Conservation Commission Meeting

Wednesday, July 10, 2024 at 7:00 PM
Remote Participation Only

Agenda

Pursuant to Chapter 2 of the Acts of 2023, the meeting and public hearing will be conducted with remote opportunities for participation. Remote participation and access methods include:

ACCESS INFORMATION:

A. This meeting will be held on July 10, 2024 at 7 pm. Location: Remote Participation Only

B. The meeting will be televised through WCATV (Watertown Cable Access Television): http://vodwcatv.org/CablecastPublicSite/watch-now?site=3

C. The Public may join the virtual meeting online: https://watertown-ma.zoom.us/j/99597080710

D. Public may join the virtual meeting audio only by phone: (877) 853-5257 or (888) 475-4499 (Toll Free) and enter Webinar ID: 995 9708 0710

E. Public may comment through email: sjenness@watertown-ma.gov

F. Please Visit the Conservation Commission Website here: https://www.watertown-ma.gov/199/Conservation-Commission

1. Call to Order
2. Roll Call
3. Public Hearings
   A. (Continued from June 5, 2024 meeting) - 10-30 Manley Way (MassDEP #: 321-0188). Notice of Intent submitted for the re-purposing of the existing structure at 10 Manley Way, Watertown, MA, for light industry, lab/R&D/non-nuisance manufacturing, or warehousing use. Proposed work is within the locally regulated 150 ft buffer zone and state-regulated 100 ft buffer zone that includes new landscaping, new stormwater retention system, and fostering connectivity from Walker Pond to the rear of the site. PPF Industrial 20 Seyon LLC c/o Morgan Stanley Real Estate (Property Owner) and Christopher Lucas (Representative).
   B. 550 Arsenal Street - Watertown Mall: Notice of Intent submitted for the redevelopment of three parcels (31.4 acres) located at 480 Arsenal Way, 500 Arsenal Street, and 550 Arsenal Street in Watertown, Massachusetts into a campus of office, residential, lab, and retail uses with two multi-story parking garages. Proposed work is within the locally regulated 150 ft buffer zone and state-regulated 100 ft buffer zone and associated resource areas including inland bank, bordering vegetated wetland, riverfront area, and isolated vegetated wetland that includes an increase in open space and landscaping improvements, and stormwater improvements.
4. Wetland Decision
   A. Arsenal Park Phase B - excess soil and ball field

5. Updates
    A. Watertown Square
    B. Faire on the Square - September 21, 12-5 pm
    C. CPC Update
    D. Agent Report
    i. Arsenal Park Phase B progress update
6. Acceptance of Minutes
    A. June 5, 2024, Conservation Commission Meeting
7. Adjourn

RJOC & ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS
80 Montvale Ave., Suite 201
Stoneham, MA 02180
781-279-0180 www.rjoconnell.com

July 2, 2024

Town of Watertown
Conservation Commission
149 Main Street, 3rd Floor.
Watertown, MA 02472
Attn: Katie Swan, Environmental Planner/Conservation Agent

Regarding: 10-30 Manley Way
Response to Conservation Commission Comments

Dear Commission Members and Ms Swan:

This letter is in response to the comments made by the Conservation Commission at the meeting on June 5th, 2024.

The comments discussed at the meeting are listed below in *italics* with our responses following in **bold**. Accompanying this letter are the following documents in response to the comments:

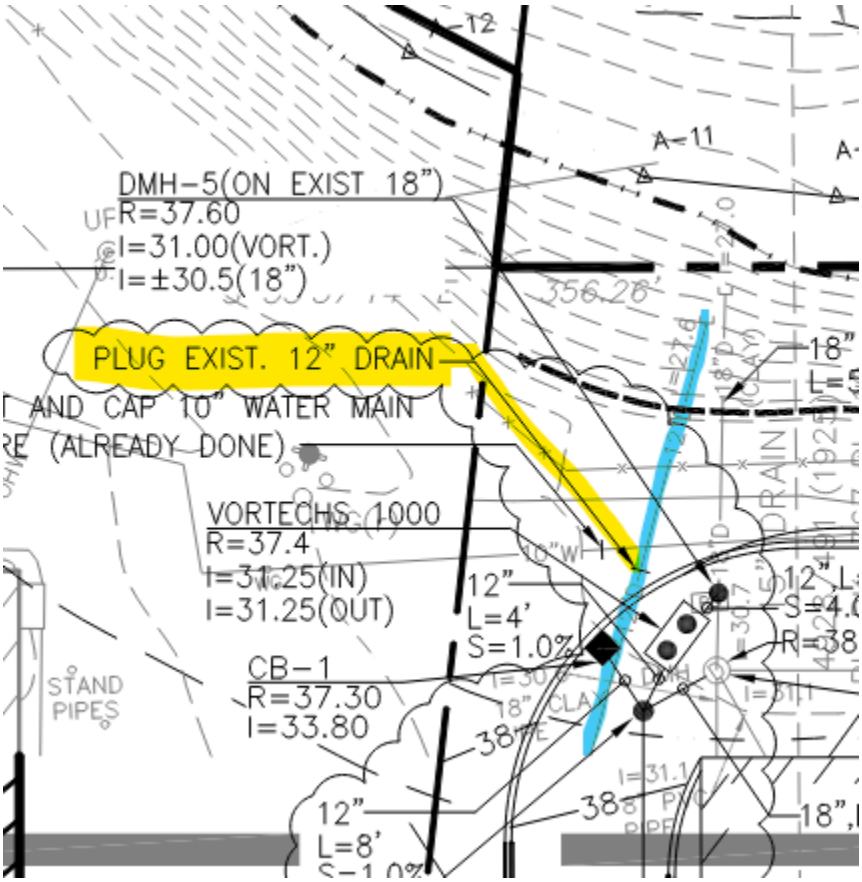
- Drawing Sheet C-1B, Demolition and Erosion Control Plan, dated 07/02/2024.
- Drawing Sheet C-2B, Grading, Drainage and Utility Plan, dated 07/02/2024.
- Drawing Sheet C-3B, Parking and Traffic Control Plan, dated 07/02/2024.
- Stormwater Report (includes the revised Operation & Maintenance Plan) dated 07/02/2024.
- Attachments are included with this letter as referenced in the following responses.

Comments

1. *Investigate if any of the existing outfalls to Walker Pond can be removed if they are abandoned.*

    - **RJ O'Connell & Associates (RJOC) has investigated the existing 12" clay drainpipe outlet located at the bottom of the slope in the northwestern corner of the site and determined that it was abandoned during the site improvements that were completed in 2009. That drainpipe was for a roof drain from a portion of the previous building on the site that was demolished in 2009. Stormwater runoff from that area of the site is currently directed into the existing Vortechnics tank that discharges through the 18" drain shown on the plan. Included here is an image from the "Grading, Drainage & Utility Plan," prepared by RJ O'Connell & Associates, dated 08/17/2009, showing that pipe to be plugged and abandoned. This plan was submitted to the Watertown Conservation**

Commission in 2009. Therefore, RJOC has revised the C-1B plan to show the flared end at the bottom of the slope to be removed and the pipe to be plugged.



- **RJOC reviewed all available plans in an attempt to determine what, if anything, is connected to the 12" concrete drain outlet located to the north of the site on the city property. Unfortunately, no information could be found related to that outlet. It appears that any drainage connected to it would be on the city property. Based on a site walk no drainage structures were found upstream of the outlet. However, not all areas of the city property are visible due to stockpiles of materials related to the city's current use of the property for a construction staging area. The location of the outlet in the Walker Pond slope and wooded area does not allow access for a camera to be used for investigation. RJOC recommends that drain outlet be further investigated and evaluated as part of the city's survey and design work for the future use of the city property.**

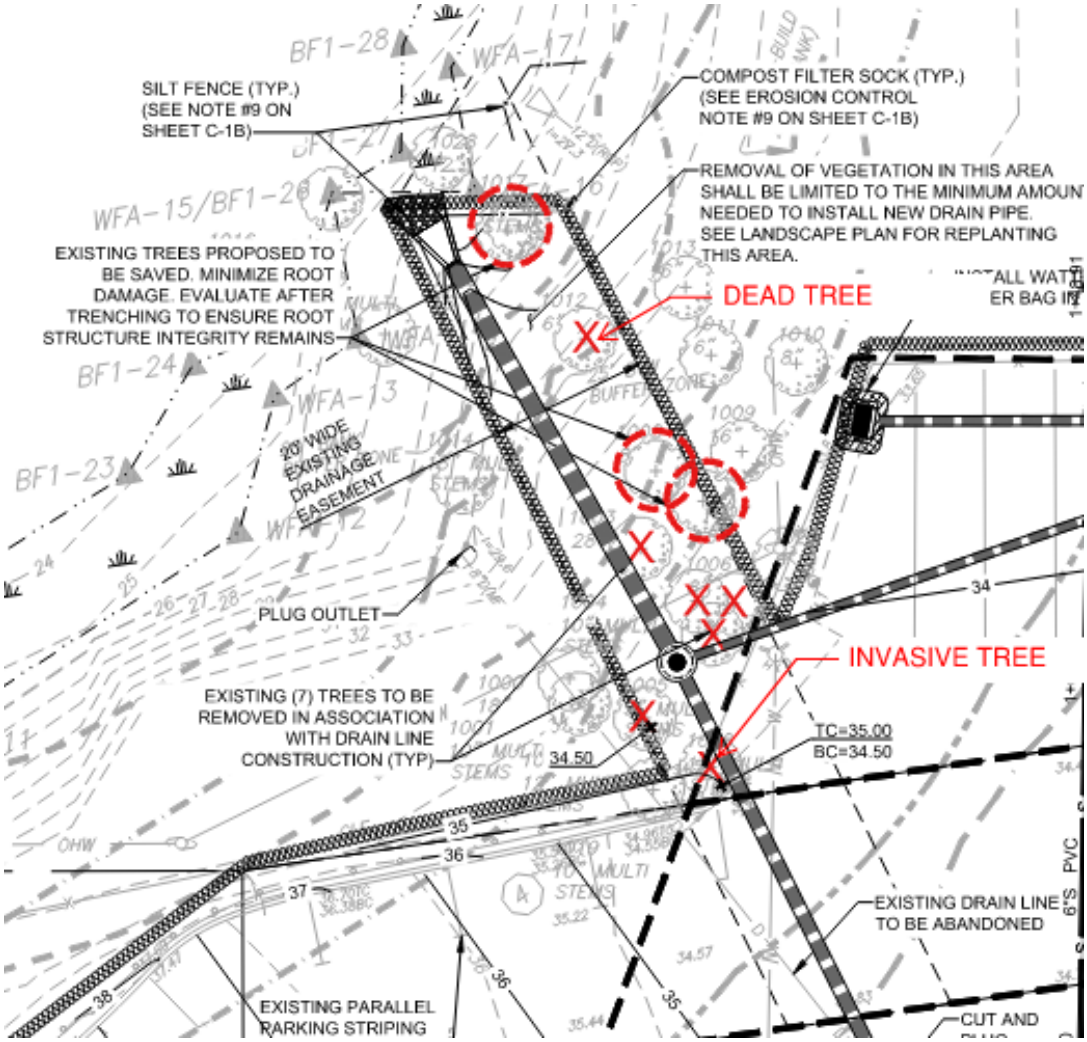
2. *Review Easement Agreement for the Truck Turnaround Area and confirm if it allows below ground utilities and/or drainage system.*

- **Based on review of the Truck Turnaround Easement it appears that in order to proceed with the drainage system that the Watertown DPW has approved, the easement would need to be amended to allow the installation of our subsurface infiltration system and associated piping. The Applicant has contacted Gideon Schreiber, the Director of Planning and Zoning and Tyler Glode, the City Engineer to discuss an amendment to the easement. We hope to have a meeting with them prior to the next Conservation**

Commission meeting on July 10th. The applicant suggests that a condition could be added to the Order of Conditions that says "The Applicant will work with the City to amend the easement to allow the subsurface drainage or relocate the drainage structures and infiltration outside the easement to the satisfaction of the City Planning Department and City Engineer". The overall design would remain the same other than just moving the structures.

3. *What is the impact to the existing trees in the area where the new drain pipe will be installed at Walker Pond to replace the existing deteriorated pipe. Any trees over 6 inches in diameter need to be located and shown on the plan or in a sketch.*

- **RJOC has completed a survey to locate all trees 6" and greater in diameter within the drain easement and Lucas Environmental has determined the species of each tree. This information has been added to the Demolition and Erosion Control Plan Sheet C-1B. The existing trees that need to be removed in association with the installation of the new drain line have been noted. It is expected that a total of 7 existing trees need to be removed. The location sizes and species are noted in red in the image below and shown on the plan. One of the trees, a 6" Maple, appears to be dead, and another tree, a 12" Tree-of-heaven is an invasive species.**



ID Number	Common Name	Description	*Latin Name*	Wetland Indicator	Nativity
1000	Eastern cottonwood	*18”*	*Populus deltoides*	FAC*	Native
1001	American linden	*10" MULTI STEMS*	*Tilia americana*	FACU	Native
1002	Northern red oak	*12" MULTI STEMS*	*Quercus rubra*	FACU	Native
1003	Northern red oak	*28”*	*Quercus rubra*	FACU	Native
1004	American elm	*10" MULTI STEMS*	*Ulmus americana*	FACW	Native
1005	American elm	*9" MULTI STEMS*	*Ulmus americana*	FACW	Native
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1019	Tree-of-heaven	*10" MULTI STEMS*	*Ailanthus altissima*	NI	Invasive
1020	Tree-of-heaven	*6”*	*Ailanthus altissima*	NI	Invasive
1028	Gray birch (fallen)	*12”*	*Betula populifolia*	FAC*	Native
1029	Red maple (dead)	*16”*	*Acer rubrum*	FAC*	Native

4. *Confirm the condition of the existing sanitary sewer pipe in the 100-foot buffer zone on the city property north of the site in case it needs to be repaired or replaced now as part of this project.*

    - **A video camera survey of the pipe is needed to evaluate its condition. RJOC investigated the ability to perform a video survey and found that the area where the manholes and sewer line are located has been completely blocked off with jersey barriers and material stockpiles as part of city’s current use of the property for a construction staging area. As the area is currently inaccessible for video camera vehicles and equipment the applicant suggests that a condition could be added to the Order to inspect the condition of the sewer during construction and repair if necessary. The Applicant will coordinate with the city DPW to obtain access to the area.**

5. *Provide a clarification on the discrepancy between the impervious area noted on the plans and in the stormwater report.*

    - **The impervious area calculations have been reviewed and the stormwater report calculations include more impervious area than the final design plan. Some of the new sidewalk areas that are porous pavement in the final design**

were counted as impervious in the stormwater calculations and an existing impervious concrete sidewalk area was counted as pervious area under the existing conditions. These discrepancies have been corrected in the stormwater report which now matches the overall impervious area reduction of 9,952 s.f. listed on Sheet OS-1 of the site plan set. The 9,995 sf impervious area listed in the Notice of Intent narrative should be 9,952 sf. The correction in the Stormwater Management Report results in less impervious area in those calculations and a better result that still complies with all state and local requirements. A copy of the corrected report has been included with this response and a copy has been provided to the City Engineer noting the correction.

- **An exhibit plan depicting the areas that caused the discrepancies in impervious calculations has been included in Attachment A of this letter.**

6. *Include snow storage in the O&M plan. Specify low deicing/more environmentally friendly deicing measures including spread rate.*

    - **A Snow Storage Plan has been provided in Appendix B of the Operation and Maintenance Plan (O&M). Additionally, Section 4, Snow Management, of the O&M has been revised to specify the use of calcium chloride for onsite deicing at the minimal rate necessary to provide for safe vehicular and pedestrian travel. The O&M notes that the property manager will monitor the application rate of calcium chloride to make sure it is kept to a minimum while ensuring safe conditions for pedestrians and vehicles.**

    - **Calcuim Chloride is considered a more environmentally friendly deicing measure, as noted within an article provided by the EPA as shown below:**

      The environmental toll and long-term costs of rock salt have inspired some states to search for alternative management practices. Magnesium chloride (MgCl)is considered to be safer than NaCl but requires twice the amount to cover the same area, making it more expensive. Calcium chloride (CaCl) is safer for the environment but is three times more expensive than NaCL and so is typically reserved for use in vulnerable areas. Innovative solutions that limit the amount of rock salt needed are also being explored.

      (A full copy of the EPA published article referenced above has been provided within Attachment B of this letter.)

7. *Include additional language in the O&M plan for spill prevention measures. Include a sign in the truck turn around area for contact information in the event of a spill.*

    - **Spill Prevention and Response Procedures are included in the Long Term Pollution Prevention Plan (LTPPP) Section 2.C of the O&M in the Appendix of the Stormwater Management Report. This section (2.C.1(f) has been revised to include the requirement for the installation of signs in the truck turnaround area with the contact information of the Spill Prevention and Control Contractor. The sign will also include the contact information for the Watertown Fire Department. The locations and information for the sign have been added to Sheet C-3B.**

- **Section 2.C.2.a) of the LTPPP has been revised to include the requirement to cover the catch basins with impervious cover and surround them with containment booms in the event of a spill.**

- **The manufacturer of the proposed water quality unit (CDS-5), which is the receiving catch basin in the truck turnaround area, has confirmed that there is 83 gallons of storage capacity within the liquid trap system of the structure in the event of a hazardous spill. This information has also been added to the revised O&M.**

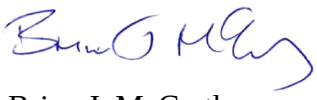
8. *Provide confirmation that the existing Vortech's system has been maintained.*

    - **The existing Vortech's system has been maintained and the applicant has provided a copy of the receipt of the most recent cleaning of the system (provided within the Attachment C of this letter).**

Please call me if you have any questions at 781-279-0180.

Sincerely,

RJO'CONNELL & ASSOCIATES



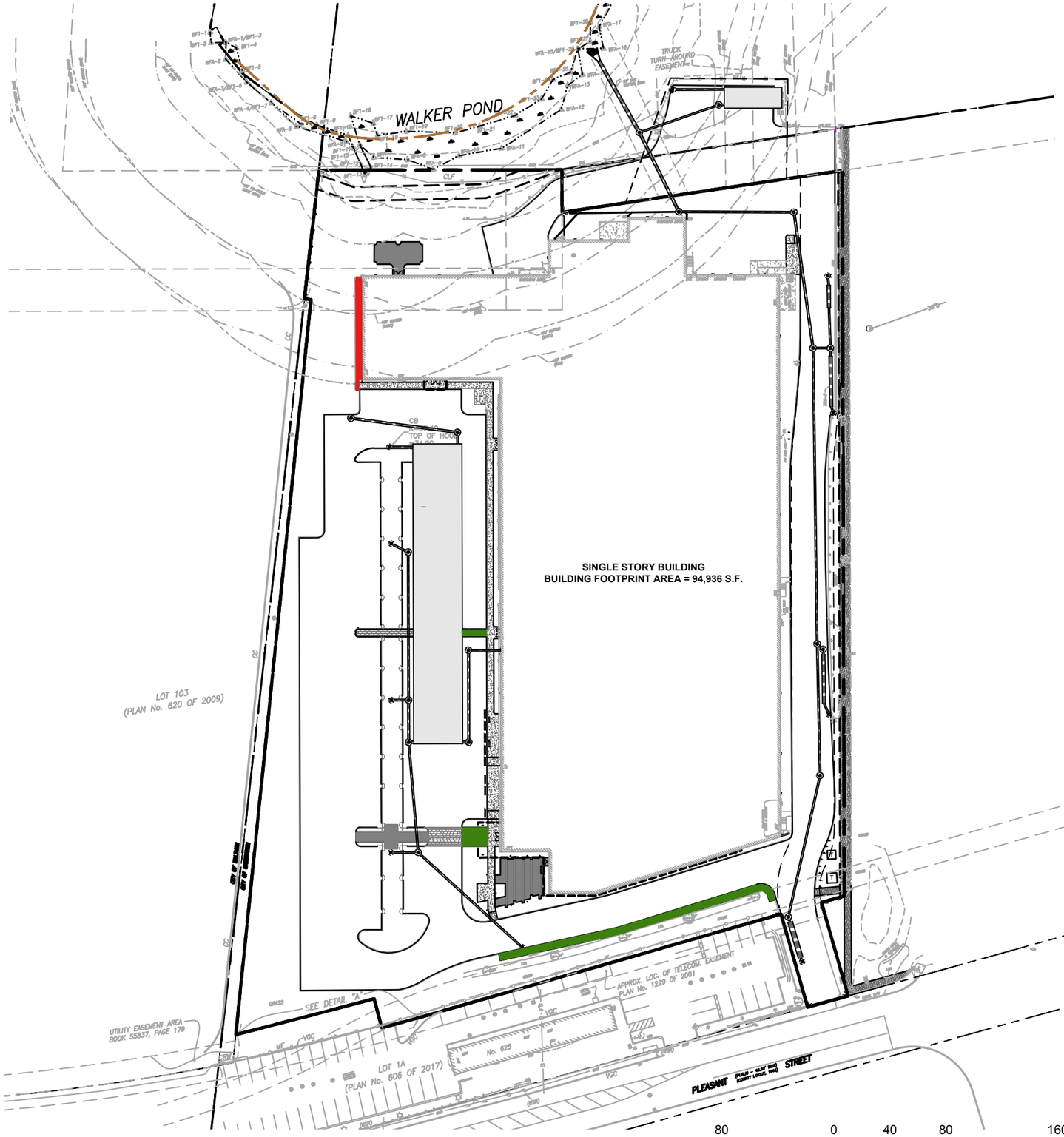
Brian J. McCarthy
Vice President

cc: PPF Industrial 20 Seyon LLC
MassDEP – NERO

ATTACHMENTS

Attachment A:
Impervious Area Discrepancy Exhibit

RJOC



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LEGEND

EXISTING IMPERVIOUS AREA THAT WAS OMITTED FROM THE EXISTING CONDITIONS MODEL IN THE HYDROCAD ANALYSIS

PROPOSED POROUS PAVEMENT/PAVERS THAT WERE MODELED AS IMPERVIOUS IN HYDROCAD ANALYSIS

RJO'CONNELL & ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 07/02/2024 SCALE: 1"=80'

ATTACHMENT A

IMPERVIOUS AREA DISCREPANCY EXHIBIT

WATERTOWN, MA

Copyright © 2023 by R.J. O'Connell & Associates, Inc.
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Attachment B:
EPA Published Article

Winter is Coming!
And with it tons of salt on our roads



Shasten Sherwell

In New England, road salting is a necessity to keep people safe during snow or cold weather as they drive to work or take their kids to school. The amount of salt used for deicing roads and highways has increased over the years along with the year-round transportation of goods and services. The many benefits that road salting provides, however are matched by some opportunities for improvement. Road salt can contaminate drinking water, kill or endanger wildlife, increase soil erosion, and damage private and public property. Alternative methods are needed to mitigate these drawbacks.

The most common substance used for deicing roads and highways is Sodium Chloride (NaCl) or table salt known as rock salt when spread on the road because of its much larger granules. Nearly half a million tons is used annually in Massachusetts alone for winter road maintenance. Rock salt is very effective at melting snow and ice and is considered to be pretty cheap. But rock salt's low cost does not include the potential damage to property, infrastructure, or the environment. Though seemingly harmless to us, rock salt can have corrosive effects in large quantities that affects cars, trucks, bridges, and roads resulting in approximately $5 billion dollars in annual repairs in the U.S. alone. In addition, road salt can also infiltrate nearby surface and ground waters and can contaminate drinking water reservoirs and wells. High sodium levels in drinking water affect people with high blood pressure, and high chloride levels in surface waters are toxic to some fish, bugs, and amphibians. Furthermore, excess road salt accumulates on roadside areas killing roadside plants and harming wildlife that eat the salt crystals. Salty roads also attract animals like deer and moose (who love licking up the salt), increasing the probability of accidents and roadkill.

The environmental toll and long-term costs of rock salt have inspired some states to search for alternative management practices. Magnesium chloride (MgCl)is considered to be safer than NaCl but requires twice the amount to cover the same area, making it more expensive. Calcium chloride (CaCl) is safer for the environment but is three times more expensive than NaCL and so is typically reserved for use in vulnerable areas. Innovative solutions that limit the amount of rock salt needed are also being explored.

New technologies, such as porous pavement, are being engineered to reduce runoff from roads and have been found reduce snow and ice cover. Porous or permeable pavement allows standing water to seep through, removing water from roads that would normally go through freeze-thaw periods, thus preventing ice formation on the roads. A recent study showed that the annual median snow/ice cover on porous pavement was three times lower than that of regular pavement, and that the low amounts of ice/snow accumulating on porous pavement led to a 77% reduction in annual salt used for maintenance. Another technology gaining traction is solar roads, made up of engineered solar panels that can be walked and driven upon. This technology has the potential of converting every single road into a source of renewable energy. In addition to the added energy source, this technology could also eliminate the need for road salt by melting ice or snow through heating water in pipes embedded in the road.

Winter is Coming!
And with it tons of salt on our roads

Shasten Sherwell



Accumulation of standing water in a parking lot after snow melt. Comparison between porous pavement (left) and regular pavement (right). Source: UNH Stormwater Center

Rhode Island has adopted several measures to reduce the amount of salt needed. Since 2012, the State has been applying a brine solution (23.3% salt-water solution) to the roads before a forecasted snow event. Known as anti-icing, this practice prevents the formation of frost on pavement, and its implementation has been increasing across New England. Another alternative is the use a 50/50 salt and sand mixture. The sand doesn't help to melt the snow or ice but increases traction, reducing the amount of road salt required. After the snow or ice melts, however, the remaining sand mixture gets washed away, filling catch basins or adjacent waterbodies with sediment, which then requires additional work hours and money to maintain and keep the basins clear. Currently, only a small fraction (5%) of the sand dispersed in Rhode Island is removed; the rest gets washed away into adjacent water bodies: clouding the water and making it difficult for aquatic plants to photosynthesize. Other alternatives include adding biodegradable substances like beet juice, pickle juice, and molasses to the salt solution to enhance performance. These salt additives lower the freezing point of water, slowing down the formation of ice; they also aid in traction, and make the solution stickier so less salt gets splashed off the roads and wasted.

The disadvantages of many current treatments have led to interest in new management approaches. New Hampshire has been successful in reducing road salt use through improved management practices and policy. In 2013 the State launched, the "New Hampshire Road Salt Reduction Initiative" to address the high number of waters impaired by chloride (19 water bodies in 2008, and 43 in 2012). In addition to the testing and use of many of the alternatives described in this article, the initiative recommends using other management practices and policies to reduce the use of road salt. These include upgrading equipment so that salt is spread using only "closed loop systems" which allow operators to accurately release and monitor the exact amount of salt applied, lowering speed limits during snow/ice events, and having mandatory use of snow tires during winter. Thanks to these initiatives the State has reduced the use of road salt by 20 percent and is on track to stop the rise of impaired waters due to high chloride levels.

While no perfect solution exists to keep our roads clear in winter, the number of tools available to public works departments continues to increase, allowing for a tailored approach to clear roads in an environmentally conscious manner without risking driver safety.

Attachment C:
Vortech Maintenance Receipt

Invoice

#INV264089

6/18/2024

Bill To

PPF INDUSTRIAL 20 SEYON, LLC
535 Boylston St, 11th Floor
Boston MA 02116
United States

TOTAL:
Amount Due:
Due Date: 7/18/2024

Terms	Due Date	Date of Service	PO #	Sales Order
Net 30	7/18/2024	6/18/2024		Sales Order #SO278086

Item	Amount
Cleaned and disposed of contents from within 7 catch basins. Vactor and dispose of contents from within one vortech unit. Disposed of 1 yard of sediment	

Subtotal	
Tax (0%)	$0.00
Total	
Amount Due	

Invoice Signature:

Name:

Job Site
PPF INDUSTRIAL 20 SEYON LLC
10-30 MANLEY WY
WATERTOWN MA 02472

Please detach and return with your payment

Pay online at
www.johnsewer.com
(781) 569-6695

Invoice #: INV264089
Date: 6/18/2024
Balance Due: $2,055.00

PPF INDUSTRIAL 20 SEYON, LLC
535 Boylston St, 11th Floor
Boston MA 02116
United States

Remit to: John's Sewer & Pipe Cleaning
4 Breed Avenue
Woburn MA 01801
United States

EXISTING TREES AT PROPOSED DRAINAGE OUTLET PIPE

ID Number	Common Name	Description	*Latin Name*	Wetland Indicator	Nativity	
1000	Eastern cottonwood	*18"*	*Populus deltoides*	FAC*	Native	
1001	American linden	*10" MULTI STEMS*	*Tilia americana*	FACU	Native	
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1017	Red maple	*14" MULTI STEMS*	*Acer rubrum*	FAC*	Native	
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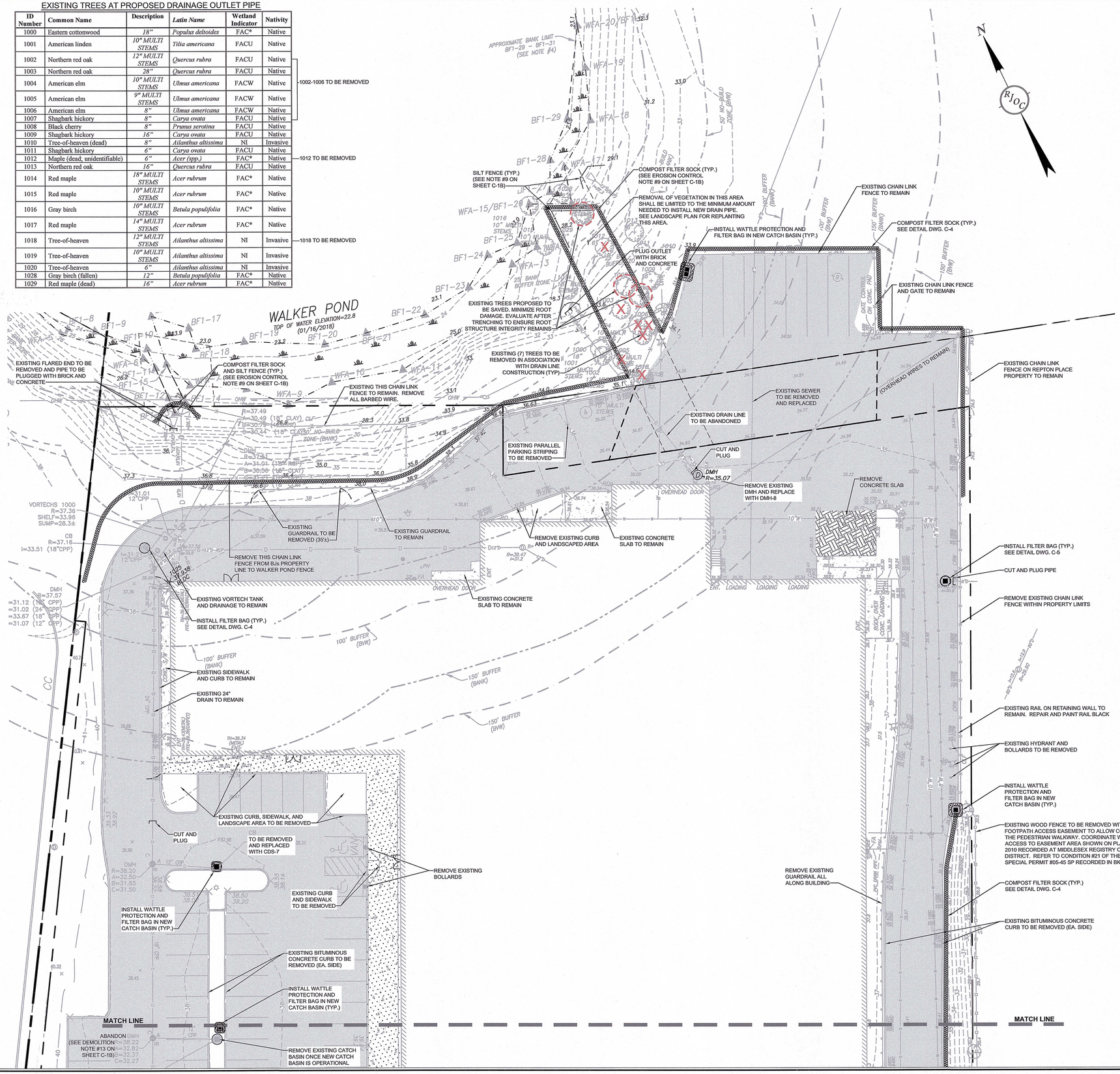

EROSION CONTROL NOTES:

1. PRIOR TO THE START OF CONSTRUCTION, ALL EROSION CONTROLS SHOWN ON THIS PLAN SHALL BE SET IN PLACE.
2. THE CONTRACTOR SHALL KEEP ON SITE AT ALL TIMES ADDITIONAL COMPOST FILTER SOCKS AND EXTRA SILTATION FENCING FOR INSTALLATION AT THE DIRECTION OF THE ENGINEER TO MITIGATE ANY EMERGENCY CONDITION.
3. THE AREA OR AREAS OF ENTRANCE AND EXIT TO AND FROM THE SITE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO THE PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY.
4. CATCH BASINS WITH SILT BAGS MUST BE INSPECTED EVERY 7 CALENDAR DAYS AND WITHIN 24 HOURS OF A RAIN EVENT OF 0.25 INCHES OR GREATER. SILT BAGS WILL BE REMOVED FROM EACH BASIN IN ACCORDANCE WITH THE SILT BAG MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
5. UPON COMPLETION OF ALL SITE WORK CONSTRUCTION, THE SITE CONTRACTOR SHALL INSPECT ALL ON-SITE CATCH BASINS AND DRAINAGE STRUCTURES AND REMOVE ALL SEDIMENT, TRASH AND DEBRIS THAT HAS ACCUMULATED WITHIN EACH STRUCTURE DURING THE COURSE OF CONSTRUCTION.
6. PRIOR TO THE START OF ANY AUTHORIZED ACTIVITY THE GENERAL CONTRACTOR SHALL SUBMIT FOR INFORMATION A DUST CONTROL PLAN TO THE ENGINEER. THE DUST CONTROL PLAN WILL OUTLINE MEASURES TO CONTROL AND MITIGATE DUST DURING ALL PHASES OF DEMOLITION AND CONSTRUCTION AND IN ALL TYPES OF WEATHER CONDITIONS. THE APPROVED DUST CONTROL PLAN SHALL BE IMPLEMENTED DURING ALL PHASES OF THE AUTHORIZED ACTIVITIES AND WILL CONTINUE UNTIL THE PROJECT HAS BEEN GRANTED AS-BUILT APPROVAL.
7. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED AND/OR CONSTRUCTED IN ACCORDANCE WITH THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS, DATED MARCH 1997, REPRINTED MAY 2003, AND ALL LOCAL MUNICIPAL REGULATIONS.
8. TO MINIMIZE THE MIGRATION OF DUST AND SILT FROM THE CONSTRUCTION SITE, THE FOLLOWING MEASURES SHALL BE IMPLEMENTED AS REQUIRED:
   - SPRAY DISTURBED AREAS WITH WATER DURING DRY AND WINDY DAYS
   - WASH WHEELS OF VEHICLES BEFORE LEAVING THE SITE
   - PERIODICALLY CLEAN SURROUNDING ROADWAYS NEAR THE ENTRANCE TO THE SITE
   - ALL VEHICLES HAULING MATERIAL TO AND FROM THE SITE SHALL PLACE SECURE COVERS OVER THEIR LOADS
9. THE APPLICANT SHALL COORDINATE WITH ALL APPLICABLE ABUTTERS PRIOR TO INSTALLATION OF ANY EROSION CONTROLS LOCATED OFFSITE.
10. EROSION CONTROLS SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY SITE DISTURBANCE. THE CONTRACTOR SHALL CONTACT THE DPW AT LEAST 24 HOURS PRIOR TO ANTICIPATED INSTALLATION COMPLETION FOR THE APPLICABLE INSPECTION.

DEMOLITION NOTES:

1. THE CONTRACTOR IS RESPONSIBLE FOR DISPOSAL OF DEMOLISHED MATERIALS OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
2. PRIOR TO THE START OF ANY DEMOLITION ACTIVITIES, ON-SITE EROSION AND SEDIMENT CONTROL MEASURES AS SHOWN ON DRAWINGS C-1A AND C-1B MUST BE INSTALLED AND APPROVED BY THE OWNER'S REPRESENTATIVE.
3. THE CONTRACTOR SHALL PROTECT AND/OR CAP OFF ALL EXISTING ON-SITE UTILITY SERVICES WHETHER DESIGNATED ON THESE DRAWINGS OR DISCOVERED DURING CONSTRUCTION. SERVICES SHALL BE CAPPED OFF AT THE PROPERTY IN ACCORDANCE WITH THE APPROPRIATE UTILITY COMPANY/ENTITY STANDARDS.
4. REUSE OF EXISTING GRANULAR PAVEMENT SUBBASE MATERIAL AND EXCAVATED MATERIAL SHALL BE DETERMINED BY THE GEOTECHNICAL ENGINEER.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING AND PROTECTING ALL EXISTING AND NEW DRAINAGE AND UTILITIES TO REMAIN AND/OR BE CONSTRUCTED.
6. DURING ON-SITE DEMOLITION WORK, STORM RUNOFF SHALL BE CONTROLLED AND DIRECTED TOWARD TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES.
7. THE EROSION CONTROL MEASURES AS SHOWN ON THE DRAWINGS DEPICT THE MINIMUM REQUIRED CONTROLS AND ARE REPRESENTATIVE OF A SINGLE PHASE OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SITING, RELOCATION AND AUGMENTATION OF EROSION CONTROL DEVICES AS THE PROJECT PROGRESSES AND SITE DRAINAGE CONDITIONS CHANGE.
8. THE CONTRACTOR SHALL MODIFY EROSION CONTROL MEASURES IF REQUIRED DUE TO WEATHER AND SEASONAL CONDITIONS AND CONSTRUCTION ACTIVITIES.
9. THE CONTRACTOR SHALL MINIMIZE THE AREA OF DISTURBED SOIL. EFFORTS SHALL BE MADE TO LIMIT THE TIME OF EXPOSURE OF DISTURBED AREAS.
10. COMPOST FILTER SOCKS OR SILT BAGS SHALL BE INSTALLED AT ALL EXISTING AND PROPOSED CATCH BASINS AS INDICATED. NO SEDIMENT SHALL BE ALLOWED TO ENTER THE ON-SITE DRAINAGE SYSTEM AT ANY TIME.
11. ALL CONSTRUCTION DUMPSTERS SHALL BE PROPERLY MAINTAINED. ALL DUMPSTERS SHALL BE LOCATED ON A BITUMINOUS CONCRETE OR CONCRETE SURFACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TRASH DISPOSAL ON A REGULAR BASIS AND SHALL ENSURE THAT THE DUMPSTER AREAS ARE PROPERLY MAINTAINED.
12. THE CONTRACTOR SHALL EMPLOY THE SERVICES OF A PEST CONTROL CONTRACTOR TO DEVELOP AND IMPLEMENT A PEST CONTROL PLAN.
13. EXISTING CASTINGS AND TOP CONE SECTION OF MANHOLES AND CATCH BASINS TO BE ABANDONED SHALL BE REMOVED AND THE REMAINING STRUCTURE SHALL BE FILLED WITH ¾-INCH CRUSHED STONE.

LEGEND

- EXISTING PAVEMENT TO BE PULVERIZED, STRIPPED STOCKPILED AND REMOVED FROM SITE
- EXISTING CONCRETE SIDEWALK TO BE REMOVED
- APPROXIMATE LIMITS OF CONCRETE SLAB TO BE REMOVED
- COMPOSITE FILTER SOCK
- SILT FENCE
- FILTER BAG
- WATTLE INLET PROTECTION

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DESIGNED BY:	BJM/MAC
DRAWN BY:	MCR
REVIEWED BY:	BJM
SCALE:	1" = 20'
DATE:	05/04/2023

DRAWING NAME:
DEMOLITION AND EROSION CONTROL PLAN

DRAWING NUMBER:
C-1B

PROJECT NUMBER:
21049

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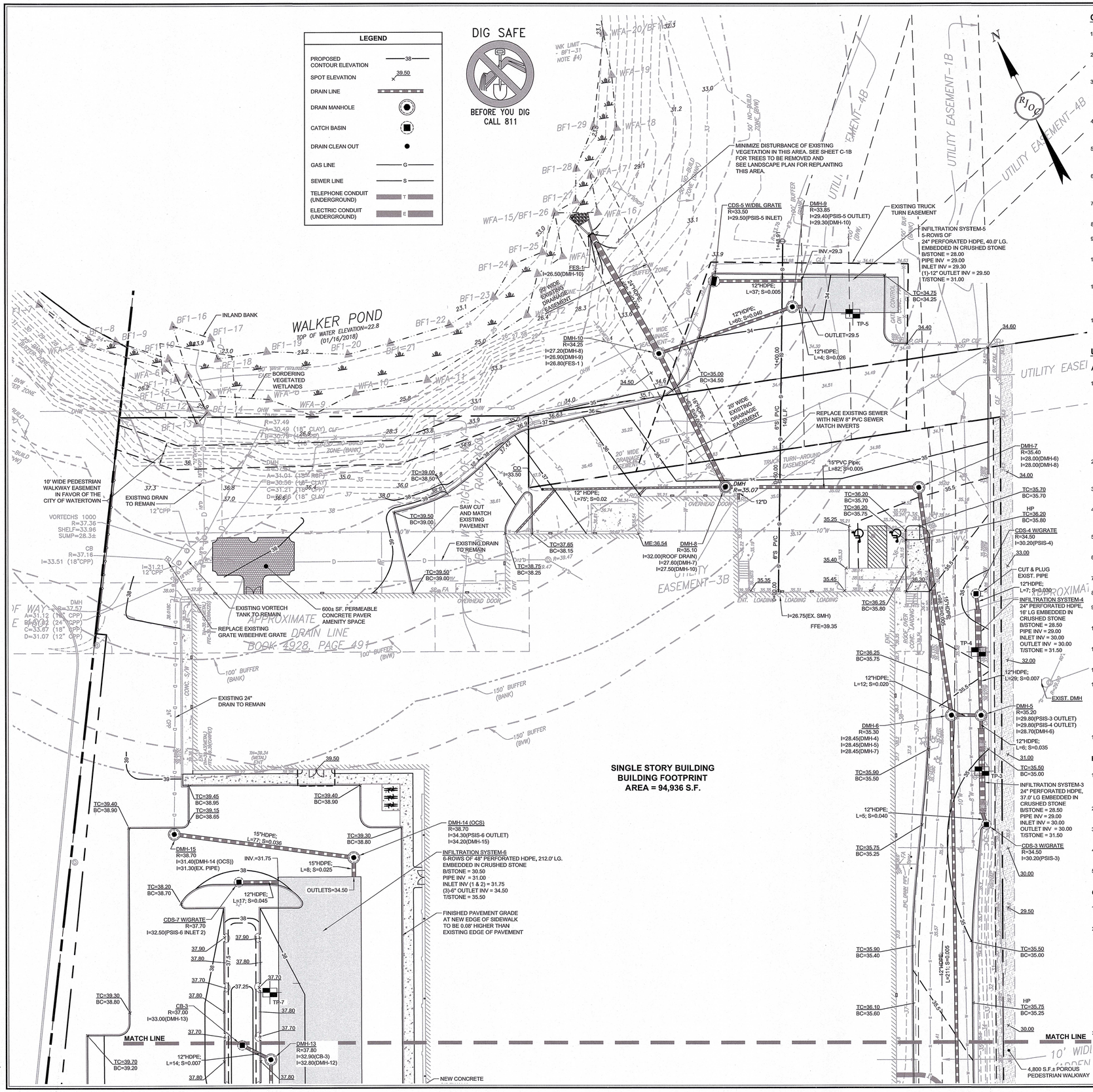

GRADING AND DRAINAGE NOTES:

1. SITE GRADING ACTIVITIES SHALL NOT PROCEED UNTIL APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES HAVE BEEN INSTALLED AND APPROVED BY THE OWNER'S REPRESENTATIVE AND/OR ENGINEER.
2. THE EXISTING UTILITIES SHOWN HEREON SHALL BE CONSIDERED APPROXIMATE. CONTRACTOR SHALL VERIFY VIA TEST PIT EXCAVATION THE LOCATION AND ELEVATION PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND ENGINEER OF DISCREPANCIES ENCOUNTERED IN THE FIELD.
3. ALL PROPOSED STORM DRAINAGE PIPES SHALL BE HIGH DENSITY POLYETHYLENE PIPE (HDPE) AND STRUCTURES SHALL BE PRECAST CONCRETE UNLESS NOTED OTHERWISE. HIGH DENSITY POLYETHYLENE PIPE (HDPE) SHALL CONFORM TO AASHTO DESIGNATIONS M294 AND M252, AND SHALL BE N-12 PIPE AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS (ADS) OR APPROVED EQUAL. PIPE JOINTS SHALL BE INTEGRAL BELL AND SPIGOT, SOIL TIGHT (ST) WITH FACTORY INSTALLED, O-RING RUBBER GASKETS CONFORMING TO ASTM F477.
4. ALL CATCH BASINS AND OTHER DRAINAGE STRUCTURES TO BE INSTALLED SHALL CONFORM TO CURRENT MASSACHUSETTS HIGHWAY DEPARTMENT STANDARDS AS PUBLISHED BY MassDOT. ALL NEW CATCH BASINS SHALL BE EQUIPPED WITH APPROPRIATELY SIZED "TEE" OR HOODS AND A FOUR (4') FOOT SUMP.
5. ALL MANHOLES, CATCH BASINS AND PARTICLE SEPARATORS SHALL BE PUMPED "DRY" AND CLEANED AT THE END OF CONSTRUCTION. SEDIMENT AND OTHER POLLUTANTS SHALL BE REMOVED OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
6. EXISTING PIPES AND/OR CULVERTS THAT ARE TO REMAIN WITHIN THE LIMIT OF WORK AREA SHALL BE CLEANED OF ANY DEBRIS AND/OR SEDIMENTATION. SEDIMENTATION AND OTHER POLLUTANTS SHALL BE REMOVED OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
7. ALL PROPOSED DRAINAGE STRUCTURES AND PIPES SHALL MEET HEAVY-DUTY TRAFFIC (H20) LOADING AND BE INSTALLED IN ACCORDANCE WITH MassDOT AND/OR DPW SPECIFICATIONS.
8. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY EARTH MOVING ACTIVITIES.
9. THE CONTRACTOR SHALL KEEP ON-SITE, AT ALL TIMES, ADDITIONAL SILTATION FENCING AND FILTER FABRIC FOR INSTALLATION AS DIRECTED BY THE TOWN TO MITIGATE ANY EMERGENCY CONDITIONS.
10. THE ENGINEER-OF-RECORD SHALL WITNESS INSTALLATION OF ANY SUB-SURFACE INFILTRATION SYSTEM. IF SUB-SURFACE SOIL CONDITIONS DIFFER FROM THAT SHOWN ON THE PLAN, THE DESIGN SHALL BE MODIFIED AND RESUBMITTED TO THE CITY FOR APPROVAL PRIOR TO CONTINUING INSTALLATION.
11. BOTTOM OF BED INSPECTIONS ARE REQUIRED FOR ALL STORMWATER MANAGEMENT INFILTRATION BEST MANAGEMENT PRACTICES (BMPs). BED INSPECTIONS SHALL BE PERFORMED ONCE THE EXCAVATION HAS BEEN PERFORMED AND THE PIT IS AT DESIGN GRADE. NO STONE SHALL BE INSTALLED PRIOR TO BED INSPECTIONS. CONTACT DPW FOR A BED INSPECTION AT LEAST 24 HOURS PRIOR TO ANTICIPATED EXCAVATION.
12. PIPE CONNECTION INSPECTIONS ARE REQUIRED FOR ALL PIPE CONNECTIONS TO INFILTRATIVE BMPs. SYSTEMS SHALL NOT BE BACKFILLED UNTIL A PIPE CONNECTION INSPECTION HAS OCCURRED. PLEASE CONTACT DPW AT LEAST 24 HOURS PRIOR TO THE ANTICIPATED PIPE CONNECTION INSPECTION.

UTILITY NOTES:

A. GENERAL NOTES

1. THE CONTRACTOR IS SPECIFICALLY ADVISED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES ESPECIALLY WHERE NEW UTILITIES CONNECT TO OR CROSS EXISTING, SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIG SAFE" (1-888-344-7233 OR 811) AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. THE CONTRACTOR IS HEREBY NOTIFIED THAT SOME PUBLIC AND PRIVATE UTILITY COMPANIES ARE NOT PART OF DIGSAFE AND MAY HAVE ADDITIONAL NOTIFICATION REQUIREMENTS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
2. ANY WORK AND MATERIAL TO BE PLACED WITHIN THE CITY RIGHT-OF-WAY, SHALL CONFORM TO THE CITY OF WATERTOWN'S DEPARTMENT OF PUBLIC WORKS REQUIREMENTS. THE CONTRACTOR SHALL OBTAIN A STREET OPENING PERMIT PRIOR TO ANY CONSTRUCTION WITHIN THE TOWN RIGHT-OF-WAY.
3. ANY DAMAGE INCURRED WITHIN THE CITY RIGHT-OF-WAY, AS A DIRECT OR INDIRECT RESULT OF CONTRACTOR'S OPERATIONS, SHALL BE REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY OF WATERTOWN.
4. PRIOR TO THE START OF ANY AUTHORIZED ACTIVITY THE SITE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FROM THE CITY OF WATERTOWN. THE CONTRACTOR SHALL OBTAIN FINAL CERTIFICATIONS AND/OR SIGN OFFS UPON MUNICIPALITY AND/OR UTILITY PROVIDER ACCEPTANCE OF WORK WITH COPIES OF FINAL ACCEPTANCE DOCUMENTATION PROVIDED TO THE OWNER.
5. THE SITE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL PERMITS AND/OR CONNECTION FEES REQUIRED FOR THE INSTALLATION OF ALL SITE UTILITIES.
6. ALL UTILITIES, PIPE MATERIALS, STRUCTURES, AND INSTALLATION METHODS, SHALL CONFORM TO THE WATERTOWN DPW/ENGINEERING DEPARTMENT STANDARDS AND REQUIREMENTS. UNLESS OTHERWISE NOTED OR DETAILED.
7. UTILITY CONTRACTOR MUST BE LICENSED TO PERFORM WORK IN THE MUNICIPALITY.
8. ALL REQUIRED UTILITY CROSSING ENCASEMENTS (CONCRETE) SHALL EXTEND TEN FEET (10') FROM EITHER SIDE OF THE CROSSING.
9. EXISTING STRUCTURES, LIGHT POLE BASES, CONDUIT AND FIXTURES TO BE REMOVED ARE TO BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
10. EXISTING UTILITY CASTINGS INDICATED TO REMAIN SHALL BE RESET TO FINISHED GRADE AS REQUIRED AND SHOWN ON GRADING AND DRAINAGE PLAN.
11. DETECTABLE WARNING TAPE SHALL BE INSTALLED A MINIMUM ONE (1') FOOT ABOVE THE UTILITY IN ACCORDANCE WITH THE APPROPRIATE UTILITY COMPANY'S REQUIREMENTS.
12. FLOWABLE FILL REQUIRED AS BACKFILL IN THE PUBLIC WAY.
13. UPON COMPLETION OF THE WORK, AS-BUILT DRAWINGS SHALL BE SUBMITTED IN BOTH PAPER AND ELECTRONIC FORMAT. THE DRAWINGS SHALL BE BASED UPON A FIELD SURVEY AND ACTUAL AS-BUILT LOCATIONS, AND SHALL BE STAMPED BY A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS. THE AS-BUILT DRAWING SHALL DEPICT ALL BUILDINGS, PAVED SURFACES, TOPOGRAPHY, AND MAJOR LANDSCAPE FEATURES. WATER, SEWER, AND DRAINAGE FEATURES, AS WELL AS OTHER UNDERGROUND UTILITIES INSTALLED BY OTHERS, SHALL BE LOCATED ON THE PLAN, INCLUDING SIZE AND MATERIAL. ALL STORMWATER MANAGEMENT CONTROLS, BOTH STRUCTURAL AND NON-STRUCTURAL, DESIGNED TO MANAGE THE STORMWATER ASSOCIATED WITH THE COMPLETED SITE SHALL ALSO BE INCLUDED.
14. USE OF FIRE HYDRANTS FOR DEMOLITION OR CONSTRUCTION IS NOT PERMITTED UNLESS APPROVED BEFOREHAND BY THE DEPARTMENT OF PUBLIC WORKS.

B. SEWER NOTES

1. PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL EXPOSE THE EXISTING SEWER SERVICE AT THE NORTH SIDE OF THE EXISTING BUILDING. THE CONTRACTOR SHALL DETERMINE THE EXISTING SEWER INVERT AT THE BUILDING WALL AND PROVIDE THE INFORMATION TO THE DESIGN ENGINEER TO VERIFY ELEVATION WITH THE PROPOSED DESIGN AND IF ANY MODIFICATIONS TO THE PROPOSED SEWER SERVICE IS NECESSARY.
2. ALL GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE PIPE (P.V.C.), S.D.R. 35 AND SHALL CONFORM WITH ASTM-D3034 UNLESS NOTED OTHERWISE.
3. ALL SEWER MAIN APPURTENANCES, MATERIALS, METHODS OF INSTALLATION AND TESTING REQUIREMENTS SHALL MEET OR EXCEED THE MUNICIPALITY'S SEWER DEPARTMENT'S STANDARDS.
4. DETECTABLE WARNING TAPE TO BE INSTALLED A MINIMUM ONE (1') FOOT ABOVE SEWER MAIN AND IN ACCORDANCE WITH THE MUNICIPALITY'S SEWER DEPARTMENT'S REQUIREMENTS.
5. ALL NEW SEWER MAINS AND ASSOCIATED MANHOLES SHALL BE TESTED FOR WATER TIGHTNESS IN THE PRESENCE OF THE AUTHORITY HAVING JURISDICTION.

C. GAS NOTES

1. CONTRACTOR IS RESPONSIBLE FOR THE LAYOUT, EXCAVATION AND BACKFILLING OF GAS MAIN TRENCH. EXCAVATION AND BACKFILLING REQUIREMENTS SHALL BE PERFORMED IN ACCORDANCE WITH THE GAS COMPANY REQUIREMENTS.
2. THE GAS TRENCH SHALL BE LAID OUT SO AS TO PROVIDE A MINIMUM OFFSET OF THIRTY-SIX (36) INCHES FROM OTHER UTILITIES. NO TRENCHING SHALL BE STARTED UNTIL AN ON-SITE MEETING HAS BEEN HELD BETWEEN THE EXCAVATING CONTRACTOR AND NATIONAL GRID PERSONNEL. PRIOR TO THE MEETING, THE EXCAVATING CONTRACTOR MUST NOTIFY DIG SAFE OF THE PROPOSED WORK. THE FOLLOWING SHALL BE CONFIRMED AT THE MEETING:
   A. THE EXCAVATING CONTRACTOR MUST PAD THE TRENCH BOTTOM WITH SIX (6) INCHES OF SAND AND MUST PROVIDE SAND SUFFICIENT TO PROVIDE A MINIMUM OF (6) INCHES OF COVER ABOVE THE GAS PIPE.
   B. THE ROUTE OF THE TRENCH.
   C. MINIMUM FOOTAGE OF THE TRENCH TO BE OPENED BEFORE NATIONAL GRID MOBILIZES CREWS TO START INSTALLING THE GAS PIPE.
   D. MINIMUM TWO (2) WEEK NOTICE REQUIRED FOR NATIONAL GRID TO START INSTALLING PIPE.
3. ASPHALT PATCHES SHALL HAVE A MINIMUM DEPTH OF 5-INCHES, OR MATCH EXISTING ROAD DEPTH.

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PROJECT NAME:
10-30 MANLEY WAY
WATERTOWN, MA

SEAL:
COMMONWEALTH OF MASSACHUSETTS
BRIAN P. DUNDON
CIVIL
No. 41595
REGISTERED PROFESSIONAL ENGINEER
7-2-2024

DESIGNED BY:	BJM/MAC
DRAWN BY:	WJH/MCR
REVIEWED BY:	BJM
SCALE:	1" = 20'
DATE:	05/04/2023

DRAWING NAME:
GRADING, DRAINAGE AND UTILITY PLAN

DRAWING NUMBER:
C-2B

PROJECT NUMBER:
21049

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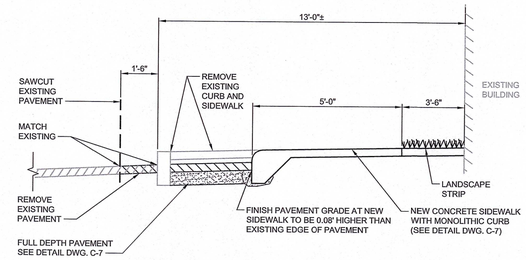

SECTION A-A

TRAFFIC CONTROL SIGN SCHEDULE

SIGN NUMBER	SIGN	SIZE OF SIGN WIDTH	SIZE OF SIGN HEIGHT	BACKGROUND	LEGEND	BORDER	MOUNT TYPE	MOUNT SIZE
R7-8	WHEELCHAIRED PENALTY $250 MINIMUM FINE	12"	18"	BLUE	WHITE	-	CHANNEL	7'-0"
R7-8A	VAN ACCESSIBLE	12"	6"	BLUE	WHITE	-	CHANNEL	6'-6"
X-2	ELECTRIC VEHICLE CHARGING STATION	18"	24"	BLUE	WHITE	WHITE	CHANNEL	7'-0"
R1-1	STOP	30"	30"	RED	WHITE	WHITE	CHANNEL	7'-0"
R5-1	DO NOT ENTER	30"	30"	RED & WHITE	WHITE	WHITE	CHANNEL	7'-0"
R3-5R	ONLY	30"	36"	WHITE	BLACK	BLACK	CHANNEL	7'-0"
R3-2		24"	24"	WHITE	BLACK & RED	BLACK	CHANNEL	7'-0"
X-1	NO SNOW STORAGE	18"	24"	WHITE	RED	-	CHANNEL	7'-0"
X-2	PLEASE USE DESIGNATED ACCESSIBLE PARKING SPACES. ACCESSIBLE PARKING SPACES ARE FOR USE BY INDIVIDUALS WITH DISABILITIES WHO POSSESS VALID STATE ISSUED DISABILITY PARKING PLACARDS OR PLATES.	30"	30"	WHITE	BLACK	-	CHANNEL	7'-0"
X-3(R)(L)	COMPACT CAR PARKING ONLY (RIGHT) ARROW; COMPACT CAR PARKING ONLY (LEFT) ARROW	12"	18"	WHITE	GREEN	-	CHANNEL	7'-0"

LEGEND

- POROUS PAVEMENT
- PERMEABLE PAVERS
- CONCRETE PAVING/SIDEWALK
- A — PRECAST CONCRETE CURB
- B — BITUMINOUS CONCRETE CURB
- C — VERTICAL GRANITE CURB
- EOP — EDGE OF PAVEMENT
- C — COMPACT SPACES (8' x 18')

PARKING AND TRAFFIC CONTROL NOTES:

1. PER SECTION 6.01(d) WHERE THE COMPUTATIONS OF REQUIRED SPACES RESULTS IN A FRACTIONAL NUMBER, A FRACTION OF ONE-HALF OR MORE SHALL BE COUNTED AS ONE.
2. PER SECTION 6.01 (g) REQUIRED OFF-STREET PARKING SHALL BE PROVIDED ON THE SAME LOT THEY SERVE, EXCEPT THAT A SPECIAL PERMIT MAY BE GRANTED TO PROVIDE OFF-STREET PARKING ON ANOTHER LOT.
3. PARKING SHALL BE SETBACK A MINIMUM OF 5' FROM BUILDINGS AND ALL LOT LINES.
4. PARKING SPACE SIZE REQUIRED = 8.5' x 18' (ANGLED) 8.5' x 22' (PARALLEL)
5. 10% OF PARKING SPACES CAN BE COMPACT AT 8' x 18'
6. 5% OF INTERIOR OF PARKING AREA SHALL BE LANDSCAPED.
7. ACCESSIBLE PARKING SPACES SHALL CONFORM TO THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (A.D.A.) ACCESSIBILITY GUIDELINES AND THE MASSACHUSETTS ARCHITECTURAL ACCESS BOARD REGULATION, 521 CMR, LATEST EDITIONS UNLESS OTHERWISE NOTED.
8. VAN ACCESSIBLE HANDICAP PARKING SPACES SHALL BE SIGNED AS "VAN ACCESSIBLE" PER A.D.A. (SEE 4.1.2.5B).
9. ALL PROPOSED CONCRETE CURBING SHALL BE PRECAST CONCRETE UNLESS OTHERWISE NOTED.
10. BITUMINOUS CONCRETE CURB SHALL BE INSTALLED WHERE NOTED.
11. ALL PAVEMENT STRIPING SHALL BE PAINTED WITH 2 COATS OF PAINT. PARKING STALLS SHALL BE MARKED WITH FOUR (4") INCH WIDE PAINTED LINES.
12. PARKING AND TRAFFIC CONTROL PLAN IS SCHEMATIC AND FOR LOCATION OF MARKINGS ONLY. SPECIFIC DETAILS OF PAVEMENT MARKINGS ARE PROVIDED AS PART OF THIS PLAN SET.
13. THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL/BUILDING PLANS FOR EXACT BUILDING LOCATIONS, BUILDING DIMENSIONS, EXACT UTILITY ENTRANCE LOCATIONS, TRUCK DOCKS, BUILDING SIDEWALKS AND DOOR LOCATIONS.
14. FOR PAVEMENT SECTION SEE DETAIL SHEET C-7.
15. THE CONTRACTOR SHALL ADJUST ALL UTILITY CASINGS TO THE PROPER LINE AND ELEVATION PRIOR TO THE PLACEMENT OF THE TOP COURSE OF PAVEMENT. NECESSARY ADJUSTMENTS SHALL BE MADE TO CASTINGS IF REQUIRED, TO MAKE THEM FLUSH WITH FINISHED GRADE. NO DEPRESSIONS OR MOUNDS TO ACCOMMODATE CASTINGS WILL BE PERMITTED.
16. ALL WORK SHALL COMPLY WITH ADA AND MAAB REQUIREMENTS.
17. ALL ACCESSIBLE CURB RAMPS SHALL BE CONSTRUCTED OF CEMENT CONCRETE.
18. CONCRETE MIX SHALL BE: 4,000 PSI CONCRETE, ¾-INCH STONE, 2 ½ -LBS LAMPBLACK PER CUBIC YARD.

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PARKING AND TRAFFIC CONTROL PLAN

DRAWING NUMBER:
C-3B

PROJECT NUMBER:
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Stormwater Report

10-30 Manley Way
Watertown, Massachusetts

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c/o Seyon
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Prepared by:
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80 Montvale Ave, Suite 201
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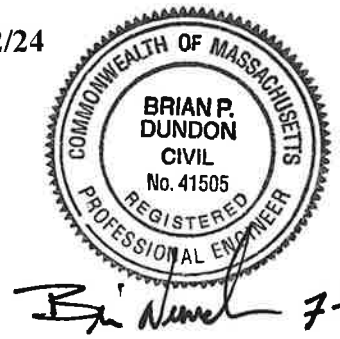
Date: June 30, 2023
Revised: 03/19/24, 07/02/24



7-2-2024

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I. STORMWATER REPORT NARRATIVE

1.0 Introduction

RJ O'Connell & Associates, Inc. (RJOC) has prepared this stormwater report on behalf of PPF Industrial 20 Seyon LLC for proposed pavement and stormwater management improvements at 10-30 Manley Way in Watertown, Massachusetts. The report presents proposed stormwater management measures that will increase groundwater recharge, reduce peaks rates of runoff to the designated design points and significantly improve the water quality of runoff discharged from the site.

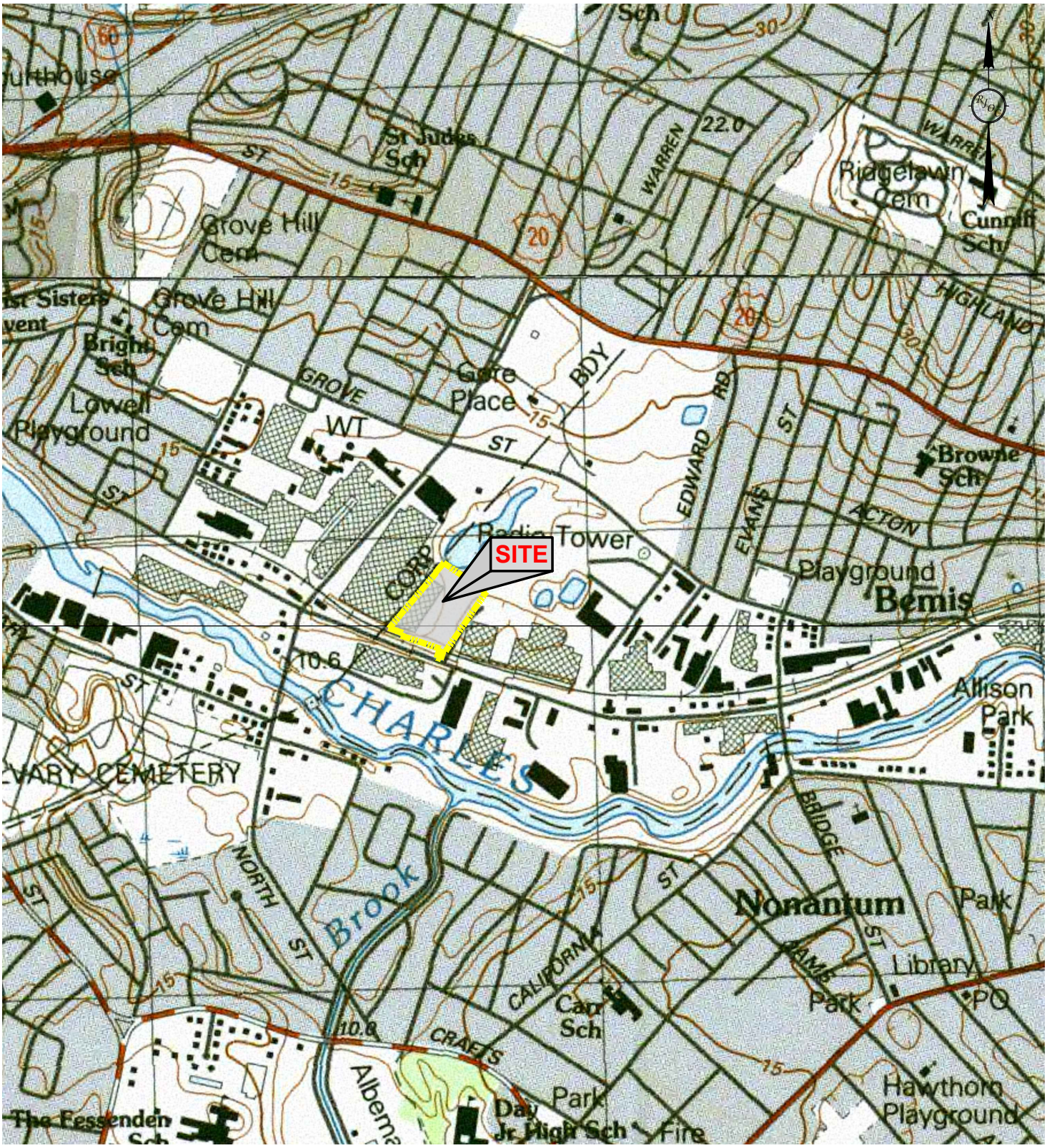
2.0 Site Location and Description

10-30 Manley Way is a 5.26 acre site located off Pleasant Street in Watertown, Massachusetts at the Waltham -Watertown city line (see Figure 1 USGS Map). It is bordered by BJ's Wholesale Club on the west, Walker Pond and Bell Watertown Apartments on the north, Repton Place Condominiums to the east and Watertown Ford and Pleasant Street on the south. Presently a 95,000 sf, one-story building, unoccupied except for Boston Rhythmic, a gymnastics school, is located on the site.

The site includes approximately 80% impervious cover, consisting of the building, paved parking, paved truck loading dock area, paved access driveways and vehicle circulation. In addition, the site has easement rights over abutting properties to provide the space needed for access and circulation at the loading docks and for drainage outfalls and utility services.

Currently, stormwater runoff from existing site discharges to two ultimate design points (DP), one being an existing 72" culvert traveling under Pleasant Street and the other being the abutting property, to the southwest, owned by Watertown Ford. Runoff from the paved parking area drains to a grassed swale and is conveyed through a drainage pipe network along with runoff from the building's roof to Walker Pond. There are three existing drainage outfalls from the site into Walker Pond. Water retained within Walker Pond is then conveyed via an existing outlet control structure to the city's 72" culvert (DP-1). Most of the stormwater runoff from the existing paved driveway on the east side of the building sheet flows off the driveway, down the slope and into the grass swale located on the adjacent Repton Place property. The grass swale conveys stormwater to a catch basin on the city's 72-inch culvert (DP-1). There is also a single catch basin in the easterly driveway with a pipe that appears to connect to the 72-inch culvert (DP-1). Additionally, the driveway entrance, adjacent to Pleasant Street, and a portion of the grassed area to the south of the existing building direct stormwater via overland flow to the abutting property owned by Watertown Ford (DP-2).

As documented in the Downgradient Property Status Opinion (DPSO) filed with MassDEP for Release Tracking Number (RTN) 3-25832, chlorinated volatile organic compounds (CVOC's) originating from an upgradient, off-site source property, have been detected in groundwater at the Site.



DESIGNED BY:	BJM/JJS
DRAWN BY:	MCR
REVIEWED BY:	BJM
SCALE:	1" = 1,000'
DATE:	07/02/2024
PROJECT NUMBER:	21049

PREPARED BY:

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PROJECT NAME: 10-30 MANLEY WAY, WATERTOWN, MA

DRAWING NAME: USGS MAP

DRAWING NO: **FIG-1**

Drawing name: G:\MA\Watertown\Seyon Group\20 Seyon Street\Reports\21049_Fig.1 USGS.dwg
Jul 01, 2024 - 10:10am

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3.0 Proposed Project

The proponent has proposed the renovation and repositioning of the existing building for occupancy by a tenant or tenants whose use will be light industry, non-nuisance manufacturing, laboratories, or warehousing. There will be no expansion of the building or parking areas. Impervious area will be reduced with the removal of the emergency access drive around the northwest corner of the building and the widening of the grassed swale in the parking area.

The proposed project will incorporate the following stormwater management measures:

1. Reduction in impervious area by approximately 9,952 sf.
2. Remove the emergency access drive around the northwest corner of the building and replace it with grass.
3. Increase the size of the grassed swale in the parking area.
4. Installation of proprietary treatment devices to improve water quality.
5. Installation of subsurface stormwater infiltration systems to provide the required Total Suspended Solids (TSS) and Total Phosphorus (TP) removal.
6. Updated Stormwater Operation and Maintenance Plan and Long-Term Pollution Prevention Plan.

The proposed project includes reclamation of the asphalt pavement in the access drive (Manley Way) that runs along the east side of the building to the loading dock area in the rear (north side) of the building, the pavement in the loading dock area and the pavement in the parking lot.

In the parking area the existing grassed swale extends down the middle of the parking lot collects runoff from the lot and discharges it into a water quality unit (Vortechs Model 1000) before out-letting into Walker Pond. The grassed swale will be widened from 7 ft to 14.5 ft. with new catch basins with deep sumps and hoods installed to collect runoff from the parking lot. The catch basins will drain to a CDS water quality unit before discharging to a subsurface infiltration basin for removal of Total Phosphorous (TP) and Total Suspended Solids (TSS). The subsurface infiltration system in the parking area consists of perforated high-density polyethylene (HDPE) pipes encased in crushed stone and is sized to hold and infiltrate the volume of stormwater runoff equivalent to the 100-year storm event over the paved area minus the volume of water retained and infiltrated in the Manley Way infiltration systems.

The sidewalk along the west side of the building will be reduced in width and new curbing within the parking lot installed in order to maintain the required amount of parking and to accommodate a revised traffic pattern within the lot due to the widened grassed swale. Curbing in the access drive along the south side of the building will also be adjusted to provide additional landscaping in front of the building. In addition, the asphalt pavement in the access drive around the northwest corner of the building will be

removed and replaced with grass. Converting asphalt pavement to grass, widening the grassed swale, and increasing landscaping in front of the building will increase the amount of pervious area on-site resulting in increased recharge to groundwater, and decreased peak rates of stormwater runoff from the site to the designed design points.

In Manley Way and the loading dock area, the asphalt pavement will be pulverized and removed, and the existing base course fine graded with minor elevation adjustments to promote more positive drainage. Existing catch basins will be removed and new cubing will direct storm runoff to hydrodynamic oil/particle separators (CDS units) equipped with grates installed at low points to collect storm runoff that is currently sheet flowing overland and untreated off-site onto the adjacent Repton Place property. The CDS units will pretreat collected runoff before discharging into subsurface infiltration systems for treatment of phosphorous and additional removal of Total Suspended Solids (TSS). The subsurface infiltration systems in Manley Way consist of perforated high-density polyethylene (HDPE) pipes encased in crushed stone and due to site constraints are only sized to hold and infiltrate the first inch of runoff which provides all the required water quality treatment.

As the infiltration systems in Manley Way are designed to retain 1-inch of stormwater runoff, a portion of the existing building roof will be directed into the subsurface infiltration system in the parking area. This roof area will provide the additional volume of stormwater required to meet the retention volume for the 100-year storm on Manley Way.

The proposed redevelopment project will result in significant improvement of runoff control and water quality that will be accomplished by implementing the following Best Management Practices (BMPs):

- Implement a Stormwater Pollution Prevention Plan (SWPPP) to control erosion and sedimentation during construction.

- Collect storm runoff in off-line, hydrodynamic oil/particle separators with grates and/or catch basins with deep sumps and hoods directed to oil/particle separators in the areas of pavement reclamation to remove a minimum of 50% TSS from the first 1-inch of runoff prior to infiltration.

- Construct subsurface infiltration systems to detain and infiltrate the first 1-inch of runoff from the areas of pavement reclamation on site, thereby removing 100% of the annual load of total phosphorous and 100% of TSS from these areas and increasing groundwater recharge on site.

- Construct a subsurface infiltration system in the parking area to retain and infiltrate the volume of stormwater runoff needed for the 100-year storm event over the on-site paved areas.

- Widen the existing grassed swale in the parking lot and replace the asphalt pavement in the emergency access drive around the northwest corner of the site with grass thereby increasing the amount of pervious area on site resulting in an increase in groundwater recharge and a reduction in peak rates of storm runoff from the site.

- Implement an updated Operations and Maintenance (O&M) Plan for the proposed stormwater management system that describes the various components of the system, identifies inspection and maintenance tasks, and provides a schedule to follow to insure the proper, long-term performance of the system.

As documented in the Downgradient Property Status Opinion (DPSO) filed with MassDEP for Release Tracking Number (RTN) 3-25832, chlorinated volatile organic compounds (CVOC's) originating from an upgradient, off-site source property, have been detected in groundwater throughout the Site. However, through consultation with the project environmental engineers it was determined that stormwater infiltration can be provided in the new stormwater management system for the retention and infiltration of all stormwater, from the on-site paved areas, for storms up to the 100-year storm event. Due to existing utilities and area constraints within Manley Way it is not feasible to accommodate the size of systems required to fully retain and infiltrate the stormwater runoff for a 100-year storm event on the impervious areas within Manley Way. Therefore, Subsurface Infiltration System (SIS)-1 through SIS-5 are sized to only infiltrate the first inch of runoff to provide the required TSS and TP removal rates. To make up for the difference in retention of the 100-year storm on Manley Way, a 36,520 s.f. portion of the existing roof will be connected to SIS-6 in the parking area on the other side of the building. This will provide an overall infiltration volume equivalent to the volume of runoff from the 100-year storm event over the on-site paved areas.

The proposed stormwater management measures described above result in no adverse impacts to adjacent properties. Because existing pervious area on-site is increased and on-site retention of the 100-year storm event is provided, peak rates of runoff and volumes discharged from the site will decrease significantly and the water quality of storm runoff from the site will be greatly improved, thereby significantly improving existing conditions and providing an overall benefit to the surrounding area. Calculations that demonstrate the removal percentages of the proposed average annual load of Total Phosphorus and TSS removal from the parking area, the loading dock area and Manley Way as a result of the pretreatment and treatment measures proposed in these areas are provided Section II.

4.0 Compliance with MassDEP Stormwater Standards

This redevelopment project consists of rehabilitating deteriorated areas of pavement and improving the existing drainage system on site. As such, it is required to meet the following Stormwater Management Standards only to the maximum extent practicable;

Standards 2 and 3 and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5 and 6. Best Management Practices (BMPs) have been incorporated into the design to comply with Stormwater Management Standards as described below:

Standard 1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

No new stormwater conveyances discharging untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth are proposed.

Standard 2: Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

As a result of the proposed widening of the existing grassed swale in the parking area, removal of the paved access drive and replacement with grass at the northwest corner of the building and installation of subsurface infiltration basins around the site for treatment of Total Phosphorous and TSS there is a decrease in post-redevelopment peak discharge rates of runoff from the site.

Standard 3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Widening the existing grass swale in the parking area and converting the paved access drive around the northwest corner of the building to grass in addition to the proposed subsurface infiltration systems to be located in Manley Way, the loading dock area and the parking lot, will result in a significant increase in the annual recharge to groundwater under redeveloped conditions compared to existing conditions.

Standard 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The proposed stormwater management system has been designed to remove 100% of TSS from the areas of pavement; Manley Way, the loading dock area and the parking lot (see TSS removal calculations in Section II).

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The project is not classified as a land use with higher pollutant loads however, a detailed source control and pollution prevention plan that includes measures to eliminate or minimize any discharges that have the potential to generate high concentrations of pollutants has been developed and is included in the updated Operations and Maintenance (O&M) Plan developed for the site.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The site is not located within a Zone II or wellhead protection area.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pre-treatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A development project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project qualifies as a redevelopment project and will comply with the Stormwater Management Standards to the maximum extent practicable as indicated herein. The proposed stormwater management measures to be implemented will significantly improve existing conditions.

Standard 8: A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentations, and pollution prevention plan) shall be developed and implemented.

A Stormwater Pollution Prevention Plan (SWPPP) to control erosion, sedimentation, and other pollutant sources, and prevent erosion and sediment from moving off-site during construction and land disturbance activities will be prepared and filed prior to construction. Erosion and Sediment Control Plans are included in the site plan set.

Standard 9: A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

An updated Operation and Maintenance Plan (O&M) to ensure the long term, post-construction operation of the stormwater management system is attached.

Standard 10: All illicit discharges to the stormwater management system are prohibited.

An illicit discharge compliance statement is included in the Operation and Maintenance Plan.

5.0 Compliance with Watertown Stormwater Performance Standards

The site discharges into the Town of Watertown's storm drain system and is regulated by the *Town of Watertown's Rules and Regulations for Stormwater Management and Erosion Control*.

Redevelopment projects shall comply with the performance standards of the Massachusetts Stormwater Management Standards, except as hereafter amended in these rules and regulations, Redevelopment shall meet the performance standards in Section 8.1 and Section 8.3.

Section 8.1 Stormwater Quality Standards

- *All projects shall implement low impact development (LID) planning and design strategies unless such practices are infeasible. LID practices shall include but not limited to, soil decompaction and amendments, grading to direct runoff toward pervious surfaces, and minimizing impervious surfaces. Additional guidelines on LID practice are provided in the Massachusetts Stormwater Handbook.*

  This redevelopment project will reduce impervious area and increase landscaping as well as stormwater quality treatment area

- *All projects shall provide removal of 90% proposed average annual load of TSS and 60% of the proposed average annual load of TP generated from total proposed impervious surfaces.*

  The proposed stormwater management improvements will provide 90% TSS and 60% phosphorus removal.

- *In no instance shall there be an increase in the estimated annual average load of TP from exiting to proposed condition.*

  There will not be an increase in the average load of TP.

- *To support compliance with the Charles River Watershed, phosphorus TMDL and the Towns MS4 permit, all BMPs shall be optimized for the removal of phosphorus. Guidelines of BMP phosphorus removal performance are found in MS4 permit.*

  The proposed BMP's have been optimized for the removal of phosphorus.

Section 8.2 Retention Standard for Redevelopment Projects

For all redevelopment projects, stormwater management systems shall be designed to provide, to the maximum extent practicable, retention of stormwater runoff for all storm events up to and including the 100-year storm. Retention may be achieved by infiltrating stormwater runoff into underlying soils or by storing rainwater for use. For

redevelopment projects with conditions that preclude infiltration, the storage volume for filtration practices may count toward meeting the retention standard. If the retention standard cannot be fully met, the applicant shall meet the maximum extent practicable standards specified in Section 8.3.1and provide offsite compliance as specified in Section 8.3.2.

The following calculations illustrate the proposed site improvements comply with Section 8.2:

- Total impervious areas within proposed disturbed areas = 94,120 SF
- 100-yr Storm runoff volume in proposed disturbed areas = 69,806 CF
- Total infiltration volume provided within SIS-1 through SIS-6 = 72,815 CF

(Provided infiltration volume exceeds the total runoff volume for the 100-year Storm from the impervious areas proposed within the disturbed areas.)

6.0 Stormwater Quality

This project includes suitable BMPs to pretreat runoff from the areas to be repaved prior to discharging to subsurface infiltration systems for treatment and removal of over 90% of the average annual post construction load of TSS and over 60% of the estimated annual average load of Total Phosphorous (see TSS and Phosphorous removal calculations in Section II).

- Catch Basins
  Stormwater runoff from pavement areas will be directed via curbing and site grading to catch basins with deep sumps and hooded outlets. Catch basins trap and remove sediments and larger particles from stormwater runoff and improve the performance of subsequent BMPs. The catch basin sumps will be a minimum of 4 feet in depth and a regular inspection and cleaning schedule will be followed to ensure optimal effectiveness. When properly constructed and maintained, catch basins with deep sumps and hooded outlets are effective in reducing the sediment and pollutant load in runoff.

- Hydrodynamic Oil/Particle Separators
  Hydrodynamic oil/particle separators (CDS units as manufactured by *Contech Construction Products, Inc.*) are precast concrete structures equipped with grates and are designed to remove settleable solids and floating contaminants from stormwater runoff. The proposed oil/particle separators achieve at least 50% TSS removal rates per the NJCAT (NJDEP) Field Test Certifications and this rate was used in the TSS removal calculation. Low storm flows are directed into a treatment chamber where floatables and buoyant debris are trapped and settleable solids sink to the sump of the structure. Larger flows are controlled by an internal diversion weir, which directs high intensity storm events around the treatment chamber, so the drainage system does not backwater. Runoff from the first 1-inch of runoff from the repaved surface areas will be routed through oil/particle separators for pre-treatment prior to discharging into subsurface infiltration systems for treatment. Regular inspection and cleaning schedules will be followed to ensure optimal effectiveness.

- Subsurface Infiltration Systems
  Stormwater runoff from repaved areas of the site will be directed into subsurface infiltration systems consisting of perforated high-density polyethylene (HDPE) pipes encased in crushed stone after proper pretreatment by hydrodynamic oil/particle separators and/or catch basins. The subsurface infiltration systems are sized to hold and infiltrate the volume of runoff from a 100-year storm event over the repaved areas.

7.0 Soil Data

Soil data has been compiled using the Natural Resources Conservation Services (NRCS) Web Soil Survey tool. The soil survey identified soils on the site as Urban Land, with no HSG designation. Refer to Figure 4, NRCS Web Soil Survey Map in Appendix A. Based on subsurface soil explorations as described below, sand classification was used for design, a HSG-A rating was assigned to the area classified as Urban Land.

Test pits were performed by RJ O'Connell & Associates on February 8, 2023. Test pits were located at or near the proposed locations for the subsurface infiltration systems and the existing bioretention area (see Figure 3, Test Pit Location Map in Appendix A). Soils encountered were generally fine to medium sand and gravel with no groundwater observed to the bottom of the holes, as depicted in the soil logs attached in Appendix A.

A subsurface infiltration Rawls rate of 8.27 in/hr. was used in the design of all subsurface infiltration systems. The systems have also been designed to provide a minimum of two (2) feet of separation from the bottom of the test hole. No groundwater was observed in any of the test pits.

8.0 Hydrologic Methodology

Pre- and post-development drainage analyses were performed for the 2, 10, 25 and 100-year storm events. Rainfall events have been compiled by NOAA Atlas 14 values for extreme precipitation for the region as noted below:

County	1-inch	2-year	10-year	25-year	100-year
Middlesex	1.0 in.	3.2 in.	4.9 in.	6.2 in.	8.9 in.

The NRCS method uses several parameters based on watershed characteristics and configuration to generate a curvilinear unit hydrograph and produce a runoff hydrograph for the watershed. Basic input data required to generate a hydrograph are the watershed area, storm frequency, time of concentration, 24-hour rainfall, and the watershed's runoff curve number.

Sizing of the subsurface infiltration systems (SIS-1 through SIS-5) to hold and infiltrate the 1-inch water quality volume was performed using HydroCAD version 10.00, which is based on the National Resources Conservation Service (NRCS) Technical Release 20

(TR-20) methodology for computing peak discharges from rainfall runoff for urban and rural watersheds.

The NRCS method uses several parameters based on watershed characteristics and confirmation to generate a curvilinear unit hydrograph and produce a runoff hydrograph for the watershed. Basic input data required to generate a hydrograph are the watershed's area, time of concentration (6 minute minimum), precipitation amount (1-inch), and the watershed's runoff curve number.

NRCS Technical Release 55 (TR-55) methodology was utilized to determine weighted runoff curve number (CN) for the watershed areas. Inputs for obtaining the weighted CN was determined based on ground cover type and the Hydrological Soil Group (HSG), as described in the Soil Data section above. Time of concentration (Tc) was determined based on the most hydrologically distant point (timewise) within the watershed.

Watershed boundaries were established based on existing and proposed grading and storm drainage layouts. (See Figures for Subcatchment Plans)

8.2 Post-development Hydrological Conditions

Under proposed redeveloped conditions, deep-sump catch basins with hooded outlets, water quality units and subsurface infiltration systems will treat and infiltrate stormwater runoff. During larger storm events, stormwater runoff from the surface and subsurface infiltration systems will overflow and discharge to the aforementioned design points (DP). Below is a comparison summary table of the pre- and post-development peak rates of runoff at the Design Points. The peak rates of stormwater discharged from the site for the storm events analyzed will be reduced under proposed conditions as compared to existing conditions.

Pre- and Post-Development Peak Rates of Runoff in Cubic Feet per Second (cfs)

Design Point #1 (72" Culvert)

Storm Frequency	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Existing Volume (cf)	Proposed Volume (cf)
2-Year	11.85	5.29	36,751	12,688
10-Year	21.43	10.57	67,352	26,561
25-Year	28.83	14.52	91,746	38,275
100-Year	44.12	22.79	143,641	69,650

Design Point #2 (Watertown Ford)

Storm Frequency	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Existing Volume (cf)	Proposed Volume (cf)
2-Year	0.24	0.00	845	0
10-Year	0.64	0.00	2,003	82
25-Year	0.97	0.03	3,026	230
100-Year	1.73	0.17	5,356	711

9.0 Hydraulic Analysis

A hydraulic analysis of the proposed storm drainage pipe system was performed for the proposed redevelopment using a spread sheet based on the rational method for estimating peak rates of runoff and the Continuity Equation and Manning's Equation for sizing pipes.

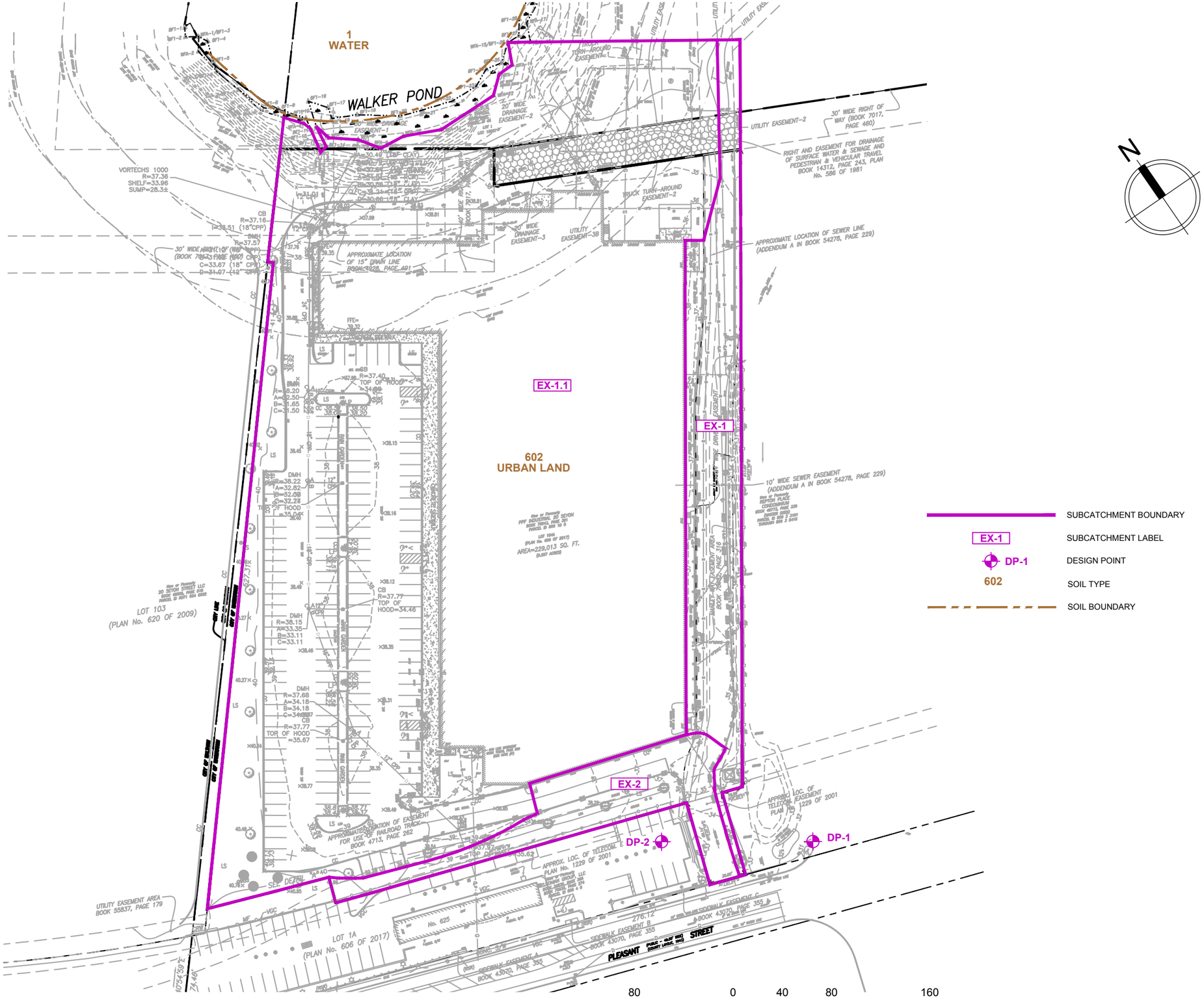
Pipes were sized to accommodate the calculated storm runoff from a regional 25-year frequency storm using a minimum time of concentration of 6 minutes. Pipe sizing calculations are provided in Section II, Calculations and Computations.

10.0 Summary

The stormwater management system for this proposed redevelopment includes measures for controlling, collecting, and treating stormwater runoff from the site. The improvements proposed herein will reduce peak flows and volumes of stormwater runoff leaving the site, increase groundwater recharge and significantly improve the water quality of runoff. The proposed measures comply with the Stormwater Management Standards of the Massachusetts Stormwater Policy and the Town of Watertown's Rules and Regulations for Stormwater Management and Erosion Control to the maximum extent practicable and represent a significant improvement over existing conditions. Implementing the inspection and maintenance program outlined in the Operations and Maintenance Plan will ensure the long-term performance of the drainage and treatment systems.

II. CALCULATIONS and COMPUTATIONS

PRE-CONSTRUCTION
HYDROLOGIC CALCULATIONS



SUBCATCHMENT BOUNDARY

EX-1 SUBCATCHMENT LABEL

DP-1 DESIGN POINT

602 SOIL TYPE

SOIL BOUNDARY

NOTE:

LOCATIONS AND TYPES OF SOIL DESIGNATIONS SHOWN HEREON HAVE BEEN DELINEATED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS) AND COMPILED BY MA GIS

80 0 40 80 160

GRAPHIC SCALE IN FEET

RJO'CONNELL & ASSOCIATES, INC.

CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 03/19/2024
REVISED: 07/02/2024

SCALE: 1"=80'

FIGURE 2

EXISTING WATERSHED PLAN

WATERTOWN, MA

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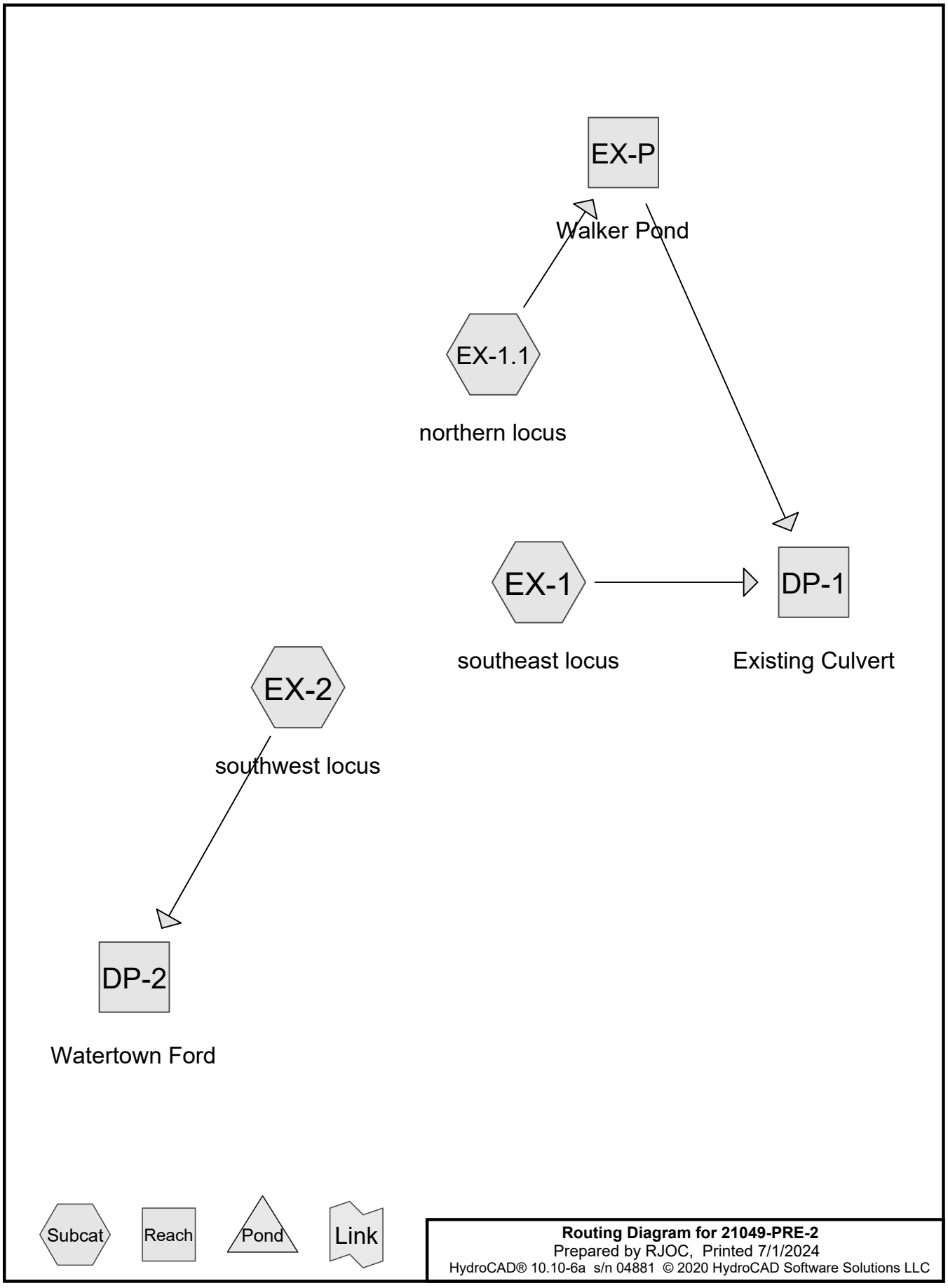

EX-P
Walker Pond
EX-1.1
northern locus
EX-1
DP-1
southeast locus
Existing Culvert
EX-2
southwest locus
DP-2
Watertown Ford
Subcat
Reach
Pond
Link
Routing Diagram for 21049-PRE-2
Prepared by RJOC, Printed 7/1/2024
HydroCAD® 10.10-6a s/n 04881 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
35,924	39	>75% Grass cover, Good, HSG A (EX-1, EX-1.1, EX-2)
3,245	39	Crushed Stone (EX-1)
94,936	98	Existing Roof Area (EX-1.1)
104,072	98	Paved parking, HSG A (EX-1, EX-1.1, EX-2)
13,668	30	Woods, Good, HSG A (EX-1.1)
251,845	**85**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: southeast locus Runoff Area=22,626 sf 63.45% Impervious Runoff Depth>0.04"
Tc=6.0 min CN=76 Runoff=0.00 cfs 72 cf

Subcatchment EX-1.1: northern locus Runoff Area=216,957 sf 82.18% Impervious Runoff Depth>0.22"
Flow Length=42' Slope=0.2200 '/' Tc=6.0 min CN=87 Runoff=1.11 cfs 4,041 cf

Subcatchment EX-2: southwest locus Runoff Area=12,262 sf 51.88% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=70 Runoff=0.00 cfs 5 cf

Reach DP-1: Existing Culvert Inflow=1.11 cfs 4,114 cf
Outflow=1.11 cfs 4,114 cf

Reach DP-2: Watertown Ford Inflow=0.00 cfs 5 cf
Outflow=0.00 cfs 5 cf

Reach EX-P: Walker Pond Inflow=1.11 cfs 4,041 cf
Outflow=1.11 cfs 4,041 cf

Total Runoff Area = 251,845 sf Runoff Volume = 4,118 cf Average Runoff Depth = 0.20"
20.98% Pervious = 52,837 sf 79.02% Impervious = 199,008 sf

Summary for Subcatchment EX-1: southeast locus

Runoff = 0.00 cfs @ 12.49 hrs, Volume= 72 cf, Depth> 0.04"
Routed to Reach DP-1 : Existing Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
*	3,245	39	Crushed Stone
	5,025	39	>75% Grass cover, Good, HSG A
	14,356	98	Paved parking, HSG A
	22,626	76	Weighted Average
	8,270		36.55% Pervious Area
	14,356		63.45% Impervious Area

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

Summary for Subcatchment EX-1.1: northern locus

Runoff = 1.11 cfs @ 12.10 hrs, Volume= 4,041 cf, Depth> 0.22"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
*	94,936	98	Existing Roof Area
	13,668	30	Woods, Good, HSG A
	24,999	39	>75% Grass cover, Good, HSG A
	83,354	98	Paved parking, HSG A
	216,957	87	Weighted Average
	38,667		17.82% Pervious Area
	178,290		82.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	42	0.2200	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.0					**Direct Entry, Min. Engineering Practice**
6.0	42	Total			

Summary for Subcatchment EX-2: southwest locus

Runoff = 0.00 cfs @ 21.34 hrs, Volume= 5 cf, Depth> 0.00"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

Area (sf)	CN	Description
5,900	39	>75% Grass cover, Good, HSG A
6,362	98	Paved parking, HSG A
12,262	70	Weighted Average
5,900		48.12% Pervious Area
6,362		51.88% Impervious Area

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

Summary for Reach DP-1: Existing Culvert

Inflow Area = 239,583 sf, 80.41% Impervious, Inflow Depth > 0.21" for 1-Inch 24 Hr event
Inflow = 1.11 cfs @ 12.10 hrs, Volume= 4,114 cf
Outflow = 1.11 cfs @ 12.10 hrs, Volume= 4,114 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 12,262 sf, 51.88% Impervious, Inflow Depth > 0.00" for 1-Inch 24 Hr event
Inflow = 0.00 cfs @ 21.34 hrs, Volume= 5 cf
Outflow = 0.00 cfs @ 21.34 hrs, Volume= 5 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 216,957 sf, 82.18% Impervious, Inflow Depth > 0.22" for 1-Inch 24 Hr event
Inflow = 1.11 cfs @ 12.10 hrs, Volume= 4,041 cf
Outflow = 1.11 cfs @ 12.10 hrs, Volume= 4,041 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Existing Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: southeast locus Runoff Area=22,626 sf 63.45% Impervious Runoff Depth>1.15"
Tc=6.0 min CN=76 Runoff=0.68 cfs 2,169 cf

Subcatchment EX-1.1: northern locus Runoff Area=216,957 sf 82.18% Impervious Runoff Depth>1.91"
Flow Length=42' Slope=0.2200 '/' Tc=6.0 min CN=87 Runoff=11.17 cfs 34,582 cf

Subcatchment EX-2: southwest locus Runoff Area=12,262 sf 51.88% Impervious Runoff Depth>0.83"
Tc=6.0 min CN=70 Runoff=0.24 cfs 845 cf

Reach DP-1: Existing Culvert Inflow=11.85 cfs 36,751 cf
Outflow=11.85 cfs 36,751 cf

Reach DP-2: Watertown Ford Inflow=0.24 cfs 845 cf
Outflow=0.24 cfs 845 cf

Reach EX-P: Walker Pond Inflow=11.17 cfs 34,582 cf
Outflow=11.17 cfs 34,582 cf

Total Runoff Area = 251,845 sf Runoff Volume = 37,596 cf Average Runoff Depth = 1.79"
20.98% Pervious = 52,837 sf 79.02% Impervious = 199,008 sf

Summary for Subcatchment EX-1: southeast locus

Runoff = 0.68 cfs @ 12.09 hrs, Volume= 2,169 cf, Depth> 1.15"
Routed to Reach DP-1 : Existing Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
*	3,245	39	Crushed Stone
	5,025	39	>75% Grass cover, Good, HSG A
	14,356	98	Paved parking, HSG A
	22,626	76	Weighted Average
	8,270		36.55% Pervious Area
	14,356		63.45% Impervious Area

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

Summary for Subcatchment EX-1.1: northern locus

Runoff = 11.17 cfs @ 12.09 hrs, Volume= 34,582 cf, Depth> 1.91"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
*	94,936	98	Existing Roof Area
	13,668	30	Woods, Good, HSG A
	24,999	39	>75% Grass cover, Good, HSG A
	83,354	98	Paved parking, HSG A
	216,957	87	Weighted Average
	38,667		17.82% Pervious Area
	178,290		82.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	42	0.2200	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.0					**Direct Entry, Min. Engineering Practice**
6.0	42	Total			

Summary for Subcatchment EX-2: southwest locus

Runoff = 0.24 cfs @ 12.10 hrs, Volume= 845 cf, Depth> 0.83"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

Area (sf)	CN	Description
5,900	39	>75% Grass cover, Good, HSG A
6,362	98	Paved parking, HSG A
12,262	70	Weighted Average
5,900		48.12% Pervious Area
6,362		51.88% Impervious Area

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

Summary for Reach DP-1: Existing Culvert

Inflow Area = 239,583 sf, 80.41% Impervious, Inflow Depth > 1.84" for 2-Yr 24 Hr event
Inflow = 11.85 cfs @ 12.09 hrs, Volume= 36,751 cf
Outflow = 11.85 cfs @ 12.09 hrs, Volume= 36,751 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 12,262 sf, 51.88% Impervious, Inflow Depth > 0.83" for 2-Yr 24 Hr event
Inflow = 0.24 cfs @ 12.10 hrs, Volume= 845 cf
Outflow = 0.24 cfs @ 12.10 hrs, Volume= 845 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 216,957 sf, 82.18% Impervious, Inflow Depth > 1.91" for 2-Yr 24 Hr event
Inflow = 11.17 cfs @ 12.09 hrs, Volume= 34,582 cf
Outflow = 11.17 cfs @ 12.09 hrs, Volume= 34,582 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Existing Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: southeast locus Runoff Area=22,626 sf 63.45% Impervious Runoff Depth>2.45"
Tc=6.0 min CN=76 Runoff=1.49 cfs 4,620 cf

Subcatchment EX-1.1: northern locus Runoff Area=216,957 sf 82.18% Impervious Runoff Depth>3.47"
Flow Length=42' Slope=0.2200 '/' Tc=6.0 min CN=87 Runoff=19.94 cfs 62,732 cf

Subcatchment EX-2: southwest locus Runoff Area=12,262 sf 51.88% Impervious Runoff Depth>1.96"
Tc=6.0 min CN=70 Runoff=0.64 cfs 2,003 cf

Reach DP-1: Existing Culvert Inflow=21.43 cfs 67,352 cf
Outflow=21.43 cfs 67,352 cf

Reach DP-2: Watertown Ford Inflow=0.64 cfs 2,003 cf
Outflow=0.64 cfs 2,003 cf

Reach EX-P: Walker Pond Inflow=19.94 cfs 62,732 cf
Outflow=19.94 cfs 62,732 cf

Total Runoff Area = 251,845 sf Runoff Volume = 69,355 cf Average Runoff Depth = 3.30"
20.98% Pervious = 52,837 sf 79.02% Impervious = 199,008 sf

Summary for Subcatchment EX-1: southeast locus

Runoff = 1.49 cfs @ 12.09 hrs, Volume= 4,620 cf, Depth> 2.45"
Routed to Reach DP-1 : Existing Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
*	3,245	39	Crushed Stone
	5,025	39	>75% Grass cover, Good, HSG A
	14,356	98	Paved parking, HSG A
	22,626	76	Weighted Average
	8,270		36.55% Pervious Area
	14,356		63.45% Impervious Area

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

Summary for Subcatchment EX-1.1: northern locus

Runoff = 19.94 cfs @ 12.09 hrs, Volume= 62,732 cf, Depth> 3.47"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
*	94,936	98	Existing Roof Area
	13,668	30	Woods, Good, HSG A
	24,999	39	>75% Grass cover, Good, HSG A
	83,354	98	Paved parking, HSG A
	216,957	87	Weighted Average
	38,667		17.82% Pervious Area
	178,290		82.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	42	0.2200	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.0					**Direct Entry, Min. Engineering Practice**
6.0	42	Total			

Summary for Subcatchment EX-2: southwest locus

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 2,003 cf, Depth> 1.96"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

Area (sf)	CN	Description
5,900	39	>75% Grass cover, Good, HSG A
6,362	98	Paved parking, HSG A
12,262	70	Weighted Average
5,900		48.12% Pervious Area
6,362		51.88% Impervious Area

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

Summary for Reach DP-1: Existing Culvert

Inflow Area = 239,583 sf, 80.41% Impervious, Inflow Depth > 3.37" for 10-Yr 24 Hr event
Inflow = 21.43 cfs @ 12.09 hrs, Volume= 67,352 cf
Outflow = 21.43 cfs @ 12.09 hrs, Volume= 67,352 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 12,262 sf, 51.88% Impervious, Inflow Depth > 1.96" for 10-Yr 24 Hr event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 2,003 cf
Outflow = 0.64 cfs @ 12.09 hrs, Volume= 2,003 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 216,957 sf, 82.18% Impervious, Inflow Depth > 3.47" for 10-Yr 24 Hr event
Inflow = 19.94 cfs @ 12.09 hrs, Volume= 62,732 cf
Outflow = 19.94 cfs @ 12.09 hrs, Volume= 62,732 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Existing Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: southeast locus Runoff Area=22,626 sf 63.45% Impervious Runoff Depth>3.55"
Tc=6.0 min CN=76 Runoff=2.16 cfs 6,692 cf

Subcatchment EX-1.1: northern locus Runoff Area=216,957 sf 82.18% Impervious Runoff Depth>4.70"
Flow Length=42' Slope=0.2200 '/' Tc=6.0 min CN=87 Runoff=26.66 cfs 85,053 cf

Subcatchment EX-2: southwest locus Runoff Area=12,262 sf 51.88% Impervious Runoff Depth>2.96"
Tc=6.0 min CN=70 Runoff=0.97 cfs 3,026 cf

Reach DP-1: Existing Culvert Inflow=28.83 cfs 91,746 cf
Outflow=28.83 cfs 91,746 cf

Reach DP-2: Watertown Ford Inflow=0.97 cfs 3,026 cf
Outflow=0.97 cfs 3,026 cf

Reach EX-P: Walker Pond Inflow=26.66 cfs 85,053 cf
Outflow=26.66 cfs 85,053 cf

Total Runoff Area = 251,845 sf Runoff Volume = 94,771 cf Average Runoff Depth = 4.52"
20.98% Pervious = 52,837 sf 79.02% Impervious = 199,008 sf

Summary for Subcatchment EX-1: southeast locus

Runoff = 2.16 cfs @ 12.09 hrs, Volume= 6,692 cf, Depth> 3.55"
Routed to Reach DP-1 : Existing Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
*	3,245	39	Crushed Stone
	5,025	39	>75% Grass cover, Good, HSG A
	14,356	98	Paved parking, HSG A
	22,626	76	Weighted Average
	8,270		36.55% Pervious Area
	14,356		63.45% Impervious Area

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

Summary for Subcatchment EX-1.1: northern locus

Runoff = 26.66 cfs @ 12.09 hrs, Volume= 85,053 cf, Depth> 4.70"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
*	94,936	98	Existing Roof Area
	13,668	30	Woods, Good, HSG A
	24,999	39	>75% Grass cover, Good, HSG A
	83,354	98	Paved parking, HSG A
	216,957	87	Weighted Average
	38,667		17.82% Pervious Area
	178,290		82.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	42	0.2200	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.0					**Direct Entry, Min. Engineering Practice**
6.0	42	Total			

Summary for Subcatchment EX-2: southwest locus

Runoff = 0.97 cfs @ 12.09 hrs, Volume= 3,026 cf, Depth> 2.96"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

Area (sf)	CN	Description
5,900	39	>75% Grass cover, Good, HSG A
6,362	98	Paved parking, HSG A
12,262	70	Weighted Average
5,900		48.12% Pervious Area
6,362		51.88% Impervious Area

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

Summary for Reach DP-1: Existing Culvert

Inflow Area = 239,583 sf, 80.41% Impervious, Inflow Depth > 4.60" for 25-Yr 24 Hr event
Inflow = 28.83 cfs @ 12.09 hrs, Volume= 91,746 cf
Outflow = 28.83 cfs @ 12.09 hrs, Volume= 91,746 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 12,262 sf, 51.88% Impervious, Inflow Depth > 2.96" for 25-Yr 24 Hr event
Inflow = 0.97 cfs @ 12.09 hrs, Volume= 3,026 cf
Outflow = 0.97 cfs @ 12.09 hrs, Volume= 3,026 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 216,957 sf, 82.18% Impervious, Inflow Depth > 4.70" for 25-Yr 24 Hr event
Inflow = 26.66 cfs @ 12.09 hrs, Volume= 85,053 cf
Outflow = 26.66 cfs @ 12.09 hrs, Volume= 85,053 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Existing Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: southeast locus Runoff Area=22,626 sf 63.45% Impervious Runoff Depth>5.98"
Tc=6.0 min CN=76 Runoff=3.61 cfs 11,270 cf

Subcatchment EX-1.1: northern locus Runoff Area=216,957 sf 82.18% Impervious Runoff Depth>7.32"
Flow Length=42' Slope=0.2200 '/' Tc=6.0 min CN=87 Runoff=40.52 cfs 132,371 cf

Subcatchment EX-2: southwest locus Runoff Area=12,262 sf 51.88% Impervious Runoff Depth>5.24"
Tc=6.0 min CN=70 Runoff=1.73 cfs 5,356 cf

Reach DP-1: Existing Culvert Inflow=44.12 cfs 143,641 cf
Outflow=44.12 cfs 143,641 cf

Reach DP-2: Watertown Ford Inflow=1.73 cfs 5,356 cf
Outflow=1.73 cfs 5,356 cf

Reach EX-P: Walker Pond Inflow=40.52 cfs 132,371 cf
Outflow=40.52 cfs 132,371 cf

Total Runoff Area = 251,845 sf Runoff Volume = 148,997 cf Average Runoff Depth = 7.10"
20.98% Pervious = 52,837 sf 79.02% Impervious = 199,008 sf

Summary for Subcatchment EX-1: southeast locus

Runoff = 3.61 cfs @ 12.09 hrs, Volume= 11,270 cf, Depth> 5.98"
Routed to Reach DP-1 : Existing Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
*	3,245	39	Crushed Stone
	5,025	39	>75% Grass cover, Good, HSG A
	14,356	98	Paved parking, HSG A
	22,626	76	Weighted Average
	8,270		36.55% Pervious Area
	14,356		63.45% Impervious Area

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

Summary for Subcatchment EX-1.1: northern locus

Runoff = 40.52 cfs @ 12.08 hrs, Volume= 132,371 cf, Depth> 7.32"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
*	94,936	98	Existing Roof Area
	13,668	30	Woods, Good, HSG A
	24,999	39	>75% Grass cover, Good, HSG A
	83,354	98	Paved parking, HSG A
	216,957	87	Weighted Average
	38,667		17.82% Pervious Area
	178,290		82.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	42	0.2200	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.0					**Direct Entry, Min. Engineering Practice**
6.0	42	Total			

Summary for Subcatchment EX-2: southwest locus

Runoff = 1.73 cfs @ 12.09 hrs, Volume= 5,356 cf, Depth> 5.24"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

Area (sf)	CN	Description
5,900	39	>75% Grass cover, Good, HSG A
6,362	98	Paved parking, HSG A
12,262	70	Weighted Average
5,900		48.12% Pervious Area
6,362		51.88% Impervious Area

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

Summary for Reach DP-1: Existing Culvert

Inflow Area = 239,583 sf, 80.41% Impervious, Inflow Depth > 7.19" for 100-Yr 24 Hr event
Inflow = 44.12 cfs @ 12.08 hrs, Volume= 143,641 cf
Outflow = 44.12 cfs @ 12.08 hrs, Volume= 143,641 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 12,262 sf, 51.88% Impervious, Inflow Depth > 5.24" for 100-Yr 24 Hr event
Inflow = 1.73 cfs @ 12.09 hrs, Volume= 5,356 cf
Outflow = 1.73 cfs @ 12.09 hrs, Volume= 5,356 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

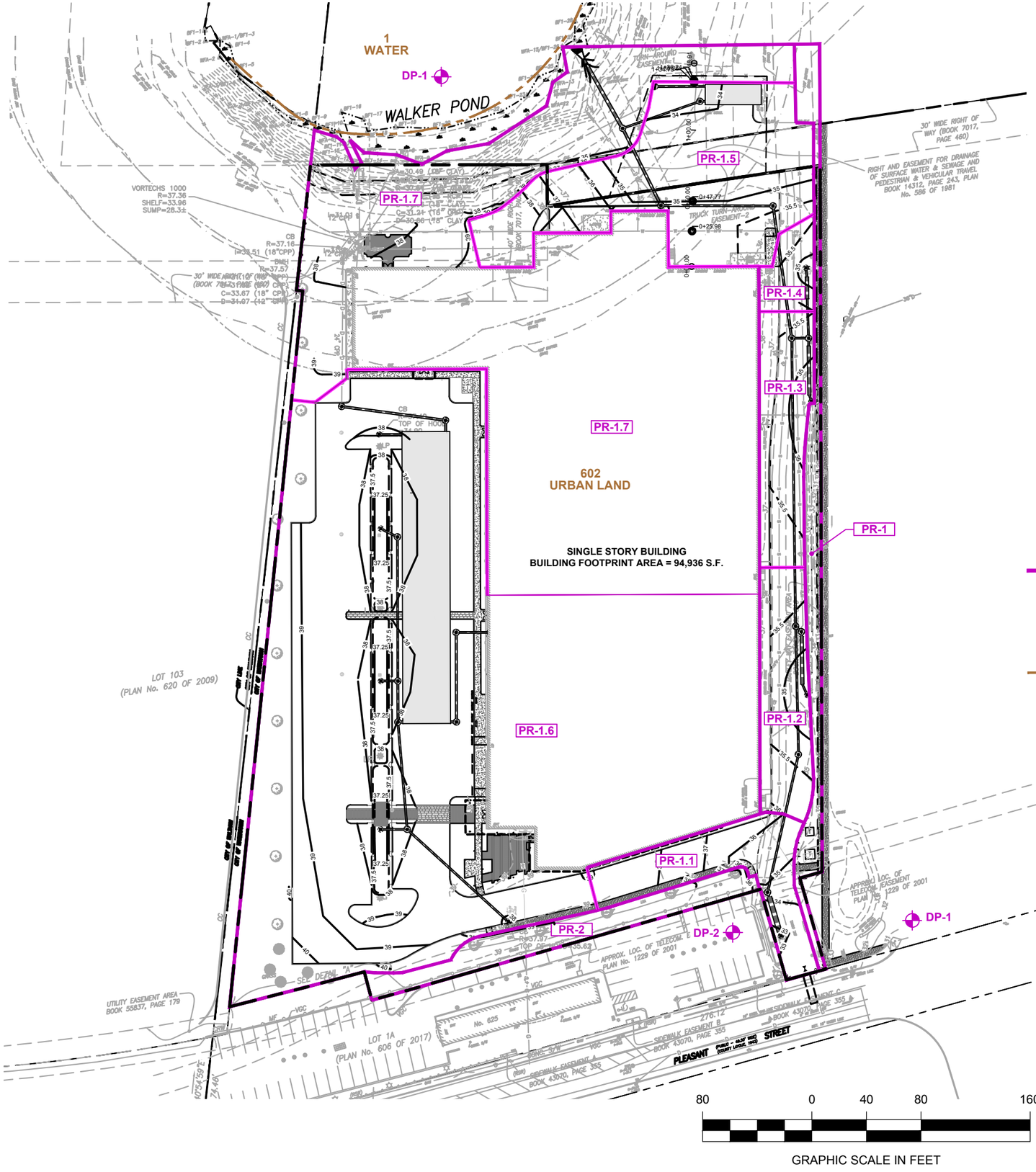
Summary for Reach EX-P: Walker Pond

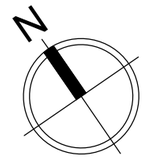
Inflow Area = 216,957 sf, 82.18% Impervious, Inflow Depth > 7.32" for 100-Yr 24 Hr event
Inflow = 40.52 cfs @ 12.08 hrs, Volume= 132,371 cf
Outflow = 40.52 cfs @ 12.08 hrs, Volume= 132,371 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Existing Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

POST-CONSTRUCTION HYDROLOGIC CALCULATIONS

RJOC





PR-1 SUBCATCHMENT BOUNDARY

PR-1 SUBCATCHMENT LABEL

DP-1 DESIGN POINT

602 SOIL TYPE

SOIL BOUNDARY

NOTE:

LOCATIONS AND TYPES OF SOIL DESIGNATIONS SHOWN HEREON HAVE BEEN DELINEATED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS) AND COMPILED BY MA GIS

RJO'CONNELL & ASSOCIATES, INC.

CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 03/19/2024
REVISED: 07/02/2024

SCALE: 1"=80'

FIGURE 3

PROPOSED WATERSHED PLAN

WATERTOWN, MA

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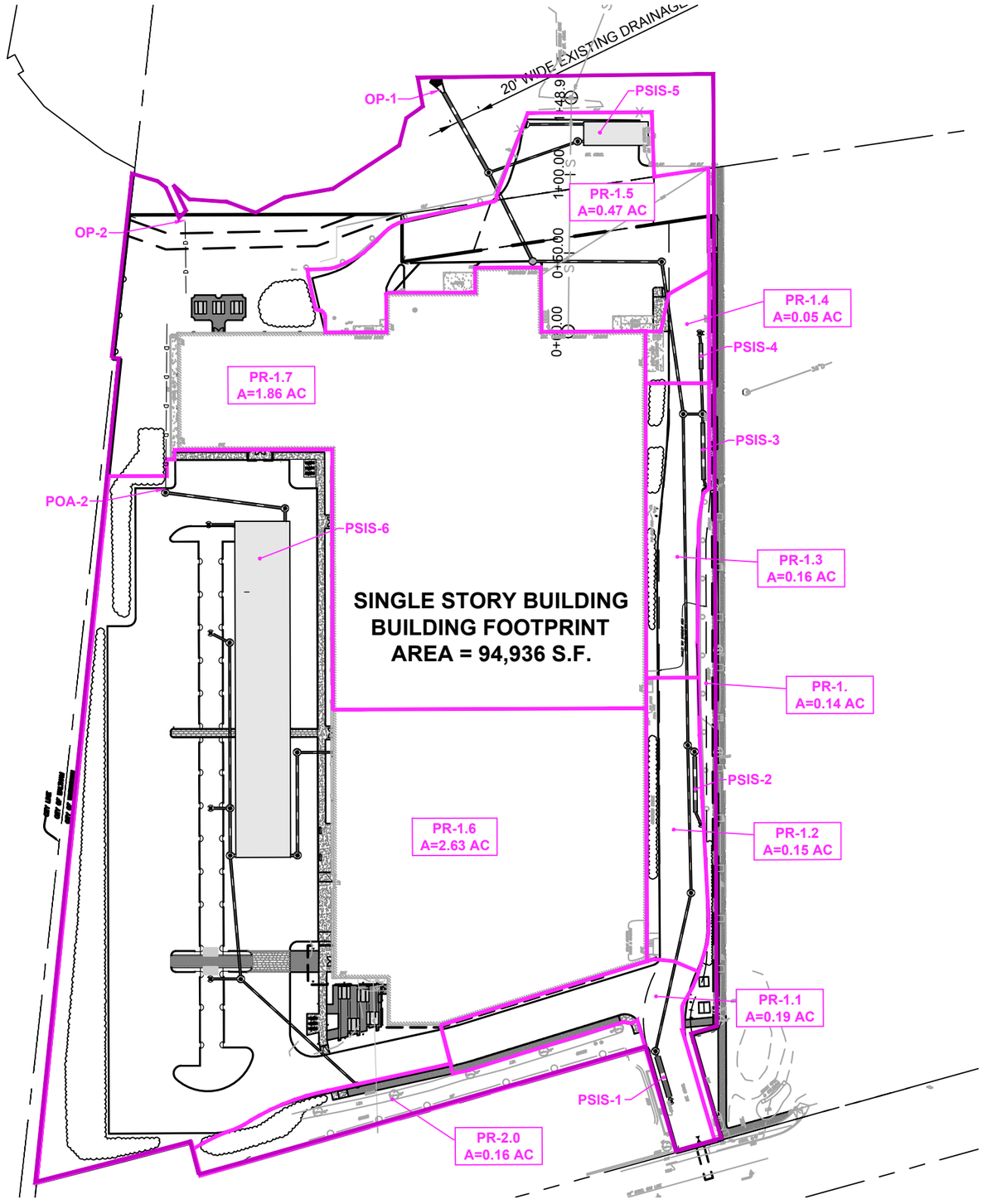

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GRAPHIC SCALE IN FEET

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CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 03/19/2024
REVISED: 07/02/2024

SCALE: 1"=200'

FIGURE 4
DRAINAGE SUBCATCHMENT PLAN

20 SEYON STREET
WATERTOWN, MA 02472

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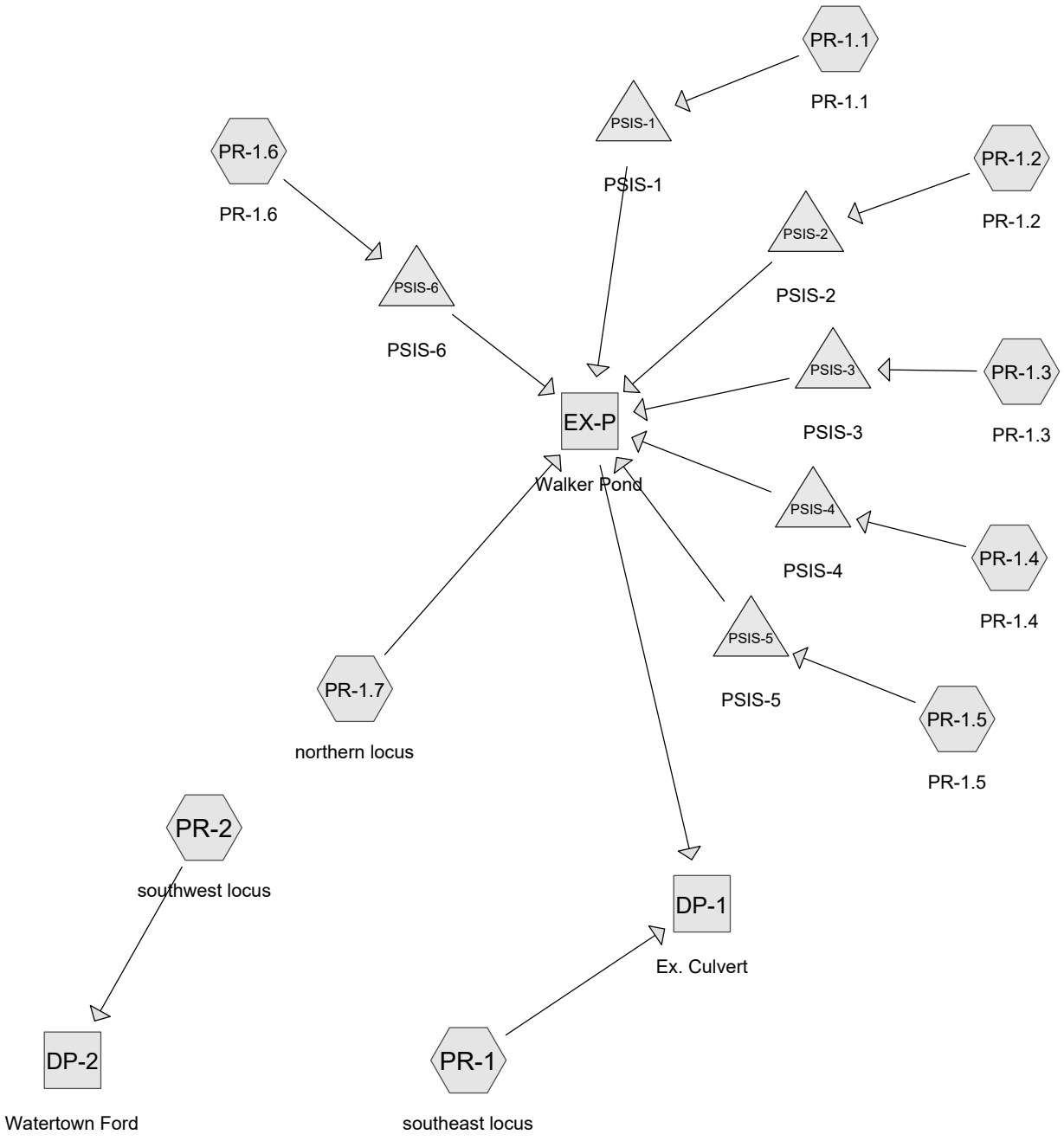

Routing Diagram for 21049-POST-3
Prepared by RJOC, Printed 7/1/2024
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
43,654	39	>75% Grass cover, Good, HSG A (PR-1, PR-1.1, PR-1.5, PR-1.6, PR-1.7, PR-2)
3,207	39	Crushed Stone (PR-1.2, PR-1.3, PR-1.4)
94,936	98	Existing Roof Area (PR-1.6, PR-1.7)
94,120	98	Paved parking, HSG A (PR-1, PR-1.1, PR-1.2, PR-1.3, PR-1.4, PR-1.5, PR-1.6, PR-1.7)
4,828	39	Porous Pavement/Pavers (PR-1, PR-1.1, PR-1.6, PR-1.7)
11,100	30	Woods, Good, HSG A (PR-1.7)
251,845	**83**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: southeast locus Runoff Area=6,192 sf 16.97% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=49 Runoff=0.00 cfs 0 cf

Subcatchment PR-1.1: PR-1.1 Runoff Area=7,400 sf 86.15% Impervious Runoff Depth>0.32"
Tc=6.0 min CN=90 Runoff=0.06 cfs 197 cf

Subcatchment PR-1.2: PR-1.2 Runoff Area=6,576 sf 80.26% Impervious Runoff Depth>0.20"
Tc=6.0 min CN=86 Runoff=0.03 cfs 108 cf

Subcatchment PR-1.3: PR-1.3 Runoff Area=6,735 sf 81.14% Impervious Runoff Depth>0.22"
Tc=6.0 min CN=87 Runoff=0.03 cfs 125 cf

Subcatchment PR-1.4: PR-1.4 Runoff Area=2,201 sf 70.97% Impervious Runoff Depth>0.10"
Tc=6.0 min CN=81 Runoff=0.00 cfs 18 cf

Subcatchment PR-1.5: PR-1.5 Runoff Area=20,630 sf 98.01% Impervious Runoff Depth>0.70"
Tc=6.0 min CN=97 Runoff=0.39 cfs 1,212 cf

Subcatchment PR-1.6: PR-1.6 Runoff Area=112,595 sf 78.09% Impervious Runoff Depth>0.17"
Tc=6.0 min CN=85 Runoff=0.39 cfs 1,626 cf

Subcatchment PR-1.7: northern locus Runoff Area=84,021 sf 72.81% Impervious Runoff Depth>0.10"
Tc=6.0 min CN=81 Runoff=0.09 cfs 684 cf

Subcatchment PR-2: southwest locus Runoff Area=5,495 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Reach DP-1: Ex. Culvert Inflow=0.09 cfs 684 cf
Outflow=0.09 cfs 684 cf

Reach DP-2: Watertown Ford Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach EX-P: Walker Pond Inflow=0.09 cfs 684 cf
Outflow=0.09 cfs 684 cf

Pond PSIS-1: PSIS-1 Peak Elev=26.64' Storage=30 cf Inflow=0.06 cfs 197 cf
Discarded=0.02 cfs 197 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 197 cf

Pond PSIS-2: PSIS-2 Peak Elev=28.53' Storage=2 cf Inflow=0.03 cfs 108 cf
Discarded=0.03 cfs 108 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 108 cf

Pond PSIS-3: PSIS-3 Peak Elev=28.58' Storage=4 cf Inflow=0.03 cfs 125 cf
Discarded=0.03 cfs 125 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 125 cf

Pond PSIS-4: PSIS-4 Peak Elev=28.51' Storage=0 cf Inflow=0.00 cfs 18 cf
Discarded=0.00 cfs 18 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 18 cf

Pond PSIS-5: PSIS-5 Peak Elev=28.73' Storage=205 cf Inflow=0.39 cfs 1,212 cf
Discarded=0.12 cfs 1,211 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 1,211 cf

Pond PSIS-6: PSIS-6 Peak Elev=30.51' Storage=40 cf Inflow=0.39 cfs 1,626 cf
Discarded=0.37 cfs 1,624 cf Primary=0.00 cfs 0 cf Outflow=0.37 cfs 1,624 cf

Total Runoff Area = 251,845 sf Runoff Volume = 3,970 cf Average Runoff Depth = 0.19"
24.93% Pervious = 62,789 sf 75.07% Impervious = 189,056 sf

Summary for Subcatchment PR-1: southeast locus

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-1 : Ex. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	3,625	39	>75% Grass cover, Good, HSG A
	1,051	98	Paved parking, HSG A
*	1,516	39	Porous Pavement/Pavers
	6,192	49	Weighted Average
	5,141		83.03% Pervious Area
	1,051		16.97% Impervious Area

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

Summary for Subcatchment PR-1.1: PR-1.1

Runoff = 0.06 cfs @ 12.10 hrs, Volume= 197 cf, Depth> 0.32"
Routed to Pond PSIS-1 : PSIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	6,375	98	Paved parking, HSG A
	425	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	7,400	90	Weighted Average
	1,025		13.85% Pervious Area
	6,375		86.15% Impervious Area

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

Summary for Subcatchment PR-1.2: PR-1.2

Runoff = 0.03 cfs @ 12.11 hrs, Volume= 108 cf, Depth> 0.20"
Routed to Pond PSIS-2 : PSIS-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	5,278	98	Paved parking, HSG A
*	1,298	39	Crushed Stone
	6,576	86	Weighted Average
	1,298		19.74% Pervious Area
	5,278		80.26% Impervious Area

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

Summary for Subcatchment PR-1.3: PR-1.3

Runoff = 0.03 cfs @ 12.10 hrs, Volume= 125 cf, Depth> 0.22"
Routed to Pond PSIS-3 : PSIS-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	5,465	98	Paved parking, HSG A
*	1,270	39	Crushed Stone
	6,735	87	Weighted Average
	1,270		18.86% Pervious Area
	5,465		81.14% Impervious Area

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

Summary for Subcatchment PR-1.4: PR-1.4

Runoff = 0.00 cfs @ 12.27 hrs, Volume= 18 cf, Depth> 0.10"
Routed to Pond PSIS-4 : PSIS-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	1,562	98	Paved parking, HSG A
*	639	39	Crushed Stone
	2,201	81	Weighted Average
	639		29.03% Pervious Area
	1,562		70.97% Impervious Area

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

Summary for Subcatchment PR-1.5: PR-1.5

Runoff = 0.39 cfs @ 12.09 hrs, Volume= 1,212 cf, Depth> 0.70"
Routed to Pond PSIS-5 : PSIS-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

Area (sf)	CN	Description
20,220	98	Paved parking, HSG A
410	39	>75% Grass cover, Good, HSG A
20,630	97	Weighted Average
410		1.99% Pervious Area
20,220		98.01% Impervious Area

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

Summary for Subcatchment PR-1.6: PR-1.6

Runoff = 0.39 cfs @ 12.11 hrs, Volume= 1,626 cf, Depth> 0.17"
Routed to Pond PSIS-6 : PSIS-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
	51,420	98	Paved parking, HSG A
	22,552	39	>75% Grass cover, Good, HSG A
*	2,112	39	Porous Pavement/Pavers
*	36,511	98	Existing Roof Area
	112,595	85	Weighted Average
	24,664		21.91% Pervious Area
	87,931		78.09% Impervious Area

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

Summary for Subcatchment PR-1.7: northern locus

Runoff = 0.09 cfs @ 12.27 hrs, Volume= 684 cf, Depth> 0.10"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

	Area (sf)	CN	Description
*	58,425	98	Existing Roof Area
	11,100	30	Woods, Good, HSG A
	11,147	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	2,749	98	Paved parking, HSG A
	84,021	81	Weighted Average
	22,847		27.19% Pervious Area
	61,174		72.81% Impervious Area

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

Summary for Subcatchment PR-2: southwest locus

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Inch 24 Hr Rainfall=1.00"

Area (sf)	CN	Description
5,495	39	>75% Grass cover, Good, HSG A
5,495		100.00% Pervious Area

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

Summary for Reach DP-1: Ex. Culvert

Inflow Area = 246,350 sf, 76.74% Impervious, Inflow Depth > 0.03" for 1-Inch 24 Hr event
Inflow = 0.09 cfs @ 12.27 hrs, Volume= 684 cf
Outflow = 0.09 cfs @ 12.27 hrs, Volume= 684 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 5,495 sf, 0.00% Impervious, Inflow Depth = 0.00" for 1-Inch 24 Hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 240,158 sf, 78.28% Impervious, Inflow Depth > 0.03" for 1-Inch 24 Hr event
Inflow = 0.09 cfs @ 12.27 hrs, Volume= 684 cf
Outflow = 0.09 cfs @ 12.27 hrs, Volume= 684 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Ex. Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond PSIS-1: PSIS-1

Inflow Area = 7,400 sf, 86.15% Impervious, Inflow Depth > 0.32" for 1-Inch 24 Hr event
Inflow = 0.06 cfs @ 12.10 hrs, Volume= 197 cf
Outflow = 0.02 cfs @ 11.98 hrs, Volume= 197 cf, Atten= 65%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.98 hrs, Volume= 197 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 26.64' @ 12.44 hrs Surf.Area= 110 sf Storage= 30 cf

Plug-Flow detention time= 7.5 min calculated for 197 cf (100% of inflow)
Center-of-Mass det. time= 7.2 min (869.2 - 861.9)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	187 cf	**36.0" Round Pipe Storage** Inside #2 L= 26.5'
#2	26.00'	101 cf	**4.00'W x 27.50'L x 4.00'H Prismatoid** 440 cf Overall - 187 cf Embedded = 253 cf x 40.0% Voids
		288 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	28.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 11.98 hrs HW=26.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=26.00' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PSIS-2: PSIS-2

Inflow Area = 6,576 sf, 80.26% Impervious, Inflow Depth > 0.20" for 1-Inch 24 Hr event
Inflow = 0.03 cfs @ 12.11 hrs, Volume= 108 cf
Outflow = 0.03 cfs @ 12.11 hrs, Volume= 108 cf, Atten= 5%, Lag= 0.2 min
Discarded = 0.03 cfs @ 12.11 hrs, Volume= 108 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.53' @ 12.13 hrs Surf.Area= 140 sf Storage= 2 cf

Plug-Flow detention time= 1.0 min calculated for 108 cf (100% of inflow)
Center-of-Mass det. time= 0.8 min (891.9 - 891.1)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104 cf	**24.0" Round Pipe Storage** Inside #2 L= 33.0'
#2	28.50'	127 cf	**4.00'W x 35.00'L x 3.00'H Prismatoid** 420 cf Overall - 104 cf Embedded = 316 cf x 40.0% Voids
		230 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.11 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PSIS-3: PSIS-3

Inflow Area = 6,735 sf, 81.14% Impervious, Inflow Depth > 0.22" for 1-Inch 24 Hr event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 125 cf
Outflow = 0.03 cfs @ 12.07 hrs, Volume= 125 cf, Atten= 25%, Lag= 0.0 min
Discarded = 0.03 cfs @ 12.07 hrs, Volume= 125 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.58' @ 12.18 hrs Surf.Area= 135 sf Storage= 4 cf

Plug-Flow detention time= 1.4 min calculated for 125 cf (100% of inflow)
Center-of-Mass det. time= 1.2 min (884.7 - 883.5)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	116 cf	**24.0" Round Pipe Storage** Inside #2 L= 37.0'
#2	28.50'	142 cf	**3.50'W x 38.50'L x 3.50'H Prismatoid** 472 cf Overall - 116 cf Embedded = 355 cf x 40.0% Voids
		258 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.07 hrs HW=28.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PSIS-4: PSIS-4

Inflow Area = 2,201 sf, 70.97% Impervious, Inflow Depth > 0.10" for 1-Inch 24 Hr event
Inflow = 0.00 cfs @ 12.27 hrs, Volume= 18 cf
Outflow = 0.00 cfs @ 12.29 hrs, Volume= 18 cf, Atten= 0%, Lag= 1.0 min
Discarded = 0.00 cfs @ 12.29 hrs, Volume= 18 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.51' @ 12.29 hrs Surf.Area= 51 sf Storage= 0 cf

Plug-Flow detention time= 1.0 min calculated for 18 cf (100% of inflow)
Center-of-Mass det. time= 0.8 min (938.3 - 937.6)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	50 cf	**24.0" Round Pipe Storage** Inside #2 L= 16.0'
#2	28.50'	41 cf	**3.00'W x 17.00'L x 3.00'H Prismatoid** 153 cf Overall - 50 cf Embedded = 103 cf x 40.0% Voids
		91 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 12.29 hrs HW=28.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PSIS-5: PSIS-5

Inflow Area = 20,630 sf, 98.01% Impervious, Inflow Depth > 0.70" for 1-Inch 24 Hr event
Inflow = 0.39 cfs @ 12.09 hrs, Volume= 1,212 cf
Outflow = 0.12 cfs @ 11.86 hrs, Volume= 1,211 cf, Atten= 69%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.86 hrs, Volume= 1,211 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.73' @ 12.41 hrs Surf.Area= 615 sf Storage= 205 cf

Plug-Flow detention time= 8.6 min calculated for 1,211 cf (100% of inflow)
Center-of-Mass det. time= 8.5 min (810.3 - 801.9)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	628 cf	**24.0" Round Pipe Storage** x 5 Inside #2 L= 40.0'
#2	28.00'	487 cf	**15.00'W x 41.00'L x 3.00'H Prismatoid** 1,845 cf Overall - 628 cf Embedded = 1,217 cf x 40.0% Voids
		1,115 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	29.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 11.86 hrs HW=28.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond PSIS-6: PSIS-6

Inflow Area = 112,595 sf, 78.09% Impervious, Inflow Depth > 0.17" for 1-Inch 24 Hr event
Inflow = 0.39 cfs @ 12.11 hrs, Volume= 1,626 cf
Outflow = 0.37 cfs @ 12.14 hrs, Volume= 1,624 cf, Atten= 6%, Lag= 1.9 min
Discarded = 0.37 cfs @ 12.14 hrs, Volume= 1,624 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.51' @ 12.14 hrs Surf.Area= 7,490 sf Storage= 40 cf

Plug-Flow detention time= 1.8 min calculated for 1,624 cf (100% of inflow)
Center-of-Mass det. time= 1.4 min (900.6 - 899.2)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	15,984 cf	**48.0" Round Pipe Storage** x 6 Inside #2 L= 212.0'
#2	30.50'	8,586 cf	**35.00'W x 214.00'L x 5.00'H Prismatoid** 37,450 cf Overall - 15,984 cf Embedded = 21,466 cf x 40.0% Voids
		24,571 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Device 3	34.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	34.50'	**15.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.50' / 34.30' S= 0.0250 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=1.43 cfs @ 12.14 hrs HW=30.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.43 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=30.50' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: southeast locus Runoff Area=6,192 sf 16.97% Impervious Runoff Depth>0.11"
Tc=6.0 min CN=49 Runoff=0.00 cfs 56 cf

Subcatchment PR-1.1: PR-1.1 Runoff Area=7,400 sf 86.15% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=90 Runoff=0.43 cfs 1,336 cf

Subcatchment PR-1.2: PR-1.2 Runoff Area=6,576 sf 80.26% Impervious Runoff Depth>1.83"
Tc=6.0 min CN=86 Runoff=0.32 cfs 1,004 cf

Subcatchment PR-1.3: PR-1.3 Runoff Area=6,735 sf 81.14% Impervious Runoff Depth>1.91"
Tc=6.0 min CN=87 Runoff=0.35 cfs 1,074 cf

Subcatchment PR-1.4: PR-1.4 Runoff Area=2,201 sf 70.97% Impervious Runoff Depth>1.47"
Tc=6.0 min CN=81 Runoff=0.09 cfs 269 cf

Subcatchment PR-1.5: PR-1.5 Runoff Area=20,630 sf 98.01% Impervious Runoff Depth>2.85"
Tc=6.0 min CN=97 Runoff=1.45 cfs 4,907 cf

Subcatchment PR-1.6: PR-1.6 Runoff Area=112,595 sf 78.09% Impervious Runoff Depth>1.76"
Tc=6.0 min CN=85 Runoff=5.33 cfs 16,472 cf

Subcatchment PR-1.7: northern locus Runoff Area=84,021 sf 72.81% Impervious Runoff Depth>1.47"
Tc=6.0 min CN=81 Runoff=3.30 cfs 10,273 cf

Subcatchment PR-2: southwest locus Runoff Area=5,495 sf 0.00% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Reach DP-1: Ex. Culvert Inflow=5.29 cfs 12,688 cf
Outflow=5.29 cfs 12,688 cf

Reach DP-2: Watertown Ford Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach EX-P: Walker Pond Inflow=5.29 cfs 12,632 cf
Outflow=5.29 cfs 12,632 cf

Pond PSIS-1: PSIS-1 Peak Elev=28.81' Storage=217 cf Inflow=0.43 cfs 1,336 cf
Discarded=0.02 cfs 873 cf Primary=0.40 cfs 462 cf Outflow=0.42 cfs 1,336 cf

Pond PSIS-2: PSIS-2 Peak Elev=30.26' Storage=140 cf Inflow=0.32 cfs 1,004 cf
Discarded=0.03 cfs 721 cf Primary=0.29 cfs 283 cf Outflow=0.32 cfs 1,004 cf

Pond PSIS-3: PSIS-3 Peak Elev=30.28' Storage=143 cf Inflow=0.35 cfs 1,074 cf
Discarded=0.03 cfs 745 cf Primary=0.31 cfs 328 cf Outflow=0.34 cfs 1,073 cf

Pond PSIS-4: PSIS-4 Peak Elev=30.11' Storage=50 cf Inflow=0.09 cfs 269 cf
Discarded=0.01 cfs 222 cf Primary=0.05 cfs 47 cf Outflow=0.06 cfs 269 cf

Pond PSIS-5: PSIS-5 Peak Elev=30.05' Storage=818 cf Inflow=1.45 cfs 4,907 cf
Discarded=0.12 cfs 3,667 cf Primary=1.12 cfs 1,239 cf Outflow=1.24 cfs 4,906 cf

Pond PSIS-6: PSIS-6 Peak Elev=31.43' Storage=3,322 cf Inflow=5.33 cfs 16,472 cf
Discarded=1.43 cfs 16,466 cf Primary=0.00 cfs 0 cf Outflow=1.43 cfs 16,466 cf

Total Runoff Area = 251,845 sf Runoff Volume = 35,391 cf Average Runoff Depth = 1.69"
24.93% Pervious = 62,789 sf 75.07% Impervious = 189,056 sf

Summary for Subcatchment PR-1: southeast locus

Runoff = 0.00 cfs @ 13.66 hrs, Volume= 56 cf, Depth> 0.11"
Routed to Reach DP-1 : Ex. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	3,625	39	>75% Grass cover, Good, HSG A
	1,051	98	Paved parking, HSG A
*	1,516	39	Porous Pavement/Pavers
	6,192	49	Weighted Average
	5,141		83.03% Pervious Area
	1,051		16.97% Impervious Area

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

Summary for Subcatchment PR-1.1: PR-1.1

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,336 cf, Depth> 2.17"
Routed to Pond PSIS-1 : PSIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	6,375	98	Paved parking, HSG A
	425	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	7,400	90	Weighted Average
	1,025		13.85% Pervious Area
	6,375		86.15% Impervious Area

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

Summary for Subcatchment PR-1.2: PR-1.2

Runoff = 0.32 cfs @ 12.09 hrs, Volume= 1,004 cf, Depth> 1.83"
Routed to Pond PSIS-2 : PSIS-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	5,278	98	Paved parking, HSG A
*	1,298	39	Crushed Stone
	6,576	86	Weighted Average
	1,298		19.74% Pervious Area
	5,278		80.26% Impervious Area

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

Summary for Subcatchment PR-1.3: PR-1.3

Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,074 cf, Depth> 1.91"
Routed to Pond PSIS-3 : PSIS-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	5,465	98	Paved parking, HSG A
*	1,270	39	Crushed Stone
	6,735	87	Weighted Average
	1,270		18.86% Pervious Area
	5,465		81.14% Impervious Area

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

Summary for Subcatchment PR-1.4: PR-1.4

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 269 cf, Depth> 1.47"
Routed to Pond PSIS-4 : PSIS-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	1,562	98	Paved parking, HSG A
*	639	39	Crushed Stone
	2,201	81	Weighted Average
	639		29.03% Pervious Area
	1,562		70.97% Impervious Area

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

Summary for Subcatchment PR-1.5: PR-1.5

Runoff = 1.45 cfs @ 12.08 hrs, Volume= 4,907 cf, Depth> 2.85"
Routed to Pond PSIS-5 : PSIS-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

Area (sf)	CN	Description
20,220	98	Paved parking, HSG A
410	39	>75% Grass cover, Good, HSG A
20,630	97	Weighted Average
410		1.99% Pervious Area
20,220		98.01% Impervious Area

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

Summary for Subcatchment PR-1.6: PR-1.6

Runoff = 5.33 cfs @ 12.09 hrs, Volume= 16,472 cf, Depth> 1.76"
Routed to Pond PSIS-6 : PSIS-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
	51,420	98	Paved parking, HSG A
	22,552	39	>75% Grass cover, Good, HSG A
*	2,112	39	Porous Pavement/Pavers
*	36,511	98	Existing Roof Area
	112,595	85	Weighted Average
	24,664		21.91% Pervious Area
	87,931		78.09% Impervious Area

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

Summary for Subcatchment PR-1.7: northern locus

Runoff = 3.30 cfs @ 12.09 hrs, Volume= 10,273 cf, Depth> 1.47"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

	Area (sf)	CN	Description
*	58,425	98	Existing Roof Area
	11,100	30	Woods, Good, HSG A
	11,147	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	2,749	98	Paved parking, HSG A
	84,021	81	Weighted Average
	22,847		27.19% Pervious Area
	61,174		72.81% Impervious Area

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

Summary for Subcatchment PR-2: southwest locus

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0 cf, Depth> 0.00"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr 24 Hr Rainfall=3.20"

Area (sf)	CN	Description
5,495	39	>75% Grass cover, Good, HSG A
5,495		100.00% Pervious Area

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

Summary for Reach DP-1: Ex. Culvert

Inflow Area = 246,350 sf, 76.74% Impervious, Inflow Depth > 0.62" for 2-Yr 24 Hr event
Inflow = 5.29 cfs @ 12.11 hrs, Volume= 12,688 cf
Outflow = 5.29 cfs @ 12.11 hrs, Volume= 12,688 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 5,495 sf, 0.00% Impervious, Inflow Depth > 0.00" for 2-Yr 24 Hr event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 240,158 sf, 78.28% Impervious, Inflow Depth > 0.63" for 2-Yr 24 Hr event
Inflow = 5.29 cfs @ 12.11 hrs, Volume= 12,632 cf
Outflow = 5.29 cfs @ 12.11 hrs, Volume= 12,632 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Ex. Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond PSIS-1: PSIS-1

Inflow Area = 7,400 sf, 86.15% Impervious, Inflow Depth > 2.17" for 2-Yr 24 Hr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 1,336 cf
Outflow = 0.42 cfs @ 12.10 hrs, Volume= 1,336 cf, Atten= 1%, Lag= 0.7 min
Discarded = 0.02 cfs @ 10.98 hrs, Volume= 873 cf
Primary = 0.40 cfs @ 12.10 hrs, Volume= 462 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.81' @ 12.10 hrs Surf.Area= 110 sf Storage= 217 cf

Plug-Flow detention time= 53.1 min calculated for 1,335 cf (100% of inflow)
Center-of-Mass det. time= 52.9 min (859.2 - 806.2)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	187 cf	**36.0" Round Pipe Storage** Inside #2 L= 26.5'
#2	26.00'	101 cf	**4.00'W x 27.50'L x 4.00'H Prismatoid** 440 cf Overall - 187 cf Embedded = 253 cf x 40.0% Voids
		288 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	28.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 10.98 hrs HW=26.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.40 cfs @ 12.10 hrs HW=28.81' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.40 cfs @ 1.91 fps)

Summary for Pond PSIS-2: PSIS-2

Inflow Area = 6,576 sf, 80.26% Impervious, Inflow Depth > 1.83" for 2-Yr 24 Hr event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 1,004 cf
Outflow = 0.32 cfs @ 12.11 hrs, Volume= 1,004 cf, Atten= 3%, Lag= 1.2 min
Discarded = 0.03 cfs @ 11.57 hrs, Volume= 721 cf
Primary = 0.29 cfs @ 12.11 hrs, Volume= 283 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.26' @ 12.11 hrs Surf.Area= 140 sf Storage= 140 cf

Plug-Flow detention time= 24.5 min calculated for 1,004 cf (100% of inflow)
Center-of-Mass det. time= 24.3 min (846.2 - 821.8)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104 cf	**24.0" Round Pipe Storage** Inside #2 L= 33.0'
#2	28.50'	127 cf	**4.00'W x 35.00'L x 3.00'H Prismatoid** 420 cf Overall - 104 cf Embedded = 316 cf x 40.0% Voids
		230 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 11.57 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.29 cfs @ 12.11 hrs HW=30.26' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.29 cfs @ 1.75 fps)

Summary for Pond PSIS-3: PSIS-3

Inflow Area = 6,735 sf, 81.14% Impervious, Inflow Depth > 1.91" for 2-Yr 24 Hr event
Inflow = 0.35 cfs @ 12.09 hrs, Volume= 1,074 cf
Outflow = 0.34 cfs @ 12.10 hrs, Volume= 1,073 cf, Atten= 2%, Lag= 0.9 min
Discarded = 0.03 cfs @ 11.47 hrs, Volume= 745 cf
Primary = 0.31 cfs @ 12.10 hrs, Volume= 328 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.28' @ 12.10 hrs Surf.Area= 135 sf Storage= 143 cf

Plug-Flow detention time= 25.4 min calculated for 1,073 cf (100% of inflow)
Center-of-Mass det. time= 25.2 min (843.4 - 818.2)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	116 cf	**24.0" Round Pipe Storage** Inside #2 L= 37.0'
#2	28.50'	142 cf	**3.50'W x 38.50'L x 3.50'H Prismatoid** 472 cf Overall - 116 cf Embedded = 355 cf x 40.0% Voids
		258 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 11.47 hrs HW=28.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.31 cfs @ 12.10 hrs HW=30.27' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.31 cfs @ 1.79 fps)

Summary for Pond PSIS-4: PSIS-4

Inflow Area = 2,201 sf, 70.97% Impervious, Inflow Depth > 1.47" for 2-Yr 24 Hr event
Inflow = 0.09 cfs @ 12.09 hrs, Volume= 269 cf
Outflow = 0.06 cfs @ 12.17 hrs, Volume= 269 cf, Atten= 28%, Lag= 4.8 min
Discarded = 0.01 cfs @ 11.68 hrs, Volume= 222 cf
Primary = 0.05 cfs @ 12.17 hrs, Volume= 47 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.11' @ 12.17 hrs Surf.Area= 51 sf Storage= 50 cf

Plug-Flow detention time= 29.2 min calculated for 269 cf (100% of inflow)
Center-of-Mass det. time= 29.0 min (867.8 - 838.7)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	50 cf	**24.0" Round Pipe Storage** Inside #2 L= 16.0'
#2	28.50'	41 cf	**3.00'W x 17.00'L x 3.00'H Prismatoid** 153 cf Overall - 50 cf Embedded = 103 cf x 40.0% Voids
		91 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 11.68 hrs HW=28.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.05 cfs @ 12.17 hrs HW=30.11' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.12 fps)

Summary for Pond PSIS-5: PSIS-5

Inflow Area = 20,630 sf, 98.01% Impervious, Inflow Depth > 2.85" for 2-Yr 24 Hr event
Inflow = 1.45 cfs @ 12.08 hrs, Volume= 4,907 cf
Outflow = 1.24 cfs @ 12.13 hrs, Volume= 4,906 cf, Atten= 15%, Lag= 2.9 min
Discarded = 0.12 cfs @ 11.23 hrs, Volume= 3,667 cf
Primary = 1.12 cfs @ 12.13 hrs, Volume= 1,239 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.05' @ 12.13 hrs Surf.Area= 615 sf Storage= 818 cf

Plug-Flow detention time= 24.2 min calculated for 4,904 cf (100% of inflow)
Center-of-Mass det. time= 24.1 min (789.6 - 765.5)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	628 cf	**24.0" Round Pipe Storage** x 5 Inside #2 L= 40.0'
#2	28.00'	487 cf	**15.00'W x 41.00'L x 3.00'H Prismatoid** 1,845 cf Overall - 628 cf Embedded = 1,217 cf x 40.0% Voids
		1,115 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	29.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 11.23 hrs HW=28.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=1.12 cfs @ 12.13 hrs HW=30.05' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 1.12 cfs @ 2.53 fps)

Summary for Pond PSIS-6: PSIS-6

Inflow Area = 112,595 sf, 78.09% Impervious, Inflow Depth > 1.76" for 2-Yr 24 Hr event
Inflow = 5.33 cfs @ 12.09 hrs, Volume= 16,472 cf
Outflow = 1.43 cfs @ 11.87 hrs, Volume= 16,466 cf, Atten= 73%, Lag= 0.0 min
Discarded = 1.43 cfs @ 11.87 hrs, Volume= 16,466 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 31.43' @ 12.47 hrs Surf.Area= 7,490 sf Storage= 3,322 cf

Plug-Flow detention time= 12.7 min calculated for 16,466 cf (100% of inflow)
Center-of-Mass det. time= 12.5 min (837.9 - 825.4)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	15,984 cf	**48.0" Round Pipe Storage** x 6 Inside #2 L= 212.0'
#2	30.50'	8,586 cf	**35.00'W x 214.00'L x 5.00'H Prismatoid** 37,450 cf Overall - 15,984 cf Embedded = 21,466 cf x 40.0% Voids
		24,571 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Device 3	34.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	34.50'	**15.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.50' / 34.30' S= 0.0250 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=1.43 cfs @ 11.87 hrs HW=30.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.43 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=30.50' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: southeast locus Runoff Area=6,192 sf 16.97% Impervious Runoff Depth>0.60"
Tc=6.0 min CN=49 Runoff=0.05 cfs 309 cf

Subcatchment PR-1.1: PR-1.1 Runoff Area=7,400 sf 86.15% Impervious Runoff Depth>3.78"
Tc=6.0 min CN=90 Runoff=0.73 cfs 2,329 cf

Subcatchment PR-1.2: PR-1.2 Runoff Area=6,576 sf 80.26% Impervious Runoff Depth>3.37"
Tc=6.0 min CN=86 Runoff=0.59 cfs 1,847 cf

Subcatchment PR-1.3: PR-1.3 Runoff Area=6,735 sf 81.14% Impervious Runoff Depth>3.47"
Tc=6.0 min CN=87 Runoff=0.62 cfs 1,947 cf

Subcatchment PR-1.4: PR-1.4 Runoff Area=2,201 sf 70.97% Impervious Runoff Depth>2.89"
Tc=6.0 min CN=81 Runoff=0.17 cfs 531 cf

Subcatchment PR-1.5: PR-1.5 Runoff Area=20,630 sf 98.01% Impervious Runoff Depth>4.54"
Tc=6.0 min CN=97 Runoff=2.25 cfs 7,812 cf

Subcatchment PR-1.6: PR-1.6 Runoff Area=112,595 sf 78.09% Impervious Runoff Depth>3.27"
Tc=6.0 min CN=85 Runoff=9.84 cfs 30,704 cf

Subcatchment PR-1.7: northern locus Runoff Area=84,021 sf 72.81% Impervious Runoff Depth>2.89"
Tc=6.0 min CN=81 Runoff=6.55 cfs 20,262 cf

Subcatchment PR-2: southwest locus Runoff Area=5,495 sf 0.00% Impervious Runoff Depth>0.18"
Tc=6.0 min CN=39 Runoff=0.00 cfs 82 cf

Reach DP-1: Ex. Culvert Inflow=10.57 cfs 26,561 cf
Outflow=10.57 cfs 26,561 cf

Reach DP-2: Watertown Ford Inflow=0.00 cfs 82 cf
Outflow=0.00 cfs 82 cf

Reach EX-P: Walker Pond Inflow=10.52 cfs 26,252 cf
Outflow=10.52 cfs 26,252 cf

Pond PSIS-1: PSIS-1 Peak Elev=28.92' Storage=226 cf Inflow=0.73 cfs 2,329 cf
Discarded=0.02 cfs 1,135 cf Primary=0.70 cfs 1,193 cf Outflow=0.72 cfs 2,328 cf

Pond PSIS-2: PSIS-2 Peak Elev=30.37' Storage=151 cf Inflow=0.59 cfs 1,847 cf
Discarded=0.03 cfs 1,031 cf Primary=0.56 cfs 816 cf Outflow=0.59 cfs 1,847 cf

Pond PSIS-3: PSIS-3 Peak Elev=30.38' Storage=153 cf Inflow=0.62 cfs 1,947 cf
Discarded=0.03 cfs 1,048 cf Primary=0.59 cfs 899 cf Outflow=0.61 cfs 1,947 cf

Pond PSIS-4: PSIS-4 Peak Elev=30.19' Storage=53 cf Inflow=0.17 cfs 531 cf
Discarded=0.01 cfs 329 cf Primary=0.16 cfs 201 cf Outflow=0.17 cfs 531 cf

Pond PSIS-5: PSIS-5 Peak Elev=30.29' Storage=919 cf Inflow=2.25 cfs 7,812 cf
Discarded=0.12 cfs 4,929 cf Primary=2.02 cfs 2,881 cf Outflow=2.13 cfs 7,810 cf

Pond PSIS-6: PSIS-6 Peak Elev=32.52' Storage=9,418 cf Inflow=9.84 cfs 30,704 cf
Discarded=1.43 cfs 30,693 cf Primary=0.00 cfs 0 cf Outflow=1.43 cfs 30,693 cf

Total Runoff Area = 251,845 sf Runoff Volume = 65,823 cf Average Runoff Depth = 3.14"
24.93% Pervious = 62,789 sf 75.07% Impervious = 189,056 sf

Summary for Subcatchment PR-1: southeast locus

Runoff = 0.05 cfs @ 12.13 hrs, Volume= 309 cf, Depth> 0.60"
Routed to Reach DP-1 : Ex. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	3,625	39	>75% Grass cover, Good, HSG A
	1,051	98	Paved parking, HSG A
*	1,516	39	Porous Pavement/Pavers
	6,192	49	Weighted Average
	5,141		83.03% Pervious Area
	1,051		16.97% Impervious Area

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

Summary for Subcatchment PR-1.1: PR-1.1

Runoff = 0.73 cfs @ 12.09 hrs, Volume= 2,329 cf, Depth> 3.78"
Routed to Pond PSIS-1 : PSIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	6,375	98	Paved parking, HSG A
	425	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	7,400	90	Weighted Average
	1,025		13.85% Pervious Area
	6,375		86.15% Impervious Area

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

Summary for Subcatchment PR-1.2: PR-1.2

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 1,847 cf, Depth> 3.37"
Routed to Pond PSIS-2 : PSIS-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	5,278	98	Paved parking, HSG A
*	1,298	39	Crushed Stone
	6,576	86	Weighted Average
	1,298		19.74% Pervious Area
	5,278		80.26% Impervious Area

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

Summary for Subcatchment PR-1.3: PR-1.3

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 1,947 cf, Depth> 3.47"
Routed to Pond PSIS-3 : PSIS-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	5,465	98	Paved parking, HSG A
*	1,270	39	Crushed Stone
	6,735	87	Weighted Average
	1,270		18.86% Pervious Area
	5,465		81.14% Impervious Area

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

Summary for Subcatchment PR-1.4: PR-1.4

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 531 cf, Depth> 2.89"
Routed to Pond PSIS-4 : PSIS-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	1,562	98	Paved parking, HSG A
*	639	39	Crushed Stone
	2,201	81	Weighted Average
	639		29.03% Pervious Area
	1,562		70.97% Impervious Area

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

Summary for Subcatchment PR-1.5: PR-1.5

Runoff = 2.25 cfs @ 12.08 hrs, Volume= 7,812 cf, Depth> 4.54"
Routed to Pond PSIS-5 : PSIS-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

Area (sf)	CN	Description
20,220	98	Paved parking, HSG A
410	39	>75% Grass cover, Good, HSG A
20,630	97	Weighted Average
410		1.99% Pervious Area
20,220		98.01% Impervious Area

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

Summary for Subcatchment PR-1.6: PR-1.6

Runoff = 9.84 cfs @ 12.09 hrs, Volume= 30,704 cf, Depth> 3.27"
Routed to Pond PSIS-6 : PSIS-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
	51,420	98	Paved parking, HSG A
	22,552	39	>75% Grass cover, Good, HSG A
*	2,112	39	Porous Pavement/Pavers
*	36,511	98	Existing Roof Area
	112,595	85	Weighted Average
	24,664		21.91% Pervious Area
	87,931		78.09% Impervious Area

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

Summary for Subcatchment PR-1.7: northern locus

Runoff = 6.55 cfs @ 12.09 hrs, Volume= 20,262 cf, Depth> 2.89"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

	Area (sf)	CN	Description
*	58,425	98	Existing Roof Area
	11,100	30	Woods, Good, HSG A
	11,147	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	2,749	98	Paved parking, HSG A
	84,021	81	Weighted Average
	22,847		27.19% Pervious Area
	61,174		72.81% Impervious Area

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

Summary for Subcatchment PR-2: southwest locus

Runoff = 0.00 cfs @ 12.50 hrs, Volume= 82 cf, Depth> 0.18"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr 24 Hr Rainfall=4.90"

Area (sf)	CN	Description
5,495	39	>75% Grass cover, Good, HSG A
5,495		100.00% Pervious Area

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

Summary for Reach DP-1: Ex. Culvert

Inflow Area = 246,350 sf, 76.74% Impervious, Inflow Depth > 1.29" for 10-Yr 24 Hr event
Inflow = 10.57 cfs @ 12.09 hrs, Volume= 26,561 cf
Outflow = 10.57 cfs @ 12.09 hrs, Volume= 26,561 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 5,495 sf, 0.00% Impervious, Inflow Depth > 0.18" for 10-Yr 24 Hr event
Inflow = 0.00 cfs @ 12.50 hrs, Volume= 82 cf
Outflow = 0.00 cfs @ 12.50 hrs, Volume= 82 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 240,158 sf, 78.28% Impervious, Inflow Depth > 1.31" for 10-Yr 24 Hr event
Inflow = 10.52 cfs @ 12.09 hrs, Volume= 26,252 cf
Outflow = 10.52 cfs @ 12.09 hrs, Volume= 26,252 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Ex. Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond PSIS-1: PSIS-1

Inflow Area = 7,400 sf, 86.15% Impervious, Inflow Depth > 3.78" for 10-Yr 24 Hr event
Inflow = 0.73 cfs @ 12.09 hrs, Volume= 2,329 cf
Outflow = 0.72 cfs @ 12.09 hrs, Volume= 2,328 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.02 cfs @ 9.64 hrs, Volume= 1,135 cf
Primary = 0.70 cfs @ 12.09 hrs, Volume= 1,193 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 28.92' @ 12.09 hrs Surf.Area= 110 sf Storage= 226 cf

