RESPONSES TO THE TOWN OF NORTHBOROUGH PLANNING REVIEW COMMENTS DATED APRIL 10, 2024

1. **COMMENT**: The Table of Density and Dimensional Regulations (Zoning Bylaw Section 7-06-030) specifies that the minimum front yard setback in the Downtown Business District is 6 feet and the maximum front yard setback is 20 feet. The Zoning Board of Appeals granted a dimensional variance to allow the proposed building to be located up to 40 feet from the front lot line to enable the large fire apparatus to maneuver into/out of the building and maintain the maximum grade of 3% and ensure clear sight lines.

   RESPONSE: *Please see revised plans with updated Zoning Table inclusive of the dimensional variances granted.*

2. **COMMENT**: The Applicant was granted a dimensional variance to install a wall sign of up to 172 square feet.

   RESPONSE: *No changes made to the site plan.*

3. **COMMENT**: The Zoning Board of Appeals denied the application for a use variance to allow an Electronic Message Center within the proposed freestanding sign. The Applicant should specify whether the freestanding sign will be removed or whether they plan to submit an alternative design without the Electronic Message Center.

   RESPONSE: *The electronic portion of the sign has been removed. The sign may be built as is or slightly modified, though it is not anticipated to change size or require zoning approval.*

4. **COMMENT**: The Applicant submitted a number of written waiver requests as detailed below. The Planning Board should determine if they are amenable to the grant of these waiver requests:
   a. All filing fees, including advertising fee.
   b. Planning Board Rules and Regulations Section 7.2(C) - Waiver from the required scale of 1"=40'. Most sheets of the site plan are at the scale of 1"=20'.
   c. Planning Board Rules and Regulations Section 7.2(C)(4) - Locus plan at the scale of 1"=100' showing the location and use of any building within 300 feet of the boundary of the site and driveway and utilities within 200 feet of the subject property along the frontage street. The submitted locus plan is Not To Scale and does not include utility information. A supplemental land use/land cover plan entitled "Figure 1: Site Locus Map" was submitted, but it also does not provide any information about utilities.
   d. Planning Board Rules and Regulations, Section 7.2(C)(7) - Extending contours at least 50 feet beyond the site boundaries. For the most part, the contours extend at least 20 feet beyond the site boundaries.
   e. Planning Board Rules and Regulations Section 7.2(D)(1)(a) – Traffic impact assessment.

RESPONSE: *Item c: An updated site locus map at scale 1" = 100' has been included with this response to comments document. This map includes the location and use of buildings within 300 feet of the project boundary and utility information within 200 feet of the subject property along the frontage. The original waiver requested for the required utility information is retracted.*

5. **COMMENT**: The following required information is missing from the site plan. The Applicant should revise the plan to depict the required information or submit a written waiver request for Planning Board consideration:

   a. Planning Board Rules and Regulations Section 7.2(C)- All plans and stormwater documents should be stamped by the qualified professional who prepared them;
   b. Planning Board Rules and Regulations, Section 7.2(9)- Calculation of proposed lot coverage;
   c. Planning Board Rules and Regulations, Section 7.2(5)- Location of the site relative to the Groundwater Protection Overlay District;
   d. Planning Board Rules and Regulations, Section 7.2(6)- Location of the site relative to the Floodplain District.

RESPONSE: *a. Stamped copies of the Site Plans and Stormwater Management Report have been provided as part of this response to comments.*

b. Calculation of proposed lot coverage has been added to the zoning table.

c. Groundwater Protection Overlay District map has been attached. A portion of the site falls within the Groundwater Protection Overlay District Area 3.

d. A FEMA flood map has been provided in the Stormwater Management Report. The FEMA flood map shows the site in relation to the Zone AE of the Cold Harbor Brook which has a Base Flood Elevation of 295.00 FT. The Zone AE is approximately 200 FT from the site.

6. **COMMENT**: A detail for precast concrete wheel stops is shown on Sheet C7.2, however the location of these wheel stops is not depicted on the layout plan. Please clarify where the wheel stops will be located or remove the detail from the site plan to avoid confusion if they will not be installed on site.

RESPONSE: *The concrete wheel stop detail has been removed from the site plan.*

7. **COMMENT**: The landscape plan on Sheet L-1 includes a detail of a fence. Although that fence is appropriate for the top of the retaining wall, the fence around the dumpster should screen the dumpster in accordance with Zoning Bylaw Section 7-09-020C.(d). A stockade or white vinyl fence is preferred over a chain link fence with privacy slats.

RESPONSE: *Please see the revised Landscape Plan for more information on the dumpster enclosure.*

8. **COMMENT**: The Demolition Plan (Sheet C2.0) shows removal of the existing brick crosswalk across Route 20 that exists in between 53 & 56 West Main Street. It is not clear if the intention is to replace the crosswalk with a striped crosswalk or eliminate the crosswalk altogether. I strongly recommend against the removal of the crosswalk as the Town is embarking on a Downtown Revitalization effort aimed at enhancing walkability throughout the Town Center and making the area more attractive. I am amenable to an alternative location for the crosswalk, but it should exist somewhere along the fire department's property frontage and should have a similar stamped asphalt design in a brick pattern so that it matches the other crosswalks in the area.

RESPONSE: *The site plan has been updated to keep the existing crosswalk as is.*

9. **COMMENT**: It is unclear if the sidewalk proposed along the east side of the building has a 7" high safety curb at the building egress location per Zoning Bylaw Section 7-09-030E(4). A detail of the curb should be added to demonstrate compliance with this requirement, or the Applicant should submit a written waiver request for Planning Board consideration.

RESPONSE: *Sheet C-400 Grading Plan has been revised to provide a 7" curb reveal.*

10. **COMMENT**: I recommend requiring submittal of the retaining wall design for Planning Board review and approval as a Condition of Approval.

RESPONSE: *A note has been added to the retaining wall detail indicating the Contractor shall provide the design of the retaining wall to the Planning Board following submission during construction.*

11. **COMMENT**: A detail of the proposed emergency gate should be added to the site plan.

RESPONSE: *The gate proposed at the center of the site between the two parking areas is proposed to be a manual gate. Please see revised Landscape Plan for more information.*

12. **COMMENT**: I recommend including a Condition of Approval that mandates a connection between the sidewalk along the applicable property frontage and the sidewalk serving the abutting property at 73-79 West Main Street. Alternatively, a new sidewalk could be constructed within the Route 20 right-of-way from the Fire Station to the first driveway serving the Hillside Grill.

RESPONSE: *The site plan has been updated to provide a walk adjacent to the right of way along the project property frontage.*

JJ/npc

RESPONSES TO THE TOWN OF NORTHBOROUGH SITE PLAN REVIEW COMMENTS DATED APRIL 11, 2024

1. **COMMENT**: The application package also included a list of Requested Waivers and there is only one item I would recommend not be granted which is the locus map at a scale of 1" = 100' showing the entire project, the location and use of any buildings within 300 feet of the project boundary. The point of requiring this item is to have a comprehensive discussion during the public hearing regarding potential conflicts with existing driveways in the area. While I understand the emergency vehicles will have priority over all other vehicles it is the entering and exiting of the non-emergency vehicles that should be discussed to minimize conflicts.

   RESPONSE: *An updated site locus map at scale 1" = 100' has been included with this response to comments document. This map includes the location and use of buildings within 300 feet of the project boundary and utility information within 200 feet of the subject property along the frontage. The original waiver requested for the required utility information is retracted.*

2. **COMMENT**: The Stormwater Management Report appears to be appropriately designed for this site; however, the Site Plans and the Stormwater Management Report are not stamped by a Professional Engineer and should be.

   RESPONSE: *Stamped copies of the Site Plans and Stormwater Management Report have been provided as part of this response to comments.*

3. **COMMENT**: The plans indicate the proposed building is to be connected to the town sewer and town water systems. Therefore, the project will be required to pay a Sewer Privilege fee in the amount of $27,300 and a Water Privilege fee in the amount of $7,000 prior to obtaining the building permit or shall obtain waivers from the Water and Sewer Commissioners.

   RESPONSE: *A waiver request will be submitted to the Water and Sewer Commissioners for the Water and Sewer Privilege fees.*

4. **COMMENT**: All existing driveway openings which are not being utilized shall be removed and replaced with a concrete sidewalk.

   RESPONSE: *Existing driveway openings serving the property via West Main Street that are not remaining will be removed and replaced with curbing and a concrete walk.*

5. **COMMENT**: The proposed plan indicates the existing crosswalk is to be removed and disposed of. I recommend the crosswalk be re-installed near the intersection of Monroe Street and an additional crosswalk could be installed at the westerly end of the property. Both crosswalks should be similar to the existing imprinted crosswalk for continuity in the downtown area.

   RESPONSE: *Please see revised plans attached with the existing crosswalk proposed to remain. One of Pare's Traffic Engineer reviewed the option of an additional crosswalk at the westerly end of the property and has indicated that it is best to limit midblock crosswalks. The Traffic Engineer has indicated that the existing location is preferable to the westerly end of the property based on the driveways and activity at the westerly end of the property. Therefore, an additional crosswalk has not been added to the plans.*

6. **COMMENT**: The project requires a State Highway Access Permit to be issued by Mass DOT and a copy of that permit shall be submitted to the Town prior to the start of any construction on site. MassDOT will have input into the location of the relocated crosswalk and must also approve the connection of the proposed drainage system.

   RESPONSE: *A State Highway Access Permit is required for this project. A note has been added to the drawings indicating that the Contractor shall submit a copy of that permit to the Town of Northborough prior to the start of construction.*

7. **COMMENT**: The project will require new preemption signals to be installed in West Main Street in front of the proposed Fire Station and once the this is accomplished the existing preemption equipment in Church Street, installed for the benefit of the existing Fire Station should be removed. The removal of the preemption equipment in Church Street will also allow for a reevaluation of the intersection of Church Street, Pierce Street and West Main Street by MassDOT.

   RESPONSE: *A new preemption signal is proposed as part of this project. Removal of the old preemption signal and reevaluation of the Church Street intersection is not proposed as part of this project.*

8. **COMMENT**: The application indicates there are approximately 30 public parking spaces to be provided. These spaces should be labelled on the plan and on site.

   RESPONSE: *Signs have been added to the plans to designate public parking and authorized vehicles only for the two respective entrances.*

9. **COMMENT**: A minimum of two permeability tests shall be performed within each of the areas to be utilized for infiltration, to verify all assumptions made in the design of the drainage system. The Town shall be provided with an opportunity to witness the testing. The permeability tests shall be performed with the results submitted to the Town Engineer prior to the issuance of the building permit.

RESPONSE: *The infiltration systems have been designed based on the infiltration rate determined from on-site soil texture and Rawls rates as published in the Massachusetts Stormwater Handbook as specified in the Town of Northborough Stormwater Management Regulations voted August 16, 2021, Section 7 Stormwater Management Plan for Permit Application, Part G Stormwater Management Design Standards number 11.*

10. **COMMENT**: The flow of water of water exiting each of the underground infiltration systems shall be at the opposite end of the system from where the flow enters to avoid short circuiting of the flow.

RESPONSE: *The outlets of each underground infiltration system have been designed with a weir to prevent water from short circuiting the systems.*

11. **COMMENT**: The plans indicate buoyancy calculations of the underground concrete vault detention system are to be provided by the contractor and I recommend these calculations be provided by the design engineer as a condition of approval.

RESPONSE: *Attached please find buoyancy calculations for the underground concrete vault detention systems. The designer of the selected system shall provide final buoyancy calculations based on the systems selected during construction.*

12. **COMMENT**: A Land Disturbance Permit from the Conservation Commission is required upon approval by the Planning Board and prior to the start of any construction.

RESPONSE: *A Land Disturbance Permit was submitted to the Conservation Commission on April 25, 2024.*

13. **COMMENT**: The Stormwater Operation and Maintenance Plan and Long Term Pollution Prevention Plan should be revised to include annual reporting to the Town. The Operation and Maintenance Plan includes some equipment requiring maintenance and/or replacement products which is not easily accomplished by the Public Works Department with their available equipment and staff. Therefore, I recommend the Public Works Director be part of a discussion to determine some alternate water quality devices and a more appropriate maintenance schedule which is more practical for the DPW to perform. In the event some alternatives are not available, then the Fire Department may need to hire an independent contractor to perform the long term operation and maintenance of the proposed drainage system.

RESPONSE: *Please see revised Stormwater Operations and Maintenance Plan and Long Term Pollution Prevention Plan which includes annual reporting to the Town.*

The proposed products noted are for reference only. The Contractor shall provide the specified products or approved equivalent. Operations and Maintenance and Long Term Pollution Prevention Plan shall be updated with the selected products

maintenance procedures per manufacturer requirements.

The Fire Department shall establish a Maintenance Agreement if the DPW is unable to perform the required maintenance and/or provide replacement products for the systems selected during construction.

14. **COMMENT**: A completed Operation and Maintenance inspection report shall be submitted with the as-built plan prior to the issuance of an occupancy permit.

RESPONSE: *An Operations and Maintenance inspection report template is provided in the Operations and Maintenance Plan. A note has been added to the plans indicating that the Contractor shall provide an Operation and Maintenance inspection report with the as-built plan.*

15. **COMMENT**: Once all comments from all approvals have been incorporated onto a final set of plans with the same revision date, the plans shall be reviewed and approved by Town Staff prior to the start of any construction.

RESPONSE: *Please see updated plans attached.*

16. **COMMENT**: An as-built plan of the entire site which is to be drawn at the same scale as the approved plan shall be submitted to the Town for approval prior to the issuance of a certificate of occupancy. The as-built plan for the entire site shall include, at a minimum and as applicable to the project, a permanent benchmark, elevation of all utilities, pipe inverts and outlets, pipe sizes, materials, slopes; all drainage structures; limits of clearing, grading and fill; all structures, pavement; contours; and all dates of fieldwork. The drainage system shall also be certified by a Professional Engineer stating the drainage system was built substantially in accordance with the design and will perform as designed. Upon approval by the Town one (1) mylar and three (3) paper copies of the as-built plan shall be submitted in addition to an electronic copy compatible with the Town's GIS system. The as-built plan shall be based on the Town's vertical datum (NAVD 88) and the horizontal datum (NAD 83).

RESPONSE: *The Contractor will be responsible for providing as-built drawings.*

JJ/npc

Northborough Fire Station

63 West Main Street
Town of Northborough, MA

CIVIL ENGINEER:

PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
401-334-4100

ARCHITECT:

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24 Roland Street,
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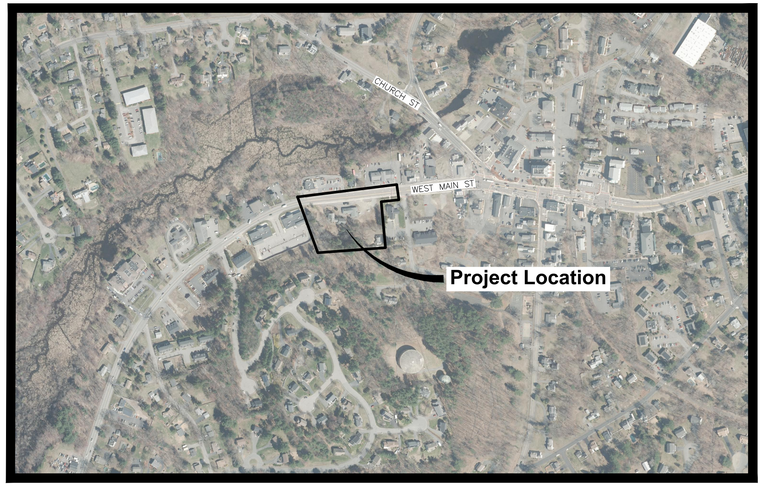


Scale : N.T.S.

INDEX OF DRAWINGS

PLANNING BOARD SUBMISSION
MARCH 18, 2024
REVISED APRIL 23, 2024
REVISED MAY 14, 2024

REFERENCE

1. PROJECT LOCATION: 61 AND 65 WEST MAIN STREET, AND 10 MONROE STREET, NORTHBOROUGH, MA 01532. ASSESSOR'S MAP 63, LOT 9 PARCEL 2, LOT 10 PARCEL 1, AND LOT 7.
2. EXISTING CONDITIONS MAPPING TAKEN FROM PLAN ENTITLED "EXISTING CONDITIONS PLAN 61-65 WEST MAIN STREET NORTHBOROUGH, MA" PREPARED BY CHAPPELL ENGINEERING ASSOCIATES, LLC, DATED SEPTEMBER 1, 2023. DATUMS: HORIZONTAL: NAD 83, VERTICAL: NAVD 88.

GENERAL NOTES

1. THE COMMONWEALTH OF MASSACHUSETTS STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGE CONSTRUCTION, 2021 EDITION OR LATEST REVISION, AND THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION CONSTRUCTION STANDARD DETAILS ARE MADE A PART HEREOF AS FULLY AND COMPLETELY AS IF ATTACHED HERETO. ALL WORK SHALL MEET OR EXCEED THE MASSACHUSETTS STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, WITH LATEST REVISIONS. THE LATEST REVISION OF THE STANDARD SPECIFICATIONS MAY BE OBTAINED AT THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
2. THE CONTRACTOR SHALL MAKE ALL NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN ALL NECESSARY CONSTRUCTION PERMITS, PAY ALL FEES AND POST ALL BONDS ASSOCIATED WITH THE SAME, AND COORDINATE WITH THE ENGINEER AND OWNER'S REPRESENTATIVE AS REQUIRED.
3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR JOB SITE SAFETY. THE CONTRACTOR SHALL PROVIDE TEMPORARY FENCING AND/OR BARRIERS AROUND ALL OPEN EXCAVATED AREAS IN ACCORDANCE WITH OSHA FEDERAL, STATE, AND LOCAL REQUIREMENTS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THAT THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS DO NOT CONFLICT WITH ANY KNOWN EXISTING OR OTHER PROPOSED IMPROVEMENTS. IF ANY CONFLICTS ARE DISCOVERED, THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE ENGINEER PRIOR TO INSTALLATION OF ANY PORTION OF THE SITE WORK WHICH WOULD BE AFFECTED. NO FIELD ADJUSTMENTS IN THE LOCATION OF SITE ELEMENTS SHALL BE MADE WITHOUT THE ENGINEERS APPROVAL.
5. IF ANY DEVIATION OR ALTERATION OF THE WORK PROPOSED ON THESE DRAWINGS IS REQUIRED, THE CONTRACTOR SHALL IMMEDIATELY CONTACT AND COORDINATE ANY DEVIATIONS WITH THE ENGINEER AND OWNER.
6. ANY AREA OUTSIDE OF THE LIMIT OF WORK THAT IS DISTURBED SHALL BE RESTORED TO ITS ORIGINAL CONDITION AT NO ADDITIONAL COST TO THE OWNER.
7. ALL SITE WORK SHALL MEET OR EXCEED THE SITE WORK SPECIFICATIONS PREPARED FOR THIS PROJECT.
8. ALL SIGNS SHALL BE REFLECTORIZED TYPE III SHEETING AND CONFORM WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, LATEST REVISION.
9. ALL UTILITIES (LOCATION AND ELEVATION) DEPICTED SHALL BE CONSIDERED APPROXIMATE ONLY. BEFORE COMMENCING SITE WORK IN ANY AREA, CONTACT "DIG SAFE" AT 1-888-DIG-SAFE (1-888-344-7233) TO ACCURATELY LOCATE UNDERGROUND UTILITIES. ALL DAMAGE TO EXISTING UTILITIES OR STRUCTURES, AND THE COST TO REPAIR THE DAMAGES TO INITIAL CONDITIONS, AS SHOWN ON THE PLANS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
10. NO EXCAVATION SHALL BE DONE UNTIL COMPANIES ARE PROPERLY NOTIFIED IN ADVANCE. NOTE THAT NOT ALL EXISTING UNDERGROUND UTILITIES ARE SHOWN. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT ALL RESPECTIVE UTILITY COMPANIES TO VERIFY AND LOCATE EXISTING UTILITIES.

LAYOUT NOTES

1. ALL LINES ARE PERPENDICULAR OR PARALLEL TO THE LINES FROM WHICH THEY ARE MEASURED UNLESS OTHERWISE INDICATED.
2. ACCESSIBLE RAMPS SHALL BE PER THE AMERICAN WITH DISABILITIES ACT (ADA) ACCESSIBILITY GUIDELINES AND CODE OF MASSACHUSETTS REGULATIONS (CMR) TITLE 521 OF THE ARCHITECTURAL ACCESS BOARD REGULATIONS.
3. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL PERFORM BENCHMARK FIELD LEVEL VERIFICATION AND COORDINATE LAYOUT CHECK. THE CONTRACTOR SHALL CONTACT PARE CORPORATION IF ANY DISCREPANCIES ARE FOUND.
4. DIMENSIONS OF PARKING SPACES AND DRIVEWAYS ARE FROM FACE OF CURB TO FACE OF CURB. DIMENSIONS FROM BUILDING ARE FROM FACE OF BUILDING TO FACE OF CURB.
5. ALIGN WALKWAYS ON DOORWAYS THEY SERVE TO PROVIDE MINIMUM REQUIRED MANEUVERING CLEARANCE IN ACCORDANCE WITH THE AMERICAN WITH DISABILITIES ACT (ADA) ACCESSIBILITY GUIDELINES AND CODE OF MASSACHUSETTS REGULATIONS (CMR) TITLE 521 OF THE ARCHITECTURAL ACCESS BOARD REGULATIONS.

DEMOLITION NOTES

1. THE CONTRACTOR SHALL COORDINATE ALL DEMOLITION OF STRUCTURES, PAVEMENT AND CONCRETE MATERIALS, AND UTILITIES WITH APPROPRIATE PROPOSED SITE GENERAL, GRADING, UTILITY, AND LANDSCAPING DRAWINGS.
2. ALL NOTED UTILITIES TO BE REMOVED AND DISPOSED OF, RELOCATED OR CAPPED REPRESENT ALL KNOWN SITE CONDITIONS TO BE DEMOLISHED. THE CONTRACTOR SHALL COORDINATE ALL UNFORESEEN CONDITIONS WITH THE PROJECT ENGINEER, OWNER AND/OR RESPECTIVE UTILITY COMPANIES PRIOR TO PROCEEDING WITH WORK.
3. WATER, SEWER, DRAINAGE, GAS, AND OTHER SITE UTILITIES SERVICING THE EXISTING FACILITIES ARE TO REMAIN ACTIVE THROUGHOUT CONSTRUCTION.
4. THERE SHALL BE NO INTERRUPTION OF UTILITY SERVICES DURING THE CONSTRUCTION OPERATION WITHOUT APPROVAL OF THE OWNER.

GRADING AND UTILITY NOTES

1. UNDERGROUND UTILITIES DEPICTED WERE COMPILED FROM AVAILABLE RECORD PLANS AND SHALL BE CONSIDERED APPROXIMATE ONLY. BEFORE COMMENCING SITE WORK IN ANY AREA, CONTACT "DIG SAFE" AT 1-888-DIG-SAFE (1-888-344-7233) TO ACCURATELY LOCATE UNDERGROUND UTILITIES. ANY DAMAGE TO EXISTING UTILITIES OR STRUCTURES DEPICTED OR NOT DEPICTED ON THE PLANS SHALL BE THE CONTRACTOR'S RESPONSIBILITY. COSTS TO REPAIR SUCH DAMAGES SHALL BE THE CONTRACTOR'S RESPONSIBILITY. NO EXCAVATION SHALL BE DONE UNTIL UTILITY COMPANIES ARE PROPERLY NOTIFIED.
2. ALL WORK PERFORMED AND ALL MATERIALS FURNISHED SHALL CONFORM WITH THE LINES AND GRADES ON THE PLANS AND SITE WORK SPECIFICATIONS.
3. AT ALL LOCATIONS WHERE EXISTING CURBING OR PAVEMENT ABUT NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE. BLEND NEW PAVEMENT AND CURBS SMOOTHLY INTO EXISTING BY MATCHING LINES, GRADES AND JOINTS.
4. ALL UTILITY COVERS, GRATES, ETC. SHALL BE ADJUSTED TO BE FLUSH WITH THE SURROUNDING SURFACE OR PAVEMENT FINISH GRADE. RIM ELEVATIONS OF STRUCTURES AND MANHOLES ARE APPROXIMATE. FINAL ELEVATIONS ARE TO BE SET FLUSH AND CONSISTENT WITH THE GRADING PLANS.
5. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION OF PRIVATE UTILITIES BY THE UTILITY COMPANIES, AS REQUIRED.
6. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR AND THE INFORMATION SHALL BE PROVIDED ON A SKETCH TO SCALE OF THE EXISTING UTILITY WITH TIES TO KNOWN POINTS, PHOTOS AND FURNISHED TO THE ENGINEER FOR RESOLUTION.
7. THE CONTRACTOR SHALL PROTECT ALL UNDERGROUND DRAINAGE, SEWER AND UTILITY FACILITIES FROM EXCESSIVE VEHICULAR LOADS DURING CONSTRUCTION. ANY DAMAGE TO THESE FACILITIES RESULTING FROM CONSTRUCTION LOADS SHALL BE RESTORED TO ORIGINAL CONDITION.
8. GAS, ELECTRIC, AND COMMUNICATIONS ROUTING ARE SUBJECT TO REVIEW AND APPROVAL BY APPROPRIATE UTILITY COMPANIES.
9. DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL PROTECT EXISTING UTILITIES BY PROVIDING TEMPORARY SUPPORTS OR SHEETING AS REQUIRED AT NO ADDITIONAL COST TO THE OWNER.
10. ALL GRAVITY SANITARY PIPING SHALL BE SDR-35 PVC. ALL SEWER CONSTRUCTION SHALL CONFORM TO THE TOWN OF NORTHBOROUGH WATER AND SEWER COMMISSION REGULATIONS.
11. ALL WATER LINE BENDS AND TEES SHALL BE REINFORCED WITH THRUST BLOCKS. ALL WATER DISTRIBUTION PIPING AND FITTINGS MUST ADHERE TO THE TOWN OF NORTHBOROUGH WATER AND SEWER COMMISSION REGULATIONS SPECIFICATIONS AND SHALL BE INSPECTED BEFORE, DURING, AND AFTER CONSTRUCTION PRIOR TO TAPPING THE SERVICE MAIN.
12. EXCAVATION REQUIRED WITHIN THE PROXIMITY OF EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER.
13. PITCH EVENLY BETWEEN SPOT GRADES. ALL PAVED AREAS MUST PITCH TO DRAIN AT A MIN. OF 1/8" PER FOOT UNLESS SPECIFIED.
14. THE PROPOSED WALKWAYS SHALL HAVE A MAXIMUM CROSS SLOPE OF 2% AND A MAXIMUM RUNNING SLOPE OF 5% AS SHOWN ON CONSTRUCTION DETAILS AND GRADING PLAN.

STATE RIGHT-OF-WAY NOTES

1. ALL WORK TO BE PERFORMED WITHIN THE COMMON WEALTH OF MASSACHUSETTS PUBLIC RIGHT-OF-WAY (ROW) SHALL CONFORM TO THE MASSDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGE CONSTRUCTION, 1988 EDITION OR LATEST REVISION, AND THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION CONSTRUCTION STANDARD DETAILS.
2. THE CONTRACTOR SHALL APPLY FOR AND OBTAIN A UTILITY PERMIT FROM THE MASSDOT FOR UTILITY WORK WITHIN THE PUBLIC ROW AND MAKE ALL NECESSARY CONSTRUCTION NOTIFICATIONS, PAY ALL FEES AND POST ALL BONDS ASSOCIATED WITH THE SAME, AND COORDINATE WITH THE ENGINEER AND OWNER'S REPRESENTATIVE AS REQUIRED.
3. THE CONTRACTOR SHALL PREPARE A TRANSPORTATION MANAGEMENT PLAN INCLUDING A TEMPORARY TRAFFIC CONTROL PLAN AS REQUIRED FOR THE MASSDOT UTILITY PERMIT APPLICATION AT NO ADDITIONAL EXPENSE TO THE OWNER.
4. ALL TEMPORARY TRAFFIC CONTROLS SHALL BE IN ACCORDANCE WITH THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD), LATEST REVISION.
5. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL SUBMIT A COPY OF THE STATE HIGHWAY ACCESS PERMIT TO THE TOWN OF NORTHBOROUGH.

EROSION AND SEDIMENTATION CONTROL NOTES - MASSACHUSETTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHING AND MAINTAINING ALL TEMPORARY SOIL EROSION AND SEDIMENT CONTROLS IN ACCORDANCE WITH THE ENVIRONMENTAL PROTECTION AGENCY'S (EPA) NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) CONSTRUCTION GENERAL PERMIT (CGP) AND THE CONTRACT DOCUMENTS.
2. THE CONTRACTOR SHALL PREPARE AND SUBMIT A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) TO THE TOWN OF NORTHBOROUGH CONSERVATION COMMISSION FOR APPROVAL PRIOR TO THE PRE-CONSTRUCTION MEETING. THE SWPPP SHALL INCLUDE:
   - OPERATION AND MAINTENANCE OF PERIMETER CONTROLS
   - TEMPORARY STABILIZATION WITHIN 14 DAYS OF NO ACTIVITY
   - INSPECTION/REPORTING FREQUENCY
   - EXIT TRACKING
   - 2 YR STORM CONTROLS
   - CONSTRUCTION SEQUENCING
   - TEMPORARY STABILIZATION PRACTICES
   - SWALES/BERMS AND TEMPORARY SEDIMENT TRAPS ON THE PLAN SUCH THAT IT WILL CONFIRM THEIR CAPACITY TO CAPTURE AT LEAST 3,600 CF/ACRE OF ALTERED AREA
3. SOIL EROSION AND SEDIMENTATION CONTROLS SHALL BE PROVIDED IN ACCORDANCE WITH THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS" AND THE NOTES AND DETAILS SHOWN IN THIS PLAN SET.
4. THE EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE PLANS ARE INTENDED TO REPRESENT THE MINIMUM CONTROLS NECESSARY TO MEET ANTICIPATED SITE CONDITIONS. ADDITIONAL MEASURES SHALL BE IMPLEMENTED AS CONDITIONS WARRANT OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
5. PRIOR TO THE START OF CONSTRUCTION: PERIMETER SEDIMENT CONTROLS MUST BE INSPECTED AND APPROVED BY THE TOWN OF NORTHBOROUGH'S CONSERVATION COMMISSION. REQUIRED PERIMETER CONTROL SHALL BE PROPERLY ESTABLISHED, CLEARLY VISIBLE AND IN OPERATION PRIOR TO INITIATING ANY LAND CLEARING ACTIVITY AND/OR OTHER CONSTRUCTION RELATED WORK. SUCH FACILITIES SHALL REPRESENT THE LIMIT OF WORK. WORKERS SHALL BE INFORMED THAT NO CONSTRUCTION ACTIVITY IS TO OCCUR BEYOND THE LIMIT OF WORK AT ANY TIME THROUGHOUT THE CONSTRUCTION PERIOD.
6. AS FEASIBLE, CONSTRUCTION SHALL BE PHASED TO LIMIT THE AREA OF EXPOSED SOIL AND THE DURATION OF EXPOSURE. ALL DISTURBED AREAS SHALL BE TEMPORARILY AND/OR PERMANENTLY STABILIZED WITHIN 14 DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES.
7. THE CONTRACTOR SHALL INSPECT AND MAINTAIN ALL EROSION AND SEDIMENTATION CONTROL MEASURES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
8. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED ON A WEEKLY BASIS AND AFTER EACH STORM EVENT OF 0.25 INCH OR GREATER DURING CONSTRUCTION TO ENSURE THAT THE EROSION CONTROL BARRIERS ARE INTACT.
9. CLEAN AND MAINTAIN SEDIMENTATION CONTROL BARRIERS WHEN SEDIMENT ACCUMULATES TO ONE HALF THE HEIGHT OF THE BARRIER. MATERIAL COLLECTED FROM THE SEDIMENTATION BARRIER SHALL BE REMOVED AS NECESSARY AND DISPOSED IN AN UPLAND AREA.
10. THE CONTRACTOR SHALL MAINTAIN A SUFFICIENT RESERVE OF VARIOUS EROSION CONTROL MATERIALS ONSITE AT ALL TIMES FOR EMERGENCY PURPOSES OR ROUTINE MAINTENANCE.
11. THE CONTRACTOR SHALL SCHEDULE HIS WORK TO ALLOW THE FINISHED SUB GRADE ELEVATIONS TO DRAIN PROPERLY WITHOUT PUDDLING. SPECIFICALLY, ALLOW WATER TO ESCAPE WHERE PROPOSED CURB MAY RETAIN RUNOFF PRIOR TO PAVING. PROVIDE TEMPORARY POSITIVE DRAINAGE, AS REQUIRED, TO STABILIZED DISCHARGE POINTS.
12. SOIL AND OTHER MATERIALS RESULTING FROM SITE CLEARING MAY BE RECYCLED AND/OR REUSED ON THE SITE AS APPROPRIATE. WASTE MATERIALS SHALL BE REMOVED FROM THE SITE.
13. CRUSHED STONE CONSTRUCTION ENTRANCES SHALL BE ESTABLISHED AT ALL POINTS OF INGRESS AND EGRESS.
14. TEMPORARY DIVERSIONS (TD) MAY CONSIST OF A DITCH OR SWALE, OR MAY BE ACHIEVED USING WOOD CHIP PILES, COIR LOGS, OR SIMILAR MATERIALS. DIVERSIONS MUST BE STABLE AND SHALL NOT SCOUR.
15. TEMPORARY SEDIMENT TRAPS (TST) AND TEMPORARY SWALES (TS) SHALL BE SIZED BY THE CONTRACTOR USING THE PARAMETERS CONTAINED IN THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES.
16. DUST SHALL BE CONTROLLED BY SPRINKLING OR OTHER APPROVED METHODS AS NECESSARY, OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
17. CATCH BASINS AND STORM DRAINS SHALL BE PROTECTED WITH STRAW BALES OR SEDIMENT BAGS IN PAVED AREAS UNTIL CONTRIBUTING AREA IS PERMANENTLY STABILIZED.
18. DEWATERING WASTEWATER PUMPED FROM EXCAVATIONS SHALL BE CONVEYED BY HOSE TO AN UPLAND AREA AND DISCHARGED INTO A DEWATERING BASIN, HAY BALE CORRALS, OR SEDIMENTATION BAGS.
19. CONSTRUCTION SITE WASTE MATERIALS SHALL BE PROPERLY CONTAINED ONSITE AND DISPOSED OFF SITE AT A LOCATION IN ACCORDANCE WITH THE LOCAL AND STATE REGULATIONS.
20. RIPRAP OR OTHER ENERGY DISSIPATERS SHALL BE USED WHERE NECESSARY TO CONTROL EROSION.
21. ANY EQUIPMENT THAT IS NOT READILY MOBILE (TRACK MACHINERY) SHALL BE PARKED WITHIN THE PROJECT LIMIT OF DISTURBANCE. LARGE AND/OR BULKY MATERIALS SHALL BE STORED SUCH THAT THEY DO NOT INTERFERE WITH THE ONGOING CONSTRUCTION ACTIVITIES OR EROSION CONTROL MEASURES.
22. NEWLY VEGETATED AREAS SHALL BE REGULARLY INSPECTED AND MAINTAINED TO ENSURE THE ESTABLISHMENT OF STABLE VEGETATED SURFACES.
23. THE CONTRACTOR SHALL NOT REMOVE ANY COMPOST FILTER SOCKS OR OTHER EROSION CONTROLS UNTIL THE CONTRIBUTING AREA IS PERMANENTLY STABILIZED AND THE CONTRACTOR HAS APPROVAL FROM THE TOWN OF NORTHBOROUGH'S CONSERVATION COMMISSION.
24. ALL DRAINAGE STRUCTURES SHALL BE CLEARED OF ACCUMULATED SEDIMENT PRIOR TO ACCEPTANCE OF THE FINAL PROJECT. THE CONTRACTOR SHALL SCHEDULE HIS WORK TO ALLOW THE FINISHED SUB GRADE ELEVATIONS TO DRAIN PROPERLY WITHOUT PONDING. SPECIFICALLY, ALLOW WATER TO ESCAPE WHERE PROPOSED CURB MAY RETAIN RUNOFF PRIOR TO APPLICATION OF SURFACE PAVING. PROVIDE TEMPORARY POSITIVE DRAINAGE, AS REQUIRED, TO STABILIZED DISCHARGE POINTS.
25. INSTALLATION OF THE EROSION CONTROL BARRIERS AS ILLUSTRATED IS INTENDED TO REPRESENT THE MINIMUM SEDIMENTATION CONTROL FACILITIES NECESSARY TO MEET ANTICIPATED SITE CONDITIONS. ADDITIONAL EROSION CONTROL MEASURES SHALL BE IMPLEMENTED AS CONDITIONS WARRANT OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
26. ALL DISTURBED AREAS SHALL BE STABILIZED WITHIN 14 DAYS UPON COMPLETION OF WORK IN THAT AREA.

STORMWATER MANAGEMENT SYSTEM INSPECTION AND MAINTENANCE NOTES

DURING CONSTRUCTION (CONTRACTOR'S RESPONSIBILITY)

1. THE CONTRACTOR SHALL REMOVE SEDIMENT AND DEBRIS FROM ALL CATCH BASINS, MANHOLES, AND THE DRAINAGE SYSTEM ON A ROUTINE BASIS, IMMEDIATELY FOLLOWING SITE STABILIZATION, AND PRIOR TO PROJECT COMPLETION AND ACCEPTANCE.
2. THE CLOSED DRAINAGE SYSTEM AND ASSOCIATED STRUCTURES SHALL BE CLEANED AND FLUSHED BY THE CONTRACTOR AT THE COMPLETION OF CONSTRUCTION, AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSPECTION AND MAINTENANCE OF THE DRAINAGE SYSTEM UNTIL ACCEPTANCE OF THE SYSTEM BY THE ENGINEER AND THE TOWN OF NORTHBOROUGH. FOLLOWING ACCEPTANCE OF THE PROPOSED DRAINAGE SYSTEM, THE OWNER OF THE SITE SHALL BE RESPONSIBLE FOR THE LONG-TERM INSPECTION AND MAINTENANCE OF THE DRAINAGE SYSTEM.
3. ANY ACCUMULATION OF PONDING WATER IN AREAS WITHIN THE LIMITS OF DISTURBANCE, OTHER THAN DESIGNATED AREAS, SHALL BE REMOVED ACCORDINGLY AND PREVENTED IN THE FUTURE.
4. THE CONTRACTOR SHALL PREVENT ANY VISIBLY TURBID STORMWATER DISCHARGE FROM THE SITE.
5. THE CONTRACTOR SHALL PROVIDE OPERATIONS AND MAINTENANCE INSPECTION REPORTS TO THE TOWN OF NORTHBOROUGH WITH AS BUILT PLANS PRIOR TO THE ISSUANCE OF OCCUPANCY PERMIT.

POST CONSTRUCTION (OWNER'S RESPONSIBILITY)

1. TRASH, LITTER, SEDIMENT AND OTHER DEBRIS SHALL BE REMOVED FROM ANY STORMWATER MANAGEMENT SYSTEM FACILITY (INCLUDING BUT NOT LIMITED TO CATCH BASINS, MANHOLES, INLET, OUTLET AND DIVERSION STRUCTURES, AND STORMWATER BEST MANAGEMENT PRACTICES (BMPs)) A MINIMUM OF TWO TIMES PER YEAR , PREFERABLY IN THE SPRING AND FALL.
2. THE PARKING LOT AND ENTRY DRIVE SHALL BE SWEPT BY THE OWNER AS EARLY AS POSSIBLE EVERY SPRING AND ONCE IN THE FALL TO REMOVE SEDIMENTS.
3. ALL CLEANING AND MAINTENANCE OF STORMWATER MANAGEMENT SYSTEMS POST-CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE OWNER.

CATCH BASINS WITH SUMPS INSPECTION, MAINTENANCE, AND REPAIR NOTES

1. INSPECTIONS SHALL BE PERFORMED A MINIMUM OF TWO TIMES PER YEAR (SPRING/FALL). UNITS SHALL BE CLEANED ANNUALLY AND WHENEVER THE DEPTH OF SEDIMENT IS GREATER THAN OR EQUAL TO HALF THE SUMP DEPTH.
2. THE INLET GRATE SHALL NOT BE WELDED TO THE FRAME OR PAVED OVER SO THAT THE SUMP CAN BE EASILY INSPECTED AND MAINTAINED.
3. CARE SHALL BE TAKEN TO AVOID DAMAGING AND DISPLACING HOODS PLACED ON HOODED OUTLETS DURING CLEANING.

UNDERGROUND INFILTRATION/DETENTION SYSTEM BASIN INSPECTION, MAINTENANCE, AND REPAIR NOTES

FOLLOWING CONSTRUCTION, THE COMPLETION OF THE INSPECTION AND MAINTENANCE REQUIREMENTS BELOW SHALL BE THE RESPONSIBILITY OF THE OWNER.

1. THE SYSTEM SHALL BE MAINTAINED AS RECOMMENDED BY THE MANUFACTURER AND AS SPECIFIED IN THE OPERATION AND MAINTENANCE PLAN.
2. FOLLOWING STORM EVENTS WITH RAINFALL EXCEEDING 2.7"
   - INSPECT INFILTRATION/DETENTION SYSTEM FOR TRASH, DEBRIS, SEDIMENT, EROSION, STANDING WATER, AND OVERALL PERFORMANCE. DEFECTS SHALL BE REPAIRED BY THE OWNER.
3. BI-ANNUALLY
   - INSPECTIONS SHALL BE PERFORMED A MINIMUM OF TWO TIMES PER YEAR ON THE INSPECTION PORTS AND DRAINAGE STRUCTURES OF THE UNDERGROUND INFILTRATION/DETENTION SYSTEM TO ENSURE PROPER OPERATION OF THE SYSTEM.
4. JETVAC MAINTENANCE IS RECOMMENDED IF SEDIMENT HAS BEEN COLLECTED TO A DEPTH OF 3" IN THE PRETREATMENT ROW. MORE FREQUENT MAINTENANCE MAY BE REQUIRED TO MAINTAIN MINIMUM FLOW RATES THROUGH THE PRETREATMENT ROW. THE JETVAC PROCESS SHALL ONLY BE PERFORMED ON THE PRETREATMENT ROW. JETVAC MAINTENANCE SHALL BE IN ACCORDANCE WITH PRODUCT MANUFACTURER'S RECOMMENDATIONS.

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station
63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42363
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	NOTES
DRAWING NO.:	C1.1
SHEET NO.	2 OF ___

ABBREVIATIONS

GENERAL

AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADA	AMERICANS WITH DISABILITIES ACT
ADJ	ADJUST
APPROX	APPROXIMATE
AC	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
ASSF	AREA SUBJECT TO STORM FLOWAGE
ATD	ASPHALT TURNDOWN
ATG	ADJUST TO GRADE
BB	BITUMINOUS BERM
BC	BOTTOM OF CURB (FINISHED GRADE ON LOW SIDE OF CURB)
BD	BOUND
BIT	BITUMINOUS
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BMP	BEST MANAGEMENT PRACTICE
BO	BY OTHERS
BOL	BOLLARD
BOS	BOTTOM OF SLOPE
BOT	BOTTOM
BPM	BLACKOUT PAVEMENT MARKING
BR	BRIDGE
BS	BOTTOM OF STAIR (FINISHED GRADE AT BOTTOM STAIR)
BW	BOTTOM OF WALL (FINISHED GRADE ON LOW SIDE OF WALL)
BWL	BROKEN WHITE LINE
BYL	BROKEN YELLOW LINE
C=	CURVE LENGTH
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CCW	CEMENT CONCRETE WALK
CD	CHECK DAM
CE	CONSTRUCTION ENTRANCE
CEM	CEMENT
CFS	COMPOST FILTER SOCK
CG	CLEAR AND GRUB VEGETATION
CH	CHORD LENGTH
CI	CURB INLET
CIP	CAST IRON PIPE
CJ	CONSTRUCTION JOINT
CL	CENTERLINE
CLDI	CEMENT-LINED DUCTILE IRON
CLF	CHAIN LINK FENCE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CLR	CLEAR
CLS	CLASS
CM	SAWCUT AND MATCH
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CP	CONCRETE PAD
CR GR	CROWN GRADE
CSP	CORRUGATED STEEL PIPE
CSTR	CONCRETE STAIRS
CTE	CONNECT TO EXISTING
CW	CROSSWALK
DEMO	DEMOLITION
DET	DETECTABLE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DIV	DIVERSION
DMH	DRAIN MANHOLE
DTP	DRIPLINE TREE PROTECTION
DWL	DOTTED WHITE LINE
DWLEx	DOTTED WHITE LINE EXTENSION
DBWL	DOUBLE WHITE LINE
DWP	DETECTABLE WARNING PAVER
DYL	DOTTED YELLOW LINE
DYLEx	DOTTED YELLOW LINE EXTENSION
DBYL	DOUBLE YELLOW LINE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
EJ	EXPANSION JOINT
ELEV (or EL)	ELEVATION
EMB	EMBANKMENT
EMH	ELECTRIC MANHOLE
EOP	EDGE OF PAVEMENT
ETR	EXISTING TO REMAIN. PROTECT DURING CONSTRUCTION.
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDC	FIRE DEPARTMENT CONNECTION
FDN	FOUNDATION
FES	FLARED END SECTION
FFE	FINISH FLOOR ELEVATION
FLDSTN	FIELDSTONE
FND	FOUND
FT	FOOT
GAR	GARAGE
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
GTD	GRADE TO DRAIN
GV	GATE VALVE
HCPS	HANDICAP ACCESSIBLE PARKING SIGN
HDBC	HEAVY DUTY BITUMINOUS CONCRETE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HDPS	HANDICAP ACCESSIBLE PARKING SIGN
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HMAW	HOT MIXED ASPHALT WALKWAY
HOR	HORIZONTAL
HPR	HEADWALL PROTECTION RACK
HYD	HYDRANT
ID	INSIDE DIAMETER
INV	INVERT
JCT	JUNCTION
L=	LENGTH OF CURVE
LB	LEACH BASIN
LOD	LIMIT OF DISTURBANCE
LP	LOW POINT
LPR	LICENSE PLATE READER
LS	LOAM AND SEED
LSOD	LOAM AND SOD
LT	LEFT
LTP	LIGHT POLE
MAX	MAXIMUM
MB	MAILBOX
MCW	MONOLITHIC CONCRETE WALK
MH	MANHOLE
MIN	MINIMUM
MON	MONITORING
MUTCD	MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
OCS	OUTLET CONTROL STRUCTURE
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OWS	OIL WATER SEPARATOR
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCFES	PRECAST CONCRETE FLARED END SECTION
PCTC	PRECAST CONCRETE TRANSITION CURB
PCR	PEDESTRIAN CURB RAMP
PE	POLYETHYLENE
PERF	PERFORATED
PGL	PROFILE GRADE LINE
PHMA	POROUS HOT MIXED ASPHALT PAVEMENT
PI	POINT OF INTERSECTION
PIV	POST INDICATOR VALVE
POC	POINT ON CURVE
POT	POINT ON TANGENT
PM	PAVEMENT MARKING
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVCH	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
QPA	QUALIFYING PERVIOUS AREA
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
R=	RADIUS
RA	RAILING
RCP	REINFORCED CONCRETE PIPE
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
RRLS	RIPRAP LEVEL SPREADER
ROW	RIGHT OF WAY
RR	RAILROAD
RRS	RIPRAP SLOPE
RS	RIPRAP SPILLWAY
RT	RIGHT
RTAD	REFER TO ARCHITECTURAL DRAWINGS
RTED	REFER TO ELECTRICAL DRAWINGS
RTFPD	REFER TO FIRE PROTECTION DRAWINGS
RTLD	REFER TO LANDSCAPE DRAWINGS
RTMD	REFER TO MECHANICAL DRAWINGS
RTPD	REFER TO PLUMBING DRAWINGS
RTSD	REFER TO STRUCTURAL DRAWINGS
S=	SLOPE
SB	SAND BAG EROSION CONTROL BARRIER
SDR	STANDARD DIMENSIONAL RATIO
SED	SEDIMENT
SESC	SOIL EROSION AND SEDIMENT CONTROL
SFL	STATE FREEWAY LINE
SFCD	SEDIMENT FOREBAY CHECK DAM
SG	SWING GATE
SHL	STATE HIGHWAY LINE
SHLD	SHOULDER
SHLO	STATE HIGHWAY LAYOUT
SHP	HANDICAP PARKING PAVEMENT MARKING
SM	SEDIMENT MARKER
SMH	SEWER MANHOLE
SSD	STOPPING SIGHT DISTANCE
ST	STREET
STA	STATION
SW	SIDEWALK
SWL	SINGLE SOLID WHITE LINE
SWR	SEWER
SYL	SINGLE SOLID YELLOW LINE
T=	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TD	TEMPORARY DIVERSION
TEMP	TEMPORARY
TC	TOP OF CURB
TDS	TEMPORARY DIVERSION SWALE
TGP	TREE GROUP PROTECTION
TIP	TEMPORARY INLET PROTECTION
TMH	TELEPHONE MANHOLE
TOS	TOP OF SLOPE
TP	TEST PIT
TRAN	TRANSITION
TRM	TURF REINFORCEMENT MAT
TS	TOP OF STAIR (FINISHED GRADE OF TOP STAIR)
TST	TEMPORARY SEDIMENT TRAP
TSW	TEMPORARY SWALE
TW	TOP OF WALL
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
VCC	VERTICAL CONCRETE CURB
VCP	VEHICULAR CONCRETE PAVEMENT
VFC	VITRIFIED CLAY
VEG	VEGETATION
VEH	VEHICULAR
VFS	VEGETATED FILTER STRIP
VGC	VERTICAL GRANITE CURB
VGTC	VERTICAL GRANITE TRANSITION CURB
VLF	VINYL FENCE
w/	WITH
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
WMH	WATER MANHOLE
WPM	WATER PAINT MARK
X-SECT	CROSS SECTION
YD	YARD DRAIN
4DY	4" DOUBLE YELLOW EPOXY RESIN PAVEMENT MARKING
4W	4" SOLID WHITE EPOXY RESIN PAVEMENT MARKING
12W	12" SOLID WHITE EPOXY RESIN PAVEMENT MARKING

MASSACHUSETTS ABBREVIATIONS

GENERAL

CMR	CODE OF MASSACHUSETTS REGULATIONS
MASSDEP	MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
MASSDOT	MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
MA STD.	MASSACHUSETTS STANDARD
MHB	MASSACHUSETTS HIGHWAY BOUND

CONSTRUCTION NOTES - MASSDOT STANDARDS

106.3.0	=	METHOD OF SETTING VERTICAL CURB - MA STD. 106.3.0
107.2.0	=	WHEELCHAIR RAMPS LESS THAN 12'-4" SIDEWALK - MA STD. 107.2.0
107.2.1	=	WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL - MA STD. 107.2.1
107.6.0	=	WHEELCHAIR RAMPS FOR ONE CONTINUOUS DIRECTION OF PEDESTRIAN TRAVEL - MA STD. 107.6.0
107.6.5	=	DETECTABLE WARNING PANEL FOR WHEELCHAIR RAMPS - MA STD. 107.6.5
107.6.9	=	WHEELCHAIR RAMP WITH LANDSCAPING STRIP - MA STD. 107.6.9
107.9.0	=	CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS - MA STD. 107.9.0
201.4.0M	=	PRECAST CONCRETE CATCH BASIN - MA STD. 201.4.0
201.6.0	=	CATCH BASIN FRAME - MA STD. 201.6.0
201.11.0	=	DROP INLET GRATE - MA STD. 201.11.0
201.12.0	=	CATCH BASIN HOOD - MA STD. 201.12.0
202.4.0	=	PRECAST CONCRETE MANHOLES 9' OR LESS IN DEPTH - MA STD. 202.4.0
204.2.0	=	GUTTER INLET - MA STD. 204.2.0
206.8.0	=	REINFORCED CONCRETE PIPE FLARED ENDS - MA STD. 206.8.0
209.1.0	=	SUBDRAIN - MA STD. 209.1.0

LEGEND

EXISTING		PROPOSED
P	PROPERTY LINE	
	SETBACKS	
	EASEMENT LINE	
255	CONTOUR	262
x 407.5	SPOT ELEVATION	x 261.5
	DRAINAGE LINE	D D D
	WATER LINE	W W W
	FIRE WATER LINE	FW FW
	SANITARY SEWER LINE	S S S
	GAS LINE	G G G
	ELECTRIC	E E E
	TELEPHONE LINE	T T T
	OVERHEAD ELECTRIC LINE	OHW
	LIMIT OF DISTURBANCE	LOD
	LIMIT OF DISTURBANCE/COMPOST FILTER SOCK	LOD/CFS
	CATCH BASIN	
	HYDRANT	
	DRAINAGE MANHOLE	
	SEWER MANHOLE	
	UTILITY POLE	
WG	WATER VALVE	
	GAS GATE	
	LIGHT POLE	
	TREE LINE	
	CHAIN LINK FENCE	
	WIRE FENCE	
	WOOD FENCE	
	FENCE	
	CURBING	
	EDGE OF PAVEMENT	
	SAWCUT LINE	
	SIGN	
	COMPOST FILTER SOCK	
	SAND BAGS	
	NO. OF PARKING SPACES	#

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station
63 West Main Street
Town of Northborough, MA

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	LEGEND
DRAWING NO.:	C1.2
SHEET NO.	3 OF

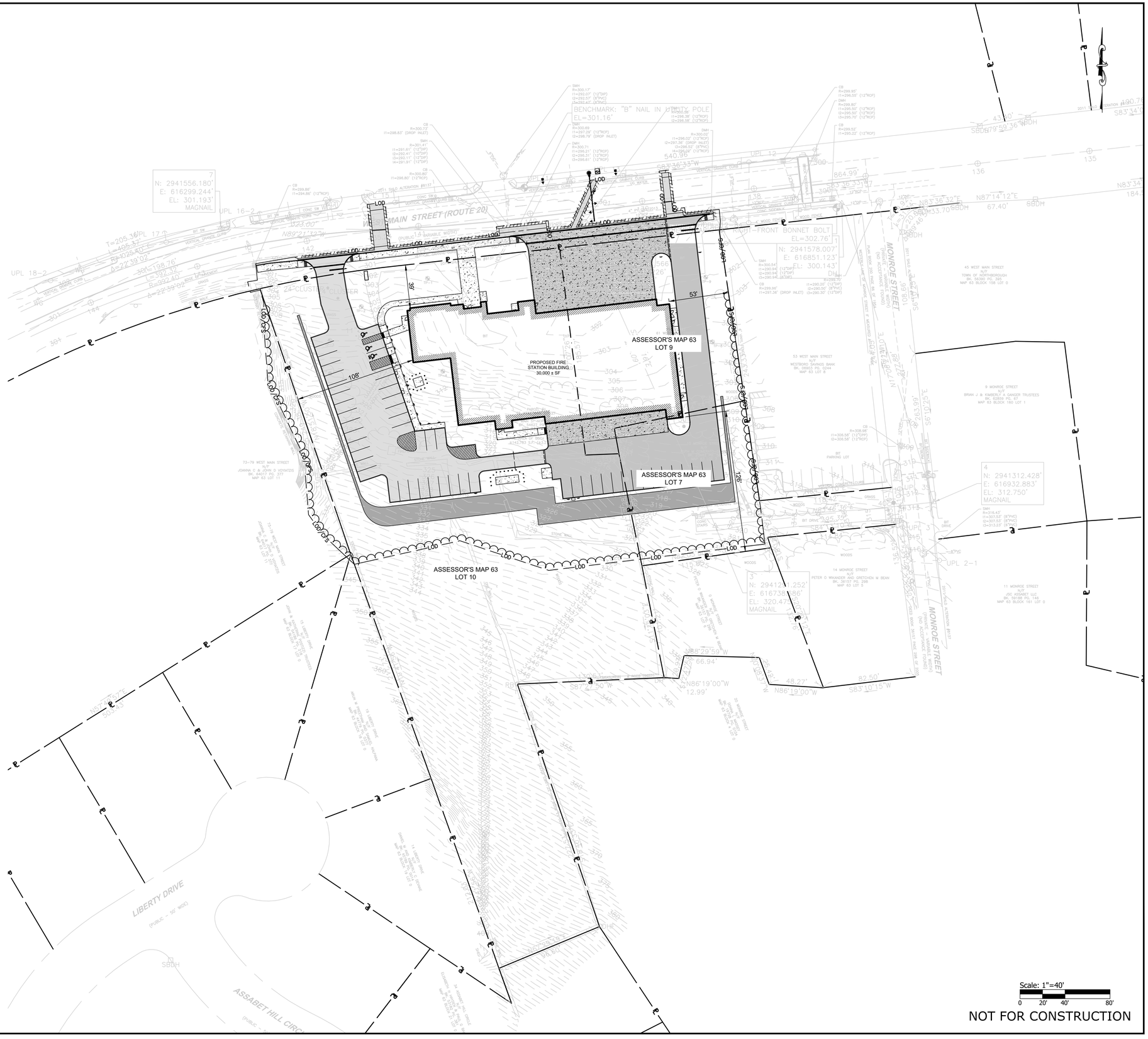
ZONING TABLE		
EXISTING ZONE: DB-DOWNTOWN BUSINESS		
TOTAL LOT AREA MAP 63 LOT 9 PARCEL 2 = 0.55 ACRES MAP 63 LOT 10 PARCEL 1 = 2.73 ACRES MAP 63 LOT 7 = 0.43 ACRES		
BUILDING AREA 30,000 ± SF		
	REQUIRED	PROVIDED
BUILDING SETBACK		
FRONT SETBACK	6 FT	39 FT
SIDE SETBACK	NONE	53 FT
REAR SETBACK	NONE	126 FT
MAX. FRONT SETBACK	20 FT *	39 FT
MIN. LOT FRONTAGE	50 FT	411 FT
MAX. BUILDING HEIGHT	45 FT	BLDG 42 FT & TOWER 68 FT ±
MAX. LOT COVERAGE	-	14%
MIN. OPEN SPACE	15%	>15%
MIN. LOT AREA	4,000 SF	161,531 SF (3 LOTS)

* THE ZONING BOARD OF APPEALS GRANTED A DIMENSIONAL VARIANCE TO ALLOW THE PROPOSED BUILDING TO BE UP TO 40 FEET FROM THE FRONT LOT LINE TO ENABLE THE LARGE FIRE APPARATUS TO MANEUVER INTO/OUT OF THE BUILDING AND MAINTAIN THE MAXIMUM GRADE OF 3% AND ENSURE CLEAR SIGHT LINES.

