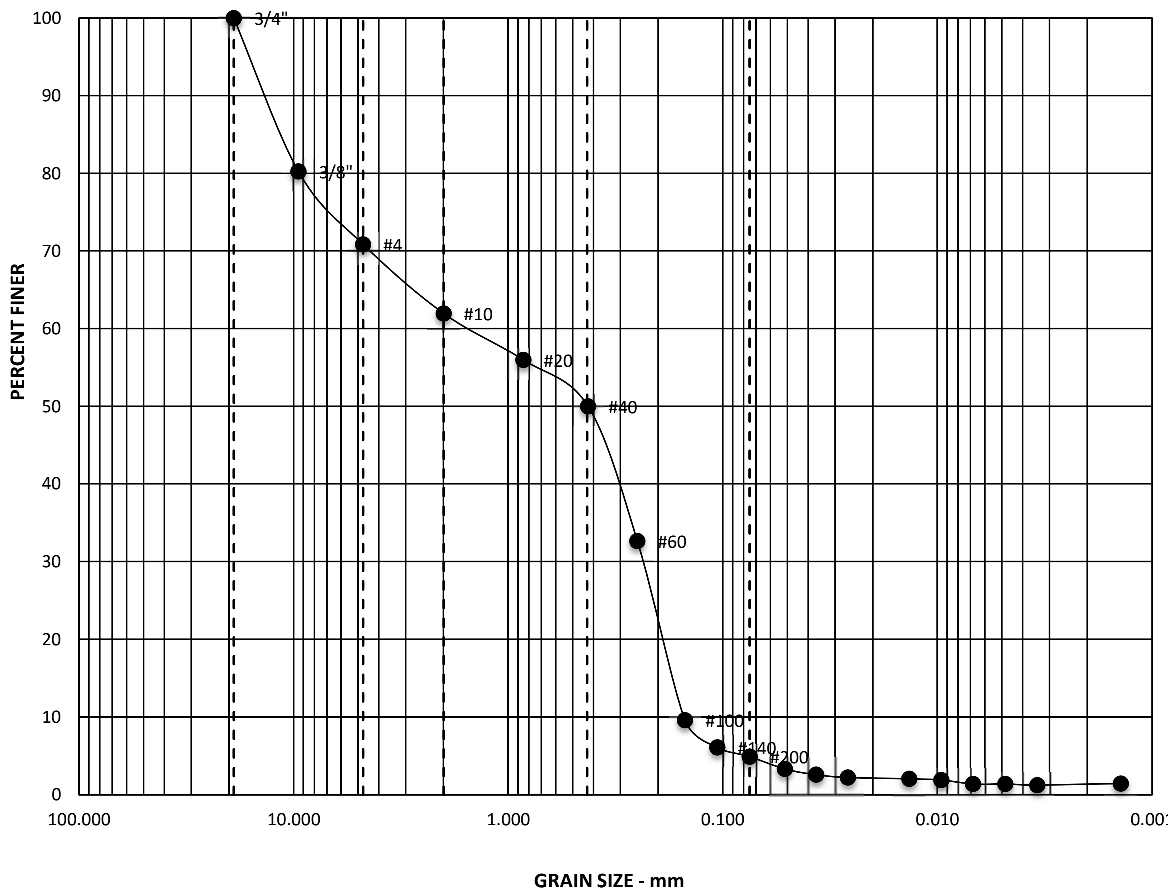
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
72.6	23.4	3.1	0.9	4.5

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
4.0	0.9	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-18
Sample:	GS-1
Depth (ft):	0.8-9.0
Lab No.	10-199487-18
Figure	S-18