Plug-Flow detention time= 43.3 min calculated for 2,327 cf (100% of inflow)
Center-of-Mass det. time= 43.1 min (833.9 - 790.8)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	187 cf	**36.0" Round Pipe Storage** Inside #2 L= 26.5'
#2	26.00'	101 cf	**4.00'W x 27.50'L x 4.00'H Prismatoid** 440 cf Overall - 187 cf Embedded = 253 cf x 40.0% Voids
		288 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	28.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 9.64 hrs HW=26.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.70 cfs @ 12.09 hrs HW=28.92' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.70 cfs @ 2.22 fps)

Summary for Pond PSIS-2: PSIS-2

Inflow Area = 6,576 sf, 80.26% Impervious, Inflow Depth > 3.37" for 10-Yr 24 Hr event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 1,847 cf
Outflow = 0.59 cfs @ 12.10 hrs, Volume= 1,847 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.03 cfs @ 10.80 hrs, Volume= 1,031 cf
Primary = 0.56 cfs @ 12.10 hrs, Volume= 816 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.37' @ 12.10 hrs Surf.Area= 140 sf Storage= 151 cf

Plug-Flow detention time= 21.3 min calculated for 1,846 cf (100% of inflow)
Center-of-Mass det. time= 21.2 min (825.7 - 804.6)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104 cf	**24.0" Round Pipe Storage** Inside #2 L= 33.0'
#2	28.50'	127 cf	**4.00'W x 35.00'L x 3.00'H Prismatoid** 420 cf Overall - 104 cf Embedded = 316 cf x 40.0% Voids
		230 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 10.80 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.56 cfs @ 12.10 hrs HW=30.37' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 2.08 fps)

Summary for Pond PSIS-3: PSIS-3

Inflow Area = 6,735 sf, 81.14% Impervious, Inflow Depth > 3.47" for 10-Yr 24 Hr event
Inflow = 0.62 cfs @ 12.09 hrs, Volume= 1,947 cf
Outflow = 0.61 cfs @ 12.10 hrs, Volume= 1,947 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.03 cfs @ 10.59 hrs, Volume= 1,048 cf
Primary = 0.59 cfs @ 12.10 hrs, Volume= 899 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.38' @ 12.10 hrs Surf.Area= 135 sf Storage= 153 cf

Plug-Flow detention time= 21.8 min calculated for 1,946 cf (100% of inflow)
Center-of-Mass det. time= 21.7 min (823.0 - 801.3)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	116 cf	**24.0" Round Pipe Storage** Inside #2 L= 37.0'
#2	28.50'	142 cf	**3.50'W x 38.50'L x 3.50'H Prismatoid** 472 cf Overall - 116 cf Embedded = 355 cf x 40.0% Voids
		258 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 10.59 hrs HW=28.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.59 cfs @ 12.10 hrs HW=30.38' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.59 cfs @ 2.11 fps)

Summary for Pond PSIS-4: PSIS-4

Inflow Area = 2,201 sf, 70.97% Impervious, Inflow Depth > 2.89" for 10-Yr 24 Hr event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 531 cf
Outflow = 0.17 cfs @ 12.09 hrs, Volume= 531 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.01 cfs @ 11.27 hrs, Volume= 329 cf
Primary = 0.16 cfs @ 12.09 hrs, Volume= 201 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.19' @ 12.09 hrs Surf.Area= 51 sf Storage= 53 cf

Plug-Flow detention time= 25.5 min calculated for 531 cf (100% of inflow)
Center-of-Mass det. time= 25.3 min (844.5 - 819.2)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	50 cf	**24.0" Round Pipe Storage** Inside #2 L= 16.0'
#2	28.50'	41 cf	**3.00'W x 17.00'L x 3.00'H Prismatoid** 153 cf Overall - 50 cf Embedded = 103 cf x 40.0% Voids
		91 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 11.27 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.16 cfs @ 12.09 hrs HW=30.19' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.16 cfs @ 1.50 fps)

Summary for Pond PSIS-5: PSIS-5

Inflow Area = 20,630 sf, 98.01% Impervious, Inflow Depth > 4.54" for 10-Yr 24 Hr event
Inflow = 2.25 cfs @ 12.08 hrs, Volume= 7,812 cf
Outflow = 2.13 cfs @ 12.11 hrs, Volume= 7,810 cf, Atten= 5%, Lag= 1.6 min
Discarded = 0.12 cfs @ 10.31 hrs, Volume= 4,929 cf
Primary = 2.02 cfs @ 12.11 hrs, Volume= 2,881 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.29' @ 12.11 hrs Surf.Area= 615 sf Storage= 919 cf

Plug-Flow detention time= 23.1 min calculated for 7,807 cf (100% of inflow)
Center-of-Mass det. time= 23.0 min (778.6 - 755.6)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	628 cf	**24.0" Round Pipe Storage** x 5 Inside #2 L= 40.0'
#2	28.00'	487 cf	**15.00'W x 41.00'L x 3.00'H Prismatoid** 1,845 cf Overall - 628 cf Embedded = 1,217 cf x 40.0% Voids
		1,115 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	29.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 10.31 hrs HW=28.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=2.02 cfs @ 12.11 hrs HW=30.29' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.02 cfs @ 3.03 fps)

Summary for Pond PSIS-6: PSIS-6

Inflow Area = 112,595 sf, 78.09% Impervious, Inflow Depth > 3.27" for 10-Yr 24 Hr event
Inflow = 9.84 cfs @ 12.09 hrs, Volume= 30,704 cf
Outflow = 1.43 cfs @ 11.69 hrs, Volume= 30,693 cf, Atten= 85%, Lag= 0.0 min
Discarded = 1.43 cfs @ 11.69 hrs, Volume= 30,693 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 32.52' @ 12.60 hrs Surf.Area= 7,490 sf Storage= 9,418 cf

Plug-Flow detention time= 43.8 min calculated for 30,693 cf (100% of inflow)
Center-of-Mass det. time= 43.6 min (851.2 - 807.7)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	15,984 cf	**48.0" Round Pipe Storage** x 6 Inside #2 L= 212.0'
#2	30.50'	8,586 cf	**35.00'W x 214.00'L x 5.00'H Prismatoid** 37,450 cf Overall - 15,984 cf Embedded = 21,466 cf x 40.0% Voids
		24,571 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Device 3	34.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	34.50'	**15.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.50' / 34.30' S= 0.0250 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=1.43 cfs @ 11.69 hrs HW=30.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.43 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=30.50' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: southeast locus Runoff Area=6,192 sf 16.97% Impervious Runoff Depth>1.17"
Tc=6.0 min CN=49 Runoff=0.15 cfs 601 cf

Subcatchment PR-1.1: PR-1.1 Runoff Area=7,400 sf 86.15% Impervious Runoff Depth>5.04"
Tc=6.0 min CN=90 Runoff=0.95 cfs 3,106 cf

Subcatchment PR-1.2: PR-1.2 Runoff Area=6,576 sf 80.26% Impervious Runoff Depth>4.60"
Tc=6.0 min CN=86 Runoff=0.79 cfs 2,518 cf

Subcatchment PR-1.3: PR-1.3 Runoff Area=6,735 sf 81.14% Impervious Runoff Depth>4.70"
Tc=6.0 min CN=87 Runoff=0.83 cfs 2,640 cf

Subcatchment PR-1.4: PR-1.4 Runoff Area=2,201 sf 70.97% Impervious Runoff Depth>4.06"
Tc=6.0 min CN=81 Runoff=0.24 cfs 745 cf

Subcatchment PR-1.5: PR-1.5 Runoff Area=20,630 sf 98.01% Impervious Runoff Depth>5.84"
Tc=6.0 min CN=97 Runoff=2.86 cfs 10,038 cf

Subcatchment PR-1.6: PR-1.6 Runoff Area=112,595 sf 78.09% Impervious Runoff Depth>4.49"
Tc=6.0 min CN=85 Runoff=13.33 cfs 42,102 cf

Subcatchment PR-1.7: northern locus Runoff Area=84,021 sf 72.81% Impervious Runoff Depth>4.06"
Tc=6.0 min CN=81 Runoff=9.13 cfs 28,442 cf

Subcatchment PR-2: southwest locus Runoff Area=5,495 sf 0.00% Impervious Runoff Depth>0.50"
Tc=6.0 min CN=39 Runoff=0.03 cfs 230 cf

Reach DP-1: Ex. Culvert Inflow=14.52 cfs 38,275 cf
Outflow=14.52 cfs 38,275 cf

Reach DP-2: Watertown Ford Inflow=0.03 cfs 230 cf
Outflow=0.03 cfs 230 cf

Reach EX-P: Walker Pond Inflow=14.37 cfs 37,673 cf
Outflow=14.37 cfs 37,673 cf

Pond PSIS-1: PSIS-1 Peak Elev=29.00' Storage=232 cf Inflow=0.95 cfs 3,106 cf
Discarded=0.02 cfs 1,286 cf Primary=0.93 cfs 1,819 cf Outflow=0.95 cfs 3,105 cf

Pond PSIS-2: PSIS-2 Peak Elev=30.44' Storage=157 cf Inflow=0.79 cfs 2,518 cf
Discarded=0.03 cfs 1,214 cf Primary=0.76 cfs 1,304 cf Outflow=0.79 cfs 2,518 cf

Pond PSIS-3: PSIS-3 Peak Elev=30.45' Storage=160 cf Inflow=0.83 cfs 2,640 cf
Discarded=0.03 cfs 1,226 cf Primary=0.80 cfs 1,413 cf Outflow=0.82 cfs 2,640 cf

Pond PSIS-4: PSIS-4 Peak Elev=30.23' Storage=55 cf Inflow=0.24 cfs 745 cf
Discarded=0.01 cfs 395 cf Primary=0.23 cfs 350 cf Outflow=0.24 cfs 745 cf

Pond PSIS-5: PSIS-5 Peak Elev=30.47' Storage=982 cf Inflow=2.86 cfs 10,038 cf
Discarded=0.12 cfs 5,692 cf Primary=2.60 cfs 4,345 cf Outflow=2.71 cfs 10,037 cf

Pond PSIS-6: PSIS-6 Peak Elev=33.40' Storage=14,708 cf Inflow=13.33 cfs 42,102 cf
Discarded=1.43 cfs 42,087 cf Primary=0.00 cfs 0 cf Outflow=1.43 cfs 42,087 cf

Total Runoff Area = 251,845 sf Runoff Volume = 90,423 cf Average Runoff Depth = 4.31"
24.93% Pervious = 62,789 sf 75.07% Impervious = 189,056 sf

Summary for Subcatchment PR-1: southeast locus

Runoff = 0.15 cfs @ 12.11 hrs, Volume= 601 cf, Depth> 1.17"
Routed to Reach DP-1 : Ex. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	3,625	39	>75% Grass cover, Good, HSG A
	1,051	98	Paved parking, HSG A
*	1,516	39	Porous Pavement/Pavers
	6,192	49	Weighted Average
	5,141		83.03% Pervious Area
	1,051		16.97% Impervious Area

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

Summary for Subcatchment PR-1.1: PR-1.1

Runoff = 0.95 cfs @ 12.08 hrs, Volume= 3,106 cf, Depth> 5.04"
Routed to Pond PSIS-1 : PSIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	6,375	98	Paved parking, HSG A
	425	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	7,400	90	Weighted Average
	1,025		13.85% Pervious Area
	6,375		86.15% Impervious Area

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

Summary for Subcatchment PR-1.2: PR-1.2

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 2,518 cf, Depth> 4.60"
Routed to Pond PSIS-2 : PSIS-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	5,278	98	Paved parking, HSG A
*	1,298	39	Crushed Stone
	6,576	86	Weighted Average
	1,298		19.74% Pervious Area
	5,278		80.26% Impervious Area

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

Summary for Subcatchment PR-1.3: PR-1.3

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 2,640 cf, Depth> 4.70"
Routed to Pond PSIS-3 : PSIS-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	5,465	98	Paved parking, HSG A
*	1,270	39	Crushed Stone
	6,735	87	Weighted Average
	1,270		18.86% Pervious Area
	5,465		81.14% Impervious Area

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

Summary for Subcatchment PR-1.4: PR-1.4

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 745 cf, Depth> 4.06"
Routed to Pond PSIS-4 : PSIS-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	1,562	98	Paved parking, HSG A
*	639	39	Crushed Stone
	2,201	81	Weighted Average
	639		29.03% Pervious Area
	1,562		70.97% Impervious Area

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

Summary for Subcatchment PR-1.5: PR-1.5

Runoff = 2.86 cfs @ 12.08 hrs, Volume= 10,038 cf, Depth> 5.84"
Routed to Pond PSIS-5 : PSIS-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

Area (sf)	CN	Description
20,220	98	Paved parking, HSG A
410	39	>75% Grass cover, Good, HSG A
20,630	97	Weighted Average
410		1.99% Pervious Area
20,220		98.01% Impervious Area

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

Summary for Subcatchment PR-1.6: PR-1.6

Runoff = 13.33 cfs @ 12.09 hrs, Volume= 42,102 cf, Depth> 4.49"
Routed to Pond PSIS-6 : PSIS-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
	51,420	98	Paved parking, HSG A
	22,552	39	>75% Grass cover, Good, HSG A
*	2,112	39	Porous Pavement/Pavers
*	36,511	98	Existing Roof Area
	112,595	85	Weighted Average
	24,664		21.91% Pervious Area
	87,931		78.09% Impervious Area

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

Summary for Subcatchment PR-1.7: northern locus

Runoff = 9.13 cfs @ 12.09 hrs, Volume= 28,442 cf, Depth> 4.06"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

	Area (sf)	CN	Description
*	58,425	98	Existing Roof Area
	11,100	30	Woods, Good, HSG A
	11,147	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	2,749	98	Paved parking, HSG A
	84,021	81	Weighted Average
	22,847		27.19% Pervious Area
	61,174		72.81% Impervious Area

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

Summary for Subcatchment PR-2: southwest locus

Runoff = 0.03 cfs @ 12.33 hrs, Volume= 230 cf, Depth> 0.50"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr 24 Hr Rainfall=6.20"

Area (sf)	CN	Description
5,495	39	>75% Grass cover, Good, HSG A
5,495		100.00% Pervious Area

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

Summary for Reach DP-1: Ex. Culvert

Inflow Area = 246,350 sf, 76.74% Impervious, Inflow Depth > 1.86" for 25-Yr 24 Hr event
Inflow = 14.52 cfs @ 12.09 hrs, Volume= 38,275 cf
Outflow = 14.52 cfs @ 12.09 hrs, Volume= 38,275 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 5,495 sf, 0.00% Impervious, Inflow Depth > 0.50" for 25-Yr 24 Hr event
Inflow = 0.03 cfs @ 12.33 hrs, Volume= 230 cf
Outflow = 0.03 cfs @ 12.33 hrs, Volume= 230 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 240,158 sf, 78.28% Impervious, Inflow Depth > 1.88" for 25-Yr 24 Hr event
Inflow = 14.37 cfs @ 12.09 hrs, Volume= 37,673 cf
Outflow = 14.37 cfs @ 12.09 hrs, Volume= 37,673 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Ex. Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond PSIS-1: PSIS-1

Inflow Area = 7,400 sf, 86.15% Impervious, Inflow Depth > 5.04" for 25-Yr 24 Hr event
Inflow = 0.95 cfs @ 12.08 hrs, Volume= 3,106 cf
Outflow = 0.95 cfs @ 12.09 hrs, Volume= 3,105 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.02 cfs @ 8.81 hrs, Volume= 1,286 cf
Primary = 0.93 cfs @ 12.09 hrs, Volume= 1,819 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 29.00' @ 12.09 hrs Surf.Area= 110 sf Storage= 232 cf

Plug-Flow detention time= 40.5 min calculated for 3,103 cf (100% of inflow)
Center-of-Mass det. time= 40.3 min (823.3 - 783.1)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	187 cf	**36.0" Round Pipe Storage** Inside #2 L= 26.5'
#2	26.00'	101 cf	**4.00'W x 27.50'L x 4.00'H Prismatoid** 440 cf Overall - 187 cf Embedded = 253 cf x 40.0% Voids
		288 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	28.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 8.81 hrs HW=26.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.93 cfs @ 12.09 hrs HW=29.00' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.93 cfs @ 2.40 fps)

Summary for Pond PSIS-2: PSIS-2

Inflow Area = 6,576 sf, 80.26% Impervious, Inflow Depth > 4.60" for 25-Yr 24 Hr event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 2,518 cf
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 2,518 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.03 cfs @ 10.14 hrs, Volume= 1,214 cf
Primary = 0.76 cfs @ 12.09 hrs, Volume= 1,304 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.44' @ 12.09 hrs Surf.Area= 140 sf Storage= 157 cf

Plug-Flow detention time= 19.6 min calculated for 2,517 cf (100% of inflow)
Center-of-Mass det. time= 19.5 min (815.4 - 795.9)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104 cf	**24.0" Round Pipe Storage** Inside #2 L= 33.0'
#2	28.50'	127 cf	**4.00'W x 35.00'L x 3.00'H Prismatoid** 420 cf Overall - 104 cf Embedded = 316 cf x 40.0% Voids
		230 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 10.14 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.76 cfs @ 12.09 hrs HW=30.44' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.76 cfs @ 2.27 fps)

Summary for Pond PSIS-3: PSIS-3

Inflow Area = 6,735 sf, 81.14% Impervious, Inflow Depth > 4.70" for 25-Yr 24 Hr event
Inflow = 0.83 cfs @ 12.09 hrs, Volume= 2,640 cf
Outflow = 0.82 cfs @ 12.09 hrs, Volume= 2,640 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.03 cfs @ 9.88 hrs, Volume= 1,226 cf
Primary = 0.80 cfs @ 12.09 hrs, Volume= 1,413 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.45' @ 12.09 hrs Surf.Area= 135 sf Storage= 160 cf

Plug-Flow detention time= 20.2 min calculated for 2,639 cf (100% of inflow)
Center-of-Mass det. time= 20.1 min (812.9 - 792.9)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	116 cf	**24.0" Round Pipe Storage** Inside #2 L= 37.0'
#2	28.50'	142 cf	**3.50'W x 38.50'L x 3.50'H Prismatoid** 472 cf Overall - 116 cf Embedded = 355 cf x 40.0% Voids
		258 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 9.88 hrs HW=28.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.80 cfs @ 12.09 hrs HW=30.45' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.80 cfs @ 2.29 fps)

Summary for Pond PSIS-4: PSIS-4

Inflow Area = 2,201 sf, 70.97% Impervious, Inflow Depth > 4.06" for 25-Yr 24 Hr event
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 745 cf
Outflow = 0.24 cfs @ 12.09 hrs, Volume= 745 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.01 cfs @ 10.73 hrs, Volume= 395 cf
Primary = 0.23 cfs @ 12.09 hrs, Volume= 350 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.23' @ 12.09 hrs Surf.Area= 51 sf Storage= 55 cf

Plug-Flow detention time= 22.7 min calculated for 745 cf (100% of inflow)
Center-of-Mass det. time= 22.6 min (832.2 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	50 cf	**24.0" Round Pipe Storage** Inside #2 L= 16.0'
#2	28.50'	41 cf	**3.00'W x 17.00'L x 3.00'H Prismatoid** 153 cf Overall - 50 cf Embedded = 103 cf x 40.0% Voids
		91 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 10.73 hrs HW=28.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.23 cfs @ 12.09 hrs HW=30.23' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.23 cfs @ 1.64 fps)

Summary for Pond PSIS-5: PSIS-5

Inflow Area = 20,630 sf, 98.01% Impervious, Inflow Depth > 5.84" for 25-Yr 24 Hr event
Inflow = 2.86 cfs @ 12.08 hrs, Volume= 10,038 cf
Outflow = 2.71 cfs @ 12.11 hrs, Volume= 10,037 cf, Atten= 5%, Lag= 1.6 min
Discarded = 0.12 cfs @ 9.54 hrs, Volume= 5,692 cf
Primary = 2.60 cfs @ 12.11 hrs, Volume= 4,345 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.47' @ 12.11 hrs Surf.Area= 615 sf Storage= 982 cf

Plug-Flow detention time= 22.7 min calculated for 10,037 cf (100% of inflow)
Center-of-Mass det. time= 22.6 min (773.6 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	628 cf	**24.0" Round Pipe Storage** x 5 Inside #2 L= 40.0'
#2	28.00'	487 cf	**15.00'W x 41.00'L x 3.00'H Prismatoid** 1,845 cf Overall - 628 cf Embedded = 1,217 cf x 40.0% Voids
		1,115 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	29.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 9.54 hrs HW=28.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=2.60 cfs @ 12.11 hrs HW=30.46' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.60 cfs @ 3.34 fps)

Summary for Pond PSIS-6: PSIS-6

Inflow Area = 112,595 sf, 78.09% Impervious, Inflow Depth > 4.49" for 25-Yr 24 Hr event
Inflow = 13.33 cfs @ 12.09 hrs, Volume= 42,102 cf
Outflow = 1.43 cfs @ 11.61 hrs, Volume= 42,087 cf, Atten= 89%, Lag= 0.0 min
Discarded = 1.43 cfs @ 11.61 hrs, Volume= 42,087 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 33.40' @ 12.83 hrs Surf.Area= 7,490 sf Storage= 14,708 cf

Plug-Flow detention time= 75.7 min calculated for 42,087 cf (100% of inflow)
Center-of-Mass det. time= 75.5 min (874.3 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	15,984 cf	**48.0" Round Pipe Storage** x 6 Inside #2 L= 212.0'
#2	30.50'	8,586 cf	**35.00'W x 214.00'L x 5.00'H Prismatoid** 37,450 cf Overall - 15,984 cf Embedded = 21,466 cf x 40.0% Voids
		24,571 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Device 3	34.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	34.50'	**15.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.50' / 34.30' S= 0.0250 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=1.43 cfs @ 11.61 hrs HW=30.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.43 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=30.50' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1: southeast locus Runoff Area=6,192 sf 16.97% Impervious Runoff Depth>2.69"
Tc=6.0 min CN=49 Runoff=0.42 cfs 1,390 cf

Subcatchment PR-1.1: PR-1.1 Runoff Area=7,400 sf 86.15% Impervious Runoff Depth>7.69"
Tc=6.0 min CN=90 Runoff=1.42 cfs 4,740 cf

Subcatchment PR-1.2: PR-1.2 Runoff Area=6,576 sf 80.26% Impervious Runoff Depth>7.20"
Tc=6.0 min CN=86 Runoff=1.21 cfs 3,945 cf

Subcatchment PR-1.3: PR-1.3 Runoff Area=6,735 sf 81.14% Impervious Runoff Depth>7.32"
Tc=6.0 min CN=87 Runoff=1.26 cfs 4,109 cf

Subcatchment PR-1.4: PR-1.4 Runoff Area=2,201 sf 70.97% Impervious Runoff Depth>6.59"
Tc=6.0 min CN=81 Runoff=0.38 cfs 1,209 cf

Subcatchment PR-1.5: PR-1.5 Runoff Area=20,630 sf 98.01% Impervious Runoff Depth>8.53"
Tc=6.0 min CN=97 Runoff=4.13 cfs 14,669 cf

Subcatchment PR-1.6: PR-1.6 Runoff Area=112,595 sf 78.09% Impervious Runoff Depth>7.08"
Tc=6.0 min CN=85 Runoff=20.56 cfs 66,411 cf

Subcatchment PR-1.7: northern locus Runoff Area=84,021 sf 72.81% Impervious Runoff Depth>6.59"
Tc=6.0 min CN=81 Runoff=14.54 cfs 46,137 cf

Subcatchment PR-2: southwest locus Runoff Area=5,495 sf 0.00% Impervious Runoff Depth>1.55"
Tc=6.0 min CN=39 Runoff=0.17 cfs 711 cf

Reach DP-1: Ex. Culvert Inflow=22.79 cfs 69,650 cf
Outflow=22.79 cfs 69,650 cf

Reach DP-2: Watertown Ford Inflow=0.17 cfs 711 cf
Outflow=0.17 cfs 711 cf

Reach EX-P: Walker Pond Inflow=22.37 cfs 68,260 cf
Outflow=22.37 cfs 68,260 cf

Pond PSIS-1: PSIS-1 Peak Elev=29.13' Storage=242 cf Inflow=1.42 cfs 4,740 cf
Discarded=0.02 cfs 1,402 cf Primary=1.40 cfs 3,217 cf Outflow=1.42 cfs 4,620 cf

Pond PSIS-2: PSIS-2 Peak Elev=30.57' Storage=168 cf Inflow=1.21 cfs 3,945 cf
Discarded=0.03 cfs 1,507 cf Primary=1.18 cfs 2,437 cf Outflow=1.21 cfs 3,945 cf

Pond PSIS-3: PSIS-3 Peak Elev=30.58' Storage=171 cf Inflow=1.26 cfs 4,109 cf
Discarded=0.03 cfs 1,510 cf Primary=1.23 cfs 2,598 cf Outflow=1.25 cfs 4,108 cf

Pond PSIS-4: PSIS-4 Peak Elev=30.30' Storage=57 cf Inflow=0.38 cfs 1,209 cf
Discarded=0.01 cfs 503 cf Primary=0.37 cfs 706 cf Outflow=0.38 cfs 1,208 cf

Pond PSIS-5: PSIS-5 Peak Elev=31.00' Storage=1,114 cf Inflow=4.13 cfs 14,669 cf
Discarded=0.12 cfs 6,913 cf Primary=3.78 cfs 7,754 cf Outflow=3.89 cfs 14,667 cf

Pond PSIS-6: PSIS-6 Peak Elev=35.40' Storage=24,280 cf Inflow=20.56 cfs 66,411 cf
Discarded=1.43 cfs 60,980 cf Primary=2.29 cfs 5,409 cf Outflow=3.73 cfs 66,390 cf

Total Runoff Area = 251,845 sf Runoff Volume = 143,322 cf Average Runoff Depth = 6.83"
24.93% Pervious = 62,789 sf 75.07% Impervious = 189,056 sf

Summary for Subcatchment PR-1: southeast locus

Runoff = 0.42 cfs @ 12.10 hrs, Volume= 1,390 cf, Depth> 2.69"
Routed to Reach DP-1 : Ex. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	3,625	39	>75% Grass cover, Good, HSG A
	1,051	98	Paved parking, HSG A
*	1,516	39	Porous Pavement/Pavers
	6,192	49	Weighted Average
	5,141		83.03% Pervious Area
	1,051		16.97% Impervious Area

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

Summary for Subcatchment PR-1.1: PR-1.1

Runoff = 1.42 cfs @ 12.08 hrs, Volume= 4,740 cf, Depth> 7.69"
Routed to Pond PSIS-1 : PSIS-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	6,375	98	Paved parking, HSG A
	425	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	7,400	90	Weighted Average
	1,025		13.85% Pervious Area
	6,375		86.15% Impervious Area

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

Summary for Subcatchment PR-1.2: PR-1.2

Runoff = 1.21 cfs @ 12.08 hrs, Volume= 3,945 cf, Depth> 7.20"
Routed to Pond PSIS-2 : PSIS-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	5,278	98	Paved parking, HSG A
*	1,298	39	Crushed Stone
	6,576	86	Weighted Average
	1,298		19.74% Pervious Area
	5,278		80.26% Impervious Area

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

Summary for Subcatchment PR-1.3: PR-1.3

Runoff = 1.26 cfs @ 12.08 hrs, Volume= 4,109 cf, Depth> 7.32"
Routed to Pond PSIS-3 : PSIS-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	5,465	98	Paved parking, HSG A
*	1,270	39	Crushed Stone
	6,735	87	Weighted Average
	1,270		18.86% Pervious Area
	5,465		81.14% Impervious Area

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

Summary for Subcatchment PR-1.4: PR-1.4

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,209 cf, Depth> 6.59"
Routed to Pond PSIS-4 : PSIS-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	1,562	98	Paved parking, HSG A
*	639	39	Crushed Stone
	2,201	81	Weighted Average
	639		29.03% Pervious Area
	1,562		70.97% Impervious Area

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

Summary for Subcatchment PR-1.5: PR-1.5

Runoff = 4.13 cfs @ 12.08 hrs, Volume= 14,669 cf, Depth> 8.53"
Routed to Pond PSIS-5 : PSIS-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

Area (sf)	CN	Description
20,220	98	Paved parking, HSG A
410	39	>75% Grass cover, Good, HSG A
20,630	97	Weighted Average
410		1.99% Pervious Area
20,220		98.01% Impervious Area

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

Summary for Subcatchment PR-1.6: PR-1.6

Runoff = 20.56 cfs @ 12.08 hrs, Volume= 66,411 cf, Depth> 7.08"
Routed to Pond PSIS-6 : PSIS-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
	51,420	98	Paved parking, HSG A
	22,552	39	>75% Grass cover, Good, HSG A
*	2,112	39	Porous Pavement/Pavers
*	36,511	98	Existing Roof Area
	112,595	85	Weighted Average
	24,664		21.91% Pervious Area
	87,931		78.09% Impervious Area

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

Summary for Subcatchment PR-1.7: northern locus

Runoff = 14.54 cfs @ 12.09 hrs, Volume= 46,137 cf, Depth> 6.59"
Routed to Reach EX-P : Walker Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

	Area (sf)	CN	Description
*	58,425	98	Existing Roof Area
	11,100	30	Woods, Good, HSG A
	11,147	39	>75% Grass cover, Good, HSG A
*	600	39	Porous Pavement/Pavers
	2,749	98	Paved parking, HSG A
	84,021	81	Weighted Average
	22,847		27.19% Pervious Area
	61,174		72.81% Impervious Area

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

Summary for Subcatchment PR-2: southwest locus

Runoff = 0.17 cfs @ 12.11 hrs, Volume= 711 cf, Depth> 1.55"
Routed to Reach DP-2 : Watertown Ford

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr 24 Hr Rainfall=8.90"

Area (sf)	CN	Description
5,495	39	>75% Grass cover, Good, HSG A
5,495		100.00% Pervious Area

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

Summary for Reach DP-1: Ex. Culvert

Inflow Area = 246,350 sf, 76.74% Impervious, Inflow Depth > 3.39" for 100-Yr 24 Hr event
Inflow = 22.79 cfs @ 12.09 hrs, Volume= 69,650 cf
Outflow = 22.79 cfs @ 12.09 hrs, Volume= 69,650 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Watertown Ford

Inflow Area = 5,495 sf, 0.00% Impervious, Inflow Depth > 1.55" for 100-Yr 24 Hr event
Inflow = 0.17 cfs @ 12.11 hrs, Volume= 711 cf
Outflow = 0.17 cfs @ 12.11 hrs, Volume= 711 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach EX-P: Walker Pond

Inflow Area = 240,158 sf, 78.28% Impervious, Inflow Depth > 3.41" for 100-Yr 24 Hr event
Inflow = 22.37 cfs @ 12.09 hrs, Volume= 68,260 cf
Outflow = 22.37 cfs @ 12.09 hrs, Volume= 68,260 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach DP-1 : Ex. Culvert

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond PSIS-1: PSIS-1

Inflow Area = 7,400 sf, 86.15% Impervious, Inflow Depth > 7.69" for 100-Yr 24 Hr event
Inflow = 1.42 cfs @ 12.08 hrs, Volume= 4,740 cf
Outflow = 1.42 cfs @ 12.09 hrs, Volume= 4,620 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.02 cfs @ 7.49 hrs, Volume= 1,402 cf
Primary = 1.40 cfs @ 12.09 hrs, Volume= 3,217 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 29.13' @ 12.09 hrs Surf.Area= 110 sf Storage= 242 cf

Plug-Flow detention time= 33.9 min calculated for 4,618 cf (97% of inflow)
Center-of-Mass det. time= 18.4 min (790.6 - 772.3)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	187 cf	**36.0" Round Pipe Storage** Inside #2 L= 26.5'
#2	26.00'	101 cf	**4.00'W x 27.50'L x 4.00'H Prismatoid** 440 cf Overall - 187 cf Embedded = 253 cf x 40.0% Voids
		288 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	28.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 7.49 hrs HW=26.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.40 cfs @ 12.09 hrs HW=29.13' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 1.40 cfs @ 2.70 fps)

Summary for Pond PSIS-2: PSIS-2

Inflow Area = 6,576 sf, 80.26% Impervious, Inflow Depth > 7.20" for 100-Yr 24 Hr event
Inflow = 1.21 cfs @ 12.08 hrs, Volume= 3,945 cf
Outflow = 1.21 cfs @ 12.09 hrs, Volume= 3,945 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.03 cfs @ 8.83 hrs, Volume= 1,507 cf
Primary = 1.18 cfs @ 12.09 hrs, Volume= 2,437 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.57' @ 12.09 hrs Surf.Area= 140 sf Storage= 168 cf

Plug-Flow detention time= 18.1 min calculated for 3,945 cf (100% of inflow)
Center-of-Mass det. time= 18.0 min (801.7 - 783.7)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104 cf	**24.0" Round Pipe Storage** Inside #2 L= 33.0'
#2	28.50'	127 cf	**4.00'W x 35.00'L x 3.00'H Prismatoid** 420 cf Overall - 104 cf Embedded = 316 cf x 40.0% Voids
		230 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 8.83 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.18 cfs @ 12.09 hrs HW=30.57' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 1.18 cfs @ 2.57 fps)

Summary for Pond PSIS-3: PSIS-3

Inflow Area = 6,735 sf, 81.14% Impervious, Inflow Depth > 7.32" for 100-Yr 24 Hr event
Inflow = 1.26 cfs @ 12.08 hrs, Volume= 4,109 cf
Outflow = 1.25 cfs @ 12.09 hrs, Volume= 4,108 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.03 cfs @ 8.60 hrs, Volume= 1,510 cf
Primary = 1.23 cfs @ 12.09 hrs, Volume= 2,598 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.58' @ 12.09 hrs Surf.Area= 135 sf Storage= 171 cf

Plug-Flow detention time= 18.8 min calculated for 4,108 cf (100% of inflow)
Center-of-Mass det. time= 18.6 min (799.7 - 781.0)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	116 cf	**24.0" Round Pipe Storage** Inside #2 L= 37.0'
#2	28.50'	142 cf	**3.50'W x 38.50'L x 3.50'H Prismatoid** 472 cf Overall - 116 cf Embedded = 355 cf x 40.0% Voids
		258 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 8.60 hrs HW=28.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.23 cfs @ 12.09 hrs HW=30.58' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 1.23 cfs @ 2.59 fps)

Summary for Pond PSIS-4: PSIS-4

Inflow Area = 2,201 sf, 70.97% Impervious, Inflow Depth > 6.59" for 100-Yr 24 Hr event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,209 cf
Outflow = 0.38 cfs @ 12.09 hrs, Volume= 1,208 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.01 cfs @ 9.56 hrs, Volume= 503 cf
Primary = 0.37 cfs @ 12.09 hrs, Volume= 706 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 30.30' @ 12.09 hrs Surf.Area= 51 sf Storage= 57 cf

Plug-Flow detention time= 20.1 min calculated for 1,208 cf (100% of inflow)
Center-of-Mass det. time= 20.0 min (816.0 - 796.0)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	50 cf	**24.0" Round Pipe Storage** Inside #2 L= 16.0'
#2	28.50'	41 cf	**3.00'W x 17.00'L x 3.00'H Prismatoid** 153 cf Overall - 50 cf Embedded = 103 cf x 40.0% Voids
		91 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	30.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 9.56 hrs HW=28.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.37 cfs @ 12.09 hrs HW=30.30' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.37 cfs @ 1.87 fps)

Summary for Pond PSIS-5: PSIS-5

Inflow Area = 20,630 sf, 98.01% Impervious, Inflow Depth > 8.53" for 100-Yr 24 Hr event
Inflow = 4.13 cfs @ 12.08 hrs, Volume= 14,669 cf
Outflow = 3.89 cfs @ 12.11 hrs, Volume= 14,667 cf, Atten= 6%, Lag= 1.7 min
Discarded = 0.12 cfs @ 8.40 hrs, Volume= 6,913 cf
Primary = 3.78 cfs @ 12.11 hrs, Volume= 7,754 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 31.00' @ 12.11 hrs Surf.Area= 615 sf Storage= 1,114 cf

Plug-Flow detention time= 22.2 min calculated for 14,667 cf (100% of inflow)
Center-of-Mass det. time= 22.0 min (767.0 - 744.9)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	628 cf	**24.0" Round Pipe Storage** x 5 Inside #2 L= 40.0'
#2	28.00'	487 cf	**15.00'W x 41.00'L x 3.00'H Prismatoid** 1,845 cf Overall - 628 cf Embedded = 1,217 cf x 40.0% Voids
		1,115 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	29.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 8.40 hrs HW=28.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=3.77 cfs @ 12.11 hrs HW=31.00' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 3.77 cfs @ 4.80 fps)

Summary for Pond PSIS-6: PSIS-6

Inflow Area = 112,595 sf, 78.09% Impervious, Inflow Depth > 7.08" for 100-Yr 24 Hr event
Inflow = 20.56 cfs @ 12.08 hrs, Volume= 66,411 cf
Outflow = 3.73 cfs @ 12.54 hrs, Volume= 66,390 cf, Atten= 82%, Lag= 27.0 min
Discarded = 1.43 cfs @ 11.20 hrs, Volume= 60,980 cf
Primary = 2.29 cfs @ 12.54 hrs, Volume= 5,409 cf
Routed to Reach EX-P : Walker Pond

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 35.40' @ 12.54 hrs Surf.Area= 7,490 sf Storage= 24,280 cf

Plug-Flow detention time= 115.2 min calculated for 66,390 cf (100% of inflow)
Center-of-Mass det. time= 115.0 min (901.3 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	15,984 cf	**48.0" Round Pipe Storage** x 6 Inside #2 L= 212.0'
#2	30.50'	8,586 cf	**35.00'W x 214.00'L x 5.00'H Prismatoid** 37,450 cf Overall - 15,984 cf Embedded = 21,466 cf x 40.0% Voids
		24,571 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Device 3	34.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	34.50'	**15.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 34.50' / 34.30' S= 0.0250 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=1.43 cfs @ 11.20 hrs HW=30.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.43 cfs)

Primary OutFlow Max=2.29 cfs @ 12.54 hrs HW=35.40' (Free Discharge)
↑—**3=Culvert** (Passes 2.29 cfs of 2.42 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 2.29 cfs @ 3.89 fps)

PIPE SIZING CALCULATIONS

80 Montvale Ave
Stoneham MA 02180
P 781.279.0173

Storm Drainage Computations

Name: 10-30 Manley Way
Watertown, MA
Client: The Seyon Group

Proj. No.: **21049**
Date: **7/3/2024**
Computed by: **MAC**
Checked by: **BJM**

Design Parameters:
25 Year Storm
k_e= 0.5

DESCRIPTION	LOCATION		AREA	Cn	Cn x A	SUM	TIME OF	INTENSITY	DESIGN					CAPACITY	
	FROM	TO	(AC.)			Cn x A	CONCENTRATION	IDF CURVE	Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s
To FES-1	CDS-1	SIS-1	0.19	0.90	0.17	0.17	6.0	6.3	1.08	5.56	0.011	12	0.032	7.53	9.59
	SIS-1	DMH-1	-	-	-	-	6.0	6.3	1.20	6.73	0.011	12	0.054	9.78	12.46
	DMH-1	DMH-2	-	-	-	-	6.0	6.3	1.20	2.78	0.011	12	0.004	2.66	3.39
	DMH-2	DMH-4	-	-	-	-	6.0	6.3	1.20	2.78	0.011	12	0.004	2.66	3.39
	CDS-2	SIS-2	0.15	0.90	0.14	0.14	6.0	6.3	0.85	4.55	0.011	12	0.023	6.39	8.13
	SIS-2	DMH-3	-	-	-	-	6.0	6.3	0.76	4.66	0.011	12	0.029	7.17	9.13
	DMH-3	DMH-4	-	-	-	-	6.0	6.3	0.76	3.91	0.011	12	0.017	5.49	6.99
	DMH-4	DMH-6	-	-	-	-	6.0	6.3	1.96	3.45	0.011	12	0.005	2.98	3.79
	CDS-3	SIS-3	0.16	0.90	0.14	0.14	6.0	6.3	0.91	5.47	0.011	12	0.040	8.42	10.72
	SIS-3	DMH-5	-	-	-	-	6.0	6.3	0.80	5.12	0.011	12	0.035	7.88	10.03
	CDS-4	SIS-4	0.05	0.90	0.05	0.05	6.0	6.3	0.28	3.06	0.011	12	0.030	7.29	9.29
	SIS-4	DMH-5	-	-	-	-	6.0	6.3	0.23	1.93	0.011	12	0.007	3.52	4.49
	DMH-5	DMH-6	-	-	-	-	6.0	6.3	1.03	4.62	0.011	12	0.020	5.95	7.58
	DMH-6	DMH-7	-	-	-	-	6.0	6.3	2.99	3.83	0.011	15	0.005	5.40	4.40
	DMH-7	DMH-8	-	-	-	-	6.0	6.3	2.99	3.83	0.011	15	0.005	5.40	4.40
	DMH-8	DMH-10	-	-	-	-	6.0	6.3	2.99	3.83	0.011	18	0.005	8.78	4.97
	CDS-5	SIS-5	0.47	0.90	0.42	0.42	6.0	6.3	2.66	5.32	0.011	12	0.013	4.80	6.11
	SIS-5	DMH-9	-	-	-	-	6.0	6.3	2.61	6.74	0.011	12	0.026	6.79	8.64
	DMH-9	DMH-10	-	-	-	-	6.0	6.3	2.61	7.93	0.011	12	0.040	8.42	10.72

80 Montvale Ave
Stoneham MA 02180
P 781.279.0173

Storm Drainage Computations

Name: 10-30 Manley Way
Watertown, MA
Client: The Seyon Group

Proj. No.: **21049**
Date: **7/3/2024**
Computed by: **MAC**
Checked by: **BJM**

Design Parameters:
25 Year Storm
k_e= 0.5

DESCRIPTION	LOCATION FROM	LOCATION TO	AREA (AC.)	Cn	Cn x A	SUM Cn x A	TIME OF CONCENTRATION	INTENSITY IDF CURVE	DESIGN Q cfs	DESIGN V fps	DESIGN n	DESIGN PIPE SIZE	DESIGN SLOPE	CAPACITY Q full ft^3/s	CAPACITY V full ft/s
	DMH-10	FES-1	-	-	-	-	6.0	6.3	5.60	4.39	0.011	24	0.005	18.90	6.02
To EX-DMH	CB-4	DMH-11	0.11	0.90	0.10	0.10	6.0	6.3	0.62	3.55	0.011	12	0.015	5.16	6.57
	CB-1	DMH-11	0.62	0.90	0.56	0.56	6.0	6.3	3.52	6.76	0.011	12	0.021	6.10	7.77
	DMH-11	CDS-6	-	-	-	0.66	6.0	6.3	4.14	6.43	0.011	12	0.015	5.16	6.57
	CB-3	DMH-13	0.43	0.90	0.39	0.39	6.0	6.3	2.44	4.17	0.011	12	0.007	3.52	4.49
	DMH-13	DMH-12	-	-	-	0.39	6.0	6.3	2.44	4.17	0.011	12	0.007	3.52	4.49
	CB-2	DMH-12	0.53	0.90	0.48	0.48	6.0	6.3	3.01	7.58	0.011	12	0.032	7.53	9.59
	DMH-12	CDS-6	-	-	-	0.86	6.0	6.3	5.44	5.21	0.011	15	0.007	6.39	5.21
	CDS-6	SIS-6	-	-	-	1.52	6.0	6.3	9.58	7.56	0.011	18	0.014	14.69	8.31
	CDS-7	SIS-6	0.10	0.90	0.09	0.09	6.0	6.3	0.57	4.89	0.011	12	0.045	8.93	11.37
	RD-1	DMH-17	0.84	0.90	0.76	0.76	6.0	6.3	4.76	6.36	0.011	12	0.013	4.80	6.11
	DMH-17	DMH-16	-	-	-	0.76	6.0	6.3	4.76	5.74	0.011	15	0.011	8.01	6.52
	DMH-16	SIS-6	-	-	-	0.76	6.0	6.3	4.76	5.93	0.011	15	0.012	8.36	6.81
	SIS-6	DMH-14	-	-	-	-	6.0	6.3	0.00	0.00	0.011	15	0.025	12.07	9.84
	DMH-14	DMH-15	-	-	-	-	6.0	6.3	0.00	0.00	0.011	15	0.036	14.49	11.80
	DMH-15	EX-DMH	-	-	-	-	6.0	6.3	0.00	0.00	0.011	24	0.003	14.64	4.66

72-HOUR DRAWDOWN CALCULATIONS

The Stormwater Handbook also requires recharge facilities be installed in soils capable of absorbing the recharge volume with the ability to drain within 72 hours. The formula for drawdown is as follows:

General Formula:

$$T_{DR} = \frac{\boldsymbol{requiredstoragevolume*}}{(\boldsymbol{RawlsRate})(\boldsymbol{BottomSurfaceAreaofSystem})}$$

(*Required storage volume for this design is equal to the volume within subsurface infiltration system for the 1-yr design storm)

PSIS-1:

Volume to Treat = 190 *cf*

$$T_{DR} = \frac{\boldsymbol{190cf}}{\left(\frac{\boldsymbol{8.27in/hr}}{\boldsymbol{12in/ft}}\right)(\boldsymbol{110sf})} = 2.5\ hrs$$

2.5 *hrs* < 72*hrs*

PSIS-2:

Volume to Treat = 115 *cf*

$$T_{DR} = \frac{\boldsymbol{115cf}}{\left(\frac{\boldsymbol{8.27in/hr}}{\boldsymbol{12in/ft}}\right)(\boldsymbol{140sf})} = 1.2\ hrs$$

1.2 *hrs* < 72*hrs*

PSIS-3:

Volume to Treat = 116 *cf*

$$T_{DR} = \frac{\boldsymbol{116cf}}{\left(\frac{\boldsymbol{8.27in/hr}}{\boldsymbol{12in/ft}}\right)(\boldsymbol{135sf})} = 1.2\ hrs$$

1.2 *hrs* < 72*hrs*

PSIS-4:

Volume to Treat = 46 *cf*

$$T_{DR} = \frac{\boldsymbol{46cf}}{\left(\frac{\boldsymbol{8.27in/hr}}{\boldsymbol{12in/ft}}\right)(\boldsymbol{51sf})} = 1.3\ hrs$$

1.3 *hrs* < 72*hrs*

PSIS-5:

Volume to Treat = 516 *cf*

$T_{DR} = \frac{\mathbf{516\ cf}}{\left(\frac{\mathbf{8.27in/hr}}{\mathbf{12in/ft}}\right)(\mathbf{570sf})}$ = 1.3 *hrs*

1.3 *hrs* < 72*hrs*

PSIS-6:

Volume to Treat = 20,883 *cf*

$T_{DR} = \frac{\mathbf{20{,}883cf}}{\left(\frac{\mathbf{8.27in/hr}}{\mathbf{12in/ft}}\right)(\mathbf{7{,}490sf})}$ = 4.0 *hrs*

4.0 *hrs* < 72*hrs*

PHOSPHOROUS LOAD REDUCTION MANLEY WAY and LOADING DOCK

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PHOSPHOROUS LOAD CALCULATION - MANLEY WAY AND LOADING DOCK AREAS

LAND USE	AREA (ACRE)	PHOSPHOROUS LAND EXPORT RATE (lbs/ACRE/YR) (1)	PHOSPHOROUS LOAD (lbs/YR.)
COMMERCIAL/ INDUSTRIAL	0.94	1.78	1.67

(1) SEE TABLE 2-4

NON-STRUCTURAL BMPs PHOSPHOROUS REMOVAL

CDS CATCH BASIN CLEANING

$CREDIT_{CB} = IA_{CB} \times PLER \times PRF_{CB}$

WHERE:
$CREDIT_{CB}$ = AMOUNT OF PHOSPHOROUS REMOVED BY CB CLEANING (lb/YR.)
IA_{CB} = IMPERVIOUS AREA TO CB = 0.94 ACRE
PLER = PHOSPHOROUS LOAD EXPORT RATE = 1.78 (lbs/ACRE/YR.)
PRF_{CB} = PHOSPHOROUS REDUCTION FOR CB CLEANING = 0.01 (SEE TABLE 2-4)

$CREDIT_{CB} = 0.94 \times 1.78 \times 0.01 = 0.02$ lb/YR.

STRUCTURAL BMPs PHOSPHOROUS REMOVAL

SUBSURFACE INFILTRATION SYSTEMS

$CREDIT_{INFIL} = I_A \times PLE \times PRF_{INFIL}$

WHERE:
PRF = 1.0 (100%) FOR INFILTRATING FIRST 1-INCH OF RUNOFF (SEE TABLE 3-17)

$CREDIT_{INFIL} = 0.94 \times 1.78 \times 1.00 = 1.67$ lbs/YR

PRODUCT 204-1 (Single Sheets) 205-1 (Padded)

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TOTAL PHOSPHOROUS REMOVED = 1.67 lbs/Yr.

WEIGHTED TOTAL PHOSPHOROUS REMOVAL PERCENT = $\frac{\text{PHOSPHOROUS REMOVED}}{\text{PHOSPHOROUS LOAD}}$ =

1.67/1.67 = 100%

PHOSPHOROUS LOAD REDUCTION PARKING LOT

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PHOSPHOROUS LOAD CALCULATION - PARKING LOT

LAND USE	AREA (ACRE)	PHOSPHOROUS LAND EXPORT RATE (lbs/ACRE/YR) (1)	PHOSPHOROUS LOAD (lbs/YR.)
COMMERCIAL/IND.	1.23	1.78	2.19

(1) SEE TABLE 2-1

NON-STRUCTURAL BMPs PHOSPHOROUS REMOVAL

CATCH BASIN/OIL/GRITSEPARATOR CLEANING

$CREDIT_{CB} = IA_{CB} \times PLE \times PRF_{CB}$

WHERE:
$CREDIT_{CB}$ = AMOUNT OF PHOSPHOROUS REMOVED BY CB CLEANING (lb/YR)
IA_{CB} = IMPERVIOUS AREA TO CB = 1.23 (ACRES)
PLER = PHOSPHOROUS LOAD EXPORT RATE = 1.78 lbs/ACRE/YR)
PRF_{CB} = PHOSPHOROUS REDUCTION FOR CB CLEANING = 0.01 (SEE TABLE 2-4)

$CREDIT_{CB} = 1.23 \times 1.78 \times 0.01 = 0.02$ lb/YR.

STRUCTURAL BMPs PHOSPHOROUS REMOVAL

SUBSURFACE INFILTRATION SYSTEMS

$CREDIT_{INFIL} = I_A \times PLER \times PRF_{INFIL}$

WHERE: PRF = 1.0 (100%) FOR INFILTRATING FIRST 1-INCH OF RUNOFF (SEE TABLE 3-17)

$CREDIT_{INFIL} = 1.23 \times 1.78 \times 1.00 = 2.19$ lbs/YR

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TOTAL PHOSPHOROUS REMOVED = 2.19 lbs/yr.

WEIGHTED TOTAL PHOSPHOROUS REMOVAL PERCENT = $\frac{\text{PHOSPHOROUS REMOVED}}{\text{PHOSPHOROUS LOAD}}$

= 2.19/2.19 = 100%

Table 2-1: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits in the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs/acre/year	P Load Export Rate, kg/ha/yr
Commercial (Com) and Industrial (Ind)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (For)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (Open)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (Ag)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.

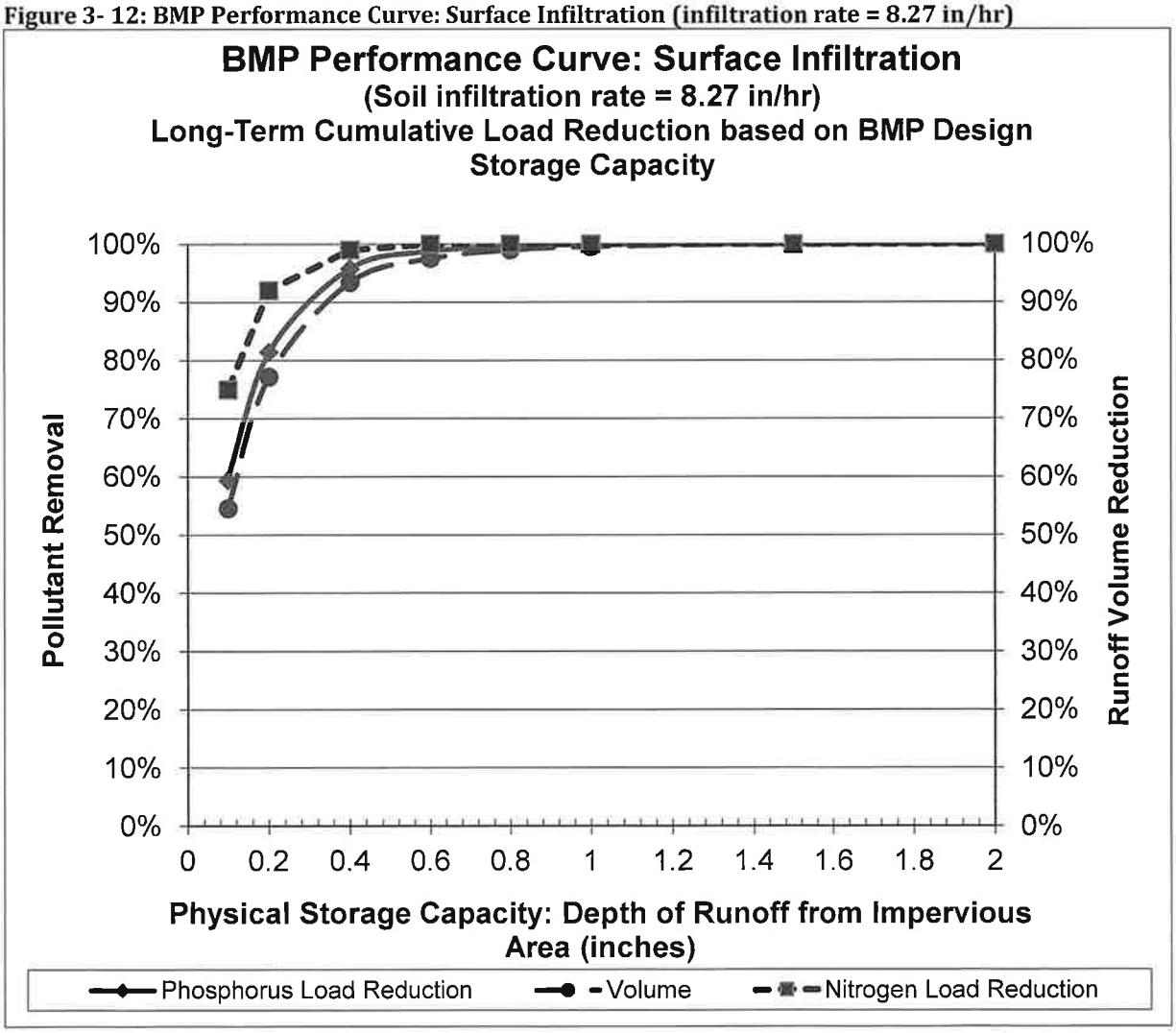
Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$	$NFR_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

Table 3- 17: Surface Infiltration (8.27 in/hr) BMP Performance Table

Surface Infiltration (8.27 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	54.6%	77.2%	93.4%	97.5%	99.0%	99.6%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	59%	81%	96%	99%	100%	100%	100%	100%
Cumulative Nitrogen Load Reduction	75%	92%	99%	100%	100%	100%	100%	100%

Figure 3- 12: BMP Performance Curve: Surface Infiltration (infiltration rate = 8.27 in/hr)



PHOSPHOROUS LOAD REDUCTION
POROUS PAVEMENT

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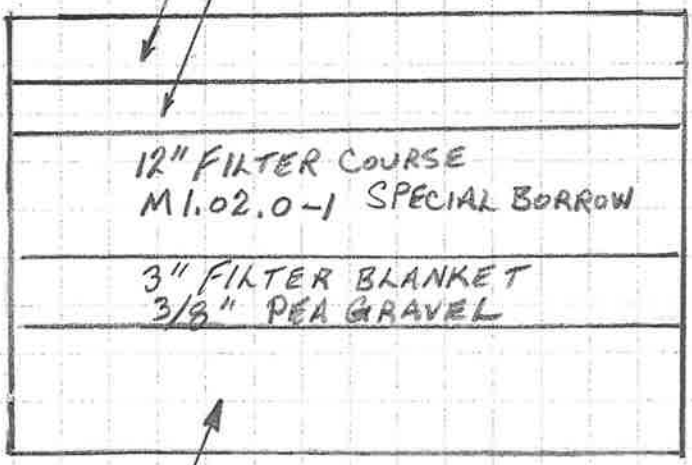

POROUS PAVEMENT SECTION

62% TP REMOVAL W/12" FILTER COURSE *

* SEE BMP PERFORMANCE TABLE FOR POROUS PAVEMENT (p.2/2)

BMP Performance Curve: Porous Pavement

BMP Performance Table

BMP Name: Porous Pavement

Land Use	Pollutant	Depth of Filter Course Layer (inches)			
		12	18	24	32
Commercial	TSS	92%	94%	96%	97%
	TP	62%	69%	74%	78%
	Zn	85%	97%	97%	98%
Industrial	TSS	92%	94%	96%	98%
	TP	62%	70%	75%	79%
	Zn	90%	94%	95%	95%
High-Density Residential	TSS	92%	94%	96%	98%
	TP	62%	70%	74%	78%
	Zn	88%	95%	96%	96%
Medium-Density Residential	TSS	95%	97%	98%	99%
	TP	61%	68%	73%	77%
	Zn	70%	71%	75%	79%
Low-Density Residential	TSS	92%	94%	96%	97%
	TP	60%	67%	71%	75%
	Zn	63%	64%	69%	74%

Annual Pollutant Loading Rates

Land use	Pollutant load (lbs/acre-year)		
	TSS	TP	Zn
Commercial	1117.77	1.66	2.33
Industrial	745.22	1.43	0.45
High-Density Residential	465.08	1.10	0.79
Medium-Density Residential	274.63	0.55	0.11
Low-Density Residential	72.11	0.042	0.043

TSS REMOVAL CALCULATIONS

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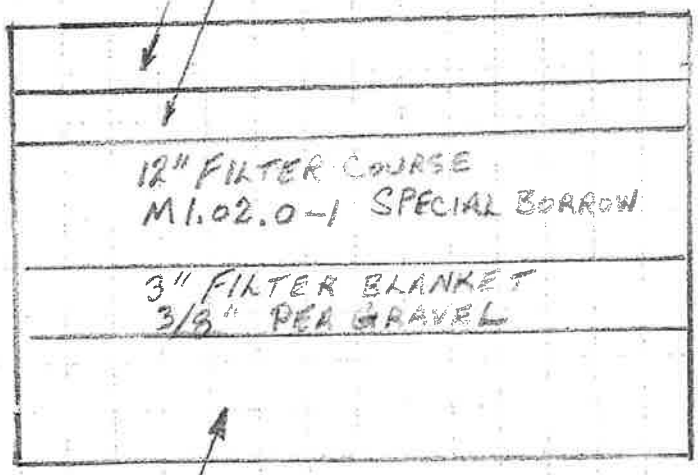


POROUS PAVEMENT SECTION

92% TSS REMOVAL W/12" FILTER COURSE *

* SEE BMP PERFORMANCE TABLE FOR POROUS PAVEMENT (P.2/2)

BMP Performance Curve: Porous Pavement

BMP Performance Table

BMP Name: Porous Pavement

Land Use	Pollutant	Depth of Filter Course Layer (inches)			
		12	18	24	32
Commercial	TSS	92%	94%	96%	97%
	TP	62%	69%	74%	78%
	Zn	85%	97%	97%	98%
Industrial	TSS	92%	94%	96%	98%
	TP	62%	70%	75%	79%
	Zn	90%	94%	95%	95%
High-Density Residential	TSS	92%	94%	96%	98%
	TP	62%	70%	74%	78%
	Zn	88%	95%	96%	96%
Medium-Density Residential	TSS	95%	97%	98%	99%
	TP	61%	68%	73%	77%
	Zn	70%	71%	75%	79%
Low-Density Residential	TSS	92%	94%	96%	97%
	TP	60%	67%	71%	75%
	Zn	63%	64%	69%	74%

Annual Pollutant Loading Rates

Land use	Pollutant load (lbs/acre-year)		
	TSS	TP	Zn
Commercial	1117.77	1.66	2.33
Industrial	745.22	1.43	0.45
High-Density Residential	465.08	1.10	0.79
Medium-Density Residential	274.63	0.55	0.11
Low-Density Residential	72.11	0.042	0.043

TSS Removal Calculation Worksheet

Location: MANLEY WAY AND LOADING DOCK AREA

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
CDS UNIT W/GRATE	0.50	1.00*	0.50	0.50
SUBSURFACE INFILTRAION	1.00	0.50	0.50	0.0

Total TSS Removal = 1.00 (100%)

Project: 10-30 MANLEY WAY, WATERTOWN
Prepared By: RJO'Connell & Associates
Date: 2-16-23

* Equals remaining load from previous BMP (E) which enters the BMP

FIGURE - 4

TSS Removal Calculation Worksheet

Location: PARKING LOT

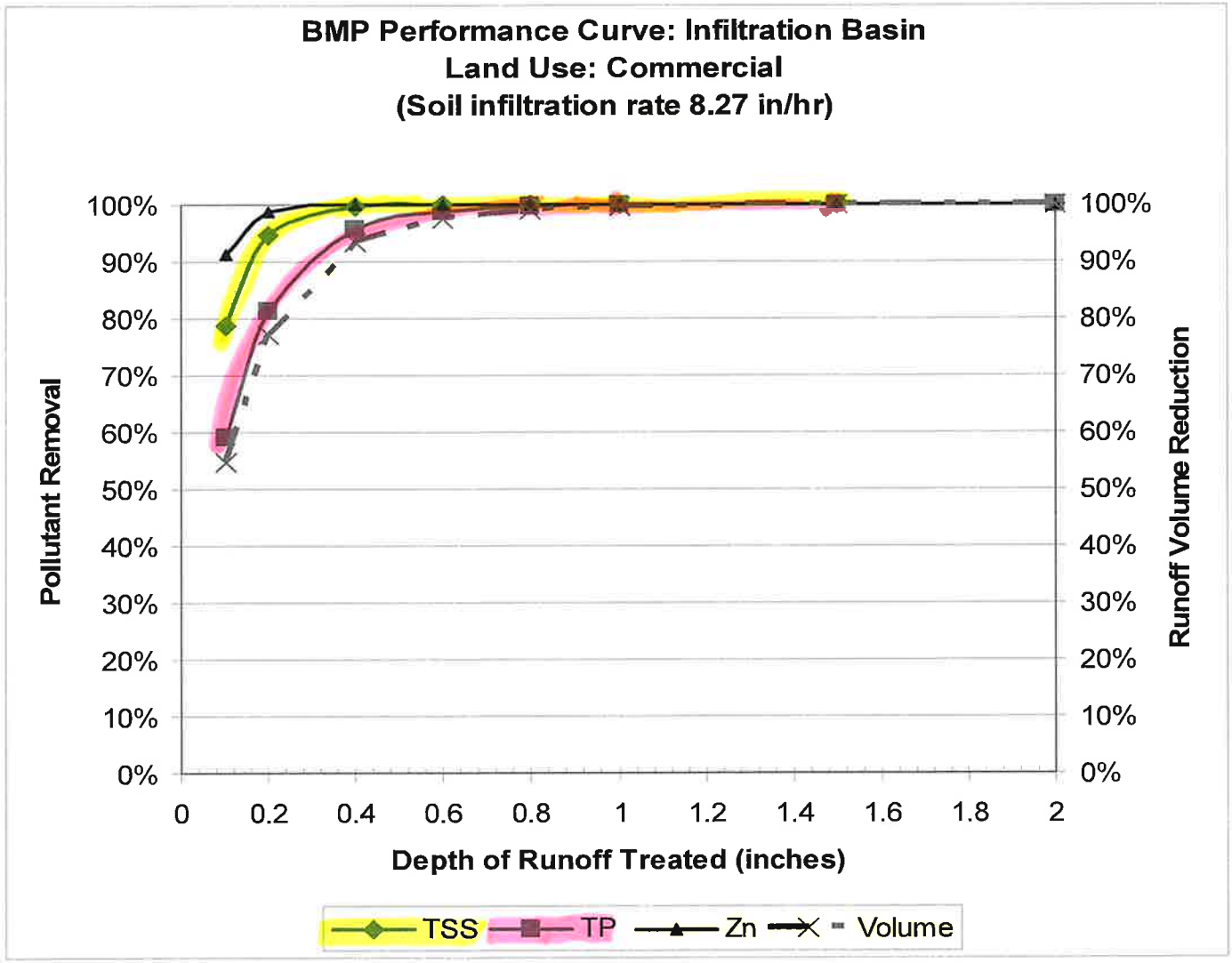
A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
DEEP SUMP CB W/HOOD	0.25	1.00*	0.25	0.75
WATER QUALITY UNIT (CDS)	0.50	0.75	0.38	0.37
SUBSURFACE INFILTRATION	1.00	0.37	0.37	0.00

Total TSS Removal = 1.00 (100%)

Project: 10-30 MANLEY WAY, WATERTOWN
Prepared By: RJO'Connell & Associates
Date: 3-27-23

* Equals remaining load from previous BMP (E) which enters the BMP

FIGURE - 4


BMP Performance Curve: Infiltration Basin
Land Use: Commercial
(Soil infiltration rate 8.27 in/hr)
Pollutant Removal
Runoff Volume Reduction
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Depth of Runoff Treated (inches)
TSS
TP
Zn
Volume

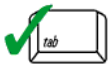
III. STORMWATER CHECKLIST

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



7-2-2024
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.

IV. OPERATONS AND MAINTENANCE PLAN

Operation and Maintenance Plan

10-30 Manley Way
Watertown, Massachusetts

Prepared for:
PPF Industrial Seyon 20 LLC
c/o Seyon
535 Boylston Street
11th Floor
Boston, MA 02116

Prepared by:
R.J. O'Connell & Associates, Inc.
80 Montvale Ave, Suite 201
Stoneham, MA 02180

Date: June 29, 2023
Revised: 3/19/24, 7/3/24

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INTRODUCTION

This Operation and Maintenance Plan has been prepared to ensure that the stormwater management system implemented at 10-30 Manley Way in Watertown, MA functions as designed, and to develop and carry out suitable practices for source control and pollution prevention. It describes the various components of the stormwater management system, identifies the inspection and maintenance tasks to be undertaken after construction is complete, and establishes a schedule for implementing these tasks to insure the proper, long-term operation of the system.

SECTION 1 - STORMWATER MANAGEMENT SYSTEM - OPERATION AND MAINTENANCE

The objectives of the stormwater management system are to effectively control and treat stormwater runoff from the site in accordance with the Massachusetts Stormwater Management Standards. To accomplish this objective, the following Best Management Practices (BMP's) are included in the stormwater management system:

Pre-Treatment BMPs

- Catch basins with deep sumps and hooded outlets to reduce the discharge of trash, debris and coarse sediment from storm runoff and provide temporary containment of oil and grease.
- Hydrodynamic particle separators for removal of oil, grease and suspended solids.
- Oil/particle separator tank for removal of heavy particulates, floating debris and hydrocarbons from stormwater runoff.

Treatment BMPs

- Subsurface infiltration systems for removal of Total Suspended Solids (TSS), pollutants and Total Phosphorous (TP) from stormwater runoff.

To ensure the ongoing and proper functioning of the on-site stormwater management BMPs, this Operation and Maintenance Plan has been developed.

In consideration of the foregoing, it is the ongoing responsibility of the landowner, their successors and assignees to adequately maintain the on-site stormwater management BMPs. Adequate maintenance is herein defined as good working condition so that these BMPs are performing their design functions.

Based on this, the landowner, their successors and assignees are required to create a Pollution Prevention Team (PPT) that will be responsible for implementing this Operation and Maintenance Plan.

Upon transfer of ownership of the property, the landowner is required to notify the new owner of the presence of the stormwater management system and the requirements of this Operation and Maintenance Plan.

Property Information

Address: 10-30 Manley Way
Watertown, MA 02472

Landowner and Pollution Prevention Team Leader

Owners Name: PPF Industrial Seyon 20 LLC c/o Seyon

Owner's Representative: Joe DiRienzo
Title: Senior Project Manager
Office Phone: (508) 414-6462
Email: jdirienzo@seyonmanagement.com

Pollution Prevention Team Leader: TBD
Title:
Office Phone:
Email:

Responsibilities: Coordinate all aspects of the Operation and Maintenance Plan, coordinate and hire the other Pollution Prevention team members in order to conduct inspections, keep all records, and coordinate with contractors for maintenance and repairs of the stormwater management system.

Spill Prevention & Control Contractor
The following contacts shall be notified only in those instances identified within 310 CMR 40.00: Massachusetts Contingency Plan-Subpart C (see the Long-Term Pollution Prevention Plan, Appendix B).

Primary Contact: TBD
Office Phone:

Emergency Contact: TBD
Company Name: The Seyon Group
Title:
Emergency Phone:

Consultant Contact:
Company Name:
Contact Name:
Phone:

Department of Environmental Protection (DEP)
Hazardous Waste Incident Response Group

Contact Name:
Phone: (617) 792-7653

Municipal Contacts

Watertown Fire Department
Contact Name: Ryan Nicholson, Fire Chief
Phone: (617) 972-6512

Watertown Department of Public Works
Contact Name: Greg St. Louis, PE, Superintendent of Public Works
Phone: (617) 972-6420

Engineering
Contact Name: Tyler Glode, PE, Town Engineer
Phone: (617) 972-6420

Watertown Health Department
Contact Name: Abbey Myers, Director
Phone: (617) 972-6446

Other Pollution Prevention Team Members

Member: Qualified Engineering and/or Environmental Consulting Firm(s).

Responsibilities: Conduct scheduled inspections, maintain records, advise the Team Leader of maintenance needs, ensure inspection maintenance and repairs are completed and keep and maintain all records and inspection reports.

Company Name(s): TBD
Address:
Office Phone:

Team Member Training

The Pollution Prevention Team Leader will coordinate an annual in-house training session with the qualified Engineering and/or Environmental Consulting Firm to discuss the Operation and Maintenance Plan, ongoing inspection and maintenance and preventative maintenance procedures.

Annual training session will generally include the following:

- Discuss the Operation and Maintenance Plan

  - What it is- identify potential sources of stormwater pollution and methods of reducing or eliminating that pollution
  - What it contains- emphasize good housekeeping measures and location of potential pollution sources.
  - Pollution Prevention Team- introduce the team and explain their responsibilities, explain the operations and continuous monitoring of the stormwater management system and encourage input and assistance from all.
- Review and explain the storm drainage system, how it works and its components, note the receiving resource area in which the storm drainage system discharges into and the role each component plays.
- Emphasize the importance of maintaining current and up-to-date inspection reports and maintenance records of BMPs. Documentation shall include any changes to the O&M Plan's procedures to accommodate changes and revisions to BMPs.

Inspections and Maintenance Requirements

The components of the stormwater management system must be inspected, monitored and maintained in accordance with the following in order to ensure that the on-site stormwater management BMPs are functioning as designed. Routine inspection and proper maintenance of these individual components is essential to providing the long-term enhancement of both the quality and quantity of the runoff from the properties.

Deep Sump Catch Basins:

Stormwater runoff from pavement areas is directed to catch basins via site grading and curbing. Catch basins are equipped with a deep (4ft) sump and a hood. The sumps are designed to capture sediment and coarse particles and the hoods prevent hydrocarbons and other floatable debris from entering the drainage system. To ensure proper functioning of catch basins, each will be inspected and maintained as follows:

Inspection: Beginning of March, June, September and December. Structural damage and other malfunctions are to be noted and reported. Basins shall also be inspected after every major rain event (3.2 inches or greater in 24 hours) to ensure the grates are not clogged and are functioning properly.

Maintenance: Catch basins to be pumped and cleaned when sump is half full of sediment. Cleaning shall be performed by a licensed contractor. Sediment and hydrocarbons will be properly handled and legally disposed of off-site in accordance with local, state, and federal guidelines and regulations. Any structural damage to catch basins and/or castings will be repaired upon discovery.

Oil/Particle Separator Tank

Particle separator tank is a precast concrete tank designed to treat incoming stormwater runoff by removing suspended solids, thereby preventing the transfer of pollutants downstream. The particle separator on the site is equipped and designed to treat stormwater runoff prior to

discharging to the Walker Pond. The particle separator is be inspected and maintained as follows:

Inspection: Inspect twice a year (March and September) see Appendix A of this report.

Maintenance: Jet vacuumed, and power washed by a licensed contractor when depth of sediment is greater than ½ the depth of the tank. Accumulated sediment and hydrocarbons will be disposed of in accordance with applicable local, state and federal guidelines and regulations.

Hydrodynamic Oil/Particle Separator

The hydrodynamic oil/particle separators are precast concrete structures designed to treat incoming stormwater runoff by removing suspended solids thereby preventing the transfer of pollutants downstream. The particle separators on site are designed to treat stormwater runoff prior to discharging into a subsurface infiltration systems. The hydrodynamic particle separators are to be inspected and maintained as follows:

Inspection: Inspect in accordance with the manufacturer's recommendations and requirements (see Appendix D). At a minimum, hydrodynamic separators are to be inspected in March and September.

Maintenance: Vacuum and power wash the separator by a licensed contractor at least once per year or as recommended by the manufacturer (see Appendix D). Accumulated sediment and hydrocarbons to be disposed of in accordance with applicable local, state and federal guidelines and regulations. Particle separators are also to be cleaned when the level of sediment depth is within 12 inches of the invert of the outlet invert.

Subsurface Infiltration Systems

The subsurface infiltration systems consist of perforated high density polyethylene (HDPE) pipe encased in crushed stone. The systems are designed to temporarily retain stormwater runoff and infiltrate into the underlying soil. In so doing, a minimum of 90% Total Suspended Solids (TSS) and 60% of Total Phosphorous load is removed from the runoff. The subsurface infiltration systems are to be inspected and maintained as follows:

Inspection: Inspect inlets for accumulation of sediment and debris annually.

Maintenance: If there is a visible build-up of sediment, it should be vacuumed out by an approved contractor and disposed of in accordance with applicable local, state and federal guidelines and regulations. If the system does not drain within 24-hours following a major rainfall event, then a qualified professional should assess the condition of the system to determine the required measures to restore infiltration functionality.

Please refer to Appendix A for the Inspection Forms, which are to be used by the Pollution Prevention Team member responsible for conducting the scheduled inspections.

SECTION 2 - LONG TERM POLLUTION PREVENTION PLAN (LTPPP)

A. MATERIALS COVERED

The following materials or substances are expected to be present onsite after construction:

Cleaning solvents	Petroleum based products
Detergents	Pesticides/Insecticides
Paints/Solvents	Fertilizers/Herbicides
Acids	Contaminated Soil
Solid Waste	

B. MATERIALS MANAGEMENT PRACTICES

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff. The Pollution Prevention Team Leader will be responsible for ensuring that these procedures are followed:

Good Housekeeping

The following good housekeeping practices will be followed onsite after construction:

a) An effort will be made to store only enough products required to do the job.
b) All materials stored onsite will be stored in a neat, orderly manner and, if possible, under a roof or in a containment area. At a minimum, all containers will be stored with their lids on when not in use. Drip pans shall be provided under all dispensers.
c) Products will be kept in their original containers with the original manufacturer's label in legible condition.
d) Substances will not be mixed with one another unless recommended by the manufacturer.
e) Whenever possible, all of a product will be used up before disposing of the container.
f) Manufacturer's recommendations for proper use and disposal will be followed.
g) A Pollution Prevention Team Member will be responsible for daily inspections to ensure proper use and disposal of materials.
h) The storage of all deicing materials on the site shall be covered and not be exposed to precipitation.

1. Hazardous Substances

These practices will be used to reduce the risks associated with hazardous substances. Material Safety Data Sheets (MSDS's) for each product with hazardous characteristics that is used on the property will be obtained and used for the proper management of potential wastes that may result from these products. An MSDS will be posted in the immediate area where such product is stored and/or used and another copy of each MSDS will be maintained on-site, in the management office. Each employee who must handle a hazardous substance will be instructed on the use of MSDS sheets and the specific information in the applicable MSDS for the product he/she is using, particularly regarding spill control techniques.

a) Products will be kept in original containers with the original labels in legible condition.
b) Original labels and MSDS's will be procured and used for each product.
c) If surplus product must be disposed of, the manufacturer's and local/state/federal required methods for proper disposal must be followed.

2. Hazardous Waste

It is imperative that all hazardous waste be properly identified and handled in accordance with all applicable hazardous waste standards, including the storage, transport and disposal of the hazardous wastes. There are significant penalties for the improper handling of hazardous wastes. It is important that the Pollution Prevention Team Leader seeks appropriate assistance in making the determination of whether a substance or material is a hazardous waste. For example, hazardous waste may include certain hazardous substances, as well as pesticides, paints, paint solvents, cleaning solvents, contaminated soils, and other materials, substances or chemicals that have been discarded (or are to be discarded) as being out-of-date, contaminated, or otherwise unusable. The Pollution Prevention Team Leader is responsible for ensuring that all Pollution Prevention Team Members are instructed as to these hazardous waste requirements and also that the requirements for handling and disposal are being followed.

3. Product Specific Practices

The following product specific practices will be followed on the job site:

a) Petroleum Products

Petroleum products will be stored in tightly sealed containers which are clearly labeled. Petroleum storage tanks shall be located a minimum of 100 linear feet from wetland resource areas, drainage ways, inlets and surface waters unless stored within a building. Any petroleum storage tanks stored onsite will be located within a containment area that is designed with an impervious surface between the tank and the ground. The secondary containment must be designed to provide a

containment volume that is equal to 110% of the volume of the largest tank. Drip pans shall be provided for all dispensers. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations. The location of any fuel tanks and/or equipment storage areas must be identified on the Erosion Control Plan by the Contractor once the locations have been determined.

b) Fertilizers, Herbicides, Pesticides, and Insecticides

Fertilizers, herbicides, pesticides, and insecticides will be applied only in the minimum amounts recommended by the manufacturer. Once applied, they will be worked so as to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags or containers will be transferred to a sealable plastic bin to avoid spills.

Fertilizers shall not be applied within wetland buffer zones or other resource areas. Refer to Drawing C-2, Grading and Drainage Plan, for location of resource areas and buffer zones.

c) Paints, Paint Solvents, and Cleaning Solvents

All containers will be tightly sealed and stored when not in use. Excess paint and solvents will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or state and federal regulations.

4. Solid Waste

All waste materials will be collected and stored in an appropriately covered container and/or securely contained metal dumpster rented from a local waste management company which must be a licensed solid waste management company. The dumpster will comply with all local and state solid waste management regulations.

All trash and debris from the site will be deposited in dumpsters. The dumpsters will be emptied a minimum of once per week or more often if necessary. All personnel will be instructed regarding the correct procedures for waste disposal.

All waste dumpsters and roll-off containers will be located in an area where the likelihood of the containers contributing to storm water discharges is negligible.

5. Contaminated Soils

Any contaminated soils (resulting from spills of hazardous substances or oil will be contained and cleaned up immediately in accordance with the procedures given in the Materials Management Plan and in accordance with applicable state and federal regulations. If there is a release, it should be reported as a spill, if it otherwise meets the requirements for a reportable spill.

C. SPILL PREVENTION AND RESPONSE PROCEDURES

The Pollution Prevention Team Leader will train all personnel in the proper handling and cleanup of spilled hazardous substances or oil. No spilled hazardous substances or oil will be allowed to come in contact with storm water discharges. If such contact occurs, the storm water discharge will be contained on site until appropriate measures in compliance with state and federal regulations are taken to dispose of such contaminated storm water. It shall be the responsibility of the Pollution Prevention Team Leader to be properly trained, and to train all personnel in spill prevention and clean up procedures.

1. In order to prevent or minimize the potential for a spill of hazardous substances or oil to come into contact with storm water, the following steps will be implemented:

    a) All hazardous substances or oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.
    b) The minimum practical quantity of all such materials will be kept on site.
    c) A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, containment booms, impermeable covers, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.
    d) Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.
    e) It is the Pollution Prevention Team Leader's responsibility to ensure that all hazardous waste on site is disposed of properly by a licensed hazardous material disposal company. The Pollution Prevention Team Leader is responsible for not exceeding hazardous waste storage requirements mandated by the EPA or state and local authority.
    f) Install a sign within the loading dock/truck turnaround area depicting the Spill Prevention & Control Contractor (as noted within Section 1 above) and the Watertown Fire Department in the event a spill occurs onsite.

2. In the event of a spill of hazardous substances or oil, the following procedures must be followed:

    a) All measures must be taken to contain and abate the spill and to prevent the discharge of the hazardous substance or oil to storm water or off-site via deployment of impervious covers surrounded by containment booms at the receiving catch basins. (The spill area must be kept well ventilated and personnel must wear appropriate protective clothing to prevent injury from contact with the hazardous substances.)
    b) For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.
    c) For spills greater than five (5) gallons of material immediately contact the MA DEP Emergency Response at (888) 304-1133, and an approved emergency response

contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Note: the receiving water quality unit located within the loading dock area has the capacity to hold up to 83 gallons of floatable contaminants before it would exit the unit). The receiving drainage structure shall be pumped out immediately after a spill occurs.

d) Dispose of all contaminated products in accordance with applicable federal, state and local regulations.
e) If there is a Reportable Quantity (RQ) release, then the National Response Center will be notified immediately at (800) 424-8802; within 14 days a report will be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan must be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

3. The Pollution Prevention Team Leader will be the spill prevention and response coordinator. He/she will designate the individuals who will receive spill prevention and response training. These individuals will each become responsible for a particular phase of prevention and response. The names of these personnel will be posted in the material storage area and in the management office.

SECTION 3 - ILLICIT DISCHARGE STATEMENT

Certain types of discharges are allowable under the U.S. Environmental Protection Agency Construction General Permit, and it is the intent of this LTPPP to allow such discharges. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to, or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Illicit discharges, if they exist currently, will be contained and eliminated in the manner specified by local, state and federal regulations, and will be prohibited in the proposed development.

SECTION 4 – SNOW MANAGEMENT

Snow management will be overseen by the Property Manager who will implement this plan and be authorized to utilize additional resources should unusual events occur. The Snow Management Contractor (SMC) shall be responsible for maintaining all roads, driveways, parking lots, sidewalks and pedestrian access areas for clear and safe travel. The SMC shall report directly to the Property Manager and maintain communication via cell phones 24 hours per day, 7 days per week. All roads, drives, entrances and exits are the first priority. During extreme events, the first priority will be to clear and maintain proper access for residents and public safety vehicles. The next priority is parking areas, sidewalks, fire hydrants, and delivery areas. Snow will be piled in designated areas as depicted on the snow storage plan. (See R.J. O'Connell Snow Storage Plan in Appendix B). Snow stored in designated areas shall have a maximum height limitation of seven (7') feet. When snow designated areas reach their capacity, surplus snow will be disposed offsite as identified in the snow management contract. Prior to November 1 of each year, the SMC shall notify in writing the Property Manager the location that snow will be hauled to.

The anti-icing operations typically precede snow plowing and will be provided when conditions warrant. A minimal application of calcium chloride will be applied to all drives and walks to allow for safe vehicular and pedestrian travel. The property manager will monitor the application rate of the calcium chloride to make sure it is kept to a minimum while ensuring safe conditions for pedestrians and vehicles. Calcium chloride is safer for the environment than rock salt and is typically used in vulnerable areas.

Snow removal shall commence upon accumulation of two inches ("2") or more. The SMC shall keep existing catch basins open for drainage or water resulting from melting.

Once the storm is over, the SMC shall monitor all areas on-site for icy spots and snowdrifts. If needed, minimal applications of calcium chloride will be applied to all drives and walks so that the surfaces remain drivable and walkable. When the ambient temperature drops below 15 degrees F, all major areas will be monitored and, if necessary, receive an application of calcium chloride to maintain melting action and an ice-free surface for as long as possible.

Deicing chemicals will be kept in original containers with the original product label in legible condition. When not in use, deicing materials will be stored in a neat, orderly manner under cover with their container lids on.

SECTION 5 – PUBLIC SAFETY FEATURES

The following measures have been incorporated into the stormwater management system to ensure the safety of the public:

- Storm drain manholes and catch basins provided with heavy duty covers and/or grates designed to withstand H20 loading.
- Control and collection of stormwater runoff through positive drainage and curbing directing it toward drainage inlet structures.
- Treatment of stormwater runoff from repaved surfaces to remove 90% of the average annual post-construction load of Total suspended Solids (TSS) and at least 60% the cumulative phosphorous load reduction.
- Reduction of peak rates of runoff and volumes from the site under redeveloped conditions as compared to pre-redeveloped conditions.
- Development and implementation of an Operation and Maintenance Plan (O&M) to ensure the proper functioning of the stormwater management system and a Long-Term Pollution Prevention Plan (LTPPP) identifying potential pollution sources and suitable practices to control and prevent them from impacting the environment and/or the public's health and safety.

Appendix A

Maintenance and Inspection Forms

Appendix A

Maintenance and Inspection Forms

10-30 Manley Way - Watertown
Operation and Maintenance Plan
Task Guide

The table below is a list of the minimum inspection and maintenance activities the Pollution Prevention Team needs to conduct for the Stormwater Operations and Management Plan and who is responsible for the activity. The task Guide is provided to assist the Pollution Prevention Team Leader and ensure that the activities are being conducted as scheduled.

Timing	Task	Responsible Party
Weekly	Inspect lot/land. Pick up and dispose of litter. Check for leaking liquid at dumpsters.	PPT PPT PPT
Monthly	Inspect soil, repair eroded areas in bioretention area and re-mulch as needed. Remove litter and debris	
Quarterly (March, June, September, December)	Inspect catch basins for sediment, trash and oil. Remove sediment when depth of deposits is greater than ½ the depth of the sump.	PPT/Contractor
Semi-Annually	Inspect oil/particle separator tank. Remove sediment when depth of deposits is greater than or equal to ½ the depth of the tank. Inspect hydrodynamic oil/particle separators. Remove sediment and clean when level of sediment is within 12 inches of outlet invert. Remove and replace dead vegetation from vegetated drainage channel (spring and fall)	PPT/Contractor PPT Contractor PPT/Contractor Contractor
Annually	Inspect subsurface infiltration systems for accumulation of sediment at inlets and remove as necessary. Conduct Pollution Prevention Team training as required. Prepare Comprehensive Annual Stormwater Evaluation and Inspection Report.	PPT Team Leader
April	Spring clean-up	Contractor
Between November 14 and December 15	Fall clean-up	Contractor

10-30 Manley Way Walnut Street - Watertown
Operation and Maintenance Plan
Comprehensive Annual Evaluation and Inspection Report

Once a year, the Pollution Prevention Team Leader must inspect and evaluate all aspects and provisions of the Operations and Maintenance Plan, complete the following report and keep a copy on file at the site.

Inspector/Reviewers:_____

Date of Inspection/Review: _____

Note any changes to the Plan in the space below and in the appropriate section of the Plan.

1. Review the Pollution Prevention Team list and update if necessary. Does the Pollution Prevention Team list need updating:
   (circle one) Yes No

2. Review the Operations and Maintenance Plan (O&M Plan). Are there sections of the O&M Plan that need updating?
   (circle one) Yes No

3. Review Monthly and Weekly Checklists. Update these as necessary

   - Are there any updates needed to Spill and Leak History and/or the checklists?
     (circle one) Yes No

4. Review site drawings and update if necessary
   - Are there updates needed to any of the drawings? (circle one) Yes No
   -

Requested Changes (attach revisions)

10-30 Manley Way - Watertown
Operation and Maintenance Plan
Annual Training Sign-off Sheet

For each Operations and Maintenance Plan training session, the Team Leader should keep records of all attending Team Members using the signoff sheet below, as well as the training agenda, notes, etc.

Training Date: _____	**Topic**:
Trainer: _____	
Team Member Name	**Team Member Signature**

10-30 Manley Way - Watertown
Operation and Maintenance Plan
Weekly Task Checklist

The site will be checked each week for trash and debris by a member of the Pollution Prevention Team. If any trash or debris is observed in the specified area, write "yes" in the 2nd column and note the problem and corrective measures taken in the appropriate space. Make a new copy of this checklist each week.

Date: _____ **Checklist completed by**: _____

GROUNDS AREA TO CHECK	TASK	DESCRIPTION OF PROBLEM	CORRECTIVE MEASURES TAKEN
Parking Lot & Roadways	Pickup and Dispose of Litter		
Landscaped Areas	Pickup and Dispose of Litter		
Compactor/Dumpster Areas	Check for Leaking Liquid Pickup and Dispose of Litter		
Perimeter of Property	Pick up and Dispose of Litter		

10-30 Manley Way Walnut Street - Watertown
Operation and Maintenance Plan
Quarterly Task Checklist (March, June, September, December)

The following will be checked each month for sources of pollutants by a member of the Pollution Prevention Team. If the condition in the "check for" column is observed, note the problem and corrective measures taken in the appropriate space. Make a new copy of the checklist each month.

Date: _____ **Checklist completed by**: _____

BMP	TASK	DESCRIPTION OF PROBLEM (IF PRESENT)	CORRECTIVE MEASURES TAKEN
Catch Basins	Inspect for Sediment, Trash, and Oil. Remove sediment when depth of deposits is greater than ½ the depth of the sump.		

10-30 Manley Way - Watertown
Operation and Maintenance Plan
Semi-Annual Task Checklist

The site will be checked semi-annually four sources of pollutants by a member of the Pollution Prevention Team. If the condition in the "check for" column is observed, note the problem and corrective measures taken in the appropriate space. Make a new copy of the checklist each month.

Date: _____ **Checklist completed by**: _____

BMP	TASK	DESCRIPTION OF PROBLEM (IF PRESENT)	CORRECTIVE MEASURES TAKEN
Oil/Particle Separator Tank	Inspect for sediment, trash, and oil. Remove sediment when depth of deposits is greater than ½ the depth of the sump.		
Vegetated Drainage Channel	Remove and replace dead vegetation from channel in the spring and fall.		
Hydrodynamic Particle Separators	Inspect and remove sediment when level of sediment is within 12 inches of outlet invert.		
Spring and Fall site clean-up	Overall clean-up of site.		

101 Walnut Street - Watertown
Operation and Maintenance Plan
Annual Task Checklist

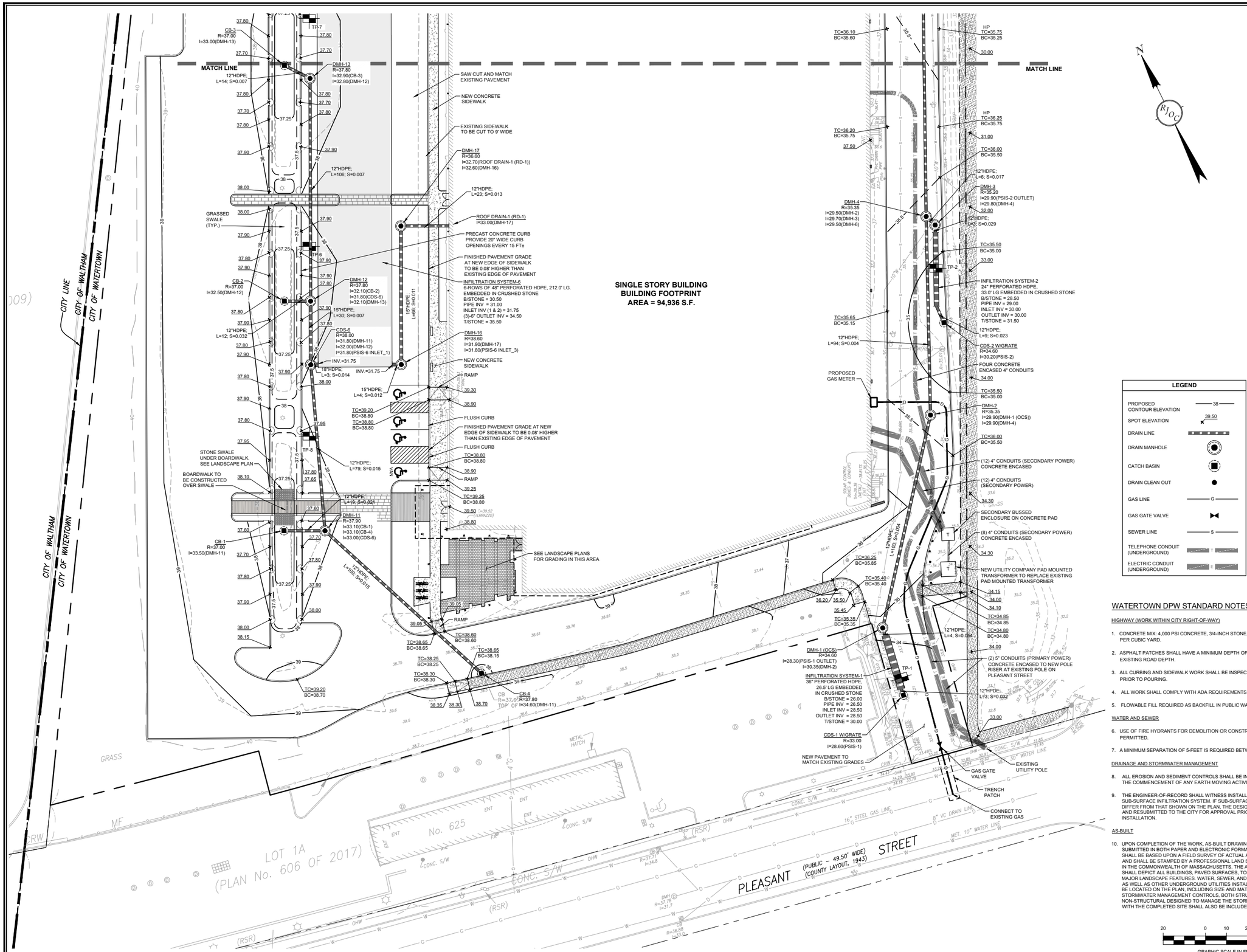
The following will be check each year for sources of pollutant by a member of the Pollution Prevention Team. If a problem is observed, note the problem and corrective measures take in the appropriate space. Make a new copy of the checklist each year.

Date: _____ **Checklist completed by**: _____

BMP	TASK	DESCRIPTION OF PROBLEM (IF PRESENT)	CORRECTIVE MEASURES TAKEN
Subsurface Infiltration Systems	Inspect for sediment accumulation at inlets and remove as necessary.		
Pollution Prevention Team Training.	Pollution Prevention Team training. Prepare comprehensive Annual Stormwater Evaluation and Inspection Report.		

Appendix B

BMP-1: BMP Location Plan – 1
BMP-2: BMP Location Plan – 2
Snow Storage Plan



WATERTOWN DPW STANDARD NOTES:

HIGHWAY (WORK WITHIN CITY RIGHT-OF-WAY)

1. CONCRETE MIX: 4,000 PSI CONCRETE, 3/4-INCH STONE, 2-1/2 LBS LAMPBLACK PER CUBIC YARD.
2. ASPHALT PATCHES SHALL HAVE A MINIMUM DEPTH OF 5-INCHES, OR MATCH EXISTING ROAD DEPTH.
3. ALL CURBING AND SIDEWALK WORK SHALL BE INSPECTED BY THE DPW PRIOR TO POURING.
4. ALL WORK SHALL COMPLY WITH ADA REQUIREMENTS.
5. FLOWABLE FILL REQUIRED AS BACKFILL IN PUBLIC WAY.

WATER AND SEWER

6. USE OF FIRE HYDRANTS FOR DEMOLITION OR CONSTRUCTION IS NOT PERMITTED.
7. A MINIMUM SEPARATION OF 5-FEET IS REQUIRED BETWEEN ALL UTILITIES.

DRAINAGE AND STORMWATER MANAGEMENT

8. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY EARTH MOVING ACTIVITIES.
9. THE ENGINEER-OF-RECORD SHALL WITNESS INSTALLATION OF ANY SUB-SURFACE INFILTRATION SYSTEM. IF SUB-SURFACE SOIL CONDITIONS DIFFER FROM THAT SHOWN ON THE PLAN, THE DESIGN SHALL BE MODIFIED AND RESUBMITTED TO THE CITY FOR APPROVAL PRIOR TO CONTINUING INSTALLATION.

AS-BUILT

10. UPON COMPLETION OF THE WORK, AS-BUILT DRAWINGS SHALL BE SUBMITTED IN BOTH PAPER AND ELECTRONIC FORMAT. THE DRAWINGS SHALL BE BASED UPON A FIELD SURVEY OF ACTUAL AS-BUILT LOCATIONS, AND SHALL BE STAMPED BY A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS. THE AS-BUILT DRAWING SHALL DEPICT ALL BUILDINGS, PAVED SURFACES, TOPOGRAPHY, AND MAJOR LANDSCAPE FEATURES. WATER, SEWER, AND DRAINAGE FEATURES, AS WELL AS OTHER UNDERGROUND UTILITIES INSTALLED BY OTHERS, SHALL BE LOCATED ON THE PLAN, INCLUDING SIZE AND MATERIAL. ALL STORMWATER MANAGEMENT CONTROLS, BOTH STRUCTURAL AND NON-STRUCTURAL DESIGNED TO MANAGE THE STORMWATER ASSOCIATED WITH THE COMPLETED SITE SHALL ALSO BE INCLUDED.

NO.	DATE	REVISION
5.	07/02/2024	REVISED PER CONSERVATION COMMISSION COMMENTS
4.	03/19/2024	REVISED PER ENGINEERING COMMENTS
3.	06/09/2023	ISSUED FOR SITE PLAN REVIEW
2.	06/14/2023	REVISED PER DPW COMMENTS
1.	05/04/2023	ISSUED FOR SPECIAL PERMIT/SITE PLAN REVIEW
NO.	DATE:	REVISION

PREPARED BY:
RJO'CONNELL & ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS
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c/o SEYON
535 BOYLSTON STREET, 11TH FLOOR
BOSTON, MA 02116
PHONE: 617.982.6592

PROJECT NAME:
10-30 MANLEY WAY
WATERTOWN, MA

SEAL:

DESIGNED BY:	BJM/MAC
DRAWN BY:	WJH/MCR
REVIEWED BY:	BJM
SCALE:	1" = 20'
DATE:	05/04/2023

DRAWING NAME:
BMP LOCATION PLAN-1

DRAWING NUMBER:
BMP-1

PROJECT NUMBER:
21049

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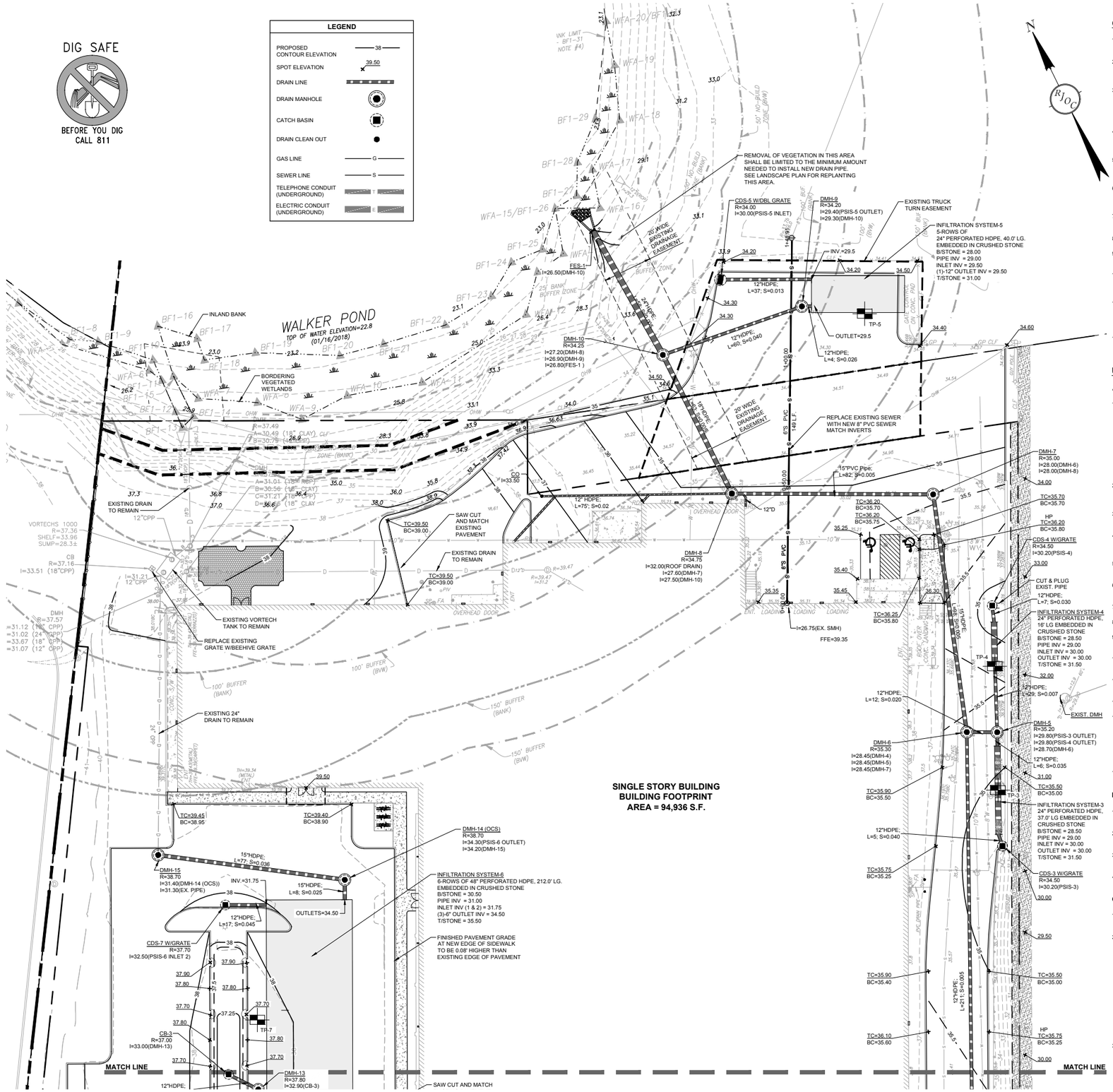
Jul 02, 2024 - 9:46am

DIG SAFE

BEFORE YOU DIG
CALL 811

LEGEND

PROPOSED CONTOUR ELEVATION	38
SPOT ELEVATION	39.50
DRAIN LINE	
DRAIN MANHOLE	
CATCH BASIN	
DRAIN CLEAN OUT	
GAS LINE	G
SEWER LINE	S
TELEPHONE CONDUIT (UNDERGROUND)	T
ELECTRIC CONDUIT (UNDERGROUND)	E



GRADING AND DRAINAGE NOTES:

1. SITE GRADING ACTIVITIES SHALL NOT PROCEED UNTIL APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES HAVE BEEN INSTALLED AND APPROVED BY THE OWNER'S REPRESENTATIVE AND/OR ENGINEER.
2. THE EXISTING UTILITIES SHOWN HEREON SHALL BE CONSIDERED APPROXIMATE. CONTRACTOR SHALL VERIFY VIA TEST PIT EXCAVATION THE LOCATION AND ELEVATION PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND ENGINEER OF DISCREPANCIES ENCOUNTERED IN THE FIELD.
3. ALL PROPOSED STORM DRAINAGE PIPES SHALL BE HIGH DENSITY POLYETHYLENE PIPE (HDPE) AND STRUCTURES SHALL BE PRECAST CONCRETE UNLESS NOTED OTHERWISE. HIGH DENSITY POLYETHYLENE PIPE (HDPE) SHALL CONFORM TO AASHTO DESIGNATIONS M294 AND M252, AND SHALL BE N-12 PIPE AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS (ADS) OR APPROVED EQUAL. PIPE JOINTS SHALL BE INTEGRAL BELL AND SPIGOT, SOIL TIGHT (ST) WITH FACTORY INSTALLED, O-RING RUBBER GASKETS CONFORMING TO ASTM F477.
4. ALL CATCH BASINS AND OTHER DRAINAGE STRUCTURES TO BE INSTALLED SHALL CONFORM TO CURRENT MASSACHUSETTS HIGHWAY DEPARTMENT STANDARDS AS PUBLISHED BY MassDOT. ALL NEW CATCH BASINS SHALL BE EQUIPPED WITH APPROPRIATELY SIZED "TEE" OR HOODS AND A FOUR (4') FOOT SUMP.
5. ALL MANHOLES, CATCH BASINS AND PARTICLE SEPARATORS SHALL BE PUMPED "DRY" AND CLEANED AT THE END OF CONSTRUCTION. SEDIMENT AND OTHER POLLUTANTS SHALL BE REMOVED OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
6. EXISTING PIPES AND/OR CULVERTS THAT ARE TO REMAIN WITHIN THE LIMIT OF WORK AREA SHALL BE CLEANED OF ANY DEBRIS AND/OR SEDIMENTATION. SEDIMENTATION AND OTHER POLLUTANTS SHALL BE REMOVED OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
7. ALL PROPOSED DRAINAGE STRUCTURES AND PIPES SHALL MEET HEAVY-DUTY TRAFFIC (H20) LOADING AND BE INSTALLED IN ACCORDANCE WITH MassDOT AND/OR DPW SPECIFICATIONS.
8. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY EARTH MOVING ACTIVITIES.
9. THE CONTRACTOR SHALL KEEP ON-SITE, AT ALL TIMES, ADDITIONAL SILTATION FENCING AND FILTER FABRIC FOR INSTALLATION AS DIRECTED BY THE TOWN TO MITIGATE ANY EMERGENCY CONDITIONS.
10. THE ENGINEER-OF-RECORD SHALL WITNESS INSTALLATION OF ANY SUB-SURFACE INFILTRATION SYSTEM. IF SUB-SURFACE SOIL CONDITIONS DIFFER FROM THAT SHOWN ON THE PLAN, THE DESIGN SHALL BE MODIFIED AND RESUBMITTED TO THE CITY FOR APPROVAL PRIOR TO CONTINUING INSTALLATION.
11. BOTTOM OF BED INSPECTIONS ARE REQUIRED FOR ALL STORMWATER MANAGEMENT INFILTRATION BEST MANAGEMENT PRACTICES (BMPs). BED INSPECTIONS SHALL BE PERFORMED ONCE THE EXCAVATION HAS BEEN PERFORMED AND THE PIT IS AT DESIGN GRADE. NO STONE SHALL BE INSTALLED PRIOR TO BED INSPECTIONS. CONTACT DPW FOR A BED INSPECTION AT LEAST 24 HOURS PRIOR TO ANTICIPATED EXCAVATION.
12. PIPE CONNECTION INSPECTIONS ARE REQUIRED FOR ALL PIPE CONNECTIONS TO INFILTRATIVE BMPs. SYSTEMS SHALL NOT BE BACKFILLED UNTIL A PIPE CONNECTION INSPECTION HAS OCCURRED. PLEASE CONTACT DPW AT LEAST 24 HOURS PRIOR TO THE ANTICIPATED PIPE CONNECTION INSPECTION.

UTILITY NOTES:

A. GENERAL NOTES

1. THE CONTRACTOR IS SPECIFICALLY ADVISED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES ESPECIALLY WHERE NEW UTILITIES CONNECT TO OR CROSS EXISTING, SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIG SAFE" (1-888-344-7233 OR 811) AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. THE CONTRACTOR IS HEREBY NOTIFIED THAT SOME PUBLIC AND PRIVATE UTILITY COMPANIES ARE NOT PART OF DIGSAFE AND MAY HAVE ADDITIONAL NOTIFICATION REQUIREMENTS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
2. ANY WORK AND MATERIAL TO BE PLACED WITHIN THE CITY RIGHT-OF-WAY, SHALL CONFORM TO THE CITY OF WATERTOWN'S DEPARTMENT OF PUBLIC WORKS REQUIREMENTS. THE CONTRACTOR SHALL OBTAIN A STREET OPENING PERMIT PRIOR TO ANY CONSTRUCTION WITHIN THE TOWN RIGHT-OF-WAY.
3. ANY DAMAGE INCURRED WITHIN THE CITY RIGHT-OF-WAY, AS A DIRECT OR INDIRECT RESULT OF CONTRACTOR'S OPERATIONS, SHALL BE REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY OF WATERTOWN.
4. PRIOR TO THE START OF ANY AUTHORIZED ACTIVITY THE SITE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FROM THE CITY OF WATERTOWN. THE CONTRACTOR SHALL OBTAIN FINAL CERTIFICATIONS AND/OR SIGN OFFS UPON MUNICIPALITY AND/OR UTILITY PROVIDER ACCEPTANCE OF WORK WITH COPIES OF FINAL ACCEPTANCE DOCUMENTATION PROVIDED TO THE OWNER.
5. THE SITE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL PERMITS AND/OR CONNECTION FEES REQUIRED FOR THE INSTALLATION OF ALL SITE UTILITIES.
6. ALL UTILITIES, PIPE MATERIALS, STRUCTURES, AND INSTALLATION METHODS, SHALL CONFORM TO THE WATERTOWN DPW/ENGINEERING DEPARTMENT STANDARDS AND REQUIREMENTS. UNLESS OTHERWISE NOTED OR DETAILED.
7. UTILITY CONTRACTOR MUST BE LICENSED TO PERFORM WORK IN THE MUNICIPALITY.
8. ALL REQUIRED UTILITY CROSSING ENCASEMENTS (CONCRETE) SHALL EXTEND TEN FEET (10') FROM EITHER SIDE OF THE CROSSING.
9. EXISTING STRUCTURES, LIGHT POLE BASES, CONDUIT AND FIXTURES TO BE REMOVED ARE TO BE DISPOSED OF OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
10. EXISTING UTILITY CASTINGS INDICATED TO REMAIN SHALL BE RESET TO FINISHED GRADE AS REQUIRED AND SHOWN ON GRADING AND DRAINAGE PLAN.
11. DETECTABLE WARNING TAPE SHALL BE INSTALLED A MINIMUM ONE (1') FOOT ABOVE THE UTILITY IN ACCORDANCE WITH THE APPROPRIATE UTILITY COMPANY'S REQUIREMENTS.
12. FLOWABLE FILL REQUIRED AS BACKFILL IN THE PUBLIC WAY.
13. UPON COMPLETION OF THE WORK, AS-BUILT DRAWINGS SHALL BE SUBMITTED IN BOTH PAPER AND ELECTRONIC FORMAT. THE DRAWINGS SHALL BE BASED UPON A FIELD SURVEY AND ACTUAL AS-BUILT LOCATIONS, AND SHALL BE STAMPED BY A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS. THE AS-BUILT DRAWING SHALL DEPICT ALL BUILDINGS, PAVED SURFACES, TOPOGRAPHY, AND MAJOR LANDSCAPE FEATURES. WATER, SEWER, AND DRAINAGE FEATURES, AS WELL AS OTHER UNDERGROUND UTILITIES INSTALLED BY OTHERS, SHALL BE LOCATED ON THE PLAN, INCLUDING SIZE AND MATERIAL. ALL STORMWATER MANAGEMENT CONTROLS, BOTH STRUCTURAL AND NON-STRUCTURAL, DESIGNED TO MANAGE THE STORMWATER ASSOCIATED WITH THE COMPLETED SITE SHALL ALSO BE INCLUDED.
14. USE OF FIRE HYDRANTS FOR DEMOLITION OR CONSTRUCTION IS NOT PERMITTED UNLESS APPROVED BEFOREHAND BY THE DEPARTMENT OF PUBLIC WORKS.

B. SEWER NOTES

1. ALL GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE PIPE (P.V.C.), S.D.R. 35 AND SHALL CONFORM WITH ASTM-D3034 UNLESS NOTED OTHERWISE.
2. ALL SEWER MAIN APPURTENANCES, MATERIALS, METHODS OF INSTALLATION AND TESTING REQUIREMENTS SHALL MEET OR EXCEED THE MUNICIPALITY'S SEWER DEPARTMENT'S STANDARDS.
3. DETECTABLE WARNING TAPE TO BE INSTALLED A MINIMUM ONE (1') FOOT ABOVE SEWER MAIN AND IN ACCORDANCE WITH THE MUNICIPALITY'S SEWER DEPARTMENT'S REQUIREMENTS.
4. ALL NEW SEWER MAINS AND ASSOCIATED MANHOLES SHALL BE TESTED FOR WATER TIGHTNESS IN THE PRESENCE OF THE AUTHORITY HAVING JURISDICTION.

C. GAS NOTES

1. CONTRACTOR IS RESPONSIBLE FOR THE LAYOUT, EXCAVATION AND BACKFILLING OF GAS MAIN TRENCH. EXCAVATION AND BACKFILLING REQUIREMENTS SHALL BE PERFORMED IN ACCORDANCE WITH THE GAS COMPANY REQUIREMENTS.
2. THE GAS TRENCH SHALL BE LAID OUT SO AS TO PROVIDE A MINIMUM OFFSET OF THIRTY-SIX (36) INCHES FROM OTHER UTILITIES. NO TRENCHING SHALL BE STARTED UNTIL AN ON-SITE MEETING HAS BEEN HELD BETWEEN THE EXCAVATING CONTRACTOR AND NATIONAL GRID PERSONNEL. PRIOR TO THE MEETING, THE EXCAVATING CONTRACTOR MUST NOTIFY DIG SAFE OF THE PROPOSED WORK. THE FOLLOWING SHALL BE CONFIRMED AT THE MEETING:
   A. THE EXCAVATING CONTRACTOR MUST PAD THE TRENCH BOTTOM WITH SIX (6) INCHES OF SAND AND MUST PROVIDE SAND SUFFICIENT TO PROVIDE A MINIMUM OF (6) INCHES OF COVER ABOVE THE GAS PIPE.
   B. THE ROUTE OF THE TRENCH.
   C. MINIMUM FOOTAGE OF THE TRENCH TO BE OPENED BEFORE NATIONAL GRID MOBILIZES CREWS TO START INSTALLING THE GAS PIPE.
   D. MINIMUM TWO (2) WEEK NOTICE REQUIRED FOR NATIONAL GRID TO START INSTALLING PIPE.
3. ASPHALT PATCHES SHALL HAVE A MINIMUM DEPTH OF 5-INCHES, OR MATCH EXISTING ROAD DEPTH.

20 0 10 20 40
GRAPHIC SCALE IN FEET

NO.	DATE	REVISION
5	07/02/2024	REVISED PER CONSERVATION COMMISSION COMMENTS
4	03/19/2024	REVISED PER ENGINEERING COMMENTS
3	06/30/2023	ISSUED FOR SITE PLAN REVIEW
2	06/14/2023	REVISED PER DPW COMMENTS
1	05/04/2023	ISSUED FOR SPECIAL PERMIT/SITE PLAN REVIEW

RJOC

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PREPARED FOR:
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c/o SEYON
535 BOYLSTON STREET, 11TH FLOOR
BOSTON, MA 02116
PHONE: 617.982.6592

PROJECT NAME:
10-30 MANLEY WAY
WATERTOWN, MA

SEAL:

DESIGNED BY:	BJM/MAC
DRAWN BY:	WJH/MCR
REVIEWED BY:	BJM
SCALE:	1" = 20'
DATE:	05/04/2023

DRAWING NAME:
BMP LOCATION PLAN-1

DRAWING NUMBER:
BMP-2

PROJECT NUMBER:
21049

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Jul 02, 2024 - 9:49am

RJOC

WALKER POND

25' BANK BUFFER ZONE

50' NO-BUILD ZONE (BANK)

25' BUFFER ZONE (BVW)

50' NO-BUILD ZONE (BVW)

25' BANK BUFFER ZONE

25' BUFFER ZONE (BVW)

50' NO-BUILD ZONE (BANK)

50' NO-BUILD ZONE (BVW)

100' BUFFER (BANK)

100' BUFFER (BVW)

150' BUFFER (BANK)

150' BUFFER (BVW)

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

SNOW STORAGE AREA

CITY LINE

CITY OF WATERTOWN

CITY OF NEWTON

ONE-WAY

ONLY

STOP

DO NOT ENTER

CRW

PLEASANT STREET

60 0 30 60 120

GRAPHIC SCALE IN FEET

RJO'CONNELL
& ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 07/02/2024 SCALE: 1" = 60'

SNOW STORAGE PLAN

10-30 MANLEY WAY
WATERTOWN, MA

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Drawing name: G:\MA\Watertown\Seyon Group\20 Seyon Street\Reports\O & M Plan\Snow Storage\21049 Snow Storage.dwg
Jul 02, 2024 - 9:51am

Appendix C

CDS Treatment Unit O&M Guidelines

OPERATIONS AND MAINTENANCE GUIDELINES

CDS Stormwater Treatment Unit

INTRODUCTION

The CDS unit is an important and effective component of your storm water management program and proper operation and maintenance of the unit are essential to demonstrate your compliance with local, state and federal water pollution control requirements.

The CDS technology features a patented non-blocking, indirect screening technique developed in Australia to treat water runoff. The unit is highly effective in the capture of suspended solids, fine sands and larger particles. Because of its non-blocking screening capacity, the CDS unit is un-matched in its ability to capture and retain gross pollutants such as trash and debris. In short, CDS units capture a very wide range of organic and in-organic solids and pollutants that typically result in tons of captured solids each year such as: Total suspended solids (TSS) and other sedimentitious materials, oil and greases, trash, and other debris (including floatables, neutrally buoyant, and negatively buoyant debris). These pollutants will be captured even under very high flow rate conditions.

CDS units are equipped with conventional oil baffles to capture and retain oil and grease. Laboratory evaluations show that the CDS units are capable of capturing up to 70% of the free oil and grease from storm water. CDS units can also accommodate the addition of oil sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff.

OPERATIONS

The CDS unit is a non-mechanical self-operating system and will function any time there is flow in the storm drainage system. The unit will continue to effectively capture pollutants in flows up to the design capacity even during extreme rainfall events when the design capacity may be exceeded. Pollutants captured in the CDS unit's separation chamber and sump will be retained even when the units design capacity is exceeded.

CDS UNIT INSPECTION

Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection (and clean out) of the separation chamber (screen/cylinder) & sump and another allows inspection (and cleanout) of sediment captured and retained behind the screen.

The unit should be periodically inspected to determine the amount of accumulated pollutants and to ensure that the cleanout frequency is adequate to handle the predicted pollutant load being processed by the CDS unit. The unit should be periodically inspected for indications of vector infestation, as well. The recommended cleanout of

solids within the CDS unit's sump should occur at 75% to 85% of the sump capacity. However, the sump may be completely full with no impact to the CDS unit's performance.

CONTECH Stormwater Solutions (previously CDS Technologies) recommends the following inspection guidelines: For new initial operation, check the condition of the unit after every runoff event for the first 30 days. For ongoing operations, the unit should be inspected after the first six inches of rainfall at the beginning of the rainfall season and at approximately 30-day intervals. The visual inspection should ascertain that the unit is functioning properly (no blockages or obstructions to inlet and/or separation screen), evidence of vector infestation, and to measure the amount of solid materials that have accumulated in the sump, fine sediment accumulated behind the screen, and floating trash and debris in the separation chamber. This can be done with a calibrated dipstick, tape measure or other measuring instrument so that the depth of deposition in the sump can be tracked.

CDS UNIT CLEANOUT

The frequency of cleaning the CDS unit will depend upon the generation of trash and debris and sediments in your application. Cleanout and preventive maintenance schedules will be determined based on operating experience unless precise pollutant loadings have been determined.

Access to the CDS unit is typically achieved through two manhole access covers – one allows cleanout of the separation chamber (screen/cylinder) & sump and another allows cleanout of sediment captured and retained behind the screen. For units possessing a sizable depth below grade (depth to pipe), a single manhole access point would allow both sump cleanout and access behind the screen.

CONTECH Stormwater Solutions Recommends The Following:

NEW INSTALLATIONS: Check the condition of the unit after every runoff event for the first 30 days. The visual inspection should ascertain that the unit is functioning properly (no blockages or obstructions to inlet and/or separation screen), measuring the amount of solid materials that have accumulated in the sump, the amount of fine sediment accumulated behind the screen, and determining the amount of floating trash and debris in the separation chamber. This can be done with a calibrated "dip stick" so that the depth of deposition can be tracked. Refer to the "Cleanout Schematic" **(Appendix B) f**or allowable deposition depths and critical distances. Schedules for inspections and cleanout should be based on storm events and pollutant accumulation.

ONGOING OPERATION: During the rainfall season, the unit should be inspected at least once every 30 days. The floatables should be removed and the sump cleaned when the sump is 75-85% full. If floatables accumulate more rapidly than the settleable solids, the floatables should be removed using a vactor truck or dip net before the layer thickness exceeds approximately one foot.

Cleanout of the CDS unit at the end of a rainfall season is recommended because of the nature of pollutants collected and the potential for odor generation

from the decomposition of material collected and retained. This end of season cleanout will assist in preventing the discharge of pore water from the CDS ® unit during summer months.

USE OF SORBENTS –The addition of sorbents is **not a requirement** for CDS units to effectively control oil and grease from storm water. The conventional oil baffle within a unit assures satisfactory oil and grease removal. However, the addition of sorbents is a unique enhancement capability unique to CDS units, enabling increased oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems.

Under normal operations, CDS units will provide effluent concentrations of oil and grease that are less than 15 parts per million (ppm) for all dry weather spills where the volume is less than or equal to the spill capture volume of the CDS unit. During wet weather flows, the oil baffle system can be expected to remove between 40 and 70% of the free oil and grease from the storm water runoff.

CONTECH Stormwater Solutions only recommends the addition of sorbents to the separation chamber if there are specific land use activities in the catchment watershed that could produce exceptionally large concentrations of oil and grease in the runoff, concentration levels well above typical amounts. If site evaluations merit an increased control of free oil and grease then oil sorbents can be added to the CDS unit to thoroughly address these particular pollutants of concern.

Recommended Oil Sorbents

Rubberizer® Particulate 8-4 mesh or OARS ™ Particulate for Filtration, HPT4100 or equal. Rubberizer is supplied by Haz-Mat Response Technologies, Inc. 4626 Santa Fe Street, San Diego, CA 92109 (800) 542-3036. OARS is supplied by AbTech Industries, 4110 N. Scottsdale Road, Suite 235, Scottsdale, AZ 85251 (800) 545-8999.

The amount of sorbent to be added to the CDS separation chamber can be determined if sufficient information is known about the concentration of oil and grease in the runoff. Frequently the actual concentrations of oil and grease are too variable and the amount to be added and frequency of cleaning will be determined by periodic observation of the sorbent. As an initial application, CDS recommends that approximately 4 to 8 pounds of sorbent material be added to the separation chamber of the CDS units per acre of parking lot or road surface per year. Typically this amount of sorbent results in a ½ inch to one (1") inch depth of sorbent material on the liquid surface of the separation chamber. The oil and grease loading of the sorbent material should be observed after major storm events. Oil Sorbent material may also be furnished in pillow or boom configurations.

The sorbent material should be replaced when it is fully discolored by skimming the sorbent from the surface. The sorbent may require disposal as a special or hazardous waste, but will depend on local and state regulatory requirements.

CLEANOUT AND DISPOSAL

A vactor truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30-40 minutes for most installations. Standard vactor operations should be employed in the cleanout of the CDS unit. Disposal of material from the CDS unit should be in accordance with the local municipality's requirements. Disposal of the decant material to a POTW is recommended. Field decanting to the storm drainage system is not recommended. Solids can be disposed of in a similar fashion as those materials collected from street sweeping operations and catch-basin cleanouts.

MAINTENANCE

The CDS unit should be pumped down at least once a year and a thorough inspection of the separation chamber (inlet/cylinder and separation screen) and oil baffle performed. The unit's internal components should not show any signs of damage or any loosening of the bolts used to fasten the various components to the manhole structure and to each other. Ideally, the screen should be power washed for the inspection. If any of the internal components is damaged or if any fasteners appear to be damaged or missing, please contact CONTECH at 800.338.2211 to make arrangements to have the damaged items repaired or replaced.

The screen assembly is fabricated from Type 316 stainless steel and fastened with Type 316 stainless steel fasteners that are easily removed and/or replaced with conventional hand tools. The damaged screen assembly should be replaced with the new screen assembly placed in the same orientation as the one that was removed.

CONFINED SPACE

The CDS unit is a confined space environment and only properly trained personnel possessing the necessary safety equipment should enter the unit to perform particular maintenance and/or inspection activities beyond normal procedure. Inspections of the internal components can, in most cases, be accomplished by observations from the ground surface.

VECTOR CONTROL

Most CDS units do not readily facilitate vector infestation. However, for CDS units that may experience extended periods of non-operation (stagnant flow conditions for more than approximately one week) there may be the potential for vector infestation. In the event that these conditions exist, the CDS unit may be designed to minimize potential vector habitation through the use of physical barriers (such as seals, plugs and/or netting) to seal out potential vectors. The CDS unit may also be configured to allow drain-down under favorable soil conditions where infiltration of storm water runoff is permissible. For standard CDS units that show evidence of mosquito infestation, the

application of larvicide is one control strategy that is recommended. Typical larvicide applications are as follows:

SOLID B.t.i. LARVICIDE: ½ to 1 briquet (typically treats 50-100 sq. ft.) one time per month (30-days) or as directed by manufacturer.

SOLID METHOPRENE LARVICIDE (not recommended for some locations): ½ to 1 briquet (typically treats 50-100 sq. ft.) one time per month (30-days) to once every 4-½ to 5-months (150-days) or as directed by manufacturer.

RECORDS OF OPERATION AND MAINTENANCE

CONTECH Stormwater Solutions recommends that the owner maintain annual records of the operation and maintenance of the CDS unit to document the effective maintenance of this important component of your storm water management program. The attached **Annual Record of Operations and Maintenance** form (see **Appendix A**) is suggested and should be retained for a minimum period of three years.

APPENDIX A

ANNUAL RECORDS OF OPERATIONS & MAINTENANCE AND INSPECTION CHECKLISTS

ANNUAL RECORD OF
OPERATION AND MAINTENANCE

OWNER _____
ADDRESS_____
OWNER REPRESENTATIVE_____**PHONE**_____

INSTALLATION:
MODEL DESIGNATION_____ **DATE** _____
SITE LOCATION_____

INSPECTIONS:

DATE/ INSPECTOR	SCREEN/INLET INTEGRITY	FLOATABLES DEPTH	DEPTH TO SEDIMENT (inches)	SEDIMENT VOLUME* (CUYDS)	SORBENT DISCOLORATION

DEPTH FROM COVER TO BOTTOM OF SUMP (SUMP INVERT) _____

DEPTH FROM COVER TO SUMP @ 75% FULL _____

VOLUME OF SUMP @ 75% FULL =_____**CUYD**

VOLUME/INCH DEPTH _____**CUFT/IN OF SUMP**

VOLUME/FOOT DEPTH_____**CUYD/FT OF SUMP**

***Calculate Sediment Volume = (Depth to Sump Invert – Depth to Sediment)*(Volume/inch)**
OBSERVATIONS OF FUNCTION: _____
_____
_____

CLEANOUT:

DATE	VOLUME FLOATABLES	VOLUME SEDIMENTS	METHOD OF DISPOSAL OF FLOATABLES, SEDIMENTS, DECANT AND SORBENTS

OBSERVATIONS:
_____
_____
_____
_____

SCREEN MAINTENANCE:
DATE OF POWER WASHING, INSPECTION AND OBSERVATIONS:
_____
_____

CERTIFICATION:_____ **TITLE:**_____ **DATE:**_____

INSPECTION CHECKLIST

1. During the rainfall season, inspect and check condition of unit at east once every 30 days ☐
2. Ascertain that the unit is funcioning properly (no blockages or obstructions to inlet and/or separation screen) ☐
3. Measure amount of solid material s that have accumulated in the sump (Unit should be cleaned when the sump is 75-85% full) ☐
4. Measure amount of fine sediment accumulated behind the screen ☐
5. Measure amount of floating trash and debris in the separation chamber ☐

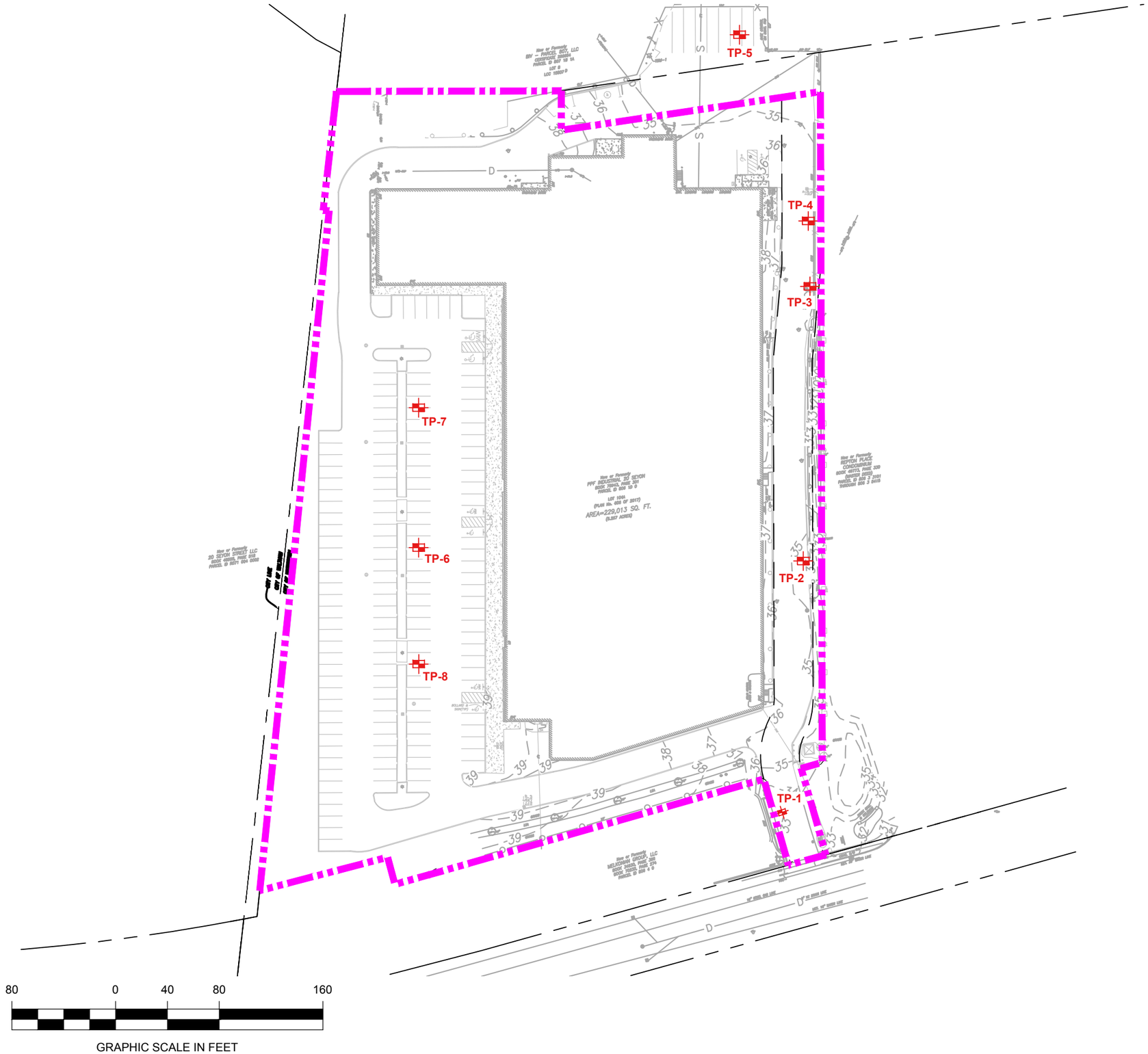
MAINTENANCE CHECKLIST

1. Cleanout unit at the end and beginning of the rainfall season ☐
2. Pump down unit (at least once a year) and thoroughly inspect separation chamber, separation screen and oil baffle ☐
3. No visible signs of damage or loosening of bolts to internal components observed * ☐

*** If there is any damage to the internal components or any fasteners are damaged or missing please contact CONTECH (800.338.1122).**

V. APPENDIX

APPENDIX A -
SOILS DATA



RJOC

Drawing name: G:\MA\Watertown\Seyon Group\20 Seyon Street\Reports\Stormwater Report\Figures\21049_FIG-5 Test Pit Figure.dwg
Jul 01, 2024 - 10:14am

RJO'CONNELL
& ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 03/19/2024 SCALE: 1"=80'
DATE: 07/02/2024

FIGURE 5
TEST PIT LOCATION MAP

20 SEYON STREET
WATERTOWN, MA 02472

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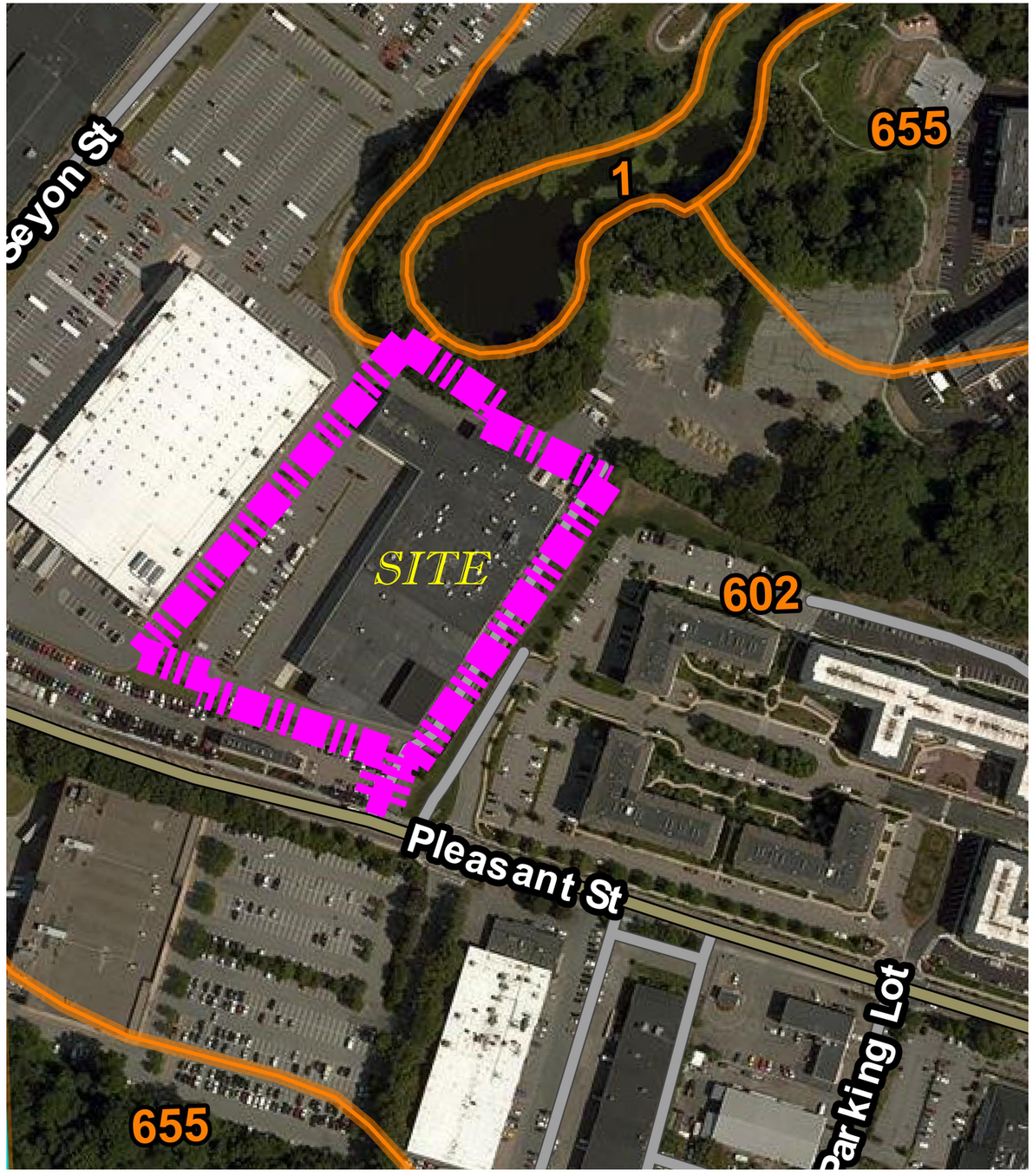
NRCS SOIL MAP LEGEND	
MAP UNIT SYMBOL	MAP UNIT NAME
1	WATER
655	UDORTHENTS, WET SUBSTRATUM
602	URBAN LAND



RJOC

N

200 0 100 200 400

GRAPHIC SCALE IN FEET

RJO'CONNELL
& ASSOCIATES, INC.
CIVIL ENGINEERS, SURVEYORS & LAND PLANNERS

DATE: 03/19/2024 SCALE: 1"=200'
DATE: 07/02/2024

FIGURE 6
NRCS WEB SOIL SURVEY MAP

20 SEYON STREET
WATERTOWN, MA 02472

Copyright © 2023 by R.J. O'Connell & Associates, Inc.

Drawing name: G:\MA\Watertown\Seyon Group\20 Seyon Street\Reports\Stormwater Report\Figures\21049_FIG-6 NRCS Soil Map.dwg
Jul 01, 2024 - 10:15am

Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	33.5+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-01	HTM	0-66"	28+/-	Crushed stone with gravel fill

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-66"	A	HTM									
66"-72"	B	SL									
72"-120"	C	G. Sand	2.5Y5/6				V	20-30%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	34.8+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-02	HTM	0-90"	27.3+/-	Urban fill with construction debris

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-90"	A	HTM									
90"-120"	C	G. Sand	2.5Y5/6				V	20-30%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	35.2+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-03	HTM	0-100"	26.9+/-	Urban fill with construction debris

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-100"	A	HTM									
100"-120"	C	G. Sand	2.5Y5/6				V	20-30%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	35.3+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-04	HTM	0-102"	26.8+/-	Urban fill with construction debris

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-102"	A	HTM									
102"-114"	C	G. Sand	2.5Y5/6				V	20-30%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	34.0+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-05	HTM	0-18"	32.5+/-	Urban fill

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-18"	A	HTM									
18-30"	B	LS									
30-108"	C	Sand	2.5Y5/6				V	30%+	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	38.0+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-06	HTM	0-32"	35.3+/-	Urban fill

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-32"	A	HTM									
32-52"	B	LS									
52-108"	C	Sand	2.5Y4/4				V	10-15%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	38.0+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-07	HTM	0-24"	36.0+/-	Urban fill

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-24"	A	HTM									
24-49"	B	LS									
49-114"	C	Sand	2.5Y4/4				V	10-15%	Loose		

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Test Pit Log

Project	10-30 Manley Way	Job Number	21049
Location	10-30 Manley Way	Date	2/8/2023
City, State	Watertown, MA	Weather	Sunny; 30 Degrees
Property Owner	The Seyon Group	Lat., Long.	

Contractor		Groundwater Observations			
Excavator	Jeff Anderson	Observed	Depth	Elevation	Notes
Logged by	Michael Capachietti (SE# 13939)	None			No Mottles or Standing Water observed
Reviewed by		Unsuitable Materials Present			
Surface Elevation	38.0+/-	Observed	Depth	Elevation	Notes
Test Pit ID	TP-08	HTM	0-20"	36.3+/-	Urban fill

				Redoximophic Features			Coarse Fragments % B.V.				
Depth	Soil Horizon	Soil Texture	Soil Matrix	Depth	Color	%	Gravel	Cobbles & Stones	Soil Structure	Soil Consistence	Other
0-4"		PVMT									
4-20"	A	HTM									
20-49"	B	LS									
49-108"	C	Sand	2.5Y4/4				V	10-15%	Loose		

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June 18, 2024

Ref: 15374.00

Leo G. Martin, Chair
Watertown Conservation Commission
149 Main Street
Watertown, MA 02472

Re: 480-550 Arsenal Street NOI

Dear Chairperson Martin,

On behalf of the Applicants, ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, and ARE-MA REGION NO. 90, LLC, Vanasse Hangen Brustlin, Inc. (VHB) respectfully submits the enclosed Notice of Intent (NOI) to redevelop three parcels of land that total 31.4 acres and are located at 480 Arsenal Way (Property ID: 1214 1F 1), 500 Arsenal Street (Property ID: 1234 1A 0), and 550 Arsenal Street (Property ID: 1234 2 0) in Watertown, Massachusetts. This Notice of Intent is filed pursuant to the Town of Watertown Wetlands Ordinance. Onsite and adjacent offsite wetland resources which are subject to the jurisdiction of the WPA and/or the Ordinance include Bordering Vegetated Wetlands (BVW), Riverfront Area (RA), and inland Bank. The WPA also establishes a 100-foot buffer zone from BVW. The Ordinance establishes a 50-foot No-Build Zone (NBZ) and a 150-foot buffer from BVW and Isolated Vegetated Wetland (IVW). The Project will not result in temporary or permanent impacts to BVW, IVW, or the 200-foot RA.

A copy of the abutter notification form is enclosed as part of the NOI. As required under the Ordinance, the following documents are included as part of this application: a WPA Form 3 and associated NOI Wetland Fee Transmittal Form, a Checklist for Filing a Notice of Intent, a Watertown Wetlands Ordinance Application Form, a Town of Watertown Fee Calculation Worksheet, and copies of the filing fee checks.

As required, a check made payable to the Commonwealth of Massachusetts in the amount $237.50 has been sent directly to the DEP Lock Box for payment of the state's share of this filing fee. Two checks made payable to the City of Watertown in the amount of $262.50 (municipal share of the WPA fee) and in the amount of $1,000 (Ordinance fee) are enclosed.

We respectfully request that the Commission place this matter on the next available meeting agenda. If you have any questions concerning this submittal or need additional information, please contact me at your convenience at 617-607-6310 or by email at tdonovan@vhb.com.

Engineers | Scientists | Planners | Designers

101 Walnut Street
PO Box 9151
Watertown, Massachusetts 02471
P 617.924.1770
F 617.924.2286

Sincerely,

Taylor Donovan

Taylor Donovan

Environmental Scientist
Vanasse Hangen Brustlin,
Inc.

CC: DEP – NERO

NOTICE OF INTENT

480-550 Arsenal Street

Watertown, MA

PREPARED FOR

ALEXANDRIA®

ARE-500 ARSENAL STREET, LLC
ARE-480 ARSENAL STREET, LLC
ARE-MA REGION NO. 90, LLC
26 North Euclid Avenue
Pasadena, CA 91101

PREPARED BY

vhb

260 Arsenal Place #2
PO Box 9151
Watertown, MA 02471
617.924.1770

June 2024

Table of Contents

NOI Forms

~~WPA Form 3~~
NOI Wetland Fee Transmittal Form
Checklist for Filing a Notice of Intent
Watertown Wetlands Ordinance Application Form
Town of Watertown Fee Calculation Worksheet
Copies of Filing Fee Checks

NOI Figures

Figure 1 – USGS Locus Map
Figure 2 – Aerial Map
Figure 3 – NHESP Map
Figure 4 – FEMA FIRM Map

Attachment A – NOI Narrative

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150-foot Buffer Zone 5

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150-foot Buffer Zone 7

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~~Attachment B – Abutter Information~~

~~Attachment C – Stormwater Report (Bound Separately)~~

~~Attachment D – Project Plans (Bound Separately)~~

Notice of Intent Forms

- ~~WPA Form 3~~
- NOI Wetland Fee Transmittal Form
- Checklist for Filing a Notice of Intent
- Watertown Wetlands Ordinance Application Form
- Town of Watertown Fee Calculation Worksheet
- Copies of Filing Fee Checks

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1525727
City/Town:WATERTOWN

A.General Information

1. Project Location:

a. Street Address	480, 500, & 550 ARSENAL STREET		
b. City/Town	WATERTOWN	c. Zip Code	02472
d. Latitude	42.36437N	e. Longitude	71.15852W
f. Map/Plat #	1234; 1234; 1214	g.Parcel/Lot #	1A 0; 2 0; 1F 1

2. Applicant:

☐ Individual ☑ Organization

a. First Name		b.Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f. State	CA	g. Zip Code	91101
h. Phone Number	617-721-7150	i. Fax		j. Email	mlower@are.com

3.Property Owner:

☑ more than one owner

a. First Name		b. Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f.State	CA	g. Zip Code	91101
h. Phone Number	617-721-7150	i. Fax		j.Email	mlower@are.com

4.Representative:

a. First Name	TAYLOR	b. Last Name	DONOVAN		
c. Organization	VHB				
d. Mailing Address	260 ARSENAL PLACE #2				
e. City/Town	WATERTOWN	f. State	MA	g. Zip Code	02472
h.Phone Number	617-607-6310	i.Fax		j.Email	tdonovan@vhb.com

5.Total WPA Fee Paid (Automatically inserted from NOI Wetland Fee Transmittal Form):

a.Total Fee Paid	500.00	b.State Fee Paid	237.50	c.City/Town Fee Paid	262.50

6.General Project Description:

THE PROJECT PROPOSES TO REDEVELOP THE SITE INTO A CAMPUS OF OFFICE, LAB, AND RETAIL USES, INCLUDING A MULTI-STORY PARKING GARAGE AND LANDSCAPE IMPROVEMENTS.

7a.Project Type:

1. ☐ Single Family Home	2. ☐ Residential Subdivision
3. ☐ Limited Project Driveway Crossing	4. ☑ Commercial/Industrial
5. ☐ Dock/Pier	6. ☐ Utilities
7. ☐ Coastal Engineering Structure	8. ☐ Agriculture (eg., cranberries, forestry)
9. ☐ Transportation	10. ☐ Other

7b.Is any portion of the proposed activity eligible to be treated as a limited project subject to 310 CMR 10.24 (coastal) or 310

CMR 10.53 (inland)?

1. ☐ Yes ☑ No If yes, describe which limited project applies to this project:
2. Limited Project

8.Property recorded at the Registry of Deeds for:

a.County:	b.Certificate:	c.Book:	d.Page:
SOUTHERN MIDDLESEX		31703	530
SOUTHERN MIDDLESEX		33088	527
SOUTHERN MIDDLESEX		77574	569

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1.Buffer Zone & Resource Area Impacts (temporary & permanent):

☑ This is a Buffer Zone only project - Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.

2.Inland Resource Areas: (See 310 CMR 10.54 - 10.58, if not applicable, go to Section B.3. Coastal Resource Areas)

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a.☐ Bank	1. linear feet	2. linear feet
b.☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c.☐ Land under Waterbodies and Waterways	1. Square feet	2. square feet
	3. cubic yards dredged	
d.☐ Bordering Land Subject to Flooding	1. square feet	2. square feet
	3. cubic feet of flood storage lost	4. cubic feet replaced
e.☐ Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced

f.☐ Riverfront Area

1. Name of Waterway (if any)

2. Width of Riverfront Area (check one)
☐ 25 ft. - Designated Densely Developed Areas only
☐ 100 ft. - New agricultural projects only
☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project
square feet

4. Proposed Alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3.Coastal Resource Areas: (See 310 CMR 10.25 - 10.35)

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under	Land under the ocean below,
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coatstal Dunes, below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab, crea.
i. ☐ Land Under Salt Ponds	1. square feet	
	2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	
	1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4.Restoration/Enhancement

☐ Restoration/Replacement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please entered the additional amount here.

a. square feet of BVW	b. square feet of Salt Marsh

5.Projects Involves Stream Crossings

☐ Project Involves Streams Crossings

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

a. number of new stream crossings b. number of replacement stream crossings

C. Other Applicable Standards and Requirements

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage of Endangered Species program (NHESP)?

a. ☐ Yes ☑ No

If yes, include proof of mailing or hand delivery of NOI to:
Natural Heritage and Endangered Species
Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

b. Date of map:FROM MAP VIEWER

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18)....

c. Submit Supplemental Information for Endangered Species Review * (Check boxes as they apply)

1.☐ Percentage/acreage of property to be altered:

(a) within Wetland Resource Area percentage/acreage

(b) outside Resource Area percentage/acreage

2.☐ Assessor's Map or right-of-way plan of site

3.☐ Project plans for entire project site, including wetland resource areas and areas outside of wetland jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

a.☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

b.☐ Photographs representative of the site

c.☐ MESA filing fee (fee information available at: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/mesa-fee-schedule.html)
Make check payable to "Natural Heritage & Endangered Species Fund" and **mail to NHESP** at above address

*Projects altering **10 or more acres** of land, also submit:*

d.☐ Vegetation cover type map of site

e.☐ Project plans showing Priority & Estimated Habitat boundaries

d. OR Check One of the following

1.☐ Project is exempt from MESA review. Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/eea/agencies/dfg/dfw/laws-regulations/cmr/321-cmr-1000-massachusetts-endangered-species-act.html#10.14; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2.☐ Separate MESA review ongoing.

a. NHESP Tracking Number

b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review...

2. For coastal projects only, is any portion of the proposed project located below the mean high waterline or in a fish run?
a. ☑ Not applicable - project is in inland resource area only
b. ☐ Yes ☐ No

If yes, include proof of mailing or hand delivery of NOI to either:

South Shore - Cohasset to Rhode Island, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 S. Rodney French Blvd
New Bedford, MA 02744

North Shore - Hull to New Hampshire:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930

If yes, it may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional office.

3. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

a. ☐ Yes ☑ No

If yes, provide name of ACEC (see instructions to WPA Form 3 or DEP Website for ACEC locations). **Note:** electronic filers click on Website.

b. ACEC Name

4. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
a. ☐ Yes ☑ No

5. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L.c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L.c. 130, § 105)?
a. ☐ Yes ☑ No

6. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
a. ☑ Yes, Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol.2, Chapter 3)
2. ☑ A portion of the site constitutes redevelopment
3. ☐ Proprietary BMPs are included in the Stormwater Management System

b. ☐ No, Explain why the project is exempt:

1. ☐ Single Family Home

2. ☐ Emergency Road Repair

3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department by regular mail delivery.

1. USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the ☑ Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2. Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland ☑ [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.
3. Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s). ☐ Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.
4. List the titles and dates for all plans and other materials submitted with this NOI. ☑

a. Plan Title:	b. Plan Prepared By:	c. Plan Signed/Stamped By:	c. Revised Final Date:	e. Scale:
WATERTOWN MALL TRANSFORMATION	VANESSA GUZMAN TANG	CONOR NAGLE	6/7/24	1" = 50'

5. If there is more than one property owner, please attach a list of these property owners not listed on this form. ☑
6. Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed. ☐
7. Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed. ☐
8. Attach NOI Wetland Fee Transmittal Form. ☑
9. Attach Stormwater Report, if needed. ☑

E. Fees

1.
Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

385270	6/12/2024
2. Municipal Check Number	3. Check date
385271	6/12/2024
4. State Check Number	5. Check date
Vanasse Hangen Brustlin, Inc.	
6. Payer name on check: First Name	7. Payer name on check: Last Name

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

See Attached Rider	
1. Signature of Applicant	2. Date
3. Signature of Property Owner(if different)	4. Date
Taylor Donovan	6/17/2024
5. Signature of Representative (if any)	6. Date

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

If the applicant has checked the "yes" box in Section C, Items 1-3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 1 of 2)

480 Arsenal Way, Watertown, MA 02472

ARE-480 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

500 Arsenal Street, Watertown, MA 02472

ARE-500 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 2 of 2)

550 Arsenal Street, Watertown, MA 02472

ARE-MA REGION NO. 90, LLC,
a Delaware limited liability company

By: ARE-San Francisco No. 21, LP,
a California limited partnership,
managing member

By: ARE-San Francisco No. 21 GP, LLC,
a Delaware limited liability company,
general partner

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Wetland FeeTransmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1525727
City/Town:WATERTOWN

A. Applicant Information

1. Applicant:

a. First Name		b.Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f. State	CA	g. Zip Code	91101
h. Phone Number	6177217150	i. Fax		j. Email	mlower@are.com

2.Property Owner:(if different)

a. First Name		b. Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f.State	CA	g. Zip Code	91101
h. Phone Number	6177217150	i. Fax		j.Email	mlower@are.com

3. Project Location:

a. Street Address	480, 500, & 550 ARSENAL STREET	b. City/Town	WATERTOWN

Are you exempted from Fee? ☐ (YOU HAVE SELECTED 'NO')

Note: Fee will be exempted if you are one of the following:

- City/Town/County/District
- Municipal Housing Authority
- Indian Tribe Housing Authority
- MBTA

State agencies are only exempt if the fee is less than $100

B. Fees

Activity Type	Activity Number	Activity Fee	RF Multiplier	Sub Total
J.) ANY OTHER ACTIVITY NOT IN CATEGORY 1,3,4,5 OR 6;	1	500.00		500.00

City/Town share of filling fee	State share of filing fee	Total Project Fee
$262.50	$237.50	$500.00

Additional Property Owners:

ARE-480 ARSENAL STREET, LLC
ARE-MA REGION NO. 90, LLC

26 North Euclid Avenue, Pasadena, CA 91101

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 - Notice of Wetland FeeTransmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:
eDEP Transaction #:1525727
City/Town:WATERTOWN

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a. First Name		b.Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f. State	CA	g. Zip Code	91101
h. Phone Number	6177217150	i. Fax		j. Email	mlower@are.com

2.Property Owner:(if different)

a. First Name		b. Last Name			
c. Organization	ARE-500 ARSENAL STREET, LLC				
d. Mailing Address	26 NORTH EUCLID AVENUE				
e. City/Town	PASADENA	f.State	CA	g. Zip Code	91101
h. Phone Number	6177217150	i. Fax		j.Email	mlower@are.com

3. Project Location:

a. Street Address	480, 500, & 550 ARSENAL STREET	b. City/Town	WATERTOWN

Are you exempted from Fee? ☐ (YOU HAVE SELECTED 'NO')

Note: Fee will be exempted if you are one of the following:

- City/Town/County/District
- Municipal Housing Authority
- Indian Tribe Housing Authority
- MBTA

State agencies are only exempt if the fee is less than $100

B. Fees

Activity Type	Activity Number	Activity Fee	RF Multiplier	Sub Total
J.) ANY OTHER ACTIVITY NOT IN CATEGORY 1,3,4,5 OR 6;	1	500.00		500.00

City/Town share of filling fee	State share of filing fee	Total Project Fee
$262.50	$237.50	$500.00

VANASSE HANGEN BRUSTLIN, INC.
260 ARSENAL PLACE • PO BOX 9151
WATERTOWN, MASSACHUSETTS 02471-9151

CITIZENS BANK
MASSACHUSETTS
5-7017/2110

385270
CHECK DATE

June 12, 2024

Two Hundred Sixty Two and 50/100

AMOUNT

$262.50

City of Watertown
149 Main Street
Watertown, MA 02472

AUTHORIZED SIGNATURE

Security Check features included. Details on back

⑈385270⑈ ⑆211070175⑆ 113016137⑆

VANASSE HANGEN BRUSTLIN, INC.
260 ARSENAL PLACE • PO BOX 9151
WATERTOWN, MASSACHUSETTS 02471-9151

CITIZENS BANK
MASSACHUSETTS
5-7017/2110

385271
CHECK DATE

June 12, 2024

Two Hundred Thirty Seven and 50/100

AMOUNT

$237.50

Commonwealth of Massachusetts
DEP-Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

AUTHORIZED SIGNATURE

Security Check features included. Details on back

⑈385271⑈ ⑆211070175⑆ 113016137⑆

City of Watertown

Administration Building
149 Main Street
Watertown, Massachusetts 02472

Conservation Commission

Tel: (617) 972-6426 • Fax: (617) 972-6484

Katherine Swan, Conservation Agent, kswan@watertown-ma.gov
Susan Jenness, Clerk sjenness@watertown-ma.gov

CHECKLIST FOR FILING A NOTICE OF INTENT (NOI)
OR A REQUEST FOR DETERMINATION OF APPLICABILITY (RDA) OR OTHER WETLANDS PERMIT

Prior to submitting the NOI* or *Other Wetlands Permit:

☒ Let the Conservation Commission office know of your intention to file a NOI or RDA or Other Wetlands permit. You may contact us at (617) 972-6426 or through e-mail Susan Jenness, Conservation Clerk, sjenness@watertown-ma.gov.

☒ Complete the NOI Form or Other Wetlands Forms including all supplemental information.
Note: *A complete NOI or Other Wetland Permit includes Fee Transmittal Form, Filing Fee Calculation Worksheet, as well as all other relevant material.*

or

☐ Complete the RDA Form including relevant supporting data and plans

☒ Prepare plans showing proposed work, existing structures, proposed and existing grades, resources areas and buffer zones. The plans must be signed, stamped and dated.

Submittal Procedures:

DEP:

☒ Send the Commonwealth's fee by certified mail to:

Massachusetts DEP
P.O. Box 4062
Boston, MA 02111

☒ Digitally upload the complete package to the eDEP portal **OR** send a copy of the NOI or Other Wetlands Permit or RDA with all plans by certified mail to:

MassDEP Northeast Regional Office
150 Presidential Way
Woburn, MA 01801

CITY ENGINEER:

☒ Send 1 copy of the NOI or Other Wetlands Permit or RDA with all plans and supplemental information by certified mail or hand deliver with receipt to:

City Engineer
Dept. of Public Works
124 Orchard Street
Watertown, MA 02472

CONSERVATION COMMISSION:

☒ Submit the following by certified mail or hand deliver with receipt to:

Conservation Commission
Administration Building, 3RD floor
149 Main Street
Watertown, MA 02472

1. A brief project introduction and summary outlining project proposal

2. The **original and 1 copy** collated of *Application for Permit/Determination Watertown Wetlands Ordinance* form and NOI or RDA.

3. **2 complete sets of plans (signed, stamped and dated)**

4. The Town's share of application fee under the Wetlands Protection Act. (*Make check payable to the **Watertown Conservation Commission)***.

5. The fee under the Watertown Wetlands Ordinance along with the completed *Fee Calculation and Transmittal Form. (Make check payable to **City of Watertown.**)*

6. A copy of the check to the Commonwealth
   Note: *Submit the state share of the filing fee to the DEP as indicated on the Notice of Intent Fee Transmittal Form.*

7. Evidence of submittal to DEP and City Engineer must be submitted to the Conservation Commission prior to the public hearing.

Upon filing on or before the "Filing Deadline," the applicant will be responsible for notifying the abutters and appropriate City Departments. Our office can generate an abutters list for you. The city will place the public notice, at your expense, in the *Boston Globe*. If you have any questions or need assistance, feel free to contact our office.

City of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

WATERTOWN WETLANDS ORDINANCE
Fee Calculation and Transmittal Form

Owner		Applicant	
Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC	Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC
Street	500 Arsenal Street, 480 Arsenal Way, 550 Arsenal Street	Street	500 Arsenal Street, 480 Arsenal Way, 550 Arsenal Street
City	Pasadena	City	Pasadena
State	CA	State	CA
Zip	91101	Zip	91101
Phone	617-721-7150	Phone	617-721-7150
e-mail	mlower@are.com	e-mail	mlower@are.com

Project Location:

_____

Any person filing an Application for Permit/RDA/NOI pursuant to the Ordinance shall, at the same time, pay a filing fee in accordance with the Filing Fee Schedule contained in the *Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008*. Municipal agencies are exempt from this requirement.

A. Fee Schedule:

Project Size	Fees
Less than 1,000 sq. ft	$50.00
1,000 sq. ft. to less than 2,000 sq. ft.	$100.00
2,000 sq. ft. to less than 3,000 sq. ft.	$150.00
3,000 sq. ft. to less than 4,000 sq. ft.	$200.00
4,000 sq. ft. to less than 5,000 sq. ft.	$250.00
5,000 sq. ft. to less than 6,000 sq. ft.	$300.00
6,000 sq. ft. to less than 10,000 sq. ft.	$400.00
10,000 sq. ft. to less than 15,000 sq. ft.	$500.00
15,000 sq. ft. to less than 20,000 sq. ft.	$650.00
20,000 sq. ft. to less than 30,000 sq. ft.	$750.00
30,000 sq. ft. to less than 50,000 sq. ft.	$850.00
50,000 sq. ft. or greater	$1000.00

Project Fee $1,000

Fee Exemption

The Commission may waive the filing fee for an Application or Request for Determination filed by a government agency, for an RDA filed by a person having no financial connection with the subject property, for any projects whose sole effect is to substantially enhance a Resource Area, or for other reasonable grounds a determined by the Commission at its discretion.

Grounds for Exemption (to be filled out by CC staff)

Signature of Owner or Applicant: See Attached Rider

Date: _____

Enclose this form with a check or money order for the calculated amount payable to the Town of Watertown with the Application for Permit or Request for Determination of Applicability. These fees are non-refundable.

Please note this payment does not relieve the Applicant from the further fee requirements as stated in the Wetlands Protection Act Regulations MGL Chapter 44, Section 53G.

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 1 of 2)

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By: Alexandria Real Estate Equities, L.P.,
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By: ARE-QRS Corp.,
a Maryland corporation,
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By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

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RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 2 of 2)

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By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

City of Watertown

Administration Building
149 Main Street
Watertown, Massachusetts 02472

Conservation Commission

Tel: (617) 972-6426 • Fax: (617) 972-6484

Katherine Swan, Conservation Agent, kswan@watertown-ma.gov
Susan Jenness, Clerk sjenness@watertown-ma.gov

CHECKLIST FOR FILING A NOTICE OF INTENT (NOI)
OR A REQUEST FOR DETERMINATION OF APPLICABILITY (RDA) OR OTHER WETLANDS PERMIT

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☒ Let the Conservation Commission office know of your intention to file a NOI or RDA or Other Wetlands permit. You may contact us at (617) 972-6426 or through e-mail Susan Jenness, Conservation Clerk, sjenness@watertown-ma.gov.

☒ Complete the NOI Form or Other Wetlands Forms including all supplemental information.
Note: *A complete NOI or Other Wetland Permit includes Fee Transmittal Form, Filing Fee Calculation Worksheet, as well as all other relevant material.*

or

☐ Complete the RDA Form including relevant supporting data and plans

☒ Prepare plans showing proposed work, existing structures, proposed and existing grades, resources areas and buffer zones. The plans must be signed, stamped and dated.

Submittal Procedures:

DEP:

☒ Send the Commonwealth's fee by certified mail to:

Massachusetts DEP
P.O. Box 4062
Boston, MA 02111

☒ Digitally upload the complete package to the eDEP portal **OR** send a copy of the NOI or Other Wetlands Permit or RDA with all plans by certified mail to:

MassDEP Northeast Regional Office
150 Presidential Way
Woburn, MA 01801

CITY ENGINEER:

☒ Send 1 copy of the NOI or Other Wetlands Permit or RDA with all plans and supplemental information by certified mail or hand deliver with receipt to:

City Engineer
Dept. of Public Works
124 Orchard Street
Watertown, MA 02472

CONSERVATION COMMISSION:

☒ Submit the following by certified mail or hand deliver with receipt to:

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Administration Building, 3RD floor
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Watertown, MA 02472

1. A brief project introduction and summary outlining project proposal

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3. **2 complete sets of plans (signed, stamped and dated)**

4. The Town's share of application fee under the Wetlands Protection Act. (*Make check payable to the **Watertown Conservation Commission)***.

5. The fee under the Watertown Wetlands Ordinance along with the completed *Fee Calculation and Transmittal Form. (Make check payable to **City of Watertown.**)*

6. A copy of the check to the Commonwealth
   Note: *Submit the state share of the filing fee to the DEP as indicated on the Notice of Intent Fee Transmittal Form.*

7. Evidence of submittal to DEP and City Engineer must be submitted to the Conservation Commission prior to the public hearing.

Upon filing on or before the "Filing Deadline," the applicant will be responsible for notifying the abutters and appropriate City Departments. Our office can generate an abutters list for you. The city will place the public notice, at your expense, in the *Boston Globe*. If you have any questions or need assistance, feel free to contact our office.

City of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

WATERTOWN WETLANDS ORDINANCE
Application for Permit/Determination

Application for:

☐Request for Determination of Applicability ☒Notice of Intent

☐Other

Owner*		Applicant	
Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC	Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC
Street	26 North Euclid Avenue	Street	26 North Euclid Avenue
City	Pasadena	City	Pasadena
State	CA	State	CA
Zip	91101	Zip	91101
Phone	617-721-7150	Phone	617-721-7150
e-mail	mlower@are.com	e-mail	mlower@are.com

**Name(s) and address(s) under which title of property is recorded at Registry of Deeds.*

1. Location of site where work is proposed:_____

500 Arsenal Street, 480 Arsenal Way, 550 Arsenal Street

Town of Watertown Assessor's Information:

Map: 1234; 1234; 1214 Lot: 1A; 2; 1F Block: 0; 0; 1

2. Briefly describe the proposed work:

The Project is proposed to redevelop the site into a campus of office, lab, and retail uses, including a multi-story parking garage and landscape improvements.

3. Are there any impediments to accessing the site? ☒No oYes

If yes, what are they (fence, dog, topography, etc.):

_____

_____

_____

If yes, what arrangements have been or will be made to ensure that the Conservation Commission members and designated representatives have safe and easy access to the site?

_____

_____

_____

6. Do you understand that notification of this application and the Public Hearing will be published in a newspaper of local circulation at your expense? Please check-off appropriate box: ☒Yes ○No

7. How much is the filing fee, for this project, under the local ordinance? And under the Wetlands Protection Act?

   $ 1,000
   (See Fee Schedule). Make check payable to the Town of Watertown.

   $ 262.50
   (See NOI Wetland Fee Transmittal Form wpaform3.doc) Make check payable to the Watertown Conservation Commission)

I hereby certify, under the pains and penalties of perjury, that the contents of this application are true and complete.

Signature of Applicant:

See Attached Rider
_____

Date: _____

By signing this application the owner grants permission to the Conservation Commission for its members and designated representative to enter upon the premises of the site.

Signature of Owner:

See Attached Rider
_____

Date: _____

Waiver

If the next regular meeting of the Conservation Commission is not within 21 days of submission of this filing, or it the agenda for the next regular meeting is full, I waive the 21 day requirement and agree to a later date for this Hearing no later than the next regular scheduled meeting or 30 days from the date of the filing a complete application (whichever is less).