PARKING SUMMARY		
	REQUIRED*	PROVIDED
STANDARD SPACES (9'x18')	44	44
ACCESSIBLE SPACES**	3	3
EV SPACES	6	6
TOTAL SPACES	53	53

* BASED ON PROGRAMMING NEEDS
23 EMPLOYEE SPACES (16 FIRE STAFF, 7 ADMINISTRATION)
30 VISITOR SPACES

** ADA REQUIREMENT FOR PARKING LOT 51 TO 75 TOTAL SPACES = 3 SPACES



PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42583
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=40'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:
OVERALL PLAN

DRAWING NO.:
C1.3

SHEET NO. 4 OF

K:\JOBS\23_JobsL\23141.00 Northborough-New Fire Station-MA\CIVIL\OVERALL PLAN.dwg

DEMOLITION NOTES:

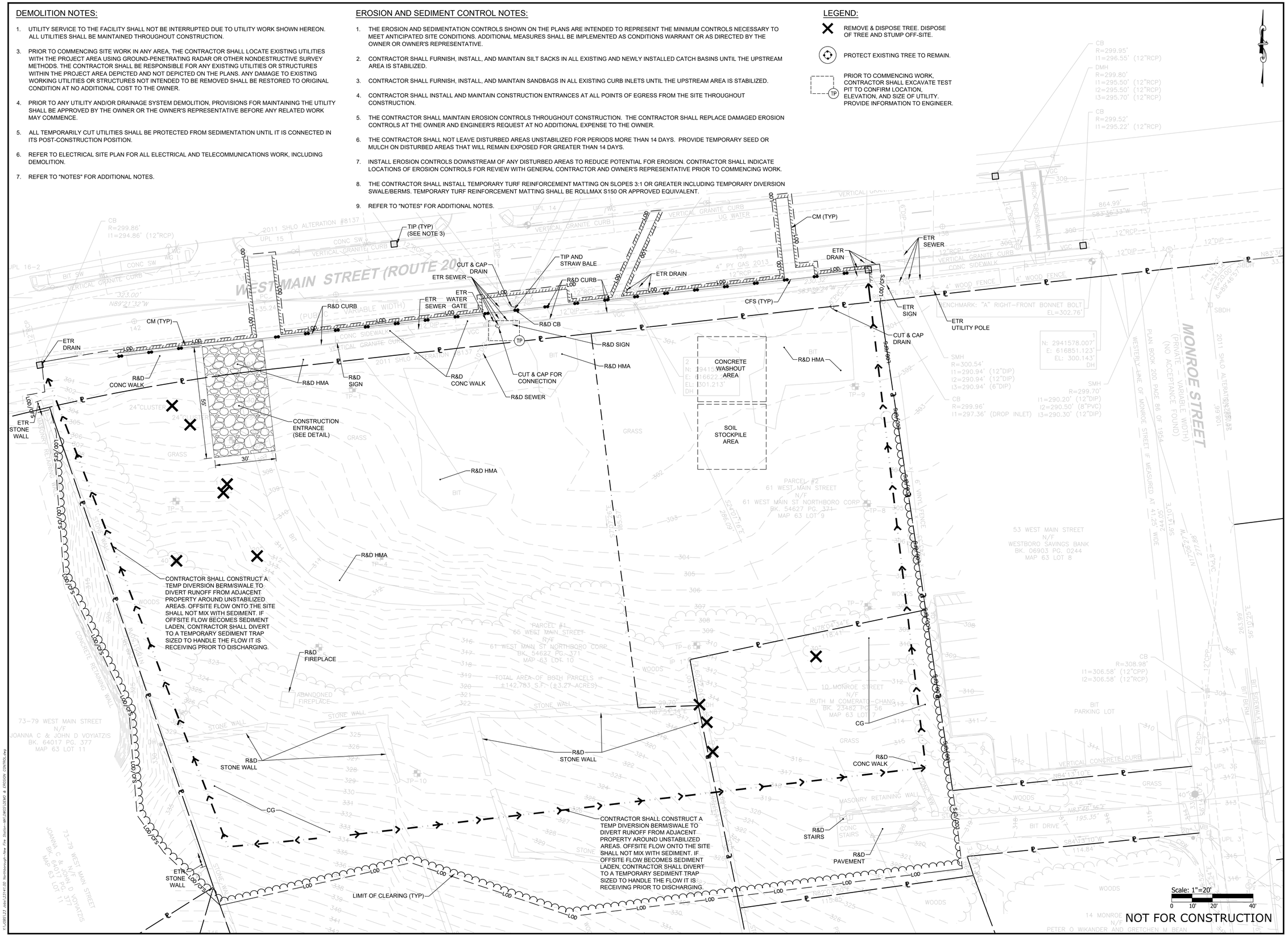
1. UTILITY SERVICE TO THE FACILITY SHALL NOT BE INTERRUPTED DUE TO UTILITY WORK SHOWN HEREON. ALL UTILITIES SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION.
3. PRIOR TO COMMENCING SITE WORK IN ANY AREA, THE CONTRACTOR SHALL LOCATE EXISTING UTILITIES WITH THE PROJECT AREA USING GROUND-PENETRATING RADAR OR OTHER NONDESTRUCTIVE SURVEY METHODS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY EXISTING UTILITIES OR STRUCTURES WITHIN THE PROJECT AREA DEPICTED AND NOT DEPICTED ON THE PLANS. ANY DAMAGE TO EXISTING WORKING UTILITIES OR STRUCTURES NOT INTENDED TO BE REMOVED SHALL BE RESTORED TO ORIGINAL CONDITION AT NO ADDITIONAL COST TO THE OWNER.
4. PRIOR TO ANY UTILITY AND/OR DRAINAGE SYSTEM DEMOLITION, PROVISIONS FOR MAINTAINING THE UTILITY SHALL BE APPROVED BY THE OWNER OR THE OWNER'S REPRESENTATIVE BEFORE ANY RELATED WORK MAY COMMENCE.
5. ALL TEMPORARILY CUT UTILITIES SHALL BE PROTECTED FROM SEDIMENTATION UNTIL IT IS CONNECTED IN ITS POST-CONSTRUCTION POSITION.
6. REFER TO ELECTRICAL SITE PLAN FOR ALL ELECTRICAL AND TELECOMMUNICATIONS WORK, INCLUDING DEMOLITION.
7. REFER TO "NOTES" FOR ADDITIONAL NOTES.

EROSION AND SEDIMENT CONTROL NOTES:

1. THE EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE PLANS ARE INTENDED TO REPRESENT THE MINIMUM CONTROLS NECESSARY TO MEET ANTICIPATED SITE CONDITIONS. ADDITIONAL MEASURES SHALL BE IMPLEMENTED AS CONDITIONS WARRANT OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
2. CONTRACTOR SHALL FURNISH, INSTALL, AND MAINTAIN SILT SACKS IN ALL EXISTING AND NEWLY INSTALLED CATCH BASINS UNTIL THE UPSTREAM AREA IS STABILIZED.
3. CONTRACTOR SHALL FURNISH, INSTALL, AND MAINTAIN SANDBAGS IN ALL EXISTING CURB INLETS UNTIL THE UPSTREAM AREA IS STABILIZED.
4. CONTRACTOR SHALL INSTALL AND MAINTAIN CONSTRUCTION ENTRANCES AT ALL POINTS OF EGRESS FROM THE SITE THROUGHOUT CONSTRUCTION.
5. THE CONTRACTOR SHALL MAINTAIN EROSION CONTROLS THROUGHOUT CONSTRUCTION. THE CONTRACTOR SHALL REPLACE DAMAGED EROSION CONTROLS AT THE OWNER AND ENGINEER'S REQUEST AT NO ADDITIONAL EXPENSE TO THE OWNER.
6. THE CONTRACTOR SHALL NOT LEAVE DISTURBED AREAS UNSTABILIZED FOR PERIODS MORE THAN 14 DAYS. PROVIDE TEMPORARY SEED OR MULCH ON DISTURBED AREAS THAT WILL REMAIN EXPOSED FOR GREATER THAN 14 DAYS.
7. INSTALL EROSION CONTROLS DOWNSTREAM OF ANY DISTURBED AREAS TO REDUCE POTENTIAL FOR EROSION. CONTRACTOR SHALL INDICATE LOCATIONS OF EROSION CONTROLS FOR REVIEW WITH GENERAL CONTRACTOR AND OWNER'S REPRESENTATIVE PRIOR TO COMMENCING WORK.
8. THE CONTRACTOR SHALL INSTALL TEMPORARY TURF REINFORCEMENT MATTING ON SLOPES 3:1 OR GREATER INCLUDING TEMPORARY DIVERSION SWALE/BERMS. TEMPORARY TURF REINFORCEMENT MATTING SHALL BE ROLLMAX S150 OR APPROVED EQUIVALENT.
9. REFER TO "NOTES" FOR ADDITIONAL NOTES.

LEGEND:

- REMOVE & DISPOSE TREE. DISPOSE OF TREE AND STUMP OFF-SITE.
- PROTECT EXISTING TREE TO REMAIN.
- TP — PRIOR TO COMMENCING WORK, CONTRACTOR SHALL EXCAVATE TEST PIT TO CONFIRM LOCATION, ELEVATION, AND SIZE OF UTILITY. PROVIDE INFORMATION TO ENGINEER.



NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

JAMES A. JACKSON, JR. CIVIL No. 42563 REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

DEMOLITION, EROSION & SEDIMENT CONTROL PLAN

DRAWING NO.:

C2.0

SHEET NO. 5 OF

X:\JOBS\23141.00 Northborough-New Fire Station-MA\CIVIL\SITE\DWG & EXHIBITS\C2.0 DEMO, EROSION & SEDIMENT CONTROL PLAN.dwg

NOTES:

1. CONTRACTOR SHALL PROVIDE LOAM AND SEED ON ALL DISTURBED AREAS UNLESS NOTED OTHERWISE. REFER TO LANDSCAPE DRAWINGS FOR SURFACE COVER IN LANDSCAPED AREAS.
2. ALL ACCESSIBLE RAMPS SHALL BE CONSTRUCTED WITH DETECTABLE WARNING PAVERS.
3. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL EMPLOY A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS TO ESTABLISH CONTROL ON THE SITE AND TO PERFORM FIELD MEASUREMENTS AS REQUIRED TO LAYOUT THE PROPOSED BUILDING AND SITE IMPROVEMENTS. THE CONTRACTOR'S SURVEYOR SHALL COORDINATE THE BUILDING LAYOUT WITH THE PROJECT LAND SURVEYOR TO ACCURATELY LOCATE THE BUILDING ON THE SITE.
4. REFER TO STRUCTURAL DRAWINGS FOR ALL CONCRETE ENTRANCE PADS.
5. REFER TO STRUCTURAL DRAWINGS FOR ALL TYPICAL SECTIONS OF ENTRY WAYS.
6. EXPANSION JOINTS (E.J.) 20 FEET O.C. (MAX.) UNLESS OTHERWISE NOTED.
7. CONTROL JOINTS (C.J.) 5 FEET O.C. (MAX.) UNLESS OTHERWISE NOTED.
8. ALL PARKING SPACES AND ISLANDS ARE TO BE MARKED WITH 4" THICK WHITE EPOXY PAVEMENT MARKING UNLESS NOTED OTHERWISE. WATERBORNE PAVEMENT MARKINGS ARE NOT ACCEPTABLE.
9. COORDINATE FINAL QUANTITY AND PLACEMENT OF BOLLARDS SURROUNDING TRANSFORMER WITH NATIONAL GRID.
10. COORDINATE FINAL QUANTITY AND PLACEMENT OF BOLLARDS SURROUNDING GENERATOR WITH ELECTRICAL DRAWINGS, UTILITY COMPANY, AND MANUFACTURER'S RECOMMENDATIONS.
11. COORDINATE ALL SIGN PLACEMENT AND SIZE WITH OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.
12. REFER TO "NOTES" FOR ADDITIONAL NOTES.

NOT FOR CONSTRUCTION

ZONING TABLE		
EXISTING ZONE: DB-DOWNTOWN BUSINESS		
TOTAL LOT AREA	MAP 63 LOT 9 PARCEL 2 = 0.55 ACRES MAP 63 LOT 10 PARCEL 1 = 2.73 ACRES MAP 63 LOT 7 = 0.43 ACRES	
BUILDING AREA	30,000 ± SF	
	REQUIRED	PROVIDED
BUILDING SETBACK		
FRONT SETBACK	6 FT	39 FT
SIDE SETBACK	NONE	53 FT
REAR SETBACK	NONE	126 FT
MAX. FRONT SETBACK	20 FT *	39 FT
MIN. LOT FRONTAGE	50 FT	411 FT
MAX. BUILDING HEIGHT	45 FT	BLDG 42 FT & TOWER 68 FT ±
MAX. LOT COVERAGE	-	14%
MIN. OPEN SPACE	15%	>15%
MIN. LOT AREA	4,000 SF	161,531 SF (3 LOTS)

* THE ZONING BOARD OF APPEALS GRANTED A DIMENSIONAL VARIANCE TO ALLOW THE PROPOSED BUILDING TO BE UP TO 40 FEET FROM THE FRONT LOT LINE TO ENABLE THE LARGE FIRE APPARATUS TO MANEUVER INTO/OUT OF THE BUILDING AND MAINTAIN THE MAXIMUM GRADE OF 3% AND ENSURE CLEAR SIGHT LINES.

PARKING SUMMARY		
	REQUIRED*	PROVIDED
STANDARD SPACES (9'x18')	44	44
ACCESSIBLE SPACES**	3	3
EV SPACES	6	6
TOTAL SPACES	53	53

* BASED ON PROGRAMMING NEEDS
23 EMPLOYEE SPACES (16 FIRE STAFF, 7 ADMINISTRATION)
30 VISITOR SPACES

** ADA REQUIREMENT FOR PARKING LOT 51 TO 75 TOTAL SPACES = 3 SPACES

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Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
Civil
No. 42563
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

GENERAL PLAN

DRAWING NO.:

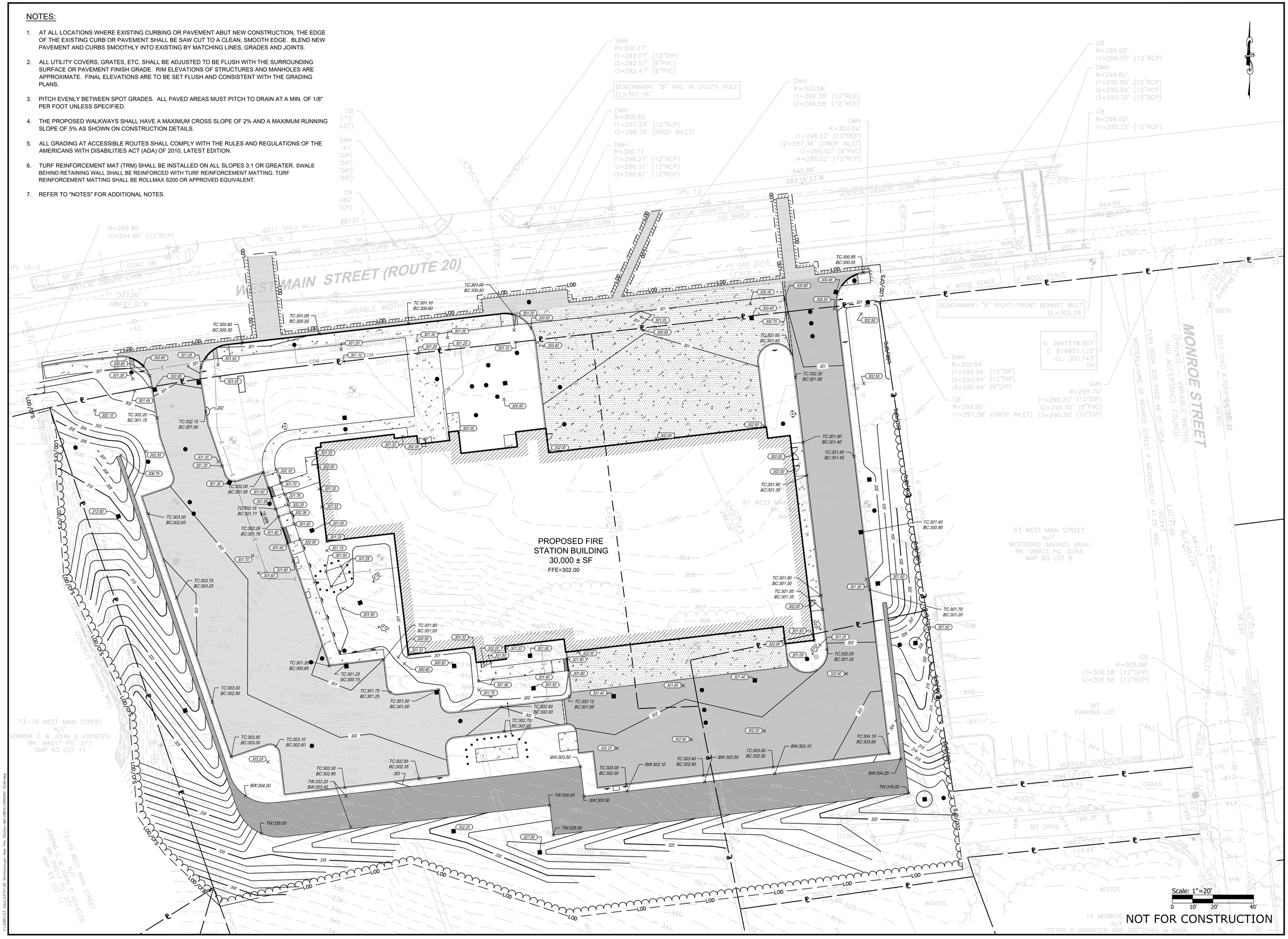
C3.0

SHEET NO. 6 OF

X:\JOBS\23_Jobs\23141.00_Northborough_New_Fire_Station-MA\DWGS\GENERAL PLAN.dwg

NOTES:

1. AT ALL LOCATIONS WHERE EXISTING CURBING OR PAVEMENT ABUT NEW CONSTRUCTION, THE EDGE OF THE EXISTING CURB OR PAVEMENT SHALL BE SAW CUT TO A CLEAN, SMOOTH EDGE. BLEND NEW PAVEMENT AND CURBS SMOOTHLY INTO EXISTING BY MATCHING LINES, GRADES AND JOINTS.
2. ALL UTILITY COVERS, GRATES, ETC. SHALL BE ADJUSTED TO BE FLUSH WITH THE SURROUNDING SURFACE OR PAVEMENT FINISH GRADE. RIM ELEVATIONS OF STRUCTURES AND MANHOLES ARE APPROXIMATE. FINAL ELEVATIONS ARE TO BE SET FLUSH AND CONSISTENT WITH THE GRADING PLANS.
3. PITCH EVENLY BETWEEN SPOT GRADES. ALL PAVED AREAS MUST PITCH TO DRAIN AT A MIN. OF 1/8" PER FOOT UNLESS SPECIFIED.
4. THE PROPOSED WALKWAYS SHALL HAVE A MAXIMUM CROSS SLOPE OF 2% AND A MAXIMUM RUNNING SLOPE OF 5% AS SHOWN ON CONSTRUCTION DETAILS.
5. ALL GRADING AT ACCESSIBLE ROUTES SHALL COMPLY WITH THE RULES AND REGULATIONS OF THE AMERICANS WITH DISABILITIES ACT (ADA) OF 2010, LATEST EDITION.
6. TURF REINFORCEMENT MAT (TRM) SHALL BE INSTALLED ON ALL SLOPES 3:1 OR GREATER. SWALE BEHIND RETAINING WALL SHALL BE REINFORCED WITH TURF REINFORCEMENT MATTING. TURF REINFORCEMENT MATTING SHALL BE ROLLMAX S200 OR APPROVED EQUIVALENT.
7. REFER TO "NOTES" FOR ADDITIONAL NOTES.



Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

SCALE ADJUSTMENT GUIDE
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COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42563
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

GRADING PLAN

DRAWING NO.:

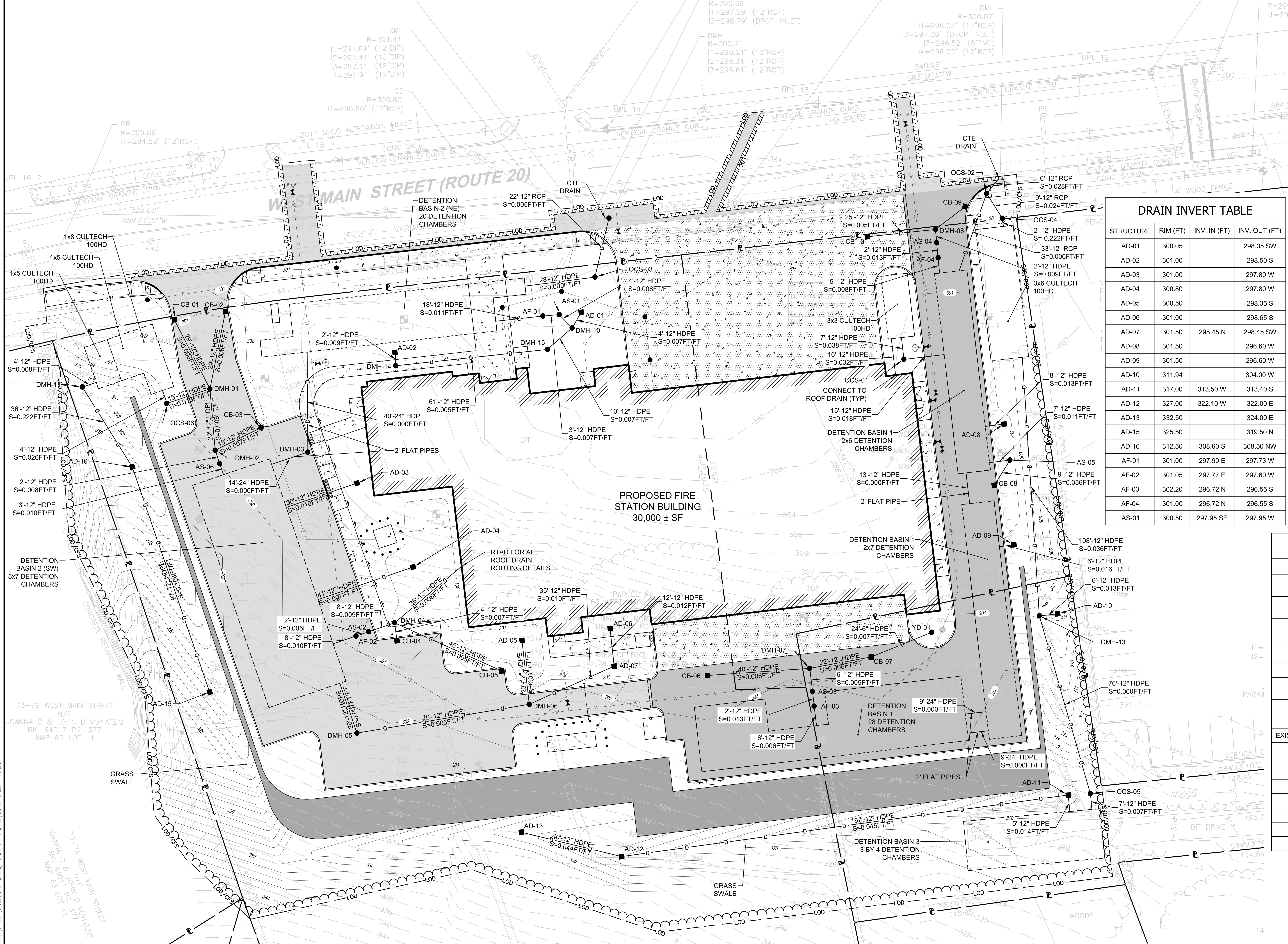
C4.0

SHEET NO. 7 OF

X:\JOBS\23141.00\Northborough-New_Fire_Station-MA\CIVIL\GRADING PLAN.dwg

NOTES:

1. ALL CATCH BASINS AND DRAIN MANHOLES SHALL BE 4' DIA. PRECAST CONCRETE UNLESS NOTED OTHERWISE.
2. ALL DRAIN PIPES SHALL BE 12" SMOOTH INTERIOR CORRUGATED HIGH DENSITY POLYETHYLENE UNLESS NOTED OTHERWISE.
3. REINFORCED CONCRETE PIPE (RCP) SHALL BE CLASS III UNLESS NOTED OTHERWISE.
4. ALL SLOPES PROVIDED ARE FT/FT.
5. ALL CATCH BASINS AND AREA DRAINS SHALL BE INSTALLED WITH A SUMP AND OUTLET HOOD PER THE DETAIL.
6. REFER TO "NOTES" FOR ADDITIONAL NOTES.



DRAIN INVERT TABLE

STRUCTURE	RIM (FT)	INV. IN (FT)	INV. OUT (FT)
AD-01	300.05		298.05 SW
AD-02	301.00		298.50 S
AD-03	301.00		297.80 W
AD-04	300.80		297.80 W
AD-05	300.50		298.35 S
AD-06	301.00		298.65 S
AD-07	301.50	298.45 N	298.45 SW
AD-08	301.50		296.60 W
AD-09	301.50		296.60 W
AD-10	311.94		304.00 W
AD-11	317.00	313.50 W	313.40 S
AD-12	327.00	322.10 W	322.00 E
AD-13	332.50		324.00 E
AD-15	325.50		319.50 N
AD-16	312.50	308.60 S	308.50 NW
AF-01	301.00	297.90 E	297.73 W
AF-02	301.05	297.77 E	297.60 W
AF-03	302.20	296.72 N	296.55 S
AF-04	301.00	296.72 N	296.55 S
AS-01	300.50	297.95 SE	297.95 W

DRAIN INVERT TABLE

STRUCTURE	RIM (FT)	INV. IN (FT)	INV. OUT (FT)
AS-02	300.95	297.80 E	297.80 W
AS-03	302.00	296.80 N	296.80 S
AS-04	298.74	296.80 N	296.80 S
AS-05	300.95	296.70 SW	296.60 W
AS-06	302.00	297.55 N	297.55 S
CB-01	300.95		298.00 SE
CB-02	300.95		298.00 S
CB-03	301.30		297.75 SW
CB-04	300.80		297.95 N
CB-05	301.00		298.15 NW
CB-06	301.40		297.10 E
CB-07	301.40	299.00 E	297.00 W
CB-08	300.90		297.40 NE
CB-09	300.45		296.95 SW
CB-10	300.40		297.00 E
DMH-01	301.35	297.80 N 297.80 NW 297.85 W	297.80 S
DMH-02	301.95	297.60 N 297.60 NE	297.60 S
DMH-03	301.65	297.50 W	297.50 N
DMH-04	301.25	297.90 S 297.90 SE 297.90 NE	297.90 W
DMH-05	302.20	297.65 E	297.65 N

DRAIN INVERT TABLE

STRUCTURE	RIM (FT)	INV. IN (FT)	INV. OUT (FT)
DMH-06	301.60	298.05 NE 298.05 N	298.05 W
DMH-07	301.80	296.85 W 296.85 E	296.85 S
DMH-08	300.60	296.85 W 296.85 NE	296.85 S
DMH-10	307.00	298.00 NE 298.00 SW	298.00 NW
DMH-11	307.00	299.65 SE	299.55 E
DMH-13	309.00	305.25 S 303.90 E	303.90 N
DMH-14	300.39	298.45 N	298.45 E
DMH-15	300.04	298.10 W	298.10 NE
EXISTING MANHOLE	299.15	297.21 S	
OCS-01	302.00	299.15 N	296.80 E
OCS-02	300.75	296.30 S 297.00 SE	296.25 NE
OCS-03	301.20	297.35 W	297.35 N
OCS-04	302.50	300.00 S	297.30 NW
OCS-05	318.30	309.95 S	309.95 N
OCS-06	303.00	299.35 N	298.10 E
YD-01	301.00		299.20 W

NOT FOR CONSTRUCTION

PARE

Northborough New Fire Station
63 West Main Street
Town of Northborough, MA

SCALE ADJUSTMENT GUIDE
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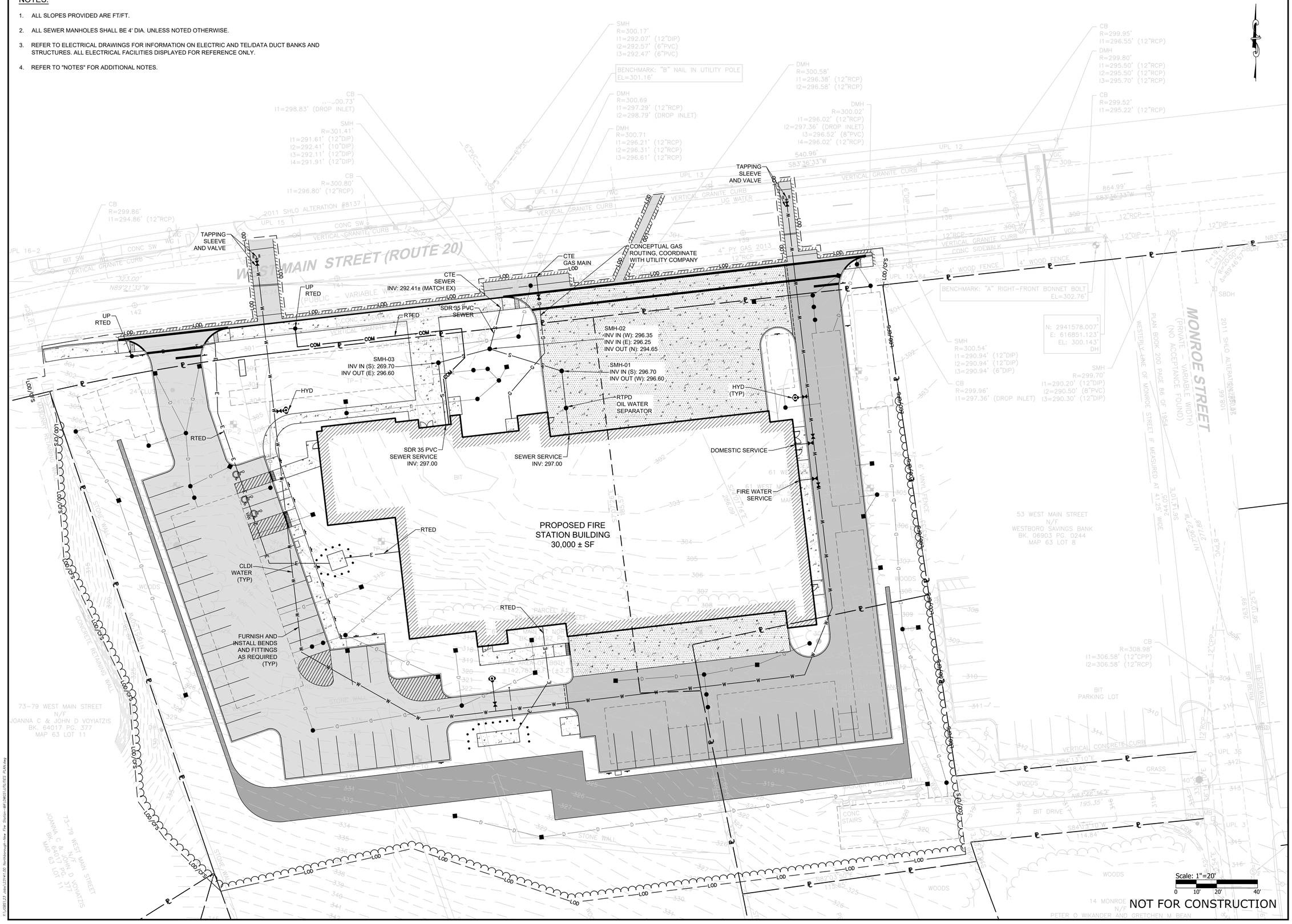
COMMONWEALTH OF MASSACHUSETTS
JAMES A JACKSON, JR.
CIVIL
No. 42363
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	DRAINAGE PLAN
DRAWING NO.:	C5.0
SHEET NO.	8 OF

NOTES:

1. ALL SLOPES PROVIDED ARE FT/FT.
2. ALL SEWER MANHOLES SHALL BE 4' DIA. UNLESS NOTED OTHERWISE.
3. REFER TO ELECTRICAL DRAWINGS FOR INFORMATION ON ELECTRIC AND TEL/DATA DUCT BANKS AND STRUCTURES. ALL ELECTRICAL FACILITIES DISPLAYED FOR REFERENCE ONLY.
4. REFER TO "NOTES" FOR ADDITIONAL NOTES.



PARE

SCALE ADJUSTMENT GUIDE
0" 1"
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Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
Civil
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REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	UTILITIES PLAN
DRAWING NO.:	C6.0
SHEET NO.	9 OF

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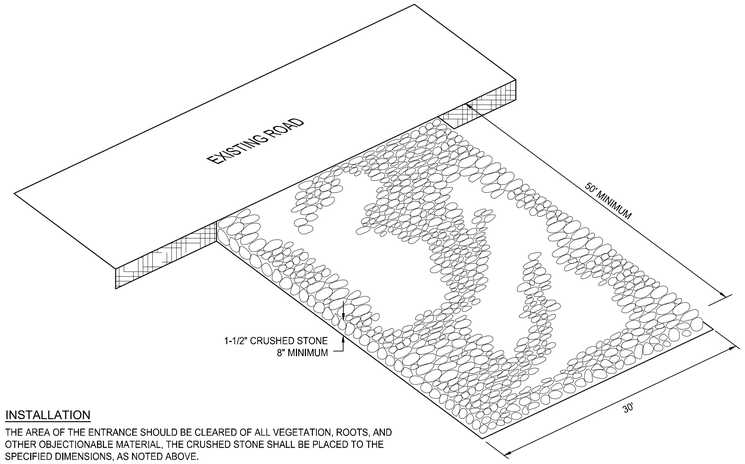


INSTALLATION

THE AREA OF THE ENTRANCE SHOULD BE CLEARED OF ALL VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL, THE CRUSHED STONE SHALL BE PLACED TO THE SPECIFIED DIMENSIONS, AS NOTED ABOVE.

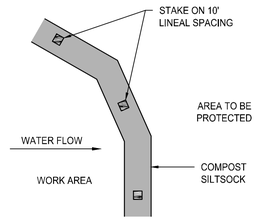
MAINTENANCE

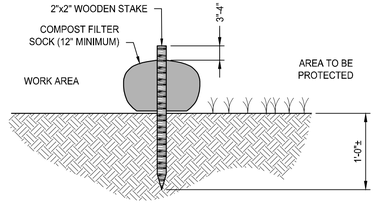
THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENTS ONTO PUBLIC RIGHT-OF-WAYS, THIS WILL REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE, OR ADDITIONAL LENGTH, AS CONDITIONS DEMAND, AND REPAIR, AND / OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAYS MUST BE REMOVED IMMEDIATELY.

LOCATION

SEE PROJECT PLANS FOR LOCATION OF CONSTRUCTION ENTRANCE.

CONSTRUCTION ENTRANCE PROTECTION STONE STABILIZATION PAD
NOT TO SCALE

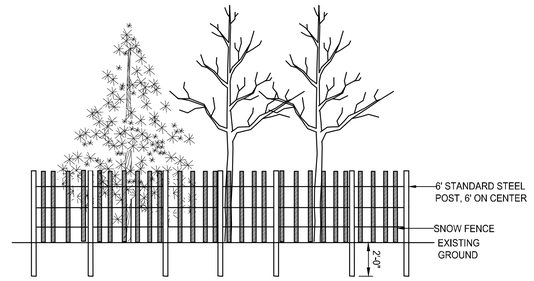




NOTES:

1. COMPOST/ SOIL/ ROCK/ SEED FILL TO MEET APPLICATION REQUIREMENTS.
2. COMPOST MATERIAL TO BE REMOVED ONCE THE CONTRIBUTING AREA IS PERMANENTLY STABILIZED AND THE CONTRACTOR HAS APPROVAL FROM THE TOWN OF NORTHBOROUGH'S CONSERVATION COMMISSION.
3. IF SOCK NETTING MUST BE JOINED, FIT BEGINNING OF NEW SOCK OVER END OF OLD SOCK, OVERLAPPING BY 2 FEET. IF SOCK NETTING IS NOT JOINED, OVERLAP OLD SOCK WITH NEW ONE BY MINIMUM OF 2 FEET.

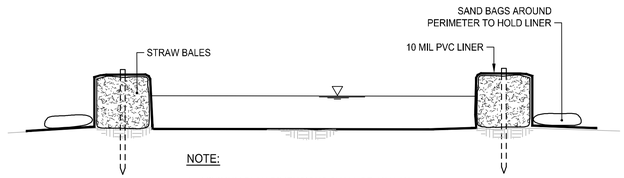
COMPOST FILTER SOCK DETAIL
NOT TO SCALE



NOTES:

1. TREE GROUP PROTECTION SHALL BE INSTALLED AT THE DRIP LINE OF THE TREES TO BE PROTECTED.

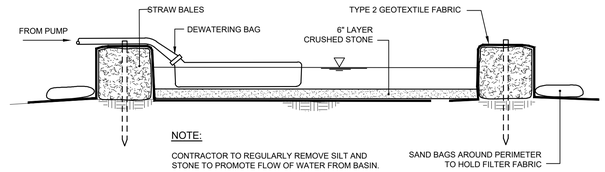
TREE GROUP PROTECTION DETAIL
NOT TO SCALE



NOTE:

1. MINIMUM PLAN DIMENSIONS SHALL BE 10' X 10'.

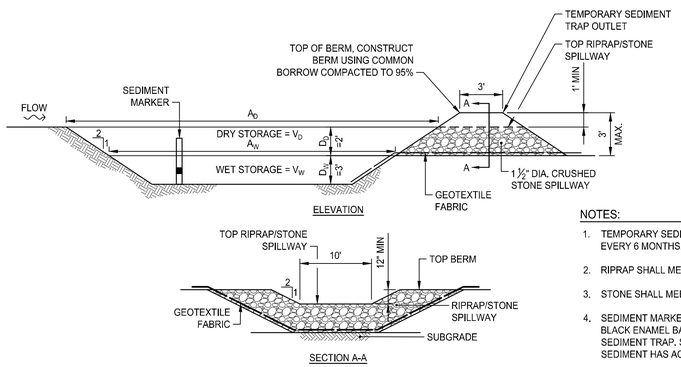
CONCRETE WASHOUT FACILITY
NOT TO SCALE



NOTE:

CONTRACTOR TO REGULARLY REMOVE SILT AND STONE TO PROMOTE FLOW OF WATER FROM BASIN.

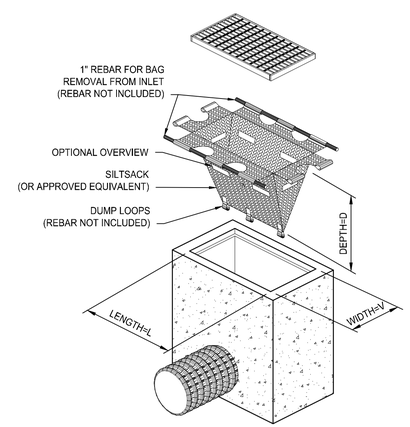
FILTER FABRIC DEWATERING BASIN
NOT TO SCALE

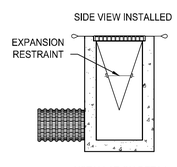


NOTES:

1. TEMPORARY SEDIMENT TRAPS SHALL BE CLEANED OR REMOVED EVERY 6 MONTHS.
2. RIPRAP SHALL MEET RIDOT STANDARD SPECIFICATION M2.02.0.
3. STONE SHALL MEET RIDOT STANDARD SPECIFICATION M2.01.4.
4. SEDIMENT MARKER SHALL BE INSTALLED SUCH THAT TOP OF BLACK ENAMEL BAND IS 1.5' FROM THE BOTTOM OF THE SEDIMENT TRAP. SEDIMENT TRAP SHALL BE CLEANED ONCE SEDIMENT HAS ACCUMULATED TO THE BLACK ENAMEL BAND.

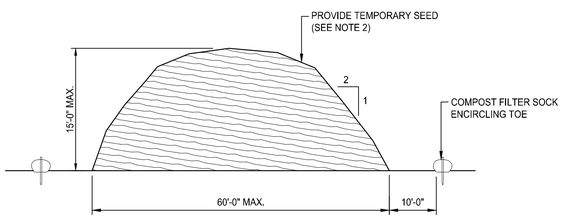
TEMPORARY SEDIMENT TRAP DETAIL
NOT TO SCALE





INSTALLATION DETAIL

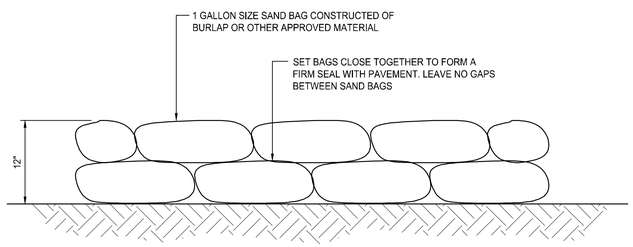
TEMPORARY INLET PROTECTION
NOT TO SCALE



NOTES:

1. STOCKPILE AREA SHALL NOT EXCEED SPECIFIED DIMENSIONS WITHOUT APPROVAL FROM ENGINEER.
2. STOCKPILED ERODIBLE MATERIAL THAT WILL NOT BE USED FOR GREATER THAN 14 DAYS SHALL BE STABILIZED WITH TEMPORARY SEED IMMEDIATELY FOLLOWING PLACEMENT.

ERODIBLE MATERIAL STOCKPILE
NOT TO SCALE



SAND BAG EROSION CONTROL BARRIER
NOT TO SCALE

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station
63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
Civil
No. 42583
REGISTERED PROFESSIONAL ENGINEER

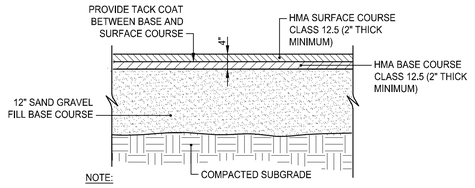
REVISIONS:

PROJECT NO.:	23141.00	
DATE:	MAY 14, 2024	
SCALE:	NOT TO SCALE	
DESIGNED BY:		
CHECKED BY:		
DRAWN BY:	AKL	
APPROVED BY:		

DRAWING TITLE:
DETAILS 1

DRAWING NO.:
C7.1

SHEET NO. 10 OF ___

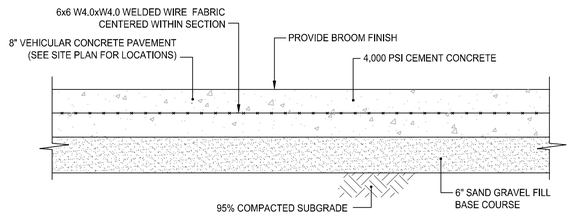


NOTE:

1. SUBMIT JOB MIX FORMULAS TO ENGINEER FOR APPROVAL PRIOR TO PLACEMENT.
2. THE CONTRACTOR SHALL CHECK EXISTING PAVEMENT DEPTH IN THE CITY RIGHT OF WAY THEN MATCH EXISTING.

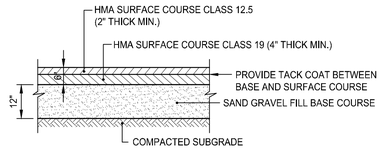
HOT MIX ASPHALT PAVEMENT

NOT TO SCALE



VEHICULAR CONCRETE PAVEMENT DETAIL

NOT TO SCALE

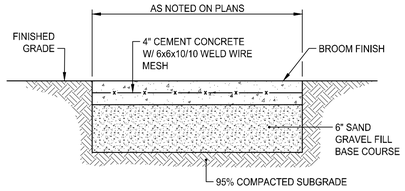


NOTE:

SUBMIT JOB MIX FORMULAS TO ENGINEER FOR APPROVAL PRIOR TO PLACEMENT

TYPICAL HEAVY DUTY PAVEMENT DETAIL

NOT TO SCALE

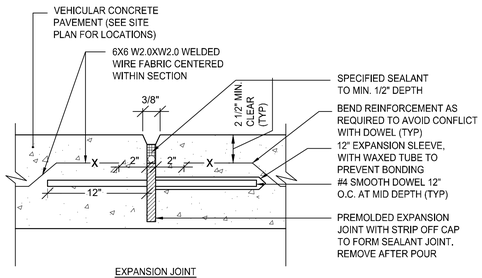


NOTES:

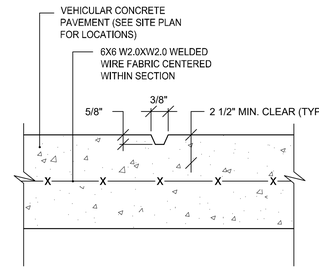
1. CONCRETE SIDEWALK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 905 OF THE RI STANDARD SPECIFICATIONS.
2. WIRE MESH SHALL BE IN ACCORDANCE WITH SECTION M.05.02 OF THE RI STANDARD SPECIFICATIONS.

TYPICAL CEMENT CONCRETE SIDEWALK

NOT TO SCALE



EXPANSION JOINT AT 20' O.C. (TYP)



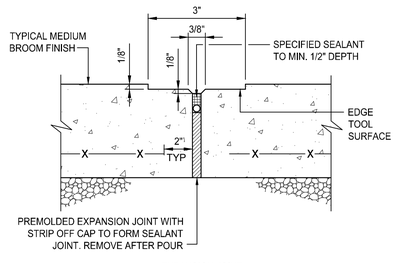
CONTROL JOINT AT 5' O.C. (TYP)

NOTES:

1. EXPANSION JOINTS (E.J.) 20' O.C. UNLESS OTHERWISE NOTED.
2. CONTROL JOINTS (C.J.) 5' O.C. UNLESS OTHERWISE NOTED.
3. WHERE EXISTING AND NEW CONCRETE SIDEWALKS MEET, SAWCUT EXISTING WALK AND INSTALL EXPANSION JOINT AND DOWELS AS SHOWN. DRILL EXISTING CONCRETE WALK EDGE TO RECEIVE STEEL DOWELS AT EXPANSION JOINT.

EXPANSION AND CONTROL JOINTS FOR VEHICULAR CONCRETE PAVING

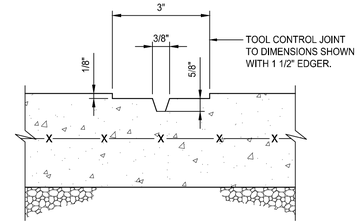
NOT TO SCALE



EXPANSION JOINT AT 20' O.C. (TYP)

NOTES:

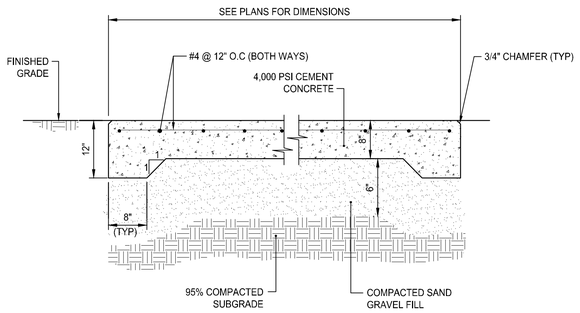
1. EXPANSION JOINTS (E.J.) 20 FEET O.C. UNLESS OTHERWISE NOTED.
2. CONTROL JOINTS (C.J.) 5 FEET O.C. UNLESS OTHERWISE NOTED.
3. WHERE EXISTING AND NEW CONCRETE SIDEWALKS MEET, SAWCUT EXISTING WALK AND INSTALL EXPANSION JOINT AND DOWELS AS SHOWN. DRILL EXISTING CONCRETE WALK EDGE TO RECEIVE STEEL DOWELS AT EXPANSION JOINT.
4. REFER TO LANDSCAPE PLANS FOR LOCATIONS.



CONTROL JOINT AT 5' O.C. (TYP)

EXPANSION AND CONTROL JOINTS FOR SIDEWALK PAVING

NOT TO SCALE

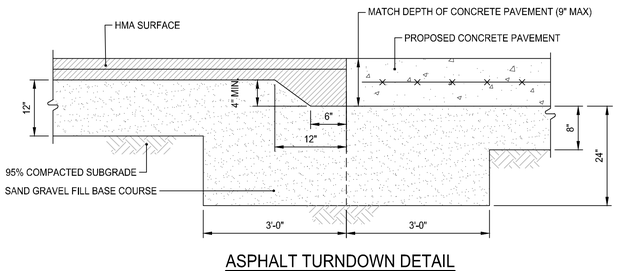


NOTES:

1. FOR DUMPSTER PAD AND BOLLARD LOCATIONS SEE PLANS.
2. REINFORCING TO BE #4 GRADE 60 BARS AND SHALL CONFORM TO ASTM STANDARD A-615 OF THE LATEST DATA. REINFORCING RODS TO BE LOCATED IN THE CENTER OF THE SLAB, WITH A MINIMUM OF 2" CLEARANCE FROM FACE OF CONCRETE.

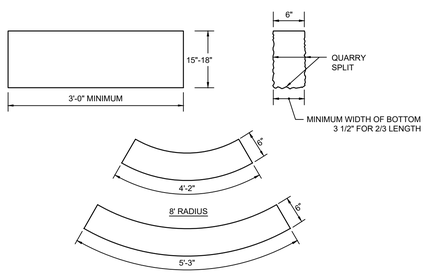
CEMENT CONCRETE DUMPSTER PAD

NOT TO SCALE



ASPHALT TURNDOWN DETAIL

NOT TO SCALE



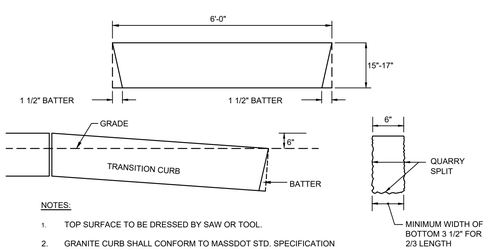
CIRCULAR CURB

NOTES:

1. MAXIMUM LENGTHS USING 8' & 10' RADII, WITH 90° ANGLE, ARE 4'-2" AND 5'-3" RESPECTIVELY.
2. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR FILLER PIECES TO BE 3'-0".
3. TOP SURFACE TO BE DRESSED BY SAW.
4. CIRCULAR CURB IS REQUIRED ON CURVES WITH RADII OF 100' OR LESS. STRAIGHT CURB TO BE USED ON CURVES OF MORE THAN 100' RADIUS.
5. GRANITE CURB SHALL CONFORM TO MASSDOT STD. SPECIFICATION MATERIALS SECTION M9.04.1 GRANITE CURB, TYPE VA4.
6. 3000 PSI CONCRETE BACKFILL IS REQUIRED FOR ALL GRANITE CURB.

GRANITE CURB QUARRY SPLIT

NOT TO SCALE

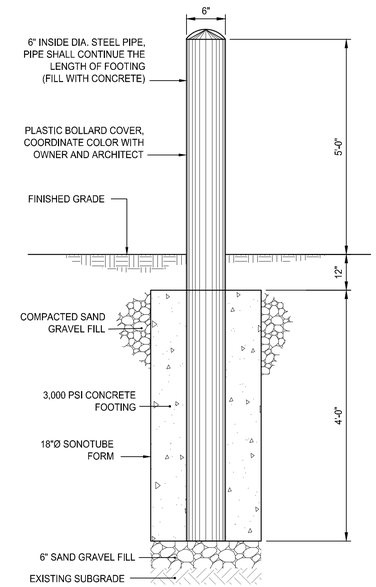


NOTES:

1. TOP SURFACE TO BE DRESSED BY SAW OR TOOL.
2. GRANITE CURB SHALL CONFORM TO MASSDOT STD. SPECIFICATION MATERIALS SECTION M9.04.1 GRANITE CURB, TYPE VA4.

6' GRANITE TRANSITION CURB

NOT TO SCALE



BOLLARD DETAIL

NOT TO SCALE

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42583
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

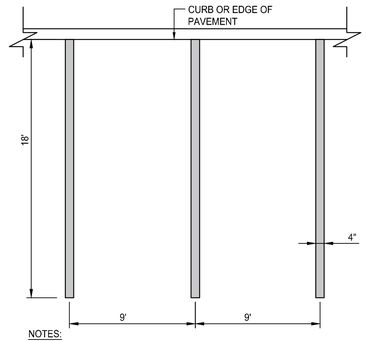
DRAWING TITLE:

DETAILS 2

DRAWING NO.:

C7.2

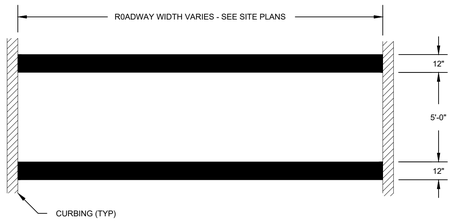
SHEET NO. 11 OF ___



NOTES:

1. COORDINATE PAVEMENT MARKING COLORS WITH PLANS.
2. ALL PARKING PAVEMENT MARKINGS SHALL BE EPOXY RESIN, CONFORMING TO THE SPECIFICATIONS.

TYPICAL PARKING STALL
NOT TO SCALE



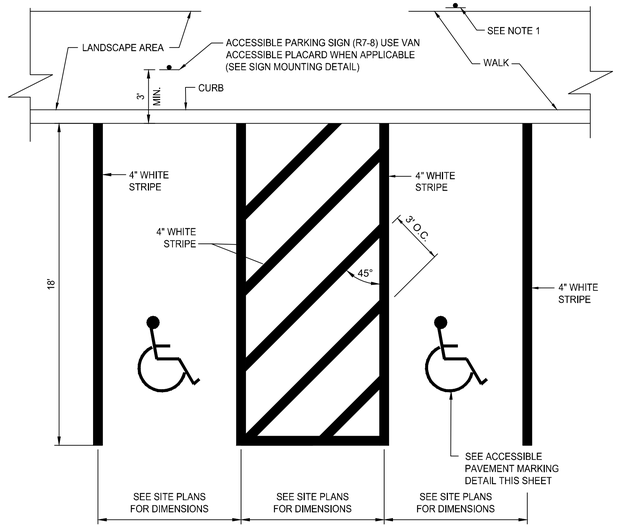
NOTE:
1. ALL LINE STRIPING TO BE 12" WIDE AND PAINTED WHITE.

CROSSWALK
NOT TO SCALE

LEGEND	DESIGNATION	SIZE
STOP	R1-1	(30" x 30")
AUTHORIZED VEHICLES ONLY	R5-11	(30" x 24")
RESERVED PARKING	R7-8	(12" x 18")
VAN ACCESSIBLE	R7-8P	(12" x 6")
	S1-1	(30" x 30")
	W16-7P	(12" x 24")
ACCESSIBLE EV CHARGING USE LAST	ACCESSIBLE EV CHARGING	(12" x 18")
PUBLIC PARKING	PUBLIC PARKING	(30" x 30")
	GENERIC CUSTOM SIGN	(12" x 18")

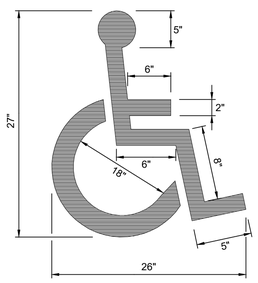
NOTE:
1. SIGNS SHALL BE CONSTRUCTED OF TYPE III REFLECTORIZED SHEETING AND IN ACCORDANCE WITH MUTCD REQUIREMENTS, LATEST REVISION.
2. THE CONTRACTOR SHALL SUBMIT SAMPLE SIGNS TO THE OWNER FOR APPROVAL PRIOR TO FURNISHING.
3. LETTERS, COLOR, AND FONT FOR NON-STANDARD SIGNS SHALL BE SELECTED BY THE OWNER.
4. R7-8 AND R7-8P SHALL CONFORM TO ACCESSIBLE SIGN MOUNTING DETAIL.