Particle Size Distribution Report



USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
38.0	58.7	2.1	1.2	11.3

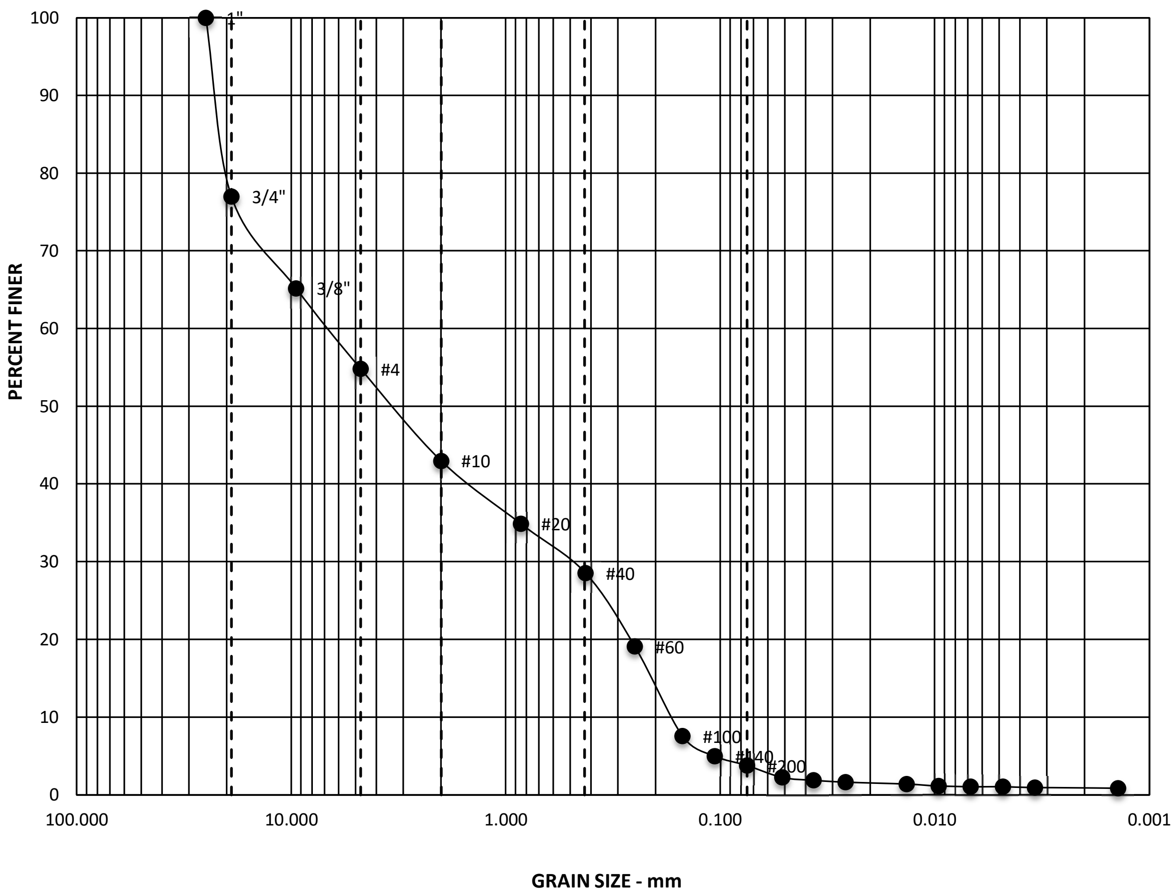
% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
3.3	1.2	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-19
Sample:	GS-1
Depth (ft):	0.5-4.5
Lab No.	10-199487-19

Figure S-19

Particle Size Distribution Report



USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
57.0	40.8	1.4	0.8	11.7

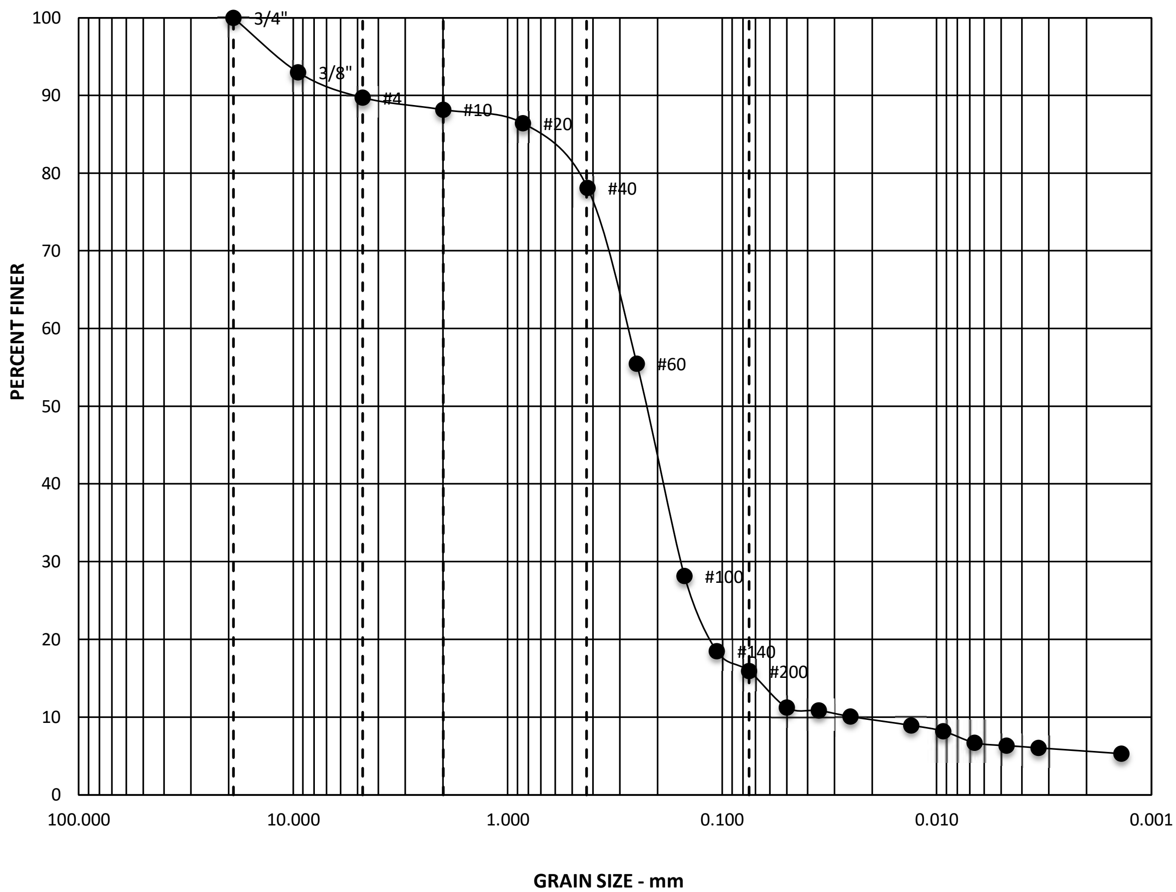
% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
2.2	0.8	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-20
Sample:	GS-1
Depth (ft):	0.5-3
Lab No.	10-199487-20