Signature of Applicant:

See Attached Rider
_____

Date: _____

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 1 of 2)

480 Arsenal Way, Watertown, MA 02472

ARE-480 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

500 Arsenal Street, Watertown, MA 02472

ARE-500 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 2 of 2)

550 Arsenal Street, Watertown, MA 02472

ARE-MA REGION NO. 90, LLC,
a Delaware limited liability company

By: ARE-San Francisco No. 21, LP,
a California limited partnership,
managing member

By: ARE-San Francisco No. 21 GP, LLC,
a Delaware limited liability company,
general partner

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

City of Watertown
Administration Building
149 Main Street
Watertown, Massachusetts 02472
Conservation Commission
Tel: (617) 972-6426 • Fax: (617) 972-6484

WATERTOWN WETLANDS ORDINANCE
Fee Calculation and Transmittal Form

Owner		Applicant	
Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC	Name	ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, ARE-MA REGION NO. 90, LLC
Street	500 Arsenal Street, 480 Arsenal Way, 550 Arsenal Street	Street	500 Arsenal Street, 480 Arsenal Way, 550 Arsenal Street
City	Pasadena	City	Pasadena
State	CA	State	CA
Zip	91101	Zip	91101
Phone	617-721-7150	Phone	617-721-7150
e-mail	mlower@are.com	e-mail	mlower@are.com

Project Location:

_____

Any person filing an Application for Permit/RDA/NOI pursuant to the Ordinance shall, at the same time, pay a filing fee in accordance with the Filing Fee Schedule contained in the *Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008*. Municipal agencies are exempt from this requirement.

A. Fee Schedule:

Project Size	Fees
Less than 1,000 sq. ft	$50.00
1,000 sq. ft. to less than 2,000 sq. ft.	$100.00
2,000 sq. ft. to less than 3,000 sq. ft.	$150.00
3,000 sq. ft. to less than 4,000 sq. ft.	$200.00
4,000 sq. ft. to less than 5,000 sq. ft.	$250.00
5,000 sq. ft. to less than 6,000 sq. ft.	$300.00
6,000 sq. ft. to less than 10,000 sq. ft.	$400.00
10,000 sq. ft. to less than 15,000 sq. ft.	$500.00
15,000 sq. ft. to less than 20,000 sq. ft.	$650.00
20,000 sq. ft. to less than 30,000 sq. ft.	$750.00
30,000 sq. ft. to less than 50,000 sq. ft.	$850.00
50,000 sq. ft. or greater	$1000.00

Project Fee $1,000

Fee Exemption

The Commission may waive the filing fee for an Application or Request for Determination filed by a government agency, for an RDA filed by a person having no financial connection with the subject property, for any projects whose sole effect is to substantially enhance a Resource Area, or for other reasonable grounds a determined by the Commission at its discretion.

Grounds for Exemption (to be filled out by CC staff)

Signature of Owner or Applicant: See Attached Rider

Date: _____

Enclose this form with a check or money order for the calculated amount payable to the Town of Watertown with the Application for Permit or Request for Determination of Applicability. These fees are non-refundable.

Please note this payment does not relieve the Applicant from the further fee requirements as stated in the Wetlands Protection Act Regulations MGL Chapter 44, Section 53G.

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 1 of 2)

480 Arsenal Way, Watertown, MA 02472

ARE-480 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

500 Arsenal Street, Watertown, MA 02472

ARE-500 ARSENAL STREET, LLC,
a Delaware limited liability company

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

RIDER
SIGNATURES OF APPLICANTS/OWNERS
(page 2 of 2)

550 Arsenal Street, Watertown, MA 02472

ARE-MA REGION NO. 90, LLC,
a Delaware limited liability company

By: ARE-San Francisco No. 21, LP,
a California limited partnership,
managing member

By: ARE-San Francisco No. 21 GP, LLC,
a Delaware limited liability company,
general partner

By: Alexandria Real Estate Equities, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS Corp.,
a Maryland corporation,
general partner

By: Michelle Lower
_____

Name: Michelle Lower_____

Date: 6/17/2024_____

VANASSE HANGEN BRUSTLIN, INC.
260 ARSENAL PLACE • PO BOX 9151
WATERTOWN, MASSACHUSETTS 02471-9151

CITIZENS BANK
MASSACHUSETTS
5-7017/2110

385270
CHECK DATE

June 12, 2024

Two Hundred Sixty Two and 50/100

AMOUNT

$262.50

City of Watertown
149 Main Street
Watertown, MA 02472

AUTHORIZED SIGNATURE

Security Check features included. Details on back

⑈385270⑈ ⑆211070175⑆ 113016137⑆

VANASSE HANGEN BRUSTLIN, INC.
260 ARSENAL PLACE • PO BOX 9151
WATERTOWN, MASSACHUSETTS 02471-9151

CITIZENS BANK
MASSACHUSETTS
5-7017/2110

385271
CHECK DATE

June 12, 2024

Two Hundred Thirty Seven and 50/100

AMOUNT

$237.50

Commonwealth of Massachusetts
DEP-Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

AUTHORIZED SIGNATURE

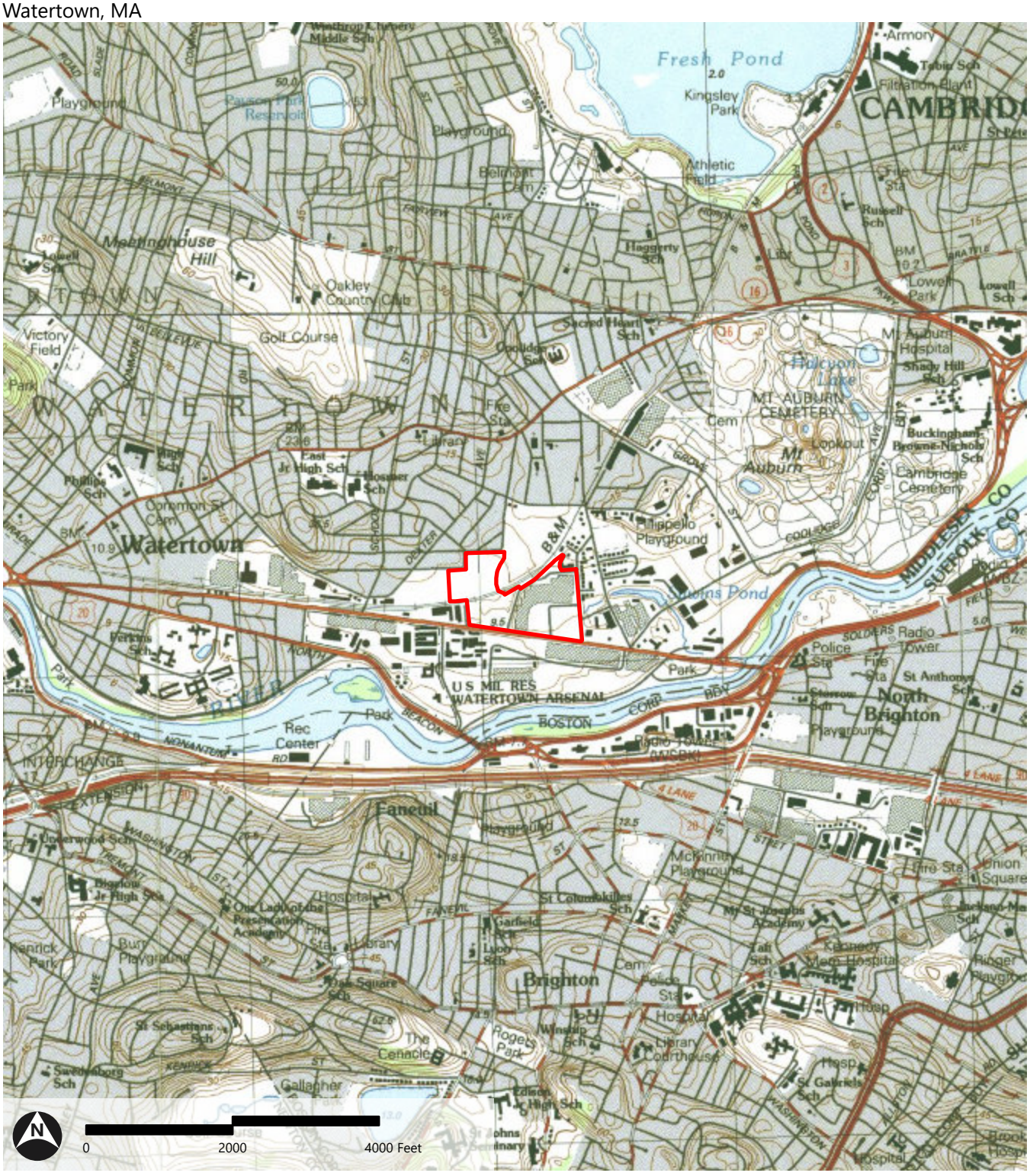
Security Check features included. Details on back

⑈385271⑈ ⑆211070175⑆ 113016137⑆

Notice of Intent Figures

- Figure 1 – Site Location Map
- Figure 2 – Aerial Map
- Figure 3 – NHESP Map
- Figure 4 – FEMA FIRM Map

Figure 1: USGS Site Location
480-550 Arsenal Street
Watertown, MA



Project Area

Sources: VHB, MassGIS

Path: \\azrgisds\gisshare\gis3\arcgissystem\arcgisinput\NOIFigures\NOIExportMap.GPServer\extracted\p30\noi_template\NOI_Template.aprx (gmsaGIS$, 6/17/2024)

Figure 2: Aerial Overview
480-550 Arsenal Street
Watertown, MA



Path: \\azrgisds\gisshare\gis3\arcgissystem\arcgisinput\NOIFigures\NOIExportMap.GPServer\extracted\p30\noi_template\NOI_Template.aprx (gmsaGIS$, 6/17/2024)

Sources: VHB, MassGIS

Figure 3: Priority Habitat
480-550 Arsenal Street
Watertown, MA



Project Area
NHESP Certified Vernal Pools
NHESP Priority Habitats of Rare Species
NHESP Potential Vernal Pools
NHESP Estimated Habitats of Rare Wildlife

*No NHESP Features Within Map Extent

Sources: VHB, MassGIS

Path: \\azrgisds\gisshare\gis3\arcgissystem\arcgisinput\NOIFigures\NOIExportMap.GPServer\extracted\p30\noi_template\NOI_Template.aprx (gmsaGIS$, 6/17/2024)

Figure 4: FEMA Floodplain

480-550 Arsenal Street
Watertown, MA



Path: \\azrgisds\gisshare\gis3\arcgissystem\arcgisinput\NOIFigures\NOIExportMap.GPServer\extracted\p30\noi_template\NOI_Template.aprx (gmsaGIS$, 6/17/2024)

Sources: VHB, MassGIS

Attachment A
Notice of Intent Narrative

- Introduction
- Site Description
- Work Description
- Mitigation Measures
- Regulatory Compliance
- Summary

Attachment A - Notice of Intent Narrative

This Notice of Intent (NOI) is filed pursuant to the Massachusetts Wetlands Protection Act (WPA) (MGL Chapter 131, Section 40[1]) and its implementing regulations (310 CMR 10.00[2]), and the Town of Watertown Wetlands Ordinance[3] (the Ordinance) and its implementing regulations (the Regulations)[4]. This narrative describes wetland resource areas associated with the Project Site, the proposed work, impacts to jurisdictional areas, mitigation measures, and how the Project is in compliance with the Bylaw Regulations.

Introduction

The Applicants, ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, and ARE-MA REGION NO. 90, LLC, are proposing to redevelop three parcels of land totaling 31.4 acres and located at 480 Arsenal Way (Property ID: 1214 1F 1), 500 Arsenal Street (Property ID: 1234 1A 0), and 550 Arsenal Street (Property ID: 1234 2 0) in Watertown, Massachusetts (the "Project Site"). The Applicant is proposing to transform the Project Site into a campus of office, residential, lab and retail uses with two multi-story parking garages, a significant increase in open space and landscape improvements, as well as associated stormwater improvements and utility relocations to support the use (the "Project"). Refer to the Project Plans (Attachment D) for a complete depiction of the proposed Project.

Portions of the Project Site contain resource areas subject to the jurisdiction of the WPA and/or the Ordinance including Bank, Bordering Vegetated Wetlands (BVW), Isolated Vegetated Wetland (IVW), and Riverfront Area (RA). The WPA also establishes a 100-foot buffer zone from Bank and BVW. The Ordinance establishes a 50-foot No-Build Zone (NBZ) and a 150-foot buffer from Bank, BVW, and IVW. The Project will not result in temporary or permanent impacts to Bank, BVW, IVW, or the 200-foot RA. A crosswalk and minor landscaping area upgrades are proposed within the existing parking lot at the southeast corner of the Project Site and within the 100-foot buffer zone to BVW and the locally-regulated 150-foot buffer to BVW. In addition, the proposed forested area immediately south of the Watertown Cambridge Greenway, portions of the A1 building and associated parking, portions of the OL2 building, and portions of the sidewalk associated with Parking Garage P2 will be constructed within the locally regulated 150-

[1] Massachusetts General Laws, 1972. Title XIX, Chapter 131, Section 40: Removal, fill, dredging or alteration of land bordering waters.

[2] MassDEP, 2017. Commonwealth of Massachusetts Regulations, 310 CMR 10.00: Wetlands Protection.

[3] Watertown Home Rule Charter, Rev. 9/2008, Title XV: Land Usage, Chapter 154 Wetlands: *Town of Watertown Wetlands Ordinance*.

[4] Rules and Regulations for the Administration of the Watertown Wetlands Ordinance of 2008

foot buffer to IVW. Lastly, the planting of the forested area and the construction of the educational boardwalk are proposed within the 50-foot NBZ to IVW.

The Project has been designed in compliance with the performance standards of the WPA and the Ordinance. The Applicant is requesting a variance under Section I General D (2) a of the Regulations for the work proposed within the 50-foot NBZ to IVW on the grounds that "the variance is necessary to accommodate an overriding public interest or to avoid a decision that so restricts the use of the property as to constitute an unconstitutional taking without compensation".

Areas of disturbance have been minimized to the extent practicable, and temporary impacts will be restored in place to their original conditions and stabilized to prevent future erosion and degradation. Wetland resource areas will be protected from impacts during construction through the implementation of an erosion and sedimentation control program. This program includes provisions to minimize areas of disturbance through phasing and sequencing, limit erosion through stabilization, and prevent sediment from leaving the Project Site by installing structural controls. Runoff generated from the Project will be collected and treated in accordance with design guidelines[5] developed by the Department of Environmental Protection (DEP) and standards contained in the WPA Regulations.

Site Description

The Project Site is comprised of three parcels of land located at 480 Arsenal Way, 500 Arsenal Street, and 550 Arsenal Street in Watertown, Massachusetts.

- **480 Arsenal Way** is a 7.89-acre parcel currently developed with an office building and associated surface parking and landscaped areas.
- **500 Arsenal Street** is a 5.26-acre parcel currently developed with a lab/office building, surface parking areas, and a landscaped courtyard in front of the building.
- **550 Arsenal Street** is a 17.84-acre parcel currently developed with a large retail building (Watertown Mall) and large surface parking areas. There is also a small, detached building (Chase Bank) located at the southeast corner of the parcel. While the western side of the property will be redeveloped, the existing Target and Chase Bank retail buildings and the easterly portion of the parking lot will remain.

The Project Site is bounded by Elm Street to the east, Arsenal Way to the northeast, Laurel Street and Cypress Street to the northwest, commercial buildings to the west, and Arsenal Street to the south. The surrounding area is developed with a mix of restaurant, retail/office, hotel, service, residential, lab, and industrial uses. The Project Site is primarily impervious and comprised of existing buildings and parking areas. The Project Site lies within the surface watershed of the Charles River.

According to the most recently available data provided by the Massachusetts Natural Heritage and Endangered Species Program[6] (NHESP), no Priority Habitats of Rare

[5] DEP, 2008. *Massachusetts Stormwater Handbook*.

[6] NHESP, 2021. Massachusetts Natural Heritage Atlas. 13th Edition.

Species, Estimated Habitats of Rare Wildlife, or certified or potential vernal pools have been mapped in the vicinity of the Project Site (Figure 3). The most recently issued Flood Insurance Rate Map (FIRM)[7] for the area, produced by the Federal Emergency Management Agency (FEMA), indicates that no portion of the Project Site is within the mapped floodplain for the 100-year storm event (Figure 4).

According to the Massachusetts Department of Environmental Protection (DEP), the Project Site is not located within an Area of Critical Environmental Concern (ACEC), or an area designated as an Outstanding Resource Water (ORW)[8]. The Natural Resources Conservation Service (NRCS) soil survey[9] has mapped the surface soils within the Project Site as Urban land.

Wetland resource areas on/near the Project Site are described below.

Wetland Resource Areas

Wetlands in the vicinity of the Project Site were delineated on June 6, 2022 by environmental scientists with Vanasse Hangen Brustlin, Inc. in accordance with methods developed by the DEP[10] and the U.S. Army Corps of Engineers[11]. The following sections of this narrative describe the wetlands and identify resource areas near the Project Site that are regulated under the WPA Regulations and the Ordinance. The resource areas are depicted on the attached Project Plans (Attachment D).

State-regulated wetland resource areas identified on or near the Project Site include Bank, BVW, and RA. These resource areas are defined under the WPA Regulations (310 CMR 10.00) as follows:

- **Bank:** As defined by 310 CMR 10.54(2)(a) and (c), Bank is *"the portion of the land surface that normally abuts and confines a water body."* This land surface *"may be partially or totally vegetated, or it may be comprised of exposed soil, gravel, or stone."* The upper boundary of a Bank is defined as *"the first observable break in slope or the mean annual flood level, whichever is lower."*
- **BVW:** As defined by 310 CMR 10.55(2)(a) and (c), BVWs are *"freshwater wetlands that border on creeks, rivers, streams, and lakes."* The boundary of BVW is determined by the presence of 50 percent or more of wetland indicator plants and saturated or inundated conditions.
- **Riverfront Area (RA):** As defined at 310 CMR 10.58 (a)(3), RA is *"the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 200 feet away."*

Locally regulated IVW were also identified near the Project Site. Vegetated Wetlands are defined in the Ordinance as, *"Freshwater wetlands" that "are typically areas where the*

[7] Federal Emergency Management Agency, National Hazard Flood Layer, Digital Flood Insurance Rate Map (DFIRM).

[8] DEP, 2010. Designated Outstanding Resource Waters of Massachusetts.

[9] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey

[10] DEP, 2022. *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act.*

[11] Environmental Laboratory, 1987. *Corps of Engineers Wetlands Delineation Manual.*

topography is low and flat, and where the soils are annually saturated." The types of freshwater wetlands are wet meadows, marshes, swamps, bogs and vernal pools.

Resource areas near the Project Site are summarized in the table below and are described in more detail in the following sections of this attachment.

Table 1 Resource Areas

Wetland Designation	Flag Numbers	Resource Type	Description
Wetland 1	WF1-88 to WF1-114	IVW	PFO wetland located to the south of Arsenal Way and the Watertown Cambridge Greenway and to the north of buildings OL2 and A1.
Sawins Pond Tributary	Not field located for this Project – see description below.	Bank, RA	Perennial stream located east of the Project Site associated with Sawins Pond. Stream is culverted beneath the Project Site.
Wetland 2	Not field located for this Project – see description below.	BVW	PEM wetland associated with the Sawins Pond tributary located to the east of the Project Site.

Source: VHB, 2022

Wetland 1

Wetland 1 is an IVW that is located to the northeast of the Project Site and culverted beneath the existing parking lot to the west. The IVW falls under the jurisdiction of the Ordinance and supports the 50-foot NBZ as well as the 150-foot buffer zone.

Wetland 1 was delineated with flagging numbered WF1-88 through WF1-114. Dominant vegetation within the wetland includes black locust (*Robinia pseudoacacia*), black willow (*Salix nigra*), red maple (*Acer rubrum*), bebb willow (*Salix bebbiana*), multiflora rose (*Rosa multiflora*), mountain laurel (*Kalmia latifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans)*. Wetland 1 slopes down from northeast to southwest, toward the culvert on the western end of the wetland. The wetland receives stormwater discharge from the adjacent development areas as well as the Greenway.

Sawins Pond Tributary

The Sawins Pond tributary is located across Elm Street to the east of the Project Site and is mapped as perennial on the USGS topographic map. The perennial stream falls under the jurisdiction of the WPA and the Ordinance and supports a 200-foot RA and 100-foot buffer zone from Bank, as well as the 50-foot NBZ and local 150-foot buffer zone from Bank. The RA does not extend onto the Project Site due to the culverted nature of the stream for more than 200 feet beneath the Project Site[12].

[12] 310 Mass. Reg. 10.58 (2) (a) 3. c. *"Where a river runs through a culvert more than 200 feet in length, the riverfront area stops at a perpendicular line at the upstream end of the culvert and resumes at the downstream end."*

The tributary to Sawins Pond was not field located since it is situated beyond the boundary of the Project Site. An approximate boundary of the resource area was established using aerial imagery. The National Wetlands Inventory (NWI) characterized the stream as a lower perennial, unconsolidated bottom, permanently flooded, excavated stream.

Wetland 2

Wetland 2 is a BVW located to the east of the Project Site, adjacent to the Sawins Pond tributary. The BVW falls under the jurisdiction of the WPA and Ordinance and supports the 100-foot buffer zone as well as the locally regulated 50-foot NBZ and 150-foot buffer zone.

Wetland 2 was not field located since it is situated beyond the boundary of the Project Site. An approximate boundary of the resource area was established using aerial imagery. The NWI characterized the wetland as a seasonally flooded, persistent palustrine emergent (PEM) wetland.

Buffer Zone

The WPA regulations (310 CMR 10.02(2)(b)) establish a 100-foot buffer zone from the limits of Bank and BVW described above. The buffer zone to BVW extends farther than the buffer zone to Bank, so the buffer zone shown on the Project Plans is the 100-foot buffer zone to BVW. The buffer zone extends onto a minor portion of the southeastern corner of the Project Site, which is currently used as an impervious parking lot with pervious landscaped areas.

Locally Regulated Buffer Zones

50-foot No Build Zone

The Regulations establish that *"Without limiting the foregoing, and as an additional local requirement, no person shall build or enlarge any structure, parking lot or impervious surface upon or within an area that extends fifty (50) feet from the outer limit of a wetland resource area, e.g., any marsh, meadow, bog, swamp or vernal pool; any bank; or any river, stream, creek or brook, lake, pond or spring."*

Within the limits of the Project Site, the 50-foot NBZ is currently comprised of impervious parking area and sidewalk.

150-foot Buffer Zone

The Ordinance establishes a 150-foot buffer zone from the limits of Bank, BVW and IVW described above. The 150-foot buffer zone from BVW extends onto a minor portion of impervious parking lot area and pervious landscaped areas located at the southeastern corner of the Project Site. The 150-foot buffer from IVW extends to the south toward the existing parking lot area and commercial building at the north side of the Project Site, as well as toward the existing parking lot and landscaped areas to the northwest.

Work Description

The Project proposes a Master Plan redevelopment of a 31.4-acre site in Watertown, MA that will consist of approximately 500,000 GSF of new office/lab, 100,000 GSF of new retail/amenities and associated new structured parking. Utility infrastructure improvements, ancillary landscaping, and the installation of new stormwater management features and upgrades to the current stormwater management system designed to comply with the Massachusetts Stormwater Standards are also proposed as part of this Project.

Detailed means and methods of construction will be at the discretion and responsibility of the contractor performing the work to construct the Project. However, the Project will consist of the following general activities:

- Before any work begins, install erosion and sedimentation controls according to the Project Plans.
- Perform grading activities.
- Install stormwater upgrades and drainage basins.
- Install new buildings and parking garage.
- Install curbing and sidewalks.
- Perform loaming, seeding, and landscaping activities.
- After all site work is complete and after all soils have stabilized, remove erosion controls.

Work in Wetland Resource Areas

There will be no direct impacts to wetland resource areas including Bank, BVW and RA from the proposed development on the Project Site. Some work will occur in wetland resource area buffer zones, which is described below.

Work in Buffer Zone

The WPA-regulated 100-foot buffer zone to BVW and Bank extends onto the eastern portion of the Project Site from Wetland 2 located offsite. New curbing will be constructed, and crosswalks will be re-striped in the 100-foot buffer zone to BVW. No permanent alteration to ground cover types is proposed within the WPA regulated 100-foot buffer zone to BVW.

Work in Locally Regulated Buffer Zone Areas

50-foot No Build Zone

The locally regulated 50-foot NBZs to Bank, BVW and IVW extend onto the Project Site from the north and east. Proposed work within the 50-foot NBZ to Wetland 1 includes conversion of approximately 9,917 SF of impervious to pervious surface, planting of the

proposed Miyawaki forested area, construction of the educational boardwalk and bioretention cells, and installation of the playground. No work is proposed within the 50-foot NBZ to Wetland 2.

150-foot Buffer Zone

The locally regulated 150-foot buffer zones to Bank, BVW and IVW extend onto the Project Site from the north and east. Proposed work within the 150-foot buffer zone to Wetland 1 includes removal of existing impervious surface and planting of the proposed forested area to the south of the Watertown Cambridge Greenway, construction of the educational boardwalk, construction of portions of the A1 building and associated parking, construction of portions of the OL2 building, and construction of portions of the sidewalk associated with Parking Garage P2. Proposed work within the 150-foot buffer zone to Wetland 2 includes construction of minor areas of new curb and sidewalk, as well as expanding existing landscaped islands. Approximately 12,944 SF of impervious surface will be converted to pervious surface within the 150-foot Buffer Zone (and outside the 50-foot NBZ) to Wetland 1, and 226 SF of impervious surface will be converted to pervious surface within the 150-foot Buffer Zone (and outside the 50-foot NBZ) to Wetland 2.

Mitigation Measures

A suite of mitigation measures is proposed to prevent short- and long-term impacts to wetland resource areas. Mitigation measures proposed for this Project include a sediment and erosion control program, which will include structural and non-structural practices.

Erosion and Sediment Control

An erosion and sedimentation control program will be implemented to minimize temporary impacts to wetland resource areas during the construction phase of the project. The program incorporates Best Management Practices (BMPs) specified in guidelines developed by the DEP[13] and the U.S. Environmental Protection Agency (EPA)[14].

Proper implementation of the erosion and sedimentation control program will:

- minimize exposed soil areas through sequencing and temporary stabilization;
- place structural erosion and sedimentation controls to manage stormwater runoff and erosion; and

13 DEP, 1997. *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas: A Guide for Planners, Designers, and Municipal Officials.*

14 EPA, 2007. *Interim Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites*. Office of Water. Report EPA 833-R-060-04.

- establish a permanent vegetative cover or other forms of stabilization as soon as practicable.

Non-Structural Practices

Non-structural practices to be used during construction include temporary stabilization, temporary seeding, permanent seeding, pavement sweeping and dust control. These practices will be initiated as soon as practicable in appropriate areas throughout the Project Site.

Temporary Stabilization

Any areas of exposed soil that will remain inactive for more than 14 days after grading or construction activities has temporarily or permanently ceased will be stabilized. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or flatter. Stockpiles that will remain inactive for more than 30 days will be seeded and mulched immediately after its formation and will not be steeper than 2:1.

Temporary Seeding

If conditions allow, a temporary vegetative cover will be established on areas of exposed soils (including stockpiles). The seeded surfaces will be covered with a layer of straw mulch applied at a rate of 90 pounds per 1,000 SF. The mulch will be anchored with a tacking coat (non-tar) applied by hydroseeding. Steeper slopes (greater than 10 percent) will be covered with a bonded fiber matrix (EcoAegis® or similar) according to the recommendations provided by the manufacturer. The seed mix shall include a blend of annual grasses, such as annual rye, that are indigenous to eastern Massachusetts, to ensure rapid germination and production of rootmass.

Permanent Seeding

Upon completion of final grading, any areas not covered by pavement, other forms of stabilization, or other methods of landscaping will be seeded with a native meadow seed mix. The mix will be applied with mulch or bonded fiber matrix as described above.

Pavement Sweeping

Areas of standard asphalt pavement, permeable asphalt pavement, and permeable pavers on walkways shall be swept as needed during construction. The sweeping program will remove sediment and other contaminants directly from paved surfaces before their release into stormwater runoff and will minimize accumulation in catch basins. Pavement sweeping has been demonstrated to be an effective initial treatment for reducing pollutant loading into stormwater. A street sweeper shall be kept at the site or at a nearby location to facilitate this practice. Once construction has been completed, sweeping at the Project Site will occur as required under the Operation and Maintenance Plan.

Dust Control

The erosion and sediment control program includes provisions to minimize the generation of dust during dry and windy conditions. When necessary, larger areas of exposed soil will be wetted to prevent wind borne transport of fine-grained sediment.

Sufficient water will be applied to wet the upper 0.5 inches of soil. The water will be applied as a fine spray to prevent erosion. A water truck will be kept on the Project Site (or at a nearby location) to facilitate this practice.

Structural Practices

Structural erosion and sedimentation controls to be used on the Project Site include barriers, stabilized construction exits, and catch basin inlet protection.

Erosion Control Barriers

Prior to any ground disturbance, an approved erosion control barrier will be installed at the downgradient limit of work. As construction progresses, additional barriers will be installed around the base of stockpiles and other erosion prone areas. The barriers will be entrenched into the substrate to prevent underflow.

If sediment has accumulated to a depth which impairs proper functioning of the barrier, it will be removed by hand or by machinery operating upslope of the barriers. This material will be either reused at the Project Site or disposed of at a suitable offsite location. Any damaged sections of the barrier will be repaired or replaced immediately upon discovery.

Stabilized Construction Exits

Stone anti-tracking pads will be installed at each access point to the work area to prevent the offsite transport of sediment by construction vehicles. The stabilized construction exits will be at least fifty feet long and will consist of a 4-inch-thick layer of crushed stone (1.5 inches in diameter). The stone will be placed over a layer of non-woven filter fabric. The anti-tracking pads will remain in place until a binder coat of pavement has been established on paved surfaces.

Catch Basin Inlet Protection

The inlets of existing and proposed catch basins will be protected from sediment inflow during the work period by surrounding them with a barrier of staked straw bales or by installing Silt Sacks®. If straw bales are used, a layer of non-woven filter fabric shall be placed beneath the grate of each basin. If sediment has collected behind the barrier or in the Silt Sack® to a point where it impairs proper functioning, it will be removed and will be either reused onsite or disposed of at a suitable offsite location.

Stormwater Management

The proposed redevelopment will provide an increase of pervious area and open space, as well as enhanced water quality due to the implementation of stormwater best management practices (BMPs). The increase in pervious area alone will significantly contribute to improved stormwater quality, peak attenuation of runoff and provide enhanced groundwater recharge.

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook, in addition to guidance from the Massachusetts MS4 General Permit and Charles River Phosphorous TMDL and the City of Watertown Stormwater Rules & Regulations. Due to geotechnical and localized environmental restrictions, the Project will meet the City of Watertown Retention Standard for Redevelopment Projects to the maximum extent practicable, as documented in this report.

Infiltration on the 500 Arsenal Street parcel will be accomplished primarily along the southern and western frontages. Infiltration on the northern and eastern portions of the parcel and within the courtyard area will be challenging due the presence of contaminants in groundwater, soils with extremely limited infiltration capacity, and the proximity to the Cambridge Aqueduct. An enhanced bioretention area is proposed in the northeast corner of this parcel. Additionally, an interconnection is proposed beneath Arsenal Way to connect the infiltration systems on the 500 Arsenal to the adjacent 446/458 Arsenal parcels, to maximize the superior soil permeability rates on 446/458.

Infiltration on the 550 Arsenal Street parcel will be accomplished primarily through subsurface infiltration along the Arsenal Street frontage, within the A1/P1 courtyard, beneath the garage footprint, and north of the garage footprint. Several bioretention areas are proposed, as well as sand filters to treat the retail parking lots east of R1 where poorly infiltrating soils and contamination is present.

Infiltration on the 480 Arsenal Way parcel will be accomplished through the construction of two subsurface infiltration systems that will retain and infiltrate a volume equivalent to the 100-year storm across the contributing redevelopment area. Two surface bioretention areas will also provide additional treatment of surface runoff prior to discharge into the subsurface infiltration system.

Regulatory Compliance

The proposed Project includes work in the 100-foot buffer zone to BVW, as well as the locally regulated 50-foot NBZ and 150-foot buffer zone to BVW and IVW. The Project includes erosion and sediment controls and fully complies with applicable performance standards contained in the WPA regulations and Ordinance. Compliance with each of the applicable performance standards is demonstrated below.

Buffer Zone

The buffer zone is not a resource area and, therefore, work within a buffer zone is not governed by specific regulatory performance standards. Per the WPA, work within a buffer zone is permissible when said work has been designed, or can be conditioned, such that there will be no impact on the downgradient wetland resource area(s) being buffered. As stated in 310 CMR 10.53(1) of the WPA Regulations:

For work in Buffer Zone subject to review under 310 CMR 10.02(2)(b)3., the Issuing Authority shall impose conditions to protect the interests of the Act identified for the adjacent Resource Area… The issuing authority may consider the characteristics of the Buffer Zone, such as the presence of steep slopes, that may increase the potential for adverse impacts on Resource Areas. Conditions may include limitations on the scope and location of work in the Buffer Zone as necessary to avoid alteration of Resource Areas. The Issuing Authority may require erosion and sedimentation controls during construction, a clear limit of work, and the preservation of natural vegetation adjacent to the Resource Area and/or other measures commensurate with the scope and location of work with the Buffer Zone to protect the interests of the Act.

The Project has been designed to address these regulations. Measures have been incorporated into the Project design to ensure that work will be done in a manner that prevents impacts to downgradient Resource Areas. A clear limit of work will be identified, and erosion and sedimentation control areas will be installed throughout the Project Site. Any temporary disturbance in vegetated areas within the buffer zone will be restored in place and seeded with a native seed mix prior to completion of the Project.

Town Of Watertown Wetlands Protection Regulations

The Watertown Conservation Commission has established performance standards for the administration of the Town of Watertown Wetlands Ordinance and adapted policies regarding work in or near wetlands. The Watertown Conservation Commission provides:

C. Banks

(4) General Performance Standards

(a) No activity, other than the maintenance of an already existing structure, which will result in the building within or upon, removing, filling, or altering of a Bank, or of land within 50 feet of any Bank, shall be permitted by the Conservation Commission, except for activity permitted under the provisions of Sections I.D(2) or IV.A(9) of these Regulations.

No Bank or land within 50 feet of a Bank will be altered by this Project.

(b) Any work permitted by the Commission on a Bank, or within 150 feet of the upper boundary of a bank, shall not impair the following:

- *The physical stability of the Bank;*
- *The water carrying capacity of the existing channel within the Bank;*

- *Groundwater and surface water quality;*
- *The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries;*
  or
- *The capacity of the Bank to provide important wildlife habitat functions.*

Erosion controls will be installed along the perimeter of the Project Site between the Bank of the Sawins Pond Tributary and the Project Site. As such, the work on the Project Site will have no impact on the Bank of the Sawins Pond Tributary.

D. Vegetated Wetlands

(4) General Performance Standards

(a) No activity, other than the maintenance of an already existing structure, which will result in the building within or upon, removing, filling, or altering of a Vegetated Wetland, or of land within 50 feet of a Vegetated Wetland, shall be permitted by the Conservation Commission, except as allowed under Sections I.D(2) or IV.A(9) of these Regulations.

A variance is being requested by the Applicant for the proposed work within 50-feet of Wetland 1 on the grounds that "*the variance is necessary to accommodate an overriding public interest or to avoid a decision that so restricts the use of the property as to constitute an unconstitutional taking without compensation.*" The removal of the existing impervious surface, planting of the proposed Miyawaki forest, and addition of the playground will all benefit the public and provide greater ecological, aesthetic, and educational value compared to existing conditions.

(b) Any proposed work, permitted by the Commission, in a Vegetated Wetland or within 150 feet of a Vegetated Wetland shall not destroy any portions of said Vegetated Wetland, nor shall the proposed work impair in any way the Vegetated Wetland's ability to perform any of the functions described in Section IV.D(1).

No portions of Vegetated Wetlands will be destroyed by the work proposed in the 150-foot buffer zone, nor will the work impair the

ability of the wetlands to perform the functions described in Section IV.D(1).

H. Buffer Zones

(4) General Performance Standards

(a) No work in a Buffer Zone should alter an adjacent Resource Area (including Intermittent Streams or Springs), or if an adjacent Resource Area is altered by work in the Buffer Zone, the alteration must comply with the applicable performance standards for the altered Resource Area and any other conditions the Commission may require to enforce those performance requirements.

Proposed work in buffer zones will not alter adjacent Resource Areas on the Project Site or surrounding areas.

(b) The Commission may consider the extent of work, the proximity of the work to the Resource Area, the presence of steep slopes, the extent to which the Buffer Zone has already been developed, the extent of natural vegetation, and other factors that affect the potential impact of work in the Buffer Zone on Resource Areas. Where prior development of the Buffer Zone is extensive, the Commission may require measures such as the restoration of natural vegetation adjacent to the Resource Area to protect the interests of the Ordinance.

The buffer zone on the Project Site is comprised of primarily impervious cover. The Project proposes the removal of impervious cover and replanting of native trees in the buffer zone to Wetland 1.

(c) No above ground or underground storage tanks containing hazardous materials or gasoline, oil or other fuels may be placed within 100 feet of an adjacent protected Resource Area (including Intermittent Streams and Springs.)

No underground or above ground storage tanks will be placed within 100 feet of any resource areas on the Project Site.

(d) The following activities will be prohibited within 25 feet of an adjacent Resource Area (including Intermittent Streams and Springs):

- *Removal of trees or surface vegetation, except for selective pruning or thinning, removal of hazardous trees, replacement of non-native or invasive species with native plantings, or replacement of lawn or other significantly artificial landscape with indigenous groundcover, trees and/or shrubs.*
- *Use of fertilizers or pesticides.*
- *Dumping of grass clippings, brush, leaves, or other debris or trash.*

- *Storage of scrap metal, construction materials or equipment, or other materials.*
- *Piling of road salt, sand or snow.*
- *Vehicle parking.*

The above listed activities will not be performed within 25 feet of any Resource Areas on the Project Site.

(e) *The Commission will not approve any alteration within 50 feet of a vernal pool, except under the provisions of Section I.D(2) or Section IV.A(9) of these Regulations. Such a waiver will at a minimum impose the same conditions and performance standards identified above for areas within 25 feet of protected Resource Areas.*

No alteration is proposed on the Project Site within 50 feet of a vernal pool.

(f) *Properties not currently in compliance with the performance standards for Buffer Zones will not be permitted to increase their degree of non-conformance.*

The existing Project Site is developed within the 150-foot buffer to Resource Areas, but the Project will result in a net decrease in impervious surface on the Project Site. As such, there will be no increase in non-conformance as a result of the Project.

(g) *The Commission may, at its sole discretion, require greater than the minimum setback distances specified above.*

This is understood by the Applicant.

(h) *Erosion and sedimentation controls must be utilized for any construction within the Buffer Zone that will result in exposed soils. No silt or sediment may be allowed to enter a Resource Area during or subsequent to construction.*

An erosion and sediment control plan has been provided under the Mitigation Measures section of this document. No sediment will be allowed to enter a Resource Area during the construction of the Project. Erosion controls can be left in place following the project at the request of the Conservation Commission to ensure no future sediment will enter the resource areas on the Project Site.

(i) *Limited projects in the Buffer Zone: The Commission may, at its sole discretion, waive specific requirements in this section for execution in the Buffer Zone of the following types of projects, where there are no reasonable alternatives with fewer adverse effects:*

- *Construction, reconstruction, operation and maintenance of underground and overhead public utilities, such as electrical distribution or transmission lines, communication, sewer,*

water or natural gas lines, and stormwater management structures.

- *Construction, rehabilitation and maintenance of footpaths, bikepaths and other pedestrian or nonmotorized vehicle access to or along waterways or water bodies.*
- *Operation and routine maintenance, but not enlargement, of water dependent structures, including boat launching ramps and docks.*
- *Routine maintenance and repair of existing public roadways, but not including widening a roadway.*

This Project is not a Limited Project and as such, does not qualify for a waiver of any Performance Standard requirements.

Summary

The Applicant is proposing to redevelop three parcels of land that total 31.4 acres located at 480 Arsenal Way, 500 Arsenal Street, and 550 Arsenal Street in Watertown, Massachusetts. As proposed, the Project includes work within the WPA-regulated 100-foot buffer zone to Bank and BVW, and the Ordinance-regulated 50-foot NDZ and 150-foot buffer zone to Bank, BVW, and IVW.

The Project has been designed in compliance with the performance standards of the WPA and the Ordinance. The Applicant is requesting a variance under Section I General D(2)a of the Ordinance Regulations for the work proposed within the 50-foot NBZ to IVW on the grounds that "*the variance is necessary to accommodate an overriding public interest or to avoid a decision that so restricts the use of the property as to constitute an unconstitutional taking without compensation*".

Areas of disturbance have been minimized to the extent practicable, and temporary impacts will be restored in place to their original conditions and stabilized to prevent future erosion and degradation. Wetland resource areas will be protected from impacts during construction through the implementation of an erosion and sedimentation control program. Runoff generation from the Project will be collected and treated in accordance with applicable design guidelines.

The Applicant respectfully requests that the Watertown Conservation Commission find these measures protective of the interests identified in the Ordinance and issue an Order of Conditions approving the work described in this NOI and shown on the accompanying plans.

NOTIFICATION TO ABUTTERS

WATERTOWN WETLANDS ORDINANCE
MASSACHUSETTS WETLANDS PROTECTION ACT M.G.L. C. 131.§40

An Application for Permit and a Notice of Intent has been filed with the Watertown Conservation Commission seeking permission to remove, fill, dredge or alter an area subject to protection under G.L. Ch. 131.§40 and/or the Watertown Wetlands Ordinance.

The names of the Applicants are: ARE-500 ARSENAL STREET, LLC, ARE-480 ARSENAL STREET, LLC, and ARE-MA REGION NO. 90, LLC

The addresses of land where the activity is proposed are: 480 Arsenal Street, 500 Arsenal Street, and 550 Arsenal Street.

The work proposed is to transform the site into a campus of office, lab, and retail uses including a multi-story parking garage, a significant increase in open space, and landscape improvements.

Copies of the Application for Permit and Notice of Intent and accompanying plans may be examined at the office of the Watertown Conservation Commission, Town Hall (3rd floor), 149 Main Street, Watertown MA during regular business hours.

For more information, call 617.607.6310, tdonovan@vhb.com
Check one: This is the Applicant [ ], Applicant's representative [X], or other [specify].

Copies of the Application for Permit and Notice of Intent may be obtained from either (check one) the Applicant [ ] or the Applicant's representative [X], by calling *617.607.6310* from *9 am – 5 pm* on *Mon. – Friday* or *tdonovan@vhb.com*.

Notice of the public hearing to be held on *7/10/24* at *7 pm* located at *City Hall*, will be published in the *Watertown Tab* and will be posted outside the Town Clerk's office on the first floor of the Watertown Town Hall, at least five business days in advance of the hearing.

Contact the Watertown Conservation Commission of the MA Department of Environmental Protection (DEP) Northeast Region Office for information about this Application or the Wetlands Protection Act, and the Commission regarding the Watertown Wetlands Ordinance.

Watertown Conservation Commission
(617) 972-6426
http://www.watertown-ma.gov/index.aspx?nid=103

MassDEP Northeast Region Office
(978) 694-3200
http://www.mass.gov/dep/

GEROS LLC
1212 4 0
29 DENBY RD
ALLSTON, MA 02134

W W GRAINGER INC
1213 4B 0
P O BOX 800729
DALLAS, TX 75380-0729

ARE-MA REGION NO.91 HOLDINGLLC
1213 6 0
P O BOX 847
CARLSBAD, CA 92018

ARE-MA REGION NO.91 HOLDINGLLC
1213 7 0
PO BOX 847
CARLSBAD, CA 92018

UNITED ELECTRIC CONTROLS CO
1214 1A A
180 DEXTER AV
WATERTOWN, MA 02272-9143

486 ARSENAL WAY LLC
1214 1F 2
486 ARESENAL WAY
WATERTOWN, MA 02472

ARMENIAN CUTURAL AND EDUCATION
1214 1F 2A
47 NICHOLS AVE
WATERTOWN, MA 02472

OFFICE PROP. LLC COLUMBIA MA
1214 1F 3
21 CUSTOM HOUSE STREET
BOSTON, MA 02110

YOUNG BRYAN ANDREW
1215 10 80A
156 CYPRESS ST
WATERTOWN, MA 02472

PROVOST ANDREW
1215 10 80B
158 CYPRESS ST-U 158
WATERTOWN, MA 02472

WEISMAN NOAH A
1215 11 81A54
154 CYPRESS ST
WATERTOWN, MA 02472

VARADAN VINAY
1215 11 81AU1
152 CYPRESS ST #1
WATERTOWN, MA 02472

ROBERTS, TRUSTEE JEFFREY W
1215 11 81AU2
152 CYPRESS ST #2
WATERTOWN, MA 02472

BARTER TIMOTHY
1215 12 82146
146 CYPRESS ST
WATERTOWN, MA 02472

MURJI MEHBOOB
1215 12 82148
148 CYPRESS ST
WATERTOWN, MA 02472

CHAMARTI RAVI
1215 13 142
5 WILSHIRE DR
SHARON, MA 02057

MONROE DEVON
1215 13 83
144 CYPRESS ST
WATERTOWN, MA 02472

PECK JONATHAN E
1215 14 84
138 CYPRESS ST
WATERTOWN, MA 02472

WANG KAI
1215 15 85
6 SMITH HILL ROAD
LINCOLN, MA 01773

CURRY ERIC
1215 16 86
130 CYPRESS ST
WATERTOWN, MA 02472

RYAN JEFFREY R
1215 1 78
144 DEXTER AVE
WATERTOWN, MA 02472

EL HENEIDI FAMILY TRUST
1215 17 87A
154 DEXTER AVE
WATERTOWN, MA 02472

SUNDAR SIDDHARTH
1215 17 87B
124 CYPRESS ST U2
WATERTOWN, MA 02471

MACDONALD JOHN R
1215 2 77
43 LAUREL ST
WATERTOWN, MA 02472

VU CUC HONG T
1215 3 76
49 LAUREL ST
WATERTOWN, MA 02472

POILLUCCI GARY A.
1215 4 75
53 LAUREL ST
WATERTOWN, MA 02472

LOPRETE DANIEL
1215 5 74
55-57 LAUREL STREET
WATERTOWN, MA 02472

SANDERS JR AARON
1215 6 73
63 LAUREL ST
WATERTOWN, MA 02472

COSTA FAMILY REVOCABLE TRUST
1215 7 72
11 EVERGREEH AVENUE
BURLINGTON, MA 01803

FEHLNER ANDREW
1215 8 71
75 LAUREL ST
WATERTOWN, MA 02472

SAWAL JITEDER
1215 9 79A
160 CYPRESS STREET
WATERTOWN, MA 02472

HISOLER CAMILO ETUX REBECCA
1215 9 79B
162 CYPRESS ST
WATERTOWN, MA 02472

KEOUGH RALPH J.
1217 1 41
8 OAK ST
WATERTOWN, MA 02472

CICCOLO NICHOLAS A
1217 2 45
82 HAMMOND ST #3
CAMBRIDGE, MA 02138

PATRIACCA BRIAN
1217 3 44
108 LAUREL ST
WATERTOWN, MA 02472

WILLIAMS EVAN J
1217 4 43
20 OAK ST
WATERTOWN, MA 02472

CULLEN MARK C
1217 5 42
14 OAK ST
WATERTOWN, MA 02472

STUART J RYAN JR REVOCABLE INTER VIVOS TRUST
1218 1 22
112 DEXTER AVE
WATERTOWN, MA 02472

PARSEKIAN HARRY TRUSTEE
1218 2 28
P.O. BOX 387
SOUTH BOSTON, MA 02127

WHOOLEY JAMES J ET MICHAEL
1218 3 27
65 KENDALL PK
WALTHAM, MA 02451

GIOGAS CHRISTOS
1218 4 26
1 BUCKMAN DR
BURLINGTON, MA 01803

ARNOLD MARKUS F
1218 5 25
56 LAUREL ST
WATERTOWN, MA 02472

AKILLIAN ANTHONY L.
1218 6 24
130-132 DEXTER AV
WATERTOWN, MA 02472

GRIGORYAN VIKTOR
1218 7 23
122 DEXTER AVE
WATERTOWN, MA 02472

MANCILIKLI SIMA
1219 10 35
9 OAK ST
WATERTOWN, MA 02472

FRIEDMAN MICHAEL P
1219 1134A 15
15 OAK ST
WATERTOWN, MA 02472

TETRADZE ALEXANDER
1219 1134A 17
17 OAK ST
WATERTOWN, MA 02472

LALOOSES PETER
1219 12 33A
21 OAK ST
WATERTOWN, MA 02472

SMITH CAROLYN J.
1219 13 32
65 WILLIAMS RD
CONCORD, MA 01742

BELIBASAKIS NICHOLAS G
1219 14 31A
7 ANTHONY RD
WAYLAND, MA 01778

GUZMAN LIRIANO AMALFIS R
1219 15 30A1
37 OAK ST - UNIT 37
WATERTOWN, MA 02472

OHANNESIAN HARRY J
1219 15 30A2
39 OAK STREET
WATERTOWN, MA 02472

OHANNESIAN HARRY
1219 16B 0
96 LAUREL ST
WATERTOWN, MA 02472

SAHAN NURITSE
1219 17A 0
211 TRAPELO RD
WALTHAM, MA 02452

KUKRETI ESHA
1219 18 12
52 QUIMBY STREET
WATERTOWN, MA 02472

CHAMBERLAIN CLAYTON
1219 18 12B
54 QUIMBY STREET
WATERTOWN, MA 02472

D`SOUZA GERARD TRUSTEE
1219 19 11A
D`SOUZA & VARIA LIVING TRUST
WATERTOWN, MA 02472

GMYREK BRENDAN
1219 19 11B
50 QUIMBY STREET
WATERTOWN, MA 02472

TROIANI MARIO
1219 20 10
44 QUIMBY ST
WATERTOWN, MA 02472

WATSON NORA F.
1219 21 9
40 QUIMBY ST
WATERTOWN, MA 02472

WATERTOWN HOUSING AUTHORITY
1219 22 12
55 WAVERLEY AVE
WATERTOWN, MA 02472

MCENTEE WILLIAM P
1219 8A 97
97 MELENDY AV
WATERTOWN, MA 02472

GONG MINGYOU
1219 8A 99
99 MELENDY AV
WATERTOWN, MA 02472

CRAWFORD LORIN A
1219 9 36U5
5 OAK STREET U5
WATERTOWN, MA 02472

GHANDUR HAIFA
1219 9 36U7
7 OAK STREET U7
WATERTOWN, MA 02472

ZAKARIAN, ESTATE OF JOHN
1220 10 27
922 WALTHAM ST SUITE 209
LEXINGTON, MA 02421

HELIE JAMES R
1220 11 21
11 HAZEL ST U-1
WATERTOWN, MA 02472

BOYLE JOSEPH T
1220 11 21B
9 HAZEL ST U-2
WATERTOWN, MA 02472

BEJOIAN KASPER H JR
1220 12 20A
13 HAZEL ST U-2
WATERTOWN, MA 02472

JOHNSON STEVEN A
1220 12 20B
15 HAZEL ST
WATERTOWN, MA 02472

LUNA PROPERTIES LLC
1220 13 19
136 FLETCHER ROAD
BELMONT, MA 02476

98-100 DEXTER AVENUE LLC
1220 15 40
1 KITSON PARK DRIVE
LEXINGTON, MA 02421

BIONDO THOMAS B
1220 8 25
51 QUIMBY ST
WATERTOWN, MA 02478

HAGOP ORCHANIAN REV TRUST HAGOP TRUSTEE
1220 9 26
10 CHURCHILL RD
WINCHESTER, MA 01890

SP 36 ARLINGTON OWNER LLC
1236 1K 0
275 WASHINGTON ST 3RD FLOOR
NEWTON, MA 02458

HATZIILIADES MAXIMOS
1236 2 0
5 MADISON ST
BELMONT, MA 02178

36 ARLINGTON STREET LLC
1236 3F 0
35 WHITE STREET
CAMBRIDGE, MA 02140

ELM STREET PROPERTY OWNER, LLC
1236 4 G
930 COMMONWEALTH AVE SOUTH
BOSTON, MA 02215

BP WATERTOWN HOTEL, LLC.
1236 5H 0
13215 BEE CAVE PKW
AUSTIN, TX 78738

FORD GEORGE
1237 11 0
42 VINELAND STREET
BRIGHTON, MA 02135

FORD GEORGE
1237 12C 0
42 VINELAND STREET
BRIGHTON, MA 02135

WOLF STEVEN T, TRUSTEE
1237 13A 0
C/O STEVEN WOLF
WAYLAND, MA 01778

BUSTEED HARRY
1237 14 0
8 YUKON AV
WATERTOWN, MA 02472

KALAKIDIS SOTIRIA
1237 15 5
57 ELM ST
WATERTOWN, MA 02472

NERPOUNI KATHLEEN
1237 16 4
59 ELM STREET
WATERTOWN, MA 02472

TRINH THIEN HOANG
1237 17 3
63 ELM ST
WATERTOWN, MA 02472

MACLEOD + MOYNIHAN INC
1237 1A 0
110 ARLINGTON ST
WATERTOWN, MA 02472

MARCHIO MARIO
1237 22D 0
166 CUSHING ST
CAMBRIDGE, MA 02138

HELVADJIAN ANTRANIK
1237 24 0
81 ELM ST
WATERTOWN, MA 02472

LOLASTAR LLC
1237 27C 0
320 WASHINGOTN ST, STE 3FF
BROOKLINE, MA 02445

NSTAR ELECTRIC COMPANY
1237 29D 0
P O BOX 270
HARTFORD, CT 06141

BUSA ROBERT E.
1237 2A 65
30 MALLARD WAY
WALTHAM, MA 02154

MASREAL CO INC
1237 2B C
55 GLENLAKE PKWY NE
ATLANTA, GA 30328

ELM STREET PROPERTY ENTERPRISE
1237 30 0
P O BOX 95
BELMONT, MA 02478

10 MUNROE LLC
1237 32F 0
10 MUNROE AVENUE
WATERTOWN, MA 02472

ELM ST PROPERTY ENTERPRISE LLC
1237 35Y 0
P O BOX 95
BELMONT, MA 02478-2139

AAA PROPERTIES LLC
1237 4B 0
320 WASHINGTON ST #3FF
BROOKLINE, MA 02445

DERMENJIAN CHARLES
1237 9 6
374 LAKE STREET
BELMONT, MA 02478

MACKIN RICHARD W TRUSTEE
1238 1 0
110 ARLINGTON STREET
WATERTOWN, MA 02472

ELM REALTY CORPORATION
1238 14 3
97 BORDER ST
WEST NEWTON, MA 02165

LAZZARO ANNA L/E
1238 15 2
108 ELM STREET
WATERTOWN, MA 02472

ELM REALTY CORPORATION
1238 16 1
97 BORDER ST
WEST NEWTON, MA 02165

MAC HOUSES LLC
1238 17 6
110 ARLINGTON ST
WATERTOWN, MA 02472

MAC HOUSES LLC
1238 19 8
110 ARLINGTON ST
WATERTOWN, MA 02472

ALJAMMAL ISSAM
1238 20 10
69 POTTER RD
WALTHAM, MA 02453

MACKIN GARY J TRUSTEE
1238 22A 0
110 ARLINGTON ST
WATERTOWN, MA 02472

TATONE REALTY LLC
1238 29 1
144 LOVELL RD
WATERTOWN, MA 02472

80 ELM PARTNERS LLC
1238 3 0
26 ELM ST
QUINCY, MA 02469

615 ARSENAL HOLDING LLC
1301 2 1
800 BOYLSTON ST STE 1390
BOSTON, MA 02199

ARSENAL YARDS CORE HOLDING LLC
1301 2 1A
800 BOYLSTON ST SUITE 1390
BOSTON, MA 02199

ARSENAL YARDS HVMA HOLDING LLC
1301 2A 1
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BOSTON, MA 02199

ARSENAL ASSOCIATES
1301 2B 1
7 JACKSON WALKWAY
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ARSENAL YARDS 500 FORGE HOLDING LLC
1301 2D 2A
800 BOYLSTON ST STE 1390
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ARSENAL YARDS 500 FORGE HOLDING LLC
1301 2D 2B
800 BOYLSTON ST STE 1390
BOSTON, MA 02199

ARSENAL YARDS 500 FORGE HOLDING LLC
1301 2D 2C
800 BOYLSTON ST STE 1390
BOSTON, MA 02199

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446-550 Arsenal Street

Watertown, MA

PREPARED FOR

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February 10, 2023
Revised Sept, 2023

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Summary of Stormwater Master Plan updates

In response to comments received from DPW and the peer review consultants, additional stormwater management system improvements have been further evaluated.

The following is a summarizes the findings and anticipated modifications:

- **Updated Geotechnical Studies**: To further inform our studies and explore supplemental areas for groundwater recharge, Haley & Aldrich conducted additional subsurface investigations to support the stormwater infiltration design recommendations and prepared a plan to illustrate areas that are conducive to stormwater recharge based on soil suitability, permeability, estimated seasonal high groundwater and environmental conditions. A memorandum entitled "Summary of Stormwater Infiltration Results and Design Recommendations", prepared by Haley & Aldrich, Inc., dated August 2023 is appended to this report.

- **Updated Stormwater Management System Improvements:** The site systems have been optimized to comply with the Retention Standard to the maximum extent possible.
    - Fully Redeveloped Sites
        - 446-458 Arsenal Street - achieves full compliance with the Retention Standard
        - 550 Arsenal Street – achieves nearly full compliance with the Retention Standard with the introduction of a diversion pipe redirecting a portion of the stormwater runoff to larger recharge systems on 446-458 Arsenal Street (subject to securing an easement to cross Arsenal Way), expanded systems and modifications to the continuous tree trench recharge capabilities.
    - Partially Redevelopment Sites
        - 480 Arsenal Way (see separate report) – optimization of the previously proposed BMP (reconfigured and supplemental recharge wells (or stone column) to improve the infiltration in the underlying more granular soil layer and expansion of the subsurface recharge system beneath the garage footprint. Only partial compliance with the Recharge Standard is achieved due to limitations associated with the 72-hour drawdown requirement.
        - 550 Arsenal Street – expansion and optimization of subsurface recharge systems.

- **Additional Mitigation to meet the Retention Standard –** The following components have been added to offset the inability to achieve full compliance on the 480 Arsenal Way and 550 Arsenal Street lots:
    - A sub-surface recharge system to collect runoff from a portion of the Arsenal Way corridor between Arsenal Street and the Watertown Cambridge Greenway has been added.
    - Two sub-surface recharge systems to collect runoff within the portions of the Target parking lots beyond the limit of work.
    - Rainwater Harvesting Systems
    - Biofiltration Systems

- **Stormwater Contingency Plan:** Despite the extensive field investigations and studies, there is some remaining uncertainty regarding the in-situ soil conditions due to the highly variable soil conditions, historic use of the site and inaccessible portions of the site. Within this report is a contingency plan to achieve the required stormwater treatment levels and peak flow rate controls in the event that pre-construction testing limits the currently assumed stormwater potential of the in-situ site soils.

Project Benefits

Enhanced Water Quality

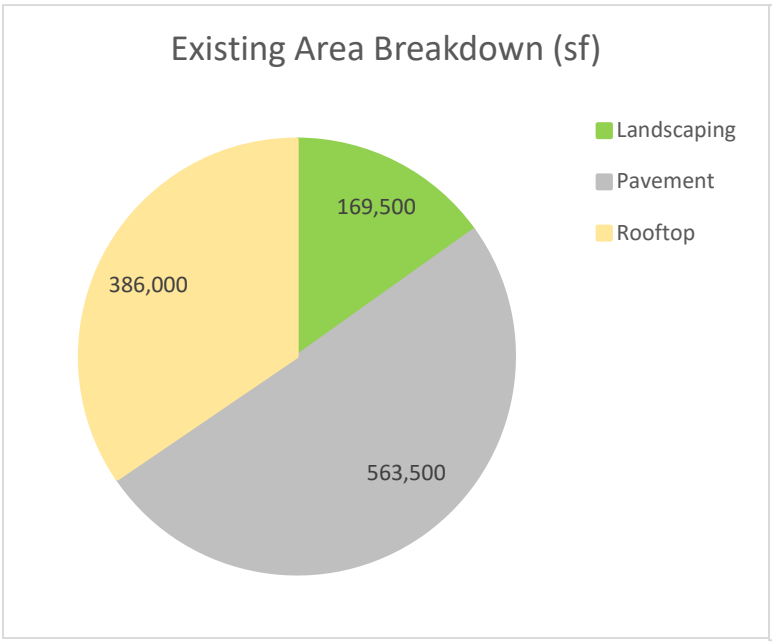
- Establishment of a more natural water cycle
- Designed to meet treatment standards set forth in MS4, TMDL, and Massachusetts Stormwater Standards
  - **>65%** Phosphrous removal
  - **>90%** TSS removal
- A suite of LID features (e.g. enhanced biofiltration, bioretention, tree trenches, permeable hardscape, subsurface infiltration) will be considered to achieve these goals

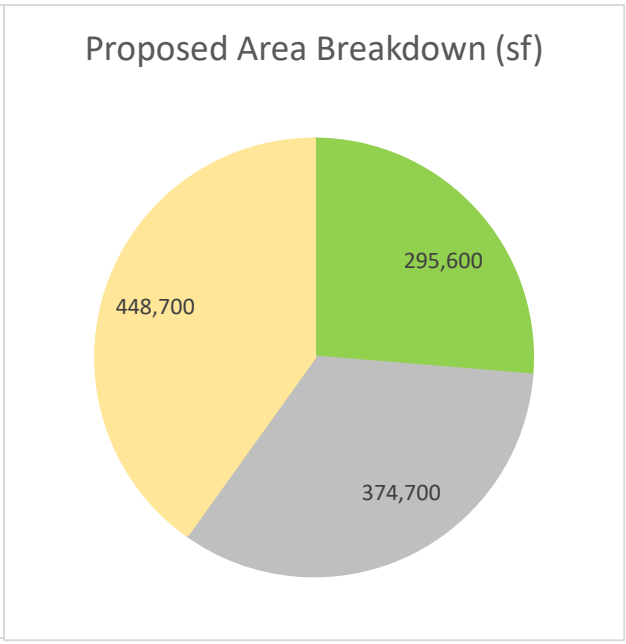
Peak Rate Attenuation

- Increase onsite pervious area by approximately 75,000 sf
- Reduction in runoff rates and volumes to the following
  - Arsenal Street drainage network
  - Municipal culvert bisecting the site,
  - Isolated wetland adjacent to Watertown Greenway

Increased Open Space

- Enchanced and increased open space area - both active and passive landscapes
- Improved vegetative cover and wildlife habitat within open spaces
- Landscape palette of native, adaptive, and drought tolerant plant materials
- Increased tree canopy cover - approximately 100 new trees will be planted, creating a long-term urban canopy





Stormwater Master Plan Narrative

This Stormwater Report has been prepared to outline the stormwater management strategies to be implemented in support of the proposed development. The report also describes the intent relative to achieving compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00), the Water Quality Certification Regulations (314 CMR 9.00) and the Watertown Rules and Regulations for Stormwater Management and Erosion Control to the extent feasible.

Project Description

The Applicant, Alexandria Real Estate Equities, Inc., is proposing to transform the Site into a campus of office, lab and retail uses including a multi-story parking garage, a significant increase in open space and landscape improvements (the "Project").

The Project will incorporate numerous Low Impact Development (LID) techniques, including increased open space, bio-retention areas, enhanced biofiltration, groundwater recharge, reduced paved areas devoted to parking and circulation and additional pervious hardscapes. Discharge offsite, both by sheet flow and physical connections to municipal drainage systems will be significantly reduced.

Site Description

The Project Site is comprised of parcels of land located at 446 Arsenal Street, 458 Arsenal Street, 500 Arsenal Street, and 550 Arsenal Street in Watertown, Massachusetts.

- 446/458 Arsenal Street consists of a retail building with surface parking areas, loading docks, and landscaped islands.
- 500 Arsenal Street includes a lab/office building with surface parking areas and a landscaped courtyard in front of the building.
- 550 Arsenal Street is a commercial property that is occupied by the Watertown Mall and large surface parking areas. While the western side of the property will be redeveloped, the existing Target retail building and the easterly portion of the parking lot will remain.

Wetland Resources

The Site lies within the surface watershed of Charles River. An isolated wetland resource area regulated under the City of Watertown Wetland Ordinance is located adjacent to the Watertown Greenway along the northern perimeter of the 500 Arsenal Street parcel. A Notice of Intent will be filed with the City of Watertown Conservation Commission for redevelopment improvements within the 150-ft buffer zone to this resource.

Soil Conditions

According to the National Resources Conservation Service (NRCS), surface soils on the Site consist entirely of Urban land, which does not have a Hydrologic Soil Group (HSG) classification.

To support the development of a master plan stormwater strategy, the Project's environmental consultant, Haley & Aldrich, Inc. (HAI), conducted subsurface investigations across the site. These investigations consisted of test pits, borings, in-situ infiltration testing, grain size analysis, and the installation of monitoring wells to observe groundwater levels and estimate seasonal high groundwater elevations.

Subsurface investigations completed to date across the Site indicate that there are areas of underlying soils which have limited infiltration capacity. Although the soil strata vary widely throughout the Site, there is generally fill ranging in depth from 5 to 18 feet deep, over a layer of organic or silty marine deposit, over glacial till. The fill consists of a heterogeneous mixture of previously imported soils with various amounts of cobbles/boulders, ash, glass, cinders, rubber, construction debris, and other miscellaneous materials.

Environmental Conditions

Environmental conditions are currently being assessed at the Project by HAI Site history, preliminary assessment results, and current regulatory status under the Massachusetts Contingency Plan (MCP) are summarized below:

500 Arsenal Street

The 500 Arsenal Street parcel was developed in late 1800s. The southern portion of the parcel was occupied by residential dwellings adjacent to Arsenal Street and the remaining portion of the parcel was used to manufacture carpet linings and bedding. The parcel was occupied by Harvard Mills Co. from before 1889 until 1894 when it was occupied by the Union Carpet Lining Company. The buildings were vacated between 1916 and 1923, and by 1928 were utilized by the Hood Rubber Company for manufacturing and storage. The buildings were demolished by 1971; the present day buildings were constructed in the 1980s.

Assessment activities conducted in February 2022 at the 500 Arsenal parcel resulted in detections of SVOCs, lead, zinc, and PCBs in soil which exceeded RCS-1 Reportable Concentrations. In addition, cadmium, lead, and zinc were detected in groundwater samples above their applicable RCGW 2 Reportable Concentrations. The parcel was reported to MassDEP in July 2022 and the parcel was assigned Release Tracking Number (RTN) 3-37593. Further investigations are currently underway to collect additional soil and groundwater quality data to support stormwater infiltration design.

550 Arsenal Street

Prior to its development in 1910, the 500 Arsenal parcel was vacant land with a stream traversing the parcel from the northwest to the east, connecting to Sawins Pond and Williams Pond. In 1910, the 550 Arsenal Street parcel was developed and occupied by the Hood Rubber Company for the processing and manufacturing of rubber products. In 1942, the parcel was occupied by the B. F. Goodrich Company. The buildings were demolished in the early 1970s and the existing Watertown Mall was constructed by 1978.

RTN 3-2538 is associated with the presence of polychlorinated biphenyls (PCBs) within a settling basin located beneath the existing Watertown Mall building encountered in December 1988. Other hazardous materials were detected in soil and groundwater attributed to former rubber manufacturing operations by Hood Rubber Company and B.F. Goodrich Rubber Companies. These contaminants include polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and heavy metals including lead, nickel, zinc, mercury, barium, and cadmium, in soil. In addition, perchloroethylene, a volatile organic compound (VOC), TPH, and heavy metals including arsenic, chromium, and lead, were detected in groundwater samples. The results of the investigation were submitted to the MassDEP and the Site was placed on its "List of Confirmed Disposal Sites and Locations to be Investigated".

Response actions, including sediment removal and restructuring of stormwater conveyance were conducted between 1989 and 1990. A Phase II Comprehensive Site Assessment was prepared in January 1991 and concluded that the site was impacted by historical industrial land use practices and urban fill resulting in the presence of oil and hazardous materials in soil and groundwater; however, no further remedial action was necessary at the subject site. A Waiver Completion Statement reporting the completion of necessary response actions was filed for the subject site on 12 February 1991.

MassDEP performed an audit of the Disposal Site in 1995 and determined that no further response actions were necessary (equivalent to a Permanent Solution under the current MCP); however, a Land Use Restriction Policy (LURP), which predates the current Activity and Use Limitation (AUL) process, was required. The LURP states that future subsurface excavations shall be performed by “qualified individuals who shall appropriately characterize conditions encountered and ensure that site activities are conducted in accordance with applicable regulatory guidelines.”

Subsurface investigations conducted in February 2022 resulted in contamination being encountered in both soil and groundwater which was consistent with the prior release from the 1980s and 1990s timeframe.

Impact to stormwater management design

In summary, due to the presence of environmental impacts to both soil and groundwater at both the 500 and 550 Arsenal parcels from prior site industrial use, stormwater infiltration will be limited to areas which are conducive to infiltration so as not to exacerbate contamination conditions, as outlined in the appended memorandum by HAI. Additional assessment will be required prior to construction to further evaluate the feasibility of stormwater infiltration in the proposed areas.

Existing Drainage Conditions

Currently, the Site is comprised of predominantly impervious areas consisting of buildings, parking lots, sidewalks, and roadways. Existing pervious open space on site is limited to vegetated landscape strips along the Site perimeter and those along the shared use path bisecting the Site, as well as limited landscape islands within the parking lots.

The topography across the Site is relatively flat. Grades along the Arsenal Street frontage are relatively gentle, ranging from elevation 31 to elevation 27. Along the north end of the properties where the Site abuts the Watertown Greenway, elevations range from elevation 31 to elevation 24. The lowest grades within the existing anchor retail tenant parking lot are at approximately elevation 20.5.

Figure 2 illustrates the existing drainage patterns on the Site. The Site has been divided into seven drainage areas as stormwater runoff flows to two defined Design Points, which have been identified as:

- DP-1 – 72" culvert : Site stormwater runoff from the east side of the shared use path along the City of Cambridge Aqueduct is collected by a network of catch basins and manholes and conveyed to a municipal 72-inch drain line to the east which traverses the Site. Stormwater flows via the municipal drain to Williams Pond after exiting the Site underground below Elm Street. The majority of the stormwater runoff from 500 Arsenal Street is collected by a drainage network of catch basins and manholes which conveys flow underground and ultimately discharges to the isolated wetland. While some runoff is exfiltrated in the wetland, most will ultimately discharge via overland relief to the 72" culvert.
- DP-2 - Arsenal Street: Small portions of the Site along the Arsenal Street Right-of-Way flow either overland or are piped into the municipal drainage network located within the Right-of-Way.

Table 2 below provides a summary of the existing conditions hydrologic data.

Table 2 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
446/458 Arsenal Street					
EX1D	Isolated Wetland/ 72" Culvert	DP-1	0.6	97	5.0
EX2A	Arsenal Street	DP-2	1.0	97	5.0
500 Arsenal Street					
EX1A	Isolated Wetland/ 72" Culvert	DP-1	4.9	94	6.4
EX2B	Arsenal Street	DP-2	0.8	83	5.0
550 Arsenal Street					
EX1B	72" Culvert	DP-1	9.1	96	5.0
EX1C	72" Culvert	DP-1	0.8	93	9.1
EX2C	Arsenal Street	DP-2	0.1	87	5.0

Proposed Drainage Conditions

The proposed redevelopment will provide an increase of approximately 75,000 square feet of pervious area and open space, as well as enhanced water quality due to the implementation of stormwater best management practices (BMPs). The increase in pervious area alone will significantly contribute to improved stormwater quality, peak attenuation of runoff and provide enhanced groundwater recharge.

Figure 3 illustrates the stormwater management features that are being proposed for the Project. To facilitate the stormwater modeling, the Site has been divided into twenty-one sub-catchment areas that discharge treated stormwater to the two existing Design Points described previously.

Proposed conditions hydrologic data is summarized in Table 3 below.

Table 3 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
445/458 Arsenal Street					
PR1A	Pond 2P	DP-2	0.2	87	5.0
PR1B	Pond 2P	DP-2	0.2	85	5.0
PR1C	Pond 3P	DP-2	0.2	92	5.0
PR1D	Pond 1P	DP-2	0.3	77	5.0
PR1E	Pond 2P	DP-2	0.6	98	5.0
PR1F	Arsenal Street	DP-2	0.2	87	5.0
500 Arsenal Street					
PR2A	Isolated Wetland	DP-1	0.2	97	5.0

PR2B	Pond 5B/Isolated Wetland	DP-1	1.5	87	5.0
PR2C	Pond 4C-P/Isolated Wetland	DP-1	2.6	90	5.0
PR2D	Pond 4A-P/Pond 4B-P/Iso wetland	DP-1	1.1	95	5.0
PR2E	Arsenal Street	DP-2	0.2	87	5.0
550 Arsenal Street					
PR3A	Pond 8P	DP-1	1.2	87	5.0
PR3B	Pond 10P	DP-1	0.6	88	5.0
PR3C	Pond 9P	DP-1	1.5	98	5.0
PR3D	Pond 12P	DP-1	1.4	94	5.0
PR3E	Isolated Pond 6P	DP-1	3.1	96	5.0
PR3F	Pond 13P	DP-1	0.7	94	5.0
PR3G	Arsenal Street	DP-2	0.5	91	5.0
PR3H	Pond 7P	DP-1	0.4	92	5.0
PR3I	Pond 11P	DP-1	0.2	86	5.0
PR3J	Pond 15P	DP-1	0.7	93	5.0

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook, in addition to guidance from the Massachusetts MS4 General Permit and Charles River Phosphorous TMDL, as well as the City of Watertown Stormwater Rules & Regulations. Due to geotechnical and localized environmental restrictions, the Project will meet the City of Watertown Retention Standard for Redevelopment Projects to the maximum extent practicable, as documented in this report.

Infiltration on 446/458 Arsenal parcel will be accomplished primarily through subsurface infiltration along the eastern and southern frontages on Arsenal Way and Arsenal Street. The design also incorporates a bioretention area in the southeast corner of the loading area.

Infiltration on the 500 Arsenal parcel will be accomplished primarily along the southern and western frontages. Infiltration on the northern and eastern portions parcel and within the courtyard area site will be challenging due the presence of contaminants in groundwater, soils with very limited infiltration capacity, and the proximity to the Cambridge Aqueduct. An enhanced bioretention area is proposed in the northeast corner of this parcel. **Additionally, an interconnection is proposed beneath Arsenal Way to connect the infiltration systems on 500 Arsenal and those on 446/458, to maximize the superior soil permeability rates on 446/458.**

Infiltration on the 550 Arsenal development parcel will be accomplished primarily subsurface along the Arsenal Street frontage, within the A1/P1 courtyard, beneath the garage footprint, and north of the garage footprint. Several bioretention areas are proposed, as well as sand filters to treat the retail parking lots east of R1 where poorly infiltrating soils and contamination is present.

The systems have been designed to remove at least 65% of the annual average phosphorous and 90% of the average annual load of TSS from the post construction newly redeveloped areas as required by the MS4. Treatment trains consisting of pretreatment elements such as deep sump and hooded catch basins, proprietary water quality units, and stone/grass filter strips as well as structural

BMPs such as infiltration structures, bioretention areas and sand fillers will be implemented to meet TSS and Total Phosphorous removal requirements on a per parcel basis through the Project.

As noted in the Summary of updates, several additional mitigation measures toward the City of Watertown infiltration standard have been added to the design.

Recharge well systems in the Target retail parking lot. These systems are comprised of lined stone columns extending through the poor fill soils, into the more permeable sand layer below. Runoff from the existing closed pipe system in the parking lot will be intercepted and diverted to a storage volume above the columns. The storage has been maximized to hold the volume of runoff that can be infiltrated through the wells within the required 72-hour drawdown time.

An infiltration system is proposed on the northwest corner of building OL3 to capture and recharge runoff from the off-site area of Arsenal Way.

As depicted on Figure 3, specific stormwater strategies for each lot include:

- 446/458 Arsenal Street: Subsurface data indicate that soils on this portion of the Site are suitable for infiltration, with rates between 7.0 in/hr and 3.5 in/hr. Two subsurface infiltration basins along the eastern and southern ends of the property (pond 1P and 2P) are currently proposed to collect and treat the roof and pavement runoff from OL4. A bioretention basin (3P) in the southeast corner of the loading area will provide treatment for a portion of the loading are before discharging into pond 2P. This parcel has the ability to meet the retention standard, fully containing the 100-year storm. Porous asphalt and permeable pavers are being studied for use in non-vehicular areas of this parcel, as well as tree trench infiltration for additional LID measures. While the buildings are still undergoing design development, stormwater harvesting for re-use will likely be implemented to help achieve the Project's sustainability goals.
- 500 Arsenal Street: subsurface infiltration chambers (pond 4A-P, 4B-P, and 4C-P) are proposed along the west and southern frontages of this parcel. The system along the southern frontage of the property has been broken into two to minimize disturbance around several mature trees which are being retained along Arsenal Street. These systems will collect and treat runoff from OL3, most of OL2, A2, and the courtyard. These systems will overflow through a closed pipe connection to the 446/458 Arsenal St infiltration system described above.
  North of the OL2 building, the pavement area runoff is directed to the enhanced bioretention area. This BMP will coexist within a "micro urban forest" within this area adjacent to the isolated wetland. Pockets of upland area will contain varying species of tree plantings and vegetative covers while the lower areas will serve as areas for stormwater treatment. Due to existing soil limitations the bioretention is required to be lined. As such this smaller portion of the runoff can't be infiltrated, and as such will be seeking relief to the meet the retention standard to the maximum extent practicable. Similar to 446/458 Arsenal, porous asphalt, permeable pavers, infiltrating tree trenches and stormwater harvesting are being studied as additional sustainability and LID measures.
- 550 Arsenal Street: Subsurface infiltration is proposed along the Arsenal Way frontage (pond 6P), the A1/P1 courtyard (8P), below the P2 garage footprint (9P), and beneath the

pavement north of the P2 garage (10P). These systems will treat runoff from the building roofs and loading areas, as well as the eastern driveway and OL1 drop off.

Bioretention basins (7P and 11P) are proposed at the southwest corner of OL1 and the landscape area east of R1. These basins are proposed to treat runoff from some roof and sidewalk areas. Two sand filters (ponds 12P and 13P) are proposed east of R1, treating the runoff from the retail parking lots. This area of the Site has poorly infiltrating soils and some contamination issues which preclude infiltration.

Similar to 446/458 and 500 Arsenal, porous asphalt, permeable pavers, infiltrating tree trenches and stormwater harvesting are being studied as additional sustainability and LID measures. While significantly reducing the 100-year storm peak rates and volumes of runoff, this parcel does not have the capacity to meet the City Retention Standard and will be seeking relief to meet the standard to the maximum extent practicable. Stormwater overflows from the systems on this parcel will overflow into the 72" culvert, which will be partially reconstructed around the A1/P1 garage.

- Additional Mitigation:

  A portion of the Arsenal Way runoff flows to a catch basin at the curb cut on the west side of the 500 Arsenal St site. The catch basin discharges to a pipe on the site, affording the opportunity to intercept and infiltrate the runoff. A sub-surface recharge system to collect runoff from a portion of the Arsenal Way corridor between Arsenal Street and the Watertown Cambridge Greenway has been added.

  Two sub-surface recharge systems collect runoff within the portions of the Target parking lots beyond the limit of work. The systems are underdrained through a series of recharge wells. The wells extend from the bottom of system through the poorly draining fill layers to sand layer beneath. The retention systems have been maximized in size to capture and hold the volume of runoff that can be drawn down in 72 hours.

Environmentally Sensitive and Low Impact Development (LID) Techniques

The master plan identifies numerous areas where Low impact Development (LID) stormwater features will be implemented. The structural BMP low impact design strategy for the Site will include features such as bioretention/rain garden areas and tree trenches. Permeable pavements will be considered in locations such as sidewalks and emergency access ways. In addition, increased tree canopy will contribute to reduced heat island impact. Although the buildings are not yet fully designed, the Project has committed to a standard of LEED Gold. LID measures related to the buildings, such as water harvesting, are currently being considered.

Figure 1 Existing Drainage Conditions Plan

LOCATED IN INDUSTRIAL-2
ZONING DISTRICT, SUBJECT TO
CONCURRENT PERMIT PROCESS

WHEELER COURT

MUNROE AVE

YUKON AVE

WILLIAMS POND

ELM STREET

ARSENAL WAY

ARSENAL STREET

EX1C

ISO-P

EX1A

EX1B

EX1D

EX2A

EX2B

EX2C

DP1

DP2

Legend

SYMBOLS

X — **DESIGN POINT/LINK DISCHARGE POINT**

X — **DRAINAGE AREA DESIGNATION**

LINETYPES

DRAINAGE AREA BOUNDARY

FLOW LINE

WETLAND BOUNDARY

NOTE:
THE SCS SOIL CLASSIFICATION FOR THE PROJECT LOCUS AND THE SURROUNDING AREA IS URBAN LAND; MAP UNIT SYMBOL 602. THERE IS NO DESIGNATED HYDROLOGIC SOIL GROUP (HSG) FOR THIS SOIL, BUT HSG C IS ASSUMED FOR EXISTING AND PROPOSED DRAINAGE ANALYSES.

0 40 80 160Feet

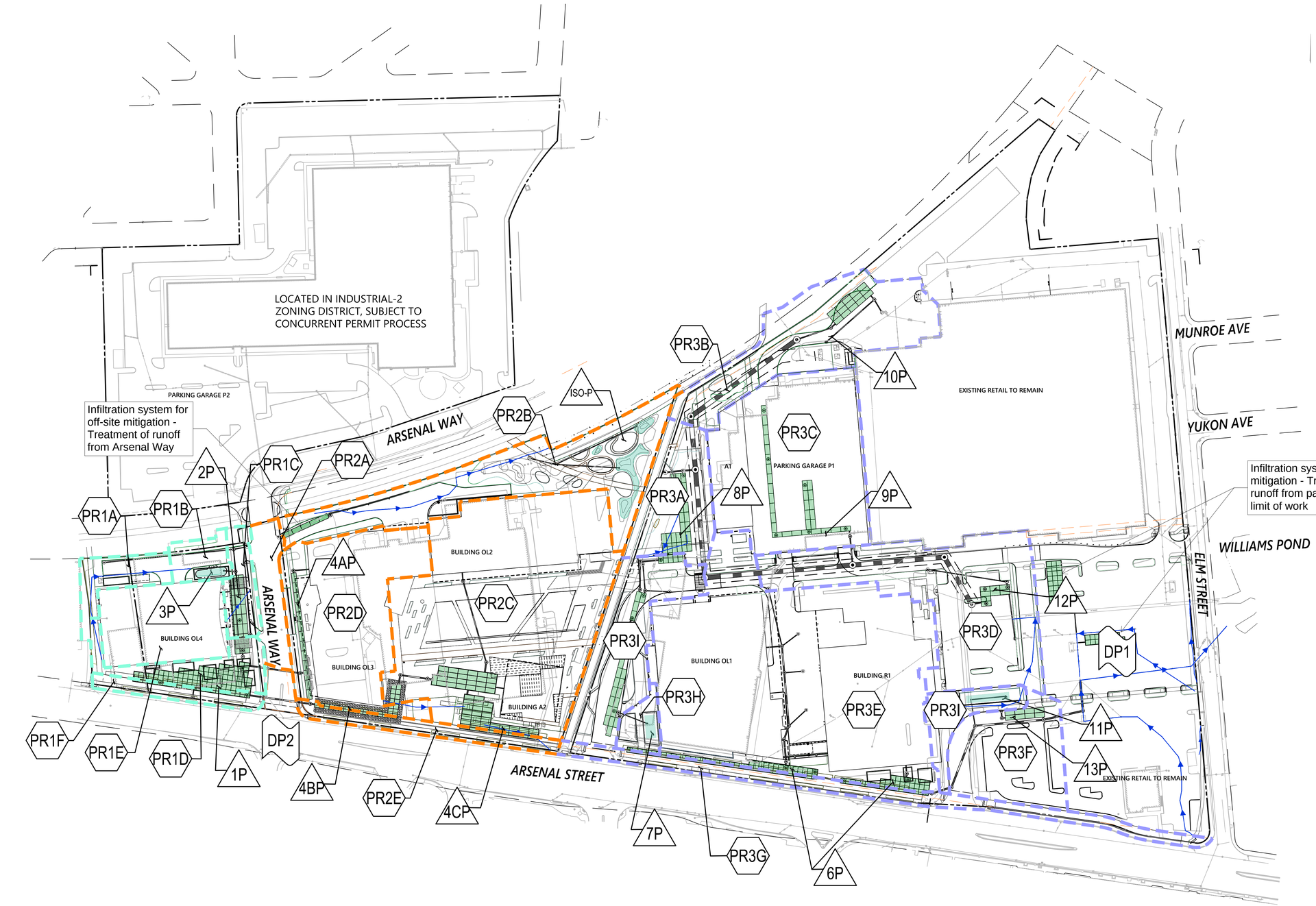
vhb

Existing Drainage Conditions
Watertown Mall Transformation
446-550 Arsenal Street
Watertown, Massachusetts

Figure 2

09/12/2023

Figure 2 Proposed Drainage Conditions Plan



Legend

SYMBOLS

- DESIGN POINT/LINK
- DRAINAGE AREA DESIGNATION
- POND

LINETYPES

- DRAINAGE AREA BOUNDARY
- FLOW LINE
- WETLAND BOUNDARY

NOTE:
THE SCS SOIL CLASSIFICATION FOR THE PROJECT LOCUS AND THE SURROUNDING AREA IS URBAN LAND; MAP UNIT SYMBOL 602. THERE IS NO DESIGNATED HYDROLOGIC SOIL GROUP (HSG) FOR THIS SOIL, BUT HSG C IS ASSUMED FOR EXISTING AND PROPOSED DRAINAGE ANALYSES.

Proposed Drainage Conditions
Watertown Mall Transformation
446-550 Arsenal Street
Watertown, Massachusetts

Figure 3

09/12/2023

Figure 3 LID (Low Impact Development) Figure

LID STORMWATER STRATEGY



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Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) – Stormwater Management Standards

As demonstrated below, the proposed Project will comply with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project will be designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system will be designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 and 6.

All proposed Project stormwater outlets and conveyances will be designed to not cause erosion or scour to wetlands or receiving waters. Outlets from closed drainage systems will be designed with flared end sections or headwalls and stone protection to dissipate discharge velocities, where applicable. Overflows from BMP's that impound stormwater will be designed to protect downgradient areas from erosion.

Standard 2: Peak Rate Attenuation

The Project will be designed to comply with Standard 2.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2 years (3.26 inches), 10 years (5.14 inches), 25 (6.32 inches) and 100 years (8.9 inches), consistent the requirements of the Watertown Stormwater Rules and Regulations. The combination of newly created open space and groundwater recharge will result in reductions in the peak discharge of stormwater runoff leaving the Site. Computations regarding the hydrologic modeling are included in Appendix A.

Table 4 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point 1 – 72" Culvert				
Existing	29.3	46.2	59.2	86.2
Proposed	6.2	13.9	41.8	73.1
Design Point 2 – Arsenal Street				
Existing	4.8	7.9	10.4	15.6
Proposed	2.3	3.9	5.1	7.7

Table 5 Peak Runoff Volumes (ac-ft)

Design Point	2-year	10-year	25-year	100-year
Design Point 1 – 72" Culvert				
Existing	2.3	3.7	5.4	8.8
Proposed	0.5	1.2	2.0	3.6
Design Point 2 - Arsenal Street				
Existing	0.4	0.6	0.8	1.2
Proposed	0.2	0.3	0.4	0.6

Standard 3: Stormwater Recharge

The Project will be designed to comply with Standard 3.

Since the proposed redevelopment will result in a net reduction in impervious area onsite, there is no Required Recharge Volume for the Project.

Notwithstanding, recharge of stormwater will be provided through subsurface infiltration systems, bioretention systems, increased open space and other LID measures.

Soil evaluation (including Geotechnical memorandums and exploration logs), computations, and supporting information are included in Appendix B.

Standard 4: Water Quality

The Project will be designed to comply with Standard 4.

The proposed stormwater management system will implement a treatment train of BMPs that has been designed to provide greater than the required 80% TSS removal of stormwater runoff from all proposed impervious surfaces. Treatment trains will include deep sump hooded catch basins and bioretention basins and/or other means of approved TSS removal, where applicable.

Computations and supporting information are included in Appendix C.

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

The Project is considered a LUHPPL and therefore will be designed with suitable BMPs sized to treat the 1-inch Water Quality Volume and provide the pretreatment requirement of 44% TSS removal prior to infiltration. Proposed source controls and pollution prevention measures will be identified in the Long-Term Pollution Prevention Plan.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

Despite being subject to Stormwater Management Standards 2-6 to the maximum extent practicable, the Project has been designed to fully comply with all ten of the Stormwater Management Standards.

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project will disturb greater than one acre of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins.

Standard 9: Operation and Maintenance Plan

A Post Construction Stormwater Operation and Maintenance (O&M) Plan is included in Appendix F

Standard 10: Prohibition of Illicit Discharges

Sanitary sewer and storm drainage structures remaining from previous development which are part of the redevelopment area will be removed or will be incorporated into updated sanitary sewer and separate stormwater sewer systems. The design plans submitted with this report have been designed so that the components included therein are in full compliance with current standards. The Long-Term Pollution Prevention Plan will include measures to prevent illicit discharges.

Local Municipal Rules and Regulations

Section 8.0 of the Watertown Rules and Regulations for Stormwater Management and Erosion Control, as adopted on 9/22/2021, describes the performance standards with which projects shall comply.

8.1 Water Quality Standard

8.1.1 – All projects shall implement (LID) planning and design strategies

The Project will implement low impact design (LID) strategies as part of a comprehensive stormwater management system.

From a stormwater management perspective, the master plan stormwater design identifies numerous areas where LID stormwater features will be considered. The low impact design strategy for the Site includes features such as increased open space, enhanced biofiltration basins, bioretention/rain garden areas, continuous tree trenches, groundwater recharge, and permeable pavements. Although

the buildings are not yet fully designed, the Project has committed to a standard of LEED Gold. To assist towards this project goal, LID measures related to the buildings, such as water harvesting, are currently being studied.

From a site design and layout perspective, the Project is also implementing an LID approach. The master plan currently proposes an approximate reduction of 10% (75,000 square feet) in impervious area. This reduction will result in less stormwater leaving the Site and help to restore a natural water cycle. The Project is also proposing the construction of a parking garage to replace the large surface parking fields currently located throughout the Site. By consolidating the parking into a smaller footprint, less stormwater potential pollutant load will be generated in the proposed condition. Along with structural stormwater improvements, this reduction will decrease the amount of TSS that discharges to the Site and municipal drainage network. The master plan is also proposing an increase in tree cover over the existing condition. Approximately 100 new trees will be planted throughout the Site, creating a diverse and resilient canopy. At this scale, a landscape palette of native, adaptive, drought tolerant trees and plantings will recreate a natural environment, providing not only cleaner water through the restoration of a more natural water cycle, but also cleaner air, and habit – improving both the hydrologic and ecological functions of this urban watershed.

8.1.2 – All projects shall provide for removal of 90% of the proposed average annual load of TSS (total suspended solids) and 60% of the proposed average annual load of TP (total phosphorous) generated from the total proposed impervious surface area.

The Project will meet all standards related to removal of both suspended solids and phosphorous. In addition to the low impact design features discussed in the above section, the stormwater management system will implement treatment trains including deep sump catch basins and hydrodynamic separators. Phosphorous removal is provided by way of infiltration practices where feasible, and bioretention and/or sand filters where not feasible.

8.1.3 – In no instance shall there be an increase in the estimate annual average load of TP (total phosphorous) from existing to proposed conditions.

The Project is designed to meet total phosphorous removal requirements, as required by the City.

8.1.4 – To support compliance with the Charles River Watershed phosphorous TMDL and the Town's MS4 permit, all BMPs shall be optimized for the removal of phosphorous. Guidance on the BMP phosphorous-removal performance may be found in the MS4 Permit Appendix F Attachment 3.

All BMPs will be designed in compliance with the Charles River Watershed Phosphorous TMDL to the maximum extent practical.

8.2 Retention Standard for New Development Projects

The Project is a redevelopment. Therefore, this standard is not applicable.

8.3 Retention Standard for Redevelopment Projects

Stormwater management systems shall be designed to provide, to the maximum extent practicable, retention of the stormwater runoff for all storm events up to and including the 100-year, 24-hour storm. Retention may be achieved by infiltrating stormwater or by storing rainwater for use. For redevelopment projects that preclude infiltration, the storage volume for filtration practices (e.g., biofiltration) may count toward meeting the Retention Standard. If the Retention Standard cannot be fully met, applicants shall meet the maximum extent practicable standards specified in section 8.3.1 and provide off-site compliance as specified in section 8.3.2.

Due to geotechnical and environmental constraints full compliance with the retention standard can't be achieved. In accordance with Section 8.3.1, the Project will meet the standards to the maximum extent practicable.

8.3.1 – Maximum Extent Practicable

1. Factors Affecting Retention Potential:

There are multiple factors, recognized as constraints by the City, that limit the retention potential on Site. The information below summarizes how these constraints impact the Project's retention potential:

Subsurface investigations completed to date across the Site have indicated that there are areas of underlying soils which have limited infiltration capacity. Although the soil strata vary widely throughout the Site, there is generally fill ranging in depth from 5 to 18 feet deep, over a layer of sand or organic or silty marine deposit, over glacial till. The fill throughout the Site generally consisted of intermixed apparent imported soils, deleterious materials (ash, glass, cinders, rubber), construction debris (metal, brick, concrete), and occasional organic material (topsoil, roots, wood).

Monitoring wells have been installed throughout the Site and will continue to be monitored for groundwater elevations as the stormwater design becomes more detailed. Initial estimated seasonal high groundwater elevations have been calculated using a Frimpter adjustment, ranging from approximately elevation 13.5 to 20.7. A groundwater contour map and ESHGW recommendations for each basin have been provided by the geotechnical engineer.

As summarized in the Environmental Conditions section above, historical industrial use of the Site, including operations of the Hood Rubber factory, resulted in subsurface contamination on one or more parcels comprising the Project. Additional investigation is underway, but at this time it is unknown to what extent environmental conditions may impact potential stormwater BMP locations. It is, however, recognized that the presence of contaminated soil and/or groundwater would make complete onsite retention physically infeasible. As such, the Project has been designed to limit the locations of stormwater management practices to areas that are less likely to have environmental contamination constraints based on preliminary environmental data collected to date.

Given that portions of the Site have limited infiltration capacity within the underlying soils and high groundwater, there is limited area where infiltration is feasible, and therefore the Project is requesting a waiver to the Retention Standard.

Additional subsurface investigations are planned and being undertaken as the building and Site design advances. Based on these findings, parcel by parcel stormwater design will be refined to ascertain the volume of stormwater that is able to be provided for each phase of the Project, working around these constraints.

2. Criteria for Determining Maximum Extent Practicable

Per the Watertown Rules and Regulations for Stormwater Management and Erosion Control, the Department of Public Works (DPW) can determine that the Retention Standard has been met to the maximum extent practicable after establishing that the Project has satisfied certain criteria. The Project's compliance with the required criteria is summarized below; italicized text is from the Watertown Stormwater Regulations, and the Project response is in plain text.

- *Applicants have demonstrated that they have made a complete evaluation of possible stormwater management measures that could be used and that they have made all reasonable efforts to fully meet the Retention Standard.*

Following the master plan permitting process, each individual phase of the Project will undergo detailed design and permitting through the City's site plan review process. Based on the current understanding of existing constraints, it is anticipated that the Retention Standard waiver will be requested. As each phase undergoes additional subsurface investigation, detailed design and review, it will be demonstrated that all reasonable efforts to meet this standard have been made.

- *Factors affecting retention potential, as described in Section 8.3.1.1 of these Rules and Regulations, have been identified and preclude the ability to fully meet the Retention Standard.*

See Section 8.3.1.1 above for more information.

- *Appropriate measures to reduce stormwater runoff have been provided through better design practices, such as removing extraneous parking, reconfiguring required parking, minimizing the use of impervious materials, and providing enhanced vegetation.*

The Project provides an increase in pervious area, which will reduce stormwater volume leaving the Site. The master plan will utilize structured parking garages in order to eliminate the existing expansive surface parking field – further reducing the footprint of a higher intensity land use which would otherwise serve as a primary source of TSS that may enter the proposed drainage system. The use of permeable pavements are also under consideration where feasible, further minimizing impervious materials. Lastly, a comprehensive planting program of trees and other vegetation will be undertaken, providing an enhanced landscape along the public rights of way, as well as internal to the Site.

- *Appropriate measures have been taken to disconnect roof runoff from direct discharge to the drainage system.*

Roof runoff from proposed buildings will be routed through stormwater management systems which will provide treatment and/or detention. Also, the Project is currently investigating the use of building runoff as a water conservation measure to support the LEED Gold rating to which it has committed.

- *Appropriate measures have been taken to disconnect other existing paved areas from direct discharge to the drainage system, allowing controlled flow over pervious areas or through BMPs providing at least partial recharge.*

Where feasible, existing impervious area will be redirected to recharge systems. For example, it is anticipated that along roadways, continuous tree trenches will be constructed to achieve increased recharge of reconstructed impervious area along the Site frontage.

- *Appropriate measures have been taken to apply LID techniques for runoff reduction. Measures such as, but not limited to, porous pavement, green roofs, rain gardens, bioretention areas, and rainwater harvesting and reuse have been considered.*

All the techniques listed above are being considered as structural LID measures implemented by the Project. As each phase and building undergoes additional detailed design, more information will be provided in each individual permit submission and filing regarding the extent of these measures.

- *There shall be a documented reduction in the rate and volume of runoff. In no instance shall there be an increase in the rate of volume of runoff.*

There will be a meaningful reduction in the rate and volume of runoff leaving the Site. This will be achieved through the reduction in total impervious area, as well as the reconstruction of the Project's stormwater management systems.

- *All Massachusetts Stormwater Management Standards have been met.*

See documentation in the above section of this memorandum discussing the Massachusetts Stormwater Standards – although a redevelopment, the Project is designed to meet all such standards.

3. Documentation of Maximum Extent Practicable

This submission includes hydrologic and hydraulic analyses for the Project. These studies provide the basis for peak runoff rates and volumes reductions for the master plan level of the Project. Conservatively, these studies do not include additional LID measures within the model - elements such as tree trenches, permeable pavements or rainwater harvesting. As each phase of the Project undergoes further design and permitting through the City of Watertown, additional stormwater management design packages will be submitted for review. Such packages will individually detail the Project's compliance with the Retention Standard to the maximum extent practicable, and further quantify the effect that the additional LID measures will have on the quantity of runoff leaving each parcel.

Stormwater Contingency Plan

Despite the extensive field investigations and studies, there is some remaining uncertainty regarding the in-situ soil conditions due to the highly variable soil conditions, historic use of the site and inaccessible portions of the site. In the event that pre-construction testing limits the currently assumed stormwater recharge potential of the in-situ site soils, the Applicant is aware that alternative means of complying with the treatment and peak rate mitigation regulations will be required. Should such a situation arise, an alternative stormwater design will be submitted to the City of Watertown DPW for approval.

The following stormwater BMPs could be utilized to achieve the required stormwater treatment levels and peak flow rate controls required under the Massachusetts Stormwater Management Regulations and City of Watertown Stormwater Ordinance:

- **Recharge Wells:** Lined recharge wells can be used to penetrate through a layer of unsuitable soil to reach more permeable materials where infiltration capacity of the bearing soil is negligible, or the soil is found to be unsuitable for environmental reasons.
  A recharge well provides limited recharge capacity through a vertical cylinder of stone sleeved through the unsuitable layer to more favorable materials below. A series of wells can provide sufficient recharge to meet the treatment requirements of the Massachusetts Stormwater Regulations and the City of Watertown Stormwater Ordinance.
  Should the soils below a currently proposed infiltration system be found to be unsuitable during pre-construction testing, it may be feasible to utilize an impermeable liner around the storage volume and resize it to maximize the flow that can be drawn down in 72-hrs through a series of recharge wells.
  This concept is currently proposed in specific locations within the stormwater design to maximize the recharge potential.

- **Sand Filters:** A sand Filter is an effective BMP for treating stormwater to remove the TSS and phosphorous loads. In the event that infiltration is found to be unattainable due to adverse findings in pre-construction soils analysis, sand filters can be an effective means of attaining compliance with the treatment requirements of the governing regulations. A detention volume can be utilized as a means of peak rate control upstream of the sand filter.
  Such a system has been used successfully elsewhere in Watertown in circumstances similar to this.

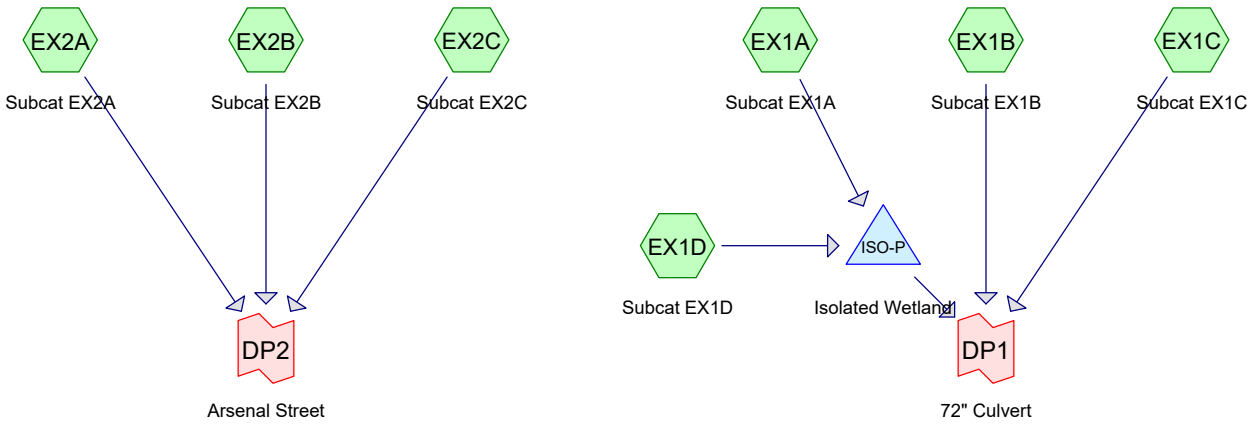
- **Extended Bioretention:** Additional extended bioretention systems, similar to that system proposed in the northeast corner of the 500 Arsenal Street site, could be utilized in other locations should additional testing determine that groundwater recharge is infeasible at any specific location.

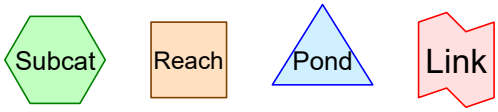
- **Proprietary Filters:** Not currently accepted by the City of Watertown as a primary means of achieving stormwater treatment. VHB understands that manufacturers of these technologies are pursuing testing and approvals at EPA and state levels.

Appendix A: Standard 2 Computations and Supporting Information

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 2, 10, 25 and 100-years. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm and precipitation depths for the site: 3.2, 4.9, 6.2, and 8.9 inches, respectively, based on Watertown Stormwater Regulations. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 2 and 3 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Drainage areas used in the analyses were described in previous sections and shown on Figures 2 and 3. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

HydroCAD Analysis: Existing Conditions





Routing Diagram for 1537400 - EX
Prepared by VHB, Printed 2/8/2023
HydroCAD® 10.10-7c s/n 01038 © 2022 HydroCAD Software Solutions LLC

2-Year Storm Event – Existing

Summary for Subcatchment EX1A: Subcat EX1A

Runoff = 13.26 cfs @ 12.09 hrs, Volume= 46,349 cf, Depth= 2.62"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
45,846	79	50-75% Grass cover, Fair, HSG C
88,192	98	Paved parking, HSG C
4,466	98	Paved roads w/curbs & sewers, HSG C
74,118	98	Roofs, HSG C
212,622	94	Weighted Average
45,846	79	21.56% Pervious Area
166,776	98	78.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	38	0.0210	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.2	12	0.0470	1.28		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	181	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0160	6.78	5.33	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	124	0.0090	6.66	11.78	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.0	22	0.0120	9.32	29.29	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	17	0.0020	0.67		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.4	407	Total			

Summary for Subcatchment EX1B: Subcat EX1B

Runoff = 27.62 cfs @ 12.07 hrs, Volume= 92,573 cf, Depth= 2.79"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
44,077	79	50-75% Grass cover, Fair, HSG C
219,830	98	Paved parking, HSG C
25,567	98	Paved roads w/curbs & sewers, HSG C
109,099	98	Roofs, HSG C
398,573	96	Weighted Average
44,077	79	11.06% Pervious Area
354,496	98	88.94% Impervious Area

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

Summary for Subcatchment EX1C: Subcat EX1C

Runoff = 1.98 cfs @ 12.12 hrs, Volume= 7,521 cf, Depth= 2.52"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
9,760	79	50-75% Grass cover, Fair, HSG C
25,261	98	Paved parking, HSG C
752	98	Paved roads w/curbs & sewers, HSG C
3	98	Roofs, HSG C
35,776	93	Weighted Average
9,760	79	27.28% Pervious Area
26,016	98	72.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.7	69	0.0560	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	81	0.0230	3.08		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	152	0.0100	6.22	7.63	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
1.2	172	0.0010	2.38	5.20	**Pipe Channel, RCP_Round 20"** 20.0" Round Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011 Concrete pipe, straight & clean
0.8	173	0.0020	3.81	11.96	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.8	275	0.0030	6.11	43.17	**Pipe Channel, RCP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
0.3	224	0.0130	11.26	55.27	**Pipe Channel, RCP_Round 30"**

30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'
n= 0.011 Concrete pipe, straight & clean

9.1	1,196	Total

Summary for Subcatchment EX1D: Subcat EX1D

Runoff = 1.92 cfs @ 12.07 hrs, Volume= 6,463 cf, Depth= 2.92"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
840	79	50-75% Grass cover, Fair, HSG C
12,315	98	Paved parking, HSG C
4	98	Paved roads w/curbs & sewers, HSG C
13,436	98	Roofs, HSG C
26,595	97	Weighted Average
840	79	3.16% Pervious Area
25,756	98	96.84% Impervious Area

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

Summary for Subcatchment EX2A: Subcat EX2A

Runoff = 3.03 cfs @ 12.07 hrs, Volume= 10,175 cf, Depth= 2.88"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
2,339	79	50-75% Grass cover, Fair, HSG C
18,309	98	Paved parking, HSG C
2,236	98	Paved roads w/curbs & sewers, HSG C
19,548	98	Roofs, HSG C
42,431	97	Weighted Average
2,339	79	5.51% Pervious Area
40,093	98	94.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	21	0.1210	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	32	0.0160	1.01		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
0.1	11	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	174	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.8	238	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment EX2B: Subcat EX2B

Runoff = 1.48 cfs @ 12.08 hrs, Volume= 4,714 cf, Depth= 1.69"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
26,384	79	50-75% Grass cover, Fair, HSG C
2,612	98	Paved parking, HSG C
4,564	98	Paved roads w/curbs & sewers, HSG C
33,560	83	Weighted Average
26,384	79	78.62% Pervious Area
7,176	98	21.38% Impervious Area

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

Summary for Subcatchment EX2C: Subcat EX2C

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 764 cf, Depth= 2.04"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
2,557	79	50-75% Grass cover, Fair, HSG C
1,868	98	Paved parking, HSG C
68	98	Paved roads w/curbs & sewers, HSG C
4,493	87	Weighted Average
2,557	79	56.92% Pervious Area
1,936	98	43.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0190	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	21	0.0090	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
2.1	31	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond ISO-P: Isolated Wetland

Inflow Area = 239,217 sf, 80.48% Impervious, Inflow Depth = 2.65" for 2-Yr event
Inflow = 15.13 cfs @ 12.09 hrs, Volume= 52,812 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 25.62' @ 24.39 hrs Surf.Area= 42,306 sf Storage= 52,794 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	143,531 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	11,914	8,846	15,463
25.00	22,357	17,136	32,598
26.00	54,294	38,326	70,924
27.00	90,920	72,607	143,531

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP1: 72" Culvert

Inflow Area = 673,567 sf, 85.08% Impervious, Inflow Depth = 1.78" for 2-Yr event
Inflow = 29.32 cfs @ 12.07 hrs, Volume= 100,094 cf
Primary = 29.32 cfs @ 12.07 hrs, Volume= 100,094 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: Arsenal Street

Inflow Area = 80,485 sf, 61.14% Impervious, Inflow Depth = 2.33" for 2-Yr event
Inflow = 4.75 cfs @ 12.07 hrs, Volume= 15,652 cf
Primary = 4.75 cfs @ 12.07 hrs, Volume= 15,652 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

10-Year Storm Event – Existing

Summary for Subcatchment EX1A: Subcat EX1A

Runoff = 21.30 cfs @ 12.09 hrs, Volume= 75,186 cf, Depth= 4.24"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
45,846	79	50-75% Grass cover, Fair, HSG C
88,192	98	Paved parking, HSG C
4,466	98	Paved roads w/curbs & sewers, HSG C
74,118	98	Roofs, HSG C
212,622	94	Weighted Average
45,846	79	21.56% Pervious Area
166,776	98	78.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	38	0.0210	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.2	12	0.0470	1.28		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	181	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0160	6.78	5.33	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	124	0.0090	6.66	11.78	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.0	22	0.0120	9.32	29.29	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	17	0.0020	0.67		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.4	407	Total			

Summary for Subcatchment EX1B: Subcat EX1B

Runoff = 43.45 cfs @ 12.07 hrs, Volume= 147,736 cf, Depth= 4.45"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
44,077	79	50-75% Grass cover, Fair, HSG C
219,830	98	Paved parking, HSG C
25,567	98	Paved roads w/curbs & sewers, HSG C
109,099	98	Roofs, HSG C
398,573	96	Weighted Average
44,077	79	11.06% Pervious Area
354,496	98	88.94% Impervious Area

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

Summary for Subcatchment EX1C: Subcat EX1C

Runoff = 3.21 cfs @ 12.12 hrs, Volume= 12,319 cf, Depth= 4.13"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
9,760	79	50-75% Grass cover, Fair, HSG C
25,261	98	Paved parking, HSG C
752	98	Paved roads w/curbs & sewers, HSG C
3	98	Roofs, HSG C
35,776	93	Weighted Average
9,760	79	27.28% Pervious Area
26,016	98	72.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.7	69	0.0560	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	81	0.0230	3.08		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	152	0.0100	6.22	7.63	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
1.2	172	0.0010	2.38	5.20	**Pipe Channel, RCP_Round 20"** 20.0" Round Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011 Concrete pipe, straight & clean
0.8	173	0.0020	3.81	11.96	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.8	275	0.0030	6.11	43.17	**Pipe Channel, RCP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
0.3	224	0.0130	11.26	55.27	**Pipe Channel, RCP_Round 30"**

30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'
n= 0.011 Concrete pipe, straight & clean

9.1	1,196	Total

Summary for Subcatchment EX1D: Subcat EX1D

Runoff = 2.98 cfs @ 12.07 hrs, Volume= 10,199 cf, Depth= 4.60"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
840	79	50-75% Grass cover, Fair, HSG C
12,315	98	Paved parking, HSG C
4	98	Paved roads w/curbs & sewers, HSG C
13,436	98	Roofs, HSG C
26,595	97	Weighted Average
840	79	3.16% Pervious Area
25,756	98	96.84% Impervious Area

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

Summary for Subcatchment EX2A: Subcat EX2A

Runoff = 4.72 cfs @ 12.07 hrs, Volume= 16,110 cf, Depth= 4.56"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
2,339	79	50-75% Grass cover, Fair, HSG C
18,309	98	Paved parking, HSG C
2,236	98	Paved roads w/curbs & sewers, HSG C
19,548	98	Roofs, HSG C
42,431	97	Weighted Average
2,339	79	5.51% Pervious Area
40,093	98	94.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	21	0.1210	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	32	0.0160	1.01		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
0.1	11	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	174	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.8	238	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment EX2B: Subcat EX2B

Runoff = 2.80 cfs @ 12.07 hrs, Volume= 8,760 cf, Depth= 3.13"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
26,384	79	50-75% Grass cover, Fair, HSG C
2,612	98	Paved parking, HSG C
4,564	98	Paved roads w/curbs & sewers, HSG C
33,560	83	Weighted Average
26,384	79	78.62% Pervious Area
7,176	98	21.38% Impervious Area

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

Summary for Subcatchment EX2C: Subcat EX2C

Runoff = 0.41 cfs @ 12.07 hrs, Volume= 1,331 cf, Depth= 3.55"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
2,557	79	50-75% Grass cover, Fair, HSG C
1,868	98	Paved parking, HSG C
68	98	Paved roads w/curbs & sewers, HSG C
4,493	87	Weighted Average
2,557	79	56.92% Pervious Area
1,936	98	43.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0190	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	21	0.0090	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
2.1	31	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond ISO-P: Isolated Wetland

Inflow Area = 239,217 sf, 80.48% Impervious, Inflow Depth = 4.28" for 10-Yr event
Inflow = 24.19 cfs @ 12.09 hrs, Volume= 85,385 cf
Outflow = 0.18 cfs @ 24.06 hrs, Volume= 2,870 cf, Atten= 99%, Lag= 718.2 min
Primary = 0.18 cfs @ 24.06 hrs, Volume= 2,870 cf
Routed to Link DP1 : 72" Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 26.23' @ 24.06 hrs Surf.Area= 62,595 sf Storage= 84,169 cf

Plug-Flow detention time= 1,257.9 min calculated for 2,869 cf (3% of inflow)
Center-of-Mass det. time= 751.1 min (1,509.2 - 758.1)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	143,531 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	11,914	8,846	15,463
25.00	22,357	17,136	32,598
26.00	54,294	38,326	70,924
27.00	90,920	72,607	143,531

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.16 cfs @ 24.06 hrs HW=26.23' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.16 cfs @ 0.41 fps)

Summary for Link DP1: 72" Culvert

Inflow Area = 673,567 sf, 85.08% Impervious, Inflow Depth = 2.90" for 10-Yr event
Inflow = 46.23 cfs @ 12.07 hrs, Volume= 162,925 cf
Primary = 46.23 cfs @ 12.07 hrs, Volume= 162,925 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: Arsenal Street

Inflow Area = 80,485 sf, 61.14% Impervious, Inflow Depth = 3.91" for 10-Yr event
Inflow = 7.92 cfs @ 12.07 hrs, Volume= 26,201 cf
Primary = 7.92 cfs @ 12.07 hrs, Volume= 26,201 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

25-Year Storm Event – Existing

Summary for Subcatchment EX1A: Subcat EX1A

Runoff = 27.50 cfs @ 12.09 hrs, Volume= 97,597 cf, Depth= 5.51"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
45,846	79	50-75% Grass cover, Fair, HSG C
88,192	98	Paved parking, HSG C
4,466	98	Paved roads w/curbs & sewers, HSG C
74,118	98	Roofs, HSG C
212,622	94	Weighted Average
45,846	79	21.56% Pervious Area
166,776	98	78.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	38	0.0210	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.2	12	0.0470	1.28		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	181	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0160	6.78	5.33	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	124	0.0090	6.66	11.78	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.0	22	0.0120	9.32	29.29	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	17	0.0020	0.67		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.4	407	Total			

Summary for Subcatchment EX1B: Subcat EX1B

Runoff = 55.60 cfs @ 12.07 hrs, Volume= 190,289 cf, Depth= 5.73"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
44,077	79	50-75% Grass cover, Fair, HSG C
219,830	98	Paved parking, HSG C
25,567	98	Paved roads w/curbs & sewers, HSG C
109,099	98	Roofs, HSG C
398,573	96	Weighted Average
44,077	79	11.06% Pervious Area
354,496	98	88.94% Impervious Area

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

Summary for Subcatchment EX1C: Subcat EX1C

Runoff = 4.17 cfs @ 12.12 hrs, Volume= 16,063 cf, Depth= 5.39"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
9,760	79	50-75% Grass cover, Fair, HSG C
25,261	98	Paved parking, HSG C
752	98	Paved roads w/curbs & sewers, HSG C
3	98	Roofs, HSG C
35,776	93	Weighted Average
9,760	79	27.28% Pervious Area
26,016	98	72.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.7	69	0.0560	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	81	0.0230	3.08		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	152	0.0100	6.22	7.63	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
1.2	172	0.0010	2.38	5.20	**Pipe Channel, RCP_Round 20"** 20.0" Round Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011 Concrete pipe, straight & clean
0.8	173	0.0020	3.81	11.96	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.8	275	0.0030	6.11	43.17	**Pipe Channel, RCP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
0.3	224	0.0130	11.26	55.27	**Pipe Channel, RCP_Round 30"**

30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'
n= 0.011 Concrete pipe, straight & clean

9.1	1,196	Total

Summary for Subcatchment EX1D: Subcat EX1D

Runoff = 3.79 cfs @ 12.07 hrs, Volume= 13,066 cf, Depth= 5.90"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
840	79	50-75% Grass cover, Fair, HSG C
12,315	98	Paved parking, HSG C
4	98	Paved roads w/curbs & sewers, HSG C
13,436	98	Roofs, HSG C
26,595	97	Weighted Average
840	79	3.16% Pervious Area
25,756	98	96.84% Impervious Area

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

Summary for Subcatchment EX2A: Subcat EX2A

Runoff = 6.01 cfs @ 12.07 hrs, Volume= 20,670 cf, Depth= 5.85"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
2,339	79	50-75% Grass cover, Fair, HSG C
18,309	98	Paved parking, HSG C
2,236	98	Paved roads w/curbs & sewers, HSG C
19,548	98	Roofs, HSG C
42,431	97	Weighted Average
2,339	79	5.51% Pervious Area
40,093	98	94.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	21	0.1210	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	32	0.0160	1.01		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
0.1	11	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	174	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.8	238	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment EX2B: Subcat EX2B

Runoff = 3.84 cfs @ 12.07 hrs, Volume= 12,049 cf, Depth= 4.31"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
26,384	79	50-75% Grass cover, Fair, HSG C
2,612	98	Paved parking, HSG C
4,564	98	Paved roads w/curbs & sewers, HSG C
33,560	83	Weighted Average
26,384	79	78.62% Pervious Area
7,176	98	21.38% Impervious Area

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

Summary for Subcatchment EX2C: Subcat EX2C

Runoff = 0.55 cfs @ 12.07 hrs, Volume= 1,784 cf, Depth= 4.76"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
2,557	79	50-75% Grass cover, Fair, HSG C
1,868	98	Paved parking, HSG C
68	98	Paved roads w/curbs & sewers, HSG C
4,493	87	Weighted Average
2,557	79	56.92% Pervious Area
1,936	98	43.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0190	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	21	0.0090	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
2.1	31	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond ISO-P: Isolated Wetland

Inflow Area = 239,217 sf, 80.48% Impervious, Inflow Depth = 5.55" for 25-Yr event
Inflow = 31.18 cfs @ 12.09 hrs, Volume= 110,663 cf
Outflow = 1.14 cfs @ 15.41 hrs, Volume= 28,148 cf, Atten= 96%, Lag= 199.1 min
Primary = 1.14 cfs @ 15.41 hrs, Volume= 28,148 cf
Routed to Link DP1 : 72" Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 26.30' @ 15.41 hrs Surf.Area= 65,117 sf Storage= 88,566 cf

Plug-Flow detention time= 582.2 min calculated for 28,148 cf (25% of inflow)
Center-of-Mass det. time= 363.4 min (1,117.9 - 754.5)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	143,531 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	11,914	8,846	15,463
25.00	22,357	17,136	32,598
26.00	54,294	38,326	70,924
27.00	90,920	72,607	143,531

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=1.12 cfs @ 15.41 hrs HW=26.30' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 1.12 cfs @ 0.78 fps)

Summary for Link DP1: 72" Culvert

Inflow Area = 673,567 sf, 85.08% Impervious, Inflow Depth = 4.18" for 25-Yr event
Inflow = 59.20 cfs @ 12.07 hrs, Volume= 234,500 cf
Primary = 59.20 cfs @ 12.07 hrs, Volume= 234,500 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: Arsenal Street

Inflow Area = 80,485 sf, 61.14% Impervious, Inflow Depth = 5.14" for 25-Yr event
Inflow = 10.40 cfs @ 12.07 hrs, Volume= 34,504 cf
Primary = 10.40 cfs @ 12.07 hrs, Volume= 34,504 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

100-Year Storm Event – Existing

Summary for Subcatchment EX1A: Subcat EX1A

Runoff = 40.41 cfs @ 12.09 hrs, Volume= 144,616 cf, Depth= 8.16"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
45,846	79	50-75% Grass cover, Fair, HSG C
88,192	98	Paved parking, HSG C
4,466	98	Paved roads w/curbs & sewers, HSG C
74,118	98	Roofs, HSG C
212,622	94	Weighted Average
45,846	79	21.56% Pervious Area
166,776	98	78.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	38	0.0210	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.2	12	0.0470	1.28		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	181	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0160	6.78	5.33	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
0.3	124	0.0090	6.66	11.78	**Pipe Channel, RCP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.0	22	0.0120	9.32	29.29	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.4	17	0.0020	0.67		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.4	407	Total			

Summary for Subcatchment EX1B: Subcat EX1B

Runoff = 80.83 cfs @ 12.07 hrs, Volume= 279,147 cf, Depth= 8.40"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
44,077	79	50-75% Grass cover, Fair, HSG C
219,830	98	Paved parking, HSG C
25,567	98	Paved roads w/curbs & sewers, HSG C
109,099	98	Roofs, HSG C
398,573	96	Weighted Average
44,077	79	11.06% Pervious Area
354,496	98	88.94% Impervious Area

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

Summary for Subcatchment EX1C: Subcat EX1C

Runoff = 6.17 cfs @ 12.12 hrs, Volume= 23,940 cf, Depth= 8.03"
Routed to Link DP1 : 72" Culvert

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
9,760	79	50-75% Grass cover, Fair, HSG C
25,261	98	Paved parking, HSG C
752	98	Paved roads w/curbs & sewers, HSG C
3	98	Roofs, HSG C
35,776	93	Weighted Average
9,760	79	27.28% Pervious Area
26,016	98	72.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.7	69	0.0560	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	81	0.0230	3.08		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	152	0.0100	6.22	7.63	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
1.2	172	0.0010	2.38	5.20	**Pipe Channel, RCP_Round 20"** 20.0" Round Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011 Concrete pipe, straight & clean
0.8	173	0.0020	3.81	11.96	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
0.8	275	0.0030	6.11	43.17	**Pipe Channel, RCP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
0.3	224	0.0130	11.26	55.27	**Pipe Channel, RCP_Round 30"**

30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'
n= 0.011 Concrete pipe, straight & clean

9.1	1,196	Total

Summary for Subcatchment EX1D: Subcat EX1D

Runoff = 5.46 cfs @ 12.07 hrs, Volume= 19,031 cf, Depth= 8.59"
Routed to Pond ISO-P : Isolated Wetland

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
840	79	50-75% Grass cover, Fair, HSG C
12,315	98	Paved parking, HSG C
4	98	Paved roads w/curbs & sewers, HSG C
13,436	98	Roofs, HSG C
26,595	97	Weighted Average
840	79	3.16% Pervious Area
25,756	98	96.84% Impervious Area

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

Summary for Subcatchment EX2A: Subcat EX2A

Runoff = 8.68 cfs @ 12.07 hrs, Volume= 30,170 cf, Depth= 8.53"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
2,339	79	50-75% Grass cover, Fair, HSG C
18,309	98	Paved parking, HSG C
2,236	98	Paved roads w/curbs & sewers, HSG C
19,548	98	Roofs, HSG C
42,431	97	Weighted Average
2,339	79	5.51% Pervious Area
40,093	98	94.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	21	0.1210	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	32	0.0160	1.01		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
0.1	11	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	174	0.0050	3.79	2.98	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.8	238	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment EX2B: Subcat EX2B

Runoff = 6.04 cfs @ 12.07 hrs, Volume= 19,142 cf, Depth= 6.84"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
26,384	79	50-75% Grass cover, Fair, HSG C
2,612	98	Paved parking, HSG C
4,564	98	Paved roads w/curbs & sewers, HSG C
33,560	83	Weighted Average
26,384	79	78.62% Pervious Area
7,176	98	21.38% Impervious Area

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

Summary for Subcatchment EX2C: Subcat EX2C

Runoff = 0.84 cfs @ 12.07 hrs, Volume= 2,751 cf, Depth= 7.35"
Routed to Link DP2 : Arsenal Street

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
2,557	79	50-75% Grass cover, Fair, HSG C
1,868	98	Paved parking, HSG C
68	98	Paved roads w/curbs & sewers, HSG C
4,493	87	Weighted Average
2,557	79	56.92% Pervious Area
1,936	98	43.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0190	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
0.5	21	0.0090	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
2.1	31	Total, Increased to minimum Tc = 5.0 min			

Summary for Pond ISO-P: Isolated Wetland

Inflow Area = 239,217 sf, 80.48% Impervious, Inflow Depth = 8.21" for 100-Yr event
Inflow = 45.72 cfs @ 12.09 hrs, Volume= 163,647 cf
Outflow = 6.85 cfs @ 12.58 hrs, Volume= 81,132 cf, Atten= 85%, Lag= 29.6 min
Primary = 6.85 cfs @ 12.58 hrs, Volume= 81,132 cf
Routed to Link DP1 : 72" Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs
Peak Elev= 26.52' @ 12.58 hrs Surf.Area= 73,196 sf Storage= 103,821 cf

Plug-Flow detention time= 339.1 min calculated for 81,132 cf (50% of inflow)
Center-of-Mass det. time= 206.6 min (956.0 - 749.4)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	143,531 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	11,914	8,846	15,463
25.00	22,357	17,136	32,598
26.00	54,294	38,326	70,924
27.00	90,920	72,607	143,531

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=6.83 cfs @ 12.58 hrs HW=26.52' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 6.83 cfs @ 1.44 fps)

Summary for Link DP1: 72" Culvert

Inflow Area = 673,567 sf, 85.08% Impervious, Inflow Depth = 6.85" for 100-Yr event
Inflow = 86.17 cfs @ 12.07 hrs, Volume= 384,218 cf
Primary = 86.17 cfs @ 12.07 hrs, Volume= 384,218 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Summary for Link DP2: Arsenal Street

Inflow Area = 80,485 sf, 61.14% Impervious, Inflow Depth = 7.76" for 100-Yr event
Inflow = 15.57 cfs @ 12.07 hrs, Volume= 52,063 cf
Primary = 15.57 cfs @ 12.07 hrs, Volume= 52,063 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs

Events for Subcatchment EX1A: Subcat EX1A

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	13.26	46,349	2.62
10-Yr	4.90	21.30	75,186	4.24
25-Yr	6.20	27.50	97,597	5.51
100-Yr	**8.90**	**40.41**	**144,616**	**8.16**

Events for Subcatchment EX1B: Subcat EX1B

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	27.62	92,573	2.79
10-Yr	4.90	43.45	147,736	4.45
25-Yr	6.20	55.60	190,289	5.73
100-Yr	**8.90**	**80.83**	**279,147**	**8.40**

Events for Subcatchment EX1C: Subcat EX1C

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.98	7,521	2.52
10-Yr	4.90	3.21	12,319	4.13
25-Yr	6.20	4.17	16,063	5.39
100-Yr	**8.90**	**6.17**	**23,940**	**8.03**

Events for Subcatchment EX1D: Subcat EX1D

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.92	6,463	2.92
10-Yr	4.90	2.98	10,199	4.60
25-Yr	6.20	3.79	13,066	5.90
100-Yr	**8.90**	**5.46**	**19,031**	**8.59**

Events for Subcatchment EX2A: Subcat EX2A

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	3.03	10,175	2.88
10-Yr	4.90	4.72	16,110	4.56
25-Yr	6.20	6.01	20,670	5.85
100-Yr	**8.90**	**8.68**	**30,170**	**8.53**

Events for Subcatchment EX2B: Subcat EX2B

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.48	4,714	1.69
10-Yr	4.90	2.80	8,760	3.13
25-Yr	6.20	3.84	12,049	4.31
100-Yr	**8.90**	**6.04**	**19,142**	**6.84**

Events for Subcatchment EX2C: Subcat EX2C

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.24	764	2.04
10-Yr	4.90	0.41	1,331	3.55
25-Yr	6.20	0.55	1,784	4.76
100-Yr	**8.90**	**0.84**	**2,751**	**7.35**

Events for Pond ISO-P: Isolated Wetland

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	15.13	0.00	25.62	52,794
10-Yr	24.19	0.18	26.23	84,169
25-Yr	31.18	1.14	26.30	88,566
100-Yr	**45.72**	**6.85**	**26.52**	**103,821**

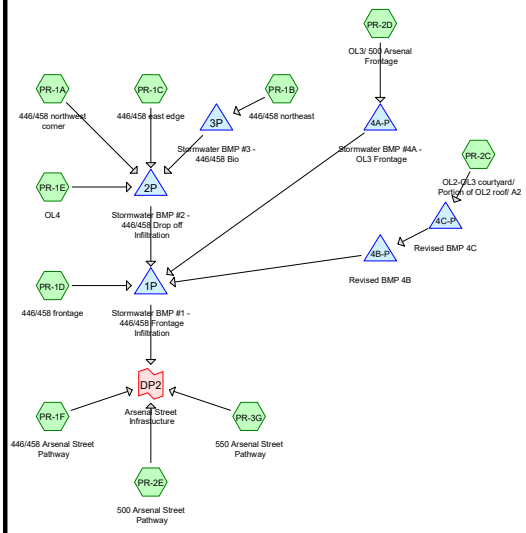
Events for Link DP1: 72" Culvert

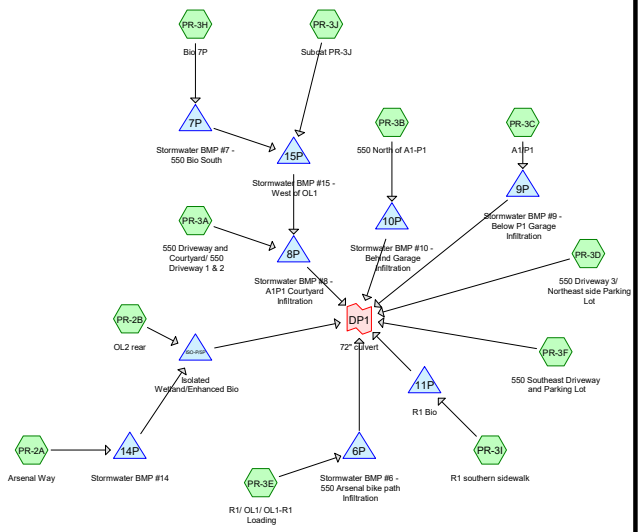
Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Yr	29.32	29.32	**0.00**
10-Yr	46.23	46.23	0.00
25-Yr	59.20	59.20	0.00
100-Yr	**86.17**	**86.17**	0.00

Events for Link DP2: Arsenal Street

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Yr	4.75	4.75	**0.00**
10-Yr	7.92	7.92	0.00
25-Yr	10.40	10.40	0.00
100-Yr	**15.57**	**15.57**	0.00

HydroCAD Analysis: Proposed Conditions





Subcat Reach Pond Link

Routing Diagram for 1537400 - PR
Prepared by VHB, Inc, Printed 9/12/2023
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2-Year Storm Event – Proposed

Summary for Subcatchment PR-1A: 446/458 northwest corner

Runoff = 0.48 cfs @ 12.07 hrs, Volume= 1,425 cf, Depth= 1.91"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
4,152	74	>75% Grass cover, Good, HSG C
3,272	98	Paved parking, HSG C
1,508	98	Paved roads w/curbs & sewers, HSG C
8,932	87	Weighted Average
4,152		46.48% Pervious Area
4,780		53.52% Impervious Area

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

Summary for Subcatchment PR-1B: 446/458 northeast

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 971 cf, Depth= 1.76"
Routed to Pond 3P : Stormwater BMP #3 - 446/458 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
3,581	74	>75% Grass cover, Good, HSG C
2,876	98	Paved parking, HSG C
169	98	Paved roads w/curbs & sewers, HSG C
6,626	85	Weighted Average
3,581		54.05% Pervious Area
3,045		45.95% Impervious Area

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

Summary for Subcatchment PR-1C: 446/458 east edge

Runoff = 0.54 cfs @ 12.07 hrs, Volume= 1,656 cf, Depth= 2.35"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
1,972	74	>75% Grass cover, Good, HSG C
4,406	98	Paved parking, HSG C
2,073	98	Paved roads w/curbs & sewers, HSG C
8,452	92	Weighted Average
1,972		23.34% Pervious Area
6,479		76.66% Impervious Area

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

Summary for Subcatchment PR-1D: 446/458 frontage

Runoff = 0.47 cfs @ 12.08 hrs, Volume= 1,447 cf, Depth= 1.21"
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
12,303	74	>75% Grass cover, Good, HSG C
24	98	Paved parking, HSG C
1,998	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
14,325	77	Weighted Average
12,303		85.88% Pervious Area
2,022		14.12% Impervious Area

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

Summary for Subcatchment PR-1E: OL4

Runoff = 1.94 cfs @ 12.07 hrs, Volume= 6,501 cf, Depth= 2.97"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
26,287	98	Roofs, HSG C
26,287		100.00% Impervious Area

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

Summary for Subcatchment PR-1F: 446/458 Arsenal Street Pathway

Runoff = 0.37 cfs @ 12.07 hrs, Volume= 1,119 cf, Depth= 1.91"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
3,348	74	>75% Grass cover, Good, HSG C
3,664	98	Paved roads w/curbs & sewers, HSG C
7,012	87	Weighted Average
3,348		47.75% Pervious Area
3,664		52.25% Impervious Area

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

Summary for Subcatchment PR-2A: Arsenal Way

Runoff = 0.78 cfs @ 12.07 hrs, Volume= 2,540 cf, Depth= 2.86"
Routed to Pond 14P : Stormwater BMP #14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
584	74	>75% Grass cover, Good, HSG C
10,088	98	Paved parking, HSG C
10,671	97	Weighted Average
584		5.47% Pervious Area
10,088		94.53% Impervious Area

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

Summary for Subcatchment PR-2B: OL2 rear

Runoff = 2.62 cfs @ 12.08 hrs, Volume= 7,813 cf, Depth= 1.76"
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
29,387	74	>75% Grass cover, Good, HSG C
11,611	98	Paved parking, HSG C
7,421	98	Paved roads w/curbs & sewers, HSG C
6	98	Roofs, HSG C
4,917	98	Water Surface, 0% imp, HSG C
53,343	85	Weighted Average
34,305		64.31% Pervious Area
19,038		35.69% Impervious Area

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

Summary for Subcatchment PR-2C: OL2-OL3 courtyard/ Portion of OL2 roof/ A2

Runoff = 7.01 cfs @ 12.07 hrs, Volume= 21,165 cf, Depth= 2.17"
Routed to Pond 4C-P : Revised BMP 4C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
26,790	74	>75% Grass cover, Good, HSG C
32,505	89	Gravel roads, HSG C
14,919	98	Paved roads w/curbs & sewers, HSG C
42,900	98	Roofs, HSG C
117,115	90	Weighted Average
59,295		50.63% Pervious Area
57,819		49.37% Impervious Area

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

Summary for Subcatchment PR-2D: OL3/ 500 Arsenal Frontage

Runoff = 3.75 cfs @ 12.07 hrs, Volume= 11,851 cf, Depth= 2.64"
Routed to Pond 4A-P : Stormwater BMP #4A - OL3 Frontage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
5,695	74	>75% Grass cover, Good, HSG C
1,122	98	Paved parking, HSG C
4,144	98	Paved roads w/curbs & sewers, HSG C
42,804	98	Roofs, HSG C
53,766	95	Weighted Average
5,695		10.59% Pervious Area
48,071		89.41% Impervious Area

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

Summary for Subcatchment PR-2E: 500 Arsenal Street Pathway

Runoff = 0.54 cfs @ 12.07 hrs, Volume= 1,626 cf, Depth= 1.91"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
4,677	74	>75% Grass cover, Good, HSG C
5,511	98	Paved roads w/curbs & sewers, HSG C
10,188	87	Weighted Average
4,677		45.91% Pervious Area
5,511		54.09% Impervious Area

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

Summary for Subcatchment PR-3A: 550 Driveway and Courtyard/ 550 Driveway 1 & 2

Runoff = 0.98 cfs @ 12.08 hrs, Volume= 2,941 cf, Depth= 1.47"
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
16,583	74	>75% Grass cover, Good, HSG C
2,817	98	Paved parking, HSG C
4,626	98	Paved roads w/curbs & sewers, HSG C
24,026	81	Weighted Average
16,583		69.02% Pervious Area
7,443		30.98% Impervious Area

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

Summary for Subcatchment PR-3B: 550 North of A1-P1

Runoff = 2.78 cfs @ 12.07 hrs, Volume= 8,441 cf, Depth= 2.26"
Routed to Pond 10P : Stormwater BMP #10 - Behind Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
13,924	74	>75% Grass cover, Good, HSG C
28,574	98	Paved parking, HSG C
2,354	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
44,852	91	Weighted Average
13,924		31.04% Pervious Area
30,928		68.96% Impervious Area

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

Summary for Subcatchment PR-3C: A1/P1

Runoff = 4.89 cfs @ 12.07 hrs, Volume= 16,359 cf, Depth= 2.97"
Routed to Pond 9P : Stormwater BMP #9 - Below P1 Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
66,153	98	Roofs, HSG C
66,153		100.00% Impervious Area

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

Summary for Subcatchment PR-3D: 550 Driveway 3/ Northeast side Parking Lot

Runoff = 4.22 cfs @ 12.07 hrs, Volume= 13,151 cf, Depth= 2.54"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
10,533	74	>75% Grass cover, Good, HSG C
41,799	98	Paved parking, HSG C
9,704	98	Paved roads w/curbs & sewers, HSG C
62,036	94	Weighted Average
10,533		16.98% Pervious Area
51,503		83.02% Impervious Area

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

Summary for Subcatchment PR-3E: R1/ OL1/ OL1-R1 Loading

Runoff = 10.14 cfs @ 12.07 hrs, Volume= 32,550 cf, Depth= 2.75"
Routed to Pond 6P : Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
13,489	74	>75% Grass cover, Good, HSG C
17,178	98	Paved parking, HSG C
3,320	98	Paved roads w/curbs & sewers, HSG C
108,094	98	Roofs, HSG C
142,081	96	Weighted Average
13,489		9.49% Pervious Area
128,592		90.51% Impervious Area

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

Summary for Subcatchment PR-3F: 550 Southeast Driveway and Parking Lot

Runoff = 1.95 cfs @ 12.07 hrs, Volume= 6,086 cf, Depth= 2.54"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
4,879	74	>75% Grass cover, Good, HSG C
23,704	98	Paved parking, HSG C
127	98	Paved roads w/curbs & sewers, HSG C
28,711	94	Weighted Average
4,879		16.99% Pervious Area
23,832		83.01% Impervious Area

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

Summary for Subcatchment PR-3G: 550 Arsenal Street Pathway

Runoff = 1.34 cfs @ 12.07 hrs, Volume= 4,066 cf, Depth= 2.26"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
6,742	74	>75% Grass cover, Good, HSG C
3,132	98	Paved parking, HSG C
11,732	98	Paved roads w/curbs & sewers, HSG C
21,605	91	Weighted Average
6,742		31.20% Pervious Area
14,863		68.80% Impervious Area

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

Summary for Subcatchment PR-3H: Bio 7P

Runoff = 0.21 cfs @ 12.08 hrs, Volume= 645 cf, Depth= 1.40"
Routed to Pond 7P : Stormwater BMP #7 - 550 Bio South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
4,202	74	>75% Grass cover, Good, HSG C
1,320	98	Paved roads w/curbs & sewers, HSG C
5,522	80	Weighted Average
4,202		76.10% Pervious Area
1,320		23.90% Impervious Area

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

Summary for Subcatchment PR-3I: R1 southern sidewalk

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 1,555 cf, Depth= 1.84"
Routed to Pond 11P : R1 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
5,285	74	>75% Grass cover, Good, HSG C
182	98	Paved parking, HSG C
4,703	98	Paved roads w/curbs & sewers, HSG C
10,171	86	Weighted Average
5,285		51.97% Pervious Area
4,885		48.03% Impervious Area

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

Summary for Subcatchment PR-3J: Subcat PR-3J

Runoff = 2.13 cfs @ 12.07 hrs, Volume= 6,558 cf, Depth= 2.45"
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
5,094	74	>75% Grass cover, Good, HSG C
3,634	89	Gravel roads, HSG C
20,819	98	Paved parking, HSG C
2,631	98	Paved roads w/curbs & sewers, HSG C
32,178	93	Weighted Average
8,728		27.12% Pervious Area
23,450		72.88% Impervious Area

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

Summary for Pond 1P: Stormwater BMP #1 - 446/458 Frontage Infiltration

Inflow Area = 235,502 sf, 63.06% Impervious, Inflow Depth = 0.21" for 2-Yr event
Inflow = 0.56 cfs @ 12.55 hrs, Volume= 4,126 cf
Outflow = 0.50 cfs @ 12.65 hrs, Volume= 4,126 cf, Atten= 10%, Lag= 5.4 min
Discarded = 0.50 cfs @ 12.65 hrs, Volume= 4,126 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP2 : Arsenal Street Infrastucture

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 19.04' @ 12.65 hrs Surf.Area= 6,464 sf Storage= 116 cf

Plug-Flow detention time= 3.8 min calculated for 4,126 cf (100% of inflow)
Center-of-Mass det. time= 3.8 min (859.6 - 855.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	2,048 cf	**32.00'W x 160.00'L x 6.67'H Field A** 34,133 cf Overall - 29,013 cf Embedded = 5,120 cf x 40.0% Voids
#2A	20.00'	22,804 cf	**retain_it retain_it 5.0'** x 80 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 4 Rows adjusted for 498.7 cf perimeter wall
#3B	19.00'	538 cf	**24.00'W x 56.00'L x 6.67'H Field B** 8,960 cf Overall - 7,616 cf Embedded = 1,344 cf x 40.0% Voids
#4B	20.00'	5,909 cf	**retain_it retain_it 5.0'** x 21 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 3 Rows adjusted for 207.8 cf perimeter wall
#5	25.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		31,361 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	27.20'	**6.0" Round Culvert** L= 12.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 27.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=1.24 cfs @ 12.65 hrs HW=19.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Stormwater BMP #2 - 446/458 Drop off Infiltration

Inflow Area = 50,297 sf, 80.70% Impervious, Inflow Depth = 2.32" for 2-Yr event
Inflow = 2.96 cfs @ 12.07 hrs, Volume= 9,739 cf
Outflow = 0.17 cfs @ 11.00 hrs, Volume= 9,739 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.17 cfs @ 11.00 hrs, Volume= 9,739 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 23.26' @ 13.80 hrs Surf.Area= 3,072 sf Storage= 4,284 cf

Plug-Flow detention time= 210.2 min calculated for 9,739 cf (100% of inflow)
Center-of-Mass det. time= 210.2 min (981.8 - 771.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.10'	1,229 cf	**24.00'W x 128.00'L x 6.58'H Field A** 20,224 cf Overall - 17,152 cf Embedded = 3,072 cf x 40.0% Voids
#2A	22.10'	13,130 cf	**Oldcastle StormCapture SC1 5'** x 24 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 3 Rows adjusted for 190.0 cf perimeter wall
		14,359 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.10'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.70'	**15.0" Round Culvert** L= 7.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 23.70' / 23.40' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	26.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 11.00 hrs HW=21.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.10' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Stormwater BMP #3 - 446/458 Bio

Inflow Area = 6,626 sf, 45.95% Impervious, Inflow Depth = 1.76" for 2-Yr event
Inflow = 0.33 cfs @ 12.08 hrs, Volume= 971 cf
Outflow = 0.14 cfs @ 12.27 hrs, Volume= 971 cf, Atten= 57%, Lag= 11.9 min
Discarded = 0.02 cfs @ 12.27 hrs, Volume= 813 cf
Primary = 0.12 cfs @ 12.27 hrs, Volume= 158 cf
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 28.80' @ 12.27 hrs Surf.Area= 416 sf Storage= 287 cf

Plug-Flow detention time= 96.9 min calculated for 970 cf (100% of inflow)
Center-of-Mass det. time= 96.9 min (922.0 - 825.2)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	1,068 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	300	0	0
29.50	518	614	614
29.60	706	61	675
29.90	1,919	394	1,068

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	25.00'	**12.0" Round Culvert** L= 15.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 25.00' / 24.60' S= 0.0267 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	28.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.27 hrs HW=28.80' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.12 cfs @ 12.27 hrs HW=28.80' (Free Discharge)
↑—**2=Culvert** (Passes 0.12 cfs of 6.87 cfs potential flow)
↑—**3=Orifice/Grate** (Weir Controls 0.12 cfs @ 0.73 fps)

Summary for Pond 4A-P: Stormwater BMP #4A - OL3 Frontage

Inflow Area = 53,766 sf, 89.41% Impervious, Inflow Depth = 2.64" for 2-Yr event
Inflow = 3.75 cfs @ 12.07 hrs, Volume= 11,851 cf
Outflow = 0.52 cfs @ 12.56 hrs, Volume= 11,851 cf, Atten= 86%, Lag= 29.6 min
Discarded = 0.04 cfs @ 7.72 hrs, Volume= 9,171 cf
Primary = 0.48 cfs @ 12.56 hrs, Volume= 2,679 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 26.30' @ 12.56 hrs Surf.Area= 1,881 sf Storage= 6,489 cf

Plug-Flow detention time= 1,025.3 min calculated for 11,850 cf (100% of inflow)
Center-of-Mass det. time= 1,025.4 min (1,805.4 - 780.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.40'	1,526 cf	**9.00'W x 209.00'L x 6.08'H Field A** 11,443 cf Overall - 7,627 cf Embedded = 3,816 cf x 40.0% Voids
#2A	22.40'	5,532 cf	**Oldcastle StormCapture SC1 4'** x 13 Inside #1 Inside= 84.0"W x 48.0"H => 27.38 sf x 16.00'L = 438.0 cf Outside= 96.0"W x 55.0"H => 36.67 sf x 16.00'L = 586.7 cf 1 Rows adjusted for 162.0 cf perimeter wall
		7,058 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 82.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 22.60' / 21.00' S= 0.0195 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#3	Device 2	26.20'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 7.72 hrs HW=21.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.46 cfs @ 12.56 hrs HW=26.30' (Free Discharge)
└**2=Culvert** (Passes 0.46 cfs of 24.87 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 0.90 fps)

Summary for Pond 4B-P: Revised BMP 4B

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 21.70' @ 0.00 hrs Surf.Area= 4,586 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.70'	3,454 cf	**22.00'W x 143.00'L x 3.67'H Field A** 11,535 cf Overall - 2,901 cf Embedded = 8,634 cf x 40.0% Voids
#2A	22.70'	1,807 cf	**retain_it retain_it 2.0'** x 17 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 1 Rows adjusted for 68.0 cf perimeter wall
#3B	21.70'	1,293 cf	**30.00'W x 48.00'L x 3.67'H Field B** 5,280 cf Overall - 2,048 cf Embedded = 3,232 cf x 40.0% Voids
#4B	22.70'	1,293 cf	**retain_it retain_it 2.0'** x 12 Inside #3 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 30.2 cf perimeter wall
#5	26.40'	71 cf	**5.00'D x 3.60'H Vertical Cone/Cylinder** -Impervious
		7,917 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.70'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 96.0' Ke= 0.500 Inlet / Outlet Invert= 22.60' / 22.00' S= 0.0063 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Device 2	24.70'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.70' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.88 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.70' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4C-P: Revised BMP 4C

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 2.17" for 2-Yr event
Inflow = 7.01 cfs @ 12.07 hrs, Volume= 21,165 cf
Outflow = 1.35 cfs @ 11.75 hrs, Volume= 21,165 cf, Atten= 81%, Lag= 0.0 min
Discarded = 1.35 cfs @ 11.75 hrs, Volume= 21,165 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 4B-P : Revised BMP 4B

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.80' @ 12.51 hrs Surf.Area= 7,040 sf Storage= 5,454 cf

Plug-Flow detention time= 24.0 min calculated for 21,164 cf (100% of inflow)
Center-of-Mass det. time= 24.0 min (830.0 - 806.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.60'	256 cf	**16.00'W x 80.00'L x 3.08'H Field A** 3,947 cf Overall - 3,307 cf Embedded = 640 cf x 40.0% Voids
#2A	22.10'	2,100 cf	**Oldcastle StormCapture SC1 2'** x 10 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 10 Chambers in 2 Rows
#3B	21.60'	512 cf	**40.00'W x 64.00'L x 3.08'H Field B** 7,893 cf Overall - 6,613 cf Embedded = 1,280 cf x 40.0% Voids
#4B	22.10'	4,200 cf	**Oldcastle StormCapture SC1 2'** x 20 Inside #3 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 20 Chambers in 5 Rows
#5C	21.60'	640 cf	**40.00'W x 80.00'L x 3.08'H Field C** 9,867 cf Overall - 8,267 cf Embedded = 1,600 cf x 40.0% Voids
#6C	22.10'	5,250 cf	**Oldcastle StormCapture SC1 2'** x 25 Inside #5 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 25 Chambers in 5 Rows
#7	24.10'	64 cf	**4.00'D x 5.10'H Vertical Cone/Cylinder** -Impervious

13,022 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.60'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	24.70'	**24.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 24.70' / 23.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	25.25'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=1.35 cfs @ 11.75 hrs HW=21.68' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.60' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 6P: Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Inflow Area = 142,081 sf, 90.51% Impervious, Inflow Depth = 2.75" for 2-Yr event
Inflow = 10.14 cfs @ 12.07 hrs, Volume= 32,550 cf
Outflow = 0.32 cfs @ 9.58 hrs, Volume= 32,550 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.32 cfs @ 9.58 hrs, Volume= 32,550 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 21.30' @ 15.67 hrs Surf.Area= 5,696 sf Storage= 18,448 cf

Plug-Flow detention time= 523.3 min calculated for 32,549 cf (100% of inflow)
Center-of-Mass det. time= 523.3 min (1,296.4 - 773.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	17.00'	1,229 cf	**16.00'W x 192.00'L x 6.67'H Field A** 20,480 cf Overall - 17,408 cf Embedded = 3,072 cf x 40.0% Voids
#2A	18.00'	13,441 cf	**retain_it retain_it 5.0'** x 48 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 2 Rows adjusted for 540.3 cf perimeter wall
#3B	17.00'	1,050 cf	**8.00'W x 328.00'L x 6.67'H Field B** 17,493 cf Overall - 14,869 cf Embedded = 2,624 cf x 40.0% Voids
#4B	18.00'	11,070 cf	**retain_it retain_it 5.0'** x 41 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 1 Rows adjusted for 872.8 cf perimeter wall
#5	23.00'	88 cf	**4.00'D x 7.00'H Vertical Cone/Cylinder** -Impervious

26,877 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.40'	**24.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 20.40' / 20.10' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.32 cfs @ 9.58 hrs HW=17.13' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=17.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 7P: Stormwater BMP #7 - 550 Bio South

Inflow Area = 5,522 sf, 23.90% Impervious, Inflow Depth = 1.40" for 2-Yr event
Inflow = 0.21 cfs @ 12.08 hrs, Volume= 645 cf
Outflow = 0.05 cfs @ 12.50 hrs, Volume= 645 cf, Atten= 77%, Lag= 25.3 min
Discarded = 0.05 cfs @ 12.50 hrs, Volume= 645 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 27.19' @ 12.50 hrs Surf.Area= 890 sf Storage= 154 cf

Plug-Flow detention time= 19.8 min calculated for 645 cf (100% of inflow)
Center-of-Mass det. time= 19.8 min (861.7 - 841.8)

Volume	Invert	Avail.Storage	Storage Description
#1	27.00'	1,125 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
27.00	750	0	0
28.00	1,500	1,125	1,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	24.00'	**12.0" Round Culvert** L= 46.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 24.00' / 23.80' S= 0.0043 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	27.75'	**12.0" Horiz. Orifice/Grate X 3.00** C= 0.600

Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.50 hrs HW=27.19' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 5.45 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 8P: Stormwater BMP #8 - A1P1 Courtyard Infiltration

Inflow Area = 61,726 sf, 52.19% Impervious, Inflow Depth = 0.57" for 2-Yr event
Inflow = 0.98 cfs @ 12.08 hrs, Volume= 2,941 cf
Outflow = 0.23 cfs @ 11.90 hrs, Volume= 2,941 cf, Atten= 77%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.90 hrs, Volume= 2,941 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.42' @ 12.49 hrs Surf.Area= 4,096 sf Storage= 693 cf

Plug-Flow detention time= 19.6 min calculated for 2,941 cf (100% of inflow)
Center-of-Mass det. time= 19.6 min (858.2 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	1,638 cf	**32.00'W x 128.00'L x 4.58'H Field A** 18,773 cf Overall - 14,677 cf Embedded = 4,096 cf x 40.0% Voids
#2A	21.00'	10,232 cf	**Oldcastle StormCapture SC1 3'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 4 Rows adjusted for 40.0 cf perimeter wall
		11,870 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	21.00'	**24.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 21.00' / 20.50' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.23 cfs @ 11.90 hrs HW=20.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 9P: Stormwater BMP #9 - Below P1 Garage Infiltration

Inflow Area = 66,153 sf,100.00% Impervious, Inflow Depth = 2.97" for 2-Yr event
Inflow = 4.89 cfs @ 12.07 hrs, Volume= 16,359 cf
Outflow = 0.22 cfs @ 10.13 hrs, Volume= 16,359 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.22 cfs @ 10.13 hrs, Volume= 16,359 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 21.85' @ 14.39 hrs Surf.Area= 3,968 sf Storage= 7,651 cf

Plug-Flow detention time= 290.0 min calculated for 16,359 cf (100% of inflow)
Center-of-Mass det. time= 290.0 min (1,045.5 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,587 cf	**8.00'W x 496.00'L x 4.58'H Field A** 18,187 cf Overall - 14,219 cf Embedded = 3,968 cf x 40.0% Voids
#2A	20.00'	9,825 cf	**Oldcastle StormCapture SC1 3'** x 31 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 1 Rows adjusted for 126.0 cf perimeter wall
		11,412 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	19.00'	**18.0" Round Culvert** L= 41.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 19.00' / 18.00' S= 0.0244 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	22.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.22 cfs @ 10.13 hrs HW=19.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 10P: Stormwater BMP #10 - Behind Garage Infiltration

Inflow Area = 44,852 sf, 68.96% Impervious, Inflow Depth = 2.26" for 2-Yr event
Inflow = 2.78 cfs @ 12.07 hrs, Volume= 8,441 cf
Outflow = 0.85 cfs @ 12.38 hrs, Volume= 8,441 cf, Atten= 69%, Lag= 18.6 min
Discarded = 0.11 cfs @ 10.57 hrs, Volume= 6,920 cf
Primary = 0.75 cfs @ 12.38 hrs, Volume= 1,521 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.54' @ 12.38 hrs Surf.Area= 1,920 sf Storage= 3,196 cf

Plug-Flow detention time= 222.3 min calculated for 8,440 cf (100% of inflow)
Center-of-Mass det. time= 222.3 min (1,023.8 - 801.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	18.00'	768 cf	**24.00'W x 80.00'L x 3.58'H Field A** 6,880 cf Overall - 4,960 cf Embedded = 1,920 cf x 40.0% Voids
#2A	19.00'	3,150 cf	**Oldcastle StormCapture SC1 2'** x 15 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 15 Chambers in 3 Rows
		3,918 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.00'	**18.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 20.00' / 17.80' S= 0.0367 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	20.40'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 10.57 hrs HW=18.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.74 cfs @ 12.38 hrs HW=20.54' (Free Discharge)
↑—**2=Culvert** (Passes 0.74 cfs of 1.44 cfs potential flow)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 0.74 cfs @ 1.05 fps)

Summary for Pond 11P: R1 Bio

Inflow Area = 10,171 sf, 48.03% Impervious, Inflow Depth = 1.84" for 2-Yr event
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 1,555 cf
Outflow = 0.40 cfs @ 12.14 hrs, Volume= 1,083 cf, Atten= 24%, Lag= 3.9 min
Primary = 0.40 cfs @ 12.14 hrs, Volume= 1,083 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.82' @ 12.14 hrs Surf.Area= 704 sf Storage= 522 cf

Plug-Flow detention time= 157.5 min calculated for 1,083 cf (70% of inflow)
Center-of-Mass det. time= 61.2 min (882.8 - 821.6)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	1,467 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.00	567	0	0
25.00	900	1,467	1,467

Device	Routing	Invert	Outlet Devices
#1	Primary	20.00'	**12.0" Round Culvert** L= 39.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 20.00' / 19.70' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	23.75'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.39 cfs @ 12.14 hrs HW=23.82' (Free Discharge)
↑—**1=Culvert** (Passes 0.39 cfs of 6.75 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 0.39 cfs @ 0.88 fps)

Summary for Pond 14P: Stormwater BMP #14

Inflow Area = 10,671 sf, 94.53% Impervious, Inflow Depth = 2.86" for 2-Yr event
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 2,540 cf
Outflow = 0.04 cfs @ 10.31 hrs, Volume= 2,540 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.31 hrs, Volume= 2,540 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.78' @ 14.37 hrs Surf.Area= 640 sf Storage= 1,204 cf

Plug-Flow detention time= 289.6 min calculated for 2,540 cf (100% of inflow)
Center-of-Mass det. time= 289.6 min (1,054.8 - 765.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	256 cf	**8.00'W x 80.00'L x 6.58'H Field A** 4,213 cf Overall - 3,573 cf Embedded = 640 cf x 40.0% Voids
#2A	21.00'	2,665 cf	**Oldcastle StormCapture SC1 5'** x 5 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 1 Rows adjusted for 110.0 cf perimeter wall
		2,921 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.20'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 23.20' / 23.10' S= 0.0167 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

#3	Device 2	25.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 10.31 hrs HW=20.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 15P: Stormwater BMP #15 - West of OL1

Inflow Area = 37,700 sf, 65.70% Impervious, Inflow Depth = 2.09" for 2-Yr event
Inflow = 2.13 cfs @ 12.07 hrs, Volume= 6,558 cf
Outflow = 0.16 cfs @ 11.39 hrs, Volume= 6,558 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.16 cfs @ 11.39 hrs, Volume= 6,558 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.64' @ 13.19 hrs Surf.Area= 2,816 sf Storage= 2,663 cf

Plug-Flow detention time= 140.6 min calculated for 6,558 cf (100% of inflow)
Center-of-Mass det. time= 140.6 min (932.3 - 791.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,126 cf	**16.00'W x 176.00'L x 6.58'H Field A** 18,539 cf Overall - 15,723 cf Embedded = 2,816 cf x 40.0% Voids
#2A	20.00'	11,970 cf	**Oldcastle StormCapture SC1 5'** x 22 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 2 Rows adjusted for 240.0 cf perimeter wall
		13,096 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.00'	**18.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 23.00' / 22.50' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	24.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.16 cfs @ 11.39 hrs HW=19.07' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond ISO-P/5P: Isolated Wetland/Enhanced Bio

Inflow Area = 64,014 sf, 45.50% Impervious, Inflow Depth = 1.46" for 2-Yr event
Inflow = 2.62 cfs @ 12.08 hrs, Volume= 7,813 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.20' @ 24.29 hrs Surf.Area= 6,140 sf Storage= 7,812 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	104,111 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	7,583	6,681	13,297
25.00	19,634	13,609	26,906
26.00	37,509	28,572	55,477
27.00	59,759	48,634	104,111

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP1: 72" culvert

Inflow Area = 479,744 sf, 76.55% Impervious, Inflow Depth = 0.55" for 2-Yr event
Inflow = 6.17 cfs @ 12.08 hrs, Volume= 21,842 cf
Primary = 6.17 cfs @ 12.08 hrs, Volume= 21,842 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Arsenal Street Infrastucture

Inflow Area = 274,308 sf, 62.90% Impervious, Inflow Depth = 0.30" for 2-Yr event
Inflow = 2.26 cfs @ 12.07 hrs, Volume= 6,811 cf
Primary = 2.26 cfs @ 12.07 hrs, Volume= 6,811 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

10-Year Storm Event – Proposed

Summary for Subcatchment PR-1A: 446/458 northwest corner

Runoff = 0.85 cfs @ 12.07 hrs, Volume= 2,585 cf, Depth= 3.47"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
4,152	74	>75% Grass cover, Good, HSG C
3,272	98	Paved parking, HSG C
1,508	98	Paved roads w/curbs & sewers, HSG C
8,932	87	Weighted Average
4,152		46.48% Pervious Area
4,780		53.52% Impervious Area

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

Summary for Subcatchment PR-1B: 446/458 northeast

Runoff = 0.60 cfs @ 12.07 hrs, Volume= 1,809 cf, Depth= 3.28"
Routed to Pond 3P : Stormwater BMP #3 - 446/458 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
3,581	74	>75% Grass cover, Good, HSG C
2,876	98	Paved parking, HSG C
169	98	Paved roads w/curbs & sewers, HSG C
6,626	85	Weighted Average
3,581		54.05% Pervious Area
3,045		45.95% Impervious Area

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

Summary for Subcatchment PR-1C: 446/458 east edge

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 2,811 cf, Depth= 3.99"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
1,972	74	>75% Grass cover, Good, HSG C
4,406	98	Paved parking, HSG C
2,073	98	Paved roads w/curbs & sewers, HSG C
8,452	92	Weighted Average
1,972		23.34% Pervious Area
6,479		76.66% Impervious Area

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

Summary for Subcatchment PR-1D: 446/458 frontage

Runoff = 1.01 cfs @ 12.08 hrs, Volume= 3,032 cf, Depth= 2.54"
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
12,303	74	>75% Grass cover, Good, HSG C
24	98	Paved parking, HSG C
1,998	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
14,325	77	Weighted Average
12,303		85.88% Pervious Area
2,022		14.12% Impervious Area

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

Summary for Subcatchment PR-1E: OL4

Runoff = 3.00 cfs @ 12.07 hrs, Volume= 10,216 cf, Depth= 4.66"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
26,287	98	Roofs, HSG C
26,287		100.00% Impervious Area

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

Summary for Subcatchment PR-1F: 446/458 Arsenal Street Pathway

Runoff = 0.67 cfs @ 12.07 hrs, Volume= 2,030 cf, Depth= 3.47"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
3,348	74	>75% Grass cover, Good, HSG C
3,664	98	Paved roads w/curbs & sewers, HSG C
7,012	87	Weighted Average
3,348		47.75% Pervious Area
3,664		52.25% Impervious Area

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

Summary for Subcatchment PR-2A: Arsenal Way

Runoff = 1.21 cfs @ 12.07 hrs, Volume= 4,044 cf, Depth= 4.55"
Routed to Pond 14P : Stormwater BMP #14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
584	74	>75% Grass cover, Good, HSG C
10,088	98	Paved parking, HSG C
10,671	97	Weighted Average
584		5.47% Pervious Area
10,088		94.53% Impervious Area

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

Summary for Subcatchment PR-2B: OL2 rear

Runoff = 4.83 cfs @ 12.07 hrs, Volume= 14,561 cf, Depth= 3.28"
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
29,387	74	>75% Grass cover, Good, HSG C
11,611	98	Paved parking, HSG C
7,421	98	Paved roads w/curbs & sewers, HSG C
6	98	Roofs, HSG C
4,917	98	Water Surface, 0% imp, HSG C
53,343	85	Weighted Average
34,305		64.31% Pervious Area
19,038		35.69% Impervious Area

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

Summary for Subcatchment PR-2C: OL2-OL3 courtyard/ Portion of OL2 roof/ A2

Runoff = 11.93 cfs @ 12.07 hrs, Volume= 36,890 cf, Depth= 3.78"
Routed to Pond 4C-P : Revised BMP 4C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
26,790	74	>75% Grass cover, Good, HSG C
32,505	89	Gravel roads, HSG C
14,919	98	Paved roads w/curbs & sewers, HSG C
42,900	98	Roofs, HSG C
117,115	90	Weighted Average
59,295		50.63% Pervious Area
57,819		49.37% Impervious Area

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

Summary for Subcatchment PR-2D: OL3/ 500 Arsenal Frontage

Runoff = 5.96 cfs @ 12.07 hrs, Volume= 19,358 cf, Depth= 4.32"
Routed to Pond 4A-P : Stormwater BMP #4A - OL3 Frontage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
5,695	74	>75% Grass cover, Good, HSG C
1,122	98	Paved parking, HSG C
4,144	98	Paved roads w/curbs & sewers, HSG C
42,804	98	Roofs, HSG C
53,766	95	Weighted Average
5,695		10.59% Pervious Area
48,071		89.41% Impervious Area

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

Summary for Subcatchment PR-2E: 500 Arsenal Street Pathway

Runoff = 0.97 cfs @ 12.07 hrs, Volume= 2,949 cf, Depth= 3.47"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
4,677	74	>75% Grass cover, Good, HSG C
5,511	98	Paved roads w/curbs & sewers, HSG C
10,188	87	Weighted Average
4,677		45.91% Pervious Area
5,511		54.09% Impervious Area

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

Summary for Subcatchment PR-3A: 550 Driveway and Courtyard/ 550 Driveway 1 & 2

Runoff = 1.94 cfs @ 12.07 hrs, Volume= 5,801 cf, Depth= 2.90"
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
16,583	74	>75% Grass cover, Good, HSG C
2,817	98	Paved parking, HSG C
4,626	98	Paved roads w/curbs & sewers, HSG C
24,026	81	Weighted Average
16,583		69.02% Pervious Area
7,443		30.98% Impervious Area

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

Summary for Subcatchment PR-3B: 550 North of A1-P1

Runoff = 4.66 cfs @ 12.07 hrs, Volume= 14,521 cf, Depth= 3.89"
Routed to Pond 10P : Stormwater BMP #10 - Behind Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
13,924	74	>75% Grass cover, Good, HSG C
28,574	98	Paved parking, HSG C
2,354	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
44,852	91	Weighted Average
13,924		31.04% Pervious Area
30,928		68.96% Impervious Area

