APPENDIX B: July 2022 SWPPP

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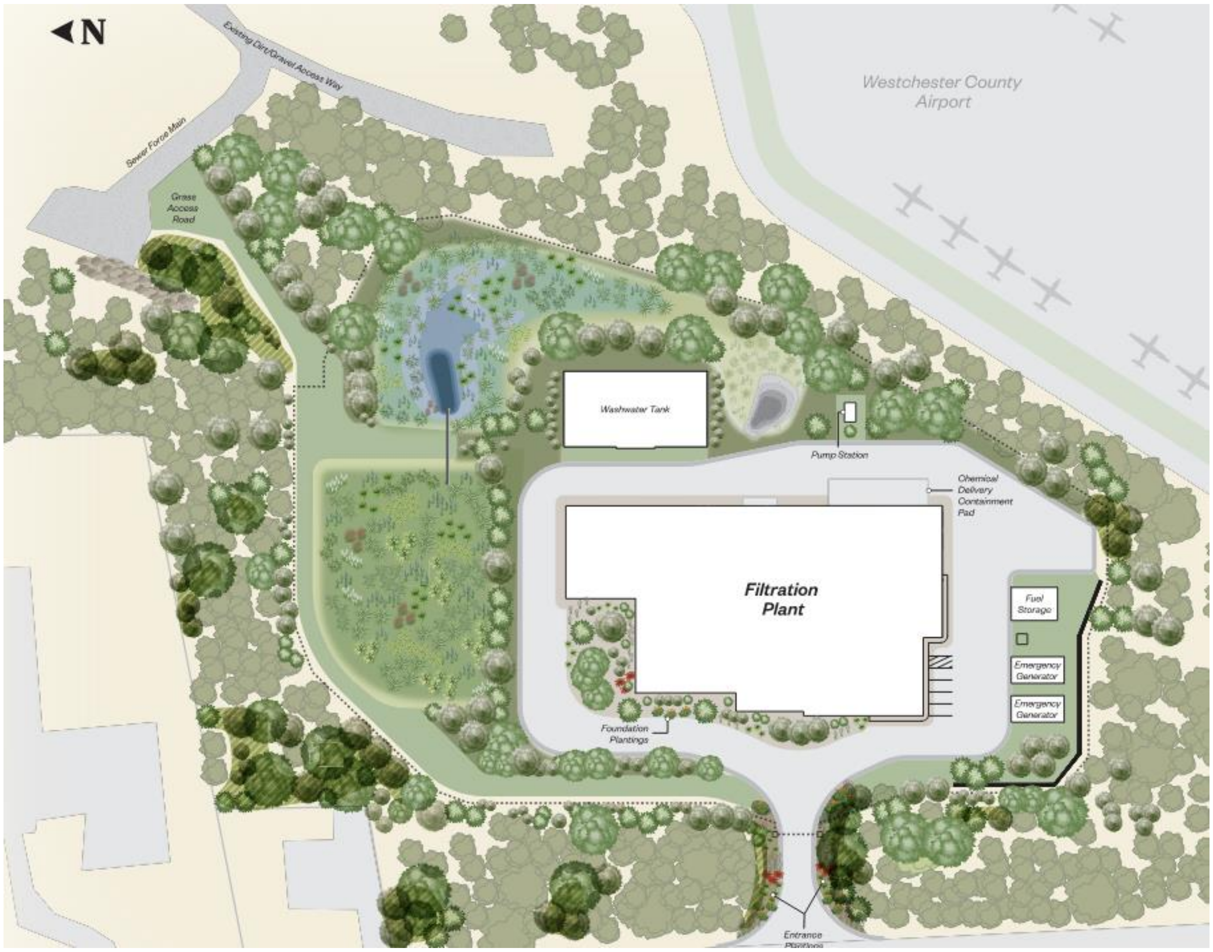

WESTCHESTER JOINT WATER WORKS

Westchester Joint Water Works

Rye Lake Water Filtration Plant

Stormwater Pollution Prevention Plan
July 2022

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1. Introduction

1.1 Stormwater Management Objectives

Based on guidance provided by New York State Department of Environmental Conservation (NYSDEC) and, the primary objectives of this Stormwater Pollution Prevention Plan (SWPPP) include the following key features:

- Background information about the scope of the project;
- Erosion and Sediment Control Plan during construction;
- Stormwater management during facility operation;
- Comparison of post-development stormwater runoff conditions with pre-development conditions;
- Description of temporary and/or permanent stormwater best management practices to ensure that the quality of stormwater runoff during and post-development is not substantially altered from pre-development conditions; and
- Identification of the type and frequency of maintenance required by the stormwater management and erosion control facilities employed by qualified professional and as directed by Engineer.

This SWPPP has been prepared in accordance with the requirements stipulated in the NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity Permit Number GP-0-20-001, the *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources (Watershed Regulations)*, and the MS4. The SWPPP has also been developed in conformance with the New York State technical standards referenced in the General Permit for Construction Activities, including *New York State Standards and Specifications for Erosion and Sediment Control (NYS SS&SESC), November 2016 or latest edition,* and *New York State Stormwater Management Design Manual (NYS SMDM), January 2015 or latest edition*.

The Contractor will be required to sign onto the Notice of Intent for the SPDES General Permit # GP-0-20-001 (**Appendix A**) as an Operator before any fieldwork commences. Since the project site is within the Town/Village of Harrison's MS4 Area, the SWPPP is required to be reviewed and approved by the Town/Village of Harrison. The MS4 Acceptance Form is part of **Appendix A**. Additionally, since the projected is located within the East of Hudson Watershed the SWPPP is required to be reviewed and approved by NYCDEP. The acceptance letter from NYCDEP is part of **Appendix A** (pending). In addition, the Contractor and relevant subcontractors will be required to sign the Contractor/Subcontractor Certification in **Appendix B**. The Contractor will be also be responsible for submitting detailed soil erosion and sediment control measures included in the Contract Specifications (**Appendix C**) and this SWPPP to the Engineer for review and approval prior to commencement of any field work. This submittal will ensure that the SWPPP complies with NYSDEC requirements as specified in herein. The Contractor is also responsible for implementing the SWPPP. This SWPPP represents the minimum acceptable level of stormwater control measures that the Contractor must comply with for the project.

1.2 Stormwater Pollution Prevention Plan Outline

The SWPPP contained herein is composed of the following elements:

Section 1 – INTRODUCTION

This Section provides a description of the project and a review of the background describing the need for it.

Section 2 – SITE DESCRIPTION

This Section presents a summary of the pre-construction project site conditions including surface water and geology and proposed conditions and activities.

Section 3 – STORMWATER MANAGEMENT AND EROSION CONTROL DURING CONSTRUCTION

This Section describes the overall construction sequencing for the project, and detail the temporary control measures and soil erosion and sediment control measures implemented during construction by a qualified professional. Activities will include mobilization, definition of the Contractor's lay down/staging areas, installation of erosion and sediment controls on the site, site clearing and grubbing, site excavation, replacement of the existing sanitary sewer and storm sewer, site drainage improvements, and construction of a new water treatment plant

Section 4 – INSPECTION AND MAINTENANCE OF STORMWATER CONTROLS DURING CONSTRUCTION

This Section will include a discussion of inspection, maintenance, and reporting procedures during construction by a qualified professional. The section also discusses the required maintenance activities post construction.

Section 5 – POST CONSTRUCTION STORMWATER MANAGEMENT PRACTICES

Section 6 – INSPECTION AND MAINTANCE OF POST CONSTRUCTION STORMWATER MANAGEMENT PRACTICES

This Section will describe the post-construction stormwater management controls for the Rye Lake Water Filtration Plan (RLWFP) project site.

The Report also includes the following Appendices as listed in the Table of Contents.

1.3 Project Description and Background

Westchester Joint Water Works (WJWW) is under a New York State Court Order to construct a water filtration facility for its Rye Lake (Kensico Reservoir) water source to comply with the New York State Sanitary Code and the United States Environmental Protection Agency's (USEPA's) Surface Water Treatment Rule. On March 28, 2019, WJWW received a USEPA Administrative Order (AO) to submit a Corrective Action Plan (CAP) outlining provisions to be taken to achieve compliance with the disinfection byproduct (DBPs) maximum contaminant levels (MCLs), including haloacetic acids (HAA5) and total trihalomethanes (TTHM). On July 11, 2019, WJWW received a certified letter from the USEPA requiring submittal of a plan to address a longstanding violation of the Surface Water Treatment Rule (SWTR) filtration requirement. Following WJWW's response, the USEPA issued another certified letter on August 20, 2019 with an implementation schedule for a filtration plant for the Rye Lake supply. On November 26, 2019, USEPA issued another AO requiring WJWW to commence design of the proposed Rye Lake Water Filtration Plant (RLWFP) and begin the New York State Environmental Quality Review (SEQR) Act process by January 31, 2020, with the filtration plant operational by October 15, 2024.

The RLWFP is proposed to be located on Westchester County property adjacent to the Westchester County Airport facility, due to its proximity to WJWW's Rye Lake Pump Station, Rye Lake source water transmission main, Purchase Street Storage Tanks, and Purchase Street Booster Pump Station. See **Figure 1-1,** which is the USGS Glenville Quadrangle Connecticut-New York 7.5-minute series, NGA Ref No. USGSX24K17486. The facility will be a 30-mgd dissolved air flotation/filtration (DAFF) plant capable of handling WJWW's current and near-future demands. The design will also integrate provisions for potential future expansion to 40 mgd. The project is anticipated to commence construction activities in October 2023 and be complete by June 2027. The project focuses on the following components:

- Water Filtration Facility Building
- Combined Waste Washwater Tanks
- Electrical equipment, generators, and propane tank
- Access road around proposed buildings and entrance from Purchase Street
- Associated yard piping and electrical duct banks, including a new sanitary service force main connection on the Westchester County Airport property
- Underground stormwater detention chambers
- Pocket wetland and bioretention Stormwater Management Practices (SMPs)

Figure 1-1 - RLWFP Location Map

2. Site Description

This Section provides a description of the existing project site, including natural resource features, surface water, and geology.

2.1 Existing Conditions

The project site for the new RLWFP is a 13.43-acre property consisting of predominantly forested area. The existing site is accessed from the east along Tower Road. The existing grade in the wooded areas generally slopes from southwest to northeast, towards a stream that runs through regulated freshwater wetlands and eventually discharges into Rye Lake to the north. The only impervious area is an existing access gravel roadway that runs through the eastern portion of the site in a north south direction. The site is bordered to the north and west by single-family residential properties, and to bordered to the south and east by the Westchester County Airport.

See **Appendix D** for Existing Conditions Plans and **Appendix H** for the existing drainage area map.

2.1.1 Wetlands, Rivers and Streams

2.1.1.1 Desktop Review

Surface waters and wetlands in the project area were identified via desktop mapping sources and natural resource surveys. The resources used included the NYSDEC's Environmental Resource Mapper, United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Maps, and United Stated Geological Survey (USGS) topographic maps. This desktop review showed mapped wetland features along the eastern edge of the project area. In addition, wetland and surface water mapping prepared for the Final Environmental Assessment of Airport Drainage Improvements Report (TRC Engineers, 2015) were reviewed. Wetlands on the Westchester County Airport property and within the proposed site were delineated in 1996 by Vanasse Hangen Brustlin (VHB) and validated by NYSDEC in June 2014. Geospatial data of these delineated wetlands were provided to Hazen on January 24, 2020 and are shown in **Figure 2-1** and **Figure 2-2**.

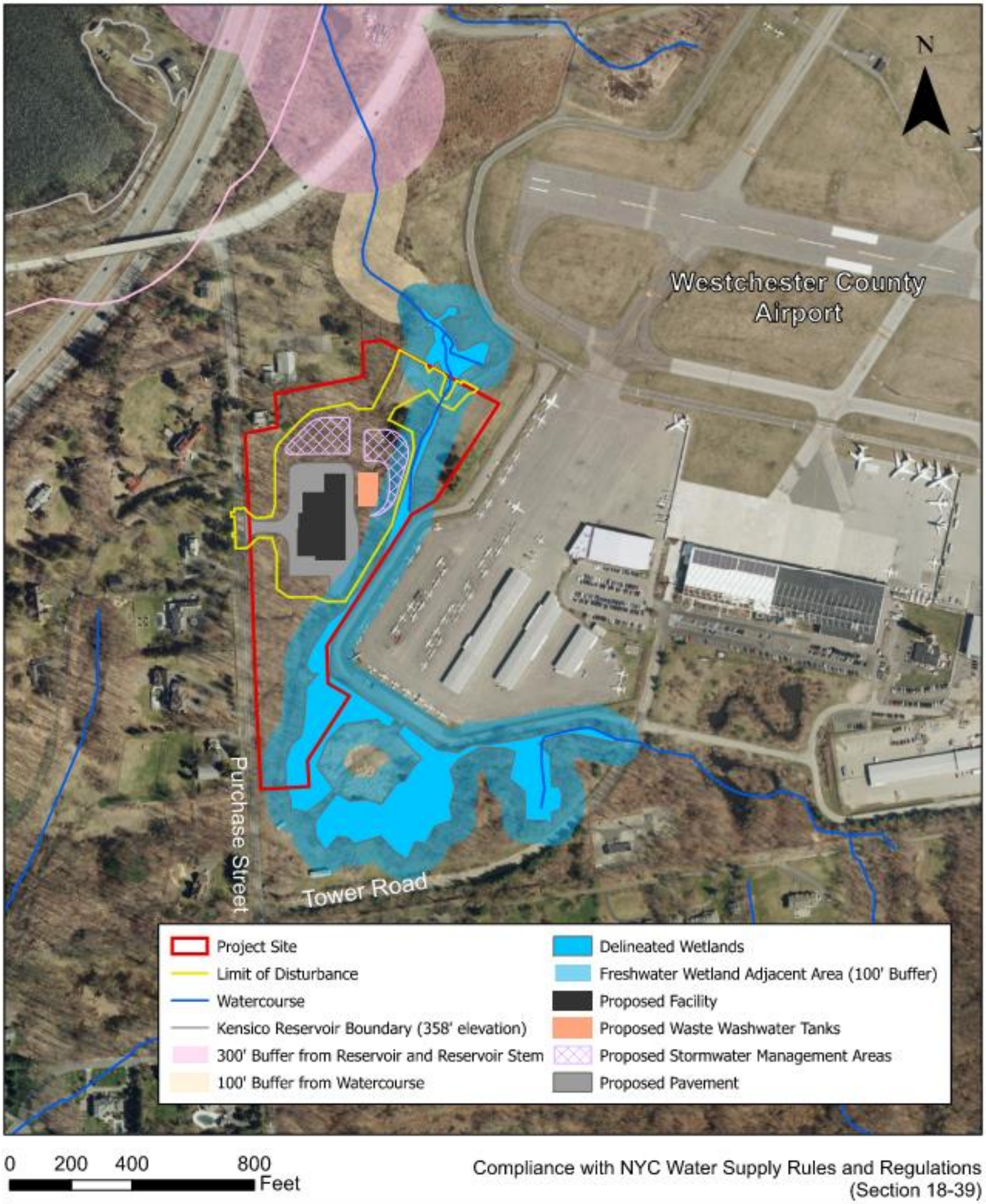


Figure 2-1 - Watercourses in the Vicinity of the Proposed Project

Figure 7 May 2021 Wetland Delineation

Hazen

Figure 2-2 - Mapped Wetland in the Vicinity of the Proposed Project

2.1.1.2 *Wetland Delineation*

Following the desktop evaluation, Hazen performed a wetland delineation immediately adjacent to the proposed filtration plant site on August 14, 2019, to confirm the location of the wetlands identified in the TRC report. The wetland delineation was performed in accordance with the three-parameter delineation method (evaluating the presence of wetland vegetation, hydric soils, and wetland hydrology) outlined in the *Wetlands Delineation Manual*, United States Army Corps of Engineers (USACE, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual* (USACE, 2012). Soil profiles were analyzed based on soil samples taken using a 2.5-in open-faced soil auger. Soil colors were classified using Munsell soil color charts. Sampling point data were recorded on USACE Northcentral and Northeast Regional Wetland Determination Data Forms. Wetland feature boundaries were recorded with a Trimble Global Positioning System (GPS) model GEO 7X with sub-meter accuracy.

Wetland boundary delineations performed by NYSDEC require revalidation after five years; therefore, an on-site delineation was conducted on May 18 and May 19, 2021. Seven wetland sampling points were collected within or adjacent to the project site using the USACE methodology described above. Based on the results of this wetland delineation, the proposed plant is likely to require authorization from NYSDEC as a portion of the project is within the freshwater wetland adjacent areas. Hazen contacted NYSDEC on June 28, 2021, for clarification on the wetland validation requirements and jurisdiction of the delineated wetlands validated by NYSDEC on June 28, 2014. The wetlands delineated in 2021 were validated by NYSDEC on August 10, 2021 and will expire on August 10, 2026, see **Figure 2-2**. Within the 13.4-acre project site, 1.2 acres of delineated wetlands and 4.7 acres of freshwater wetland adjacent area are present, as summarized in **Table 2-1**. Additional information regarding the wetland delineation is available in the *Wetland Delineation Report for Rye Lake Water Filtration Plant Engineering Services* dated December 2021.

Table 2-1 - Delineated Wetlands and Freshwater Wetland Adjacent Area (FWAA) at Project Site

Work Limit	Wetland Area Type	Area (Acres)
Project Site	Delineated Wetlands	1.2
	FWAA	4.7

2.1.1.3 *Wetland Impacts*

Wetlands delineated by Hazen and validated by NYSDEC in 2021 are mapped in **Figures 2-1 and 2-2** . 1.20 acres and 4.70 acres of wetlands and freshwater wetland adjacent area, respectively, were delineated within the property line. Potential temporary construction impacts to NYSDEC-regulated freshwater adjacent areas within the project site are limited to areas within the anitcipated limits of disturbance. Potential permanent impacts to NYSDEC-regulated freshwater wetland adjacent areas within the project site are limited and associated with the proposed perimeter access road, a small portion of the waste washwater tanks, and the proposed post-construction stormwater management practices. These potential impacts are summarized in **Table 2-2** and shown in **Figure 2-1**. Impacts to freshwater wetland adjacent areas may require compensatory mitigation; the extent of compensatory mitigation, if needed, will be determined in coordination with NYSDEC. The amount of wetland mitigation is determined by the regulatory agency on a project-by-project basis, in consideration of the function and benefits lost or gained, acreage involved, and the mitigation being proposed.

Table 2-2 - Potential Impacts on Delineated Wetlands and Freshwater Wetland Adjacent Area (FWAA)

Wetland Type	Impact Type	Impervious Area of Disturbance (AC)	Pervious Area of Disturbance (AC)	Total Area of Disturbance (AC)
Delineated Wetlands	Temporary	0.0	0.0	0.0
	Permanent	0.0	0.0	0.0
Freshwater Wetland Adjacent Area	Temporary	1.7	0.0	1.7
	Permanent	0.2	0.4	0.6

2.1.2 Geology and Soil Conditions

The existing site is predominantly forested. Based on the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Soil Surveys, the project site is predominately underlain by Udorthents, smoothed (Ub); Woodbridge Loam, 3 to 8 percent slopes (WdB); Paxton fine sandy loam, 3 to 8 percent slopes (PnB). **Figure 2-3** shows the spatial arrangement of all soil types found in the project area as documented by USDA NRCS.

Figure 2-3 - RLWFP Project Area Soil Survey Map

Table 2-3 contains a complete list of soil names, and **Table 2-4** describes drainage characteristics of each Hydrologic Soil Group.

Table 2-3 - USDA Soil Names and Hydrologic Soil Groups in Project Site

Soil Group Map Unit Symbol	Map Unit Name/Soil Group Name	Hydrologic Soil Group
LcA	Leicester Loam, 0 to 3 percent slopes, stony	A/D
PnB	Paxton fine sandy loam, 3 to 9 percent slopes	C
Sh	Sun loam	C/D
Ud	Uderthents, smoothed	none
WdB	Woodbridge loam, 3 to 8 percent slopes	C/D

Source: Soil Survey Staff, NRCS, USDA. Web Soil Survey. Available online at **http://websoilsurvey.nrcs.usda.gov/** accessed February 24, 2020

Table 2-4 - Hydrologic Soil Group (HSG) Descriptions

Group A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
Group B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
Group C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
Group D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.
Dual Hydrologic Soil Groups	There are three dual classes, A/D, B/D, and C/D, where the first letter is for drained areas and the second is for undrained areas. Only the soils that are in group D in their natural condition are assigned dual classes.

Source: Soil Survey Staff, NRCS, USDA. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed May 3, 2007.

In addition to the NRCS data, geotechnical investigations including soil borings, test pits, and percolation tests were performed to determine subsurface conditions throughout the site by GZA GeoEnvironmental of New York. Their findings were compiled in Geotechnical Engineering Report, Westchester Joint Water Works Filtration, Proposed Filtration Plant, File No 41.0162892.00, dated January 27, 2022. The soil boring, test pit, and percolation test logs are included in **Appendix E.** The evaluation of these samples are important in determining the load-bearing capacity of the soil, the depth of the seasonally high water table (SHWT), the depth to bedrock, and the soil's infiltration rate.

There were three initial soil borings conducted in 2019 by General Borings Inc, which were commissioned as part of Haley & Aldrich's 2019 subsurface exploration program. In May & June 2021 an additional 28 soil borings were across the site, and located in areas for the new RLWFP building, combined waste washwater tanks, electrical equipment, access road, and SMPs. The borings showed the site generally consists of a topsoil layer ranging from 1-inch to 12-inches thick. Silty sand was encountered in each boring except for two, in depths ranging between 2 and 10 feet. The silty sand layer contained 50 percent silt, up to 20 percent gravel, and up to 10 percent clay. Glacial till was observed below the silty sand layer in every boring except for one, with depths ranging from 18.5 feet to 43.5 feet. The Glacial Till was generally medium dense to very dense. Decomposed Rock was encountered below the Glacial Till stratum, and is defined as a dense to very dense material that has retained the parent rock structure.

Three initial percolation tests were also taken in June 2019 to determine if infiltration on site was feasible. The initial percolation tests were taken on the western side of the site, at varying depths representing the possible bottom elevations of a bioretention SMP. The tests showed infiltration rates ranging from 0.026 in/hr to 0.003 in/hr, far below the 0.50 in/hr requirement for an infiltration-based SMP. Per correspondence with NYCDEP in October 2021, given the initial poor infiltration rates, Type D soils, and high groundwater table, additional infiltration testing was not pursued at this site. Based on this infiltration testing and high groundwater, no infiltration SMPs are proposed for the site.

In August 2021, six test pits were excavated in the western portion of the site to identify the SHWT, and an additional seven test pits were excavated to the north in November 2021. The test pits were excavated to a depth of 4 feet or more below the proposed SMP bottom elevation. The test pits were then observed by a geotechnical expert for soil mottling and staining to determine the SHWT. In general, the test pits showed a higher SHWT in the western portion of the site (adjacent to the existing wetlands). The highest SHWT observed in this area was at elevation 396.50. The test pits showed a much lower SHWT to the north, with several test pits showing no evidence of a SHWT. The highest SHWT encountered in this area was 387.00. Both rounds of test pit excavations were coordinated with NYCDEP, and NYCDEP staff observed all test pit excavations.

2.2 Proposed Conditions

2.2.1 New Plant Construction

The new facility will be located approximately 1,100 ft north of Tower Road and approximately 150 ft east of Purchase Street; see Final Site Plans in **Appendix D**. A total of 6.13 acres will be disturbed as part of the plant's construction. Construction will be phased so that no more than 5 acres is disturbed at one time, see Section 3 for additional information. The new facilities finished floor is set at elevation 407 ft (NAVD88). A new access road from Purchase Street is proposed and will accommodate entry and exit traffic and maneuvering of large chemical delivery trucks. This access road will be 26 ft wide per local fire code requirements for aerial truck access. To provide access to all critical mechanical, electrical, and chemical facilities, the access road loops around the facility. Chemical delivery trucks are proposed to make their deliveries on the eastern side of the facility, in a spill containment area. In addition, a roll-up door is located along the southeast side of the facility to provide access to a roll-off disposal bin for residuals disposal. Parking for the facility will be provided along the south side of the facility. The facility's waste washwater tanks will be located east of the building and accessed by the access loop road. The emergency generators, emergency generator load bank, transformers, network protectors, and propane tank, will be located south of the facility and south of the access loop road. Refer to drawings **C-141** and **C-142** in **Appendix D**.

2.2.2 Installation of Stormwater BMPs

A pocket wetland and bioretention cell are located east and north of the facility to treat the 1-yr runoff for all new impervious areas. Drain inlets and roof drains collect stormwater and discharge to the pocket wetland. The pocket wetland outlets to the bioretention cell via a low flow orifice and a level spreader. A series of underground stormwater detention chambers are installed below the bioretention cell to detain runoff from larger storm events. A diversion structure is provided in the pocket wetland to divert the larger storms directly to the detention chambers. An overflow control structure will be installed at the detention chambers outlet to allow for a controlled release from the chamber. From the overflow control structure, stormwater runoff is piped to its ultimate discharge location at the northeastern property line

2.2.3 Other Discharges

The filtration plant has four separate emergency overflows associated with the combined waste washwater tanks, filtered water transfer tanks, backwash water tanks, and the mixed water from the static mixer channel. The overflow associated with the waste washwater tanks has the potential for a 23 mgd overflow and will exit each tank from the north side. The filtered water transfer tanks and the backwash water tank overflows will exit the plant from the east side at a maximum overflow of 16.5 mgd each and 33 mgd total. The mixed water overflow is also a maximum of 33 mgd and exits the west side of the plant. The total maximum overflow possible from any process tank at one time is 33 mgd. The overflow piping combines in the yard to provide one common outfall for all discharges. The overflows ultimately discharge to the existing stream located in the northeast corner of the property. An emergency high-flow drain to prevent flooding in the gallery will also be provided. This drain will discharge separate from the overflows to the stream at the north end of the site. The drain will have an air gap between the discharge location and the ground. The stream has ample capacity to receive any discharges from the process overflows and gallery drain based on hydraulic analysis of the existing stream. These discharges will only be operated on an emergency basis and require the procurement of a NYSDEC State Pollutant Discharge Elimination System (SPDES) Industrial Permit (NY-2C) for Process Emergency Overflow.

2.2.4 Sanitary Force Main

A new sanitary service line leaves the southeast corner of the plant to a below grade package pump station. From the pump station the 6” sanitary force main travels north to the site’s property line. The sanitary force main will be designed and constructed to the property line as part of WJWW’s Rye Lake Filtration Plant Project. From the property line the sanitary force main will travel east through the Westchester County Airport’s property and connect into an existing sewer manhole.

The force main design and construction on airport property are separate contracts from the WFP to be procured by Westchester County. The off-property force main work and associated construction activities are not as part of this SWPPP. As the design for the force main develops, a separate SWPPP will need to be prepared under a separate permit or an amendment to this SWPPP document will need to be prepared for coverage under this permit to cover the offsite force main construction activities. Either the separate SWPPP or amended SWPPP will require separate review and approval by the NYCDEP, the Town, and potentially NYSDEC.

3. Stormwater Management and Erosion Control During Construction

The following Section provides a description of the stormwater management measures that will be implemented during construction. It also describes the overall sequence of construction for the new RLWFP and associated facilities. This SWPPP satisfies relevant requirements required by NYSDEC and NYCDEP [1, 2, 3, 4].

Structural soil erosion and sediment control practices and stabilization techniques have been included in the project design to prevent on-site erosion and to maintain water quality of downstream and on-site water bodies. As noted in **Section 1.1 Stormwater Management Objectives** the Contractor for this Project will be responsible for preparing and submitting for review and approval to the Engineer, and implementing an Erosion and Sediment Control Plan (E&SCP). The Contractor is also responsible for ensuring that E&SCP complies with and is in agreement with the NYSDEC, NYCDEP, and MS4 requirements as specified in the SWPPP. The E&SCP must be consistent with the level of stormwater and erosion and sediment control measures presented in this SWPPP.

3.1 Construction Sequencing

Work for the proposed project will be completed under two contracts. The construction of the new RLWFP will be completed in four phases:

- Phase 1: Site Preparation
- Phase 2: Excavation and Structure Support
- Phase 3: Stormwater Infrastructure and Yard Piping
- Phase 4: Final Grading and Paving

See **Appendix D,** drawings C-111 to C114 for erosion and sediment control phasing plans**.**

[1] New York State Stormwater Management Design Manual (January 2015). New York State Department of Environmental Conservation; Center for Watershed Protection.

[2] New York State Standards and Specifications for Erosion and Sediment Control (November 2016). New York State Department of Environmental Conservation.

[3] New York State Department of Environmental Conservation (2015). State Pollution Discharge Elimination System (SPDES) General Permit For Stormwater Discharges from Construction Activity GP-0-020-001

[4] New York City Department of Environmental Protection (November 2019) Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources

Construction Phase 1 – Site Preparation

1. Contractor signs onto SWPPP.
2. Install silt fence, tree protection fence, and stabilized construction access.
3. Clear and grub staging area and area for sediment basin.
4. Install outfall structures and excavate and install temporary sediment basins.
5. Install construction ditches.
6. Perform clearing and grubbing for remainder of site.

Construction Phase 2 –Excavation and Structure Support

7. Perform excavation and dewatering activities for the Filtration Plant and Combined Waste Washwater Tanks.
8. Construct Filtration Building foundation and tanks and Combined Waste Washwater Tanks.
9. Backfill and establish subgrade around Filtration Plant. Prior to establishing subgrade, perform soil restoration measures.
10. Construct MSE retaining wall for electrical equipment.

Construction Phase 3 – Stormwater Infrastructure and Yard Piping

1. Install storm drain piping and structures to accommodate discharge from detention chambers and wetland.
2. Excavate for subsurface detention chambers and install chambers. Connect chamber systems to storm drainage piping network.
3. Install bioretention soil media and stabilize areas around the bioretention.
4. Upon completion of chambers and stabilization of bioretention, install overflow structure for stormwater wetland.
5. Excavate and grade stormwater wetland from outfall structure back to headwall.
6. Furnish landscaping within stormwater wetland and provide temporary stabilization measures.
7. Install storm drain and yard piping throughout project site.
8. Install sanitary force main and pump station.
9. Install electrical duct banks, generators, storage tank, and associated concrete pads and foundations.
10. Install new transmission mains and water main extension from Purchase Street to Filtration Plant.

Construction Phase 4 – Final Grading and Paving

1. Install truck delivery containment are and associated drainage piping.
2. Install vegetated maintenance road.
3. Perform final grading. Prior to establishing final grading, perform soil restoration measures.
4. Install curb and gutters. Install asphalt paving.
5. Install ornamental gate and perimeter fence.
6. Perform final landscaping. Establish permanent vegetation or other ground cover over all disturbed areas.
7. Remove all temporary erosion control measures upon final stabilization.
8. File Notice of Termination with NYSDEC.

3.2 Stormwater Management during Construction

During Phase 1 and 2 of construction ditches line the disturbed area perimeter to convey runoff to a temporary sediment basin. Construction of a temporary sediment basin will be used to prevent sediment laden water leaving the site, see **Appendix F** for calculations. The filtration plant and combined waste washwater tank have large underground components, and therefore require large, deep, excavations. Rainfall over these areas will be collected in sumps and pumped to a portable sediment tank(s). The particles will settle out in the tank prior to the release of stormwater. Rainfall collected from smaller excavation pits or trenches on site will be pumped into either a portable sediment tank or a dewatering filter bag prior to discharge. Temporary seeding will be used throughout construction to stabilize areas not actively under construction.

In Phase 3 and 4 of construction the permanent stormwater conveyance network will be installed. Once the majority of construction is complete, the sediment basin will transition into the construction of the pocket wetland and bioretention SMPs. To prevent sediment build up in the SMPs and underground detention structure, construction of these practices will not begin until the final phases of construction. All areas that are disturbed and that are not being made impervious will be restored with topsoil and turf grass, native ground coverings, trees, or shrubs at project completion. Post construction stormwater quality and quantity control is further discussed in **Section 5.**

3.2.1 Construction Dewatering

Effluent from dewatering operations will be directed to a sedimentation device, such as a portable sediment tank, prior to discharge to the stream. These devices will allow the suspended solids to settle out prior to discharge downstream to the existing stream. The Contractor will regularly remove the captured sediments from the bottom of the device. The type of dewatering system to be utilized will depend on the amount of groundwater to be drawn down or pumped and as selected by the Contractor through their means and methods.

All dewatering activities shall be done in accordance with the contract specifications **(Appendix C).** The dewatering operations will also need to follow the requirements of the associated NYCDEC Water Withdrawal Permit and NYSDEC SPDES Permit for Industrial Activities.

3.3 Erosion and Sediment Control Measures

The erosion and sediment control practices listed below represent the minimal measures needed for erosion and sediment control on-site. The Contractor shall update the SWPPP and install additional measures if the practices listed do not prevent sediment from leaving the site.

Temporary Structural

- **Construction Road Stabilization:** Stabilization of temporary construction routes/roads and parking areas to mitigate erosion. Maintain throughout construction until final paving and site restoration is complete.
- **Dust Control:** Suppress dust at all travelled work areas. Maintain this practice throughout construction.

- **Construction Ditches:** Divert stormwater around the site to the sediment basin as shown on the Contract Drawings. Maintain throughout construction until permanent storm drain conveyance network is installed and site is graded to provide drainage towards proposed inlets.
- **Sediment Basin:** Collect sediment-laden runoff and provide proper particle settling time prior to discharging to existing stream. Maintain throughout construction until permanent stormwater SMPs are in place.
- **Portable Sediment Tank:** Use to collect flow from dewatering and sump operations. Maintain and use as needed during construction activities involving excavations.
- **Reinforced Silt Fence:** Install silt fence prior to the start of clearing and grubbing. Maintain throughout construction until final stabilization.
- **Stabilized Construction Access:** Install prior to clearing and before accessing the grassy and forested areas on-site. Maintain throughout construction until final paving and site restoration is complete.
- **Storm Drain Inlet Protection:** Install on-site immediately after inlets are constructed as shown on the erosion and sediment control plan. Maintain throughout construction and until final stabilization is completed.

Vegetative Measures

- **Mulching:** Install mulch around trees and shrubs to cover soil surface to provide erosion control while planting is establishing. Maintain throughout site restoration and guarantee period.
- **Protecting Vegetation:** Install temporary fencing around the project site's limit of disturbance to protect trees and vegetation. Fence shall be maintained throughout construction until erection of final site fence and final restoration.
- **Seeding:** Disturbed areas shall be seeded as shown on the Contract Drawings. Disturbed areas shall be seeded within 7 days of completion of final site grading.
- **Topsoiling:** Topsoil shall be spread over seeded restoration areas and around trees and shrubs.

Permanent Structural

- **Land Grading:** Perform through construction and during restoration prior to installation of final surface treatments.
- **Retaining Wall:** Permanent structural wall installed where grading at a slope is constrained or is impractical.
- **Rock Outlet Protection:** Install at the outlets for the construction ditches, sediment basin, and outfall pipes.
- **Erosion Control Matting:** Stabilization mats will be provided on slopes steeper than 3:1 slopes.

3.3.1 Spill Prevention and Containment

This portion of the SWPPP presents the measures to be implemented to avoid accidental releases of oil or Other Hazardous Materials (OHMs) and contain spills should they occur during construction. To prevent and mitigate impacts to resource areas from accidental spills or OHMs on the RLWFP project site, the following measures and procedures shall be implemented:

1. No equipment storage, or refueling and maintenance of construction vehicles or equipment will occur outside the limits of construction. To minimize the possibility of leakage of hydraulic fluid, all hydraulic lines on all construction equipment and vehicles will be inspected at the end of each workday. If any excessive wear or leakage is observed, the line will be repaired prior to further use.
2. Spill containment equipment will be stored in equipment storage and refueling areas in an easily accessible manner for use in the cleanup of accidental releases of fuel or other hazardous materials. The Contractor will maintain a sufficient supply of oil absorbent pads, oil absorbent materials, containment booms, and appropriate fifty-five-gallon drums to contain potential fuel spills. All reportable spills of OHMs, as specified in the NYSDEC regulations governing notification of releases and threats of release of OHMs, will be reported to the NYSDEC. All remediation waste generated as the result of spills of OHM will be stored, handled, and disposed of in accordance with all applicable laws and regulations.

Furthermore, the Contractor will be required to prepare specific measures that will be implemented to prevent and clean up chemical and petroleum product spills that may occur during all phases of work on the RLWFP project site. These include, but are not limited to, fuel storage and refueling activities. Equipment maintenance activities and equipment washing will be kept away from all sensitive water bodies.

3.4 Good Housekeeping and Pollution Prevention

This section summarizes good housekeeping measures and pollution prevention that will be implanted during the construction of the RLWFP.

- Minimized Material Exposure: Topsoil and other approved non-surplus material stockpiles shall be located on unpaved, level, dry ground. The maximum slope of stockpiles shall be 1:2, and they shall be covered with tarps or temporary seeding and surrounded by properly installed hay bale/straw bale sediment barriers and/or silt fencing. If the stockpiles are unable to be located on unpaved surfaces, the Contractor shall, at the discretion of the Engineer, place a tarp down and stockpile material on top and cover and contain as described previously. Silt fence shall be installed per Specification Section 31 25 00 in **Appendix D**.

- Litter and Construction Debris: The Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish. At reasonable intervals during the progress of the demolition and removal work, or as directed by the Engineer, the Contractor shall haul debris and rubbish off-site and dispose of it at proper facilities. The Contractor shall also wet down dry materials to lay down and prevent blowing dust.

- Dust Control: Visible dust generated by work operations and moving vehicles and equipment will be minimized by the application of water to the roadways and active work areas. Dust control will be implemented when soils are exposed, and before, during, and after work ceases. Methods of dust control must be in accordance with the Detailed Specification Section 01 57 00 Temporary Controls (Appendix D). However, the use of chemicals for dust control, including calcium chloride, will not be permitted.

- Construction Chemicals: The Contractor shall maintain Safety Data Sheets for all chemicals stored or used on site. The Contractor shall also provide storage containers and containment facilities for all chemical products, and comply with all applicable rules and regulations for disposable of the materials. Chemical products shall not be stored within 50 feet of delineated wetlands. It shall be the Contractors responsibility to prevent the disposal of chemicals or other such substances to adjacent waterways and sanitary or storm sewers.

- Chlorine Disposal: The Contractor shall thoroughly flush the chlorine solution used in the disinfection of the tanks and pipes prior to placing either in service. The Contractor must dispose of the spent chlorine solution in such a way as not to be detrimental to animal, plant or fish life. The Contractor shall pay all civil penalties, fines, costs, assessments, etc. associated with any discharge of spent chlorine solution associated with the Contractor's work. Residual tests will be made after flushing to assure that residual is not in excess of 1 ppm at any point in the system.

- Concrete Washout: The concrete washout area shall be installed as shown on drawing C-301 in **Appendix E**. The washout should be dug in an unpaved area, with an earthen berm on all sides and a plastic liner placed in the bottom of the dugout section. The plastic liner shall be held down by gravel-filled bags at each corner. At grade, the contractor shall stack straw bales (max two high) along all sides of the washout, held in place by wood or metal stakes. Contractor shall provide a "CONCRETE WASHOUT" sign to signify the area.

- Stucco, Painting, Curing Compounds and Other Construction Material Washout: the Contractor shall employ best management practices to contain painting activities as required to prevent discharge of pollutants to the environment and atmosphere. Place tarps/plastic sheets under areas being painted. For spray painting or sandblasting, shroud work area with plastic sheeting or plywood to contain airborne overspray or dust/particulates. Painting operations shall be suspended when sanding debris or paint cannot be properly confined.

- Drilling Spoils: All drilling spoils associated with the installation of wells, piles, or supports of excavation shall be containerized and hauled offsite. Discharge of drilling spoils directly to any waterbody, sewer, wetland, or ground surface shall be prohibited. Contractor shall provide means of containing spoils within work area and disposing at the appropriate facilities.

4. Inspection and Maintenance of Stormwater Controls during Construction

4.1 Inspections and Reporting

To ensure proper functioning of the soil erosion and sediment control measures described in the previous Section, the Contractor is required to have a Qualified Inspector conduct site inspections. A Qualified Inspector shall be as defined by the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-20-001). A licensed Professional Engineer shall perform inspections of any post-construction stormwater management practices that include structural components, such as conveyance intake and outfall structures.

The inspector will be required to conduct and perform a RLWFP project site self-inspection a minimum of twice per week. In addition, inspection reports must be submitted to NYSDEC within twenty-four hours of the end of a storm event of one-half inches or greater.

The inspection will include but not limited to, at a minimum, the following areas:

- All disturbed areas of the RLWFP project construction site that have not been stabilized.
- The Contractor’s lay down/staging areas that are exposed to precipitation and have not been finally stabilized.
- Stockpiles of soil, sand, or any other erodible material.
- Areas where vehicles exit the RLWFP project site and Stabilized Construction Access.
- Construction ditches
- Sediment basins
- Reinforced silt fences.
- Catch basin inlet protection
- Roadways abutting the project site

Inspection and monitoring of all erosion control measures will be required at the following frequency in accordance with NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-20-001):

- minimum of twice a week (every 7 calendar days) during active construction;
- within 24 hours after every 0.50 inches of rainfall;
- once a month (every 30 calendar days) during temporary suspension of soil disturbances or winter shutdown, provided the Site has been temporarily stabilized. Written notification shall be submitted to Owner, NYSDEC, NYCDEP, and the Town/Village of Harrison prior to the reduction of inspection frequency

Prior to reducing the frequency of inspections, the Qualified Inspector shall notify the NYCDEP and Town/Village of Harrison in writing. A Sample Inspection Form is included in **Appendix H**. If the inspections reveal the need for additional control devices to prevent erosion and control sediment, the Contractor shall promptly install additional protection devices as required and as directed by Engineer. Maintenance of the erosion and sediment control measures, temporary and permanent vegetation, and other protective measures will be conducted as needed and directed by Engineer, by repair of erosion and sediment control measures such as barrier or diversion systems (reinforced silt fencing) and containment systems (portable sediment tanks), and restoration of destroyed vegetative cover. The Contractor will also be responsible for identifying and repairing erosion on slopes, loss of stabilizing vegetation or mulch, as well as sediment removal from swales, basins, and roadways, as needed and directed by Engineer and/or Owner.

Records of the inspections and repairs shall be prepared and maintained on the RLWFP project site by the Contractor. The inspection reports shall contain at a minimum:

- Date and Time of Inspection
- Name and title of person(s) performing inspection;
- A description of the weather and soil conditions (e.g. dry, wet, saturated) at the time of the inspection;
- A description of the condition of the runoff at all points of discharge from the construction site. Include discharges from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow. Photographs of discharges from outfalls and contrast with receiving water bodies. This shall include identification of any discharges of sediment from the construction site. Discharge shall not cause stream turbidity. If stream turbidity is caused by discharge, water quality violation must be reported to NYSDEC within 24 hours and corrective action immediately implemented;
- Identification of all erosion and sediment control practices that need repair or maintenance;
- Identification of all erosion and sediment control practices that were not installed properly or are not functioning as designed and need to be reinstalled or replaced.
- Description and sketch of areas that are disturbed at the time of inspections and areas that have been stabilized (temporary and/or final) since the last inspections.
- Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards; and
- Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s).
- Rain levels.

The Qualified Inspector is required to notify the Owner and Contractor of any corrective actions that must be taken. The Contractor will implement the corrective action(s) within one business day of notification by the inspector and shall complete the corrective actions in a reasonable timeframe.

If no incidents of non-compliance are found, the report will contain a certification that the facility is in compliance with the SWPPP and the permit. Each month, a summary report documenting inspection activities shall be prepared by the Contractor and submitted to the Engineer. The report will outline the status of construction and the erosion control measures in place and identify any erosion control maintenance completed or outstanding. Inspection reports will be maintained in a log book at the RLWFP project site.

Furthermore, written Summary Reports of compliance status shall be prepared by the Contractor quarterly in compliance with the SPDES permit and submitted to the Engineer.

4.1.1 Winter Shutdown

At the end of the each construction season when soil disturbance activities will be finalized or suspended until the following spring, it may be desirable to reduce the frequency of required inspections. The owner or operator will notify the NYSDEC Regional Office stormwater contact person in writing prior to reducing the frequency of inspection.

If the soil disturbance is completely suspended and the RLWFP project site is properly stabilized, the Contractor may reduce the self-inspection frequency, but shall maintain a minimum of monthly inspection in all situations (even when there is total winter shutdown). During periods of reduced inspection frequency, inspections must still be done after every storm event of one-half inches per twenty-four hour period or greater.

To reduce inspection frequencies, the Contractor must complete stabilization activities (perimeter controls, barriers, stabilized construction entrances, etc.) before proper installation is precluded by snow cover or frozen ground. If vegetation is desired, seeding, planting, and/or sodding must be scheduled to avoid die-off from fall frosts and allow for proper germination/establishment.

All erosion and sediment controls must be maintained according to the *New York State Standards and Specifications for Erosions and Sediment Control (NYS SS&SESC), August 2016 or latest edition*. The main items to consider before and during winter are: Site Stabilization; Sediment Barriers; Slopes; Soil Stockpiles; Construction Entrances; and Snow Management.

Frozen ground, winter conditions, and equipment can affect erosion and sediment control practices. Check for damage during monthly inspections and repair as necessary. This is especially important during thaw and prior to the spring rain events. Weekly inspections must resume no later than March 15th or as directed by the NYSDEC.

4.2 Maintenance

Stormwater controls must be maintained in good operating condition until all disturbed soils are permanently stabilized. Control devices in need of repair will be repaired promptly after identification by qualified professional and as directed by Engineer. An adequate quantity of erosion control materials will be stored on the RLWFP project site and under cover for emergency repairs and routine maintenance. Erosion control devices will be maintained until all disturbed area has been permanently stabilized.

Construction Ditches: Construction ditches should be inspected after every major rain event. If there has been no rain event, the construction diteches should be inspected once a week. Accumulated sediment should be removed from the flow area and repair the diversion ridge. Inspect outlets and make repairs as needed to avoid gully formations.

Sediment Basin: Sediment basins should be inspected after every major rain event. If there has been no rain event, the sediment basins should be inspected once a week. Sediment should be removed from the basin when it reaches the specified depth for cleanout noted on the plans, which should not exceed 50%

of the capacity of the sediment storage zone. This sediment shall be placed in such a manner that is will not erode from the site.

Reinforced Silt Fence: Sediment within fenced areas will be periodically removed and legally disposed and in no case will the accumulated sediment be allowed to rise above one-third the height of the silt fence. Silt fence will be maintained or replaced when they become ineffective, until they are no longer necessary, and at that time the silt fence will be removed. The immediate area occupied by the fence will be shaped to an acceptable grade and stabilized.

Slopes: Any indication of slope erosion shall be addressed immediately. If necessary, additional slope stabilization materials will be placed on the slope, or an additional diversion shall be implemented. The decision regarding further slope stabilization methods will be the responsibility of the on-site construction manager or the resident engineer.

Catch Basin Inserts: Catch basins should be inspected after every major rain event. If there have been no major events, the catch basin should be inspected every 2-3 weeks. Inspection of inserts is important for to prevent "ponding" around storm drains due to collecting sediment.

Portable Sediment Tank: The tank shall be cleaned out when six inches of the storage volume is filled with sediment. All sediment collected shall be disposed of in a sediment trapping device, an approved location where further sediment transport will not occur.

Stabilized Construction Access: The access shall be maintained in a condition that will prevent tracking of sediment onto roadways. Periodic top dressing with additional aggregate will be conducted when required. All sediment spilled, dropped, or washed onto roadways will be removed immediately.

Inlet Structures: Inlet structures, such as yard inlets, will be inspected after all rainfall events that generate storm flows. All debris, sediment, or other material that affect the operation of the grating or piping will be removed.

Outlet Structures: Outlet structures, such as outfalls, will be inspected after all rainfall events that generate storm flows. All debris or other material that affect the operation of the outfall pipe will be removed.

4.3 Record of Construction Activities

The Contractor shall maintain a record of the following construction activities:

- The dates when major grading activities occur in a particular area, such as clearing and grubbing, excavation, embankment, and grading;
- The dates when major construction activities temporarily or permanently cease on a portion of the RLWFP project construction site; and
- The dates when stabilization practices are initiated.

4.4 Significant Spills and Leaks

The Contractor(s) will take preventive measures to avoid spillage of petroleum products and other chemical substances, including but not limited to the measures identified in **Section 3.3.1 Spill Prevention and Containment** of this SWPPP. If there is a release or spill of oil or other hazardous substances, as defined in 40 CFR 117 and 40 CFR 302, then Westchester Joint Water Works personnel will do the following in coordination with Contractor and Engineer:

- Notify the National Response Center at (800) 424-8802 as soon as the Westchester Joint Water Works has knowledge of the discharge.
- Within fourteen calendar days, submit a written description of the release, the date it occurred, the circumstances leading to the release, and the steps taken to prevent and control future releases to the following address:

  NYS Department of Environmental Conservation
  Division of Water
  625 Broadway
  Albany, NY 12233-3500

- Within fourteen calendar days, modify and update the SWPPP to include a description and the date of the release, the circumstances leading up to the release, and any alterations to the SWPPP that may be necessary to prevent future releases and/or provide improved response methods.

4.5 Revising the SWPPP

The SWPPP will be kept current at all times. The SWPPP must be revised if any of the following, but not limited to, circumstances arise:

- Inspections show that the stormwater controls are not effective in controlling pollutants in stormwater;
- There are changes in design, construction, operation, or maintenance not otherwise addressed in the current SWPPP, which has a significant effect on the potential for the discharge of pollutants;
- The erosion controls and/or stormwater management facilities described in the SWPPP prove ineffective in controlling the discharge of pollutants from the RLWFP project site;
- New Contractor and/or Subcontractor(s) will replace a Contractor and/or Subcontractor(s) identified in the current SWPPP;
- New Contractors or Subcontractors are employed for the project;
- The construction schedule is deviated from the Project Schedule; or
- When the nature of the RLWFP project site activities changes.

In addition, an updated SWPPP must include copies of written Summary Reports of compliance and non-compliance status that are prepared quarterly by the Contractor. The updated SWPPP and required Reports must be signed/certified by the Permit Applicant.

5. Post-Construction Stormwater Management

The following section presents the post-construction drainage plan for the completed RLWFP project and an assessment of stormwater runoff quality and quantity pre- and post-construction.

The key components of the permanent stormwater management plan are stormwater collection, quality control and quantity control. The permanent stormwater management system has been designed to safely collect, convey, and treat the stormwater runoff generated from the new RLWFP site in accordance with the new development guidelines specified by NYSDEC. The permanent stormwater management plan will include a stormwater collection system designed to convey runoff from the 10-year storm event.

5.1 Post-Construction Stormwater Water Quality Control

To provide stormwater quality control for the runoff discharging from the site, the stormwater SMP's have been sized in accordance with *NYS SMDM*'s development criteria.

5.1.1 Design Criteria and Methodology

Water quality control is broken down into two different components: water quality volume and runoff reduction. The following section explains and defines each of these components. In order to calculate the corresponding runoff volumes for water quality, a drainage area was delineated to encompass all areas draining to the proposed SMPs, and any additional impervious area disturbed during construction. This drainage area is referred to as Final Drainage Area 1A-WQv (FDA 1A-WQv) (**Appendix G)**. Any on-site existing impervious area to be disturbed for yard piping installation has also been included in FDA 1A-WQv for WQv and RRv calculation proposes. As such, FDA 1A-WQv is slightly larger than the drainage area FDA 1A utilized in the water quantity calculations. 0.10 acre of future impervious area was also delineated as part of FDA 1A-WQv and included in the water quality calculations to accommodate for future plant expansion. **Table 5-1** shows the Curve Numbers (CN) used within the design calculations. **Table 5-2** and **Table 5-3** below summarize the pre and post-development impervious area within FDA 1A.

Table 5-1 - Curve Number Summary Table

Cover Type	CN (HSG D)
Paved Parking/Roof	98
Grass	80

Table 5-2 - Pre-Development Impervious Area for Water Quality Control

Drainage Area	Ex Impervious Area Removed (ac)	Ex Impervious Area Disturbed (ac)
FDA 1A-WQv	0.21	0.13

Table 5-3 - Post-Development Impervious Area for Water Quality Control

Drainage Area	New Impervious Area (ac)	Future Impervious Area (ac)	Demolished Impervious Area Re-development Credit	Disturbed Ex Impervious Area Required to be Treated
FDA 1A-WQv	2.06	0.10	0.16	0.03
Total Regulated Impervious Area = (New Area + Future Area – Credit + Disturbed)				**2.03**

5.1.1.1 Water Quality Volume

Typically, the corresponding design storm for WQv calculations is the 90th percentile storm. However, since this project is located within the Rye Lake (Kensico Reservoir) watershed, which is in the New York City Water Supply, the associated regulations require the one-year, 24-hour rainfall event to be used to calculate the WQv. The WQv was calculated in HydroCAD, which utilizes TR-20 methodologies.

The HydroCAD calculation was backchecked by also calculating a WQv using the 90% storm and *NYS SMDM* Section 4.2 equations. The backcheck confirmed the HydroCAD calculation was the most conservative design approach, and therefore has been used for SMP sizing. See **Appendix F** for full calculations.

5.1.1.2 Runoff Reduction Volume

NYSDEC also requires a minimum Runoff Reduction Volume (RR_V) for new development sites. The RR_V provides reduction to the total WQ_V by application of green infrastructure and SMPs to replicate pre-development hydrology. The *NYS SMDM* identifies RR_V with the following equation:

$$RRv = \frac{S \times Aic \times P \times R_v}{12}$$

where:
S = Hydrologic Soil Group Specific Reduction Factor
Aic = Impervious Cover (feet)
P = one-year 24-hour rainfall amount (inches)
R_v = 0.05+0.009(I), where I = 100%

The RR_V has been calculated for FDA 1A (see **Appendix F**).

5.1.1.3 Pollutant Loading

The pre and post-development pollutant loading for the site was analyzed using the Simple Method (Schueler, 1987):

$$L = 0.226 \times R \times C \times A$$

where:
L = Annual load (lbs/yr)
R = Annual runoff (inches)
C = Pollutant concentration (mg/l)
A = Area (acres)
.226 = Unit conversion factor

For bacteria, the equation is slightly different to account for the differences in units:

$$L = 103 \times R \times C \times A$$

where:
- L = Annual load (Billion Colonies)
- R = Annual runoff (inches)
- C = Bacteria concentration (1,000/ml)
- A = Area (acres)
- 103 = Unit conversion factor

The pollutant loading has been calculated for FDA 1A (see **Appendix F**).

5.1.2 Water Quality Control Analysis and Summary

5.1.2.1 Water Quality and Runoff Reduction Volume

Section 18-39 of the NYCDEP *Watershed Regulations*, requires the WQv to be treated by two different SMPs in series if the drainage area is greater than 20% impervious and an infiltration based SMP is not utilized. As discussed in Section 2, the site is over 20% impervious and the geotechnical investigations showed poor soils for infiltration, previously mentioned in **Section 2.1.2,** therefore two practices in series were designed. Due to the site configuration, very limited area is available for the SMPs. The western portion of the site has a relatively shallow SHWT, and therefore a pocket wetland practice is provided in this area.

The pocket wetland consists of a forebay, marsh zones with permanent water depths ranging from 0 – 18”, and a deepwater micro pool. Water is collected from the developed area via drain inlets and roof rains and is piped to a forebay for pretreatment. Runoff then flows through the wetland marsh zones and into a deepwater micropool. At the end of the deepwater micropool a compound outlet structure directs the WQv and CPv to the bioretention surface and all other storms directly to the underground stormwater detention chambers. All of the WQv is stored in the pocket wetland’s permanent pool. A low flow orifice is located above the permanent pool to provide 24-hour extended detention of the 1-yr storm event to meet Stream Channel Protection Volume (Cp_v) requirements, see **Section 5.2.1.1**. Once water flows through the low flow orifice it enters a discharge pipe. The discharge pipe conveys water from the wetland to a gravel trench. The gravel trench is designed as a “bubble-up” level spreader to evenly diffuse flow across the bioretention surface. Refer to drawing C-211 in **Appendix D**.

The bioretention cell is downstream of the pocket wetland and serves as the second practice in series. The bioretention cell detail is located on drawing C-217 in **Appendix D**. The stormwater is treated as it filters through the mulch and planting bed layers. Treated stormwater that is not absorbed into the surrounding soil flows into detention chambers located directly beneath the bioretention cell. Excess stormwater above the ponding elevation enters overflow inlets within the bioretention cell, which connect directly into the detention chambers. As discussed further in **Section 5.2.2.2**, this site is highly constrained, and the detention chambers were placed beneath the bioretention cell as a space saving measure. Maintenance is critical to the performance of any stormwater management practice, and the bioretention cell has been designed to minimize any required maintenance as much as possible allow for ease of maintenance when needed. Operation and maintenance procedures for the bioretention cell and detention chambers are discussed further in **Section 6**.

The outlet structure also includes a weir opening to send the 10 and 100-yr storms directly to the detention chambers. The weir opening is located just above the maximum water surface elevation (WSEL) for the Cp_v. Details for the wetland outlet structure are provided on drawing C-212 in **Appendix D**.

Calculations, drainage area maps, and modeling of the wetland and bioretention cell are provided in **Appendices F**, **G**, and **I**, respectively. Detailed landscaping plans have been created for the pocket wetland and bioretention. The plantings have been selected to optimize phosphorus uptake, be adaptable to varying soil moisture conditions, provide forage and habitat for native species and pollinators while filtering stormwater. See **Appendix D** for the landscaping design.

The WQ_V and RR_V associated with drainage area FDA 1A are summarized in **Table 5-4** below:

Table 5-4 – FDA 1A WQV and RRV Summary

Drainage Area	Total Area (acres)	Total Imp. Area (acres)	Req'd WQ_V (cu-ft)	RRV (cu-ft)		Adjusted WQ_V (cu-ft)		WQ_V + RRV
			(a)	(b) Min Req'd	(c) Prov'd	(a - c)	(d) Prov'd	(c + d) Prov'd
FDA 1A-WQ_V	3.23	2.03	**22,433**	**3,967**	9,381	13,052	13,052	22,433

5.1.2.2 Pollutant Loading

The pollutant loading for the site was also analyzed to quantify the impacts of development. Utilizing the Simple Method the following pollutants were analyzed: total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN), fecal coliform (F. Coli), copper (Cu), lead (Pb), and Zinc (Zn). The removal summary is provided in **Table 5-6** below, see **Appendix F** for full calculations.

The SMPs for the site were chose for their pollutant removal capabilities. The NYS SMDM rates SMPs on a Good, Fair, and Poor scale for pollutant removal capacity. Bioretention is rated as "Good" for phosphorous, nitrogen, and metals, and "Fair" for pathogens. Wetlands are rated "Good" for phosphorous, nitrogen, and pathogens, and "Fair" for metals. Additionally, Table A.4 of the *NYS SMDM* provides removal efficiencies for bioretention and wetlands, summarized in **Table 5-5** below.

Table 5-5 - Pollutant Removal Rates for SMPs

	TSS	TP	TN	Bacteria	Metals
Stormwater Wetlands	80%	50%	30%	80%	40%
Filtering Practices (includes bioretention)	85%	60%	40%	35%	70%

Table 5-6 - Pollutant Loading Removal Summary

	L_{TSS} (lbs/yr)	L_{TP} (lbs/yr)	L_{TN} (lbs/yr)	$L_{F\ Coli}$ (Billion Colonies/yr)	L_{Cu} (lbs/yr)	L_{Pb} (lbs/yr)	L_{Zn} (lbs/yr)
FDA 1A Pre-Development	99	0.39	3.22	98,549	0.216	0.066	0.610
FDA 1A Post-Development	67	1.13	14.9	35,663	0.064	0.049	0.424

5.2 Stormwater Water Quantity Control

Adding impervious area to the site triggers NYSDEC's General Permit requirement to provide stormwater quantity control for the new RLWFP site. The stormwater quantity analysis of this section is provided to demonstration the pre- and post- construction stormwater peak flow analysis of the project site.

5.2.1 Design Criteria and Methodology

NYS SMDM's Unified Stormwater Sizing Criteria for quantity control includes the analysis of the following:

- Stream Channel Protection Volume (Cp_v) for 24-hour extended detention of post-developed 1-year, 24-hour storm event;
- Overbank Flood Control (Q_p) for the attenuation of the post-developed 10-year, 24-hour storm peak discharge to pre-development rates; and
- Extreme Flood Control (Q_f) for the attenuation of the post-developed 100-year, 24-hour peak discharge to pre-development rates.

Table 5-7 provides the curve numbers utilized in *HydroCAD* TR-20 calculations. **Table 5-8** provides the summary of the rainfall depths used for the quantity analysis.

Table 5-7 - Curve Number Summary, Quantity

Cover Type	CN (HSG C)	CN (HSG D)
Paved Parking/Roof	98	98
SMP Surface	98	98
Woods, Good	70	77
Grass, Good	74	80

Table 5-8 – Rainfall Depth Summary Table

Storm	Rainfall Depth (in)	Source
1-year, 24-hour Event	2.83	NRCC, Extreme Precipitation Tables
10-year, 24-hour Event	5.11	NRCC, Extreme Precipitation Tables
25-year, 24-hour Event	6.42	NRCC, Extreme Precipitation Tables
100-year, 24-hour Event	9.05	NRCC, Extreme Precipitation Tables

5.2.1.1 Stream Channel Protection Volume

Per the *NYS SMDM*, the "Stream Channel Protection Volume (Cp_v) requirements are designed to protect stream channels from erosion. In New York State this goal is accomplished by providing 24-hour extended detention of the one-year, 24-hour storm event."

The Cp_v was calculated utilizing the computer program *HydroCAD*. HydroCAD utilizes TR-20 methodology in conjunction with NRCC precipitation values to calculate the runoff volume generated from the one-year, 24-hour storm event (V_S). This runoff volume is then utilized to determine a goal release rate, as calculated below:

$$Goal\ Release\ Rate\ (cfs) = V_s \div (24\ hrs \times 3600s)$$

where: V_s = Channel Protection Storage Volume (cf)

5.2.1.2 Overbank Flood Control and Extreme Flood Control

Per the *NYS SMDM* "the primary purpose of the overbank flood control sizing criterion is the prevent the frequency and magnitude of out-of-bank flooding generated by urban development." The overbank flood control is defined as attenuating the post-development 10-yr 24-hr storm. The primary purpose of the overbank flood criteria (Qp) is "to (a) prevent the increased risk of flood damage from large storm events, (b) maintain the boundaries of the predevelopment 100-yr floodplain, and (c) protect the physical integrity of stormwater management practices." The extreme flood control (Qf) is defined as attenuating the post-development 100-yr 24-hr storm to predevelopment rates.

To analyze the pre and post construction stormwater runoff, drainage areas were delineated for the project site. The following analysis points (AP) and drainage areas (DA) were delineated for the pre and post-developed conditions:

Analysis Points:

1. AP 1: At property line, downhill of the developed site's stormwater outfall
2. AP 2: Within existing stream, downhill of AP-1.
3. AP 3: Within the existing stream, downstream of AP-2, allows for the project site's full drainage area in existing and proposed conditions.

Pre-Development:

1. EDA 1 – Existing area that drains to AP 1, located central to the site property.
2. EDA 2 – Existing area that drains to AP 2, located on the eastern half of the site property.

3. EDA 3 – Existing area that drains to AP 3. Encompasses the western half of the site property and neighboring parcels to the north.

Post-Development:

1. FDA 1A – Developed area of the site, includes all new impervious areas. This area flows through the proposed storm drains and SMPs, and outfalls to AP 1.
2. Wetlands Direct Rainfall – The surface area of the wetland permanent pool
3. Bioretention Direct Rainfall – The surface area of the bioretention cell
4. FDA 1B – Two yard inlets are proposed on each side of the plant access gate to convey runoff from un-disturbed areas around the developed portion of the site. FDA 1B was delineated to calculate the runoff entering these inlets. The yard inlets combine with the SMP discharge to outfall to AP 1.
5. FDA 1C – Grassed area that surface flows to AP 1 under post-development conditions.
6. FDA 2 – Area that drains to AP 2 under post-developed conditions. This area is located on the eastern portion of the site and does not include any impervious areas or SMPs.
7. FDA 3 – Area that drains to AP 3 under post-development conditions. Encompasses western portions of the site, and neighboring parcels to the north.

Although no new impervious area is proposed within EDA 2-3 and FDA 2-3, by including these drainage areas in the *HydroCAD* modeling all hydrological changes due to the site development are properly analyzed. These impacts are predominately in the form of time of concentration changes and limited tree clearing for yard piping corridors.

The drainage areas were added to *HydroCAD* as subcatchments and time of concentration values were calculated utilizing TR-55 and Part 630 of the *National Engineering Handboook (NEH)* methodologies. FDA 1A is highly developed and consists of storm drain piping, therefore a minimum time of concentration of 6 minutes was used. A time of concentration of 0 minutes was utilized for the Wetland and Bioretention Direct Rainfall areas.

The wetland SMP and underground detention chambers were modeled in *HydroCAD* as pond nodes, and the storage and outlet structure configurations were input into the model. To avoid taking water quantity benefits for the bioretention SMP, this SMP was not modeled in *HydroCAD*. Each subcatchment (drainage area) was routed to the appropriate pond node. Links and Reaches were utilized in *HydroCAD* to link the subcatchment and pond nodes to one common analysis point.

After inputting the subcatchment, pond, link, and reach nodes, *HydroCAD* can be utilized to evaluate stormwater runoff volume, peak rates of discharge, hydrographs and storage volumes for proposed quantity control SMPs. The modeling output is available in **Appendix I**.

5.2.1.3 Receiving Waterbody

In addition to a peak flow analysis for the 1, 10, 25- and 100-yr storms, the receiving water body was analyzed to ensure the new development does not increase or exacerbate erosion or flooding conditions. Channel geometry was determined from available GIS topographic information and the Manning's Equation was used to determine the total channel capacity and normal depth. Shear stress was calculated using the below equation:

$$T = \gamma ds$$

where: T = shear stress (lbs/sf)
γ = unit weight of water (62.4 lbs/cf)
d = flow depth (ft)
s = channel slope (ft/ft)

5.2.2 Analysis and Results

5.2.2.1 Stream Channel Protection Volume

The Cpv is captured and released as part of the stormwater wetland discussed previously in Section 5.1.2. A low flow orifice is provided in the wetland outlet structure to slowly release the Cpv over a 24-hour period. The outflow from the wetland during the 1-yr storm was checked in HydroCAD to confirm the peak outflow was below the goal release rate. See **Appendix F** for the goal release rate calculations, and **Appendix F** for the HydroCAD report. The detailed plan and cross sections of the stormwater wetland are provided on drawings C-211 and C-212 in **Appendix D**.

5.2.2.2 Overbank Flood Control and Extreme Flood Control

To mitigate the runoff from the new impervious areas, a series of underground HDPE stormwater chambers are proposed to provide water quantity control. A stormwater pond was considered for this site, and ultimately not pursued due to space constrictions of steep slopes, streams, wetlands, and zoning setbacks.

As mentioned, this site is highly constrained, and there is no additional space to accommodate the required footprint of the detention system. Therefore, the HDPE stormwater chambers are stacked beneath the bioretention cell. This configuration allows the stormwater management area to be as space efficient as possible, while minimizing disturbance to the wetlands, streams, and their buffers, existing woods, steep slopes, and property line setbacks. The chambers are separated from the bioretention media as shown on drawing C-217 in **Appendix D.** The HDPE chambers have side perforations and open bottoms, allowing the surrounding stone to provide additional storage volume. Hydraulicly the chambers will function as the bioretention underdrain, allowing any water that is not absorbed the soil media to be captured in the chamber layer. There are also overflow inlets above the bioretention ponding that connect directly into the detention chambers. As previously mentioned, the wetland outlet structure doubles as a diversion structure, and has piped connection to send larger storm events directly to the detention structures.

Stormwater is stored in the chambers and released slowly via the chamber outlet structure. The chamber outlet structure sends flow through a piped outfall and ultimately discharges to the unnamed tributary of Rye Lake located northeast of the site.

Given the below grade detention methodology, proper pretreatment design and routine maintenance is critical to the success of the detention system. To prevent sediment from ever entering the detention chambers, the following pretreatment measures have been provided. A full description of the maintenance and inspection procedures is provided in **Section 6**.

- 2’ sumps in all storm drain inlets (See drawing C-216, Appendix D)
- Forebay at storm drain outfall (See drawing C-211, Appendix D
- Micropool at wetland outlet (See drawing C-211, Appendix D)
- 2’ sump in wetland outlet structure (inlet to chambers) (See drawing C-218, Appendix D)
- Separator row within detention chambers (See drawing C-211, Appendix D)

Pre and post development discharge rates associated with the entire site are provided in **Table 5-9**. The stormwater modeling report for this site is provided in **Appendix I.**

Table 5-9 - Total Site Peak Flow Summary

Point of Analysis	1-Yr, 24-hr Storm (cfs)			10-Yr, 24-hr Storm (cfs)			25-Yr, 24-hr Storm (cfs)			100-Yr, 24-hr Storm (cfs)		
	Pre	Post	Delta	Pre-	Post	Delta	Pre-	Post	Delta	Pre-	Post	Delta
AP 1	1.54	1.37	-0.17	4.32	4.24	-0.08	5.95	6.57	0.62	9.24	13.16	3.92
AP 2	4.94	6.27	1.33	13.67	17.41	3.74	18.78	24.45	5.67	29.08	38.57	9.49
AP 3*	**10.44**	**9.35**	**-1.09**	**29.91**	**26.72**	**-3.19**	**41.45**	**37.66**	**-3.79**	**64.87**	**59.92**	**-4.95**

*AP-1 and AP-2 encompasses a portion the project site’s total drainage area. AP-3 is considered the analysis point for the full project drainage area. See Section 5.2.1.2 for full analysis point descriptions.

5.2.2.3 Receiving Waterbody

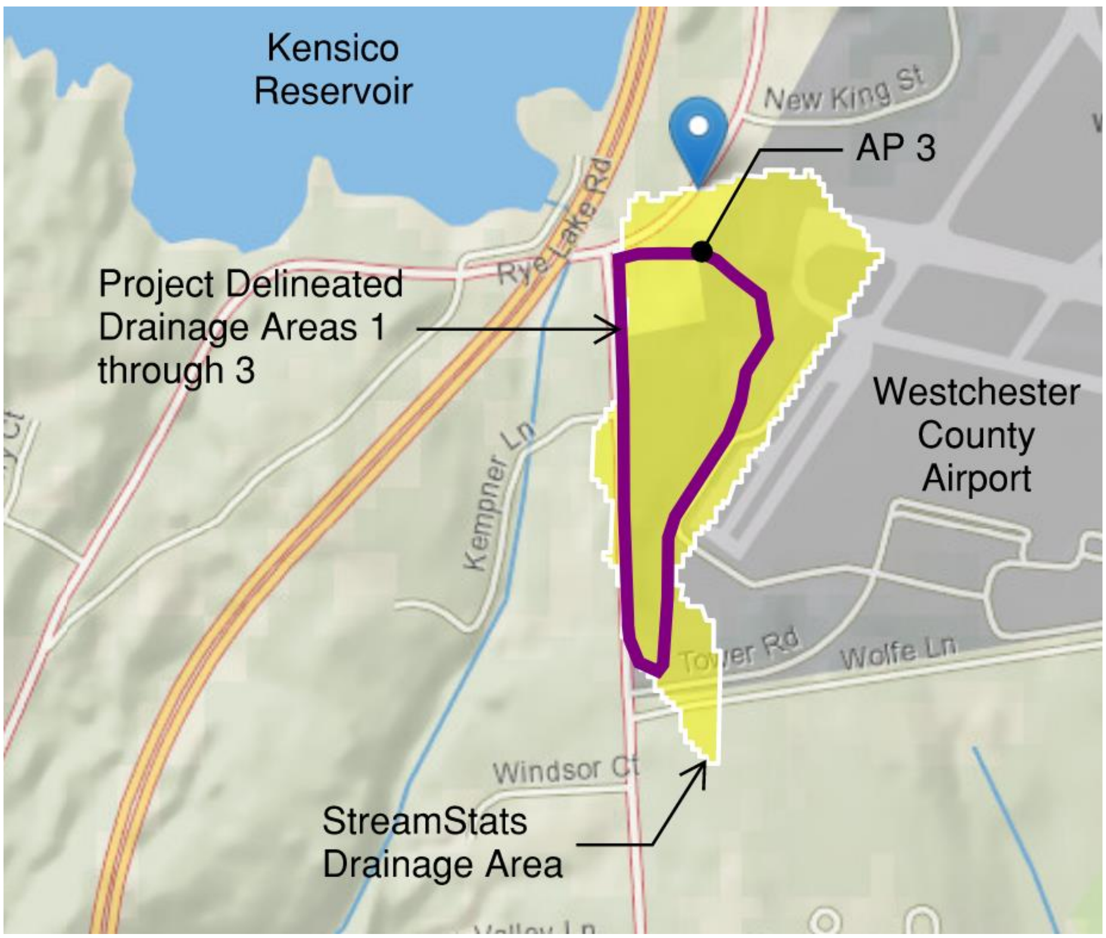
To protect the receiving channel from smaller, frequent storms, the site was designed in compliance with the *NYS SMDM* CPv requirements which “are designed to protect stream channels from erosion. In New York State this goal is accomplished by providing 24-hour extended detention of the one-year, 24-hour storm event.” Overall, the RLWFP site has been designed to discharge stormwater at or below pre-development peak flow rates for the 1, 10, 25, and 100-yr storm events, and has mitigated the potential flooding conditions as a result of development. However, since the drainage area maps have three points of analysis, each point is discussed in more detail this section.

At AP 1, there is no existing stream or channel in the existing condition and therefore no receiving waterbody analysis was performed. To protect the neighboring property between AP-1 and the existing stream, a riprap channel has been provided at the storm drain outfall to dissipate energy. At the end of the channel, a level spreader is designed to transition the outfall to sheet flow prior to water leaving the property. AP 1 discharges directly into AP 2, which can be used to analyze the impacts of development to the existing channel

AP 2 and AP 3 represent points of analysis within the receiving waterbody, the existing stream. While the project overall provides post development peak flow reductions at AP 3, there are increases in flow at AP 2 where the site is discharging to the stream (see **Table 5-9** above). To evaluate the impacts of this increase in flow in the post development condition at AP-2, the flows and cross section of the stream were evaluated. See calculations in **Appendix F**. The existing stream has a capacity of approximately 864 cfs and 167 cfs at AP 2 and AP 3 respectively. The increases in flow for respective storms at AP 2 during the design storm represents less than 1% of the available capacity at that point in the stream. The receiving waterbody has capacity to accommodate the increase in flow at AP 2.

At AP 2 and AP 3, the existing stream was also analyzed to evaluate the developed site's potential to increase or exacerbate erosion or flooding conditions. Since the discharge point is an existing stream beyond the limits of the project site, stream data from the United States Geologic Survey's (USGS) website, *StreamStats* was used to evaluate potential for erosion and flooding. A *StreamStats* report was run for the receiving channel, which showed an overall drainage area of 47 acres for the existing stream. The total delineated drainage area for the project at AP 3 encompasses approximately 40% of the total 47 acres discharging to the stream according to *StreamStats*. See the *StreamStats* tributary area of the stream below in **Figure 5-1.**Note, the Westchester County Airport also has a stormwater outfall located in the vicinity of the existing stream, and the associated discharges have been included in the receiving water body analysis. Westchester County Airport discharge numbers have been taken from Appendix H of the *Westchester County Airport (HPN) Final Environmental Assessment (EA) of Airport Drainage Improvements Stormwater Management Upgrades* prepared by TRC Engineers in April 2015.

Figure 5-1 - StreamStats Drainage Area



Although there is a slight increase in shear stress of 0.02 lbs/sf at AP 2 for the 1-yr storm, the shear stress is below 1.7 lbs/sf for both the pre-development and post-development conditions. Per *Stability Thresholds for Stream Restoration Materials* by Craig Fischenich, the stream should remain stable for shear stress conditions under 1.7 lbs/sf. There is also a slight increase in shear stress of 0.03 and 0.04 lbs/sf for the 10-yr and 100-yr storms, respectively. Both the pre-development and post-development shear stresses are above the 1.7 lbs/sf. Erosion may be happening in the existing stream for larger storm events, but the proposed RLWFP will not exacerbate any existing issues. There is no increase in shear stress at AP 3 for the 1, 10, and 100-yr storms. Additionally, the shear stress remains below 1.7 lbs/sf for both the pre and post-development conditions. See **Table 5-10** and **Table 5-11** for a summary, **Figure 5-2** and **Figure 5-3** for existing stream pictures, and **Appendix F** for full calculations.

Table 5-10 - Receiving Waterbody Analysis Summary – Shear Stress

Point of Analysis	1-Yr, 24-hr Storm Shear Stress (lbs/sf)		10-Yr, 24-hr Storm Shear Stress (lbs/sf)		100-Yr, 24-hr Storm Shear Stress (lbs/sf)	
	Pre	Post	Pre	Post	Pre	Post
AP 2	1.54	1.56	2.99	3.02	4.41	4.45
AP 3	0.23	0.22	0.44	0.44	0.66	0.66

Table 5-11 - Receiving Waterbody Analysis Summary - Capacity

Point of Analysis	1-Yr, 24 Hr Storm Flow Depth (ft)		10-Yr, 24-hr Storm Flow Depth (ft)		100-Yr, 24-hr Storm Flow Depth (ft)	
	Pre	Post	Pre	Post	Pre	Post
AP 2	0.98	1.00	1.91	1.93	2.82	2.85
AP 3	0.73	0.72	1.42	1.41	2.11	2.10

Figure 5-2 - Existing Stream at AP 2

Figure 5-3 - Existing Stream at AP 3

5.3 Stormwater Conveyance

Stormwater piping networks will be used to collect and convey stormwater runoff from the RLWFP site both during and after construction. Due to space and slope constraints, a piped network was chosen over an open drainage system.

5.3.1 Runoff Calculation Methodology

The peak flow rates for the storm drain piping have been calculated using the Rational Method as follows:

$$Q = C \times i \times A$$

where:
- Q = Peak runoff, cfs
- C = runoff coefficient, dimensionless
- i = Rainfall intensity, inches/hour
- A = Drainage Area, acres

Typically, a rainfall intensity, *i*, for the Rational Method is chosen based upon the assumption that the storm duration is equal to the time of concentration ($t_{c.}$) The time of concentration for a given drainage area was calculated using the method outlined in NRCS TR-55 for overland flow and added to the time of concentration calculated for flow through the swale or storm piping to the outlet point. For sheet flow less than 100 feet, the Manning's kinematic solution for time of concentration was used as follows:

$$t_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5} S^{0.4}}$$ for sheet flow less than 100 feet

where:
- t_c = time of concentration, minute
- *n = Manning's roughness coefficient*
- L = length of flow, ft
- *P_2 = 2-year, 24-hour rainfall, in*
- S = watershed gradient in, ft/ft

After 100 feet of sheet flow, flow is considered to change to shallow concentrated flow, for which calculations are dependent on whether the surface is paved or unpaved as shown below:

$$t_c = \frac{L}{x * S^{0.5}}$$ for shallow concentrated flow

where:
- t_c = time of concentration, minute
- *x = 20.3282 for paved surfaces*
  = 16.1345 for unpaved surfaces
- L = length of flow, ft
- *P_2 = 2-year, 24-hour rainfall, in*

Finally, the time of concentration through the storm piping was calculated using the length of the storm piping divided by velocity through the pipe. Per the *NYS SMDM* and the *Watershed Regulations,* all storm sewer piping was sized for a 10-year storm frequency. The storm intensity of the 10-year, 5-minute storm event for Westchester County, NY is 6.36 inches per hour, based on Northeast Regional Climate Center[4]. The hydrological calculations can be found in **Appendix F.**

The runoff coefficient, "C," is based on the type of land cover in each drainage area. "C" values for various types of land cover may be found in **Table 5-12** below. Various types of land cover in the drainage area have been determined by calculating composite runoff coefficients, a weighted average, for each drainage area. (See **Appendix F** for Calculations and **Appendix G** for Drainage Areas.)

Table 5-12 - Rational Method Runoff Coefficient "C"

Surface Description	C
Pavement	0.96
Grass	0.22

5.3.2 Storm Drain Sizing Methodology

Storm drains were modeled in *Hydraflow Storm Sewers Extension for Autodesk Civil3D*. *Hydraflow* uses drainage area, rainfall intensity, and pipe inputs to determine the network capacity using Manning's Equation. Manning's Equations is below. The "Q" value is obtained from previous Rational Method calculations. As previously mentioned, the storm drains were sized for the 10-yr storm event. Although the storm drains were not sized for the 100-yr storm, the 100-yr storm was modeled in *Hydraflow* and the model indicated no inlets overtopped during the associated storm events. See **Appendix F** for the stormwater calculations for the storm drain network.

$$Q = \frac{1.49}{n} \times A \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$$

where: Q = Flow, cfs (from Rational Method, above)
n = Manning's coefficient, dimensionless (see **Table 5-13 - Manning's n Coefficients (Roughness Coefficients))**
A = Cross-sectional area of flow, ft^2
R = Hydraulic radius, feet
S = Longitudinal channel slope, feet/feet

Table 5-13 - Manning's n Coefficients (Roughness Coefficients)

Surface Description	n
Ductile Iron Pipe	0.012
High-Density Polyethylene Pipe	0.013
PVC Pipe	0.010
Reinforced Concrete Pipe	0.013

4 http://www.nrcc.cornell.edu/

6. Inspection and Maintenance of Post Construction Stormwater Management Practices

The following section provides a description of the maintenance and inspection activities required for the post-construction stormwater management practices on site. Routine maintenance and inspection is critical to the performance of stormwater management practices.

6.1.1 Pocket Wetland

The pocket wetland shall be routinely inspected on a monthly basis, with critical elements being inspected after major storms. Unlike some stormwater management practices, permanent ponding within the wetland is critical to maintaining the vegetation and performance of the wetland. However, prolonged ponding in excess of the design depths will kill the selected vegetation. Ponding in excess of the design would most likely be due to clogging of the wetland outlet structure. Routine inspection of the outlet structure can help prevent this excess ponding from occurring. Unlike other some other stormwater management practices, sediment should only selectively be removed from the wetland as to not disturb the plant vegetation. With this in mind, sediment removal activities should be isolated to the forebay and micropool areas.

Establishment of vegetation is critical to the success of a pocket wetland. If a minimum of 50% coverage is not achieved in the planting zones after the second growing season, reinforcement planting is required. Wetland plantings should not be fertilized after the initial fertilization required to establish growth. Water levels shall be monitored as per the specifications until satisfactory initial growth is established.

The pocket wetland consists of the following elements:

- Forebay
- Marsh zones with permanent water depths ranging from 0-18”
- Deepwater micropool
- Compound outlet structure

A brief description of the inspection and maintenance activities required for the pocket wetland are shown in **Table 6-1**. A full inspection checklist can be found in **Appendix H**.

Table 6-1 - Pocket Wetland Inspection and Maintenance Schedule

Activity	Frequency
Inspect wetland embankment areas for erosion and structural damage	Annual, after major storms
Inspect outlet structure for debris accumulation and structural damage	Annual
Inspect permanent pool for undesirable plant growth and visible pollution	Monthly
Inspect forebay for accumulated sediment and debris	Monthly
Inspect dry pond areas for undesirable plant growth, erosion, and debris accumulation	Monthly
Inspect outfalls for erosion and structural damage	Annual, after major storms
Inspect wetland vegetation for adequate growing conditions	Annual

6.1.2 Bioretention Cell

Typical maintenance of the bioretention cells include removal of debris, weeding and mulching. Weeding is especially important during the first two years as plants are establishing their root systems. Silt and sediment removal from the filter bed shall be conducted when the accumulation exceeds one inch or every five to six years. If the filter bed ponds water at the surface for more than 48 hours, the top 4-6 inches of material below the mulch layer shall be removed and replaced with fresh material. Any plant material removed during clean-out shall be replaced in kind.

The bioretention cell consists of the following elements:

- Landscaping
- Level spreader
- 12” ponding area
- Overflow inlets
- 3” mulch layer
- 2.5’ soil media layer
- 3” choker stone layer

Required maintenance activities for the bioretention cell are shown in **Table 6-2**.

Table 6-2 - Bioretention Cell Inspection and Maintenance Schedule

Activity	Frequency
Inspect bioretention filter area for debris	Monthly
Inspect bioretention for signs of standing water	Monthly, after major storm events
Inspect bioretention vegetation for signs of erosion and adequate growth	Monthly
Inspect gravel trench and level spreader for signs of clogging and damage	Annually, after major storm events
Inspect overflow inlets	Annual, after major storms
Replace mulch	Annually
Debris/trash removal	As needed

6.1.3 Underground Stormwater Detention Chambers

Routine maintenance of the site, storm drain network, wetland, and bioretention cell will help protect the integrity of the underground stormwater detention chambers. While provisions are provided to remove accumulated debris from the detention chambers, removing of the debris in the upstream system will be both easier and cheaper. Routine maintenance to prevent debris accumulation within chambers include:

- Removal of litter and debris from site
- Revegetating baren areas on site
- Inspection storm drain inlet sumps for debris, and removal when half full
- Removal of accumulated sediment from wetland forebay and micropool
- Removal of floatable debris from wetland and bioretention ponding areas
- Inspection and mediation of erosion within the wetland and bioretention planting areas
- Removal of debris from wetland outlet structure sump
- Removal of leaf litter from bioretention surface

The inlet to the chambers has been designed as a separator row, which aims to isolate any accumulation of debris to the first row of chambers. Inspection ports are provided within the separator row and serve as visual access to the chambers. If a visual inspection indicates debris has accumulated in the chambers and needs cleared, a jet vacuum can be utilized to remove the debris. The vacuum truck can remove the debris through the wetland overflow structure. Additionally, a geotextile is provided along the bottom of the separator row to prevent the jet vacuum from scouring the stone base.

Table 6-3 - Underground Stormwater Detention Chambers Inspection and Maintenance Schedule

Activity	Frequency
Regular inspection and maintenance of storm drain network	Annually
Regular inspection and maintenance of the pocket wetland	See Table 6-1
Regular inspection and maintenance of bioretention cell	See Table 6-2
Inspect separator row and remove accumulated sediment as necessary through jet vacuuming	Annually

6.1.4 Stormwater System Components

All storm drain inlets have been provided with 2’ sumps to aid in the capture of litter and debris. Regular maintenance of the site, including removal of debris and litter will help prevent these unwanted items from entering the storm drainage network. Storm drain inlets should be inspected on an annual basis, and accumulated sediment, debris, and litter removed from drain sumps as needed. Bare areas of the site shall be re-vegetated as required to prevent sediment from entering the stormwater system.

All structural stormwater components must be inspected for cracking, leaking, subsidence, spalling, erosion, deterioration, and disconnected joints at least annually. Structural components include manholes, inlets, level spreaders, and headwalls.

Table 6-4 - Stormwater System Components Inspection and Maintenance Schedule

Stormwater Treatment System	Inspection Frequency
Inlets	Biannually
Stormwater System	Biannually
Vegetated Areas	No mowing for two years after initial seeding and annually for subsequent years

Appendix A: Notice of Intent, SPDES General Permit, MS4 SWPPP Acceptance Form, and NYCDEP Approvals

NOTICE OF INTENT

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

NYR ☐☐☐☐☐☐
(for DEC use only)

Stormwater Discharges Associated with Construction Activity Under State Pollutant Discharge Elimination System (SPDES) General Permit # GP-0-15-002

All sections must be completed unless otherwise noted. Failure to complete all items may result in this form being returned to you, thereby delaying your coverage under this General Permit. Applicants must read and understand the conditions of the permit and prepare a Stormwater Pollution Prevention Plan prior to submitting this NOI. Applicants are responsible for identifying and obtaining other DEC permits that may be required.

-IMPORTANT-
RETURN THIS FORM TO THE ADDRESS ABOVE
OWNER/OPERATOR MUST SIGN FORM

Owner/Operator Information

Owner/Operator (Company Name/Private Owner Name/Municipality Name)
Westchester Joint Water Works

Owner/Operator Contact Person Last Name (NOT CONSULTANT)
Kutzy

Owner/Operator Contact Person First Name
Paul

Owner/Operator Mailing Address
1625 Mamaroneck Ave

City
Mamaroneck

State
NY

Zip
10543 -

Phone (Owner/Operator)
914 - 698 - 3500

Fax (Owner/Operator)
914 - 381 - 0349

Email (Owner/Operator)
pkutzy@wjww.org

FED TAX ID
13 - 6007087 (not required for individuals)

Project Site Information

Project/Site Name
Rye Lake Water Filtration Plant

Street Address (NOT P.O. BOX)
Purchase Street

Side of Street
○ **North** ○ **South** ● **East** ○ **West**

City/Town/Village (THAT ISSUES BUILDING PERMIT)
Harrison

State	Zip	County	DEC Region
NY	10604 -	Westchester	3

Name of Nearest Cross Street
Lake Street

Distance to Nearest Cross Street (Feet)
950

Project In Relation to Cross Street
○ **North** ○ **South** ● **East** ○ **West**

Tax Map Numbers
Section-Block-Parcel
97-971-8

Tax Map Numbers
000971000000800

1. Provide the Geographic Coordinates for the project site in NYTM Units. To do this you **must** go to the NYSDEC Stormwater Interactive Map on the DEC website at:

www.dec.ny.gov/imsmaps/stormwater/viewer.htm

Zoom into your Project Location such that you can accurately click on the centroid of your site. Once you have located your project site, go to the tool boxes on the top and choose "i"(identify). Then click on the center of your site and a new window containing the X, Y coordinates in UTM will pop up. Transcribe these coordinates into the boxes below. For problems with the interactive map use the help function.

X Coordinates (Easting)	Y Coordinates (Northing)
607656	4546618

2. What is the nature of this construction project?

● **New Construction**

○ **Redevelopment with increase in impervious area**

○ **Redevelopment with no increase in impervious area**

4107089829

3. Select the predominant land use for both pre and post development conditions.
SELECT ONLY ONE CHOICE FOR EACH

Pre-Development Existing Land Use

- ○ FOREST
- ○ PASTURE/OPEN LAND
- ○ CULTIVATED LAND
- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY
- ○ PARKING LOT
- ● OTHER

Airport

Post-Development Future Land Use

- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ MUNICIPAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY (water, sewer, gas, etc.)
- ○ PARKING LOT
- ○ CLEARING/GRADING ONLY
- ○ DEMOLITION, NO REDEVELOPMENT
- ○ WELL DRILLING ACTIVITY *(Oil, Gas, etc.)
- ● OTHER

Water Supply

Number of Lots:

***Note**: for gas well drilling, non-high volume hydraulic fractured wells only

4. In accordance with the larger common plan of development or sale, enter the total project site area; the total area to be disturbed; existing impervious area to be disturbed (for redevelopment activities); and the future impervious area constructed within the disturbed area. (Round to the nearest tenth of an acre.)

Total Site Area	Total Area To Be Disturbed	Existing Impervious Area To Be Disturbed	Future Impervious Area Within Disturbed Area
13.4	6.1	0.3	0.1

5. Do you plan to disturb more than 5 acres of soil at any one time? ○ **Yes** ● **No**

6. Indicate the percentage of each Hydrologic Soil Group(HSG) at the site.

A	B	C	D
0 %	0 %	17 %	83 %

7. Is this a phased project? ● **Yes** ○ **No**

8. Enter the planned start and end dates of the disturbance activities.

Start Date 10/09/2023 - **End Date** 06/14/2027

9. Identify the nearest surface waterbody(ies) to which construction site runoff will discharge.

Name

unnamed tributary to Kensico Reservoir

9a. Type of waterbody identified in Question 9?

- (●) Wetland / State Jurisdiction On Site (Answer 9b)
- ( ) Wetland / State Jurisdiction Off Site
- ( ) Wetland / Federal Jurisdiction On Site (Answer 9b)
- ( ) Wetland / Federal Jurisdiction Off Site
- (●) Stream / Creek On Site
- ( ) Stream / Creek Off Site
- ( ) River On Site
- ( ) River Off Site
- ( ) Lake On Site
- ( ) Lake Off Site
- ( ) Other Type On Site
- ( ) Other Type Off Site

9b. How was the wetland identified?

- ( ) Regulatory Map
- (●) Delineated by Consultant
- ( ) Delineated by Army Corps of Engineers
- ( ) Other (identify)

10. Has the surface waterbody(ies) in question 9 been identified as a 303(d) segment in Appendix E of GP-0-15-002? ( ) **Yes** (●) **No**

11. Is this project located in one of the Watersheds identified in Appendix C of GP-0-15-002? (●) **Yes** ( ) **No**

12. Is the project located in one of the watershed areas associated with AA and AA-S classified waters?
If no, skip question 13. (●) **Yes** ( ) **No**

13. Does this construction activity disturb land with no existing impervious cover and where the Soil Slope Phase is identified as an E or F on the USDA Soil Survey? ( ) **Yes** (●) **No**
If Yes, what is the acreage to be disturbed?

____ . _

14. Will the project disturb soils within a State regulated wetland or the protected 100 foot adjacent area? (●) **Yes** ( ) **No**

15. Does the site runoff enter a separate storm sewer system (including roadside drains, swales, ditches, culverts, etc)?

○ Yes ○ No ● Unknown

16. What is the name of the municipality/entity that owns the separate storm sewer system?

Town/Village of Harrison

17. Does any runoff from the site enter a sewer classified as a Combined Sewer?

○ Yes ● No ○ Unknown

18. Will future use of this site be an agricultural property as defined by the NYS Agriculture and Markets Law?

○ Yes ● No

19. Is this property owned by a state authority, state agency, federal government or local government?

● Yes ○ No

20. Is this a remediation project being done under a Department approved work plan? (i.e. CERCLA, RCRA, Voluntary Cleanup Agreement, etc.)

○ Yes ● No

21. Has the required Erosion and Sediment Control component of the SWPPP been developed in conformance with the current NYS Standards and Specifications for Erosion and Sediment Control (aka Blue Book)?

● Yes ○ No

22. Does this construction activity require the development of a SWPPP that includes the post-construction stormwater management practice component (i.e. Runoff Reduction, Water Quality and Quantity Control practices/techniques)?
If No, skip questions 23 and 27-39.

● Yes ○ No

23. Has the post-construction stormwater management practice component of the SWPPP been developed in conformance with the current NYS Stormwater Management Design Manual?

● Yes ○ No

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24. The Stormwater Pollution Prevention Plan (SWPPP) was prepared by:

- ● **Professional Engineer (P.E.)**
- ○ **Soil and Water Conservation District (SWCD)**
- ○ **Registered Landscape Architect (R.L.A)**
- ○ **Certified Professional in Erosion and Sediment Control (CPESC)**
- ○ **Owner/Operator**
- ○ **Other**

SWPPP Preparer
Hazen and Sawyer

Contact Name (Last, Space, First)
Sheeran, Daniel

Mailing Address
498 Seventh Avenue

City
New York

State: NY Zip: 10018 -

Phone: 212-539-7000 Fax: - -

Email
dsheeran@hazenandsawyer.com

SWPPP Preparer Certification

I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the GP-0-15-002. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

First Name: Daniel **MI**: J

Last Name: Sheeran

Signature

Date / /

25. Has a construction sequence schedule for the planned management practices been prepared? ● Yes ○ No

26. Select **all** of the erosion and sediment control practices that will be employed on the project site:

Temporary Structural

- ○ Check Dams
- ● Construction Road Stabilization
- ● Dust Control
- ○ Earth Dike
- ○ Level Spreader
- ● Perimeter Dike/Swale
- ○ Pipe Slope Drain
- ● Portable Sediment Tank
- ○ Rock Dam
- ● Sediment Basin
- ○ Sediment Traps
- ● Silt Fence
- ● Stabilized Construction Entrance
- ● Storm Drain Inlet Protection
- ○ Straw/Hay Bale Dike
- ○ Temporary Access Waterway Crossing
- ○ Temporary Stormdrain Diversion
- ○ Temporary Swale
- ○ Turbidity Curtain
- ○ Water bars

Biotechnical

- ○ Brush Matting
- ○ Wattling

Vegetative Measures

- ○ Brush Matting
- ○ Dune Stabilization
- ○ Grassed Waterway
- ● Mulching
- ● Protecting Vegetation
- ○ Recreation Area Improvement
- ● Seeding
- ○ Sodding
- ○ Straw/Hay Bale Dike
- ○ Streambank Protection
- ○ Temporary Swale
- ● Topsoiling
- ○ Vegetating Waterways

Permanent Structural

- ○ Debris Basin
- ● Diversion
- ○ Grade Stabilization Structure
- ● Land Grading
- ○ Lined Waterway (Rock)
- ○ Paved Channel (Concrete)
- ○ Paved Flume
- ● Retaining Wall
- ○ Riprap Slope Protection
- ● Rock Outlet Protection
- ○ Streambank Protection

Other

Post-construction Stormwater Management Practice (SMP) Requirements

Important: Completion of Questions 27-39 is not required if response to Question 22 is No.

27. Identify all site planning practices that were used to prepare the final site plan/layout for the project.

- ● **Preservation of Undisturbed Areas**
- ○ **Preservation of Buffers**
- ● **Reduction of Clearing and Grading**
- ○ **Locating Development in Less Sensitive Areas**
- ○ **Roadway Reduction**
- ○ **Sidewalk Reduction**
- ○ **Driveway Reduction**
- ○ **Cul-de-sac Reduction**
- ○ **Building Footprint Reduction**
- ○ **Parking Reduction**

27a. Indicate which of the following soil restoration criteria was used to address the requirements in Section 5.1.6("Soil Restoration") of the Design Manual (2010 version).

- ● All disturbed areas will be restored in accordance with the Soil Restoration requirements in Table 5.3 of the Design Manual (see page 5-22).
- ○ Compacted areas were considered as impervious cover when calculating the **WQv Required**, and the compacted areas were assigned a post-construction Hydrologic Soil Group (HSG) designation that is one level less permeable than existing conditions for the hydrology analysis.

28. Provide the total Water Quality Volume (WQv) required for this project (based on final site plan/layout).

Total WQv Required

0.515 **acre-feet**

29. Identify the RR techniques (Area Reduction), RR techniques(Volume Reduction) and Standard SMPs with RRv Capacity in Table 1 (See Page 9) that were used to reduce the Total WQv Required(#28).

Also, provide in Table 1 the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

Note: Redevelopment projects shall use Tables 1 and 2 to identify the SMPs used to treat and/or reduce the WQv required. If runoff reduction techniques will not be used to reduce the required WQv, skip to question 33a after identifying the SMPs.

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Table 1 - Runoff Reduction (RR) Techniques and Standard Stormwater Management Practices (SMPs)

Practice	Total Contributing Area (acres)		Total Contributing Impervious Area(acres)
RR Techniques (Area Reduction)			
○ Conservation of Natural Areas (RR-1)	.	and/or	.
○ Sheetflow to Riparian Buffers/Filters Strips (RR-2)	.	and/or	.
○ Tree Planting/Tree Pit (RR-3)	.	and/or	.
○ Disconnection of Rooftop Runoff (RR-4)	.	and/or	.
RR Techniques (Volume Reduction)			
○ Vegetated Swale (RR-5)			.
○ Rain Garden (RR-6)			.
○ Stormwater Planter (RR-7)			.
○ Rain Barrel/Cistern (RR-8)			.
○ Porous Pavement (RR-9)			.
○ Green Roof (RR-10)			.
Standard SMPs with RRv Capacity			
○ Infiltration Trench (I-1)			.
○ Infiltration Basin (I-2)			.
○ Dry Well (I-3)			.
○ Underground Infiltration System (I-4)			.
● Bioretention (F-5)			2.03
○ Dry Swale (O-1)			.
Standard SMPs			
○ Micropool Extended Detention (P-1)			.
○ Wet Pond (P-2)			.
○ Wet Extended Detention (P-3)			.
○ Multiple Pond System (P-4)			.
○ Pocket Pond (P-5)			.
○ Surface Sand Filter (F-1)			.
○ Underground Sand Filter (F-2)			.
○ Perimeter Sand Filter (F-3)			.
○ Organic Filter (F-4)			.
○ Shallow Wetland (W-1)			.
○ Extended Detention Wetland (W-2)			.
○ Pond/Wetland System (W-3)			
● Pocket Wetland (W-4)			2.03
○ Wet Swale (O-2)			.

Table 2 - Alternative SMPs (DO NOT INCLUDE PRACTICES BEING USED FOR PRETREATMENT ONLY)

Alternative SMP	Total Contributing Impervious Area(acres)
○ Hydrodynamic	.
○ Wet Vault	.
○ Media Filter	.
○ Other	.

Provide the name and manufacturer of the Alternative SMPs (i.e. proprietary practice(s)) being used for WQv treatment.

Name

Manufacturer

Note: Redevelopment projects which do not use RR techniques, shall use questions 28, 29, 33 and 33a to provide SMPs used, total WQv required and total WQv provided for the project.

30. Indicate the Total RRv provided by the RR techniques (Area/Volume Reduction) and Standard SMPs with RRv capacity identified in question 29.

Total RRv provided

0.215 **acre-feet**

31. Is the Total RRv provided (#30) greater than or equal to the total WQv required (#28).

If Yes, go to question 36.
If No, go to question 32.

○ Yes ● No

32. Provide the Minimum RRv required based on HSG.
[Minimum RRv Required = (P)(0.95)(Ai)/12, Ai=(S)(Aic)]

Minimum RRv Required

0.091 **acre-feet**

32a. Is the Total RRv provided (#30) greater than or equal to the Minimum RRv Required (#32)?

● Yes ○ No

If Yes, go to question 33.
Note: Use the space provided in question #39 to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). A detailed evaluation of the specific site limitations and justification for not reducing 100% of the WQv required (#28) must also be included in the SWPPP.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

33. Identify the Standard SMPs in Table 1 and, if applicable, the Alternative SMPs in Table 2 that were used to treat the remaining total WQv(=Total WQv Required in 28 - Total RRv Provided in 30).

Also, provide in Table 1 and 2 the total impervious area that contributes runoff to each practice selected.

Note: Use Tables 1 and 2 to identify the SMPs used on Redevelopment projects.

33a. Indicate the Total WQv provided (i.e. WQv treated) by the SMPs identified in question #33 and Standard SMPs with RRv Capacity identified in question 29.

WQv Provided

0.815 **acre-feet**

Note: For the standard SMPs with RRv capacity, the WQv provided by each practice = the WQv calculated using the contributing drainage area to the practice - RRv provided by the practice. (See Table 3.5 in Design Manual)

34. Provide the sum of the Total RRv provided (#30) and the WQv provided (#33a). 1.030

35. Is the sum of the RRv provided (#30) and the WQv provided (#33a) greater than or equal to the total WQv required (#28)? ● **Yes** ○ **No**

If Yes, go to question 36.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

36. Provide the total Channel Protection Storage Volume (CPv) required and provided or select waiver (36a), if applicable.

CPv Required	**CPv Provided**
0.515 **acre-feet**	0.515 **acre-feet**

36a. The need to provide channel protection has been waived because:

○ Site discharges directly to tidal waters or a fifth order or larger stream.

○ Reduction of the total CPv is achieved on site through runoff reduction techniques or infiltration systems.

37. Provide the Overbank Flood (Qp) and Extreme Flood (Qf) control criteria or select waiver (37a), if applicable.

Total Overbank Flood Control Criteria (Qp)

Pre-Development	**Post-development**
29.91 **CFS**	26.72 **CFS**

Total Extreme Flood Control Criteria (Qf)

Pre-Development	**Post-development**
64.87 **CFS**	59.92 **CFS**

37a. The need to meet the Qp and Qf criteria has been waived because:

- ○ Site discharges directly to tidal waters or a fifth order or larger stream.
- ○ Downstream analysis reveals that the Qp and Qf controls are not required

38. Has a long term Operation and Maintenance Plan for the post-construction stormwater management practice(s) been developed? ● Yes ○ No

If Yes, Identify the entity responsible for the long term Operation and Maintenance

Westchester Joint Water Works

39. Use this space to summarize the specific site limitations and justification for not reducing 100% of WQv required(#28). (See question 32a) This space can also be used for other pertinent project information.

Geotechnical investigations showed poor infiltration and high seasonally high water table (SHWT) on site, making an infiltration based practice infeasible. The NRCS soil surveys also indicated HSG D soils, which greatly reduce the RRv capacity of the Standard SMPs. The SMP footprints could not be enlarged to provide additional RRv without disturbing wetland, wetland buffers, property line buffers, or steep slopes.

40. Identify other DEC permits, existing and new, that are required for this project/facility.

- ○ Air Pollution Control
- ○ Coastal Erosion
- ○ Hazardous Waste
- ○ Long Island Wells
- ○ Mined Land Reclamation
- ○ Solid Waste
- ○ Navigable Waters Protection / Article 15
- ○ Water Quality Certificate
- ○ Dam Safety
- ○ Water Supply
- ● Freshwater Wetlands/Article 24
- ○ Tidal Wetlands
- ○ Wild, Scenic and Recreational Rivers
- ○ Stream Bed or Bank Protection / Article 15
- ○ Endangered or Threatened Species(Incidental Take Permit)
- ○ Individual SPDES
- ● SPDES Multi-Sector GP
- ● Other 401 Water Quality Cert
- ○ None

41. Does this project require a US Army Corps of Engineers Wetland Permit? ○ Yes ● No
If Yes, Indicate Size of Impact.

42. Is this project subject to the requirements of a regulated, traditional land use control MS4? ● Yes ○ No
(If No, skip question 43)

43. Has the "MS4 SWPPP Acceptance" form been signed by the principal executive officer or ranking elected official and submitted along with this NOI? ● Yes ○ No

44. If this NOI is being submitted for the purpose of continuing or transferring coverage under a general permit for stormwater runoff from construction activities, please indicate the former SPDES number assigned.

Owner/Operator Certification

I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I hereby certify that this document and the corresponding documents were prepared under my direction or supervision. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgment that I will receive as a result of submitting this NOI and can be as long as sixty (60) business days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction, and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.

Print First Name

Paul

MI

Print Last Name

Kutzy

Owner/Operator Signature

Date

/ /

Appendix B: Contractor/Subcontractor Certification

Contractor/Subcontractor Certification

In accordance with SPDES General Permit for Stormwater Discharges Part III.A.6:

“I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I am aware that there are significant penalties for submitting false information that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations.”

Contractor

Name & Organization: ____

Signature ________________________________ Date_______________

Subcontractor

Name & Organization: ____

Signature ________________________________ Date_______________

Subcontractor

Name & Organization: ____

Signature ________________________________ Date_______________

Subcontractor

Name & Organization: ____

Signature ________________________________ Date_______________

Appendix C-1: Contract Specifications, Rye Lake Water Filtration Plant

SECTION 01 57 52

DEWATERING AND FLOW DIVERSION FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

A. This work shall consist of flow diversion, dewatering and maintaining water level for preparing work areas when construction activities take place within stream areas as specified in the Contract Documents or as directed by the Owner or Owner's Representative, and shall be in accordance with the requirements of the applicable State, District or Commonwealth in which the project is located:

1. New York State Standards and Specifications for Erosion and Sediment Control (2016 or most current version) as developed by the New York State Department of Environmental Conservation (NYSDEC).

B. This item includes placement, operation, maintenance and removal upon completion. Diversions are used to isolate work areas from flow during the construction of in-stream projects. Diversions which have an insufficient flow capacity can fail and severely erode the disturbed channel section under construction. Therefore, in-channel construction activities should occur only during conditions where the diversion is designed to convey the anticipated flow such as periods of low rainfall. The cost for maintenance of these devices is solely the Contractor's responsibility. These works are temporary and shall be removed and the area restored to its original state when they are no longer needed or permanent measures are installed.

C. Related Sections:

1. Section 31 00 01 – Earthwork

1.02 SUBMITTALS

A. Product data for each type and/or size of dewatering coffer dam or pump around equipment as described on the Contract Documents.

1.03 QUALITY ASSURANCE

A. Contractor shall forward one copy of a stream Dewatering and Flow Diversion plan to the Owner or Owner's Representative for review and approval. The plan shall include a description of means and methods plus a list of materials including pump equipment, etc., that shall be employed. The Contractor shall document the flow volume anticipated to be passed around the work area during normal operations. Specifications for any proprietary devices will be required for review and approval by the Owner or Owner's Representative.

10-26-20

PART 2 – PRODUCTS

2.01 MATERIALS

A. Coffers: It is suggested that the Contractor utilize sand bags with plastic sheeting to impound water as necessary to construct stream work. However, the Contractor may submit for review by the design Owner or Owner's Representative alternative methods for coffer systems including proprietary devices.

B. Impervious Sheeting: Sheeting shall consist of ten (10) mil or thicker polyethylene plastic, which is impervious and resistant to puncture and tearing.

C. Pump(s): Pump(s) shall be large enough for dewatering stream section in a timely fashion without creating unsafe conditions or producing additional erosion or sediment discharge. The pump around shall include a hose, high density polyethylene (HDPE) or metal pipe suitable to convey water overland to the downstream discharge point. Pump inlets will have a screen (mesh size <1 inch) over opening. The pump(s) shall be shut off at night unless otherwise indicated on the Construction Documents. The size and number of pumps shall be determined by the Contractor based on his/her review of field conditions, interpretation of the Contract Documents and experience. All pipe work shall be secured in place.

D. Sand bags: Sandbags shall consist of materials, which are resistant to ultraviolet radiation, tearing and puncture, and woven tightly enough to prevent leakage of fill material (i.e., sand, fine gravel, etc.).

E. Filter Bags: Per Section 31 25 00 Erosion and Sediment Control

F. Dewatering Sumps: Per Section 31 25 00 Erosion and Sediment Control

PART 3 – EXECUTION

3.01 INSTALLATION, OPERATION AND REMOVAL

A. Installation and Removal: Installation of piping, sand bags, sheeting and pump around shall be in accordance with the approved Erosion and Sediment Control Plan in the Contract Documents or as directed by the Owner or Owner's Representative. Unless otherwise specified on the Contract Documents, install diversion structures from upstream to downstream. The Contractor shall relocate the discharge pipe(s) as necessary to complete all work as shown on the Contract Documents at no additional expense to the Owner. Provide piping, sumps, sedimentation tanks, dewatering basins or non-woven dewatering bags as required by the Owner or Owner's Representative. The Contractor is responsible for ensuring water is adequately filtered or otherwise treated per State/Commonwealth, County, and City sediment control requirements before discharging into a stream or storm drain system. Contractor shall use filter bags and dewatering sumps where directed by the Contract Documents or directed by the Owner or Owner's Representative. Cost of filter bags and dewatering sumps are considered incidental to this item and will not be paid for separately. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, Contractor shall restore damaged structures and foundation soils at no additional expense to the Owner. Remove dewatering system from project site upon completion of construction activities related to the dewatering areas only with the approval of the Owner or the Owner’s Representative.

B. Pump-around Length and Stream Aquatics: In order to protect the existing benthic, fish and other aquatic organisms, the Contractor is not to exceed the pump-around work area limits as shown on the Contract Documents (usually less than 300 feet) without written authorization from the Owner or Owner’s Representative nor is he/she to operate the pumps beyond the time frames as specified on the Contract Documents. It is anticipated and necessary that base flow be passed back over work areas at night unless specifically called out as a "24 hour" dry work area on the Contract Documents. Fish trapped within "pockets" of water shall be removed by hand netting or sieving and shall be placed downstream of the work area or as directed by the Owner at the Contractor’s expense.

C. Disposal of Water: Dispose of water removed by dewatering in a manner that avoids sediment deposition, endangering public health, property, and portions of work under construction or completed.

D. Daily Work Area Pump-down: The Contractor is expected to pump down any flooded work areas prior to each day's work so that operations are "in the dry". If water removed from work areas is turbid, it shall be pumped first to a filter bag or other approved filtration device prior to this water re-entering the stream; see Section 31 25 00 Erosion and Sediment Control for more detail.

E. Hours of Operation: If pump operations occur between 5 PM and 7 AM, then the Contractor must have an employee on site at all times to monitor pumping operations.

F. Noise: Pumps utilized in the stream diversion must be in compliance with Local Noise Ordinances and if necessary, the Contractor will construct devices to muffle pump noise at no additional compensation. Should noise reduction be required, then noise-abatement dewatering shall be accomplished by the use of a “quiet” brand of critically silenced Dri-Prime Pump(s) manufactured by Godwin or approved equal. These quiet pumps shall be enclosed in 14-gauge sheet metal lined with 1-inch and 2-inch layers of polydamp acoustical sound deadening material to achieve a noise reduction to 69dBA at 30 feet. All exhaust pipes must be muffled.

G. Pump Line Placement: Any piping that crosses paved trails will have a wooden ramp at a slope of 1:20 (vertical: horizontal) for pedestrian and bike passage. A warning sign must also be placed in advance of the pipe crossing on both sides of trail.

H. Inspection: Contractor to inspect pipes regularly for leaks and repair as necessary. Repairs are considered incidental to this item and will not be paid for separately.

I. Elimination of Concentrated Flow Scour: All stream diversion outfalls will utilize a velocity reduction device such as a temporary riprap pad to prevent erosion.

END OF SECTION

SECTION 31 00 01
EARTHWORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment, and materials required to complete all work associated with excavation (including off-site borrow excavation), fill and backfill placement and compaction, testing of soil materials and compaction by an independent Materials Testing Consultant, constructing embankments, dewatering, construction of drainage layers, installing foundation and backfill aggregate, placing filter and separation fabrics, stockpiling topsoil and any excess suitable material, designing, installing, maintaining and removing excavation support systems, disposing of all excess and unsuitable materials, providing erosion and sedimentation control, encasing utility conduits, site grading, preparation of pavement and structure subgrades, and other related and incidental work as required to complete the work shown on the Drawings and as specified herein.

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be prevented to the maximum extent practicable.

D. Earthwork performed under this Contract shall be done in conformance with these specifications. Items and activities not addressed herein shall be subject to the limitations of the latest editions of the New York State Department of Transportation Standard Specifications. If there is a conflict between this specification and the NYSDOT Standard Specifications, the more conservative of the two shall take precedent.

E. Erosion and Sediment Control shall be performed in accordance with Section 31 25 00 of these specifications and with the latest edition of the New York State Standards and Specifications for Erosion and Sediment Control. If there is a conflict between this specification and the Erosion and Sediment Control Standards, the more conservative of the two shall take precedent.

F. All fill materials (soil, aggregate, topsoil, etc.) imported to the site and onsite materials to be reused as fill, backfill, or embankment shall be subjected to the testing requirements contained in Part 1.03 of this Section. The Contractor shall retain a Materials Testing Consultant who shall perform all testing. The test results shall be used to determine if a material meets the requirements included herein. The Contractor shall furnish all necessary samples for laboratory testing and shall provide assistance and cooperation during field tests. The Contractor shall plan their operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction.

G. Any costs for re-testing required as a result of failure to meet compaction requirements shall be borne solely by the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Divisions 02, 31,32, and 33 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Department of Transportation Standard Specifications, latest edition.

2. New York State Department Environmental Conservation, Standards and Specifications for Erosion and Sediment Control

3. New York State Environmental Conservation Law
   a. Freshwater Wetlands:
      — No disturbance to wetlands is authorized.
      — Employ measures sufficient to prevent contamination of the freshwater wetland by sediment, fuels, concrete leachate or any other pollutants associated with construction or construction procedures.

   b. Protection of Waters:
      — No modifications to the bed or banks of streams are authorized.
      — All instream work, as well as any work that may result in the suspension of sediment, is prohibited during the trout spawning and incubation period commencing October 1 and ending April 30.
      — No turbid water resulting from dewatering operations shall be discharged directly to or allowed to enter drainage swales or storm sewers. Such water shall be pumped to settling tanks and discharged to an upland vegetated area prior to any discharge to drainage swale or storm sewers. All other necessary measures shall be implemented to prevent any visible increase in turbidity or sedimentation downstream of the work site.

4. New York State Industrial Code, Part 23, “Protection in Construction, Demolition, and Excavation Operations.”

5. American Society for Testing and Materials (ASTM):

ASTM C127 Test for Specific Gravity and Absorption of Coarse Aggregate.
ASTM C136 Test for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D422 Particle Size Analysis of Soils.

ASTM D423 Test for Liquid Limit of Soils.

ASTM D424 Test for Plastic Limit and Plasticity Index of Soils.

ASTM C535	Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM D698	Standard Method of Test for the Moisture - Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12-inch (305 mm) Drop.
ASTM D1556	Test for Density of Soil in Place by the Sand-Cone Method.
ASTM D1557	Test for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lbs. (4.5 kg) Rammer and 18-inch (457 mm) Drop.
ASTM D2049	Test Method for Relative Density of Cohesionless Soils.
ASTM D2167	Test for Density of Soil in Place by the Rubber-Balloon Method.
ASTM D2216	Test for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
ASTM D2487	Test for Classification of Soils for Engineering Purposes.
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

a. ASTM D 6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

b. ASTM D 6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

c. ASTM D7929 – Standard Test Method for Particle Size Distribution of Fine-Grained Soils Using Hydrometer Analysis

1.04 SUBSURFACE CONDITIONS

A. Information on subsurface conditions is referenced under Division 01, General Requirements.

B. Attention is directed to the possible location of water pipes, sanitary pipes, storm drains, and other utilities located in the area of proposed excavation. In the event excavation activities disrupt service, the Contractor shall perform all repairs at no additional cost to the Owner. The Contractor shall contact Dig Safely New York at phone number 811 or 1-800-962-7962 to request an underground utility location mark-out at least two (2) working days, not including the day the request is called in, but no more than ten (10) working days prior to the beginning of excavation. The Contractor shall also contact and request utility location mark-out from buried utility owners with utilities on the project site that are not participants of Dig Safely New York.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Evidence the Contractor has a minimum of five (5) years of experience performing excavation and backfill in flood embankments similar in size to the work for this project.

2. Name and location of all material suppliers.

3. Certificate of compliance with the standards specified herein for each source of each material.

4. List of disposal sites for excess, waste, and unsuitable materials and all required permits for use of those sites.

5. Plans and cross sections of open cut excavations showing side slopes and limits of the excavation at grade.

6. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review and approval prior to any earthwork operations.

7. Samples of synthetic filter fabric and reinforced plastic membrane with manufacturer's certificates or catalog cuts stating the mechanical and physical properties. Samples shall be at least one (1) foot wide and four (4) feet long taken across the roll with the warp direction appropriately marked.

8. Construction drawings and structural calculations for any types of excavation support required. Drawings and calculations shall be sealed by a currently registered Professional Engineer in New York State.

9. Monitoring plan and pre-construction condition inspection and documentation of all adjacent structures, utilities, and roadways near proposed installation of excavation support systems and near areas where dewatering is required to facilitate construction.

10. A representative sample of the on-site or off-site source of each class of fill material weighing approximately 50 lbs. The sample shall be delivered to a location designated by the Engineer.

11. The Contractor shall be required to submit plans of open cut excavation for review by the Engineer before approval is given to proceed.

12. Submit excavation support installer qualifications with installation history.

13. Drawings and calculations on proposed excavation support systems sealed by a Professional Engineer currently registered in New York State in which the project is located.

14. Contractor shall also submit a monitoring plan developed by the excavation support design engineer.

15. Earthwork contractor qualifications.

16. All required permits and a list of disposal sites for excess and unsuitable materials within thirty (30) consecutive days after Notice to Proceed. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.

17. Except where borrow is to be obtained from a commercial source, a borrow source development, use, and reclamation plan jointly developed by the Contractor and the property owner prior to engaging in any land disturbing activity on the proposed source (other than material sampling that may be necessary). The Contractor's plan shall address the following

    a. <u>Drainage</u>: The source shall be graded to drain such that no water will collect or stand and a functioning drainage system shall be provided. If drainage is not practical, and the source is to serve as a pond, the minimum average depth below the water table shall be 4 feet or the source graded so as to create wetlands as appropriate, or as agreed to with the property owner

    b. <u>Slopes</u>: The source shall be dressed and shaped in a continuous manner to contours which are comparable to and blend in with the adjacent topography, but in no case will slopes steeper than 3:1 be permitted.

    c. <u>Erosion Control</u>: Except where borrow is to be obtained from a commercial source, the Contractor and the property owner shall jointly submit a Borrow Source Development, Use, and Erosion Control Plan to the appropriate State or Local permitting authority for approval and provide evidence of such to the Engineer for their approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

1.06 PRODUCT HANDLING

A. Soil and rock material shall be excavated, transported, placed, and stored in a manner so as to prevent contamination, segregation and excessive wetting. Materials which have become contaminated or segregated will not be permitted in the performance of the work and shall be removed from the site.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. The contractor shall be responsible for providing fill materials meeting the gradation requirements included herein.

B. All fill materials shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.

C. Bedding material installed above and below the water table shall meet the requirements of the New York State Department of Transportation Standard Specifications, latest edition.

D. Below-grade walls shall be backfilled with Select Fill.

E. When the excavated material from required excavations meets the requirements of Select Fill or Common Fill, but is replaced with off-site borrow material for the Contractor's convenience, the costs associated with such work and material shall be borne by the Contractor.

F. Where excavated material does not meet requirements for Select Fill or Common Fill, the Contractor shall furnish off-site borrow material meeting the specified requirements herein. Determination of whether the borrow material will be paid for as an extra cost will be made based on the contract documents.

G. Contractor may stockpile excavated material to be used as Select Fill, Common Fill, Drainage Fill or Topsoil on site in areas designated in the Contract Documents. Soil materials may be stockpiled as necessary to sort, segregate, test, and transfer the materials. Excess material and materials considered unsuitable for reuse by the Engineer shall be removed from the site for off-site disposal. No stockpiling of excavated material is allowed in a manner or location that would permit erosion and its subsequent sedimentation in wetlands or other natural areas.

2.02 SELECT FILL

A. Select fill shall be used where shown on the Contract Drawings.

B. Select fill shall not include particles or lumps larger than 3 inches.

C. Select fill used as backfill against walls shall not contain any rock larger than 1½ -inches.

D. Select fill shall consist of non-plastic materials classifying as GW, GW-GM, GP, SW, SW-SM, SP-SM, or SP per ASTM D-2487. Select fill shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.

E. Open-graded and dense-graded NYSDOT aggregates meeting the gradation requirements above may be used as Select Fill.

F. Select Fill to be used as pavement subbase material shall be NYSDOT Aggregate Base Course.

G. Select Fill shall be placed in 8-inch-thick lifts, with the exception of NYSDOT No. 57 aggregate, which may be placed in 12-inch-thick lifts.

H. Select Fill shall be compacted to not less than 95 percent of the maximum dry density obtainable by ASTM D 698 and does not contain unsuitable material.

I. Select Fill shall be compacted at a moisture content within +/- 4 percent of the optimum moisture content of the fill material in accordance with the ASTM D 698, Standard Proctor.

J. All materials used as Select Fill are subject to approval by the Engineer.

2.03 DRAINAGE FILL

A. Drainage Fill shall be used where shown on the Contract Drawings.

B. Drainage Fill shall consist of NYSDOT No. 57 aggregate.

2.04 COMMON FILL

A. Common Fill shall be used where shown on the Contract Drawings.

B. Common Fill shall consist of non-organic on-site soils classifying as CH, MH, CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW according to ASTM D 2487.

C. Common Fill shall be placed in 8-inch-thick loose lifts.

D. Common Fill shall be compacted to not less than 95 percent of the maximum dry density obtainable by ASTM D 698 and does not contain unsuitable material.

E. Common Fill shall be compacted at a moisture content within 20 percent of the optimum moisture content of the fill material in accordance with the ASTM D 698, Standard Proctor.

F. All material used as common fill is subject to approval by the Engineer. If there is insufficient suitable material onsite, import whatever additional material is required which conforms to the specifications, at no additional cost to the Owner.

G. Select Fill may be used as Common Fill, subject to approval by the Engineer. Select fill may be used as Common Fill at no change in the Contract Price.

2.05 TOPSOIL

A. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support health vegetation. It shall contain no substance potentially toxic to plant growth. All topsoil shall be tested by a recognized laboratory for the following criteria: Organic matter content shall not be less than 1.5% by weight. pH range shall be from 6.0 -7.5. If pH is less than 6.0, lime shall be added in accordance with test results or in accordance with the recommendations of the vegetative establishment practice being used. Soluble salts shall not exceed 500 ppm. If additional topsoil is needed, it must meet the standards stated above.

2.05 GEOTEXTILES

A. The Contractor shall provide geotextiles as indicated on the Contract Drawings and specified herein. The materials and placement shall be as indicated under Section 31 05 19 - Geotextiles.

PART 3 – EXECUTION

3.01 STRIPPING OF TOPSOIL

A. In all areas to be excavated, filled, or paved, the topsoil shall be stripped as indicated in Section 31 10 00 – Clearing, Grubbing and Site Preparation.

B. Topsoil may be stockpiled for subsequent reuse on site at locations shown on the Contract Drawings or designated by the Owner or Engineer. Topsoil shall be kept separated from other excavated materials and shall be piled free of roots and other undesirable materials. Topsoil shall not be stored in areas where it will interfere with surface drainage or with the conservation of trees, shrubs, and other vegetation to remain. No stockpile shall be placed within 50-feet of a pond, stream, wetland, or stormwater inlet.

3.02 EXCAVATION

A. All material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED EXCAVATION. Excavation shall include the removal of all soil, rock, weathered rock, rocks of all types, boulders, conduits, pipe, all other obstacles encountered, and all other obstacles shown to be removed within the limits of excavation shown on the Contract Drawings or specified herein. The cost of excavation shall be included in the Lump Sum Bid Price. Additional payment may be made for excavation of rock or large boulders (with a volume greater than one half (1/2) cubic yard) with approval by the Engineer.

B. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the Drawings or indicated by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. Refer to the drawings for specific location and placement of suitable excavated materials in the formation of embankments, backfill, and structural and roadway foundations. THE ENGINEER AND/OR MATERIALS TESTING CONSULTANT WILL DESIGNATE MATERIALS THAT ARE UNSUITABLE. The Contractor shall furnish off-site disposal areas for the unsuitable material. Where suitable materials containing excessive moisture are encountered above grade in cuts, the Contractor shall construct above grade ditch drains prior to the excavation of the cut material when in the opinion of the Engineer and/or materials testing consultant such measures are necessary to provide proper construction.

C. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such excavation support, pumping and drainage as may be required. Excavation shall be made in accordance with the grades and details shown on the Drawings and as specified herein.

D. Excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade or damage of adjacent areas. Excavation requirements and slopes shall be as indicated in the Drawings.

E. The Contractor shall intercept and collect surface runoff both at the top and bottom of cut slopes. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the Drawings or as may be indicated by the Engineer. Concurrent with the excavation of cuts the Contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the Drawings or designated by the Engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations. No rock or boulders shall be left in place which protrude more than 1 foot within the typical section cut slope lines, and all rock cuts shall be cleaned of loose and overhanging material. All protruding roots and other objectionable vegetation shall be removed from slopes.

F. It is the intent of these Specifications that all structures shall bear on an aggregate base, crushed stone or screened gravel bedding placed to the thickness shown on the Drawings, specified in these Specifications, or not less than 6-inches. Bedding for process piping shall be as specified in Section 40 05 00 – Basic Mechanical Requirements, or as shown on the Drawings.

G. The bottom of all excavations for structures and pipes shall be examined by the Engineer and/or materials testing consultant for bearing value and the presence of unsuitable material. If, in the opinion of the Engineer and/or materials testing consultant, additional excavation is required due to the low bearing value of the subgrade material, or if the in place soils are soft, yielding, pumping or wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, and/or crushed stone or screened gravel as indicated by the Engineer. Payment for such additional work ordered by the Engineer shall be made as an extra by a Change Order in accordance with the General Conditions and Division 01. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.

H. All cuts shall be brought to the grade and cross section shown on the Drawings, or established by the Engineer, prior to final inspection and acceptance by the Engineer.

I. Slides and over-breaks which occur due to negligence, carelessness or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as indicated by the Engineer at no additional cost to the Owner. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed.

J. Where the excavation exposes sludge, sludge contaminated soil or other odorous materials, the Contractor shall cover such material at the end of each workday with a minimum of 6 inches and a maximum of 24-inches of Common fill. The work shall be an odor abatement measure and the material shall be placed to the depth deemed satisfactory by the Engineer for this purpose.

3.03 EXCAVATION SUPPORT

A. The Contractor shall furnish, place, and maintain such excavation support which may be required to provide safe working conditions and support sides of excavation or to protect structures, pipes, and utilities from possible. The Contractor shall be exclusively responsible for maintaining safe working conditions and structure integrity without overstressing or damaging existing structures, pipes, and utilities resulting from the Contractor temporarily placing, moving, or removing loads on or adjacent to existing structures, pipes, and utilities. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, the Engineer may order additional supports put in at the expense of the Contractor. The Contractor shall be responsible for the adequacy of all supports used and for all damage resulting from failure of support system or from placing, maintaining and removing the support system.

B. The selection of and design of any proposed excavation support systems is exclusively the responsibility of the Contractor. Contractor shall submit drawings and calculations to the Engineer on the proposed systems sealed by a Professional Engineer currently registered in the in the State of New York.

C. The excavation support system shall be installed by a specialized contactor with a minimum of five (5) years’ experience installing the type of excavation support system proposed.

D. The Contractor shall exercise caution in the installation and removal of supports to ensure no excessive or unusual loadings or vibrations are transmitted to any new or existing structure. The Contractor shall promptly repair at their expense any and all damage that can be reasonably attributed to installation or removal of excavation support system.

E. Contractor shall monitor movement and vibration in the excavation support systems as well as movement and vibration at adjacent structures, utilities and roadways near excavation supports. Contractor shall submit a monitoring plan developed by the excavation support design engineer. All pre-construction condition assessment and documentation of adjacent structures on-site and off-site shall be performed by the Contractor. If any sign of distress such as cracking or movement occurs in any adjacent structure, utility or roadway during installation of supports, subsequent excavation, service period of supports, subsequent backfill and construction, or removal of supports, Engineer shall be notified immediately. The Contractor shall be exclusively responsible for repair of any damage to any roadway, structure, utility, pipes, etc. both on-site and off-site, as a result of their operations.

F. All excavation supports shall be removed upon completion of the work except as indicated herein. The Engineer may permit supports to be left in place at the request and expense of the Contractor. The Engineer may order certain supports left permanently in place in addition to that required by the Contract. The cost of the materials so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra by a Change Order in accordance with the General Conditions and Division 01. Vibrations of new and existing structures shall be considered when the Contractor decides whether to remove excavation supports or leave them in place.

G. Any excavation supports left in place shall be cut off at least five (5) feet below the finished ground surface or as directed by the Engineer.

3.04 PROTECTION OF SUBGRADE

A. To minimize the disturbance of bearing materials and provide a firm foundation, the Contractor shall comply with the following requirements:

1. Use of heavy rubber tired construction equipment shall not be permitted on the final subgrade unless it can be demonstrated that drawdown of groundwater throughout the entire area of the structure is at least 3 feet below the bottom of the excavation (subgrade). Even then, the use of such equipment shall be prohibited should subgrade disturbance result from concentrated wheel loads.

2. Subgrade soils disturbed through the operations of the Contractor shall be excavated and replaced with compacted select fill or crushed stone at the Contractor's expense as indicated by the Engineer.

3. The Contractor shall provide positive protection against penetration of frost into materials below the bearing level during work in winter months. This protection can consist of a temporary blanket of straw or salt hay covered with a plastic membrane or other acceptable means.

3.05 PROOF-ROLLING

A. The subgrade of all structures and all areas that will support pavements or select fill shall be proof-rolled. After stripping of topsoil, excavation to subgrade and prior to placement of fills, the exposed subgrade shall be carefully inspected by probing and testing as needed. Any topsoil or other organic material still in place, frozen, wet, soft, or loose soil, and other undesirable materials shall be removed. The exposed subgrade shall be proof-rolled with a heavily loaded tandem-wheeled dump truck to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed shall be removed and replaced with an approved compacted material, as directed by the Materials Consultant.

3.06 DEWATERING

A. See Section 31 23 19 for dewatering specifications.

3.07 FILL OR EMBANKMENTS

A. Contractor shall perform the construction of fill or embankments in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. The operation of removing excavation material from any cut and the placement of embankment in any fill shall be a continuous operation to completion unless otherwise permitted by the Engineer.

B. Subgrades upon which fill or embankments are to be constructed shall be stripped of topsoil, organic material, rubbish and other extraneous materials. After stripping and prior to placing fill or embankment material, the Contractor shall compact the top 12-inches of in place soil as specified under Paragraph 3.09, COMPACTION.

C. Any soft or unsuitable materials revealed before or during placement fill or embankment placement shall be removed as indicated by the Engineer and/or materials testing consultant and replaced with select fill and compacted as required.

D. Fill subgrades on which fill or embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the embankment with the existing surface. The fill or embankment soils shall be as specified under Part 2 - Products, and shall be deposited and spread in successive, uniform, approximately horizontal layers. The loose thickness of each lift shall not exceed the thickness for each fill type noted in Paragraph 3.09, COMPACTION.

E. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. Fill or embankment subgrades shall be properly drained at all times and kept free of flowing or ponding water, snow, ice and frozen soils. Saturated soils, snow, ice, or frozen soils shall be removed as recommended by the Engineer.

F. Each layer of the embankment shall be thoroughly compacted to the density specified under Paragraph 3.09, COMPACTION.

G. The embankment or fill material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Moisture conditions and manipulation of the fill or embankment material, when necessary, shall be performed to maintain a uniform moisture content throughout the layer. Should the material be too wet or too dry to permit proper compaction, earthwork operations shall be delayed until the material is adequately moisture conditioned. Samples of all fill or embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

H. Where fill or embankments materials are to be placed and compacted on sloped subgrades steeper than 4:1 shall be benched. Benches shall be at least 6-feet wide.

I. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portions of the embankments and the other material which meets the requirements for select fill shall be incorporated into the formation of the embankments. Stones or fragmentary rock larger than 4inches in their greatest dimension will not be allowed within the top 6inches of the final grade. Stones, fragmentary rock, or boulders larger than 12inches in their greatest dimension will not be allowed in any portions of embankments and shall be disposed of by the Contractor as indicated by the Engineer. When rock fragments or stone are used in embankments, the material shall be brought up in layers as specified or directed and every effort shall be exerted to fill the voids with finer material to form a dense, compact mass which meets the densities specified for embankment compaction.

3.08 BACKFILLING

A. All structures and pipes shall be backfilled with the type of materials shown on the Drawings and specified herein. Fill placed as structure or utility backfill shall be deposited in successive, uniform, approximately horizontal lifts. The thickness of each lift shall not exceed the requirements of Paragraph 3.09, COMPACTION.

B. Each lift of fill placed backfill shall be thoroughly compacted to the density specified for each type of fill included in Paragraph 3.09, COMPACTION.

C. Where excavation support is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when supports are removed. If significant volumes of soil cannot be prevented from clinging to the extracted supports, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that supports will be installed in similar soil conditions or employ other appropriate means to prevent loss of support.

D. Backfill against concrete or masonry structure shall not be performed until the Work has been reviewed and backfilling permitted. Backfill against walls shall also be deferred until the structural slab for floors above the top fill line have been placed and attained design strength or earlier at the discretion of the Engineer. Partial backfilling against adequately braced wall may be considered by the Engineer on an individual situation basis. Where walls are to be waterproofed, all Work shall be completed and membrane materials dried or cured according to the manufacturer's instructions before backfilling.

E. Backfill against tanks and other structures which are to retain liquids shall not be performed until leakage tests are completed and accepted by the Engineer in accordance with the Section entitled "Water Tightness Testing".

3.09 COMPACTION

A. The Contractor shall compact embankments, backfill, crushed stone, aggregate base, and in place subgrade in accordance with the requirements of this Section. The densities specified herein refer to percentages of maximum density as determined by the noted test methods. Compaction of materials on the project shall be in accordance with the following schedule:

	Density % Standard Proctor (D 698)	**Density % Mod. Proctor (D 1557)**	**Max. Lift Thickness as Compacted Inches**
Embankments Beneath Structures, Roadways, and Sidewalks*	98	95	8
Common Fill Areas	95	95	8
Backfill Around Structures	95	95	8
Backfill in Pipe Trenches	95	95	8
Crushed Stone Beneath Structures	**	**	12
Select Sand	98	92	8
Aggregate Base Course (ABC) Beneath Structures, Roadways, and Sidewalks	**	**	8
Crushed Stone Backfill	**	**	12
Crushed Stone Pipe Bedding	**	**	12
In Place Subgrade Beneath Structures, Roadways, and Sidewalks	98	92	Top 12-inches

* Embankments beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope.
** The aggregate shall be compacted to a degree acceptable to the Engineer by use of a vibratory compactor and/or crawler tractor.

B. Compaction Near Existing Structures

1. Vibratory equipment shall not be used with 25 feet of any existing structure.

2. Within 25 feet of any existing structure, non-vibratory compaction equipment such as a drum roller with a maximum weight of 4 tons should be used. Within 5 feet of any existing structure, a walk behind vibratory sled or roller shall be used.

C. Field density tests will be made by the Materials Testing Consultant to determine if the specified densities have been achieved, and these tests shall be the basis for accepting or rejecting the compaction. In-place density tests will be performed in accordance with ASTM D 1556, ASTM D 1557, or ASTM D 6938. The Engineer, in conjunction with the Materials Testing Consultant, will be the judge as to which test method will be the most appropriate. Failure to achieve the specified densities shall require the Contractor to recompact the material or remove it as required. The Contractor shall, if necessary, increase the compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the thickness of the layers. The Contractor shall adjust the moisture contents of the soils to bring them within the optimum range by drying them or adding water as required.

D. Testing will be performed as frequently as deemed necessary by the Engineer and/or Materials Testing Consultant. As a minimum, one in place density test shall be performed for each 1000 cubic yards of embankment placed and 500 cubic yards of backfill placed or one test performed each day for either or as directed by the Engineer or recommended by Material Testing Consultant.

3.10 VIBRATION MONITORING

A. Vibration monitoring shall be performed at nearby structures when compaction work is ongoing. A single monitoring point using vibration monitoring equipment capable of detecting velocities of 0.1 inch/second or less and survey measurements shall be used for vibration monitoring at each of the nearest structures. An elevation measurement on nearby structures shall be taken before compaction work starts, and then at least twice a day during the work with one reading taken at the conclusion of the day's operations. Elevation measurements shall be recorded to an accuracy of 0.005 foot. If at any time the Contractor detects settlement or heave of 0.005-feet or more, or vibration levels of 1.0 inch/second or more, the vibratory compaction shall be stopped immediately, and the Engineer notified.

3.11 REMOVAL OF EXCESS AND UNSUITABLE MATERIALS

A. The Contractor shall remove and dispose of off-site all excess and unsuitable materials. Within thirty (30) consecutive days after Notice to Proceed, the Contractor shall submit to the Engineer for review all required permits and a list of disposal sites for the unsuitable materials. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.

B. All excess and unsuitable materials shall be disposed of in locations and under conditions that comply with federal, state/commonwealth and local laws and regulations.

C. The Contractor shall obtain an off-site disposal area prior to beginning demolition or excavation operations.

D. All excess and unsuitable materials shall be hauled in trucks of sufficient capacity and tight construction to prevent spillage. Trucks shall be covered to prevent the propagation of dust.

E. The Contractor is responsible for procuring and providing all labor and materials for testing and sampling excess and unsuitable materials as required by their applicable disposal site.

F. When all excess and unsuitable material disposal operations are completed, the Contractor shall leave the disposal sites in a condition acceptable to the Owner and Owner(s) of the disposal site(s).

3.12 BORROW EXCAVATION

A. Description

1. The work covered by this section consists of the excavation of approved material from borrow sources and the hauling and utilization of such material as required on the Drawings or directed by the Engineer. It shall also include the removing, stockpiling, and replacement of topsoil on the borrow source; the satisfactory disposition of material from the borrow source which is not suitable for use; and the satisfactory restoration of the borrow source and haul roads to an acceptable condition upon completion of the work.

2. Borrow excavation shall not be used before all available suitable unclassified excavation has been used for backfilling and incorporated into the embankments.

B. Coordination with Seeding Operations

1. The Contractor shall coordinate the work covered by this section with the construction of embankments and area fill so the requirements of Section 32 90 00 – Final Grading and Landscaping are met.

C. Borrow Materials

1. All material shall meet the requirements of Section 2 for Select Fill or shall meet the requirements of Common Fill and classify as SM or coarser according to ASTM D 2487.

D. Construction Methods

1. General

a. The surface of the borrow area shall be thoroughly cleared and grubbed and cleaned of all unsuitable material including all organics, topsoil, etc., before beginning the excavation. Disposal of material resulting from clearing and grubbing shall be in accordance with Section 31 10 00 – Clearing, Grubbing, and Site Preparation.

b. Each borrow operation shall not be allowed to accumulate exposed, erodible slope area in excess of 1 acre at any one given time without the Contractor's beginning permanent seeding and mulching of the borrow source or other erosion control measures as may be approved by the Engineer.

c. The topsoil shall be removed and stockpiled at locations that will not interfere with the borrow operations and that meet the approval of the Engineer. Temporary erosion control measures shall be installed as necessary to prevent the erosion of the stockpile material. Once all borrow material has been removed from the source or portion thereof, the stockpiled topsoil shall be spread uniformly over the source.

d. Where it is necessary to haul borrow material over existing roads, the Contractor shall use all necessary precautions to prevent damage to the existing roads. The Contractor shall also conduct hauling operations in such a manner as to not interfere with the normal flow of traffic and shall always keep the traffic lanes free from spillage.

2. Owner Furnished Sources

a. Where borrow sources are furnished by the Owner the location of such sources will be as designated on the Drawings or as directed by the Engineer.

b. The Owner will furnish the necessary haul road right-of-way at locations designated by the Engineer. All haul roads required shall be built, maintained, and when directed by the Engineer, obliterated, at no cost to the Owner. Where the haul road is to be reclaimed for cultivation the Contractor shall plow or scarify the area to a minimum depth of 8 inches, or to the depth requested by the property owner.

c. The borrow sources shall be left in a neat and presentable condition after use. All slopes shall be smoothed, rounded, and constructed not steeper than 3:1. Where the source is to be reclaimed for cultivation the source shall be plowed or scarified to a minimum depth of 8 inches, disc harrowed, and terraces constructed. The source shall be graded to drain such that no water will collect or stand, and a functioning drainage system shall be provided.

d. All sources shall be seeded and mulched in accordance with Section 32 90 00 – Final Grading and Landscaping.

3. Contractor Furnished Sources

a. Prior to the approval of any off-site borrow source(s) developed for use on this project, the Contractor shall obtain certification from the State/Commonwealth Historic Preservation Officer of the State/Commonwealth Department of Cultural Resources certifying that the removal of the borrow material from the borrow source(s) will have no effect on any known district, site building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places. A copy of this certification shall be furnished to the Engineer prior to performing any work on the proposed borrow source.

b. The approval of borrow sources furnished by the Contractor shall be subject to the following conditions:

1) The Contractor shall be responsible for acquiring the right to take the material and any rights of access that may be necessary; for locating and developing the source; and any clearing and grubbing and drainage ditches necessary.

a) Such right shall be in writing and shall include an agreement with the Owner that the borrow source may be dressed, shaped, seeded, mulched, and drained as required by these Specifications after all borrow has been removed.

2) The Contractor and the property owner shall jointly submit a borrow source development, use, and reclamation plan to the Engineer, as described in Paragraph 1.05, for approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

4. Maintenance

a. During construction and until final acceptance the Contractor shall use any methods approved by the Engineer which are necessary to maintain the work covered by this Section so that the work will not contribute to excessive soil erosion.

END OF SECTION

SECTION 31 05 16
AGGREGATE MATERIALS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment and materials required to complete all work associated with the installation of aggregate material beneath foundations, as backfill and as roadway subgrades and other related and incidental work as required to complete the work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 42 00 – References

B. Section 31 00 01 – Earthwork

C. Section 31 25 00 – Erosion and Sedimentation Control

D. Section 32 10 00 – Paving and Surfacing

E. Section 33 41 13 – Foundation Drainage Systems

F. Section 32 90 00 – Final Grading and Landscaping

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New York State Department of Transportation Standard Specifications

2. ASTM C 127 – Test for Specific Gravity and Absorption of Coarse Aggregate.

3. ASTM C 136 – Test for Sieve Analysis of Fine and Coarse Aggregates.

4. ASTM C 535 – Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.04 SUBMITTALS

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A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Materials gradation and certification.

2. ASTM C127, ASTM C136, and ASTM C535 test results

1.05 DEFINITIONS

A. Unsuitable material: vegetation, muck, coal, sludge, refuse, construction debris, plastic, concrete, bricks, rubble, hazardous waste as defined by 40 CFR 261.3, soft unstable materials, mud, frozen material, organic material including peat, ash, and topsoil, and other deleterious matter designated by the Engineer. Contaminated materials may be considered unsuitable at the discretion of the Engineer.

PART 2 – PRODUCTS

2.01 CRUSHED STONE

A. Crushed stone shall meet the following gradation requirements and shall consist of durable crushed rock or durable crushed gravel stone and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter or material:

U.S. Standard Sieve Size	Percent Finer by Weight
1 in.	100
3/4 in.	90-100
1/2 in.	10-50
3/8 in.	0-20
No. 4	0-5
No. 200	0-1

NOTE: NYSDOT Type B-3 material may also be used as crushed stone.

2.02 GRANULAR FILL

A. Granular fill shall meet the following gradation requirements and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter:

U.S. Standard Sieve Size	Percent Finer by Weight
2/3 of the loose lift thickness	100
No. 10	30-95
No. 40	0-70
No. 200	*0-15 *0-8 where used behind walls

NOTE: NYSDOT Type B-2 material may also be used as granular fill.

2.03 SAND-GRAVEL

A. Sand-gravel shall meet the following gradation requirements and shall consist of durable sand and gravel and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter or material:

U.S. Standard Sieve Size	Percent Finer by Weight
3 in.	100
1/2 in.	50-85
No. 4	40-75
No. 40	10-35
No. 200	0-8

NOTE: NYSDOT Type B-3 material may also be used as sand-gravel.

2.04 DRAINAGE STONE

A. Drainage stone shall meet the requirements of Section 703-02 of the NYSDOT Standard Specifications for materials and gradation. The Contractor shall match the requirements of No. 3A stone found in Table 703-4 and below:

U.S. Standard Sieve Size	Percent Finer by Weight
2 in.	100
1 1/2 in.	90-100
1 in.	0-15

PART 3 – EXECUTION

3.01 CRUSHED STONE AND LIGHTWEIGHT FILL

A. Contractor shall install crushed stone and screened gravel in accordance with the NYSDOT Standard Specifications and as indicated in the Contract Documents.

1. Unless otherwise stated herein or shown on the Drawings, all mat foundations (bottom slabs) for the proposed structures shall have a blanket of No. 67 stone 6-inches thick maximum. The blanket shall extend a minimum of 12 inches beyond the extremities of the mat.

2. For subgrade preparation at structures and structural fill, the foundation material

shall be specified on Drawings; otherwise, crushed stone or screened gravel shall be used.

3. For underdrains, pipe bedding, and drainage layers beneath structures, the coarse aggregate shall meet the requirements of 703-2 and 703-3 as defined by NYSDOT Standard Specifications.

3.02 STOCKPILING

A. Stockpile materials on site within the site limits at locations indicated designated by Engineer.

B. Stockpile differing materials separately to prevent mixing.

C. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

D. Stockpile Cleanup: Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

3.03 COMPACTION

A. Refer to Section 31 00 01 Earthwork for compaction requirements related to crushed stone, sand-gravel and crushed stone.

END OF SECTION

SECTION 31 05 19
GEOTEXTILES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all Geotextiles, including all necessary and incidental items, as detailed or required for the Contractor to complete the installation in accordance with the Drawings and these Specifications.

B. For the location of each type of Geotextile see the Drawings.

1.02 REFERENCES

A. ASTM Standards

1. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles

2. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

3. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles

4. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. AASHTO Standards

1. AASHTO M 288-06 (2011) Geotextile Specification for Highway Applications

1.03 SUBMITTALS

A. Prior to shipping to the site, the Contractor shall submit to the Engineer two copies of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for each type of Geotextile. The Supplier shall also submit three Geotextile samples of each product, 1 yard square each, seamed and unseamed as appropriate, with the mill certificate for each Geotextile type supplied. The mill certificate or affidavit shall attest that the Geotextile meets the chemical, physical and manufacturing requirements stated in the specifications. The samples shall be labeled with the manufacturer's lot number, machine direction, date of sampling, project number, specifications, manufacturer and product name.

B. The Engineer shall be furnished copies of the delivery tickets or other acceptable receipts as evidence for materials received that will be incorporated into construction.

PART 2 – MATERIALS

2.01 MATERIALS

A. Filter Geotextile shall be a minimum 6-ounce per square yard (nominal) nonwoven needle punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The Geotextiles shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10. The Geotextiles shall have a minimum threshold water head of 0.25-inches in the "as received" condition.

   1. Filter Geotextile shall have a Survivability Class of Class 1 or 2 in accordance with AASHTO M288, unless otherwise specified herein.

B. Cushion Geotextile shall be a minimum 16-ounce per square yard nonwoven needle punched synthetic fabric consisting of continuous filament or staple polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The Geotextiles shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10.

   1. Cushion Geotextile shall have a Survivability Class of Class 1 in accordance with AASHTO M288.

C. Type I Separator Geotextile shall be a minimum 8-ounce per square yard (nominal) nonwoven needle punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene manufactured in a manner accepted by the Engineer and the Owner. The Geotextiles shall be inert and unaffected by long term exposure to chemicals or liquids with a pH range from 3 to 10.

   1. Type I Separator Geotextile shall have a Survivability Class of Class 1 or 2 in accordance with AASHTO M288, unless otherwise specified herein.

D. Type II Separator Geotextile shall be a woven slit film or monofilament synthetic fabric consisting of polyester or polypropylene in a manner approved by the Engineer. Geotextile shall be treated to resist degradation due to exposure to ultraviolet light.

   1. Type II Separator Geotextile shall have a Survivability Class of Class 1 in accordance with AASHTO M288, unless otherwise specified herein.

E. All Geotextiles shall conform to the properties listed using the test methods listed in Table 1. The Contractor shall be responsible for timely submittals of all confirmation test data for Geotextiles.

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PART 3 – EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

A. During all periods of shipment and storage, all Geotextiles shall be protected from direct sunlight, temperature greater than 140°F water, mud, dirt, dust, and debris.

B. To the extent possible, the Geotextile shall be maintained wrapped in heavy-duty protective covering until use. Geotextile delivered to the project site without protective covering shall be rejected. After the protective covering has been removed, the Geotextile shall not be left uncovered for longer than fourteen (14) days, under any circumstances.

C. The Owner shall approve the shipping and delivery schedule prior to shipment. The Owner shall designate the on-site storage area for the Geotextiles. Unloading and storage of Geotextiles shall be the responsibility of the Contractor.

D. Geotextiles that are damaged during shipping or storage shall be rejected and replaced at Contractor expense.

3.02 QUALITY ASSURANCE CONFORMANCE TESTING

A. At the option of the Engineer representative samples of Geotextiles shall be obtained and tested by the Engineer to assure that the material properties conform to these Specifications. Conformance testing shall be conducted by the Engineer and paid for by the Owner.

B. Conformance testing shall be completed at a minimum frequency of one sample per 100,000 square feet of Geotextile delivered to the project site. Sampling and testing shall be as directed by the Engineer.

C. Conformance testing of the Geotextiles shall include but not be limited to the following properties:

1. Mass Per Unit Area (ASTM D5261)

2. Grab Tensile Strength (ASTM D4632)

3. Trapezoidal Tear (ASTM D4533)

4. Puncture Resistance (ASTM D6241)

D. The Engineer may add to, remove or revise the test methods used for determination of conformance properties to allow for use of improved methods.

E. All Geotextile conformance test data shall meet or exceed requirements outlined in Table 1 of these Specifications for the particular category of Geotextile prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Engineer.

F. Each roll of Geotextile will be visually inspected by the Engineer or his representative. The Engineer reserves the right to sample and test at any time and reject, if necessary, any material based on visual inspection or verification tests.

G. A Geotextile that is rejected shall be removed from the project site and replaced at the Contractor's expense. Sampling and conformance testing of the Geotextile supplied as replacement for rejected material shall be performed by the Engineer at Contractor's expense.

3.03 INSTALLATION

A. Geotextiles shall be placed to the lines and grades shown on the Drawings. At the time of installation, the Geotextile shall be rejected by the Engineer if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.

B. It is the intent of these Specifications that Geotextiles used to protect natural drainage media be placed the same day as the drainage media to prevent soil, sediment or windblown soils to make contact with the drainage media.

C. The Geotextiles shall be placed smooth and free of excessive wrinkles. Geotextiles shall conform to and be in contact with the approved subgrade.

D. When the Geotextiles are placed on slopes, the upslope fabric portion shall be lapped such that it is the upper or exposed Geotextile.

E. Geotextiles shall be temporarily secured in a manner accepted by the Engineer prior to placement of overlying materials.

F. In the absence of specific requirements shown on the Drawings, the following shall be used for overlaps of adjacent rolls of Geotextile:

Geotextile Type / Application	Overlap of Adjacent Rolls(1) (Inches)	Transverse End Overlap (Inches)
Filter Geotextile	6 min	12 min
Cushion Geotextile	12 min	12 min
Separator - Roadway Applications	12 min	24 min
Separator - Slope Protection	18 min	24 min
Separator Geotextile	12 min	18 min

(1) Overlaps may be reduced if adjacent panels are sewn or heat bonded where approved by the Engineer.

G. Any Geotextile that is torn or punctured shall be repaired or replaced as directed by the Engineer by the Contractor at no additional cost to the Owner. The repair shall consist of a patch of the same type of Geotextile placed over the failed areas and shall overlap the existing Geotextile a minimum of 12-inches from any point of the rupture.

H. Any Geotextile that is subjected to excessive sediment buildup on its surface during construction shall be replaced by the Contractor prior to placement of overlying material.

Table 1: Minimum Required Geotextile Properties*

Geotextile Property	Filter Geotextile	Cushion Geotextile	Type I Separator Geotextile	Type II Separator Geotextile
Geotextile Construction	Nonwoven Needle punched	Nonwoven Needle punched	Nonwoven Needle punched	Woven
Ultraviolet Resistance, (500 hrs.) ASTM D7238, Average % Strength Retention	70	70	70	70
Grab Tensile Strength (lbs.), ASTM D4632	120	340	160	315
Grab Tensile elongation (%) ASTM D4632	50	50	50	15
Trapezoid Tear Strength (lbs) ASTM D4533	50	155	60	120
Apparent Opening Size (AOS), (mm), ASTM D4751	0.212	N/A	0.212	0.425
Permittivity at 50 mm constant head (sec^{-1}), ASTM D4491	0.5	N/A	1.5	0.1
CBR Puncture Strength, ASTM D6241 (lb)	340	1100	410	900

* MINIMUM AVERAGE ROLL VALUE (MARV)

END OF SECTION

SECTION 31 10 00

CLEARING, GRUBBING, AND SITE PREPARATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Includes all labor, material, equipment and appliances required for the complete execution of any additions, modifications, or alterations to existing building(s) and new construction work as shown on the Drawings and specified herein.

B. Principal items of work include:

1. Notifying all authorities owning utility lines running to or on the property. Protecting and maintaining all utility lines to remain and capping those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.

2. Clearing the site within the Contract Limit Lines, including removal of grass, brush, shrubs, trees, loose debris and other encumbrances except for trees marked to remain.

3. Boxing and protecting all trees, shrubs, lawns and the like within areas to be preserved. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.

4. Repairing all injury to trees, shrubs, and other plants caused by site preparation operations shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.

5. Removing topsoil to its full depth from designated areas and stockpiling on site where directed by the Engineer for future use.

6. Disposing from the site all debris resulting from work under this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sedimentation Control

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS 082905

A. New York State, Title 6 Department of Environmental Conservation, Chapter X Division of Water Resources.

1.04 STREET AND ROAD BLOCKAGE

A. Closing of streets and roads during progress of the work shall be in compliance with the requirements of the Owner and other authorities having jurisdiction. Access shall be provided to all facilities remaining in operation.

1.05 PROTECTION OF PERSONS AND PROPERTY

A. All work shall be performed in such a manner to protect all personnel, workmen, pedestrians and adjacent property and structures from possible injury and damage.

B. All conduits, wires, cables and appurtenances above or below ground shall be protected from damage.

C. Provide warning and barrier fence where shown on the Drawings and as specified herein.

PART 2 – EXECUTION

2.01 CLEARING OF SITE

A. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shall be cleared and grubbed.

B. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, sanitary landfill material, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas. Prior to the start of construction, the Contractor shall survey the entire Contract site and shall prepare a plan which defines the areas to be cleared and grubbed, trees to be pruned, extent of tree pruning, and/or areas which are to be cleared but not grubbed. This plan shall be submitted to the Engineer for approval. Should it become necessary to remove a tree, bush, brush or other plants adjacent to the area to be excavated, the Contractor shall do so only after permission has been granted by the Engineer.

C. Excavation resulting from the removal of trees, roots and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 31 00 01 – Earthwork.

D. Unless otherwise shown or specified, the Contractor shall clear and grub a strip at least 15-ft. wide along all permanent fence lines installed under this Contract.

E. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, are too close to the work to be maintained or have become damaged due to the Contractor's operations.

2.02 STRIPPING AND STOCKPILING EXISTING TOPSOIL

A. Erosion and sedimentation control measures shall be installed as per the Federal, State or Locally approved Erosion and Sedimentation Control Plan for the project and Specification Section 31 25 00 – Erosion and Sedimentation Control before any stripping and stockpiling of topsoil can occur.

B. Existing topsoil and sod on the site within areas designated on the Drawings shall be stripped to 12-inches or whatever depth it may occur and stored in locations directed by the Engineer. If topsoil is not stored, Contractor shall provide topsoil for restoration as needed.

C. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling the topsoil.

D. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

2.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks and other perishable materials to a depth of at least 6-inches below ground surfaces.

B. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

2.04 DISPOSAL OF MATERIAL

A. All debris resulting from the clearing and grubbing work shall be disposed of offsite by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed by the Engineer for reuse in this Project or removal by others.

B. Burning of any debris resulting from the clearing and grubbing work will not be permitted at the site.

C. Contractor is prohibited from disposal of material onsite or the areas directly surrounding the project site.

2.05 WARNING AND BARRIER FENCE

A. The fence shall be made of a visible, lightweight, flexible, high strength polyethylene material. The fence shall be Guardian Visual Barrier as manufactured by TEMAX, or equal.

B. Physical Properties

Fence	
Color	International Orange
Roll Size	4' x 100'
Roll weight	9 lbs.
Mesh opening	1-3/4" x 1-3/4"
Posts	
ASTM Designation:	ASTM 702
Length:	6 feet long (T-Type)
Weight:	1.25 #/Foot (min)
Area of Anchor Plate:	14 Sq. In.

C. Drive posts 18 inches into ground every 8'. Wrap fence material around first terminal post allowing overlap of one material opening. Use metal tie wire or plastic tie wrap to fasten material to itself at top, middle and bottom. At final post, cut with utility knife or scissors at a point halfway across an opening. Wrap around and tie at final post in the same way as the first post.

D. Use tie wire or tie wrap at intermediate posts and splices as well. Thread ties around a vertical member of the fence material and the post and bind tightly against the post. For the most secure fastening, tie at top, middle and bottom. Overlap splices a minimum of four fence openings, tie as above, fastening both edges of the fence material splice overlap.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Design, ffurnish all labor, materials, and equipment, and perform all work necessary to lower and control the groundwater levels and hydrostatic pressures to permit all excavations and construction to be performed in dry and stable conditions. The work shall include the following:

1. Design dewatering system, including engineering analysis by a qualified New York State licensed Professional Engineer.

2. Testing, operation, maintenance, supervision, rewatering, and final dismantling and removal from the site of the dewatering system.

3. Compliance with all regulations relating to this work, including water discharge and sediment/debris disposal. The Contractor’s dewatering approach shall not be allowed to exceed the maximum daily discharge, pretreatment scheme, or point of discharge permitted by the project permit applications without prior approval from the Engineer and Agencies granting permit authority.

4. The diversion, collection, and removal of all ice, snow and surface runoff from the work areas, and removal of groundwater from new excavations to permit construction in the dry.

5. Coordinate with the work requiring dewatering including Excavation, Support of Excavation (SOE), Waterproofing and Foundation Construction.

6. The cost of any replacement or rehabilitation of the subgrade or structures damaged due to dewatering system failures, or Contractor negligence.

7. Use of chloride-based deicing is not allowed on this project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Division 01 and Division 02 of these Specifications.

1.03 REFERENCE SPECIFICATIONS CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents to the extent that the provisions therein are not in conflict with the requirements of this Section.

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1. ASTM D1556 – Density of soil in place by the Sand Cone Method.

2. ASTM D2167 – Density of soil in place by the Rubber Balloon Method.

3. Bureau of Reclamation – Groundwater Manual Sediment Test by Imhoff Cone.

4. New York State Pollution Discharge Elimination System (SPDES) Permit.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures:

1. Dewatering Qualification Data per Article 1.05.B.

2. Existing Conditions: Using photographs, show the existing conditions of all adjacent construction and site improvements per Article 3.01.C.

3. Shop Drawings indicating the following:

    a. Plans showing the methods and location of dewatering and discharge including a sufficient number of detailed sections to clearly illustrate the scope of work.

        1. Show arrangement, locations, and details of wells and sumps; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

        2. Include layouts of observation wells and flow-measuring devices for monitoring performance of dewatering system.

        3. Relationship of the dewatering system components to existing site features, utilities, streets, and new construction.

    b. Drawings shall bear the seal and signature of the qualified New York State licensed Professional Engineer who is in charge of designing the dewatering system and preparing the drawings.

    c. List of materials and equipment to be used.

    d. A sample of well records and monitoring forms to be maintained during construction.

4. Detailed description of the sequence of dewatering operations.

5. Dewatering well installation records indicating an identification number, location, dimensions, and installation procedures and materials.

6. Observation well installation records indicating an identification number, location, dimensions, and installation procedures and materials.

7. Emergency observation plan to be put into operation during failure of the dewatering system.

8. Monthly Dewatering System Monitoring Reports per Article 3.06 containing the following data on approved forms:

    a. For observation wells, daily piezometric levels shall be identified by date, time, well number and system (subsystem if multiple pumps are used) pumping rate. Piezometric levels shall be noted in feet of drawdown and groundwater elevation.

    b. For dewatering wells, suspended material test results shall be identified by date, time, well number, well pumping rate (if monitored) and system (subsystem if multiple pumps are used) pumping rate.

    c. Installation records for new wells.

9. Schedule and records of all maintenance tests for primary and standby dewatering systems including the following:

    a. Maintenance tests and water quality tests for suspended matter at the discharge point including date, time of day, elapsed times of tests procedures, components tested, suspended particles, resultant observations and well readings.

    b. Daily discharge rates.

    c. Installation and removal of wells.

    d. General observations of the system such as equipment running times, and failures.

10. Dewatering well (and sump) removal records per Article 3.07.K.

11. Observation well removal records per Article 3.07.K.

1.05 QUALITY ASSURANCE

A. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the work described herein.

B. The Contractor shall be solely responsibility for monitoring the performance of the dewatering system to meet pretreatment and permitted discharge requirements.

C. Contractor shall employ the services of a Dewatering Specialist or Subcontractor having the following qualifications:

1. Have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years.

2. Retain the services of a field representative having a minimum of five (5) years of experience in installation of well points, sumps, deep wells, or equal systems.

3. Retain the services of a New York Registered Professional Engineer having a minimum of five (5) years of experience in the design of well points, sumps, deep wells, or equal systems.

D. Dewatering shall prevent the loss of fines, seepage, boils, quick conditions or softening of the foundation strata while maintaining stability of the sides and bottom of the excavation and providing dry conditions for construction operations.

E. The Contractor shall be responsible for all remedial action due to problems arising from improper/illegal dewatering.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide casings, well screens, sump screens, piping, fittings, pumps, power, controls and other items required for dewatering system and suited for their intended purpose.

B. Materials and equipment used in the dewatering system shall adhere to accepted industry standards and be in good operating condition and able to perform satisfactorily over the required duration of the construction dewatering.

C. Provide treatment equipment as necessary to meet permit discharge requirements. Treatment to remove sediment and adjust for pH should be anticipated.

C. Provide sand and gravel filter materials around the dewatering well screens/sump screens. Wrapping geotextile fabric directly around the well screens shall not be allowed. Surging of the natural formation to form a "gravel pack" is strictly prohibited.

D. Materials, especially well and sump screens, shall be compatible with the environment to prevent erosion, deterioration, and clogging.

E. Provide standby power supply and/or emergency generator capabilities for maintaining uninterrupted construction dewatering.

F. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown. At least one (1) spare pump shall be stored onsite for every five (5) used.

G. Provide temporary pumps, pipes, hoses, flumes, or channels for the transport of dewatering discharge water to the outfall location after required pre-treatment.

H. Provide cement grout for well abandonment.

I. Provide sampling ports and flow meters.

PART 3 – EXECUTION

3.01 EXAMINATION OF THE SITE

A. Become familiar with the surface and subsurface site conditions.

B. Obtain the data required to analyze the water and soil environment at the site in order to assure that the materials used for the dewatering systems will not erode, deteriorate, clog or otherwise hinder the system's performance during the period of the dewatering.

C. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

D. Examine the areas and conditions where dewatering system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

E. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed and approved by the Owner and Engineer, to confirm that satisfactorily addressed and the geotechnical instrumentation has been installed and baselined.

3.02 DESIGN

A. The dewatering system shall be capable of relieving all hydrostatic pressure against the height of the excavation walls and of lowering the hydrostatic level below the bottom of the base slab a minimum of two (2) feet below the lowest excavation in the work areas both prior to excavation, and during excavation and construction.

B. The dewatering system shall be segmented so that if the operation of any one segment is disrupted, the remaining segment plus activated redundant components are capable of maintaining the groundwater at the stated levels.

C. Provide, operate and maintain all ditches, berms, site grading, sumps and pumping facilities to divert, collect and remove all surface water from work areas. All collected water shall be discharged into the outfall pipe.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction, or completed. The dewatering effluent water will be discharged under a SPDES permit. Compliance with the SPDES permit requirements should be incorporated into the dewatering system design.

E. Provide pipe and pumps of sufficient size and quantity to be able to flood the excavation within 12 hours in an emergency situation. Restoration of the working area shall be carried out by the Contractor at no additional cost to the Owner.

F. Carry the dewatering system discharge through pipes out of the area of the excavation into the outfall junction manhole shown on the Drawings. Provide meters to measure the discharge flow.

G. Provide a standby dewatering system that meets the following requirements:

1. Provide 100 percent standby power.

2. Provide a 15 percent minimum increase in the number of wells or pumping volume and related equipment required to operate the dewatering system installed and ready to operate.

3. Provide a minimum of three separate power units for the standby power system and one installed auxiliary unit for each individually powered pump.

4. Provide separate discharge lines from each well or common lines with valves such that any well or wells that malfunction or are damaged can be isolated form the others.

5. The systems shall be laid out and designed in such a way that portions of the system may be isolated for routine maintenance or repair in case of accidental damage without affecting the normal operation of the system.

H. Provide contracts or sufficient on-site fuel to maintain a five-day supply on site for fuel-powered systems.

I. Provide observation wells to determine compliance with dewatering requirements as indicated on the Drawings, Shop Drawings, and the Engineer.

J. Designate certain observation wells as emergency observation wells.

3.03 INSPECTION

A. All tests and inspections require the witnessing and written approval of the Owner and Engineer.

B. Provide safe access for the Owner and Engineer to perform testing and inspection.

C. The Owner and Engineer will provide oral and written notice to the Contractor for all tests and inspections that do not meet approval.

3.04 INSTALLATION AND TESTING

A. Install the dewatering system from the existing ground surface or from the bottom of an excavation which is located above the natural groundwater level.

B. Pump each pumping well and/or dewatering sump individually at its maximum or design flow and take a water sample using the following procedures:

1. Obtain samples from stopcocks located along the discharge lines at points of high turbulence or between 4 and 8 o'clock on the perimeter of straight sections of pipe.

2. Flush the stopcock for a few seconds before taking a sample.

3. Take a 1 liter sample with the stopcock fully open.

C. Test the sample following the Sediment Test by Imhoff Cone for two to three minutes and measure the volume of settled materials to the nearest 0.01 milliliters (0.01 milliliters = 10 ppm).

D. All pumping wells and dewatering sumps shall be evaluated as follows:

1. Wells/sumps producing 10 ppm or less shall be accepted.

2. Wells/sumps producing between 10 and 20 ppm may be accepted by the Engineer based on the evaluation of average ppm for all wells, ppm of adjacent wells, and total quantity of water which is actually pumped to dewater the excavation.

3. Wells/sumps producing more than 20 ppm shall be remediated to provide acceptable testing results, or backfilled and reinstalled if acceptable results cannot be achieved.

E. Observation wells shall consist of a standpipe or riser of minimum 1.0-inch inside diameter and a minimum three (3) foot long well-point screen or slotted PVC section at the bottom. Observation wells shall be installed as follows:

1. Jetting installation method for observation wells will be considered acceptable except for observation wells installed within 10 feet of existing structures, piping or utilities.

2. Employ Case Boring Techniques for all observation wells within 10 feet of existing structures, piping, or utilities and backfill the annulus between the well point or riser and the natural soil with a free-flowing granular material similar to Ottawa Sand.

F. Test observation wells by adding or removing water from the riser to demonstrate their proper functioning.

G. Test the standby dewatering system with the following procedures:

1. 1. Shut off the primary power source and demonstrate that the standby power can be activated prior to the groundwater level rising to within one (1) foot of the bottom of base slab elevation and that the standby power source is adequate to draw the groundwater level back down to the Contractor's design depth or to the minimum required depths.

2. 2. Shut off one segment of the system and show that redundant components can be activated prior to the groundwater level rising to within one (1) foot of the bottom of base slab elevation and that the system is adequate to draw the groundwater level back down to the Contractor's design depth or to the minimum required depths.

3. ~~1.~~ If the dewatering system fails to meet either performance requirement, the Contractor shall draw the groundwater level to a greater depth, add wells, or modify the system such that it will be in conformance with these requirements when retested.

H. Provide for temporary grading to facilitate dewatering and control of surface water.

I. Protect and maintain temporary erosion and sedimentation controls during dewatering operations, which are specified in Section 31 25 00 - Erosion and Sediment Control .

3.05 DEWATERING PROCEDURE

A. Maintain dewatering system in operation as required to properly dewater the excavation until work which requires dewatering is complete. In addition, do not excavate until the dewatering system is operational and the water level has been lowered below the anticipated depth of excavation.

1. The performance of the dewatering system shall be monitored and maintained as the excavation progresses deeper.

2. All equipment, berms, ditches, trenches and sump installations shall be checked and maintained daily to remove debris and keep open flow paths.

3. Adjust pumping speed/ flow rates and/or pipe sizes to achieve required dewatering.

Perform dewatering in such a manner as to prevent undermining or disturbing foundations of existing structures, utilities, or of work ongoing or previously completed. Schedule the dewatering work to coordinate with all the other related work such as excavation support systems, excavation, placing of concrete walls and slabs, and any other operations by other Contractors that might be affected by this work.

C. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and resubmit to the Engineer at no additional cost to the Owner.

D. Operate the dewatering system continuously twenty-four (24) hours per day, seven (7) days per week until all structures have been satisfactorily constructed, including placement of fill materials, and no longer require dewatering.

E. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

F. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

G. Heat and light system (as necessary) for continuous operation, including during winter months, at no additional cost to the Owner.

3.06 MONITORING

A. Measure the water levels to the nearest one-tenth foot in all observation wells and submit the readings daily.

B. Measure the concentration of suspended material in the discharge water of each well once every two days. Wells which exceed the acceptable level of solids concentration shall be replaced.

C. Observe and record the total discharge volume and average total pumping rate of the pumping system (record all system flow meters) on a daily basis.

D. Test the performance of the standby system and all components by demonstrating that the system is operational at least every two weeks.

E. Test the observation wells every two weeks by adding and removing water from the risers to demonstrate their proper functioning.

F. Observation wells that become inoperable shall be immediately replaced while construction is halted if the Engineer determines that the observation well is critical.

G. Repair leaks promptly to prevent damage.

H. Remove and add riser pipe of each observation well located within the excavation as construction progresses until the well conflicts with the structure. When the conflict occurs, abandon the observation well, fill it with grout, and cut the riser off at grade.

I. In the event of a dewatering system failure, take the following steps:

Conduct in situ density tests conforming to ASTM D1556 or ASTM D2167 immediately above an at the structure founding grades.

Remove all soils that show unacceptable density and replace them with compacted fill as indicated in Section 31 00 01 – Earthwork.

Test the repaired soils as required by the Owner and Engineer to verify that they have been returned to their original in situ state or better.

Repair or replace damaged structures.

3.07 REMOVAL OF DEWATERING SYSTEM

A. Obtain written approval from the Owner and Engineer to begin rewatering operations.

B. Provide an adequate weight of fill to prevent buoyancy.

C. Pump water into the excavation such that the water level inside the excavation is always at a higher level than the rising groundwater on the outside until the groundwater level has reached its static level.

D. Obtain written approval from the Owner and Engineer prior to ceasing dewatering operations. The Engineer shall provide confirmation that the structural components provide adequate weight to prevent buoyancy.

E. Obtain written approval from the Engineer to remove dewatering components when the dewatering system is no longer needed.

F. Remove all dewatering wells/sumps, buried and surface piping, cables, pump foundations, structural supports, and all other components and/or support facilities.

G. Backfill as specified in Section 31 00 01 – Earthwork, all trenches and excavations below final grades or in fill areas.

H. The Contractor shall be responsible for proper decontamination of dewatering system equipment and proper disposal of all residual contaminated materials (such as filter material and settlement silts) accumulated during operation of the pretreatment system equipment.

I. The Contractor shall repair all penetrations of the foundation slab required for the dewatering system in a manner that maintains the warranty of the waterproofing system.

J. Repair any damage caused by the Contractor during dewatering operations at no additional cost to the Owner.

K. Provide documentation of dewatering and observation well removal including the date of removal, well number, location, procedures, and materials used.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01. THE REQUIREMENTS

1. The Contractor is responsible for implementing Best Management Practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This item covers the work necessary for the installation of structures and measures for the prevention of soil erosion and control of sedimentation. The Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting, and removal (where applicable) of erosion prevention and sediment control measures and, if applicable, to cause compliance with all local permits.

2. The Contractor shall comply with the New York State Department of Conservation (NYSDEC) State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities

3. Any land disturbance as the result of modifications to a site's drainage features or topography requires protection from erosion and sedimentation.

4. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.

5. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that erosion of disturbed areas and off site sedimentation be absolutely minimized.

6. All work under this Contract shall be done in conformance with and subject to the limitations of the New York State Environmental Conservation Rules and Regulations, Title 6, Chapter X, Part 750.

7. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the erosion and sediment control devices will be adjusted on several occasions to reflect the current phase of construction. The construction schedule adopted by the Contractor will impact the placement and need for specific devices required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation. The location and extent of erosion and sedimentation control devices shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from constructed areas.

All deviations from the erosion and sedimentation control provisions shown on the Contract Drawings shall have the prior acceptance of the Engineer and shall be completed at no additional cost to the Owner.

8. Erosion and sedimentation controls applicable to this project shall be as shown on the Contract Drawings, as specified herein, as indicated by the Engineer and as detailed in the New York State Standards and Specifications for Erosion and Sediment Control.

1.02. RELATED WORK SPECIFIED ELSEWHERE

1. Section 01300 – Submittals

2. Section 02100 – Clearing, Grubbing, and Site Preparation

3. Section 02200 – Earthwork

4. Section 02274 – Geotextiles

5. Section 02910 – Final Grading and Landscaping

1.03. REFERENCE SPECIFICATIONS, CODES AND STANDARDS

1. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.

   A. New York State Environmental Conservation Rules and Regulations, Title 6, Chapter X, Part 750

   B. New York Standards and Specifications for Erosion and Sediment Controls

   C. New York State Pollutant Discharge Elimination System for Stormwater Discharges from Construction Activities (Permit No. GP-0-15-002), for any land disturbance or construction activity of one (1) acre or more.

   D. The "Erosion and Sediment Control, Best Management Practices Manual Series, Westchester County, New York", as applicable.

2. See Specification Section 01090 - Reference Standards.

1.04. REGULATORY COMPLIANCE

1. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States and the

State of New York. Contractor is the Co-Operator under the provisions of the SPDES Permit. As such, the Contractor will be required to sign certain certifications as described in the Permit. Contractor shall comply with requirements specified in the Contract Documents or by the Engineer. Contractor shall also comply with all other laws, rules, regulations, ordinances, guidelines, and requirements concerning soil erosion and sediment control established in the United States and the State of New York. The following documents and the documents referenced therein define the regulatory requirements for this Section 02276.

A. SPDES PERMIT: The New York State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities governs land disturbance or construction activities of one (1) acre or more in New York State or located in the New York City Watershed East of the Hudson that disturb between five thousand (5000) square feet and one (1) acre of land. On applicable sites, Contractor is responsible for complying with terms and conditions of this permit.

B. New York State Standards and Specifications for Erosion and Sediment Control (NYSSSE&SC): Contractor shall follow Standards and Specifications of the New York State Department of Environmental Protection's (NYSDEC's) Standards and Specifications for Erosion and Sediment Control, latest edition.

C. SWPPP: When a Storm Water Pollution Prevention Plan (SWPPP) is provided in the Contract Documents, the Contractor shall follow the practices described in the SWPPP. (See the Appendix for the SWPPP, if applicable).

3. Storm Water Pollution Prevention Plans (SWPPPs)

A. The Contractor shall abide by the site specific Stormwater Pollution Prevention Plan.

1. During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge stormwater associated with construction activity including clearing, grading and excavation activities resulting in the disturbance of land and related support activities. Such discharges shall be controlled, limited and monitored.

1.05. SUBMITTALS

1. Prior to the start of the work, the Contractor shall prepare and submit a plan for implementing the temporary and permanent erosion and sedimentation control measures as shown on the Erosion and Sediment Control Plan approved by the

appropriate regulatory authority. Construction work shall not commence until the schedule of work and the methods of operations have been reviewed and approved.

2. Qualified Inspector: The Contractor shall submit a Qualified Inspector in accordance with Part IV.C. of the NYSDEC SPDES General Permit for Stormwater Discharges to perform site inspections as stated in Article 3.12 of this specification. Contractor shall not start any work that will result in the disturbance of the site until the Engineer has approved the credentials of the Qualified Inspector.

3. In accordance with the procedures and requirements set forth in the General Conditions Division 1 and Section 01300 - Submittals, the Contractor shall submit the following:

   A. Name and location of all material suppliers.

   B. Certificate of compliance with the standards specified above for each source of each material.

   C. List of disposal sites for waste and unsuitable materials and evidence of all required permits for use of those sites.

1.06 EROSION AND SEDIMENTATION CONTROL DEVICES

1. SILT FENCE

   A. Silt Fence shall be constructed at the locations shown on the Drawings, and at other locations indicated by the Engineer. Silt Fence shall not be installed across streams, ditches, or waterways. Silt Fence shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

2. INLET EROSION CONTROL MEASURES

   A. Yard, Curb and other Inlet Erosion Control Measures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer. Inlet erosion control measures shall be used to prevent or limit the introduction of sediment to storm drain systems and allow early use of the of the storm drainage system. Curb Inlet Erosion Control Measures shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

3. TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

   A. Temporary Gravel Construction Entrances shall be located at points where vehicles enter and leave a construction site, or at other locations indicated by the Engineer. Temporary Gravel Construction Entrances shall be designed, installed and maintained in accordance with the requirements of requirements of Section 5 of the NYSSSE&SC.

4. PORTABLE SEDIMENT TANKS

A. Portable Sediment Tanks shall be manufactured and installed as shown on the Drawings and as specified herein. They shall be constructed of steel with interior baffles and sized sufficiently for inflow and outflow requirements. Portable sediment tanks shall be cleaned out and maintained in accordance with Part 3 of this Section and Section 5 of the NYSSSE&SC to the satisfaction of the Engineer until the site has been stabilized.

5. ANCHORED STABILIZATION MATTING

A. Anchored stabilization matting shall be installed on all seeded earthen slopes steeper than 3 horizontal to 1 vertical. Matting is not required on slopes stabilized with sod, rock riprap or hard armor material.

1.07. GUARANTEE

A. All restoration and re-vegetation work shall be subject to the one-year guarantee period of the Contract as specified in the General Conditions.

PART 2 – GENERAL

2.01. MATERIALS

1. Materials for use in erosion and sedimentation control devices shall be in accordance with the New York Standards and Specifications for Erosion and Sediment Controls

2. All erosion and sediment control bid prices shall include all excavation, grading, maintenance, legal sediment disposal, permits and all other work and appurtenances necessary to design, install and maintain the sediment and erosion control measures as detailed herein and in accordance with New York Standards and Specifications for Erosion and Sediment Controls

2.02. SILT FENCE

1. Silt Fence shall be a woven geotextile filter fabric made specifically for sediment control. Filter fabric shall not rot when buried and shall resist attack from soil chemicals, alkalies and acids in the pH range from 2 to 13, and shall resist damage due to prolonged ultraviolet exposure. Filter fabric shall be Type FX-11, as manufactured by Carthage Mills, Geotex 910SC as manufactured by Synthetic Industries, Inc., Amoco 2130 as manufactured by Amoco Fabrics & Fibers Co., or equal.

2. Filter fabric for the silt fence shall have the following minimum properties:

	Value	Test Method
Grab Tensile Strength	110 lbs	ASTM D 4632
Grab Elongation	20%	ASTM D 4632
Trapezoid Tear Strength	50 lbs	ASTM D 4533
Mullen Burst Strength	300 lbs	ASTM D 3786
Puncture Strength	60 lbs	ASTM D 4833

Retained Strength (500 hrs. accelerated UV exposure)	70%	ASTM D 4355
Filtration Efficiency	75%	VTM-51
Flow Rate	25 gal/min/ft^2	ASTM-D4491
Height	36 inches	

3. Posts for silt fence shall be steel and shall have the following properties:

ASTM Designation:	ASTM A702
Length:	5-Feet Long (T-Type)
Weight:	1.25#/Foot (min.)
Area of Anchor Plate:	14 Sq. In.