SIGN SCHEDULE



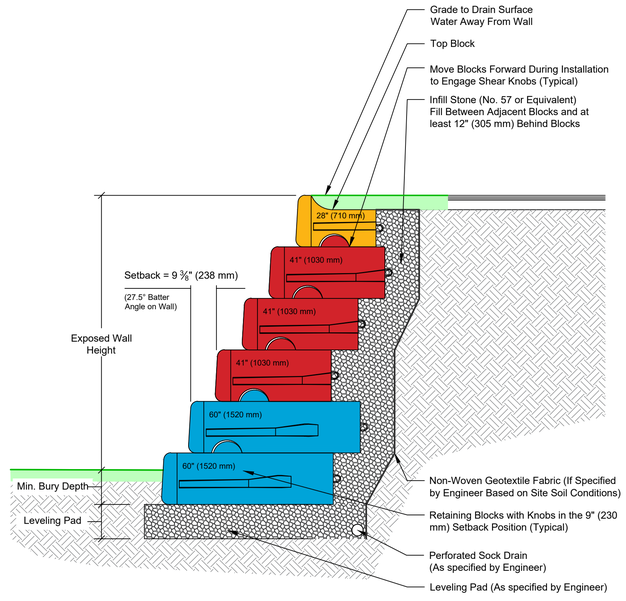
NOTES:
1. WHERE STALLS ABUT SIDEWALK, PARKING SIGNS SHOULD BE PLACED AT BACK EDGE OF SIDEWALK.
2. ALL PAVEMENT MARKINGS TO BE EPOXY RESIN.

ACCESSIBLE PARKING STALLS @ 90°
NOT TO SCALE



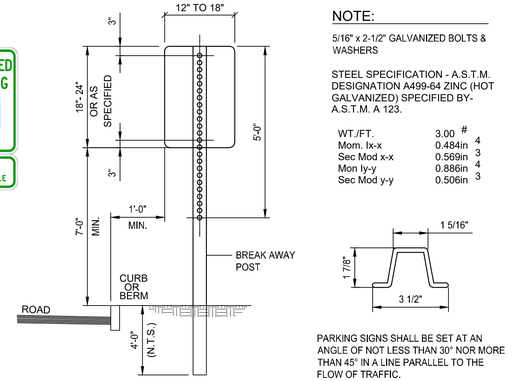
NOTE:
ACCESSIBLE PARKING AND SIGNAGE SHALL BE IN CONFORMANCE WITH THE RULES & REGULATIONS OF THE AMERICANS WITH DISABILITIES ACT.

ACCESSIBLE PAVEMENT MARKING
NOT TO SCALE



LARGE BATTER WALL SECTION
NOT TO SCALE

1. MANUFACTURER SHALL BE REDI-ROCK INTERNATIONAL OR APPROVED EQUIVALENT.
2. THE DETAIL REPRESENTS A TYPICAL BATTERED WALL CROSS SECTION. BLOCK SIZES LEVELING PAD AND DRAINAGE SHOWN SUBJECT TO CHANGE BEST ON THE DESIGN BY THE WALL DESIGN ENGINEER.
3. CONTRACTOR SHALL SUBMIT MANUFACTURERS SHOP DRAWINGS, INCLUDING PLANS, ELEVATIONS, SECTIONS, AND DETAILS, INDICATING LAYOUT, DIMENSIONS, FOUNDATION, COVER, AND JOINTS. INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET AND OUTLET PIPE OPENINGS.
4. CONTRACTOR SHALL SUBMIT FINAL WALL DESIGN TO PLANNING BOARD FOR REVIEW AND COMMENT.
5. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO UNIT INSTALLATION.
6. RETAINING WALL SHALL BE REDI-ROCK "COBBLESTONE" STANDARD COLOR OR APPROVED EQUIVALENT.



NOTE:
5/16" x 2-1/2" GALVANIZED BOLTS & WASHERS

STEEL SPECIFICATION - A.S.T.M. DESIGNATION A499-64 ZINC (HOT GALVANIZED) SPECIFIED BY- A.S.T.M. A 123.

WT./FT.	3.00	#
Mom. Ix-x	0.484in	4
Sec Mod x-x	0.569in	3
Mon Iy-y	0.886in	4
Sec Mod y-y	0.506in	3

PARKING SIGNS SHALL BE SET AT AN ANGLE OF NOT LESS THAN 30° NOR MORE THAN 45° IN A LINE PARALLEL TO THE FLOW OF TRAFFIC.

NOTES:
1. ALL LAG SCREWS, BOLTS AND WASHERS SHALL BE GALVANIZED 5/16"x2 1/2" LONG UNLESS OTHERWISE NOTED.
2. WASHERS SHALL BE 0.07" THICK.
3. ALL SIGN COLORS, RADII AND BORDERS AS SPECIFIED IN "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES."
4. PARKING SIGNS SHALL BE SET AT AN ANGLE OF NOT LESS THAN 30° NOT MORE THAN 45° WITH A LINE PARALLEL TO FLOW OF TRAFFIC, 1'-6" (1'-0" MIN.) FROM THE EDGE OF CURB FACE.
5. ALL ACCESSIBLE PARKING AND SIGNAGE SHALL BE IN CONFORMANCE WITH THE RULES & REGULATIONS AS SPECIFIED BY THE AMERICAN DISABILITIES ACT (ADA).
6. SIGN(S) SHALL BE LOCATED SO THEY CANNOT BE OBSCURED BY A VEHICLE PARKED IN THE SPACE.
7. FOR ACCESSIBLE VAN SPACE USE SIGN AS DETAILED.
8. FOR ACCESSIBLE SPACE FOR AUTOMOBILES USE ONLY HANDICAPPED PARKING SIGN.

ACCESSIBLE SIGN MOUNTING
NOT TO SCALE

NOT FOR CONSTRUCTION

PARE

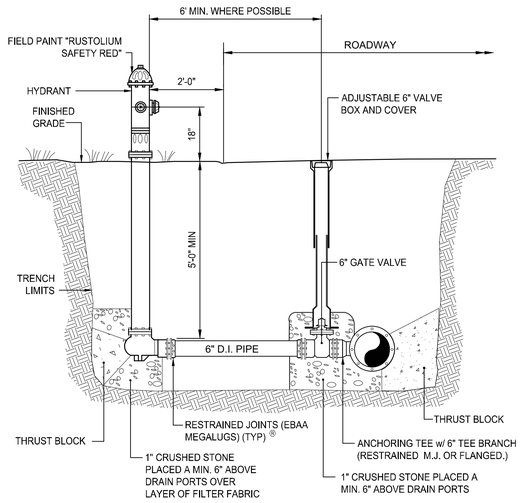
SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station
63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
Civil
No. 42583
REGISTERED PROFESSIONAL ENGINEER

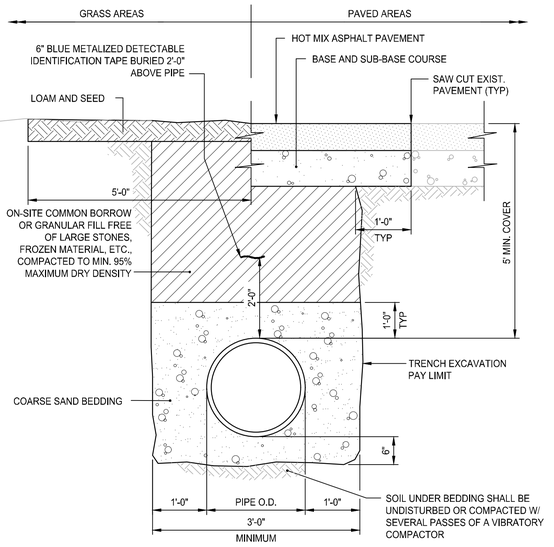
REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	DETAILS 3
DRAWING NO.:	C7.3
SHEET NO.	12 OF ___



HYDRANT DETAIL

NOT TO SCALE

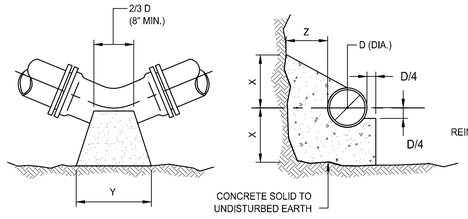


NOTES:

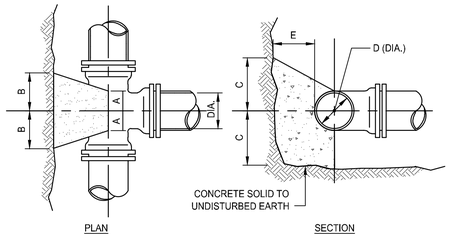
1. WHERE THE DISTANCE BETWEEN THE SAWCUT AND EDGE OF PAVEMENT IS 3' OR LESS, THE CONTRACTOR SHALL REPLACE THE PAVEMENT FROM THE TRENCH EDGE TO THE EXISTING EDGE OF PAVEMENT.
2. PIPE SHALL BE BEDDED IN 3/4-INCH CRUSHED STONE IF WITHIN GROUNDWATER.

TYPICAL WATER MAIN TRENCH DETAIL

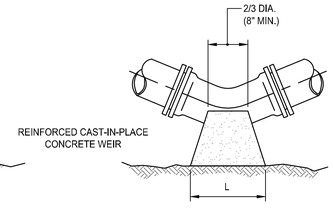
NOT TO SCALE

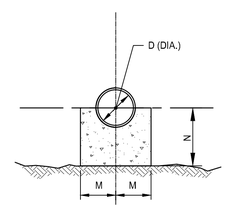


HORIZONTAL BENDS

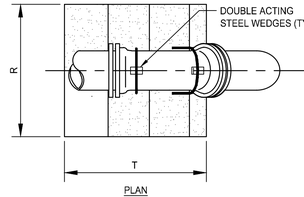


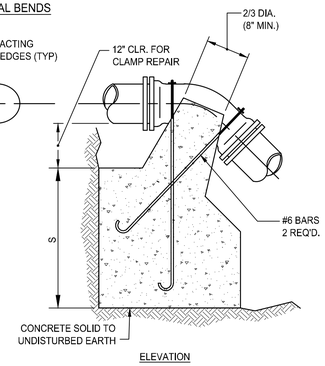
TEES





VERTICAL BENDS





NOTES:

1. CONCRETE THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED EARTH. IN AREAS WHERE BEARINGS SOILS HAVE BEEN DISTURBED, RESTRAINED JOINTS SHALL BE USED.
2. ALL FORCE MAIN BENDS, TEES, MAIN TAPS, AND END CAPS SHALL REQUIRE A CONCRETE THRUST BLOCK.

CONC. ANCHORAGE

TEES		PIPE SIZE-D (DIA.)				
		6"	8"	12"	16"	20"
A		8"	10"	1'-0"	1'-3"	1'-6"
B		8"	10"	1'-2"	1'-4"	1'-6"
C		10"	1'-0"	1'-3"	1'-6"	1'-8"
E		8"	10"	1'-2"	1'-6"	1'-10"

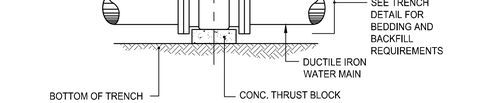
HORIZONTAL BENDS		PIPE SIZE-D (DIA.)				
BEND		6"	8"	12"	16"	20"
1/8	X	1'-0"	1'-0"	1'-0"	1'-3"	1'-6"
	Y	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"
	Z	8"	10"	1'-2"	1'-4"	1'-6"
1/16	X	1'-0"	1'-0"	1'-0"	1'-3"	1'-6"
	Y	1'-0"	1'-4"	1'-6"	1'-9"	2'-6"
	Z	8"	10"	1'-2"	1'-4"	1'-6"
1/32	X	1'-0"	1'-0"	1'-0"	1'-2"	1'-4"
	Y	1'-0"	1'-0"	1'-2"	1'-4"	1'-6"
	Z	8"	10"	1'-2"	1'-4"	1'-6"

VERTICAL BENDS		PIPE SIZE-D (DIA.)				
BEND		6"	8"	12"	16"	20"
1/8	L	1'-3"	1'-8"	2'-6"	3'-6"	4'-8"
	M	7"	8"	11"	1'-4"	1'-6"
	N	7"	8"	11"	1'-4"	1'-6"
1/16	L	9"	1'-0"	1'-9"	2'-6"	3'-0"
	M	7"	7"	10"	1'-0"	1'-2"
	N	7"	7"	8"	10"	1'-0"
1/32	L	6"	8"	1'-0"	1'-4"	1'-9"
	M	7"	7"	10"	1'-0"	1'-2"
	N	7"	7"	8"	10"	1'-0"

ANCHORAGES		PIPE SIZE-D (DIA.)				
BEND		6"	8"	12"	16"	20"
1/8	R	2'-6"	3'-0"	4'-6"	5'-4"	6'-0"
	S	2'-6"	2'-9"	3'-6"	2'-6"	5'-6"
	T	3'-0"	4'-0"	4'-9"	7'-0"	9'-6"
1/16	R	2'-0"	2'-8"	4'-0"	4'-6"	5'-0"
	S	1'-9"	2'-3"	2'-6"	3'-2"	3'-8"
	T	2'-6"	3'-4"	4'-0"	6'-0"	8'-6"
1/32	R	1'-6"	2'-0"	3'-0"	3'-8"	4'-3"
	S	1'-3"	1'-9"	2'-0"	2'-4"	2'-6"
	T	2'-0"	2'-6"	3'-0"	4'-6"	5'-9"

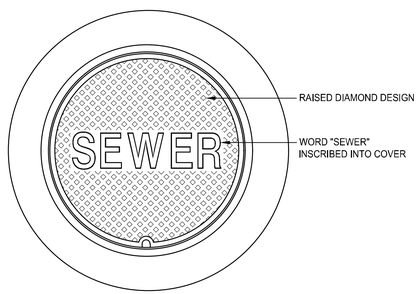
CONCRETE THRUST BLOCKS

NOT TO SCALE



VALVE BOX DETAIL

NOT TO SCALE

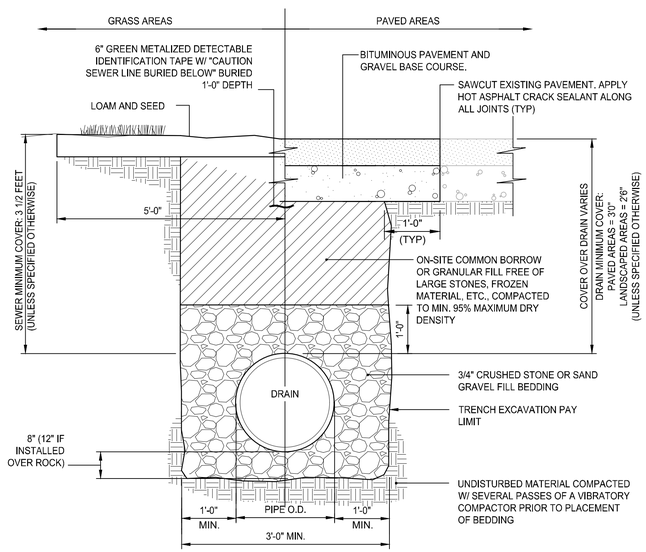


NOTES:

1. NEENAH FOUNDRY, INC. MODEL #R-1557 OR APPROVED EQUIVALENT.
2. COVER SHALL MEET H-20 LOADING CRITERIA.

SANITARY MANHOLE FRAME & COVER

NOT TO SCALE



NOTES:

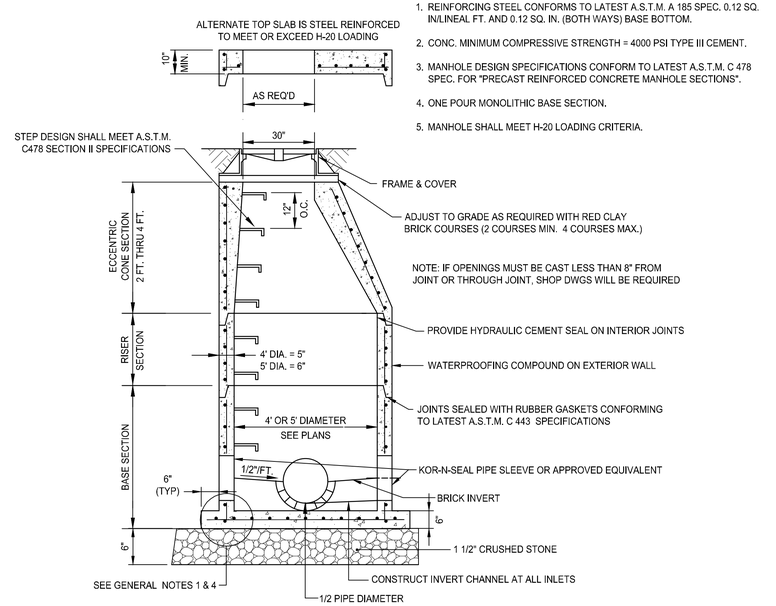
1. WHERE THE DISTANCE BETWEEN THE SAWCUT AND EDGE OF PAVEMENT IS 3' OR LESS, THE CONTRACTOR SHALL REPLACE THE PAVEMENT FROM THE TRENCH EDGE TO THE EXISTING EDGE OF PAVEMENT.
2. 3/4" DIA. CRUSHED STONE SHALL BE USED AS BEDDING WHERE TRENCH IS BELOW THE GROUND WATER TABLE.

DRAIN/SEWER TRENCH DETAIL

NOT TO SCALE

GENERAL NOTES:

1. REINFORCING STEEL CONFORMS TO LATEST A.S.T.M. A 185 SPEC. 0.12 SQ. IN/LINEAL FT. AND 0.12 SQ. IN. (BOTH WAYS) BASE BOTTOM.
2. CONC. MINIMUM COMPRESSIVE STRENGTH = 4000 PSI TYPE III CEMENT.
3. MANHOLE DESIGN SPECIFICATIONS CONFORM TO LATEST A.S.T.M. C 478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
4. ONE POUR MONOLITHIC BASE SECTION.
5. MANHOLE SHALL MEET H-20 LOADING CRITERIA.



TYPICAL SEWER MANHOLE DETAIL

NOT TO SCALE

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

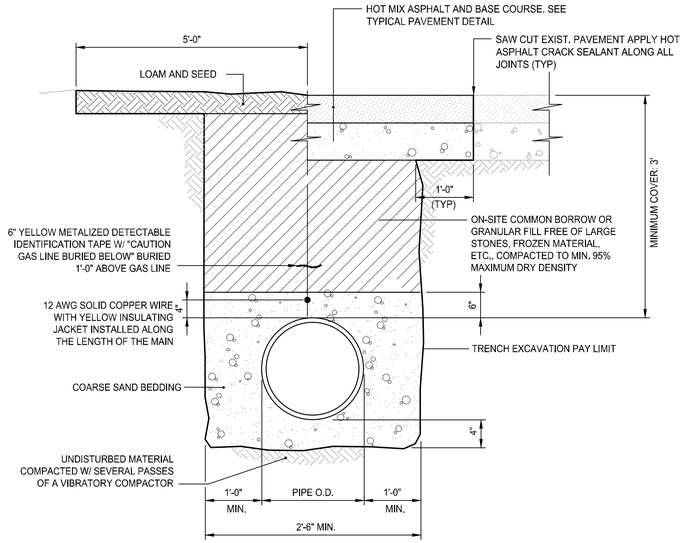
Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42583
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

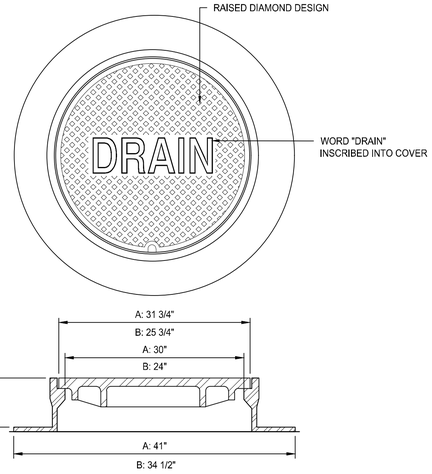
PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	DETAILS 4
DRAWING NO.:	C7.4
SHEET NO.	13 OF ___



NOTES:

1. WHERE THE DISTANCE BETWEEN THE SAWCUT AND EDGE OF PAVEMENT IS 3' OR LESS, THE CONTRACTOR SHALL REPLACE THE PAVEMENT FROM THE TRENCH EDGE TO THE EXISTING EDGE OF PAVEMENT.
2. WHERE A SLEEVE IS INSTALLED, A TRACING WIRE SHALL BE INSTALLED OUTSIDE OF SLEEVE.
3. GAS TRENCH SHALL BE COORDINATED WITH REQUIREMENTS OF THE GAS COMPANY PRIOR TO COMMENCING WORK.

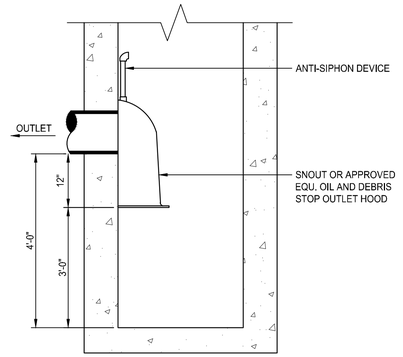
GAS TRENCH DETAIL
NOT TO SCALE



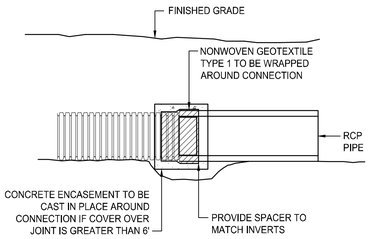
NOTES:

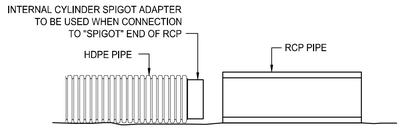
1. ALL FRAMES AND COVERS SHALL MEET H-20 LOADING CRITERIA.
2. PROVIDE:
   A: 30" DIA. DRAIN MANHOLE FRAME AND COVER SHALL BE NEENAH FOUNDRY, INC. MODEL #R-1557 OR APPROVED EQUIVALENT.
   B: 24" DIA. DRAIN MANHOLE FRAME AND COVER SHALL BE NEENAH FOUNDRY, INC. MODEL #R-1556 OR APPROVED EQUIVALENT.
3. ALL DRAIN MANHOLES SHALL HAVE 24" DIA. DRAIN MANHOLE COVER UNLESS NOTED OTHERWISE.

DRAIN MANHOLE FRAME & COVER
NOT TO SCALE



OUTLET HOOD DETAIL
NOT TO SCALE

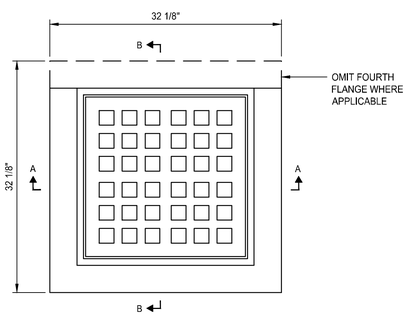




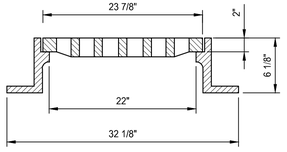
NOTES:

1. FOR USE WHERE HDPE PIPE CONNECTS TO PRECAST CONCRETE FLARED END SECTION.
2. INTERNAL CYLINDER ADAPTER TO BE WELDED TO HDPE, OUTSIDE DIAMETER TO BE INSERTED INTO INSIDE DIAMETER OF CONCRETE PIPE.
3. NON-WOVEN GEOTEXTILE TO BE WRAPPED AROUND CONNECTION WITH FULL SEAM OVERLAP TO PROVIDE FULL PROTECTION FROM SOIL INTRUSION.
4. CONNECTION TO BE MADE IN ACCORDANCE WITH PIPE MANUFACTURER'S REQUIREMENTS.
5. INTERNAL CYLINDER SPIGOT ADAPTER NOT REQUIRED IF HDPE IS CONNECTION TO "BELL" END OF RCP.

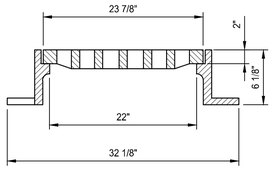
HDPE/RCP PIPE JOINT
NOT TO SCALE



PLAN



SECTION A-A



SECTION B-B

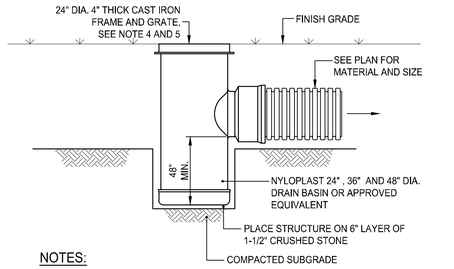
NOTES:

1. NEENAH FOUNDRY R-3405-A OR APPROVED EQUIVALENT.
2. FRAME AND GRATE SHALL MEET H-20 LOADING CRITERIA.

GENERAL NOTES:

1. REINFORCING STEEL CONFORMS TO LATEST A.S.T.M. A 185 SPEC. 0.12 SQ. IN/LINEAL FT. AND 0.12 SQ. IN. (BOTH WAYS) BASE BOTTOM
2. CONC. MINIMUM COMPRESSIVE STRENGTH = 4000 PSI TYPE III CEMENT.
3. MANHOLE DESIGN SPECIFICATIONS CONFORM TO LATEST A.S.T.M. C 478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
4. PROVIDE ONE POUR 6" THICK REINFORCED MONOLITHIC BASE SECTION.
5. MANHOLE SHALL MEET H-20 LOADING CRITERIA.
6. ALL LIFTING HOLES TO BE PLUGGED IN AND OUT WITH HYDRAULIC CEMENT
7. MANHOLES SHALL HAVE 6" THICK WALLS.

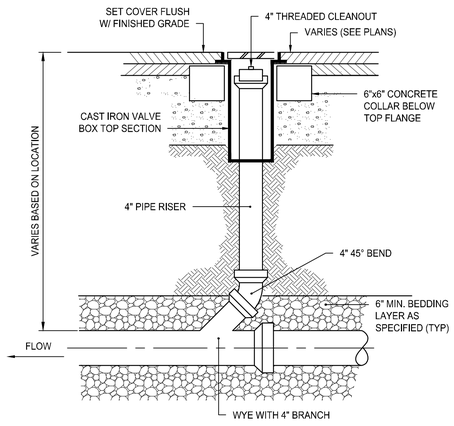
SQUARE CATCH BASIN FRAME & GRATE
NOT TO SCALE



NOTES:

1. DRAIN BASIN SHALL BE CUSTOM MANUFACTURED FOR THE PROJECT WITH THE INLETS AND OUTLETS REQUIRED.
2. STRUCTURES SHALL BE CONSTRUCTED TO WITHSTAND LOADS IMPOSED BY CONSTRUCTION VEHICLES.
3. DRAIN BASIN SHALL BE CONSTRUCTED OF HIGH DENSITY POLYETHYLENE.
4. FRAME AND GRATE SHALL BE CONSTRUCTED OF DUCTILE IRON AND CONFORM TO ASTM A536 GRADE 70-50-05, UNLESS OTHERWISE SPECIFIED. PROVIDE NYLOPLAST 2499CGS OR APPROVED EQUIVALENT.
5. PROVIDE DOME GRATE AT AD-XX, AD-XX, AND AD-XX. PROVIDE NYLOPLAST 2499CGD OR APPROVED EQUIVALENT.
6. PROVIDE PEDESTRIAN GRATE AT AD-XX, AD-XX AND AD-XX. PROVIDE NYLOPLAST 2499CGP OR APPROVED EQUIVALENT. FRAME AND GRATE SHALL BE ADA COMPLIANT.

AREA DRAIN DETAIL
NOT TO SCALE



CLEANOUT DETAIL
NOT TO SCALE

NOT FOR CONSTRUCTION

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PARE

SCALE ADJUSTMENT GUIDE
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Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
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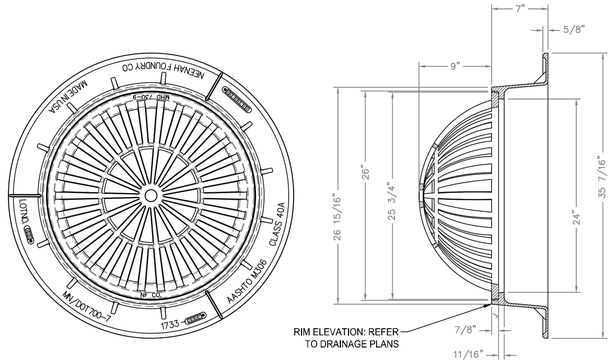
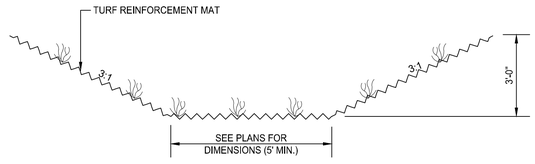
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	DETAILS 5
DRAWING NO.:	C7.5
SHEET NO.	14 OF ___



NOTES:

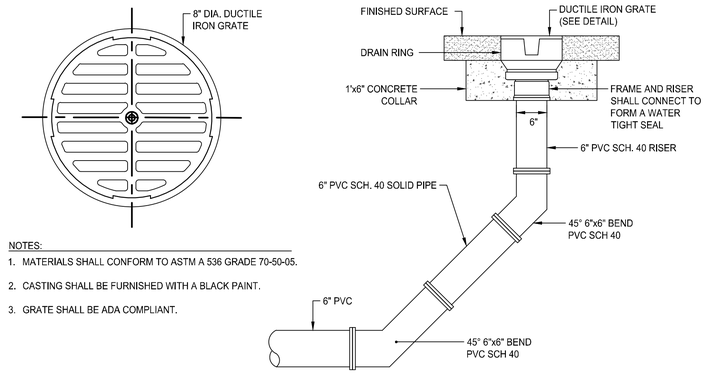
1. NEENA FOUNDRY R2561 OR APPROVED EQUIVALENT.
2. FRAME AND GRATE SHALL MEET H-20 LOADING CRITERIA.
3. ALL LIFTING HOLES TO BE PLUGGED IN AND OUT WITH HYDRAULIC CEMENT.
4. MANHOLES SHALL HAVE 6" THICK WALLS.
5. PROVIDE DOME GRATE AT THE FOLLOWING CATCH BASINS: CB-XX, CB-XX, AND CB-XX.

DOME GRATE DETAIL
NOT TO SCALE



NOTE:
MINIMUM LONGITUDINAL SLOPE IS 0.01FT/FT

GRASS SWALE SECTION
NOT TO SCALE



NOTES:

1. MATERIALS SHALL CONFORM TO ASTM A 536 GRADE 70-50-05.
2. CASTING SHALL BE FURNISHED WITH A BLACK PAINT.
3. GRATE SHALL BE ADA COMPLIANT.

YARD DRAIN DETAIL
NOT TO SCALE

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

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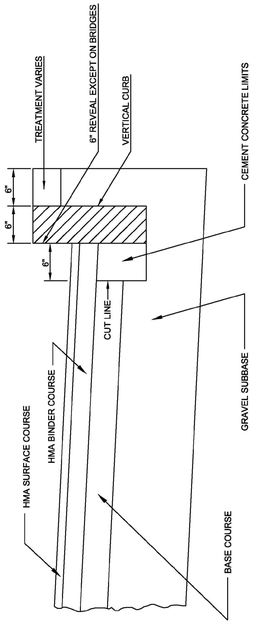
DRAWING TITLE:
DETAILS 6

DRAWING NO.:
C7.6

SHEET NO. 15 OF ___



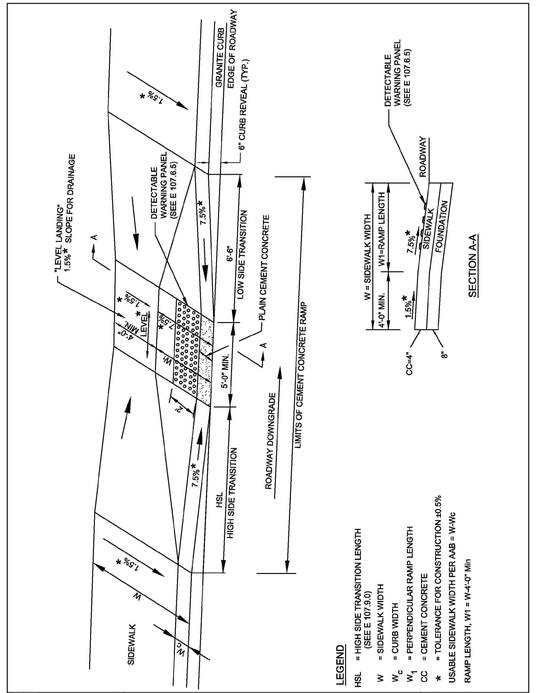
NOTES:

1. THIS PROCEDURE IS APPLICABLE ONLY IF CURB IS TO BE SET AFTER BASE COURSE IS IN PLACE PRIOR TO BINDER AND TOP PLACEMENT.
2. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BASE AND GRAVEL. REPLACE WITH CEMENT CONCRETE.
3. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS MAY BE USED. ALL STRENGTH REQUIREMENTS ARE WAIVED. HOT MIX ASPHALT SHALL NOT TO BE USED AS A SUBSTITUTE.

massDOT Highway Division — CONSTRUCTION STANDARDS

METHOD OF SETTING VERTICAL CURB

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 106.3.0**



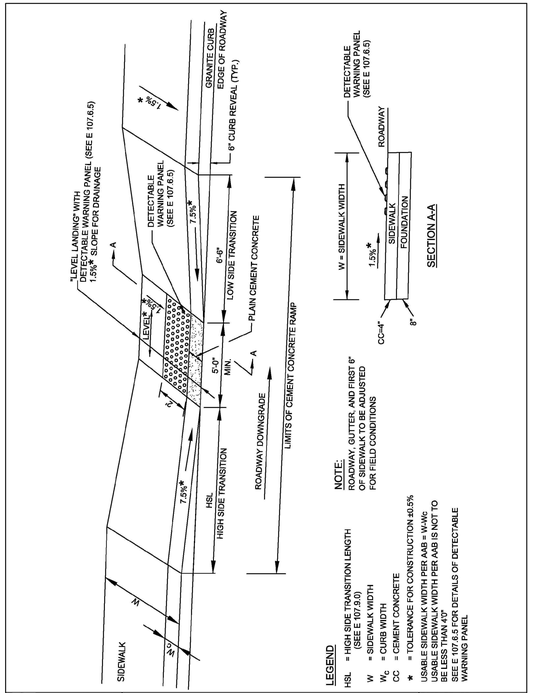
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)
W = SIDEWALK WIDTH
W_C = CURB WIDTH
W_1 = PERPENDICULAR RAMP LENGTH
CC = CEMENT CONCRETE
* = TOLERANCE FOR CONSTRUCTION ±0.5%
USABLE SIDEWALK WIDTH PER AAB = W-Wc
RAMP LENGTH, W1 = W-4'-0" Min

massDOT Highway Division — CONSTRUCTION STANDARDS

WHEELCHAIR RAMPS LESS THAN 12'-4" SIDEWALK

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.2.0**



NOTE:
ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS

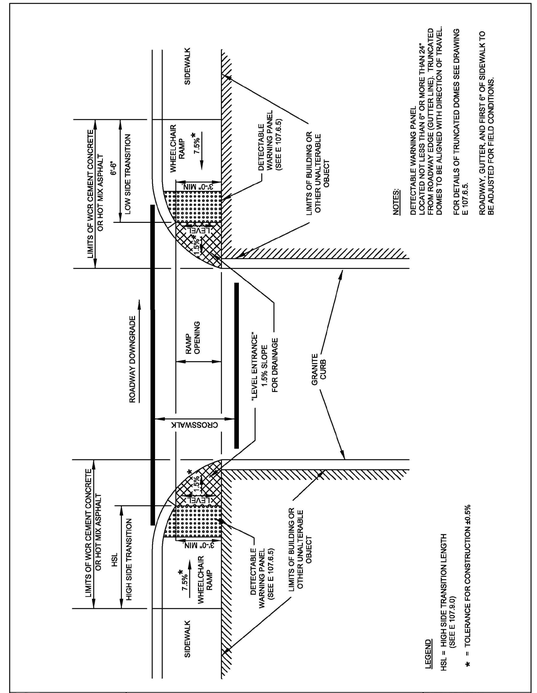
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)
W = SIDEWALK WIDTH
W_C = CURB WIDTH
CC = CEMENT CONCRETE
* = TOLERANCE FOR CONSTRUCTION ±0.5%
USABLE SIDEWALK WIDTH PER AAB = W-Wc
USABLE SIDEWALK WIDTH PER AAB IS NOT TO BE LESS THAN 3'-0"
SEE E 107.6.5 FOR DETAILS OF DETECTABLE WARNING PANEL

massDOT Highway Division — CONSTRUCTION STANDARDS

WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.2.1**



NOTES:
DETECTABLE WARNING PANEL SHALL BE CONTINUOUS FOR NOT MORE THAN 24" FROM ROADWAY EDGE (GUTTER LINE). TRUNCATED DOMES TO BE ALIGNED WITH DIRECTION OF TRAVEL.

FOR DETAILS OF TRUNCATED DOMES SEE DRAWING E 107.6.5.

ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS.

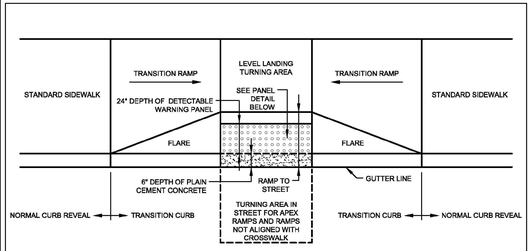
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)
* = TOLERANCE FOR CONSTRUCTION ±0.5%

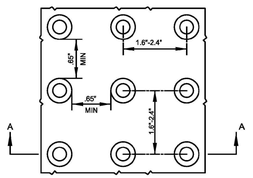
massDOT Highway Division — CONSTRUCTION STANDARDS

WHEELCHAIR RAMP FOR ONE CONTINUOUS DIRECTION OF PEDESTRIAN TRAVEL

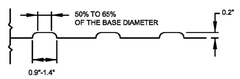
DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.6.0**



TYPICAL INSTALLATION



DETAIL OF DETECTABLE WARNING PANEL



SECTION A-A

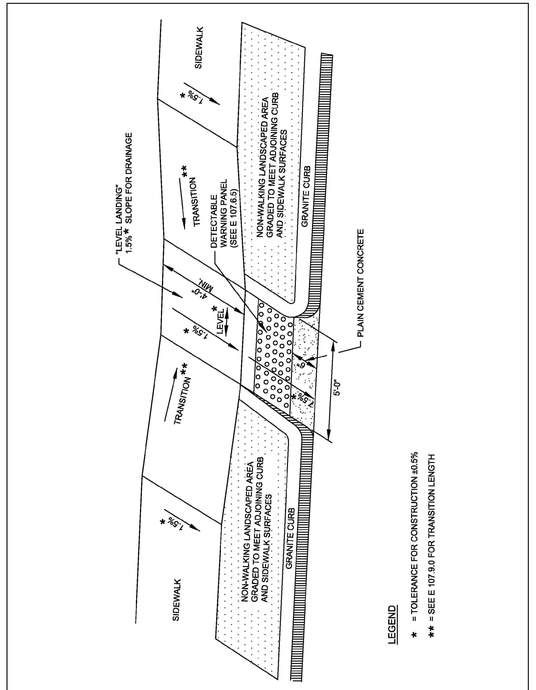
NOTE:

PANELS MAY BE CONCRETE PRECAST OR CAST IN PLACE OR OTHER SUITABLE MATERIAL PERMANENTLY APPLIED TO THE RAMP. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.

massDOT Highway Division — CONSTRUCTION STANDARDS

DETECTABLE WARNING PANEL FOR WHEELCHAIR RAMPS AND STANDARD RAMP TERMINOLOGY

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.6.5**



LEGEND

* = TOLERANCE FOR CONSTRUCTION ±0.5%
** = SEE E 107.9.0 FOR TRANSITION LENGTH

massDOT Highway Division — CONSTRUCTION STANDARDS

WHEELCHAIR RAMP WITH LANDSCAPING STRIP

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.6.9**

* HIGH SIDE TRANSITION LENGTH	ENGLISH UNITS	ROADWAY PROFILE GRADE	%
6'-6"		=0%	
7'-8"		>0% TO 1%	
9'-0"		>1% TO 2%	
11'-0"		>2% TO 3%	
14'-0"		>3% TO 4%	
15'-0" Max		>4% TO 5%	

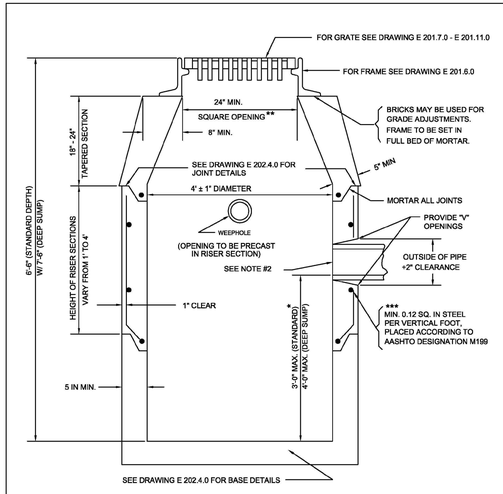
NOTE:

* BASED ON A DESIGN SLOPE OF 7.5% AND A REVEAL OF 6".

massDOT Highway Division — CONSTRUCTION STANDARDS

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 107.9.0**



* MINIMUM DEPTH OF SUMP TO BE 2 FT
** WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 24"±1" X 27"±1"
*** REINFORCING STEEL BASED ON A WALL THICKNESS OF 5".

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON E 201.3.0
2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
4. ALL CONCRETE TO BE AIR ENTRAINED
5. CATCH BASINS SHALL HAVE OUTLET HOODS.
6. ALL CATCH BASINS SHALL BE DEEP SUMP. DEEP SUMP CATCH BASINS SHALL HAVE A SUMP OF 4' MINIMUM.

massDOT Highway Division — CONSTRUCTION STANDARDS

PRECAST CONCRETE CATCH BASIN

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 201.4.0**M

NOT FOR CONSTRUCTION

PARE

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0" 1"
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DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

DETAILS 7

DRAWING NO.:

C7.7

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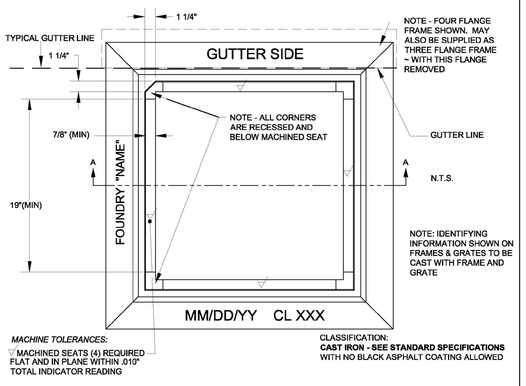
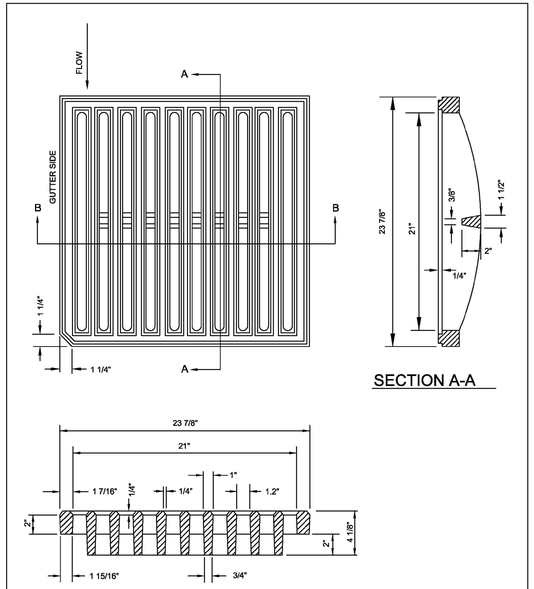


massDOT Highway Division — CONSTRUCTION STANDARDS

CATCH BASIN FRAME

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 201.6.0**



NOTES:
1. MATERIAL - CAST IRON; SEE STANDARD SPECIFICATIONS
2. MINIMUM MASS - 210 LBS.

massDOT Highway Division — CONSTRUCTION STANDARDS

DROP INLET GRATE

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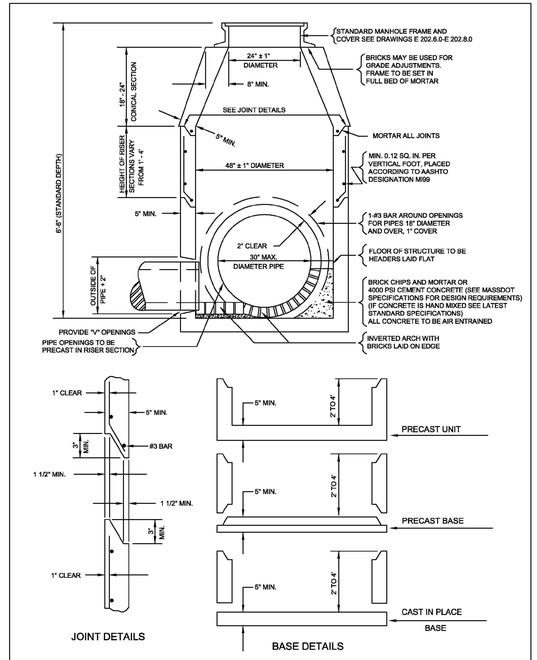
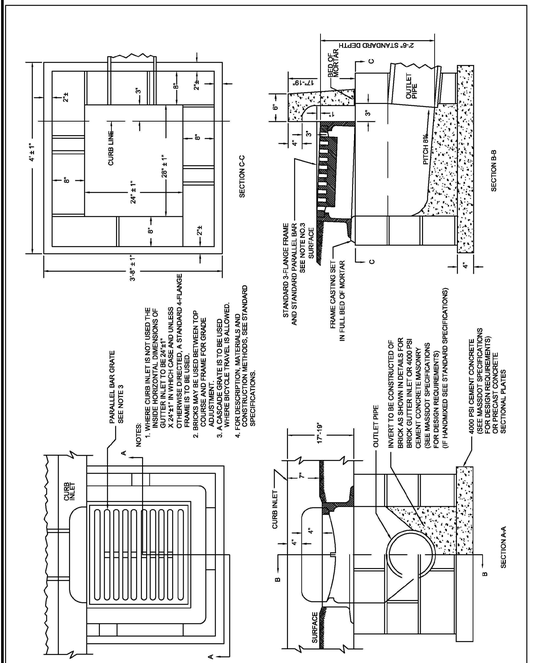


NOTE:
1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

massDOT Highway Division — CONSTRUCTION STANDARDS

PRECAST CONCRETE MANHOLES 9' OR LESS IN DEPTH

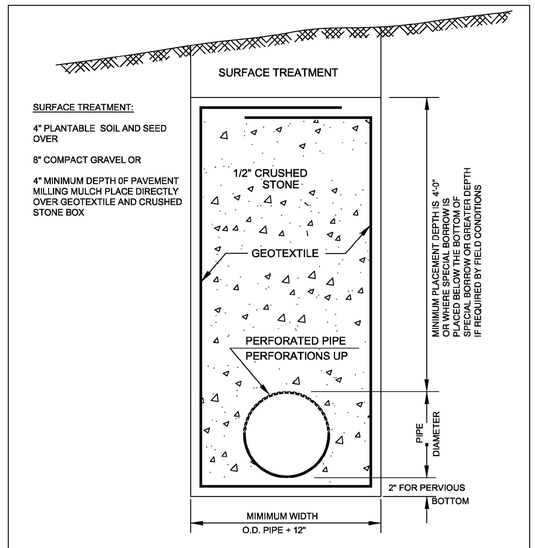
DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 202.4.0**



massDOT Highway Division — CONSTRUCTION STANDARDS

GUTTER INLET

DATE OF ISSUE: OCTOBER 2017
DRAWING NUMBER: **E 204.2.0**



SURFACE TREATMENT:

4" PLANTABLE SOIL AND SEED OVER

8" COMPACT GRAVEL OR

4" MINIMUM DEPTH 0F PAVEMENT MILLING MULCH PLACE DIRECTLY OVER GEOTEXTILE AND CRUSHED STONE BOX

NOTES:

1. GEOTEXTILE FABRIC AS DESCRIBED IN SECTION M9.50
2. PIPE SHALL BE SET AT BOTTOM OF TRENCH FOR IMPERVIOUS BOTTOM.
3. SUBDRAIN LOCATED APPROXIMATELY AT INTERSECTION OF TANGENTS (SEE DWG. E102.1.0)
4. GRAVEL (AND SPECIAL BORROW WHERE REQUIRED) SHALL INTERSECT CRUSHED STONE FOR SUBDRAIN

massDOT Highway Division — CONSTRUCTION STANDARDS

SUBDRAIN

DATE OF ISSUE: OCTOBER 2017
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NOT FOR CONSTRUCTION

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SCALE:	NOT TO SCALE	
DESIGNED BY:		
CHECKED BY:		
DRAWN BY:	AKL	
APPROVED BY:		

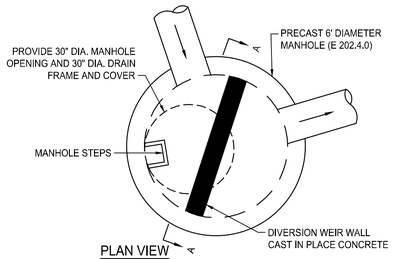
DRAWING TITLE:

DETAILS 8

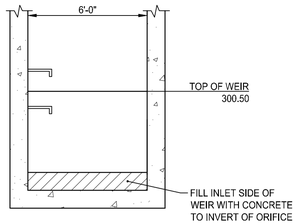
DRAWING NO.: C7.8

SHEET NO. 17 OF ____

K:\JOBS\23141.00 Northborough-New Fire Station-Mill\DWGS\C7.8.dwg



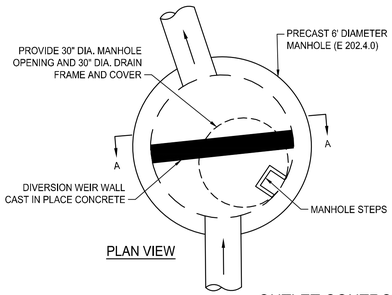
PLAN VIEW



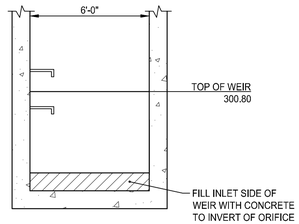
SECTION A-A

OUTLET CONTROL STRUCTURE 1 (OCS-1)

NOT TO SCALE



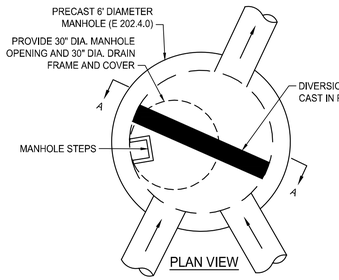
PLAN VIEW



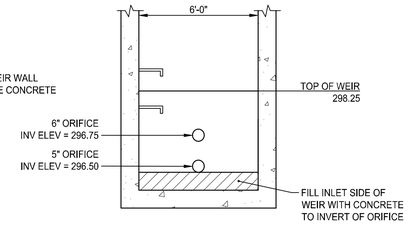
SECTION A-A WEIR WALL ELEVATION

OUTLET CONTROL STRUCTURE 4 (OCS-4)

NOT TO SCALE



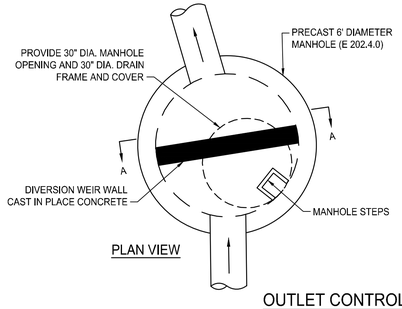
PLAN VIEW



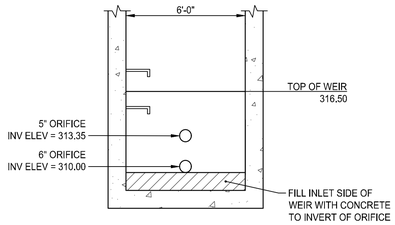
SECTION A-A WEIR WALL ELEVATION

OUTLET CONTROL STRUCTURE 2 (OCS-2)

NOT TO SCALE



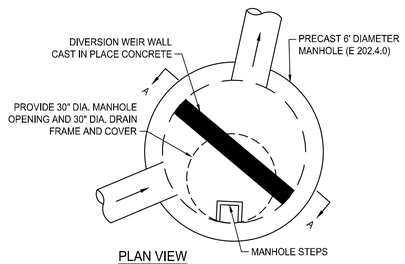
PLAN VIEW



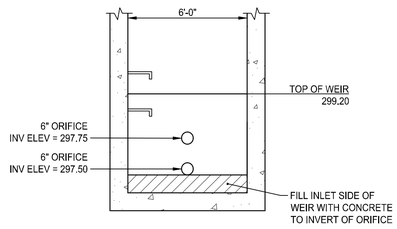
SECTION A-A WEIR WALL ELEVATION

OUTLET CONTROL STRUCTURE 5 (OCS-5)

NOT TO SCALE



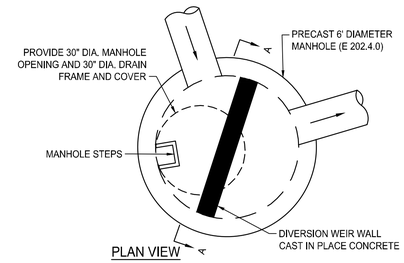
PLAN VIEW



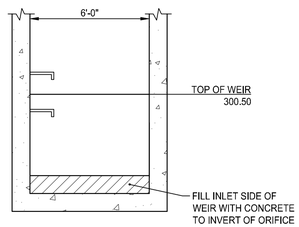
SECTION A-A WEIR WALL ELEVATION

OUTLET CONTROL STRUCTURE 3 (OCS-3)

NOT TO SCALE



PLAN VIEW

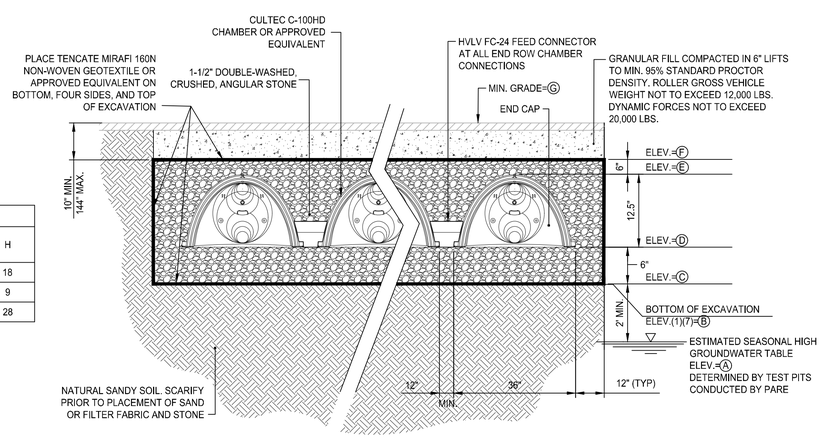


SECTION A-A

OUTLET CONTROL STRUCTURE 6 (OCS-6)

NOT TO SCALE

UGIS SCHEDULE								
	A	B	C	D	E	F	G	H
1	296.50	298.50	298.50	299.00	300.05	300.55	301.38	18
2	296.50	298.50	298.50	299.00	300.05	300.55	301.38	9
3	297.00	299.00	299.00	299.50	300.55	301.05	301.88	28



UNDERGROUND INFILTRATION SYSTEM DETAIL

NOT TO SCALE

NOTES:

1. CONTRACTOR SHALL TAKE PRECAUTION NOT TO COMPACT SUBGRADE.
2. CONTRACTOR SHALL NOT PLACE OR OPERATE MACHINERY ON SUBGRADE.
3. CONTRACTOR SHALL NOTIFY ENGINEER (48 HRS MIN) PRIOR TO EXPOSING SUBGRADE TO SCHEDULE INSPECTION.
4. ONCE CONTRACTOR HAS SUBGRADE EXPOSED, THE ENGINEER SHALL BE CONTACTED FOR INSPECTION.
5. CONSTRUCTION OF THE SYSTEM SHALL NOT COMMENCE UNTIL ENGINEER INSPECTS SUBGRADE AND CRUSHED STONE AND GRANTS PERMISSION TO PROCEED.
6. CONTRACTOR SHALL INSTALL UNDERGROUND INFILTRATION SYSTEM PER MANUFACTURERS RECOMMENDATIONS.
7. REMOVE AND REPLACE TO NATURAL SOIL ELEVATION WITH C-33 SAND WRAPPED IN NON-WOVEN GEOTEXTILE FABRIC WHERE FILL IS PRESENT BELOW STONE BASE.
8. REFER TO DRAINAGE PLAN FOR LAYOUT OF CHAMBERS. NUMBER OF CHAMBERS =H.
9. UNDERGROUND INFILTRATION SYSTEM SHALL BE CULTEC C-100HD OR APPROVED EQUIVALENT.
10. CONTRACTOR SHALL SUBMIT MANUFACTURERS SHOP DRAWINGS, INCLUDING PLANS, ELEVATIONS, SECTIONS, AND DETAILS, INDICATING LAYOUT, DIMENSIONS, FOUNDATION, COVER, AND JOINTS. INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET AND OUTLET PIPE OPENINGS.
11. CONTRACTOR SHALL SUBMIT DESIGN CALCULATIONS INCLUDING STORMWATER VOLUME SIZING AND STRUCTURAL CALCULATIONS.
12. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO UNIT INSTALLATION.