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

Summary for Subcatchment PR-3C: A1/P1

Runoff = 7.54 cfs @ 12.07 hrs, Volume= 25,708 cf, Depth= 4.66"
Routed to Pond 9P : Stormwater BMP #9 - Below P1 Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
66,153	98	Roofs, HSG C
66,153		100.00% Impervious Area

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

Summary for Subcatchment PR-3D: 550 Driveway 3/ Northeast side Parking Lot

Runoff = 6.78 cfs @ 12.07 hrs, Volume= 21,761 cf, Depth= 4.21"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
10,533	74	>75% Grass cover, Good, HSG C
41,799	98	Paved parking, HSG C
9,704	98	Paved roads w/curbs & sewers, HSG C
62,036	94	Weighted Average
10,533		16.98% Pervious Area
51,503		83.02% Impervious Area

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

Summary for Subcatchment PR-3E: R1/ OL1/ OL1-R1 Loading

Runoff = 15.92 cfs @ 12.07 hrs, Volume= 52,489 cf, Depth= 4.43"
Routed to Pond 6P : Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
13,489	74	>75% Grass cover, Good, HSG C
17,178	98	Paved parking, HSG C
3,320	98	Paved roads w/curbs & sewers, HSG C
108,094	98	Roofs, HSG C
142,081	96	Weighted Average
13,489		9.49% Pervious Area
128,592		90.51% Impervious Area

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

Summary for Subcatchment PR-3F: 550 Southeast Driveway and Parking Lot

Runoff = 3.14 cfs @ 12.07 hrs, Volume= 10,071 cf, Depth= 4.21"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
4,879	74	>75% Grass cover, Good, HSG C
23,704	98	Paved parking, HSG C
127	98	Paved roads w/curbs & sewers, HSG C
28,711	94	Weighted Average
4,879		16.99% Pervious Area
23,832		83.01% Impervious Area

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

Summary for Subcatchment PR-3G: 550 Arsenal Street Pathway

Runoff = 2.24 cfs @ 12.07 hrs, Volume= 6,995 cf, Depth= 3.89"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
6,742	74	>75% Grass cover, Good, HSG C
3,132	98	Paved parking, HSG C
11,732	98	Paved roads w/curbs & sewers, HSG C
21,605	91	Weighted Average
6,742		31.20% Pervious Area
14,863		68.80% Impervious Area

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

Summary for Subcatchment PR-3H: Bio 7P

Runoff = 0.43 cfs @ 12.07 hrs, Volume= 1,291 cf, Depth= 2.81"
Routed to Pond 7P : Stormwater BMP #7 - 550 Bio South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
4,202	74	>75% Grass cover, Good, HSG C
1,320	98	Paved roads w/curbs & sewers, HSG C
5,522	80	Weighted Average
4,202		76.10% Pervious Area
1,320		23.90% Impervious Area

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

Summary for Subcatchment PR-3I: R1 southern sidewalk

Runoff = 0.94 cfs @ 12.07 hrs, Volume= 2,860 cf, Depth= 3.37"
Routed to Pond 11P : R1 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
5,285	74	>75% Grass cover, Good, HSG C
182	98	Paved parking, HSG C
4,703	98	Paved roads w/curbs & sewers, HSG C
10,171	86	Weighted Average
5,285		51.97% Pervious Area
4,885		48.03% Impervious Area

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

Summary for Subcatchment PR-3J: Subcat PR-3J

Runoff = 3.46 cfs @ 12.07 hrs, Volume= 10,993 cf, Depth= 4.10"
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.90"

Area (sf)	CN	Description
5,094	74	>75% Grass cover, Good, HSG C
3,634	89	Gravel roads, HSG C
20,819	98	Paved parking, HSG C
2,631	98	Paved roads w/curbs & sewers, HSG C
32,178	93	Weighted Average
8,728		27.12% Pervious Area
23,450		72.88% Impervious Area

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

Summary for Pond 1P: Stormwater BMP #1 - 446/458 Frontage Infiltration

Inflow Area = 235,502 sf, 63.06% Impervious, Inflow Depth = 0.66" for 10-Yr event
Inflow = 7.27 cfs @ 12.06 hrs, Volume= 12,862 cf
Outflow = 1.24 cfs @ 12.06 hrs, Volume= 12,862 cf, Atten= 83%, Lag= 0.0 min
Discarded = 1.24 cfs @ 12.06 hrs, Volume= 12,862 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP2 : Arsenal Street Infrastucture

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.19' @ 12.54 hrs Surf.Area= 6,464 sf Storage= 3,674 cf

Plug-Flow detention time= 21.9 min calculated for 12,862 cf (100% of inflow)
Center-of-Mass det. time= 21.9 min (842.6 - 820.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	2,048 cf	**32.00'W x 160.00'L x 6.67'H Field A** 34,133 cf Overall - 29,013 cf Embedded = 5,120 cf x 40.0% Voids
#2A	20.00'	22,804 cf	**retain_it retain_it 5.0'** x 80 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 4 Rows adjusted for 498.7 cf perimeter wall
#3B	19.00'	538 cf	**24.00'W x 56.00'L x 6.67'H Field B** 8,960 cf Overall - 7,616 cf Embedded = 1,344 cf x 40.0% Voids
#4B	20.00'	5,909 cf	**retain_it retain_it 5.0'** x 21 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 3 Rows adjusted for 207.8 cf perimeter wall
#5	25.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		31,361 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	27.20'	**6.0" Round Culvert** L= 12.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 27.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=1.24 cfs @ 12.06 hrs HW=19.17' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 2P: Stormwater BMP #2 - 446/458 Drop off Infiltration

Inflow Area = 50,297 sf, 80.70% Impervious, Inflow Depth = 3.90" for 10-Yr event
Inflow = 5.26 cfs @ 12.07 hrs, Volume= 16,345 cf
Outflow = 0.17 cfs @ 9.73 hrs, Volume= 16,345 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.17 cfs @ 9.73 hrs, Volume= 16,345 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 25.01' @ 15.29 hrs Surf.Area= 3,072 sf Storage= 8,860 cf

Plug-Flow detention time= 450.3 min calculated for 16,345 cf (100% of inflow)
Center-of-Mass det. time= 450.3 min (1,212.3 - 762.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.10'	1,229 cf	**24.00'W x 128.00'L x 6.58'H Field A** 20,224 cf Overall - 17,152 cf Embedded = 3,072 cf x 40.0% Voids
#2A	22.10'	13,130 cf	**Oldcastle StormCapture SC1 5'** x 24 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 3 Rows adjusted for 190.0 cf perimeter wall
		14,359 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.10'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.70'	**15.0" Round Culvert** L= 7.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 23.70' / 23.40' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	26.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 9.73 hrs HW=21.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.10' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Stormwater BMP #3 - 446/458 Bio

Inflow Area = 6,626 sf, 45.95% Impervious, Inflow Depth = 3.28" for 10-Yr event
Inflow = 0.60 cfs @ 12.07 hrs, Volume= 1,809 cf
Outflow = 0.58 cfs @ 12.10 hrs, Volume= 1,809 cf, Atten= 4%, Lag= 1.3 min
Discarded = 0.02 cfs @ 12.10 hrs, Volume= 1,076 cf
Primary = 0.55 cfs @ 12.10 hrs, Volume= 733 cf
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 28.89' @ 12.10 hrs Surf.Area= 430 sf Storage= 326 cf

Plug-Flow detention time= 74.0 min calculated for 1,809 cf (100% of inflow)
Center-of-Mass det. time= 74.0 min (881.3 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	1,068 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	300	0	0
29.50	518	614	614
29.60	706	61	675
29.90	1,919	394	1,068

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	25.00'	**12.0" Round Culvert** L= 15.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 25.00' / 24.60' S= 0.0267 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	28.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.10 hrs HW=28.89' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.55 cfs @ 12.10 hrs HW=28.89' (Free Discharge)
└**2=Culvert** (Passes 0.55 cfs of 6.96 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 0.55 cfs @ 1.23 fps)

Summary for Pond 4A-P: Stormwater BMP #4A - OL3 Frontage

Inflow Area = 53,766 sf, 89.41% Impervious, Inflow Depth = 4.32" for 10-Yr event
Inflow = 5.96 cfs @ 12.07 hrs, Volume= 19,358 cf
Outflow = 6.32 cfs @ 12.06 hrs, Volume= 19,358 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 5.80 hrs, Volume= 9,527 cf
Primary = 6.28 cfs @ 12.06 hrs, Volume= 9,831 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 26.75' @ 12.06 hrs Surf.Area= 1,881 sf Storage= 6,662 cf

Plug-Flow detention time= 650.7 min calculated for 19,357 cf (100% of inflow)
Center-of-Mass det. time= 650.7 min (1,418.5 - 767.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.40'	1,526 cf	**9.00'W x 209.00'L x 6.08'H Field A** 11,443 cf Overall - 7,627 cf Embedded = 3,816 cf x 40.0% Voids
#2A	22.40'	5,532 cf	**Oldcastle StormCapture SC1 4'** x 13 Inside #1 Inside= 84.0"W x 48.0"H => 27.38 sf x 16.00'L = 438.0 cf Outside= 96.0"W x 55.0"H => 36.67 sf x 16.00'L = 586.7 cf 1 Rows adjusted for 162.0 cf perimeter wall
		7,058 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert**
			L= 82.0' CPP, end-section conforming to fill, Ke= 0.500
			Inlet / Outlet Invert= 22.60' / 21.00' S= 0.0195 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#3	Device 2	26.20'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 5.80 hrs HW=21.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=6.28 cfs @ 12.06 hrs HW=26.75' (Free Discharge)
└**2=Culvert** (Passes 6.28 cfs of 26.86 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 6.28 cfs @ 2.27 fps)

Summary for Pond 4B-P: Revised BMP 4B

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 0.00" for 10-Yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 21.70' @ 0.00 hrs Surf.Area= 4,586 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.70'	3,454 cf	**22.00'W x 143.00'L x 3.67'H Field A**
			11,535 cf Overall - 2,901 cf Embedded = 8,634 cf x 40.0% Voids
#2A	22.70'	1,807 cf	**retain_it retain_it 2.0'** x 17 Inside #1
			Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf
			Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf
			1 Rows adjusted for 68.0 cf perimeter wall
#3B	21.70'	1,293 cf	**30.00'W x 48.00'L x 3.67'H Field B**
			5,280 cf Overall - 2,048 cf Embedded = 3,232 cf x 40.0% Voids
#4B	22.70'	1,293 cf	**retain_it retain_it 2.0'** x 12 Inside #3
			Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf
			Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf
			2 Rows adjusted for 30.2 cf perimeter wall
#5	26.40'	71 cf	**5.00'D x 3.60'H Vertical Cone/Cylinder** -Impervious
		7,917 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.70'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 96.0' Ke= 0.500 Inlet / Outlet Invert= 22.60' / 22.00' S= 0.0063 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Device 2	24.70'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.70' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.88 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.70' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4C-P: Revised BMP 4C

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 3.78" for 10-Yr event
Inflow = 11.93 cfs @ 12.07 hrs, Volume= 36,890 cf
Outflow = 1.35 cfs @ 11.62 hrs, Volume= 36,890 cf, Atten= 89%, Lag= 0.0 min
Discarded = 1.35 cfs @ 11.62 hrs, Volume= 36,890 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 4B-P : Revised BMP 4B

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.99' @ 12.70 hrs Surf.Area= 7,040 sf Storage= 12,338 cf

Plug-Flow detention time= 64.2 min calculated for 36,890 cf (100% of inflow)
Center-of-Mass det. time= 64.2 min (854.7 - 790.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.60'	256 cf	**16.00'W x 80.00'L x 3.08'H Field A** 3,947 cf Overall - 3,307 cf Embedded = 640 cf x 40.0% Voids
#2A	22.10'	2,100 cf	**Oldcastle StormCapture SC1 2'** x 10 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 10 Chambers in 2 Rows
#3B	21.60'	512 cf	**40.00'W x 64.00'L x 3.08'H Field B** 7,893 cf Overall - 6,613 cf Embedded = 1,280 cf x 40.0% Voids
#4B	22.10'	4,200 cf	**Oldcastle StormCapture SC1 2'** x 20 Inside #3 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 20 Chambers in 5 Rows
#5C	21.60'	640 cf	**40.00'W x 80.00'L x 3.08'H Field C** 9,867 cf Overall - 8,267 cf Embedded = 1,600 cf x 40.0% Voids
#6C	22.10'	5,250 cf	**Oldcastle StormCapture SC1 2'** x 25 Inside #5 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 25 Chambers in 5 Rows
#7	24.10'	64 cf	**4.00'D x 5.10'H Vertical Cone/Cylinder** -Impervious

13,022 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.60'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	24.70'	**24.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 24.70' / 23.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	25.25'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=1.35 cfs @ 11.62 hrs HW=21.68' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.60' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 6P: Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Inflow Area = 142,081 sf, 90.51% Impervious, Inflow Depth = 4.43" for 10-Yr event
Inflow = 15.92 cfs @ 12.07 hrs, Volume= 52,489 cf
Outflow = 3.08 cfs @ 12.50 hrs, Volume= 52,444 cf, Atten= 81%, Lag= 26.1 min
Discarded = 0.32 cfs @ 8.20 hrs, Volume= 45,003 cf
Primary = 2.76 cfs @ 12.50 hrs, Volume= 7,441 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 23.31' @ 12.50 hrs Surf.Area= 5,696 sf Storage= 26,793 cf

Plug-Flow detention time= 659.5 min calculated for 52,444 cf (100% of inflow)
Center-of-Mass det. time= 658.9 min (1,420.9 - 761.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	17.00'	1,229 cf	**16.00'W x 192.00'L x 6.67'H Field A** 20,480 cf Overall - 17,408 cf Embedded = 3,072 cf x 40.0% Voids
#2A	18.00'	13,441 cf	**retain_it retain_it 5.0'** x 48 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 2 Rows adjusted for 540.3 cf perimeter wall
#3B	17.00'	1,050 cf	**8.00'W x 328.00'L x 6.67'H Field B** 17,493 cf Overall - 14,869 cf Embedded = 2,624 cf x 40.0% Voids
#4B	18.00'	11,070 cf	**retain_it retain_it 5.0'** x 41 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 1 Rows adjusted for 872.8 cf perimeter wall
#5	23.00'	88 cf	**4.00'D x 7.00'H Vertical Cone/Cylinder** -Impervious

26,877 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.40'	**24.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 20.40' / 20.10' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.32 cfs @ 8.20 hrs HW=17.13' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=2.39 cfs @ 12.50 hrs HW=23.30' (Free Discharge)
└**2=Culvert** (Passes 2.39 cfs of 20.51 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 2.39 cfs @ 1.58 fps)

Summary for Pond 7P: Stormwater BMP #7 - 550 Bio South

Inflow Area = 5,522 sf, 23.90% Impervious, Inflow Depth = 2.81" for 10-Yr event
Inflow = 0.43 cfs @ 12.07 hrs, Volume= 1,291 cf
Outflow = 0.06 cfs @ 12.60 hrs, Volume= 1,291 cf, Atten= 86%, Lag= 31.2 min
Discarded = 0.06 cfs @ 12.60 hrs, Volume= 1,291 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 27.46' @ 12.60 hrs Surf.Area= 1,098 sf Storage= 428 cf

Plug-Flow detention time= 56.1 min calculated for 1,291 cf (100% of inflow)
Center-of-Mass det. time= 56.1 min (877.8 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	27.00'	1,125 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
27.00	750	0	0
28.00	1,500	1,125	1,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	24.00'	**12.0" Round Culvert** L= 46.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 24.00' / 23.80' S= 0.0043 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	27.75'	**12.0" Horiz. Orifice/Grate X 3.00** C= 0.600

Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.60 hrs HW=27.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 5.45 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 8P: Stormwater BMP #8 - A1P1 Courtyard Infiltration

Inflow Area = 61,726 sf, 52.19% Impervious, Inflow Depth = 1.13" for 10-Yr event
Inflow = 1.94 cfs @ 12.07 hrs, Volume= 5,801 cf
Outflow = 0.23 cfs @ 11.70 hrs, Volume= 5,801 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.70 hrs, Volume= 5,801 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 21.10' @ 12.75 hrs Surf.Area= 4,096 sf Storage= 1,988 cf

Plug-Flow detention time= 66.8 min calculated for 5,800 cf (100% of inflow)
Center-of-Mass det. time= 66.8 min (885.8 - 819.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	1,638 cf	**32.00'W x 128.00'L x 4.58'H Field A** 18,773 cf Overall - 14,677 cf Embedded = 4,096 cf x 40.0% Voids
#2A	21.00'	10,232 cf	**Oldcastle StormCapture SC1 3'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 4 Rows adjusted for 40.0 cf perimeter wall
		11,870 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	21.00'	**24.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 21.00' / 20.50' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.23 cfs @ 11.70 hrs HW=20.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 9P: Stormwater BMP #9 - Below P1 Garage Infiltration

Inflow Area = 66,153 sf,100.00% Impervious, Inflow Depth = 4.66" for 10-Yr event
Inflow = 7.54 cfs @ 12.07 hrs, Volume= 25,708 cf
Outflow = 2.03 cfs @ 12.40 hrs, Volume= 25,708 cf, Atten= 73%, Lag= 20.1 min
Discarded = 0.22 cfs @ 8.66 hrs, Volume= 21,169 cf
Primary = 1.80 cfs @ 12.40 hrs, Volume= 4,539 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.75' @ 12.40 hrs Surf.Area= 3,968 sf Storage= 10,603 cf

Plug-Flow detention time= 320.5 min calculated for 25,708 cf (100% of inflow)
Center-of-Mass det. time= 320.5 min (1,067.9 - 747.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,587 cf	**8.00'W x 496.00'L x 4.58'H Field A** 18,187 cf Overall - 14,219 cf Embedded = 3,968 cf x 40.0% Voids
#2A	20.00'	9,825 cf	**Oldcastle StormCapture SC1 3'** x 31 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 1 Rows adjusted for 126.0 cf perimeter wall
		11,412 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	19.00'	**18.0" Round Culvert** L= 41.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 19.00' / 18.00' S= 0.0244 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	22.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.22 cfs @ 8.66 hrs HW=19.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=1.80 cfs @ 12.40 hrs HW=22.75' (Free Discharge)
└**2=Culvert** (Passes 1.80 cfs of 14.74 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.80 cfs @ 1.42 fps)

Summary for Pond 10P: Stormwater BMP #10 - Behind Garage Infiltration

Inflow Area = 44,852 sf, 68.96% Impervious, Inflow Depth = 3.89" for 10-Yr event
Inflow = 4.66 cfs @ 12.07 hrs, Volume= 14,521 cf
Outflow = 3.71 cfs @ 12.13 hrs, Volume= 14,521 cf, Atten= 20%, Lag= 3.4 min
Discarded = 0.11 cfs @ 9.13 hrs, Volume= 8,297 cf
Primary = 3.60 cfs @ 12.13 hrs, Volume= 6,224 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.90' @ 12.13 hrs Surf.Area= 1,920 sf Storage= 3,766 cf

Plug-Flow detention time= 163.0 min calculated for 14,521 cf (100% of inflow)
Center-of-Mass det. time= 163.1 min (949.6 - 786.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	18.00'	768 cf	**24.00'W x 80.00'L x 3.58'H Field A** 6,880 cf Overall - 4,960 cf Embedded = 1,920 cf x 40.0% Voids
#2A	19.00'	3,150 cf	**Oldcastle StormCapture SC1 2'** x 15 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 15 Chambers in 3 Rows
		3,918 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.00'	**18.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 20.00' / 17.80' S= 0.0367 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	20.40'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 9.13 hrs HW=18.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=3.60 cfs @ 12.13 hrs HW=20.90' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 3.60 cfs @ 3.24 fps)
↑—**3=Broad-Crested Rectangular Weir** (Passes 3.60 cfs of 5.36 cfs potential flow)

Summary for Pond 11P: R1 Bio

Inflow Area = 10,171 sf, 48.03% Impervious, Inflow Depth = 3.37" for 10-Yr event
Inflow = 0.94 cfs @ 12.07 hrs, Volume= 2,860 cf
Outflow = 0.92 cfs @ 12.09 hrs, Volume= 2,387 cf, Atten= 3%, Lag= 1.1 min
Primary = 0.92 cfs @ 12.09 hrs, Volume= 2,387 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.88' @ 12.09 hrs Surf.Area= 713 sf Storage= 560 cf

Plug-Flow detention time= 105.7 min calculated for 2,387 cf (83% of inflow)
Center-of-Mass det. time= 37.7 min (842.0 - 804.3)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	1,467 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.00	567	0	0
25.00	900	1,467	1,467

Device	Routing	Invert	Outlet Devices
#1	Primary	20.00'	**12.0" Round Culvert** L= 39.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 20.00' / 19.70' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	23.75'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.92 cfs @ 12.09 hrs HW=23.88' (Free Discharge)
↑—**1=Culvert** (Passes 0.92 cfs of 6.80 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 0.92 cfs @ 1.16 fps)

Summary for Pond 14P: Stormwater BMP #14

Inflow Area = 10,671 sf, 94.53% Impervious, Inflow Depth = 4.55" for 10-Yr event
Inflow = 1.21 cfs @ 12.07 hrs, Volume= 4,044 cf
Outflow = 0.04 cfs @ 8.86 hrs, Volume= 4,044 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.04 cfs @ 8.86 hrs, Volume= 4,044 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 24.79' @ 15.76 hrs Surf.Area= 640 sf Storage= 2,278 cf

Plug-Flow detention time= 554.0 min calculated for 4,044 cf (100% of inflow)
Center-of-Mass det. time= 554.0 min (1,309.2 - 755.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	256 cf	**8.00'W x 80.00'L x 6.58'H Field A** 4,213 cf Overall - 3,573 cf Embedded = 640 cf x 40.0% Voids
#2A	21.00'	2,665 cf	**Oldcastle StormCapture SC1 5'** x 5 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 1 Rows adjusted for 110.0 cf perimeter wall
		2,921 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.20'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 23.20' / 23.10' S= 0.0167 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

#3	Device 2	25.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 8.86 hrs HW=20.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 15P: Stormwater BMP #15 - West of OL1

Inflow Area = 37,700 sf, 65.70% Impervious, Inflow Depth = 3.50" for 10-Yr event
Inflow = 3.46 cfs @ 12.07 hrs, Volume= 10,993 cf
Outflow = 0.16 cfs @ 10.47 hrs, Volume= 10,993 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.16 cfs @ 10.47 hrs, Volume= 10,993 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 21.76' @ 14.50 hrs Surf.Area= 2,816 sf Storage= 5,343 cf

Plug-Flow detention time= 301.4 min calculated for 10,993 cf (100% of inflow)
Center-of-Mass det. time= 301.4 min (1,079.4 - 778.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,126 cf	**16.00'W x 176.00'L x 6.58'H Field A** 18,539 cf Overall - 15,723 cf Embedded = 2,816 cf x 40.0% Voids
#2A	20.00'	11,970 cf	**Oldcastle StormCapture SC1 5'** x 22 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 2 Rows adjusted for 240.0 cf perimeter wall
		13,096 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.00'	**18.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 23.00' / 22.50' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	24.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.16 cfs @ 10.47 hrs HW=19.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond ISO-P/5P: Isolated Wetland/Enhanced Bio

Inflow Area = 64,014 sf, 45.50% Impervious, Inflow Depth = 2.73" for 10-Yr event
Inflow = 4.83 cfs @ 12.07 hrs, Volume= 14,561 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 24.15' @ 24.29 hrs Surf.Area= 9,372 sf Storage= 14,556 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	104,111 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	7,583	6,681	13,297
25.00	19,634	13,609	26,906
26.00	37,509	28,572	55,477
27.00	59,759	48,634	104,111

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: 72" culvert

Inflow Area = 479,744 sf, 76.55% Impervious, Inflow Depth = 1.31" for 10-Yr event
Inflow = 13.85 cfs @ 12.08 hrs, Volume= 52,423 cf
Primary = 13.85 cfs @ 12.08 hrs, Volume= 52,423 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Arsenal Street Infrastucture

Inflow Area = 274,308 sf, 62.90% Impervious, Inflow Depth = 0.52" for 10-Yr event
Inflow = 3.88 cfs @ 12.07 hrs, Volume= 11,973 cf
Primary = 3.88 cfs @ 12.07 hrs, Volume= 11,973 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

25-Year Storm Event – Proposed

Summary for Subcatchment PR-1A: 446/458 northwest corner

Runoff = 1.14 cfs @ 12.07 hrs, Volume= 3,505 cf, Depth= 4.71"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
4,152	74	>75% Grass cover, Good, HSG C
3,272	98	Paved parking, HSG C
1,508	98	Paved roads w/curbs & sewers, HSG C
8,932	87	Weighted Average
4,152		46.48% Pervious Area
4,780		53.52% Impervious Area

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

Summary for Subcatchment PR-1B: 446/458 northeast

Runoff = 0.81 cfs @ 12.07 hrs, Volume= 2,480 cf, Depth= 4.49"
Routed to Pond 3P : Stormwater BMP #3 - 446/458 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
3,581	74	>75% Grass cover, Good, HSG C
2,876	98	Paved parking, HSG C
169	98	Paved roads w/curbs & sewers, HSG C
6,626	85	Weighted Average
3,581		54.05% Pervious Area
3,045		45.95% Impervious Area

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

Summary for Subcatchment PR-1C: 446/458 east edge

Runoff = 1.16 cfs @ 12.07 hrs, Volume= 3,709 cf, Depth= 5.27"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
1,972	74	>75% Grass cover, Good, HSG C
4,406	98	Paved parking, HSG C
2,073	98	Paved roads w/curbs & sewers, HSG C
8,452	92	Weighted Average
1,972		23.34% Pervious Area
6,479		76.66% Impervious Area

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

Summary for Subcatchment PR-1D: 446/458 frontage

Runoff = 1.46 cfs @ 12.07 hrs, Volume= 4,362 cf, Depth= 3.65"
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
12,303	74	>75% Grass cover, Good, HSG C
24	98	Paved parking, HSG C
1,998	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
14,325	77	Weighted Average
12,303		85.88% Pervious Area
2,022		14.12% Impervious Area

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

Summary for Subcatchment PR-1E: OL4

Runoff = 3.80 cfs @ 12.07 hrs, Volume= 13,060 cf, Depth= 5.96"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
26,287	98	Roofs, HSG C
26,287		100.00% Impervious Area

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

Summary for Subcatchment PR-1F: 446/458 Arsenal Street Pathway

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 2,752 cf, Depth= 4.71"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
3,348	74	>75% Grass cover, Good, HSG C
3,664	98	Paved roads w/curbs & sewers, HSG C
7,012	87	Weighted Average
3,348		47.75% Pervious Area
3,664		52.25% Impervious Area

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

Summary for Subcatchment PR-2A: Arsenal Way

Runoff = 1.54 cfs @ 12.07 hrs, Volume= 5,197 cf, Depth= 5.84"
Routed to Pond 14P : Stormwater BMP #14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
584	74	>75% Grass cover, Good, HSG C
10,088	98	Paved parking, HSG C
10,671	97	Weighted Average
584		5.47% Pervious Area
10,088		94.53% Impervious Area

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

Summary for Subcatchment PR-2B: OL2 rear

Runoff = 6.54 cfs @ 12.07 hrs, Volume= 19,966 cf, Depth= 4.49"
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
29,387	74	>75% Grass cover, Good, HSG C
11,611	98	Paved parking, HSG C
7,421	98	Paved roads w/curbs & sewers, HSG C
6	98	Roofs, HSG C
4,917	98	Water Surface, 0% imp, HSG C
53,343	85	Weighted Average
34,305		64.31% Pervious Area
19,038		35.69% Impervious Area

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

Summary for Subcatchment PR-2C: OL2-OL3 courtyard/ Portion of OL2 roof/ A2

Runoff = 15.66 cfs @ 12.07 hrs, Volume= 49,196 cf, Depth= 5.04"
Routed to Pond 4C-P : Revised BMP 4C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
26,790	74	>75% Grass cover, Good, HSG C
32,505	89	Gravel roads, HSG C
14,919	98	Paved roads w/curbs & sewers, HSG C
42,900	98	Roofs, HSG C
117,115	90	Weighted Average
59,295		50.63% Pervious Area
57,819		49.37% Impervious Area

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

Summary for Subcatchment PR-2D: OL3/ 500 Arsenal Frontage

Runoff = 7.62 cfs @ 12.07 hrs, Volume= 25,137 cf, Depth= 5.61"
Routed to Pond 4A-P : Stormwater BMP #4A - OL3 Frontage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
5,695	74	>75% Grass cover, Good, HSG C
1,122	98	Paved parking, HSG C
4,144	98	Paved roads w/curbs & sewers, HSG C
42,804	98	Roofs, HSG C
53,766	95	Weighted Average
5,695		10.59% Pervious Area
48,071		89.41% Impervious Area

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

Summary for Subcatchment PR-2E: 500 Arsenal Street Pathway

Runoff = 1.30 cfs @ 12.07 hrs, Volume= 3,998 cf, Depth= 4.71"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
4,677	74	>75% Grass cover, Good, HSG C
5,511	98	Paved roads w/curbs & sewers, HSG C
10,188	87	Weighted Average
4,677		45.91% Pervious Area
5,511		54.09% Impervious Area

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

Summary for Subcatchment PR-3A: 550 Driveway and Courtyard/ 550 Driveway 1 & 2

Runoff = 2.71 cfs @ 12.07 hrs, Volume= 8,142 cf, Depth= 4.07"
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
16,583	74	>75% Grass cover, Good, HSG C
2,817	98	Paved parking, HSG C
4,626	98	Paved roads w/curbs & sewers, HSG C
24,026	81	Weighted Average
16,583		69.02% Pervious Area
7,443		30.98% Impervious Area

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

Summary for Subcatchment PR-3B: 550 North of A1-P1

Runoff = 6.08 cfs @ 12.07 hrs, Volume= 19,261 cf, Depth= 5.15"
Routed to Pond 10P : Stormwater BMP #10 - Behind Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
13,924	74	>75% Grass cover, Good, HSG C
28,574	98	Paved parking, HSG C
2,354	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
44,852	91	Weighted Average
13,924		31.04% Pervious Area
30,928		68.96% Impervious Area

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

Summary for Subcatchment PR-3C: A1/P1

Runoff = 9.56 cfs @ 12.07 hrs, Volume= 32,865 cf, Depth= 5.96"
Routed to Pond 9P : Stormwater BMP #9 - Below P1 Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
66,153	98	Roofs, HSG C
66,153		100.00% Impervious Area

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

Summary for Subcatchment PR-3D: 550 Driveway 3/ Northeast side Parking Lot

Runoff = 8.72 cfs @ 12.07 hrs, Volume= 28,406 cf, Depth= 5.49"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
10,533	74	>75% Grass cover, Good, HSG C
41,799	98	Paved parking, HSG C
9,704	98	Paved roads w/curbs & sewers, HSG C
62,036	94	Weighted Average
10,533		16.98% Pervious Area
51,503		83.02% Impervious Area

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

Summary for Subcatchment PR-3E: R1/ OL1/ OL1-R1 Loading

Runoff = 20.31 cfs @ 12.07 hrs, Volume= 67,803 cf, Depth= 5.73"
Routed to Pond 6P : Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
13,489	74	>75% Grass cover, Good, HSG C
17,178	98	Paved parking, HSG C
3,320	98	Paved roads w/curbs & sewers, HSG C
108,094	98	Roofs, HSG C
142,081	96	Weighted Average
13,489		9.49% Pervious Area
128,592		90.51% Impervious Area

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

Summary for Subcatchment PR-3F: 550 Southeast Driveway and Parking Lot

Runoff = 4.03 cfs @ 12.07 hrs, Volume= 13,146 cf, Depth= 5.49"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
4,879	74	>75% Grass cover, Good, HSG C
23,704	98	Paved parking, HSG C
127	98	Paved roads w/curbs & sewers, HSG C
28,711	94	Weighted Average
4,879		16.99% Pervious Area
23,832		83.01% Impervious Area

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

Summary for Subcatchment PR-3G: 550 Arsenal Street Pathway

Runoff = 2.93 cfs @ 12.07 hrs, Volume= 9,278 cf, Depth= 5.15"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
6,742	74	>75% Grass cover, Good, HSG C
3,132	98	Paved parking, HSG C
11,732	98	Paved roads w/curbs & sewers, HSG C
21,605	91	Weighted Average
6,742		31.20% Pervious Area
14,863		68.80% Impervious Area

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

Summary for Subcatchment PR-3H: Bio 7P

Runoff = 0.61 cfs @ 12.07 hrs, Volume= 1,823 cf, Depth= 3.96"
Routed to Pond 7P : Stormwater BMP #7 - 550 Bio South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
4,202	74	>75% Grass cover, Good, HSG C
1,320	98	Paved roads w/curbs & sewers, HSG C
5,522	80	Weighted Average
4,202		76.10% Pervious Area
1,320		23.90% Impervious Area

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

Summary for Subcatchment PR-3I: R1 southern sidewalk

Runoff = 1.27 cfs @ 12.07 hrs, Volume= 3,899 cf, Depth= 4.60"
Routed to Pond 11P : R1 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
5,285	74	>75% Grass cover, Good, HSG C
182	98	Paved parking, HSG C
4,703	98	Paved roads w/curbs & sewers, HSG C
10,171	86	Weighted Average
5,285		51.97% Pervious Area
4,885		48.03% Impervious Area

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

Summary for Subcatchment PR-3J: Subcat PR-3J

Runoff = 4.47 cfs @ 12.07 hrs, Volume= 14,427 cf, Depth= 5.38"
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.20"

Area (sf)	CN	Description
5,094	74	>75% Grass cover, Good, HSG C
3,634	89	Gravel roads, HSG C
20,819	98	Paved parking, HSG C
2,631	98	Paved roads w/curbs & sewers, HSG C
32,178	93	Weighted Average
8,728		27.12% Pervious Area
23,450		72.88% Impervious Area

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

Summary for Pond 1P: Stormwater BMP #1 - 446/458 Frontage Infiltration

Inflow Area = 235,502 sf, 63.06% Impervious, Inflow Depth = 1.08" for 25-Yr event
Inflow = 9.04 cfs @ 12.07 hrs, Volume= 21,208 cf
Outflow = 1.24 cfs @ 11.91 hrs, Volume= 21,208 cf, Atten= 86%, Lag= 0.0 min
Discarded = 1.24 cfs @ 11.91 hrs, Volume= 21,208 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP2 : Arsenal Street Infrastucture

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 20.87' @ 12.60 hrs Surf.Area= 6,464 sf Storage= 7,568 cf

Plug-Flow detention time= 52.2 min calculated for 21,208 cf (100% of inflow)
Center-of-Mass det. time= 52.2 min (867.3 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	2,048 cf	**32.00'W x 160.00'L x 6.67'H Field A** 34,133 cf Overall - 29,013 cf Embedded = 5,120 cf x 40.0% Voids
#2A	20.00'	22,804 cf	**retain_it retain_it 5.0'** x 80 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 4 Rows adjusted for 498.7 cf perimeter wall
#3B	19.00'	538 cf	**24.00'W x 56.00'L x 6.67'H Field B** 8,960 cf Overall - 7,616 cf Embedded = 1,344 cf x 40.0% Voids
#4B	20.00'	5,909 cf	**retain_it retain_it 5.0'** x 21 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 3 Rows adjusted for 207.8 cf perimeter wall
#5	25.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		31,361 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	27.20'	**6.0" Round Culvert** L= 12.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 27.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=1.24 cfs @ 11.91 hrs HW=19.14' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Stormwater BMP #2 - 446/458 Drop off Infiltration

Inflow Area = 50,297 sf, 80.70% Impervious, Inflow Depth = 5.13" for 25-Yr event
Inflow = 6.84 cfs @ 12.07 hrs, Volume= 21,522 cf
Outflow = 0.43 cfs @ 13.46 hrs, Volume= 21,522 cf, Atten= 94%, Lag= 83.4 min
Discarded = 0.17 cfs @ 8.92 hrs, Volume= 20,139 cf
Primary = 0.25 cfs @ 13.46 hrs, Volume= 1,383 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 26.07' @ 13.46 hrs Surf.Area= 3,072 sf Storage= 11,642 cf

Plug-Flow detention time= 553.8 min calculated for 21,521 cf (100% of inflow)
Center-of-Mass det. time= 553.8 min (1,311.4 - 757.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.10'	1,229 cf	**24.00'W x 128.00'L x 6.58'H Field A** 20,224 cf Overall - 17,152 cf Embedded = 3,072 cf x 40.0% Voids
#2A	22.10'	13,130 cf	**Oldcastle StormCapture SC1 5'** x 24 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 3 Rows adjusted for 190.0 cf perimeter wall
		14,359 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.10'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.70'	**15.0" Round Culvert** L= 7.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 23.70' / 23.40' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	26.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 8.92 hrs HW=21.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.23 cfs @ 13.46 hrs HW=26.07' (Free Discharge)
└**2=Culvert** (Passes 0.23 cfs of 7.79 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 0.72 fps)

Summary for Pond 3P: Stormwater BMP #3 - 446/458 Bio

Inflow Area = 6,626 sf, 45.95% Impervious, Inflow Depth = 4.49" for 25-Yr event
Inflow = 0.81 cfs @ 12.07 hrs, Volume= 2,480 cf
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 2,480 cf, Atten= 3%, Lag= 1.1 min
Discarded = 0.02 cfs @ 12.09 hrs, Volume= 1,232 cf
Primary = 0.77 cfs @ 12.09 hrs, Volume= 1,248 cf
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 28.93' @ 12.09 hrs Surf.Area= 435 sf Storage= 341 cf

Plug-Flow detention time= 65.6 min calculated for 2,480 cf (100% of inflow)
Center-of-Mass det. time= 65.6 min (864.1 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	1,068 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	300	0	0
29.50	518	614	614
29.60	706	61	675
29.90	1,919	394	1,068

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	25.00'	**12.0" Round Culvert** L= 15.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 25.00' / 24.60' S= 0.0267 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	28.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.09 hrs HW=28.93' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.76 cfs @ 12.09 hrs HW=28.93' (Free Discharge)
↑—**2=Culvert** (Passes 0.76 cfs of 7.00 cfs potential flow)
↑—**3=Orifice/Grate** (Weir Controls 0.76 cfs @ 1.38 fps)

Summary for Pond 4A-P: Stormwater BMP #4A - OL3 Frontage

Inflow Area = 53,766 sf, 89.41% Impervious, Inflow Depth = 5.61" for 25-Yr event
Inflow = 7.62 cfs @ 12.07 hrs, Volume= 25,137 cf
Outflow = 7.62 cfs @ 12.07 hrs, Volume= 25,137 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.04 cfs @ 4.52 hrs, Volume= 9,675 cf
Primary = 7.58 cfs @ 12.07 hrs, Volume= 15,462 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 26.82' @ 12.07 hrs Surf.Area= 1,881 sf Storage= 6,668 cf

Plug-Flow detention time= 511.4 min calculated for 25,136 cf (100% of inflow)
Center-of-Mass det. time= 511.5 min (1,273.4 - 761.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.40'	1,526 cf	**9.00'W x 209.00'L x 6.08'H Field A** 11,443 cf Overall - 7,627 cf Embedded = 3,816 cf x 40.0% Voids
#2A	22.40'	5,532 cf	**Oldcastle StormCapture SC1 4'** x 13 Inside #1 Inside= 84.0"W x 48.0"H => 27.38 sf x 16.00'L = 438.0 cf Outside= 96.0"W x 55.0"H => 36.67 sf x 16.00'L = 586.7 cf 1 Rows adjusted for 162.0 cf perimeter wall
		7,058 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 82.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 22.60' / 21.00' S= 0.0195 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#3	Device 2	26.20'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 4.52 hrs HW=21.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=7.57 cfs @ 12.07 hrs HW=26.82' (Free Discharge)
└**2=Culvert** (Passes 7.57 cfs of 27.14 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 7.57 cfs @ 2.44 fps)

Summary for Pond 4B-P: Revised BMP 4B

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 0.54" for 25-Yr event
Inflow = 8.75 cfs @ 12.19 hrs, Volume= 5,239 cf
Outflow = 0.88 cfs @ 12.20 hrs, Volume= 5,242 cf, Atten= 90%, Lag= 0.5 min
Discarded = 0.88 cfs @ 12.20 hrs, Volume= 5,242 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 23.37' @ 12.56 hrs Surf.Area= 4,586 sf Storage= 3,596 cf

Plug-Flow detention time= 39.7 min calculated for 5,239 cf (100% of inflow)
Center-of-Mass det. time= 39.7 min (780.9 - 741.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.70'	3,454 cf	**22.00'W x 143.00'L x 3.67'H Field A** 11,535 cf Overall - 2,901 cf Embedded = 8,634 cf x 40.0% Voids
#2A	22.70'	1,807 cf	**retain_it retain_it 2.0'** x 17 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 1 Rows adjusted for 68.0 cf perimeter wall
#3B	21.70'	1,293 cf	**30.00'W x 48.00'L x 3.67'H Field B** 5,280 cf Overall - 2,048 cf Embedded = 3,232 cf x 40.0% Voids
#4B	22.70'	1,293 cf	**retain_it retain_it 2.0'** x 12 Inside #3 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 30.2 cf perimeter wall
#5	26.40'	71 cf	**5.00'D x 3.60'H Vertical Cone/Cylinder** -Impervious
		7,917 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.70'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 96.0' Ke= 0.500 Inlet / Outlet Invert= 22.60' / 22.00' S= 0.0063 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Device 2	24.70'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.88 cfs @ 12.20 hrs HW=21.89' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=21.70' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4C-P: Revised BMP 4C

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 5.04" for 25-Yr event
Inflow = 15.66 cfs @ 12.07 hrs, Volume= 49,196 cf
Outflow = 10.10 cfs @ 12.19 hrs, Volume= 49,196 cf, Atten= 35%, Lag= 7.3 min
Discarded = 1.35 cfs @ 11.40 hrs, Volume= 43,957 cf
Primary = 8.75 cfs @ 12.19 hrs, Volume= 5,239 cf
Routed to Pond 4B-P : Revised BMP 4B

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 26.01' @ 12.19 hrs Surf.Area= 7,040 sf Storage= 12,982 cf

Plug-Flow detention time= 62.6 min calculated for 49,196 cf (100% of inflow)
Center-of-Mass det. time= 62.6 min (845.3 - 782.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.60'	256 cf	**16.00'W x 80.00'L x 3.08'H Field A** 3,947 cf Overall - 3,307 cf Embedded = 640 cf x 40.0% Voids
#2A	22.10'	2,100 cf	**Oldcastle StormCapture SC1 2'** x 10 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 10 Chambers in 2 Rows
#3B	21.60'	512 cf	**40.00'W x 64.00'L x 3.08'H Field B** 7,893 cf Overall - 6,613 cf Embedded = 1,280 cf x 40.0% Voids
#4B	22.10'	4,200 cf	**Oldcastle StormCapture SC1 2'** x 20 Inside #3 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 20 Chambers in 5 Rows
#5C	21.60'	640 cf	**40.00'W x 80.00'L x 3.08'H Field C** 9,867 cf Overall - 8,267 cf Embedded = 1,600 cf x 40.0% Voids
#6C	22.10'	5,250 cf	**Oldcastle StormCapture SC1 2'** x 25 Inside #5 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 25 Chambers in 5 Rows
#7	24.10'	64 cf	**4.00'D x 5.10'H Vertical Cone/Cylinder** -Impervious

13,022 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.60'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	24.70'	**24.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 24.70' / 23.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	25.25'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=1.35 cfs @ 11.40 hrs HW=21.68' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=7.89 cfs @ 12.19 hrs HW=25.95' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 7.89 cfs @ 3.81 fps)
↑—**3=Broad-Crested Rectangular Weir** (Passes 7.89 cfs of 9.40 cfs potential flow)

Summary for Pond 6P: Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Inflow Area = 142,081 sf, 90.51% Impervious, Inflow Depth = 5.73" for 25-Yr event
Inflow = 20.31 cfs @ 12.07 hrs, Volume= 67,803 cf
Outflow = 23.46 cfs @ 12.14 hrs, Volume= 69,056 cf, Atten= 0%, Lag= 4.4 min
Discarded = 0.32 cfs @ 7.17 hrs, Volume= 47,365 cf
Primary = 23.14 cfs @ 12.14 hrs, Volume= 21,691 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 24.30' @ 12.14 hrs Surf.Area= 5,696 sf Storage= 26,806 cf

Plug-Flow detention time= 507.0 min calculated for 67,803 cf (100% of inflow)
Center-of-Mass det. time= 533.7 min (1,290.3 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	17.00'	1,229 cf	**16.00'W x 192.00'L x 6.67'H Field A** 20,480 cf Overall - 17,408 cf Embedded = 3,072 cf x 40.0% Voids
#2A	18.00'	13,441 cf	**retain_it retain_it 5.0'** x 48 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 2 Rows adjusted for 540.3 cf perimeter wall
#3B	17.00'	1,050 cf	**8.00'W x 328.00'L x 6.67'H Field B** 17,493 cf Overall - 14,869 cf Embedded = 2,624 cf x 40.0% Voids
#4B	18.00'	11,070 cf	**retain_it retain_it 5.0'** x 41 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 1 Rows adjusted for 872.8 cf perimeter wall
#5	23.00'	88 cf	**4.00'D x 7.00'H Vertical Cone/Cylinder** -Impervious

26,877 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.40'	**24.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 20.40' / 20.10' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.32 cfs @ 7.17 hrs HW=17.13' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=20.27 cfs @ 12.14 hrs HW=24.14' (Free Discharge)
└**2=Culvert** (Passes 20.27 cfs of 25.05 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 20.27 cfs @ 3.55 fps)

Summary for Pond 7P: Stormwater BMP #7 - 550 Bio South

Inflow Area = 5,522 sf, 23.90% Impervious, Inflow Depth = 3.96" for 25-Yr event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 1,823 cf
Outflow = 0.07 cfs @ 12.75 hrs, Volume= 1,823 cf, Atten= 89%, Lag= 40.3 min
Discarded = 0.07 cfs @ 12.75 hrs, Volume= 1,823 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 27.67' @ 12.75 hrs Surf.Area= 1,252 sf Storage= 669 cf

Plug-Flow detention time= 83.7 min calculated for 1,823 cf (100% of inflow)
Center-of-Mass det. time= 83.7 min (895.6 - 811.9)

Volume	Invert	Avail.Storage	Storage Description
#1	27.00'	1,125 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
27.00	750	0	0
28.00	1,500	1,125	1,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	24.00'	**12.0" Round Culvert** L= 46.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 24.00' / 23.80' S= 0.0043 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	27.75'	**12.0" Horiz. Orifice/Grate X 3.00** C= 0.600

Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.75 hrs HW=27.67' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.00' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 5.45 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 8P: Stormwater BMP #8 - A1P1 Courtyard Infiltration

Inflow Area = 61,726 sf, 52.19% Impervious, Inflow Depth = 1.58" for 25-Yr event
Inflow = 2.71 cfs @ 12.07 hrs, Volume= 8,142 cf
Outflow = 0.23 cfs @ 11.58 hrs, Volume= 8,142 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.58 hrs, Volume= 8,142 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 21.45' @ 13.04 hrs Surf.Area= 4,096 sf Storage= 3,180 cf

Plug-Flow detention time= 116.0 min calculated for 8,142 cf (100% of inflow)
Center-of-Mass det. time= 116.0 min (925.3 - 809.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	1,638 cf	**32.00'W x 128.00'L x 4.58'H Field A** 18,773 cf Overall - 14,677 cf Embedded = 4,096 cf x 40.0% Voids
#2A	21.00'	10,232 cf	**Oldcastle StormCapture SC1 3'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 4 Rows adjusted for 40.0 cf perimeter wall
		11,870 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	21.00'	**24.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 21.00' / 20.50' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.23 cfs @ 11.58 hrs HW=20.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 9P: Stormwater BMP #9 - Below P1 Garage Infiltration

Inflow Area = 66,153 sf,100.00% Impervious, Inflow Depth = 5.96" for 25-Yr event
Inflow = 9.56 cfs @ 12.07 hrs, Volume= 32,865 cf
Outflow = 5.25 cfs @ 12.18 hrs, Volume= 32,865 cf, Atten= 45%, Lag= 6.5 min
Discarded = 0.22 cfs @ 7.93 hrs, Volume= 22,765 cf
Primary = 5.03 cfs @ 12.18 hrs, Volume= 10,100 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.98' @ 12.18 hrs Surf.Area= 3,968 sf Storage= 11,360 cf

Plug-Flow detention time= 276.5 min calculated for 32,864 cf (100% of inflow)
Center-of-Mass det. time= 276.5 min (1,020.2 - 743.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,587 cf	**8.00'W x 496.00'L x 4.58'H Field A** 18,187 cf Overall - 14,219 cf Embedded = 3,968 cf x 40.0% Voids
#2A	20.00'	9,825 cf	**Oldcastle StormCapture SC1 3'** x 31 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 1 Rows adjusted for 126.0 cf perimeter wall
		11,412 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	19.00'	**18.0" Round Culvert** L= 41.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 19.00' / 18.00' S= 0.0244 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	22.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.22 cfs @ 7.93 hrs HW=19.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=5.02 cfs @ 12.18 hrs HW=22.98' (Free Discharge)
└**2=Culvert** (Passes 5.02 cfs of 15.30 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 5.02 cfs @ 2.08 fps)

Summary for Pond 10P: Stormwater BMP #10 - Behind Garage Infiltration

Inflow Area = 44,852 sf, 68.96% Impervious, Inflow Depth = 5.15" for 25-Yr event
Inflow = 6.08 cfs @ 12.07 hrs, Volume= 19,261 cf
Outflow = 7.24 cfs @ 12.07 hrs, Volume= 19,261 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.11 cfs @ 8.37 hrs, Volume= 9,077 cf
Primary = 7.13 cfs @ 12.07 hrs, Volume= 10,184 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 21.44' @ 12.07 hrs Surf.Area= 1,920 sf Storage= 3,918 cf

Plug-Flow detention time= 139.8 min calculated for 19,260 cf (100% of inflow)
Center-of-Mass det. time= 139.8 min (918.9 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	18.00'	768 cf	**24.00'W x 80.00'L x 3.58'H Field A** 6,880 cf Overall - 4,960 cf Embedded = 1,920 cf x 40.0% Voids
#2A	19.00'	3,150 cf	**Oldcastle StormCapture SC1 2'** x 15 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 15 Chambers in 3 Rows
		3,918 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.00'	**18.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 20.00' / 17.80' S= 0.0367 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	20.40'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 8.37 hrs HW=18.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=7.03 cfs @ 12.07 hrs HW=21.42' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 7.03 cfs @ 4.06 fps)
↑—**3=Broad-Crested Rectangular Weir** (Passes 7.03 cfs of 17.12 cfs potential flow)

Summary for Pond 11P: R1 Bio

Inflow Area = 10,171 sf, 48.03% Impervious, Inflow Depth = 4.60" for 25-Yr event
Inflow = 1.27 cfs @ 12.07 hrs, Volume= 3,899 cf
Outflow = 1.24 cfs @ 12.09 hrs, Volume= 3,427 cf, Atten= 2%, Lag= 1.0 min
Primary = 1.24 cfs @ 12.09 hrs, Volume= 3,427 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.90' @ 12.09 hrs Surf.Area= 718 sf Storage= 581 cf

Plug-Flow detention time= 88.2 min calculated for 3,426 cf (88% of inflow)
Center-of-Mass det. time= 32.7 min (828.3 - 795.6)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	1,467 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.00	567	0	0
25.00	900	1,467	1,467

Device	Routing	Invert	Outlet Devices
#1	Primary	20.00'	**12.0" Round Culvert** L= 39.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 20.00' / 19.70' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	23.75'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.24 cfs @ 12.09 hrs HW=23.90' (Free Discharge)
↑—**1=Culvert** (Passes 1.24 cfs of 6.83 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 1.24 cfs @ 1.28 fps)

Summary for Pond 14P: Stormwater BMP #14

Inflow Area = 10,671 sf, 94.53% Impervious, Inflow Depth = 5.84" for 25-Yr event
Inflow = 1.54 cfs @ 12.07 hrs, Volume= 5,197 cf
Outflow = 0.15 cfs @ 12.79 hrs, Volume= 5,197 cf, Atten= 90%, Lag= 43.4 min
Discarded = 0.04 cfs @ 8.18 hrs, Volume= 4,677 cf
Primary = 0.12 cfs @ 12.79 hrs, Volume= 520 cf
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 25.54' @ 12.79 hrs Surf.Area= 640 sf Storage= 2,675 cf

Plug-Flow detention time= 591.4 min calculated for 5,197 cf (100% of inflow)
Center-of-Mass det. time= 591.4 min (1,342.0 - 750.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	256 cf	**8.00'W x 80.00'L x 6.58'H Field A** 4,213 cf Overall - 3,573 cf Embedded = 640 cf x 40.0% Voids
#2A	21.00'	2,665 cf	**Oldcastle StormCapture SC1 5'** x 5 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 1 Rows adjusted for 110.0 cf perimeter wall
		2,921 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.20'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 23.20' / 23.10' S= 0.0167 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

#3	Device 2	25.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 8.18 hrs HW=20.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.10 cfs @ 12.79 hrs HW=25.54' (Free Discharge)
└**2=Culvert** (Passes 0.10 cfs of 5.13 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.10 cfs @ 0.55 fps)

Summary for Pond 15P: Stormwater BMP #15 - West of OL1

Inflow Area = 37,700 sf, 65.70% Impervious, Inflow Depth = 4.59" for 25-Yr event
Inflow = 4.47 cfs @ 12.07 hrs, Volume= 14,427 cf
Outflow = 0.16 cfs @ 9.71 hrs, Volume= 14,427 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.16 cfs @ 9.71 hrs, Volume= 14,427 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.76' @ 15.33 hrs Surf.Area= 2,816 sf Storage= 7,737 cf

Plug-Flow detention time= 437.7 min calculated for 14,427 cf (100% of inflow)
Center-of-Mass det. time= 437.7 min (1,208.8 - 771.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,126 cf	**16.00'W x 176.00'L x 6.58'H Field A** 18,539 cf Overall - 15,723 cf Embedded = 2,816 cf x 40.0% Voids
#2A	20.00'	11,970 cf	**Oldcastle StormCapture SC1 5'** x 22 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 2 Rows adjusted for 240.0 cf perimeter wall
		13,096 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.00'	**18.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 23.00' / 22.50' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	24.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.16 cfs @ 9.71 hrs HW=19.07' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond ISO-P/5P: Isolated Wetland/Enhanced Bio

Inflow Area = 64,014 sf, 45.50% Impervious, Inflow Depth = 3.84" for 25-Yr event
Inflow = 6.54 cfs @ 12.07 hrs, Volume= 20,485 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 24.63' @ 24.29 hrs Surf.Area= 15,187 sf Storage= 20,481 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	104,111 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	7,583	6,681	13,297
25.00	19,634	13,609	26,906
26.00	37,509	28,572	55,477
27.00	59,759	48,634	104,111

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP1: 72" culvert

Inflow Area = 479,744 sf, 76.55% Impervious, Inflow Depth = 2.18" for 25-Yr event
Inflow = 41.77 cfs @ 12.14 hrs, Volume= 86,954 cf
Primary = 41.77 cfs @ 12.14 hrs, Volume= 86,954 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Arsenal Street Infrastucture

Inflow Area = 274,308 sf, 62.90% Impervious, Inflow Depth = 0.70" for 25-Yr event
Inflow = 5.12 cfs @ 12.07 hrs, Volume= 16,027 cf
Primary = 5.12 cfs @ 12.07 hrs, Volume= 16,027 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

100-Year Storm Event – Proposed

Summary for Subcatchment PR-1A: 446/458 northwest corner

Runoff = 1.73 cfs @ 12.07 hrs, Volume= 5,454 cf, Depth= 7.33"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
4,152	74	>75% Grass cover, Good, HSG C
3,272	98	Paved parking, HSG C
1,508	98	Paved roads w/curbs & sewers, HSG C
8,932	87	Weighted Average
4,152		46.48% Pervious Area
4,780		53.52% Impervious Area

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

Summary for Subcatchment PR-1B: 446/458 northeast

Runoff = 1.25 cfs @ 12.07 hrs, Volume= 3,912 cf, Depth= 7.08"
Routed to Pond 3P : Stormwater BMP #3 - 446/458 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
3,581	74	>75% Grass cover, Good, HSG C
2,876	98	Paved parking, HSG C
169	98	Paved roads w/curbs & sewers, HSG C
6,626	85	Weighted Average
3,581		54.05% Pervious Area
3,045		45.95% Impervious Area

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

Summary for Subcatchment PR-1C: 446/458 east edge

Runoff = 1.71 cfs @ 12.07 hrs, Volume= 5,589 cf, Depth= 7.94"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
1,972	74	>75% Grass cover, Good, HSG C
4,406	98	Paved parking, HSG C
2,073	98	Paved roads w/curbs & sewers, HSG C
8,452	92	Weighted Average
1,972		23.34% Pervious Area
6,479		76.66% Impervious Area

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

Summary for Subcatchment PR-1D: 446/458 frontage

Runoff = 2.41 cfs @ 12.07 hrs, Volume= 7,289 cf, Depth= 6.11"
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
12,303	74	>75% Grass cover, Good, HSG C
24	98	Paved parking, HSG C
1,998	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
14,325	77	Weighted Average
12,303		85.88% Pervious Area
2,022		14.12% Impervious Area

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

Summary for Subcatchment PR-1E: OL4

Runoff = 5.47 cfs @ 12.07 hrs, Volume= 18,970 cf, Depth= 8.66"
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
26,287	98	Roofs, HSG C
26,287		100.00% Impervious Area

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

Summary for Subcatchment PR-1F: 446/458 Arsenal Street Pathway

Runoff = 1.36 cfs @ 12.07 hrs, Volume= 4,282 cf, Depth= 7.33"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
3,348	74	>75% Grass cover, Good, HSG C
3,664	98	Paved roads w/curbs & sewers, HSG C
7,012	87	Weighted Average
3,348		47.75% Pervious Area
3,664		52.25% Impervious Area

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

Summary for Subcatchment PR-2A: Arsenal Way

Runoff = 2.21 cfs @ 12.07 hrs, Volume= 7,594 cf, Depth= 8.54"
Routed to Pond 14P : Stormwater BMP #14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
584	74	>75% Grass cover, Good, HSG C
10,088	98	Paved parking, HSG C
10,671	97	Weighted Average
584		5.47% Pervious Area
10,088		94.53% Impervious Area

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

Summary for Subcatchment PR-2B: OL2 rear

Runoff = 10.09 cfs @ 12.07 hrs, Volume= 31,492 cf, Depth= 7.08"
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
29,387	74	>75% Grass cover, Good, HSG C
11,611	98	Paved parking, HSG C
7,421	98	Paved roads w/curbs & sewers, HSG C
6	98	Roofs, HSG C
4,917	98	Water Surface, 0% imp, HSG C
53,343	85	Weighted Average
34,305		64.31% Pervious Area
19,038		35.69% Impervious Area

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

Summary for Subcatchment PR-2C: OL2-OL3 courtyard/ Portion of OL2 roof/ A2

Runoff = 23.32 cfs @ 12.07 hrs, Volume= 75,078 cf, Depth= 7.69"
Routed to Pond 4C-P : Revised BMP 4C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
26,790	74	>75% Grass cover, Good, HSG C
32,505	89	Gravel roads, HSG C
14,919	98	Paved roads w/curbs & sewers, HSG C
42,900	98	Roofs, HSG C
117,115	90	Weighted Average
59,295		50.63% Pervious Area
57,819		49.37% Impervious Area

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

Summary for Subcatchment PR-2D: OL3/ 500 Arsenal Frontage

Runoff = 11.07 cfs @ 12.07 hrs, Volume= 37,180 cf, Depth= 8.30"
Routed to Pond 4A-P : Stormwater BMP #4A - OL3 Frontage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
5,695	74	>75% Grass cover, Good, HSG C
1,122	98	Paved parking, HSG C
4,144	98	Paved roads w/curbs & sewers, HSG C
42,804	98	Roofs, HSG C
53,766	95	Weighted Average
5,695		10.59% Pervious Area
48,071		89.41% Impervious Area

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

Summary for Subcatchment PR-2E: 500 Arsenal Street Pathway

Runoff = 1.97 cfs @ 12.07 hrs, Volume= 6,222 cf, Depth= 7.33"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
4,677	74	>75% Grass cover, Good, HSG C
5,511	98	Paved roads w/curbs & sewers, HSG C
10,188	87	Weighted Average
4,677		45.91% Pervious Area
5,511		54.09% Impervious Area

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

Summary for Subcatchment PR-3A: 550 Driveway and Courtyard/ 550 Driveway 1 & 2

Runoff = 4.31 cfs @ 12.07 hrs, Volume= 13,206 cf, Depth= 6.60"
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
16,583	74	>75% Grass cover, Good, HSG C
2,817	98	Paved parking, HSG C
4,626	98	Paved roads w/curbs & sewers, HSG C
24,026	81	Weighted Average
16,583		69.02% Pervious Area
7,443		30.98% Impervious Area

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

Summary for Subcatchment PR-3B: 550 North of A1-P1

Runoff = 9.00 cfs @ 12.07 hrs, Volume= 29,207 cf, Depth= 7.81"
Routed to Pond 10P : Stormwater BMP #10 - Behind Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
13,924	74	>75% Grass cover, Good, HSG C
28,574	98	Paved parking, HSG C
2,354	98	Paved roads w/curbs & sewers, HSG C
0	98	Roofs, HSG C
44,852	91	Weighted Average
13,924		31.04% Pervious Area
30,928		68.96% Impervious Area

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

Summary for Subcatchment PR-3C: A1/P1

Runoff = 13.75 cfs @ 12.07 hrs, Volume= 47,739 cf, Depth= 8.66"
Routed to Pond 9P : Stormwater BMP #9 - Below P1 Garage Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
66,153	98	Roofs, HSG C
66,153		100.00% Impervious Area

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

Summary for Subcatchment PR-3D: 550 Driveway 3/ Northeast side Parking Lot

Runoff = 12.70 cfs @ 12.07 hrs, Volume= 42,274 cf, Depth= 8.18"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
10,533	74	>75% Grass cover, Good, HSG C
41,799	98	Paved parking, HSG C
9,704	98	Paved roads w/curbs & sewers, HSG C
62,036	94	Weighted Average
10,533		16.98% Pervious Area
51,503		83.02% Impervious Area

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

Summary for Subcatchment PR-3E: R1/ OL1/ OL1-R1 Loading

Runoff = 29.37 cfs @ 12.07 hrs, Volume= 99,679 cf, Depth= 8.42"
Routed to Pond 6P : Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
13,489	74	>75% Grass cover, Good, HSG C
17,178	98	Paved parking, HSG C
3,320	98	Paved roads w/curbs & sewers, HSG C
108,094	98	Roofs, HSG C
142,081	96	Weighted Average
13,489		9.49% Pervious Area
128,592		90.51% Impervious Area

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

Summary for Subcatchment PR-3F: 550 Southeast Driveway and Parking Lot

Runoff = 5.88 cfs @ 12.07 hrs, Volume= 19,565 cf, Depth= 8.18"
Routed to Link DP1 : 72" culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
4,879	74	>75% Grass cover, Good, HSG C
23,704	98	Paved parking, HSG C
127	98	Paved roads w/curbs & sewers, HSG C
28,711	94	Weighted Average
4,879		16.99% Pervious Area
23,832		83.01% Impervious Area

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

Summary for Subcatchment PR-3G: 550 Arsenal Street Pathway

Runoff = 4.34 cfs @ 12.07 hrs, Volume= 14,069 cf, Depth= 7.81"
Routed to Link DP2 : Arsenal Street Infrastucture

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
6,742	74	>75% Grass cover, Good, HSG C
3,132	98	Paved parking, HSG C
11,732	98	Paved roads w/curbs & sewers, HSG C
21,605	91	Weighted Average
6,742		31.20% Pervious Area
14,863		68.80% Impervious Area

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

Summary for Subcatchment PR-3H: Bio 7P

Runoff = 0.98 cfs @ 12.07 hrs, Volume= 2,979 cf, Depth= 6.47"
Routed to Pond 7P : Stormwater BMP #7 - 550 Bio South

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
4,202	74	>75% Grass cover, Good, HSG C
1,320	98	Paved roads w/curbs & sewers, HSG C
5,522	80	Weighted Average
4,202		76.10% Pervious Area
1,320		23.90% Impervious Area

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

Summary for Subcatchment PR-3I: R1 southern sidewalk

Runoff = 1.95 cfs @ 12.07 hrs, Volume= 6,108 cf, Depth= 7.21"
Routed to Pond 11P : R1 Bio

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
5,285	74	>75% Grass cover, Good, HSG C
182	98	Paved parking, HSG C
4,703	98	Paved roads w/curbs & sewers, HSG C
10,171	86	Weighted Average
5,285		51.97% Pervious Area
4,885		48.03% Impervious Area

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

Summary for Subcatchment PR-3J: Subcat PR-3J

Runoff = 6.55 cfs @ 12.07 hrs, Volume= 21,603 cf, Depth= 8.06"
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.90"

Area (sf)	CN	Description
5,094	74	>75% Grass cover, Good, HSG C
3,634	89	Gravel roads, HSG C
20,819	98	Paved parking, HSG C
2,631	98	Paved roads w/curbs & sewers, HSG C
32,178	93	Weighted Average
8,728		27.12% Pervious Area
23,450		72.88% Impervious Area

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

Summary for Pond 1P: Stormwater BMP #1 - 446/458 Frontage Infiltration

Inflow Area = 235,502 sf, 63.06% Impervious, Inflow Depth = 2.73" for 100-Yr event
Inflow = 21.97 cfs @ 12.19 hrs, Volume= 53,585 cf
Outflow = 1.24 cfs @ 11.51 hrs, Volume= 53,585 cf, Atten= 94%, Lag= 0.0 min
Discarded = 1.24 cfs @ 11.51 hrs, Volume= 53,585 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP2 : Arsenal Street Infrastucture

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 24.94' @ 13.62 hrs Surf.Area= 6,464 sf Storage= 30,976 cf

Plug-Flow detention time= 238.3 min calculated for 53,584 cf (100% of inflow)
Center-of-Mass det. time= 238.3 min (1,027.3 - 789.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	2,048 cf	**32.00'W x 160.00'L x 6.67'H Field A** 34,133 cf Overall - 29,013 cf Embedded = 5,120 cf x 40.0% Voids
#2A	20.00'	22,804 cf	**retain_it retain_it 5.0'** x 80 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 4 Rows adjusted for 498.7 cf perimeter wall
#3B	19.00'	538 cf	**24.00'W x 56.00'L x 6.67'H Field B** 8,960 cf Overall - 7,616 cf Embedded = 1,344 cf x 40.0% Voids
#4B	20.00'	5,909 cf	**retain_it retain_it 5.0'** x 21 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 3 Rows adjusted for 207.8 cf perimeter wall
#5	25.00'	63 cf	**4.00'D x 5.00'H Vertical Cone/Cylinder** -Impervious
		31,361 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	27.20'	**6.0" Round Culvert** L= 12.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 27.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=1.24 cfs @ 11.51 hrs HW=19.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=19.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Stormwater BMP #2 - 446/458 Drop off Infiltration

Inflow Area = 50,297 sf, 80.70% Impervious, Inflow Depth = 7.74" for 100-Yr event
Inflow = 10.07 cfs @ 12.07 hrs, Volume= 32,440 cf
Outflow = 4.76 cfs @ 12.21 hrs, Volume= 32,441 cf, Atten= 53%, Lag= 8.5 min
Discarded = 0.17 cfs @ 7.68 hrs, Volume= 22,057 cf
Primary = 4.59 cfs @ 12.21 hrs, Volume= 10,384 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 26.46' @ 12.21 hrs Surf.Area= 3,072 sf Storage= 12,669 cf

Plug-Flow detention time= 414.8 min calculated for 32,440 cf (100% of inflow)
Center-of-Mass det. time= 414.9 min (1,166.5 - 751.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.10'	1,229 cf	**24.00'W x 128.00'L x 6.58'H Field A** 20,224 cf Overall - 17,152 cf Embedded = 3,072 cf x 40.0% Voids
#2A	22.10'	13,130 cf	**Oldcastle StormCapture SC1 5'** x 24 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 3 Rows adjusted for 190.0 cf perimeter wall
		14,359 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.10'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.70'	**15.0" Round Culvert** L= 7.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 23.70' / 23.40' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	26.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 7.68 hrs HW=21.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=4.57 cfs @ 12.21 hrs HW=26.46' (Free Discharge)
└**2=Culvert** (Passes 4.57 cfs of 8.63 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 4.57 cfs @ 2.00 fps)

Summary for Pond 3P: Stormwater BMP #3 - 446/458 Bio

Inflow Area = 6,626 sf, 45.95% Impervious, Inflow Depth = 7.08" for 100-Yr event
Inflow = 1.25 cfs @ 12.07 hrs, Volume= 3,912 cf
Outflow = 1.22 cfs @ 12.09 hrs, Volume= 3,912 cf, Atten= 2%, Lag= 1.0 min
Discarded = 0.02 cfs @ 12.09 hrs, Volume= 1,485 cf
Primary = 1.20 cfs @ 12.09 hrs, Volume= 2,427 cf
Routed to Pond 2P : Stormwater BMP #2 - 446/458 Drop off Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 28.99' @ 12.09 hrs Surf.Area= 444 sf Storage= 368 cf

Plug-Flow detention time= 55.5 min calculated for 3,912 cf (100% of inflow)
Center-of-Mass det. time= 55.5 min (841.5 - 786.0)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	1,068 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	300	0	0
29.50	518	614	614
29.60	706	61	675
29.90	1,919	394	1,068

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	25.00'	**12.0" Round Culvert** L= 15.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 25.00' / 24.60' S= 0.0267 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	28.75'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.09 hrs HW=28.99' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.20 cfs @ 12.09 hrs HW=28.99' (Free Discharge)
└**2=Culvert** (Passes 1.20 cfs of 7.06 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 1.20 cfs @ 1.60 fps)

Summary for Pond 4A-P: Stormwater BMP #4A - OL3 Frontage

Inflow Area = 53,766 sf, 89.41% Impervious, Inflow Depth = 8.30" for 100-Yr event
Inflow = 11.07 cfs @ 12.07 hrs, Volume= 37,180 cf
Outflow = 11.07 cfs @ 12.07 hrs, Volume= 37,180 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.04 cfs @ 3.03 hrs, Volume= 9,850 cf
Primary = 11.02 cfs @ 12.07 hrs, Volume= 27,329 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 26.97' @ 12.07 hrs Surf.Area= 1,881 sf Storage= 6,681 cf

Plug-Flow detention time= 360.6 min calculated for 37,180 cf (100% of inflow)
Center-of-Mass det. time= 360.6 min (1,114.6 - 753.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.40'	1,526 cf	**9.00'W x 209.00'L x 6.08'H Field A** 11,443 cf Overall - 7,627 cf Embedded = 3,816 cf x 40.0% Voids
#2A	22.40'	5,532 cf	**Oldcastle StormCapture SC1 4'** x 13 Inside #1 Inside= 84.0"W x 48.0"H => 27.38 sf x 16.00'L = 438.0 cf Outside= 96.0"W x 55.0"H => 36.67 sf x 16.00'L = 586.7 cf 1 Rows adjusted for 162.0 cf perimeter wall
		7,058 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 82.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 22.60' / 21.00' S= 0.0195 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#3	Device 2	26.20'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 3.03 hrs HW=21.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=11.01 cfs @ 12.07 hrs HW=26.97' (Free Discharge)
└**2=Culvert** (Passes 11.01 cfs of 27.76 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 11.01 cfs @ 2.86 fps)

Summary for Pond 4B-P: Revised BMP 4B

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 1.97" for 100-Yr event
Inflow = 30.98 cfs @ 12.05 hrs, Volume= 19,247 cf
Outflow = 11.41 cfs @ 12.19 hrs, Volume= 19,235 cf, Atten= 63%, Lag= 8.1 min
Discarded = 0.88 cfs @ 12.05 hrs, Volume= 10,651 cf
Primary = 10.54 cfs @ 12.19 hrs, Volume= 8,583 cf
Routed to Pond 1P : Stormwater BMP #1 - 446/458 Frontage Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 25.45' @ 12.19 hrs Surf.Area= 4,586 sf Storage= 7,846 cf

Plug-Flow detention time= 49.3 min calculated for 19,234 cf (100% of inflow)
Center-of-Mass det. time= 49.3 min (786.4 - 737.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.70'	3,454 cf	**22.00'W x 143.00'L x 3.67'H Field A** 11,535 cf Overall - 2,901 cf Embedded = 8,634 cf x 40.0% Voids
#2A	22.70'	1,807 cf	**retain_it retain_it 2.0'** x 17 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 1 Rows adjusted for 68.0 cf perimeter wall
#3B	21.70'	1,293 cf	**30.00'W x 48.00'L x 3.67'H Field B** 5,280 cf Overall - 2,048 cf Embedded = 3,232 cf x 40.0% Voids
#4B	22.70'	1,293 cf	**retain_it retain_it 2.0'** x 12 Inside #3 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 30.2 cf perimeter wall
#5	26.40'	71 cf	**5.00'D x 3.60'H Vertical Cone/Cylinder** -Impervious
		7,917 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.70'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	22.60'	**24.0" Round Culvert** L= 96.0' Ke= 0.500 Inlet / Outlet Invert= 22.60' / 22.00' S= 0.0063 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#3	Device 2	24.70'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.88 cfs @ 12.05 hrs HW=21.99' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=10.34 cfs @ 12.19 hrs HW=25.44' (Free Discharge)
└**2=Culvert** (Passes 10.34 cfs of 18.44 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 10.34 cfs @ 2.79 fps)

Summary for Pond 4C-P: Revised BMP 4C

Inflow Area = 117,115 sf, 49.37% Impervious, Inflow Depth = 7.69" for 100-Yr event
Inflow = 23.32 cfs @ 12.07 hrs, Volume= 75,078 cf
Outflow = 32.33 cfs @ 12.05 hrs, Volume= 75,078 cf, Atten= 0%, Lag= 0.0 min
Discarded = 1.35 cfs @ 10.81 hrs, Volume= 55,831 cf
Primary = 30.98 cfs @ 12.05 hrs, Volume= 19,247 cf
Routed to Pond 4B-P : Revised BMP 4B

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 29.84' @ 12.05 hrs Surf.Area= 7,040 sf Storage= 13,022 cf

Plug-Flow detention time= 54.4 min calculated for 75,078 cf (100% of inflow)
Center-of-Mass det. time= 54.4 min (826.4 - 771.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.60'	256 cf	**16.00'W x 80.00'L x 3.08'H Field A** 3,947 cf Overall - 3,307 cf Embedded = 640 cf x 40.0% Voids
#2A	22.10'	2,100 cf	**Oldcastle StormCapture SC1 2'** x 10 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 10 Chambers in 2 Rows
#3B	21.60'	512 cf	**40.00'W x 64.00'L x 3.08'H Field B** 7,893 cf Overall - 6,613 cf Embedded = 1,280 cf x 40.0% Voids
#4B	22.10'	4,200 cf	**Oldcastle StormCapture SC1 2'** x 20 Inside #3 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 20 Chambers in 5 Rows
#5C	21.60'	640 cf	**40.00'W x 80.00'L x 3.08'H Field C** 9,867 cf Overall - 8,267 cf Embedded = 1,600 cf x 40.0% Voids
#6C	22.10'	5,250 cf	**Oldcastle StormCapture SC1 2'** x 25 Inside #5 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 25 Chambers in 5 Rows
#7	24.10'	64 cf	**4.00'D x 5.10'H Vertical Cone/Cylinder** -Impervious

13,022 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.60'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	24.70'	**24.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 24.70' / 23.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	25.25'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=1.35 cfs @ 10.81 hrs HW=21.68' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=28.56 cfs @ 12.05 hrs HW=29.27' (Free Discharge)
↑**2=Culvert** (Inlet Controls 28.56 cfs @ 9.09 fps)
↑**3=Broad-Crested Rectangular Weir** (Passes 28.56 cfs of 133.55 cfs potential flow)

Summary for Pond 6P: Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Inflow Area = 142,081 sf, 90.51% Impervious, Inflow Depth = 8.42" for 100-Yr event
Inflow = 29.37 cfs @ 12.07 hrs, Volume= 99,679 cf
Outflow = 29.34 cfs @ 12.07 hrs, Volume= 100,025 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.32 cfs @ 5.32 hrs, Volume= 50,484 cf
Primary = 29.02 cfs @ 12.07 hrs, Volume= 49,541 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 25.08' @ 12.07 hrs Surf.Area= 5,696 sf Storage= 26,815 cf

Plug-Flow detention time= 394.5 min calculated for 99,677 cf (100% of inflow)
Center-of-Mass det. time= 400.4 min (1,149.8 - 749.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	17.00'	1,229 cf	**16.00'W x 192.00'L x 6.67'H Field A** 20,480 cf Overall - 17,408 cf Embedded = 3,072 cf x 40.0% Voids
#2A	18.00'	13,441 cf	**retain_it retain_it 5.0'** x 48 Inside #1 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 2 Rows adjusted for 540.3 cf perimeter wall
#3B	17.00'	1,050 cf	**8.00'W x 328.00'L x 6.67'H Field B** 17,493 cf Overall - 14,869 cf Embedded = 2,624 cf x 40.0% Voids
#4B	18.00'	11,070 cf	**retain_it retain_it 5.0'** x 41 Inside #3 Inside= 84.0"W x 60.0"H => 36.41 sf x 8.00'L = 291.3 cf Outside= 96.0"W x 68.0"H => 45.33 sf x 8.00'L = 362.7 cf 1 Rows adjusted for 872.8 cf perimeter wall
#5	23.00'	88 cf	**4.00'D x 7.00'H Vertical Cone/Cylinder** -Impervious

26,877 cf Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.40'	**24.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 20.40' / 20.10' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.00'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.32 cfs @ 5.32 hrs HW=17.13' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=29.00 cfs @ 12.07 hrs HW=25.08' (Free Discharge)
└**2=Culvert** (Inlet Controls 29.00 cfs @ 9.23 fps)
└**3=Broad-Crested Rectangular Weir** (Passes 29.00 cfs of 49.65 cfs potential flow)

Summary for Pond 7P: Stormwater BMP #7 - 550 Bio South

Inflow Area = 5,522 sf, 23.90% Impervious, Inflow Depth = 6.47" for 100-Yr event
Inflow = 0.98 cfs @ 12.07 hrs, Volume= 2,979 cf
Outflow = 0.49 cfs @ 12.20 hrs, Volume= 2,979 cf, Atten= 50%, Lag= 7.8 min
Discarded = 0.08 cfs @ 12.20 hrs, Volume= 2,480 cf
Primary = 0.42 cfs @ 12.20 hrs, Volume= 499 cf
Routed to Pond 15P : Stormwater BMP #15 - West of OL1

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 27.81' @ 12.20 hrs Surf.Area= 1,355 sf Storage= 849 cf

Plug-Flow detention time= 82.4 min calculated for 2,979 cf (100% of inflow)
Center-of-Mass det. time= 82.4 min (880.5 - 798.0)

Volume	Invert	Avail.Storage	Storage Description
#1	27.00'	1,125 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
27.00	750	0	0
28.00	1,500	1,125	1,125

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	24.00'	**12.0" Round Culvert** L= 46.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 24.00' / 23.80' S= 0.0043 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	27.75'	**12.0" Horiz. Orifice/Grate X 3.00** C= 0.600

Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 12.20 hrs HW=27.81' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.41 cfs @ 12.20 hrs HW=27.81' (Free Discharge)
└**2=Culvert** (Passes 0.41 cfs of 6.37 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 0.41 cfs @ 0.78 fps)

Summary for Pond 8P: Stormwater BMP #8 - A1P1 Courtyard Infiltration

Inflow Area = 61,726 sf, 52.19% Impervious, Inflow Depth = 2.92" for 100-Yr event
Inflow = 4.31 cfs @ 12.07 hrs, Volume= 15,034 cf
Outflow = 0.23 cfs @ 11.05 hrs, Volume= 15,034 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.05 hrs, Volume= 15,034 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.75' @ 15.43 hrs Surf.Area= 4,096 sf Storage= 7,610 cf

Plug-Flow detention time= 303.5 min calculated for 15,034 cf (100% of inflow)
Center-of-Mass det. time= 303.5 min (1,105.2 - 801.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	1,638 cf	**32.00'W x 128.00'L x 4.58'H Field A** 18,773 cf Overall - 14,677 cf Embedded = 4,096 cf x 40.0% Voids
#2A	21.00'	10,232 cf	**Oldcastle StormCapture SC1 3'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 4 Rows adjusted for 40.0 cf perimeter wall
		11,870 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	21.00'	**24.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 21.00' / 20.50' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Device 2	23.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.23 cfs @ 11.05 hrs HW=20.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 9P: Stormwater BMP #9 - Below P1 Garage Infiltration

Inflow Area = 66,153 sf,100.00% Impervious, Inflow Depth = 8.66" for 100-Yr event
Inflow = 13.75 cfs @ 12.07 hrs, Volume= 47,739 cf
Outflow = 16.35 cfs @ 12.06 hrs, Volume= 47,739 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.22 cfs @ 6.42 hrs, Volume= 25,270 cf
Primary = 16.13 cfs @ 12.06 hrs, Volume= 22,468 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.48' @ 12.06 hrs Surf.Area= 3,968 sf Storage= 11,412 cf

Plug-Flow detention time= 222.0 min calculated for 47,739 cf (100% of inflow)
Center-of-Mass det. time= 222.0 min (961.0 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,587 cf	**8.00'W x 496.00'L x 4.58'H Field A** 18,187 cf Overall - 14,219 cf Embedded = 3,968 cf x 40.0% Voids
#2A	20.00'	9,825 cf	**Oldcastle StormCapture SC1 3'** x 31 Inside #1 Inside= 84.0"W x 36.0"H => 20.06 sf x 16.00'L = 321.0 cf Outside= 96.0"W x 43.0"H => 28.67 sf x 16.00'L = 458.7 cf 1 Rows adjusted for 126.0 cf perimeter wall
		11,412 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	19.00'	**18.0" Round Culvert** L= 41.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 19.00' / 18.00' S= 0.0244 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	22.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.22 cfs @ 6.42 hrs HW=19.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=16.13 cfs @ 12.06 hrs HW=23.48' (Free Discharge)
└**2=Culvert** (Passes 16.13 cfs of 16.44 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 16.13 cfs @ 3.29 fps)

Summary for Pond 10P: Stormwater BMP #10 - Behind Garage Infiltration

Inflow Area = 44,852 sf, 68.96% Impervious, Inflow Depth = 7.81" for 100-Yr event
Inflow = 9.00 cfs @ 12.07 hrs, Volume= 29,207 cf
Outflow = 9.94 cfs @ 12.07 hrs, Volume= 29,207 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.11 cfs @ 6.88 hrs, Volume= 10,210 cf
Primary = 9.84 cfs @ 12.07 hrs, Volume= 18,997 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 22.09' @ 12.07 hrs Surf.Area= 1,920 sf Storage= 3,918 cf

Plug-Flow detention time= 110.0 min calculated for 29,207 cf (100% of inflow)
Center-of-Mass det. time= 110.0 min (878.7 - 768.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	18.00'	768 cf	**24.00'W x 80.00'L x 3.58'H Field A** 6,880 cf Overall - 4,960 cf Embedded = 1,920 cf x 40.0% Voids
#2A	19.00'	3,150 cf	**Oldcastle StormCapture SC1 2'** x 15 Inside #1 Inside= 84.0"W x 24.0"H => 13.13 sf x 16.00'L = 210.0 cf Outside= 96.0"W x 31.0"H => 20.67 sf x 16.00'L = 330.7 cf 15 Chambers in 3 Rows
		3,918 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	20.00'	**18.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 20.00' / 17.80' S= 0.0367 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	20.40'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 6.88 hrs HW=18.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=9.83 cfs @ 12.07 hrs HW=22.09' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 9.83 cfs @ 5.56 fps)
↑—**3=Broad-Crested Rectangular Weir** (Passes 9.83 cfs of 36.32 cfs potential flow)

Summary for Pond 11P: R1 Bio

Inflow Area = 10,171 sf, 48.03% Impervious, Inflow Depth = 7.21" for 100-Yr event
Inflow = 1.95 cfs @ 12.07 hrs, Volume= 6,108 cf
Outflow = 1.91 cfs @ 12.09 hrs, Volume= 5,636 cf, Atten= 2%, Lag= 0.9 min
Primary = 1.91 cfs @ 12.09 hrs, Volume= 5,636 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 23.96' @ 12.09 hrs Surf.Area= 726 sf Storage= 618 cf

Plug-Flow detention time= 67.1 min calculated for 5,636 cf (92% of inflow)
Center-of-Mass det. time= 26.9 min (810.2 - 783.4)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	1,467 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.00	567	0	0
25.00	900	1,467	1,467

Device	Routing	Invert	Outlet Devices
#1	Primary	20.00'	**12.0" Round Culvert** L= 39.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 20.00' / 19.70' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	23.75'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.91 cfs @ 12.09 hrs HW=23.95' (Free Discharge)
↑—**1=Culvert** (Passes 1.91 cfs of 6.89 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 1.91 cfs @ 1.48 fps)

Summary for Pond 14P: Stormwater BMP #14

Inflow Area = 10,671 sf, 94.53% Impervious, Inflow Depth = 8.54" for 100-Yr event
Inflow = 2.21 cfs @ 12.07 hrs, Volume= 7,594 cf
Outflow = 1.70 cfs @ 12.13 hrs, Volume= 7,594 cf, Atten= 23%, Lag= 3.8 min
Discarded = 0.04 cfs @ 6.64 hrs, Volume= 5,081 cf
Primary = 1.67 cfs @ 12.13 hrs, Volume= 2,512 cf
Routed to Pond ISO-P/5P : Isolated Wetland/Enhanced Bio

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 25.74' @ 12.13 hrs Surf.Area= 640 sf Storage= 2,782 cf

Plug-Flow detention time= 451.5 min calculated for 7,594 cf (100% of inflow)
Center-of-Mass det. time= 451.5 min (1,196.1 - 744.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	20.00'	256 cf	**8.00'W x 80.00'L x 6.58'H Field A** 4,213 cf Overall - 3,573 cf Embedded = 640 cf x 40.0% Voids
#2A	21.00'	2,665 cf	**Oldcastle StormCapture SC1 5'** x 5 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 1 Rows adjusted for 110.0 cf perimeter wall
		2,921 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	20.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.20'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 23.20' / 23.10' S= 0.0167 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

#3	Device 2	25.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.04 cfs @ 6.64 hrs HW=20.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.65 cfs @ 12.13 hrs HW=25.74' (Free Discharge)
└**2=Culvert** (Passes 1.65 cfs of 5.40 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.65 cfs @ 1.38 fps)

Summary for Pond 15P: Stormwater BMP #15 - West of OL1

Inflow Area = 37,700 sf, 65.70% Impervious, Inflow Depth = 7.04" for 100-Yr event
Inflow = 6.55 cfs @ 12.07 hrs, Volume= 22,102 cf
Outflow = 0.47 cfs @ 13.20 hrs, Volume= 22,102 cf, Atten= 93%, Lag= 67.8 min
Discarded = 0.16 cfs @ 8.52 hrs, Volume= 20,274 cf
Primary = 0.31 cfs @ 13.20 hrs, Volume= 1,828 cf
Routed to Pond 8P : Stormwater BMP #8 - A1P1 Courtyard Infiltration

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 24.58' @ 13.20 hrs Surf.Area= 2,816 sf Storage= 12,080 cf

Plug-Flow detention time= 624.3 min calculated for 22,102 cf (100% of inflow)
Center-of-Mass det. time= 624.3 min (1,385.7 - 761.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	1,126 cf	**16.00'W x 176.00'L x 6.58'H Field A** 18,539 cf Overall - 15,723 cf Embedded = 2,816 cf x 40.0% Voids
#2A	20.00'	11,970 cf	**Oldcastle StormCapture SC1 5'** x 22 Inside #1 Inside= 84.0"W x 60.0"H => 34.69 sf x 16.00'L = 555.0 cf Outside= 96.0"W x 67.0"H => 44.67 sf x 16.00'L = 714.7 cf 2 Rows adjusted for 240.0 cf perimeter wall
		13,096 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	23.00'	**18.0" Round Culvert** L= 45.0' Ke= 0.500 Inlet / Outlet Invert= 23.00' / 22.50' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Device 2	24.50'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.16 cfs @ 8.52 hrs HW=19.07' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.29 cfs @ 13.20 hrs HW=24.58' (Free Discharge)
2=Culvert (Passes 0.29 cfs of 7.73 cfs potential flow)
3=Broad-Crested Rectangular Weir (Weir Controls 0.29 cfs @ 0.77 fps)

Summary for Pond ISO-P/5P: Isolated Wetland/Enhanced Bio

Inflow Area = 64,014 sf, 45.50% Impervious, Inflow Depth = 6.37" for 100-Yr event
Inflow = 10.27 cfs @ 12.11 hrs, Volume= 34,004 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link DP1 : 72" culvert

Routing by Stor-Ind method, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs
Peak Elev= 25.32' @ 24.29 hrs Surf.Area= 25,282 sf Storage= 34,002 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	20.00'	104,111 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
20.00	7	0	0
21.00	341	174	174
22.00	3,383	1,862	2,036
23.00	5,778	4,581	6,617
24.00	7,583	6,681	13,297
25.00	19,634	13,609	26,906
26.00	37,509	28,572	55,477
27.00	59,759	48,634	104,111

Device	Routing	Invert	Outlet Devices
#1	Primary	26.20'	**15.0' long x 11.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.53 2.59 2.70 2.68 2.67 2.68 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=20.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link DP1: 72" culvert

Inflow Area = 479,744 sf, 76.55% Impervious, Inflow Depth = 3.96" for 100-Yr event
Inflow = 73.14 cfs @ 12.08 hrs, Volume= 158,481 cf
Primary = 73.14 cfs @ 12.08 hrs, Volume= 158,481 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Arsenal Street Infrastucture

Inflow Area = 274,308 sf, 62.90% Impervious, Inflow Depth = 1.07" for 100-Yr event
Inflow = 7.67 cfs @ 12.07 hrs, Volume= 24,573 cf
Primary = 7.67 cfs @ 12.07 hrs, Volume= 24,573 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-400.00 hrs, dt= 0.01 hrs

Events for Subcatchment PR-1A: 446/458 northwest corner

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.48	1,425	1.91
10-Yr	4.90	0.85	2,585	3.47
25-Yr	6.20	1.14	3,505	4.71
100-Yr	**8.90**	**1.73**	**5,454**	**7.33**

Events for Subcatchment PR-1B: 446/458 northeast

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.33	971	1.76
10-Yr	4.90	0.60	1,809	3.28
25-Yr	6.20	0.81	2,480	4.49
100-Yr	**8.90**	**1.25**	**3,912**	**7.08**

Events for Subcatchment PR-1C: 446/458 east edge

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.54	1,656	2.35
10-Yr	4.90	0.89	2,811	3.99
25-Yr	6.20	1.16	3,709	5.27
100-Yr	**8.90**	**1.71**	**5,589**	**7.94**

Events for Subcatchment PR-1D: 446/458 frontage

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.47	1,447	1.21
10-Yr	4.90	1.01	3,032	2.54
25-Yr	6.20	1.46	4,362	3.65
100-Yr	**8.90**	**2.41**	**7,289**	**6.11**

Events for Subcatchment PR-1E: OL4

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.94	6,501	2.97
10-Yr	4.90	3.00	10,216	4.66
25-Yr	6.20	3.80	13,060	5.96
100-Yr	**8.90**	**5.47**	**18,970**	**8.66**

Events for Subcatchment PR-1F: 446/458 Arsenal Street Pathway

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.37	1,119	1.91
10-Yr	4.90	0.67	2,030	3.47
25-Yr	6.20	0.89	2,752	4.71
100-Yr	**8.90**	**1.36**	**4,282**	**7.33**

Events for Subcatchment PR-2A: Arsenal Way

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.78	2,540	2.86
10-Yr	4.90	1.21	4,044	4.55
25-Yr	6.20	1.54	5,197	5.84
100-Yr	**8.90**	**2.21**	**7,594**	**8.54**

Events for Subcatchment PR-2B: OL2 rear

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	2.62	7,813	1.76
10-Yr	4.90	4.83	14,561	3.28
25-Yr	6.20	6.54	19,966	4.49
100-Yr	**8.90**	**10.09**	**31,492**	**7.08**

Events for Subcatchment PR-2C: OL2-OL3 courtyard/ Portion of OL2 roof/ A2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	7.01	21,165	2.17
10-Yr	4.90	11.93	36,890	3.78
25-Yr	6.20	15.66	49,196	5.04
100-Yr	**8.90**	**23.32**	**75,078**	**7.69**

Events for Subcatchment PR-2D: OL3/ 500 Arsenal Frontage

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	3.75	11,851	2.64
10-Yr	4.90	5.96	19,358	4.32
25-Yr	6.20	7.62	25,137	5.61
100-Yr	**8.90**	**11.07**	**37,180**	**8.30**

Events for Subcatchment PR-2E: 500 Arsenal Street Pathway

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.54	1,626	1.91
10-Yr	4.90	0.97	2,949	3.47
25-Yr	6.20	1.30	3,998	4.71
100-Yr	**8.90**	**1.97**	**6,222**	**7.33**

Events for Subcatchment PR-3A: 550 Driveway and Courtyard/ 550 Driveway 1 & 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.98	2,941	1.47
10-Yr	4.90	1.94	5,801	2.90
25-Yr	6.20	2.71	8,142	4.07
100-Yr	**8.90**	**4.31**	**13,206**	**6.60**

Events for Subcatchment PR-3B: 550 North of A1-P1

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	2.78	8,441	2.26
10-Yr	4.90	4.66	14,521	3.89
25-Yr	6.20	6.08	19,261	5.15
100-Yr	**8.90**	**9.00**	**29,207**	**7.81**

Events for Subcatchment PR-3C: A1/P1

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	4.89	16,359	2.97
10-Yr	4.90	7.54	25,708	4.66
25-Yr	6.20	9.56	32,865	5.96
100-Yr	**8.90**	**13.75**	**47,739**	**8.66**

Events for Subcatchment PR-3D: 550 Driveway 3/ Northeast side Parking Lot

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	4.22	13,151	2.54
10-Yr	4.90	6.78	21,761	4.21
25-Yr	6.20	8.72	28,406	5.49
100-Yr	**8.90**	**12.70**	**42,274**	**8.18**

Events for Subcatchment PR-3E: R1/ OL1/ OL1-R1 Loading

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	10.14	32,550	2.75
10-Yr	4.90	15.92	52,489	4.43
25-Yr	6.20	20.31	67,803	5.73
100-Yr	**8.90**	**29.37**	**99,679**	**8.42**

Events for Subcatchment PR-3F: 550 Southeast Driveway and Parking Lot

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.95	6,086	2.54
10-Yr	4.90	3.14	10,071	4.21
25-Yr	6.20	4.03	13,146	5.49
100-Yr	**8.90**	**5.88**	**19,565**	**8.18**

Events for Subcatchment PR-3G: 550 Arsenal Street Pathway

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	1.34	4,066	2.26
10-Yr	4.90	2.24	6,995	3.89
25-Yr	6.20	2.93	9,278	5.15
100-Yr	**8.90**	**4.34**	**14,069**	**7.81**

Events for Subcatchment PR-3H: Bio 7P

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.21	645	1.40
10-Yr	4.90	0.43	1,291	2.81
25-Yr	6.20	0.61	1,823	3.96
100-Yr	**8.90**	**0.98**	**2,979**	**6.47**

Events for Subcatchment PR-3I: R1 southern sidewalk

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	0.52	1,555	1.84
10-Yr	4.90	0.94	2,860	3.37
25-Yr	6.20	1.27	3,899	4.60
100-Yr	**8.90**	**1.95**	**6,108**	**7.21**

Events for Subcatchment PR-3J: Subcat PR-3J

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Yr	3.20	2.13	6,558	2.45
10-Yr	4.90	3.46	10,993	4.10
25-Yr	6.20	4.47	14,427	5.38
100-Yr	**8.90**	**6.55**	**21,603**	**8.06**

Events for Pond 1P: Stormwater BMP #1 - 446/458 Frontage Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.56	0.50	0.50	**0.00**	19.04	116
10-Yr	7.27	**1.24**	**1.24**	0.00	20.19	3,674
25-Yr	9.04	1.24	1.24	0.00	20.87	7,568
100-Yr	**21.97**	1.24	1.24	0.00	**24.94**	**30,976**

Events for Pond 2P: Stormwater BMP #2 - 446/458 Drop off Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	2.96	0.17	**0.17**	0.00	23.26	4,284
10-Yr	5.26	0.17	0.17	0.00	25.01	8,860
25-Yr	6.84	0.43	0.17	0.25	26.07	11,642
100-Yr	**10.07**	**4.76**	0.17	**4.59**	**26.46**	**12,669**

Events for Pond 3P: Stormwater BMP #3 - 446/458 Bio

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.33	0.14	0.02	0.12	28.80	287
10-Yr	0.60	0.58	0.02	0.55	28.89	326
25-Yr	0.81	0.79	0.02	0.77	28.93	341
100-Yr	**1.25**	**1.22**	**0.02**	**1.20**	**28.99**	**368**

Events for Pond 4A-P: Stormwater BMP #4A - OL3 Frontage

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	3.75	0.52	**0.04**	0.48	26.30	6,489
10-Yr	5.96	6.32	0.04	6.28	26.75	6,662
25-Yr	7.62	7.62	0.04	7.58	26.82	6,668
100-Yr	**11.07**	**11.07**	0.04	**11.02**	**26.97**	**6,681**

Events for Pond 4B-P: Revised BMP 4B

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.00	0.00	0.00	0.00	21.70	0
10-Yr	0.00	0.00	0.00	0.00	21.70	0
25-Yr	8.75	0.88	**0.88**	0.00	23.37	3,596
100-Yr	**30.98**	**11.41**	0.88	**10.54**	**25.45**	**7,846**

Events for Pond 4C-P: Revised BMP 4C

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	7.01	1.35	**1.35**	0.00	22.80	5,454
10-Yr	11.93	1.35	1.35	0.00	23.99	12,338
25-Yr	15.66	10.10	1.35	8.75	26.01	12,982
100-Yr	**23.32**	**32.33**	1.35	**30.98**	**29.84**	**13,022**

Events for Pond 6P: Stormwater BMP #6 - 550 Arsenal bike path Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	10.14	0.32	**0.32**	0.00	21.30	18,448
10-Yr	15.92	3.08	0.32	2.76	23.31	26,793
25-Yr	20.31	23.46	0.32	23.14	24.30	26,806
100-Yr	**29.37**	**29.34**	0.32	**29.02**	**25.08**	**26,815**

Events for Pond 7P: Stormwater BMP #7 - 550 Bio South

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.21	0.05	0.05	0.00	27.19	154
10-Yr	0.43	0.06	0.06	0.00	27.46	428
25-Yr	0.61	0.07	0.07	0.00	27.67	669
100-Yr	**0.98**	**0.49**	**0.08**	**0.42**	**27.81**	**849**

Events for Pond 8P: Stormwater BMP #8 - A1P1 Courtyard Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.98	**0.23**	**0.23**	**0.00**	20.42	693
10-Yr	1.94	0.23	0.23	0.00	21.10	1,988
25-Yr	2.71	0.23	0.23	0.00	21.45	3,180
100-Yr	**4.31**	0.23	0.23	0.00	**22.75**	**7,610**

Events for Pond 9P: Stormwater BMP #9 - Below P1 Garage Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	4.89	0.22	**0.22**	0.00	21.85	7,651
10-Yr	7.54	2.03	0.22	1.80	22.75	10,603
25-Yr	9.56	5.25	0.22	5.03	22.98	11,360
100-Yr	**13.75**	**16.35**	0.22	**16.13**	**23.48**	**11,412**

Events for Pond 10P: Stormwater BMP #10 - Behind Garage Infiltration

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	2.78	0.85	**0.11**	0.75	20.54	3,196
10-Yr	4.66	3.71	0.11	3.60	20.90	3,766
25-Yr	6.08	7.24	0.11	7.13	21.44	**3,918**
100-Yr	**9.00**	**9.94**	0.11	**9.84**	**22.09**	3,918

Events for Pond 11P: R1 Bio

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.52	0.40	23.82	522
10-Yr	0.94	0.92	23.88	560
25-Yr	1.27	1.24	23.90	581
100-Yr	**1.95**	**1.91**	**23.96**	**618**

Events for Pond 14P: Stormwater BMP #14

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	0.78	0.04	**0.04**	0.00	22.78	1,204
10-Yr	1.21	0.04	0.04	0.00	24.79	2,278
25-Yr	1.54	0.15	0.04	0.12	25.54	2,675
100-Yr	**2.21**	**1.70**	0.04	**1.67**	**25.74**	**2,782**

Events for Pond 15P: Stormwater BMP #15 - West of OL1

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	2.13	0.16	**0.16**	0.00	20.64	2,663
10-Yr	3.46	0.16	0.16	0.00	21.76	5,343
25-Yr	4.47	0.16	0.16	0.00	22.76	7,737
100-Yr	**6.55**	**0.47**	0.16	**0.31**	**24.58**	**12,080**

Events for Pond ISO-P/5P: Isolated Wetland/Enhanced Bio

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Yr	2.62	**0.00**	23.20	7,812
10-Yr	4.83	0.00	24.15	14,556
25-Yr	6.54	0.00	24.63	20,481
100-Yr	**10.27**	0.00	**25.32**	**34,002**

Events for Link DP1: 72" culvert

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Yr	6.17	6.17	**0.00**
10-Yr	13.85	13.85	0.00
25-Yr	41.77	41.77	0.00
100-Yr	**73.14**	**73.14**	0.00

Events for Link DP2: Arsenal Street Infrastucture

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Yr	2.26	2.26	**0.00**
10-Yr	3.88	3.88	0.00
25-Yr	5.12	5.12	0.00
100-Yr	**7.67**	**7.67**	0.00

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Appendix B: Standard 3 Computations and Supporting Documentation

- Geotechnical memorandum with stormwater recommendations and environmental summary
- NRCS Soils Map
- 72 hour drawdown analysis

Geotechnical Memorandums

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SUMMARY OF STORMWATER INFILTRATION RESULTS AND DESIGN RECOMMENDATIONS WATERTOWN MALL REDEVELOPMENT 446/458, 480, 500 AND 550 ARSENAL STREET WATERTOWN, MASSACHUSETTS

by
Haley & Aldrich, Inc.
Boston, Massachusetts

for
ARE-MA Region No. 90, LLC
Cambridge, Massachusetts

File No. 0203699-001
August 2023

HALEY & ALDRICH, INC.
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31 August 2023
File No. 0203699-001

ARE-MA Region No. 90, LLC
215 First Street, Suite 100
Cambridge, Massachusetts 02142

Attention: Rickie Golden

Subject: Summary of Stormwater Infiltration Results and Design Recommendations
Watertown Mall Redevelopment
446/458, 480, 500 and 550 Arsenal Street
Watertown, Massachusetts

Dear Mr. Golden:

This report provides a summary of geotechnical subsurface conditions and environmental soil and groundwater quality related to the proposed stormwater infiltration systems at the 446/458, 480, 500 and 550 Arsenal Street properties (Site) located in Watertown, Massachusetts and provides recommendations relative to stormwater infiltration for the subject properties. A locus depicting the general project area is provided on Figure 1.

Subsurface investigations and testing were conducted in several phases to characterize the in-situ infiltration rates at the proposed stormwater infiltration areas and to estimate the seasonal high groundwater elevation. Refer to the latest VHB drawings for the locations of the proposed stormwater Best Management Practices (BMPs).

This memorandum has been revised for the following objectives:

- Address comments from the City's Peer Reviewer (Weston & Sampson) provided in their 9 May 2023 memorandum;
- Provide recommendations in areas previously not considered for stormwater infiltration (e.g., the Target Store parking lot on 550 Arsenal); and,
- Incorporate the results from the January/February 2023 and July 2023 subsurface exploration and chemical testing programs.

Note: This revised report supersedes, and updates previous design recommendations provided in prior memoranda.

Site History and Subsurface Conditions

Site history and subsurface conditions of the four subject properties are summarized in the data report titled "Geotechnical and Environmental Subsurface Data Report, Watertown Mall Redevelopment, 446/458, 480, 500 and 550 Arsenal Street, Watertown, Massachusetts" dated 21 March 2023 prepared by Haley & Aldrich (referenced herein as "Subsurface Data Report").

Explorations conducted during recent and previous subsurface exploration programs are shown on Figures 2 and 3. Historical site features, including former structures (from 1950 Sanborn Map) and former Hood Pond, are also depicted on Figure 2. Elevations noted herein are in feet and reference the North American Vertical Datum (NAVD 1988) and are based on the Existing Conditions plan provided by VHB which is used as the base plan for the attached figures.

RECENT JULY 2023 PROGRAM

Haley & Aldrich conducted a subsurface exploration program at the 480, 500, and 550 Arsenal Street properties consisting of 4 test borings (designated HA23-401, HA23-402, HA23-404, and HA23-405), and nine geoprobes (designated HA23-410 through HA23-418). The test borings, geoprobes, and well installations were completed by Geologic Earth Explorations, Inc. of Norfolk, Massachusetts during the period between 17 and 25 July 2023. Groundwater observation wells were installed in five completed boreholes (HA23-402, -404, -405, -411, and -416). Refer to Appendix A for recent exploration logs and observation well installation reports.

Groundwater Conditions

Groundwater levels measured from site observation wells through August 2023 are summarized on Table I. A plan depicting elevation contours for groundwater based on readings obtained in the observation wells in February 2023 is provided on Figure 14 of the subsurface data report. An updated plan depicting groundwater elevation contours based on readings measured on 10 August 2023 is provided on Figure 4.

SEASONAL HIGH GROUNDWATER ESTIMATE

Determination of the estimated seasonal high groundwater elevation was performed by employing the USGS Frimpter methodology on nearby Index well MA-WKW 2R located in Wayland, Massachusetts. A calculation and data showing the Frimpter method is included in Appendix B. A summary of estimated seasonal high groundwater level at each well location is summarized on Table 1 below, broken up by parcel.

Table 1 – Summary of Estimated Seasonal High Groundwater Levels

Observation Well ID	Ground Surface Elevation (FT, NAVD88)	Seasonal High Groundwater Level (Depth)	Seasonal High Groundwater Elevation (FT, NAVD88)
446/458 Arsenal			
HA22-101 (OW)	28.5	6.6	21.9
HA22-102 (OW)	29.0	11.6	17.4
HA22-103 (OW)	30.6	17.1	13.5
HA22-312 (OW)	30.2	16.9	13.3
480 Arsenal			
HA22-219 (OW)	35.8	17.4	18.4
HA23-411 (OW)	32.0	12.5	19.5
500 Arsenal			
HA22-15 (OW)	29.0	6.7	22.3
HA22-17 (OW)	29.0	11.4	17.6
HA22-214 (OW)	25.7	5.0	20.7
HA22-215 (OW)	29.3	11.9	17.4
HA22-216 (OW)	26.0	2.7	23.3
HA22-317 (OW)	32.0	14.3	17.7
550 Arsenal			
HA22-01 (OW)	27.0	14.4	12.6
HA22-04 (OW)	22.3	9.8	12.5
HA22-05 (OW)	25.0	12.3	12.7
HA22-09 (OW)	22.0	11.1	10.9
HA22-201 (OW)	25.8	12.9	12.9
HA22-203 (OW)	22.8	9.5	13.3
HA22-207 (OW)	24.5	11.2	13.3
HA22-209 (OW)	21.3	7.3	14.0
HA22-213 (OW)	22.5	7.5	15.0
HA23-402 (OW)	25.0	7.2	17.8
HA23-404 (OW)	22.0	9.5	12.5
HA23-405 (OW)	27.0	14.6	12.4
HA23-416 (OW)	22.0	8.4	13.6

Field Infiltration Testing

Falling head infiltration tests were completed in the unsaturated zone within the fill, marine and/or glacial deposits during drilling. The falling head test data was evaluated using an unsaturated infiltration test method by the International Institute for Land Reclamation and Improvement (ILRI). A summary of the hydraulic conductivity (k) results is provided on Table 2 below.

Table 2 – Summary of ILRI Hydraulic Conductivity Results – Unsaturated Zone

Boring ID	Test Elevation (NAVD)	Material Description	Geometric Mean Hydraulic Conductivity	
			(cm/sec)	(in/hr)
446/458 Arsenal				
HA22-102 (OW)	23.0 to 25.0	Glaciofluvial	5E-03	7.0
HA22-103 (OW)	24.6 to 26.6	Glaciofluvial	1E-02	14.0
500 Arsenal				
HA22-17	24.0 to 26.0	Glaciofluvial	5.5E-04	0.8
550 Arsenal				
HA22-01	19.0 to 21.0	Fill	3.5E-04	0.5
HA22-04	16.0 to 18.0	Fill	2.5E-03	3.5
HA22-05	19.0 to 21.0	Fill	6E-03	8.0
HA22-07	19.5 to 21.5	Fill	6E-03	8.0
HA22-201	13.8 to 15.8	Fill	3E-04	0.5
HA22-202	10.1 to 12.1	Fill	3E-03	4.3
HA22-203	10.8 to 12.8	Fill	1E-03	1.4
HA22-209	14.3 to 16.3	Fill	3E-03	4.3
HA22-211	16.3 to 18.3	Fill / Marine	6E-04	0.8

Two in-situ infiltration tests were performed using a Guelph Permeameter in completed test pits TP-9 and TP-11 located on the 550 Arsenal property. A summary of results is provided in Table 3.

Table 3 – Summary of Guelph Permeameter Results

Test Pit Location	Test Elevation (NAVD)	Material Description	Calculated Field Saturated Hydraulic Conductivity (in/hr)
550 Arsenal			
TP-9	22.2 to 23.0	Fill	0.14
TP-11	18.3 to 19.0	Fill	1.81

Twelve slug tests were performed within completed monitoring wells to estimate hydraulic conductivity of the saturated glacial deposits. Recovery data was interpreted using the Bouwer & Rice (1976) analytical method. A summary of the geometric mean test results is provided in Table 4.

Table 4 – Summary of Bouwer & Rice Hydraulic Conductivity Results – Saturated Zone

Boring ID	Test Elevation (NAVD)	Material Description	Geometric Mean Hydraulic Conductivity (cm/sec)	(in/hr)
446/458 Arsenal				
HA22-102	4.0 to 14.0	Glaciofluvial Deposits	2.7E-02	39.0
480 Arsenal				
HA22-219	15.0 to 25.0	Glaciofluvial Deposits	1.8E-04	0.3
550 Arsenal				
HA22-01	3.0 to 13.0	Glaciofluvial Deposits	4.4E-02	63.0
HA22-05	1.0 to 11.0	Glaciofluvial Deposits	2.4E-03	3.5
HA22-09	-1.0 to 9.0	Glaciofluvial Deposits	7.7E-03	11.0
HA22-201	7.0 to 17.0	Fill / Glaciofluvial Deposits	1.8E-02	25.7
HA22-209	1.0 to 11.0	Marine / Glaciofluvial Deposits	1.0E-02	14.4
HA22-213	2.0 to 12.0	Glaciofluvial Deposits	2.0E-02	28.4
HA22-219	15.0 to 25.0	Glaciofluvial Deposits	1.8E-04	0.3
HA23-404	-8.0 to 2.0	Glaciofluvial Deposits	3.6E-03	5.1
HA23-405	-13.0 to 7.0	Glaciofluvial Deposits	8.5E-03	12.1
HA23-416	-7.0 to 2.0	Glaciofluvial Deposits	1.3E-02	19.5

PERMEABILITY CORRELATIONS TO GRAIN SIZE USING USDA TEXTURAL TRIANGLES

Grain size and hydrometer testing was conducted on 39 soil samples collected from the subsurface explorations conducted for Haley & Aldrich in 2022 and 2023 in general accordance with applicable ASTM standards. The laboratory testing results are provided in Appendix B. In accordance with procedures in the Massachusetts Department of Environmental Protection Stormwater Handbook, the results of the laboratory testing were plotted on a soil texture triangle to aid classification for estimating soil water infiltration rates are also provided in Appendix B and summarized on Table 5 below.

Table 5 – Summary of Rawls Rates

Boring ID	Depth Interval	Elevation (NAVD88)	Soil Texture (USDA)	Material Description	Rawls Rate (in/hr)
446/458 Arsenal					
HA22-102(OW)	4.0 to 6.0	23.0 to 25.0	Loamy Sand	Glaciofluvial	2.41
HA22-103(OW)	4.0 to 6.0	24.6 to 26.6	Sand	Glaciofluvial	8.27
HA22-106	9.0 to 11.0	19.0 to 21.0	Silt Loam	Marine	0.27
HA23-312	10.0 to 12.0	18.2 to 20.2	Loamy Sand	Fill	2.41
HA23-313	8.0 to 10.0	17.5 to 19.5	Sand	Glaciofluvial	8.27
HA23-314	8.0 to 10.0	20.0 to 22.0	Loamy Sand	Glaciofluvial	2.41

Boring ID	Depth Interval	Elevation (ft)	Soil Texture (USDA)	Material Description	Rawls Rate (in/hr)
480 Arsenal					
HA22-217	19.0 to 21.0	12.2 to 14.2	Loamy Sand	Glaciofluvial	2.41
HA22-218	6.0 to 8.0	26.4 to 28.4	Sandy Loam	Fill	1.02
HA22-219	13.0 to 15.0	20.8 to 22.8	Loam	Glacial Till	0.52
HA22-231	10.0 to 15.0	18.7 to 23.7	Sandy Loam	Glaciofluvial	1.02
HA23-401	14.0 to 16.0	17.5 to 19.5	Silt Loam	Marine	0.27
HA23-410	15.0 to 20.0	16.0 to 21.0	Sandy Loam	Glaciofluvial	1.02
500 Arsenal					
HA22-17	5.0 to 7.0	22.7 to 24.7	Sand	Glaciofluvial	8.27
HA22-18	5.0 to 7.0	23.5 to 25.5	Sand	Glaciofluvial	8.27
HA22-19	4.0 to 6.0	24.5 to 26.5	Sand	Glaciofluvial	8.27
HA23-316	7.0 to 9.0	20.5 to 22.5	Sandy Loam	Fill	1.02
HA23-317	10.0 to 12.0	20.0 to 22.0	Sand	Glaciofluvial	8.27
HA23-412	7.5 to 10.0	19.0 to 21.5	Silt Loam	Marine	0.27
550 Arsenal					
HA22-01	7.0 to 9.0	19.0 to 21.0	Loamy Sand	Fill	2.41
HA22-02	10.0 to 12.0	15.5 to 17.5	Loamy Sand	Glaciofluvial	2.41
HA22-03	3.0 to 5.0	18.0 to 20.0	Sandy Loam	Fill	1.02
HA22-03	11.0 to 13.0	10.0 to 12.0	Sandy Loam	Glaciofluvial	1.02
HA22-04	5.0 to 7.0	16.0 to 18.0	Sandy Loam	Fill	1.02
HA22-05	3.0 to 8.0	18.0 to 23.0	Loamy Sand	Fill	2.41
HA22-07	5.0 to 6.0	18.5 to 19.5	Sandy Loam	Fill	1.02
HA22-09	5.0 to 7.0	15.0 to 17.0	Loamy Sand	Fill	2.41
TP-05	2.0 to 5.0	17.0 to 20.0	Sand	Glaciofluvial	8.27
HA22-208	2.0 to 5.0	16.7 to 19.7	Loamy Sand	Fill	2.41
HA22-211	7.0 to 9.0	19.0 to 21.0	Loamy Sand	Marine	2.41
HA22-213	13.0 to 15.0	7.5 to 9.5	Loamy Sand	Glaciofluvial	2.41
HA22-220	8.0 to 12.0	18.0 to 22.0	Sandy Loam	Fill	1.02
HA22-224	10.0 to 15.0	12.4 to 17.4	Loamy Sand	Fill	2.41
HA23-302	6.0 to 8.0	16.0 to 18.0	Loamy Sand	Fill	2.41
HA23-304	4.0 to 6.0	18.0 to 20.0	Loamy Sand	Fill	2.41
HA23-320	6.0 to 8.0	20.5 to 22.5	Loam	Marine	0.52
HA23-402	6.0 to 8.0	16.0 to 18.0	Silt Loam	Marine	0.27
HA23-413	0 to 5.0	17.5 to 22.5	Loam	Marine	0.52
HA23-414	10.0 to 15.0	8.0 to 13.0	Sandy Loam	Glaciofluvial	1.02
HA23-416	5.0 to 10.0	12.0 to 7.0	Loamy Sand	Marine	2.41

Stormwater Infiltration Design Recommendations and Considerations

To address comments from the City's Peer Reviewer (Weston & Sampson) provided in the 9 May 2023 memorandum, the design team has expanded the areas being considered for stormwater infiltration. We understand that VHB is considering additional stormwater Best Management Practices (BMPs) including both traditional infiltration basins and infiltration basins utilizing recharge wells hydraulically connected to deeper sand deposits in areas where thick fills are present. A summary of infiltration favorability relative to subsurface conditions, including environmental conditions and areas where recharge wells are considered feasible, is depicted on Figure 5.

TRADITIONAL STORMWATER BMPS

In-situ hydraulic conductivity will vary in the field with variation in soil gradation, fabric, density, saturation, and other factors. Based on the testing performed and discussed herein, we recommend using the hydraulic conductivities presented in Table 6 below for stormwater basin design. Recommendations relative to the potential infiltration expansion areas are also included on Table 6. For design, a factor of safety of 2 should be applied to account for variation in subsurface conditions and changes in hydraulic conductivity over time per the Massachusetts Stormwater Handbook (Stormwater Policy).

Table 6 – Summary of Recommended Hydraulic Conductivity Rates

Stormwater BMP No.	Estimated Seasonal High Groundwater El. (NAVD 88)	Bottom of System El. (NAVD 88)	Subgrade Conditions at Basin Bottom	Rawls Rate	In-situ Unfactored Hydraulic Conductivity Results (in/hr)
446/458 Arsenal					
1	El. 13.5	El. 21.0	Marine Sand	8.27 (HA22-103) 8.27 (HA23-313)	14.0 (HA22-103)
2	El. 17.1	El. 20.0	Marine Sand	2.41 (HA23-314)	7.0 (HA22-102)
3 (Lined)	El. 17.1	El. 24.0	NA	NA	NA
480 Arsenal					
1	El. 19.5	El. 21.4	Marine Silt over Marine Sand	0.27 (HA23-401) 2.41 (HA22-217; El. 15)	NA
2	El. 18.4	El. 20.5	Glaciomarine Sand	1.02 (HA23-410)	0.26 (HA22-219)
500 Arsenal					
4A	El. 17.4	El. 22.0	Fill over Marine Deposits	1.02 (HA23-316)	NA
4B	El. 17.7	El. 19.0	Marine Sand	8.27 (HA22-18) 8.27 (HA22-19)	NA
4C	El. 17.6	El. 20.0	Marine Sand	8.27 (HA22-17)	0.8 (HA22-17) *El. 24 to 26, NA
5 (Lined)	El. 20.7	El. 20.4	NA	NA	NA
14	El. 17.5	El. 20.0	Marine Sand	2.41 (HA22-102)	7.0 (HA22-102)

Stormwater BMP No.	Estimated Seasonal High Groundwater El. (NAVD 88)	Bottom of System El. (NAVD 88)	Subgrade Conditions at Basin Bottom	Rawls Rate	In-situ Unfactored Hydraulic Conductivity Results (in/hr)
550 Arsenal					
6	El. 12.7	El. 18.0	Fill / Glacial Deposits	2.41 (HA22-02) 2.41 (HA22-05)	8.0 (HA22-05)
7	El. 10.9	El. 24.0	Fill	2.41 (HA22-09) 2.41 (HA22-208)	11.0 (HA22-09) *El. -1 to 9, NA
8	El. 17.5	El. 20.0	Glacial Deposits	8.27 (HA-TP05) 2.41 (HA22-211)	NA
9	El. 15.0	El. 20.0	Fill	2.41 (HA22-302) 2.41 (HA22-304)	NA
10	El. 15.0	El. 17.0	Fill	1.02 (HA23-414)	NA
11 (Lined)	El. 13.3	El. 20.0	Fill	NA	NA
12 (Sand Filter)	EL. 13.3	El. 11.2	Fill	NA	NA
13 (Sand Filter)	El. 12.9	El. 15.9	Fill	NA	NA
15	El. 14.0	El. 20.0	Fill	2.41 (HA22-09) 2.41 (HA22-208)	11.0 (HA22-09) *El. -1 to 9, NA
Potential Expansion Areas for Stormwater BMPs					
HA22-232 (480)	El. 18.4	El. 23.5 to 28.5	Marine Deposits	0.52 (HA22-232)	NA
HA22-412 (500)	El. 17.1	El. 21.5 to 24.0	Fill / Marine Deposits	0.27 (HA23-412)	NA
HA23-402 (550)	El. 17.8	El. 20.0 to 22.0	Fill / Marine Deposits	2.41 (HA23-402)	NA
HA23-415 (550)	El. 13.6	El. 17.0 to 19.0	Marine Deposits	2.41 (HA23-416)	NA
HA23-416 (550)	El. 13.6	El. 17.0 to 19.0	Marine Deposits	2.41 (HA23-416)	NA

MOUNDING ANALYSES FOR TRADITIONAL STORMWATER BMPS

Based on the proposed infiltration system information provided by VHB and the subsurface data discussed herein, Haley & Aldrich conducted a mounding analysis for the seven BMPs positioned with less than 4 ft vertical separation between the bottom of the BMP and the estimated season high groundwater elevation. The mounding analysis conducted provides an estimated total mound (above the estimated seasonal high groundwater level) in response to the volume of water infiltrated over an assumed 72-hour period, and an estimated lateral extent of the mound. The volume and BMP areas were provided by VHB based on their site wide hydrologic analysis of the existing and proposed stormwater flows.

The mounding analysis was conducted using a computer model of the Hantush analytical method (1967) using a spreadsheet solution of the Hantush equation developed by the USGS that is used to calculate the resulting groundwater mound in response to a designated recharge rate. The input parameters

include the hydraulic properties of the saturated zone, consisting of the hydraulic conductivity, saturated thickness, and specific yield. The input relative to the groundwater recharge includes the recharge basin (e.g., BMP dimensions), recharge rates associated with the 10-year storm and the BMP treatment volume, and duration of the recharge event (72-hour period). The horizontal hydraulic conductivity was approximated using the recommended vertical hydraulic conductivities provided in Table 6 using an anisotropy of 2H:1V for naturally deposited soils and isotropic conditions (i.e., 1H:1V) for fill soils. A summary of input parameters used in the mounding analyses is provided on Table 7 below:

Table 7 – Summary of Mounding Analysis – Input Parameters and Assumptions

Infiltration System (BMP No.)	Recharge Volume: 10 Year Storm (CF)	Recharge Volume: Treatment (CF)	Area (SF)	System Bottom Elevation	Approx. Groundwater Elevation	Horizontal Hydraulic Conductivity (ft/day)	Initial Saturated Thickness (ft)
446/458 Arsenal							
BMP 2	17,297	6,258	3,072	20.0	17.4	9.64	31.0
480 Arsenal							
BMP 1	34,747	5,981	5,981	21.4	18.4	0.68	17.4
BMP 2	1,931	126	840	20.5	17.4	1.04	16.5
500 Arsenal							
BMP 4c	31,324	10,538	3,584	21.0	17.6	33.08	4.0
BMP 14	34,747	1,681	9,728	20.0	17.5	9.64	14.5
550 Arsenal							
BMP 8	13,125	1,241	2,504	20.0	17.5	9.64	15.5
BMP 10	7,198	4,639	1,920	17.9	15.0	4.82	22.9

A summary of results for the simulated mounding heights below for the center of each BMP is provided on Table 8. Additional information regarding the mounding analysis and results is provided in Appendix D. Note that four of the seven simulated groundwater mounds using the 10-year storm discarded volumes extend above the design bottom of BMP elevations indicating that the BMPs will not fully infiltrate the 10-year storm recharge volume. The mounding analyses were repeated using a recharge rate based on the BMP treatment volumes provided by VHB. The results of the mounding analyses using the BMP treatment volumes indicate sufficient groundwater mound separation (i.e., the BMP treatment volume can infiltrate during the 72-hour period following the design storm). Additional mounding analyses will be performed by Haley & Aldrich, if/when needed, to address potential future modifications to the site stormwater basin design.

Table 8 – Summary of Mounding Analysis Results

Infiltration Area	Recharge Volume: 10 Year Storm (CF)	Recharge Volume: Treatment (CF)	Approx. Groundwater Elevation	Simulated Mounding (ft)	
				10-Year Storm Recharge Rate	Treatment Volume Recharge Rate
446/458 Arsenal					
BMP 2	17,297	6,258	17.4	4.0	1.5
480 Arsenal					
BMP 1	34,747	5,981	18.4	17.5	3.0
BMP 2	1,931	126	17.4	3.6	0.2
500 Arsenal					
BMP 4c	31,324	10,538	17.6	8.1	3.3
BMP 14	34,747	1,681	17.5	2.3	0.9
550 Arsenal					
BMP 8	13,125	1,241	17.5	2.0	0.4
BMP 10	7,198	4,639	15.0	5.7	2.8

STORMWATER BMPS WITH RECHARGE WELLS

In areas with thicker fill and/or poorly draining soils such as organic deposits, silts, or clayey soils underlain by granular soils, construction of "stone column" recharge wells are recommended to hydraulically connected the stormwater basin to the underlying sand deposits. We recommend assuming the stone columns would be approximately 18 to 24-in. diameter extending 5 to 10 ft into the underlying granular deposits.

Haley & Aldrich conducted mounding analyses using analytical software to assess well interference and cumulative mounding of the groundwater in response to the prescribed recharge rate. The model used is the MLU Model (2019), referred to as the Aquifer Test Analysis for Unsteady-Flow in Multiple Aquifer Systems. The input parameters included the hydraulic properties of the saturated zone consisting of the hydraulic conductivity, saturated thickness of the soils, and the storage coefficient of the soils. The input relative to the groundwater recharge was selected by estimating flow rates that each well could accept within areas of the site. By trial and error, the well spacings and orientation were adjusted until the mound heights of a series of wells was under about 4 ft as summarized in Table 9 below.

The stormwater BMPs utilizing stone column recharge wells were sized to maintain a maximum mound height of about 4 ft considering the quality of the existing fill materials in areas where suitable subsurface conditions are present (e.g., existing Target Store parking lot and portions of the 480 Arsenal parking lot). Figure 5 shows the approximate concept locations of the well areas. Well fields of 28, 50 and 100 wells spaced 15 ft by 30 ft were modeled using an average 2 gpm capacity in the existing Target Store parking lot. The resulting simulated maximum groundwater mounds ranged from 7.4 ft to 12.5 ft.

Due to the unfavorable height of the estimated mound for the larger systems, smaller, isolated well fields of approximately 12 wells were subsequently run using a well spacing of 15 ft by 15 ft and a capacity of 1 gpm per well. A summary of the mounding analysis and recommended design guidance for stormwater basin design in areas utilizing recharge wells constructed as "stone columns" is presented on Table 9 below.

Table 9 – Summary of Mounding Results and Recharge Well Design Recommendations

Area/ Nearest Boring Location	Estimated Seasonal High Groundwater El. (NAVD 88)	Recharge Well Spacing (ft)	Recharge Rate per Recharge Well (gpm)	Number of Wells	Simulated Groundwater Mound Height (ft)
480 Arsenal					
HA22-217	19.5	15 by 30	0.5	28	3.6
550 Arsenal					
Target Lot	Ave. 13.0	15 by 15	1.0	12	4.2
Target Lot	Ave. 13.0	15 by 30	2.0	28	7.4
Target Lot	Ave. 13.0	15 by 30	2.0	50	11.2
Target Lot	Ave. 13.0	15 by 30	2.0	100	12.5

Environmental Soil and Groundwater Quality Data

Approximately 162 soil samples were collected from the various subsurface investigation programs and submitted to Alpha Analytical Laboratories of Westborough, Massachusetts (Alpha) for analysis of one or more of the following: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH), metals, polychlorinated biphenyls (PCBs), and waste characteristics (reactivity, ignitability, corrosivity, and conductivity). In addition, Toxicity Characteristic Leaching Procedure (TCLP) was conducted if compounds exceeded twenty times (20x) the Resource Conservation and Recovery Act (RCRA) hazardous waste criteria.

A total of 19 groundwater samples were collected from observation wells installed at the Site and submitted to Alpha for analysis of one or more of the following: VOCs, SVOCs, EPH and VPH carbon ranges, metals, total dissolved solids, ammonia, chloride, residual chlorine, total cyanide, nitrate/nitrite, total kjeldahl nitrogen (TKN), nitrogen, and total suspended solids.

The results of observations of subsurface conditions and laboratory analysis of soil samples indicates that the Site has been impacted by SVOCs and metals above Massachusetts Contingency Plan (MCP) RCS-1 Reportable Concentrations for Soil (RCS-1), consistent with the presence of urban fill. In addition, the historic use of certain portions of the Site by the Hood Rubber Company and Union Carpet Lining Company has impacted Site soils with petroleum hydrocarbons, chlorinated VOCs, metals that are not consistent with urban fill (e.g., zinc, antimony), PCBs, and an unidentified purple liquid likely associated with historic operations at the Union Carpet Lining Company. Metals were also detected in

groundwater above RCGW-2 at two wells on the 500 Arsenal Street parcel.

Summaries of analytical data for soil and groundwater are provided on the enclosed Tables II and III, respectively. Soil data was compared to typical acceptance criteria for soil-receiving facilities and categorized into groups. The results by group classification are graphically shown on Figure 6.

Environmental Considerations for Stormwater Infiltration

Based on the extensive subsurface investigation programs conducted at the Site to date, we do not anticipate that stormwater infiltration systems will exacerbate existing known contamination over the majority of the 32.5-acre Site; however, three areas were identified where stormwater infiltration has the potential to mobilize contaminants and is therefore not recommended within these areas. These areas are further described in the following sections.

480 ARSENAL STREET

A very strong petroleum-like odor was observed in soil samples from 12 to 25 feet (ft) below ground surface (bgs) during advancement of HA23-411. Laboratory analysis of soil samples detected 2-methylnaphthalene, naphthalene, biphenyl, TPH, EPH carbon ranges, and VPH carbon ranges above RCS-1. A groundwater sample that was subsequently collected from HA23-411(OW) detected petroleum constituents below RCGW-2; however, a sheen was observed on purge water during well development and sampling. Explorations conducted to the northwest and west of the HA23-411 did not exhibit evidence of petroleum impacts. Additional delineation to the northeast and south will be conducted in the future. The source of the petroleum impacts is not currently known but may be related to the historic use of the property as a stove foundry.

Based on the presence of petroleum impacts to soil and groundwater and the potential for said impacts to be exacerbated by stormwater infiltration, we do not recommend infiltration of stormwater in this approximately 13,000 sf area of 480 Arsenal Street, as shown on Figure 5.

500 ARSENAL STREET

The following areas are deemed unsuitable for infiltration at the 500 Arsenal parcel due to the presence of environmental conditions as summarized below:

- HA22-214 area - Due to concentrations of leachable lead in a soil sample collected from HA22-214, and due to shallow groundwater and poorly draining organic soils, this area is also not considered suitable for infiltration.
- HA22-216 area - a petroleum-like odor and sheen were observed in soil samples from 4 to 14 ft bgs. In addition, an unidentified purple liquid was observed on the soil sample sleeve from 10 to 14 ft bgs. Laboratory analysis of soil samples collected from HA22-216 detected SVOCs (including bis-(2-ethylhexyl) phthalate), TPH, antimony, and lead above RCS-1. Purge water generated during development and sampling of HA22-216(OW) was also observed to be purple. The results of analysis of the groundwater sample detected lead above RCGW-2 and acetone, toluene, 3&4-methyphenol, phenol, bis-(2-ethylhexyl) phthalate, and manganese above

laboratory reporting limits but below RCGW-2. The source of the purple water is not known but may be related to the historic use of the Site by the Union Carpet Lining Company and/or Hood Rubber Factory.

- HA22-229 area - located downgradient of HA22-216(OW), a petroleum-like odor was observed on soil samples from the ground surface to 8 ft bgs. Laboratory analysis of soil samples collected from HA22-229 detected one VOC (naphthalene), SVOCs, TPH, and metals above RCS-1.

550 ARSENAL STREET

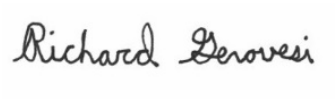
Several subsurface explorations located within the south-central side of the 550 Arsenal Street property exhibited petroleum and/or chemical like odors with corresponding concentrations of petroleum-related VOCs, TPH, and/or SVOCs above RCS-1 (HA22-201, HA22-204, HA22-205, HA22-206, HA22-207, HA22-209, HA22-213, HA22-221, and TP-08). In addition, several soil samples within this area also exhibited concentrations of TCLP lead in excess of the RCRA Hazardous Waste Criteria (HA22-201, HA22-205, HA22-220, HA22-221, HA22-224, and TP-12).

Based on the presence of petroleum impacts to soil, the leachability of lead, the proximity of these impacts adjacent to the southern property line, and the potential for said impacts to migrate off-site as a result of stormwater infiltration, we do not recommend infiltration of stormwater in the areas shown on Figure 5.

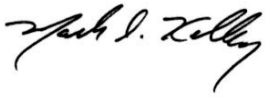
CLOSING

Please contact us with any questions or comments regarding this report or if you require additional information.

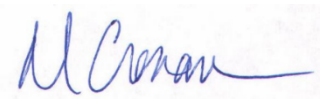
Sincerely yours,
HALEY & ALDRICH, INC.



Richard Genovesi, PE
Senior Project Manager



Mark Kelley, PE
Technical Expert



Michael Cronan, LSP
Program Manager



Rebecca Higgins, PE
Principal Consultant

Attachments:

Table I: Summary of Groundwater Measurements
Table II: Soil Quality Data
Table III: Groundwater Quality Data

Figure 1 – Project Locus
Figure 2 – Historic Site Features
Figure 3 – Site and Subsurface Exploration Location Plan
Figure 4 – Groundwater Contour Plan (August 2023)
Figure 5 – Summary of Stormwater Infiltration Feasibility Plan
Figure 6 – Soil Classification Plan

Appendix A – Recent Exploration Logs and Observation Well Installation Reports
Appendix B – Frimpter Method and Seasonal High Groundwater
Appendix C – Results of Geotechnical Laboratory Testing
Appendix D – Results of Groundwater Mounding Analyses for Traditional BMPs

c: VHB, Inc.; Richard Hollworth, Conor Nagle

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TABLES

TABLE I
SUMMARY OF GROUNDWATER MEASUREMENTS
WATERTOWN MALL REDEVELOPMENT
WATERTOWN, MASSACHUSETTS
FILE NO. 0203699

	446/458 ARSENAL								480 ARSENAL				500 ARSENAL											
Observation Well ID	HA22-101(OW)		HA22-102(OW)		HA22-103(OW)		HA23-312 (OW)		HA22-219(OW)		HA23-411(OW)		HA22-15(OW)		HA22-17(OW)		HA22-214(OW)		HA22-215(OW)		HA22-216(OW)		HA23-317(OW)	
Ground surface El. (ft)	28.5		29.0		30.6		30.2		35.8		32.0		29.0		29.0		25.7		29.3		26.0		32.0	
Top of Well Screen Depth (ft)	5		15		10		10		15		15		15		15		15		15		10		10	
Bottom of Well Screen Depth (ft)	15		25		20		20		25		20		25		25		25		25		15		20	
Date	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)
2/10/2022					19.2	11.4																		
2/16/2022					20.1	10.5							8.4	20.6										
2/28/2022													8.1	20.9	13.4	15.6								
7/6/2022	8.9	19.6	13.9	15.1																				
7/20/2022	9.1	19.4	14.0	15.0																				
10/24/2022																	10.0	15.7						
10/31/2022																	8.3	17.4						
11/4/2022																	8.4	17.3	14.6	14.7	5.8	20.2		
12/8/2022	9.6	18.9	14.9	14.1	20.1	10.5			20.6	15.2			9.7	19.3	14.4	14.6	8.0	17.7	14.9	14.4	5.7	20.3		
2/9/2023							18.7	11.5															16.7	15.3
7/26/2023											14.2	17.8												
8/10/2023	8.9	19.6	13.4	15.6			16.8	13.4	17.7	18.1	13.9	18.1	7.9	21.1	12.9	16.1	6.8	18.9	11.6	17.7	4.6	21.4	15.8	16.2

	550 ARSENAL																							
Observation Well ID	HA22-01(OW)		HA22-04(OW)		HA22-05(OW)		HA22-09(OW)		HA22-201(OW)		HA22-203(OW)		HA22-207(OW)		HA22-209(OW)		HA22-213(OW)		HA23-307(OW)		HA23-402(OW)		HA23-404(OW)		HA23-405(OW)		HA23-416(OW)	
Ground surface El. (ft)	27.0		22.3		25.0		22.0		25.8		22.8		24.5		21.3		22.5		25.0		25.0		22.0		27.0		22.0	
Top of Well Screen Depth (ft)	15		15		15		15		9		10		15		10		10		5		15.0		20.0		20.0		19	
Bottom of Well Screen Depth (ft)	25		25		25		25		19		20		25		20		20		15		25.0		30.0		40.0		29	
Date	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)	Depth (ft)	El. (ft)
2/10/2022	17.0	10.0			14.6	10.4																						
2/16/2022	17.1	9.9			14.6	10.4	13.5	8.5																				
2/28/2022	17.1	9.9	11.3	11.0	14.5	10.5	13.3	8.7																				
7/6/2022																												
7/20/2022																												
10/24/2022											12.3	10.5	14.1	10.4			10.3	12.2										
10/31/2022									15.7	10.1			14.0	10.5														
11/4/2022									15.7	10.1	12.4	10.4	13.2	11.3			10.4	12.1										
12/8/2022	17.4	9.6			15.3	9.7	14.1	7.9	15.9	9.9	12.5	10.3	14.2	10.3	11.0	10.3	10.5	12.0										
2/9/2023																			10.6	14.4								
7/26/2023																					9.1	15.9	11.4	10.6	16.5	10.5	10.3	11.7
8/10/2023	16.7	10.3			14.1	10.9	13.4	8.6	15.2	10.6	11.9	10.9	13.4	11.1	10.3	11.0	9.3	13.2	9.2	15.8	8.8	16.2	11.3	10.7	16.3	10.7	10.0	12.0

Note: Elevations are in feet and reference the North American Vertical Datum of 1988 (NAVD 88)

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		446/458 Arsenal			480 Arsenal														
Location Name			HA23-312	HA23-313	HA23-314	HA22-217	HA22-217	HA22-217	HA22-218	HA22-218	HA22-218	HA22-219(OW)	HA22-219(OW)	HA22-219(OW)	HA22-230	HA22-230	HA22-231	HA22-231	HA22-232	HA22-232
Sample Name			HA23-312_0-5	HA23-313_0-4.0	HA23-314_0-1.8	HA22-217_0-5	HA22-217_5-10	HA22-217_10-15	HA22-218_0-5	HA22-218_5-10	HA22-218_10-14	HA22-219_0-5	HA22-219_5-11	HA22-219_11-15	HA22-230_0-4	HA22-230_4-9	HA22-231_0-2	HA22-231_2-7	HA22-232_0-2	HA22-232_2-7
Sample Date	MCP		02/07/2023	02/07/2023	02/07/2023	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/20/2022	10/20/2022	10/20/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022
	Reportable		L2306624-03						L2259108-01	L2259108-02	L2259108-03									
Lab Sample ID	Concentration	TCLP	L2306965-01	L2306624-02	L2306624-01	L2259108-04	L2259108-05	L2259108-06	L2259720-01	L2259720-02	L2259720-03	L2258747-01	L2258747-02	L2258747-03	L2260559-06	L2260559-07	L2260559-04	L2260559-05	L2260559-02	L2260559-03
Sample Depth (bgs)	RCS-1		0 - 5 (ft)	0 - 4 (ft)	0 - 1.8 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 11 (ft)	11 - 15 (ft)	0 - 4 (ft)	4 - 9 (ft)	0 - 2 (ft)	2 - 7 (ft)	0 - 2 (ft)	2 - 7 (ft)
Sample Elevation (ft NAVD 88)	2014		30.2 to 25.2	27.5 to 23.5	30 to 28.2	33.2 to 28.2	28.2 to 23.2	23.2 to 18.2	34.4 to 29.4	29.4 to 24.4	24.4 to 20.4	35.8 to 30.8	30.8 to 24.8	24.8 to 20.8	34.3 to 30.3	30.3 to 25.3	33.7 to 31.7	31.7 to 26.7	33.5 to 31.5	31.5 to 26.5
Soil Description			FILL	FILL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	NATURAL	FILL	NATURAL	FILL	NATURAL
Soil Disposal Classification			II-1	I-3	I-3*	I-3*	I-2*	I-2*	II-1	II-1	II-3	I-3*	I-3*	I-2	II-3	I-2	I-3*	I-1	I-3	I-1
Volatile Organic Compounds (mg/kg)																				
1,2,4-Trimethylbenzene	1000	NA	ND (0.0028)	ND (0.0021)	ND (0.0028)	ND (0.0011)	ND (0.0024)	ND (0.0029)	ND (0.0029)	ND (0.0024)	ND (0.0071)	0.0078	ND (0.0043)	ND (0.0022)	ND (0.002)	ND (0.0024)	ND (0.0023)	ND (0.0029)	ND (0.0029)	ND (0.003)
1,3,5-Trimethylbenzene	10	NA	ND (0.0028)	ND (0.0021)	ND (0.0028)	ND (0.0011)	ND (0.0024)	ND (0.0029)	ND (0.0029)	ND (0.0024)	ND (0.0071)	ND (0.0023)	ND (0.0043)	ND (0.0022)	ND (0.002)	ND (0.0024)	ND (0.0023)	ND (0.0029)	ND (0.0029)	ND (0.003)
1,4-Dichlorobenzene	0.7	NA	ND (0.0028)	ND (0.0021)	ND (0.0028)	ND (0.0011)	ND (0.0024)	ND (0.0029)	ND (0.0029)	ND (0.0024)	ND (0.0071)	ND (0.0023)	ND (0.0043)	ND (0.0022)	ND (0.002)	ND (0.0024)	ND (0.0023)	ND (0.0029)	ND (0.0029)	ND (0.003)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.014)	ND (0.011)	ND (0.014)	ND (0.0055)	ND (0.012)	ND (0.014)	ND (0.014)	ND (0.012)	ND (0.035)	ND (0.012)	ND (0.022)	ND (0.011)	ND (0.0098)	ND (0.012)	ND (0.012)	ND (0.014)	ND (0.015)	ND (0.015)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Acetone	6	NA	ND (0.034)	ND (0.026)	ND (0.035)	ND (0.014)	ND (0.03)	ND (0.036)	ND (0.036)	ND (0.03)	ND (0.088)	ND (0.029)	ND (0.054)	ND (0.028)	ND (0.024)	ND (0.03)	ND (0.029)	ND (0.036)	ND (0.037)	ND (0.037)
Benzene	2	NA	ND (0.00069)	ND (0.00053)	ND (0.0007)	ND (0.00028)	ND (0.00061)	ND (0.00073)	ND (0.00072)	ND (0.0006)	ND (0.0018)	0.00086	ND (0.0011)	ND (0.00055)	ND (0.00049)	ND (0.0006)	ND (0.00058)	ND (0.00073)	ND (0.00073)	ND (0.00074)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0021)	ND (0.0016)	ND (0.0021)	ND (0.00083)	ND (0.0018)	ND (0.0022)	ND (0.0022)	ND (0.0018)	ND (0.0053)	0.002	ND (0.0032)	ND (0.0017)	ND (0.0015)	ND (0.0018)	ND (0.0017)	ND (0.0022)	ND (0.0022)	ND (0.0022)
cis-1,2-Dichloroethene	0.1	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Ethylbenzene	40	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Isopropylbenzene (Cumene)	1000	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Naphthalene	4	NA	ND (0.0055)	ND (0.0042)	ND (0.0056)	ND (0.0022)	ND (0.0049)	ND (0.0058)	ND (0.0058)	0.011	ND (0.014)	0.039	ND (0.0086)	ND (0.0044)	ND (0.0039)	ND (0.0048)	ND (0.0046)	ND (0.0058)	ND (0.0059)	ND (0.0059)
n-Butylbenzene	NA	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	0.003	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
n-Propylbenzene	100	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Styrene	3	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
Tetrachloroethene	1	NA	ND (0.00069)	ND (0.00053)	0.0014	ND (0.00028)	ND (0.00061)	ND (0.00073)	ND (0.00072)	ND (0.0006)	ND (0.0018)	ND (0.00059)	ND (0.0011)	ND (0.00055)	ND (0.00049)	ND (0.0006)	ND (0.00058)	ND (0.00073)	ND (0.00073)	ND (0.00074)
Tetrahydrofuran	500	NA	ND (0.0055)	ND (0.0042)	ND (0.0056)	ND (0.0022)	ND (0.0049)	ND (0.0058)	ND (0.0058)	ND (0.0048)	ND (0.014)	ND (0.0047)	ND (0.0086)	ND (0.0044)	ND (0.0039)	ND (0.0048)	ND (0.0046)	ND (0.0058)	ND (0.0059)	ND (0.0059)
Toluene	30	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	0.0013	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
trans-1,2-Dichloroethene	1	NA	ND (0.0021)	ND (0.0016)	ND (0.0021)	ND (0.00083)	ND (0.0018)	ND (0.0022)	ND (0.0022)	ND (0.0018)	ND (0.0053)	ND (0.0018)	ND (0.0032)	ND (0.0017)	ND (0.0015)	ND (0.0018)	ND (0.0017)	ND (0.0022)	ND (0.0022)	ND (0.0022)
Trichloroethene	0.3	NA	ND (0.00069)	ND (0.00053)	ND (0.0007)	ND (0.00028)	ND (0.00061)	ND (0.00073)	ND (0.00072)	ND (0.0006)	ND (0.0018)	ND (0.00059)	ND (0.0011)	ND (0.00055)	ND (0.00049)	ND (0.0006)	ND (0.00058)	ND (0.00073)	ND (0.00073)	ND (0.00074)
Xylene (Total)	100	NA	ND (0.0014)	ND (0.0011)	ND (0.0014)	ND (0.00055)	ND (0.0012)	ND (0.0014)	ND (0.0014)	ND (0.0012)	ND (0.0035)	ND (0.0012)	ND (0.0022)	ND (0.0011)	ND (0.00098)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0015)
SUM of Volatile Organic Compounds	NA	NA	ND	ND	0.0014	ND	ND	ND	ND	0.011	ND	0.05266	ND	ND	ND	0.0013	ND	ND	ND	ND
Semi-Volatile Organic Compounds (mg/kg)																				
2,4-Dimethylphenol	0.7	NA	ND (0.075)	ND (0.076)	ND (0.087)	ND (0.077)	ND (0.081)	ND (0.079)	ND (0.075)	ND (0.077)	**ND (0.79)**	ND (0.39)	ND (0.39)	ND (0.08)	ND (0.076)	ND (0.078)	ND (0.073)	ND (0.074)	ND (0.078)	ND (0.078)
2-Methylnaphthalene	0.7	NA	ND (0.075)	ND (0.076)	ND (0.087)	ND (0.077)	ND (0.081)	ND (0.079)	ND (0.075)	0.2	**2**	ND (0.39)	ND (0.39)	ND (0.08)	0.12	ND (0.078)	ND (0.073)	ND (0.074)	ND (0.078)	ND (0.078)
3&4-Methylphenol	NA	NA	ND (0.26)	ND (0.26)	ND (0.3)	ND (0.26)	ND (0.28)	ND (0.27)	ND (0.26)	ND (0.26)	ND (2.7)	ND (1.3)	ND (1.3)	ND (0.28)	ND (0.26)	ND (0.27)	ND (0.25)	ND (0.25)	ND (0.27)	ND (0.27)
Acenaphthene	4	NA	ND (0.14)	ND (0.14)	ND (0.16)	ND (0.15)	ND (0.15)	ND (0.15)	0.21	0.65	**7.2**	ND (0.74)	ND (0.74)	ND (0.15)	0.14	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.15)
Acenaphthylene	1	NA	0.25	ND (0.14)	ND (0.16)	0.17	ND (0.15)	ND (0.15)	0.3	0.43	**4.6**	ND (0.74)	ND (0.74)	ND (0.15)	**1.5**	ND (0.15)	0.2	ND (0.14)	ND (0.15)	ND (0.15)
Aniline	1000	NA	ND (0.21)	ND (0.22)	ND (0.25)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.21)	ND (0.22)	ND (2.2)	ND (1.1)	ND (1.1)	ND (0.23)	ND (0.22)	ND (0.22)	ND (0.21)	ND (0.21)	ND (0.22)	ND (0.22)
Anthracene	1000	NA	0.48	ND (0.11)	ND (0.12)	0.25	0.22	ND (0.11)	0.67	2	23	ND (0.56)	0.59	ND (0.11)	2.5	ND (0.11)	0.36	ND (0.11)	ND (0.11)	ND (0.11)
Benzo(a)anthracene	7	NA	1.9	0.18	0.24	1.1	0.62	ND (0.11)	2.6	4.1	**33**	0.76	1.5	ND (0.11)	**10**	0.26	1.8	ND (0.11)	0.21	ND (0.11)
Benzo(a)pyrene	2	NA	**2.2**	0.21	0.32	0.98	0.55	ND (0.15)	**2.6**	**3.5**	**26**	0.74	1.3	ND (0.15)	**10**	0.24	1.8	ND (0.14)	0.23	ND (0.15)
Benzo(b)fluoranthene	7	NA	2.2	0.22	0.37	1.2	0.64	ND (0.11)	3.1	4.1	**31**	1.1	1.6	ND (0.11)	**11**	0.29	2	ND (0.11)	0.29	ND (0.11)
Benzo(g,h,i)perylene	1000	NA	0.99	ND (0.14)	0.25	0.54	0.31	ND (0.15)	1.5	2	14	ND (0.74)	ND (0.74)	ND (0.15)	4.7	ND (0.15)	0.93	ND (0.14)	0.16	ND (0.15)
Benzo(k)fluoranthene	70	NA	1.1	ND (0.11)	0.13	0.39	0.23	ND (0.11)	0.96	1.2	11	ND (0.56)	ND (0.56)	ND (0.11)	2.8	ND (0.11)	0.75	ND (0.11)	ND (0.11)	ND (0.11)
Biphenyl	0.05	NA	ND (0.036)	ND (0.036)	ND (0.041)	ND (0.037)	ND (0.039)	ND (0.038)	ND (0.036)	**0.062**	**0.64**	**ND (0.18)**	**ND (0.18)**	ND (0.038)	0.049	ND (0.037)	ND (0.035)	ND (0.035)	ND (0.037)	ND (0.037)
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (1.9)	ND (0.92)	ND (0.93)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Butyl benzylphthalate (BBP)	100	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (1.9)	ND (0.92)	ND (0.93)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Chrysene	70	NA	1.8	0.19	0.28	0.96	0.55	ND (0.11)	2.5	3.7	29	0.81	1.4	ND (0.11)	6.9	0.2	1.6	ND (0.11)	0.2	ND (0.11)
Dibenz(a,h)anthracene	0.7	NA	0.3	ND (0.076)	ND (0.087)	0.13	ND (0.081)	ND (0.079)	0.34	0.48	**3.9**	ND (0.39)	ND (0.39)	ND (0.08)	**1.2**	ND (0.078)	0.25	ND (0.074)	ND (0.078)	ND (0.078)
Dibenzofuran	100	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	0.52	7.1	ND (0.92)	ND (0.93)	ND (0.19)	0.42	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Di-n-butylphthalate (DBP)	50	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (1.9)	ND (0.92)	ND (0.93)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Fluoranthene	1000	NA	3.5	0.31	0.46	1.8	1.3	ND (0.11)	5.5	9.5	71	1.3	3.2	0.12	20	0.51	3.3	ND (0.11)	0.41	ND (0.11)
Fluorene	1000	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	0.2	0.68	16	ND (0.92)	ND (0.93)	ND (0.19)	0.38	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Indeno(1,2,3-cd)pyrene	7	NA	0.94	ND (0.14)	0.19	0.63	0.36	ND (0.15)	1.7	2.4	**17**	ND (0.74)	0.79	ND (0.15)	5.9	0.17	1.1	ND (0.14)	0.19	ND (0.15)
Naphthalene	4	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	0.22	0.31	3	ND (0.92)	ND (0.93)	ND (0.19)	0.32	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Phenanthrene	10	NA	1.2	ND (0.11)	0.24	0.66	1	ND (0.11)	2.7	8.4	**120**	ND (0.56)	2.5	0.14	**11**	0.26	1.3	ND (0.11)	0.13	ND (0.11)
Phenol	1	NA	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	**ND (1.9)**	ND (0.92)	ND (0.93)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Pyrene	1000	NA	3.2	0.3	0.46	1.5	1.2	ND (0.11)	4.8	8	56	1.2	2.6	ND (0.11)	17	0.42	3.1	ND (0.11)	0.35	ND (0.11)
SUM of Semi-Volatile Organic Compounds	NA	NA	20.06	1.41	2.94	10.31	6.98	ND	29.9	52.232	475.44	5.91	15.48	0.26	105.929	2.35	18.49	ND	2.17	ND
Total Petroleum Hydrocarbons (mg/kg)																				
Petroleum hydrocarbons	1000	NA	94.7	ND (35.3)	ND (40.3)	102	ND (38.3)	ND (37.2)	234	177	627	723	391	ND (37)	296	ND (35.5)	60	ND (34.9)	46.9	ND (36.9)
EPH (mg/kg)																				
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		446/458 Arsenal			480 Arsenal														
Location Name			HA23-312	HA23-313	HA23-314	HA22-217	HA22-217	HA22-217	HA22-218	HA22-218	HA22-218	HA22-219(OW)	HA22-219(OW)	HA22-219(OW)	HA22-230	HA22-230	HA22-231	HA22-231	HA22-232	HA22-232
Sample Name			HA23-312_0-5	HA23-313_0-4.0	HA23-314_0-1.8	HA22-217_0-5	HA22-217_5-10	HA22-217_10-15	HA22-218_0-5	HA22-218_5-10	HA22-218_10-14	HA22-219_0-5	HA22-219_5-11	HA22-219_11-15	HA22-230_0-4	HA22-230_4-9	HA22-231_0-2	HA22-231_2-7	HA22-232_0-2	HA22-232_2-7
Sample Date	MCP		02/07/2023	02/07/2023	02/07/2023	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/21/2022	10/20/2022	10/20/2022	10/20/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022	10/28/2022
Lab Sample ID	Reportable Concentration	TCLP	L2306624-03 L2306965-01	L2306624-02	L2306624-01	L2259108-04	L2259108-05	L2259108-06	L2259108-01 L2259720-01	L2259108-02 L2259720-02	L2259108-03 L2259720-03	L2258747-01	L2258747-02	L2260559-06	L2260559-07	L2260559-04	L2260559-05	L2260559-02	L2260559-03
Sample Depth (bgs)	RCS-1		0 - 5 (ft)	0 - 4 (ft)	0 - 1.8 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 11 (ft)	0 - 4 (ft)	4 - 9 (ft)	0 - 2 (ft)	2 - 7 (ft)	0 - 2 (ft)	2 - 7 (ft)
Sample Elevation (ft NAVD 88)	2014		30.2 to 25.2	27.5 to 23.5	30 to 28.2	33.2 to 28.2	28.2 to 23.2	23.2 to 18.2	34.4 to 29.4	29.4 to 24.4	24.4 to 20.4	35.8 to 30.8	30.8 to 24.8	34.3 to 30.3	30.3 to 25.3	33.7 to 31.7	31.7 to 26.7	33.5 to 31.5	31.5 to 26.5
Soil Description			FILL	FILL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	NATURAL	FILL	NATURAL	FILL	NATURAL
Soil Disposal Classification			II-1	I-3	I-3*	I-3*	I-2*	I-2*	II-1	II-1	II-3	I-3*	I-3*	I-2	II-3	I-2	I-3*	I-1	I-3	I-1
VPH (mg/kg)																				
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																				
Antimony	20	NA	ND (2.09)	ND (2.1)	ND (2.41)	ND (2.16)	ND (2.27)	ND (2.18)	2.32	2.18	ND (2.17)	ND (2.2)	ND (2.2)	ND (4.52)	ND (2.13)	ND (2.21)	ND (2.04)	ND (2.08)	ND (2.15)	ND (2.2)
Arsenic	20	NA	8.67	2.86	4.88	4.16	3.94	6.02	8.55	7.31	7.69	2.97	5.36	6.22	4.66	3.7	3.75	4.37	4.41	4.42
Barium	1000	NA	80.9	21	23.2	30.4	24.8	48.3	43.3	41.4	43.5	21.6	47.9	106	30.2	18.1	21.6	16	26.2	18.6
Beryllium	90	NA	0.541	0.468	0.625	0.69	0.635	0.952	0.507	0.518	0.544	ND (0.22)	ND (0.22)	1.33	0.258	0.223	0.22	0.234	ND (0.215)	0.25
Cadmium	70	NA	ND (0.418)	ND (0.42)	ND (0.482)	ND (0.433)	ND (0.454)	ND (0.437)	0.854	0.758	0.807	ND (0.441)	0.529	ND (0.904)	ND (0.426)	ND (0.442)	ND (0.407)	ND (0.415)	ND (0.429)	ND (0.44)
Chromium	100	NA	17.2	7.6	10	11.5	11.2	15.8	12	10.9	11.6	9.01	9.46	31.3	11	9.82	10.5	9.12	12.2	10.7
Lead	200	NA	**209**	7.93	23.2	27.5	11.9	6.66	118	120	112	12.8	67.5	10.5	31.2	4.73	9.07	4.26	34.1	4.13
Mercury	20	NA	0.077	ND (0.072)	0.13	0.202	ND (0.093)	ND (0.076)	0.114	0.123	0.139	ND (0.08)	0.096	ND (0.084)	0.133	ND (0.09)	ND (0.074)	ND (0.074)	ND (0.083)	ND (0.089)
Nickel	600	NA	13.7	5.53	6.42	10.6	11.2	14.6	22.4	20.8	23.3	8	9.87	27.7	15.1	8.91	10.4	9.88	10.3	9.68
Selenium	400	NA	ND (2.09)	ND (2.1)	ND (2.41)	ND (2.16)	ND (2.27)	ND (2.18)	ND (2.07)	ND (2.15)	ND (2.17)	ND (2.2)	ND (2.2)	ND (4.52)	ND (2.13)	ND (2.21)	ND (2.04)	ND (2.08)	ND (2.15)	ND (2.2)
Silver	100	NA	ND (0.418)	ND (0.42)	ND (0.482)	ND (0.433)	ND (0.454)	ND (0.437)	ND (0.414)	ND (0.43)	ND (0.434)	ND (0.441)	ND (0.441)	ND (0.904)	ND (0.426)	ND (0.442)	ND (0.407)	ND (0.415)	ND (0.429)	ND (0.44)
Thallium	8	NA	ND (2.09)	ND (2.1)	ND (2.41)	ND (2.16)	ND (2.27)	ND (2.18)	ND (2.07)	ND (2.15)	ND (2.17)	ND (2.2)	ND (2.2)	ND (4.52)	ND (2.13)	ND (2.21)	ND (2.04)	ND (2.08)	ND (2.15)	ND (2.2)
Vanadium	400	NA	21.6	11	17	21.6	22.7	29.7	23.4	22.4	24.8	17.8	16.8	52.5	20.2	18.7	18.9	17.9	23.1	19.6
Zinc	1000	NA	182	22.8	27	42.3	40.2	39.5	105	106	112	32.6	92.3	82.6	61.5	23.2	33.3	25	35.7	30.9
TCLP Inorganic Compounds (mg/L)																				
Lead	NA	5	ND (0.5)	-	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	-	-	-	-	-	-	-	-	-
PCBs (mg/kg)																				
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1254 (PCB-1254)	1	NA	0.0906	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	0.041	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1260 (PCB-1260)	1	NA	0.0365	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0349)	ND (0.0351)	ND (0.0408)	ND (0.0356)	ND (0.0376)	ND (0.038)	ND (0.0343)	ND (0.0371)	ND (0.0366)	ND (0.036)	ND (0.0373)	ND (0.0363)	ND (0.0349)	ND (0.0355)	ND (0.0348)	ND (0.0346)	ND (0.0368)	ND (0.0362)
SUM of PCBs	1	NA	0.1271	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.041	ND	ND	ND	ND	ND
Other																				
Total Solids (%)	NA	NA	91.5	91.3	79.5	88.9	85	87.1	92.3	89.5	87.9	89.3	87.5	86.5	90.8	88.3	93.1	93.1	87.5	87.9
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	9.9	7	7.2	8	8	7.9	9.4	8.6	9	10.1	9.4	8.2	7.1	7.5	7.4	6.8	7.4	6.5
Conductivity (umhos/cm)	NA	NA	160	210	110	260	120	100	160	220	150	170	140	140	33	40	42	80	21	72