Note: Five (T) Fasteners shall be furnished with each post.

4. Wire Fabric for the silt fence shall have the following properties:

Wire Fabric Designation:	832-12-10-12.5 Class 1
Designation:	ASTM A116
Width:	32"
Number of Line Wires:	8
Stay Wire Spacing:	12"
Line and Stay Wires:	12.5 Ga.
Top and Bottom Wires:	10 Ga.
Wire Coating:	ASTM Class 1 Zinc Coating

Silt Fence shall be installed and maintained in accordance with Part 3 of this Section, and 5 of the NYSSSE&SC, to the satisfaction of the Engineer until the site has been stabilized. The cost of Silt Fence shall include the fabric, posts, wire fabric, excavation and all maintenance and restoration activities required.

2.03. INLET EROSION CONTROL MEASURES

1. Yard, Curb and other Inlet Erosion Control Measures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer. Inlet erosion control measures shall be used to prevent or limit the introduction of sediment to storm drain systems and allow early use of the of the storm drainage system. Curb Inlet Erosion Control Measures shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

2.04 STABILIZED CONSTRUCTION ENTRANCES

1. Stabilized construction entrances shall be constructed as shown on the Drawings and as specified herein. Temporary gravel construction entrances shall be maintained in accordance with Part 3 of this Section and Sections 5 and 7A of the NYSSSE&SC to the satisfaction of the Engineer until the site has been stabilized. The cost of the stabilized construction entrances shall include the gravel and all maintenance activities required.

2.05 ROLLED EROSION CONTROL MATTING (RECM)

1. Single Net Straw Blanket
   a. Single net straw blankets shall be used for slopes 3:1 and shallower (length to width ratio).
      i. Single Net Straw Blanket shall be ECS-1B Single Net Biodegradable Rolled Erosion Control product as manufactured by East Coast Erosion Control Blankets, Bernville, PA or Curlex I Single Net Excelsior Erosion Control Blanket as manufactured by American Excelsior Company, Arlington, TX or approved equal
2. The mat shall consist of clean wheat straw from agricultural crops made into a knitted straw mat that is machine assembled. The straw shall be evenly distributed throughout the mat. The mat shall be covered with a biodegradable synthetic mesh attached to the straw with degradable thread. Non-biodegradable mesh is not acceptable.
3. The Contractor shall place the Single Net Straw Blanket immediately after the seeding operation. The netting shall be on top with the filling material in contact with the soil.
4. Stakes: Stakes for RECM shall be of sound quality hardwood with a minimum dimension of 24 inch x 2 inch x 2 inch and shall be 100% biodegradable. Wood shall not be pressure treated. 100% biodegradable stakes such as the E-Staple by American Excelsior Company or equal are also acceptable.
5. The Contractor shall immediately repair or replace any section of RECM which is not functioning properly or has been damaged in any way until a stable planting cover has been established.
6. RECM shall be installed and maintained in accordance with Part 3 of this Section and the Contract Drawings. The cost for Rolled Erosion Control Products shall include all excavation, grading, and materials, and all maintenance activities.

2.06 TEMPORARY SOIL STABILIZER

1. The temporary agent for soil erosion control shall consist of an especially prepared highly concentrated powder which, when mixed with water, forms a thick liquid such as "MA-60 Soil Stabilizer" by Enviroseal Corporation, "BIND | ATLAS SUPERDUTY" by Quattro Environmental, Inc., or "VERTEX" by LSC Environmental Products, Inc., and having no growth or germination inhibiting factors. The agent shall be used for hydroseeding grass seed in combination with other approved amendments resulting in a highly viscous slurry which, when sprayed directly on the soil, forms a gelatinous crust.

2.07. RIP RAP

1. The Contractor shall place rip rap as shown on the Contract Drawings, as detailed in Section requirements of Section 5 of the NYSSSE&SC . The stone for rip rap shall consist of field stone or rough un-hewn quarry stone. The rip rap shall be sound, tough, dense, and resistant to the action of air and water. Neither the width nor thickness of individual stones shall be less than one third their length.

2. Rip rap shall be designed, installed and maintained in accordance with Part 3 of this Section, Section 5 of the NYSSSE&SC.

2.08. TEMPORARY AND PERMANENT CHANNELS

1. Temporary and permanent channels shall be installed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 5 of the NYSSSE&SC . Temporary and permanent channels shall be used to convey concentrated runoff without damage from erosion, deposition or flooding.

2. All temporary and permanent channels shall be stabilized immediately with temporary or permanent Anchored Stabilization Matting as shown on the Contract Drawings.

3. Temporary and permanent channels shall be designed, installed and maintained in accordance with Part 3 of this Section 5 of the NYSSSE&SC

2.09. OUTLET STABILIZATION STRUCTURE

1. Outlet stabilization structures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 5 of the NYSSSE&SC. These structures shall be used where the discharge velocity of the upstream water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.

2. Structures shall be sized for a capacity equivalent to a 10-year, peak runoff or design discharge of the water conveyance structure, whichever is greater. Riprap materials shall be as specified on the Contract Drawings. Type II Separator Geotextile, as specified in Section 02274 – Geotextiles, shall be placed beneath rip rap of all Outlet Stabilization Structures.

4. Outlet stabilization structures shall be designed, installed and maintained in accordance with Part 3 of this Section and Section 5 of the NYSSSE&SC

PART 3 – GENERAL

3.01. INSTALLATION AND MAINTENANCE

1. Erosion and sedimentation control devices shall be established prior to or concurrent with the clearing operations in a given area. Where such practice is not feasible, the erosion and sedimentation control device(s) shall be established immediately following completion of the clearing operation.

2. The Contractor shall furnish the labor, materials and equipment required for routine maintenance of all erosion and sedimentation control devices. Maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device. Maintenance shall include but not be limited to 1) the removal and satisfactory disposal of accumulated sediment from traps or silt barriers and 2) replacement of filter fabrics used for silt fences and stone used in temporary sediment traps, stone filters, gravel construction entrances, etc.. Sediment removed from erosion and sedimentation control devices shall be disposed of in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner.

3.02. SILT FENCE

1. Silt fence shall be erected as shown on the Drawings and specified herein. Silt fence shall be erected and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Replacement of the filter fabric, if required by the Engineer, will be at the Contractor's expense.

   A. Silt fence shall be erected around all catch basins which are located downstream from any construction work. Should any catch basins be indicated to be relocated or modified, silt fence shall be utilized until work is completed on the catch basins. Upon completion of the modification, the area shall be rough graded, as shown on the Drawings, until the end of the project, at which time final grading shall occur.

   B. Inspect silt fence at least once a week and after each rainfall. Make any required repairs immediately.

   C. Should the fabric of a silt fence collapse, tear, decompose or become in-effective, replace it promptly.

   D. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

   E. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized. Removal of any silt fence shall be permitted only with the prior approval of the Engineer, or the local governing agency.

3.03 STABILIZED CONSTRUCTION ENTRANCE

1. The Contractor shall provide temporary gravel construction entrances at all locations noted on the Contract Drawings, and at all other locations as may be directed by the Engineer.

   A. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect each construction entrance and clean out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

3.04. RIPRAP

1. Riprap shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC . Riprap shall be graded so that the smaller stones are uniformly distributed through the mass. The Contractor may place the stone by mechanical methods, augmented by hand placing where necessary or ordered by the Engineer. The placed riprap shall form a properly graded, dense, neat layer of stone. The placed riprap shall have a minimum depth of 6 inches unless otherwise specified by the Engineer. Type II Separator Geotextile, as specified in Section 02274 – Geotextiles, shall be used under all riprap unless otherwise noted.

2. Inspect periodically for scour or dislodged stones. Control of weed and brush growth may be needed.

3.05. ROLLED EROSION CONTROL MATS (RECMs)

1. RECMs shall be biodegradable and installed as shown on the Contract Drawings, and at other locations indicated by the Engineer, as specified herein.

2. RECMs shall be utilized to aid stabilization of slopes 3H:1V or greater and with more than 10 feet of vertical relief, and to aid in permanent stabilization of vegetated channels where runoff velocity will exceed 2 feet/second. RECMs should also be used when mulch cannot be adequately tacked and where immediate ground cover is required to prevent erosion damage.

3. Base soil shall be tilled to a twelve-inch depth except where bedrock layers are encountered or steepness of slope does not allow operation of tilling equipment; rake in three inches of organic matter and 6-inches of top soil prior to RECM placement.

4. Seeding shall be per the designated limits of the planting zones and schedules as shown on the Contract Documents. Permanent seed shall be placed if it is the correct time of year for installation in accordance with detailed specification 02910 – Final Grading and Landscaping.

5. The Contractor shall unroll the erosion control fiber matting along the slope face anchoring the blanket into the top, bottom end, and sides of the slope by 'keying' the blanket a minimum of 1 foot into the existing ground. Matting shall be placed loosely and in full contact with the soil. Matting shall be laid within footer trench with stones then placed on erosion control mat.

6. Blanket edges (blankets side by side at a given elevation) shall overlap approximately 8 inches, with the upstream blanket on top. Stakes shall straddle the edge of the blanket on the top and the underlying blanket.

7. Blanket ends (blankets ending upslope from down slope blankets) shall overlap approximately 8 inches with the upslope blanket over the down slope blanket. The overlapping area shall be secured with staking spaced at a minimum of 2 feet on center.

8. Matting shall be "keyed" into ground 12 inches on the top and bottom of slopes. Secure with 24 inch x 2 inch x 2 inch stakes, 2 per square yard for slopes less than 2:1. Stakes shall be installed so that no more than 2 inches of the stake remains above finished grade.

9. Permanent seeding for RECM areas shall be seeded with mix as described in the Contract Documents.

10. Extreme care must be taken by vegetation planting crews so that RECM is not excessively damaged during planting installation. At no time can the mat be cut more than 6 inches beyond the root ball of plant being installed.

3.06. TEMPORARY AND PERMANENT STABILIZATION OF DISTURBED AREAS

1. The Contractor shall provide temporary or permanent ground cover adequate to restrain erosion on all disturbed areas that will be left unworked for periods exceeding 15 working or 30 calendar days.

   A. Reseed and mulch temporary seeding areas where seedling emergence is poor, or where erosion occurs, as soon as possible. Do not mow. Protect from traffic as much as possible.

   B. Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

C. **Reseeding** – If a stand has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or over-seed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.

D. If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

E. **Fertilization** – On the typical disturbed site, full establishment usually requires refertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.

3.07. TEMPORARY AND PERMANENT CHANNELS

1. Temporary and permanent channels shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC . The Contractor shall provide temporary and/or permanent channels at all locations noted on the Contract Drawings, and at all other locations as may be directed by the Engineer.

2. Remove all trees, brush, stumps, etc. from the channel area and dispose of properly.

3. Excavate the channel to the dimensions shown on the plans, over-excavating to allow for liner thickness. Remove and properly dispose of all excess soil so that surface water may enter the channel freely.

4. Immediately armor the channel as specified on the Contract Drawings. If the specified channel lining requires an establishment period, protect the channel with mulch or a temporary liner sufficient to withstand anticipated velocities during this period.

5. During the establishment period, inspect channels weekly and after every rainfall. After lining has been fully established, inspect channels after any storm event of greater than ½ inch of rain per 24-hour period. Immediately make repairs.

6. Perform all channel construction to keep erosion and water pollution to a minimum. Immediately upon completion of the channel, vegetate all disturbed areas or otherwise protect them against soil erosion. Where channel construction will take longer than 7 days, stabilize channels by reaches.

7. Inspect the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Give special attention to outlets and points where concentrated flow enters the channel.

8. Maintain all vegetation adjacent to and in the channel in a healthy, vigorous condition to protect the area from erosion.

9. Remove all significant sediment accumulations to maintain the designed carrying capacity.

3.08. TEMPORARY SEDIMENT TRAPS, AND SEDIMENT BASINS

1. Temporary sediment traps shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC . Sediment basins shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC . The Contractor shall provide these structures at all locations shown on the Contract Drawings and at all other locations as may be directed by the Engineer.

2. Care shall be taken to ensure that proper site preparation operations are conducted prior to trap or basin construction. Clear, grub and strip embankment location.

3. A cut-off trench shall be excavated along the center line of the earth fill embankment for sediment basins and skimmer sediment basins. Keep the trench dry during backfilling and compaction operations.

4. Fill material shall be free of roots, woody vegetation, rocks, and other objectionable materials. Fill shall be placed in 6 to 8 inch layers and compacted. Construct the embankment to an elevation 10 percent (minimum of 6 inches) higher than the design height to allow for settling.

5. Inlets to the sediment traps and basins shall be immediately armored with anchored stabilization matting or riprap so as to prevent erosion. Use diversions to divert sediment-laden water to the upper end of the basin.

6. Shape the sediment trap or basin to the specified dimensions as shown on contract drawings.

7. Following construction of the embankment, clear the sediment trap or basin area below the crest elevation of the spillway to facilitate sediment cleanout. Provide access for cleanout of accumulated sediment.

8. Spillway/outlet configuration shall be constructed as specified below.

9. Temporary sediment trap

    A. Provide emergency bypass in natural, stable areas, located so that flow will not damage the embankment.

B. Securely attach the riser to the barrel or barrel stub to make a watertight structural connection. Secure all barrel connections with approved watertight assemblies. Install anti-seep collar(s) as noted on the Contract Drawings. Ensure that the pipe stays in firm contact with its foundation when compacting fill around the pipe. Do not use pervious material as backfill around the pipe. Anchor the riser to prevent floatation. Install trash guard to prevent the riser and barrel from becoming clogged.

C. Install basin dewatering mechanism as noted on the Contract Drawings.

D. Install outlet protection as specified at principal spillway outlet. Install the emergency spillway in undisturbed soil and provide stabilization as specified.

10. Sediment traps and basins shall be constructed so that the area disturbed and resulting erosion is minimized. The emergency spillway, embankment, and all other disturbed areas above the crest of the principal spillway are to be stabilized immediately after construction with vegetation or temporary or permanent anchored stabilization matting as shown on the Contract Drawings.

11. Sediment traps and basins may attract children and should be considered dangerous. Steep side slopes should be avoided and fences with warning signs may be necessary if trespassing is likely.

12. Inspect temporary sediment traps, sediment basins, and skimmer sediment basins once a week and within 24 hours after any storm event of greater than ½ inch of rain per 24-hour period. Repairs shall be made immediately.

A. Sediment, limbs and other debris shall be cleared and the trap or basin shall be restored to its original dimensions when it accumulates to one-half the design depth or more frequently as directed by the Engineer. Sediment material removed from traps and basins shall be disposed of by the Contractor in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner. If no suitable on site locations are available, all such sediment will be legally disposed of off site, at no additional cost to the Owner.

B. The embankment, spillways and outlet shall be checked for erosion damage and the embankment shall be checked for piping and settlement. Immediately fill any settlement of the embankment to slightly above design grade. Any riprap displaced from the spillway must be replaced immediately. Replace contaminated gravel facing of riprap outlets as necessary. Inspect vegetation. Reseed, re-mulch, or reinstall matting as necessary.

C. Debris shall be removed from the skimmer to prevent clogging. Special precautions shall be taken in winter to prevent the skimmer from plugging with ice.

D. Sediment shall be removed and trap restored to original dimensions when the sediment had accumulated to ½ of the design depth. Sediment removed from the trap shall be deposited in a protected area and in such a manner that it will not erode.

3.09. OUTLET STABILIZATION STRUCTURE

1. Outlet stabilization structures shall be designed, installed and maintained in accordance with the requirements of Section 5 of the NYSSSE&SC.

2. The Contractor shall ensure the subgrade, riprap and gravel filter conforms to the grading limits shown on the plans.

3. Riprap shall be installed in accordance with the specifications contained herein, with Type II Separation fabric placed under the riprap.

4. The apron shall be constructed on zero grade with no overfill. Ensure the apron is properly aligned with the receiving stream.

5. All disturbed areas shall be stabilized with vegetation immediately after construction.

6. Outlet stabilization structures shall be inspected at least weekly and within 24 hours after any storm event of greater than ½ inch of rain per 24-hour period to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Repairs shall be made immediately.

3.10. ADDITIONAL REQUIREMENTS

1. All storm sewer piping shall be blocked at the end of every working day until the inlet is constructed above grade.

2. All streets around the construction area shall be scraped as necessary to prevent accumulation of dirt and debris.

3. The Contractor shall provide adequate means to prevent any sediment from entering any storm drains, curb inlets (curb inlet filter box), ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of offsite areas. Silt fence will be provided, at no additional cost to

the Owner, around excavation materials if deemed necessary by the Engineer. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed.

4. The Engineer may direct the Contractor to place any additional sediment and erosion control devices at other locations not shown on the Drawings.

3.11. INSPECTIONS AND MAINTENANCE

1. The Contractor shall designate a Qualified Inspector to perform inspections required by this Section. The following areas are to be inspected and maintenance performed, if needed, at least once every 7 calendar days and within 24 hours of a rainfall event that has a precipitation of 1/2 inch or greater.

    1. Disturbed areas of the construction site that have not undergone final stabilization.

    2. Erosion and sediment control structures.

    3. All locations where vehicles enter or exit the site.

    4. Material storage and construction laydown areas that are exposed to precipitation and have not been finally stabilized

2. When a SWPPP is provided in the Contract Documents, the Qualified Inspector shall follow the practices inspection and maintenance requirements described in the SWPPP. (See the Appendix for the SWPPP, if applicable). All appropriate records required by the SWPPP shall be maintained on site.

3. Immediate action will be taken to correct deficiencies to BMP's. The State reserves the right to stop all construction activities not related to maintaining BMP's until such deficiencies are repaired.

4. In areas that have been finally stabilized, inspections and, if necessary, maintenance by Contractor will occur at least once per month for the duration of the contract or project, whichever is longer.

5. During inspections the following will be observed and appropriate maintenance procedures taken:

    A. The conformance to specifications and current condition of all erosion and sediment control structures.

    B. The effectiveness and operational success of all erosion and sediment control measures.

C. The presence of sediments or other pollutants in storm water runoff at all runoff discharge points

D. If reasonably accessible, the presence of sediments or other pollutants in receiving waters

E. Evidence of off-site tracking at all locations where vehicles enter or exit the site

6. An inspection checklist is included in the SWPPP, if required, and is attached at the Appendix. This checklist must be completed during each inspection, dated, and signed by the Qualified Inspector conducting the inspection. Completed inspection checklist shall be kept on-site with the Contract Documents and submitted to the Engineer on a monthly basis. The Contractor will repair deficiencies within 24 hours of inspection.

3.12. MONITORING AND REPORTING

A. Monitoring: The Contractor shall be responsible for the implementation of the Inspections and Maintenance Procedures as included in the approved erosion and sediment control plan. The implementation must comply with guidelines as set forth in the SPDES General Permit as well as those of any local regulatory authorities. Minimum monitoring requirements are as follows:

1. A rain gauge shall be maintained in good working order on the site.

2. A written record of the daily rainfall amounts shall be retained. (Note: if no rainfall occurred the Contractor must record "zero").

3. The control measures shall be inspected to ensure that they are operating correctly. Inspection records must be maintained for each inspection event and for each measure. All erosion and sedimentation control measures must be inspected by the Contractor at least once every seven calendar days and within 24 hours after any storm event of greater than ½ inch of rain per 24 hour period unless otherwise noted herein. Some measures require inspection following each rainfall event.

4. Once land disturbance has begun on the site, stormwater runoff discharge outfalls shall be inspected by observation for erosion, sedimentation and other stormwater discharge characteristics such as clarity, floating solids, and oil sheens. Inspections of the outfalls shall be made at least once every seven calendar days and within 24 hours after any storm event of greater than ½ inch of rain per 24 hour period. Inspection records must be maintained for each inspection event and for each discharge location.

5. If any visible sedimentation is leaving the site or entering waters of the State, corrective action shall be taken immediately to control the discharge

of sediments.

B. Reporting: The Contractor shall prepare and submit a summary of the monitoring results to the Engineer, the Designer and the NYSDEC as required in the SPDES permit. The State reserves the right to use its own resources to duplicate monitoring and verify the work required by the Contractor in this section.

3.13 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

A. At such time that temporary erosion and sediment control structures are no longer required under this item, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures. The Contractor shall obtain the Engineer's approval in writing prior to removal. Once the Contractor has received such written approval from the Engineer, the Contractor shall remove, as approved, the temporary structures and all sediments accumulated at the removed structure shall be returned upgrade and stabilized so they do not re-erode. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and seeded as specified in Section 02910 - Final Grading and Landscaping.

\- END OF SECTION -

SECTION 32 11 00
SURFACE RESTORATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, equipment, and materials necessary for final grading, topsoil placement, and miscellaneous site work not included under other Sections but required to complete the work as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 25 00 – Erosion and Sedimentation Control

C. Section 32 90 00 – Final Grading and Landscaping

PART 2 – MATERIALS

2.01 TOPSOIL

A. Topsoil shall meet the requirements of Section 31 00 01 – Earthwork.

PART 3 – EXECUTION

3.01 FINAL GRADING

A. Following approval of rough grading the subgrade shall be prepared as follows:

1. For riprap, bare soil 24 inches below finish grade or as directed by Engineer.

2. For topsoil, scarify 2-inches deep at 4 inches below finish grade.

3.02 TOPSOIL PLACEMENT

A. Topsoil shall be placed over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped.

B. Topsoil shall be spread in place for lawn and road shoulder seed areas at a 4-inch consolidated depth and at a sufficient quantity for plant beds and backfill for shrubs and trees.

C. Topsoil shall not be placed in a frozen or muddy condition.

082905

D. Final surface shall be hand or mechanically raked to an even finished surface to finish grade as shown on Drawings.

E. All stones, roots over 4-inches,rubbish, and other deleterious materials shall be removed and disposed of.

END OF SECTION

SECTION 32 90 00

FINAL GRADING AND LANDSCAPING

PART 1 -- GENERAL

1.01. THE REQUIREMENT

1. Furnish all labor, equipment, and materials necessary for final grading, topsoiling, seeding, planting, and miscellaneous site work not included under other Sections, but required to complete the work as shown on the Drawings and specified herein. Under this Section, all areas of the project site disturbed by excavation, materials storage, temporary roads, etc., shall be reseeded as specified herein.

1.02. REFERENCE STANDARDS

1. American Association of Nurserymen, Inc. (American National Standards Institute) Nursery Stock (Z60.1)

2. American Joint Committee on Horticultural Nomenclature Standardized Plant Names.

3. A Checklist of New York State Plants, Contributions to a Flora of New York State, Checklist III, Bulletin #458, Richard S. Mitchell, State Botanist, New York State Museum, 1986.

4. Gleason, The Late Henry A. and Arthur Cronquist. 1991. Manual of the Vascular Plants of Northeastern United States and Adjacent Canada, 2nd ed, New York Botanical Garden.

5. Mitchell, Richard S. and Gordon C. Tucker. 1997. A Revised Checklist of New York State Plants, Bull. #490, New York State Museum.

1.02. RELATED WORK SPECIFIED ELSEWHERE

1. Section 01 33 00 – Submittal Procedures

2. Section 31 00 01 - Earthwork

3. Section 31 25 00 - Erosion and Sedimentation Control

4. Section 21 11 00 - Surface Restoration

4.

1.03. SUBMITTALS

1. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

1. Subcontractors proposed for landscaping and associated restoration and site work must be approved by the Engineer prior to start of work. The Contractor shall submit at least three (3) alternative Subcontractors to the Engineer for review and approval. The Subcontractors proposed

shall be evaluated on the following criteria, prioritized in descending order:

2. The Subcontractors shall submit a minimum of three (3) projects similar in scope and type within the last five years whereby the Subcontractor was directly responsible for the installation, restoration and maintenance of native habitats and wetlands. References and xerographic reproductions of photographs of the projects shall be submitted. Projects shall not be more than five years old.

3. Demonstrated capacity to accomplish the work in the required time including qualification of experienced foreman and key personnel.

4. Experience in digging and transplanting field stock.

5. Experience with State or Federal Agencies, particularly with experience in conducting mitigation pursuant to USACE or NYSDEC requirements.

6. Landscape subcontractor shall have performed at least three (3) contracts that involved the installation and maintenance of soil erosion and sediment control devices during construction of the project. The projects shall be at least three (3) years old and successful.

7. Other references or experience deemed appropriate to obtaining approval.

8. List of growers/nurseries.

9. Certified arborist or nurseryman, experienced in tree pruning and removal.

10. List of all materials and certificates specified within this Item.

    a. The General Contractor shall submit the following information (as listed in E through J) prior to construction:

11. Certificates:

12. All necessary State, Federal and other inspection certificates as may be required by law.

13. Two (2) copies to the Engineer of manufacturers' or vendors' certified analysis for soil treatments and fertilizer materials shall be submitted with samples.

14. Certification and guarantee that all plant material is true to name and in conformance with these specifications.

15. The invoice or a written statement showing the size and grade of materials received or shipped, together with the source and health of the plant material and verification that balled and burlapped plants.No plants shall be accepted that have been collected from property other than that owned or leased by a nursery.

16. Certification that all herbaceous plant material was grown from seed or stock collected within a 250-radius of the project site.

17. Certificates from seed vendors: certified statement for each seed mixture required, stating

botanical and common name, percentage by weight and percentages of purity, germination, and weed seed for each species.

18. Planting Schedule. Submit proposed planting schedule within one month of official Notice to Commence Work, indicating dates for each type of landscape work during normal seasons and as specified in the Contract for such work in area of site. Included shall be a schedule of nursery visits for the Restoration Specialist to tag plant material. Correlate from date of substantial completion. Once accepted, revise dates only as approved in writing by the Engineer, after documentation of reasons for delays.

19. List of equipment, methods of operation, and maintenance plan, including methods for protection of existing vegetation.

20. Manufacturer's Literature. Manufacturer's literature for all materials furnished shall be submitted with samples of same.

21. The Contractor is required to perform a separate germination test on the seed mixes to be used on this project prior to submitting the seed mix and supplier. The results of the germination test shall be included in with the information submitted to the Engineer for review and acceptance. The Contractor is advised that these tests can run two-months or more and should be prepared to have these tests completed in sufficient time for the next seeding season. Seed shall conform to all applicable state and federal regulations and to test provisions of the Association of Official Seed Analysts. There shall be no exceptions.

22. The Landscape Subcontractor shall submit a watering and weeding plan and maintenance schedule prior to the installation of plant material, to be approved by the Engineer. The plan shall include proposed methods of watering and weeding, including but not limited to tree gators (bags), sprinklers, drip hoses, irrigation, tanker vehicles and hand watering, etc., as well as manual weeding and weeding tools. No additional payment will be made for watering and weeding during installation and during the two-year guarantee period.

    a. The approved plan and schedule do not relieve the Contractor in any way from any aspect of the replacement of dead plant material. The Landscape Subcontractor may alter the maintenance schedule based on weather and field conditions.

1.04 PRODUCT HANDLING

1. The Contractor shall provide equipment and personnel necessary to handle products by methods to prevent soiling or damage to products or packaging.

2. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.

3. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

4. Delivery of Planting Materials:

a. Packaged Materials. Deliver packaged materials in unopened bags or containers, each bearing the name, warranty, and trademark of the producer and the composition, analysis and the weight of the material. Contractor shall notify the Engineer 48 hours in advance of delivery of all plant material.

b. Trees and Plants. The Contractor shall provide trees and plants of the stock type and quantities shown on the Contract Drawings. Do not prune prior to delivery unless otherwise approved by the Engineer. Do not bend or bind-tie trees or plants in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery, and insure that all balled and burlapped stock, container stock, tube stock, and/or bare root material is handled properly and is not dropped.

c. All plant materials shall be protected from drying out and from wind damage during delivery.

d. The Contractor shall deliver trees and plants after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and plants in shade, protect from wind, weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Water as necessary.

e. The Contractor shall not remove container grown stock from container until planting time.

f. Material should be planted in the ground immediately after delivery to site. Plants should be covered with damp-not wet-leaf compost while awaiting ground installation. Do not allow the plants to dry out or freeze.

g. Fertilizer delivered to the job site shall be in original, unopened containers bearing the manufacturer's chemical analysis and essential information. Fertilizer containers shall be protected from exposure to precipitation and direct sunlight.

h. All materials shall be stored in upland areas that are protected from weather.

a. Seeding:

    i. Seed shall be clean and fresh and delivered to the site in the original, unopened bags showing the net weight, composition of mix, suppliers name and guarantee of analysis. Seed shall be delivered and stored in original unopened packages, kept dry, and not opened until needed for use. Damaged or faulty packages shall not be used and will be rejected. Seed shall have been harvested for planting in the current growing season and shall have been packed within the last 9 months.

    ii. All seed shall be interagency certified under the auspices of a State Seed Improvement Cooperative and shall bear their seals of certification on each 50-pound bag. Permanent seed shall be 75% pure live seed minimum. The specified seed application rates shall be adjusted based upon results of pure live seed calculations.

    iii. Seed materials will be inspected by the Engineer upon arrival at the job site and prior to planting. Any materials not in compliance with specifications will not be accepted and shall be removed from the job site immediately.

    iv. All seed materials shall be protected from drying out and from wind damage during delivery.

    v. Furnish seed in sealed, standard containers with germination and purity percentages clearly labeled.

vi. Plant Material: Provide healthy, vigorous growing specimens exhibiting uniform growth and form characteristic of their species that satisfy the project specifications. Plants shall be free of chlorosis, yellowing, blemished or damaged parts.

vii. Label all flats of plants and all separate plants with a securely attached waterproof tag, bearing legible designation of botanical and common name, written with waterproof ink.

b. Storage of materials

Store and cover materials to prevent deterioration. Remove packaged materials which have become wet or show deterioration or water marks from the site and replaced.

Seed that is wet or moldy or that has been otherwise damaged in transit or storage shall be replaced.

1.05 QUALITY ASSURANCE

1. Source Quality Control:

2. All nursery sources must be within a 250- mile radius of the planting site. All specified plants shall have also been grown in the same USDA climatic zone as that of the planting site.

   a. All seed and original stock material for herbaceous plants shall have been collected from locally within a 250-mile radius of the project site.

   b. No substitutions of specified plants will be accepted without prior written approval of the Engineer..

3. General. Ship landscape material with certificates of inspection when required by governmental authorities. Comply with governing regulations applicable to landscape material.

4. Packaged Material. Package standard products with manufacturer's certified analysis. For other material, such as topsoil, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable, or as further specified.

5. All seed shall be interagency certified under the auspices of a State Seed Improvement Cooperative and must bear their seals of certification on bag. Permanent seed shall be 75% Pure Live Seed minimum. Weed content of seed lots shall not exceed 0.25 percent. All seed shall be free of noxious weeds. Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America.

6. Trees and plants shall be specified as in the Contract Documents. Nurseries which collect plants from the wild shall be rejected. No substitutions shall be permitted, except as authorized in writing by Engineer. If specified landscape material is not obtainable, submit proof of non-availability to Engineer, together with proposal for use of equivalent material.

7. The Contractor shall provide trees and plants of quantity, size, genus, species and variety shown and scheduled in the Contract Documents for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock" and

the Manual of Vascular Plants of the Northeastern United States and Adjacent Canada. The Contractor shall provide healthy, vigorous stock, grown in a recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries abrasions, or disfigurement. Contractor shall submit certification that wetland plants are procured at least six months prior to scheduled planting.

8. All plants furnished under this Item shall be true to name. Plant names shall agree with the nomenclature of Standardized Plant Names as adopted by the American Joint Committee on Horticultural Nomenclature, 1942 Edition. Size and grading shall conform to those of the American Standard for Nursery Stock (ANSI Z60.1 – 2014).

9. Soil Mixes shall conform with Section 32 90 05 – Soil Mixes and Section 31 00 01 – Earthword.

10. Inspection:

11. The Engineer shall inspect trees and shrubs at place of growth before planting, for compliance with requirements for genus, species, variety, size and quality. Contractor shall be responsible for all inspection costs beyond a 50-mile radius from the Site.

12. Plant materials shall be inspected by the Engineer upon arrival at the job site and prior to planting. Any materials not in compliance with specifications shall not be accepted and shall be removed from the job site immediately.

13. The Engineer retains the right to further inspect trees for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. The Contractor shall remove rejected trees immediately from project site.

14. Tagged samples of plant materials shall be delivered to the site and planted in locations approved by the Engineer. These tagged samples shall be maintained, protected and used as standards for comparison with the plants furnished for the work.

15. The Contractor shall be responsible for all certificates of inspection of plant material that may be required by Federal, State or other authorities to accompany each shipment of plants. On arrival, the certificates shall be filed with the Engineer. The Engineer shall receive a copy of each shipping invoice immediately after the delivery has arrived at the job site.

1.05 INSTALLATION REQUIREMENTS

1. The Contractor shall take all necessary measurements in the field to determine the exact dimensions for all work and verify all pertinent data and dimensions shown on the Contract Drawings.

2. Unless otherwise directed by the Engineer, evergreen material shall be planted and transplanted from April 1st to May 15th and from September 1st to October 15th. Deciduous material shall be planted and transplanted from March 1st to May 30th and from October 15th to December 15th. Container-grown herbaceous material shall be planted and transplanted from April 15th to May 30th and from September 1st to October 15th. Perform actual planting when conditions are suitable. No plant material shall be planted when the ground is frozen or in excessively moist condition. All material labeled as fall planting hazard shall be installed during the spring only. Notify the

Engineer before proceeding with any planting operations.

3. Time of Planting and Transplanting. Perform actual planting when conditions are suitable within the timeframes per vegetation type. No plant material shall be planted when the ground is frozen or in excessively moist condition. Notify the Engineer before proceeding with any planting operations.

4. The Contractor shall proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

5. Utilities. The Contractor shall determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is approved by the Engineer.

6. Excavation. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse draining conditions, or obstructions, notify the Engineer.

7. Preservation and Restoration of Existing Trees and Shrubs.

    a. To avoid surface and subsurface root damage and soil compaction, the Contractor shall not be permitted to stockpile materials of any nature under the drip line of existing trees and shrubs. This directive shall apply to all areas within or outside the Contract limit line.

    b. The Contractor shall assume the responsibility for any remedial work such as root and top pruning required and/or necessary to prevent loss of plant material when this article is violated or when trees or shrubs are injured by construction equipment.

    c. Compensatory pruning and fertilizing of existing trees and shrubs shall be performed to compensate for damage of roots incurred. Fertilize in areas around undamaged roots only and not adjacent to the trunk or main stem. Fertilizer shall be applied in the fall unless otherwise approved by Engineer.

    d. Tree pruning shall be performed in accordance with NYSDOT Standard Highway Specification Section 614.

    e. No separate payment will be made for fertilizing and pruning of trees and shrubs in stockpile areas or when trees or shrubs are injured by construction equipment, but the cost thereof will be deemed to be included in the various prices bid for the items for which such pruning and fertilizing are necessary.

    f. No existing trees, shrubs or herbaceous plants shall be removed, except as specifically required by this Contract or as specified on Contract Documents, or as specifically approved in writing by the Engineer.

    g. Any areas or items of existing landscape which are removed or damaged shall be replaced by the Contractor at the cost of the Contractor. The Contractor shall match the existing condition prior to damage or as directed by the Engineer.

    h. All existing landscape features including trees, shrubs, perennial, meadows, lawns, wetlands, paving, walls, stairs, etc. shall be protected by the Contractor, utilizing methods approved by the Engineer prior to start of work.

1.07 LANDSCAPE GUARANTEE

1. Guarantee. All landscaping work shall have a replacement guarantee for a period of two (2) years beginning at the date of acceptance of the Landscaping work or the date of substantial completion, whichever is later.

2. Operations. The Contractor shall, for a period of two (2) years, cultivate, weed, mulch, prune, and water all trees, shrubs, herbaceous plants, vines, and permanent seeded areas under this Contract, to the satisfaction of the Engineer. The Contractor shall replace, according to the original specifications, any plant material which is dead or in a dying condition at the request of the Engineer. The Engineer shall be the sole judge as to the condition of the plants. The guarantee and maintenance applies to all planted and grassed areas, meadows, paved and other landscaped areas.

3. Replacement. Any plant material that is dead or not showing satisfactory growth, as determined by the Engineer, shall be promptly removed and replaced by the Contractor during normal planting season. Initial replacement of dead material and the repair of bare areas will take place one year following the acceptance of plant material. The replacement shall be of the same variety, size and character as specified for the original planting. Unless a written waiver of this clause is issued, under the terms of the guarantee, replacement plants shall be chosen only by the Engineer.

    a. At the end of the guarantee period, and upon written request, an inspection will be made by the Engineer. If mortality exceeds ten percent or if bare areas occur, the Contractor shall replace plant material.

PART 2 -- PRODUCTS

2.01. CONTRACTOR'S RESPONSIBILITIES

1. Furnish and submit certification for the materials used as specified in the General Conditions, Division 1 and Division 2.

2.02. TOPSOIL

1. Upon completion and approval of the rough grading, the Contractor shall place the topsoil over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped. Topsoil is to be installed over Underground Storage Chambers as per drawing detail. Topsoil shall be as defined under Section 31 00 01 – Earthwork and Section 32 90 05 – Soil Mixes

2.03. WATER

1. Water shall be furnished by Contractor.

2. The Contractor shall furnish all hoses and connections necessary to complete the landscaping work.

2.04. FERTILIZER

1. Fertilizer shall be a complete commercial fertilizer with components derived from commercial sources. Fertilizer analysis shall be determined from field soil sampling in appropriate number taken by the Contractor and analyzed by the N.Y. Department of Agriculture or other independent laboratory. Contractor shall furnish fertilizer in accordance with the recommendations of the N.Y. Department of Agriculture.

2. Fertilizer shall be Osmocote, The Scotts Company, Marysville, OH slow-release fertilizer, or approved equal and Holly-tone Evergreen and Azalea Food granular fertilizer for ericaceous shrubs and trees. Fertilizer shall be furnished in standard containers, with name, weight and guarantee analysis of contents clearly marked thereon. Appropriate containers to disperse specified amounts of fertilizer into planting holes shall be supplied and used by the Contractor.

3. Fertilizer shall be stored in weatherproof storage areas and in such a manner that its effectiveness will not be impaired.

2.05. MYCORRHIZAL INOCULANTS

1. Mycorrhizal inoculants shall be used in all tree and shrub planting operations in all areas receiving topsoil from off-site sources, or stripped topsoil stockpiled in excess of one year.

2. The inoculants for trees and shrubs shall be "Mycor Tree Saver" by Plant Health Care, Inc.; Rhizanova Tree Transplant, by Becker Underwood, Inc.; “DIEHARD” by Horticultural Alliance; or approved equal. The inoculants shall contain fresh, live and viable spores of both endo (VAM) and ecto (Pt) mycorrhizal fungi. All inoculants shall be delivered in sealed containers or packages of the Vendor, listing the weight, content, date of packaging and name of Vendor.

3. The inoculants for herbaceous plants and grasses shall be Mycor Plant Saver as manufactured by Plant Health Care, Inc.; “DIEHARD” by Horticultural Alliance’ “mycorrhiza ROOTS Soluble’ by Lebanon Turf; or approved equal. The inoculants shall contain fresh, live and viable spores of both endo (VAM) and ecto (Pt) mycorrhizal fungi. All inoculants shall be delivered in sealed containers or packages of the Vendor, listing the weight, content, date of packaging and name of Vendor.

4. The inoculants shall be stored in unopened containers in a cool, dry location. All containers must be inspected by the Engineer prior to opening. Any inoculants dated eighteen (18) months or more prior to the date of intended use shall not be used. Any inoculant that has been in a wet condition shall not be used. Any inoculant rejected by the Engineer shall be removed from the site.

5. For trees and shrubs, the Contractor shall incorporate the inoculant into the top eight inches (8") of the topsoil mix used in the planting operations as per the manufacturer's instructions. The amount of inoculant used at each plant shall be based on the plant's size - see manufacturer's instructions. For herbaceous plants, the Contractor shall place the inoculant into each planting hole as per manufacturer’s application rate and project plans.

2.06. PLANT MATERIAL

1. Provide plant material to meet or exceed applicable ANLA standards in all ways in addition to other standards specified. Plant names, size and grading standards shall conform to those

prepared by American Nursery and Landscape Association (American National Standards Institute), American Standard for Nursery Stock (ANSI Z60.1, latest edition). Plants shall be true to species and, if specified as to variety or cultivar, shall be as listed in http://newyork.plantatlas.usf.edu/Default.aspx to determine nativity and as listed in http://plants.usda.gov/java/ for taxonomy. Plants shall be typical of their species or variety with normal habits of growth, in accordance with ASNS: Sound, healthy and vigorous, well-branched and densely foliated when in leaf, with healthy well developed root systems; free from disease, abrasions of the bark, insect pests, eggs or larvae.

2. Plant species native to the Eastern United States, as specified in the planting plan and Contract, shall be provided by the Contractor. Non-native species shall not be considered as substitutes for native species.

3. Native plant material shall be derived from the local genotypes of the native plants specified to the greatest extent practicable. Plants must be nursery grown in hardiness zones no warmer or colder than the project sites as determined by the USDA Agricultural Research Service, Plant Hardiness Zone Map. All plants shall be straight species, not cultivars, unless otherwise indicated on the Contract Drawings. Substitution of cultivars for straight species or for other specified varieties is not allowed unless otherwise authorized in writing in advance of plant procurement.

4. Plants that have escaped cultivation, or have accidentally been introduced into native habitats, shall not be considered native to the Eastern United States. Refer to USDA Plants Database for taxonomy and to G&C, NYSPC and the New York Flora Atlas to determine nativity.

    a. No plant material shall be collected or harvested from non-nursery areas.
    b. All balled and burlapped trees shall be freshly dug for this project.

5. Sources: Nursery sources of supply shall have been investigated by the Contractor prior to submitting its bid to confirm that size, variety, and quantity of plant material specified on the Plant List can be supplied. Failure to take this precaution will not relieve the Contractor from the responsibility for furnishing and installing all plant material in strict accordance with the Contract requirements and without additional expense to the Client.

6. Quality: All woody plant material shall be nursery grown in accordance with good horticultural practice, for at least two (2) years under climatic conditions and soils similar to those at project site. All plants shall be of specimen quality. Except where multi-stem trees have been specified in the contract or approved in writing in advance of plant procurement, all trees are to be uniform and matched. All trees shall have straight trunks with leader intact, undamaged and uncut. Trees with damaged or crooked leaders, bark or abrasions, sunscald, disfiguring knots, or insect damage will not be accepted.

7. Depth of planting shall be checked on all trees being tagged at the nursery. Remove all soil or other fill material above the natural point where the tree trunk begins to spread, (the flare), prior to digging and ball and burlap operations.

8. Size:
    a. Caliper measurement shall be taken on the trunk at 6 inches above the natural ground line for trees up to and including 4 inches in caliper, and 12 inches above the ground for trees greater than 4 inches in caliper.
    b. Height and spread dimensions refer to the main body of plant, and not from branch tip to tip.

c. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified.
d. Plants that meet measurements but do not possess a normal balance between height and spread shall be rejected.
e. Plants larger than specified may be used only if approved by Engineer. Use of such plants shall not increase the contract price nor decrease the number of plants required per the Contract Drawings. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant.

9. All balled and burlapped tree stock (B&B), shall have a compact natural ball of earth, firmly wrapped and tied in burlap fabric.
   a. Root ball sizes shall be in accordance with standards specified in ASNS.
   b. Plants with cracked or broken rootballs will not be accepted.
   c. Only natural burlap fabric shall be acceptable for balling. Plastic and other non-biodegradable fabrics will not be accepted.

2.07 EROSION CONTROL MATTING

Erosion Control Matting shall be in accordance with Section 6.17 of the New York State Standards and Specifications for Erosion and Sediment Control, latest edition, and Section 31 25 00 – Erosion and Sedimentation Control is required on any seeded areas and on all slopes steeper than 3 feet horizontal to 1 foot vertical.

2.08 MULCHES

1. Mulch shall be a double-shredded natural forest product of a uniform grade, partially decomposed, dark brown in color, free from sawdust, with no additives or any other treatment. Size of bark shall be from 5/8 inch to one and 1-1/4 inch. The pH range shall be 5.8 to 6.2.

2. Mulch sources shall be free of diseases or pest infestations including but not limited to the Emerald Ash Borer or Asian Longhorned Beetle. Use of material from any areas that have been designated for quarantine of wood products by any state or federal agency is strictly prohibited.

B.

2.09 TOPSOIL

Topsoil shall conform to Section 32 90 05 – Soil Mixes.

2.10 MATERIALS FOR STAKING AND GUYING

Stakes. The Contractor shall provide straight, sound cedar or oak stakes, 2 x 2-1/2 inch diameter (50 x 50 mm or 63 mm diameter) in size.

In natural areas, where wind-disturbance is unlikely Engineer will determine if stakes are necessary. If it is determined that staking is required, a modified staking system shall be used. The modified stakes shall be shorter than conventional stakes and shall protrude 18 inches above the finished grade. Stakes shall be anchored and fastened in the same manner as in conventional staking.

Tree guys. The Contractor shall provide guys of 3/4” woven polypropylene fabric, such as “Arbor-Tie” or approved equal. Each end shall be coiled tightly, with enough slack left in guy so as to allow slight movement of tree trunk. <u>Guying shall be performed under the direct supervision of the Engineer.</u>

2.11 DEER FENCE

1. The Contractor shall furnish all materials, labor, and equipment necessary to install the deer fence specified herein as required by the Engineer.

2. The deer fence shall be maintained in good condition and repaired as necessary by the Contractor during the landscaping and plant guarantee period as directed by the Engineer and restoration specialist.

The deer fence Deer Fence shall be 8.0’ high, 14 gauge Welded Wire, 2 x 4” mesh, black powder coated galvanized steel, with heavy duty fence posts and 5’ wide gate as furnished by Deer Busters, 144 Cleveland Ave., Waynesboro, PA 17268. (888) 422-3337, Deerbusters.com or approved equal. The posts shall be 10 ft. tall and placed 8 ft. on center and are driven into the subgrade a minimum of 2 ft. The fence shall be 8 ft. high and conform to the detail on the Contract drawings.

The deer fence shall be inspected periodically (at least once per week), or as directed by the Engineer through the two-year Landscape Warranty period. Any required repairs shall be made immediately. At the end of the two-year Landscape Warranty period the fence shall be removed by the Contractor.

2.12 SEED

1. Temporary Seed Requirements: Soil stockpiles and cleared and graded areas shall receive oat seed (*Avena sativa*) for temporary stabilization as required during the spring and summer months according to Section 31 25 00 – Erosion and Sedimentation Control. Areas requiring temporary stabilization after August shall be seeded with certified Canada wild rye (*Elymus canadensis*).

2. Permanent Seed Requirements:

a. Seed areas shall be fresh recleaned seed of the latest crop.
b. All seed shall be delivered in standard size bags of the vendor, showing weight, purity, and percentage of seed varieties.

c. Seed shall be stored in original unopened packages, kept dry and not opened until needed for use. Damaged or faulty packages shall not be used and will be rejected. Seed shall have been harvested from the previous growing season. Seed sources shall be located within a 250-mile radius of the project site.

d. Seed shall be cold stratified and no less than 75% PLS (pure live seed). Quantities shall be calculated based upon percent of Pure Live Seed.

e. Legume seed shall be inoculated with Rhizobia bacteria.

f. Seed shall be delivered to site in separate packages and shall be machine mixed or hand broadcast in smaller areas where appropriate, on site as approved by the Engineer.

g. Apply seed with drop or cyclone spreaders to uniformly cover seedbed at the rate required.

h. Carrier Medium for Seed Applied by Conventional Seeding Methods shall be mixed with clean moistened sand.
   i. Sand shall consist of clean, hard, durable, uncoated stone particles, free from lumps of clay and all deleterious substances.
   j. Sand shall be so graded that when dry, one-hundred percent (100%) shall pass through a one-quarter inch (1/4") square opening sieve; not more than thirty-five percent (35%) by weight shall pass a No.50 sieve and not more than ten percent (10%) by weight shall pass a No.100 sieve. Sand may be rejected for this class if it contains more than ten percent (10%) by weight of loam and/or silt.
   k. Sand shall be mixed at a rate of 10 parts sand to 1 part seed.

l. The Contractor shall apply Erosion Control Mat to all seeded areas as specified Section 31 25 00 – Erosion and Sedimentation Control.

3. Seed Mixtures

a. Lawn Areas

1. Grass Seed for Lawn Areas shall be the species and percentage composition as follows:

BOTANICAL NAME	COMMON NAME	PERCENTAGE
Festuca rubra	creeping red fescue	25
Lolium multiflorum	annual ryegrass	25
Lolium perenne , 'Blackstone'	perennial ryegrass, 'Blackstone'	25
Lolium perenee 'Confetti III'	Perennial ryegrass, Confetti III' turf type	25

Grass seed for Lawn Areas shall be applied at a rate of 150 lbs/acre.

b. FACW Wetland Seed Mix

1. FACW Wetland Seed Mix shall be the species and percentage composition as follows:

BOTANICAL NAME	COMMON NAME	PERCENTAGE
Asclepias incarnata	swamp milkweed	10
Carex crinita	fringed sedge	5
Elymus virginicus	Virginia wildrye	20
Eupatorium maculatum	spotted Joe-Pye-weed	3
Eupatorium perfoliatum	boneset	5
Juncus effusus	soft rush	15
Lobelia cardinalis	cardinal flower	3
Schoenoplectus tabernaemontani	softstem bulrush	5
Scirpus atrovirens	green bulrush	5
Scirpus cyperinus	wool grass	15
Solidago gigantea	late godenrod	3
Symphiotrychum novae-angliae	New England aster	5
Verbena hastata	blue vervain	3
Vernonia noveboracensis	New York ironweed	3

FACW Wetland Seed Mix shall be applied at a rate of 30 lbs/acre.

c. Native Groundcover Seed Mix

1. Native Groundcover Seed Mix shall be the species and percentage composition as follows:

BOTANICAL NAME	COMMON NAME	PERCENTAGE
Carex grisea	gray wood sedge	20
Carex pensylvanica	Pensylvania sedge	20
Sporobolus heterolepis	prairie dropseed	20
Achillea millefolium	common yarrow	5
Aquilegia canadensis	wild columbine	5
Asclepias tuberosa	butterfly milkweed	5
Conoclinium coelestinum	blue mistflower	5
Eurybia divarica	white wood aster	5
Solidago nemoralis	gray goldenrod	5
Symphyotrichum novi-belgii	New York aster	5

Native Groundcover Seed Mix shall be applied at a rate of 15 lbs/acre and overseeded with a cover crop of oats (Avena sativa) during spring season and certified Canada wild rye (*Elymus canadensis*) during fall seeding season.

PART 3 -- EXECUTION

3.01 GRADING

1. After approval of the rough grading, the Contractor shall commencepreparations of the subgrade for the various major conditions of the work as follows:

A. For topsoil areas scarify 2-inch depth of subgrade at 4-inches below final grade prior to placing topsoil.

2. For final surface grading be mechanically raked or hand raked to an even finished surface.

TOPSOIL

1. Topsoil shall be placed over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped to a depth of 4 inches unless specified elsewhere.

2. Topsoil shall not be placed in a frozen or muddy condition.

Final surface shall be hand or mechanically raked to an even finished surface to finish grade as shown on Contract Drawings.

All stones and roots over 4-inches and rubbish and other deleterious materials shall be removed and disposed of.

3.03 SEEDBED PREPARATION

1. Contractor shall prepare all areas to receive temporary or permanent seeding measures prior to planting. Subgrade shall be kept free of masonry, concrete, metal waste materials, and debris.

2. Remove stones over 1-1/2 inches in any dimension, as well as sticks, rubbish and other extraneous matter.

3. No topsoil mix is to be placed until the subgrade is approved by the Engineer. Topsoil shall be placed in areas to be seeded and roughened with tracked equipment or other suitable measures. Slopes steeper than 3:1 may be roughened by grooving, furrowing, tracking, or stairstep grading. Slopes flatter than 3:1 should be grooved by disking, harrowing, raking, operating planting equipment on the contour.

4. For planting beds, spread topsoil mix to minimum depth required to meet lines, grades and elevations shown on the Contract Drawings, after light rolling and natural settlement.

5. The planting beds and pits shall be worked up well and shall be free of other vegetation and large clods of soil.

6. Soil amendments including, but not limited to, lime and fertilizer shall be spread as necessary, and at the rates specified in this Section. Seeding shall be as per the type and rates specified in this Section. Seed shall be broadcast as soon as possible following roughening, before surface has been sealed by rainfall.

7. 3.04 DELIVERY, INSPECTION AND INSTALLATION

8. Delivery: Plants shall be packed, transported, and handled with utmost care to insure adequate protection against injury. When transported in closed vehicles, plants shall receive adequate ventilation to prevent sweating. When transported in open vehicles, plants shall be protected by tarpaulins or other suitable cover material. All bare root plants shall be adequately protected from

drying out and immediately after inspection shall be heeled in moist soil. Balled and burlapped plants shall be set on the ground and the ball covered with soil. Until planted, all material shall be properly maintained and kept adequately moist, to the satisfaction of the Engineer.

9. Inspection: Inspection may be made before digging if the Engineer directs, but no plant material shall be planted by the Contractor until inspected by the Engineer at the site of the work. Plant material will be rejected if delivered with broken or damaged root balls, or if damaged on site by rough handling. All rejected material shall be immediately removed from the site and replaced with acceptable material at the Contractor's cost. Final inspection shall be made upon completion of the Contract.
10. Installation:
    a. Planting Operations.
        i. Layout: All trees, shrubs and herbaceous shall be laid out as specified in the Contract Drawings unless otherwise directed by the Engineer. All plant and planting area locations shall be staked prior to planting by the Engineer. Place no plantings within two (2) feet of pavements or structures, unless otherwise indicated.
        ii. Loosen subsoil/subgrade to a depth of four (4) inches prior to topsoil placement so that the topsoil and subsoil layers do not mix. Loosen subsoil with rototiller, backhoe or discer. The soil-loosening operation shall be conducted in such a way as to back its way out of the site. After this, no more heavy machinery shall be allowed on the planting beds.
        iii. Rototill/cultivate soils to a depth equal to the depth of the root ball and two times the diameter of the root ball. Set the tree/shrub on the undisturbed solid ground in the center of the area.
        iv. Obstructions Below Ground: Remove any rock, rubble, masonry, concrete, metal, stones over one inch or other underground obstructions to the depth necessary to permit proper planting.
        v. Disposal: Remove and dispose of all excess excavations and unsuitable materials. Dispose in accordance with all local laws and regulations at Contractor's cost.
        vi. Apply topsoil, utilizing small equipment that does not compact soil.
    b. Plant Beds:
        i. All plant material shall be planted in existing on-site and/or locally available topsoil, except for shallow plantings installed within the specified four-inch (minimum) topsoil layer.
        ii. Bare root material shall be adequately protected from drying out and immediately heeled in after inspection. The bundles of heeled-in plants shall be set upright on the ground, covered with mulch, and kept adequately moist until the time of installation. Until the time of planting, all plant material shall be stored in an approved location, securely fenced and maintained, to the satisfaction of the Engineer, at the Contractor's expense. All plants not planted immediately shall be watered as necessary to maintain optimal health until planting.
    c. Setting Plants:
        i. Plant all plants to the same depth as their place of growth, unless otherwise directed. Center the plants in their planting pits. Set in the natural upright position at such a level that, after settlement, a normal or natural relationship of the crown of the plant with the ground surface shall be established. Be careful not to exert any pressure that will damage any portion of the plant.
        ii. Topsoil mix shall be lightly tamped around the base of all plants and trees. Avoid compacting the soil. Do not leave plants exposed to sun or wind prior to planting. Take special care to avoid desiccation of fibrous-rooted plants.

iii. The Contractor shall be liable for any damage to property caused by planting operations and the Contractor shall, without any additional cost, restore to original condition or replace all trees, plant beds, lawns, meadows and all construction disturbed or damaged in performing the work of this Contract.

d. Planting Trees and Shrubs.

i. Trees and shrubs shall be planted before herbaceous plants to avoid trampling of the smaller material. The Contractor shall properly sequence plant delivery to achieve this progression.

ii. Balled and burlapped. The roots of balled and burlapped plants shall, if not immediately planted after digging and inspection, be adequately protected by topsoil until planted in their final location. Handle balled plants so that the ball will not be loosened. After the soil has been thoroughly firmed under and around the ball, cut the burlap away from the upper half of the ball and adjust remaining burlap to prevent the formation of air pockets; when directed by the Engineer remove the burlap entirely. Firm the soil at 6" to 8" intervals and thoroughly settle with water. Remove all wire baskets from root balls, unless otherwise directed by the Engineer. Install mulch around trees and shrubs immediately after installation.

iii. Container. Cut containers on two sides with an approved can cutter and remove plant from container. Set container grown stock as specified. If container grown plant is root-bound or can be easily pulled from container, plant shall be rejected. Place plant on a cushion of planting soil mixture and carefully work soil mix around roots by hand and puddle with water until the soil mix layers are completely saturated.

iv. Mix granular 12-14 month slow release Osmocote into the top two inches (2") of soil backfill at the rates indicated on the Contract Drawings and/or manufacturer's recommendations. For ericaceous trees and shrubs, incorporate Holly-tone fertilizer in place of osmocote at the manufacturer's recommended rate. Apply Mycorrhizal inoculants directly to the root ball. The top of the root ball/container soil shall be level with the substrate surface. Excess substrate shall be distributed around the planting sites. Form a 3-inch saucer around the planting sites with the excess substrate.

v. Provide a minimum three (3) inch thick layer of mulch within tree planting pit saucers and work into top of soil and finish level with adjacent finish grades. Do <u>not</u> place mulch within six (6) inches of tree trunks, nor should the base of shrubs and other plants be covered by mulch.

vi. Prune, thin out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Engineer, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune plant material to retain natural character.

vii. Trees shall be placed with the tags facing North. Placing the trees in the same orientation to the North as they were grown in the nursery shall serve to limit bark sun scald.

viii. Guy and stake street trees immediately after planting, as required by the Engineer. Trees planted as part of a natural area restoration must use modified staking system if deemed necessary. Stakes shall be removed after one complete growing season.

11. Method of Work: Submit a list of proposed methods of execution of work under this section for review by the Engineer when proposed methods are different from, or supplementary to, those specified herein.

3.05 TEMPORARY SEED MIXTURE

A temporary seed mixture shall be used to stabilize stockpiles and portions of the site where construction activities have temporarily or permanently ceased not more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased. This requirement does not apply if earth-disturbing activities will be resumed within fourteen (14) days.

Seed mixture – Temporary seeding shall be oat seed (*Avena sativa*) at a rate of 30 lbs per acre of 0.7 lbs per 1,000 sq. ft. If area is seeded during months of September through November, certified Canada wild rye (*Elymus canadensis*) shall be used at a rate of 50 lbs per acre or 1.25 lbs per 1,000 sq. ft.

If temporary seeding is not made within 24 hours of construction/disturbance the soil must be scarified prior to seeding.

Method of seeding – seed shall be evenly applied with broadcast seeder, drill or cultipack seeder.

If temporary seeding is made under favorable soil and site conditions during the optimum seeding dates (March 15 – May 15 or September 1 – October 15) mulch is not required. Terra-tack, as manufactured by Reinco, Inc., Hydrobond by JRM Chemical, Inc, Dustout by DustoutUS, or equivalent as approved by the engineer, shall be used. Temporary seeded area can be mulched with a straw of oat or wheat stalks (not hay) applied at a rate of 2 tons per acre (100 - 200 bales / acre) uniformly distributed over the sown seeds and held in place through the use of a straw crimper.

Any area with fail to establish vegetative cover adequate to prevent rill erosion will be reseeded as soon as such areas are identified.

3.06 PERMANENT SEED MIXTURE

Seed materials shall be inspected by the Engineer upon arrival at the job site and prior to planting. Any materials not in compliance with specifications shall not be accepted and shall be removed from the job site immediately.

All seed materials shall be protected from drying out and from wind damage during delivery.

All areas shown to receive seed on Contract Drawings and all areas which are disturbed and not planted shall be seeded.

Seedbed Preparation – Scarify all compacted areas and remove all debris and obstacles such as rocks and stumps.

Do not broadcast seed by mechanical application when the wind velocity is such as to prevent uniform seed distribution.

Time of Seeding – Permanent seeding shall be done within 15 days of final construction activities. Optimum seeding times are in the Spring from March 15 – May 15 and in Fall from September 1 – October 15. If construction is completed during mid-summer, seeding may be done if watering will be provided.

Method of Seeding – Seed shall be evenly applied with a broadcast seeder, drill or multipack seeder.

Following the seeding operation, 10-10-10 fast release fertilizer shall be broadcast at a rate of 400 lbs/acre throughout the seeded area by hand or mechanically using a cyclone broadcaster. Seed shall be watered as recommended by the seed manufacturer to achieve specified growth coverage.

All seeded areas and areas with slopes of 3:1 or steeper, areas shall be covered with anchored stabilization matting in accordance with Section 31 25 00 – Erosion and Sedimentation Control

Seeding shall be deemed acceptable when 85% coverage of the seeded area with the seeded species has been achieved. Any area not meeting this requirement shall be reseeded with the original seed mix.

Areas seeded with temporary cover grass shall be rototilled and/or harrowed prior to seeding with permanent seed mix during the allowed time period.

3.08 STORMWATER BASIN PLANTINGS

Installation: The Contractor shall complete all work in the best manner, so that the work as a whole is of uniform quality and appearance. The Contractor shall conform to the requirements specified hereafter. Plant material scheduled for planting in coconut fiber logs shall also be rooted and potted in coconut fibers, and not in potting soil. This requirement shall serve to safeguard against plants floating out of coconut fiber logs due to the washing away of potting soil.

At the elevations described and shown on the plans, the areas shall be fine graded, prepared for planting and landscaped.

Subgrade shall be kept free of waste material and debris. Subgrade shall be compacted prior to topsoil application at the Engineer’s direction.

Remove stones over 1-1/2 inches in any dimension, as well as sticks, rubbish and other extraneous matter.

The planting areas shall be worked up well, and shall be free of other vegetation and large clods of soil.

Install erosion control mat above the permanent pool elevation.

Apply fertilizer at rate specified during planting and seeding operations.

2. Erosion Control Blankets

a. Center a blanket in the bottom of the wetland area and anchor the erosion control blankets in a minimum 8" x 8" slot using five evenly spaced staples. Unroll blankets carefully in the direction of water flow, being careful to place blankets loosely and in full contact with the soil.

b. Overlap blanket edges approximately 4" with downstream edges over upstream edges.

c. Staple blankets using approximately 3 staples per square yard.

d. Overlap blanket ends 6" in a minimum 8" x 8" check slot, upper blanket over lower blanket and staple using five evenly spaced staples.

e. Cut excess blanket with scissors and anchor at the entrance to the weir/micro pool in a minimum 8" x 8" check slot with five evenly spaced staples.

f. Blanket shall not float or bubble anywhere after wetland is inundated with water.

3. Planting Operations

A. Layout: All plants shall be laid out in random and naturalistic arrangements, as specified in the Contract Drawings unless otherwise directed by the Engineer. All plant and planting area locations shall be staked prior to planting by the Engineer. Place no plantings within two (2) feet of pavements or structures, unless otherwise indicated.

B. When planting containerized wetland plants, care shall be taken so as not to set the plants in water where there is in excess of 3" - 4" of water between the top of plant and the water surface. When planting dormant wetland plants, care shall be taken so as not to set the plants in water where there is in excess of 12" - 14" of water between the top of plant and the water surface.

C. When planting containerized or tube wetland plants, care shall be taken so to set the plants in the water regime noted on the Contract Drawings plant schedule.

D. Rototill/cultivate soils to a depth equal to the depth of the root ball and two times the diameter of the root ball. Set the tree/shrub on the solid ground in the center of the area.

E. Obstructions Below Ground: remove any rock, rubble, masonry, concrete, metal, stones over one inch in diameter or other underground obstructions to the depth necessary to permit proper planting.

F. Disposal: Remove and dispose of all excess excavations and unsuitable materials. Dispose in accordance with all local laws and regulations at Contractor's cost.

G. The stormwater basin should not be put into service for 6 to 8 weeks after completion of the associated wetland plantings. This will permit the wetland plantings to establish themselves.

3.09 PLANT PROTECTION AND MAINTENANCE

5. The Contractor shall be responsible for watering and maintaining all seeded areas through the end of Landscape Warranty period. Plant and Seed material will not be accepted unless the plants exhibit healthy growth and satisfactory foliage conditions. Maintenance shall include but not be limited to, annual fertilization, mowing, repair of seeded areas, irrigation, and weed control. The Contractor shall provide, at the Contractor's own expense, protection for all seeded areas against trespassing and damage at all times until acceptance of the work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

6. The Contractor shall submit a watering and weeding plan and maintenance schedule prior to the

installation of plant material, to be approved by the Engineer. The plan shall include proposed methods of watering and weeding, including but not limited to tree gators (bags), sprinklers, drip hoses, irrigation, tanker vehicles and hand watering, etc., as well as manual weeding and weeding tools. The approved plan and schedule do not relieve the Contractor in any way from any aspect of the replacement of dead plant material.

7. Mowing shall be scheduled to maintain a minimum stand height of 4-inches or as directed by the Engineer. Stand height shall be allowed to reach 8 to 10-inches prior to mowing.
8. All seeded areas shall be inspected on a regular basis and any necessary repairs or reseedings made within the planting season, if possible. If the stand should be over 15% damaged, it shall be re-established following the original seeding recommendations.
9. Weed growth shall be maintained mechanically.
10. Where required, the Contractor shall install and maintain deer fence for the control of deer browsing on new tree plantings. The Contractor shall install deer fence where shown on the Contract Drawings and maintain the deer fence during the plant guarantee period. Deer fence shall be installed as per manufacturer's specifications.

3.10 CLEANUP

23. The Contractor shall remove from the site all subsoil excavated and all other materials, supplies, equipment which the Contractor or any Subcontractors may have used in the performance of the work, and debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds. The Contractor shall broom clean paved surfaces.
24. The Contractor shall thoroughly clean all materials, equipment and structures installed under this Contract; all marred surfaces shall be touched up to match adjacent surfaces.
25. The Contractor shall clean all landscaped areas of all debris and any objectionable material, as determined by the Engineer, and shall remove all such debris off-site.
26. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer. The Contractor shall also cut all perimeter grass and weeds before final acceptance.

3.11 FINAL ACCEPTANCE

All trees, shrubs and herbaceous plants must be thriving. Planting pits and beds must be evenly mulched and free of invasive nonnative plant species. Paving/landscape interface must be a smooth, crafted transition free from defects such as gaps, sharp edges or sudden level changes.

- END OF SECTION -

SECTION 33 05 61
UTILITY STRUCTURES

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, equipment, and tools required for the design, fabrication, delivery and installment of utility structures and appurtenances in accordance with the Drawings and as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 03 21 00 – Reinforcing Steel

C. Section 03 15 00 – Concrete Accessories

D. Section 03 30 00 – Cast-in-Place Concrete

E. Section 03 40 00 – Precast Concrete

F. Section 05 53 00 – Gratings, Checkered Floor Plates, and Access Doors.

G. Section 05 56 00 – Castings

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C478 – Specification for Precast Reinforced Concrete Manhole Sections

2. ASTM C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

3. ASTM C990 – Specifications for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

1.04 SUBMITTALS

A. Submit samples and/or Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

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B. In addition to items listed in Section 03 40 00 – Precast Concrete, Shop Drawings shall include, but not be limited to:

1. Complete layout and installation Drawings and schedules with clearly marked dimensions.

2. Material certificates on all piping materials.

3. Structural design calculations sealed by a Professional Engineer registered in the State or Commonwealth in which the project is located. Design calculations for precast manholes and vaults shall include confirmation structures adequately resist flotation when they are totally empty and subjected to groundwater full height of structure.

4. Results of leakage test

PART 2 – PRODUCTS

2.01 PRECAST MANHOLES, VAULTS, AND METER BOXES

A. Precast utility structures shall be furnished with water-stops, sleeves and openings as noted on the Drawings. Box out for wall pipes shall conform accurately to the sizes and elevations of the adjoining pipes. Precast utility structures shall be watertight and conform to the requirements of ASTM C 478 and ASTM C857 with the following modifications there to:

1. Materials shall conform to Section 03 40 00 – Precast Concrete.

2. Manholes shall meet the following:

   a. Manhole section shall have an internal diameter of 4'-0", unless noted otherwise. Clear lid openings shall be 24-inch diameter.

   b. Minimum manhole wall thicknesses shall be 5 inches for 4-foot and 5-foot diameter manholes, 6 inches for 6-foot diameter manholes and 7 inches for 7-foot diameter manholes.

   c. Manholes and utility structures shall include ballast concrete and/or other means necessary to insure manholes resist flotation when empty and subjected to groundwater full height of structure.

   d. Precast manholes and utility structures shall be as manufactured by Oldcastle, Tindall Corporation, or equal.

3. The date and name of manufacturer shall be marked inside each precast section.

4. No more than two lift holes may be cast or drilled in each section.

5. Dimensions shall be as shown on the Drawings.

6. Covers and frames shall be as specified in Paragraph 2.12.

7. Mechanical Details such as piping, electrical, and other details shall be as shown on the Drawings.

B. Joints between manhole and utility structures riser sections and at base slabs shall be groove type.

2.02 BRICK

A. Brick shall be sound, hard-burned common brick conforming to ASTM C32, Grade MS.

2.03 MORTAR

A. Mortar shall conform to Section 04 05 13 – Mortar and Masonry Grout.

2.04 CONCRETE

A. Concrete shall conform to Section 03 30 00 – Cast-in-Place Concrete.

2.05 REINFORCING

A. Reinforcing shall conform to Section 03 21 00 – Reinforcing Steel.

2.06 PRECAST CONCRETE

A. Precast concrete shall conform to Section 03 40 00 – Precast Concrete.

2.07 CONCRETE BLOCK

A. Concrete block shall be solid, rectangular concrete masonry units conforming to ASTM C139.

2.08 CASTINGS

A. Castings shall conform to Section 05 56 00 – Castings. Casting shall be of the type and size indicated on the Drawings.

2.09 STEPS

A. Steps shall be constructed of Grade 60 steel reinforcing rod (min. 1/2-inch) and completely encapsulated with a wear resistant and chemical resistant rubber.

B. Each step shall have a minimum vertical load resistance of 800 pounds and a minimum pull-out resistance of 400 pounds.

C. The steps shall have 11-inch minimum tread width and shall be placed at 16-inches on center, as shown on the Drawings.

D. Steps shall be cast in place with the concrete.

E. Steps shall only be installed as shown on the Drawings or required in the Specifications.

2.10 JOINT SEALANT

A. Joint sealant shall be a preformed flexible sealant conforming to the requirements of ASTM C990, paragraph 6.2, Butyl Rubber Sealant. Joint sealant shall be Pro-Stik Butyl Sealant by Press-Seal Corporation, Butyl-Nek Join Sealant by Henry Company, CS-102 Butyl Rubber Sealant for all Precast Structures by ConSeal Concrete Sealants, Inc., or equal.

2.11 PIPE TO MANHOLE CONNECTIONS

A. The spring set type shall have a stainless steel interior power sleeve or expander and shall be the PSX assembly by Press-Seal Gasket Corporation, the Kor-N-Seal® | 106-406 Series assembly by National Pollution Control Systems, or QUIK-LOK Boot Connector by A-LOK Products, Inc, or equal.

B. The cast-in-place type shall conform to ASTM C923-18 for sanitary sewer connections between reinforced concrete manhole structures, pipes, and laterals, ASTM C1478-19 for storm drain connections between pipes, and laterals, and ASTM F2510 for storm drain connections between reinforced concrete manhole structures, and dual and triple-wall polyethylene and polypropylene pipes. Sleeves shall include stainless steel take up clamps.

C. Flexible seal assemblies shall permit at least an eight (8) degree deflection from the center line of the opening in any direction while maintaining a watertight connection.

2.12 COVERS AND FRAMES

A. Covers and frames shall comply with Section 05 56 00 – Castings and shall be provided by the utility structure manufacturer.

B. Manhole covers and frames shall meet the following requirements:

1. Locate so that there is ready access to the manhole steps

2. Clear opening shall be a minimum of 22 inches, unless otherwise indicated on the Drawings.

3. Watertight manhole frames and covers shall be suitable for 20 psi internal pressure and shall be Neenah Model R-1915, Type E or equal, cast in place.

4. Non-watertight manhole covers shall be perforated and shall be Neenah Model R-1668, or equal.

5. Storm drain grated inlet frames and grates shall be Neenah R-1878-B7G, East Jordan Iron Works V5660, or equal.

6. Curb inlet frames and grates shall be Neenah R-3067, East Jordan Iron Works EJ 7030, or equal, and shall include frame, grate, and hood.

C. Vault covers shall have lifting handles and shall be bolted with stainless steel bolts complying with Section 05 05 23 – Metal Fastening.

D. Frames and covers shall be identical throughout the Contract.

E. Where shown on the Contract Drawings, Access Doors shall comply with Section 05 53 00 – Gratings, Checkered Floor Plates, and Access Doors.

2.13 GRATES

A. Grates shall comply with Section 05 56 00 – Castings.

2.14 CONCRETE BALLAST

A. Concrete ballast shall be Class B concrete in conformance with Section 03 30 00 – Cast-in-Place Concrete. Ballast shall be provided as necessary to insure manhole resists flotation when empty and subjected to full height groundwater conditions.

2.15 FLEXIBLE JOINT SEALER

A. Flexible joint sealer shall be a rubber ring waterstop as manufactured by Fernco Joint Sealer Co., or equal.

2.16 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to Section 03 15 00 – Concrete Accessories.

PART 3 – EXECUTION

3.01 DESIGN CRITERIA

A. Minimum structural design loading for underground precast concrete vaults shall be as indicated in ASTM C857, unless otherwise noted herein. Precast items subjected to vehicular traffic shall be designed for H-20 traffic loading. Other precast items shall be designed for a vertical live load of 300 psf.

B. Walls of precast items shall be designed for a vertical surcharge resulting in a 100 psf horizontal load.

C. Precast manholes and vaults shall be designed to resist flotation when totally empty and subjected to groundwater full height of the manhole/vault.

3.02 FABRICATION AND CASTING

A. Fabrication and casting shall conform to Section 03 40 00 – Precast Concrete and Section 03 30 00 – Cast-in-Place Concrete.

B. All base sections designated to receive concrete ballast and all electrical manholes shall extend monolithically a minimum of 6 inches beyond the outside face of the wall for the entire periphery. All other utility structures shall have a standard base.

C. Utility structures built around existing pipe shall have a cast-in-place base slab.

3.03 HANDLING, TRANSPORTING, AND STORING

A. Handling, transporting and storing of precast items shall comply with Section 03 40 00 – Precast Concrete.

3.04 INSTALLATION

A. Installation shall conform with Section 03 40 00 – Precast Concrete and with the manufacturer's recommendations or to Section 03 30 00 – Cast-in-Place Concrete.

B. Frames and covers or grates shall be set so that tops are at elevations indicated on the Drawings or flush with finished grade where no elevation is indicated.

C. Joints between riser sections shall be sealed with joint sealant.

D. All openings in utility structures shall have flexible rubber sleeves sized to fit the connecting pipe and installed to provide watertight joints in accordance with the manufacturer's recommendations. The interior of the sleeve shall be filled with Class B concrete.

E. Openings that are too large for flexible rubber sleeves shall utilize rubber bladder seals which are expanded by water injected using a pressure pump.

F. All units shall be installed plumb and level.

G. All lift holes and joints shall be filled with non-shrink grout conforming to Section 03 60 00 – Grout, grout inside and out.

H. The manhole frames shall be set to their required elevations either with grade rings or with two or three courses of brick masonry laid around the top of the upper wall section. Such brick work shall be given a 1-inch mortar coat on the inside and out.

I. Concrete ballast shall be placed so that it bears directly on the utility structure base against the outer wall monolithically encircling the structure for the full height indicated on the Drawings. Additional ballast may be required where the depth or elevation of the structure varies from the Drawings.

J. Brick or Concrete Block

1. Brick or concrete block shall be laid with broken joints and all horizontal and vertical joints filled with cement-sand mortar. Outside of walls shall be plastered with a minimum 1-inch thick coat of cement-sand mortar troweled smooth.

K. Connection to Existing Pipe

1. Verify the diameter and invert elevation of existing pipe to be connected to new utility structures prior to beginning work on the structures.

2. Provide adequate protection to prevent damage to the existing pipe.

3. Provide adequate means for plugging and/or transferring the existing flow in the pipe to allow for the construction of inverts and grouting.

4. Cut off the existing pipe sufficiently for connection to the new structure and remove.

5. Thoroughly clean all foreign matter and coat the pipe surface with epoxy adhesive where the pipe joins the new structure.

6. Install a flexible joint sealer around the pipe.

7. Grout inside and outside of wall penetration with non-shrink grout.

L. Backfill structures in accordance with Section 31 00 01 – Earthwork.

M. Clean all structures of any accumulation of silt, debris, or foreign matter and keep clean until final acceptance of the work.

N. Excavation shall conform to Section 31 00 01 – Earthwork.

O. Structure bases shall bear on a minimum of 8-inches of compacted stone unless otherwise indicated on the Drawings.

P. Channel Inverts

1. Inverts shall be placed using Class B concrete with forms sufficient to provide a smooth half-round shape as shown on the Drawings. Manhole bases employing full depth precast inverts are acceptable.

2. Where the slope of the line does not change through a manhole, a constant slope shall be maintained in the invert. Where slope changes occur within a given manhole, the transition shall be smooth and shall occur at the approximate center of the manhole.

3. Inverts shown on the Drawings are taken at the center of the manhole unless otherwise noted.

3.05 ADJUSTMENTS TO EXISTING UTILITY STRUCTURES

A. Adjust structures as indicated on the Drawings using concrete or cast iron adjustment rings by approved methods.

B. Clean covers and inlet castings of all foreign material.

3.06 ADJUSTING COLLARS AND FINAL ADJUSTMENTS

A. Adjusting collars shall be as shown on the Drawings, or as necessary meet final grade. Final adjustments shall be made so that the manhole ring and cover will be smooth and flush with the finished grade of the adjacent surface, or as otherwise indicated on the Drawings for manholes shown above grade.

3.07 LEAKAGE TESTING FOR MANHOLES

A. All manholes shall be vacuum tested as specified below. Refer to Section 33 24 00 – Storm Drains and Roof Drains for storm water pipe testing methods and requirements and Section 40 05 00 – Basic Mechanical Requirements for sanitary pipe testing methods and requirements.

B. Manhole vacuum testing shall include the following minimum requirements:

1. Testing shall be done in accordance with ASTM C1244-05 (or latest revision).

2. Prior to testing all pipes, holes, and vents entering manhole shall be plugged and braced.

3. Contractor shall have an approved test head and copy of instructions for use by the manufacturer.

4. Contractor shall furnish two (2) certified and calibrated vacuum test gauges for the test.

   a. A vacuum of 10-inch hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time for the vacuum pressure to drop to 9-inch hg shall be measured. If the test time meets or exceeds the test time as specified in Table 1, the manhole is acceptable; otherwise, the test has failed and the manhole should be checked for leaks, repaired, and re-tested.

Table 1
Minimum Vacuum Test Times (Seconds) for Various Manhole Diameters and Depths

Manholes Ø (inches)

Depth (ft)	48	60	72	84	96	108	120
6’	15	20	25	29	34	38	43
8	20	26	33	38	45	51	57

Depth (ft)	48	60	72	84	96	108	120
10	25	33	41	48	56	63	71
12	30	39	49	57	67	76	85
14	35	46	57	67	78	89	100
16	40	52	67	76	89	101	114
18	45	59	73	86	100	114	128
20	50	65	81	95	111	126	142
22	55	72	89	105	122	139	156
24	59	78	97	114	133	152	170
26	64	85	105	124	144	164	185
28	69	91	113	133	155	177	199
30	74	98	121	143	166	189	213
Add. VF	+2.5	+3.25	+4.0	+4.75	+5.5	+6.5	+7.0

3.08 FLUSHING AND TESTING OF SEWERS

A. After backfilling, all sewers shall be inspected for obstructions and shall be flushed with water. Flushing shall be a minimum velocity of 2.5 feet per second for a duration acceptable to the Engineer. Flushing shall remove all dirt, stones, pieces of wood and other debris which accumulated in the sewer during construction. The Contractor shall provide a means acceptable to the Engineer for removal of debris flushed from each section of sewer. If after flushing, any obstructions remain, they shall be removed at the Contractor's expense.

B. Visual Inspection – Sewer lines shall be visually inspected from every manhole by use of mirrors, television cameras, or other devices for visual inspection, and the lines shall all exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade or have structural defects shall be corrected to meet these qualifications. Any visual water infiltration of water into the manhole shall be repaired using hydraulic cement or other approved materials.

C. Leakage – Sewers shall be tested for leakage. The program of testing shall fit the conditions as mutually determined by the Engineer and the Contractor. The Contractor shall take all necessary precautions to prevent any joints from drawing while the sewers or their appurtenances are being tested. The Contractor shall, at his own expense, correct any excess leakage and repair any damage to the pipe and their appurtenances, or to any structures resulting from or caused by these tests.

D. Leakage Test Procedure – Each section of sewer shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers and filling the pipe and manhole with water to a point 6 feet above the crown of the open sewer in the upper manhole, or, if ground water is present, 6 feet above the sections average adjacent ground water level as indicated by a monitor well installed adjacent to each manhole. The line shall be filled with water prior to testing and allowed to stand until the pipe has reached its maximum absorption, but not less than two (2) hours. After maximum absorption has been reached, the head shall be reestablished and tested for at least six (6) hours maintaining the head specified above by measured additions of water. The sum of these additions shall be the leakage for the test period.

1. If ground water is present to a height of at least 6 feet above the crown of the sewer at the upper end of the pipe section to be tested, the leakage test may be made by measuring the rate of infiltration using a suitable weir or other measuring device approved by the Engineer. Whether the test is made by infiltration or exfiltration, the allowable leakage shall not exceed 100 gallons per day per inch of diameter per mile of sewer being tested.

2. Where the actual leakage exceeds the allowable, the Contractor shall discover the cause and correct it before the sewer will be accepted. For the purpose of this subsection, a section of sewer is defined as that length of sewer between successive manholes or special structures or stub-outs for future connections.

E. Low Pressure Compressed Air Test – If the leakage cannot be located by infiltration or exfiltration testing, this type test may be used. The pipeline shall be considered acceptable, when tested at an average pressure of 3.0 psi greater than the average back pressure of any groundwater that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0030 cfm per sq. ft. of internal pipe surface.

F. Deflection Test – No sooner than thirty (30) days after final backfill installation, each section of PVC pipe shall be checked for vertical deflection using an electronic deflectometer or a rigid "GoNoGo" device. Vertical deflection shall not exceed five (5) percent of the inside pipe diameter for PVC pipe.

1. Where the actual deflection exceeds the allowable, the Contractor shall discover the cause and correct it before the pipe will be acceptable. For the purpose of this subsection, a section of sewer is defined as that length of sewer between successive manholes or special structures or stubouts for future connections.

G. Cost of Testing and Repairs – Any and all work necessary to bring the line into conformance with the infiltration and deflection specifications shall be performed by the Contractor at no extra cost to the Owner. All apparent sources of infiltration and excessive deflection shall be repaired by the Contractor.

1. The Contractor shall provide all water, plugs, hoses, pumps, equipment, etc. necessary for the proper flushing and testing of the sewers.

END OF SECTION

SECTION 33 24 00
STORM DRAINS AND ROOF DRAINS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, equipment and materials in connection with the installation of exterior underground Storm drains and Roof drains as shown on the Contract Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM C 76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 150 – Standard Specification for Portland Cement.

C. ASTM C 443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

D. ASTM C478 –Standard Specification for Precast Reinforced Concrete Manhole Sections

E. ASTM C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

F. ASTM C969 – Standard Practices for Infiltration and Exfiltration Testing of Installed Precast Concrete Pipe Sewer Lines

G. ASTM C990 – Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

H. ASTM C1103 – Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

I. ASTM C1619 – Standard Specifications for Elastomeric Seals for Joining Concrete Structures

J. ASTM C1628 – Standard Specifications for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets

K. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.

L. ASTM D 3350 – Standard Specifications for Polyethylene Plastic Pipe and Fitting Material.

M. AWWA C 110 – Standard Specification for Ductile Iron Pipe & Fittings for Water and Other Liquids.

N. AWWA C 151 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

O. AASHTO M 198 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

P. AASHTO M 294 – Standard Specifications for Corrugated Polyethylene Pipe (12” to 36”).

Q. AASHTO Section 30 – Thermoplastic Pipe.

1.04 SUBMITTALS

A. Furnish and submit shop drawings and certificates for the piping work as outlined in the General Conditions and Division 1.

B. Special care shall be exercised during delivery, distribution and storage of the pipe and fittings to prevent damage. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Storage of pipe and fittings, prior to use, shall be in such a manner as to keep the materials clean and dry.

PART 2 – PRODUCTS

2.01 REINFORCED CONCRETE PIPE (RCP) – STORM DRAINS AND CULVERTS

A. Pipe and Joints

1. Reinforced concrete pipe for storm drains and culverts shall conform to ASTM Standard C76, Class III, Wall thickness B, unless otherwise noted on the Contract Drawings. Elliptical reinforcement will not be permitted. All pipe shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site. All pipe shall be of the sizes indicated on the drawings

2. Joints for the reinforced concrete culvert and storm drain pipe shall have bell and spigot ends with preformed flexible joint sealants meeting the requirements of ASTM C 990.

B. Gaskets

1. Gaskets shall be leak-resistant with elastomeric seals (gaskets) made of natural rubber, synthetic rubber, or a blend of both meeting the physical requirements prescribed in Specification ASTM 1619-19 for Class A, C, or E gaskets.

C. Joint Lubricant

1. Joint lubricant shall be of the type recommended by the manufacturer. Use of petroleum based lubricants is not permitted.

2.02 DUCTILE IRON PIPE (DIP) ROOF DRAINS

A. Pipe

1. Shall be centrifugally cast in metal molds or sand lined molds in accordance with ANSI A21.51 (AWWA C151) of grade 705005 ductile iron. The above standard covers ductile iron pipe with nominal pipe sizes from three (3) inches up to and including fifty-four (54) inches in diameter.

2. Shall have a rated working pressure of 150 psi.

3. Shall be a minimum PC 150.

B. Fittings

1. Shall be manufactured in accordance with ANSI A21.10 (AWWA C110).

2. Shall be manufactured of grade 70 50 05 ductile iron.

3. Shall have a rated working pressure of 250 psi.

4. Grey iron fittings which conform to the specifications contained herein may be used with ductile iron pipe providing the piping systems minimum working pressure is met or exceeded, and only where ductile iron fittings are not manufactured for a specific fitting.

C. Coatings and Linings for Pipe and Fittings

1. The standard asphaltic coating shall be applied to the exterior wall of the pipe and fittings in accordance with ANSI A21.51 (AWWA C151).

2. The pipe and fittings shall be cement mortar lined to twice the standard thickness in accordance with ANSI A21.4 (AWWA C104) except as specified in the pipe schedule. A seal coat of asphaltic material shall be applied to the mortar lining.

D. Joints

1. Joints shall be push on type in accordance with ANSI A21.11 (AWWA CIII).

2.03 SMOOTH LINED CORRUGATED HIGH-DENSITY POLYETHYLENE (HDPE) PIPE - STORM DRAINS AND CULVERTS

A. General

1. Smooth lined corrugated high-density polyethylene (HDPE) pipe shall be used for storm drains and shall be BLUE SEAL watertight HDPE pipe as manufactured by Hancor, Inc., N-12 WT IB (Watertight) Pipe by ADS, Inc., or approved equal.

B. Pipe and Fittings

1. Smooth lined corrugated HDPE pipe and fittings shall conform to AASHTO M252-TYPE S for 4" to 10"φ and AASHTO M294 - TYPE S for 12" to 36"φ. All pipes shall be of the sizes indicated on the drawings.

C. Joints

1. Joints shall be watertight bell and spigot type; Hancor, Inc. BLUE SEAL, ADS, Inc. N-12 WT IB, or equal.

D. Foundation Drains

1. Foundation drains shall conform to AASHTO M252-TYPE C. Drains shall have drilled perforations and be Heavy Duty-AASHTO Pipe as manufactured by Hancor, Inc., Single Wall Corrugate Pipe by ADS, Inc., or approved equal.

2.04 BACKFILL MATERIAL

A. The material obtained from excavation of the pipe trench or elsewhere on site with a particle size not greater than 3 inches shall be used for pipe backfill if they conform with the soil classes given in Table 1. Imported materials meeting the criteria of Table 1 may also be used.

Table 1: Acceptable Backfill Material and Compaction Requirements

Soil Classifications				
Description	**ASTM D 1479**	**ASTM D 2487**	**AASHTO M 43**	**Minimum Standard Proctor Density %**
Graded or crushed, crushed stone, gravel	Class I	--	5 56	Dumped
Well-graded sand, gravels and gravel/sand mixtures, poorly graded sand, gravels and gravel/sand mixtures; little or no fines	Class II	GW GP SW SP	57 6	95%
Silty or clayey gravels, gravel/sand/silt or gravel and clay mixtures; silty or clayey sands, sand/clay or sand/silt mixtures	Class III	GM GC SM SC	Gravel and Sand (<10% fines)	95%

PART 3 – EXECUTION

3.01 INSPECTION

A. Each length of pipe and fittings delivered to the property shall be inspected by the Contractor, in the presence of the Engineer, for flaws, cracks, dimensional tolerances and compliance with the referenced Standards. The Contractor shall provide the Engineer with suitable templates or calipers for checking pipe dimensions. Only lengths of pipe and fittings accepted by the Engineer and so marked may be installed in the work.

3.02 INSTALLATION

A. Trenching, bedding and backfilling shall be as specified in Section 31 00 01 – Earthwork of these Specifications and Paragraph 2.04 Backfill Material of this Specification. Under no condition shall pipe be laid in water or when trench conditions or weather are unsuitable for such work.

B. All pipes and fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists or lowered on skidways in such a manner as to avoid shock. Derricks, ropes or other suitable equipment shall be used for lowering the pipe into the trench. Pipe and fittings shall not be dropped or dumped.

C. Each pipe and fitting shall be inspected before it is lowered into the trench. The interior of the pipe and all joint surfaces shall be thoroughly cleaned and shall thereafter be maintained clean. The open ends of pipe shall be securely plugged whenever pipe laying is not in progress.

D. Pipe and fittings shall be selected so that there will be as small a deviation as possible at the joints and so that inverts present a smooth surface. All joints shall be installed, made up and inspected in accordance with approved printed instructions of the manufacturer. Pipe and fittings which do not fit together to form a tight joint will be rejected.

E. Cutting of reinforced concrete pipe will be permitted only at connections to structures and be accomplished by abrasive saws. Cutting of other pipe materials shall be done only with mechanical cutters and in accordance with the manufacturer's recommendations.

F. Pipe shall be laid accurately to the lines and grades shown on the drawings or as directed by the Engineer.

G. If an adequate foundation for the pipe is not available at the desired depth, additional excavation shall be required, and the foundation brought to desired grade with suitable granular material.

H. Rock outcroppings, very soft soils such as muck, and other similar materials not providing proper foundation support shall be removed/replaced with suitable granular material.

I. Bedding material directly under the pipe invert shall be left in native condition and not compacted. Pipe shall be placed on the bedding, then backfilled under the pipe haunches before further backfill is placed.

J. Class I materials may be dumped around pipe. Voids shall be eliminated by knifing under and around the pipe or by other approved technique.

K. Inorganic silts, and gravelly, sandy, or silty clays, and other Class IV materials (not shown in Table 1) shall not be used for pipe backfill.

L. Any section of the pipe that is found defective in material, alignment, grade, joints, or otherwise, shall be satisfactorily corrected by the Contractor at no additional cost to the Owner.

3.03 COMPACTION

A. General

1. Place and assure backfill and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.

2. In no case shall degree of compaction below “Minimum Compactions” specified be accepted.

B. Compaction Requirements: Unless noted otherwise on the Drawings or more stringently by other Sections of these Specifications, comply with following trench compaction criteria:

Table 2: Minimum Compactions

Location	Soil Type	Density
Compacted Select Backfill		
All applicable areas	Cohesive soil	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254
Common Trench Backfill		
Under pavements roadways surfaces, D698 within highway rights-of-way, adjacent to retaining walls	Cohesive soils	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded plant seeded, non-traffic areas	Cohesive soils	95 percent of maximum dry density by ASTM D698
	Cohensionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254

C. Ensure backfill materials have moisture content within three (3) percent of optimum moisture content at the time of placement.

3.04 INSPECTION AND TESTING

A. General

1. The Contractor shall provide at his own expense, all labor, material, video and measuring devices, water, plugs, or other equipment necessary to perform the required tests. All tests shall be performed in the presence of the Engineer. Disposal of water shall be in accordance with Section 01 11 00 – Summary of Work.

B. Tests by Manufacturer

1. Reinforced Concrete Storm Drains and Culverts - An infiltration and exfiltration test for the pipe shall be made at the place of manufacture. Certified test results shall be submitted. The infiltration or exfiltration allowance shall not exceed the limits as set in the “Performance requirements for Joints” paragraph in ASTM C443 – 12 (2017) or ASTM C990-09 (2014), depending on the type of gasket specified.

2. DIP and HDPE - An infiltration and exfiltration test for the pipe shall be made at the place of manufacture. Certified test results shall be submitted. The infiltration or exfiltration allowance shall not exceed 250 gallons per inch of pipe diameter per mile per day. One joint test for each two hundred feet of pipe to be furnished.

C. Field Test - Visual Inspection

1. Examine structures and pipes for:

a. Physical damage.

b. Indication of displacement of pipes or structures, reinforcement, forms, or bedding.

c. Porous areas or voids.

d. Proper placement of seals, gaskets, and embedments.

e. Visible infiltration.

2. Verify structures and pipes are set to proper line, grade as per the Contract Drawings, and are plumb.

3. Verify structure and pipe dimensions and thickness match Contract Drawings.

4. Measure inside dimensions of all flexible (HDPE) pipe prior to installation. Use these dimensions when sizing the mandrel should deflection testing be required.

   a. Using light to inspect pipe shall be done following pipe trench backfill is compacted and brought to grade or pavement subgrade.

   b. Full pipe diameter shall be visible for entire length of each section between structures.

   c. No less than half pipe diameter shall be visible for horizontal alignment.

5. The Contractor shall be responsible to provide video recording of the all installed storm sewer systems at least 30 days after completion of backfill and one month before Owner or Engineer gives final acceptance for the two-year warranty. The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator, then the camera shall be reversed and an extended look at the area will be recorded. All recordings will have time, date, and footage displayed. Supplement the video recording with a written log or orally recorded tape log noting observations, findings, and deficiencies shown on the video tape.

   a. The video recording inspection shall be performed by an outside independent testing agency acceptable to the Owner or Engineer.

   b. The video tape and log will be given to the Engineer for review. If the Engineer finds any problems with the storm sewer, the Contractor will repair the problem and re-camera the repaired area before final acceptance will be given, at no added cost to the Owner.

c. Video recording of storm sewer may be waived if pipe diameter is sufficient for human access, as determined by the Engineer. A log shall be developed for such inspection.

d. One copy of the video tape and log will become permanent property of the Engineer and Owner as record.

D. Field Test - Manhole Testing

1. The finished manholes shall be as watertight as the pipe system of which it is part. See Section 33 05 61 – Utility Structures for manhole testing criteria.

2. Observed leaks (infiltration or exfiltration) at any time within the warranty period shall be cause for rejection.

E. Field Test - Storm Drains and Culverts less than 30” Ø

1. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Engineer finds there is a potential joint tightness problem, or excessive deflection, and the Contractor does not agree to repairing defects in pipe based on visual inspection, he/she may require leakage testing of the line.

   a. Reference ASTM C696, latest revision. Test shall be used if the groundwater level is less than 2 ft. above the crown of the pipe measured from the highest elevation of the pipe length being tested.

   b. Leakage rate testing applies to only circular pipe less than 30” Ø. The length of pipe tested shall not exceed 700 ft.

   c. The leakage testing shall occur at least 30 days after completion of the backfilling and compaction.

   d. If the Engineer determines reliable and uniform results are produced by the Contractor's construction techniques, the leakage testing may occur after initial backfill and compaction.

2. The Contractor shall provide all equipment and personnel to perform the leakage testing.

3. The Engineer shall record times and calculation leakage rates during the test period.

4. The leakage test shall be performed as follows:

   a. Plug all pipe outlets discharging into the upstream manhole and the test section outlet. Fill the sewer line with water.

b. At the upstream manhole the test head shall be established as minimum of 2 ft above the crown of the pipe, or at least 2 ft above existing groundwater, whichever is higher.

c. Allow the pipe to remain saturated for a period long enough to allow water absorption in the pipe, a minimum of 4 hours and up to a maximum of 72 hours. After the absorption period, refill the pipe to the required test head.

d. Measure the leakage loss over a timed test period. The minimum test period shall be 15 minutes and the maximum shall not exceed 24 hours.

5. The allowable leakage limit including manholes is 250 gal/(in. of internal diameter) (mile of sewer) (24 h) when the average head on the test section is 6 ft or less.

6. When the average head on the test section is greater than 6 ft, the allowable leakage shall be multiplied by the ratio of the square root of the average test head and the square root of the base head of 6 ft.

7. Manholes shall be tested separately and independently or with the pipeline with an allowance of 0.1 gal/(ft of diameter) (ft of head) (h).

8. Sections of the pipe which fail the air test, shall have the defects repaired, and the test shall be repeated.

a. The initial leakage testing, repair, and repeat testing of the failed section of pipe shall be repeated at no added cost to the Owner until the testing requirements are met.

F. Field Test - Storm Drains and Culverts 30” Ø and greater

1. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Engineer finds there is a potential joint tightness problem, or excessive deflection, and the Contractor does not agree to repairing defects in pipe based on visual inspection, he/she may require air or water pressure testing of individual pipe joints.

a. Reference ASTM C1103, latest revision. The following procedures apply to testing with either air or water.

b. Pressure testing applies to only circular pipe 30” Ø or greater and not elliptical, arch or box sections.

c. The pressure test shall occur at least 30 days after completion of the backfilling and compaction.

d. If the Engineer determines reliable and uniform results are produced by the Contractor's construction techniques, the pressure test may occur after initial backfill and compaction.

2. The Contractor shall provide all equipment and personnel to perform the pressure testing.

3. The Engineer shall record times and observe pressure losses during the test period.

4. If the groundwater pressure is equal to or greater than the test pressure, and the storm drain or joint is not leaking, the storm drain or joint is acceptable in accordance with ASTM C969 and no additional testing is required. If one or more joints are leaking, but the total amount of leakage in the storm drain being tested is equal to, or less than, the allowable leakage rate established in accordance with ASTM C969, the line is acceptable and no additional testing is required provided visible leaks are repaired. Moisture or beads of water appearing on the surface of the joint will not be considered as visible leakage.

5. The pressure test shall be performed as follows:

   a. Move the joint test apparatus into the sewer line to the joint to be tested and position it over the joint. The end element sealing tubes must straddle both sides of the joint and the hoses are attached. For the water test, the bleed-off petcock must be located at top dead center.

   b. Inflate end element sealing tubes with air or water in accordance with equipment and manufacturer's instructions.

   c. All test pressures are measured as gauge pressure, defined as any pressure greater than atmospheric pressure. Test observer shall note water produces a pressure of 0.43 psi for every foot of depth, and therefore test pressures must be increased to offset the depth of groundwater over the sewer line. If the groundwater level is 2 ft or more above the top of the pipe at the upstream end or if the pressure required for the test is greater than 6-psi gauge, the joint test method shall not be used and the infiltration test may be used (see ASTM C969).

   d. An air or water reservoir shall be included in the joint test system. By maintaining a constant supply of air or water in a reservoir, continuous pumping of air or water is not required, and any variances in test equipment and joint space will be negated. The reservoir shall have a minimum volume of 2.5 ft^3.

6. The joint air pressure test shall be performed as follows

   a. Pressurize the void volume with air to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Allow the air pressure and temperature to stabilize before shutting off the air supply and start of test timing.

b. If pressure holds, or drops less than 1 psi in 5 seconds, the joint is acceptable.

c. If the joint being tested fails, it shall be retested, or repaired if necessary, and retested.

d. After the joint test is completed, exhaust void volume, then exhaust end element tubes prior to removal of apparatus.

7. The joint water pressure test shall be performed as follows

a. Introduce water into void volume until water flows evenly from open petcock. Close the petcock and pressurize with water to 3.5 psi above the pressure exerted by groundwater above the pipe. Shut off the water supply.

b. If pressure holds, or drops less than 1 psi in 5 seconds, the joint is acceptable.

c. If the joint being tested fails, it shall be retested, or repaired if necessary, and retested.

d. After the joint test is completed, exhaust end element tubes which will automatically release the water from the void volume, prior to removal of apparatus.

G. Deflection Test – Flexible Pipe

1. If after the visual or video inspection of the storm trunk or lateral lines, the Inspector finds there is “egging or deflection” of a section of pipe, a deflection test shall be performed on the defective section of pipe installed. Test shall be performed using an odd-legged mandrel pulled through the pipe without mechanical assistance or by laser profiling. The mandrel size shall be the measured inside diameter of the subject pipe minus 5% of the measured diameter. The mandrel shall have no less than nine legs.

2. Any pipe failing any deflection test shall be removed, replaced, and retested.

3. At the end of the two-year warranty period, the flexible storm pipe will be visually inspected for “egging or deflection”. If excess deflection is observed, the Owner/Warranty Holder will, at his/her expense, retest questionable portions per this section.

H. Repair

1. Repair or replace any unacceptable work at no additional cost to the Owner.

2. Repair all visible leaks.

3. Remove any concrete webs or protrusions.

4. Remove form ties and repair tie holes.

END OF SECTION

SECTION 33 46 00

BIORETENTION CELL

PART 1 – GENERAL

1.01 THE REQUIREMENTS

A. The Contractor is responsible for installing bioretention cell(s) to manage post-construction stormwater runoff. This item covers the work necessary for installation of the bioretention cell. The Contractor shall furnish all material, labor, and equipment necessary for the proper installation of this facility.

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.

D. Installation of the bioretention cell should occur after the contributing watershed has been stabilized. It shall be the responsibility of the contractor to make any necessary repairs if the performance of the system is impacted by sediment during construction or due to improper construction sequencing. The contractor shall implement additional measures as deemed necessary to prevent sediment impacts to the bioretention cell during construction.

E. Activities related to the installation of a bioretention cell shall include but not be limited to the following items of work:

1. Excavation of bioretention basin

2. Preparation of bioretention soil media

3. Installation of bioretention cell components, including drainage layers, overflow structures, drainage pipes, and soil media

4. Installation of bioretention plants

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00 – Clearing, Grubbing, and Site Preparation

B. Section 31 00 01 – Earthwork

C. Section 31 25 00 – Erosion and Sedimentation Control

D. Section 32 11 00 – Surface Restoration

E. Section 33 05 61 – Utility Structures

F. Section 32 90 00 – Final Grading and Landscaping

G. Section 33 24 00 – Storm Drains and Roof Drains

H. Section 33 46 23 – Modular Buried Stormwater Storage Units

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.

1. New York State Stormwater Design Manual

2. New York State Standard Specifications for Erosion and Sediment Control

3. Local stormwater permitting authority

4. New York State Department of Transportation (NYSDOT) Standard Specifications

5. ASTM C 33 – Standard Specification for Concrete Aggregates

6. ASTM C 136 – Test for Sieve Analysis of Fine and Coarse Aggregates

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions, Division 01 and Section 01 33 00 – Submittal Procedures, the Contractor shall submit the following:

1. Name and location of all material suppliers.

2. Certificate of compliance with the standards specified above for each source of each material.

3. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.

4. Analysis results for soil media before placement in bioretention cell.

5. Inspection/maintenance reports for the bioretention cell until the Bioretention Operation and Maintenance Agreement is in effect.

1.05 GUARANTEE

A. All work related to the installation of the bioretention cell shall be subject to the one-year guarantee period of the Contract as specified in the General Conditions.

PART 2 – MATERIALS

2.01 MATERIALS

A. Materials for use in bioretention cells shall be in accordance with the New York State Stormwater Management Design Manual and this specification.

2.02 SOIL MEDIA

A. The soil media should be uniform and free of stones, stumps, roots or other woody material over 1" in diameter. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth or prove a hindrance to the planting or maintenance operations. The soil media shall be free of noxious weeds.

B. The soil media should be a sandy loam, loamy sand, loam (USDA) or a loam/sand mix (should contain a minimum of 35 to 60% sand, by volume. The media should not contain clay. A permeability of at least 1.0 feet per day (0.5 in/hr) is required.

C. The soil media shall meet the characteristics given in Table 1.

Table 1: Soil Media Characteristics

Parameter	**Value**
pH Range	5.2 to 7.00
Organic Matter	1.5 to 4.00%
Magnesium	35 lbs. per acre, min
Phosphorus (P_2O_5)	75 lbs, per acre, min
Potassium (K_2O)	85 lbs per acre, min
Soluble Salts	500 ppm
Clay	0%
Silt	30 to 55%
Sand	35 to 60%

D. Soil media should be analyzed by the New York State Department of Agriculture lab or other approved testing facility. If more than one sample is tested, all testing shall be performed by the same testing facility. In addition to having a textural analysis performed, the soil shall be tested for and shall meet the following criteria:

1. pH range: 5.5 – 6.5

2. Phosphorus Index: 0 - 25

E. The soil media should be tested to determine an actual drainage rate after placement. The permeability should fall between 1 and 6 inches per hour. A permeability of 1-2 inches per hour is preferred. The infiltration rates should be approximately 2 in/hr and 1 in/hr for 8% and 12% fines, respectively.

2.03 SUBSURFACE DETENTION CHAMBERS

A. Subsurface detention chambers shall be provided beneath bioretention as shown on the Contract Drawings. The subsurface detention chambers shall conform to Section 33 46 23 – Modular Buried Stormwater Storage Units.

2.04 GRAVEL DRAINAGE LAYER

A. A choker stone layer shall be provided beneath soil media. Choking stone be ASTM C33 #8 or #89 washed stone in conformance with the below gradation requirements.

U.S. Standard Sieve Size	Percent Finer by Weight	
	#8	#89
1/2 in.	100	100
3/8 in.	85-100	90-100
No. 4	10-30	20-55
No. 8	0-10	5-30
No. 16	0-5	0-10

B. In areas where there are no subsurface detention chambers directly below the soil media, a gravel drainage layer shall be provided beneath the choking stone. Washed stone shall meet the gradation of crushed stone as found in Section 31 05 16 – Aggregate Materials, or washed ASTM C33 #57 stone in conformance with the below graduation requirements.

U.S. Standard Sieve Size	Percent Finer by Weight
1 1/2 in.	100
1 in.	95-100
1/2 in.	25-60
No. 4	0-10
No. 8	0-5

2.05 MULCH

A. Mulch shall be placed in a uniform 3” layer above the soil media.

1. Mulch shall be standard landscape style, single or double, shredded hardwood mulch. The mulch layer should be well aged (stockpiled or stored for at least 12 months), uniform in color, and free of other materials such as weed seeds, soil, roots, etc. No pine needles, pine bark, wood chips, or grass clippings shall be used as mulch material.

2.06 PLANTS

A. Plant materials shall be as specified on the drawings and the 32 90 00 – Final Grading and Landscaping Specification.

2.07 OVERFLOW INLETS AND OUTLET STRUCTURES

A. The system outlet structures shall be as described in Section 33 46 23 – Modular Buried Stormwater Storage Units.

B. The overflow inlets shall consist of a dome grate inlet piped into below stormwater detention chambers. Overflow inlets shall be as described in Section 33 46 23 – Modular Buried Stormwater Storage Units.

PART 3 – EXECUTION

3.01 CONSTRUCTION SEQUENCING

A. The bioretention cell shall not be constructed until the contributing watershed has been stabilized.

   1. If the cell is excavated before the watershed is stabilized, additional excavation may be required to remove accumulated sediments from the base of the cell in order to restore the permeability of the in-situ soil.

   2. If soil media is installed before the watershed is stabilized, removal and replacement of all or a portion of the media may be required if the media is clogged by sediment from the site.

3.02 EXCAVATION

A. Excavation of the bioretention cell shall be completed so as to minimize compaction of the subsoil beneath the cell.

   1. When possible, excavation hoes shall be used to remove original soil.

   2. If cells are excavated using a loader, use low ground pressure (LGP) equipment (<6 psi). Engineer shall approve equipment in advance.

   3. Use of equipment with narrow tracks, narrow tires, rubber tires with large lugs, or high-pressure tires shall be avoided.

B. If subsoil beneath the cell is compacted during excavation of the cell, compaction shall be alleviated by using a primary tilling operation such as a chisel plow, ripper, or subsoiler to refracture the soil profile through the 12-inch compaction zone. The method of refracturing must be approved by the Engineer. Rototillers are not acceptable.

C. The bioretention cell may be surrounded by an earthen impoundment.

1. Fill material for the impoundment shall be free of roots, woody vegetation, rocks, and other objectionable materials.

2. Fill shall be placed in 6 to 8 inch layers and compacted.

3. Construct the embankment to an elevation 10 percent higher than the design height to allow for settling.

4. Stabilize the impoundment as shown on the Contract Drawings immediately upon completion of the grading.

3.03 SUBSURFACE DETENTION CHAMBERS AND STONE INSTALLATION

A. The subsurface detention chambers, choking stone, and drainage stone shall be installed prior to placement of soil media.

1. Subsurface detention chambers shall be installed per Section 33 46 23 – Modular Buried Stormwater Storage Units.

B. The gravel drainage layer shall be installed in the base of the bioretention cell before placement of the soil media.

1. Install an 8 inch thick (minimum) layer of washed crushed stone or washed #57 stone in the base of the bioretention cell.

2. Install a 2-inch layer of chocking stone above the drainage stone

3. Installation of the detention chambers, chocking stone, and gravel drainage layer shall be completed with equipment which minimizes compaction of the layer and underlying soils.

3.04 SOIL MEDIA PREPARATION

A. The components of the soil media (sand, silt fines, organic material, and any other prescribed additives) shall be thoroughly mixed so that the media is homogeneous.

B. Prior to placement in the bioretention cell, the soil media shall be tested as described in Part 2 of this Section. Analysis criteria for the soil media are listed herein. The soil analysis shall be submitted to the Engineer prior to placement in the bioretention cell.

3.05 SOIL MEDIA INSTALLATION

A. Soil media shall be placed in the bioretention cell above the choking stone, and gravel drainage layer.

1. Soil media shall be installed in lifts of 12 – 18 inches. Water lifts lightly to encourage natural settlement.

2. Heavy equipment shall not be used within the bioretention cell. The use of heavy equipment around the perimeter of the cell is acceptable to supply soils and sand.

3. Grade soil media by hand or with light (LGP) equipment. Minimal compaction may be applied with the bucket from a dozer or backhoe.

4. Backfill the remainder of the soil media to final grade. Overfill by 10 – 15% to allow for settlement of soil media.

3.06 MULCH INSTALLATION

A. Mulch all plantings and the earth saucers surrounding plantings to a depth of 3 inches immediately after plant installation.

1. Do not place mulch in contact with trunk of trees or shrubs.

2. Aged (12 months or older) single or double shredded hardwood mulch is the only allowable type of mulch. Pine mulch and wood chips shall not be used because of their tendency to float and clog the outlet structure.

3.07 PLANT INSTALLATION

A. Plants shall be installed as shown on the planting plan the drawings and the 32 90 00 – Final Grading and Landscaping Specification.

3.08 LONG-TERM INSPECTION AND MAINTENANCE

A. Monthly and after every rainfall during the first year:

1. Inspect trees and shrubs and replace specimens that did not survive planting or are severely diseased.

2. Remove mulch from outlet structures.

3. Repair damaged tree stakes and replace with longer stakes if necessary.

4. Inspect inlets for gullies, rills, and other signs of erosion. Add riprap and armor as necessary.

5. Contact Engineer if standing water remains for longer than 48 hours. Remediation may be necessary.

6. Inspect edge of bioretention cell for excess settlement relative to surrounding soil.

B. Annually:

1. Add coarse shredded hardwood mulch to maintain 3” thick layer over bioretention soil media. Grassed areas should not receive mulch.

2. Mulch shall be removed and replaced every 2-3 years to ensure that design volume is maintained and to increase surface infiltration.

3. Remove dead branches, debris, and litter from cell.

4. Inspect overflow inlets for blockage and clean as necessary.

5. Open cleanouts and inspect sediment deposition in underground detention chambers. Clean isolator row if sediment accumulation is greater than 3 inches.

6. Test planting soil for pH. If the pH is below 5.2, apply limestone. If the pH is above 7.0, apply iron sulfate plus sulfur.

7. Remove particular species that fail to establish after multiple attempts.

8. Remove tree stakes after 2 years.

C. Inspection and Maintenance Reporting

1. All inspection and maintenance activities should be reported. Copies of the reports shall be sent to the Engineer on a monthly basis. The reports shall include the following.

   a. Date of inspection

   b. Name of inspector

   c. Condition of the bioretention cell

   d. Perimeter

   e. Inlet device

   f. Pretreatment area

   g. Vegetation

   h. Soils and mulch

   i. Underdrain system

   j. Outlet structure(s)

   k. Receiving water

   l. Maintenance work performed

m. Issues noted for future maintenance

END OF SECTION

SECTION 33 46 23

MODULAR BURIED STORMWATER STORAGE UNITS

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide HDPE Stormwater Chambers, constructed of the sizes shown on the plans, all in accordance with the specifications and standards of the manufacturer.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 01 – Earthwork

B. Section 31 05 19 – Geotextiles

C. Section 31 23 19 – Dewatering

D. Section 32 90 00 – Final Grading and Landscaping

E. Section 33 24 00 – Storm Drains and Roof Drains

F. Section 33 46 00 – Bioretention Cell

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. New York City Department of Environmental Protection (“NYCDEP”) Standard Designs and Guidelines for Green Infrastructure Practices

1.04 SUBMITTALS

A. The Contractor, prior to the start of Work, shall submit to the Engineer for approval catalog samples and cut sheets of the proposed HDPE Stormwater Chambers including certification that materials meet specified requirements and proposed dimensions of the Contract Drawings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the Site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in clean, dry area in accordance with manufacturer's instructions. 01-17-20

C. Protect materials during handling and installation to prevent damage.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. CULTEC Inc.
Brookfield, CT 06804

B. StormTech (ADS)
Rocky Hill, CT 06067

C. Or Approved Equal

D. The stormwater chamber must be manufactured of high molecular weight high density polyethylene in an ISO-9001 certified manufacturing facility and meet ASTM D-3350 Cell Class 324420C. Chambers will be manufactured with an open bottom and side walls. If approved by the manufacturer, the units may be trimmed to custom length. The stormwater chamber must conform to the dimensions as shown in the Contract Drawings with placement on bedding and backfill as shown. The minimum acceptable storage volume is 6.08 cubic feet per linear foot.

2.02 CLEANOUTS, OVERFLOW INLETS, AND OUTLET STRUCTURES

A. Cleanouts shall be provided on chambers as shown in Contract Drawings and as required by manufacturer. Cleanouts shall consist of Schedule 40 or SDR smooth wall PVC Pipe with a threaded PVC cleanout cover. The cleanout shall extend 8” above the finished grade.

B. Overflow inlets shall be provided on chambers as shown in Contract Drawings. Overflow inlets shall consist of Schedule 40 or SDR smooth wall PVC Pipe with dome grate cover. The overflow inlets shall be at elevations as noted on the Contract Drawings.

C. Outlet structures shall utilized to control the peak flow leaving chambers. The outlet structures shall be as detailed in the Contract Drawings

PART 3 – EXECUTION

3.01 INSTALLATION

A. Prior to the installation of the stormwater chamber, the Contractor shall excavate the locations to the satisfaction of the Engineer. Remove any standing water. Dewatering, if necessary, shall be per performed per Section 31 23 19 - Dewatering.

B. Install stone base, stormwater chamber, and backfill as indicated and required by the Contract Documents and manufacturer installation instructions.

END OF SECTION

Appendix C-2: Contract Specifications, Sanitary Force Main

Appendix D-1: Contract Drawings, Rye Lake Water Filtration Plant

GENERAL NOTES:

1. SITE INFORMATION TAKEN FROM SITE SURVEY CONDUCTED BY GEORGE J. MOTTARELLA, PE, LS, PC, DATED 7-21-2021.
2. HORIZONTAL CONTROL IS REFERENCED TO THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD 83). VERTICAL CONTROL IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. CONTRACTOR SHALL VERIFY FIELD CONDITIONS BEFORE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL VERIFY EXISTING ELEVATIONS AND DIMENSIONS WHERE NEW WORK WILL MATCH EXISTING. DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR RESOLUTION PRIOR TO THE COMMENCEMENT OF WORK.
4. CONTRACTOR SHALL OBTAIN ALL THE NECESSARY PERMITS FROM THE APPROPRIATE AUTHORITIES, DEPARTMENTS, AND/OR AGENCIES HAVING JURISDICTION PRIOR TO COMMENCING WORK.
5. CONTRACTOR SHALL TAKE CARE TO AVOID DAMAGE TO EXISTING PAVEMENT, TREES, VEGETATION, STRUCTURES, AND UTILITIES NOT INDICATED TO BE DEMOLISHED OR REMOVED. ANY DAMAGE TO EXISTING PAVEMENT, TREES, VEGETATION, STRUCTURES, AND UTILITIES NOT INDICATED TO BE DEMOLISHED OR REMOVED SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
6. UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE GIS INFORMATION, RECORD DRAWINGS, AND SITE SURVEY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THEIR EXACT LOCATION AND TO AVOID DAMAGE TO THEM. THE CONTRACTOR SHALL CONTACT DIG SAFELY NEW YORK AT PHONE NUMBER 811 OR 1-800-962-7962 TO REQUEST UNDERGROUND UTILITY LOCATION MARK-OUT AT LEAST TWO (2) WORKING DAYS BUT NO MORE THAN TEN (10) WORKING DAYS PRIOR TO BEGINNING EXCAVATION, INCLUDING SOIL DRILLING. THE CONTRACTOR SHALL ALSO CONTACT AND REQUEST UTILITY LOCATION MARK-OUT FROM BURIED UTILITY OWNERS WITH UTILITIES ON THE PROJECT SITE THAT ARE NOT PARTICIPANTS OF DIG SAFELY NEW YORK.
7. WHERE PROPOSED WORK IS IN THE VICINITY OF UTILITY POLES, SUCH THAT SUPPORT OF THE POLE(S) WILL BE REQUIRED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE UTILITY OF THE WORK. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE WITH THE UTILITY FOR SUPPORT OF THE POLE.
8. WHERE OVERHEAD POWER LINES ARE PRESENT, CONTRACTOR MUST CONTACT THE UTILITY PRIOR TO CONSTRUCTION ACTIVITIES TO DETERMINE THE MINIMUM REQUIRED EQUIPMENT CLEARANCE (MEC) DISTANCE BASED UPON LINE STRENGTH.
9. DURING STRUCTURAL EXCAVATION AND PLACEMENT OF UTILITIES THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE SAFETY REGULATIONS, INCLUDING BUT NOT LIMITED TO 29 CFR 1926 SUBPART P EXCAVATIONS AND NYS CR 753 DIG SAFELY NY REGULATIONS, AND SHALL SUBMIT TO THE ENGINEER FOR APPROVAL SHEET PILING, SHORING AND/OR BRACING DESIGNS, PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF NEW YORK, AS MAY BE NECESSARY TO COMPLY WITH THESE REGULATIONS.
10. GROUNDWATER FROM ALL DEWATERING OPERATIONS SHALL BE DISCHARGED THROUGH AN APPROVED SEDIMENT FILTERING DEVICE TO AN ENVIRONMENTALLY ACCEPTABLE LOCATION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, OR AS DIRECTED BY THE ENGINEER.
11. ALL TEMPORARY FACILITIES ARE SUBJECT TO THE SAME HEALTH AND SAFETY REQUIREMENTS AS PERMANENT FACILITIES, AS SPECIFIED IN THE CONTRACT DOCUMENTS AND HEALTH SAFETY PLAN (HASP).
12. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL DEBRIS GENERATED DURING THE PROJECT OFF SITE AT A PROPERLY PERMITTED DISPOSAL FACILITY.
13. CONTRACTOR SHALL MAKE EVERY EFFORT TO SAVE AND MAINTAIN ALL PROPERTY IRONS, MONUMENTS, OTHER PERMANENT POINTS AND LINES OF REFERENCE AND CONSTRUCTION STAKES. A STATE OF NEW YORK REGISTERED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE SHALL REPLACE PROPERTY IRONS, MONUMENTS, AND OTHER PERMANENT POINTS OF REFERENCE DESTROYED BY THE CONTRACTOR.
14. CONTRACTOR IS REQUIRED TO UTILIZE HAND DIGGING OR HYDROEXCAVATION TO A DEPTH OF 4 FEET IN AREAS WHERE UNDERGROUND UTILITIES ARE PRESENT.

ABBREVIATIONS

ACF	ANNUAL CHANCE FLOOD	G	GAS	SD	STORM DRAIN	PVC	POLYVINYL CHLORIDE
EOP	EDGE OF PAVEMENT	SS	SANITARY SEWER	MH	MANHOLE	FM	FORCE MAIN
LOC	LIMITS OF CONSTRUCTION	W	WATER	OF	OVERFLOW	FDC	FIRE DEPARTMENT CONNECTION
OHE	OVERHEAD ELECTRIC	℞	PROPERTY LINE	DIP	DUCTILE IRON PIPE	FP	FIRE PROTECTION
FOC	FIBER OPTIC CABLE	℄	CENTER LINE	WWR	WASHWATER RECYLE	PW	POTABLE WATER
LP	LIGHT POLE	RECM	ROLLED EROSION CONTROL MATTING	GD	GALLERY DRAIN	LF	LINEAR FEET
UGE	UNDERGROUND ELECTRIC	SHWT	SEASONALLY HIGH WATER TABLE	WWW	WASTE WASHWATER	PPE	POLYPROPYLENE
PP	POWER POLE	TP	TEST PIT	CMP	CORRUGATED METAL PIPE		

LEGEND

SYMBOLS

TP-1	TEST BORING LOCATION
B-3	SOIL BORING LOCATION
	EXISTING FIRE HYDRANT
	YARD VALVE

NEW	DEMO	EXISTING	
			BUILDING/STRUCTURE
			BITUMINOUS PAVEMENT
			CONCRETE CURB AND GUTTER
			CONCRETE PAD/PAVING
			CONCRETE SIDEWALK
X	X	X	FENCE LINE

NEW	EXISTING	
300	300	CONTOUR
×302.00	302.00 ×	SPOT ELEVATION
		PROPERTY LINE
OHE	OHE	OVERHEAD ELECTRIC
W	W	WATER PIPING
		ELECTRIC DUCTBANK
	UGT	UNDERGROUND COMMUNICATION
	UGE	UNDERGROUND ELECTRIC
GAS		GAS LINE
SD		STORM LINE

NEW	DEMO	EXISTING	
			APPROXIMATE WOODLINE
			YARD PIPING
			MANHOLE
			YARD INLET
			FLARED END SECTION
			CURB INLET
			STORM DRAIN LINE

	EXISTING DITCH LINE
	EXISTING WETLAND AREA
	WETLAND OR DITCH BUFFER
	STABILIZED OUTLET FOR SILT FENCE
	YARD INLET PROTECTION
	GRAVEL CONSTRUCTION ENTRANCE
SF	SILT FENCE
TPF	TREE PROTECTION FENCE
LOD	LIMITS OF DISTURBANCE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

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Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
GENERAL NOTES, LEGEND AND ABBREVIATIONS

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-001

NOTES:

1. EXISTING BUILDINGS AND STRUCTURES ON ADJACENT PROPERTIES ARE APPROXIMATE AND WERE OVERLAID FROM AVAILABLE AERIAL IMAGERY FROM NYS GIS CLEARINGHOUSE AND GOOGLE EARTH IMAGERY.
2. EXISTING WETLANDS AND STREAM ARE BASED ON FIELD WORK PERFORMED BY HAZEN AND SAWYER IN JUNE 2021.

CONTROL POINTS (CONC. MONUMENT)

Point #	Elevation	Northing	Easting	Description
1	406.63	813522.0616	707483.3911	CP1
2	406.46	813342.9070	707852.1734	CP2

BULK TABLE, ZONE SB-0

MINIMUM	REQUIRED	PROVIDED
LOT AREA (ACRES)	5 ACRES	13.4 ACRES
LOT WIDTH (FEET)	300	1165
FRONT YARD (FEET)	50	100
SIDE YARD (FEET)		
ADJOINING A RESIDENCE DISTRICT	100	287
ADJOINING A BUSINESS DISTRICT	75	755
REAR YARD (FEET)	100	100
BUFFER STRIPS (FEET)		
FRONT YARD		
ADJOINING A RESIDENCE DISTRICT	50	100
ADJOINING A BUSINESS DISTRICT	25	100
SIDE AND REAR YARD		
ADJOINING A RESIDENCE DISTRICT	50	100
ADJOINING A BUSINESS DISTRICT	50	100
MAXIMUM		
LOT COVERAGE (%)		
BUILDING COVERAGE	20	6
BUILDING HEIGHT		
FEET	55*	30
STORIES	4	2

* FOR BUILDINGS OR STRUCTURES MORE THAN 10 FEET FROM THE STREET LINE AT THE FRONT OF THEIR LOT, THE VERTICAL DISTANCE MEASURED IN FEET OR STORIES FROM THE AVERAGE FINISHED GRADES MEASURED ALONG A LINE OFFSET 10 FEET FROM THE PERIPHERY OF THE BUILDING OR STRUCTURE TO THE TOP OF A FLAT ROOF OR OF A MANSARD ROOF OR THE AVERAGE HEIGHT OF A PITCHED ROOF.

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PLOT DATE: 7/20/2022 5:57 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
OVERALL SITE PLAN

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-101

PLAN
SCALE: 1" = 30'

NOTES:

1. TREE REMOVAL SHALL INCLUDE REMOVAL OF THE STUMP (CLEAR AND GRUB). SEE SPECIFICATION SECTION 31 10 00 - CLEARING, GRUBBING, AND SITE PREPARATION.
2. CONTRACTOR TO VERIFY LOCATION OF ALL UTILITIES PRIOR TO START OF WORK.
3. BASE MAPPING INFORMATION BASED ON SITE SURVEY PERFORMED BY GEORGE J. MOTARELLA, PE, PS, PC DATED 7-21-2021
4. ALL TREES ROOTED WITHIN THE LIMITS OF DISTURBANCE ARE TO BE CLEARED AND GRUBBED.
5. ALL DEMOLITION WORK MUST BE PERFORMED IN ACCORDANCE WITH 29 CFR 1926 SUBPART T DEMOLITION AND 1926.1153 RESPIRABLE CRYSTALLINE SILICA.
6. SOIL BORINGS (2") PERFORMED BY GZA MAY AND JUNE 2021.
7. TEST PITS 1-6 PERFORMED IN AUGUST 2021 AND TEST PITS 7-13 PERFORMED IN NOVEMBER 2021 BY GZA.
8. CONTRACTOR SHALL USE AREA OF TREE PLANTING AND VEGETATIVE INFILL FOR THE WORK SHOWN ON THE LANDSCAPING DWGS ONLY. ONLY HAND DIGGING ALLOWED OUTSIDE OF TREE PROTECTION FENCE. USE FOR ANY OTHER CONSTRUCTION ACTIVITIES IS PROHIBITED.

AREA OF TREE PLANTING AND VEGETATIVE INFILL ONLY
SEE LANDSCAPE DWGS

SCALE: 1" = 30'

30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
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HARRISON, NY

CIVIL
EXISTING CONDITIONS AND DEMOLITION PLAN - AREA 1

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-102

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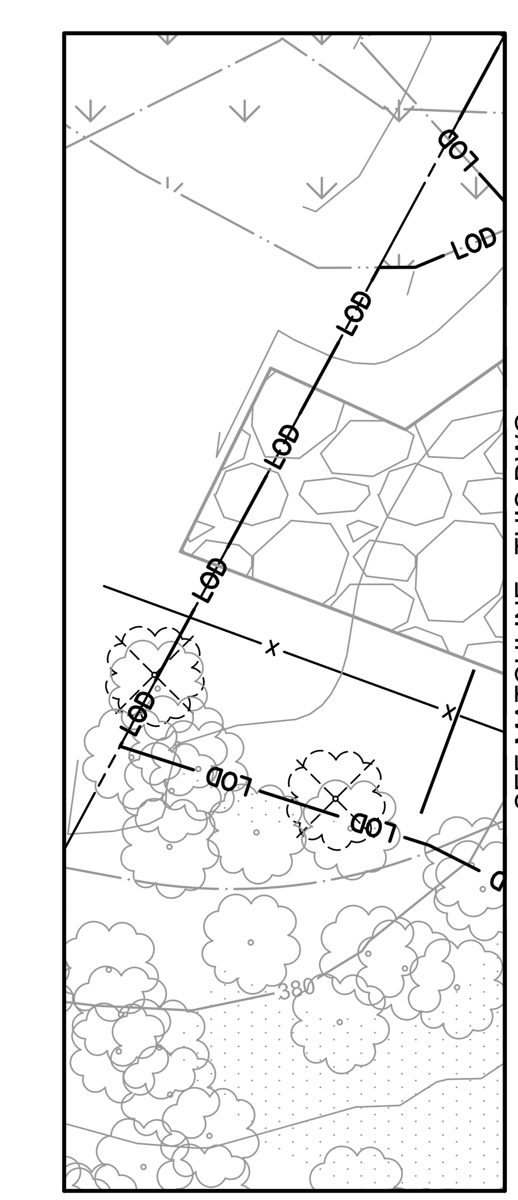

NOTES:

1. TREE REMOVAL SHALL INCLUDE REMOVAL OF THE STUMP (CLEAR AND GRUB). SEE SPECIFICATION SECTION 31 10 00 - CLEARING, GRUBBING, AND SITE PREPARATION.
2. CONTRACTOR TO VERIFY LOCATION OF ALL UTILITIES PRIOR TO START OF WORK.
3. BASE MAPPING INFORMATION BASED ON SITE SURVEY PERFORMED BY GEORGE J. MOTARELLA, PE, PS, PC DATED 7-21-2021
4. ALL TREES ROOTED WITHIN THE LIMITS OF DISTURBANCE ARE TO BE CLEARED AND GRUBBED.
5. ALL DEMOLITION WORK MUST BE PERFORMED IN ACCORDANCE WITH 29 CFR 1926 SUBPART T DEMOLITION AND 1926.1153 RESPIRABLE CRYSTALLINE SILICA.
6. CONTRACTOR SHALL USE AREA OF TREE PLANTING AND VEGETATIVE INFILL FOR THE WORK SHOWN ON THE LANDSCAPING DWGS ONLY. ONLY HAND DIGGING ALLOWED OUTSIDE OF TREE PROTECTION FENCE. USE FOR ANY OTHER CONSTRUCTION ACTIVITIES IS PROHIBITED.
6. SOIL BORINGS (2") PERFORMED BY GZA MAY AND JUNE 2021.
7. TEST PITS 1-6 PERFORMED IN AUGUST 2021 AND TEST PITS 7-13 PERFORMED IN NOVEMBER 2021 BY GZA.

AREA OF TREE PLANTING AND VEGETATIVE INFILL ONLY
SEE LANDSCAPE DWGS

PLAN
SCALE: 1" = 30'

SCALE: 1" = 30'
30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
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HARRISON, NY

CIVIL
EXISTING CONDITIONS AND DEMOLITION PLAN - AREA 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-103

EROSION AND SEDIMENT CONTROL - PHASE 1 - SITE PREPARATION

1. CONTRACTOR SIGNS ONTO SWPPP.
2. INSTALL SILT FENCE, TREE PROTECTION FENCE, AND STABILIZED CONSTRUCTION ACCESS.
3. CLEAR AND GRUB STAGING AREA AND AREA FOR SEDIMENT BASIN.
4. INSTALL OUTFALL STRUCTURES AND EXCAVATE AND INSTALL TEMPORARY SEDIMENT BASINS.
5. INSTALL CONSTRUCTION DITCHES.
6. PERFORM CLEARING AND GRUBBING FOR REMAINDER OF SITE.

NOTES

1. SEE DRAWINGS C-301 - C-303 FOR EROSION CONTROL DETAILS.
2. CONTRACTOR SHALL NOT STORE EXCAVATED MATERIAL INSIDE THE WETLAND BUFFER.
3. CONSTRUCTION PHASING AS SHOWN IS SUGGESTED AND FOR THE PURPOSES OF EROSION AND SEDIMENT CONTROL. CONTRACTOR MAY PERFORM WORK IN ALTERNATIVE PHASES OR SEQUENCE PROVIDED CONTRACT RESTRICTIONS ARE FOLLOWED AND SEQUENCE IS APPROVED BY THE ENGINEER.
4. CONTRACTOR SHALL TEMPORARILY CONNECT SEDIMENT BASIN OUTLET PIPES TO STORM DRAIN MANHOLES. UPON COMPLETION OF STORMWATER WETLAND AND BIORETENTION CELLS, SEDIMENT BASIN OUTLET PIPE SHALL BE REMOVED AND PENETRATION IN MANHOLES SEALED.

REV	ISSUED FOR	DATE	BY	

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN

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RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EROSION AND SEDIMENT CONTROL PHASING PLAN - PHASE 1

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-111

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EROSION AND SEDIMENT CONTROL - PHASE 2 - EXCAVATION AND STRUCTURE SUPPORT

1. PERFORM EXCAVATION AND DEWATERING ACTIVITIES FOR THE FILTRATION PLANT AND COMBINED WASTE WASHWATER TANKS.
2. CONSTRUCT FILTRATION BUILDING FOUNDATION AND TANKS AND COMBINED WASTE WASHWATER TANKS.
3. BACKFILL AND ESTABLISH SUBGRADE AROUND FILTRATION PLANT. PRIOR TO ESTABLISHING SUBGRADE, PERFORM SOIL RESTORATION MEASURES.
4. CONSTRUCT MSE RETAINING WALL FOR ELECTRICAL EQUIPMENT.

NOTES

1. SEE DRAWINGS C-301 - C-303 FOR EROSION CONTROL DETAILS.
2. CONTRACTOR SHALL NOT STORE EXCAVATED MATERIAL INSIDE THE WETLAND BUFFER.
3. CONSTRUCTION PHASING AS SHOWN IS SUGGESTED AND FOR THE PURPOSES OF EROSION AND SEDIMENT CONTROL. CONTRACTOR MAY PERFORM WORK IN ALTERNATIVE PHASES OR SEQUENCE PROVIDED CONTRACT RESTRICTIONS ARE FOLLOWED AND SEQUENCE IS APPROVED BY THE ENGINEER.

REV	ISSUED FOR	DATE	BY

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CIVIL
EROSION AND SEDIMENT CONTROL PHASING PLAN - PHASE 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-112

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PLAN
SCALE: 1" = 50'

EROSION AND SEDIMENT CONTROL - PHASE 3 - STORMWATER AND INFRASTRUCTURE YARD PIPING

1. INSTALL STORM DRAIN PIPING AND STRUCTURES TO ACCOMMODATE DISCHARGE FROM DETENTION CHAMBERS AND WETLAND.
2. EXCAVATE FOR SUBSURFACE DETENTION CHAMBERS AND INSTALL CHAMBERS. CONNECT CHAMBER SYSTEMS TO STORM DRAINAGE PIPING NETWORK.
3. INSTALL BIORETENTION SOIL MEDIA AND STABILIZE AREAS AROUND THE BIORETENTION.
4. UPON COMPLETION OF CHAMBERS AND STABILIZATION OF BIORETENTION, INSTALL OVERFLOW STRUCTURE FOR STORMWATER WETLAND.
5. EXCAVATE AND GRADE STORMWATER WETLAND FROM OUTFALL STRUCTURE BACK TO HEADWALL.
6. FURNISH LANDSCAPING WITHIN STORMWATER WETLAND AND PROVIDE TEMPORARY STABILIZATION MEASURES.
7. INSTALL STORM DRAIN AND YARD PIPING THROUGHOUT PROJECT SITE.
8. INSTALL SANITARY FORCE MAIN AND PUMP STATION.
9. INSTALL ELECTRICAL DUCT BANKS, GENERATORS, STORAGE TANK, AND ASSOCIATED CONCRETE PADS AND FOUNDATIONS.
10. INSTALL NEW TRANSMISSION MAINS AND WATER MAIN EXTENSION FROM PURCHASE STREET TO FILTRATION PLANT.

NOTES

1. SEE DRAWINGS C-301 - C-303 FOR EROSION CONTROL DETAILS.
2. SEE YARD PIPING DRAWINGS C-131 TO C-132 FOR TRANSMISSION MAINS, WATER MAIN, SANITARY FORCE MAIN, GALLERY DRAIN, OVERFLOWS, PROCESS PIPING, AND ELECTRICAL DUCT BANKS.
3. SEE GRADING AND DRAINAGE PLAN DRAWINGS C-121 TO C-122 FOR STORM DRAIN PIPING.
4. CONTRACTOR SHALL NOT STORE EXCAVATED MATERIAL INSIDE THE WETLAND BUFFER.
5. CONSTRUCTION PHASING AS SHOWN IS SUGGESTED AND FOR THE PURPOSES OF EROSION AND SEDIMENT CONTROL. CONTRACTOR MAY PERFORM WORK IN ALTERNATIVE PHASES OR SEQUENCE PROVIDED CONTRACT RESTRICTIONS ARE FOLLOWED AND SEQUENCE IS APPROVED BY THE ENGINEER.
6. PRIOR TO CONSTRUCTION OF THE SUBSURFACE DETENTION CHAMBERS, BIORETENTION CELLS, AND STORMWATER WETLAND THE CONTRACTOR SHALL:
   - A. REMOVE ACCUMULATED SEDIMENT FROM THE SEDIMENT BASINS AND DISPOSE OF OFFSITE.
   - B. PROVIDE PORTABLE SEDIMENT TANKS WITH SUMP PUMPS TO CONVEY THE RUNOFF ENTERING THE EXCAVATIONS.
   - C. INSTALL STORM DRAIN PIPING AND STRUCTURES AS SHOWN ON DWG C-215.
   - D. CONTRACTOR SHALL MAINTAIN SEDIMENT BASIN OUTLETS AND SKIMMER UNTIL NEW INFRASTRUCTURE TO OUTLET STORMWATER RUNOFF IS INSTALLED.
   - E. CONTRACTOR SHALL RELOCATE CONSTRUCTION DITCH AS NECESSARY TO MAINTAIN FLOWS TO SEDIMENT BASIN AS STORM DRAIN PIPING AND STRUCTURES ARE INSTALLED.

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN
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NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EROSION AND SEDIMENT CONTROL PHASING
PLAN - PHASE 3

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-113

EROSION AND SEDIMENT CONTROL - PHASE 4 - FINAL GRADING AND PAVING

1. INSTALL TRUCK DELIVERY CONTAINMENT ARE AND ASSOCIATED DRAINAGE PIPING.
2. INSTALL VEGETATED MAINTENANCE ROAD.
3. PERFORM FINAL GRADING. PRIOR TO ESTABLISHING FINAL GRADING, PERFORM SOIL RESTORATION MEASURES.
4. INSTALL CURB AND GUTTERS. INSTALL ASPHALT PAVING.
5. INSTALL ORNAMENTAL GATE AND PERIMETER FENCE.
6. PERFORM FINAL LANDSCAPING. ESTABLISH PERMANENT VEGETATION OR OTHER GROUND COVER OVER ALL DISTURBED AREAS.
7. REMOVE ALL TEMPORARY EROSION CONTROL MEASURES UPON FINAL STABILIZATION.
8. FILE NOTICE OF TERMINATION WITH NYSDEC.

NOTES

1. SEE DRAWINGS C-301 - C-303 FOR EROSION CONTROL DETAILS.
2. SEE FINAL SITE PLANS DWGS C-141 AND C-142 AND LANDSCAPE DRAWINGS FOR FINAL SURFACE RESTORATION.
3. CONTRACTOR SHALL NOT STORE EXCAVATED MATERIAL INSIDE THE WETLAND BUFFER.
4. CONSTRUCTION PHASING AS SHOWN IS SUGGESTED AND FOR THE PURPOSES OF EROSION AND SEDIMENT CONTROL. CONTRACTOR MAY PERFORM WORK IN ALTERNATIVE PHASES OR SEQUENCE PROVIDED CONTRACT RESTRICTIONS ARE FOLLOWED AND SEQUENCE IS APPROVED BY THE ENGINEER.
5. UPON FINAL STABILIZATION OF THE PROJECT SITE, THE CONTRACTOR (WITH THE ENGINEER) SHALL INSPECT ALL STORMWATER STRUCTURES, PIPES AND MANAGEMENT PRACTICES INCLUDING THE BIORETENTION CELLS AND WETLAND. THE CONTRACTOR IS REQUIRED TO PERFORM ALL REQUIRED OPERATION AND MAINTENANCE ACTIVITIES AS REQUIRED IN THE SWPPP REGARDLESS OF INSPECTION INTERVAL ONCE FINAL STABILIZATION HAS BEEN ESTABLISHED.
6. THE CONTRACTOR SHALL PROVIDE A CCTV INSPECTION OF ALL STORM DRAIN, GALLERY DRAIN, AND OVERFLOW PIPING UPON FINAL STABILIZATION OF THE SITE. ANY SEDIMENT, DEBRIS, OR MATERIALS FOUND DURING CCTV INSPECTION SHALL BE REMOVED. ANY DEFECTS IN PIPELINE OR ASSOCIATED STRUCTURE INSTALLATION SHALL BE REPAIRED BY THE CONTRACTOR.
7. ALL BELOW GRADE INFRASTRUCTURE IS NOT SHOWN FOR CLARITY, SEE YARD PIPING AND GRADING AND DRAINAGE DRAWINGS FOR BELOW GRADE INFRASTRUCTURE.

PLAN
SCALE: 1" = 50"

PROJECT ENGINEER:	R. FROST	PERMIT SUBMITTAL DO NOT USE FOR CONSTRUCTION FOR PERMIT REVIEW PURPOSES ONLY	Hazen HAZEN AND SAWYER 498 SEVENTH AVENUE, 11th FLOOR NEW YORK, NEW YORK 10018	WESTCHESTER JOINT WATER WORKS MAMARONECK, NY	DATE: JULY 2022
DESIGNED BY:	C. JOHNSON				HAZEN NO.: 90388-000
DRAWN BY:	C. JOHNSON			RYE LAKE WATER FILTRATION PLANT HARRISON, NY	CONTRACT NO.: A1364-A
CHECKED BY:	D. SHEERAN			CIVIL EROSION AND SEDIMENT CONTROL PHASING PLAN - PHASE 4	DRAWING NUMBER: C-114
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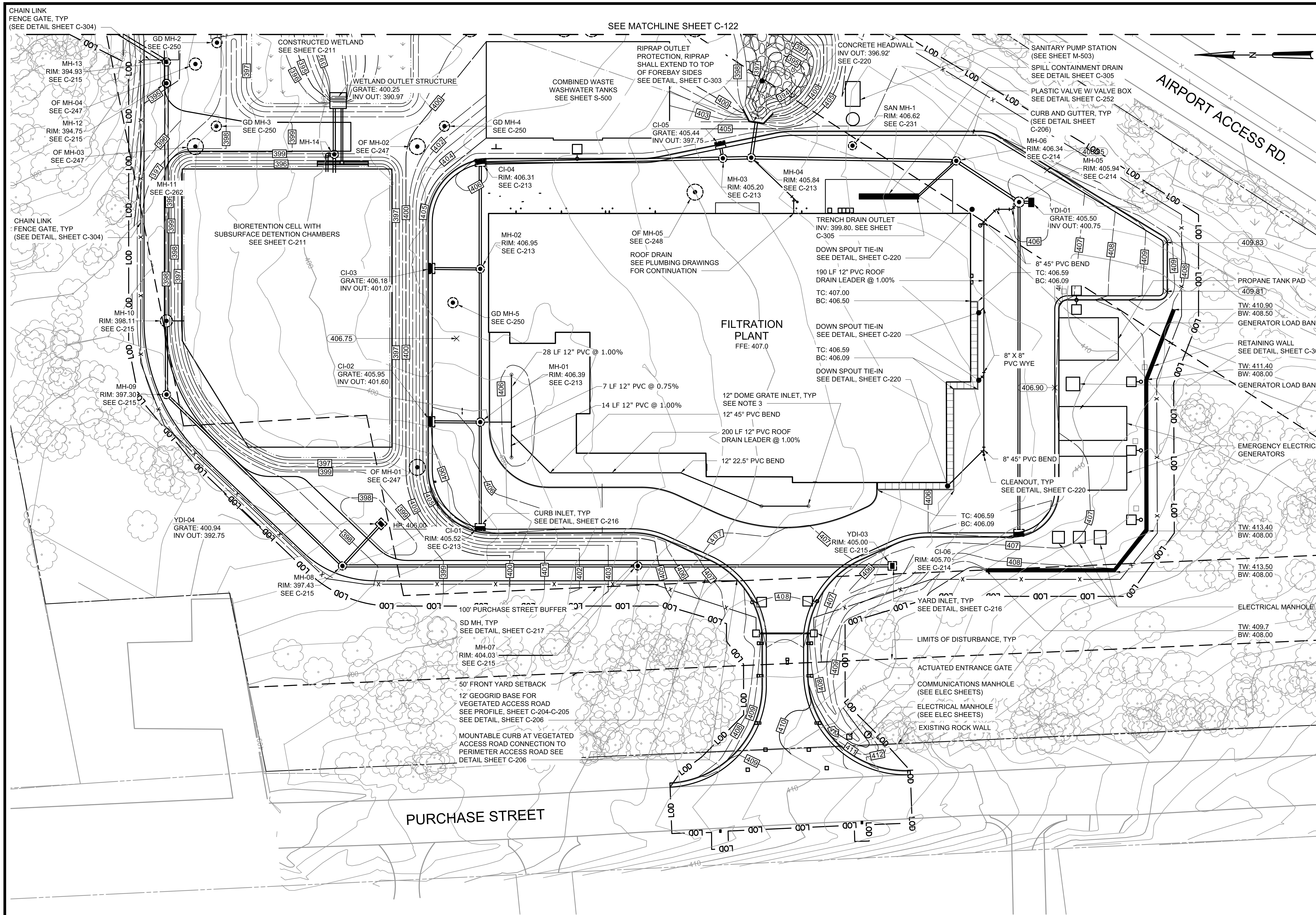

PLAN
SCALE: 1" = 30'

NOTES:

1. SEE SHEET C-131 FOR YARD PIPING.
2. REFER TO SHEETS C-213 THROUGH C-215 FOR STORM DRAIN PROFILES.
3. INLET SHALL CONSIST OF A NYLOPLAST INLINE DRAIN WITH 12" DOME GRATE COVER, OR APPROVED EQUAL.
4. DIP STORM DRAIN PIPING AND FITTINGS SHALL BE OF GRADE 70 50 05 DUCTILE IRON IN ACCORDANCE WITH ANSI A21.51 (AWWA C151).
5. HDPE STORM DRAIN PIPING AND FITTINGS SHALL BE SMOOTH LINED CORRUGATED WATERTIGHT HIGH-DENSITY POLYETHYLENE PIPE, AS MANUFACTURED BY HANCOR, INC., N-12 WT IB (WATERTIGHT) PIPE BY ADS, OR APPROVED EQUAL.
6. REINFORCED CONCRETE PIPE (RCP) FOR STORM DRAINS SHALL CONFIRM TO ASTM STANDARD C76, CLASS III, WALL THICKNESS B. PIPE JOINTS SHALL BE DESIGNED PER ASTM C-443-19A AND ASTM C-1628-19. PIPE SHALL BE PROVIDED WITH BELL AND SPIGOT ENDS.

SCALE: 1" = 30'
30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

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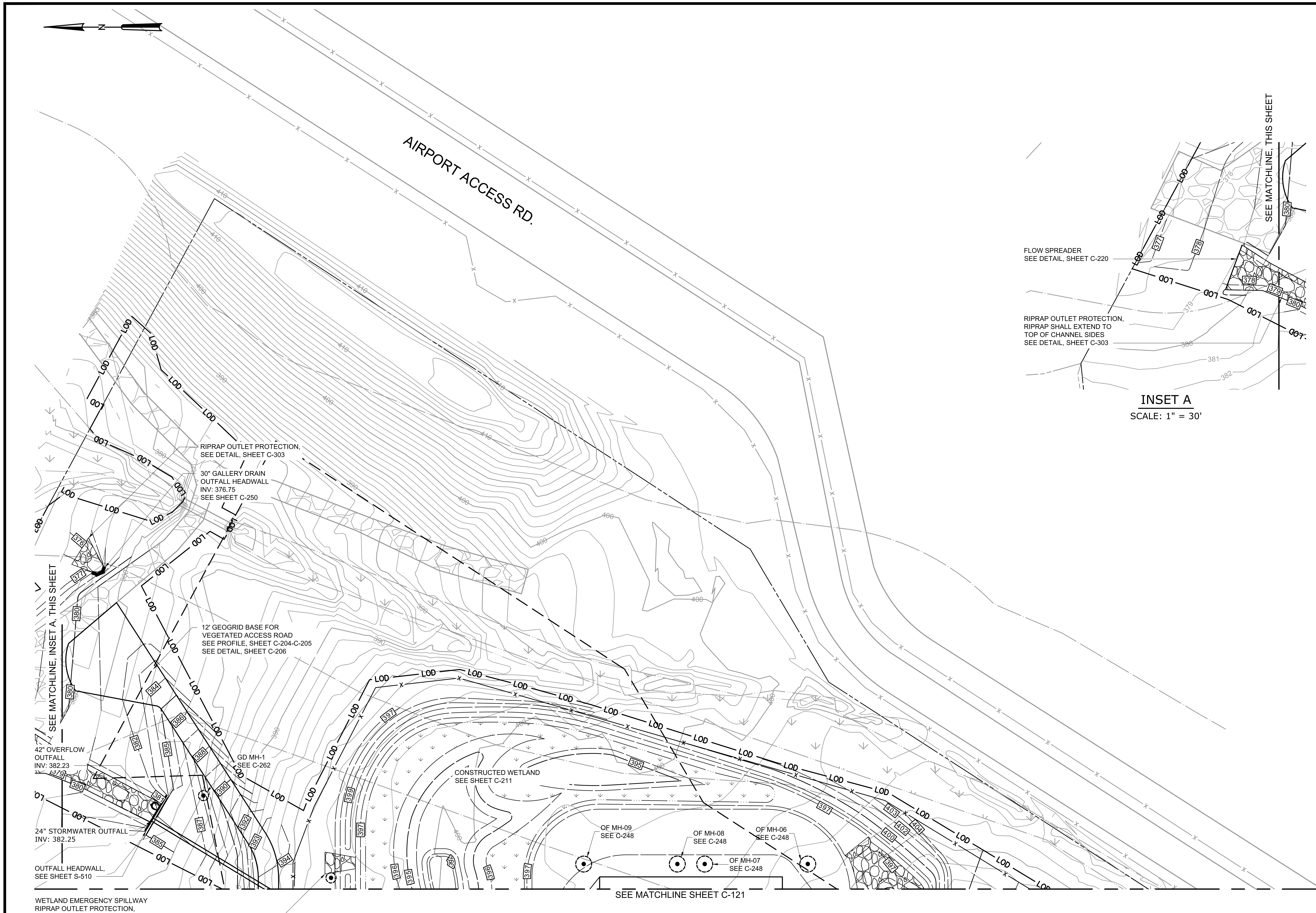
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
GRADING AND DRAINAGE PLAN - AREA 1

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-121

NOTES:

1. SEE SHEET C-132 FOR YARD PIPING
2. REFER TO SHEETS C-213 THROUGH C-215 FOR STORM DRAIN PROFILES.



INSET A
SCALE: 1" = 30'

PLAN
SCALE: 1" = 30'

SCALE: 1" = 30' 30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
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DRAWN BY:	C. JOHNSON
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HARRISON, NY

CIVIL
GRADING AND DRAINAGE PLAN - AREA 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-122

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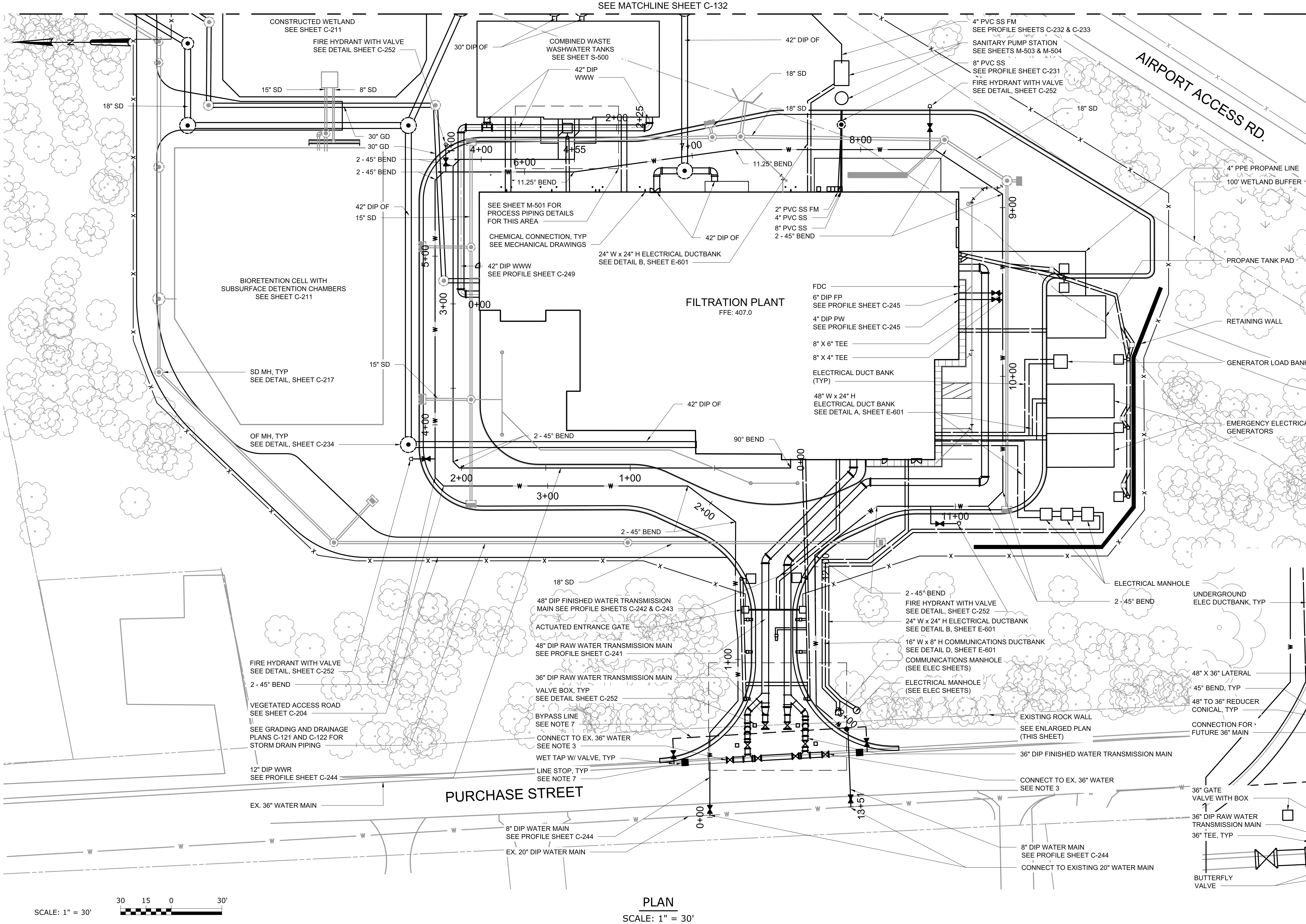
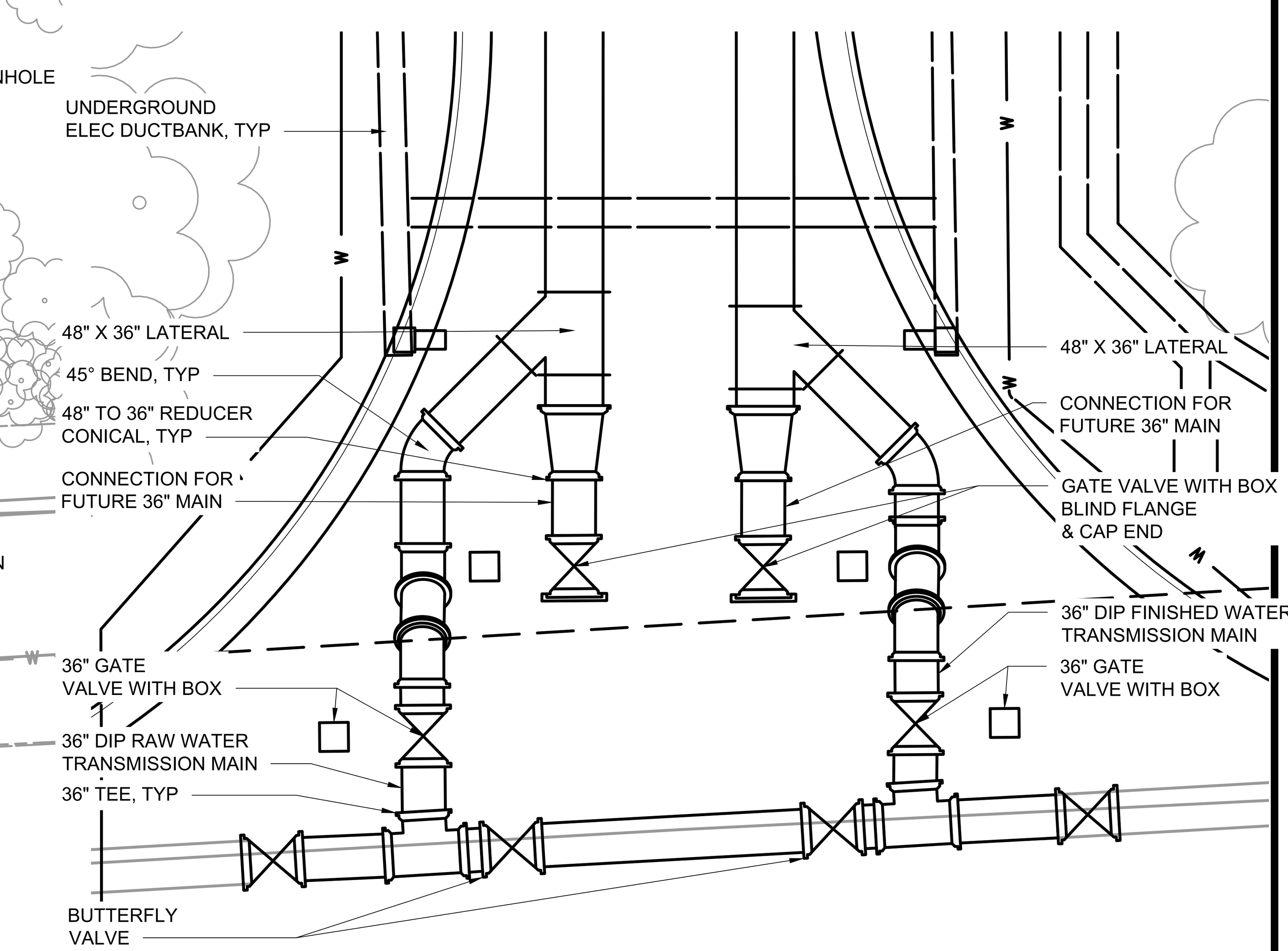


PLAN

SCALE: 1" = 30'



ENLARGED PLAN

SCALE: 1" = 10'

NOTES:

1. EXISTING AND FINAL CONTOURS NOT SHOWN FOR CLARITY. SEE SHEET C-121 FOR CONTOURS.
2. REFER TO SHEETS C-121, C-213-C-215, & C-211 FOR STORM DRAINAGE SYSTEM INFORMATION. STORM DRAINAGE SHOWN ON THIS SHEET SCREENED FOR INFORMATION ONLY.
3. CONTRACTOR SHALL CONNECT TO EXISTING 36" WATER MAIN UTILIZING A LINE STOP AND BYPASS SYSTEM.
4. REFER TO MECHANICAL DRAWINGS FOR YARD PIPING CONNECTIONS AT STRUCTURES.
5. ALL VALVES SHALL BE GATE UNLESS OTHERWISE NOTED.
6. GATE VALVES ON TRANSMISSION MAINS SHALL BE INSTALLED HORIZONTALLY. SEE DETAIL SHEET C-252.
7. CONTRACTOR SHALL PROVIDE ADEQUATE THRUST BLOCKING OR JOINT RESTRAINT TO PROTECT EXISTING TRANSMISSION MAIN. BYPASS LINE SHALL BE 24".
8. ALL DIP SHALL BE SPECIAL THICKNESS CLASS 53 WITH MECHANICAL JOINT FITTINGS AND RESTRAINED JOINTS GLANDS. ALL JOINTS SHALL BE RESTRAINED. ALL DIP PIPES SHALL BE DOUBLE CEMENT LINED ON THE INSIDE.

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

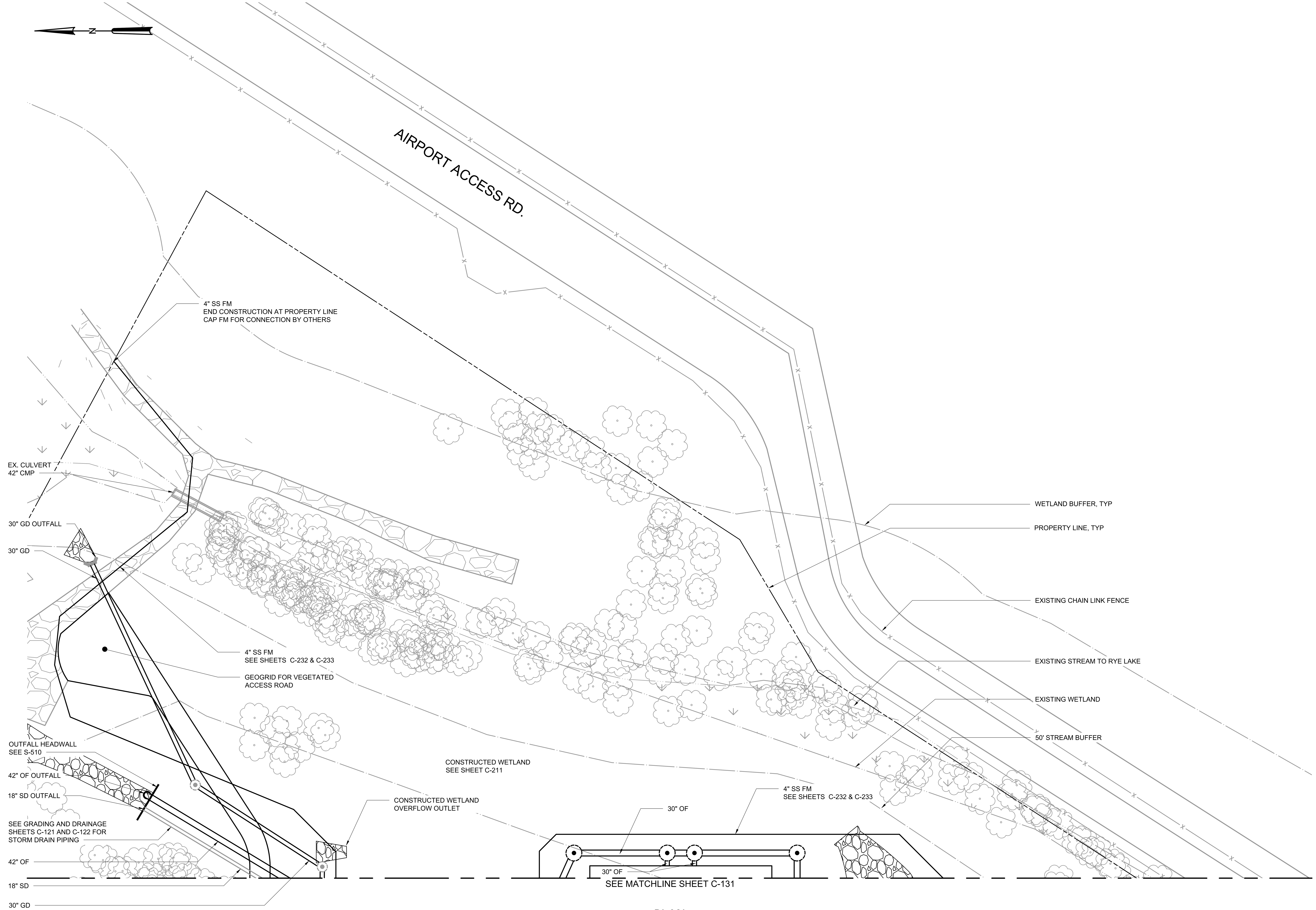
CIVIL
YARD PIPING PLAN - AREA 1

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-131

File: C:\BMS\HAZEN-PW\D0103283\C-131 Saved by: CMCNICOL Save date: 7/19/2022 1:14 PM
PLOT DATE: 7/20/2022 6:01 PM BY: CMCNICOL

NOTES:

1. EXISTING AND FINAL CONTOURS NOT SHOWN FOR CLARITY. SEE SHEET C-122 FOR CONTOURS.
2. REFER TO SHEETS C-122, C-213-C-215, & C-211 FOR STORM DRAINAGE SYSTEM INFORMATION.



PLAN

SCALE: 1" = 30'

SCALE: 1" = 30'

30 15 0 30'

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

REV	ISSUED FOR	DATE	BY

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

0 1/2" 1"

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HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

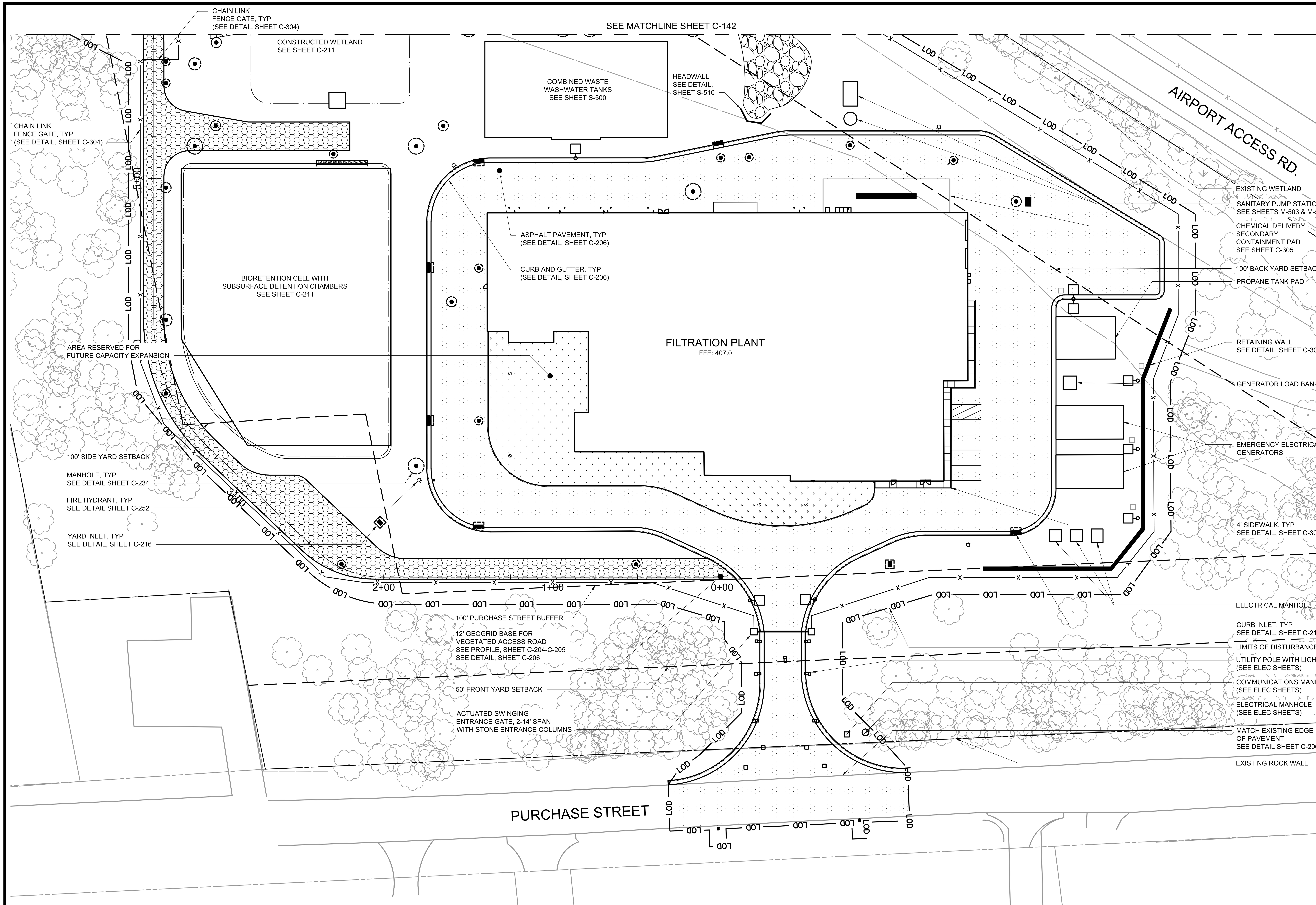
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
YARD PIPING PLAN - AREA 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-132

File: C:\BMS\HAZEN-PW\D0103283\C-132 Saved by CMCNICOL Save date: 7/19/2022 1:16 PM
PLOT DATE: 7/20/2022 6:02 PM BY: CMCNICOL



PLAN
SCALE: 1" = 30'

SCALE: 1" = 30'
30' 15' 0 30'

NOTES:

1. EXISTING AND FINAL CONTOURS NOT SHOWN FOR CLARITY. SEE SHEET C-121 FOR TOPOGRAPHIC INFORMATION.
2. SEE SHEET C-121 FOR UNDERGROUND STORMWATER PIPING.
3. SEE SHEET C-131 FOR YARD PIPING.
4. REFER TO SHEETS C-213 THROUGH C-215 FOR STORM DRAIN PROFILES.
5. ALL DISTURBED AREAS THAT ARE NOT PAVED SHALL BE RESTORED BY TOPSOIL AND SEEDING. SEE LANDSCAPE DWGS.
6. ALL AREAS DESIGNATED FOR LANDSCAPE RESTORATION SHALL HAVE SOILS RESTORED IN ACCORDANCE WITH THE SOIL RESTORATION TABLE ON DRAWING C-301. SOIL RESTORATION IS NOT REQUIRED FOR AREAS OF STRUCTURES, BUILDING, EQUIPMENT PADS, RIP RAP, VEGETATED AND PAVED ROADWAYS. ALL AREAS SHALL BE CONSIDERED AREAS OF CUT OR FILL WITH THE EXCEPTION OF THE FOLLOWING:

   A. THE BIORETENTION CELL SHALL BE CONSIDERED AN AREA OF RUNOFF REDUCTION PRACTICES ARE APPLIED.

   B. THE INFILL AREAS (SEE DWG C-102 AND LANDSCAPE DWGS) SHALL BE CONSIDERED MINIMAL SOIL DISTURBANCE.

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
FINAL SITE PLAN - AREA 1

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-141

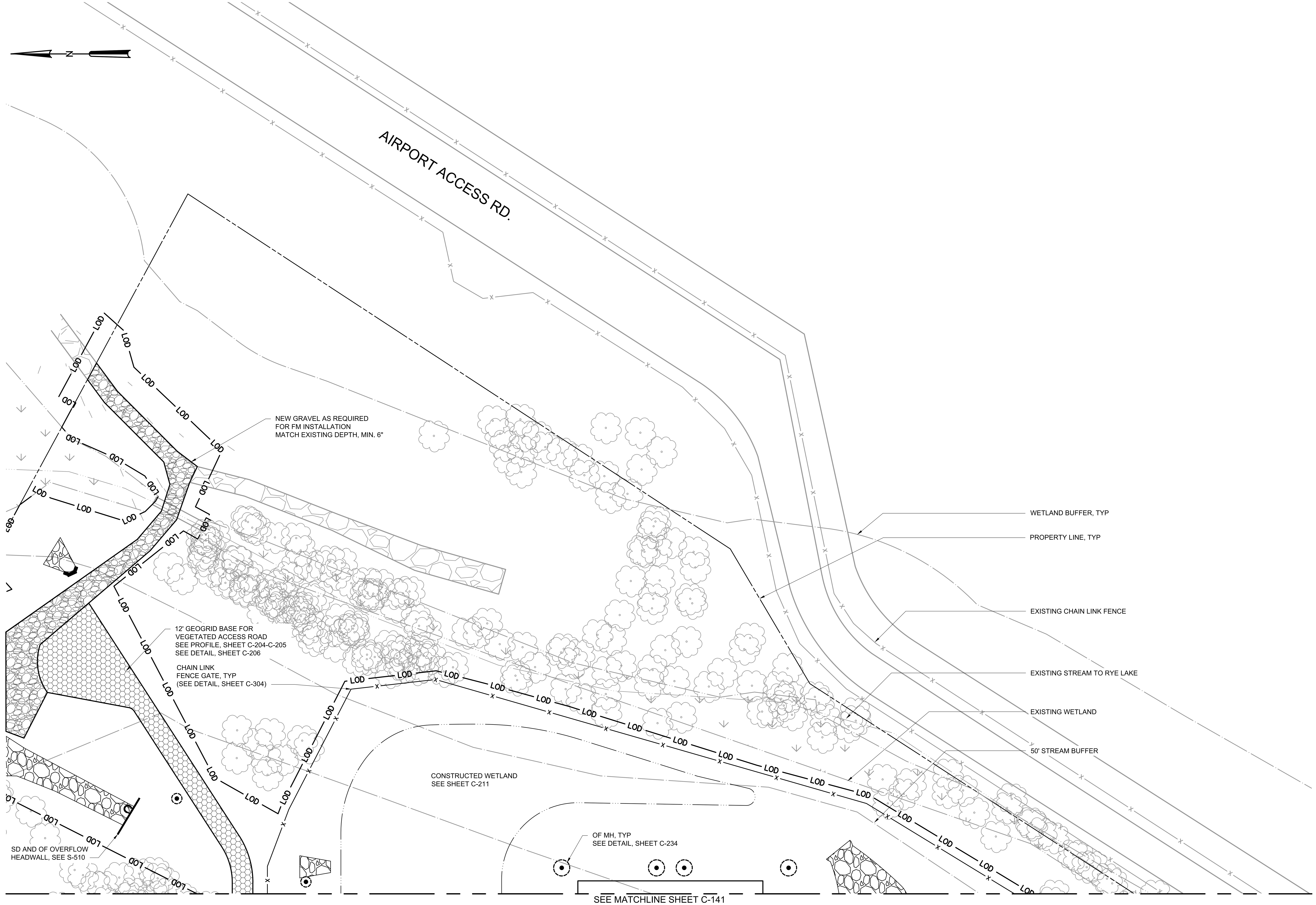
File: C:\BMS\HAZEN-PW\D0103283\C-141A Saved by: JTANNER Save date: 7/12/2022 1:46 PM
PLOT DATE: 7/20/2022 6:02 PM BY: CMCNICOL

NOTES:

1. EXISTING AND FINAL CONTOURS NOT SHOWN FOR CLARITY. SEE SHEET C-121 FOR TOPOGRAPHIC INFORMATION.
2. SEE SHEET C-121 FOR UNDERGROUND STORMWATER PIPING.
3. SEE SHEET C-131 FOR YARD PIPING.
4. REFER TO SHEETS C-213 THROUGH C-215 FOR STORM DRAIN PROFILES.
5. ALL DISTURBED AREAS THAT ARE NOT PAVED SHALL BE RESTORED BY TOPSOIL AND SEEDING. SEE LANDSCAPE DWGS.
6. ALL AREAS DESIGNATED FOR LANDSCAPE RESTORATION SHALL HAVE SOILS RESTORED IN ACCORDANCE WITH THE SOIL RESTORATION TABLE ON DRAWING C-301. SOIL RESTORATION IS NOT REQUIRED FOR AREAS OF STRUCTURES, BUILDING, EQUIPMENT PADS, RIP RAP, VEGETATED AND PAVED ROADWAYS. ALL AREAS SHALL BE CONSIDERED AREAS OF CUT OR FILL WITH THE EXCEPTION OF THE FOLLOWING:

   A. THE BIORETENTION CELL SHALL BE CONSIDERED AN AREA OF RUNOFF REDUCTION PRACTICES ARE APPLIED.

   B. THE INFILL AREAS (SEE DWG C-102 AND LANDSCAPE DWGS) SHALL BE CONSIDERED MINIMAL SOIL DISTURBANCE.



PLAN
SCALE: 1" = 30'

SCALE: 1" = 30'   30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
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HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

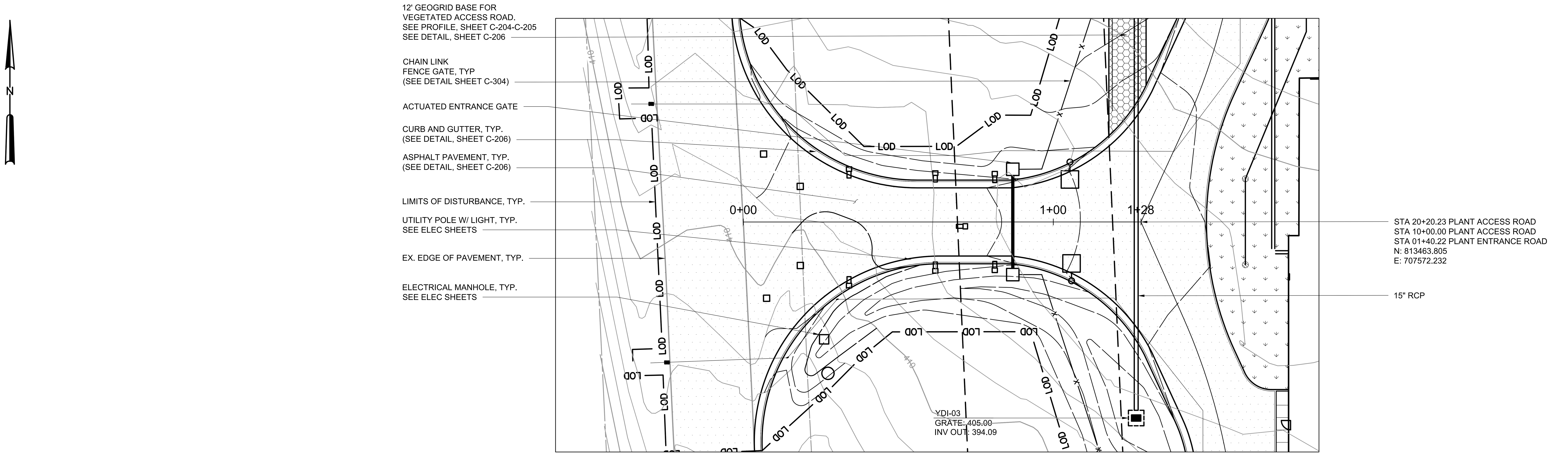
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
FINAL SITE PLAN - AREA 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-142

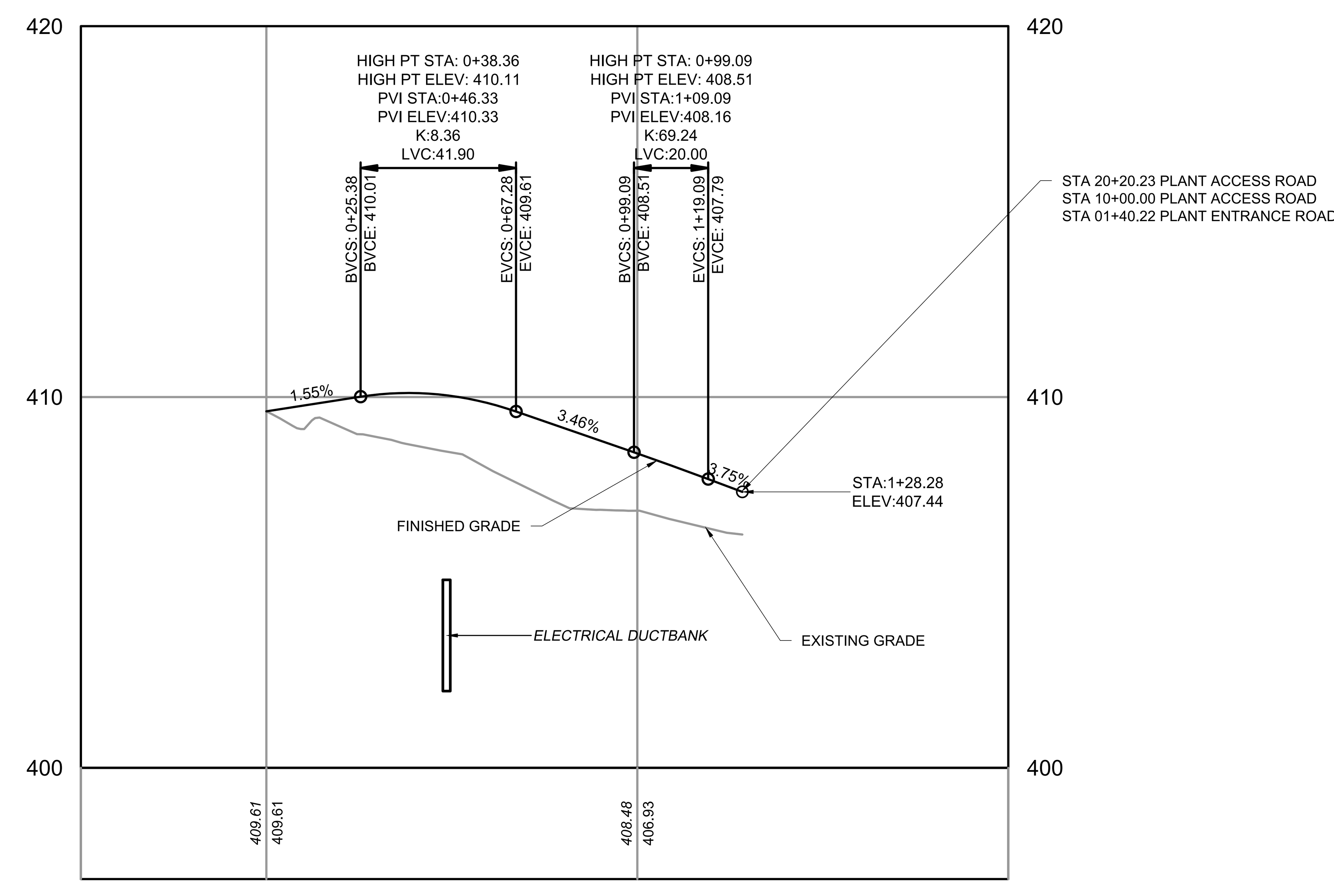
NOTE:

YARD PIPING NOT SHOWN FOR CLARITY. SEE SHEETS C-131 & C-132 FOR BELOW GRADE PIPING AND STRUCTURES.