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
Civil
No. 42583
05/14/2024
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

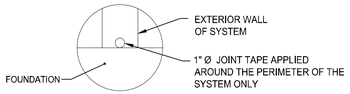
DRAWING TITLE:

DETAILS 9

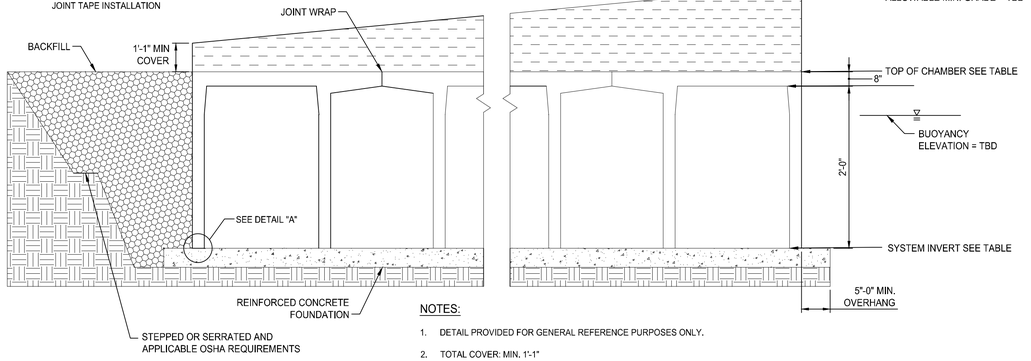
DRAWING NO.:

C7.9

SHEET NO. 18 OF ___



DETAIL "A"
JOINT TAPE INSTALLATION



NOTES:

1. DETAIL PROVIDED FOR GENERAL REFERENCE PURPOSES ONLY.
2. TOTAL COVER: MIN. 1'-1"
3. CONCRETE CHAMBER DESIGNED FOR AASHTO HS-20 HIGHWAY LOADING. MIN. SOIL PRESSURE 3,000 PSF.
4. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO INSTALLATION.
5. SYSTEM SHALL BE WATERTIGHT.

	DETENTION SYSTEM 1	DETENTION SYSTEM 2	DETENTION SYSTEM 3
SYSTEM INVERT	296.50	297.50	310.00
NUMBER OF CHAMBERS	54	55	12
TOP OF CHAMBER	299.17	300.17	312.67
ESTIMATED GROUNDWATER ELEVATION	303.50*	299.67 NE 303.25* SW	323.00*

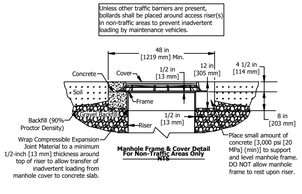
* GROUNDWATER SHALL BE ASSUMED TO BE FINISHED GRADE FOR CONSERVATIVE BUOYANCY CALCULATIONS.

UNDERGROUND CONCRETE VAULT DETENTION SYSTEM

NOT TO SCALE
(STORMTRAP CONCRETE VAULT SYSTEM OR APPROVED EQUIVALENT)

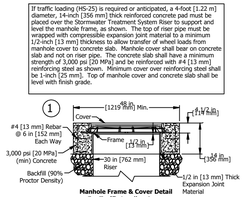
1. MANUFACTURER SHALL BE AQUASHIELD, INC. OR APPROVED EQUIVALENT.
2. CONTRACTOR SHALL SUBMIT MANUFACTURERS SHOP DRAWINGS, INCLUDING PLANS, ELEVATIONS, SECTIONS, AND DETAILS, INDICATING LAYOUT, DIMENSIONS, FOUNDATION, COVER, AND JOINTS. INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET AND OUTLET PIPE OPENINGS.
3. CONTRACTOR SHALL SUBMIT DESIGN CALCULATIONS INCLUDING STORMWATER VOLUME SIZING, STRUCTURAL CALCULATIONS, AND BUOYANCY CALCULATIONS.
4. THE SYSTEM SHALL BE WATER TIGHT.
5. CHAMBER SHALL BE DESIGNED FOR AASHTO HS-20 HIGHWAY LOADING. MIN. SOIL PRESSURE 4000 PSF.
6. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO UNIT INSTALLATION.

Unless other traffic barriers are present, bollards shall be placed around access riser(s) in non-traffic areas to prevent inadvertent loading by maintenance vehicles.



Manhole Frame & Cover Detail
For Non-Traffic Areas Only
NTS

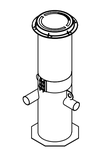
If traffic loading (HS-25) is required or anticipated, a 4-foot [1.22 m] diameter, 14-inch [356 mm] thick reinforced concrete pad must be placed over the Stormwater Treatment System Riser to support and level the manhole frame, as shown. The top of riser pipe must be wrapped with compressible expansion joint material to a minimum 1/2-inch [13 mm] thickness to allow transfer of wheel loads from manhole cover to concrete slab. Manhole cover shall bear on concrete slab and not on riser pipe. The concrete slab shall have a minimum strength of 3,000 psi [20 MPa] and be reinforced with #4 [13 mm] reinforcing steel as shown. Minimum cover over reinforcing steel shall be 1-inch [25 mm]. Top of manhole cover and concrete slab shall be level with finish grade.



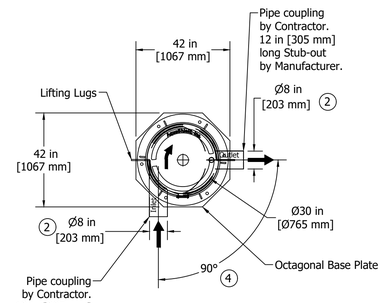
Manhole Frame & Cover Detail
For Traffic Loading Areas
NTS

See Site Plan for actual system orientation. Approximate dry (pick) weight: 1000 lbs [500 kg].

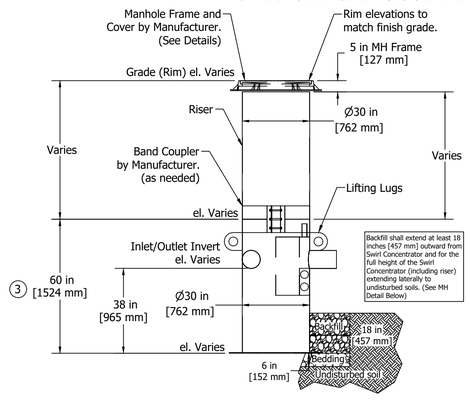
1. As an alternative, 42 in [1067 mm] diameter, HS-20/25 rated precast concrete rings may be substituted. 14 in [356 mm] thickness must be maintained.
2. AS-2 inlet/outlet pipe size ranges from 4 in [102 mm] to 8 in [203 mm].
3. AS-2 chamber height may vary from 48 in [1219 mm] to 60 in [1524 mm], depending on inlet/outlet pipe size.
4. Orientation may vary from 90°, 180°, or custom angles to meet site conditions.
5. REFER TO DRAINAGE PLAN FOR SYSTEM INVERTS.



Projected View
SCALE 1:60



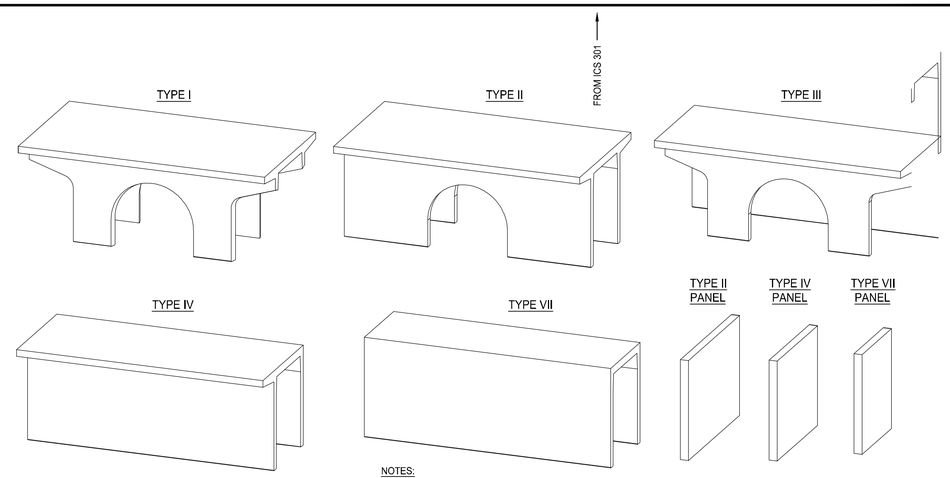
Plan View
SCALE 1:30



Elevation View
SCALE 1:30

WATER QUALITY UNIT (TSS)

NOT TO SCALE
AQUA SWIRL OR APPROVED EQUIVALENT
DETAIL PROVIDED FOR GENERAL REFERENCE PURPOSES ONLY



NOTES:

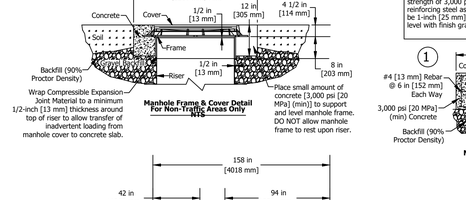
1. OPENING LOCATIONS VARY ON UNIT HEIGHT AND LENGTHS.
2. SP - INDICATES A UNIT WITH MODIFICATIONS.
3. POCKET WINDOW OPENINGS ARE OPTIONAL

UNDERGROUND CONCRETE VAULT DETENTION SYSTEM UNIT TYPES

NOT TO SCALE
(STORMTRAP CONCRETE VAULT SYSTEM OR APPROVED EQUIVALENT)

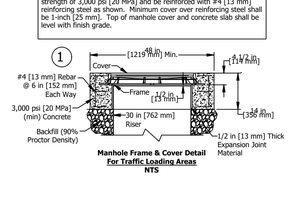
1. MANUFACTURER SHALL BE AQUASHIELD, INC. OR APPROVED EQUIVALENT.
2. CONTRACTOR SHALL SUBMIT MANUFACTURERS SHOP DRAWINGS, INCLUDING PLANS, ELEVATIONS, SECTIONS, AND DETAILS, INDICATING LAYOUT, DIMENSIONS, FOUNDATION, COVER, AND JOINTS. INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET AND OUTLET PIPE OPENINGS.
3. CONTRACTOR SHALL SUBMIT DESIGN CALCULATIONS INCLUDING STORMWATER VOLUME SIZING, STRUCTURAL CALCULATIONS, AND BUOYANCY CALCULATIONS.
4. THE SYSTEM SHALL BE WATER TIGHT.
5. CHAMBER SHALL BE DESIGNED FOR AASHTO HS-20 HIGHWAY LOADING. MIN. SOIL PRESSURE 4000 PSF.
6. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO UNIT INSTALLATION.

Unless other traffic barriers are present, bollards shall be placed around access riser(s) in non-traffic areas to prevent inadvertent loading by maintenance vehicles.

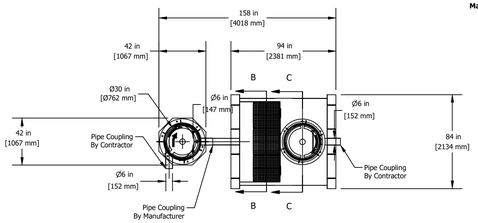


Manhole Frame & Cover Detail
For Non-Traffic Areas Only
NTS

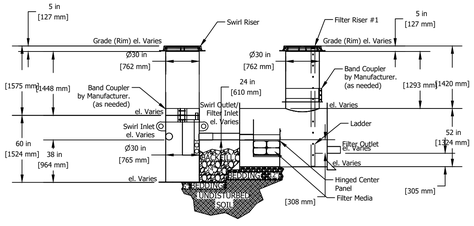
If traffic loading (HS-25) is required or anticipated, a 4-foot [1.22 m] diameter, 14-inch [356 mm] thick reinforced concrete pad must be placed over the Stormwater Treatment System Riser to support and level the manhole frame, as shown. The top of riser pipe must be wrapped with compressible expansion joint material to a minimum 1/2-inch [13 mm] thickness to allow transfer of wheel loads from manhole cover to concrete slab. Manhole cover shall bear on concrete slab and not on riser pipe. The concrete slab shall have a minimum strength of 3,000 psi [20 MPa] and be reinforced with #4 [13 mm] reinforcing steel as shown. Minimum cover over reinforcing steel shall be 1-inch [25 mm]. Top of manhole cover and concrete slab shall be level with finish grade.



Manhole Frame & Cover Detail
For Traffic Loading Areas
NTS



Plan View
SCALE 1:70

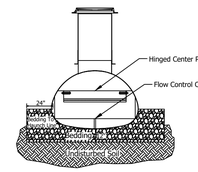


Elevation View
SCALE 1:70

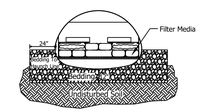
WATER QUALITY UNIT (TSS AND PHOSPHORUS)

NOT TO SCALE
AQUA FILTER OR APPROVED EQUIVALENT
DETAIL PROVIDED FOR GENERAL REFERENCE PURPOSES ONLY

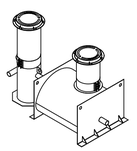
1. As an alternative, 42 in [1067 mm] diameter, HS-20/25 rated precast concrete rings may be substituted. 14 in [365 mm] thickness must be maintained.
2. REFER TO DRAINAGE PLAN FOR SYSTEM INVERTS.



SECTION C-C
SCALE 1:70



SECTION B-B
SCALE 1:70



Projected View
SCALE 1:100

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

COMMONWEALTH OF MASSACHUSETTS
JAMES A. JACKSON, JR.
CIVIL
No. 42583
REGISTERED PROFESSIONAL ENGINEER

REVISIONS:

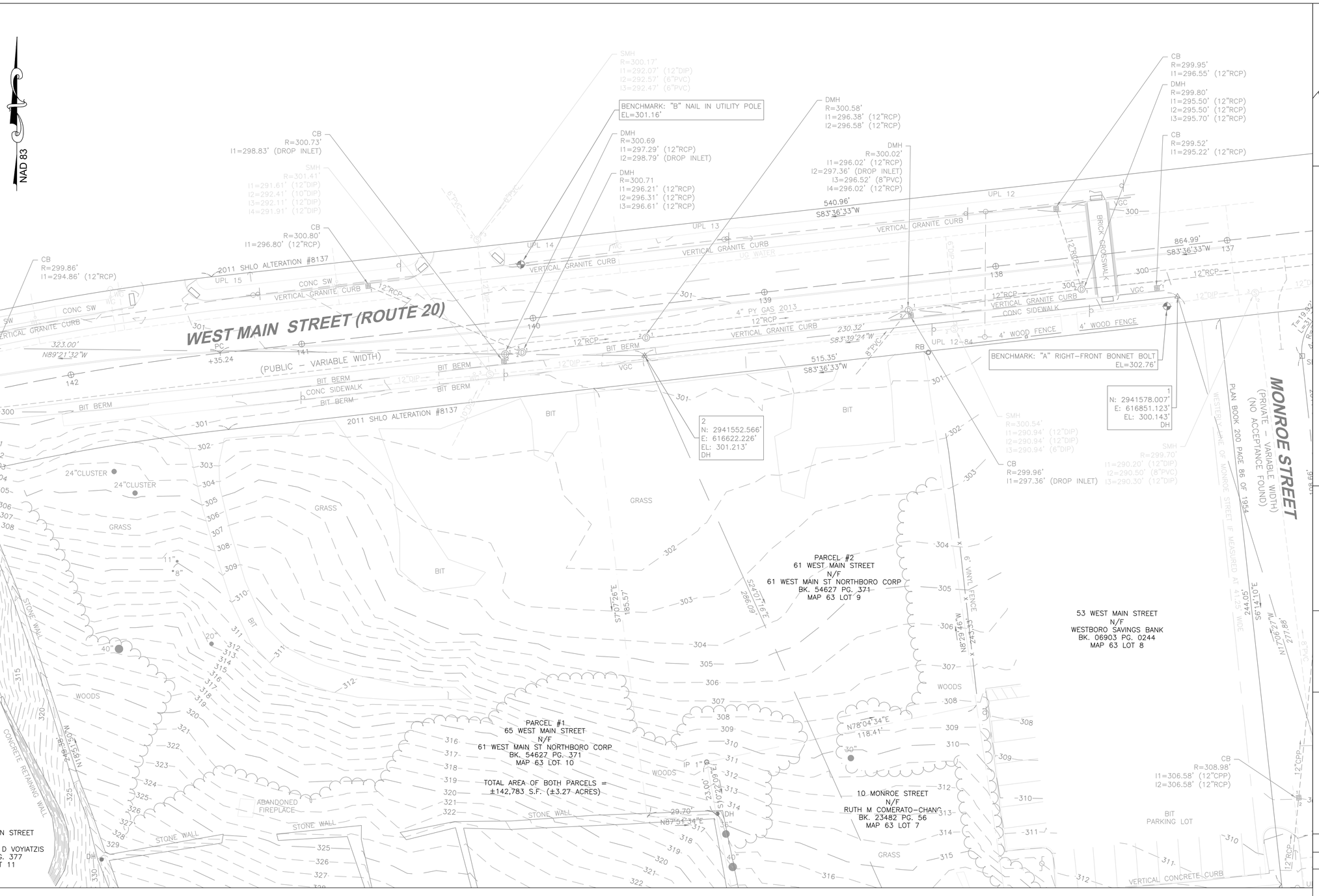
PROJECT NO.:	23141.00
DATE:	MAY 14, 2024
SCALE:	NOT TO SCALE
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

DETAILS 10

DRAWING NO.:
C7.10
SHEET NO. 19 OF

K:\...\DWG\23_site\23141.00_Northborough_New_Fire_Station_MA.DWG\C7.10.dwg



0 20 50 100

SCALE: 1" = 20'

FIELD SURVEY PERFORMED BY CHAPPELL ENGINEERING ASSOCIATES, LLC. COMPLETED AUGUST, 2023.

PROPERTY LINE INFORMATION SHOWN IS CALCULATED FROM FIELD OBSERVATIONS, STATE HIGHWAY LAYOUTS, AND TOWN OF NORTHBOROUGH, MASS. RECORDS AND PLANS & DEEDS RECORDED AT THE MIDDLESEX COUNTY REGISTRY OF DEEDS.

DATUMS; HORIZONTAL; NAD 83, VERTICAL; NAVD 88

NOTES;

1. NO OFFICIAL ACCEPTANCE OF MONROE STREET BY TOWN FOUND. WESTERLY SIDELINE IS BASED ON RECORD PLANS AND EXISTING MONUMENTATION. RECORD PLANS SHOW MONROE STREET AS BEING 41.25 FEET WIDE (SHOWN ON PLAN FOR REFERENCE). CALCULATED WIDTH VARIES FROM 33.33 FEET TO30.92 FEET.

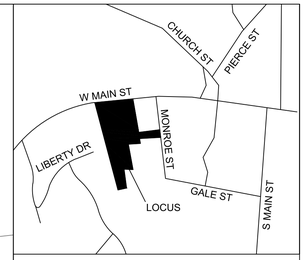
I HEREBY CERTIFY THAT THIS PLAN IS BASED ON AN ON THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING AND COMPLETED IN AUGUST, 2023.

COMMONWEALTH OF MASSACHUSETTS
WILLIAM TIRRELL
No. 49930
REGISTERED
PROFESSIONAL LAND SURVEYOR

William Tirrell

DATE

WILLIAM–TIRRELL–49930



LEGEND

- STREET R.O.W. LINE
- ABUTTER PROPERTY LINE
- PARCEL LINE
- EDGE OF PAVEMENT
- EDGE OF CONCRETE
- EDGE OF WOODS/BRUSH
- WOOD FENCE
- CONTOUR LINE
- SEWER MANHOLE
- CATCH BASIN
- DRAIN MANHOLE
- UTILITY POLE
- GUY WIRE ANCHOR
- HYDRANT
- WG/WSO WATER GATE/SHUTOFF
- SIGN
- XX" TREE + DIAMETER
- BOUND
- DH DRILLHOLE
- IP IRON PIPE
- RB REBAR
- SURVEY CONTROL POINT

PLAN REFERENCES

ROAD LAYOUTS
2011 STATE HIGHWAY LAYOUT OF WEST MAIN STREET #8137

RECORDED PLANS
PLAN BOOK 200 PAGE 86
PLAN BOOK 200 PLAN 87
PLAN BOOK 323 PLAN 42
PLAN BOOK 355 PLAN 65
PLAN BOOK 378 PLAN 51
PLAN BOOK 529 PLAN 38
PLAN BOOK 644 PLAN 78
PLAN BOOK 694 PLAN 138
PLAN BOOK 699 PLAN 123
PLAN BOOK 720 PLAN 41
PLAN BOOK 725 PLAN 55
PLAN BOOK 883 PLAN 70
PLAN BOOK 902 PAGE 11
PLAN BOOK 912 PAGE 108
PLAN BOOK 664 PAGE 56

OWNER:
61 WEST MAIN ST NORTHBORO CORP

22 HICKORY CIRCLE
HOLDEN, MA 01520
BOOK 54627 PAGE 371
MAP 63 LOT 9 AND 10

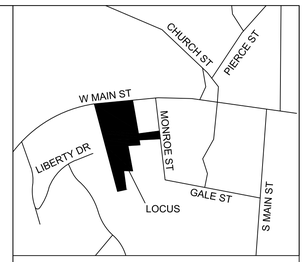
EXISTING CONDITIONS PLAN

61–65 WEST MAIN STREET NORTHBOROUGH, MA

SCALE: 1" = 20'

DATE: SEPTEMBER 1, 2023

CHAPPELL ENGINEERING ASSOCIATES, LLC
Civil Structural Land Surveying
201 BOSTON POST ROAD WEST–SUITE 101
MARLBOROUGH, MA 01752
TEL (508) 481–7400
www.chappellengineering.com



LEGEND

- STREET R.O.W. LINE
- ABUTTER PROPERTY LINE
- PARCEL LINE
- EDGE OF PAVEMENT
- EDGE OF CONCRETE
- EDGE OF WOODS/BRUSH
- WOOD FENCE
- CONTOUR LINE
- SEWER MANHOLE
- CATCH BASIN
- DRAIN MANHOLE
- UTILITY POLE
- GUY WIRE ANCHOR
- HYDRANT
- WG/WSO WATER GATE/SHUTOFF
- SIGN
- XX" TREE + DIAMETER
- BOUND
- DH DRILLHOLE
- IP IRON PIPE
- RB REBAR
- SURVEY CONTROL POINT

PLAN REFERENCES

ROAD LAYOUTS
2011 STATE HIGHWAY LAYOUT OF WEST MAIN STREET #8137

RECORDED PLANS
PLAN BOOK 200 PAGE 86
PLAN BOOK 200 PLAN 87
PLAN BOOK 323 PLAN 42
PLAN BOOK 355 PLAN 65
PLAN BOOK 378 PLAN 51
PLAN BOOK 529 PLAN 38
PLAN BOOK 644 PLAN 78
PLAN BOOK 694 PLAN 138
PLAN BOOK 699 PLAN 123
PLAN BOOK 720 PLAN 41
PLAN BOOK 725 PLAN 55
PLAN BOOK 883 PLAN 70
PLAN BOOK 902 PAGE 11
PLAN BOOK 912 PAGE 108
PLAN BOOK 664 PAGE 56

OWNER:
61 WEST MAIN ST NORTHBORO CORP

22 HICKORY CIRCLE
HOLDEN, MA 01520
BOOK 54627 PAGE 371
MAP 63 LOT 9 AND 10

EXISTING CONDITIONS PLAN

61-65 WEST MAIN STREET NORTHBOROUGH, MA

SCALE: 1" = 20'

DATE: SEPTEMBER 1, 2023

FIELD SURVEY PERFORMED BY CHAPPELL ENGINEERING ASSOCIATES, LLC. COMPLETED AUGUST, 2023.

PROPERTY LINE INFORMATION SHOWN IS CALCULATED FROM FIELD OBSERVATIONS, STATE HIGHWAY LAYOUTS, AND TOWN OF NORTHBOROUGH, MASS. RECORDS AND PLANS & DEEDS RECORDED AT THE MIDDLESEX COUNTY REGISTRY OF DEEDS.

DATUMS; HORIZONTAL; NAD 83, VERTICAL; NAVD 88

NOTES;
1. NO OFFICIAL ACCEPTANCE OF MONROE STREET BY TOWN FOUND. WESTERLY SIDELINE IS BASED ON RECORD PLANS AND EXISTING MONUMENTATION. RECORD PLANS SHOW MONROE STREET AS BEING 41.25 FEET WIDE (SHOWN ON PLAN FOR REFERENCE). CALCULATED WIDTH VARIES FROM 33.33 FEET TO30.92 FEET.

0 20 50 100
SCALE: 1" = 20'

I HEREBY CERTIFY THAT THIS PLAN IS BASED ON AN ON THE GROUND SURVEY PERFORMED BY CHAPPELL ENGINEERING AND COMPLETED IN AUGUST, 2023.

COMMONWEALTH OF MASSACHUSETTS
WILLIAM TIRRELL
No. 49930
REGISTERED
PROFESSIONAL LAND SURVEYOR

William Tirrell

DATE WILLIAM-TIRRELL-49930

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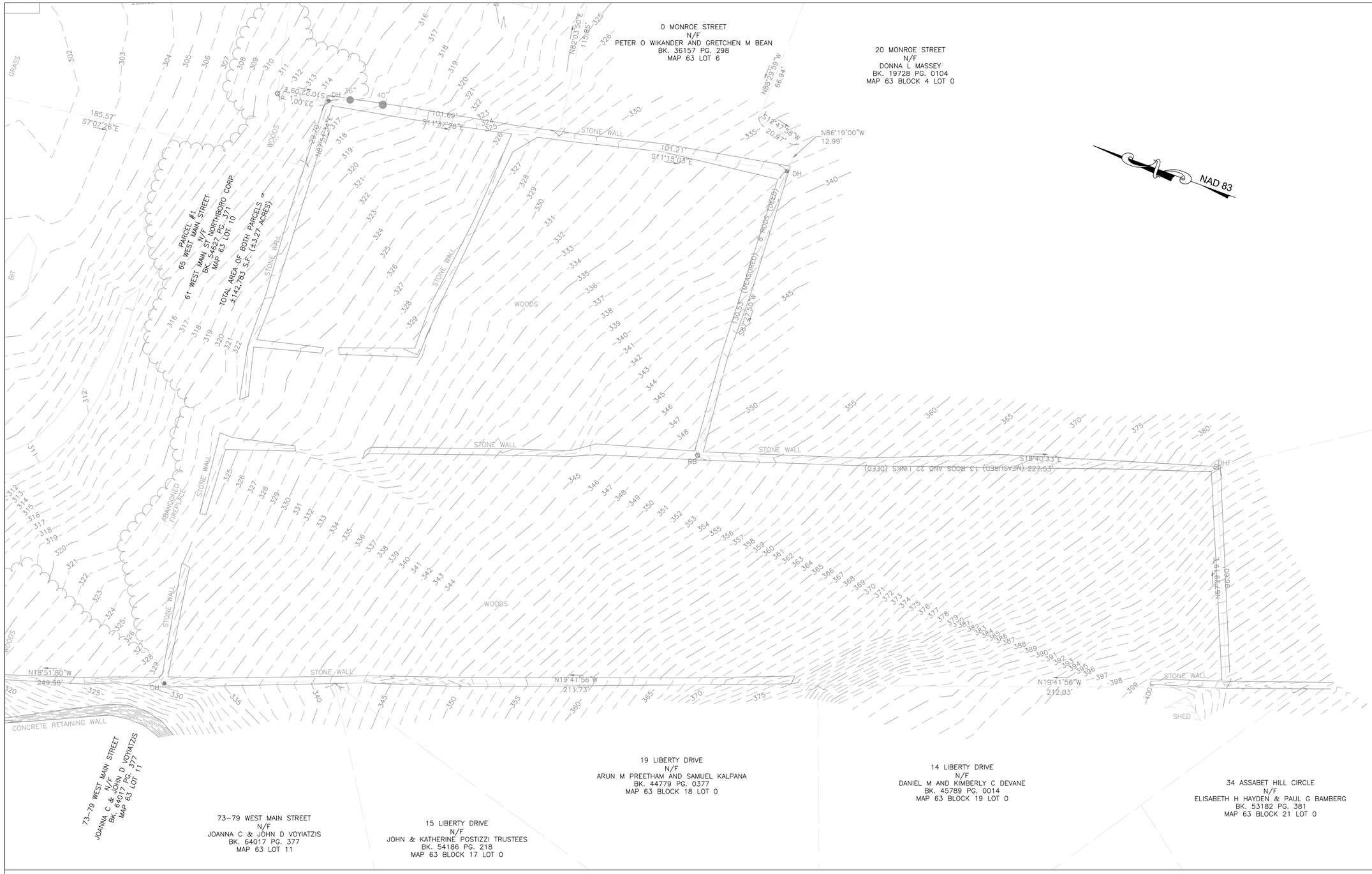

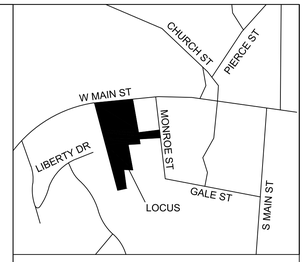

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61-65 WEST MAIN STREET NORTHBOROUGH, MA

SCALE: 1" = 20'

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COMMONWEALTH OF MASSACHUSETTS
WILLIAM TIRRELL
No. 49930
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William Tirrell

DATE

WILLIAM-TIRRELL-49930

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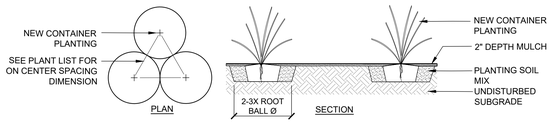
PLANT LIST

KEY	QTY	BOTANICAL NAME	COMMON NAME	MIN. SIZE	REMARKS
TREES					
AB	13	ABIES BALSAMEA	BALSAM FIR	8' HT.	B&B
AC	2	AMELANCHIER CANADENSIS	SHADBLOW SERVICEBERRY	6-7' HT.	B&B
AF	4	ACER FREEMANII "ARMSTRONG"	ARMSTRONG MAPLE	3" CAL	B&B
AL	7	AMELANCHIER LAEVIS	ALLEGHENY SERVICEBERRY	6-7' HT.	B&B
AR	2	ACER RUBRUM	RED MAPLE	3" CAL	B&B
CC	3	CERCIS CANADENSIS	EASTERN REDBUD	7-8' HT.	B&B
JV	4	JUNIPERUS VIRGINIANA	EASTERN RED CEDAR	10' HT.	B&B
LS	3	LIQUIDAMBAR STYRACIFLUA	SWEET GUM	3" CAL	B&B
PS	6	PINUS STROBUS	EASTERN WHITE PINE	12' HT.	B&B
QM	6	QUERCUS MACROCARPA 'JFS-KW3'	URBAN PINNACLE BUR OAK	3" CAL	B&B
SHRUBS					
CA	27	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	SWEET PEPPERBUSH	#3 CONT	3' OC
DL	42	DIERVILLA LONICERA	BUSH HONEYSUCKLE	#2 CONT	3.5' OC
IG	11	ILEX GLABRA	INKBERRY	#3 CONT	4' OC
IV	13	ILEX VERTICILLATA 'MARYLAND BEAUTY'	WINTERBERRY	#3 CONT	3' OC
IVM	1	ILEX VERTICILLATA 'JIM DANDY'	MALE WINTERBERRY	#3 CONT	3' OC
PERENNIALS, GRASSES AND VINES					
AG	82	ANDROPOGON GERARDII 'RAIN DANCE'	RAIN DANCE BIG BLUESTEM	#2 CONT	2' OC
PT	25	PARTHENOCISSUS TRICUSPIDATA	BOSTON IVY	#2 CONT	15' OC
SH	140	SPOROBOLUS HETEROLEPIS	PRAIRIE DROPSEED	#1 CONT	2' OC
SS	36	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	#2 CONT	2' OC
RAIN GARDEN					
AI	328	ASCLEPIAS INCARNATA	SWAMP MILKWEED	5" PLUG	12" OC
EM	204	EUTROCHIUM MACULATUM	JOE PYE WEED	5" PLUG	12" OC
MF	171	MONARDA FISTULOSA	WILD BERGAMOT	5" PLUG	12" OC
SG	209	SOLIDAGO GRAMINIFOLIA	GRASS-LEAVED GOLDENROD	5" PLUG	12" OC
ZA	330	ZIZIA AUREA	GOLDEN ALEXANDER	5" PLUG	12" OC

LEGEND

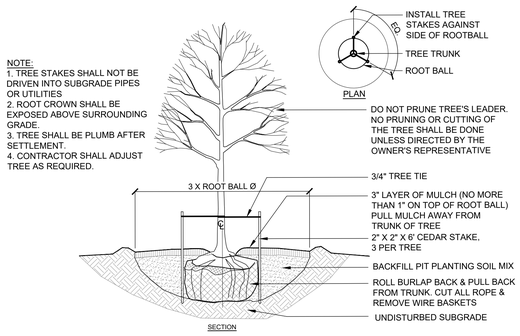
NEW DECIDUOUS TREE
NEW STREET TREE
NEW EVERGREEN TREE
NEW SHRUBS
NEW MOWN SEEDED LAWN
NEW SWALE SEED MIX
NEW ANNUAL FLOWER BED
NEW GRASSES & PERENNIALS
NEW VINE



2 CONTAINER PLANTING - SECTION

SCALE: NTS

NOTE:
1. TREE STAKES SHALL NOT BE DRIVEN INTO SUBGRADE PIPES OR UTILITIES
2. ROOT CROWN SHALL BE EXPOSED ABOVE SURROUNDING GRADE.
3. TREE SHALL BE PLUMB AFTER SETTLEMENT.
4. CONTRACTOR SHALL ADJUST TREE AS REQUIRED.

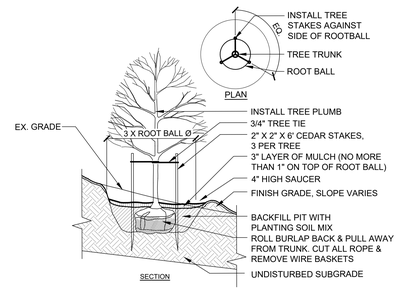


3 TREE PLANTING - SECTION

SCALE: NTS

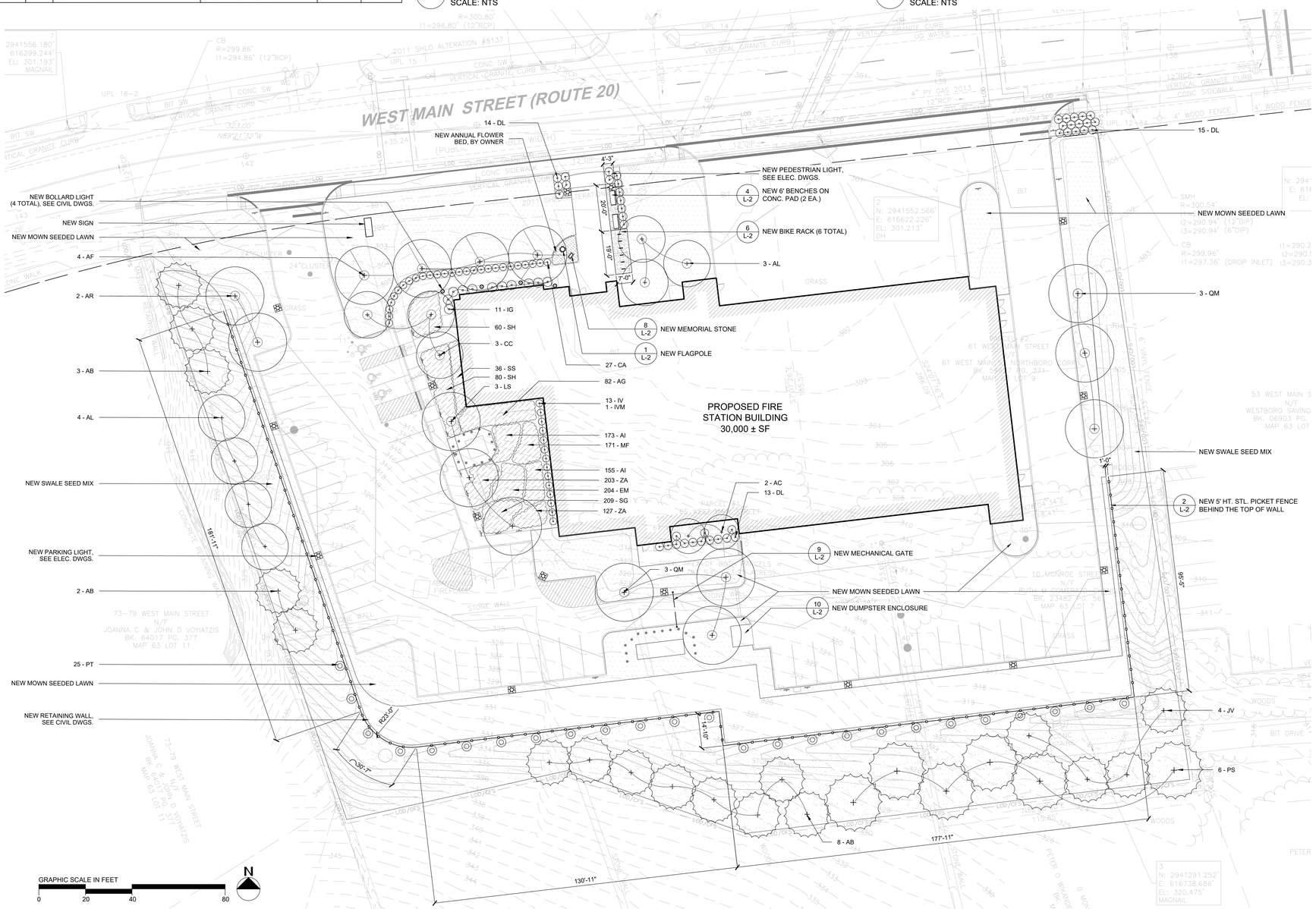
PLANTING NOTES:

1. ALL NEW TREES AND SHRUBS SHALL BE MULCHED WITH 2" MIN. DEPTH OF MULCH.
2. SEED ALL DISTURBED AREAS.
3. FOR LIMIT OF WORK, REFER TO CIVIL DRAWINGS.



4 TREE PLANTING ON SLOPE - SECTION

SCALE: NTS



1 LANDSCAPE PLAN

SCALE: 1"=20'-0"

HKT architects inc.
24 Roland Street, Suite 301
Charlestown, MA 02129
T: 617.776.6545
F: 617.776.6678
www.hktarchitects.com

Revision Schedule

NO.	Revision	Date

Registrations

Consultants

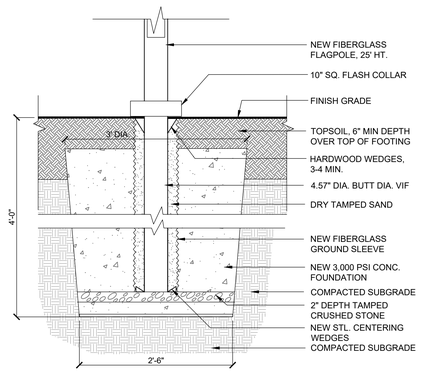
RAY DUNETZ
LANDSCAPE ARCHITECTURE, INC.
179 GREEN STREET
BOSTON, MA 02130
617-524-6265 T

Project
NORTHBOROUGH FIRE STATION
63 WEST MAIN STREET
TOWN OF NORTHBOROUGH, MA

Drawing Title
LANDSCAPE PLAN AND PLANT LIST

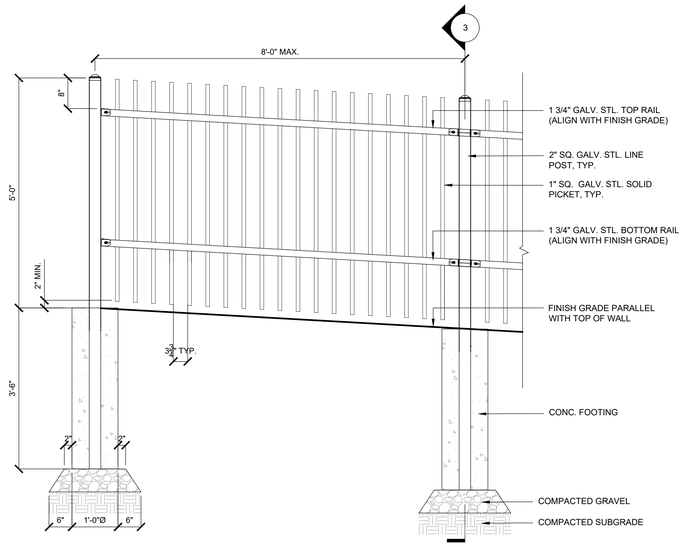
NL, SD — Drawn by
RD — Checked by
05/03/2024 — Date
22314 — Job number
DESIGN DEVELOPMENT PRICING — Drawing set

Drawing number
L-1



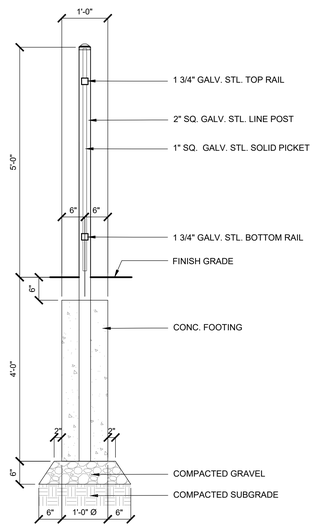
1 FLAGPOLE - SECTION

SCALE: 1"=1'-0"



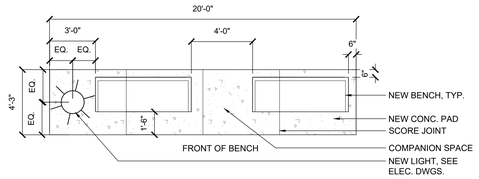
2 FENCE - ELEVATION

SCALE: 3/4"=1'-0"



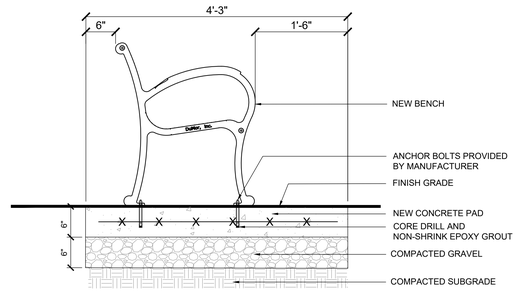
3 FENCE - SECTION

SCALE: 3/4"=1'-0"



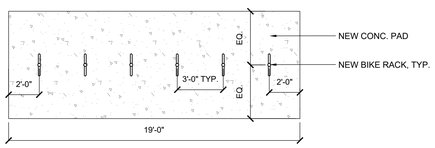
4 BENCH - PLAN

SCALE: 1/4"=1'-0"



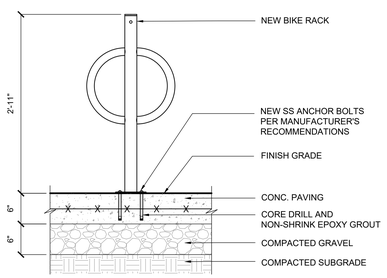
5 BENCH - SECTION

SCALE: 1"=1'-0"



6 BIKE RACK - PLAN

SCALE: 1/4"=1'-0"

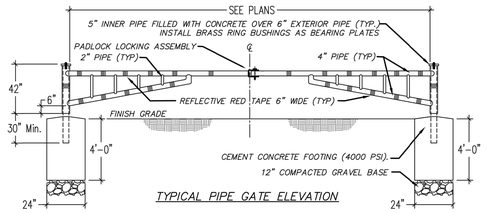


7 BIKE RACK - SECTION

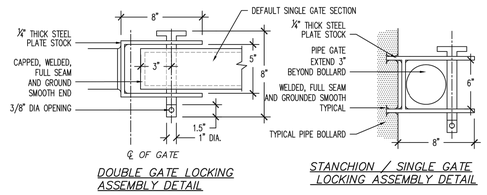
SCALE: 1"=1'-0"

8 MEMORIAL STONE - IMAGE

SCALE: NTS



GENERAL NOTES:
1. Steel pipe for gates shall be seamless steel pipe in accordance with ASTM 53 type F.
2. All hardware shall conform to ASTM A307 requirements and shall be galvanized per ASTM A153.
3. Welding shall be in conformance with AWS codes. All connections shall be formed with fish-mouthed joints full seam welds, grounded smooth and sanded.
4. All gates shall be set plumb and level. Concrete footings shall be installed using approved formwork and rebar spacing (if required). Submit shop drawing for approval/review.
5. Gate must be free to open a min. of 95° from closed position.
6. Gate to be primed, enameled and painted. Paint type to be approved by owner. Color is Black.

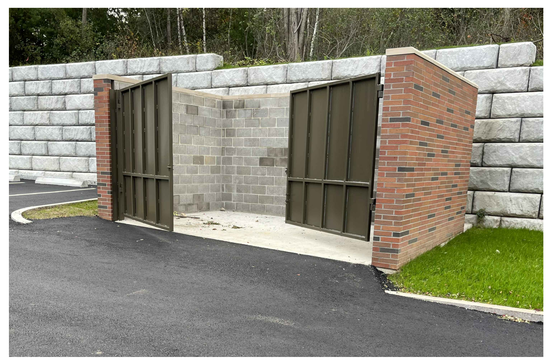


DOUBLE GATE LOCKING ASSEMBLY DETAIL

STANCHION / SINGLE GATE LOCKING ASSEMBLY DETAIL

9 MECHANICAL GATE - DETAIL

SCALE: NTS



10 DUMPSTER ENCLOSURE - IMAGE

SCALE: NTS

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Drawing number
L-2

PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
401-334-4100

MASS GIS

1 INCH=100 FEET

0" 1"

BAR IS ONE INCH ON ORIGINAL DRAWING

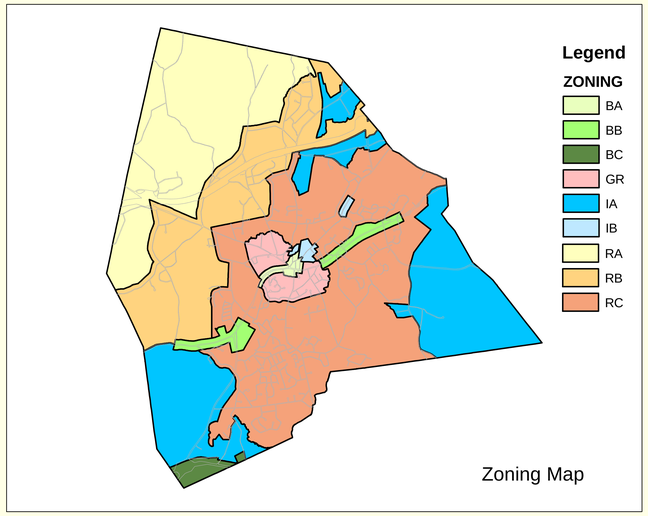
NORTHBOROUGH FIRE STATION

NORTHBOROUGH, MA

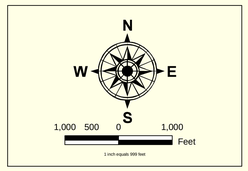
PROJECT NO.: 23141.00
DATE: MARCH 2024
SCALE: AS NOTED

FIGURE 1: SITE LOCUS MAP

Town of Northborough Groundwater Protection Overlay District Map



Zoning Map



Legend

Groundwater District

- Area 1
- Area 2
- Area 3

Groundwater Protection Overlay District Establishment and Delineation

The Groundwater Protection Overlay Districts include the acquifer's significant areas of recharge consisting of:

Area 1: Area of influence of all existing municipal wells within the Town, confirmed by long-term pump test or by stabilized water levels after maximum duration pumping/primary recharge area.

Area 2: Potential water supply area/primary recharge area.

Area 3: Primary recharge area.

Please refer to Northborough Zoning Bylaw for complete text.

October 2002

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -1 BUOYANCY (South)

Assumptions:

Estimated Seasonal High Groundwater Elevation:	303.50	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 1 Specifics:

Finished Grade Elevation: 303.50 ft
Outside Length: 113.0 ft
Outside Width: 27.5 ft
Outside Height: 2.67 ft
Inside Length: 112.0 ft
Inside Width: 26.5 ft
Inside Height: 2.00 ft
Invert: 296.5 ft

Average Pond Area (**A**):
L x W = 3,108 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 8,287 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **517,088** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **775,632** **lbs**

Actual Counteracting Weight:

System Concrete Weight:
Outside Volume of System 8,286.7 cf
Inside Volume of System 5,936.0 cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 2,351 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 340,847 lbs

Soil Weight:
Area of System **(A)**: 3,107.5 ft^2
Min. Depth of Soil Cover **(D)**: 4.33 ft

Total Volume of Soil (**V_s**):
A x D = 13,466 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 1,615,900 lbs

Results:

Total Weight Counteracting Buoyancy Forces: 1,956,747 lbs > 517,088 lbs
Actual Factor of Safety: 3.78

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -1 BUOYANCY (Southeast)

Assumptions:

Estimated Seasonal High Groundwater Elevation:	303.50	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 1 Specifics:

Finished Grade Elevation: 303.50 ft
Outside Length: 100.0 ft
Outside Width: 13.5 ft
Outside Height: 2.67 ft
Inside Length: 99.0 ft
Inside Width: 12.5 ft
Inside Height: 2.00 ft
Invert: 296.5 ft

Average Pond Area (**A**):
L x W = 1,350 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 3,600 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **224,640** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **336,960** **lbs**

Actual Counteracting Weight:

System Concrete Weight:
Outside Volume of System 3,600.0 cf
Inside Volume of System 2,475.0 cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 1,125 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 163,125 lbs

Soil Weight:
Area of System **(A)**: 1,350.0 ft^2
Min. Depth of Soil Cover **(D)**: 1.83 ft

Total Volume of Soil (**V_s**):
A x D = 2,471 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 296,460 lbs

Results:

Total Weight Counteracting Buoyancy Forces: **459,585** **lbs** **>** **224,640** **lbs**
Actual Factor of Safety: **2.05**

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -1 BUOYANCY (Northeast)

Assumptions:

Estimated Seasonal High Groundwater Elevation:	301.00	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 1 Specifics:

Finished Grade Elevation: 301.00 ft
Outside Length: 85.0 ft
Outside Width: 13.5 ft
Outside Height: 2.67 ft
Inside Length: 84.0 ft
Inside Width: 12.5 ft
Inside Height: 2.00 ft
Invert: 296.5 ft

Average Pond Area (**A**):
L x W = 1,148 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 3,060 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **190,944** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **286,416** **lbs**

Actual Counteracting Weight:

System Concrete Weight:
Outside Volume of System 3,060.0 cf
Inside Volume of System 2,100.0 cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 960 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 139,200 lbs

Soil Weight:
Area of System **(A)**: 1,147.5 ft^2
Min. Depth of Soil Cover **(D)**: 1.83 ft

Total Volume of Soil (**V_s**):
A x D = 2,104 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 252,450 lbs

Results:

Total Weight Counteracting Buoyancy Forces: **391,650** **lbs** **>** **190,944** **lbs**
Actual Factor of Safety: **2.05**

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -2 BUOYANCY (Northeast)

Assumptions:

Estimated Seasonal High Groundwater Elevation:	299.67	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 2 Specifics:

Finished Grade Elevation: 301.25 ft
Outside Length: 86.0 ft
Outside Width: 21.0 ft
Outside Height: 2.67 ft
Inside Length: 85.0 ft
Inside Width: 20.0 ft
Inside Height: 2.00 ft
Invert: 297.5 ft

Average Pond Area (**A**):
L x W = 1,806 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 3,919 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **244,547** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **366,820** **lbs**

Actual Counteracting Weight:

System Concrete Weight:
Outside Volume of System 4,816.0 cf
Inside Volume of System 3,400.0 cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 1,416 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 205,320 lbs

Soil Weight:
Area of System **(A)**: 1,806.0 ft^2
Min. Depth of Soil Cover **(D)**: 1.08 ft

Total Volume of Soil (**V_s**):
A x D = 1,957 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 234,780 lbs

Results:

Total Weight Counteracting Buoyancy Forces: **440,100** **lbs** **>** **244,547** **lbs**
Actual Factor of Safety: **1.80**

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -2 BUOYANCY (Southwest)

Assumptions:

Estimated Seasonal High Groundwater Elevation:	303.25	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 2 Specifics:

Finished Grade Elevation: 303.25 ft
Outside Length: 99.0 ft
Outside Width: 34.0 ft
Outside Height: 2.67 ft
Inside Length: 98.0 ft
Inside Width: 33.0 ft
Inside Height: 2.00 ft
Invert: 297.5 ft

Average Pond Area (**A**):
L x W = 3,366 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 8,976 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **560,102** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **840,154** **lbs**

Actual Counteracting Weight:

System Concrete Weight:
Outside Volume of System 8,976.0 cf
Inside Volume of System 6,468.0 cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 2,508 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 363,660 lbs

Soil Weight:
Area of System **(A)**: 3,366.0 ft^2
Min. Depth of Soil Cover **(D)**: 3.08 ft

Total Volume of Soil (**V_s**):
A x D = 10,379 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 1,245,420 lbs

Results:

Total Weight Counteracting Buoyancy Forces: **1,609,080** **lbs** **>** **560,102** **lbs**
Actual Factor of Safety: **2.87**

PARE CORPORATION

Project Name: Northborough Fire Station
Project Number: 23141.00

Designed By: NPC
Checked By:

DENTION SYSTEM -3 BUOYANCY

Assumptions:

Estimated Seasonal High Groundwater Elevation:	323.00	ft*
Specific Weight of Water (SW_w):	62.4	lbs / ft^3
Specific Weight of Unsaturated Soil (SW_s):	120	lbs / ft^3
Unit Weight of Concrete (SW_L)*:	145	lbs / ft^3

Detention System - 2 Specifics:

Finished Grade Elevation:	323.00	ft
Outside Length:	58.0	ft
Outside Width:	21.0	ft
Outside Height:	8.17	ft
Inside Length:	57.0	ft
Inside Width:	20.0	ft
Inside Height:	7.50	ft
Invert:	310	ft

Average Pond Area (**A**):
L x W = 1,218 ft^2

Volume of Ground Water Displaced (**V**):
A x Depth in GW = 9,951 ft^3

Buoyancy:

Groundwater Force **(F_b)**:
SW_w x V = **620,946** **lbs**

Required Force to Counteract **(F_b)** using a FS of 1.5:
F_b x F.S.= **931,419** **lbs**

Actual Counteracting Weight:

System Concrete Weight:

Outside Volume of System	9,951.1	cf
Inside Volume of System	8,553.8	cf

Total Volume of System Concrete (**V_{GT}**):
Outside Area - Inside Area= 1,397 ft^3
Weight of Detention System **(SW_{GT})**:
V_{GT} x SW_{GT} = 202,603 lbs

Soil Weight:

Area of System **(A)**:	1,218.0	ft^2
Min. Depth of Soil Cover **(D)**:	4.83	ft

Total Volume of Soil (**V_s**):
A x D = 5,883 ft^3
Weight of Soil Cover **(SW_S)**:
V_s x SW_s = 705,953 lbs

Results:

Total Weight Counteracting Buoyancy Forces: **908,556** **lbs** **>** **620,946** **lbs**

Actual Factor of Safety: **1.46**

STORMWATER MANAGEMENT REPORT

Northborough Fire Station
61&65 West Main Street
Northborough, Massachusetts

Assessors Map 63, Lots 9 & 10

Prepared for:

Town of Northborough, MA
63 Main Street
Northborough, MA 01532

Prepared by:

Pare Corporation
10 Lincoln Road
Foxborough, MA 02035

MARCH 2024

PARE CORPORATION
ENGINEERS SCIENTISTS PLANNERS

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PURPOSE

Pare Corporation (Pare) has prepared this report to summarize the stormwater management system for the proposed Town of Northborough's new fire station. The proposed building will be located at 65 West Main Street Northborough, MA. The project will include a new fire station building, parking and access drives, curbing, concrete walks, a retaining wall, associated stormwater management, and utility lines. The project is proposed on three lots, a 2.73 +/- acre parcel, a 0.54 +/- acre parcel and a 0.43 +/- acre property. The existing Site previously contained an abandoned gas station and residential property. The site lies on Northborough's Assessor's Map 63, Lot 7, 9, & 10.

The following sections of the report discuss the existing conditions, proposed development, methodology employed to evaluate stormwater runoff for existing and proposed conditions, and design elements for the proposed stormwater management system components. Supporting documentation is provided in the attached appendices.

PROJECT DESCRIPTION

The study area, hereby referred to as the "Site", included in this hydrologic study comprises approximately 4.51 +/- acres of land. The Site is bound by West Main Street and commercial properties to the north and west, a bank to the east, and woodland and residential properties to the south.