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 May 2014.
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported herein. For a complete list of analytes see the laboratory data sheets.
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		480 Arsenal													500 Arsenal							
Location Name			HA23-308	HA23-309	HA23-310	HA23-311	HA23-401	HA23-410	HA23-411	HA23-411	HA23-411	HA23-411	HA23-411	HA23-TP301	HA23-TP303	HA23-TP304	HA22-13	HA22-14	HA22-15	HA22-15	HA22-16	HA22-17	HA22-18	HA22-19
Sample Name			HA23-308_1-5	HA23-309_1-5	HA23-310_1-5	HA23-311_1-5	HA23-401_0-6.0	HA23-410_0-6.0	HA23-411_0-6.0	HA23-411_6.0-12.0	HA23-411_12.0-13.0	HA23-411_13.0-19.0	HA23-411_19.0-25.0	HA23-TP301_1-3	HA23-TP303_1-5	HA23-TP304_1-5	HA22-13_0-5	HA22-14_1-5	HA22-15_1-5	HA22-15_5-6	HA22-16_1-5	HA22-17_0-4	HA22-18_0-5	HA22-19_0-5
Sample Date	MCP		01/30/2023	01/30/2023	01/31/2023	01/31/2023	07/25/2023	07/19/2023	07/19/2023	07/19/2023	07/19/2023	07/19/2023	07/19/2023	01/26/2023	01/26/2023	01/26/2023	02/11/2022	02/15/2022	02/14/2022	02/14/2022	02/11/2022	02/15/2022	02/16/2022	02/17/2022
	Reportable				L2305319-01			L2341558-06		L2341558-02				L2304625-01	L2304625-02	L2304625-03				L2207756-03				
Lab Sample ID	Concentration	TCLP	L2305071-01	L2305071-02	L2305986-01	L2305319-02	L2342829-01	L2342905-02	L2341558-01	L2342905-01	L2341558-03	L2343648-01	L2343648-02	L2305315-01	L2305315-02	L2305315-03	L2207539-01	L2208019-01	L2207756-02	L2208440-01	L2207539-02	L2208019-01	L2208237-01	L2208491-01
Sample Depth (bgs)	RCS-1		1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 6 (ft)	0 - 6 (ft)	0 - 6 (ft)	6 - 12 (ft)	12 - 13 (ft)	13 - 19 (ft)	19 - 25 (ft)	1 - 3 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	5 - 6 (ft)	1 - 5 (ft)	0 - 4 (ft)	0 - 5 (ft)	0 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		34 to 30	33 to 29	34.2 to 30.2	34 to 30	33.5 to 27.5	36 to 30	32.5 to 26.5	26.5 to 20.5	20.5 to 19.5	19.5 to 13.5	13.5 to 7.5	32.5 to 30.5	33 to 29	32.5 to 28.5	25.5 to 20.5	25.8 to 21.8	28 to 24	24 to 23	28 to 24	29.7 to 25.7	30.5 to 25.5	30.5 to 25.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL/NATURAL	FILL
Soil Disposal Classification			I-3	I-3*	II-1	I-3	I-3	II-3	I-3	I-3*	II-2	II-1	I-1	II-1	II-1	II-1	I-3	I-3*	I-3	III-2/II-5	II-1	I-3	I-3	I-3*
Volatile Organic Compounds (mg/kg)																								
1,2,4-Trimethylbenzene	1000	NA	ND (0.0019)	ND (0.0024)	ND (0.002)	ND (0.0019)	ND (0.0011)	ND (0.0014)	ND (0.0015)	ND (0.0014)	0.048	-	-	ND (0.0024)	ND (0.0022)	ND (0.003)	ND (0.0015)	ND (0.0013)	ND (0.0014)	-	ND (0.0016)	ND (0.0016)	ND (0.0016)	ND (0.0015)
1,3,5-Trimethylbenzene	10	NA	ND (0.0019)	ND (0.0024)	ND (0.002)	ND (0.0019)	ND (0.0011)	ND (0.0014)	ND (0.0015)	ND (0.0014)	0.052	-	-	ND (0.0024)	ND (0.0022)	ND (0.003)	ND (0.0015)	ND (0.0013)	ND (0.0014)	-	ND (0.0016)	ND (0.0016)	ND (0.0016)	ND (0.0015)
1,4-Dichlorobenzene	0.7	NA	ND (0.0019)	ND (0.0024)	ND (0.002)	ND (0.0019)	ND (0.0011)	ND (0.0014)	ND (0.0015)	ND (0.0014)	ND (0.0012)	-	-	ND (0.0024)	ND (0.0022)	ND (0.003)	ND (0.0015)	ND (0.0013)	ND (0.0014)	-	ND (0.0016)	ND (0.0016)	ND (0.0016)	ND (0.0015)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.0096)	ND (0.012)	ND (0.0099)	ND (0.0096)	ND (0.0054)	ND (0.0069)	ND (0.0075)	ND (0.0069)	0.01	-	-	ND (0.012)	ND (0.011)	ND (0.015)	ND (0.0077)	ND (0.0066)	ND (0.0069)	-	ND (0.0078)	ND (0.0082)	ND (0.0078)	ND (0.0074)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.011	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Acetone	6	NA	0.025	ND (0.03)	ND (0.025)	ND (0.024)	0.02	ND (0.017)	ND (0.019)	ND (0.017)	0.034	-	-	ND (0.03)	ND (0.028)	ND (0.038)	0.021	ND (0.016)	ND (0.017)	-	ND (0.019)	ND (0.02)	ND (0.02)	ND (0.018)
Benzene	2	NA	ND (0.00048)	ND (0.0006)	ND (0.00049)	ND (0.00048)	ND (0.00027)	ND (0.00034)	ND (0.00037)	ND (0.00034)	ND (0.00031)	-	-	ND (0.0006)	ND (0.00056)	ND (0.00076)	ND (0.00039)	ND (0.00033)	ND (0.00035)	-	ND (0.00039)	ND (0.00041)	ND (0.00039)	ND (0.00037)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0014)	ND (0.0018)	ND (0.0015)	ND (0.0014)	ND (0.00081)	ND (0.001)	ND (0.0011)	ND (0.001)	ND (0.00093)	-	-	ND (0.0018)	ND (0.0017)	ND (0.0023)	ND (0.0012)	ND (0.00099)	ND (0.001)	-	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0011)
cis-1,2-Dichloroethene	0.1	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	ND (0.00062)	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.045	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Ethylbenzene	40	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.015	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Isopropylbenzene (Cumene)	1000	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.012	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Naphthalene	4	NA	ND (0.0038)	ND (0.0048)	ND (0.004)	ND (0.0038)	ND (0.0022)	ND (0.0027)	ND (0.003)	ND (0.0028)	0.17	-	-	ND (0.0048)	ND (0.0045)	ND (0.006)	0.0088	ND (0.0026)	ND (0.0028)	-	ND (0.0031)	ND (0.0033)	ND (0.0031)	ND (0.0029)
n-Butylbenzene	NA	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.02	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
n-Propylbenzene	100	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.026	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Styrene	3	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	ND (0.00062)	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
Tetrachloroethene	1	NA	ND (0.00048)	ND (0.0006)	ND (0.00049)	ND (0.00048)	ND (0.00027)	ND (0.00034)	ND (0.00037)	ND (0.00034)	ND (0.00031)	-	-	ND (0.0006)	ND (0.00056)	ND (0.00076)	ND (0.00039)	ND (0.00033)	ND (0.00035)	-	ND (0.00039)	ND (0.00041)	ND (0.00039)	ND (0.00037)
Tetrahydrofuran	500	NA	ND (0.0038)	ND (0.0048)	ND (0.004)	ND (0.0038)	ND (0.0022)	ND (0.0027)	ND (0.003)	ND (0.0028)	ND (0.0025)	-	-	ND (0.0048)	ND (0.0045)	ND (0.006)	ND (0.0031)	ND (0.0026)	ND (0.0028)	-	ND (0.0031)	ND (0.0033)	ND (0.0031)	ND (0.0029)
Toluene	30	NA	0.0022	ND (0.0012)	0.0016	0.0032	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	ND (0.00062)	-	-	0.0016	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	0.001	ND (0.00074)
trans-1,2-Dichloroethene	1	NA	ND (0.0014)	ND (0.0018)	ND (0.0015)	ND (0.0014)	ND (0.00081)	ND (0.001)	ND (0.0011)	ND (0.001)	ND (0.00093)	-	-	ND (0.0018)	ND (0.0017)	ND (0.0023)	ND (0.0012)	ND (0.00099)	ND (0.001)	-	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0011)
Trichloroethene	0.3	NA	ND (0.00048)	ND (0.0006)	ND (0.00049)	ND (0.00048)	ND (0.00027)	ND (0.00034)	ND (0.00037)	ND (0.00034)	ND (0.00031)	-	-	ND (0.0006)	ND (0.00056)	ND (0.00076)	ND (0.00039)	ND (0.00033)	ND (0.00035)	-	ND (0.00039)	ND (0.00041)	ND (0.00039)	ND (0.00037)
Xylene (Total)	100	NA	ND (0.00096)	ND (0.0012)	ND (0.00099)	ND (0.00096)	ND (0.00054)	ND (0.00069)	ND (0.00075)	ND (0.00069)	0.016	-	-	ND (0.0012)	ND (0.0011)	ND (0.0015)	ND (0.00077)	ND (0.00066)	ND (0.00069)	-	ND (0.00078)	ND (0.00082)	ND (0.00078)	ND (0.00074)
SUM of Volatile Organic Compounds	NA	NA	0.0272	ND	0.0016	0.0032	0.02	ND	ND	ND	0.459	-	-	0.0016	ND	ND	0.0298	ND	ND	-	ND	ND	0.001	ND
Semi-Volatile Organic Compounds (mg/kg)																								
2,4-Dimethylphenol	0.7	NA	ND (0.079)	ND (0.078)	ND (0.076)	ND (0.079)	ND (0.082)	**ND (0.75)**	ND (0.077)	ND (0.079)	ND (0.084)	-	-	ND (0.08)	ND (0.077)	ND (0.079)	ND (0.082)	ND (0.37)	ND (0.076)	-	ND (0.077)	ND (0.075)	ND (0.075)	ND (0.072)
2-Methylnaphthalene	0.7	NA	ND (0.079)	ND (0.078)	ND (0.076)	ND (0.079)	ND (0.082)	**0.84**	ND (0.077)	0.66	**3.8**	-	-	0.14	ND (0.077)	0.08	ND (0.082)	ND (0.37)	ND (0.076)	-	0.64	ND (0.075)	ND (0.075)	ND (0.072)
3&4-Methylphenol	NA	NA	ND (0.27)	ND (0.27)	ND (0.26)	ND (0.27)	ND (0.28)	ND (2.6)	ND (0.26)	ND (0.27)	ND (0.29)	-	-	ND (0.27)	ND (0.26)	ND (0.27)	ND (0.28)	ND (1.3)	ND (0.26)	-	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.25)
Acenaphthene	4	NA	0.15	0.23	ND (0.14)	ND (0.15)	ND (0.16)	1.9	ND (0.15)	ND (0.15)	1.8	-	-	0.29	0.16	0.24	ND (0.16)	ND (0.71)	ND (0.14)	-	0.16	ND (0.14)	ND (0.14)	ND (0.14)
Acenaphthylene	1	NA	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.15)	ND (0.16)	**ND (1.4)**	ND (0.15)	ND (0.15)	ND (0.16)	-	-	0.9	0.43	0.38	0.18	ND (0.71)	ND (0.14)	-	**2.8**	ND (0.14)	ND (0.14)	ND (0.14)
Aniline	1000	NA	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.23)	ND (2.1)	ND (0.22)	ND (0.23)	ND (0.24)	-	-	ND (0.23)	ND (0.22)	ND (0.23)	ND (0.23)	ND (1.1)	ND (0.22)	-	ND (0.22)	ND (0.21)	ND (0.21)	ND (0.21)
Anthracene	1000	NA	0.46	0.51	0.34	0.27	ND (0.12)	4.8	0.26	0.38	2	-	-	1.6	0.64	0.97	0.56	ND (0.53)	0.16	-	1.9	0.11	0.18	ND (0.1)
Benzo(a)anthracene	7	NA	1.3	1.4	1.1	0.94	0.25	**13**	0.97	0.73	0.13	-	-	4.5	1.9	2.6	1.2	0.71	0.55	-	2.3	0.41	0.55	ND (0.1)
Benzo(a)pyrene	2	NA	1.2	1.4	1.2	1.1	0.26	**12**	1	0.67	ND (0.16)	-	-	**4**	**2.1**	**2.3**	1.1	0.89	0.64	-	**3.1**	0.42	0.5	ND (0.14)
Benzo(b)fluoranthene	7	NA	1.4	1.6	1.3	1.3	0.35	**14**	1.1	0.83	0.13	-	-	4.9	2.4	2.8	1.6	1.2	0.85	-	3.5	0.53	0.62	ND (0.1)
Benzo(g,h,i)perylene	1000	NA	0.66	0.73	0.7	0.62	0.16	6.4	0.74	0.46	ND (0.16)	-	-	2.2	1.1	1.3	0.75	ND (0.71)	0.37	-	2.6	0.25	0.3	ND (0.14)
Benzo(k)fluoranthene	70	NA	0.46	0.48	0.34	0.52	ND (0.12)	4.8	0.55	0.27	ND (0.12)	-	-	1.6	0.7	0.86	0.43	ND (0.53)	0.31	-	0.69	0.14	0.24	ND (0.1)
Biphenyl	0.05	NA	ND (0.038)	ND (0.037)	ND (0.036)	ND (0.038)	ND (0.039)	**ND (0.36)**	ND (0.036)	0.04	**1.8**	-	-	**0.051**	ND (0.037)	ND (0.038)	ND (0.039)	**ND (0.18)**	ND (0.036)	-	**0.15**	ND (0.036)	ND (0.036)	ND (0.034)
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	ND (1.8)	ND (0.18)	ND (0.19)	ND (0.2)	-	-	0.71	ND (0.18)	3.5	ND (0.2)	11	0.9	-	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.17)
Butyl benzylphthalate (BBP)	100	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	ND (1.8)	ND (0.18)	ND (0.19)	ND (0.2)	-	-	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.2)	1.6	ND (0.18)	-	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.17)
Chrysene	70	NA	1.2	1.3	1	1	0.3	12	0.92	0.76	0.12	-	-	4	1.8	2.3	1.1	0.88	0.69	-	2.7	0.41	0.56	ND (0.1)
Dibenz(a,h)anthracene	0.7	NA	0.15	0.18	0.14	0.14	ND (0.082)	**1.6**	0.18	0.12	ND (0.084)	-	-	0.61	0.24	0.36	0.18	ND (0.37)	0.082	-	0.66	ND (0.075)	0.079	ND (0.072)
Dibenzofuran	100	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	ND (1.8)	ND (0.18)	ND (0.19)	1.5	-	-	0.38	ND (0.18)	ND (0.19)	0.2	ND (0.88)	ND (0.18)	-	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.17)
Di-n-butylphthalate (DBP)	50	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	ND (1.8)	ND (0.18)	ND (0.19)	ND (0.2)	-	-	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.88)	ND (0.18)	-	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.17)
Fluoranthene	1000	NA	2.6	2.8	2.2	2.2	0.45	30	1.9	1.7	0.41	-	-	11	3.7	5.7	2.6	1.3	1.8	-	4	0.79	1.1	ND (0.1)
Fluorene	1000	NA	ND (0.19)	0.2	ND (0.18)	ND (0.19)	ND (0.19)	2.4	ND (0.18)	ND (0.19)	4.1	-	-	0.48	ND (0.18)	0.28	0.42	ND (0.88)	ND (0.18)	-	0.38	ND (0.18)	ND (0.18)	ND (0.17)
Indeno(1,2,3-cd)pyrene	7	NA	0.76	0.84	0.65	0.6	ND (0.16)	**8.2**	0.65	0.37	ND (0.16)	-	-	2.7	1.1	1.6	0.86	ND (0.71)	0.42	-	2.4	0.28	0.35	ND (0.14)
Naphthalene	4	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	1.8	ND (0.18)	0.28	0.57	-	-	0.38	ND (0.18)	0.19	ND (0.2)	ND (0.88)	ND (0.18)	-	1.1	ND (0.18)	ND (0.18)	ND (0.17)
Phenanthrene	10	NA	1.6	2.1	1.3	1.1	0.18	**18**	0.89	1.8	7.3	-	-	6	2	3.2	2.1	0.62	0.63	-	2.6	0.45	0.83	ND (0.1)
Phenol	1	NA	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.19)	**ND (1.8)**	ND (0.18)	ND (0.19)	ND (0.2)	-	-	ND (0.19)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.88)	ND (0.18)	-	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.17)
Pyrene	1000	NA	2.2	2.6	2	1.9	0.45	23	1.6	1.4	1	-	-	9	3.3	4.8	1.8	1.2	1.4	-	5.9	0.7	0.9	ND (0.1)
SUM of Semi-Volatile Organic Compounds	NA	NA	14.14	16.37	12.27	11.69	2.4	154.74	10.76	10.47	24.66	-	-	55.441	21.57	33.46	15.08	19.4	8.802	-	37.58	4.49	6.209	ND
Total Petroleum Hydrocarbons (mg/kg)																								
Petroleum hydrocarbons	1000	NA	208	161	179	276	348	207	178	95.2	**4290**	-	-	274	236	85.8	442	742	250	-	715	66.9	ND (34.8)	ND (34.7)
EPH (mg/kg)																								
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	**4220**	12.5	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	306	ND (7.77)	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	**3920**	7.88	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	**230**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	50	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	**ND (7.2)**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	**17**	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	ND (7.2)	ND (0.388)	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		480 Arsenal														500 Arsenal							
Location Name			HA23-308	HA23-309	HA23-310	HA23-311	HA23-401	HA23-410	HA23-411	HA23-411	HA23-411	HA23-411	HA23-411	HA23-TP301	HA23-TP303	HA23-TP304	HA22-13	HA22-14	HA22-15	HA22-15	HA22-16	HA22-17	HA22-18	HA22-19
Sample Name			HA23-308_1-5	HA23-309_1-5	HA23-310_1-5	HA23-311_1-5	HA23-401_0-6.0	HA23-410_0-6.0	HA23-411_0-6.0	HA23-411_6.0-12.0	HA23-411_12.0-13.0	HA23-411_13.0-19.0	HA23-411_19.0-25.0	HA23-TP301_1-3	HA23-TP303_1-5	HA23-TP304_1-5	HA22-13_0-5	HA22-14_1-5	HA22-15_1-5	HA22-15_5-6	HA22-16_1-5	HA22-17_0-4	HA22-18_0-5	HA22-19_0-5
Sample Date	MCP Reportable		01/30/2023	01/30/2023	01/31/2023 L2305319-01	01/31/2023	07/25/2023	07/19/2023 L2341558-06	07/19/2023	07/19/2023 L2341558-02	07/19/2023	07/19/2023	07/19/2023	01/26/2023 L2304625-01	01/26/2023 L2304625-02	01/26/2023 L2304625-03	02/11/2022	02/15/2022	02/14/2022	02/14/2022 L2207756-03	02/11/2022	02/15/2022	02/16/2022	02/17/2022
Lab Sample ID	Concentration	TCLP	L2305071-01	L2305071-02	L2305986-01	L2305319-02	L2342829-01	L2342905-02	L2341558-01	L2342905-01	L2341558-03	L2343648-01	L2343648-02	L2305315-01	L2305315-02	L2305315-03	L2207539-01	L2208019-02	L2207756-02	L2208440-01	L2207539-02	L2208019-01	L2208237-01	L2208491-01
Sample Depth (bgs)	RCS-1		1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 6 (ft)	0 - 6 (ft)	0 - 6 (ft)	6 - 12 (ft)	12 - 13 (ft)	13 - 19 (ft)	19 - 25 (ft)	1 - 3 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	5 - 6 (ft)	1 - 5 (ft)	0 - 4 (ft)	0 - 5 (ft)	0 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		34 to 30	33 to 29	34.2 to 30.2	34 to 30	33.5 to 27.5	36 to 30	32.5 to 26.5	26.5 to 20.5	20.5 to 19.5	19.5 to 13.5	13.5 to 7.5	32.5 to 30.5	33 to 29	32.5 to 28.5	25.5 to 20.5	25.8 to 21.8	28 to 24	24 to 23	28 to 24	29.7 to 25.7	30.5 to 25.5	30.5 to 25.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL/NATURAL	FILL
Soil Disposal Classification			I-3	I-3*	II-1	I-3	I-3	II-3	I-3	I-3*	II-2	II-1	I-1	II-1	II-1	II-1	I-3	I-3*	I-3	III-2/II-5	II-1	I-3	I-3	I-3*
VPH (mg/kg)																								
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	ND (96)	ND (5.42)	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	**582**	7.91	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	291	ND (5.42)	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	ND (1.92)	ND (0.108)	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	ND (1.92)	ND (0.108)	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	**ND (0.96)**	ND (0.054)	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	**14.7**	ND (0.217)	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	ND (1.92)	ND (0.108)	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																								
Antimony	20	NA	ND (2.24)	ND (2.2)	6.41	2.97	ND (2.24)	4.06	ND (2.15)	3.01	ND (2.37)	-	-	ND (2.17)	3.23	3.54	ND (2.32)	ND (2.11)	ND (2.18)	15.9	ND (2.16)	ND (2.07)	ND (2.08)	ND (2)
Arsenic	20	NA	4.45	6.39	11.2	6.57	4.4	11	10.9	7.64	2.71	-	-	5.24	7.02	6.51	3.16	2.77	3.71	7.66	5.1	3.42	3.45	2.96
Barium	1000	NA	28	42.7	55.4	29.7	25.2	58.3	34.6	30.3	24.6	-	-	39.2	45.3	44.9	25.2	30.6	32.5	28.9	36.3	17.6	20.9	16.7
Beryllium	90	NA	0.365	0.465	1.73	1.59	0.696	ND (0.21)	ND (0.215)	ND (0.23)	ND (0.237)	-	-	1.37	1.52	1.38	ND (0.232)	ND (0.211)	0.24	ND (0.262)	0.263	ND (0.207)	0.22	ND (0.2)
Cadmium	70	NA	ND (0.448)	0.862	0.986	0.472	ND (0.447)	0.669	0.626	ND (0.46)	ND (0.473)	-	-	0.588	0.739	0.694	ND (0.463)	ND (0.422)	ND (0.437)	4.7	ND (0.431)	ND (0.415)	ND (0.416)	ND (0.401)
Chromium	100	NA	15.5	15.4	14.1	14.4	15.8	17.7	15.8	9.61	9.17	-	-	12.8	12.9	13	11.6	10.4	9.89	7.63	8.61	12.9	8.64	6.62
Lead	200	NA	36.3	81.1	**267**	54.2	13.2	**227**	46.9	121	19.2	-	-	105	185	175	11.4	21.2	7.48	**1080**	14.7	15.4	15.6	13.6
Mercury	20	NA	ND (0.082)	0.116	ND (0.085)	ND (0.085)	0.474	ND (0.079)	ND (0.08)	ND (0.084)	ND (0.09)	-	-	0.212	0.133	ND (0.085)	ND (0.082)	0.078	0.183	2.38	0.1	ND (0.073)	ND (0.072)	ND (0.071)
Nickel	600	NA	13.6	17.3	20.1	12.3	12	24	21.1	17.5	7.83	-	-	14.6	16.3	16.5	8.53	9.16	8.2	4.7	6.79	7.37	6.9	4.35
Selenium	400	NA	ND (2.24)	ND (2.2)	ND (2.16)	ND (2.22)	ND (2.24)	ND (2.1)	ND (2.15)	ND (2.3)	ND (2.37)	-	-	ND (2.17)	ND (2.12)	ND (2.22)	ND (2.32)	ND (2.11)	ND (2.18)	ND (2.62)	ND (2.16)	ND (2.07)	ND (2.08)	ND (2)
Silver	100	NA	ND (0.448)	ND (0.44)	ND (0.433)	ND (0.443)	ND (0.447)	ND (0.42)	ND (0.43)	ND (0.46)	ND (0.473)	-	-	ND (0.431)	ND (0.43)	ND (0.435)	ND (0.463)	ND (0.422)	ND (0.437)	ND (0.524)	ND (0.431)	ND (0.415)	ND (0.416)	ND (0.401)
Thallium	8	NA	ND (2.24)	ND (2.2)	ND (2.16)	ND (2.22)	ND (2.24)	ND (2.1)	ND (2.15)	ND (2.3)	ND (2.37)	-	-	ND (2.17)	ND (2.12)	ND (2.22)	ND (2.32)	ND (2.11)	ND (2.18)	ND (2.62)	ND (2.16)	ND (2.07)	ND (2.08)	ND (2)
Vanadium	400	NA	21.3	25.2	25.6	23.8	25.3	26.8	26.9	17.5	13.2	-	-	22.6	23.6	23.5	17.1	15	15.7	7.3	11.5	13.1	13.5	8.22
Zinc	1000	NA	50.2	245	129	55.8	34.8	131	73.4	98.5	39.2	-	-	98.1	134	152	31.7	70	29.4	**5050**	120	31.2	27.3	19.1
TCLP Inorganic Compounds (mg/L)																								
Lead	NA	5	-	-	ND (0.5)	-	-	ND (0.5)	-	ND (0.5)	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	-	-	-	**6.07**	-	-	-	-
PCBs (mg/kg)																								
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1260 (PCB-1260)	1	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	0.151	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0375)	ND (0.0357)	ND (0.0358)	ND (0.0367)	ND (0.0581)	ND (0.0504)	ND (0.0516)	ND (0.0549)	ND (0.0593)	-	-	ND (0.0374)	ND (0.0373)	ND (0.0364)	ND (0.038)	ND (0.0359)	ND (0.0363)	-	ND (0.0354)	ND (0.035)	ND (0.0353)	ND (0.0344)
SUM of PCBs	1	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	ND	ND	ND	ND	0.151	ND	-	ND	ND	ND	ND
Other																								
Total Solids (%)	NA	NA	87.8	88.6	89.1	87.1	84.1	91.6	90.2	86.8	81.7	87.5	83.3	87.4	89.1	87.8	84.3	92.5	91.1	75.6	91.1	91.9	91.7	94.3
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	-	-	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	-	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	-	-	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	-	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	-	-	NI	NI	NI	NI	NI	NI	-	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	8	9.7	8.4	8.3	8.25	8.04	7.44	6.19	6.79	-	-	7.9	8.2	8.6	7.4	8.3	8.2	-	7.4	6.6	6.2	7
Conductivity (umhos/cm)	NA	NA	90	230	120	170	79	150	350	340	190	-	-	66	140	73	500	110	58	-	86	ND (10)	ND (10)	11

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		500 Arsenal																			
Location Name			HA22-214(OW)	HA22-214(OW)	HA22-214(OW)	HA22-215(OW)	HA22-215(OW)	HA22-215(OW)	HA22-216(OW)	HA22-216(OW)	HA22-216(OW)	HA22-227	HA22-227	HA22-227	HA22-228	HA22-228	HA22-228	HA22-229	HA22-229	HA22-229	HA23-315	HA23-412	HA23-412	HA-TP01
Sample Name			HA22-214_0-5	HA22-214_5-13	HA22-214_13-15	HA22-215_0-5	HA22-215_5-8	HA22-215_8-13	HA22-216_0-5	HA22-216_5-10	HA22-216_10-14	HA22-227_0-5	HA22-227_5-8	HA22-227_8-13	HA22-228_0-5	HA22-228_5-10	HA22-228_10-16	HA22-229_0-5	HA22-229_5-8	HA22-229_8-13	HA23-315_0-5	HA23-412_0-4.0	HA23-412_4.0-7.5	HA-TP1_1-5
Sample Date	MCP		10/18/2022	10/18/2022	10/18/2022	10/17/2022	10/17/2022	10/17/2022	10/14/2022	10/14/2022	10/14/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	02/06/2023	07/17/2023	07/17/2023	02/24/2022
Lab Sample ID	Reportable Concentration	TCLP	L2258006-02 L2258006-01	L2258897-01	L2258006-03	L2257786-01	L2257786-02	L2257786-03	L2257534-01 L2258144-01	L2257534-02 L2258144-02	L2257534-03 L2258144-03	L2260022-01	L2260022-02	L2260022-03	L2260022-07	L2260022-08	L2260022-09 L2260458-02	L2260022-04	L2260458-01	L2260022-06	L2306360-06 L2306970-02	L2340803-05	L2340803-06	L2209993-02
Sample Depth (bgs)	RCS-1		0 - 5 (ft)	5 - 13 (ft)	13 - 15 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 16 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	0 - 4 (ft)	4 - 7.5 (ft)	1 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		25.7 to 20.7	20.7 to 12.7	12.7 to 10.7	29.3 to 24.3	24.3 to 21.3	21.3 to 16.3	26 to 21	21 to 16	16 to 12	26 to 21	21 to 18	18 to 13	23.9 to 18.9	18.9 to 13.9	13.9 to 7.9	26 to 21	21 to 18	18 to 13	29 to 24	29 to 25	25 to 21.5	27.5 to 23.5
Soil Description			FILL	FILL/ORGANICS	NATURAL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	III-2/II-5	I-1	I-3*	I-3*	I-3*	II-3	II-2	II-1	II-1	I-3*	I-2	I-3*	I-3*	I-3*	II-3	III-3	I-2*	II-1	II-1	II-1	I-3*
Volatile Organic Compounds (mg/kg)																								
1,2,4-Trimethylbenzene	1000	NA	ND (0.0029)	ND (0.0027)	ND (0.0022)	ND (0.0022)	ND (0.003)	ND (0.0024)	ND (0.0023)	ND (0.0024)	ND (0.0038)	ND (0.0023)	ND (0.0023)	ND (0.0028)	ND (0.003)	ND (0.0032)	ND (0.0019)	0.0037	ND (0.21)	ND (0.0023)	ND (0.0041)	ND (0.0015)	ND (0.0012)	ND (0.0014)
1,3,5-Trimethylbenzene	10	NA	ND (0.0029)	ND (0.0027)	ND (0.0022)	ND (0.0022)	ND (0.003)	ND (0.0024)	ND (0.0023)	ND (0.0024)	ND (0.0038)	ND (0.0023)	ND (0.0023)	ND (0.0028)	ND (0.003)	ND (0.0032)	ND (0.0019)	ND (0.0026)	ND (0.21)	ND (0.0023)	ND (0.0041)	ND (0.0015)	ND (0.0012)	ND (0.0014)
1,4-Dichlorobenzene	0.7	NA	ND (0.0029)	ND (0.0027)	ND (0.0022)	ND (0.0022)	ND (0.003)	ND (0.0024)	ND (0.0023)	ND (0.0024)	ND (0.0038)	ND (0.0023)	ND (0.0023)	ND (0.0028)	ND (0.003)	ND (0.0032)	ND (0.0019)	ND (0.0026)	ND (0.21)	ND (0.0023)	ND (0.0041)	ND (0.0015)	ND (0.0012)	ND (0.0014)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.014)	ND (0.014)	ND (0.011)	ND (0.011)	ND (0.015)	ND (0.012)	ND (0.011)	ND (0.012)	0.022	ND (0.012)	ND (0.012)	ND (0.014)	ND (0.015)	ND (0.016)	ND (0.0094)	ND (0.013)	ND (1)	ND (0.012)	ND (0.02)	ND (0.0076)	ND (0.0059)	ND (0.0069)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Acetone	6	NA	ND (0.036)	0.058	ND (0.027)	ND (0.027)	ND (0.038)	ND (0.03)	ND (0.028)	0.04	0.13	ND (0.029)	ND (0.029)	ND (0.036)	ND (0.037)	ND (0.04)	ND (0.023)	ND (0.032)	ND (1)	ND (0.029)	ND (0.051)	ND (0.019)	ND (0.015)	ND (0.017)
Benzene	2	NA	ND (0.00072)	ND (0.00068)	ND (0.00054)	ND (0.00055)	ND (0.00075)	ND (0.0006)	ND (0.00057)	ND (0.00059)	ND (0.00094)	ND (0.00058)	ND (0.00058)	ND (0.00071)	ND (0.00075)	ND (0.0008)	ND (0.00047)	0.0073	ND (0.053)	ND (0.00058)	ND (0.001)	ND (0.00038)	ND (0.0003)	ND (0.00035)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0022)	ND (0.002)	ND (0.0016)	ND (0.0016)	ND (0.0022)	ND (0.0018)	ND (0.0017)	ND (0.0018)	ND (0.0028)	ND (0.0017)	ND (0.0017)	ND (0.0021)	ND (0.0022)	ND (0.0024)	ND (0.0014)	ND (0.0019)	ND (0.16)	ND (0.0017)	ND (0.0031)	ND (0.0011)	ND (0.00088)	ND (0.001)
cis-1,2-Dichloroethene	0.1	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	**ND (0.1)**	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	0.0027	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Ethylbenzene	40	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	0.0018	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Isopropylbenzene (Cumene)	1000	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Naphthalene	4	NA	ND (0.0058)	ND (0.0055)	ND (0.0043)	ND (0.0044)	ND (0.006)	ND (0.0048)	ND (0.0045)	ND (0.0047)	ND (0.0076)	ND (0.0047)	ND (0.0046)	ND (0.0057)	ND (0.006)	ND (0.0064)	ND (0.0037)	ND (0.59)	**8.5**	0.049	ND (0.0082)	ND (0.003)	ND (0.0024)	ND (0.0028)
n-Butylbenzene	NA	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
n-Propylbenzene	100	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Styrene	3	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	ND (0.0013)	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
Tetrachloroethene	1	NA	ND (0.00072)	ND (0.00068)	ND (0.00054)	ND (0.00055)	ND (0.00075)	ND (0.0006)	ND (0.00057)	ND (0.00059)	ND (0.00094)	ND (0.00058)	ND (0.00058)	ND (0.00071)	ND (0.00075)	ND (0.0008)	ND (0.00047)	ND (0.00064)	ND (0.053)	ND (0.00058)	ND (0.001)	ND (0.00038)	ND (0.0003)	ND (0.00035)
Tetrahydrofuran	500	NA	ND (0.0058)	ND (0.0055)	ND (0.0043)	ND (0.0044)	ND (0.006)	ND (0.0048)	ND (0.0045)	ND (0.0047)	ND (0.0076)	ND (0.0047)	ND (0.0046)	ND (0.0057)	ND (0.006)	ND (0.0064)	ND (0.0037)	ND (0.0051)	ND (0.42)	ND (0.0046)	ND (0.0082)	ND (0.003)	ND (0.0024)	ND (0.0028)
Toluene	30	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	0.17	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	0.0022	ND (0.1)	ND (0.0012)	0.003	ND (0.00076)	ND (0.00059)	0.002
trans-1,2-Dichloroethene	1	NA	ND (0.0022)	ND (0.002)	ND (0.0016)	ND (0.0016)	ND (0.0022)	ND (0.0018)	ND (0.0017)	ND (0.0018)	ND (0.0028)	ND (0.0017)	ND (0.0017)	ND (0.0021)	ND (0.0022)	ND (0.0024)	ND (0.0014)	ND (0.0019)	ND (0.16)	ND (0.0017)	ND (0.0031)	ND (0.0011)	ND (0.00088)	ND (0.001)
Trichloroethene	0.3	NA	ND (0.00072)	ND (0.00068)	ND (0.00054)	ND (0.00055)	ND (0.00075)	ND (0.0006)	ND (0.00057)	ND (0.00059)	ND (0.00094)	ND (0.00058)	ND (0.00058)	ND (0.00071)	ND (0.00075)	ND (0.0008)	ND (0.00047)	ND (0.00064)	ND (0.053)	ND (0.00058)	ND (0.001)	ND (0.00038)	ND (0.0003)	ND (0.00035)
Xylene (Total)	100	NA	ND (0.0014)	ND (0.0014)	ND (0.0011)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0011)	ND (0.0012)	ND (0.0019)	ND (0.0012)	ND (0.0012)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.00094)	0.0084	ND (0.1)	ND (0.0012)	ND (0.002)	ND (0.00076)	ND (0.00059)	ND (0.00069)
SUM of Volatile Organic Compounds	NA	NA	ND	0.058	ND	ND	ND	ND	ND	0.04	0.3247	ND	ND	ND	ND	ND	ND	0.01683	8.5	0.049	0.003	ND	ND	0.002
Semi-Volatile Organic Compounds (mg/kg)																								
2,4-Dimethylphenol	0.7	NA	ND (0.077)	ND (0.084)	ND (0.08)	ND (0.081)	ND (0.087)	ND (0.086)	ND (0.079)	ND (0.082)	ND (0.12)	ND (0.074)	ND (0.08)	ND (0.085)	ND (0.074)	ND (0.078)	ND (0.081)	ND (0.077)	ND (0.075)	ND (0.086)	ND (0.37)	ND (0.37)	ND (0.37)	ND (0.37)
2-Methylnaphthalene	0.7	NA	ND (0.077)	ND (0.084)	ND (0.08)	ND (0.081)	ND (0.087)	ND (0.086)	0.15	ND (0.082)	ND (0.12)	0.12	ND (0.08)	ND (0.085)	ND (0.074)	ND (0.078)	ND (0.081)	**13**	**13**	0.3	ND (0.37)	ND (0.37)	ND (0.37)	ND (0.37)
3&4-Methylphenol	NA	NA	ND (0.26)	ND (0.29)	ND (0.28)	ND (0.28)	ND (0.3)	ND (0.3)	ND (0.27)	ND (0.28)	31	ND (0.26)	ND (0.28)	ND (0.29)	ND (0.26)	ND (0.27)	ND (0.28)	ND (0.26)	ND (0.26)	ND (0.3)	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)
Acenaphthene	4	NA	ND (0.15)	ND (0.16)	ND (0.15)	0.16	ND (0.16)	ND (0.16)	0.33	0.22	ND (0.23)	0.41	ND (0.15)	ND (0.16)	ND (0.14)	ND (0.15)	ND (0.15)	**13**	**12**	0.34	ND (0.7)	ND (0.7)	ND (0.71)	ND (0.7)
Acenaphthylene	1	NA	ND (0.15)	ND (0.16)	ND (0.15)	ND (0.15)	ND (0.16)	ND (0.16)	0.42	ND (0.16)	ND (0.23)	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.14)	ND (0.15)	ND (0.15)	0.26	0.18	ND (0.16)	0.74	0.91	ND (0.71)	ND (0.7)
Aniline	1000	NA	ND (0.22)	ND (0.24)	ND (0.23)	ND (0.23)	ND (0.25)	ND (0.25)	ND (0.22)	ND (0.23)	ND (0.35)	ND (0.21)	ND (0.23)	ND (0.24)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.21)	ND (0.25)	ND (1)	ND (1)	ND (1.1)	ND (1)
Anthracene	1000	NA	ND (0.11)	0.26	ND (0.11)	0.34	ND (0.12)	ND (0.12)	1.1	0.54	ND (0.17)	1.6	0.65	ND (0.12)	0.31	0.17	0.43	19	17	0.52	1.2	1.2	1.2	ND (0.53)
Benzo(a)anthracene	7	NA	0.12	0.71	ND (0.11)	1.2	0.26	ND (0.12)	2.7	1.6	ND (0.17)	3.5	1.4	ND (0.12)	0.88	0.56	1.4	**17**	**13**	0.48	3.4	2.9	2.6	ND (0.53)
Benzo(a)pyrene	2	NA	ND (0.15)	0.66	ND (0.15)	1.3	0.28	ND (0.16)	**2.6**	1.5	ND (0.23)	**3.8**	1.4	ND (0.16)	0.94	0.52	1.2	**20**	**14**	0.44	**4.1**	**2.9**	**2.5**	ND (0.7)
Benzo(b)fluoranthene	7	NA	0.15	0.75	ND (0.11)	1.5	0.32	ND (0.12)	3.5	1.6	ND (0.17)	4.1	1.5	ND (0.12)	1.3	0.68	1.6	**21**	**13**	0.44	4.6	3.4	2.9	ND (0.53)
Benzo(g,h,i)perylene	1000	NA	ND (0.15)	0.33	ND (0.15)	0.94	0.17	ND (0.16)	1.6	0.87	ND (0.23)	2.7	0.88	ND (0.16)	0.62	0.31	0.72	12	6.8	0.26	2.4	1.9	1.6	ND (0.7)
Benzo(k)fluoranthene	70	NA	ND (0.11)	0.27	ND (0.11)	0.53	ND (0.12)	ND (0.12)	0.95	0.4	ND (0.17)	1	0.38	ND (0.12)	0.31	0.25	0.44	2.1	2.5	0.14	1.5	1	0.94	ND (0.53)
Biphenyl	0.05	NA	ND (0.037)	ND (0.04)	ND (0.038)	ND (0.038)	ND (0.041)	ND (0.041)	**0.062**	ND (0.039)	**ND (0.058)**	ND (0.035)	ND (0.038)	ND (0.04)	ND (0.035)	ND (0.037)	ND (0.038)	**1.1**	**1.2**	ND (0.041)	**ND (0.18)**	**ND (0.18)**	**ND (0.18)**	**ND (0.18)**
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.18)	ND (0.2)	ND (0.19)	0.27	ND (0.21)	ND (0.2)	**170**	6.9	1.6	2.6	ND (0.19)	ND (0.2)	4.4	0.38	0.65	2.8	ND (0.18)	ND (0.2)	4.4	2.6	5.3	ND (0.88)
Butyl benzylphthalate (BBP)	100	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	0.76	ND (0.19)	ND (0.29)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.2)	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Chrysene	70	NA	0.12	0.7	ND (0.11)	1.2	0.24	ND (0.12)	2.7	1.7	ND (0.17)	3.3	1.3	ND (0.12)	0.9	0.56	1.3	17	13	0.41	3.7	2.8	2.6	ND (0.53)
Dibenz(a,h)anthracene	0.7	NA	ND (0.077)	ND (0.084)	ND (0.08)	0.16	ND (0.087)	ND (0.086)	0.42	0.17	ND (0.12)	0.42	0.14	ND (0.085)	0.14	ND (0.078)	0.16	**1.2**	**1**	ND (0.086)	0.61	0.41	ND (0.37)	ND (0.37)
Dibenzofuran	100	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	0.29	ND (0.19)	ND (0.29)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	4	4.6	ND (0.2)	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Di-n-butylphthalate (DBP)	50	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.29)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.2)	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Fluoranthene	1000	NA	0.22	1.4	ND (0.11)	2.1	0.41	ND (0.12)	5.7	2.5	ND (0.17)	6.8	3.1	ND (0.12)	1.9	1.3	3	46	38	1.2	7	5.5	5	0.53
Fluorene	1000	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	0.41	0.21	ND (0.29)	0.4	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	12	11	0.3	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Indeno(1,2,3-cd)pyrene	7	NA	ND (0.15)	0.37	ND (0.15)	0.9	0.18	ND (0.16)	1.9	0.8	ND (0.23)	2.8	0.92	ND (0.16)	0.7	0.34	0.8	**13**	**7.1**	0.27	2.1	2	1.6	ND (0.7)
Naphthalene	4	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	0.36	ND (0.19)	ND (0.29)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	**16**	**15**	0.36	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Phenanthrene	10	NA	0.11	1.2	ND (0.11)	1.4	0.25	ND (0.12)	3.3	2.4	ND (0.17)	5.1	2.2	ND (0.12)	1	0.8	1.4	**64**	**60**	1.9	4.6	3.7	3.7	ND (0.53)
Phenol	1	NA	ND (0.18)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.21)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.29)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.2)	ND (0.88)	ND (0.88)	ND (0.89)	ND (0.88)
Pyrene	1000	NA	0.19	1.3	ND (0.11)	1.8	0.35	ND (0.12)	4.9	3.2	ND (0.17)	7	3.1	ND (0.12)	1.5	1	2.5	46	37	1.2	6.5	4.8	4.2	ND (0.53)
SUM of Semi-Volatile Organic Compounds	NA	NA	0.91	7.95	ND	13.8	2.46	ND	204.152	24.61	32.6	45.65	16.97	ND	14.9	6.87	15.6	340.46	279.38	8.56	46.85	36.02	34.14	0.53
Total Petroleum Hydrocarbons (mg/kg)																								
Petroleum hydrocarbons	1000	NA	121	627	ND (39)	756	246	ND (39.8)	928	**2780**	**1830**	616	214	ND (41.2)	255	346	489	**2450**	570	102	643	505	860	129
EPH (mg/kg)																								
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		500 Arsenal																				
Location Name			HA22-214(OW)	HA22-214(OW)	HA22-214(OW)	HA22-215(OW)	HA22-215(OW)	HA22-215(OW)	HA22-216(OW)	HA22-216(OW)	HA22-216(OW)	HA22-227	HA22-227	HA22-227	HA22-228	HA22-228	HA22-228	HA22-229	HA22-229	HA22-229	HA23-315	HA23-412	HA23-412	HA-TP01
Sample Name			HA22-214_0-5	HA22-214_5-13	HA22-214_13-15	HA22-215_0-5	HA22-215_5-8	HA22-215_8-13	HA22-216_0-5	HA22-216_5-10	HA22-216_10-14	HA22-227_0-5	HA22-227_5-8	HA22-227_8-13	HA22-228_0-5	HA22-228_5-10	HA22-228_10-16	HA22-229_0-5	HA22-229_5-8	HA22-229_8-13	HA23-315_0-5	HA23-412_0-4.0	HA23-412_4.0-7.5	HA-TP1_1-5
Sample Date	MCP Reportable		10/18/2022	10/18/2022	10/18/2022	10/17/2022	10/17/2022	10/17/2022	10/14/2022	10/14/2022	10/14/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	02/06/2023	07/17/2023	07/17/2023	02/24/2022
Lab Sample ID	Concentration	TCLP	L2258006-01	L2258006-02 L2258897-01	L2258006-03	L2257786-01	L2257786-02	L2257786-03	L2258144-01	L2257534-02 L2258144-02	L2257534-03 L2258144-03	L2260022-01	L2260022-02	L2260022-03	L2260022-07	L2260022-08	L2260022-09 L2260458-02	L2260022-04	L2260458-01	L2260022-06	L2306360-06 L2306970-02	L2340803-05	L2340803-06	L2209993-02
Sample Depth (bgs)	RCS-1		0 - 5 (ft)	5 - 13 (ft)	13 - 15 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 16 (ft)	0 - 5 (ft)	5 - 8 (ft)	8 - 13 (ft)	0 - 5 (ft)	0 - 4 (ft)	4 - 7.5 (ft)	1 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		25.7 to 20.7	20.7 to 12.7	12.7 to 10.7	29.3 to 24.3	24.3 to 21.3	21.3 to 16.3	26 to 21	21 to 16	16 to 12	26 to 21	21 to 18	18 to 13	23.9 to 18.9	18.9 to 13.9	13.9 to 7.9	26 to 21	21 to 18	18 to 13	29 to 24	29 to 25	25 to 21.5	27.5 to 23.5
Soil Description			FILL	FILL/ORGANICS	NATURAL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	III-2/II-5	I-1	I-3*	I-3*	I-3*	II-3	II-2	II-1	II-1	I-3*	I-2	I-3*	I-3*	I-3*	II-3	II-3	I-2*	II-1	II-1	II-1	I-3*
VPH (mg/kg)																								
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																								
Antimony	20	NA	ND (2.1)	**51.9**	ND (2.27)	ND (2.27)	ND (2.45)	ND (2.4)	**85.9**	ND (2.3)	ND (3.38)	ND (2.07)	ND (2.34)	ND (2.39)	ND (2.1)	ND (2.18)	ND (2.36)	ND (2.17)	ND (2.11)	ND (2.45)	ND (2.1)	ND (2.08)	ND (2.06)	ND (4.18)
Arsenic	20	NA	2.04	5.42	2.52	5.48	5.28	3.77	7.38	8.23	2.7	4.25	4.51	3.01	4.05	4.68	4.32	4.92	**34.3**	2.76	8.35	6.26	4.21	5.2
Barium	1000	NA	27.8	391	30.5	46.5	85.3	18	81.8	42.9	202	49.9	68.6	38.2	34.8	32.5	39.6	45.7	70.5	23.4	80.3	34.1	24.7	45.9
Beryllium	90	NA	ND (0.21)	0.244	ND (0.227)	0.303	0.432	0.268	0.539	0.365	ND (0.338)	0.381	0.484	0.835	0.32	0.42	0.38	0.5	0.468	0.288	0.38	ND (0.208)	ND (0.206)	ND (0.418)
Cadmium	70	NA	ND (0.42)	1.17	ND (0.454)	0.73	ND (0.49)	ND (0.481)	0.462	ND (0.46)	ND (0.676)	ND (0.414)	ND (0.468)	ND (0.478)	ND (0.42)	ND (0.436)	ND (0.472)	ND (0.434)	0.727	ND (0.489)	0.789	ND (0.417)	ND (0.412)	ND (0.836)
Chromium	100	NA	9.44	19.7	15.2	19.5	11.4	8.96	14.5	13.4	3.84	12.5	18.3	23.8	10.6	15.7	33.4	16.1	14.4	9.29	16.8	13	13.9	13.4
Lead	200	NA	8.1	**3020**	10.4	84.5	89.1	3.38	**235**	126	**259**	81	55	8.85	53.3	22.3	108	45.6	**807**	19.1	193	80.2	52.1	17.7
Mercury	20	NA	ND (0.075)	0.106	ND (0.074)	0.202	0.229	ND (0.081)	0.252	0.33	ND (0.131)	0.201	0.162	ND (0.087)	ND (0.079)	ND (0.082)	0.207	0.97	0.173	ND (0.089)	0.243	0.127	0.15	ND (0.071)
Nickel	600	NA	12	31	11.2	10.1	6.91	6.28	15.8	13.2	2.74	9.33	10.8	14.7	8.95	10	12.2	11.8	10	6.6	14.2	11.7	12.5	9.82
Selenium	400	NA	ND (2.1)	ND (2.3)	ND (2.27)	ND (2.27)	ND (2.45)	ND (2.4)	ND (2.21)	ND (2.3)	ND (3.38)	ND (2.07)	ND (2.34)	ND (2.39)	ND (2.1)	ND (2.18)	ND (2.36)	ND (2.17)	ND (2.11)	ND (2.45)	ND (2.1)	ND (2.08)	ND (2.06)	ND (4.18)
Silver	100	NA	ND (0.42)	ND (0.46)	ND (0.454)	ND (0.455)	ND (0.49)	ND (0.481)	ND (0.443)	ND (0.46)	ND (0.676)	ND (0.414)	ND (0.468)	ND (0.478)	ND (0.42)	ND (0.436)	ND (0.472)	ND (0.434)	ND (0.422)	ND (0.489)	ND (0.42)	ND (0.417)	ND (0.412)	ND (0.836)
Thallium	8	NA	ND (2.1)	ND (2.3)	ND (2.27)	ND (2.27)	ND (2.45)	ND (2.4)	ND (2.21)	ND (2.3)	ND (3.38)	ND (2.07)	ND (2.34)	ND (2.39)	ND (2.1)	ND (2.18)	ND (2.36)	ND (2.17)	ND (2.11)	ND (2.45)	ND (2.1)	ND (2.08)	ND (2.06)	ND (4.18)
Vanadium	400	NA	13.3	24.7	23.6	19.8	13.9	13	18.9	11.8	9.19	18.3	19.8	35.1	16.9	22.6	19.6	27.3	17.1	12.2	26.3	26.2	22.6	21.2
Zinc	1000	NA	42.6	775	34.7	73.4	36.2	14.2	227	80.6	175	138	124	33.6	87.5	55.4	81.9	126	229	35.3	143	90.1	56.6	51.6
TCLP Inorganic Compounds (mg/L)																								
Lead	NA	5	-	**38.1**	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	-	-	-	-	-	ND (0.5)	-	1.44	-	ND (0.5)	-	-	-
PCBs (mg/kg)																								
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	0.0484	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	0.0661	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1260 (PCB-1260)	1	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	0.538	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	0.105	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	0.261	0.185	ND (0.0349)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	0.292	0.12	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0366)	ND (0.0393)	ND (0.0382)	ND (0.0377)	ND (0.0401)	ND (0.0387)	ND (0.188)	ND (0.0562)	ND (0.0564)	ND (0.0354)	ND (0.037)	ND (0.0406)	ND (0.0348)	ND (0.0369)	ND (0.038)	ND (0.0369)	ND (0.0354)	ND (0.0402)	ND (0.0348)	ND (0.0509)	ND (0.0506)	ND (0.0349)
SUM of PCBs	1	NA	ND	ND	ND	0.1145	ND	ND	0.538	ND	ND	ND	ND	ND	0.292	0.12	0.105	ND	ND	ND	ND	0.261	0.185	ND
Other																								
Total Solids (%)	NA	NA	90	82.2	85.2	86.3	79.3	81	87.3	85.1	56.6	92.2	84.8	80.1	92.7	88.3	84.4	88.8	91.3	80.2	92.3	92.8	92.5	92.4
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	8.6	7.1	6.5	11.4	9.8	8.2	8.9	9.9	7	8.4	10.2	7.3	8.9	10.7	8.1	8.4	8.8	9.1	10.4	8.26	8.29	8.9
Conductivity (umhos/cm)	NA	NA	67	90	54	510	170	50	150	150	330	330	340	120	270	320	210	150	140	100	270	180	150	110

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		500 Arsenal		550 Arsenal																		
Location Name			HA-TP02	HA-TP03	HA22-01	HA22-02	HA22-03	HA22-04	HA22-05	HA22-06	HA22-07	HA22-08	HA22-09	HA22-10	HA22-201	HA22-201	HA22-201	HA22-202	HA22-202	HA22-202	HA22-203	HA22-203	HA22-203	HA22-204	HA22-204
Sample Name			HA-TP2_1-5	HA-TP3_1-5	HA22-01_1-5	HA22-02_0-5	HA22-03_1-5	HA22-04_1-5	HA22-05_1-5	HA22-06_1-5	HA22-07_1-5	HA22-08_1-5	HA22-09_1-5	HA22-10_1-5	HA22-201_0-5	HA22-201_5-10	HA22-201_10-13	HA22-202_0-5	HA22-202_5-9	HA22-202_10-15	HA22-203_0-5	HA22-203_5-10	HA22-203_10-15	HA22-204_0-5	HA22-204_5-10
Sample Date	MCP		02/23/2022	02/24/2022	02/01/2022	02/10/2022	02/03/2022	02/03/2022	02/02/2022	02/07/2022	02/07/2022	02/07/2022	02/14/2022	02/08/2022	10/04/2022	10/04/2022	10/04/2022	10/05/2022	10/05/2022	10/05/2022	10/06/2022	10/06/2022	10/06/2022	10/11/2022	10/11/2022
Lab Sample ID	Reportable Concentration	TCLP	L2209666-04	L2209993-01	L2205228-01 L2206042-01	L2207101-01 L2208093-01	L2205923-02 L2206211-02	L2205923-01 L2206211-01	L2205462-01	L2206290-03 L2206660-03	L2206290-01 L2206660-01	L2206290-02 L2206660-02	L2207756-01	L2206492-01	L2254771-01 L2256043-01	L2254771-02 L2256043-02	L2254771-03 L2256043-03	L2255129-01 L2256100-01	L2255129-02 L2256100-02	L2255129-03	L2255533-01	L2255533-02 L2256442-01	L2255533-03 L2256442-02	L2256559-01 L2257361-01	L2256559-02 L2257361-02
Sample Depth (bgs)	RCS-1		1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 13 (ft)	0 - 5 (ft)	5 - 9 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)
Sample Elevation (ft NAVD 88)	2014		26 to 22	26.5 to 22.5	26 to 22	27.5 to 22.5	20.5 to 16.5	21.3 to 17.3	24 to 20	23.5 to 19.5	22.5 to 18.5	22.2 to 18.2	21 to 17	21 to 17	25.8 to 20.8	20.8 to 15.8	15.8 to 12.8	22.1 to 17.1	17.1 to 13.1	12.1 to 7.1	22.8 to 17.8	17.8 to 12.8	12.8 to 7.799999	23.4 to 18.4	18.4 to 13.4
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			II-1	II-1	I-3	I-3*	II-1	II-2	I-3*	II-1	II-1	II-1	I-3*	I-3*	III-2/II-5	III-2/II-5	II-3	I-3*	II-1	I-3*	I-3*	II-1	II-1	II-1	II-1
Volatile Organic Compounds (mg/kg)																									
1,2,4-Trimethylbenzene	1000	NA	ND (0.0015)	ND (0.0012)	ND (0.0013)	ND (0.0015)	0.0034	ND (0.092)	ND (0.0015)	ND (0.0013)	ND (0.089)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.0023)	ND (0.0024)	ND (0.28)	ND (0.002)	ND (0.0021)	ND (0.0025)	ND (0.0024)	ND (0.0025)	0.0026	ND (0.0029)	ND (0.3)
1,3,5-Trimethylbenzene	10	NA	ND (0.0015)	ND (0.0012)	ND (0.0013)	ND (0.0015)	0.0022	ND (0.092)	ND (0.0015)	ND (0.0013)	ND (0.089)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.0023)	ND (0.0024)	ND (0.28)	ND (0.002)	ND (0.0021)	ND (0.0025)	ND (0.0024)	ND (0.0025)	ND (0.0022)	ND (0.0029)	ND (0.3)
1,4-Dichlorobenzene	0.7	NA	ND (0.0015)	ND (0.0012)	ND (0.0013)	ND (0.0015)	ND (0.0021)	ND (0.092)	ND (0.0015)	ND (0.0013)	ND (0.089)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.0023)	ND (0.0024)	ND (0.28)	ND (0.002)	ND (0.0021)	ND (0.0025)	ND (0.0024)	ND (0.0025)	ND (0.0022)	ND (0.0029)	ND (0.3)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.0076)	ND (0.0063)	ND (0.0066)	ND (0.0077)	ND (0.01)	ND (0.46)	ND (0.0077)	ND (0.0066)	ND (0.45)	ND (0.0068)	ND (0.0062)	ND (0.0063)	ND (0.012)	ND (0.012)	ND (1.4)	ND (0.01)	ND (0.011)	ND (0.013)	ND (0.012)	ND (0.012)	ND (0.011)	0.02	ND (1.5)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
Acetone	6	NA	ND (0.019)	ND (0.016)	ND (0.016)	ND (0.019)	ND (0.026)	ND (0.46)	0.036	0.024	ND (0.45)	ND (0.017)	ND (0.016)	ND (0.016)	0.041	ND (0.031)	ND (1.4)	ND (0.026)	ND (0.027)	ND (0.032)	ND (0.03)	0.034	ND (0.028)	0.083	ND (1.5)
Benzene	2	NA	ND (0.00038)	ND (0.00031)	ND (0.00033)	ND (0.00038)	0.0014	ND (0.023)	ND (0.00039)	0.00034	ND (0.022)	ND (0.00034)	ND (0.00031)	ND (0.00031)	ND (0.00058)	ND (0.00061)	ND (0.071)	ND (0.00051)	ND (0.00054)	0.0007	ND (0.00059)	ND (0.00063)	ND (0.00056)	0.00084	ND (0.075)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0011)	ND (0.00094)	ND (0.00099)	ND (0.0012)	ND (0.0016)	ND (0.069)	ND (0.0012)	ND (0.001)	ND (0.067)	ND (0.001)	ND (0.00093)	ND (0.00094)	ND (0.0017)	ND (0.0018)	**ND (0.21)**	ND (0.0015)	ND (0.0016)	ND (0.0019)	ND (0.0018)	ND (0.0019)	ND (0.0017)	ND (0.0022)	**ND (0.22)**
cis-1,2-Dichloroethene	0.1	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	**0.4**	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	**ND (0.14)**	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	**ND (0.15)**
Cymene (p-Isopropyltoluene)	100	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	0.017	0.063	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	0.0034	0.19	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	0.0048	ND (0.0014)	0.22
Ethylbenzene	40	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	0.0013	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
Isopropylbenzene (Cumene)	1000	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	0.0021	0.0014	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
Naphthalene	4	NA	ND (0.0031)	ND (0.0025)	ND (0.0026)	ND (0.0031)	0.078	1.1	ND (0.0031)	0.003	0.74	0.0057	ND (0.0025)	ND (0.0025)	ND (0.0046)	0.0072	**5.9**	ND (0.0041)	0.013	0.02	ND (0.0047)	ND (0.005)	0.12	0.014	2.3
n-Butylbenzene	NA	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
n-Propylbenzene	100	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
Styrene	3	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	ND (0.001)	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.15)
Tetrachloroethene	1	NA	ND (0.00038)	ND (0.00031)	ND (0.00033)	ND (0.00038)	ND (0.00053)	**1.9**	ND (0.00039)	0.00054	ND (0.022)	ND (0.00034)	0.0078	0.00034	ND (0.00058)	ND (0.00061)	0.32	ND (0.00051)	ND (0.00054)	ND (0.00064)	ND (0.00059)	ND (0.00063)	ND (0.00056)	ND (0.00072)	ND (0.075)
Tetrahydrofuran	500	NA	ND (0.0031)	ND (0.0025)	ND (0.0026)	ND (0.0031)	ND (0.0042)	ND (0.18)	ND (0.0031)	ND (0.0026)	ND (0.18)	ND (0.0027)	ND (0.0025)	ND (0.0025)	ND (0.0046)	ND (0.0049)	ND (0.57)	ND (0.0041)	ND (0.0043)	ND (0.0051)	ND (0.0047)	ND (0.005)	ND (0.0044)	ND (0.0058)	ND (0.6)
Toluene	30	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	0.0017	0.054	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	ND (0.0011)	0.002	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.0014)	0.15
trans-1,2-Dichloroethene	1	NA	ND (0.0011)	ND (0.00094)	ND (0.00099)	ND (0.0012)	ND (0.0016)	0.67	ND (0.0012)	ND (0.001)	ND (0.067)	ND (0.001)	ND (0.00093)	ND (0.00094)	ND (0.0017)	ND (0.0018)	ND (0.21)	ND (0.0015)	ND (0.0016)	ND (0.0019)	ND (0.0018)	ND (0.0019)	ND (0.0017)	ND (0.0022)	ND (0.22)
Trichloroethene	0.3	NA	ND (0.00038)	ND (0.00031)	ND (0.00033)	ND (0.00038)	ND (0.00053)	0.27	ND (0.00039)	ND (0.00033)	ND (0.022)	ND (0.00034)	ND (0.00031)	ND (0.00031)	ND (0.00058)	ND (0.00061)	ND (0.071)	ND (0.00051)	ND (0.00054)	ND (0.00064)	ND (0.00059)	ND (0.00063)	ND (0.00056)	ND (0.00072)	ND (0.075)
Xylene (Total)	100	NA	ND (0.00076)	ND (0.00063)	ND (0.00066)	ND (0.00077)	0.0013	ND (0.046)	ND (0.00077)	ND (0.00066)	ND (0.045)	ND (0.00068)	ND (0.00062)	ND (0.00063)	ND (0.0012)	ND (0.0012)	ND (0.14)	ND (0.001)	0.0016	0.0067	ND (0.0012)	ND (0.0012)	0.0018	ND (0.0014)	ND (0.15)
SUM of Volatile Organic Compounds	NA	NA	ND	ND	ND	ND	0.105	4.457	0.036	0.02788	0.74	0.0057	0.0078	0.00034	0.041	0.0106	6.41	ND	0.0167	0.0321	ND	0.034	0.1292	0.11784	2.67
Semi-Volatile Organic Compounds (mg/kg)																									
2,4-Dimethylphenol	0.7	NA	ND (0.081)	ND (0.074)	ND (0.076)	ND (0.081)	ND (0.077)	0.14	ND (0.077)	ND (0.077)	**ND (0.79)**	ND (0.074)	ND (0.075)	ND (0.073)	ND (0.077)	ND (0.078)	**ND (0.82)**	ND (0.38)	ND (0.082)	ND (0.41)	ND (0.078)	ND (0.089)	ND (0.41)	ND (0.087)	ND (0.08)
2-Methylnaphthalene	0.7	NA	0.23	0.087	0.12	ND (0.081)	0.15	0.5	ND (0.077)	0.13	**ND (0.79)**	0.32	ND (0.075)	ND (0.073)	ND (0.077)	ND (0.078)	**1.4**	ND (0.38)	0.26	ND (0.41)	ND (0.078)	0.45	**0.76**	0.093	0.35
3&4-Methylphenol	NA	NA	ND (0.28)	ND (0.25)	ND (0.26)	ND (0.28)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.26)	ND (2.7)	ND (0.25)	ND (0.26)	ND (0.25)	ND (0.26)	ND (0.27)	ND (2.8)	ND (1.3)	ND (0.28)	ND (1.4)	ND (0.27)	ND (0.3)	ND (1.4)	ND (0.3)	ND (0.27)
Acenaphthene	4	NA	0.55	0.16	0.44	ND (0.15)	0.64	1.3	ND (0.15)	0.81	1.6	0.48	ND (0.14)	ND (0.14)	0.43	0.2	**6.6**	ND (0.72)	0.52	ND (0.79)	ND (0.15)	1.2	1.5	0.46	1.2
Acenaphthylene	1	NA	0.23	0.18	ND (0.14)	ND (0.15)	0.16	0.34	ND (0.15)	ND (0.15)	**ND (1.5)**	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.15)	**ND (1.6)**	ND (0.72)	0.64	ND (0.79)	ND (0.15)	0.32	ND (0.79)	ND (0.17)	0.2
Aniline	1000	NA	ND (0.23)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.22)	ND (2.3)	ND (0.21)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.22)	ND (2.4)	ND (1.1)	ND (0.23)	ND (1.2)	ND (0.22)	0.3	ND (1.2)	ND (0.25)	ND (0.23)
Anthracene	1000	NA	2	0.59	0.7	ND (0.12)	1.4	2.5	0.41	1.5	3.4	0.83	ND (0.11)	0.11	1.4	0.36	11	ND (0.54)	3.4	0.69	ND (0.11)	3.3	3	0.87	3.4
Benzo(a)anthracene	7	NA	4.2	2.1	1.9	0.34	2.8	5.6	1.1	2.9	**7**	1.5	0.13	0.35	2.2	0.73	**19**	0.85	**7.5**	1.3	0.12	6.1	3.7	1.5	6.4
Benzo(a)pyrene	2	NA	**3.8**	**2.3**	1.7	0.35	**2.8**	**4.3**	0.98	**2.9**	**6.4**	1.5	0.15	0.34	**2.1**	0.7	**16**	0.73	**6.5**	1.1	ND (0.15)	**4.7**	**2.8**	1.4	**6.9**
Benzo(b)fluoranthene	7	NA	4.4	2.7	2.3	0.46	3.2	5.6	1.3	3.3	**7**	1.8	0.18	0.44	2.4	0.85	**17**	0.89	**7.7**	1.2	0.15	5.9	3.4	1.5	**7.5**
Benzo(g,h,i)perylene	1000	NA	2.5	1.6	1.1	0.23	1.4	2.3	0.58	1.6	3	0.75	ND (0.14)	0.19	1.2	0.35	7.5	ND (0.72)	2.9	ND (0.79)	ND (0.15)	2.2	1.4	0.73	3.3
Benzo(k)fluoranthene	70	NA	1.7	0.99	0.59	0.17	1.1	1.1	0.35	1.2	2.9	0.62	ND (0.11)	0.12	0.8	0.22	7.5	ND (0.54)	2	ND (0.59)	ND (0.11)	1.5	1.2	0.56	2.5
Biphenyl	0.05	NA	**0.077**	ND (0.035)	ND (0.036)	ND (0.039)	0.042	**0.13**	ND (0.037)	ND (0.037)	**ND (0.38)**	**0.062**	ND (0.036)	ND (0.035)	ND (0.037)	ND (0.037)	**0.44**	**ND (0.18)**	ND (0.039)	**ND (0.2)**	ND (0.037)	**0.13**	**ND (0.2)**	ND (0.042)	**0.12**
bis(2-Ethylhexyl)phthalate	90	NA	6.1	1.1	0.9	ND (0.19)	2.1	3.9	0.72	0.18	ND (1.9)	1.2	ND (0.18)	ND (0.17)	0.3	ND (0.18)	3.7	ND (0.9)	9.7	6.5	ND (0.19)	ND (0.21)	2	0.37	0.47
Butyl benzylphthalate (BBP)	100	NA	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.19)	0.76	ND (0.18)	ND (0.18)	ND (0.18)	ND (1.9)	ND (0.18)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.18)	ND (2)	ND (0.9)	1.1	1.6	ND (0.19)	ND (0.21)	1.6	ND (0.21)	ND (0.19)
Chrysene	70	NA	4.2	2.3	2	0.37	2.6	4.6	1.1	2.8	6.4	1.4	0.13	0.39	2.1	0.65	17	0.86	6.6	1.4	0.12	5.6	3.4	1.3	6.2
Dibenz(a,h)anthracene	0.7	NA	**0.72**	0.37	0.23	ND (0.081)	0.34	0.63	0.14	0.34	**ND (0.79)**	0.18	ND (0.075)	ND (0.073)	0.26	0.09	**2**	ND (0.38)	**0.82**	ND (0.41)	ND (0.078)	0.56	ND (0.41)	0.17	**0.81**
Dibenzofuran	100	NA	0.54	ND (0.18)	0.18	ND (0.19)	0.37	0.87	ND (0.18)	0.4	ND (1.9)	0.34	ND (0.18)	ND (0.17)	0.4	ND (0.18)	4.2	ND (0.9)	0.36	ND (0.98)	ND (0.19)	1.1	1.4	0.29	0.9
Di-n-butylphthalate (DBP)	50	NA	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (1.9)	ND (0.18)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.18)	ND (2)	ND (0.9)	ND (0.2)	ND (0.98)	ND (0.19)	ND (0.21)	ND (0.98)	ND (0.21)	ND (0.19)
Fluoranthene	1000	NA	6.9	3.5	3.7	0.74	7.1	15	2.1	7.1	15	3.8	0.27	0.64	5.4	1.8	41	1.7	15	3	0.18	16	10	3.8	16
Fluorene	1000	NA	0.81	ND (0.18)	0.32	ND (0.19)	0.74	1.5	ND (0.18)	0.86	1.9	0.51	ND (0.18)	ND (0.17)	0.64	0.18	6.7	ND (0.9)	0.85	ND (0.98)	ND (0.19)	1.7	2	0.6	1.5
Indeno(1,2,3-cd)pyrene	7	NA	2.9	1.7	1.2	0.26	1.7	2.8	0.66	2	3.7	0.86	ND (0.14)	0.21	1.4	0.43	**9.3**	ND (0.72)	3.7	ND (0.79)	ND (0.15)	2.8	1.8	0.85	4.1
Naphthalene	4	NA	0.46	0.25	0.21	ND (0.19)	0.25	1.2	ND (0.18)	0.21	ND (1.9)	0.43	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.18)	3.6	ND (0.9)	0.78	ND (0.98)	ND (0.19)	1.1	1.6	ND (0.21)	0.8
Phenanthrene	10	NA	6.4	1.8	2.5	0.4	5.1	**11**	1.2	5.6	**12**	3.3	0.15	0.37	5.4	1.3	**36**	1.4	9.7	2.9	ND (0.11)	**12**	**11**	3	**12**
Phenol	1	NA	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	**ND (1.9)**	ND (0.18)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.18)	**ND (2)**	ND (0.9)	ND (0.2)	ND (0.98)	ND (0.19)	ND (0.21)	ND (0.98)	ND (0.21)	ND (0.19)
Pyrene	1000	NA	5.9	3.1	3.4	0.61	5.8	12	1.9	5.9	12	3.1	0.22	0.63	4.5	1.4	32	1.4	12	2.9	0.16	12	8.1	3.2	13
SUM of Semi-Volatile Organic Compounds	NA	NA	54.617	24.827	23.49	3.93	40.552	77.31	12.54	39.73	82.3	22.982	1.23	3.79	30.93	9.26	241.94	7.83	92.03	22.59	0.73	78.96	60.66	20.693	87.65
Total Petroleum Hydrocarbons (mg/kg)																									
Petroleum hydrocarbons	1000	NA	339	123	287	104	**1220**	**1150**	285	270	**1610**	**1100**	ND (35.6)	133	606	125	**1290**	572	307	622	201	705	461	239	541
EPH (mg/kg)																									
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		500 Arsenal		550 Arsenal																			
Location Name			HA-TP02	HA-TP03	HA22-01	HA22-02	HA22-03	HA22-04	HA22-05	HA22-06	HA22-07	HA22-08	HA22-09	HA22-10	HA22-201	HA22-201	HA22-201	HA22-202	HA22-202	HA22-202	HA22-203	HA22-203	HA22-203	HA22-204	HA22-204
Sample Name			HA-TP2_1-5	HA-TP3_1-5	HA22-01_1-5	HA22-02_0-5	HA22-03_1-5	HA22-04_1-5	HA22-05_1-5	HA22-06_1-5	HA22-07_1-5	HA22-08_1-5	HA22-09_1-5	HA22-10_1-5	HA22-201_0-5	HA22-201_5-10	HA22-201_10-13	HA22-202_0-5	HA22-202_5-9	HA22-202_10-15	HA22-203_0-5	HA22-203_5-10	HA22-203_10-15	HA22-204_0-5	HA22-204_5-10
Sample Date	MCP		02/23/2022	02/24/2022	02/01/2022	02/10/2022	02/03/2022	02/03/2022	02/02/2022	02/07/2022	02/07/2022	02/07/2022	02/14/2022	02/08/2022	10/04/2022	10/04/2022	10/04/2022	10/05/2022	10/05/2022	10/05/2022	10/06/2022	10/06/2022	10/06/2022	10/11/2022	10/11/2022
	Reportable				L2205228-01	L2207101-01	L2205923-02	L2205923-01		L2206290-03	L2206290-01	L2206290-02			L2254771-01	L2254771-02	L2254771-03	L2255129-01	L2255129-02			L2255533-02	L2255533-03	L2256559-01	L2256559-02
Lab Sample ID	Concentration	TCLP	L2209666-04	L2209993-01	L2206042-01	L2208093-01	L2206211-02	L2206211-01	L2205462-01	L2206660-03	L2206660-01	L2206660-02	L2207756-01	L2206492-01	L2256043-01	L2256043-02	L2256043-03	L2256100-01	L2256100-02	L2255129-03	L2255533-01	L2256442-01	L2256442-02	L2257361-01	L2257361-02
Sample Depth (bgs)	RCS-1		1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 13 (ft)	0 - 5 (ft)	5 - 9 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)
Sample Elevation (ft NAVD 88)	2014		26 to 22	26.5 to 22.5	26 to 22	27.5 to 22.5	20.5 to 16.5	21.3 to 17.3	24 to 20	23.5 to 19.5	22.5 to 18.5	22.2 to 18.2	21 to 17	21 to 17	25.8 to 20.8	20.8 to 15.8	15.8 to 12.8	22.1 to 17.1	17.1 to 13.1	12.1 to 7.1	22.8 to 17.8	17.8 to 12.8	12.8 to 7.799999	23.4 to 18.4	18.4 to 13.4
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			II-1	II-1	I-3	I-3*	II-1	II-2	I-3*	II-1	II-1	II-1	I-3*	I-3*	III-2/II-5	III-2/II-5	II-3	I-3*	II-1	I-3*	I-3*	II-1	II-1	II-1	II-1
VPH (mg/kg)																									
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																									
Antimony	20	NA	ND (2.25)	ND (2.04)	ND (2.06)	ND (2.28)	ND (2.14)	7.8	ND (2.14)	ND (2.18)	ND (2.22)	ND (2.03)	ND (2.16)	ND (2.04)	ND (2.24)	ND (2.16)	2.39	ND (2.17)	ND (2.24)	ND (2.28)	ND (2.21)	ND (2.5)	ND (2.37)	3.37	3.12
Arsenic	20	NA	3.96	2.8	5.44	8.8	4.62	3.51	2.71	4.62	5.05	8.24	2.39	3.25	4.76	3.62	6.87	5.02	3.34	3.25	5.46	8.28	5.78	5.16	6.05
Barium	1000	NA	65.7	38.1	72.9	47.9	82.5	107	62.7	83.6	91.7	59.5	32.8	26.9	185	161	332	53	81.6	42.8	32.7	112	94.9	210	145
Beryllium	90	NA	0.288	0.278	0.234	ND (0.228)	0.287	0.22	0.231	0.305	0.293	0.256	0.237	0.245	0.278	0.22	0.333	ND (0.217)	0.274	ND (0.228)	0.283	0.485	0.385	1.12	0.956
Cadmium	70	NA	ND (0.45)	0.47	0.871	0.611	ND (0.428)	6.8	ND (0.427)	ND (0.436)	ND (0.444)	ND (0.406)	ND (0.432)	ND (0.409)	1.28	1.6	2.98	ND (0.435)	1.53	ND (0.456)	ND (0.442)	1.15	0.969	1.84	1.01
Chromium	100	NA	16.4	14.2	19.4	15.3	12.2	10.6	9.93	13.3	19.3	15.9	10.3	13.4	18.6	11.1	17	15	14.2	10.9	39.4	17	20.1	16.8	13.4
Lead	200	NA	88.2	26.3	109	137	103	**231**	76.9	163	**348**	**204**	16.2	15.6	**533**	**1510**	**1120**	122	**361**	46	17.4	**224**	177	**233**	161
Mercury	20	NA	0.295	0.084	0.384	0.319	0.678	0.798	0.271	0.271	0.987	0.273	ND (0.071)	ND (0.069)	0.659	0.167	0.508	0.415	0.574	0.126	0.101	2.16	0.182	0.358	0.429
Nickel	600	NA	10.9	10.2	11.6	9.81	9.34	7.43	9.48	10.1	12.9	10.3	8.21	10.1	13.2	8.1	13	8.21	9.3	7.1	12.6	11.7	12.7	12.3	11.5
Selenium	400	NA	ND (2.25)	ND (2.04)	ND (2.06)	ND (2.28)	ND (2.14)	ND (2.12)	ND (2.14)	ND (2.18)	ND (2.22)	ND (2.03)	ND (2.16)	ND (2.04)	ND (2.24)	ND (2.16)	ND (2.31)	ND (2.17)	ND (2.24)	ND (2.28)	ND (2.21)	ND (2.5)	ND (2.37)	ND (2.39)	ND (2.2)
Silver	100	NA	ND (0.45)	ND (0.408)	ND (0.411)	ND (0.456)	ND (0.428)	ND (0.423)	ND (0.427)	ND (0.436)	ND (0.444)	ND (0.406)	ND (0.432)	ND (0.409)	ND (0.448)	ND (0.431)	ND (0.462)	ND (0.435)	ND (0.449)	ND (0.456)	ND (0.442)	ND (0.5)	ND (0.475)	ND (0.478)	ND (0.44)
Thallium	8	NA	ND (2.25)	ND (2.04)	ND (2.06)	ND (2.28)	ND (2.14)	ND (2.12)	ND (2.14)	ND (2.18)	ND (2.22)	ND (2.03)	ND (2.16)	ND (2.04)	ND (2.24)	ND (2.16)	ND (2.31)	ND (2.17)	ND (2.24)	ND (2.28)	ND (2.21)	ND (2.5)	ND (2.37)	ND (2.39)	ND (2.2)
Vanadium	400	NA	21.3	21.5	20.2	18.8	19.5	15.9	21.1	18.2	17.9	20.5	13.5	18.6	20.2	13.1	20	17.4	17.7	17.6	19	24	25.7	21.2	20.7
Zinc	1000	NA	134	51.2	303	101	362	236	134	264	380	256	44.2	43.2	749	936	**2390**	154	529	88.6	45.1	740	417	**1050**	429
TCLP Inorganic Compounds (mg/L)																									
Lead	NA	5	-	-	0.977	0.523	ND (0.5)	ND (0.5)	-	0.769	ND (0.5)	ND (0.5)	-	-	**8.33**	**44.7**	ND (0.5)	0.623	1.46	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
PCBs (mg/kg)																									
Aroclor-1016 (PCB-1016)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	0.0709	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	0.0575	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	0.0482	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	0.0686	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	0.324
Aroclor-1260 (PCB-1260)	1	NA	ND (0.193)	0.0779	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	0.112	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	0.0746	0.0494	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1262 (PCB-1262)	NA	NA	1.74	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	0.4	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.193)	ND (0.0345)	ND (0.0342)	ND (0.0369)	ND (0.0369)	ND (0.0368)	ND (0.0357)	ND (0.0375)	ND (0.0379)	ND (0.0341)	ND (0.0352)	ND (0.0355)	ND (0.0376)	ND (0.0359)	ND (0.0374)	ND (0.036)	ND (0.0384)	ND (0.0374)	ND (0.0374)	ND (0.0411)	ND (0.0397)	ND (0.0412)	ND (0.0372)
SUM of PCBs	1	NA	**1.74**	0.0779	ND	ND	ND	0.4	ND	ND	0.2311	ND	ND	ND	ND	0.0746	0.1755	ND	ND	ND	ND	ND	ND	ND	0.324
Other																									
Total Solids (%)	NA	NA	85.4	92	91.6	86.1	88.8	88.9	90.4	88.3	87.4	93.5	90.7	93	88.4	88.9	84.4	90.5	84	84.2	87.1	77.7	82.6	78.7	85.4
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	7.8	8	8.2	6.8	10.9	9.3	8.2	8.4	8.4	9.7	10	9.7	8.6	8	11	8.8	8.8	11.3	9.6	8	10.8	10.7	11.4
Conductivity (umhos/cm)	NA	NA	40	72	300	19	360	200	170	160	170	160	69	160	160	170	330	160	70	390	780	340	260	190	340

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																			
Location Name			HA22-204	HA22-205	HA22-205	HA22-205	HA22-206	HA22-206	HA22-206	HA22-207	HA22-207	HA22-207	HA22-208	HA22-208	HA22-208	HA22-209	HA22-209	HA22-209	HA22-210	HA22-210	HA22-211	HA22-211	HA22-211	HA22-213
Sample Name			HA22-204_10-15	HA22-205_0-5	HA22-205_5-10	HA22-205_10-14.5	HA22-206_0-5	HA22-206_5-10	HA22-206_10-14	HA22-207_0-5	HA22-207_5-10	HA22-207_10-15	HA22-208_0-5	HA22-208_5-10	HA22-208_10-15	HA22-209_0-5	HA22-209_5-6.75	HA22-209_6.75-12	HA22-210_0-5	HA22-210_5-9	HA22-211_0-5	HA22-211_5-7	HA22-211_7-12	HA22-213-0-5
Sample Date	MCP		10/11/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/7/2022	10/7/2022	10/7/2022	10/3/2022	10/3/2022	10/3/2022	09/30/2022	09/30/2022	09/30/2022	09/29/2022	09/29/2022	09/29/2022	09/29/2022	09/29/2022	09/28/2022
Lab Sample ID	Reportable Concentration	TCLP	L2256559-03 L2257361-03	L2257163-01 L2257800-01	L2257163-02 L2257800-02	L2257163-03	L2257163-05 L2257800-03	L2257163-06 L2257800-04	L2257163-07 L2257800-05	L2255862-01 L2256691-01	L2255862-02 L2256691-02	L2255862-03 L2256691-03	L2254449-01	L2254449-02	L2254449-03 L2254449-04	L2254255-01	L2254255-02	L2254255-03	L2253869-04	L2253869-05	L2253869-01	L2253869-02	L2253869-03	L2253537-01
Sample Depth (bgs)	RCS-1		10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14.5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10.4 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5.6 - 6.8 (ft)	6.8 - 12 (ft)	0 - 5 (ft)	5 - 9 (ft)	0 - 5 (ft)	5 - 7 (ft)	7 - 12 (ft)	0 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		13.4 to 8.4	22.8 to 17.8	17.8 to 12.8	12.8 to 8.299999	24.2 to 19.2	19.2 to 14.2	13.8 to 10.2	24.5 to 19.5	19.5 to 14.5	14.5 to 9.5	21.7 to 16.7	16.7 to 11.7	11.7 to 6.700001	21.3 to 16.3	15.7 to 14.5	14.5 to 9.299999	20.8 to 15.8	15.8 to 11.8	23.3 to 18.3	18.3 to 16.3	16.3 to 11.3	22.5 to 17.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	NATURAL	FILL
Soil Disposal Classification			II-3	II-1	III-2/II-5	II-2	I-3	II-1	II-3	II-1	II-2	II-3	I-3	I-3	I-3	I-3*	I-3*	II-3	I-3*	I-3	I-3*	I-3*	I-2	I-3*
Volatile Organic Compounds (mg/kg)																								
1,2,4-Trimethylbenzene	1000	NA	0.0046	ND (0.0023)	ND (0.0022)	ND (0.002)	ND (0.0021)	ND (0.28)	ND (0.0032)	ND (0.0014)	ND (0.15)	ND (0.24)	ND (0.0022)	ND (0.0019)	ND (0.0026)	ND (0.002)	ND (0.002)	ND (0.26)	ND (0.0022)	ND (0.0019)	ND (0.0024)	0.0031	ND (0.0028)	ND (0.0022)
1,3,5-Trimethylbenzene	10	NA	ND (0.0023)	ND (0.0023)	ND (0.0022)	ND (0.002)	ND (0.0021)	ND (0.28)	ND (0.0032)	ND (0.0014)	ND (0.15)	ND (0.24)	ND (0.0022)	ND (0.0019)	ND (0.0026)	ND (0.002)	ND (0.002)	ND (0.26)	ND (0.0022)	ND (0.0019)	ND (0.0024)	ND (0.0022)	ND (0.0028)	ND (0.0022)
1,4-Dichlorobenzene	0.7	NA	ND (0.0023)	ND (0.0023)	ND (0.0022)	ND (0.002)	ND (0.0021)	ND (0.28)	ND (0.0032)	ND (0.0014)	ND (0.15)	ND (0.24)	ND (0.0022)	ND (0.0019)	ND (0.0026)	ND (0.002)	ND (0.002)	ND (0.26)	ND (0.0022)	ND (0.0019)	ND (0.0024)	ND (0.0022)	ND (0.0028)	ND (0.0022)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.011)	0.014	ND (0.011)	ND (0.01)	0.03	ND (1.4)	ND (0.016)	ND (0.0072)	ND (0.77)	ND (1.2)	ND (0.011)	ND (0.0095)	ND (0.013)	ND (0.01)	ND (0.0099)	ND (1.3)	ND (0.011)	ND (0.0094)	ND (0.012)	ND (0.011)	ND (0.014)	ND (0.011)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Acetone	6	NA	ND (0.029)	0.074	0.071	0.052	0.12	ND (1.4)	0.077	0.026	ND (0.77)	ND (1.2)	ND (0.028)	ND (0.024)	ND (0.033)	ND (0.026)	ND (0.025)	ND (1.3)	ND (0.027)	ND (0.024)	ND (0.03)	ND (0.028)	ND (0.035)	ND (0.028)
Benzene	2	NA	ND (0.00057)	0.00066	ND (0.00054)	ND (0.00051)	0.00058	ND (0.07)	ND (0.00081)	ND (0.00036)	ND (0.038)	ND (0.059)	ND (0.00056)	ND (0.00047)	ND (0.00066)	ND (0.00051)	ND (0.00049)	ND (0.066)	ND (0.00054)	ND (0.00047)	ND (0.0006)	ND (0.00056)	ND (0.0007)	ND (0.00056)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0017)	ND (0.0017)	ND (0.0016)	ND (0.0015)	ND (0.0016)	**ND (0.21)**	ND (0.0024)	ND (0.0011)	ND (0.12)	ND (0.18)	ND (0.0017)	ND (0.0014)	ND (0.002)	ND (0.0015)	ND (0.0015)	**ND (0.2)**	ND (0.0016)	ND (0.0014)	ND (0.0018)	ND (0.0017)	ND (0.0021)	ND (0.0017)
cis-1,2-Dichloroethene	0.1	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	**ND (0.14)**	ND (0.0016)	ND (0.00072)	ND (0.077)	**ND (0.12)**	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	**ND (0.13)**	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Cymene (p-Isopropyltoluene)	100	NA	0.034	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	0.19	0.0058	ND (0.00072)	ND (0.077)	0.24	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Ethylbenzene	40	NA	0.0017	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	0.12	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Isopropylbenzene (Cumene)	1000	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Naphthalene	4	NA	0.13	0.011	ND (0.0043)	ND (0.0041)	ND (0.0042)	3.5	0.12	0.013	**4.6**	3.8	ND (0.0045)	0.0083	ND (0.0052)	0.0055	ND (0.004)	**9.4**	ND (0.0044)	ND (0.0038)	0.0071	0.092	0.05	ND (0.0045)
n-Butylbenzene	NA	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	0.85	ND (0.0011)	ND (0.00094)	ND (0.0012)	0.0062	0.0037	ND (0.0011)
n-Propylbenzene	100	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Styrene	3	NA	ND (0.0011)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	0.12	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
Tetrachloroethene	1	NA	ND (0.00057)	ND (0.00058)	ND (0.00054)	ND (0.00051)	ND (0.00052)	0.084	ND (0.00081)	ND (0.00036)	0.17	ND (0.059)	ND (0.00056)	ND (0.00047)	ND (0.00066)	0.0031	ND (0.00049)	ND (0.066)	ND (0.00054)	ND (0.00047)	ND (0.0006)	ND (0.00056)	ND (0.0007)	ND (0.00056)
Tetrahydrofuran	500	NA	ND (0.0046)	ND (0.0046)	ND (0.0043)	ND (0.0041)	ND (0.0042)	ND (0.56)	ND (0.0065)	ND (0.0029)	ND (0.31)	ND (0.47)	ND (0.0045)	ND (0.0038)	ND (0.0052)	ND (0.0041)	ND (0.004)	ND (0.53)	ND (0.0044)	ND (0.0038)	ND (0.0048)	ND (0.0045)	ND (0.0056)	ND (0.0045)
Toluene	30	NA	0.0013	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
trans-1,2-Dichloroethene	1	NA	ND (0.0017)	ND (0.0017)	ND (0.0016)	ND (0.0015)	ND (0.0016)	ND (0.21)	ND (0.0024)	ND (0.0011)	ND (0.12)	ND (0.18)	ND (0.0017)	ND (0.0014)	ND (0.002)	ND (0.0015)	ND (0.0015)	ND (0.2)	ND (0.0016)	ND (0.0014)	ND (0.0018)	ND (0.0017)	ND (0.0021)	ND (0.0017)
Trichloroethene	0.3	NA	ND (0.00057)	ND (0.00058)	ND (0.00054)	ND (0.00051)	ND (0.00052)	ND (0.07)	ND (0.00081)	ND (0.00036)	ND (0.038)	ND (0.059)	ND (0.00056)	ND (0.00047)	ND (0.00066)	ND (0.00051)	ND (0.00049)	ND (0.066)	ND (0.00054)	ND (0.00047)	ND (0.0006)	ND (0.00056)	ND (0.0007)	ND (0.00056)
Xylene (Total)	100	NA	0.0038	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.14)	ND (0.0016)	ND (0.00072)	ND (0.077)	ND (0.12)	ND (0.0011)	ND (0.00095)	ND (0.0013)	ND (0.001)	ND (0.00099)	ND (0.13)	ND (0.0011)	ND (0.00094)	ND (0.0012)	ND (0.0011)	ND (0.0014)	ND (0.0011)
SUM of Volatile Organic Compounds	NA	NA	0.1754	0.09966	0.071	0.052	0.15058	3.774	0.2028	0.039	4.77	4.28	ND	0.0083	ND	0.0086	ND	10.25	ND	ND	0.0071	0.1013	0.0537	ND
Semi-Volatile Organic Compounds (mg/kg)																								
2,4-Dimethylphenol	0.7	NA	ND (0.088)	ND (0.074)	ND (0.076)	ND (0.09)	ND (0.083)	ND (0.079)	ND (0.079)	ND (0.076)	ND (0.076)	0.086	ND (0.075)	ND (0.077)	ND (0.075)	ND (0.075)	ND (0.077)	ND (0.081)	ND (0.081)	ND (0.075)	ND (0.072)	ND (0.076)	ND (0.08)	ND (0.076)
2-Methylnaphthalene	0.7	NA	0.52	0.18	ND (0.076)	ND (0.09)	ND (0.083)	0.17	**0.72**	0.34	0.33	0.61	ND (0.075)	ND (0.077)	ND (0.075)	ND (0.075)	ND (0.077)	0.16	ND (0.081)	ND (0.075)	ND (0.072)	ND (0.076)	ND (0.08)	ND (0.076)
3&4-Methylphenol	NA	NA	ND (0.3)	ND (0.25)	ND (0.26)	ND (0.31)	ND (0.29)	ND (0.27)	ND (0.27)	ND (0.26)	ND (0.26)	ND (0.28)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.28)	ND (0.28)	ND (0.26)	ND (0.25)	ND (0.26)	ND (0.28)	ND (0.26)
Acenaphthene	4	NA	2.2	0.98	ND (0.14)	ND (0.17)	0.21	0.56	**6.1**	1.5	1.2	2.6	ND (0.14)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.14)
Acenaphthylene	1	NA	0.24	0.17	ND (0.14)	ND (0.17)	ND (0.16)	0.34	0.51	0.28	0.18	0.32	ND (0.14)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.14)
Aniline	1000	NA	ND (0.25)	ND (0.21)	ND (0.22)	ND (0.26)	ND (0.24)	ND (0.23)	ND (0.22)	ND (0.22)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.22)	ND (0.23)	ND (0.23)	ND (0.21)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)
Anthracene	1000	NA	4.8	1.7	ND (0.11)	ND (0.13)	0.69	1.9	14	3.1	3.6	4.9	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.1)	ND (0.11)	ND (0.11)	ND (0.11)
Benzo(a)anthracene	7	NA	**7.9**	3.5	ND (0.11)	ND (0.13)	2	4.6	**21**	6.8	6.3	**9**	ND (0.11)	ND (0.11)	ND (0.11)	0.18	ND (0.11)	ND (0.12)	0.2	ND (0.11)	0.52	ND (0.11)	ND (0.11)	0.12
Benzo(a)pyrene	2	NA	**8**	**2.9**	ND (0.14)	ND (0.17)	1.8	**3.8**	**18**	**6**	**5.4**	**7.1**	ND (0.14)	ND (0.15)	ND (0.14)	0.15	ND (0.15)	ND (0.16)	0.16	ND (0.14)	0.52	ND (0.14)	ND (0.15)	ND (0.14)
Benzo(b)fluoranthene	7	NA	**8.2**	3.4	ND (0.11)	ND (0.13)	2.2	4.6	**20**	**8.4**	6.6	**8.8**	0.11	ND (0.11)	ND (0.11)	0.17	ND (0.11)	ND (0.12)	0.19	ND (0.11)	0.62	ND (0.11)	ND (0.11)	0.14
Benzo(g,h,i)perylene	1000	NA	3.7	1.6	ND (0.14)	ND (0.17)	1	2	9	3.1	2.8	3.6	ND (0.14)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.15)	ND (0.14)	0.24	ND (0.14)	ND (0.15)	ND (0.14)
Benzo(k)fluoranthene	70	NA	3.2	1.2	ND (0.11)	ND (0.13)	0.62	1.2	4	1.7	1.9	2.4	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.11)	0.18	ND (0.11)	ND (0.11)	ND (0.11)
Biphenyl	0.05	NA	**0.19**	0.044	ND (0.036)	ND (0.043)	ND (0.04)	0.048	**0.26**	**0.094**	**0.082**	**0.19**	ND (0.036)	ND (0.037)	ND (0.036)	ND (0.036)	ND (0.037)	ND (0.039)	ND (0.039)	ND (0.036)	ND (0.034)	ND (0.036)	ND (0.038)	ND (0.036)
bis(2-Ethylhexyl)phthalate	90	NA	2.4	0.37	ND (0.18)	ND (0.21)	0.26	0.21	2.2	1.6	0.44	2.2	ND (0.18)	ND (0.18)	ND (0.18)	0.57	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Butyl benzylphthalate (BBP)	100	NA	0.8	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.2)	ND (0.19)	0.43	ND (0.18)	ND (0.18)	0.71	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Chrysene	70	NA	7.5	3	ND (0.11)	0.14	2	4.3	20	5.9	5.6	7.3	ND (0.11)	ND (0.11)	ND (0.11)	0.17	ND (0.11)	ND (0.12)	0.18	ND (0.11)	0.44	ND (0.11)	ND (0.11)	0.13
Dibenz(a,h)anthracene	0.7	NA	**0.99**	0.38	ND (0.076)	ND (0.09)	0.24	0.49	**2.8**	0.39	0.66	0.52	ND (0.075)	ND (0.077)	ND (0.075)	ND (0.075)	ND (0.077)	ND (0.081)	ND (0.081)	ND (0.075)	ND (0.072)	ND (0.076)	ND (0.08)	ND (0.076)
Dibenzofuran	100	NA	1.5	0.57	ND (0.18)	ND (0.21)	ND (0.2)	0.39	4.2	1.1	0.8	1.7	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Di-n-butylphthalate (DBP)	50	NA	ND (0.21)	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.2)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Fluoranthene	1000	NA	19	7.2	0.15	0.22	4.4	8.8	54	18	14	19	ND (0.11)	ND (0.11)	ND (0.11)	0.36	ND (0.11)	ND (0.12)	0.38	ND (0.11)	0.93	ND (0.11)	ND (0.11)	0.24
Fluorene	1000	NA	2.4	0.88	ND (0.18)	ND (0.21)	0.27	0.73	8	1.9	1.6	2.8	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Indeno(1,2,3-cd)pyrene	7	NA	4.6	2	ND (0.14)	ND (0.17)	1.2	2.4	**10**	4	3.5	4.6	ND (0.14)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.15)	ND (0.14)	0.28	ND (0.14)	ND (0.15)	ND (0.14)
Naphthalene	4	NA	1.1	0.42	ND (0.18)	ND (0.21)	ND (0.2)	0.39	0.99	0.49	0.78	1.5	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	0.45	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Phenanthrene	10	NA	**16**	6.9	0.14	0.2	2	5.4	**47**	**13**	**13**	**18**	ND (0.11)	ND (0.11)	ND (0.11)	0.2	ND (0.11)	ND (0.12)	0.18	ND (0.11)	0.32	ND (0.11)	ND (0.11)	0.28
Phenol	1	NA	ND (0.21)	ND (0.18)	ND (0.18)	ND (0.21)	ND (0.2)	ND (0.19)	0.45	ND (0.18)	ND (0.18)	0.66	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)
Pyrene	1000	NA	15	5.7	0.12	0.18	3.5	7.3	43	14	11	15	ND (0.11)	ND (0.11)	ND (0.11)	0.32	ND (0.11)	ND (0.12)	0.34	ND (0.11)	0.82	ND (0.11)	ND (0.11)	0.2
SUM of Semi-Volatile Organic Compounds	NA	NA	110.24	43.094	0.41	0.74	22.39	49.628	286.66	91.694	79.772	113.596	0.11	ND	ND	2.12	ND	0.61	1.63	ND	4.87	ND	ND	1.11
Total Petroleum Hydrocarbons (mg/kg)																								
Petroleum hydrocarbons	1000	NA	**1170**	691	972	**2880**	702	868	**1230**	**2210**	**1160**	**1180**	160	42.5	ND (35.3)	47.3	ND (36.4)	ND (38.1)	65.4	223	ND (34.3)	ND (35.9)	ND (38)	690
EPH (mg/kg)																								
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																			
Location Name			HA22-204	HA22-205	HA22-205	HA22-205	HA22-206	HA22-206	HA22-206	HA22-207	HA22-207	HA22-207	HA22-208	HA22-208	HA22-208	HA22-209	HA22-209	HA22-209	HA22-210	HA22-210	HA22-211	HA22-211	HA22-211	HA22-213
Sample Name			HA22-204_10-15	HA22-205_0-5	HA22-205_5-10	HA22-205_10-14.5	HA22-206_0-5	HA22-206_5-10	HA22-206_10-14	HA22-207_0-5	HA22-207_5-10	HA22-207_10-15	HA22-208_0-5	HA22-208_5-10	HA22-208_10-15	HA22-209_0-5	HA22-209_5-6.75	HA22-209_6.75-12	HA22-210_0-5	HA22-210_5-9	HA22-211_0-5	HA22-211_5-7	HA22-211_7-12	HA22-213-0-5
Sample Date	MCP		10/11/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/13/2022	10/07/2022	10/07/2022	10/07/2022	10/03/2022	10/03/2022	10/03/2022	09/30/2022	09/30/2022	09/30/2022	09/29/2022	09/29/2022	09/29/2022	09/29/2022	09/29/2022	09/28/2022
Lab Sample ID	Reportable Concentration	TCLP	L2256559-03 L2257361-03	L2257163-01 L2257800-01	L2257163-02 L2257800-02	L2257163-03	L2257163-05 L2257800-03	L2257163-06 L2257800-04	L2257163-07 L2257800-05	L2255862-01 L2256691-01	L2255862-02 L2256691-02	L2255862-03 L2256691-03	L2254449-01	L2254449-02	L2254449-03	L2254255-01	L2254255-02	L2254255-03	L2253869-04	L2253869-05	L2253869-01	L2253869-02	L2253869-03	L2253537-01
Sample Depth (bgs)	RCS-1		10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14.5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10.4 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5.6 - 6.8 (ft)	6.8 - 12 (ft)	0 - 5 (ft)	5 - 9 (ft)	0 - 5 (ft)	5 - 7 (ft)	7 - 12 (ft)	0 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		13.4 to 8.4	22.8 to 17.8	17.8 to 12.8	12.8 to 8.299999	24.2 to 19.2	19.2 to 14.2	13.8 to 10.2	24.5 to 19.5	19.5 to 14.5	14.5 to 9.5	21.7 to 16.7	16.7 to 11.7	11.7 to 6.700001	21.3 to 16.3	15.7 to 14.5	14.5 to 9.299999	20.8 to 15.8	15.8 to 11.8	23.3 to 18.3	18.3 to 16.3	16.3 to 11.3	22.5 to 17.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL	NATURAL	FILL
Soil Disposal Classification			II-3	II-1	III-2/II-5	II-2	I-3	II-1	II-3	II-1	II-2	II-3	I-3	I-3	I-3	I-3*	I-3*	II-3	I-3*	I-3	I-3*	I-3*	I-2	I-3*
VPH (mg/kg)																								
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																								
Antimony	20	NA	2.74	2.14	3	3.18	2.85	2.65	3.62	ND (2.13)	ND (2.16)	ND (2.22)	ND (2.17)	ND (2.15)	ND (2.11)	ND (2.13)	ND (2.17)	ND (2.29)	ND (2.23)	ND (2.11)	ND (1.98)	ND (2.15)	ND (2.17)	ND (2.15)
Arsenic	20	NA	6.9	4.01	4.16	6.4	5.66	5.73	5.5	6.34	5.11	4.36	3.78	2.98	3.56	2.58	2.04	4.3	4.16	2.89	1.75	2.17	1.95	2.84
Barium	1000	NA	115	74.1	51.3	57.6	88.7	84.2	112	68.4	76.3	91.3	25.2	20.5	34.9	26.3	18.6	27	22.1	21.9	24.1	17.4	16	38.1
Beryllium	90	NA	0.938	1.15	1.33	1.34	1.4	1.58	1.34	0.379	0.371	0.402	0.276	ND (0.215)	0.273	ND (0.213)	ND (0.217)	0.279	0.295	0.286	0.249	0.224	0.235	ND (0.215)
Cadmium	70	NA	0.911	0.763	0.532	ND (0.471)	0.829	0.843	1.4	ND (0.426)	ND (0.432)	0.532	ND (0.434)	ND (0.431)	ND (0.421)	ND (0.426)	ND (0.435)	ND (0.457)	ND (0.446)	ND (0.421)	ND (0.396)	ND (0.431)	ND (0.435)	ND (0.43)
Chromium	100	NA	15.8	13.9	11.4	12.6	16	16.5	17.1	14.9	15	12.4	14.9	12.9	16.6	10.2	14.7	16.2	9.96	29.9	10.4	12.7	11.1	9.92
Lead	200	NA	123	**281**	133	90.6	140	128	176	168	102	172	18.7	6.97	5.89	11.6	9.4	6.38	10.4	6.87	9.03	6.74	5.87	13.5
Mercury	20	NA	0.545	0.398	0.199	0.351	0.318	0.679	1.74	2.12	0.241	0.163	ND (0.081)	ND (0.078)	ND (0.077)	0.109	ND (0.072)	ND (0.088)	ND (0.087)	ND (0.076)	ND (0.073)	ND (0.07)	ND (0.086)	0.247
Nickel	600	NA	12	14.5	9.69	10.8	13.8	12.9	13.8	10.6	10.9	10.2	15	12.9	14.9	9.84	9.27	11.2	8.37	13.1	8.31	8.87	8.22	7.53
Selenium	400	NA	ND (2.45)	ND (2.06)	ND (2.13)	ND (2.35)	ND (2.45)	ND (2.19)	ND (2.14)	ND (2.13)	ND (2.16)	ND (2.22)	ND (2.17)	ND (2.15)	ND (2.11)	ND (2.13)	ND (2.17)	ND (2.29)	ND (2.23)	ND (2.11)	ND (1.98)	ND (2.15)	ND (2.17)	ND (2.15)
Silver	100	NA	ND (0.489)	ND (0.412)	ND (0.427)	ND (0.471)	ND (0.49)	ND (0.438)	ND (0.427)	ND (0.426)	ND (0.432)	ND (0.445)	ND (0.434)	ND (0.431)	ND (0.421)	ND (0.426)	ND (0.435)	ND (0.457)	ND (0.446)	ND (0.421)	ND (0.396)	ND (0.431)	ND (0.435)	ND (0.432)
Thallium	8	NA	ND (2.45)	ND (2.06)	ND (2.13)	ND (2.35)	ND (2.45)	ND (2.19)	ND (2.14)	ND (2.13)	ND (2.16)	ND (2.22)	ND (2.17)	ND (2.15)	ND (2.11)	ND (2.13)	ND (2.17)	ND (2.29)	ND (2.23)	ND (2.11)	ND (1.98)	ND (2.15)	ND (2.17)	ND (2.15)
Vanadium	400	NA	22.1	20.9	23.9	21.2	30.1	25.8	27.5	21	33.2	17.6	21.1	20.4	26.3	18.5	19.5	20.4	15.3	28.2	20.3	19.5	17.8	26.7
Zinc	1000	NA	265	217	229	102	290	242	363	181	162	239	59.6	38.8	53.4	40.9	33.1	30.4	33	33.9	65.7	31.3	27.7	36.2
TCLP Inorganic Compounds (mg/L)																								
Lead	NA	5	ND (0.5)	0.709	**5.28**	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (mg/kg)																								
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	0.471	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1248 (PCB-1248)	1	NA	0.161	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1254 (PCB-1254)	1	NA	0.149	0.0637	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	0.0398	ND (0.0358)	0.0955	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1260 (PCB-1260)	1	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	0.0727
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0407)	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
Aroclor-1268 (PCB-1268)	NA	NA	0.223	ND (0.0358)	ND (0.0351)	ND (0.0368)	ND (0.0382)	ND (0.0364)	ND (0.0354)	ND (0.0354)	ND (0.0358)	ND (0.0368)	ND (0.0361)	ND (0.0357)	ND (0.0348)	ND (0.0357)	ND (0.0355)	ND (0.0385)	ND (0.0373)	ND (0.0346)	ND (0.0348)	ND (0.0362)	ND (0.0385)	ND (0.0349)
SUM of PCBs	1	NA	0.533	0.0637	ND	ND	ND	ND	ND	0.0398	ND	0.5665	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0727
Other																								
Total Solids (%)	NA	NA	78.5	93.1	91.5	86.5	83.8	86.7	88.7	89.9	90.1	85.7	90.5	90.4	91.7	90.4	90.3	83.4	85.6	91.7	95	90	86.5	90
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	11.5	8.2	7.8	10.4	8.3	8.1	11	8.6	10.4	10.3	8.3	8.8	8.4	9.3	9.1	7.9	9.1	7.3	9.2	9.2	8.1	9.3
Conductivity (umhos/cm)	NA	NA	320	270	74	150	190	170	300	240	260	180	72	44	51	130	78	96	110	150	110	100	81	140

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																				
Location Name			HA22-213	HA22-213	HA22-220	HA22-220	HA22-220	HA22-221	HA22-221	HA22-221	HA22-222	HA22-222	HA22-222	HA22-223	HA22-223	HA22-223	HA22-224	HA22-224	HA22-224	HA22-224	HA22-225	HA22-226	HA22-226	HA22-226
Sample Name			HA22_213-5-7	HA22-213-7-12	HA22-220_0-5	HA22-220_5-10	HA22-220_10-13	HA22-221_0-5	HA22-221_5-10	HA22-221_10-14	HA22-222_0-5	HA22-222_5-10	HA22-222_10-14	HA22-223_0-5	HA22-223_5-10	HA22-223_10-15	HA22-224_0-5	HA22-224_5-10	HA22-224_10-17	HA22-224_17-20	HA22-225_0-5	HA22-226_0-5	HA22-226_5-10	HA22-226_10-16
Sample Date	MCP		09/28/2022	09/28/2022	10/27/2022	10/27/2022	10/27/2022	10/26/2022	10/26/2022	10/26/2022	10/27/2022	10/27/2022	10/28/2022	10/27/2022	10/27/2022	10/27/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/27/2022	10/27/2022	10/27/2022	10/27/2022
	Reportable				L2260338-10	L2260338-11	L2260338-12	L2260022-10	L2260022-11	L2260022-12	L2260338-14	L2260338-15	L2260559-01		L2260338-07	L2260338-08	L2260022-13	L2260022-14	L2260022-15		L2260338-01	L2260338-02	L2260338-03	
Lab Sample ID	Concentration	TCLP	L2253537-02	L2253537-03	L2260796-06	L2260796-07	L2260796-08	L2260458-04	L2260458-03	L2260458-06	L2260796-10	L2260796-09	L2261205-01	L2260338-06	L2260796-04	L2260796-05	L2260458-05	L2260458-07	L2260458-08	L2260022-16	L2260796-01	L2260796-02	L2260796-03	L2260338-04
Sample Depth (bgs)	RCS-1		5 - 7 (ft)	7 - 12 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 17 (ft)	17 - 20 (ft)	0 - 5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 16 (ft)
Sample Elevation (ft NAVD 88)	2014		17.5 to 15.5	15.5 to 10.5	28 to 23	23 to 18	18 to 15	25.3 to 20.3	20.3 to 15.3	15.3 to 11.3	22.8 to 17.8	17.8 to 12.8	12.8 to 8.799999	20.9 to 15.9	15.9 to 10.9	10.9 to 5.9	27.4 to 22.4	22.4 to 17.4	17.4 to 10.4	10.4 to 7.4	22.5 to 17.5	22 to 17	17 to 12	12 to 6
Soil Description			FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3*	II-2	III-2/II-5	III-2/II-5	II-1	III-2/II-5	II-2	II-1	II-1	II-1	II-1	I-3	II-1	I-3*	II-1	III-2/II-5	III-2/II-5	I-1	II-3	II-1	II-3	II-1
Volatile Organic Compounds (mg/kg)																								
1,2,4-Trimethylbenzene	1000	NA	ND (0.0023)	ND (0.0015)	ND (0.0019)	ND (0.0021)	ND (0.0022)	ND (0.0031)	ND (0.0025)	ND (0.0027)	ND (0.0024)	ND (0.0025)	ND (0.0019)	ND (0.002)	ND (0.0022)	ND (0.003)	ND (0.0026)	ND (0.0023)	ND (0.0025)	ND (0.0024)	ND (0.0027)	0.0034	ND (0.0013)	ND (0.0025)
1,3,5-Trimethylbenzene	10	NA	ND (0.0023)	ND (0.0015)	ND (0.0019)	ND (0.0021)	ND (0.0022)	ND (0.0031)	ND (0.0025)	ND (0.0027)	ND (0.0024)	ND (0.0025)	ND (0.0019)	ND (0.002)	ND (0.0022)	ND (0.003)	ND (0.0026)	ND (0.0023)	ND (0.0025)	ND (0.0024)	ND (0.0027)	ND (0.0026)	ND (0.0013)	ND (0.0025)
1,4-Dichlorobenzene	0.7	NA	ND (0.0023)	0.0048	ND (0.0019)	ND (0.0021)	ND (0.0022)	ND (0.0031)	ND (0.0025)	ND (0.0027)	ND (0.0024)	ND (0.0025)	ND (0.0019)	ND (0.002)	ND (0.0022)	ND (0.003)	ND (0.0026)	ND (0.0023)	ND (0.0025)	ND (0.0024)	ND (0.0027)	ND (0.0026)	ND (0.0013)	ND (0.0025)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.011)	ND (0.0075)	ND (0.0097)	ND (0.01)	ND (0.011)	ND (0.015)	ND (0.012)	ND (0.014)	ND (0.012)	ND (0.012)	ND (0.0095)	ND (0.01)	0.013	ND (0.015)	ND (0.013)	ND (0.012)	ND (0.012)	ND (0.012)	ND (0.013)	ND (0.013)	ND (0.0064)	ND (0.012)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Acetone	6	NA	ND (0.029)	ND (0.019)	ND (0.024)	0.027	0.028	0.046	0.051	0.037	0.034	0.041	0.046	0.03	0.087	0.047	ND (0.032)	ND (0.029)	ND (0.031)	ND (0.03)	0.052	ND (0.033)	0.022	0.046
Benzene	2	NA	ND (0.00057)	ND (0.00038)	ND (0.00049)	ND (0.00052)	ND (0.00055)	ND (0.066)	0.00086	0.00074	ND (0.0006)	ND (0.00063)	ND (0.00048)	ND (0.00051)	0.00098	0.0013	ND (0.00065)	ND (0.00058)	ND (0.00062)	ND (0.0006)	ND (0.00067)	ND (0.00065)	ND (0.00032)	ND (0.00062)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0017)	ND (0.0011)	ND (0.0015)	ND (0.0016)	ND (0.0016)	ND (0.0023)	ND (0.0019)	ND (0.002)	ND (0.0018)	ND (0.0019)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.0022)	ND (0.0019)	ND (0.0017)	ND (0.0019)	ND (0.0018)	ND (0.002)	ND (0.002)	ND (0.00095)	ND (0.0019)
cis-1,2-Dichloroethene	0.1	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	0.0038	0.0034	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	0.0052	0.002	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	0.0051	0.001	ND (0.0012)
Ethylbenzene	40	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	0.0026	0.0018	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	0.0052	0.0067	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Isopropylbenzene (Cumene)	1000	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	0.0064	0.0029	ND (0.0012)	0.0024	ND (0.00095)	ND (0.001)	0.0051	0.0052	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Naphthalene	4	NA	0.012	ND (0.003)	ND (0.0039)	ND (0.0042)	0.019	ND (0.0061)	0.012	0.0066	ND (0.0048)	ND (0.005)	0.0097	ND (0.004)	0.022	ND (0.0059)	ND (0.0052)	ND (0.0046)	ND (0.005)	ND (0.0048)	0.015	0.076	0.032	ND (0.005)
n-Butylbenzene	NA	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
n-Propylbenzene	100	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Styrene	3	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0012)	ND (0.0014)	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	ND (0.0011)	ND (0.0015)	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
Tetrachloroethene	1	NA	ND (0.00057)	ND (0.00038)	ND (0.00049)	ND (0.00052)	ND (0.00055)	ND (0.00076)	ND (0.00062)	ND (0.00068)	ND (0.0006)	ND (0.00063)	ND (0.00048)	ND (0.00051)	0.0012	0.00095	ND (0.00065)	ND (0.00058)	ND (0.00062)	ND (0.0006)	ND (0.00067)	ND (0.00065)	ND (0.00032)	ND (0.00062)
Tetrahydrofuran	500	NA	ND (0.0046)	ND (0.003)	ND (0.0039)	ND (0.0042)	ND (0.0044)	ND (0.0061)	ND (0.005)	ND (0.0054)	ND (0.0048)	ND (0.005)	ND (0.0038)	ND (0.004)	ND (0.0044)	0.018	ND (0.0052)	ND (0.0046)	ND (0.005)	ND (0.0048)	ND (0.0054)	ND (0.0052)	ND (0.0025)	ND (0.005)
Toluene	30	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	0.0025	0.0021	ND (0.0012)	ND (0.0012)	ND (0.00095)	ND (0.001)	0.0033	0.004	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	ND (0.0013)	ND (0.00064)	ND (0.0012)
trans-1,2-Dichloroethene	1	NA	ND (0.0017)	ND (0.0011)	ND (0.0015)	ND (0.0016)	ND (0.0016)	ND (0.0023)	ND (0.0019)	ND (0.002)	ND (0.0018)	ND (0.0019)	ND (0.0014)	ND (0.0015)	ND (0.0016)	ND (0.0022)	ND (0.0019)	ND (0.0017)	ND (0.0019)	ND (0.0018)	ND (0.002)	ND (0.002)	ND (0.00095)	ND (0.0019)
Trichloroethene	0.3	NA	ND (0.00057)	ND (0.00038)	ND (0.00049)	ND (0.00052)	ND (0.00055)	ND (0.00076)	ND (0.00062)	ND (0.00068)	ND (0.0006)	ND (0.00063)	ND (0.00048)	ND (0.00051)	ND (0.00055)	ND (0.00074)	ND (0.00065)	ND (0.00058)	ND (0.00062)	ND (0.0006)	ND (0.00067)	ND (0.00065)	ND (0.00032)	ND (0.00062)
Xylene (Total)	100	NA	ND (0.0011)	ND (0.00075)	ND (0.00097)	ND (0.001)	ND (0.0011)	ND (0.0015)	0.024	0.015	ND (0.0012)	0.0025	ND (0.00095)	ND (0.001)	0.028	0.023	ND (0.0013)	ND (0.0012)	ND (0.0012)	ND (0.0012)	ND (0.0013)	0.0015	ND (0.00064)	ND (0.0012)
SUM of Volatile Organic Compounds	NA	NA	0.012	0.0048	ND	0.027	0.047	0.046	0.10316	0.06954	0.034	0.0459	0.0557	0.03	0.17098	0.10815	ND	ND	ND	ND	0.067	0.086	0.055	0.046
Semi-Volatile Organic Compounds (mg/kg)																								
2,4-Dimethylphenol	0.7	NA	ND (0.077)	ND (0.072)	ND (0.077)	ND (0.078)	ND (0.075)	ND (0.076)	ND (0.079)	ND (0.078)	ND (0.073)	ND (0.078)	ND (0.081)	ND (0.076)	ND (0.4)	ND (0.078)	ND (0.074)	ND (0.077)	ND (0.076)	ND (0.078)	ND (0.39)	ND (0.076)	ND (0.39)	ND (0.078)
2-Methylnaphthalene	0.7	NA	ND (0.077)	ND (0.072)	0.091	0.22	ND (0.075)	0.091	0.088	0.17	ND (0.073)	0.22	0.17	ND (0.076)	0.57	0.092	ND (0.074)	ND (0.077)	ND (0.076)	ND (0.078)	**0.87**	0.2	**0.96**	0.43
3&4-Methylphenol	NA	NA	ND (0.26)	ND (0.25)	ND (0.26)	ND (0.27)	ND (0.26)	ND (0.26)	ND (0.27)	ND (0.27)	ND (0.25)	ND (0.26)	ND (0.28)	ND (0.26)	ND (1.4)	ND (0.27)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.27)	ND (1.3)	ND (0.26)	ND (1.3)	ND (0.27)
Acenaphthene	4	NA	ND (0.15)	ND (0.14)	0.36	0.62	0.31	0.3	0.26	0.3	0.15	0.74	0.88	0.16	ND (0.75)	ND (0.15)	ND (0.14)	0.45	0.14	ND (0.15)	3.1	0.5	2.3	0.87
Acenaphthylene	1	NA	ND (0.15)	ND (0.14)	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.14)	ND (0.15)	0.16	ND (0.14)	ND (0.15)	ND (0.16)	ND (0.14)	ND (0.75)	ND (0.15)	ND (0.14)	0.15	ND (0.14)	ND (0.15)	ND (0.75)	0.18	ND (0.74)	0.26
Aniline	1000	NA	ND (0.22)	ND (0.2)	ND (0.22)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)	ND (1.1)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.22)	ND (0.22)	ND (1.1)	ND (0.22)	ND (1.1)	ND (0.22)
Anthracene	1000	NA	ND (0.11)	ND (0.1)	0.52	1.2	0.54	0.59	2.5	1	0.3	1.4	1.6	0.47	ND (0.56)	0.34	0.16	2.6	0.29	ND (0.11)	6.4	1.1	4.5	1.9
Benzo(a)anthracene	7	NA	ND (0.11)	ND (0.1)	1.4	2.7	1.2	1.5	4.9	2.4	0.92	3.3	3.8	1.2	1.3	1.2	0.65	4.2	1.2	ND (0.11)	**11**	2.1	6.5	2.8
Benzo(a)pyrene	2	NA	ND (0.15)	ND (0.14)	1.6	**2.8**	1.4	1.3	**4.2**	1.7	1	**3.3**	**3.6**	1.3	1.5	1.3	0.46	**3.4**	1.1	ND (0.15)	**11**	**2.2**	**6.3**	**2.5**
Benzo(b)fluoranthene	7	NA	0.12	ND (0.1)	1.8	3.4	1.6	1.6	5.2	2	1.2	4	4.7	1.5	1.7	1.5	0.59	3.7	1.4	ND (0.11)	**13**	2.6	**7.5**	3
Benzo(g,h,i)perylene	1000	NA	ND (0.15)	ND (0.14)	0.68	1.2	0.76	0.84	2.1	0.93	0.54	1.8	2	0.51	ND (0.75)	0.52	0.33	1.8	0.65	ND (0.15)	5	0.98	2.8	1.4
Benzo(k)fluoranthene	70	NA	ND (0.11)	ND (0.1)	0.7	1.1	0.48	0.44	1.2	0.45	0.44	1.3	1.1	0.58	0.57	0.57	0.22	1.2	0.35	ND (0.11)	4.4	0.85	2.5	0.9
Biphenyl	0.05	NA	ND (0.036)	ND (0.034)	ND (0.037)	**0.071**	ND (0.036)	ND (0.036)	ND (0.038)	0.043	ND (0.035)	0.04	0.046	ND (0.036)	**ND (0.19)**	ND (0.037)	ND (0.035)	ND (0.037)	ND (0.036)	ND (0.037)	**0.24**	**0.064**	**0.26**	**0.094**
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.18)	ND (0.17)	1.5	2.3	0.33	0.61	5.3	7.3	ND (0.17)	1.4	1.9	2.6	11	2.5	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	3.8	4.5	3.4	11
Butyl benzylphthalate (BBP)	100	NA	ND (0.18)	ND (0.17)	ND (0.18)	5.3	ND (0.18)	ND (0.18)	1.5	1	ND (0.17)	0.18	0.68	ND (0.18)	ND (0.94)	0.33	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.93)	ND (0.18)	ND (0.93)	ND (0.19)
Chrysene	70	NA	ND (0.11)	ND (0.1)	1.4	2.7	1.2	1.3	4.5	2.1	0.9	3.2	3.6	1.2	1.3	1.2	0.52	3.8	1.3	ND (0.11)	11	2	6.2	2.5
Dibenz(a,h)anthracene	0.7	NA	ND (0.077)	ND (0.072)	0.16	0.29	0.18	0.19	0.51	0.22	0.15	0.45	0.52	0.14	ND (0.4)	0.14	0.084	0.41	0.16	ND (0.078)	**1.3**	0.25	**0.74**	0.37
Dibenzofuran	100	NA	ND (0.18)	ND (0.17)	ND (0.18)	0.43	0.22	0.18	0.2	ND (0.19)	ND (0.17)	0.38	0.43	ND (0.18)	ND (0.94)	ND (0.18)	ND (0.18)	0.32	ND (0.18)	ND (0.19)	2.2	0.46	2	0.68
Di-n-butylphthalate (DBP)	50	NA	ND (0.18)	ND (0.17)	ND (0.18)	0.25	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.94)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.93)	ND (0.18)	ND (0.93)	ND (0.19)
Fluoranthene	1000	NA	0.14	ND (0.1)	2.9	5.6	2.8	3.6	16	4.3	1.9	10	10	2.4	2.5	2.2	1.3	14	2.1	ND (0.11)	27	4.6	17	7
Fluorene	1000	NA	ND (0.18)	ND (0.17)	0.2	0.75	0.34	0.29	0.48	0.39	ND (0.17)	0.78	0.84	ND (0.18)	ND (0.94)	ND (0.18)	ND (0.18)	0.63	ND (0.18)	ND (0.19)	3.5	0.59	3.3	1.4
Indeno(1,2,3-cd)pyrene	7	NA	ND (0.15)	ND (0.14)	0.8	1.4	0.88	0.97	2.6	1	0.63	2.1	2.5	0.63	0.87	0.66	0.38	2.1	0.7	ND (0.15)	6.1	1.2	3.5	1.6
Naphthalene	4	NA	ND (0.18)	ND (0.17)	ND (0.18)	0.38	ND (0.18)	0.29	0.26	0.6	ND (0.17)	0.32	0.33	ND (0.18)	1.1	0.21	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	2.7	0.4	1.7	0.68
Phenanthrene	10	NA	ND (0.11)	ND (0.1)	1.8	4.1	1.7	2.5	6.8	3.9	1.1	5.3	6.2	0.82	2.1	1.2	0.58	**11**	1.6	ND (0.11)	**21**	3.9	**17**	6.8
Phenol	1	NA	ND (0.18)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.19)	ND (0.17)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.94)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.93)	ND (0.18)	ND (0.93)	ND (0.19)
Pyrene	1000	NA	0.13	0.15	2.5	4.9	2.5	3	12	4.2	1.6	6.3	7.6	2.1	2.3	1.8	1.1	12	2.4	ND (0.11)	23	3.9	13	5.8
SUM of Semi-Volatile Organic Compounds	NA	NA	0.39	0.15	18.411	41.711	16.44	19.591	70.598	34.163	10.83	46.51	52.496	15.61	26.81	15.762	6.374	61.76	13.39	ND	156.61	32.574	101.46	51.984
Total Petroleum Hydrocarbons (mg/kg)																								
Petroleum hydrocarbons	1000	NA	524	**4640**	**1030**	388	523	296	**2900**	**1130**	114	592	667	429	588	274	232	148	186	ND (35.8)	956	323	**1140**	579
EPH (mg/kg)																								
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																			
Location Name			HA22-213	HA22-213	HA22-220	HA22-220	HA22-220	HA22-221	HA22-221	HA22-221	HA22-222	HA22-222	HA22-222	HA22-223	HA22-223	HA22-223	HA22-224	HA22-224	HA22-224	HA22-224	HA22-225	HA22-226	HA22-226	HA22-226
Sample Name			HA22_213-5-7	HA22-213-7-12	HA22-220_0-5	HA22-220_5-10	HA22-220_10-13	HA22-221_0-5	HA22-221_5-10	HA22-221_10-14	HA22-222_0-5	HA22-222_5-10	HA22-222_10-14	HA22-223_0-5	HA22-223_5-10	HA22-223_10-15	HA22-224_0-5	HA22-224_5-10	HA22-224_10-17	HA22-224_17-20	HA22-225_0-5	HA22-226_0-5	HA22-226_5-10	HA22-226_10-16
Sample Date	MCP		09/28/2022	09/28/2022	10/27/2022	10/27/2022	10/27/2022	10/26/2022	10/26/2022	10/26/2022	10/27/2022	10/27/2022	10/28/2022	10/27/2022	10/27/2022	10/27/2022	10/26/2022	10/26/2022	10/26/2022	10/26/2022	10/27/2022	10/27/2022	10/27/2022	10/27/2022
	Reportable				L2260338-10	L2260338-11	L2260338-12	L2260022-10	L2260022-11	L2260022-12	L2260338-14	L2260338-15	L2260559-01		L2260338-07	L2260338-08	L2260022-13	L2260022-14	L2260022-15		L2260338-01	L2260338-02	L2260338-03	
Lab Sample ID	Concentration	TCLP	L2253537-02	L2253537-03	L2260796-06	L2260796-07	L2260796-08	L2260458-04	L2260458-03	L2260458-06	L2260796-10	L2260796-09	L2261205-01	L2260338-06	L2260796-04	L2260796-05	L2260458-05	L2260458-07	L2260458-08	L2260022-16	L2260796-01	L2260796-02	L2260796-03	L2260338-04
Sample Depth (bgs)	RCS-1		5 - 7 (ft)	7 - 12 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 13 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 14 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 15 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 17 (ft)	17 - 20 (ft)	0 - 5 (ft)	0 - 5 (ft)	5 - 10 (ft)	10 - 16 (ft)
Sample Elevation (ft NAVD 88)	2014		17.5 to 15.5	15.5 to 10.5	28 to 23	23 to 18	18 to 15	25.3 to 20.3	20.3 to 15.3	15.3 to 11.3	22.8 to 17.8	17.8 to 12.8	12.8 to 8.799999	20.9 to 15.9	15.9 to 10.9	10.9 to 5.9	27.4 to 22.4	22.4 to 17.4	17.4 to 10.4	10.4 to 7.4	22.5 to 17.5	22 to 17	17 to 12	12 to 6
Soil Description			FILL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3*	II-2	III-2/II-5	III-2/II-5	II-1	III-2/II-5	II-2	II-1	II-1	II-1	II-1	I-3	II-1	I-3*	II-1	III-2/II-5	III-2/II-5	I-1	II-3	II-1	II-3	II-1
VPH (mg/kg)																								
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																								
Antimony	20	NA	ND (2.2)	ND (2.05)	ND (2.13)	2.25	2.7	2.95	ND (2.26)	ND (2.27)	2.45	5.04	9.33	ND (2.09)	ND (2.23)	2.86	ND (2.13)	4.8	2.18	ND (2.2)	ND (2.27)	ND (2.08)	ND (2.19)	ND (2.14)
Arsenic	20	NA	3.13	1.14	9.58	6.9	5.59	6.19	6.94	10.5	2.85	5.63	8.93	4.1	12.1	3.54	5.73	4.07	7.79	4.02	7.34	3.98	7.88	4.72
Barium	1000	NA	19.9	12.4	95.1	224	331	245	128	122	150	240	272	118	115	69.5	128	165	205	14.7	91.9	67.2	94.1	70.2
Beryllium	90	NA	0.237	ND (0.205)	0.43	0.511	0.472	0.379	0.49	0.581	0.255	0.339	ND (0.224)	0.424	0.438	0.339	0.397	0.355	0.34	0.363	0.615	0.378	0.451	0.442
Cadmium	70	NA	ND (0.439)	ND (0.41)	0.734	1.18	1.35	1.38	0.785	0.818	1.02	0.72	1.39	ND (0.418)	1.72	0.482	0.815	0.796	0.87	ND (0.441)	0.611	0.432	0.993	0.45
Chromium	100	NA	11.5	10.8	15.6	19.5	19.5	13.9	18.4	20.4	10.2	13.8	19.2	15.8	15.7	13.2	14.4	12.9	15.7	19.3	19.4	13	16	16.8
Lead	200	NA	17.7	6.01	**376**	**576**	**520**	**673**	**270**	**290**	**328**	**269**	**510**	88.5	**232**	168	**420**	**632**	**740**	5.9	159	120	**226**	96.5
Mercury	20	NA	0.359	ND (0.077)	1.78	0.579	0.448	0.443	0.445	0.682	1.97	0.179	0.422	0.258	1.18	0.32	0.536	0.214	0.208	ND (0.083)	0.553	0.499	0.549	0.264
Nickel	600	NA	11	8.46	29.9	15.9	14.5	12	14.2	14.7	7.79	11.2	17.2	10.5	18.1	8.25	15.7	9.69	11.3	9.76	12.7	10.1	13.1	12
Selenium	400	NA	ND (2.2)	ND (2.05)	ND (2.13)	ND (2.2)	ND (2.13)	ND (2.16)	ND (2.26)	ND (2.27)	ND (2.02)	ND (2.24)	ND (2.24)	ND (2.09)	ND (2.23)	ND (2.19)	ND (2.13)	ND (2.2)	ND (2.13)	ND (2.2)	ND (2.27)	ND (2.08)	ND (2.19)	ND (2.14)
Silver	100	NA	ND (0.433)	ND (0.403)	ND (0.426)	ND (0.44)	ND (0.426)	ND (0.432)	ND (0.453)	ND (0.455)	ND (0.404)	ND (0.448)	ND (0.448)	ND (0.418)	ND (0.447)	ND (0.437)	ND (0.425)	ND (0.441)	ND (0.426)	ND (0.441)	ND (0.454)	ND (0.416)	ND (0.438)	ND (0.428)
Thallium	8	NA	ND (2.2)	ND (2.05)	ND (2.13)	ND (2.2)	ND (2.13)	ND (2.16)	ND (2.26)	ND (2.27)	ND (2.02)	ND (2.24)	ND (2.24)	ND (2.09)	ND (2.23)	ND (2.19)	ND (2.13)	ND (2.2)	ND (2.13)	ND (2.2)	ND (2.27)	ND (2.08)	ND (2.19)	ND (2.14)
Vanadium	400	NA	27.4	15.4	248	47.5	43	18.8	30.1	29.4	14.1	17.2	21.2	22.5	86.1	20.9	20.6	16.2	16.3	19.2	26	19.5	24.1	30
Zinc	1000	NA	40.7	36.9	412	773	861	859	503	456	642	619	**1080**	232	492	290	637	772	797	33.4	335	259	473	290
TCLP Inorganic Compounds (mg/L)																								
Lead	NA	5	-	-	**6.4**	**13.8**	4.14	**10**	1.22	2.11	3.75	2.1	2.23	-	0.798	0.817	2.88	**7.78**	**5.66**	-	ND (0.5)	ND (0.5)	ND (0.5)	-
PCBs (mg/kg)																								
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	0.0391	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1260 (PCB-1260)	1	NA	0.0449	ND (0.0334)	0.0438	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0357)	ND (0.0334)	ND (0.0363)	ND (0.037)	ND (0.0349)	ND (0.0357)	ND (0.0378)	ND (0.0371)	ND (0.0343)	ND (0.0365)	ND (0.0388)	ND (0.0359)	ND (0.0361)	ND (0.0358)	ND (0.0352)	ND (0.0348)	ND (0.0361)	ND (0.0373)	ND (0.0376)	ND (0.035)	ND (0.0361)	ND (0.0365)
SUM of PCBs	1	NA	0.0449	ND	0.0438	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0391	ND	ND	ND	ND	ND	ND	ND	ND	ND
Other																								
Total Solids (%)	NA	NA	89.2	95.6	90	88.1	91.1	90	85.8	87	93.5	87.7	83.9	90.7	87.8	87.7	91.4	90.2	90.2	88	87.1	90.3	87	87.5
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	9	7.5	8.4	8.4	8.1	8.1	7.6	8.2	8.3	8.2	8.9	8.9	8.7	10.6	8.4	7.8	7.9	7.6	9.2	8.8	9.6	10.1
Conductivity (umhos/cm)	NA	NA	120	59	250	200	120	420	320	280	170	230	160	250	330	300	110	200	100	63	280	220	290	300

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																				
Location Name			HA23-301	HA23-302	HA23-303	HA23-304	HA23-307	HA23-307	HA23-318	HA23-318	HA23-318	HA23-319	HA23-320	HA23-321	HA23-321	HA23-402	HA23-404	HA23-404	HA23-405	HA23-405	HA23-405	HA23-414	HA23-414	HA23-415
Sample Name			HA23-301_0-6	HA23-302_0-4	HA23-303_0-4	HA23-304_0-4	HA23-307_0-5	HA23-307_5-10	HA23-318_0-5	HA23-318_5-12.6	HA23-318_12.6-15	HA23-319_0-5	HA23-320_0-5	HA23-321_7-12	HA23-321_12-15	HA23-402_0-4.0	HA23-404_0-6	HA23-404_6-12	HA23-405_0-6	HA23-405_6-12	HA23-405_12-16	HA23-414_0-4.0	HA23-414_4.0-7.5	HA23-415_0-7.0
Sample Date	MCP Reportable		01/31/2023	01/31/2023	02/01/2023	02/02/2023	02/01/2023	02/01/2023	02/06/2023	02/06/2023 L2306360-04	02/06/2023	02/02/2023	02/02/2023 L2305909-01	02/06/2023	02/06/2023	07/24/2023	07/20/2023	07/20/2023	07/21/2023	07/21/2023 L2342123-02	07/21/2023 L2342123-03	07/17/2023	07/17/2023	07/18/2023
Lab Sample ID	Concentration	TCLP	L2305218-01	L2305452-01	L2305919-01	L2306035-01	L2305617-01	L2305617-02	L2306360-03	L2306970-01	L2306360-05	L2305909-02	L2306246-01	L2306360-01	L2306360-02	L2342401-01	L2341764-01	L2341764-02	L2342123-01	L2343832-01	L2343832-02	L2340803-03	L2340803-04	L2341026-03
Sample Depth (bgs)	RCS-1		0 - 6 (ft)	0 - 4 (ft)	0 - 4 (ft)	0 - 4 (ft)	0 - 5 (ft)	5 - 10 (ft)	0 - 5 (ft)	5 - 12.6 (ft)	12.6 - 15 (ft)	0 - 5 (ft)	0 - 5 (ft)	7 - 12 (ft)	12 - 15 (ft)	0 - 4 (ft)	0 - 6 (ft)	6 - 12 (ft)	0 - 6 (ft)	6 - 12 (ft)	12 - 16 (ft)	0 - 4 (ft)	4 - 7.5 (ft)	0 - 7 (ft)
Sample Elevation (ft NAVD 88)	2014		24 to 18	24 to 20	24 to 20	24 to 20	25 to 20	20 to 15	25.5 to 20.5	20.5 to 12.9	12.9 to 10.5	25.5 to 20.5	28.5 to 23.5	16 to 11	11 to 8	24 to 20	22 to 16	16 to 10	27 to 21	21 to 15	15 to 9	23 to 19	19 to 15.5	25 to 18
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	I-3	I-3*	I-3	I-3	I-3	I-3	II-1	I-2*	II-3	II-1	I-2	I-2	I-3	II-3	II-1	I-3	II-1	II-1	II-1	I-3	I-3
Volatile Organic Compounds (mg/kg)																								
1,2,4-Trimethylbenzene	1000	NA	ND (0.0019)	ND (0.002)	0.0081	ND (0.0017)	ND (0.0018)	ND (0.0024)	ND (0.0021)	ND (0.0024)	ND (0.002)	ND (0.0018)	ND (0.2)	ND (0.0021)	ND (0.0021)	ND (0.0012)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.001)	ND (0.0016)	ND (0.0011)	ND (0.0014)	ND (0.0014)
1,3,5-Trimethylbenzene	10	NA	ND (0.0019)	ND (0.002)	0.004	ND (0.0017)	ND (0.0018)	ND (0.0024)	ND (0.0021)	ND (0.0024)	ND (0.002)	ND (0.0018)	ND (0.2)	ND (0.0021)	ND (0.0021)	ND (0.0012)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.001)	ND (0.0016)	ND (0.0011)	ND (0.0014)	ND (0.0014)
1,4-Dichlorobenzene	0.7	NA	ND (0.0019)	ND (0.002)	ND (0.002)	ND (0.0017)	ND (0.0018)	ND (0.0024)	ND (0.0021)	ND (0.0024)	ND (0.002)	ND (0.0018)	ND (0.2)	ND (0.0021)	ND (0.0021)	ND (0.0012)	ND (0.0011)	ND (0.0013)	ND (0.0012)	ND (0.001)	ND (0.0016)	ND (0.0011)	ND (0.0014)	ND (0.0014)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.0094)	ND (0.0099)	ND (0.01)	ND (0.0087)	ND (0.0091)	ND (0.012)	ND (0.01)	ND (0.012)	ND (0.01)	ND (0.0089)	ND (1)	ND (0.01)	ND (0.01)	ND (0.0062)	ND (0.0054)	ND (0.0067)	ND (0.0063)	ND (0.0052)	ND (0.0078)	ND (0.0055)	ND (0.0068)	ND (0.0069)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Acetone	6	NA	ND (0.024)	ND (0.025)	0.042	ND (0.022)	0.025	0.048	ND (0.026)	ND (0.03)	ND (0.025)	ND (0.022)	ND (1)	ND (0.026)	ND (0.026)	ND (0.015)	ND (0.014)	0.024	ND (0.016)	ND (0.013)	ND (0.02)	ND (0.014)	ND (0.017)	ND (0.017)
Benzene	2	NA	ND (0.00047)	ND (0.0005)	ND (0.0005)	ND (0.00044)	ND (0.00046)	ND (0.00061)	ND (0.00052)	ND (0.00061)	ND (0.0005)	ND (0.00044)	ND (0.051)	ND (0.00052)	ND (0.00052)	ND (0.00031)	ND (0.00027)	0.00044	ND (0.00031)	ND (0.00026)	ND (0.00039)	ND (0.00027)	ND (0.00034)	ND (0.00034)
Chloroform (Trichloromethane)	0.2	NA	ND (0.0014)	ND (0.0015)	ND (0.0015)	ND (0.0013)	ND (0.0014)	ND (0.0018)	ND (0.0016)	ND (0.0018)	ND (0.0015)	ND (0.0013)	ND (0.15)	ND (0.0016)	ND (0.0016)	ND (0.00092)	ND (0.00081)	ND (0.001)	ND (0.00094)	ND (0.00078)	ND (0.0012)	ND (0.00082)	ND (0.001)	ND (0.001)
cis-1,2-Dichloroethene	0.1	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	**ND (0.1)**	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Ethylbenzene	40	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Isopropylbenzene (Cumene)	1000	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Naphthalene	4	NA	ND (0.0038)	ND (0.004)	0.024	ND (0.0035)	ND (0.0036)	ND (0.0049)	ND (0.0042)	ND (0.0049)	ND (0.004)	ND (0.0035)	2.5	ND (0.0042)	ND (0.0042)	ND (0.0025)	0.046	0.0071	ND (0.0025)	ND (0.0021)	ND (0.0031)	ND (0.0022)	ND (0.0027)	ND (0.0028)
n-Butylbenzene	NA	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	0.0022	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
n-Propylbenzene	100	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Styrene	3	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	ND (0.00089)	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
Tetrachloroethene	1	NA	ND (0.00047)	0.00054	ND (0.0005)	ND (0.00044)	ND (0.00046)	ND (0.00061)	ND (0.00052)	ND (0.00061)	0.032	ND (0.00044)	ND (0.051)	ND (0.00052)	ND (0.00052)	ND (0.00031)	ND (0.00027)	ND (0.00033)	ND (0.00031)	ND (0.00026)	ND (0.00039)	ND (0.00027)	ND (0.00034)	ND (0.00034)
Tetrahydrofuran	500	NA	ND (0.0038)	ND (0.004)	ND (0.004)	ND (0.0035)	ND (0.0036)	ND (0.0049)	ND (0.0042)	ND (0.0049)	ND (0.004)	ND (0.0035)	ND (0.41)	ND (0.0042)	ND (0.0042)	ND (0.0025)	ND (0.0022)	ND (0.0027)	ND (0.0025)	ND (0.0021)	ND (0.0031)	ND (0.0022)	ND (0.0027)	ND (0.0028)
Toluene	30	NA	0.0016	0.001	0.0021	0.0012	ND (0.00091)	0.0026	0.0011	0.0018	0.0011	ND (0.00089)	ND (0.1)	0.0023	0.0022	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
trans-1,2-Dichloroethene	1	NA	ND (0.0014)	ND (0.0015)	ND (0.0015)	ND (0.0013)	ND (0.0014)	ND (0.0018)	ND (0.0016)	ND (0.0018)	ND (0.0015)	ND (0.0013)	ND (0.15)	ND (0.0016)	ND (0.0016)	ND (0.00092)	ND (0.00081)	ND (0.001)	ND (0.00094)	ND (0.00078)	ND (0.0012)	ND (0.00082)	ND (0.001)	ND (0.001)
Trichloroethene	0.3	NA	ND (0.00047)	ND (0.0005)	ND (0.0005)	ND (0.00044)	ND (0.00046)	ND (0.00061)	ND (0.00052)	ND (0.00061)	0.00066	ND (0.00044)	ND (0.051)	ND (0.00052)	ND (0.00052)	ND (0.00031)	ND (0.00027)	ND (0.00033)	ND (0.00031)	ND (0.00026)	ND (0.00039)	ND (0.00027)	ND (0.00034)	ND (0.00034)
Xylene (Total)	100	NA	ND (0.00094)	ND (0.00099)	ND (0.001)	ND (0.00087)	ND (0.00091)	ND (0.0012)	ND (0.001)	ND (0.0012)	ND (0.001)	0.00094	ND (0.1)	ND (0.001)	ND (0.001)	ND (0.00062)	ND (0.00054)	ND (0.00067)	ND (0.00063)	ND (0.00052)	ND (0.00078)	ND (0.00055)	ND (0.00068)	ND (0.00069)
SUM of Volatile Organic Compounds	NA	NA	0.0016	0.00154	0.0802	0.0012	0.025	0.0506	0.0011	0.0018	0.03376	0.00094	2.5	0.0023	0.0022	ND	0.0482	0.03154	ND	ND	ND	ND	ND	ND
Semi-Volatile Organic Compounds (mg/kg)																								
2,4-Dimethylphenol	0.7	NA	ND (0.072)	ND (0.073)	ND (0.077)	ND (0.075)	ND (0.078)	ND (0.08)	ND (0.076)	ND (0.082)	ND (0.084)	ND (0.076)	ND (0.084)	ND (0.083)	ND (0.077)	ND (0.079)	ND (0.085)	ND (0.079)	ND (0.086)	ND (0.4)	ND (0.082)	ND (0.074)	ND (0.075)	ND (0.075)
2-Methylnaphthalene	0.7	NA	ND (0.072)	ND (0.073)	ND (0.077)	ND (0.075)	ND (0.078)	0.095	ND (0.076)	0.14	ND (0.084)	**0.83**	0.11	ND (0.083)	ND (0.077)	ND (0.079)	0.18	0.34	ND (0.086)	ND (0.4)	ND (0.082)	ND (0.074)	ND (0.075)	ND (0.075)
3&4-Methylphenol	NA	NA	ND (0.25)	ND (0.25)	ND (0.26)	ND (0.26)	ND (0.27)	ND (0.27)	ND (0.26)	ND (0.28)	ND (0.29)	ND (0.26)	ND (0.29)	ND (0.28)	ND (0.26)	ND (0.27)	ND (0.29)	ND (0.27)	ND (0.29)	ND (1.4)	ND (0.28)	ND (0.26)	ND (0.26)	ND (0.26)
Acenaphthene	4	NA	ND (0.14)	ND (0.14)	ND (0.15)	ND (0.14)	ND (0.15)	0.29	ND (0.14)	ND (0.16)	ND (0.16)	2.9	ND (0.16)	ND (0.16)	ND (0.15)	ND (0.15)	ND (0.16)	0.66	ND (0.16)	1	ND (0.16)	ND (0.14)	ND (0.14)	ND (0.14)
Acenaphthylene	1	NA	ND (0.14)	ND (0.14)	ND (0.15)	0.2	ND (0.15)	ND (0.15)	ND (0.14)	ND (0.16)	ND (0.16)	0.72	ND (0.16)	ND (0.16)	ND (0.15)	ND (0.15)	ND (0.16)	0.32	ND (0.16)	ND (0.77)	ND (0.16)	ND (0.14)	ND (0.14)	ND (0.14)
Aniline	1000	NA	ND (0.2)	ND (0.21)	ND (0.22)	ND (0.21)	ND (0.22)	ND (0.23)	ND (0.22)	ND (0.24)	ND (0.24)	ND (0.22)	ND (0.24)	ND (0.24)	ND (0.22)	ND (0.23)	ND (0.24)	ND (0.22)	ND (0.24)	ND (1.2)	ND (0.23)	ND (0.21)	ND (0.22)	ND (0.21)
Anthracene	1000	NA	ND (0.1)	0.23	ND (0.11)	0.5	0.31	0.78	ND (0.11)	0.22	ND (0.12)	6	0.28	ND (0.12)	ND (0.11)	ND (0.11)	0.5	1.7	0.12	3.2	ND (0.12)	0.11	ND (0.11)	0.27
Benzo(a)anthracene	7	NA	0.23	0.55	0.22	2	0.9	1.8	ND (0.11)	0.47	ND (0.12)	**15**	0.38	ND (0.12)	ND (0.11)	0.18	1.2	2.8	0.27	5.1	0.18	0.41	0.19	0.83
Benzo(a)pyrene	2	NA	0.26	0.61	0.24	1.8	0.99	1.7	ND (0.14)	0.44	ND (0.16)	**13**	0.32	ND (0.16)	ND (0.15)	0.19	1.4	**2.8**	0.29	**4.8**	0.17	0.4	0.2	0.78
Benzo(b)fluoranthene	7	NA	0.3	0.69	0.3	2.1	1	1.9	ND (0.11)	0.48	ND (0.12)	**15**	0.38	ND (0.12)	ND (0.11)	0.23	1.3	3.4	0.34	5.5	0.23	0.53	0.26	0.88
Benzo(g,h,i)perylene	1000	NA	0.16	0.35	ND (0.15)	1	0.54	0.91	ND (0.14)	0.22	ND (0.16)	6.6	0.19	ND (0.16)	ND (0.15)	ND (0.15)	0.65	1.1	0.17	2.5	0.27	0.32	0.15	0.48
Benzo(k)fluoranthene	70	NA	0.1	0.26	ND (0.11)	0.77	0.39	0.68	ND (0.11)	0.19	ND (0.12)	3.4	0.13	ND (0.12)	ND (0.11)	ND (0.11)	0.47	1.3	ND (0.12)	1.6	ND (0.12)	0.17	ND (0.11)	0.35
Biphenyl	0.05	NA	ND (0.034)	ND (0.035)	ND (0.037)	ND (0.036)	ND (0.037)	ND (0.038)	ND (0.036)	**0.057**	ND (0.04)	**0.21**	ND (0.04)	ND (0.039)	ND (0.037)	ND (0.038)	ND (0.04)	**0.059**	ND (0.041)	**ND (0.19)**	ND (0.039)	ND (0.036)	ND (0.036)	ND (0.036)
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.17)	ND (0.17)	1.9	0.33	ND (0.18)	0.72	ND (0.18)	ND (0.2)	ND (0.2)	0.19	0.28	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	0.63	ND (0.2)	ND (0.96)	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Butyl benzylphthalate (BBP)	100	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.19)	ND (0.2)	ND (0.96)	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Chrysene	70	NA	0.22	0.56	0.24	1.8	0.9	1.8	ND (0.11)	0.5	ND (0.12)	14	0.39	ND (0.12)	ND (0.11)	0.2	1.3	2.7	0.26	4.7	0.22	0.41	0.2	0.84
Dibenz(a,h)anthracene	0.7	NA	ND (0.072)	0.085	ND (0.077)	0.27	0.14	0.24	ND (0.076)	ND (0.082)	ND (0.084)	**1.7**	ND (0.084)	ND (0.083)	ND (0.077)	ND (0.079)	0.15	0.4	ND (0.086)	0.62	ND (0.082)	ND (0.074)	ND (0.075)	0.13
Dibenzofuran	100	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	0.24	ND (0.18)	ND (0.2)	ND (0.2)	1.4	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	0.47	ND (0.2)	1	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Di-n-butylphthalate (DBP)	50	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.19)	ND (0.2)	ND (0.96)	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Fluoranthene	1000	NA	0.36	1.1	0.41	3.6	1.6	3.7	ND (0.11)	0.95	ND (0.12)	34	0.97	ND (0.12)	ND (0.11)	0.42	2.5	6.6	0.58	13	0.4	0.71	0.3	1.5
Fluorene	1000	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	0.32	ND (0.18)	ND (0.2)	ND (0.2)	2.7	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	0.89	ND (0.2)	1.4	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Indeno(1,2,3-cd)pyrene	7	NA	0.15	0.4	ND (0.15)	1.2	0.61	1.1	ND (0.14)	0.26	ND (0.16)	**7.8**	0.2	ND (0.16)	ND (0.15)	ND (0.15)	0.58	1.1	0.19	3.1	ND (0.16)	0.31	0.15	0.51
Naphthalene	4	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.2)	ND (0.2)	1.4	0.21	ND (0.2)	ND (0.18)	ND (0.19)	0.24	0.43	ND (0.2)	ND (0.96)	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Phenanthrene	10	NA	0.15	0.76	0.23	1.6	1.2	3	ND (0.11)	1	ND (0.12)	**27**	1.1	ND (0.12)	ND (0.11)	0.2	1.5	6.7	0.38	**12**	0.37	0.39	0.13	0.9
Phenol	1	NA	ND (0.17)	ND (0.17)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.2)	ND (0.2)	ND (0.18)	ND (0.19)	ND (0.2)	ND (0.19)	ND (0.2)	ND (0.96)	ND (0.2)	ND (0.18)	ND (0.18)	ND (0.18)
Pyrene	1000	NA	0.36	0.92	0.46	3.2	1.6	3.3	ND (0.11)	0.84	ND (0.12)	32	0.84	ND (0.12)	ND (0.11)	0.4	2.2	5.7	0.48	10	0.32	0.62	0.28	1.5
SUM of Semi-Volatile Organic Compounds	NA	NA	2.29	6.515	4	20.37	10.18	22.575	ND	5.767	ND	185.85	5.78	ND	ND	1.82	14.17	40.099	3.08	69.52	2.16	4.38	1.86	8.97
Total Petroleum Hydrocarbons (mg/kg)																								
Petroleum hydrocarbons	1000	NA	122	59.4	937	162	110	210	ND (35)	417	ND (39.4)	262	803	ND (39.2)	ND (36.6)	134	301	349	351	310	143	414	319	108
EPH (mg/kg)																								
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal																				
Location Name			HA23-301	HA23-302	HA23-303	HA23-304	HA23-307	HA23-307	HA23-318	HA23-318	HA23-318	HA23-319	HA23-320	HA23-321	HA23-321	HA23-402	HA23-404	HA23-404	HA23-405	HA23-405	HA23-405	HA23-414	HA23-414	HA23-415
Sample Name			HA23-301_0-6	HA23-302_0-4	HA23-303_0-4	HA23-304_0-4	HA23-307_0-5	HA23-307_5-10	HA23-318_0-5	HA23-318_5-12.6	HA23-318_12.6-15	HA23-319_0-5	HA23-320_0-5	HA23-321_7-12	HA23-321_12-15	HA23-402_0-4.0	HA23-404_0-6	HA23-404_6-12	HA23-405_0-6	HA23-405_6-12	HA23-405_12-16	HA23-414_0-4.0	HA23-414_4.0-7.5	HA23-415_0-7.0
Sample Date	MCP		01/31/2023	01/31/2023	02/01/2023	02/02/2023	02/01/2023	02/01/2023	02/06/2023	02/06/2023 L2306360-04	02/06/2023	02/02/2023	02/02/2023 L2305909-01	02/06/2023	02/06/2023	07/24/2023	07/20/2023	07/20/2023	07/21/2023	07/21/2023 L2342123-02	07/21/2023 L2342123-03	07/17/2023	07/17/2023	07/18/2023
Lab Sample ID	Reportable Concentration	TCLP	L2305218-01	L2305452-01	L2305919-01	L2306035-01	L2305617-01	L2305617-02	L2306360-03	L2306970-01	L2306360-05	L2305909-02	L2306246-01	L2306360-01	L2306360-02	L2342401-01	L2341764-01	L2341764-02	L2342123-01	L2343832-01	L2343832-02	L2340803-03	L2340803-04	L2341026-03
Sample Depth (bgs)	RCS-1		0 - 6 (ft)	0 - 4 (ft)	0 - 4 (ft)	0 - 4 (ft)	0 - 5 (ft)	5 - 10 (ft)	0 - 5 (ft)	5 - 12.6 (ft)	12.6 - 15 (ft)	0 - 5 (ft)	0 - 5 (ft)	7 - 12 (ft)	12 - 15 (ft)	0 - 4 (ft)	0 - 6 (ft)	6 - 12 (ft)	0 - 6 (ft)	6 - 12 (ft)	12 - 16 (ft)	0 - 4 (ft)	4 - 7.5 (ft)	0 - 7 (ft)
Sample Elevation (ft NAVD 88)	2014		24 to 18	24 to 20	24 to 20	24 to 20	25 to 20	20 to 15	25.5 to 20.5	20.5 to 12.9	12.9 to 10.5	25.5 to 20.5	28.5 to 23.5	16 to 11	11 to 8	24 to 20	22 to 16	16 to 10	27 to 21	21 to 15	15 to 9	23 to 19	19 to 15.5	25 to 18
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	NATURAL	FILL	FILL	NATURAL	NATURAL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	I-3	I-3*	I-3	I-3	I-3	I-3	II-1	I-2*	II-3	II-1	I-2	I-2	I-3	II-3	II-1	I-3	II-1	II-1	II-1	I-3	I-3
VPH (mg/kg)																								
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)																								
Antimony	20	NA	ND (2.05)	ND (2.04)	ND (2.1)	ND (2.04)	ND (2.14)	ND (2.21)	ND (2.17)	ND (2.37)	ND (2.3)	ND (2.07)	4.29	ND (2.35)	ND (2.14)	ND (2.22)	ND (2.42)	ND (2.25)	ND (2.38)	ND (2.27)	ND (2.29)	ND (2.14)	ND (2.06)	ND (2.12)
Arsenic	20	NA	3.5	3.57	6.33	3.24	11.7	5.22	5.41	5.43	4.41	4.89	8.92	2.08	3.09	6.23	**54.8**	3.26	4.35	5.47	6.4	9.89	8.29	4.56
Barium	1000	NA	41.5	31.2	49.3	25.6	59.1	48.1	28.5	86.6	25.7	38	130	19.7	28.2	12.2	23.4	21.7	25.2	118	63.2	41.8	42.7	38.5
Beryllium	90	NA	2.43	ND (0.204)	2.27	ND (0.204)	0.608	0.501	0.37	0.449	0.418	2.23	1.49	ND (0.235)	ND (0.214)	0.373	ND (0.242)	0.235	ND (0.238)	ND (0.227)	ND (0.229)	ND (0.214)	0.213	0.412
Cadmium	70	NA	0.433	ND (0.408)	0.423	ND (0.408)	ND (0.428)	ND (0.442)	ND (0.434)	ND (0.474)	ND (0.46)	0.597	0.602	ND (0.471)	ND (0.427)	ND (0.445)	ND (0.484)	ND (0.451)	ND (0.476)	1.07	ND (0.458)	ND (0.427)	ND (0.412)	ND (0.423)
Chromium	100	NA	13.5	13.9	20	9.93	15.1	15.1	17.7	14.8	12.6	21.5	8.18	6.1	30.4	10.8	30	7.23	12.3	13.7	7.51	16	18.7	12.1
Lead	200	NA	25.4	19.4	24.2	25.6	80.3	75	21.2	**226**	12.8	35.4	**242**	52.1	11.6	8.94	45	8.64	51	**453**	**261**	83.6	65.7	44.3
Mercury	20	NA	ND (0.079)	ND (0.078)	0.673	0.087	0.689	0.206	ND (0.078)	ND (0.086)	ND (0.088)	0.871	0.408	ND (0.087)	ND (0.08)	ND (0.083)	0.098	ND (0.078)	0.118	0.322	ND (0.085)	1.35	1.82	0.134
Nickel	600	NA	10	13	244	8.35	22.7	12.1	12.8	12	8.84	22.4	7.72	4.78	17.9	6.15	17.6	5.93	10.1	11.3	8.87	32.2	26.3	9.06
Selenium	400	NA	ND (2.05)	ND (2.04)	ND (2.1)	ND (2.04)	ND (2.14)	ND (2.21)	ND (2.17)	ND (2.37)	ND (2.3)	ND (2.07)	ND (2.31)	ND (2.35)	ND (2.14)	ND (2.22)	ND (2.42)	ND (2.25)	ND (2.38)	ND (2.27)	ND (2.29)	ND (2.14)	ND (2.06)	ND (2.12)
Silver	100	NA	ND (0.411)	ND (0.408)	7.96	ND (0.408)	ND (0.428)	ND (0.442)	ND (0.434)	ND (0.474)	ND (0.46)	ND (0.414)	ND (0.461)	ND (0.471)	ND (0.427)	ND (0.445)	ND (0.484)	ND (0.451)	ND (0.476)	ND (0.455)	ND (0.458)	ND (0.427)	ND (0.412)	ND (0.423)
Thallium	8	NA	ND (2.05)	ND (2.04)	ND (2.1)	ND (2.04)	ND (2.14)	ND (2.21)	ND (2.17)	ND (2.37)	ND (2.3)	ND (2.07)	ND (2.31)	ND (2.35)	ND (2.14)	ND (2.22)	ND (2.42)	ND (2.25)	ND (2.38)	ND (2.27)	ND (2.29)	ND (2.14)	ND (2.06)	ND (2.12)
Vanadium	400	NA	27.6	36	25.4	17.2	123	33.6	22.3	22.9	19.2	83	15.2	11	38.5	12.4	19	12.1	20.7	22.8	10.7	**469**	93.6	18.4
Zinc	1000	NA	80.9	70.8	76.8	77.3	145	153	77.3	190	25.7	91.7	427	49.2	40.3	20.5	72	133	94	590	195	214	93.8	57.6
TCLP Inorganic Compounds (mg/L)																								
Lead	NA	5	-	-	-	-	-	-	-	ND (0.5)	-	-	0.52	-	-	-	-	-	-	2.96	1.65	-	-	-
PCBs (mg/kg)																								
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1260 (PCB-1260)	1	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	0.551	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0337)	ND (0.0337)	ND (0.0363)	ND (0.0353)	ND (0.0353)	ND (0.0381)	ND (0.0351)	ND (0.0396)	ND (0.195)	ND (0.0361)	ND (0.0394)	ND (0.0385)	ND (0.0361)	ND (0.0528)	ND (0.059)	ND (0.0553)	ND (0.0595)	ND (0.0557)	ND (0.0545)	ND (0.0501)	ND (0.0512)	ND (0.054)
SUM of PCBs	1	NA	ND	ND	ND	ND	ND	ND	ND	ND	0.551	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Other																								
Total Solids (%)	NA	NA	95	94.3	90	93	89	85.7	90.6	83.3	82.5	91.1	82.4	82.9	88.7	87.2	80.3	86.2	80.3	86.2	84.3	93.2	91.7	91.1
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	7.2	8.6	9.8	8.4	8.4	8.6	7.7	6.6	6.9	9.2	8.2	7.2	7.6	7.58	8.26	8.07	8.14	8.24	8.03	8.94	8.24	10
Conductivity (umhos/cm)	NA	NA	96	110	120	110	130	160	32	45	71	99	63	170	37	21	140	200	83	110	140	110	120	350

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal										
Location Name			HA23-418	HA23-418	HA-TP05	HA-TP06	HA-TP07	HA-TP08	HA-TP09	HA-TP10	HA-TP11	HA-TP11	HA-TP12
Sample Name			HA23-418_0-6	HA23-418_6-13.5	TP5_1-5	HA-TP6_1-5	HA-TP7_1-5	TP8_1-5	TP9_0-5	HA-TP10_1-4	HA-TP11_1-5	HA-TP11_5-8.5	HA-TP12_1-5
Sample Date	MCP		07/17/2023	07/17/2023	02/21/2022	02/22/2022	02/22/2022	02/21/2022	02/21/2022	02/23/2022	02/23/2022	02/23/2022	02/22/2022
	Reportable					L2209378-02	L2209378-01	L2209166-03					L2209378-03
Lab Sample ID	Concentration	TCLP	L2340803-01	L2340803-02	L2209166-01	L2210411-01	L2210411-02	L2210514-01	L2209166-02	L2209666-01	L2209666-02	L2209666-03	L2210411-03
Sample Depth (bgs)	RCS-1		0 - 6 (ft)	6 - 13.5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 4 (ft)	1 - 5 (ft)	5 - 8.5 (ft)	1 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		22 to 16	16 to 8.5	21.5 to 17.5	23 to 19	21 to 17	22 to 18	26.5 to 21.5	21.8 to 18.8	22 to 18	18 to 14.5	25.5 to 21.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	II-3	I-3	II-1	II-3	II-3	I-3	II-1	I-3	II-1	III-2/II-5
Volatile Organic Compounds (mg/kg)													
1,2,4-Trimethylbenzene	1000	NA	ND (0.0012)	ND (0.0012)	ND (0.0015)	ND (0.0016)	ND (0.0016)	0.0023	ND (0.0014)	0.018	ND (0.0014)	ND (0.0013)	ND (0.0015)
1,3,5-Trimethylbenzene	10	NA	ND (0.0012)	ND (0.0012)	ND (0.0015)	ND (0.0016)	ND (0.0016)	ND (0.0015)	ND (0.0014)	0.0083	ND (0.0014)	ND (0.0013)	ND (0.0015)
1,4-Dichlorobenzene	0.7	NA	ND (0.0012)	ND (0.0012)	ND (0.0015)	ND (0.0016)	ND (0.0016)	ND (0.0015)	ND (0.0014)	ND (0.0015)	ND (0.0014)	ND (0.0013)	ND (0.0015)
2-Butanone (Methyl Ethyl Ketone)	4	NA	ND (0.0062)	ND (0.0062)	ND (0.0076)	0.01	0.013	ND (0.0074)	ND (0.0068)	ND (0.0073)	ND (0.007)	ND (0.0067)	ND (0.0074)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	0.00097	ND (0.0007)	ND (0.00067)	ND (0.00074)
Acetone	6	NA	ND (0.015)	ND (0.015)	ND (0.019)	0.056	0.062	ND (0.018)	ND (0.017)	ND (0.018)	ND (0.018)	ND (0.017)	0.037
Benzene	2	NA	ND (0.00031)	ND (0.00031)	ND (0.00038)	ND (0.00039)	ND (0.00039)	ND (0.00037)	ND (0.00034)	ND (0.00036)	ND (0.00035)	ND (0.00034)	0.00061
Chloroform (Trichloromethane)	0.2	NA	ND (0.00093)	ND (0.00093)	ND (0.0011)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.0011)
cis-1,2-Dichloroethene	0.1	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	ND (0.00073)	ND (0.0007)	ND (0.00067)	ND (0.00074)
Cymene (p-Isopropyltoluene)	100	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	0.00092	ND (0.00078)	0.0066	ND (0.00068)	0.0046	ND (0.0007)	ND (0.00067)	0.0034
Ethylbenzene	40	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	0.0012	ND (0.0007)	ND (0.00067)	ND (0.00074)
Isopropylbenzene (Cumene)	1000	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	0.00082	ND (0.00078)	ND (0.00074)	ND (0.00068)	0.00085	ND (0.0007)	ND (0.00067)	ND (0.00074)
Naphthalene	4	NA	ND (0.0025)	0.0082	ND (0.0031)	0.12	0.014	0.16	ND (0.0027)	0.11	ND (0.0028)	ND (0.0027)	0.084
n-Butylbenzene	NA	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	0.00077	ND (0.0007)	ND (0.00067)	ND (0.00074)
n-Propylbenzene	100	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	0.0012	ND (0.0007)	ND (0.00067)	ND (0.00074)
Styrene	3	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	ND (0.00074)	ND (0.00068)	ND (0.00073)	ND (0.0007)	ND (0.00067)	ND (0.00074)
Tetrachloroethene	1	NA	ND (0.00031)	ND (0.00031)	ND (0.00038)	ND (0.00039)	ND (0.00039)	ND (0.00037)	ND (0.00034)	0.002	ND (0.00035)	ND (0.00034)	ND (0.00037)
Tetrahydrofuran	500	NA	ND (0.0025)	ND (0.0025)	ND (0.0031)	ND (0.0031)	ND (0.0031)	ND (0.003)	ND (0.0027)	ND (0.0029)	ND (0.0028)	ND (0.0027)	ND (0.003)
Toluene	30	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	ND (0.00078)	ND (0.00078)	0.00078	ND (0.00068)	0.00085	ND (0.0007)	ND (0.00067)	ND (0.00074)
trans-1,2-Dichloroethene	1	NA	ND (0.00093)	ND (0.00093)	ND (0.0011)	ND (0.0012)	ND (0.0012)	ND (0.0011)	ND (0.001)	ND (0.0011)	ND (0.001)	ND (0.001)	ND (0.0011)
Trichloroethene	0.3	NA	ND (0.00031)	ND (0.00031)	ND (0.00038)	ND (0.00039)	ND (0.00039)	ND (0.00037)	ND (0.00034)	ND (0.00036)	ND (0.00035)	ND (0.00034)	ND (0.00037)
Xylene (Total)	100	NA	ND (0.00062)	ND (0.00062)	ND (0.00076)	0.0017	ND (0.00078)	0.0011	ND (0.00068)	0.0081	ND (0.0007)	ND (0.00067)	0.0032
SUM of Volatile Organic Compounds	NA	NA	ND	0.0082	ND	0.18944	0.089	0.17078	ND	0.15684	ND	ND	0.12821
Semi-Volatile Organic Compounds (mg/kg)													
2,4-Dimethylphenol	0.7	NA	ND (0.074)	ND (0.073)	ND (0.079)	ND (0.077)	ND (0.077)	**ND (0.77)**	ND (0.076)	ND (0.077)	ND (0.075)	ND (0.074)	ND (0.076)
2-Methylnaphthalene	0.7	NA	0.087	**1.1**	ND (0.079)	0.36	0.14	**1.8**	ND (0.076)	**1**	ND (0.075)	0.68	0.22
3&4-Methylphenol	NA	NA	ND (0.25)	ND (0.25)	ND (0.27)	ND (0.26)	ND (0.26)	ND (2.6)	ND (0.26)	ND (0.26)	ND (0.26)	ND (0.25)	ND (0.26)
Acenaphthene	4	NA	0.34	1.5	ND (0.15)	1.1	0.4	**8.9**	ND (0.14)	2	ND (0.14)	3.6	1
Acenaphthylene	1	NA	ND (0.14)	0.51	ND (0.15)	0.2	0.16	**ND (1.5)**	ND (0.14)	0.3	ND (0.14)	ND (0.14)	**1.4**
Aniline	1000	NA	ND (0.21)	0.28	ND (0.23)	ND (0.22)	ND (0.22)	ND (2.2)	ND (0.22)	ND (0.22)	ND (0.21)	ND (0.21)	ND (0.22)
Anthracene	1000	NA	0.83	3.5	ND (0.11)	1.8	0.8	17	0.25	2.8	0.17	3.5	6.3
Benzo(a)anthracene	7	NA	2	6.4	ND (0.11)	4	2.1	**32**	0.6	4.2	0.59	5.7	**19**
Benzo(a)pyrene	2	NA	1.8	**5.5**	ND (0.15)	**3.1**	1.9	**26**	0.58	**3.7**	0.63	**5.6**	**14**
Benzo(b)fluoranthene	7	NA	2	**8.5**	ND (0.11)	4	2.5	**34**	0.61	4.6	0.7	5.2	**20**
Benzo(g,h,i)perylene	1000	NA	1.1	3.3	ND (0.15)	1.2	0.82	15	0.31	2.2	0.44	3	5
Benzo(k)fluoranthene	70	NA	0.63	3.5	ND (0.11)	1	0.64	12	0.22	1.2	0.28	1.5	2
Biphenyl	0.05	NA	ND (0.035)	**0.33**	ND (0.038)	**0.1**	ND (0.037)	**0.67**	ND (0.036)	**0.23**	ND (0.036)	**0.2**	**0.076**
bis(2-Ethylhexyl)phthalate	90	NA	ND (0.18)	ND (0.17)	ND (0.19)	ND (0.18)	6.5	6.7	ND (0.18)	2	0.26	0.18	0.41
Butyl benzylphthalate (BBP)	100	NA	ND (0.18)	ND (0.17)	ND (0.19)	ND (0.18)	0.29	ND (1.8)	ND (0.18)	0.65	ND (0.18)	ND (0.18)	ND (0.18)
Chrysene	70	NA	1.8	5.1	ND (0.11)	3.4	2	28	0.56	4.2	0.61	6.2	16
Dibenz(a,h)anthracene	0.7	NA	0.28	**1**	ND (0.079)	0.27	0.21	**3.9**	ND (0.076)	0.59	0.11	**0.77**	**1.1**
Dibenzofuran	100	NA	0.22	2	ND (0.19)	0.8	0.33	5.3	ND (0.18)	1.4	ND (0.18)	0.27	0.86
Di-n-butylphthalate (DBP)	50	NA	ND (0.18)	ND (0.17)	ND (0.19)	ND (0.18)	ND (0.18)	ND (1.8)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)
Fluoranthene	1000	NA	3.7	17	ND (0.11)	7.2	3.9	66	1.2	11	0.95	7.4	38
Fluorene	1000	NA	0.34	2.4	ND (0.19)	1.1	0.44	9.3	ND (0.18)	2	ND (0.18)	2.7	2.2
Indeno(1,2,3-cd)pyrene	7	NA	1.2	3.9	ND (0.15)	1.6	1.1	**18**	0.33	2.6	0.48	3.2	**7**
Naphthalene	4	NA	ND (0.18)	3.2	ND (0.19)	0.95	0.28	**4.2**	ND (0.18)	1.8	ND (0.18)	0.56	0.57
Phenanthrene	10	NA	3	**20**	ND (0.11)	5.8	2.6	**56**	0.74	**11**	0.57	**12**	**30**
Phenol	1	NA	ND (0.18)	ND (0.17)	ND (0.19)	ND (0.18)	ND (0.18)	**ND (1.8)**	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)
Pyrene	1000	NA	3.3	13	ND (0.11)	6.1	3.5	53	1.1	6.9	0.91	11	29
SUM of Semi-Volatile Organic Compounds	NA	NA	22.627	102.02	ND	44.08	30.61	397.77	6.5	66.37	6.7	73.26	194.136
Total Petroleum Hydrocarbons (mg/kg)													
Petroleum hydrocarbons	1000	NA	77.9	132	ND (38.3)	612	232	**1730**	92.4	**2180**	398	79.5	265
EPH (mg/kg)													
C11-C22 Aromatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatic Hydrocarbons	3000	NA	-	-	-	-	-	-	-	-	-	-	-
C9-C18 Aliphatic Hydrocarbons	1000	NA	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	4	NA	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	1	NA	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1000	NA	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	7	NA	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	NA	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	NA	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1000	NA	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	NA	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	NA	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	NA	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1000	NA	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1000	NA	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	NA	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	10	NA	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1000	NA	-	-	-	-	-	-	-	-	-	-	-

TABLE II
SUMMARY OF SOIL QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

Precharacterization Grid	Action Level		550 Arsenal										
Location Name			HA23-418	HA23-418	HA-TP05	HA-TP06	HA-TP07	HA-TP08	HA-TP09	HA-TP10	HA-TP11	HA-TP11	HA-TP12
Sample Name			HA23-418_0-6	HA23-418_6-13.5	TP5_1-5	HA-TP6_1-5	HA-TP7_1-5	TP8_1-5	TP9_0-5	HA-TP10_1-4	HA-TP11_1-5	HA-TP11_5-8.5	HA-TP12_1-5
Sample Date	MCP		07/17/2023	07/17/2023	02/21/2022	02/22/2022	02/22/2022	02/21/2022	02/21/2022	02/23/2022	02/23/2022	02/23/2022	02/22/2022
	Reportable					L2209378-02	L2209378-01	L2209166-03					L2209378-03
Lab Sample ID	Concentration	TCLP	L2340803-01	L2340803-02	L2209166-01	L2210411-01	L2210411-02	L2210514-01	L2209166-02	L2209666-01	L2209666-02	L2209666-03	L2210411-03
Sample Depth (bgs)	RCS-1		0 - 6 (ft)	6 - 13.5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	1 - 5 (ft)	0 - 5 (ft)	1 - 4 (ft)	1 - 5 (ft)	5 - 8.5 (ft)	1 - 5 (ft)
Sample Elevation (ft NAVD 88)	2014		22 to 16	16 to 8.5	21.5 to 17.5	23 to 19	21 to 17	22 to 18	26.5 to 21.5	21.8 to 18.8	22 to 18	18 to 14.5	25.5 to 21.5
Soil Description			FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
Soil Disposal Classification			I-3	II-3	I-3	II-1	II-3	II-3	I-3	II-1	I-3	II-1	III-2/II-5
VPH (mg/kg)													
C5-C8 Aliphatic Hydrocarbons, Adjusted	100	NA	-	-	-	-	-	-	-	-	-	-	-
C9-C10 Aromatic Hydrocarbons	100	NA	-	-	-	-	-	-	-	-	-	-	-
C9-C12 Aliphatic Hydrocarbons, Adjusted	1000	NA	-	-	-	-	-	-	-	-	-	-	-
Benzene	2	NA	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	40	NA	-	-	-	-	-	-	-	-	-	-	-
Methyl Tert Butyl Ether (MTBE)	0.1	NA	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	4	NA	-	-	-	-	-	-	-	-	-	-	-
Toluene	30	NA	-	-	-	-	-	-	-	-	-	-	-
Inorganic Compounds (mg/kg)													
Antimony	20	NA	ND (2.03)	ND (2.09)	ND (4.39)	ND (2.1)	ND (2.22)	ND (2.16)	ND (2.12)	ND (2.07)	ND (2.18)	ND (2.05)	ND (2.16)
Arsenic	20	NA	4.46	4.07	4.52	3.52	3.6	3.92	3.48	3.56	6.55	**20.8**	4.29
Barium	1000	NA	38.8	27.2	45.4	44.1	58	130	36.9	55.2	50.4	32.2	198
Beryllium	90	NA	ND (0.203)	ND (0.209)	0.448	0.235	0.23	ND (0.216)	ND (0.212)	0.27	0.3	0.378	ND (0.216)
Cadmium	70	NA	ND (0.406)	ND (0.418)	ND (0.878)	0.516	0.634	1.1	ND (0.425)	ND (0.415)	ND (0.435)	ND (0.411)	1.42
Chromium	100	NA	7.98	10.7	15.9	12.9	11	10.7	8.25	13.9	14.5	41.2	12.8
Lead	200	NA	58.4	63.6	8.53	**226**	124	183	81.2	76.7	67.8	54.5	**534**
Mercury	20	NA	0.186	0.106	ND (0.078)	0.134	0.518	0.97	0.109	0.253	1.11	0.208	0.438
Nickel	600	NA	7.24	8.35	12.7	10.9	9.04	9.04	7.26	11.9	18.7	22.2	10.8
Selenium	400	NA	ND (2.03)	ND (2.09)	ND (4.39)	ND (2.1)	ND (2.22)	ND (2.16)	ND (2.12)	ND (2.07)	ND (2.18)	ND (2.05)	ND (2.16)
Silver	100	NA	ND (0.406)	ND (0.418)	ND (0.878)	ND (0.419)	ND (0.443)	ND (0.431)	ND (0.425)	ND (0.415)	ND (0.435)	ND (0.411)	ND (0.433)
Thallium	8	NA	ND (2.03)	ND (2.09)	ND (4.39)	ND (2.1)	ND (2.22)	ND (2.16)	ND (2.12)	ND (2.07)	ND (2.18)	ND (2.05)	ND (2.16)
Vanadium	400	NA	11.2	12.6	22	21.6	18.3	16.3	16.4	40	136	26.4	18
Zinc	1000	NA	63.7	85.3	39	148	236	401	92.9	189	126	88.4	724
TCLP Inorganic Compounds (mg/L)													
Lead	NA	5	-	-	-	0.578	ND (0.5)	ND (0.5)	-	-	-	-	**5.86**
PCBs (mg/kg)													
Aroclor-1016 (PCB-1016)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1221 (PCB-1221)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1232 (PCB-1232)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1242 (PCB-1242)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	0.116	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1248 (PCB-1248)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1254 (PCB-1254)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	0.188	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1260 (PCB-1260)	1	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	0.057	0.0664	ND (0.0355)	ND (0.035)	0.0419	ND (0.0353)	ND (0.0358)
Aroclor-1262 (PCB-1262)	NA	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
Aroclor-1268 (PCB-1268)	NA	NA	ND (0.0506)	ND (0.0514)	ND (0.0383)	ND (0.0355)	ND (0.0375)	ND (0.0364)	ND (0.0355)	ND (0.035)	ND (0.0363)	ND (0.0353)	ND (0.0358)
SUM of PCBs	1	NA	ND	ND	ND	ND	0.057	0.3704	ND	ND	0.0419	ND	ND
Other													
Total Solids (%)	NA	NA	92.7	92.9	86.3	89.7	88.1	89.2	91.8	90.6	90.3	92.3	89.9
Reactive Cyanide (mg/kg)	NA	NA	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)	ND (130)
Reactive Sulfide (mg/kg)	NA	NA	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
Ignitability (Flashpoint)	NA	NA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
pH (lab) (pH units)	NA	NA	7.82	8.38	7.7	7.9	8.2	10	7.9	9.6	8.3	8.3	8.7
Conductivity (umhos/cm)	NA	NA	58	79	110	290	230	280	39	320	100	120	160

ABBREVIATIONS AND NOTES:
mg/kg: milligram per kilogram
mg/L: milligram per liter
umhos/cm: micromhos per centimeter

-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 I
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
NI: Not Ignitable
* Sample may not meet some Group I Facilities.
- Analytes detected in Volatile and Semi-Volatile Organics for at least one sample are reported
- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCS-1** or **TCLP** criteria.

TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			480 Arsenal		500 Arsenal				
Location Name	MCP	MCP	MCP	HA22-219(OW)	HA23-411	HA22-15 (OW)	HA22-17 (OW)	HA22-214(OW)	HA22-215(OW)	HA22-216(OW)
Sample Name	Method 1	Method 1	Reportable	HA22-219(OW)-2022-111	HA23-411_2023_28-7	HA22-15 (OW)-20220322	HA22-17 (OW)-20220322	HA22-214(OW)-2022-1031	HA22-215-2022-1102	HA22-216(OW)-2022-114
Sample Date	GW-2	GW-3	Concentration	11/01/2022	07/28/2023	03/22/2022	03/22/2022	10/31/2022	11/02/2022	11/04/2022
Lab Sample ID	2014	2014	RCGW-2	L2261198-01	L2343817-02	L2214864-03	L2214864-04	L2260835-01	L2261557-01	L2262112-02
Sample Elevation (ft NAVD 88)			2014	20.8 to 10.8	17.5 to 12.5	14 to 4	14.7 to 4.7	10.7 to 0.7	14.3 to 4.3	16 to 11
Volatile Organic Compounds (ug/L)										
1,1,1,2-Tetrachloroethane	10	50000	10	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1,1-Trichloroethane	4000	20000	4000	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1,2,2-Tetrachloroethane	9	50000	9	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1,2-Trichloroethane	900	50000	900	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1-Dichloroethane	2000	20000	2000	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1-Dichloroethene	80	30000	80	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,1-Dichloropropene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2,3-Trichlorobenzene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2,3-Trichloropropane	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2,4-Trichlorobenzene	200	50000	200	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2,4-Trimethylbenzene	NA	NA	100000	ND (2)	4.2	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2-Dibromo-3-chloropropane (DBCP)	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2-Dibromoethane (Ethylene Dibromide)	2	50000	2	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,2-Dichlorobenzene	8000	2000	2000	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,2-Dichloroethane	5	20000	5	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,2-Dichloroethene (total)	NA	NA	100	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,2-Dichloropropane	3	50000	3	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,3,5-Trimethylbenzene	NA	NA	1000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,3-Dichlorobenzene	6000	50000	6000	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,3-Dichloropropane	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
1,3-Dichloropropene	10	200	10	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.8)	ND (0.4)	ND (2)
1,4-Dichlorobenzene	60	8000	60	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
1,4-Dioxane	6000	50000	6000	ND (250)	ND (250)	ND (250)	ND (250)	ND (500)	ND (250)	ND (1200)
2,2-Dichloropropane	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
2-Butanone (Methyl Ethyl Ketone)	50000	50000	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (10)	ND (5)	ND (25)
2-Chlorotoluene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
2-Hexanone (Methyl Butyl Ketone)	NA	NA	10000	ND (5)	ND (5)	ND (5)	ND (5)	ND (10)	ND (5)	ND (25)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
4-Chlorotoluene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	50000	50000	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (10)	ND (5)	ND (25)
Acetone	50000	50000	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (10)	ND (5)	56
Benzene	1000	10000	1000	ND (0.5)	1.4	ND (0.5)	ND (0.5)	ND (1)	ND (0.5)	ND (2.5)
Bromobenzene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Bromodichloromethane	6	50000	6	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Bromoform	700	50000	700	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Bromomethane (Methyl Bromide)	7	800	7	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Carbon disulfide	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Carbon tetrachloride	2	5000	2	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Chlorobenzene	200	1000	200	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Chlorobromomethane	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Chloroethane	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Chloroform (Trichloromethane)	50	20000	50	1.1	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Chloromethane (Methyl Chloride)	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
cis-1,2-Dichloroethene	20	50000	20	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
cis-1,3-Dichloropropene	NA	NA	5	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.8)	ND (0.4)	ND (2)
Cymene (p-Isopropyltoluene)	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Dibromochloromethane	20	50000	20	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Dibromomethane	NA	NA	50000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Dichlorodifluoromethane (CFC-12)	NA	NA	100000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Diisopropyl ether (DIPE)	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Ethyl Ether	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Ethylbenzene	20000	5000	5000	ND (1)	20	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Hexachlorobutadiene	50	3000	50	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (1.2)	ND (0.6)	ND (3)
Isopropylbenzene (Cumene)	NA	NA	100000	ND (2)	2.8	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
m,p-Xylenes	NA	NA	NA	ND (2)	3.1	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Methyl Tert Butyl Ether (MTBE)	50000	50000	5000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Methylene chloride (Dichloromethane)	2000	50000	2000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Naphthalene	700	20000	700	ND (2)	59	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
n-Butylbenzene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
n-Propylbenzene	NA	NA	10000	ND (2)	4.2	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
o-Xylene	NA	NA	NA	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Styrene	100	6000	100	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Tert-Amyl Methyl Ether (TAME)	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Tert-Butyl Ethyl Ether (ETBE)	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
tert-Butylbenzene	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Tetrachloroethene	50	30000	50	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Tetrahydrofuran	NA	NA	50000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Toluene	50000	40000	40000	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	43
trans-1,2-Dichloroethene	80	50000	80	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
trans-1,3-Dichloropropene	NA	NA	5	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.8)	ND (0.4)	ND (2)
Trichloroethene	5	5000	5	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Trichlorofluoromethane (CFC-11)	NA	NA	100000	ND (2)	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (10)
Vinyl chloride	2	50000	2	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)
Xylene (Total)	3000	5000	3000	ND (1)	3.1	ND (1)	ND (1)	ND (2)	ND (1)	ND (5)

TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			480 Arsenal		500 Arsenal				
Location Name	MCP Method 1 GW-2 2014	MCP Method 1 GW-3 2014	MCP Reportable Concentration RCGW-2 2014	HA22-219(OW)	HA23-411	HA22-15 (OW)	HA22-17 (OW)	HA22-214(OW)	HA22-215(OW)	HA22-216(OW)
Sample Name				HA22-219(OW)-2022-111	HA23-411_2023_28-7	HA22-15 (OW)-20220322	HA22-17 (OW)-20220322	HA22-214(OW)-2022-1031	HA22-215-2022-1102	HA22-216(OW)-2022-114
Sample Date				11/01/2022	07/28/2023	03/22/2022	03/22/2022	10/31/2022	11/02/2022	11/04/2022
Lab Sample ID				L2261198-01	L2343817-02	L2214864-03	L2214864-04	L2260835-01	L2261557-01	L2262112-02
Sample Elevation (ft NAVD 88)				20.8 to 10.8	17.5 to 12.5	14 to 4	14.7 to 4.7	10.7 to 0.7	14.3 to 4.3	16 to 11
Semi-Volatile Organic Compounds (ug/L)										
1,2,4-Trichlorobenzene	200	50000	200	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
1,2-Dichlorobenzene	8000	2000	2000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,3-Dichlorobenzene	6000	50000	6000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,4-Dichlorobenzene	60	8000	60	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2,2'-oxybis(1-Chloropropane)	100	50000	100	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2,4,5-Trichlorophenol	50000	3000	3000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4,6-Trichlorophenol	5000	500	500	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dichlorophenol	30000	2000	2000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dimethylphenol	40000	50000	40000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dinitrophenol	50000	20000	20000	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)
2,4-Dinitrotoluene	20000	50000	20000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,6-Dinitrotoluene	NA	NA	10000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Chloronaphthalene	NA	NA	100000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
2-Chlorophenol	20000	7000	7000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Methylnaphthalene	2000	20000	2000	ND (2)	520	ND (2)	ND (2)	ND (2)	-	ND (2)
2-Methylphenol (o-Cresol)	NA	NA	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Nitrophenol	NA	NA	10000	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
3&4-Methylphenol	NA	NA	NA	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	9500
3,3'-Dichlorobenzidine	NA	2000	2000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
4-Bromophenyl phenyl ether (BDE-3)	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
4-Chloroaniline	30000	300	300	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
4-Nitrophenol	NA	NA	10000	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Acenaphthene	NA	10000	6000	ND (2)	6	ND (2)	ND (2)	ND (2)	-	ND (2)
Acenaphthylene	10000	40	40	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Acetophenone	NA	NA	100	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Aniline	NA	NA	100000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Anthracene	NA	30	30	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Azobenzene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(a)anthracene	NA	1000	1000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Benzo(a)pyrene	NA	500	500	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Benzo(b)fluoranthene	NA	400	400	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Benzo(g,h,i)perylene	NA	20	20	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Benzo(k)fluoranthene	NA	100	100	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Biphenyl	200	50000	200	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)
bis(2-Chloroethoxy)methane	NA	NA	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
bis(2-Chloroethyl)ether	30	50000	30	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
bis(2-Ethylhexyl)phthalate	NA	50000	50000	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	4.6
Butyl benzylphthalate (BBP)	NA	NA	10000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Chrysene	NA	70	70	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Dibenz(a,h)anthracene	NA	40	40	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Dibenzofuran	NA	NA	10000	ND (2)	4.8	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Diethyl phthalate	50000	9000	9000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Dimethyl phthalate	50000	50000	50000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Di-n-butylphthalate (DBP)	NA	NA	5000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Di-n-octyl phthalate (DnOP)	NA	NA	100000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Fluoranthene	NA	200	200	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Fluorene	NA	40	40	ND (2)	9	ND (2)	ND (2)	ND (2)	-	ND (2)
Hexachlorobenzene	1	6000	1	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Hexachlorobutadiene	50	3000	50	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Hexachloroethane	100	50000	100	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Indeno(1,2,3-cd)pyrene	NA	100	100	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Isophorone	NA	NA	10000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Naphthalene	700	20000	700	ND (2)	31	ND (2)	ND (2)	ND (2)	-	ND (2)
Nitrobenzene	NA	NA	50000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Pentachlorophenol	NA	200	200	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	-	ND (10)
Phenanthrene	NA	10000	10000	ND (2)	6.3	ND (2)	ND (2)	ND (2)	-	ND (2)
Phenol	50000	2000	2000	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	8.7
Pyrene	NA	20	20	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	-	ND (2)
Pyridine	NA	NA	50000	-	-	-	-	-	-	-
EPH (ug/L)										
C11-C22 Aromatic Hydrocarbons, Adjusted	50000	5000	5000	ND (100)	1840	ND (100)	ND (100)	ND (100)	ND (100)	295
C19-C36 Aliphatic Hydrocarbons	NA	50000	50000	ND (100)	ND (500)	ND (100)	ND (100)	ND (100)	ND (100)	490
C9-C18 Aliphatic Hydrocarbons	5000	50000	5000	ND (100)	517	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
VPH (ug/L)										
C5-C8 Aliphatic Hydrocarbons, Adjusted	3000	50000	3000	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
C9-C10 Aromatic Hydrocarbons	4000	50000	4000	ND (100)	493	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
C9-C12 Aliphatic Hydrocarbons, Adjusted	5000	50000	5000	ND (100)	118	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)

TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			480 Arsenal		500 Arsenal				
Location Name	MCP	MCP	MCP	HA22-219(OW)	HA23-411	HA22-15 (OW)	HA22-17 (OW)	HA22-214(OW)	HA22-215(OW)	HA22-216(OW)
Sample Name	Method 1	Method 1	Reportable	HA22-219(OW)-2022-111	HA23-411_2023_28-7	HA22-15 (OW)-20220322	HA22-17 (OW)-20220322	HA22-214(OW)-2022-1031	HA22-215-2022-1102	HA22-216(OW)-2022-114
Sample Date	GW-2	GW-3	Concentration	11/01/2022	07/28/2023	03/22/2022	03/22/2022	10/31/2022	11/02/2022	11/04/2022
Lab Sample ID	2014	2014	RCGW-2	L2261198-01	L2343817-02	L2214864-03	L2214864-04	L2260835-01	L2261557-01	L2262112-02
Sample Elevation (ft NAVD 88)			2014	20.8 to 10.8	17.5 to 12.5	14 to 4	14.7 to 4.7	10.7 to 0.7	14.3 to 4.3	16 to 11
Inorganic Compounds (ug/L)										
Antimony, Dissolved	NA	8000	8000	ND (4)	ND (50)	ND (4)	ND (4)	ND (4)	ND (50)	ND (40)
Arsenic, Dissolved	NA	900	900	ND (5)	ND (5)	0.5	ND (0.5)	10.3	ND (5)	ND (50)
Barium, Dissolved	NA	50000	50000	-	-	41.8	86	-	-	-
Beryllium, Dissolved	NA	200	200	-	-	ND (0.5)	ND (0.5)	-	-	-
Cadmium, Dissolved	NA	4	4	ND (4)	ND (4)	**19.2**	1.2	ND (4)	ND (4)	ND (40)
Chromium, Dissolved	NA	300	300	-	-	ND (1)	1.1	-	-	-
Lead, Dissolved	NA	10	10	ND (10)	ND (10)	**26.4**	ND (1)	ND (10)	ND (10)	**411**
Manganese, Dissolved	NA	NA	NA	-	-	-	-	-	-	1790
Mercury, Dissolved	NA	20	20	-	-	ND (0.2)	ND (0.2)	-	-	-
Nickel, Dissolved	NA	200	200	-	-	34.7	5.3	-	-	-
Selenium, Dissolved	NA	100	100	-	-	ND (5)	ND (5)	-	-	-
Silver, Dissolved	NA	7	7	-	-	ND (0.5)	ND (0.5)	-	-	-
Thallium, Dissolved	NA	3000	3000	-	-	ND (1)	ND (1)	-	-	-
Vanadium, Dissolved	NA	4000	4000	-	-	ND (5)	ND (5)	-	-	-
Zinc, Dissolved	NA	900	900	ND (50)	ND (50)	**19570**	577	ND (50)	ND (50)	ND (500)
Copper, Total	NA	NA	100000	-	-	-	-	-	3.27	-
Hardness, Total	NA	NA	NA	-	150000	-	-	-	-	-
Iron, Total	NA	NA	NA	-	-	-	-	-	808.6	-
Other										
Total Dissolved Solids (TDS) (ug/L)	NA	NA	NA	-	-	-	-	-	910000	-
Ammonia, Total (ug/L)	NA	NA	NA	-	-	-	-	-	ND (75)	-
Chloride, Total (ug/L)	NA	NA	NA	-	-	-	-	-	349000	-
Chlorine, residual, Total (ug/L)	NA	NA	NA	-	-	-	-	-	ND (20)	-
Cyanide, Total (ug/L)	NA	30	30	-	-	-	-	-	ND (5)	-
Nitrite/Nitrate, Total (ug/L)	NA	NA	NA	-	-	-	-	-	3100	-
Total Kjeldahl Nitrogen (TKN) (ug/L)	NA	NA	NA	-	-	-	-	-	ND (300)	-
Total Nitrogen (ug/L)	NA	NA	NA	-	-	-	-	-	3100	-
Total Suspended Solids (TSS) (ug/L)	NA	NA	NA	-	-	-	-	-	20000	-

ABBREVIATIONS AND NOTES:
µg/L: micrograms per liter
mg/L: milligram per liter
-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 May 2014.
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
TEBL: Technology based effluent limitations

- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCGW-2** criteria.
- Groundwater samples analyzed for dissolved metals were filtered in the field with a 0.45 micrometer filter.

TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			550 Arsenal											
Location Name	MCP Method 1 GW-2 2014	MCP Method 1 GW-3 2014	MCP Reportable Concentration RCGW-2 2014	HA22-01 (OW)	HA22-04 (OW)	HA22-05 (OW)	HA22-201(OW)	HA22-203(OW)	HA22-207(OW)	HA22-209(OW)	HA22-213(OW)	HA23-402 (OW)	HA23-404 (OW)	HA23-405 (OW)	HA23-416 (OW)
Sample Name				HA22-01 (OW)-20220322	HA22-04 (OW)-20220323	HA22-05 (OW)-20220322	HA22-201(OW)-2022-113	HA22-203(OW)-2022-111	HA22-207(OW)-2022-111	HA22-209(OW)-2022-113	HA22-213(OW)-2022-114	HA23-402_2023_28-7	HA23-404_2023-27-7	HA23-405_2023-27-7	HA23-416_2023-27-7
Sample Date				03/22/2022	03/23/2022	03/22/2022	11/03/2022	11/01/2022	11/01/2022	11/03/2022	11/04/2022	07/28/2023	07/27/2023	07/27/2023	07/27/2023
Lab Sample ID				L2214864-02	L2215204-01	L2214864-01	L2261836-02	L2261199-01	L2261199-02	L2261836-01	L2262112-01	L2343817-01	L2343377-02	L2343377-01	L2343377-03
Sample Elevation (ft NAVD 88)				12 to 2	7.3 to -2.7	10 to 0	16.8 to 6.8	12.8 to 2.8	9.5 to -0.5	11.3 to 1.3	12.5 to 2.5	9 to -1	2 to -8	7 to -13	3 to -7
Volatile Organic Compounds (ug/L)															
1,1,1,2-Tetrachloroethane	10	50000	10	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1,1-Trichloroethane	4000	20000	4000	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1,2,2-Tetrachloroethane	9	50000	9	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1,2-Trichloroethane	900	50000	900	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1-Dichloroethane	2000	20000	2000	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1-Dichloroethene	80	30000	80	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,1-Dichloropropene	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2,3-Trichlorobenzene	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2,3-Trichloropropane	NA	NA	10000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2,4-Trichlorobenzene	200	50000	200	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2,4-Trimethylbenzene	NA	NA	100000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2-Dibromo-3-chloropropane (DBCP)	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2-Dibromoethane (Ethylene Dibromide)	2	50000	2	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,2-Dichlorobenzene	8000	2000	2000	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,2-Dichloroethane	5	20000	5	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,2-Dichloroethene (total)	NA	NA	100	ND (1)	ND (1)	ND (1)	3.4	2	ND (1)	ND (1)	ND (1)	ND (1)	7	5.1	ND (1)
1,2-Dichloropropane	3	50000	3	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,3,5-Trimethylbenzene	NA	NA	1000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,3-Dichlorobenzene	6000	50000	6000	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,3-Dichloropropane	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,3-Dichloropropene	10	200	10	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
1,4-Dichlorobenzene	60	8000	60	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
1,4-Dioxane	6000	50000	6000	ND (250)	-	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)	ND (250)
2,2-Dichloropropane	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Butanone (Methyl Ethyl Ketone)	50000	50000	50000	ND (5)	-	ND (5)	8.8	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Chlorotoluene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Hexanone (Methyl Butyl Ketone)	NA	NA	10000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Phenylbutane (sec-Butylbenzene)	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
4-Chlorotoluene	NA	NA	NA	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	50000	50000	50000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Acetone	50000	50000	50000	ND (5)	-	ND (5)	58	13	15	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Benzene	1000	10000	1000	ND (0.5)	-	ND (0.5)	1.4	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Bromobenzene	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Bromodichloromethane	6	50000	6	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Bromoform	700	50000	700	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Bromomethane (Methyl Bromide)	7	800	7	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Carbon disulfide	NA	NA	10000	ND (2)	-	ND (2)	5.8	16	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Carbon tetrachloride	2	5000	2	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Chlorobenzene	200	1000	200	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Chlorobromomethane	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Chloroethane	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Chloroform (Trichloromethane)	50	20000	50	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Chloromethane (Methyl Chloride)	NA	NA	10000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
cis-1,2-Dichloroethene	20	50000	20	ND (1)	ND (1)	ND (1)	3.4	2	ND (1)	ND (1)	ND (1)	ND (1)	7	5.1	ND (1)
cis-1,3-Dichloropropene	NA	NA	5	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
Cymene (p-Isopropyltoluene)	NA	NA	10000	ND (2)	-	ND (2)	5.4	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Dibromochloromethane	20	50000	20	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Dibromomethane	NA	NA	50000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Dichlorodifluoromethane (CFC-12)	NA	NA	100000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Diisopropyl ether (DIPE)	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Ethyl Ether	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Ethylbenzene	20000	5000	5000	ND (1)	-	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Hexachlorobutadiene	50	3000	50	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)	ND (0.6)
Isopropylbenzene (Cumene)	NA	NA	100000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
m,p-Xylenes	NA	NA	NA	ND (2)	-	ND (2)	2	2.1	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Methyl Tert Butyl Ether (MTBE)	50000	50000	5000	ND (2)	-	ND (2)	ND (2)	ND (2)	2.4	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Methylene chloride (Dichloromethane)	2000	50000	2000	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Naphthalene	700	20000	700	ND (2)	-	ND (2)	110	64	14	ND (2)	ND (2)	ND (2)	ND (2)	4.4	ND (2)
n-Butylbenzene	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
n-Propylbenzene	NA	NA	10000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
o-Xylene	NA	NA	NA	ND (1)	-	ND (1)	1.6	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Styrene	100	6000	100	ND (1)	-	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Tert-Amyl Methyl Ether (TAME)	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Tert-Butyl Ethyl Ether (ETBE)	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
tert-Butylbenzene	NA	NA	10000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Tetrachloroethene	50	30000	50	ND (1)	ND (1)	ND (1)	1.1	ND (1)	ND (1)	ND (1)	ND (1)	2.6	ND (1)	ND (1)	2.8
Tetrahydrofuran	NA	NA	50000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	2.5	ND (2)	ND (2)
Toluene	50000	40000	40000	ND (1)	-	ND (1)	2.5	6.3	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
trans-1,2-Dichloroethene	80	50000	80	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
trans-1,3-Dichloropropene	NA	NA	5	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
Trichloroethene	5	5000	5	ND (1)	ND (1)	ND (1)	1.1	ND (1)	ND (1)	ND (1)	ND (1)	1.5	ND (1)	ND (1)	3.9
Trichlorofluoromethane (CFC-11)	NA	NA	100000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Vinyl chloride	2	50000	2	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)
Xylene (Total)	3000	5000	3000	ND (1)	-	ND (1)	3.6	2.1	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)

TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			550 Arsenal											
Location Name	MCP Method 1 GW-2 2014	MCP Method 1 GW-3 2014	MCP Reportable Concentration RCGW-2 2014	HA22-01 (OW)	HA22-04 (OW)	HA22-05 (OW)	HA22-201(OW)	HA22-203(OW)	HA22-207(OW)	HA22-209(OW)	HA22-213(OW)	HA23-402 (OW)	HA23-404 (OW)	HA23-405 (OW)	HA23-416 (OW)
Sample Name				HA22-01 (OW)-20220322	HA22-04 (OW)-20220323	HA22-05 (OW)-20220322	HA22-201(OW)-2022-113	HA22-203(OW)-2022-111	HA22-207(OW)-2022-111	HA22-209(OW)-2022-113	HA22-213(OW)-2022-114	HA23-402_2023_28-7	HA23-404_2023-27-7	HA23-405_2023-27-7	HA23-416_2023-27-7
Sample Date				03/22/2022	03/23/2022	03/22/2022	11/03/2022	11/01/2022	11/01/2022	11/03/2022	11/04/2022	07/28/2023	07/27/2023	07/27/2023	07/27/2023
Lab Sample ID				L2214864-02	L2215204-01	L2214864-01	L2261836-02	L2261199-01	L2261199-02	L2261836-01	L2262112-01	L2343817-01	L2343377-02	L2343377-01	L2343377-03
Sample Elevation (ft NAVD 88)				12 to 2	7.3 to -2.7	10 to 0	16.8 to 6.8	12.8 to 2.8	9.5 to -0.5	11.3 to 1.3	12.5 to 2.5	9 to -1	2 to -8	7 to -13	3 to -7
Semi-Volatile Organic Compounds (ug/L)															
1,2,4-Trichlorobenzene	200	50000	200	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
1,2-Dichlorobenzene	8000	2000	2000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,3-Dichlorobenzene	6000	50000	6000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
1,4-Dichlorobenzene	60	8000	60	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2,2'-oxybis(1-Chloropropane)	100	50000	100	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2,4,5-Trichlorophenol	50000	3000	3000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4,6-Trichlorophenol	5000	500	500	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dichlorophenol	30000	2000	2000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dimethylphenol	40000	50000	40000	ND (5)	-	ND (5)	18	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,4-Dinitrophenol	50000	20000	20000	ND (20)	-	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)
2,4-Dinitrotoluene	20000	50000	20000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2,6-Dinitrotoluene	NA	NA	10000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Chloronaphthalene	NA	NA	100000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Chlorophenol	20000	7000	7000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Methylnaphthalene	2000	20000	2000	ND (2)	-	ND (2)	5.4	4.3	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
2-Methylphenol (o-Cresol)	NA	NA	50000	ND (5)	-	ND (5)	6.7	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
2-Nitrophenol	NA	NA	10000	ND (10)	-	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
3&4-Methylphenol	NA	NA	NA	ND (5)	-	ND (5)	55	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
3,3'-Dichlorobenzidine	NA	2000	2000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
4-Bromophenyl phenyl ether (BDE-3)	NA	NA	10000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
4-Chloroaniline	30000	300	300	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
4-Nitrophenol	NA	NA	10000	ND (10)	-	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Acenaphthene	NA	10000	6000	ND (2)	-	3.6	14	7.7	3.2	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Acenaphthylene	10000	40	40	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Acetophenone	NA	NA	100	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Aniline	NA	NA	100000	ND (2)	-	ND (2)	4.9	35	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Anthracene	NA	30	30	ND (2)	-	ND (2)	3.7	2.8	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Azobenzene	NA	NA	NA	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(a)anthracene	NA	1000	1000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(a)pyrene	NA	500	500	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(b)fluoranthene	NA	400	400	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(g,h,i)perylene	NA	20	20	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Benzo(k)fluoranthene	NA	100	100	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Biphenyl	200	50000	200	ND (0.73)	-	ND (0.73)	1.3	0.89	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)	ND (0.73)
bis(2-Chloroethoxy)methane	NA	NA	50000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
bis(2-Chloroethyl)ether	30	50000	30	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
bis(2-Ethylhexyl)phthalate	NA	50000	50000	ND (3)	-	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)	ND (3)
Butyl benzylphthalate (BBP)	NA	NA	10000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Chrysene	NA	70	70	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Dibenz(a,h)anthracene	NA	40	40	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Dibenzofuran	NA	NA	10000	ND (2)	-	ND (2)	7	4.4	2	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Diethyl phthalate	50000	9000	9000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Dimethyl phthalate	50000	50000	50000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Di-n-butylphthalate (DBP)	NA	NA	5000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Di-n-octyl phthalate (DnOP)	NA	NA	100000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Fluoranthene	NA	200	200	ND (2)	-	ND (2)	4	2.1	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Fluorene	NA	40	40	ND (2)	-	ND (2)	10	6.1	2.8	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Hexachlorobenzene	1	6000	1	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Hexachlorobutadiene	50	3000	50	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Hexachloroethane	100	50000	100	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Indeno(1,2,3-cd)pyrene	NA	100	100	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Isophorone	NA	NA	10000	ND (5)	-	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Naphthalene	700	20000	700	ND (2)	-	ND (2)	38	26	6.7	ND (2)	ND (2)	ND (2)	ND (2)	2.1	ND (2)
Nitrobenzene	NA	NA	50000	ND (2)	-	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Pentachlorophenol	NA	200	200	ND (10)	-	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Phenanthrene	NA	10000	10000	2.5	-	ND (2)	17	10	6.6	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Phenol	50000	2000	2000	ND (5)	-	ND (5)	6.2	19	27	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Pyrene	NA	20	20	ND (2)	-	ND (2)	2.7	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Pyridine	NA	NA	50000	-	-	-	-	-	-	-	-	-	ND (3.5)	ND (3.5)	ND (3.5)
EPH (ug/L)															
C11-C22 Aromatic Hydrocarbons, Adjusted	50000	5000	5000	ND (100)	-	ND (100)	311	179	102	ND (100)	ND (100)	ND (100)	123	ND (100)	ND (100)
C19-C36 Aliphatic Hydrocarbons	NA	50000	50000	ND (100)	-	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	111	ND (100)	ND (100)
C9-C18 Aliphatic Hydrocarbons	5000	50000	5000	ND (100)	-	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
VPH (ug/L)															
C5-C8 Aliphatic Hydrocarbons, Adjusted	3000	50000	3000	ND (100)	-	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
C9-C10 Aromatic Hydrocarbons	4000	50000	4000	ND (100)	-	ND (100)	128	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)
C9-C12 Aliphatic Hydrocarbons, Adjusted	5000	50000	5000	ND (100)	-	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)	ND (100)

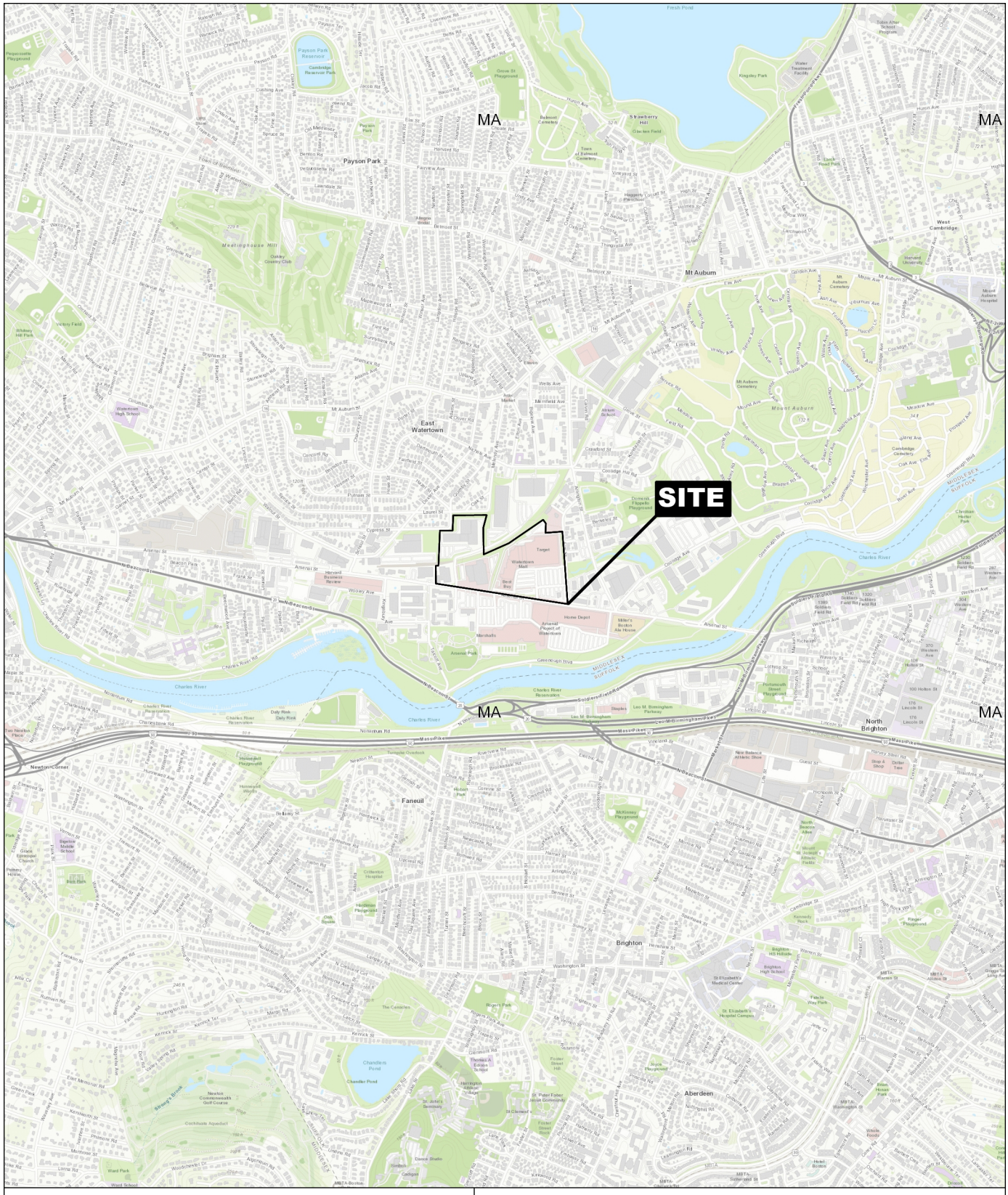
TABLE III
SUMMARY OF GROUNDWATER QUALITY DATA
WATERTOWN MALL
WATERTOWN, MA
FILE NO. 0203699

	Action Level			550 Arsenal											
Location Name	MCP Method 1 GW-2 2014	MCP Method 1 GW-3 2014	MCP Reportable Concentration RCGW-2 2014	HA22-01 (OW)	HA22-04 (OW)	HA22-05 (OW)	HA22-201(OW)	HA22-203(OW)	HA22-207(OW)	HA22-209(OW)	HA22-213(OW)	HA23-402 (OW)	HA23-404 (OW)	HA23-405 (OW)	HA23-416 (OW)
Sample Name				HA22-01 (OW)-20220322	HA22-04 (OW)-20220323	HA22-05 (OW)-20220322	HA22-201(OW)-2022-113	HA22-203(OW)-2022-111	HA22-207(OW)-2022-111	HA22-209(OW)-2022-113	HA22-213(OW)-2022-114	HA23-402_2023_28-7	HA23-404_2023-27-7	HA23-405_2023-27-7	HA23-416_2023-27-7
Sample Date				03/22/2022	03/23/2022	03/22/2022	11/03/2022	11/01/2022	11/01/2022	11/03/2022	11/04/2022	07/28/2023	07/27/2023	07/27/2023	07/27/2023
Lab Sample ID				L2214864-02	L2215204-01	L2214864-01	L2261836-02	L2261199-01	L2261199-02	L2261836-01	L2262112-01	L2343817-01	L2343377-02	L2343377-01	L2343377-03
Sample Elevation (ft NAVD 88)				12 to 2	7.3 to -2.7	10 to 0	16.8 to 6.8	12.8 to 2.8	9.5 to -0.5	11.3 to 1.3	12.5 to 2.5	9 to -1	2 to -8	7 to -13	3 to -7
Inorganic Compounds (ug/L)															
Antimony, Dissolved	NA	8000	8000	ND (4)	-	ND (4)	ND (4)	4.1	ND (4)	ND (4)	ND (4)	ND (50)	ND (50)	ND (50)	ND (50)
Arsenic, Dissolved	NA	900	900	4.9	-	1.3	9.5	16	7.4	ND (5)	ND (5)	ND (5)	12.9	6.9	ND (5)
Barium, Dissolved	NA	50000	50000	386.6	-	297.3	-	-	-	-	-	-	-	-	-
Beryllium, Dissolved	NA	200	200	ND (0.5)	-	ND (0.5)	-	-	-	-	-	-	-	-	-
Cadmium, Dissolved	NA	4	4	ND (0.5)	-	ND (0.5)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Chromium, Dissolved	NA	300	300	ND (1)	-	1.1	-	-	-	-	-	-	-	-	-
Lead, Dissolved	NA	10	10	ND (1)	-	ND (1)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Manganese, Dissolved	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Mercury, Dissolved	NA	20	20	ND (0.2)	-	ND (0.2)	-	-	-	-	-	-	-	-	-
Nickel, Dissolved	NA	200	200	ND (2)	-	ND (2)	-	-	-	-	-	-	-	-	-
Selenium, Dissolved	NA	100	100	ND (5)	-	ND (5)	-	-	-	-	-	-	-	-	-
Silver, Dissolved	NA	7	7	ND (0.5)	-	ND (0.5)	-	-	-	-	-	-	-	-	-
Thallium, Dissolved	NA	3000	3000	ND (1)	-	ND (1)	-	-	-	-	-	-	-	-	-
Vanadium, Dissolved	NA	4000	4000	ND (5)	-	ND (5)	-	-	-	-	-	-	-	-	-
Zinc, Dissolved	NA	900	900	11.8	-	11.7	ND (50)	ND (50)	ND (50)	ND (50)	ND (50)	ND (50)	ND (50)	ND (50)	94.5
Copper, Total	NA	NA	100000	-	-	-	-	-	-	-	-	-	-	-	-
Hardness, Total	NA	NA	NA	-	-	-	-	-	-	-	-	178000	826000	432000	287000
Iron, Total	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Other															
Total Dissolved Solids (TDS) (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia, Total (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Chloride, Total (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Chlorine, residual, Total (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Total (ug/L)	NA	30	30	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite/Nitrate, Total (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (TKN) (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids (TSS) (ug/L)	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-

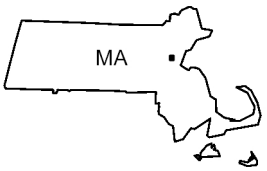
ABBREVIATIONS AND NOTES:
µg/L: micrograms per liter
mg/L: milligram per liter
-: Not Analyzed
bgs: below ground surface
ft: feet
MCP: 310 CMR 40.0000 Massachusetts Contingency Plan effective 25 April 2014; revisions 23 May 2014.
NA: Not Applicable
ND (2.5): Not detected, number in parentheses is the laboratory reporting limit
TEBL: Technology based effluent limitations

- For test methods used, see the laboratory data sheets.
- Bold values indicate an exceedance of the **RCGW-2** criteria.
- Groundwater samples analyzed for dissolved metals were filtered in the field with a 0.45 micrometer filt

FIGURES



SITE COORDINATES: 42°21'49"N, 71°09'34"W





MAP SOURCE: USGS

HALEY ALDRICH

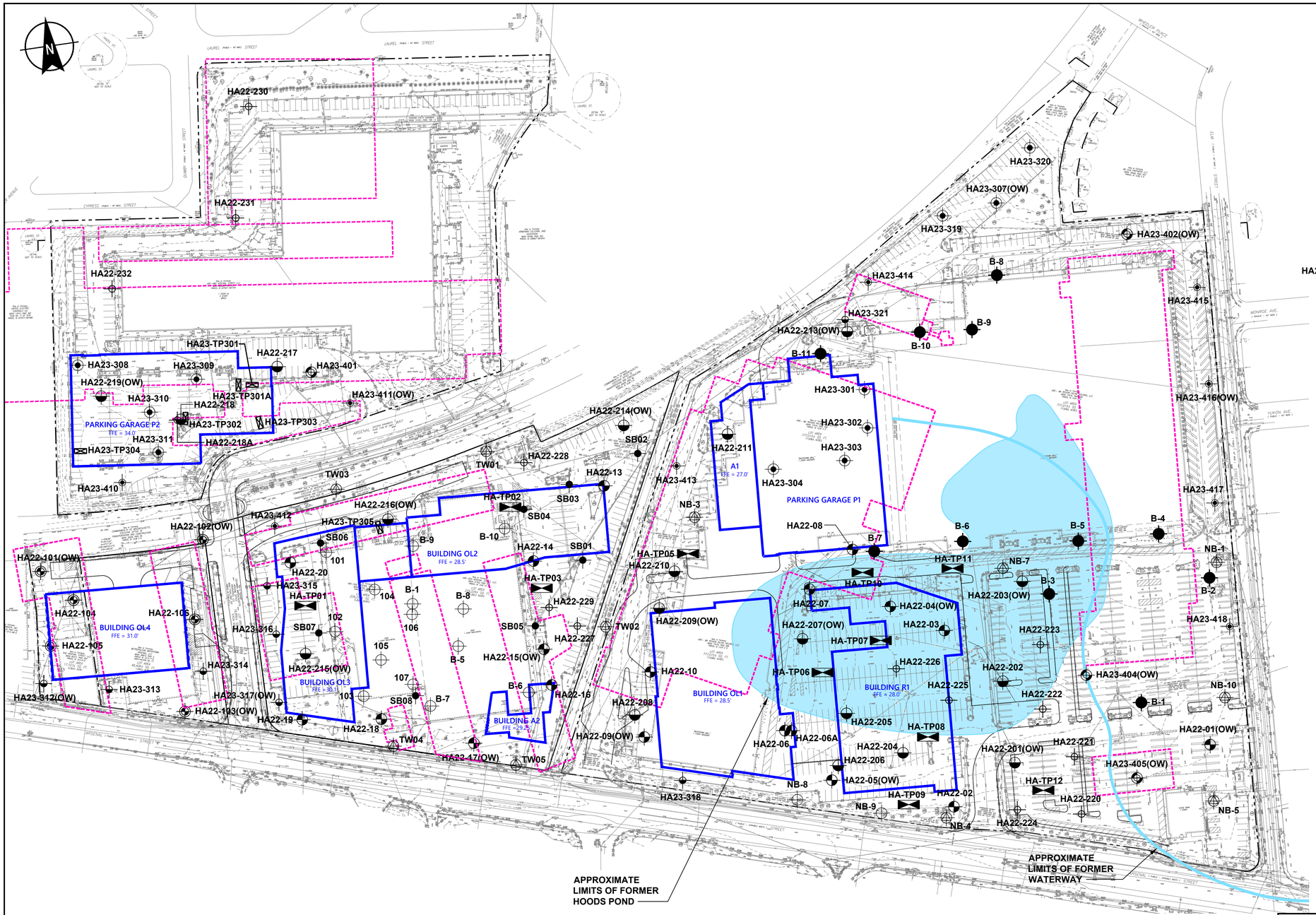
WATERTOWN MALL REDEVELOPMENT
446-458, 480, 500 AND 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

PROJECT LOCUS

APPROXIMATE SCALE: 1 INCH = 2,000 FEET
JUNE 2023

FIGURE 1

0203699_001_LOCUS HALEYALDRICH\DHERLING



LEGEND

HA23-401	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY GEOLOGIC EARTH EXPLORATIONS, IN. FROM 20 TO 25 JULY 2023 AND MONITORED BY HALEY AND ALDRICH, INC.
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HA22-104	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY GEOLOGIC EARTH EXPLORATIONS, INC., FROM 27 JUNE 2022 TO 6 JULY 2022, AND MONITORED BY HALEY & ALDRICH, INC.
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B-1	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING DRILLED BY SOIL EXPLORATION CORP. IN MARCH 2007.
NB-8	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY OTHERS, BETWEEN 28 FEBRUARY 1978 TO 12 OCTOBER 1988.
NB-7	DESIGNATION AND APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY OTHERS, BETWEEN 29 SEPTEMBER 1978 TO 22 DECEMBER 1999.
SB-01	DESIGNATION AND APPROXIMATE LOCATION OF GEOPROBE PERFORMED BY OTHERS, ON 30 NOVEMBER 1999.
(OW)	INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE
	APPROXIMATE LIMITS OF PROPOSED STRUCTURES
	APPROXIMATE LIMITS OF HISTORICAL FEATURES TAKEN FROM A 1951 SANDBORN MAP (SEE NOTE 7)

NOTES

1. BASE PLAN TAKEN FROM ELECTRONIC FILE TITLED "2200012_EC-1-2022-1214.DWG" PROVIDED BY FELDMAN, INC. ON 21 DECEMBER 2022.
2. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE OBTAINED BY HALEY & ALDRICH, INC. BY TAPING TO EXISTING SITE FEATURES AT THE TIME THE EXPLORATION WAS CONDUCTED.
4. APPROXIMATE LIMITS OF PROPOSED STRUCTURES AND FIRST FLOOR ELEVATION (FFE) TAKEN FROM ELECTRONIC FILE TITLED "1537400_PR.dwg" PROVIDED BY VHB, INC. ON 2 DECEMBER 2022.
5. APPROXIMATE LIMITS OF FORMER HOODS POND AND WATERWAY TAKEN FROM HISTORIC MAPS FROM 1925 AND 1908, RESPECTIVELY.
6. HISTORICAL FEATURES SHOWN TAKEN FROM THE 1951 SANBORN MAPS; REFER TO HISTORIC PLANS FOR OTHER HISTORIC STRUCTURES FROM OTHER YEARS.

0 80 160 240 320
SCALE IN FEET

HALEY ALDRICH

WATERTOWN MALL REDEVELOPMENT
446 TO 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

HISTORIC SITE FEATURES

SCALE: AS SHOWN
AUGUST 2023

FIGURE 2

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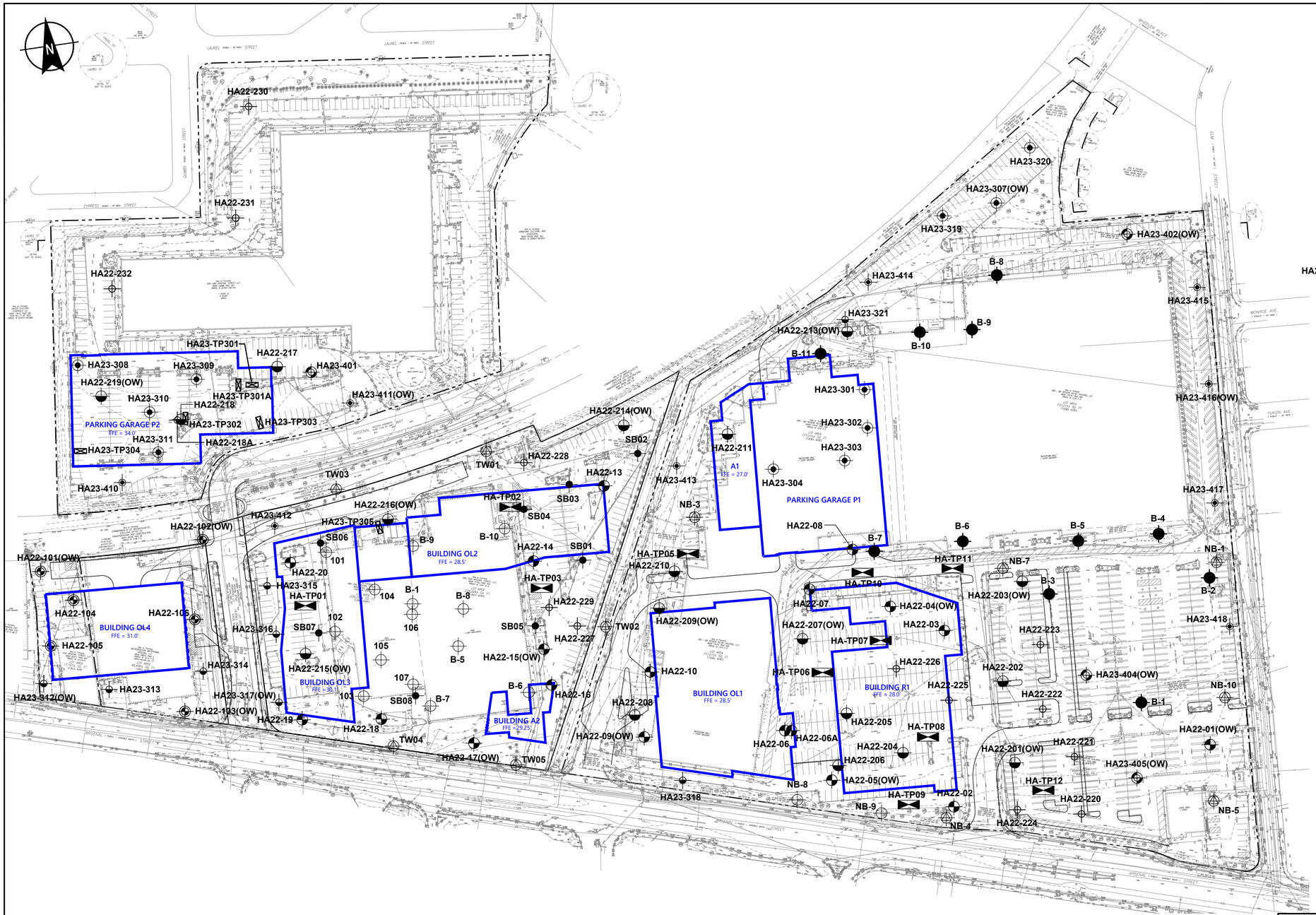

LEGEND

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B-1	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING DRILLED BY SOIL EXPLORATION CORP. IN MARCH 2007.
NB-8	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY OTHERS, BETWEEN 28 FEBRUARY 1978 TO 12 OCTOBER 1988.
NB-7	DESIGNATION AND APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY OTHERS, BETWEEN 29 SEPTEMBER 1978 TO 22 DECEMBER 1999.
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(OW)	INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE
	APPROXIMATE LIMITS OF PROPOSED STRUCTURES

NOTES

1. BASE PLAN TAKEN FROM ELECTRONIC FILE TITLED "2200012_EC-1-2022-1214.DWG" PROVIDED BY FELDMAN, INC. ON 21 DECEMBER 2022.
2. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. LOCATIONS OF TEST BORINGS ARE APPROXIMATE AND WERE OBTAINED BY HALEY & ALDRICH, INC. BY TAPING TO EXISTING SITE FEATURES AT THE TIME THE EXPLORATION WAS CONDUCTED.
4. APPROXIMATE LIMITS OF PROPOSED STRUCTURES AND FIRST FLOOR ELEVATION (FFE) TAKEN FROM ELECTRONIC FILE TITLED "1537400_PR.dwg" PROVIDED BY VHB, INC. ON 2 DECEMBER 2022.

HALEY ALDRICH

WATERTOWN MALL REDEVELOPMENT
446 TO 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
AUGUST 2023

FIGURE 3

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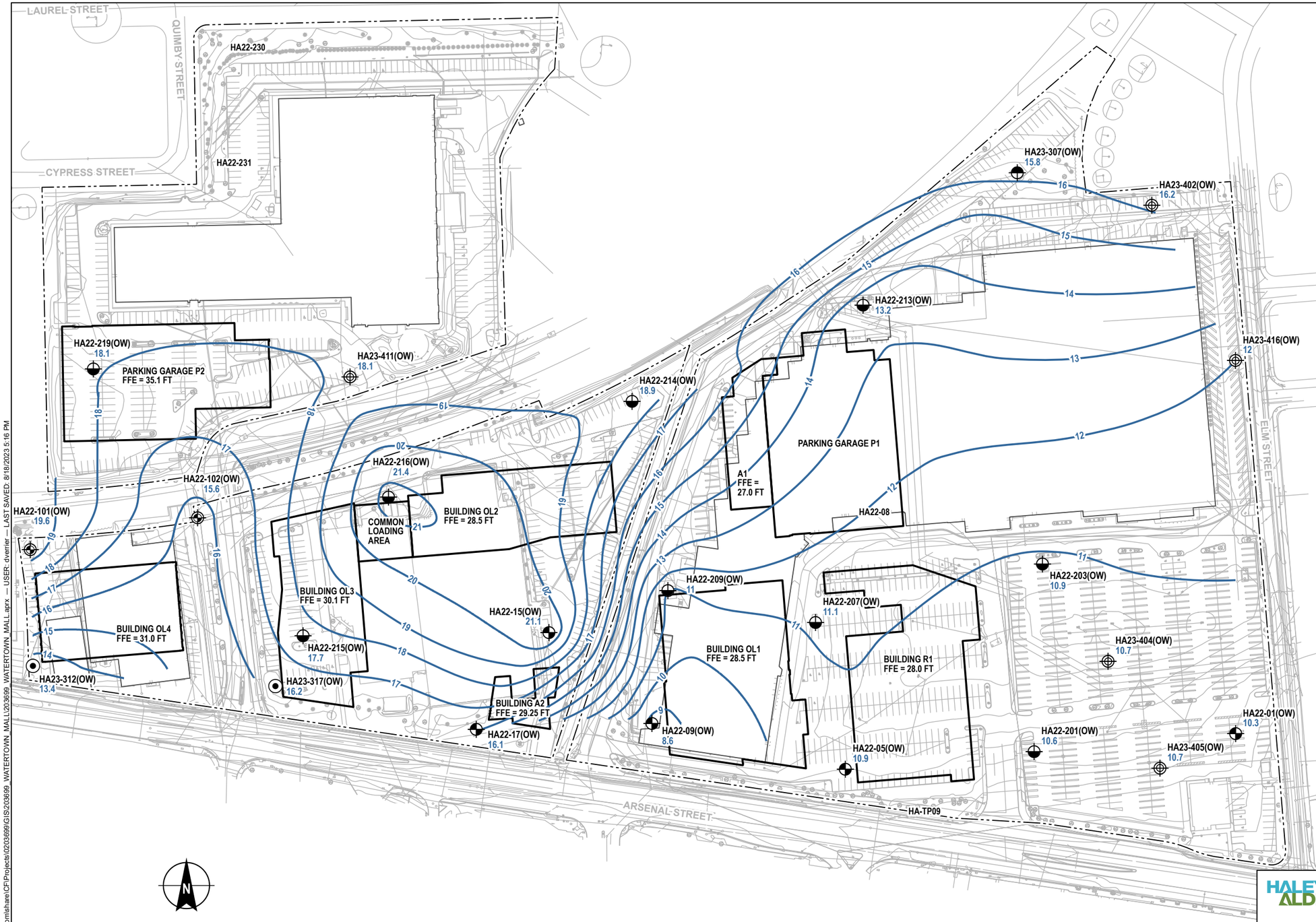

LEGEND

- HA23-402(OW) — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY GEOLOGIC EARTH EXPLORATIONS, INC. FROM 20 TO 25 JULY 2023 AND MONITORED BY HALEY AND ALDRICH, INC.
- HA23-312(OW) — DESIGNATION AND APPROXIMATE LOCATION OF GEOPROBE PERFORMED BY GEOLOGIC EARTH EXPLORATIONS, INC. FROM 6 TO 7 FEBRUARY 2023 AND MONITORED BY HALEY & ALDRICH, INC.
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- HA22-201(OW) — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY CAR-DEE CORP, FROM 27 JUNE 2022 TO 6 JULY 2022, AND MONITORED BY HALEY & ALDRICH, INC.
- HA22-01(OW) — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING PERFORMED BY CAR-DEE CORP, FROM 3 FEBRUARY 2022 TO 15 FEBRUARY 2022, AND MONITORED BY HALEY & ALDRICH, INC.
- GROUNDWATER ELEVATION CONTOUR, 1-FT INTERVAL
- PROPOSED STRUCTURE FOOTPRINT
- EXISTING STRUCTURE FOOTPRINT
- SITE BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. ELEVATIONS ARE IN FEET (FT) AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. OW = OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE
4. GROUNDWATER READINGS OBTAINED ON 10 AUGUST 2023.
5. PROPOSED STRUCTURES DATA SOURCE: ELECTRONIC FILE TITLED "CIV_ARE-WATERTOWN_15374.00_480_LAYOUT_CAD2018.DWG," BY VHB INC, 28 OCTOBER 2022
6. BASE PLAN SOURCE: ELECTRONIC FILE TITLED "2200012-EC-1-2022-1214.DWG," FELDMAN, INC, 21 DECEMBER 2022.

HALEY ALDRICH

WATERTOWN MALL REDEVELOPMENT
446 TO 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

GROUNDWATER CONTOUR PLAN AUGUST 2023

AUGUST 2023

FIGURE 4

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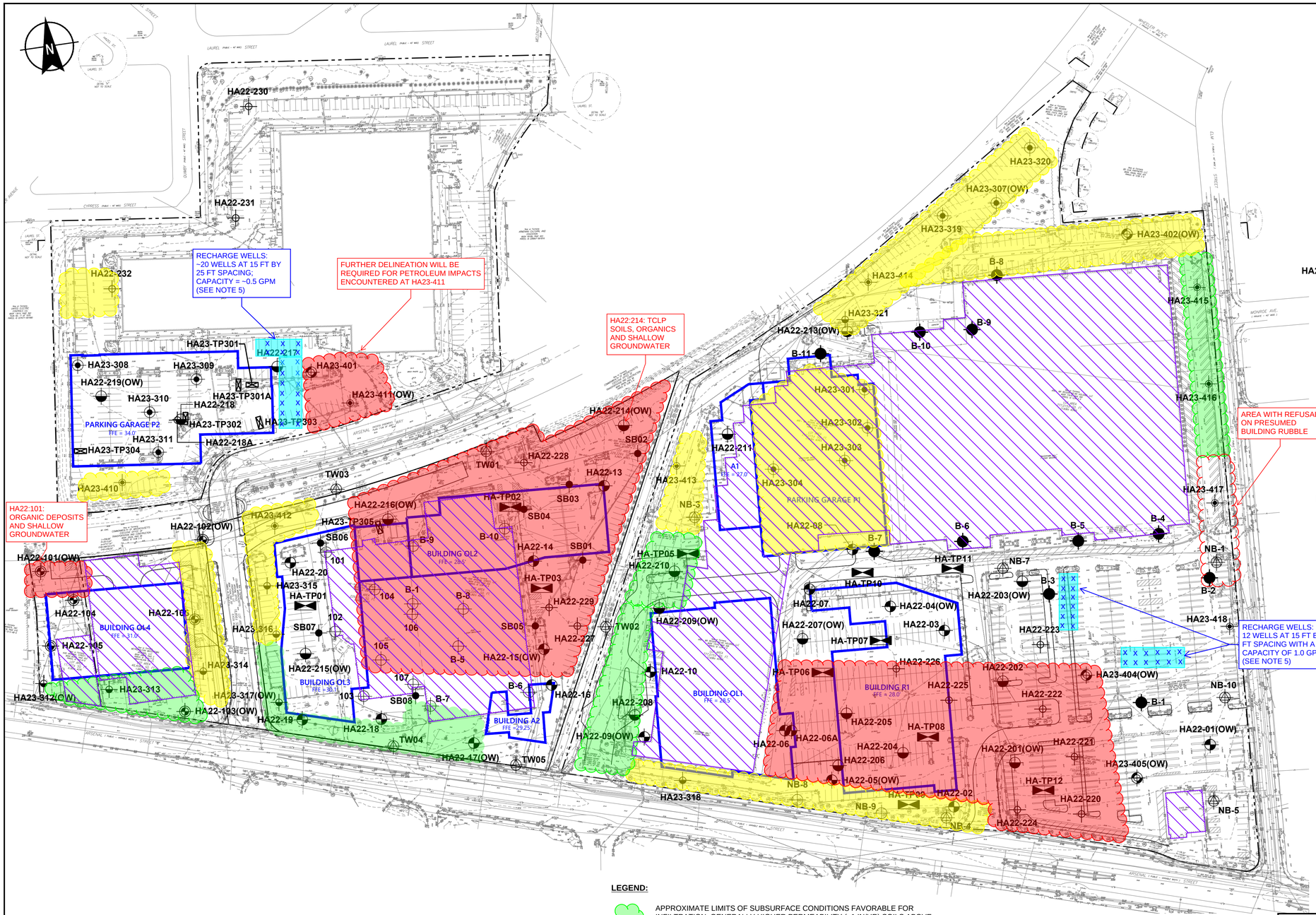

LEGEND

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	APPROXIMATE LIMITS OF PROPOSED STRUCTURES

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5. CONCEPTUAL LAYOUT OF RECHARGE WELLS IS BASED ON MOUNDING ANALYSES USING INPUTS PROVIDED BY VHB WITH THE GOAL OF MINIMIZING MOUND HEIGHT TO LESS THAN 4 FT. RECHARGE WELLS ARE CONSIDERED FEASIBLE IN AREAS WITH DEEPER GRANULAR DEPOSITS TO INCREASE INFILTRATION. LOCATIONS OF RECHARGE WELLS ARE SCHEMATIC ONLY AND WILL BE SHOWN ON VHB PLANS.

LEGEND:

- APPROXIMATE LIMITS OF SUBSURFACE CONDITIONS FAVORABLE FOR INFILTRATION: GENERALLY HIGHER PERMEABILITY (>1 IN/HR) SOILS ABOVE GROUNDWATER TABLE.
- APPROXIMATE LIMITS OF SUBSURFACE CONDITIONS WITH MODERATELY FAVORABLE INFILTRATION CONDITIONS: LOW TO MODERATE PERMEABILITY (< 1 IN/HR) SOILS ABOVE GROUNDWATER TABLE.
- APPROXIMATE LIMITS OF SUBSURFACE CONDITIONS NOT FEASIBLE FOR SHALLOW INFILTRATION BUT ARE FAVORABLE FOR RECHARGE WELLS WHICH EXTEND TO NATURAL GLACIAL SAND DEPOSIT (BELOW THICK FILL / GROUNDWATER TABLE).
- APPROXIMATE LIMITS OF SUBSURFACE CONDITIONS NOT FEASIBLE FOR INFILTRATION DUE TO GEOLOGIC AND/OR ENVIRONMENTAL CONDITIONS.
- APPROXIMATE LIMITS OF EXISTING BUILDINGS (LIMITED ACCESS FOR EXPLORATIONS)

HALEY ALDRICH

WATERTOWN MALL REDEVELOPMENT
446 TO 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

SUMMARY OF STORMWATER INFILTRATION FEASIBILITY PLAN

SCALE: AS SHOWN
AUGUST 2023

FIGURE 5

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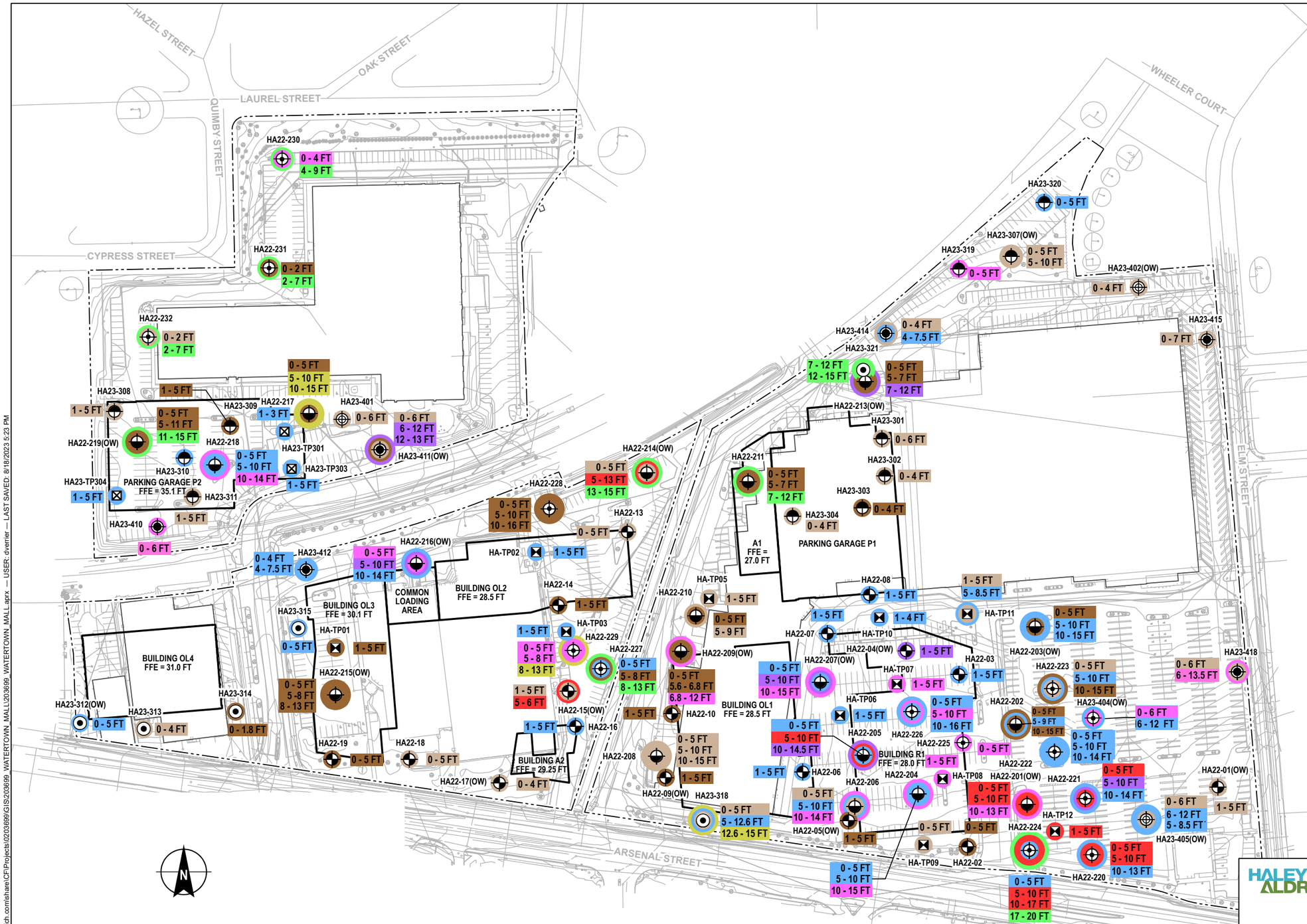

LEGEND

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SOIL CLASSIFICATION GROUP

- I-1/I-2, <RCS 1 CRITERIA, NATURAL
- I-1/I-2*, <RCS-1 BUT MAY NOT MEET SOME GROUP I FACILITIES
- I-3, <RCS-1 CRITERIA
- I-3*, <RCS-1 BUT MAY NOT MEET SOME GROUP I FACILITIES
- II-1, UNLINED LANDFILL
- II-2, LINED LANDFILL
- II-3, RECYCLING
- III-2/II-5, CHARACTERIZED HAZARDOUS WASTE FOR TCLP FAILED LEAD; TREAT THEN DISPOSE AS II-5

0 - 5 FT / 5 - 10 FT / 10 - 15 FT — SAMPLE DEPTH INTERVAL IN FEET

PROPOSED STRUCTURE FOOTPRINT

EXISTING STRUCTURE FOOTPRINT

SITE BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

2. DEFINITIONS:
RCS = REPORTABLE CONCENTRATIONS
TCLP = TOXICITY CHARACTERISTIC LEACHING PROCEDURE
FT = FEET
FFE = FIRST FLOOR ELEVATION

3. PROPOSED STRUCTURES DATA SOURCE: ELECTRONIC FILE TITLED "CIV_ARE-WATERTOWN_ 15374.00_480_LAYOUT_CAD2018.DWG," BY VHB INC, 28 OCTOBER 2022.

4. BASE PLAN SOURCE: ELECTRONIC FILE TITLED "2200012-EC-1-2022-1214.DWG," FELDMAN, INC, 21 DECEMBER 2022

HALEY ALDRICH

WATERTOWN MALL REDEVELOPMENT
446 TO 550 ARSENAL STREET
WATERTOWN, MASSACHUSETTS

SOIL CLASSIFICATION PLAN

AUGUST 2023

FIGURE 6

GIS FILE PATH: \\haleyaldrich.com\share\CP\Projects\0203699\GIS\203699_WATERTOWN_MALL\203699_WATERTOWN_MALL.aprx — USER: dvernier — LAST SAVED: 8/18/2023 5:23 PM

APPENDIX A
RECENT EXPLORATION LOGS AND OBSERVATION WELL INSTALLATION REPORTS

TEST BORING REPORT

Boring No. HA23-401

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 25 July 2023
Finish 25 July 2023
Driller T. Martineli
H&A Rep. J. Shaw
Elevation 33.5 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: CME 75
Inside Diameter (in.)	4	1.4	-	Bit Type: Roller
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Drive and Wash
				Hoist/Hammer: Winch Automatic hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.0		33.0	-ASPHALT-										
	13 7 11	S1 13	0.5 2.0		SP-SM	0.5	Medium dense brown to tan poorly-graded SAND with silt (SP-SM), no structure, no odor, dry			10	20	60	10				
	8 4 3 3	S2 16	2.0 4.0	0.0	SM	31.5 2.0	Loose brown silty SAND with gravel (SM), no structure, no odor, moist, trace brick		15	10	20	35	20				
5	8 5 3 4	S3 18	4.0 6.0	0.1	SM		Loose dark brown silty SAND (SM), no structure, no odor, moist		10	15	20	35	20				
	3 3 2 3	S4 10	6.0 8.0	0.0	SM		Similar to S3		5	10	15	50	20				
	3 2 6 6	S5 8	8.0 10.0	0.0	CL	25.5 8.0	Medium stiff tan lean CLAY with sand (CL), no structure, no odor, moist					20	80				
10	10 10 9 10	S6 20	10.0 12.0	0.0	CL	23.5 10.0	- FILL - Medium dense tan sandy SILT (ML), no structure, no door, moist					40	60				
	13 6 8 9	S7 14	14.0 16.0	0.0	ML		Medium dense tan sandy SILT (ML), no structure, no odor, moist					4	96				
15							MARINE DEPOSITS-										
						17.5 16.0	Note: Drill action indicates stratum change at 16 ft.										
	24 13 13 11	S8 12	19.0 21.0	0.0	SP		Medium dense brown to tan poorly-graded SAND with gravel (SP), no structure, no odor, wet	10	20	15	20	30	5				
20							-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 30.9
Rock Cored (ft) -
Samples S10
Boring No. HA23-401

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA23-401
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
						9.5											
25	14 9 18 17	S9 12	24.0 26.0	0.0	CL	24.0	Very stiff gray-brown gravelly lean CLAY (CL), bonded, no odor, moist - GLACIAL TILL -	10	15	15			60				
30	16 18 20 100/5"	S10 10	29.0 30.9	0.0	CL		Very dense gray-brown gravelly lean CLAY (CL), bonded, no odor, wet, chips of bedrock in spoon tip	30	10				60				
						2.6 30.9	BOTTOM OF EXPLORATION 30.9 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-401

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

TEST BORING REPORT

Boring No HA23-402(OW)

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 24 July 2023
Finish 24 July 2023
Driller T. Martineli
H&A Rep. J. Shaw
Elevation 24.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: CME 75
Inside Diameter (in.)	4	1.4	-	Bit Type: Roller
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Drive and Wash
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.0/0.0			23.5	-ASPHALT-										
	10 12 10	S1 12	0.5 2.0		SP		0.5	Gray-brown poorly-graded SAND (SP), no structure, no odor, moist		5	10	25	60					
	12 10 11 8	S2 17	2.0 4.0	0.0/0.0	SP			- FILL - Medium dense gray-brown poorly-graded SAND (SP), no structure, no odor, moist		10	15	25	50					
				0.0	SP		20.0	Medium dense tan poorly-graded SAND (SP), no structure, no odor, moist				20	80					
5	9 7 10 8	S3 14	4.0 6.0	0.0	SP		4.0	Medium dense tan poorly-graded SAND (SP), no structure, no odor, dry to moist				20	80					
	7 8 7 7	S4 17	6.0 8.0	0.0	ML		18.0 6.0	Medium dense SILT (ML), no structure, no odor, moist, frequent clay pockets					7	93				
	6 14 24 15	S5 13	8.0 10.0	0.0	CL		16.0 8.0	Hard tan to gray-brown sandy lean CLAY (CL), bonded, no odor, moist			10	15	15	60				
10	11 11 15 15	S6 17	10.0 12.0	0.0	SP		14.0 10.0	Medium dense brown to red-brown poorly-graded SAND (SP), no structure, no odor, moist					100					
							10.0											
	8 12 15 10	S7 18	14.0 16.0	0.0	CL		14.0	Very stiff brown lean CLAY (CL), no structure, no odor, moist					10	90				
15								- MARINE DEPOSITS -										
	5 14 29 78	S8 12	19.0 21.0	0.0	SM		5.0 19.0	Dense brown to red-yellow silty SAND with gravel (SM), no structure, no odor, moist	5	10	10	20	30	25				
20								- GLACIOFLUVIAL DEPOSITS -										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
08/10/23			24.0	31.0	8.8

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 31.0
Rock Cored (ft) -
Samples S10

Boring No. HA23-402(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

TEST BORING REPORT

Boring No. HA23-402(OW)
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
							0.0											
25	44 41 21 9	S9 3	24.0 26.0	0.0	CL		24.0	Very dense gray gravelly lean CLAY (CL), bonded, no odor, moist	10	15	15			60				
								- GLACIAL TILL -										
30	13 14 16 16	S10 10	29.0 31.0	0.0	CL			Very stiff gray sandy lean CLAY with gravel (CL), bonded, no odor, moist	5	15	10		10	60				
							-7.0 31.0	BOTTOM OF EXPLORATION 31.0 FT Note: Observation well installed in completed borehole.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-402(OW)

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

TEST BORING REPORT

Boring No HA23-404(OW)

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 20 July 2023
Finish 20 July 2023
Driller T. Martineli
H&A Rep. J. Shaw
Elevation 22.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: CME 75
Inside Diameter (in.)	4	1.4	-	Bit Type: Roller
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Drive and Wash
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				0.0/1.0			21.5	-ASPHALT-										
	20 16 21	S1 12	0.5 2.0		SM		0.5 21.0	Dense brown to dark brown silty SAND (SM), no structure, no odor, moist, trace brick			15	25	40	20				
					SP		1.0	Dense brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist to wet, trace brick and cinders	5	10	15	30	35	5				
	10 20 11 9	S2 19	2.0 4.0	0.0/1.2	SM			Dense gray-brown silty SAND (SM), no structure, no odor, moist, trace brick			10	20	30	40				
5	7 18 7 10	S3 12	4.0 6.0	0.0	CL		18.0 4.0	Very stiff brown to gray-brown sandy lean CLAY (CL), no structure, no odor, moist			5	15	20	60				
	22 17 14 16	S4 12	6.0 8.0	0.0	SP		16.0 6.0	Dense brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, trace rubber	5	10	15	25	45					
	7 7 6 6	S5 22	8.0 10.0	0.0	SP			Medium dense brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist		15	15	25	45					
10	4 5 5 7	S6 10	10.0 12.0	0.0	SP-SM		12.0 10.0	Loose brown to gray-brown poorly-graded SAND with silt and gravel (SP-SM), no structure, no odor, moist		15	10	25	40	10				
							10.0	- FILL -										
	9 5 4 6	S7 10	12.0 14.0	0.0	SP-SM		12.0	Loose brown to gray-brown poorly-graded SAND with silt (SP-SM), no structure, no odor, moist		5	15	25	45	10				
15	3 5 5 7	S8 6	14.0 16.0	0.0	SP			Loose gray-brown poorly-graded SAND (SP), no structure, no odor, moist			15	35	45	5				
								- GLACIOFLUVIAL DEPOSITS -										
	5 6 6 8	S9 20	19.0 21.0	0.0	GP		3.0 19.0	Medium dense gray-brown poorly-graded GRAVEL with sand (GP), no structure, no odor, wet	20	50	20	10						
20																		

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
08/10/23			29.0	38.0	11.3

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 38.0
Rock Cored (ft) -
Samples S13

Boring No. HA23-404(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
							-2.0											
25	5 4 5 7	S10 6	24.0 26.0	0.0	CL		24.0	Stiff gray-brown sandy lean CLAY (CL), no structure, no odor, wet				10	30	60				
							-7.0											
30	8 4 7 17	S11 12	29.0 31.0	0.0	SW		29.0	Medium dense gray-brown well-graded SAND (SW), no structure, no odor, wet		10	30	30	30					
								- GLACIOFLUVIAL DEPOSITS -										
35	13 16 17 34	S12 12	34.0 36.0	0.0	SP			Dense gray poorly-graded SAND (SP), interbedded with frequent layers of lean clay, no odor, moist	15	20	15	25	25					
							-13.5	POSSIBLE TOP OF WEATHERED BEDROCK 35.5 FT										
	10 11 19 21	S13 10	36.0 38.0	0.0	CL		35.5	Hard gray lean CLAY (CL), no structure, no odor, moist, exhibits distinct rock fabric	5		5			90				
								- POSSIBLE WEATHERED BEDROCK -										
							-16.0 38.0	BOTTOM OF EXPLORATION 38.0 FT										
								Note: Observation well installed in completed borehole.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

TEST BORING REPORT

Boring No HA23-405(OW)

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 21 July 2023
Finish 24 July 2023
Driller T. Martineli
H&A Rep. J. Shaw
Elevation 27.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: CME 75
Inside Diameter (in.)	4	1.4	-	Bit Type: Roller
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: Drive and Wash
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							26.5	-ASPHALT-										
	14 16 11	S1 4	0.5 2.0	0.0	SP		0.5	Medium dense gray-brown to brown poorly-graded SAND (SP), no structure, no odor, moist		5	20	30	40	5				
	14 52 25 11	S2 18	2.0 4.0	0.0	SP			Very dense gray-brown to brown poorly-graded SAND (SP), no structure, no odor, moist, trace brick		10	15	30	40	5				
5	38 23 10 10	S3 10	4.0 6.0	0.0	SP			Dense gray-brown to brown poorly-graded SAND (SP), no structure, no odor, moist		10	15	30	45					
	5 4 41 2	S4 12	6.0 8.0	0.0	SP			Dense brown to gray-brown poorly-graded SAND (SP), no structure, no odor, moist		10	15	30	40	5				
	14 14 14 18	S5 12	8.0 10.0	0.0	SP			Medium dense brown poorly-graded SAND (SP), no structure, no odor, moist, trace brick			10	30	55	5				
10	26 19 29 23	S6 24	10.0 12.0	0.0	SP			Dense brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, trace brick	5	10	15	25	45					
					SP			Dense gray-brown poorly-graded SAND (SP), no structure, no odor, moist, trace brick and ash			10	30	60					
	25 14 13 16	S7 12	12.0 14.0	0.0	SP			Medium dense dark brown to black poorly-graded SAND (SP), no structure, no odor, moist, trace cinders, metal fragments, ash			10	35	55					
								- FILL -										
15	18 15 14 11	S8 6	14.0 16.0	0.0	SP			Medium dense brown poorly-graded SAND (SP), no structure, no odor, moist		10	15	25	50					
							11.0 16.0	- GLACIOFLUVIAL DEPOSITS -										
20	8 8 7 6	S9 10	19.0 21.0	0.0	SP			Medium dense gray-brown poorly-graded SAND (SP), no structure, no odor, wet		10	15	30	45					

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
08/10/23			39.0	42.0	16.3

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 42.0
Rock Cored (ft) -
Samples S14

Boring No. HA23-405(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

TEST BORING REPORT

HALEY ALDRICH

Boring No. HA23-405(OW)
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
25	5 4 4 6	S10 18	24.0 26.0	0.0	SP			Loose gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, wet	5	10	15	25	45					
30	21 9 14 20	S11 14	29.0 31.0	0.0	SP			Medium dense gray-brown poorly-graded SAND (SP), no structure, no odor, wet, contains lean clay seams		10	15	25	50					
							-7.0											
35	15 26 30 23	S12 18	34.0 36.0	0.0	GP		34.0	Very dense gray-brown poorly-graded GRAVEL (GP), no structure, no odor, wet	30	50	20							
	20 16 16 18	S13 9	36.0 38.0	0.0	GP			Dense gray-brown poorly-graded GRAVEL (GP), no structure, no odor, wet	60	40								
								- GLACIOFLUVIAL DEPOSITS -										
40	8 13 20 15	S14 17	40.0 42.0	0.0	CL		-13.0 40.0	Hard gray-brown lean CLAY (CL), bonded, no odor, wet		15	15			70				
								- GLACIAL TILL -										
							-15.0 42.0	BOTTOM OF EXPLORATION 42.0 FT Note: Observation well installed in completed borehole.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-405(OW)

H&A-TEST BORING W/ PERM PID COL(PID TAB) HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No. HA23-410

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 18 July 2023
Finish 19 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 36.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 54	0.0 5.0	0.0		35.5	-ASPHALT-						
					SP	0.5	Brown poorly-graded SAND (SP), no structure, no odor, moist, trace cinders, coal, and brick		10	15	30	40	5
					SP		Gray-brown poorly-graded SAND (SP), no structure, no odor, moist, trace brick			15	25	55	5
5		G2 48	5.0 10.0	1.8									
					SP		Brown to black poorly-graded SAND with gravel (SP), no structure, no odor, moist, trace cinders, coal, and brick Note: Coal pocket 7 to 7.2 ft depth.	5	10	15	30	35	5
							- FILL -						
						28.0							
					ML	8.0	Tan sandy SILT (ML), no structure, no odor, moist					40	60
10		G3 42	10.0 15.0	0.0	ML		Tan sandy SILT (ML), no structure, no odor, moist with pockets of increased water content (probable perched water).					40	60
						22.5							
					SP	13.5	Tan poorly-graded SAND with gravel (SP), no structure, no odor, moist	10	15	10	25	35	5
						21.0							
15		G4 36	15.0 20.0	0.0	SM	15.0	Black to tan silty SAND with gravel (SM), no odor, moist Note: Gradation from sample G4 taken from sieve and hydrometer lab analysis results.		15	7	19	22	37
							- GLACIOFLUVIAL DEPOSITS -						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 22.0
Rock Cored (ft) -
Samples G5

Boring No. HA23-410

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-410
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
20		G5 6	20.0 22.0	0.0	ML	16.0 20.0	Tan sandy SILT (ML), mps 2.0 in., bonded, no odor, moist - GLACIAL TILL - Sampler refusal at 22.0 ft on possible boulder.			5	10	30	55
						14.0 22.0	BOTTOM OF EXPLORATION 22.0 FT						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-410

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No HA23-411(OW)

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 18 July 2023
Finish 19 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 32.5 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 48	0.0 - 5.0	0.0	SP		32.0 / 0.5	-ASPHALT-						
								Brown poorly-graded SAND (SP), no structure, no odor, moist		10	10	30	45	5
					SP		30.5 / 2.0	Brown to dark brown poorly-graded SAND (SP), no structure, no odor, moist, trace roots, wood, cinders		10	10	35	45	
					SP		30.0 / 2.5	Brown poorly-graded SAND (SP), no structure, no odor, moist		10	10	30	45	5
5		G2 48	5.0 - 10.0	10.5	SP			Brown poorly-graded SAND (SP), no structure, no odor, moist		10	10	30	45	5
					SP		25.5 / 7.0	Dark brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, 30% ash, 20% cinders, trace brick, 10% coal	5	10	15	25	40	5
10		G3 48	10.0 - 15.0	14.7				Dark brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, 30% ash, 20% cinders, trace brick, 10% coal	5	10	15	25	40	5
								- FILL -						
				140.9	ML		20.5 / 12.0	Dark brown sandy SILT (ML), no structure, very strong petroleum-like odor, moist, very strong odor				10	40	50
					ML		19.5 / 13.0	Gray-brown sandy SILT (ML), no structure, very strong petroleum-like odor, wet at 13.5 ft				15	35	50
15		G4 36	15.0 - 20.0	104.0	SP		18.5 / 14.0	Gray-brown to gray poorly-graded SAND with gravel (SP), no structure, very strong petroleum-like odor, wet		15	20	30	35	
								- GLACIOFLUVIAL DEPOSITS -						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
08/10/23			20.0	25.0	13.9

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 25.0
Rock Cored (ft) -
Samples G5

Boring No. HA23-411(OW)

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-411(OW)
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
					ML		13.5	Gray-brown to gray sandy SILT (ML), no structure, very strong petroleum-				15	30	55
				107.0	SW		19.0 13.0	like odor, wet	5	10	20	30	35	
20		G5 30	20.0 25.0				19.5	Brown to gray-brown well-graded SAND with gravel (SW), no structure, very strong petroleum-like odor, wet						
				1.8	SW			Brown to gray-brown well-graded SAND with gravel (SW), no structure, petroleum-like odor, wet	10	15	20	25	30	
								- GLACIOFLUVIAL DEPOSITS -						
25							7.5 25.0	BOTTOM OF EXPLORATION 25.0 FT						
								Note: Installed groundwater observation well in completed geoprobe hole.						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-411(OW)

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No. HA23-412

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 1
Start 17 July 2023
Finish 17 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 29.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 58	0.0 5.0	0.0	SP	28.6 0.4	-ASPHALT-						
							Brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, trace ash, cinders and brick	5	15	10	25	45	
5		G2 54	5.0 10.0	0.0			- FILL -						
					SW	23.0 6.0	Brown to dark brown well-graded SAND with silt (SW), no structure, no odor, moist		10	15	25	30	20
					ML	21.5 7.5	Brown to tan sandy SILT (ML), no structure, no odor, moist to wet Note: Gradation from sample G2 from 7.5 to 10 ft depth taken from sieve and hydrometer lab analysis results.					15	85
10		G3 42	10.0 15.0	0.0	CL	19.0 10.0	Brown to tan lean CLAY (CL), no structure, no odor, moist						100
							- MARINE DEPOSITS -						
15						14.0 15.0	BOTTOM OF EXPLORATION 15.0 FT						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 15.0
Rock Cored (ft) -
Samples G3

Boring No. HA23-412

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No. HA23-413

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 1
Start 17 July 2023
Finish 17 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 22.5 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 58	0.0 5.0	0.0	ML	22.1 0.4	-ASPHALT-						
							Brown to gray-brown sandy SILT (ML), no structure, no odor, dry to moist, trace cinders		11	4	15	11	59
					ML	20.5 2.0	- FILL -		11	4	15	11	59
							Brown to tan sandy SILT (ML), bonded, no odor, dry to moist Note: Gradation from sample G1 from 0.4 to 5 ft depth taken from sieve and hydrometer lab analysis results.						
5		G2 60	5.0 10.0	0.0			Similar to G1		10	5	15	10	60
					CL	16.5 6.0	Gray-brown sandy lean CLAY (CL), no structure, no odor, moist				10	30	60
					CL		Gray-brown lean CLAY (CL), no structure, no odor, moist						100
10		G3 60	10.0 15.0	0.0	CL		Gray-brown sandy lean CLAY (CL), no structure, no odor, wet at about 11 ft				10	30	60
					ML	10.5 12.0	Brown to red-brown sandy SILT (ML), no structure, no odor, wet					30	70
					SP	10.0 12.5	Brown to red-brown poorly-graded SAND with gravel (SP), no structure, no odor, wet	5	10	15	30	35	5
					CL	8.5 14.0	Gray-brown sandy lean CLAY (CL), no structure, no odor, moist				10	30	60
15		G4 48	15.0 20.0										
				0.0	SM	6.5 16.0	Gray-brown to red-brown silty SAND (SM), no structure, no odor, wet					30	70
							- MARINE DEPOSITS -						
					SP	3.5 19.0	Gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, wet	5	15	15	30	35	
20						2.5 20.0	BOTTOM OF EXPLORATION 20.0 FT						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 20.0
Rock Cored (ft) -
Samples G4

Boring No. HA23-413

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No. HA23-414

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 17 July 2023
Finish 17 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 23.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 12	0.0 5.0	0.0	SP	22.7 0.4	-ASPHALT-						
							Brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, dry to moist, trace concrete, asphalt, brick	10	10	10	25	45	
5		G2 36	5.0 10.0	0.0	SP		Similar to G1	10	10	10	25	45	
							- FILL -						
					SM	16.0 7.0	Brown to tan silty SAND (SM), no structure, no odor, wet at 8 ft				10	40	50
10		G3 42	10.0 15.0	0.0	SM		Brown to tan silty SAND (SM), no structure, no odor, wet Note: Gradation from sample G3 taken from sieve and hydrometer lab analysis results.		1	1	7	62	29
15		G4 60	15.0 20.0	0.0	SM		Brown to tan silty SAND with gravel (SM), no structure, no odor, wet	5	10	5	15	30	35
							- GLACIOFLUVIAL DEPOSITS -						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 25.0
Rock Cored (ft) -
Samples G5

Boring No. HA23-414

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-414
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
20		G5 60	20.0 25.0	0.0	SM		Brown to tan silty SAND with gravel (SM), no structure, no odor, wet	5	15	5	15	25	35
							- GLACIOFLUVIAL DEPOSITS -						
25						-2.0 25.0	BOTTOM OF EXPLORATION 25.0 FT						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-414

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No. HA23-415

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 18 July 2023
Finish 18 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 25.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 42	0.0 5.0	0.0	SP	24.7 0.3	-ASPHALT- Brown poorly-graded SAND (SP), no structure, no odor, moist - FILL -		10	10	30	50	
						22.0 3.0 21.5	- CONCRETE -						
					SP	3.5	Brown poorly-graded SAND (SP), no structure, no odor, moist, trace plastic - FILL -		10	10	30	50	
5		G2 48	5.0 10.0	0.0									
						18.5							
					ML	6.5 18.0	Brown to gray-brown sandy SILT (ML), no structure, no odor, wet				10	30	60
					SP	7.0 17.5	Brown poorly-graded SAND with gravel (SP), no structure, no odor, wet	5	10	10	30	45	
					SP	7.5	Light brown to tan poorly-graded SAND (SP), no structure, no odor, moist				30	70	
10		G3 48	10.0 15.0	0.0	SP		Similar to G2 below 7.5 ft				30	70	
					SP		Brown to tan poorly-graded SAND with gravel (SP), no structure, no odor, wet		15	15	30	35	5
						11.0							
					ML	14.0	Light brown sandy SILT (ML), no structure, no odor, wet					40	60
						10.0							
15		G4 60	15.0 20.0	0.0	SP	15.0	Light brown to tan poorly-graded SAND (SP), no structure, no odor, wet - GLACIOFLUVIAL DEPOSITS -				30	70	
						7.0							
					ML	18.0	Light brown sandy SILT (ML), no structure, no odor, wet					40	60

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 30.0
Rock Cored (ft) -
Samples G6

Boring No. HA23-415

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-415
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
						5.0							
20		G5 36	20.0 25.0	0.0	SP-SM	20.0	Brown to yellow-brown poorly-graded SAND with silt and gravel (SP-SM), no structure, no odor, wet	10	15	10	30	25	10
							- GLACIOFLUVIAL DEPOSITS -						
25		G6 42	25.0 30.0	0.0	SP-SM		Yellow-brown poorly-graded SAND with silt and gravel (SP-SM), no structure, no odor, wet						
						-2.0							
					CL	27.0	Gray sandy lean CLAY (CL), bonded, no odor, moist			5	10	20	65
							- GLACIAL TILL -						
30						-5.0 30.0	BOTTOM OF EXPLORATION 30.0 FT						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-415

H&A-GEOPROBE-09-W/PID COL-NO FT HA-LIB09-BOS-HAR - COPY.GLB HA-TB+CORE+WELL-09 W FENCE.GDT \\HALEYALDRICH.COM\SHARE\CF\PROJECTS\0203699\GINT\0203699-001-TBTP_400-SERIES.GPJ 18 Aug 23

GEOPROBE REPORT

Boring No HA23-416(OW)

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 18 July 2023
Finish 18 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 22.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 48	0.0 5.0	0.0	SP		21.7 0.3	-ASPHALT-						
								Brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, trace cinders	5	10	15	20	50	
								- FILL -						
					SM		19.0 3.0	Yellow-brown to tan silty SAND (SM), no structure, no odor, moist		5	5	10	60	20
5		G2 54	5.0 10.0	0.0	SM			Yellow-brown to tan silty SAND (SM), no structure, no odor, moist Note: Gradation from sample G2 taken from sieve and hydrometer lab analysis results.		7	3	11	58	21
10		G3 60	10.0 15.0	0.0	SP			Yellow-brown to tan poorly-graded SAND (SP), no structure, no odor, wet near 10 ft				20	80	
					SP			Yellow-brown to tan poorly-graded SAND with gravel (SP), no structure, no odor, wet		15	20	30	35	
					CL		9.0 13.0	Yellow-brown to light brown lean CLAY (CL), no structure, no odor, wet						100
					SP		8.0 14.0	Yellow-brown to tan poorly-graded SAND with gravel (SP), no structure, no odor, wet		15	20	30	35	
15		G4 46	15.0 20.0	0.0										
					CL		5.5 16.5	Yellow-brown to light-brown lean CLAY (CL), no structure, no odor, wet						100
								- MARINE DEPOSITS -						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
08/10/23			29.0	30.0	10

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 30.0
Rock Cored (ft) -
Samples G6

Boring No. HA23-416(OW)

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-416(OW)
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Well Diagram	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
				0.0	SW		3.0 19.0	Yellow-brown to tan well-graded SAND with gravel (SW), no structure, no odor, wet, occasional clay pockets	5	15	20	30	30	
20		G5 46	20.0 25.0											
25		G6 36	25.0 30.0	0.0	SP			Yellow-brown to tan poorly-graded SAND with gravel (SP), no structure, no odor, wet, occasional clay pockets		15	20	25	40	
								- GLACIOFLUVIAL DEPOSITS -						
							-7.0 29.0							
					GP			Brown to gray-brown poorly-graded GRAVEL (GP), no structure, no odor, wet	80	20				
30							-8.0 30.0	BOTTOM OF EXPLORATION 30.0 FT Note: Installed groundwater observation well in completed geoprobe hole.						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-416(OW)

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GEOPROBE REPORT

Boring No. HA23-417

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 1
Start 18 July 2023
Finish 18 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 21.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 54	0.0 5.0	0.0	SP	20.7 0.4	-ASPHALT-						
							Brown to gray-brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, 10% concrete, trace cinders	5	10	10	25	50	
					SP		Brown poorly-graded SAND with gravel (SP), no structure, no odor, moist	5	10	15	25	45	
5		G2 36	5.0 10.0	0.0	SP		Brown to tan poorly-graded SAND (SP), no structure, no odor, moist		5	10	25	60	
					SP		Brown poorly-graded SAND with gravel (SP), no structure, no odor, dry to moist, trace brick and cinders	5	10	15	30	40	
							- FILL -						
10						11.0 10.0	BOTTOM OF EXPLORATION 10.0 FT						
							Note: Refusal encountered at 10 ft depth on possible wood and/or concrete obstruction. Multiple offsets attempted nearby with refusals ranging from 8 to 9 ft depths in the fill soils.						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 10.0
Rock Cored (ft) -
Samples G2

Boring No. HA23-417

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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GEOPROBE REPORT

Boring No. HA23-418

Project	WATERTOWN MALL REDEVELOPMENT, WATERTOWN, MA
Client	ARE-MA REGION NO. 90 LLC
Contractor	GEOLOGIC EARTH EXPLORATION, INC.

File No. 0203699-001
Sheet No. 1 of 2
Start 17 July 2023
Finish 17 July 2023
Driller T. Grenier
H&A Rep. J. Shaw
Elevation 22.0 (est.)
Datum NAVD88
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	GP Macro	G	-	Rig Make & Model: Geoprobe 6620
Inside Diameter (in.)	3.25	1.5	-	Bit Type: Geoprobe Spoon
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: None
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: Tiger 10.6 eV

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
0		G1 41	0.0 5.0	0.0	SP	21.5 0.5	-ASPHALT- Brown to gray-brown poorly-graded SAND (SP), no structure, no odor, moist, trace rubber, glass, concrete, and cinders, frequent CLAY seams with bonding at 4 ft		10	15	35	40	
5		G2 54	5.0 10.0	0.0	SP		Brown poorly-graded SAND with gravel (SP), no structure, no odor, moist, infrequent clay pockets, trace glass and brick	5	10	10	30	45	
10		G3 42	10.0 15.0	0.0	SP		Brown poorly-graded SAND (SP), no structure, no odor, moist, trace cinders		10	15	35	40	
						8.5	- FILL -						
				0.0	SM	13.5	Gray to gray-brown silty SAND (SM), no structure, no odor, wet		10	10	25	30	25
15		G4 60	15.0 20.0	0.0	SM		Gray to gray-brown silty SAND (SM), no structure, no odor, wet		10	10	25	30	25
							- GLACIOFLUVIAL DEPOSITS -						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 30.0
Rock Cored (ft) -
Samples G6

Boring No. HA23-418

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

GEOPROBE REPORT

Boring No. HA23-418
File No. 0203699-001
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm) (sample/bkgd)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines
				0.0	SP	3.0 19.0	Gray to gray-brown poorly-graded SAND with silt (SP), no structure, no odor, wet		10	15	30	40	5
20		G5 60	20.0 25.0										
25		G6 60	25.0 30.0	0.0	SP		Gray poorly-graded SAND with gravel (SP), no structure, no odor, wet, sampler tip contained gravel fragments	10	20	15	25	30	
							- GLACIOFLUVIAL DEPOSITS -						
30						-8.0 30.0	BOTTOM OF EXPLORATION 30.0 FT						

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA23-418

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA23-402(OW)
Boring No. HA23-402(OW)

Project WATERTOWN MALL REDEVELOPMENT
Location WATERTOWN, MA
Client ARE-MA REGION NO. 90 LLC
Contractor GEOLOGIC EARTH EXPLORATION, INC.
Driller T. Martineli

Initial Water Level (depth bgs) 8.8 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 0203699-001
Date Installed 24 Jul 2023
H&A Rep. J. Shaw
Location See Plan

Ground El. 24.0 (est.)
Datum NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	24.0
ASPHALT	0.5			1.0	23.0
FILL	4.0			11.0	13.0
				13.0	11.0
MARINE DEPOSITS	19.0			15.0	9.0
GLACIOFLUVIAL DEPOSITS	24.0			25.0	-1.0
GLACIAL TILL	31.0				

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted - 9/16" hex.
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.1 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	11.0	2.0
	-	-

Diameter of borehole: 4.0 in.
Depth to top of well screen: 15.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Sand
- Depth to bottom of well screen: 25.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 31.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA23-404(OW)
Boring No. HA23-404(OW)

Project WATERTOWN MALL REDEVELOPMENT
Location WATERTOWN, MA
Client ARE-MA REGION NO. 90 LLC
Contractor GEOLOGIC EARTH EXPLORATION, INC.
Driller T. Martineli

Initial Water Level (depth bgs) 11.3 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 0203699-001
Date Installed 20 Jul 2023
H&A Rep. J. Shaw
Location See Plan

Ground El. 22.0 (est.)
Datum NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	22.0
ASPHALT	0.5			1.0	21.0
FILL	12.0			15.0	7.0
				17.0	5.0
				20.0	2.0
GLACIOFLUVIAL DEPOSITS				30.0	-8.0
POSSIBLE WEATHERED	35.5				
	38.0			38.0	-16.0

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted - 9/16" hex.
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 3.0 in.
- Depth of bottom of riser pipe: 20.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	15.0	2.0
	-	-

Diameter of borehole: 4.0 in.
Depth to top of well screen: 20.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 3.0 in.
- Type of Backfill around Screen: Sand
- Depth to bottom of well screen: 30.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 38.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA23-405(OW)
Boring No. HA23-405(OW)

Project WATERTOWN MALL REDEVELOPMENT
Location WATERTOWN, MA
Client ARE-MA REGION NO. 90 LLC
Contractor GEOLOGIC EARTH EXPLORATION, INC.
Driller T. Martineli

Initial Water Level (depth bgs) 16.3 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 0203699-001
Date Installed 24 Jul 2023
H&A Rep. J. Shaw
Location See Plan

Ground El. 27.0 (est.)
Datum NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	27.0
ASPHALT	0.5			1.0	26.0
FILL				14.0	13.0
	16.0			17.0	10.0
GLACIOFLUVIAL DEPOSITS				20.0	7.0
	40.0			40.0	-13.0
GLACIAL TILL	42.0			42.0	-15.0

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted - 9/16" hex.
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.1 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 20.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	14.0	3.0
	-	-

Diameter of borehole: 4.0 in.
Depth to top of well screen: 20.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Sand
- Depth to bottom of well screen: 40.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 42.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA23-411(OW)
Boring No. HA23-411(OW)

Project WATERTOWN MALL REDEVELOPMENT
Location WATERTOWN, MA
Client ARE-MA REGION NO. 90 LLC
Contractor GEOLOGIC EARTH EXPLORATION, INC.
Driller T. Grenier

Initial Water Level (depth bgs) 13.9 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 0203699-001
Date Installed 19 Jul 2023
H&A Rep. J. Shaw
Location See Plan

Ground El. 32.5 (est.)
Datum NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	32.5
ASPHALT	0.5			1.0	31.5
FILL	12.0			11.0	21.5
				13.0	19.5
				15.0	17.5
GLACIOFLUVIAL DEPOSITS	25.0			20.0	12.5
				25.0	7.5

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted - 9/16" hex.
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.2 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 1.0 in.
- Depth of bottom of riser pipe: 15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	11.0	2.0
	-	-

Diameter of borehole: 2.0 in.
Depth to top of well screen: 15.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 1.0 in.
- Type of Backfill around Screen: Sand
- Depth to bottom of well screen: 20.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 25.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA23-416(OW)
Boring No. HA23-416(OW)

Project WATERTOWN MALL REDEVELOPMENT
Location WATERTOWN, MA
Client ARE-MA REGION NO. 90 LLC
Contractor GEOLOGIC EARTH EXPLORATION, INC.
Driller T. Grenier

Initial Water Level (depth bgs) 10.0 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 0203699-001
Date Installed 18 Jul 2023
H&A Rep. J. Shaw
Location See Plan

Ground El. 22.0 (est.)
Datum NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	22.0
ASPHALT	0.3			1.0	21.0
FILL	3.0				
GLACIOFLUVIAL DEPOSITS				13.0	9.0
				15.0	7.0
				19.0	3.0
				29.0	-7.0
	30.0			30.0	-8.0

WELL CONSTRUCTION DETAILS

Type of protective cover: Bolted - 9/16" hex.
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 1.0 in.
- Depth of bottom of riser pipe: 19.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	13.0	2.0
	-	-

Diameter of borehole: 2.0 in.
Depth to top of well screen: 19.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 1.0 in.
- Type of Backfill around Screen: Sand
- Depth to bottom of well screen: 29.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 30.0 ft

COMMENTS:

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APPENDIX B
Frimpter Method and Seasonal High Groundwater

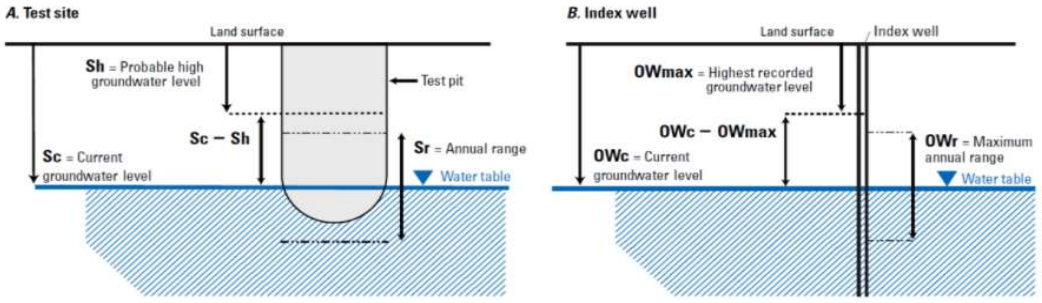
PROBLEM STATEMENT & OBJECTIVE

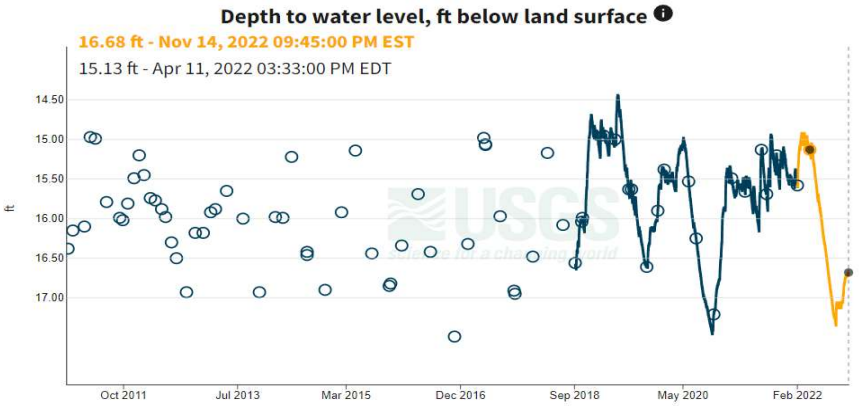
To evaluate the following:

a) Estimate the seasonal high groundwater level at the subject Site using the Frimpter Method

REFERENCES

1. Barclay, J.R., and Mullaney, J.R., 2020, Updating data inputs, assessing trends, and evaluating a method to estimate probable high groundwater levels in selected areas of Massachusetts: U.S. Geological Survey Scientific Investigations Report 2020–5036, 45 p., https://doi.org/10.3133/sir20205036.
2. USGS Current Conditions for USGS 421853071220501 MA-WKW 2R WAYLAND, MA





$$\frac{Sc - Sh}{Sr} = \frac{OWc - OWmax}{OWr}, \text{ or} \quad (1)$$

$$Sh = Sc - \frac{Sr}{OWr}(OWc - OWmax), \quad (2)$$

where

Sc	is the current groundwater level at the test site;
Sr	is an estimate of the annual groundwater-level range at the test site;
OWc	is the current groundwater level at an index well;
$OWmax$	is the historical high groundwater level at an index well; and
OWr	is the annual groundwater-level range at an index well.

SUMMARY TABLE

Well ID	Index Well ID	Current GW Level at Site (Sc)	Estimate of annual GW Range (Sr)	Current GW level at Index Well (OWc)	Historic high groundwater level at index well (OWmax)	Annual GW Level Range at Index Well (OWr)	Seasonal High Groundwater Level (Sh)
HA22-102	MA-WKW 2R	14.8	3.7	16.7	13.5	3.7	11.6
HA22-219	MA-WKW 2R	20.6	3.7	16.7	13.5	3.7	17.4
						Average	**14.5**

Note 1: 10 November 2022 groundwater level data used in analysis.
Note 2: Estimate of annual GW Range (Sr) value uses Index well value due to insufficient data at subject Site.

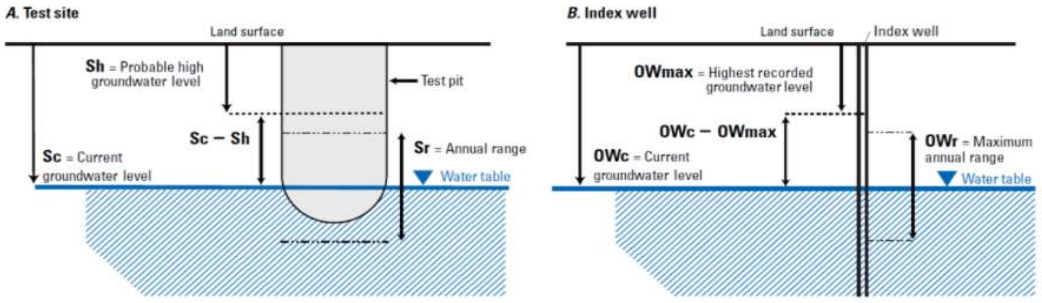
PROBLEM STATEMENT & OBJECTIVE

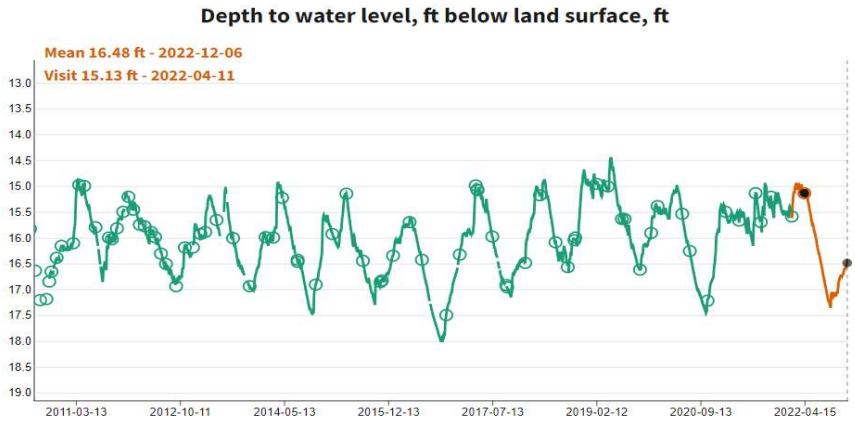
To evaluate the following:

a) Estimate the seasonal high groundwater level at the subject Site using the Frimpter Method

REFERENCES

1. Barclay, J.R., and Mullaney, J.R., 2020, Updating data inputs, assessing trends, and evaluating a method to estimate probable high groundwater levels in selected areas of Massachusetts: U.S. Geological Survey Scientific Investigations Report 2020–5036, 45 p., https://doi.org/10.3133/sir20205036.
2. USGS Current Conditions for USGS 421853071220501 MA-WKW 2R WAYLAND, MA





$$\frac{Sc - Sh}{Sr} = \frac{OWc - OWmax}{OWr}, \text{ or} \quad (1)$$

$$Sh = Sc - \frac{Sr}{OWr}(OWc - OWmax), \quad (2)$$

where

Sc	is the current groundwater level at the test site;
Sr	is an estimate of the annual groundwater-level range at the test site;
OWc	is the current groundwater level at an index well;
$OWmax$	is the historical high groundwater level at an index well; and
OWr	is the annual groundwater-level range at an index well.

SUMMARY TABLE

Well ID	Index Well ID	Current GW Level at Site (Sc)	Estimate of annual GW Range (Sr)	Current GW level at Index Well (OWc)	Historic high groundwater level at index well (OWmax)	Annual GW Level Range at Index Well (OWr)	Seasonal High Groundwater Level (Sh)
HA22-101	MA-WKW 2R	9.6	3.7	16.5	13.5	3.7	6.6
HA22-102	MA-WKW 2R	14.9	3.7	16.5	13.5	3.7	11.9
HA22-103	MA-WKW 2R	20.1	3.7	16.5	13.5	3.7	17.1
						Average	**11.9**

Note 1: 8 December 2022 groundwater level data used in analysis.
Note 2: Estimate of annual GW Range (Sr) value uses Index well value due to insufficient data at subject Site.

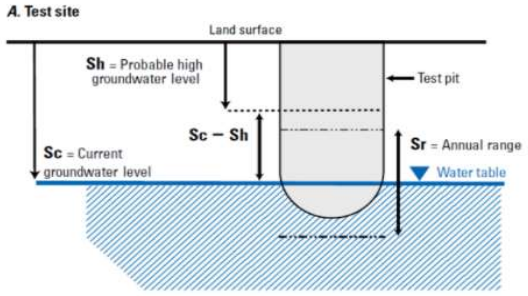
PROBLEM STATEMENT & OBJECTIVE

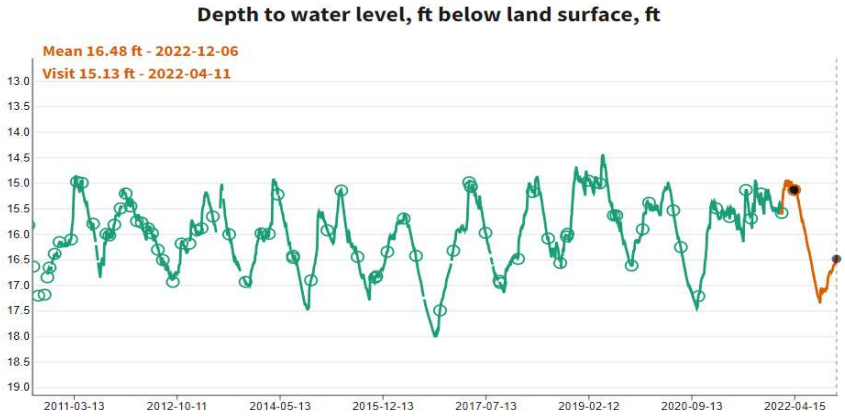
To evaluate the following:

a) Estimate the seasonal high groundwater level at the subject Site using the Frimpter Method

REFERENCES

1. Barclay, J.R., and Mullaney, J.R., 2020, Updating data inputs, assessing trends, and evaluating a method to estimate probable high groundwater levels in selected areas of Massachusetts: U.S. Geological Survey Scientific Investigations Report 2020–5036, 45 p., https://doi.org/10.3133/sir20205036.
2. USGS Current Conditions for USGS 421853071220501 MA-WKW 2R WAYLAND, MA





$$\frac{Sc - Sh}{Sr} = \frac{OWc - OWmax}{OWr}, \text{ or} \qquad (1)$$

$$Sh = Sc - \frac{Sr}{OWr}(OWc - OWmax), \qquad (2)$$

where

Sc	is the current groundwater level at the test site;
Sr	is an estimate of the annual groundwater-level range at the test site;
OWc	is the current groundwater level at an index well;
$OWmax$	is the historical high groundwater level at an index well; and
OWr	is the annual groundwater-level range at an index well.

SUMMARY TABLE

Well ID	Index Well ID	Current GW Level at Site (Sc)	Estimate of annual GW Range (Sr)	Current GW level at Index Well (OWc)	Historic high groundwater level at index well (OWmax)	Annual GW Level Range at Index Well (OWr)	Seasonal High Groundwater Level (Sh)
HA22-15	MA-WKW 2R	9.7	3.7	16.5	13.5	3.7	6.7
HA22-17	MA-WKW 2R	14.4	3.7	16.5	13.5	3.7	11.4
HA22-214	MA-WKW 2R	8.0	3.7	16.5	13.5	3.7	5.0
HA22-215	MA-WKW 2R	14.9	3.7	16.5	13.5	3.7	11.9
HA22-216	MA-WKW 2R	5.7	3.7	16.5	13.5	3.7	2.7
						Average	**7.6**

Note 1: 8 December 2022 groundwater level data used in analysis.
Note 2: Estimate of annual GW Range (Sr) value uses Index well value due to insufficient data at subject Site.

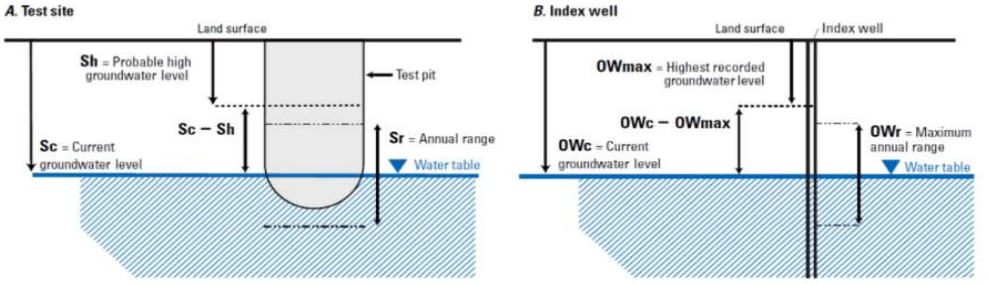
PROBLEM STATEMENT & OBJECTIVE

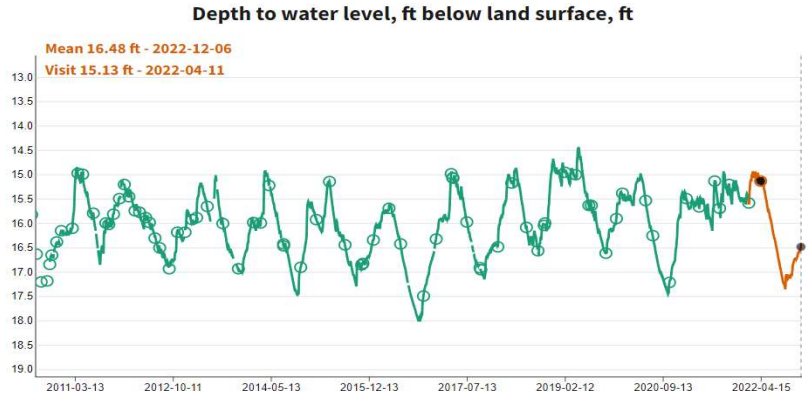
To evaluate the following:

a) Estimate the seasonal high groundwater level at the subject Site using the Frimpter Method

REFERENCES

1. Barclay, J.R., and Mullaney, J.R., 2020, Updating data inputs, assessing trends, and evaluating a method to estimate probable high groundwater levels in selected areas of Massachusetts: U.S. Geological Survey Scientific Investigations Report 2020–5036, 45 p., https://doi.org/10.3133/sir20205036.
2. USGS Current Conditions for USGS 421853071220501 MA-WKW 2R WAYLAND, MA





$$\frac{Sc - Sh}{Sr} = \frac{OWc - OWmax}{OWr}, \text{ or} \quad (1)$$

$$Sh = Sc - \frac{Sr}{OWr}(OWc - OWmax), \quad (2)$$

where

Sc is the current groundwater level at the test site;

Sr is an estimate of the annual groundwater-level range at the test site;

OWc is the current groundwater level at an index well;

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SUMMARY TABLE

Well ID	Index Well ID	Current GW Level at Site (Sc)	Estimate of annual GW Range (Sr)	Current GW level at Index Well (OWc)	Historic high groundwater level at index well (OWmax)	Annual GW Level Range at Index Well (OWr)	Seasonal High Groundwater Level (Sh)
HA22-01	MA-WKW 2R	17.4	3.7	16.5	13.5	3.7	14.4
HA22-05	MA-WKW 2R	15.3	3.7	16.5	13.5	3.7	12.3
HA22-09	MA-WKW 2R	14.1	3.7	16.5	13.5	3.7	11.1
HA22-201	MA-WKW 2R	15.9	3.7	16.5	13.5	3.7	12.9
HA22-203	MA-WKW 2R	12.5	3.7	16.5	13.5	3.7	9.5
HA22-207	MA-WKW 2R	14.2	3.7	16.5	13.5	3.7	11.2
HA22-209	MA-WKW 2R	10.3	3.7	16.5	13.5	3.7	7.3
HA22-213	MA-WKW 2R	10.5	3.7	16.5	13.5	3.7	7.5
						Average	**10.8**

Note 1: 8 December 2022 groundwater level data used in analysis.
Note 2: Estimate of annual GW Range (Sr) value uses Index well value due to insufficient data at subject Site.

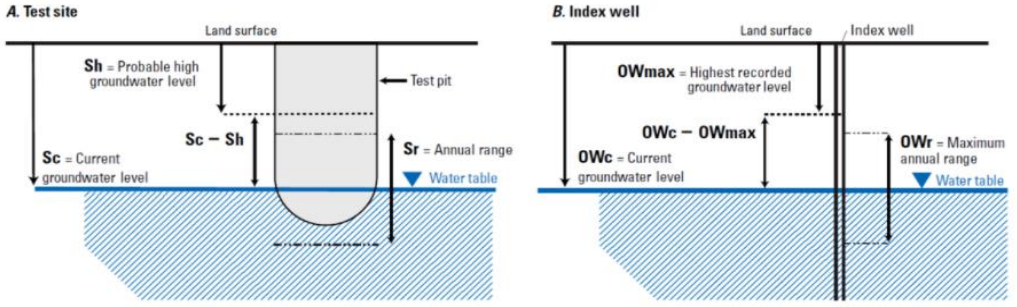
PROBLEM STATEMENT & OBJECTIVE

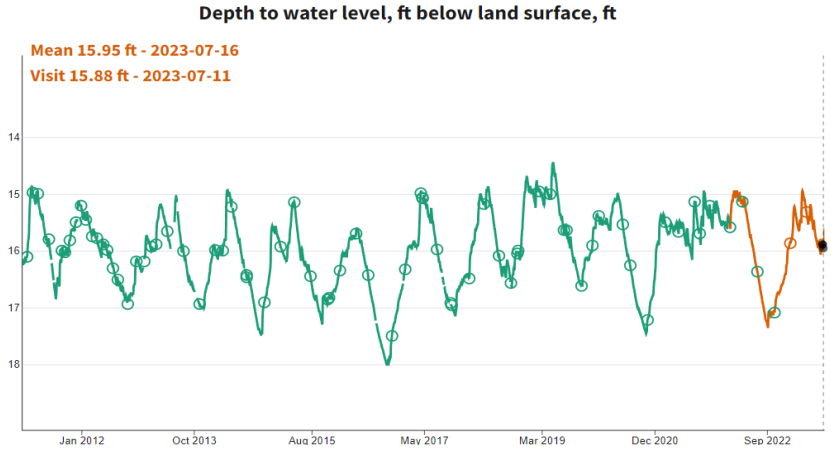
To evaluate the following:

a) Estimate the seasonal high groundwater level at the subject Site using the Frimpter Method

REFERENCES

1. Barclay, J.R., and Mullaney, J.R., 2020, Updating data inputs, assessing trends, and evaluating a method to estimate probable high groundwater levels in selected areas of Massachusetts: U.S. Geological Survey Scientific Investigations Report 2020–5036, 45 p., https://doi.org/10.3133/sir20205036.
2. USGS Current Conditions for USGS 421853071220501 MA-WKW 2R WAYLAND, MA





$$\frac{Sc - Sh}{Sr} = \frac{OWc - OWmax}{OWr}, \text{ or} \qquad (1)$$

$$Sh = Sc - \frac{Sr}{OWr}(OWc - OWmax), \qquad (2)$$

where

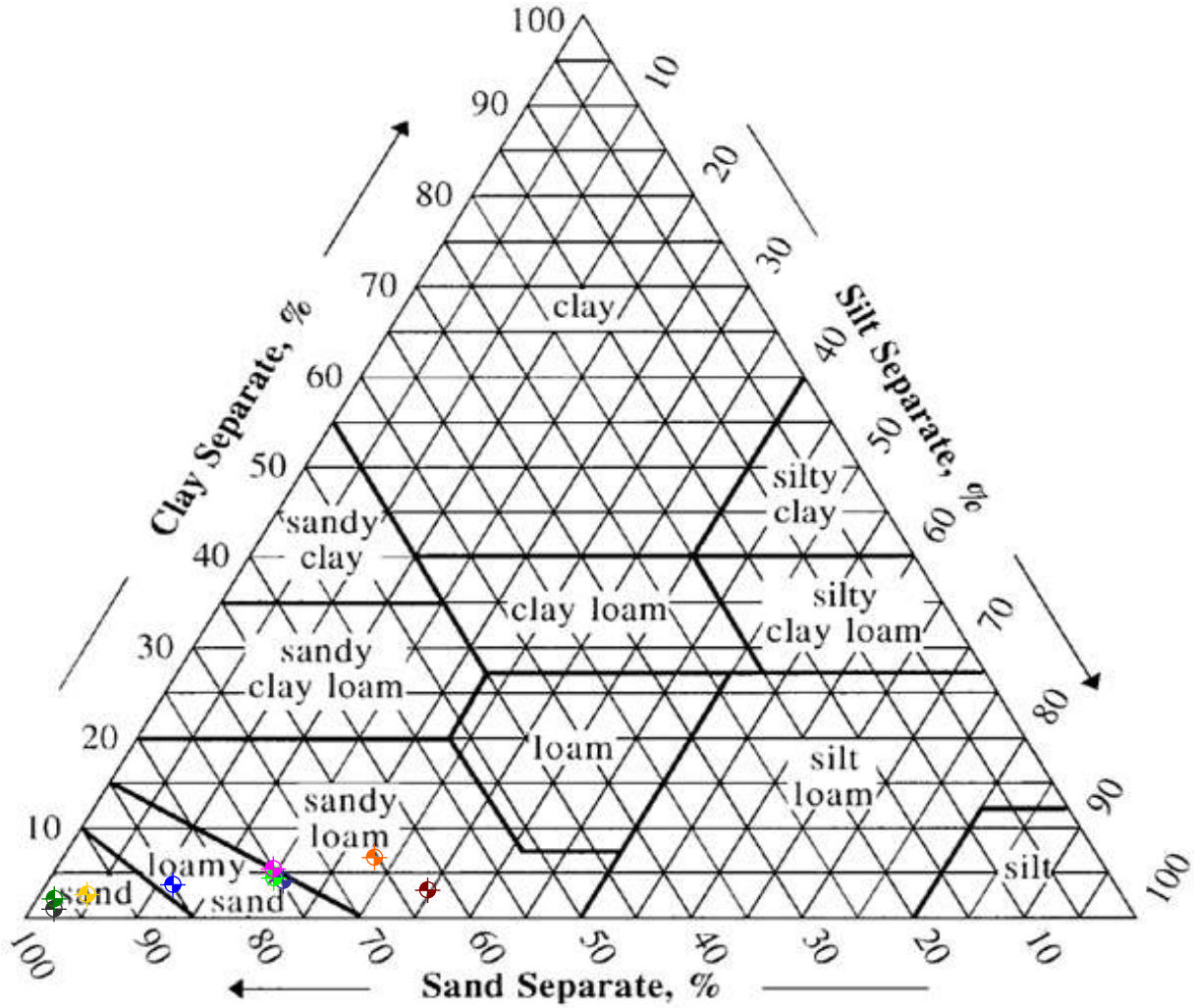
- Sc is the current groundwater level at the test site;
- Sr is an estimate of the annual groundwater-level range at the test site;
- OWc is the current groundwater level at an index well;
- $OWmax$ is the historical high groundwater level at an index well; and
- OWr is the annual groundwater-level range at an index well.

SUMMARY TABLE

Well ID	Index Well ID	Current GW Level at Site (Sc)	Estimate of annual GW Range (Sr)	Current GW level at Index Well (OWc)	Historic high groundwater level at index well (OWmax)	Annual GW Level Range at Index Well (OWr)	Seasonal High Groundwater Level (Sh)
HA23-317	MA-WKW 2R	15.8	3.7	15.4	13.5	3.7	14.3
HA23-402	MA-WKW 2R	9.1	3.7	15.4	13.5	3.7	7.2
HA23-404	MA-WKW 2R	11.4	3.7	15.4	13.5	3.7	9.5
HA23-405	MA-WKW 2R	16.5	3.7	15.4	13.5	3.7	14.6
HA23-411	MA-WKW 2R	14.2	3.7	15.4	13.5	3.7	12.5
HA23-416	MA-WKW 2R	10.3	3.7	15.4	13.5	3.7	8.4

Note 1: 26 July 2023 groundwater level data used in analysis.
Note 2: Estimate of annual GW Range (Sr) value uses Index well value due to insufficient data at subject Site.

APPENDIX C
Results of Geotechnical Laboratory Testing



LEGEND:

HA22-01; S4 (7-9 ft) - FILL	El.	19 to 21
HA22-03; S2 (3-5 ft) - FILL	El.	18 to 20
HA22-03; S6 (11-13 ft) - GLACIOFLUVIAL	El.	10 to 12
HA22-04; S3 (5-7 ft) - FILL	El.	16 to 18
HA22-05; S2&S3 (3-8 ft) - FILL	El.	18 to 23
HA22-07; S3 (5-6 ft) - FILL	El.	18.5 to 19.5
HA22-17; S3 (5-7 ft) - GLACIOFLUVIAL	El.	22.7 to 24.7
HA22-18; S4 (5-7 ft) - GLACIOFLUVIAL	El.	23.5 to 25.5
HA22-19; S3 (4-6 ft) - GLACIOFLUVIAL	El.	24.5 to 26.5

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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HALEY ALDRICH

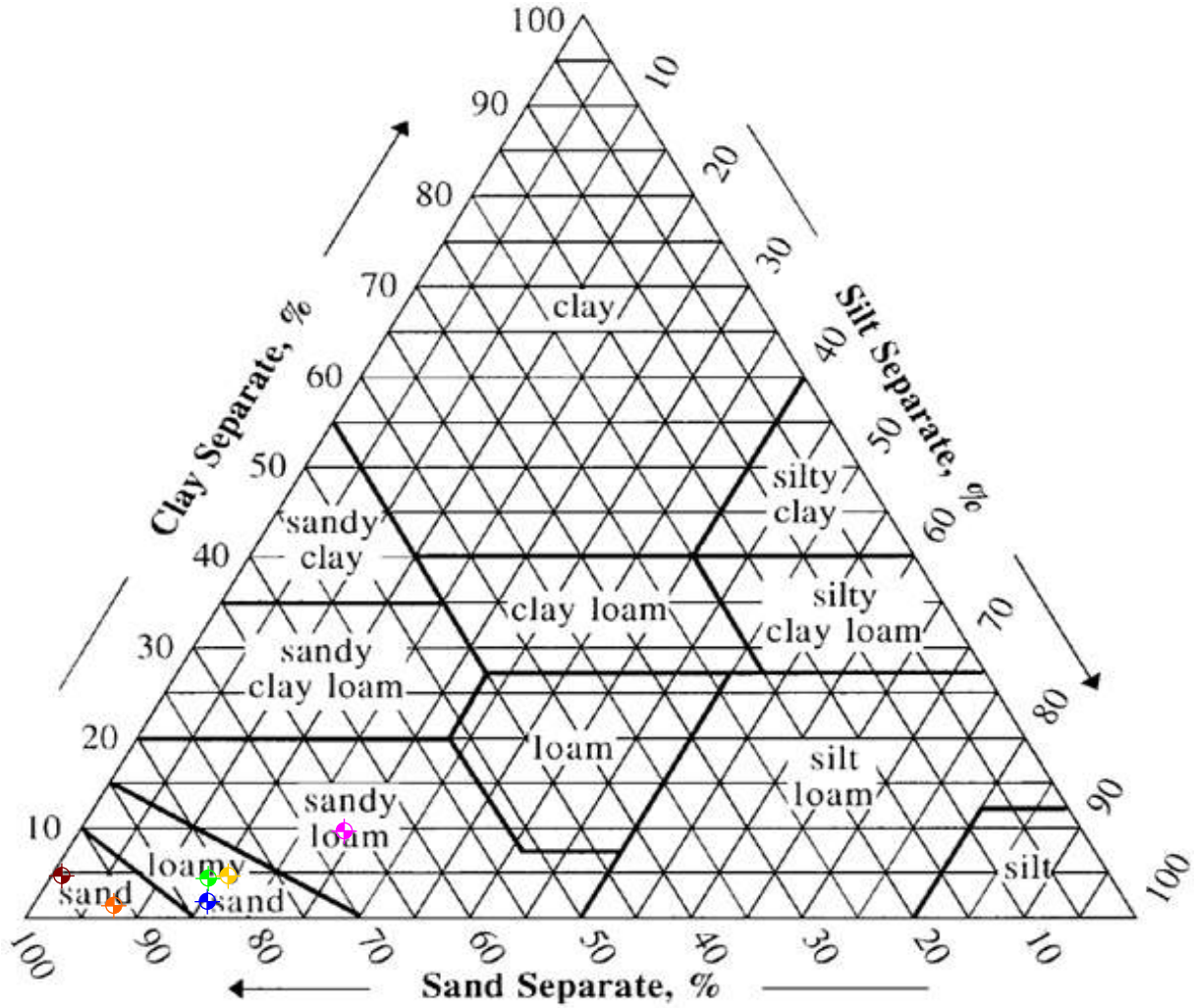
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

Watertown Mall Redevelopment
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

FEBRUARY 2023

FILE NO. 203699



LEGEND:

HA22-102; S3 (4-6 ft) - GLACIOFLUVIAL	El.	23 to 25
HA22-103; S3 (4-6 ft) - GLACIOFLUVIAL	El.	24.6 to 26.6
HA-TP05; (2-5 ft) - GLACIOFLUVIAL	El.	17 to 20
HA22-211; S5 (7-9 ft) - MARINE	El.	19 to 21
HA22-220; G3 (8-12 ft) - FILL	El.	18.0 to 22.0
HA22-224; G3 (10-15 ft) - FILL	El.	12.4 to 17.4

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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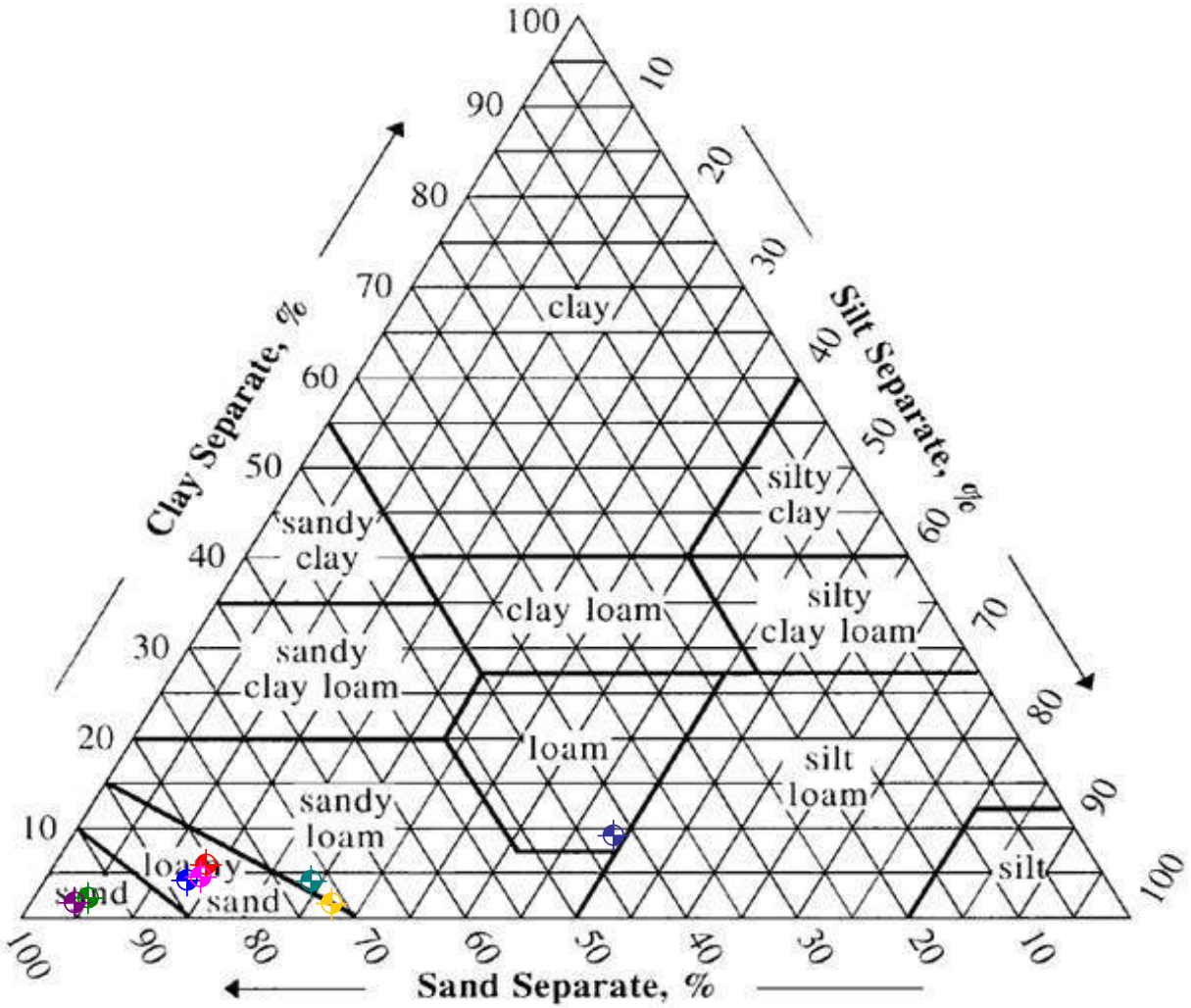
Watertown Mall Redevelopment
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

FEBRUARY 2023

FILE NO. 203699



LEGEND:

HA23-302; S4 (6-8 ft) - FILL	El.	16 to 18
HA23-304; S3 (4-6 ft) - FILL	El.	18 to 20
HA23-312; G3 (10-12 ft) - FILL	El.	18.2 to 20.2
HA23-313; G3 (8-10 ft) - GLACIOFLUVIAL	El.	17.5 to 19.5
HA23-314; G2 (8-10 ft) - GLACIOFLUVIAL	El.	20 to 22
HA23-316; G3 (7-9 ft) - FILL	El.	20.5 to 22.5
HA23-317; G3 (10-12 ft) - GLACIOFLUVIAL	El.	20 to 22
HA23-320; S4 (6-8 ft) - MARINE	El.	20.5 to 22.5

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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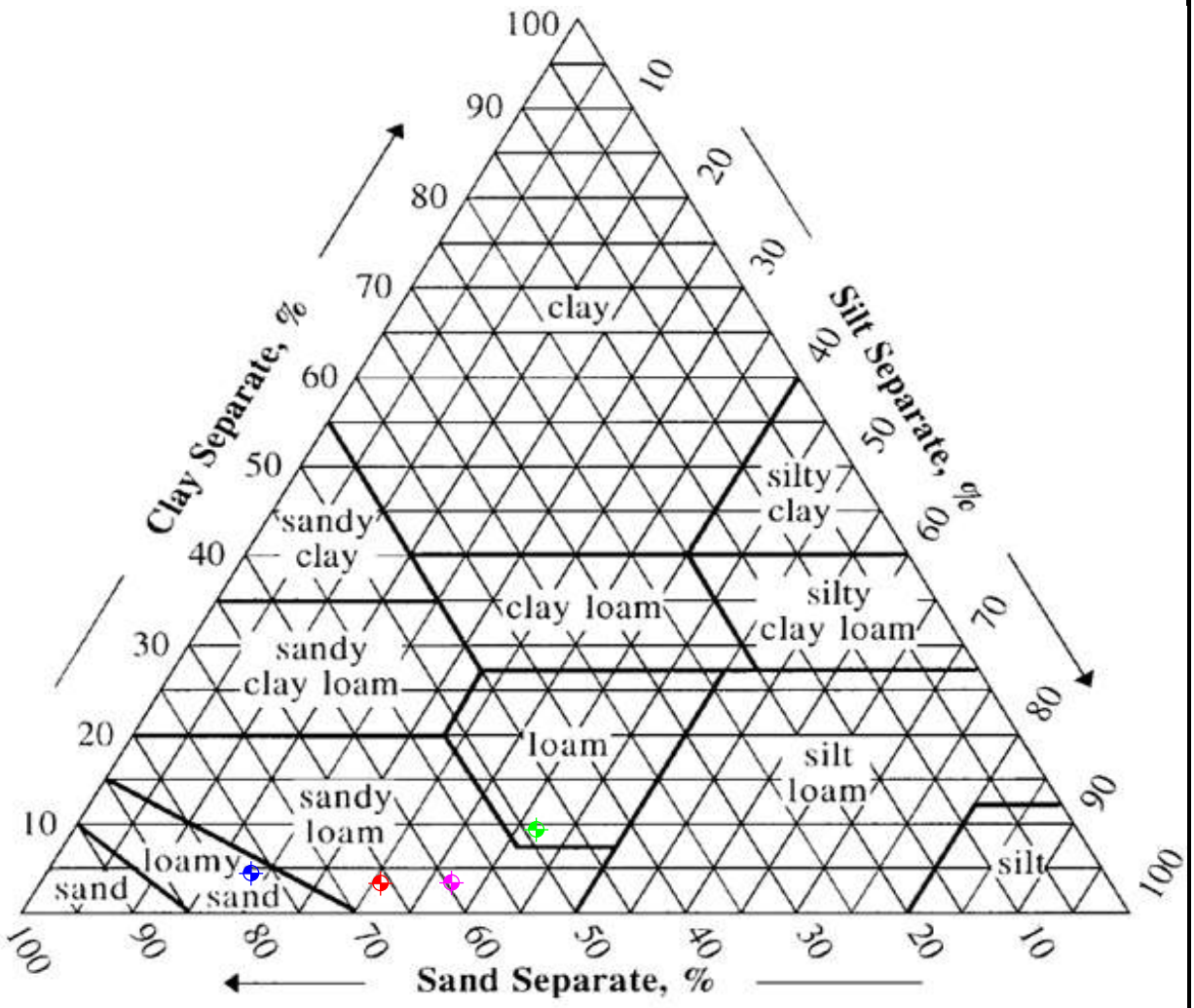
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

Watertown Mall Redevelopment
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

February 2023

FILE NO. 203699



LEGEND:

✦	**HA22-217; S9 (19-21 ft) - GLACIOFLUVIAL**	**EL. 12.2 to 14.2**
✦	**HA22-218; S4 (6-8 ft) - FILL**	**EL. 26.4 to 28.4**
✦	**HA22-219; S8 (13-15 ft) - GLACIAL TILL**	**EL. 20.8 to 22.8**
✦	**HA22-231; G3 (10-15 ft) - GLACIOFLUVIAL**	**EL. 18.7 to 23.7**

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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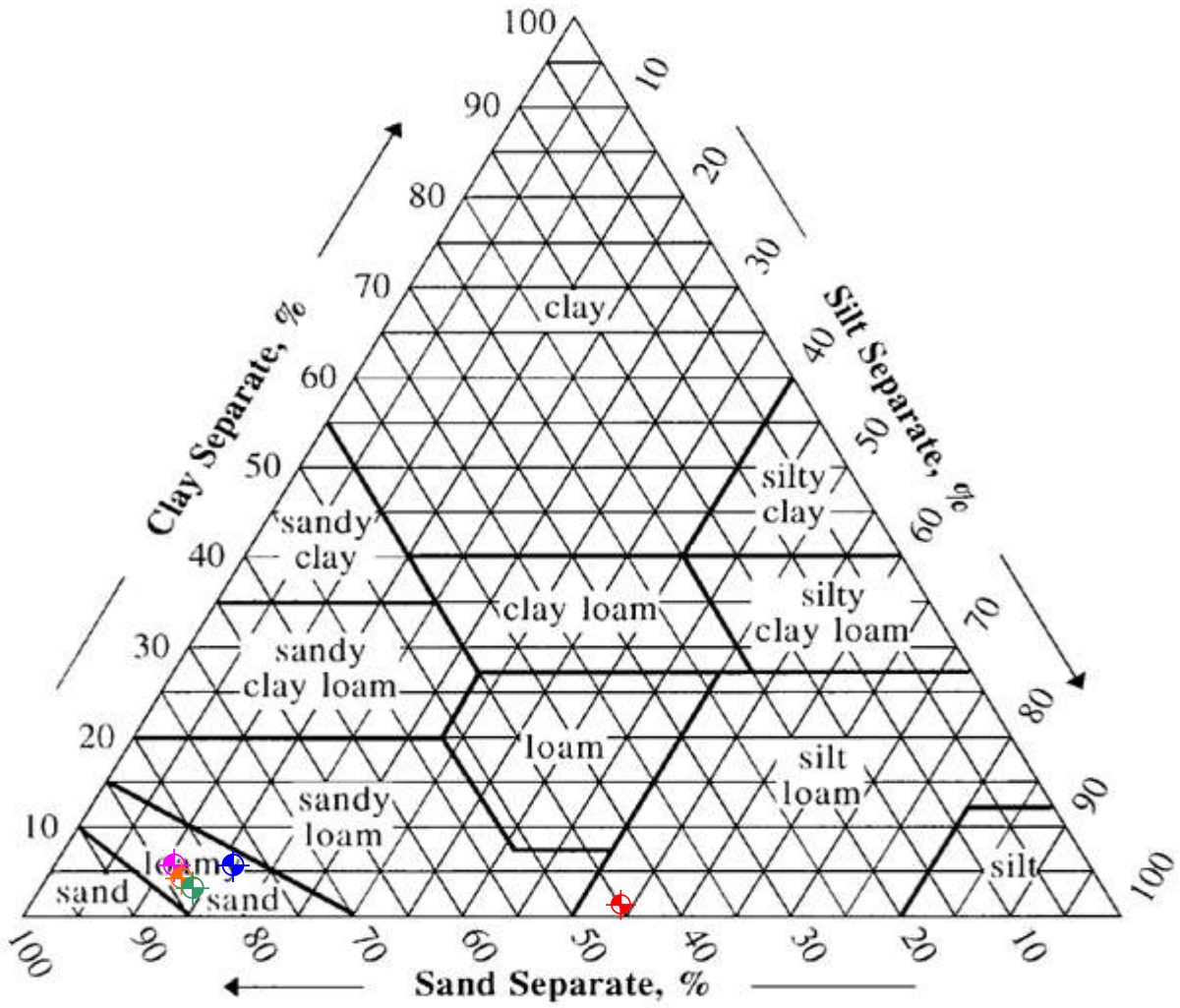
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

Watertown Mall Redevelopment
480 Arsenal St.
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

November 2022

FILE NO. 203699



LEGEND:

⊕	**HA22-02; S6 (10-12 ft) - GLACIOFLUVIAL**	**El. 15.5 to 17.5**
⊕	**HA22-09; S3 (5-7 ft) - FILL**	**El. 15.0 to 17.0**
⊕	**HA22-106; S4 (9-11 ft) - MARINE**	**El. 19.0 to 21.0**
⊕	**HA22-208; S2 (2-5 ft) - FILL**	**El. 16.7 to 19.7**
⊕	**HA22-213; S7 (13-15 ft) - GLACIOFLUVIAL**	**El. 7.5 to 9.5**

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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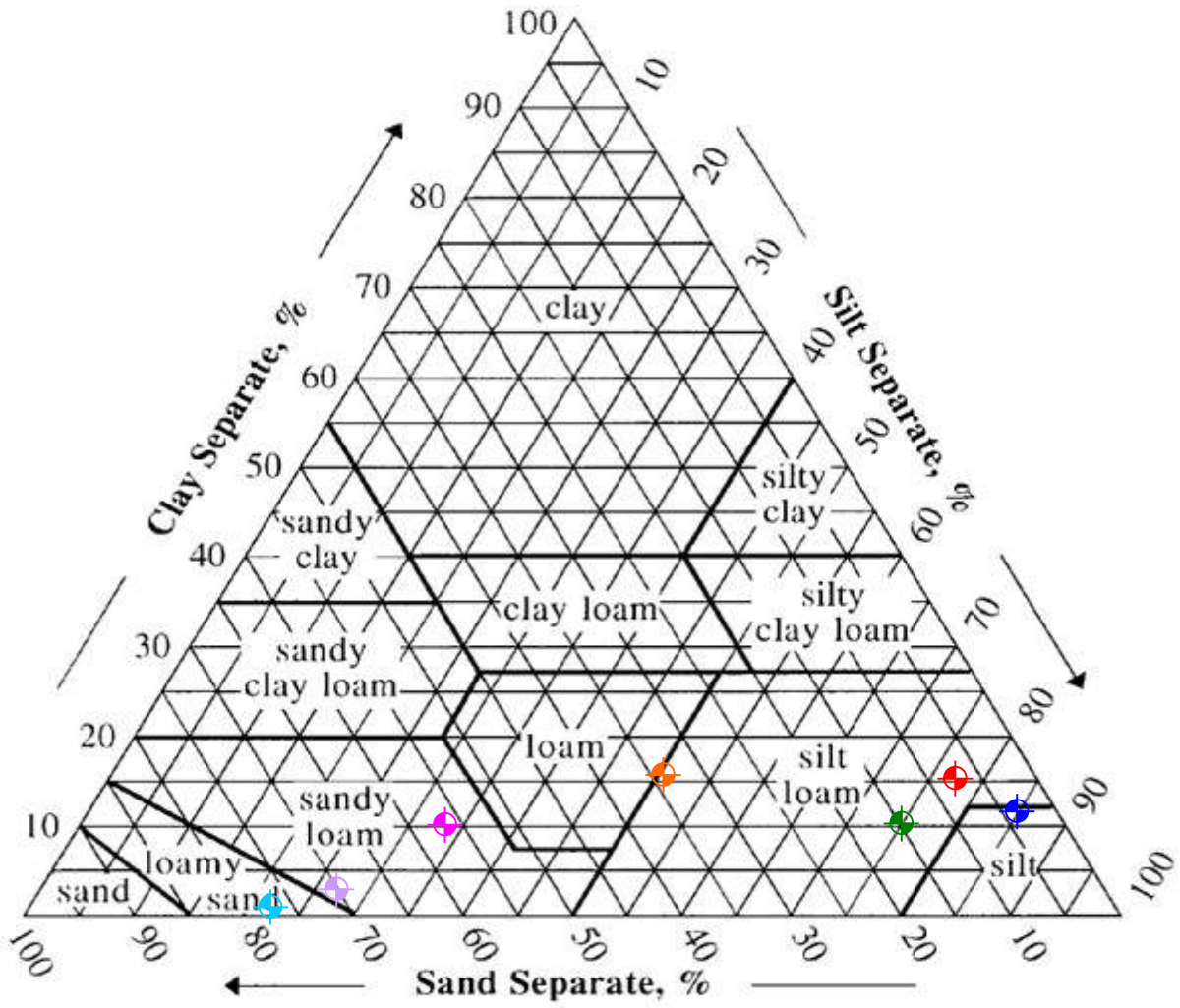
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

Watertown Mall Redevelopment
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

AUGUST 2023

FILE NO. 203699



LEGEND:

HA23-401; S7 (14-16 ft) - MARINE	El. 17.5 to 19.5
HA23-402; S4 (6-8 ft) - MARINE	El. 16.0 to 18.0
HA23-410; G4 (15-20 ft) - GLACIOFLUVIAL	El. 16.0 to 21.0
HA23-412; G2 (7.5-10 ft) - GLACIOFLUVIAL	El. 19.5 to 21.5
HA23-413; G1 (0-5 ft) - MARINE	El. 17.5 to 22.5
HA23-414; G3 (10-15 ft) - GLACIOFLUVIAL	El. 8.0 to 13.0
HA23-416; G2 (5-10 ft) - MARINE	El. 12.0 to 17.0

Notes:

1. Guidance Document: USDA, 2016, National Soil Survey Handbook, Section 618.87 (Texture Class, Texture Modifier, and Terms Used in Lieu of Texture.)
2. Elevations are considered approximate.

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

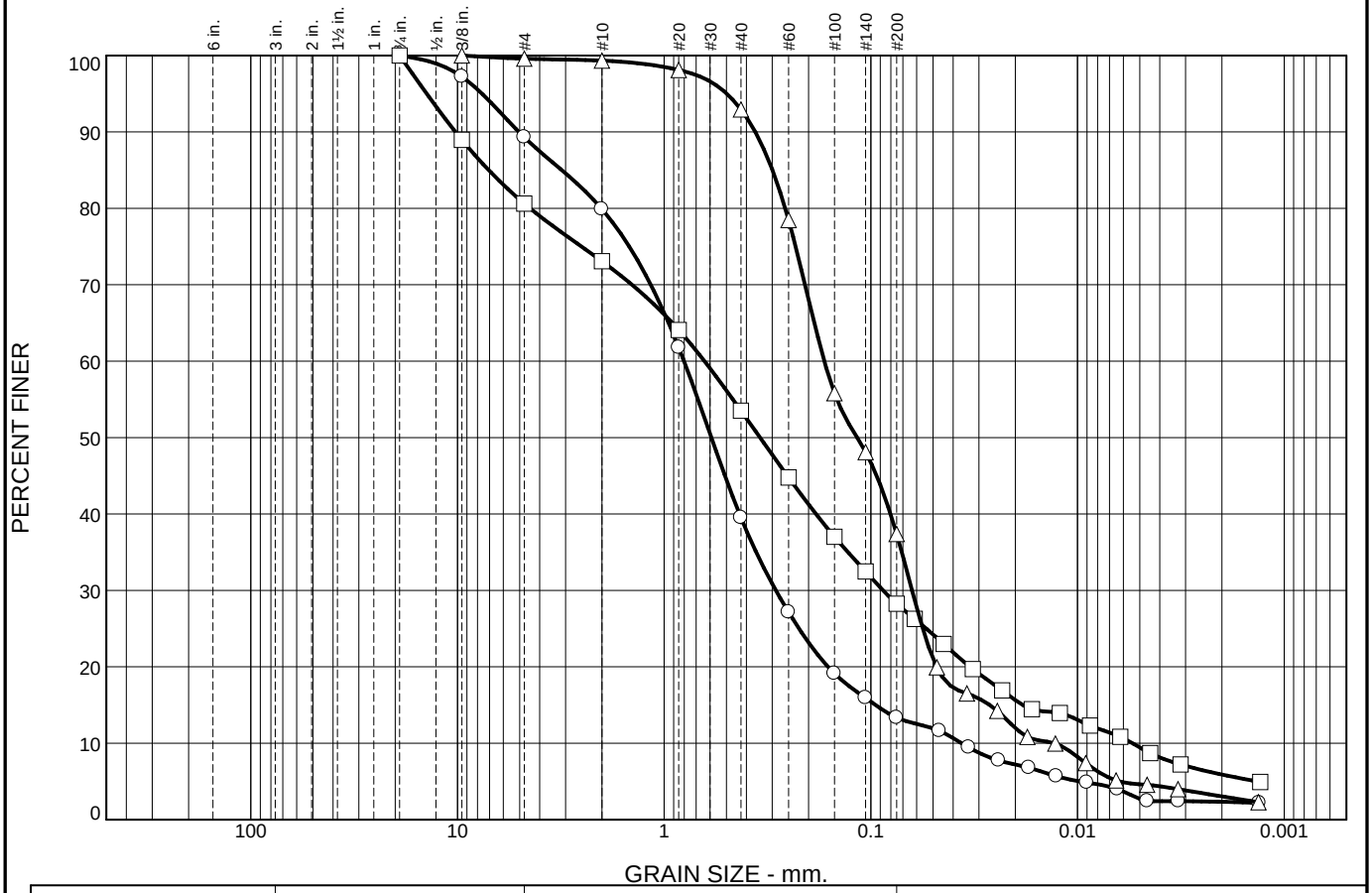
Watertown Mall Redevelopment
Watertown, MA

NRCS SOIL TEXTURE TRIANGLE

JULY 2023

FILE NO. 203699

U.S. STANDARD SIEVE SIZE



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	10.7	9.4	40.4	26.1	11.1	2.3
□	0.0	0.0	19.4	7.5	19.6	25.2	22.4	5.9
△	0.0	0.0	0.4	0.3	6.4	55.5	34.4	3.0

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				w_L	w_P	I_P				
○	HA22-01	S04	7.0-9.0				7.0	22.02	2.84	SM
□	HA22-03	S02	3.0-5.0				11.9	117.72	2.20	SM
△	HA22-03	S06	11.0-13.0				22.6	12.99	1.84	SM

	Sample Description
○	Gray silty sand
□	Gray silty sand with gravel
△	Gray silty sand

Remarks:

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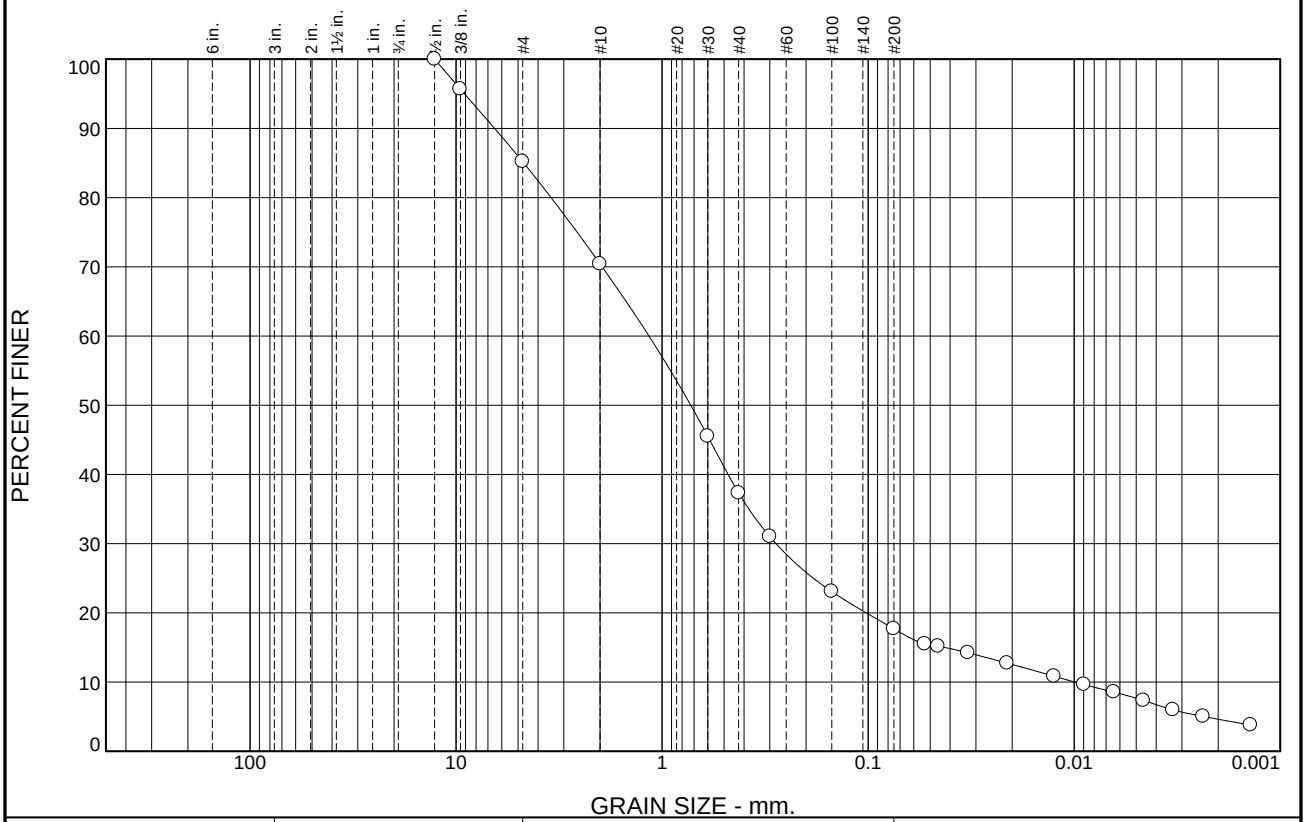
Watertown Mall Redevelopment - Geotechnical & Environmental Design
Watertown, Massachusetts

GRAIN SIZE DISTRIBUTION

DATE: 2/18/2022

FILE NO: 203699-001

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.8	14.8	33.1	19.6	13.1	4.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	95.7		
#4	85.2		
#10	70.4		
#30	45.5		
#40	37.3		
#50	31.0		
#100	23.1		
#200	17.7		
#270	15.5		
0.0457 mm.	15.2		
0.0328 mm.	14.2		
0.0211 mm.	12.7		
0.0125 mm.	10.8		
0.0090 mm.	9.6		
0.0064 mm.	8.6		
0.0046 mm.	7.3		
0.0033 mm.	6.0		
0.0024 mm.	5.0		
0.0014 mm.	3.8		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.5040 D_{85}= 4.6955 D_{60}= 1.1580
D_{50}= 0.7258 D_{30}= 0.2798 D_{15}= 0.0424
D_{10}= 0.0099 C_u= 116.60 C_c= 6.81

Classification

USCS= AASHTO=

Remarks

The sample size was somewhat small relative to the largest particle size and contained freshly fractured gravel. This should be considered when interpreting this data.