PLAN

SCALE: 1" = 30'



PLANT ENTRANCE ROAD PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=5'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

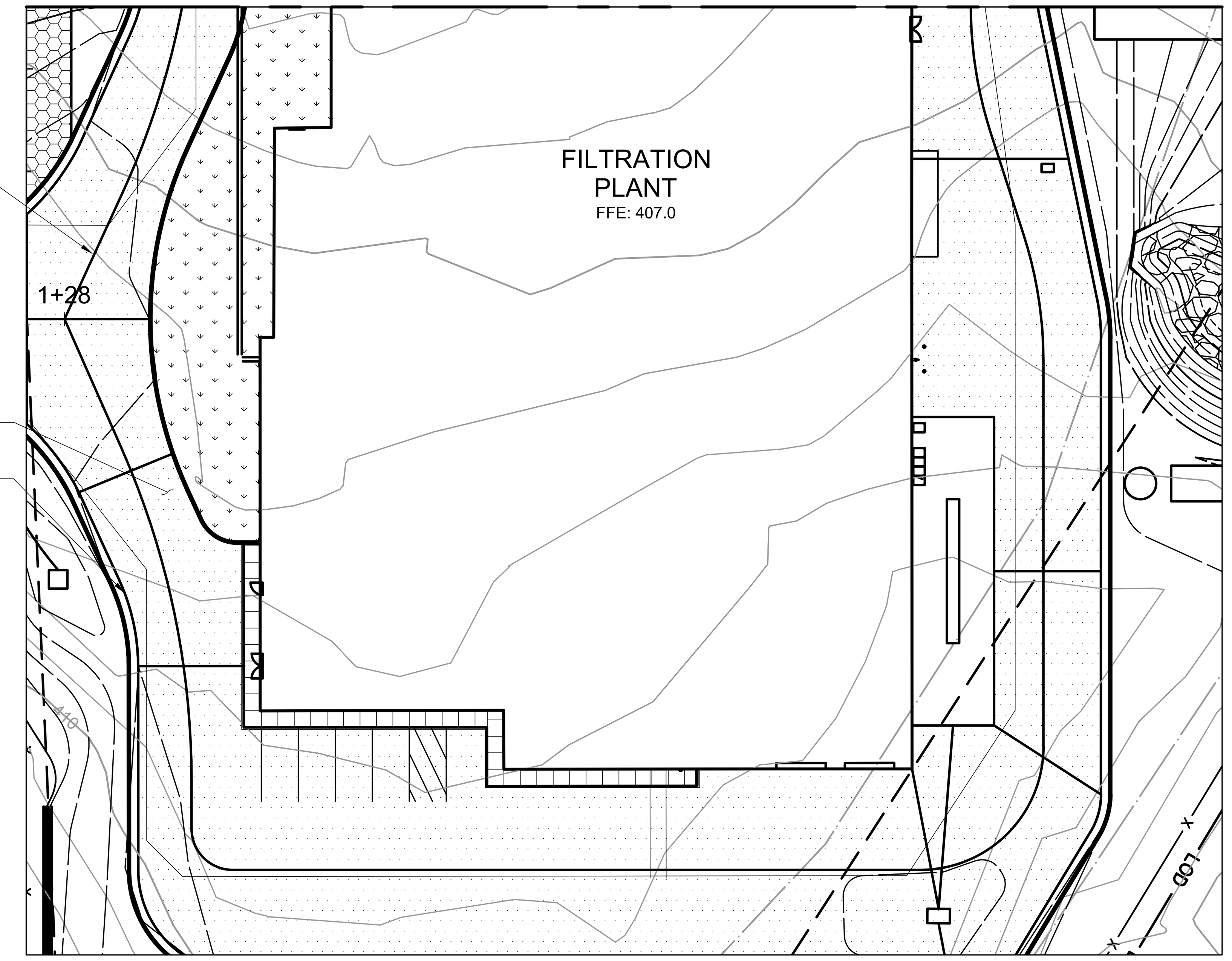
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
PLANT ENTRANCE ROAD PLAN AND PROFILE

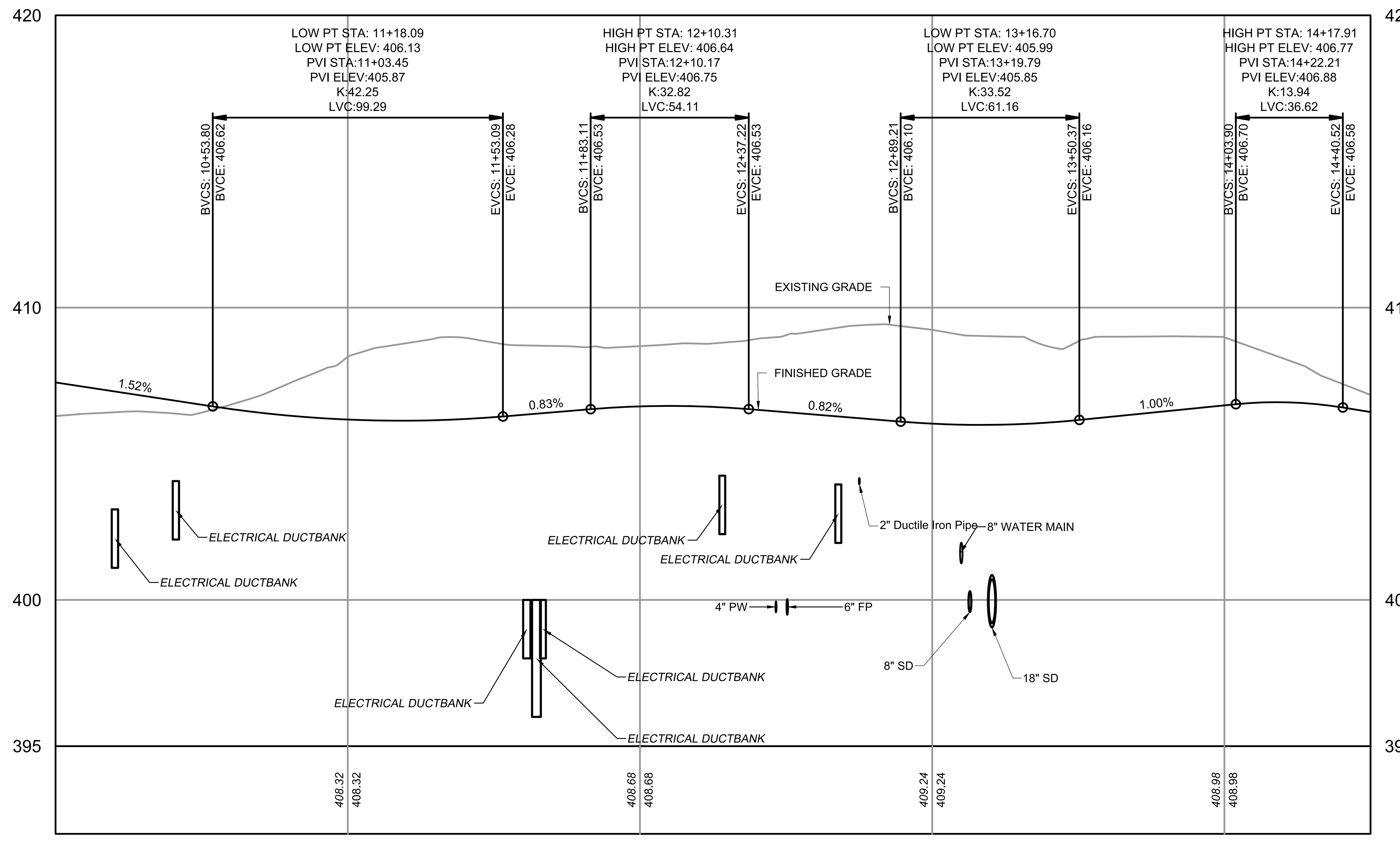
DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-201

NOTE:

YARD PIPING NOT SHOWN FOR CLARITY. SEE DWGS C-131 & C-132 FOR BELOW GRADE PIPING AND STRUCTURES.



PLAN
SCALE: 1" = 30'



PERIMETER ACCESS ROAD PROFILE

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1"= 3'

File: C:\BMS\HAZEN-PW\D0103283\C-202 Saved by: JTANNER Save date: 7/20/2022 12:32 PM
PLOT DATE: 7/20/2022 6:03 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
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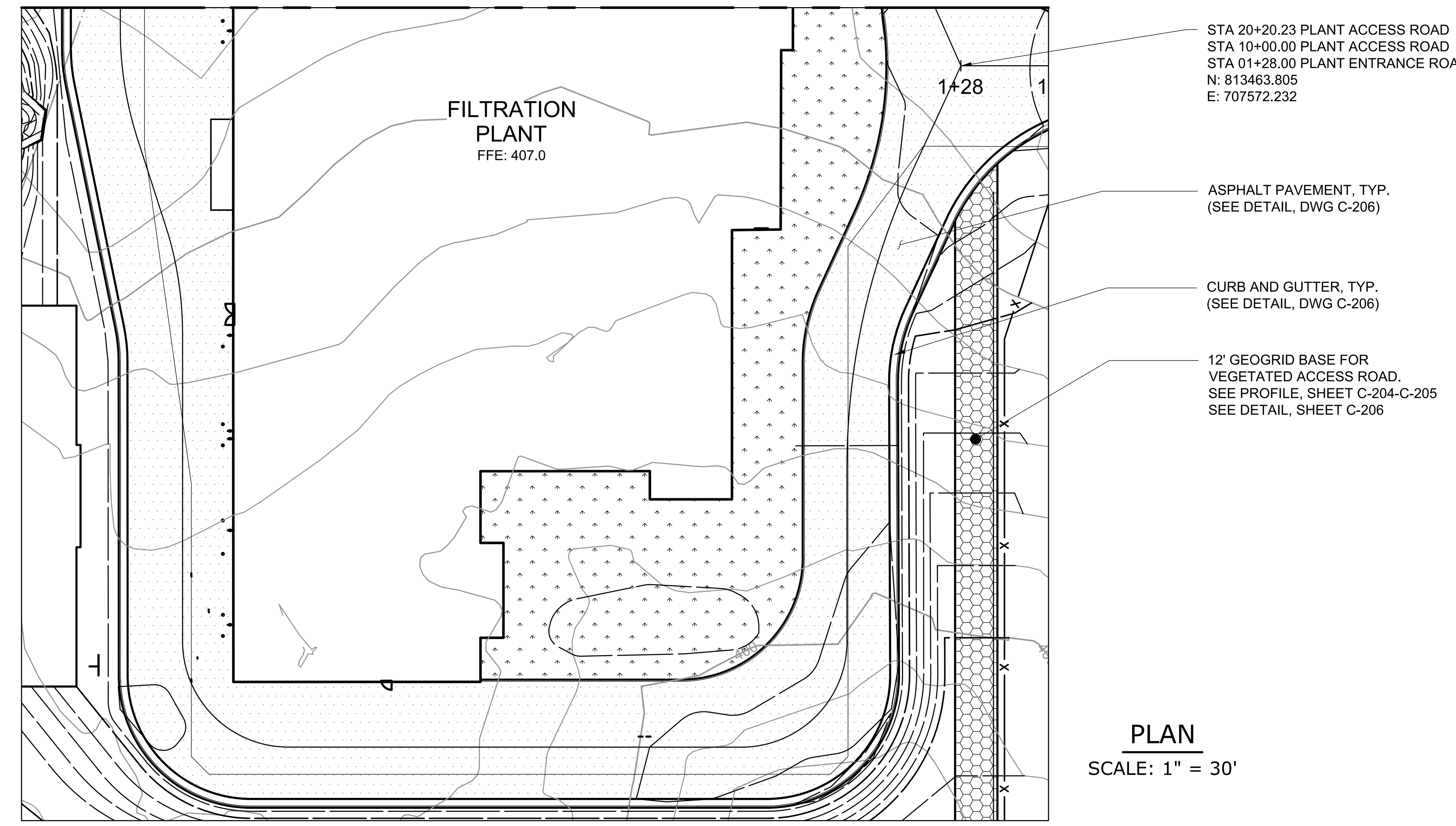
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
PLANT ACCESS ROAD PLAN AND PROFILE - STA 10+00 TO STA 14+50

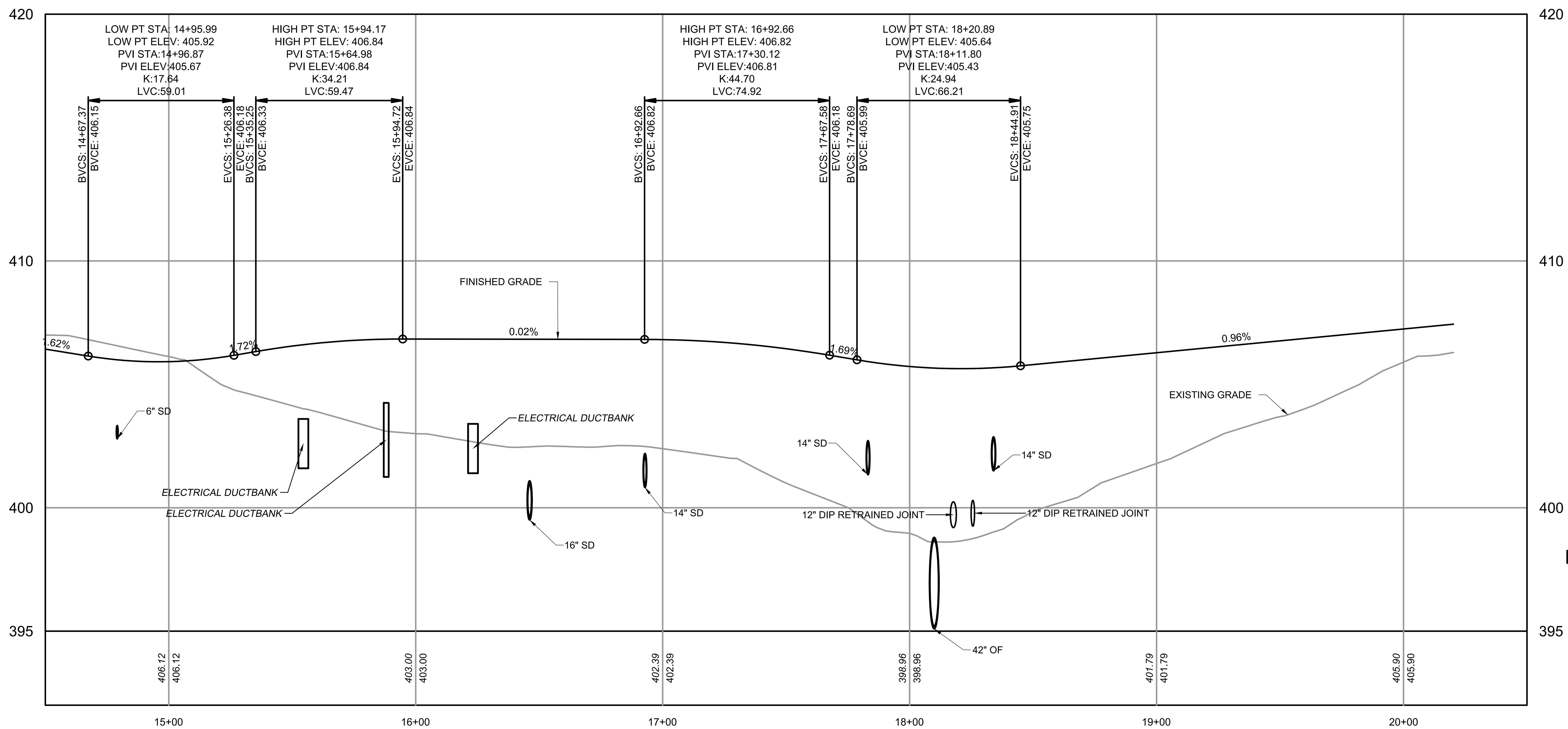
DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-202



PLAN
SCALE: 1" = 30'

NOTE:

YARD PIPING NOT SHOWN FOR CLARITY. SEE DWGS C-131 & C-132 FOR BELOW GRADE PIPING AND STRUCTURES.



PLANT ACCESS ROAD PROFILE
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
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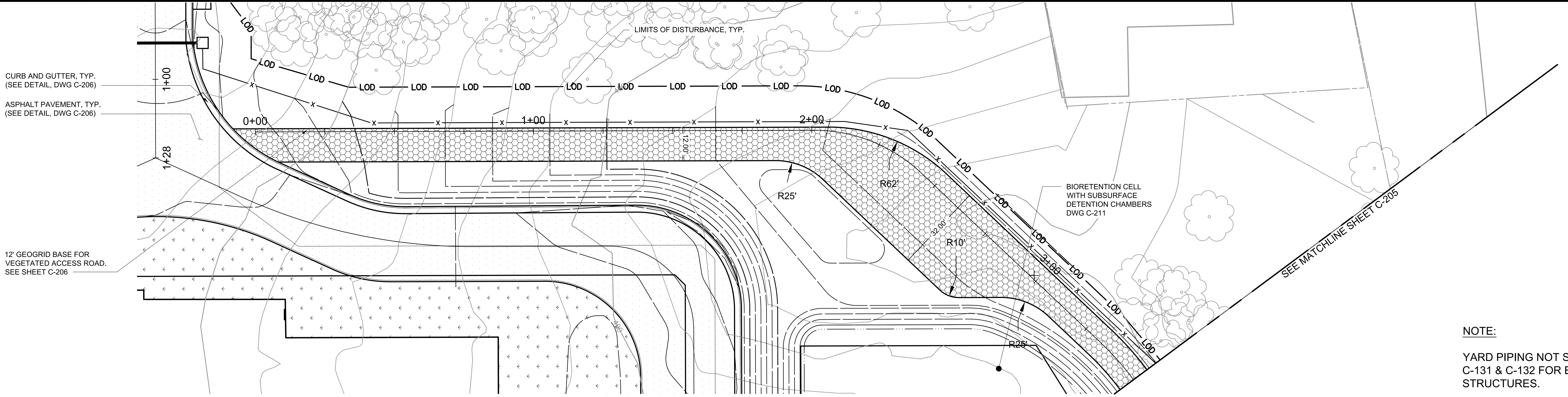
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
PLANT ACCESS ROAD PLAN AND PROFILE - STA 14+50 TO STA 20+20

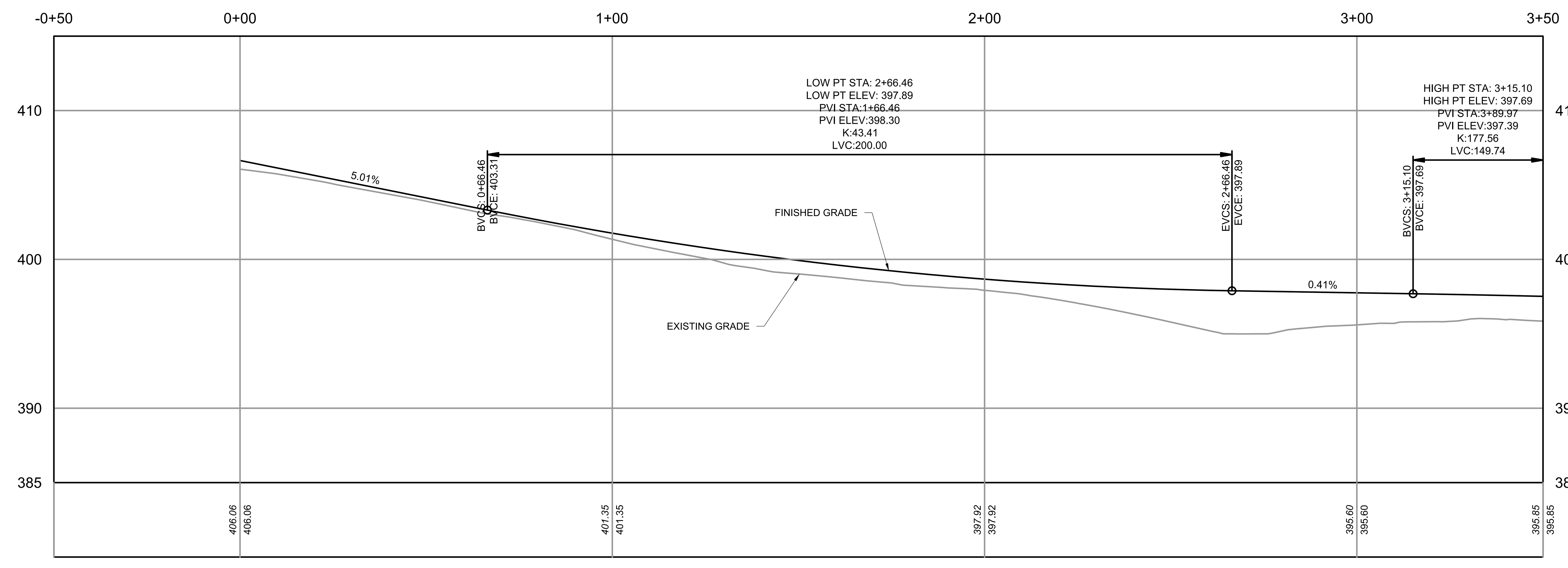
DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-203



PLAN
SCALE: 1" = 20'

NOTE:

YARD PIPING NOT SHOWN FOR CLARITY. SEE DWGS C-131 & C-132 FOR BELOW GRADE PIPING AND STRUCTURES.



VEGETATED ACCESS ROAD PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=5'

HORIZONTAL SCALE: 1" = 50'
50 25 0 50'
5 0 5
VERTICAL SCALE: 1"=5'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
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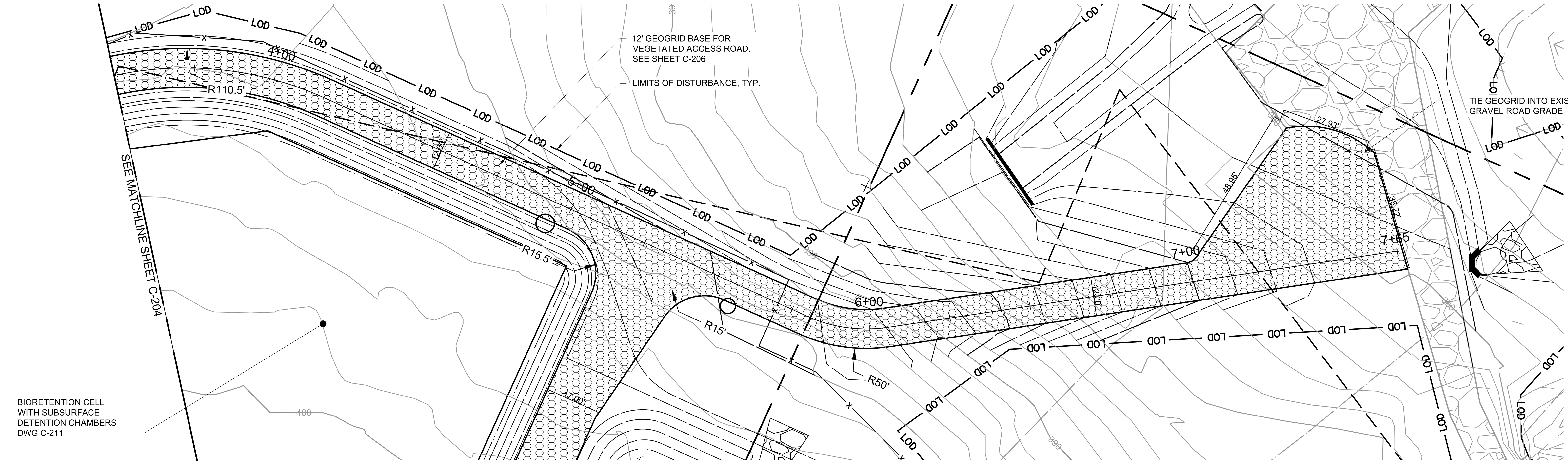
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

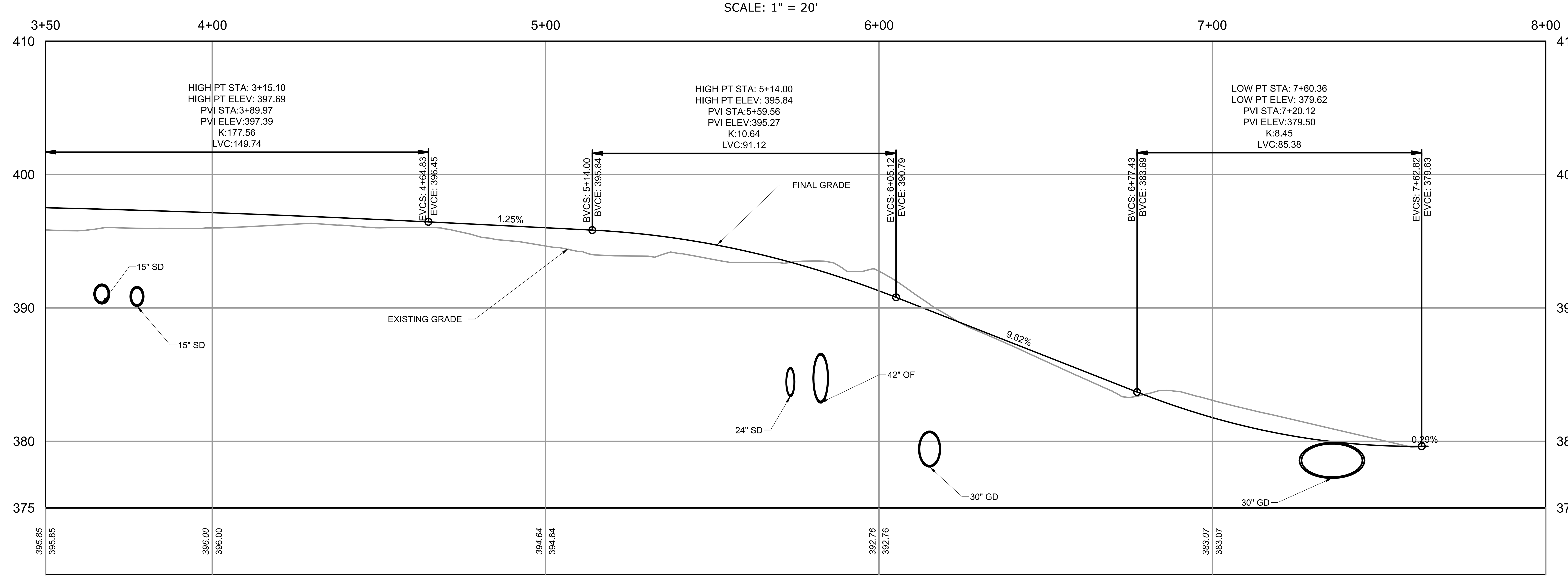
CIVIL
VEGETATED ACCESS ROAD PLAN AND PROFILE - SHEET 1 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-204



PLAN

SCALE: 1" = 20'



VEGETATED ACCESS ROAD PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=5'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

PERMIT SUBMITTAL
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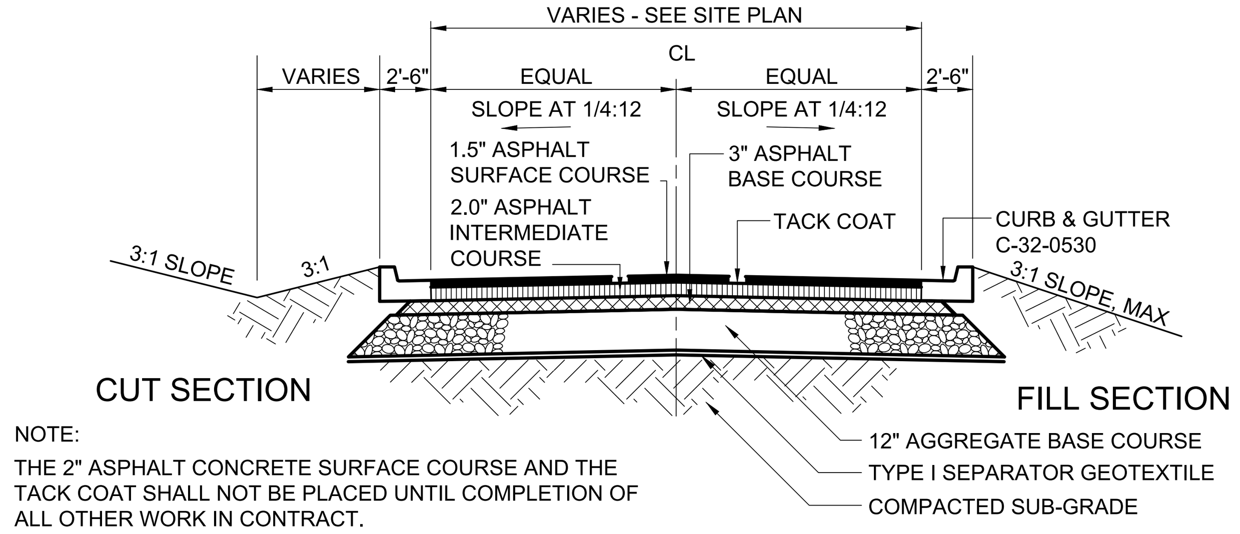
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
VEGETATED ACCESS ROAD PLAN AND PROFILE - SHEET 2 OF 2

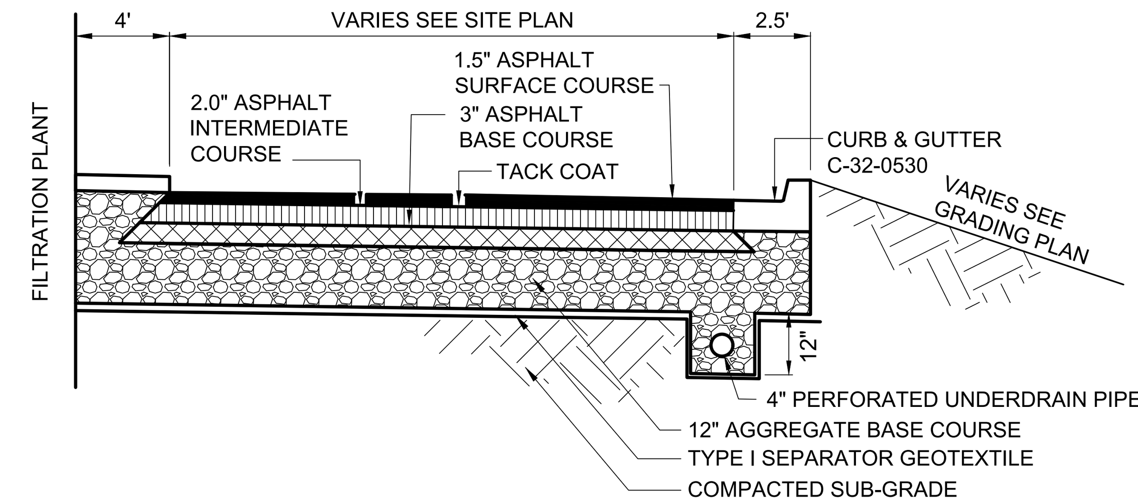
DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-205



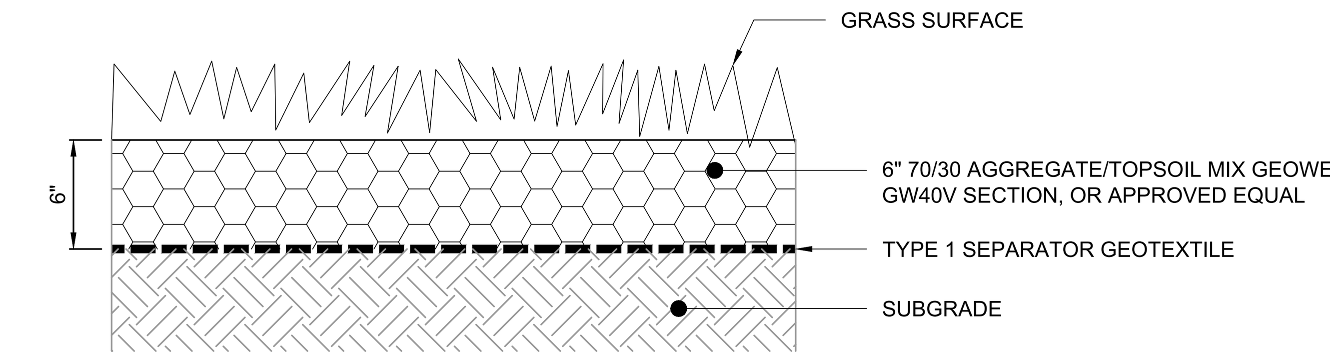
NOTE:
THE 2" ASPHALT CONCRETE SURFACE COURSE AND THE TACK COAT SHALL NOT BE PLACED UNTIL COMPLETION OF ALL OTHER WORK IN CONTRACT.

TYPICAL PLANT ENTRANCE ROADWAY SECTION

C-32-0552

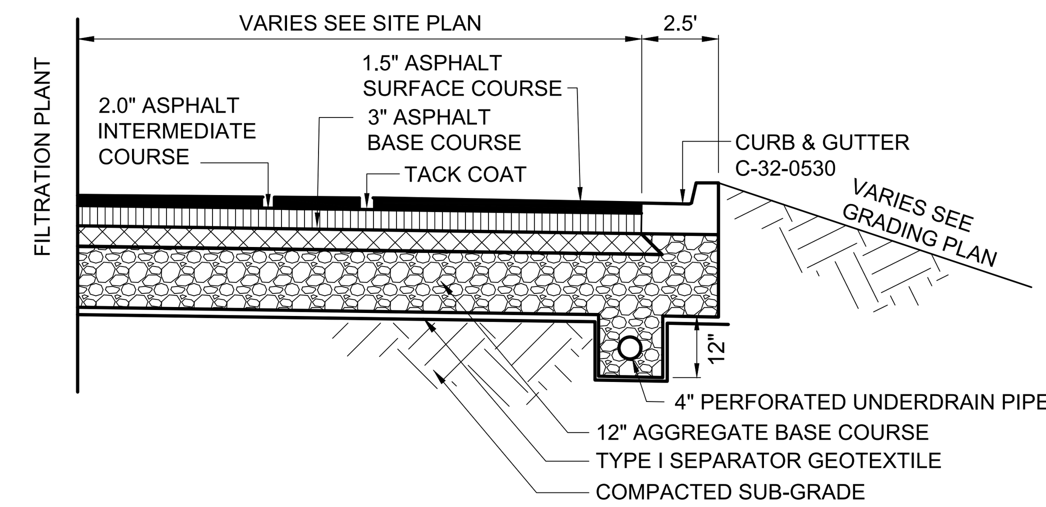


TYPICAL PLANT ACCESS ROAD SECTION
WITH SIDEWALK

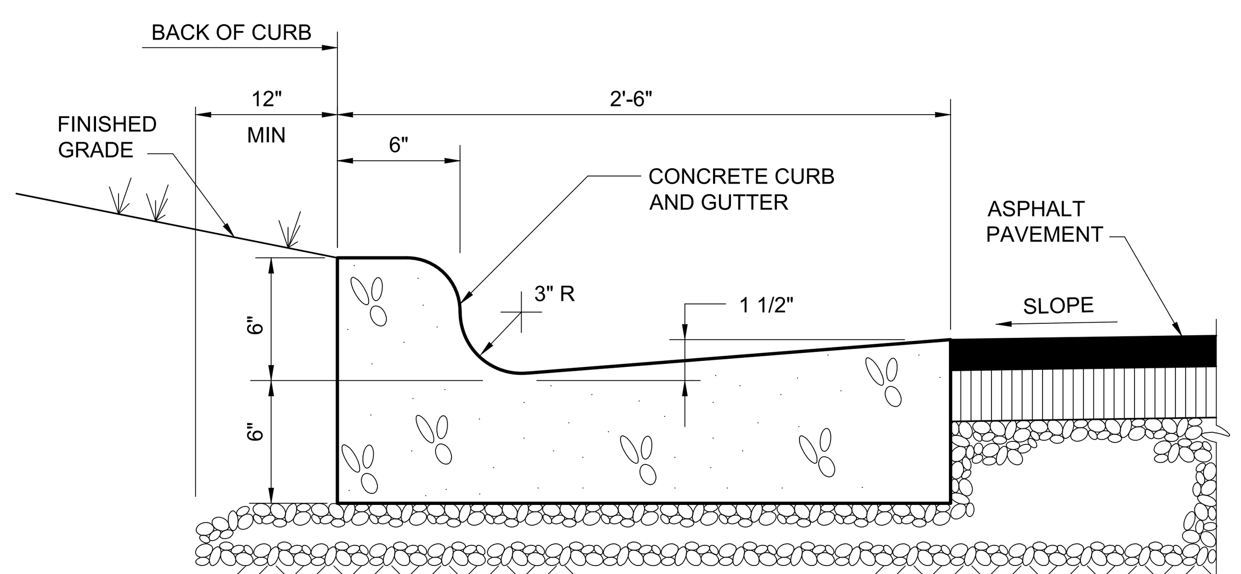


VEGETATED ACCESS ROAD

SCALE: NTS



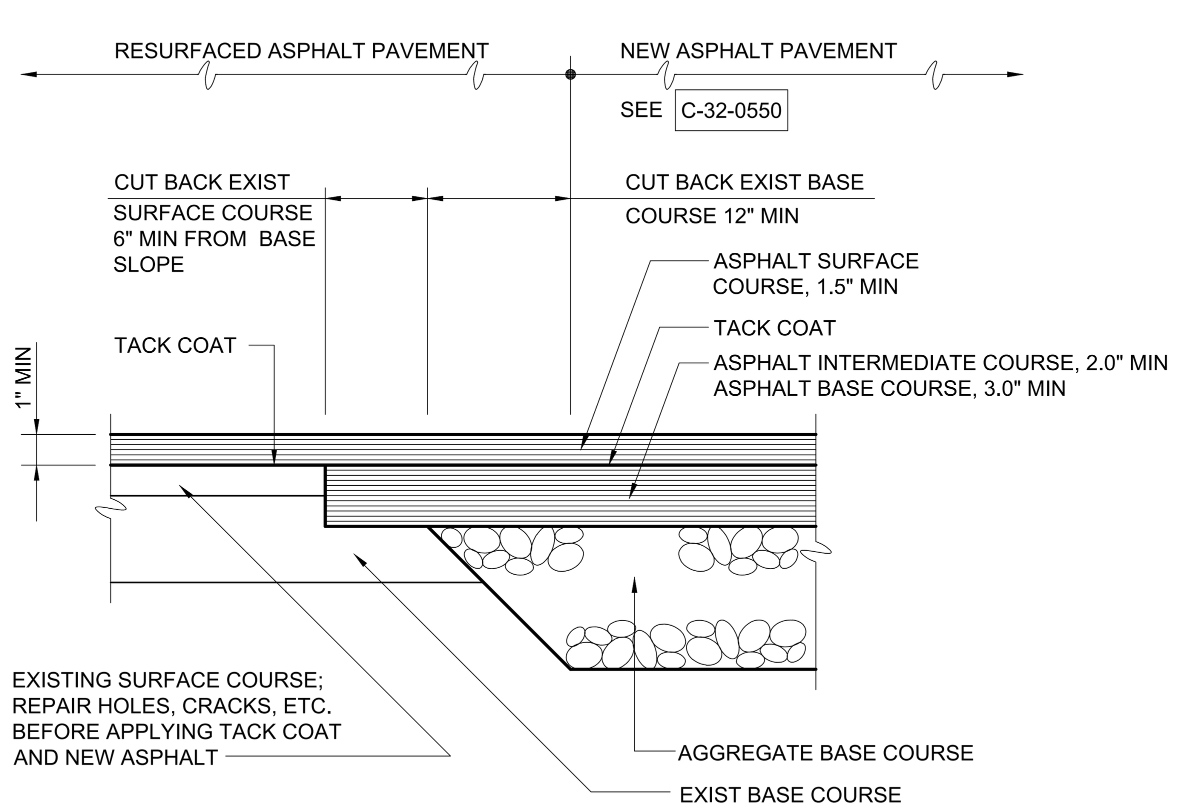
TYPICAL PLANT ACCESS ROAD SECTION
WITHOUT SIDEWALK



NOTES:
1. CONTRACTION JOINTS SHALL BE PLACED AT 10 FOOT INTERVALS, OR 15 FOOT INTERVALS WHEN A MACHINE IS USED TO PLACE THE CURB.
2. EXPANSION JOINTS SHALL BE PLACED AT 90 FOOT INTERVALS AND ADJACENT TO ALL RIGID OBJECTS.

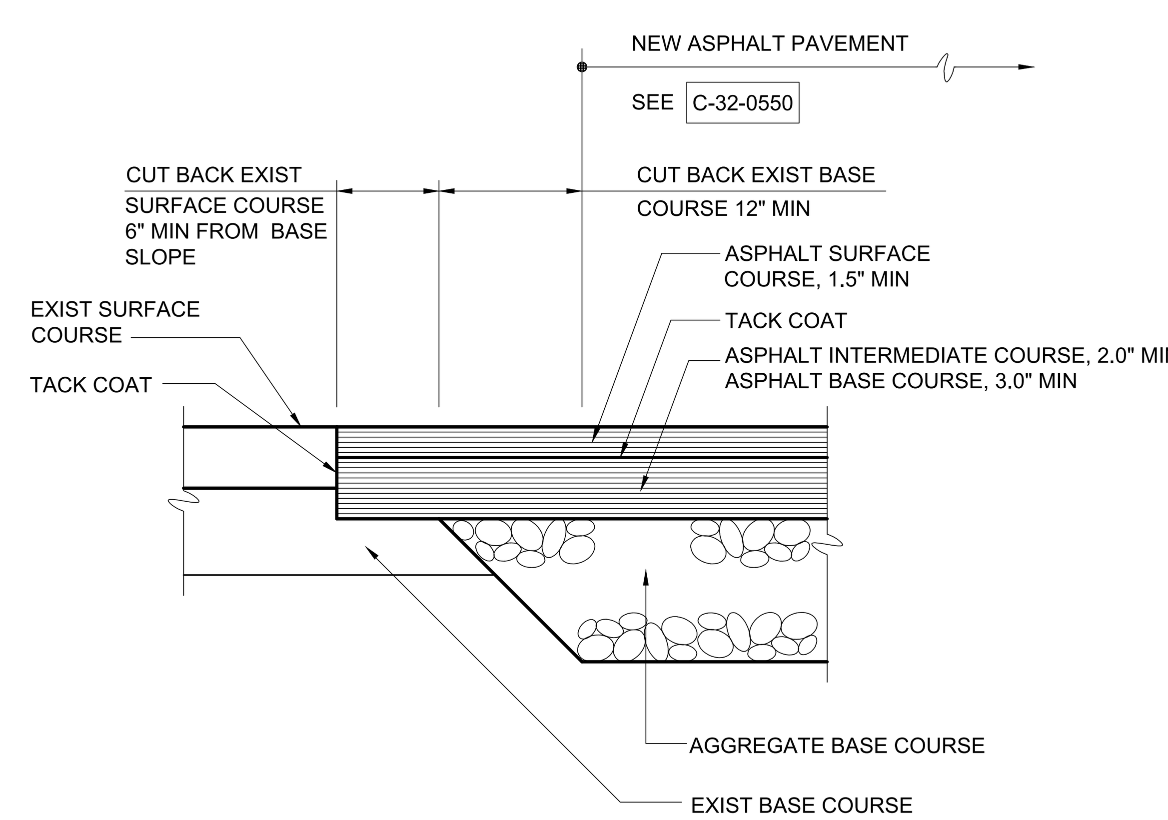
CURB AND GUTTER

C-32-0530



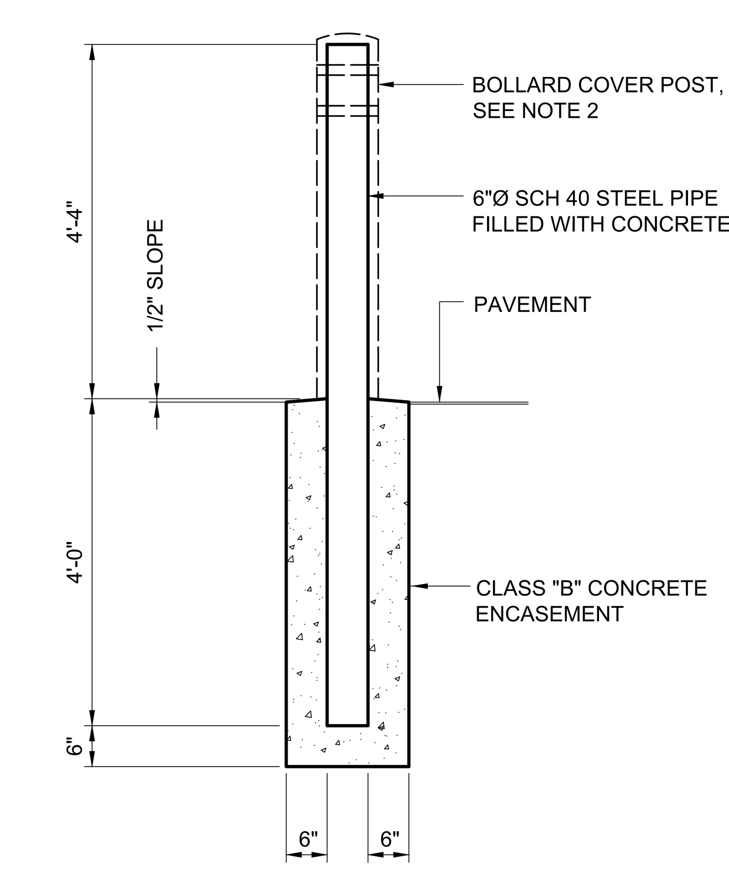
TYPICAL PAVEMENT JUNCTION WITH
RESURFACING OF EXISTING PAVEMENT

C-32-0555



TYPICAL PAVEMENT JUNCTION

C-32-0556



BOLLARD TYPE 1

NOTES:
1. UNLESS OTHERWISE NOTED, ALL BOLLARDS SHALL BE TYPE 1.
2. BOLLARD COVER SHALL BE POST GUARD MODEL CL1386F 7"Øx52" HIGH, YELLOW WITH REFLECTIVE RED STRIPES, OR APPROVED EQUAL AND SECURED TO STEEL PIPE WITH COMPRESSIVE FOAM STRIPS.

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
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Hazen

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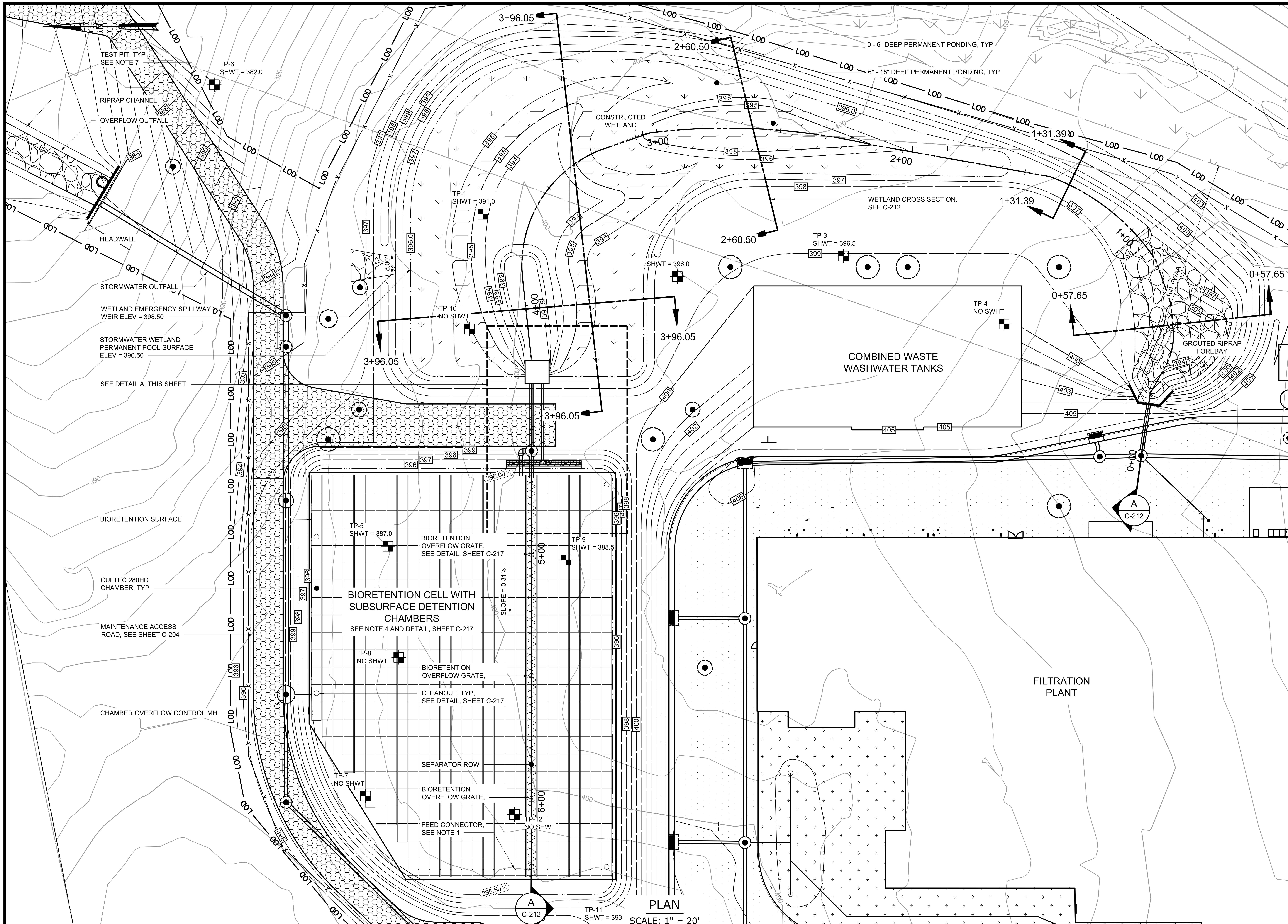
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

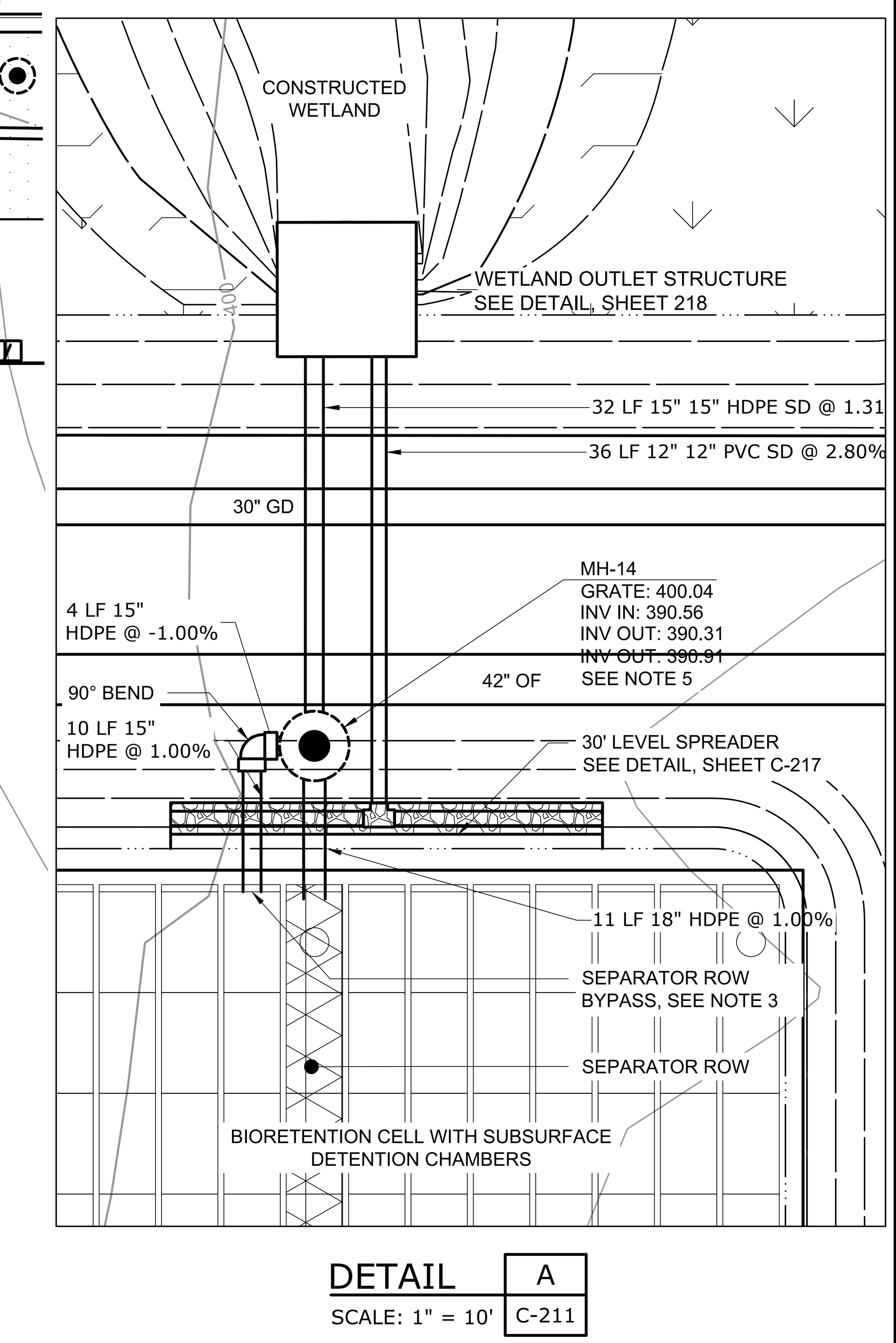
CIVIL
ROADWAY DETAILS

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-206



NOTES:

1. FEED CONNECTOR SHALL BE LOCATED ON FIRST AND LAST CHAMBER OF EVERY ROW. SEPARATOR ROW SHALL ONLY HAVE FEED CONNECTOR ON THE LAST CHAMBER OF THE ROW. PROVIDE NON-WOVEN GEOTEXTILE UNDER ALL FEED CONNECTORS FOR SCOUR PROTECTION.
2. NON-WOVEN GEOTEXTILE SHALL BE PLACED BENEATH SEPARATOR ROW CHAMBERS. SEPARATOR ROW CHAMBERS, INCLUDING CHAMBER BOTTOMS, SHALL ALSO BE WRAPPED IN NON-WOVEN GEOTEXTILE.
3. NON-WOVEN GEOTEXTILE SHALL BE PLACED BENEATH AT SEPARATOR ROW BYPASS CHAMBERS FOR SCOUR PROTECTION. GEOTEXTILE SHALL EXTEND TO END OF ROW.
4. CONTRACTOR SHALL PROVIDE 597 CULTEC 280HD CHAMBERS FOR A TOTAL STATIC CHAMBER VOLUME OF 25,404 CF. TOTAL SYSTEM STORAGE INCLUDING SURROUNDING STONE SHALL BE 39,681 CF.
5. MH-11 TO SERVE HAS THE SEPARATOR BYPASS MANHOLE FOR LARGER STORM EVENTS. MH-11 SHALL ALSO SERVE AS THE DETENTION SYSTEM ACCESS POINT FOR JET-VAC MAINTENANCE.
6. SEE L-101 AND L-102 FOR BIORETENTION CELL AND CONSTRUCTED WETLAND PLANTING PLAN.
7. TEST PITS PERFORMED BY GZA GEOENVIRONMENTAL OF NEW YORK TO DETERMINE THE SEASONALLY HIGH WATER TABLE. SEE JANUARY 27, 2022 REPORT ENTITLED "WESTCHESTER JOINT WATER WORKS (WJWW) - PROPOSED FILTRATION PLANT" FOR ADDITIONAL INFORMATION.



DETAIL A C-211
SCALE: 1" = 10'

SCALE: 1" = 20'
20 10 0 20'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. MCNICOL
DRAWN BY:	C. MCNICOL
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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Hazen
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
STORMWATER MANAGEMENT PLAN

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-211

File: C:\BMS\HAZEN-PW\D0193283\C-211 Saved by: CMCNICOL Save date: 7/7/2022 7:23 PM
PLOT DATE: 7/20/2022 6:05 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. MCNICOL
DRAWN BY: C. MCNICOL
CHECKED BY: D. SHEERAN
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HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
STORMWATER MANAGEMENT
CROSS SECTIONS

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-212

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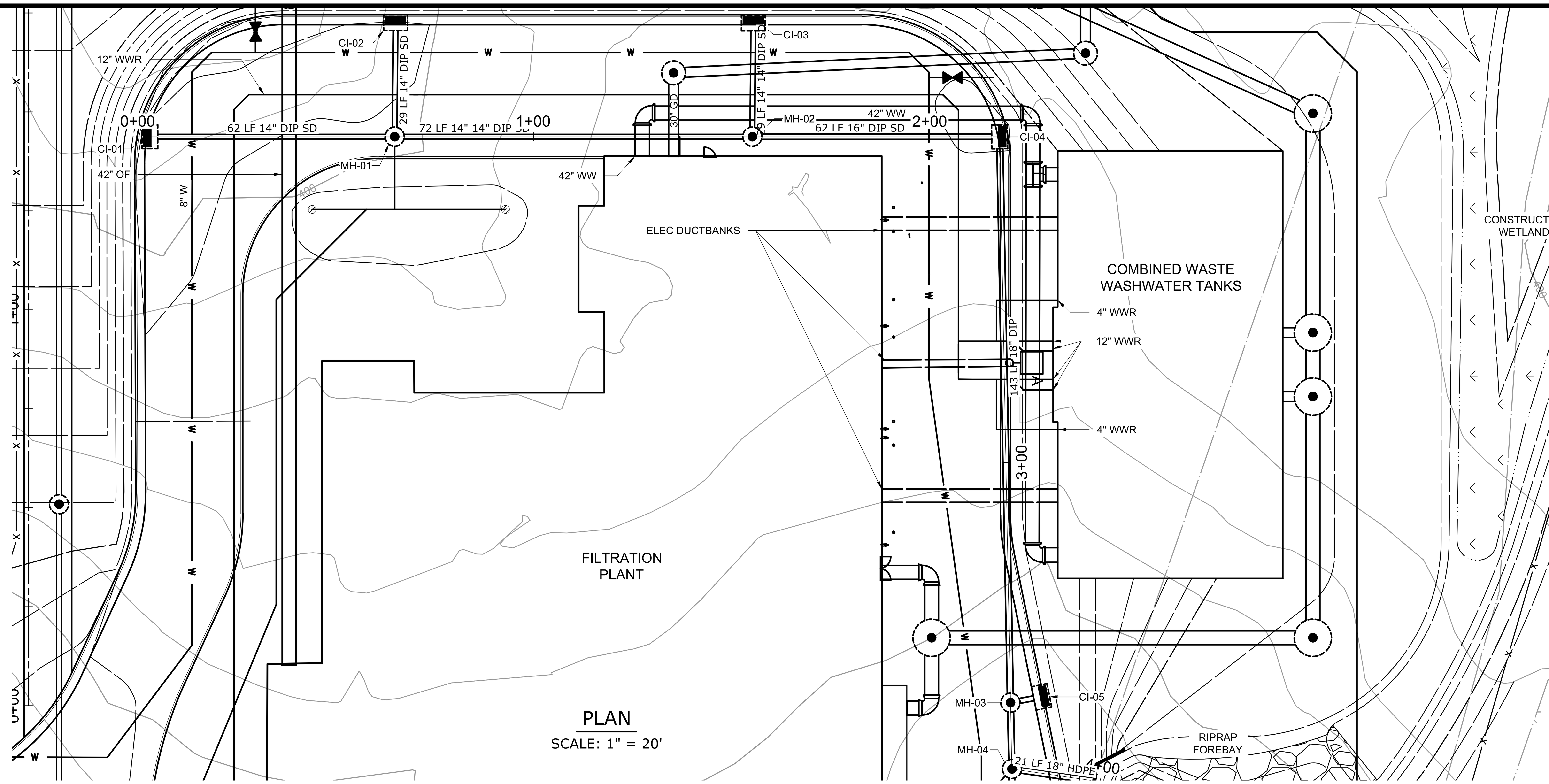
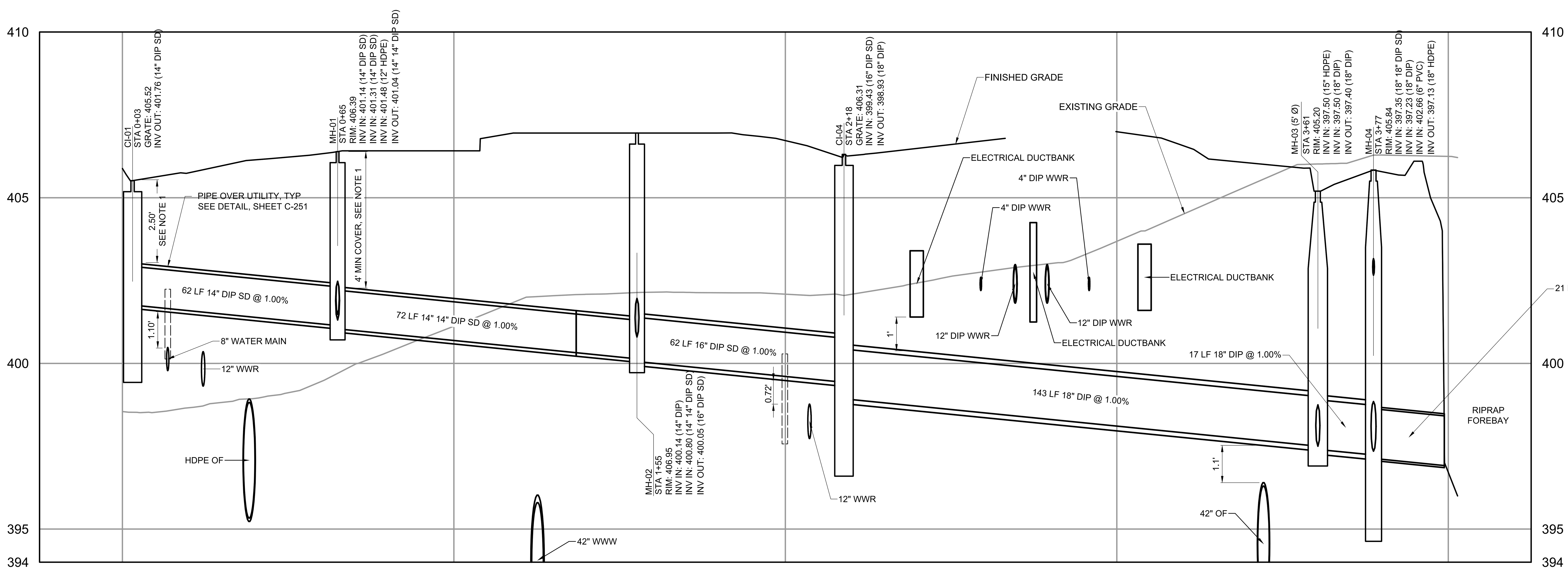


PLAN
SCALE: 1" = 20'



NOTES:

1. ALL STORM DRAINS SHALL HAVE A MINIMUM COVER OF 4' UNLESS SHOWN OTHERWISE.

PROFILE A
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=2'

HORIZONTAL SCALE: 1" = 20'
20 10 0 20'
2 1 0 2
VERTICAL SCALE: 1"=2'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. MCNICOL
DRAWN BY:	C. MCNICOL
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

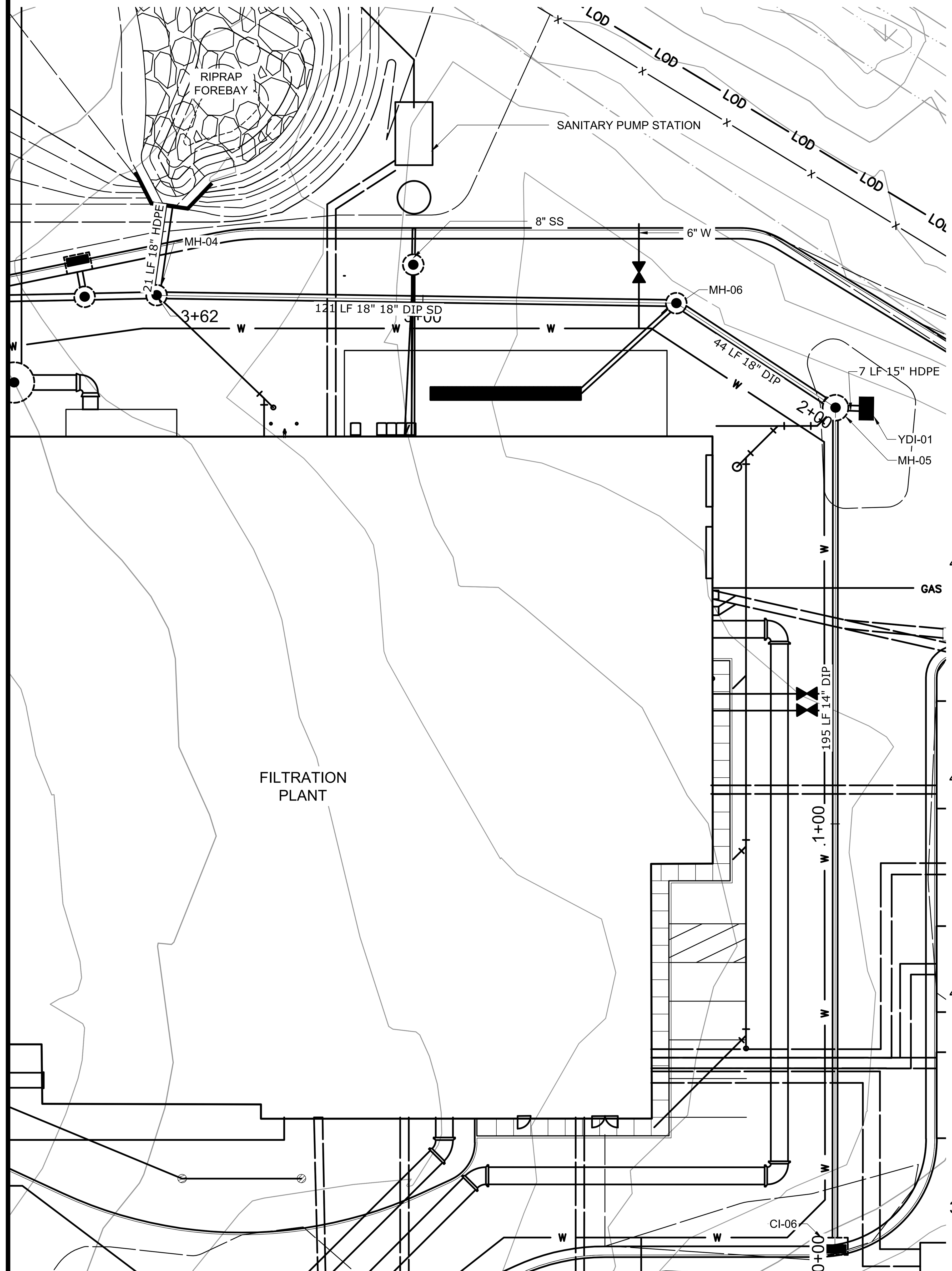
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
STORMWATER DRAINAGE PROFILES - SHEET 1 OF 3

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-213

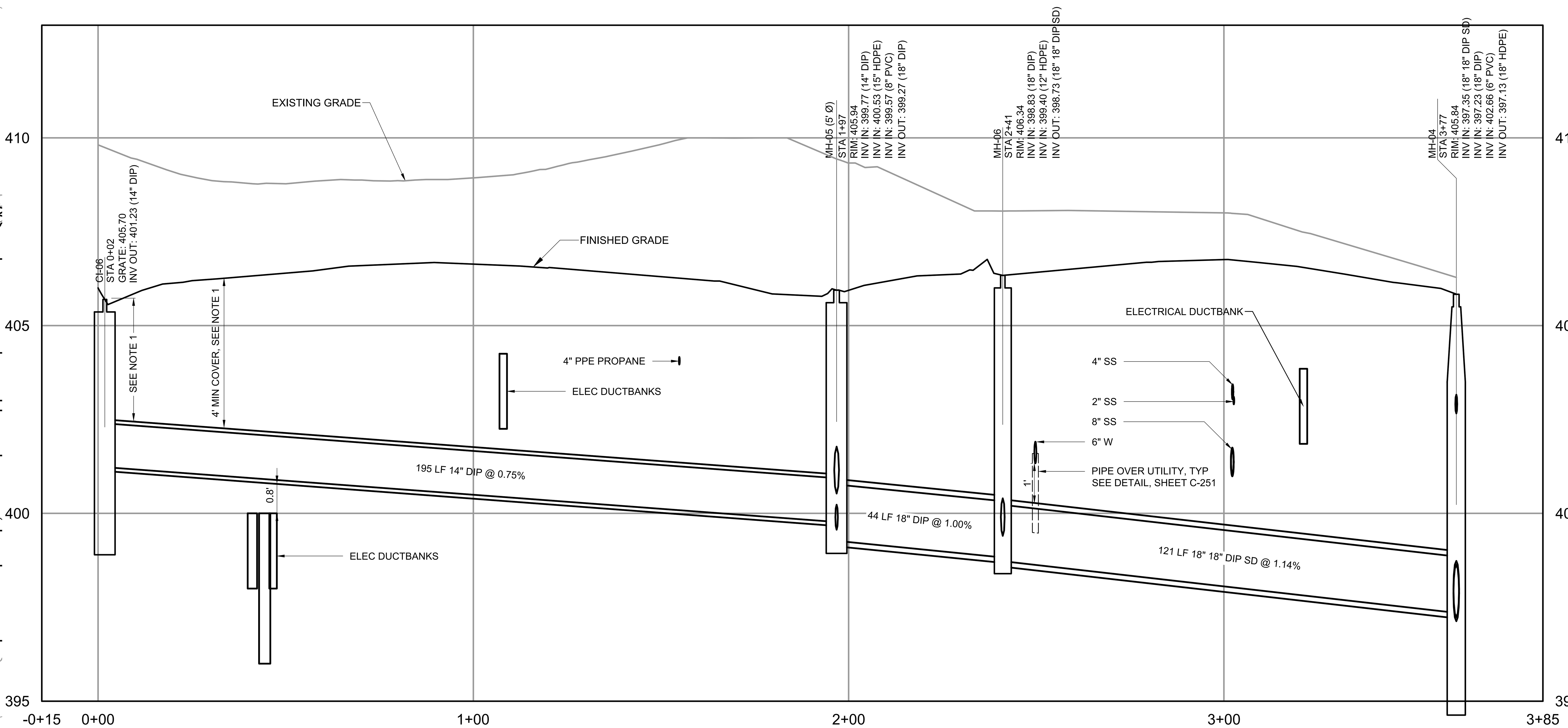
NOTES:

1. ALL STORM DRAINS SHALL HAVE A MINIMUM COVER OF 4' UNLESS SHOWN OTHERWISE.



PLAN

SCALE: 1" = 20'



PROFILE B

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=2'

HORIZONTAL SCALE: 1" = 20'

20 10 0 20'

2 1 0 2

VERTICAL SCALE: 1"=2'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. MCNICOL
DRAWN BY:	C. MCNICOL
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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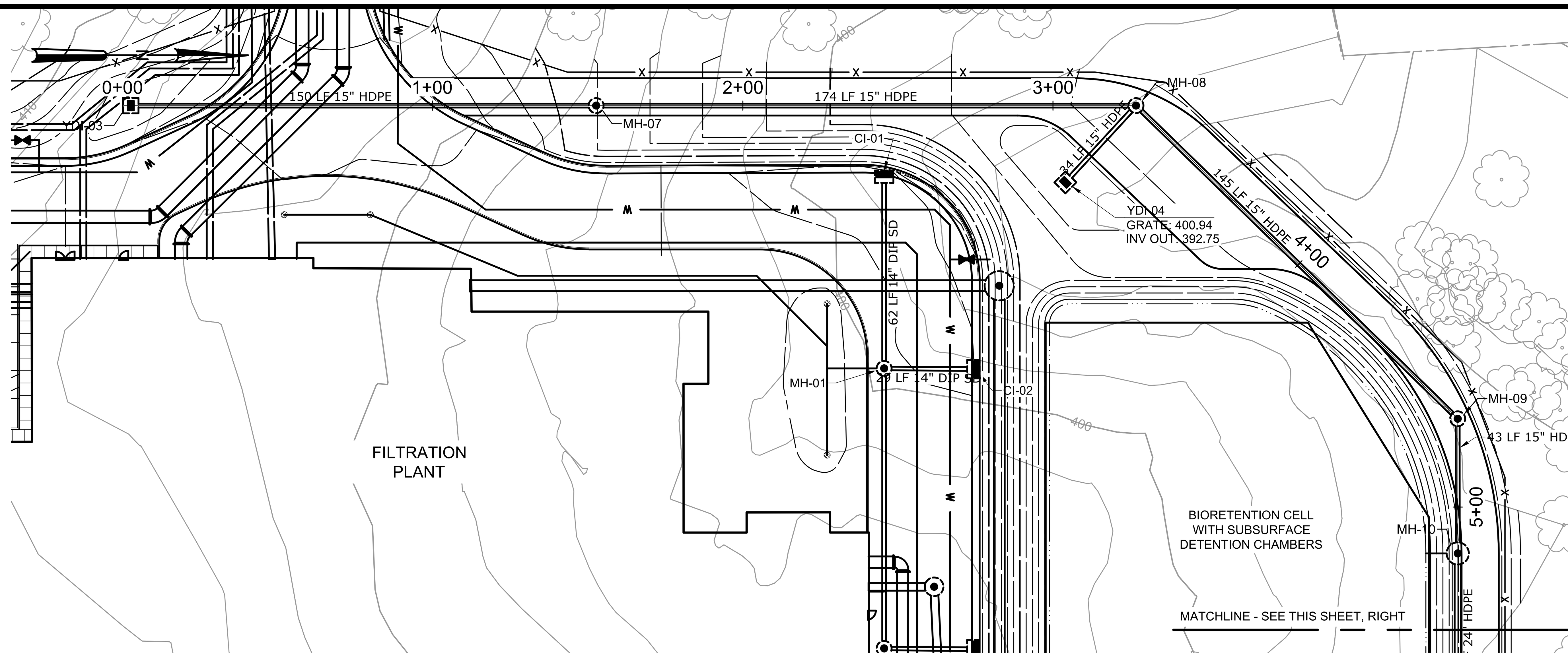
CIVIL
STORMWATER DRAINAGE PROFILES - SHEET 2 OF 3

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-214

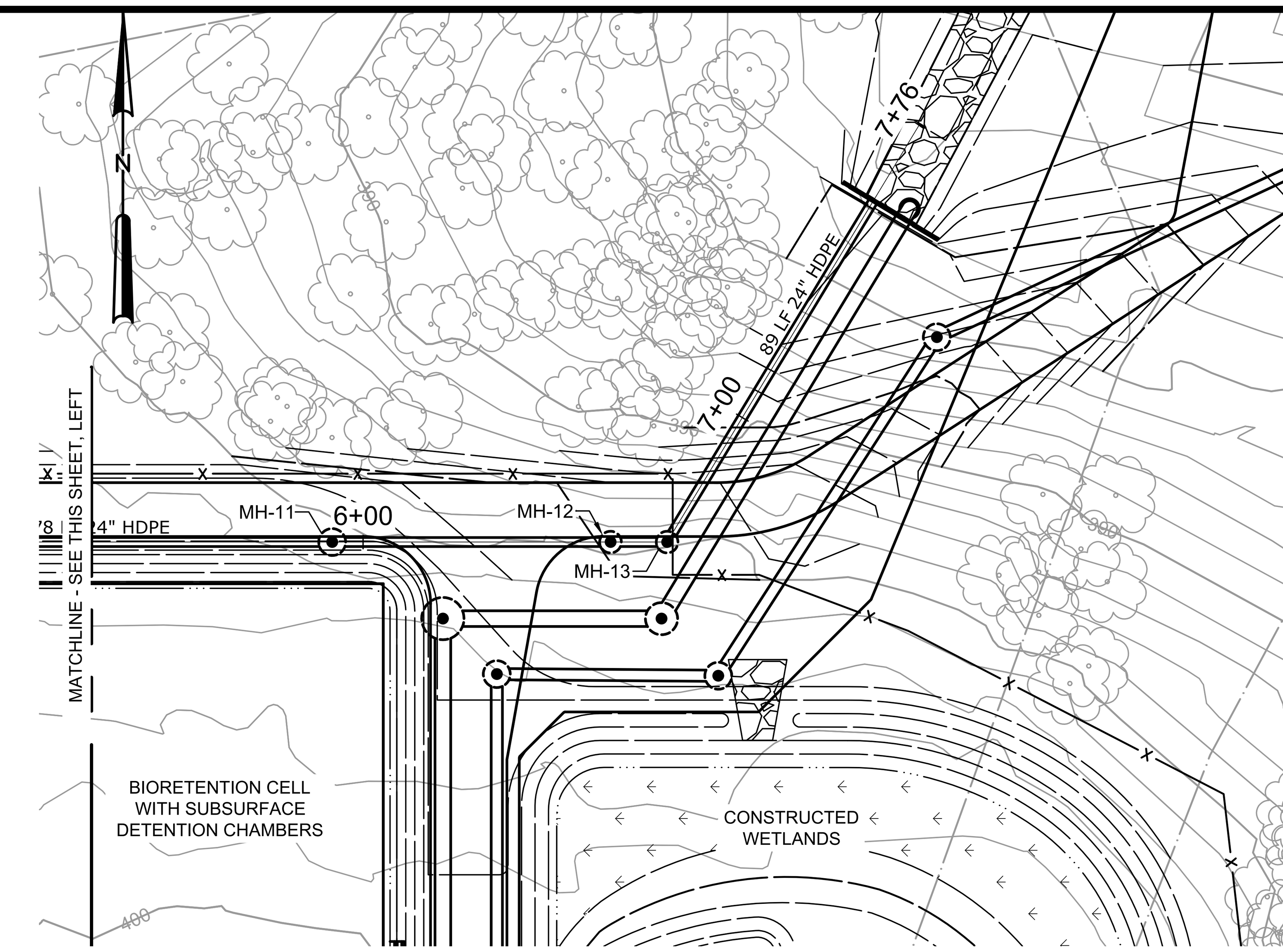
NOTES:

1. ALL STORM DRAINS SHALL HAVE A MINIMUM COVER OF 4' UNLESS SHOWN OTHERWISE.



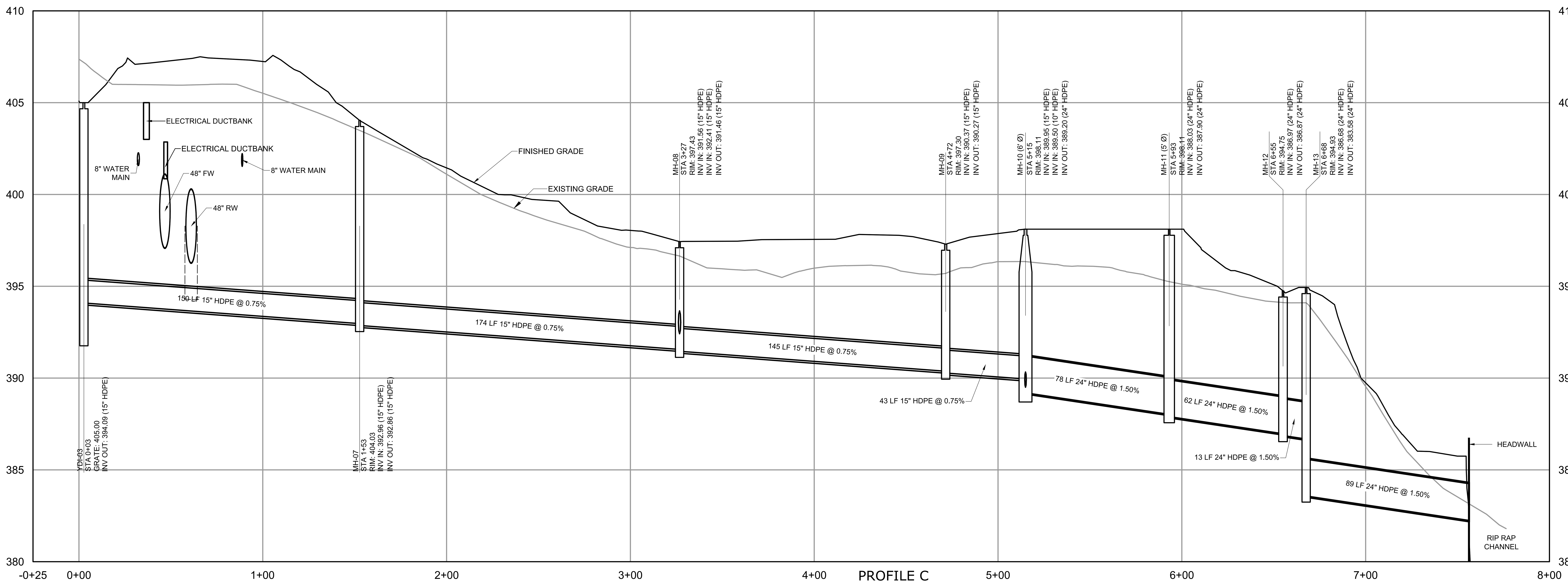
PLAN

SCALE: 1" = 30'



PLAN

SCALE: 1" = 30'



PROFILE C

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1"= 3'

HORIZONTAL SCALE: 1" = 30'

30 15 0 30'

2 1 0 2

VERTICAL SCALE: 1"=3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. MCNICOL
DRAWN BY:	C. MCNICOL
CHECKED BY:	D. SHEERAN
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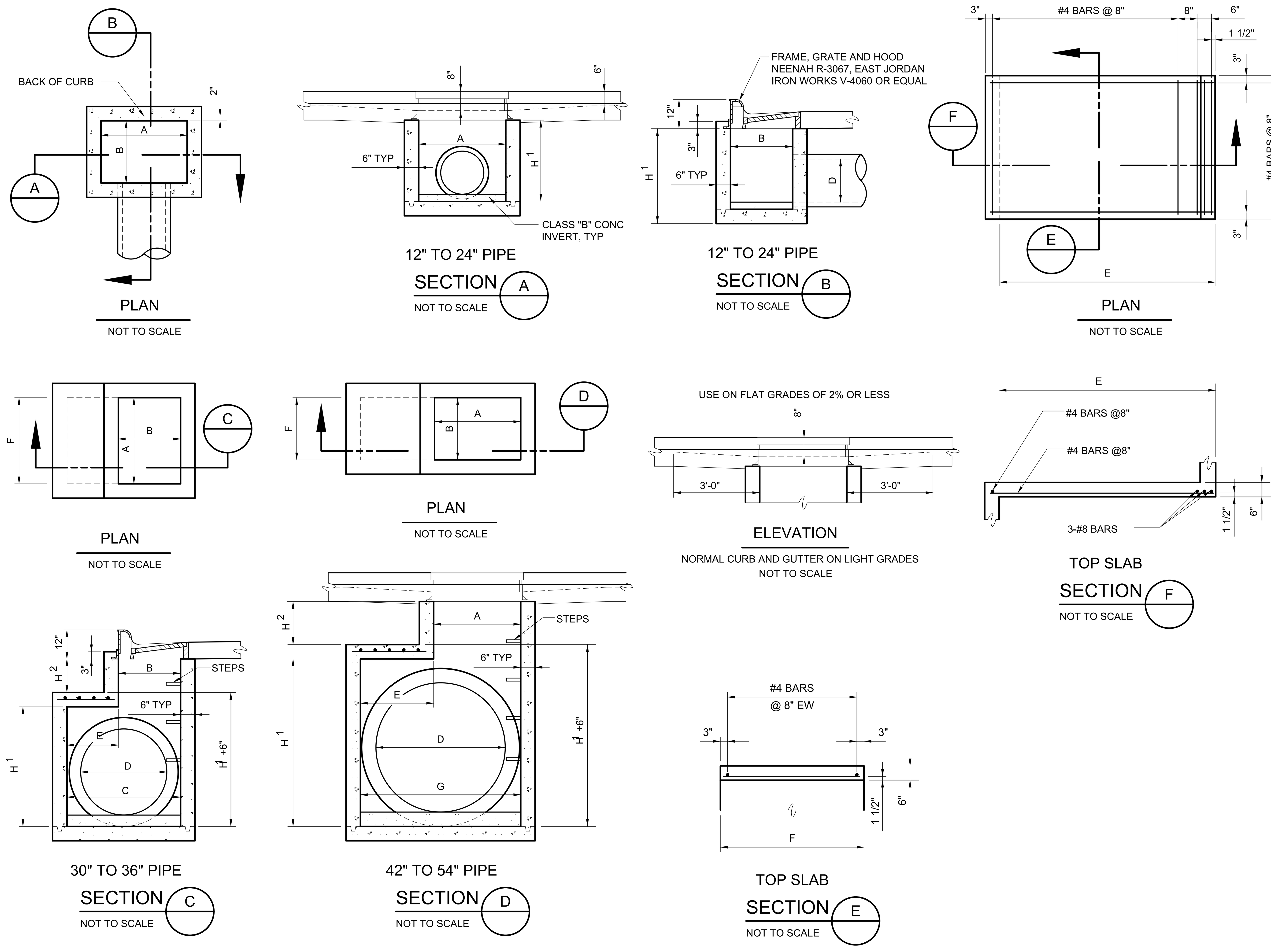
HARRISON, NY

CIVIL
STORMWATER DRAINAGE PROFILES - SHEET 3 OF 3

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-215



STANDARD CONCRETE CURB INLET 12" THROUGH 54" PIPE

SCALE: NTS

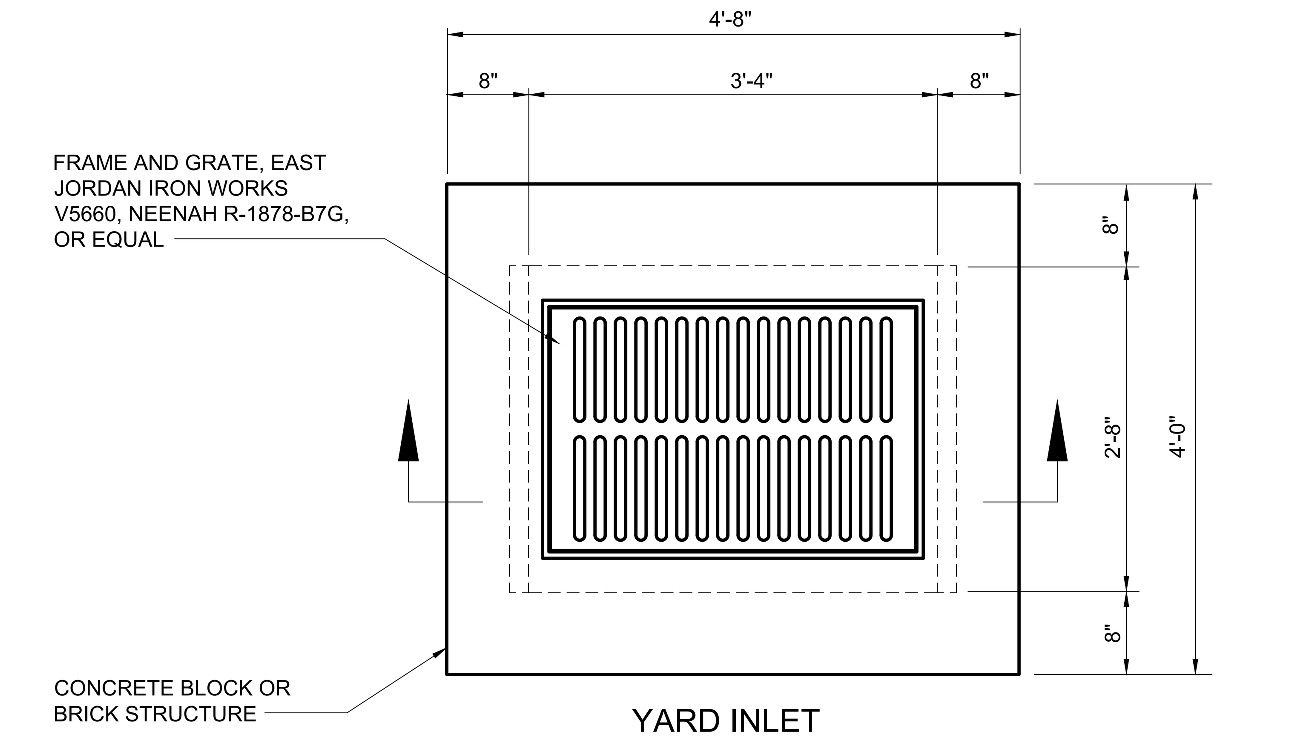
NOTE:

1. STRUCTURAL GEOMETRY AND REINFORCEMENT SHOWN ON THIS DRAWING ARE FOR REFERENCE PURPOSES ONLY. CONTRACTOR SHALL BE RESPONSIBLE FOR THE STRUCTURAL DESIGN OF ALL UTILITY STRUCTURE ELEMENTS PER SPECIFICATION SECTION 33 05 61.

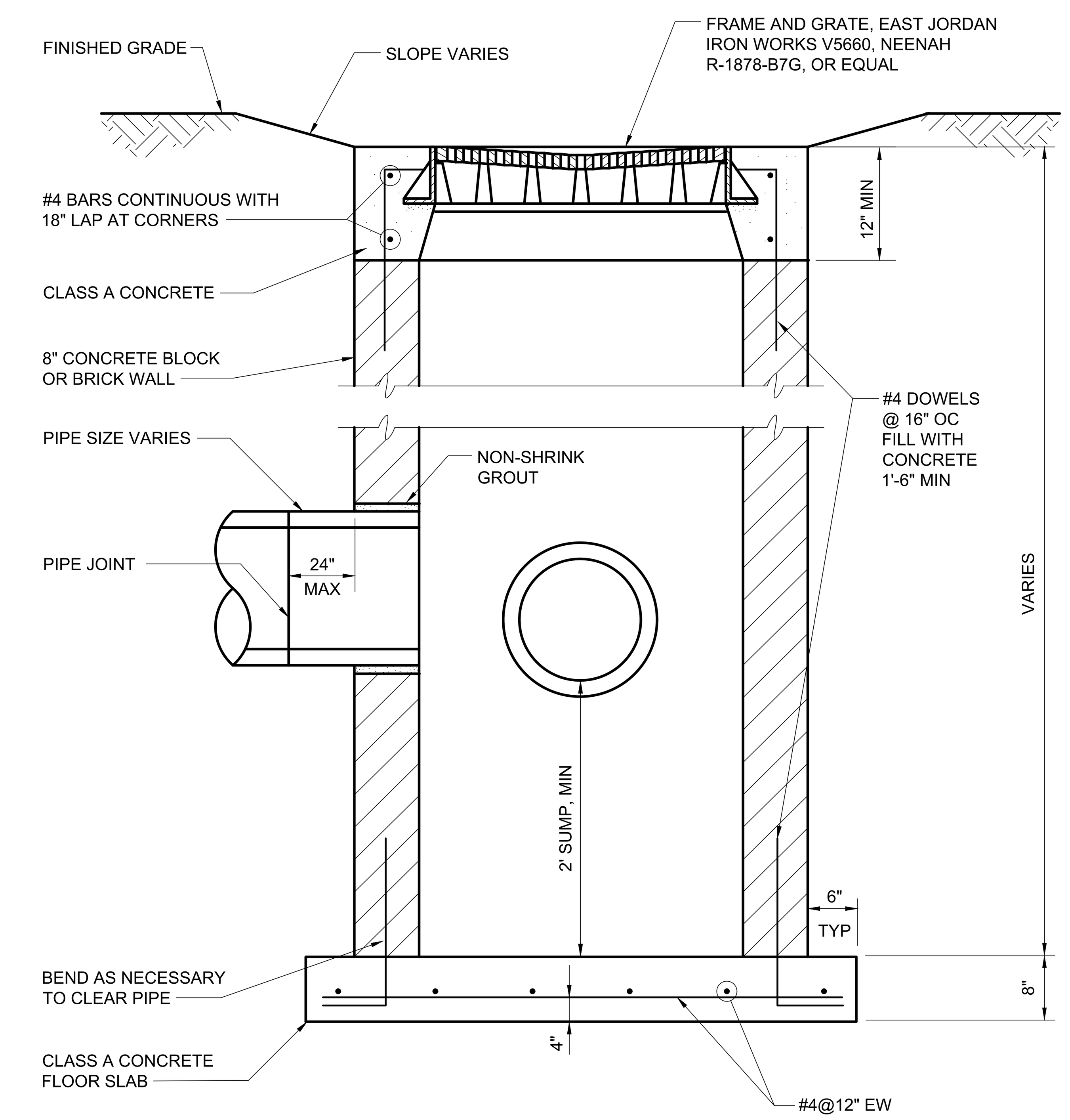
MINIMUM DIMENSIONS FOR CONCRETE CURB INLETS								
DIMENSIONS OF BOX AND PIPE							COVER DIMENSIONS	
PIPE	SPAN	WIDTH	WIDTH	SPAN	HEIGHT	HEIGHT		
D	A	B	C	G	MIN H 1	H 2	E	F
12"	3'-0"	2'-2"	—	—	2'-6"	—	—	—
15"	3'-0"	2'-2"	—	—	2'-9"	—	—	—
18"	3'-0"	2'-2"	—	—	3'-1"	—	—	—
24"	3'-0"	2'-2"	—	—	3'-7"	—	—	—
30"	3'-0"	2'-2"	3'-4"	3'-4"	3'-6"	VARIABLE	1'-8"	4'-0"
36"	3'-0"	2'-2"	3'-10"	3'-10"	4'-1"		2'-2"	4'-0"
42"	3'-0"	2'-2"	—	4'-5"	4'-10"		1'-11"	3'-2"
48"	3'-0"	2'-2"	—	5'-0"	5'-4"		2'-6"	3'-2"
54"	3'-0"	2'-2"	—	5'-7"	5'-11'		3'-1"	3'-2"

CONCRETE CURB INLET NOTES:

1. CLASS "A1" CONCRETE TO BE USED THROUGHOUT.
2. ALL WALLS SHALL BE REINFORCED WITH #4 BARS @ AT 12" EACH WAY PLACED AT MID-DEPTH. BARS SHALL BE BENT AT CORNERS WITH STD. 90° HOOKS. BOTTOM SLAB SHALL BE REINFORCED WITH #5@12" EACH WAY AT MID-DEPTH.
3. ALL CURB INLETS OVER 3'-6" IN DEPTH TO BE PROVIDED WITH STEPS 14" OC. STEPS SHALL BE IN ACCORDANCE WITH SPECIFICATIONS.
4. FOR 8'-0" IN HEIGHT OR LESS USE 6" WALLS AND BOTTOM SLAB. OVER 8'-0" AND UP TO 15'-0" USE 8" WALLS AND BOTTOM SLAB.



C-22-0300



YARD INLET

SCALE: NTS

NOTE:
YARD INLET MAY BE PRECAST CONCRETE - SEE SPECIFICATIONS

REV	ISSUED FOR	DATE	BY

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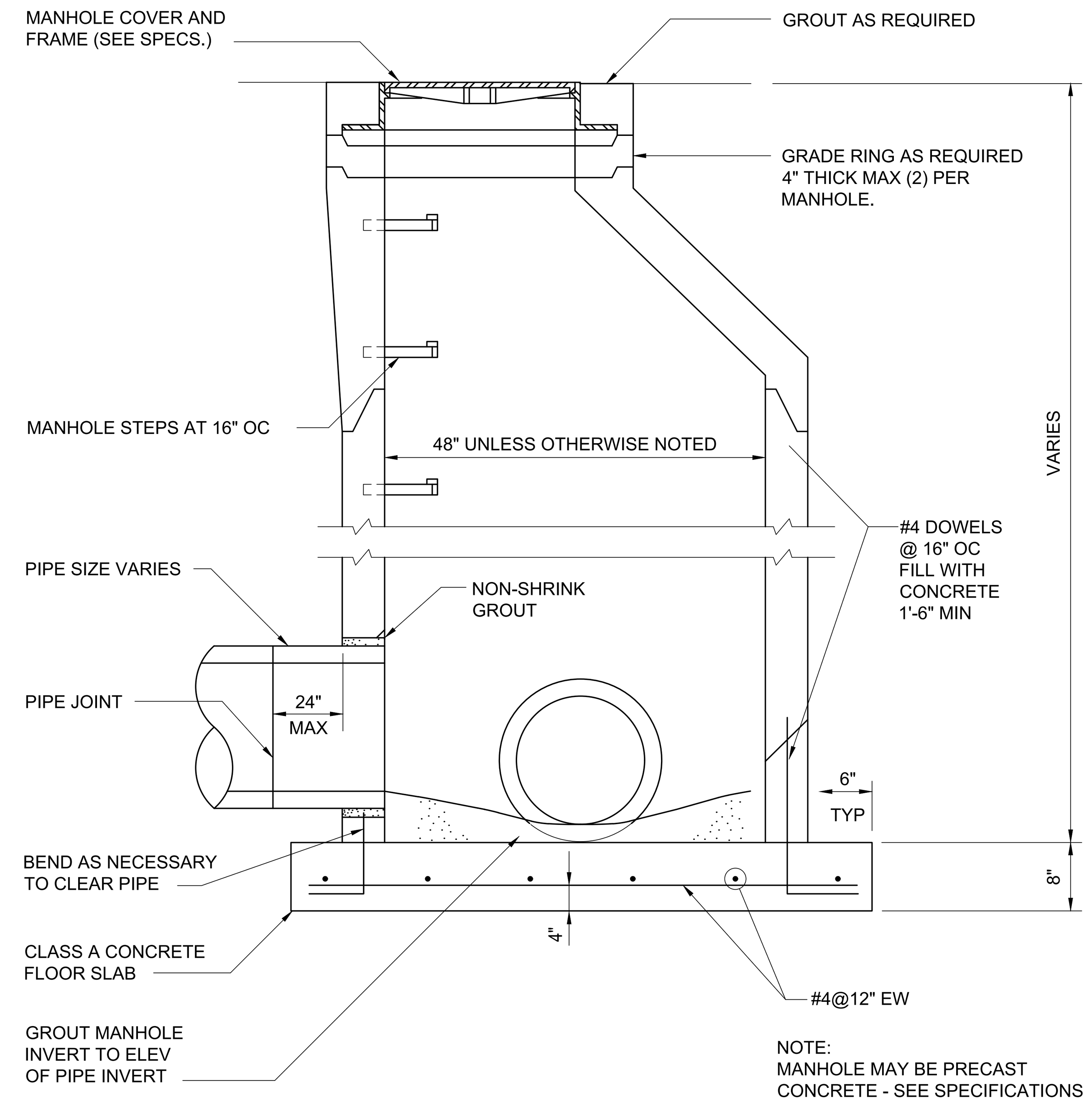
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

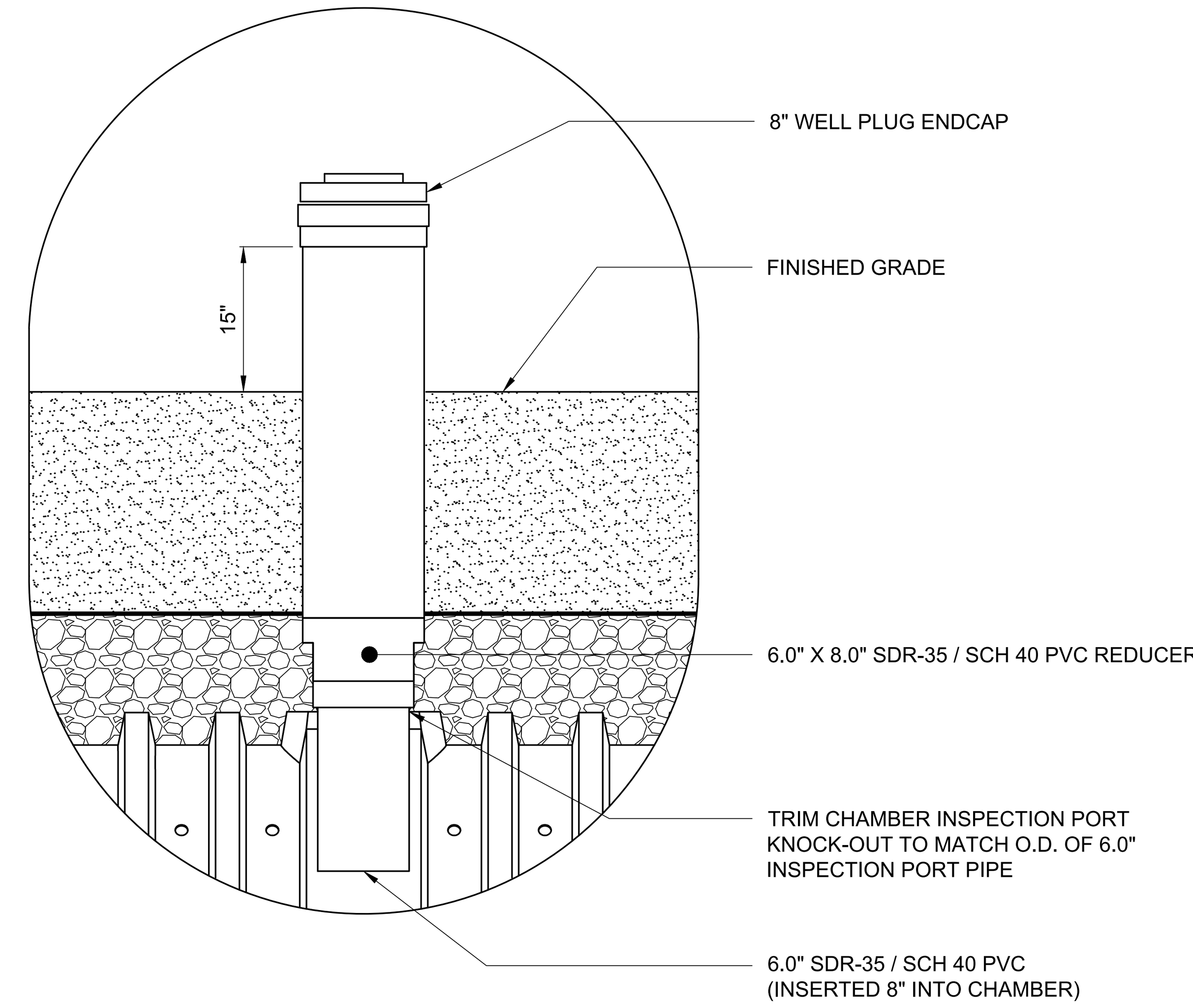
CIVIL
STORMWATER DETAILS - SHEET 1 OF 5

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-216



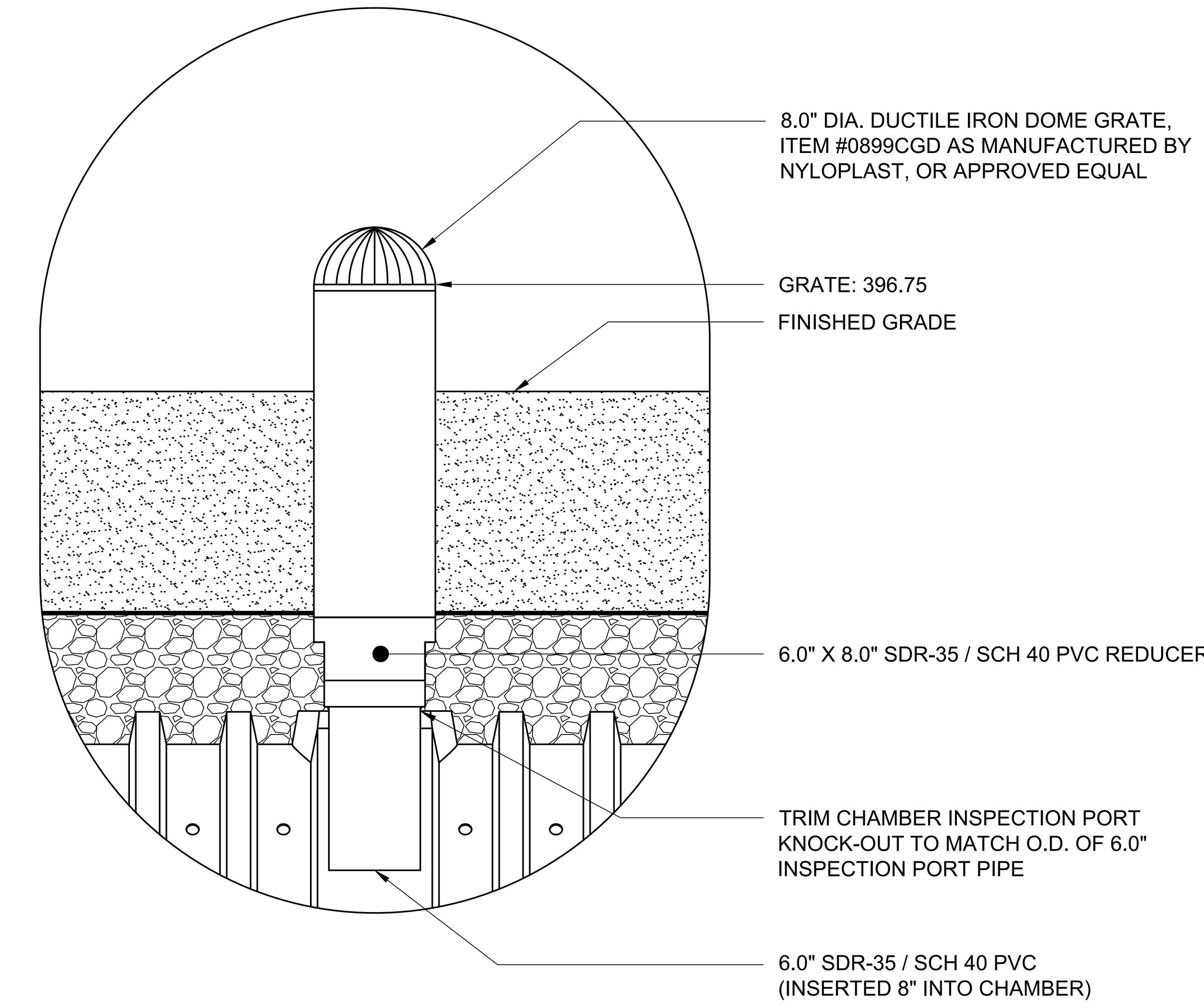
STORMWATER MANHOLE

SCALE: NTS



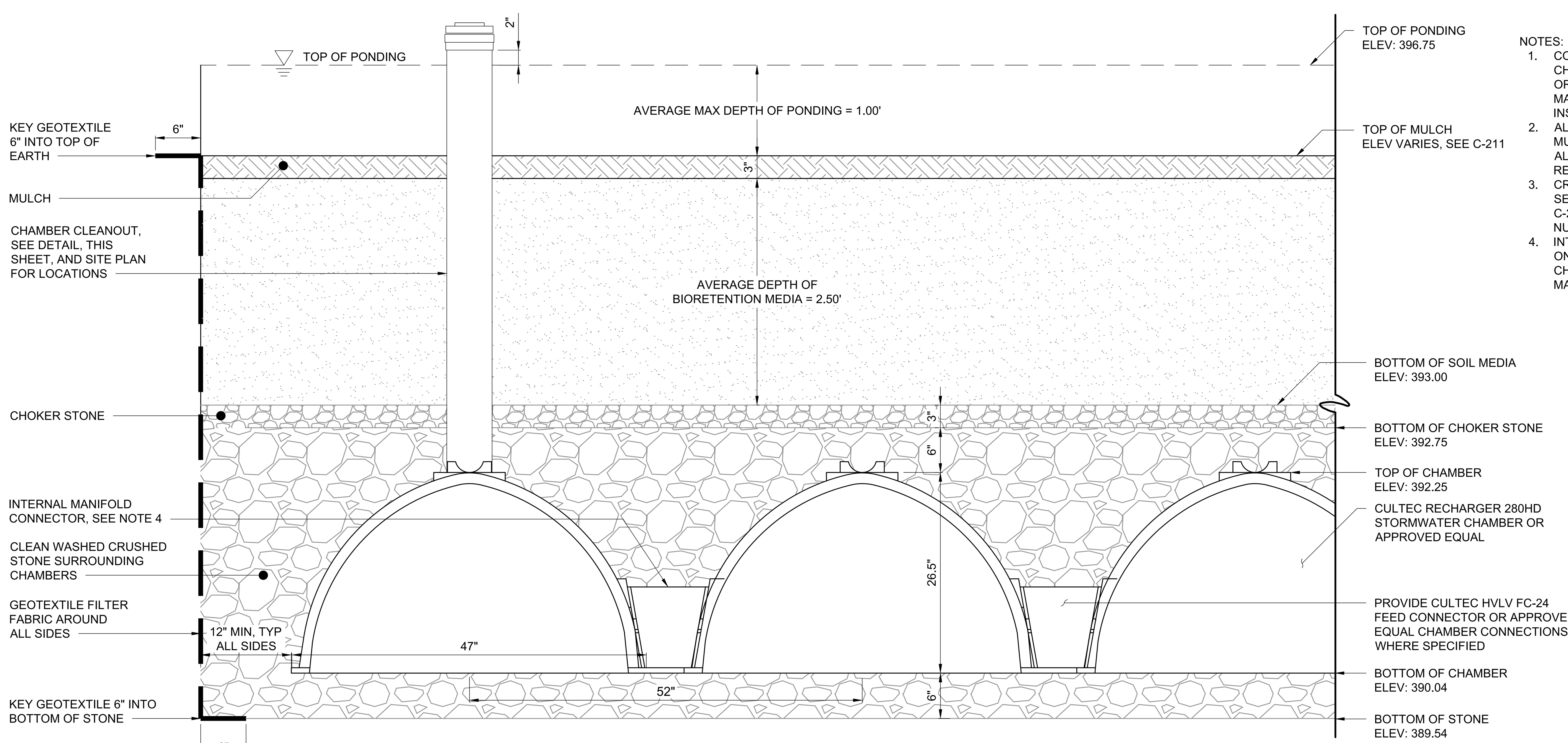
CHAMBER CLEANOUT

SCALE: NTS



BIORETENTION OVERFLOW GRATE

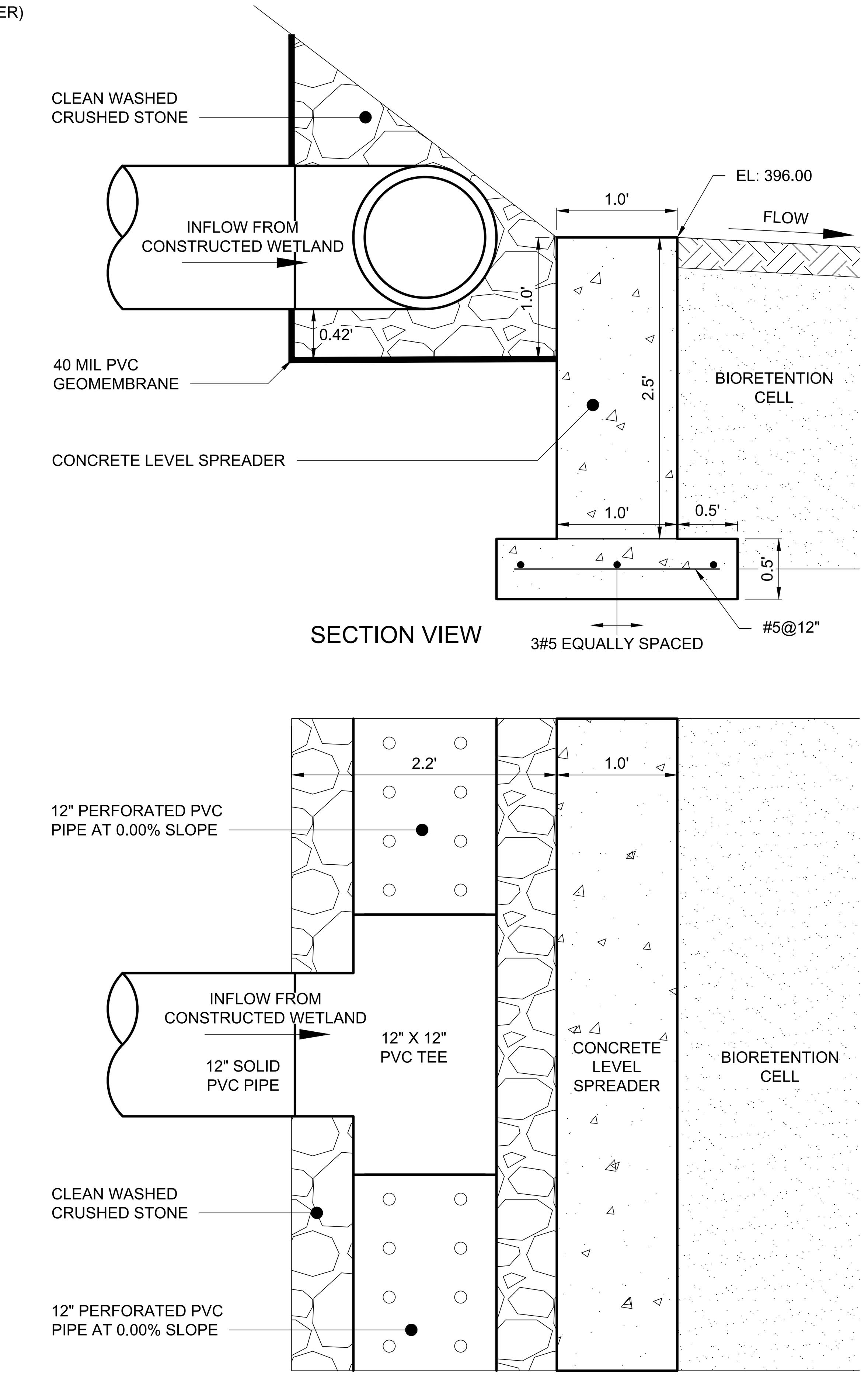
SCALE: NTS



NOTES:
1. CONTRACTOR TO INSTALL CULTEC 280HD CHAMBERS, AS MANUFACTURED BY CULTEC, OR APPROVED EQUAL. REFER TO MANUFACTURER'S CURRENT RECOMMENDED INSTALLATION GUIDELINES.
2. ALL UNDERGROUND STORAGE CHAMBERS MUST BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
3. CROSS SECTION SHOWN IS A TYPICAL CROSS SECTION FOR THE CHAMBERS, REFER TO C-211 FOR THE STORAGE VOLUME AND NUMBER OF CHAMBERS REQUIRED.
4. INTERNAL MANIFOLD CONNECTION SHALL ONLY BE INSTALLED ON THE FIRST AND LAST CHAMBER OF EACH ROW, OR PER MANUFACTURER REQUIREMENTS.

SUBSURFACE STORAGE CHAMBERS

SCALE: 1" = 1'



LEVEL SPREADER

SCALE: 1:1

REV	ISSUED FOR	DATE	BY

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WESTCHESTER JOINT WATER WORKS
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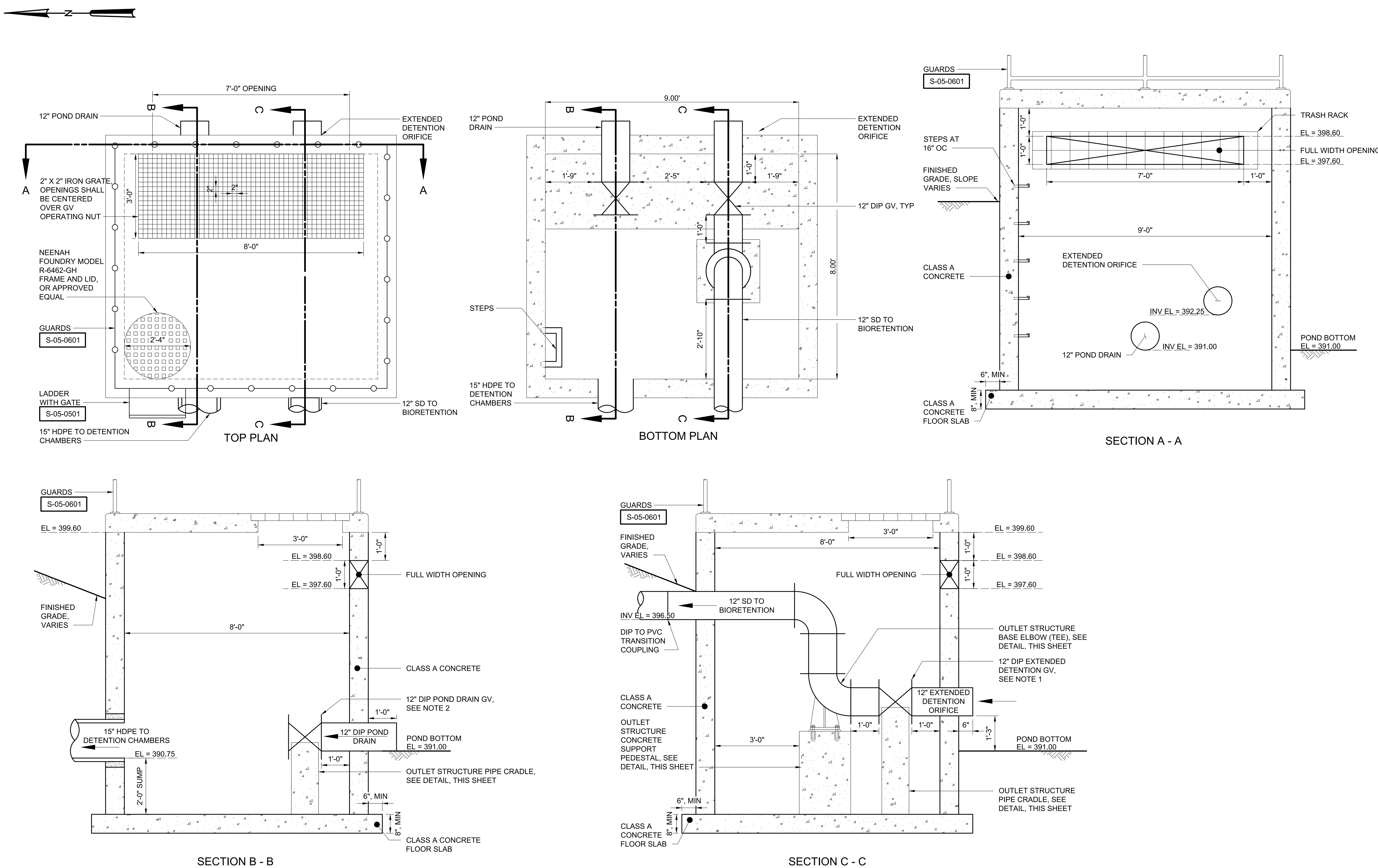
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

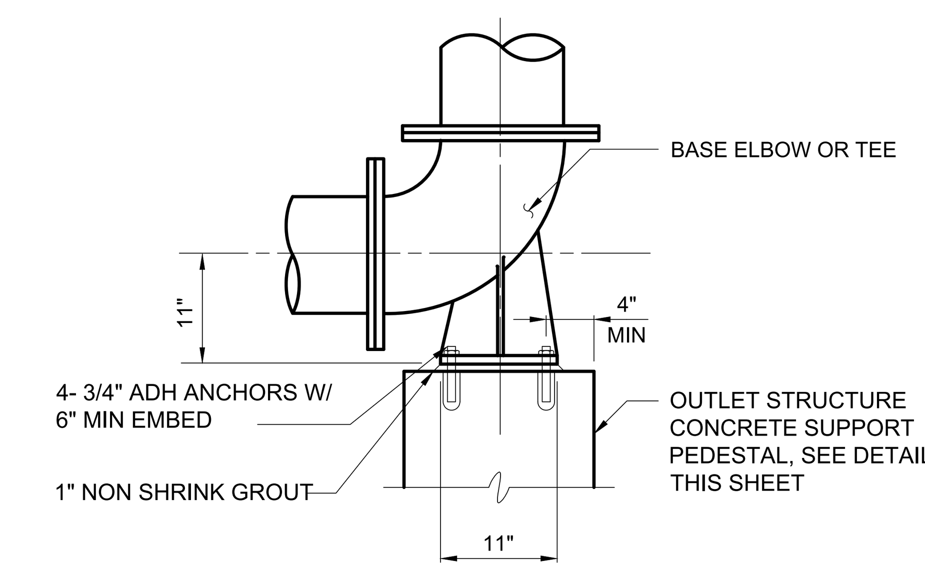
CIVIL
STORMWATER DETAILS - SHEET 2 OF 5

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-217



WETLAND OUTLET STRUCTURE

SCALE: 1" = 2'



OUTLET STRUCTURE ELBOW (TEE)

SCALE: N.T.S.

NOTES:

1. EXTENDED DETENTION ORIFICE 12" GV SHALL BE OPENED TO THE EQUIVALENT AREA OF A 3" DIAMETER ORIFICE.
2. POND DRAIN 12" GV SHALL BE NORMALLY CLOSED.

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

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. MCNICOL
DRAWN BY:	C. MCNICOL
CHECKED BY:	D. SHEERAN
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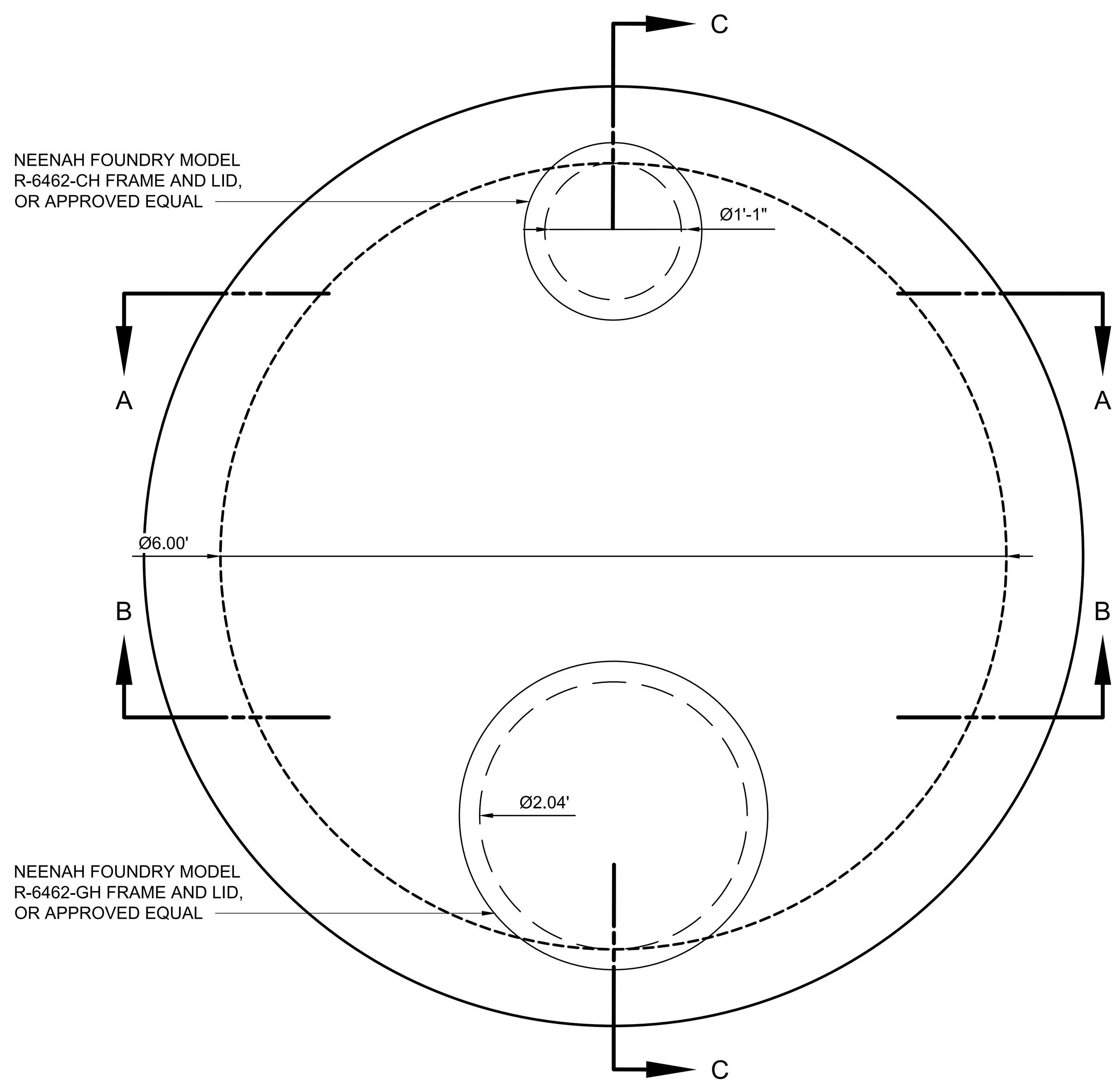
HARRISON, NY

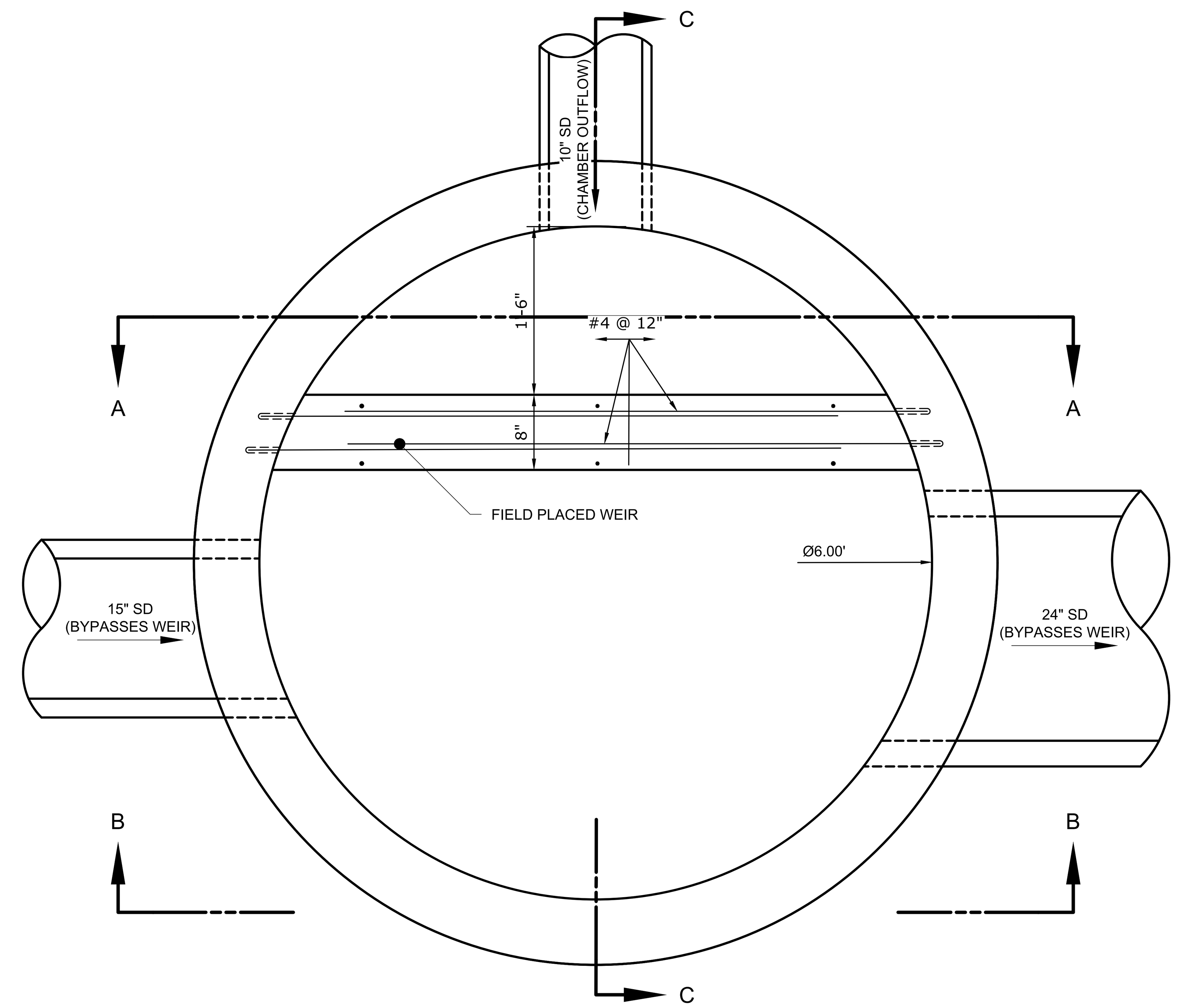
CIVIL
STORMWATER DETAILS - SHEET 3 OF 5

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-218



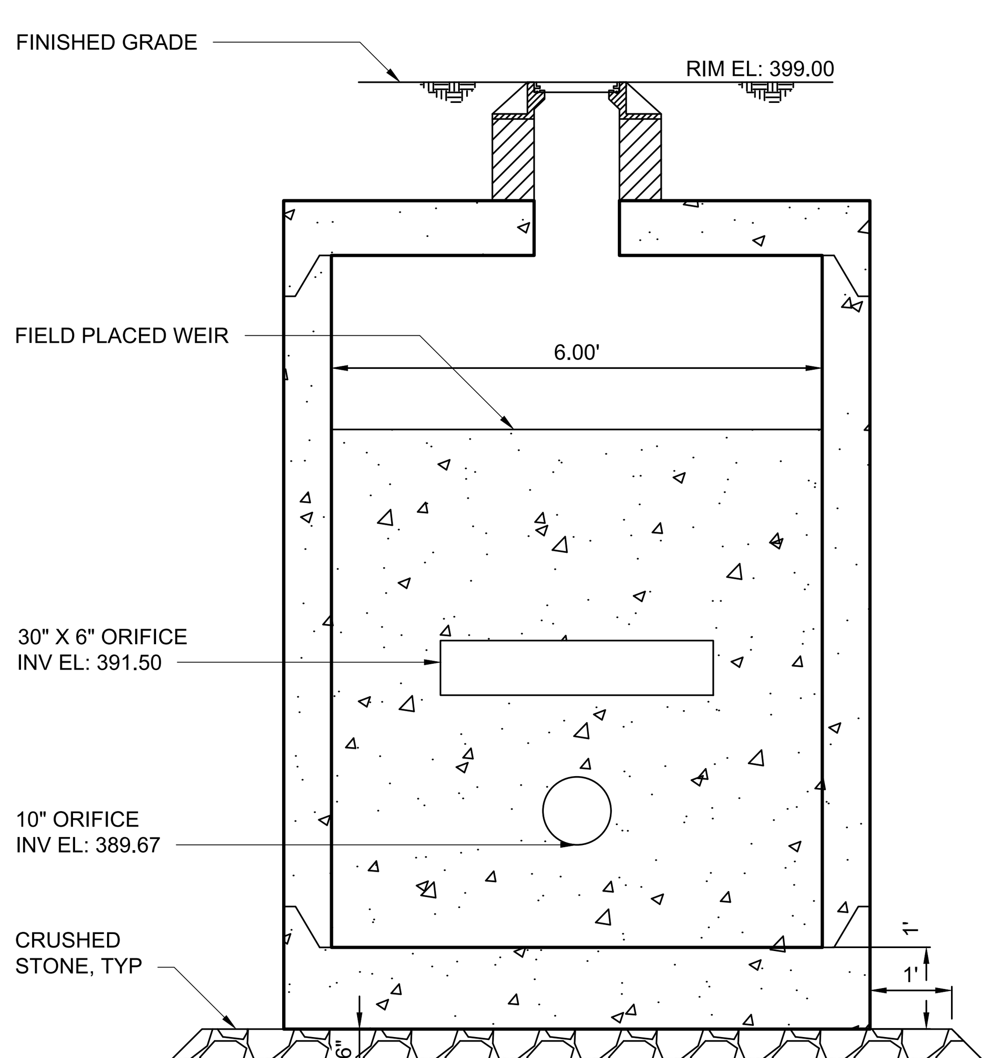
TOP PLAN

SCALE: 1" = 1'



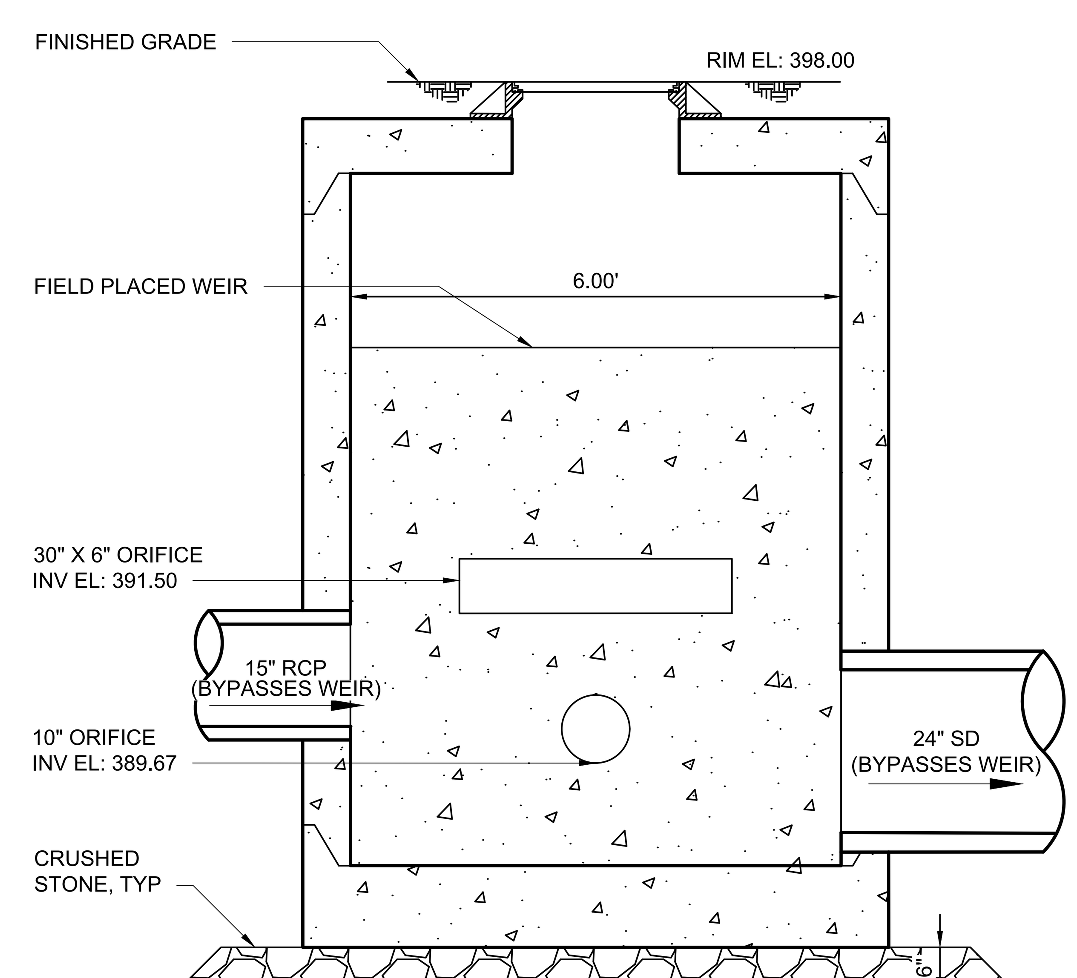
BOTTOM PLAN

SCALE: 1" = 1'



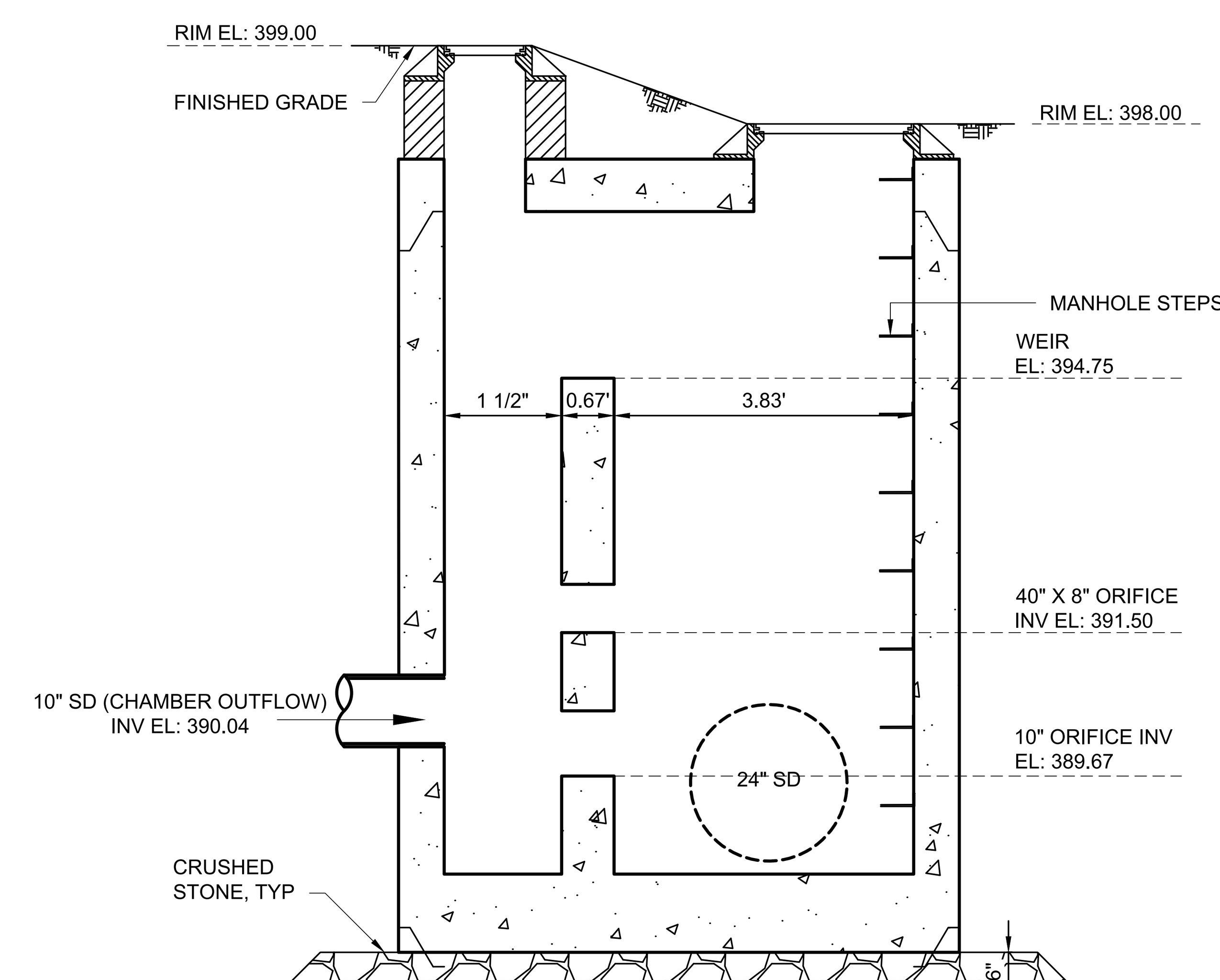
SECTION A-A

SCALE: 1" = 2'



SECTION B-B

SCALE: 1" = 2'



SECTION C-C

SCALE: 1" = 2'

DETENTION CHAMBER OUTLET STRUCTURE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

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0 1/2" 1"

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CIVIL
STORMWATER DETAILS - SHEET 4 OF 5

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-219

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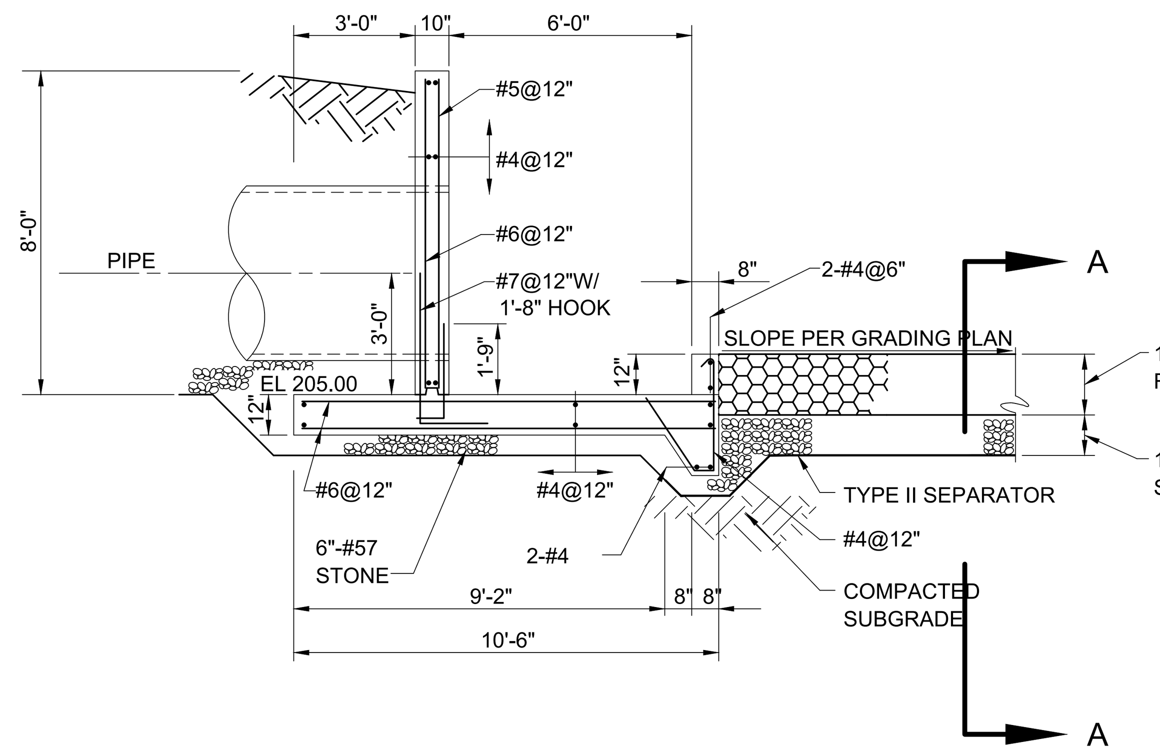
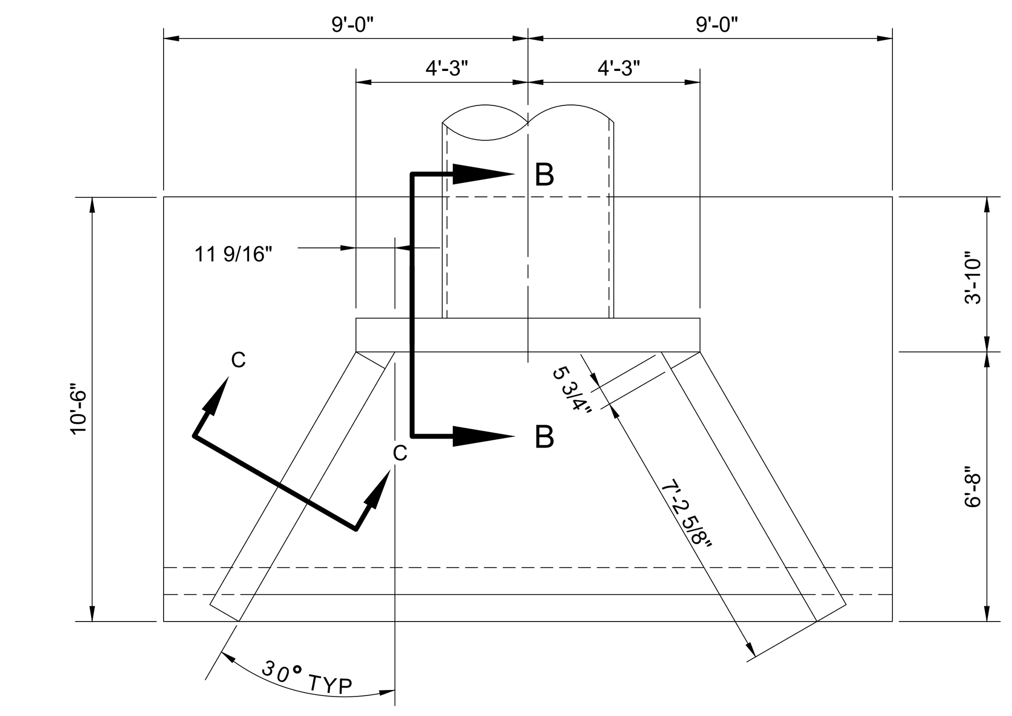
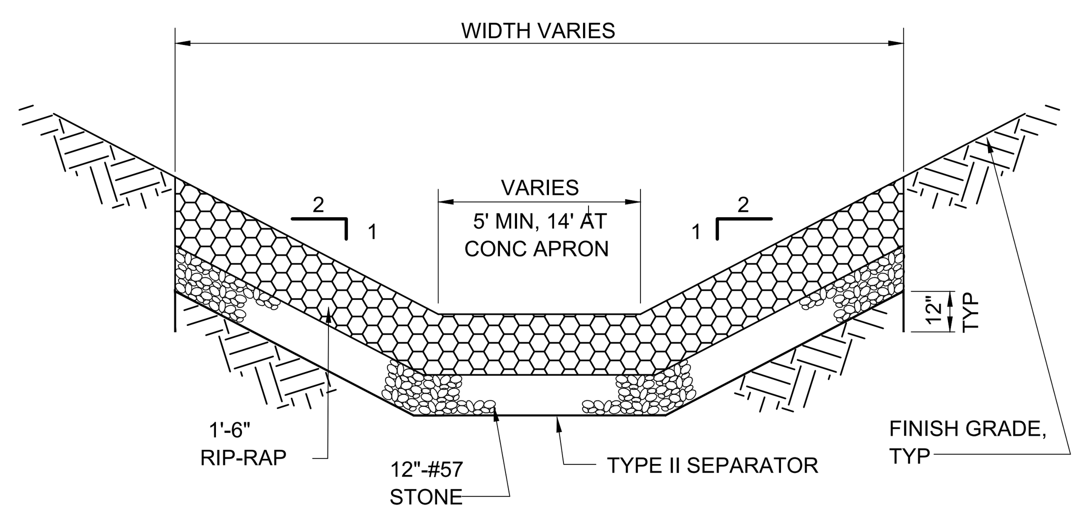


ELEVATION

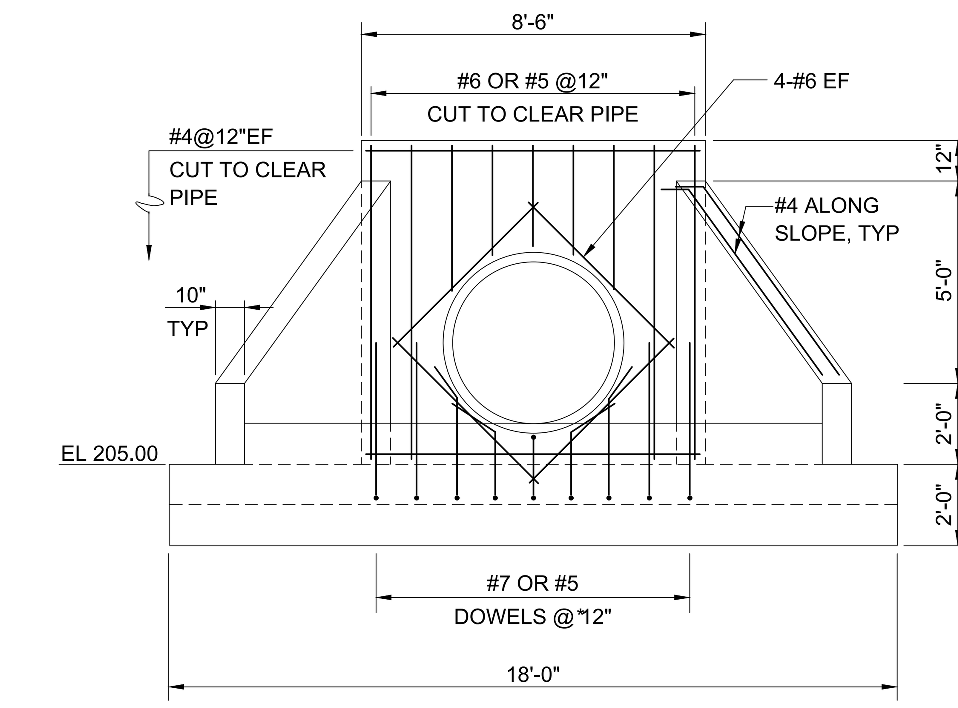


** THESE BARS SHALL EXTEND INTO HEADWALL 8" W/ STD 90° HOOKS

PLAN



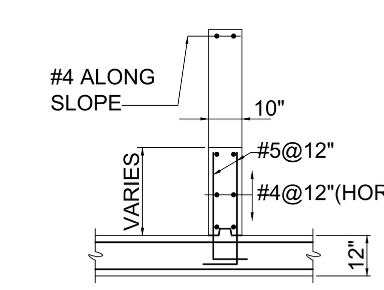
SECTION A - A



NOTE: OTHER REINFORCING NOT SHOWN FOR CLARITY

SECTION B - B

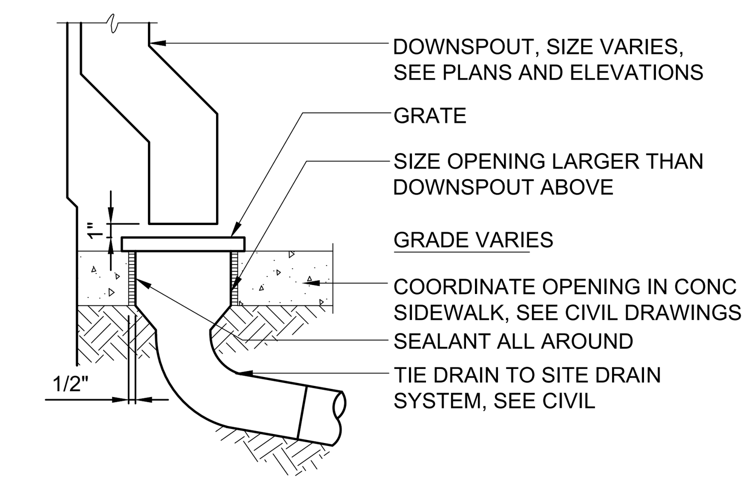
* BEND AS SHOWN TO CLEAR PIPE



SECTION C - C

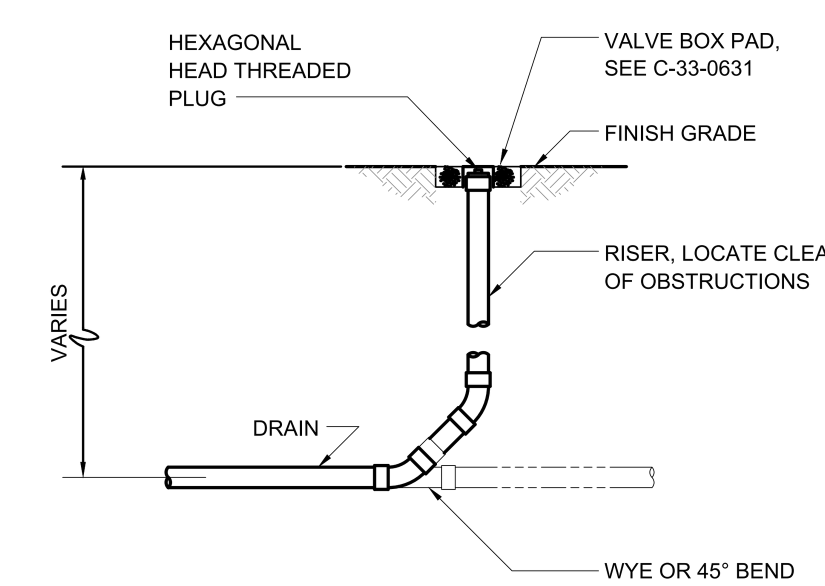
SINGLE PIPE HEADWALL

SCALE: N.T.S.



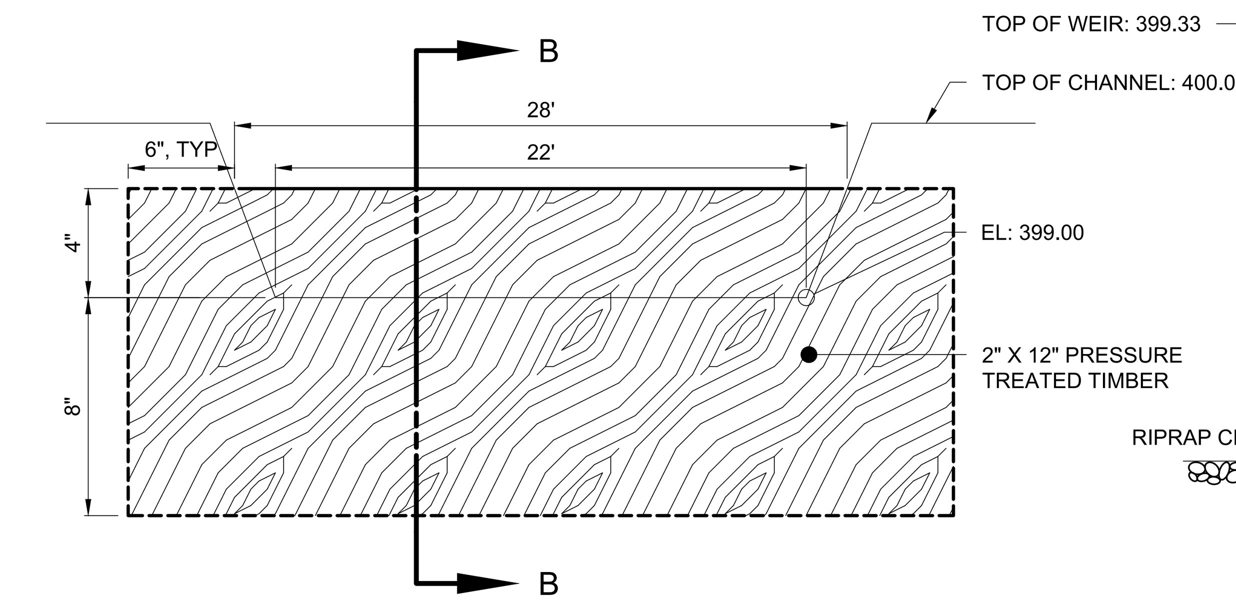
DOWN SPOUT TIE-IN

SCALE: N.T.S.

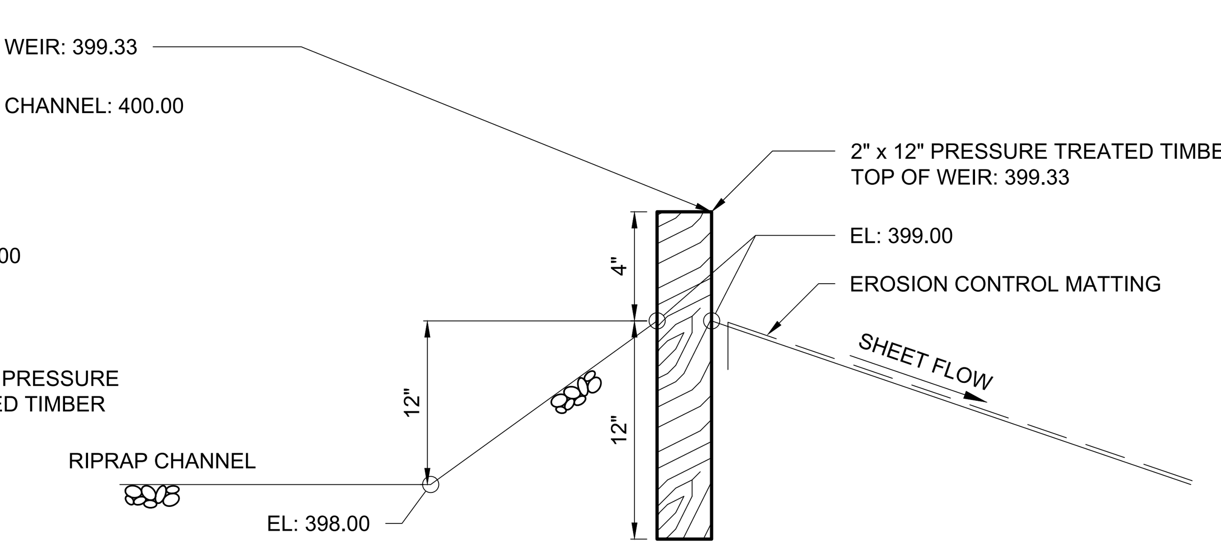


CLEANOUT FOR GRAVITY LINES

SCALE: N.T.S.



SECTION A - A



SECTION B - B

FLOW SPREADER

SCALE: N.T.S.

REV	ISSUED FOR	DATE	BY

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DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
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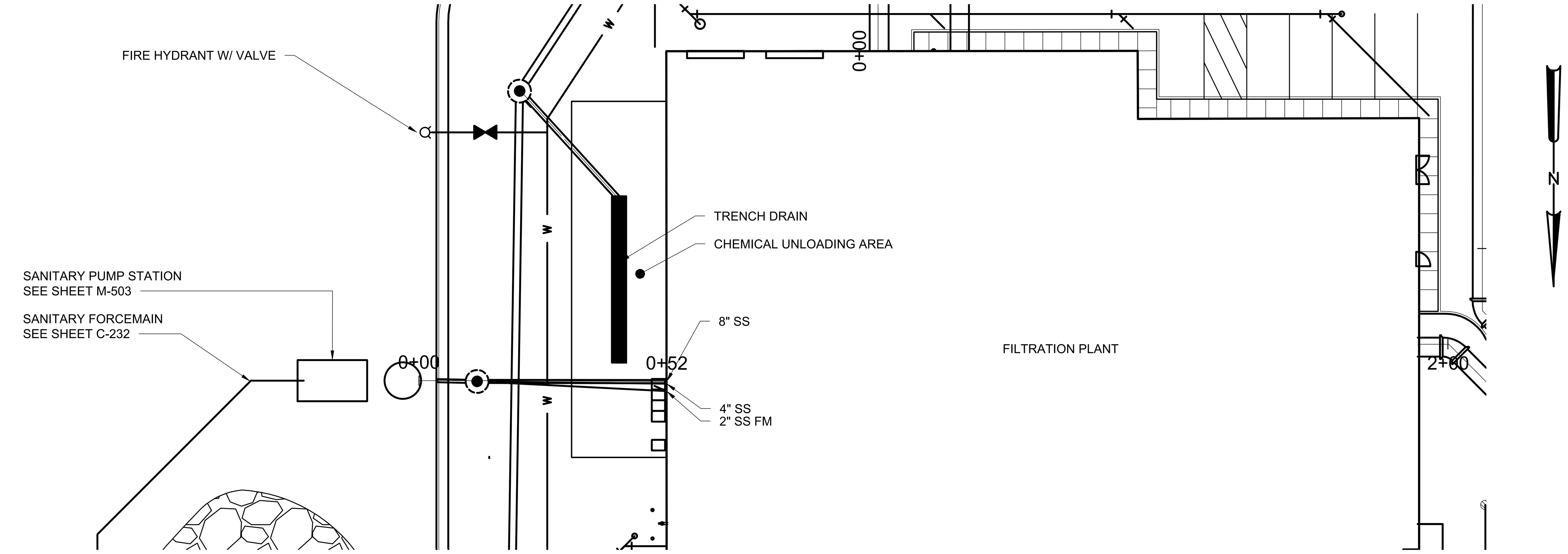
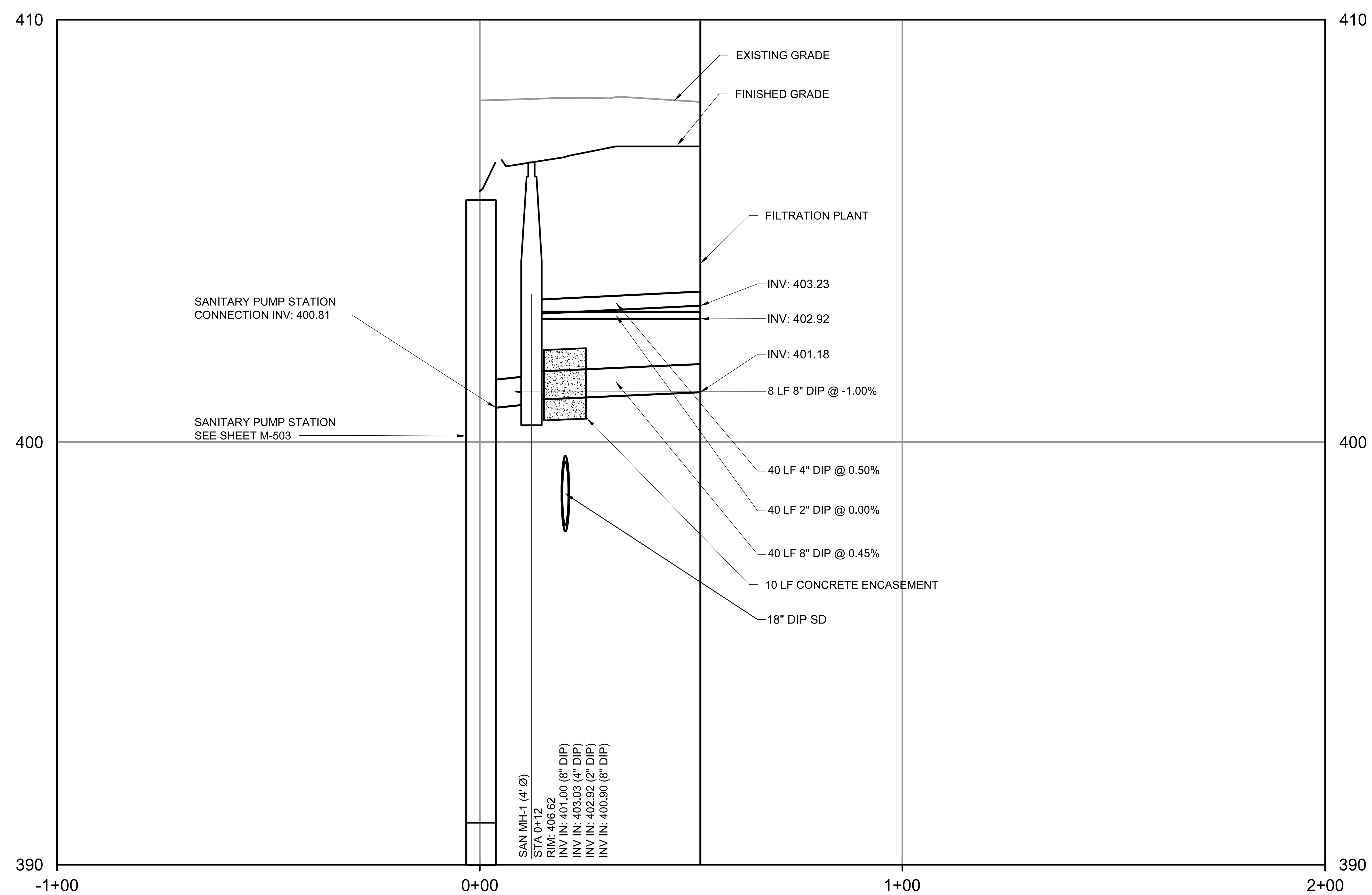
CIVIL
STORMWATER DETAILS - SHEET 5 OF 5

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-220

File: C:\BMS\HAZEN-PW\D0193283\C-220 Saved by CMCNICOL Save date: 7/1/2022 3:56 PM
PLOT DATE: 7/20/2022 6:08 PM BY: CMCNICOL



PLAN
SCALE: 1" = 20'



PROFILE
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=4'

HORIZONTAL SCALE: 1" = 20'
20 10 0 20'
2 1 0 2
VERTICAL SCALE: 1"=2'

File: C:\BMS\HAZEN-PW\D0193283\C-231 Saved by JTANNER Save date: 7/19/2022 8:02 PM
PLOT DATE: 7/20/2022 6:28 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

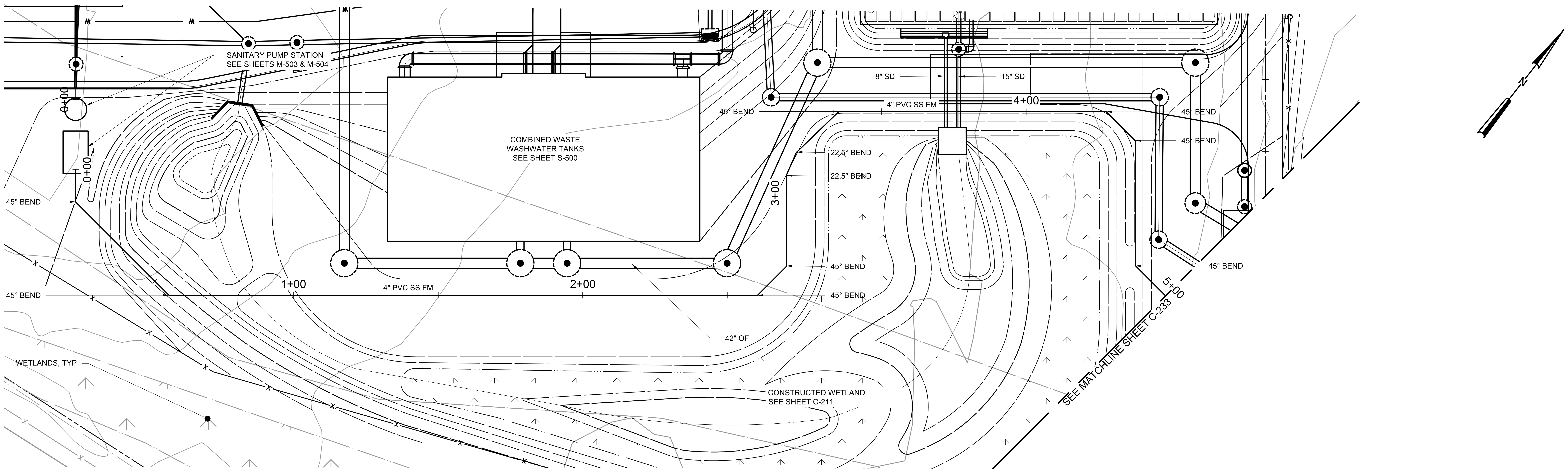
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

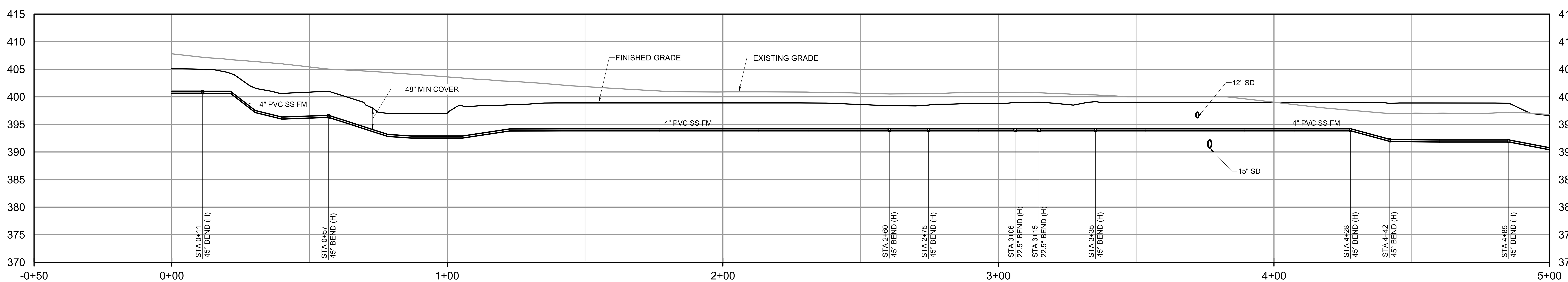
CIVIL
SANITARY SEWER PLAN AND PROFILE

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-231



PLAN

SCALE: 1" = 20'



PROFILE

HORIZONTAL SCALE 1"=20'
VERTICAL SCALE: 1"=10'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

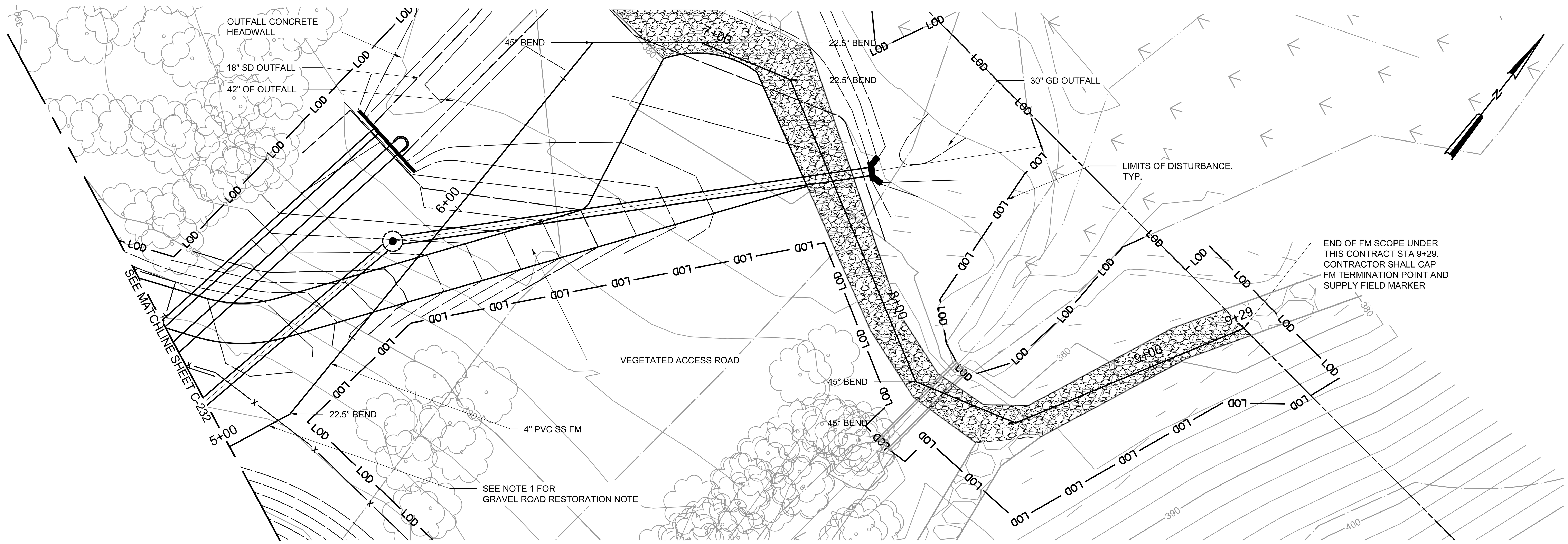
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
SANITARY SEWER FM - STA
0+00 TO STA 5+00

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-232

File: C:\BMS\HAZEN-PW\D0193283\C-232 Saved by JTANNER Save date: 7/20/2022 12:21 PM
PLOT DATE: 7/20/2022 6:09 PM BY: CMCNICOL

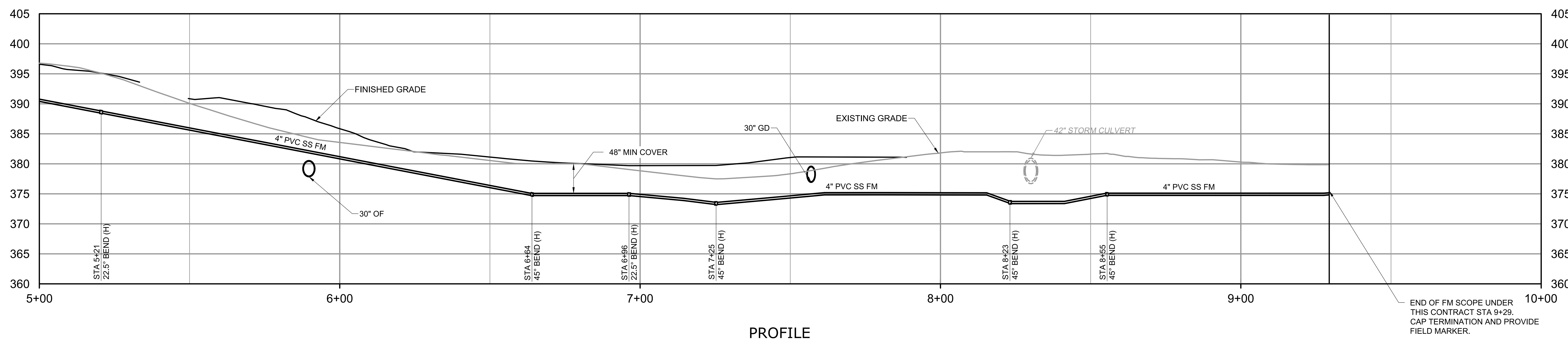


PLAN

SCALE: 1" = 20'

NOTES:

1. RESTORE GRAVEL ROAD TO EXISTING TYPE AND DEPTH OF MATERIAL AS REQUIRED FOR FORCEMAIN INSTALLATION.



PROFILE

HORIZONTAL SCALE 1"=20'
VERTICAL SCALE: 1"=10'

File: C:\BMS\HAZEN-PW\D0193283\C-232 Saved by JTANNER Save date: 7/20/2022 12:21 PM
PLOT DATE: 7/20/2022 6:09 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

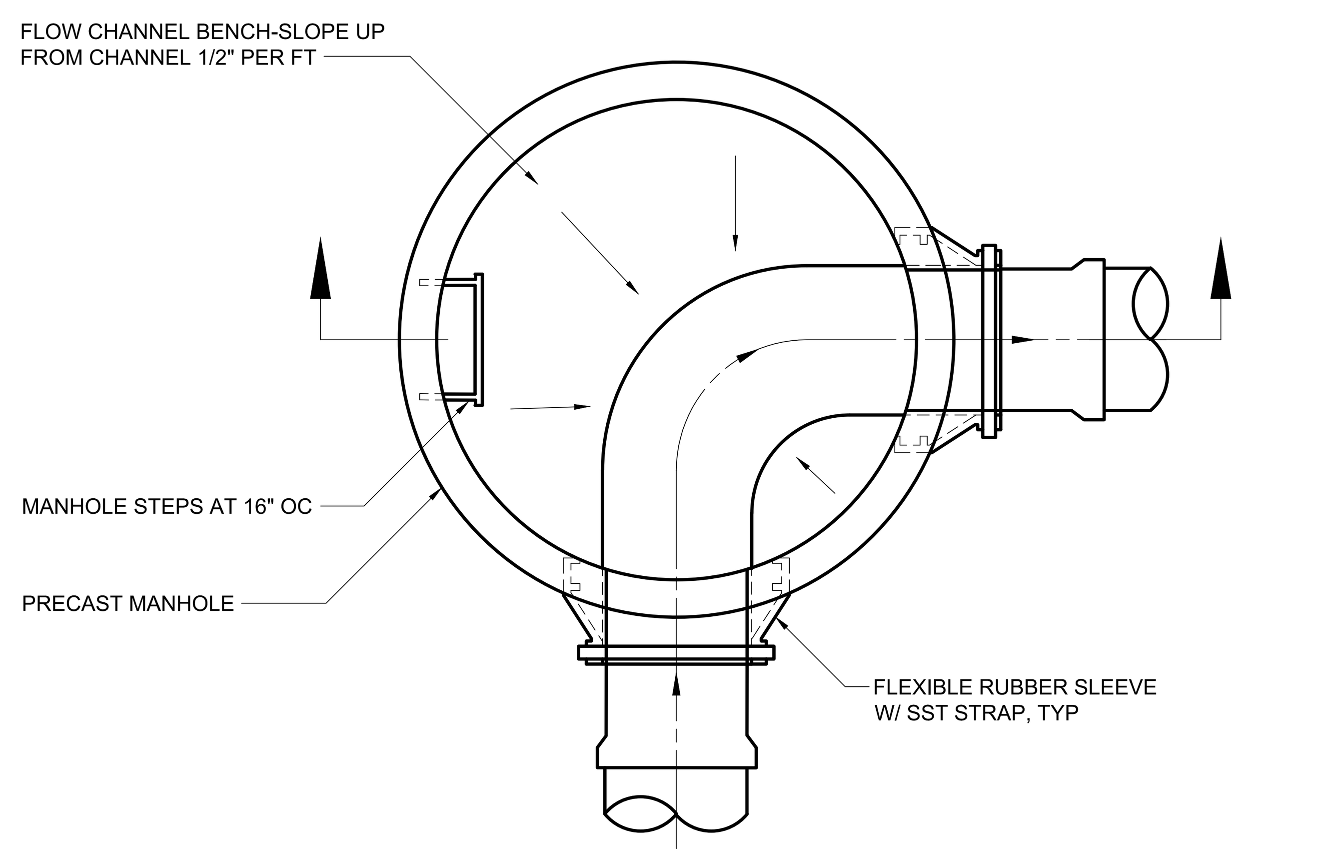
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

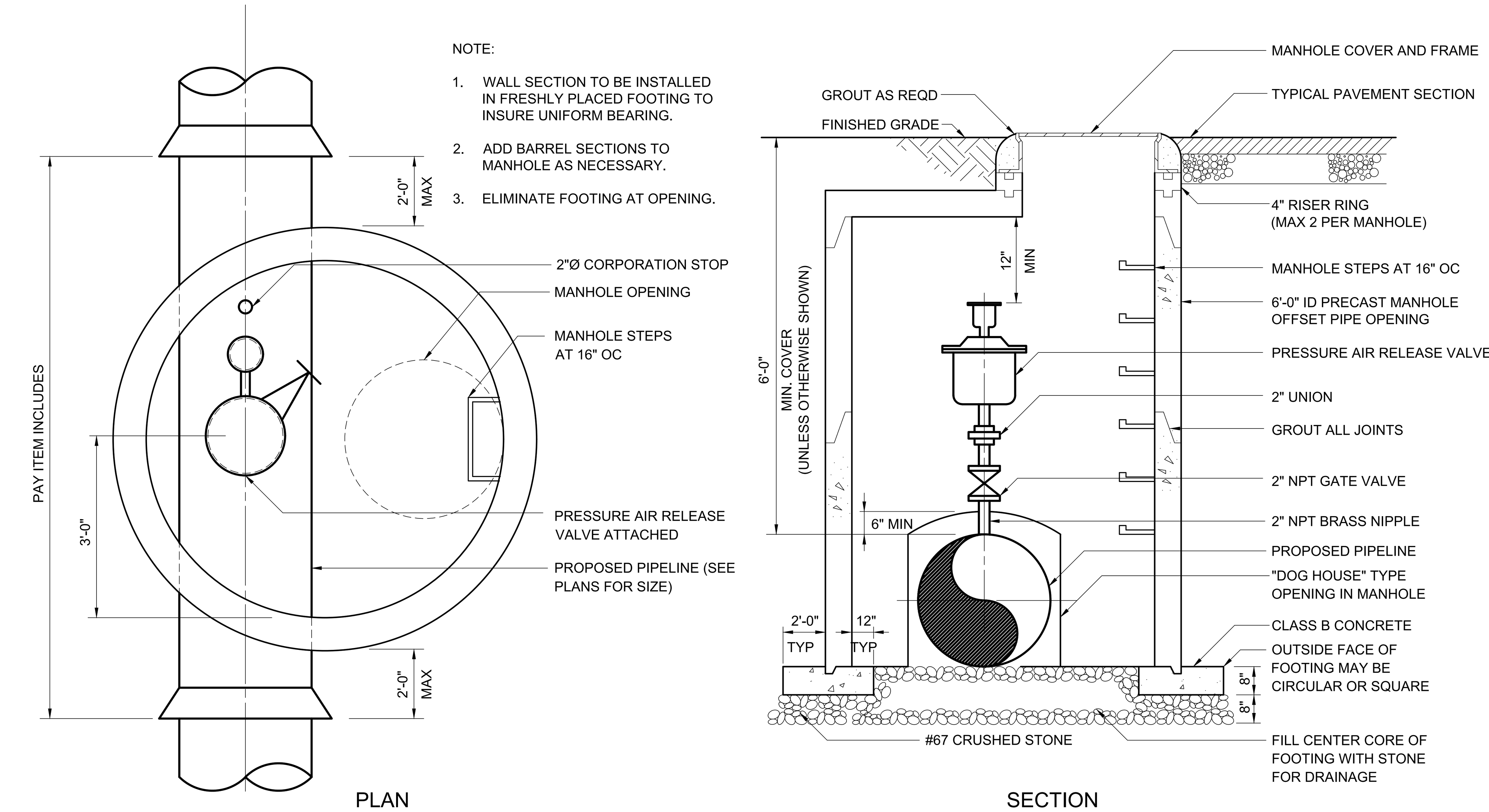
CIVIL
SANITARY SEWER FM - STA 5+00 TO STA 9+29

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-233



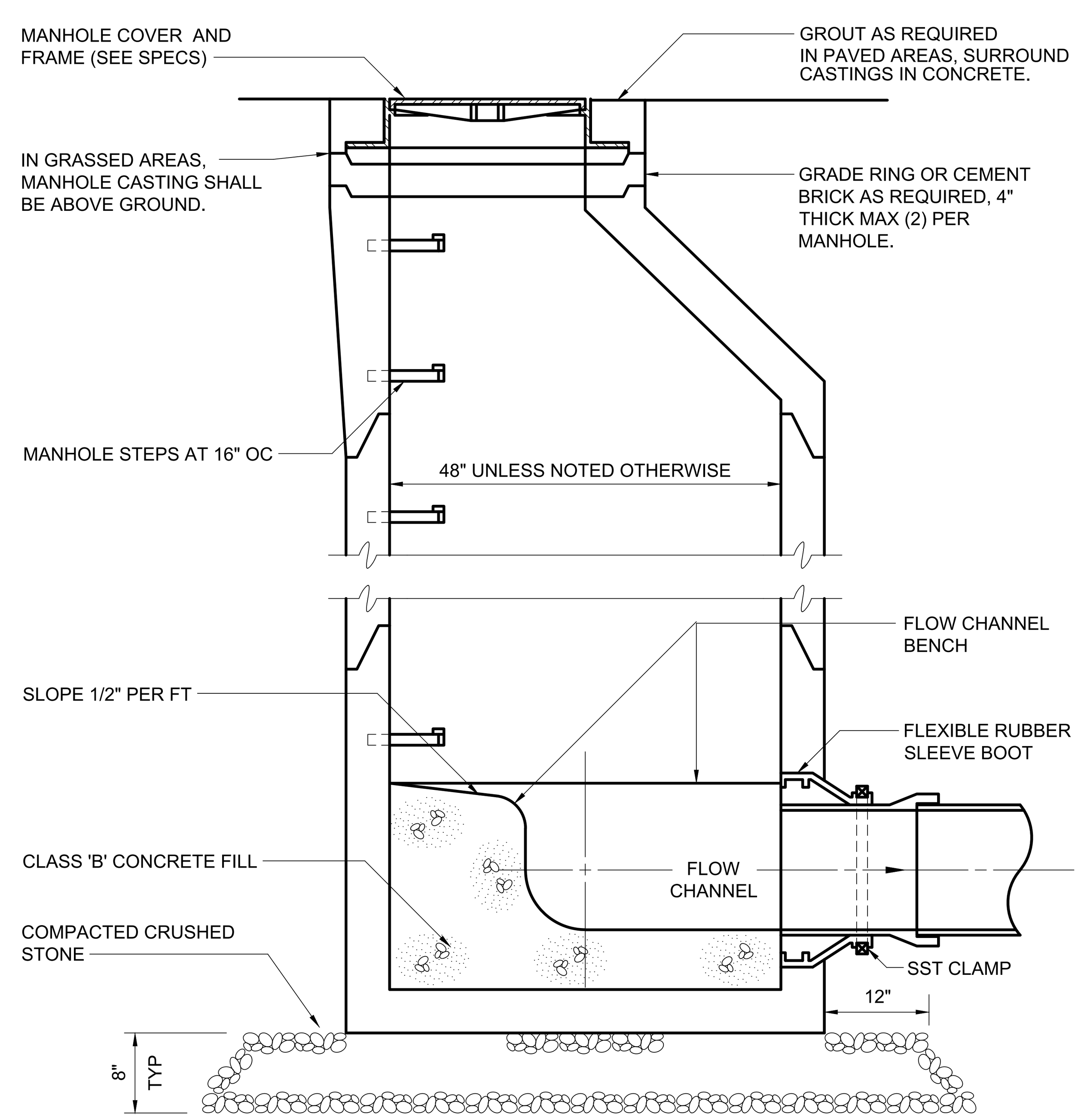
MANHOLE PLAN

C-33-0600



PRESSURE AIR RELEASE VALVE ASSEMBLY (ARV)

C-33-0604



MANHOLE SECTION

C-33-0601

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PLOT DATE: 7/20/2022 6:09 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

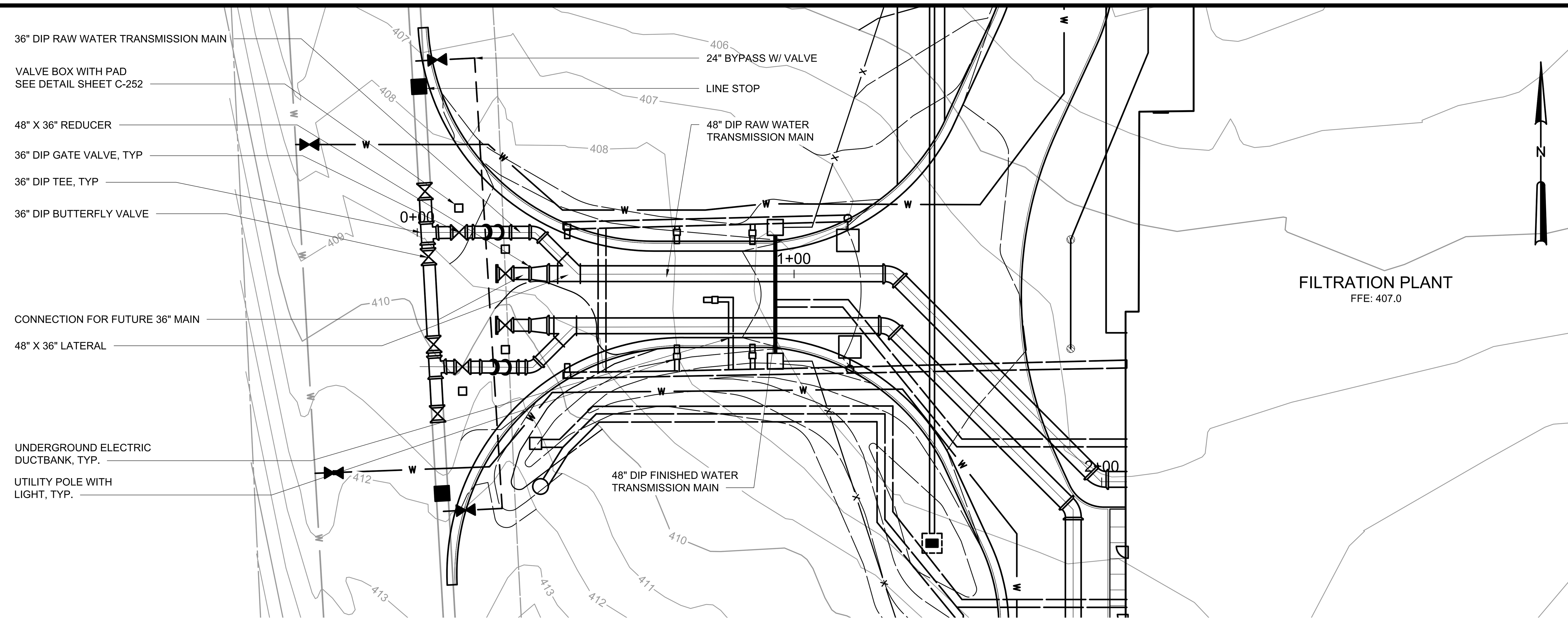
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
SANITARY SEWER DETAILS

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-234

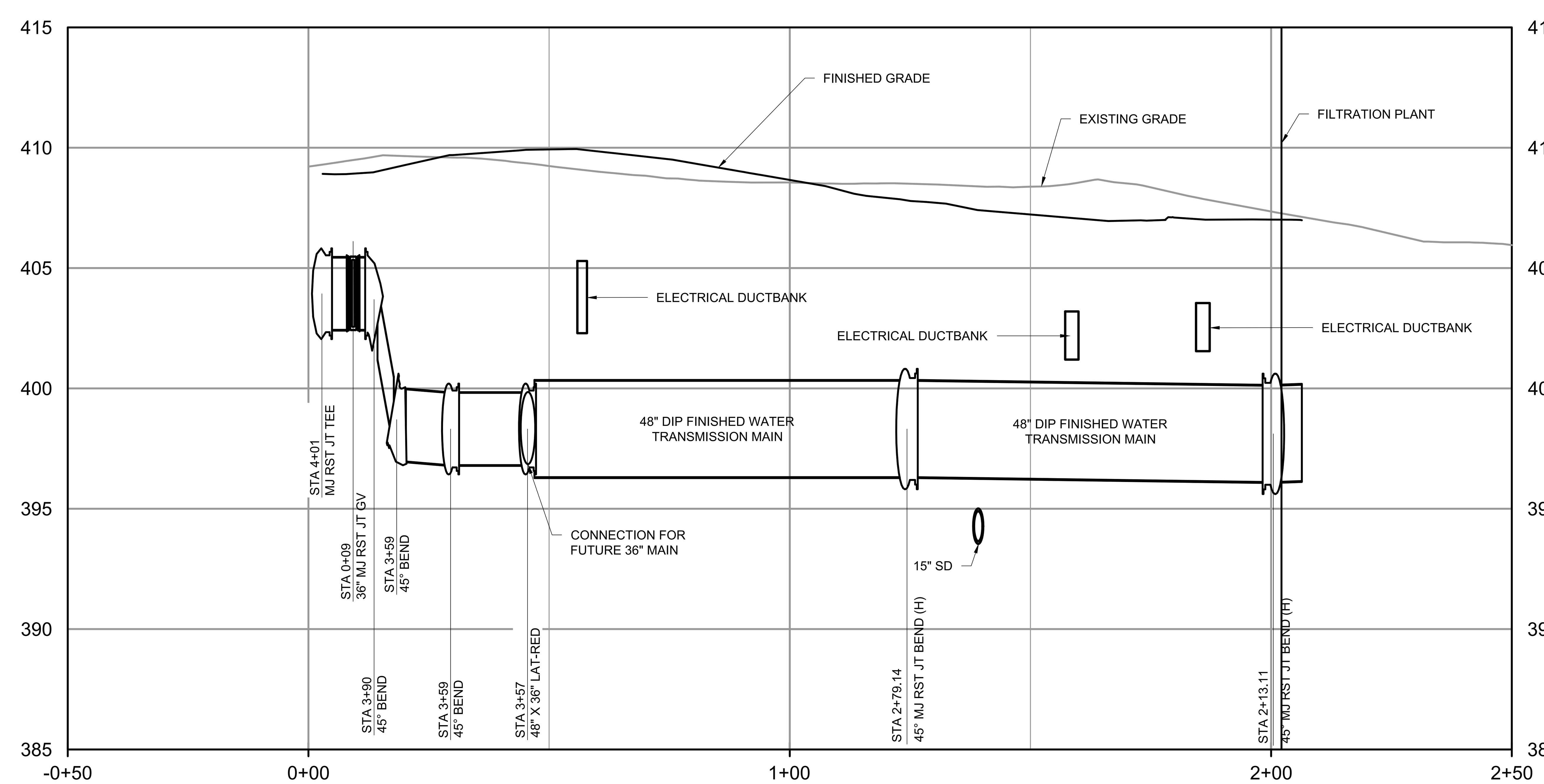


PLAN

SCALE: 1" = 20'

NOTES:

1. ALL VALVES SHALL BE GATE UNLESS OTHERWISE NOTED.
2. GATE VALVES ON TRANSMISSION MAINS SHALL BE INSTALLED HORIZONTALLY. SEE DETAIL SHEET C-252.
3. CONTRACTOR SHALL PROVIDE ADEQUATE THRUST BLOCKING OR JOINT RESTRAINT TO PROTECT EXISTING TRANSMISSION MAIN. BYPASS LINE SHALL BE 36".
4. ALL DIP SHALL BE SPECIAL THICKNESS CLASS 53 WITH MECHANICAL JOINT FITTINGS AND RESTRAINED JOINTS GLANDS. ALL JOINTS SHALL BE RESTRAINED. ALL DIP PIPES SHALL BE DOUBLE CEMENT LINED ON THE INSIDE.



PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=4'

HORIZONTAL SCALE: 1" = 20'

20 10 0 20'

4 2 0 4

VERTICAL SCALE: 1"=4'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
RAW WATER MAIN PLAN AND PROFILE

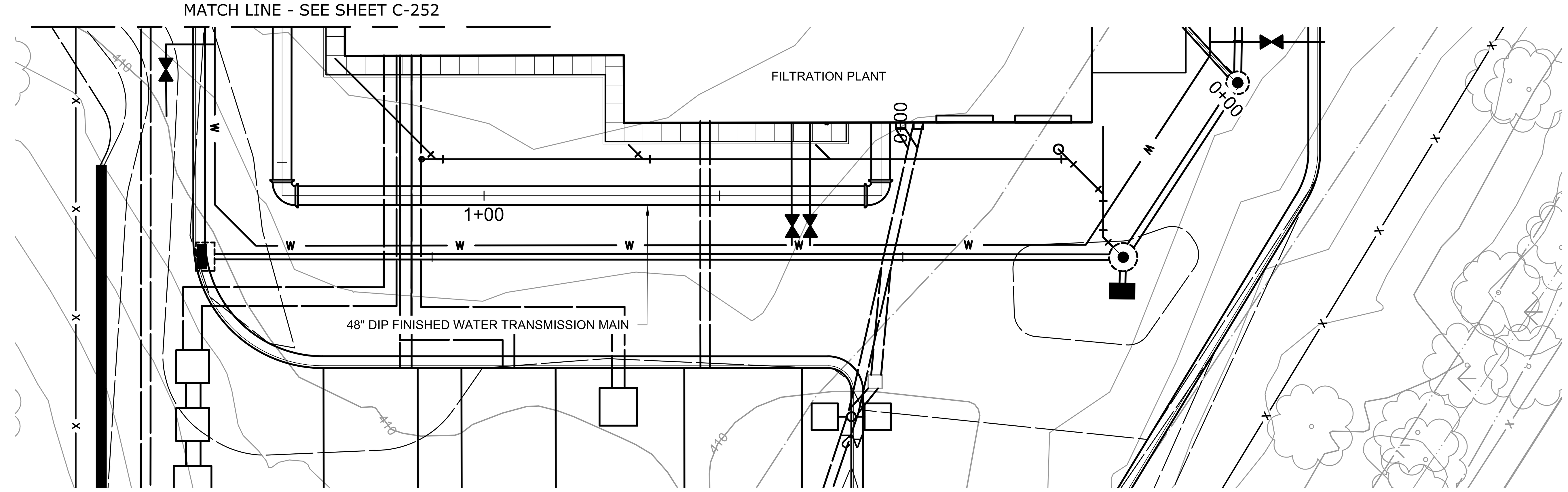
DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-241

File: C:\BMS\HAZEN-PW\D0193283\C-241 Saved by JTANNER Save date: 7/19/2022 11:15 AM
PLOT DATE: 7/20/2022 6:10 PM BY: CMCNICOL

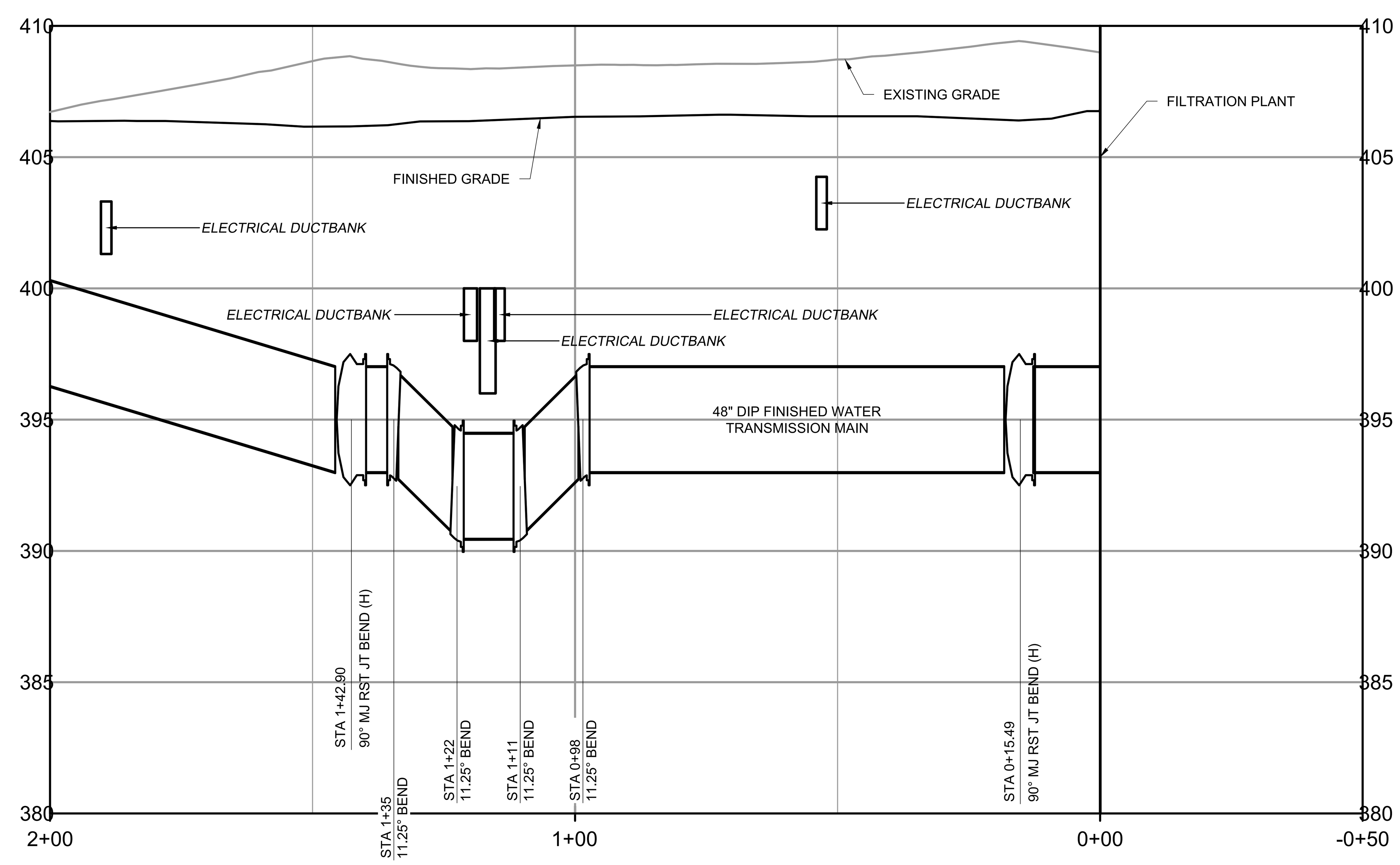
NOTES:

1. ALL VALVES SHALL BE GATE UNLESS OTHERWISE NOTED.
2. GATE VALVES ON TRANSMISSION MAINS SHALL BE INSTALLED HORIZONTALLY. SEE DETAIL SHEET C-252.
3. CONTRACTOR SHALL PROVIDE ADEQUATE THRUST BLOCKING OR JOINT RESTRAINT TO PROTECT EXISTING TRANSMISSION MAIN. BYPASS LINE SHALL BE 36".
4. ALL DIP SHALL BE SPECIAL THICKNESS CLASS 53 WITH MECHANICAL JOINT FITTINGS AND RESTRAINED JOINTS GLANDS. ALL JOINTS SHALL BE RESTRAINED. ALL DIP PIPES SHALL BE DOUBLE CEMENT LINED ON THE INSIDE.

MATCH LINE - SEE SHEET C-252



PLAN
SCALE: 1" = 20'



PROFILE
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=4'

HORIZONTAL SCALE: 1" = 20'
20 10 0 20'
4 2 0 4
VERTICAL SCALE: 1"=4'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	M. SEEBOLD
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
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Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

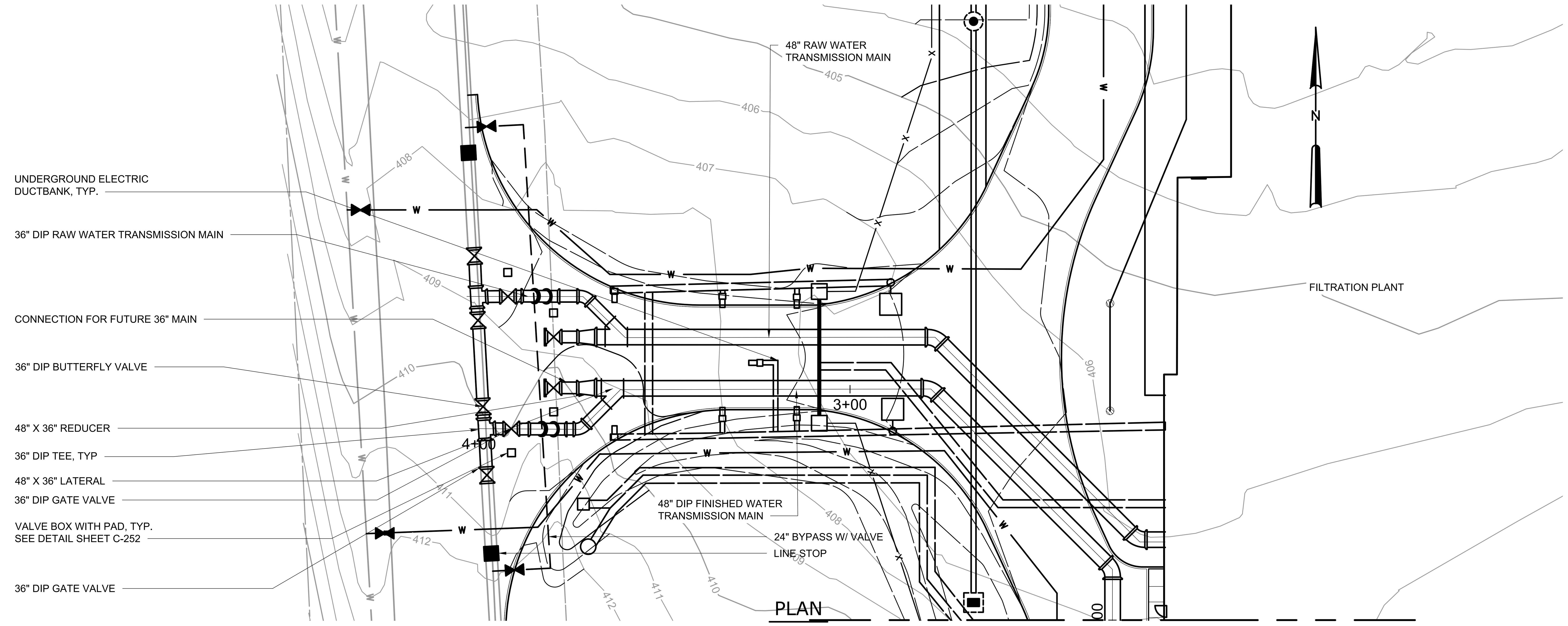
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
FINISHED WATER MAIN PLAN AND PROFILE - SHEET 1 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-242

File: C:\BMS\HAZEN-PW\D0193283\C-242 Saved by CMCNICOL Save date: 7/7/2022 7:25 PM
PLOT DATE: 7/20/2022 6:10 PM BY: CMCNICOL



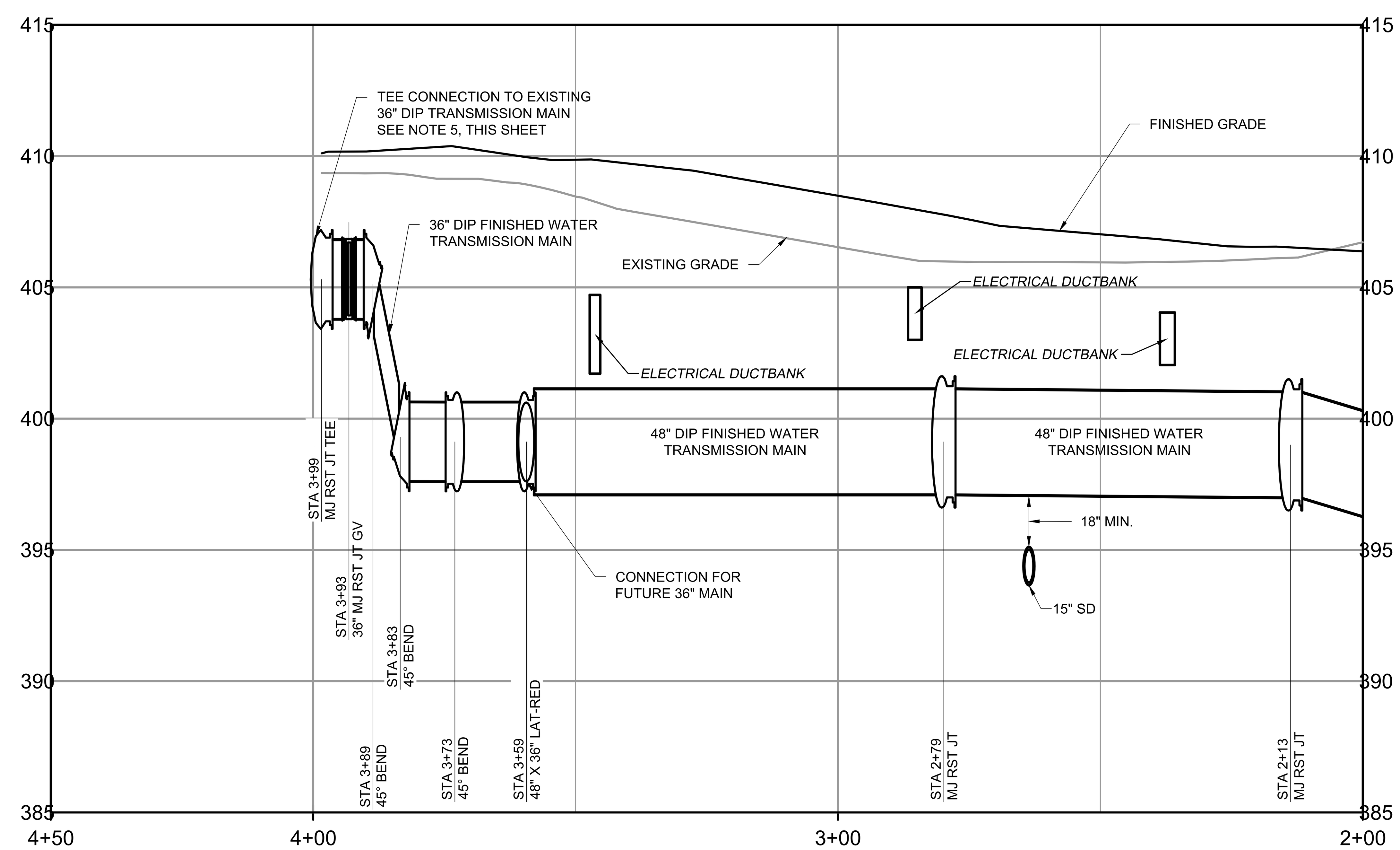
PLAN

SCALE: 1" = 20'

MATCH LINE - SEE SHEET C-251

NOTES:

1. ALL VALVES SHALL BE GATE UNLESS OTHERWISE NOTED.
2. GATE VALVES ON TRANSMISSION MAINS SHALL BE INSTALLED HORIZONTALLY. SEE DETAIL SHEET C-252.
3. CONTRACTOR SHALL PROVIDE ADEQUATE THRUST BLOCKING OR JOINT RESTRAINT TO PROTECT EXISTING TRANSMISSION MAIN. BYPASS LINE SHALL BE 36".
4. ALL DIP SHALL BE SPECIAL THICKNESS CLASS 53 WITH MECHANICAL JOINT FITTINGS AND RESTRAINED JOINTS GLANDS. ALL JOINTS SHALL BE RESTRAINED. ALL DIP PIPES SHALL BE DOUBLE CEMENT LINED ON THE INSIDE.
5. SEE YARD PIPING PLAN C-131 FOR LINESTOP AND BYPASS REQUIREMENTS FOR CONNECTION TO EXISTING 36" TRANSMISSION MAIN.



PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1"=2'

HORIZONTAL SCALE: 1" = 20'
20 10 0 20'
2 1 0 2
VERTICAL SCALE: 1"=2'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	M. SEEBOLD
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
FINISHED WATER MAIN PLAN AND PROFILE - SHEET 2 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-243

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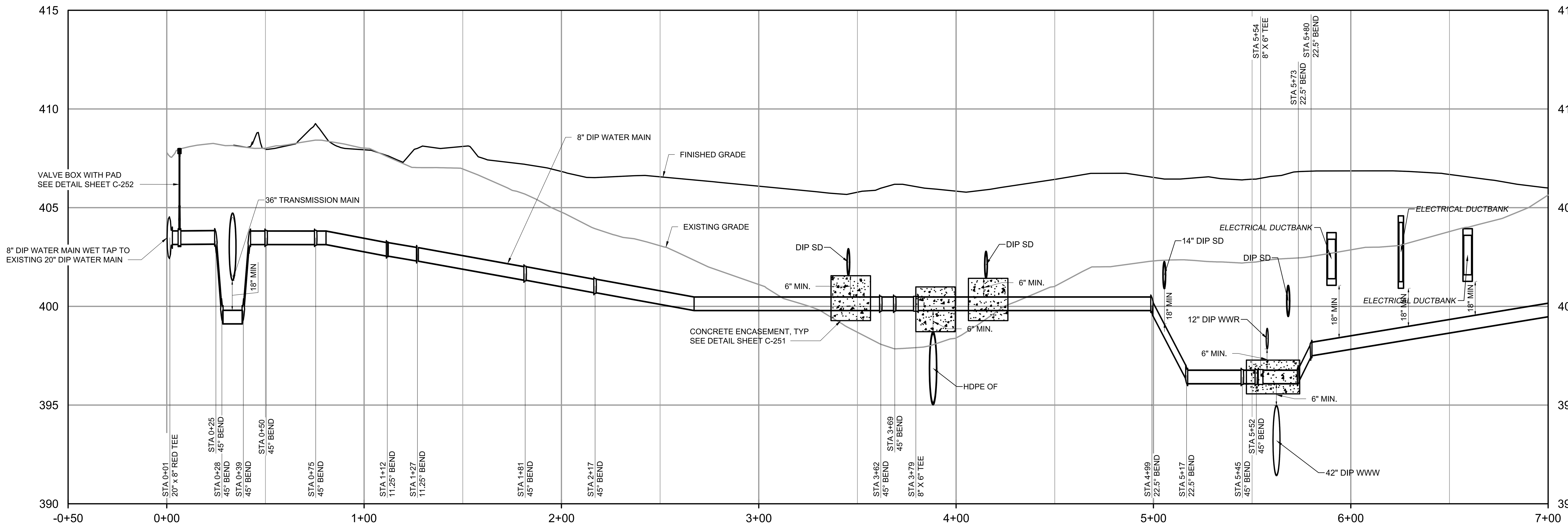

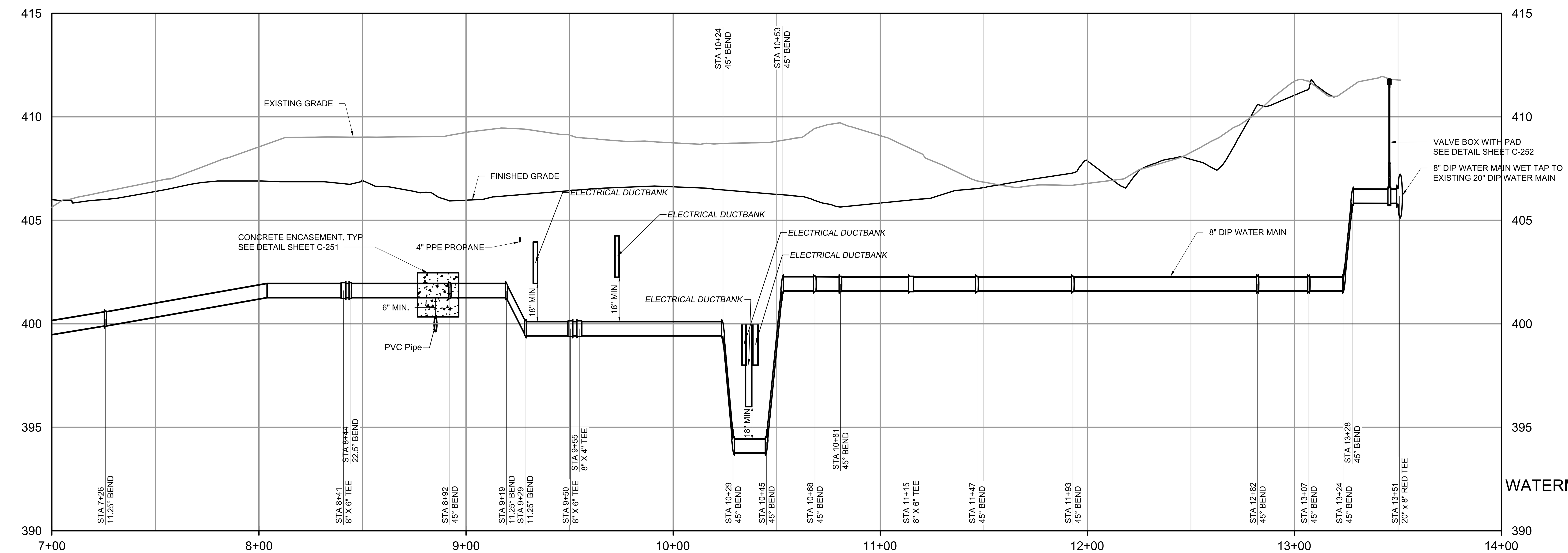

WATERMAIN EXTENSION PROFILE

HORIZONTAL SCALE: 1"= 30'
VERTICAL SCALE: 1"= 4'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE   0   1/2"   1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
WATERMAIN EXTENSION PROFILE

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-244

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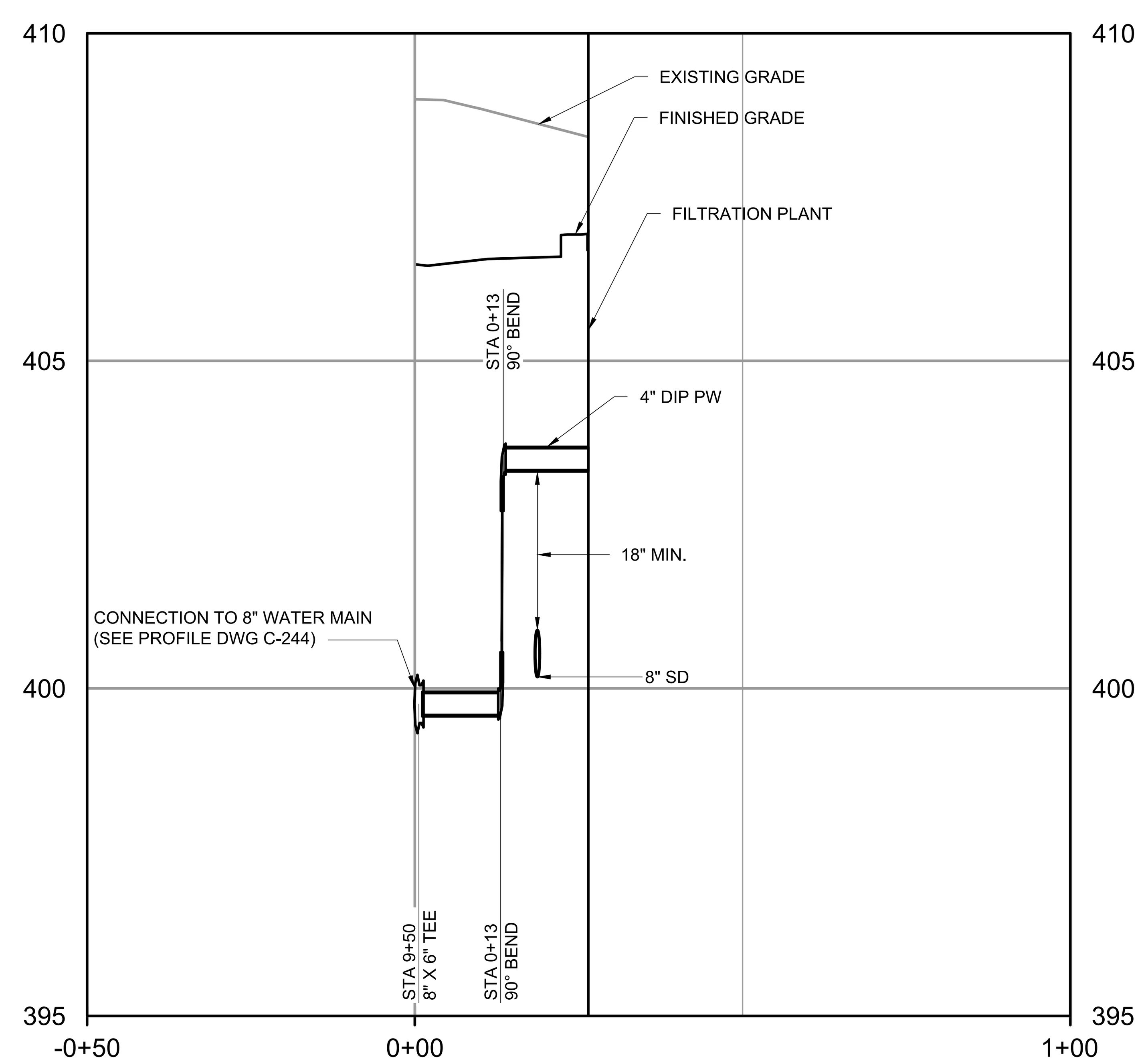
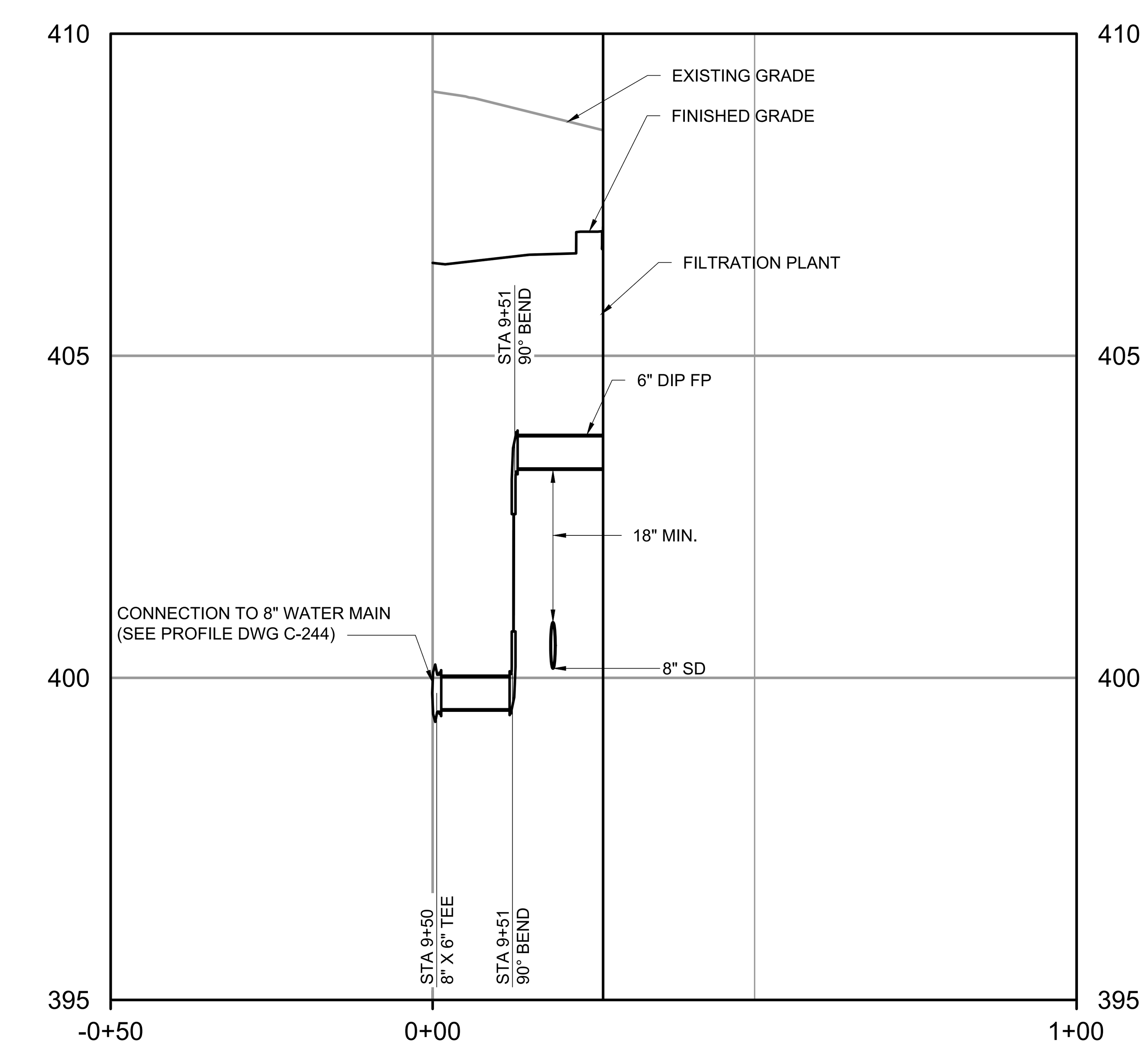


POTABLE WATER (PW) PROFILE

HORIZONTAL SCALE: 1"= 20'
VERTICAL SCALE: 1"= 2'



FIRE PROTECTION SERVICE (FP) PROFILE

HORIZONTAL SCALE: 1"= 20'
VERTICAL SCALE: 1"= 2'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
PW AND FP PROFILES

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-245

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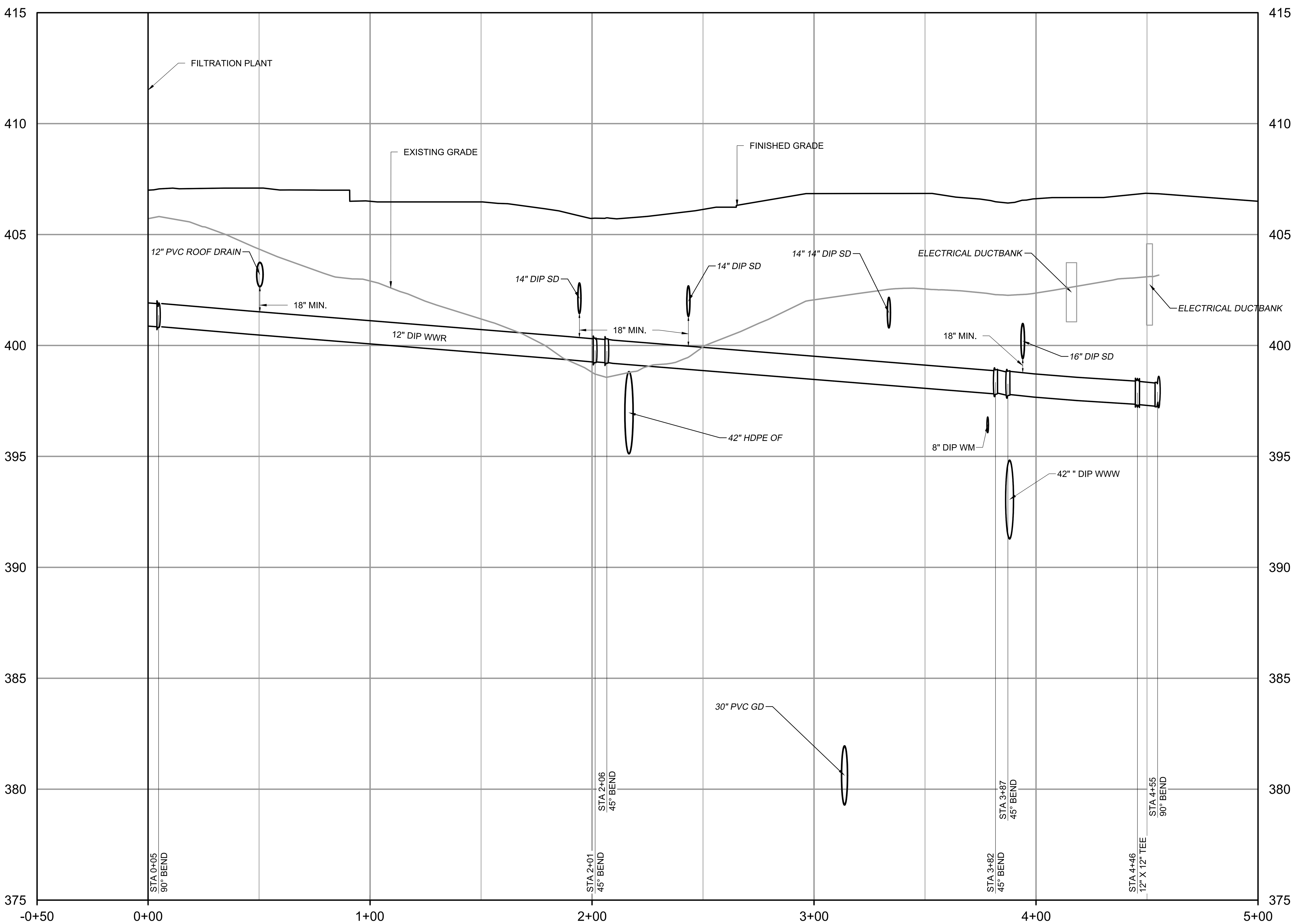


WASHWATER RECYLE (WWR) PROFILE

HORIZONTAL SCALE: 1"= 30'
VERTICAL SCALE: 1"= 3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

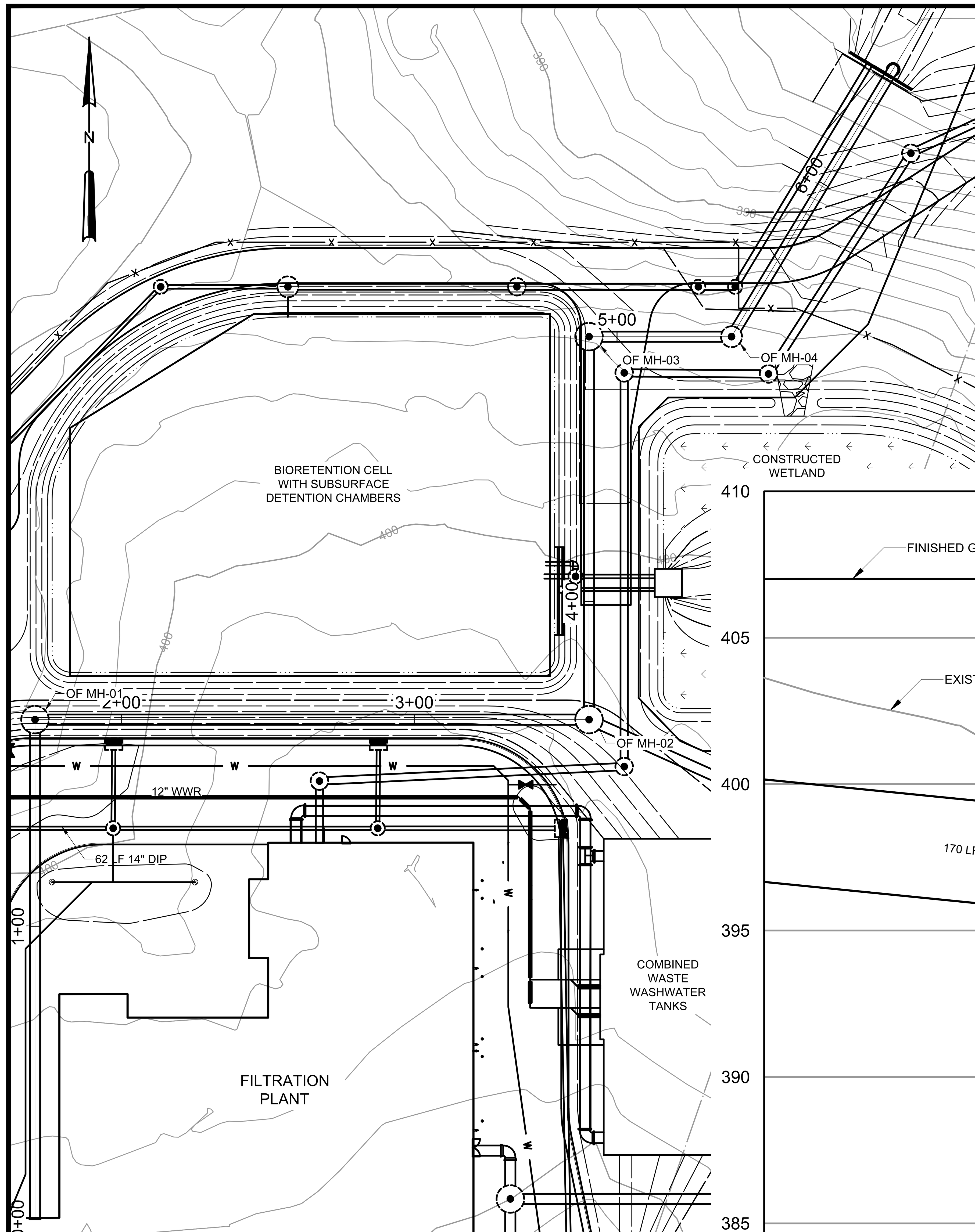
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

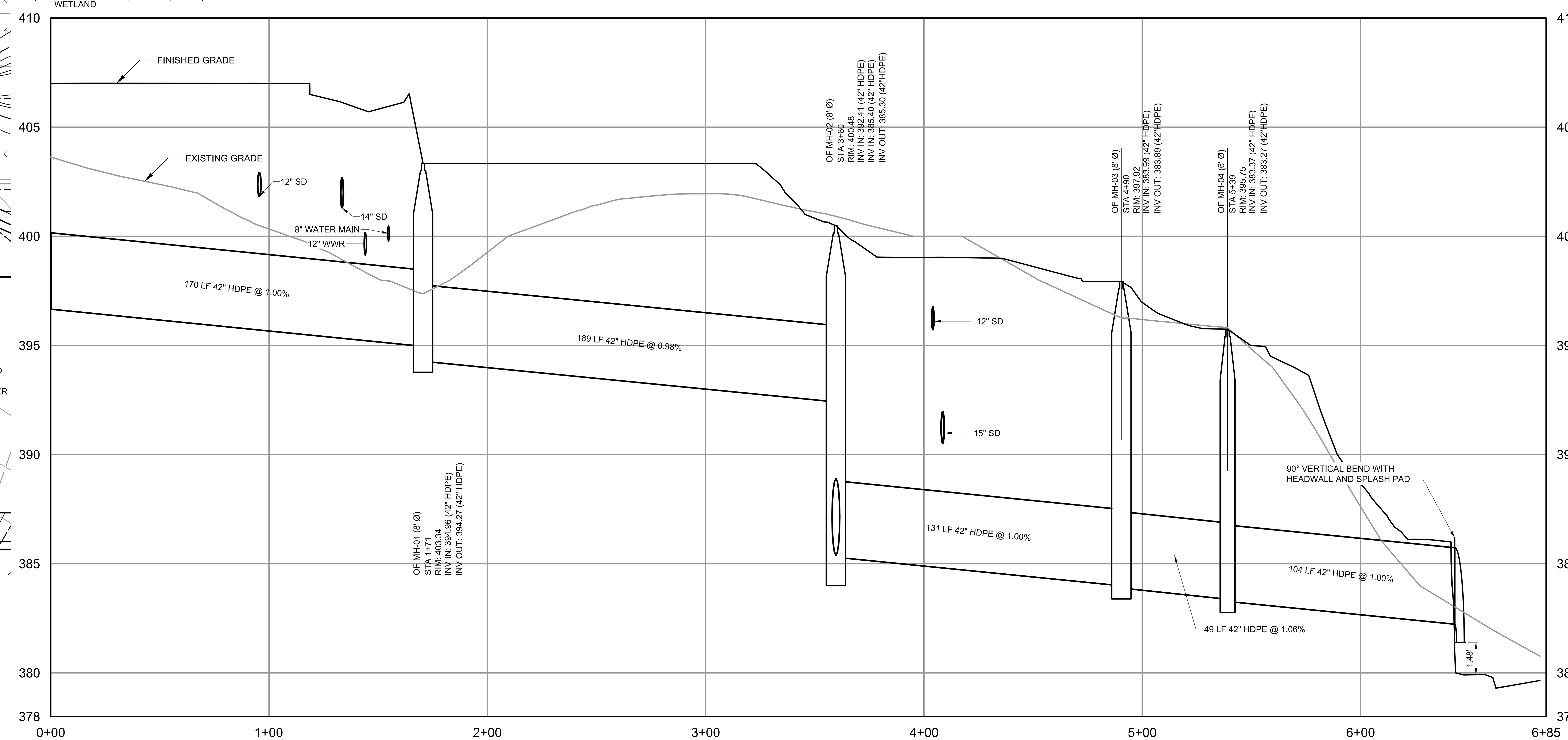
RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
WWR PROFILE

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-246



PLAN
SCALE: 1" = 30'



PROFILE
HORIZONTAL SCALE: 1"= 30'
VERTICAL SCALE: 1"= 3'

HORIZONTAL SCALE: 1" = 30'
30 15 0 30'
3 1.5 0 3
VERTICAL SCALE: 1"=3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
OVERFLOW PROFILE - SHEET 1 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-247

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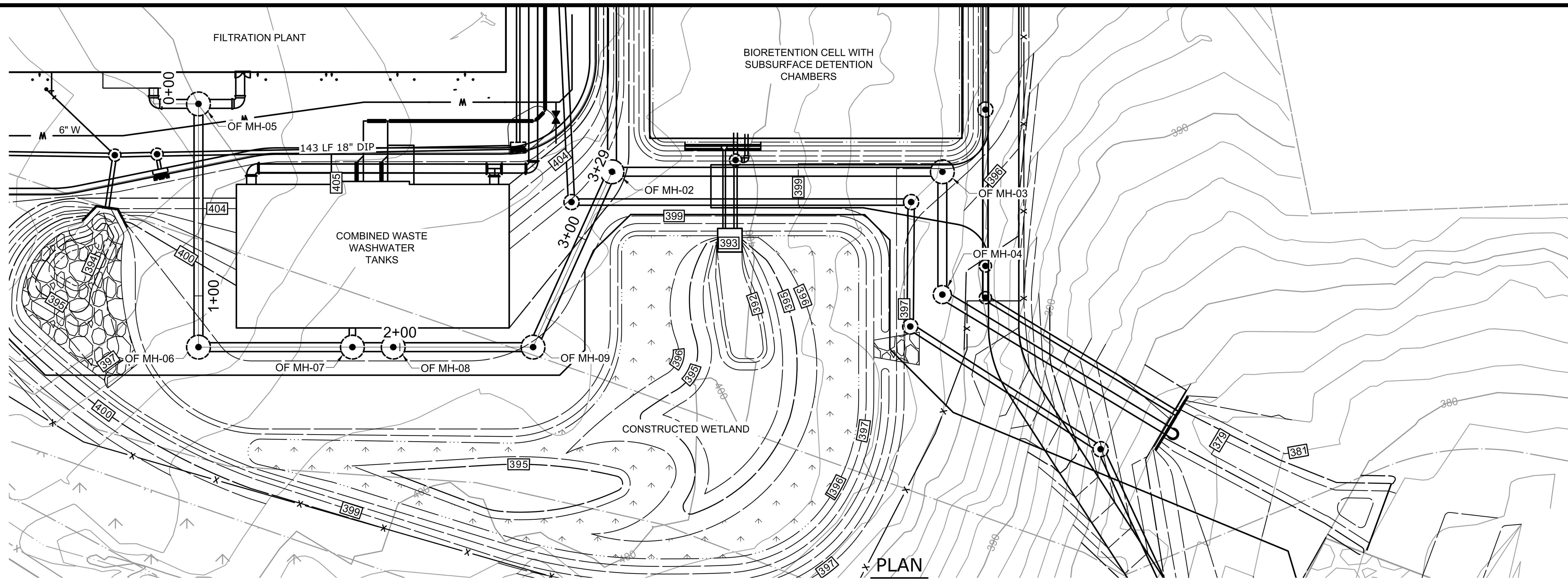
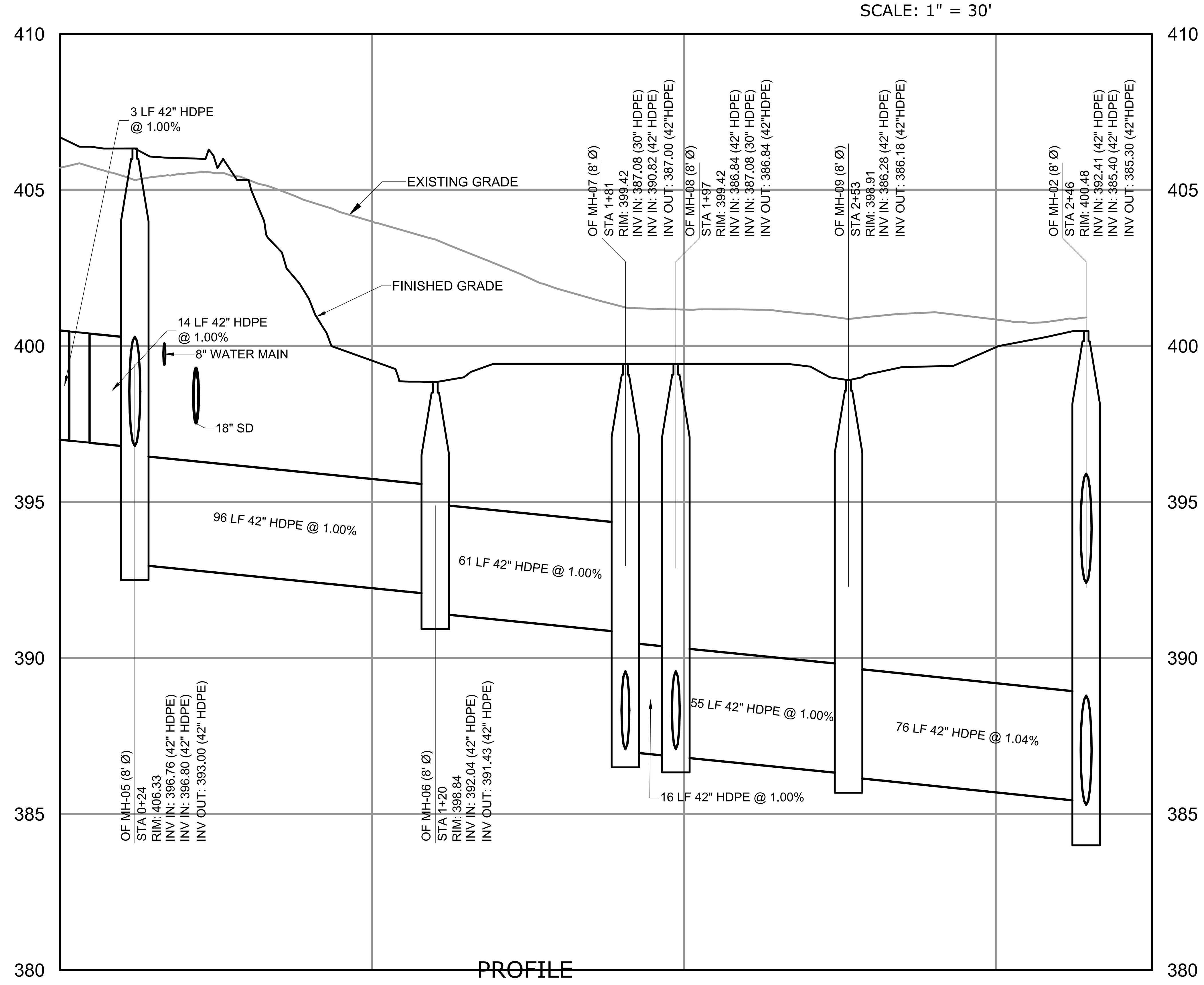
PLOT DATE: 7/20/2022 6:12 PM BY: CMCNICOL



PLAN
SCALE: 1" = 30'



PROFILE
HORIZONTAL SCALE: 1"= 30'
VERTICAL SCALE: 1"= 3'

HORIZONTAL SCALE: 1" = 30'
30 15 0 30'
3 1.5 0 3
VERTICAL SCALE: 1"=3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: C. JOHNSON
DRAWN BY: C. JOHNSON
CHECKED BY: D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

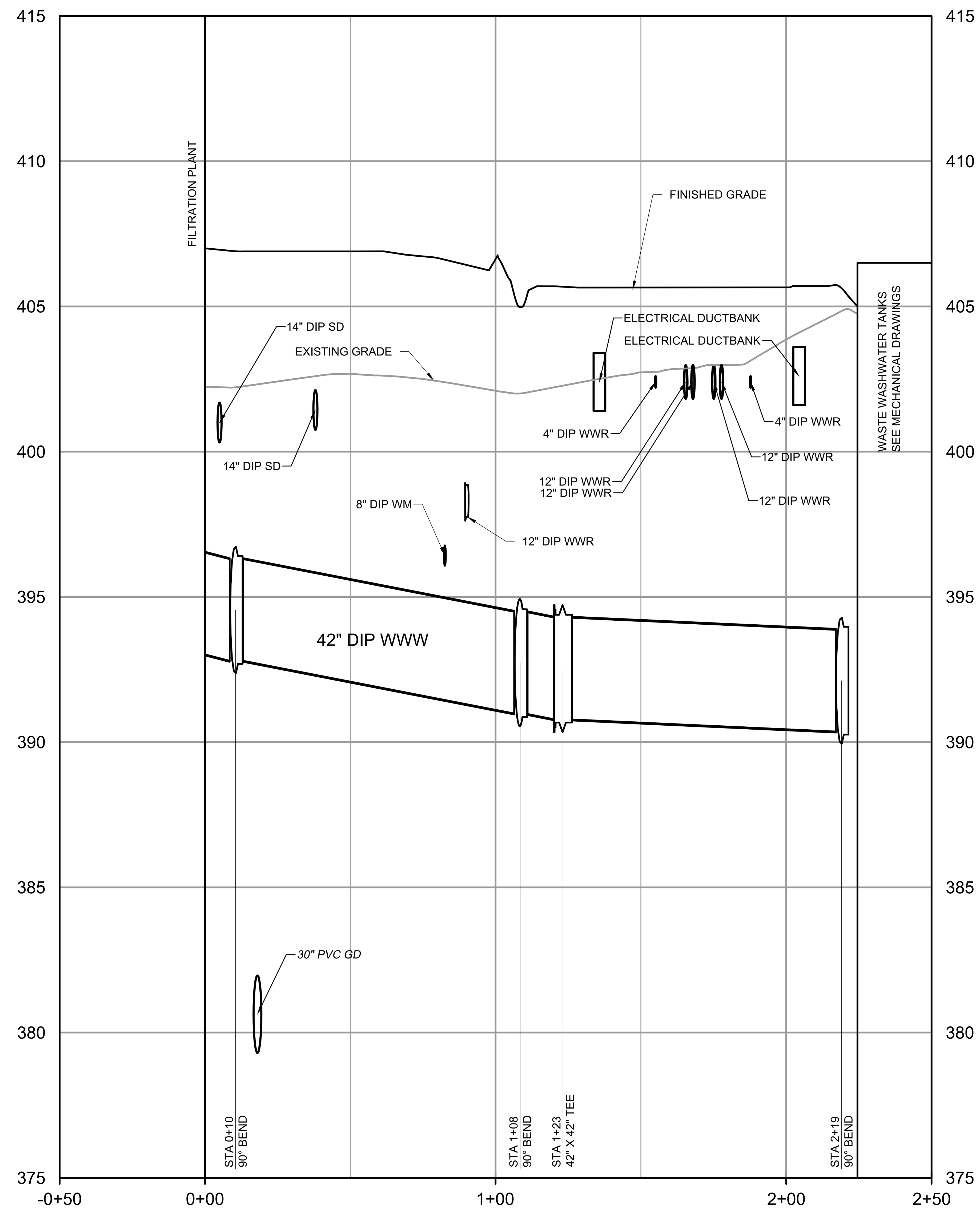
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
OVERFLOW PROFILE - SHEET 2 OF 2

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: C-248

File: C:\BMS\HAZEN-PW\D0193283\C-248 Saved by CMCNICOL Save date: 7/15/2022 10:34 AM
PLOT DATE: 7/20/2022 6:13 PM BY: CMCNICOL



WASTE WASHWATER PROFILE

HORIZONTAL SCALE: 1"= 30'
VERTICAL SCALE: 1"= 3'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
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Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

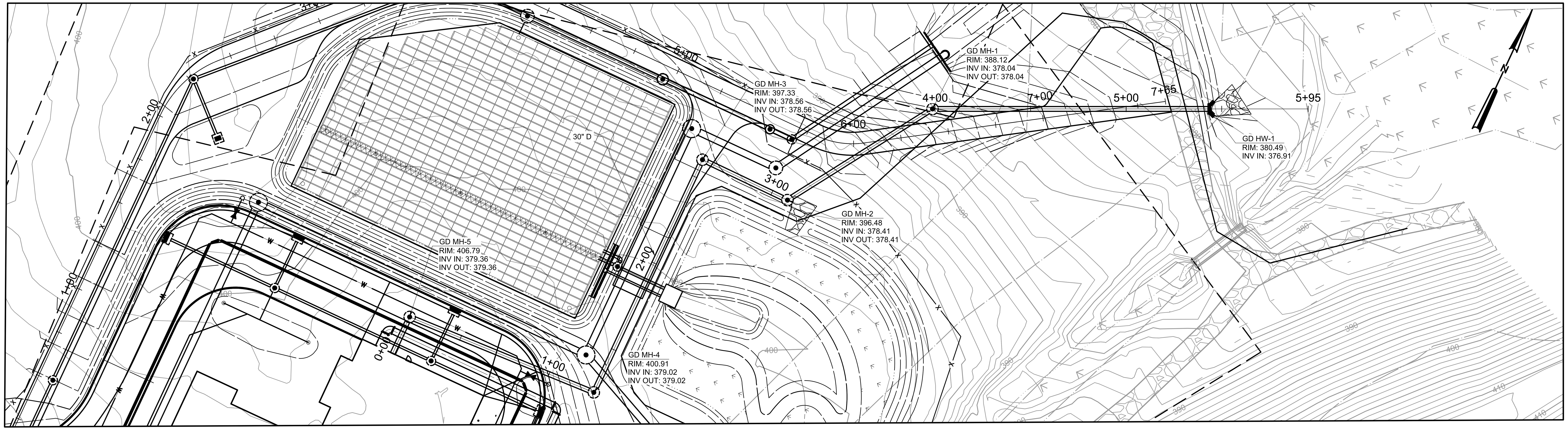
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
WWW PROFILE

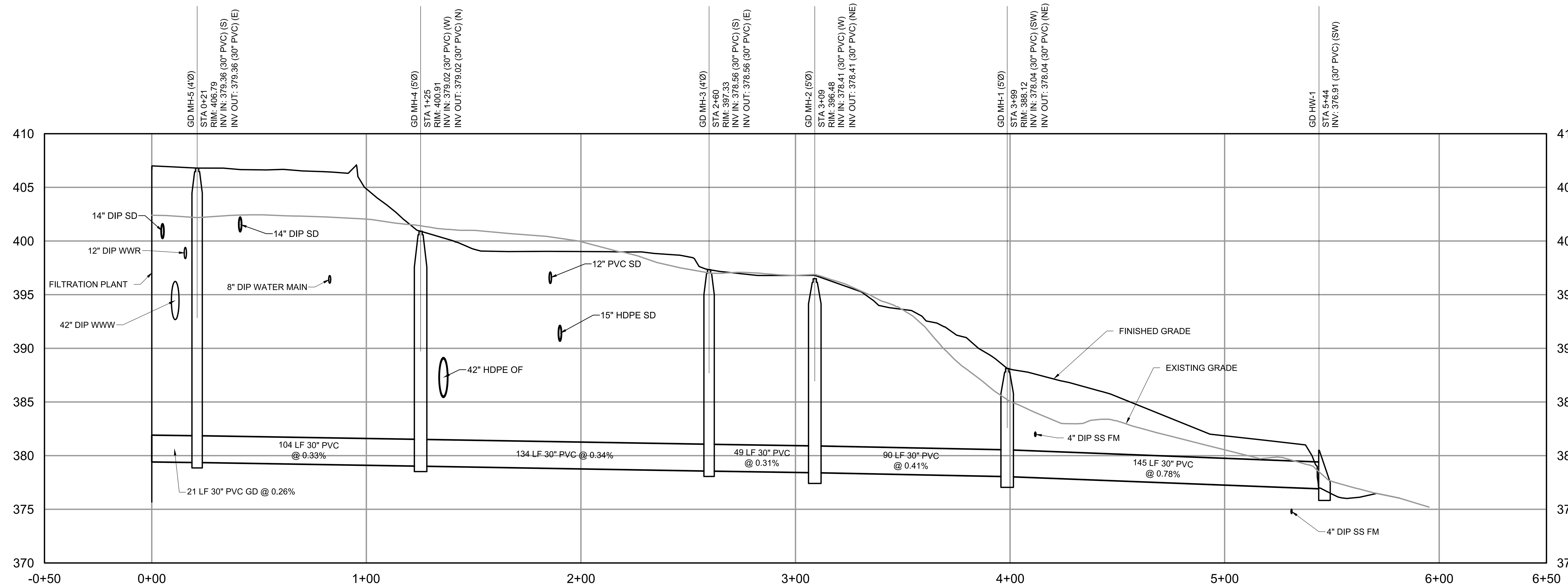
DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-249

File: C:\BMS\HAZEN-PW\D0193283\C-249 Saved by JTANNER Save date: 7/19/2022 7:50 PM
PLOT DATE: 7/20/2022 6:13 PM BY: CMCNICOL



PLAN

SCALE 1" = 30'



PROFILE

HORIZONTAL SCALE 1" = 30'
VERTICAL SCALE: 1" = 6'

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

REV	ISSUED FOR	DATE	BY

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

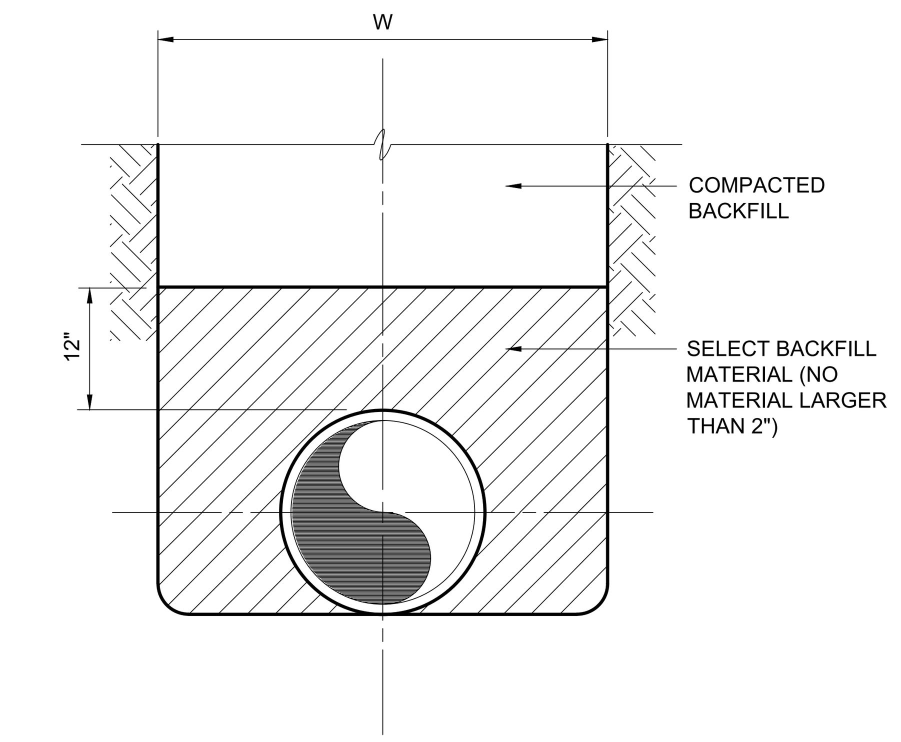
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

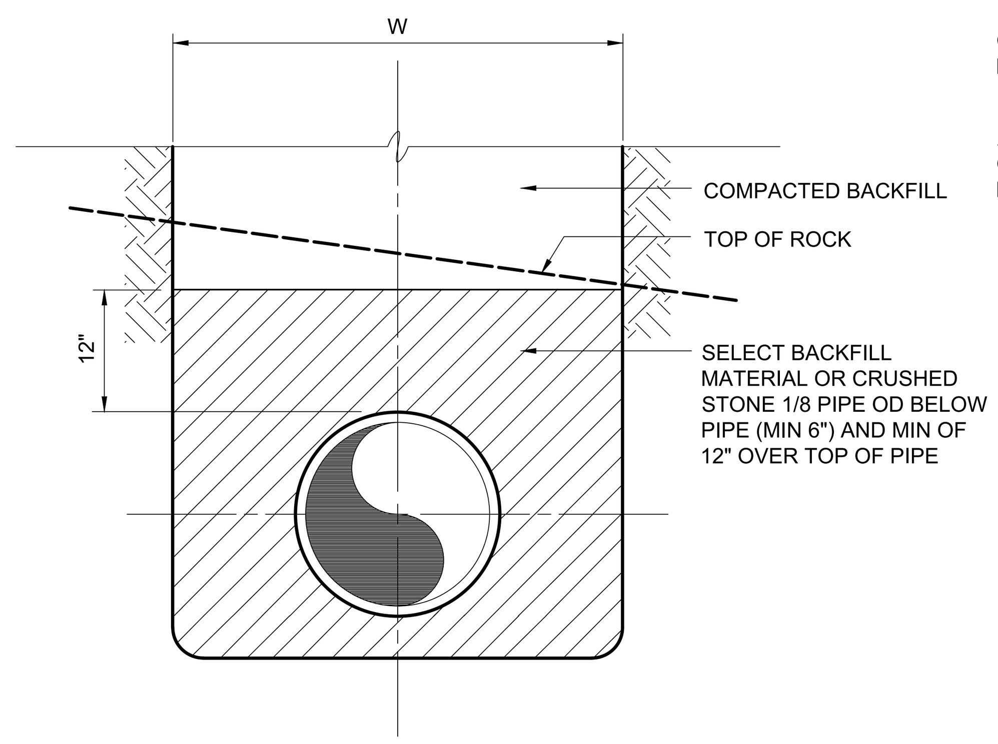
CIVIL
GALLERY DRAIN PROFILE

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-250



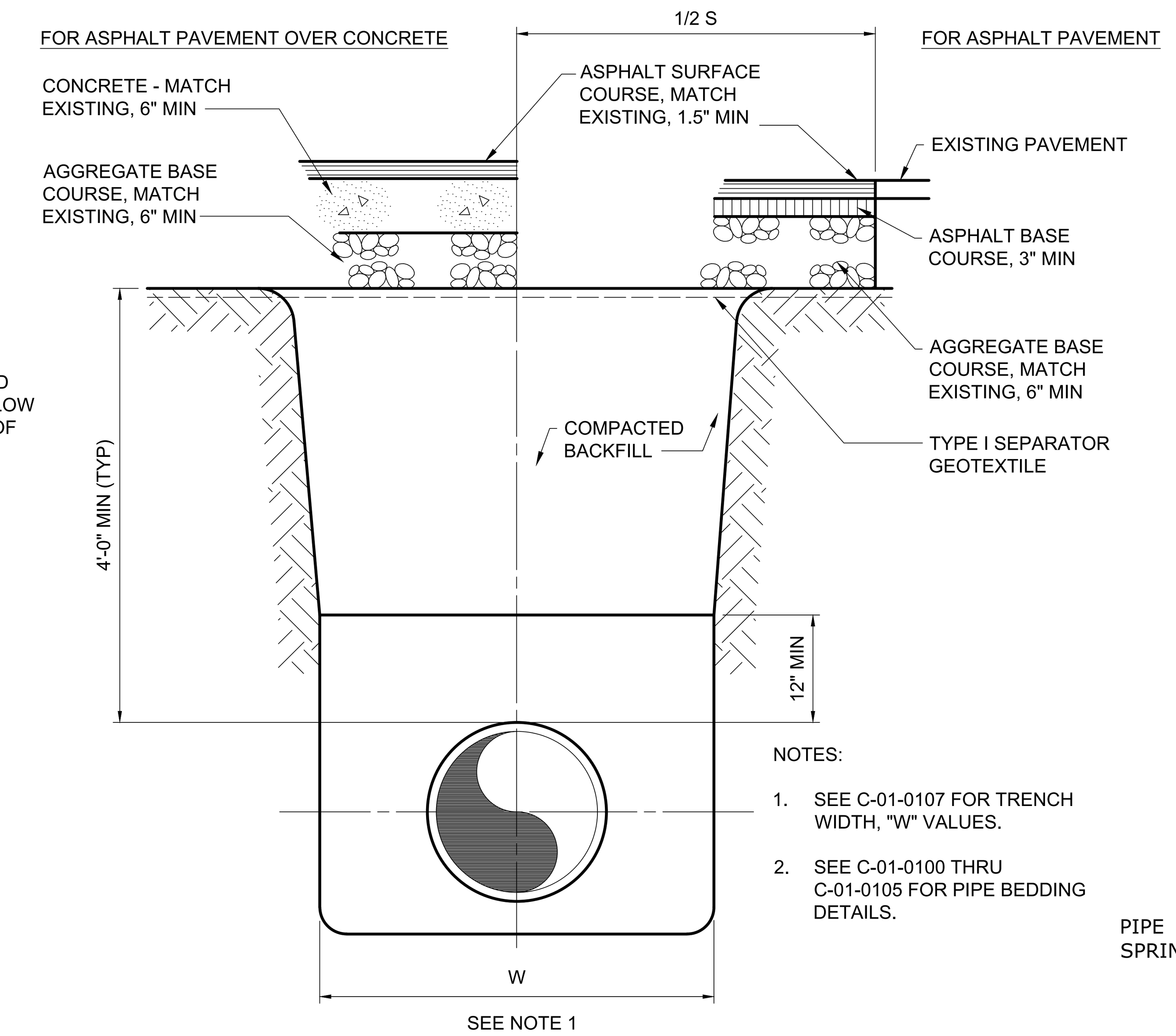
TYPE A
IN EARTH

C-01-0100



TYPE A
IN ROCK

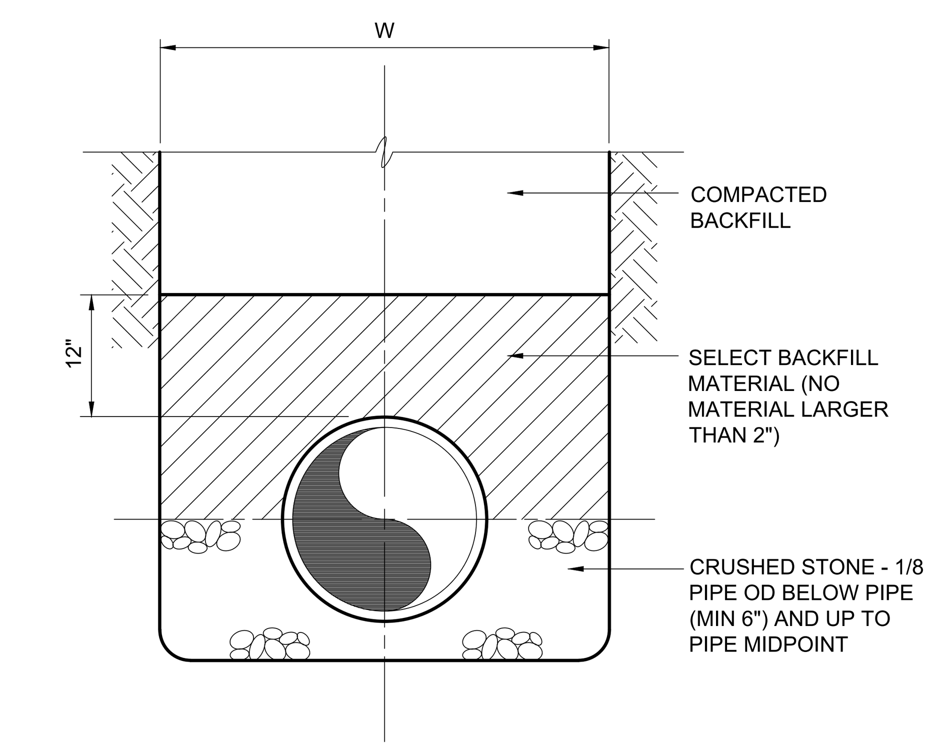
C-01-0101



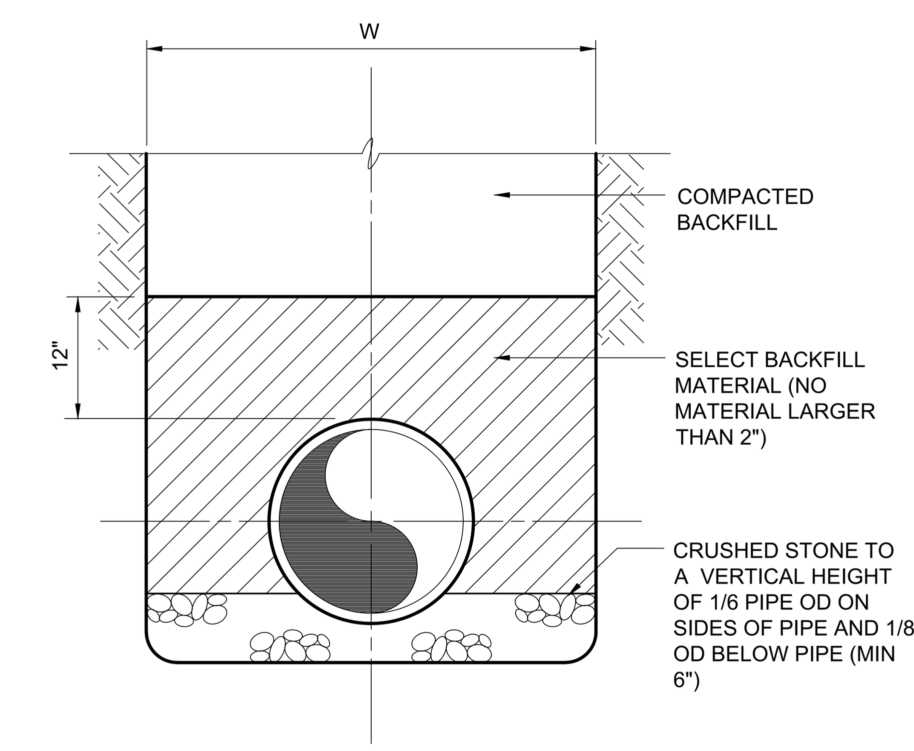
NOTES:

1. SEE C-01-0107 FOR TRENCH WIDTH, "W" VALUES.
2. SEE C-01-0100 THRU C-01-0105 FOR PIPE BEDDING DETAILS.

TYPICAL TRENCH
C-01-0106

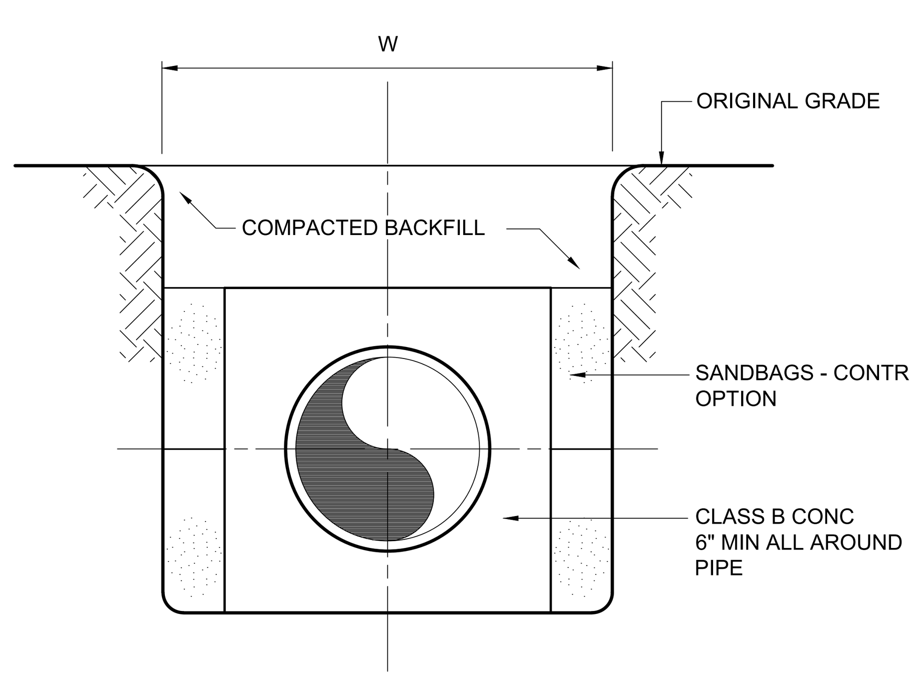


TYPE B
C-01-0102



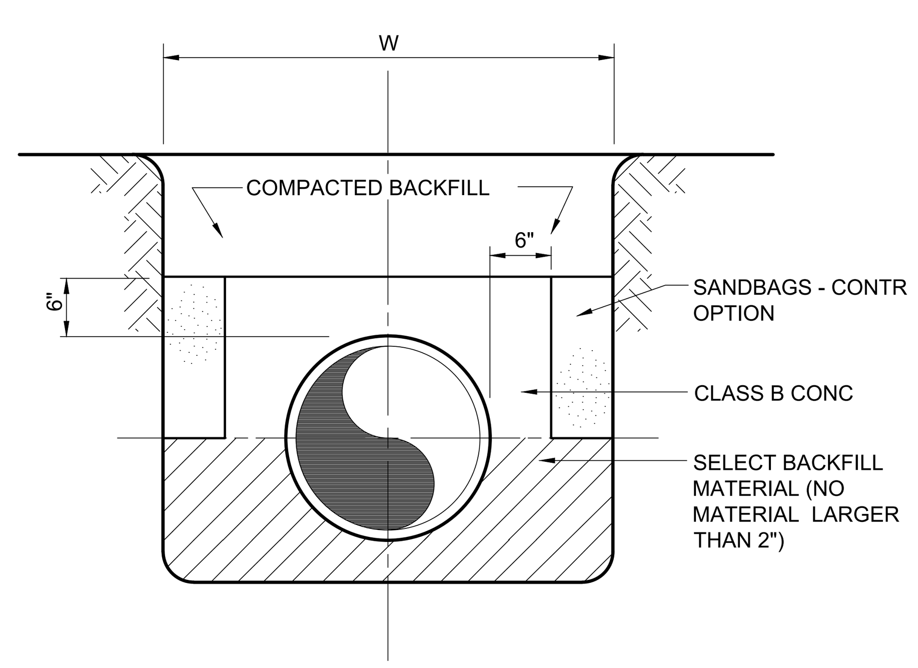
TYPE C

C-01-0103



CONCRETE ENCASEMENT
(SEE NOTE 1)

C-01-0104



CONCRETE ARCH
(SEE NOTE 1)

C-01-0105

TRENCH EXCAVATION LIMITS		
INTERNAL DIAMETER OF PIPE	W WIDTH OF TRENCH	
	MAX	W=MIN
4"-6"	3'-9"	2'-0"
8"-10"	3'-9"	2'-2"
12"	3'-9"	O.D.+2'
14"-16"	4'-2"	O.D.+2'
18"	4'-4"	O.D.+2'
20",21"	4'-8"	O.D.+2'
24"	4'-11"	O.D.+2'
27"	5'-9"	O.D.+2'
30"	6'-7"	O.D.+2'
36"	7'-4"	O.D.+2'
42"	8'-2"	O.D.+2'
48"	8'-9"	O.D.+2'
54"	9'-4"	O.D.+2'
60"	9'-10"	O.D.+2'
72"	11'-0"	O.D.+2'
78"	11'-8"	O.D.+2'
84"	12'-0"	O.D.+2'
90"	12'-6"	O.D.+2'
96"	13'-0"	O.D.+2'
108"	14'-0"	O.D.+2'
DEPTH OF CUT	S MAXIMUM PAVEMENT REPLACEMENT WIDTH	
0-6'	S=W+4'	
>6-8'	S=W+8'	
>8-10'	S=W+12'	
>10-12'	S=W+16'	
>12-14'	S=W+20'	
>14-16'	S=W+24'	
>16-18'	S=W+28'	
>18'	S=W+32'	
W = TRENCH WIDTH AT BOTTOM OF PIPE. TRENCH SIDE SLOPES SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS.		

C-01-0107

TRANSMISSION MAIN NOTES:

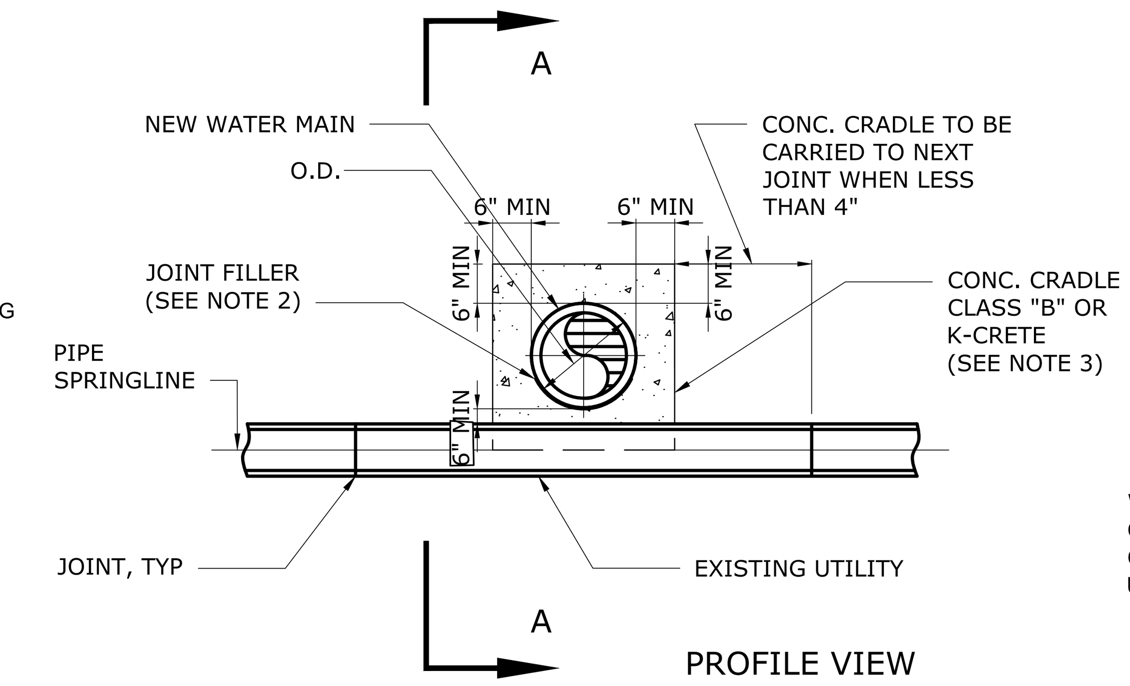
1. EXISTING UTILITIES TO BE RAISED/LOWERED TO FINISH GRADE. (INCLUDES CB'S, DI'S, MH'S, VALVES, HYDRANTS, ETC.)
2. PROVIDE 18" VERTICAL SEPARATION BETWEEN WATER MAIN AND SANITARY SEWER; AND 18" SEPARATION BETWEEN WATER MAIN AND STORMSEWER.
3. PROVIDE 10' HORIZONTAL SEPARATION BETWEEN WATER MAIN AND ALL OTHER UTILITIES.
4. EXISTING ON SITE WATER SYSTEM IS TO BE PRESSURE TESTED AND DISINFECTED.
5. EXISTINED SANITARY SEWER MANHOLES THAT WILL BE CONNECTED TO ARE TO BE RECONSTRUCTED AS REQUIRED WITH 4' DIA. PRECAST RISERS WITH ROOF SLAB AND 3' DIA. OPENING. (SEE DETAILS FOR MANHOLE).
6. SEE THRUST BLOCK DETAILS FOR WATER MAIN SYSTEM.
7. ALL WATER MAINS TO BE TESTED AND CHLORINATED IN ACCORDANCE WITH AWWA STANDARDS C 600-93 SECTION 4 & C651-99 EXCEPT FOR SECTION 4.4.2 (TABLET METHOD). ALL TESTING MUST BE PERFORMED, RESULTS CERTIFIED BY A NYS PR AND SENT TO AND APPROVED BY WESTCHESTER COUNTY DEPARTMENT OF HEALTH BEFORE WATER MAIN IS PUT INTO SERVICE.
8. EXISTING WATER MAINS THAT ARE BEING REPLACED WITH NEW WATER MAINS SHALL BE REMOVED OR ABANDONED AFTER THE NEW MAIN HAS BEEN PLACE IN SERVICE.
9. ALL VALVES ASSOCIATED WITH TRANSMISSION MAINS SHALL ONLY BE OPERATED BY DPW STAFF.

PRESSURE LEAKAGE TESTING:

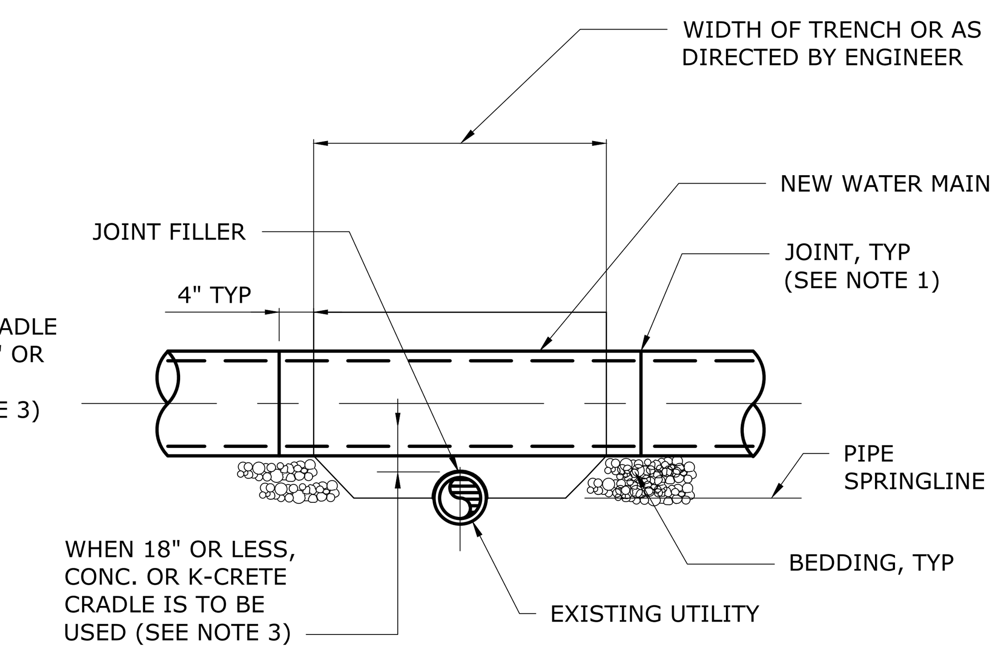
1. ALL PIPE INSTALLED SHALL BE PRESSURE TESTED AND LEAKAGE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF AWWA STANDARD C600-93 SECTION 4.
2. 48 HOUR NOTICE TO DPW AND WCDOH IS REQUIRED FOR SCHEDULING PRESSURE/LEAKAGE TESTING.

DISINFECTION

1. ALL NEW, CLEANED, OR REPAIRED WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH TEH LATEST EDITION OF AWWA STANDARDS C 600-93 SECTION 4 & C651-99 EXCEPT FOR SECTION 4.4.2 (TABLET METHOD).



PROFILE VIEW

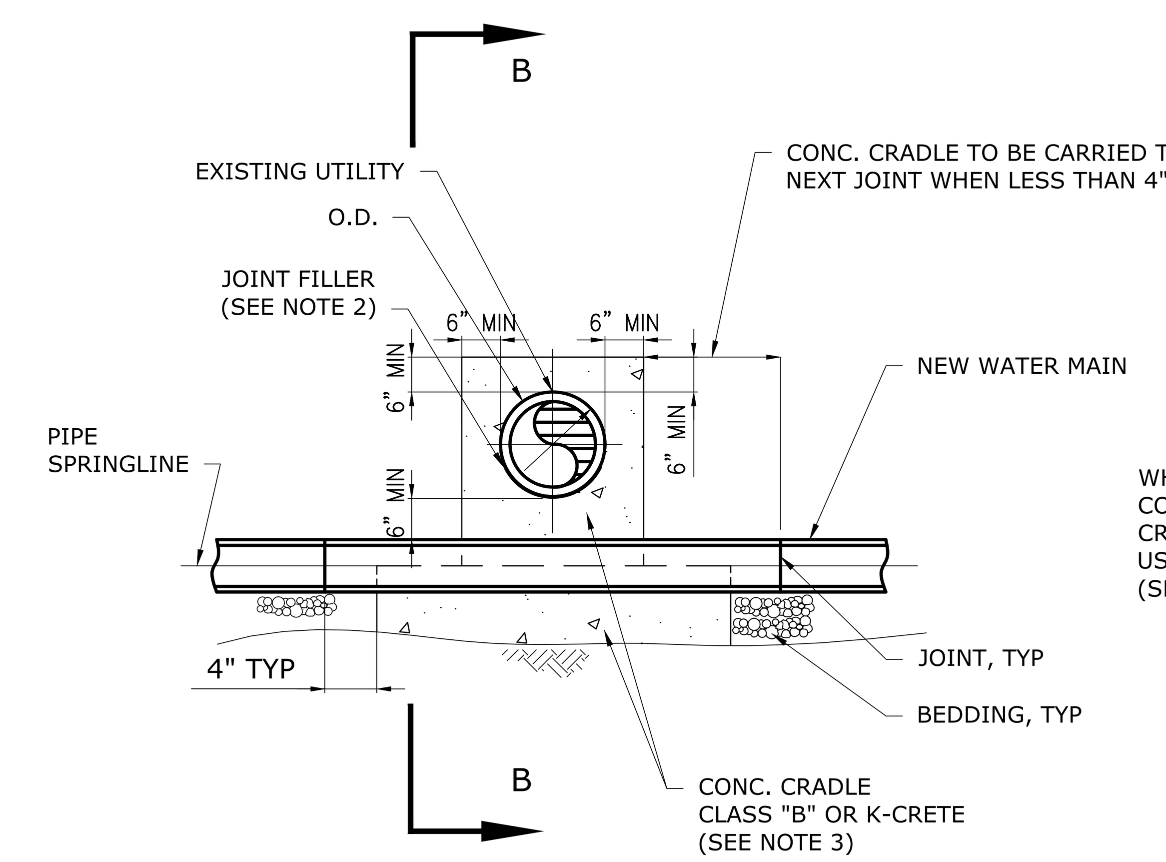


SECTION A-A

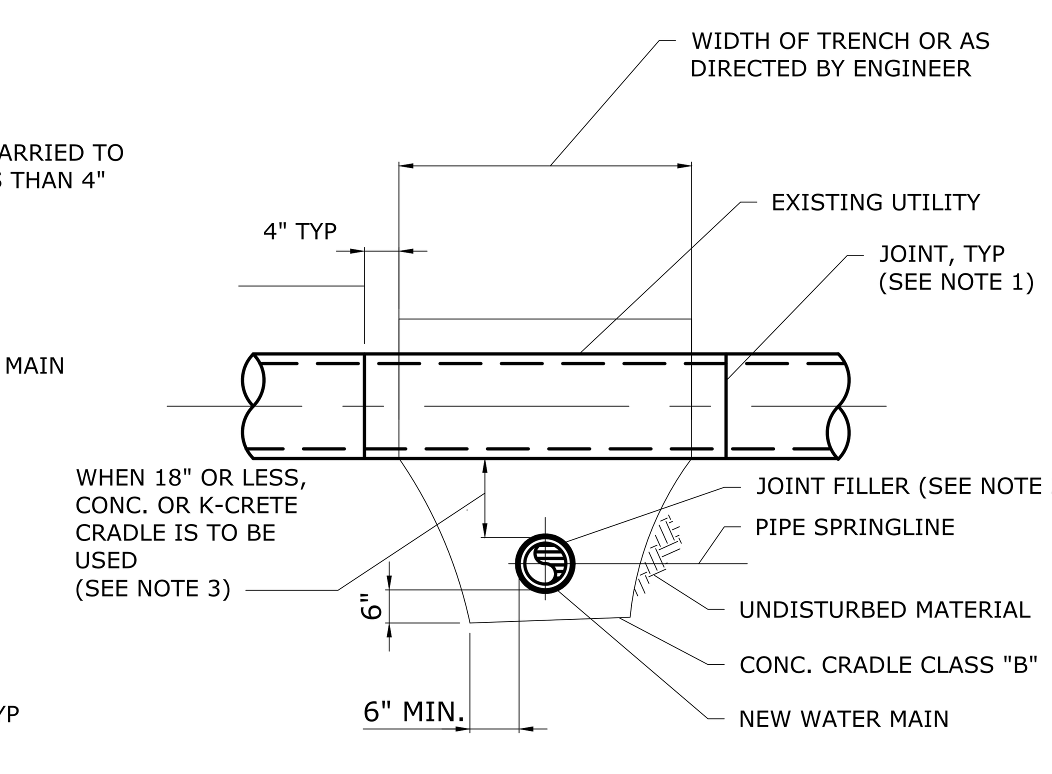
NOTES:

1. ARRANGE SO NEITHER NEW OR EXISTING PIPE HAS JOINT IN CONTACT WITH CONCRETE.
2. JUTE OR SIMILAR BITUMINOUS IMPREGNATED JOINT FILLER SHALL BE INSTALLED BETWEEN BOTH PIPES AND CONCRETE.
3. IF 10' OF HORIZONTAL SEPARATION OR 18" VERTICAL SEPARATION CANNOT BE MADE, THE CONTRACTOR WILL ENCASE THE NEW WATER MAIN IN K-CRETE (SEE WATER MAIN INSTALLATION NEAR SANITARY SEWER). HEALTH DEPARTMENT APPROVAL SHALL BE REQUIRED.

NEW PIPE OVER EXIST. UTILITY
C-01-0120R



PROFILE VIEW



SECTION B-B

NOTES:

1. ARRANGE SO NEITHER NEW OR EXISTING PIPE HAS JOINT IN CONTACT WITH CONCRETE.
2. JUTE OR SIMILAR BITUMINOUS IMPREGNATED JOINT FILLER SHALL BE INSTALLED BETWEEN BOTH PIPES AND CONCRETE.
3. IF 10' OF HORIZONTAL SEPARATION OR 18" VERTICAL SEPARATION CANNOT BE MADE, THE CONTRACTOR WILL ENCASE THE NEW WATER MAIN IN K-CRETE (SEE WATER MAIN INSTALLATION NEAR SANITARY SEWER). HEALTH DEPARTMENT APPROVAL SHALL BE REQUIRED.

NEW PIPE UNDER EXIST. UTILITIES
C-01-0120R

REV	ISSUED FOR	DATE	BY

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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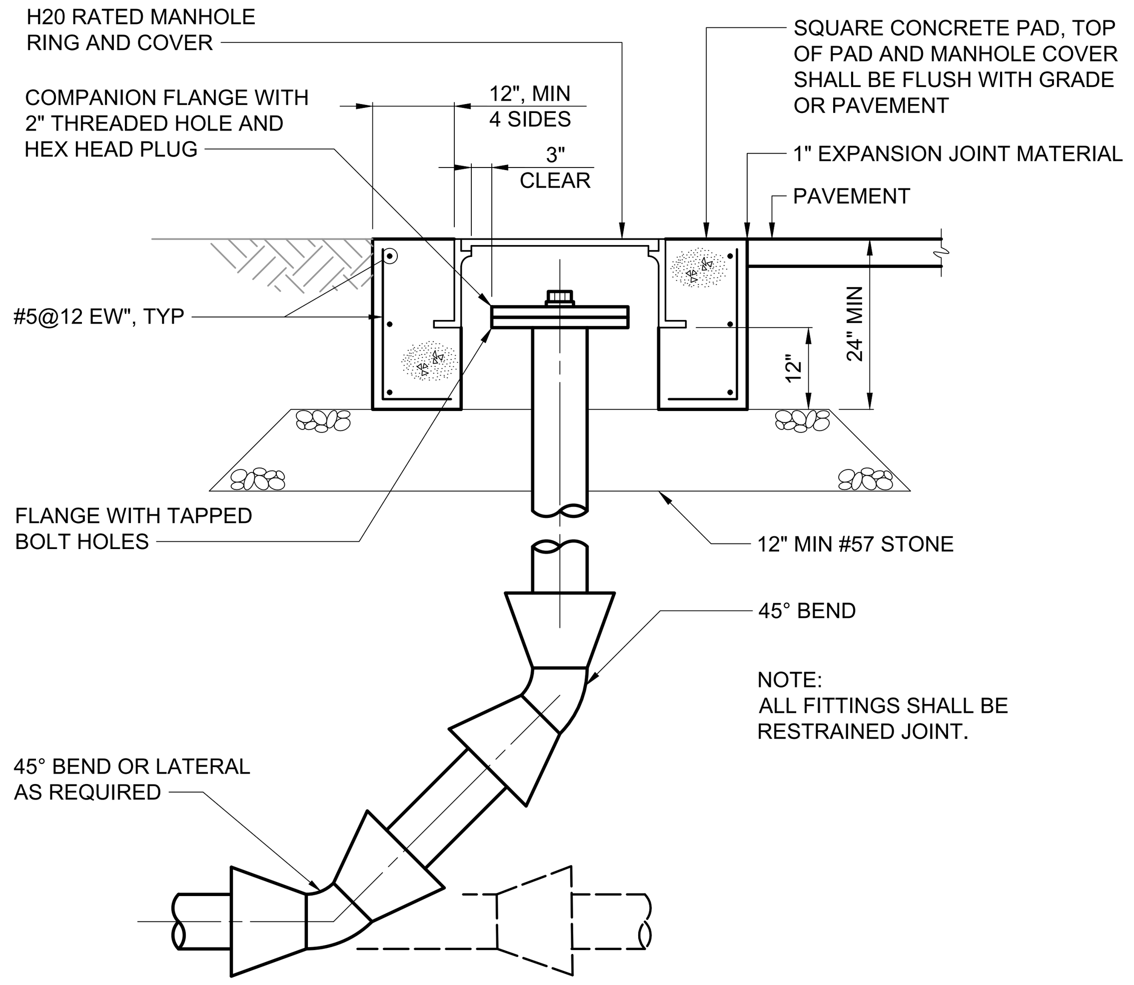
WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

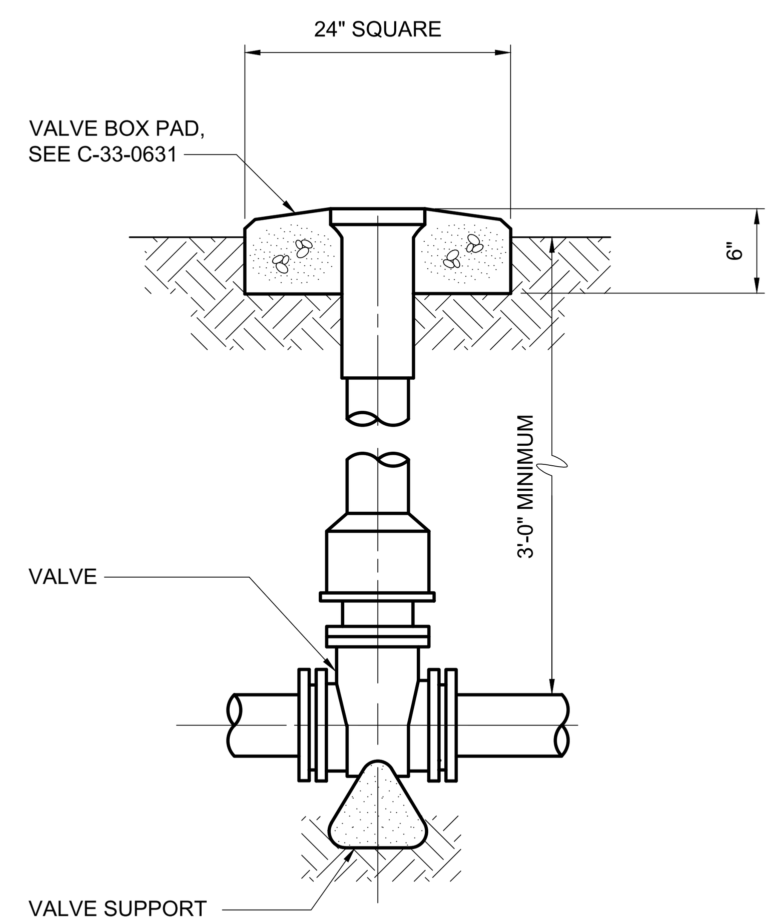
CIVIL
YARD PIPING DETAILS - SHEET 1 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-251



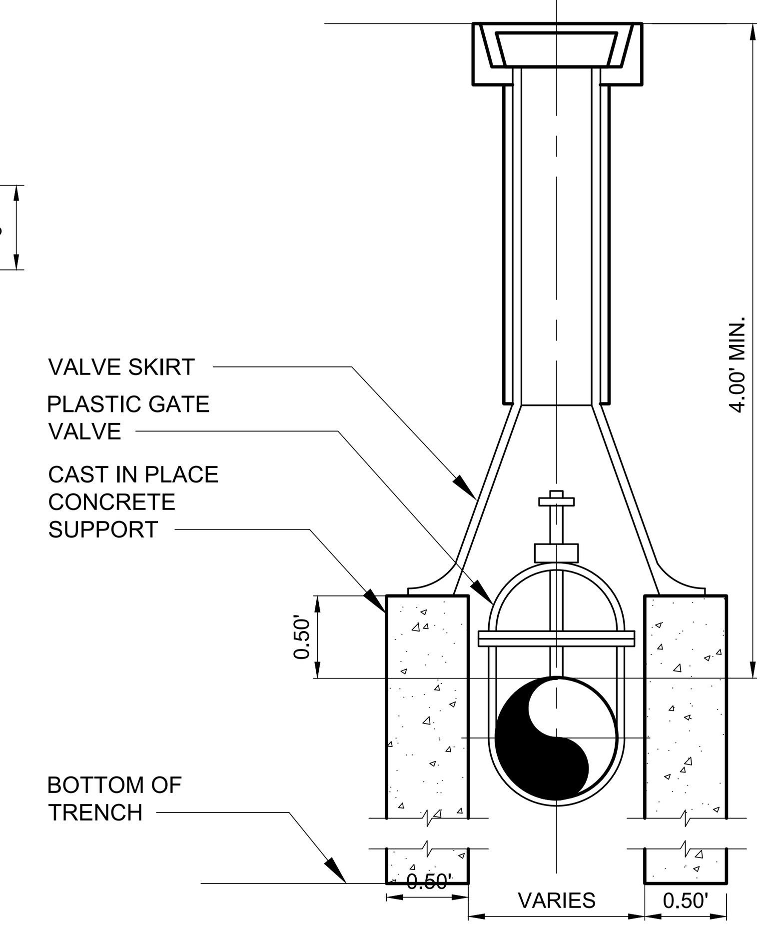
CLEANOUT RISER FOR PRESSURIZED LINES 4"-12"

C-33-0643



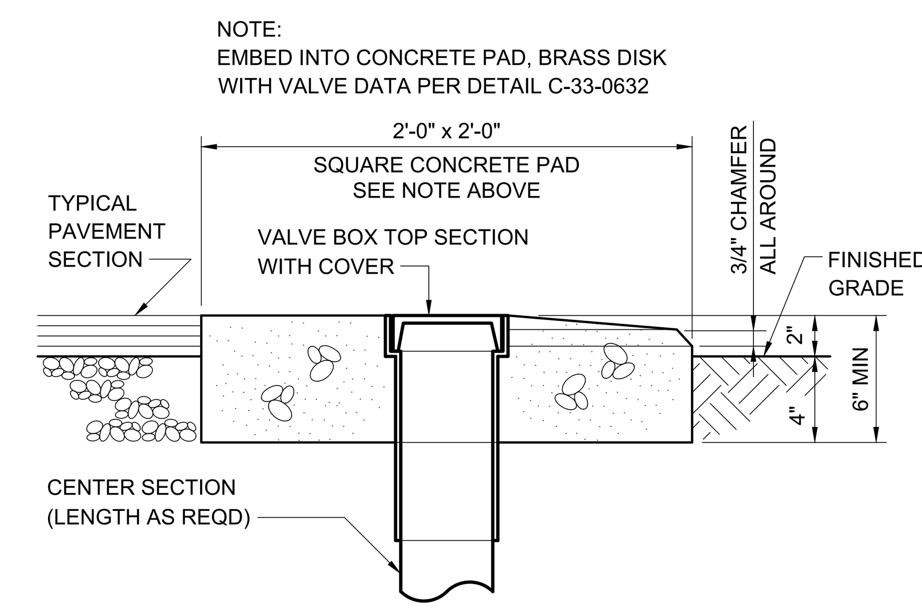
VALVE BOX

C-33-0630



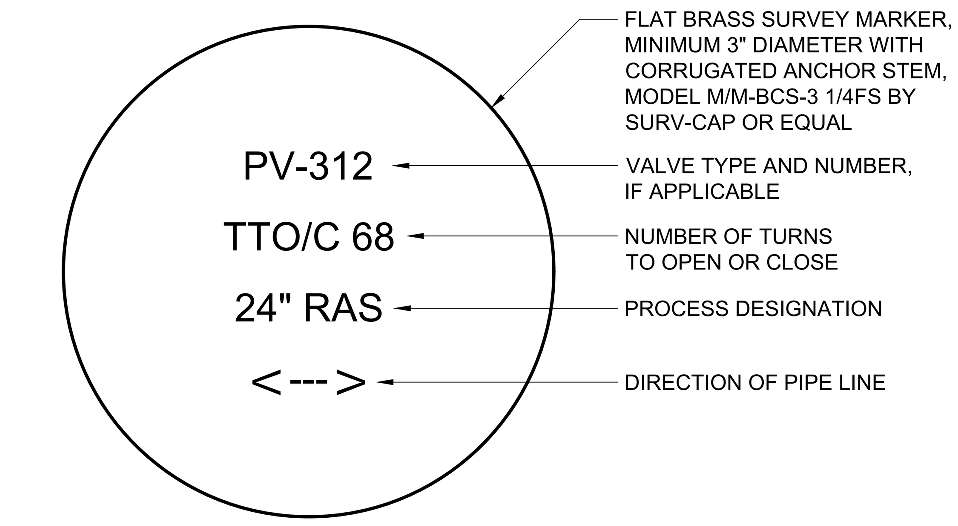
PLASTIC VALVE BOX DETAIL

NTS



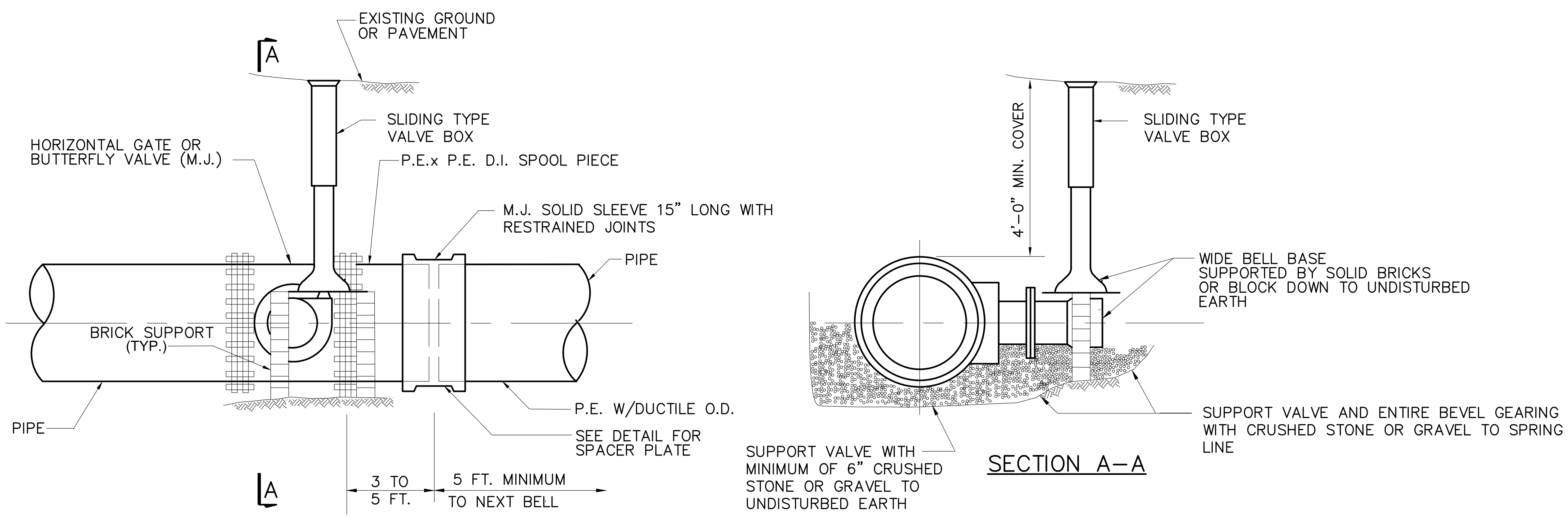
VALVE BOX PAD

C-33-0631



NOTES:
1. ENGRAVING SHALL BE MINIMUM 3/16" TALL CAPITAL LETTERS IN A BLOCK FONT SIMILAR TO ARIAL, CENTERED AND SPACED AS SHOWN.
2. ALL MARKINGS SHALL BE NEATLY MACHINE ENGRAVED.
3. ALTERNATELY, MARKINGS MAY BE HAND STAMPED, PROVIDED STAMPING IS DEEP ENOUGH TO WITHSTAND NORMAL TRAFFIC AND WEATHERING. STAMPING OF DISK SHALL BE ACCOMPLISHED PRIOR TO SETTING IN CONCRETE VALVE BOX PAD.
4. SUBMIT ONE SAMPLE FOR APPROVAL PRIOR TO ENGRAVING ALL MARKERS.
5. REGARDLESS OF ENGRAVING METHOD SELECTED, CONTRACTOR SHALL PROVIDE COMPATIBLE STAMP SET AND ANVIL TO OWNER UPON COMPLETION OF PROJECT FOR FUTURE REPAIR OF ENGRAVINGS.

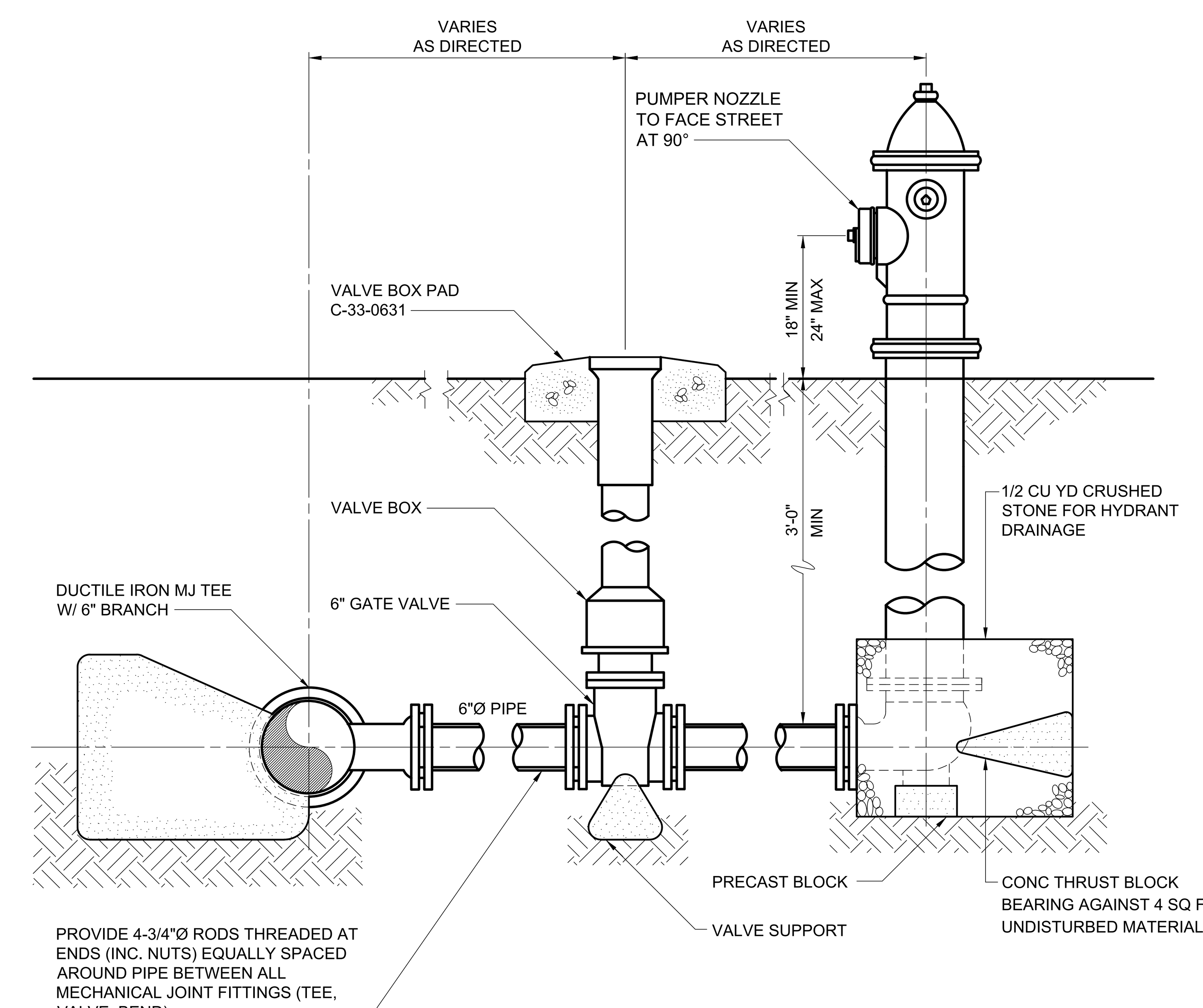
C-33-0632



ELEVATION

NOTES: 1.) NO PART OF VALVE BOX OR BASE TO TOUCH VALVE.
2.) PAINT NUTS AND BOLTS ON JOINTS WITH 2 COATS BITUMASTIC AFTER INSTALLATION.

TYPICAL HORIZONTAL MAIN – LINE GATE OR BUTTERFLY VALVE INSTALLATION DETAIL



FIRE HYDRANT

C-33-0642

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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WESTCHESTER JOINT WATER WORKS
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RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
YARD PIPING DETAILS - SHEET 2 OF 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-252

EROSION AND SEDIMENT CONTROL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE APPROVED STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IF APPLICABLE, AND/OR WITH THE SOIL EROSION AND SEDIMENT CONTROL REQUIREMENTS SPECIFIED BY THE NYSDEC STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (NOVEMBER 2016), AND THE TOWN/VILLAGE OF HARRISON STANDARDS FOR EROSION AND SEDIMENT CONTROL.
3. IN THE EVENT OF CONFLICT BETWEEN THESE SPECIFICATION REQUIREMENTS AND POLLUTION CONTROL LAWS, RULES, REGULATIONS OR PERMIT CONDITIONS BY OTHER FEDERAL OR STATE OR LOCAL GOVERNMENT AGENCIES, THE MORE RESTRICTIVE LAWS, RULES OR REGULATIONS SHALL APPLY.
4. DUE TO THE NATURE OF THE WORK REQUIRED BY THIS CONTRACT, IT IS ANTICIPATED THE LOCATION AND NATURE OF EROSION AND SEDIMENT CONTROL MEASURES WILL BE ADJUSTED AS CONSTRUCTION PROGRESSES TO REFLECT THE CURRENT PHASE OF WORK. THE CONSTRUCTION SCHEDULE ADOPTED BY THE CONTRACTOR WILL IMPACT THE PLACEMENT AND NEED FOR SPECIFIC DEVICES REQUIRED FOR THE CONTROL OF EROSION. THE LOCATION AND EXTENT OF EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REVISED AT EACH PHASE OF CONSTRUCTION RESULTING IN A CHANGE OF EITHER THE QUANTITY OR DIRECTION OF SURFACE RUNOFF FROM THE CONSTRUCTION AREAS. PERMANENT EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE AT THE CONCLUSION OF THE PROJECT.
5. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE ENGINEER, OWNER, AND REGULATORY AGENCIES FOR DEVIATIONS FROM THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
6. NO LAND DISTURBANCE, DEMOLITION OR CONSTRUCTION ACTIVITIES SHALL BEGIN UNTIL ALL PERIMETER EROSION AND SEDIMENT CONTROL MEASURES, INCLUDING, BUT NOT LIMITED TO, SILT FENCING, INLET PROTECTION, TEMPORARY DIVERSIONS, SEDIMENT BASIN PROTECTION HAVE BEEN INSTALLED AS SHOWN ON THE CONTRACT DRAWINGS. IF CLEARING IS REQUIRED FOR INSTALLATION OF A PARTICULAR MEASURE, ALL MEASURES NOT REQUIRING CLEARING SHALL BE INSTALLED FIRST. CLEARING OF THE NECESSARY LAND FOR INSTALLATION OF THE PARTICULAR MEASURE MAY THEN PROCEED.
7. CLEARING SHALL BE LIMITED AS MUCH AS POSSIBLE TO AREAS REQUIRED FOR CURRENT CONSTRUCTION ACTIVITIES. MASS CLEARING AND GRADING SHALL BE AVOIDED.
8. ALL EROSION CONTROL MEASURES SHALL BE INSPECTED BY A QUALIFIED INSPECTOR WITHIN 24 HOURS FOLLOWING EVERY RAINFALL BUT IN NO CASE LESS THAN TWICE EVERY SEVEN CALENDAR DAYS. THE TWO INSPECTIONS SHALL BE SEPARATED BY A MINIMUM OF TWO (2) FULL CALENDAR DAYS.
9. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED, REPAIRED, OR REPLACED IMMEDIATELY BY THE CONTRACTOR AS REQUIRED TO MAINTAIN PERFORMANCE OF MEASURE DURING THE LIFE OF THE PROJECT, INCLUDING WINTER SHUTDOWN, ETC. SUCH INSPECTION AND MAINTENANCE SHALL CONTINUE UNTIL AFTER PERMANENT STABILIZATION MEASURES ARE IN PLACE AND THE TEMPORARY CONTROL MEASURES ARE ORDERED TO BE REMOVED BY THE ENGINEER.
10. TIMELY MAINTENANCE OF SEDIMENT CONTROL PRACTICES IS THE RESPONSIBILITY OF THE CONTRACTOR. ALL PRACTICES SHALL BE MAINTAINED IN GOOD WORKING ORDER AT ALL TIMES. THE SEDIMENT LEVEL IN ALL PRACTICES SHALL BE CLOSELY MONITORED AND SEDIMENT REMOVED PROMPTLY WHEN MAXIMUM LEVELS ARE REACHED OR AS ORDERED BY THE ENGINEER. ALL SEDIMENT CONTROL PRACTICES SHALL BE INSPECTED BY THE END OF EACH WORK DAY, PRIOR TO EVERY WEEKEND, BEFORE AND AFTER EACH RAINFALL OF 0.5" OR GREATER WITHIN A 12 HOUR PERIOD, OR AS DIRECTED BY THE ENGINEER IN ORDER TO INSURE PROPER OPERATION.
11. WHERE EROSION CONTROL MATERIALS HAVE BEEN USED ON FINAL GRADE THAT HAVE BEEN PERMANENTLY SEEDED, THE CONTRACTOR SHALL CARE FOR THE AREAS UNTIL ACCEPTANCE OF THE CONTRACT OR ACCEPTANCE OF THE TURF, WHICHEVER IS LATER. WHERE NECESSARY, SUCH CARE MAY INCLUDE, BUT IS NOT LIMITED TO PROVIDING WARNING SIGNS OR BARRICADES FOR PROTECTION AGAINST TRAFFIC, ANY SURFACES THAT HAVE SETTLED, BECOME GULLIED, OR OTHERWISE DAMAGED SHALL BE REPAIRED AT NO ADDITIONAL EXPENSE TO THE CITY TO REESTABLISH THE GRADE AND SOIL CONDITIONS THAT EXISTED PRIOR TO PLACING EROSION CONTROL MATERIALS.
12. DUST CONTROL MUST BE PROVIDED AS DIRECTED.
13. CONTRACTOR SHALL INITIATE STABILIZATION MEASURES AS SOON AS PRACTICABLE ON STOCKPILES AND IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN 7 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. THIS REQUIREMENT DOES NOT APPLY IN THE FOLLOWING INSTANCES:

   A) WHERE THE INITIATION OF STABILIZATION MEASURES BY THE 7TH DAY AFTER CONSTRUCTION ACTIVITY TEMPORARILY OR PERMANENTLY CEASED IS PRECLUDED BY SNOW COVER OR FROZEN GROUND CONDITIONS, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE;

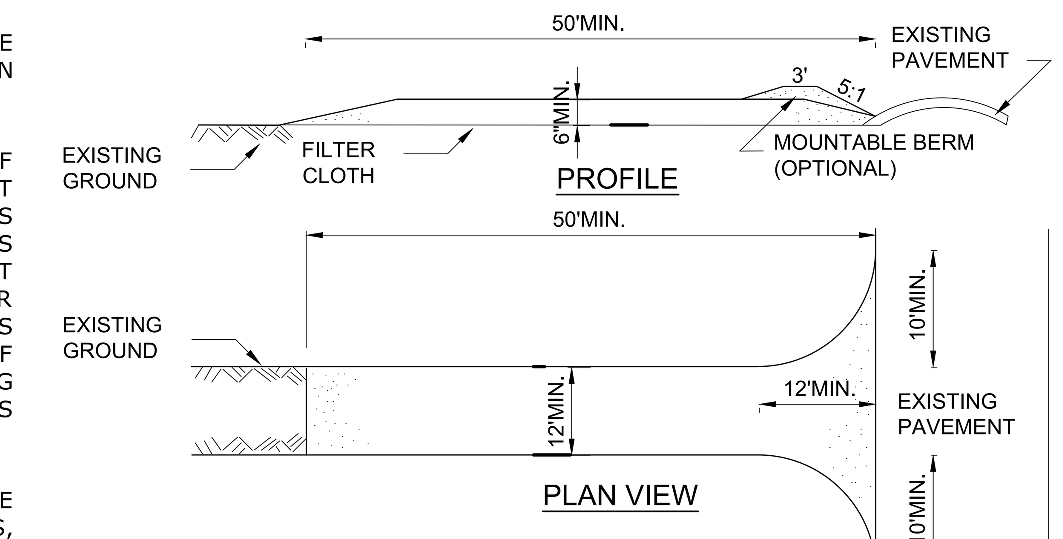
   B) WHERE CONSTRUCTION ACTIVITY ON A PORTION OF THE SITE IS TEMPORARILY CEASED, AND EARTH-DISTURBING ACTIVITIES WILL BE RESUMED WITHIN FOURTEEN (14) DAYS, TEMPORARY STABILIZATION MEASURES NEED NOT BE INITIATED ON THAT PORTION OF THE SITE.
14. ALL DISTURBED AREAS SHALL DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBANCE ACTIVITIES AND UNTIL FINAL STABILIZATION IS ACHIEVED. SEDIMENT-LADEN GROUNDWATER ENCOUNTERED DURING TRENCHING, BORING, OR OTHER ACTIVITIES SHALL BE PUMPED INTO A SEDIMENT TRAPPING DEVICE PRIOR TO BEING DISCHARGED INTO A STREAM, POND, SWALE, OR CATCH BASIN.
15. SOIL STOCKPILE AND LAYDOWN AREAS SHALL HAVE PERIMETER SEDIMENT CONTROL MEASURES AND TEMPORARY OR PERMANENT STABILIZATION MEASURES INSTALLED AS SOON AS POSSIBLE AND AT COMPLETION OF STOCKPILING AND LAYDOWN ACTIVITIES. STOCKPILE SIDE SLOPES SHALL NOT EXCEED 3H : 1V UNLESS APPROVED BY ENGINEER. TOP OF STOCKPILE SHALL BE GRADED WITH A MINIMUM 5% SLOPE TO INSURE PROPER DRAINAGE.
16. EARTHEN-MATERIAL STOCKPILES MUST BE LOCATED A MINIMUM OF 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES ARE AVAILABLE.
17. DEDICATED AREAS FOR DEMOLITION, CONSTRUCTION, AND OTHER WASTES MUST BE LOCATED A MINIMUM OF 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES ARE AVAILABLE.
18. STAGING AREA, STOCKPILES, AND OTHER STORAGE LOCATIONS SHALL BE PROTECTED FROM EROSION.
19. ALL DISTURBED SOIL AREAS SHALL BE FERTILIZED, SEEDED AND MULCHED IN ACCORDANCE WITH THE SPECIFICATIONS AND THE SEEDING SCHEDULE, AND RE-SEEDED AS NECESSARY, TO ESTABLISH AND MAINTAIN A VIGOROUS, DENSE VEGETATIVE COVER.
20. ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS SHALL BE PROTECTED TO PREVENT THE DEPOSITION OF MATERIALS ONTO TRAVERSED OFFSITE ROADWAYS. IF MATERIAL IS TRACKED ONTO OFFSITE ROADWAYS, IT SHALL BE REMOVED IMMEDIATELY. DO NOT UTILIZE A WATER HOSE TO CLEAN ROADS UNLESS THE RUNOFF IS DIRECTED TO A PROPERLY DESIGNED AND FUNCTIONING SEDIMENT CONTROL DEVICE. PROPER PRECAUTIONS SHALL BE TAKEN TO ENSURE THAT MATERIALS DEPOSITED ONTO OFFSITE ROADWAYS ARE REMOVED SO THAT THEY DO NOT ENTER YARD INLETS, CATCH BASINS, SEWERS, WETLANDS, SURFACE WATER BODIES, OR ROADSIDE SWALES. DO NOT UTILIZE A FIRE OR GARDEN HOSE TO CLEAN ROADS UNLESS THE RUNOFF IS DIRECTED TO A PROPERLY DESIGNED AND FUNCTIONING SEDIMENT CONTROL DEVICE. WATER PUMPED OUT OF THE EXCAVATED AREAS CONTAINS SEDIMENTS THAT MUST BE REMOVED PRIOR TO DISCHARGING TO RECEIVING BODIES OF WATER USING REMOVABLE PUMPING STATIONS, SUMP PITS, PORTABLE SEDIMENTATION TANKS AND/OR SILT CONTROL BAGS.
21. WHERE CONCRETE EQUIPMENT WASHING IS REQUIRED, THIS MUST BE DONE IN AN APPROVED "CONCRETE CONTAINMENT AREA". CONTRACTOR SHALL NOT DISCHARGE ANY CONCRETE WASHOUT WATER INTO SEWERS, SURFACE WATER BODIES OR ONTO THE GROUND. ALL WASHOUT WATER MUST BE REMOVED FROM THE SITE(S) DAILY.
22. SEEDING DATES: THE FOLLOWING SEEDING DATES ARE BEST RECOMMENDED TO ESTABLISH PERMANENT VEGETATIVE COVER WITHIN MOST LOCATIONS IN THE WESTCHESTER COUNTY SOIL AND WATER CONSERVATION DISTRICT: SPRING - 3/1-6/1 AND FALL - 9/1 - 10/15
23. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION, PERMITTING, AND OPERATION OF A DEWATERING SYSTEM AS REQUIRED FOR THE COMPLETION OF THE WORK. PROCEDURES FOR DEWATERING INCLUDING ASSOCIATED EROSION AND SEDIMENT CONTROL PROPOSED BY THE CONTRACTOR SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO ANY EARTHWORK OPERATIONS. ALL WATER REMOVED BY DEWATERING OPERATIONS SHALL BE DISPOSED OF IN ACCORDANCE WITH THE SOIL EROSION AND SEDIMENT CONTROL REQUIREMENTS SPECIFIED BY THE NYSDEC STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (NOVEMBER 2016). CONTRACTOR MAY USE PORTABLE SETTLING TANK, SEDIMENT FILTER BAG, OR OTHER APPROVED METHOD TO SETTLE DEWATERING FLOW OF SEDIMENT BEFORE DISCHARGE.
24. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL CONSTRUCTION IS COMPLETE, PERMANENT VEGETATION IS ESTABLISHED ON ALL DISTURBED AREAS, AND LOCAL AUTHORITIES HAVE GIVEN PERMISSION FOR REMOVAL. ONCE FINAL STABILIZATION IS COMPLETE, REMOVE EROSION AND SEDIMENT CONTROL MEASURES AND PERFORM FINAL SITE RESTORATION.
25. IF INSPECTIONS BY THE ENGINEER OR THE TOWN/VILLAGE OF HARRISON'S DPW INSPECTOR OR ENGINEER FIND FAILURE(S) BY THE CONTRACTOR TO COMPLY, THE ENTIRE PROJECT WILL BE STOPPED WITH NO COMPENSATION TO THE CONTRACTOR UNTIL ALL FINDINGS HAVE BEEN IDENTIFIED, ADDRESSED AND COMPLETED BY THE CONTRACTOR.
26. IF DIRECTED, THE CONTRACTOR SHALL PROVIDE TO THE ENGINEER WEEKLY COPIES OF A REPORT FOR HIS INSPECTION, FINDINGS AND ACTIONS TAKEN.

SITE RESTORATION REQUIREMENTS

TYPE OF SOIL DISTURBANCE	SOIL RESTORATION REQUIREMENT		COMMENTS / EXAMPLES
NO SOIL DISTURBANCE	RESTORATION NOT PERMITTED		PRESERVATION OF NATURAL FEATURES
MINIMAL SOIL DISTURBANCE	RESTORATION NOT PERMITTED		CLEARING AND GRUBBING
AREAS WHERE TOPSOIL IS STRIPPED ONLY - NO CHANGE IN GRADE	HSG A & B	HSG C & D	PROTECT AREA FROM ANY ONGOING CONSTRUCTION ACTIVITIES
	APPLY 6 INCHES OF TOPSOIL	AERATE* AND APPLY 6 INCHES OF TOPSOIL	
AREAS OF CUT OR FILL	HSG A & B	HSG C & D	
	AERATE* AND APPLY 6 INCHES OF TOPSOIL	APPLY FULL SOIL RESTORATION**	
HEAVY TRAFFIC AREAS ON SITE (ESPECIALLY IN ZONE 5-25 FEET AROUND BUILDINGS BUT NOT WITHIN 5 FOOT PERIMETER AROUND FOUNDATION WALLS	APPLY FULL SOIL RESTORATION (DECOMPACTION AND COMPOST ENHANCEMENT)		
AREAS WHERE RUNOFF REDUCTION AND/OR INFILTRATION PRACTICES ARE APPLIED	RESTORATION NOT REQUIRED, BY MAY BE APPLIED TO ENHANCE THE REDUCTION SPECIFIED FOR APPROPRIATE PRACTICES		KEEP CONSTRUCTION EQUIPMENT FROM CROSSING THESE AREAS. TO PROTECT NEWLY INSTALLED PRACTICE FROM ANY ONGOING CONSTRUCTION ACTIVITIES CONSTRUCT A SINGLE PHASE OPERATION FENCE AREA
REDEVELOPMENT PROJECTS	SOIL RESTORATION IS REQUIRED ON REDEVELOPMENT PROJECTS IN AREAS WHERE EXISTING IMPERVIOUS AREA WILL BE CONVERTED TO PERVIOUS AREA		

* AERATION INCLUDES THE USE OF MACHINES SUCH AS TRACTOR-DRAWN IMPLEMENTS WITH COULTERS MAKING A NARROW SLIT IN THE SOIL, A ROLLER WITH MANY SPIKES MAKING INDENTATIONS IN THE SOIL, OR PRONGS WHICH FUNCTION LIKE A MINI-SUBSOILER.

** PER "DEEP RIPPING AND DE-COMPACTION, DEC 2008".

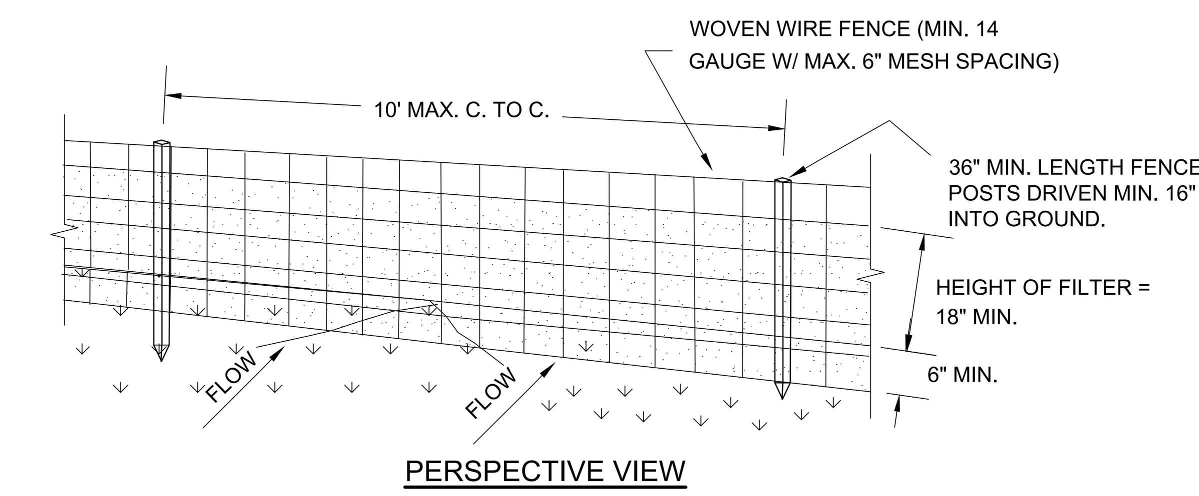


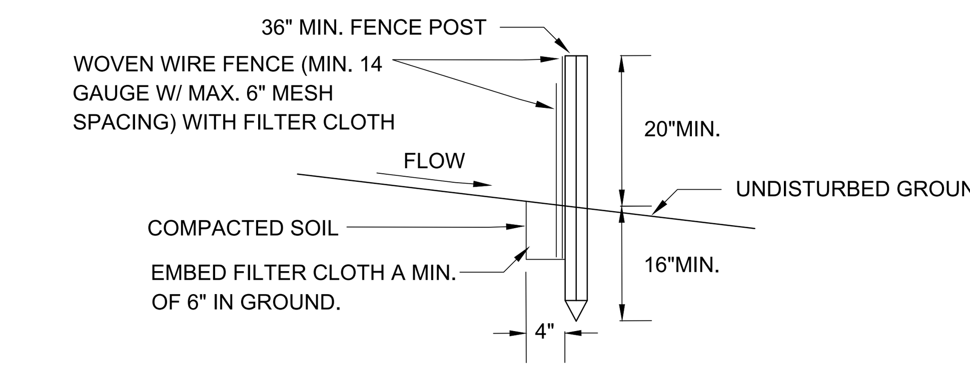
CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 1-4 INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ACCESS SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ACCESS

NTS



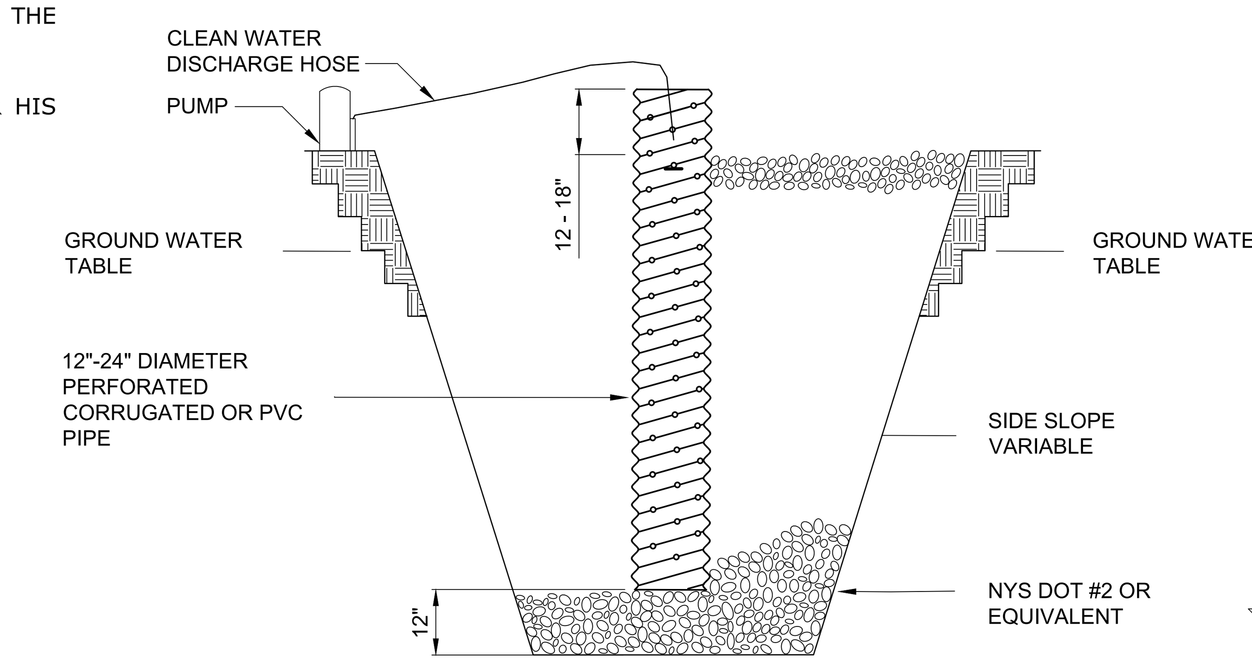


CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL MEET THE MINIMUM REQUIREMENTS SHOWN.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

REINFORCED SILT FENCE

NTS

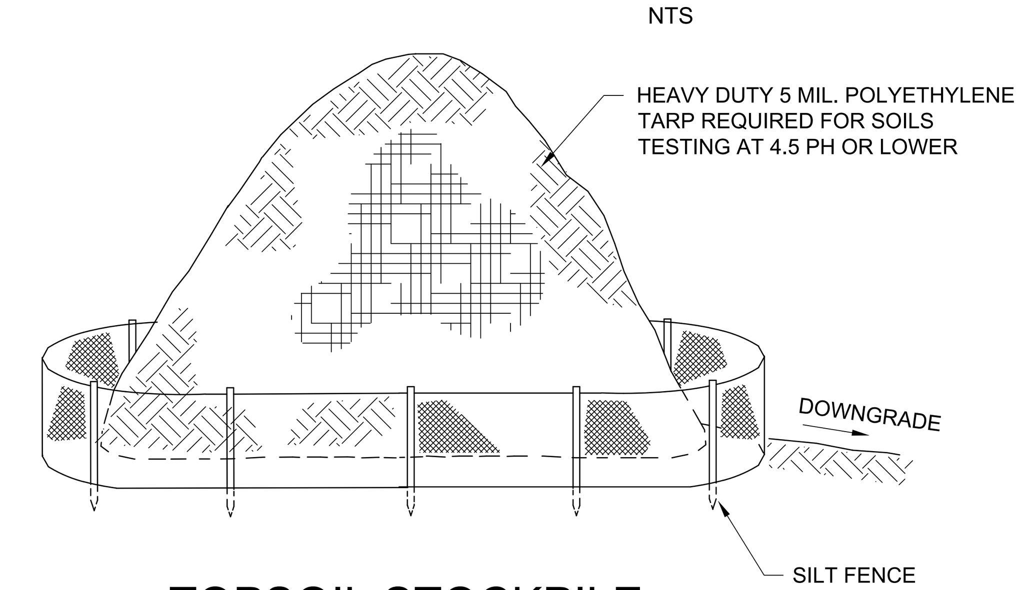


CONSTRUCTION SPECIFICATIONS

1. PIT DIMENSIONS ARE VARIABLE.
2. THE STANDPIPE SHOULD BE CONSTRUCTED BY PERFORATING A 12-24" DIAMETER CORRUGATED OR PVC PIPE.
3. A BASE OF NYS DOT #2 OR EQUIVALENT AGGREGATE SHOULD BE PLACED IN THE PIT TO A DEPTH OF 12". AFTER INSTALLING THE STANDPIPE, THE PIT SURROUNDING THE STANDPIPE SHOULD BE BACKFILLED WITH NYS DOT #2 OR EQUIVALENT AGGREGATE.
4. THE STANDPIPE SHOULD EXTEND 12-18" ABOVE THE LIP OF THE PIT.
5. IF DISCHARGE WILL BE PUMPED DIRECTLY TO A STORM DRAINAGE SYSTEM, THE STANDPIPE SHOULD BE WRAPPED WITH FILTERCLOTH BEFORE INSTALLATION. IT IS RECOMMENDED THAT 1/4"-1/2" HARDWARE CLOTH MAY BE PLACED AROUND THE STANDPIPE, PRIOR TO ATTACHING THE FILTERCLOTH.

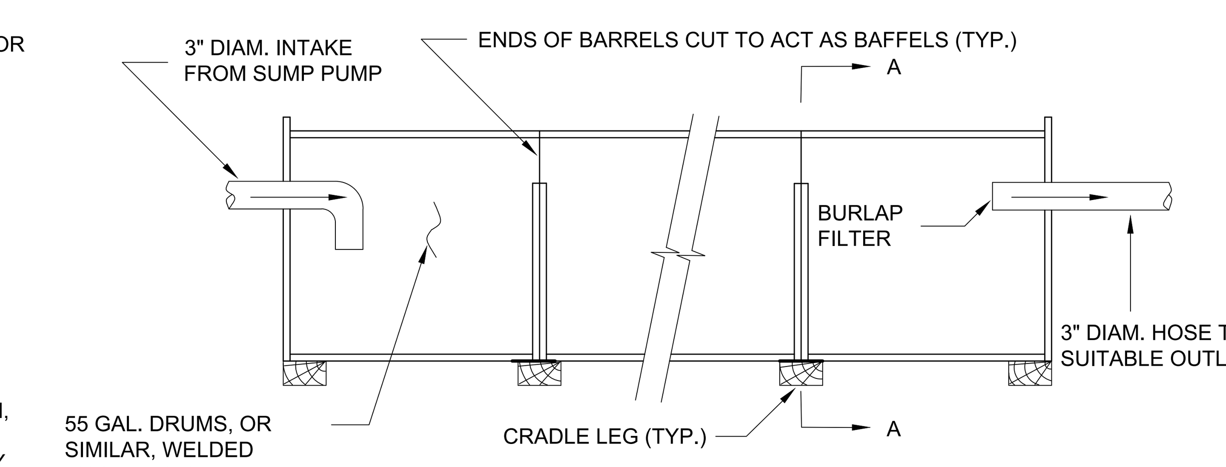
DEWATERING SUMP PIT

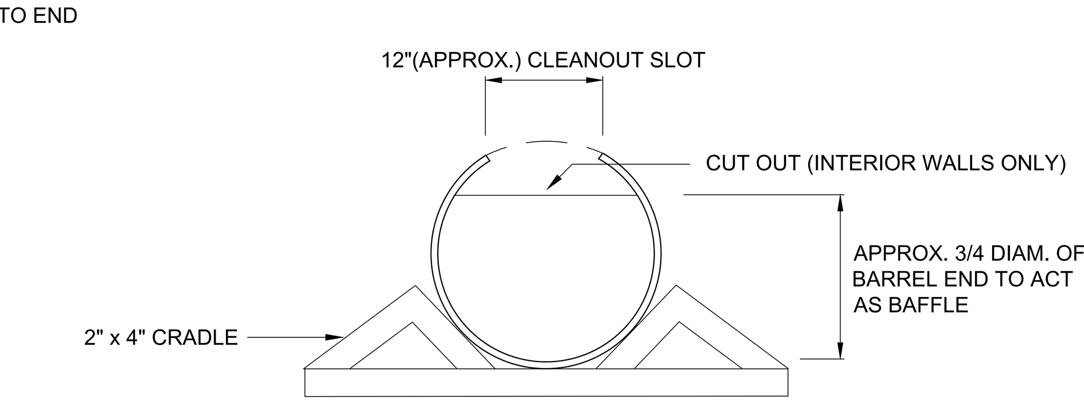
NTS



TOPSOIL STOCKPILE

NTS





CONSTRUCTION SPECIFICATIONS

1. CLEAN OUT THE SEDIMENT TANK WHEN ONE THIRD (1/3) FILLED WITH SILT.
2. STEEL DRUMS ARE USED AS AN EXAMPLE DUE TO THEIR READY AVAILABILITY. ANY TANKS MAY BE USED, PROVIDING THAT THE VOLUME REQUIREMENTS ARE MET.
3. ALL SEDIMENT COLLECTED IN THE TANK SHALL BE DISPOSED OF IN A SEDIMENT TRAPPING DEVICE OR AS APPROVED BY THE INSPECTOR.

PORTABLE SEDIMENT TANK

NTS

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EROSION AND SEDIMENT CONTROL NOTES

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-301

File: C:\BMS\HAZEN-PW\D0193283\C-301 Saved by JPERRUZZA Save date: 7/19/2022 2:36 PM
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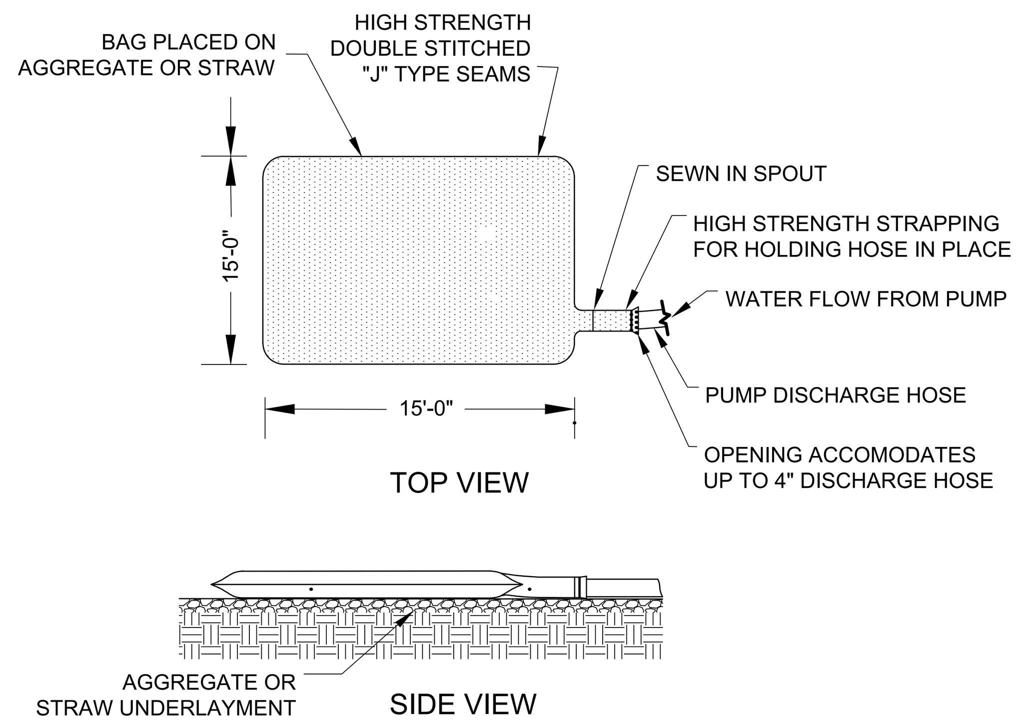

NOTES:
1. SILT CONTROL SYSTEM TO BE USED IN CONJUNCTION WITH PUMP AROUND IF DEEMED NECESSARY BY SEDIMENT CONTROL INSPECTOR TO TREAT ANY SEDIMENT-LADEN WATER WITHIN THE DRY WORK AREA.
2. GEOTEXTILE FILTER BAG SHALL BE PLACED AT LEAST 50 FT FROM ALL WETLANDS, STREAMS, OR OTHER SURFACE WATERS.

DEWATERING/FILTER BAG MATERIALS SPECIFICATIONS:

THE DEWATERING/FILTER BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MINIMUM SURFACE AREA OF 225 SQUARE FEET PER SIDE. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD. THE SEAM STRENGTH SHALL WITHSTAND 100LB/IN USING ASTM D-4884 TEST METHOD. THE DEWATERING/FILTER BAG SHALL HAVE A NOZZLE LARGE ENOUGH TO ACCOMMODATE A FOUR INCH DISCHARGE HOSE. THE NOZZLE SHALL BE SEALED TIGHTLY AROUND THE DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE TO PREVENT UNTREATED WATER FROM ESCAPING. THE GEOTEXTILE FABRIC SHALL BE A NON-WOVEN FABRIC WITH THE FOLLOWING PROPERTIES:

WEIGHT	ASTM D-3776	10 OZ/YD
GRAB TENSILE	ASTM D-4632	270 LBS
PUNCTURE	ASTM D-4833	150 LBS
FLOW RATE	ASTM D-4491	70 GAL/MIN/SQ FT
PERMITIVITY	ASTM D-4991	1/1.3 SEC
UV RESISTANCE	ASTM D-4355	70%
AOS % RETAINED	ASTM D-4751	100

CONSTRUCTION:

THE DEWATERING/FILTER BAG SHALL BE INSTALLED OVER A 3 INCH GRAVEL BASE OR A STRAW BALE BASE TO PROMOTE INFILTRATION AND DEWATERING OF THE FILTER BAG.

GEOTEXTILE FILTER BAG

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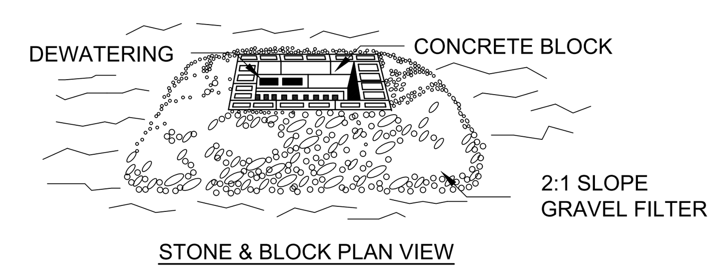
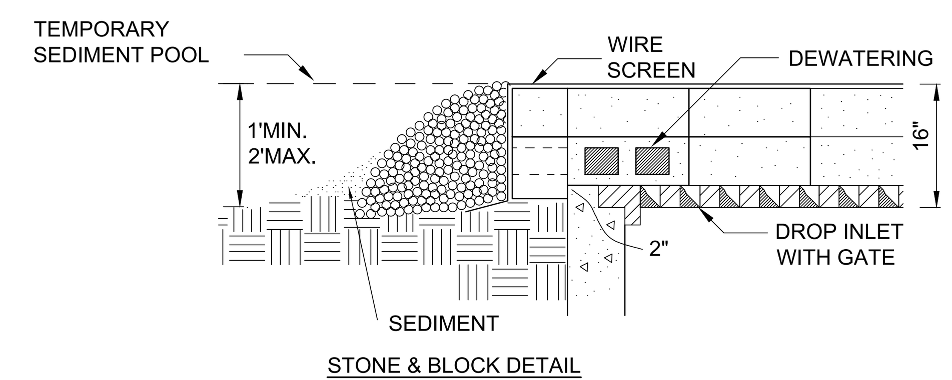


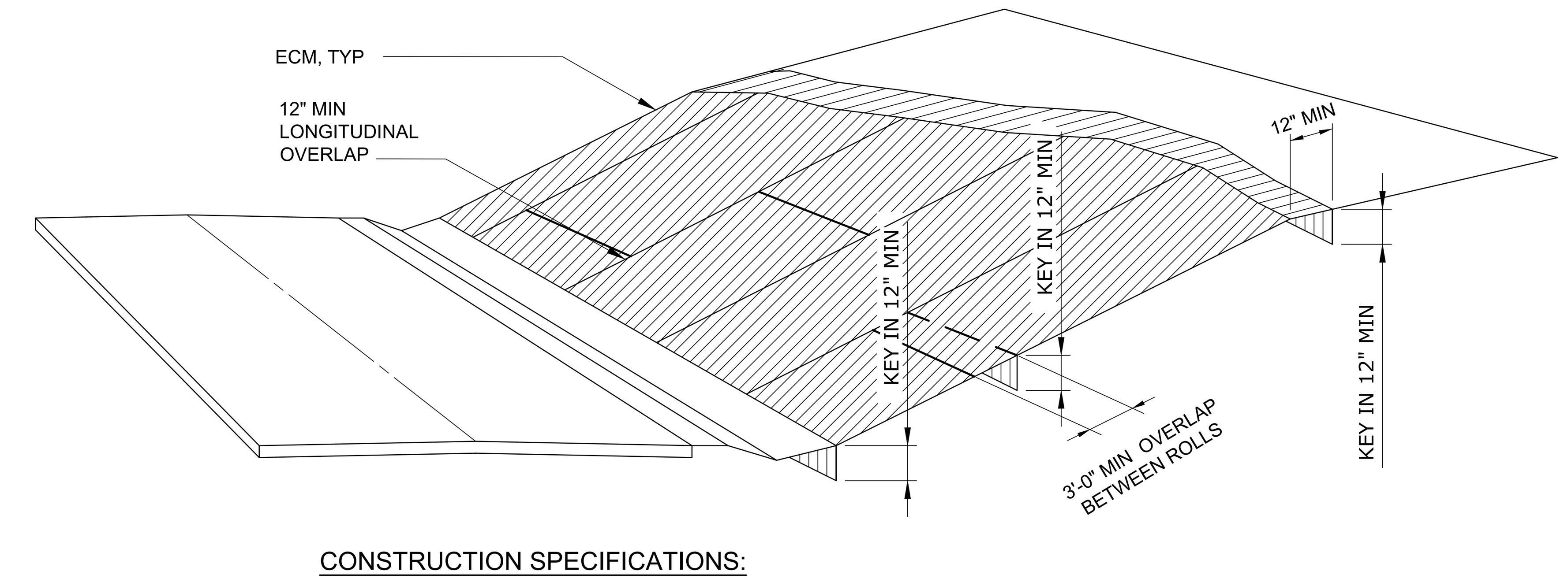


CONSTRUCTION SPECIFICATIONS

1. LAY ONE BLOCK ON EACH SIDE OF THE STRUCTURE ON ITS SIDE FOR DEWATERING. FOUNDATION SHALL BE 2 INCHES MINIMUM BELOW REST OF INLET AND BLOCKS SHALL BE PLACED AGAINST INLET FOR SUPPORT.
2. HARDWARE CLOTH OR 1/2" WIRE MESH SHALL BE PLACED OVER BLOCK OPENINGS TO SUPPORT STONE.
3. USE CLEAN STONE OR GRAVEL 1/2-3/4 INCH IN DIAMETER PLACED 2 INCHES BELOW TOP OF THE BLOCK ON A 2:1 SLOPE OR FLATTER.
4. FOR STONE STRUCTURES ONLY, A 1 FOOT THICK LAYER OF THE FILTER STONE WILL BE PLACED AGAINST THE 3 INCH STONE AS SHOWN ON THE DRAWINGS.
5. MAXIMUM DRAINAGE AREA 1 ACRE.
6. INSERTS SHALL PROVIDE A MINIMUM OF 50-PERCENT OF THE OPENING. UNOBSTRUCTED DESIGN FLOW AREA OF THE STORM DRAIN INLET OPENING.

STONE & BLOCK DROP INLET PROTECTION

NTS

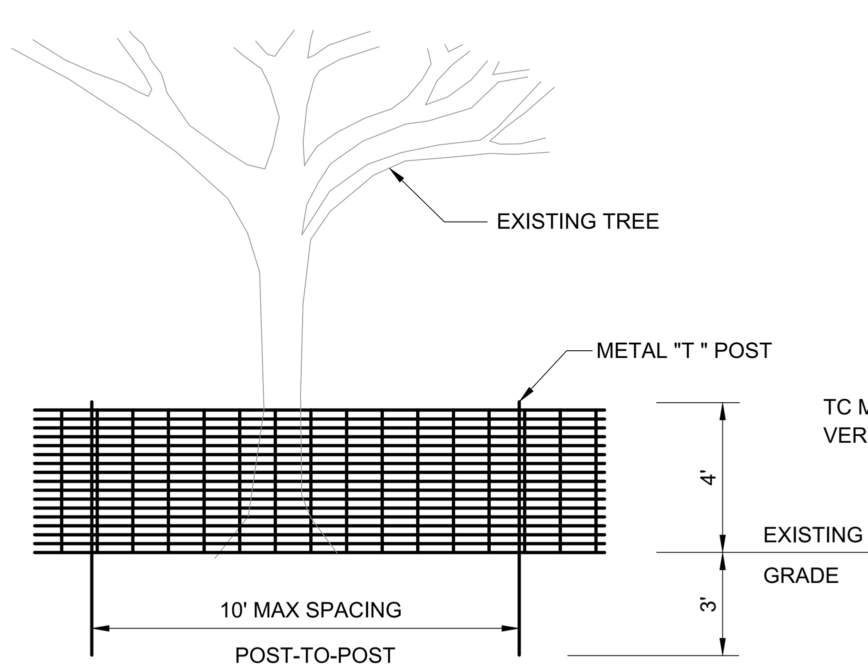


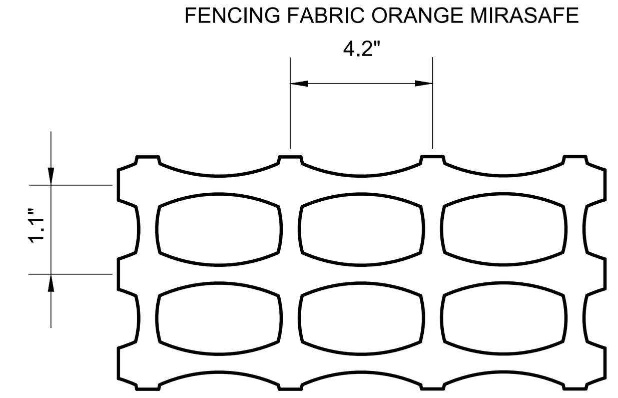
CONSTRUCTION SPECIFICATIONS:

1. BEGIN AT TOP OF SLOPE AND ANCHOR FIBER MATTING IN A 12 INCH DEEP INITIAL ANCHOR TRENCH. BACKFILL TRENCH AND TAMP EARTH FIRMLY.
2. UNROLL FIBER MATTING DOWNSLOPE IN THE DIRECTION OF WATER FLOW.
3. OVERLAP EDGES OF ADJACENT PARALLEL ROLLS A MINIMUM 12 INCHES AND ANCHOR AT 12 INCHES O.C.
4. WHEN FIBER MAT MUST BE SPLICED, PLACE END OVER END (SHINGLE STYLE) WITH 12 INCH OVERLAP AND ANCHOR USING TWO STAGGERED ROWS OF STAKES AT 6 INCHES O.C.
5. LAY FIBER MAT LOOSELY AND ANCHOR SUFFICIENTLY TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
6. FOR SLOPES 2:1 AND STEEPER, USE A MINIMUM 3 STAKES PER SQUARE YARD AND FOR SLOPES FLATTER THAN 2:1, USE A MINIMUM OF 2 STAKES PER SQUARE YARD.
7. ANCHOR, FILL, AND COMPACT END OF FIBER MATTING IN A 12X6 INCH TERMINAL ANCHOR TRENCH (MIRROR IMAGE OF EXISTING TRENCH).

EROSION CONTROL MATTING

NTS

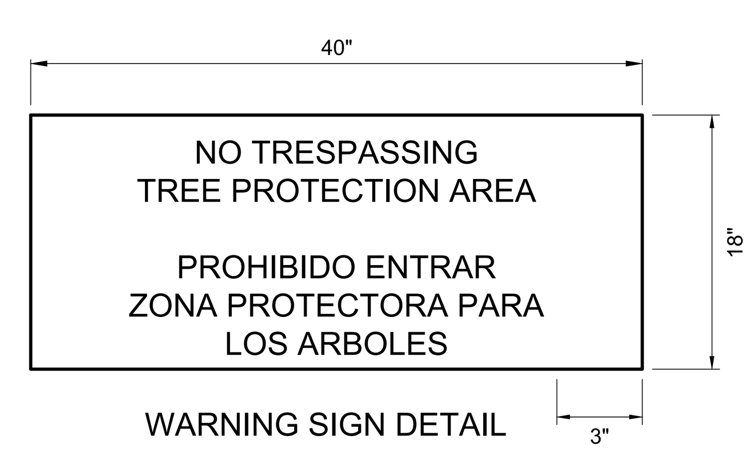




TC MIRAFI MIRASAFE OR AN APPROVED EQUAL. STAPLE TO VERTICAL 2X4 OR TIE TO METAL "T" POSTS.

MAINTENANCE REQUIREMENTS:
1. INSPECT WEEKLY AND AFTER EACH RAINFALL PRODUCING 1/2 INCH OR MORE OF RAIN.
2. REPAIR OR RELACE DAMAGED FENCING IMMEDIATELY.
3. REPLACE ANY DAMAGED SIGNAGE IMMEDIATELY AS NEEDED.

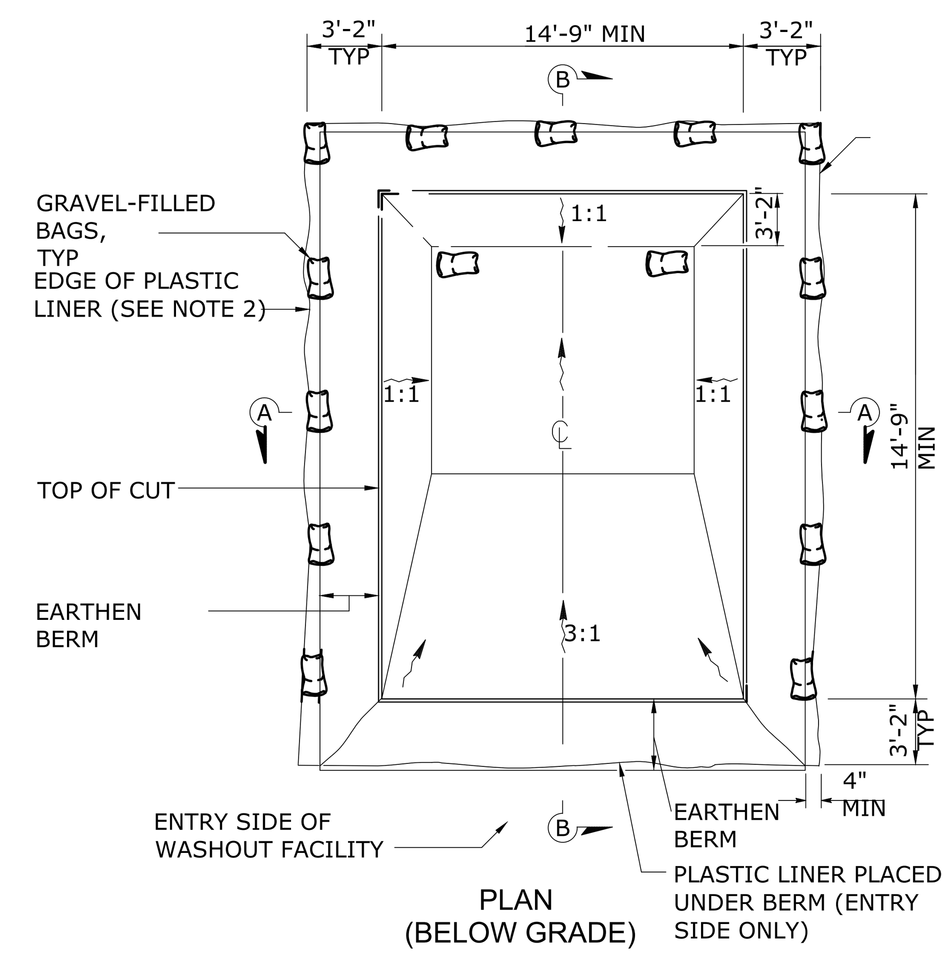
NOTES:
1. PLACE CONTINUOUS RUN OF FENCE MATERIAL ON BOTH SIDES OF IMMEDIATE WORK ZONE IN WOODED AREAS AS SHOWN ON THE PLANS. DO NOT ATTACH FENCE MATERIAL TO TREES.
2. TREE PROTECTION FENCING FABRIC TO BE PLACED AT THE DRIP LINE OF THE TREES THAT ARE TO BE PROTECTED.
3. "MIRASAFE" HIGH STRENGTH POLYMER GEOGRID FABRIC BY MIRAFI CONSTRUCTION PRODUCTS, PENDERGRASS, GEORGIA. FENCE MATERIAL TO BE WARNING AND BARRIER FENCE AS PER SPECIFICATION 31 10 00.
4. ONE SIGN PER 300' OF TREE PROTECTION FENCING SHALL READ, AS SHOWN TO THE RIGHT.