There are no established wetland or natural resource areas located in and around the site based on research of GIS overlays on Mass Mapper. There are also no historical records of wetland or natural resource areas in and around the site.

There are no NHESP Priority Habitats, Certified Vernal Pools, or Potential Vernal Pools onsite as mapped by MassGIS. The Site is not located in a Zone II Wellhead Protection Area, Interim Wellhead Protection Area, or Zone I Wellhead Protection Area. Additionally, the Site is not located in a Zone A, B, or C Surface Water Protection Area.

According to the FEMA Flood Insurance Rate Map for Worcester County, Massachusetts (Community-Panel 25027C0634F, revision date July 16, 2014), included in Appendix A of this report, the project Site is located entirely within FEMA Zone X.

The existing topography of the Site generally slopes from the southwest to the southeast. A portion of the site at the east of the site flows to an abutting property, the rest of the site flows overland to a state MS4.

SOIL DATA

NRCS Soil mapping indicates that natural soil in the north of the Site is comprised of Merrimac series sandy loam, 3 to 8 percent slopes. Merrimac series soils are classified as a Hydrologic Soil Group (HSG) rating A. Class A soils are typically well drained to excessively well drained soils. Test pit investigations referenced on this page suggest that this area is better described as a Charlton Series material, a Class B soil that is well drained rather than excessively well drained. This description remains true for all site areas, whether they be located in the north close to the grade of the road or more southerly on the hillside. The southern portion of the Site is located on a drumlin, which typically have tighter, more compacted soils. The more compacted soils from the drumlin may cause a perched water table, if the soil is removed the water table may reset to the depth of the surrounding soils.

A subsurface investigation, inclusive of ten (10) test pits was conducted to evaluate soil conditions at the Site on 2/21/2024 (TP-1 through TP-10). Test pit logs from the investigation are provided in Appendix A.

The soil profile and the natural material found did not vary widely across the ten test pits conducted. Fill was found in TP-102, 103, and 104 at depths ranging from 16" – 18". Natural soil typically saw a 6" – 24" A layer of organics followed by a 2"-13" B layer. The natural occurring parent material in the C layer was a course, homogenized sand; typical of the Carver series suspected to be present. This sand was loose in place, allowing for the conclusion that the parent material across the developed areas of the Site reflect the A type composition previously indicated, though appearing much deeper than the surface depositional layer as found in TP-3. This parent material was found to be overlain by a more recent depositional event, more reflective of the Class B soil used to model surficial hydrology(classified as Merrimac/Paxton in the attached soil logs).

Groundwater varied somewhat widely across the site. In some test pits (TP-3 for example) the groundwater elevation was deeper than the limits of the machine doing the digging. In other test pits (TP-2 or TP-4 for example), the groundwater table was determined through weeping or through redox. For design purposes, bottom of pit was determined to be seasonal high groundwater elevation where no evidence was found. These results, though, reflect a site that may be subject to localized perching of the water table, with the true water table in an on-site well likely reflected a much lower elevation.

Soil disturbance onsite will include the excavation around the foundations for the building addition, construction of the proposed stormwater systems, and excavation for all proposed utilities, in addition

to paving of vehicular areas. Water will be sprayed as necessary to control dust. Existing catch basins in the vicinity of the Site will require inlet protection.

METHODOLOGY

Hydrologic calculations for existing and proposed conditions were performed using HydroCAD Version 10.00 software, which uses TR-55 methodology to calculate runoff and TR-20 methodology for storm routing through the stormwater detention facilities. Site hydrology was evaluated for the 2-year, 10-year, 25-year, and 100-year frequency storms in accordance with the guidelines of the Massachusetts Stormwater Handbook. Existing and Proposed Watershed Maps, indicating the subwatersheds and associated stormwater flow paths may be found in Appendix D.

The hydraulic design calculations were completed using HydroCAD to calculate the accumulated flows to each structure. The stormwater conveyance system was designed using Manning's Equation. The stormwater conveyance system was designed to handle the runoff generated by a 25-year design storm.

EXISTING CONDITIONS OF STUDY AREA

The Site is currently used as a residential property and an abandoned gas station. Also, on site a paved driveways, landscaped areas, and woods. Under existing conditions, six (6) subwatersheds were analyzed, EDA-1, EDA-2A, EDA-2B, EDA-2C, EDA-3A, and EDA-3B.

The existing Site contains approximately 0.74 acres of impervious area within the hydrologic boundary, which consists of paved parking and access areas and existing buildings. The remaining portions of the Site are grassed or wooded areas.

The Site is considered to have three design points (DP-1 Mass DOT East, DP-2 Mass DOT West, DP-3 Bank Parking Lot. DP-1 & 2 are analyzed for flow to the Massachusetts MS4 system. DP-3 is analyzed for flow heading off-site to an abutting property. The Existing Hydrology Plan, H1.0, included in Appendix D, depicts the limits of the Existing Drainage Areas (EDA), described below:

- **EDA-1**: EDA-1 is located at the northwest corner of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 46. Runoff for this subcatchment flows overland to a catch basin in West Main Street. EDA-1 contributes to Design Point "DP-1 Mass DOT West".

- **EDA-2A**: EDA-2A is located at the north side of the site and analyzes on-site flow. It is comprised of woods, grass cover, paved drives, and existing buildings, the composite CN value for this subcatchment is 67. Runoff for this subcatchment flows overland to a catch basin in West Main Street. EDA-2A contributes to Design Point "DP-2 Mass DOT East".

- **EDA-2B**: EDA-2B is located at the south east side of the site and analyzes off-site flow. It is comprised entirely of woods, the composite CN value for this subcatchment is 70. Runoff for this subcatchment flows overland first over EDA-2A then to a catch basin in West Main Street. EDA-2B contributes to Design Point "DP-2 Mass DOT East".

- **EDA-2C**: EDA-2C is located at the southwest corner of the site and analyzes off-site flow. It is comprised of woods and residential properties, the composite CN value for this subcatchment is 76. Runoff for this subcatchment flows overland first over EDA-2A then to a catch basin in West Main Street. EDA-2C contributes to Design Point "DP-2 Mass DOT East".

- **EDA-3A**: EDA-3A is located in two separate locations, one at the east side of the site and the other on the southeast side if the site. EDA-3A analyzes on-site flow. It is comprised of woods, grass cover, and a paved access drive, the composite CN value for this subcatchment is 56. Runoff for this subcatchment flows overland to a catch basin in the abutting property to the east. EDA-3A contributes to Design Point "DP-3 Bank Parking Lot".

PROPOSED CONDITIONS OF STUDY AREA

Included in the proposed site is a new Fire Station, with associated site features. Those site features include access drives, paved parking, pedestrian walks, a retaining wall, the associated stormwater management, and utilities. The proposed condition has approximately 1.74 acres of impervious cover within the analyzed drainage area, resulting in a net increase of 1.00 acres of impervious.

The site has two main entrances, one in the northwest corner of the site for public access, and one on the northeast corner of the site for fire apparatus and employee access. ADA parking is provided in the western parking lot adjacent to the pedestrian walkway. Parking for visitors and administration is located in the western parking lot, parking for fire staff is on the eastern lot behind the building.

The proposed project will be outfitted with a stormwater system to better achieve groundwater recharge, treatment requirements, and peak flow attenuation. All new stormwater collection, storage, and treatment systems have been designed in accordance with the guidelines of the Massachusetts Stormwater Handbook prepared by the Massachusetts Department of Environmental Protection (MADEP). Post-development runoff rates will be maintained or reduced from the pre-development condition and released into the existing Mass-DOT drainage system. Proposed impervious areas will be treated prior to leaving the Site in accordance with the handbook.

The grading scheme is designed to shed water to match the existing conditions to the maximum extent possible. Grades generally slope away from the Fire Station building to protect the structure from stormwater runoff. Stormwater is conveyed to best management practices (BMP's) via overland flow and a stormwater conveyance system consisting of catch basins, area drains, manholes, and HDPE piping.

The drainage system is designed to incorporate features that address flow rate, quantity of runoff, and quality of runoff from the developed Site. Runoff from the Site flows overland into catch basins, the street, or the building's roof and foundation drainage system into an underground infiltration system or water quality unit. Flow from the water quality units and overflow from infiltration system 1 & 2 is sent to underground detention basins on-site. Underground infiltration system 3 overflow is controlled by a diversion manhole. Overflow from the underground infiltration systems is connected via a pipe to a diversion manhole, which overtops upon the filling of the infiltration system. The overflow in this instance would then flow via pipe to the existing drainage system in the road, where the existing stormwater already flows directly to.

- **Source Control and Maintenance**: Properly maintaining sources of pollutants promotes a site that produces higher quality stormwater runoff than sites that do not control sources of pollutants. An example of source control includes the removal of sediment buildup from best management practices during regular maintenance per the Long-Term Operations & Maintenance Plan.

- **Underground Infiltration System**: The underground infiltration system has been designed in accordance with the Massachusetts Stormwater Handbook Standards to promote water quality. The system is sized to exfiltrate the entire water quality volume through the surrounding soils prior to use of any overflows. Any excess stormwater that enters the infiltration system will overflow into the outlet control structure and subsequently into the existing wetlands.

- **Water Quality Unit**: The water quality unit is a proprietary water quality structure (WQS) that has been designed in accordance with the Massachusetts Stormwater Handbook requirements to promote water quality. The system is sized to treat the water quality flow passing through the system and is also sized to bypass flows during a 25-year storm event. Sizing calculations for the system are included in Appendix C. The units within the scope of the current design achieve 93% TSS removal efficiency and 88.6% Phosphorus removal efficiency.

Under proposed conditions, twenty-two subwatersheds were analyzed. The Proposed Hydrology Plan, H-2.0, included in Appendix D, depicts the limits of the Proposed Drainage Areas (PDA), described below:

- **PDA-1**: PDA-1 is located at the northwest corner of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 83. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-1 contributes to Design Point "DP-1 Mass DOT West".

- **PDA-2A**: PDA-2A is located at the north of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 83. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-2A contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2B**: PDA-2B is located at the northeast corner of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-2B contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2C**: PDA-2C is located at the northwest corner of the site, north of the proposed building and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 73. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2C contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2D**: PDA-2D is located at the north of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 66. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2D contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2E**: PDA-2E is located at the north of the site and analyzes both on-site and off-site flow. It is comprised entirely of paved area cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2E contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2F**: PDA-2F is located at the northeast corner of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2F contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2G**: PDA-2G is located at the northeast corner of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 85. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2G contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2H**: PDA-2H is located at the east of the site and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2H contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2I**: PDA-2I is located at the east of the site and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and sent to UGIS-5. PDA-2I contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2J**: PDA-2J is located at the center of the site, south of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2J contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2K**: PDA-2K is located in the center of the site, southwest of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 64. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2K contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2L**: PDA-2L is located in the center of the site, southeast of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 93. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2L contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2M**: PDA-2M is located at the northwest corner of the site and analyzes on-site flow. It is comprised of paved areas, woods, and grass cover, the composite CN value for this subcatchment is 85. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2M contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2N**: PDA-2N is located at the west of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-1. PDA-2N contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2O**: PDA-2O is located in the center of the site, south of the proposed retaining wall and analyzes on-site flow. It is comprised of paved areas, woods, and grass cover, the composite CN value for this subcatchment is 56. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2O contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2P**: PDA-2P is located at the southeast corner of the site and analyzes off-site flow. It is comprised entirely of woods, the composite CN value for this subcatchment is 55. Runoff for

this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2P contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2Q**: PDA-2Q is located at the southwest corner of the site and analyzes off-site flow. It is comprised of paved areas, woods, roof cover, and grass cover, the composite CN value for this subcatchment is 68. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2Q contributes to Design Point "DP-2 Mass DOT East".

- **PDA-2R**: PDA-2R is located at the east side of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2R contributes to Design Point "DP-2 Mass DOT East".

- **PDA-ROOF1**: PDA-ROOF1 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to Detention Basin 2. PDA-ROOF1 contributes to Design Point "DP-2 Mass DOT East".

- **PDA-ROOF2**: PDA-ROOF2 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to UGIS-2. PDA-ROOF2 contributes to Design Point "DP-2 Mass DOT East".

- **PDA-ROOF3**: PDA-ROOF3 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to Detention Basin 2. PDA-ROOF2 contributes to Design Point "DP-2 Mass DOT East".

STORMWATER MANAGEMENT STANDARDS

This proposed stormwater management system complies with the current regulations of the Massachusetts Stormwater Handbook) and the Town of Northborough requirements. Compliance and applicability of the ten (10) Stormwater Management Standards for this redevelopment project are discussed below.

STANDARD #1 – NO NEW UNTREATED DISCHARGES

No new point discharges of untreated stormwater are proposed for the project. Water quality is achieved by source control and conveying stormwater from impervious areas through the proposed best management practices. Stormwater throughout the Site is treated using the proposed underground infiltration systems and proprietary water quality systems. Portions of the Site directly adjacent to offsite areas will remain untreated as in the existing condition.

STANDARD #2 – POST-DEVELOPMENT PEAK DISCHARGE RATES

MassDEP Stormwater Standard #2 states that runoff rates from the developed Site must not exceed existing runoff rates for the 2-year and 10-year, 24-hour storm events. Standard 2 states that the 100-year, 24-hour storm event must also be evaluated to demonstrate that there will be no increased flooding impacts off-site. The 25-year storm is shown for additional clarity.

The proposed stormwater management system is designed to reduce runoff rates from the 2-, 10-, 25-, and 100-year, 24-hour storm events. This is achieved by controlling runoff using the proposed stormwater management systems and their associated outlet control structures.

Existing and proposed peak runoff rates from the Site were generated for the rainfall events having a return rate of 2-year, 10-year, and 100-year using the SCS TR-20 Method (refer to Appendix B for hydrology calculations). Runoff hydrographs were developed for the existing and proposed conditions for each of the design points of the Site. Results for each storm event and the net difference in pre- and post-development flows are shown in Table 1 below; a negative number indicates flows are decreased in the proposed condition. The peak flows for this site have been reduced at all design points, however the peak volumes for design point 2 going to the Mass DOT system are increasing.

Table 1: Peak Flow Table (CFS)

Design Storm:	2	10	25	100
DP-1: Mass-DOT West				
Pre	0.08	0.32	0.49	0.79
Post	0.07	0.14	0.18	0.24
Difference	-0.01	-0.18	-0.31	-0.55
DP-2: Mass-DOT East				
Pre	2.91	8.92	13.49	21.00
Post	2.77	4.89	6.25	10.83
Difference	-0.14	-4.03	-7.24	-10.17
DP-3: Bank Parking Lot				
Pre	0.01	0.06	0.10	0.16
Post	0.00	0.00	0.10	0.00
Difference	-0.01	-0.06	-0.10	-0.16

Table 2: Peak Volume Table (CF)

Design Storm:	2	10	25	100
DP-1: Mass-DOT West				
Pre	239	707	1,069	1,701

Post	159	304	398	548
Percent Reduction	33.5%	57.0%	62.8%	67.8%
DP-2: Mass-DOT East				
Pre	10,091	25,672	37,237	56,950
Post	18,058	36,608	49,629	71,293
Percent Reduction	-79.0%	-42.6%	-33.3%	-25.2%
DP-3: Bank Parking Lot				
Pre	43	139	214	346
Post	0	0	0	0
Percent Reduction	100%	100%	100%	100%

STANDARD #3 – RECHARGE TO GROUNDWATER

Stormwater Standard #3 states that loss of groundwater recharge from the proposed development shall be eliminated or minimized and at a minimum, the recharge volume, which is dependent on soil type, shall be recharged to the groundwater. The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. This standard is being met through the use of an underground infiltration BMP. Groundwater recharge calculations are provided in Appendix C of this report.

STANDARD #4 – TSS REMOVAL

Stormwater Standard #4 requires that stormwater management systems shall be designed to remove the annual post-construction load of Total Suspended Solids (TSS) to the maximum extent practicable. TSS is being removed using underground infiltration systems and proprietary systems. See Appendix C for TSS calculations.

STANDARD #5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPL)

Standard #5 specifies that LUHPPLs appropriately reduce and control potential pollutants from entering groundwater or waterways. LUHPPLs are identified in the Massachusetts stormwater handbook as "Land uses with higher potential pollutant loads are defined in 310 CMR 10.04 and 314 CMR 9.02 to include the following: Land uses identified in 310 CMR 22.20B(2), 310 CMR 22.20C(2)(a)-(k) and (m), 310 CMR 22.21(2)(a)(1)-(8) and 310 CMR 22.21(2)(b)(1)-(6)". 310 CMR 22.21(2)(b)6 notes that a cut of soil within 4' of the historical high groundwater table would qualify as a LUHPPL. Since there is a large elevation change over the Site, a cut within 4' of the historic high ground water table will be

required. The proposed system complies with 314 CMR 3.00, 4.00, and 5.00. For a detailed source control and pollution prevention plan see Standard #8. See Standard #4 for TSS removal compliance.

STANDARD #6 – PROTECTION OF CRITICAL AREAS

The proposed development is not located within a Zone II or Interim Wellhead Protection Area. Standard #6 is not applicable to this project.

STANDARD #7 – REDEVELOPMENT PROJECTS

The proposed development is designated as a new development, therefore Standard #7 is not applicable to this project.

STANDARD #8 – EROSION & SEDIMENT CONTROL PLAN

The project proposes to disturb greater than 1 acre of land and is therefore required to develop a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP) for discharges from construction activities. The SWPPP will include means and methods at the discretion of the Contractor to comply with the NPDES CGP. The SWPPP and the Notice of Intent under the CGP will be required to be prepared and submitted by the Contractor as the Operator of the Site. The SWPPP is required to be submitted to the town prior to the start of earth disturbing activities.

Minimum erosion and sediment control features, including perimeter silt fencing, filter socks, and inlet protection are shown on the Project Plans.

STANDARD #9 – OPERATIONS AND MAINTENANCE PLAN

The Town of Northborough will be responsible for the Operation and Maintenance of the Stormwater Management System post-construction. The Stormwater Operation and Maintenance Plan is included under separate cover.

STANDARD #10 – ILLICIT DISCHARGES

The Stormwater Management System has been designed to treat stormwater by a best-management practice prior to discharge. To Pare Corporation's knowledge, based on the best-available information and in-field reviews of the current Site, there are no known non-stormwater discharges that will be connected to the proposed stormwater collection system that would convey pollutants directly to groundwater or surface waters.

PROPOSED DRAINAGE CONVEYANCE SYSTEM

The proposed stormwater conveyance system includes catch basins, drain manholes, an outlet control structures, water quality units, detention basins, and underground infiltration systems. The proposed system has been designed for a 25-year 24-hour storm event utilizing the Rational Method. The Manning equation was used to model the stormwater conveyance system and perform the hydraulic analysis of the system. The following criteria were used to design the conveyance system:

- Manholes are provided at directional changes, connections, and conduit size increases.
- Pipes are designed to convey the 25-year stormwater event.
- All new conduit is HDPE pipe sized 12" diameter or larger.
- Minimum pipe velocity is 0.83 feet per second.
- Maximum pipe velocity is 7.85 feet per second.

All pipes are modeled in the hydraulic calculations in Appendix B of this report.

SUMMARY

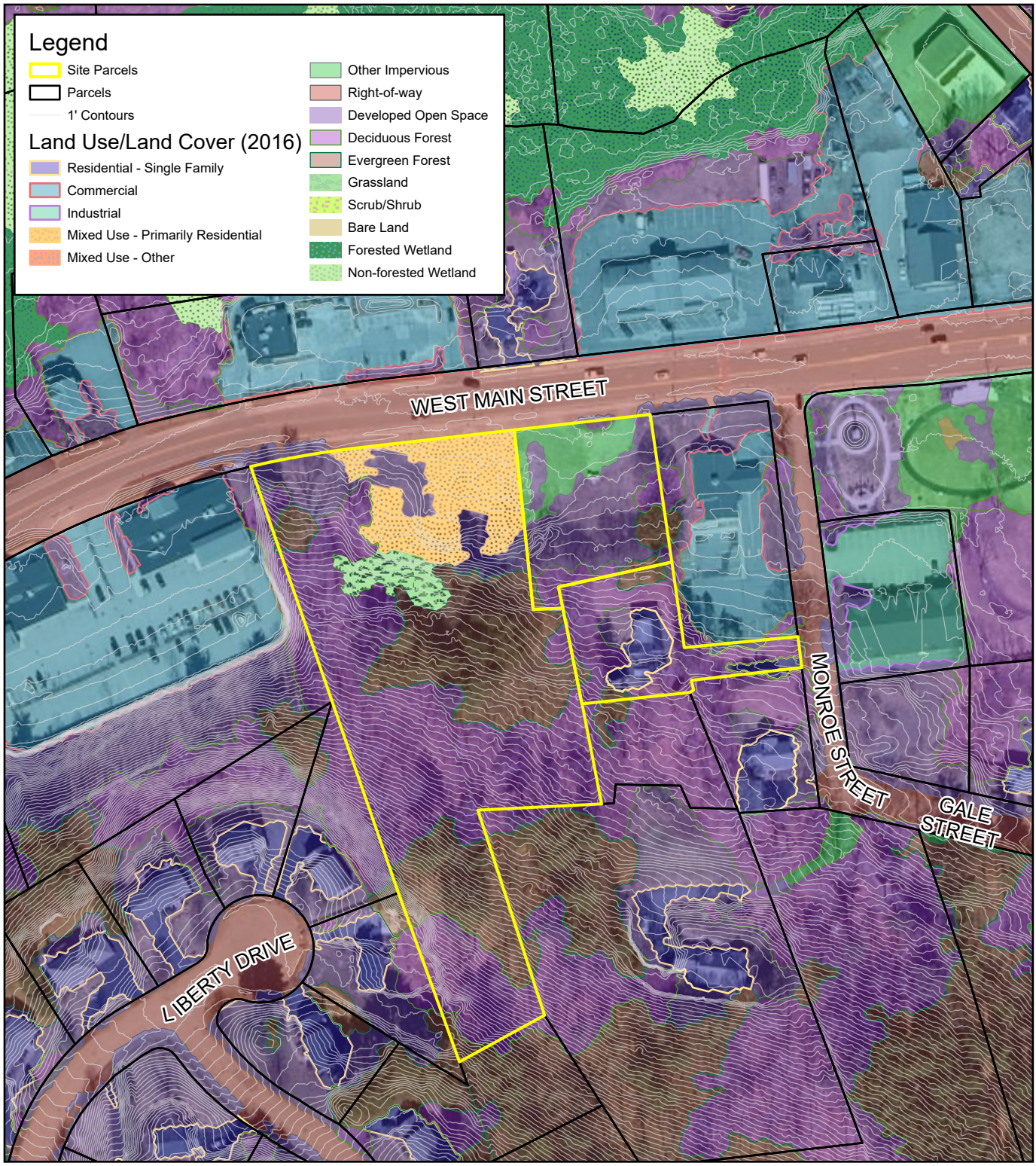
The proposed developments at 65 West Main Street will be creating new impervious areas. The post-development stormwater management system has been designed in accordance with the Massachusetts Stormwater Handbook requirements to the maximum extent practical. The proposed stormwater management system addresses both the quantity and quality of the stormwater runoff. The stormwater management system promotes recharge and ultimately provides reductions in peak runoff rate within the hydrologic analysis area for the design storm events. The development of the property is proposed to improve existing conditions and the stormwater discharges to the State Right of Way.

Town of Northborough

NORTHBOROUGH FIRE STATION

APPENDIX A

Locus Map
NRCS Soils Map
FEMA Firmette
IDF Curve
TR-55 Curve Numbers
Design Storms
Stormwater Checklist
Test Pit Logs



MASS GIS

SITE LOCUS MAP

SCALE: 1" = 200'

N
W E
S

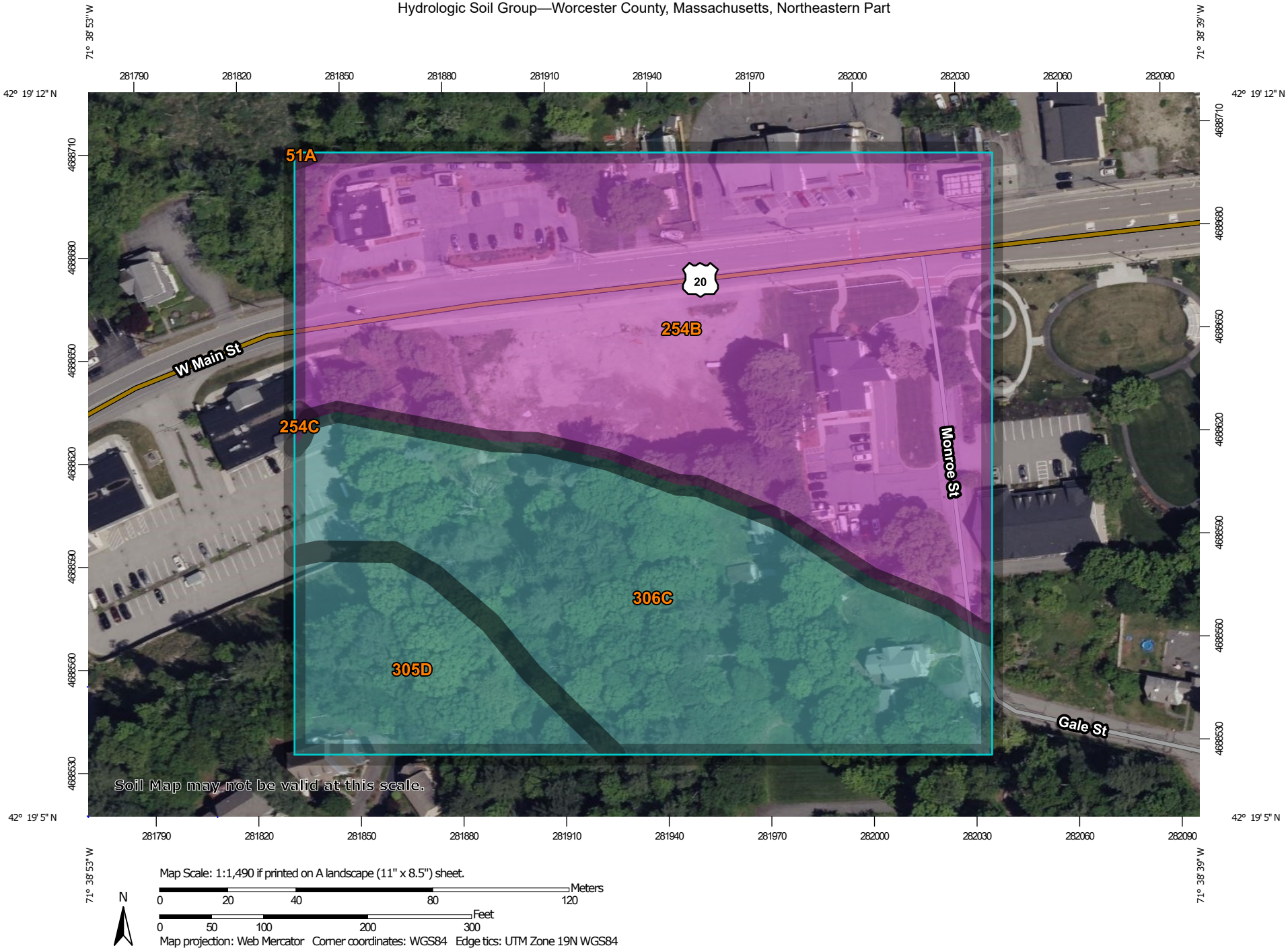
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
(401) 334-4100

10 LINCOLN ROAD, SUITE 210
FOXBORO, MA 02035
(508) 543-1755

PARE PROJECT No. 23141.00 MARCH 2024

FIGURE 1

NORTHBOROUGH FIRE STATION
NORTHBOROUGH, MA



Map Scale: 1:1,490 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 1:20,000.

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: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 18, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	B/D	0.0	0.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	5.0	56.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	0.0	0.1%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	0.9	10.6%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	2.9	33.1%
Totals for Area of Interest			**8.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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 claypan 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.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA

71°39'6"W 42°19'21"N

71°38'29"W 42°18'55"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

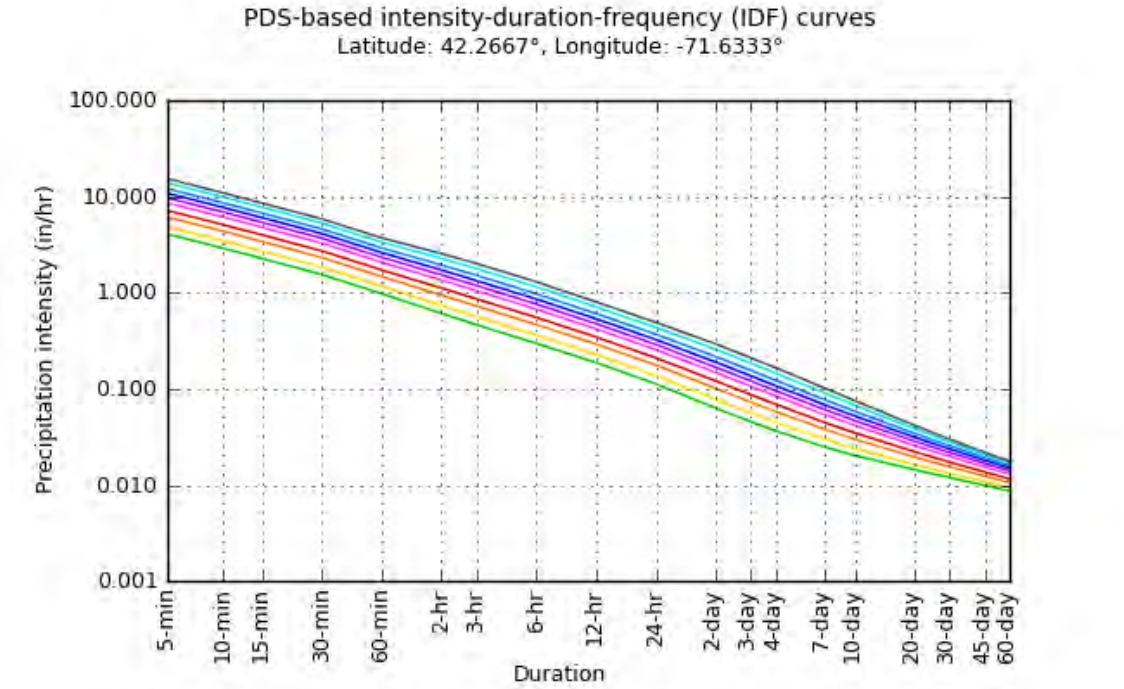
N

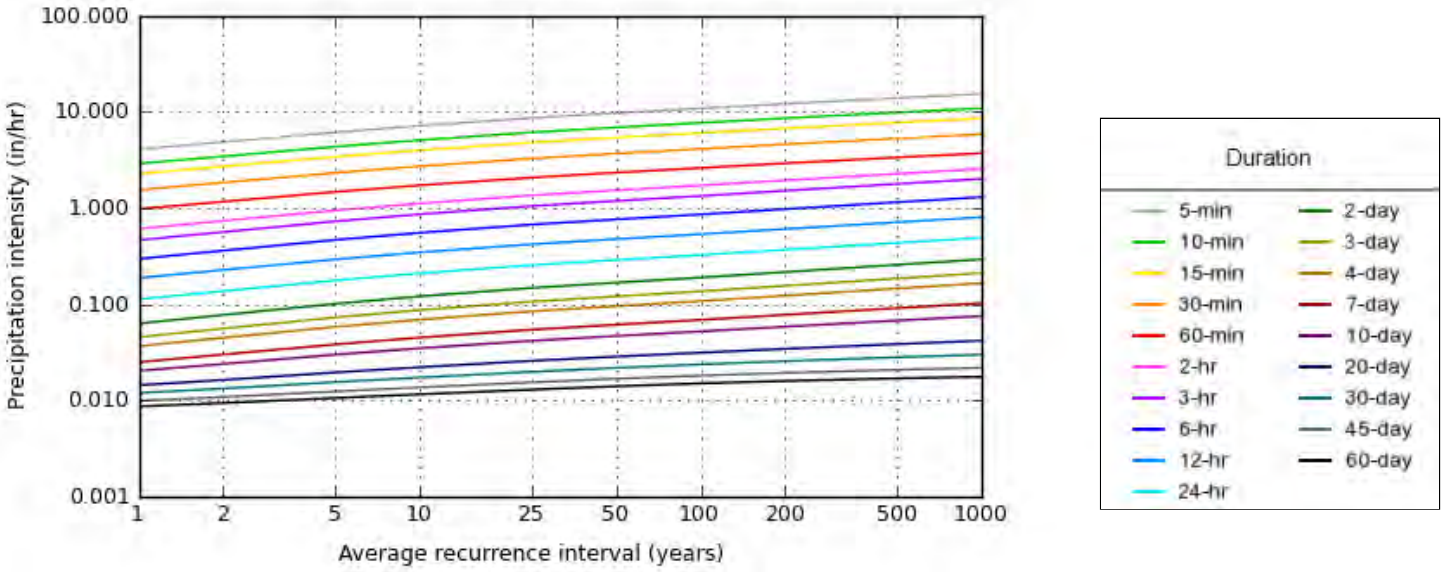
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/20/2023 at 9:42 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.





NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Thu Nov 12 16:06:19 2020

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Maps & aerials

Small scale terrain

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

NOAA Atlas 14, Volume 10, Version 3
Location name: Northborough, Massachusetts, USA*
Latitude: 42.3195°, Longitude: -71.6465°
Elevation: 302 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.346** (0.264-0.445)	**0.408** (0.312-0.526)	**0.510** (0.389-0.660)	**0.595** (0.451-0.774)	**0.712** (0.524-0.966)	**0.800** (0.578-1.11)	**0.892** (0.626-1.28)	**0.992** (0.665-1.46)	**1.13** (0.732-1.72)	**1.24** (0.787-1.94)
10-min	**0.490** (0.375-0.631)	**0.578** (0.442-0.746)	**0.723** (0.551-0.936)	**0.843** (0.639-1.10)	**1.01** (0.742-1.37)	**1.13** (0.819-1.57)	**1.26** (0.887-1.81)	**1.41** (0.942-2.07)	**1.60** (1.04-2.45)	**1.76** (1.12-2.74)
15-min	**0.576** (0.441-0.742)	**0.680** (0.520-0.877)	**0.850** (0.648-1.10)	**0.992** (0.752-1.29)	**1.19** (0.873-1.61)	**1.33** (0.963-1.85)	**1.49** (1.04-2.13)	**1.65** (1.11-2.44)	**1.89** (1.22-2.88)	**2.07** (1.31-3.23)
30-min	**0.779** (0.596-1.00)	**0.921** (0.704-1.19)	**1.15** (0.879-1.49)	**1.35** (1.02-1.75)	**1.61** (1.19-2.19)	**1.81** (1.31-2.51)	**2.02** (1.42-2.90)	**2.25** (1.51-3.31)	**2.57** (1.66-3.92)	**2.83** (1.79-4.40)
60-min	**0.982** (0.751-1.26)	**1.16** (0.888-1.50)	**1.46** (1.11-1.88)	**1.70** (1.29-2.21)	**2.04** (1.50-2.76)	**2.29** (1.65-3.17)	**2.56** (1.80-3.67)	**2.85** (1.91-4.19)	**3.25** (2.10-4.96)	**3.58** (2.27-5.58)
2-hr	**1.22** (0.939-1.56)	**1.47** (1.13-1.88)	**1.87** (1.43-2.41)	**2.21** (1.68-2.86)	**2.67** (1.98-3.62)	**3.01** (2.20-4.17)	**3.38** (2.40-4.87)	**3.81** (2.56-5.58)	**4.44** (2.88-6.72)	**4.96** (3.15-7.67)
3-hr	**1.39** (1.08-1.78)	**1.69** (1.30-2.16)	**2.17** (1.67-2.78)	**2.56** (1.96-3.31)	**3.11** (2.32-4.21)	**3.52** (2.58-4.87)	**3.96** (2.83-5.70)	**4.48** (3.02-6.54)	**5.25** (3.41-7.93)	**5.91** (3.76-9.10)
6-hr	**1.78** (1.38-2.26)	**2.16** (1.68-2.74)	**2.78** (2.15-3.55)	**3.30** (2.54-4.23)	**4.01** (3.00-5.40)	**4.54** (3.34-6.25)	**5.11** (3.67-7.32)	**5.79** (3.92-8.40)	**6.81** (4.44-10.2)	**7.68** (4.90-11.8)
12-hr	**2.27** (1.77-2.86)	**2.74** (2.14-3.47)	**3.52** (2.74-4.47)	**4.17** (3.23-5.32)	**5.06** (3.81-6.77)	**5.73** (4.23-7.83)	**6.44** (4.64-9.15)	**7.28** (4.94-10.5)	**8.54** (5.59-12.7)	**9.61** (6.15-14.6)
24-hr	**2.70** (2.12-3.39)	**3.28** (2.58-4.12)	**4.23** (3.31-5.34)	**5.02** (3.91-6.37)	**6.10** (4.62-8.11)	**6.90** (5.13-9.39)	**7.77** (5.64-11.0)	**8.80** (6.00-12.6)	**10.4** (6.80-15.4)	**11.7** (7.50-17.6)
2-day	**2.99** (2.37-3.73)	**3.67** (2.90-4.59)	**4.79** (3.78-6.01)	**5.72** (4.48-7.21)	**6.99** (5.33-9.26)	**7.93** (5.94-10.8)	**8.96** (6.56-12.7)	**10.2** (6.99-14.6)	**12.2** (8.00-17.9)	**13.8** (8.91-20.7)
3-day	**3.23** (2.57-4.02)	**3.96** (3.15-4.94)	**5.16** (4.09-6.46)	**6.16** (4.85-7.75)	**7.53** (5.76-9.95)	**8.55** (6.42-11.6)	**9.65** (7.08-13.6)	**11.0** (7.55-15.6)	**13.1** (8.64-19.2)	**14.9** (9.62-22.3)
4-day	**3.46** (2.76-4.30)	**4.23** (3.37-5.27)	**5.49** (4.36-6.85)	**6.53** (5.15-8.20)	**7.96** (6.11-10.5)	**9.02** (6.79-12.2)	**10.2** (7.48-14.3)	**11.6** (7.96-16.4)	**13.8** (9.09-20.1)	**15.6** (10.1-23.3)
7-day	**4.14** (3.32-5.13)	**4.97** (3.98-6.16)	**6.33** (5.05-7.87)	**7.45** (5.91-9.31)	**9.00** (6.92-11.8)	**10.2** (7.66-13.6)	**11.4** (8.37-15.8)	**12.9** (8.87-18.1)	**15.1** (10.0-21.9)	**17.0** (11.0-25.2)
10-day	**4.82** (3.87-5.94)	**5.68** (4.56-7.02)	**7.09** (5.68-8.79)	**8.26** (6.58-10.3)	**9.88** (7.61-12.8)	**11.1** (8.37-14.7)	**12.4** (9.07-17.0)	**13.9** (9.58-19.4)	**16.0** (10.7-23.2)	**17.9** (11.6-26.4)
20-day	**6.86** (5.56-8.42)	**7.79** (6.30-9.57)	**9.30** (7.49-11.5)	**10.6** (8.45-13.1)	**12.3** (9.50-15.8)	**13.6** (10.3-17.8)	**14.9** (10.9-20.2)	**16.4** (11.4-22.8)	**18.4** (12.3-26.4)	**19.9** (12.9-29.2)
30-day	**8.57** (6.96-10.5)	**9.53** (7.74-11.7)	**11.1** (8.98-13.6)	**12.4** (9.98-15.3)	**14.2** (11.0-18.1)	**15.6** (11.8-20.3)	**17.0** (12.4-22.7)	**18.4** (12.8-25.4)	**20.1** (13.5-28.8)	**21.5** (14.0-31.3)
45-day	**10.7** (8.72-13.0)	**11.7** (9.53-14.3)	**13.3** (10.8-16.3)	**14.7** (11.9-18.1)	**16.6** (12.9-21.0)	**18.1** (13.7-23.3)	**19.5** (14.2-25.8)	**20.8** (14.6-28.6)	**22.4** (15.1-31.9)	**23.5** (15.3-34.2)
60-day	**12.4** (10.2-15.1)	**13.5** (11.0-16.4)	**15.2** (12.4-18.6)	**16.6** (13.5-20.4)	**18.6** (14.5-23.5)	**20.1** (15.3-25.9)	**21.6** (15.7-28.4)	**22.9** (16.1-31.4)	**24.4** (16.4-34.5)	**25.3** (16.5-36.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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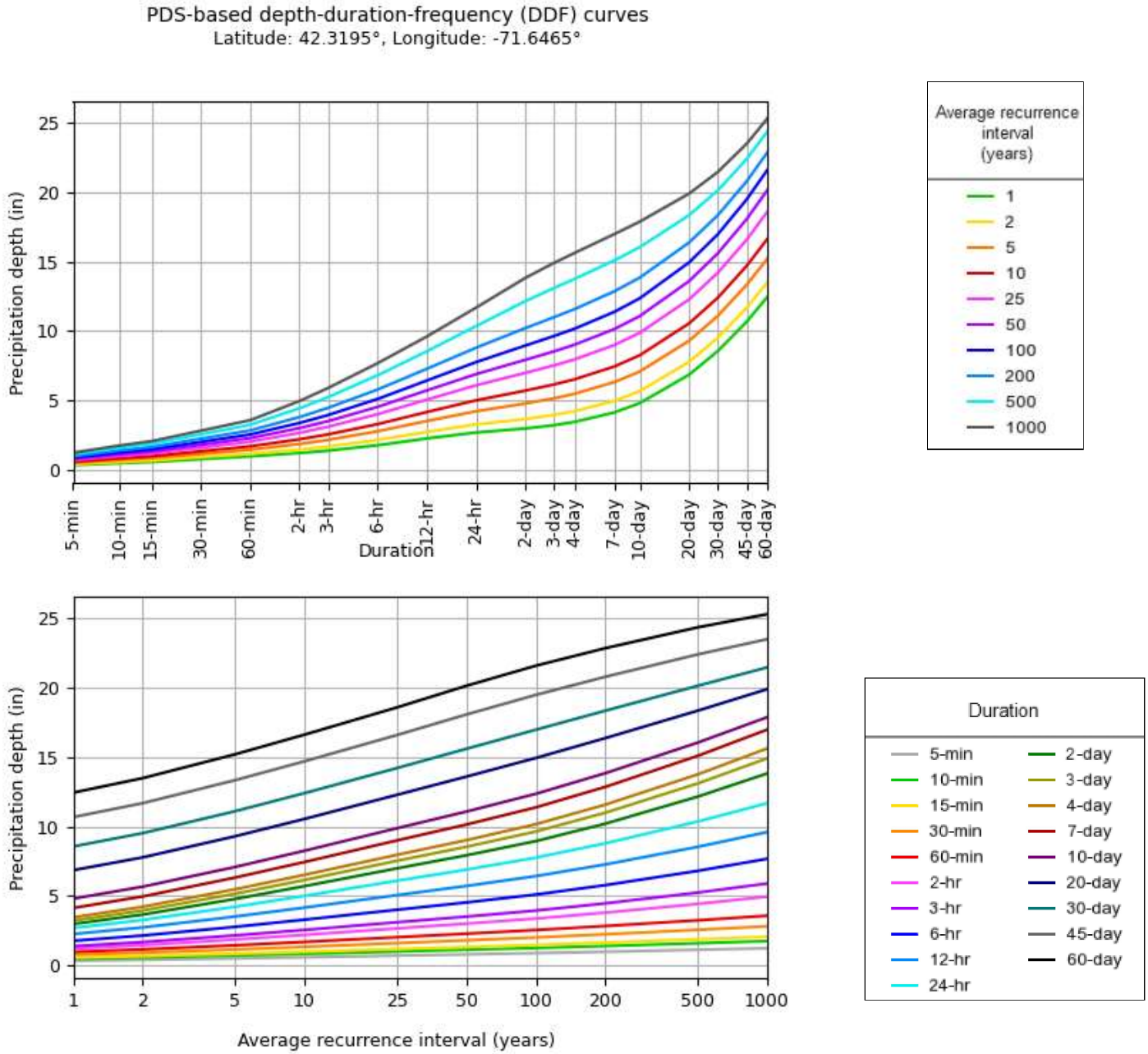
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Tue Feb 13 17:07:10 2024

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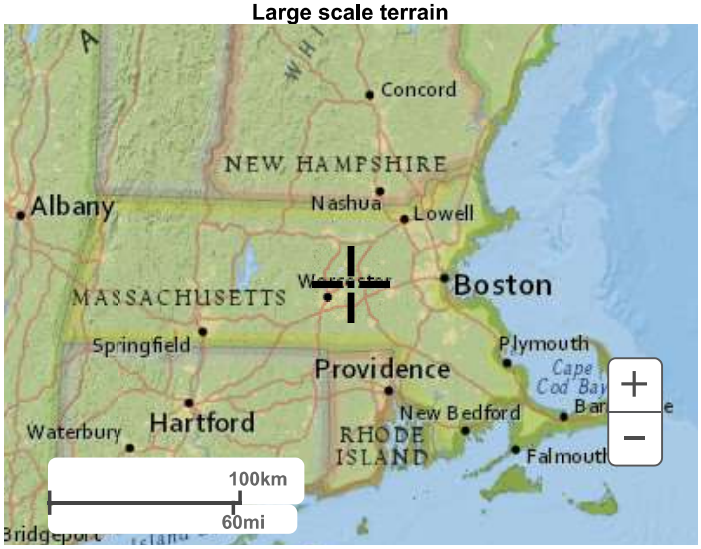
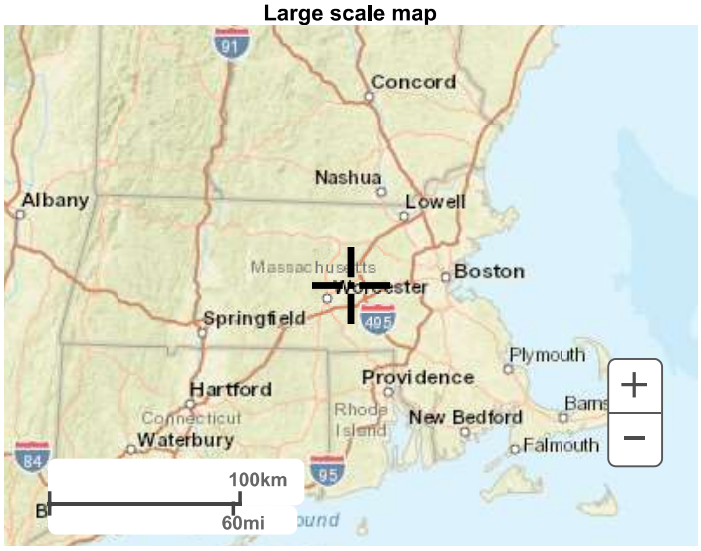
Maps & aerials

Small scale terrain

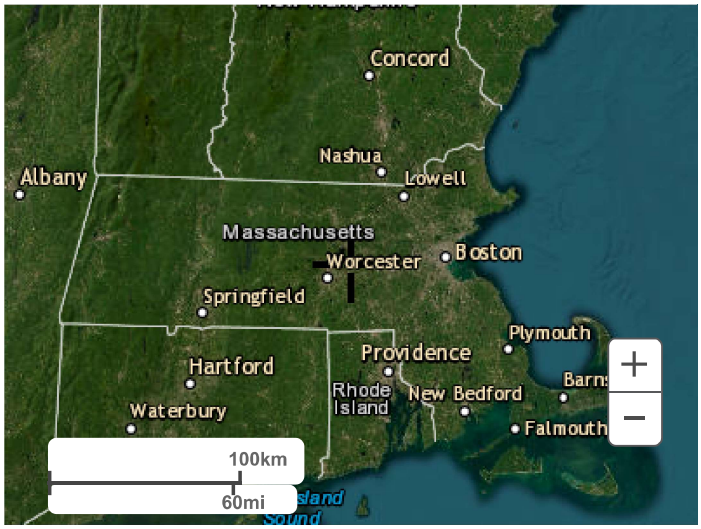
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

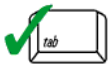
Disclaimer

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

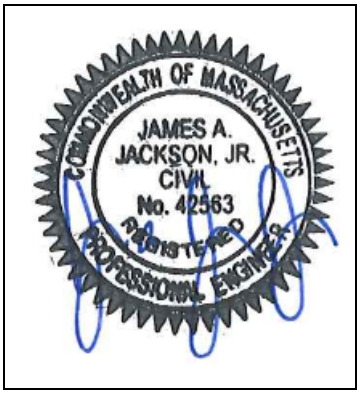
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



5/14/24

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☒ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☒ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☒ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☒ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☒ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☒ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-1**

SHEET 1 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 7:45am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-38"											
C1	38-71"			10yr 6/4	10yr 6/8 (C)				Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 71"

Depth to Groundwater or Seepage: N/A

Depth to Impervious or Limiting Layer: 71" (boulders)

Estimated Seasonal High Water Table: 298.17

Surface Elevation of Test Pit (approximate): 303

COMMENTS:

Brick @ 36", asphalt at 13"

Heavy redox @ 58"

TEST HOLE NO. **TP-1**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-2**

SHEET 2 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 8:30am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-35"											
C1	35-50"			10yr 6/3					Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S
C2	50-67"			10yr 7/1					Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 67"

Depth to Groundwater or Seepage: 67"

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 300.42

Surface Elevation of Test Pit (approximate): 306

COMMENTS:

Clay pipe @39", broken
Various fill material down to 35", fly ash as well
Ponding @ 67"

TEST HOLE NO. **TP-2**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-3**

SHEET 3 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 9:00am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-12"			10yr 4/2					Sandy Loam	Massive	Friable	5% G 5% C 0% S
Bw	12-28"			10yr 5/6					Sandy Loam	Massive	Friable	10% G 5% C 0% S
C1	28-84"			10 yr 5/3					Rocky Sandy Loam	Massive	Friable	15% G 10% C 5% S
C2	84-120"			10 yr 7/2					Loamy Sand	Massive	Friable	5% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 120"

Depth to Groundwater or Seepage: N/A

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 301

Surface Elevation of Test Pit (approximate): 311

COMMENTS:

(none)

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-4**

SHEET 4 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 1:15pm

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-55"			10yr 5/3								
C	55-72"			10yr 6/4	10yr 5/8 (C)				Find Sandy Loam	Massive	Friable	10% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 72"

Depth to Groundwater or Seepage: 72" (ponding)

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 304.08

Surface Elevation of Test Pit (approximate): 309.5

COMMENTS:

Very bouldery throughout. Brick, concrete throughout fill layer
Ponding @ 72"
Redox @ 65"

TEST HOLE NO. **TP-4**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-5**

SHEET 5 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 1:45pm

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-13"			10yr 4/2					Sandy Loam	Massive	Friable	10% G 5% C 0% S
C	13-68"			10yr 5/3	10yr 5/6 (C) 10yr 5/2 (D)				Sandy Loam	Massive	Friable	10% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 68"

Depth to Groundwater or Seepage: N/A Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 313.33 Surface Elevation of Test Pit (approximate): 319

COMMENTS:

Redox @ 21", inconsistant

TEST HOLE NO. **TP-5**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-6**

SHEET 6 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 12:45pm

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-14"			10yr 2/2					Sandy Loam	Massive	Friable	10% G 10% C 10% S
C	14-45"			10yr 5/4					Sandy Loam	Massive	Friable	10% G 10% C 10% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 45"

Depth to Groundwater or Seepage: 45"

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 306.75

Surface Elevation of Test Pit (approximate): 310.5

COMMENTS:

Ponding @ 45", steady weeping

TEST HOLE NO. **TP-6**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-7**

SHEET 7 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 11:15am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-10"			10yr 4/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C1	10-25"			10yr 2/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C2	25-53"			10yr 6/4	10yr 5/8 (c) 10yr 7/1 (D)				Sandy Loam	Massive	Friable	10% G 5% C 5% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 55"

Depth to Groundwater or Seepage: 55"

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 305

Surface Elevation of Test Pit (approximate): 308

COMMENTS:

Redox @ 36", consistant

Weeping @ 55"

TEST HOLE NO. **TP-7**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-8**

SHEET 8 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 10:30am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-10"			10yr 3/2					Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S
Bw	10-23"			10yr 5/4					Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S
C1	23-37"			10yr 2/2					Fine Sandy Loam	Massive	Friable	5% G 0% C 0% S
C2	37-69"			10yr 6/4	10yr 5/6 (C)				Fine Sandy Loam	Massive	Friable	5% G 0% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 69"

Depth to Groundwater or Seepage: 55" Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 300.42 Surface Elevation of Test Pit (approximate): 305

COMMENTS:

Weeping @ 55"

Redox @ 40", inconsistant

TEST HOLE NO. **TP-8**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-9**

SHEET 9 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 10:00am

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-39"											
C	39-66"			10yr 5/3					Fine Sandy Loam	Massive	Friable	15% G 10% C 10% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 66"

Depth to Groundwater or Seepage: 66"

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 296.5

Surface Elevation of Test Pit (approximate): 302

COMMENTS:

Asphalt pieces down to 33", many boulders throughout
Ponding @ 66"

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND

ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-10**

SHEET 10 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 2:15pm

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes ☑ No ☐

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-11"			10yr 3/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
Bw	11-23"			10yr 6/4					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C	23-84"			10yr 5/4	10yr 5/6 C 10yr 6/2 (D)				Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S

Soil Class: Merrimac / Paxton fsl

Total Depth of Test Hole: 84" (machine limit)

Depth to Groundwater or Seepage: 33"

Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 324.42

Surface Elevation of Test Pit (approximate): 327.5

COMMENTS:

Redox @ 37", around pit

Weeping @ 33", left side of pit only (slow, minor)

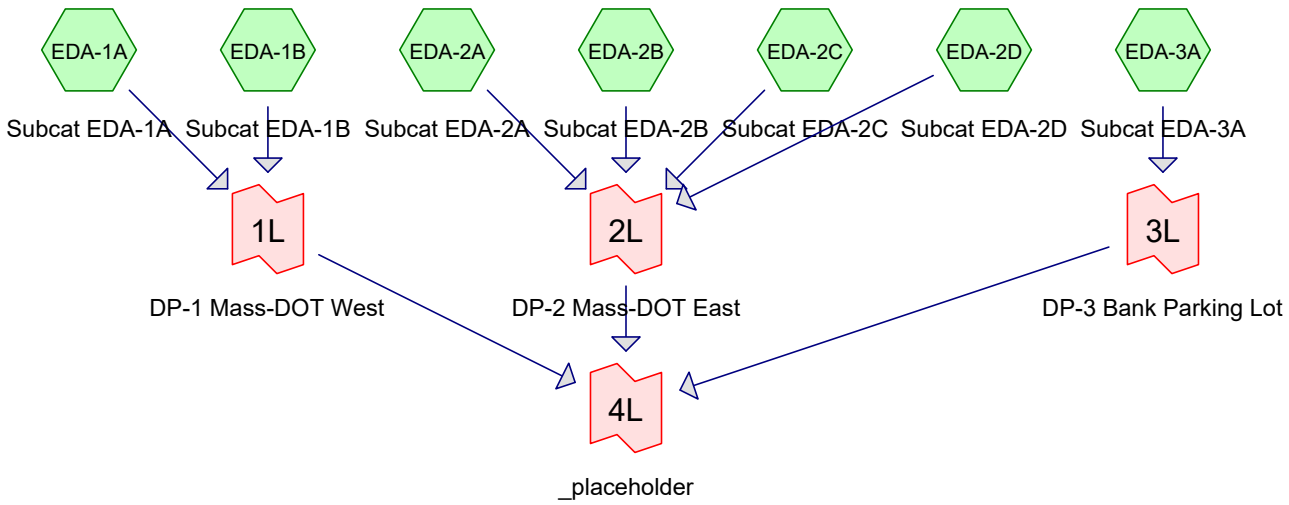
TEST HOLE NO. **TP-10**

Town of Northborough

NORTHBOROUGH FIRE STATION

APPENDIX B

Hydrologic Calculations - Existing and Proposed Conditions
Hydraulic Design Table



Subcat Reach Pond Link

Routing Diagram for Ex Hydro
Prepared by Pare Corporation, Printed 3/15/2024

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=0.37"
Tc=6.0 min CN=58 Runoff=0.05 cfs 166 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=68 Runoff=0.03 cfs 73 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=0.56"
Flow Length=582' Tc=11.7 min CN=63 Runoff=1.99 cfs 6,704 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=55 Runoff=0.07 cfs 336 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=0.78"
Flow Length=136' Tc=6.0 min CN=68 Runoff=0.63 cfs 1,436 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=96 Runoff=0.68 cfs 1,615 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=0.37"
Tc=6.0 min CN=58 Runoff=0.01 cfs 43 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.08 cfs 239 cf
Primary=0.08 cfs 239 cf

Link 2L: DP-2 Mass-DOT East Inflow=2.91 cfs 10,091 cf
Primary=2.91 cfs 10,091 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.01 cfs 43 cf
Primary=0.01 cfs 43 cf

Link 4L: _placeholder Inflow=2.99 cfs 10,373 cf
Primary=2.99 cfs 10,373 cf

Total Runoff Area = 196,431 sf Runoff Volume = 10,373 cf Average Runoff Depth = 0.63"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