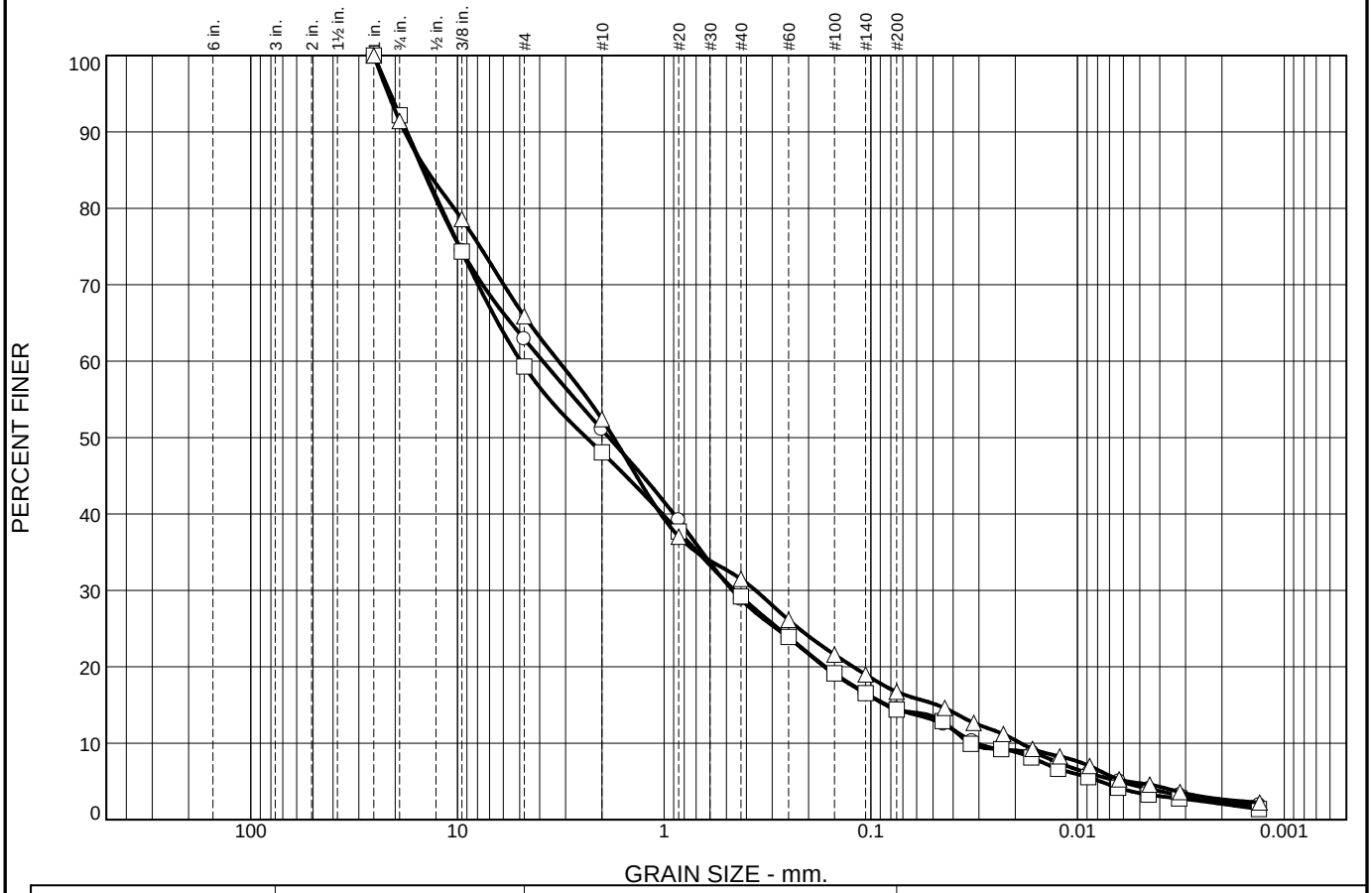
Source of Sample: HA22-02 **Depth:** 10-12
Sample Number: S6 **Date:** 6/5/2023

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-013 **Figure**

U.S. STANDARD SIEVE SIZE



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	7.9	29.2	11.9	22.2	14.3	12.1	2.4
□	0.0	7.8	32.9	11.2	18.9	14.8	12.3	2.1
△	0.0	8.6	25.5	13.5	20.9	14.8	14.0	2.7

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				w_L	w_P	I_P				
○	HA22-04	S03	5.0-7.0				18.5	125.33	1.83	SM
□	HA22-05	S2-S3	3.0-8.0				15.5	148.83	1.27	SM
△	HA22-07	S03	5.0-5.9				16.5	172.47	2.14	SM

	Sample Description
○	Gray silty sand with gravel
□	Gray silty sand with gravel
△	Gray silty sand with gravel

Remarks:

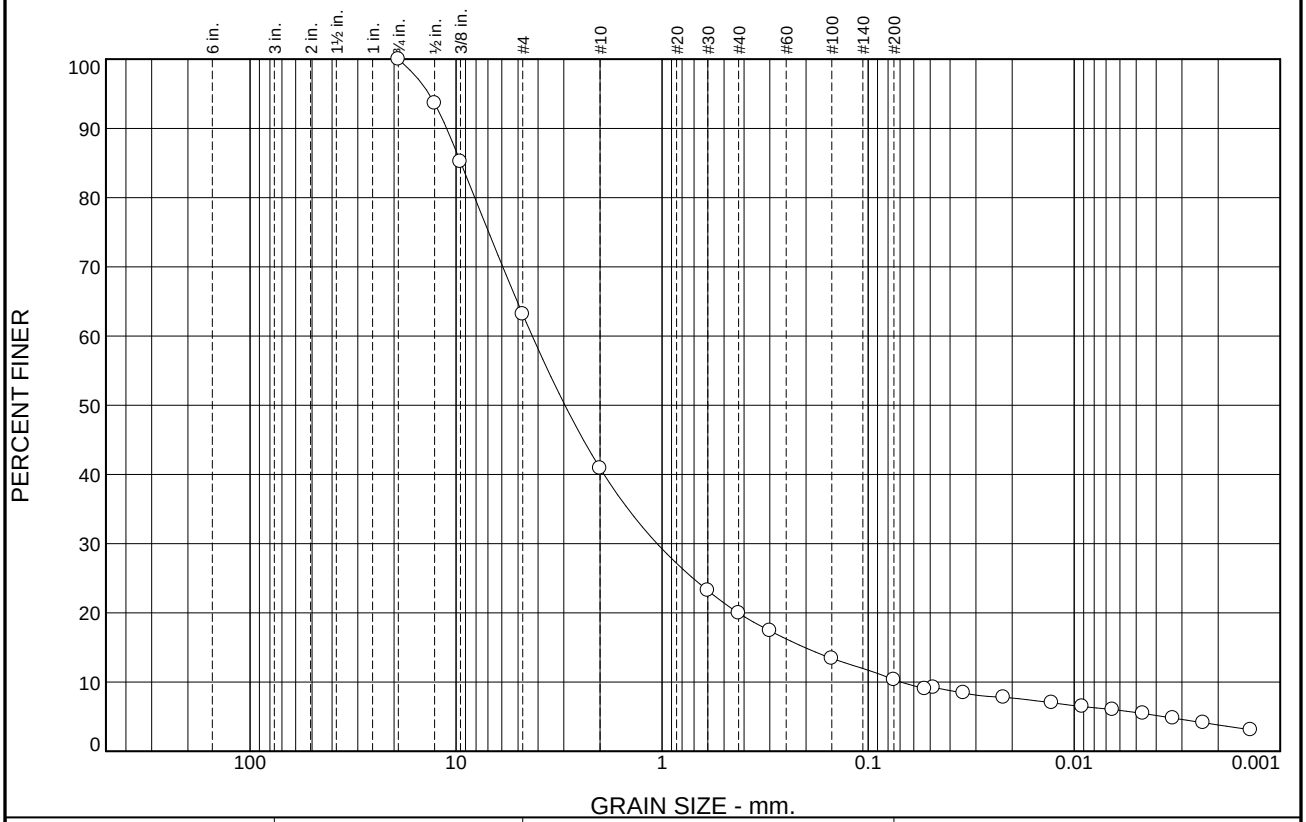
HALEY ALDRICH

Watertown Mall Redevelopment - Geotechnical & Environmental Design
Watertown, Massachusetts

GRAIN SIZE DISTRIBUTION

DATE: 2/18/2022 FILE NO: 203699-001

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	36.8	22.3	20.9	9.7	6.5	3.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	93.6		
3/8"	85.2		
#4	63.2		
#10	40.9		
#30	23.2		
#40	20.0		
#50	17.4		
#100	13.4		
#200	10.3		
#270	9.0		
0.0482 mm.	9.2		
0.0345 mm.	8.5		
0.0220 mm.	7.8		
0.0129 mm.	7.0		
0.0091 mm.	6.5		
0.0065 mm.	6.0		
0.0046 mm.	5.5		
0.0033 mm.	4.8		
0.0024 mm.	4.1		
0.0014 mm.	3.1		

* (no specification provided)

Soil Description

Brown Poorly-Graded SAND w/ Silt & Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.1056 D_{85}= 9.4700 D_{60}= 4.2669
D_{50}= 2.9597 D_{30}= 1.0565 D_{15}= 0.2033
D_{10}= 0.0691 C_u= 61.73 C_c= 3.78

Classification

USCS= AASHTO=

Remarks

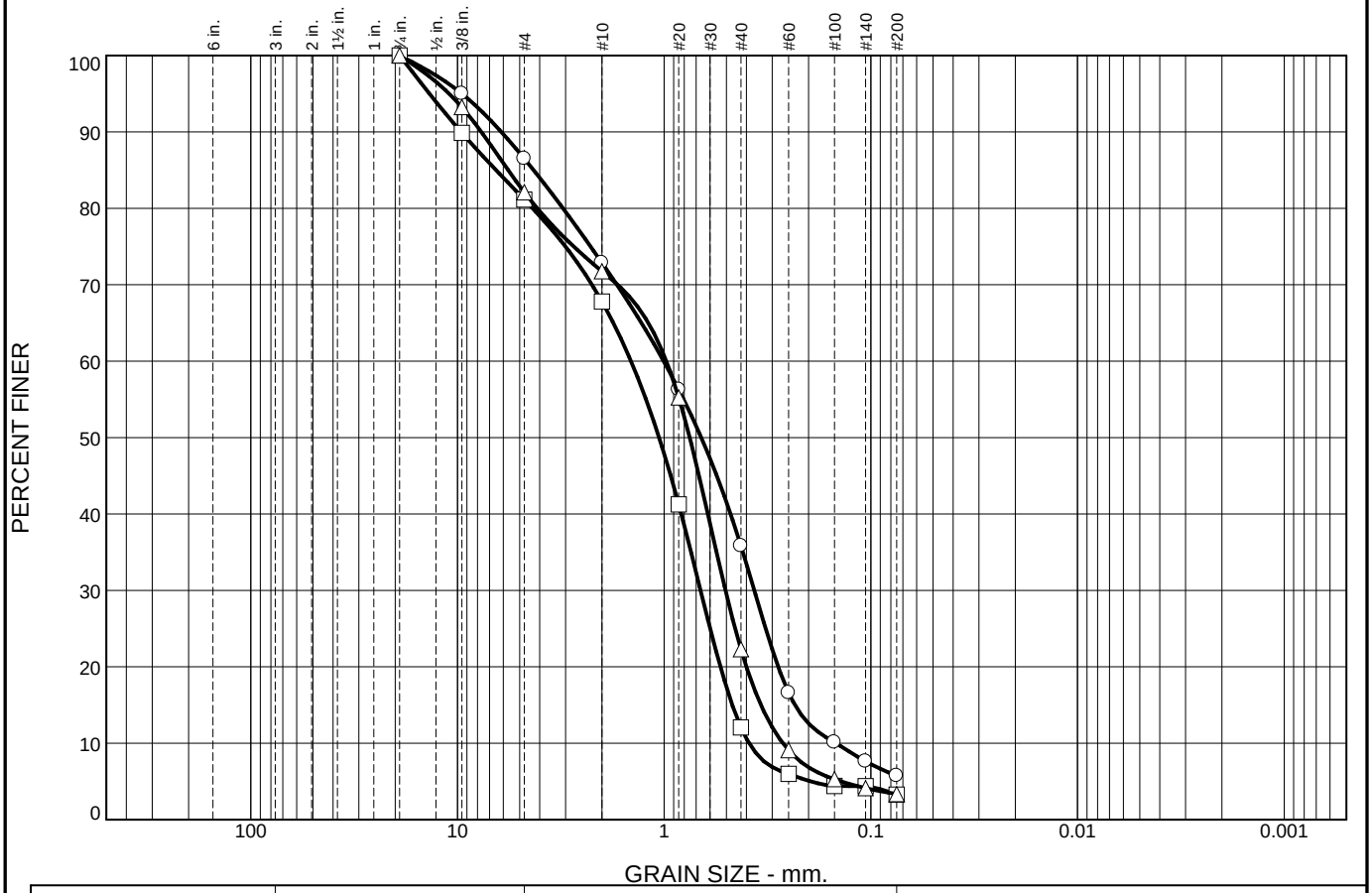
The sample size was small relative to the largest particle size. This should be considered when interpreting. The largest individual particle was 2.1% of the sample weight.

Source of Sample: HA22-09 **Depth:** 5-7
Sample Number: S3 **Date:** 6/5/2023

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001
Project No: 063-013 **Figure**

U.S. STANDARD SIEVE SIZE



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	13.5	13.6	37.1	30.1	5.7	
□	0.0	0.0	18.9	13.3	55.7	8.8	3.3	
△	0.0	0.0	17.9	10.3	49.5	19.0	3.3	

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				w_L	w_P	I_P				
○	HA22-17	S03	5.0-7.0				12.4	6.81	0.90	SP-SM
□	HA22-18	S04	5.0-7.0				2.6	3.73	0.79	SP
△	HA22-19	S03	4.0-6.0				3.1	3.66	0.98	SP

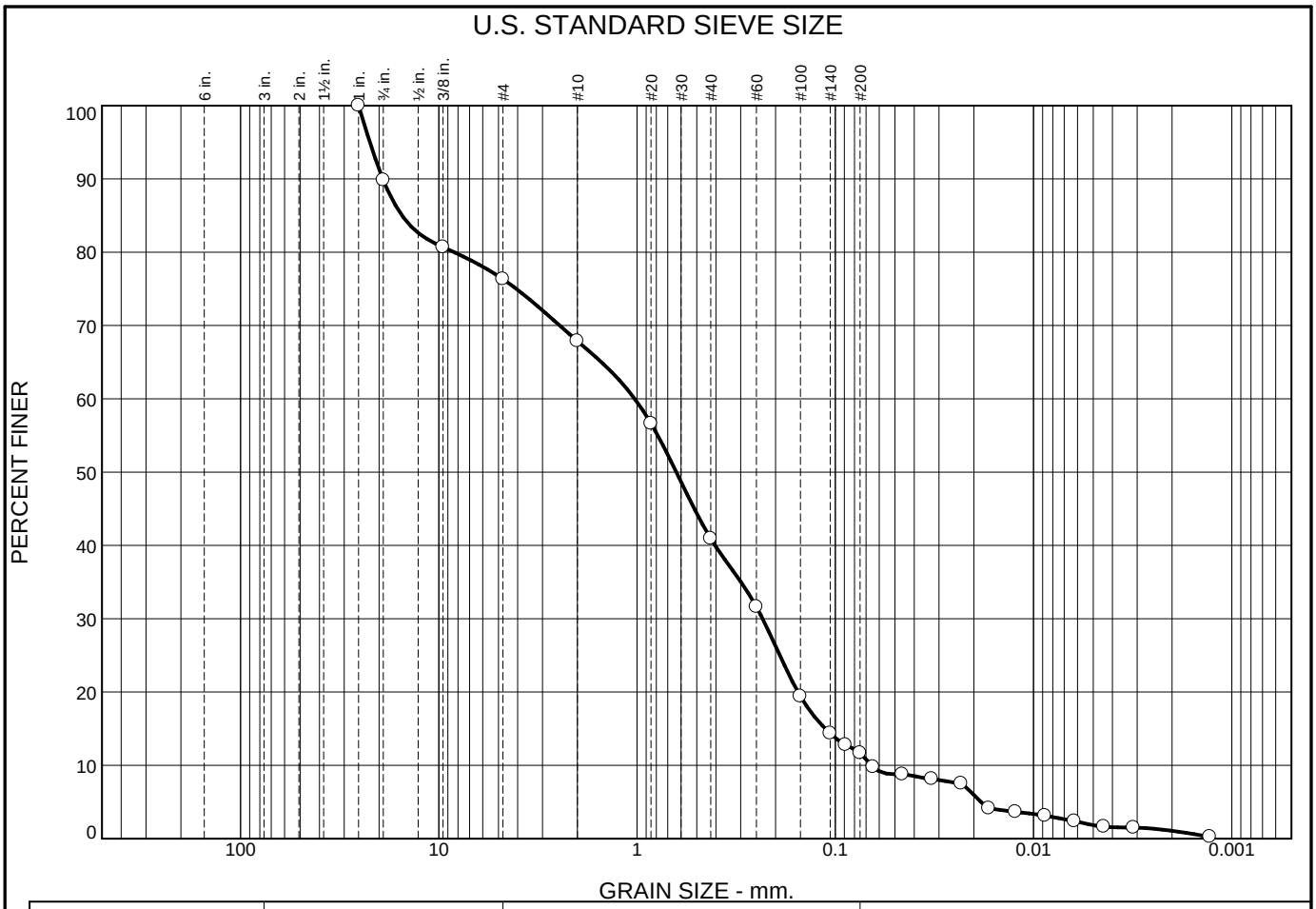
	Sample Description
○	Brown poorly graded sand with silt
□	Brown poorly graded sand with gravel
△	Brown poorly graded sand with gravel

Remarks:

Watertown Mall Redevelopment - Geotechnical & Environmental Design
Watertown, Massachusetts

GRAIN SIZE DISTRIBUTION

DATE: 4/14/2022 FILE NO: 203699-001



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	10.2	13.5	8.4	27.0	29.2	10.6	1.1

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				w_L	w_P	I_P				
○	HA22-102	S03	4-6				11.4	15.63	0.80	SP-SM

	Sample Description
○	Yellow brown poorly graded sand with silt and gravel

Remarks:

HALEY ALDRICH

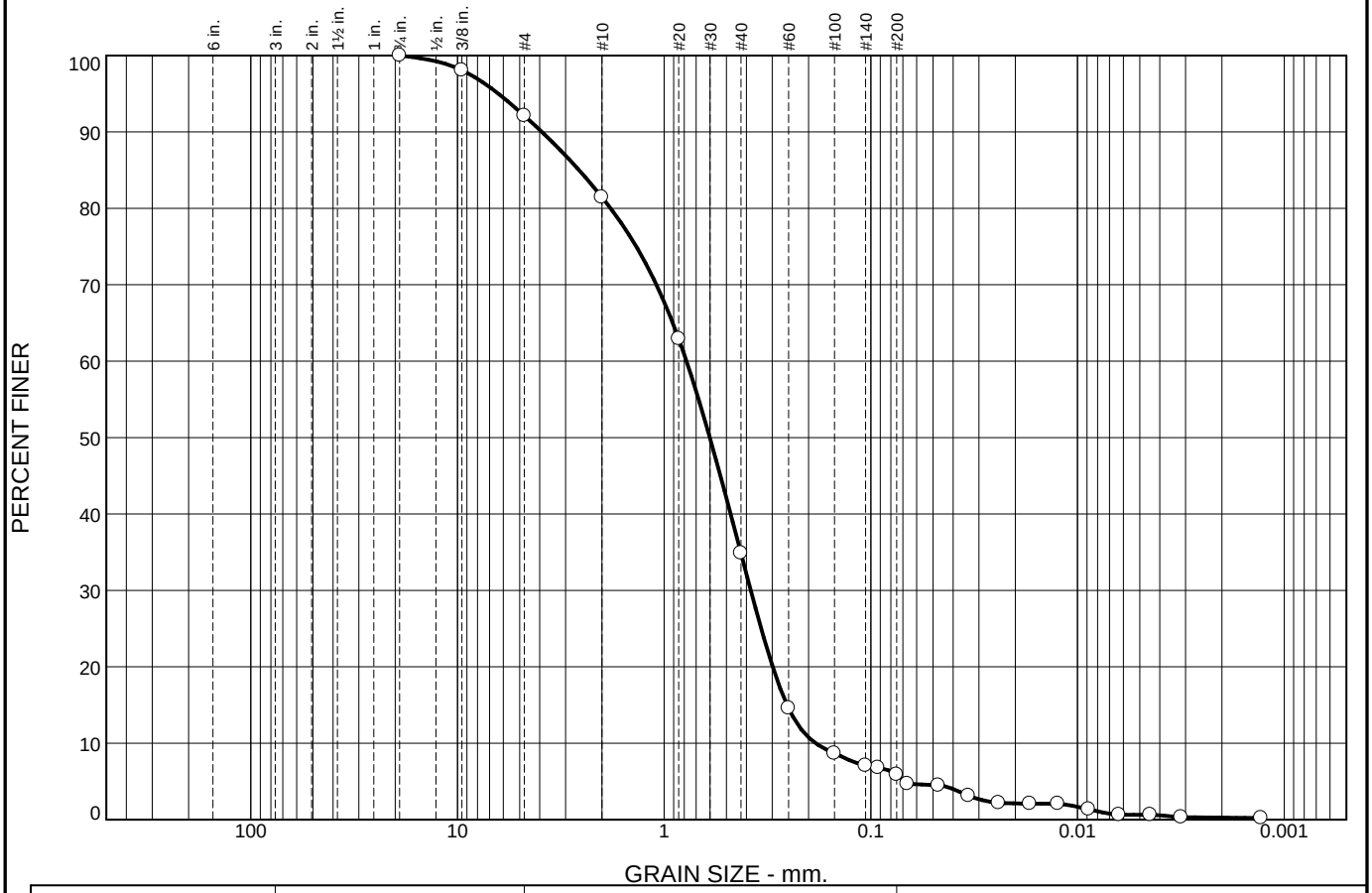
Watertown Mall Redevelopment - Geotechnical & Environmental Design
Watertown, Massachusetts

GRAIN SIZE DISTRIBUTION

DATE: 7/22/2022

FILE NO: 203699-001

U.S. STANDARD SIEVE SIZE



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.9	10.6	46.6	29.0	5.6	0.3

	Expl. No.	Sample No.	Depth (ft)	Atterberg Limits %			Water Content (%)	C_u	C_c	USCS
				w_L	w_P	I_P				
○	HA22-103	S03	4-6				9.9	4.21	1.01	SP-SM

	Sample Description
○	Yellow brown poorly graded sand with silt

Remarks:

HALEY ALDRICH

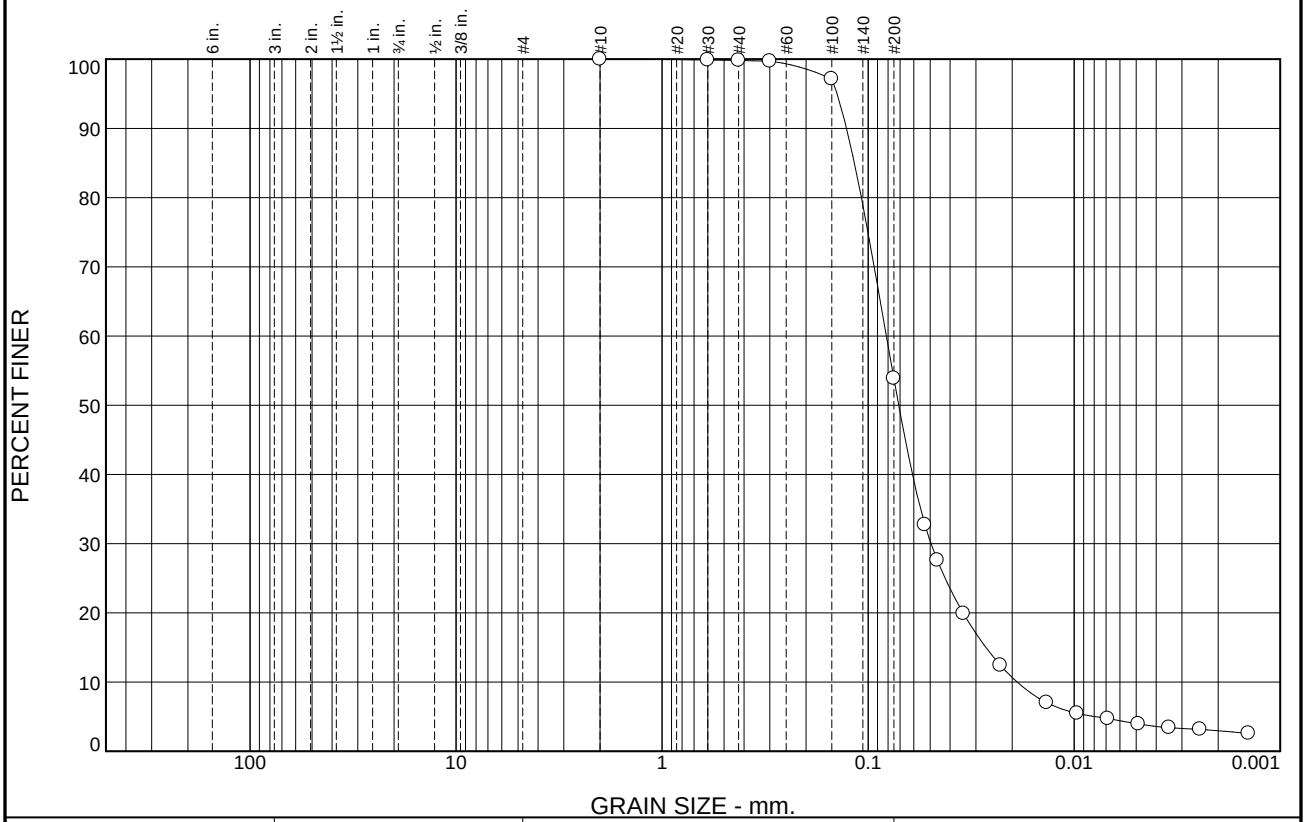
Watertown Mall Redevelopment - Geotechnical & Environmental Design
Watertown, Massachusetts

GRAIN SIZE DISTRIBUTION

DATE: 7/22/2022

FILE NO: 203699-001

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	45.9	50.9	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.9		
#40	99.8		
#50	99.7		
#100	97.1		
#200	53.9		
#270	32.7		
0.0462 mm.	27.6		
0.0344 mm.	19.9		
0.0228 mm.	12.4		
0.0136 mm.	7.0		
0.0097 mm.	5.5		
0.0069 mm.	4.7		
0.0049 mm.	4.0		
0.0035 mm.	3.4		
0.0025 mm.	3.2		
0.0014 mm.	2.6		

* (no specification provided)

Soil Description

Pale Brown Sandy SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1272 D_{85}= 0.1166 D_{60}= 0.0816
D_{50}= 0.0710 D_{30}= 0.0495 D_{15}= 0.0268
D_{10}= 0.0189 C_u= 4.31 C_c= 1.59

Classification

USCS= AASHTO=

Remarks

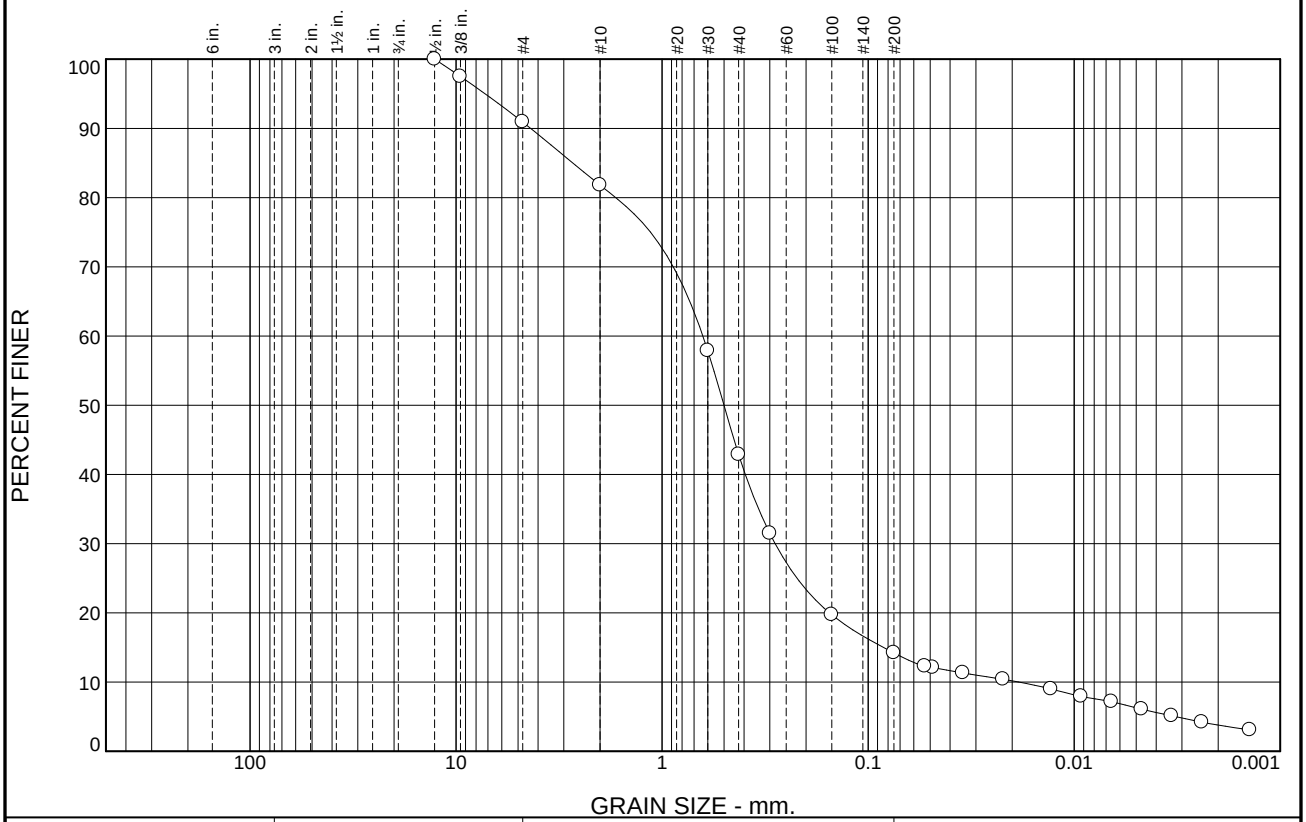
Source of Sample: HA22-106 **Depth:** 9-11
Sample Number: S4 **Date:** 6/5/2023

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-013 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.1	9.1	38.9	28.7	10.4	3.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	97.5		
#4	90.9		
#10	81.8		
#30	57.9		
#40	42.9		
#50	31.5		
#100	19.7		
#200	14.2		
#270	12.3		
0.0486 mm.	12.1		
0.0346 mm.	11.3		
0.0221 mm.	10.4		
0.0130 mm.	9.0		
0.0092 mm.	7.9		
0.0066 mm.	7.2		
0.0047 mm.	6.1		
0.0034 mm.	5.1		
0.0024 mm.	4.2		
0.0014 mm.	3.1		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.3437 D_{85}= 2.7129 D_{60}= 0.6337
D_{50}= 0.5008 D_{30}= 0.2825 D_{15}= 0.0840
D_{10}= 0.0185 C_u= 34.17 C_c= 6.79

Classification

USCS= AASHTO=

Remarks

The sample size was somewhat small relative to the largest particle size. This should be considered when interpreting this data.

Source of Sample: HA22-208 **Depth:** 2-5
Sample Number: S2,S3

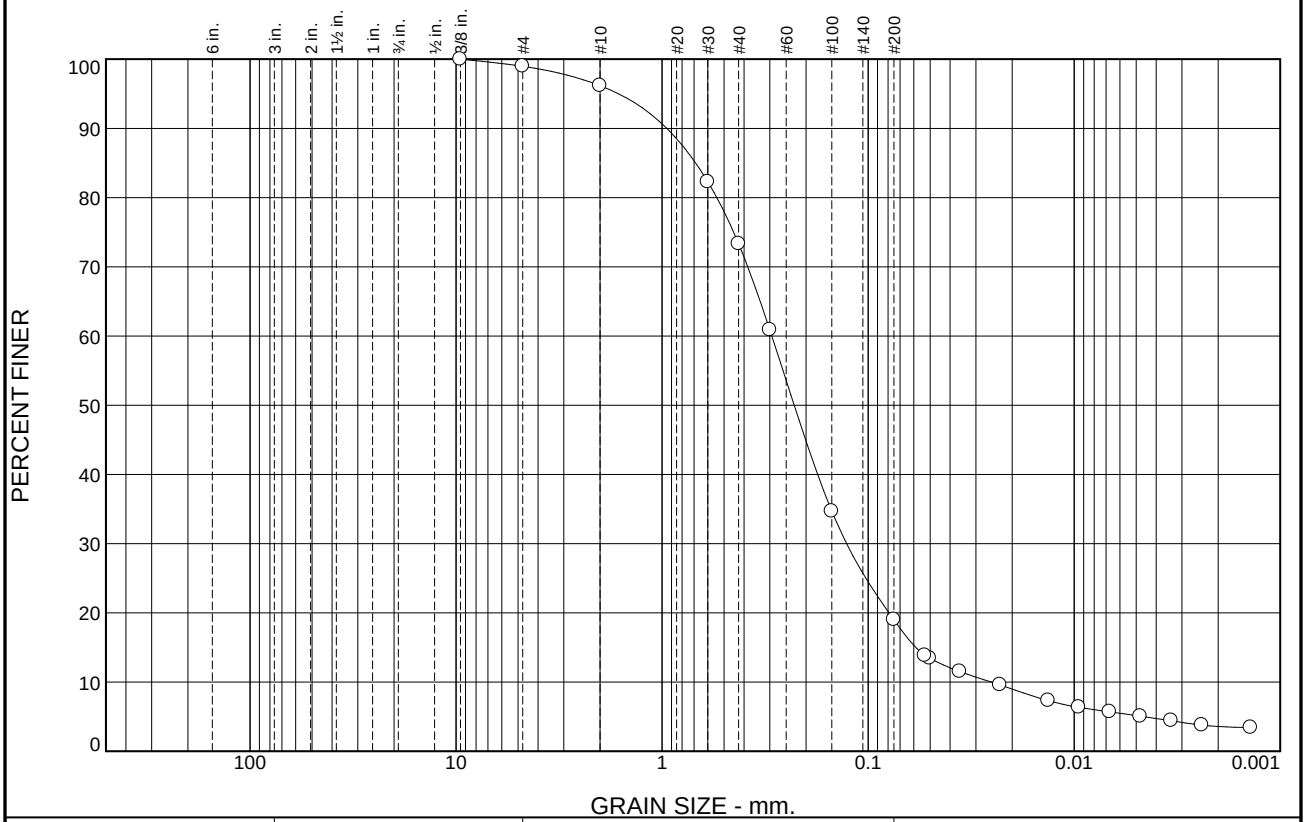
Date: 6/5/2023

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-013 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	2.8	22.9	54.3	15.4	3.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.0		
#10	96.2		
#30	82.3		
#40	73.3		
#50	60.9		
#100	34.7		
#200	19.0		
#270	13.9		
0.0503 mm.	13.5		
0.0359 mm.	11.5		
0.0229 mm.	9.6		
0.0134 mm.	7.3		
0.0095 mm.	6.4		
0.0067 mm.	5.7		
0.0048 mm.	5.1		
0.0034 mm.	4.4		
0.0024 mm.	3.8		
0.0014 mm.	3.4		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9481 D_{85}= 0.6876 D_{60}= 0.2933
D_{50}= 0.2284 D_{30}= 0.1271 D_{15}= 0.0587
D_{10}= 0.0252 C_u= 11.64 C_c= 2.19

Classification

USCS= AASHTO=

Remarks

The sample size was smaller than ideal. This should be considered when interpreting this data.

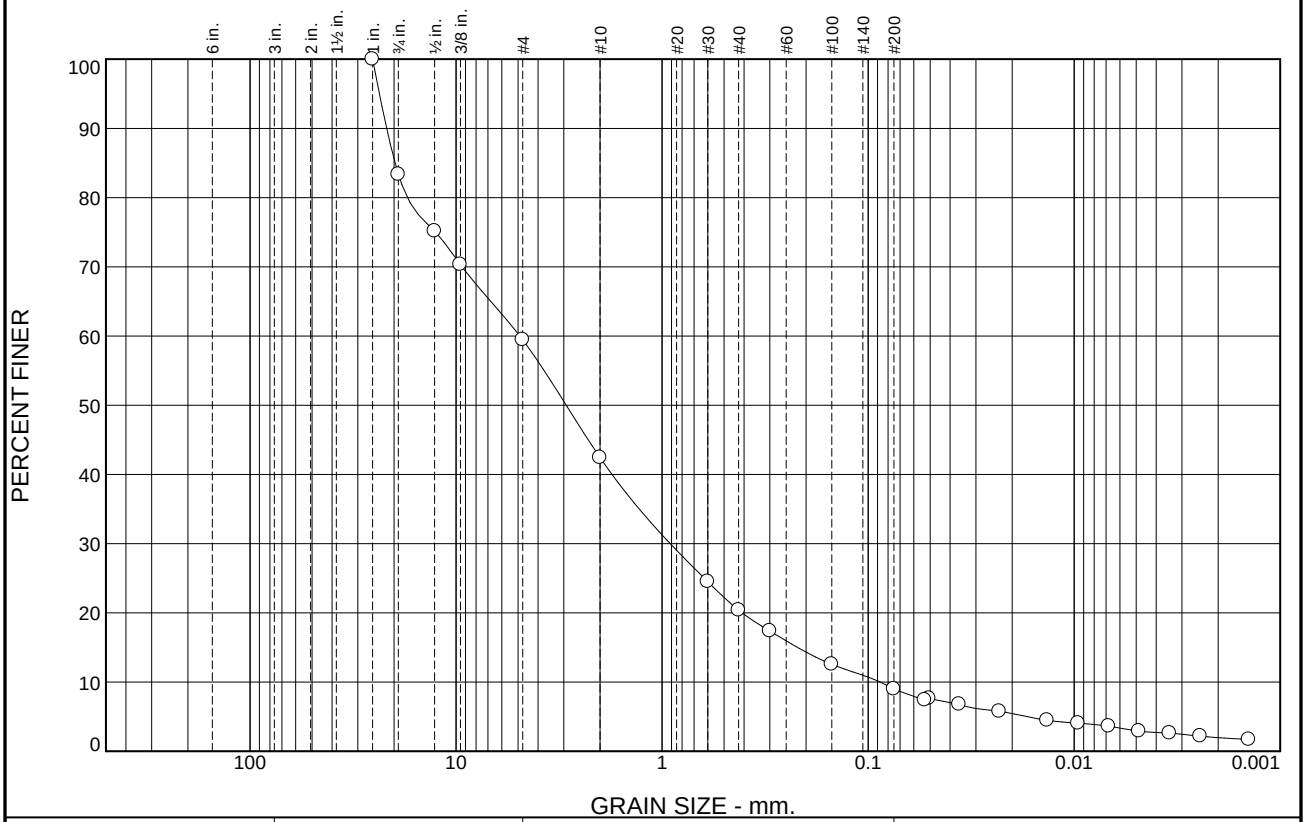
Source of Sample: HA22-211 **Depth:** 7-9
Sample Number: S5 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.7	23.8	17.1	22.0	11.4	7.0	2.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	83.3		
1/2"	75.2		
3/8"	70.3		
#4	59.5		
#10	42.4		
#30	24.5		
#40	20.4		
#50	17.4		
#100	12.6		
#200	9.0		
#270	7.4		
0.0506 mm.	7.6		
0.0361 mm.	6.8		
0.0231 mm.	5.8		
0.0135 mm.	4.5		
0.0096 mm.	4.1		
0.0068 mm.	3.6		
0.0048 mm.	2.9		
0.0034 mm.	2.6		
0.0024 mm.	2.2		
0.0014 mm.	1.7		

* (no specification provided)

Soil Description

Grayish Brown Well-Graded SAND w/ Silt & Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.7138 D_{85}= 19.7753 D_{60}= 4.9058
D_{50}= 2.9182 D_{30}= 0.9123 D_{15}= 0.2198
D_{10}= 0.0873 C_u= 56.19 C_c= 1.94

Classification

USCS= AASHTO=

Remarks

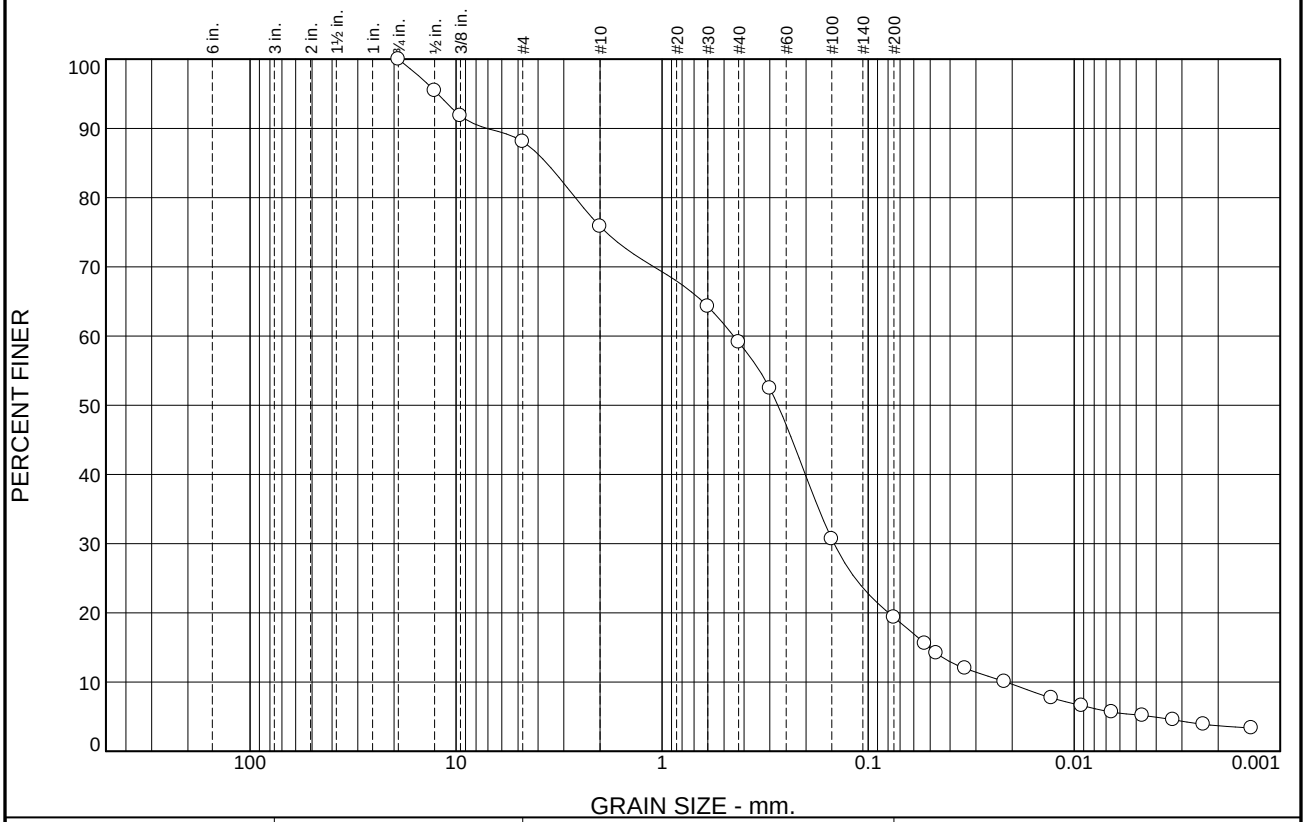
This sample was very small and contained freshly fractured gravel. The largest individual particle was 8.4% of the sample weight. Results are very approximate.

Source of Sample: HA22-213 **Depth:** 13-15
Sample Number: S7 **Date:** 6/5/2023

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001
Project No: 063-013 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.9	12.3	16.7	39.7	15.7	3.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	95.4		
3/8"	91.8		
#4	88.1		
#10	75.8		
#30	64.3		
#40	59.1		
#50	52.4		
#100	30.7		
#200	19.4		
#270	15.6		
0.0467 mm.	14.2		
0.0338 mm.	12.0		
0.0218 mm.	10.1		
0.0129 mm.	7.7		
0.0092 mm.	6.6		
0.0066 mm.	5.7		
0.0047 mm.	5.2		
0.0033 mm.	4.6		
0.0024 mm.	3.9		
0.0014 mm.	3.4		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.0726 D_{85}= 3.6337 D_{60}= 0.4496
D_{50}= 0.2742 D_{30}= 0.1463 D_{15}= 0.0503
D_{10}= 0.0214 C_u= 21.00 C_c= 2.22

Classification

USCS= AASHTO=

Remarks

This sample was small and contained freshly fractured gravel. Results approximate.

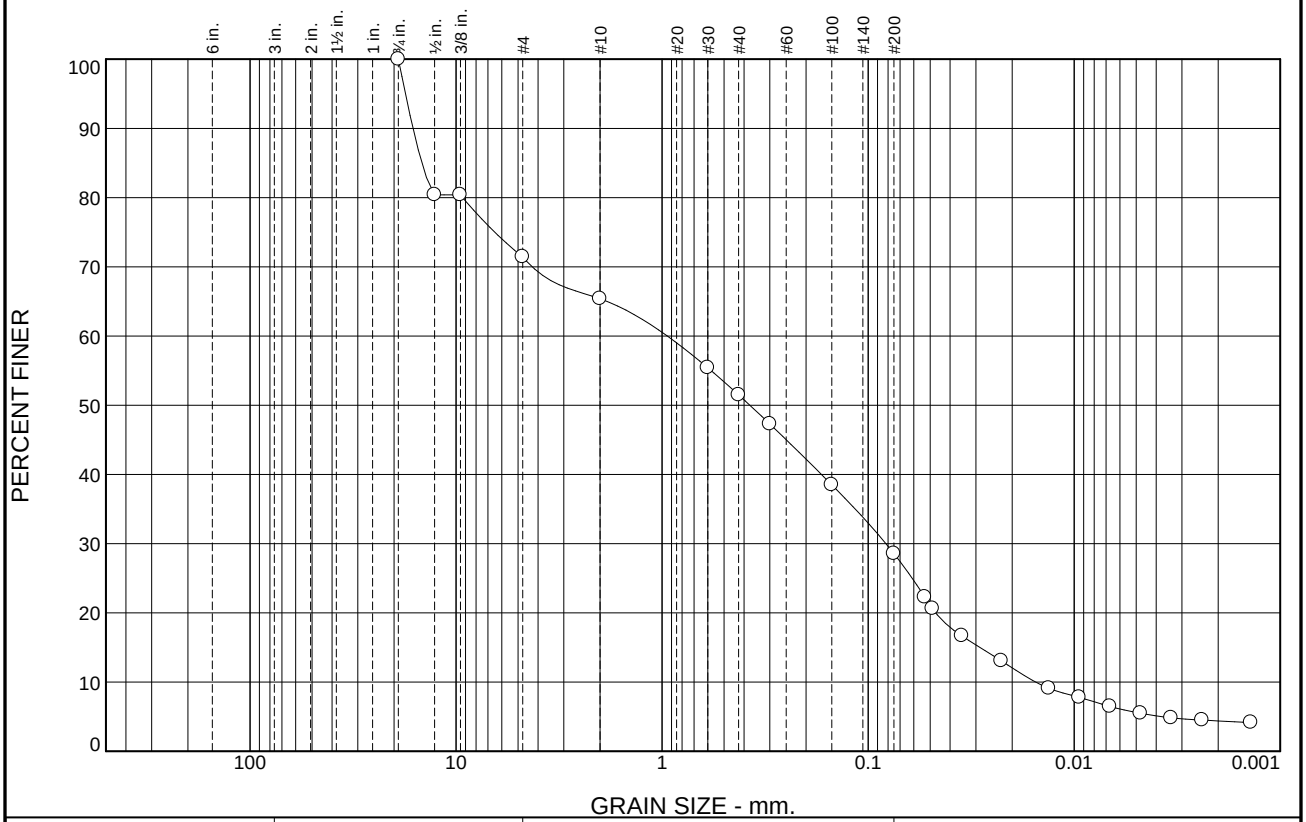
Source of Sample: HA22-217 **Depth:** 19-21
Sample Number: S9 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-006 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	28.6	6.0	13.9	22.9	24.2	4.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	80.4		
3/8"	80.4		
#4	71.4		
#10	65.4		
#30	55.4		
#40	51.5		
#50	47.3		
#100	38.5		
#200	28.6		
#270	22.3		
0.0487 mm.	20.6		
0.0351 mm.	16.7		
0.0226 mm.	13.1		
0.0133 mm.	9.1		
0.0094 mm.	7.8		
0.0067 mm.	6.5		
0.0048 mm.	5.5		
0.0034 mm.	4.8		
0.0024 mm.	4.5		
0.0014 mm.	4.2		

* (no specification provided)

Soil Description

Dark Brown Silty SAND w/ Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.1771 D_{85}= 14.6606 D_{60}= 0.9424
D_{50}= 0.3748 D_{30}= 0.0820 D_{15}= 0.0286
D_{10}= 0.0154 C_u= 61.36 C_c= 0.46

Classification

USCS= AASHTO=

Remarks

Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

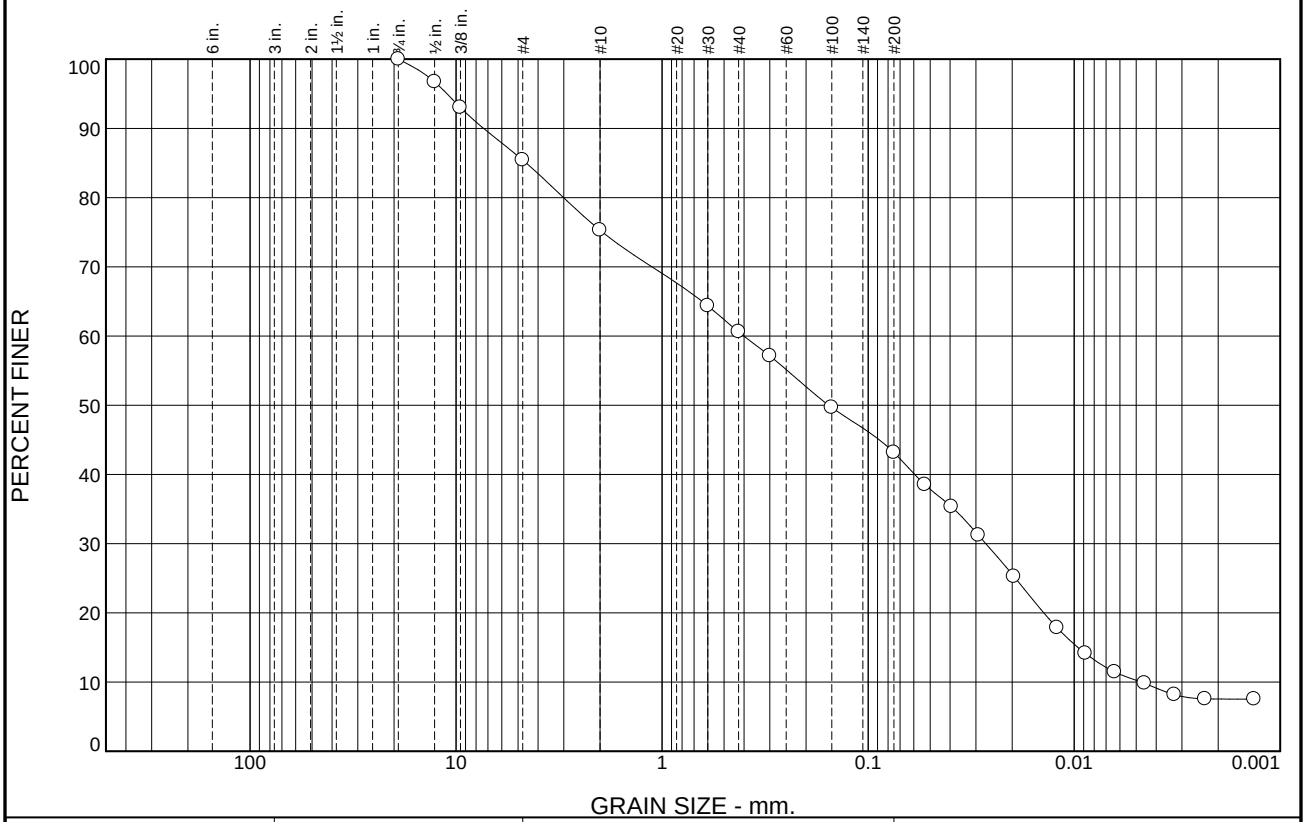
Source of Sample: HA22-218 **Depth:** 6-8
Sample Number: S4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.6	10.1	14.7	17.4	35.6	7.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.7		
3/8"	93.0		
#4	85.4		
#10	75.3		
#30	64.4		
#40	60.6		
#50	57.1		
#100	49.7		
#200	43.2		
#270	38.5		
0.0394 mm.	35.3		
0.0292 mm.	31.2		
0.0196 mm.	25.3		
0.0121 mm.	17.8		
0.0088 mm.	14.1		
0.0064 mm.	11.5		
0.0046 mm.	9.8		
0.0033 mm.	8.2		
0.0023 mm.	7.6		
0.0013 mm.	7.5		

* (no specification provided)

Soil Description

Pale Brown SILT & Grayish Brown Silty SAND (combined sample is Silty SAND)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.3480 D_{85}= 4.5692 D_{60}= 0.4007
D_{50}= 0.1553 D_{30}= 0.0268 D_{15}= 0.0096
D_{10}= 0.0047 C_u= 84.74 C_c= 0.38

Classification

USCS= AASHTO=

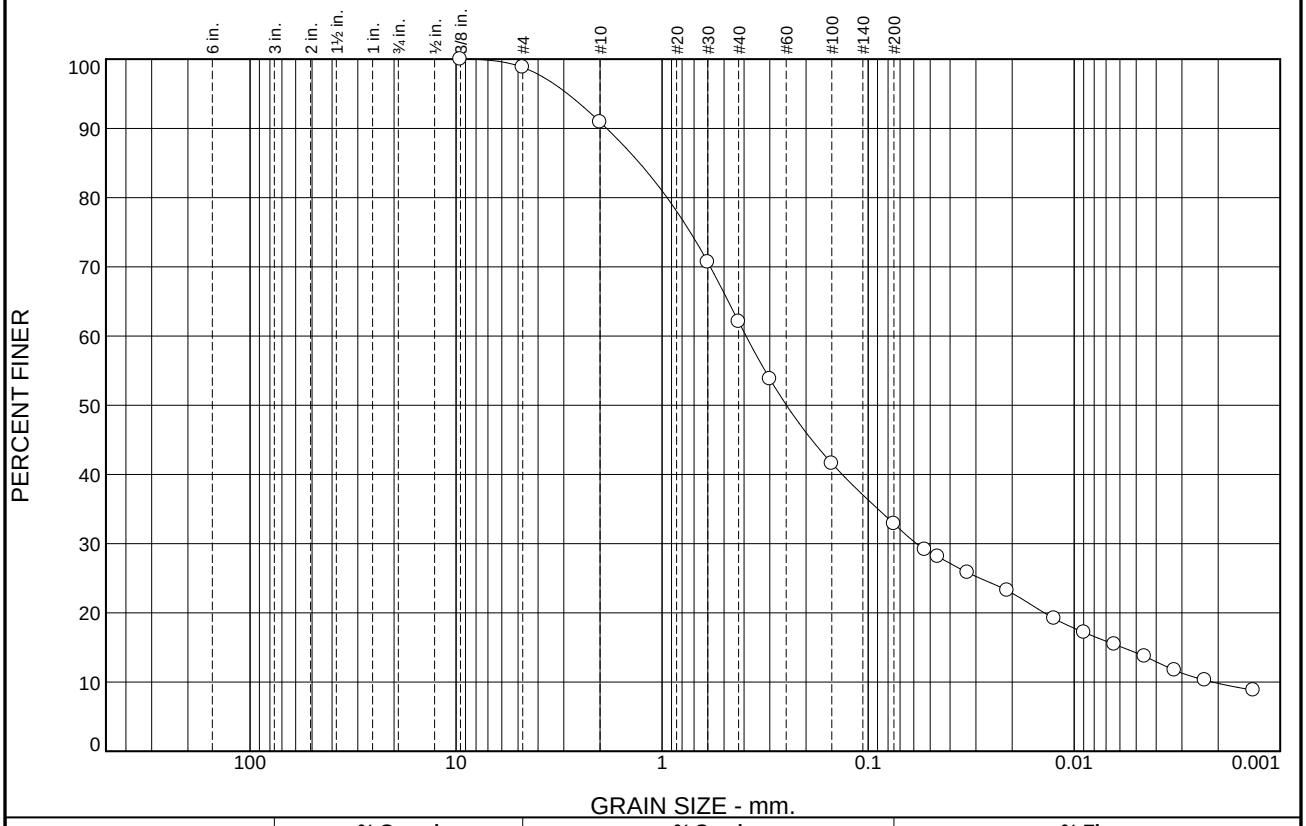
Remarks

Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

Source of Sample: HA22-219 **Depth:** 13-15
Sample Number: S8 **Date:**

Benchmark Geotechnical Labs, LLC	**Client:** Haley & Aldrich **Project:** Watertown Mall Redevelopment - 203699-001 **Project No:** 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	7.9	28.8	29.2	23.1	9.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	98.8		
#10	90.9		
#30	70.7		
#40	62.1		
#50	53.8		
#100	41.6		
#200	32.9		
#270	29.1		
0.0459 mm.	28.1		
0.0329 mm.	25.8		
0.0211 mm.	23.2		
0.0125 mm.	19.2		
0.0089 mm.	17.2		
0.0064 mm.	15.4		
0.0046 mm.	13.7		
0.0033 mm.	11.7		
0.0023 mm.	10.3		
0.0014 mm.	8.8		

* (no specification provided)

Soil Description

Very Dark Gray Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.8578 D_{85}= 1.2868 D_{60}= 0.3912
D_{50}= 0.2492 D_{30}= 0.0582 D_{15}= 0.0058
D_{10}= 0.0021 C_u= 183.94 C_c= 4.07

Classification

USCS= AASHTO=

Remarks

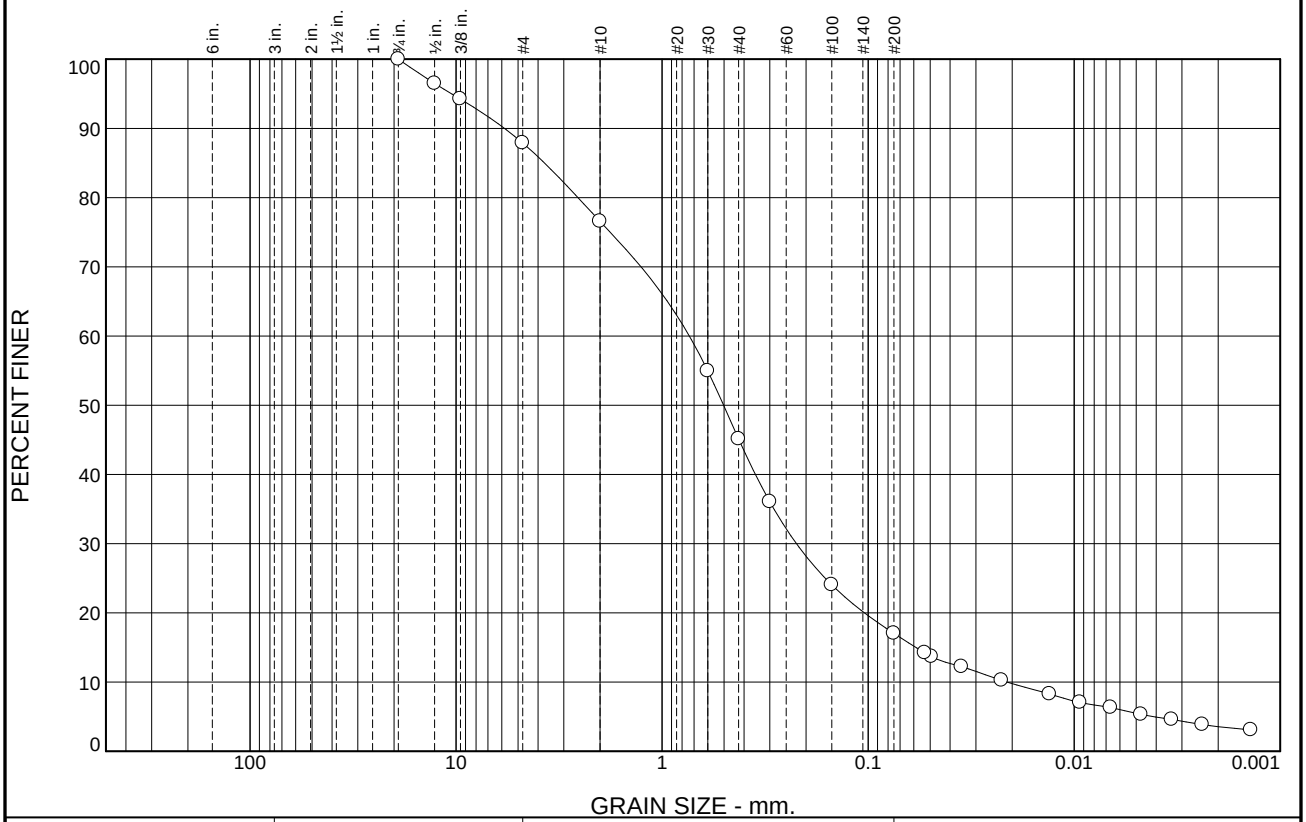
Source of Sample: HA22-220 **Depth:** 8-12
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.1	11.3	31.5	28.1	13.4	3.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.5		
3/8"	94.2		
#4	87.9		
#10	76.6		
#30	54.9		
#40	45.1		
#50	36.1		
#100	24.0		
#200	17.0		
#270	14.2		
0.0492 mm.	13.7		
0.0351 mm.	12.2		
0.0225 mm.	10.3		
0.0132 mm.	8.3		
0.0094 mm.	7.0		
0.0067 mm.	6.3		
0.0047 mm.	5.3		
0.0034 mm.	4.6		
0.0024 mm.	3.9		
0.0014 mm.	3.1		

* (no specification provided)

Soil Description

Very Dark Gray Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.8180 D_{85}= 3.7223 D_{60}= 0.7375
D_{50}= 0.5030 D_{30}= 0.2228 D_{15}= 0.0586
D_{10}= 0.0211 C_u= 34.88 C_c= 3.18

Classification

USCS= AASHTO=

Remarks

Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

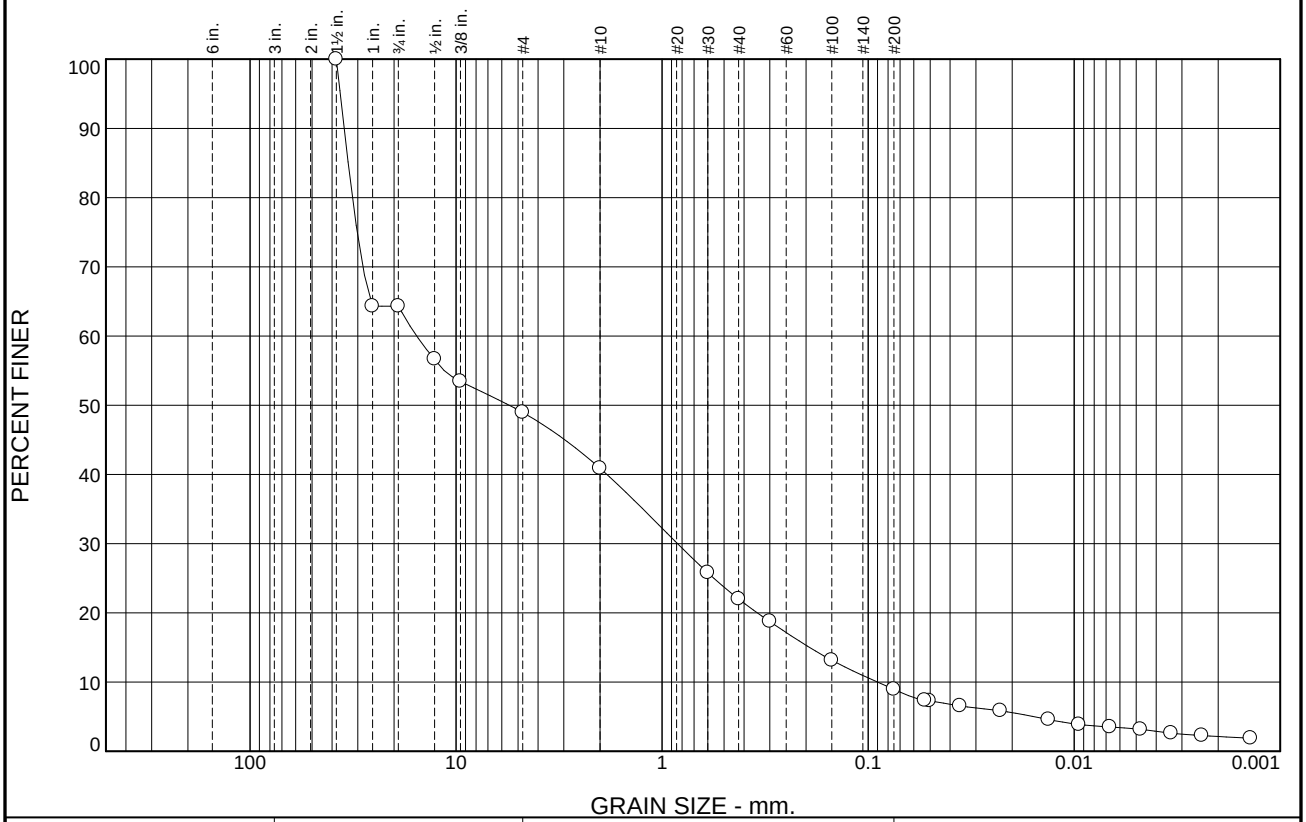
Source of Sample: HA22-224 **Depth:** 10-15
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.7	15.3	8.1	18.9	13.0	6.9	2.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	64.3		
3/4"	64.3		
1/2"	56.7		
3/8"	53.5		
#4	49.0		
#10	40.9		
#30	25.8		
#40	22.0		
#50	18.8		
#100	13.2		
#200	9.0		
#270	7.4		
0.0504 mm.	7.3		
0.0358 mm.	6.6		
0.0228 mm.	5.9		
0.0133 mm.	4.6		
0.0095 mm.	3.9		
0.0067 mm.	3.5		
0.0048 mm.	3.2		
0.0034 mm.	2.6		
0.0024 mm.	2.3		
0.0014 mm.	1.9		

* (no specification provided)

Soil Description

Dark Grayish Brown Poorly-Graded GRAVEL w/ Silt & Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 34.9315 D_{85}= 33.3813 D_{60}= 15.5271
D_{50}= 5.5177 D_{30}= 0.8414 D_{15}= 0.1923
D_{10}= 0.0899 C_u= 172.77 C_c= 0.51

Classification

USCS= AASHTO=

Remarks

Due to the extremly small sample size, relative to the largest particle size, this data should be considered to be very approximate. Sample contained freshly fractured gravel.

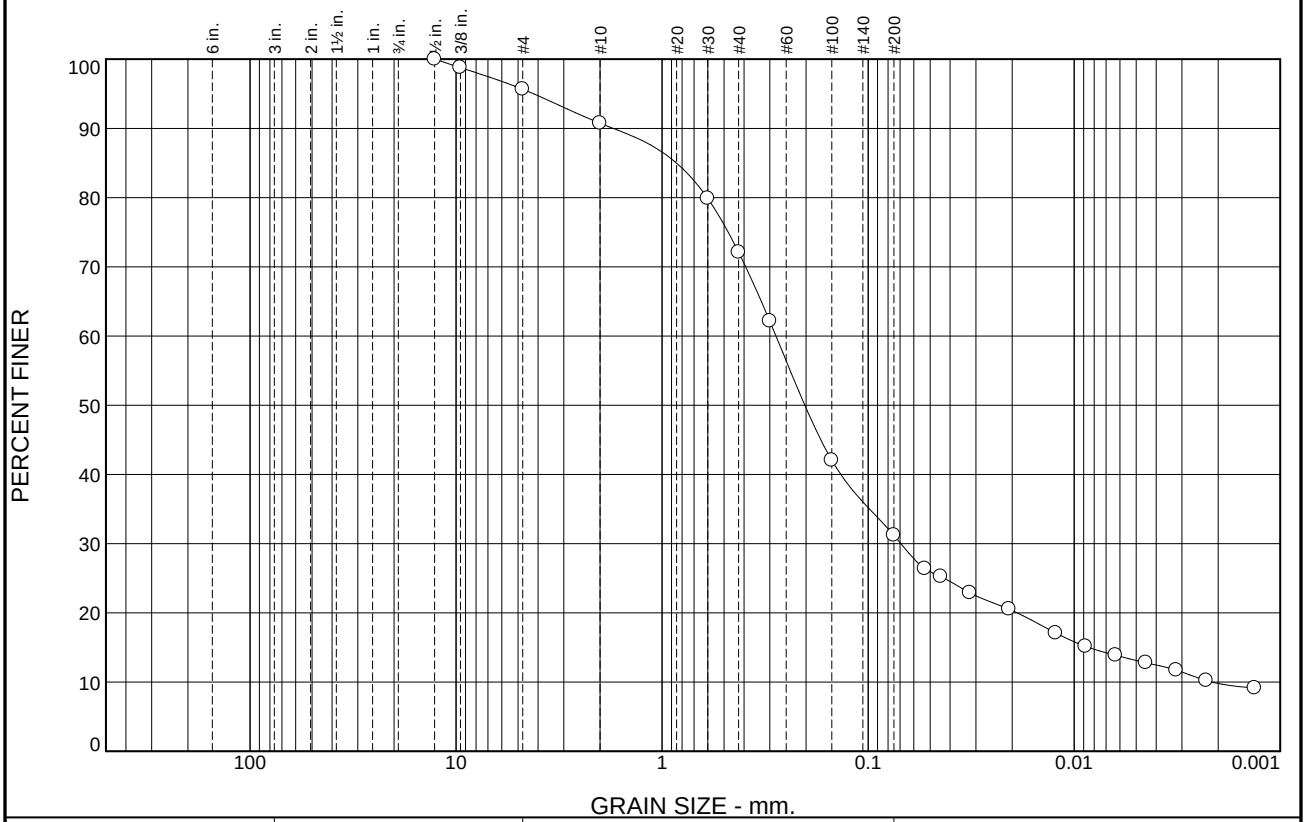
Source of Sample: HA22-229 **Depth:** 5-10
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.3	5.0	18.6	40.9	21.4	9.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.8		
#4	95.7		
#10	90.7		
#30	79.9		
#40	72.1		
#50	62.1		
#100	42.0		
#200	31.2		
#270	26.4		
0.0444 mm.	25.3		
0.0321 mm.	22.9		
0.0207 mm.	20.5		
0.0123 mm.	17.1		
0.0088 mm.	15.2		
0.0063 mm.	13.9		
0.0045 mm.	12.8		
0.0032 mm.	11.7		
0.0023 mm.	10.2		
0.0013 mm.	9.1		

* (no specification provided)

Soil Description

Brown Sand w/ Silt & Brown SILT (combined sample is Silty Sand)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.7250 D_{85}= 0.8511 D_{60}= 0.2800
D_{50}= 0.2030 D_{30}= 0.0693 D_{15}= 0.0085
D_{10}= 0.0021 C_u= 130.56 C_c= 8.01

Classification

USCS= AASHTO=

Remarks

The sample size was small relative to the largest particle size. This should be considered when interpreting this data.

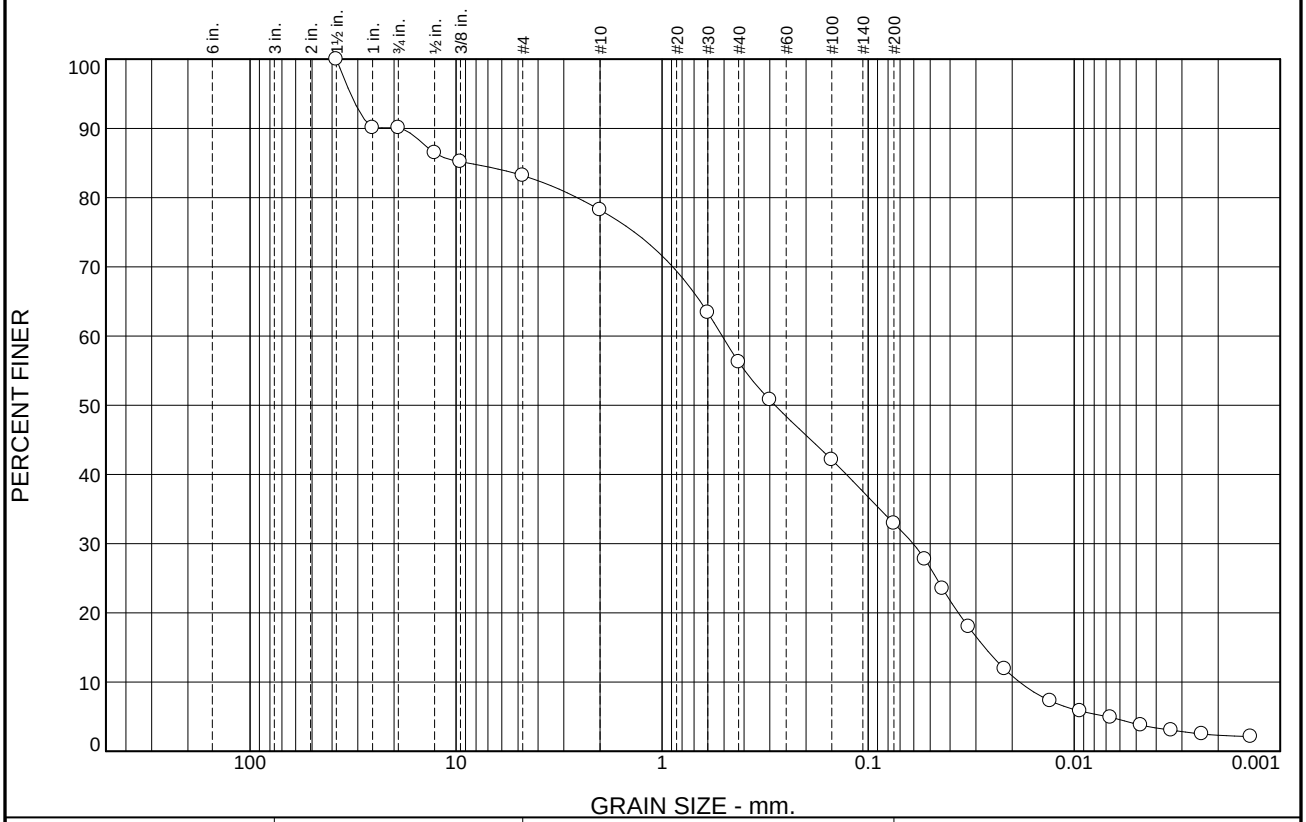
Source of Sample: HA22-230 **Depth:** 5-10
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.9	6.9	5.0	22.0	23.3	30.6	2.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	90.1		
3/4"	90.1		
1/2"	86.5		
3/8"	85.2		
#4	83.2		
#10	78.2		
#30	63.4		
#40	56.2		
#50	50.8		
#100	42.1		
#200	32.9		
#270	27.7		
0.0435 mm.	23.5		
0.0326 mm.	18.0		
0.0218 mm.	11.9		
0.0131 mm.	7.3		
0.0094 mm.	5.8		
0.0067 mm.	4.9		
0.0048 mm.	3.8		
0.0034 mm.	3.1		
0.0024 mm.	2.5		
0.0014 mm.	2.1		

* (no specification provided)

Soil Description

Brown SAND w/ Silt & Gravel & Brown SILT (combined sample is Silty SAND w/ Gravel)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 18.4538 D_{85}= 8.7664 D_{60}= 0.5108
D_{50}= 0.2831 D_{30}= 0.0604 D_{15}= 0.0272
D_{10}= 0.0184 C_u= 27.76 C_c= 0.39

Classification

USCS= AASHTO=

Remarks

Due to the extremly small sample size, relative to the largest particle size, this data should be considered to be very approximate. Sample contained freshly fractured gravel.

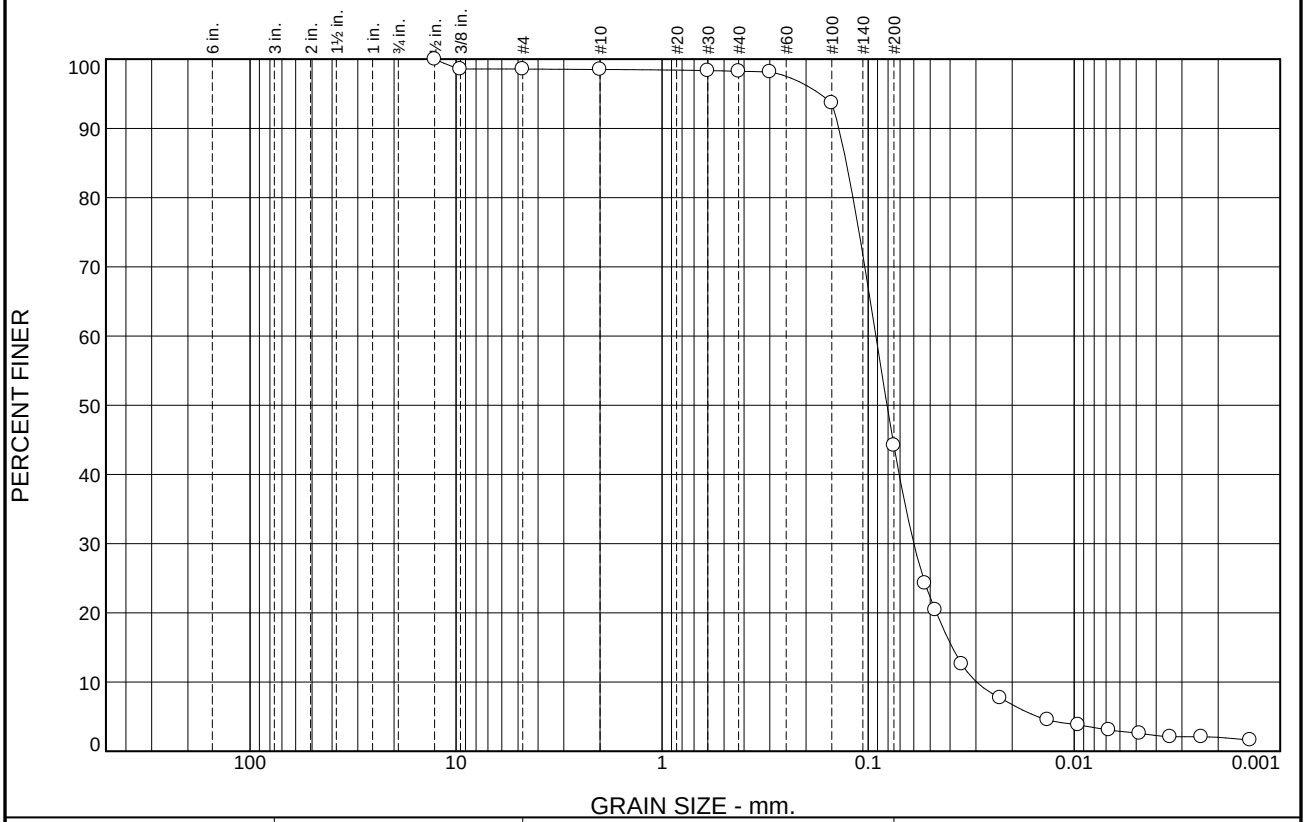
Source of Sample: HA22-231 **Depth:** 10-15
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	0.1	0.2	54.1	42.2	2.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.6		
#4	98.6		
#10	98.5		
#30	98.3		
#40	98.3		
#50	98.2		
#100	93.7		
#200	44.2		
#270	24.3		
0.0472 mm.	20.4		
0.0352 mm.	12.6		
0.0229 mm.	7.7		
0.0135 mm.	4.5		
0.0096 mm.	3.8		
0.0068 mm.	3.1		
0.0048 mm.	2.6		
0.0034 mm.	2.1		
0.0024 mm.	2.1		
0.0014 mm.	1.6		

* (no specification provided)

Soil Description

Light Yellowish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1388 D_{85}= 0.1275 D_{60}= 0.0917
D_{50}= 0.0810 D_{30}= 0.0600 D_{15}= 0.0391
D_{10}= 0.0298 C_u= 3.08 C_c= 1.32

Classification

USCS= AASHTO=

Remarks

The sample size was small relative to the largest particle size. This should be considered when interpreting this data.

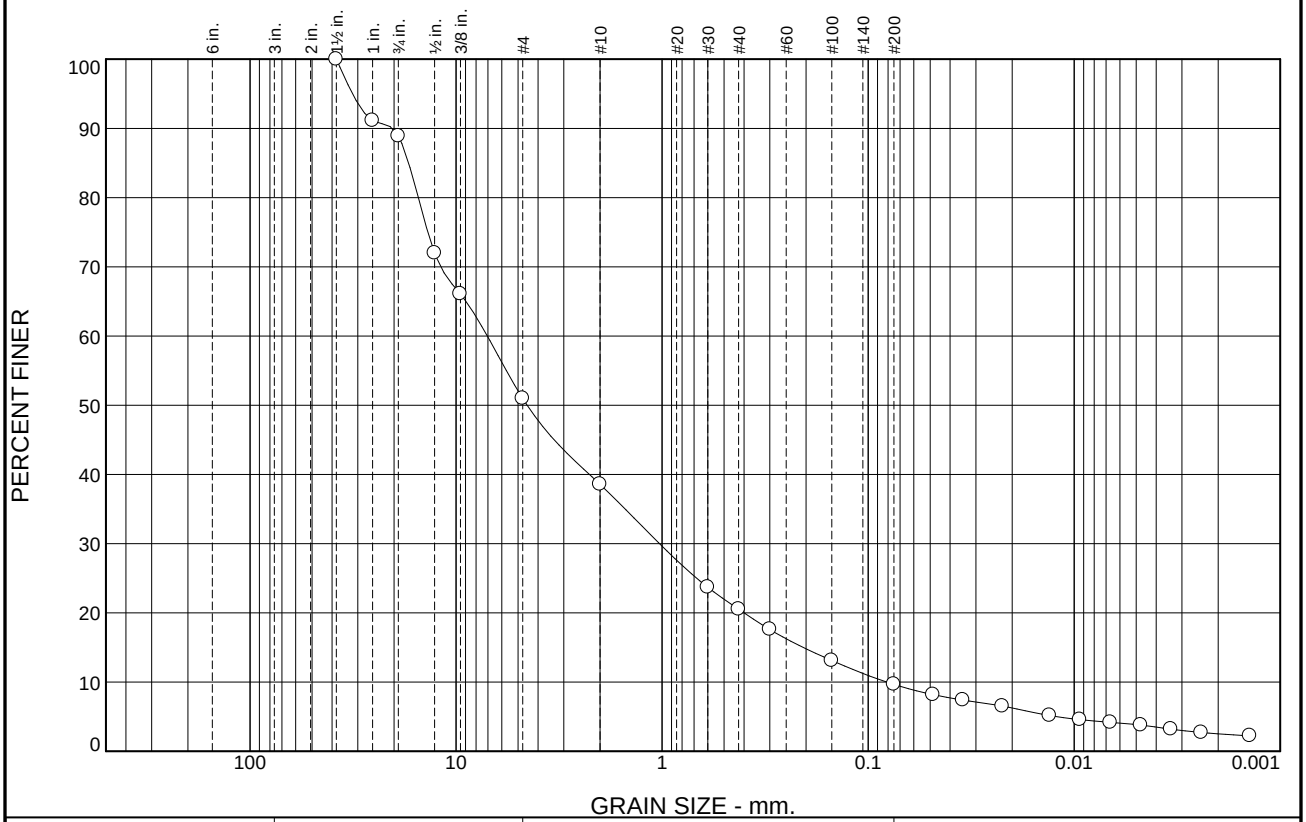
Source of Sample: HA22-232 **Depth:** 5-10
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-004 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.1	37.9	12.4	18.1	10.8	7.2	2.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	91.1		
3/4"	88.9		
1/2"	72.0		
3/8"	66.1		
#4	51.0		
#10	38.6		
#30	23.7		
#40	20.5		
#50	17.6		
#100	13.1		
#200	9.7		
0.0484 mm.	8.2		
0.0347 mm.	7.4		
0.0223 mm.	6.5		
0.0131 mm.	5.2		
0.0094 mm.	4.6		
0.0067 mm.	4.2		
0.0047 mm.	3.8		
0.0034 mm.	3.2		
0.0024 mm.	2.7		
0.0014 mm.	2.2		

* (no specification provided)

Soil Description

Brown Well-Graded GRAVEL w/ Silt & Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.3373 D_{85}= 16.9855 D_{60}= 7.0495
D_{50}= 4.5190 D_{30}= 1.0285 D_{15}= 0.2064
D_{10}= 0.0811 C_u= 86.87 C_c= 1.85

Classification

USCS= AASHTO=

Remarks

This sample was small and contained freshly fractured gravel. Results approximate.

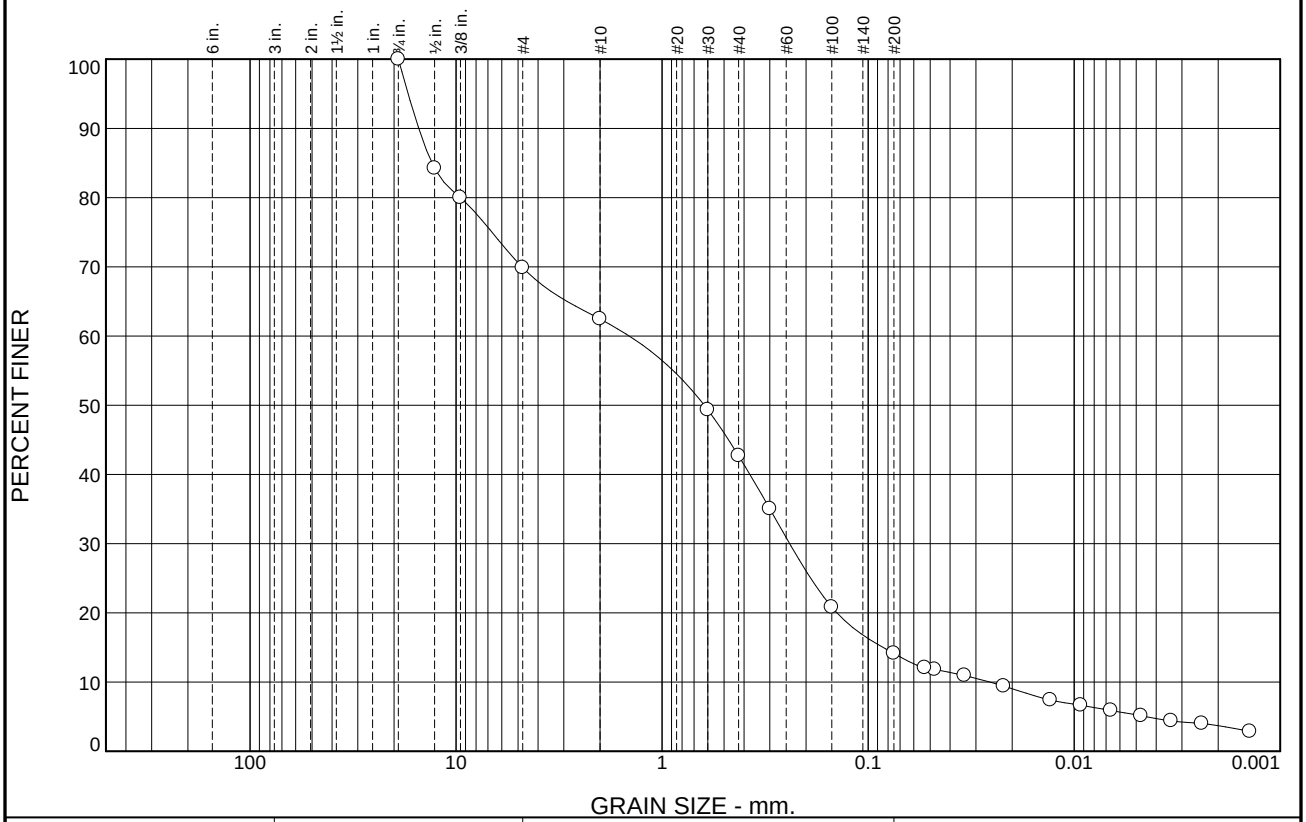
Source of Sample: HA23-302 **Depth:** 6-8
Sample Number: S4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.1	7.4	19.8	28.6	10.4	3.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	84.2		
3/8"	80.0		
#4	69.9		
#10	62.5		
#30	49.3		
#40	42.7		
#50	35.0		
#100	20.8		
#200	14.1		
#270	12.1		
0.0476 mm.	11.8		
0.0340 mm.	10.9		
0.0220 mm.	9.4		
0.0130 mm.	7.4		
0.0093 mm.	6.7		
0.0066 mm.	5.9		
0.0047 mm.	5.1		
0.0034 mm.	4.4		
0.0024 mm.	4.0		
0.0014 mm.	2.9		

* (no specification provided)

Soil Description

Brown Silty SAND w/ Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.1760 D_{85}= 13.0895 D_{60}= 1.4439
D_{50}= 0.6240 D_{30}= 0.2403 D_{15}= 0.0845
D_{10}= 0.0256 C_u= 56.41 C_c= 1.56

Classification

USCS= AASHTO=

Remarks

The sample size was small relative to the largest particle size. This should be considered when interpreting. The largest individual particle was about 2.6% of the sample weight.

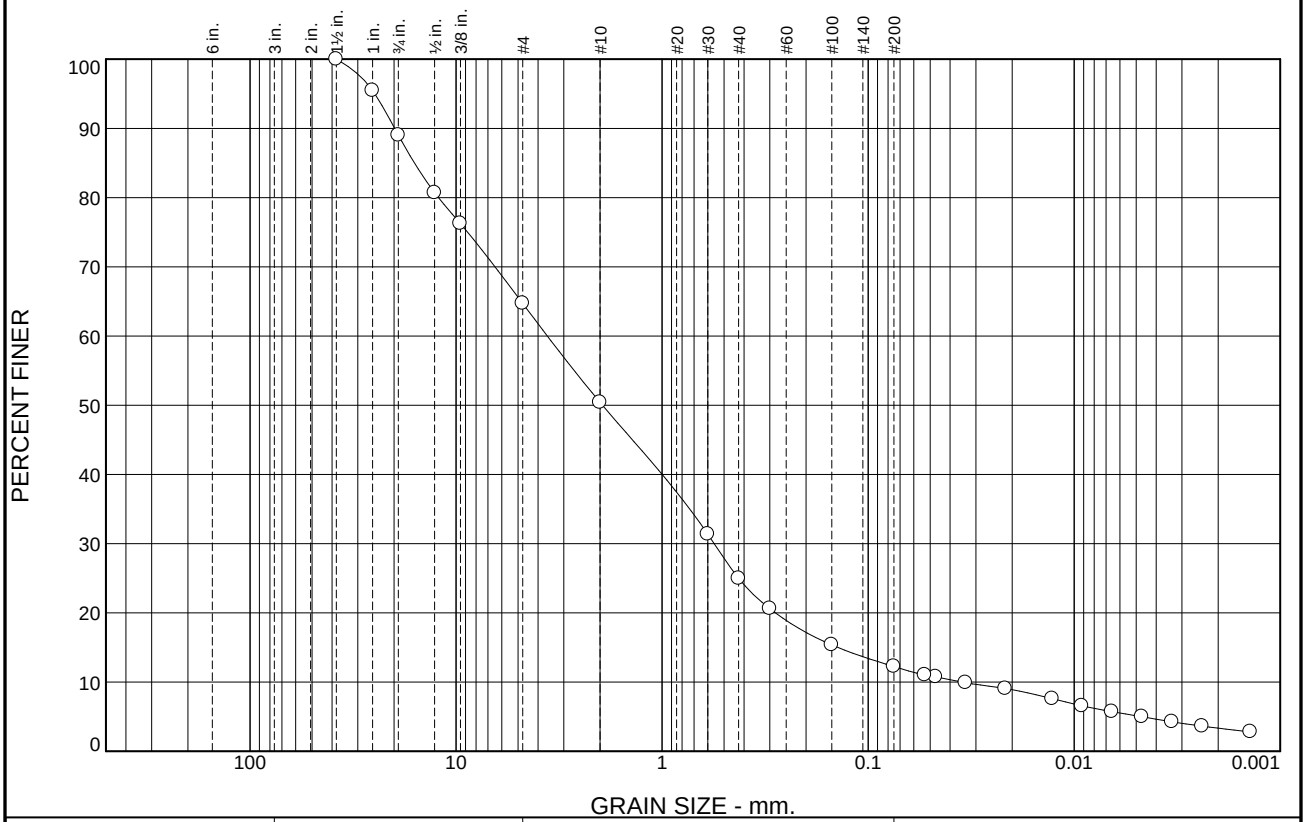
Source of Sample: HA23-304 **Depth:** 4-6
Sample Number: S3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.0	24.3	14.3	25.4	12.8	8.9	3.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	95.5		
3/4"	89.0		
1/2"	80.7		
3/8"	76.2		
#4	64.7		
#10	50.4		
#30	31.4		
#40	25.0		
#50	20.6		
#100	15.4		
#200	12.2		
#270	11.0		
0.0469 mm.	10.7		
0.0337 mm.	9.9		
0.0216 mm.	9.1		
0.0128 mm.	7.6		
0.0092 mm.	6.6		
0.0066 mm.	5.7		
0.0047 mm.	5.0		
0.0033 mm.	4.3		
0.0024 mm.	3.6		
0.0014 mm.	2.8		

* (no specification provided)

Soil Description

Dark Brown Silty SAND w/ Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.8572 D_{85}= 15.9160 D_{60}= 3.6037
D_{50}= 1.9465 D_{30}= 0.5587 D_{15}= 0.1400
D_{10}= 0.0350 C_u= 103.04 C_c= 2.48

Classification

USCS= AASHTO=

Remarks

The sample size was small and contained freshly fractured gravel.This should be considered when interpreting. The largest individual particle was 4.5% of the sample weight.

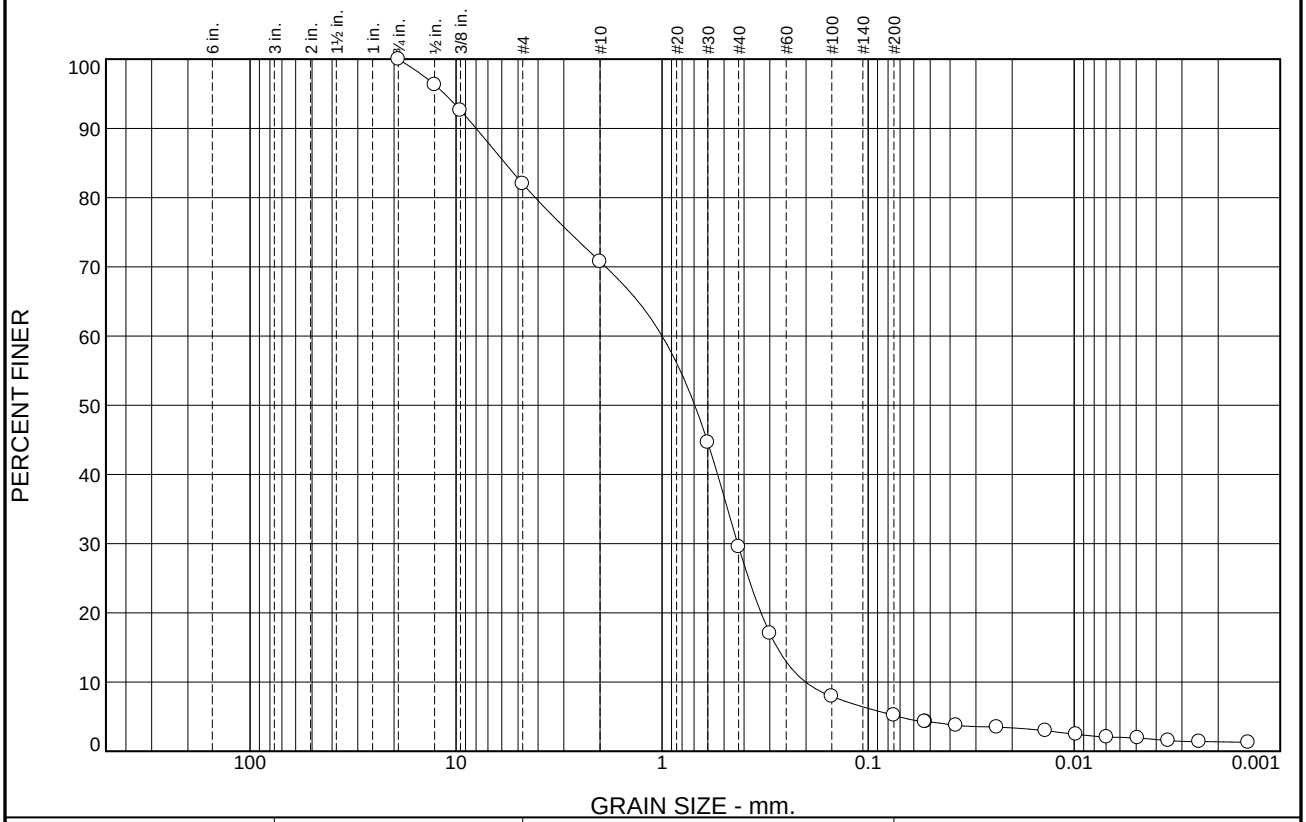
Source of Sample: HA23-312 **Depth:** 10-12
Sample Number: G4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.0	11.2	41.3	24.3	3.8	1.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.3		
3/8"	92.6		
#4	82.0		
#10	70.8		
#30	44.6		
#40	29.5		
#50	17.0		
#100	7.9		
#200	5.2		
#270	4.3		
0.0526 mm.	4.3		
0.0374 mm.	3.8		
0.0237 mm.	3.5		
0.0138 mm.	3.0		
0.0098 mm.	2.5		
0.0069 mm.	2.1		
0.0049 mm.	1.9		
0.0035 mm.	1.5		
0.0025 mm.	1.4		
0.0014 mm.	1.3		

* (no specification provided)

Soil Description

Brown Poorly-Graded SAND w/ Silt & Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.9867 D_{85}= 5.7886 D_{60}= 0.9992
D_{50}= 0.6938 D_{30}= 0.4295 D_{15}= 0.2766
D_{10}= 0.2014 C_u= 4.96 C_c= 0.92

Classification

USCS= AASHTO=

Remarks

The largest individual particle was about 0.6% of the sample weight.

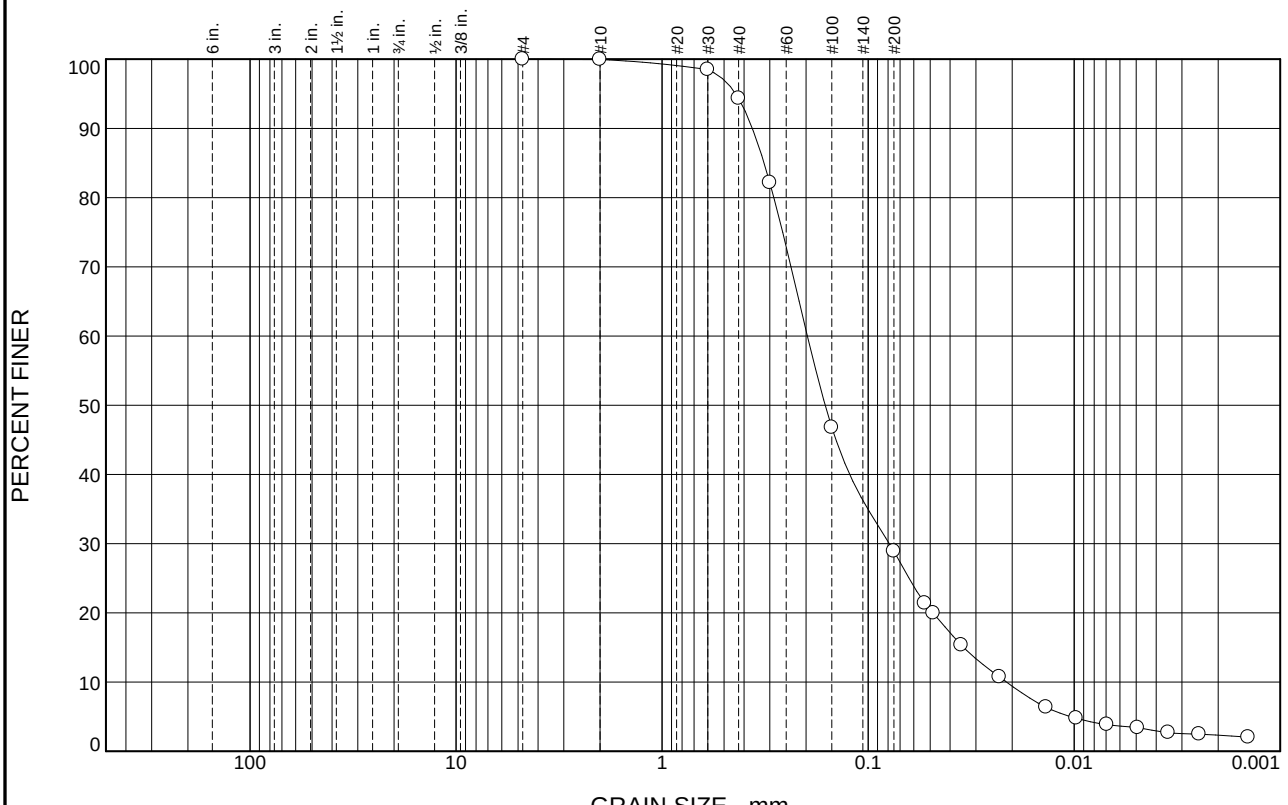
Source of Sample: HA23-313 **Depth:** 8-10
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	5.6	65.4	26.6	2.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#30	98.5		
#40	94.3		
#50	82.1		
#100	46.8		
#200	28.9		
#270	21.4		
0.0483 mm.	20.0		
0.0353 mm.	15.3		
0.0230 mm.	10.7		
0.0137 mm.	6.4		
0.0098 mm.	4.8		
0.0069 mm.	3.9		
0.0049 mm.	3.4		
0.0035 mm.	2.7		
0.0025 mm.	2.5		
0.0014 mm.	2.0		

* (no specification provided)

Soil Description

Light Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3646 D_{85}= 0.3199 D_{60}= 0.1972
D_{50}= 0.1616 D_{30}= 0.0789 D_{15}= 0.0344
D_{10}= 0.0213 C_u= 9.26 C_c= 1.48

Classification

USCS= AASHTO=

Remarks

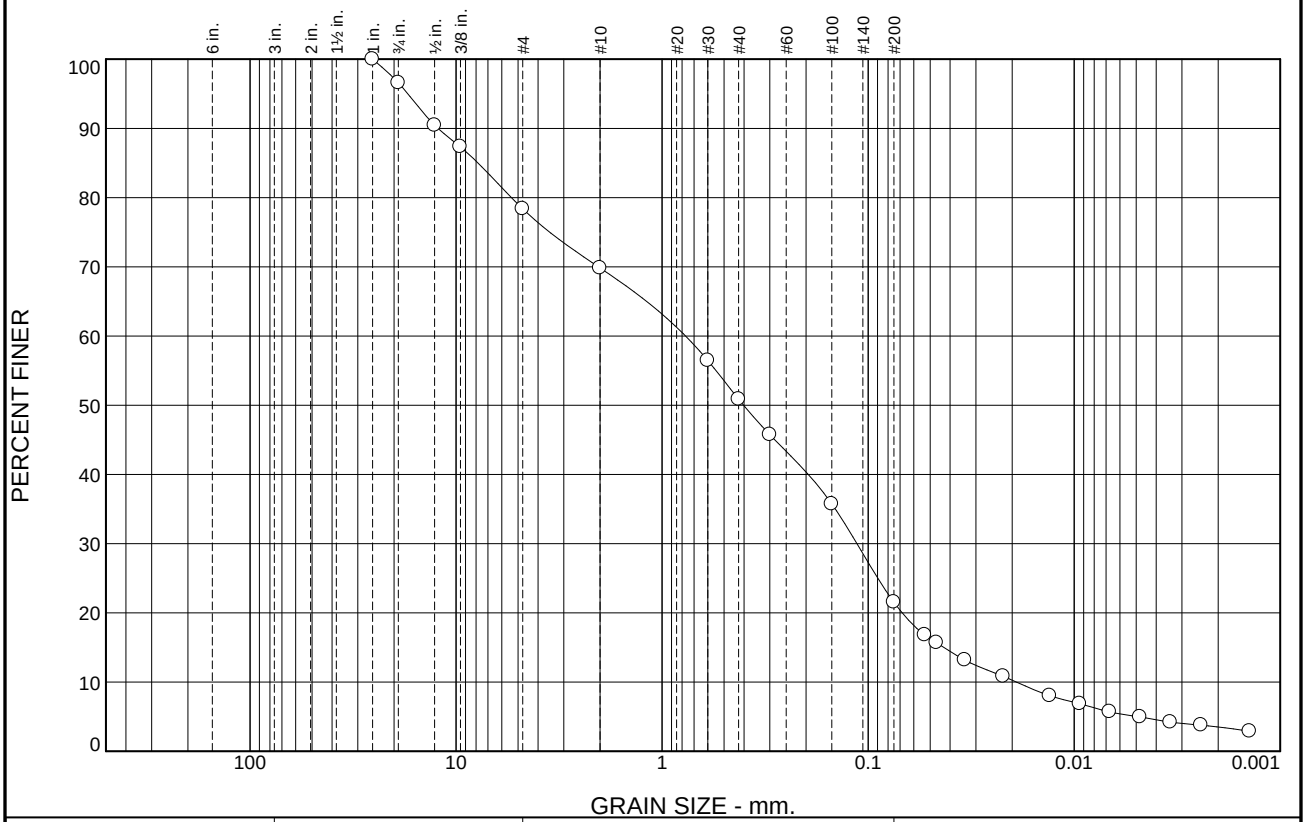
Source of Sample: HA23-314 **Depth:** 8-9.8
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.4	18.2	8.6	18.9	29.4	18.0	3.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.6		
1/2"	90.5		
3/8"	87.3		
#4	78.4		
#10	69.8		
#30	56.5		
#40	50.9		
#50	45.8		
#100	35.7		
#200	21.5		
#270	16.8		
0.0466 mm.	15.7		
0.0340 mm.	13.2		
0.0221 mm.	10.8		
0.0131 mm.	8.0		
0.0094 mm.	6.9		
0.0067 mm.	5.7		
0.0048 mm.	5.0		
0.0034 mm.	4.2		
0.0024 mm.	3.8		
0.0014 mm.	2.9		

* (no specification provided)

Soil Description

Brown Silty SAND w/ Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.2464 D_{85}= 7.8256 D_{60}= 0.7691
D_{50}= 0.4021 D_{30}= 0.1133 D_{15}= 0.0429
D_{10}= 0.0190 C_u= 40.43 C_c= 0.88

Classification

USCS= AASHTO=

Remarks

This sample contained some freshly fractured gravel. The largest individual particle was about 1.7% of the sample weight. This should be considered when interpeting this data.

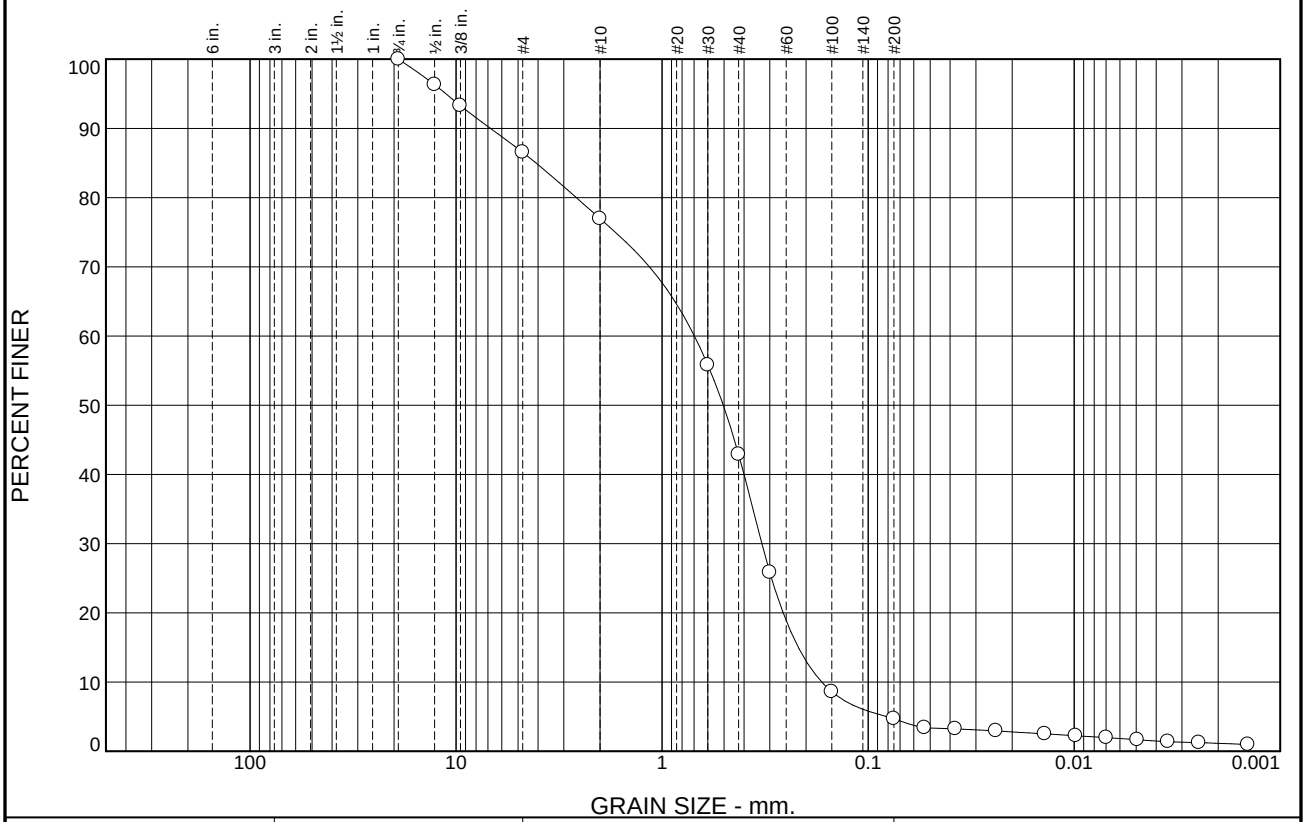
Source of Sample: HA23-316 **Depth:** 7-9
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.5	9.5	34.1	38.2	3.5	1.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.3		
3/8"	93.3		
#4	86.5		
#10	77.0		
#30	55.8		
#40	42.9		
#50	25.8		
#100	8.6		
#200	4.7		
0.0533 mm.	3.4		
0.0377 mm.	3.2		
0.0239 mm.	3.0		
0.0139 mm.	2.5		
0.0098 mm.	2.3		
0.0070 mm.	2.0		
0.0049 mm.	1.7		
0.0035 mm.	1.4		
0.0025 mm.	1.2		
0.0014 mm.	1.0		

* (no specification provided)

Soil Description

Brown Poorly-Graded SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.8090 D_{85}= 4.0938 D_{60}= 0.6969
D_{50}= 0.5045 D_{30}= 0.3278 D_{15}= 0.2181
D_{10}= 0.1679 C_u= 4.15 C_c= 0.92

Classification

USCS= SP AASHTO=

Remarks

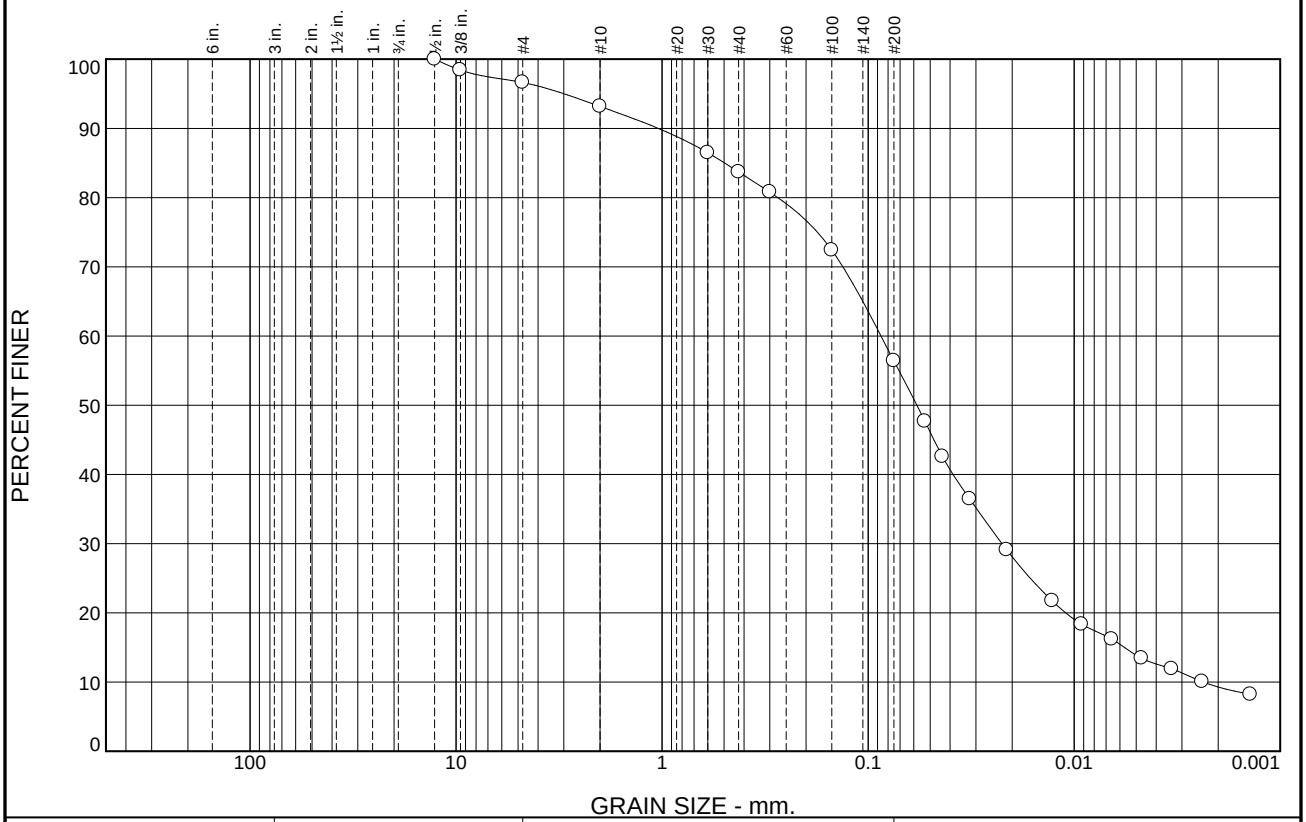
Source of Sample: HA23-317 (OW) **Depth:** 10-12
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	3.4	9.5	27.3	47.1	9.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.4		
#4	96.6		
#10	93.2		
#30	86.5		
#40	83.7		
#50	80.8		
#100	72.4		
#200	56.4		
#270	47.7		
0.0436 mm.	42.6		
0.0321 mm.	36.5		
0.0212 mm.	29.1		
0.0128 mm.	21.7		
0.0092 mm.	18.4		
0.0066 mm.	16.2		
0.0047 mm.	13.4		
0.0034 mm.	11.9		
0.0024 mm.	10.1		
0.0014 mm.	8.2		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.0434 D_{85}= 0.4976 D_{60}= 0.0866
D_{50}= 0.0580 D_{30}= 0.0224 D_{15}= 0.0057
D_{10}= 0.0024 C_u= 36.66 C_c= 2.45

Classification

USCS= AASHTO=

Remarks

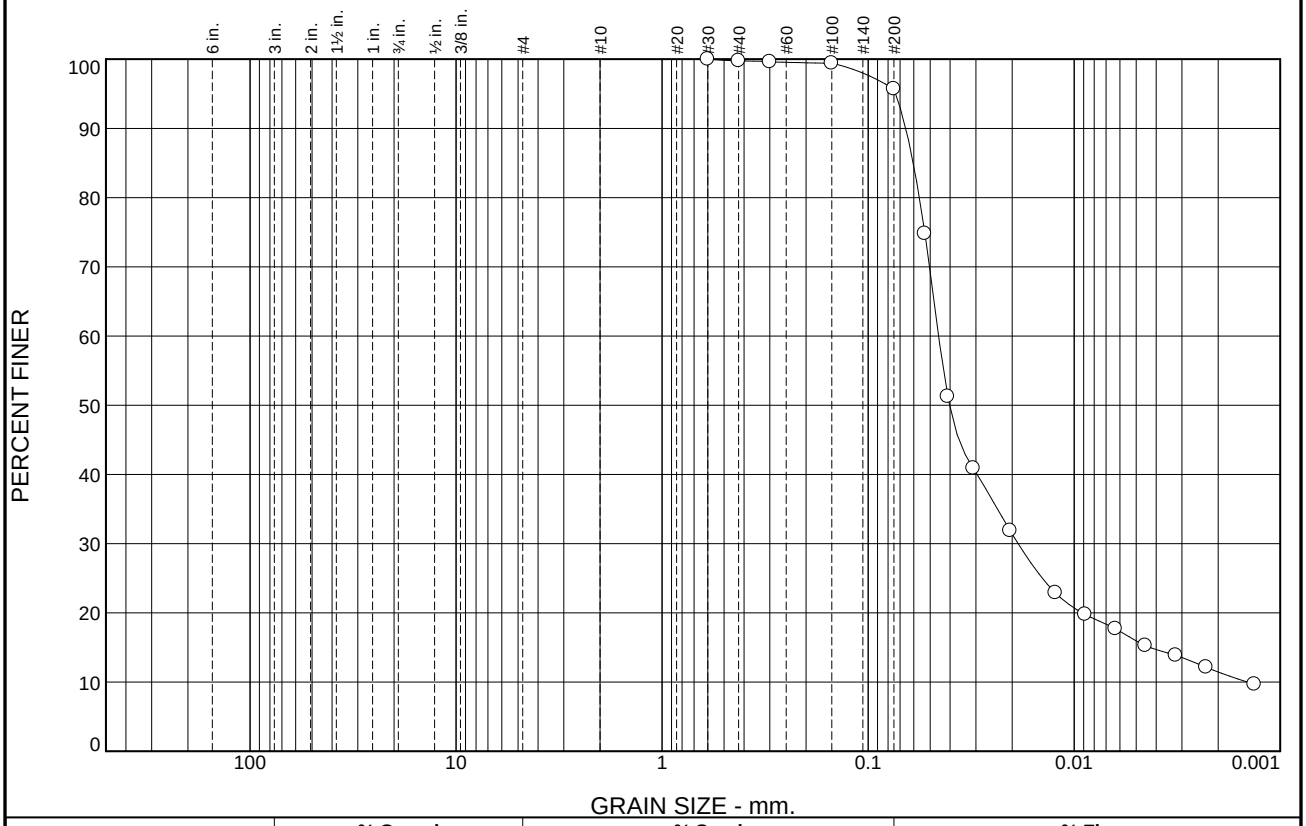
Source of Sample: HA23-320 **Depth:** 6-8
Sample Number: S4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 203699-001

Project No: 063-009 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
					4.1	84.2	11.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#30	100.0		
#40	99.8		
#50	99.6		
#100	99.4		
#200	95.7		
#270	74.8		
0.0410 mm.	51.3		
0.0308 mm.	40.9		
0.0204 mm.	31.9		
0.0123 mm.	22.9		
0.0088 mm.	19.8		
0.0063 mm.	17.7		
0.0045 mm.	15.3		
0.0032 mm.	13.9		
0.0023 mm.	12.1		
0.0013 mm.	9.7		

* (no specification provided)

Soil Description

Brown SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0657 D_{85}= 0.0604 D_{60}= 0.0455
D_{50}= 0.0402 D_{30}= 0.0187 D_{15}= 0.0043
D_{10}= 0.0014 C_u= 31.56 C_c= 5.33

Classification

USCS= AASHTO=

Remarks

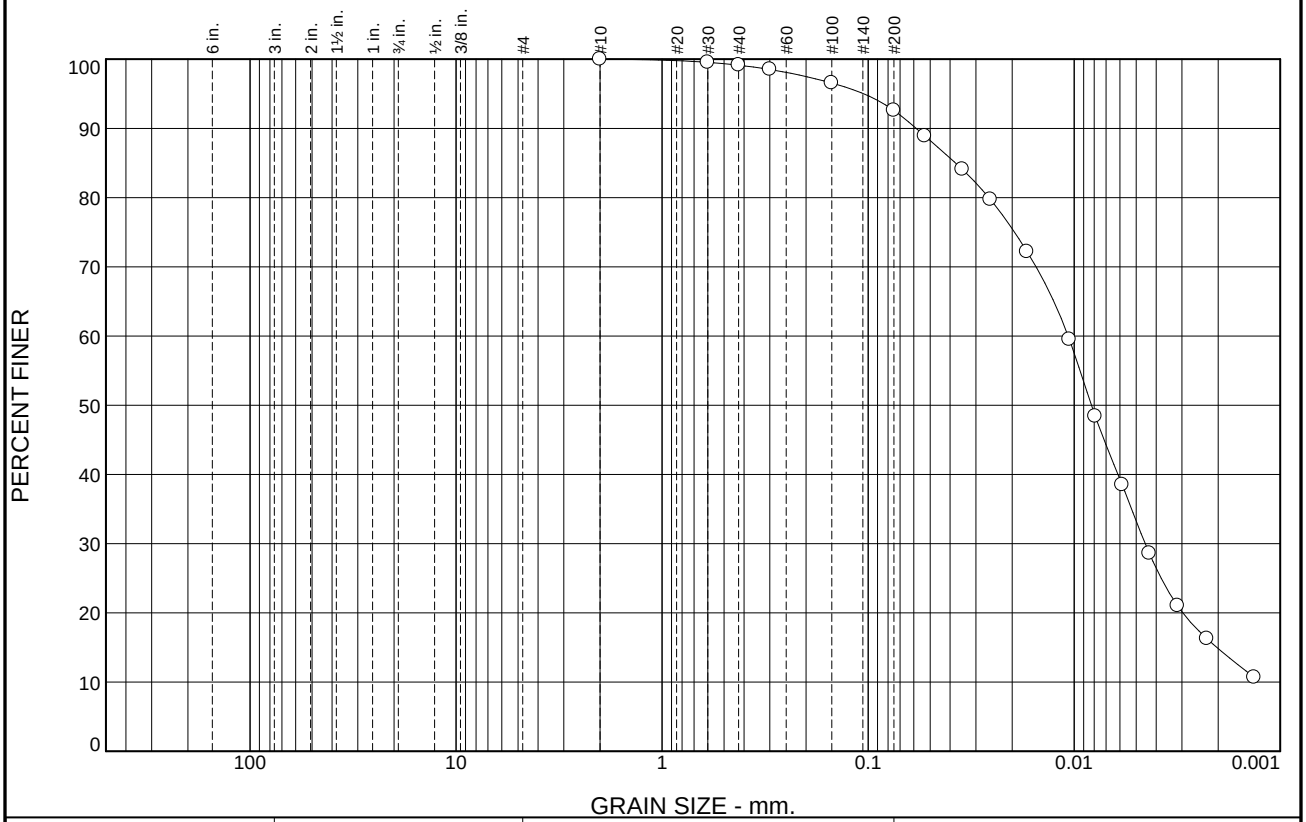
Source of Sample: HA23-401 **Depth:** 14-16
Sample Number: S7 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.9	6.5	77.8	14.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.5		
#40	99.1		
#50	98.5		
#100	96.5		
#200	92.6		
#270	88.9		
0.0349 mm.	84.1		
0.0255 mm.	79.7		
0.0169 mm.	72.2		
0.0105 mm.	59.5		
0.0079 mm.	48.4		
0.0058 mm.	38.5		
0.0043 mm.	28.6		
0.0031 mm.	21.0		
0.0023 mm.	16.3		
0.0013 mm.	10.7		

* (no specification provided)

Soil Description

Grayish Brown SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0585 D_{85}= 0.0377 D_{60}= 0.0107
D_{50}= 0.0082 D_{30}= 0.0045 D_{15}= 0.0020
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

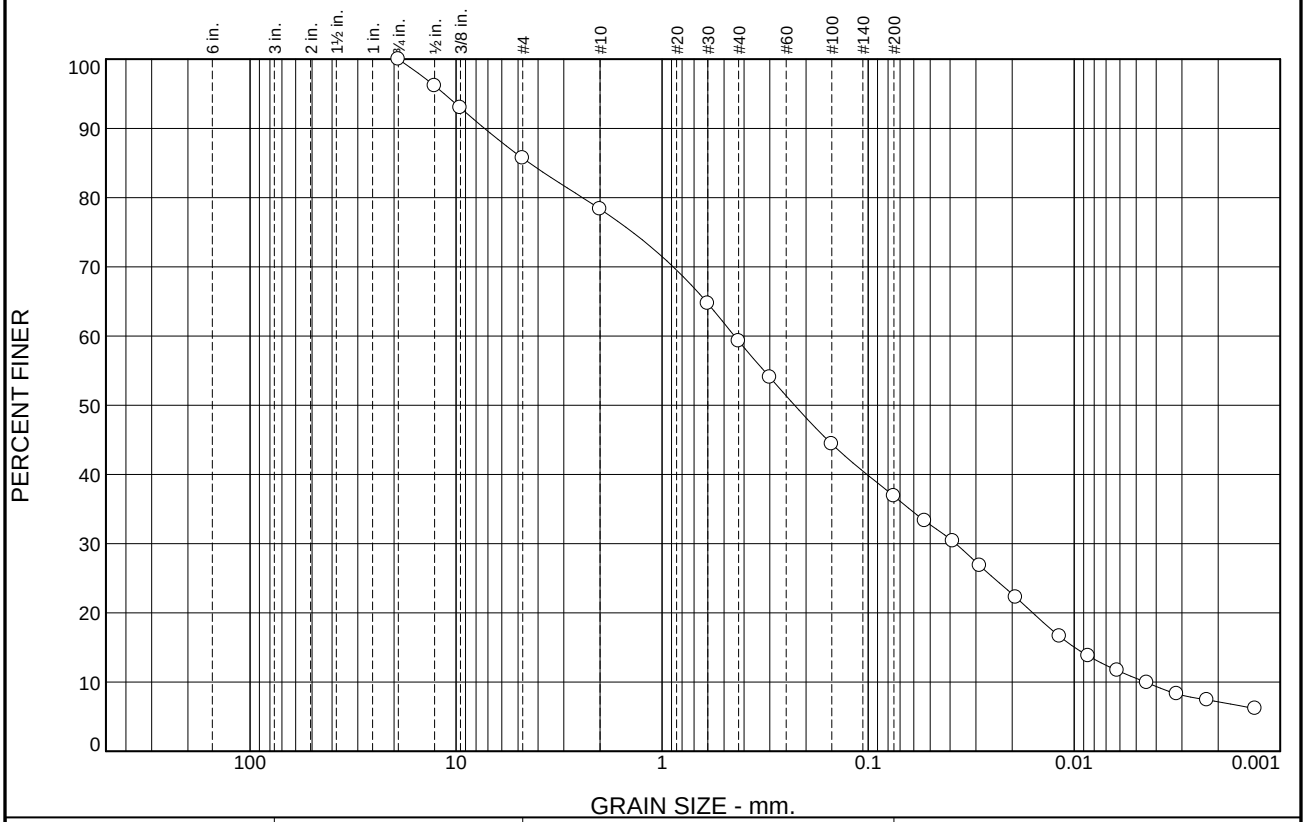
Source of Sample: HA23-402 **Depth:** 6-8
Sample Number: S4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.3	7.4	19.0	22.4	29.8	7.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.2		
3/8"	93.0		
#4	85.7		
#10	78.3		
#30	64.7		
#40	59.3		
#50	54.0		
#100	44.4		
#200	36.9		
#270	33.3		
0.0388 mm.	30.4		
0.0287 mm.	26.8		
0.0192 mm.	22.2		
0.0118 mm.	16.6		
0.0085 mm.	13.8		
0.0062 mm.	11.7		
0.0044 mm.	9.9		
0.0032 mm.	8.3		
0.0023 mm.	7.4		
0.0013 mm.	6.2		

* (no specification provided)

Soil Description

Brown & Dark Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.2750 D_{85}= 4.4007 D_{60}= 0.4455
D_{50}= 0.2275 D_{30}= 0.0375 D_{15}= 0.0099
D_{10}= 0.0045 C_u= 98.85 C_c= 0.70

Classification

USCS= AASHTO=

Remarks

This data is approx due to small sample size vs. the largest part. size. The largest indiv. part. was 3.8% of the sample wt.

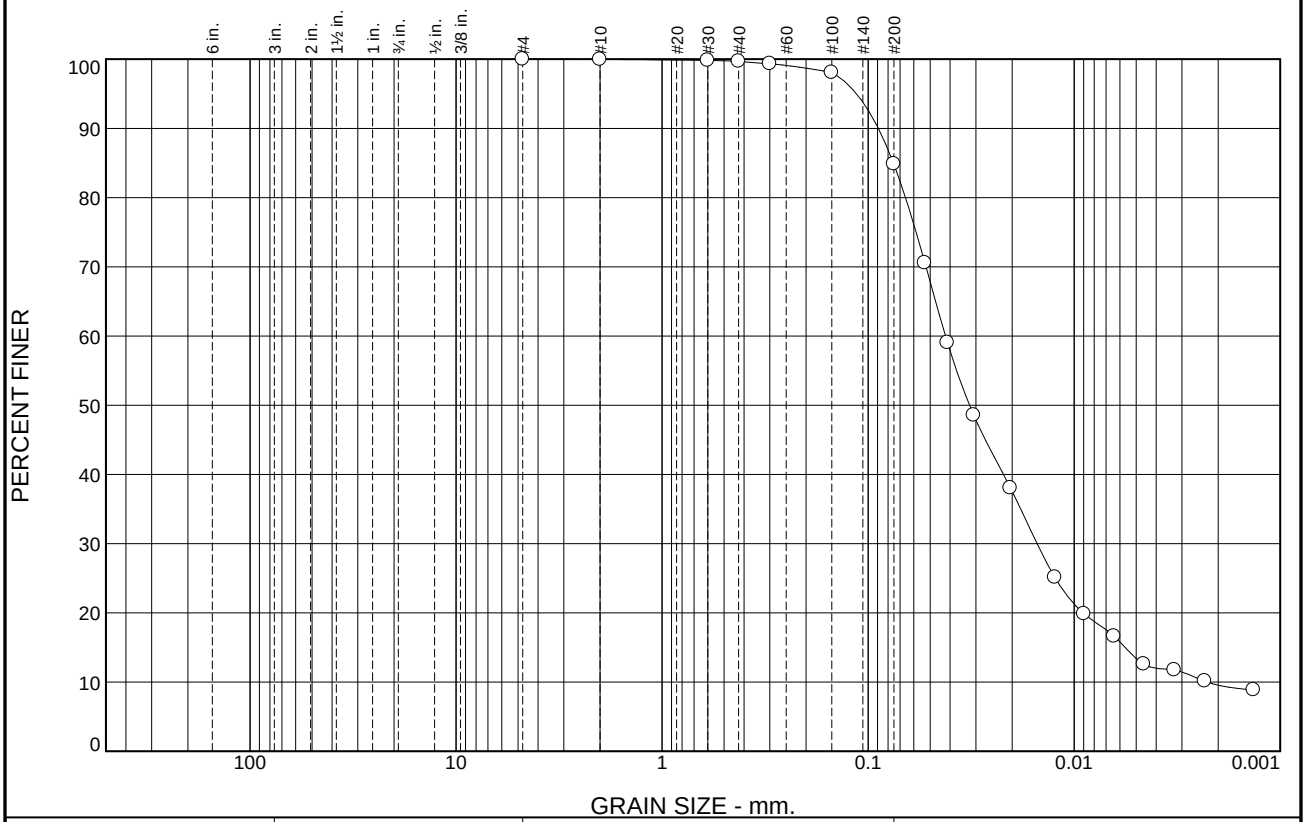
Source of Sample: HA23-410 **Depth:** 15-20
Sample Number: G4 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	14.9	75.2	9.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#30	99.8		
#40	99.7		
#50	99.3		
#100	98.1		
#200	84.8		
#270	70.6		
0.0412 mm.	59.0		
0.0307 mm.	48.5		
0.0204 mm.	38.0		
0.0124 mm.	25.1		
0.0089 mm.	19.9		
0.0064 mm.	16.6		
0.0046 mm.	12.6		
0.0033 mm.	11.7		
0.0023 mm.	10.1		
0.0013 mm.	8.9		

* (no specification provided)

Soil Description

Grayish Brown SILT w/ Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0892 D_{85}= 0.0754 D_{60}= 0.0421
D_{50}= 0.0322 D_{30}= 0.0151 D_{15}= 0.0057
D_{10}= 0.0023 C_u= 18.66 C_c= 2.41

Classification

USCS= AASHTO=

Remarks

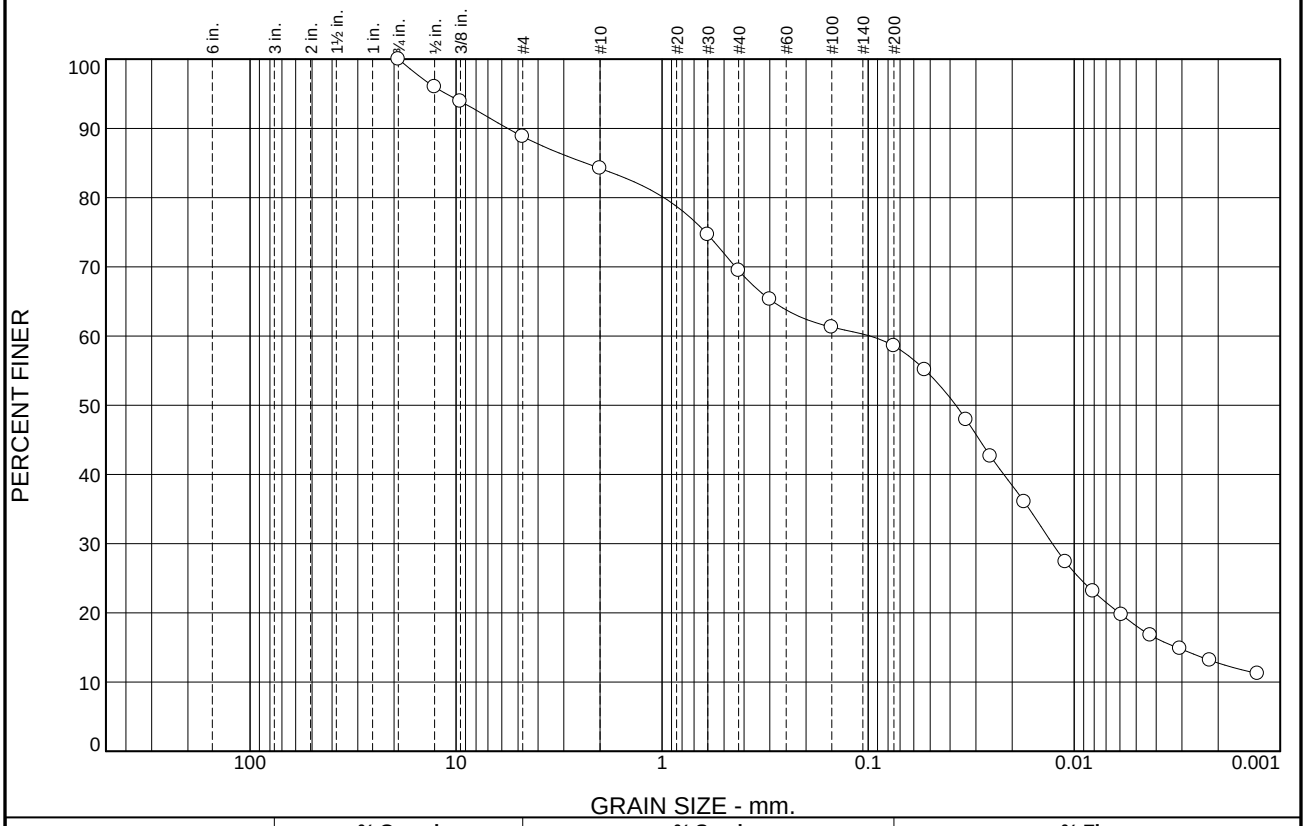
Source of Sample: HA23-412 **Depth:** 7.5-10
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.2	4.6	14.7	10.9	45.9	12.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.0		
3/8"	93.9		
#4	88.8		
#10	84.2		
#30	74.6		
#40	69.5		
#50	65.3		
#100	61.3		
#200	58.6		
#270	55.1		
0.0334 mm.	47.9		
0.0255 mm.	42.6		
0.0174 mm.	36.0		
0.0110 mm.	27.4		
0.0081 mm.	23.1		
0.0059 mm.	19.7		
0.0043 mm.	16.8		
0.0031 mm.	14.8		
0.0022 mm.	13.1		
0.0013 mm.	11.2		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.6220 D_{85}= 2.3568 D_{60}= 0.0978
D_{50}= 0.0375 D_{30}= 0.0128 D_{15}= 0.0032
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

This data is approx due to small sample size vs. the largest part. size. The largest indiv. part. was 4.0% of the sample wt.

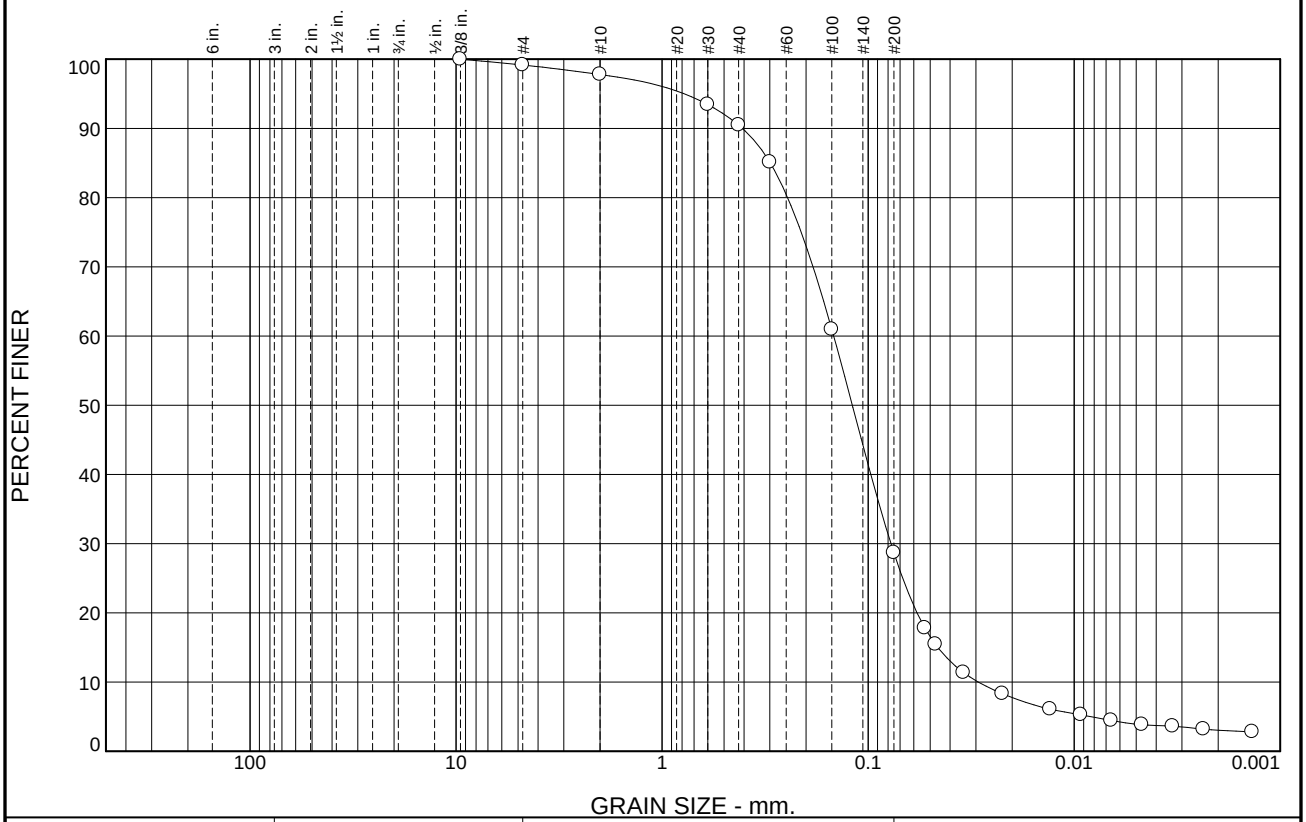
Source of Sample: HA23-413 **Depth:** 0-5
Sample Number: G1 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	1.4	7.3	61.8	25.6	3.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.2		
#10	97.8		
#30	93.4		
#40	90.5		
#50	85.1		
#100	60.9		
#200	28.7		
#270	17.8		
0.0471 mm.	15.5		
0.0344 mm.	11.4		
0.0223 mm.	8.3		
0.0131 mm.	6.1		
0.0093 mm.	5.3		
0.0066 mm.	4.5		
0.0047 mm.	3.8		
0.0033 mm.	3.6		
0.0024 mm.	3.2		
0.0014 mm.	2.8		

* (no specification provided)

Soil Description

Grayish Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4080 D_{85}= 0.2982 D_{60}= 0.1469
D_{50}= 0.1193 D_{30}= 0.0775 D_{15}= 0.0459
D_{10}= 0.0292 C_u= 5.04 C_c= 1.40

Classification

USCS= AASHTO=

Remarks

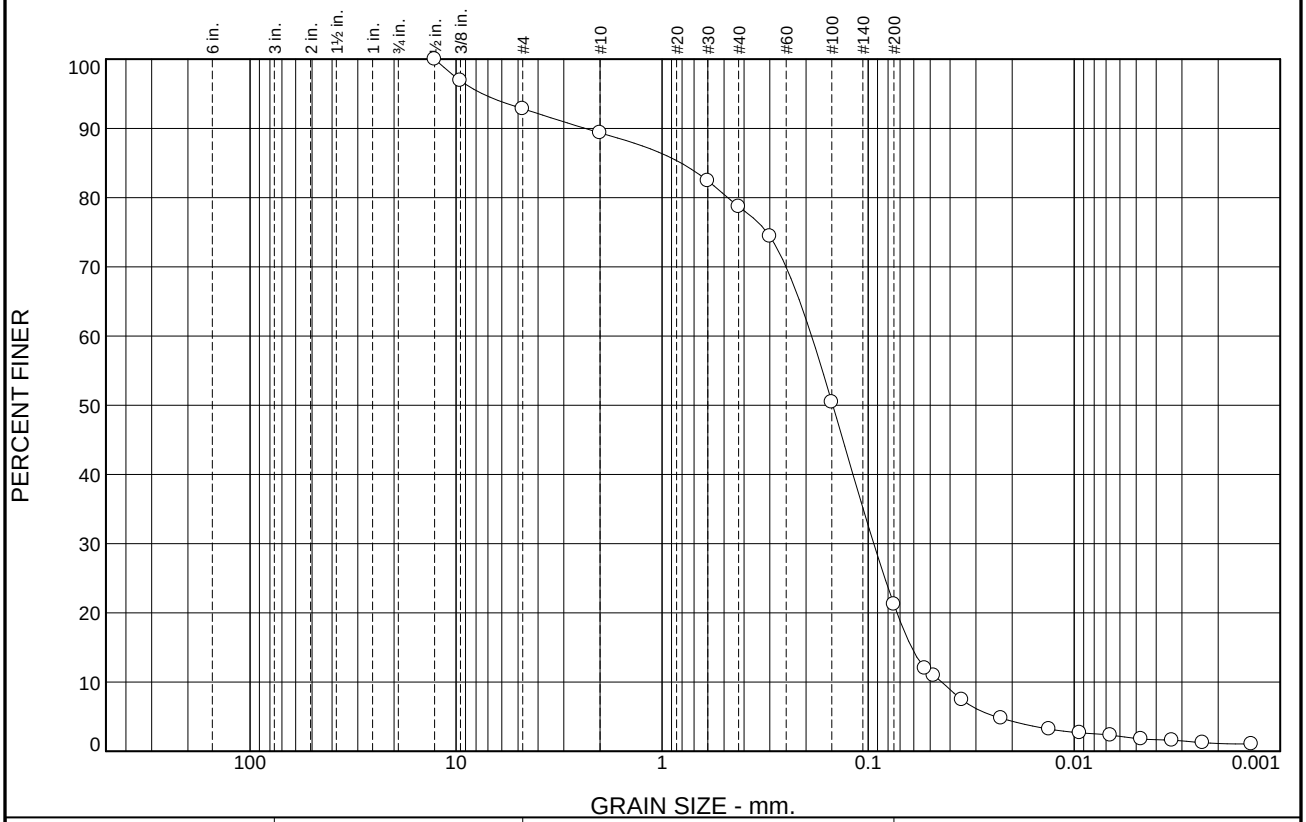
Source of Sample: HA23-414 **Depth:** 10-15
Sample Number: G3 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.2	3.4	10.7	57.4	20.2	1.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	96.9		
#4	92.8		
#10	89.4		
#30	82.4		
#40	78.7		
#50	74.4		
#100	50.5		
#200	21.3		
#270	12.0		
0.0480 mm.	11.0		
0.0350 mm.	7.4		
0.0226 mm.	4.8		
0.0132 mm.	3.2		
0.0094 mm.	2.7		
0.0067 mm.	2.3		
0.0047 mm.	1.8		
0.0034 mm.	1.6		
0.0024 mm.	1.2		
0.0014 mm.	1.1		

* (no specification provided)

Soil Description

Brown Silty SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.3651 D_{85}= 0.8091 D_{60}= 0.1881
D_{50}= 0.1484 D_{30}= 0.0939 D_{15}= 0.0615
D_{10}= 0.0439 C_u= 4.29 C_c= 1.07

Classification

USCS= AASHTO=

Remarks

Sample size small rel. to the largest particle size. This should be considered. The largest indiv. particle was 0.7% of the sample wt.

Source of Sample: HA23-416 **Depth:** 5-10
Sample Number: G2 **Date:**

Benchmark Geotechnical Labs, LLC

Client: Haley & Aldrich, Inc.
Project: Watertown Mall Redevelopment - 20369-001

Project No: 063-014 **Figure**

APPENDIX D
RESULTS OF GROUNWATER MOUNDING ANALYSES FOR TRADITIONAL STORMWATER BMPS

TRADITIONAL STORMWATER BMPS
10 YEAR STORM VOLUME

480 Arsenal - BMP No. 1

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)

Input Values		use consistent units (e.g. feet & days **or** inches & hours)
1.1900	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
0.68	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
49.000	**x**	**1/2 length of basin (x direction, in feet)**
49.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
17.400	**hi(0)**	**initial thickness of saturated zone (feet)**

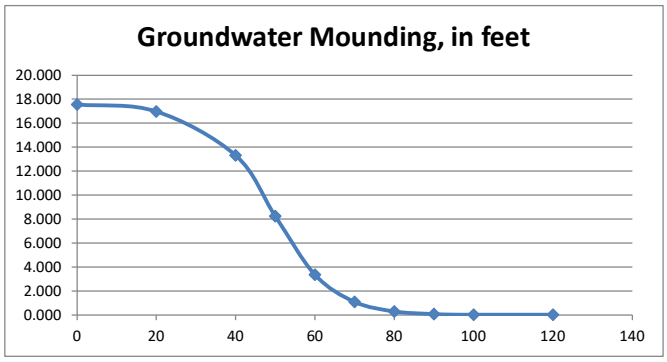
Conversion Table	
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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).

34.965	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
17.565	**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**
17.565	**0**
16.983	**20**
13.322	**40**
8.237	**50**
3.347	**60**
1.082	**70**
0.288	**80**
0.067	**90**
0.016	**100**
0.006	**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.

480 Arsenal - BMP No. 2

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)

Input Values		
0.7700	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
1.04	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
40.000	x	**1/2 length of basin (x direction, in feet)**
5.500	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
16.500	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

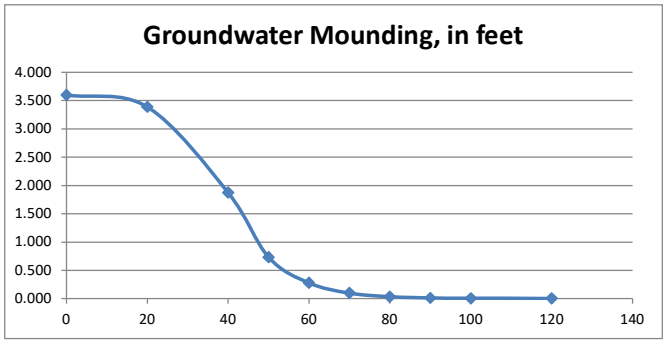
hours	days
36	1.50

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).

20.098	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
3.598	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
3.598	0
3.388	20
1.874	40
0.730	50
0.277	60
0.098	70
0.032	80
0.011	90
0.006	100
0.004	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.

446/458 Arsenal - BMP No. 2

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)

Input Values		
1.8800	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
12.000	**x**	**1/2 length of basin (x direction, in feet)**
65.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
31.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

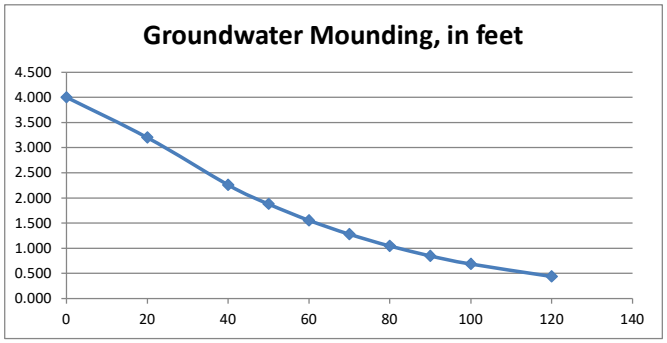
hours	days
36	1.50

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).

35.000	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
4.000	**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
4.000	0
3.203	20
2.260	40
1.881	50
1.556	60
1.279	70
1.046	80
0.850	90
0.686	100
0.439	120

Re-Calculate Now



Disclaimer

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500 Arsenal - BMP No. 4c

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).

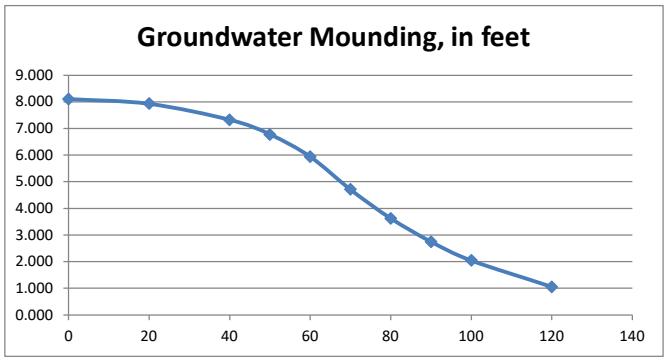
Input Values

2.9600	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
33.08	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.000	x	**1/2 length of basin (x direction, in feet)**
14.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
4.000	hi(0)	**initial thickness of saturated zone (feet)**

12.107	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
8.107	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
8.107	0
7.929	20
7.324	40
6.778	50
5.943	60
4.710	70
3.624	80
2.749	90
2.043	100
1.053	120

Re-Calculate Now



Disclaimer

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550 Arsenal - BMP No. 8

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)

Input Values		
0.5100	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
14.000	**x**	**1/2 length of basin (x direction, in feet)**
73.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
15.500	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

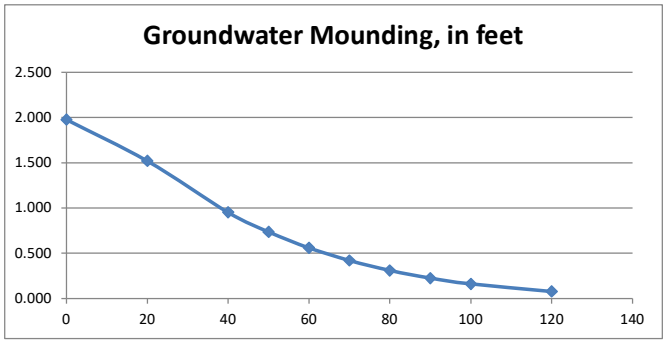
hours	days
36	1.50

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).

17.477	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.977	**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
1.977	0
1.521	20
0.953	40
0.736	50
0.561	60
0.420	70
0.310	80
0.226	90
0.162	100
0.080	120

Re-Calculate Now



Disclaimer

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550 Arsenal - BMP No. 10

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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Input Values		use consistent units (e.g. feet & days **or** inches & hours)
1.7500	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.82	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
40.000	**x**	**1/2 length of basin (x direction, in feet)**
12.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
22.000	**hi(0)**	**initial thickness of saturated zone (feet)**

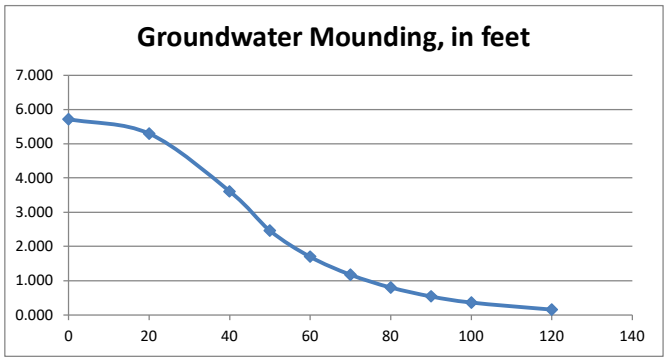
Conversion Table		
inch/hour	**feet/day**	
0.67	1.33	
2.00	4.00	
hours	**days**	
36	1.50	

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).

27.717	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
5.717	**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**
5.717	**0**
5.292	**20**
3.607	**40**
2.464	**50**
1.700	**60**
1.171	**70**
0.800	**80**
0.540	**90**
0.360	**100**
0.154	**120**

Re-Calculate Now



Disclaimer

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500 Arsenal - BMP No. 14

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".

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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).

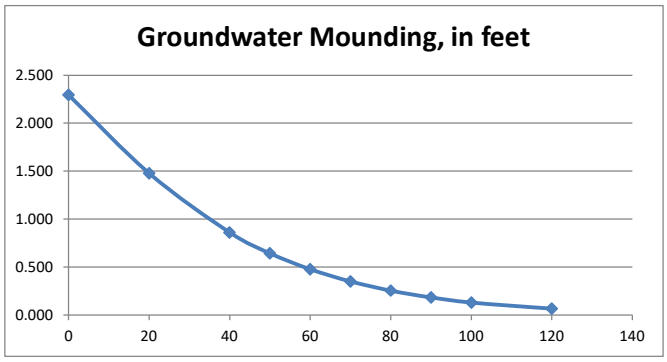
Input Values

2.2200	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
4.000	x	**1/2 length of basin (x direction, in feet)**
40.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
14.500	hi(0)	**initial thickness of saturated zone (feet)**

16.794	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.294	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
2.294	0
1.477	20
0.859	40
0.644	50
0.477	60
0.350	70
0.254	80
0.182	90
0.130	100
0.065	120

Re-Calculate Now



Disclaimer

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TRADITIONAL STORMWATER BMPS
TREATMENT VOLUME

480 Arsenal - BMP No. 1

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".

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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.2000	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
0.68	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
49.000	x	**1/2 length of basin (x direction, in feet)**
49.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
17.400	hi(0)	**initial thickness of saturated zone (feet)**

20.385	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.985	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Conversion Table

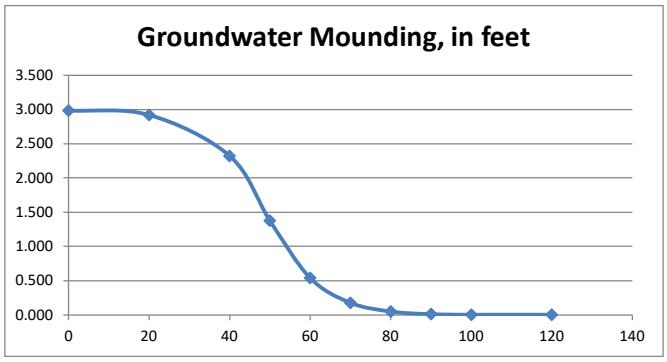
inch/hour	feet/day
0.67	1.33
2.00	4.00

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).

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.985	0
2.921	20
2.321	40
1.378	50
0.540	60
0.176	70
0.048	80
0.011	90
0.003	100
0.001	120

Re-Calculate Now



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480 Arsenal - BMP No. 2

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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.0500	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
1.04	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
40.000	x	**1/2 length of basin (x direction, in feet)**
5.500	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
16.500	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

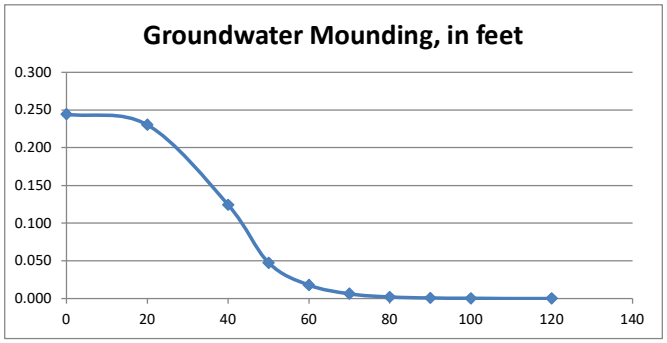
hours	days
36	1.50

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).

16.744	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.244	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
0.244	0
0.230	20
0.124	40
0.047	50
0.018	60
0.006	70
0.002	80
0.001	90
0.000	100
0.000	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.

446/458 Arsenal - BMP No. 2

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)

Input Values		
0.6800	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
12.000	**x**	**1/2 length of basin (x direction, in feet)**
65.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
31.000	**hi(0)**	**initial thickness of saturated zone (feet)**

32.484	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.484	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Conversion Table

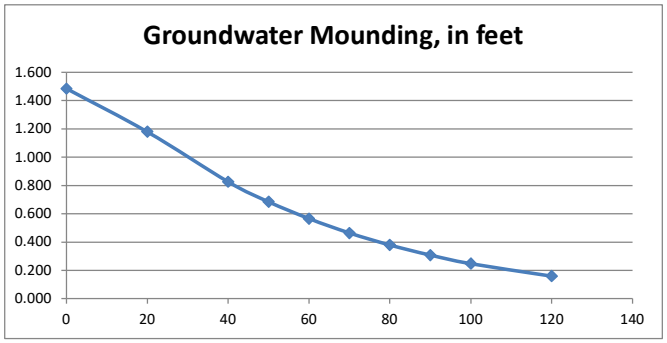
inch/hour	feet/day
0.67	1.33
2.00	4.00

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).

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.484	0
1.180	20
0.825	40
0.685	50
0.565	60
0.464	70
0.378	80
0.307	90
0.248	100
0.158	120

Re-Calculate Now



Disclaimer

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500 Arsenal - BMP No. 4c

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).

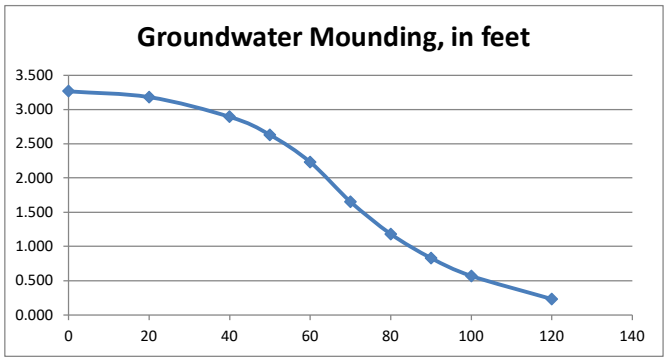
Input Values

0.9800	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
33.08	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.000	x	**1/2 length of basin (x direction, in feet)**
14.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
4.000	hi(0)	**initial thickness of saturated zone (feet)**

7.266	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
3.266	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
3.266	0
3.181	20
2.892	40
2.630	50
2.231	60
1.654	70
1.182	80
0.831	90
0.569	100
0.232	120

Re-Calculate Now



Disclaimer

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550 Arsenal - BMP No. 8

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)

Input Values		
0.1000	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
14.000	**x**	**1/2 length of basin (x direction, in feet)**
73.000	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
15.500	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

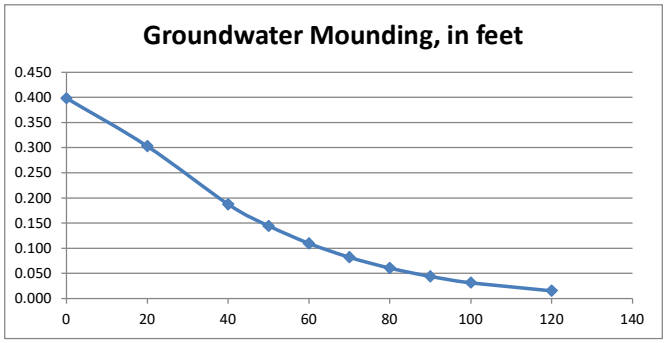
hours	days
36	1.50

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).

15.898	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.398	**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
0.398	0
0.303	20
0.188	40
0.145	50
0.110	60
0.082	70
0.061	80
0.044	90
0.032	100
0.016	120

Re-Calculate Now



Disclaimer

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550 Arsenal - BMP No. 10

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).

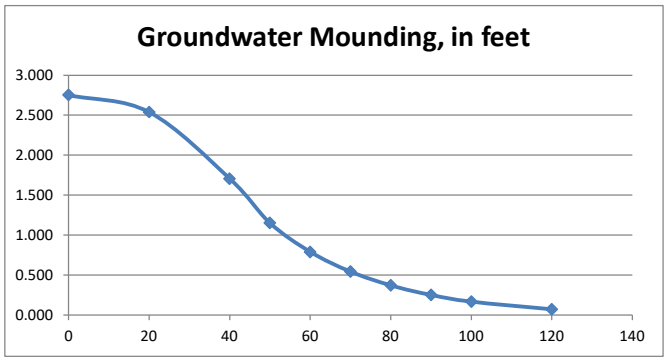
Input Values

0.8100	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.82	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
40.000	x	**1/2 length of basin (x direction, in feet)**
12.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
22.000	hi(0)	**initial thickness of saturated zone (feet)**

24.752	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.752	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
2.752	0
2.539	20
1.705	40
1.152	50
0.790	60
0.542	70
0.369	80
0.249	90
0.166	100
0.071	120

Re-Calculate Now



Disclaimer

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500 Arsenal - BMP No. 14

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).