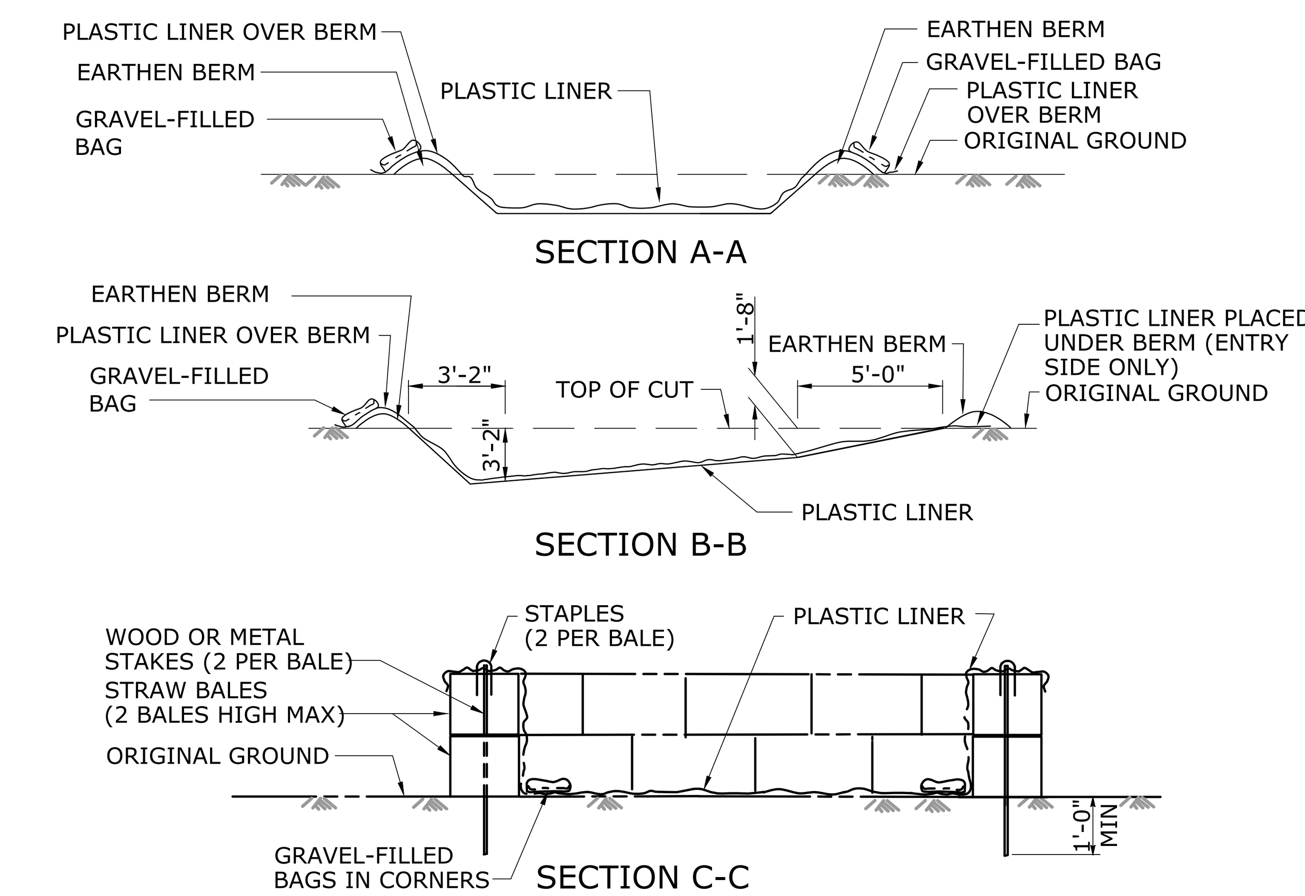
WARNING SIGN DETAIL

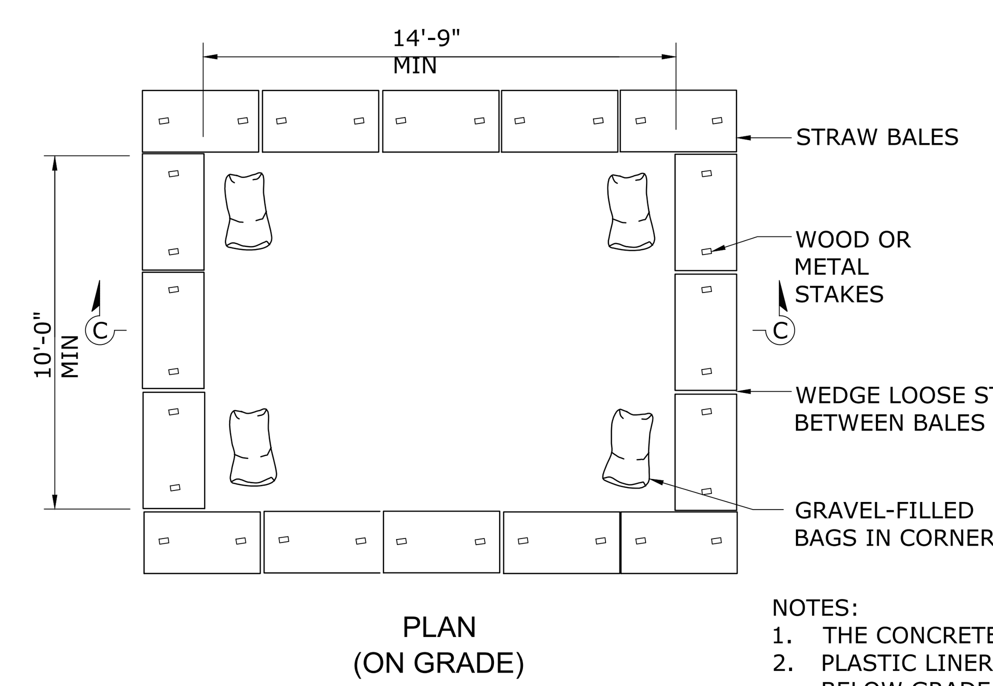
TREE PROTECTION BARRIER FENCE

NTS

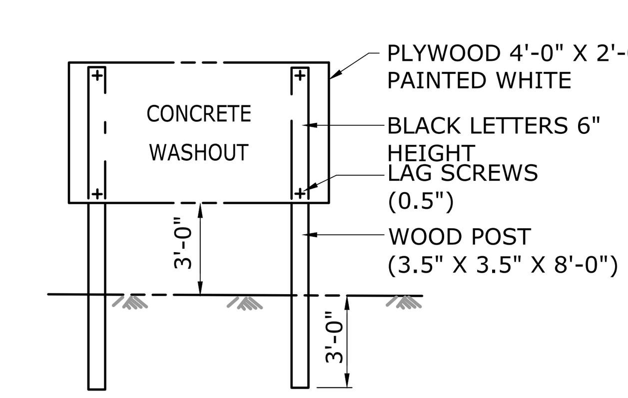


PLAN (BELOW GRADE)

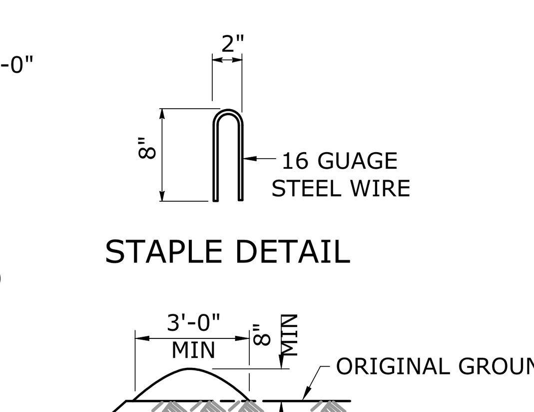




PLAN (ON GRADE)



CONCRETE WASHOUT SIGN DETAIL



TYPICAL SECTION EARTHEN BERM

NOTES:
1. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 32'-10" OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
2. PLASTIC LINER SHALL HAVE A MINIMUM THICKNESS OF 10MIL AND SHALL BE ANCHORED WITH GRAVEL-FILLED BAGS FOR BELOW GRADE CONCRETE WASHOUT FACILITY.
3. CONCRETE WASHOUT SHALL BE LOCATED A MINIMUM OF 100-FEET FROM DRAINAGE SWALES, STORM DRAIN INLETS, WETLANDS, STREAMS, AND OTHER SURFACE WATERS

CONCRETE WASHOUT

NTS

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EROSION AND SEDIMENT CONTROL DETAILS

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-302

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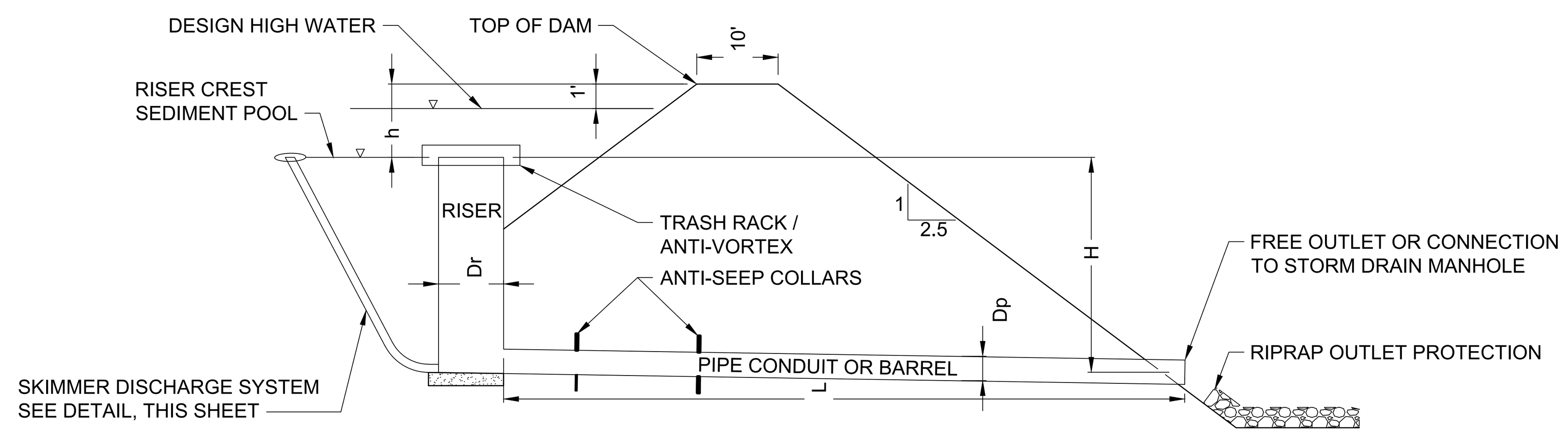
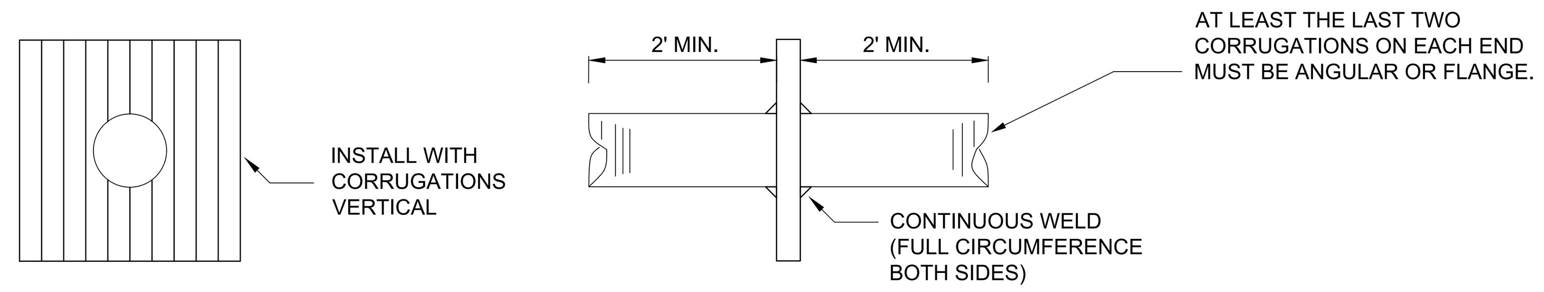


BASIN ID	BOTTOM OF BASIN ELEVATION	TOP OF DAM ELEVATION	TOP OF SEDIMENT STORAGE ZONE ELEVATION	TOP OF DEWATERING ZONE, RISER CREST ELEVATION	H (FT)	h (FT)	L (FT)	Dp (IN)	Dr (IN)
1	394.00	399.35	395.00	398.00	10.28	1.35	60.00	15.00	72.00
2	393.00	399.00	394.00	397.00	8.97	2.00	21.00	24.00	48.00

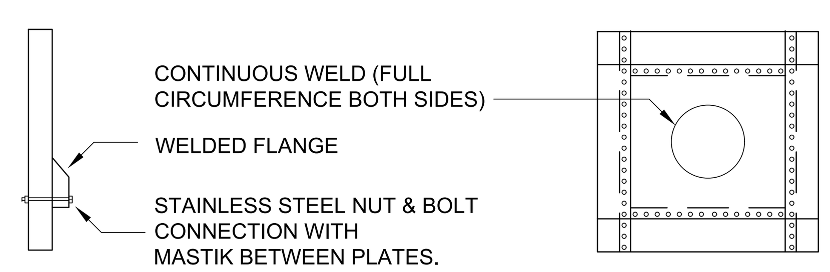
SEDIMENT BASIN PIPE SPILLWAY

NTS

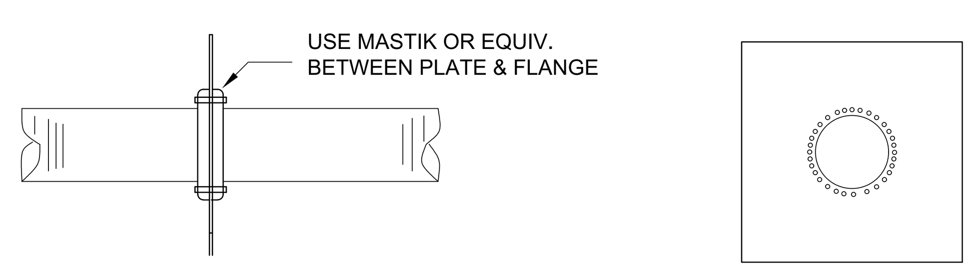


COLLAR WELDED IN PLACE ON BARREL SECTION

1. PLATES TO BE PRE-CUT CLAMPED TOGETHER & PRE-DRILLED & LABELED TO FACILITATE WATER TIGHT FIELD ASSEMBLY.



MULTI-PIECE COLLAR FOR LARGE PIPES

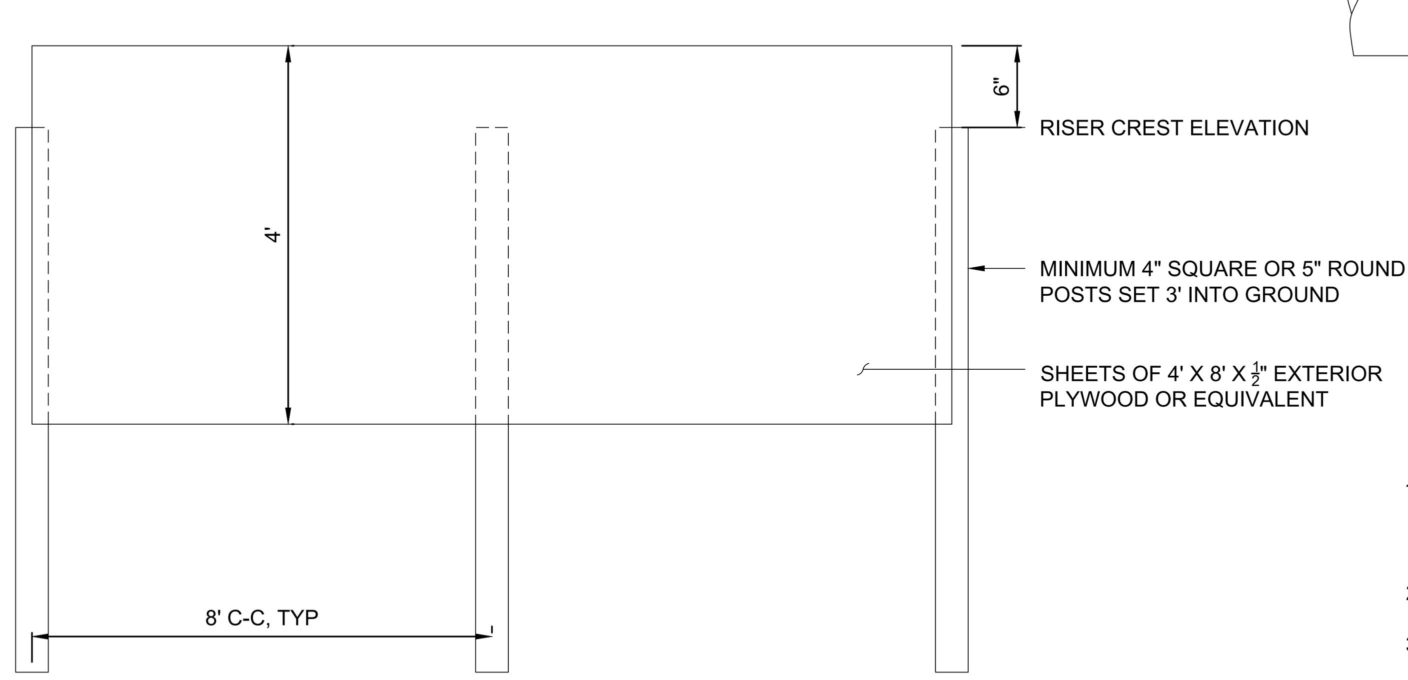


COLLAR FOR FLANGE JOINT PIPE

BASIN ID	# OF COLLARS	COLLAR SIZE (FT x FT)	COLLAR PROJECTION (FT)
1	4.00	3.33 x 3.33	1.10
2	4.00	3.33 x 3.33	1.10

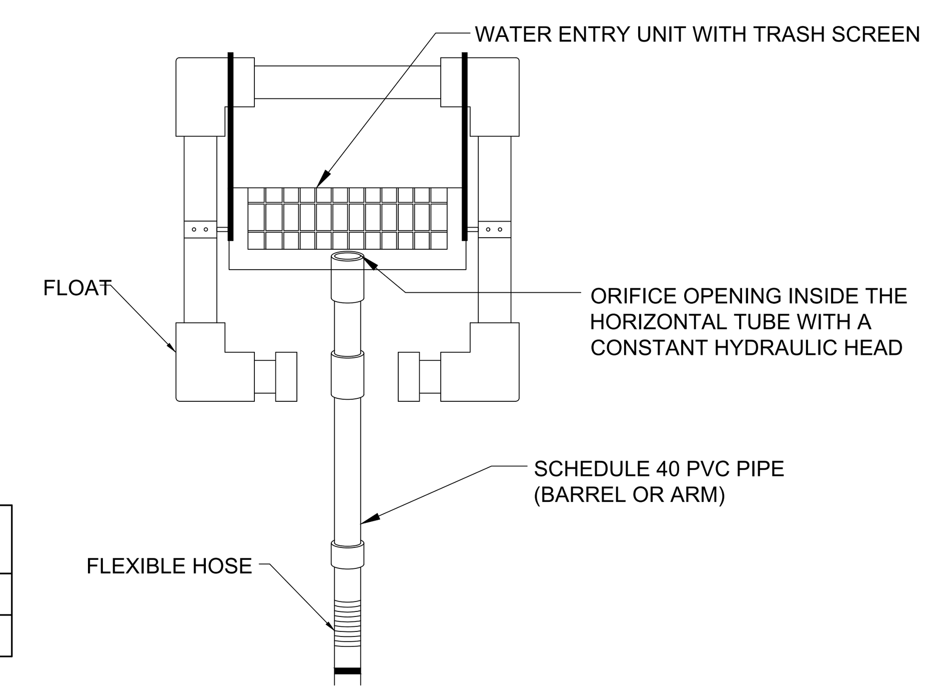
ANTI SEEP COLLAR

NTS

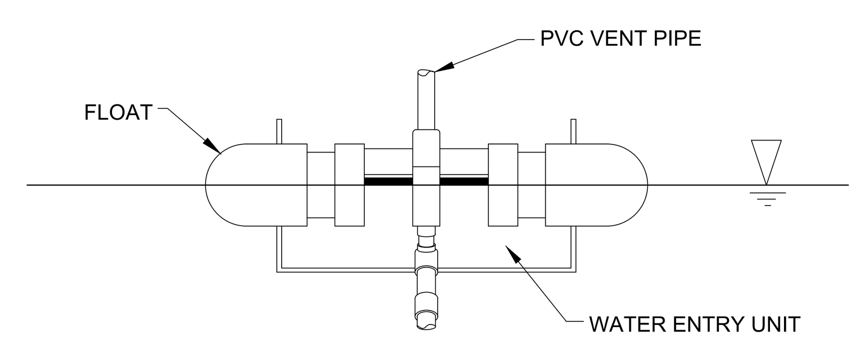


SEDIMENT BASIN BAFFLE

NTS



SKIMMER PLAN VIEW



SKIMMER PROFILE VIEW

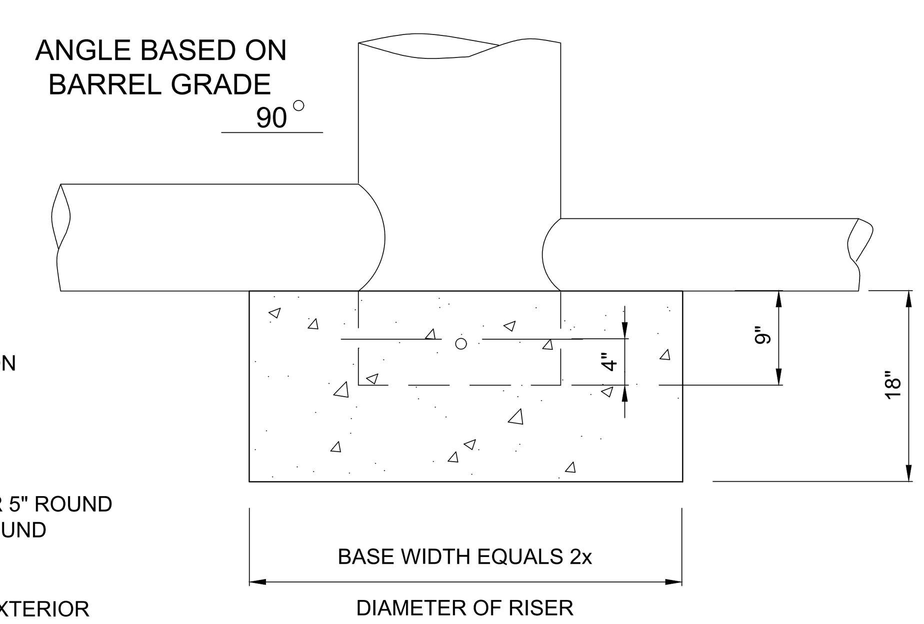
CONSTRUCTION NOTES

1. PIPE FLOTATION SECTION SHALL BE SOLVENT WELDED TO ENSURE AN AIRTIGHT ASSEMBLY. THE CONTRACTOR IS REQUIRED TO CONDUCT A TEST TO CHECK FOR LEAKS PRIOR TO INSTALLATION.
2. SKIMMER SECTION SHALL HAVE 12 ROW OF ½" DIAMETER HOLES, 1 ¼" ON CENTER. IF ADDITIONAL FILTRATION IS NECESSARY, THE FILTERING MEDIA SHALL CONSIST OF A TYPE GD-II GEOTEXTILE FABRIC WRAPPED AROUND THE PERFORATED PORTION OF THE SKIMMER AND ATTACHED WITH PLASTIC SNAP TIES, BANDS, ETC.
3. FLEXIBLE PIPE SHALL BE INSERTED INTO SOLID PIPE AND FASTENED WITH 2 #8 WOOD SCREWS.
4. AT A MINIMUM, THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED. IF VANDALISM IS A PROBLEM, MORE FREQUENT INSPECTION MAY BE NECESSARY.
5. CONSTRUCTION OPERATION SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION ARE MINIMIZED.
6. THE STRUCTURE SHALL ONLY BE REMOVED WHEN THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

BASIN ID	WATER SURFACE ELEVATION	ARM LENGTH (FT)	ARM DIAMETER (IN)	ORIFICE SIZE (IN)	TOP OF LANDING DEVICE ELEVATION	FLEXIBLE HOSE LENGTH (IN)	FLEXIBLE HOSE ATTACHMENT ELEVATION
1	398.35	12.00	3.00	3.00	395.00	72.00	394.00
2	397	13.00	3.00	3.00	394.00	72.00	393.00

SKIMMER DISCHARGE SYSTEM

NTS

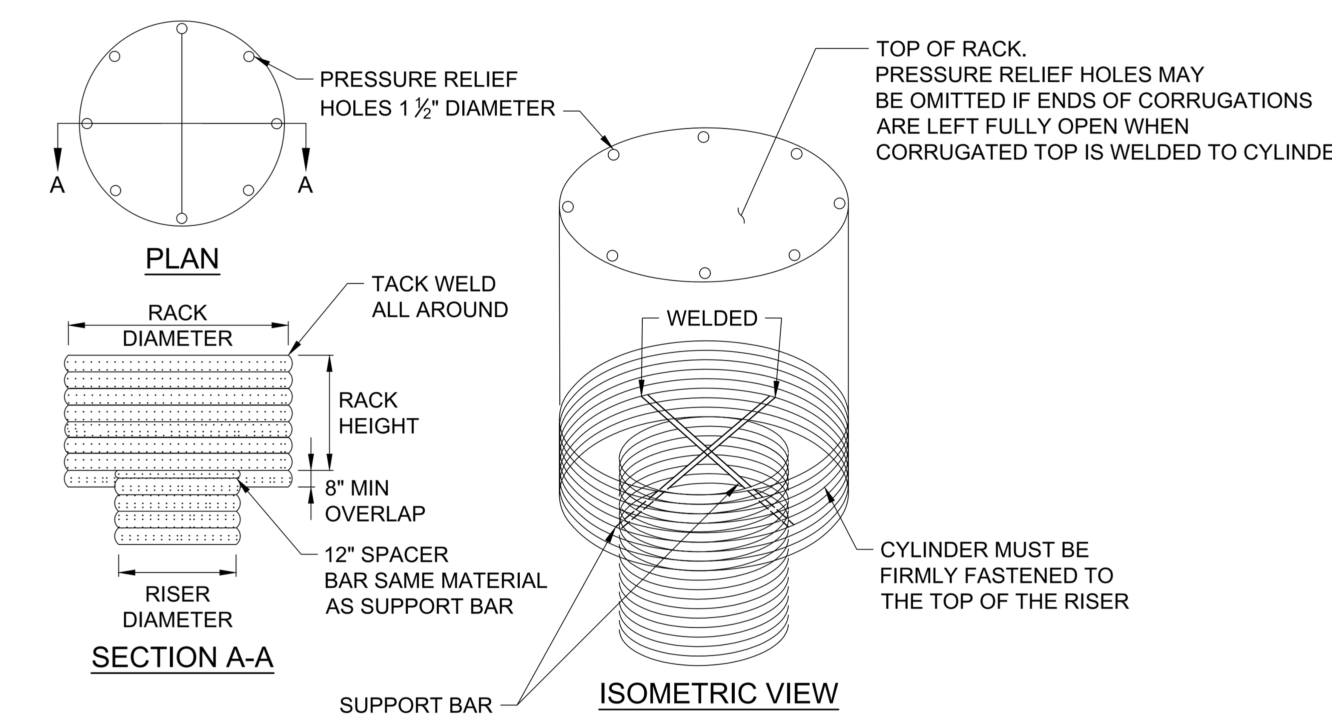


CONSTRUCTION NOTES

1. THE CONCRETE BASE SHALL BE POURED IN SUCH A MANNER TO INSURE THAT THE CONCRETE FILLS THE BOTTOM OF THE RISER TO THE INVERT OF THE OUTLET PIPE TO PREVENT THE RISER FROM BREAKING AWAY FROM THE BASE.
2. WITH ALUMINUM OR ALUMINIZED PIPE, THE EMBEDDED SECTION MUST BE PAINTED WITH CHROMATE OR EQUIVALENT.
3. RISER BASE MAY BE SIZED AS COMPUTED USING FLOATATION WITH A FACTOR OF SAFETY OF 1.2.

RISER BASE SEDIMENT BASIN DETAIL

NTS



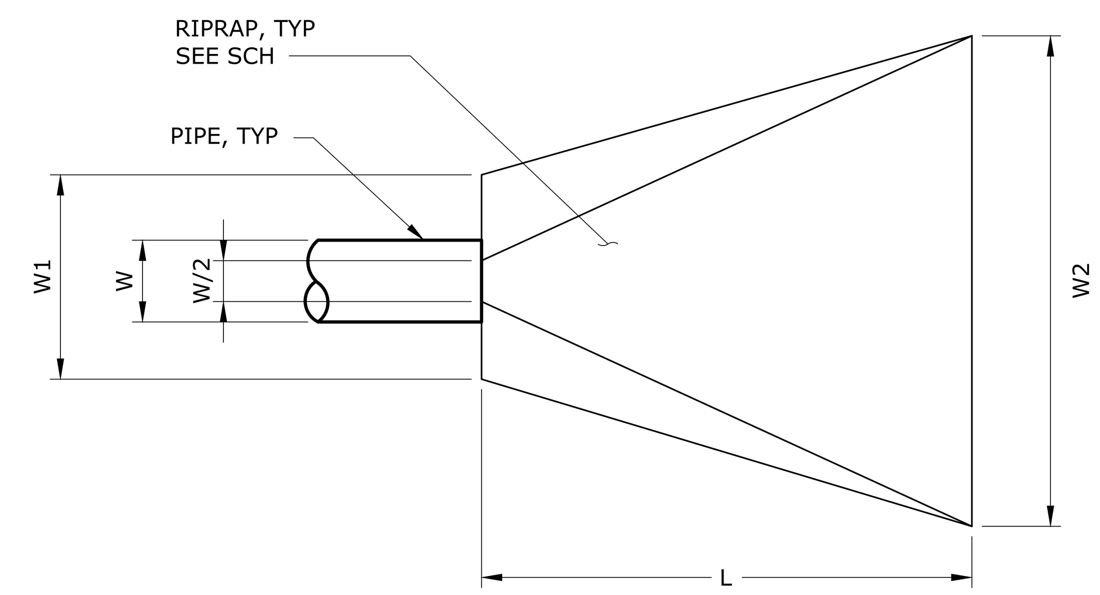
CONSTRUCTION NOTES

1. THE CYLINDER MUST BE FIRMLY FASTENED TO THE TOP OF THE RISER.
2. SUPPORT BARS ARE WELDED TO THE TOP OF THE RISER OR ATTACHED BY STRAPS BOLTED TO TOP OF RISER.

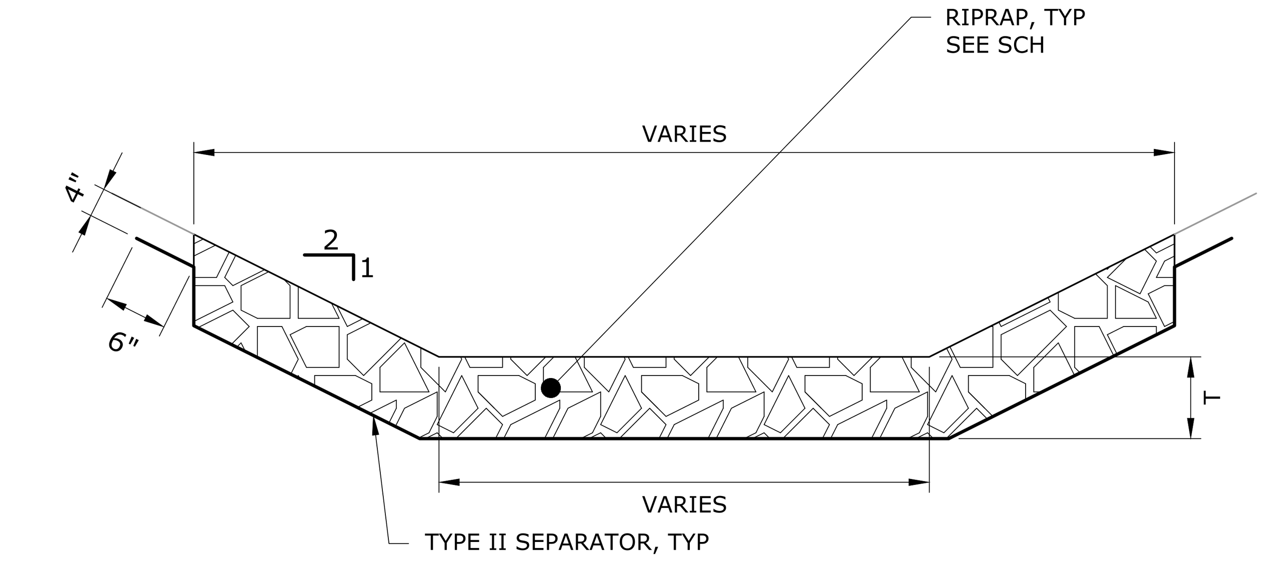
BASIN ID	RISER DIAMETER (IN)	RACK DIAMETER (IN)	RACK HEIGHT (IN)	THICKNESS GAGE	MINIMUM SUPPORT SIZE SUPPORT BAR	MINIMUM TOP	
						THICKNESS	STIFFENER
1	72	102	36	10	2" PIPE OR 2 x 2 x 3/16 ANGLE W/ STIFFENER	8 ga.	2 x 2 x ¼ ANGLE
2	48	72	21	12	1-¼" PIPE OR 1-¼ x 1-¼ x ¼ ANGLE	10 ga.	-

CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE DETAIL

NTS



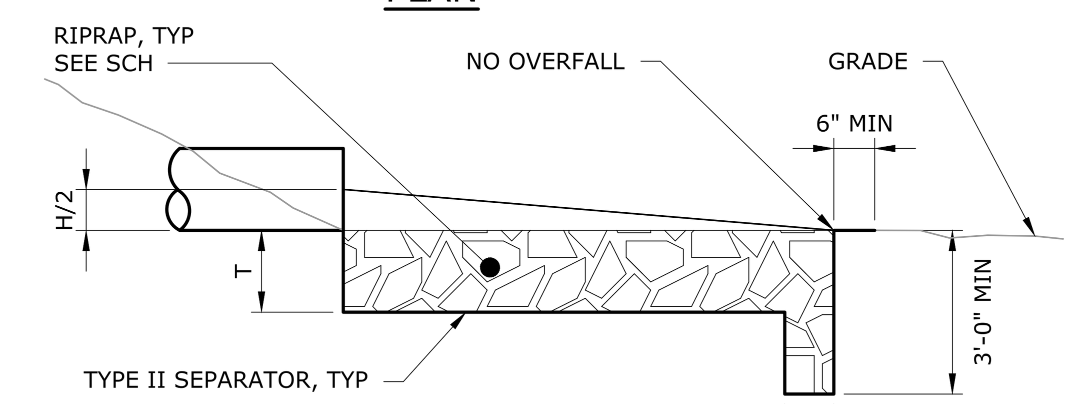
PLAN



CROSS-SECTION

NOTES:

1. DETAIL AND SCHEDULE PROVIDE MINIMUM DIMENSIONS. SEE CONTRACT DWGS FOR LOCATIONS, EXTENTS, AND SHAPE OF RIPRAP OUTLET PROTECTION.
2. RIPRAP SHALL BE COMPOSED OF A WELL-GRADED MIXTURE OF ROCK SIZE SO THAT 50 PERCENT OF THE PIECES, BY WEIGHT SHALL BE LARGER THAN THE D50 SIZE. WELL-GRADED MIXTURE IS DEFINED AS A MIXTURE COMPOSED OF PRIMARILY LARGER ROCK SIZES, BUT WITH SUFFICIENT MIXTURE OF OTHER SIZES TO FILL THE SMALLER VOIDS BETWEEN THE ROCKS.



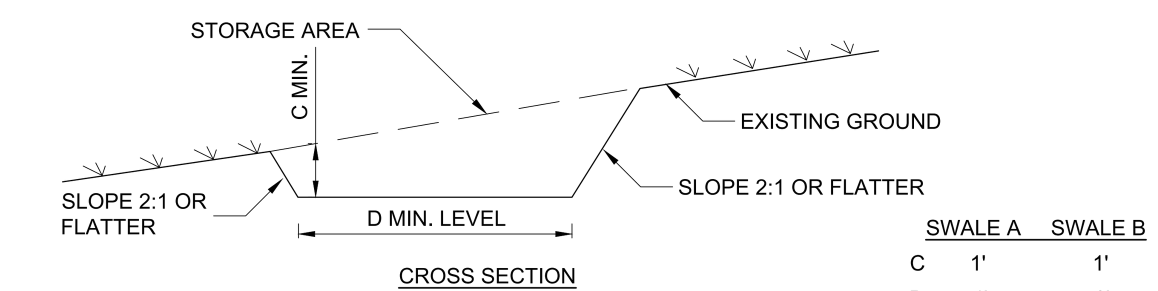
PROFILE

SCHEDULE OF DIMENSIONS

PIPE	H	W	W1	W2	L	T	D_{50}	D_{MAX}
SD AND OF OUTFALL	SEE GRADING PLANS					20"	9"	14"
WETLAND SPILLWAY	2'	--	8'	26'	22'	20"	9"	14"
FOREBAY HEADWALL	SEE GRADING PLANS					20"	9"	14"
GALLERY DRAIN	1.25'	--	7.5'	18.5'	17'	20"	9"	14"

RIPRAP OUTLET PROTECTION

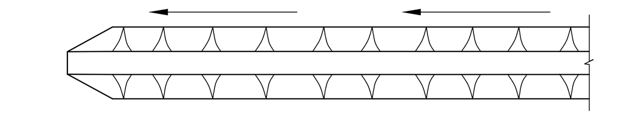
NTS



	SWALE A	SWALE B
C	1'	1'
D	4'	6'

POSITIVE DRAINAGE: 0.5% OR STEEPER DEPENDENT ON TOPOGRAPHY

OUTLET AS REQUIRED
SEE ITEM 8 BELOW.



PLAN VIEW

CONSTRUCTION DITCH SCHEDULE

DITCH ID	SWALE TYPE	TYPE OF TREATMENT	SIDE SLOPES	SLOPE
CD-1	A	2	2:1	< 5%
CD-2	A	2	2:1	< 5%

CONSTRUCTION SPECIFICATIONS

1. ALL CONSTRUCTION DITCHES SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET.
2. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.
3. DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL OUTLET DIRECTLY INTO AN UNDISTURBED STABILIZED AREA AT NON-EROSIVE VELOCITY.
4. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE SWALE.
5. THE DITCH SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
6. FILLS SHALL BE COMPACTED BY EARTH MOVING EQUIPMENT.
7. ALL EARTH REMOVED AND NOT NEEDED FOR CONSTRUCTION SHALL BE PLACED SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE DITCH.
8. STABILIZATION SHALL BE AS PER THE FLOW CHANNEL STABILIZATION CHART BELOW:

TYPE OF TREATMENT	CHANNEL GRADE	A (5 AC. OR LESS)	B (5 AC. - 10 AC)
1	0.5 - 3.0%	SEED AND STRAW MULCH	SEED AND STRAW MULCH
2	3.1 - 5.0%	SEED AND STRAW MULCH	SEED AND COVER USING RECP
3	5.1 - 8.0%	SEED AND COVER WITH RECP	LINED WITH 4-8" RIP-RAP OR GEOTEXTLE
4	8.1 - 10.%	LINED WITH 4-8" RIP-RAP OR GEOTEXTILE	SITE SPECIFIC DESIGN

9. PERIODIC INSPECTION AND REQUIRED MAINTENANCE MUST BE PROVIDED AFTER EACH RAIN EVENT.

CONSTRUCTION DITCH

NTS

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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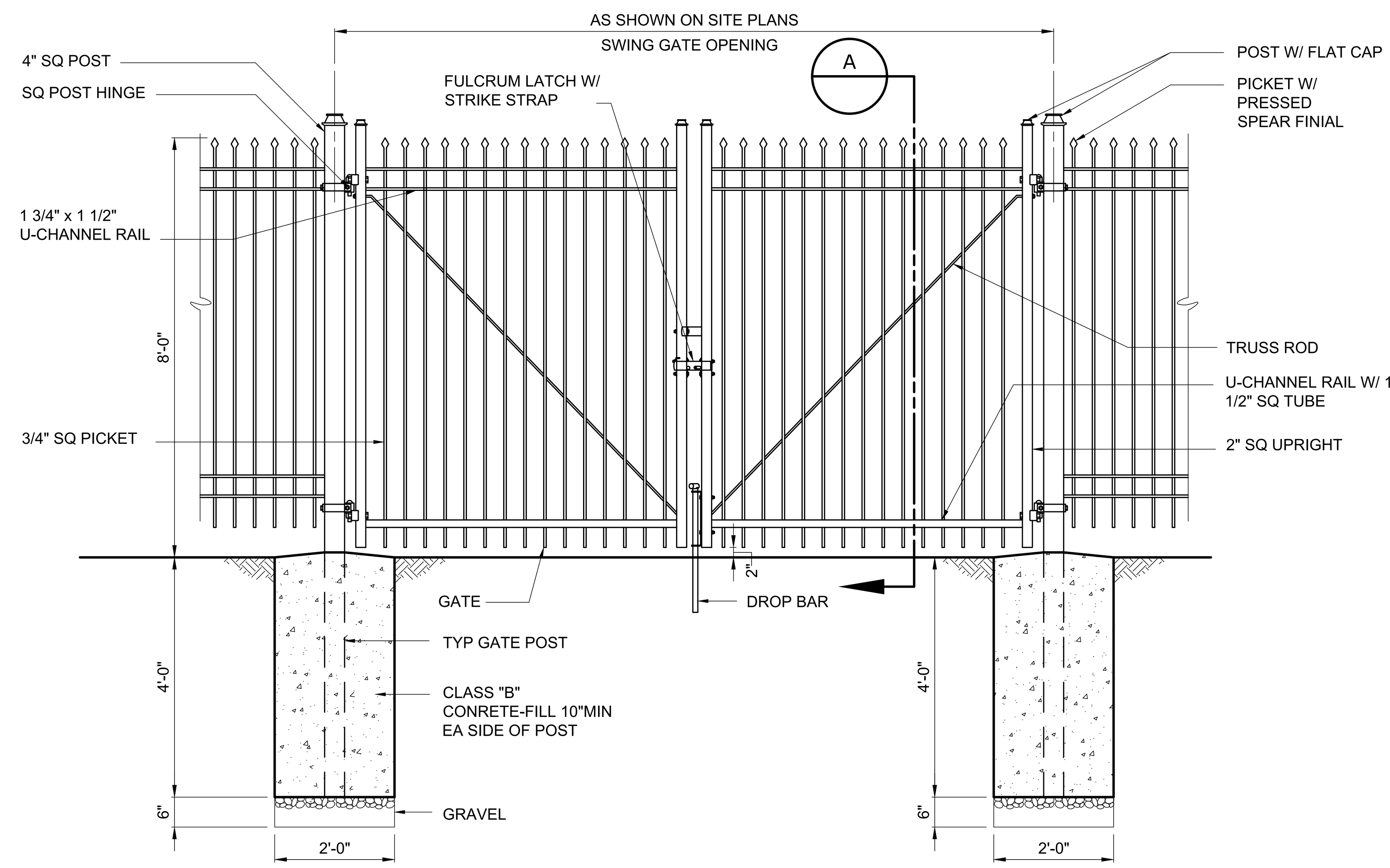
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EROSION AND SEDIMENT CONTROL DETAILS

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-303

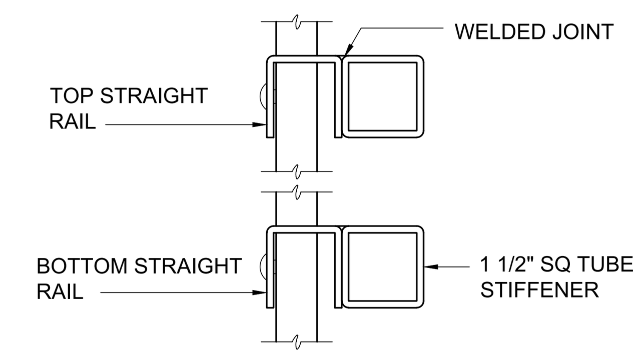


ORNAMENTAL SWING GATE ELEVATION

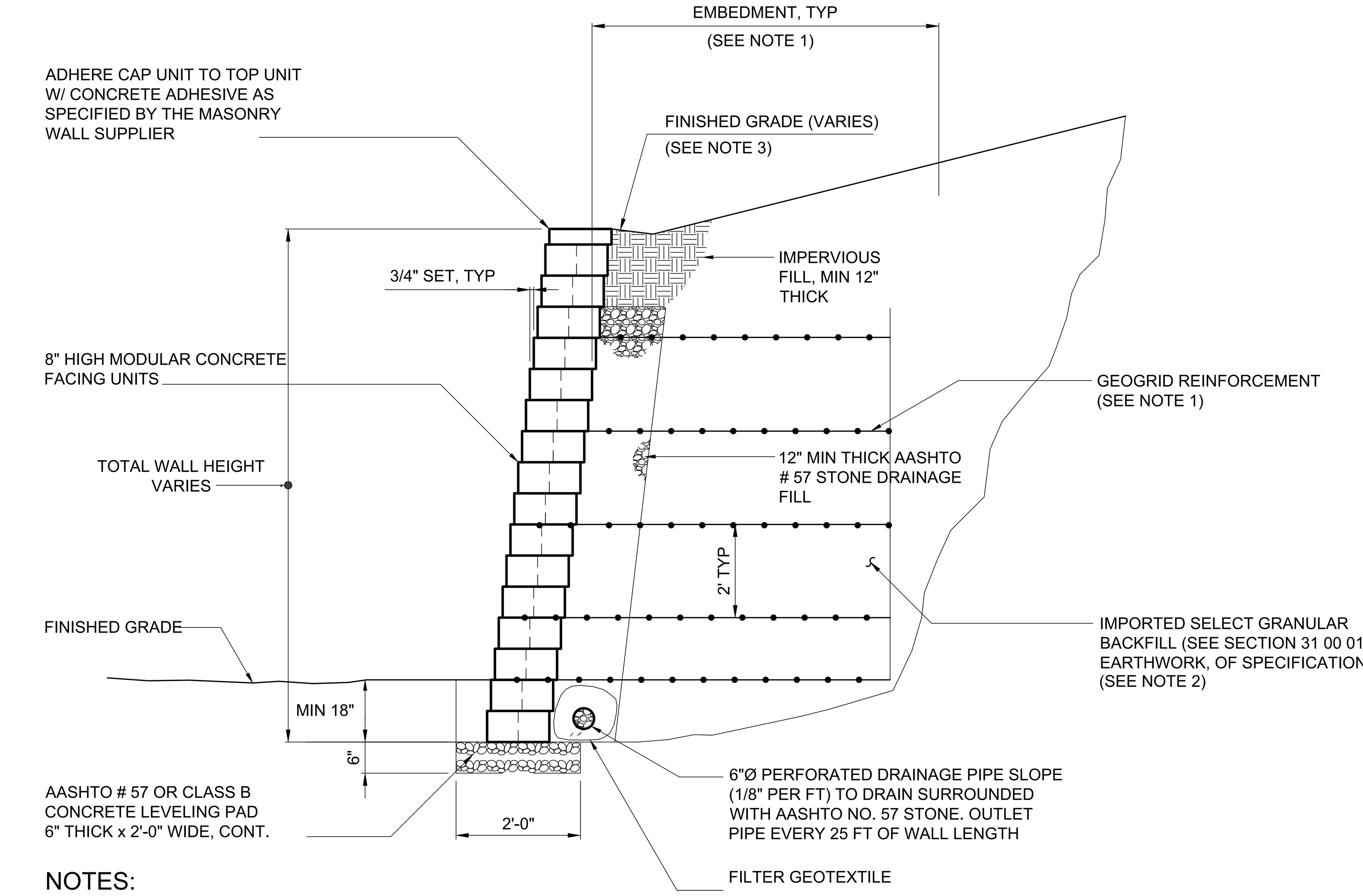
C-32-0512

NOTES:

1. PROVIDE LATCHING DEVICES TO HOLD GATE IN OPEN POSITION.
2. IF ROCK IS ENCOUNTERED WHEN SETTING POSTS, DRILL HOLES 4" ARGER IN DIA. THAN POSTS AND BACKFILL TO GRADE WITH CLASS "B" CONCRETE.
3. SEE SPECIFICATION 32-31-19 FOR ADDITIONAL INFORMATION.



SECTION A
NTS

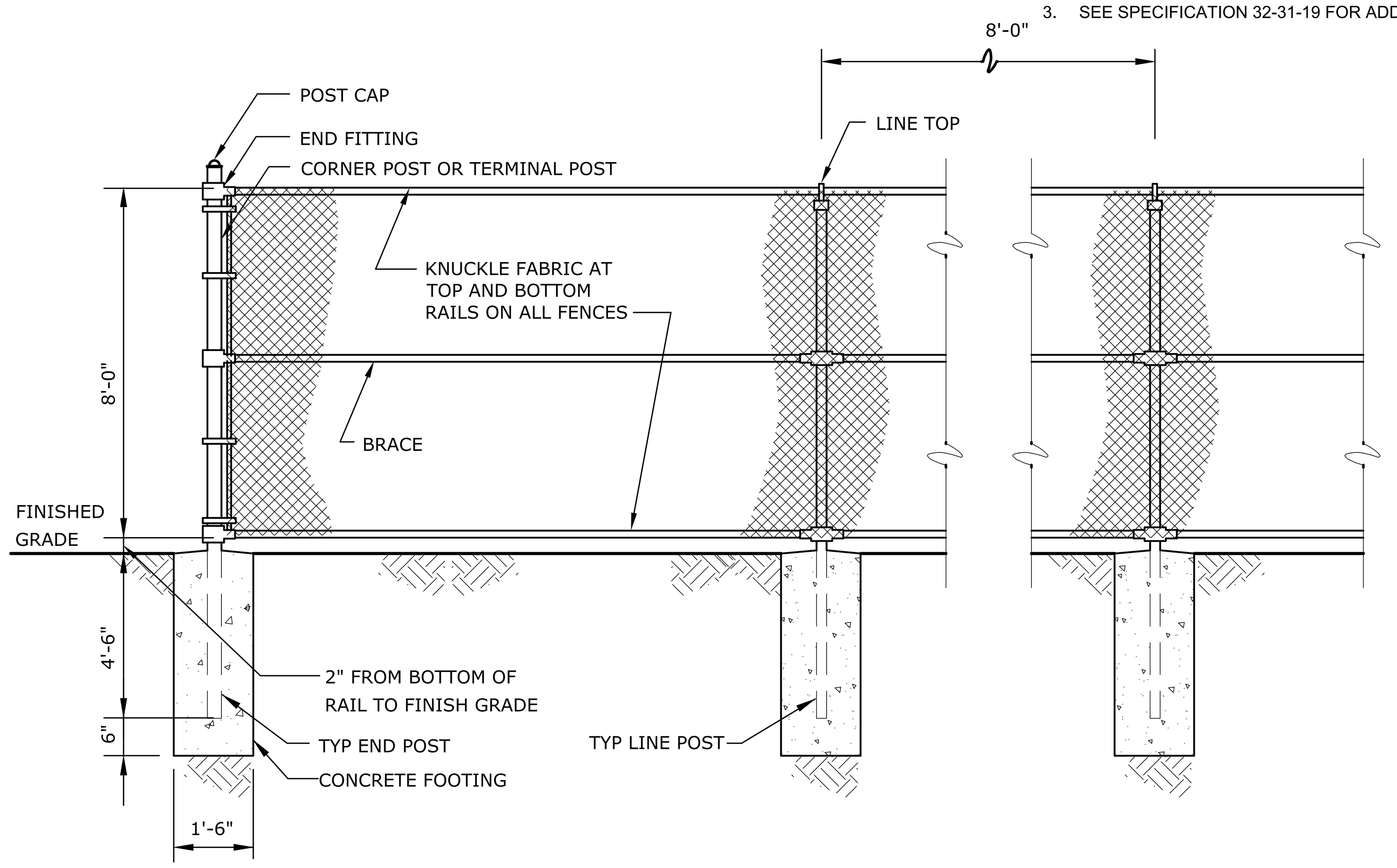


NOTES:

1. GEOGRID REINFORCEMENT MATERIAL AND EMBEDMENT LENGTH TO BE ESTABLISHED BY PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF NEW YORK BASED UPON CURRENT AND PROJECTED LOADINGS AND PROPER DRAINAGE. MINIMUM GEOGRID LENGTH TO BE 0.75 TIMES THE MAXIMUM WALL HEIGHT AND TO BE UNIFORM FOR ALL LAYERS. SEE SPECIFICATION 31 34 19.13.
2. WALL BACKFILL MATERIAL USED IN DESIGN SHALL BE ON-SITE MATERIAL OR MATERIAL MATCHING WALL DESIGN PARAMETERS SHALL BE SUPPLIED BY CONTRACTOR AT NO ADDITIONAL COST. IT SHOULD BE ASSUMED BACKFILL MATERIAL IS NOT AVAILABLE ON SITE. SEE SPECIFICATION SECTION 32 32 35 FOR BACKFILL SPECIFICATIONS.
3. PROVIDE POSITIVE DRAINAGE AWAY FROM BACK OF WALL.
4. INCLUDE SUBGRADE LOADING FOR PARKING AREA WHERE APPLICABLE. DESIGN TO ACCOMODATE H-20 LOADING AS MINIMUM.

MSE RETAINING WALL

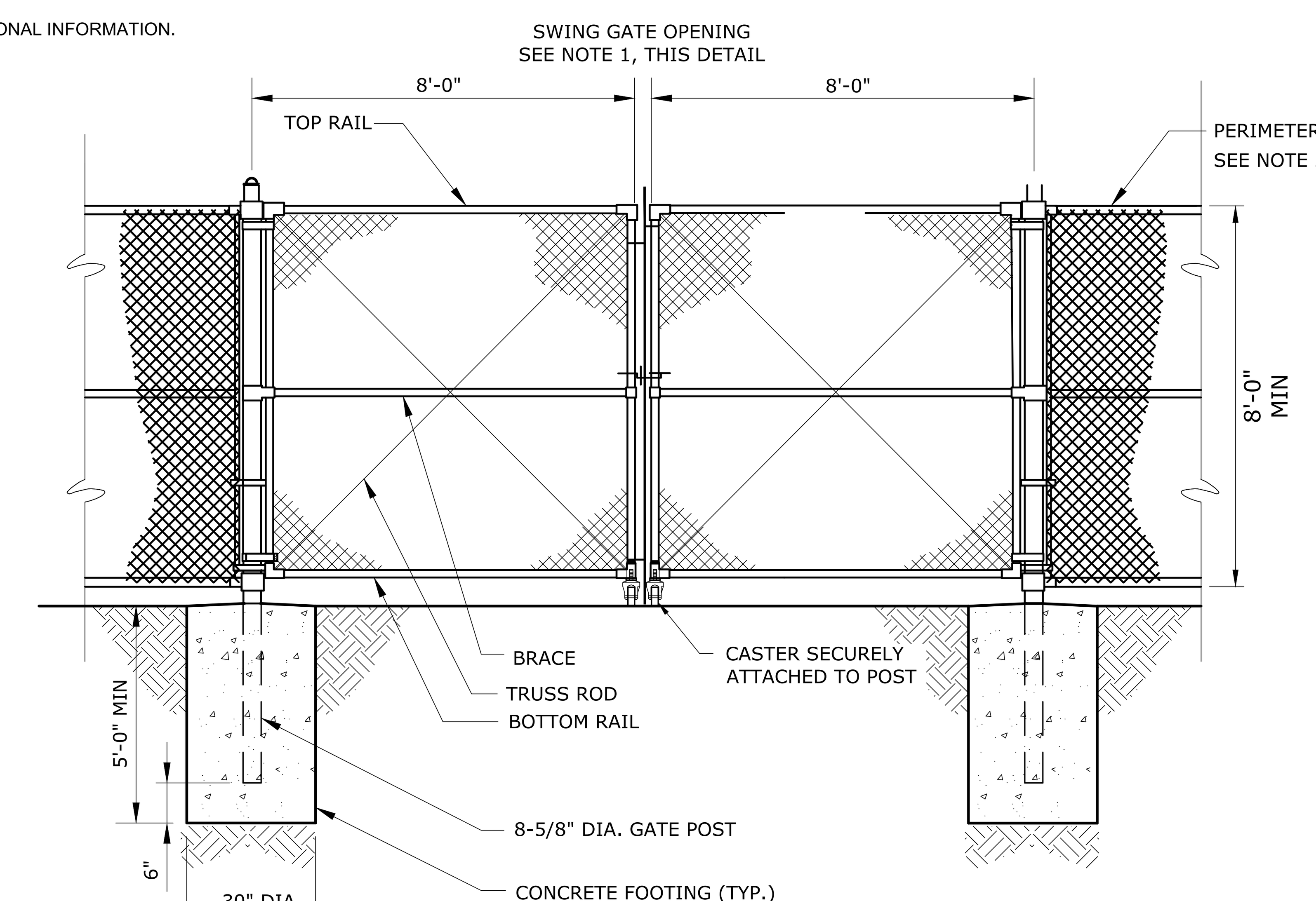
C-32-0580



NOTES:

1. GATES SHALL BE IN ACCORDANCE WITH THE DETAILS ON THE ARCH DRAWINGS.
2. FENCE SHALL BE POLYOLEFIN COATED CHAIN LINK FENCE PER SPECIFICATION 32 31 13.
3. ORIENTATION AND LIMIT OF PERIMETER FENCE SHALL BE INSTALLED PER DWGS AND AS DIRECTED BY ENGINEER.
4. IF ROCK IS ENCOUNTERED WHEN SETTING POSTS, DRILL HOLES 4 INCHES LARGER IN DIAMETER THAN POSTS AND BACKFILL TO GRADE WITH CLASS "B" CONCRETE.

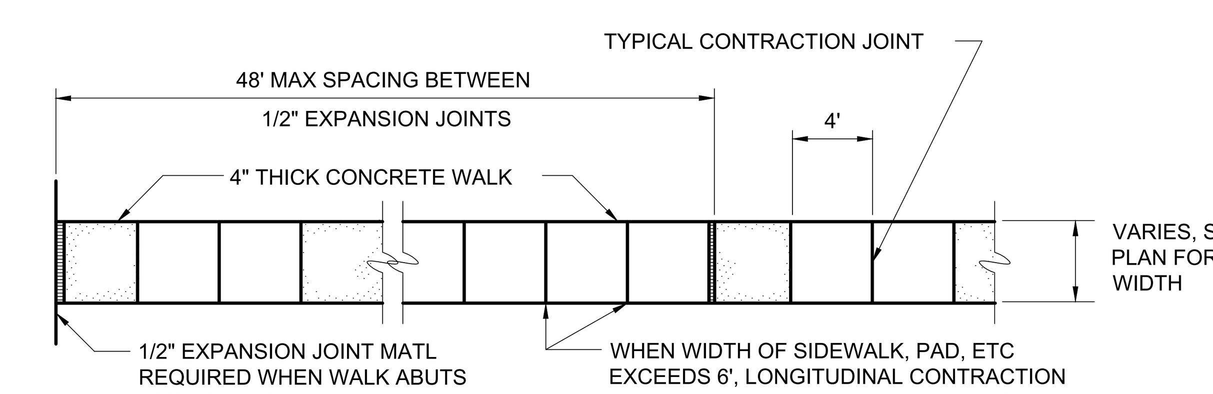
TYPICAL PERIMETER FENCE
NTS



NOTES:

1. PROVIDE LATCHING DEVICES TO HOLD GATES IN OPEN POSITION AND PADLOCK MASTER LOCK NUMBER 12 OR EQUAL TO LOCK GATES CLOSED.
2. ORIENTATION AND LIMIT OF PERIMETER FENCE SHALL BE INSTALLED AS DIRECTED BY ENGINEER.
3. IF ROCK IS ENCOUNTERED WHEN SETTING POSTS, DRILL HOLES 1/2" INCH LARGER IN DIAMETER THAN POSTS AND BACKFILL TO GRADE WITH CLASS "B" CONCRETE.

TYPICAL CHAIN LINK FENCE GATE
NTS



TYPICAL CONCRETE WALKWAY

C-32-0520

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

PERMIT SUBMITTAL
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HAZEN AND SAWYER
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NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
SITE DETAILS

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-304

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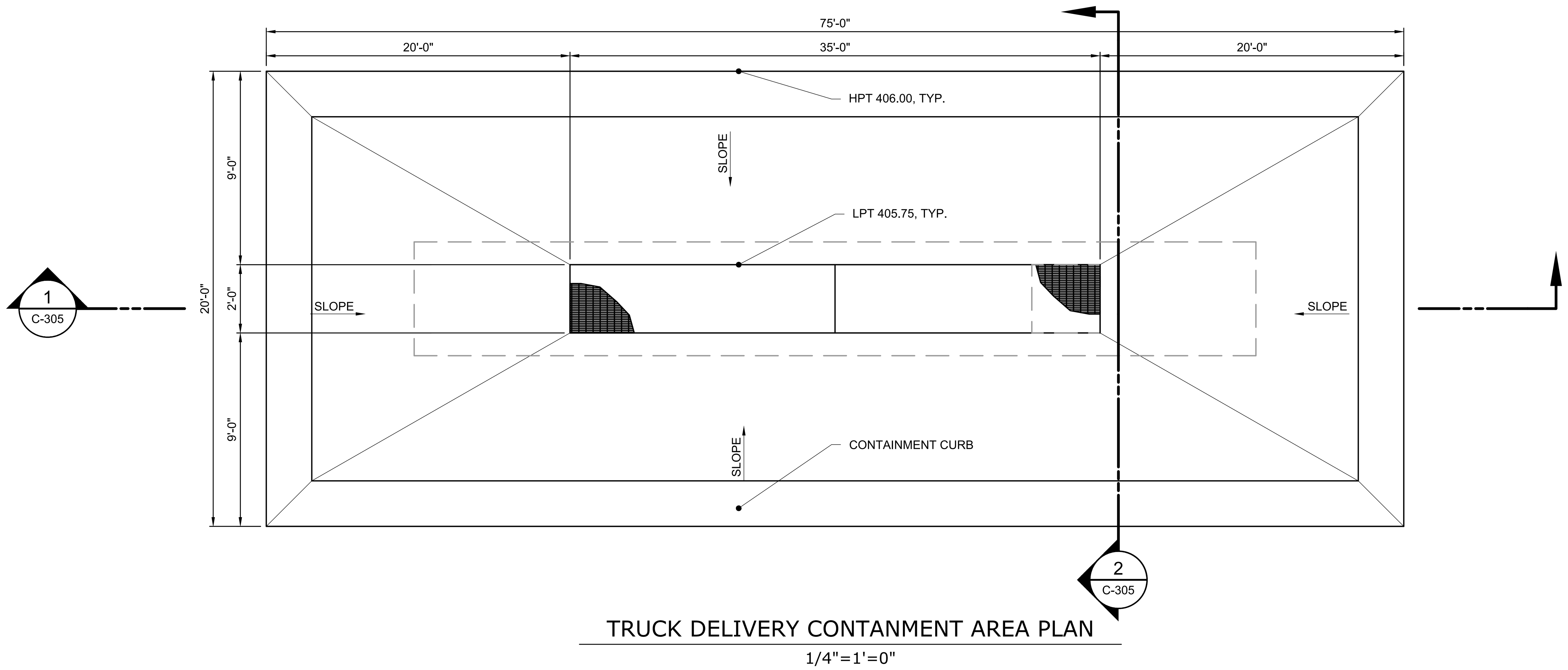
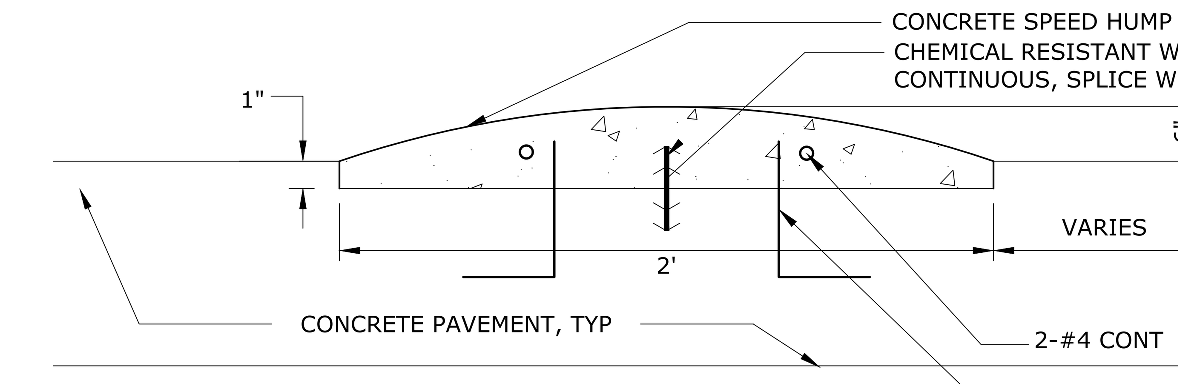


TRUCK DELIVERY CONTANMENT AREA PLAN

1/4"=1'=0"

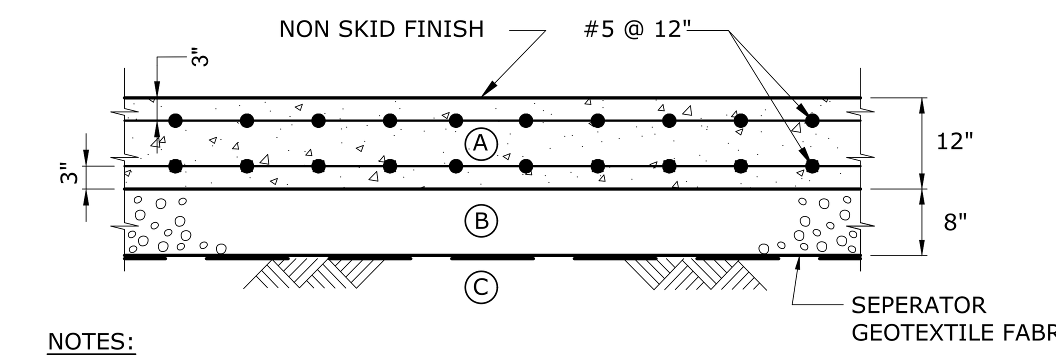


NOTES:

1. USE CURB AND CURB & GUTTER MEETING THE MATERIAL AND CONSTRUCTION REQUIREMENTS OF SECTION 609 OF THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.

CONTAINMENT CURB

NTS



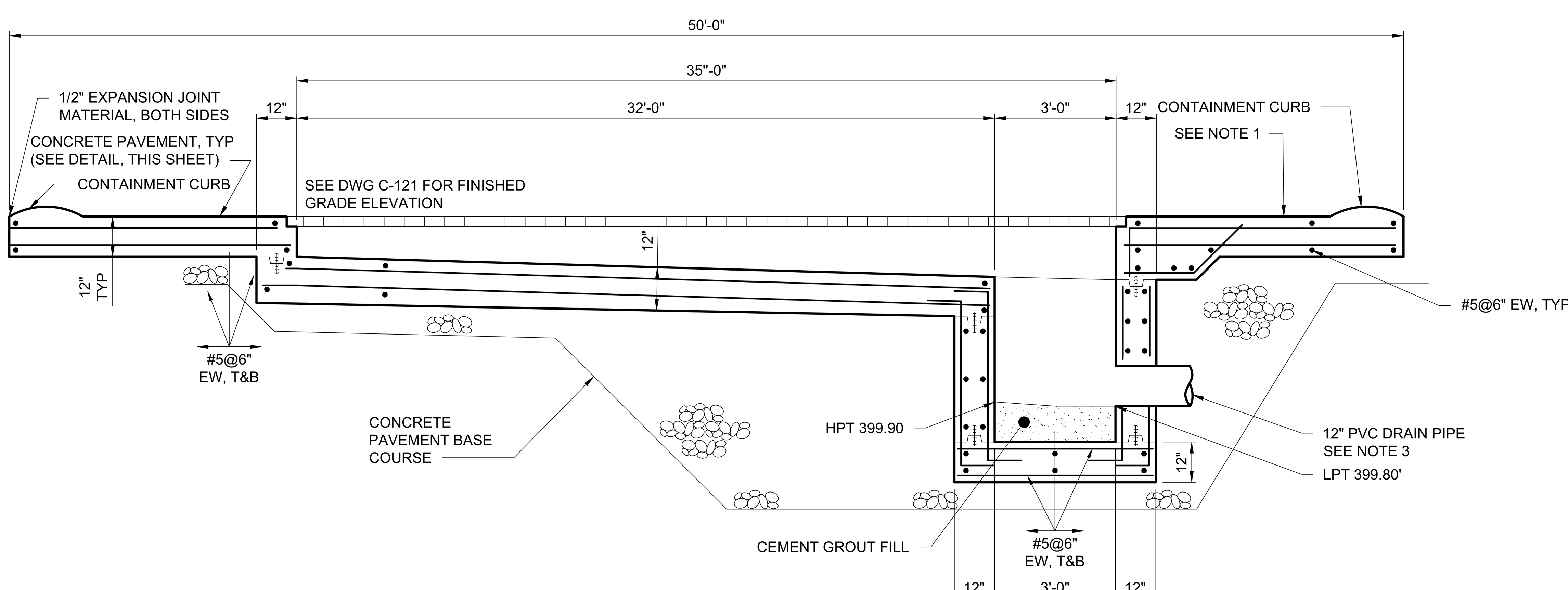
NOTES:

1. ALL COMPACTION REFERS TO PERCENT OF MAXIMUM DENSITY AS DETERMINED BY ASTM D-1557 METHOD D, SEE NOTES.
2. CONCRETE SHALL BE 4,500 PSI.
3. REINFORCING SHALL BE #5 @ 12" C/C AT DEPTH OF 3" FROM TOP OF COURSE AND 3" FROM BOTTOM OF COURSE.

KEY:
- (A) = CONCRETE PAVEMENT
- (B) = BASE COURSE COMPACTED TO 95%
- (C) = SUBGRADE COMPACTED TO 95%

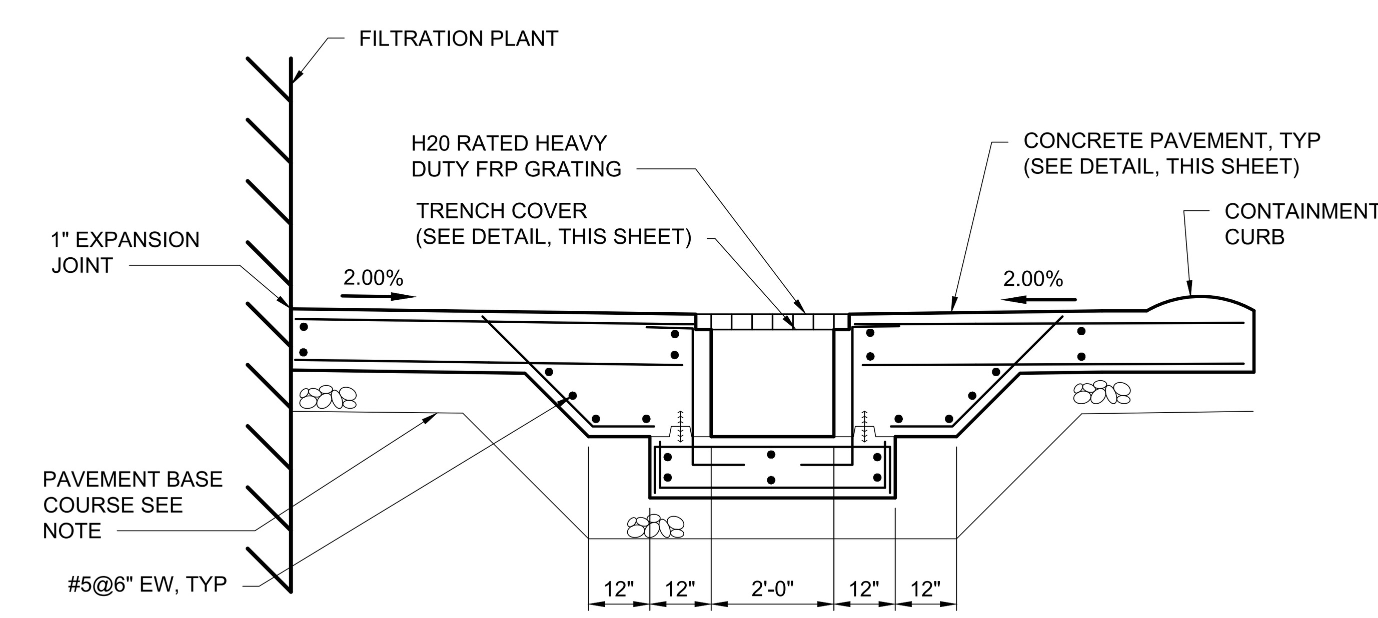
CONCRETE PAVEMENT SECTION

NTS



SECTION 1 C-352

NTS

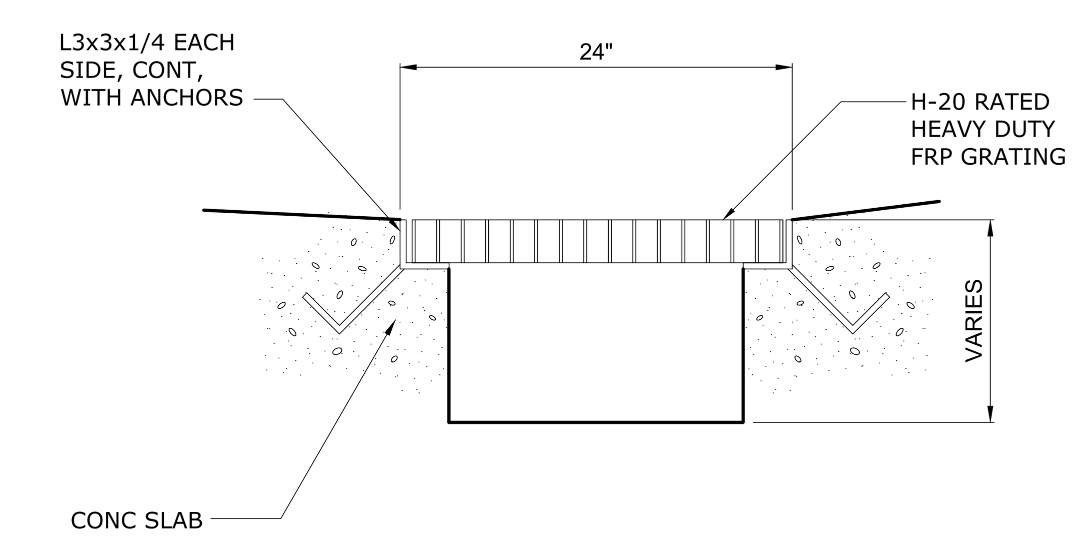


SECTION 2 C-352

NTS

NOTE:

1. APPLY CONCRETE TOPPING ON ALL CONCRETE SURFACES WITHIN THE AREA ENCLOSED BY SPEED HUMPS AND EDGE OF BUILDING AS PART OF THE SECONDARY CONTAINMENT AREA IN ACCORDANCE WITH SPECIFICATION 099700 - SPECIAL COATINGS.
2. PAVEMENT BASE COURSE SHALL BE PER SPECIFICATION 321000 - PAVING AND SURFACING.
3. PIPE PENETRATION SHALL BE SEALED USING A LINK-SEAL, AS MANUFACTURED BY GPT, OR APPROVED EQUAL.



TRENCH COVER

NTS

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	C. JOHNSON
CHECKED BY:	D. SHEERAN
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

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498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
TRUCK DELIVERY CONTAINMENT DETAIL

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-305

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NORTH BOUND MOT

SCALE: NTS

SOUTH BOUND MOT

SCALE: NTS

NOTES

1. WHEN PAVED SHOULDERS HAVING A WIDTH OF 8' OR MORE ARE CLOSED, CHANNELIZING DEVICES SHALL BE USED TO CLOSE THE SHOULDER IN ADVANCE TO DELINEATE THE BEGINNING OF THE WORK AREA AND DIRECT VEHICULAR TRAFFIC TO REMAIN IN THE TRAVEL WAY.
2. WHEN A SIDE ROAD OR DRIVEWAY INTERSECTS THE ROADWAY WITHIN A WORK ZONE TRAFFIC CONTROL AREA, ADDITIONAL TEMPORARY TRAFFIC CONTROL DEVICES AND/OR FLAGGERS SHALL BE PLACED AS NEEDED. ADDITIONAL FLAGGERS SHALL BE LOCATED AT ALL INTERSECTIONS AND COMMERCIAL DRIVEWAYS LOCATED WITHIN OR NEAR THE ACTIVE WORK SPACE.
3. NO WORK ACTIVITY, EQUIPMENT, OR STORAGE OF VEHICLES, OR MATERIAL SHALL OCCUR WITHIN THE BUFFER SPACE AT ANY TIME.
4. CHANNELIZING DEVICE SPACING (CENTER TO CENTER) SHALL NOT EXCEED 40' IN THE ACTIVE WORK SPACE.
5. TRANSVERSE DEVICES SHALL BE REQUIRED (AS PER 619 STANDARD SPECIFICATIONS) WHEN A PAVED SHOULDER HAVING A WIDTH OF 8' OR GREATER IS CLOSED FOR A DISTANCE GREATER THAN 1500'.
6. THE END ROAD WORK SIGN (G20-2) SHALL BE PLACED A MAXIMUM OF 500' PAST THE END OF THE WORK SPACE.
7. WHERE DIRECTED BY THE ENGINEER, A BUFFER SPACE SHALL BE PROVIDED IN ORDER TO LOCATE THE ONE-LANE, TWO-WAY TRAFFIC TAPER PRIOR TO ANY HORIZONTAL OR VERTICAL CURVE, IN ORDER TO PROVIDE ADEQUATE SIGHT DISTANCE FOR THE FLAGGERS AND/OR A QUEUE OF STOPPED VEHICLES.
8. THE FLAG TREE SHALL BE LOCATED ON THE SHOULDER, AT APPROXIMATELY ½ THE DISTANCE BETWEEN THE FLAGGER SIGN (W20-7A) AND THE FLAGGER.
9. FLAGGER SIGN (W20-7A) AND ONE LANE ROAD AHEAD SIGN (W20-4) SHALL BE REMOVED, COVERED OR TURNED AWAY FROM ROAD USERS WHEN FLAGGING OPERATIONS ARE NOT OCCURING.
10. FLAGGER AND FLAG TREE SHALL BE ILUMINATED TO LEVEL II ILLUMINATION DURING NIGHT TIME OPERATIONS.
11. ALL FLAGGERS SHALL USE 24" (MIN.) OCTAGON SHAPED STOP/SLOW PADDLES HAVING 6' STAFF.
12. CENTERLINE CHANNELIZING DEVICES ARE OPTIONAL AND MAY BE ELIMINATED WHERE SPACE CONSTRAINTS EXIST.

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	C. JOHNSON
DRAWN BY:	M. SEEBOLD
CHECKED BY:	D. SHEERAN

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0 1/2" 1"

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NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
MAINTENANCE OF TRAFFIC DETAIL

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	C-306

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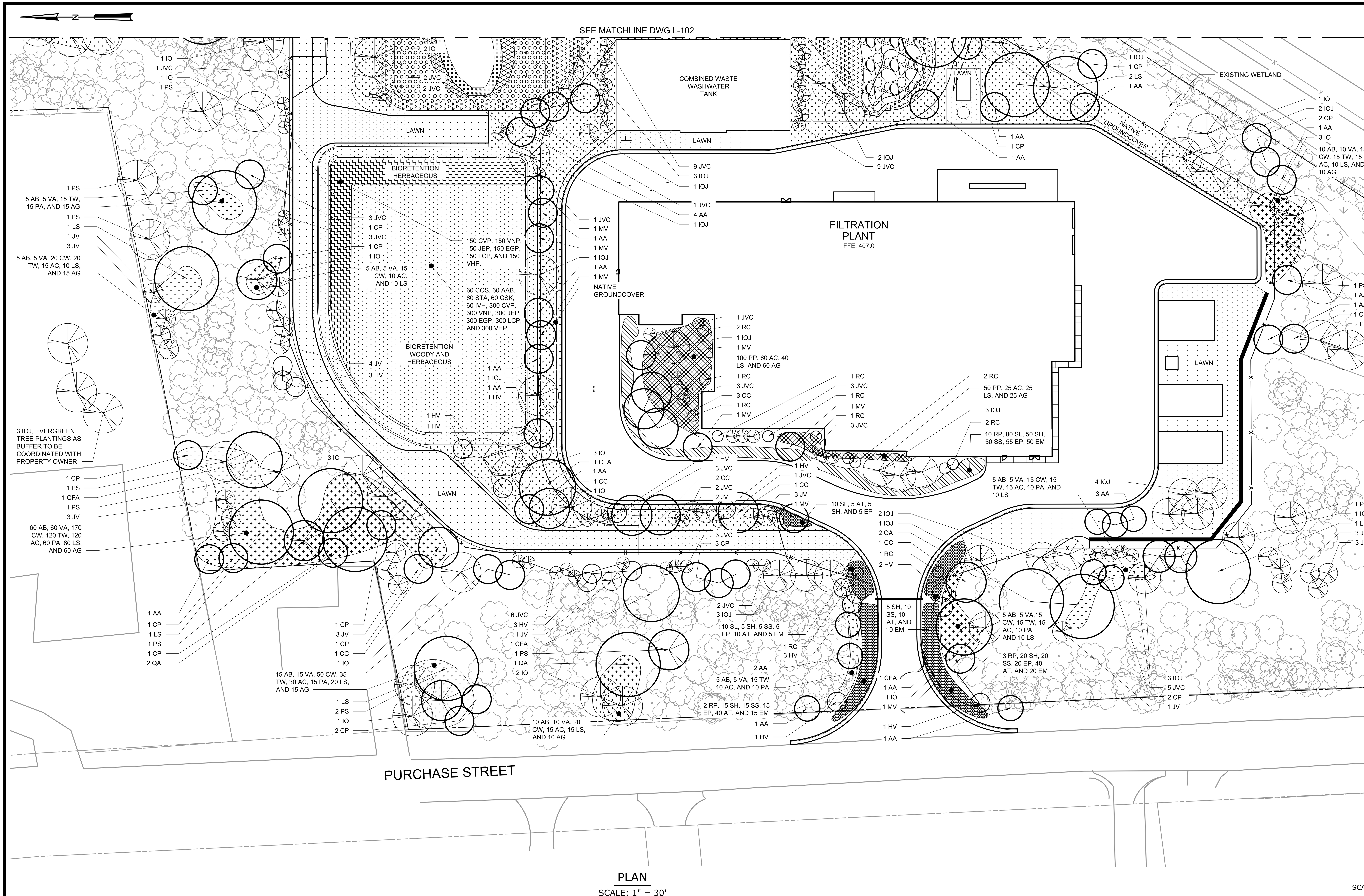

PLAN
SCALE: 1" = 30'

NOTES:

1. SEE L-101 LANDSCAPE PLAN - SHEET 2 FOR PLANTING NOTES.
2. SEE L-301 FOR LANDSCAPE SCHEDULES.
3. SEE L-302 FOR LANDSCAPE DETAILS.
4. ALL WORK OUTSIDE THE TREE PROTECTION FENCE SHALL BE PERFORMED WITH HAND TOOLS ONLY. NO HEAVY MACHINERY MAY BE USED.

LEGEND

- ZONE 1 - LAWN
- ZONE 2 - NATIVE GROUNDCOVER
- ZONE 3 - ENTRANCE
- ZONE 4 - FOUNDATION PART SUN
- ZONE 5 - FOUNDATION SHADE
- ZONE 6 - WOODLAND
- ZONE 7 - BIORETENTION HERBACEOUS
- ZONE 8 - BIORETENTION WOODY AND HERBACEOUS
- ZONE 9 - WETLAND DEEP WATER
- ZONE 10 - WETLAND SHALLOW WATER BENCH
- ZONE 11 - WETLAND SHORELINE FRINGE
- ZONE 12 - WETLAND RIPARIAN FRINGE

30 15 0 30'
SCALE: 1" = 30'

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PLOT DATE: 7/20/2022 5:13 PM BY: CMCNICOL

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: E. MOSKALENKO
DRAWN BY: E. MOSKALENKO
CHECKED BY:
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0 1/2" 1"

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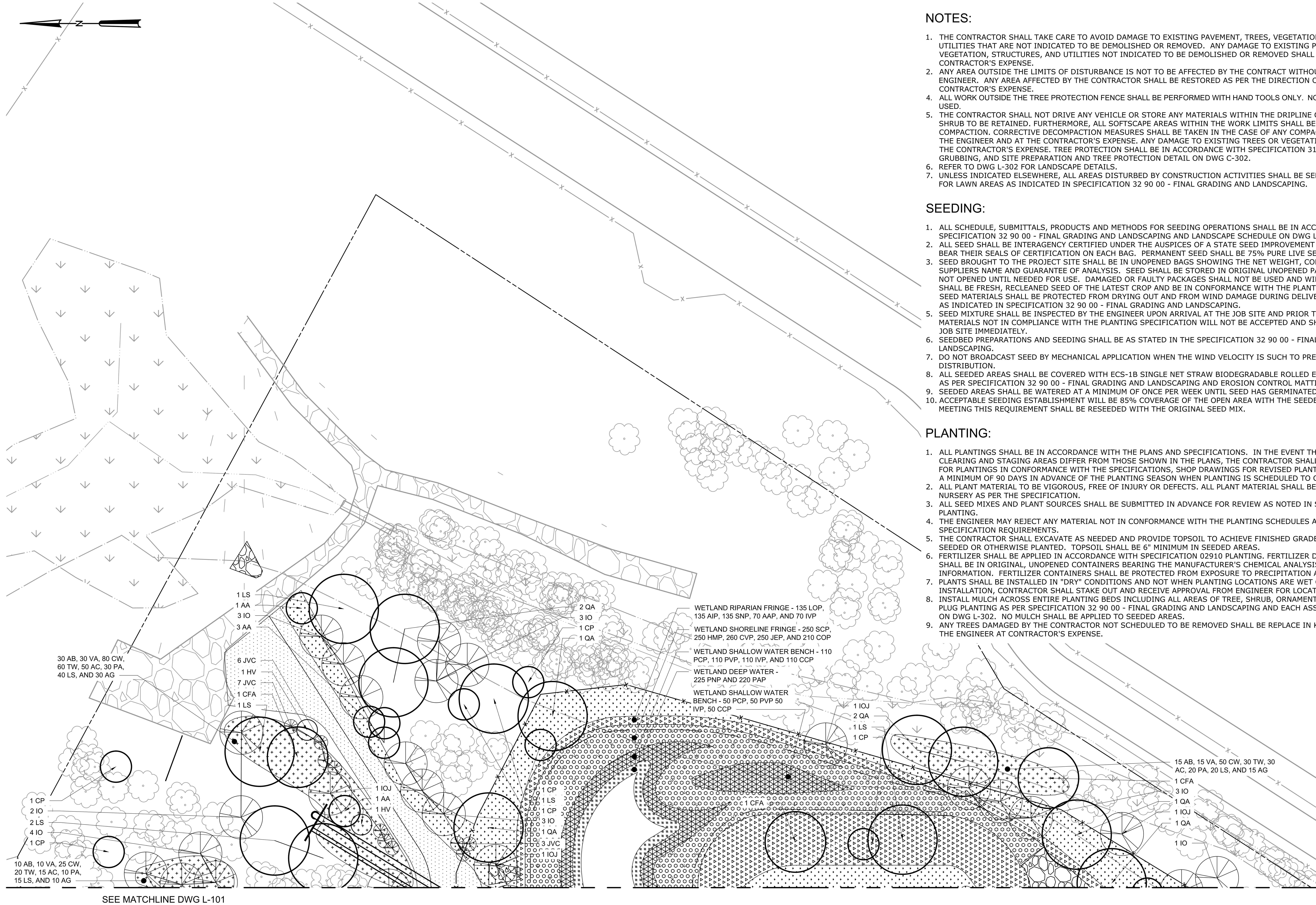
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

LANDSCAPE
LANDSCAPE PLAN - SHEET 1

DATE: JULY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: L-101



PLAN
SCALE: 1" = 30'

NOTES:

1. THE CONTRACTOR SHALL TAKE CARE TO AVOID DAMAGE TO EXISTING PAVEMENT, TREES, VEGETATION, STRUCTURES, AND UTILITIES THAT ARE NOT INDICATED TO BE DEMOLISHED OR REMOVED. ANY DAMAGE TO EXISTING PAVEMENT, TREES, VEGETATION, STRUCTURES, AND UTILITIES NOT INDICATED TO BE DEMOLISHED OR REMOVED SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
2. ANY AREA OUTSIDE THE LIMITS OF DISTURBANCE IS NOT TO BE AFFECTED BY THE CONTRACT WITHOUT PRE-APPROVAL FROM THE ENGINEER. ANY AREA AFFECTED BY THE CONTRACTOR SHALL BE RESTORED AS PER THE DIRECTION OF THE ENGINEER AT THE CONTRACTOR'S EXPENSE.
4. ALL WORK OUTSIDE THE TREE PROTECTION FENCE SHALL BE PERFORMED WITH HAND TOOLS ONLY. NO HEAVY MACHINERY MAY BE USED.
5. THE CONTRACTOR SHALL NOT DRIVE ANY VEHICLE OR STORE ANY MATERIALS WITHIN THE DRIPLINE OF ANY EXISTING TREE OR SHRUB TO BE RETAINED. FURTHERMORE, ALL SOFTSCAPE AREAS WITHIN THE WORK LIMITS SHALL BE PROTECTED FROM COMPACTION. CORRECTIVE DECOMPACTION MEASURES SHALL BE TAKEN IN THE CASE OF ANY COMPACTION AT THE DIRECTION OF THE ENGINEER AND AT THE CONTRACTOR'S EXPENSE. ANY DAMAGE TO EXISTING TREES OR VEGETATION SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE. TREE PROTECTION SHALL BE IN ACCORDANCE WITH SPECIFICATION 31 10 00 - CLEARING, GRUBBING, AND SITE PREPARATION AND TREE PROTECTION DETAIL ON DWG C-302.
6. REFER TO DWG L-302 FOR LANDSCAPE DETAILS.
7. UNLESS INDICATED ELSEWHERE, ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE SEEDED WITH GRASS SEED FOR LAWN AREAS AS INDICATED IN SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING.

SEEDING:

1. ALL SCHEDULE, SUBMITTALS, PRODUCTS AND METHODS FOR SEEDING OPERATIONS SHALL BE IN ACCORDANCE WITH SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING AND LANDSCAPE SCHEDULE ON DWG L-301.
2. ALL SEED SHALL BE INTERAGENCY CERTIFIED UNDER THE AUSPICES OF A STATE SEED IMPROVEMENT COOPERATIVE AND SHALL BEAR THEIR SEALS OF CERTIFICATION ON EACH BAG. PERMANENT SEED SHALL BE 75% PURE LIVE SEED MINIMUM.
3. SEED BROUGHT TO THE PROJECT SITE SHALL BE IN UNOPENED BAGS SHOWING THE NET WEIGHT, COMPOSITION OF MIX, SUPPLIERS NAME AND GUARANTEE OF ANALYSIS. SEED SHALL BE STORED IN ORIGINAL UNOPENED PACKAGES, KEPT DRY, AND NOT OPENED UNTIL NEEDED FOR USE. DAMAGED OR FAULTY PACKAGES SHALL NOT BE USED AND WILL BE REJECTED. SEED SHALL BE FRESH, RECLEANED SEED OF THE LATEST CROP AND BE IN CONFORMANCE WITH THE PLANTING SPECIFICATION. ALL SEED MATERIALS SHALL BE PROTECTED FROM DRYING OUT AND FROM WIND DAMAGE DURING DELIVERY. SEED MIXES AND RATES AS INDICATED IN SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING.
5. SEED MIXTURE SHALL BE INSPECTED BY THE ENGINEER UPON ARRIVAL AT THE JOB SITE AND PRIOR TO INSTALLATION. ANY MATERIALS NOT IN COMPLIANCE WITH THE PLANTING SPECIFICATION WILL NOT BE ACCEPTED AND SHALL BE REMOVED FROM THE JOB SITE IMMEDIATELY.
6. SEEDBED PREPARATIONS AND SEEDING SHALL BE AS STATED IN THE SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING.
7. DO NOT BROADCAST SEED BY MECHANICAL APPLICATION WHEN THE WIND VELOCITY IS SUCH TO PREVENT UNIFORM SEED DISTRIBUTION.
8. ALL SEEDED AREAS SHALL BE COVERED WITH ECS-1B SINGLE NET STRAW BIODEGRADABLE ROLLED EROSION CONTROL PRODUCT AS PER SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING AND EROSION CONTROL MATTING DETAIL, DWG C-303.
9. SEEDED AREAS SHALL BE WATERED AT A MINIMUM OF ONCE PER WEEK UNTIL SEED HAS GERMINATED AND BECOME ESTABLISHED.
10. ACCEPTABLE SEEDING ESTABLISHMENT WILL BE 85% COVERAGE OF THE OPEN AREA WITH THE SEEDED SPECIES. ANY AREA NOT MEETING THIS REQUIREMENT SHALL BE RESEEDED WITH THE ORIGINAL SEED MIX.

PLANTING:

1. ALL PLANTINGS SHALL BE IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. IN THE EVENT THE ACTUAL LIMITS OF SITE CLEARING AND STAGING AREAS DIFFER FROM THOSE SHOWN IN THE PLANS, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR PLANTINGS IN CONFORMANCE WITH THE SPECIFICATIONS, SHOP DRAWINGS FOR REVISED PLANTINGS SHALL BE SUBMITTED A MINIMUM OF 90 DAYS IN ADVANCE OF THE PLANTING SEASON WHEN PLANTING IS SCHEDULED TO OCCUR.
2. ALL PLANT MATERIAL TO BE VIGOROUS, FREE OF INJURY OR DEFECTS. ALL PLANT MATERIAL SHALL BE STOCK FROM AN APPROVED NURSERY AS PER THE SPECIFICATION.
3. ALL SEED MIXES AND PLANT SOURCES SHALL BE SUBMITTED IN ADVANCE FOR REVIEW AS NOTED IN SPECIFICATION 02910 PLANTING.
4. THE ENGINEER MAY REJECT ANY MATERIAL NOT IN CONFORMANCE WITH THE PLANTING SCHEDULES AND THE PLANTING SPECIFICATION REQUIREMENTS.
5. THE CONTRACTOR SHALL EXCAVATE AS NEEDED AND PROVIDE TOPSOIL TO ACHIEVE FINISHED GRADES IN ALL AREAS TO BE SEEDED OR OTHERWISE PLANTED. TOPSOIL SHALL BE 6" MINIMUM IN SEEDED AREAS.
6. FERTILIZER SHALL BE APPLIED IN ACCORDANCE WITH SPECIFICATION 02910 PLANTING. FERTILIZER DELIVERED TO THE SITE SHALL BE IN ORIGINAL, UNOPENED CONTAINERS BEARING THE MANUFACTURER'S CHEMICAL ANALYSIS AND ESSENTIAL INFORMATION. FERTILIZER CONTAINERS SHALL BE PROTECTED FROM EXPOSURE TO PRECIPITATION AND DIRECT SUNLIGHT.
7. PLANTS SHALL BE INSTALLED IN "DRY" CONDITIONS AND NOT WHEN PLANTING LOCATIONS ARE WET OR FROZEN. PRIOR TO INSTALLATION, CONTRACTOR SHALL STAKE OUT AND RECEIVE APPROVAL FROM ENGINEER FOR LOCATIONS OF PLANTINGS.
8. INSTALL MULCH ACROSS ENTIRE PLANTING BEDS INCLUDING ALL AREAS OF TREE, SHRUB, ORNAMENTAL GRASS AND HERBACEOUS PLUG PLANTING AS PER SPECIFICATION 32 90 00 - FINAL GRADING AND LANDSCAPING AND EACH ASSOCIATED PLANTING DETAIL ON DWG L-302. NO MULCH SHALL BE APPLIED TO SEEDED AREAS.
9. ANY TREES DAMAGED BY THE CONTRACTOR NOT SCHEDULED TO BE REMOVED SHALL BE REPLACE IN KIND AT THE DIRECTION OF THE ENGINEER AT CONTRACTOR'S EXPENSE.

LEGEND

- ZONE 1 - LAWN
- ZONE 2 - NATIVE GROUNDCOVER
- ZONE 3 - ENTRANCE
- ZONE 4 - FOUNDATION PART SUN
- ZONE 5 - FOUNDATION SHADE
- ZONE 6 - WOODLAND
- ZONE 7 - BIORETENTION HERBACEOUS
- ZONE 8 - BIORETENTION WOODY AND HERBACEOUS
- ZONE 9 - WETLAND DEEP WATER
- ZONE 10 - WETLAND SHALLOW WATER BENCH
- ZONE 11 - WETLAND SHORELINE FRINGE
- ZONE 12 - WETLAND RIPARIAN FRINGE

SCALE: 1" = 30'
30 15 0 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. FROST
DESIGNED BY:	E. MOSKALENKO
DRAWN BY:	E. MOSKALENKO
CHECKED BY:	

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 1/2" 1")

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

LANDSCAPE
LANDSCAPE PLAN - SHEET 2

DATE:	JULY 2022
HAZEN NO.:	90388-000
CONTRACT NO.:	A1364-A
DRAWING NUMBER:	L-102

File: C:\BMS\HAZEN-PW\D0207015\L-102 Saved by EMOSKALENKO Save date: 3/21/2022 6:44 PM
PLOT DATE: 7/20/2022 5:14 PM BY: CMCNICOL

LANDSCAPE SCHEDULE

ZONE 1 - Lawn Seed Mix **30,205 SF**
ZONE 2 - Native Groundcover Mix **30,100 SF**
Refer to Final Grading and Landscaping Specification for seed mixes and application rates.

ZONES 3, 4, 5, & 6

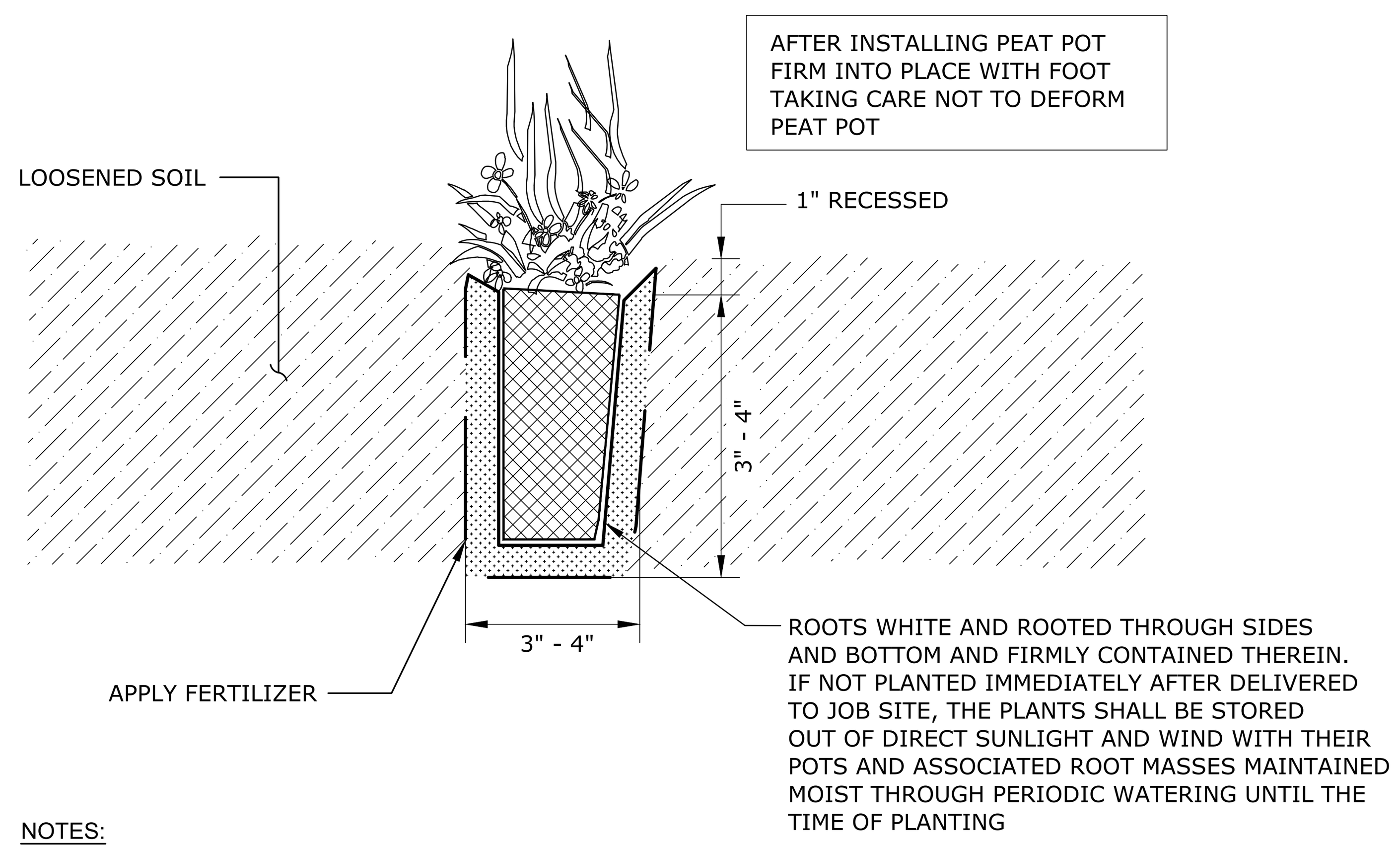
	Quantity	Code	Scientific Name	Common Name	Size	Form	Spacing	Comments
Trees								
	30	AA	*Amelanchier arborea*	downy serviceberry	#7	cont.	as shown	
	24	CP	*Carpinus caroliniana*	american hornbeam	#10	cont.	as shown	
	9	CC	*Cercis canadensis*	eastern redbud	#20	cont.	as shown	acceptable cultivars: 'Ace of Hearts', 'Forest Pansy', 'Ruby Falls'
	7	CFA	*Cornus florida* 'Appalachian Spring'	Appalachian Spring flowering dogwood	#10	cont.	as shown	
	40	IO	*Ilex opaca*	american holly	#15	cont.	as shown	
	36	IOJ	*Ilex opaca* 'Jersey Princess'	Jersey Princess american holly	#65	cont.	as shown	
	28	JV	*Juniperus virginiana*	eastern red cedar	#15	cont.	as shown	
	79	JVC	*Juniperus virginiana* 'Emerald Sentinel'	Emerald Sentinel™ red cedar	#65	cont.	as shown	
	12	LS	*Liquidambar styraciflua*	american sweetgum	1.5" cal	B&B	as shown	
	8	MV	*Magnolia virginiana 'Henry Hicks'*	Henry Hicks southern magnolia	3.5" cal	B&B	as shown	
	13	PS	*Pinus strobus*	eastern white pine	#25	cont.	as shown	
	13	QA	*Quercus alba*	white oak	1.5" cal	B&B	as shown	
Shrubs								
	180	AB	*Aronia arbutifolia*	red chokeberry	72 cell	tubeling	2' O.C.	naturalistic clusters of 3 to 5
	19	HV	*Hamamelis virginiana* 'Mohonk Red'	Mohonk red witchhazel	#5	cont.	as shown	
	13	RC	*Rhododendron catawbiense* ' Roseum Elegans'	English Roseum catawba rhododendron	#7	cont.	5' - 7' O.C.	
	15	RP	*Rhododendron* 'P.J.M. Elite'	Elite rhododendron	#5	cont.	4' O.C.	
	180	VA	*Vaccinium angustifolium*	lowbush blueberry	72 cell	tubeling	2' O.C.	naturalistic clusters of 3 to 5
Herbaceous / Grasses								
	475	CW	Carex woodii	wood sedge	2"	plug	1' O.C.	naturalistic clusters of 3 to 5
	360	TW	Tiarella wherryi	wherry's foam flower	2"	plug	1.5' O.C.	naturalistic clusters of 3 to 5
	425	AC	Anemone canadensis	windflower	2"	plug	1.5' O.C.	naturalistic clusters of 3 to 5
	95	EM	Eurybia macrophyllus 'Twilight'	twilight big leaf aster	2"	plug	1.5' O.C.	naturalistic clusters of 3 to 5
	180	PA	Polystichum acrostichoides	christmas fern	32 cell	tubeling	1' O.C.	naturalistic clusters of 3 to 5
	100	SL	Symphyotrichum laeve	smooth blue aster	2"	plug	1.5' O.C.	naturalistic clusters of 3 to 5
	315	LS	Lobelia siphilitica	great blue lobelia	2"	plug	1' O.C.	naturalistic clusters of 3 to 5
	150	PP	Phlox stolonifera 'Sherwood Purple'	Sherwood Purple creeping phlox	2"	plug	0.5' O.C.	naturalistic clusters of 3 to 5
	100	SH	Sporobolus heterolepis	prairie dropseed	#1	cont.	1.5' O.C.	naturalistic clusters of 3 to 5
	100	SS	Schizachyrium scoparium 'Carousel'	Carousel little bluestem	#1	cont.	1.5' O.C.	naturalistic clusters of 3 to 5
	270	AG	Aquilegia canadensis	eastern red columbine	2"	plug	1' O.C.	naturalistic clusters of 3 to 5
	100	EP	Echinacea purpurea	eastern purple coneflower	2"	plug	1' O.C.	naturalistic clusters of 3 to 5
	105	AT	Asclepias tuberosa	butteryfly weed	2"	plug	1' O.C.	naturalistic clusters of 3 to 5

ZONES 7 & 8 - BIORETENTION

	No.	Sym	Scientific Name	Common Name	Size	Form	Spacing	Comments
Shrubs								
	60	COS	*Cephalanthus occidentalis* 'Sugar Shack'	Sugar Shack buttonbush	#1	cont.	3' O.C.	Cluster of 3,5,7
	60	AAB	*Aronia arbutifolia* 'Brillantissima'	Brilliantissima red chokeberry	#1	cont.	3' O.C.	Cluster of 3,5,7
	60	STA	*Spirea tomentosa*	steeplebush	#1	cont.	3' O.C.	Cluster of 3,5,7
	60	CSK	*Cornus sericea* ' Kelseyi'	Kelsey red-twig dogwood	#1	cont.	3' O.C.	Cluster of 3,5,7
	60	IVH	*Itea virginica* 'Henry's Garnet'	Henry's Garnet sweetspire	#1	cont.	3' O.C.	Cluster of 3,5,7
Herbaceous								
	450	CVP	*Carex vulpinoidea*	fox sedge	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	450	VNP	*Vernonia noveboracensis*	new york ironweed	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	450	JEP	*Juncus effusus*	soft rush	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	450	EGP	*Euthamia graminifolia*	grass-leaved goldenrod	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	450	LCP	*Lobelia cardinalis*	cardinal flower	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	450	VHP	*Verbena hastata*	blue vervein	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows

Wetland

	Quantity	Code	Scientific Name	Common Name	Size	Form	Spacing	Comments
Zone 9 -Wetland Deep Water (Area: 1,325 SF)								
	225	PNP	*Potamogeton nodusus*	long-leaved pond weed	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	220	PAP	*Polygonum amphibium*	water smartweed	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
Zone 10 - Wetland Shallow Water Bench (Area A: 2,440 SF + Area B: 1,100 SF = 3,540 SF)								
	160	PCP	*Pontederia cordata*	pickerelweed	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	160	PVP	*Peltandra virginica*	arrow arrum	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	160	IVP	*Iris versicolor*	blue flag	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	160	CCP	*Carex crinita*	fringed sedge	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
Zone 11 - Wetland Shoreline Fringe (Area: 11,000 SF)								
Herbaceous								
	310	SCP	*Saururus cernuus*	lizard's tail	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	310	HMP	*Hibiscus mosheutos*	marsh hibiscus	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	320	CVP	*Carex vulpinoidea*	fox sedge	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	310	JEP	*Juncus effusus*	soft rush	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
Shrubs								
	260	COP	*Cephalanthus occidentalis*	Buttonbush	72 cell	tubeling	4' O.C.	Cluster of 3,5,7
Zone 12 - Wetland Riparian Fringe (9,875 SF)								
Herbaceous								
	135	LOP	*Leersia oryzoides*	rice cutgrass	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	135	AIP	*Asclepias incarnata*	butterfly weed	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
	135	SNP	*Symphyotrichum novae-angliae*	New England aster	2"	plug	2' O.C.	Groups of 5,7,9 in alternating rows
Shrubs								
	70	AAP	*Aronia arbutifolia*	red chokeberry	72 cell	tubeling	4' O.C.	Cluster of 3,5,7
	70	IVP	*Itea virginica*	virginia sweetspire	72 cell	tubeling	4' O.C.	Cluster of 3,5,7

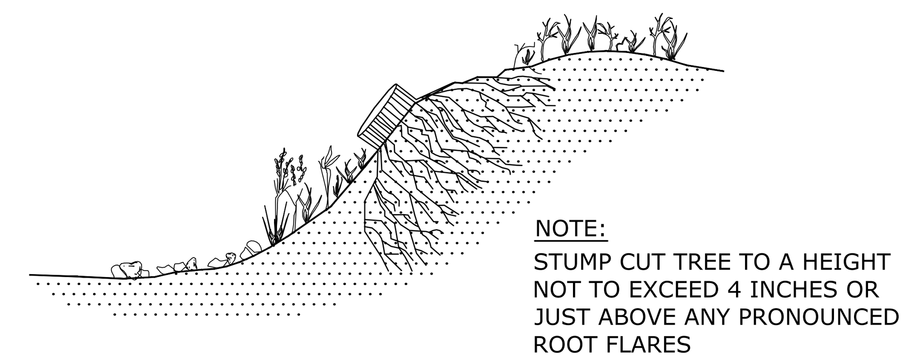


NOTES:

1. ALL PLASTIC WRAP SHALL BE REMOVED PRIOR TO PLANTING.

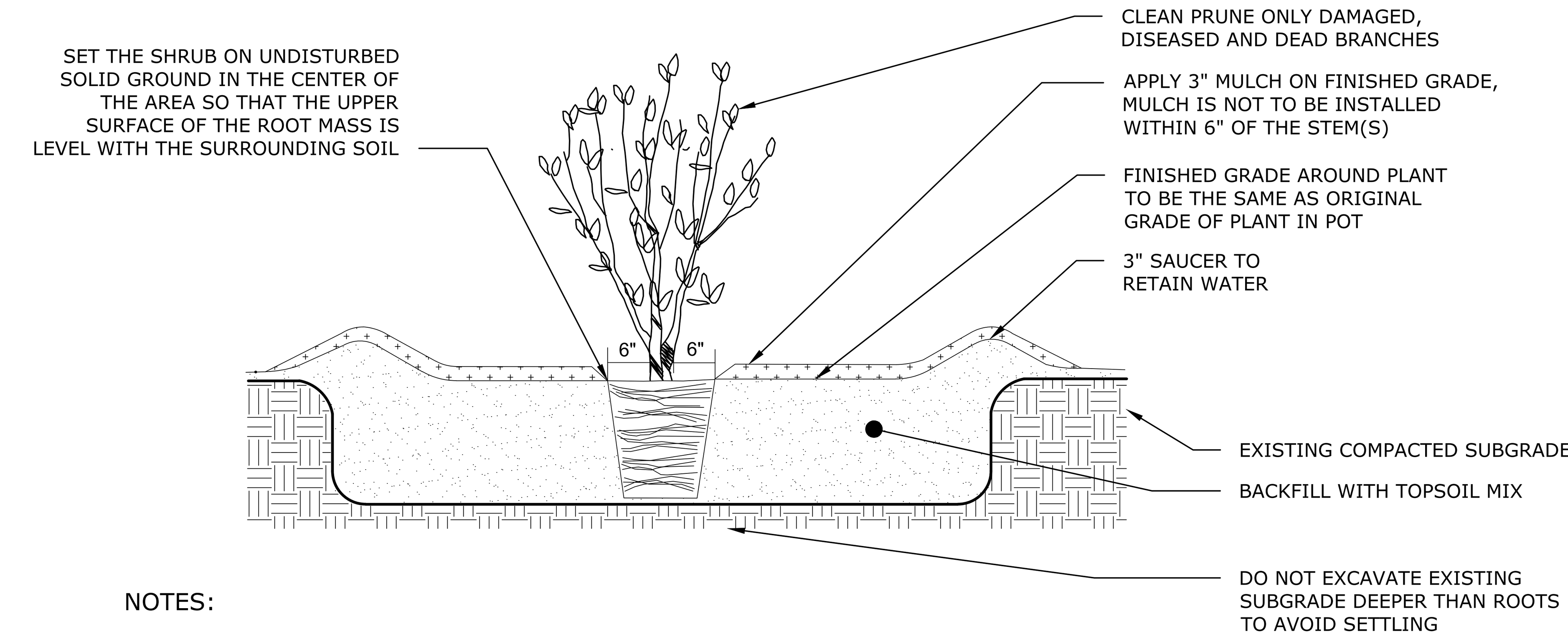
TYPICAL PLUG PLANTING DETAIL

NOT TO SCALE



FLUSH CUT

NOT TO SCALE

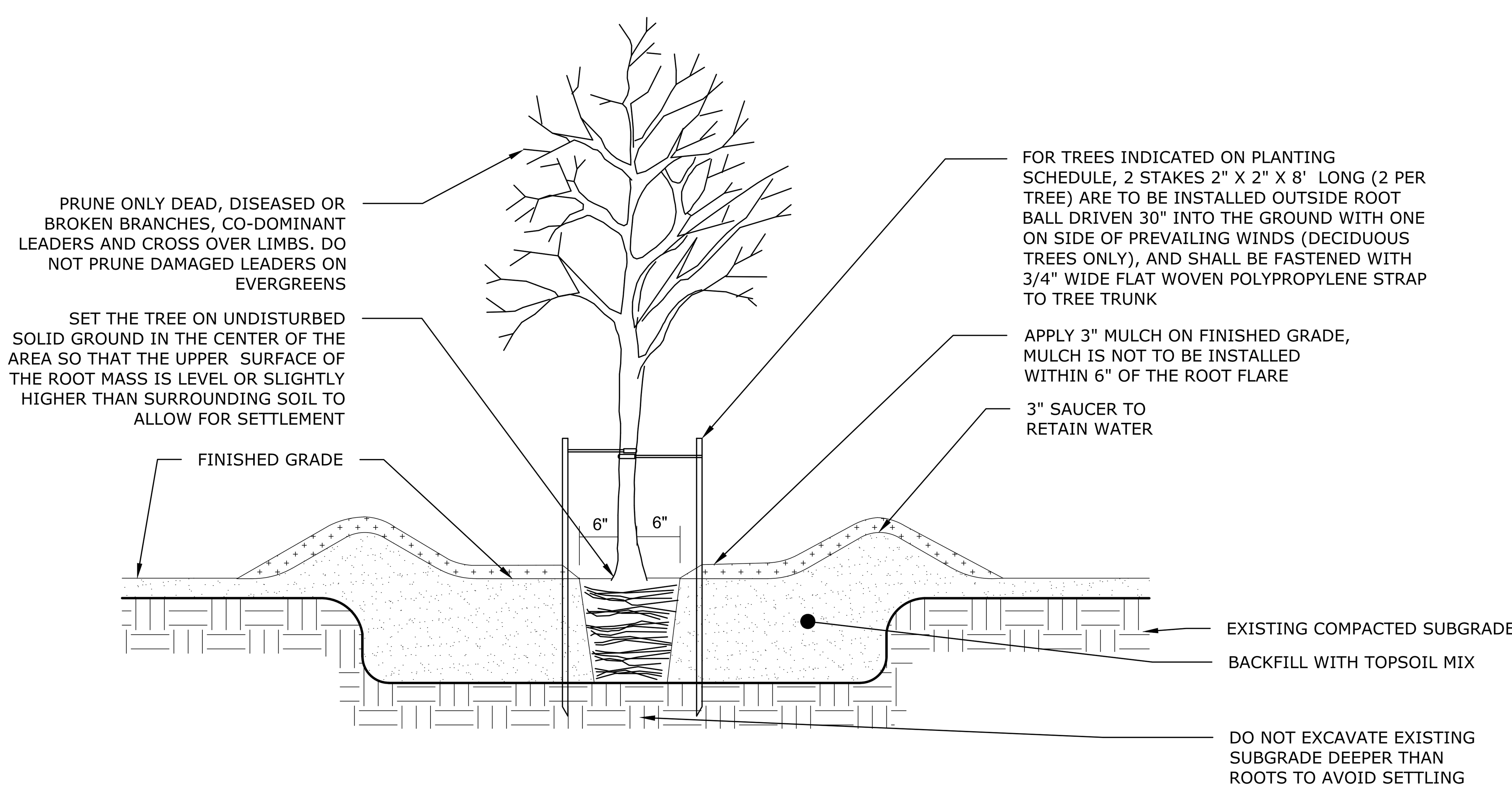


NOTES:

1. PRUNING, IF NECESSARY, SHALL BE DONE BY A CERTIFIED ARBORIST.
2. NOTIFY ENGINEER IF IMPERVIOUS OR UNACCEPTABLE NATIVE SOIL TO BE REMOVED IS ENCOUNTERED IN SHRUB PLANTING LOCATIONS.
3. ROTOTILL/CULTIVATE SOILS TO A DEPTH EQUAL TO THE DEPTH OF ROOT BALL AND TWO TIMES THE DIAMETER OF THE ROOT BALL.
2. APPLY FERTILIZER AND MYCORRHIZAL INOCULANT PER PLANTING SPECIFICATION. TAMP SOIL IN 6" LAYERS AROUND ROOT BALL AND WATER THOROUGHLY AFTER PLANTING. WATER THOROUGHLY AFTER EXCAVATION AND AFTER PLANT INSTALLATION.
3. CONTAINER: REMOVE ROOT BALL FROM CONTAINER. LOOSEN POT- BOUND, SPIRALLY-GROWING AND GIRDLING ROOTS. B&B: CAREFULLY REMOVE TOP 1/3 OF BURLAP. CUT SEVERAL SLITS IN BURLAP TO FACILITATE ROOT PENETRATION
4. REMOVE AND DISPOSE OF ALL NON-BIODEGRADABLES FROM PLANTING HOLES AND ROOT BALL.

TYPICAL SHRUB PLANTING DETAIL

NOT TO SCALE

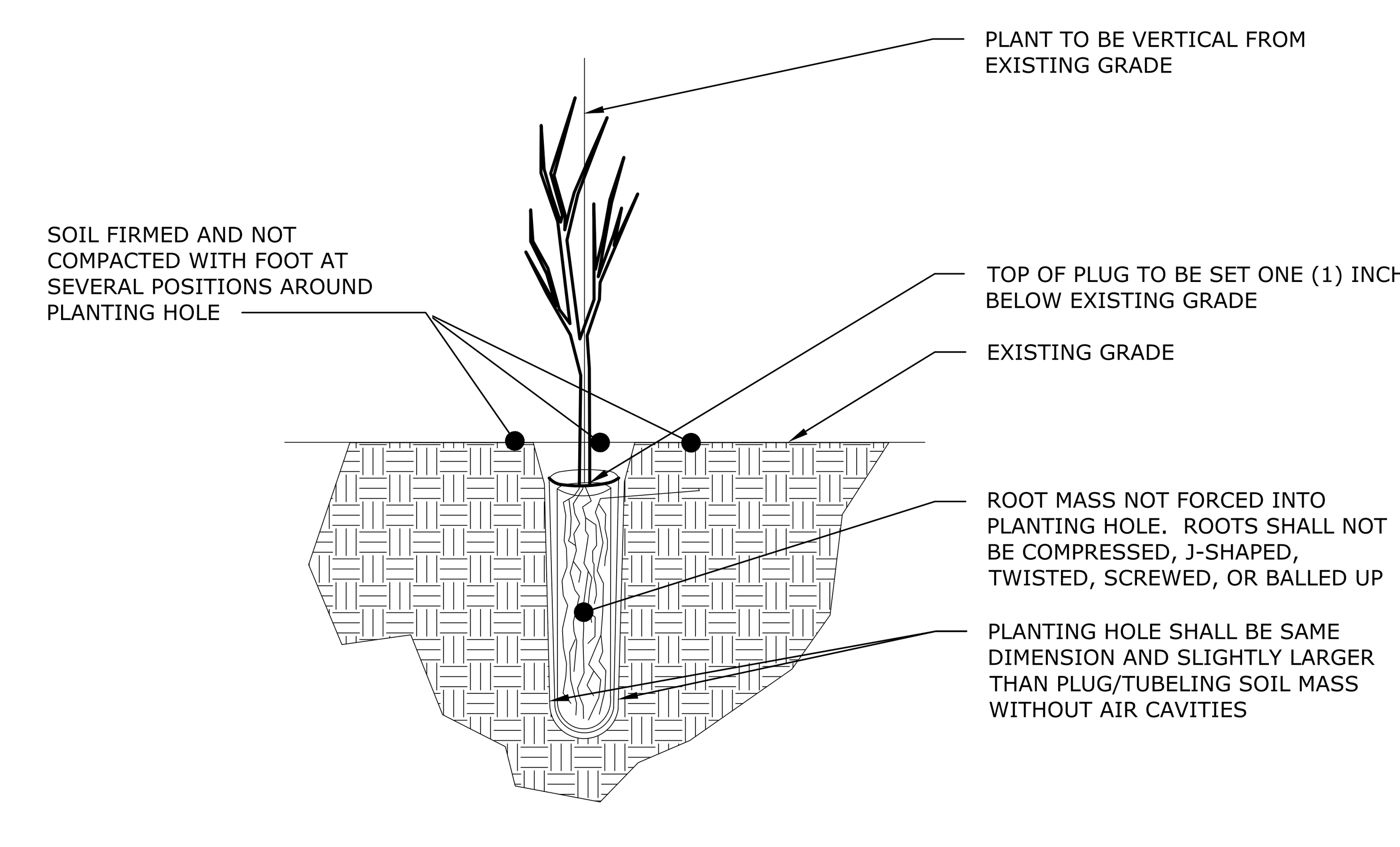


NOTES:

1. PRUNING, IF NECESSARY, SHALL BE DONE BY A CERTIFIED ARBORIST.
2. NOTIFY ENGINEER IF IMPERVIOUS OR UNACCEPTABLE NATIVE SOIL TO BE REMOVED IS ENCOUNTERED IN TREE PIT LOCATIONS.
3. ROTOTILL/CULTIVATE SOILS TO A DEPTH EQUAL TO THE DEPTH OF ROOT BALL AND TWO TIMES THE DIAMETER OF THE ROOT BALL.
4. APPLY FERTILIZER AND MYCORRHIZAL INOCULANT PER PLANTING SPECIFICATION. TAMP SOIL IN 6" LAYERS AROUND ROOT BALL AND WATER THOROUGHLY AFTER PLANTING. WATER THOROUGHLY AFTER EXCAVATION AND AFTER PLANT INSTALLATION.
5. COMPLETELY UNWRAP OR CUT GIRDLING ROOTS. DO NOT DAMAGE MAIN ROOTS OR ROOT BALL WHEN INSTALLING TREE.
6. FOR CONTAINER: REMOVE ROOT BALL FROM CONTAINER. LOOSEN POT- BOUND, SPIRALLY-GROWING ROOTS. FOR B&B: CUT TWINE AND REMOVE BURLAP AND UPPER THIRD OF WIRE BASKET TO A MINIMUM DEPTH OF 18".
7. REMOVE AND DISPOSE OF ALL NON-BIODEGRADABLES FROM PLANTING HOLES AND ROOT BALL.
8. REMOVE STAKES AFTER FIRST YEAR.

TYPICAL TREE PLANTING DETAIL

NOT TO SCALE



NOTES:

1. LOCATE THE CYLINDRICAL DIBBLE OR PLUG EXTRACTOR IN THE CENTER OF THE PLANTING SPOT, ORIENT THE TOOL VERTICALLY (STRAIGHT DOWN), AND APPLY FIRM PRESSURE ON THE FOOTSTEP SO THAT THE PLANTING TOOL PENETRATES TO THE FULL DESIGN DEPTH. THE CREATED HOLE SHALL BE WITHIN 10 DEGREES OR VERTICAL.
2. REMOVE THE PLANTING TOOL AND EXAMINE THE PLANTING HOLE. THE CREATED HOLE SHALL BE CLEAN AND CONFORM TO THE SHAPE OF THE PLUG/TUBELING DIMENSIONS. IF IT DOES NOT CONFORM TO THE REQUIRED SHAPE, INSERT THE TOOL AGAIN TO CREATE THE CORRECT DIMENSIONS. IF DIMENSION ARE STILL NOT CORRECT OR A LARGE AIR POCKET IS CREATED, THE HOLE SHALL BE ABANDONED AND A NEW PLANTING LOCATION SELECTED.
3. ONCE THE CORRECT PLANTING HOLE SIZE IS ACHIEVED, GENTLY REMOVE THE TUBELING FROM THE PLANT TRAY, PLANT CARRIER OR SHIPPING CONTAINER AND CAREFULLY REMOVE THE TREE/SHRUB FROM THE PLANT TUBE. ALTERNATELY, CAREFULLY REMOVE A PLUG FROM THE PLANTING BAG OR PLANT CARRIER.
4. APPLY FERTILIER PER PLANTING SPECIFICATION TO THE HOLE. IMMEDIATELY PLACE THE TREE/SHRUB IN THE PLANTING HOLE. THE TREES/SHRUB SHALL BE PLACED IN THE PLANTING HOLE SUCH THAT THE TOP OF THE TUBELING ROOT COLLAR OR PLUG ROOTMASS IS ONE (1) INCH BELOW THE ADJACENT SOIL ELEVATION WITH THE ROOTS ORIENTED DOWNWARD. DO NOT FORCE INTO THE PLANTING HOLE. THE ROOT SYSTEM SHALL NOT BE COMPRESSED, TWISTED, SCREWED, J-SHAPED OR BALLED UP.
5. WITH THE FOOT, SCRAPE ENOUGH SOIL FROM THE SURROUNDING AREA TO CLOSE THE PLANTING HOLE AND FULLY COVER THE PLANTING SURFACE OF THE TUBELING/PLUG TO AN ELEVATION SLIGHTLY HIGHER THAN THE ADJACENT GRADE.
6. WHILE GENTLY HOLDING THE TOP OF THE TREE/SHRUB APPLY FIRM FOOT PRESSURE IN SEVERAL DIFFERENT POSITIONS IMMEDIATELY AROUND THE TREE/SHRUB TO FIRM THE SOIL AND ELIMINATE AIR POCKETS. THE FINAL PLACEMENT SHALL RESULT IN THE TOP OF THE ROOT MASS BEING ONE (1) INCH BELOW THE SOIL SURFACE WITH THE PLANTING HOLE BEING TOTALLY CLOSED WITH FIRMED, UNCOMPACTED SOIL WITHOUT ANY AIR POCKETS.

TUBELING PLANTING DETAIL

NOT TO SCALE

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY: E. MOSKALENKO
DRAWN BY: E. MOSKALENKO
CHECKED BY:
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

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WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
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LANDSCAPE
LANDSCAPE DETAILS

DATE: JULY 2022
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DRAWING NUMBER: L-302

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PLOT DATE: 7/20/2022 5:14 PM BY: CMCNICOL

Appendix D-2: Contract Drawings, Sanitary Force Main

Appendix E-1: Soil Information, USDA NRCS Soil Survey

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
Westchester County, New York

Rye Lake Water Filtration Plant

December 30, 2021

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.

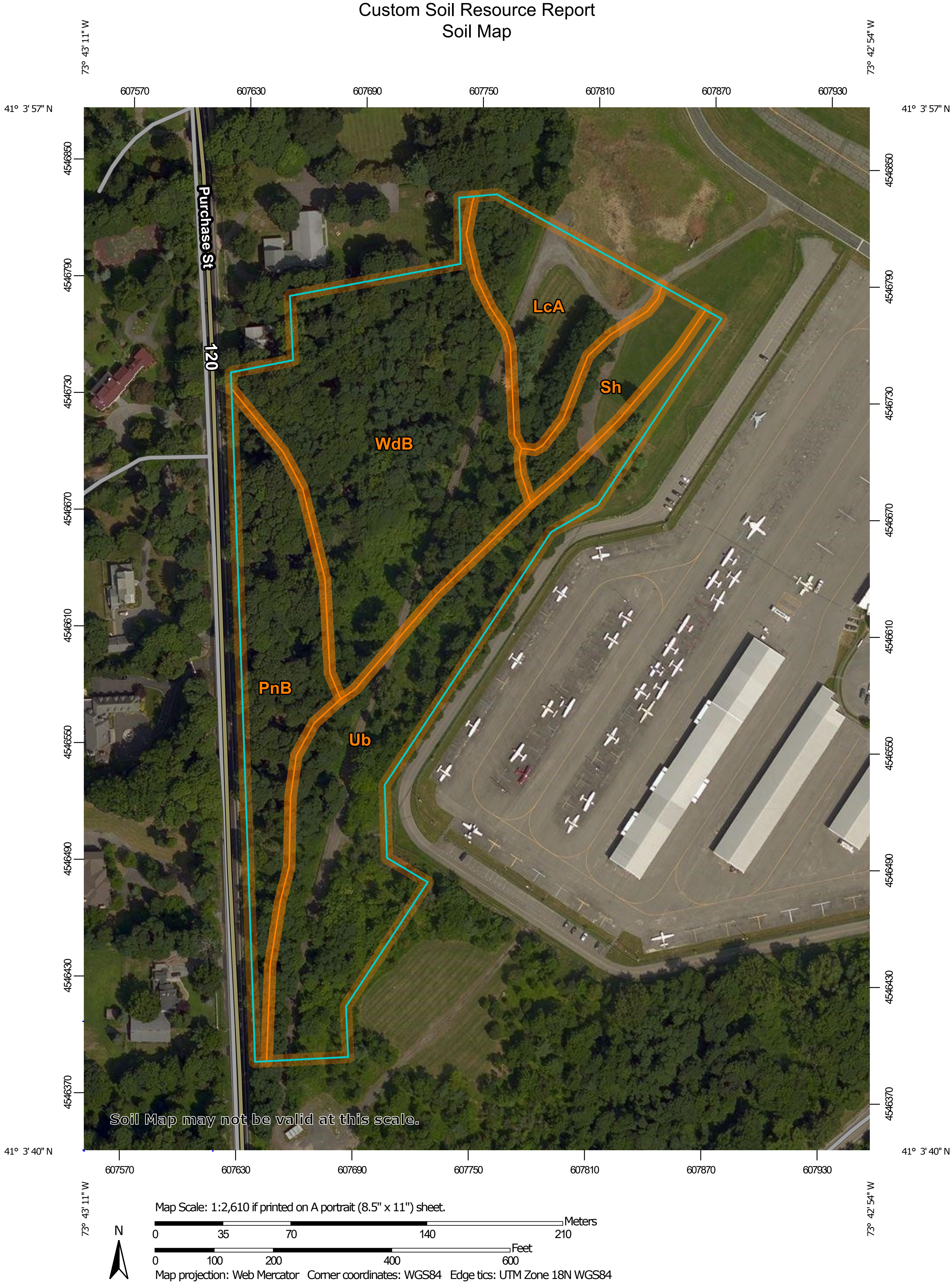
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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: 1:2,610 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

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 1:12,000.

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: Westchester County, New York
Survey Area Data: Version 17, Sep 1, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 21, 2014—Aug 27, 2014

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
LcA	Leicester loam, 0 to 3 percent slopes, stony	1.6	11.8%
PnB	Paxton fine sandy loam, 3 to 8 percent slopes	2.3	17.0%
Sh	Sun loam	0.8	6.0%
Ub	Udorthents, smoothed	3.9	28.7%
WdB	Woodbridge loam, 3 to 8 percent slopes	4.9	36.5%
Totals for Area of Interest		**13.4**	**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.

Westchester County, New York

LcA—Leicester loam, 0 to 3 percent slopes, stony

Map Unit Setting

National map unit symbol: bd8v
Elevation: 0 to 1,120 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Leicester, poorly drained, and similar soils: 50 percent
Leicester, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leicester, Poorly Drained

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 acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Leicester, Somewhat Poorly Drained

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 acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: No

Minor Components

Sun

Percent of map unit: 7 percent
Landform: Depressions
Hydric soil rating: Yes

Sutton

Percent of map unit: 5 percent
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

PnB—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet

Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Paxton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sh—Sun loam

Map Unit Setting

National map unit symbol: bd9q
Elevation: 600 to 1,800 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sun and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sun

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 till derived primarily from limestone and sandstone, with a component of schist, shale, or granitic rocks in some areas

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 27 inches: loam
H3 - 27 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained
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: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: F144AY039NY - Semi-Rich Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Leicester

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ridgebury

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Palms

Percent of map unit: 3 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Sun, stony

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Ub—Udorthents, smoothed

Map Unit Setting

National map unit symbol: bd7f
Elevation: 0 to 2,400 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, smoothed, and similar soils: 80 percent
Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Smoothed

Typical profile

H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 70 inches: very gravelly loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 18 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Minor Components

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Leicester

Percent of map unit: 2 percent
Hydric soil rating: No

Hollis

Percent of map unit: 2 percent
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 2 percent
Hydric soil rating: No

Sun

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

WdB—Woodbridge loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w688
Elevation: 0 to 1,280 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, loam, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Loam

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, footslope, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 6 inches: loam
Bw1 - 6 to 18 inches: gravelly loam
Bw2 - 18 to 29 inches: gravelly loam
Cd - 29 to 65 inches: gravelly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

Minor Components

Ridgebury

Percent of map unit: 7 percent
Landform: Depressions, ground moraines, hills, drainageways, drumlins
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton

Percent of map unit: 7 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Sutton

Percent of map unit: 1 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

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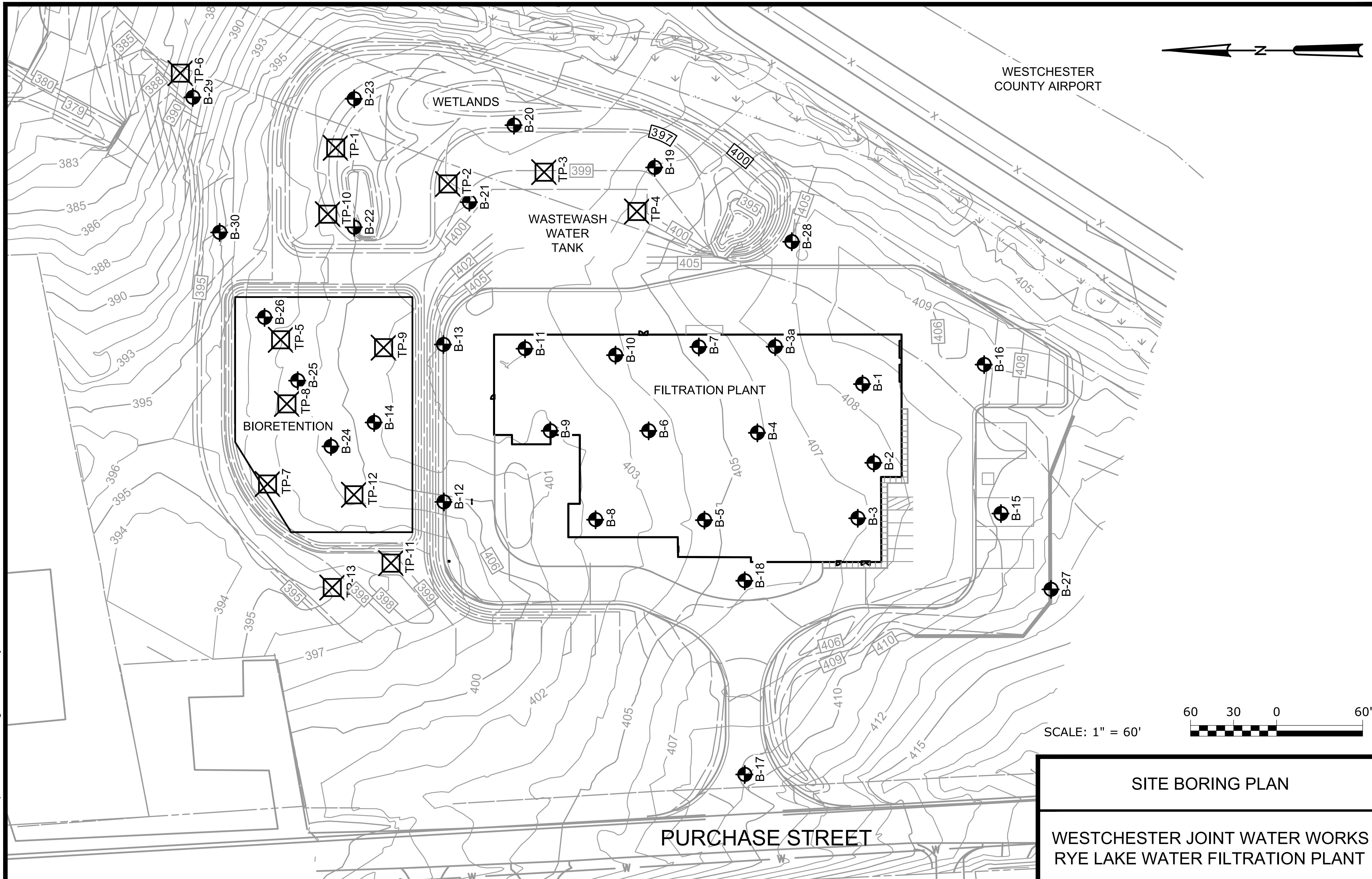
Appendix E-2 Soil Information, Geotechnical Investigation



File = C:\bms\hazen-pw\d0200915\Boring Plan Saved by CMcNicol Save date = 7/5/2022 2:32 PM

TABLES

Table 1 – Test Boring Summary

Test Boring ID	Test Boring Location	Depth (ft)	Approx. Ground Surface El. in (ft)
B-1	Filtration Plant	60.2	408
B-2		60.2	408
B-3		100.2	407
B-3a(OW)		60.2	407
B-4		60.2	406
B-5		60.3	404
B-6		60.3	403
B-7		60.3	405
B-8		60.2	402
B-9		60.3	402
B-10		Eliminated	
B-11		60.4	403
B-12	Access Roadway	Eliminated	
B-13		60.2	402
B-14		Eliminated	
B-15	Generator Pads	60.2	410
B-16	Access Roadway	22	410
B-17		22	409
B-18		22	406
B-19	Combined Waste Washwater Tanks	22	403
B-20		22	401
B-21		22	401
B-22	Constructed Wetland	22	399
B-23		22	399
B-24	Bioretention w/566 Storage Chambers Beneath	22	399
B-25		22	398
B-26		22	397
B-27	Retaining Wall	22	412
B-28	Additional Borings Outside Proposed Structure Footprint	22	408
B-29(OW)		22	389
B-30		22	394

Table 2 - Subsurface Stratigraphy Summary

Boring ID	Year of Boring	Approx. Ground Surface El. (ft)	Top of Silty Sand			Top of Glacial Till			Top of Decomposed Rock	
			Approx. Depth to Top(ft)	Approx. El. (ft)	Layer Thickness (ft)	Approx. Depth to Top (ft)	Approx. El. (ft)	Layer Thickness (ft)	Approx. Depth (ft)	Approx. El. (ft)
B-1(OW)	2019	401	0.5	400.5	5.0	5.5	395.5	-	-	-
B-2	2019	400	0.3	399.7	4.7	5	395.0	-	-	-
B-3	2019	405	0.5	404.5	3.0	3.5	401.5	-	-	-
B-1	2021	408	0.3	407.7	5.7	6.0	402.0	17.5	23.5	384.5
B-2	2021	408	0.3	407.7	7.7	8.0	400.0	15.5	23.5	384.5
B-3	2021	407	0.3	406.7	9.7	10.0	397.0	13.5	23.5	383.5
B-3a(OW)	2021	407	0.3	406.7	0.0	0.3	406.7	23.2	23.5	383.5
B-4	2021	406	0.3	405.7	7.7	8.0	398.0	15.5	23.5	382.5
B-5	2021	404	0.3	403.7	3.7	4.0	400.0	19.5	23.5	380.5
B-6	2021	403	0.3	402.7	3.7	4.0	399.0	19.5	23.5	379.5
B-7	2021	405	0.3	404.7	3.7	4.0	401.0	29.5	33.5	371.5
B-8	2021	402	0.3	401.7	3.7	4.0	398.0	19.5	23.5	378.5
B-9	2021	402	0.3	401.7	1.7	2.0	400.0	21.5	23.5	378.5
B-11	2021	403	0.3	402.7	3.7	4.0	399.0	34.5	38.5	364.5
B-13	2021	402	0.3	401.7	3.7	4.0	398.0	29.5	33.5	368.5
B-15	2021	410	0.3	409.7	3.7	4.0	406.0	39.5	43.5	366.5
B-16	2021	410	0.3	409.7	8.7	9.0	401.0	-	-	-
B-17	2021	409	0.3	408.7	1.7	2.0	407.0	-	-	-
B-18	2021	406	0.3	405.7	6.7	7.0	399.0	-	-	-
B-19	2021	403	0.3	402.7	1.7	2.0	401.0	-	-	-
B-20	2021	401	0.3	400.7	-	-	-	-	-	-
B-21	2021	401	0.3	400.7	1.7	2.0	399.0	16.5	18.5	382.5
B-22	2021	399	0.3	398.7	3.7	4.0	395.0	14.5	18.5	380.5
B-23	2021	399	0.3	398.7	3.7	4.0	395.0	-	-	-
B-24	2021	399	-	-	-	0.3	398.7	-	-	-
B-25	2021	398	0.3	397.7	3.7	4.0	394.0	-	-	-
B-26	2021	397	0.3	396.7	3.7	4.0	393.0	14.5	18.5	378.5
B-27	2021	412	0.3	411.7	5.7	6.0	406.0	-	-	-
B-28	2021	408	0.3	407.7	3.7	4.0	404.0	-	-	-
B-29(OW)	2021	389	0.3	388.7	3.7	4.0	385.0	-	-	-
B-30	2021	394	0.3	393.7	9.7	10.0	384.0	-	-	-

Table 3 – Test Pit Findings Summary

Test Pit Location	Approx. Ground Surface El. (ft)	Bottom of Excavation		Soil Mottling		Moist Soil		Groundwater	
		Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)
TP-1	399.5	12	387.5	9	391	10	390	Deeper than 12	Deeper than 387.5
TP-2	401	13	388	5	396	11	390	Deeper than 13	Deeper than 388
TP-3	401.5	13.5	388	5	396.5	8	394	12	389.5
TP-4A*	403	13.5	389.5	-	-	11	392	Deeper than 13.5	Deeper than 389.5
TP-5	398	13	385	11	387	11	387	Deeper than 13	Deeper than 384
TP-6	387	8.5	378.5	5	382	-	-	7.5	379.5
TP-7	397.5	13	384.5	-	-	8	390	13	384.5
TP-8	398	13	385	-	-	11	387	Deeper than 13'	Deeper than 385
TP-9	401	13.5	387.5	-	-	10	391	12.5	388.5
TP-10	398.5	9	389.5	-	-	-	-	Deeper than 9'	Deeper than 389.5
TP-11	397	8	389	4	393	5	392	6	391
TP-12	399	14	385	-	-	10	389	13	386
TP-13	396	11	385	3	393	3	393	8	388

* Test pit TP-4 was offset due to a boulder at approximately 7 feet below grade.

Table 5 – Permeability Testing Summary

Falling Head Test[1]			
Test Boring ID	**Test Depth (ft)**	**Test Elev. in NAVD88 (ft)**	**Average Rate, Kv (in/hr)**
B-19	8.5	394.5	0.003
B-20	7.5	393.5	0.005
B-22	9.0	390.0	0.026
Rising Head Test[2]			
Well ID	**Test ID**	**Average Recharge Rate (in/min)**	
B-3a	Test 1	5.434	
B-29	Test 2	116.988	
B-29	Test 2	104.567	

1. Based on the results of the Falling Head tests, it can be interpreted that the water will preferentially flow horizontally and not penetrate the strata.
2. The results of the rising head test are higher than anticipated. The pumped water may have been from the casing and filter pack, given the high fines content of tested soils, unlikely that a steady state flow condition had time to develop. Therefore, published k values for silty sand which are typically less than 2.4 in/min should be used for dewatering.

Table 6 – Geotechnical Laboratory Test Result Summary

Boring ID	Sample ID	Sample Depth (ft)	Stratum	Identification Test Results			Unit Weight Tests		Direct Shear Tests		CBR at 0.1-inch Penetration
				Water Content (%)	USCS (Group Symbol)	Sieve Minus 200 (%)	Total Unit Weight (pcf)	Dry Unit Weight (pcf)	Peak Shear Strength (ksf)	Pd at Peak Shear Strength (%)	
B-16/17/18	S-1/2/3	0'-5'	Silty Sand	-	-	-	-	-	-	-	50.1
B-20	S-4	8'-10'		13.4	SM	23	-	-	-	-	-
B-2	S-9	25'-27'	Glacial Till	11.4	SM	26	-	-	-	-	-
B-6	S-7	15'-17'		12.5	SM	32	-	-	-	-	-
B-7	S-6	10'-12		11.0	SC	-	142.0	127.9	-	-	-
B-7	S-7	15'-17'		14.8	SC	-	139.4	121.4	1.1	4.1	-
B-11	S-8	20'-22'		12.5	SM	34	-	-			-
B-22	S-5	10'-12'		12.8	SM	33	-	-			-
B-25	S-6	10'-12'		10.4	SM	30	-	-			-
B-26	S-6	10'-12		10.9	SM	-	141.3	127.5	0.8	9.7	-
B-26	S-7	15'-17'		10.4	SC	-	144.6	131.0			-
B-27	S-5	8'-10		9.0	SM	-	127.4	116.9			-
B-27	S-6	10'-12'		14.4	SM	15	-	-			-
B-27	S-7	15'-17'		12.2	SM	-	141.3	126.0	1.1	3.8	-

BORING LOGS AND GROUNDWATER OBSERVATION WELL INSTALLATION LOGS

LOG KEY

GZA
Geo Environmental, Inc.
Engineers and Scientists

BURMISTER SOIL CLASSIFICATION

COMPONENT	NAME	PROPORTIONAL TERM	PERCENT BY WEIGHT
MAJOR	GRAVEL, SAND, FINES*		>50
Minor	Gravel, Sand, Fines*	and	35 - 50
		some	20-35
		little	10-20
*See identification of fines table.		trace	0-10

IDENTIFICATION OF FINES

Material	PI	Atterberg Thread Dia.
SILT	0	Cannot Roll
Clayey SILT	1-5	1/4"
SILT & CLAY	5-10	1/8"
CLAY & SILT	10-20	1/16"
Silty CLAY	20-40	1/32"
CLAY	>40	1/64"

GRADATION DESIGNATION	PROPORTION OF COMPONENT
Fine to coarse	All fractions > 10%
Medium to coarse	<10% fine
Fine to medium	<10% coarse
Coarse	<10% fine and medium
Medium	<10% coarse and fine
Fine	<10% coarse and medium

PLASTIC SOILS

Consistency	Blows/Ft. SPT N-Value
Very Soft	< 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

GRAVEL & SAND

Density	Blows/Ft. SPT N-Value
Very Loose	< 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) (ASTM D 2487)

MAJOR DIVISIONS			Group Symbols
Coarse Grained Soils More than 50% of material larger than No. 200 sieve.	Gravel More than 50% larger than No. 4 sieve.	Clean Gravels (Little or no fines)	GW GP
		Gravels with Fines (Appreciable amount of fines)	GM GC
	Sand More than 50% smaller than No. 4 sieve.	Clean Sands (Little or no fines)	SW SP
		Sands with Fines (Appreciable amount of fines)	SM SC
Fine Grained Soils More than 50% of material smaller than No. 200 sieve.		Silts and Clays Liquid Limit <50	ML CL
		Silts and CLays Liquid Limit >50	OL MH CH OH
		Highly Organic Soils	Pt

ORGANIC SOIL CLASSIFICATION

Fibrous PEAT (Pt) - Lightweight, spongy, mostly visible organic matter, water squeezes readily from sample. Typically near top of deposit.
Fine Grained PEAT (Pt) - Lightweight, spongy, little visible organic matter, water squeezes readily from sample. Typically below fibrous peat.
Organic Silt (OL) - Typically gray to dark gray, often has strong H2S odor. Typically contains shells or shell fragments. Lightweight. Usually found near coastal regions. May contain wide range of sand fractions.
Organic Clay (OH) - Typically gray to dark gray, high plasticity. Usually found near coastal regions. May contain wide range of sand fractions. Need organic content test for final identification.

ABBREVIATIONS

MR = Mud Rotary
HSA = Hollow Stem Auger
SSA = Solid Stem Auger
SS = Split Spoon Sampler
U = Undisturbed Sample (Shelby Tube)
MC = Modified California Sampler
V = Vibracore
M = Macrocore

USCS = Unified Soil Classification System (ASTM D2487)
NYCBC = New York City Building Code
WOR = Weight of Rods
WOH= Weight of Hammer
SPT = Standard Penetration Test (ASTM D1586)
N-Value = Cumulative number of uncorrected blows for the middle two six-inch intervals (blows/foot).

Tv = Field Vane Shear Test (Torvane) Shear Strength
PP = Pocket Penetrometer Shear Strength
PI = Plasticity Index
Wn = Moisture Content
CO = Consolidation
UC = Unconfined Compression Test
UU = Unconsolidated Undrained (Triaxial) Test
SI = Sieve Analysis
DS = Direct Shear
PID = Photoionization Detector
ppm = Parts Per Million
REC = Recovery
RQD = Rock Quality Designation
▼ = Measured Water Level

TEST BORING LOG

GZA GeoEnvironmental of New York
Engineers and Scientists

Westchester Joint Water Works
Water Treatment Plant
Westchester County, New York

EXPLORATION NO.: B-19
SHEET: 1 of 1
PROJECT NO: 41.0162892.00
REVIEWED BY: D. Patel

Logged By: A. Amador
Drilling Co.: Craig Test Boring Co., Inc.
Foreman: P. Mullins/S. Schultz
Date Start: 6/4/2021 **Finish:** 6/4/2021

Type of Rig: ATV
Rig Model: CME 750X
Drilling Method:
Mud Rotary

Boring Location: See Plan
Stationing (ft.): **Offset (ft.):**
Ground Surface Elevation (ft.): 403
Final Boring Depth (ft.): 22

H. Datum: -
V. Datum: NAVD 88
Northing:
Easting:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	20	1 2 7 8	9	S-1: Top 1": TOPSOIL Bottom 19": Loose, brown, fine to medium SAND, some Silt, little Gravel.			0.3	TOPSOIL	402.7
											2	SILTY SAND	401.0
		S-2	2.0-4	24	21	11 13 14 17	27	S-2: Medium dense, brown, fine to medium SAND and SILT, little Gravel.					
5		S-3	4.0-6	24	16	8 9 15 17	24	S-3: Medium dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
		S-4	6.0-8	24	15	10 17 18 24	35	S-4: Dense, brown, fine to coarse SAND and SILT, little Gravel, trace mica.	1				
10		S-5	10.0-12	24	20	14 19 18 18	37	S-5: Dense, brown, fine to coarse SAND and SILT, little Gravel, trace mica.				GLACIAL TILL	
15		S-6	15.0-17	24	20	9 14 16 35	30	S-6: Medium dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.					
20		S-7	20.0-22	24	22	11 17 21 25	38	S-7: Dense, gray-brown fine to medium SAND and SILT, little Gravel, trace mica.	2		22		381.0
								End of exploration at 22 feet.	3				
25													
30													

REMARKS

1 - Percolation test performed at approximately 8.5 feet. See Percolation Test log for more details.
2 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
3 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-19

TEST BORING LOG

GZA GeoEnvironmental of New York *Engineers and Scientists*	Westchester Joint Water Works Water Treatment Plant Westchester County, New York	**EXPLORATION NO.: B-20** **SHEET: 1 of 1** **PROJECT NO: 41.0162892.00** **REVIEWED BY: D. Patel**

Logged By: A. Amador **Drilling Co.:** Craig Test Boring Co., Inc. **Foreman:** P. Mullins/S. Schultz **Date Start:** 6/3/2021 **Finish:** 6/3/2021	**Type of Rig:** ATV **Rig Model:** CME 750X **Drilling Method:** Mud Rotary	**Boring Location:** See Plan **Stationing (ft.):** **Offset (ft.):** **Ground Surface Elevation (ft.):** 401 **Final Boring Depth (ft.):** 22	**H. Datum:** - **V. Datum:** NAVD 88 **Northing:** **Easting:**

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab. Time**
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	13	1 2 5 5	7	S-1: Top 1": TOPSOIL Bottom 12": Loose, brown, fine to medium SAND and SILT, little Gravel.			0.3	TOPSOIL	400.7
		S-2	2.0-4	24	18	5 9 10 12	19	S-2: Medium dense, brown, fine to medium SAND and SILT, little Gravel.					
5		S-3	4.0-6	24	17	10 11 15 14	26	S-3: Medium dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
									1				
		S-4	8.0-10	24	17	6 11 13 16	24	S-4: Medium dense, brown, fine to medium SAND, some Silt, trace Gravel, trace mica.					
10		S-5	10.0-12	24	14	6 8 13 17	21	S-5: Medium dense, brown, fine to medium SAND, some Silt, trace Gravel, trace mica.				SILTY SAND	
15		S-6	15.0-17	24	15	12 14 16 15	30	S-6: Medium dense, brown, fine to coarse SAND and SILT, little Gravel, trace mica.					
20		S-7	20.0-22	24	12	9 8 14 20	22	S-7: Medium dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.	2		22		379.0
								End of exploration at 22 feet.	3				
25													
30													

REMARKS

1 - Percolation test performed at approximately 7.5 feet depth. See Percolation Test log for more details.
2 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
3 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-20

TEST BORING LOG

GZA GeoEnvironmental of New York *Engineers and Scientists*	Westchester Joint Water Works Water Treatment Plant Westchester County, New York	**EXPLORATION NO.:** B-21 **SHEET:** 1 of 1 **PROJECT NO:** 41.0162892.00 **REVIEWED BY:** D. Patel

Logged By: A. Amador **Drilling Co.:** Craig Test Boring Co., Inc. **Foreman:** P. Mullins/S. Schultz **Date Start:** 6/3/2021 **Finish:** 6/3/2021	**Type of Rig:** ATV **Rig Model:** CME 750X **Drilling Method:** Mud Rotary	**Boring Location:** See Plan **Stationing (ft.):** **Offset (ft.):** **Ground Surface Elevation (ft.):** 401 **Final Boring Depth (ft.):** 22	**H. Datum:** - **V. Datum:** NAVD 88 **Northing:** **Easting:**

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab. Time**
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	9	3 5 3 6	8	S-1: Top 2": ASPHALT Bottom 8": Loose, brown, fine to medium SAND and SILT, little Gravel, trace Asphalt fragments.			0.3	ASPHALT	400.7
											2	SILTY SAND	399.0
		S-2	2.0-4	24	16	8 15 20 27	35	S-2: Dense, brown, fine to medium SAND and SILT, little Gravel, trace Asphalt fragments.					
5		S-3	4.0-6	24	15	13 20 24 23	44	S-3: Dense, brown, fine to coarse SAND, some Silt, little Gravel, trace mica.					
		S-4	6.0-8	24	15	16 22 19 20	41	S-4: Dense, brown, fine to coarse SAND, some Silt, little Gravel, trace mica.					
		S-5	8.0-10	24	7	9 13 25 19	38	S-5: Dense, brown, fine to coarse SAND, some Gravel, some Silt, trace mica.					
10		S-6	10.0-12	24	14	20 24 21 28	45	S-6: Dense, brown, fine to coarse SAND, some Gravel, some Silt, trace mica.				GLACIAL TILL	
15		S-7	15.0-17	24	13	9 10 13 26	23	S-7: Medium dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.			18.5		382.5
20		S-8	20.0-22	24	14	9 60 17 40	77	S-8: Very dense, gray-brown, fine to medium SAND, some Gravel, some Silt, trace mica.	1		22	DECOMPOSED ROCK	379.0
								End of exploration at 22 feet.	2				
25													
30													

REMARKS

1 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
2 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-21

TEST BORING LOG

GZA GeoEnvironmental of New York
Engineers and Scientists

Westchester Joint Water Works
Water Treatment Plant
Westchester County, New York

EXPLORATION NO.: B-22
SHEET: 1 of 1
PROJECT NO: 41.0162892.00
REVIEWED BY: D. Patel

Logged By: A. Amador
Drilling Co.: Craig Test Boring Co., Inc.
Foreman: Dave Cooke/S. Schultz
Date Start: 5/25/2021 **Finish:** 5/25/2021

Type of Rig: ATV
Rig Model: CME 750X
Drilling Method:
Mud Rotary

Boring Location: See Plan
Stationing (ft.): **Offset (ft.):**
Ground Surface Elevation (ft.): 399
Final Boring Depth (ft.): 22

H. Datum: -
V. Datum: NAVD 88
Northing:
Easting:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	10	1 3 4 4	7	S-1: Top 1": TOPSOIL Bottom 9": Loose, brown, fine to medium SAND and SILT, little Gravel, occasional roots.			0.3	TOPSOIL	398.7
		S-2	2.0-4	24	12	2 4 5 9	9	S-2: Loose, brown, fine to medium SAND and SILT, little Gravel, trace Clay, trace mica.			4	SILTY SAND	395.0
5		S-3	4.0-6	24	15	17 16 12 16	28	S-3: Medium dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
		S-4	6.0-8	24	18	22 56 35 20	91	S-4: Very dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
10									1				
		S-5	10.0-12	24	14	20 17 12 15	29	S-5: Medium dense, brown, fine to medium SAND, some Silt, trace Gravel, trace mica.				GLACIAL TILL	
15		S-6	15.0-17	24	13	15 16 20 25	36	S-6: Dense, brown, fine to medium SAND, some Silt, trace Gravel, trace mica.			18.5		380.5
20		S-7	20.0-22	24	17	18 33 32 62	65	S-7: Very dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.	2		22	DECOMPOSED ROCK	377.0
								End of exploration at 22 feet.	3				
25													
30													

REMARKS

1 - Percolation test performed at approximately 9 feet depth. See Percolation Test logs for more details.
2 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
3 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-22

TEST BORING LOG

GZA GeoEnvironmental of New York
Engineers and Scientists

Westchester Joint Water Works
Water Treatment Plant
Westchester County, New York

EXPLORATION NO.: B-23
SHEET: 1 of 1
PROJECT NO: 41.0162892.00
REVIEWED BY: D. Patel

Logged By: A. Amador
Drilling Co.: Craig Test Boring Co., Inc.
Foreman: P. Mullins/S. Schultz
Date Start: 6/3/2021 **Finish:** 6/3/2021

Type of Rig: ATV
Rig Model: CME 750X
Drilling Method: Mud Rotary

Boring Location: See Plan
Stationing (ft.): **Offset (ft.):**
Ground Surface Elevation (ft.): 399
Final Boring Depth (ft.): 22

H. Datum: -
V. Datum: NAVD 88
Northing:
Easting:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)			
Date	Time	Water Depth	Stab. Time
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	4	1 1 2 2	3	S-1: Top 1": TOPSOIL Bottom 3": Very loose, brown, fine to medium SAND, some Silt, little Gravel, trace roots.	1		0.3	TOPSOIL	398.7
		S-2	2.0-4	24	16	2 2 6 11	8	S-2: Loose, brown, fine to medium SAND and SILT, little Gravel, trace mica.			4	SILTY SAND	395.0
5		S-3	4.0-6	24	15	13 17 14 21	31	S-3: Dense, brown, fine to coarse SAND, some Gravel, some Silt, trace mica.					
		S-4	6.0-8	24	11	21 40 31 29	71	S-4: Very dense, brown, fine to coarse SAND, some Gravel, some Silt, trace mica.					
		S-5	8.0-10	24	14	11 14 23 31	37	S-5: Dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
10		S-6	10.0-12	24	13	11 83 44 21	>100	S-6: Very dense, brown, fine to coarse SAND, some Gravel, some Silt, trace mica.	2				
15		S-7	15.0-17	24	12	7 10 16 24	26	S-7: Medium dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.				GLACIAL TILL	
20		S-8	20.0-22	24	15	15 19 29 35	48	S-8: Dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.	3		22		377.0
								End of exploration at 22 feet.	4				
25													
30													

REMARKS

1 - Gravel fragment encountered at tip of split spoon at sample S-1
2 - Hard drilling from approximately 6-12 feet in depth.
3 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
4 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-23

TEST BORING LOG

GZA GeoEnvironmental of New York *Engineers and Scientists*	Westchester Joint Water Works Water Treatment Plant Westchester County, New York	**EXPLORATION NO.:** B-24 **SHEET:** 1 of 1 **PROJECT NO:** 41.0162892.00 **REVIEWED BY:** D. Patel

Logged By: A. Amador
Drilling Co.: Craig Test Boring Co., Inc.
Foreman: Dave Cooke/S. Schultz
Date Start: 5/25/2021 **Finish:** 5/26/2021

Type of Rig: ATV
Rig Model: CME 750X
Drilling Method: Mud Rotary

Boring Location: See Plan
Stationing (ft.): **Offset (ft.):**
Ground Surface Elevation (ft.): 399
Final Boring Depth (ft.): 22

H. Datum: -
V. Datum: NAVD 88
Northing:
Easting:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	15	10 77 81 69	>100	S-1: Top 1": TOPSOIL Bottom 14": Very dense, brown, fine to coarse Gravel, little sand, trace roots.			0.3	TOPSOIL	398.7
		S-2	2.0-4	24	7	14 15 16 17	31	S-2: Dense, brown, fine to medium SAND, some Silt, little Gravel.					
5		S-3	4.0-6	24	17	19 22 16 17	38	S-3: Dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.					
		S-4	6.0-8	5	5	100/5"	R	S-4: Very dense, brown, fine to medium SAND, some Gravel, some Silt, trace mica.					
		S-5	8.0-10	24	16	6 5 9 11	14	S-5: Medium dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
10		S-6	10.0-12	24	10	12 14 22 49	36	S-6: Dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.				GLACIAL TILL	
15		S-7	15.0-17	24	0	10 13 15 22	28	S-7: No recovery.	1				
20		S-8	20.0-22	24	16	6 8 12 12	20	S-8: Medium dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.	2		22		377.0
								End of exploration at 22 feet.	3				
25													
30													

REMARKS

1 - Gravel encountered at tip of split spoon at sample S-7.
2 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
3 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-24

TEST BORING LOG

GZA GeoEnvironmental of New York
Engineers and Scientists

Westchester Joint Water Works
Water Treatment Plant
Westchester County, New York

EXPLORATION NO.: B-25
SHEET: 1 of 1
PROJECT NO: 41.0162892.00
REVIEWED BY: D. Patel

Logged By: A. Amador
Drilling Co.: Craig Test Boring Co., Inc.
Foreman: Dave Cooke/S. Schultz
Date Start: 5/25/2021 **Finish:** 5/25/2021

Type of Rig: ATV
Rig Model: CME 750X
Drilling Method: Mud Rotary

Boring Location: See Plan
Stationing (ft.): **Offset (ft.):**
Ground Surface Elevation (ft.): 398
Final Boring Depth (ft.): 22

H. Datum: -
V. Datum: NAVD 88
Northing:
Easting:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab. Time**
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	6	1 1 1 1	2	S-1: Top 1": TOPSOIL Bottom 5": Very loose, brown, fine to medium SAND, some Silt, trace Gravel, occasional roots.			0.3	TOPSOIL	397.7
		S-2	2.0-4	24	15	3 3 7 14	10	S-2: Loose, brown, fine to medium SAND and SILT, little Gravel, trace Clay.			4	SILTY SAND	394.0
5		S-3	4.0-6	24	18	15 20 24 25	44	S-3: Dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
		S-4	6.0-8	24	15	15 36 26 25	62	S-4: Very dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
		S-5	8.0-10	24	14	26 30 26 24	56	S-5: Very dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.					
10		S-6	10.0-12	24	17	12 22 20 24	42	S-6: Dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.				GLACIAL TILL	
15		S-7	15.0-17	24	22	11 20 28 30	48	S-7: Dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.					
20		S-8	20.0-22	24	20	12 21 22 32	43	S-8: Dense, gray-brown, fine to medium SAND and SILT, little Gravel, trace mica.	1		22		376.0
								End of exploration at 22 feet.	2				
25													
30													

REMARKS

1 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
2 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-25

TEST BORING LOG

GZA GeoEnvironmental of New York *Engineers and Scientists*	**Westchester Joint Water Works Water Treatment Plant Westchester County, New York**	**EXPLORATION NO.:** B-26 **SHEET:** 1 of 1 **PROJECT NO:** 41.0162892.00 **REVIEWED BY:** D. Patel

Logged By: A. Amador **Drilling Co.:** Craig Test Boring Co., Inc. **Foreman:** Dave Cooke/S. Schultz **Date Start:** 5/25/2021 **Finish:** 5/25/2021	**Type of Rig:** ATV **Rig Model:** CME 750X **Drilling Method:** Mud Rotary	**Boring Location:** See Plan **Stationing (ft.):** **Offset (ft.):** **Ground Surface Elevation (ft.):** 397 **Final Boring Depth (ft.):** 22	**H. Datum:** - **V. Datum:** NAVD 88 **Northing:** **Easting:**

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/3.5

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
Not	Measured		

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.0-2	24	14	1 1 1 3	2	S-1: Top 1": TOPSOIL Bottom 13": Very loose, brown, fine to medium SAND, some Silt, little Gravel, occasional roots.			0.3	TOPSOIL	396.7
		S-2	2.0-4	24	15	6 8 10 12	18	S-2: Medium dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.				SILTY SAND	
5		S-3	4.0-6	24	15	11 32 20 25	52	S-3: Very dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.			4		393.0
		S-4	6.0-8	11	8	21 100/5"	R	S-4: Very dense, brown, fine to medium SAND, some Silt, little Gravel, trace mica.	1				
		S-5	8.0-10	24	6	41 27 50 30	77	S-5: Very dense, brown, fine to medium SAND and SILT, little Gravel.					
10		S-6	10.0-12	24	10	21 40 37 29	77	S-6: Very dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.				GLACIAL TILL	
15		S-7	15.0-17	24	13	11 21 19 20	40	S-7: Dense, brown, fine to medium SAND and SILT, little Gravel, trace mica.					
											18.5		378.5
20		S-8	20.0-22	24	15	19 25 45 64	70	S-8: Top 9": Dense, brown, fine to medium SAND and SILT, little Gravel, trace mica. Bottom 6": Hard, gray SILT, little Gravel, trace Sand, trace mica.	2			DECOMPOSED ROCK	
									3		22		375.0
								End of exploration at 22 feet.					
25													
30													

REMARKS

1 - Possible Cobbles/Boulders at approximately 7 feet below ground surface.
2 - Photoionization Detector (PID) readings were obtained for all samples. Results PID = 0 ppm throughout.
3 - Borehole was backfilled with soil cuttings and bentonite upon completion.

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: B-26

PERMEABILITY TESTING AND GROUNDWATER MONITORING RESULTS

Permeability Test Log

GZA	GZA GeoEnvironmental of NY 104 West 29th Street, 10th Floor New York, NY 10001	PT ID No. PT-19 Sheet 1 of 1

Prepared for: Hazen and Sawyer	Project: Westchester Joint Water Works Water Treatment Plant Location/Borough: Westchester County, NY

INSPECTOR: A. Amador CONTRACTOR: CRAIG TESTING	DRILLER: Paul Muliins HELPER: Steve Schultz	Start Date: 06/04/2021 Start Time: 0830	Weather: Cloudy, Low 70s F

Test Depth: 8.5 ft Test El. (NAVD88): 394.5 ft Rig Type: CME 750 X	Drill Bit Type: Roller-bit Casing Inside Diameter: 4 in. Casing Length: 126 in.	Weight of Hammer for Casing: 140 lbs. Type of Hammer: Automatic

ASTM D-6391-06
PERMEABILITY COEFFICIENT (Km) FORMULA:

General Formula:

$$K_m = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for 4" I.D. casing (in/hr):

$$K_m = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

PT-20 @ 8.5 ft

TEST 1

FIELD DATA		CALCULATED DATA				
Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)
1	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
2	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
3	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
4	0.0313	126.0000	125.9688	0.0002	0.0167	0.0170
5	0.0313	125.9688	125.9688	0.0000	0.0167	0.0000
10	0.0625	125.9688	125.9375	0.0002	0.0833	0.0034
15	0.0938	125.9375	125.9063	0.0002	0.0833	0.0034

TEST 2

FIELD DATA		CALCULATED DATA				
Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)
1	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
2	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
3	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
4	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
5	0.0313	126.0000	125.9688	0.0002	0.0167	0.0170
10	0.0625	125.9688	125.9375	0.0002	0.0833	0.0034
15	0.0938	125.9375	125.9063	0.0002	0.0833	0.0034

TEST 1 FINAL RESULTS

Time Weighted Average Permeability Coefficient Kv= 0.0034 in/hr

TEST 2 FINAL RESULTS

Time Weighted Average Permeability Coefficient Kv= 0.0034 in/hr

AVERAGE PT

Time Weighted Average Permeability Coefficient Kv= 0.003 in/hr

Inspector's Remarks:
Soil sampling continued at 10 feet after percolation test was completed. See B-19 boring log.

DEFINITIONS OF VARIABLES

*Kv= Vertical permeability
I.D.= Internal diameter of casing in the same units elected for Kv
Ln= Natural Logarithmic
t1= Time at the start of the test in the same units selected for Kv
t2= Time at the end of the test in the units selected for Kv
h1= Height of the water above the bottom of the casing at the start of the same units selected for Kv
h2= Height of the water above the bottom of the casing at the end of the test in

Permeability Test Log

GZA GeoEnvironmental of NY
104 West 29th Street, 10th Floor
New York, NY 10001

PT ID No. PT-20
Sheet 1 of 1

Prepared for:
Hazen and Sawyer

Project: Westchester Joint Water Works Water Treatment Plant
Location/Borough: Westchester County, NY

INSPECTOR: A. Amador
CONTRACTOR: CRAIG TESTING
DRILLER: Paul Muliins
HELPER: Steve Schultz
Start Date: 06/03/2021
Start Time: 1155
Weather:
Cloudy, High 60s F

Test Depth: 7.5 ft
Test El. (NAVD88): 393.5 ft
Rig Type: CME 750 X
Drill Bit Type: Roller-bit
Casing Inside Diameter: 4 in.
Casing Length: 102 in.
Weight of Hammer for Casing: 140 lbs.
Type of Hammer: Automatic

ASTM D-6391-06
PERMEABILITY COEFFICIENT (Km) FORMULA:

General Formula:

$$K_m = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for 4" I.D. casing in/hr):

$$K_m = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

PT-20 @ 7.5 ft

TEST 1

FIELD DATA		CALCULATED DATA				
Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)
1	0.0000	102.0000	102.0000	0.0000	0.0167	0.0000
2	0.0313	102.0000	101.9688	0.0003	0.0167	0.0210
3	0.0313	101.9688	101.9688	0.0000	0.0167	0.0000
4	0.0625	101.9688	101.9375	0.0003	0.0167	0.0210
5	0.0625	101.9375	101.9375	0.0000	0.0167	0.0000
10	0.0938	101.9375	101.9063	0.0003	0.0833	0.0042
15	0.1250	101.9063	101.8750	0.0003	0.0833	0.0042

TEST 2

FIELD DATA		CALCULATED DATA				
Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)
1	0.0000	102.0000	102.0000	0.0000	0.0167	0.0000
2	0.0000	102.0000	102.0000	0.0000	0.0167	0.0000
3	0.0000	102.0000	102.0000	0.0000	0.0167	0.0000
4	0.0313	102.0000	101.9688	0.0003	0.0167	0.0210
5	0.0313	101.9688	101.9688	0.0000	0.0167	0.0000
10	0.0625	101.9688	101.9375	0.0003	0.0833	0.0042
15	0.0938	101.9375	101.9063	0.0003	0.0833	0.0042

TEST 1 FINAL RESULTS

Time Weighted Average Kv= 0.0056 in/hr
Permeability Coefficient

TEST 2 FINAL RESULTS

Time Weighted Average Kv= 0.0042 in/hr
Permeability Coefficient

AVERAGE PT

Time Weighted Average Kv= 0.005 in/hr
Permeability Coefficient

Inspector's Remarks:
Soil sampling continued at 8 feet after percolation test was completed. See B-20 boring log.

DEFINITIONS OF VARIABLES

*Kv= Vertical permeability
I.D.= Internal diameter of casing in the same units elected for Kv
Ln= Natural Logarithmic
t1= Time at the start of the test in the same units selected for Kv
t2= Time at the end of the test in the units selected for Kv
h1= Height of the water above the bottom of the casing at the start of the same units selected for Kv
h2= Height of the water above the bottom of the casing at the end of the test in

Permeability Test Log

GZA GeoEnvironmental of NY 104 West 29th Street, 10th Floor New York, NY 10001	PT ID No. PT-22 Sheet 1 of 1	
Prepared for: Hazen and Sawyer	Project: Westchester Joint Water Works Water Treatment Plant Location/Borough: Westchester County, NY	
INSPECTOR: A. Amador CONTRACTOR: CRAIG TESTING	DRILLER: Dave Cooke HELPER: Steve Schultz	Start Date: 05/25/2021 Start Time: 0900	Weather: Cloudy, 60s F
Test Depth: 9 ft Test El. (NAVD88): 390 ft Rig Type: CME 750 X	Drill Bit Type: Roller-bit Casing Inside Diameter: 4 in. Casing Length: 126 in.	Weight of Hammer for Casing: 140 lbs. Type of Hammer: Automatic

ASTM D-6391-06
PERMEABILITY COEFFICIENT (Km) FORMULA:

General Formula:

$$K_m = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for 4" I.D. casing in/hr):

$$K_m = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

PT-22 @ 9 ft

TEST 1							TEST 2						
FIELD DATA		CALCULATED DATA					FIELD DATA		CALCULATED DATA				
Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)	Time (min)	Depth (in)	h_1 (in)	h_2 (in)	Ln (h1/h2)	(t2-t1)	*Kv (in/hr)
1	0.0313	126.0000	125.9688	0.0002	0.0167	0.0170	1	0.0000	126.0000	126.0000	0.0000	0.0167	0.0000
2	0.0625	125.9688	125.9375	0.0002	0.0167	0.0170	2	0.0313	126.0000	125.9688	0.0002	0.0167	0.0170
3	0.1250	125.9375	125.8750	0.0005	0.0167	0.0340	3	0.0625	125.9688	125.9375	0.0002	0.0167	0.0170
4	0.1875	125.8750	125.8125	0.0005	0.0167	0.0340	4	0.1250	125.9375	125.8750	0.0005	0.0167	0.0340
5	0.2188	125.8125	125.7813	0.0002	0.0167	0.0170	5	0.1875	125.8750	125.8125	0.0005	0.0167	0.0340
10	0.5000	125.7813	125.5000	0.0022	0.0833	0.0307	10	0.4375	125.8125	125.5625	0.0020	0.0833	0.0273
15	0.7188	125.5000	125.2813	0.0017	0.0833	0.0239	15	0.6875	125.5625	125.3125	0.0020	0.0833	0.0273

TEST 1 FINAL RESULTS		**TEST 2 FINAL RESULTS**	
Time Weighted Average Permeability Coefficient	Kv= 0.02613 in/hr	Time Weighted Average Permeability Coefficient	Kv= 0.02499 in/hr

AVERAGE PT	
Time Weighted Average Permeability Coefficient	Kv= 0.026 in/hr

Inspector's Remarks:
Soil sampling continued at 10 feet after percolation test was completed. See B-22 boring log.

DEFINITIONS OF VARIABLES
*Kv= Vertical permeability
I.D.= Internal diameter of casing in the same units elected for Kv
Ln= Natural Logarithmic
t1= Time at the start of the test in the same units selected for Kv
t2= Time at the end of the test in the units selected for Kv
h1= Height of the water above the bottom of the casing at the start of the same units selected for Kv
h2= Height of the water above the bottom of the casing at the end of the test in

TEST PIT LOGS AND PHOTOGRAPHIC DOCUMENTATION

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JOB 41.0162892.00
SHEET NO. 01 OF 11
CALCULATED BY KDP DATE 8/20/21
CHECKED BY DATE
SCALE N.T.S

TP-1

- Craig cleared wooded area & GZA markout the test pit (TP).
- TP-1 excavated down to approx. 12ft bgs
- Spot motling encountered at approx. 9'ft to 10ft bgs.
- Soil at approximately 10ft bgs encountered to be slightly moist.
- GW not encountered within test pit.

Soil description:-

* 0' to 1' : Top SOIL: D. Brown, f-m SAND, some silt, trace Gravel, frq. roots & wood fgmts, dry.
* 1' to 12': SILTY SAND: Brown, f-m SAND and SILT, little Cobble, little Gravel. (Soil @ approx. 10ft bgs slightly moist).

- Upon completion, TP backfilled with excavated spoils flushed to ground surface.

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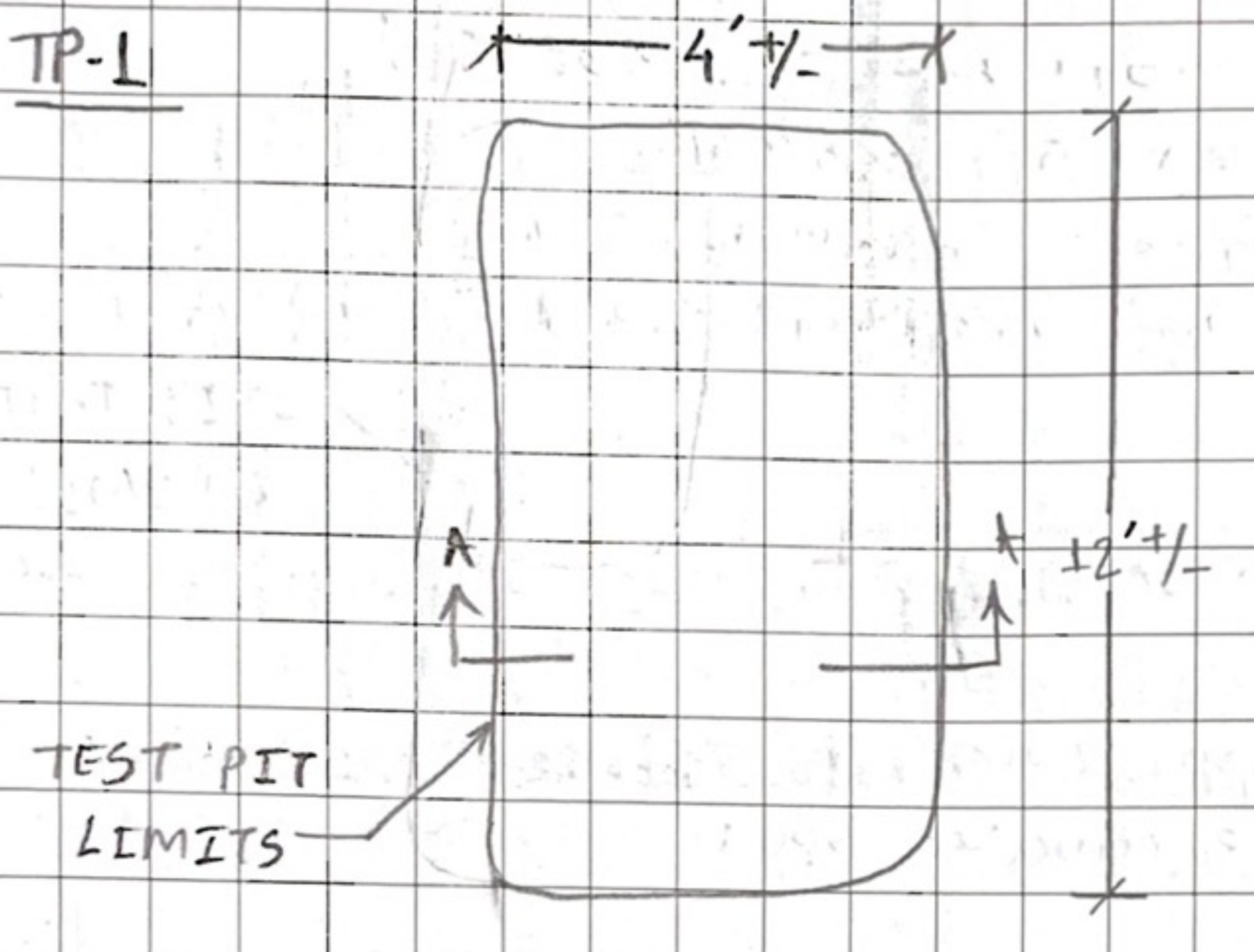
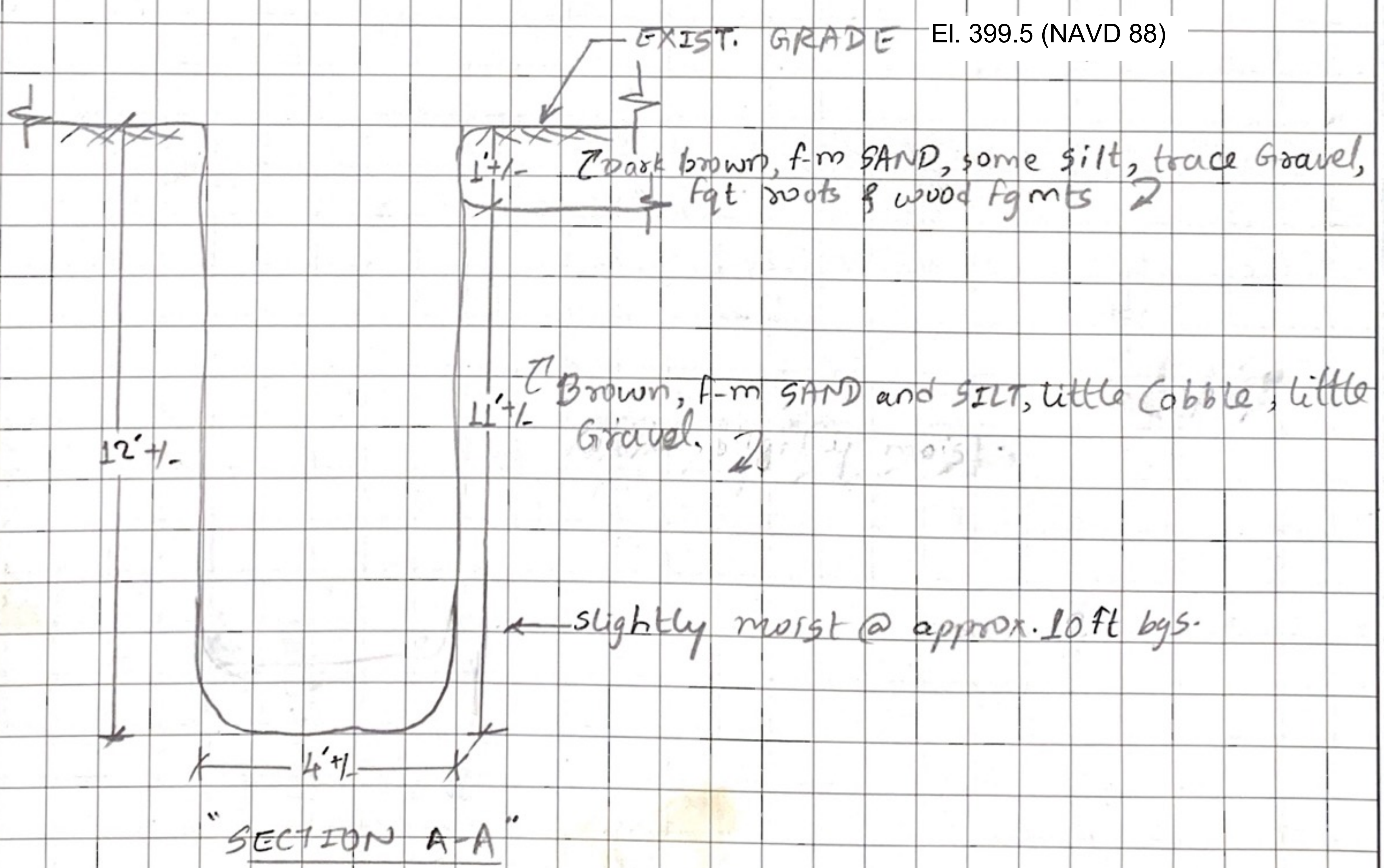
JOB	41.0162892.00
SHEET NO.	02 OF 11
CALCULATED BY	KDP DATE 8/20/21
CHECKED BY	DATE
SCALE	N.T.S

TP-1



PLAN VIEW



"SECTION A-A"

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JOB 41.0162892.
SHEET NO. 03 OF 11
CALCULATED BY KDP DATE 8/20/21
CHECKED BY DATE
SCALE N.T.S

TP-2.

- Craig cleared wooded area & GZA layout the test pit (TP) location.
- TP excavated down to 13 ft bgs
- Spot mottling encountered at approx. 5ft bgs
- Boulder encountered at approx. 7ft bgs
- GW not encountered within test pit.
- Soil description:-
- * 0' to 1' → TOP SOIL :- D. Brown, f-m SAND, some Silt, trace Gravel, Frq. roots & wood fgmts.
* 1' to 11' → SILTY SAND :- Brown, f-m SAND and SILT, little Cobble, little Gravel, trace boulder, trace mica, dry.
(Spot mottling indications at approximately 5-ft bgs.)
* 11' to 13' → SILTY SAND :- Dark brown, f-m SAND and SILT, little Gravel, trace cobble, moist.

* upon completion, TP backfilled with excavated spoils flushed to ground surface.

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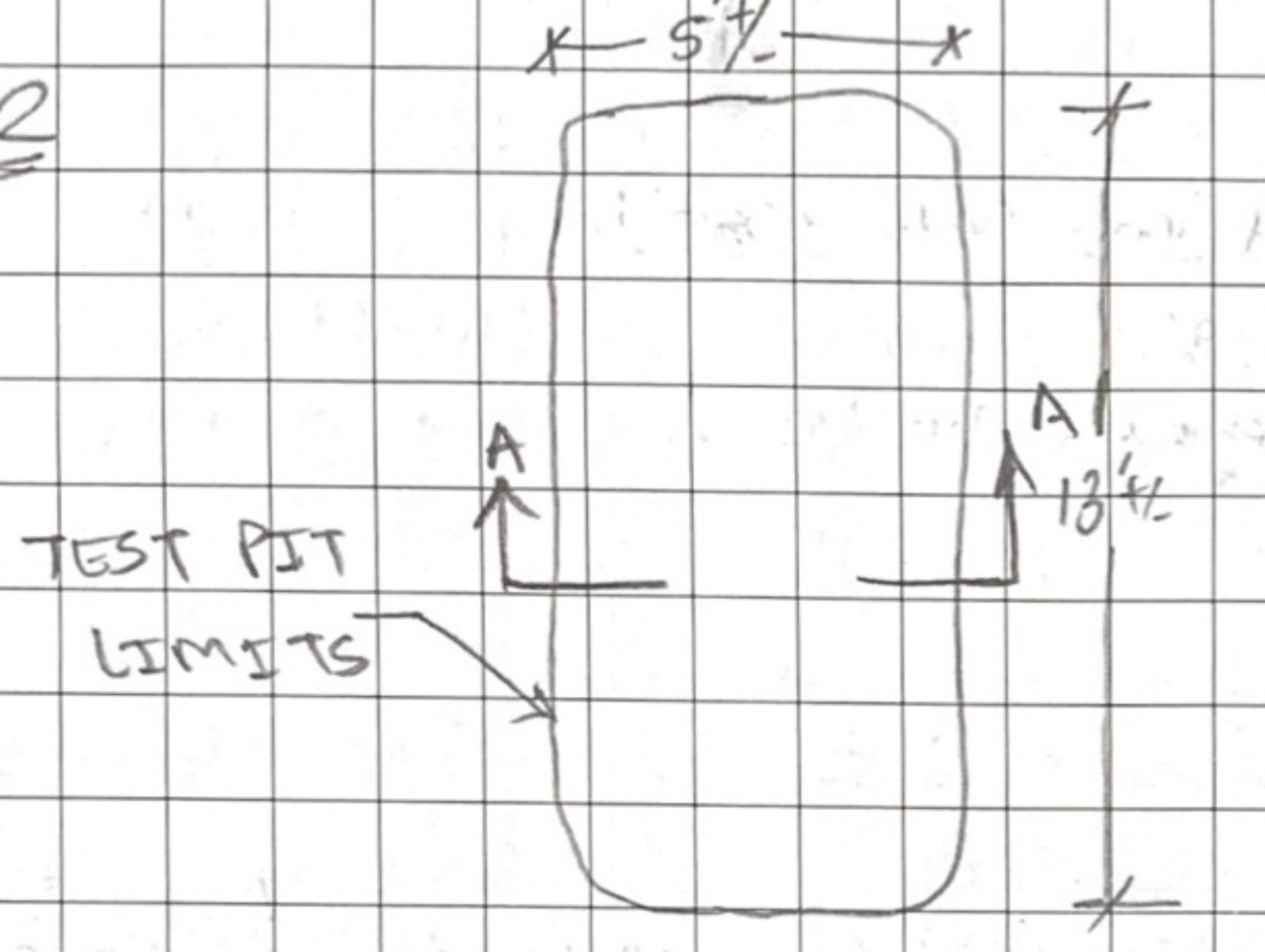
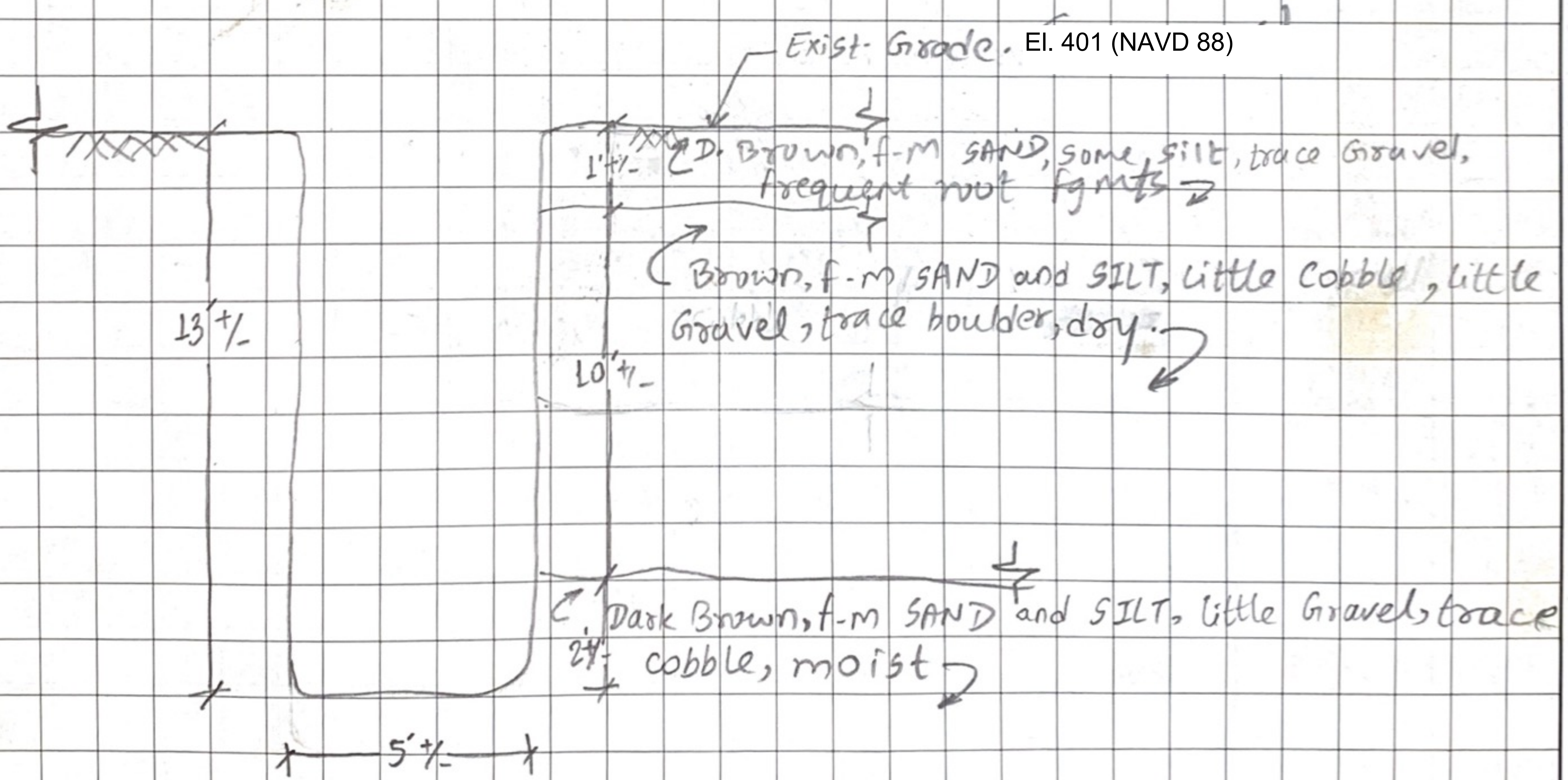
JOB 41.0162892.00
SHEET NO. 04 OF 11
CALCULATED BY KDP DATE 8/20/21
CHECKED BY ______ DATE ______
SCALE N.T.S

TP-2



PLAN VIEW



"SECTION A-A"

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SHEET NO. 05 OF 11
CALCULATED BY KDP DATE 8/20/21
CHECKED BY DATE
SCALE N.T.S.