Summary for Subcatchment EDA-1A: Subcat EDA-1A

Runoff = 0.05 cfs @ 12.16 hrs, Volume= 166 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,546	61	>75% Grass cover, Good, HSG B
2,838	55	Woods, Good, HSG B
5,384	58	Weighted Average
5,384	58	100.00% Pervious Area

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

Summary for Subcatchment EDA-1B: Subcat EDA-1B

Runoff = 0.03 cfs @ 12.14 hrs, Volume= 73 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
911	61	>75% Grass cover, Good, HSG B
214	98	Paved parking, HSG B
1,125	68	Weighted Average
911	61	80.98% Pervious Area
214	98	19.02% Impervious Area

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

Summary for Subcatchment EDA-2A: Subcat EDA-2A

Runoff = 1.99 cfs @ 12.23 hrs, Volume= 6,704 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
40,064	61	>75% Grass cover, Good, HSG B
14,578	98	Paved parking, HSG B
6,125	98	Roofs, HSG B
84,026	55	Woods, Good, HSG B
144,794	63	Weighted Average
124,091	57	85.70% Pervious Area
20,704	98	14.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	25	0.3600	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.28"
2.4	25	0.2800	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.28"
6.1	378	0.1693	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	74	0.0743	1.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	80	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.7	582	Total			

Summary for Subcatchment EDA-2B: Subcat EDA-2B

Runoff = 0.07 cfs @ 12.19 hrs, Volume= 336 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
14,672	55	Woods, Good, HSG B
14,672	55	100.00% Pervious Area

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

Summary for Subcatchment EDA-2C: Subcat EDA-2C

Runoff = 0.63 cfs @ 12.14 hrs, Volume= 1,436 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
12,544	61	>75% Grass cover, Good, HSG B
2,235	98	Paved parking, HSG B
2,780	98	Roofs, HSG B
4,633	55	Woods, Good, HSG B
22,192	68	Weighted Average
17,178	59	77.40% Pervious Area
5,015	98	22.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.2600	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.28"
0.6	32	0.1250	0.88		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	54	0.1204	2.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	136	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment EDA-2D: Subcat EDA-2D

Runoff = 0.68 cfs @ 12.13 hrs, Volume= 1,615 cf, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
378	61	>75% Grass cover, Good, HSG B
6,476	98	Paved parking, HSG B
6,854	96	Weighted Average
378	61	5.52% Pervious Area
6,476	98	94.48% Impervious Area

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

Summary for Subcatchment EDA-3A: Subcat EDA-3A

Runoff = 0.01 cfs @ 12.16 hrs, Volume= 43 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
760	61	>75% Grass cover, Good, HSG B
649	55	Woods, Good, HSG B
1,409	58	Weighted Average
1,409	58	100.00% Pervious Area

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

Summary for Link 1L: DP-1 Mass-DOT West

Inflow Area = 6,509 sf, 3.29% Impervious, Inflow Depth = 0.44" for 2-year Storm event
Inflow = 0.08 cfs @ 12.16 hrs, Volume= 239 cf
Primary = 0.08 cfs @ 12.16 hrs, Volume= 239 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 2L: DP-2 Mass-DOT East

Inflow Area = 188,513 sf, 17.08% Impervious, Inflow Depth = 0.64" for 2-year Storm event
Inflow = 2.91 cfs @ 12.19 hrs, Volume= 10,091 cf
Primary = 2.91 cfs @ 12.19 hrs, Volume= 10,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 3L: DP-3 Bank Parking Lot

Inflow Area = 1,409 sf, 0.00% Impervious, Inflow Depth = 0.37" for 2-year Storm event
Inflow = 0.01 cfs @ 12.16 hrs, Volume= 43 cf
Primary = 0.01 cfs @ 12.16 hrs, Volume= 43 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 4L: _placeholder

Inflow Area = 196,431 sf, 16.50% Impervious, Inflow Depth = 0.63" for 2-year Storm event
Inflow = 2.99 cfs @ 12.19 hrs, Volume= 10,373 cf
Primary = 2.99 cfs @ 12.19 hrs, Volume= 10,373 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=58 Runoff=0.23 cfs 529 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=1.89"
Tc=6.0 min CN=68 Runoff=0.08 cfs 178 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=1.52"
Flow Length=582' Tc=11.7 min CN=63 Runoff=6.65 cfs 18,359 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=55 Runoff=0.51 cfs 1,210 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=1.89"
Flow Length=136' Tc=6.0 min CN=68 Runoff=1.64 cfs 3,502 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=4.55"
Tc=6.0 min CN=96 Runoff=1.06 cfs 2,600 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=58 Runoff=0.06 cfs 139 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.32 cfs 707 cf
Primary=0.32 cfs 707 cf

Link 2L: DP-2 Mass-DOT East Inflow=8.92 cfs 25,672 cf
Primary=8.92 cfs 25,672 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.06 cfs 139 cf
Primary=0.06 cfs 139 cf

Link 4L: _placeholder Inflow=9.37 cfs 26,518 cf
Primary=9.37 cfs 26,518 cf

Total Runoff Area = 196,431 sf Runoff Volume = 26,518 cf Average Runoff Depth = 1.62"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=58 Runoff=0.37 cfs 816 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=68 Runoff=0.12 cfs 253 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=2.25"
Flow Length=582' Tc=11.7 min CN=63 Runoff=10.09 cfs 27,108 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=1.58"
Tc=6.0 min CN=55 Runoff=0.86 cfs 1,926 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=2.70"
Flow Length=136' Tc=6.0 min CN=68 Runoff=2.34 cfs 4,989 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=5.63"
Tc=6.0 min CN=96 Runoff=1.29 cfs 3,214 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=58 Runoff=0.10 cfs 214 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.49 cfs 1,069 cf
Primary=0.49 cfs 1,069 cf

Link 2L: DP-2 Mass-DOT East Inflow=13.49 cfs 37,237 cf
Primary=13.49 cfs 37,237 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.10 cfs 214 cf
Primary=0.10 cfs 214 cf

Link 4L: _placeholder Inflow=14.03 cfs 38,520 cf
Primary=14.03 cfs 38,520 cf

Total Runoff Area = 196,431 sf Runoff Volume = 38,520 cf Average Runoff Depth = 2.35"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=58 Runoff=0.62 cfs 1,322 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=68 Runoff=0.18 cfs 379 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=3.49"
Flow Length=582' Tc=11.7 min CN=63 Runoff=15.89 cfs 42,096 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=55 Runoff=1.49 cfs 3,213 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=4.04"
Flow Length=136' Tc=6.0 min CN=68 Runoff=3.49 cfs 7,477 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=7.29"
Tc=6.0 min CN=96 Runoff=1.66 cfs 4,165 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=58 Runoff=0.16 cfs 346 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.79 cfs 1,701 cf
Primary=0.79 cfs 1,701 cf

Link 2L: DP-2 Mass-DOT East Inflow=21.00 cfs 56,950 cf
Primary=21.00 cfs 56,950 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.16 cfs 346 cf
Primary=0.16 cfs 346 cf

Link 4L: _placeholder Inflow=21.87 cfs 58,998 cf
Primary=21.87 cfs 58,998 cf

Total Runoff Area = 196,431 sf Runoff Volume = 58,998 cf Average Runoff Depth = 3.60"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=58/0 Runoff=0.00 cfs 0 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=0.19"
Tc=6.0 min CN=61/98 Runoff=0.01 cfs 18 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=0.14"
Flow Length=582' Tc=11.7 min CN=57/98 Runoff=0.60 cfs 1,701 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=55/0 Runoff=0.00 cfs 0 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=0.22"
Flow Length=136' Tc=6.0 min CN=59/98 Runoff=0.18 cfs 412 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=0.93"
Tc=6.0 min CN=61/98 Runoff=0.23 cfs 532 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=58/0 Runoff=0.00 cfs 0 cf

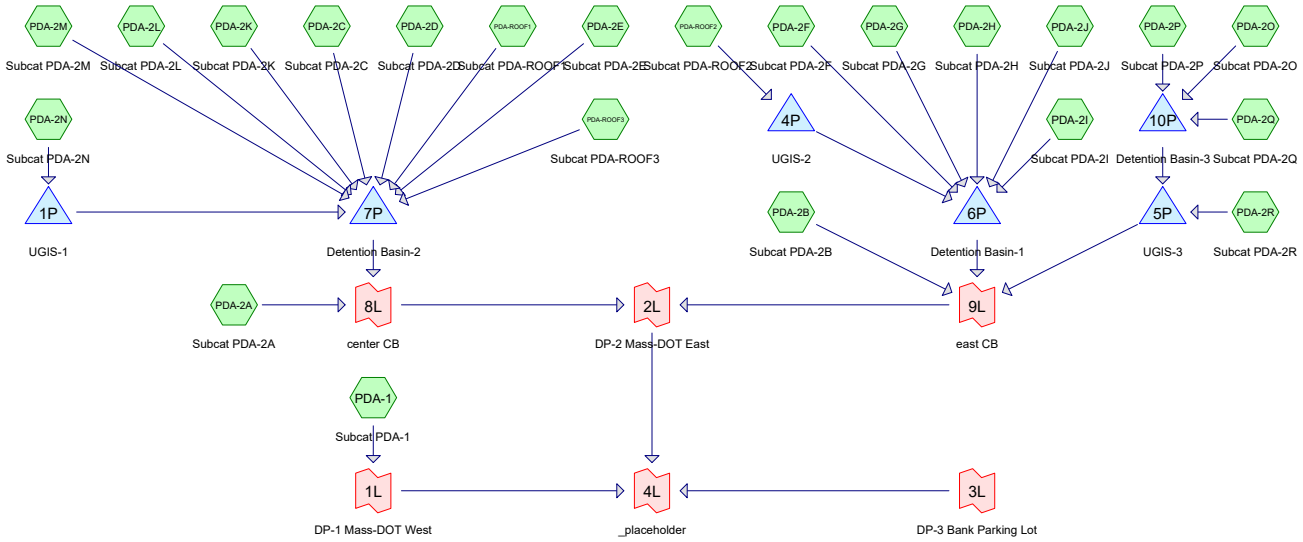
Link 1L: DP-1 Mass-DOT West Inflow=0.01 cfs 18 cf
Primary=0.01 cfs 18 cf

Link 2L: DP-2 Mass-DOT East Inflow=0.95 cfs 2,644 cf
Primary=0.95 cfs 2,644 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=0.96 cfs 2,662 cf
Primary=0.96 cfs 2,662 cf

Total Runoff Area = 196,431 sf Runoff Volume = 2,662 cf Average Runoff Depth = 0.16"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf



Subcat Reach Pond Link

Routing Diagram for Pro Hydro
Prepared by Pare Corporation, Printed 3/15/2024

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment PDA-1: Subcat PDA-1 Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=83 Runoff=0.07 cfs 159 cf

Subcatchment PDA-2A: Subcat PDA-2A Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=83 Runoff=0.21 cfs 446 cf

Subcatchment PDA-2B: Subcat PDA-2B Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=94 Runoff=0.16 cfs 378 cf

Subcatchment PDA-2C: Subcat PDA-2C Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=1.03"
Tc=6.0 min CN=73 Runoff=0.24 cfs 512 cf

Subcatchment PDA-2D: Subcat PDA-2D Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=0.68"
Tc=6.0 min CN=66 Runoff=0.06 cfs 133 cf

Subcatchment PDA-2E: Subcat PDA-2E Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=98 Runoff=0.34 cfs 846 cf

Subcatchment PDA-2F: Subcat PDA-2F Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=94 Runoff=0.39 cfs 890 cf

Subcatchment PDA-2G: Subcat PDA-2G Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=85 Runoff=0.23 cfs 485 cf

Subcatchment PDA-2H: Subcat PDA-2H Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=94 Runoff=0.34 cfs 791 cf

Subcatchment PDA-2I: Subcat PDA-2I Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=61 Runoff=0.04 cfs 119 cf

Subcatchment PDA-2J: Subcat PDA-2J Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=2.62"
Tc=6.0 min CN=94 Runoff=1.40 cfs 3,242 cf

Subcatchment PDA-2K: Subcat PDA-2K Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=0.60"
Tc=6.0 min CN=64 Runoff=0.11 cfs 263 cf

Subcatchment PDA-2L: Subcat PDA-2L Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=2.52"
Tc=6.0 min CN=93 Runoff=1.24 cfs 2,816 cf

Subcatchment PDA-2M: Subcat PDA-2M Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=85 Runoff=0.53 cfs 1,142 cf

Subcatchment PDA-2N: Subcat PDA-2N Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=61 Runoff=0.07 cfs 185 cf

Subcatchment PDA-2O: Subcat PDA-2O Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=0.31"
Flow Length=391' Tc=9.3 min CN=56 Runoff=0.31 cfs 1,505 cf

Subcatchment PDA-2P: Subcat PDA-2P Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=55 Runoff=0.07 cfs 336 cf

Subcatchment PDA-2Q: Subcat PDA-2Q Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=68 Runoff=0.63 cfs 1,436 cf

Subcatchment PDA-2R: Subcat PDA-2R Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=61 Runoff=0.02 cfs 63 cf

Subcatchment PDA-ROOF1: Subcat Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=98 Runoff=0.72 cfs 1,794 cf

Subcatchment PDA-ROOF2: Subcat Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=98 Runoff=1.21 cfs 3,019 cf

Subcatchment PDA-ROOF3: Subcat Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=98 Runoff=0.27 cfs 665 cf

Pond 1P: UGIS-1 Peak Elev=299.17' Storage=41 cf Inflow=0.07 cfs 185 cf
Discarded=0.02 cfs 185 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 185 cf

Pond 4P: UGIS-2 Peak Elev=300.15' Storage=255 cf Inflow=1.21 cfs 3,019 cf
Discarded=0.01 cfs 766 cf Primary=1.17 cfs 2,252 cf Outflow=1.18 cfs 3,019 cf

Pond 5P: UGIS-3 Peak Elev=300.91' Storage=741 cf Inflow=0.61 cfs 3,354 cf
Discarded=0.04 cfs 1,987 cf Primary=0.63 cfs 1,366 cf Outflow=0.66 cfs 3,354 cf

Pond 6P: Detention Basin-1 Peak Elev=297.30' Storage=3,586 cf Inflow=3.55 cfs 7,779 cf
Outflow=1.02 cfs 7,742 cf

Pond 7P: Detention Basin-2 Peak Elev=298.23' Storage=3,303 cf Inflow=3.48 cfs 8,171 cf
Outflow=1.12 cfs 8,126 cf

Pond 10P: Detention Basin-3 Peak Elev=310.65' Storage=157 cf Inflow=0.91 cfs 3,278 cf
Outflow=0.59 cfs 3,291 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.07 cfs 159 cf
Primary=0.07 cfs 159 cf

Link 2L: DP-2 Mass-DOT East Inflow=2.77 cfs 18,058 cf
Primary=2.77 cfs 18,058 cf

Link 3L: DP-3 Bank Parking Lot
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=2.78 cfs 18,217 cf
Primary=2.78 cfs 18,217 cf

Link 8L: center CB Inflow=1.20 cfs 8,571 cf
Primary=1.20 cfs 8,571 cf

Link 9L: east CB

Inflow=1.65 cfs 9,487 cf
Primary=1.65 cfs 9,487 cf

Total Runoff Area = 196,433 sf Runoff Volume = 21,226 cf Average Runoff Depth = 1.30"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Summary for Subcatchment PDA-1: Subcat PDA-1

Runoff = 0.07 cfs @ 12.13 hrs, Volume= 159 cf, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
453	61	>75% Grass cover, Good, HSG B
689	98	Paved parking, HSG B
1,142	83	Weighted Average
453	61	39.69% Pervious Area
689	98	60.31% Impervious Area

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

Summary for Subcatchment PDA-2A: Subcat PDA-2A

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 446 cf, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,311	61	>75% Grass cover, Good, HSG B
1,883	98	Paved parking, HSG B
3,194	83	Weighted Average
1,311	61	41.04% Pervious Area
1,883	98	58.96% Impervious Area

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

Summary for Subcatchment PDA-2B: Subcat PDA-2B

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 378 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
172	61	>75% Grass cover, Good, HSG B
1,558	98	Paved parking, HSG B
1,730	94	Weighted Average
172	61	9.92% Pervious Area
1,558	98	90.08% Impervious Area

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

Summary for Subcatchment PDA-2C: Subcat PDA-2C

Runoff = 0.24 cfs @ 12.14 hrs, Volume= 512 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,030	61	>75% Grass cover, Good, HSG B
1,884	98	Paved parking, HSG B
30	98	Roofs, HSG B
5,944	73	Weighted Average
4,030	61	67.79% Pervious Area
1,914	98	32.21% Impervious Area

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

Summary for Subcatchment PDA-2D: Subcat PDA-2D

Runoff = 0.06 cfs @ 12.15 hrs, Volume= 133 cf, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,003	61	>75% Grass cover, Good, HSG B
326	98	Paved parking, HSG B
2,329	66	Weighted Average
2,003	61	85.98% Pervious Area
326	98	14.02% Impervious Area

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

Summary for Subcatchment PDA-2E: Subcat PDA-2E

Runoff = 0.34 cfs @ 12.13 hrs, Volume= 846 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
3,332	98	Paved parking, HSG B
3,332	98	100.00% Impervious Area

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

Summary for Subcatchment PDA-2F: Subcat PDA-2F

Runoff = 0.39 cfs @ 12.13 hrs, Volume= 890 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
390	61	>75% Grass cover, Good, HSG B
3,683	98	Paved parking, HSG B
4,072	94	Weighted Average
390	61	9.57% Pervious Area
3,683	98	90.43% Impervious Area

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

Summary for Subcatchment PDA-2G: Subcat PDA-2G

Runoff = 0.23 cfs @ 12.13 hrs, Volume= 485 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,112	61	>75% Grass cover, Good, HSG B
2,078	98	Paved parking, HSG B
3,190	85	Weighted Average
1,112	61	34.86% Pervious Area
2,078	98	65.14% Impervious Area

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

Summary for Subcatchment PDA-2H: Subcat PDA-2H

Runoff = 0.34 cfs @ 12.13 hrs, Volume= 791 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
384	61	>75% Grass cover, Good, HSG B
3,237	98	Paved parking, HSG B
3,620	94	Weighted Average
384	61	10.60% Pervious Area
3,237	98	89.40% Impervious Area

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

Summary for Subcatchment PDA-2l: Subcat PDA-2l

Runoff = 0.04 cfs @ 12.15 hrs, Volume= 119 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,949	61	>75% Grass cover, Good, HSG B
37	98	Paved parking, HSG B
2,986	61	Weighted Average
2,949	61	98.77% Pervious Area
37	98	1.23% Impervious Area

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

Summary for Subcatchment PDA-2J: Subcat PDA-2J

Runoff = 1.40 cfs @ 12.13 hrs, Volume= 3,242 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,539	61	>75% Grass cover, Good, HSG B
13,302	98	Paved parking, HSG B
14,841	94	Weighted Average
1,539	61	10.37% Pervious Area
13,302	98	89.63% Impervious Area

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

Summary for Subcatchment PDA-2K: Subcat PDA-2K

Runoff = 0.11 cfs @ 12.15 hrs, Volume= 263 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,848	61	>75% Grass cover, Good, HSG B
432	98	Paved parking, HSG B
3	98	Roofs, HSG B
5,283	64	Weighted Average
4,848	61	91.77% Pervious Area
435	98	8.23% Impervious Area

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

Summary for Subcatchment PDA-2L: Subcat PDA-2L

Runoff = 1.24 cfs @ 12.13 hrs, Volume= 2,816 cf, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,637	61	>75% Grass cover, Good, HSG B
11,758	98	Paved parking, HSG B
13,395	93	Weighted Average
1,637	61	12.22% Pervious Area
11,758	98	87.78% Impervious Area

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

Summary for Subcatchment PDA-2M: Subcat PDA-2M

Runoff = 0.53 cfs @ 12.13 hrs, Volume= 1,142 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,605	61	>75% Grass cover, Good, HSG B
4,889	98	Paved parking, HSG B
9	55	Woods, Good, HSG B
7,503	85	Weighted Average
2,614	61	34.84% Pervious Area
4,889	98	65.16% Impervious Area

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

Summary for Subcatchment PDA-2N: Subcat PDA-2N

Runoff = 0.07 cfs @ 12.15 hrs, Volume= 185 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,609	61	>75% Grass cover, Good, HSG B
52	55	Woods, Good, HSG B
4,661	61	Weighted Average
4,661	61	100.00% Pervious Area

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

Summary for Subcatchment PDA-2O: Subcat PDA-2O

Runoff = 0.31 cfs @ 12.24 hrs, Volume= 1,505 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
11,200	61	>75% Grass cover, Good, HSG B
47,992	55	Woods, Good, HSG B
59,192	56	Weighted Average
59,192	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	25	0.3600	0.19		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.28"
2.4	25	0.2800	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.28"
4.1	260	0.1769	1.05		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	81	0.1099	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.3	391	Total			

Summary for Subcatchment PDA-2P: Subcat PDA-2P

Runoff = 0.07 cfs @ 12.19 hrs, Volume= 336 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
14,672	55	Woods, Good, HSG B
14,672	55	100.00% Pervious Area

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

Summary for Subcatchment PDA-2Q: Subcat PDA-2Q

Runoff = 0.63 cfs @ 12.14 hrs, Volume= 1,436 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
12,545	61	>75% Grass cover, Good, HSG B
2,235	98	Paved parking, HSG B
2,780	98	Roofs, HSG B
4,634	55	Woods, Good, HSG B
22,194	68	Weighted Average
17,179	59	77.41% Pervious Area
5,015	98	22.59% Impervious Area

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

Summary for Subcatchment PDA-2R: Subcat PDA-2R

Runoff = 0.02 cfs @ 12.15 hrs, Volume= 63 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,575	61	>75% Grass cover, Good, HSG B
3	55	Woods, Good, HSG B
1,578	61	Weighted Average
1,578	61	100.00% Pervious Area

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

Summary for Subcatchment PDA-ROOF1: Subcat PDA-ROOF1

Runoff = 0.72 cfs @ 12.13 hrs, Volume= 1,794 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
11	61	>75% Grass cover, Good, HSG B
7,054	98	Roofs, HSG B
7,065	98	Weighted Average
11	61	0.16% Pervious Area
7,054	98	99.84% Impervious Area

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

Summary for Subcatchment PDA-ROOF2: Subcat PDA-ROOF2

Runoff = 1.21 cfs @ 12.13 hrs, Volume= 3,019 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1	61	>75% Grass cover, Good, HSG B
26	98	Paved parking, HSG B
11,860	98	Roofs, HSG B
11,888	98	Weighted Average
1	61	0.01% Pervious Area
11,886	98	99.99% Impervious Area

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

Summary for Subcatchment PDA-ROOF3: Subcat PDA-ROOF3

Runoff = 0.27 cfs @ 12.13 hrs, Volume= 665 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
24	61	>75% Grass cover, Good, HSG B
2	98	Paved parking, HSG B
2,593	98	Roofs, HSG B
2,620	98	Weighted Average
24	61	0.93% Pervious Area
2,596	98	99.07% Impervious Area

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

Summary for Pond 1P: UGIS-1

Inflow Area = 4,661 sf, 0.00% Impervious, Inflow Depth = 0.48" for 2-year Storm event
Inflow = 0.07 cfs @ 12.15 hrs, Volume= 185 cf
Outflow = 0.02 cfs @ 12.66 hrs, Volume= 185 cf, Atten= 77%, Lag= 30.1 min
Discarded = 0.02 cfs @ 12.66 hrs, Volume= 185 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 299.17' @ 12.66 hrs Surf.Area= 617 sf Storage= 41 cf

Plug-Flow detention time= 19.7 min calculated for 185 cf (100% of inflow)
Center-of-Mass det. time= 19.7 min (891.6 - 871.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	299.00'	396 cf	**61.67'W x 10.00'L x 2.04'H Field A** 1,259 cf Overall - 268 cf Embedded = 991 cf x 40.0% Voids
#2A	299.50'	268 cf	**Cultec C-100HD** x 18 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 18 rows
		664 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	299.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 296.50' Phase-In= 0.01'
#2	Primary	299.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 299.50' / 299.25' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	300.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 12.66 hrs HW=299.17' (Free Discharge)
↑└**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=299.00' TW=297.50' (Dynamic Tailwater)
↑└**2=Culvert** (Controls 0.00 cfs)
↑└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: UGIS-1 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 18 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

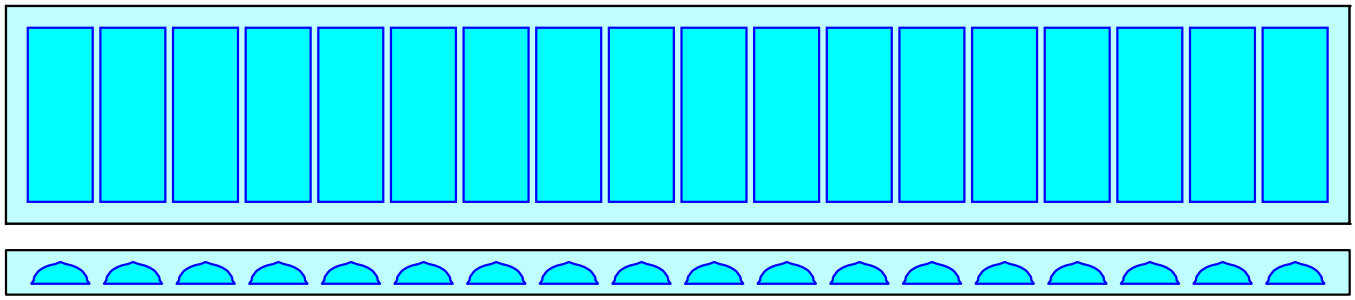
1 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
18 Rows x 36.0" Wide + 4.0" Spacing x 17 + 12.0" Side Stone x 2 = 61.67' Base Width
6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

18 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 18 Rows = 268.1 cf Chamber Storage

1,259.0 cf Field - 268.1 cf Chambers = 991.0 cf Stone x 40.0% Voids = 396.4 cf Stone Storage

Chamber Storage + Stone Storage = 664.4 cf = 0.015 af
Overall Storage Efficiency = 52.8%
Overall System Size = 10.00' x 61.67' x 2.04'

18 Chambers
46.6 cy Field
36.7 cy Stone



Stage-Discharge for Pond 1P: UGIS-1

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
299.00	0.00	0.00	0.00
299.05	0.01	0.01	0.00
299.10	0.02	0.02	0.00
299.15	0.02	0.02	0.00
299.20	0.02	0.02	0.00
299.25	0.02	0.02	0.00
299.30	0.02	0.02	0.00
299.35	0.02	0.02	0.00
299.40	0.02	0.02	0.00
299.45	0.02	0.02	0.00
299.50	0.02	0.02	0.00
299.55	0.02	0.02	0.00
299.60	0.02	0.02	0.00
299.65	0.02	0.02	0.00
299.70	0.02	0.02	0.00
299.75	0.02	0.02	0.00
299.80	0.02	0.02	0.00
299.85	0.02	0.02	0.00
299.90	0.02	0.02	0.00
299.95	0.02	0.02	0.00
300.00	0.02	0.02	0.00
300.05	0.02	0.02	0.00
300.10	0.02	0.02	0.00
300.15	0.02	0.02	0.00
300.20	0.02	0.02	0.00
300.25	0.02	0.02	0.00
300.30	0.02	0.02	0.00
300.35	0.02	0.02	0.00
300.40	0.02	0.02	0.00
300.45	0.02	0.02	0.00
300.50	0.02	0.02	0.00
300.55	0.21	0.02	0.18
300.60	0.54	0.02	0.51
300.65	0.97	0.02	0.94
300.70	1.48	0.02	1.45
300.75	2.05	0.02	2.02
300.80	2.65	0.03	2.62
300.85	2.65	0.03	2.62
300.90	2.75	0.03	2.73
300.95	2.86	0.03	2.83
301.00	**2.96**	**0.03**	**2.93**

Stage-Area-Storage for Pond 1P: UGIS-1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
299.00	**617**	0
299.05	617	12
299.10	617	25
299.15	617	37
299.20	617	49
299.25	617	62
299.30	617	74
299.35	617	86
299.40	617	99
299.45	617	111
299.50	617	123
299.55	617	147
299.60	617	170
299.65	617	194
299.70	617	216
299.75	617	239
299.80	617	262
299.85	617	285
299.90	617	307
299.95	617	329
300.00	617	351
300.05	617	372
300.10	617	393
300.15	617	414
300.20	617	434
300.25	617	453
300.30	617	471
300.35	617	488
300.40	617	504
300.45	617	518
300.50	617	531
300.55	617	543
300.60	617	556
300.65	617	568
300.70	617	580
300.75	617	593
300.80	617	605
300.85	617	617
300.90	617	630
300.95	617	642
301.00	617	**654**

Summary for Pond 4P: UGIS-2

Inflow Area = 11,888 sf, 99.99% Impervious, Inflow Depth = 3.05" for 2-year Storm event
Inflow = 1.21 cfs @ 12.13 hrs, Volume= 3,019 cf
Outflow = 1.18 cfs @ 12.14 hrs, Volume= 3,019 cf, Atten= 2%, Lag= 1.1 min
Discarded = 0.01 cfs @ 12.14 hrs, Volume= 766 cf
Primary = 1.17 cfs @ 12.14 hrs, Volume= 2,252 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 300.15' @ 12.14 hrs Surf.Area= 292 sf Storage= 255 cf

Plug-Flow detention time= 39.4 min calculated for 3,017 cf (100% of inflow)
Center-of-Mass det. time= 39.5 min (792.3 - 752.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	298.50'	245 cf	**11.67'W x 25.00'L x 2.54'H Field A** 741 cf Overall - 128 cf Embedded = 613 cf x 40.0% Voids
#2A	299.50'	128 cf	**Cultec C-100HD** x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	298.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 296.50' Phase-In= 0.01'
#2	Primary	299.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 299.50' / 298.75' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Primary	300.50'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 12.14 hrs HW=300.14' (Free Discharge)
└**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=1.15 cfs @ 12.14 hrs HW=300.14' TW=297.14' (Dynamic Tailwater)
├**2=Culvert** (Inlet Controls 1.15 cfs @ 2.15 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: UGIS-2 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor®100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 3 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

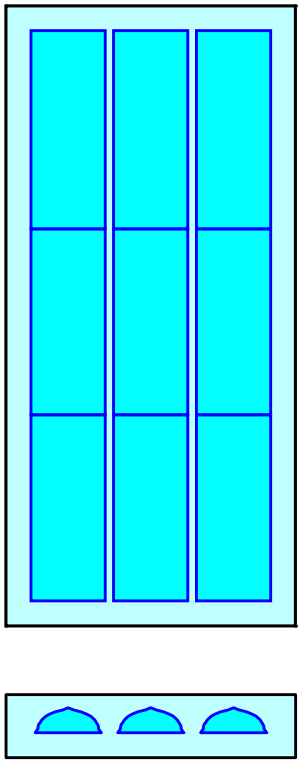
3 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 23.00' Row Length +12.0" End Stone x 2 = 25.00' Base Length
3 Rows x 36.0" Wide + 4.0" Spacing x 2 + 12.0" Side Stone x 2 = 11.67' Base Width
12.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

9 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 3 Rows = 128.4 cf Chamber Storage

741.3 cf Field - 128.4 cf Chambers = 612.9 cf Stone x 40.0% Voids = 245.2 cf Stone Storage

Chamber Storage + Stone Storage = 373.6 cf = 0.009 af
Overall Storage Efficiency = 50.4%
Overall System Size = 25.00' x 11.67' x 2.54'

9 Chambers
27.5 cy Field
22.7 cy Stone



Stage-Discharge for Pond 4P: UGIS-2

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
298.50	0.00	0.00	0.00
298.55	0.01	0.01	0.00
298.60	0.01	0.01	0.00
298.65	0.01	0.01	0.00
298.70	0.01	0.01	0.00
298.75	0.01	0.01	0.00
298.80	0.01	0.01	0.00
298.85	0.01	0.01	0.00
298.90	0.01	0.01	0.00
298.95	0.01	0.01	0.00
299.00	0.01	0.01	0.00
299.05	0.01	0.01	0.00
299.10	0.01	0.01	0.00
299.15	0.01	0.01	0.00
299.20	0.01	0.01	0.00
299.25	0.01	0.01	0.00
299.30	0.01	0.01	0.00
299.35	0.01	0.01	0.00
299.40	0.01	0.01	0.00
299.45	0.01	0.01	0.00
299.50	0.01	0.01	0.00
299.55	0.02	0.01	0.01
299.60	0.05	0.01	0.03
299.65	0.09	0.01	0.08
299.70	0.15	0.01	0.13
299.75	0.22	0.01	0.21
299.80	0.30	0.01	0.29
299.85	0.40	0.01	0.39
299.90	0.51	0.01	0.50
299.95	0.63	0.01	0.62
300.00	0.76	0.01	0.75
300.05	0.89	0.01	0.88
300.10	1.04	0.01	1.02
300.15	1.18	0.01	1.17
300.20	1.33	0.01	1.32
300.25	1.48	0.01	1.47
300.30	1.63	0.01	1.62
300.35	1.78	0.01	1.76
300.40	1.91	0.01	1.90
300.45	2.03	0.01	2.02
300.50	2.12	0.01	2.11
300.55	2.41	0.01	2.40
300.60	2.84	0.01	2.83
300.65	3.37	0.01	3.35
300.70	3.96	0.01	3.95
300.75	4.62	0.01	4.61
300.80	5.34	0.01	5.32
300.85	6.11	0.01	6.09
300.90	6.92	0.02	6.90
300.95	7.77	0.02	7.76
301.00	**8.67**	**0.02**	**8.65**

Stage-Area-Storage for Pond 4P: UGIS-2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
298.50	**292**	0
298.55	292	6
298.60	292	12
298.65	292	17
298.70	292	23
298.75	292	29
298.80	292	35
298.85	292	41
298.90	292	47
298.95	292	52
299.00	292	58
299.05	292	64
299.10	292	70
299.15	292	76
299.20	292	82
299.25	292	88
299.30	292	93
299.35	292	99
299.40	292	105
299.45	292	111
299.50	292	117
299.55	292	128
299.60	292	139
299.65	292	150
299.70	292	161
299.75	292	172
299.80	292	183
299.85	292	193
299.90	292	204
299.95	292	215
300.00	292	225
300.05	292	235
300.10	292	245
300.15	292	255
300.20	292	264
300.25	292	273
300.30	292	282
300.35	292	290
300.40	292	298
300.45	292	304
300.50	292	310
300.55	292	316
300.60	292	322
300.65	292	328
300.70	292	334
300.75	292	340
300.80	292	345
300.85	292	351
300.90	292	357
300.95	292	363
301.00	292	**369**

Summary for Pond 5P: UGIS-3

Inflow Area = 97,637 sf, 5.14% Impervious, Inflow Depth = 0.41" for 2-year Storm event
Inflow = 0.61 cfs @ 12.30 hrs, Volume= 3,354 cf
Outflow = 0.66 cfs @ 12.47 hrs, Volume= 3,354 cf, Atten= 0%, Lag= 9.8 min
Discarded = 0.04 cfs @ 12.47 hrs, Volume= 1,987 cf
Primary = 0.63 cfs @ 12.47 hrs, Volume= 1,366 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 300.91' @ 12.47 hrs Surf.Area= 896 sf Storage= 741 cf

Plug-Flow detention time= 159.5 min calculated for 3,354 cf (100% of inflow)
Center-of-Mass det. time= 159.5 min (1,038.2 - 878.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	299.50'	574 cf	**16.00'W x 56.00'L x 2.04'H Field A** 1,829 cf Overall - 395 cf Embedded = 1,435 cf x 40.0% Voids
#2A	300.00'	395 cf	**Cultec C-100HD** x 28 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		969 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	299.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 297.50' Phase-In= 0.01'
#2	Primary	299.50'	**12.0" Round Culvert** L= 3.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 299.50' / 299.25' S= 0.0833 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	300.80'	**5.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.04 cfs @ 12.47 hrs HW=300.91' (Free Discharge)
└**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.57 cfs @ 12.47 hrs HW=300.91' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.57 cfs of 2.84 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 1.08 fps)

Pond 5P: UGIS-3 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor®100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 4 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

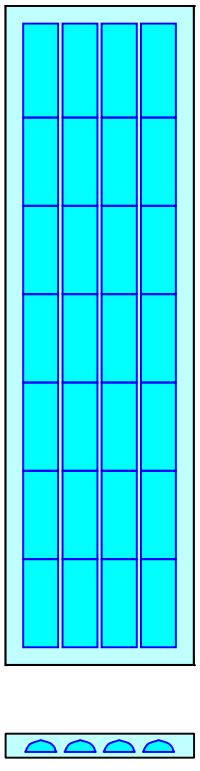
7 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 53.00' Row Length +18.0" End Stone x 2 = 56.00' Base Length
4 Rows x 36.0" Wide + 4.0" Spacing x 3 + 18.0" Side Stone x 2 = 16.00' Base Width
6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

28 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 394.6 cf Chamber Storage

1,829.3 cf Field - 394.6 cf Chambers = 1,434.7 cf Stone x 40.0% Voids = 573.9 cf Stone Storage

Chamber Storage + Stone Storage = 968.5 cf = 0.022 af
Overall Storage Efficiency = 52.9%
Overall System Size = 56.00' x 16.00' x 2.04'

28 Chambers
67.8 cy Field
53.1 cy Stone



Stage-Discharge for Pond 5P: UGIS-3

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
299.50	0.00	0.00	0.00
299.55	0.02	0.02	0.00
299.60	0.02	0.02	0.00
299.65	0.02	0.02	0.00
299.70	0.02	0.02	0.00
299.75	0.02	0.02	0.00
299.80	0.02	0.02	0.00
299.85	0.02	0.02	0.00
299.90	0.03	0.03	0.00
299.95	0.03	0.03	0.00
300.00	0.03	0.03	0.00
300.05	0.03	0.03	0.00
300.10	0.03	0.03	0.00
300.15	0.03	0.03	0.00
300.20	0.03	0.03	0.00
300.25	0.03	0.03	0.00
300.30	0.03	0.03	0.00
300.35	0.03	0.03	0.00
300.40	0.03	0.03	0.00
300.45	0.03	0.03	0.00
300.50	0.03	0.03	0.00
300.55	0.03	0.03	0.00
300.60	0.03	0.03	0.00
300.65	0.03	0.03	0.00
300.70	0.03	0.03	0.00
300.75	0.03	0.03	0.00
300.80	0.03	0.03	0.00
300.85	0.22	0.04	0.18
300.90	0.56	0.04	0.52
300.95	1.00	0.04	0.96
301.00	1.52	0.04	1.49
301.05	2.12	0.04	2.09
301.10	2.79	0.04	2.75
301.15	3.24	0.04	3.20
301.20	3.31	0.04	3.27
301.25	3.38	0.04	3.34
301.30	3.44	0.04	3.40
301.35	3.51	0.04	3.47
301.40	3.57	0.04	3.53
301.45	3.64	0.04	3.60
301.50	3.70	0.04	3.66
301.55	3.76	0.04	3.72
301.60	3.82	0.04	3.78
301.65	3.88	0.04	3.83
301.70	3.94	0.04	3.89
301.75	3.99	0.04	3.95
301.80	**4.05**	**0.05**	**4.01**

Stage-Area-Storage for Pond 5P: UGIS-3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
299.50	**896**	0
299.55	896	18
299.60	896	36
299.65	896	54
299.70	896	72
299.75	896	90
299.80	896	108
299.85	896	125
299.90	896	143
299.95	896	161
300.00	896	179
300.05	896	214
300.10	896	248
300.15	896	282
300.20	896	315
300.25	896	349
300.30	896	382
300.35	896	415
300.40	896	448
300.45	896	480
300.50	896	512
300.55	896	543
300.60	896	574
300.65	896	604
300.70	896	633
300.75	896	661
300.80	896	687
300.85	896	712
300.90	896	735
300.95	896	756
301.00	896	774
301.05	896	792
301.10	896	810
301.15	896	828
301.20	896	846
301.25	896	864
301.30	896	882
301.35	896	900
301.40	896	918
301.45	896	936
301.50	896	954
301.55	896	**969**
301.60	896	969
301.65	896	969
301.70	896	969
301.75	896	969
301.80	896	969

Summary for Pond 6P: Detention Basin-1

Inflow Area = 40,597 sf, 84.30% Impervious, Inflow Depth = 2.30" for 2-year Storm event
Inflow = 3.55 cfs @ 12.13 hrs, Volume= 7,779 cf
Outflow = 1.02 cfs @ 12.35 hrs, Volume= 7,742 cf, Atten= 71%, Lag= 12.7 min
Primary = 1.02 cfs @ 12.35 hrs, Volume= 7,742 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 297.30' @ 12.35 hrs Surf.Area= 5,278 sf Storage= 3,586 cf

Plug-Flow detention time= 121.9 min calculated for 7,737 cf (99% of inflow)
Center-of-Mass det. time= 120.6 min (890.4 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	296.50'	0 cf	**41.38'W x 127.56'L x 2.67'H Field A** 14,074 cf Overall - 14,074 cf Embedded = 0 cf x 40.0% Voids
#2A	296.50'	8,991 cf	**StormTrap ST1 SingleTrap 2-0** x 54 Inside #1 Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf 54 Chambers in 6 Rows 41.38' x 126.56' Core + 0.00' x 0.50' Border = 41.38' x 127.56' System
		8,991 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	296.50'	**12.0" Round Culvert** L= 34.8' Ke= 0.900 Inlet / Outlet Invert= 296.50' / 296.30' S= 0.0057 '/' Cc= 0.900 n= 0.009, Flow Area= 0.79 sf
#2	Device 1	296.50'	**5.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	296.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	298.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.02 cfs @ 12.35 hrs HW=297.30' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.02 cfs of 1.61 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.50 cfs @ 3.70 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.52 cfs @ 2.63 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Detention Basin-1 - Chamber Wizard Field A

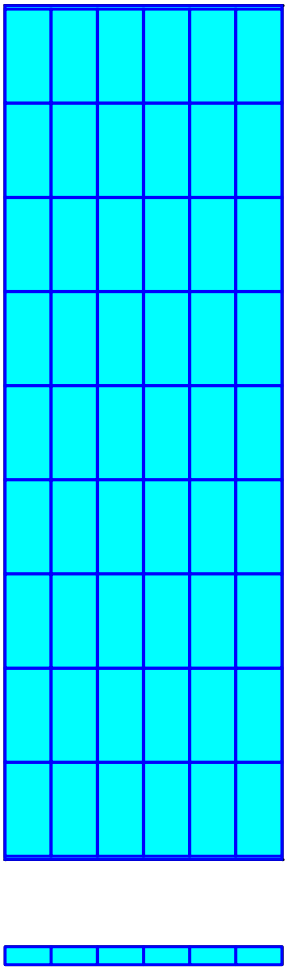
Chamber Model = StormTrap ST1 SingleTrap 2-0 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf
Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf

9 Chambers/Row x 14.06' Long = 126.56' Row Length +6.0" Border x 2 = 127.56' Base Length
6 Rows x 82.7" Wide = 41.38' Base Width
32.0" Chamber Height = 2.67' Field Height

54 Chambers x 166.5 cf = 8,991.0 cf Chamber Storage
54 Chambers x 258.6 cf + 110.3 cf Border = 14,074.4 cf Displacement

Chamber Storage = 8,991.0 cf = 0.206 af
Overall Storage Efficiency = 63.9%
Overall System Size = 127.56' x 41.38' x 2.67'

54 Chambers (plus border)
521.3 cy Field



Stage-Discharge for Pond 6P: Detention Basin-1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
296.50	0.00	297.52	1.27	298.54	3.70
296.52	0.00	297.54	1.29	298.56	3.73
296.54	0.00	297.56	1.31	298.58	3.75
296.56	0.01	297.58	1.33	298.60	3.78
296.58	0.02	297.60	1.35	298.62	3.80
296.60	0.03	297.62	1.37	298.64	3.82
296.62	0.04	297.64	1.39	298.66	3.85
296.64	0.05	297.66	1.41	298.68	3.87
296.66	0.07	297.68	1.43	298.70	3.89
296.68	0.08	297.70	1.44	298.72	3.92
296.70	0.10	297.72	1.46	298.74	3.94
296.72	0.12	297.74	1.48	298.76	3.96
296.74	0.14	297.76	1.50	298.78	3.98
296.76	0.16	297.78	1.51	298.80	4.01
296.78	0.18	297.80	1.53	298.82	4.03
296.80	0.20	297.82	1.55	298.84	4.05
296.82	0.23	297.84	1.56	298.86	4.07
296.84	0.26	297.86	1.58	298.88	4.09
296.86	0.29	297.88	1.60	298.90	4.12
296.88	0.32	297.90	1.61	298.92	4.14
296.90	0.36	297.92	1.63	298.94	4.16
296.92	0.38	297.94	1.65	298.96	4.18
296.94	0.42	297.96	1.66	298.98	4.20
296.96	0.45	297.98	1.68	299.00	4.22
296.98	0.49	298.00	1.69	299.02	4.24
297.00	0.52	298.02	1.71	299.04	4.26
297.02	0.56	298.04	1.72	299.06	4.29
297.04	0.59	298.06	1.74	299.08	4.31
297.06	0.63	298.08	1.75	299.10	4.33
297.08	0.67	298.10	1.77	299.12	4.35
297.10	0.71	298.12	1.78	299.14	4.37
297.12	0.74	298.14	1.79	299.16	**4.39**
297.14	0.78	298.16	1.81		
297.16	0.82	298.18	1.82		
297.18	0.85	298.20	1.84		
297.20	0.89	298.22	1.85		
297.22	0.92	298.24	1.87		
297.24	0.94	298.26	1.90		
297.26	0.97	298.28	1.98		
297.28	1.00	298.30	2.09		
297.30	1.02	298.32	2.22		
297.32	1.05	298.34	2.37		
297.34	1.07	298.36	2.54		
297.36	1.10	298.38	2.72		
297.38	1.12	298.40	2.92		
297.40	1.14	298.42	3.12		
297.42	1.17	298.44	3.34		
297.44	1.19	298.46	3.57		
297.46	1.21	298.48	3.63		
297.48	1.23	298.50	3.66		
297.50	1.25	298.52	3.68		

Stage-Area-Storage for Pond 6P: Detention Basin-1

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
296.50	0	297.52	4,585	298.54	8,991
296.52	90	297.54	4,675	298.56	8,991
296.54	180	297.56	4,765	298.58	8,991
296.56	270	297.58	4,855	298.60	8,991
296.58	360	297.60	4,945	298.62	8,991
296.60	450	297.62	5,035	298.64	8,991
296.62	539	297.64	5,125	298.66	8,991
296.64	629	297.66	5,215	298.68	8,991
296.66	719	297.68	5,305	298.70	8,991
296.68	809	297.70	5,395	298.72	8,991
296.70	899	297.72	5,485	298.74	8,991
296.72	989	297.74	5,574	298.76	8,991
296.74	1,079	297.76	5,664	298.78	8,991
296.76	1,169	297.78	5,754	298.80	8,991
296.78	1,259	297.80	5,844	298.82	8,991
296.80	1,349	297.82	5,934	298.84	8,991
296.82	1,439	297.84	6,024	298.86	8,991
296.84	1,528	297.86	6,114	298.88	8,991
296.86	1,618	297.88	6,204	298.90	8,991
296.88	1,708	297.90	6,294	298.92	8,991
296.90	1,798	297.92	6,384	298.94	8,991
296.92	1,888	297.94	6,474	298.96	8,991
296.94	1,978	297.96	6,563	298.98	8,991
296.96	2,068	297.98	6,653	299.00	8,991
296.98	2,158	298.00	6,743	299.02	8,991
297.00	2,248	298.02	6,833	299.04	8,991
297.02	2,338	298.04	6,923	299.06	8,991
297.04	2,428	298.06	7,013	299.08	8,991
297.06	2,517	298.08	7,103	299.10	8,991
297.08	2,607	298.10	7,193	299.12	8,991
297.10	2,697	298.12	7,283	299.14	8,991
297.12	2,787	298.14	7,373	299.16	**8,991**
297.14	2,877	298.16	7,463		
297.16	2,967	298.18	7,552		
297.18	3,057	298.20	7,642		
297.20	3,147	298.22	7,732		
297.22	3,237	298.24	7,822		
297.24	3,327	298.26	7,912		
297.26	3,417	298.28	8,002		
297.28	3,506	298.30	8,092		
297.30	3,596	298.32	8,182		
297.32	3,686	298.34	8,272		
297.34	3,776	298.36	8,362		
297.36	3,866	298.38	8,452		
297.38	3,956	298.40	8,541		
297.40	4,046	298.42	8,631		
297.42	4,136	298.44	8,721		
297.44	4,226	298.46	8,811		
297.46	4,316	298.48	8,901		
297.48	4,406	298.50	8,991		
297.50	4,496	298.52	8,991		

Summary for Pond 7P: Detention Basin-2

Inflow Area = 52,134 sf, 61.96% Impervious, Inflow Depth = 1.88" for 2-year Storm event
Inflow = 3.48 cfs @ 12.13 hrs, Volume= 8,171 cf
Outflow = 1.12 cfs @ 12.32 hrs, Volume= 8,126 cf, Atten= 68%, Lag= 11.1 min
Primary = 1.12 cfs @ 12.32 hrs, Volume= 8,126 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 298.23' @ 12.32 hrs Surf.Area= 5,278 sf Storage= 3,303 cf

Plug-Flow detention time= 119.6 min calculated for 8,126 cf (99% of inflow)
Center-of-Mass det. time= 116.0 min (895.8 - 779.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	297.50'	0 cf	**41.38'W x 127.56'L x 2.67'H Field A** 14,074 cf Overall - 14,074 cf Embedded = 0 cf x 40.0% Voids
#2A	297.50'	8,991 cf	**StormTrap ST1 SingleTrap 2-0** x 54 Inside #1 Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf 54 Chambers in 6 Rows 41.38' x 126.56' Core + 0.00' x 0.50' Border = 41.38' x 127.56' System
		8,991 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	297.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 297.50' / 297.25' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	299.20'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	297.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	297.75'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.12 cfs @ 12.32 hrs HW=298.23' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.12 cfs of 1.28 cfs potential flow)
  ├─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 0.66 cfs @ 3.35 fps)
  └─**4=Orifice/Grate** (Orifice Controls 0.46 cfs @ 2.37 fps)

Pond 7P: Detention Basin-2 - Chamber Wizard Field A

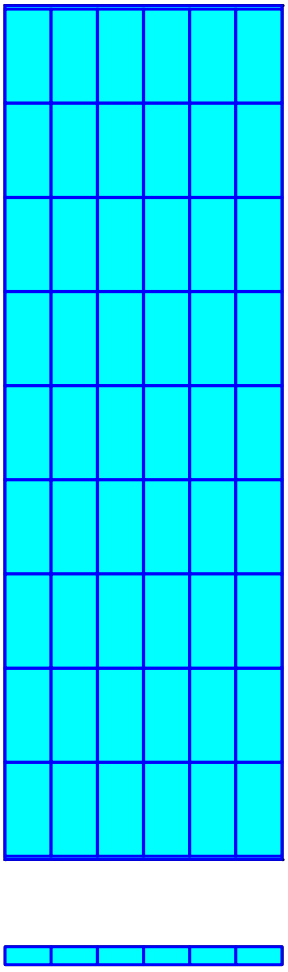
Chamber Model = StormTrap ST1 SingleTrap 2-0 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf
Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf

9 Chambers/Row x 14.06' Long = 126.56' Row Length +6.0" Border x 2 = 127.56' Base Length
6 Rows x 82.7" Wide = 41.38' Base Width
32.0" Chamber Height = 2.67' Field Height

54 Chambers x 166.5 cf = 8,991.0 cf Chamber Storage
54 Chambers x 258.6 cf + 110.3 cf Border = 14,074.4 cf Displacement

Chamber Storage = 8,991.0 cf = 0.206 af
Overall Storage Efficiency = 63.9%
Overall System Size = 127.56' x 41.38' x 2.67'

54 Chambers (plus border)
521.3 cy Field



Stage-Discharge for Pond 7P: Detention Basin-2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
297.50	0.00	298.52	1.51	299.54	3.70
297.52	0.00	298.54	1.54	299.56	3.73
297.54	0.00	298.56	1.56	299.58	3.75
297.56	0.01	298.58	1.58	299.60	3.78
297.58	0.02	298.60	1.60	299.62	3.80
297.60	0.03	298.62	1.63	299.64	3.82
297.62	0.04	298.64	1.65	299.66	3.85
297.64	0.06	298.66	1.67	299.68	3.87
297.66	0.07	298.68	1.69	299.70	3.89
297.68	0.09	298.70	1.71	299.72	3.92
297.70	0.11	298.72	1.73	299.74	3.94
297.72	0.13	298.74	1.75	299.76	3.96
297.74	0.16	298.76	1.77	299.78	3.98
297.76	0.18	298.78	1.79	299.80	4.01
297.78	0.21	298.80	1.81	299.82	4.03
297.80	0.24	298.82	1.83	299.84	4.05
297.82	0.27	298.84	1.85	299.86	4.07
297.84	0.31	298.86	1.87	299.88	4.09
297.86	0.35	298.88	1.89	299.90	4.12
297.88	0.39	298.90	1.91	299.92	4.14
297.90	0.43	298.92	1.93	299.94	4.16
297.92	0.47	298.94	1.95	299.96	4.18
297.94	0.51	298.96	1.97	299.98	4.20
297.96	0.56	298.98	1.98	300.00	4.22
297.98	0.60	299.00	2.00	300.02	4.24
298.00	0.64	299.02	2.02	300.04	4.26
298.02	0.68	299.04	2.04	300.06	4.29
298.04	0.73	299.06	2.06	300.08	4.31
298.06	0.77	299.08	2.07	300.10	4.33
298.08	0.81	299.10	2.09	300.12	4.35
298.10	0.86	299.12	2.11	300.14	4.37
298.12	0.90	299.14	2.12	300.16	**4.39**
298.14	0.94	299.16	2.14		
298.16	0.98	299.18	2.16		
298.18	1.02	299.20	2.17		
298.20	1.06	299.22	2.24		
298.22	1.10	299.24	2.34		
298.24	1.13	299.26	2.46		
298.26	1.16	299.28	2.61		
298.28	1.19	299.30	2.77		
298.30	1.22	299.32	2.95		
298.32	1.25	299.34	3.14		
298.34	1.28	299.36	3.34		
298.36	1.31	299.38	3.51		
298.38	1.33	299.40	3.53		
298.40	1.36	299.42	3.56		
298.42	1.39	299.44	3.58		
298.44	1.41	299.46	3.61		
298.46	1.44	299.48	3.63		
298.48	1.46	299.50	3.66		
298.50	1.49	299.52	3.68		

Stage-Area-Storage for Pond 7P: Detention Basin-2

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
297.50	0	298.52	4,585	299.54	8,991
297.52	90	298.54	4,675	299.56	8,991
297.54	180	298.56	4,765	299.58	8,991
297.56	270	298.58	4,855	299.60	8,991
297.58	360	298.60	4,945	299.62	8,991
297.60	450	298.62	5,035	299.64	8,991
297.62	539	298.64	5,125	299.66	8,991
297.64	629	298.66	5,215	299.68	8,991
297.66	719	298.68	5,305	299.70	8,991
297.68	809	298.70	5,395	299.72	8,991
297.70	899	298.72	5,485	299.74	8,991
297.72	989	298.74	5,574	299.76	8,991
297.74	1,079	298.76	5,664	299.78	8,991
297.76	1,169	298.78	5,754	299.80	8,991
297.78	1,259	298.80	5,844	299.82	8,991
297.80	1,349	298.82	5,934	299.84	8,991
297.82	1,439	298.84	6,024	299.86	8,991
297.84	1,528	298.86	6,114	299.88	8,991
297.86	1,618	298.88	6,204	299.90	8,991
297.88	1,708	298.90	6,294	299.92	8,991
297.90	1,798	298.92	6,384	299.94	8,991
297.92	1,888	298.94	6,474	299.96	8,991
297.94	1,978	298.96	6,563	299.98	8,991
297.96	2,068	298.98	6,653	300.00	8,991
297.98	2,158	299.00	6,743	300.02	8,991
298.00	2,248	299.02	6,833	300.04	8,991
298.02	2,338	299.04	6,923	300.06	8,991
298.04	2,428	299.06	7,013	300.08	8,991
298.06	2,517	299.08	7,103	300.10	8,991
298.08	2,607	299.10	7,193	300.12	8,991
298.10	2,697	299.12	7,283	300.14	8,991
298.12	2,787	299.14	7,373	300.16	**8,991**
298.14	2,877	299.16	7,463		
298.16	2,967	299.18	7,552		
298.18	3,057	299.20	7,642		
298.20	3,147	299.22	7,732		
298.22	3,237	299.24	7,822		
298.24	3,327	299.26	7,912		
298.26	3,417	299.28	8,002		
298.28	3,506	299.30	8,092		
298.30	3,596	299.32	8,182		
298.32	3,686	299.34	8,272		
298.34	3,776	299.36	8,362		
298.36	3,866	299.38	8,452		
298.38	3,956	299.40	8,541		
298.40	4,046	299.42	8,631		
298.42	4,136	299.44	8,721		
298.44	4,226	299.46	8,811		
298.46	4,316	299.48	8,901		
298.48	4,406	299.50	8,991		
298.50	4,496	299.52	8,991		