Figure S-20

Particle Size Distribution Report



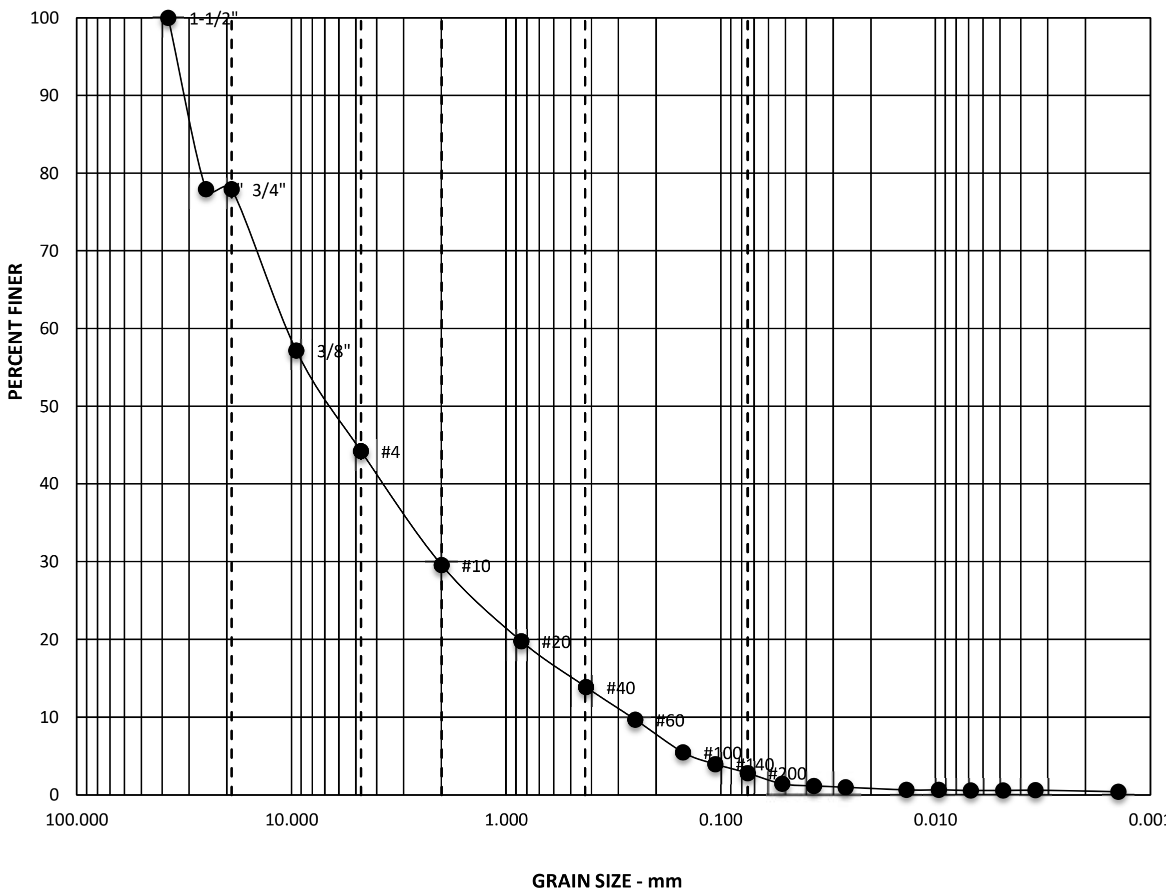
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
11.8	77.0	5.5	5.7	12.5

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
11.2	5.7	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-21
Sample:	GS-2
Depth (ft):	2.5-5
Lab No.	10-199487-21
Figure	S-21