"TP-4" NOTES:

- Craig cleared wooded area to access test pit (TP) location.
- GZA & Hazen located TP using hand held GPS device.
- Craig started excavating for TP-4.
- TP terminated after encountering refusal (likely boulder) at approx. 7ft bgs.
- TP offset approx. 10ft towards East side.
- TP-4 excavated down to approx. 13.5 ft bgs
- Soil description:

0'–1' : TOPSOIL → Dark brown, f-m SAND, some silt, trace Gravel, frequent roots & woods fgmts.

1'–11' : SILTY SAND → Light brown – brown, f-m SAND and SILT, little Cobble, little Gravel, trace Boulder, trace mica, dry

11'–13.5' : SILTY SAND → Dark brown, f-m SAND, some silt, little Gravel, trace Cobble, significantly moist.

- GW was not encountered within test pit.
- Upon completion, TP was backfilled using excavated spoils flushed to ground surface.

"TP-3" NOTES

- Craig cleared the wooded area near proposed test pit (TP) location.
- GZA & Hazen located TP location using hand held GPS device.
- TP-3 excavated down to approx. 13.5ft bgs
- Spot mottling and staining encountered at approx. 5ft bgs.
- Moist soil encountered at approx. 8ft bgs
- soil description:

0'–1' : TOPSOIL → Dark brown, f-m SAND, some silt, trace Gravel, fqt roots & wood fgmt.

1'–5' : SILTY SAND → Brown, f-m SAND and SILT, little Cobble, little Gravel, dry.

5'–13.5' : SILTY SAND → Dark brown, f-m SAND and SILT, little Gravel, moist.

- GW encountered at approx. 12 ft bgs
- Upon completion, TP backfilled using excavated spoils flushed to ground surface.

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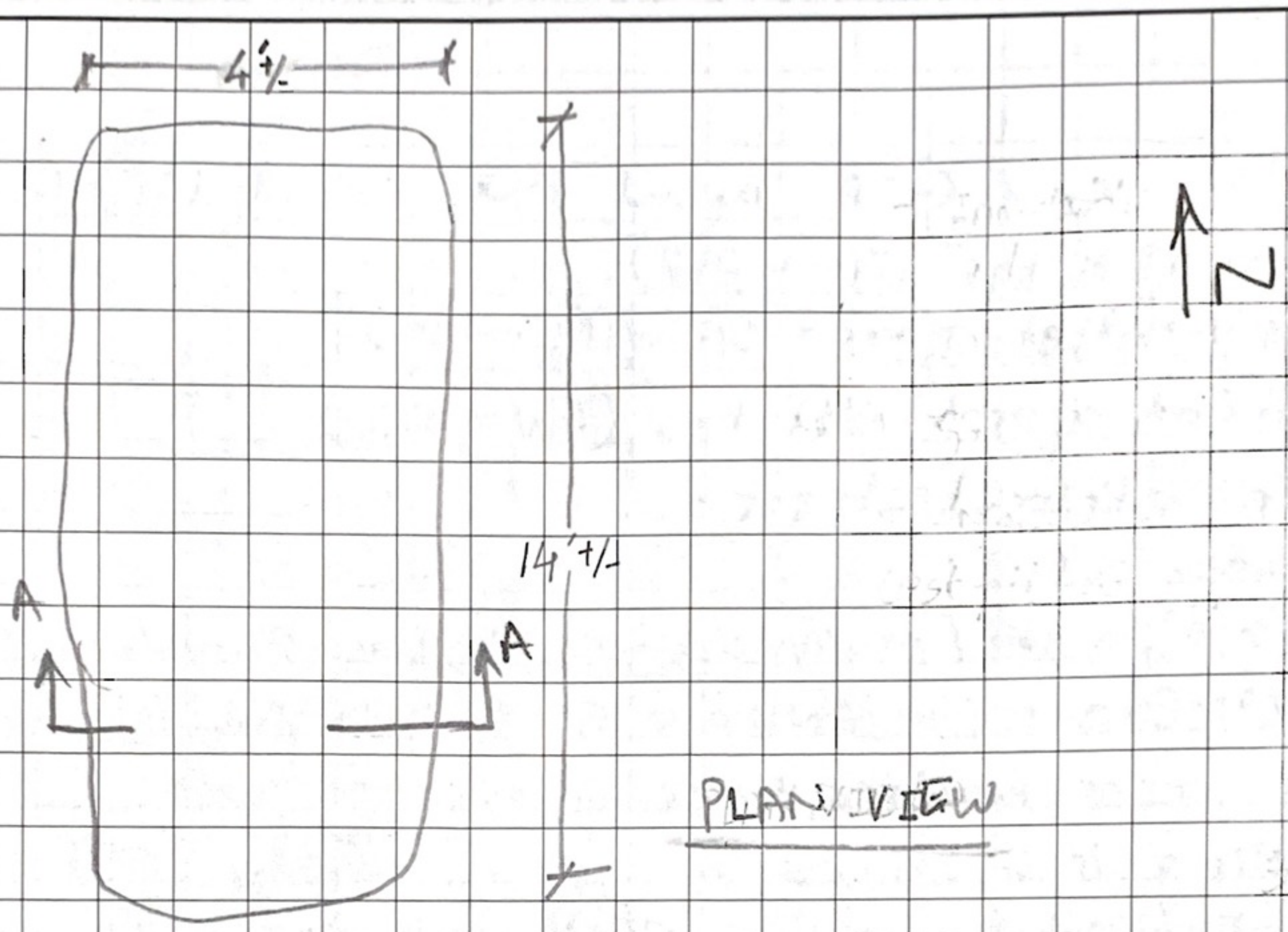
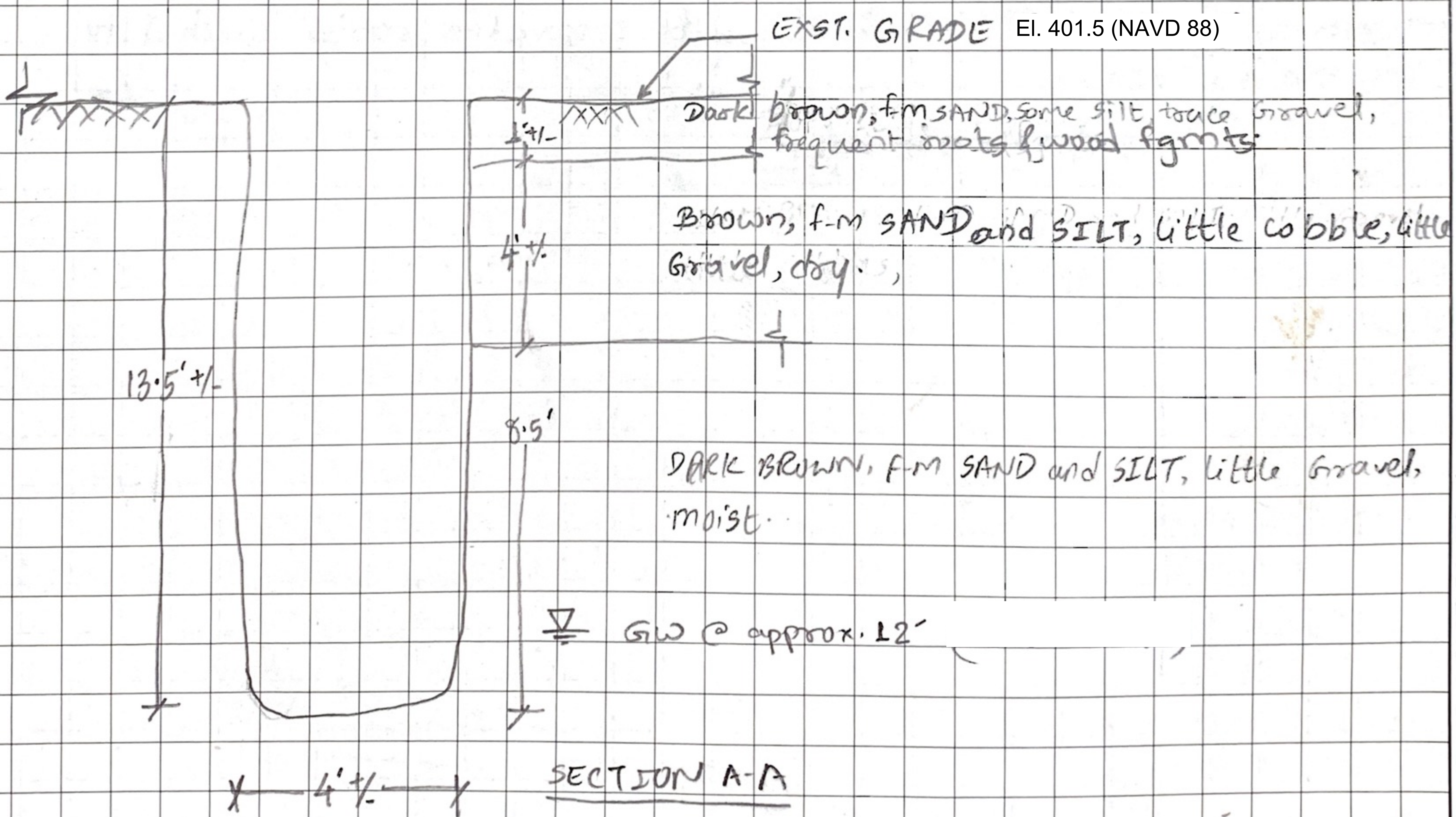
JOB 41.0162892.00
SHEET NO. 06 OF 11
CALCULATED BY KDP DATE 8/20/21
CHECKED BY ______ DATE ______
SCALE N.T.S

TP-3



PLAN VIEW



SECTION A-A

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SHEET NO. 07 OF 11
CALCULATED BY KDP DATE 8/20/21
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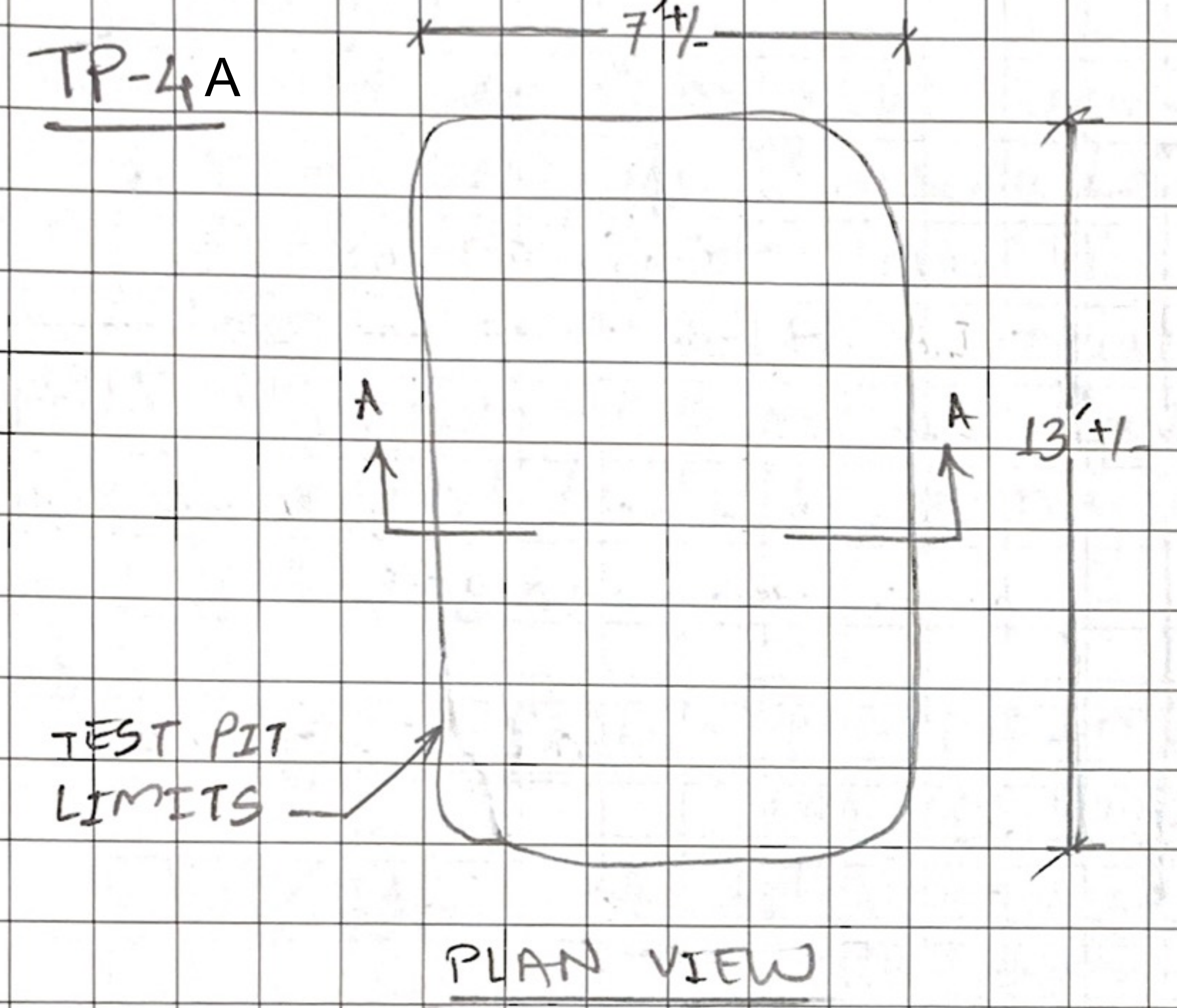
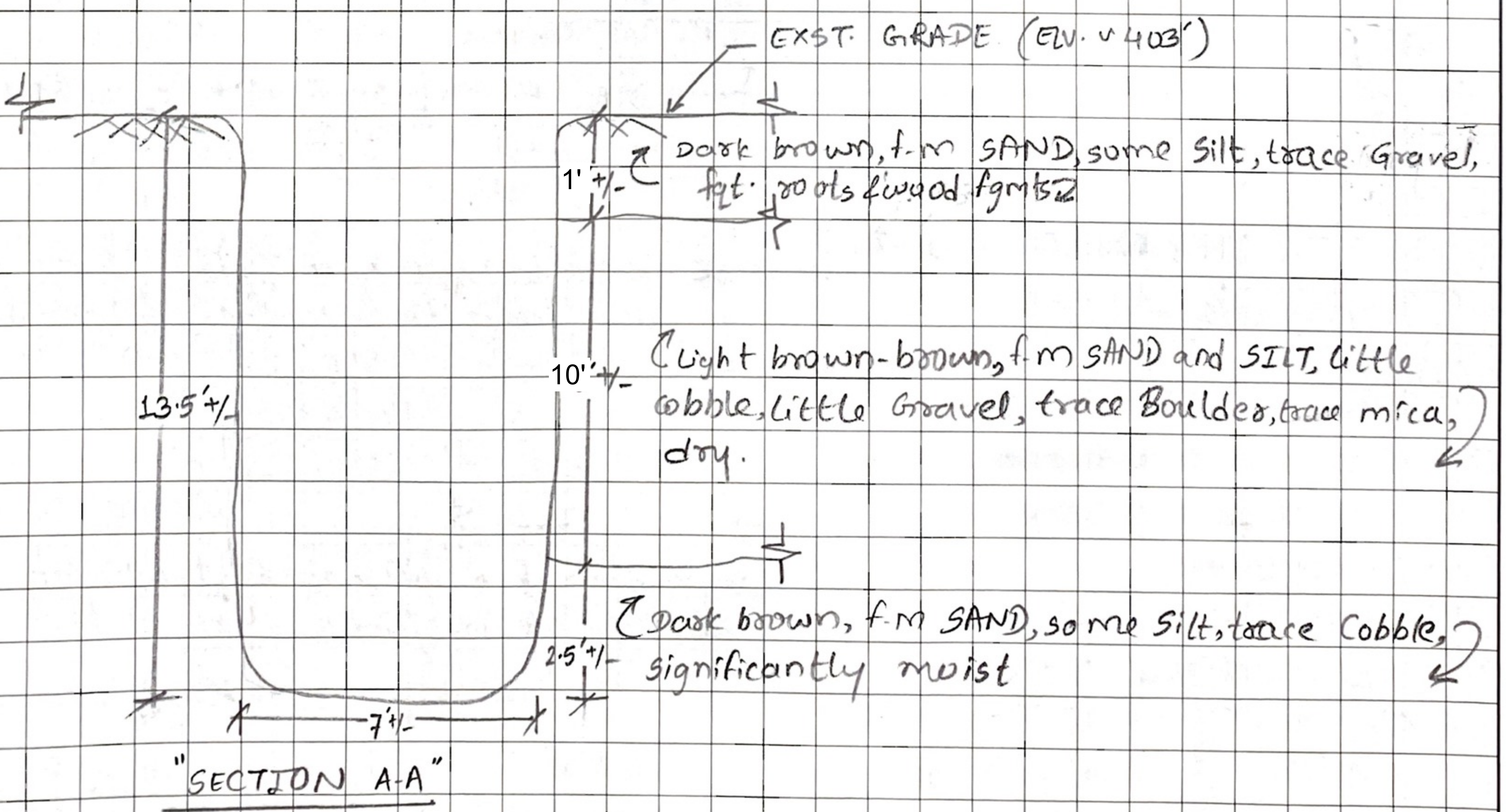
SCALE N.T.S





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SHEET NO. 08 OF 11
CALCULATED BY KDP DATE 8/20/21
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SCALE N.T.S

TP-5

- TP-5 excavated in vicinity of B-25 & B-26, down to 14ft bgs.
- Boulder encountered at approx. 9ft bgs.
- Spot motting encountered at approx. 11ft bgs.
- GW not encountered within test pit.
- Soil description
  - 0' to 0.5': TOP SOIL: D. Brown, f-m SAND, some silt, fgt. root fgmts.
  - 0.5' to 11': SILTY SAND: Brown, f-m SAND and SILT, little Gravel, little cobble, trace Boulder, dry.
  - 11' to 14': SILTY SAND: D. BROWN, f-m SAND and SILT, some Gravel, little cobble, slightly moist.
- Upon completion, test pit backfilled with excavated spoils flush to exist. ground surface.

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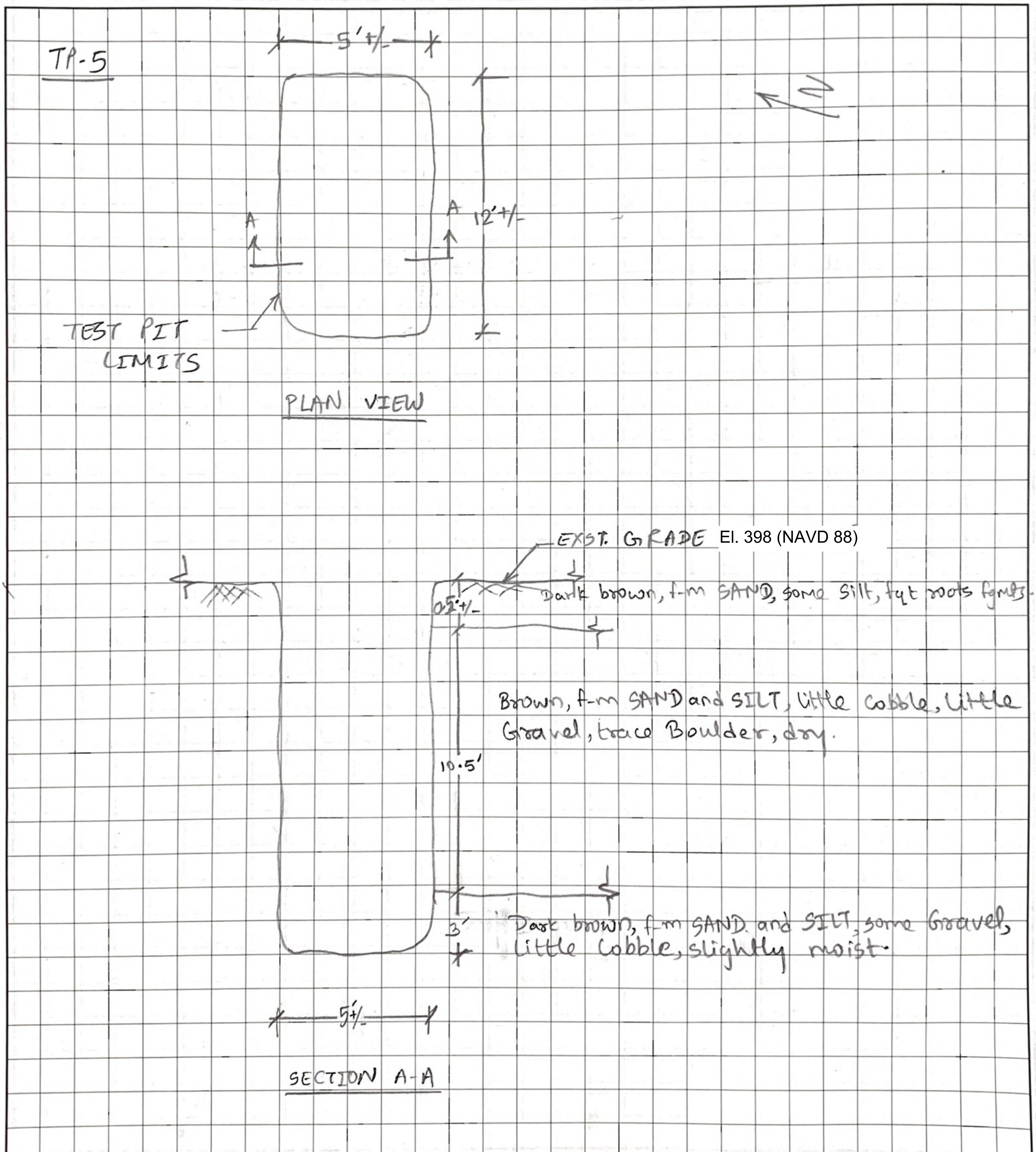
SHEET NO. 09 OF 11

CALCULATED BY KDP DATE 8/20/21

CHECKED BY DATE

SCALE N.T.S



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CALCULATED BY KDP DATE 8/20/21
CHECKED BY DATE
SCALE N.T.S

TP-6

- Craig excavated TP-6 down to 8.5ft bgs
- Motling layer encountered at approx. 5ft to 7ft bgs.
- GW encountered at approx. 7.5ft bgs
- TP was terminated at approx. 8.5ft bgs. due to GW intruded within TP.
- Soil description:
  - 0'-1' ; TOPSOIL → Dark brown, f-m SAND, some silt, trace Gravel, fqt roots / wood fgmts.
  - 1'-8.5' : Brown, f-m SAND and SILT, little cobble, little Gravel.
- Soil Motling layer encountered at approx. 5ft to 7ft bgs.
- Upon completion, TP backfilled with excavated spoils flushed to ground surface.

- GW at boring B-29:-

GW level = 13.5' from top of steel casing. (Casing stick up: 3.5')

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SHEET NO. 11 OF 11
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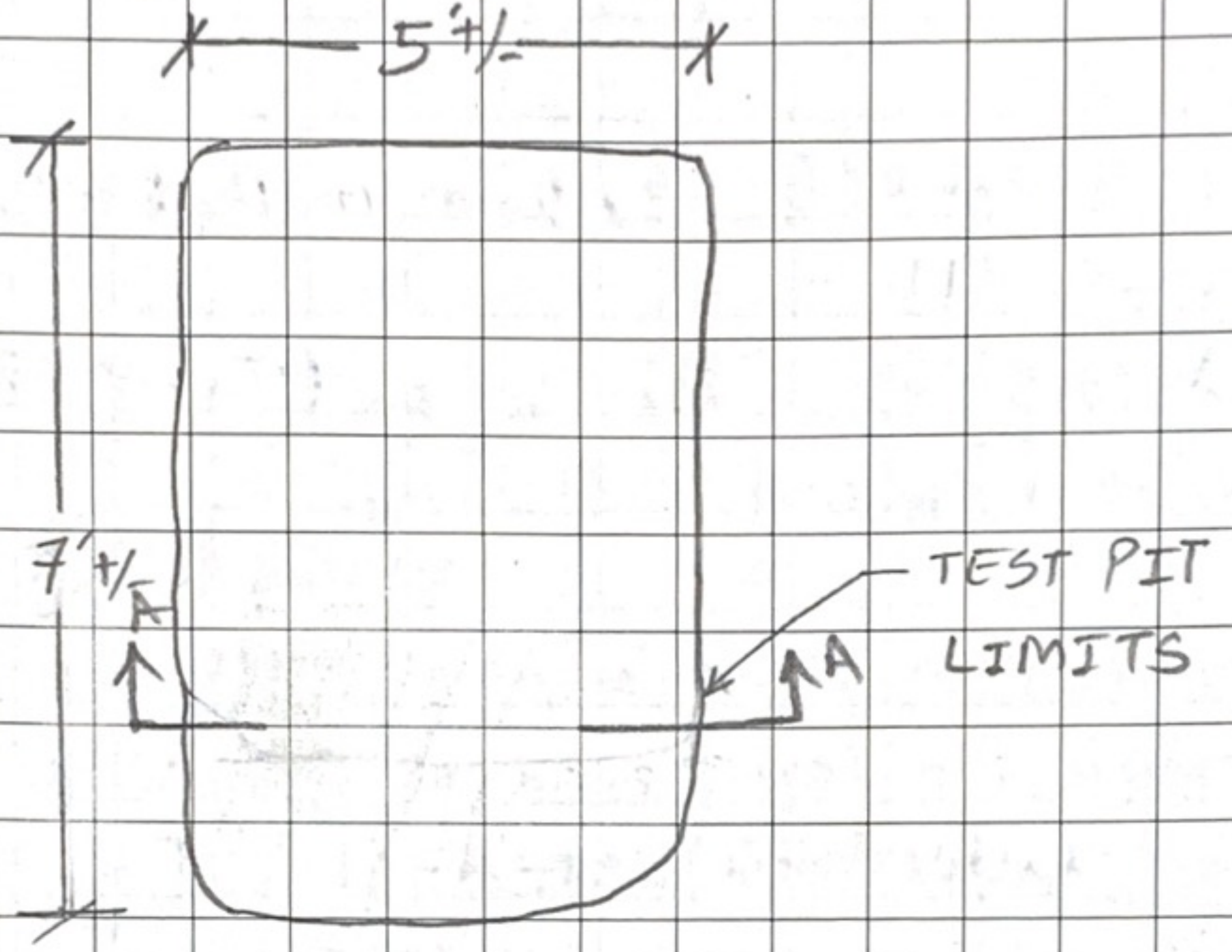
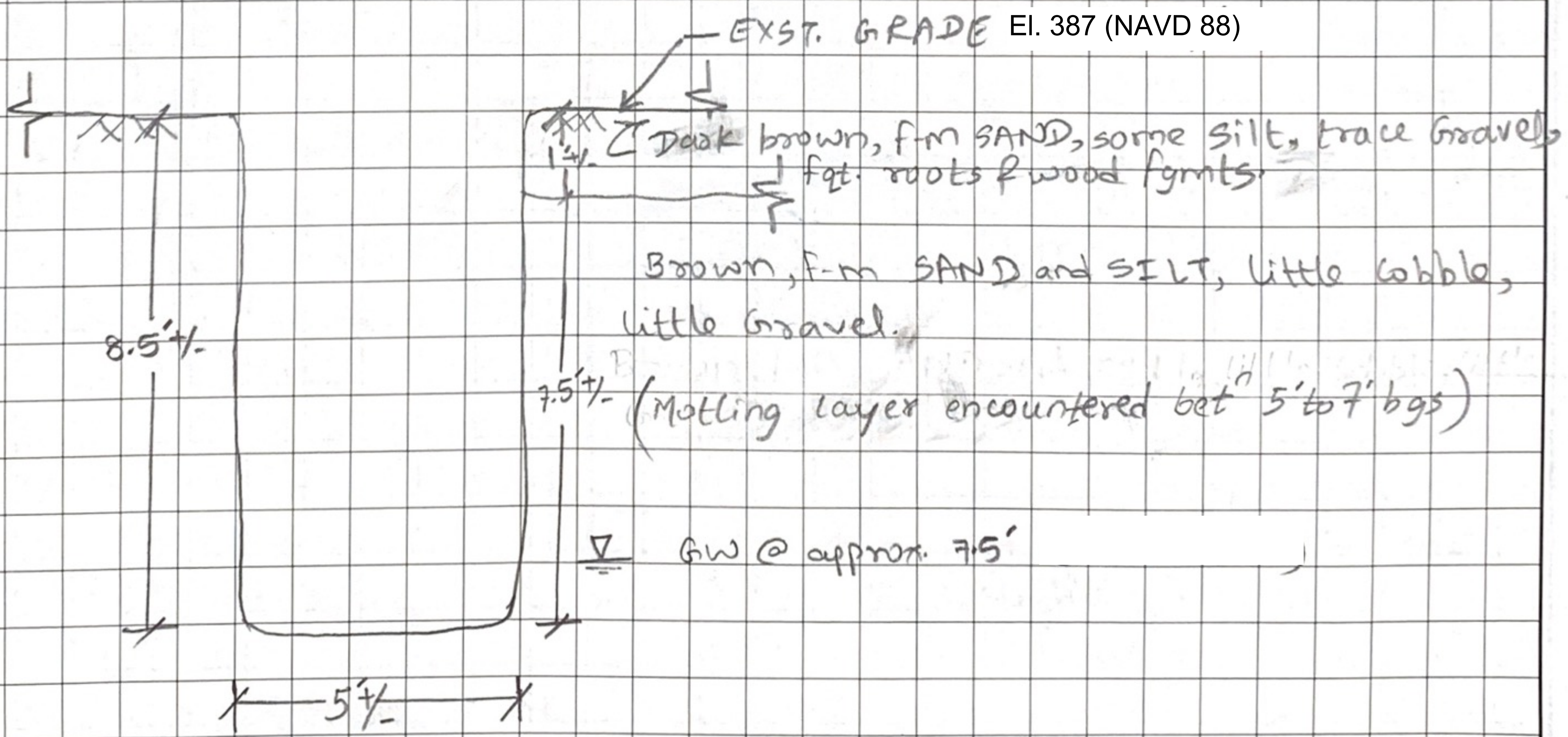
SCALE N.T.S

TP-6



PLAN VIEW



"SECTION A-A"

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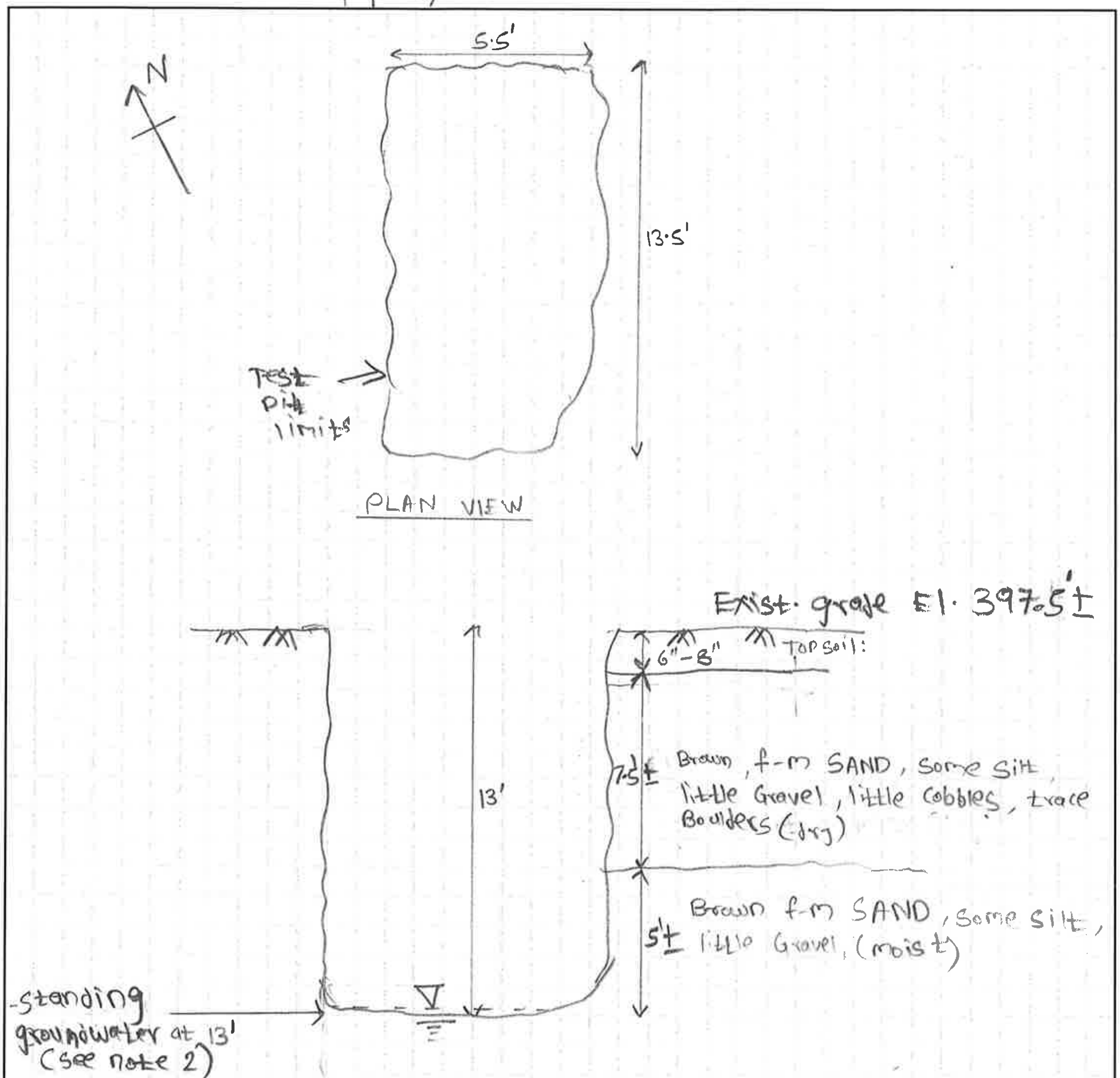
SHEET NO. ______ OF ______

CALCULATED BY TSS DATE 11/4/21

CHECKED BY ______ DATE ______

SCALE N.T.S.

TP-7



1. Mottling layer not observed
2. Groundwater observed 2 hrs after the test pit was excavated.

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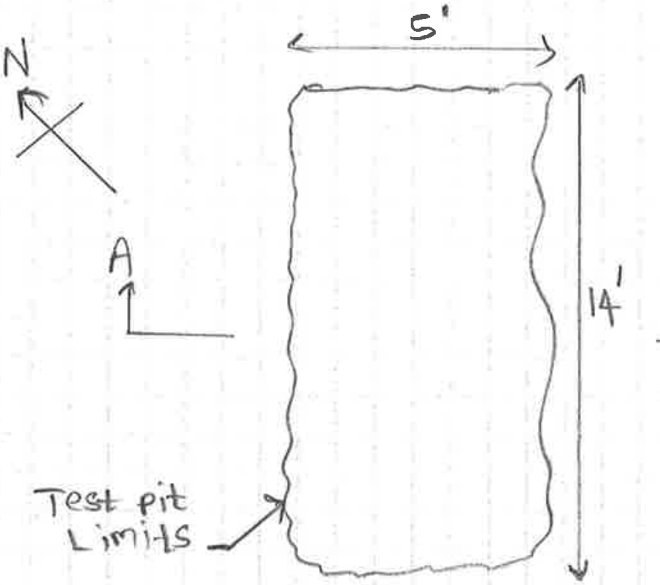
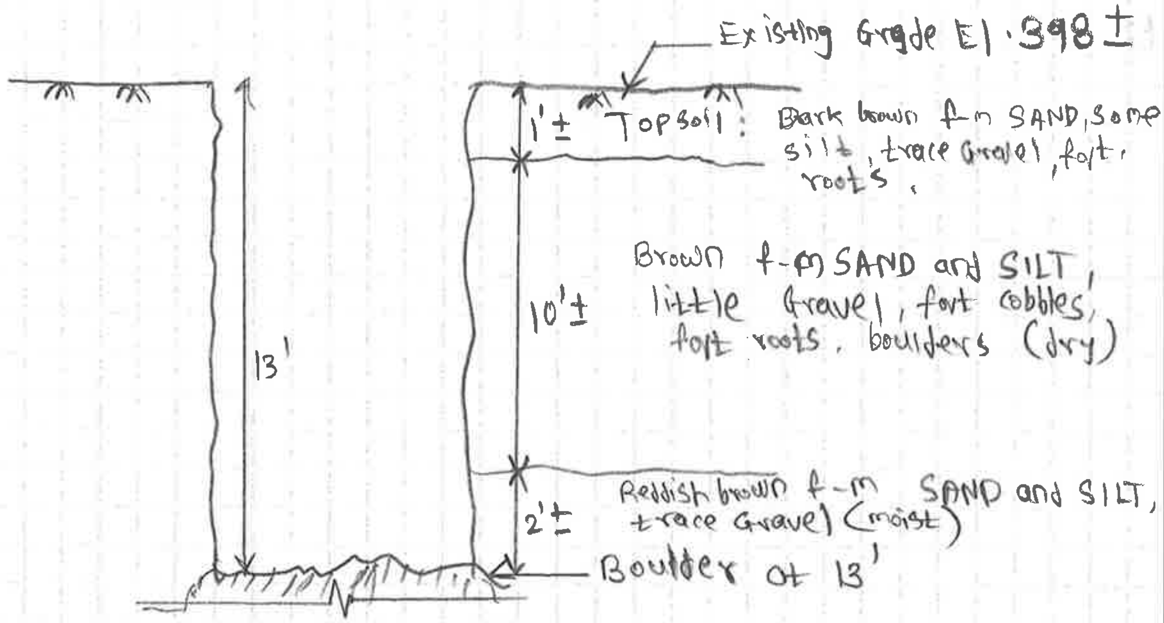
SHEET NO. ________ OF ________
CALCULATED BY TSS DATE 11/4/21
CHECKED BY ________ DATE ________
SCALE N.T.S.

TP-8



PLAN VIEW



SECTION A-A

Note:
1. No soil mottling layer observed
2. No Groundwater observed

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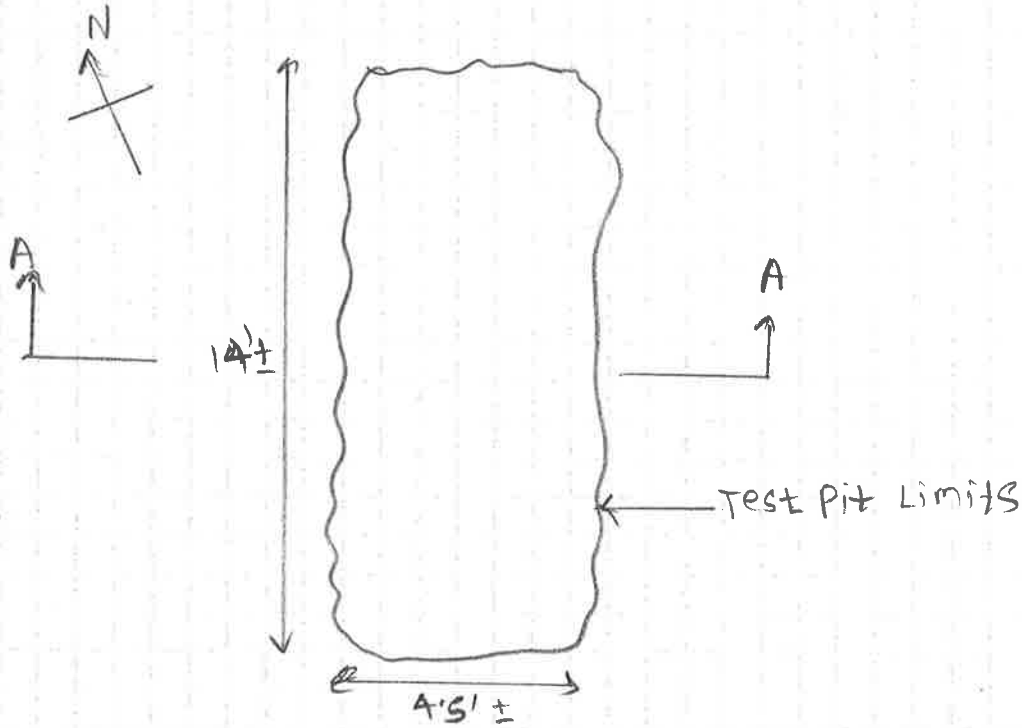
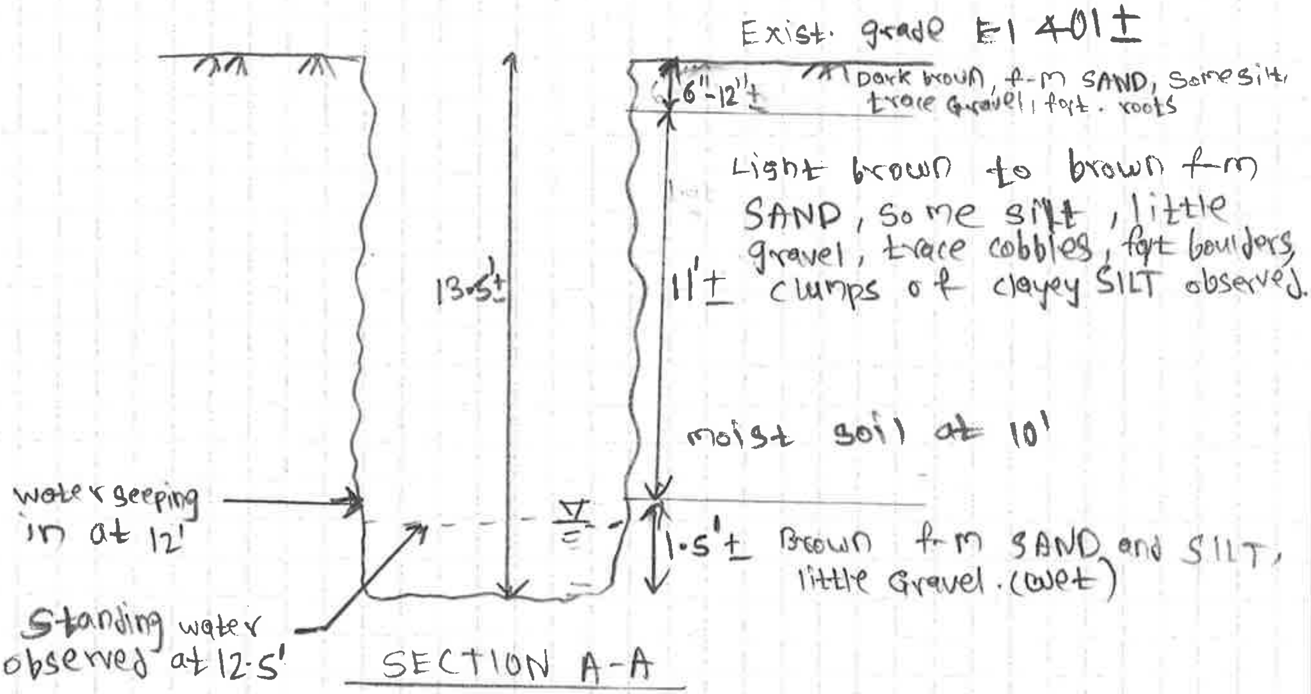
SHEET NO. ______ OF ______
CALCULATED BY TSS DATE 11/4/21
CHECKED BY ______ DATE ______
SCALE N.T.S.

TP-9



PLAN VIEW



SECTION A-A

Notes:
1. No Soil mottling layer observed.

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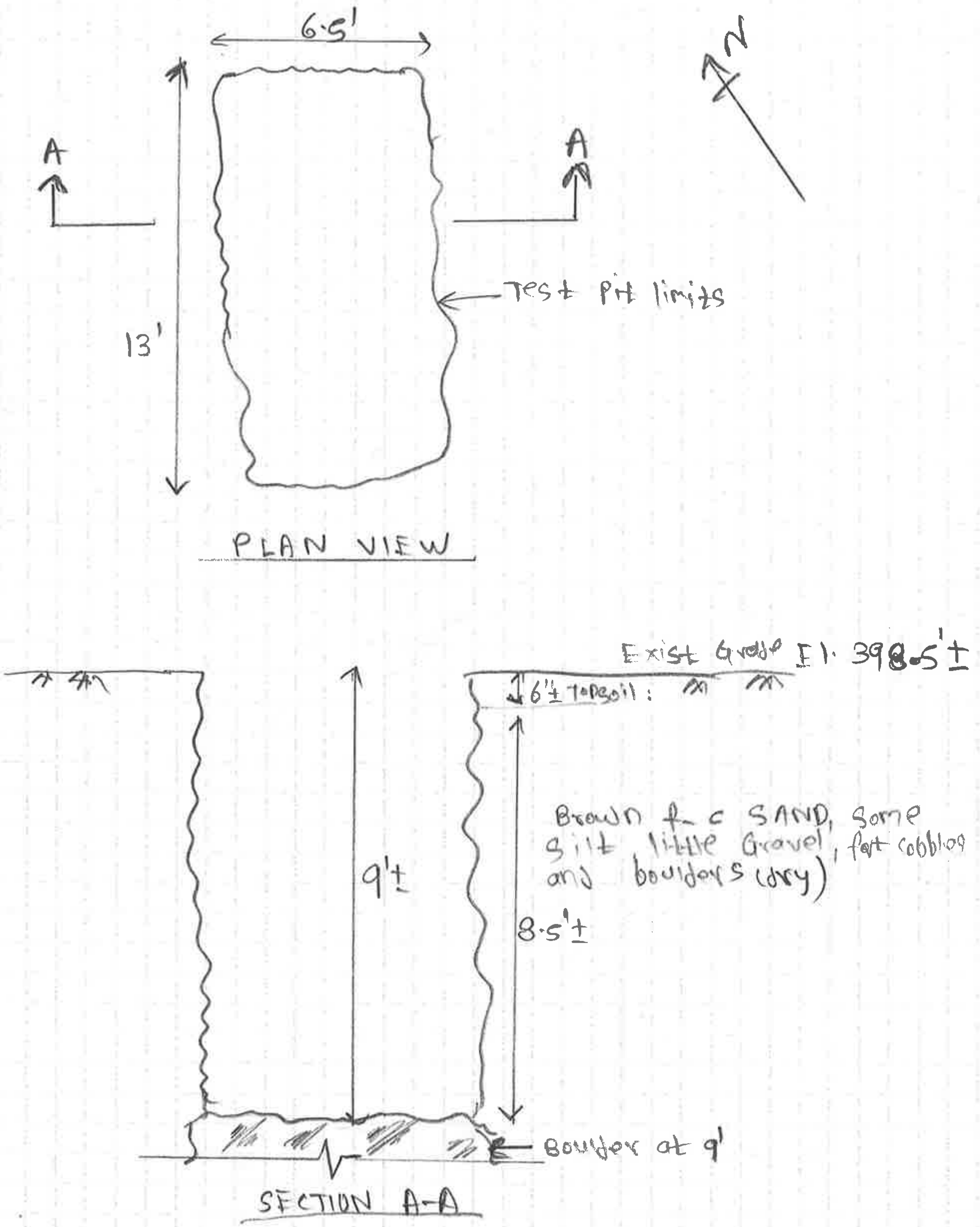
SHEET NO. ______ OF ______

CALCULATED BY TSS DATE 11/4/21

CHECKED BY ______ DATE ______

SCALE N.T.S.

TP-10



Note:
1. No mottling layer observed
2. No Groundwater observed.

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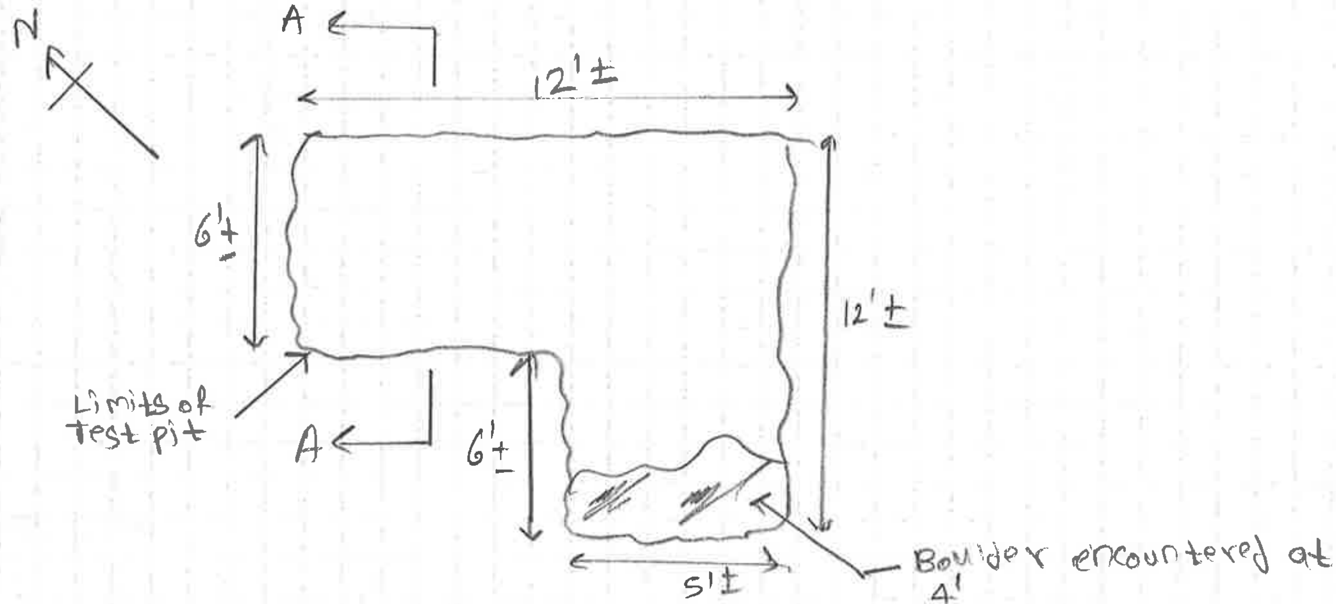
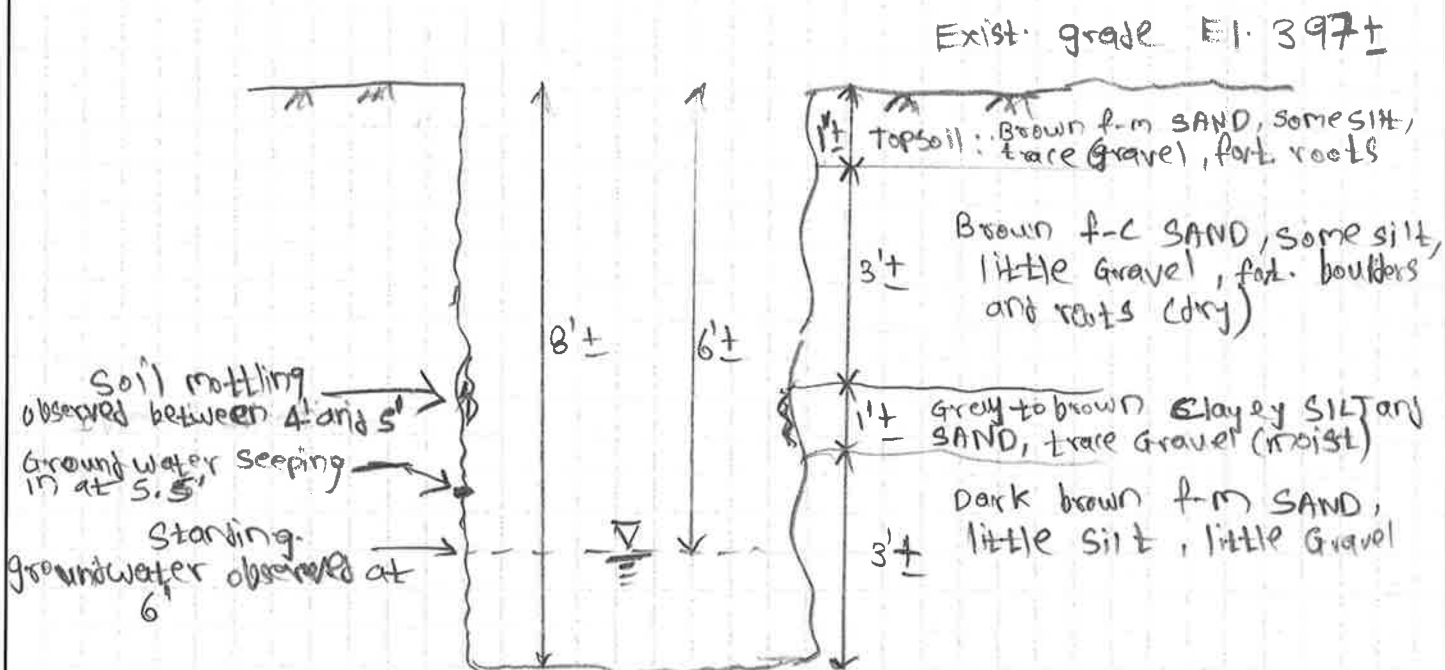
SHEET NO. ______ OF ______
CALCULATED BY TSS DATE 1/4/21
CHECKED BY ______ DATE ______
SCALE ______

TP-11



PLAN VIEW



SECTION A-A

Note:
1. Soil mottling layer observed between 4' and 5'

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JOB ____________________

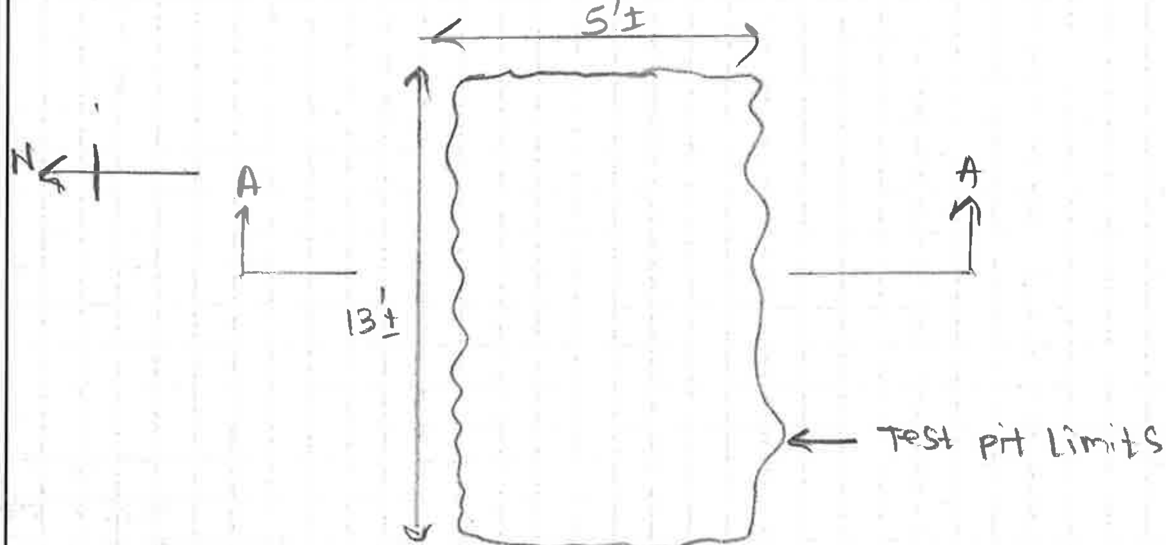
SHEET NO. ____________ OF ______

CALCULATED BY ____________ DATE ______

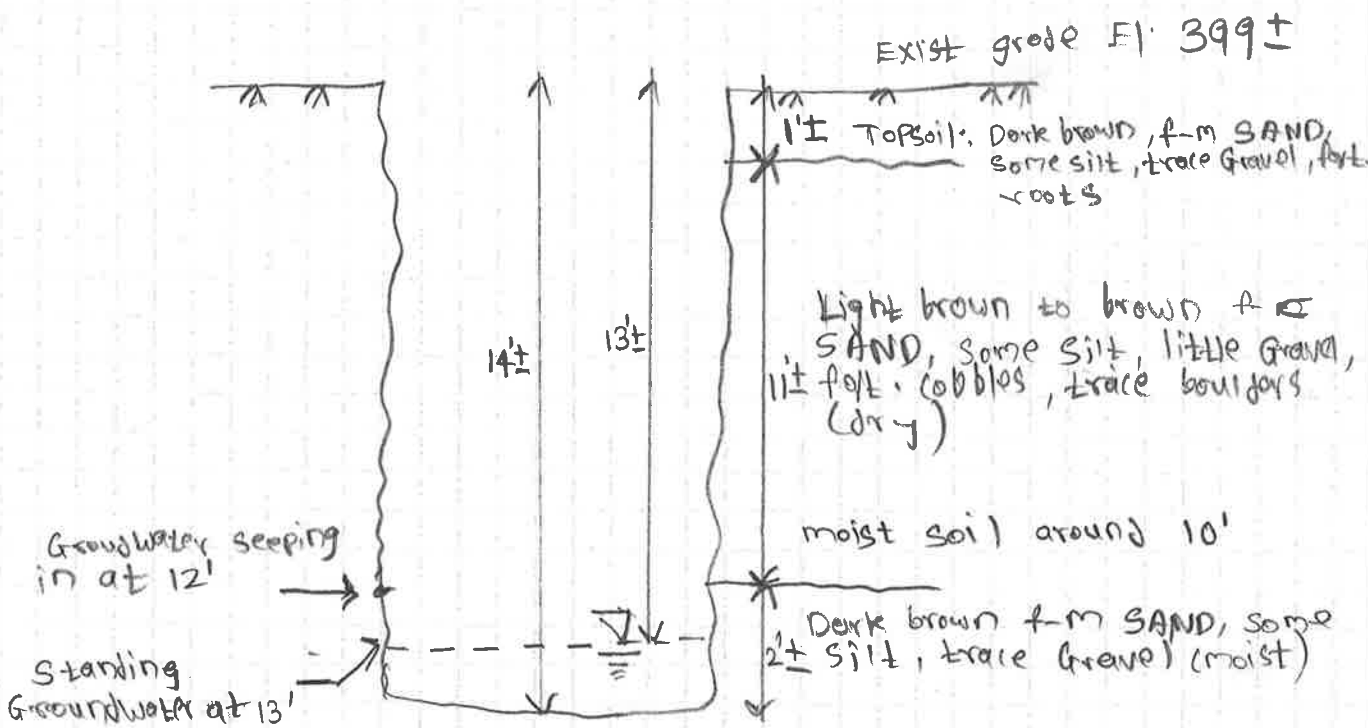
CHECKED BY ____________ DATE ______

SCALE ____________________

TP-12



PLAN VIEW



Note:
1. No soil mottling layer observed.

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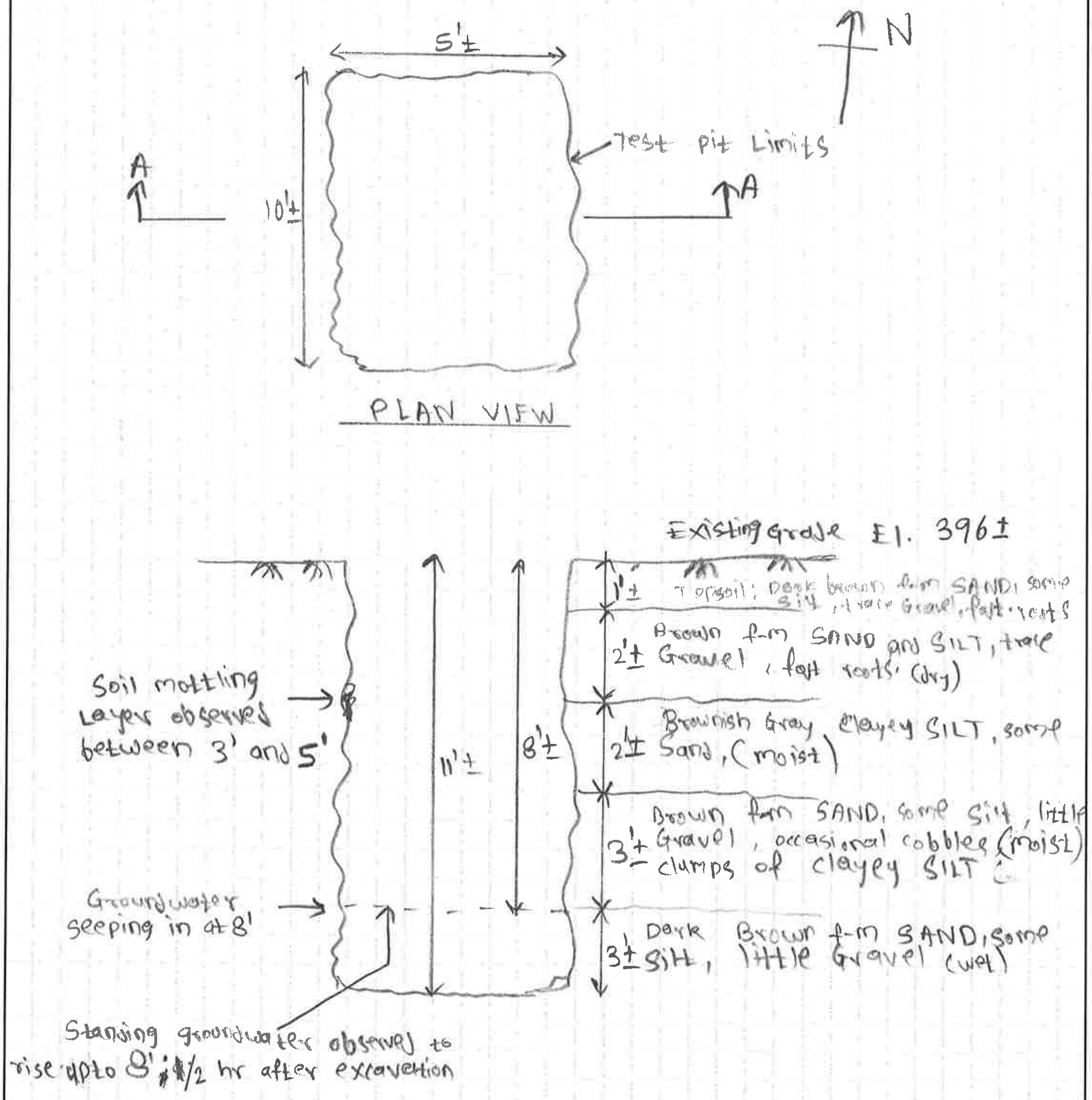
JOB 21.0162892.00
SHEET NO. ______ OF ______
CALCULATED BY TSG DATE 11/4/21
CHECKED BY ______ DATE ______
SCALE N.T.S.

TP-13



SECTION A-A

Note:
1. Soil mottling layer observed between 3' and 5'
2.

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 1	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: General view of TP-1 advanced to total depth of 12 feet. Groundwater was not encountered in TP-1.	

Photo No. 2	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: Side view of TP-1. Soil mottling observed at approximately 9 feet depth and moist soil noted at approximately 10 feet depth.	

Test Pit Photographic Log

Client Name: Hazen and Sawyer	Site Location: Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	Project No. 41.0162892.00

Photo No.	Date:
3	8/20/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-2 advanced to total depth of 13 feet.

Groundwater was not encountered in TP-2.

Photo No.	Date:
4	8/20/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-2.

Soil mottling observed at approximately 5 feet depth and moist soil noted at approximately 11 feet depth.

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 5	**Date:** 8/20/21	
Direction Photo Taken: Looking Down		
Description: General view of TP-3 advanced to total depth of 13.5 feet. Groundwater was encountered in TP-3 at approximately 12 feet depth.		

Photo No. 6	**Date:** 8/20/21	
Direction Photo Taken: Looking Down		
Description: Side view of TP-3. Soil mottling observed at approximately 5 feet depth and moist soil noted at approximately 8 feet depth.		

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 7	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: General view of TP-4A advanced to total depth of 14 feet. Groundwater was not encountered in TP-4A.	

Photo No. 8	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: Side view of TP-4A. Moist soil noted at approximately 11 feet depth.	

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 9	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: General view of TP-5 advanced to total depth of 13 feet. Groundwater was not encountered in TP-5.	

Photo No. 10	**Date:** 8/20/21
Direction Photo Taken: Looking Down	
Description: Side view of TP-5. Soil mottling observed at approximately 11 feet depth and moist soil noted at approximately 11 feet depth.	

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 11	**Date:** 8/20/21	
Direction Photo Taken: Looking Down		
Description: General view of TP-6 advanced to total depth of 8.5 feet. Groundwater was encountered in TP-6 at approximately 7.5 feet depth.		

Photo No. 12	**Date:** 8/20/21	
Direction Photo Taken: Looking Down		
Description: Side view of TP-6. Soil mottling observed at approximately 5 feet depth.		

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No.	**Date:**
1	11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-7 advanced to total depth of 13 feet.

Groundwater was encountered in TP-3 at approximately 13 feet depth.

Photo No.	**Date:**
2	11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-7.

Soil mottling not observed in TP-7.

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 3 | **Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-8 advanced to total depth of 13 feet.

Groundwater was not encountered in TP-8.

Photo No. 4 | **Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-8.

Soil mottling not observed in TP-8 and moist soil noted at approximately 11 feet depth.

Boulder encountered at approximately 13 feet

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 5	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-9 advanced to total depth of 13.5 feet.

Groundwater was encountered in TP-9 at approximately 12.5 feet depth.

Photo No. 6	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-9.

Soil mottling not observed in TP-9.

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 7	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-10 advanced to total depth of 9 feet.

Groundwater was not encountered in TP-10.

Photo No. 8	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-10.

Soil mottling not observed in TP-10. Boulder encountered at approximately 9 feet

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 9	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-11 advanced to total depth of 8 feet.

Groundwater was encountered in TP-11 at approximately 6 feet depth.

Photo No. 10	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-11.

Soil mottling observed at approximately 4 feet depth.

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 11	**Date:** 11/4/21	
Direction Photo Taken: Looking Down		
Description: General view of TP-12 advanced to total depth of 14 feet. Groundwater was encountered in TP-12 at approximately 13 feet depth.		

Photo No. 12	**Date:** 11/4/21	
Direction Photo Taken: Looking Down		
Description: Side view of TP-12. Soil mottling not observed in TP-10.		

Test Pit Photographic Log

Client Name: Hazen and Sawyer	**Site Location:** Westchester Joint Water Works (WJWW) Rye Lake Water Filtration Plant West Harrison, New York	**Project No.** 41.0162892.00

Photo No. 13	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
General view of TP-13 advanced to total depth of 11 feet.

Groundwater was encountered in TP-13 at approximately 8 feet depth.

Photo No. 14	**Date:** 11/4/21

Direction Photo Taken:
Looking Down

Description:
Side view of TP-13.

Soil mottling observed at approximately 3 feet depth.

Appendix F: Design Calculations

Water Quality Volume Calculations

Project:	Rye Lake WWTF
Location:	Harrison, NY
Project No.:	90388-000
Subject:	WQv Calculation
Performed by:	CJM **Date:** 6/24/2022
Checked by:	**Date:**

Objective: Provide a summary of the land cover and total area used in the FDA 1A-WQv Calculations

1	Total FDA 1A Area	3.10	ac
2	New Impervious Area (including future)	2.16	ac
3	Demolished Existing Impervious Area	0.21	ac
4	New Impervious Area, after redevelopment credit	2.00	ac
5	Existing Impervious Area disturbed during construction	0.13	ac
6	Existing Impervious Area disturbed during construction, added to WQv	0.03	ac
7	**Total Impervious Area in FDA 1A-WQv**	**2.03**	**ac**
8	**Total Area in FDA 1A-Wqv** **[1] + [5]**	**3.23**	**ac**

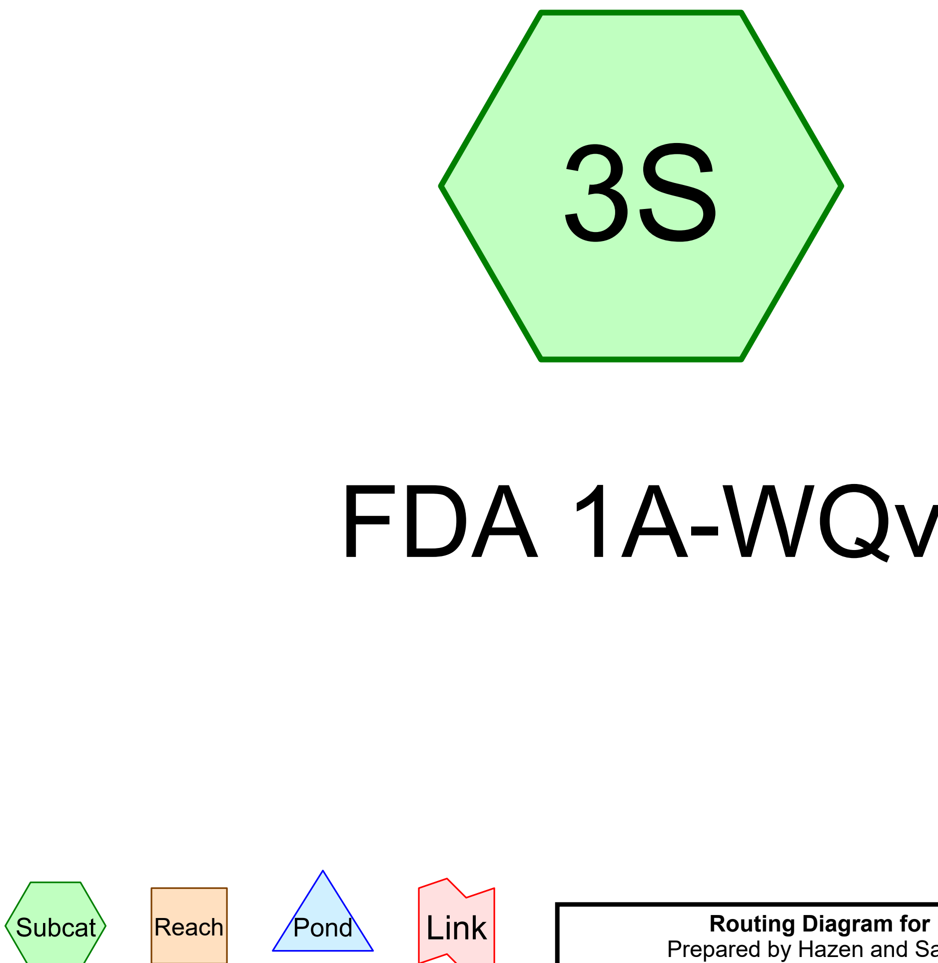
Objective: Calculate the WQv in HydroCAD

From HydroCAD Subcatchment FDA 1A-WQv:

WQv = 0.515 ac-ft

WQv = 22433 cf

WQv Calculation



Routing Diagram for Rye Lake HydroCAD
Prepared by Hazen and Sawyer, Printed 6/24/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	NRCC Precip Data 24-hr S1	1-yr	Default	24.00	1	2.83	2

Summary for Subcatchment 3S: FDA 1A-WQv

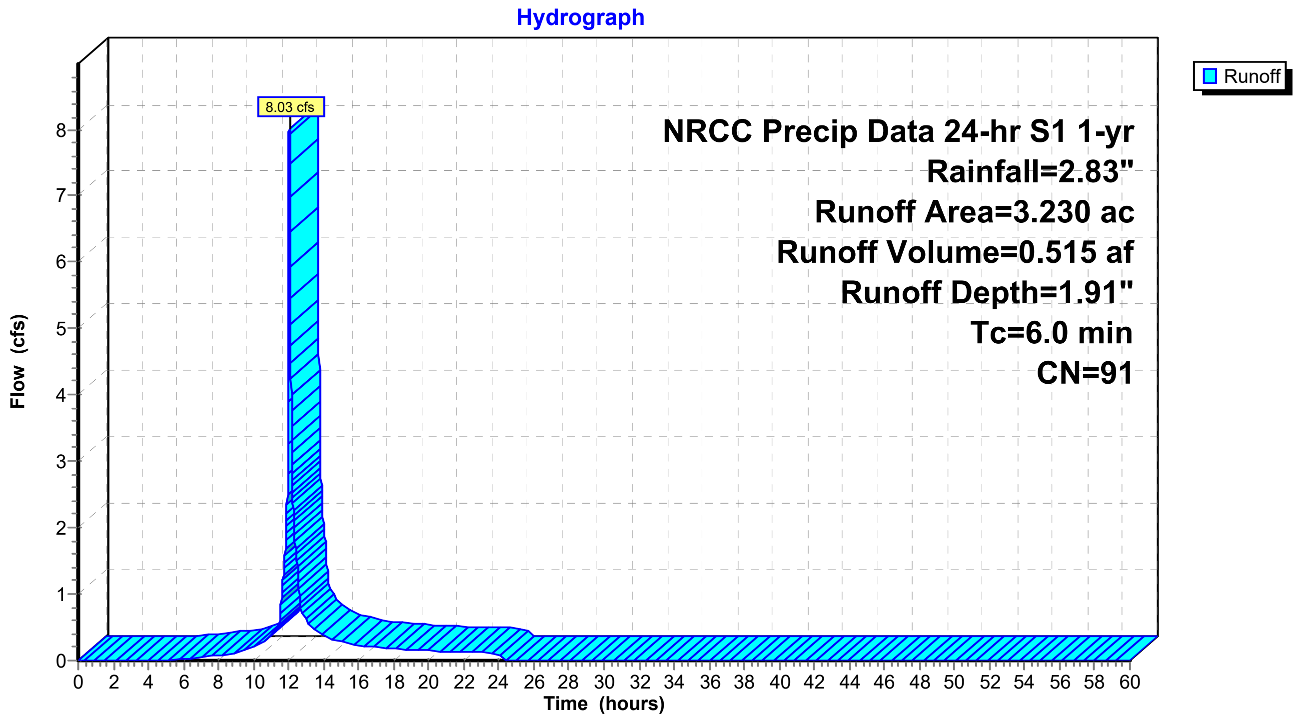
Runoff = 8.03 cfs @ 12.04 hrs, Volume= 0.515 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
2.030	98	Paved parking, HSG D
1.200	80	>75% Grass cover, Good, HSG D
3.230	91	Weighted Average
1.200		37.15% Pervious Area
2.030		62.85% Impervious Area

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

Subcatchment 3S: FDA 1A-WQv



Project:	Rye Lake WWTF
Location:	Harrison, NY
Project No.:	90388-000
Subject:	WQv Calculation

Performed by: CJM **Date:** 6/24/2022
Checked by: DJS **Date:**

Objective: Calculate the 1-yr storm volume using the below equation to confirm calculating via HydroCAD is the more conservative design approach

WQv = (P * Rv * A)/12

Where:

P = 1-yr 24-hr storm (in) from NRCC
Rv = 0.05 + 0.009(1), where I is percent impervious cover
A = contributing area

P = 2.83 in
A = 3.23 ac
I = 63%

Rv = 0.62
WQv = 0.47 ac-ft
WQv = 20451 cf

WQv Calculcated in HydroCAD = 22433 cf

USE HydroCAD VALUE

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are dis

Smoothing	Yes
State	New York
Location	
Longitude	73.718 degrees West
Latitude	41.064 degrees North
Elevation	0 feet
Date/Time	Mon, 18 Jan 2021 15:48:26 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr
1yr	0.33	0.51	0.64	0.83	1.04	1.30	**1yr**	0.90	1.23	1.49	1.85	2.29	2.83	3.19
2yr	0.40	0.62	0.77	1.02	1.28	1.60	**2yr**	1.10	1.49	1.84	2.27	2.80	3.44	3.87
5yr	0.47	0.74	0.93	1.24	1.59	2.00	**5yr**	1.37	1.84	2.31	2.86	3.52	4.31	4.89
10yr	0.53	0.84	1.06	1.44	1.87	2.38	**10yr**	1.61	2.16	2.75	3.41	4.19	5.11	5.84
25yr	0.62	0.99	1.26	1.74	2.32	2.98	**25yr**	2.00	2.67	3.47	4.31	5.29	6.42	7.40
50yr	0.71	1.14	1.46	2.04	2.74	3.55	**50yr**	2.36	3.14	4.13	5.14	6.29	7.62	8.85
100yr	0.80	1.30	1.68	2.38	3.24	4.22	**100yr**	2.79	3.69	4.93	6.13	7.50	9.05	10.59
200yr	0.92	1.49	1.94	2.78	3.83	5.02	**200yr**	3.31	4.34	5.88	7.31	8.93	10.77	12.67
500yr	1.10	1.81	2.36	3.43	4.79	6.32	**500yr**	4.14	5.39	7.41	9.24	11.27	13.55	16.08

Project: Rye Lake WWTF

Location: Harrison, NY

Project No.: 90388-000

Subject: WQv Calculation

Performed by: CJM **Date:** 6/24/2022

Checked by: DJS **Date:**

Objective:

Calculate the WQv using the 90% storm and the below equation to confirm calculating using the 1-yr storm in HydroCAD is the more conservative design approach

WQv = (P * Rv * A)/12

Where:

P = 1-yr 24-hr storm (in) from NRCC

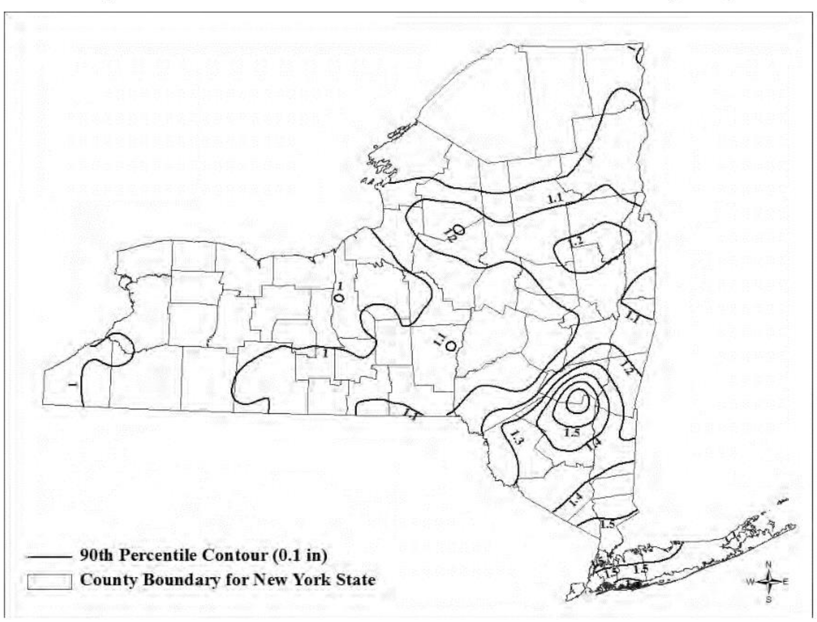
Rv = 0.05 + 0.009(1), where I is percent impervious cover

A = contributing area

P =	1.50	in
A =	3.23	ac
I =	62.93%	
Rv =	0.62	
WQv =	0.25	ac-ft
WQv =	10,840	cf
WQv Calculated using 1-yr storm and HydroCAD =	22,433	cf

USE HydroCAD VALUE

Figure 4.1: 90th Percentile Rainfall in New York State (NYSDEC, 2013)



Channel Protection Volume Calculations

Project:	Rye Lake WWTF		
Location:	Harrison, NY		
Project No.:	90388-000		
Subject:	Channel Protection Volume (CPv)		
Performed by:	CJM	**Date:**	6/23/2022
Checked by:		**Date:**	

Objective: Calculate the required outflow rate to slowly release the Channel Protection Volume (CPv) over a 24-hour period.

Methodology:

Calculate the 1-yr 24-hr storm in HydroCAD and divide by time to get the goal release rate

CPv =	0.515	ac-ft	*from HydroCAD, subcatchment "FDA 1A-WQv"*
CPv =	22,433	cf	
Goal Release Rate =	CPv / (86,400 sec)	cfs	
Goal Release Rate =	0.26	cfs	
Release Rate Provided =	0.22	cfs	*from HydroCAD, pond "Wetlands" outflow*

Wetland Sizing Calculations

Project:	**Rye Lake Water Filteration Plant**		
Location:	**Harrison, NY**		
Project No:	**90388-000**		
Subject:	**Wetland Sizing**		
Performed By:	**CJM**	**Date:**	**11/17/2021**
Checked By:	**DJS**	**Date:**	**3/9/2022**

Objective: Size a stormwater wetland for the WQv and CPv per NYS Stormwater Manual

WQv = 22,433 cf

Permanent Pool

	Stage	Elevation (ft)	Area (ft^2)	Volume (ft^3)	Total Vol. (ft^3)	Notes
MICROPOOL	0.0	391.5	516	0	0	
	0.5	392.0	661	294	294	
	1.5	393.0	970	816	1,110	
	2.5	394.0	2,519	1,745	2,854	
	3.5	395.0	3,839	3,179	6,033	
	4.5	396.0	6,274	5,057	11,090	
LOW AND HIGH MARSH	3.5	395.0	1,152	0	11,090	
	4.5	396.0	8,065	4,609	15,698	
	5.0	396.5	15,835	7,544	23,242	Top of permanent pool

Forebay Permanent Pool

	Stage	Elevation (ft)	Area (ft^2)	Volume (ft^3)	Total Vol. (ft^3)	Notes
FOREBAY	2.0	393.5	168	0	0	
	2.5	394.0	303	118	118	
	3.5	395.0	602	453	570	
	4.5	396.0	901	752	1,322	
	5.5	397.0	1,496	1,199	2,520	Top of permanent pool

Total Permanent Pool Volume (ft^3) 25,762

Extended Detention

	Stage	Elevation (ft)	Area (ft^2)	Volume (ft^3)	Total Vol. (ft^3)	Notes
	5.0	396.5	15,835	0	0	
	5.5	397.0	18,271	8,527	8,527	
	6.5	398.0	22,789	20,530	29,057	
	7.0	398.5	24,171	11,740	40,797	Max WSEL in wetland
	7.5	399.0	30,553	13,681	54,478	Top of Berm

Total Extended Detention Volume (ft^3) 54,478

Summary Table

	Vol. (ft^3)	% of Required	WSEL Elevation	Notes
WQv-Perm. Pool	25,762	115%	396.50	Required WQv =22433 cf
Remaining Wetland Storage Vol.	29,057	--	398.50	

Design Checks

MICROPOOL		
Total Vol.	11,090	cf
Required Vol. (25% of WQv)	5,608	cf
Design Check	OKAY	
LOW AND HIGH MARSH		
Total Wetland Area	15,835	sf
High Marsh Area, water depth 6" or less	7,769	sf
Req. High Marsh Area (35% of Total Wetland Area)	5,542	sf
Design Check	OKAY	
Total Marsh Area, water depth 18" or less	11,985	sf
Req. Marsh Area (65% of Total Wetland Area)	7,790	sf
Design Check	OKAY	
FOREBAY		
Total Vol.	2,520	cf
Required Vol. (10% of WQv)	2,243	cf
Design Check	OKAY	

Project:	Rye Lake WWTF		
Location:	Harrison, NY		
Project No.:	90388-000		
Subject:	Level Spreader Sizing		
Performed by:	CJM	**Date:**	6/23/2022
Checked by:	DJS	**Date:**	

Objective: Size the level spreader for flow leaving the wetland and going to bioretention surface

Methodology: Level spreader calculations are based on Section 3 of the NYS Standards and Specifications for Erosion and Sediment Control

Required L = Q_{10} * 2 lf/cfs

where

L = level spreader length

Q_{10} = 10yr storm peak flow reaching level spreader

Q_{10} = 0.27 cfs *from HydroCAD Model*

Required L = 0.54 ft

NYSDEC Green Infrastructure Worksheet

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?...						Yes		
Design Point:	1		*This workbook can not be used (see Appendix F for 1-yr storm WQv Calculation)*					
P=	2.83	*inch*						

Breakdown of Subcatchments								
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Description**		
1	3.23	2.03	63%	0.62	22,433	Bioretention		
2								
3								
4								
5								
6								
7								
8								
9								
10								
Subtotal (1-30)	3.23	2.03	63%	0.62	**22,433**	**Subtotal 1**		
Total	3.23	2.03	63%	0.62	**22,433**	**Initial WQv**	**0.51**	**af**

Identify Runoff Reduction Techniques By Area			
Technique	**Total Contributing Area** *(Acre)*	**Contributing Impervious Area** *(Acre)*	**Notes**
Conservation of Natural Areas	0.00	0.00	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per*
Total	**0.00**	**0.00**	

Recalculate WQv after application of Area Reduction Techniques							
	Total Area *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Runoff Coefficient Rv**	**WQv** *(ft^3)*		
"<<Initial WQv"	3.23	2.03	63%	0.62	22,433		
Subtract Area	0.00	0.00					
WQv adjusted after Area Reductions	**3.23**	**2.03**	63%	0.62	22,433		
Disconnection of Rooftops		0.00					
Adjusted WQv after Area Reduction and Rooftop Disconnect	3.23	2.03	63%	0.62	**22,433**	**0.51**	**af**
WQv reduced by Area Reduction techniques					0	**0.00**	**af**

Runoff Reduction Volume and Treated volumes						
Runoff Reduction Techiques/Standard SMPs			Total Contributing Area (acres)	Total Contributing Impervious Area (acres)	WQv Reduced (RRv) cf	WQv Treated cf
Area/Volume Reduction	Conservation of Natural Areas	RR-1	0.00	0.00		
	Sheetflow to Riparian Buffers/Filter Strips	RR-2	0.00	0.00		
	Tree Planting/Tree Pit	RR-3	0.00	0.00		
	Disconnection of Rooftop Runoff	RR-4		0.00		
	Vegetated Swale	RR-5	0.00	0.00	0	
	Rain Garden	RR-6	0.00	0.00	0	
	Stormwater Planter	RR-7	0.00	0.00	0	
	Rain Barrel/Cistern	RR-8	0.00	0.00	0	
	Porous Pavement	RR-9	0.00	0.00	0	
	Green Roof (Intensive & Extensive)	RR-10	0.00	0.00	0	
Standard SMPs w/RRv Capacity	Infiltration Trench	I-1	0.00	0.00	0	0
	Infiltration Basin	I-2	0.00	0.00	0	0
	Dry Well	I-3	0.00	0.00	0	0
	Underground Infiltration System	I-4				
	Bioretention & Infiltration Bioretention	F-5	3.23	2.03	9381	13052
	Dry swale	O-1	0.00	0.00	0	0
Standard SMPs	Micropool Extended Detention (P-1)	P-1				
	Wet Pond (P-2)	P-2				
	Wet Extended Detention (P-3)	P-3				
	Multiple Pond system (P-4)	P-4				
	Pocket Pond (p-5)	P-5				
	Surface Sand filter (F-1)	F-1				
	Underground Sand filter (F-2)	F-2				
	Perimeter Sand Filter (F-3)	F-3				
	Organic Filter (F-4	F-4				
	Shallow Wetland (W-1)	W-1				
	Extended Detention Wetland (W-2	W-2				
	Pond/Wetland System (W-3)	W-3				
	Pocket Wetland (W-4)	W-4	3.23	2.03		22433
	Wet Swale (O-2)	O-2				
Totals by Area Reduction →			0.00	0.00	0	
Totals by Volume Reduction →			0.00	0.00	0	
Totals by Standard SMP w/RRV →			3.23	2.03	9381	13052
Totals by Standard SMP →			3.23	2.03		22433
Totals (Area + Volume + all SMPs) →			6.46	4.07	9,381	35,485
	Impervious Cover √	okay				
	Total Area √	okay				

Enter the Soils Data for the site		
Soil Group	Acres	S
A		55%
B		40%
C		30%
D	**3.23**	20%
Total Area	3.23	
Calculate the Minimum RRv		
S =	**0.20**	
Impervious =	2.03	*acre*
Redeveloped Area	0.00	*acre*
Re-Dev Impervious =	2.03	*acre*
Precipitation	2.83	*in*
Rv	0.950	
Minimum RRv	**3,967**	***ft3***
	0.091	af

#	NOI Question	Reported Value	
		cf	af
28	Total Water Quality Volume (WQv) Required	22433	*0.515*
30	Total RRV Provided	9381	*0.215*
31	Is RRv Provided ≥WQv Required?	No	
32	Minimum RRv	3967	*0.091*
32a	Is RRv Provided ≥ Minimum RRv Required?	Yes	
33a	Total WQv Treated	35485	*0.815*
34	Sum of Volume Reduced & Treated	44866	*1.030*
34	Sum of Volume Reduced and Treated	44866	*1.030*
35	Is Sum RRv Provided and WQv Provided ≥WQv Required?	Yes	

Apply Peak Flow Attenuation			
36	Channel Protection	*Cpv*	
37	Overbank	*Qp*	
37	Extreme Flood Control	*Qf*	
	Are Quantity Control requirements met?	*Yes*	Plan Completed

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	**1**						
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	3.23	2.03	0.63	0.62	22433.00	2.83	
Enter Impervious Area Reduced by Disconnection of Rooftops		0.00	63%	0.62	22,433	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.					0	*ft^3*	
Soil Information							
Soil Group		D					
Soil Infiltration Rate		0.00	*in/hour*	*Okay*			
Using Underdrains?		Yes	*Okay*				
Calculate the Minimum Filter Area							
				Value		Units	Notes
WQv				22,433		*ft^3*	
Enter Depth of Soil Media			*df*	2.5		*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity			*k*	0.5		*ft/day*	
Enter Average Height of Ponding			*hf*	0.5		*ft*	*6 inches max.*
Enter Filter Time			*tf*	2		*days*	
Required Filter Area			***Af***	**18694**		***ft^2***	
Determine Actual Bio-Retention Area							
Filter Width		121	*ft*	*Max Width (irregular shape)*			
Filter Length		170	*ft*	*Max Length (irregular shape)*			
Filter Area		19544	*ft^2*	*irregular shape, surface area calculated in CAD*			
Actual Volume Provided		23453	*ft^3*				
Determine Runoff Reduction							
Is the Bioretention contributing flow to another practice?			NO	Select Practice			
RRv		9,381					
RRv applied		**9,381**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***			
Volume Treated		13,052	*ft^3*	*This is the portion of the WQv that is not reduced in the practice.*			
Volume Directed		0	*ft^3*	This volume is directed another practice			
Sizing √		OK		*Check to be sure Area provided ≥ Af*			

Pollutant Loading Calculations

Project:	Rye Lake Filtration Facility
Location:	West Harrison, NY
Project No.:	90388-000
Subject:	Pollutant Loading Calculations
Performed by:	JAP Date: 6/6/2022
Checked by:	DJS Date: 7/15/2022

Objective: Determine the pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration in the pre and post development conditions.

Methodology:

Simple Method - Chemical

$$L = 0.226 * R * C * A$$

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/L)
A = Area (acres)
.
0.226 = Unit Conversion Factor

Simple Method - Bacteria

$$L = 103 * R * C * A$$

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Bacteria Concentration (1,000/mL)
A = Area (acres)
103 = Unit Conversion Factor

The Simple Method calculates annual runoff as a prodict of annual runoff volume

$$R = P * P_j * Rv$$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = Fraction of Annual Rainfall Events that Produce Runoff (Usually 0.9)
Rv = Runoff Coefficient

Runoff Coefficient

$$Rv = 0.05 + 0.9Ia$$

Where:

Ia = Impervious Fraction

SMP Pollutant Removal

$$R = L\ [(E_1)+(1- E_1)E_2+(1-((E_1)+(1- E_1)E_2)E_3+\ldots]$$

Where:

R = Pollutant Removal (lbs)

L = Annual Load from Simple Method (lbs)

E_i = Efficiency of the ith practice in a series

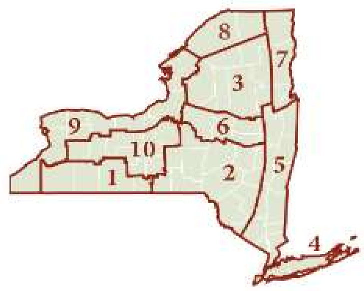
Project:	Rye Lake Filtration Facility
Location:	West Harrison, NY
Project No.:	90388-000
Subject:	Pollutant Loading Calculations
Performed by:	JAP Date: 6/6/2022
Checked by:	DJS Date: 7/15/2022

Objective: Determine the precipitation data using NRCC website.

Website: NRCC Summary Tables (cornell.edu)

New York - 5 - Hudson Valley

Year	Annual Precipitation (in)
2000	48.57
2001	33.01
2002	45.42
2003	53.55
2004	46.65
2005	51.1
2006	50.32
2007	47.42
2008	52.77
2009	45.66
2010	44.09
2011	62.95
2012	39.31
2013	42.08
2014	42.57
2015	38.85
2016	35.56
2017	40.61
2018	53.83
2019	47.75
2020	39.14
2021	47.68
AVG	45.86



Project:	Rye Lake Filtration Facility
Location:	Harrison, NY
Project No.:	90388-000
Subject:	Pollutant Loading Calculations
Performed by:	CJM Date: 7/1/2022
Checked by:	DJS Date: 7/15/2022

Data:

Annual Rainfall, P= 45.86 in (From NRCC)

P_j = 0.9

Pollutant Concentrations from Source Areas

Source Area	Pollutant Concentrations, C (mg/L, 1000 col/mL**)						
	TSS	TP	TN	Coli	Cu	Pb	Zn
Lawn	602	2.1	9.1	24	0.017	0.017	0.050
Landscaping	37	0	0	94	0.094	0.029	0.263
Woods*	37	0.15	1.33	94	0.094	0.029	0.263
Roof (Industrial)	17	0	0	5.8	0.062	0.043	0.719
Roof (Commercial)	9	0.14	2.1	1.1	0.007	0.017	0.256
Driveway	173	0.56	2.1	17	0.017	0.000	0.107
C/R Parking	27	0.15	1.9	1.8	0.051	0.028	0.139
Industrial Parking	228	0	0	2.7	0.034	0.085	0.224
Devloped Site	--	--	--	--	--	--	--

*Woods is not a source area in the Pollutant Concentration Table A.2 (Reference 1), Landscaping used for loading values

** Coliform is calculated in 1,000 colonies per mL

1. New York State Stormwater Management Design Manual, October 2001 - Appendix A (Reference 1)
2. East of Hudson Watershed Corporation Stormwater Retrofit Project Design Manual, Table 4 (Refernce 2)
3. The National Water Quality Database, Version 1.1 Feb 16, 2004 (Reference 3)

	Area (ac)											
	Lawn	Landscaping	Woods	Roof (Ind)	Roof (Comm)	Driveway	C/R Parking	Indus Parking	Total Area	**Ia**	**Rv**	**R (in)**
Pre-Development	0	0	2.99	0	0	0.11	0	0	3.1	0.04	0.08	3.38
Post-Development	0.27	0.82	0	0	0.96	1.01	0.04	0	3.1	0.65	0.63	26.15

	Weighted Concentration, C (mg/L, 1000 col/mL*)							Annual Load, L (lbs/yr, Billions Colonies/yr*)						
	TSS	TP	TN	Coli	Cu	Pb	Zn	TSS	TP	TN	Coli	Cu	Pb	Zn
Pre-Dev	**42**	**0.165**	**1.357**	**91**	**0.091**	**0.028**	**0.257**	**99**	**0.39**	**3.22**	**98,549**	**0.216**	**0.066**	**0.610**
Post-Dev w/o SMPs	122	0.411	2.152	33	0.035	0.015	0.190	2230	7.5	39.42	274,332	0.636	0.271	3.478
Pollutants Removed	118	0.35	1.34	29	0.031	0.012	0.167	2163	6.39	24.52	238,668	0.572	0.222	3.054
Post-Dev w/ SMPs	**3.7**	**0.06**	**0.81**	**4.27**	**0.00**	**0.00**	**0.02**	**67**	**1.13**	**14.90**	**35,663**	**0.064**	**0.049**	**0.424**
					Post -Dev w/ SMPs - Pre-Dev			**-32.20**	**0.74**	**11.68**	**-62,886**	**-0.15**	**-0.02**	**-0.19**

* Coliform is calculated in 1,000 colonies per mL and billion colonies per year

Removal Rate for SMP's

	Removal Rates						
	TSS	TP	TN	Bacteria	Cu	Pb	Zn
Stormwater Wetland	0.80	0.57	0.30	0.80	0.47	0.40	0.42
Filtering Practices	0.85	0.65	0.46	0.35	0.81	0.70	0.79
E'	0.97	0.85	0.62	0.87	0.90	0.82	0.88

1. New York State Stormwater Management Design Manual, October 2001 - Appendix A (Reference 1)
2. East of Hudson Watershed Corporation Stormwater Retrofit Project Design Manual, Table 4 (Reference 2)
3. National Pollutant Removal Performance Database Version 3, September 2007 (Reference 4)

Reference 1 - New York State Stormwater Design Manual, October 2001, Appendix A

Table A.2 Pollutant Concentrations from Source Areas

Constituent	TSS[1]	TP[2]	TN[3]	F Coli[1]	Cu[1]	Pb[1]	Zn[1]
	mg/l	mg/L	mg/l	1,000 col/ ml	ug/l	ug/l	ug/l
Resid Roof	19	0.11	1.5	0.26	20	21	312
Comm Roof	9	0.14	2.1	1.1	7	17	256
Indust Roof	17	-	-	5.8	62	43	1,390
C/R Parking	27	0.15	1.9	1.8	51	28	139
Indust Parking	228	-	-	2.7	34	85	224
Res Street	172	0.55	1.4	37	25	51	173
Comm Street	468	-	-	12	73	170	450
Rural Highway	51	-	22	-	22	80	80
Urban Highway	142	0.32	3.0	-	54	400	329
Lawns	602	2.1	9.1	24	17	17	50
Landscaping	37	-	-	94	94	29	263
Driveway	173	0.56	2.1	17	17	-	107
Gas Station	31	-	-	-	88	80	290
Auto Recycler	335	-	-	-	103	182	520
Heavy Industrial	124	-	-	-	148	290	1600

1: Claytor and Schueler (1996)
2: Average of Steuer et al. (1997),Bannerman (1993) and Waschbusch (2000)
3: Steuer et al. (1997)

Table A.4. Suggested Removal Rates for SMPs

	TSS	TP	TN	Metals[1]	Bacteria
Wet Ponds	80	50 (51)	35 (33)	60 (62)	70
Stormwater Wetlands	80[2] (76)	50 (49)	30	40 (42)	80 (78)
Filtering Practices	85 (86)	60 (59)	40 (38)	70 (69)	35 (37)
Infiltration Practices [4]	90[3] (95)	70	50 (51)	90[3] (99)	90[4]
Water Quality Swales	85 (84)	40 (39)	50[5] (84)	70	0 (-25)[6]

1. Average of zinc and copper. Only zinc for infiltration
2. Many wetland practices in the database were poorly designed, and we consequently adjusted sediment removal upward.
3. It is assumed that no practice is greater than 90% efficient.
4. Data inferred from sediment removal.
5. Actual data is based on only two highly performing practices.
6. Assume 0 rather than a negative removal.

Note: Data in parentheses represent median pollutant removal data reported in the *National Pollutant Removal Database - Revised Edition* (Winer, 2000). These data were adjusted for convenience and to reflect biases in the data.

Reference 2 - East of Hudson Watershed Corporation - Stormwater Retrofit Project Design Manual

Table 2: Phosphorus Loading Coefficients (C)

Land Use	Phosphorus Concentration (C) (mg/L)
Residential	0.41
Impervious	0.50
Commercial	0.34
Industrial	0.45
Actively Grazed Pasture	0.40
Forest	0.15
Developed Open Space*	0.59

** e.g. golf courses, parks, cemeteries, single houses with large lawns.*

Table 4: SRP Phosphorus Removal Efficiency

Retrofit Type	Phosphorus Reduction (%)
Micropool Extended Detention Pond	40
Wet Pond	49
Wet Extended Detention Pond	55
Multiple Pond System	76
Pocket Pond	67
Shallow Wetland	43
ED Shallow Wetland	39
Pond/Wetland System	56
Pocket Wetland	57
Infiltration Trench	68
Infiltration Basin	50
Dry Well	50
Surface Sand Filter	59
Underground Sand Filter	59
Perimeter Sand Filter	41
Organic Filter	61
Bioretention	65
Dry Swale	50
Wet Swale	28
Green Infrastructure*	*See Below
Cartridge System	40
Hydrodynamic Separators**	10
Channel Stabilization	See Channel Stabilization Below

Reference 3 - The National Water Quality Database, Version 1.1 Feb 16, 2004

Table 1. Summary of Available Stormwater Data Included in NSQD Database, version 1.1 (continued)

	Fecal Coliform (mpn/100 mL)	Fecal Strep. (mpn/100 mL)	Total Coliform (mpn/100 mL)	Total E. Coli (mpn/100 mL)	NH3 (mg/L)	N02+NO3 (mg/L)	Nitrogen, Total Kjeldahl (mg/L)	Phos., filtered (mg/L)	Phos., total (mg/L)	Sb, total (ug/L)	As, total (ug/L)	As, filtered (ug/L)	Be, total (ug/L)
Mixed Industrial (252)													
Number of observations	115	70	39		125	213	196	215	217		101		
% of samples above detection	95.7	97.1	89.7		31.2	98.6	93.9	87.0	96.3		86.1		
Median	3033	10000	16000		0.43	0.57	1.0	0.08	0.20		3.0		
Coefficient of variation	2.5	2.6	2.4		0.7	0.7	1.5	2.2	1.5		0.9		
Institutional (18)													
Number of observations					18	18	18	17	17				
% of samples above detection					88.9	100	100	82.4	94.1				
Median					0.31	0.6	1.35	0.13	0.18				
Coefficient of variation					0.5	0.6	0.5	0.5	1.0				
Freeways (185)													
Number of observations	49	25	16	13	79	25	125	22	128		61	72	
% of samples above detection	100	100	100	100	87.3	96.0	96.8	95.5	99.2		55.7	50.0	
Median	1700	17000	50000	1900	1.07	0.28	2.0	0.20	0.25		2.4	1.4	
Coefficient of variation	2.0	1.2	1.5	2.2	1.3	1.2	1.4	2.1	1.8		0.7	2.0	
Mixed Freeways (20)													
Number of observations	16	12				14	16	13	14		15		
% of samples above detection	81.3	93.8				100	100	100	100		80		
Median	730	19000				0.6	1.6	0.04	0.26		3.0		
Coefficient of variation	2.0	1.1				0.7	0.9	0.8	0.8		0.7		
Open Space (68)													
Number of observations	23	22			32	44	45	44	46		19		
% of samples above detection	91.3	90.9			18.8	84.1	71.1	79.6	84.8		31.6		
Median	7200	24900			0.18	0.59	0.74	0.13	0.31		4.0		
Coefficient of variation	1.1	1.0			1.24	0.9	0.9	0.9	3.5		0.4		
Mixed Open Space (159)													
Number of observations	95	75			71	172	144	148	173		88		
% of samples above detection	97.9	100			22.5	97.7	91.0	85.8	96.5		44.3		
Median	2600	21000			0.51	0.7	1.12	0.09	0.27		3.0		
Coefficient of variation	2.3	2.4			1.2	0.8	1.3	1.1	1.0		0.9		

Reference 4 - National Pollutant Removal Performance Database Version 3, September 2007

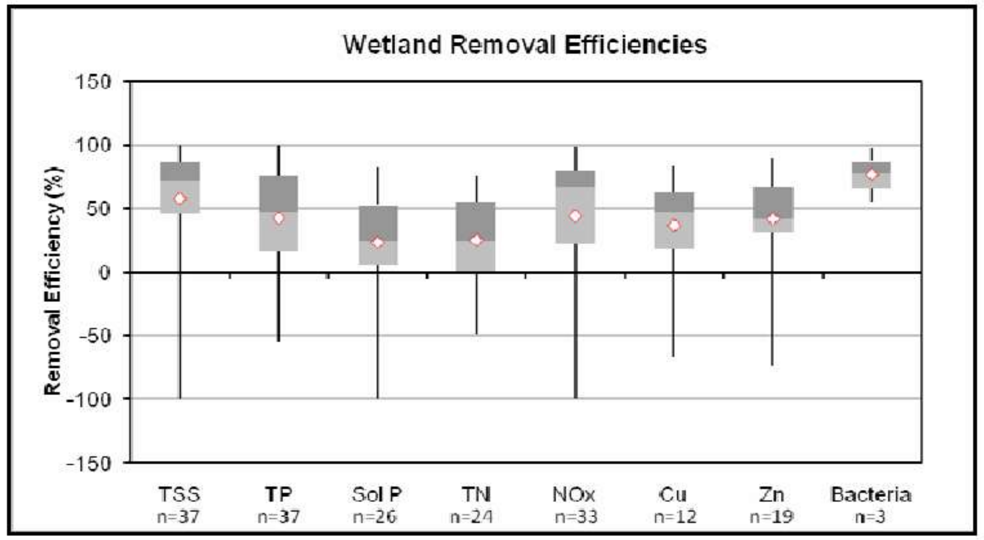


Figure 3. Wetland Removal Efficiencies

Table 3. Wetland Removal Efficiency Statistics

	TSS	TP	Sol P	TN	NO_x	Cu	Zn	Bacteria
Median	72	48	25	24	67	47	42	78
Min	-100	-55	-100	-49	-100	-67	-74	55
Max	100	100	82	76	99	84	90	97
Q1	46	16	6	0	22	18	31	67
Q3	86	76	53	55	80	63	68	88
Number	37	37	26	24	33	12	19	3

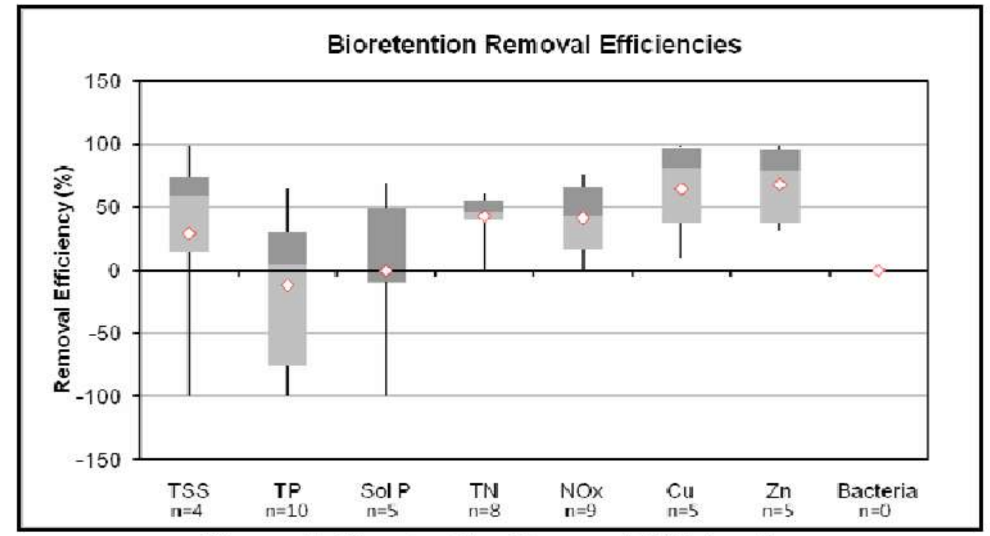


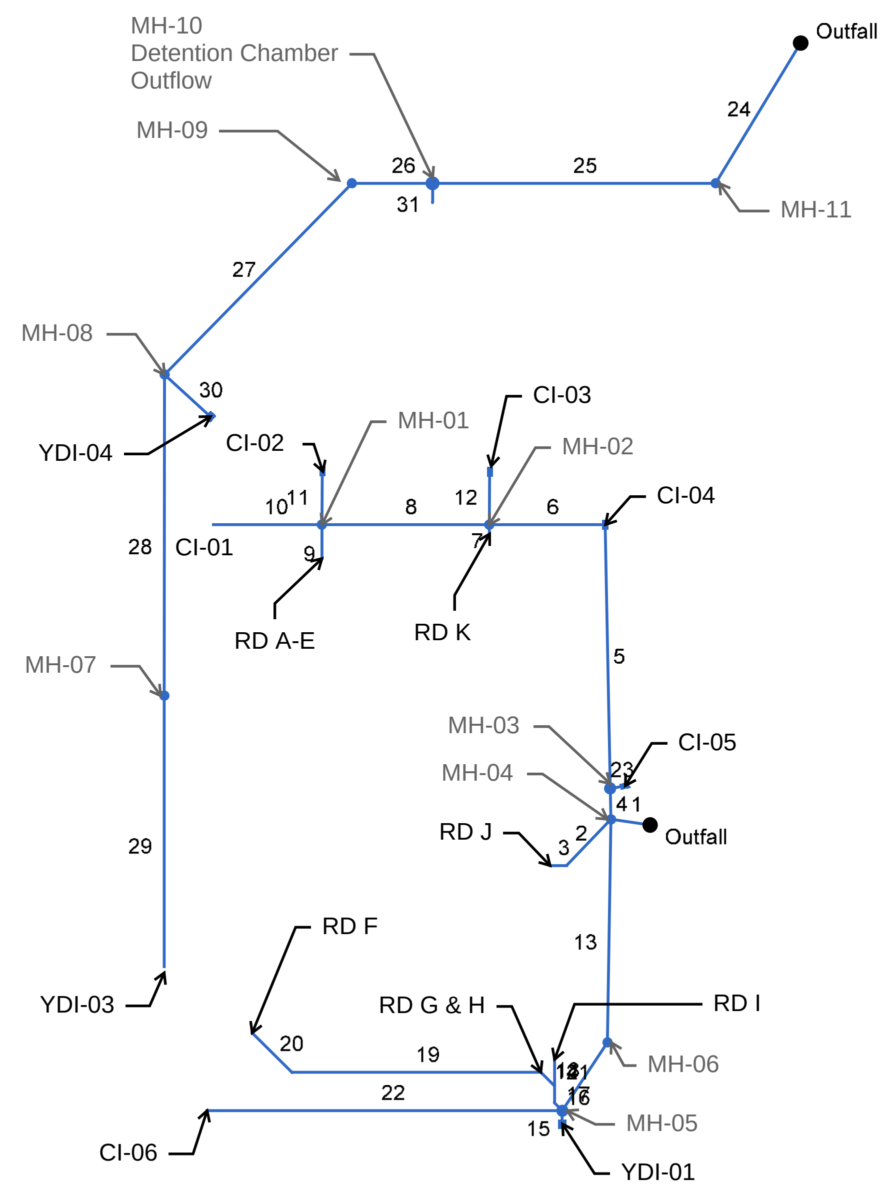
Figure 5. Bioretention Removal Efficiencies

Table 5. Bioretention Removal Efficiency Statistics

	TSS	TP	Sol P	TN	NO_x	Cu	Zn	Bacteria
Median	59	5	-9	46	43	81	79	N/A
Min	-100	-100	-100	-2	0	9	31	N/A
Max	98	65	69	61	76	99	98	N/A
Q1	15	-76	-9	40	16	37	37	N/A
Q3	74	30	49	55	67	97	95	N/A
Number	4	10	5	8	9	5	5	0

Storm Drain Sizing Calculation

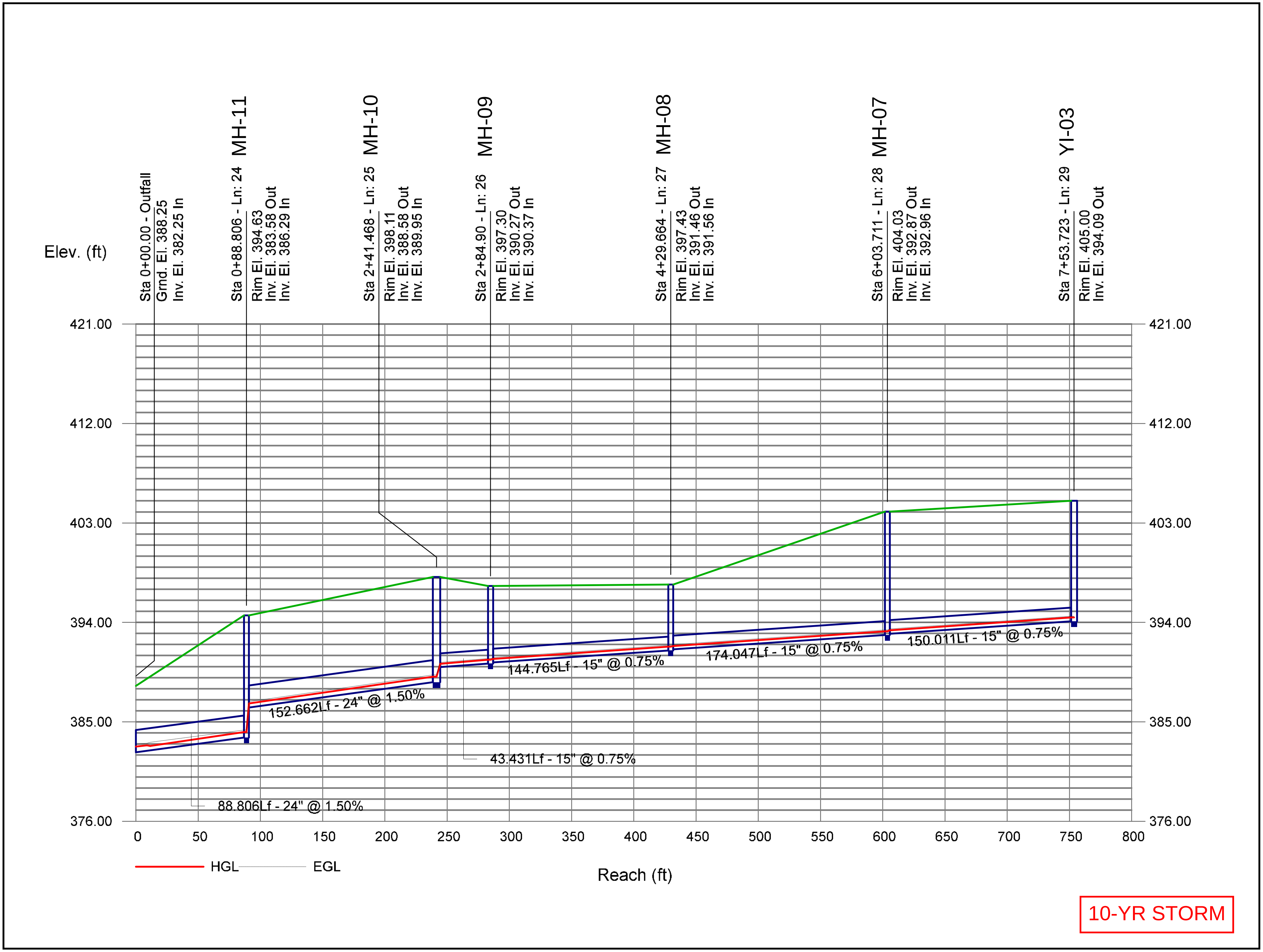
Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Rye Lake 10yr Storm.stm	Number of lines: 31	Date: 6/24/2022

Storm Sewer Profile

Proj. file: Rye Lake 10yr Storm.stm



Storm Sewer Profile

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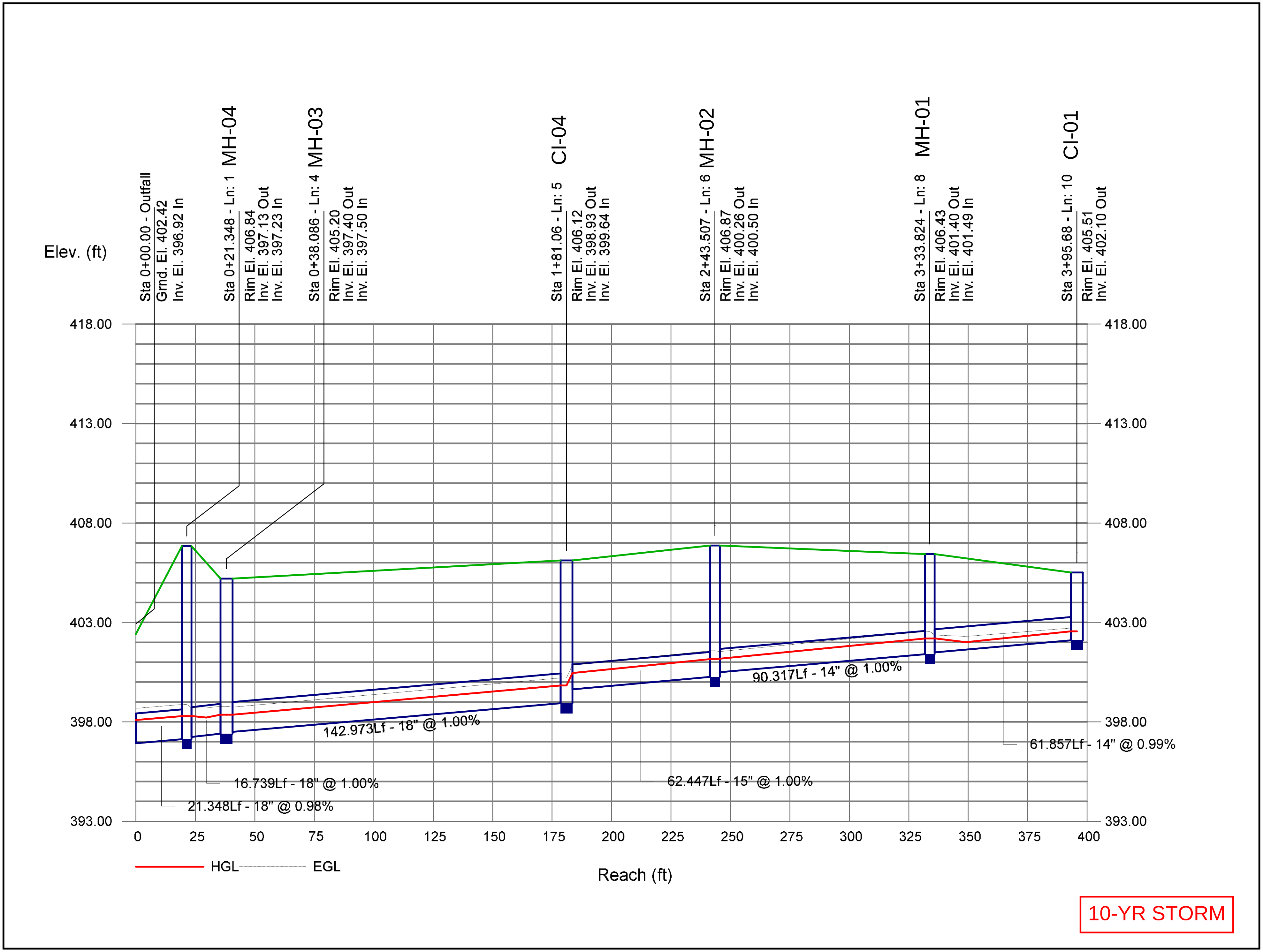

Storm Sewer Profile

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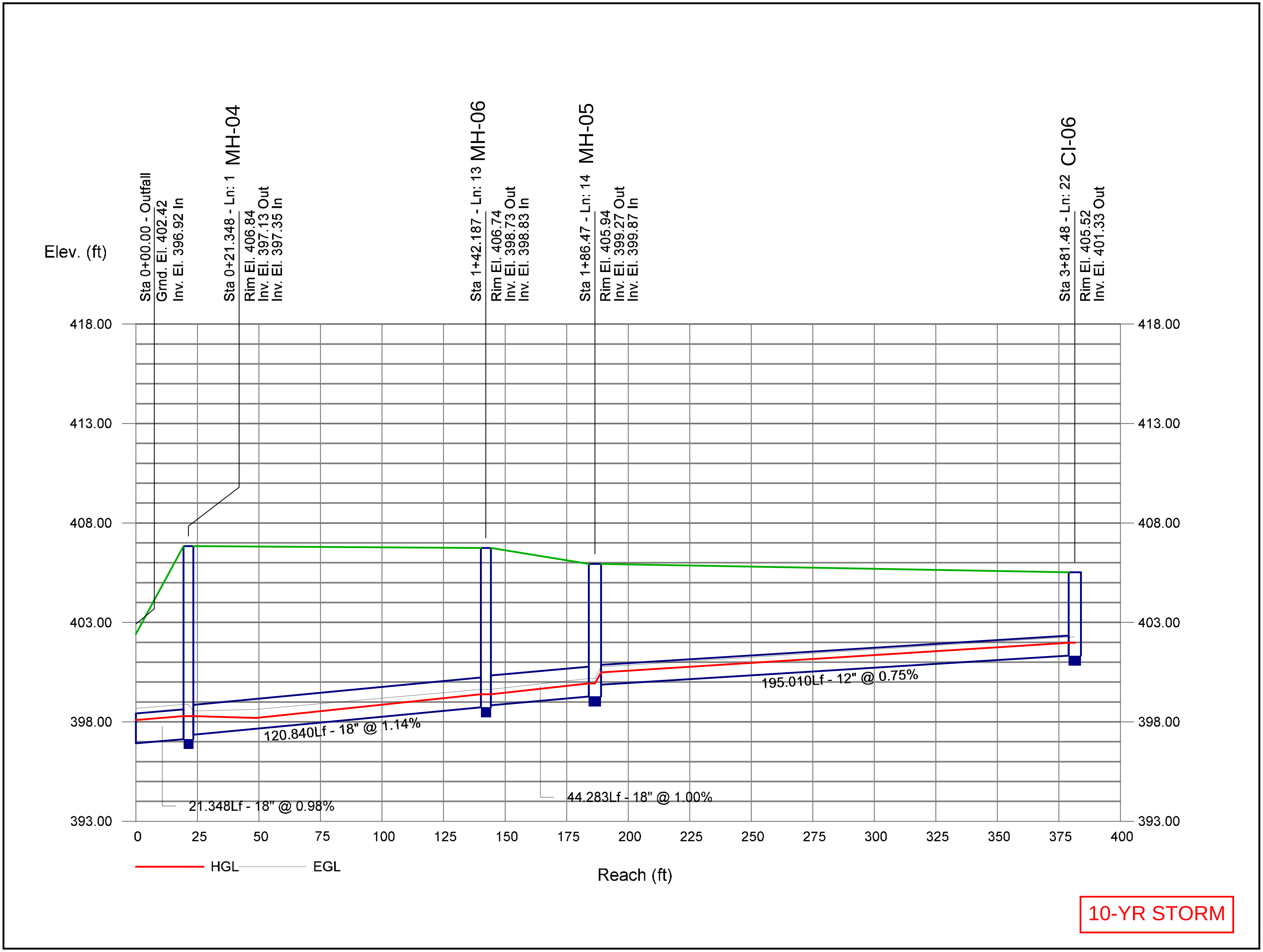


Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	21.348	0.00	2.40	0.00	0.00	2.03	0.0	13.2	4.4	9.00	10.42	6.11	18	0.98	396.92	397.13	398.09	398.29	0.00	406.84	Pipe - (17)
2	1	34.656	0.00	0.23	0.00	0.00	0.22	0.0	6.0	6.0	1.31	2.83	5.12	9	2.50	402.41	403.28	402.77	403.80	406.84	404.25	Pipe - (177)
3	2	8.908	0.23	0.23	0.95	0.22	0.22	6.0	6.0	6.0	1.32	2.82	3.97	9	2.47	403.28	403.50	403.80	404.03	404.25	0.00	Pipe - (176)
4	1	16.739	0.00	1.35	0.00	0.00	1.16	0.0	8.6	5.3	6.18	10.50	4.91	18	1.00	397.23	397.40	398.29	398.36	406.84	405.20	Pipe - (170)
5	4	142.973	0.12	1.17	0.95	0.11	0.99	6.0	7.9	5.5	5.45	10.50	5.06	18	1.00	397.50	398.93	398.36	399.83	405.20	406.12	Pipe - (21)
6	5	62.447	0.00	1.05	0.00	0.00	0.88	0.0	7.6	5.6	4.88	6.46	5.49	15	1.00	399.64	400.26	400.45	401.16	406.12	406.87	Pipe - (10) (1)
7	6	4.895	0.17	0.17	0.95	0.16	0.16	6.0	6.0	6.0	0.97	1.37	6.33	6	5.11	403.50	403.75	403.81	404.22	406.87	0.00	Pipe - (178)
8	6	90.317	0.00	0.81	0.00	0.00	0.65	0.0	7.2	5.7	3.69	5.82	5.27	14	1.00	400.50	401.40	401.17	402.19	406.87	406.43	Pipe - (10)
9	8	18.385	0.38	0.38	0.95	0.36	0.36	6.0	6.0	6.0	2.17	3.37	3.90	12	0.76	401.48	401.62	402.19	402.25	406.43	423.02	Pipe - (140)
10	8	61.857	0.28	0.28	0.74	0.21	0.21	6.0	6.0	6.0	1.25	5.78	2.57	14	0.99	401.49	402.10	402.19	402.55	406.43	405.51	Pipe - (8)
11	8	28.784	0.15	0.15	0.55	0.08	0.08	6.0	6.0	6.0	0.50	6.48	1.51	15	1.01	401.31	401.60	402.19	401.87	406.43	405.85	Pipe - (22)
12	6	28.757	0.07	0.07	0.95	0.07	0.07	6.0	6.0	6.0	0.40	6.26	1.87	15	0.94	400.80	401.07	401.16	401.32	406.87	406.09	Pipe - (33)
13	1	120.840	0.00	0.82	0.00	0.00	0.65	0.0	12.3	4.6	2.98	11.21	3.28	18	1.14	397.35	398.73	398.29	399.38	406.84	406.74	Pipe - (11) (1)
14	13	44.283	0.00	0.82	0.00	0.00	0.65	0.0	11.9	4.6	3.02	11.38	4.55	18	1.00	398.83	399.27	399.38	399.93	406.74	405.94	Pipe - (11)
15	14	7.186	0.17	0.17	0.95	0.16	0.16	6.0	6.0	6.0	0.97	11.30	4.32	15	3.06	400.53	400.75	400.78	401.14	405.94	405.50	Pipe - (23)
16	14	5.996	0.00	0.11	0.00	0.00	0.10	0.0	11.8	4.7	0.49	1.13	2.68	8	0.75	399.57	399.61	399.93	399.94	405.94	400.34	Pipe - (171)
17	16	9.176	0.00	0.11	0.00	0.00	0.10	0.0	11.8	4.7	0.49	1.13	2.88	8	0.75	399.61	399.68	399.94	400.01	400.34	400.67	Pipe - (148) (1)
18	17	10.428	0.05	0.08	0.95	0.05	0.08	6.0	11.6	4.7	0.36	1.15	2.35	8	0.77	399.68	399.76	400.01	400.04	400.67	400.48	Pipe - (147)
19	18	134.390	0.00	0.03	0.00	0.00	0.03	0.0	7.0	5.7	0.16	1.13	1.62	8	0.75	399.76	400.77	400.04	400.95	400.48	401.49	Pipe - (146)
20	19	30.187	0.03	0.03	0.95	0.03	0.03	6.0	6.0	6.0	0.17	1.12	2.17	8	0.73	400.77	400.99	400.95	401.18	401.49	0.00	Pipe - (174)
21	17	14.293	0.03	0.03	0.95	0.03	0.03	6.0	6.0	6.0	0.17	0.85	1.90	8	0.42	399.94	400.00	400.14	400.20	400.67	0.00	Pipe - (148)
22	14	195.010	0.54	0.54	0.71	0.38	0.38	6.0	6.0	6.0	2.31	3.34	4.43	12	0.75	399.87	401.33	400.48	401.98	405.94	405.52	Pipe - (20)

Project File: Rye Lake 10yr Storm.stm | Number of lines: 31 | Run Date: 6/24/2022

NOTES:Intensity = 43.47 / (Inlet time + 8.20) ^ 0.75; Return period =Yrs. 10 ; c = cir e = ellip b = box

10-YR STORM

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	4	7.974	0.18	0.18	0.95	0.17	0.17	6.0	6.0	6.0	1.03	11.43	2.10	15	3.14	397.50	397.75	398.36	398.15	405.20	405.00	Pipe - (169)
24	End	88.806	0.00	0.87	0.00	0.00	0.26	0.0	74.5	1.6	2.05	27.67	3.31	24	1.50	382.25	383.58	382.76	384.07	0.00	394.63	Pipe - (109)
25	24	152.662	0.00	0.87	0.00	0.00	0.26	0.0	70.7	1.7	2.06	27.70	4.27	24	1.50	386.29	388.58	386.66	389.08	394.63	398.11	Pipe - (108)
26	25	43.431	0.00	0.87	0.00	0.00	0.26	0.0	29.4	2.9	0.75	5.59	2.98	15	0.75	389.95	390.27	390.26	390.61	398.11	397.30	Pipe - (106)
27	26	144.765	0.00	0.87	0.00	0.00	0.26	0.0	26.2	3.1	0.80	5.59	3.04	15	0.75	390.37	391.46	390.69	391.81	397.30	397.43	Pipe - (105)
28	27	174.047	0.00	0.64	0.00	0.00	0.21	0.0	21.7	3.5	0.73	5.59	2.96	15	0.75	391.56	392.87	391.86	393.20	397.43	404.03	Pipe - (104)
29	28	150.011	0.64	0.64	0.33	0.21	0.21	17.9	17.9	3.8	0.81	5.60	3.05	15	0.75	392.96	394.09	393.28	394.44	404.03	405.00	Pipe - (103)
30	27	33.635	0.23	0.23	0.20	0.05	0.05	6.0	6.0	6.0	0.28	6.49	2.38	15	1.01	392.41	392.75	392.59	392.95	397.43	400.94	Pipe - (112)
31	25	10.278	0.00	0.00	0.00	0.00	0.00	70.6	70.6	0.0	1.63	3.99	5.51	10	2.82	389.25	389.54	389.62	390.11	398.11	0.00	Pipe - (110)

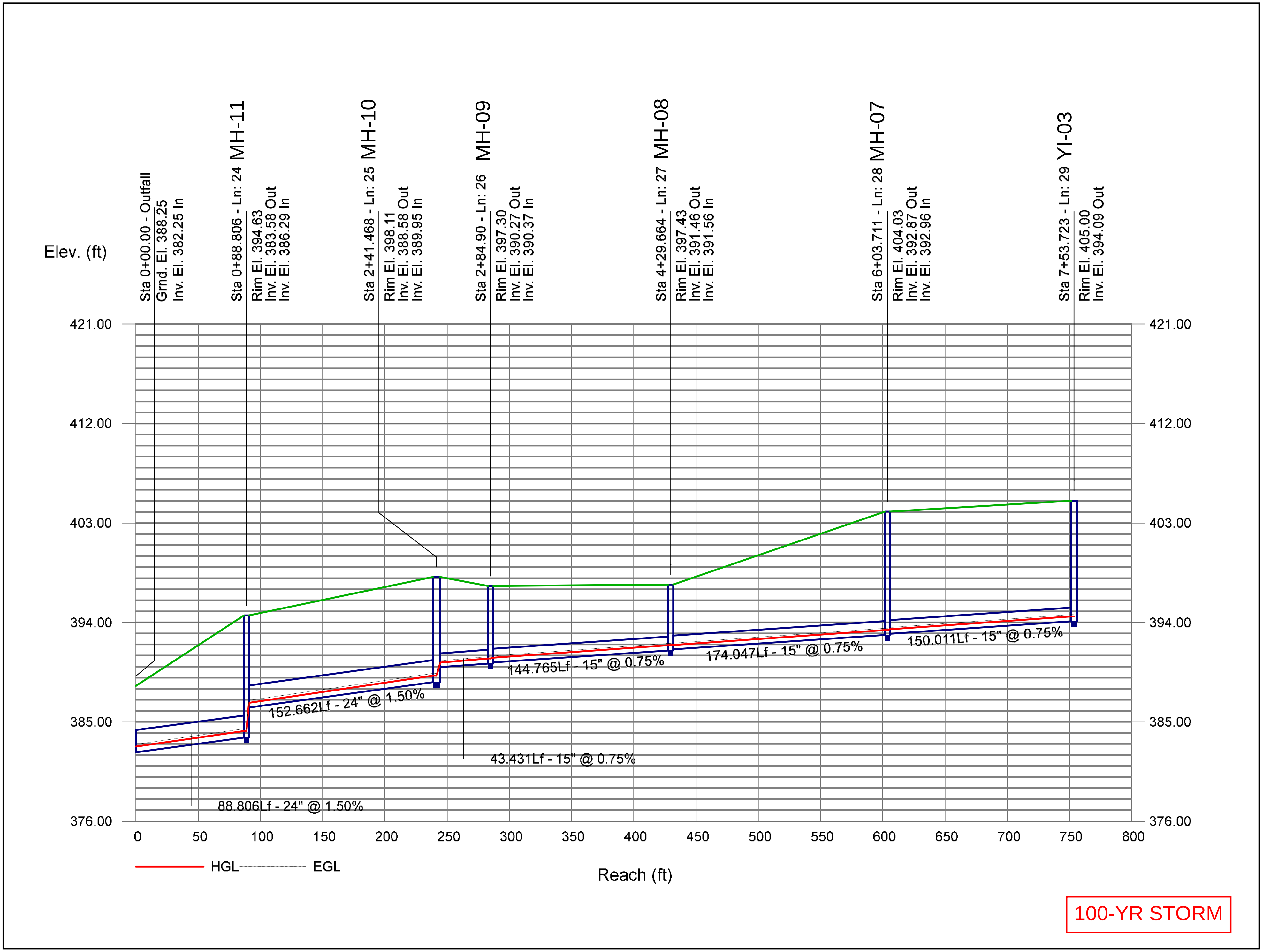
Project File: Rye Lake 10yr Storm.stm | Number of lines: 31 | Run Date: 6/24/2022

NOTES:Intensity = 43.47 / (Inlet time + 8.20) ^ 0.75; Return period =Yrs. 10 ; c = cir e = ellip b = box

10-YR STORM

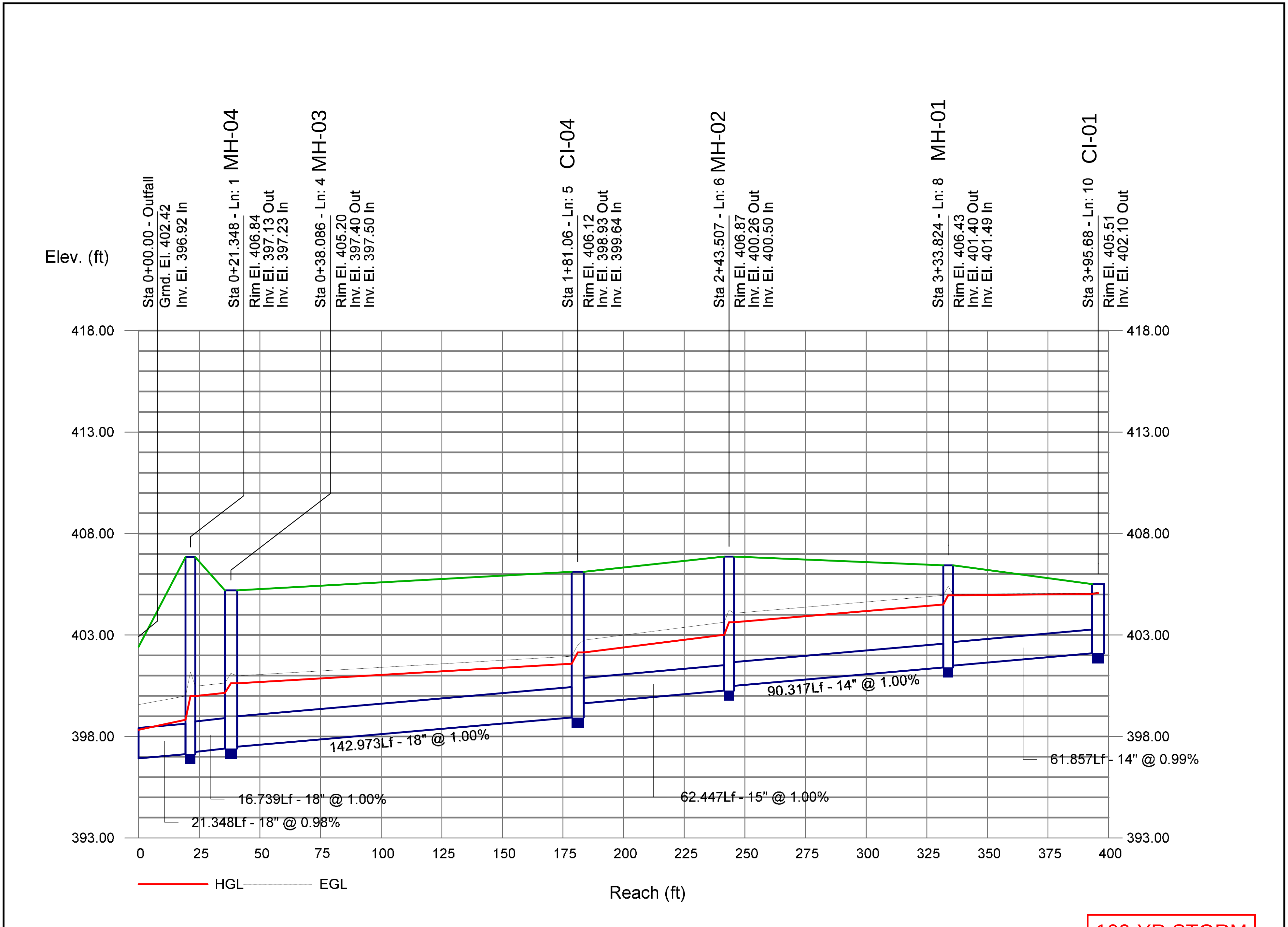
Storm Sewer Profile

Proj. file: Rye Lake 100yr Storm.stm



Storm Sewer Profile

Proj. file: Rye Lake 100yr Storm.stm

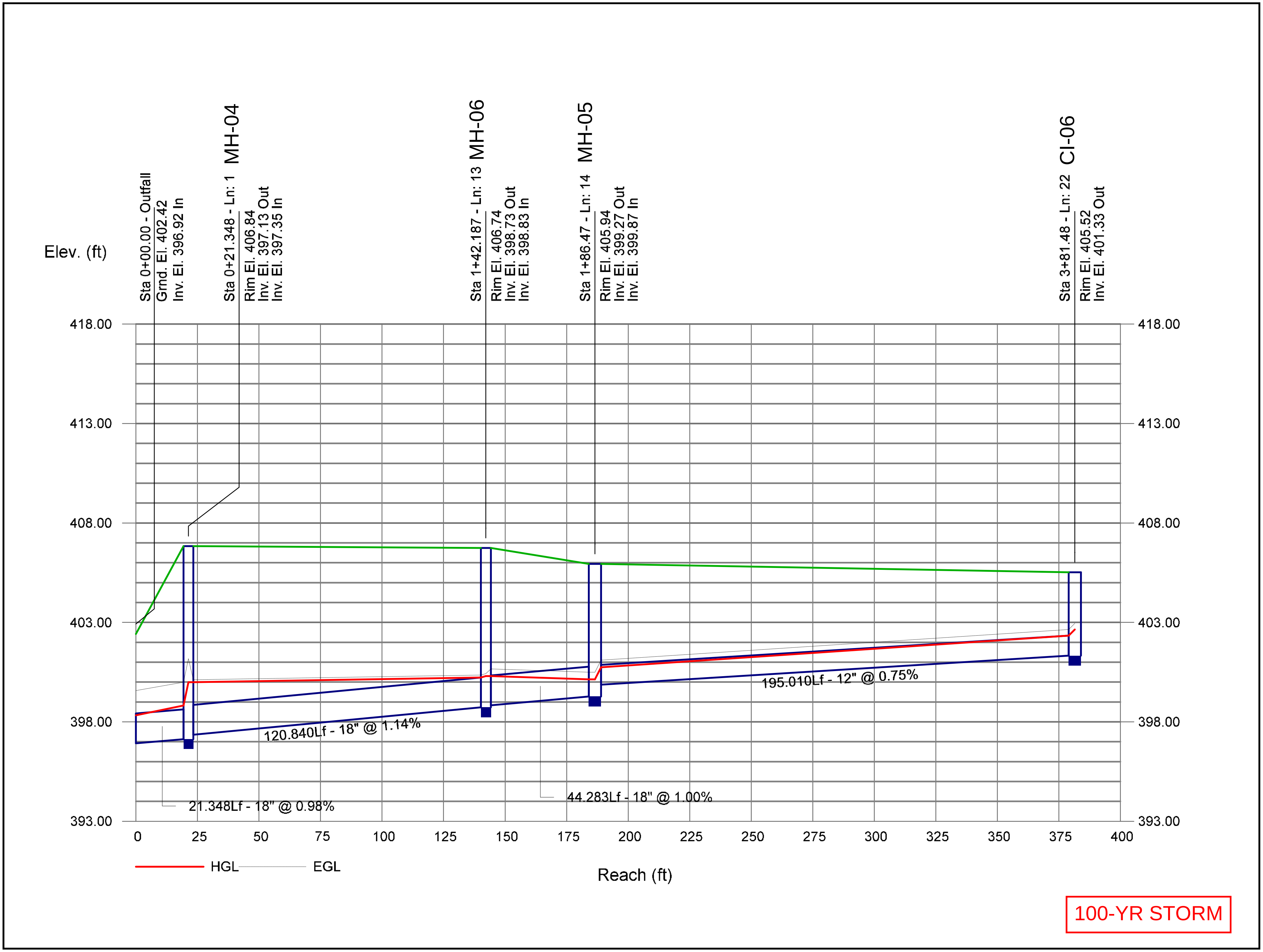


100-YR STORM

Storm Sewers

Storm Sewer Profile

Proj. file: Rye Lake 100yr Storm.stm



Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	21.348	0.00	2.40	0.00	0.00	2.03	0.0	10.7	7.6	15.38	10.42	8.80	18	0.98	396.92	397.13	398.33	398.82	0.00	406.84	Pipe - (17)
2	1	34.656	0.00	0.23	0.00	0.00	0.22	0.0	6.0	9.1	2.00	2.83	5.95	9	2.50	402.41	403.28	402.88	403.92	406.84	404.25	Pipe - (177)
3	2	8.908	0.23	0.23	0.95	0.22	0.22	6.0	6.0	9.2	2.00	2.82	4.98	9	2.47	403.28	403.50	403.92	404.14	404.25	0.00	Pipe - (176)
4	1	16.739	0.00	1.35	0.00	0.00	1.16	0.0	7.7	8.5	9.88	10.50	5.59	18	1.00	397.23	397.40	399.99	400.14	406.84	405.20	Pipe - (170)
5	4	142.973	0.12	1.17	0.95	0.11	0.99	6.0	7.2	8.7	8.60	10.50	4.87	18	1.00	397.50	398.93	400.62	401.58	405.20	406.12	Pipe - (21)
6	5	62.447	0.00	1.05	0.00	0.00	0.88	0.0	7.1	8.7	7.67	6.46	6.25	15	1.00	399.64	400.26	402.14	403.02	406.12	406.87	Pipe - (10) (1)
7	6	4.895	0.17	0.17	0.95	0.16	0.16	6.0	6.0	9.2	1.48	1.37	7.54	6	5.11	403.50	403.75	404.00	404.24	406.87	0.00	Pipe - (178)
8	6	90.317	0.00	0.81	0.00	0.00	0.65	0.0	6.8	8.8	5.75	5.82	5.38	14	1.00	400.50	401.40	403.63	404.51	406.87	406.43	Pipe - (10)
9	8	18.385	0.38	0.38	0.95	0.36	0.36	6.0	6.0	9.2	3.30	3.37	4.21	12	0.76	401.48	401.62	404.96	405.09	406.43	423.02	Pipe - (140)
10	8	61.857	0.28	0.28	0.74	0.21	0.21	6.0	6.0	9.2	1.90	5.78	1.77	14	0.99	401.49	402.10	404.96	405.02	406.43	405.51	Pipe - (8)
11	8	28.784	0.15	0.15	0.55	0.08	0.08	6.0	6.0	9.2	0.75	6.48	0.62	15	1.01	401.31	401.60	404.96	404.96	406.43	405.85	Pipe - (22)
12	6	28.757	0.07	0.07	0.95	0.07	0.07	6.0	6.0	9.2	0.61	6.26	0.50	15	0.94	400.80	401.07	403.63	403.63	406.87	406.09	Pipe - (33)
13	1	120.840	0.00	0.82	0.00	0.00	0.65	0.0	10.1	7.7	5.03	11.21	2.84	18	1.14	397.35	398.73	399.99	400.22	406.84	406.74	Pipe - (11) (1)
14	13	44.283	0.00	0.82	0.00	0.00	0.65	0.0	9.9	7.8	5.07	11.38	3.84	18	1.00	398.83	399.27	400.30	400.14	406.74	405.94	Pipe - (11)
15	14	7.186	0.17	0.17	0.95	0.16	0.16	6.0	6.0	9.2	1.48	11.30	4.88	15	3.06	400.53	400.75	400.84	401.23	405.94	405.50	Pipe - (23)
16	14	5.996	0.00	0.11	0.00	0.00	0.10	0.0	9.8	7.8	0.82	1.13	3.01	8	0.75	399.57	399.61	400.14	400.04	405.94	400.34	Pipe - (171)
17	16	9.176	0.00	0.11	0.00	0.00	0.10	0.0	9.8	7.8	0.82	1.13	3.46	8	0.75	399.61	399.68	400.04	400.11	400.34	400.67	Pipe - (148) (1)
18	17	10.428	0.05	0.08	0.95	0.05	0.08	6.0	9.7	7.9	0.60	1.15	2.80	8	0.77	399.68	399.76	400.11	400.12	400.67	400.48	Pipe - (147)
19	18	134.390	0.00	0.03	0.00	0.00	0.03	0.0	6.7	8.9	0.25	1.13	1.82	8	0.75	399.76	400.77	400.12	401.00	400.48	401.49	Pipe - (146)
20	19	30.187	0.03	0.03	0.95	0.03	0.03	6.0	6.0	9.2	0.26	1.12	2.42	8	0.73	400.77	400.99	401.00	401.23	401.49	0.00	Pipe - (174)
21	17	14.293	0.03	0.03	0.95	0.03	0.03	6.0	6.0	9.2	0.26	0.85	2.14	8	0.42	399.94	400.00	400.19	400.25	400.67	0.00	Pipe - (148)
22	14	195.010	0.54	0.54	0.71	0.38	0.38	6.0	6.0	9.2	3.51	3.34	4.64	12	0.75	399.87	401.33	400.75	402.33	405.94	405.52	Pipe - (20)

Project File: Rye Lake 100yr Storm.stm | Number of lines: 31 | Run Date: 6/24/2022

NOTES:Intensity = 54.11 / (Inlet time + 8.40) ^ 0.67; Return period =Yrs. 100 ; c = cir e = ellip b = box

100-YR STORM

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	4	7.974	0.18	0.18	0.95	0.17	0.17	6.0	6.0	9.2	1.56	11.43	1.28	15	3.14	397.50	397.75	400.62	400.63	405.20	405.00	Pipe - (169)
24	End	88.806	0.00	0.87	0.00	0.00	0.26	0.0	30.9	4.7	2.84	27.67	4.09	24	1.50	382.25	383.58	382.76	384.17	0.00	394.63	Pipe - (109)
25	24	152.662	0.00	0.87	0.00	0.00	0.26	0.0	28.2	4.9	2.90	27.70	4.71	24	1.50	386.29	388.58	386.72	389.17	394.63	398.11	Pipe - (108)
26	25	43.431	0.00	0.87	0.00	0.00	0.26	0.0	25.0	5.2	1.34	5.59	3.52	15	0.75	389.95	390.27	390.37	390.73	398.11	397.30	Pipe - (106)
27	26	144.765	0.00	0.87	0.00	0.00	0.26	0.0	23.1	5.4	1.40	5.59	3.56	15	0.75	390.37	391.46	390.80	391.93	397.30	397.43	Pipe - (105)
28	27	174.047	0.00	0.64	0.00	0.00	0.21	0.0	20.3	5.8	1.22	5.59	3.43	15	0.75	391.56	392.87	391.96	393.30	397.43	404.03	Pipe - (104)
29	28	150.011	0.64	0.64	0.33	0.21	0.21	17.9	17.9	6.1	1.29	5.60	3.49	15	0.75	392.96	394.09	393.37	394.54	404.03	405.00	Pipe - (103)
30	27	33.635	0.23	0.23	0.20	0.05	0.05	6.0	6.0	9.2	0.42	6.49	2.68	15	1.01	392.41	392.75	392.63	393.00	397.43	400.94	Pipe - (112)
31	25	10.278	0.00	0.00	0.00	0.00	0.00	28.1	28.1	0.0	1.63	3.99	5.51	10	2.82	389.25	389.54	389.62	390.11	398.11	0.00	Pipe - (110)

Project File: Rye Lake 100yr Storm.stm | Number of lines: 31 | Run Date: 6/24/2022

NOTES:Intensity = 54.11 / (Inlet time + 8.40) ^ 0.67; Return period =Yrs. 100 ; c = cir e = ellip b = box

100-YR STORM

Outlet Protection Sizing Calculations

Erosion Control Measure - Rock Outlet Protection Calculations

Rock Outlet Protection

Project: Rye Lake Water Filtration Plant
Owner: Westchester Joint Water Works

Objective: To prevent erosion at the stormwater and process overflow outles by reducing the velocity of flow and dissipating the energy.

Reference: New York State Standards and Specifications for Erosion and Sediment Control

Calculations:

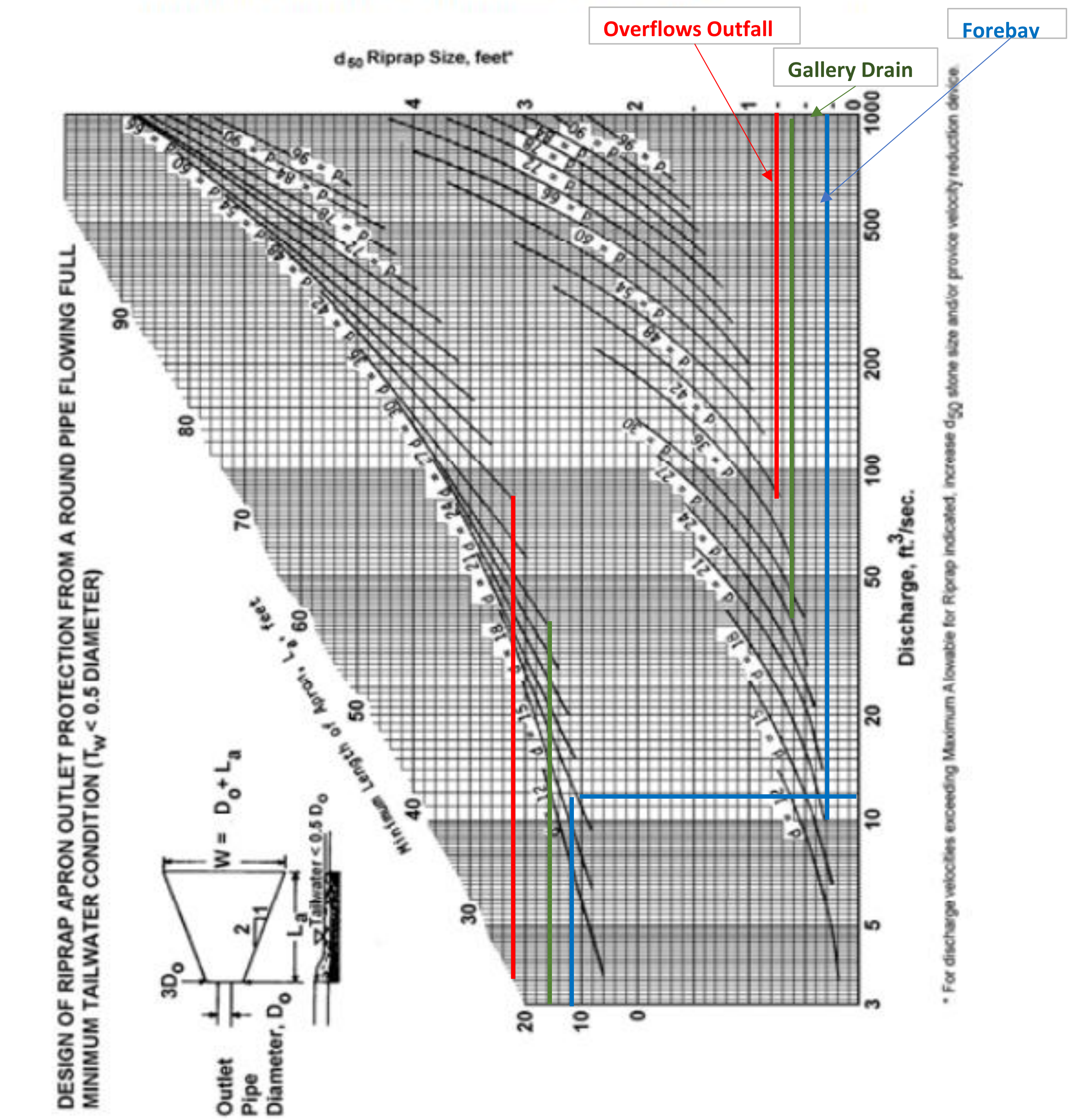
Location:	**Stormwater and Process Overflows Outfall**	
Max Pipe Diameter =	42	in
Max Flow =	62	cfs
From Figure 3.16		
d50 =	9	in
Length Min =	22	ft
Width at Pipe Outlet =	10.5	ft
Width at Apron End =	25.5	ft
Design d50 =	6	in
Design Length =	90	ft
Design width at Pipe Outlet =	12	ft
Design Width at Apron End =	22	ft
Design dimensions based on channel grading		

Location:	**Forebay**				
Max Pipe Diameter =	18	in	Pipe Area =	1.8	sf
25-yr Storm Flow =	11.32	cfs	Pw =	4.7	ft
Full Pipe Flow =	11.29	cfs	Pipe Slope =	1.15%	ft/ft
			n =	0.013	
From Figure 3.16					
d50 =	3	in			
Length Min =	11	ft			
Min Width at Pipe Outlet =	4.5	ft			
Min Width at Apron End =	12.5	ft			
Design d50 =	9	in			
Design Length =	70	ft			
Design width at Pipe Outlet =	12	ft			
Design Width at Apron End =	14	ft			
Design dimensions based on forebay grading					

Location:	**Gallery Drain**	
Max Pipe Diameter =	30	in
Max Flow =	20.5	cfs
From Figure 3.16		
d50 =	6	in
Length Min =	16	ft
Min Width at Pipe Outlet =	7.5	ft
Min Width at Apron End =	18.5	ft
Design d50 =	9	in
Design Length =	17	ft
Design width at Pipe Outlet =	7.5	ft
Design Width at Apron End =	18.5	ft
Design dimensions based on forebay grading		

Calculations by CJM
Checked by DJS

Figure 3.16
Outlet Protection Design—Minimum Tailwater Condition Chart
(Design of Outlet Protection from a Round Pipe Flowing Full,
Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)



Calculations by CJM
Checked by DJS

Project:	Rye Lake WWTF
Location:	Harrison, NY
Project No.:	90388-000
Subject:	Level Spreader Sizing
Performed by:	CJM **Date:** 6/21/2022
Checked by:	DJS **Date:** 7/1/2022

Objective: Size a level spreader for dispersing flow from riprap channel prior to runoff leaving the property line

Methodology: Level spreader calculations are based on Section 3 of the NYS Standards and Specifications for Erosion and Sediment Control

Required L = Q_{10} * 2 lf/cfs

where L = level spreader length

Q_{10} = 10yr storm peak flow reaching level spreader

Q_{10} = 4.2 cfs *from HydroCAD Model*

Required L = 8.4 ft

Level spreader is not in an offline configuration, consider the 100-yr storm

Q_{100} = 13.16 cfs *from HydroCAD Model*

Provided L = 28 ft

Receiving Water Body Analysis

Stream Capacity Calculations at Analysis Points

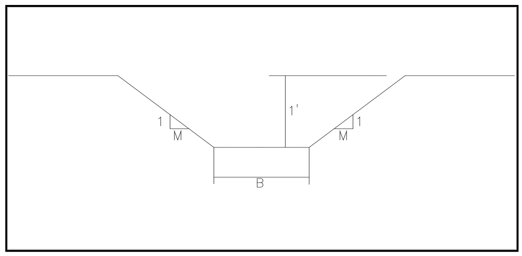
Project: Rye Lake WFP
Client: Westchester Joint Waterworks
Location: Harrison, NY

Objective: Check the stream capacity and shear stress under pre and post-development conditions to

References: (1) North Carolina Erosion and Sediment Control Planning and Design Manual
(2) Elements of Urban Stormwater Design, H.R. Malcom.

Procedure: Use procedures outlined in the above reference. Normal depth will be calculated using Mannings Equation and water velocity will be calculated using the principle of continuity (Q = VA)

blue text = user input
black text = calculated value



AP-2

Channel Geometry	
S_{max} (ft/ft) =	0.025
B (ft) =	5
M(ft) =	5

Pre-Development

	1-yr	10-yr	100-yr	
Peak Flow (cfs) =	38.32	159.00	386.55	*From HydroCAD*
Calculate normal depth and velocity via goal seek				
n =	0.045	0.045	0.045	
Flow (cfs) =	38.32	159.00	386.55	
normal depth (ft) =	1.0	1.9	2.8	
shear stress (lbs/sf)	1.5	3.0	4.4	

Post-Development

	1-yr	10-yr	100-yr	
Peak Flow (cfs) =	39.65	162.74	396.04	*From HydroCAD*
Calculate normal depth and velocity via goal seek				
n =	0.045	0.045	0.045	
Flow (cfs) =	39.65	162.74	396.04	
normal depth (ft) =	1.0	1.9	2.9	
shear stress (lbs/sf)	1.6	3.0	4.5	

Objective: Check the total capacity of the stream cross section using Manning's Equation

Cross Sectional Area	
b1 =	44
b2 =	5
h =	4
Area (sf) =	98.00
Pw (ft) =	44.81
R =	2.19
R^2/3 =	1.68
n =	0.045
slope (ft/ft) =	0.025
Q (cfs) =	864

Flow as a % of Total Channel Capacity			
	1-yr	10-yr	100-yr
Pre	4.4%	18.4%	44.7%
Post	4.6%	18.8%	45.8%
% Change	0.2%	0.4%	1.1%

AP-3

Channel Geometry	
S_{max} (ft/ft) =	0.005
B (ft) =	23
M(ft) =	24

Pre-Development

	1-yr	10-yr	100-yr	
Peak Flow (cfs) =	43.82	175.24	422.34	*From HydroCAD*
Calculate normal depth and velocity via goal seek				
n =	0.045	0.045	0.045	
Flow (cfs) =	43.82	175.24	422.34	
normal depth (ft) =	0.7	1.4	2.1	
shear stress (lbs/sf)	0.2	0.4	0.7	

Post-Development

	1-yr	10-yr	100-yr	
Peak Flow (cfs) =	42.73	172.05	417.39	*From HydroCAD*
Calculate normal depth and velocity via goal seek				
n =	0.045	0.045	0.045	
Flow (cfs) =	42.73	172.05	417.39	
normal depth (ft) =	0.7	1.4	2.1	
shear stress (lbs/sf)	0.2	0.4	0.7	

Objective: Check the total capacity of the stream cross section using Manning's Equation

Cross Sectional Area	
b1 =	85
b2 =	17
h =	1.5
Area (sf) =	76.50
Pw (ft) =	85.07
R =	0.90
R^2/3 =	0.93
n =	0.045
slope (ft/ft) =	0.005
Q (cfs) =	167

Flow as a % of Total Channel Capacity			
	1-yr	10-yr	100-yr
Pre	26.3%	105%	253%
Post	25.6%	103%	250%
% Change	-0.7%	-1.9%	-3.0%

Reference 1: Chow, V. T. *Open-Channel Hydraulics*

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	**0.022**	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	**0.030**	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

Reference 2: Fischenich, C. *Stability Thresholds for Stream Restoration Materials*

Table 2. Permissible Shear and Velocity for Selected Lining Materials[1]

Boundary Category	Boundary Type	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)	Citation(s)
Soils	Fine colloidal sand	0.02 - 0.03	1.5	A
	Sandy loam (noncolloidal)	0.03 - 0.04	1.75	A
	Alluvial silt (noncolloidal)	0.045 - 0.05	2	A
	Silty loam (noncolloidal)	0.045 - 0.05	1.75 – 2.25	A
	Firm loam	0.075	2.5	A
	Fine gravels	0.075	2.5	A
	Stiff clay	0.26	3 – 4.5	A, F
	Alluvial silt (colloidal)	0.26	3.75	A
	Graded loam to cobbles	0.38	3.75	A
	Graded silts to cobbles	0.43	4	A
	Shales and hardpan	0.67	6	A
Gravel/Cobble	1-in.	0.33	2.5 – 5	A
	2-in.	0.67	3 – 6	A
	6-in.	2.0	4 – 7.5	A
	12-in.	4.0	5.5 – 12	A
Vegetation	Class A turf	3.7	6 – 8	E, N
	Class B turf	2.1	4 - 7	E, N
	Class C turf	1.0	3.5	E, N
	Long native grasses	1.2 – 1.7	4 – 6	G, H, L, N
	Short native and bunch grass	0.7 - 0.95	3 – 4	G, H, L, N
	Reed plantings	0.1-0.6	N/A	E, N
	Hardwood tree plantings	0.41-2.5	N/A	E, N
Temporary Degradable RECPs	Jute net	0.45	1 – 2.5	E, H, M
	Straw with net	1.5 – 1.65	1 – 3	E, H, M
	Coconut fiber with net	2.25	3 – 4	E, M
	Fiberglass roving	2.00	2.5 – 7	E, H, M
Non-Degradable RECPs	Unvegetated	3.00	5 – 7	E, G, M
	Partially established	4.0-6.0	7.5 – 15	E, G, M
	Fully vegetated	8.00	8 – 21	F, L, M
Riprap	6 – in. d_{50}	2.5	5 – 10	H
	9 – in. d_{50}	3.8	7 – 11	H
	12 – in. d_{50}	5.1	10 – 13	H
	18 – in. d_{50}	7.6	12 – 16	H
	24 – in. d_{50}	10.1	14 – 18	E
Soil Bioengineering	Wattles	0.2 – 1.0	3	C, I, J, N
	Reed fascine	0.6-1.25	5	E
	Coir roll	3 - 5	8	E, M, N
	Vegetated coir mat	4 - 8	9.5	E, M, N
	Live brush mattress (initial)	0.4 – 4.1	4	B, E, I
	Live brush mattress (grown)	3.90-8.2	12	B, C, E, I, N
	Brush layering (initial/grown)	0.4 – 6.25	12	E, I, N
	Live fascine	1.25-3.10	6 – 8	C, E, I, J
	Live willow stakes	2.10-3.10	3 – 10	E, N, O
Hard Surfacing	Gabions	10	14 – 19	D
	Concrete	12.5	>18	H

[1] Ranges of values generally reflect multiple sources of data or different testing conditions.

A. Chang, H.H. (1988).
B. Florineth. (1982)
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G. Kouwen, N.; Li, R. M.; and Simons, D.B., (1980).
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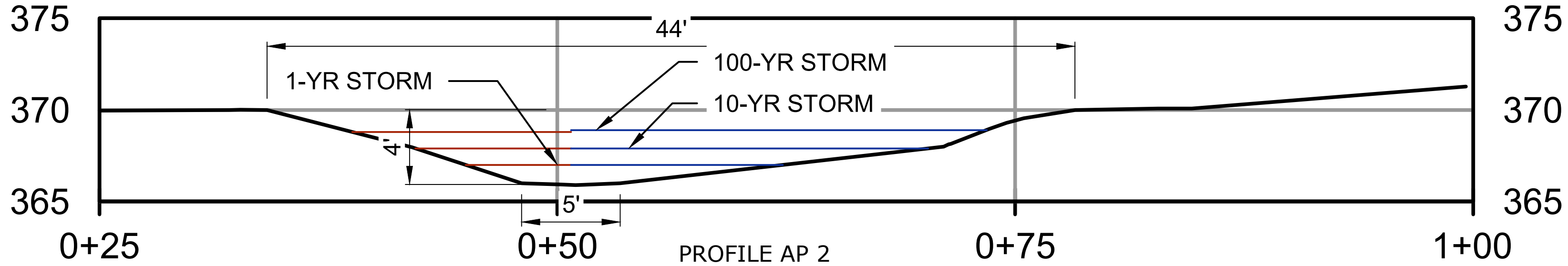
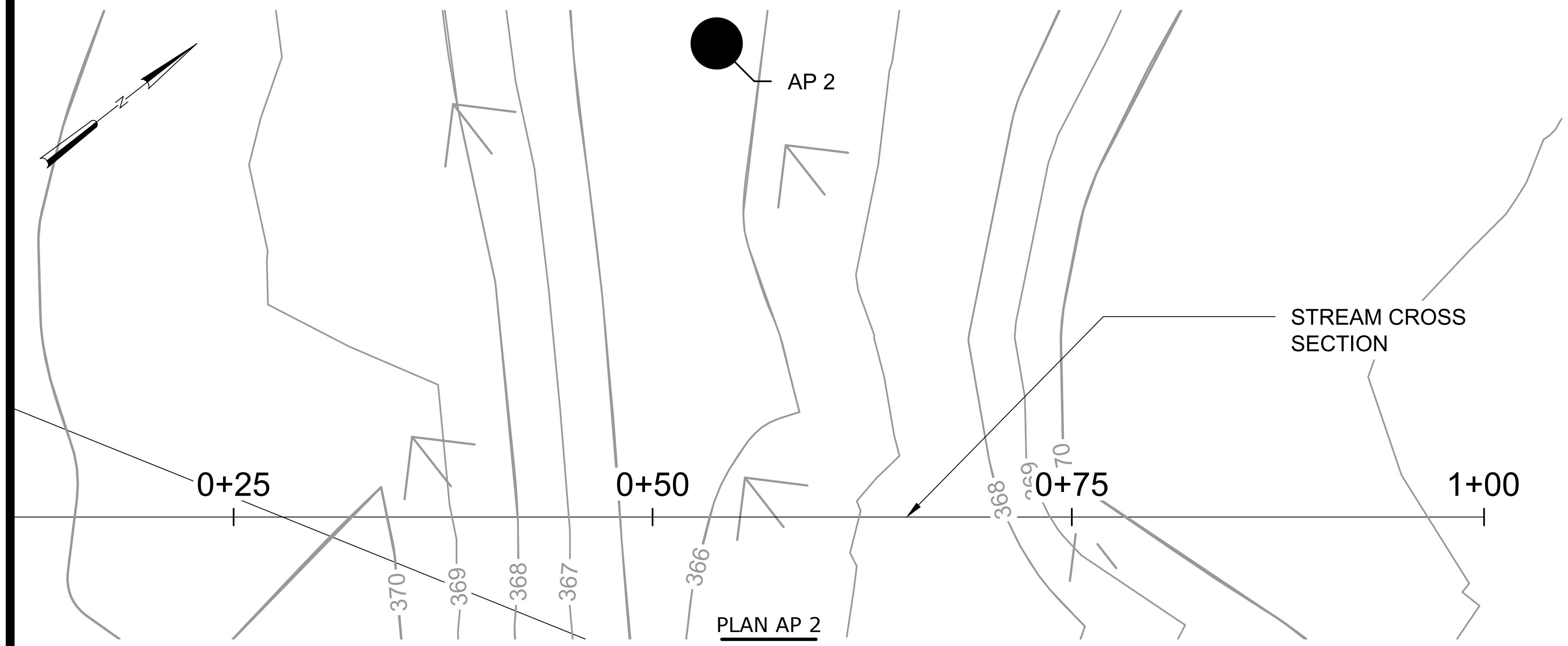
N. Data from Author (2001)
O. USACE (1997).



PROFILE AP 2

HORIZONTAL SCALE: 1" = 10'
VERTICAL SCALE: 1"= 10'



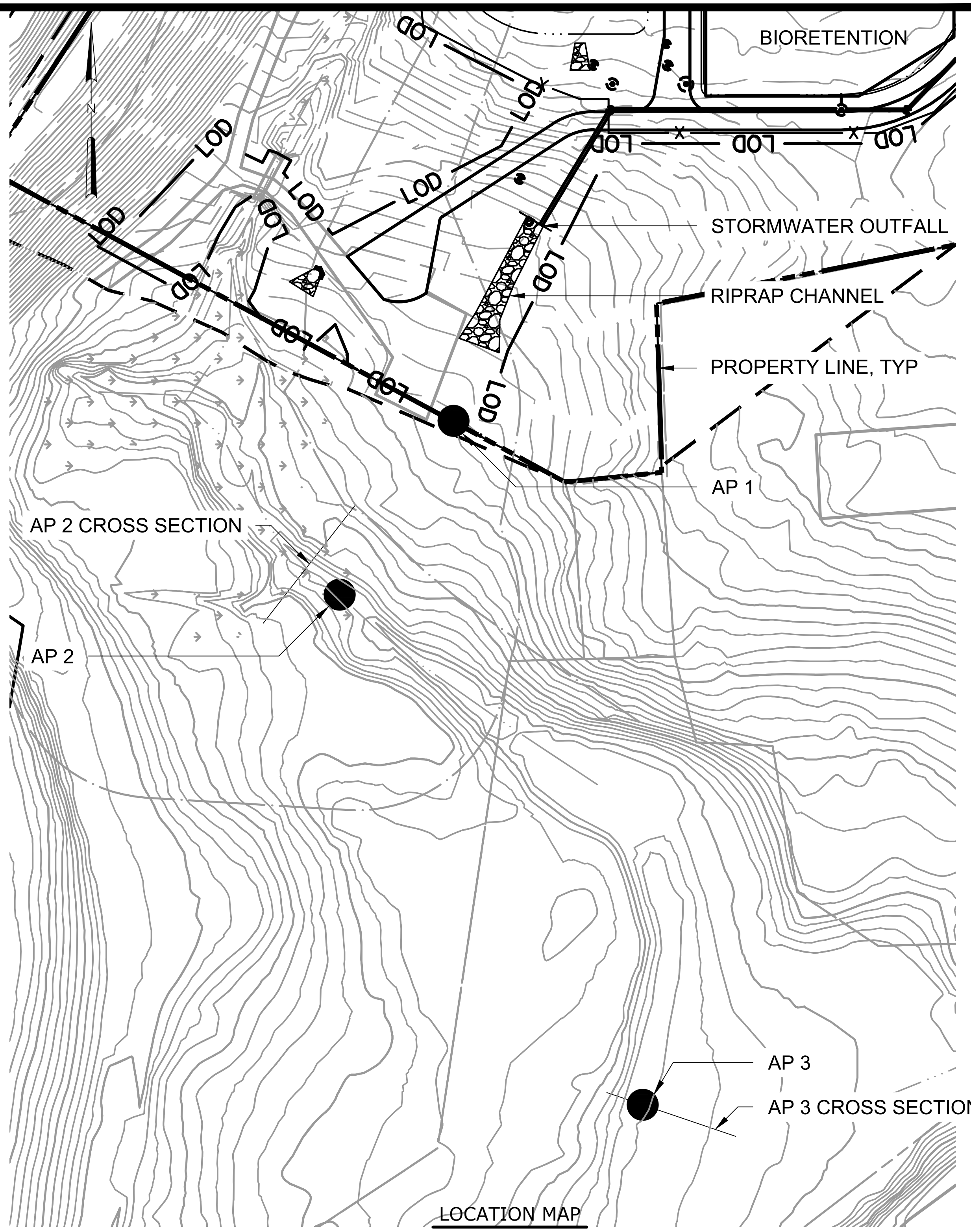
PLAN AP 2

SCALE: 1" = 10'

NOTE: CONTOURS SHOWN ARE FROM GIS, NOT SURVEY

SCALE: 1" = 10'

10 5 0 10'



LOCATION MAP

SCALE: 1" = 100'

LEGEND

(red line)	PRE-DEVELOPMENT FLOW DEPTH
(blue line)	POST-DEVELOPMENT FLOW DEPTH

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

RYE LAKE WFP

STREAM CROSS SECTION
AP 2

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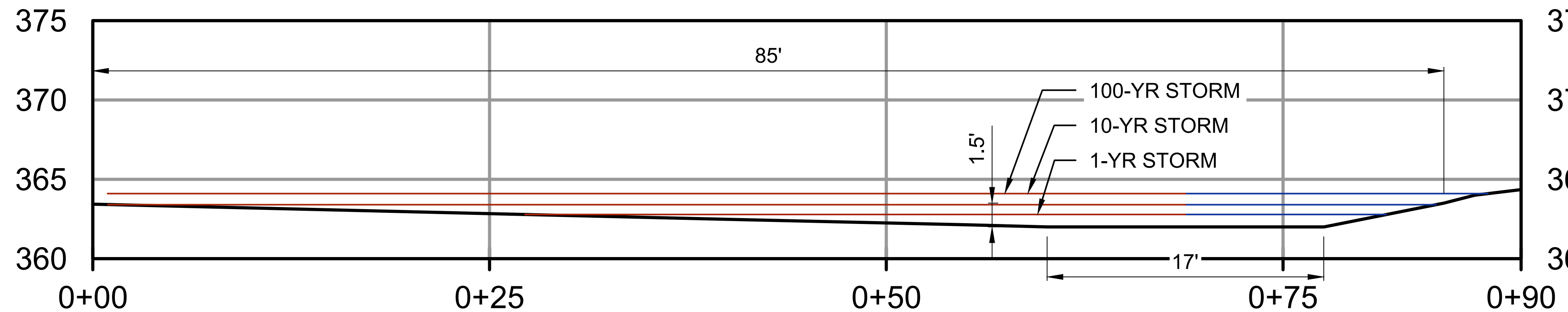
LEGEND

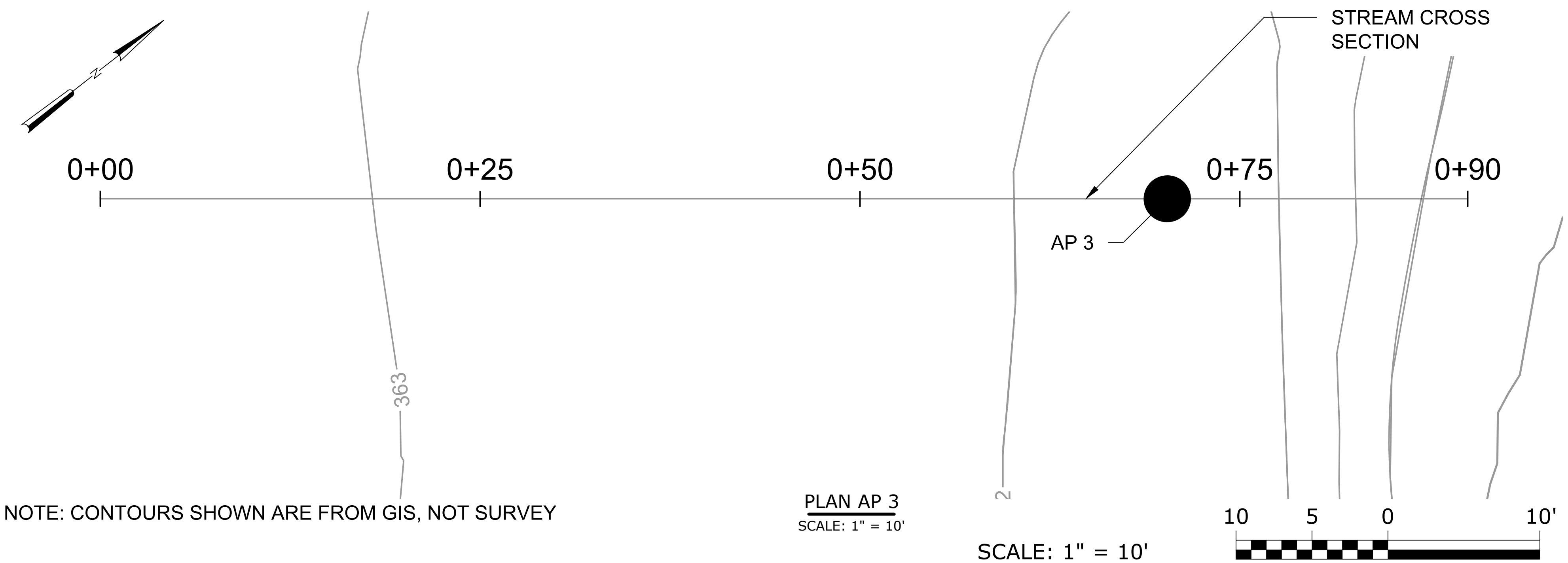
PRE-DEVELOPMENT FLOW DEPTH

POST-DEVELOPMENT FLOW DEPTH



PROFILE AP 3

HORIZONTAL SCALE: 1" = 10'
VERTICAL SCALE: 1"= 10'

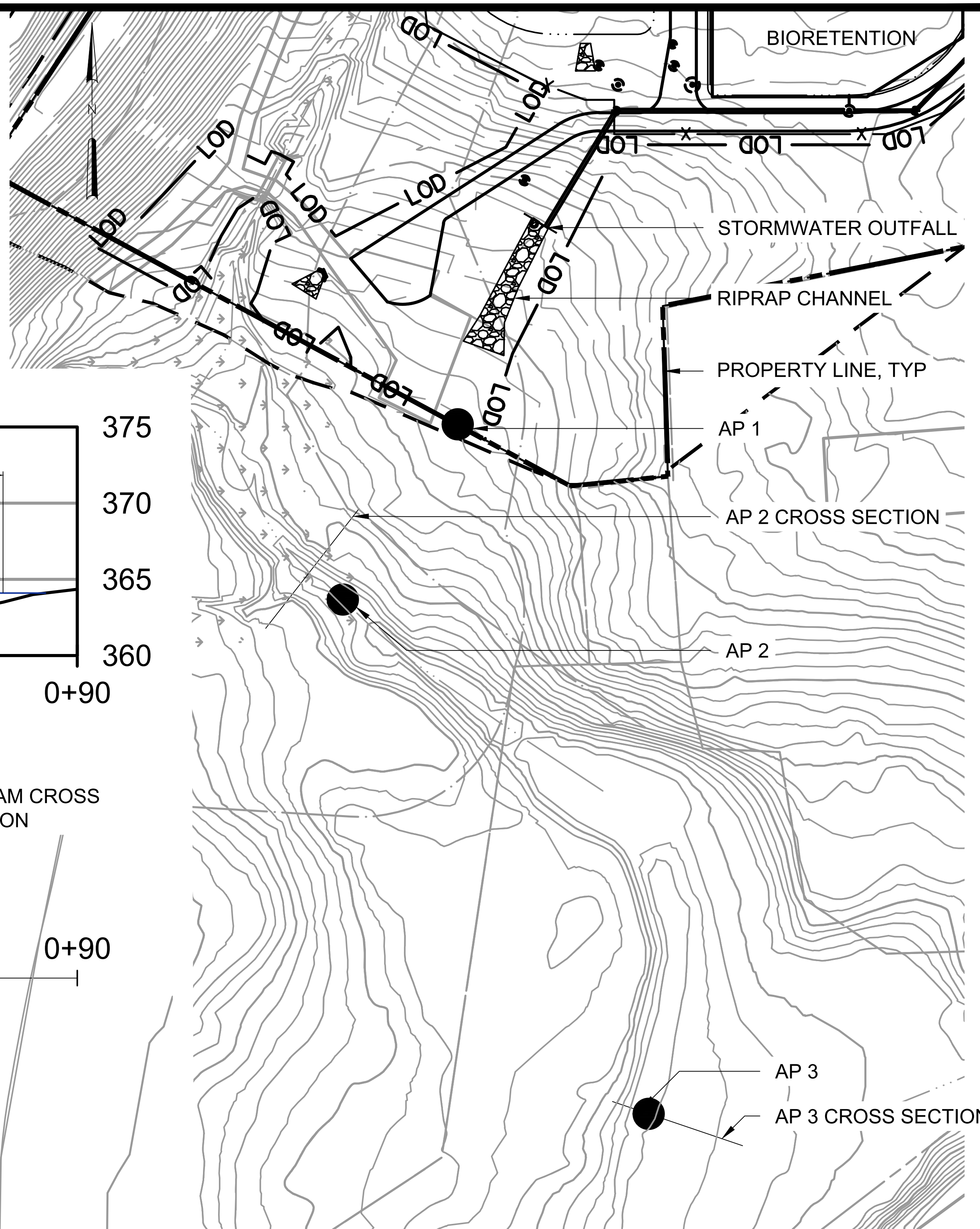


NOTE: CONTOURS SHOWN ARE FROM GIS, NOT SURVEY

PLAN AP 3

SCALE: 1" = 10'

SCALE: 1" = 10'



LOCATION MAP

SCALE: 1" = 100'

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

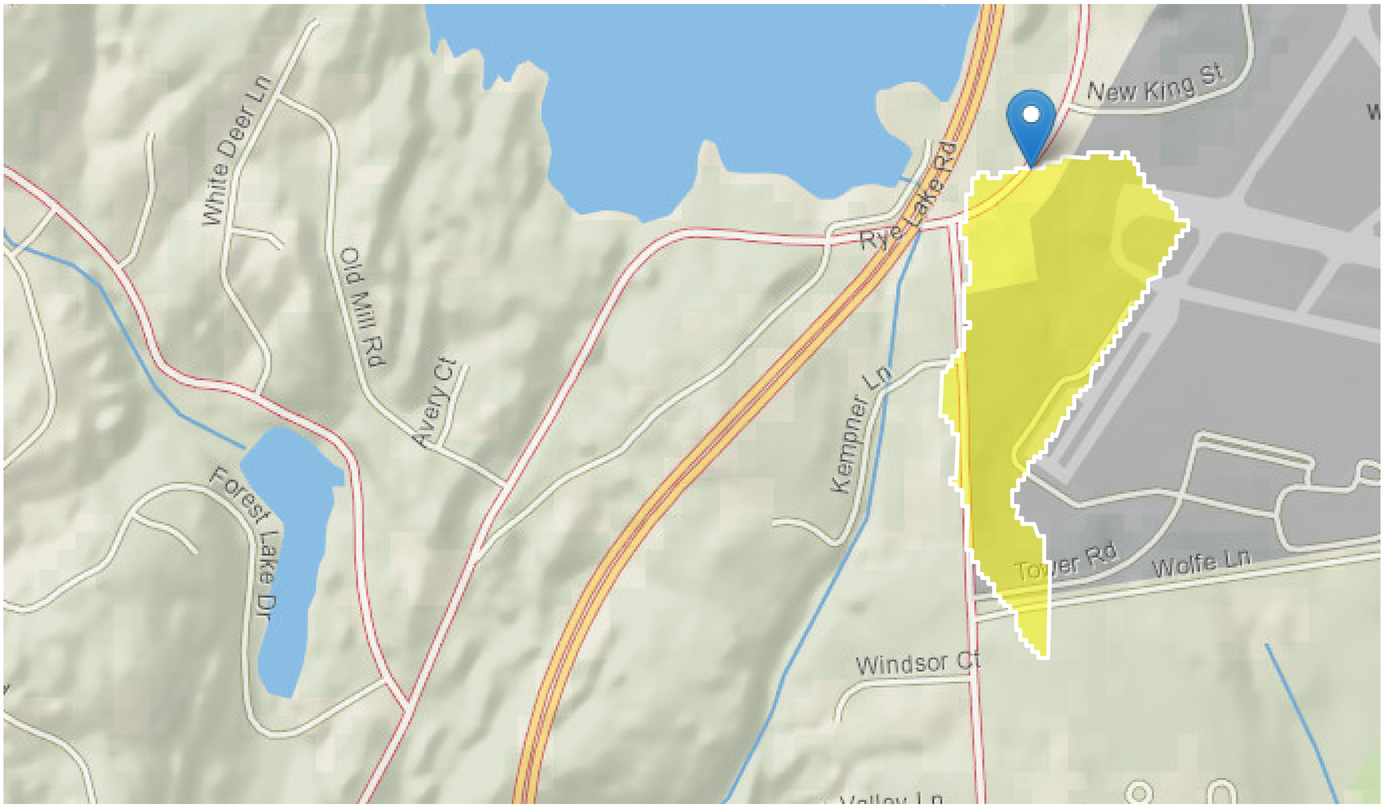
RYE LAKE WFP

STREAM CROSS SECTION
AP 3

File = C:\bms\hazen-pw\d0200915\Stream Cross Sections Saved by CMcNicol Save date = 7/13/2022 10:33 AM

StreamStats Report

Region ID: NY
Workspace ID: NY20220628172451384000
Clicked Point (Latitude, Longitude): 41.06741, -73.71768
Time: 2022-06-28 13:25:10 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.0736	square miles
LAGFACTOR	Lag Factor as defined in SIR 2006-5112	0.00378	dimensionless
MAR	Mean annual runoff for the period of record in inches	23.8	inches
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [2006 Full Region 2]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0736	square miles	1.93	996
LAGFACTOR	Lag Factor	0.00378	dimensionless	0.014	6.997
STORAGE	Percent Storage	0	percent	0	11.88
MAR	Mean Annual Runoff in inches	23.8	inches	16.03	33.95

Peak-Flow Statistics Disclaimers [2006 Full Region 2]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [2006 Full Region 2]

Statistic	Value	Unit
80-percent AEP flood	3.88	ft^3/s
66.7-percent AEP flood	5.05	ft^3/s
50-percent AEP flood	6.81	ft^3/s
20-percent AEP flood	12.5	ft^3/s
10-percent AEP flood	17.3	ft^3/s
4-percent AEP flood	24.4	ft^3/s
2-percent AEP flood	30.7	ft^3/s
1-percent AEP flood	37.7	ft^3/s
0.5-percent AEP flood	45.5	ft^3/s
0.2-percent AEP flood	57.5	ft^3/s

Peak-Flow Statistics Citations

Lumia, Richard, Freehafer, D.A., and Smith, M.J.,2006, Magnitude and Frequency of Floods in New York: U.S. Geological Survey Scientific Investigations Report 2006–5112, 152 p. (http://pubs.usgs.gov/sir/2006/5112/)

Bankfull Statistics

Bankfull Statistics Parameters [Bankfull Region 3 SIR2009 5144]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0736	square miles	0.42	329

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0736	square miles	0.07722	940.1535

Bankfull Statistics Parameters [New England P Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0736	square miles	3.799224	138.999861

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0736	square miles	0.07722	59927.7393

Bankfull Statistics Disclaimers [Bankfull Region 3 SIR2009 5144]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [Bankfull Region 3 SIR2009 5144]

Statistic	Value	Unit
Bankfull Area	10.7	ft^2
Bankfull Depth	0.96	ft
Bankfull Streamflow	14.3	ft^3/s
Bankfull Width	11.2	ft

Bankfull Statistics Disclaimers [Appalachian Highlands D Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [Appalachian Highlands D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	5.15	ft
Bieger_D_channel_depth	0.53	ft
Bieger_D_channel_cross_sectional_area	2.75	ft^2

Bankfull Statistics Disclaimers [New England P Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [New England P Bieger 2015]

Statistic	Value	Unit
Bieger_P_channel_width	12.2	ft
Bieger_P_channel_depth	0.775	ft
Bieger_P_channel_cross_sectional_area	9.15	ft^2

Bankfull Statistics Disclaimers [USA Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	4.94	ft
Bieger_USA_channel_depth	0.692	ft
Bieger_USA_channel_cross_sectional_area	4.18	ft^2

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bankfull Area	10.7	ft^2

Statistic	Value	Unit
Bankfull Depth	0.96	ft
Bankfull Streamflow	14.3	ft^3/s
Bankfull Width	11.2	ft
Bieger_D_channel_width	5.15	ft
Bieger_D_channel_depth	0.53	ft
Bieger_D_channel_cross_sectional_area	2.75	ft^2
Bieger_P_channel_width	12.2	ft
Bieger_P_channel_depth	0.775	ft
Bieger_P_channel_cross_sectional_area	9.15	ft^2
Bieger_USA_channel_width	4.94	ft
Bieger_USA_channel_depth	0.692	ft
Bieger_USA_channel_cross_sectional_area	4.18	ft^2

Bankfull Statistics Citations

Mulvihill, C.I., Baldigo, B.P., Miller, S.J. , and DeKoskie, Douglas,2009, Bankfull Discharge and Channel Characteristics of Streams in New York State: U.S. Geological Survey Scientific Investigations Report 2009-5144, 51 p. (http://pubs.usgs.gov/sir/2009/5144/)

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_

Application Version: 4.10.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

Erosion and Sediment Control Calculations

Project:	Rye Lake Filtration Facility		
Location:	West Harrison, NY		
Project No.:	90388-000		
Subject:	Sediment Basin 1 Design		
Performed by:	JAP	Date:	6/30/2022
Checked by:	DJS	Date:	7/19/2022

Objective: Size a sediment basin in accordance with the NYS Standards and Specifications for Erosion and Sediment

Basin Number: 1

Total DA draining to basin (≤50 AC): 1.36 acres = 59,332 sf

Drainage Area Data

Outside DA LOD:	0.30	acres	CN =	77	C -Coeff =	0.54
Inside DA LOD:	1.06	acres	CN =	91	C- Coeff =	0.82
					Weighted C:	0.76

Basin Size Design

Step 1

Number of Disturbed Area witihin DA:	1.06	Acres
Sediment Storage Zone Volume = (1,000 CF * Number of Dist Arces) =	1,059	CF
Bottom of Basin Elevation:	394.00	ft
Sediment Storage Elevation:	394.39	ft
Design Top of Zone Elevation:	395.00	ft
Check - Sediment Storage Zone Depth (One Foot Minimum):	1.00	ft

Step 2

Number of Drainage Area Acres:	1.36	Acres
Dewatering Zone Volume = 3,600 cf x number of drainage area acres =	4,903	CF
Dewatering Zone Elevation:	395.44	ft
Design Top of Zone Elevation:	398.00	ft
Check - Dewatering Zone Depth (Three Foot Minimum):	3.00	ft

Step 3

Length =	140	ft	Width =	42.17	ft

Baffles Provided: Yes

Length to Width Ratio (Minimum of Two):	3.32	

Sediment Basin Stage / Storage

Stage	Elev	Area (sf)	Vol (cf)	(cf)
0.00	394.0	3,328.1	-	-
1.00	395.0	3,941.7	3,635	3,635
2.00	396.0	4,594.6	4,268	7,903
3.00	397.0	5,286.7	4,941	12,844
4.00	398.0	6,018.2	5,652	18,496
5.00	399.0	6,788.9	6,404	24,900
5.35	399.4	6,987.7	2,411	27,311

Step 4

A. Cleanout at 50% of the Storage Zone Volume Elevation:	394.5	ft
B. Distance below top of riser:	3.5	ft

Step 5

Larger of Minimum Surface Area

(0.01)$Q_{(10)}$ =	0.07	Acres
0.015(DA) =	0.02	Acres
Min Surface Area Req'd =	0.07	Acres
Min Surface Area Prov'd =	**0.14**	**Acres**

<u>Design of Spillways and Elevations - Runoff</u>

Step 6 - Rational Method

10-Year Rainfall Intensity, I:	6.36	in/hr
10-Year Design Flow, $Q_{P(10)}$	6.56	cfs

Design of Spillways and Elevations - Pipe Spillway (Q_{ps})

Step 7

Minimum pipe spillway capacity

Q_{ps} = 0.2 * DA	0.27	cfs
Note: if there is no emergancy spillway, then required $Q_{ps}=Q_{p(10)}$	6.56	cfs

Step 8

H, head (interval between centerline of outlet pipe and design high water)	9.65	ft
Barrel Length	60	ft

Step 9

Barrel Diameter	15	inches	
Q	11	cfs	Figure 5.12
Cor fac	1.06		Figure 5.12
Q_{ps} = (Q) x (cor fac)	11.66	cfs	

Check:

	INV IN	INV OUT	Length (ft)	Slope (ft/ft)	A (sf)	P (ft)	R (ft)	Capacity Q_{full}(cfs)	V (fps)
Basin 1 Outlet	390.12	387.72	60.00	0.040	1.23	3.93	0.31	6.74	5.49

Q_{full} = 6.74 cfs therefore: Outlet Capacity Greater than Qps

Step 10

Riser Diameter	72	inches	(see Figure 5.10)
Length	7.88	ft	(Riser Crest - Outlet Invert)
h	0.35	ft	(during $Q_{p(10)}$)
Crest Elevation	398.00		

Freeboard Check:

Crest Elevation + h: 398.35

Top of Embankment: 399.35

Available Freeboard (one foot min): 1.00 feet

Check:

Weir Flow, Qw = 9.739 x Dr x H^3/2

Qw = 12.10 cfs therefore: Capacity Greater than Qps

Step 11

Trash Rack Diameter	102	inches	(see Figure 5.14)
H, height	36	inches	

Design of Spillways and Elevations - Emergancy Spillway Design

Step 12/13 - Emergency spill design not required since $Q_{ps} = Q_{p(10)}$. The Emergency spillway is not provided since the outlet pipe from the sediment basin to mitigate the potential for the sediment basins being influenced by the shallow seasonal high groundwater of the site.