Summary for Pond 10P: Detention Basin-3

Inflow Area = 96,059 sf, 5.22% Impervious, Inflow Depth = 0.41" for 2-year Storm event
Inflow = 0.91 cfs @ 12.17 hrs, Volume= 3,278 cf
Outflow = 0.59 cfs @ 12.31 hrs, Volume= 3,291 cf, Atten= 34%, Lag= 8.6 min
Primary = 0.59 cfs @ 12.31 hrs, Volume= 3,291 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 310.65' @ 12.31 hrs Surf.Area= 1,191 sf Storage= 157 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.4 min (878.9 - 877.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	310.00'	0 cf	**20.69'W x 57.58'L x 8.17'H Field A** 9,729 cf Overall - 9,729 cf Embedded = 0 cf x 40.0% Voids
#2A	310.00'	7,512 cf	**StormTrap ST1 DoubleTrap 7-0** x 12 Inside #1 Inside= 82.7"W x 84.0"H => 44.52 sf x 14.06'L = 626.0 cf Outside= 82.7"W x 98.0"H => 56.32 sf x 14.06'L = 791.9 cf 3 Rows adjusted for 406.0 cf perimeter wall 20.69' x 56.25' Core + 0.00' x 0.67' Border = 20.69' x 57.58' System
		7,512 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	310.00'	**12.0" Round Culvert** L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 310.00' / 300.00' S= 0.0500 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	310.00'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	313.35'	**5.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	316.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 Width (feet) 5.00 5.00

Primary OutFlow Max=0.59 cfs @ 12.31 hrs HW=310.64' TW=300.56' (Dynamic Tailwater)
↑**1=Culvert** (Passes 0.59 cfs of 1.16 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.59 cfs @ 3.03 fps)
3=Orifice/Grate (Controls 0.00 cfs)
4=Custom Weir/Orifice (Controls 0.00 cfs)

Pond 10P: Detention Basin-3 - Chamber Wizard Field A

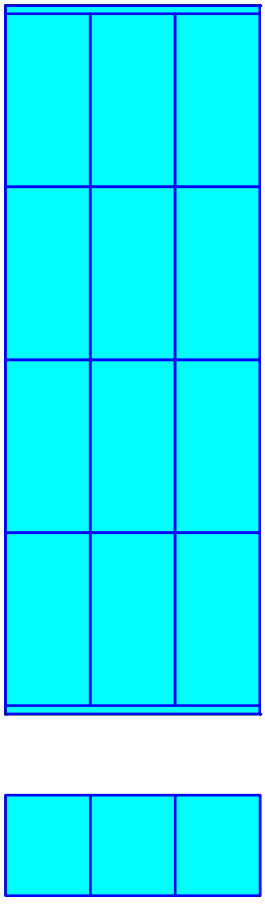
Chamber Model = StormTrap ST1 DoubleTrap 7-0 (StormTrap ST1 DoubleTrap® Type I/III/VI)
Inside= 82.7"W x 84.0"H => 44.52 sf x 14.06'L = 626.0 cf
Outside= 82.7"W x 98.0"H => 56.32 sf x 14.06'L = 791.9 cf
3 Rows adjusted for 406.0 cf perimeter wall

4 Chambers/Row x 14.06' Long = 56.25' Row Length +8.0" Border x 2 = 57.58' Base Length
3 Rows x 82.7" Wide = 20.69' Base Width
98.0" Chamber Height = 8.17' Field Height

20.0 cf Sidewall x 4 x 2 + 41.0 cf Endwall x 3 x 2 = 406.0 cf Perimeter Wall
12 Chambers x 626.0 cf - 406.0 cf Perimeter wall = 7,105.9 cf Chamber Storage
12 Chambers x 791.9 cf + 225.3 cf Border = 9,728.6 cf Displacement

Chamber Storage = 7,105.9 cf = 0.163 af
Overall Storage Efficiency = 73.0%
Overall System Size = 57.58' x 20.69' x 8.17'

12 Chambers (plus border)
360.3 cy Field



Stage-Discharge for Pond 10P: Detention Basin-3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
310.00	0.00	312.55	1.43	315.10	2.90	317.65	7.98
310.05	0.01	312.60	1.45	315.15	2.92	317.70	8.01
310.10	0.03	312.65	1.46	315.20	2.94	317.75	8.04
310.15	0.07	312.70	1.48	315.25	2.97	317.80	8.07
310.20	0.11	312.75	1.49	315.30	2.99	317.85	8.09
310.25	0.17	312.80	1.51	315.35	3.01	317.90	8.12
310.30	0.23	312.85	1.52	315.40	3.04	317.95	8.15
310.35	0.30	312.90	1.54	315.45	3.06	318.00	8.18
310.40	0.36	312.95	1.55	315.50	3.08	318.05	8.20
310.45	0.43	313.00	1.57	315.55	3.10	318.10	8.23
310.50	0.47	313.05	1.58	315.60	3.12	318.15	**8.26**
310.55	0.52	313.10	1.60	315.65	3.15		
310.60	0.56	313.15	1.61	315.70	3.17		
310.65	0.60	313.20	1.62	315.75	3.19		
310.70	0.63	313.25	1.64	315.80	3.21		
310.75	0.67	313.30	1.65	315.85	3.23		
310.80	0.70	313.35	1.66	315.90	3.25		
310.85	0.73	313.40	1.69	315.95	3.27		
310.90	0.76	313.45	1.72	316.00	3.29		
310.95	0.79	313.50	1.76	316.05	3.31		
311.00	0.82	313.55	1.82	316.10	3.33		
311.05	0.85	313.60	1.88	316.15	3.35		
311.10	0.87	313.65	1.94	316.20	3.37		
311.15	0.90	313.70	2.00	316.25	3.39		
311.20	0.92	313.75	2.06	316.30	3.41		
311.25	0.95	313.80	2.10	316.35	3.43		
311.30	0.97	313.85	2.15	316.40	3.45		
311.35	0.99	313.90	2.19	316.45	3.47		
311.40	1.01	313.95	2.23	316.50	3.49		
311.45	1.04	314.00	2.27	316.55	3.69		
311.50	1.06	314.05	2.30	316.60	4.05		
311.55	1.08	314.10	2.34	316.65	4.50		
311.60	1.10	314.15	2.37	316.70	5.03		
311.65	1.12	314.20	2.40	316.75	5.63		
311.70	1.14	314.25	2.44	316.80	6.29		
311.75	1.16	314.30	2.47	316.85	7.01		
311.80	1.18	314.35	2.50	316.90	7.55		
311.85	1.20	314.40	2.53	316.95	7.58		
311.90	1.21	314.45	2.56	317.00	7.61		
311.95	1.23	314.50	2.59	317.05	7.64		
312.00	1.25	314.55	2.61	317.10	7.67		
312.05	1.27	314.60	2.64	317.15	7.70		
312.10	1.29	314.65	2.67	317.20	7.73		
312.15	1.30	314.70	2.70	317.25	7.76		
312.20	1.32	314.75	2.72	317.30	7.79		
312.25	1.34	314.80	2.75	317.35	7.81		
312.30	1.35	314.85	2.77	317.40	7.84		
312.35	1.37	314.90	2.80	317.45	7.87		
312.40	1.39	314.95	2.82	317.50	7.90		
312.45	1.40	315.00	2.85	317.55	7.93		
312.50	1.42	315.05	2.87	317.60	7.96		

Stage-Area-Storage for Pond 10P: Detention Basin-3

Elevation (feet)	Storage (cubic-feet)
310.00	0
310.10	0
310.20	0
310.30	0
310.40	0
310.50	0
310.60	107
310.70	215
310.80	322
310.90	429
311.00	537
311.10	644
311.20	751
311.30	859
311.40	966
311.50	1,073
311.60	1,180
311.70	1,288
311.80	1,395
311.90	1,502
312.00	1,610
312.10	1,717
312.20	1,824
312.30	1,932
312.40	2,039
312.50	2,146
312.60	2,254
312.70	2,361
312.80	2,468
312.90	2,576
313.00	2,683
313.10	2,790
313.20	2,897
313.30	3,005
313.40	3,112
313.50	3,219
313.60	3,327
313.70	3,434
313.80	3,541
313.90	3,649
314.00	3,756
314.10	3,863
314.20	3,971
314.30	4,078
314.40	4,185
314.50	4,293
314.60	4,400
314.70	4,507
314.80	4,614
314.90	4,722
315.00	4,829
315.10	4,936
315.20	5,044
315.30	5,151
315.40	5,258
315.50	5,366
315.60	5,473
315.70	5,580
315.80	5,688
315.90	5,795
316.00	5,902
316.10	6,010
316.20	6,117
316.30	6,224
316.40	6,332
316.50	6,439
316.60	6,546
316.70	6,653
316.80	6,761
316.90	6,868
317.00	6,975
317.10	7,083
317.20	7,190
317.30	7,297
317.40	7,405
317.50	7,512
317.60	7,512
317.70	7,512
317.80	7,512
317.90	7,512
318.00	7,512
318.10	**7,512**

Summary for Link 1L: DP-1 Mass-DOT West

Inflow Area = 1,142 sf, 60.31% Impervious, Inflow Depth = 1.68" for 2-year Storm event
Inflow = 0.07 cfs @ 12.13 hrs, Volume= 159 cf
Primary = 0.07 cfs @ 12.13 hrs, Volume= 159 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 2L: DP-2 Mass-DOT East

Inflow Area = 195,291 sf, 38.40% Impervious, Inflow Depth > 1.11" for 2-year Storm event
Inflow = 2.77 cfs @ 12.46 hrs, Volume= 18,058 cf
Primary = 2.77 cfs @ 12.46 hrs, Volume= 18,058 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 3L: DP-3 Bank Parking Lot

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 4L: _placeholder

Inflow Area = 196,433 sf, 38.52% Impervious, Inflow Depth > 1.11" for 2-year Storm event
Inflow = 2.78 cfs @ 12.46 hrs, Volume= 18,217 cf
Primary = 2.78 cfs @ 12.46 hrs, Volume= 18,217 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 8L: center CB

Inflow Area = 55,328 sf, 61.79% Impervious, Inflow Depth > 1.86" for 2-year Storm event
Inflow = 1.20 cfs @ 12.26 hrs, Volume= 8,571 cf
Primary = 1.20 cfs @ 12.26 hrs, Volume= 8,571 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link 9L: east CB

Inflow Area = 139,963 sf, 29.15% Impervious, Inflow Depth > 0.81" for 2-year Storm event
Inflow = 1.65 cfs @ 12.46 hrs, Volume= 9,487 cf
Primary = 1.65 cfs @ 12.46 hrs, Volume= 9,487 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment PDA-1: Subcat PDA-1 Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=83 Runoff=0.14 cfs 304 cf

Subcatchment PDA-2A: Subcat PDA-2A Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=83 Runoff=0.39 cfs 850 cf

Subcatchment PDA-2B: Subcat PDA-2B Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=94 Runoff=0.26 cfs 624 cf

Subcatchment PDA-2C: Subcat PDA-2C Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=2.30"
Tc=6.0 min CN=73 Runoff=0.53 cfs 1,137 cf

Subcatchment PDA-2D: Subcat PDA-2D Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=66 Runoff=0.16 cfs 338 cf

Subcatchment PDA-2E: Subcat PDA-2E Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=98 Runoff=0.52 cfs 1,328 cf

Subcatchment PDA-2F: Subcat PDA-2F Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=94 Runoff=0.62 cfs 1,469 cf

Subcatchment PDA-2G: Subcat PDA-2G Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=3.39"
Tc=6.0 min CN=85 Runoff=0.41 cfs 900 cf

Subcatchment PDA-2H: Subcat PDA-2H Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=94 Runoff=0.55 cfs 1,306 cf

Subcatchment PDA-2I: Subcat PDA-2I Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=61 Runoff=0.16 cfs 344 cf

Subcatchment PDA-2J: Subcat PDA-2J Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=94 Runoff=2.24 cfs 5,352 cf

Subcatchment PDA-2K: Subcat PDA-2K Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=1.59"
Tc=6.0 min CN=64 Runoff=0.32 cfs 702 cf

Subcatchment PDA-2L: Subcat PDA-2L Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=4.22"
Tc=6.0 min CN=93 Runoff=2.00 cfs 4,708 cf

Subcatchment PDA-2M: Subcat PDA-2M Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=3.39"
Tc=6.0 min CN=85 Runoff=0.96 cfs 2,117 cf

Subcatchment PDA-2N: Subcat PDA-2N Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=61 Runoff=0.24 cfs 537 cf

Subcatchment PDA-2O: Subcat PDA-2O Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=391' Tc=9.3 min CN=56 Runoff=1.87 cfs 5,189 cf

Subcatchment PDA-2P: Subcat PDA-2P Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=55 Runoff=0.51 cfs 1,210 cf

Subcatchment PDA-2Q: Subcat PDA-2Q Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=1.89"
Tc=6.0 min CN=68 Runoff=1.64 cfs 3,503 cf

Subcatchment PDA-2R: Subcat PDA-2R Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=61 Runoff=0.08 cfs 182 cf

Subcatchment PDA-ROOF1: Subcat Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=98 Runoff=1.11 cfs 2,816 cf

Subcatchment PDA-ROOF2: Subcat Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=98 Runoff=1.86 cfs 4,738 cf

Subcatchment PDA-ROOF3: Subcat Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=98 Runoff=0.41 cfs 1,044 cf

Pond 1P: UGIS-1 Peak Elev=299.77' Storage=246 cf Inflow=0.24 cfs 537 cf
Discarded=0.02 cfs 537 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 537 cf

Pond 4P: UGIS-2 Peak Elev=300.37' Storage=293 cf Inflow=1.86 cfs 4,738 cf
Discarded=0.01 cfs 883 cf Primary=1.82 cfs 3,855 cf Outflow=1.83 cfs 4,738 cf

Pond 5P: UGIS-3 Peak Elev=300.99' Storage=772 cf Inflow=1.40 cfs 10,095 cf
Discarded=0.04 cfs 2,293 cf Primary=1.40 cfs 7,801 cf Outflow=1.44 cfs 10,095 cf

Pond 6P: Detention Basin-1 Peak Elev=297.79' Storage=5,786 cf Inflow=5.77 cfs 13,226 cf
Outflow=1.52 cfs 13,188 cf

Pond 7P: Detention Basin-2 Peak Elev=298.73' Storage=5,518 cf Inflow=6.01 cfs 14,191 cf
Outflow=1.74 cfs 14,145 cf

Pond 10P: Detention Basin-3 Peak Elev=312.39' Storage=2,026 cf Inflow=3.86 cfs 9,902 cf
Outflow=1.38 cfs 9,913 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.14 cfs 304 cf
Primary=0.14 cfs 304 cf

Link 2L: DP-2 Mass-DOT East Inflow=4.89 cfs 36,608 cf
Primary=4.89 cfs 36,608 cf

Link 3L: DP-3 Bank Parking Lot
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=5.07 cfs 36,912 cf
Primary=5.07 cfs 36,912 cf

Link 8L: center CB Inflow=1.90 cfs 14,994 cf
Primary=1.90 cfs 14,994 cf

Link 9L: east CB Inflow=2.99 cfs 21,613 cf
Primary=2.99 cfs 21,613 cf

Total Runoff Area = 196,433 sf Runoff Volume = 40,697 cf Average Runoff Depth = 2.49"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment PDA-1: Subcat PDA-1 Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=83 Runoff=0.18 cfs 398 cf

Subcatchment PDA-2A: Subcat PDA-2A Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=83 Runoff=0.50 cfs 1,114 cf

Subcatchment PDA-2B: Subcat PDA-2B Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=94 Runoff=0.32 cfs 778 cf

Subcatchment PDA-2C: Subcat PDA-2C Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=3.17"
Tc=6.0 min CN=73 Runoff=0.73 cfs 1,571 cf

Subcatchment PDA-2D: Subcat PDA-2D Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=2.51"
Tc=6.0 min CN=66 Runoff=0.23 cfs 488 cf

Subcatchment PDA-2E: Subcat PDA-2E Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=0.64 cfs 1,628 cf

Subcatchment PDA-2F: Subcat PDA-2F Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=94 Runoff=0.76 cfs 1,831 cf

Subcatchment PDA-2G: Subcat PDA-2G Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=4.40"
Tc=6.0 min CN=85 Runoff=0.52 cfs 1,169 cf

Subcatchment PDA-2H: Subcat PDA-2H Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=94 Runoff=0.67 cfs 1,628 cf

Subcatchment PDA-2I: Subcat PDA-2I Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=61 Runoff=0.24 cfs 516 cf

Subcatchment PDA-2J: Subcat PDA-2J Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=94 Runoff=2.76 cfs 6,673 cf

Subcatchment PDA-2K: Subcat PDA-2K Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=2.33"
Tc=6.0 min CN=64 Runoff=0.48 cfs 1,028 cf

Subcatchment PDA-2L: Subcat PDA-2L Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=93 Runoff=2.47 cfs 5,895 cf

Subcatchment PDA-2M: Subcat PDA-2M Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=4.40"
Tc=6.0 min CN=85 Runoff=1.23 cfs 2,749 cf

Subcatchment PDA-2N: Subcat PDA-2N Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=61 Runoff=0.37 cfs 805 cf

Subcatchment PDA-2O: Subcat PDA-2O Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=1.66"
Flow Length=391' Tc=9.3 min CN=56 Runoff=3.14 cfs 8,167 cf

Subcatchment PDA-2P: Subcat PDA-2P Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=1.58"
Tc=6.0 min CN=55 Runoff=0.86 cfs 1,926 cf

Subcatchment PDA-2Q: Subcat PDA-2Q Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=68 Runoff=2.34 cfs 4,990 cf

Subcatchment PDA-2R: Subcat PDA-2R Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=61 Runoff=0.13 cfs 273 cf

Subcatchment PDA-ROOF1: Subcat Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=1.35 cfs 3,451 cf

Subcatchment PDA-ROOF2: Subcat Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=2.27 cfs 5,807 cf

Subcatchment PDA-ROOF3: Subcat Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=0.50 cfs 1,280 cf

Pond 1P: UGIS-1 Peak Elev=300.18' Storage=424 cf Inflow=0.37 cfs 805 cf
Discarded=0.02 cfs 805 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 805 cf

Pond 4P: UGIS-2 Peak Elev=300.53' Storage=314 cf Inflow=2.27 cfs 5,807 cf
Discarded=0.01 cfs 918 cf Primary=2.24 cfs 4,888 cf Outflow=2.25 cfs 5,807 cf

Pond 5P: UGIS-3 Peak Elev=301.06' Storage=796 cf Inflow=2.25 cfs 15,370 cf
Discarded=0.04 cfs 2,343 cf Primary=2.21 cfs 13,027 cf Outflow=2.25 cfs 15,370 cf

Pond 6P: Detention Basin-1 Peak Elev=298.10' Storage=7,198 cf Inflow=7.16 cfs 16,705 cf
Outflow=1.77 cfs 16,667 cf

Pond 7P: Detention Basin-2 Peak Elev=299.06' Storage=7,016 cf Inflow=7.62 cfs 18,091 cf
Outflow=2.06 cfs 18,044 cf

Pond 10P: Detention Basin-3 Peak Elev=313.94' Storage=3,688 cf Inflow=6.17 cfs 15,084 cf
Outflow=2.22 cfs 15,098 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.18 cfs 398 cf
Primary=0.18 cfs 398 cf

Link 2L: DP-2 Mass-DOT East Inflow=6.25 cfs 49,629 cf
Primary=6.25 cfs 49,629 cf

Link 3L: DP-3 Bank Parking Lot
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=6.30 cfs 50,028 cf
Primary=6.30 cfs 50,028 cf

Link 8L: center CB Inflow=2.27 cfs 19,157 cf
Primary=2.27 cfs 19,157 cf

Link 9L: east CB Inflow=4.07 cfs 30,472 cf
Primary=4.07 cfs 30,472 cf

Total Runoff Area = 196,433 sf Runoff Volume = 54,165 cf Average Runoff Depth = 3.31"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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

Subcatchment PDA-1: Subcat PDA-1 Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=83 Runoff=0.24 cfs 548 cf

Subcatchment PDA-2A: Subcat PDA-2A Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=83 Runoff=0.68 cfs 1,532 cf

Subcatchment PDA-2B: Subcat PDA-2B Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=7.05"
Tc=6.0 min CN=94 Runoff=0.41 cfs 1,017 cf

Subcatchment PDA-2C: Subcat PDA-2C Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=4.61"
Tc=6.0 min CN=73 Runoff=1.05 cfs 2,282 cf

Subcatchment PDA-2D: Subcat PDA-2D Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=3.82"
Tc=6.0 min CN=66 Runoff=0.35 cfs 741 cf

Subcatchment PDA-2E: Subcat PDA-2E Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=7.53"
Tc=6.0 min CN=98 Runoff=0.81 cfs 2,091 cf

Subcatchment PDA-2F: Subcat PDA-2F Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=7.05"
Tc=6.0 min CN=94 Runoff=0.97 cfs 2,393 cf

Subcatchment PDA-2G: Subcat PDA-2G Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=5.99"
Tc=6.0 min CN=85 Runoff=0.70 cfs 1,593 cf

Subcatchment PDA-2H: Subcat PDA-2H Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=7.05"
Tc=6.0 min CN=94 Runoff=0.87 cfs 2,128 cf

Subcatchment PDA-2I: Subcat PDA-2I Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=61 Runoff=0.38 cfs 814 cf

Subcatchment PDA-2J: Subcat PDA-2J Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=7.05"
Tc=6.0 min CN=94 Runoff=3.55 cfs 8,723 cf

Subcatchment PDA-2K: Subcat PDA-2K Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=3.60"
Tc=6.0 min CN=64 Runoff=0.74 cfs 1,584 cf

Subcatchment PDA-2L: Subcat PDA-2L Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=6.93"
Tc=6.0 min CN=93 Runoff=3.18 cfs 7,741 cf

Subcatchment PDA-2M: Subcat PDA-2M Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=5.99"
Tc=6.0 min CN=85 Runoff=1.64 cfs 3,746 cf

Subcatchment PDA-2N: Subcat PDA-2N Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=61 Runoff=0.60 cfs 1,270 cf

Subcatchment PDA-2O: Subcat PDA-2O Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=2.73"
Flow Length=391' Tc=9.3 min CN=56 Runoff=5.39 cfs 13,484 cf

Subcatchment PDA-2P: Subcat PDA-2P Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=55 Runoff=1.49 cfs 3,213 cf

Subcatchment PDA-2Q: Subcat PDA-2Q Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=68 Runoff=3.49 cfs 7,477 cf

Subcatchment PDA-2R: Subcat PDA-2R Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=61 Runoff=0.20 cfs 430 cf

Subcatchment PDA-ROOF1: Subcat Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=7.53"
Tc=6.0 min CN=98 Runoff=1.72 cfs 4,434 cf

Subcatchment PDA-ROOF2: Subcat Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=7.53"
Tc=6.0 min CN=98 Runoff=2.89 cfs 7,460 cf

Subcatchment PDA-ROOF3: Subcat Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=7.53"
Tc=6.0 min CN=98 Runoff=0.64 cfs 1,644 cf

Pond 1P: UGIS-1 Peak Elev=300.54' Storage=542 cf Inflow=0.60 cfs 1,270 cf
Discarded=0.02 cfs 1,048 cf Primary=0.15 cfs 222 cf Outflow=0.18 cfs 1,270 cf

Pond 4P: UGIS-2 Peak Elev=300.62' Storage=324 cf Inflow=2.89 cfs 7,460 cf
Discarded=0.01 cfs 955 cf Primary=2.91 cfs 6,505 cf Outflow=2.92 cfs 7,460 cf

Pond 5P: UGIS-3 Peak Elev=301.46' Storage=939 cf Inflow=3.81 cfs 24,613 cf
Discarded=0.04 cfs 2,426 cf Primary=3.61 cfs 22,187 cf Outflow=3.65 cfs 24,613 cf

Pond 6P: Detention Basin-1 Peak Elev=298.46' Storage=8,800 cf Inflow=9.37 cfs 22,156 cf
Outflow=3.54 cfs 22,118 cf

Pond 7P: Detention Basin-2 Peak Elev=299.47' Storage=8,846 cf Inflow=10.14 cfs 24,486 cf
Outflow=3.62 cfs 24,439 cf

Pond 10P: Detention Basin-3 Peak Elev=316.57' Storage=6,517 cf Inflow=10.15 cfs 24,174 cf
Outflow=3.75 cfs 24,183 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.24 cfs 548 cf
Primary=0.24 cfs 548 cf

Link 2L: DP-2 Mass-DOT East Inflow=10.83 cfs 71,293 cf
Primary=10.83 cfs 71,293 cf

Link 3L: DP-3 Bank Parking Lot
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=10.91 cfs 71,841 cf
Primary=10.91 cfs 71,841 cf

Link 8L: center CB Inflow=4.07 cfs 25,971 cf
Primary=4.07 cfs 25,971 cf

Link 9L: east CB

Inflow=6.98 cfs 45,321 cf
Primary=6.98 cfs 45,321 cf

Total Runoff Area = 196,433 sf Runoff Volume = 76,346 cf Average Runoff Depth = 4.66"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PDA-1: Subcat PDA-1 Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=0.59"
Tc=6.0 min CN=61/98 Runoff=0.02 cfs 57 cf

Subcatchment PDA-2A: Subcat PDA-2A Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=0.58"
Tc=6.0 min CN=61/98 Runoff=0.07 cfs 155 cf

Subcatchment PDA-2B: Subcat PDA-2B Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=0.89"
Tc=6.0 min CN=61/98 Runoff=0.05 cfs 128 cf

Subcatchment PDA-2C: Subcat PDA-2C Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=0.32"
Tc=6.0 min CN=61/98 Runoff=0.07 cfs 157 cf

Subcatchment PDA-2D: Subcat PDA-2D Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=0.14"
Tc=6.0 min CN=61/98 Runoff=0.01 cfs 27 cf

Subcatchment PDA-2E: Subcat PDA-2E Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=0/98 Runoff=0.12 cfs 274 cf

Subcatchment PDA-2F: Subcat PDA-2F Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=0.89"
Tc=6.0 min CN=61/98 Runoff=0.13 cfs 302 cf

Subcatchment PDA-2G: Subcat PDA-2G Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=0.64"
Tc=6.0 min CN=61/98 Runoff=0.07 cfs 171 cf

Subcatchment PDA-2H: Subcat PDA-2H Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=0.88"
Tc=6.0 min CN=61/98 Runoff=0.11 cfs 266 cf

Subcatchment PDA-2I: Subcat PDA-2I Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=0.01"
Tc=6.0 min CN=61/98 Runoff=0.00 cfs 3 cf

Subcatchment PDA-2J: Subcat PDA-2J Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=0.88"
Tc=6.0 min CN=61/98 Runoff=0.47 cfs 1,093 cf

Subcatchment PDA-2K: Subcat PDA-2K Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=0.08"
Tc=6.0 min CN=61/98 Runoff=0.02 cfs 36 cf

Subcatchment PDA-2L: Subcat PDA-2L Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=0.87"
Tc=6.0 min CN=61/98 Runoff=0.41 cfs 966 cf

Subcatchment PDA-2M: Subcat PDA-2M Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=0.64"
Tc=6.0 min CN=61/98 Runoff=0.17 cfs 402 cf

Subcatchment PDA-2N: Subcat PDA-2N Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=61/0 Runoff=0.00 cfs 0 cf

Subcatchment PDA-2O: Subcat PDA-2O Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=391' Tc=9.3 min CN=56/0 Runoff=0.00 cfs 0 cf

Subcatchment PDA-2P: Subcat PDA-2P Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=55/0 Runoff=0.00 cfs 0 cf

Subcatchment PDA-2Q: Subcat PDA-2Q Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=59/98 Runoff=0.18 cfs 412 cf

Subcatchment PDA-2R: Subcat PDA-2R Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=61/0 Runoff=0.00 cfs 0 cf

Subcatchment PDA-ROOF1: Subcat Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=0.98"
Tc=6.0 min CN=61/98 Runoff=0.25 cfs 579 cf

Subcatchment PDA-ROOF2: Subcat Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=61/98 Runoff=0.42 cfs 976 cf

Subcatchment PDA-ROOF3: Subcat Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=0.98"
Tc=6.0 min CN=61/98 Runoff=0.09 cfs 213 cf

Pond 1P: UGIS-1 Peak Elev=299.00' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Pond 4P: UGIS-2 Peak Elev=299.85' Storage=193 cf Inflow=0.42 cfs 976 cf
Discarded=0.01 cfs 457 cf Primary=0.38 cfs 519 cf Outflow=0.39 cfs 976 cf

Pond 5P: UGIS-3 Peak Elev=299.91' Storage=148 cf Inflow=0.18 cfs 412 cf
Discarded=0.03 cfs 412 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 412 cf

Pond 6P: Detention Basin-1 Peak Elev=296.80' Storage=1,340 cf Inflow=1.16 cfs 2,354 cf
Outflow=0.20 cfs 2,319 cf

Pond 7P: Detention Basin-2 Peak Elev=297.81' Storage=1,377 cf Inflow=1.14 cfs 2,653 cf
Outflow=0.25 cfs 2,610 cf

Pond 10P: Detention Basin-3 Peak Elev=310.26' Storage=0 cf Inflow=0.18 cfs 412 cf
Outflow=0.18 cfs 412 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.02 cfs 57 cf
Primary=0.02 cfs 57 cf

Link 2L: DP-2 Mass-DOT East Inflow=0.47 cfs 5,212 cf
Primary=0.47 cfs 5,212 cf

Link 3L: DP-3 Bank Parking Lot
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=0.48 cfs 5,268 cf
Primary=0.48 cfs 5,268 cf

Link 8L: center CB Inflow=0.26 cfs 2,764 cf
Primary=0.26 cfs 2,764 cf

Link 9L: east CB Inflow=0.21 cfs 2,447 cf
Primary=0.21 cfs 2,447 cf

Total Runoff Area = 196,433 sf Runoff Volume = 6,215 cf Average Runoff Depth = 0.38"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Hydraulic Design Table (25-year Design Storm)

Date 3/18/2023
Initials AJM

From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Total Drop	Average Slope	Pipe Diameter or Height	Manning's Roughness	Peak Flow	Max Flow Velocity	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio
Column1	Column2	(ft)	(ft)3	(ft)5	(ft)7	(%)	(inches)	Column10	(cfs)16	(ft/sec)	(cfs)17	Column18	Column19
DB-2	OCS-03	29.79	297.50	297.34	0.16	0.5400	12.000	0.0120	2.74	4.68	2.83	0.97	0.89
DB-01	OCS-02	34.77	296.50	296.27	0.23	0.6600	12.000	0.0120	1.82	2.79	3.14	0.58	0.99
OCS-04	OCS-02	12.49	297.30	297.00	0.30	2.4000	12.000	0.0150	2.23	4.91	4.79	0.47	0.56
UGIS-02	OCS-01	9.28	299.50	299.15	0.35	3.7700	12.000	0.0150	2.24	5.50	6.00	0.37	0.52
UGIS-01	OCS-06	5.79	299.50	299.35	0.15	2.5900	12.000	0.0150	0.00	0.00	4.97	0.00	0.00
OCS-06	DMH-01	19.26	298.10	297.85	0.25	1.3000	12.000	0.0150	0.00	0.00	3.52	0.00	0.11
AD-10	DMH-13	7.77	304.00	303.90	0.10	1.2900	12.000	0.0150	0.22	1.34	3.50	0.06	0.36
OCS-05	DMH-13	78.26	309.95	305.25	4.70	6.0100	12.000	0.0150	2.17	7.85	7.57	0.29	0.38
CB-01	DMH-01	32.94	298.00	297.80	0.20	0.6100	12.000	0.0120	0.27	1.84	3.01	0.09	0.25
DMH-05	Out-1Pipe - (104)	22.29	297.65	297.50	0.15	0.6700	12.000	0.0120	0.11	1.79	3.17	0.04	0.13
CB-08	AS-05	12.50	297.40	296.70	0.70	5.6000	12.000	0.0120	0.41	4.59	9.13	0.04	0.17
AS-05	Out-1Pipe - (106)	8.73	296.60	296.50	0.10	1.1500	12.000	0.0120	0.41	2.82	4.13	0.10	0.24
AD-04	Out-1Pipe - (19)	42.51	297.80	297.50	0.30	0.7100	12.000	0.0120	0.10	1.78	3.24	0.03	0.12
CB-05	DMH-04	49.66	298.15	297.90	0.25	0.5000	12.000	0.0120	0.48	0.85	2.74	0.18	0.88
AD-13	AD-12	43.65	324.00	322.10	1.90	4.3500	12.000	0.0120	0.31	4.71	8.05	0.04	0.14
AD-12	AD-11	190.82	322.00	312.10	9.90	5.1900	12.000	0.0120	0.57	1.20	8.79	0.07	0.59
AD-11	Out-01	6.98	313.40	313.30	0.10	1.4300	12.000	0.0120	3.10	4.94	4.62	0.67	0.74
CB-02	DMH-01	33.38	298.00	297.80	0.20	0.6000	12.000	0.0120	0.11	1.05	2.99	0.04	0.20
CB-06	DMH-07	43.51	297.10	296.85	0.25	0.5700	12.000	0.0120	0.76	1.65	2.93	0.26	0.66
AF-03	Out-1Pipe - (32)	8.31	296.55	296.50	0.05	0.6000	12.000	0.0120	1.60	3.22	2.99	0.54	0.60
AS-03	AF-03	6.27	296.80	296.72	0.08	1.2800	12.000	0.0120	1.60	3.48	4.36	0.37	0.58
DMH-07	AS-03	9.85	296.85	296.80	0.05	0.5100	12.000	0.0120	1.61	2.73	2.75	0.59	0.71
CB-07	DMH-07	26.37	297.00	296.85	0.15	0.5700	12.000	0.0120	0.90	1.98	2.91	0.31	0.72
CB-10	DMH-08	29.02	297.00	296.85	0.15	0.5200	12.000	0.0120	0.45	1.62	2.77	0.16	0.39
CB-03	DMH-02	21.62	297.75	297.60	0.15	0.6900	12.000	0.0120	0.36	1.97	3.22	0.11	0.38
AD-15	AD-16	100.82	319.50	308.60	10.90	10.8100	12.000	0.0120	0.11	4.95	12.69	0.01	0.07
AD-06	AD-07	16.01	298.65	298.45	0.20	1.2500	12.000	0.0120	0.02	0.83	4.31	0.01	0.08
AD-07	DMH-06	39.40	298.45	298.05	0.40	1.0200	12.000	0.0120	0.08	1.52	3.89	0.02	0.12
DMH-06	DMH-05	73.93	298.05	297.65	0.40	0.5400	12.000	0.0120	0.11	1.72	2.84	0.04	0.14
AD-05	DMH-06	27.22	298.35	298.05	0.30	1.1000	12.000	0.0120	0.04	1.16	4.05	0.01	0.11

Hydraulic Design Table (25-year Design Storm)

Date 3/18/2023
Initials AJM

From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Total Drop	Average Slope	Pipe Diameter or Height	Manning's Roughness	Peak Flow	Max Flow Velocity	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio
Column1	Column2	(ft)	(ft)3	(ft)5	(ft)7	(%)	(inches)	Column10	(cfs)16	(ft/sec)	(cfs)17	Column18	Column19
AD-03	Out-1Pipe - (67)	31.56	297.80	297.50	0.30	0.9500	12.000	0.0120	0.04	1.47	3.76	0.01	0.07
AD-16	DMH-11	39.84	308.50	299.65	8.85	22.2200	12.000	0.0120	0.22	6.76	18.19	0.01	0.09
DMH-01	DMH-02	26.13	297.80	297.60	0.20	0.7700	12.000	0.0120	0.36	1.45	3.38	0.11	0.36
AS-06	Out-1Pipe - (75)	4.95	297.55	297.50	0.05	1.0100	12.000	0.0120	0.70	3.03	3.88	0.18	0.33
DMH-02	AS-06	5.95	297.60	297.55	0.05	0.8400	12.000	0.0120	0.70	2.29	3.54	0.20	0.41
DMH-11	Out-1Pipe - (76)	6.20	299.55	299.50	0.05	0.8100	12.000	0.0120	0.22	2.11	3.47	0.06	0.19
DMH-12	AD-15	60.78	322.00	319.50	2.50	4.1100	12.000	0.0120	0.04	1.88	7.83	0.01	0.09
AD-14	DMH-12	16.25	322.75	322.00	0.75	4.6200	12.000	0.0120	0.05	2.35	8.29	0.01	0.08
CB-04	DMH-04	7.62	297.95	297.90	0.05	0.6600	12.000	0.0120	1.05	1.35	3.13	0.34	0.99
AF-02	Out-1Pipe - (80)	10.21	297.60	297.50	0.10	0.9800	12.000	0.0120	2.31	4.17	3.82	0.60	0.66
AS-02	AF-02	5.71	297.80	297.77	0.03	0.5300	12.000	0.0120	2.31	3.53	2.80	0.83	0.78
DMH-04	AS-02	11.59	297.90	297.80	0.10	0.8600	12.000	0.0120	2.31	3.01	3.59	0.64	0.95
AD-01	DMH-10	7.62	298.05	298.00	0.05	0.6600	12.000	0.0120	0.53	1.17	3.13	0.17	0.68
AD-02	DMH-10	75.70	298.40	298.00	0.40	0.5300	12.000	0.0120	0.39	1.05	2.81	0.14	0.51
DMH-10	AS-01	7.88	298.00	297.95	0.05	0.6300	12.000	0.0120	1.35	2.52	3.08	0.44	0.65
AF-01	Out-1Pipe - (85)	20.02	297.73	297.50	0.23	1.1500	12.000	0.0120	1.35	3.99	4.14	0.33	0.44
AS-01	AF-01	6.99	297.95	297.90	0.05	0.7200	12.000	0.0120	1.35	3.26	3.27	0.41	0.52
OCS-03	Out-1Pipe - (88)	25.65	297.34	297.21	0.13	0.5100	12.000	0.0150	2.06	3.34	2.20	0.94	0.73
OCS-01	Out-1Pipe - (91)	17.12	296.80	296.50	0.30	1.7500	12.000	0.0120	2.38	5.16	5.11	0.47	0.58
AF-04	Out-1Pipe - (92)	6.50	296.55	296.50	0.05	0.7700	12.000	0.0120	0.72	2.86	3.38	0.21	0.36
AS-04	AF-04	6.36	296.80	296.72	0.08	1.2600	12.000	0.0120	0.72	3.27	4.33	0.17	0.32
DMH-08	AS-04	5.70	296.85	296.80	0.05	0.8800	12.000	0.0120	0.72	2.42	3.61	0.20	0.40
CB-09	DMH-08	15.80	296.95	296.85	0.10	0.6300	12.000	0.0120	0.28	1.39	3.07	0.09	0.40
OCS-02	Out-1Pipe - (95)	8.26	296.27	296.02	0.25	3.0300	12.000	0.0150	4.03	5.83	5.37	0.75	0.82
AD-08	Out-1Pipe - (97)	7.97	296.60	296.50	0.10	1.2600	12.000	0.0120	0.04	1.58	4.32	0.01	0.07
DMH-13	Out-1Pipe - (98)	109.73	303.90	300.00	3.90	3.5500	12.000	0.0120	2.22	7.70	7.28	0.31	0.40
AD-09	Out-1Pipe - (99)	6.17	296.60	296.50	0.10	1.6200	12.000	0.0120	0.04	1.69	4.91	0.01	0.07

Town of Northborough

NORTHBOROUGH FIRE STATION

APPENDIX C

Channel Capacity Calculations
Stormwater Treatment – TSS & Phosphorus Calculations
Proprietary Systems Calculations
Underground Infiltration System Calculations
Mounding Analysis Calculations
Recharge Volume Calculations

PROJECT	Northborough Fire Station		PROJECT NUMBER
SUBJECT	Channel Capacity		23141.00
COMPUTATIONS BY	AJM	DATE	13-Mar
CHECK BY		DATE	

Stormwater Conveyance Channel Design - Behind Retaining Wall

Purpose: To size the depth of flow within a Trapezoidal Swale

ROADWAY SWALE - MAXIMUM FLOW & SLOPE

Using Manning's Equation

Channel Geometry

Input:

b =	2	ft		
d =	1.5	ft		
Z = e/d =	3	(e.g. 3:1 - input "3")		
e =	4.5	ft		
T =	11	ft		
Area =	9.75	sf		
Wetted Perimeter =	11.49	ft		
Hyd Radius =	0.85	ft		
Q25 * =	5.43	cfs*	*From PDA-3 from HydroCAD	
S =	0.030			
n ** =	0.030			
V =	3.8	fps	(from below)	
d required =	0.43	ft		*The town of Northborough requires there to be at least 1' of free board for swales
d provided =	1.50	ft*	ok!	

Solve through Trial and Error

d (ft)	A (SF)	P (ft)	R (ft)	V (fps)	Q (cfs)
0.40	1.28	4.53	0.28	3.69	4.73
0.41	1.32	4.59	0.29	3.74	4.96
0.42	1.37	4.66	0.29	3.79	5.19
0.43	1.41	4.72	0.30	3.84	5.44
0.44	1.46	4.78	0.31	3.89	5.68
0.45	1.51	4.85	0.31	3.94	5.94
0.46	1.55	4.91	0.32	3.99	6.20
0.47	1.60	4.97	0.32	4.03	6.46

A = (b+2*d)*d

Pw = b+2*y*(1+z^2)^0.5

* From Proposed Hydrology

** Avg. of natural channels, good condition and natural channels with stones and weeds (CEN Ref Manual, A-35)

PARE CORPORATION

PROJECT Northborough Fire Station		PROJECT NUMBER	23141.00
SUBJECT Stormwater Treatment Area			
COMPUTATIONS BY	SWL	DATE	3/15/2024
CHECK BY	JAJ	DATE	3/15/2024

Stormwater Treatment Area Calculation - Area Required

Total Project Area	196,433	ft^2	4.51	acres
Total Existing Impervious Area within LOD	31,857	ft^2	0.73	acres
Total Proposed Impervious area within LOD	75,709	ft^2	1.74	acres
Off Site Impervious (PDA-1, 2A, 2B, 2Q)	9,145	ft^2	0.21	acres
Impervious Area Treatment Requirement	**66564**	**ft^2**	1.53	acres

BMP Descriptions	Phosphorus Removal Efficiency	TSS Removal Efficiency
(1) Aqua Swirl*	0.0%	93.3%
(2) Aqua Filter**	88.6%	0.0%
(3) Underground Infiltration Field***	67.5%	88.2%

*AquaShield Statement of Qualifications Table 3
**AquaShield Statement of Qualifications Table 4
***BATT Calculations Provided

Phosphorus

	Total Area	Total Imp.	BMP	Efficency	% Reduction
PDA-1	1142	0	-	0.00	0.00
PDA-2A	3194	0	-	0.00	0.00
PDA-2B	1730	0	-	0.00	0.00
PDA-2C	5944	1914	-	0.00	0.00
PDA-2D	2329	326	1	0.89	0.00
PDA-2E	3332	3332	1	0.89	0.04
PDA-2F	4072	3683	1	0.89	0.05
PDA-2G	3190	2078	1	0.89	0.03
PDA-2H	3620	3237	1	0.89	0.04
PDA-2I	2986	37	-	0.00	0.00
PDA-2J	14841	13302	1	0.89	0.18
PDA-2K	5283	435	-	0.00	0.00
PDA-2L	13395	11758	1	0.89	0.16
PDA-2M	7503	4889	1	0.89	0.07
PDA-2N	4661	0	3	0.00	0.00
PDA-2O	59192	0	-	0.00	0.00
PDA-2P	14672	0	-	0.00	0.00
PDA-2Q	22194	0	-	0.00	0.00
PDA-2R	1578	0	3	0.00	0.00
PDA-ROOF1	7065	7065	1	0.89	0.09
PDA-ROOF2	11888	11888	3	0.68	0.12
PDA-ROOF3	*2620*	*2620*	1	0.89	0.03
Total		**66564**			**81.7%**

TSS

	Total Area	Total Imp.	BMP	Efficency	% Reduction
PDA-1	1142	0	-	0.00	0.00
PDA-2A	3194	0	-	0.00	0.00
PDA-2B	1730	0	-	0.00	0.00
PDA-2C	5944	1914	2	0.93	0.03
PDA-2D	2329	326	2	0.93	0.00
PDA-2E	3332	3332	2	0.93	0.05
PDA-2F	4072	3683	2	0.93	0.05
PDA-2G	3190	2078	2	0.93	0.03
PDA-2H	3620	3237	2	0.93	0.05
PDA-2I	2986	37	-	0.00	0.00
PDA-2J	14841	13302	2	0.93	0.19
PDA-2K	5283	435	-	0.00	0.00
PDA-2L	13395	11758	2	0.93	0.16
PDA-2M	7503	4889	2	0.93	0.07
PDA-2N	4661	0	3	0.00	0.00
PDA-2O	59192	0	-	0.00	0.00
PDA-2P	14672	0	-	0.00	0.00

PDA-2Q	22194	0	-	0.00	0.00
PDA-2R	1578	0	3	0.00	0.00
PDA-ROOF1	7065	7065	2	0.93	0.10
PDA-ROOF2	11888	11888	3	0.88	0.16
PDA-ROOF3	*2620*	*2620*	2	0.93	0.04
Total		**66564**			**91.7%**

AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station
Structure ID: DMH-09

Water Quality Flow (cfs) to be treated	0.14
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-08 **replace with AS-2 only**

Flow (cfs)to be treated	0.09
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
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AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station
Structure ID: DMH-07

Flow (cfs)to be treated	0.3
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
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AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-02 **replace with AS-2 only**

Flow (cfs)to be treated	0.08
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
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AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
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26	312	6240	13.90

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AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-04 **replace with AS-2 only**

Flow (cfs)to be treated	0.3
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
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AquaShield™
STORMWATER TREATMENT SOLUTIONS

Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station
Structure ID: DMH-XX

Flow (cfs)to be treated	0.12
HDS req'd	AS-2
AF rows	1
AF unit	AF-2.1

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs)[1]
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
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AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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State	MASSACHUSETTS
Municipality	NORTHBOROUGH
Permit Type	Local
Permit Number	na
Major Watershed	CONCORD
TP Load Reduction Target	N/A
TN Load Reduction Target	N/A
TSS Load Reduction Target	N/A

Table 1. Project Summary Credit for NORTHBOROUGH, MASSACHUSETTS

Project Type	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)
Structural	0.28	3.43	105.67
Non-Structural	0	0	0
Land Use Conversion	0	0	0
Total	0.28	3.43	105.67

Table 2. Structural Project Summary for NORTHBOROUGH, MASSACHUSETTS

Project ID	BMP Type	BMP Storage Capacity (ft^3)/ Filter Depth (in.)	Phosphorus BMP Efficiency (%)	Nitrogen BMP Efficiency (%)	Sediment BMP Efficiency (%)	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)	Impervious Area Treated (ac)	Runoff Depth (in.)
PDA-ROOF2	INFILTRATION TRENCH	355	67.59	89.09	88.21	0.28	3.43	105.67	0.2729	0.36

Table 3. Non-Structural Project Summary for NORTHBOROUGH, MASSACHUSETTS

There are no non-structural BMPs.

Table 4. Land Use Conversion Project Summary for NORTHBOROUGH, MASSACHUSETTS

There are no land use conversion projects.

PARE CORPORATION

PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 1 Calculation

Infiltration System

Total Area to Infiltration System =	4,172	SF	
Total Impervious Area =	0	SF	

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	0	CF	
Required WQV Volume (including pretreatment) =	**0**	**CF**	
Volume provided in UGIS =	**531**	**CF**	
Total Volume =	**531**	**CF**	

Pretreatment

Separator Row			
0.1" x Impervious Area =	0	CF	
Required Pretreatment Volume =	0	CF	
Volume Provided =	**0**	**CF***	*no seperator row is proposed for UGIS-1

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)

Provided Volume =	**531**	**CF**	
K = saturated hydraulic conductivity =	**2.04**	**FT/DAY**	
Bottom Area (Average) =	**650**	**SF**	
Time (hrs) =	**10**	**hrs**	**< 48 hrs**

PARE CORPORATION

PROJECT	NorthBorough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 2 Calculation

Infiltration System

Total Area to Infiltration System =	11,855	SF	
Total Trafficked Impervious Area =	0	SF	

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	0	CF	
Required WQV Volume (including pretreatment) =	**0**	**CF**	
Volume provided in UGIS =	**273**	**CF**	
Total Volume =	**273**	**CF**	

Pretreatment

Separator Row			
0.1" x Impervious Area =	0	CF	
Required Pretreatment Volume =	0	CF	*Runoff directed to this system is from non-pollutant loading impervious (roof runoff), therefore pretreatment is not required for this system
Volume Provided =	**0**	**CF***	

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)			
Provided Volume =	**273**	**CF**	
K = saturated hydraulic conductivity =	**2.04**	**FT/DAY**	
Bottom Area (Average) =	**292**	**SF**	
Time (hrs) =	**11**	**hrs**	**< 48 hrs**

PARE CORPORATION

PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 3 Calculation

Infiltration System

Total Area to Infiltration System =	133,266	SF	
Total Impervious Area =	6,064	SF	

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	505	CF	
Required WQV Volume (including pretreatment) =	**505**	**CF**	* Impervious area directed to this UGIS is from offsite flow, therefore water quality treatment is not required for this system
Volume provided in UGIS =	**718**	**CF**	
Total Volume =	**718**	**CF**	* Water Quality Volume displayed is additional treatment of offsite impervious

Pretreatment

Pretreatment			
0.1" x Impervious Area =	51	CF	* Pre-treatment achieved through flow path, drainage channel, and conveyance structure sumps
Required Pretreatment Volume =	51	CF	
Volume Provided =	**>51**	**CF***	

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)			
Provided Volume =	**718**	**CF**	
K = saturated hydraulic conductivity =	**2.04**	**FT/DAY**	
Bottom Area (Average) =	**817**	**SF**	
Time (hrs) =	**10**	**hrs**	**< 48 hrs**

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.0860	***R***	**Recharge (infiltration) rate (feet/day)**
0.330	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
20.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
25.700	**x**	**1/2 length of basin (x direction, in feet)**
25.700	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
32.500	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00

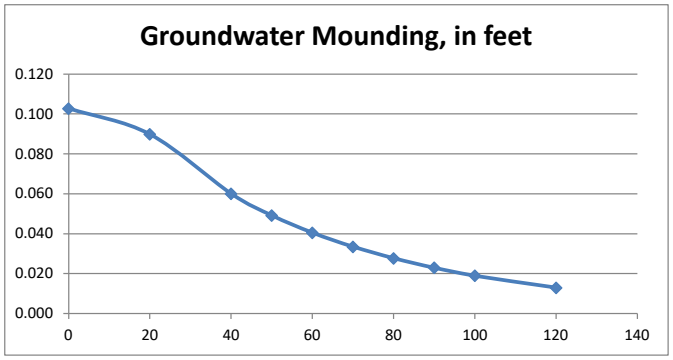
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

32.603	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.103	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.103	**0**
0.090	**20**
0.060	**40**
0.049	**50**
0.041	**60**
0.034	**70**
0.028	**80**
0.023	**90**
0.019	**100**
0.013	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

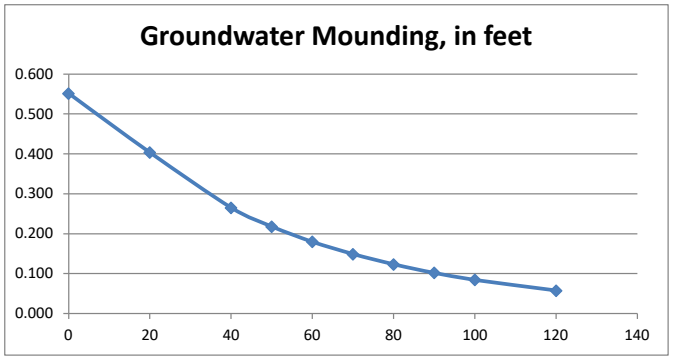
Input Values

0.8750	***R***	**Recharge (infiltration) rate (feet/day)**
0.330	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
20.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
11.670	**x**	**1/2 length of basin (x direction, in feet)**
25.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
31.500	**hi(0)**	**initial thickness of saturated zone (feet)**

32.052	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.552	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.552	**0**
0.404	**20**
0.266	**40**
0.218	**50**
0.180	**60**
0.149	**70**
0.124	**80**
0.102	**90**
0.085	**100**
0.058	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.6700	***R***	**Recharge (infiltration) rate (feet/day)**
0.330	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1]**
20.10	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
16.000	**x**	**1/2 length of basin (x direction, in feet)**
56.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
31.500	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00

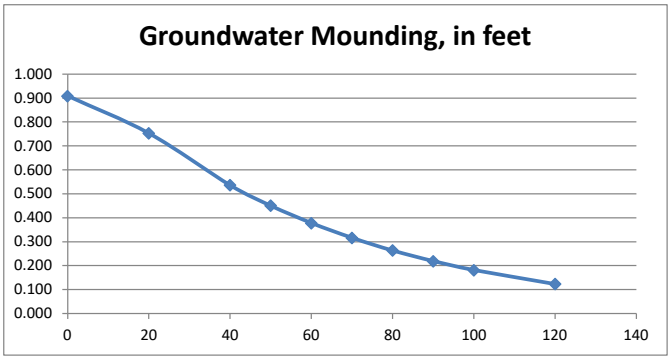
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

32.409	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.909	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.909	**0**
0.753	**20**
0.537	**40**
0.451	**50**
0.378	**60**
0.317	**70**
0.264	**80**
0.220	**90**
0.182	**100**
0.124	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

PARE CORPORATION

PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Required Recharge Volume		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Groundwater Recharge Calculation

A. Resources:

MassDEP Stormwater Handbook, 2008 Volume 1 & 3

B. Data:

	HSG A	HSG B	HSG C	HSG D	Total
Existing Impervious Area (SF)	0	31,857	0	0	31,857
Proposed Impervious Area (SF)	0	66,564		0	66,564
Net Increase (SF)	0	34,707	0	0	34,707

*9,145 SF Off-Site Impervious not included

C. Equation

$$R_v = F \times Impervious\ Area$$

R_v = Require Recharge Volume, Ft^3
F = Target Depth Factor
Impervious Area = net impervious area

Target Depth Factor For Each Soil Group	
Hydrologic Group	Target Depth Factor (F)
A	0.60 inches
B	0.35 inches
C	0.25 inches
D	0.10 inches

C. Calculations:

Required Recharge Volume:

Soil Group	Impervious Area (SF)	Required Volume (CF)
A	0	0
B	34,707	1012
C	0	0
D	0	0
Total	34,707	1012

Provided Recharge Volume

	BMP Provided Recharge*
UGIS-1	531 CF
UGIS-2	273 CF
UGIS-3	718 CF
Total	1522 CF
Required	1012 CF

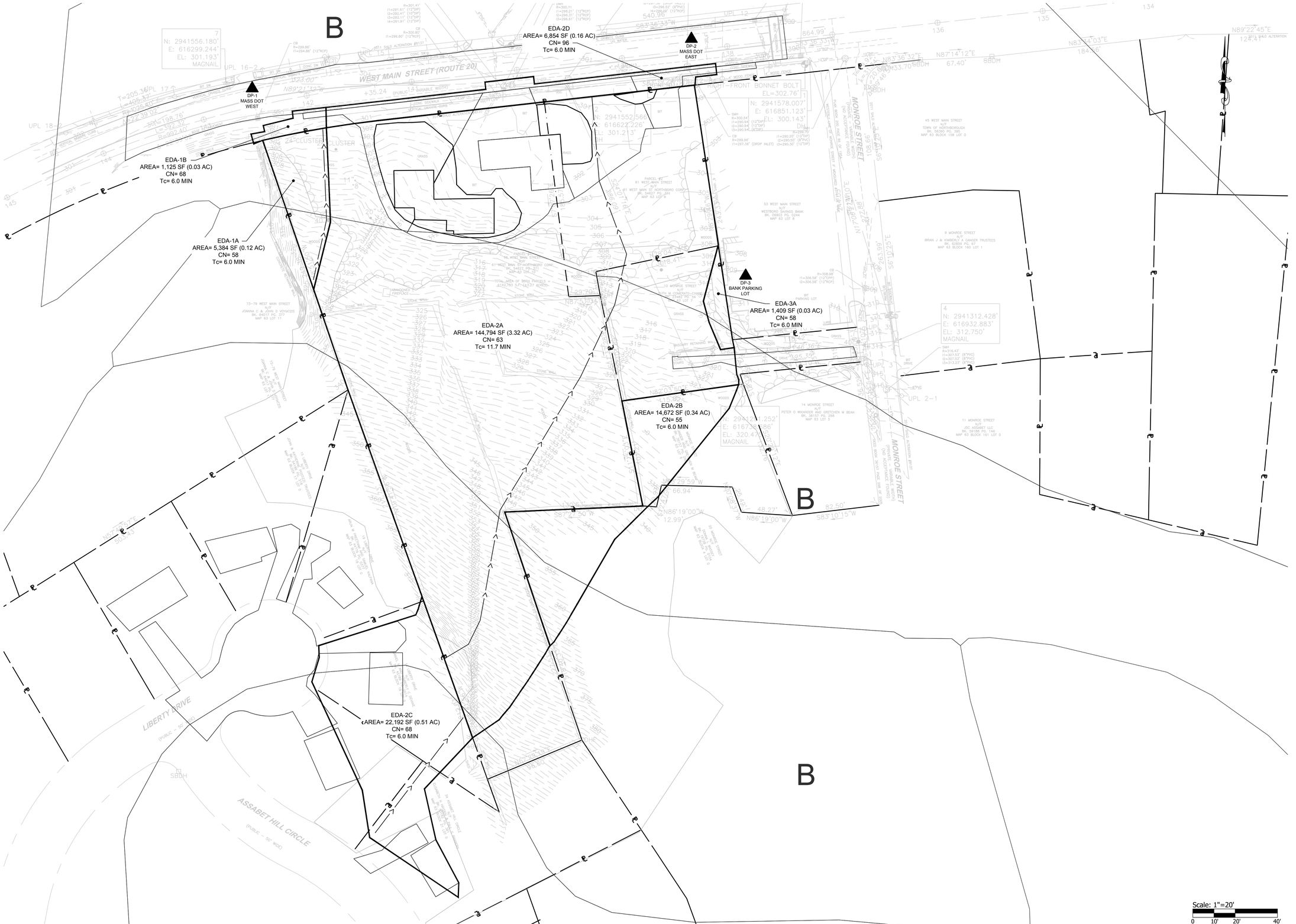
*Recharge volumes take from HydroCAD, Volume is taken from the volume stored below the lowest outlet, volume infiltrated during the storm event is not included

Town of Northborough

NORTHBOROUGH FIRE STATION

APPENDIX D

H1.0 Existing Hydrology
H2.0 Proposed Hydrology



PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MARCH 18, 2024
SCALE:	
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	EXISTING HYDROLOGY
DRAWING NO.:	H1.0
SHEET NO.	- OF -

PDA-ROOF3
AREA= 2,620 SF (0.06 AC)
CN= 98
Tc= 6.0 MIN

PDA-2E
AREA= 3,332 SF (0.08 AC)
CN= 98
Tc= 6.0 MIN

PDA-2B
AREA= 1,730 SF (0.04 AC)
CN= 94
Tc= 6.0 MIN

PDA-2D
AREA= 2,329 SF (0.05 AC)
CN= 66
Tc= 6.0 MIN

PDA-2F
AREA= 4,072 SF (0.09 AC)
CN= 94
Tc= 6.0 MIN

PDA-2A
AREA= 3,194 SF (0.07 AC)
CN= 83
Tc= 6.0 MIN

DP-1
MASS DOT
WEST

DP-2
MASS DOT
EAST

PDA-1
AREA= 1,142 SF (0.03 AC)
CN= 83
Tc= 6.0 MIN

PDA-2C
AREA= 5,944 SF (0.14 AC)
CN= 73
Tc= 6.0 MIN

PDA-2G
AREA= 3,190 SF (0.07 AC)
CN= 85
Tc= 6.0 MIN

PDA-2I
AREA= 2,986 SF (0.07 AC)
CN= 61
Tc= 6.0 MIN

PDA-2M
AREA= 7,503 SF (0.17 AC)
CN= 85
Tc= 6.0 MIN

PDA-2Q
AREA= 22,194 SF (0.51 AC)
CN= 68
Tc= 6.0 MIN

PROPOSED FIRE
STATION BUILDING
18,000 ± SF

PDA-2Q
AREA= 22,194 SF (0.51 AC)
CN= 68
Tc= 6.0 MIN

PDA-2H
AREA= 3,620 SF (0.08 AC)
CN= 94
Tc= 6.0 MIN

PDA-2K
AREA= 5,283 SF (0.12 AC)
CN= 64
Tc= 6.0 MIN

DP-3
PROPOSED
BANK PARKING
LOT

PDA-2J
AREA= 14,841 SF (0.34 AC)
CN= 94
Tc= 6.0 MIN

PDA-2L
AREA= 13,395 SF (0.31 AC)
CN= 93
Tc= 6.0 MIN

PDA-2R
AREA= 1,578 SF (0.04 AC)
CN= 61
Tc= 6.0 MIN

PDA-2N
AREA= 4,661 SF (0.11 AC)
CN= 61
Tc= 6.0 MIN

PDA-2O
AREA= 59,192 SF (1.36 AC)
CN= 56
Tc= 9.3 MIN

PDA-2P
AREA= 14,672 SF (0.34 AC)
CN= 55
Tc= 6.0 MIN

PDA-2Q
AREA= 22,194 SF (0.51 AC)
CN= 68
Tc= 6.0 MIN

LOD/CFS

MONROE STREET

LIBERTY DRIVE
(PUBLIC – 50' WIDE)

ASSABET HILL CIRCLE
(PUBLIC – 50' WIDE)

Scale: 1"=40'
0 20' 40' 80'

NOT FOR CONSTRUCTION

PARE

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street
Town of Northborough, MA

REVISIONS:

PROJECT NO.:	23141.00
DATE:	MARCH 18, 2024
SCALE:	
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	
DRAWING TITLE:	PROPOSED HYDROLOGY
DRAWING NO.:	H2.0
SHEET NO.	- OF -

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STORMWATER OPERATION AND MAINTENANCE PLAN
LONG TERM POLLUTION PREVENTION PLAN

Pare Project No. 23141.00

NORTHBOROUGH FIRE STATION
61 & 65 West Main Street
Northborough, Massachusetts

Assessors Map 63, Lots 9 & 10

Prepared for:

Town of Northborough, MA
63 Main Street
Westerly, RI 02891

Prepared by:

Pare Corporation
10 Lincoln Road
Foxborough, MA 02035

MARCH 2024
REVISED APRIL 2024
REVISED MAY 2024

PARE CORPORATION
ENGINEERS SCIENTISTS PLANNERS

STORMWATER OPERATION AND MAINTENANCE PLAN
LONG TERM POLLUTION PREVENTION PLAN
TABLE OF CONTENTS

STORMWATER OPERATION AND MAINTENANCE PLAN

General Operation and Maintenance Notes

Following construction, the completion of the inspection and maintenance requirements below shall be the responsibility of the Owner (See Attachment OM-1).