Particle Size Distribution Report



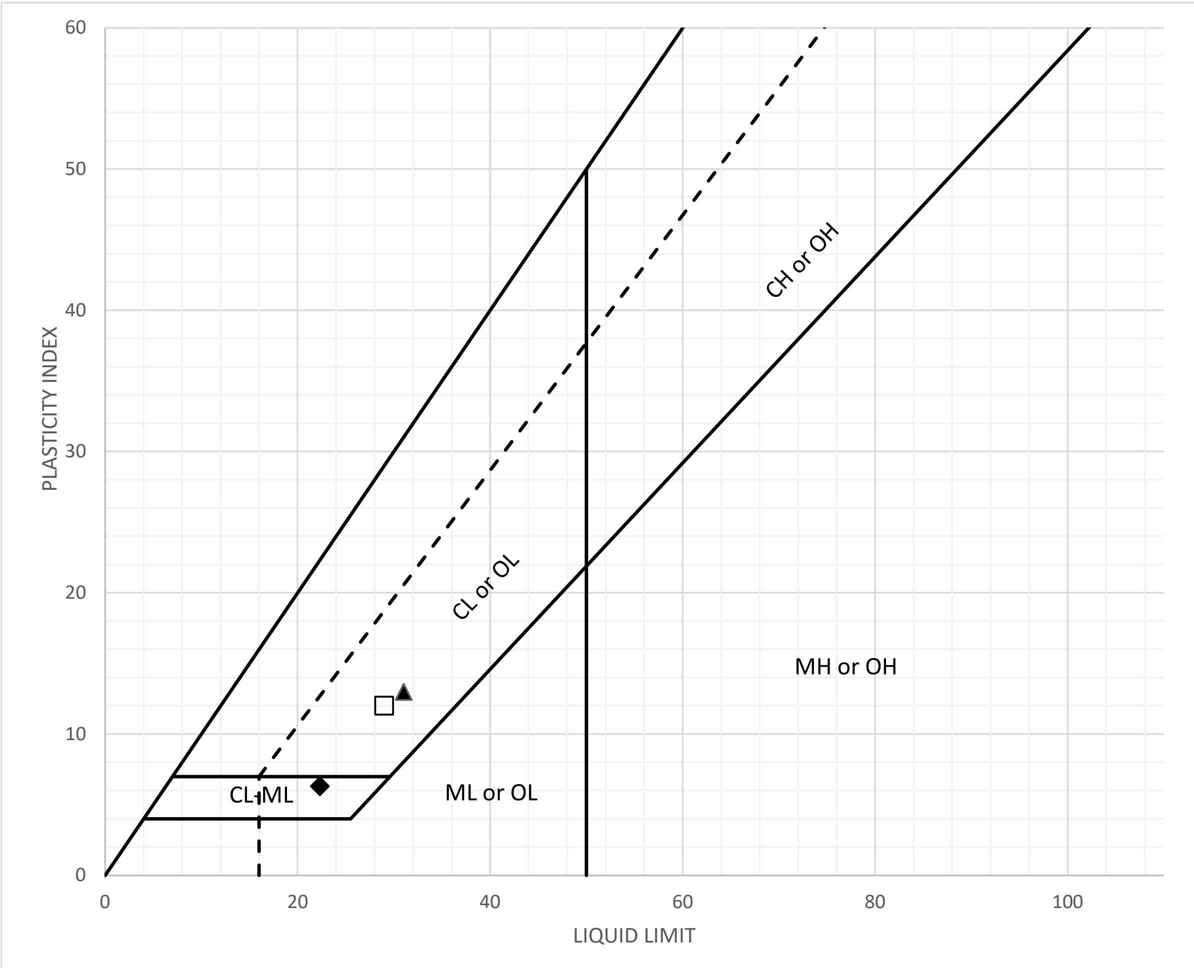
USDA Grain Size Distribution				
% Gravel	% Sand	% Fines		Moisture (%)
		Silt	Clay	
70.4	28.2	0.9	0.5	8.8

% Finer Than:		
0.05 mm	0.002 mm	Specific Gravity
1.4	0.5	2.7

PENNONI ASSOCIATES INC.

Client:	Moffatt & Nichol
Project:	NJ Wind Port - Parcel G Geotech
Location:	Salem, NJ
Source:	TP-22
Sample:	GS-1
Depth (ft):	1.0-3.5
Lab No.	10-199487-22
Figure	S-22