Anti-Seep Collar / Seepage Diaphram Design
Step 14

y =	7.88	ft
Z =	2.5	: 1
Pipe Slope =	0.040	ft/ft
L_s =	60.98	ft
Collars Used	4	Collars
Size	3.33 x 3.33	square
Projection	1.10	ft

# of Collars	Collar Size (ft x ft)	Collar Projection (ft)
1	10.5 x 10.5	4.60
2	5.75 x 5.75	2.20
3	4.25 x 4.25	1.50
4	3.33 x 3.33	1.10

(See Figure 5.17)

Diaphragms not used.

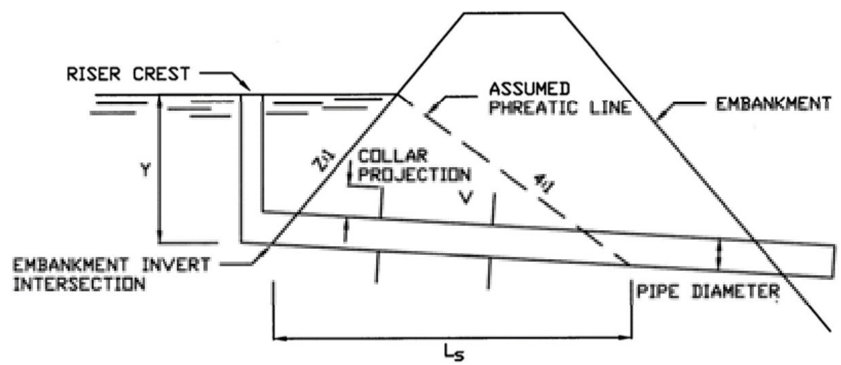
$$L_s = y\,(z + 4)\left[1 + \frac{\text{pipe slope}}{0.25 - \text{pipe slope}}\right]$$

Where: L_s = length of pipe in the saturated zone (ft.)

y = distance in feet from upstream invert of pipe to highest normal water level expected to occur during the life of the structure, usually the top of the riser.

z = slope of upstream embankment as a ratio of z ft. horizontal to one ft. vertical.

pipe slope = slope of pipe in feet per foot.



Dewatering Orifice Sizing

Step 15

Dewatering Orifice Diameter:	3	inches
Skimmer	3	inches
Riser	N/A	

Step 16

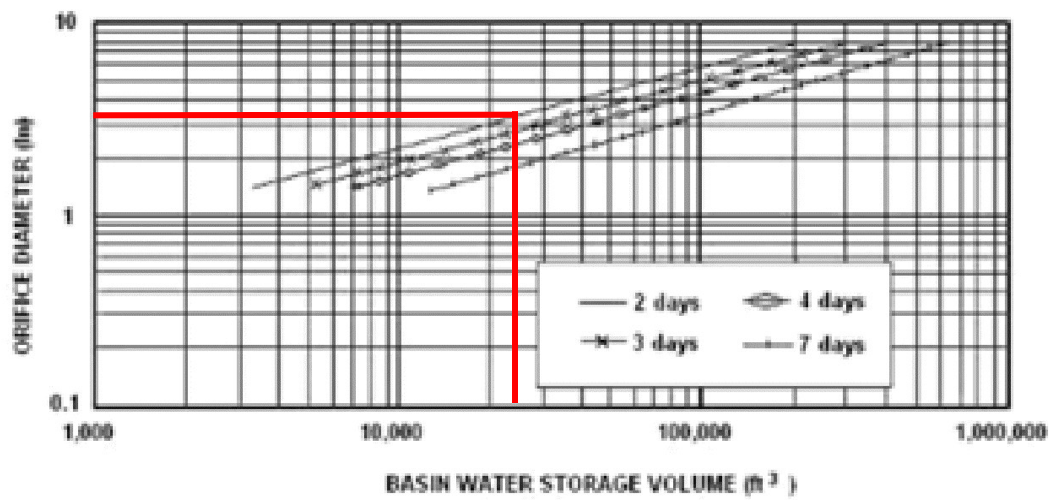
Dewatering Time	2	days

Basin No	Water Surface Elevation	Arm Length (ft)*	Arm Dia (in)	Orifice Size**	Top of Landing Device Elevation	Flexible Hose Length (in)	Flexible Hose Attachement Elevation (ft)
1	398.35	12.00	3	3	395.00	72	394.00

* Minimum Arm length = Full design storage depth x 1.414 (for 45 deg angle)

** Must be equal to or less than arm diameter

Figure 5.3 - Skimmer Orifice Design Chart



* Figure adapted from Penn State Agricultural and Biological Fact Sheet F-253

Figure 5.11
Pipe Flow Chart; "n" = 0.025 (USDA - NRCS)

PIPE FLOW CHART n = 0.025
FOR CORRUGATED METAL PIPE INLET $K_m = K_e + K_b = 1.0$ AND 70 FEET OF CORRUGATED METAL PIPE CONDUIT (full flow assumed)
Note correction factors for pipe lengths other than 70 feet
diameter of pipe in inches

H, in feet	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
1	0.33	0.70	1.25	1.90	3.46	5.47	7.99	11.0	18.8	28.8	41.1	55.7	72.6	91.8	113	137	163	191	222	255	290
2	0.47	0.99	1.76	2.00	4.92	7.74	11.3	15.6	26.6	40.8	58.2	78.8	103	130	160	194	231	271	314	360	410
3	0.58	1.22	2.16	3.43	6.02	9.48	13.8	19.1	32.6	49.9	71.2	96.5	126	159	196	237	282	331	384	441	502
4	0.67	1.40	2.49	3.97	6.96	10.9	16.0	22.1	37.6	57.7	82.3	111	145	184	226	274	326	383	444	510	580
5	0.74	1.57	2.79	4.41	7.78	12.2	17.9	24.7	42.1	64.5	92.0	125	162	205	253	306	365	428	496	570	648
6	0.82	1.72	3.05	4.86	8.52	13.4	19.6	27.0	46.1	70.6	101	136	178	225	277	336	399	469	544	624	710
7	0.88	1.86	3.30	5.25	9.20	14.5	21.1	29.2	49.8	76.3	109	147	192	243	300	362	431	506	587	674	767
8	0.94	1.99	3.53	5.61	9.84	15.5	22.6	31.2	53.2	81.5	116	158	205	260	320	388	461	541	628	721	820
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.4	24.0	33.1	56.4	86.5	123	167	218	275	340	411	489	574	666	764	870
10	1.05	2.22	3.94	6.27	11.0	17.3	25.3	34.9	59.5	91.2	130	176	230	290	358	433	516	605	702	806	917
11	1.10	2.33	4.13	6.58	11.5	18.2	26.5	36.6	62.4	95.6	136	185	241	304	376	454	541	635	736	845	962
12	1.15	2.43	4.32	6.87	12.1	19.0	27.7	38.2	65.2	99.9	142	193	252	318	392	475	565	663	769	883	1004
13	1.20	2.53	4.49	7.15	12.6	19.7	28.8	39.8	67.8	104	148	201	262	331	408	494	588	690	800	919	1045
14	1.25	2.63	4.66	7.42	13.0	20.5	29.9	41.3	70.4	108	154	208	272	343	424	513	610	716	830	953	1085
15	1.29	2.72	4.83	7.68	13.5	21.2	30.9	42.8	72.8	112	159	216	281	355	439	531	631	741	860	987	1123
16	1.33	2.81	4.99	7.93	13.9	21.9	32.0	44.2	75.2	115	165	223	290	367	453	548	652	765	888	1019	1160
17	1.37	2.90	5.14	8.18	14.3	22.6	32.9	45.5	77.5	119	170	230	229	378	467	565	672	789	915	1051	1195
18	1.41	2.98	5.29	8.41	14.8	23.2	33.9	46.8	79.8	120	174	236	308	389	480	581	692	812	942	1081	1230
19	1.45	3.06	5.43	8.64	15.2	23.9	34.8	48.1	82.0	126	179	243	316	400	494	597	711	834	967	1111	1264
20	1.49	3.14	5.57	8.87	15.6	24.5	35.7	49.4	84.1	129	184	249	325	410	506	613	729	856	993	1139	1297
21	1.53	3.22	5.71	9.09	15.9	25.1	36.6	50.6	86.2	132	188	255	333	421	519	628	747	877	1017	1168	1329
22	1.56	3.29	5.85	9.30	16.3	25.7	37.5	51.8	88.2	135	193	261	341	430	531	643	765	898	1041	1195	1360
23	1.60	3.37	5.98	9.51	16.7	26.2	38.3	53.0	90.2	138	197	267	348	440	543	657	782	918	1064	1222	1390
24	1.63	3.44	6.11	9.72	17.0	26.8	39.1	54.1	92.1	141	201	273	356	450	555	671	799	937	1087	1248	1420
25	1.66	3.51	6.23	9.92	17.4	27.4	39.9	55.2	94.0	144	206	279	363	459	566	685	815	957	1110	1274	1450
26	1.70	3.58	6.36	10.1	17.7	27.9	40.7	56.3	95.9	147	210	284	370	468	577	699	831	976	1132	1299	1478
27	1.73	3.65	6.48	10.3	18.1	28.4	41.5	57.4	97.7	150	214	290	377	477	588	712	847	994	1153	1324	1507
28	1.76	3.72	6.60	10.5	18.4	29.0	42.3	58.4	99.5	153	218	295	384	486	599	725	863	1013	1174	1348	1534
29	1.79	3.78	6.71	10.7	18.7	29.5	43.0	59.5	101	155	221	300	391	494	610	738	878	1030	1195	1372	1561
30	1.82	3.85	6.83	10.9	19.1	30.0	43.7	60.5	103	158	225	305	398	503	620	750	893	1048	1216	1396	1588

Correction Factors For Other Pipe Lengths

L, in feet	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
20	1.69	1.63	1.58	1.53	1.47	1.42	1.37	1.34	1.28	1.24	1.20	1.18	1.16	1.14	1.13	1.11	1.10	1.10	1.09	1.08	1.08
30	1.44	1.41	1.39	1.36	1.32	1.29	1,27	1.24	1.21	1.18	1.15	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.07	1.06	1.06
40	1.26	1.27	1.25	1.23	1.21	1.20	1.18	1.17	1.14	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.05	1.04
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.03	1.03	1.03
60	1.07	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.94	.94	.95	.95	.95	.95	.96	.96	.96	.97	.97	.97	.98	.98	.98	.98	.98	.98	.99	.99	.99
90	.89	.89	.90	.90	.91	.91	.92	.92	.93	.94	.94	.95	.95	.96	.96	.96	.97	.97	.97	.97	.94
100	.85	.85	.86	.86	.87	.88	.89	.89	.90	.91	.92	.93	.93	.94	.94	.95	.95	.95	.96	.96	.94
120	.78	.79	.79	.80	.81	.82	.83	.83	.85	.86	.87	.89	.89	.90	.91	.89	.92	.93	.93	.94	.92
140	.72	.73	.74	.75	.76	.77	.78	.79	.81	.82	.84	.85	.86	.87	.88	.86	.89	.90	.91	.91	.90
160	.68	.69	.69	.70	.71	.73	.74	.75	.77	.79	.80	.82	.83	.84	.85	.92	.87	.88	.89	.89	

Figure 5.10
Riser Inflow Chart (USDA - NRCS)

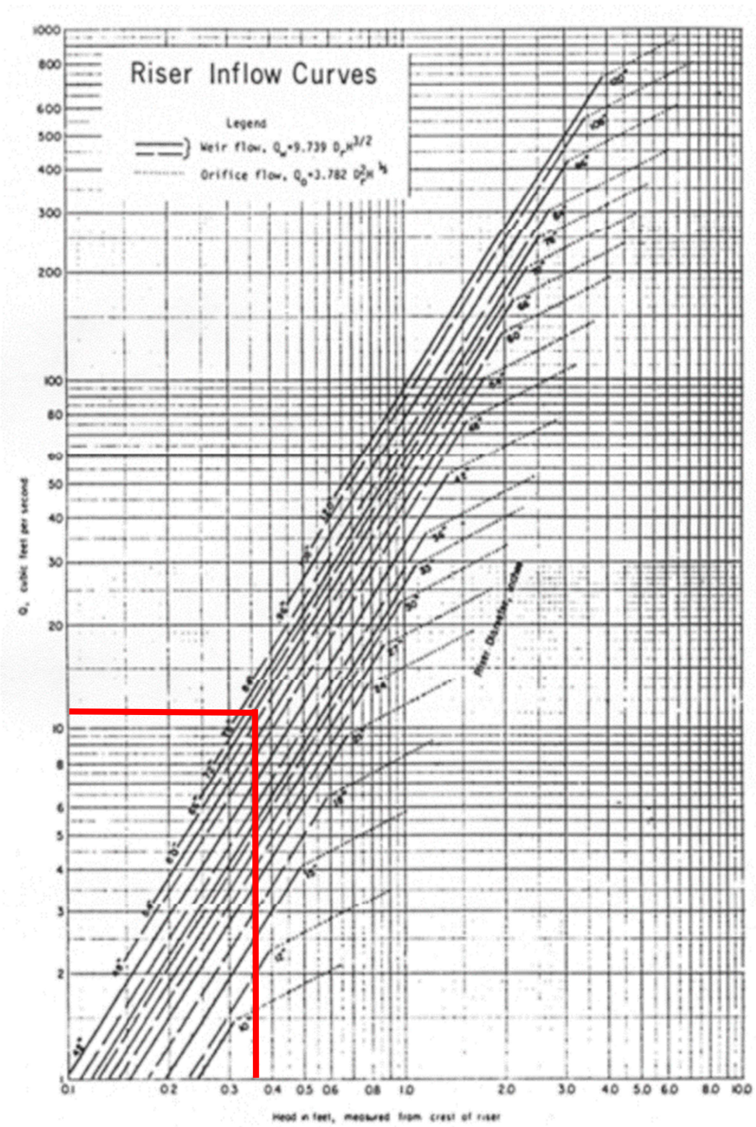
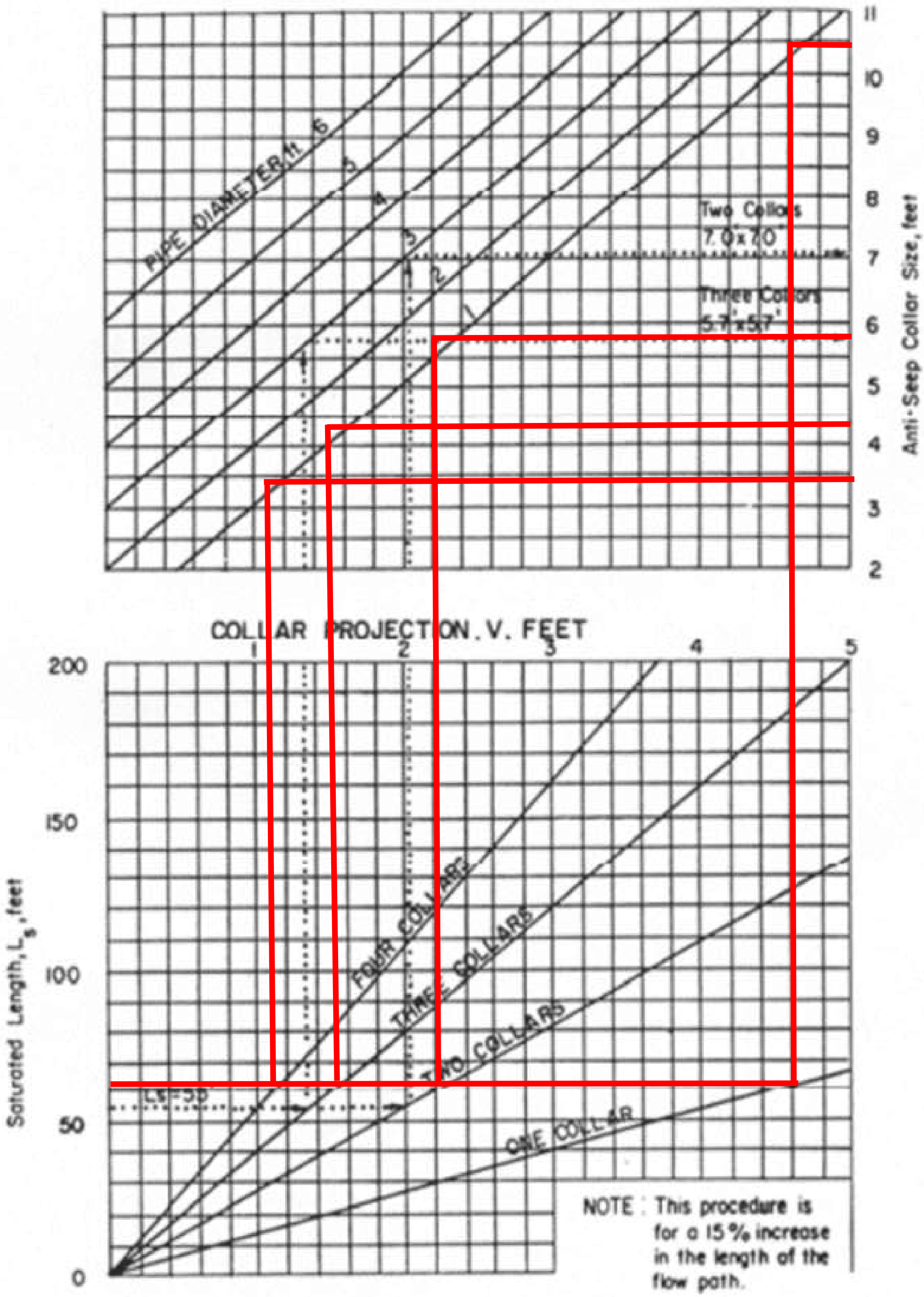


Figure 5.14
Concentric Trash Rack and Anti-Vortex Device Design Table
(USDA - NRCS)

Riser Diam.(in)	Cylinder Diam.(in.)	Thick. Gage	H (in.)	Minimum Size Support Bar	Minimun Top Thickness	Minimun Top Stiffener
12	18	16	6	#6 Rebar	16 ga.	—
15	21	16	7	#6 Rebar	16 ga.	—
18	27	16	8	#6 Rebar	16 ga.	—
21	30	16	11	#6 Rebar	16 ga.	—
24	36	16	13	#6 Rebar	14 ga.	—
27	42	16	15	#6 Rebar	14 ga.	—
36	54	14	17	#8 Rebar	12 ga.	—
42	60	14	19	#8 Rebar	12 ga.	—
48	72	12	21	1 1/4" pipe or 1 1/4x1 1/4x1/4 angle	10 ga.	—
54	78	12	25	See 48" Riser	10 ga.	—
60	90	12	29	1 1/2" pipe or 1 1/2x1 1/2x1/2 angle	8 ga.	—
66	96	10	33	2" pipe or 2x2x3/16 angle	8 ga. w/stiffener	2x2x1/4 angle
72	102	10	36	———See 66" Riser———		2 1/2x2 1/2x1/4 angle
78	114	10	39	2 1/2" pipe or 2x2x1/4 angle	See 72" Riser	See 72" Riser
84	120	10	42	2 1/2" pipe or 2 1/2x2 1/2x1/4 angle	See 72" Riser	2 1/2x 2 1/2x 5/16 angle

Note: The criteria for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.

Figure 5.17
Anti-Seep Collar Design Charts (USDA - NRCS)



Project:	Rye Lake Filtration Facility
Location:	West Harrison, NY
Project No.:	90388-000
Subject:	Sediment Basin 2 Design
Performed by:	JAP Date: 6/30/2022
Checked by:	DJS Date: 7/19/2022

Objective: Size a sediment basin in accordance with the NYS Standards and Specifications for Erosion and Sediment

Basin Number: 2

Total DA draining to basin (≤50 AC): 4.31 acres = 187,858.9 sf

Drainage Area Data

Outside DA LOD: 1.24 acres CN = 77 C -Coeff = 0.54

Inside DA LOD: 3.08 acres CN = 91 C- Coeff = 0.82

Weighted C: 0.74

Basin Size Design

Step 1

Number of Disturbed Area witihin DA:	3.08	Acres
Sediment Storage Zone Volume = (1,000 CF * Number of Dist Arces) =	3,076	CF
Bottom of Basin Elevation:	393.00	ft
Sediment Storage Elevation:	393.43	ft
Design Top of Zone Elevation:	394.00	ft
Check - Sediment Storage Zone Depth (One Foot Minimum):	1.00	ft

Step 2

Number of Drainage Area Acres:	4.31	Acres
Dewatering Zone Volume = 3,600 cf x number of drainage area acres =	15,526	CF
Dewatering Zone Elevation:	394.82	ft
Design Top of Zone Elevation:	397.00	ft
Check - Dewatering Zone Depth (Three Foot Minimum):	3.00	ft

Step 3

Length =	165.1	ft	Width =	82	ft

Length to Width Ratio (Minimum of Two):	2.01	

Sediment Basin Stage / Storage

Stage	Elev	Area (sf)	Vol (cf)	(cf)
0.0	393.0	8,714.9	-	-
1.0	394.0	9,655.8	9,185	9,185
2.0	395.0	10,636.0	10,146	19,331
3.0	396.0	11,655.4	11,146	30,477
4.0	397.0	12,714.1	12,185	42,662
5.0	398.0	13,812.0	13,263	55,925
6.0	399.0	14,949.3	14,381	70,305

Step 4

A. Cleanout at 50% of the Storage Zone Volume Elevation:	393.5	ft
B. Distance below top of riser:	3.50	ft

Step 5

Larger of Minimum Surface Area

$(0.01)Q_{(10)}$ =	0.20	Acres
0.015(DA) =	0.06	Acres
Min Surface Area Req'd =	0.20	Acres
Min Surface Area Prov'd =	**0.31**	**Acres**

Design of Spillways and Elevations - Runoff

Step 6 - Rational Method

10-Year Rainfall Intensity, I:	6.36	in/hr
10-Year Design Flow, $Q_{P(10)}$	20.29	cfs

Design of Spillways and Elevations - Pipe Spillway (Q_{ps})

Step 7

Minimum pipe spillway capacity

Q_{ps} = 0.2 * DA	0.86	cfs
Note: if there is no emergancy spillway, then required $Q_{ps}=Q_{p(10)}$	20.29	cfs

Step 8

H, head (interval between centerline of outlet pipe and design high water)	7.97	ft
Barrel Length	25	ft

Step 9

Barrel Diameter	24	inches	(see Figure 5.12)
Q	31.3	cfs	
Cor fac	1.24		
Q_{ps} = (Q) x (cor fac)	38.81	cfs	

Check:

	INV IN	INV OUT	Length (ft)	Slope (ft/ft)	A (sf)	P (ft)	R (ft)	Capacity Q_{full}(cfs)	V (fps)
Basin 2 Outlet	388.45	388.03	21.00	0.020	3.14	6.28	0.50	32.08	10.21

Q_{full} = 32.08 therefore: Outlet Capacity Greater than Qps

Step 10

Riser Diameter	48	inches	(see Figure 5.10)
Length	8.55	ft	(Riser Crest - Bottom of Basin)
h	1	ft	(during $Q_{p(10)}$)
Crest Elevation	397.00	ft	

Freeboard Check:

Crest Elevation + h:	398.00	
Top of Embankment:	399.00	
Available Freeboard (one foot min):	1.00	feet

Check:

Weir Flow, Qw = 9.739 x Dr x H^3/2

Qw = 38.96 cfs therefore: Capacity Greater than Qp(10)

Step 11

Trash Rack Diameter	72	inches	(see Figure 5.14)
H, height	21	inches	

Design of Spillways and Elevations - Emergancy Spillway Design

Step 12/13 - Emergency spill design not required since $Q_{ps} = Q_{p(10)}$. The Emergency spillway is not provided since the outlet pipe from the sediment basin to mitigate the potential for the sediment basins being influenced by the shallow seasonal high groundwater of the site.

Anti-Seep Collar / Seepage Diaphram Design

Step 14

y =	8.55	ft
Z =	2.5	: 1
Pipe Slope =	0.020	ft/ft
L_s =	60.41	ft
Collars Used	4	Collars
Size	3.33 x 3.33	square
Projection	1.10	ft

$$L_s = y\,(z + 4)\left[1 + \frac{\text{pipe slope}}{0.25-\text{pipe slope}}\right]$$

Where: L_s = length of pipe in the saturated zone (ft.)

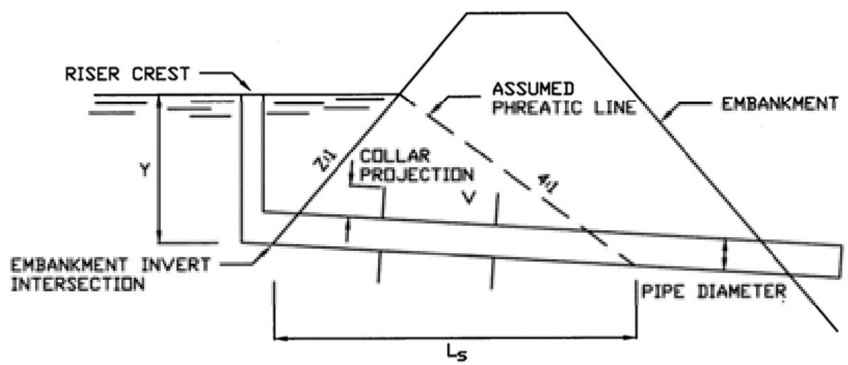
y = distance in feet from upstream invert of pipe to highest normal water level expected to occur during the life of the structure, usually the top of the riser.

z = slope of upstream embankment as a ratio of z ft. horizontal to one ft. vertical.

pipe slope = slope of pipe in feet per foot.

# of Collars	Collar Size (ft x ft)	Collar Projection (ft)
1	10.5 x 10.5	4.60
2	5.75 x 5.75	2.20
3	4.25 x 4.25	1.50
4	3.33 x 3.33	1.10

(See Figure 5.17)



Diaphragms not used.

Dewatering Orifice Sizing

Step 15

Dewatering Orifice Diameter:	3	inches
Skimmer	3	inches
Riser	N/A	

Step 16

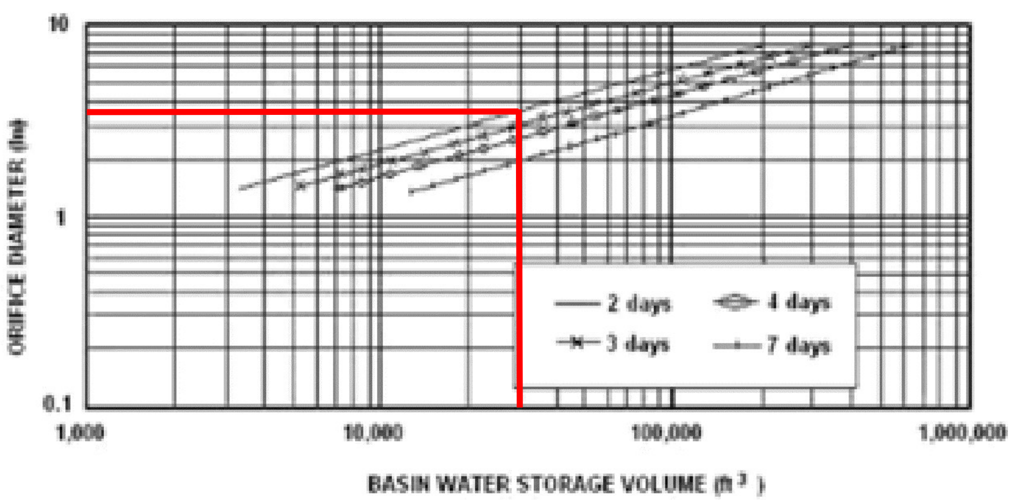
Dewatering Time	2	days

Basin No	Water Surface Elevation	Arm Length (ft)*	Arm Dia (in)	Orifice Size**	Top of Landing Device Elevation	Flexible Hose Length (in)	Flexible Hose Attachement Elevation (ft)
2	397.00	13.00	3	3	394.00	72	393.00

* Minimum Arm length = Full design storage depth x 1.414 (for 45 deg angle)

** Must be equal to or less than arm diameter

Figure 5.3 - Skimmer Orifice Design Chart



* Figure adapted from Penn State Agricultural and Biological Fact Sheet F-253

Figure 5.11
Pipe Flow Chart; "n" = 0.025 (USDA - NRCS)

PIPE FLOW CHART n = 0.025
FOR CORRUGATED METAL PIPE INLET $K_m = K_e + K_b = 1.0$ AND 70 FEET OF CORRUGATED METAL PIPE CONDUIT (full flow assumed)
Note correction factors for pipe lengths other than 70 feet
diameter of pipe in inches

H, in feet	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
1	0.33	0.70	1.25	1.90	3.48	5.47	7.99	11.0	18.8	28.8	41.1	55.7	72.6	91.8	113	137	163	191	222	255	290
2	0.47	0.99	1.76	2.80	4.92	7.74	11.3	15.6	26.6	40.8	58.2	78.8	103	130	160	194	231	271	314	360	410
3	0.58	1.22	2.16	3.43	6.02	9.48	13.8	19.1	32.6	49.9	71.2	96.5	126	159	196	237	282	331	384	441	502
4	0.67	1.40	2.49	3.97	6.96	10.9	16.0	22.1	37.6	57.7	82.3	111	145	184	226	274	326	383	444	510	580
5	0.74	1.57	2.79	4.43	7.78	12.2	17.9	24.7	42.1	64.5	92.0	125	162	205	253	306	365	428	496	570	648
6	0.82	1.72	3.05	4.86	8.52	13.4	19.6	27.0	46.1	70.6	101	136	178	225	277	336	399	469	544	624	710
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	49.8	76.3	109	147	192	243	300	362	431	506	587	674	767
8	0.94	1.99	3.53	5.61	9.84	15.5	22.6	31.2	53.2	81.5	116	158	205	260	320	388	461	541	628	721	820
9	1.00	2.11	3.74	5.95	10.4	16.4	24.0	33.1	56.4	86.5	123	167	218	275	340	411	489	574	666	764	870
10	1.05	2.22	3.94	6.27	11.0	17.3	25.3	34.9	59.5	91.2	130	176	230	290	358	433	516	605	702	806	917
11	1.10	2.33	4.13	6.58	11.5	18.2	26.5	36.6	62.4	95.6	136	185	241	304	376	454	541	635	736	845	962
12	1.15	2.43	4.32	6.87	12.1	19.0	27.7	38.2	65.2	99.9	142	193	252	318	392	475	565	663	769	883	1004
13	1.20	2.53	4.49	7.15	12.6	19.7	28.8	39.8	67.8	104	148	201	262	331	408	494	588	690	800	919	1045
14	1.25	2.63	4.66	7.42	13.0	20.5	29.9	41.3	70.4	108	154	208	272	343	424	513	610	716	830	953	1085
15	1.29	2.72	4.83	7.68	13.5	21.2	30.9	42.8	72.8	112	159	216	281	355	439	531	631	741	860	987	1123
16	1.33	2.81	4.99	7.93	13.9	21.9	32.0	44.2	75.2	115	165	223	290	367	453	548	652	765	888	1019	1160
17	1.37	2.90	5.14	8.18	14.3	22.6	32.9	45.5	77.5	119	170	230	229	378	467	565	672	789	915	1051	1195
18	1.41	2.98	5.29	8.41	14.8	23.2	33.9	46.8	79.8	120	174	236	308	389	480	581	692	812	942	1081	1230
19	1.45	3.06	5.43	8.64	15.2	23.9	34.8	48.1	82.0	126	179	243	316	400	494	597	711	834	967	1111	1264
20	1.49	3.14	5.57	8.87	15.6	24.5	35.7	49.4	84.1	129	184	249	325	410	506	613	729	856	993	1139	1297
21	1.53	3.22	5.71	9.09	15.9	25.1	36.6	50.6	86.2	132	188	255	333	421	519	628	747	877	1017	1168	1329
22	1.56	3.29	5.85	9.30	16.3	25.7	37.5	51.8	88.2	135	193	261	341	430	531	643	765	898	1041	1195	1360
23	1.60	3.37	5.98	9.51	16.7	26.2	38.3	53.0	90.2	138	197	267	348	440	543	657	782	918	1064	1222	1390
24	1.63	3.44	6.11	9.72	17.0	26.8	39.1	54.1	92.1	141	201	273	356	450	555	671	799	937	1087	1248	1420
25	1.66	3.51	6.23	9.92	17.4	27.4	39.9	55.2	94.0	144	206	279	363	459	566	685	815	957	1110	1274	1450
26	1.70	3.58	6.36	10.1	17.7	27.9	40.7	56.3	95.9	147	210	284	370	468	577	699	831	976	1132	1299	1478
27	1.73	3.65	6.48	10.3	18.1	28.4	41.5	57.4	97.7	150	214	290	377	477	588	712	847	994	1153	1324	1507
28	1.76	3.72	6.60	10.5	18.4	29.0	42.3	58.4	99.5	153	218	295	384	486	599	725	863	1013	1174	1348	1534
29	1.79	3.78	6.71	10.7	18.7	29.5	43.0	59.5	101	155	221	300	391	494	610	738	878	1030	1195	1372	1561
30	1.82	3.85	6.83	10.9	19.1	30.0	43.7	60.5	103	158	225	305	398	503	620	750	893	1048	1216	1396	1588

Correction Factors For Other Pipe Lengths

L, in feet	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.28	1.24	1.20	1.18	1.16	1.14	1.13	1.11	1.10	1.10	1.09	1.08	1.08
[illegible]	1.44	1.41	1.39	1.36	1.32	1.29	1,27	1.24	1.21	1.18	1.15	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.07	1.06	1.06
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.14	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.05	1.04
50	1.16	1.16	1.15	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.03	1.03	1.03
60	1.07	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.94	.94	.95	.95	.95	.95	.96	.96	.96	.97	.97	.97	.98	.98	.98	.98	.98	.98	.99	.99	.99
90	.89	.89	.90	.90	.91	.91	.92	.92	.93	.94	.94	.95	.95	.96	.96	.96	.97	.97	.97	.97	.94
100	.85	.85	.86	.86	.87	.88	.89	.89	.90	.91	.92	.93	.93	.94	.94	.95	.95	.95	.96	.96	.94
120	.78	.79	.79	.80	.81	.82	.83	.83	.85	.86	.87	.89	.89	.90	.91	.89	.92	.93	.93	.94	.92
140	.72	.73	.74	.75	.76	.77	.78	.79	.81	.82	.84	.85	.86	.87	.88	.86	.89	.90	.91	.91	.90
160	.68	.69	.69	.70	.71	.73	.74	.75	.77	.79	.80	.82	.83	.84	.85	.92	.87	.88	.89	.89	

Figure 5.10
Riser Inflow Chart (USDA - NRCS)

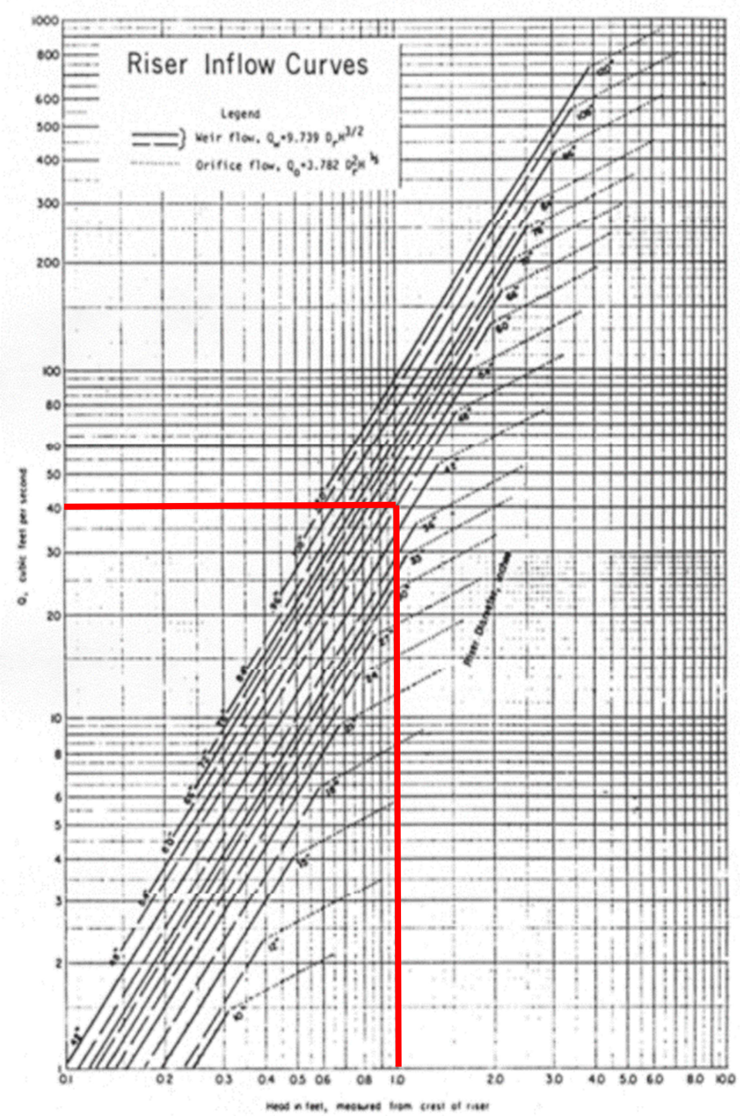
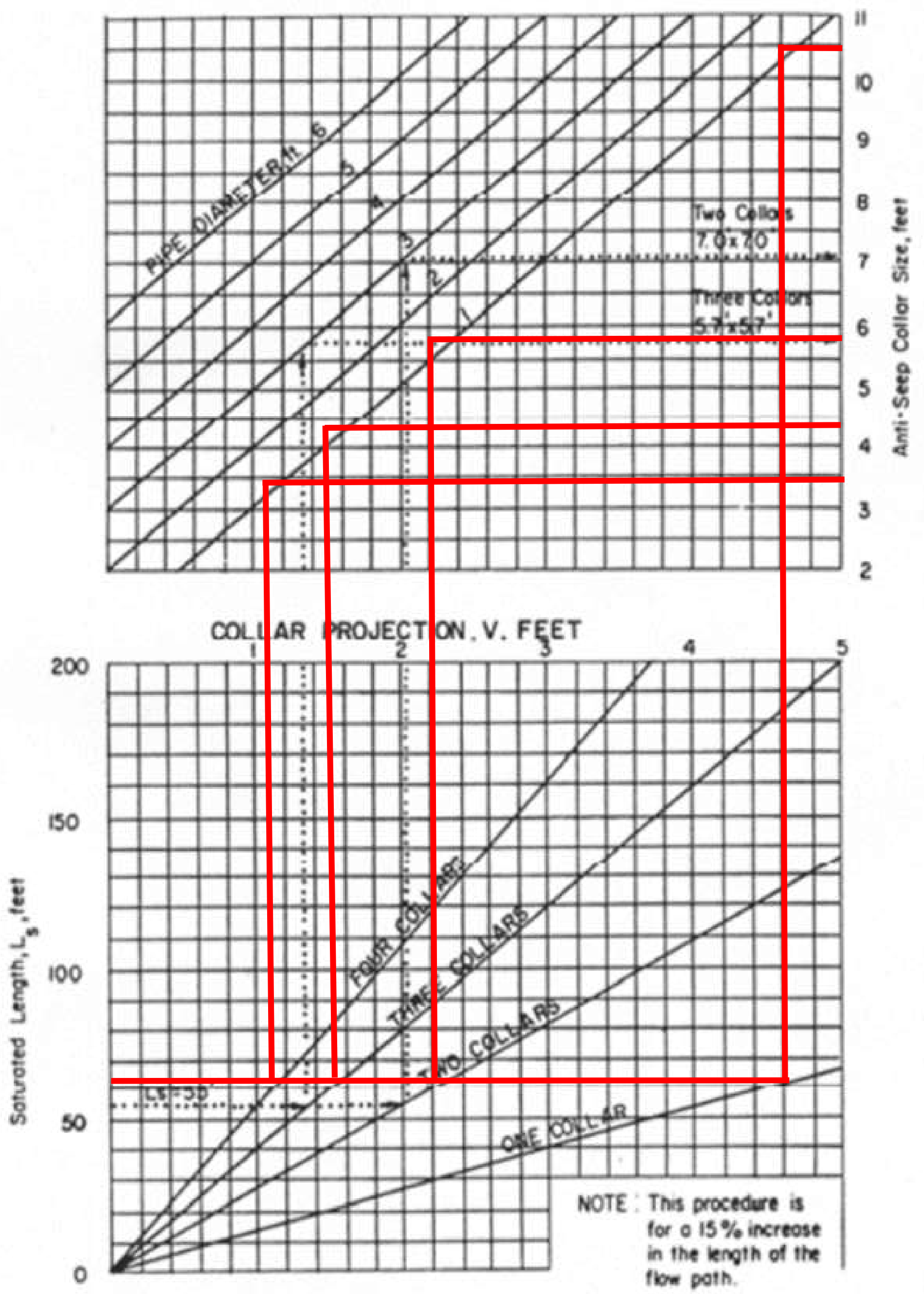


Figure 5.14
Concentric Trash Rack and Anti-Vortex Device Design Table
(USDA - NRCS)

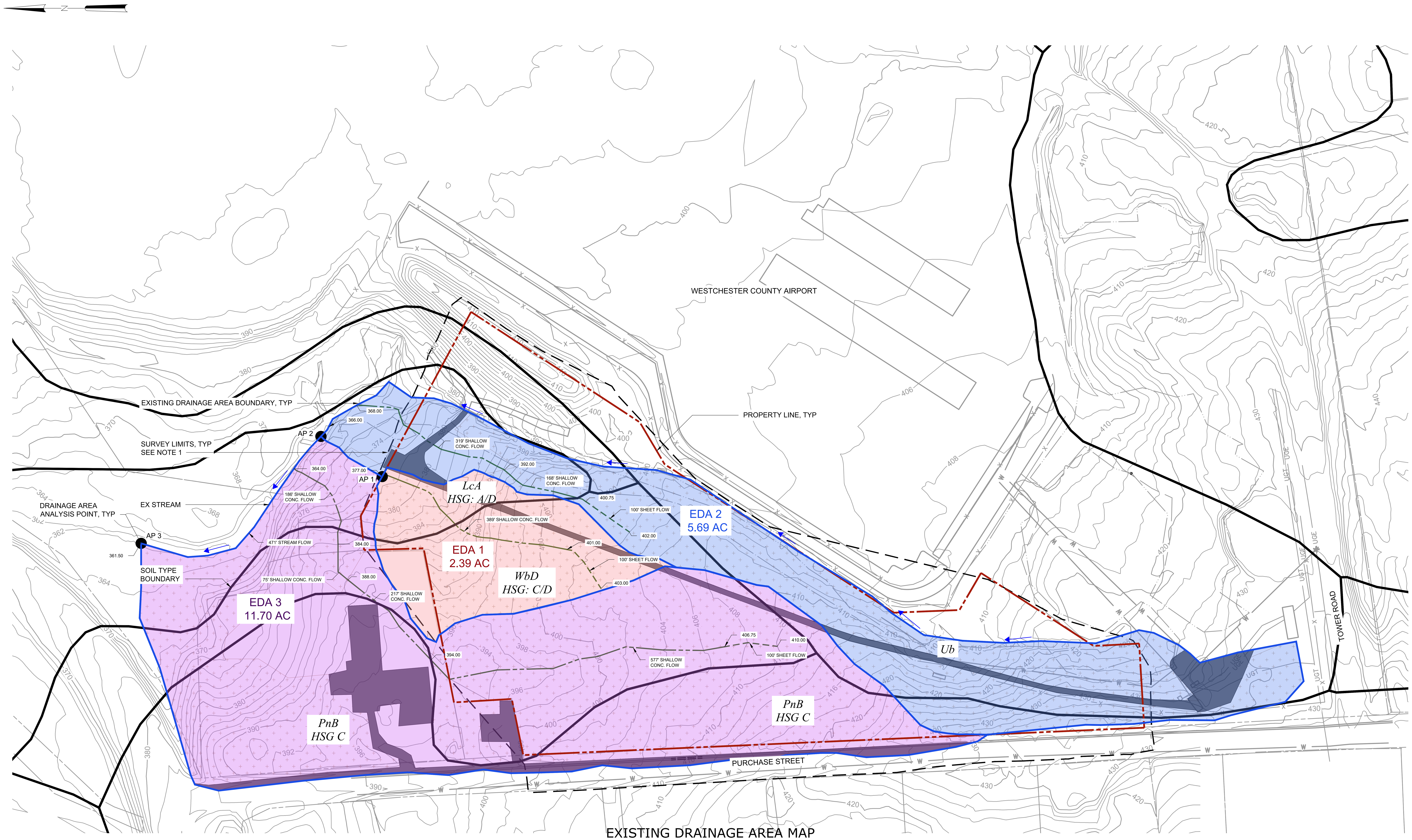
Riser Diam.(in)	Cylinder Diam.(in.)	Thick. Gage	H (in.)	Minimum Size Support Bar	Minimun Top Thickness	Minimun Top Stiffener
12	18	16	6	#6 Rebar	16 ga.	—
15	21	16	7	#6 Rebar	16 ga.	—
18	27	16	8	#6 Rebar	16 ga.	—
21	30	16	11	#6 Rebar	16 ga.	—
24	36	16	13	#6 Rebar	14 ga.	—
27	42	16	15	#6 Rebar	14 ga.	—
36	54	14	17	#8 Rebar	12 ga.	—
42	60	14	19	#8 Rebar	12 ga.	—
48	72	12	21	1 1/4" pipe or 1 1/4x1 1/4x1/4 angle	10 ga.	—
54	78	12	25	See 48" Riser	10 ga.	—
60	90	12	29	1 1/2" pipe or 1 1/2x1 1/2x1/2 angle	8 ga.	—
66	96	10	33	2" pipe or 2x2x3/16 angle	8 ga. w/stiffener	2x2x1/4 angle
72	102	10	36	——See 66" Riser——		2 1/2x2 1/2x1/4 angle
78	114	10	39	2 1/2" pipe or 2x2x1/4 angle	See 72" Riser	See 72" Riser
84	120	10	42	2 1/2" pipe or 2 1/2x2 1/2x1/4 angle	See 72" Riser	2 1/2x 2 1/2x 5/16 angle

Note: The criteria for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.

Figure 5.17
Anti-Seep Collar Design Charts (USDA - NRCS)



Appendix G: Drainage Area Maps



EXISTING DRAINAGE AREA MAP

SCALE: 1" = 100'

LEGEND

- WOODS
- IMPERVIOUS AREAS
- GRASS
- EDA 1
- EDA 2
- EDA 3
- DRAINAGE AREA BOUNDARY
- PROPERTY LINE
- TIME OF CONCENTRATION FLOW PATH

NOTES:

1. CONTOUR INFORMATION OUTSIDE OF SURVEY LIMITS DOWNLOADED FROM WESTCHESTER COUNTY GIS.

SCALE: 1" = 100'

100 50 0 100'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST

DESIGNED BY:

DRAWN BY:

CHECKED BY:

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 1/2" 1")

PERMIT SUBMITTAL
DO NOT USE FOR
CONSTRUCTION
FOR PERMIT REVIEW
PURPOSES ONLY

Hazen

HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
EXISTING DRAINAGE AREA MAP

DRAFT - NOT FOR CONSTRUCTION

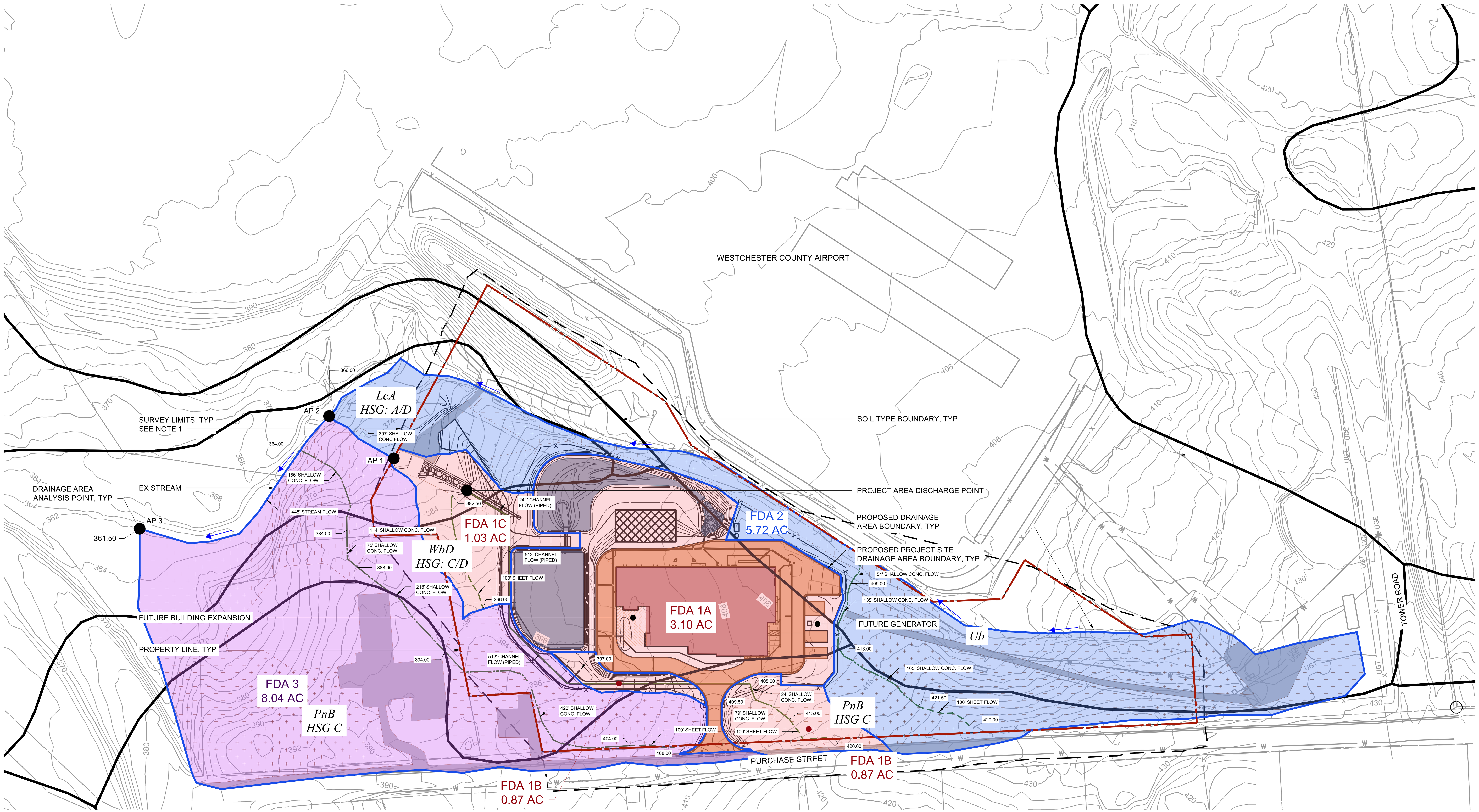
DATE: MAY 2022

HAZEN NO.: 90388-000

CONTRACT NO.: A1364-A

DRAWING NUMBER: FIGURE 1

File: C:\BMS\HAZEN-PW\0019420\DRAINAGE AREA MAPS Saved by CMCNICOL Save date: 7/1/2022 3:18 PM
PLOT DATE: 7/1/2022 3:27 PM BY: CMCNICOL



LEGEND

- WOODS
- IMPERVIOUS AREAS (ROOF)
- IMPERVIOUS AREAS (OTHER)
- EX IMPERVIOUS AREAS
- SMP SURFACE
- OPEN TANK (SEE NOTE 2)
- GRASS (HSG D)
- FDA 1
- FDA 2
- FDA 3
- DRAINAGE AREA BOUNDARY
- PROPERTY LINE
- TIME OF CONCENTRATION FLOW PATH

NOTES:
1. CONTOUR INFORMATION OUTSIDE OF SURVEY LIMITS DOWNLOADED FROM WESTCHESTER COUNTY GIS.
2. COMBINED WASH WATER TANK AREA IS AN OPEN-AIR TANK CONNECTED INTO THE PLANT TREATMENT SYSTEM. RAINWATER OVER THE TANK WILL BE RECYCLED TO THE HEAD OF THE PLANT AND WILL NOT CAUSE ANY RUNOFF. WITH THIS IN MIND,THE TANK AREA (0.14 ACRES) HAS BEEN REMOVED FROM THE SITE'S POST-DEVELOPMENT DRAINAGE AREA

PROPOSED DRAINAGE AREA MAP
SCALE: 1" = 100'

SCALE: 1" = 100'
100 50 0 100'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY:
DRAWN BY:
CHECKED BY:
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
PROPOSED DRAINAGE AREA MAP

DRAFT - NOT FOR CONSTRUCTION

DATE: MAY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: FIGURE 2

File: C:\BMS\HAZEN-PW\D0194207\DRAINAGE AREA MAPS Saved by CMCNICOL Save date: 7/1/2022 3:18 PM
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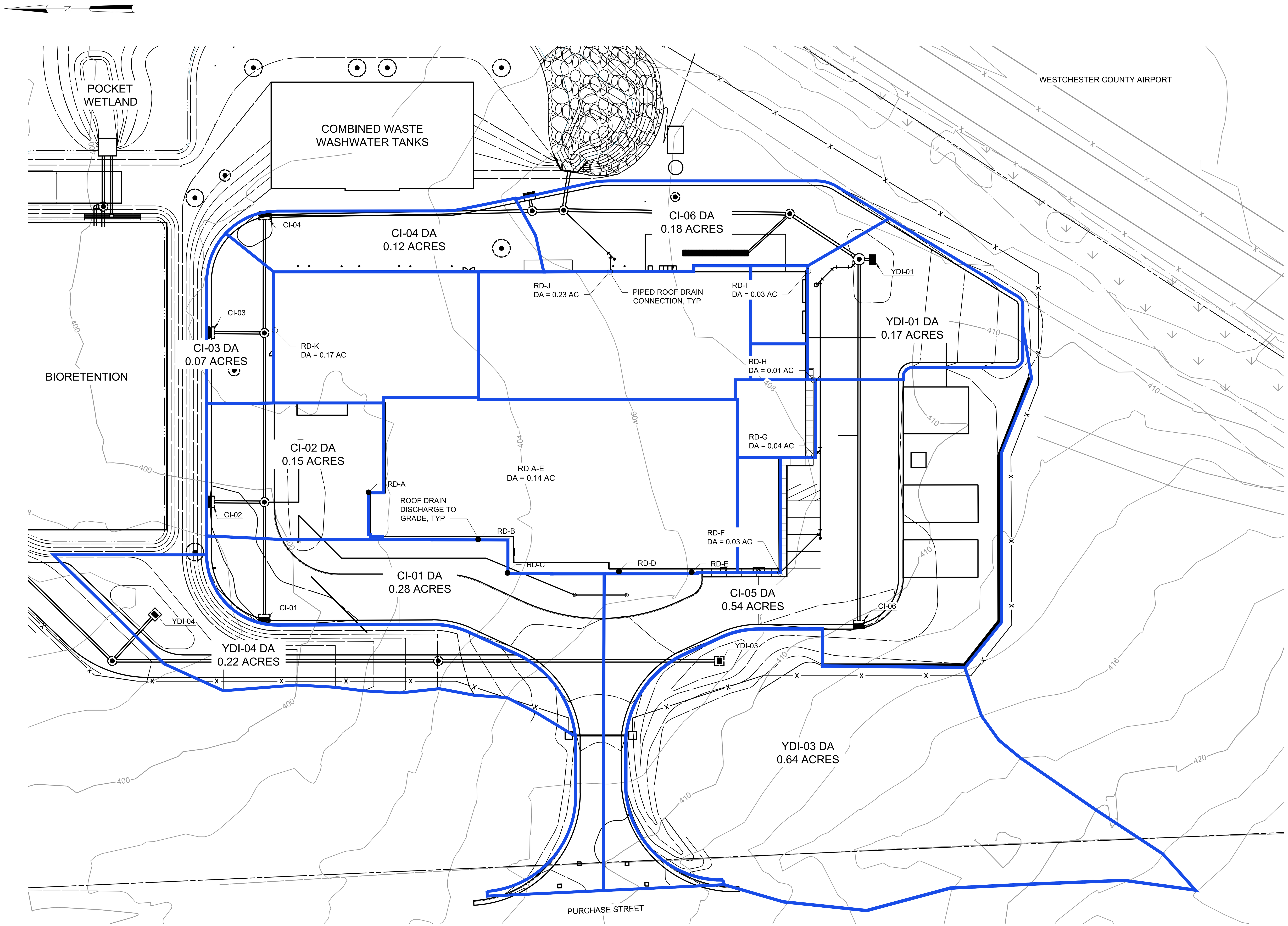


LEGEND

SUB DRAINAGE AREA BOUNDARY

NOTES:
1. SEE PROPOSED DRAINAGE AREA MAP FOR LAND COVER INFORMATION.

STORMWATER NETWORK DRAINAGE AREA MAP

SCALE: 1" = 30'

SCALE: 1" = 30'

REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER: R. FROST
DESIGNED BY:
DRAWN BY:
CHECKED BY:
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PERMIT SUBMITTAL
DO NOT USE FOR CONSTRUCTION
FOR PERMIT REVIEW PURPOSES ONLY

Hazen
HAZEN AND SAWYER
498 SEVENTH AVENUE, 11th FLOOR
NEW YORK, NEW YORK 10018

WESTCHESTER JOINT WATER WORKS
MAMARONECK, NY

RYE LAKE WATER FILTRATION PLANT
HARRISON, NY

CIVIL
STORMWATER NETWORK DRAINAGE AREA MAP

DRAFT - NOT FOR CONSTRUCTION

DATE: MAY 2022
HAZEN NO.: 90388-000
CONTRACT NO.: A1364-A
DRAWING NUMBER: FIGURE 3

File: C:\BMS\HAZEN-PW\D0194207\DRAINAGE AREA MAPS Saved by CMCNICOL Save date: 6/23/2022 7:11 PM
PLOT DATE: 6/23/2022 7:13 PM BY: CMCNICOL

Appendix H: Sample Inspection and Maintanence Form

Construction Duration Inspections

Instructions:

- Inspection Forms will be filled out during the entire construction phase of the project.
- Complete inspections must include:
  - ✓ An inspection form
  - ✓ A site plan showing the areas under active construction
  - ✓ Color Photos with date and time stamps showing any deficiencies or corrections to previous deficiencies
  - ✓ The signature of the QI
  - ✓ If the QI is working under the direction of a PE or RLA, the signature of the PE or RLA.
- **Required Elements:**
  - ✓ On a site map, indicate the extent of all disturbed site areas and drainage pathways.
    - Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period.
    - Indicate, on a site map, all areas of the site that have undergone temporary or permanent stabilization.
    - Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period.
  - ✓ Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of sediment storage volume (for example, 10 percent, 20 percent, and 50 percent).
  - ✓ Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps).
  - ✓ Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching.
  - ✓ Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated risers pipes to pass water.
  - ✓ Immediately report to the Developer any deficiencies that are identified with the implementation of the SWPPP.
  - ✓ Take color photos with time and date stamps of any identified deficiencies or corrections to previous deficiencies
  - ✓ Maintain onsite a record of all inspection documents and reports in the site log book.

Example Construction Duration Inspection Form

Maintaining Water Quality

Yes No N/A

☐ ☐ ☐ Is there an increase in turbidity causing or reasonably likely to cause a substantial visible contrast to natural conditions?

☐ ☐ ☐ Is there residue from oil and floating substances, visible oil film, or globules or grease?

☐ ☐ ☐ All disturbance is within the limits of the approved plans.

☐ ☐ ☐ Have receiving lake/bay, stream, and/or wetland been impacted by silt from the project?

Housekeeping

1. **General Site Conditions**

Yes No N/A

☐ ☐ ☐ Is construction site litter and debris appropriately managed?

☐ ☐ ☐ Are facilities and equipment necessary for implementation or erosion and sediment control in working order and/or properly maintained?

☐ ☐ ☐ Is construction impacting the adjacent property?

☐ ☐ ☐ Is dust adequately controlled?

Runoff Control Practices

1. **Excavation Dewatering**

Yes No N/A

☐ ☐ ☐ Upstream and downstream berms (sandbags, inflatable dams, etc.) are installed per plan.

☐ ☐ ☐ Clean water from upstream pool is being pumped to the downstream pool.

☐ ☐ ☐ Sediment laden water from work area is being discharged to a silt trapping device.

☐ ☐ ☐ Constructed upstream berm with one-foot minimum freeboard.

Soil Stabilization

1. **Topsoil and Spoil Stockpiles**

Yes No N/A

☐ ☐ ☐ Stockpiles are stabilized with vegetation and/or mulch.

☐ ☐ ☐ Sediment control is installed at the toe of the slope.

2. **Revegetation**

Yes No N/A

☐ ☐ ☐ Temporary seeding and mulch have been applied to idle areas.

☐ ☐ ☐ 6 inches minimum of topsoil has been applied under permanent seeding.

Sediment Control Practices

1. Stabilized Construction Entrance

Yes No N/A

☐ ☐ ☐ Stone is clean enough to effectively remove mud from vehicles.

☐ ☐ ☐ Installed per standards and specifications?

☐ ☐ ☐ Does all traffic use the stabilized entrance to enter and leave site?

☐ ☐ ☐ Is adequate drainage provided to prevent ponding at entrance?

2. Silt Fence

Yes No N/A

☐ ☐ ☐ Installed on Contour, 10 feet from toe of slope (not across conveyance channels).

☐ ☐ ☐ Joints constructed by wrapping the two ends together for continuous support.

☐ ☐ ☐ Fabric buried 6 inches minimum.

☐ ☐ ☐ Post are stable, fabric is tight and without rips or frayed areas. Sediment accumulation is ___% of design capacity.

3. Storm Drain Inlet Protection

(Use for Stone & Block, Filter Fabric, Curb, or Excavated practices)

Yes No N/A

☐ ☐ ☐ Installed concrete blocks lengthwise so open ends face outward, not upward.

☐ ☐ ☐ Placed wire screen between No. 3 crushed stone and concrete blocks.

☐ ☐ ☐ Drainage area is 1 acre or less.

☐ ☐ ☐ Excavated area is 900 cubic feet.

☐ ☐ ☐ Excavated side slopes should be 2:1.

☐ ☐ ☐ 2" x 5" frame is constructed and structurally sound.

☐ ☐ ☐ Posts 3-foot maximum spacing between posts.

☐ ☐ ☐ Fabric is embedded 1 to 1.5 feet below ground and secured to frame/posts with staples at max 8-inch spacing.

☐ ☐ ☐ Posts are stable, fabric is tight and without rips or frayed areas.
Sediments accumulation ___% of design capacity.

4. Rolled Erosion Control Matting

Yes No N/A

☐ ☐ ☐ Installed in accordance with the standard and specifications?

☐ ☐ ☐ Vegetation is established

☐ ☐ ☐ Fabric is without rips or frayed areas, unless a stable plant cover has been established.

☐ ☐ ☐ Fabric is maintaining ground cover and has not become dislodged or mis-aligned.

5. **Mulching**

Yes No N/A

☐ ☐ ☐ Mulch is maintaining ground cover over soil surface.
☐ ☐ ☐ Mulch is not applied to areas where concentrated flows are anticipated.
☐ ☐ ☐ Installed according to standards and specifications.

6. **Permanent Construction Area Seeding**

Yes No N/A

☐ ☐ ☐ Seed mixture applied according to standards and specifications?
☐ ☐ ☐ Proper soil to seed contact is implemented.
☐ ☐ ☐ Mulch is maintaining ground cover over soil surface.
☐ ☐ ☐ Area is free of stones or other obstructions greater than 4" that will interfere with maintenance.

7. **Temporary Construction Seeding**

Yes No N/A

☐ ☐ ☐ Seed mixture applied according to standards and specifications?
☐ ☐ ☐ Proper soil to seed contact is implemented.
☐ ☐ ☐ Mulch is maintaining ground cover over soil surface.
☐ ☐ ☐ Area is free of stones or other obstructions greater than 4" that will interfere with maintenance.

8. **Compost Sock**

Yes No N/A

☐ ☐ ☐ Installed along the contour with both terminal ends of the sock extended 8 feet upslope at a 45-degree angle to prevent bypass flow.
☐ ☐ ☐ Compost sock is anchored with 2" by 2" stakes driven 12" into the soil on 10-feet centers on the centerline of the sock.
☐ ☐ ☐ Sediment is not accumulated greater than half the above ground height of the sock.
☐ ☐ ☐ Fabric is not torn, ripped, or frayed.

9. **Straw Bale Dike**

Yes No N/A

☐ ☐ ☐ All bales are placed along the contour with cut edge of bale adhering to the ground and in row with ends tightly abutting adjacent bales.
☐ ☐ ☐ Bales are embedded in the soil a minimum of 4 inches.
☐ ☐ ☐ Bales are placed so the bindings are horizontal.
☐ ☐ ☐ Bales are securely anchored in place by either two stakes or re-bars driven through the bale. Stakes or re-bar are flush with top of bale,
☐ ☐ ☐ Bale does not block or impede storm flow or drainage.
☐ ☐ ☐ Drainage area is no more than ¼ acre per 100 feet of straw bale dike.
☐ ☐ ☐ Straw bale minimum height is maintained above grade.

10. Construction Road Stabilization

Yes No N/A

☐ ☐ ☐ Maximum grade of 12%.

☐ ☐ ☐ Roadway is 12-foot minimum for one-way traffic or 24-foot minimum for two-way traffic.

☐ ☐ ☐ Side slope of road embankment is 2:1 or flatter.

☐ ☐ ☐ Surface is adequately covered with gravel with minimal depressions.

11. Concrete Truck Washout

Yes No N/A

☐ ☐ ☐ Minimum size is 8 feet by 8 feet at the bottom and 2 feet deep.

☐ ☐ ☐ Facility is located at least 100 feet from storm drain inlets, surface waters, and drainage ditches.

☐ ☐ ☐ Liner of at least 10 mils thickness is installed to prevent leaching of liquids, anchored beyond the top of the pit, and does not have any holes or tears

☐ ☐ ☐ No excess rainwater has accumulated over hardened concrete.

☐ ☐ ☐ Accumulated hardened material does not exceed 75% of storage capacity.

12. Protect Vegetation During Construction

Yes No N/A

☐ ☐ ☐ Soil placement over existing tree and shrub roots does not exceed 3 inches.

☐ ☐ ☐ Fencing or barriers of wood are present around valuable vegetation to protect from construction equipment.

☐ ☐ ☐ Obstructive or broken branches are properly pruned.

☐ ☐ ☐ Construction limits are clearly identified and marked to exclude equipment.

*(**Note:** Not all erosion and sediment control practices are included in this listing. Add additional pages to this list as required by site specific design. Construction inspection checklists for post-development stormwater Management practices can be found in Appendix F of the New York State Stormwater Management Design Manual.)*

CONSTRUCTION DURATION INSPECTIONS

Modifications to the SWPPP (To be completed as described below)

The Developer shall amend the SWPPP whenever:

1. There is a significant change in design, construction, operation, or maintenance which may have a significant effect on the potential for the discharge of pollutants to the waters of the State and which has not otherwise been addressed in the SWPPP; or
2. The SWPPP proves to be ineffective in;
    a. Eliminating or significantly minimizing pollutants from sources identified in the SWPPP and as required by this permit; or
    b. Achieving the general objectives of controlling pollutants in stormwater discharges from permitted construction activity; and
3. Additionally, the SWPPP shall be amended to identify any new contractor or subcontractor that will implement any measure of the SWPPP.

Modification & Reason:

Insert Text Here

SITE PLAN/SKETCH

PHOTOS

Inspector (Print name)	Date of Inspection
Qualified Professional (print name)	Qualified Professional Signature

The above signed acknowledges that, to the best of his/her knowledge, all information provided on the forms is accurate and complete.

Bioretention Operation, Maintenance and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Bioretention and contributing areas clean of debris		
No dumping of yard wastes into practice		
Litter (branches, etc.) have been removed		
2. Vegetation (Monthly)		
Plant height not less than design water depth		
Fertilized per specifications		
Plant composition according to approved plans		
No placement of inappropriate plants		
Grass height not greater than 6 inches		
No evidence of erosion		
3. Check Dams/Energy Dissipaters/Sumps (Annual, After Major Storms)		
No evidence of sediment buildup		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
Sumps should not be more than 50% full of sediment		
No evidence of erosion at downstream toe of drop structure		
4. Dewatering (Monthly)		
Dewaters between storms		
No evidence of standing water		
5. Sediment Deposition (Annual)		
Swale clean of sediments		
Sediments should not be > 20% of swale design depth		
6. Outlet/Overflow Spillway (Annual, After Major Storms)		
Good condition, no need for repair		
No evidence of erosion		
No evidence of any blockages		
7. Integrity of Filter Bed (Annual)		
Filter bed has not been blocked or filled inappropriately		

Comments:

Actions to be Taken:

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project ______________________________
Location: ______________________________
Site Status: ______________________________

Date: ______________________________
Time: ______________________________

Inspector: ______________________________

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway (Annual, After Major Storms)		
1. Vegetation and ground cover adequate		
2. Embankment erosion		
3. Animal burrows		
4. Unauthorized planting		
5. Cracking, bulging, or sliding of dam		
a. Upstream face		
b. Downstream face		
c. At or beyond toe		
downstream		
upstream		
d. Emergency spillway		
6.Pond, toe & chimney drains clear and functioning		
7.Seeps/leaks on downstream face		
8.Slope protection or riprap failure		
9. Vertical/horizontal alignment of top of dam “As-Built”		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
10. Emergency spillway clear of obstructions and debris		
11. Other (specify)		
2. Riser and principal spillway (Annual)		
Type: Reinforced concrete ______ Corrugated pipe ________ Masonry ________ 1. Low flow orifice obstructed		
2. Low flow trash rack. a. Debris removal necessary		
b. Corrosion control		
3. Weir trash rack maintenance a. Debris removal necessary		
b. corrosion control		
4. Excessive sediment accumulation insider riser		
5. Concrete/masonry condition riser and barrels a. cracks or displacement		
b. Minor spalling (<1")		
c. Major spalling (rebars exposed)		
d. Joint failures		
e. Water tightness		
6. Metal pipe condition		
7. Control valve a. Operational/exercised		
b. Chained and locked		
8. Pond drain valve a. Operational/exercised		
b. Chained and locked		
9. Outfall channels functioning		
10. Other (specify)		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
3. Permanent Pool (Wet Ponds) (monthly)		
1. Undesirable vegetative growth		
2. Floating or floatable debris removal required		
3. Visible pollution		
4. Shoreline problem		
5. Other (specify)		
4. Sediment Forebays		
1.Sedimentation noted		
2. Sediment cleanout when depth < 50% design depth		
5. Dry Pond Areas		
1. Vegetation adequate		
2. Undesirable vegetative growth		
3. Undesirable woody vegetation		
4. Low flow channels clear of obstructions		
5. Standing water or wet spots		
6. Sediment and / or trash accumulation		
7. Other (specify)		
6. Condition of Outfalls (Annual , After Major Storms)		
1. Riprap failures		
2. Slope erosion		
3. Storm drain pipes		
4.Endwalls / Headwalls		
5. Other (specify)		
7. Other (Monthly)		
1. Encroachment on pond, wetland or easement area		

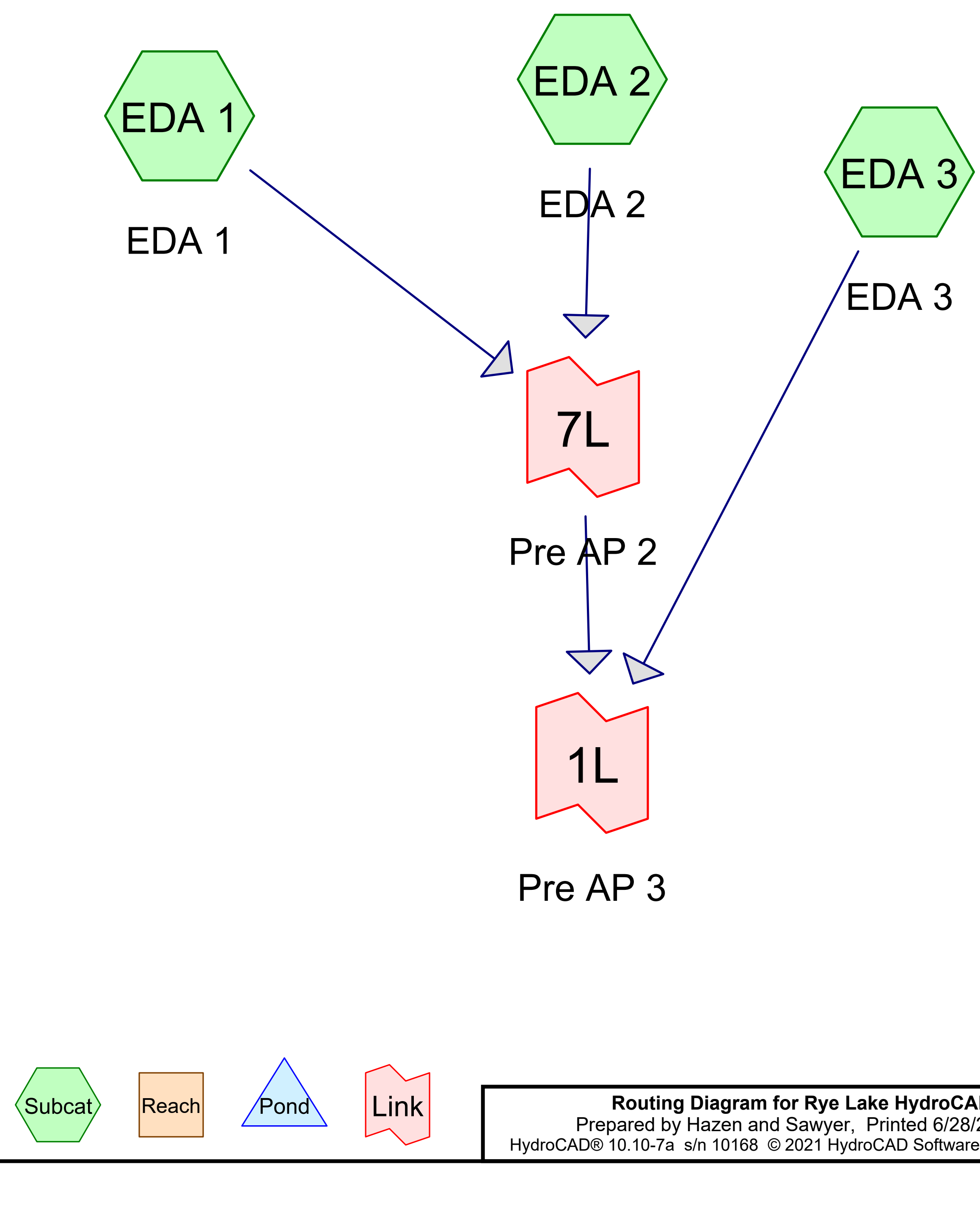
Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
2. Complaints from residents		
3.Aesthetics a. Grass growing required		
b. Graffiti removal needed		
c. Other (specify)		
4. Conditions of maintenance access routes.		
5. Signs of hydrocarbon build-up		
6. Any public hazards (specify)		
8. Wetland Vegetation (Annual)		
1. Vegetation healthy and growing Wetland maintaining 50% surface area coverage of wetland plants after the second growing season. (If unsatisfactory, reinforcement plantings needed)		
2. Dominant wetland plants: Survival of desired wetland plant species Distribution according to landscaping plan?		
3. Evidence of invasive species		
4. Maintenance of adequate water depths for desired wetland plant species		
5. Harvesting of emergent plantings needed		
6. Have sediment accumulations reduced pool volume significantly or are plants “choked” with sediment		
7. Eutrophication level of the wetland.		
8. Other (specify)		

Comments:

Actions to be Taken:

Appendix I: HydroCAD Reports

Pre-Development



Routing Diagram for Rye Lake HydroCAD
Prepared by Hazen and Sawyer, Printed 6/28/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	NRCC Precip Data 24-hr S1	1-yr	Default	24.00	1	2.83	2
2	10-yr	NRCC Precip Data 24-hr S1	10-yr	Default	24.00	1	5.11	2
3	25-yr	NRCC Precip Data 24-hr S1	25-yr	Default	24.00	1	6.42	2
4	100-yr	NRCC Precip Data 24-hr S1	100-yr	Default	24.00	1	9.05	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.960	74	>75% Grass cover, Good, HSG C (EDA 3)
1.430	80	>75% Grass cover, Good, HSG D (EDA 1, EDA 2, EDA 3)
1.860	98	Paved parking, HSG D (EDA 1, EDA 2, EDA 3)
4.170	70	Woods, Good, HSG C (EDA 2, EDA 3)
11.360	77	Woods, Good, HSG D (EDA 1, EDA 2, EDA 3)
19.780	**78**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.130	HSG C	EDA 2, EDA 3
14.650	HSG D	EDA 1, EDA 2, EDA 3
0.000	Other	
19.780		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.960	1.430	0.000	2.390	>75% Grass cover, Good	EDA 1, EDA 2, EDA 3
0.000	0.000	0.000	1.860	0.000	1.860	Paved parking	EDA 1, EDA 2, EDA 3
0.000	0.000	4.170	11.360	0.000	15.530	Woods, Good	EDA 1, EDA 2, EDA 3
0.000	**0.000**	**5.130**	**14.650**	**0.000**	**19.780**	**TOTAL AREA**	

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentEDA 1: EDA 1 Runoff Area=2.390 ac 5.44% Impervious Runoff Depth=1.01"
Flow Length=489' Tc=25.9 min CN=78 Runoff=1.54 cfs 0.201 af

SubcatchmentEDA 2: EDA 2 Runoff Area=5.690 ac 9.67% Impervious Runoff Depth=1.07"
Flow Length=1,126' Tc=32.2 min CN=79 Runoff=3.48 cfs 0.505 af

SubcatchmentEDA 3: EDA 3 Runoff Area=11.700 ac 10.09% Impervious Runoff Depth=0.95"
Flow Length=1,523' Tc=38.0 min CN=77 Runoff=5.72 cfs 0.931 af

Link 1L: Pre AP 3 Inflow=10.44 cfs 1.637 af
Primary=10.44 cfs 1.637 af

Link 7L: Pre AP 2 Inflow=4.94 cfs 0.706 af
Primary=4.94 cfs 0.706 af

Total Runoff Area = 19.780 ac Runoff Volume = 1.637 af Average Runoff Depth = 0.99"
90.60% Pervious = 17.920 ac 9.40% Impervious = 1.860 ac

Summary for Subcatchment EDA 1: EDA 1

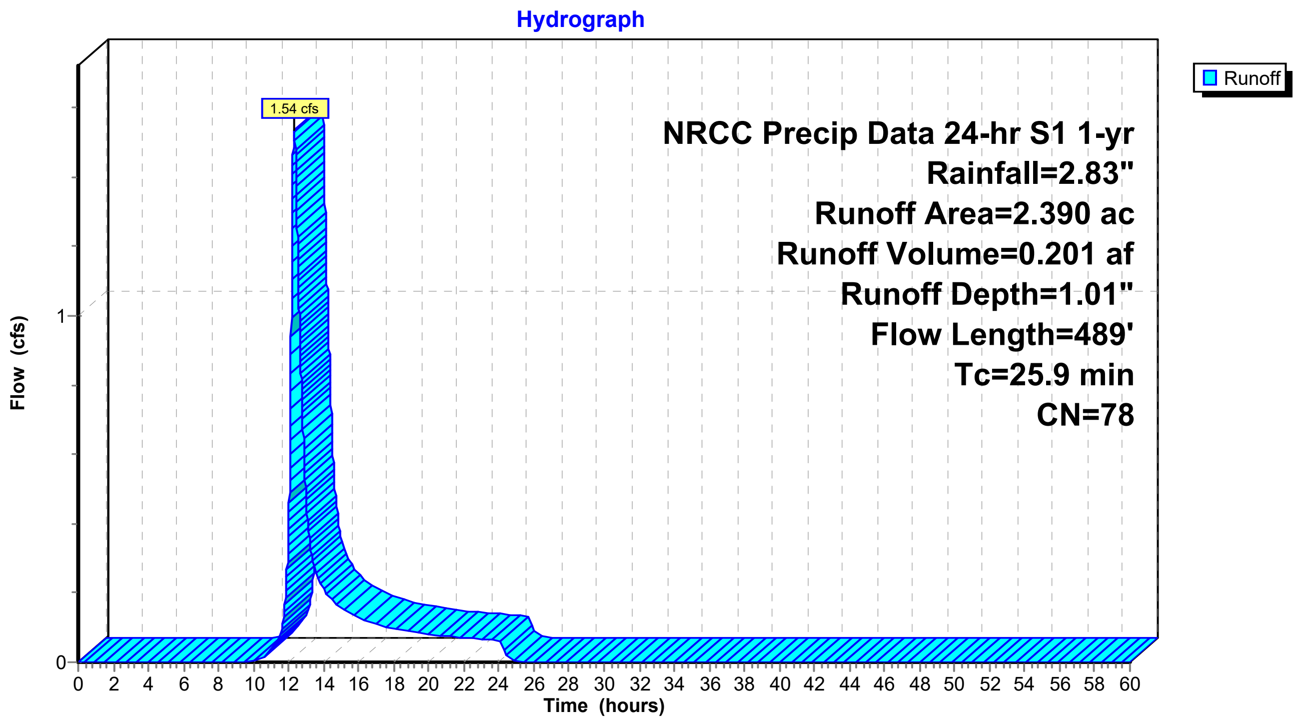
Runoff = 1.54 cfs @ 12.32 hrs, Volume= 0.201 af, Depth= 1.01"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
2.000	77	Woods, Good, HSG D
0.130	98	Paved parking, HSG D
0.260	80	>75% Grass cover, Good, HSG D
2.390	78	Weighted Average
2.260		94.56% Pervious Area
0.130		5.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		**Sheet Flow, Woods Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.44"
5.2	389	0.0620	1.24		**Shallow Concentrated Flow, Woods Shallow Conc** Woodland Kv= 5.0 fps
25.9	489	Total			

Subcatchment EDA 1: EDA 1



Summary for Subcatchment EDA 2: EDA 2

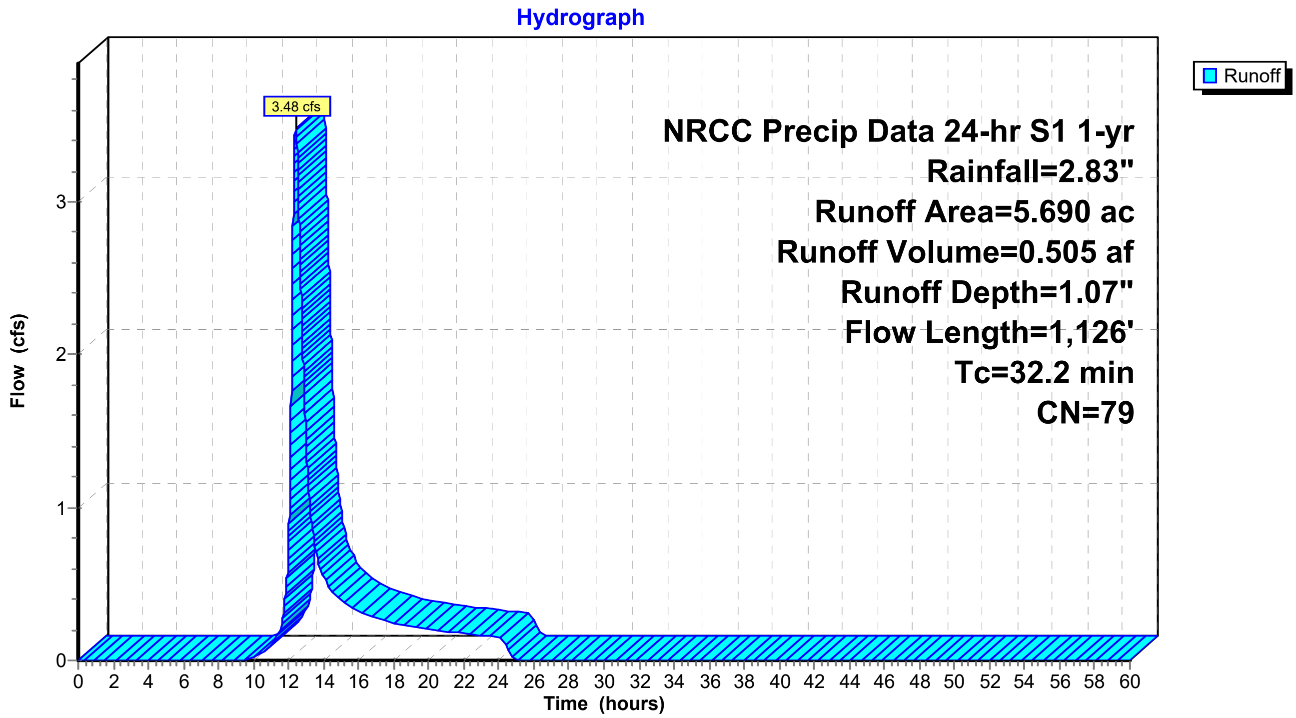
Runoff = 3.48 cfs @ 12.41 hrs, Volume= 0.505 af, Depth= 1.07"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
3.960	77	Woods, Good, HSG D
0.420	70	Woods, Good, HSG C
0.550	98	Paved parking, HSG D
0.760	80	>75% Grass cover, Good, HSG D
5.690	79	Weighted Average
5.140		90.33% Pervious Area
0.550		9.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	100	0.0125	0.07		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.5	168	0.0520	1.14		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
2.8	319	0.0750	1.92		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	539	0.0110	4.74	124.60	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
32.2	1,126	Total			

Subcatchment EDA 2: EDA 2



Summary for Subcatchment EDA 3: EDA 3

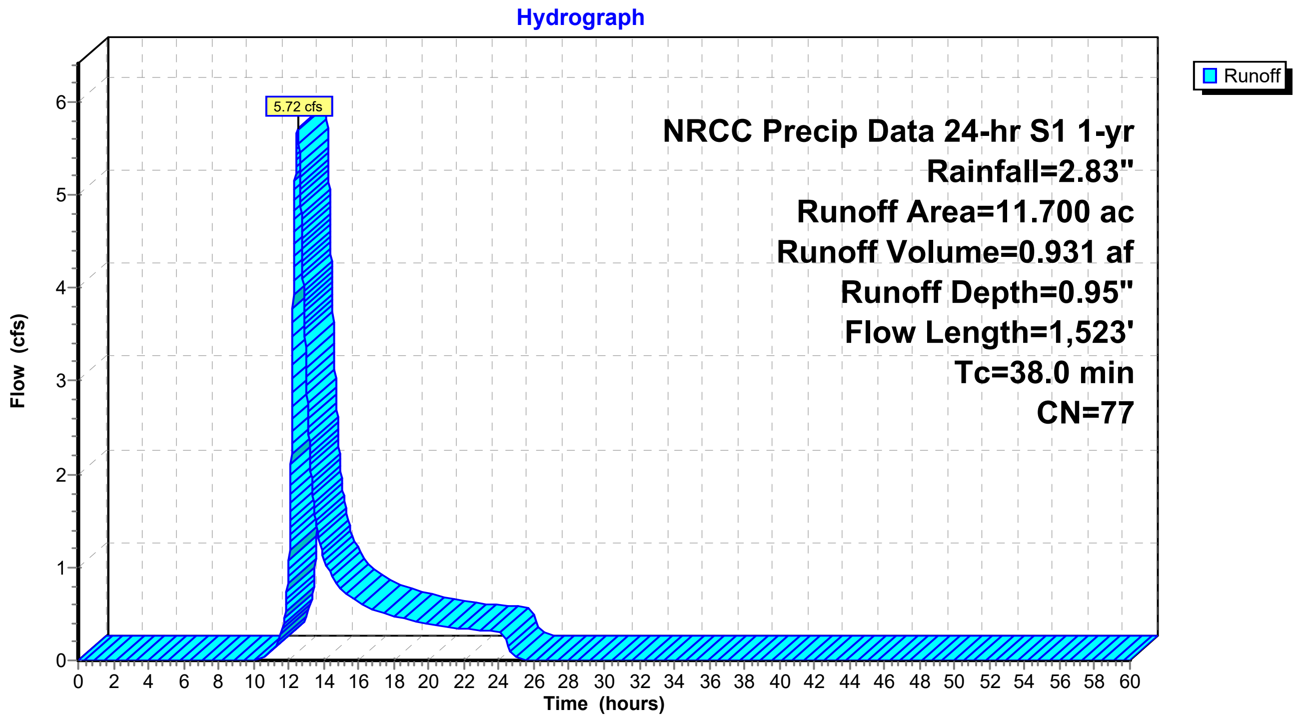
Runoff = 5.72 cfs @ 12.50 hrs, Volume= 0.931 af, Depth= 0.95"
Routed to Link 1L : Pre AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
5.400	77	Woods, Good, HSG D
3.750	70	Woods, Good, HSG C
1.180	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.410	80	>75% Grass cover, Good, HSG D
11.700	77	Weighted Average
10.520		89.91% Pervious Area
1.180		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0325	0.10		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
12.9	577	0.0221	0.74		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	217	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0533	1.15		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods Steep** Woodland Kv= 5.0 fps
1.9	368	0.0050	3.19	84.00	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
38.0	1,523	Total			

Subcatchment EDA 3: EDA 3

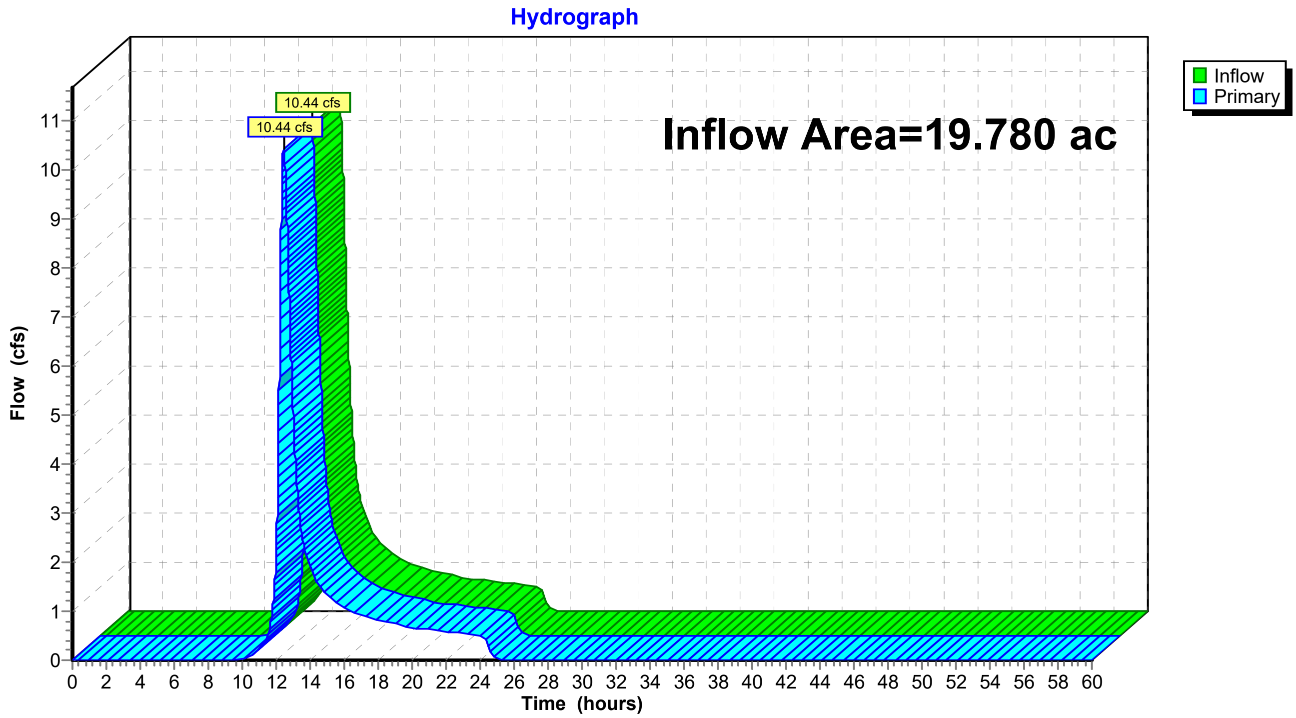


Summary for Link 1L: Pre AP 3

Inflow Area =	19.780 ac,	9.40% Impervious,	Inflow Depth = 0.99"	for 1-yr event
Inflow =	10.44 cfs @	12.45 hrs, Volume=	1.637 af	
Primary =	10.44 cfs @	12.45 hrs, Volume=	1.637 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 1L: Pre AP 3

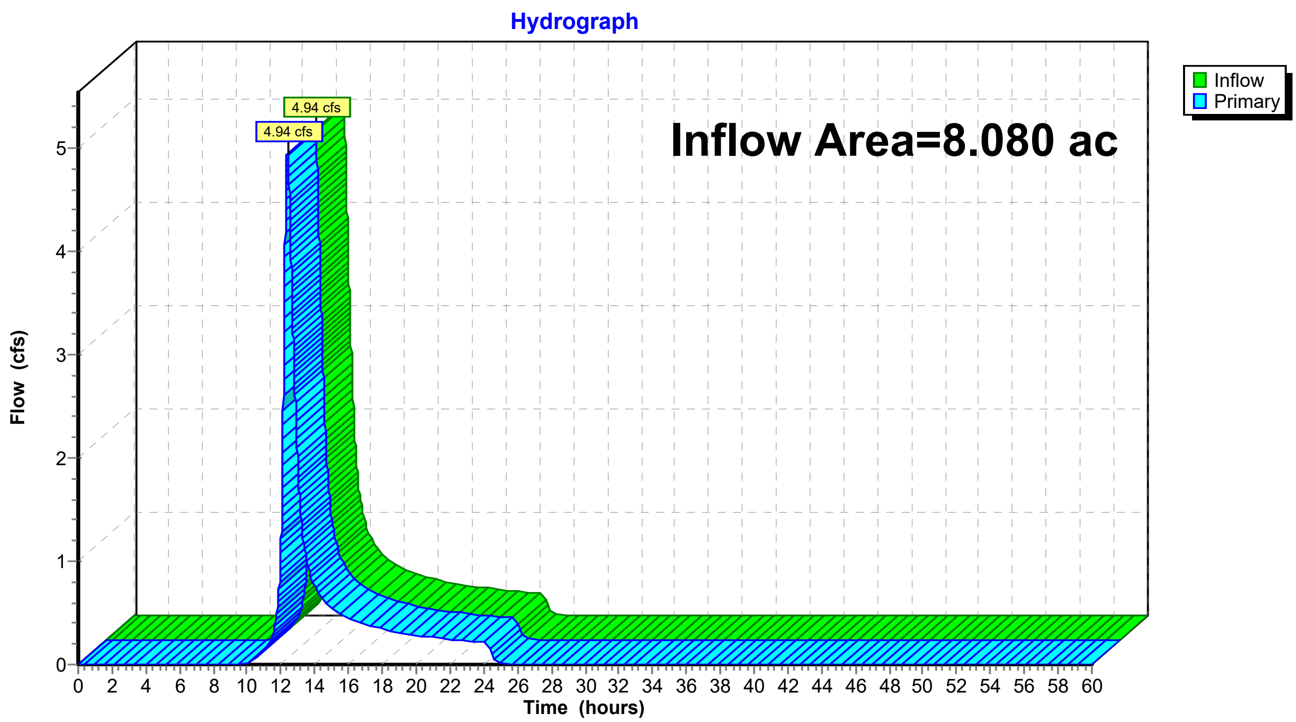


Summary for Link 7L: Pre AP 2

Inflow Area = 8.080 ac, 8.42% Impervious, Inflow Depth = 1.05" for 1-yr event
Inflow = 4.94 cfs @ 12.38 hrs, Volume= 0.706 af
Primary = 4.94 cfs @ 12.38 hrs, Volume= 0.706 af, Atten= 0%, Lag= 0.0 min
Routed to Link 1L : Pre AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 7L: Pre AP 2



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentEDA 1: EDA 1 Runoff Area=2.390 ac 5.44% Impervious Runoff Depth=2.81"
Flow Length=489' Tc=25.9 min CN=78 Runoff=4.32 cfs 0.559 af

SubcatchmentEDA 2: EDA 2 Runoff Area=5.690 ac 9.67% Impervious Runoff Depth=2.90"
Flow Length=1,126' Tc=32.2 min CN=79 Runoff=9.54 cfs 1.373 af

SubcatchmentEDA 3: EDA 3 Runoff Area=11.700 ac 10.09% Impervious Runoff Depth=2.72"
Flow Length=1,523' Tc=38.0 min CN=77 Runoff=16.84 cfs 2.647 af

Link 1L: Pre AP 3 Inflow=29.91 cfs 4.580 af
Primary=29.91 cfs 4.580 af

Link 7L: Pre AP 2 Inflow=13.67 cfs 1.932 af
Primary=13.67 cfs 1.932 af

Total Runoff Area = 19.780 ac Runoff Volume = 4.580 af Average Runoff Depth = 2.78"
90.60% Pervious = 17.920 ac 9.40% Impervious = 1.860 ac

Summary for Subcatchment EDA 1: EDA 1

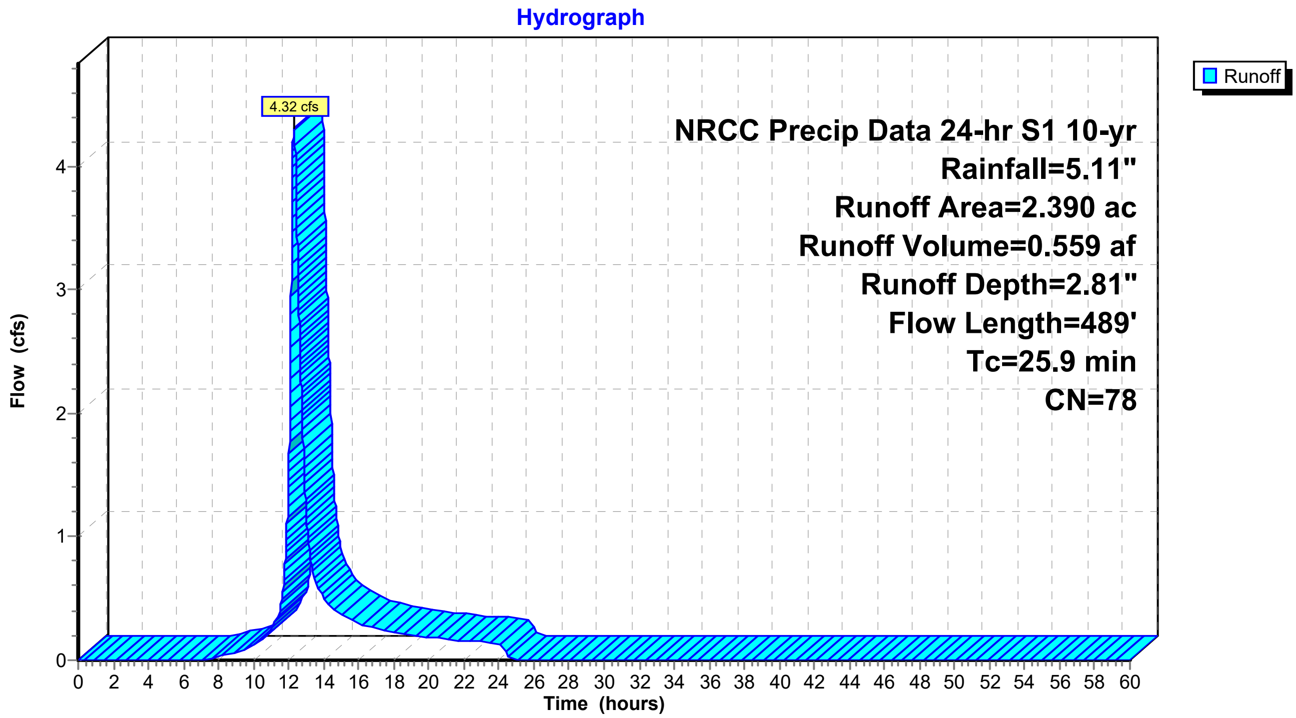
Runoff = 4.32 cfs @ 12.31 hrs, Volume= 0.559 af, Depth= 2.81"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
2.000	77	Woods, Good, HSG D
0.130	98	Paved parking, HSG D
0.260	80	>75% Grass cover, Good, HSG D
2.390	78	Weighted Average
2.260		94.56% Pervious Area
0.130		5.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		**Sheet Flow, Woods Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.44"
5.2	389	0.0620	1.24		**Shallow Concentrated Flow, Woods Shallow Conc** Woodland Kv= 5.0 fps
25.9	489	Total			

Subcatchment EDA 1: EDA 1



Summary for Subcatchment EDA 2: EDA 2

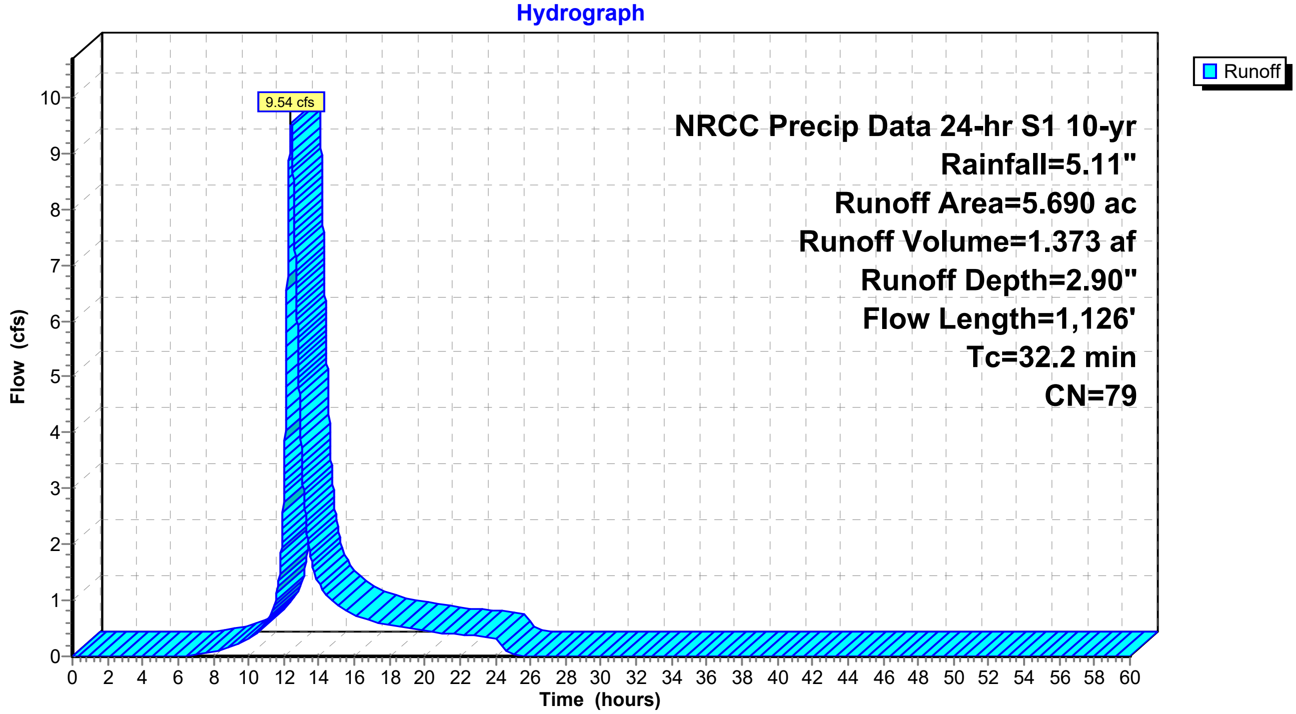
Runoff = 9.54 cfs @ 12.41 hrs, Volume= 1.373 af, Depth= 2.90"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
3.960	77	Woods, Good, HSG D
0.420	70	Woods, Good, HSG C
0.550	98	Paved parking, HSG D
0.760	80	>75% Grass cover, Good, HSG D
5.690	79	Weighted Average
5.140		90.33% Pervious Area
0.550		9.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	100	0.0125	0.07		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.5	168	0.0520	1.14		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
2.8	319	0.0750	1.92		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	539	0.0110	4.74	124.60	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
32.2	1,126	Total			

Subcatchment EDA 2: EDA 2



Summary for Subcatchment EDA 3: EDA 3

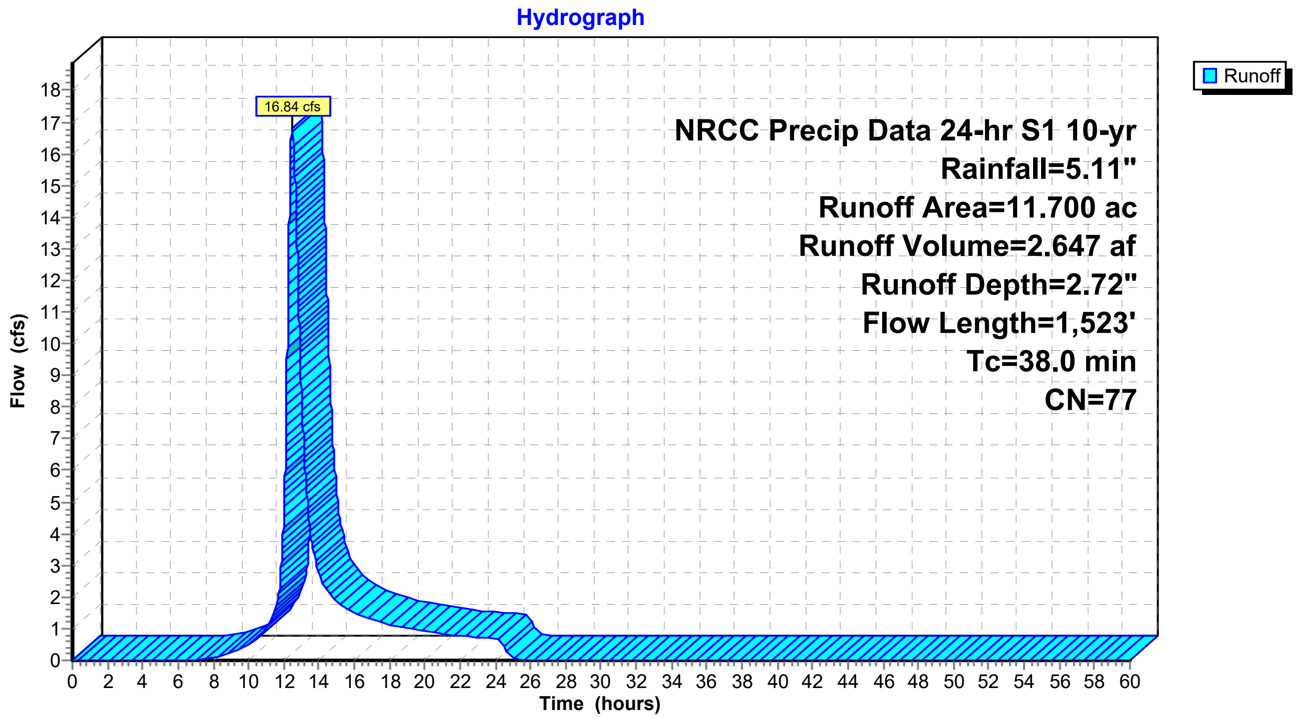
Runoff = 16.84 cfs @ 12.46 hrs, Volume= 2.647 af, Depth= 2.72"
Routed to Link 1L : Pre AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
5.400	77	Woods, Good, HSG D
3.750	70	Woods, Good, HSG C
1.180	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.410	80	>75% Grass cover, Good, HSG D
11.700	77	Weighted Average
10.520		89.91% Pervious Area
1.180		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0325	0.10		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
12.9	577	0.0221	0.74		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	217	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0533	1.15		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods Steep** Woodland Kv= 5.0 fps
1.9	368	0.0050	3.19	84.00	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
38.0	1,523	Total			

Subcatchment EDA 3: EDA 3

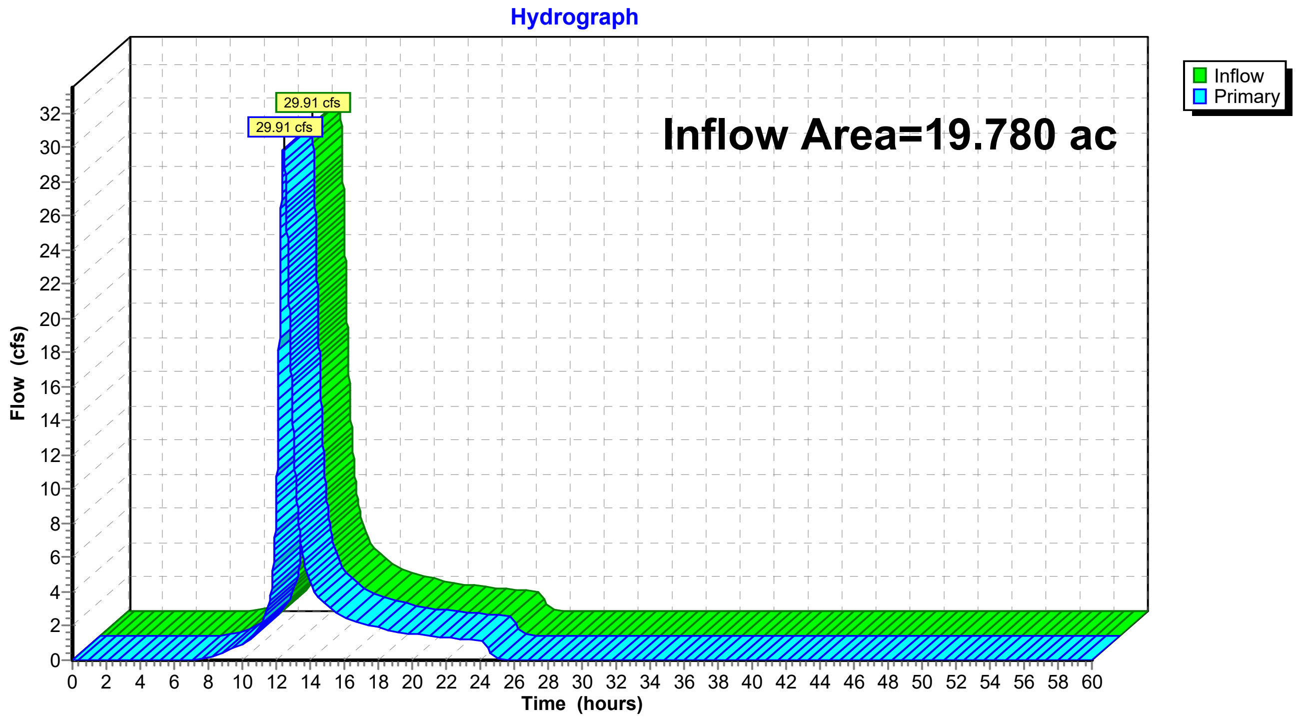


Summary for Link 1L: Pre AP 3

Inflow Area = 19.780 ac, 9.40% Impervious, Inflow Depth = 2.78" for 10-yr event
Inflow = 29.91 cfs @ 12.42 hrs, Volume= 4.580 af
Primary = 29.91 cfs @ 12.42 hrs, Volume= 4.580 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 1L: Pre AP 3

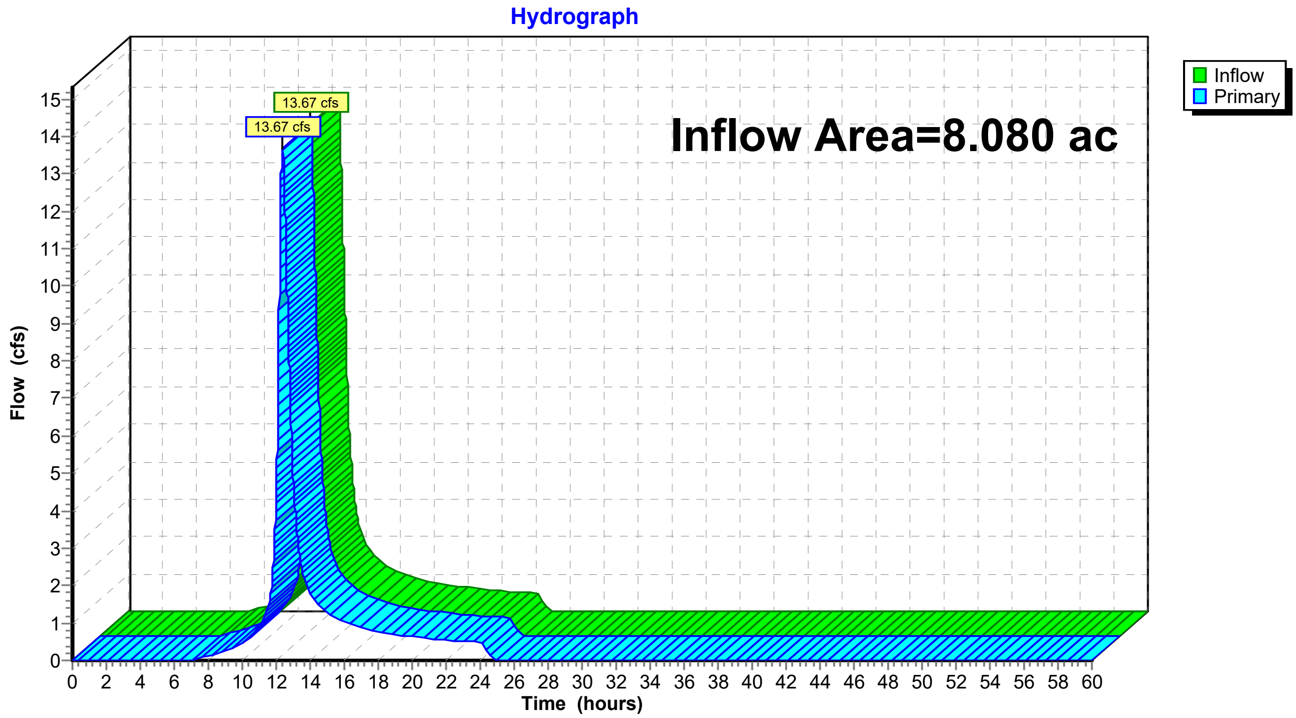


Summary for Link 7L: Pre AP 2

Inflow Area = 8.080 ac, 8.42% Impervious, Inflow Depth = 2.87" for 10-yr event
Inflow = 13.67 cfs @ 12.37 hrs, Volume= 1.932 af
Primary = 13.67 cfs @ 12.37 hrs, Volume= 1.932 af, Atten= 0%, Lag= 0.0 min
Routed to Link 1L : Pre AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 7L: Pre AP 2



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentEDA 1: EDA 1 Runoff Area=2.390 ac 5.44% Impervious Runoff Depth=3.95"
Flow Length=489' Tc=25.9 min CN=78 Runoff=5.95 cfs 0.787 af

SubcatchmentEDA 2: EDA 2 Runoff Area=5.690 ac 9.67% Impervious Runoff Depth=4.06"
Flow Length=1,126' Tc=32.2 min CN=79 Runoff=13.07 cfs 1.924 af

SubcatchmentEDA 3: EDA 3 Runoff Area=11.700 ac 10.09% Impervious Runoff Depth=3.85"
Flow Length=1,523' Tc=38.0 min CN=77 Runoff=23.48 cfs 3.752 af

Link 1L: Pre AP 3 Inflow=41.45 cfs 6.463 af
Primary=41.45 cfs 6.463 af

Link 7L: Pre AP 2 Inflow=18.78 cfs 2.711 af
Primary=18.78 cfs 2.711 af

Total Runoff Area = 19.780 ac Runoff Volume = 6.463 af Average Runoff Depth = 3.92"
90.60% Pervious = 17.920 ac 9.40% Impervious = 1.860 ac

Summary for Subcatchment EDA 1: EDA 1

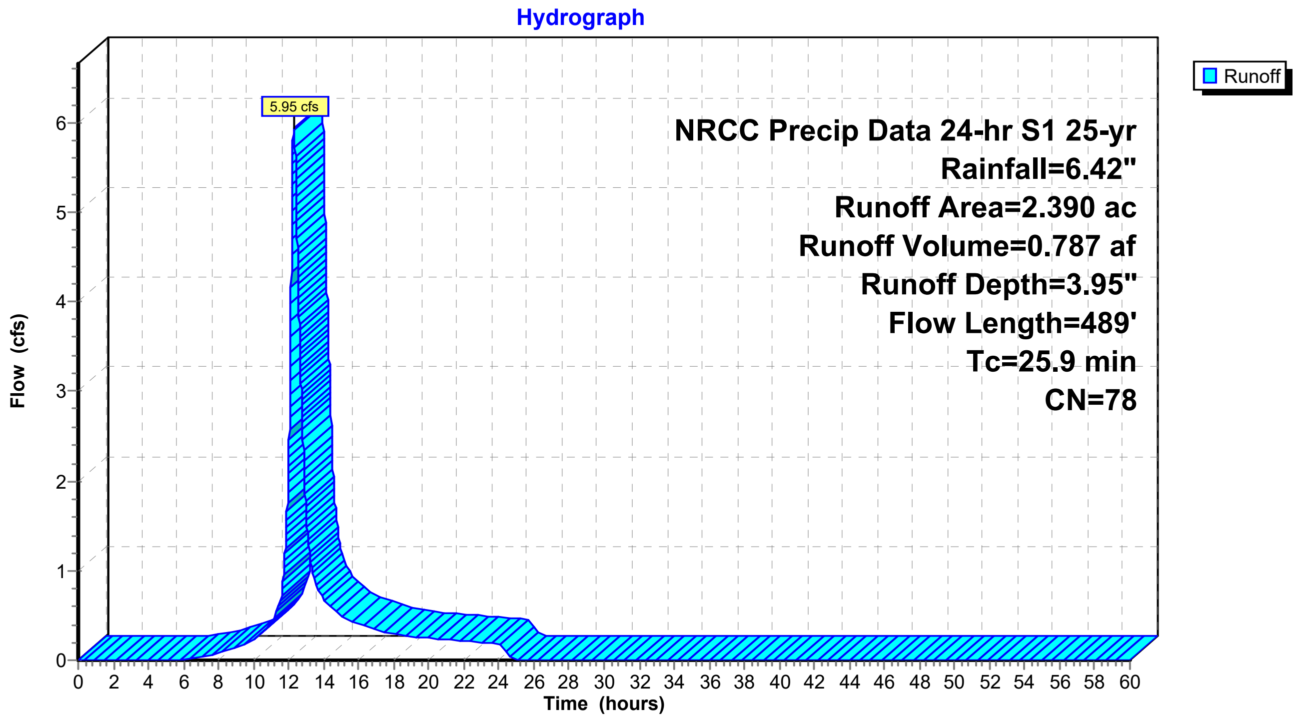
Runoff = 5.95 cfs @ 12.31 hrs, Volume= 0.787 af, Depth= 3.95"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
2.000	77	Woods, Good, HSG D
0.130	98	Paved parking, HSG D
0.260	80	>75% Grass cover, Good, HSG D
2.390	78	Weighted Average
2.260		94.56% Pervious Area
0.130		5.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		**Sheet Flow, Woods Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.44"
5.2	389	0.0620	1.24		**Shallow Concentrated Flow, Woods Shallow Conc** Woodland Kv= 5.0 fps
25.9	489	Total			

Subcatchment EDA 1: EDA 1



Summary for Subcatchment EDA 2: EDA 2

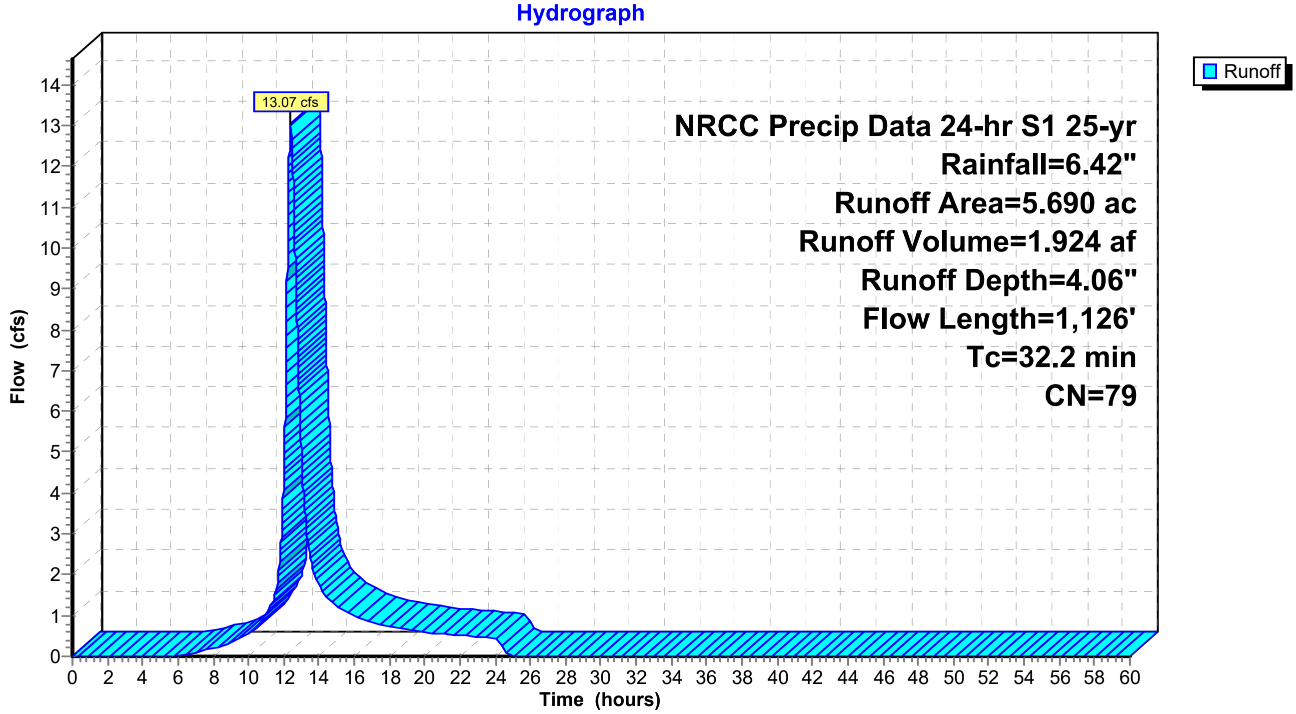
Runoff = 13.07 cfs @ 12.41 hrs, Volume= 1.924 af, Depth= 4.06"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
3.960	77	Woods, Good, HSG D
0.420	70	Woods, Good, HSG C
0.550	98	Paved parking, HSG D
0.760	80	>75% Grass cover, Good, HSG D
5.690	79	Weighted Average
5.140		90.33% Pervious Area
0.550		9.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	100	0.0125	0.07		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.5	168	0.0520	1.14		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
2.8	319	0.0750	1.92		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	539	0.0110	4.74	124.60	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
32.2	1,126	Total			

Subcatchment EDA 2: EDA 2



Summary for Subcatchment EDA 3: EDA 3

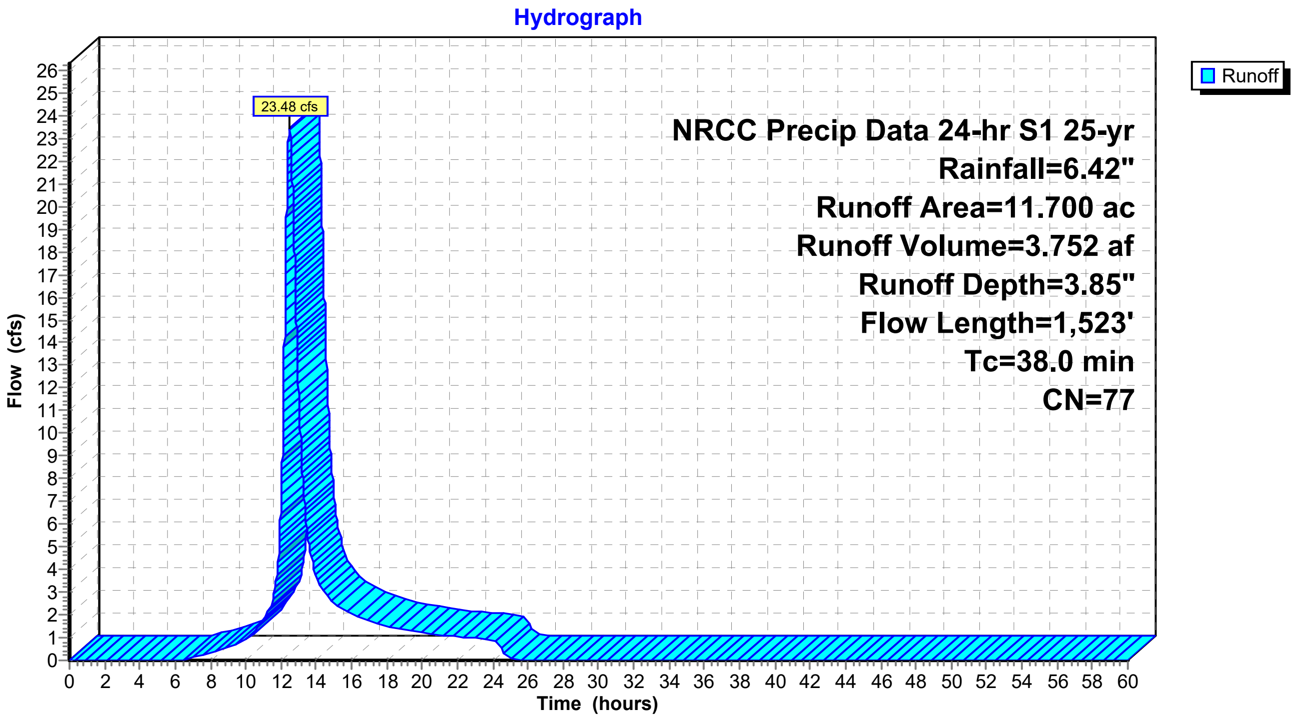
Runoff = 23.48 cfs @ 12.46 hrs, Volume= 3.752 af, Depth= 3.85"
Routed to Link 1L : Pre AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
5.400	77	Woods, Good, HSG D
3.750	70	Woods, Good, HSG C
1.180	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.410	80	>75% Grass cover, Good, HSG D
11.700	77	Weighted Average
10.520		89.91% Pervious Area
1.180		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0325	0.10		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
12.9	577	0.0221	0.74		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	217	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0533	1.15		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods Steep** Woodland Kv= 5.0 fps
1.9	368	0.0050	3.19	84.00	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
38.0	1,523	Total			

Subcatchment EDA 3: EDA 3

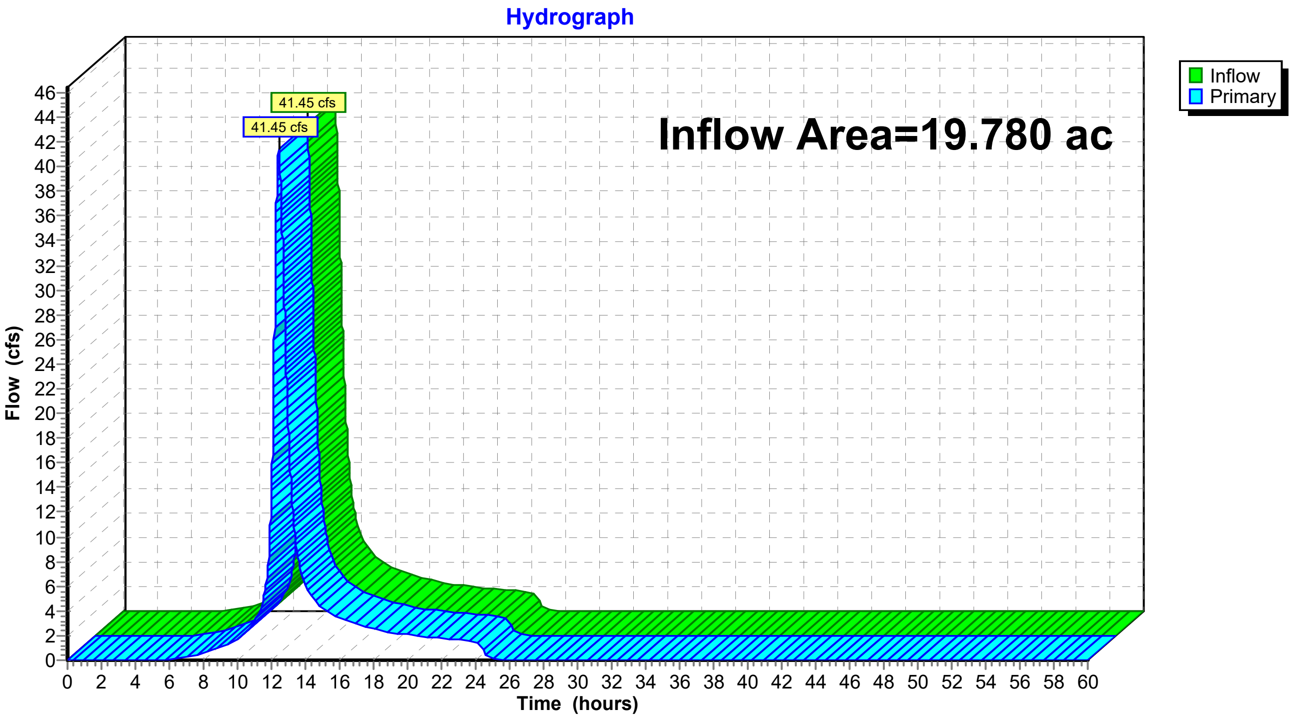


Summary for Link 1L: Pre AP 3

Inflow Area =	19.780 ac,	9.40% Impervious, Inflow Depth = 3.92"	for 25-yr event	
Inflow =	41.45 cfs @	12.42 hrs, Volume=	6.463 af	
Primary =	41.45 cfs @	12.42 hrs, Volume=	6.463 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 1L: Pre AP 3

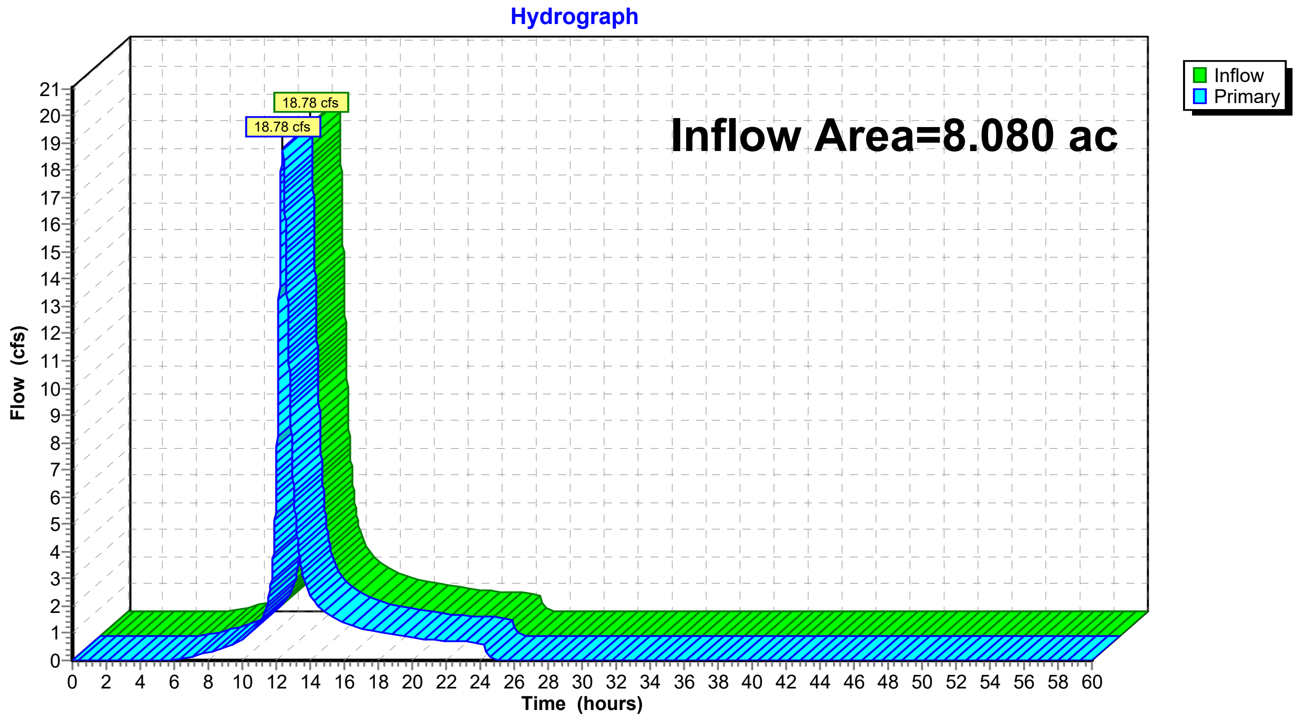


Summary for Link 7L: Pre AP 2

Inflow Area = 8.080 ac, 8.42% Impervious, Inflow Depth = 4.03" for 25-yr event
Inflow = 18.78 cfs @ 12.35 hrs, Volume= 2.711 af
Primary = 18.78 cfs @ 12.35 hrs, Volume= 2.711 af, Atten= 0%, Lag= 0.0 min
Routed to Link 1L : Pre AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 7L: Pre AP 2



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentEDA 1: EDA 1 Runoff Area=2.390 ac 5.44% Impervious Runoff Depth=6.37"
Flow Length=489' Tc=25.9 min CN=78 Runoff=9.24 cfs 1.268 af

SubcatchmentEDA 2: EDA 2 Runoff Area=5.690 ac 9.67% Impervious Runoff Depth=6.49"
Flow Length=1,126' Tc=32.2 min CN=79 Runoff=20.16 cfs 3.078 af

SubcatchmentEDA 3: EDA 3 Runoff Area=11.700 ac 10.09% Impervious Runoff Depth=6.25"
Flow Length=1,523' Tc=38.0 min CN=77 Runoff=37.04 cfs 6.089 af

Link 1L: Pre AP 3 Inflow=64.87 cfs 10.436 af
Primary=64.87 cfs 10.436 af

Link 7L: Pre AP 2 Inflow=29.08 cfs 4.347 af
Primary=29.08 cfs 4.347 af

Total Runoff Area = 19.780 ac Runoff Volume = 10.436 af Average Runoff Depth = 6.33"
90.60% Pervious = 17.920 ac 9.40% Impervious = 1.860 ac

Summary for Subcatchment EDA 1: EDA 1

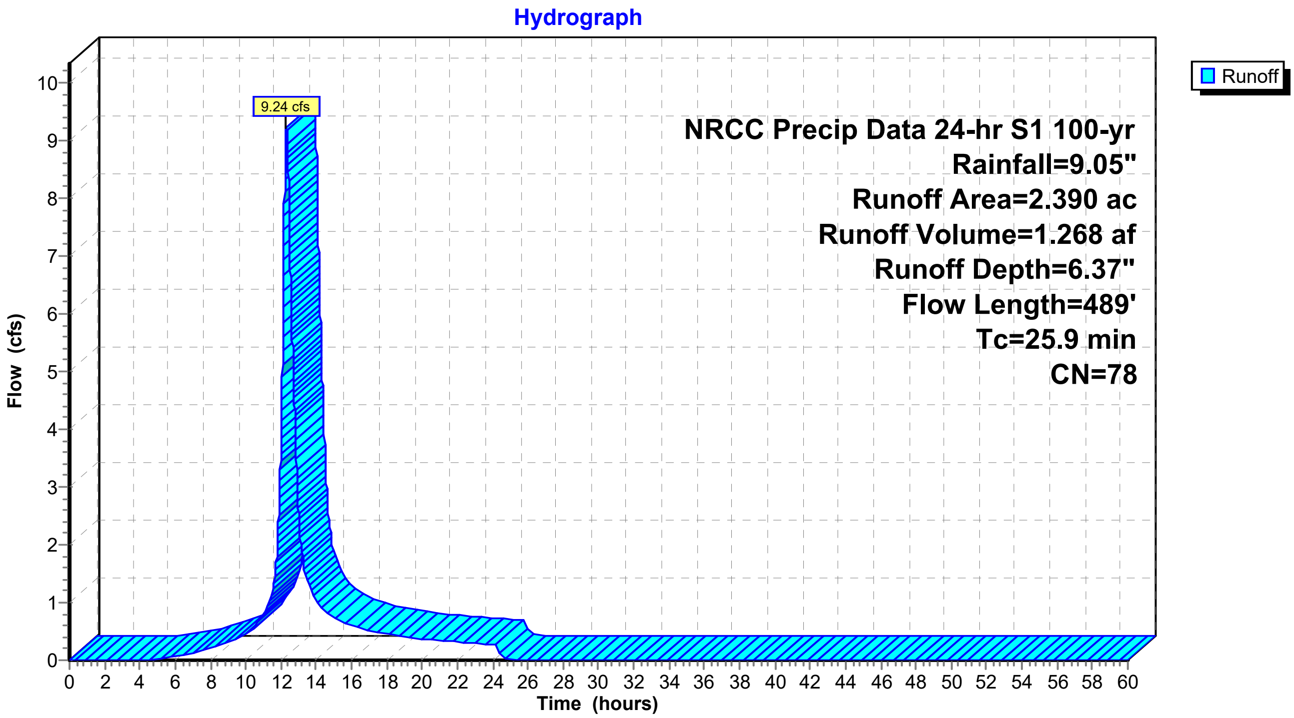
Runoff = 9.24 cfs @ 12.29 hrs, Volume= 1.268 af, Depth= 6.37"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
2.000	77	Woods, Good, HSG D
0.130	98	Paved parking, HSG D
0.260	80	>75% Grass cover, Good, HSG D
2.390	78	Weighted Average
2.260		94.56% Pervious Area
0.130		5.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	100	0.0200	0.08		**Sheet Flow, Woods Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.44"
5.2	389	0.0620	1.24		**Shallow Concentrated Flow, Woods Shallow Conc** Woodland Kv= 5.0 fps
25.9	489	Total			

Subcatchment EDA 1: EDA 1



Summary for Subcatchment EDA 2: EDA 2

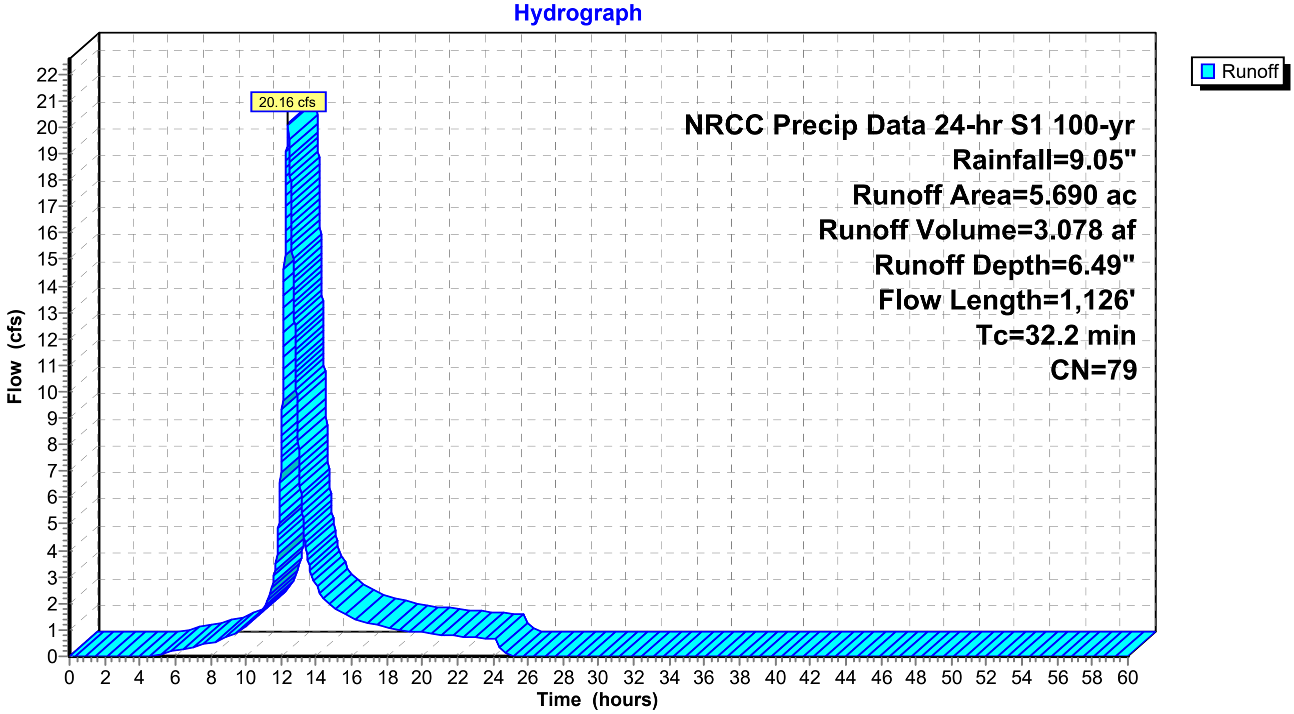
Runoff = 20.16 cfs @ 12.39 hrs, Volume= 3.078 af, Depth= 6.49"
Routed to Link 7L : Pre AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
3.960	77	Woods, Good, HSG D
0.420	70	Woods, Good, HSG C
0.550	98	Paved parking, HSG D
0.760	80	>75% Grass cover, Good, HSG D
5.690	79	Weighted Average
5.140		90.33% Pervious Area
0.550		9.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	100	0.0125	0.07		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.5	168	0.0520	1.14		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
2.8	319	0.0750	1.92		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	539	0.0110	4.74	124.60	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
32.2	1,126	Total			

Subcatchment EDA 2: EDA 2



Summary for Subcatchment EDA 3: EDA 3

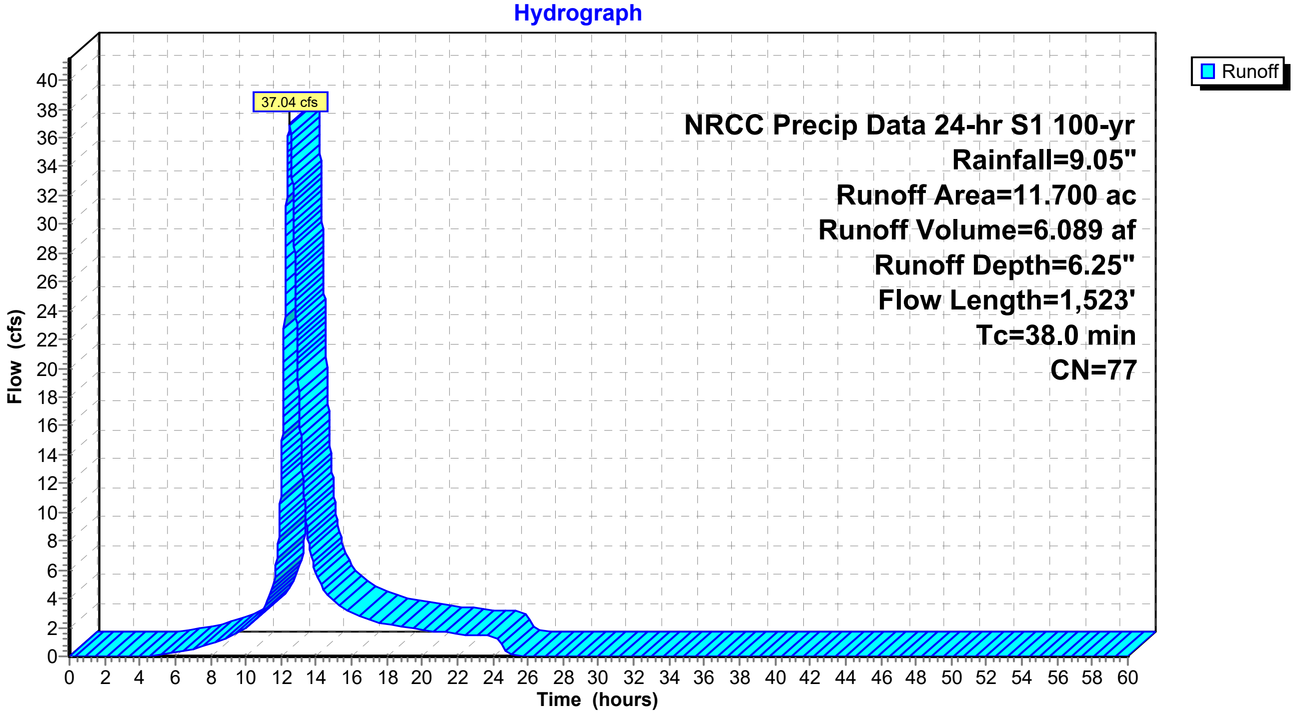
Runoff = 37.04 cfs @ 12.46 hrs, Volume= 6.089 af, Depth= 6.25"
Routed to Link 1L : Pre AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
5.400	77	Woods, Good, HSG D
3.750	70	Woods, Good, HSG C
1.180	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.410	80	>75% Grass cover, Good, HSG D
11.700	77	Weighted Average
10.520		89.91% Pervious Area
1.180		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0325	0.10		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
12.9	577	0.0221	0.74		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	217	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0533	1.15		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods Steep** Woodland Kv= 5.0 fps
1.9	368	0.0050	3.19	84.00	**Channel Flow, Channel - Stream** Area= 26.3 sf Perim= 30.2' r= 0.87' n= 0.030
38.0	1,523	Total			

Subcatchment EDA 3: EDA 3

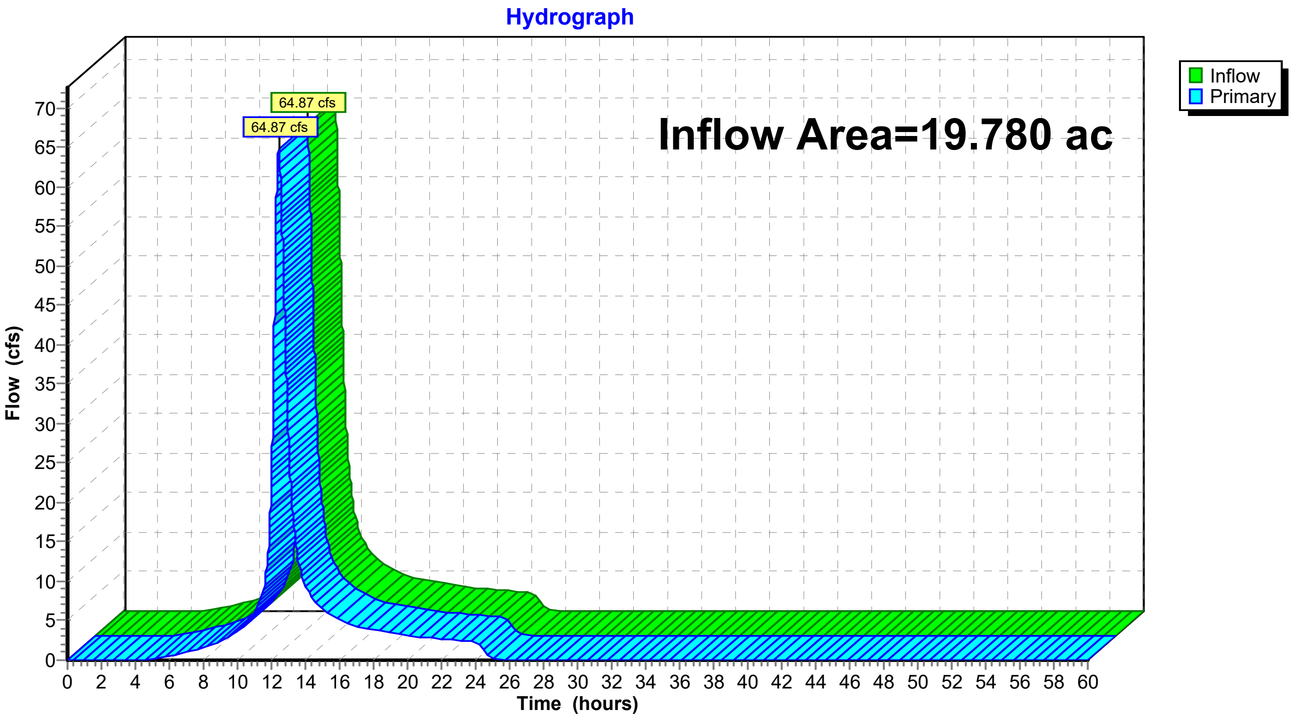


Summary for Link 1L: Pre AP 3

Inflow Area = 19.780 ac, 9.40% Impervious, Inflow Depth = 6.33" for 100-yr event
Inflow = 64.87 cfs @ 12.42 hrs, Volume= 10.436 af
Primary = 64.87 cfs @ 12.42 hrs, Volume= 10.436 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 1L: Pre AP 3

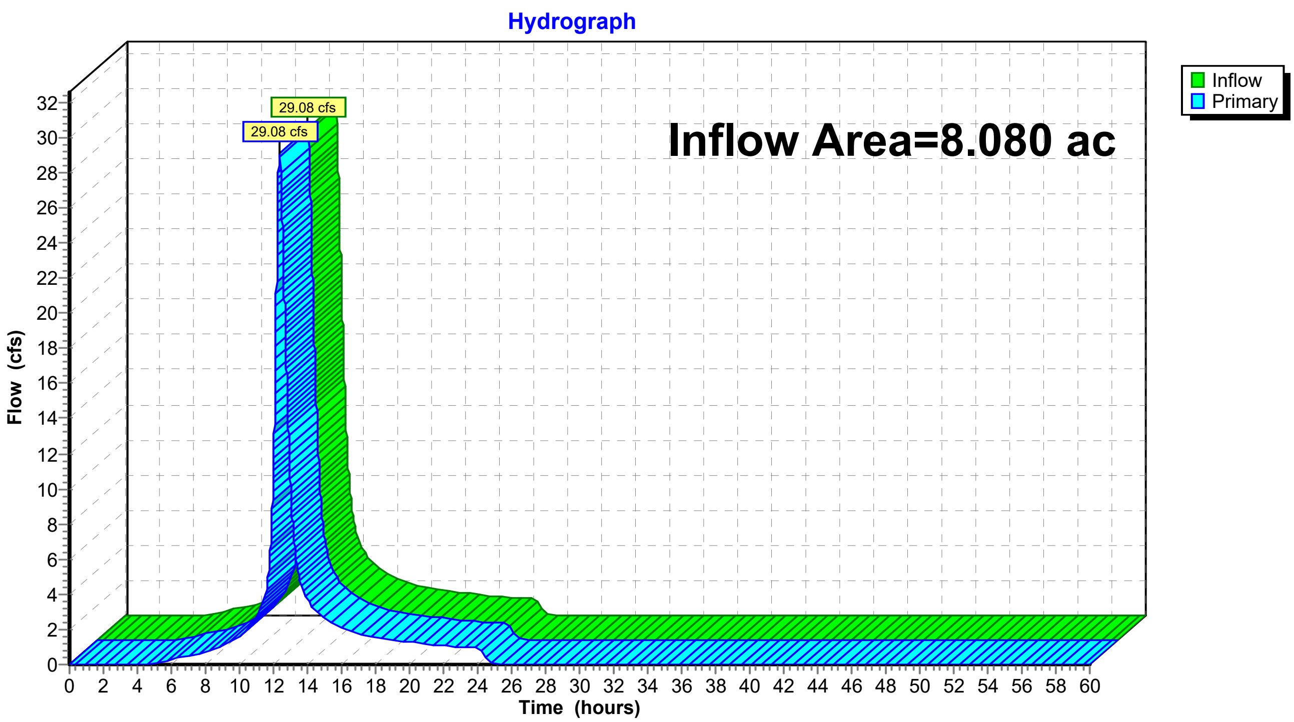


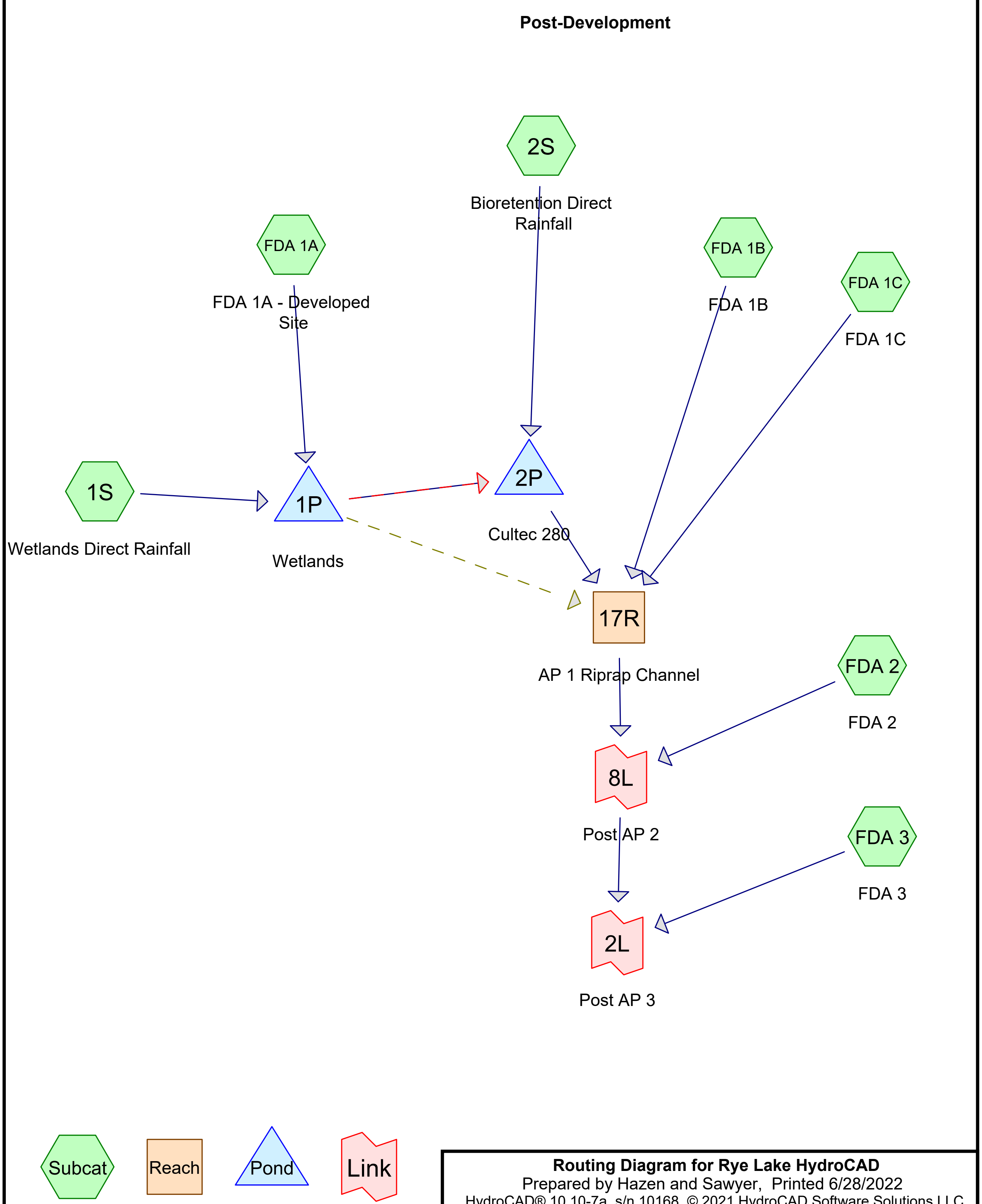
Summary for Link 7L: Pre AP 2

Inflow Area = 8.080 ac, 8.42% Impervious, Inflow Depth = 6.46" for 100-yr event
Inflow = 29.08 cfs @ 12.35 hrs, Volume= 4.347 af
Primary = 29.08 cfs @ 12.35 hrs, Volume= 4.347 af, Atten= 0%, Lag= 0.0 min
Routed to Link 1L : Pre AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 7L: Pre AP 2





Routing Diagram for Rye Lake HydroCAD
Prepared by Hazen and Sawyer, Printed 6/28/2022
HydroCAD® 10.10-7a s/n 10168 © 2021 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	NRCC Precip Data 24-hr S1	1-yr	Default	24.00	1	2.83	2
2	10-yr	NRCC Precip Data 24-hr S1	10-yr	Default	24.00	1	5.11	2
3	25-yr	NRCC Precip Data 24-hr S1	25-yr	Default	24.00	1	6.42	2
4	100-yr	NRCC Precip Data 24-hr S1	100-yr	Default	24.00	1	9.05	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.170	74	>75% Grass cover, Good, HSG C (FDA 1B, FDA 3)
3.640	80	>75% Grass cover, Good, HSG D (FDA 1A, FDA 1B, FDA 1C, FDA 2, FDA 3)
0.460	98	Bioretention Cell Surface (2S)
2.880	98	Paved parking, HSG D (FDA 1A, FDA 1C, FDA 2, FDA 3)
0.870	98	Roofs, HSG D (FDA 1A)
0.420	98	Wetland Permanent Pool (1S)
3.540	70	Woods, Good, HSG C (FDA 1B, FDA 2, FDA 3)
6.660	77	Woods, Good, HSG D (FDA 1C, FDA 2, FDA 3)
19.640	**81**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.710	HSG C	FDA 1B, FDA 2, FDA 3
14.050	HSG D	FDA 1A, FDA 1B, FDA 1C, FDA 2, FDA 3
0.880	Other	1S, 2S
19.640		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.170	3.640	0.000	4.810	>75% Grass cover, Good	FDA 1A, FDA 1B, FDA 1C, FDA 2, FDA 3
0.000	0.000	0.000	0.000	0.460	0.460	Bioretention Cell Surface	2S
0.000	0.000	0.000	2.880	0.000	2.880	Paved parking	FDA 1A, FDA 1C, FDA 2, FDA 3
0.000	0.000	0.000	0.870	0.000	0.870	Roofs	FDA 1A
0.000	0.000	0.000	0.000	0.420	0.420	Wetland Permanent Pool	1S
0.000	0.000	3.540	6.660	0.000	10.200	Woods, Good	FDA 1B, FDA 1C, FDA 2, FDA 3
0.000	**0.000**	**4.710**	**14.050**	**0.880**	**19.640**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	FDA 1B	0.00	0.00	512.0	0.0075	0.013	0.0	15.0	0.0
2	FDA 1B	0.00	0.00	241.0	0.0150	0.013	0.0	24.0	0.0
3	1P	396.50	395.50	35.7	0.0280	0.010	0.0	12.0	0.0
4	1P	390.97	390.56	31.7	0.0129	0.013	0.0	15.0	0.0
5	2P	389.20	386.91	152.7	0.0150	0.013	0.0	24.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Wetlands Direct Runoff Area=0.420 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=1.50 cfs 0.091 af

Subcatchment2S: Bioretention Direct Runoff Area=0.460 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=1.64 cfs 0.100 af

SubcatchmentFDA 1A: FDA 1A - Runoff Area=3.100 ac 69.68% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=93 Runoff=8.32 cfs 0.540 af

SubcatchmentFDA 1B: FDA 1B Runoff Area=0.870 ac 0.00% Impervious Runoff Depth=0.75"
Flow Length=956' Tc=17.9 min CN=73 Runoff=0.47 cfs 0.055 af

SubcatchmentFDA 1C: FDA 1C Runoff Area=1.030 ac 0.97% Impervious Runoff Depth=1.07"
Flow Length=214' Tc=14.8 min CN=79 Runoff=0.94 cfs 0.091 af

SubcatchmentFDA 2: FDA 2 Runoff Area=5.720 ac 10.66% Impervious Runoff Depth=1.07"
Flow Length=454' Tc=16.7 min CN=79 Runoff=4.91 cfs 0.508 af

SubcatchmentFDA 3: FDA 3 Runoff Area=8.040 ac 12.06% Impervious Runoff Depth=1.01"
Flow Length=1,370' Tc=32.8 min CN=78 Runoff=4.58 cfs 0.676 af

Reach 17R: AP 1 Riprap Channel Avg. Flow Depth=0.20' Max Vel=0.91 fps Inflow=1.38 cfs 0.702 af
n=0.078 L=90.0' S=0.0222 '/' Capacity=50.49 cfs Outflow=1.37 cfs 0.702 af

Pond 1P: Wetlands Peak Elev=397.52' Storage=18,690 cf Inflow=8.89 cfs 0.631 af
Primary=0.22 cfs 0.587 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=0.22 cfs 0.587 af

Pond 2P: Cultec 280 Peak Elev=390.29' Storage=8,066 cf Inflow=1.78 cfs 0.687 af
Outflow=0.23 cfs 0.556 af

Link 2L: Post AP 3 Inflow=9.35 cfs 1.886 af
Primary=9.35 cfs 1.886 af

Link 8L: Post AP 2 Inflow=6.27 cfs 1.210 af
Primary=6.27 cfs 1.210 af

Total Runoff Area = 19.640 ac Runoff Volume = 2.061 af Average Runoff Depth = 1.26"
76.43% Pervious = 15.010 ac 23.57% Impervious = 4.630 ac

Summary for Subcatchment 1S: Wetlands Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

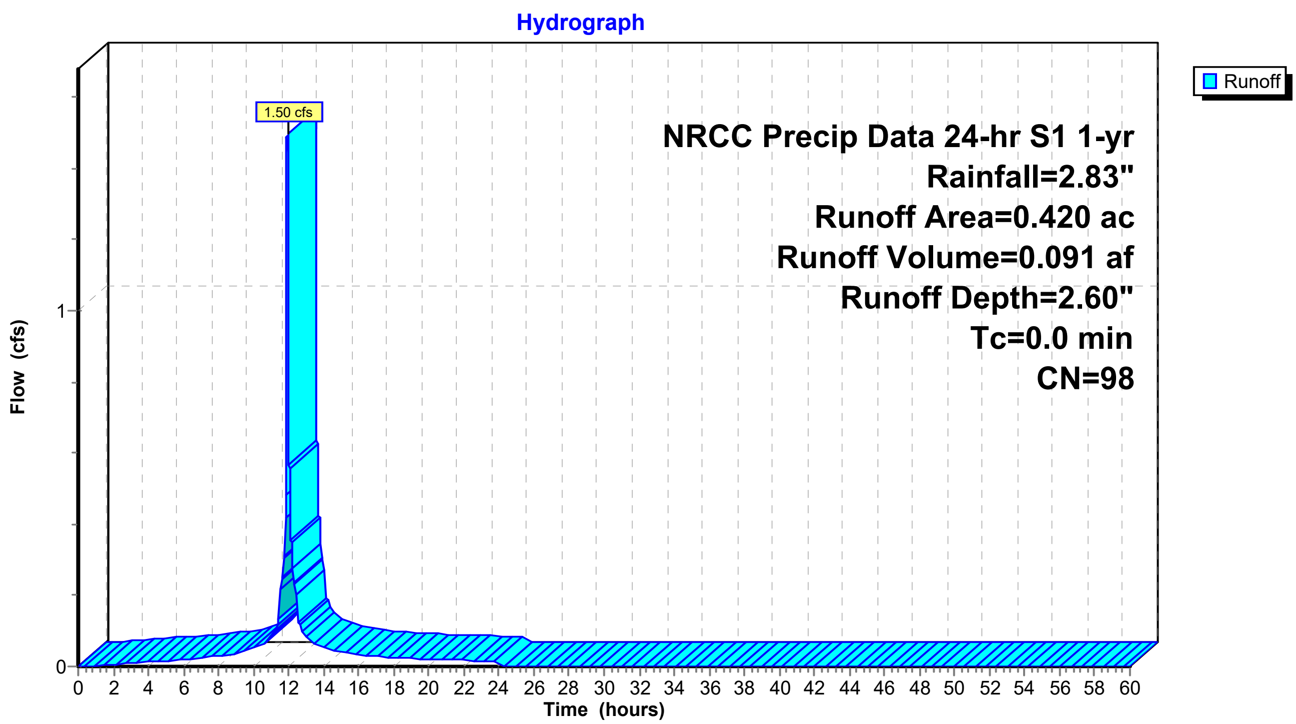
Runoff = 1.50 cfs @ 11.99 hrs, Volume= 0.091 af, Depth= 2.60"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

	Area (ac)	CN	Description
*	0.420	98	Wetland Permanent Pool
	0.420		100.00% Impervious Area

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

Subcatchment 1S: Wetlands Direct Rainfall



Summary for Subcatchment 2S: Bioretention Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

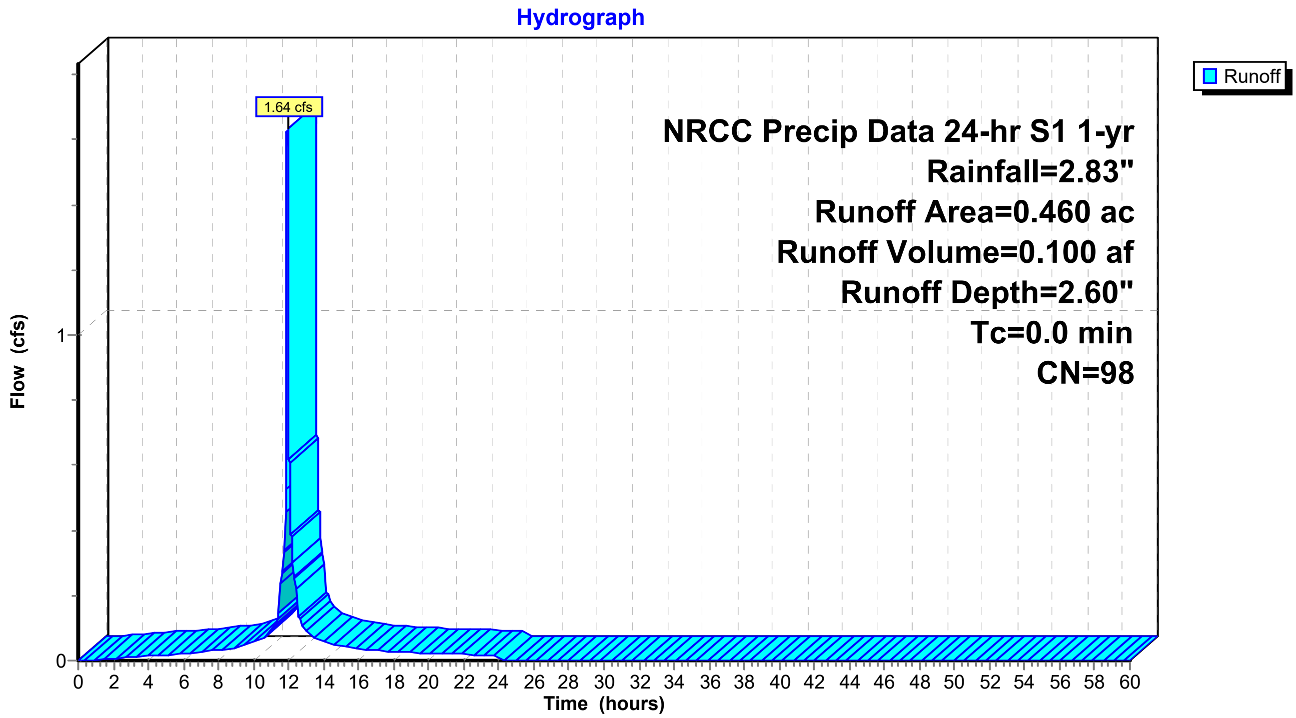
Runoff = 1.64 cfs @ 11.99 hrs, Volume= 0.100 af, Depth= 2.60"
Routed to Pond 2P : Cultec 280

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

	Area (ac)	CN	Description
*	0.460	98	Bioretention Cell Surface
	0.460		100.00% Impervious Area

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

Subcatchment 2S: Bioretention Direct Rainfall



Summary for Subcatchment FDA 1A: FDA 1A - Developed Site

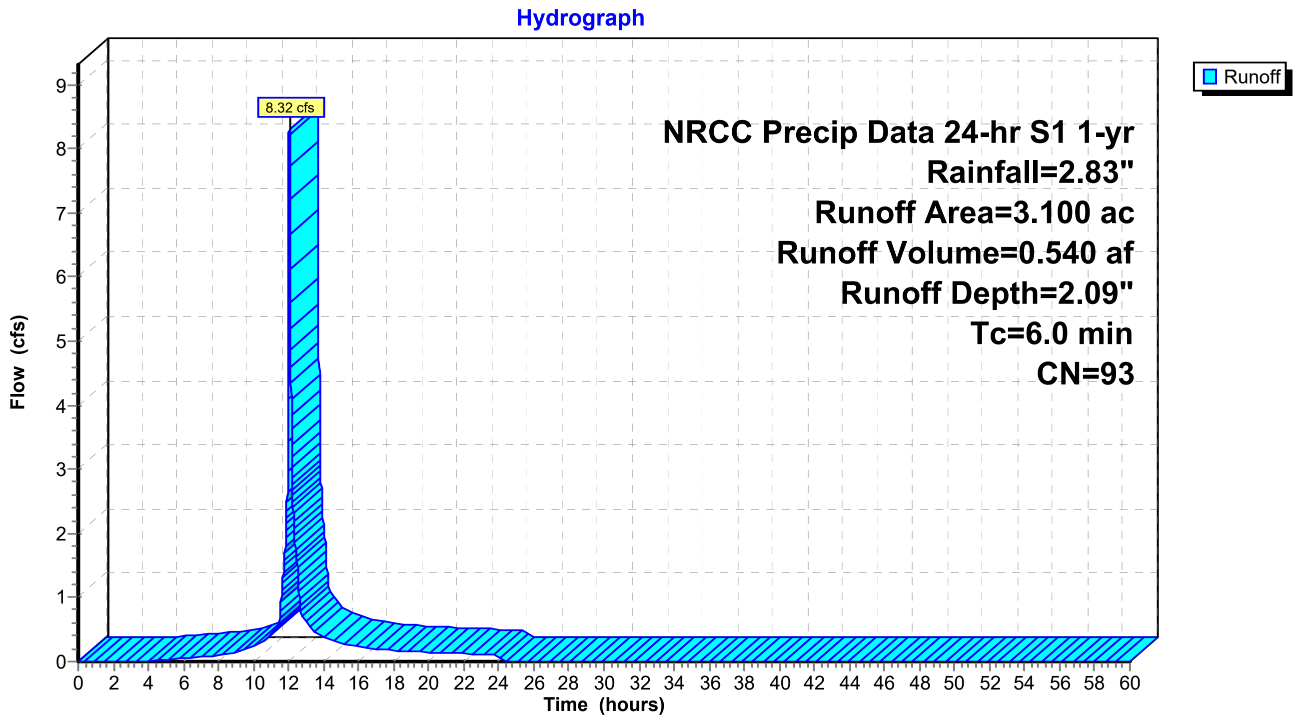
Runoff = 8.32 cfs @ 12.04 hrs, Volume= 0.540 af, Depth= 2.09"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
1.290	98	Paved parking, HSG D
0.870	98	Roofs, HSG D
0.940	80	>75% Grass cover, Good, HSG D
3.100	93	Weighted Average
0.940		30.32% Pervious Area
2.160		69.68% Impervious Area