1. The parking lot and entry drives shall be swept by the Owner once in the spring and once during the fall to remove sediments.

2. Trash, litter, sediment and other debris shall be removed from any stormwater facility (including catch basins, manholes, erosion control measures, inlets, diversion and outlet structures) at least once per month at the cost of the Owner.

3. The site shall be checked for all signs of erosion monthly. All signs of erosion shall be reported to the owner.

4. All sediments removed shall be disposed of at an approved and permitted location.

5. Snow storage is prohibited in the stormwater BMP's.

6. All cleaning and maintenance of drainage system BMP's shall be the responsibility of the property owner. See additional inspection, maintenance, and repair notes for the stormwater system.

7. Annual reports shall be submitted to the Town of Northborough Stormwater Authority by June 1st of every year.

Catch Basins/Area Drains with Sump Inspection, Maintenance, and Repair Notes

1. Inspections shall be performed a minimum of four times per year (quarterly) for the first year. Bi-annual inspections shall be performed following the first year. Units shall be cleaned annually and whenever the depth of sediment is greater than or equal to half the sump depth.

2. The inlet grate shall not be welded to the frame or paved over so that the sump can be easily inspected and maintained.

3. Care shall be taken to avoid damaging and displacing hoods placed on hooded outlets during cleaning. Damaged hoods shall be replaced promptly.

Underground Infiltration/Detention System Inspection, Maintenance, and Repair Notes

1. The system shall be maintained as recommended by the manufacturer.

2. Following storm events with rainfall exceeding 3.1"

- Inspect infiltration/detention system for trash, debris, sediment, erosion, standing water, and overall performance. Defects shall be repaired by the Owner.

3. Use inspection port on inlet row to inspect system. Measure down from inspection port to determine depth of sediment. CCTV inspections can be deployed through the access port to determine if any sediment has accumulated in the inlet row.

4. For the first year the systems shall be inspected monthly.

5. Bi-annually
   - Inspections shall be performed a minimum of two times per year on the inspection ports and drainage structures of the underground infiltration/detention system to ensure proper operation of the system.

Water Quality Units

1. The system shall be maintained as recommended by the manufacturer. Operation and maintenance guides are provided as part of this submission for all proposed water quality units.

2. Following storm events with rainfall exceeding 3.1"
   - Inspect water quality units for trash, debris, sediment, erosion, standing water, and overall performance. Defects shall be repaired by the Owner per manufacturer suggested specifications.

3. Bi-annually
   - Inspections shall be performed a minimum of two times per year on the inspection ports and drainage structures of the water quality units to ensure proper operation.

Swale Inspection, Maintenance, and Repair Notes

1. The swale must be inspected quarterly during the first year of operation, and semiannually thereafter for sediment, ponding, erosion, and vegetation.

2. Remove accumulated sediment from the swale annually or at any time that the sediment exceeds 1”.

3. Repair any side slopes that have been damaged due to erosion or other means. Replace any vegetation that has died or been damaged.

4. The grass shall be maintained within the swale a minimum of twice annually and maintain a minimum grass height of 4”.

5. Trash and debris shall be removed from the swale as necessary.

6. The swale shall not be used for snow storage.

LONG TERM POLLUTION PREVENTION PLAN

Pollution Prevention and Source Controls

In addition, the following site specific controls and performance procedures shall be followed. From *Massachusetts Erosion and Sediment Control Guidelines.*

1 General Pollution Prevention Design Features

An inspection and maintenance schedule shall be developed by the owner to prevent trash and debris from backing up the stormwater management system.

2 Solid Waste Containment

Trash and recycling receptacles will be placed throughout the site.

3 Roads and Parking Area Management

Snow shall not be dumped and/or stored in the water quality best management practices (Underground Infiltration Area).

3.1 Street and Parking Lot Sweeping

The roads shall be swept to remove sediment and debris.

3.2 Deicing and Salt Storage

Deicing and sanding materials create water quality problems. Refer to Table G-1 in the Appendix when selecting a deicer. All deicing materials shall be stored under cover.

3.3 Snow Disposal

Snow shall not be dumped and/or stored in stormwater management areas.

3.4 Driveway and Parking Lot Sealants

DEM recommends asphalt based sealant rather coal-tar based sealants to be used on driveways and parking lots

4 Hazardous Materials Containment

Stormwater shall be prevented from entering areas with hazardous materials to the maximum extent feasible. Spill containment shall be provided in areas where a spill might occur.

Town of Northborough

NORTHBOROUGH FIRE STATION

APPENDIX A

Sample O&M Log
BMP Maintenance and Management Inspection Checklist
AquaShield AquaFilter Inspection and Maintenance Manual
AquaShield AquaSwirl Inspection and Maintenance Manual
Cultec Operation and Maintenance Guidelines
OM-1 Operation and Maintenance Plan (11 x 17)

Sample Operation and Maintenance Log

Site Maintenance Supervisor: _____ Date: _____

☐ Routine ☐ Response to Rainfall Event _____ in ☐ Other _____

BMP	Frequency	Date Performed	Comments
Yard Drain/ Catch Basins/ Manholes/ Outlet Control Structures	Quarterly Inspections		
	Maintenance as necessary		
	Maintain per manufacturer's recommendations		
Water Quality Structures	Inspect per manufacturer's recommendations		
	Maintain per manufacturer's recommendations		
Vegetated Areas	Maintenance as necessary		
Spring Clean Up	Between April and May		
Sweeping	Biannually		
Grass Mowing	As required		
Mulching	As required		
Edging	As required		
Weed Control	As required		
Pruning	As required		
Aeration	As required		
Lime Application	As required		
Fall Clean up	Between October and December		
Drainage Piping	Annual Inspection		
	Maintenance as necessary		

CATCH BASIN (CB) INSPECTION FORM

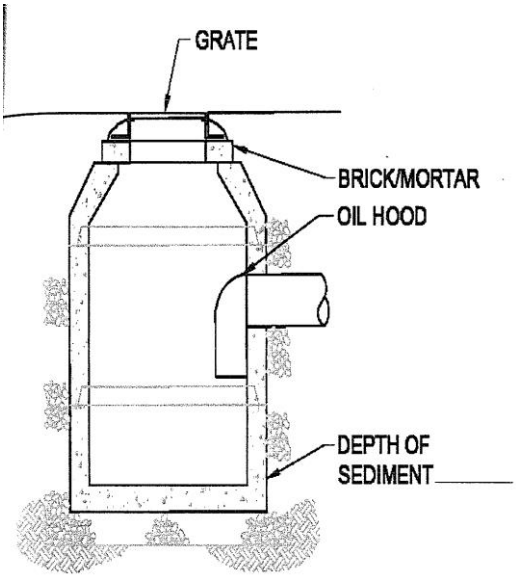
Owner: _____

Property Manager: _____

Inspected by: _____

Date of Inspection: _____

Catch Basin Inspected #_____



Acceptable ☐ Needs Work ☐

NOTES:

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_____

Date of cleaning: _____ By Whom: _____

Date of repair: _____ By Whom: _____

Note any discrepancies and suggested corrective actions

_____
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_____

UDERGROUND INFILTRATION SYSTEM INSPECTION FORM

Northborough Fire Station

Owner: _____

Property Manager: _____

Inspected by: _____

Date of Inspection: _____

Underground Infiltration System Inspected #_____

Acceptable ☐ Needs Work ☐

NOTES:

_____
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_____
_____

Date of cleaning: _____ By Whom: _____

Date of repair: _____ By Whom: _____

Note any discrepancies and suggested corrective actions

_____
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_____
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_____

Aqua-Filter™
Stormwater Filtration System

Inspection and Maintenance Manual

AquaShield™, Inc.
2733 Kanasita Drive
Suite 111
Chattanooga, TN 37343
Toll free (888) 344-9044
Phone: (423) 870-8888
Fax: (423) 826-2112
Email: info@aquashieldinc.com
www.aquashieldinc.com

March 2014

Table of Contents

AquaShield™, Inc.
2733 Kanasita Drive
Suite 111
Chattanooga, Tennessee 37343
Toll free (888) 344-9044
(423) 870-8888
Fax (423) 826-2112
www.aquashieldinc.com

AquaShield™, Inc
Stormwater Treatment Solutions

The highest priority of AquaShield™, Inc. (AquaShield™) is to protect waterways by providing stormwater treatment solutions to businesses across the world. These solutions have a reliable foundation based on over 20 years of water treatment experience.

Local regulators, engineers, and contractors have praised the AquaShield™ systems for their simple design and ease of installation. All the systems are fabricated from high performance, durable and lightweight materials. Contractors prefer the quick and simple installation of our structures that saves them money.

The patented line of AquaShield™ stormwater treatment products that provide high levels of stormwater treatment include the following:

- **Aqua-Swirl® Stormwater Treatment System:** hydrodynamic separator, which provides a highly effective means for the removal of sediment, floating debris and free-oil.

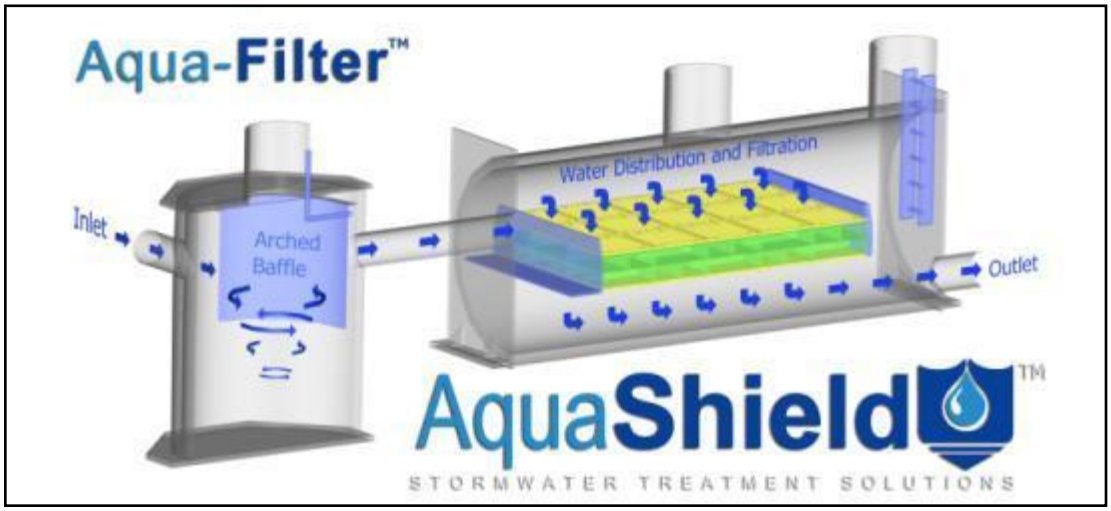
- **Aqua-Filter™ Stormwater Filtration System:** treatment train stormwater filtration system capable of removing gross contaminants, fine sediments, waterborne hydrocarbons, heavy metals and total phosphorous.

Aqua-Swirl®

Filtration Chamber of Aqua-Filter™ system

Aqua-Filter™ Stormwater Filtration System

The Aqua-Filter™ Stormwater Filtration System is designed for projects that require advanced treatment of stormwater runoff. Each system is custom engineered for site-specific needs. The patented Aqua-Filter™ system utilizes a unique "treatment-train" approach that includes an Aqua-Swirl® hydrodynamic separator for pretreatment followed by a filtration chamber for secondary treatment. A variety of natural filter media are used in order to complete the treatment process by polishing the stormwater prior to discharge. Independent laboratory and field performance verifications have shown that the Aqua-Filter™ system achieves over 80% suspended solids removal efficiency on a net annual basis.



Aqua-Filter™ Stormwater Filtration System showing Aqua-Swirl® for pretreatment followed by filtration chamber for secondary treatment prior to discharge.

The Aqua-Filter™ Stormwater Filtration System is designed for sites that require advanced treatment of runoff stormwater to meet stringent discharge requirements. Each Aqua-Filter™ system is custom engineered and utilizes a unique approach for pollutant removal. This patented configuration begins with the removal of sediment, debris and free-floating oil by the Aqua-Swirl® Stormwater Treatment System (pretreatment chamber), followed by the removal of fine sediments and other waterborne pollutants by the filtration chamber. The system can be designed for new construction projects or be used for retrofit applications. Inspection and maintenance are made simplified with oversized risers that allow for both examination and cleanout. An ingress/egress ladder is provided for the filtration chamber to better facilitate maintenance. Each Aqua-Filter™ is constructed of high performance, lightweight and durable materials including polymer coated steel (PCS) or high density polyethylene (HDPE). These materials eliminate the need for heavy lifting equipment during installation.

Third party performance and functionality testing has demonstrated Total Suspended Solids (TSS) removals of greater than 80% on a net annual basis. In addition, the Aqua-Filter™ is effective for the removal of other pollutants including petroleum hydrocarbons as well as total phosphorus and various heavy metals when bound to particulate material.

System Operation

The Aqua-Filter™ Stormwater Filtration System operates under gravitational and hydrodynamic forces with no moving parts or valves which simplifies the treatment process. The Aqua-Filter™ system is typically installed to operate in an off-line configuration. However, local jurisdictions may allow for in-line (on-line) installations. AquaShield™ recommends that local guidelines be confirmed during the site design process to ensure the proper installation rules for an Aqua-Filter™ system.

Step 1: Pretreatment by Aqua-Swirl®

Peripheral pretreatment of stormwater is not necessary when using the Aqua-Filter™. In fact, each Aqua-Filter™ is custom engineered to utilize a unique treatment train approach. Operation begins when stormwater enters the Aqua-Swirl® through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminates to settle to the base of the unit. Since stormwater flow is intermittent by nature, the Aqua-Swirl® retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms. A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest. The treated flow then exits the Aqua-Swirl® behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.

Aqua-Swirl® component of the Aqua-Filter™ System.
Note tangential inlet and outlet piping stubouts.

Step 2: Secondary Treatment by Filtration Chamber

The filtration chamber in the Aqua-Filter™ is designed to refine and enhance the stormwater quality prior to discharge into sensitive receiving waters. As the pretreated water enters the filtration chamber, it is evenly distributed across the filter bed and allowed to permeate by gravity flow through the filter media. Either a downflow or upflow configuration can be used for the filtration chamber. The filter media are contained in individual and durable nylon mesh containers (bags) positioned in such manner to avoid short circuiting (see Filter Replacement).

Filtration chamber of Aqua-Filter™ system being lowered into place. Access risers are visible along the top length of the chamber.

The natural filter media used for filtration is capable of removing the remaining waterborne pollutants such as fine-grained sediment, oil, total phosphorus, and heavy metals (e.g., copper, lead, zinc). The most commonly used media is coarse perlite. Other filter media such as zeolite, granulated activated carbon, leaf compost, bone char and various proprietary media blends are available to target site-specific pollutant treatment goals and discharge limits.

AquaShield™ Product System Maintenance

The long term performance of any stormwater treatment structure, including manufactured or land based systems, depends on a consistent maintenance plan. Inspection and maintenance functions are simple and easy for AquaShield™ Stormwater Treatment Systems allowing all inspections to be performed from the surface. It is important that a routine inspection and maintenance program be established for each unit based on: (a) the volume or load of the contaminants of concern, (b) the frequency of releases of contaminants at the facility or location, and (c) the nature of the area being drained.

In order to ensure that our systems are being maintained properly, AquaShield™ offers a maintenance solution to all of our customers. We will arrange to have maintenance performed.

Distinctive AquaShield™ logo is visible on manhole covers for each system.

Filter containers (bags) are easily managed.

Inspection

All AquaShield™ products can be inspected from the surface, eliminating the need to enter the systems to determine when cleanout should be performed. In most cases, AquaShield™ recommends a quarterly inspection for the first year of operation to develop an appropriate schedule of maintenance. Based on experience of the system's first year in operation, we recommend that the inspection schedule be revised to reflect site-specific conditions being encountered. Typically, the inspection schedule for subsequent years is reduced to semi-annual inspection events.

Discussions pertaining to maintenance of the Aqua-Swirl® and Filtration Chamber are provided below

Aqua-Swirl® Maintenance

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single swirl chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free-floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

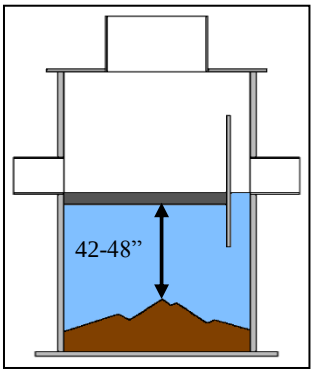
Aqua-Swirl® Inspection Procedure

To inspect the Aqua-Swirl® pretreatment chamber, a hook is needed to remove the manhole cover. AquaShield™ provides a customized manhole cover with our distinctive logo to make it easy for maintenance crews to locate a system in the field. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl® model size and serial number.

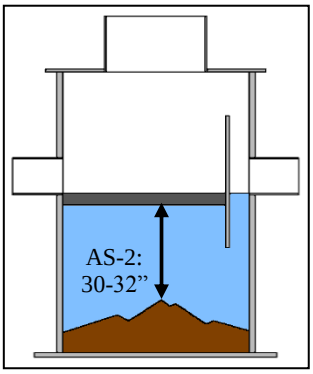
The only tools needed to inspect the Aqua-Swirl® system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water.

Sediment inspection using a stadia rod in a single chamber.

The maintenance trigger for Aqua-Swirl® Models AS-3 through AS-13 occurs when the sediment pile is within 42 to 48 inches of the standing water surface. For the Aqua-Swirl® Model AS-2, maintenance is needed when the top of the sediment pile is measured to be 30 to 32 inches below the standing water surface.



Maintenance trigger for Aqua-Swirl® Models AS-3 through AS-13 occurs when sediment pile is 42-48 inches below water surface.



Maintenance trigger for Aqua-Swirl® Model AS-2 occurs when sediment pile is 30-32” inches below water surface.

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the *top* of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl® design allows for the sediment to accumulate in a semi-conical fashion as illustrated above. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

Aqua-Swirl® Cleanout Procedure

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose from the surface (reaching all the sides). Since there are no multiple or limited (hidden or “blind”) chambers in the Aqua-Swirl®, there are no restrictions to impede on-site maintenance tasks.

Disposal of Recovered Materials from Aqua-Swirl®

Disposal of recovered material is typically handled in the same fashion as catch basin cleanouts. AquaShield™ recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used. AquaShield™ also recommends that all materials removed from the Aqua-Swirl® and any external structures (e.g, bypass features) be handled and disposed in full accordance with any applicable local and state requirements.

Vacuum truck quickly cleans the Aqua-Swirl® from a single chamber

Filtration Chamber Maintenance

The filter media is also easily observed from the surface. Manhole covers are spaced over the entire filtration bed to provide easy access. AquaShield™ provides a customized manhole cover with our logo to make it easy for maintenance crews to locate a system in the field. An entry riser provides direct access into the filtration chamber with a permanent ladder welded into the downstream section of the filtration chamber. This additional access allows for the vacuuming of any standing water and an unobstructed access to the downstream side of the filter bed.

A permanent ingress/egress ladder provides access to filter chamber. Note metal product identification plate above ladder.

Initially, perlite filter media is light tan or white in color. When the media color turns black or dark brown, it has become saturated due to pollutant loading and requires replacement. Call toll free (888) 344-9044 to order replacement filters.

Replacement of the filtration media typically requires entry into the filtration chamber by one of a two-member maintenance crew. Confined space entry methods should be followed by the maintenance crew when removing and replacing the filters. The spent filter containers are normally retrieved from the filter chamber by a second crewmember at the surface through the multiple 30-inch risers spaced across the top of the filter bed. In addition, the filter containers can be accessed directly from within the filtration chamber via a vertical removable panel (bulkhead door) at the rear of the filter bed and directly across from the ladder.

Filter Media Disposal

Disposal of recovered material is typically handled in the same fashion as catch basin cleanouts. AquaShield™ recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used. AquaShield™ also recommends that all materials removed from the Aqua-Swirl® and any external structures (e.g, bypass features) be handled and disposed in full accordance with any applicable local and state requirements.

Spent filter media can often be recycled or sent to a permitted lined landfill. Always check local regulations to ensure proper disposal of spent filter media.

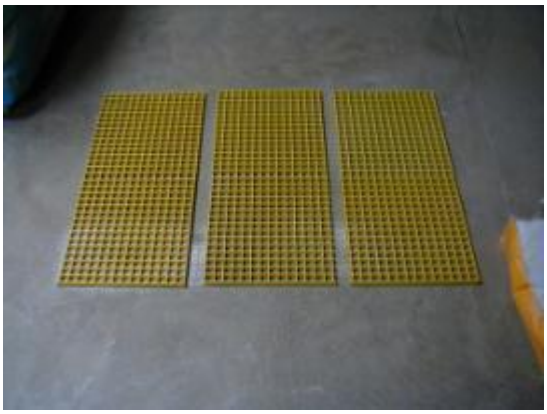
Filter Media Replacement

Instructions and photographs are provided on page 12 showing the procedures to follow to install fresh filter media containers. The bottom of two courses is placed on the fiberglass grates. Cargo netting is used across the top course of the filter containers to secure them in place.

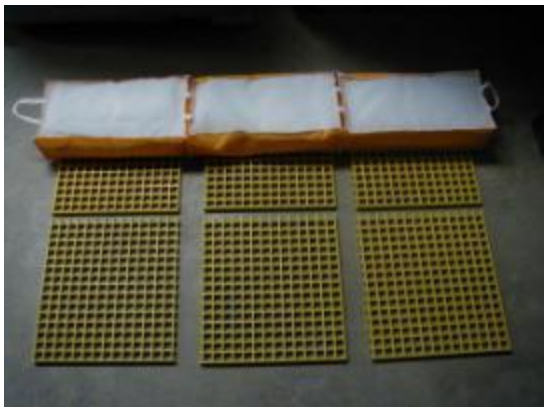
Cargo Netting Installation

Cargo netting is used to secure filter containers in place after containers are installed in the appropriate orientation within the filtration chamber. ***Cargo netting is placed on top of the top course of filter containers*** and stretched into place using provided heavy duty cable ties. The netting is cable tied to anchor blocks and attached to the side walls of the filtration chamber. It is important to install the netting in such a way as to both cover the entire surface area of the containers while stretching netting snuggly to minimize container movement under high flow conditions. Netting installation is complete when all surface area of filter containers are covered with netting and netting is secured with cable ties to anchor blocks.

INSTALLATION INSTRUCTIONS for FILTER CONTAINERS

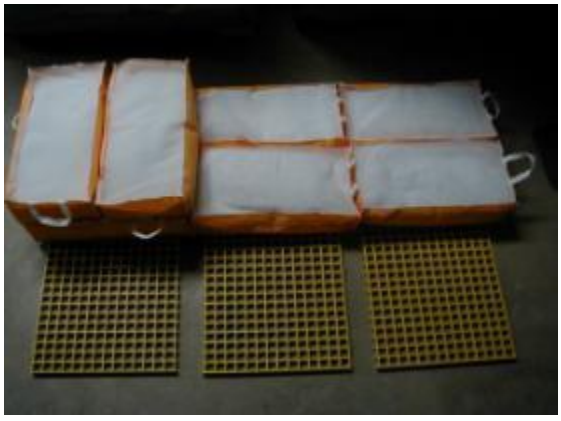


(1) Bottom Grates found in chamber



(2) First row first course

(3) Second row



(4) Second course started

(5) Second course complete

Aqua-Filter™ Inspection and Maintenance Manual
Work Sheets

SITE and OWNER INFORMATION

Site Name: _____

Site Location: _____

Date: _____ Time: _____

Inspector Name: _____

Inspector Company: _____ Phone #: _____

Owner Name: _____

Owner Address: _____

Owner Phone #: _____ Emergency Phone #: _____

INSPECTION

Note: Aqua-Filter™ system is a treatment train including Aqua-Swirl® pretreatment hydrodynamic separator and filtration chamber.

I. Floatable Debris and Oil in Aqua-Swirl®

1. Remove manhole lid to expose liquid surface of the Aqua-Swirl®.
2. Remove floatable debris with basket or net if any present.
3. If oil is present, measure its depth. Clean liquids from system if one half (½) inch or more oil is present.

   Note: Water in Aqua-Swirl® can appear black and similar to oil due to the dark body of the surrounding structure. Oil may appear darker than water in the system and is usually accompanied by oil stained debris (e.g. Styrofoam, etc.). The depth of oil can be measured with an oil/water interface probe, a stadia rod with water finding paste, a coliwasa, or collect a representative sample with a jar attached to a rod.

II. Sediment Accumulation in Aqua-Swirl®

1. Lower measuring device (e.g. stadia rod) into swirl chamber through service access provided until top of sediment pile is reached
2. Record distance to top of sediment pile from top of standing water: _____ inches
3. For Aqua-Swirl® Models AS-3 through AS-13, schedule cleaning if value in Step #2 is 48 to 42 inches or less.
4. For Aqua-Swirl® Model AS-2, schedule cleaning if value in Step #2 is 32 to 30 inches or less.

III. Filtration Chamber

1. Remove manhole lid(s) to expose filter media bed and access ingress/egress ladder. At a minimum, one manhole lid will be present to access ladder. Larger filtration chamber sizes may have one or more manhole lids to access filter media bed.
2. Enter filtration chamber via ladder or through access riser(s) over filter bed. Note that water may be present at minimal depths in the filtration chamber prior to clean-out during inspection.
3. Remove bulkhead door (gate) at downstream end of filtration chamber and across from ladder (Figure 1).
4. Remove filter grate covers/cargo nets and filters through access risers located along filtration chamber length or through ingress/egress ladder manhole.
5. Visually inspect filter media noting color and saturation or contaminants.
6. If (perlite) media is dark brown or black, the media is fully spent and should be replaced (Figure 2).

Figure 1. Removable bulkhead door across from ingress/egress ladder at rear of filtration chamber.

Figure 2. Perlite filter media needs replacement.

7. Contact AquaShield™ for replacement filter media containers at (888) 344-9044, or info@aquashieldinc.com.
8. Schedule cleaning as described below.

IV. Diversion Structures (External Bypass Features)

Diversion (external bypass) structures should be inspected as follows:

1. Inspect weir or other bypass feature for structural decay or damage. Weirs are more susceptible to damage than off-set piping and should be checked to confirm that they are not crumbling (concrete or brick) or decaying (steel).
2. Inspect diversion structure and bypass piping for signs of structural damage or blockage from debris or sediment accumulation.
3. When feasible, measure elevations on diversion weir or piping to ensure it is consistent with site plan designs.

4. Inspect downstream (convergence) structure(s) for sign of blockage or structural failure as noted above.

CLEANING

Schedule cleaning with local vactor company or AquaShield™ to remove sediment, oil and other floatable pollutants. The spent filter containers and captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate that appropriate actions be taken to clean and dispose of materials captured and retained by the Aqua-Filter™ system. All cleaning activities should be performed in accordance with property health and safety procedures.

AquaShield™ always recommends that all materials removed from the Aqua-Filter™ system (Aqua-Swirl® and filtration chamber) during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements.

MAINTENANCE SCHEDULE

I. During Construction

Inspect the Aqua-Filter™ system (Aqua-Swirl® and filtration chamber) every three (3) months and clean the system as needed. The Aqua-Filter™ should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance triggers including any of the following:

- depth to sediment is 42 to 48 inches water surface in Aqua-Swirl® Models AS-3 through AS-13,
- depth to sediment is 30 to 32 inches water surface in Aqua-Swirl® Model AS-2
- Oil is present to the degree that requires cleaning, and/or
- filter media exhibits black to dark brown color and/or is saturated with contaminants.

II. First Year Post-Construction

Inspect the Aqua-Filter™ every three (3) months and clean the system as needed.

Inspect and clean the system once annually regardless of whether it has reached its sediment or floatable pollutant storage capacity.

III. Second and Subsequent Years Post-Construction

If the Aqua-Filter™ did not reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Filter™ reached full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once

every six (6) months and cleaned as needed. The Aqua-Filter™ should be cleaned annually regardless of whether it reaches its sediment or floatable pollutant capacity.

IV. Bypass Structures

Bypass structures should be inspected whenever the Aqua-Filter™ is inspected. Maintenance should be performed on bypass structures as needed.

MAINTENANCE COMPANY INFORMATION

Company Name: _____

Street Address: _____

City: _____ State/Prov.:_____ Zip/Postal Code: _____

Contact: _____ Title: _____

Office Phone: _____ Cell Phone: _____

ACTIVITY LOG

Date of Cleaning: _____ (Next inspection should be 3 months from this data for first year).

Time of Cleaning: Start: _____ End: _____

Date of Next Inspection: _____

Floatable debris present in Aqua-Swirl®: Yes No

Notes: _____

_____

Oil present in Aqua-Swirl®: Yes No Oil depth (inches): _____

Measurement method and notes: _____

_____

_____

Filter Media Needs Replacement: Yes No

Filter grate / cargo netting needs repair/replacement: Yes No

Number of Filter Containers (bags) needing replacement: _____

Type of Filter Media: Perlite Other(s): _____

Other Filtration Chamber Needs and Observations: _____

_____

_____

STRUCTURAL CONDITIONS and OBSERVATIONS

Structural damage: Yes No Where: _____

Structural wear: Yes No Where: _____

Odors present: Yes No Describe: _____

Clogging: Yes No Describe: _____

Other Observations: _____

_____

_____

NOTES

Additional Comments and/or Actions To Be Taken	Time Frame

ATTACHMENTS

- Attach site plan showing Aqua-Filter™ location.
- Attach detail drawing showing Aqua-Filter™ dimensions and model number.
- Attach details showing basic design and elevations (where feasible) of diversion configuration.

Aqua-Filter™

TABULAR MAINTENANCE SCHEDULE

Date Construction Started: _____

Date Construction Ended: _____

During Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* Aqua-Filter™ should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity. In addition, the system should be cleaned at the **end of construction** regardless of whether it has reach full pollutant storage capacity.

First Year Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* Aqua-Filter™ should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity.

Second and Subsequent Years Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed												X*
Inspect Bypass, maintain as needed												X*
Clean System*												X*

* If the Aqua-Filter™ did **not** reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Filter™ **reached** full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months or more frequently if past history warrants, and cleaned as needed. The Aqua-Filter™ should be cleaned annually regardless of whether it reaches its full sediment or floatable pollutant capacity.

Stormwater Treatment System Inspection and Maintenance Manual

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Chattanooga, TN 37343
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Fax: (423) 826-2112
Email: info@aquashieldinc.com
www.aquashieldinc.com

June 2022

Aqua-Swirl® Stormwater Treatment System

The Aqua-Swirl® Stormwater Treatment System (Aqua-Swirl®) is a vortex-type hydrodynamic separator designed and supplied by AquaShield™, Inc. (AquaShield™). Aqua-Swirl® technology removes pollutants including suspended solids, trash, floatables and free-floating oil from stormwater runoff. Both treatment and storage are accomplished in the single swirl chamber without the use of multiple or hidden, blind access chambers.

Floatable debris in the Aqua-Swirl®

Aqua-Swirl® System Maintenance

The long term performance of any stormwater treatment structure, including manufactured or land based systems, depends on a consistent maintenance plan. Inspection and maintenance functions are simple and easy for the Aqua-Swirl® allowing all inspections to be performed from the surface.

It is important that a routine inspection and maintenance program be established for each unit based on: (a) the volume or load of the contaminants of concern, (b) the frequency of releases of contaminants at the facility or location, and (c) the nature of the area being drained.

Example of Aqua-Swirl® manhole cover

Inspection

The Aqua-Swirl® can be inspected from the surface thereby eliminating the need to enter the system to determine when cleanout should be performed. AquaShield™ recommends in most cases that a quarterly inspection take place for the first year of operation to develop an appropriate schedule of maintenance. Based on experience of the system's first year in operation, we recommend that the inspection schedule be revised to reflect the site-specific conditions encountered. The typical inspection schedule for subsequent years is reduced to semi-annual inspection events. **Table 1** below lists the available Aqua-Swirl® models as well their inner diameters, oil/debris storage capacities and the sediment storage capacities.

Table 1. Aqua-Swirl® Storage Capacities

Aqua-Swirl® Model	Inner Diameter (ft)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft^3)
AS-2	2.5	37	6
AS-3	3.5	110	11
AS-4	4.5	190	19
AS-5	5.5	270	23
AS-6	6.5	390	33
AS-7	7.5	540	45
AS-8	8.5	710	58
AS-9	9.5	910	74
AS-10	10.5	1,130	91
AS-11	11.5	1,422	110
AS-12	12.5	1,698	131
AS-13	13.0	1,986	154
AS-XX	Custom*		

* Custom designs to meet site-specific criteria, can include multiple (twin) units for increased flow and materials storage capacity.

Maintenance

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber of the system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free-floating oil and floatable trash can be directly observed and maintained through the manhole access provided directly over the swirl chamber. If so equipped, the trash screen can be exposed once the water is removed from the unit and inspected.

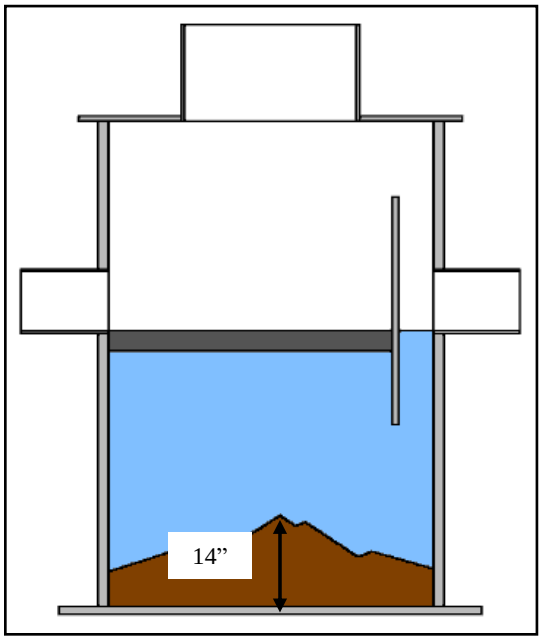
Aqua-Swirl® Inspection Procedure

To inspect the Aqua-Swirl®, a hook is typically needed to remove the manhole cover. AquaShield™ provides a customized manhole cover with our distinctive logo to make it easy for maintenance crews to locate the system in the field. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl® model size, and serial number.

The only tools needed to inspect the Aqua-Swirl® system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water.

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the *top* of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile. The Aqua-Swirl® design allows for the captured sediment to accumulate in a semi-conical fashion as illustrated below. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

Sediment inspection using a stadia rod



Maximum recommended sediment depth prior to cleanout
is 14 inches for all Aqua-Swirl® models (not to scale)

Aqua-Swirl® Cleanout Procedure

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable trash can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose from the surface reaching all the sides. Since there are no multiple or limited (blind) access chambers in the Aqua-Swirl®, there are no restrictions to impede on-site maintenance tasks. If applicable, the trash screen can be reached from the surface and cleaned with a vacuum hose.

Disposal of Recovered Materials

AquaShield™ recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used. AquaShield™ also recommends that all materials removed from the Aqua-Swirl® and any external bypass structures (divergent and convergent) be handled and disposed of in full accordance with any applicable local and state requirements.

Vacuum (vactor) truck quickly cleans the single open access swirl chamber

Aqua-Swirl®
Inspection and Maintenance Work Sheets
on following pages

Aqua-Swirl®
Inspection and Maintenance Work Sheets

SITE and OWNER INFORMATION

Site Name: _____

Site Location: _____

Date: _____ Time: _____

Inspector Name: _____

Inspector Company: _____ Phone #: _____

Owner Name: _____

Owner Address: _____

Owner Phone #: _____ Emergency Phone #: _____

INSPECTIONS

I. Floatable Trash/Debris and Oil

1. Remove manhole lid to expose liquid surface of the Aqua-Swirl®.
2. Remove floatable trash/debris with basket or net if any present.
3. If oil is present, measure its depth. Clean liquids from system if one half (½) inch or more of oil and/or trash is present.
4. If applicable, clean trash screen surface with vacuum hose.

Note: Water in Aqua-Swirl® can appear black and similar to oil due to the dark body of the surrounding structure. Oil may appear darker than water in the system and is usually accompanied by oil stained debris (e.g. Styrofoam, etc.). The depth of oil can be measured with an oil/water interface probe, a stadia rod with water finding paste, a coliwasa, or collect a representative sample with a jar attached to a rod.

II. Sediment Accumulation

1. Lower measuring device (e.g. stadia rod) into swirl chamber through service access provided until top of sediment pile is reached.
2. Record distance to top of sediment pile from top of standing water: _____ inches.
3. Maximum recommended sediment depth prior to cleanout is 14 inches for all models. Consult system shop drawing for treatment chamber depth as measured from the inlet pipe invert to base of the unit.

III. Diversion Structures (External Bypass Features)

If a diversion (external bypass) configuration is present, it should be inspected as follows:

1. Inspect weir or other bypass feature for structural decay or damage. Weirs are more susceptible to damage than off-set piping and should be checked to confirm that they are not crumbling (concrete or brick) or decaying (steel).
2. Inspect diversion structure and bypass piping for signs of structural damage or blockage from debris or sediment accumulation.
3. When feasible, measure elevations on diversion weir or piping to ensure it is consistent with site plan designs.
4. Inspect downstream (convergence) structure(s) for sign of blockage or structural failure as noted above.

CLEANING

Schedule cleaning with local vactor company to remove sediment, trash, oil and other floatable pollutants. The captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate that appropriate actions be taken to clean and dispose of materials captured and retained by the Aqua-Swirl®. All cleaning activities should be performed in accordance with property health and safety procedures.

AquaShield™ always recommends that all materials removed from the Aqua-Swirl® during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements.

MAINTENANCE SCHEDULE

I. During Construction

Inspect the Aqua-Swirl® full capture device every three (3) months and clean the system as needed. The Aqua-Swirl® should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance trigger.

II. First Year Post-Construction

Inspect the Aqua-Swirl® every three (3) months and clean the system as needed.

Inspect and clean the system once annually regardless of whether it has reached its sediment, trash or floatable pollutant storage capacity.

III. Second and Subsequent Years Post-Construction

If the Aqua-Swirl® did not reach full sediment or floatable trash capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® reached full sediment, trash or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months and cleaned as needed.

The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its sediment, trash or floatable pollutant capacity.

IV. Bypass Structures

Bypass structures should be inspected whenever the Aqua-Swirl® is inspected. Maintenance should be performed on bypass structures as needed.

MAINTENANCE COMPANY INFORMATION

Company Name: _____

Street Address: _____

City: _____ State/Prov.:_____ Zip/Postal Code: _____

Contact: _____ Title: _____

Office Phone: _____ Cell Phone: _____

ACTIVITY LOG

Date of Cleaning: _____ (Next inspection should be 3 months from this data for first year).

Time of Cleaning: Start: _____ End: _____

Date of Next Inspection: _____

Floatable debris present: Yes No

Notes: _____

_____

_____

Oil present: Yes No Oil depth (inches): _____

Measurement method and notes: _____

_____

_____

STRUCTURAL CONDITIONS and OBSERVATIONS

Structural damage: Yes No Where: _____

Structural wear: Yes No Where: _____

Odors present: Yes No Describe: _____

Clogging: Yes No Describe: _____

Other Observations: _____

_____

_____

NOTES

Additional Comments and/or Actions To Be Taken	Time Frame

ATTACHMENTS

- Attach site plan showing Aqua-Swirl® location.
- Attach detail drawing showing Aqua-Swirl® dimensions and model number.
- If a diversion configuration is used, attach details showing basic design and elevations (where feasible).

Aqua-Swirl®

TABULAR MAINTENANCE SCHEDULE

Date Construction Started: _____

Date Construction Ended: _____

During Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity. In addition, the system should be cleaned at the **end of construction** regardless of whether it has reach full pollutant storage capacity.

First Year Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity.

Second and Subsequent Years Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed												X*
Inspect Bypass, maintain as needed												X*
Clean System*												X*

* If the Aqua-Swirl® did **not** reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® **reached** full sediment, trash or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months or more frequently if past history warrants, and cleaned as needed. The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its full sediment, trash or floatable pollutant capacity.

Contactor® & Recharger®
Stormwater Chambers

Operation and Maintenance Guidelines
for CULTEC Stormwater Management Systems

The Founder of Plastic Chamber Technology

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CULTEC®

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U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; and others; U.S. Designs D613819; D638,095; D668,318 and others; Canadian Patent 2,591,255 and others; Community Designs 1092191; 1745209; and others.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

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May 2017

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

WQMP
Operation & Maintenance (O&M) Plan

Project Name:_____

Prepared for:

Project Name: _____

Address:_____

City, State Zip:_____

Prepared on:

Date:_____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Month 1	Date:	
□ Month 2	Date:	
□ Month 3	Date:	
□ Month 4	Date	
□ Month 5	Date:	
□ Month 6	Date:	
□ Month 7	Date:	
□ Month 8	Date:	
□ Month 9	Date:	
□ Month 10	Date:	
□ Month 11	Date:	
□ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Year 1	Date:	
□ Year 4	Date:	
□ Year 7	Date:	
□ Year 10	Date:	
□ Year 13	Date:	
□ Year 16	Date:	
□ Year 19	Date:	
□ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	□ Year 1	Date:	
	□ Year 4	Date:	
	□ Year 7	Date:	
	□ Year 10	Date:	
	□ Year 13	Date:	
	□ Year 16	Date:	
	□ Year 19	Date:	
	□ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		□ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	□ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		□ Clean stormwater management chambers and feed connectors of any debris. □ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	□ Year 9	Date:	
	□ Year 18	Date:	
	□ Year 27	Date:	
	□ Year 36	Date:	
	45 years after commissioning		□ Clean stormwater management chambers and feed connectors of any debris. □ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. □ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. □ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. □ Attain the appropriate approvals as required. □ Establish a new operation and maintenance schedule.
			Notes
	□ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Month 1	Date:	
	□ Month 2	Date:	
	□ Month 3	Date:	
	□ Month 4	Date:	
	□ Month 5	Date:	
	□ Month 6	Date:	
	□ Month 7	Date:	
	□ Month 8	Date:	
	□ Month 9	Date:	
	□ Month 10	Date:	
	□ Month 11	Date:	
	□ Month 12	Date:	
	Spring and Fall		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	Yearly		□ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	□ Year 1	Date:	
	□ Year 2	Date:	
	□ Year 3	Date:	
	□ Year 4	Date:	
	□ Year 5	Date:	
	□ Year 6	Date:	
	□ Year 7	Date:	

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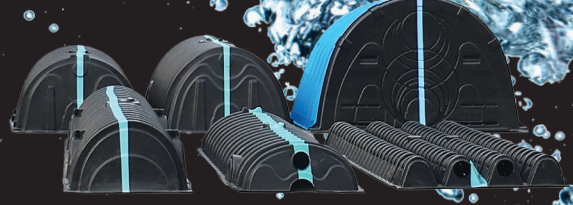

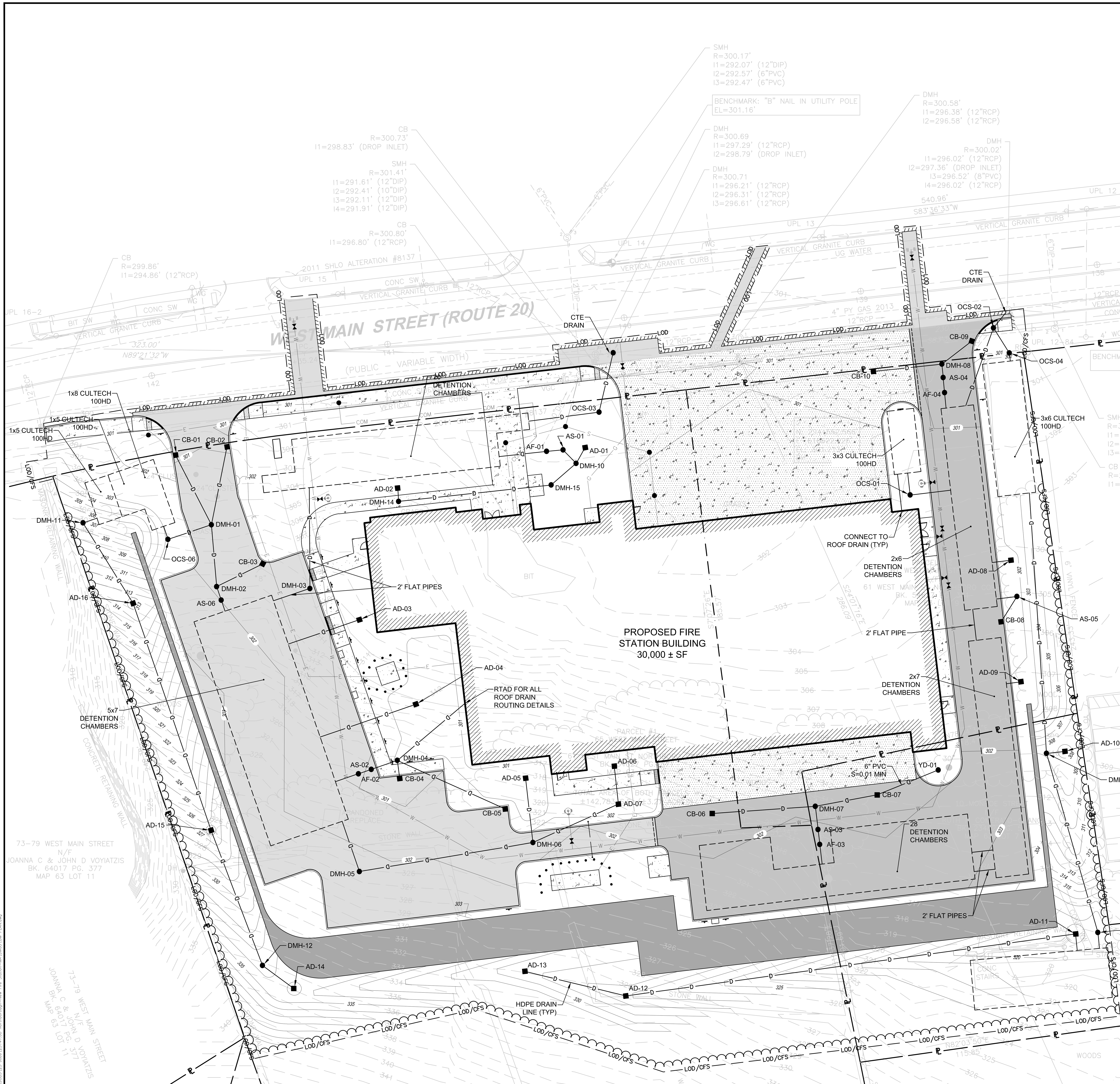

Scale: 1"=20'

0 10' 20' 40'

NOT FOR CONSTRUCTION

STORMWATER MANAGEMENT SYSTEM INSPECTION AND MAINTENANCE NOTES

DURING CONSTRUCTION (CONTRACTOR'S RESPONSIBILITY)

1. THE CONTRACTOR SHALL REMOVE SEDIMENT AND DEBRIS FROM ALL CATCH BASINS, MANHOLES, AND THE DRAINAGE SYSTEM ON A ROUTINE BASIS, IMMEDIATELY FOLLOWING SITE STABILIZATION, AND PRIOR TO PROJECT COMPLETION AND ACCEPTANCE.
2. THE CLOSED DRAINAGE SYSTEM AND ASSOCIATED STRUCTURES SHALL BE CLEANED AND FLUSHED BY THE CONTRACTOR AT THE COMPLETION OF CONSTRUCTION, AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSPECTION AND MAINTENANCE OF THE DRAINAGE SYSTEM UNTIL ACCEPTANCE OF THE SYSTEM BY THE ENGINEER AND THE TOWN OF SMITHFIELD. FOLLOWING ACCEPTANCE OF THE PROPOSED DRAINAGE SYSTEM, THE OWNER OF THE SITE SHALL BE RESPONSIBLE FOR THE LONG-TERM INSPECTION AND MAINTENANCE OF THE DRAINAGE SYSTEM.
3. ANY ACCUMULATION OF PONDING WATER IN AREAS WITHIN THE LIMITS OF DISTURBANCE, OTHER THAN DESIGNATED AREAS, SHALL BE REMOVED ACCORDINGLY AND PREVENTED IN THE FUTURE.

POST CONSTRUCTION (OWNER'S RESPONSIBILITY)

1. TRASH, LITTER, SEDIMENT AND OTHER DEBRIS SHALL BE REMOVED FROM ANY STORMWATER MANAGEMENT SYSTEM FACILITY (INCLUDING BUT NOT LIMITED TO CATCH BASINS, MANHOLES, INLET, OUTLET AND DIVERSION STRUCTURES, AND STORMWATER BEST MANAGEMENT PRACTICES (BMPs)) A MINIMUM OF TWO TIMES PER YEAR, PREFERABLY IN THE SPRING AND FALL.
2. THE PARKING LOT AND ENTRY DRIVE SHALL BE SWEPT BY THE OWNER AS EARLY AS POSSIBLE EVERY SPRING AND ONCE IN THE FALL TO REMOVE SEDIMENTS.
3. ALL CLEANING AND MAINTENANCE OF STORMWATER MANAGEMENT SYSTEMS POST-CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE OWNER.

CATCH BASINS (WITH SUMP) INSPECTION, MAINTENANCE, AND REPAIR NOTES

1. INSPECTIONS SHALL BE PERFORMED A MINIMUM OF TWO TIMES PER YEAR (SPRING/FALL). UNITS SHALL BE CLEANED ANNUALLY AND WHENEVER THE DEPTH OF THE SEDIMENT IS GREATER THAN OR EQUAL TO HALF THE SUMP DEPTH.
2. THE INLET GRATE SHALL NOT BE WELDED TO THE FRAME OR PAVED OVER SO THAT THE SUMP CAN BE EASILY INSPECTED AND MAINTAINED.
3. CARE SHALL BE TAKEN TO AVOID DAMAGING AND DISPLACING HOODS PLACED ON HOODED OUTLETS DURING CLEANING.

AREA DRAIN INSPECTION, MAINTENANCE, AND REPAIR NOTES

1. INSPECTIONS SHALL BE PERFORMED A MINIMUM OF TWO TIMES PER YEAR (SPRING/FALL). UNITS SHALL BE CLEANED ANNUALLY AND WHENEVER THE DEPTH OF SEDIMENT IS GREATER THAN OR EQUAL TO HALF THE SUMP DEPTH.
2. THE INLET GRATE SHALL NOT BE WELDED TO THE FRAME OR PAVED OVER SO THAT THE SUMP CAN BE EASILY INSPECTED AND MAINTAINED.
3. CARE SHALL BE TAKEN TO AVOID DAMAGING AND DISPLACING HOODS PLACED ON HOODED OUTLETS DURING CLEANING.

PARE

SCALE ADJUSTMENT GUIDE

0" 1"

BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station

63 West Main Street

Town of Northborough, MA

REVISIONS:

PROJECT NO.:	23141.00
DATE:	APRIL 23, 2024
SCALE:	1"=20'
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	AKL
APPROVED BY:	

DRAWING TITLE:

OPERATION AND MAINTENANCE PLAN

DRAWING NO.:

OM-1

SHEET NO. ____ OF ____