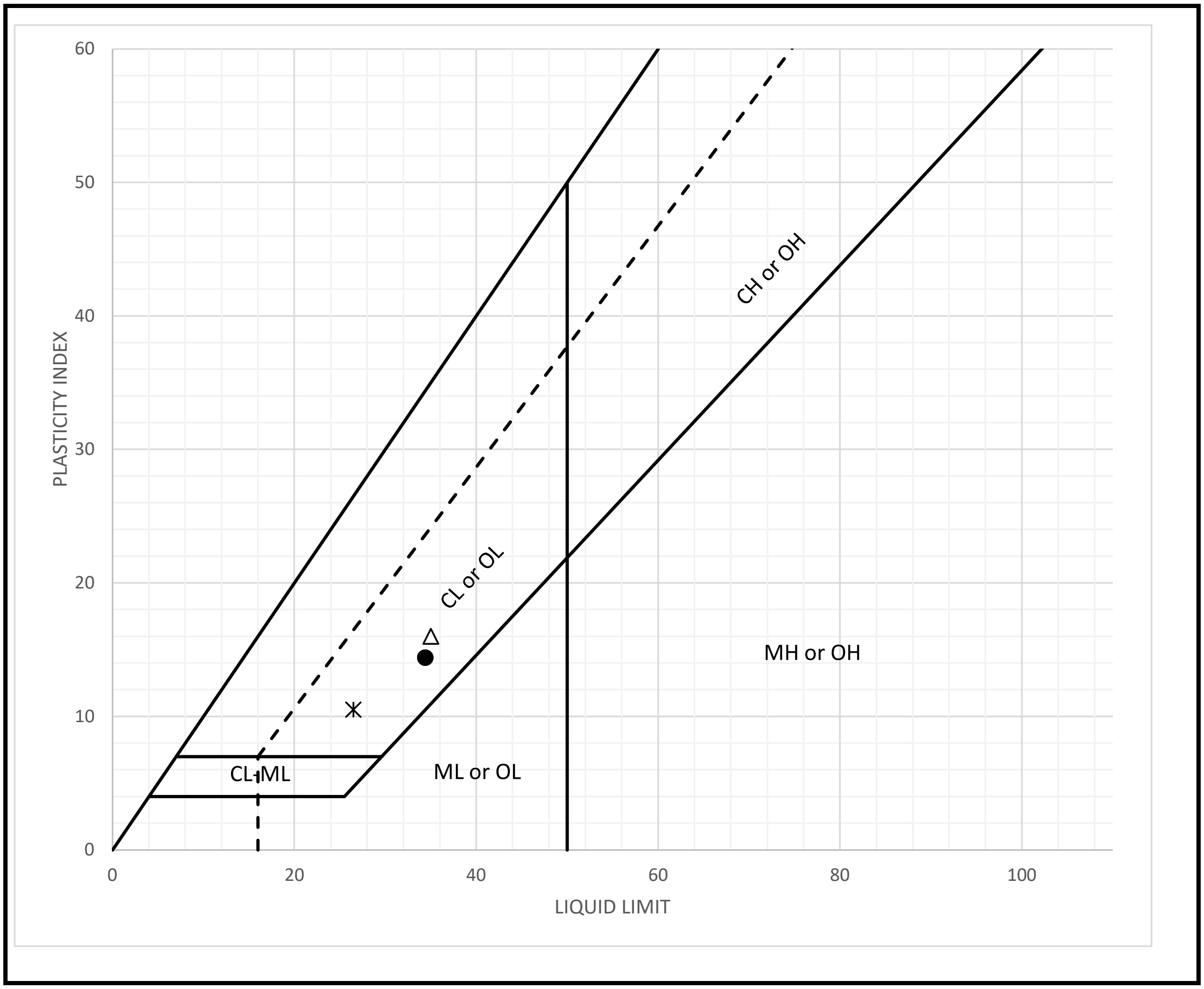
ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils



Symbol	Source	Sample No.	Depth	Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index	USCS (fines only)
△	TP-01	GS-2	1.5-4.5	14.8	NP	NV	NP	ML
●	TP-02	GS-2	2.5-6.5	16.3				
◆	TP-03	GS-3	3.0-6.5	22.7	16	22	6	CL-ML
□	TP-04	GS-2	2.5-10.0	23.0	17	29	12	CL
✻	TP-05	GS-2	1.5-6.0	17.3	NP	NV	NP	ML
▲	TP-06	GS-3	4.5-7.5	23.2	18	31	13	CL

PENNONI ASSOCIATES INC. **Bethlehem, PA**	**Project No.:** MOFNI 22003 **Client:** Moffatt & Nichol **Project:** NJ Wind Port - Parcel G Geotech Infiltration Testing **Notes:** Plastic Limit Procedure 1 Manual liquid limit device and plastic grooving tool **Figure** A-1

ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

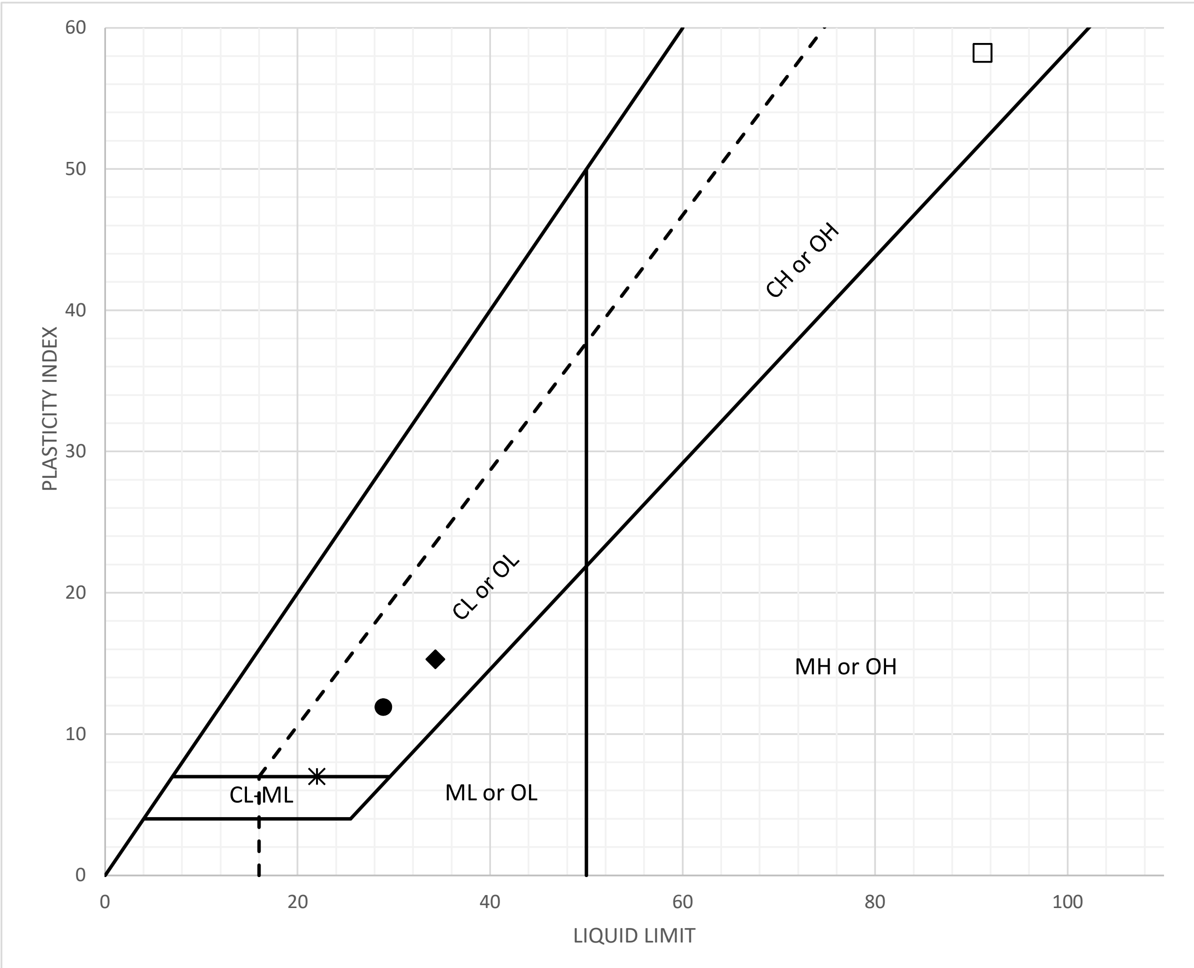


Symbol	Source	Sample No.	Depth	Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index	USCS (fines only)
△	TP-07	GS-2	2.5-5.0	23.2	19	35	16	CL
●	TP-08	GS-2	2.5-5.0	23.3	20	34	14	CL
◆	TP-09	GS-1	1-6	17.2				
□	TP-10	GS-1	1.2-6.5	14.3				
*	TP-11	GS-1	0.8-5.8	19.7	16	27	11	CL
▲	TP-12	GS-1	0.9-5.5	24.0				

PENNONI ASSOCIATES INC. **Bethlehem, PA**	**Project No.:** MOFNI 22003 **Client:** Moffatt & Nichol **Project:** NJ Wind Port - Parcel G Geotech Infiltration Testing **Notes:** Plastic Limit Procedure 1 Manual liquid limit device and plastic grooving tool **Figure** A-2

AASHTO R18

ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils



Symbol	Source	Sample No.	Depth	Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index	USCS (fines only)
△	TP-13	GS-2	3.5-11	17.2				
●	TP-14	GS-2	5-13	18.1	17	29	12	CL
◆	TP-15	GS-2	5-12	22.6	19	34	15	CL
□	TP-16	GS-3	4.5-14	0.0	33	91	58	CH
*	TP-17	GS-2	6.5-18	12.1	15	22	7	CL-ML
▲	TP-18	GS-1	0.8-9.0	4.5				

PENNONI ASSOCIATES INC.
Bethlehem, PA

Project No.: MOFNI 22003 **Client:** Moffatt & Nichol
Project: NJ Wind Port - Parcel G Geotech Infiltration Testing
Notes: Plastic Limit Procedure 1
Manual liquid limit device and plastic grooving tool