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

Subcatchment FDA 1A: FDA 1A - Developed Site



Summary for Subcatchment FDA 1B: FDA 1B

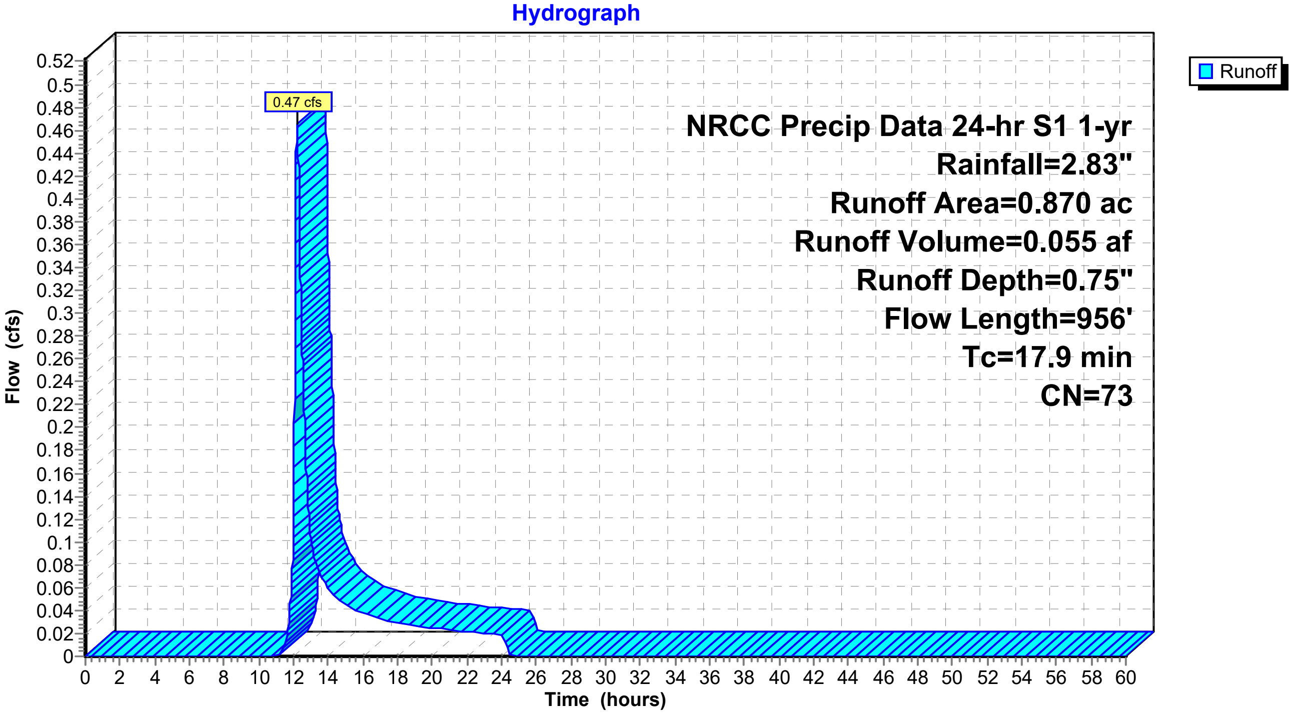
Runoff = 0.47 cfs @ 12.22 hrs, Volume= 0.055 af, Depth= 0.75"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
0.210	74	>75% Grass cover, Good, HSG C
0.220	80	>75% Grass cover, Good, HSG D
0.440	70	Woods, Good, HSG C
0.870	73	Weighted Average
0.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.0500	0.12		**Sheet Flow, Sheets Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	79	0.0700	1.32		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
0.1	24	0.1880	3.04		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	512	0.0075	4.56	5.59	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.5	241	0.0150	8.82	27.71	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
17.9	956	Total			

Subcatchment FDA 1B: FDA 1B



Summary for Subcatchment FDA 1C: FDA 1C

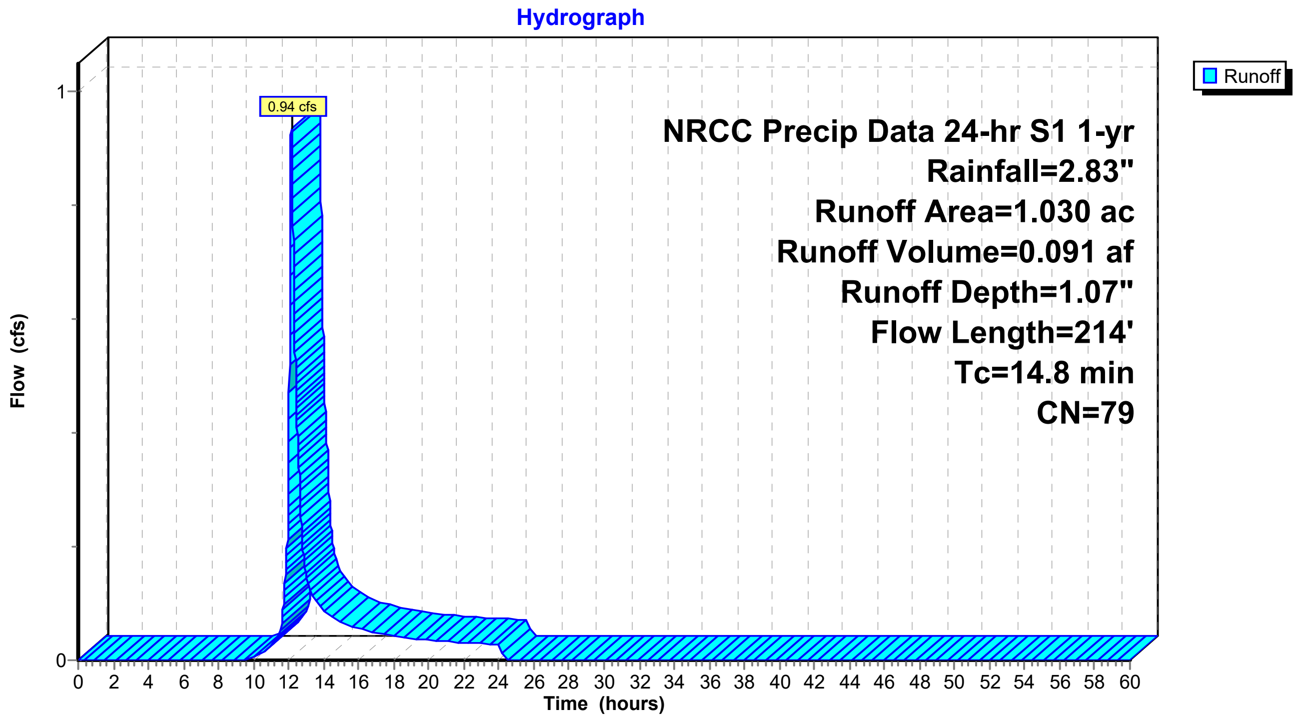
Runoff = 0.94 cfs @ 12.16 hrs, Volume= 0.091 af, Depth= 1.07"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
0.490	77	Woods, Good, HSG D
0.010	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
1.030	79	Weighted Average
1.020		99.03% Pervious Area
0.010		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0600	0.12		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.5	114	0.0660	1.28		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
14.8	214	Total			

Subcatchment FDA 1C: FDA 1C



Summary for Subcatchment FDA 2: FDA 2

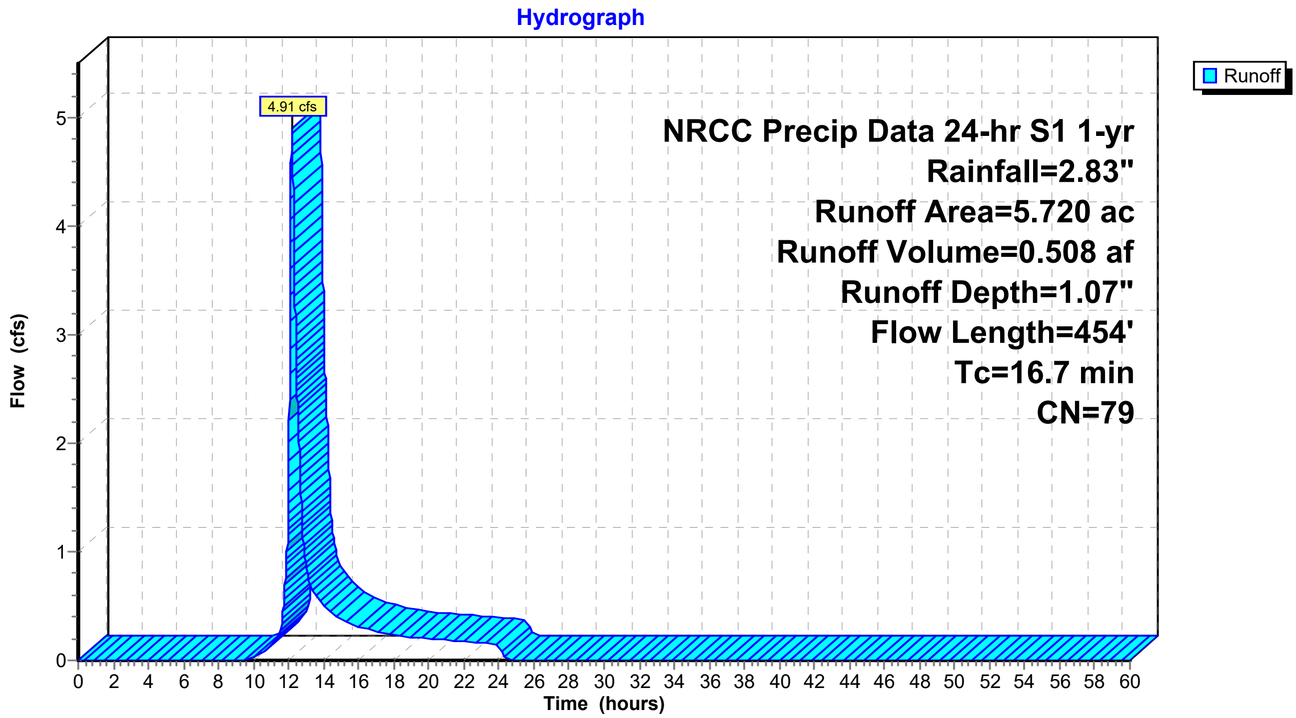
Runoff = 4.91 cfs @ 12.19 hrs, Volume= 0.508 af, Depth= 1.07"
Routed to Link 8L : Post AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
2.990	77	Woods, Good, HSG D
1.000	70	Woods, Good, HSG C
0.610	98	Paved parking, HSG D
1.120	80	>75% Grass cover, Good, HSG D
5.720	79	Weighted Average
5.110		89.34% Pervious Area
0.610		10.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0750	0.14		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.4	165	0.0515	1.13		**Shallow Concentrated Flow, Shallow Conc** Woodland Kv= 5.0 fps
1.9	135	0.0300	1.21		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
0.2	54	0.8300	4.56		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
16.7	454	Total			

Subcatchment FDA 2: FDA 2



Summary for Subcatchment FDA 3: FDA 3

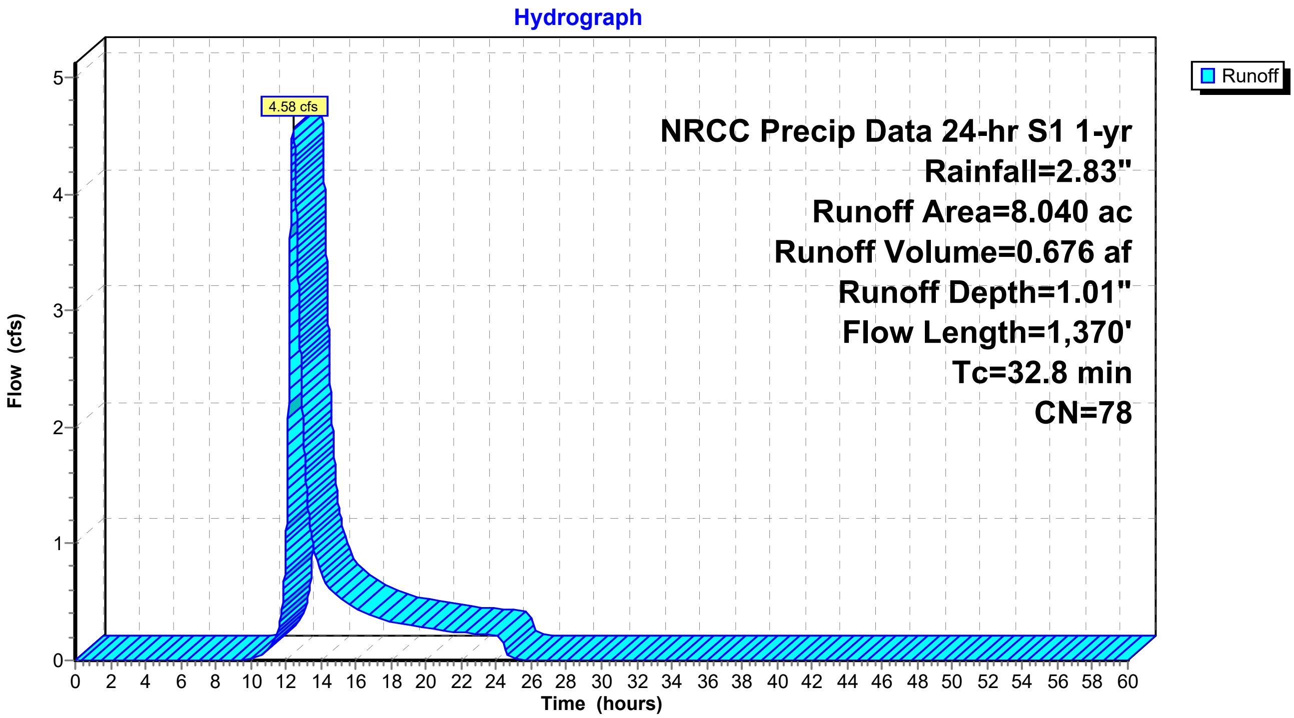
Runoff = 4.58 cfs @ 12.43 hrs, Volume= 0.676 af, Depth= 1.01"
Routed to Link 2L : Post AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 1-yr Rainfall=2.83"

Area (ac)	CN	Description
3.180	77	Woods, Good, HSG D
2.100	70	Woods, Good, HSG C
0.970	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.830	80	>75% Grass cover, Good, HSG D
8.040	78	Weighted Average
7.070		87.94% Pervious Area
0.970		12.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0400	0.11		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
9.2	423	0.0236	0.77		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	218	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0540	1.16		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
1.8	368	0.0050	3.49	146.64	**Channel Flow, Channel Stream** Area= 42.0 sf Perim= 42.2' r= 1.00' n= 0.030
32.8	1,370	Total			

Subcatchment FDA 3: FDA 3



Summary for Reach 17R: AP 1 Riprap Channel

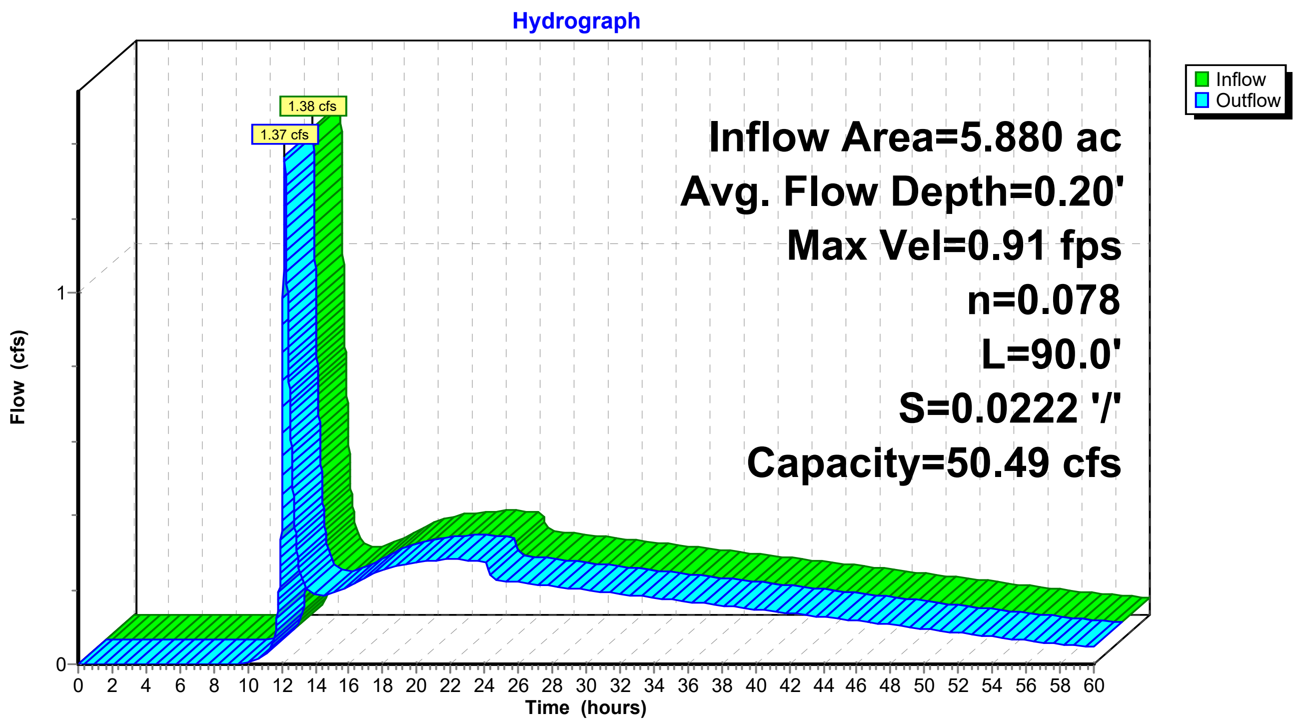
Inflow Area = 5.880 ac, 51.87% Impervious, Inflow Depth > 1.43" for 1-yr event
Inflow = 1.38 cfs @ 12.18 hrs, Volume= 0.702 af
Outflow = 1.37 cfs @ 12.20 hrs, Volume= 0.702 af, Atten= 1%, Lag= 1.0 min
Routed to Link 8L : Post AP 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.91 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.40 fps, Avg. Travel Time= 3.8 min

Peak Storage= 135 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.20' , Surface Width= 8.19'
Bank-Full Depth= 1.50' Flow Area= 17.3 sf, Capacity= 50.49 cfs

7.00' x 1.50' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 90.0' Slope= 0.0222 '/'
Inlet Invert= 380.00', Outlet Invert= 378.00'

Reach 17R: AP 1 Riprap Channel



Summary for Pond 1P: Wetlands

Inflow Area = 3.520 ac, 73.30% Impervious, Inflow Depth = 2.15" for 1-yr event
Inflow = 8.89 cfs @ 12.04 hrs, Volume= 0.631 af
Outflow = 0.22 cfs @ 17.18 hrs, Volume= 0.587 af, Atten= 97%, Lag= 308.4 min
Primary = 0.22 cfs @ 17.18 hrs, Volume= 0.587 af
Routed to Pond 2P : Cultec 280
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 2P : Cultec 280
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 397.52' @ 17.18 hrs Surf.Area= 20,632 sf Storage= 18,690 cf

Plug-Flow detention time= 994.4 min calculated for 0.587 af (93% of inflow)
Center-of-Mass det. time= 954.7 min (1,754.8 - 800.1)

Volume	Invert	Avail.Storage	Storage Description
#1	396.50'	54,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
396.50	15,835	0	0
397.00	18,271	8,527	8,527
398.00	22,789	20,530	29,057
398.50	24,171	11,740	40,797
399.00	30,553	13,681	54,478

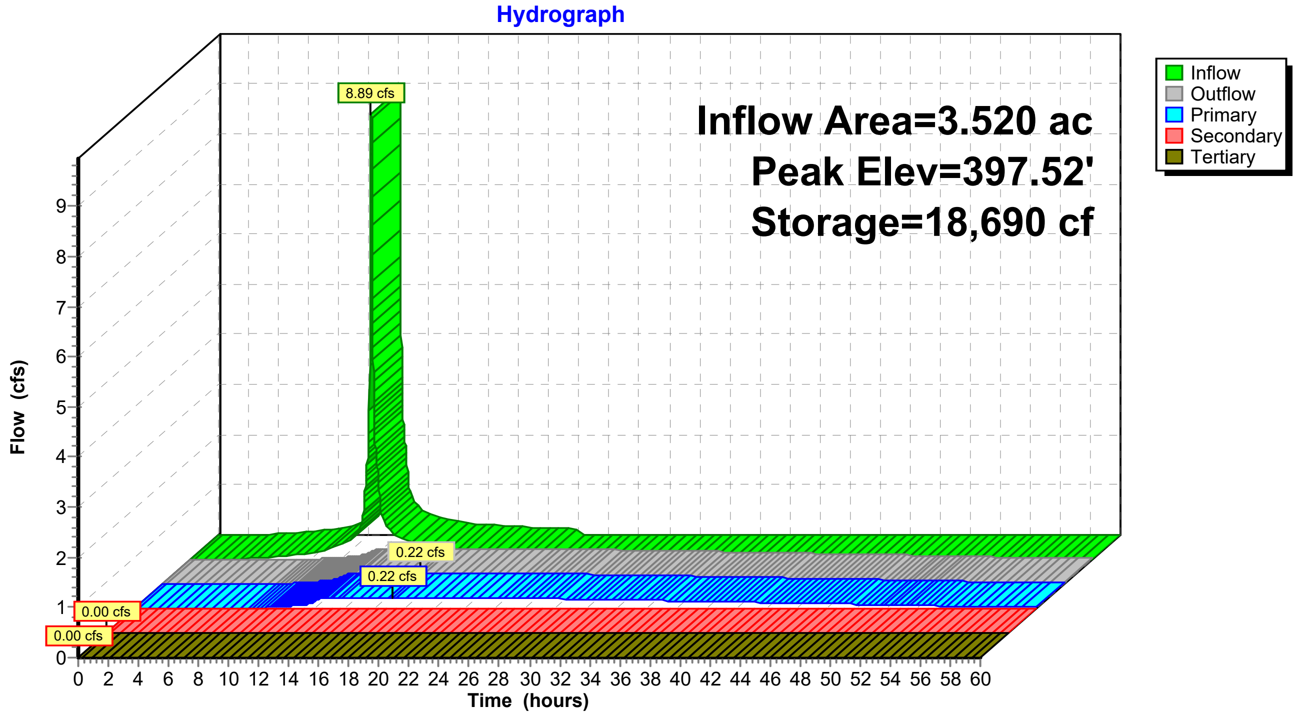
Device	Routing	Invert	Outlet Devices
#1	Primary	396.50'	**12.0" Round Culvert** L= 35.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 396.50' / 395.50' S= 0.0280 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	396.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	390.97'	**15.0" Round Culvert** L= 31.7' Ke= 0.500 Inlet / Outlet Invert= 390.97' / 390.56' S= 0.0129 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#4	Device 3	397.60'	**7.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#5	Tertiary	398.50'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.22 cfs @ 17.18 hrs HW=397.52' TW=390.24' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.22 cfs of 2.73 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.22 cfs @ 4.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=396.50' TW=389.54' (Dynamic Tailwater)
└─**3=Culvert** (Passes 0.00 cfs of 13.09 cfs potential flow)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=396.50' TW=380.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Wetlands



Summary for Pond 2P: Cultec 280

Inflow Area = 3.980 ac, 76.38% Impervious, Inflow Depth > 2.07" for 1-yr event
Inflow = 1.78 cfs @ 11.99 hrs, Volume= 0.687 af
Outflow = 0.23 cfs @ 23.99 hrs, Volume= 0.556 af, Atten= 87%, Lag= 719.8 min
Primary = 0.23 cfs @ 23.99 hrs, Volume= 0.556 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 390.29' @ 23.99 hrs Surf.Area= 19,043 sf Storage= 8,066 cf

Plug-Flow detention time= 660.3 min calculated for 0.556 af (81% of inflow)
Center-of-Mass det. time= 374.9 min (1,984.8 - 1,609.9)

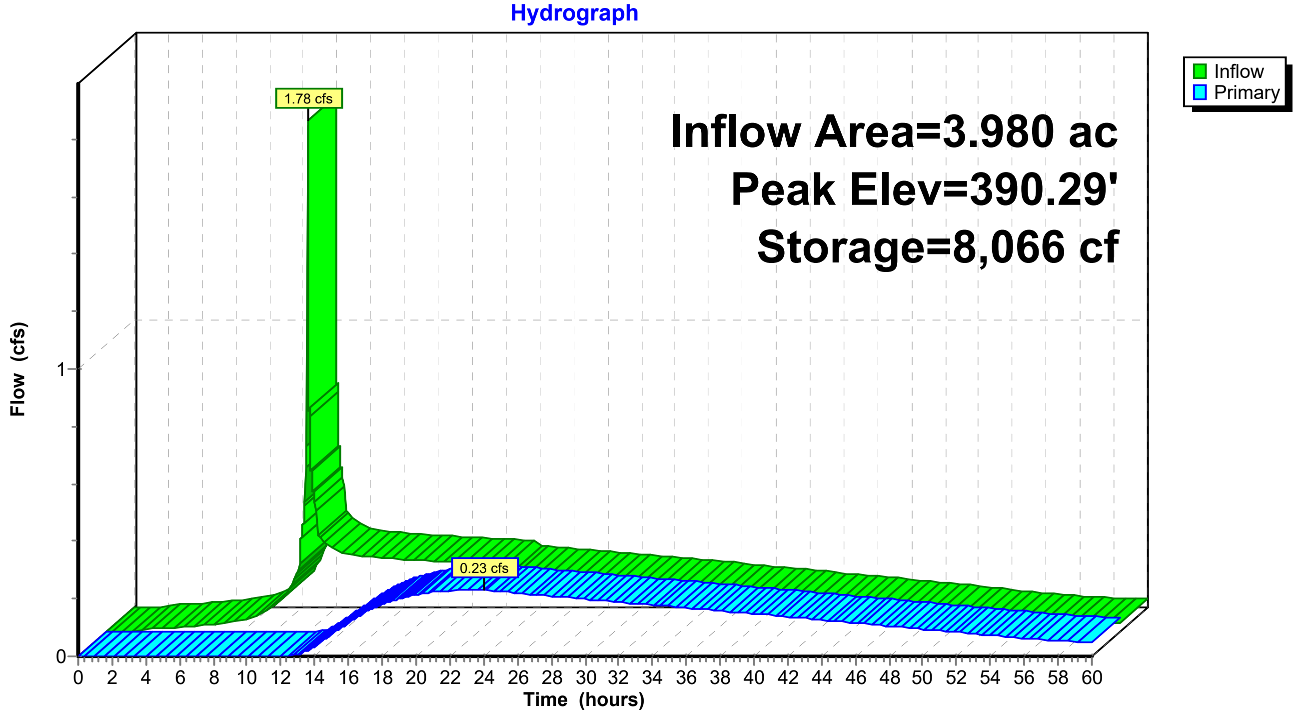
Volume	Invert	Avail.Storage	Storage Description
#1	389.54'	14,302 cf	**Chamber Stone (Prismatic)** Listed below (Recalc) 61,128 cf Overall - 25,374 cf Embedded = 35,754 cf x 40.0% Voids
#2	390.04'	25,374 cf	**Cultec R-280HD** x 597 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
		39,676 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
389.54	19,043	0	0
392.75	19,043	61,128	61,128

Device	Routing	Invert	Outlet Devices
#1	Primary	389.20'	**24.0" Round Culvert** L= 152.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 389.20' / 386.91' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	390.04'	**10.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	391.50'	**40.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.23 cfs @ 23.99 hrs HW=390.29' TW=380.08' (Dynamic Tailwater)
1=Culvert (Passes 0.23 cfs of 6.21 cfs potential flow)
2=Orifice/Grate (Orifice Controls 0.23 cfs @ 1.70 fps)
3=Orifice/Grate (Controls 0.00 cfs)

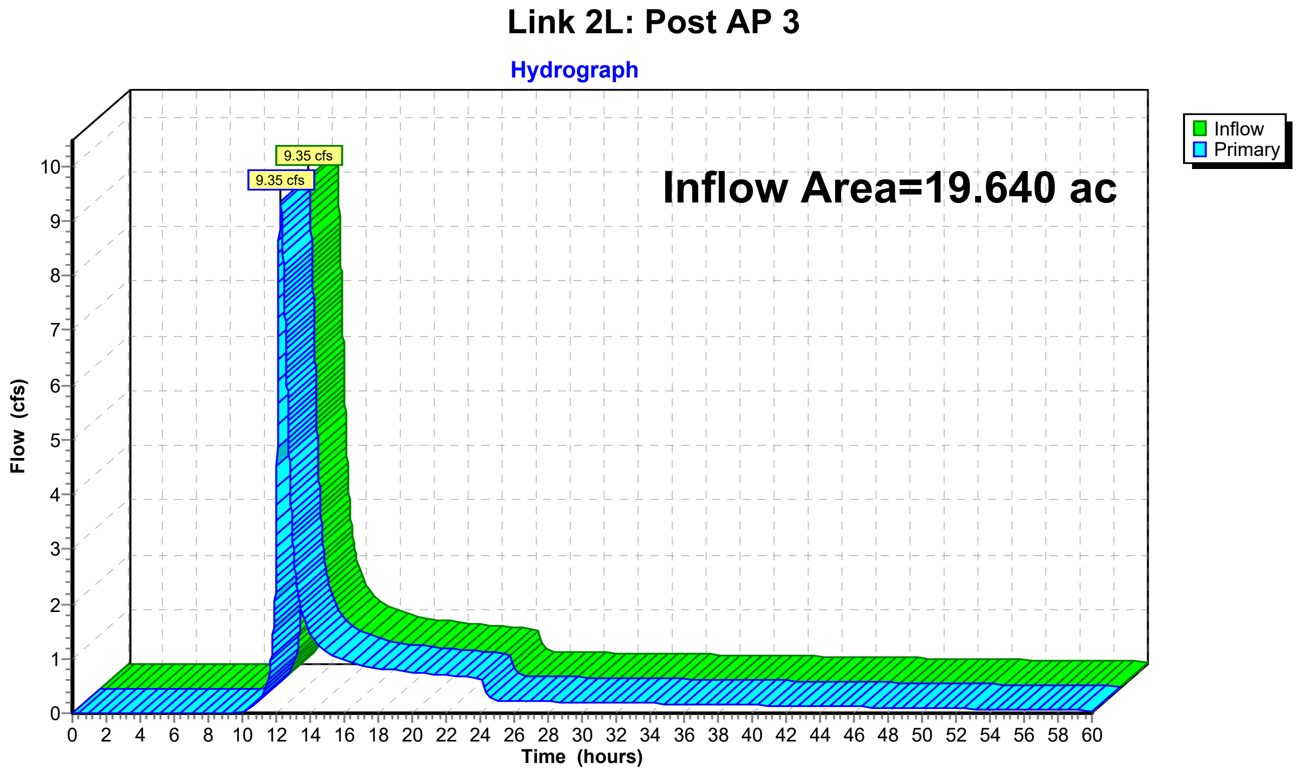
Pond 2P: Cultec 280



Summary for Link 2L: Post AP 3

Inflow Area = 19.640 ac, 23.57% Impervious, Inflow Depth > 1.15" for 1-yr event
Inflow = 9.35 cfs @ 12.25 hrs, Volume= 1.886 af
Primary = 9.35 cfs @ 12.25 hrs, Volume= 1.886 af, Atten= 0%, Lag= 0.0 min

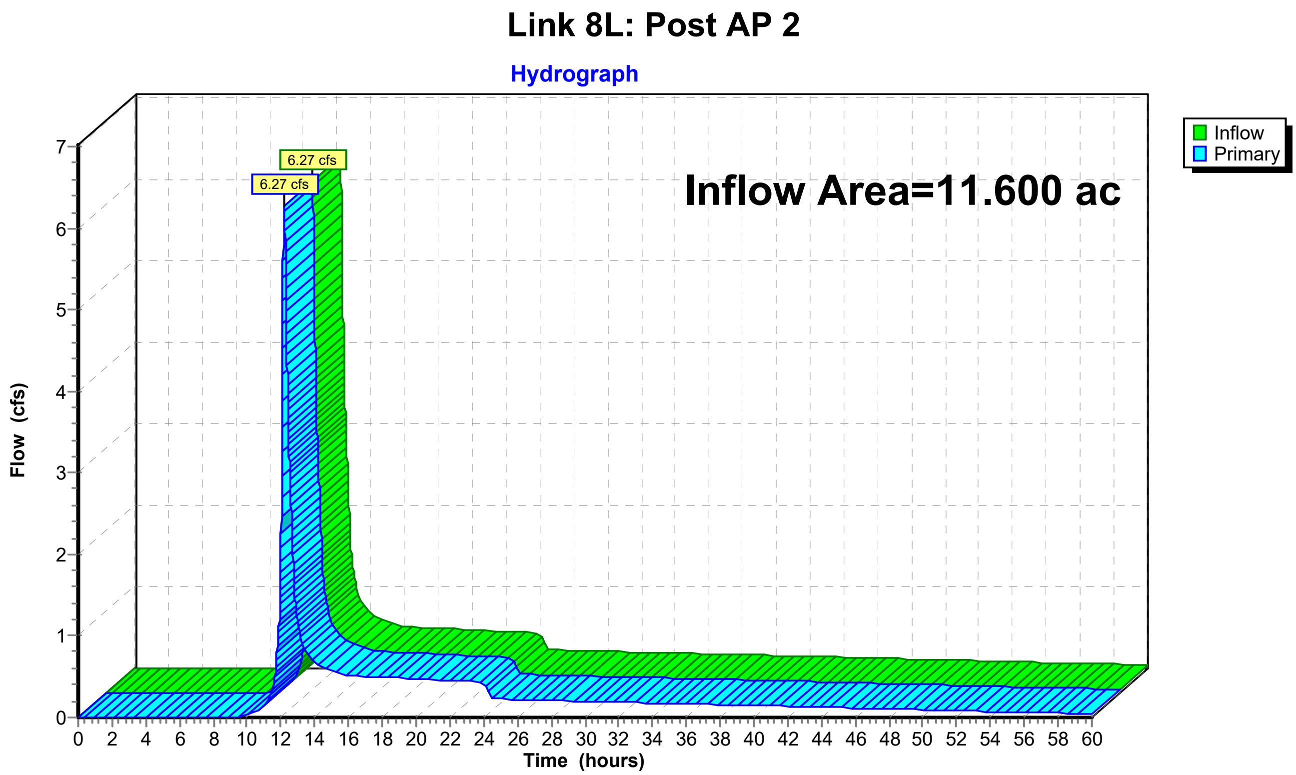
Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs



Summary for Link 8L: Post AP 2

Inflow Area = 11.600 ac, 31.55% Impervious, Inflow Depth > 1.25" for 1-yr event
Inflow = 6.27 cfs @ 12.19 hrs, Volume= 1.210 af
Primary = 6.27 cfs @ 12.19 hrs, Volume= 1.210 af, Atten= 0%, Lag= 0.0 min
Routed to Link 2L : Post AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Wetlands Direct Runoff Area=0.420 ac 100.00% Impervious Runoff Depth=4.87"
Tc=0.0 min CN=98 Runoff=2.49 cfs 0.171 af

Subcatchment2S: Bioretention Direct Runoff Area=0.460 ac 100.00% Impervious Runoff Depth=4.87"
Tc=0.0 min CN=98 Runoff=2.73 cfs 0.187 af

SubcatchmentFDA 1A: FDA 1A - Runoff Area=3.100 ac 69.68% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=93 Runoff=15.19 cfs 1.112 af

SubcatchmentFDA 1B: FDA 1B Runoff Area=0.870 ac 0.00% Impervious Runoff Depth=2.37"
Flow Length=956' Tc=17.9 min CN=73 Runoff=1.57 cfs 0.172 af

SubcatchmentFDA 1C: FDA 1C Runoff Area=1.030 ac 0.97% Impervious Runoff Depth=2.90"
Flow Length=214' Tc=14.8 min CN=79 Runoff=2.51 cfs 0.249 af

SubcatchmentFDA 2: FDA 2 Runoff Area=5.720 ac 10.66% Impervious Runoff Depth=2.90"
Flow Length=454' Tc=16.7 min CN=79 Runoff=13.17 cfs 1.381 af

SubcatchmentFDA 3: FDA 3 Runoff Area=8.040 ac 12.06% Impervious Runoff Depth=2.81"
Flow Length=1,370' Tc=32.8 min CN=78 Runoff=12.93 cfs 1.880 af

Reach 17R: AP 1 Riprap Channel Avg. Flow Depth=0.38' Max Vel=1.36 fps Inflow=4.25 cfs 1.697 af
n=0.078 L=90.0' S=0.0222 '/' Capacity=50.49 cfs Outflow=4.24 cfs 1.696 af

Pond 1P: Wetlands Peak Elev=397.91' Storage=26,920 cf Inflow=16.23 cfs 1.283 af
Primary=0.27 cfs 0.705 af Secondary=4.01 cfs 0.523 af Tertiary=0.00 cfs 0.000 af Outflow=4.27 cfs 1.227 af

Pond 2P: Cultec 280 Peak Elev=390.83' Storage=17,088 cf Inflow=4.81 cfs 1.414 af
Outflow=1.63 cfs 1.277 af

Link 2L: Post AP 3 Inflow=26.72 cfs 4.957 af
Primary=26.72 cfs 4.957 af

Link 8L: Post AP 2 Inflow=17.41 cfs 3.077 af
Primary=17.41 cfs 3.077 af

Total Runoff Area = 19.640 ac Runoff Volume = 5.150 af Average Runoff Depth = 3.15"
76.43% Pervious = 15.010 ac 23.57% Impervious = 4.630 ac

Summary for Subcatchment 1S: Wetlands Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

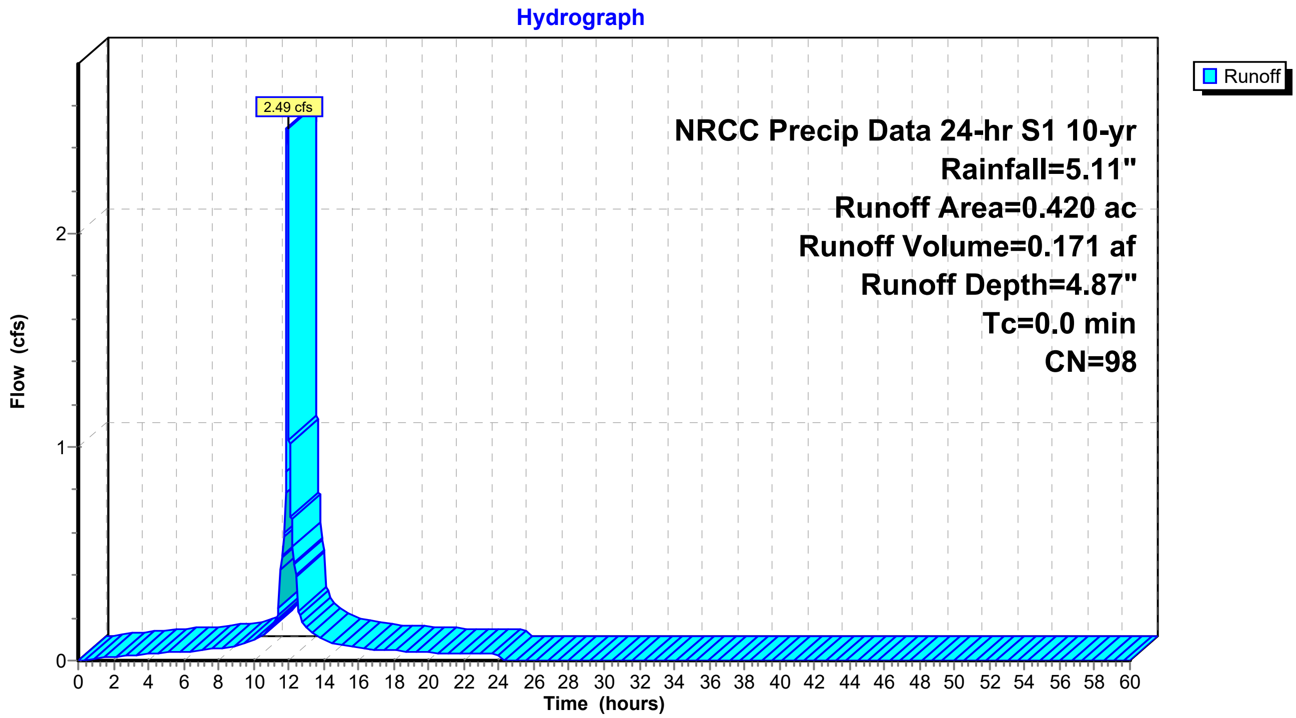
Runoff = 2.49 cfs @ 11.99 hrs, Volume= 0.171 af, Depth= 4.87"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

	Area (ac)	CN	Description
*	0.420	98	Wetland Permanent Pool
	0.420		100.00% Impervious Area

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

Subcatchment 1S: Wetlands Direct Rainfall



Summary for Subcatchment 2S: Bioretention Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

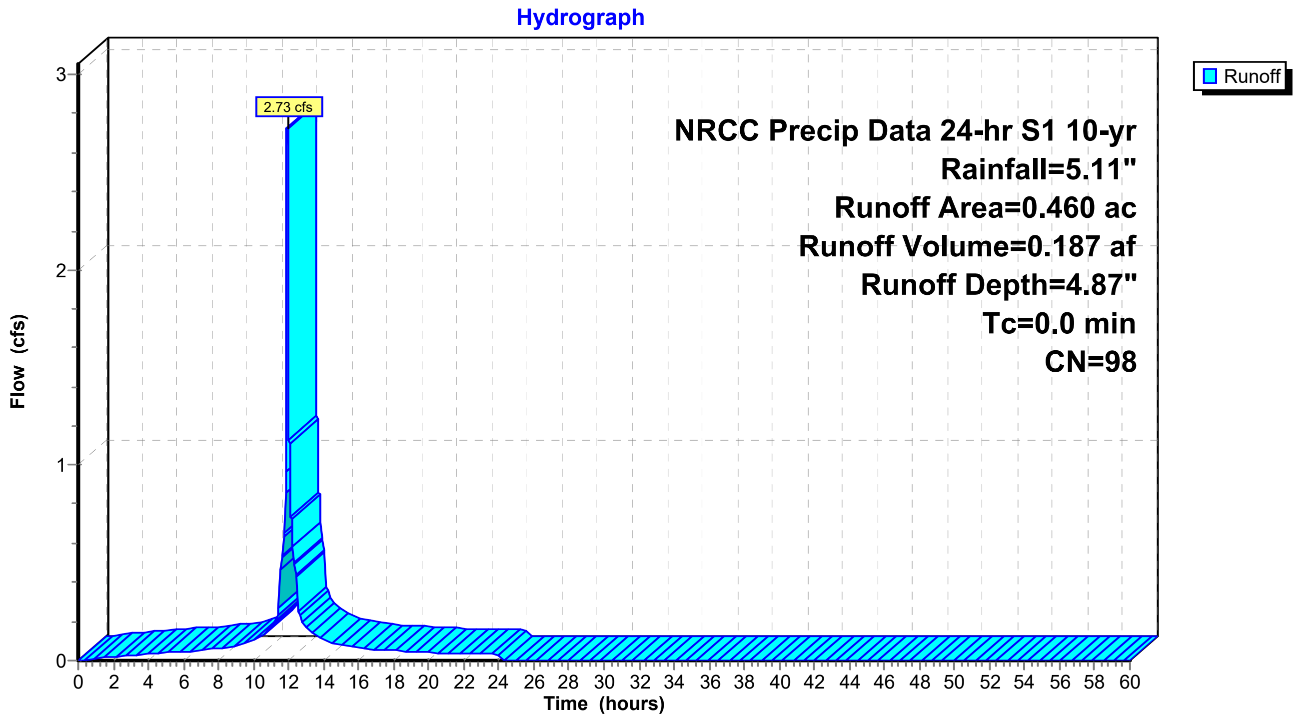
Runoff = 2.73 cfs @ 11.99 hrs, Volume= 0.187 af, Depth= 4.87"
Routed to Pond 2P : Cultec 280

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

	Area (ac)	CN	Description
*	0.460	98	Bioretention Cell Surface
	0.460		100.00% Impervious Area

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

Subcatchment 2S: Bioretention Direct Rainfall



Summary for Subcatchment FDA 1A: FDA 1A - Developed Site

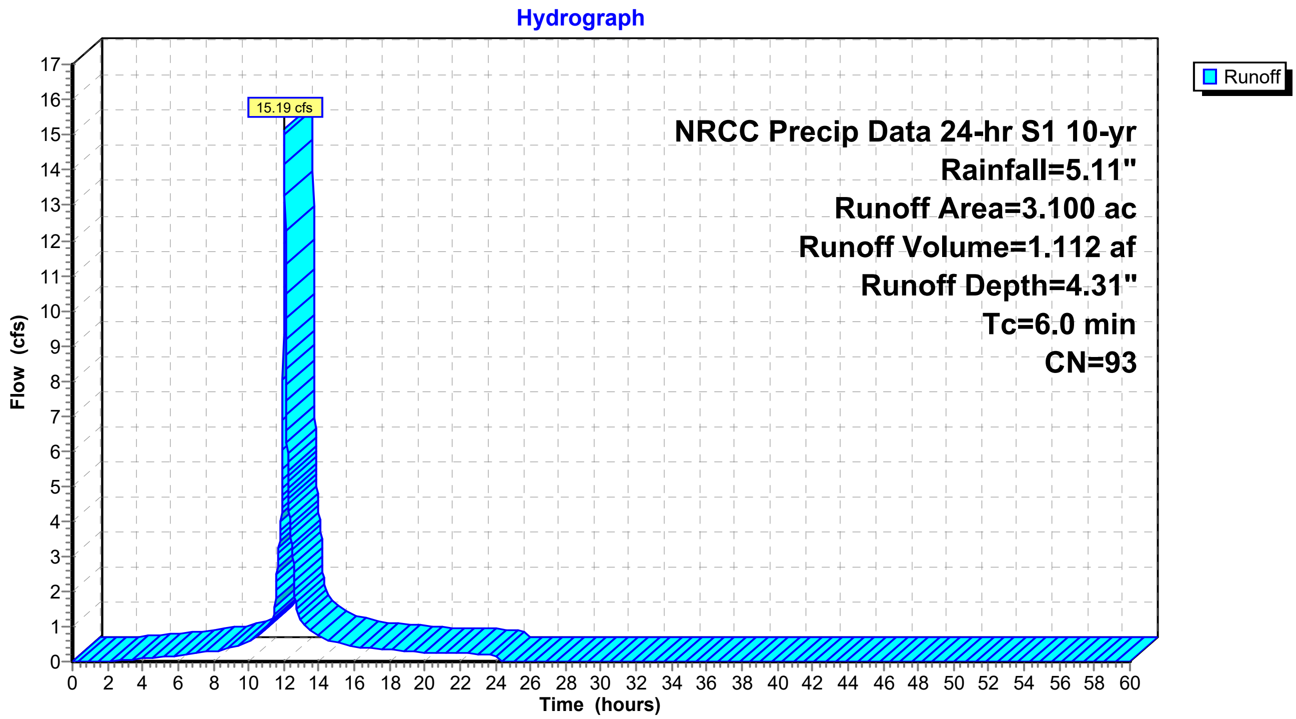
Runoff = 15.19 cfs @ 12.04 hrs, Volume= 1.112 af, Depth= 4.31"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
1.290	98	Paved parking, HSG D
0.870	98	Roofs, HSG D
0.940	80	>75% Grass cover, Good, HSG D
3.100	93	Weighted Average
0.940		30.32% Pervious Area
2.160		69.68% Impervious Area

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

Subcatchment FDA 1A: FDA 1A - Developed Site



Summary for Subcatchment FDA 1B: FDA 1B

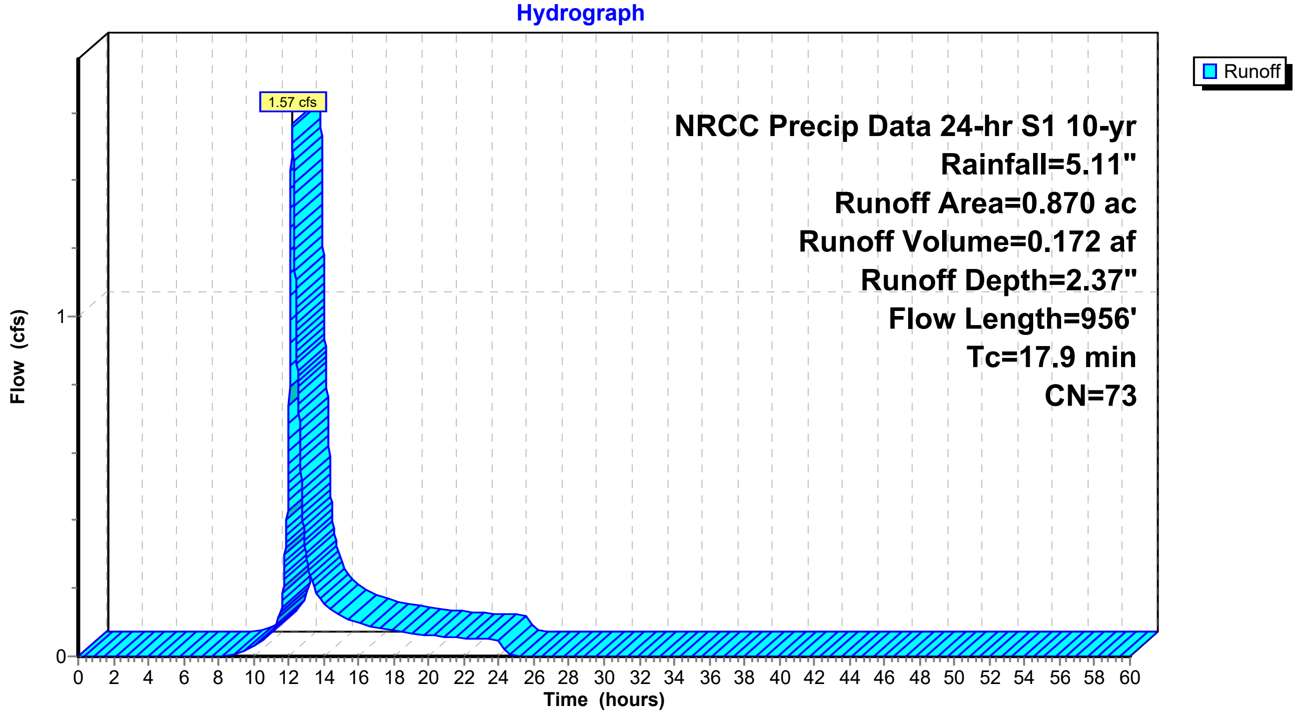
Runoff = 1.57 cfs @ 12.20 hrs, Volume= 0.172 af, Depth= 2.37"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
0.210	74	>75% Grass cover, Good, HSG C
0.220	80	>75% Grass cover, Good, HSG D
0.440	70	Woods, Good, HSG C
0.870	73	Weighted Average
0.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.0500	0.12		**Sheet Flow, Sheets Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	79	0.0700	1.32		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
0.1	24	0.1880	3.04		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	512	0.0075	4.56	5.59	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.5	241	0.0150	8.82	27.71	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
17.9	956	Total			

Subcatchment FDA 1B: FDA 1B



Summary for Subcatchment FDA 1C: FDA 1C

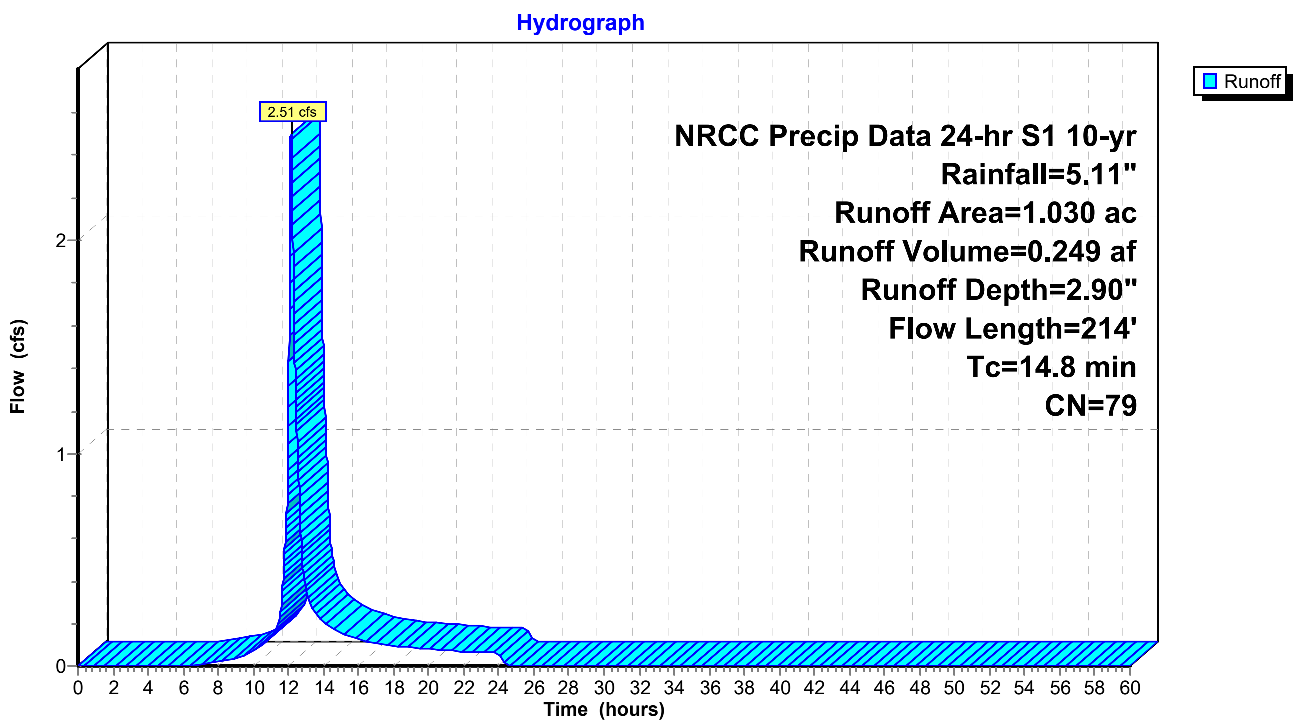
Runoff = 2.51 cfs @ 12.15 hrs, Volume= 0.249 af, Depth= 2.90"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
0.490	77	Woods, Good, HSG D
0.010	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
1.030	79	Weighted Average
1.020		99.03% Pervious Area
0.010		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0600	0.12		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.5	114	0.0660	1.28		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
14.8	214	Total			

Subcatchment FDA 1C: FDA 1C



Summary for Subcatchment FDA 2: FDA 2

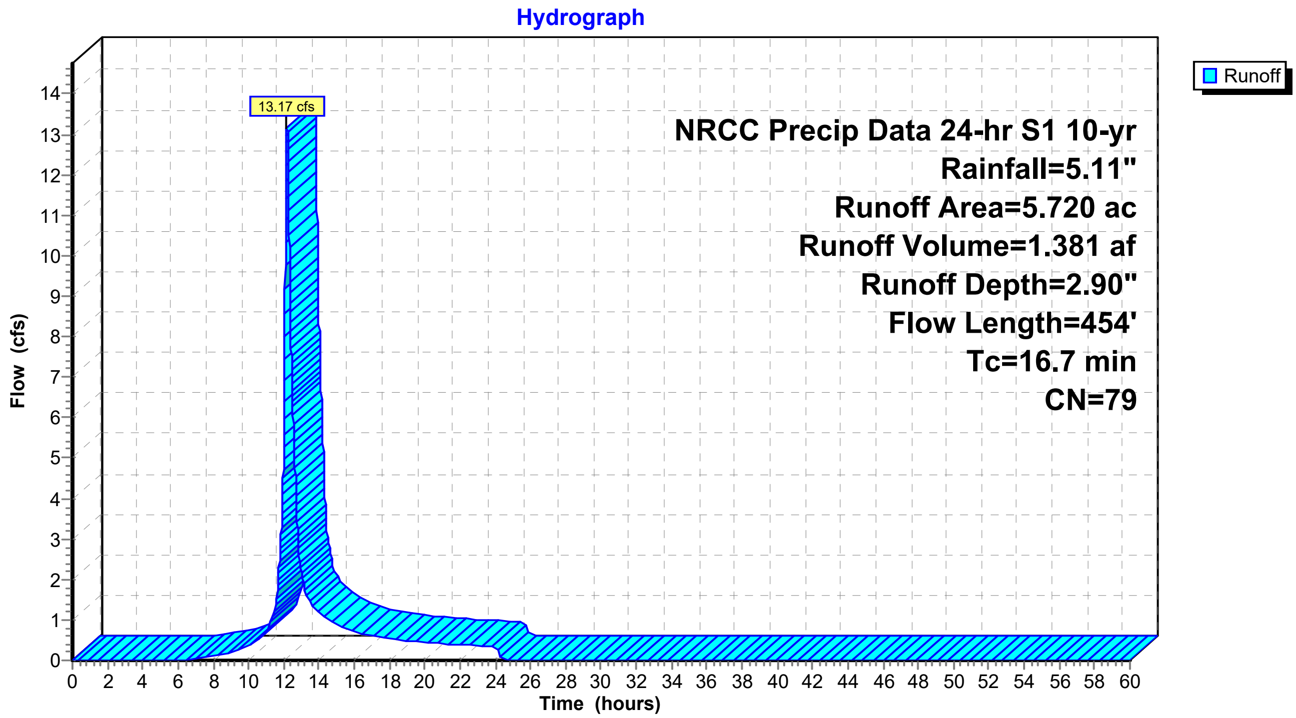
Runoff = 13.17 cfs @ 12.19 hrs, Volume= 1.381 af, Depth= 2.90"
Routed to Link 8L : Post AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
2.990	77	Woods, Good, HSG D
1.000	70	Woods, Good, HSG C
0.610	98	Paved parking, HSG D
1.120	80	>75% Grass cover, Good, HSG D
5.720	79	Weighted Average
5.110		89.34% Pervious Area
0.610		10.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0750	0.14		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.4	165	0.0515	1.13		**Shallow Concentrated Flow, Shallow Conc** Woodland Kv= 5.0 fps
1.9	135	0.0300	1.21		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
0.2	54	0.8300	4.56		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
16.7	454	Total			

Subcatchment FDA 2: FDA 2



Summary for Subcatchment FDA 3: FDA 3

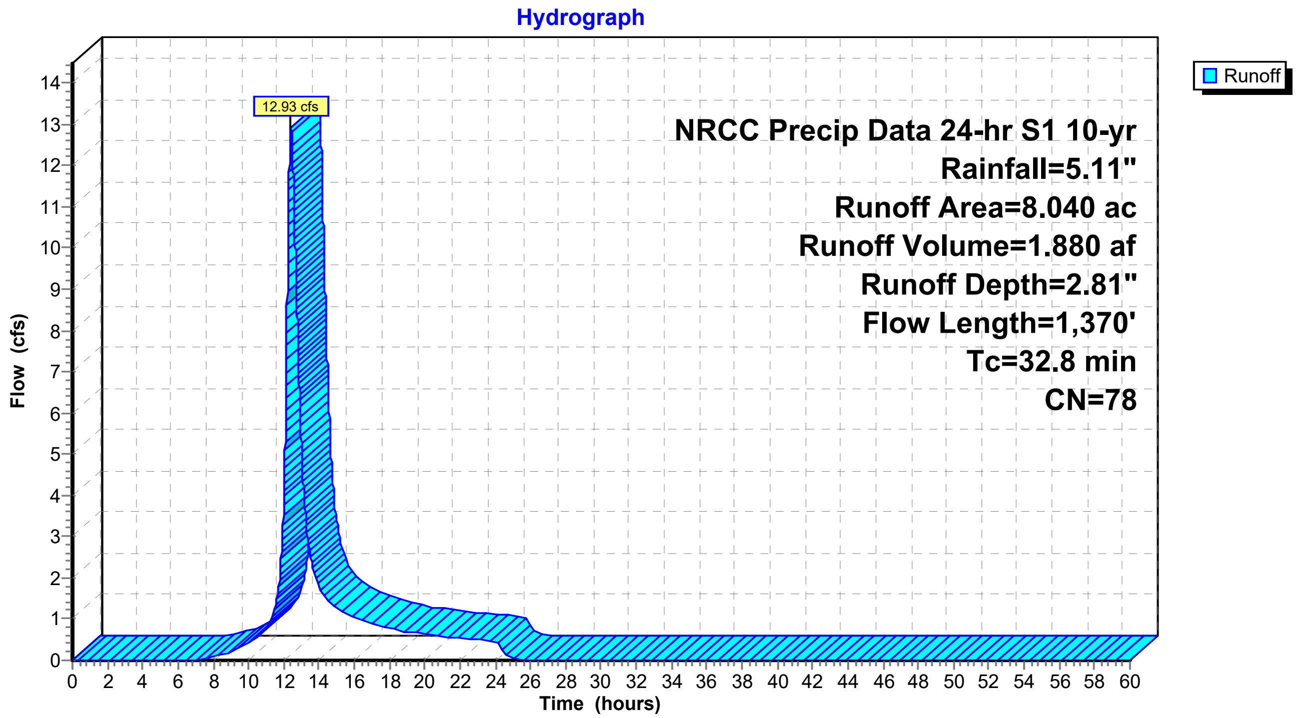
Runoff = 12.93 cfs @ 12.42 hrs, Volume= 1.880 af, Depth= 2.81"
Routed to Link 2L : Post AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 10-yr Rainfall=5.11"

Area (ac)	CN	Description
3.180	77	Woods, Good, HSG D
2.100	70	Woods, Good, HSG C
0.970	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.830	80	>75% Grass cover, Good, HSG D
8.040	78	Weighted Average
7.070		87.94% Pervious Area
0.970		12.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0400	0.11		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
9.2	423	0.0236	0.77		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	218	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0540	1.16		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
1.8	368	0.0050	3.49	146.64	**Channel Flow, Channel Stream** Area= 42.0 sf Perim= 42.2' r= 1.00' n= 0.030
32.8	1,370	Total			

Subcatchment FDA 3: FDA 3



Summary for Reach 17R: AP 1 Riprap Channel

Inflow Area = 5.880 ac, 51.87% Impervious, Inflow Depth > 3.46" for 10-yr event
Inflow = 4.25 cfs @ 12.18 hrs, Volume= 1.697 af
Outflow = 4.24 cfs @ 12.19 hrs, Volume= 1.696 af, Atten= 0%, Lag= 0.6 min
Routed to Link 8L : Post AP 2

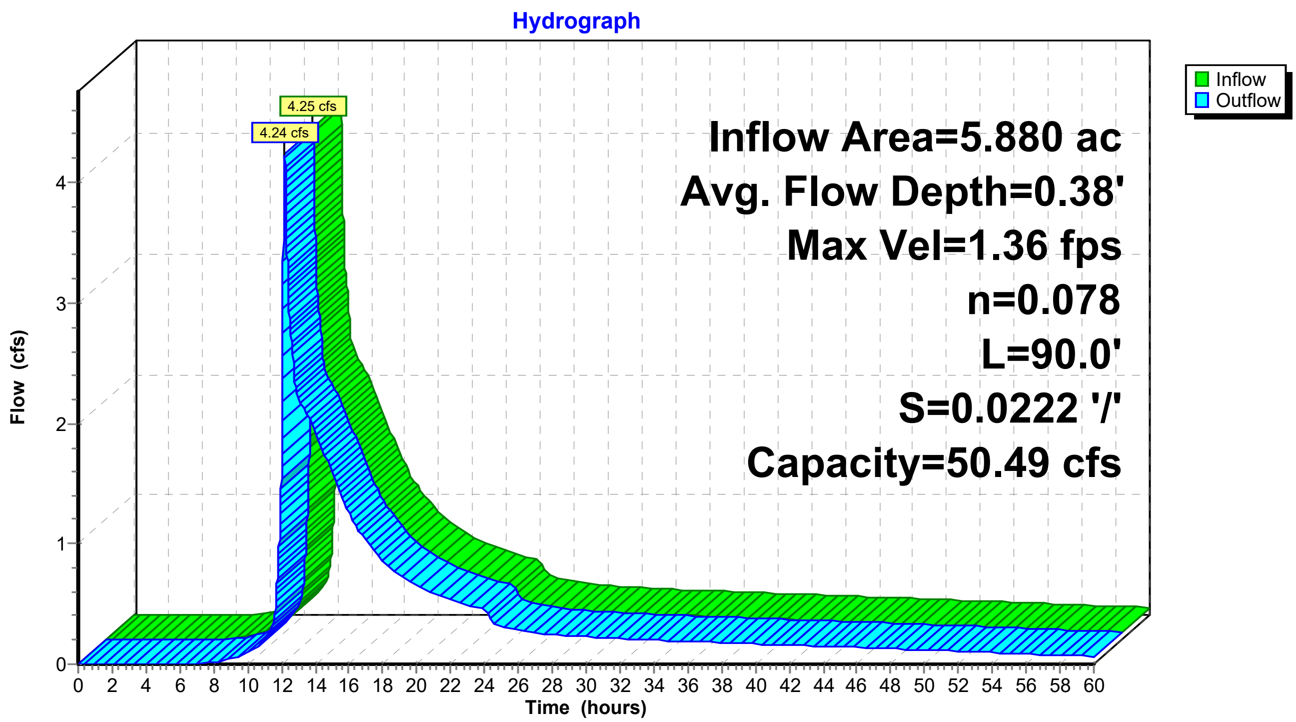
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.36 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 3.1 min

Peak Storage= 281 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.38' , Surface Width= 9.30'
Bank-Full Depth= 1.50' Flow Area= 17.3 sf, Capacity= 50.49 cfs

7.00' x 1.50' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 90.0' Slope= 0.0222 '/'
Inlet Invert= 380.00', Outlet Invert= 378.00'

‡

Reach 17R: AP 1 Riprap Channel



Summary for Pond 1P: Wetlands

Inflow Area = 3.520 ac, 73.30% Impervious, Inflow Depth = 4.37" for 10-yr event
Inflow = 16.23 cfs @ 12.04 hrs, Volume= 1.283 af
Outflow = 4.27 cfs @ 12.35 hrs, Volume= 1.227 af, Atten= 74%, Lag= 18.9 min
Primary = 0.27 cfs @ 12.35 hrs, Volume= 0.705 af
Routed to Pond 2P : Cultec 280
Secondary = 4.01 cfs @ 12.35 hrs, Volume= 0.523 af
Routed to Pond 2P : Cultec 280
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 397.91' @ 12.35 hrs Surf.Area= 22,361 sf Storage= 26,920 cf

Plug-Flow detention time= 609.3 min calculated for 1.227 af (96% of inflow)
Center-of-Mass det. time= 582.8 min (1,361.4 - 778.5)

Volume	Invert	Avail.Storage	Storage Description
#1	396.50'	54,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
396.50	15,835	0	0
397.00	18,271	8,527	8,527
398.00	22,789	20,530	29,057
398.50	24,171	11,740	40,797
399.00	30,553	13,681	54,478

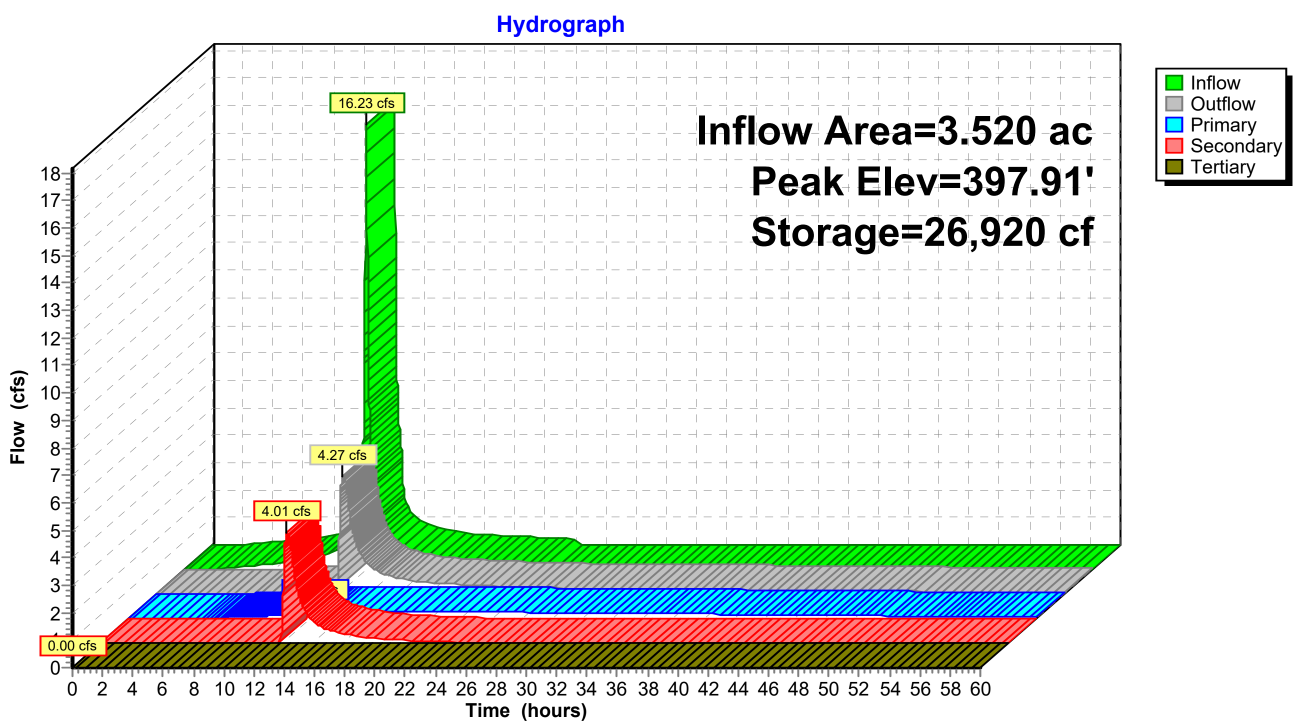
Device	Routing	Invert	Outlet Devices
#1	Primary	396.50'	**12.0" Round Culvert** L= 35.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 396.50' / 395.50' S= 0.0280 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	396.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	390.97'	**15.0" Round Culvert** L= 31.7' Ke= 0.500 Inlet / Outlet Invert= 390.97' / 390.56' S= 0.0129 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#4	Device 3	397.60'	**7.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#5	Tertiary	398.50'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.27 cfs @ 12.35 hrs HW=397.91' TW=390.45' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.27 cfs of 3.60 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 5.45 fps)

Secondary OutFlow Max=4.01 cfs @ 12.35 hrs HW=397.91' TW=390.45' (Dynamic Tailwater)
└─**3=Culvert** (Passes 4.01 cfs of 14.84 cfs potential flow)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 4.01 cfs @ 1.87 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=396.50' TW=380.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Wetlands



Summary for Pond 2P: Cultec 280

Inflow Area = 3.980 ac, 76.38% Impervious, Inflow Depth > 4.26" for 10-yr event
Inflow = 4.81 cfs @ 12.29 hrs, Volume= 1.414 af
Outflow = 1.63 cfs @ 13.47 hrs, Volume= 1.277 af, Atten= 66%, Lag= 70.6 min
Primary = 1.63 cfs @ 13.47 hrs, Volume= 1.277 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 390.83' @ 13.47 hrs Surf.Area= 19,043 sf Storage= 17,088 cf

Plug-Flow detention time= 383.3 min calculated for 1.277 af (90% of inflow)
Center-of-Mass det. time= 203.7 min (1,483.4 - 1,279.7)

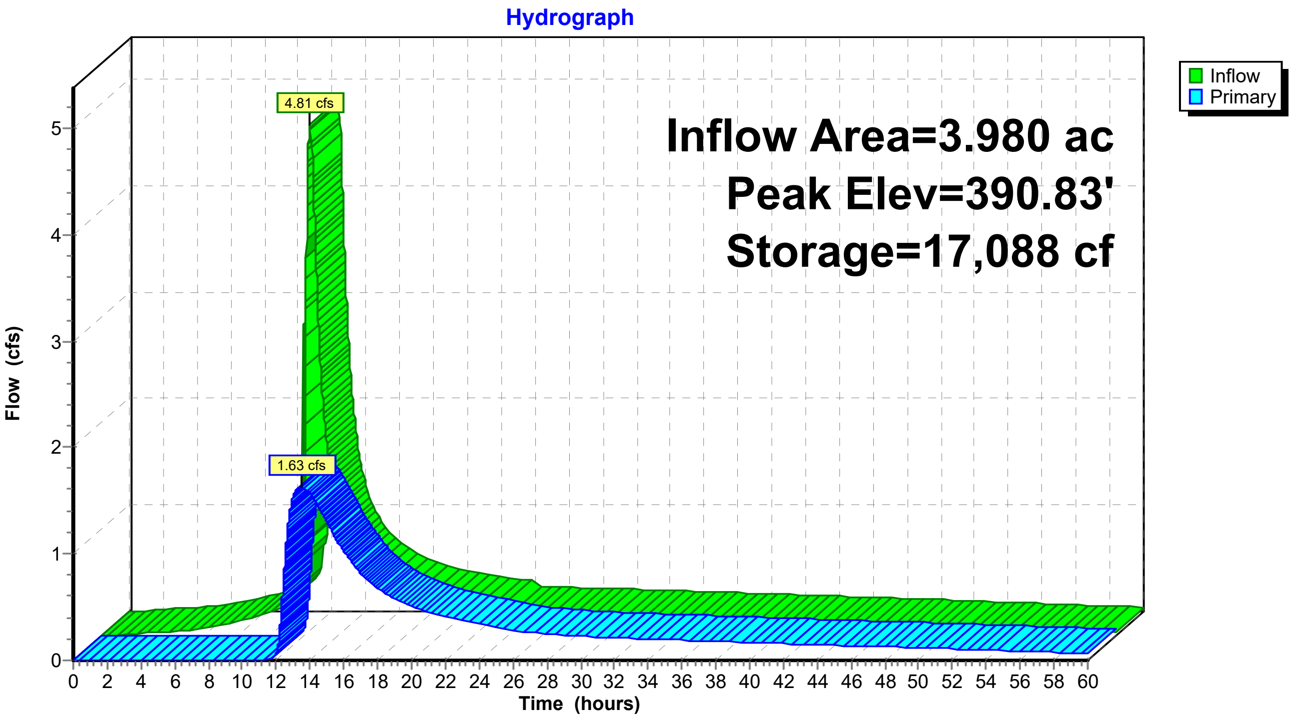
Volume	Invert	Avail.Storage	Storage Description
#1	389.54'	14,302 cf	**Chamber Stone (Prismatic)** Listed below (Recalc) 61,128 cf Overall - 25,374 cf Embedded = 35,754 cf x 40.0% Voids
#2	390.04'	25,374 cf	**Cultec R-280HD** x 597 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
		39,676 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
389.54	19,043	0	0
392.75	19,043	61,128	61,128

Device	Routing	Invert	Outlet Devices
#1	Primary	389.20'	**24.0" Round Culvert** L= 152.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 389.20' / 386.91' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	390.04'	**10.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	391.50'	**40.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.63 cfs @ 13.47 hrs HW=390.83' TW=380.25' (Dynamic Tailwater)
1=Culvert (Passes 1.63 cfs of 11.95 cfs potential flow)
2=Orifice/Grate (Orifice Controls 1.63 cfs @ 3.03 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: Cultec 280

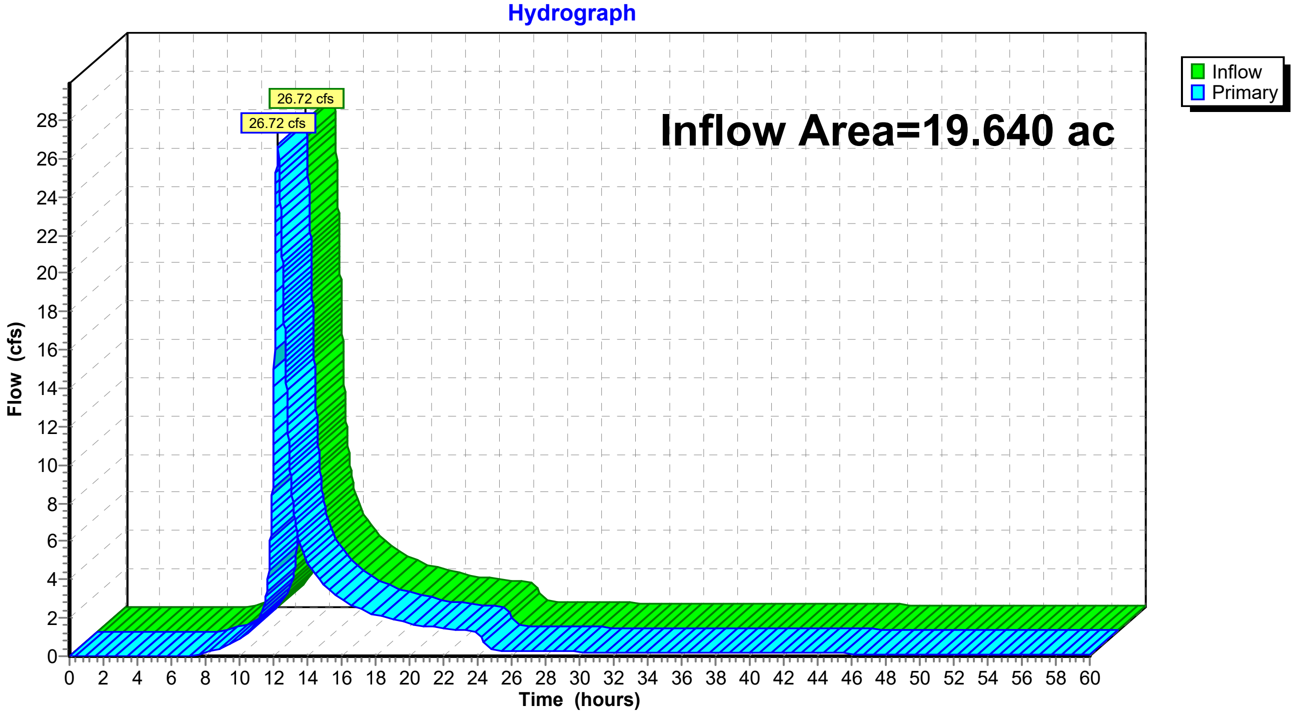


Summary for Link 2L: Post AP 3

Inflow Area = 19.640 ac, 23.57% Impervious, Inflow Depth > 3.03" for 10-yr event
Inflow = 26.72 cfs @ 12.24 hrs, Volume= 4.957 af
Primary = 26.72 cfs @ 12.24 hrs, Volume= 4.957 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 2L: Post AP 3

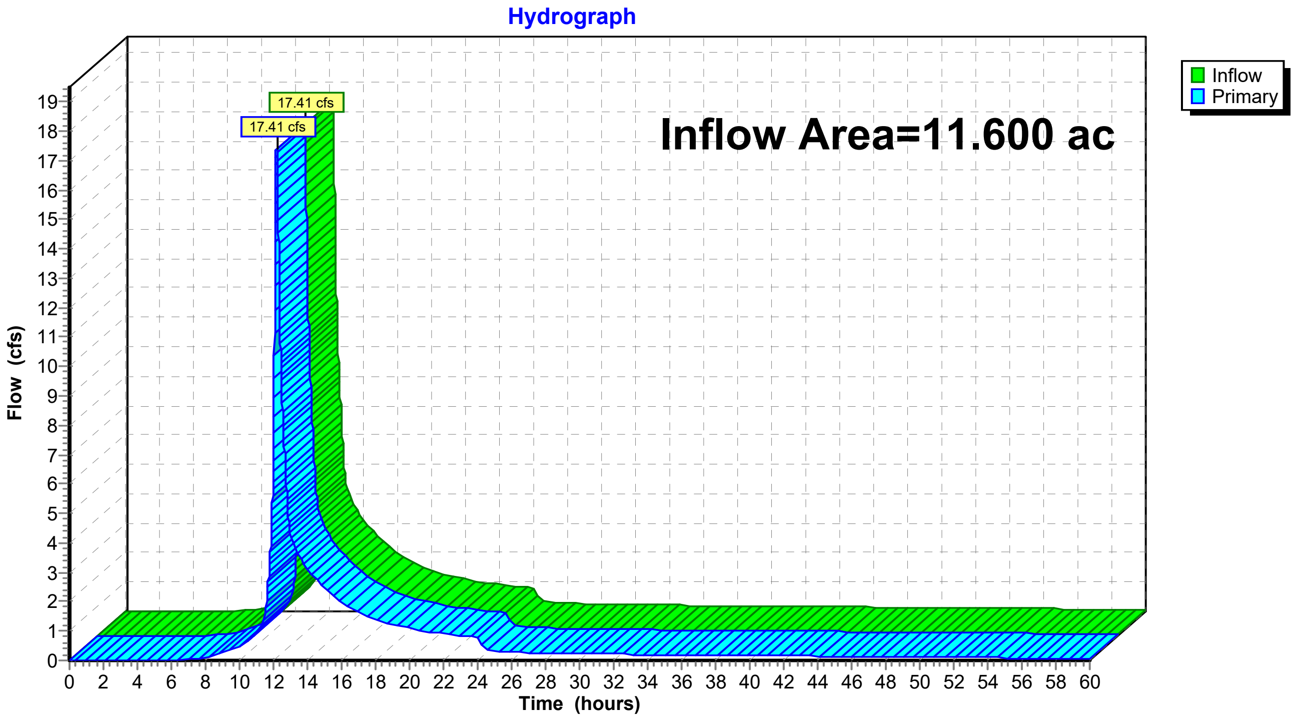


Summary for Link 8L: Post AP 2

Inflow Area = 11.600 ac, 31.55% Impervious, Inflow Depth > 3.18" for 10-yr event
Inflow = 17.41 cfs @ 12.19 hrs, Volume= 3.077 af
Primary = 17.41 cfs @ 12.19 hrs, Volume= 3.077 af, Atten= 0%, Lag= 0.0 min
Routed to Link 2L : Post AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Link 8L: Post AP 2



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Wetlands Direct Runoff Area=0.420 ac 100.00% Impervious Runoff Depth=6.18"
Tc=0.0 min CN=98 Runoff=3.01 cfs 0.216 af

Subcatchment2S: Bioretention Direct Runoff Area=0.460 ac 100.00% Impervious Runoff Depth=6.18"
Tc=0.0 min CN=98 Runoff=3.30 cfs 0.237 af

SubcatchmentFDA 1A: FDA 1A - Runoff Area=3.100 ac 69.68% Impervious Runoff Depth=5.60"
Tc=6.0 min CN=93 Runoff=18.74 cfs 1.446 af

SubcatchmentFDA 1B: FDA 1B Runoff Area=0.870 ac 0.00% Impervious Runoff Depth=3.44"
Flow Length=956' Tc=17.9 min CN=73 Runoff=2.24 cfs 0.249 af

SubcatchmentFDA 1C: FDA 1C Runoff Area=1.030 ac 0.97% Impervious Runoff Depth=4.06"
Flow Length=214' Tc=14.8 min CN=79 Runoff=3.41 cfs 0.348 af

SubcatchmentFDA 2: FDA 2 Runoff Area=5.720 ac 10.66% Impervious Runoff Depth=4.06"
Flow Length=454' Tc=16.7 min CN=79 Runoff=17.92 cfs 1.934 af

SubcatchmentFDA 3: FDA 3 Runoff Area=8.040 ac 12.06% Impervious Runoff Depth=3.95"
Flow Length=1,370' Tc=32.8 min CN=78 Runoff=17.83 cfs 2.648 af

Reach 17R: AP 1 Riprap Channel Avg. Flow Depth=0.49' Max Vel=1.57 fps Inflow=6.58 cfs 2.302 af
n=0.078 L=90.0' S=0.0222 '/' Capacity=50.49 cfs Outflow=6.57 cfs 2.302 af

Pond 1P: Wetlands Peak Elev=398.09' Storage=31,050 cf Inflow=20.02 cfs 1.662 af
Primary=0.29 cfs 0.730 af Secondary=8.24 cfs 0.876 af Tertiary=0.00 cfs 0.000 af Outflow=8.53 cfs 1.606 af

Pond 2P: Cultec 280 Peak Elev=391.37' Storage=25,401 cf Inflow=9.45 cfs 1.843 af
Outflow=2.51 cfs 1.705 af

Link 2L: Post AP 3 Inflow=37.66 cfs 6.884 af
Primary=37.66 cfs 6.884 af

Link 8L: Post AP 2 Inflow=24.45 cfs 4.236 af
Primary=24.45 cfs 4.236 af

Total Runoff Area = 19.640 ac Runoff Volume = 7.079 af Average Runoff Depth = 4.33"
76.43% Pervious = 15.010 ac 23.57% Impervious = 4.630 ac

Summary for Subcatchment 1S: Wetlands Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

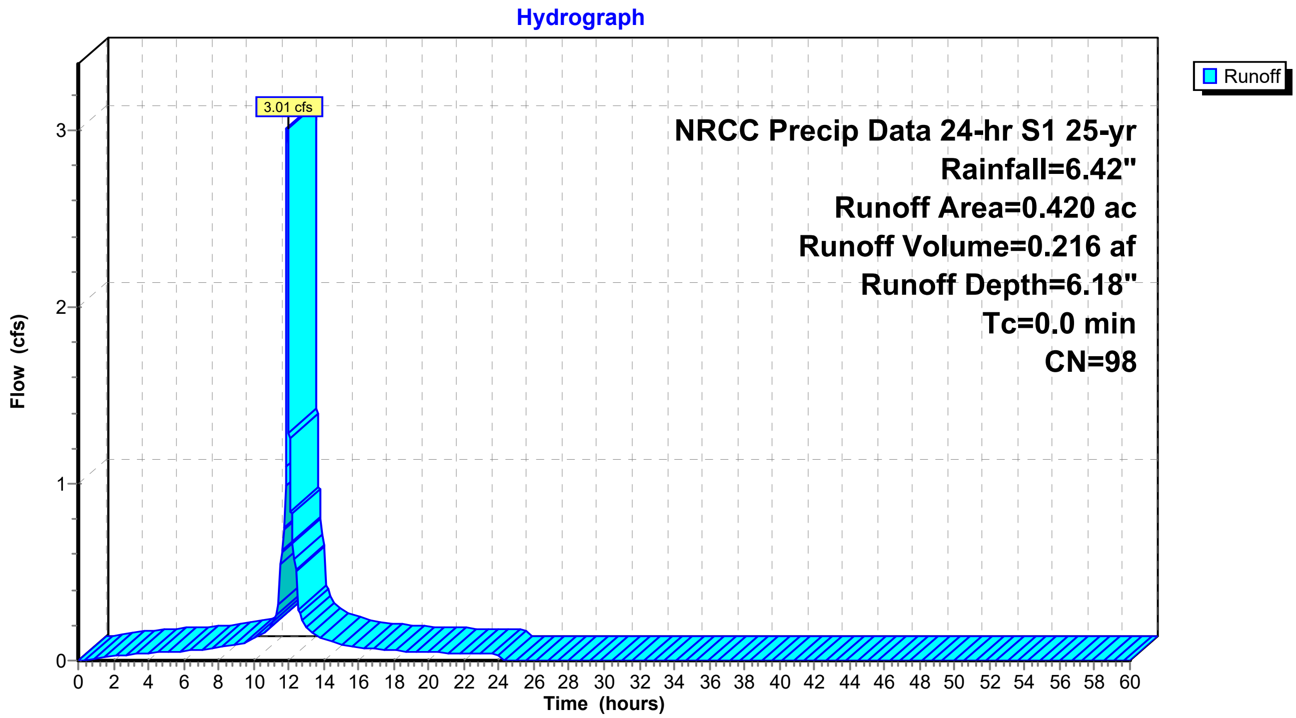
Runoff = 3.01 cfs @ 11.99 hrs, Volume= 0.216 af, Depth= 6.18"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

	Area (ac)	CN	Description
*	0.420	98	Wetland Permanent Pool
	0.420		100.00% Impervious Area

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

Subcatchment 1S: Wetlands Direct Rainfall



Summary for Subcatchment 2S: Bioretention Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

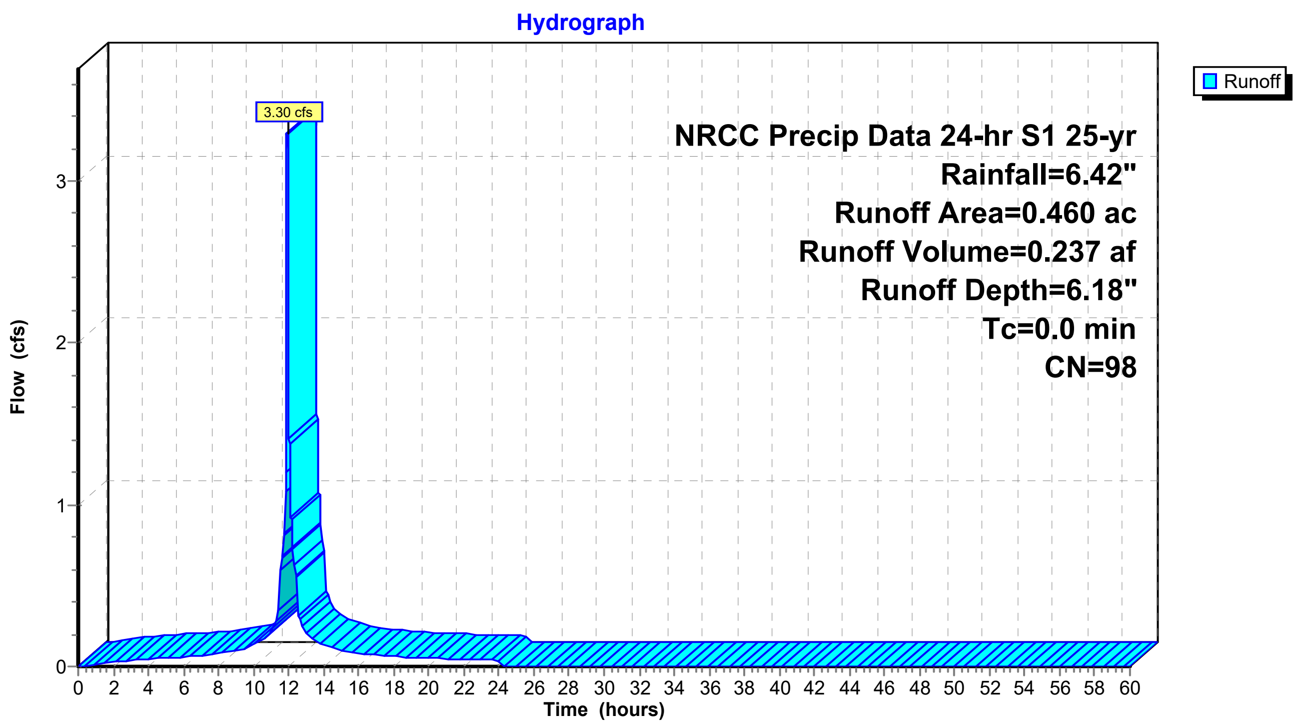
Runoff = 3.30 cfs @ 11.99 hrs, Volume= 0.237 af, Depth= 6.18"
Routed to Pond 2P : Cultec 280

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

	Area (ac)	CN	Description
*	0.460	98	Bioretention Cell Surface
	0.460		100.00% Impervious Area

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

Subcatchment 2S: Bioretention Direct Rainfall



Summary for Subcatchment FDA 1A: FDA 1A - Developed Site

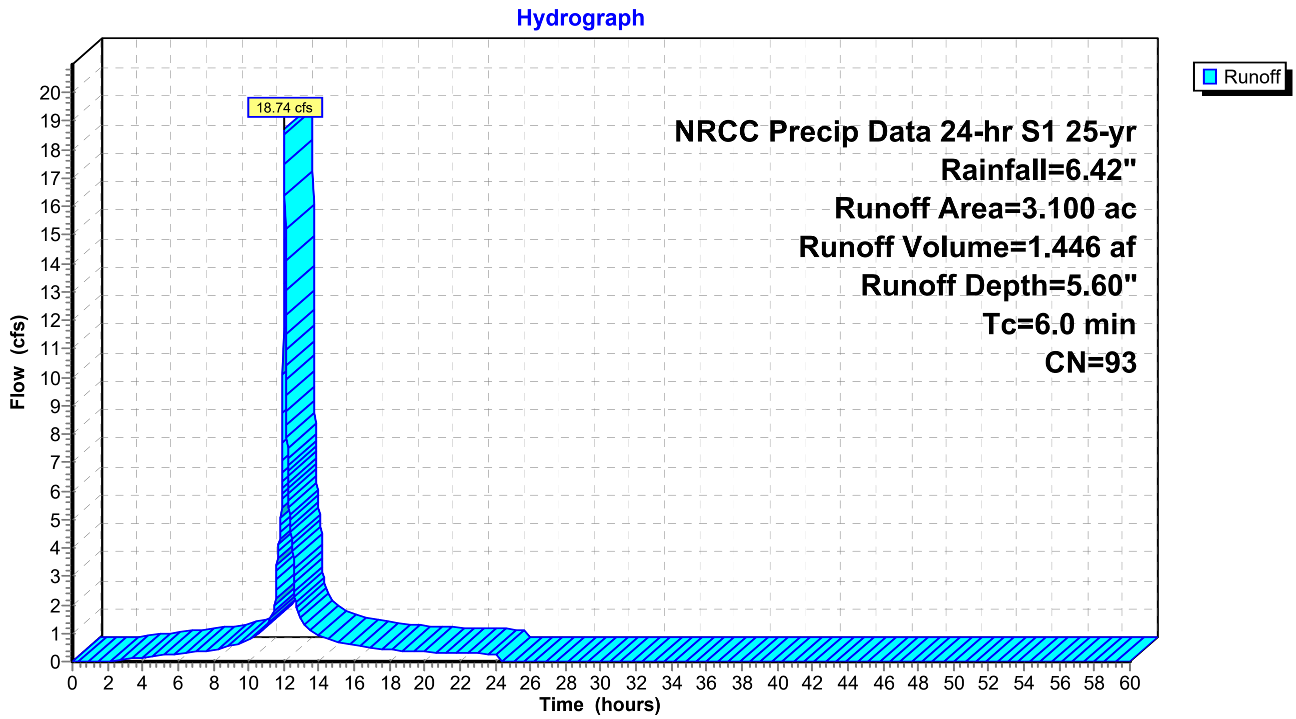
Runoff = 18.74 cfs @ 12.04 hrs, Volume= 1.446 af, Depth= 5.60"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
1.290	98	Paved parking, HSG D
0.870	98	Roofs, HSG D
0.940	80	>75% Grass cover, Good, HSG D
3.100	93	Weighted Average
0.940		30.32% Pervious Area
2.160		69.68% Impervious Area

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

Subcatchment FDA 1A: FDA 1A - Developed Site



Summary for Subcatchment FDA 1B: FDA 1B

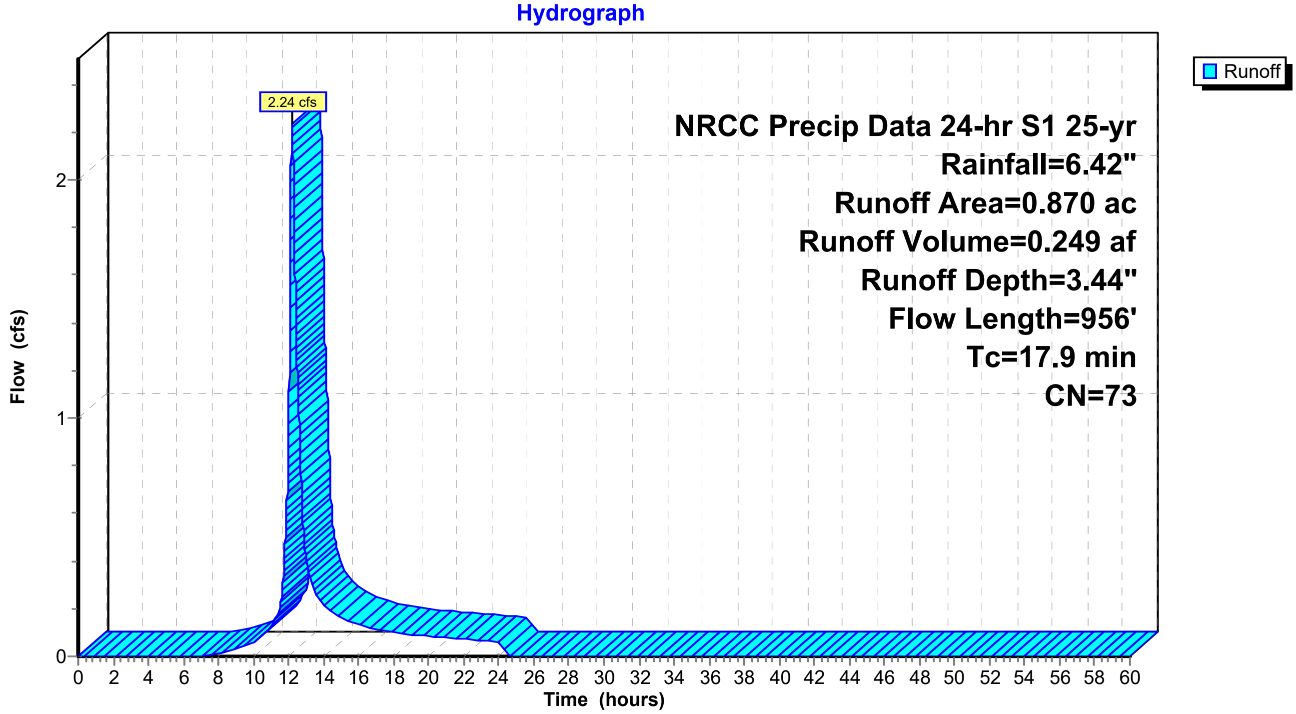
Runoff = 2.24 cfs @ 12.20 hrs, Volume= 0.249 af, Depth= 3.44"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.210	74	>75% Grass cover, Good, HSG C
0.220	80	>75% Grass cover, Good, HSG D
0.440	70	Woods, Good, HSG C
0.870	73	Weighted Average
0.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.0500	0.12		**Sheet Flow, Sheets Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	79	0.0700	1.32		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
0.1	24	0.1880	3.04		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	512	0.0075	4.56	5.59	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.5	241	0.0150	8.82	27.71	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
17.9	956	Total			

Subcatchment FDA 1B: FDA 1B



Summary for Subcatchment FDA 1C: FDA 1C

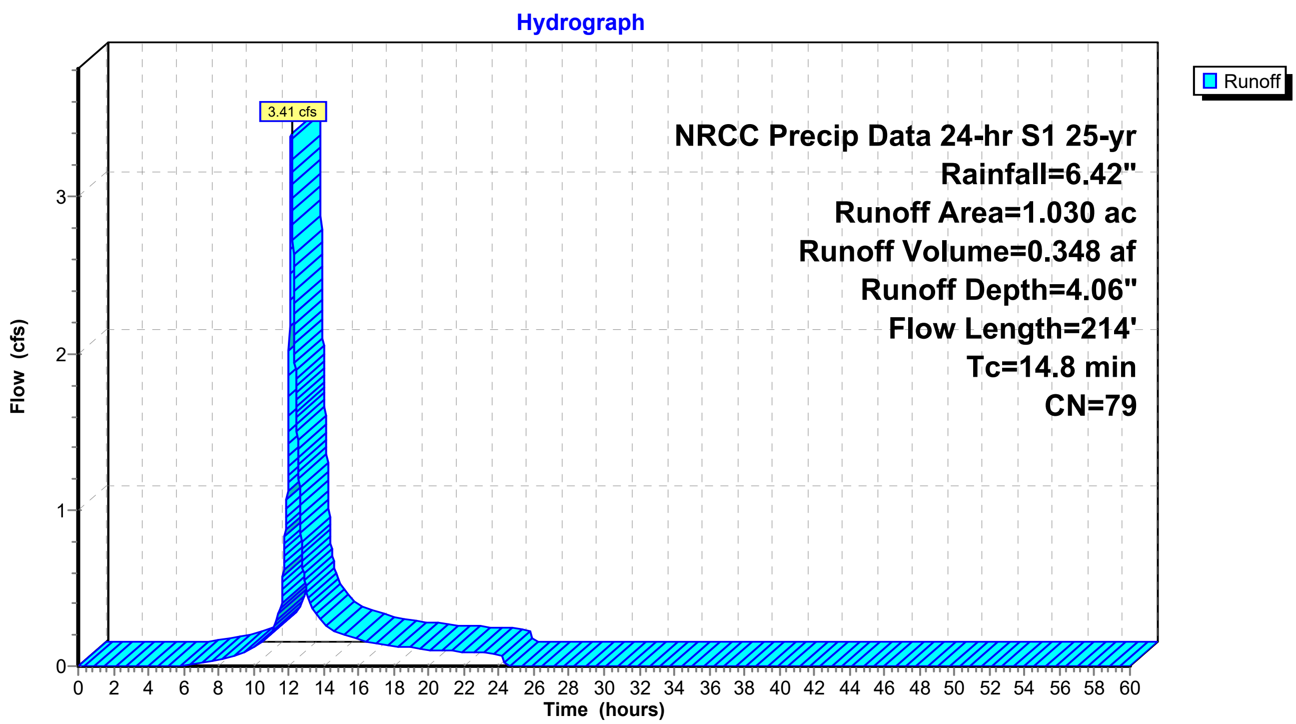
Runoff = 3.41 cfs @ 12.15 hrs, Volume= 0.348 af, Depth= 4.06"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.490	77	Woods, Good, HSG D
0.010	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
1.030	79	Weighted Average
1.020		99.03% Pervious Area
0.010		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0600	0.12		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.5	114	0.0660	1.28		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
14.8	214	Total			

Subcatchment FDA 1C: FDA 1C



Summary for Subcatchment FDA 2: FDA 2

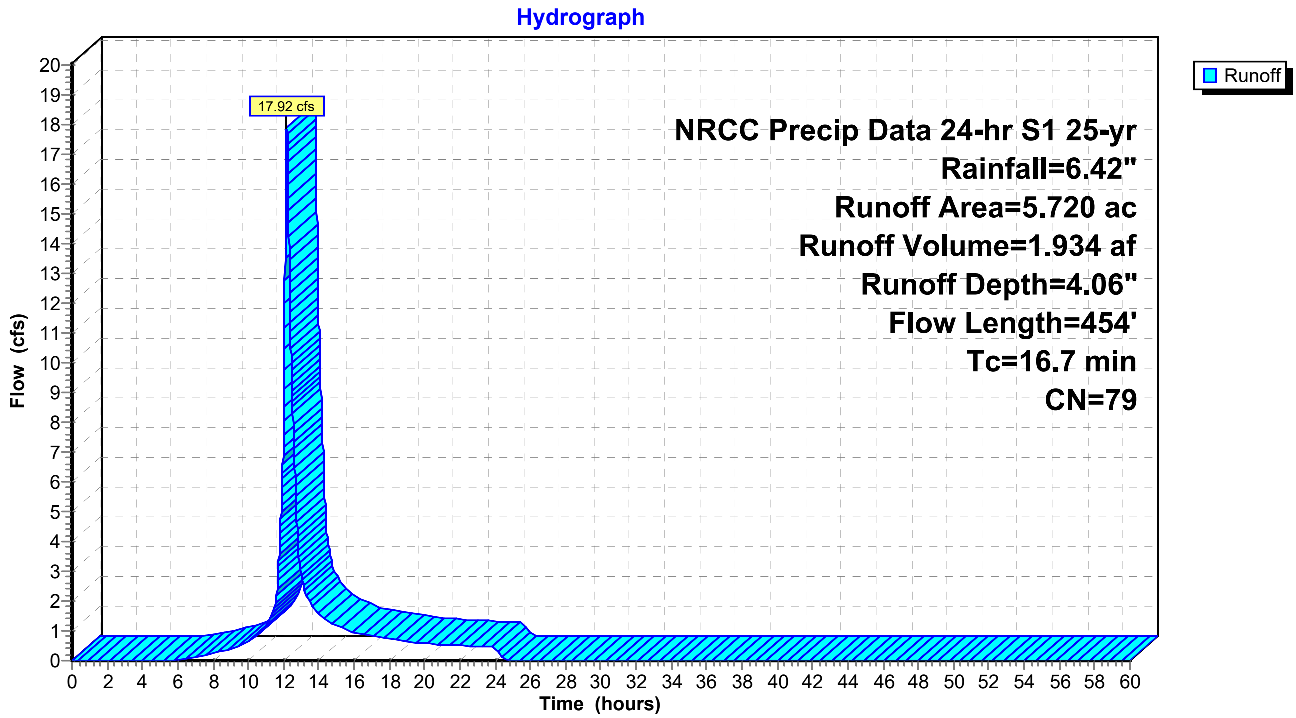
Runoff = 17.92 cfs @ 12.19 hrs, Volume= 1.934 af, Depth= 4.06"
Routed to Link 8L : Post AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
2.990	77	Woods, Good, HSG D
1.000	70	Woods, Good, HSG C
0.610	98	Paved parking, HSG D
1.120	80	>75% Grass cover, Good, HSG D
5.720	79	Weighted Average
5.110		89.34% Pervious Area
0.610		10.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0750	0.14		**Sheet Flow, Sheet Woods**
					Woods: Light underbrush n= 0.400 P2= 3.44"
2.4	165	0.0515	1.13		**Shallow Concentrated Flow, Shallow Conc**
					Woodland Kv= 5.0 fps
1.9	135	0.0300	1.21		**Shallow Concentrated Flow, Shallow Conc Grass**
					Short Grass Pasture Kv= 7.0 fps
0.2	54	0.8300	4.56		**Shallow Concentrated Flow, Shallow Conc Woods 2**
					Woodland Kv= 5.0 fps
16.7	454	Total			

Subcatchment FDA 2: FDA 2



Summary for Subcatchment FDA 3: FDA 3

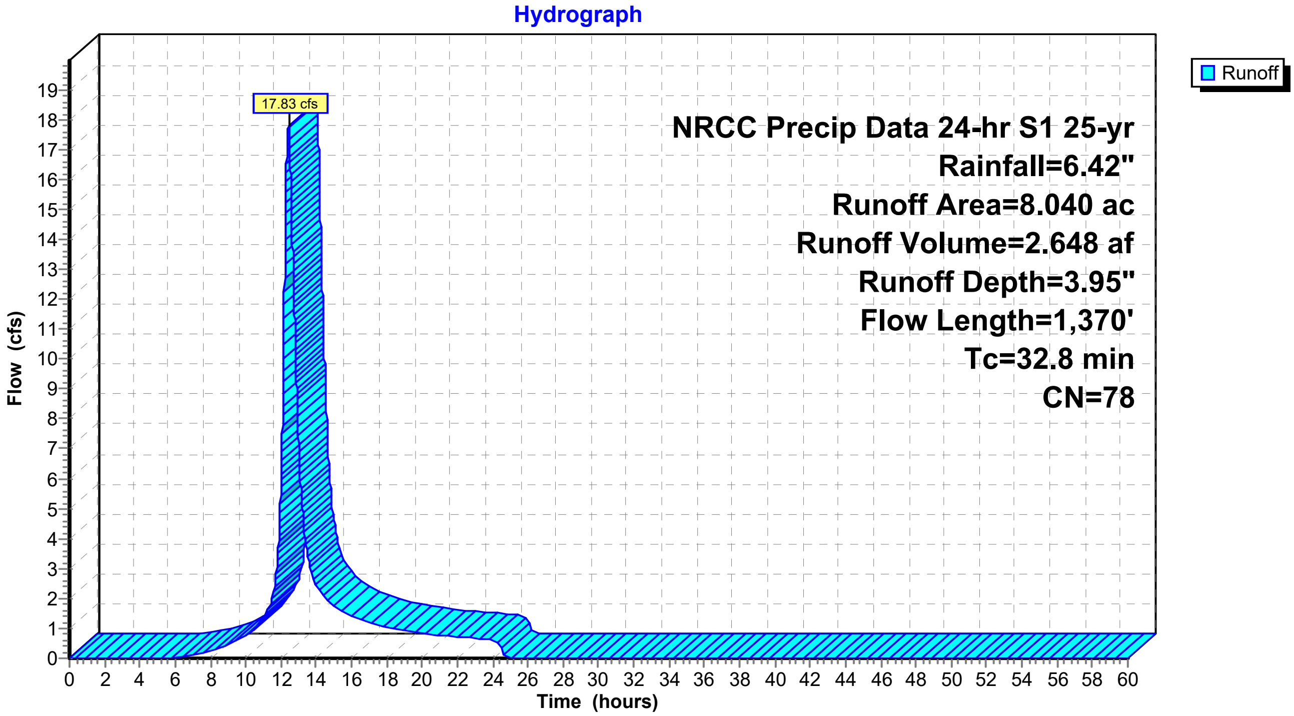
Runoff = 17.83 cfs @ 12.42 hrs, Volume= 2.648 af, Depth= 3.95"
Routed to Link 2L : Post AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 25-yr Rainfall=6.42"

Area (ac)	CN	Description
3.180	77	Woods, Good, HSG D
2.100	70	Woods, Good, HSG C
0.970	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.830	80	>75% Grass cover, Good, HSG D
8.040	78	Weighted Average
7.070		87.94% Pervious Area
0.970		12.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0400	0.11		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
9.2	423	0.0236	0.77		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	218	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0540	1.16		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
1.8	368	0.0050	3.49	146.64	**Channel Flow, Channel Stream** Area= 42.0 sf Perim= 42.2' r= 1.00' n= 0.030
32.8	1,370	Total			

Subcatchment FDA 3: FDA 3



Summary for Reach 17R: AP 1 Riprap Channel

Inflow Area = 5.880 ac, 51.87% Impervious, Inflow Depth > 4.70" for 25-yr event
Inflow = 6.58 cfs @ 12.19 hrs, Volume= 2.302 af
Outflow = 6.57 cfs @ 12.20 hrs, Volume= 2.302 af, Atten= 0%, Lag= 0.7 min
Routed to Link 8L : Post AP 2

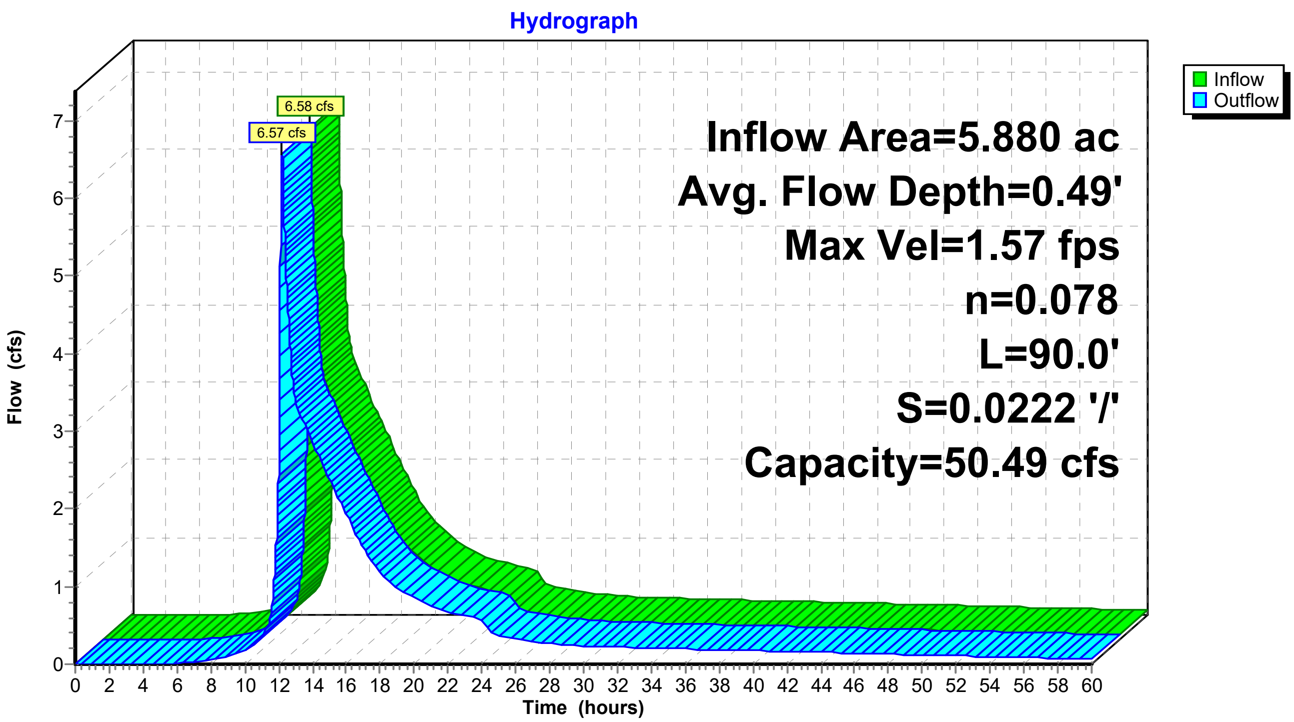
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.57 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 2.9 min

Peak Storage= 375 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.49' , Surface Width= 9.95'
Bank-Full Depth= 1.50' Flow Area= 17.3 sf, Capacity= 50.49 cfs

7.00' x 1.50' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 90.0' Slope= 0.0222 '/'
Inlet Invert= 380.00', Outlet Invert= 378.00'

‡

Reach 17R: AP 1 Riprap Channel



Summary for Pond 1P: Wetlands

Inflow Area = 3.520 ac, 73.30% Impervious, Inflow Depth = 5.67" for 25-yr event
Inflow = 20.02 cfs @ 12.04 hrs, Volume= 1.662 af
Outflow = 8.53 cfs @ 12.19 hrs, Volume= 1.606 af, Atten= 57%, Lag= 9.5 min
Primary = 0.29 cfs @ 12.19 hrs, Volume= 0.730 af
Routed to Pond 2P : Cultec 280
Secondary = 8.24 cfs @ 12.19 hrs, Volume= 0.876 af
Routed to Pond 2P : Cultec 280
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 398.09' @ 12.19 hrs Surf.Area= 23,030 sf Storage= 31,050 cf

Plug-Flow detention time= 488.6 min calculated for 1.606 af (97% of inflow)
Center-of-Mass det. time= 467.3 min (1,238.8 - 771.5)

Volume	Invert	Avail.Storage	Storage Description
#1	396.50'	54,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
396.50	15,835	0	0
397.00	18,271	8,527	8,527
398.00	22,789	20,530	29,057
398.50	24,171	11,740	40,797
399.00	30,553	13,681	54,478

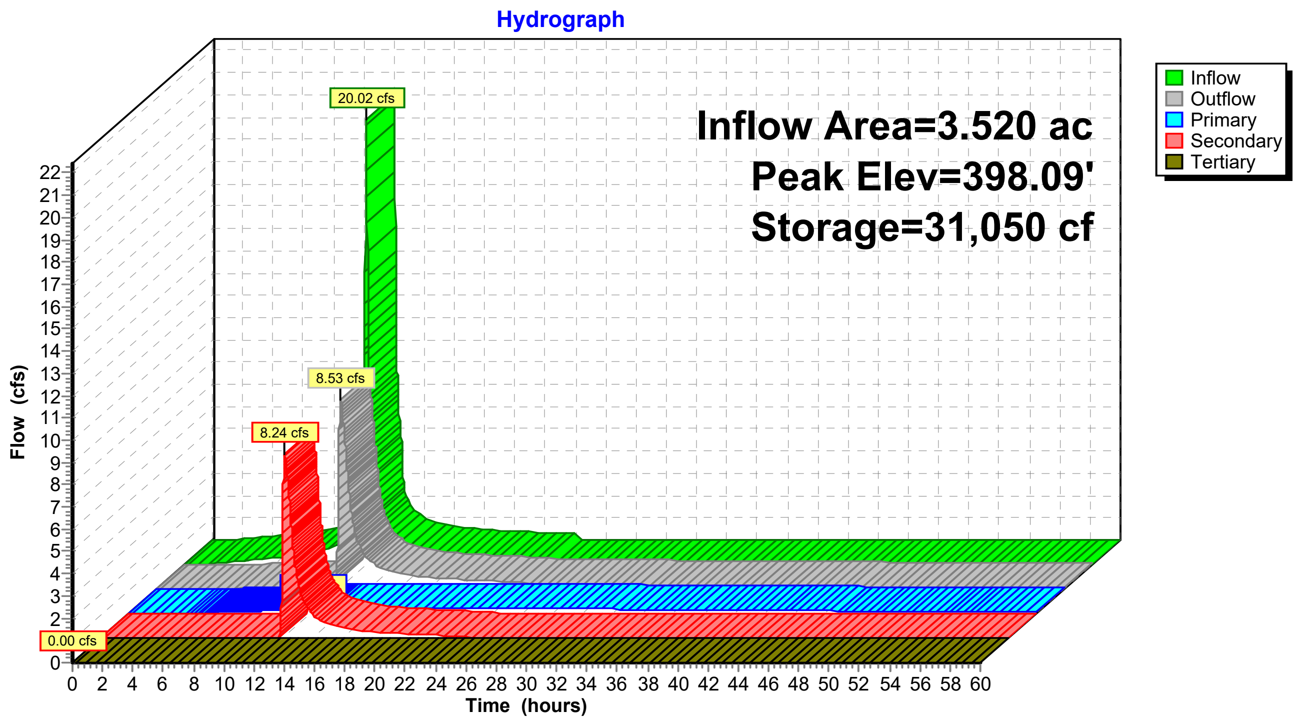
Device	Routing	Invert	Outlet Devices
#1	Primary	396.50'	**12.0" Round Culvert** L= 35.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 396.50' / 395.50' S= 0.0280 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	396.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	390.97'	**15.0" Round Culvert** L= 31.7' Ke= 0.500 Inlet / Outlet Invert= 390.97' / 390.56' S= 0.0129 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#4	Device 3	397.60'	**7.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#5	Tertiary	398.50'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.29 cfs @ 12.19 hrs HW=398.09' TW=390.62' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.29 cfs of 3.94 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.29 cfs @ 5.82 fps)

Secondary OutFlow Max=8.24 cfs @ 12.19 hrs HW=398.09' TW=390.62' (Dynamic Tailwater)
└─**3=Culvert** (Passes 8.24 cfs of 15.06 cfs potential flow)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 8.24 cfs @ 2.42 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=396.50' TW=380.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Wetlands



Summary for Pond 2P: Cultec 280

Inflow Area = 3.980 ac, 76.38% Impervious, Inflow Depth > 5.56" for 25-yr event
Inflow = 9.45 cfs @ 12.19 hrs, Volume= 1.843 af
Outflow = 2.51 cfs @ 13.22 hrs, Volume= 1.705 af, Atten= 73%, Lag= 62.1 min
Primary = 2.51 cfs @ 13.22 hrs, Volume= 1.705 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 391.37' @ 13.22 hrs Surf.Area= 19,043 sf Storage= 25,401 cf

Plug-Flow detention time= 323.3 min calculated for 1.705 af (92% of inflow)
Center-of-Mass det. time= 179.3 min (1,353.8 - 1,174.5)

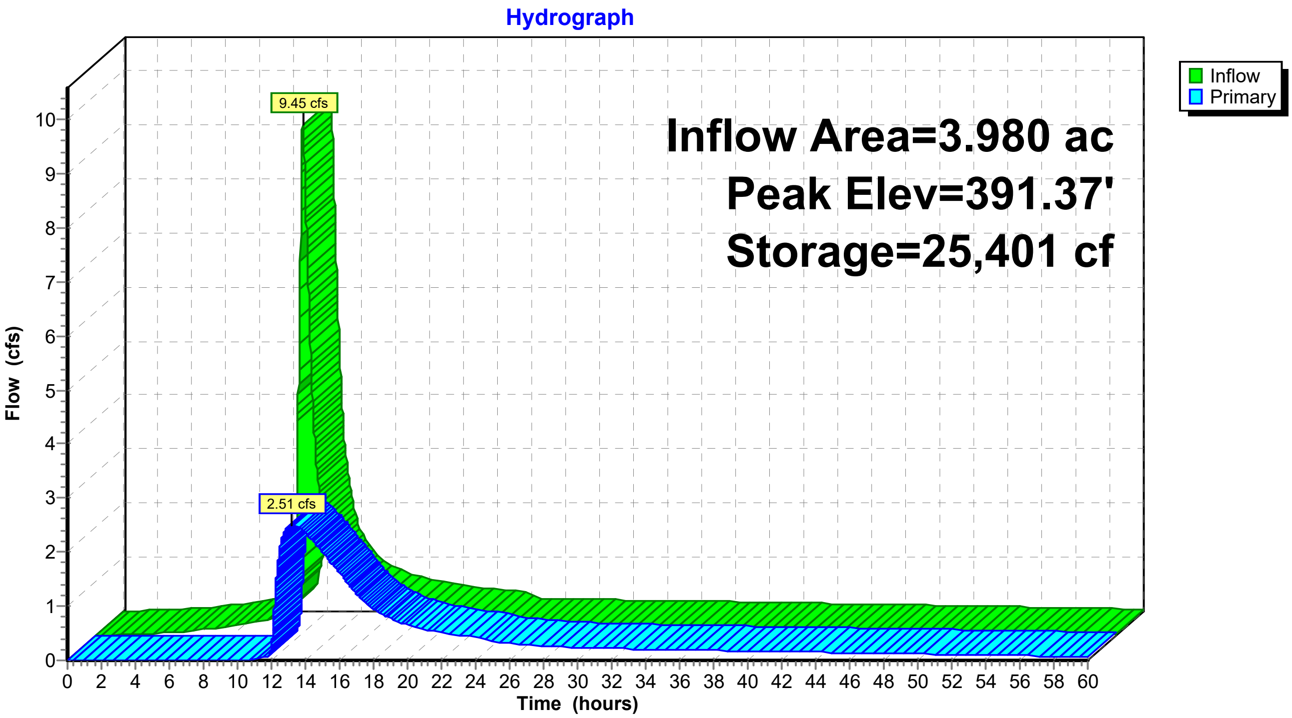
Volume	Invert	Avail.Storage	Storage Description
#1	389.54'	14,302 cf	**Chamber Stone (Prismatic)** Listed below (Recalc) 61,128 cf Overall - 25,374 cf Embedded = 35,754 cf x 40.0% Voids
#2	390.04'	25,374 cf	**Cultec R-280HD** x 597 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
		39,676 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
389.54	19,043	0	0
392.75	19,043	61,128	61,128

Device	Routing	Invert	Outlet Devices
#1	Primary	389.20'	**24.0" Round Culvert** L= 152.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 389.20' / 386.91' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	390.04'	**10.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	391.50'	**40.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.51 cfs @ 13.22 hrs HW=391.37' TW=380.33' (Dynamic Tailwater)
1=Culvert (Passes 2.51 cfs of 16.36 cfs potential flow)
2=Orifice/Grate (Orifice Controls 2.51 cfs @ 4.60 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: Cultec 280

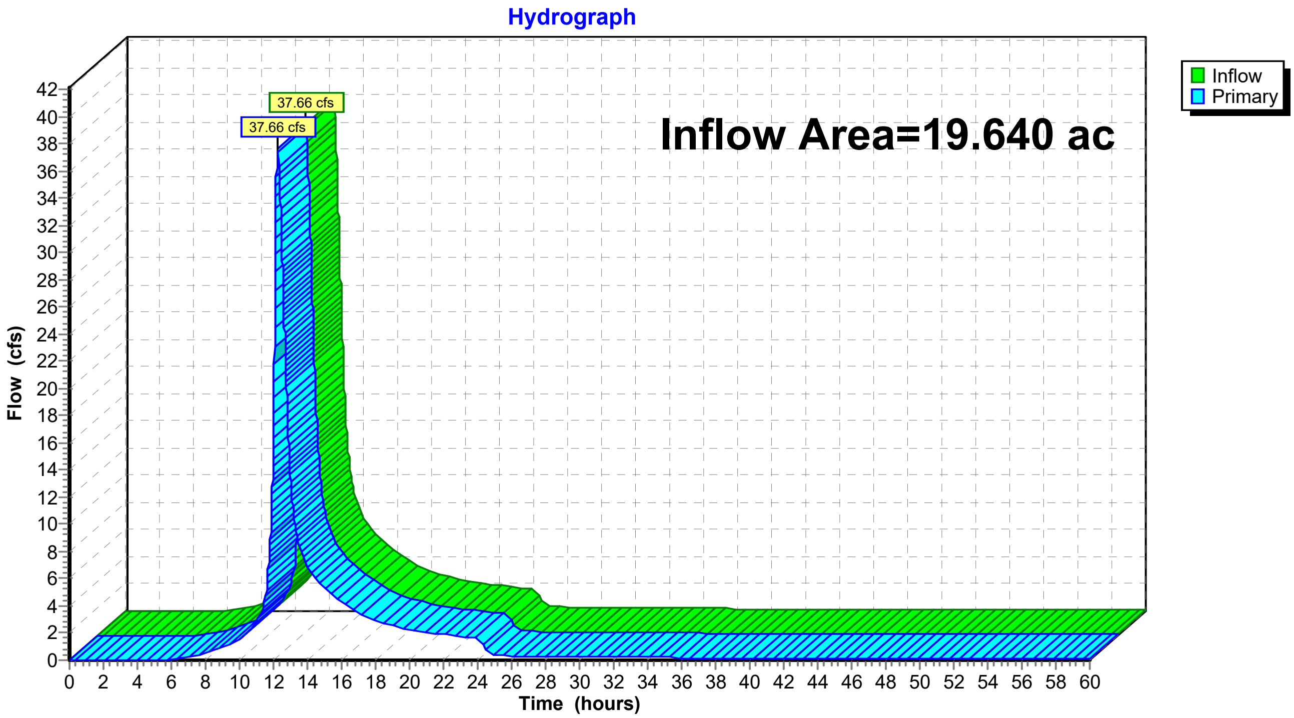


Summary for Link 2L: Post AP 3

Inflow Area = 19.640 ac, 23.57% Impervious, Inflow Depth > 4.21" for 25-yr event
Inflow = 37.66 cfs @ 12.24 hrs, Volume= 6.884 af
Primary = 37.66 cfs @ 12.24 hrs, Volume= 6.884 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

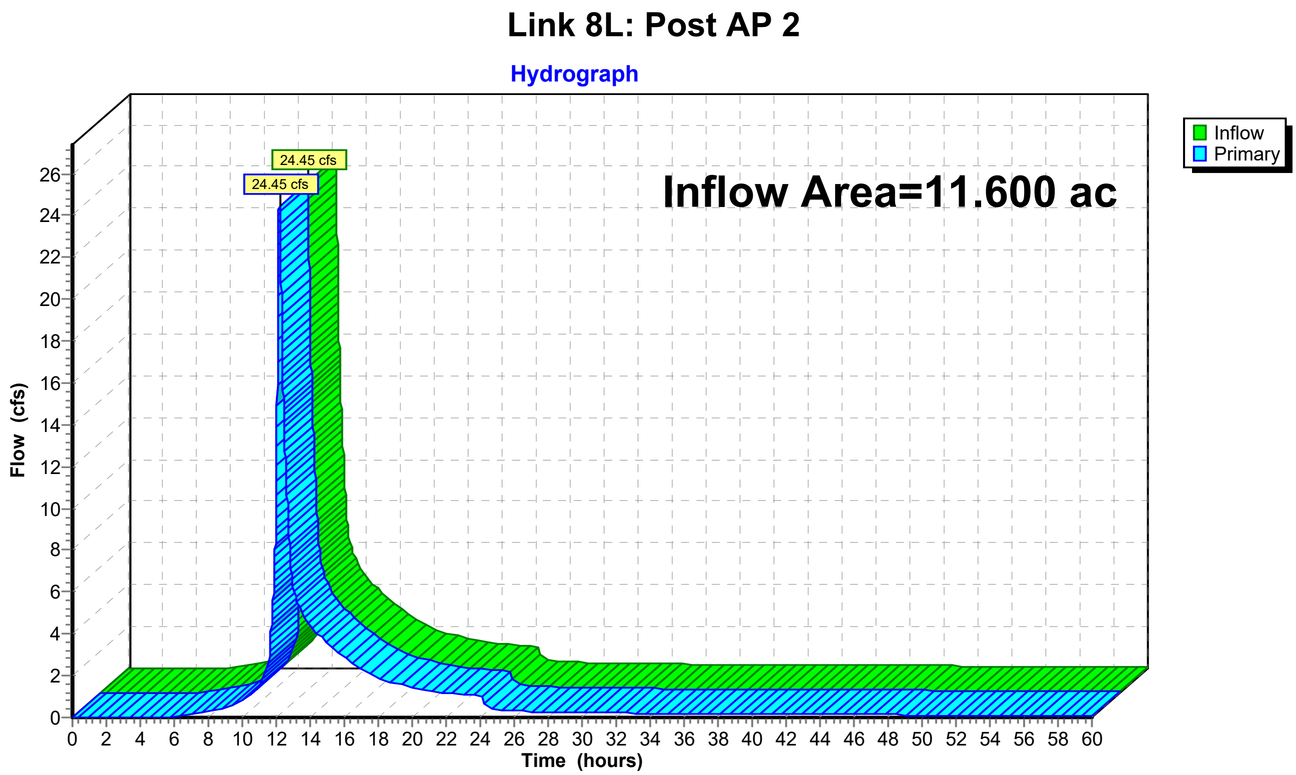
Link 2L: Post AP 3



Summary for Link 8L: Post AP 2

Inflow Area = 11.600 ac, 31.55% Impervious, Inflow Depth > 4.38" for 25-yr event
Inflow = 24.45 cfs @ 12.19 hrs, Volume= 4.236 af
Primary = 24.45 cfs @ 12.19 hrs, Volume= 4.236 af, Atten= 0%, Lag= 0.0 min
Routed to Link 2L : Post AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Wetlands Direct Runoff Area=0.420 ac 100.00% Impervious Runoff Depth=8.81"
Tc=0.0 min CN=98 Runoff=4.01 cfs 0.308 af

Subcatchment2S: Bioretention Direct Runoff Area=0.460 ac 100.00% Impervious Runoff Depth=8.81"
Tc=0.0 min CN=98 Runoff=4.39 cfs 0.338 af

SubcatchmentFDA 1A: FDA 1A - Runoff Area=3.100 ac 69.68% Impervious Runoff Depth=8.21"
Tc=6.0 min CN=93 Runoff=25.48 cfs 2.120 af

SubcatchmentFDA 1B: FDA 1B Runoff Area=0.870 ac 0.00% Impervious Runoff Depth=5.75"
Flow Length=956' Tc=17.9 min CN=73 Runoff=3.61 cfs 0.417 af

SubcatchmentFDA 1C: FDA 1C Runoff Area=1.030 ac 0.97% Impervious Runoff Depth=6.49"
Flow Length=214' Tc=14.8 min CN=79 Runoff=5.19 cfs 0.557 af

SubcatchmentFDA 2: FDA 2 Runoff Area=5.720 ac 10.66% Impervious Runoff Depth=6.49"
Flow Length=454' Tc=16.7 min CN=79 Runoff=27.30 cfs 3.095 af

SubcatchmentFDA 3: FDA 3 Runoff Area=8.040 ac 12.06% Impervious Runoff Depth=6.37"
Flow Length=1,370' Tc=32.8 min CN=78 Runoff=27.78 cfs 4.267 af

Reach 17R: AP 1 Riprap Channel Avg. Flow Depth=0.73' Max Vel=1.97 fps Inflow=13.17 cfs 3.544 af
n=0.078 L=90.0' S=0.0222 '/' Capacity=50.49 cfs Outflow=13.16 cfs 3.543 af

Pond 1P: Wetlands Peak Elev=398.33' Storage=36,701 cf Inflow=27.28 cfs 2.428 af
Primary=0.31 cfs 0.770 af Secondary=15.33 cfs 1.600 af Tertiary=0.00 cfs 0.000 af Outflow=15.64 cfs 2.371 af

Pond 2P: Cultec 280 Peak Elev=392.16' Storage=35,194 cf Inflow=17.19 cfs 2.708 af
Outflow=9.21 cfs 2.570 af

Link 2L: Post AP 3 Inflow=59.92 cfs 10.905 af
Primary=59.92 cfs 10.905 af

Link 8L: Post AP 2 Inflow=38.57 cfs 6.638 af
Primary=38.57 cfs 6.638 af

Total Runoff Area = 19.640 ac Runoff Volume = 11.102 af Average Runoff Depth = 6.78"
76.43% Pervious = 15.010 ac 23.57% Impervious = 4.630 ac

Summary for Subcatchment 1S: Wetlands Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

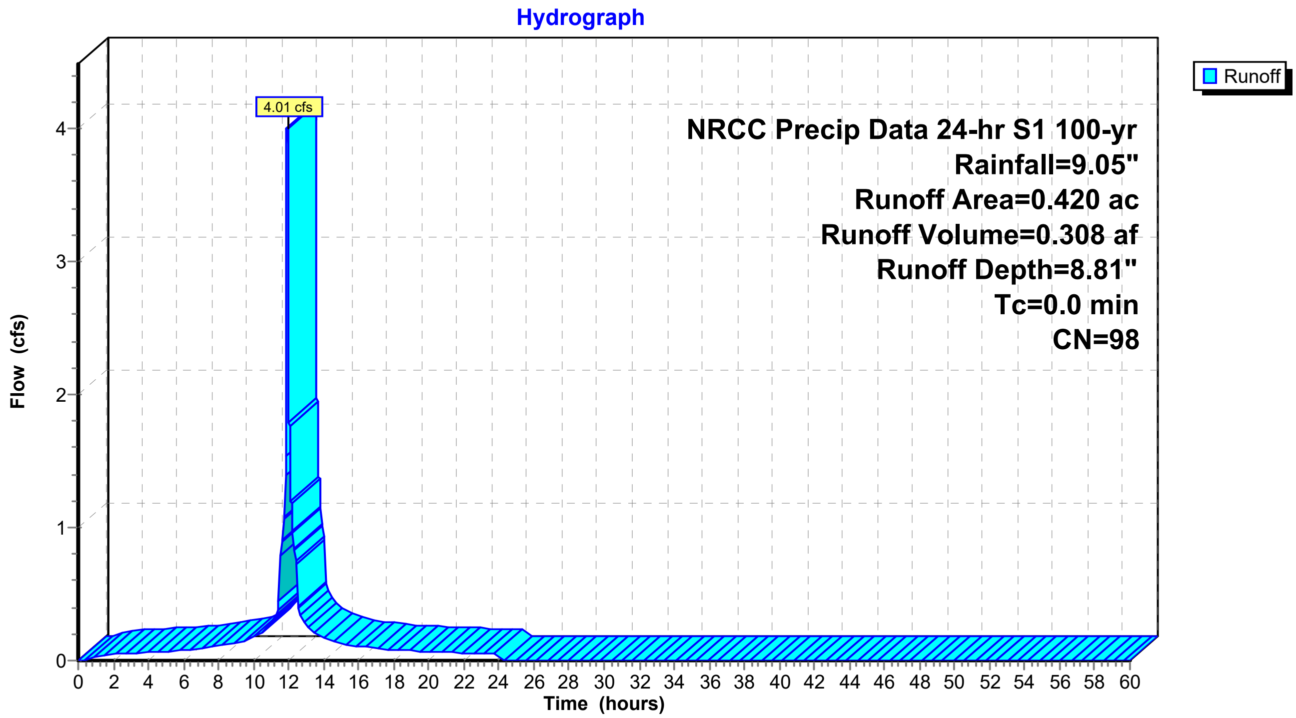
Runoff = 4.01 cfs @ 11.99 hrs, Volume= 0.308 af, Depth= 8.81"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

	Area (ac)	CN	Description
*	0.420	98	Wetland Permanent Pool
	0.420		100.00% Impervious Area

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

Subcatchment 1S: Wetlands Direct Rainfall



Summary for Subcatchment 2S: Bioretention Direct Rainfall

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

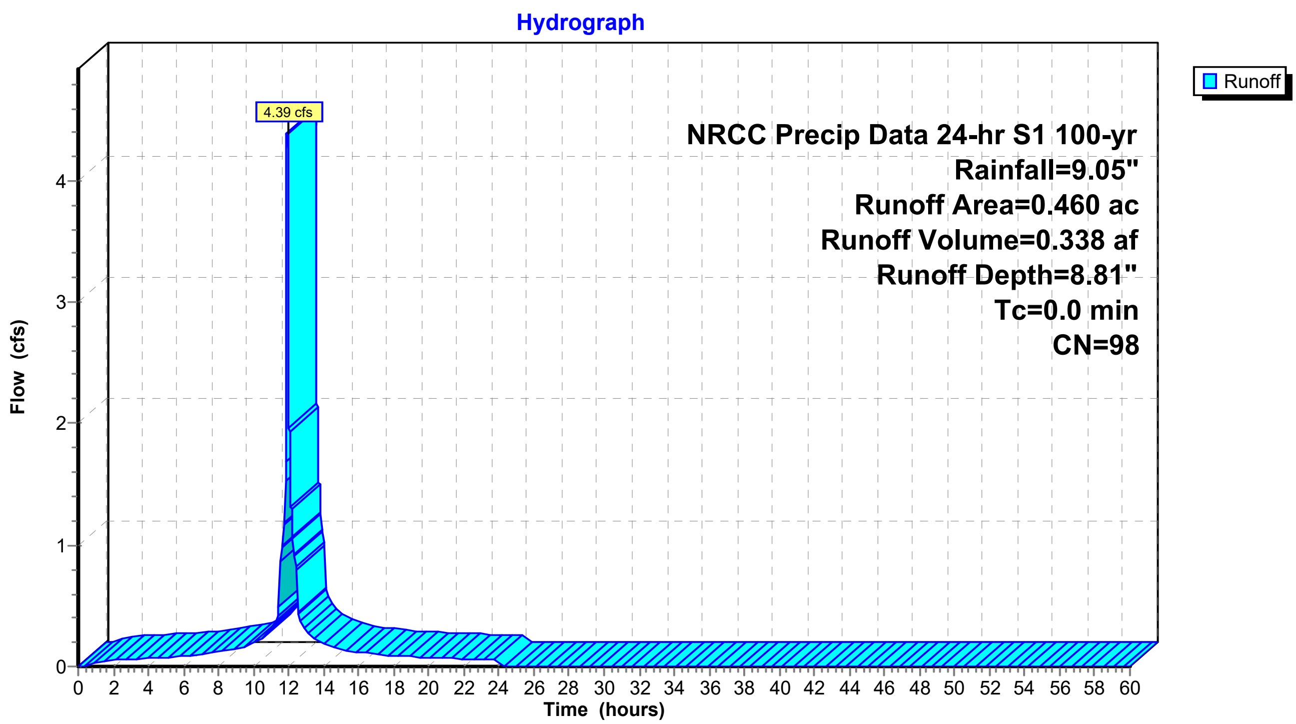
Runoff = 4.39 cfs @ 11.99 hrs, Volume= 0.338 af, Depth= 8.81"
Routed to Pond 2P : Cultec 280

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

	Area (ac)	CN	Description
*	0.460	98	Bioretention Cell Surface
	0.460		100.00% Impervious Area

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

Subcatchment 2S: Bioretention Direct Rainfall



Summary for Subcatchment FDA 1A: FDA 1A - Developed Site

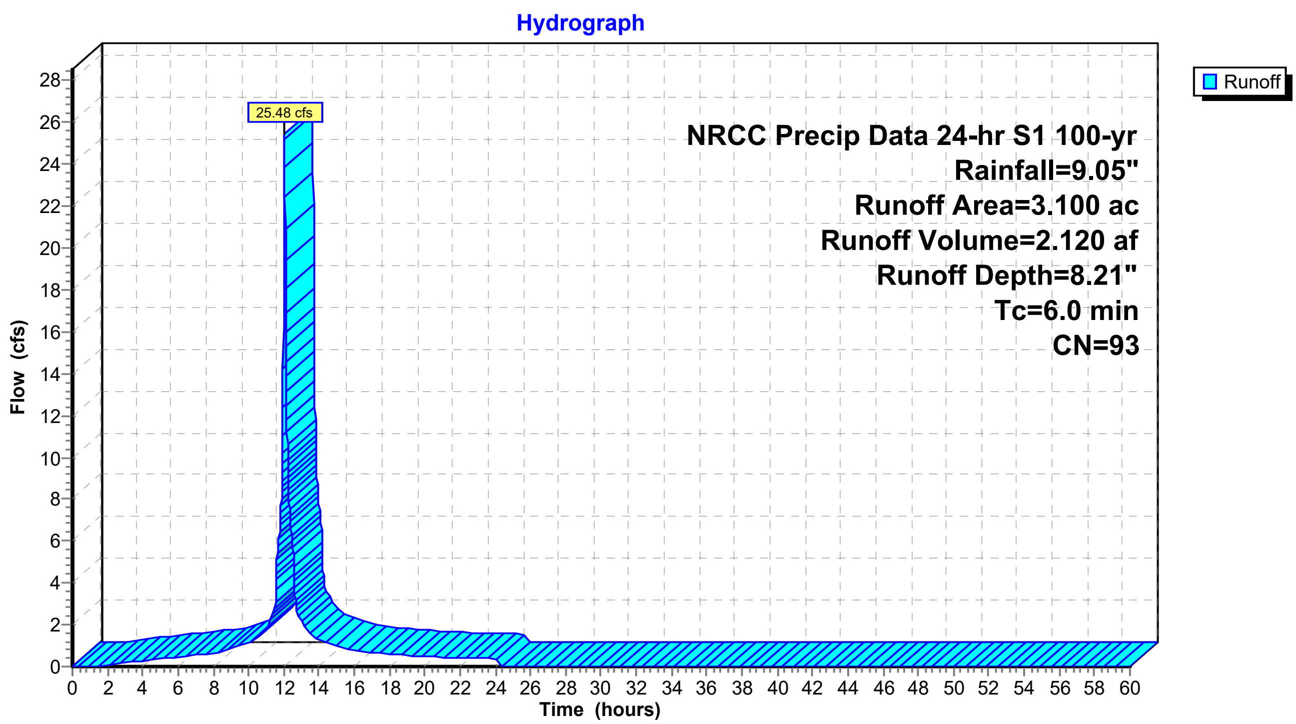
Runoff = 25.48 cfs @ 12.04 hrs, Volume= 2.120 af, Depth= 8.21"
Routed to Pond 1P : Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
1.290	98	Paved parking, HSG D
0.870	98	Roofs, HSG D
0.940	80	>75% Grass cover, Good, HSG D
3.100	93	Weighted Average
0.940		30.32% Pervious Area
2.160		69.68% Impervious Area

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

Subcatchment FDA 1A: FDA 1A - Developed Site



Summary for Subcatchment FDA 1B: FDA 1B

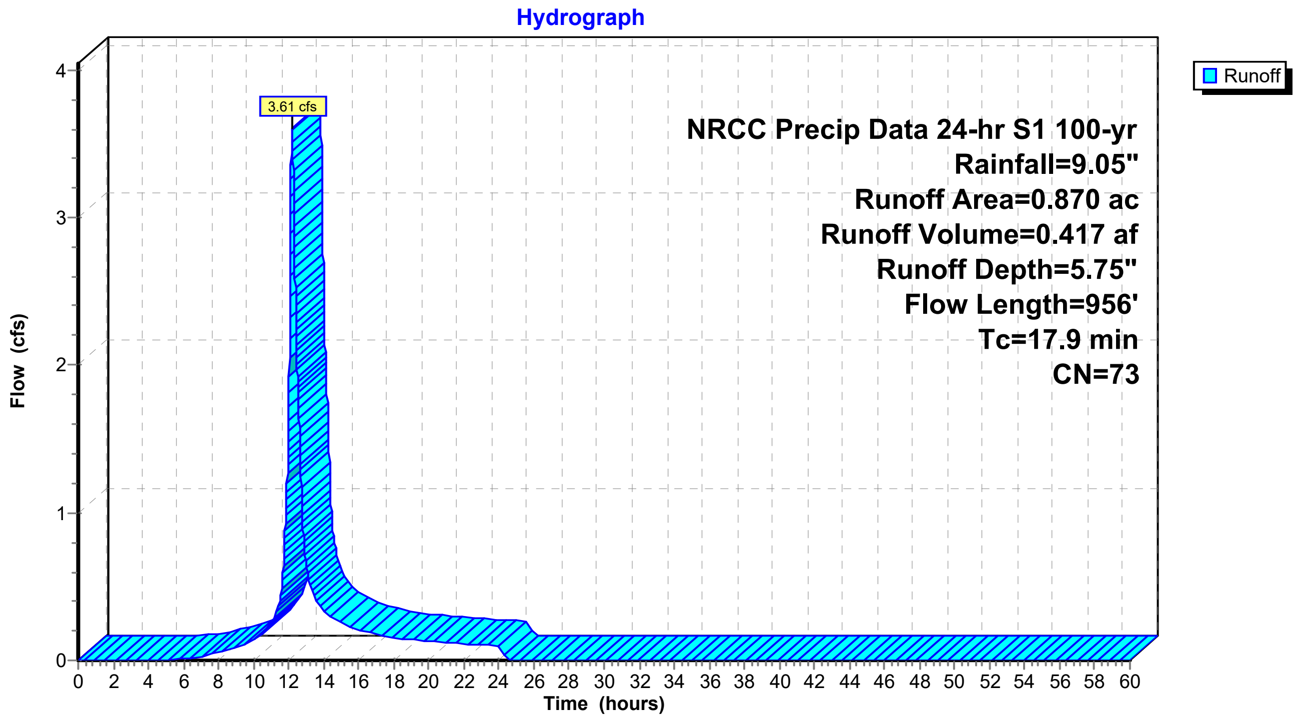
Runoff = 3.61 cfs @ 12.20 hrs, Volume= 0.417 af, Depth= 5.75"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
0.210	74	>75% Grass cover, Good, HSG C
0.220	80	>75% Grass cover, Good, HSG D
0.440	70	Woods, Good, HSG C
0.870	73	Weighted Average
0.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.0500	0.12		**Sheet Flow, Sheets Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	79	0.0700	1.32		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
0.1	24	0.1880	3.04		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.9	512	0.0075	4.56	5.59	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.5	241	0.0150	8.82	27.71	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
17.9	956	Total			

Subcatchment FDA 1B: FDA 1B



Summary for Subcatchment FDA 1C: FDA 1C

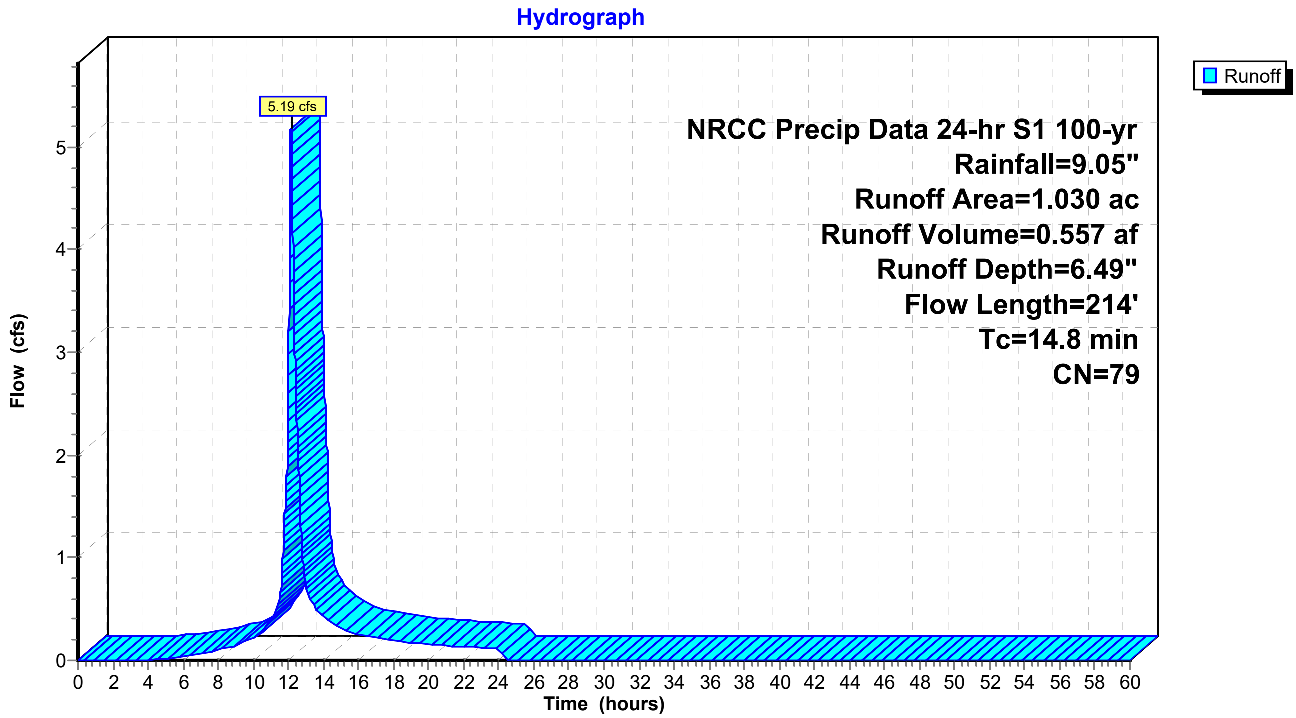
Runoff = 5.19 cfs @ 12.15 hrs, Volume= 0.557 af, Depth= 6.49"
Routed to Reach 17R : AP 1 Riprap Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
0.490	77	Woods, Good, HSG D
0.010	98	Paved parking, HSG D
0.530	80	>75% Grass cover, Good, HSG D
1.030	79	Weighted Average
1.020		99.03% Pervious Area
0.010		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	100	0.0600	0.12		**Sheet Flow, Sheet Woods**
					Woods: Light underbrush n= 0.400 P2= 3.44"
1.5	114	0.0660	1.28		**Shallow Concentrated Flow, Shallow Conc Woods**
					Woodland Kv= 5.0 fps
14.8	214	Total			

Subcatchment FDA 1C: FDA 1C



Summary for Subcatchment FDA 2: FDA 2

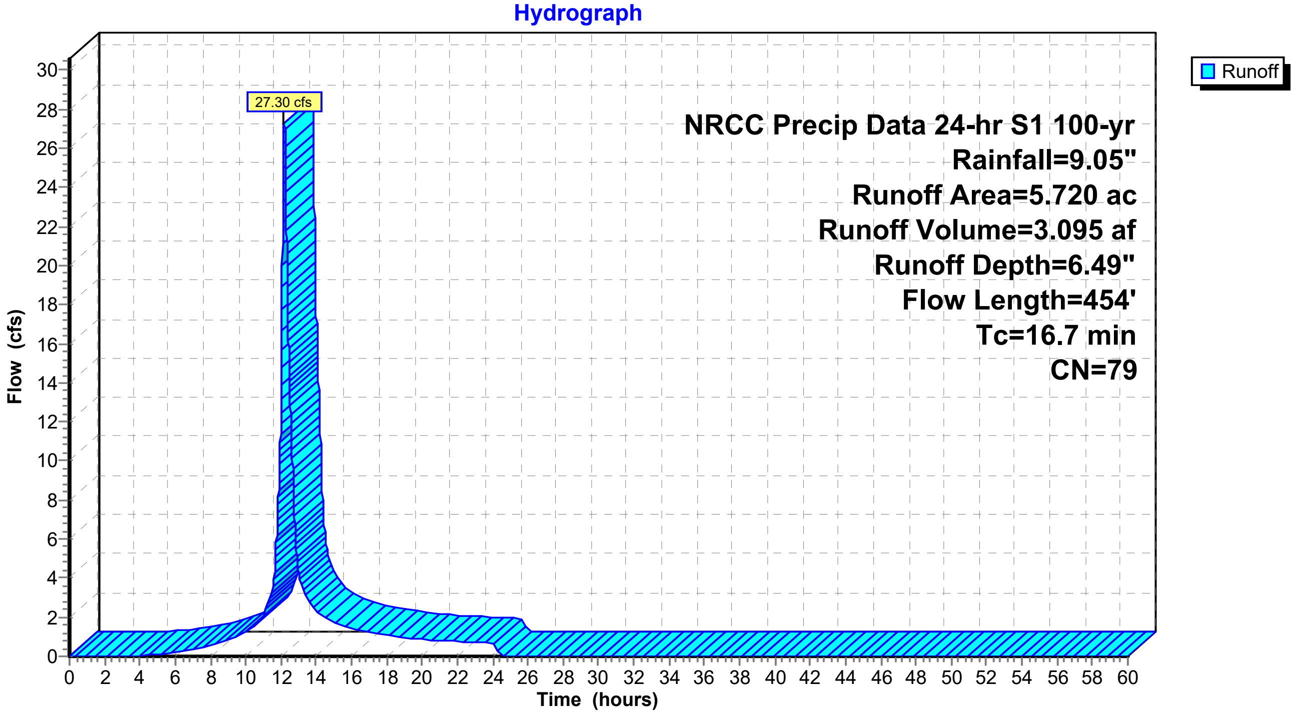
Runoff = 27.30 cfs @ 12.19 hrs, Volume= 3.095 af, Depth= 6.49"
Routed to Link 8L : Post AP 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
2.990	77	Woods, Good, HSG D
1.000	70	Woods, Good, HSG C
0.610	98	Paved parking, HSG D
1.120	80	>75% Grass cover, Good, HSG D
5.720	79	Weighted Average
5.110		89.34% Pervious Area
0.610		10.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	100	0.0750	0.14		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
2.4	165	0.0515	1.13		**Shallow Concentrated Flow, Shallow Conc** Woodland Kv= 5.0 fps
1.9	135	0.0300	1.21		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
0.2	54	0.8300	4.56		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
16.7	454	Total			

Subcatchment FDA 2: FDA 2



Summary for Subcatchment FDA 3: FDA 3

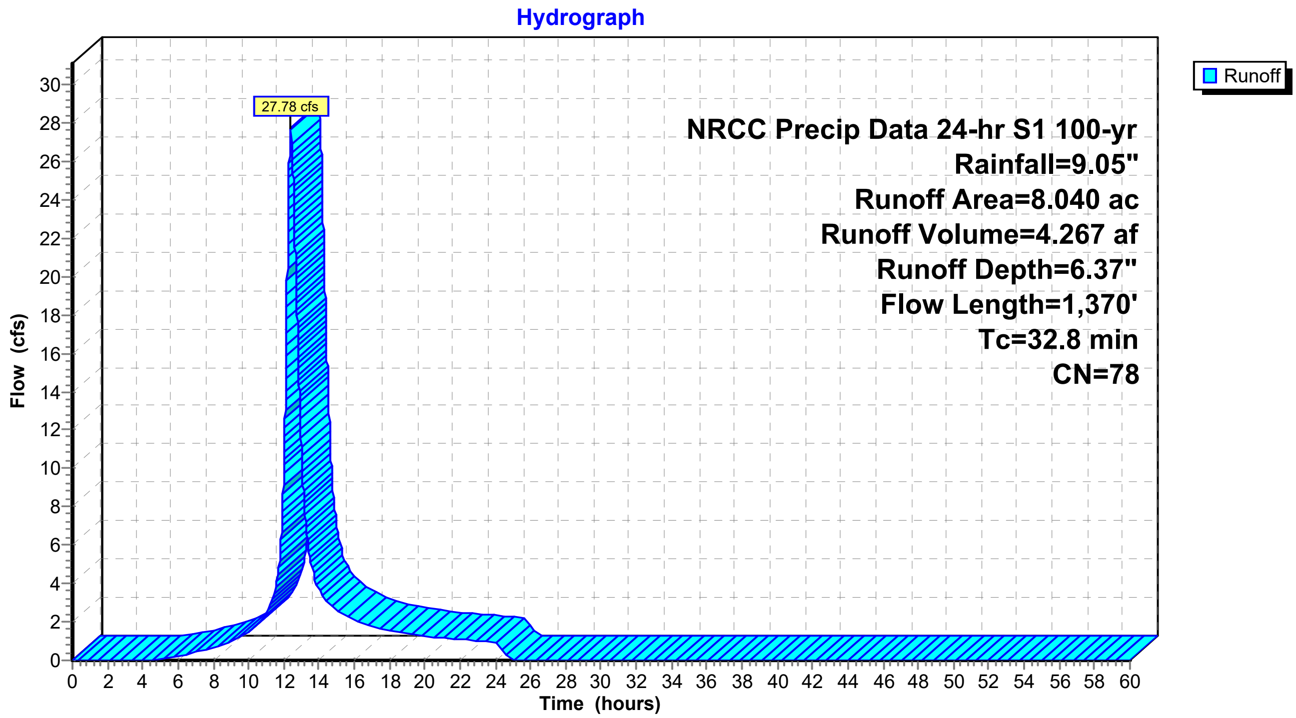
Runoff = 27.78 cfs @ 12.40 hrs, Volume= 4.267 af, Depth= 6.37"
Routed to Link 2L : Post AP 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
NRCC Precip Data 24-hr S1 100-yr Rainfall=9.05"

Area (ac)	CN	Description
3.180	77	Woods, Good, HSG D
2.100	70	Woods, Good, HSG C
0.970	98	Paved parking, HSG D
0.960	74	>75% Grass cover, Good, HSG C
0.830	80	>75% Grass cover, Good, HSG D
8.040	78	Weighted Average
7.070		87.94% Pervious Area
0.970		12.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0400	0.11		**Sheet Flow, Sheet Woods** Woods: Light underbrush n= 0.400 P2= 3.44"
9.2	423	0.0236	0.77		**Shallow Concentrated Flow, Shallow Conc Woods** Woodland Kv= 5.0 fps
3.1	218	0.0280	1.17		**Shallow Concentrated Flow, Shallow Conc Grass** Short Grass Pasture Kv= 7.0 fps
1.1	75	0.0540	1.16		**Shallow Concentrated Flow, Shallow Conc Woods Gentle** Woodland Kv= 5.0 fps
1.9	186	0.1080	1.64		**Shallow Concentrated Flow, Shallow Conc Woods 2** Woodland Kv= 5.0 fps
1.8	368	0.0050	3.49	146.64	**Channel Flow, Channel Stream** Area= 42.0 sf Perim= 42.2' r= 1.00' n= 0.030
32.8	1,370	Total			

Subcatchment FDA 3: FDA 3



Summary for Reach 17R: AP 1 Riprap Channel

Inflow Area = 5.880 ac, 51.87% Impervious, Inflow Depth > 7.23" for 100-yr event
Inflow = 13.17 cfs @ 12.50 hrs, Volume= 3.544 af
Outflow = 13.16 cfs @ 12.51 hrs, Volume= 3.543 af, Atten= 0%, Lag= 0.5 min
Routed to Link 8L : Post AP 2

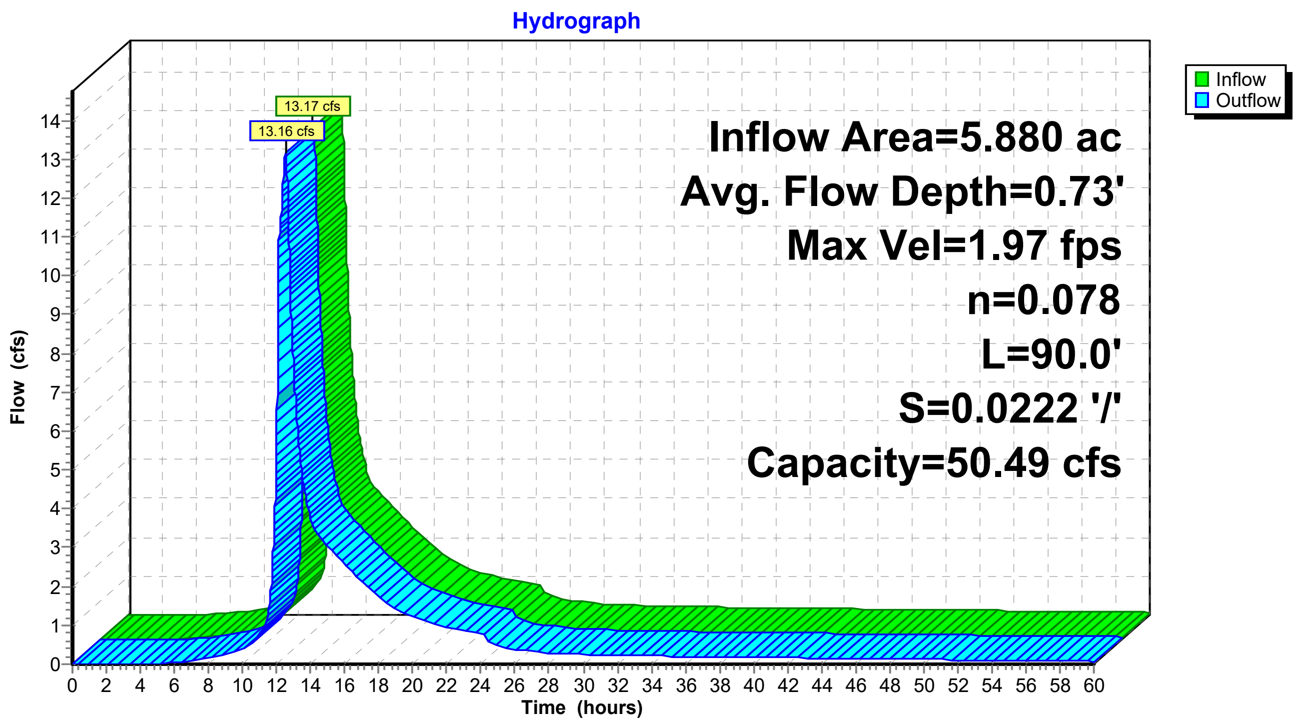
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.97 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.56 fps, Avg. Travel Time= 2.7 min

Peak Storage= 602 cf @ 12.51 hrs
Average Depth at Peak Storage= 0.73' , Surface Width= 11.37'
Bank-Full Depth= 1.50' Flow Area= 17.3 sf, Capacity= 50.49 cfs

7.00' x 1.50' deep channel, n= 0.078 Riprap, 12-inch
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 90.0' Slope= 0.0222 '/'
Inlet Invert= 380.00', Outlet Invert= 378.00'

‡

Reach 17R: AP 1 Riprap Channel



Summary for Pond 1P: Wetlands

Inflow Area = 3.520 ac, 73.30% Impervious, Inflow Depth = 8.28" for 100-yr event
Inflow = 27.28 cfs @ 12.04 hrs, Volume= 2.428 af
Outflow = 15.64 cfs @ 12.14 hrs, Volume= 2.371 af, Atten= 43%, Lag= 6.4 min
Primary = 0.31 cfs @ 12.14 hrs, Volume= 0.770 af
Routed to Pond 2P : Cultec 280
Secondary = 15.33 cfs @ 12.14 hrs, Volume= 1.600 af
Routed to Pond 2P : Cultec 280
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 398.33' @ 12.14 hrs Surf.Area= 23,698 sf Storage= 36,701 cf

Plug-Flow detention time= 358.3 min calculated for 2.370 af (98% of inflow)
Center-of-Mass det. time= 343.2 min (1,105.1 - 761.9)

Volume	Invert	Avail.Storage	Storage Description
#1	396.50'	54,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

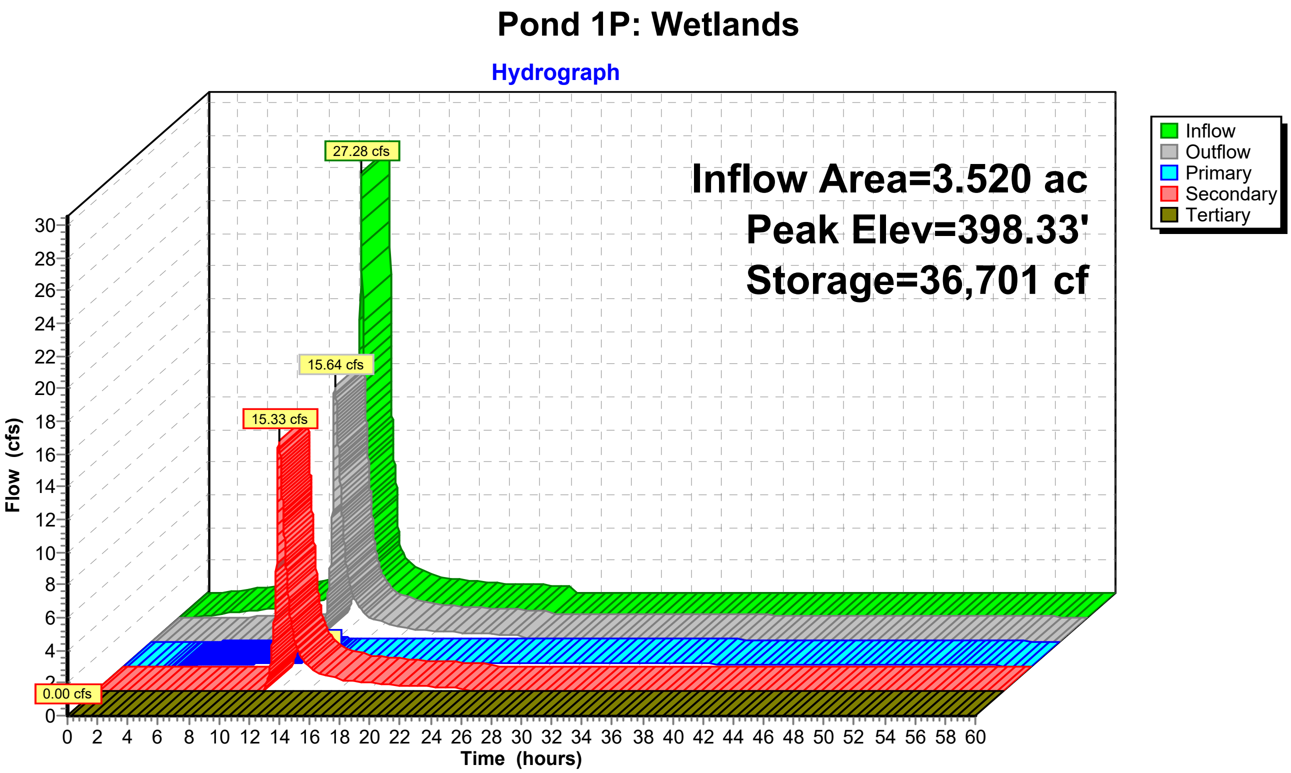
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
396.50	15,835	0	0
397.00	18,271	8,527	8,527
398.00	22,789	20,530	29,057
398.50	24,171	11,740	40,797
399.00	30,553	13,681	54,478

Device	Routing	Invert	Outlet Devices
#1	Primary	396.50'	**12.0" Round Culvert** L= 35.7' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 396.50' / 395.50' S= 0.0280 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	396.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	390.97'	**15.0" Round Culvert** L= 31.7' Ke= 0.500 Inlet / Outlet Invert= 390.97' / 390.56' S= 0.0129 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#4	Device 3	397.60'	**7.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#5	Tertiary	398.50'	**8.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.31 cfs @ 12.14 hrs HW=398.33' TW=391.31' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.31 cfs of 4.36 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.31 cfs @ 6.28 fps)

Secondary OutFlow Max=15.33 cfs @ 12.14 hrs HW=398.33' TW=391.31' (Dynamic Tailwater)
└─**3=Culvert** (Inlet Controls 15.33 cfs @ 12.49 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Passes 15.33 cfs of 15.51 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=396.50' TW=380.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Summary for Pond 2P: Cultec 280

Inflow Area = 3.980 ac, 76.38% Impervious, Inflow Depth > 8.17" for 100-yr event
Inflow = 17.19 cfs @ 12.09 hrs, Volume= 2.708 af
Outflow = 9.21 cfs @ 12.56 hrs, Volume= 2.570 af, Atten= 46%, Lag= 28.1 min
Primary = 9.21 cfs @ 12.56 hrs, Volume= 2.570 af
Routed to Reach 17R : AP 1 Riprap Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 392.16' @ 12.56 hrs Surf.Area= 19,043 sf Storage= 35,194 cf

Plug-Flow detention time= 246.0 min calculated for 2.569 af (95% of inflow)
Center-of-Mass det. time= 143.5 min (1,202.3 - 1,058.9)

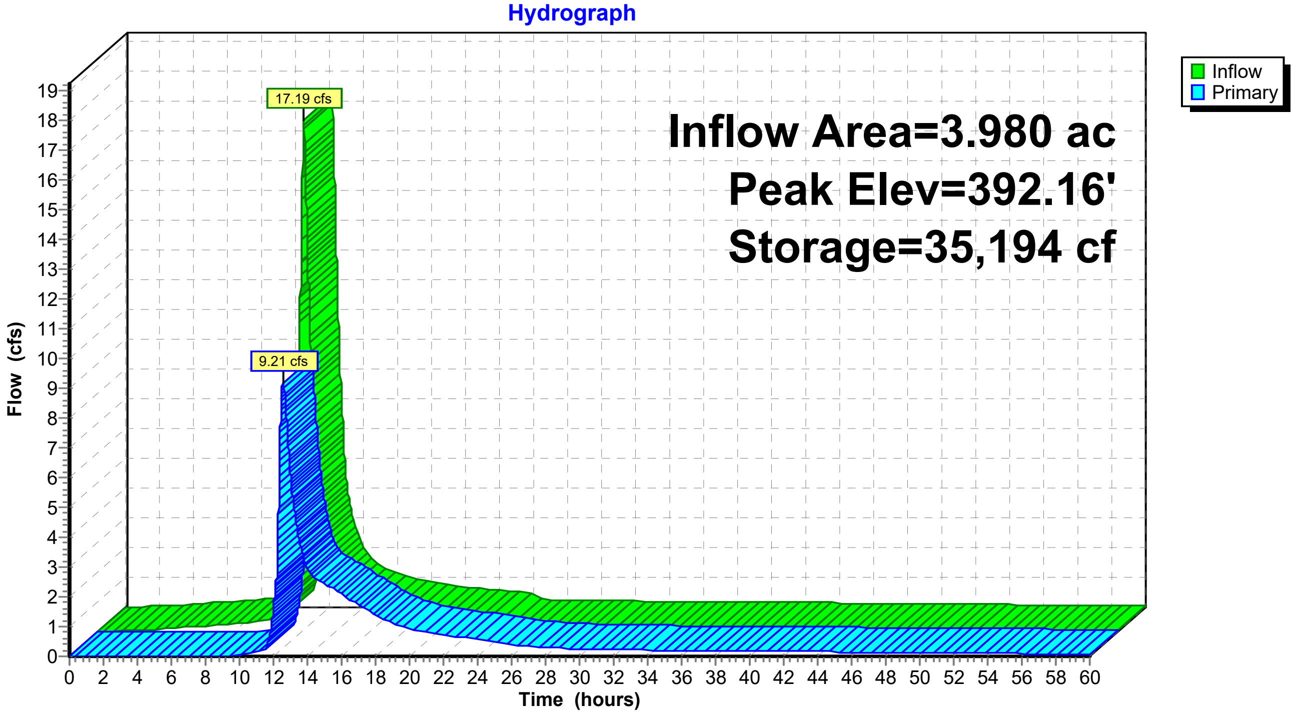
Volume	Invert	Avail.Storage	Storage Description
#1	389.54'	14,302 cf	**Chamber Stone (Prismatic)** Listed below (Recalc) 61,128 cf Overall - 25,374 cf Embedded = 35,754 cf x 40.0% Voids
#2	390.04'	25,374 cf	**Cultec R-280HD** x 597 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
		39,676 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
389.54	19,043	0	0
392.75	19,043	61,128	61,128

Device	Routing	Invert	Outlet Devices
#1	Primary	389.20'	**24.0" Round Culvert** L= 152.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 389.20' / 386.91' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	390.04'	**10.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	391.50'	**40.0" W x 8.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.21 cfs @ 12.56 hrs HW=392.16' TW=380.72' (Dynamic Tailwater)
1=Culvert (Passes 9.21 cfs of 21.20 cfs potential flow)
2=Orifice/Grate (Orifice Controls 3.43 cfs @ 6.29 fps)
3=Orifice/Grate (Orifice Controls 5.78 cfs @ 2.61 fps)

Pond 2P: Cultec 280

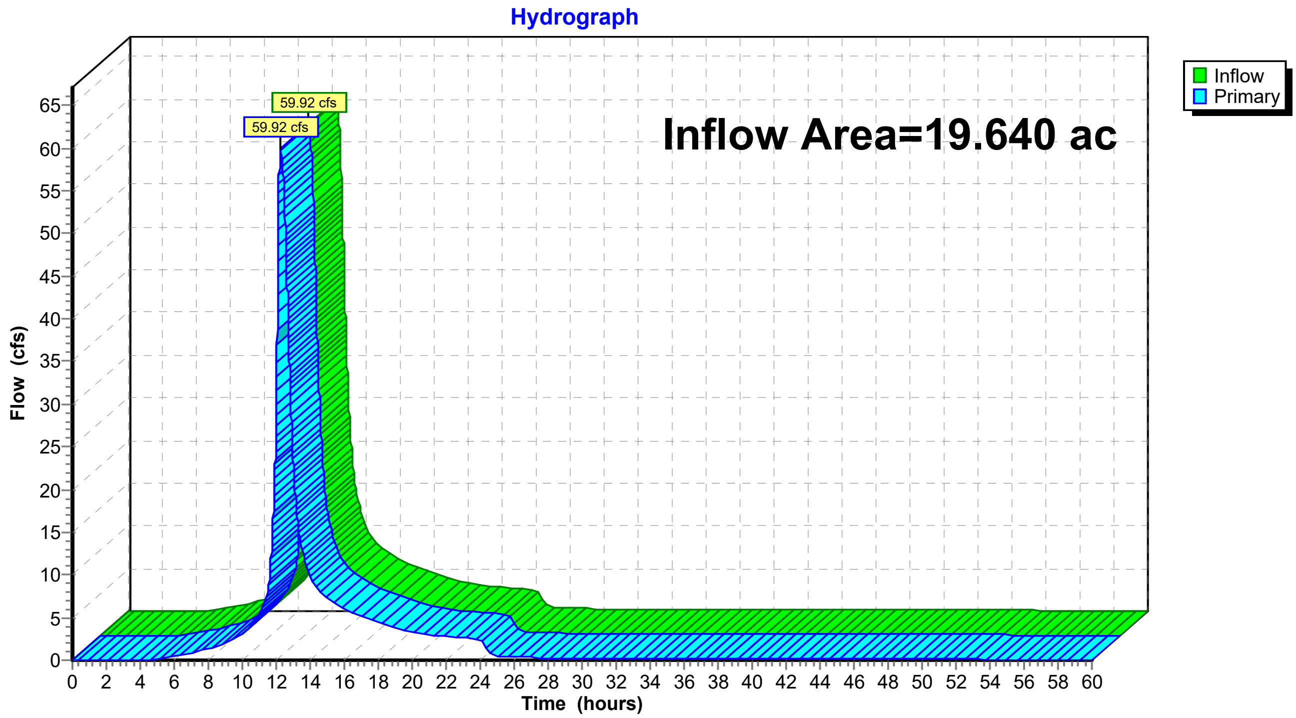


Summary for Link 2L: Post AP 3

Inflow Area =	19.640 ac,	23.57% Impervious,	Inflow Depth > 6.66"	for 100-yr event
Inflow =	59.92 cfs @	12.25 hrs, Volume=	10.905 af	
Primary =	59.92 cfs @	12.25 hrs, Volume=	10.905 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

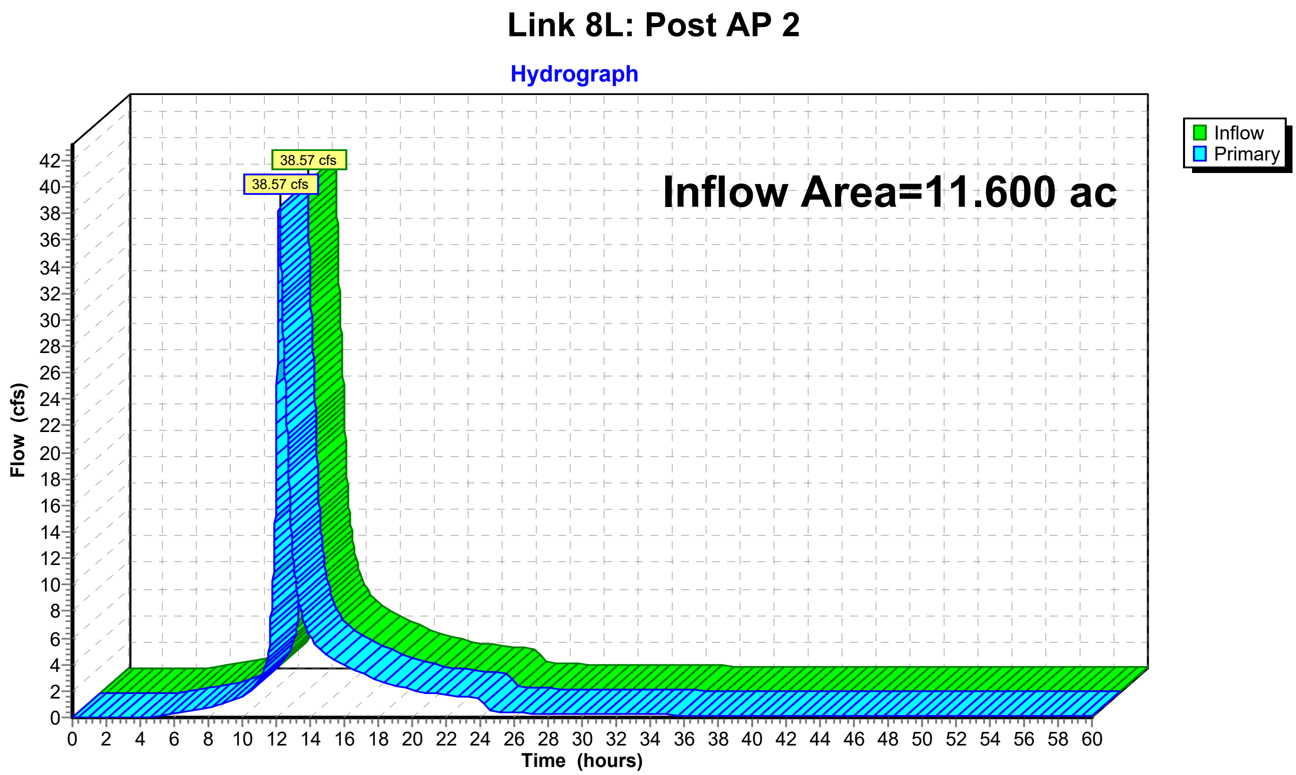
Link 2L: Post AP 3



Summary for Link 8L: Post AP 2

Inflow Area = 11.600 ac, 31.55% Impervious, Inflow Depth > 6.87" for 100-yr event
Inflow = 38.57 cfs @ 12.19 hrs, Volume= 6.638 af
Primary = 38.57 cfs @ 12.19 hrs, Volume= 6.638 af, Atten= 0%, Lag= 0.0 min
Routed to Link 2L : Post AP 3

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs



Appendix J: Other Permits List

Other Permits and Approvals	
Government Entity / Agency	**Approval(s) Required**
USEPA	Compliance with Administrative Order SDWA-02-2020-8001
USEPA	Water Infrastructure Finance and Innovation Act (WIFIA) Program
United States Army Corp on Engineers (USACE)	Wetlands / Section 404 Clean Water Act
United States Fish and Wildlife Service (USFWS)	Section 7 Consultation
Federal Aviation Administration (FAA)	Notice of Proposed Construction or Alteration (FAA Form 7460-1)
NYSDEC	State Pollution Discharge Elimination System (SPDES) General Permit for Construction Activity
NYSDEC	SPDES Industrial Permit (NY-2C) for Process Emergency Overflow
NYSDEC	401 Water Quality Certification
NYSDEC	Freshwater Wetlands
Environmental Facilities Corporation / NYSDOH	Drinking Water State Revolving Fund Program
Environmental Facilities Corporation / NYSDOH	Water Infrastructure Improvement Act (WIIA) Grant Program
NYSDOH	Compliance with Judgment and Order of New York State Supreme Court Index No. 13364-99, Justice Louis A. Barone
NYSDOH	Approval of Plans for Public Water Supply Improvement Completed Works Approval
New York State Office of Parks and Historic Preservation (NYSOPRHP)	State Historic Preservation Office (SHPO) Consultation
New York City of Environmental Protection (NYCDEP)	Sanitary Sewer Extension Permit
Westchester County Department of Health (WCDOH)	Approval of Plans for Public Water Supply Improvement Completed Works Approval
Westchester County Board of Legislators	Approvals for obtaining property rights and sewer easements
Westchester Department of Public Works	Building Approvals and Road Permits
Westchester County Department of Environmental Facilities	Approval to Connect to County Sewer System
Westchester County Planning Board	Administrative Review
Town of Mamaroneck Town Board	Approval of Funding for Project
Village of Mamaroneck Town Board	Approval of Funding for Project
Town/Village of Harrison, Town Board	Approval of Funding for Project
Town/Village of Harrison Planning Board	Freshwater Wetlands Permit
Town/Village of Harrison Planning Board	Site Plan Approval
Town/Village of Harrison Zoning Board of Appeals	Area Variance
Town/Village of Harrison Town Board	Special Exception Use Permit
Town/Village of Harrison Architectural Board of Review	Architecture Approval
Town/Village of Harrison Building Department	Building Permit
Town/Village of Harrison Building Department	Tree Removal Permit
Town/Village of Harrison Dept of Public Works	Street Opening Permit

Appendix K: State Historic Preservation Office

ANDREW M. CUOMO
Governor

ERIK KULLESEID
Commissioner

April 12, 2021

Ms. Natalie Ceresnak
Assistant Scientist
Hazen and Sawyer
498 Seventh Avenue
11th Floor
New York, NY 10018

Re: EPA
Rye Lake Filtration Plant Site Investigation
Purchase Street (adjacent to airport), Town of Harrison, Westchester County, NY
19PR06449

Dear Ms. Ceresnak:

Thank you for requesting the comments of the New York State Historic Preservation Office (SHPO). We have reviewed the submitted materials in accordance with Section 106 of the National Historic Preservation Act of 1966. These comments are those of the SHPO and relate only to Historic/Cultural resources. They do not include other environmental impacts to New York State Parkland that may be involved in or near your project. Such impacts must be considered as part of the environmental review of the project pursuant to the National Environmental Policy Act and/or the State Environmental Quality Review Act (New York Environmental Conservation Law Article 8).

OPRHP has reviewed Phase I Archaeological Survey, Rye Lake Water Filtration Facility Site, Town/Village of Harrison, Westchester County, New York (Richard Grubb & Associates, 3 December 2019). Based on this and other submitted information, it is the opinion of the New York SHPO that no historic properties, including archaeological and/or historic resources, will be affected by this undertaking.

If you have any questions, please don't hesitate to contact me.

Sincerely,

Philip A. Perazio, Historic Preservation Program Analyst - Archaeology Unit
Phone: 518-268-2175
e-mail: philip.perazio@parks.ny.gov via e-mail only

cc: Eileen Feldman, Hazen and Sawyer; Michael Gall and Lauren Lembo, RGA