Figure A-3

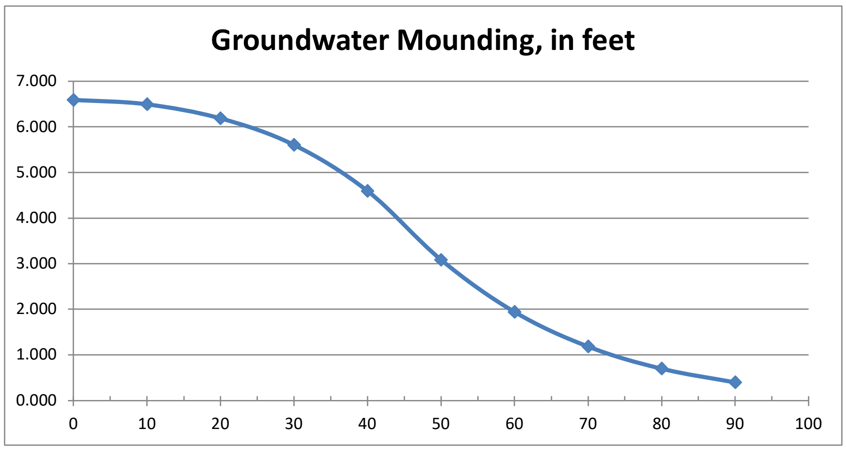
Appendix I – Groundwater Table Impacts- Hantush Workbook

Input Values		
2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
44.500	x	1/2 length of basin (x direction, in feet)
16.500	y	1/2 width of basin (y direction, in feet)
11.22	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.588	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.588	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.588	0
6.492	10
6.184	20
5.600	30
4.591	40
3.084	50
1.940	60
1.182	70
0.698	80
0.399	90

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

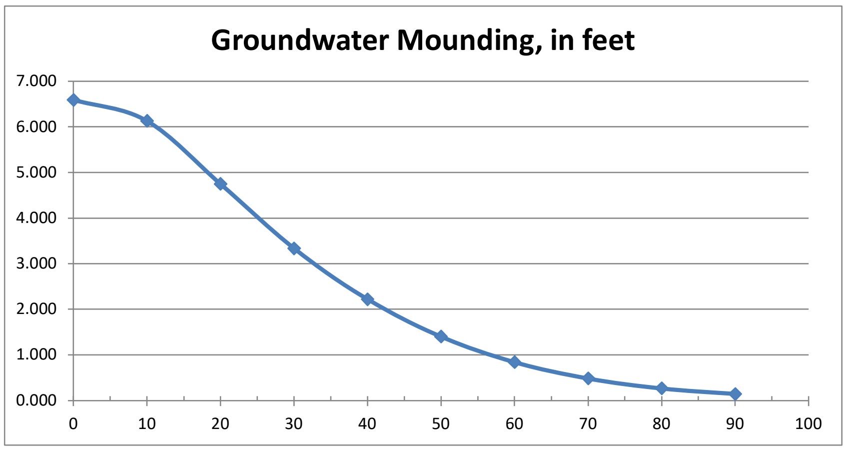
Input Values

2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
16.500	x	1/2 length of basin (x direction, in feet)
44.500	y	1/2 width of basin (y direction, in feet)
11.22	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.588	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.588	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.588	0
6.129	10
4.746	20
3.333	30
2.217	40
1.398	50
0.839	60
0.481	70
0.265	80
0.141	90

Re-Calculate Now



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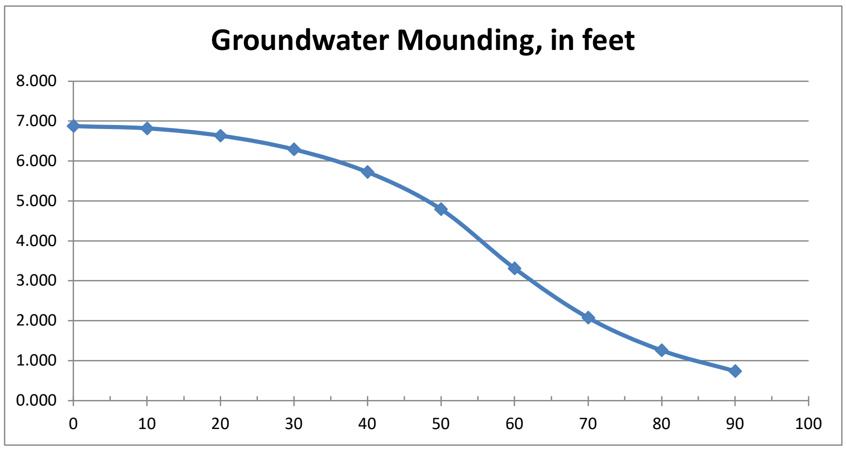
Input Values

2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
56.500	x	1/2 length of basin (x direction, in feet)
16.500	y	1/2 width of basin (y direction, in feet)
10.81	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.874	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.874	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.874	0
6.816	10
6.632	20
6.291	30
5.723	40
4.791	50
3.309	60
2.072	70
1.256	80
0.737	90

Re-Calculate Now



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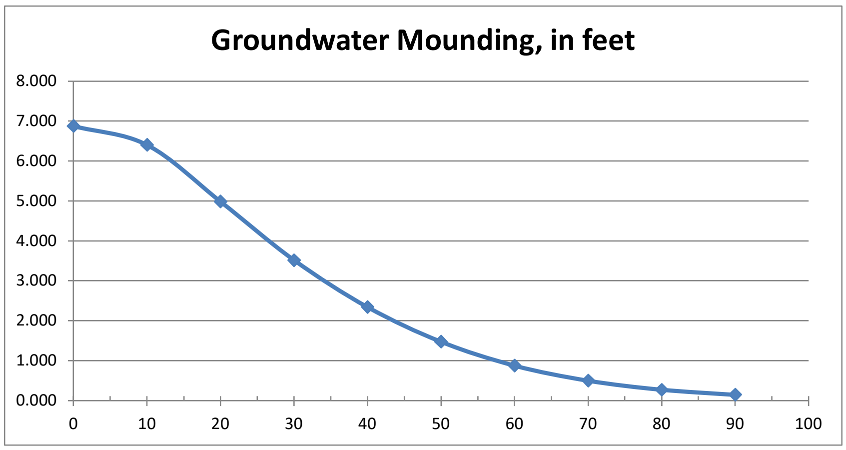
Input Values

2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
16.500	x	1/2 length of basin (x direction, in feet)
56.500	y	1/2 width of basin (y direction, in feet)
10.81	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.874	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.874	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.874	0
6.402	10
4.982	20
3.514	30
2.339	40
1.469	50
0.874	60
0.496	70
0.270	80
0.141	90

Re-Calculate Now



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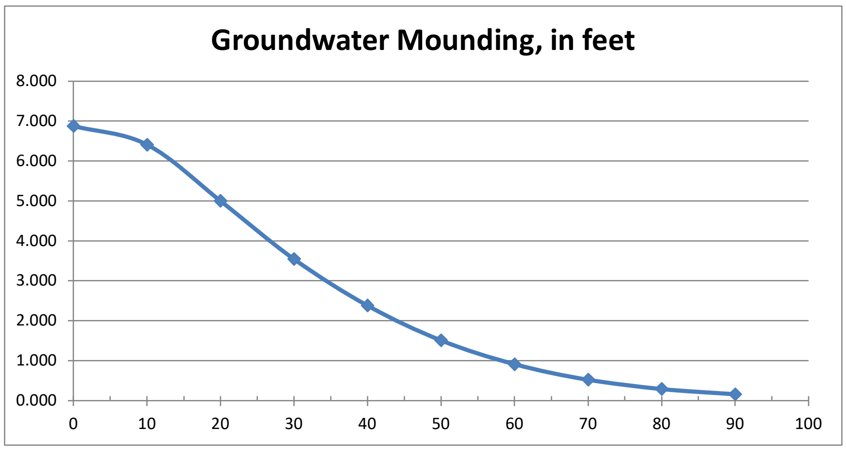
Input Values

2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
16.500	x	1/2 length of basin (x direction, in feet)
52.500	y	1/2 width of basin (y direction, in feet)
11.21	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.875	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.875	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.875	0
6.407	10
4.999	20
3.543	30
2.375	40
1.507	50
0.907	60
0.521	70
0.288	80
0.153	90

Re-Calculate Now



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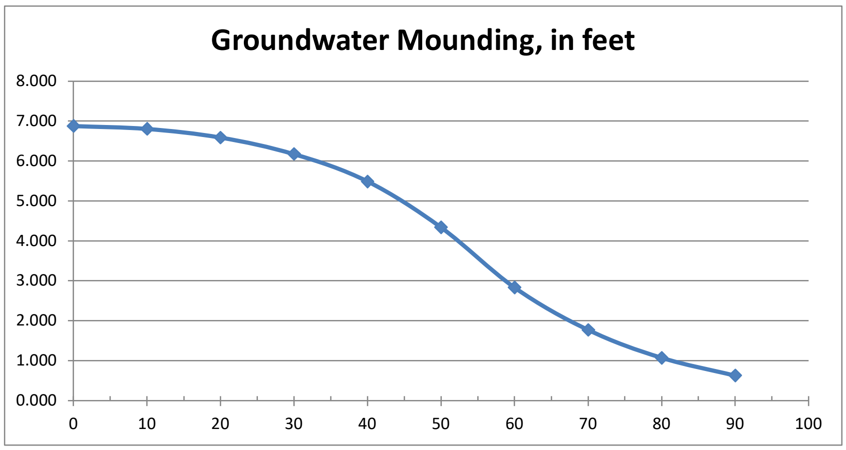
Input Values

2.75	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
13.75	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
52.500	x	1/2 length of basin (x direction, in feet)
16.500	y	1/2 width of basin (y direction, in feet)
11.21	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

16.875	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
6.875	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
6.875	0
6.806	10
6.585	20
6.173	30
5.485	40
4.337	50
2.827	60
1.765	70
1.067	80
0.625	90

Re-Calculate Now



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