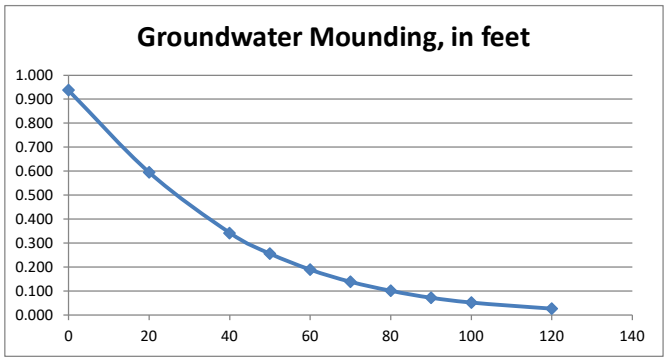
Input Values

0.8800	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
9.64	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
4.000	x	**1/2 length of basin (x direction, in feet)**
40.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
14.500	hi(0)	**initial thickness of saturated zone (feet)**

15.437	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.937	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
0.937	0
0.594	20
0.342	40
0.256	50
0.189	60
0.138	70
0.100	80
0.072	90
0.051	100
0.026	120

Re-Calculate Now



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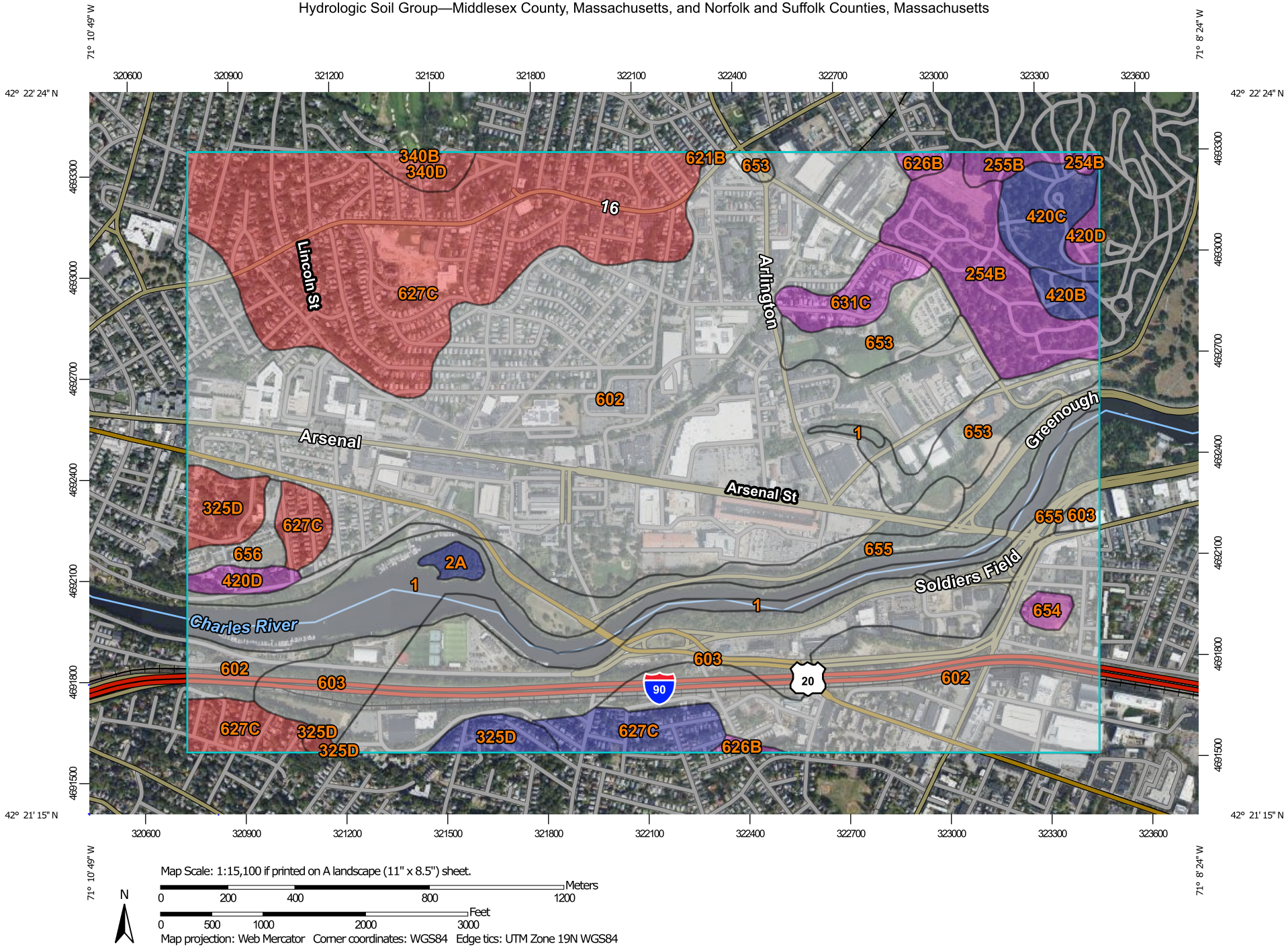
71° 10' 49" W
71° 8' 24" W
42° 22' 24" N
42° 21' 15" N
320600
320900
321200
321500
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322700
323000
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323600
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4693000
4692700
4692400
4692100
4691800
4691500
340B
340D
621B
653
626B
255B
254B
16
420C
420D
Lincoln St
627C
Arlington
254B
631C
420B
653
602
Arsenal
1
653
Greenough
Arsenal St
325D
627C
655 603
656
2A
655
420D
1
Soldiers Field
1
654
Charles River
603
602
603
90
20
602
627C
325D
325D
325D
627C
626B
Map Scale: 1:15,100 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 200 400 800 1200
Feet
0 500 1000 2000 3000
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 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Aug 13, 2020—Oct 4, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		60.5	5.0%
2A	Pootatuck fine sandy loam, 0 to 3 percent slopes, occasionally flooded	B	3.5	0.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	44.8	3.7%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	4.9	0.4%
325D	Newport channery fine sandy loam, 8 to 25 percent slopes	D	13.3	1.1%
340B	Broadbrook very fine sandy loam, 3 to 8 percent slopes	D	0.4	0.0%
340D	Broadbrook very fine sandy loam, 8 to 25 percent slopes	D	6.3	0.5%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	5.7	0.5%
420C	Canton fine sandy loam, 8 to 15 percent slopes	B	18.4	1.5%
420D	Canton fine sandy loam, 15 to 25 percent slopes	A	9.4	0.8%
602	Urban land		441.8	36.8%
603	Urban land, wet substratum		19.7	1.6%
621B	Scio-Urban land complex, 0 to 8 percent slopes	B/D	0.4	0.0%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	2.5	0.2%
627C	Newport-Urban land complex, 3 to 15 percent slopes	D	184.6	15.4%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	A	14.0	1.2%
653	Udorthents, sandy		46.5	3.9%
655	Udorthents, wet substratum		46.7	3.9%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
656	Udorthents-Urban land complex		7.5	0.6%
Subtotals for Soil Survey Area			**930.8**	**77.5%**
Totals for Area of Interest			**1,201.2**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		24.0	2.0%
325D	Newport silt loam, 15 to 25 percent slopes	B	8.2	0.7%
602	Urban land, 0 to 15 percent slopes		112.9	9.4%
603	Urban land, wet substratum, 0 to 3 percent slopes		92.5	7.7%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	1.5	0.1%
627C	Newport-Urban land complex, 3 to 15 percent slopes	B	16.2	1.3%
654	Udorthents, loamy	A	3.4	0.3%
655	Udorthents, wet substratum		11.7	1.0%
Subtotals for Soil Survey Area			**270.3**	**22.5%**
Totals for Area of Interest			**1,201.2**	**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

Required and Provided Recharge Volumes

72-Hour Drawdown Analysis

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

446/458 Arsenal Street

Stormwater BMP #1 (Pond 1P)

OL4 Frontage Infiltration

Volumes provided below outlet at elevation: 27.20

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	6,464	**31,326**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**8.27**	(in/hr)
Drawdown Time:	**7**	(hours)

Stormwater BMP #2 (Pond 2P)

OL4 Drop off area infiltration

Volumes provided below weir at elevation: 26.0

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	3,072	**11,470**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**2.41**	(in/hr)
Drawdown Time:	**19**	(hours)

Stormwater BMP #3 (Pond 3P)

OL4 Bio Area

Volumes provided below inlet at elevation: 28.75

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	300	**266**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**2.41**	(in/hr)
Drawdown Time:	**4**	(hours)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

500 Arsenal Street

Stormwater BMP #4A (Pond 4A-P)

Infiltration west of OL3

Volumes provided below weir at elevation: 26.2

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	1,881	**6,338**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**1.02**	(in/hr)
Drawdown Time:	**40**	(hours)

Stormwater BMP #4B (Pond 4B-P)

Infiltration south of OL3

Volumes provided below weir at elevation: 24.70

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	4,740	**7,118**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**8.27**	(in/hr)
Drawdown Time:	**2**	(hours)

Stormwater BMP #4C (Pond 4C-P)

Infiltration south and west of A2

Volumes provided below weir at elevation: 25.25

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	7,040	**12,972**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**8.27**	(in/hr)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

Drawdown Time:	**3**	(hours)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

Stormwater BMP #14 (Pond 14P)

Infiltration Behind OL2

Volumes provided below weir at elevation: 25.5

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	640	**2,654**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**21**	(hours)

550 Arsenal Street

Stormwater BMP #6 (Pond 6P)

OL1/R1 frontage infiltration

Volumes provided below inlet at elevation: 23.00

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	5,888	**26,789**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**23**	(hours)

Stormwater BMP #7 (Pond 7P)

OL1 bio area

Volumes provided below inlet at elevation: 27.75

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	938	**773**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**4**	(hours)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

Stormwater BMP #8 (Pond 8P)

Infiltration at A1/P1 courtyard

Volumes provided below weir at elevation: 23.5

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	4,096	**10,165**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**12**	(hours)

Stormwater BMP #9 (Pond 9P)

Infiltration Below Garage

Volumes provided below weir at elevation: 22.5

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	3,968	**9,775**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**12**	(hours)

Stormwater BMP #10 (Pond 10P)

Infiltration behind P1

Volumes provided below weir at elevation: 20.4

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	1,920	**2,973**

Drawdown:	$(V_{Infiltration}/A_{Bottom})$/Rawl's Rate		
	Rawls Recharge Rate:	**2.41**	(in/hr)
	Drawdown Time:	**8**	(hours)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

Stormwater BMP #11 (Pond 11P)

Infiltration by R1 Bio

Volumes provided below weir at elevation: 23.75

Provided Volume:	**Bottom Area** (ft^2)	**Volume** (ft^3)
	692	**472**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**2.41**	(in/hr)
Drawdown Time:	**3**	(hours)

Recharge Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/7/2023

Stormwater BMP #15 (Pond 15P)

Infiltration west of OL1

Volumes provided below weir at elevation: 24.5

Provided Volume:	**Bottom Area (ft^2)**	**Volume (ft^3)**
	2,816	**11,899**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**2.41**	(in/hr)
Drawdown Time:	**21**	(hours)

Appendix C: Standard 4 Computations and Supporting Information

- Water Quality Volume Calculations
- Sand Filter Sizing Calculations
- TSS Removal Worksheets
- Phosphorus Removal Calculations

Water Quality Volume Calculations

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Note: Water quality runoff depths reported here correspond to runoff depths for TP removal calculations, using a 2" max event.

Stormwater BMP #1 (Pond 1P)

Runoff from subcatchment area PR-1D

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**2,022**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**337**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Outlet Pipe Elevation	27.20	6,464	31,326

Stormwater BMP #2 (Pond 2P)

Runoff from subcatchment area PR-1A, PR-1C, PR-1E

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**37,546**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**6,258**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	26.0	3,072	11,470

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #3 (Pond 3P)

Runoff from subcatchment area PR-1B

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth (in)		**1.05**
Total Impervious Area (ft^2)		**3,045**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.1	**266**

Provided Volume:		**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
	Orifice Elevation	28.75	300	266

Stormwater BMP #4A (Pond 4A-P)

Runoff from subcatchment area PR-2D

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth (in)		**1.6**
Total Impervious Area (ft^2)		**48,070**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.6	**6,329**

Provided Volume:		**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Pond 4A-P	Weir Elevation	26.20	1,881	6,338

Stormwater BMP #4B/C (Pond 4B-P/4C-P)

Runoff from subcatchment area PR-2C

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth (in)		**1.72**
Total Impervious Area (ft^2)		**90,324**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.7	**12,946**

Provided Volume:		**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Pond 4B-P	Weir Elevation	24.70	4,740	7,118
Pond 4C-P	Weir Elevation	25.25	7,040	12,972
			total=	20,090

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #5 (Pond 5P)

Runoff from subcatchment area PR-2B

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.08**
Total Impervious Area	(ft^2)	**19,038**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.1	**1,713**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	24.0	1,566	1,716

Stormwater BMP #6 (Pond 6P)

Runoff from subcatchment area PR-3E

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.00**
Total Impervious Area	(ft^2)	**128,592**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**21,432**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	23.0	5,888	26,789

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #7 (Pond 7P)

Runoff from subcatchment area PR-3H

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**1,320**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**220**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Orifice Elevation	27.75	938	773

Stormwater BMP #8 (Pond 8P)

Runoff from subcatchment area PR-3A

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**7,443**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**1,241**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	23.5	4,096	10,165

Stormwater BMP #9 (Pond 9P)

Runoff from subcatchment area PR-3C

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.77**
Total Impervious Area	(ft^2)	**66,153**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.8	**9,758**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	22.5	3,968	9,775

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #10 (Pond 10P)

Runoff from subcatchment area PR-3B

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.15**
Total Impervious Area	(ft^2)	**30,928**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.2	**2,964**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	20.4	1,920	2,973

Stormwater BMP #11 (Pond 11P)

Runoff from subcatchment area PR-3I

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.16**
Total Impervious Area	(ft^2)	**4,885**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.2	**472**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Orifice Elevation	23.75	692	472

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #12

Runoff from subcatchment area PR-3D

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.0**
Total Impervious Area	(ft^2)	**51,503**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.0	**4,292**

Provided Volume: **See sand filter calculations**

Stormwater BMP #13

Runoff from subcatchment area PR-3F

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**1.2**
Total Impervious Area	(ft^2)	**23,831**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	1.2	**2,383**

Provided Volume: **See sand filter calculations**

Stormwater BMP #14 (Pond 14P)

Runoff from subcatchment area PR-2A

Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**10,088**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**1,681**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	25.5	640	2,654

Water Quality Volume Calculations

Project	Watertown Mall	**Project #**	15374
Calculated by	LMT	**Date**	9/7/2023
Checked by	SRM	**Date**	9/11/2023

Stormwater BMP #15 (Pond 15P)
Runoff from subcatchment area PR-3J
Volumes provided below the lowest outlet

Water Quality Storm Runoff Depth	(in)	**2.0**
Total Impervious Area	(ft^2)	**27,084**

BASIN WQV:

Required Volume:	**Runoff Depth to be Treated (in)**	**Required Volume (ft^3)**
	2.0	**4,514**

Provided Volume:	**Elevation**	**Area (ft^2)**	**Cumulative Volume (ft^3)**
Weir Elevation	24.5	2,816	11,899

TSS Removal Worksheets

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**1 OF 5**
Project Number:	**15374.00**	Date:	**22-Jun-2023**
Location:	**446/458 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP2**	Checked by:	
Drainage Area(s):	**PR 1A, 1C**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
	0%	**38%**	**0%**	**38%**
		Pre-Treatment TSS Removal =		**63%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
Subsurface Infiltration Structure	**80%**	**38%**	**30%**	**8%**
	0%	**8%**	**0%**	**8%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)
*** 50% removal for proprietary seperator per City of Watertown comment.

Treatment Train TSS Removal = **93%**

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**1 OF 5**
Project Number:	**15374.00**	Date:	**22-Jun-2023**
Location:	**500 and 550 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR2A, 3B, 3C, 3E, 3I, 3J**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
	0%	**38%**	**0%**	**38%**
		Pre-Treatment TSS Removal =		**63%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
Subsurface Infiltration Structure	**80%**	**38%**	**30%**	**8%**
	0%	**8%**	**0%**	**8%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)
*** 50% removal for proprietary seperator per City of Watertown comment.

Treatment Train TSS Removal = **93%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**2 OF 5**
Project Number:	**15374.00**	Date:	**23-Jun-2023**
Location:	**446/458 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP2**	Checked by:	
Drainage Area(s):	**PR 1D, 1E**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Subsurface Infiltration Structure	**80%**	**1.00**	**0.80**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **80%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
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Project Name:	**Watertown Mall Transformat**	Sheet:	**2 OF 5**
Project Number:	**15374.00**	Date:	**23-Jun-2023**
Location:	**500 and 550 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR 2C, 2D, 3A**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Subsurface Infiltration Structure	**80%**	**1.00**	**0.80**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **80%**

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**1 OF 5**
Project Number:	**15374.00**	Date:	**22-Jun-2023**
Location:	**500 and 550 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR2B**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Sediment Forebay	**25%**	**100%**	**25%**	**75%**
	0%	**75%**	**0%**	**75%**
	0%	**75%**	**0%**	**75%**
		Pre-Treatment TSS Removal =		**25%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Bioretention Area	**90%**	**100%**	**90%**	**10%**
	0%	**10%**	**0%**	**10%**
	0%	**10%**	**0%**	**10%**
	0%	**10%**	**0%**	**10%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)
*** 50% removal for proprietary seperator per City of Watertown comment.

Treatment Train TSS Removal = **90%**

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**1 OF 5**
Project Number:	**15374.00**	Date:	**22-Jun-2023**
Location:	**500 and 550 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR3D, 3F**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
	0%	**38%**	**0%**	**38%**
		Pre-Treatment TSS Removal =		**63%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Contech CDS	**50%**	**75%**	**38%**	**38%**
Sand Filter	**80%**	**38%**	**30%**	**8%**
	0%	**8%**	**0%**	**8%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)
*** 50% removal for proprietary seperator per City of Watertown comment.

Treatment Train TSS Removal = **93%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**2 OF 5**
Project Number:	**15374.00**	Date:	**23-Jun-2023**
Location:	**446/458 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP2**	Checked by:	
Drainage Area(s):	**PR 1B**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Bioretention Area	**90%**	**1.00**	**0.90**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **90%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Watertown Mall Transformat**	Sheet:	**2 OF 5**
Project Number:	**15374.00**	Date:	**23-Jun-2023**
Location:	**500 and 550 Arsenal Street**	Computed by:	**JRB**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR 3H**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Bioretention Area	**90%**	**1.00**	**0.90**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **90%**

Phosphorus Removal Calculations

Site Summary

Project	Watertown Mall	**Project #**	15374
Calculated by	JRB	**Date**	6/26/2023
Checked by	SRM	**Date**	9/11/2023

446/458 Arsenal Street								
Treatment Category	**Area to Treatment Category (ac)**	**Impervious Area to Treatment Category (ac)**	**P Load of Impervious Area (lb/yr)**	**P Load Removed (lb/yr)**	**Average Area Weighted P Reduction (%)**	**TSS Load of Impervious Area (lb/yr)**	**TSS Load Removed (lb/yr)**	**Average Area Weighted TSS Reduction (%)**
Structural BMPs	1.48	0.98	1.7	1.7	95%	369	365	95%
Untreated	0.16	0.08	0.1	0	0%	32	0	0%
TOTAL	**1.64**	**1.06**	**1.9**	**1.7**	**88%**	**401**	**365**	**88%**

TP Loading Summary - 446/458 Arsenal				
	Area (ac)	**12,972.0**		**TP (lb)**
Existing Impervious (ac)	1.5	1.8	lb/ac/yr	2.7
Existing Pervious (ac)	0.1	0.2	lb/ac/yr	0.0
		Existing Conditions TP load (lb)		2.7
		Post Construction Pre Treatment TP Load (lb)		1.9
		Post Construction Post Treatment TP Load (lb)		0.2

500 Arsenal Street								
Treatment Category	**Area to Treatment Category (ac)**	**Impervious Area to Treatment Category (ac)**	**P Load of Impervious Area (lb/yr)**	**P Load Removed (lb/yr)**	**Average Area Weighted P Reduction (%)**	**TSS Load of Impervious Area (lb/yr)**	**TSS Load Removed (lb/yr)**	**Average Area Weighted TSS Reduction (%)**
Structural BMPs	5.4	3.8	6.8	6.9	97%	4,407	1,541	100%
Untreated	0.2	0.1	0.2	0	0%	48	0	0%
TOTAL	**5.6**	**4.0**	**7.1**	**6.9**	**94%**	**4,455**	**1,541**	**97%**

TP Loading Summary - 500 Arsenal				
	Area (ac)	**Loading Rate**		**TP (lb)**
Existing Impervious (ac)	4.0	1.8	lb/ac/yr	7.1
Existing Pervious (ac)	1.7	0.2	lb/ac/yr	0.3
		Existing Conditions TP load (lb)		7.5
		Post Construction Pre Treatment TP Load (lb)		7.1
		Post Construction Post Treatment TP Load (lb)		0.1

550 Arsenal Street								
Treatment Category	**Area to Treatment Category (ac)**	**Impervious Area to Treatment Category (ac)**	**P Load of Impervious Area (lb/yr)**	**P Load Removed (lb/yr)**	**Average Area Weighted P Reduction (%)**	**TSS Load of Impervious Area (lb/yr)**	**TSS Load Removed (lb/yr)**	**Average Area Weighted TSS Reduction (%)**
Structural BMPs	9.5	7.8	14.0	12.7	89%	2,958	3,053	100%

Untreated	0.5	0.3	0.6	0	0%	129	0	0%
TOTAL	**10.0**	**8.2**	**14.6**	**12.7**	**85%**	**3,086**	**3,053**	**96%**

TP Loading Summary - 550 Arsenal				
	Area (ac)	**Loading Rate**		**TP (lb)**
Existing Impervious (ac)	8.4	1.8	lb/ac/yr	15.0
Existing Pervious (ac)	1.2	0.2	lb/ac/yr	0.3
		Existing Conditions TP load (lb)		15.2
		Post Construction Pre Treatment TP Load (lb)		14.6
		Post Construction Post Treatment TP Load (lb)		1.9

Untreated Area Calculations

Project	Watertown Mall	Project #	15374
Calculated by	JRB	Date	6/26/2023
Checked by	SRM	Date	9/11/2023

User Inputs				Load Calculations			
Untreated Area ID	Impervious Area (ft^2)	Pervious Area (ft^2)	Land Use	Impervious TP Loading Rate (lb/ac/yr)	P Load of Impervious Area (lb/yr)	Impervious TSS Loading Rate (lb/ac/yr)	TSS Load of Impervious Area (lb/yr)
446/458 Arsenal							
PR-1F	3,664	3,348	Commercial	1.8	0.1	377	32
500 Arsenal							
PR-2E	5,511	4,677	Commercial	1.8	0.2	377	48
550 Arsenal							
PR-3G	14,864	6,742	Commercial	1.8	0.6	377	129

Structural BMP Calculations

Project	Watertown Mall	Project #	15374
Calculated by	JRB	Date	6/26/2023
Checked by	SRM	Date	9/11/2023

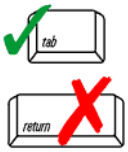
User Inputs										Water Quality Results													
										Phosphorus							Total Suspended Solids (TSS Reduction values can NOT be used for DEP Stormwater Standard 4 Compliance at this time.)						
BMP ID	BMP Type	BMP Soil Type	BMP Design Storage Volume (ft^3)	Impervious Catchment Area (ft^2)	Pervious Catchment Area (ft^2)	Catchment Primary Land Use	Catchment Primary HSG	Runoff Depth from Impervious Area (in)	EPA Water Quality Curve	Impervious P Loading Rate (lb/ac/yr)	Impervious P Load to BMP (lb/yr)	Pervious P Loading Rate (lb/ac/yr)	Pervious P Load to BMP (lb/yr)	Total P Load to BMP (lb/yr)	P Removal Credit (%)	P Load Reduction (lb/yr)	Impervious TSS Loading Rate (lb/ac/yr)	Impervious TSS Load to BMP (lb/yr)	Pervious TSS Loading Rate (lb/ac/yr)	Pervious TSS Load to BMP (lb/yr)	Total TSS Load to BMP (lb/yr)	TSS Removal Credit (%)	TSS Load Reduction (lb/yr)
446/458 Arsenal																							
1P	Infiltration Trench	Sand (8.27 in/hr)	31,326	2,022	12,303	Commercial	HSG C	185.91	Infiltration Trench	1.8	0.1	0.2	0.1	0.1			377	17	60	17	34		
2P	Infiltration Trench	Loamy Sand (2.41 in/hr)	11,470	37,546	6,124	Commercial	HSG C	3.67	Infiltration Trench	1.8	1.5	0.2	0.0	1.6	100%	1.6	377	325	60	8	333	100%	333
3P	Bioretention Basin (no underdrain)	Loamy Sand (2.41 in/hr)	266	3,045	3,581	Commercial	HSG C	1.05	Infiltration Basin	1.8	0.1	0.2	0.0	0.1	98%	0.1	377	26	60	5	31	100%	31
500 Arsenal																							
4A-P	Infiltration Trench	Sandy Loam (1.02 in/hr)	6,338	48,070	5,695	Commercial	HSG C	1.58	Infiltration Trench	1.8	2.0	0.2	0.0	2.0	99%	2.0	377	416	60	8	424	100%	424
4B-P	Infiltration Trench	Sand (8.27 in/hr)	7,118		-	Commercial	HSG C		Infiltration Trench	1.8	-	0.2	-	-			377	-	60	-	-		
4C-P	Infiltration Trench	Sand (8.27 in/hr)	12,972	90,324	26,790	Commercial	HSG C	1.72	Infiltration Trench	1.8	3.7	0.2	0.1	3.8	100%	3.8	377	782	60	37	819	100%	819
5P	Enhanced Bio-filtration w/ ISR	Clay (0.02 in/hr)	1,716	19,038	34,304	Commercial	HSG C	1.08	Enhanced Bio-filtration w/ ISR	1.8	0.8	0.2	0.2	0.9	77%	0.7	377	165	60	47	212	99%	210
14P	Infiltration Trench	Loamy Sand (2.41 in/hr)	2,654	10,088	584	Commercial	HSG C	3.16	Infiltration Trench	1.8	0.4	0.2	0.0	0.4	100%	0.4	377	87	60	1	88	100%	88
550 Arsenal																							
6P	Infiltration Trench	Loamy Sand (2.41 in/hr)	26,789	128,592	13,489	Commercial	HSG C	2.50	Infiltration Trench	1.8	5.3	0.2	0.1	5.3	100%	5.3	377	1,113	60	19	1,132	100%	1,132
7P	Bioretention Basin (w/ underdrain)	Loamy Sand (2.41 in/hr)	773	1,320	4,202	Commercial	HSG C	7.03	Bio-filtration	1.8	0.1	0.2	0.0	0.1	63%	0.0	377	11	60	6	17	100%	17
8P	Infiltration Trench	Loamy Sand (2.41 in/hr)	10,165	7,443	16,583	Commercial	HSG C	16.39	Infiltration Trench	1.8	0.3	0.2	0.1	0.4	100%	0.4	377	64	60	23	87	100%	87
9P	Infiltration Trench	Loamy Sand (2.41 in/hr)	9,775	66,153	-	Commercial	HSG C	1.77	Infiltration Trench	1.8	2.7	0.2	-	2.7	100%	2.7	377	573	60	-	573	100%	573
10P	Infiltration Trench	Loamy Sand (2.41 in/hr)	2,973	30,928	13,924	Commercial	HSG C	1.15	Infiltration Trench	1.8	1.3	0.2	0.1	1.3	99%	1.3	377	268	60	19	287	100%	287
11P	Bioretention Basin (w/ underdrain)	Clay (0.02 in/hr)	472	4,885	5,285	Commercial	HSG C	1.16	Bio-filtration	1.8	0.2	0.2	0.0	0.2	55%	0.1	377	42	60	7	50	99%	49
12P	Sand Filter (w/ underdrain)	Clay (0.02 in/hr)	4,291	51,503	10,533	Commercial	HSG C	1.00	Sand Filter	1.8	2.1	0.2	0.1	2.2	53%	1.1	377	446	60	15	460	99%	456
13P	Sand Filter (w/ underdrain)	Clay (0.02 in/hr)	2,393	23,831	4,879	Commercial	HSG C	1.20	Sand Filter	1.8	1.0	0.2	0.0	1.0	55%	0.5	377	206	60	7	213	99%	212
15P	Infiltration Trench	Loamy Sand (2.41 in/hr)	11,899	27,084	5,094	Commercial	HSG C	5.27	Infiltration Trench	1.8	1.1	0.2	0.0	1.1	100%	1.1	377	234	60	7	241	100%	241

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.

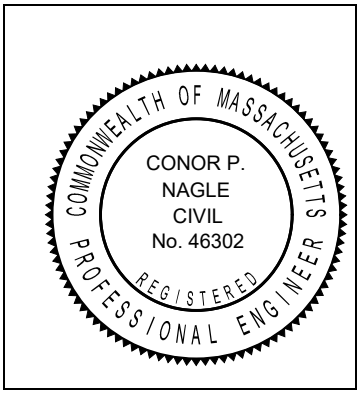
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



Conor Nagle 02/09/2023

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;

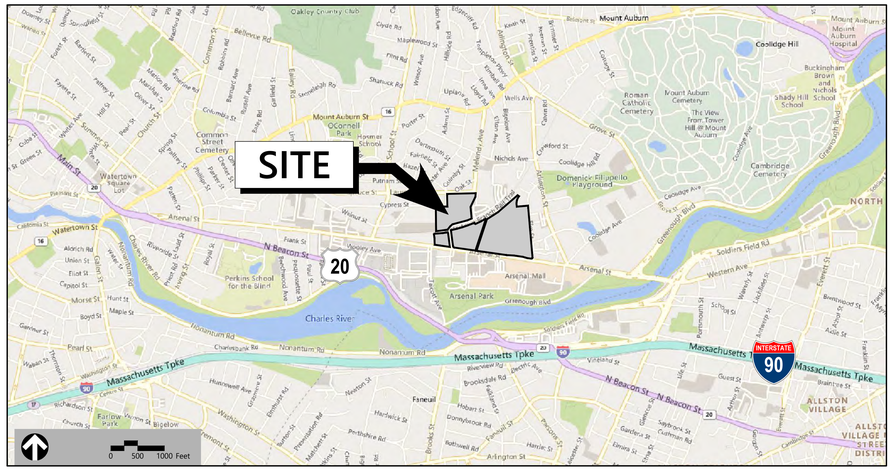
☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Site Plans

Issued for	Notice of Intent
Date Issued	June 07, 2024
Latest Issue	June 07, 2024

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA



Civil Drawings And Landscape Sheet Index

No.	Drawing Title	Latest Issue
C1.00	Legend and General Notes	June 07, 2024
C2.01	Site Preparation and Demolition Plan	June 07, 2024
C2.02	Site Preparation and Demolition Plan - 480 Arsenal Way	June 07, 2024
C3.00	Approval Master Plan	June 07, 2024
C4.00	Key Plan	June 07, 2024
C5.00	Site Plan - Overall	June 07, 2024
C5.01	Site Plan - 446/458 Arsenal Street	June 07, 2024
C5.02	Site Plan - 500 Arsenal Street	June 07, 2024
C5.03	Site Plan - 550 Arsenal Street	June 07, 2024
C5.04	Site Plan - 550 Arsenal Street	June 07, 2024
C5.05	Site Plan - 480 Arsenal Way	June 07, 2024
C6.00	Grading and Drainage Plan - Overall	June 07, 2024
C6.01	Grading and Drainage Plan - 446/458 Arsenal Street	June 07, 2024
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C7.00	Utility Plan - Overall	June 07, 2024
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C8.01	Details - Site	June 07, 2024
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L-100	Tree Protection and Removals Plan - 446-550 Arsenal Street	June 07, 2024
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L-500	Planting Plan - Overall	June 07, 2024
L-510	Planting Plan - 446/458 Arsenal Street	June 07, 2024
L-520	Planting Plan - 500 Arsenal Street	June 07, 2024
L-530	Planting Plan - 550 Arsenal Street	June 07, 2024
L-540	Planting Plan - 550 Arsenal Street	June 07, 2024
L-550	Planting Plan - 550 Arsenal Street	June 07, 2024
L-560	Planting Plan - 550 Arsenal Street	June 07, 2024
L-570	Planting Plan - 480 Arsenal Way	June 07, 2024
L-700	Details - Paving	June 07, 2024
L-710	Details - Boardwalk	June 07, 2024
L-720	Details - Light Pole Footings	June 07, 2024
L-730	Details - Site Furnishings	June 07, 2024
L-731	Details - Site Furnishings	June 07, 2024
L-740	Details - Site Furnishings	June 07, 2024
L-750	Details - Site	June 07, 2024
L-800	Details - Planting	June 07, 2024

Reference Drawings

No.	Drawing Title	Latest Issue
1 - 8	Existing Conditions Plans	February 27, 2023

ALEXANDRIA.

Owner/Applicant

ARE-MA Region No. 91, LLC
ARE-500 Arsenal Street, LLC
ARE-MA Region No. 90, LLC
c/o Alexandria Real Estate Equities, Inc.
215 First Street, Suite 100
Cambridge, MA 02142

Parcel Identification Numbers:
1234-2-0, 1234-1A-0, 1213-7-0, 123-6-0

vhb.com

vhb

101 Walnut Street
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130 Bishop Allen Drive
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Feldman Land Surveyors
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617.357.9740

COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
CIVIL
No. 46302
PROFESSIONAL ENGINEER
06/18/2024

VHB Project: 15374.00
Issued for: Notice of Intent

C:\USERS\VGUZMANTAN\DOCUMENTS\ACCDOCS\VHB\15374.00 ARE-WATERTOWN MALL\PROJECT FILES\5.WORK\CAD\LDP\LANSET\11.CON
COM\15374.00_COV 18 June 2024

Legend

Exist.	Prop.	
		PROPERTY LINE
		PROJECT LIMIT LINE
		RIGHT-OF-WAY/PROPERTY LINE
		EASEMENT
		BUILDING SETBACK
		PARKING SETBACK
10+00	10+00	BASELINE
		CONSTRUCTION LAYOUT
		ZONING LINE
		TOWN LINE
		LIMIT OF DISTURBANCE
		WETLAND LINE WITH FLAG
		FLOODPLAIN
BLSF		BORDERING LAND SUBJECT TO FLOODING
BZ		WETLAND BUFFER ZONE
NBZ		NO BUILD ZONE
NDZ		NO DISTURB ZONE
200'RA		200' RIVERFRONT AREA
		GRAVEL ROAD
EOP	EOP	EDGE OF PAVEMENT
BB	BB	BITUMINOUS BERM
BC	BC	BITUMINOUS CURB
CC	CC	CONCRETE CURB
	CG	CURB AND GUTTER
CC	ECC	EXTRUDED CONCRETE CURB
CC	MCC	MONOLITHIC CONCRETE CURB
CC	PCC	PRECAST CONC. CURB
SGE	SGE	SLOPED GRAN. EDGING
VGC	VGC	VERT. GRAN. CURB
		LIMIT OF CURB TYPE
		SAWCUT
		BUILDING
	EN	BUILDING ENTRANCE
	LD	LOADING DOCK
		BOLLARD
D	D	DUMPSTER PAD
		SIGN
		DOUBLE SIGN
		STEEL GUARDRAIL
		WOOD GUARDRAIL
		PATH
		TREE LINE
		WIRE FENCE
		FENCE
		STOCKADE FENCE
		STONE WALL
		RETAINING WALL
		STREAM / POND / WATER COURSE
		DETENTION BASIN
		HAY BALES
		SILT FENCE
		SILT SOCK / STRAW WATTLE
4	4	MINOR CONTOUR
20	20	MAJOR CONTOUR
10	10	PARKING COUNT
	C10	COMPACT PARKING STALLS
DYL	DYL	DOUBLE YELLOW LINE
SL	SL	STOP LINE
		CROSSWALK
		ACCESSIBLE CURB RAMP
		ACCESSIBLE PARKING
VAN	VAN	VAN-ACCESSIBLE PARKING

Exist.	Prop.	
		CONCRETE
		HEAVY DUTY PAVEMENT
		BUILDINGS
		RIPRAP
		CONSTRUCTION EXIT
27.35 TC×	27.35 TC×	TOP OF CURB ELEVATION
26.85 BC×	26.85 BC×	BOTTOM OF CURB ELEVATION
132.75 ×	132.75 ×	SPOT ELEVATION
45.0 TW 38.5 BW ×	45.0 TW 38.5 BW ×	TOP & BOTTOM OF WALL ELEVATION
		BORING LOCATION
		TEST PIT LOCATION
MW	MW	MONITORING WELL
UD	UD	UNDERDRAIN
12"D	12"D	DRAIN
6"RD	6"RD	ROOF DRAIN
12"S	12"S	SEWER
FM	FM	FORCE MAIN
OHW	OHW	OVERHEAD WIRE
6"W	6"W	WATER
4"FP	4"FP	FIRE PROTECTION
	2"DW	DOMESTIC WATER
3"G	G	GAS
E	E	ELECTRIC
STM	STM	STEAM
T	T	TELEPHONE
FA	FA	FIRE ALARM
CATV	CATV	CABLE TV
		CATCH BASIN CONCENTRIC
		CATCH BASIN ECCENTRIC
		DOUBLE CATCH BASIN CONCENTRIC
		DOUBLE CATCH BASIN ECCENTRIC
		GUTTER INLET
D		DRAIN MANHOLE CONCENTRIC
D		DRAIN MANHOLE ECCENTRIC
TD		TRENCH DRAIN
		PLUG OR CAP
CO	CO	CLEANOUT
		FLARED END SECTION
		HEADWALL
S		SEWER MANHOLE CONCENTRIC
S		SEWER MANHOLE ECCENTRIC
CS	CS	CURB STOP & BOX
WV	WV	WATER VALVE & BOX
TSV	TSV	TAPPING SLEEVE, VALVE & BOX
		FIRE DEPARTMENT CONNECTION
HYD	HYD	FIRE HYDRANT
WM	WM	WATER METER
PIV	PIV	POST INDICATOR VALVE
W	W	WATER WELL
GG	GG	GAS GATE
GM	GM	GAS METER
E	EMH	ELECTRIC MANHOLE
EM	EM	ELECTRIC METER
		LIGHT POLE
T	TMH	TELEPHONE MANHOLE
T	T	TRANSFORMER PAD
		UTILITY POLE
		GUY POLE
		GUY WIRE & ANCHOR
HH	HH	HAND HOLE
PB	PB	PULL BOX
Match Line See Sheet C1.01		MATCHLINE

Sign Summary

M.U.T.C.D. Number	Specification Width	Specification Height	Desc.
R1-1	30"	30"	STOP
R5-1	30"	30"	DO NOT ENTER
R3-7	30"	30"	LEFT LANE MUST TURN LEFT
R7-2C (L)	12"	6"	
R7-8	12"	18"	RESERVED PARKING
R7-8P	12"	6"	VAN ACCESSIBLE
W11-1	30"	30"	
W11-2	30"	30"	
W16-1P	18"	24"	SHARE THE ROAD
W16-7P (L)	24"	12"	
SP-1	12"	18"	NO PARKING VIOLATORS WILL BE TOWED AT OWNERS EXPENSES

Abbreviations

General

ABAN	ABANDON
ACR	ACCESSIBLE CURB RAMP
ADJ	ADJUST
APPROX	APPROXIMATE
BIT	BITUMINOUS
BS	BOTTOM OF SLOPE
BWLL	BROKEN WHITE LANE LINE
CONC	CONCRETE
DYCL	DOUBLE YELLOW CENTER LINE
EL	ELEVATION
ELEV	ELEVATION
EX	EXISTING
FDN	FOUNDATION
FFE	FIRST FLOOR ELEVATION
GRAN	GRANITE
GTD	GRADE TO DRAIN
LA	LANDSCAPE AREA
LOD	LIMIT OF DISTURBANCE
MAX	MAXIMUM
MIN	MINIMUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PERF	PERFORATED
PROP	PROPOSED
REM	REMOVE
RET	RETAIN
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
SWEL	SOLID WHITE EDGE LINE
SWLL	SOLID WHITE LANE LINE
TS	TOP OF SLOPE
TYP	TYPICAL

Utility

CB	CATCH BASIN
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
DCB	DOUBLE CATCH BASIN
DMH	DRAIN MANHOLE
CIP	CAST IRON PIPE
COND	CONDUIT
DIP	DUCTILE IRON PIPE
FES	FLARED END SECTION
FM	FORCE MAIN
F&G	FRAME AND GRATE
F&C	FRAME AND COVER
GI	GUTTER INLET
GT	GREASE TRAP
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HH	HANDHOLE
HW	HEADWALL
HYD	HYDRANT
INV	INVERT ELEVATION
I=	INVERT ELEVATION
LP	LIGHT POLE
MES	METAL END SECTION
PIV	POST INDICATOR VALVE
PWW	PAVED WATER WAY
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
R=	RIM ELEVATION
RIM=	RIM ELEVATION
SMH	SEWER MANHOLE
TSV	TAPPING SLEEVE, VALVE AND BOX
UG	UNDERGROUND
UP	UTILITY POLE

Notes

General

1. CONTRACTOR SHALL NOTIFY "DIG-SAFE" (1-888-344-7233) AT LEAST 72 HOURS BEFORE EXCAVATING. THE CONTRACTOR IS HEREBY NOTIFIED THAT SOME PUBLIC AND PRIVATE UTILITY COMPANIES ARE NOT PART OF DIGSAFE AND MAY HAVE ADDITIONAL NOTIFICATION REQUIREMENTS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SECURITY AND JOB SAFETY. CONSTRUCTION ACTIVITIES SHALL BE IN ACCORDANCE WITH OSHA STANDARDS AND LOCAL REQUIREMENTS.
3. ACCESSIBLE ROUTES, PARKING SPACES, RAMPS, SIDEWALKS AND WALKWAYS SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE FEDERAL AMERICANS WITH DISABILITIES ACT AND WITH STATE AND LOCAL LAWS AND REGULATIONS (WHICHEVER ARE MORE STRINGENT).
4. AREAS DISTURBED DURING CONSTRUCTION AND NOT RESTORED WITH IMPERVIOUS SURFACES (BUILDINGS, PAVEMENTS, WALKS, ETC.) SHALL RECEIVE (6) INCHES LOAM AND SEED.
5. WITHIN THE LIMITS OF THE BUILDING FOOTPRINT, THE SITE CONTRACTOR SHALL PERFORM EARTHWORK OPERATIONS REQUIRED UP TO SUBGRADE ELEVATIONS.
6. WORK WITHIN THE LOCAL RIGHTS-OF-WAY SHALL CONFORM TO LOCAL MUNICIPAL STANDARDS. WORK WITHIN STATE RIGHTS-OF-WAY SHALL CONFORM TO THE LATEST EDITION OF THE STATE HIGHWAY DEPARTMENTS STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES.
7. UPON AWARD OF CONTRACT, CONTRACTOR SHALL MAKE NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN NECESSARY PERMITS, PAY FEES, AND POST BONDS ASSOCIATED WITH THE WORK INDICATED ON THE DRAWINGS, IN THE SPECIFICATIONS, AND IN THE CONTRACT DOCUMENTS. DO NOT CLOSE OR OBSTRUCT ROADWAYS, SIDEWALKS, AND FIRE HYDRANTS, WITHOUT APPROPRIATE PERMITS.
8. TRAFFIC SIGNAGE AND PAVEMENT MARKINGS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
9. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
10. IN THE EVENT THAT SUSPECTED CONTAMINATED SOIL, GROUNDWATER, AND OTHER MEDIA ARE ENCOUNTERED DURING EXCAVATION AND CONSTRUCTION ACTIVITIES BASED ON VISUAL, OLFACTORY, OR OTHER EVIDENCE, THE CONTRACTOR SHALL STOP WORK IN THE VICINITY OF THE SUSPECT MATERIAL TO AVOID FURTHER SPREADING OF THE MATERIAL, AND SHALL NOTIFY THE OWNER IMMEDIATELY SO THAT THE APPROPRIATE TESTING AND SUBSEQUENT ACTION CAN BE TAKEN.
11. CONTRACTOR SHALL PREVENT DUST, SEDIMENT, AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIRS AND CORRECTIVE ACTION IF SUCH OCCURS.
12. DAMAGE RESULTING FROM CONSTRUCTION LOADS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
13. CONTRACTOR SHALL CONTROL STORMWATER RUNOFF DURING CONSTRUCTION TO PREVENT ADVERSE IMPACTS TO OFF SITE AREAS, AND SHALL BE RESPONSIBLE TO REPAIR RESULTING DAMAGES, IF ANY, AT NO COST TO OWNER.
14. THIS PROJECT DISTURBS MORE THAN ONE ACRE OF LAND AND FALLS WITHIN THE NPDES CONSTRUCTION GENERAL PERMIT (CGP) PROGRAM AND EPA JURISDICTION. PRIOR TO THE START OF CONSTRUCTION CONTRACTOR IS TO FILE A CGP NOTICE OF INTENT WITH THE EPA AND PREPARE A STORMWATER POLLUTION PREVENTION PLAN IN ACCORDANCE WITH THE NPDES REGULATIONS. CONTRACTOR SHALL CONFIRM THE OWNER HAS ALSO FILED A NOTICE OF INTENT WITH THE EPA.
15. ANY WORK AND MATERIAL TO BE PLACED WITHIN THE TOWN RIGHT-OF-WAY SHALL CONFORM TO THE TOWN OF WATERTOWN REQUIREMENTS.
16. CONCRETE MIX: 4,000 PSI CONCRETE, 3/4-INCH STONE, 2 1/2-LBS LAMPBLACK PER CUBIC YARD, UNLESS OTHERWISE NOTED.
17. ASPHALT PATCHES SHALL HAVE A MINIMUM DEPTH OF 5-INCHES, OR MATCH EXISTING ROAD DEPTH.
18. ALL CURBING AND SIDEWALK WORK SHALL BE INSPECTED BY THE DPW PRIOR TO POURING.
19. ALL WORK SHALL COMPLY WITH ADA AND MAAB REQUIREMENTS.
20. FLOWABLE FILL REQUIRED AS BACKFILL IN PUBLIC WAY.
21. THE CONTRACTOR SHALL OBTAIN A STREET OPENING PERMIT PRIOR TO ANY CONSTRUCTION WITHIN THE TOWN RIGHT-OF-WAY.
22. ANY DAMAGE IN THE TOWN RIGHT-OF-WAY, AS A DIRECT OR INDIRECT RESULT OF THE CONTRACTORS OPERATIONS, SHALL BE REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE TOWN.

Utilities

1. THE LOCATIONS, SIZES, AND TYPES OF EXISTING UTILITIES ARE SHOWN AS AN APPROXIMATE REPRESENTATION ONLY. THE OWNER OR ITS REPRESENTATIVE(S) HAVE NOT INDEPENDENTLY VERIFIED THIS INFORMATION AS SHOWN ON THE PLANS. THE UTILITY INFORMATION SHOWN DOES NOT GUARANTEE THE ACTUAL EXISTENCE, SERVICEABILITY, OR OTHER DATA CONCERNING THE UTILITIES, NOR DOES IT GUARANTEE AGAINST THE POSSIBILITY THAT ADDITIONAL UTILITIES MAY BE PRESENT THAT ARE NOT SHOWN ON THE PLANS. PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY AND DETERMINE THE EXACT LOCATIONS, SIZES, AND ELEVATIONS OF THE POINTS OF CONNECTIONS TO EXISTING UTILITIES AND, SHALL CONFIRM THAT THERE ARE NO INTERFERENCES WITH EXISTING UTILITIES AND THE PROPOSED UTILITY ROUTES, INCLUDING ROUTES WITHIN THE PUBLIC RIGHTS OF WAY.
2. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, OR EXISTING CONDITIONS DIFFER FROM THOSE SHOWN SUCH THAT THE WORK CANNOT BE COMPLETED AS INTENDED, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED IN WRITING TO THE OWNER'S REPRESENTATIVE FOR THE RESOLUTION OF THE CONFLICT AND CONTRACTOR'S FAILURE TO NOTIFY PRIOR TO PERFORMING ADDITIONAL WORK RELEASES OWNER FROM OBLIGATIONS FOR ADDITIONAL PAYMENTS WHICH OTHERWISE MAY BE WARRANTED TO RESOLVE THE CONFLICT.
3. SET CATCH BASIN RIMS, AND INVERTS OF SEWERS, DRAINS, AND DITCHES IN ACCORDANCE WITH ELEVATIONS ON THE GRADING AND UTILITY PLANS.
4. RIM ELEVATIONS FOR DRAIN AND SEWER MANHOLES, WATER VALVE COVERS, GAS GATES, ELECTRIC AND TELEPHONE PULL BOXES, AND MANHOLES, AND OTHER SUCH ITEMS, ARE APPROXIMATE AND SHALL BE SET/RESET AS FOLLOWS:
   A. PAVEMENTS AND CONCRETE SURFACES: FLUSH
   B. ALL SURFACES ALONG ACCESSIBLE ROUTES: FLUSH
   C. LANDSCAPE, LOAM AND SEED, AND OTHER EARTH SURFACE AREAS: ONE INCH ABOVE SURROUNDING AREA AND TAPER EARTH TO THE RIM ELEVATION.
5. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PROPOSED PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, TELEPHONE, ELECTRIC, FIRE ALARM, ETC.). FINAL DESIGN LOADS AND LOCATIONS TO BE COORDINATED WITH OWNER AND ARCHITECT.
6. CUT AND CAP EXISTING WATER AND SEWER SERVICES AT THE MAIN PRIOR TO ANY BUILDING DEMOLITION.
7. USE OF FIRE HYDRANTS FOR DEMOLITION OR CONSTRUCTION IS NOT PERMITTED UNLESS APPROVED BEFOREHAND BY THE WATERTOWN DEPARTMENT OF PUBLIC WORKS.
8. ALL GATE VALVES SHALL "OPEN RIGHT".
9. CONTRACTOR SHALL MAKE ARRANGEMENTS FOR AND SHALL BE RESPONSIBLE FOR PAYING FEES FOR POLE RELOCATION AND FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE, FIRE ALARM, AND ANY OTHER PRIVATE UTILITIES, WHETHER WORK IS PERFORMED BY CONTRACTOR OR BY THE UTILITIES COMPANY.
10. UTILITY PIPE MATERIALS SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED ON THE PLAN:
    A. WATER PIPES SHALL BE DUCTILE IRON (DI) THICKNESS CLASS 52
    B. SANITARY SEWER PIPES SHALL BE SDR-35 POLYVINYL CHLORIDE (PVC) SEWER PIPE
    C. STORM DRAINAGE PIPES SHALL BE HIGH DENSITY POLYETHYLENE (HDPE)
    D. PIPE INSTALLATION AND MATERIALS SHALL COMPLY WITH THE STATE PLUMBING CODE WHERE APPLICABLE. CONTRACTOR SHALL COORDINATE WITH LOCAL PLUMBING INSPECTOR PRIOR TO BEGINNING WORK.
11. CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR AND SHALL FURNISH EXCAVATION, INSTALLATION, AND BACKFILL OF ELECTRICAL FURNISHED SITEWORK RELATED ITEMS SUCH AS PULL BOXES, CONDUITS, DUCT BANKS, LIGHT POLE BASES, AND CONCRETE PADS. SITE CONTRACTOR SHALL FURNISH CONCRETE ENCASEMENT OF DUCT BANKS IF REQUIRED BY THE UTILITY COMPANY AND AS INDICATED ON THE DRAWINGS.
12. CONTRACTOR SHALL EXCAVATE AND BACKFILL TRENCHES FOR GAS IN ACCORDANCE WITH GAS COMPANY'S REQUIREMENTS.
13. ALL DRAINAGE AND SANITARY STRUCTURE INTERIOR DIAMETERS (4' MIN.) SHALL BE DETERMINED BY THE MANUFACTURER BASED ON THE PIPE CONFIGURATIONS SHOWN ON THESE PLANS AND LOCAL MUNICIPAL STANDARDS. FOR MANHOLES THAT ARE 20 FEET IN DEPTH AND GREATER, THE MINIMUM DIAMETER SHALL BE 5 FEET.
14. WATER PIPES SHALL BE INSTALLED AT A MINIMUM DEPTH OF 5-FEET FROM TOP OF PIPE.
15. 10' OFFSET WATER (DOMESTIC AND FIRE) FROM SANITARY SEWER. ALL OTHER UTILITIES REQUIRE MINIMUM 5-FEET SEPARATION FROM OTHER UTILITIES.

Drainage and Stormwater Management

1. THE ENGINEER-OF-RECORD SHALL WITNESS INSTALLATION OF ANY SUB-SURFACE INFILTRATION SYSTEM. IF SUB-SURFACE SOIL CONDITIONS DIFFER FROM THAT SHOWN ON THE PLAN, THE DESIGN SHALL BE MODIFIED AND RESUBMITTED TO THE TOWN FOR APPROVAL PRIOR TO CONTINUING INSTALLATION.
2. UPON COMPLETION OF ALL SITE WORK; THE CONTRACTOR SHALL INSPECT ALL ON-SITE AND OFF-SITE CATCH BASINS (THAT RECEIVED CATCH BASIN PROTECTION) AND DRAINAGE MANHOLES AND REMOVE ALL SEDIMENT AND DEBRIS THAT HAS ACCUMULATED DURING THE COURSE OF CONSTRUCTION.

Layout and Materials

1. DIMENSIONS ARE FROM THE FACE OF CURB, FACE OF BUILDING, FACE OF WALL, AND CENTER LINE OF PAVEMENT MARKINGS, UNLESS OTHERWISE NOTED.
2. CURB RADII ARE (3) FEET UNLESS OTHERWISE NOTED.
3. CURBING WITHIN THE SITE SHALL BE AS NOTED ON THE MATERIALS PLANS.
4. SEE ARCHITECTURAL DRAWINGS FOR EXACT BUILDING DIMENSIONS AND DETAILS CONTIGUOUS TO THE BUILDING, INCLUDING SIDEWALKS, RAMPS, BUILDING ENTRANCES, STAIRWAYS, UTILITY PENETRATIONS, CONCRETE DOOR PADS, COMPACTOR PAD, LOADING DOCKS, BOLLARDS, ETC.
5. PROPOSED BOUNDS AND ANY EXISTING PROPERTY LINE MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE SET OR RESET BY A PROFESSIONAL LAND SURVEYOR.
6. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL VERIFY EXISTING PAVEMENT ELEVATIONS AT INTERFACE WITH PROPOSED PAVEMENTS, AND EXISTING GROUND ELEVATIONS ADJACENT TO DRAINAGE OUTLETS TO ASSURE PROPER TRANSITIONS BETWEEN EXISTING AND PROPOSED FACILITIES.

Demolition

1. CONTRACTOR SHALL REMOVE AND DISPOSE OF EXISTING MANMADE SURFACE FEATURES WITHIN THE LIMIT OF WORK INCLUDING BUILDINGS, STRUCTURES, PAVEMENTS, SLABS, CURBING, FENCES, UTILITY POLES, SIGNS, ETC. UNLESS INDICATED OTHERWISE ON THE DRAWINGS. REMOVE AND DISPOSE OF EXISTING UTILITIES, FOUNDATIONS AND UNSUITABLE MATERIAL BENEATH AND FOR A DISTANCE OF 10 FEET BEYOND THE PROPOSED BUILDING FOOTPRINT INCLUDING EXTERIOR COLUMNS.
2. EXISTING UTILITIES SHALL BE TERMINATED, UNLESS OTHERWISE NOTED, IN CONFORMANCE WITH LOCAL, STATE AND INDIVIDUAL UTILITY COMPANY STANDARD SPECIFICATIONS AND DETAILS. THE CONTRACTOR SHALL COORDINATE UTILITY SERVICE DISCONNECTS WITH THE UTILITY REPRESENTATIVES.
3. CONTRACTOR SHALL DISPOSE OF DEMOLITION DEBRIS IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS, ORDINANCES AND STATUTES.
4. THE DEMOLITION LIMITS DEPICTED IN THE PLANS IS INTENDED TO AID THE CONTRACTOR DURING THE BIDDING AND CONSTRUCTION PROCESS AND IS NOT INTENDED TO DEPICT EACH AND EVERY ELEMENT OF DEMOLITION. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING THE DETAILED SCOPE OF DEMOLITION BEFORE SUBMITTING ITS BID/PROPOSAL TO PERFORM THE WORK AND SHALL MAKE NO CLAIMS AND SEEK NO ADDITIONAL COMPENSATION FOR CHANGED CONDITIONS OR UNFORESEEN OR LATENT SITE CONDITIONS RELATED TO ANY CONDITIONS DISCOVERED DURING EXECUTION OF THE WORK.
5. UNLESS OTHERWISE SPECIFICALLY PROVIDED ON THE PLANS OR IN THE SPECIFICATIONS, THE ENGINEER HAS NOT PREPARED DESIGNS FOR AND SHALL HAVE NO RESPONSIBILITY FOR THE PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF HAZARDOUS MATERIALS, TOXIC WASTES OR POLLUTANTS AT THE PROJECT SITE. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR ANY CLAIMS OF LOSS, DAMAGE, EXPENSE, DELAY, INJURY OR DEATH ARISING FROM THE PRESENCE OF HAZARDOUS MATERIAL AND CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ANY CLAIMS MADE IN CONNECTION THEREWITH. MOREOVER, THE ENGINEER SHALL HAVE NO ADMINISTRATIVE OBLIGATIONS OF ANY TYPE WITH REGARD TO ANY CONTRACTOR AMENDMENT INVOLVING THE ISSUES OF PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF ASBESTOS OR OTHER HAZARDOUS MATERIALS.

Erosion Control

1. PRIOR TO STARTING ANY OTHER WORK ON THE SITE, THE CONTRACTOR SHALL NOTIFY APPROPRIATE AGENCIES AND SHALL INSTALL EROSION CONTROL MEASURES AS SHOWN ON THE PLANS AND AS IDENTIFIED IN FEDERAL, STATE, AND LOCAL APPROVAL DOCUMENTS PERTAINING TO THIS PROJECT.
2. CONTRACTOR SHALL INSPECT AND MAINTAIN EROSION CONTROL MEASURES AT A MINIMUM ONCE EVERY SEVEN (7) CALENDAR DAYS AND WITHIN 24 HOURS OF THE OCCURRENCE OF A STORM EVENT THAT PRODUCES 0.25 INCHES OR MORE OF RAIN WITHIN A 24-HOURS PERIOD, OR WITHIN 24 HOURS OF A SNOWMELT DISCHARGE FROM A STORM EVENT THAT PRODUCES 3.25 INCHES OR MORE OF SNOW WITHIN A 24-HOUR PERIOD. THE CONTRACTOR SHALL ADDRESS DEFICIENCIES AND MAINTENANCE ITEMS WITHIN TWENTY-FOUR HOURS OF INSPECTION. CONTRACTOR SHALL PROPERLY DISPOSE OF SEDIMENT SUCH THAT IT DOES NOT ENCUMBER OTHER DRAINAGE STRUCTURES AND PROTECTED AREAS.
3. CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CONTROL CONSTRUCTION SUCH THAT SEDIMENTATION SHALL NOT AFFECT REGULATORY PROTECTED AREAS, WHETHER SUCH SEDIMENTATION IS CAUSED BY WATER, WIND, OR DIRECT DEPOSIT.
4. CONTRACTOR SHALL PERFORM CONSTRUCTION SEQUENCING SUCH THAT EARTH MATERIALS ARE EXPOSED FOR A MINIMUM OF TIME BEFORE THEY ARE COVERED, SEEDED, OR OTHERWISE STABILIZED TO PREVENT EROSION.
5. UPON COMPLETION OF CONSTRUCTION AND ESTABLISHMENT OF PERMANENT GROUND COVER, CONTRACTOR SHALL REMOVE AND DISPOSE OF EROSION CONTROL MEASURES AND CLEAN SEDIMENT AND DEBRIS FROM ENTIRE DRAINAGE AND SEWER SYSTEMS.
6. THE CONTRACTOR SHALL KEEP ON SITE, AT ALL TIMES, ADDITIONAL SILTATION FENCING AND FILTER FABRIC FOR INSTALLATION AS DIRECTED BY THE TOWN TO MITIGATE ANY EMERGENCY CONDITIONS.

Existing Conditions Information

1. BASE PLAN: PROPERTY LINE AND EXISTING CONDITIONS INFORMATION BASED ON PLANS ENTITLED EXISTING CONDITIONS PLAN, DATED SEPTEMBER 1, 2022; PROVIDED BY FELDMAN GEOSPATIAL.
2. TOPOGRAPHY: ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. GEOTECHNICAL DATA INCLUDING TEST PIT AND BORING LOCATIONS AND ELEVATIONS WERE OBTAINED FROM HALEY & ALDRICH INC. "GEOTECHNICAL SUBSURFACE MEMORANDUM" DATED FEBRUARY 2, 2023.

Document Use

1. THESE PLANS AND CORRESPONDING CADD DOCUMENTS ARE INSTRUMENTS OF PROFESSIONAL SERVICE, AND SHALL NOT BE USED, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN FOR WHICH IT WAS CREATED WITHOUT THE EXPRESSED, WRITTEN CONSENT OF VHB. ANY UNAUTHORIZED USE, REUSE, MODIFICATION OR ALTERATION, INCLUDING AUTOMATED CONVERSION OF THIS DOCUMENT SHALL BE AT THE USER'S SOLE RISK WITHOUT LIABILITY OR LEGAL EXPOSURE TO VHB.
2. CONTRACTOR SHALL NOT RELY SOLELY ON ELECTRONIC VERSIONS OF PLANS, SPECIFICATIONS, AND DATA FILES THAT ARE OBTAINED FROM THE DESIGNERS, BUT SHALL VERIFY LOCATION OF PROJECT FEATURES IN ACCORDANCE WITH THE PAPER COPIES OF THE PLANS AND SPECIFICATIONS THAT ARE SUPPLIED AS PART OF THE CONTRACT DOCUMENTS.
3. SYMBOLS AND LEGENDS OF PROJECT FEATURES ARE GRAPHIC REPRESENTATIONS AND ARE NOT NECESSARILY SCALED TO THEIR ACTUAL DIMENSIONS OR LOCATIONS ON THE DRAWINGS. THE CONTRACTOR SHALL REFER TO THE DETAIL SHEET DIMENSIONS, MANUFACTURERS' LITERATURE, SHOP DRAWINGS AND FIELD MEASUREMENTS OF SUPPLIED PRODUCTS FOR LAYOUT OF THE PROJECT FEATURES.
4. UPON COMPLETION OF THE WORK, AS-BUILT DRAWINGS SHALL BE SUBMITTED IN BOTH PAPER AND ELECTRONIC FORMAT. THE DRAWINGS SHALL BE BASED UPON A FIELD SURVEY OF ACTUAL AS-BUILT LOCATIONS, AND SHALL BE STAMPED BY A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS. THE AS-BUILT DRAWING SHALL DEPICT ALL BUILDING, PAVED SURFACES, TOPOGRAPHY, AND MAJOR LANDSCAPE FEATURES. WATER, SEWER, AND DRAINAGE FEATURES, AS WELL AS OTHER UNDERGROUND UTILITIES INSTALLED BY OTHERS, SHALL BE LOCATED ON THE PLAN, INCLUDING SIZE AND MATERIAL. ALL STORMWATER MANAGEMENT CONTROLS, BOTH STRUCTURAL AND NON-STRUCTURAL, DESIGNED TO MANAGE THE STORMWATER ASSOCIATED WITH THE COMPLETED SITE SHALL ALSO BE INCLUDED.

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NOTE:

MATERIAL SHOWING FOR REFERENCE ONLY; REFER TO MATERIAL PLAN FOR PROPOSED MATERIAL DETAILS

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT — Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Legend and General Notes**

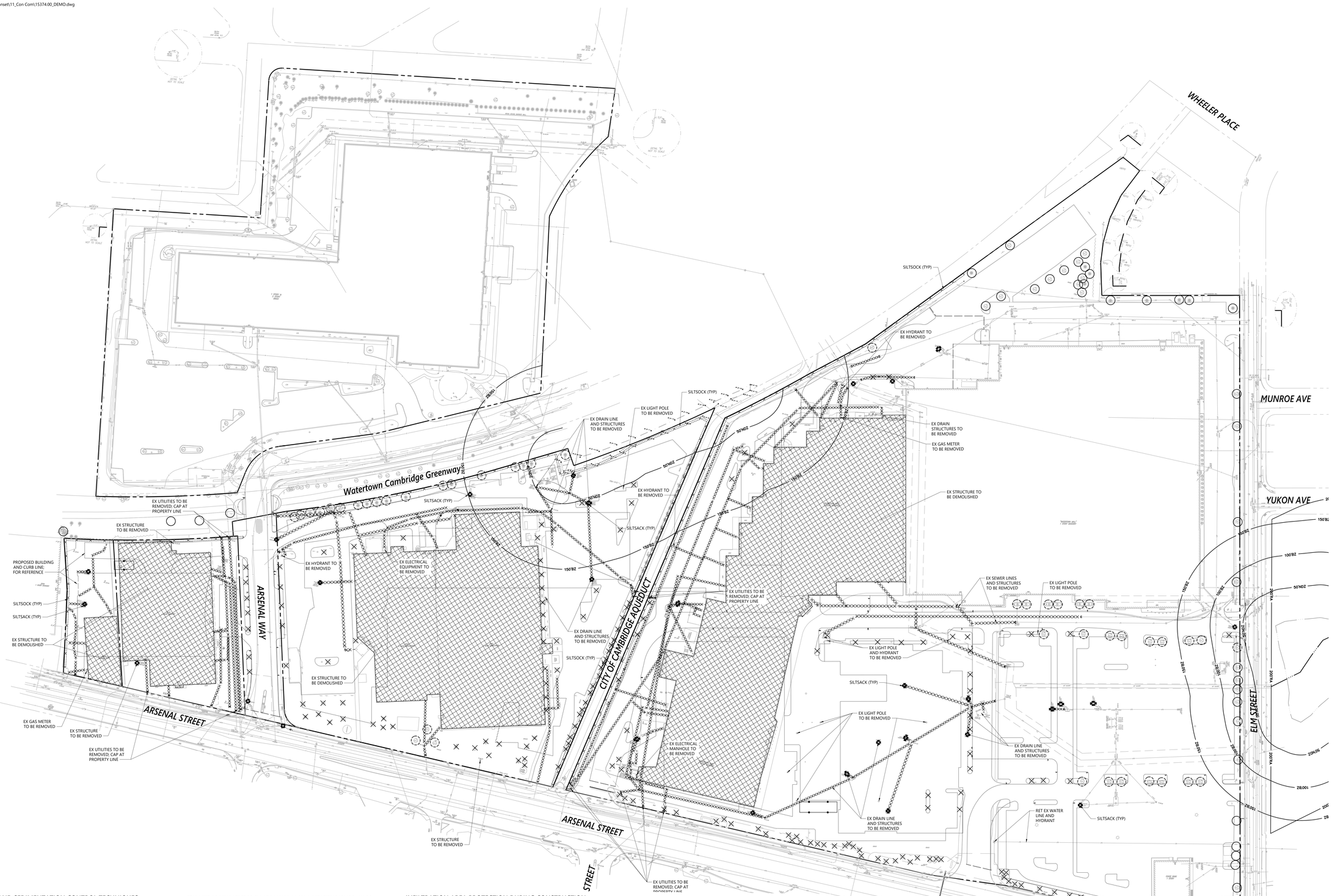
COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE CIVIL No. 46302 — REGISTERED PROFESSIONAL ENGINEER
06/18/2024

Drawing Number: **C1.00**

Scale: N/A

Project Number: 15374.00

Saved Monday, June 3, 2024 4:48:24 PM VGUZMANTANG Plotted Wednesday, June 5, 2024 2:21:57 PM Vanessa Guzman Tang



EROSION AND SEDIMENTATION CONTROL TECHNIQUES:

THE EROSION AND SEDIMENTATION CONTROLS SHOWN HEREON ARE PERIMETER MEASURES ONLY AND ARE PROVIDED AS A STARTING POINT FOR CONTRACTOR'S STORMWATER POLLUTION PREVENTION PLAN (SWPPP). THE CONTRACTOR IS REQUIRED TO PROVIDE ADDITIONAL INTERIM EROSION AND SEDIMENTATION CONTROLS, INCLUDING BUT NOT LIMITED TO THOSE LISTED BELOW. THE CONTRACTOR SHALL MANAGE EROSION AND SEDIMENTATION DURING CONSTRUCTION TO PREVENT IMPACTS TO RESOURCE AREAS, ROADWAYS, AND ABUTTING PROPERTIES. THE CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN THE EROSION AND SEDIMENTATION CONTROLS THROUGHOUT THE DURATION OF CONSTRUCTION.

CATCH BASIN PROTECTION:

NEWLY CONSTRUCTED AND EXISTING CATCH BASINS WILL BE PROTECTED WITH SILT SACKS THROUGHOUT CONSTRUCTION.

GRAVEL AND CONSTRUCTION ENTRANCE/EXIT:

A TEMPORARY CRUSHED-STONE CONSTRUCTION ENTRANCE/EXIT WILL BE CONSTRUCTED. A CROSS SLOPE WILL BE PLACED IN THE ENTRANCE TO DIRECT RUNOFF TO THE SEDIMENT TRAP.

VEGETATIVE SLOPE STABILIZATION:

STABILIZATION OF OPEN SOIL SURFACES WILL BE IMPLEMENTED WITHIN 14 DAYS AFTER GRADING OR CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, UNLESS THERE IS SUFFICIENT SNOW COVER TO PROHIBIT IMPLEMENTATION. VEGETATIVE SLOPE STABILIZATION WILL BE USED TO MINIMIZE EROSION ON SLOPES OF 3:1 OR FLATTER. ANNUAL GRASSES, SUCH AS ANNUAL RYE, WILL BE USED TO ENSURE RAPID GERMINATION AND PRODUCTION OF ROOTMASS. PERMANENT STABILIZATION WILL BE COMPLETED WITH THE PLANTING OF PERENNIAL GRASSES OR LEGUMES. ESTABLISHMENT OF TEMPORARY AND PERMANENT VEGETATIVE COVER MAY BE ESTABLISHED BY HYDRO-SEEDING OR SODDING. A SUITABLE TOPSOIL, GOOD SEEDBED PREPARATION, AND ADEQUATE LIME, FERTILIZER AND WATER WILL BE PROVIDED FOR EFFECTIVE ESTABLISHMENT OF THESE VEGETATIVE STABILIZATION METHODS. MULCH WILL ALSO BE USED AFTER PERMANENT SEEDING TO PROTECT SOIL FROM THE IMPACT OF FALLING RAIN AND TO INCREASE THE CAPACITY OF THE SOIL TO ABSORB WATER.

TEMPORARY SEDIMENT BASINS

TEMPORARY SEDIMENT BASINS WILL BE DESIGNED EITHER AS EXCAVATIONS OR BERMED STORMWATER DETENTION STRUCTURES (DEPENDING ON GRADING) THAT WILL RETAIN RUNOFF FOR A SUFFICIENT PERIOD OF TIME TO ALLOW SUSPENDED SOIL PARTICLES TO SETTLE OUT PRIOR TO DISCHARGE. THESE TEMPORARY BASINS WILL BE LOCATED BASED ON CONSTRUCTION NEEDS AS DETERMINED BY THE CONTRACTOR AND OUTLET DEVICES WILL BE DESIGNED TO CONTROL VELOCITY AND SEDIMENT. POINTS OF DISCHARGE FROM SEDIMENT BASINS WILL BE STABILIZED TO MINIMIZE EROSION. AT A MINIMUM, SEDIMENTATION BASINS SHALL BE DESIGNED AND CONSTRUCTED TO PROVIDE STORAGE FOR THE VOLUME OF RUNOFF GENERATED FROM A 2-YR, 24-HR DESIGN STORM, OR AT LEAST 3,600 CUBIC FEET OF STORAGE PER ACRE DRAINING TO THE BASIN.

STOCKPILE MANAGEMENT:

SIDESLOPES OF STOCKPILED MATERIAL SHALL BE NO STEEPER THAN 2:1. STOCKPILES NOT USED WITHIN 30 DAYS NEED TO BE SEEDED AND MULCHED IMMEDIATELY AFTER FORMATION OF THE STOCKPILE. STRAW BALES AND SILT FENCE ARE TO BE PLACED AROUND THE STOCKPILE AREA APPROXIMATELY 10 FEET FROM THE TOE OF SLOPE.

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PERIODICALLY MOISTEN EXPOSED SURFACES ON UNPAVED TRAVELWAYS TO KEEP THE TRAVELWAY DAMP AND REDUCE DUST.

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DAMAGED OR DETERIORATED ITEMS WILL BE REPAIRED IMMEDIATELY AFTER IDENTIFICATION.

SEDIMENT THAT IS COLLECTED IN STRUCTURES SHALL BE DISPOSED OF PROPERLY AND COVERED IF STORED ON-SITE.

EROSION CONTROL STRUCTURES SHALL REMAIN IN PLACE UNTIL ALL DISTURBED EARTH HAS BEEN SECURELY STABILIZED. AFTER REMOVAL OF STRUCTURES, DISTURBED AREAS SHALL BE REGRADED AND STABILIZED AS SOON AS PRACTICAL.

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INFILTRATION AREA PROTECTION DURING CONSTRUCTION:

FOR THE LONG-TERM FUNCTION OF THE INFILTRATION BASIN(S)/STRUCTURE(S), CARE SHALL BE TAKEN IN THE INFILTRATION AREAS DURING CONSTRUCTION THE CONSTRACTOR SHALL EMPLOY THE FOLLOWING MINIMUM BEST MANAGEMENT PRACTICES (BMPs):

1. INFILTRATION AREAS SHALL NOT BE USED AS TEMPORARY CONSTRUCTION SEDIMENTATION BASINS WITHOUT THE PRIOR APPROVAL OF THE ENGINEER. IF INFILTRATION AREAS ARE USED AS TEMPORARY SEDIMENTATION BASINS DURING CONSTRUCTION, THEN THE SOILS SHALL BE EXCAVATED A MINIMUM OF 2' FROM THE TEMPORARY BASIN BOTTOM TO REMOVE CLOGGED SOILS.
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3. CONSTRUCTION EQUIPMENT, VEHICULAR TRAFFIC, PARKING OF VEHICLES, AND STOCKPILING OF CONSTRUCTION MATERIALS SHALL BE LOCATED OUTSIDE OF THE INFILTRATION AREAS.
4. EXCAVATION FOR CONSTRUCTION OF THE INFILTRATION BASIN(S)/STRUCTURE(S) SHALL ENSURE THAT THE SOIL AT THE BOTTOM OF THE EXCAVATION IS NOT COMPACTED OR SMEARED.
5. THE PERIMETER OF THE INFILTRATION AREAS SHALL BE STAKED AND FLAGGED TO PREVENT THE USE OF THE AREA FOR ACTIVITIES THAT MIGHT DAMAGE THE INFILTRATION ABILITY OF THE SYSTEM.

LEGEND

- TREE PROTECTION FENCING, TREE TO REMAIN
- TREE TO REMAIN
- TREE TO BE REMOVED
- XXXXXX - UNDERGROUND PIPE TO BE REMOVED

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NOTE:

REFER TO SHEET L-100 FOR TREE PROTECTION AND REMOVALS

0 25 50 100Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** — Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Site Preparation and Demolition Plan**

Drawing Number: **C2.01**

Scale: 1" = 50'

Project Number: **15374.00**

COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE — CIVIL — No. 48302 — REGISTERED PROFESSIONAL ENGINEER
06/18/2024

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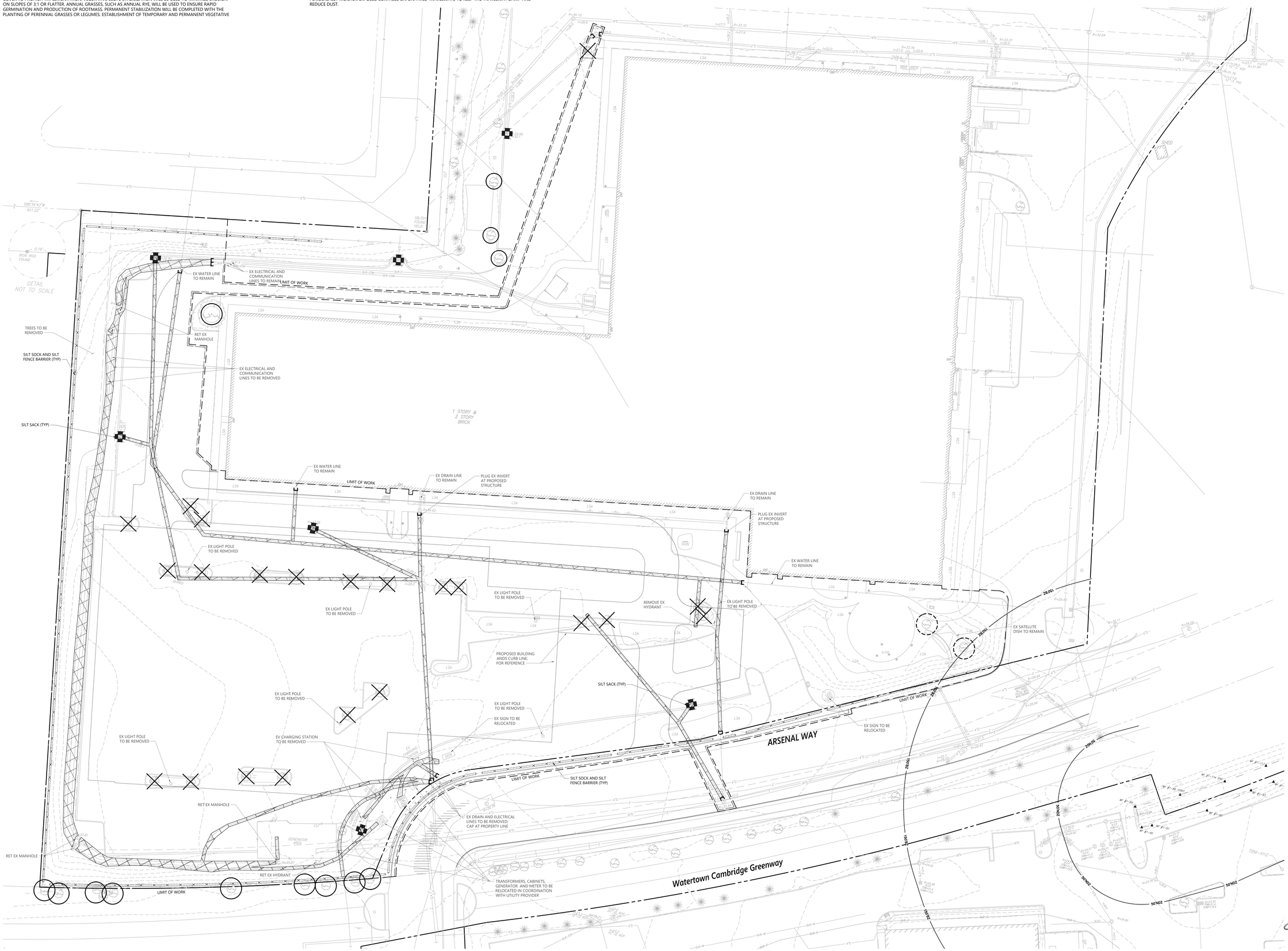
LEGEND

- TREE PROTECTION FENCING, TREE TO REMAIN
- TREE TO REMAIN
- TREE TO BE REMOVED
- UNDERGROUND PIPE TO BE REMOVED



NOTE:

REFER TO SHEET L-100 FOR TREE PROTECTION AND REMOVALS

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** — Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Site Preparation and Demolition Plan 480 Arsenal Way**

Drawing Number: **C2.02**

Scale: 1" = 50'

Project Number: 15374.00

CONOR P. NAGLE CIVIL No. 46302 — 06/12/2024

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Saved Wednesday, June 5, 2024 1:52:27 PM VGUZMANTANG Plotted Wednesday, June 5, 2024 2:23:12 PM Vanessa Guzman Tang

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480 ARSENAL AND P2 ARE SHOWN FOR REFERENCE AND NOT PART OF PHASE 1 SITE PLAN REVIEW SUBMISSION.
AS APPROVED BY THE PLANNING BOARD ON 11/08/2023; AND THE ZONING BOARD OF APPEALS ON 11/29/2023.

PARKING GARAGE P2

ARSENAL WAY

Watertown Cambridge Greenway

PHASE 1 LIMIT OF WORK

BUILDING OL2

BUILDING OL4

FUTURE PHASE: TEMPORARY PARKING LOT PART OF PHASE 1

ARSENAL WAY

BUILDING OL3

PHASE 1

CITY OF CAMBRIDGE AQUEDUCT

ARSENAL STREET

BUILDING A2

PHASE 1 LIMIT OF WORK

ARSENAL STREET

BOND STREET

BUILDING OL1
FUTURE PHASE

BUILDING R1
FUTURE PHASE

PARKING GARAGE P1
FUTURE PHASE

A1
FUTURE PHASE

EXISTING RETAIL TO REMAIN

EXISTING BANK TO REMAIN

WHEELER PLACE

MUNROE AVE

ELM STREET

YUKON AVE

ELM STREET

ARSENAL STREET

0 25 50 100Feet

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title: Approval Master Plan

Drawing Number: C3.00

Scale: 1"=50'

Project Number: 15374.00

COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
CIVIL
No. 46302
REGISTERED PROFESSIONAL ENGINEER
06/13/2024

Saved Tuesday, June 4, 2024 3:18:10 PM KOUZMANTANG Plotted Wednesday, June 5, 2024 2:24:36 PM Vanessa Guzman Tang

CX.04

CX.02

CX.01

CX.03

PARKING GARAGE P2
700 SPACES

ARSENAL WAY

Watertown Cambridge Greenway

BUILDING OL2
156,000 GFA

BUILDING OL4
117,500 GFA

BUILDING OL3
162,500 GFA

ARSENAL STREET

BUILDING A2
8,000 GFA

BUILDING OL1
240,500 GFA

CITY OF CAMBRIDGE AQUEDUCT

BOND STREET

PARKING GARAGE P1
1,180 SPACES

A1
21,500 GFA

EXISTING RETAIL TO REMAIN
166,500 GSF

BUILDING R1
157,320 GFA

EXISTING BANK
TO REMAIN
4,000 GSF

WHEELER PLACE

MUNROE AVE

YUKON AVE

ELM STREET

0 25 50 100Feet

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title: Key Plan

Drawing Number: C4.00

CONOR P. NAGLE
CIVIL
No. 46302
COMMONWEALTH OF MASSACHUSETTS
REGISTERED PROFESSIONAL ENGINEER
06/18/2024

Scale: 1" = 50'

Project Number: 15374.00

Saved Tuesday, June 4, 2024 3:18:56 PM VGUZMANTANG Plotted Wednesday, June 5, 2024 7:25:41 PM Vanessa Guzman Tang

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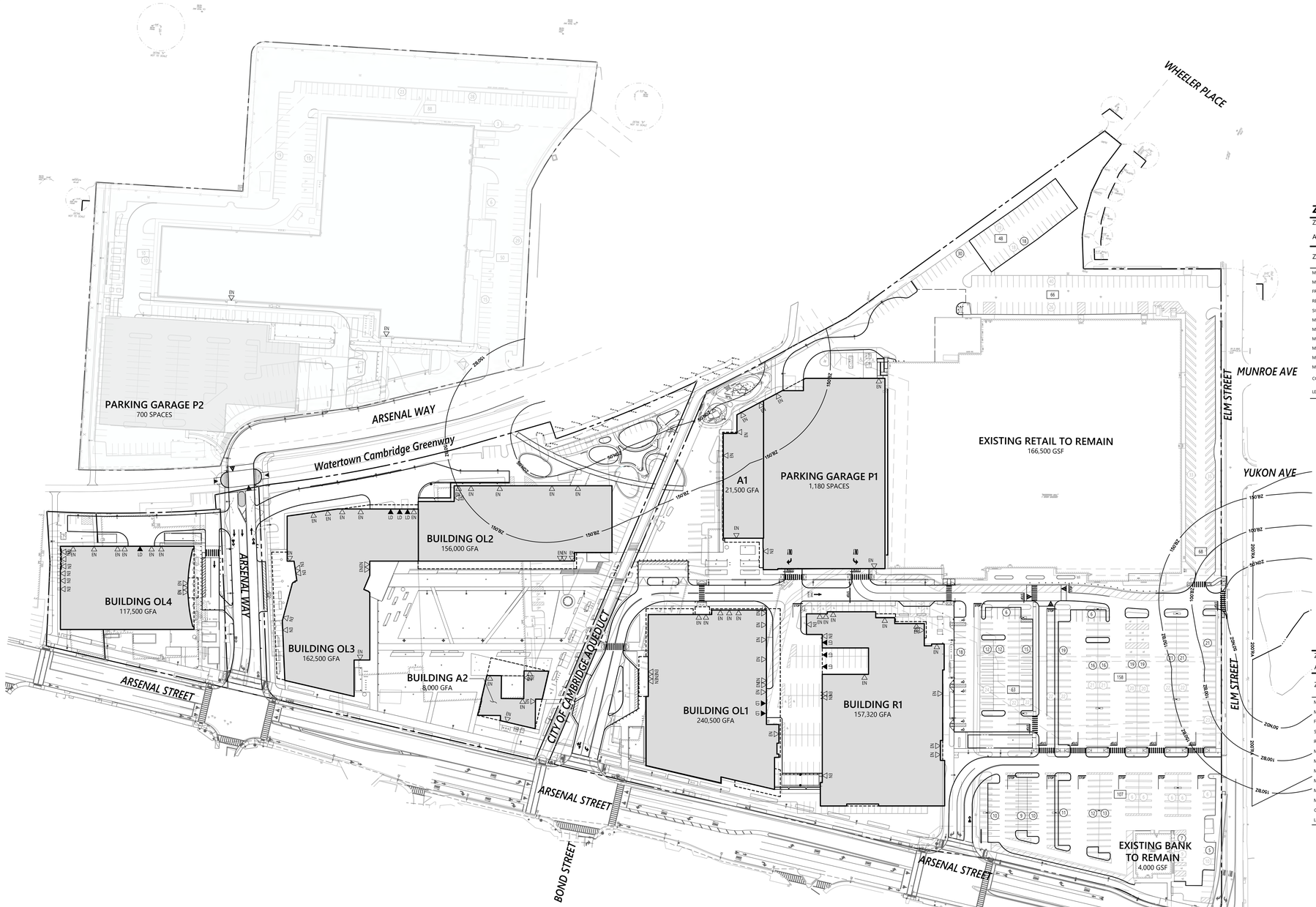

Watertown Mall Transformation - Required Parking Summary

Parking Requirements: Office Buildings

446-550 ARSENAL STREET AND 480 ARSENAL WAY							
RETAIL SALES/OFFICE (GROUND FLOOR)	403,700 SF	x	1 SPACES	/	350 SF	=	1,154 SPACES
OFFICE (ABOVE GROUND FLOOR)	634,000 SF	x	1 SPACES	/	400 SF	=	1,585 SPACES
BANK (EXISTING)	4,000 SF	x	1 SPACES	/	300 SF	=	14 SPACES
AMENITY	116 SEATS	x	1 SPACES	/	4 SEATS	=	29 SPACES
MULTI-FAMILY	(SEE MULTI-FAMILY PARKING REQUIREMENT ON ADJACENT SHEET)					=	98 SPACES
					TOTAL PARKING REQUIRED	=	2,880 SPACES

- NOTE:
- EXISTING RETAIL TO REMAIN CLASSIFIED AS RETAIL.

Parking Requirements: R/D Buildings

446-550 ARSENAL STREET AND 480 ARSENAL WAY							
RESEARCH AND DEVELOPMENT	819,000 SF	x	1 SPACES	/	600 SF	=	1,365 SPACES
RETAIL SALES (GROUND FLOOR)	208,200 SF	x	1 SPACES	/	350 SF	=	595 SPACES
RETAIL (ABOVE GROUND FLOOR)	12,000 SF	x	1 SPACES	/	400 SF	=	30 SPACES
BANK (EXISTING)	4,000 SF	x	1 SPACES	/	300 SF	=	14 SPACES
AMENITY	116 SEATS	x	1 SPACES	/	4 SEATS	=	29 SPACES
MULTI-FAMILY	(SEE MULTI-FAMILY PARKING REQUIREMENT ON ADJACENT SHEET)					=	98 SPACES
					TOTAL PARKING REQUIRED	=	2,131 SPACES

- NOTE:
- EXISTING RETAIL TO REMAIN CLASSIFIED AS RETAIL.

Multi-Family Parking Requirements:

MINIMUM PARKING SPACES PER UNIT					
STUDIO	12 UNITS	x	0.75 SPACES	=	9 SPACES
1 BEDROOM	53 UNITS	x	1 SPACES	=	53 SPACES
2 BEDROOMS	20 UNITS	x	1.5 SPACES	=	30 SPACES
3+ BEDROOMS	3 UNITS	x	2 SPACES	=	6 SPACES
			TOTAL PARKING REQUIRED	=	98 SPACES
MAXIMUM PARKING SPACES PER UNIT					
STUDIO	12 UNITS	x	1 SPACES	=	12 SPACES
1 BEDROOM	53 UNITS	x	1.25 SPACES	=	67 SPACES
2 BEDROOMS	20 UNITS	x	1.75 SPACES	=	35 SPACES
3+ BEDROOMS	3 UNITS	x	2.25 SPACES	=	7 SPACES
			TOTAL PARKING REQUIRED	=	121 SPACES

- NOTE:
- SEEKING APPROVAL FOR THE MINIMUM PARKING FOR MULTI-FAMILY AS SPECIFIED IN THE WATERTOWN ZONING ORDINANCE SECTION 6.01(b).

Parking Provided:

Description	Required as Office	Required as R/D	Parking Spaces Provided: 550 Arsenal St P1 Parking Garage	550 Arsenal St Surface Parking	480 Arsenal Way P2 Parking Garage	480 Arsenal Way Surface Parking	Total
STANDARD SPACES	2,836	2,094	918	494	551	142	2,105
EV STANDARD SPACES	5	5	229	-	130	-	359
EV STANDARD ACCESSIBLE SPACES	-		5	-	4	-	9
EV VAN ACCESSIBLE SPACES	-		2	-	1	-	3
STANDARD ACCESSIBLE SPACES[1]	34	28	21	5	11	6	43
VAN ACCESSIBLE SPACES[1]	5	4	5	11	3	-	19
TOTAL SPACES	2,880[2]	2,131	1,180	510	700	148	2,538

(1) ADA/STATE/LOCAL REQUIREMENTS BASED ON PROVIDED PARKING.
(2) SEEKING APPROVAL FOR A PARKING REDUCTION OF UP TO 342 SPACES (±12% OF REQUIRED AMOUNT IN AN OFFICE SCENARIO), REDUCING TOTAL REQUIRED AMOUNT TO 2,540 SPACES PURSUANT TO ZONING ORDINANCE SECTION 5.180(H)(4) AND 6.01(F) .

Watertown Mall Transformation - Overall Bike Parking Summary

	Required	Provided Indoor	Provided Outdoor
480 ARSENAL WAY			
P2	47	23	23
EX. 480	10	5	5
446-550 ARSENAL STREET			
OL1	–	45	6
OL2	–	32	4
OL3	–	32	20
OL4	–	23	10
P1	79	17	4
A1	–	0	10
A2	–	0	14
R1	4	0	4
EX. TARGET	30	0	16
TOTAL	170	293	

Loading Summary Chart - Overall

446/458 Arsenal St	Gross Floor Area (SF)[1]	Zoning Requirement	Number of Loading Bays: Required	Provided
OFFICE/R&D	117,500	1 BAY FOR 100,000SF-150,000 SF.	1	1
500 Arsenal St				
OFFICE/R&D	323,500	1 BAY FOR 100,000SF-150,000 SF. 1 BAY PER EACH ADDITIONAL 150,000 SF	2	3
550 Arsenal St				
RETAIL/WHOLESALE	233,347	4 BAYS FOR 100,000SF-150,000 SF. 1 BAY PER EACH ADDITIONAL 150,000 SF	4	6
OFFICE/R&D	240,500	1 BAY FOR 100,000SF-150,000 SF. 1 BAY PER EACH ADDITIONAL 150,000 SF	2	3

1. Gross floor area of structure as specified in the Watertown Zoning Ordinance Amended December 11, 2018.

Zoning Summary Chart - Overall Site

Zoning District:	Regional Mixed Use Development (RMUD)	
Abutting Districts:	Open Space/Conservancy District (OSC), Industrial-1	
Zoning Regulation Requirements	Required	Provided
TOTAL PROPERTY AREA	-	1,069,757 Square Feet
MAXIMUM FLOOR AREA RATIO	1.0	0.97
MAXIMUM BUILDING COVERAGE	75%	42.4%
MAXIMUM IMPERVIOUS	85%	81%
MINIMUM OPEN SPACE	20%	29.6%

Zoning Summary Chart - 550 Arsenal St

Zoning District:	Regional Mixed Use Development (RMUD)		
Abutting Districts:	Open Space/Conservancy District (OSC), Industrial-1		
Zoning Regulation Requirements	Required[1] By Right	Required[1] With Special Permit	Provided
MINIMUM LOT AREA	10,000 Square Feet	10,000 Square Feet	777,015 Square Feet
MINIMUM FRONTAGE	50 Feet	50 Feet	1,047 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2,3]	10-30 Feet	>30 Feet	30-30.2 Feet (OL1; R1)
REAR YARD SETBACK[2,3]	15 Feet	0 Feet	51.5 Feet
SIDE YARD SETBACK[2,3]	20 Feet	>50 Feet	45.0 Feet
MAXIMUM FLOOR AREA RATIO[4]	1.0	2.0	0.76
MAXIMUM BUILDING HEIGHT[5]	55 Feet/5 Stories	79 Feet	79 Feet
MECHANICAL PENTHOUSE[6]	15 Feet	>15 Feet	25 Feet
MAXIMUM BUILDING COVERAGE	75 %	75 %	44.2 %
MAXIMUM IMPERVIOUS[8]	85 %	85 %	84.7%
MINIMUM OPEN SPACE	20 %	20 %	20.4%
CONTIGUOUS FACADE[7]	150 Feet	>250 Feet	388.4 Feet (EXISTING NON-CONFORMING)
LENGTH OF BUILDING[7]	300 Feet	>300 Feet	388.4 Feet (EXISTING NON-CONFORMING)

Zoning Summary Chart - 500 Arsenal St

Zoning District:	Regional Mixed Use Development (RMUD)		
Abutting Districts:	Open Space/Conservancy District (OSC)		
Zoning Regulation Requirements	Required[1] By Right	Required[1] With Special Permit	Provided
MINIMUM LOT AREA	10,000 Square Feet	10,000 Square Feet	229,229 Square Feet
MINIMUM FRONTAGE	50 Feet	50 Feet	410 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2,3]	10-30 Feet	>30 Feet	31.4 Feet (OL2) - 46.2 Feet (A2)
SIDE YARD SETBACK[2,3]	15 Feet	0 Feet	15.7 Feet
REAR YARD SETBACK[2,3]	20 Feet	>50 Feet	51.1 Feet
MAXIMUM FLOOR AREA RATIO[4]	1.0	2.0	1.44
MAXIMUM BUILDING HEIGHT[5]	55 Feet/5 Stories	79 Feet	79 Feet
MECHANICAL PENTHOUSE[6]	15 Feet	>15 Feet	25 Feet
MAXIMUM BUILDING COVERAGE	75 %	75 %	36.5 %
MAXIMUM IMPERVIOUS	85 %	85 %	70.1% ±
MINIMUM OPEN SPACE	20 %	20 %	57.3% ±
CONTIGUOUS FACADE[7]	150 Feet	>250 Feet	250 Feet (OL2)
LENGTH OF BUILDING[7]	300 Feet	>300 Feet	286 Feet (OL2)

Zoning Summary Chart - 446/458 Arsenal St

Zoning District:	Regional Mixed Use Development (RMUD)		
Abutting Districts:	Open Space/Conservancy District (OSC)		
Zoning Regulation Requirements	Required[1] By Right	Required[1] With Special Permit	Provided
MINIMUM LOT AREA	10,000 Square Feet	10,000 Square Feet	63,513 Square Feet
MINIMUM FRONTAGE	50 Feet	50 Feet	289 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2,3]	10-30 Feet	>30 Feet	29.3 - 75.7 Feet
SIDE YARD SETBACK[2,3]	15 Feet	0 Feet	15.7 Feet
REAR YARD SETBACK[2,3]	20 Feet	N/A	50.5 Feet
MAXIMUM FLOOR AREA RATIO[4]	1.0	2.0	1.85
MAXIMUM BUILDING HEIGHT[5]	55 Feet/5 Stories	79 Feet	79 Feet
MECHANICAL PENTHOUSE[6]	15 Feet	>15 Feet	25 Feet
MAXIMUM BUILDING COVERAGE	75 %	75 %	41.4 %
MAXIMUM IMPERVIOUS	85 %	85 %	74.4% ±
MINIMUM OPEN SPACE	20 %	20 %	42.9% ±
CONTIGUOUS FACADE[7]	150 Feet	>250 Feet	204 Feet (OL4)
LENGTH OF BUILDING[7]	300 Feet	>300 Feet	204 Feet (OL4)

1. Requirements as specified in the Watertown Zoning Ordinance Amended December 11, 2018. All notations below to sections noted below refer to the Watertown Zoning Ordinance with emphasis added.

2. Pursuant to § 5.18 (C) (B) Setbacks:
   (A) Front: Build-to-line of 10 to 30 feet as specified in § 5.04 and 5.05(a); per § 5.05(g), the front build-to-line may be reduced to be consistent with surrounding existing buildings by Special Permit.
   (B) Side: 15 feet; per § 5.05(d), side yards may be omitted by Special Permit provided that the side yard does not adjoin a Residential District or a Residential Use in existence on September 25, 2015, and that access to the rear is appropriate.
   (C) Rear: 20 feet; per § 5.05(g), rear yards may be reduced to be consistent with surrounding existing buildings by Special Permit.
   (D) Special setbacks and stepbacks: Any structure within 50 feet of Open Space/Conservancy (OSC) zoned land, and the facade of any structure which fronts on a public way, shall be required to incorporate appropriate setbacks, stepbacks, and/or other techniques, in keeping with adopted Design Guidelines, to mitigate potential adverse impacts on environmentally sensitive areas and public ways, as determined by the SPGA.

3. Pursuant to § 4.11 Exceptions to Setback Requirements.
   (d) Exceptions to build-to-line Requirements.
   A build-to-line may be increased as specified below for purposes of amenities such as a plaza, square, courtyard, recessed entrance, sidewalk, multi-use path, raised terrace, facade offsets pursuant to § 5.05(f) or outdoor dining, but not intended for automobile use. For components of a project in keeping with the adopted Design Guidelines, an increased Build-to-Line may be required by the SPGA or requested by an applicant if it is found that the strict adherence to the Build-to-Line is inconsistent with adopted Design Guidelines and development pattern, as determined by the SPGA or is required pursuant to § 5.05(f). The Build-to Line may allow for averaging a building's setback from the property line to accommodate changes in building facade and irregular property boundaries, but no area of a building shall encroach by more than 10% of the required setback.
   (e) Exceptions to Side Yard Setback Requirements. Developments in the NB, LB, CB, I-1, I-2, I-3, RMUD, and PSCD Districts may be contiguous on a block: zero lot line and/or shared party wall. Corner lots may be developed with two front yards with yards determined by the Zoning Enforcement Officer.

4. Pursuant to § 5.05 (i) Notes to Dimensional Requirements:
   No use in the RMUD, I-1, I-2 or I-3 Districts shall exceed an FAR of 1.0 without receiving a special permit consistent with § 9.03-9.15 and in no instance shall the increased intensity of use allowed by the special permit exceed an FAR of 2.0. In addition, no residential use in the I-3 district shall be allowed without receiving a special permit consistent with the above noted sections and § 5.07.
   And, Pursuant to § 5.18 (C) (2) (B) Notes to Dimensional Requirements:
   No use in the RMUD shall exceed an FAR of 1.0 without receiving a Special Permit or Master Plan Special Permit pursuant to § 9.03-9.05 and 9.09-9.13 and in keeping with the intent and purpose of the RMUD Ordinance pursuant to § 5.18.a, and in no instance shall the increased intensity of use allowed by Special Permit exceed an FAR of 2.0.

5. Pursuant to § 5.18 (C) (5) Height of Building
   (B) Maximum height of building: 55 feet, or 79 feet by Master Plan Special Permit.

6. Pursuant to § 4.10
   The limitations of height in feet shall not apply to necessary features usually carried above roofs of buildings, but not used for living purposes, such as water tanks, satellite dishes, chimneys, ventilation systems, bulkheads, aerials, church towers or spires, elevator penthouses, solar arrays, and reception antennas for the use of the occupants of the building. If visible, rooftop ventilation systems shall be visually screened in a manner compatible with the architectural language of the building. Screening of rooftop features shall also be excluded from the calculation of building height. Such features exceeding the height permitted in the district by 15 feet or more shall be allowed only by special permit.

7. Pursuant to § 5.05 (f) Notes to Table of Dimensional Regulations:
   For all new construction in the RMUD, NB, LB, CB, I-1, I-2, and I-3 Districts the maximum length of a contiguous building facade shall be no more than 150 feet long or up to 250 feet long by Special Permit in keeping with adopted Design Guidelines. Offsets of a minimum of 25 feet in depth and 50 feet in length, shall be incorporated for facades to not be considered contiguous. The maximum linear dimension of a building shall be less than 300 feet long, unless a project of greater length, by Special Permit, is determined to be in keeping with adopted Design Guidelines. Buildings with a substantial, publicly-accessible pass through at the ground floor that is a minimum of 50 feet across and 20 feet in height, or an equivalent area, may be considered as separate buildings, as determined by the Zoning Enforcement Officer.
   Exceptions -- In the RMUD, both the maximum contiguous wall and the overall length of a building may be increased through the use of a Master Plan Special Permit, but any increase must be in-keeping with adopted Design Guidelines and the local context.

NOTE:

MATERIAL SHOWN FOR REFERENCE ONLY; REFER TO MATERIAL PLAN FOR DETAILS

0 30 60 120Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.
1	MPSP REV	10/04/2023	CPN

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** | Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Overall Site Plan**

Drawing Number: **C5.00**

CONOR P. NAGLE CIVIL No. 46302 COMMONWEALTH OF MASSACHUSETTS PROFESSIONAL ENGINEER
06/18/2024

Scale: 1" = 50'

Project Number: **15374.00**

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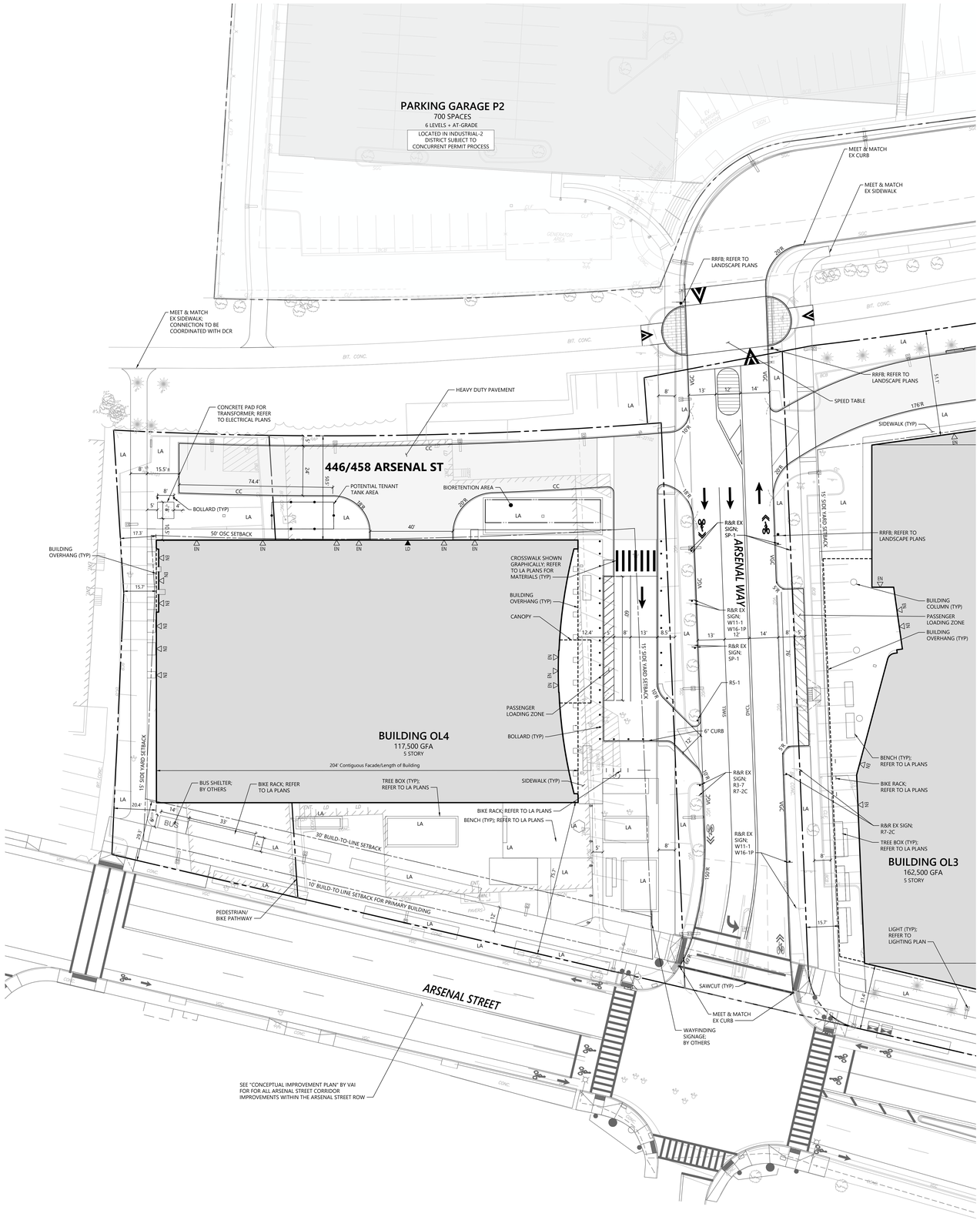

Zoning Summary Chart - 446/458 Arsenal St

Zoning District:	Regional Mixed Use Development (RMUD)
Abutting Districts:	Open Space/Conservancy District (OSC)

Zoning Regulation Requirements	Required[1]		Provided
	By Right	With Special Permit	
MINIMUM LOT AREA	10,000 Square Feet	10,000 Square Feet	63,513 Square Feet
MINIMUM FRONTAGE	50 Feet	50 Feet	289 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2,3]	10-30 Feet	>30 Feet	29.3 - 75.7 Feet
SIDE YARD SETBACK[2,3]	15 Feet	0 Feet	15.7 Feet
REAR YARD SETBACK[2,3]	20 Feet	N/A	50.5 Feet
MAXIMUM FLOOR AREA RATIO[4]	1.0	2.0	1.85
MAXIMUM BUILDING HEIGHT[5]	55 Feet/5 Stories	79 Feet	79 Feet
MECHANICAL PENTHOUSE[6]	15 Feet	>15 Feet	25 Feet
MAXIMUM BUILDING COVERAGE	75 %	75 %	41.4 %
MAXIMUM IMPERVIOUS	85 %	85 %	74.4% ±
MINIMUM OPEN SPACE	20 %	20 %	42.9% ±
CONTIGUOUS FACADE[7]	150 Feet	>250 Feet	204 Feet (OL4)
LENGTH OF BUILDING[7]	300 Feet	>300 Feet	204 Feet (OL4)

1. Requirements as specified in the Watertown Zoning Ordinance Amended December 11, 2018. All notations below to sections noted below refer to the Watertown Zoning Ordinance with emphasis added.

2. Pursuant to § 5.18 (C) (B) Setbacks:
(A) Front: Build-to-line of 10 to 30 feet as specified in § 5.04 and 5.05(q); per § 5.05(p), the front build-to-line may be reduced to be consistent with surrounding existing buildings by Special Permit.
(B) Side: 15 feet; per § 5.05(d), side yards may be omitted by Special Permit provided that the side yard does not adjoin a Residential District or a Residential Use in existence on September 25, 2015, and that access to the rear is appropriate.
(C) Rear: 20 feet; per § 5.05(p), rear yards may be reduced to be consistent with surrounding existing buildings by Special Permit.
(D) Special setbacks and stepbacks: Any structure within 50 feet of Open Space/Conservancy (OSC) zoned land, and the facade of any structure which fronts on a public way, shall be required to incorporate appropriate setbacks, stepbacks, and/or other techniques, in keeping with adopted Design Guidelines, to mitigate potential adverse impacts on environmentally sensitive areas and public ways, as determined by the SPGA.

3. Pursuant to § 4.11 Exceptions to Setback Requirements:
(d) Exceptions to build-to-line Requirements.
A build-to-line may be increased as specified below for purposes of amenities such as a plaza, square, courtyard, recessed entrance, sidewalk, multi-use path, raised terrace, facade offsets pursuant to § 5.05(f) or outdoor dining, but not intended for automobile use. For components of a project in keeping with the adopted Design Guidelines, an increased Build-to Line may be required by the SPGA or requested by an applicant if it is found that the strict adherence to the Build-to-Line is inconsistent with adopted Design Guidelines and development patters, as determined by the SPGA or is required pursuant to § 5.05(f). The Build-to Line may allow for averaging a building's setback from the property line to accommodate changes in building facade and irregular property boundaries, but no area of a building shall encroach by more than 10% of the required setback.
(e) Exceptions to Side Yard Setback Requirements. Developments in the NB, LB, CB, I-1, I-2, I-3, RMUD, and PSCD Districts may be contiguous on a block: zero lot line and/or shared party wall. Corner lots may be developed with two front yards with yards determined by the Zoning Enforcement Officer.

4. Pursuant to § 5.05 (i) Notes to Dimensional Requirements:
No use in the RMUD, I-1, I-2 or I-3 Districts shall exceed an FAR of 1.0 without receiving a special permit consistent with § 9.03-9.15 and in no instance shall the increased intensity of use allowed by the special permit exceed an FAR of 2.0. In addition, no residential use in the I-3 district shall be allowed without receiving a special permit consistent with the above noted sections and § 5.07.
And, Pursuant to § 5.18 (c) (2) Notes to Dimensional Requirements:
No use in the RMUD shall exceed an FAR of 1.0 without receiving a Special Permit or Master Plan Special Permit pursuant to § 9.03-9.05 and 9.09-9.13 and in keeping with the intent and purpose of the RMUD Ordinance pursuant to § 5.18.a, and in no instance shall the increased intensity of use allowed by Special Permit exceed an FAR of 2.0.

5. Pursuant to § 5.18 (C) (5)(B) Height of Building
(B) Maximum height of building: 55 feet, or 79 feet by Master Plan Special Permit.

6. Pursuant to § 4.10:
The limitations of height in feet shall not apply to necessary features usually carried above roofs of buildings, but not used for living purposes, such as water tanks, satellite dishes, chimneys, ventilation systems, bulkheads, aerials, church towers or spires, elevator penthouses, solar arrays, and reception antennas for the use of the occupants of the building. If visible, rooftop ventilation systems shall be visually screened in a manner compatible with the architectural language of the building. Screening of rooftop features shall also be excluded from the calculation of building height. Such features exceeding the height permitted in the district by 15 feet or more shall be allowed only by special permit.

7. Pursuant to § 5.05 (f) Notes to Table of Dimensional Regulations:
For all new construction in the RMUD, NB, LB, CB, I-1, I-2, and I-3 Districts the maximum length of a contiguous building facade shall be no more than 150 feet long or up to 250 feet long by Special Permit in keeping with adopted Design Guidelines. Offsets of a minimum of 25 feet in depth and 50 feet in length, shall be incorporated for facades to not be considered contiguous. The maximum linear dimension of a building shall be less than 300 feet long, unless a project of greater length, by Special Permit, is determined to be in keeping with adopted Design Guidelines. Buildings with a substantial, publicly-accessible pass through at the ground floor that is a minimum of 50 feet across and 20 feet in height, or an equivalent area, may be considered as separate buildings, as determined by the Zoning Enforcement Officer.

Exceptions -- In the RMUD, both the maximum contiguous wall and the overall length of a building may be increased through the use of a Master Plan Special Permit, but any increase must be in keeping with adopted Design Guidelines and the local context.

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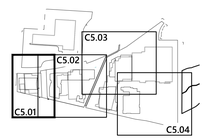

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Apprvd.

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** — Date: 06/07/2024

Not Issued for Construction

Drawing Title
Site Plan
446/458 Arsenal Street

Drawing Number
C5.01

Scale 1" = 40'
1" = 40'

Project Number
15374.00

CONOR P. NAGLE CIVIL No. 46302 COMMONWEALTH OF MASSACHUSETTS PROFESSIONAL ENGINEER
06/12/2024

NOTE:

MATERIAL SHOWN FOR REFERENCE ONLY; REFER TO MATERIAL PLAN FOR DETAILS

Saved Monday, June 17, 2024 1:52:22 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:05:47 PM Vanessa Guzman Tang

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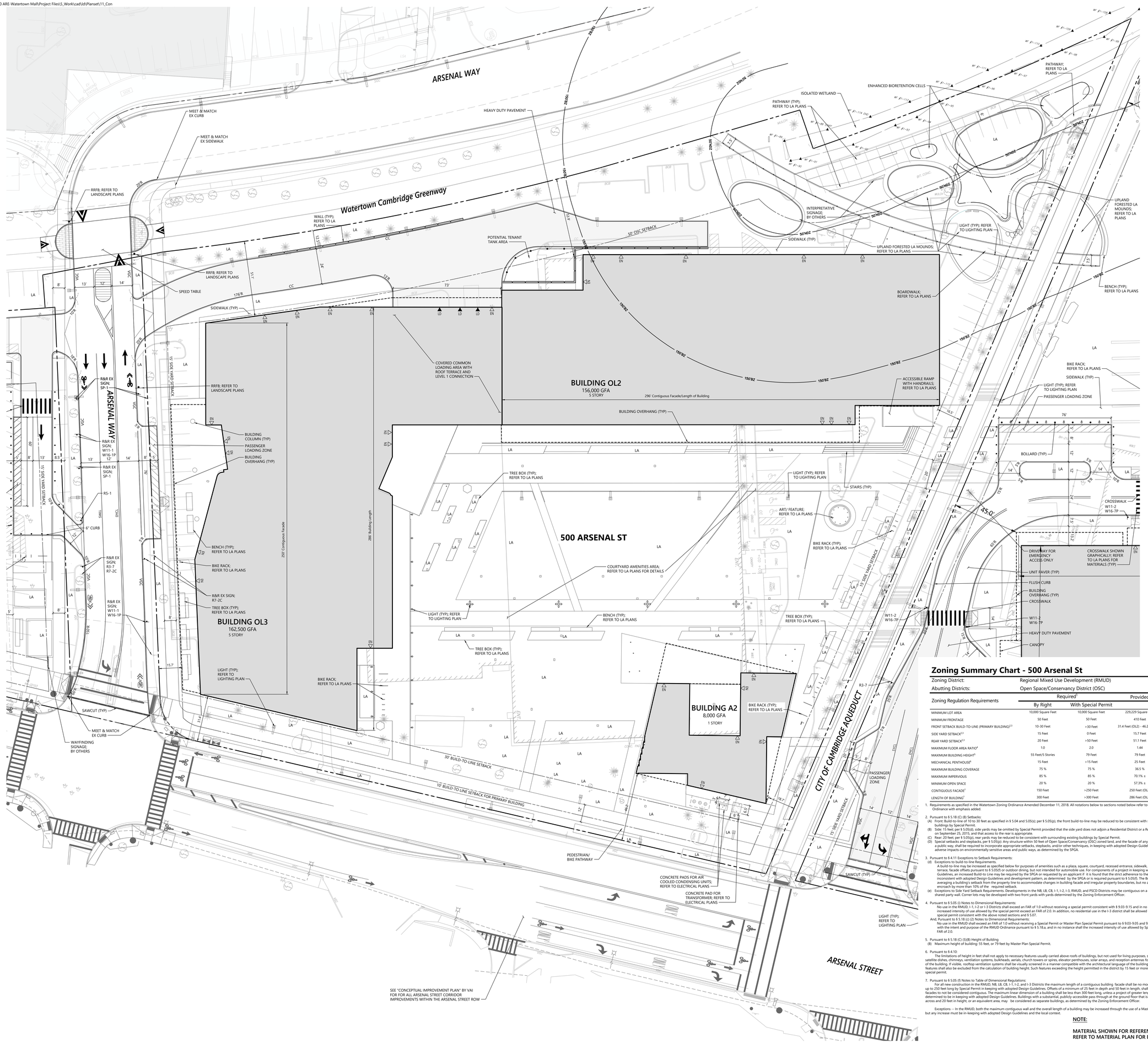

Zoning Summary Chart - 500 Arsenal St

Zoning District:	Regional Mixed Use Development (RMUD)
Abutting Districts:	Open Space/Conservancy District (OSC)

Zoning Regulation Requirements	Required[1]		Provided
	By Right	With Special Permit	
MINIMUM LOT AREA	10,000 Square Feet	10,000 Square Feet	229,229 Square Feet
MINIMUM FRONTAGE	50 Feet	50 Feet	410 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2,3]	10-30 Feet	>30 Feet	31.4 Feet (OL2) - 46.2 Feet (A2)
SIDE YARD SETBACK[2,3]	15 Feet	0 Feet	15.7 Feet
REAR YARD SETBACK[2,3]	20 Feet	>50 Feet	51.1 Feet
MAXIMUM FLOOR AREA RATIO[4]	1.0	2.0	1.44
MAXIMUM BUILDING HEIGHT[5]	55 Feet/5 Stories	79 Feet	79 Feet
MECHANICAL PENTHOUSE[6]	15 Feet	>15 Feet	25 Feet
MAXIMUM BUILDING COVERAGE	75 %	75 %	36.5 %
MAXIMUM IMPERVIOUS	85 %	85 %	70.1% ±
MINIMUM OPEN SPACE	20 %	20 %	67.3% ±
CONTIGUOUS FACADE[7]	150 Feet	>250 Feet	250 Feet (OL2)
LENGTH OF BUILDING[7]	300 Feet	>300 Feet	286 Feet (OL2)

1. Requirements as specified in the Watertown Zoning Ordinance Amended December 11, 2018. All notations below to sections noted below refer to the Watertown Zoning Ordinance with emphasis added.

2. Pursuant to § 5.18 (C) (B) Setbacks:
   (A) Front: Build-to-line of 10 to 30 feet as specified in § 5.04 and 5.05(s); per § 5.05(p), the front build-to-line may be reduced to be consistent with surrounding existing buildings by Special Permit.
   (B) Side: 15 feet; per § 5.05(d), side yards may be omitted by Special Permit provided that the side yard does not adjoin a Residential District or a Residential Use in existence on September 25, 2015, and that access to the rear is appropriate.
   (C) Rear: 20 feet; per § 5.05(p), rear yards may be reduced to be consistent with surrounding existing buildings by Special Permit.
   (D) Special setbacks and stepbacks, per § 5.05(p): Any structure within 50 feet of Open Space/Conservancy (OSC) zoned land, and the facade of any structure which fronts on a public way, shall be required to incorporate appropriate setbacks, stepbacks, and/or other techniques, in keeping with adopted Design Guidelines, to mitigate potential adverse impacts on environmentally sensitive areas and public ways, as determined by the SPGA.

3. Pursuant to § 4.11 Exceptions to Setback Requirements:
   (d) Exceptions to build-to-line Requirements:
   A build-to-line may be increased as specified below for purposes of amenities such as a plaza, square, courtyard, recessed entrance, sidewalk, multi-use path, raised terrace, facade offsets pursuant to § 5.05(f) or outdoor dining, but not intended for automobile use. For components of a project in keeping with the adopted Design Guidelines, an increased Build-to Line may be required by the SPGA or requested by an applicant if it is found that the strict adherence to the Build-to-Line is inconsistent with adopted Design Guidelines and development pattern, as determined by the SPGA or is required pursuant to § 5.05(f). The Build-to Line may allow for averaging a building's setback from the property line to accommodate changes in building facade and irregular property boundaries, but no area of a building shall encroach by more than 10% of the required setback.
   (e) Exceptions to Side Yard Setback Requirements. Developments in the NB, LB, CB, I-1, I-2, I-3, RMUD, and PSCD Districts may be contiguous on a block: zero lot line and/or shared party wall. Corner lots may be developed with two front yards with yards determined by the Zoning Enforcement Officer.

4. Pursuant to § 5.05 (I) Notes to Dimensional Requirements:
   No use in the RMUD, I-1, I-2 or I-3 Districts shall exceed an FAR of 1.0 without receiving a special permit consistent with § 9.03-9.15 and in no instance shall the increased intensity of use allowed by the special permit exceed an FAR of 2.0. In addition, no residential use in the I-3 district shall be allowed without receiving a special permit consistent with the above noted sections and § 5.07.
   And; Pursuant to § 5.18 (c) (2) Notes to Dimensional Requirements:
   No use in the RMUD shall exceed an FAR of 1.0 without receiving a Special Permit or Master Plan Special Permit pursuant to § 9.03-9.05 and 9.09-9.13 and in keeping with the intent and purpose of the RMUD Ordinance pursuant to § 5.18.a, and in no instance shall the increased intensity of use allowed by Special Permit exceed an FAR of 2.0.

5. Pursuant to § 5.18 (C) (5)(B) Height of Building
   (B) Maximum height of building: 55 feet, or 79 feet by Master Plan Special Permit.

6. Pursuant to § 4.10
   The limitations of height in feet shall not apply to necessary features usually carried above roofs of buildings, but not used for living purposes, such as water tanks, satellite dishes, chimneys, ventilation systems, bulkheads, aerials, church towers or spires, elevator penthouses, solar arrays, and reception antennas for the use of the occupants of the building. If visible, rooftop ventilation systems shall be visually screened in a manner compatible with the architectural language of the building. Screening of rooftop features shall also be excluded from the calculation of building height. Such features exceeding the height permitted in the district by 15 feet or more shall be allowed only by special permit.

7. Pursuant to § 5.05 (f) Notes to Table of Dimensional Regulations:
   For all new construction in the RMUD, NB, LB, CB, I-1, I-2, and I-3 Districts the maximum length of a contiguous building facade shall be no more than 150 feet long or up to 250 feet long by Special Permit in keeping with adopted Design Guidelines. Offsets of a minimum of 25 feet in depth and 50 feet in length, shall be incorporated for facades to not be considered contiguous. The maximum linear dimension of a building shall be less than 300 feet long, unless a project of greater length, by Special Permit, is determined to be in keeping with adopted Design Guidelines. Buildings with a substantial, publicly-accessible pass through at the ground floor that is a minimum of 50 feet across and 20 feet in height, or an equivalent area, may be considered as separate buildings, as determined by the Zoning Enforcement Officer.

   Exceptions -- In the RMUD, both the maximum contiguous wall and the overall length of a building may be increased through the use of a Master Plan Special Permit, but any increase must be in-keeping with adopted Design Guidelines and the local context.

NOTE:

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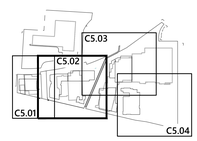

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: Site Plan 500 Arsenal Street

Drawing Number: C5.02

Scale: 1" = 20'

Project Number: 15374.00

CONOR P. NAGLE CIVIL No. 46302 — 06/28/2024

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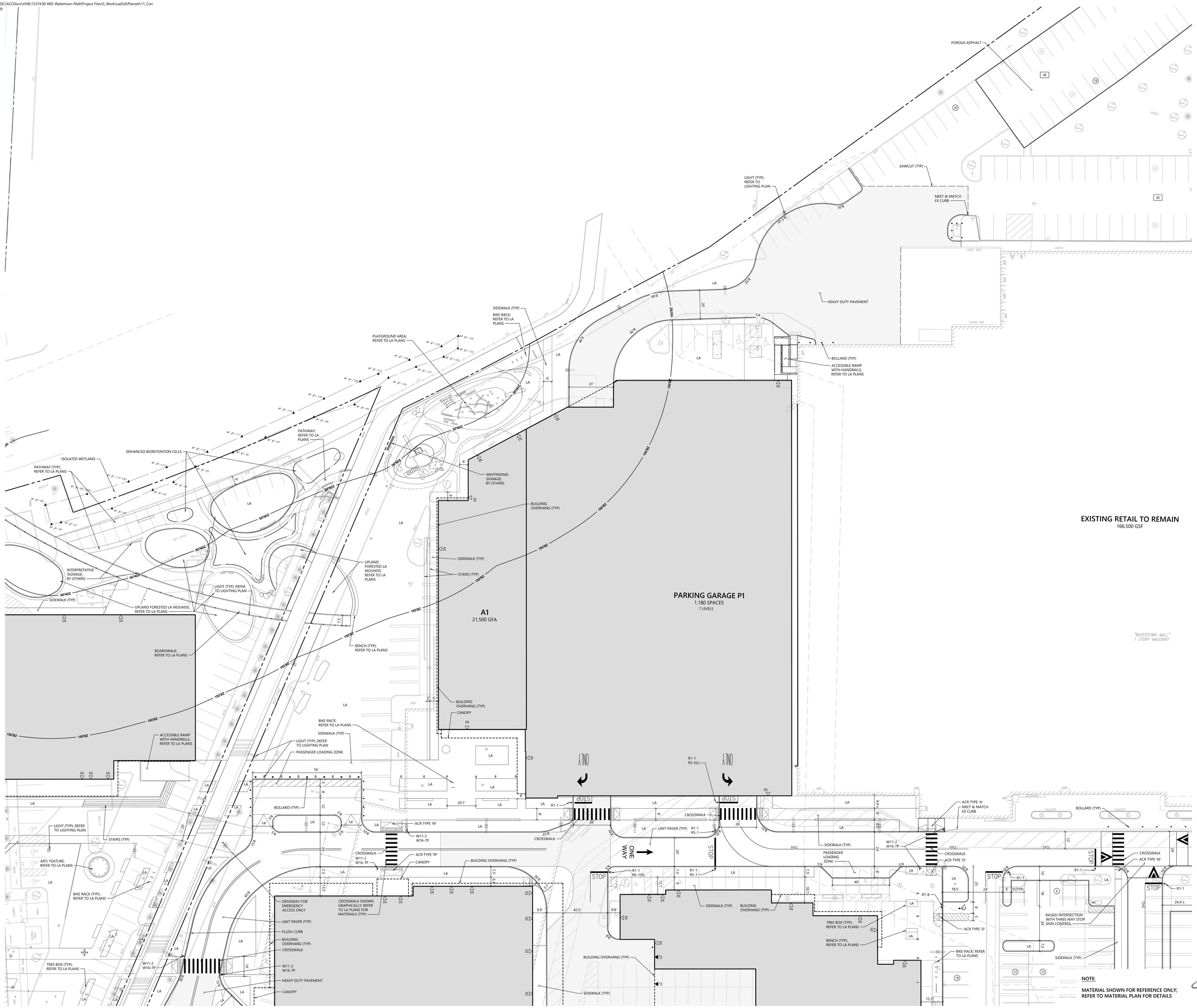

EXISTING RETAIL TO REMAIN
166,500 GSF

NOTE:
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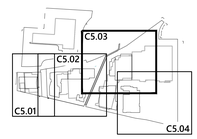

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** | Date: 06/07/2024

Not Issued for Construction

Drawing Title
Site Plan 550 Arsenal Street

Drawing Number
C5.03

Scale
1" = 20'

Project Number
15374.00

COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE — CIVIL — No. 46302 — REGISTERED PROFESSIONAL ENGINEER
06/28/2024

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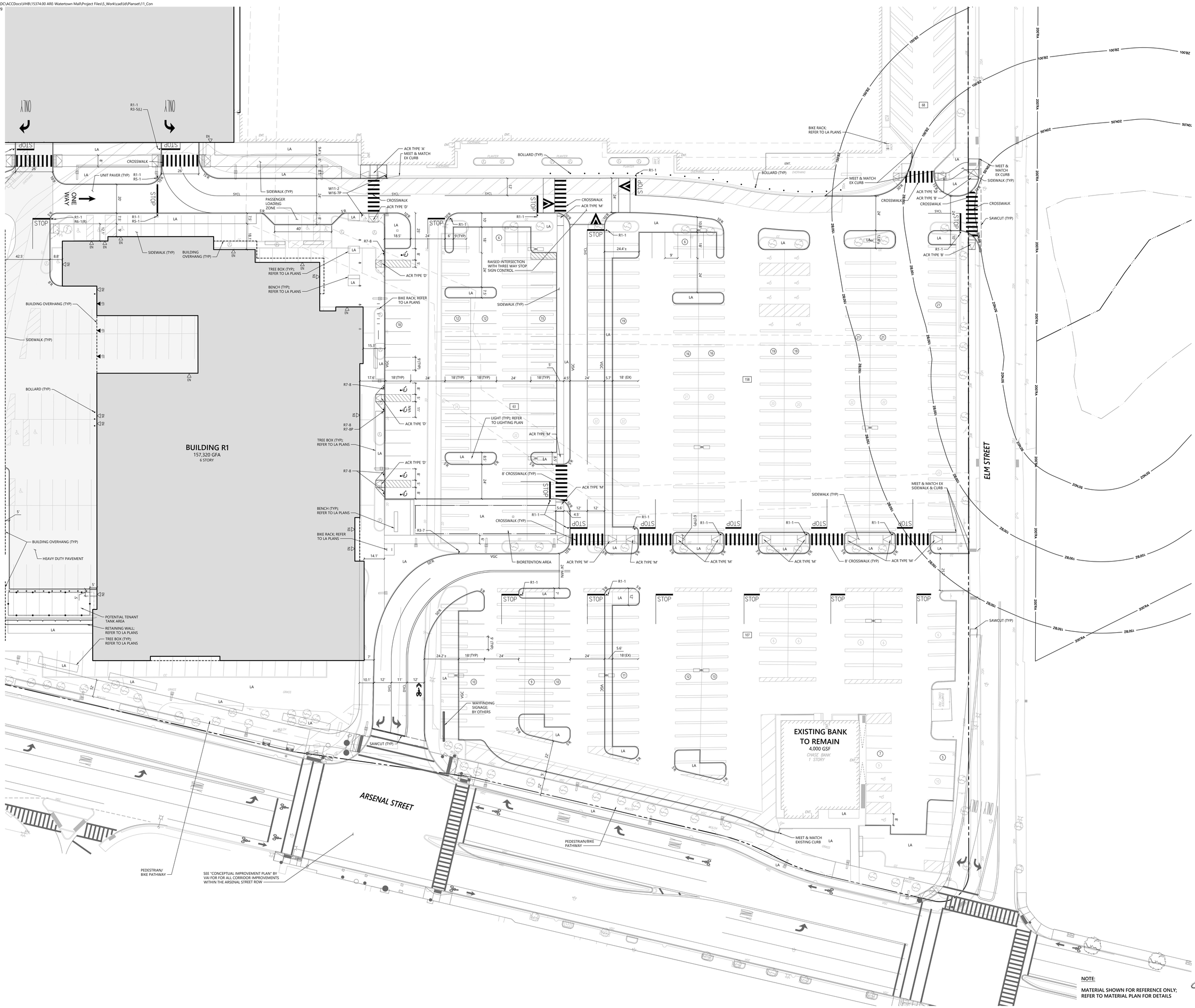

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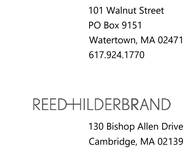

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: **Notice of Intent** | Date: 06/07/2024

Not Issued for Construction

Drawing Title
Site Plan
550 Arsenal Street

Drawing Number
C5.04

Scale
1" = 20'

Project Number
15374.00

CONOR P. NAGLE CIVIL No. 46302 COMMONWEALTH OF MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER
06/28/2024

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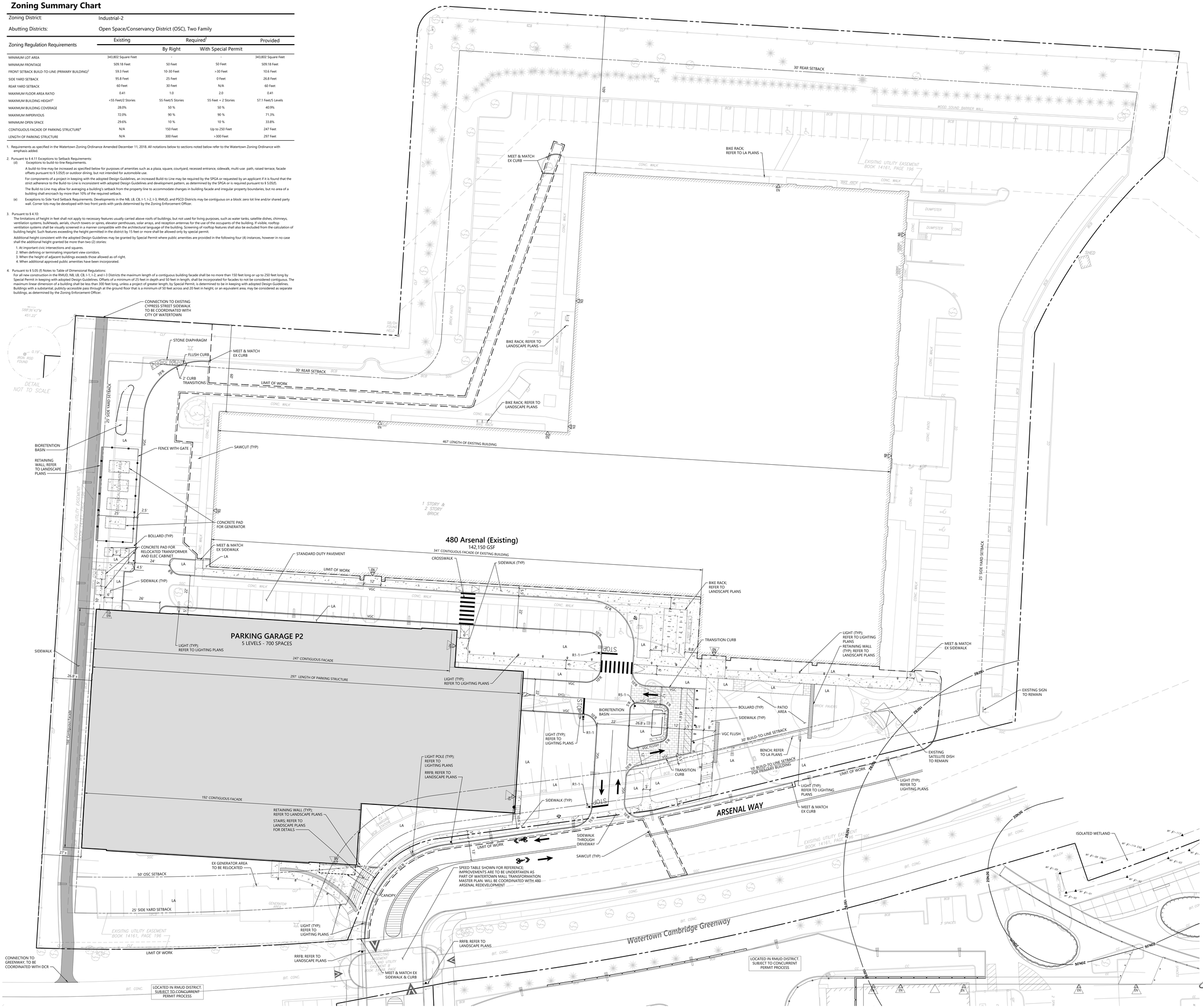
Zoning Summary Chart

Zoning District:	Industrial-2
Abutting Districts:	Open Space/Conservancy District (OSC), Two Family

Zoning Regulation Requirements	Existing	Required[1]		Provided
		By Right	With Special Permit	
MINIMUM LOT AREA	343,802 Square Feet			343,802 Square Feet
MINIMUM FRONTAGE	509.18 Feet	50 Feet	50 Feet	509.18 Feet
FRONT SETBACK BUILD-TO-LINE (PRIMARY BUILDING)[2]	59.3 Feet	10-30 Feet	>30 Feet	10.6 Feet
SIDE YARD SETBACK	95.8 Feet	25 Feet	0 Feet	26.8 Feet
REAR YARD SETBACK	60 Feet	30 Feet	N/A	60 Feet
MAXIMUM FLOOR AREA RATIO	0.41	1.0	2.0	0.41
MAXIMUM BUILDING HEIGHT[3]	<55 Feet/2 Stories	55 Feet/5 Stories	55 Feet + 2 Stories	57.1 Feet/5 Levels
MAXIMUM BUILDING COVERAGE	28.0%	50 %	50 %	40.9%
MAXIMUM IMPERVIOUS	72.0%	90 %	90 %	71.3%
MINIMUM OPEN SPACE	29.6%	10 %	10 %	33.8%
CONTIGUOUS FACADE OF PARKING STRUCTURE[4]	N/A	150 Feet	Up to 250 Feet	247 Feet
LENGTH OF PARKING STRUCTURE	N/A	300 Feet	>300 Feet	297 Feet

1. Requirements as specified in the Watertown Zoning Ordinance Amended December 11, 2018. All notations below to sections noted below refer to the Watertown Zoning Ordinance with emphasis added.
2. Pursuant to § 4.11 Exceptions to Setback Requirements:
   (d) Exceptions to build-to-line Requirements.
   A build-to-line may be increased as specified below for purposes of amenities such as a plaza, square, courtyard, recessed entrance, sidewalk, multi-use path, raised terrace, facade offsets pursuant to § 5.05(f) or outdoor dining, but not intended for automobile use.
   For components of a project in keeping with the adopted Design Guidelines, an increased Build-to Line may be required by the SPGA or requested by an applicant if it is found that the strict adherence to the Build-to-Line is inconsistent with adopted Design Guidelines and development pattern, as determined by the SPGA or is required pursuant to § 5.05(f).
   The Build-to Line may allow for averaging a building's setback from the property line to accommodate changes in building facade and irregular property boundaries, but no area of a building shall encroach by more than 10% of the required setback.
   (e) Exceptions to Side Yard Setback Requirements. Developments in the NB, LB, CB, I-1, I-2, I-3, RMUD, and PSCD Districts may be contiguous on a block: zero lot line and/or shared party wall. Corner lots may be developed with two front yards with yards determined by the Zoning Enforcement Officer.
3. Pursuant to § 4.10:
   The limitations of height in feet shall not apply to necessary features usually carried above roofs of buildings, but not used for living purposes, such as water tanks, satellite dishes, chimneys, ventilation systems, bulkheads, aerials, church towers or spires, elevator penthouses, solar arrays, and reception antennas for the use of the occupants of the building. If visible, rooftop ventilation systems shall be visually screened in a manner compatible with the architectural language of the building. Screening of rooftop features shall also be excluded from the calculation of building height. Such features exceeding the height permitted in the district by 15 feet or more shall be allowed only by special permit.
   Additional height consistent with the adopted Design Guidelines may be granted by Special Permit where public amenities are provided in the following four (4) instances, however in no case shall the additional height granted be more than two (2) stories:
   1. At important civic intersections and squares.
   2. When defining or terminating important view corridors.
   3. When the height of adjacent buildings exceeds those allowed as-of-right.
   4. When additional approved public amenities have been incorporated.
4. Pursuant to § 5.05 (f) Notes to Table of Dimensional Regulations:
   For all new construction in the RMUD, NB, LB, CB, I-1, I-2, and I-3 Districts the maximum length of a contiguous building facade shall be no more than 150 feet long or up to 250 feet long by Special Permit in keeping with adopted Design Guidelines. Offsets of a minimum of 25 feet in depth and 50 feet in length, shall be incorporated for facades to not be considered contiguous. The maximum linear dimension of a building shall be less than 300 feet long, unless a project of greater length, by Special Permit, is determined to be in keeping with adopted Design Guidelines. Buildings with a substantial, publicly-accessible pass through at the ground floor that is a minimum of 50 feet across and 20 feet in height, or an equivalent area, may be considered as separate buildings, as determined by the Zoning Enforcement Officer.



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NOTE:

MATERIAL SHOWING FOR REFERENCE ONLY; REFER TO MATERIAL PLAN FOR DETAILS

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT | Checked by: CPN

Issued for: **Notice of Intent** | Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Site Plan**
480 Arsenal Way

Drawing Number: **C5.05**

COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE — CIVIL — No. 46302 — REGISTERED PROFESSIONAL ENGINEER
06/18/2024

Scale: 1" = 20'

Project Number: 15374.00

Saved Wednesday, June 5, 2024 2:12:49 PM VKUZMANTANG Plotted Wednesday, June 5, 2024 3:09:14 PM Vanessa Guzman Tang

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PARKING GARAGE P2

SUBJECT TO I-2 PERMIT PROCESS

ARSENAL WAY

Watertown Cambridge Greenway

BUILDING OL4

FFE = 31.0'

BUILDING OL3

FFE =30.1'

BUILDING OL2

FFE = 30.1'

PARKING GARAGE P1

A1

FFE = 27.0'

EXISTING RETAIL TO REMAIN

FFE = 24.7'

WHEELER PLACE

MUNROE AVE

YUKON AVE

ARSENAL WAY

ARSENAL STREET

CITY OF CAMBRIDGE AQUEDUCT

BUILDING OL1

FFE = 28.5'

BUILDING R1

FFE = 28.0'

BUILDING A2

FFE =29.25'

ARSENAL STREET

ELM STREET

BOND STREET

EXISTING BANK TO REMAIN

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.
1	MPSP REV	11/03/2023	CPN

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: Overall Grading and Drainage Plan

Drawing Number: C6.00

Scale: 1" = 50'

Project Number: 15374.00

GONOR P. NAGLE CIVIL No. 46302 — COMMONWEALTH OF MASSACHUSETTS — REGISTERED PROFESSIONAL ENGINEER
06/13/2024

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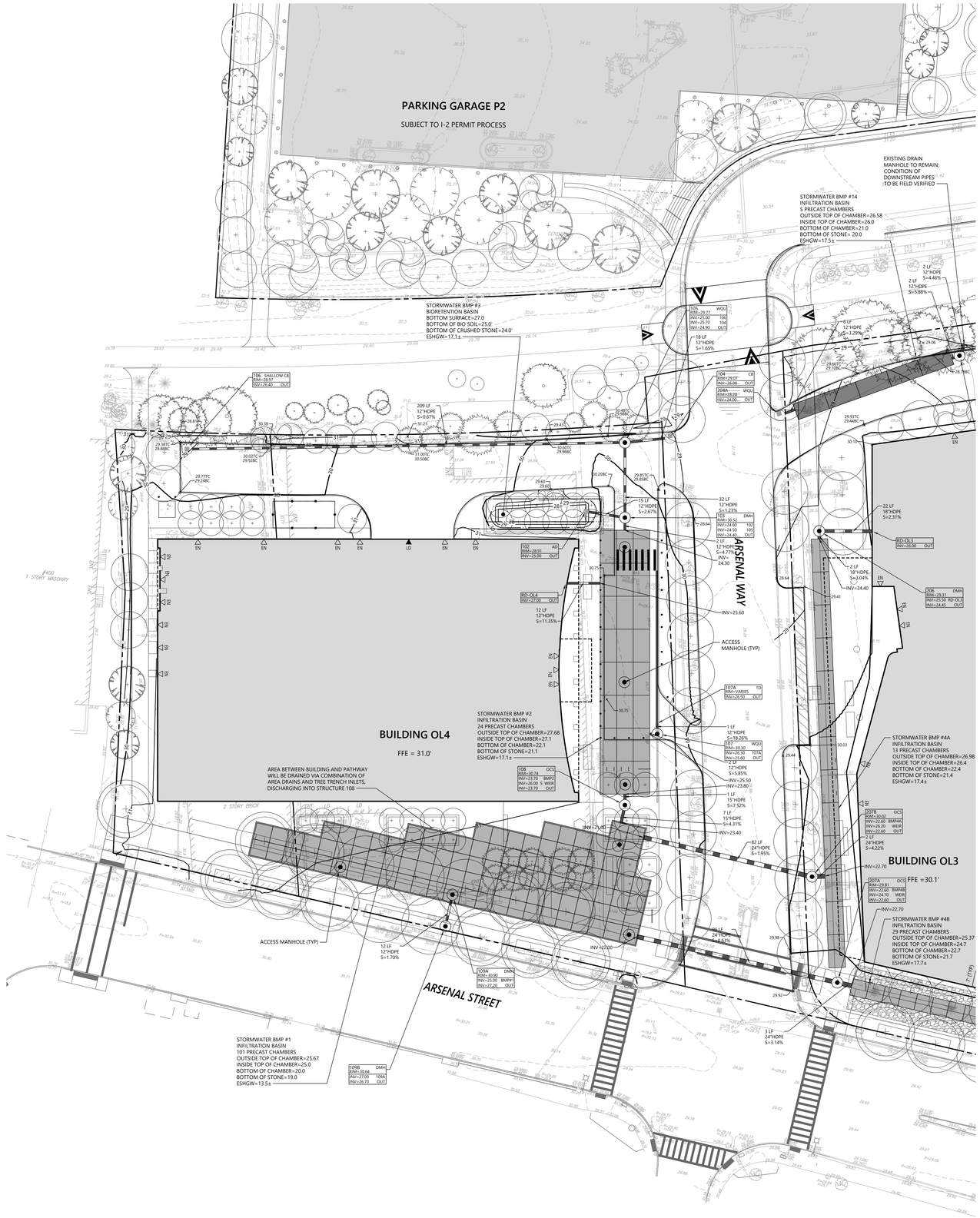

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FELDMAN GEOSPATIAL
152 Hampden Street
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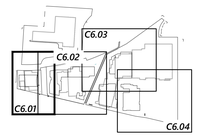

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title
Grading and Drainage Plan 446/458 Arsenal Street

Drawing Number
C6.01

Scale
1" = 20'

Project Number
15374.00



Saved Monday, June 17, 2024 2:02:21 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:02:31 PM Vanessa Guzman Tang

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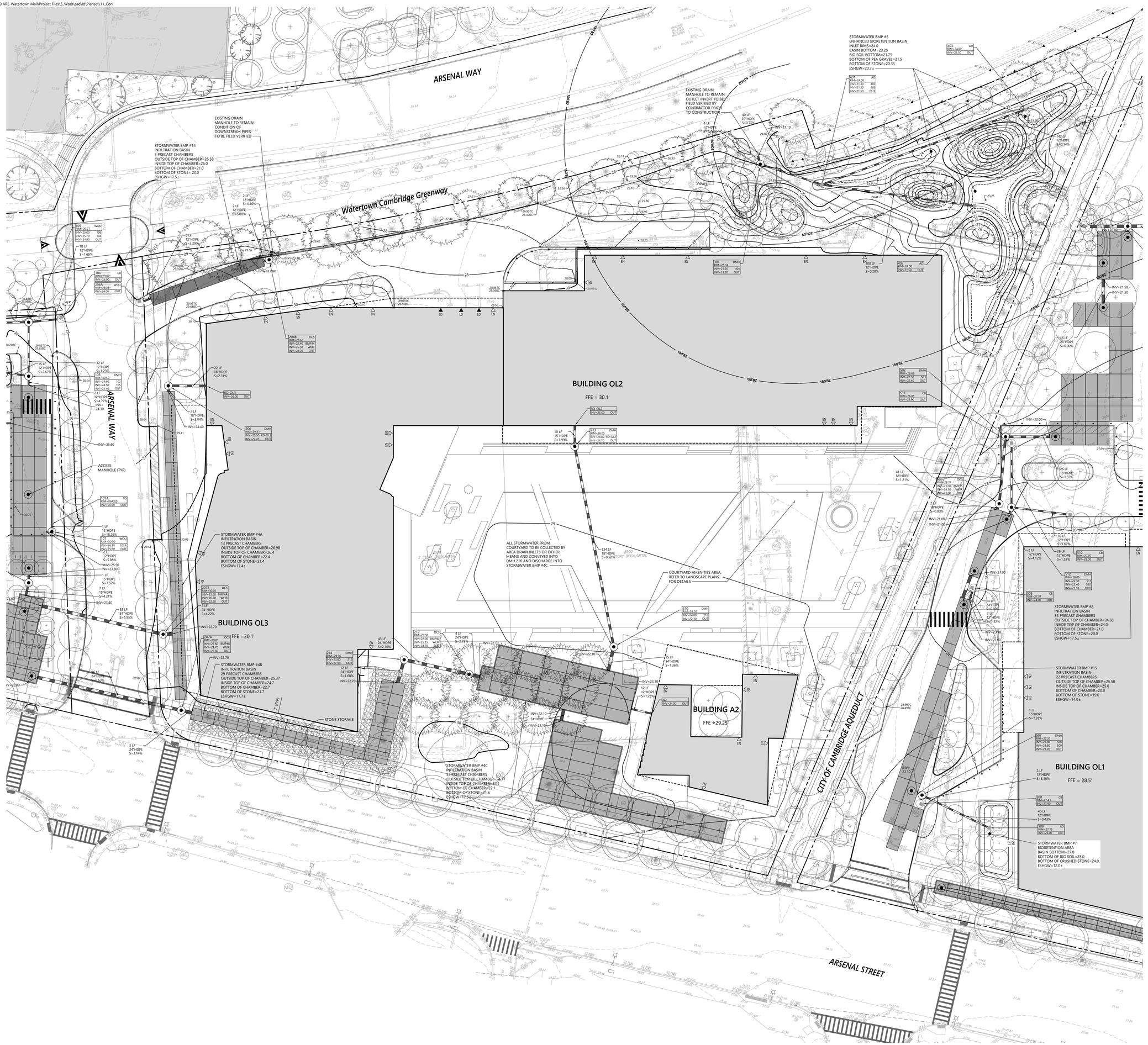

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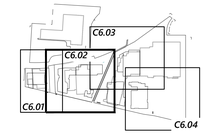

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation
500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title
Grading and Drainage Plan 500 Arsenal Street

CONOR P. NAGLE CIVIL No. 46302 — Commonwealth of Massachusetts — Professional Engineer
06/18/2024

Drawing Number
C6.02

Scale
1" = 20'

Project Number
15374.00

Saved Monday, June 17, 2024 2:02:21 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:03:09 PM Vanessa Guzman Tang

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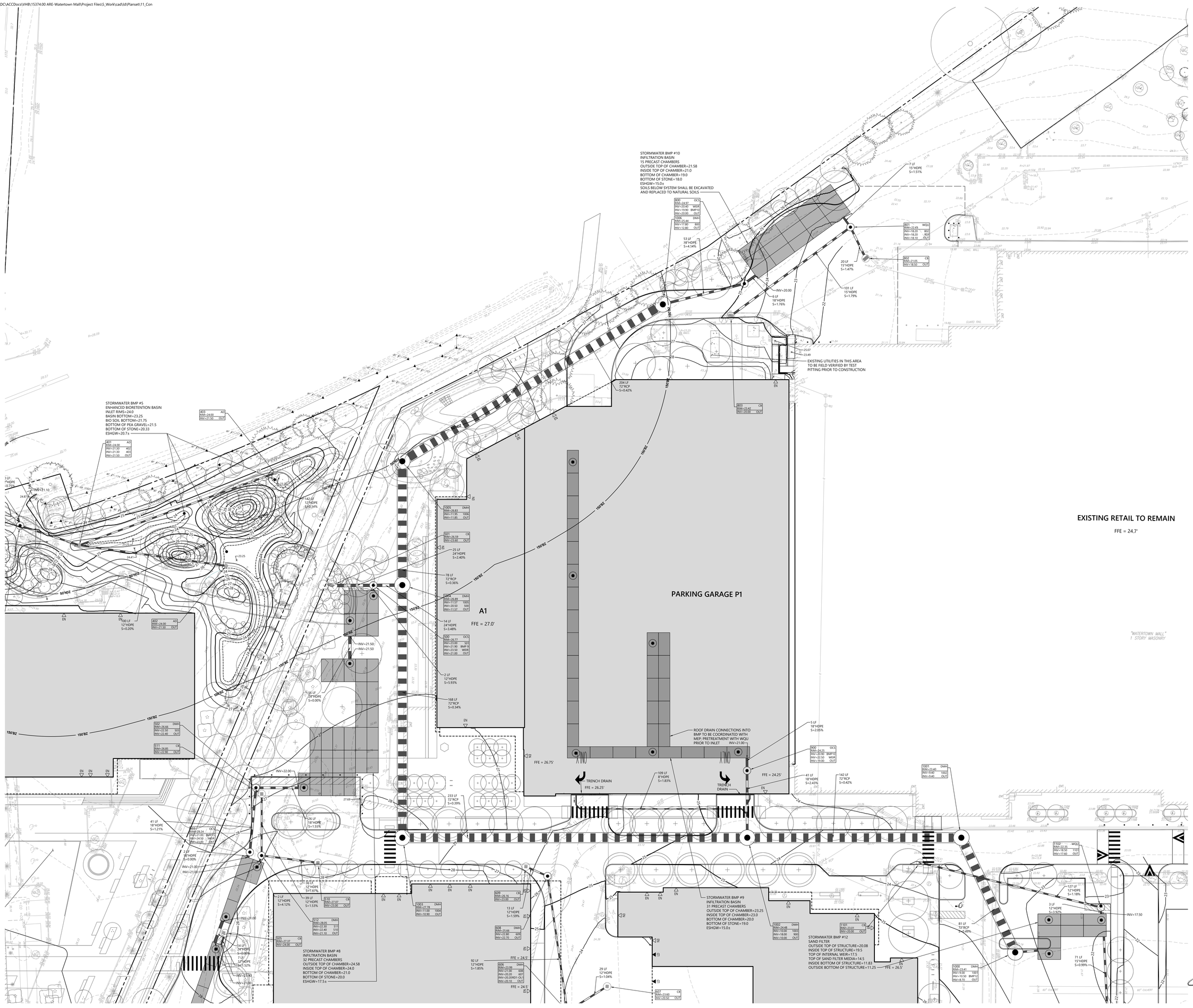

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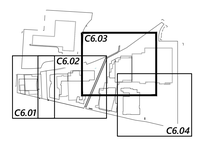

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN
Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title
Grading and Drainage Plan 550 Arsenal Street

CONNOR P. NAGLE CIVIL No. 46302 REGISTERED PROFESSIONAL ENGINEER
06/18/2024

Drawing Number
C6.03

Scale
1" = 20'

Project Number
15374.00

Saved Monday, June 17, 2024 2:02:21 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:03:28 PM Vanessa Guzman Tang

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ROOF DRAIN CONNECTIONS INTO BMP TO BE COORDINATED WITH MEP; PRETREATMENT WITH WQU PRIOR TO INLET. INV=21.00±

5 LF 18"HDPE S=2.05%

900 OCS RIM=24.25 INV=20.90 BMP10 INV=22.50 WEIR INV=19.90 OUT

TRENCH DRAIN FFE = 26.25'

109 LF 8"HDPE S=1.83%

TRENCH DRAIN

FFE = 24.25'

41 LF 18"HDPE S=2.43%

142 LF 72"RCP S=0.42%

1001 DMH RIM=23.40 INV=9.40 1002 OUT INV=9.40

1102 WQU RIM=22.35 INV=18.50 1101 INV=17.60 OUT

127 LF 12"HDPE S=1.18%

STORMWATER BMP #9 INFILTRATION BASIN 31 PRECAST CHAMBERS OUTSIDE TOP OF CHAMBER=23.25 INSIDE TOP OF CHAMBER=23.0 BOTTOM OF CHAMBER=20.0 BOTTOM OF STONE=19.0 ESHGW=15.0±

1002 DMH RIM=24.48 INV=10.00 1003 INV=10.00 900 OUT

1101 CB RIM=23.01 INV=20.00 OUT

STORMWATER BMP #12 SAND FILTER OUTSIDE TOP OF STRUCTURE=20.08 INSIDE TOP OF STRUCTURE=19.5 TOP OF INTERNAL WEIR=17.5 TOP OF SAND FILTER MEDIA=14.5 INSIDE BOTTOM OF STRUCTURE=11.83 OUTSIDE BOTTOM OF STRUCTURE=11.25

3 LF 12"HDPE S=1.92%

INV=17.50

81 LF 72"RCP S=0.49%

1000 DMH RIM=23.41 INV=9.00 1001 INV=10.50 BMP12 INV=8.70 OUT

71 LF 15"HDPE S=0.99%

STORMWATER BMP #17 INFILTRATION BASIN 30 PRECAST CHAMBERS OUTSIDE TOP OF CHAMBER=19.67 INSIDE TOP OF CHAMBER=19.0 BOTTOM OF CHAMBER=15.8 BOTTOM OF STONE=15.3 ESHGW=13.3±

INV=15.80

15 LF 12"HDPE S=1.34%

731 OCS RIM=21.66 INV=16.10 EX DMH INV=16.00 OUT

44 LF 12"HDPE S=0.92%

STORMWATER BMP #16 INFILTRATION BASIN 15 PRECAST CHAMBERS OUTSIDE TOP OF CHAMBER=19.67 INSIDE TOP OF CHAMBER=19.0 BOTTOM OF CHAMBER=15.0 BOTTOM OF STONE=14.5 ESHGW=12.5±

INV=16.50

12 LF 12"HDPE S=0.85%

INV=15.00

INV=15.10

PROPOSED WEIR INV=18.50

RETAIN EXISTING CATCHBASIN, RAISE RIM TO ELEVATION 21.0±

1103 DCB RIM=22.36 INV=18.20 OUT

53 LF 12"HDPE S=0.00%

706 RIM=23.75 INV=20.00 AD 705 INV=20.00 OUT

RETAIN EXISTING DMH, CORE NEW HOLE FOR 36"D

INV=16.50

46 LF 36"HDPE S=1.52%

62 LF 30"HDPE S=1.29%

700 DMH RIM=24.26 INV=15.90 705 INV=17.20 OUT

2 LF 18"HDPE S=4.11%

64"

INV=20.70

8 LF 18"HDPE S=1.32%

703 OCS RIM=24.42 INV=21.40 OUT

704 DMH RIM=25.78 INV=18.10 701 INV=19.70 705 INV=18.00 OUT

4 LF 18"HDPE S=2.67%

108 LF 30"HDPE S=1.39%

703 DMH RIM=24.79 INV=16.50 704 INV=16.40 INV=16.40 OUT

39 LF 12"HDPE S=0.76%

STORMWATER BMP #13 SAND FILTER OUTSIDE TOP OF STRUCTURE=22.75 INSIDE TOP OF STRUCTURE=22.17 TOP OF INTERNAL WEIR=20.67 TOP OF SAND FILTER MEDIA=19.17 INSIDE BOTTOM OF STRUCTURE=16.5 OUTSIDE BOTTOM OF STRUCTURE=15.92

702 WQU RIM=24.70 INV=21.30 701 INV=20.80 OUT

103 LF 30"HDPE S=1.84%

707 DMH RIM=22.52 INV=20.50 708 INV=20.80 OUT

EXISTING BANK TO REMAIN

CHASE BANK 1 STORY

ENT.

29 LF 12"HDPE S=1.04%

607 CB RIM=23.60 INV=20.50 OUT

40 LF 24"HDPE S=1.01%

604 DMH RIM=23.95 INV=19.80 605 INV=19.70 606 INV=19.60 OUT

27 LF 12"HDPE S=1.50%

605 CB RIM=23.53 INV=20.20 OUT

FFE = 26.5'

BUILDING R1

FFE = 28.0'

83 LF 24"HDPE S=0.72%

STORMWATER BMP #11 BIORETENTION BASIN BOTTOM SURFACE=23.0 BOTTOM OF BIO SOIL=21.0 BOTTOM OF CRUSHED STONE AND IMPERMEABLE LINER=20.0 ESHGW=15.0±

705 AD RIM=23.00 INV=20.00 OUT INV=20.00 OUT

601 CB RIM=23.32 INV=20.20 OUT

34 LF 12"HDPE S=2.04%

602 WQU RIM=23.98 INV=19.50 603 INV=19.00 604 INV=18.90 OUT

19 LF 24"HDPE S=1.05%

INV=19.00

36 LF 24"HDPE S=0.00%

INV=19.00

INV=20.00

11 LF 18"HDPE S=1.78%

INV-R1 INV=23.00 OUT

701 DMH RIM=23.20 INV=20.10 OUT

30 LF 30"HDPE S=1.01%

2 LF 24"HDPE S=5.32%

STORMWATER BMP #6 INFILTRATION BASIN 89 PRECAST CHAMBERS OUTSIDE TOP OF CHAMBER=23.67 INSIDE TOP OF CHAMBER=23.0 BOTTOM OF CHAMBER=18.0 BOTTOM OF STONE=17.0 ESHGW=12.7±

INV=20.40

2 LF 24"HDPE S=5.71%

708 OCS RIM=28.40 INV=22.40 BMP5 INV=23.00 WEIR INV=20.40 OUT

ARSENAL STREET

ELM STREET

SLOPE

100-YR

50-YR

ZR.001

ZR.002

ZR.003

ZR.004

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ZR.006

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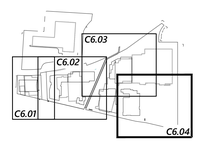

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: Grading and Drainage Plan 550 Arsenal Street

CONOR P. NAGLE CIVIL No. 46302 COMMONWEALTH OF MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER
06/18/2024

Drawing Number: C6.04

Scale: 1" = 20'

Project Number: 15374.00

Saved Monday, June 17, 2024 2:02:21 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:03:47 PM Vanessa Guzman Tang

DETAIL "A"
NOT TO SCALE

S85°36'43"W
451.22'

IRON ROD FOUND

DETAIL
NOT TO SCALE

LIMIT OF WORK

22 LF
12"HDPE
S=0.00%

STORMWATER BMP #3
BIORETENTION BASIN

14 LF
15"HDPE
S=1.46%

STORMWATER BMP #6
SUBSURFACE INFILTRATION SYSTEM
8 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 27.57
INSIDE TOP OF CHAMBER = 26.90
BOTTOM OF CHAMBER= 23.40
BOTTOM OF STONE = 22.40
ESHGW = 18.4±

5 LF
12"HDPE
S=3.66%

INV=26.00

480 Arsenal (Existing)

PARKING GARAGE P2

FFE = 34.0'

83 LF
15"HDPE
S=0.97%

INV=25.10

111 LF
18"HDPE
S=0.99%

GAS, OIL AND SAND INTERCEPTOR, REFER TO MEP PLANS FOR DETAIL

STORMWATER BMP #5
SUBSURFACE INFILTRATION SYSTEM
46 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 30.07
INSIDE TOP OF CHAMBER = 29.40
BOTTOM OF CHAMBER= 22.40
BOTTOM OF STONE = 21.40
ESHGW = 18.4±

24 LF
12"HDPE
S=2.08%

25 LF
12"HDPE
S=0.40%

10 LF
8"HDPE
S=4.02%

10 LF
8"HDPE
S=3.92%

STORMWATER BMP #2
SUBSURFACE INFILTRATION SYSTEM
12 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 29.07
INSIDE TOP OF CHAMBER = 28.40
BOTTOM OF CHAMBER= 23.40
BOTTOM OF STONE = 22.40
ESHGW = 18.4±
SOILS BELOW SYSTEM SHALL BE EXCAVATED AND REPLACED TO GLACIAL SAND/TILL LAYER

1 STORY &
2 STORY
BRICK

93 LF
24"HDPE
S=0.97%

1 LF
12"HDPE
S=6.17%

8 LF
15"HDPE
S=1.03%

ACCESS MANHOLE FOR MAINTENANCE (TYP)

2 LF
12"HDPE
S=5.36%

40 LF
12"HDPE
S=0.75%

33 LF
24"HDPE
S=0.00%

2 LF
12"HDPE
S=0.83%

22 LF
24"HDPE
S=1.81%

2 LF
24"HDPE
S=2.56%

118 LF
15"HDPE
S=1.02%

EX ROOF DRAIN INVERT AT THIS LOCATION TO BE CONFIRMED BY CONTRACTOR PRIOR TO CONSTRUCTION

STORMWATER BMP #1
SUBSURFACE INFILTRATION SYSTEM
28 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 24.98
INSIDE TOP OF CHAMBER = 25.40
BOTTOM OF CHAMBER= 22.40
BOTTOM OF STONE = 21.40
ESHGW = 18.4±
SOILS BELOW SYSTEM SHALL BE EXCAVATED AND REPLACED TO GLACIAL SAND/ TILL LAYER

STORMWATER BMP #4
BIORETENTION BASIN

9 LF
12"HDPE
S=5.53%

6 LF
6"HDPE
S=5.19%

14 LF
6"HDPE
S=3.66%

27 LF
12"HDPE
S=1.87%

59 LF
30"HDPE
S=1.19%

ARSENAL WAY

PRIOR TO CONSTRUCTION, CONTRACTOR TO TEST PIT FOR EX UTILITY DEPTHS ALONG PROPOSED UTILITIES WITHIN ARSENAL WAY TO CONFIRM INVERTS

Watertown Cambridge Greenway

WOOD SOUND BARRIER WALL

SHED

LIMIT OF WORK

110	AD; RIM=32.60; INV=27.60 OUT
109	AD; RIM=32.60; INV=27.00 110; INV=27.00 OUT
108	DMH; RIM=33.70; INV=26.80 109; INV=26.70 OUT
107	CB; RIM=32.80; INV=27.50 OUT
106	OCS; RIM=33.10; INV=25.90 BMP/FB; INV=25.90 WEIR; INV=25.90 OUT
105	CB; RIM=33.10; INV=30.00 OUT
104	WQU; RIM=33.20; INV=25.90 105; INV=25.10 OUT
GDSI-1	DMH; RIM=34.10; INV=28.80 GARAGE; INV=28.70 OUT
GARAGE	INV=29.00 OUT
103	DMH; RIM=34.20; INV=24.00 104; INV=28.60 EX RD; INV=28.50 GDSI-1; INV=23.90 OUT
102	WQU; RIM=33.10; INV=29.00 OUT
101	DMH; RIM=33.30; INV=23.00 103; INV=28.80 102; INV=22.90 OUT
100	DMH; RIM=33.50; INV=22.50 101; INV=22.45 OUT
503	DMH; RIM=34.90; INV=28.80 EX RD; INV=28.00 OUT
502	DMH; RIM=29.25; INV=26.80 OUT; INV=26.70 OUT
401	AD; RIM=32.95; INV=28.00 OUT
601	AD; RIM=31.50; INV=28.00 OUT
602	TD; RIM=33.80; INV=29.80 OUT
600	WQU; RIM=33.20; INV=29.50 601; INV=27.50 601; INV=25.90 OUT
501	OCS; RIM=32.20; INV=25.40 WEIR; INV=24.00 BMP/FB; INV=24.00 OUT
500	DMH; RIM=30.44; INV=23.80 502
300	WQU; RIM=32.05; INV=25.50 301; INV=25.50 OUT
301	DMH; RIM=31.67; INV=31.17 DMH
302	DMH; RIM=31.25; INV=31.17 DMH
303	DMH; RIM=31.19
700	WQU; RIM=33.50; INV=29.00 701; INV=27.00 703; INV=23.50 OUT
701	CO; RIM=33.34; INV=29.50 702; INV=29.40 OUT
702	AD; RIM=33.80; INV=30.00 OUT
703	TD; RIM=31.34; INV=28.00 OUT
704	WQU; RIM=35.50; INV=27.00 705; INV=23.50 OUT
705	TD; RIM=31.50; INV=28.00 OUT
706	OCS; RIM=34.80; INV=23.40 BMP/FB; INV=26.40 WEIR; INV=23.40 OUT

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0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title:
Grading and Drainage Plan 480 Arsenal Way

Drawing Number: C6.05

Scale: 1" = 20'

Project Number: 15374.00

COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
CIVIL
No. 46302
REGISTERED PROFESSIONAL ENGINEER
06/13/2024

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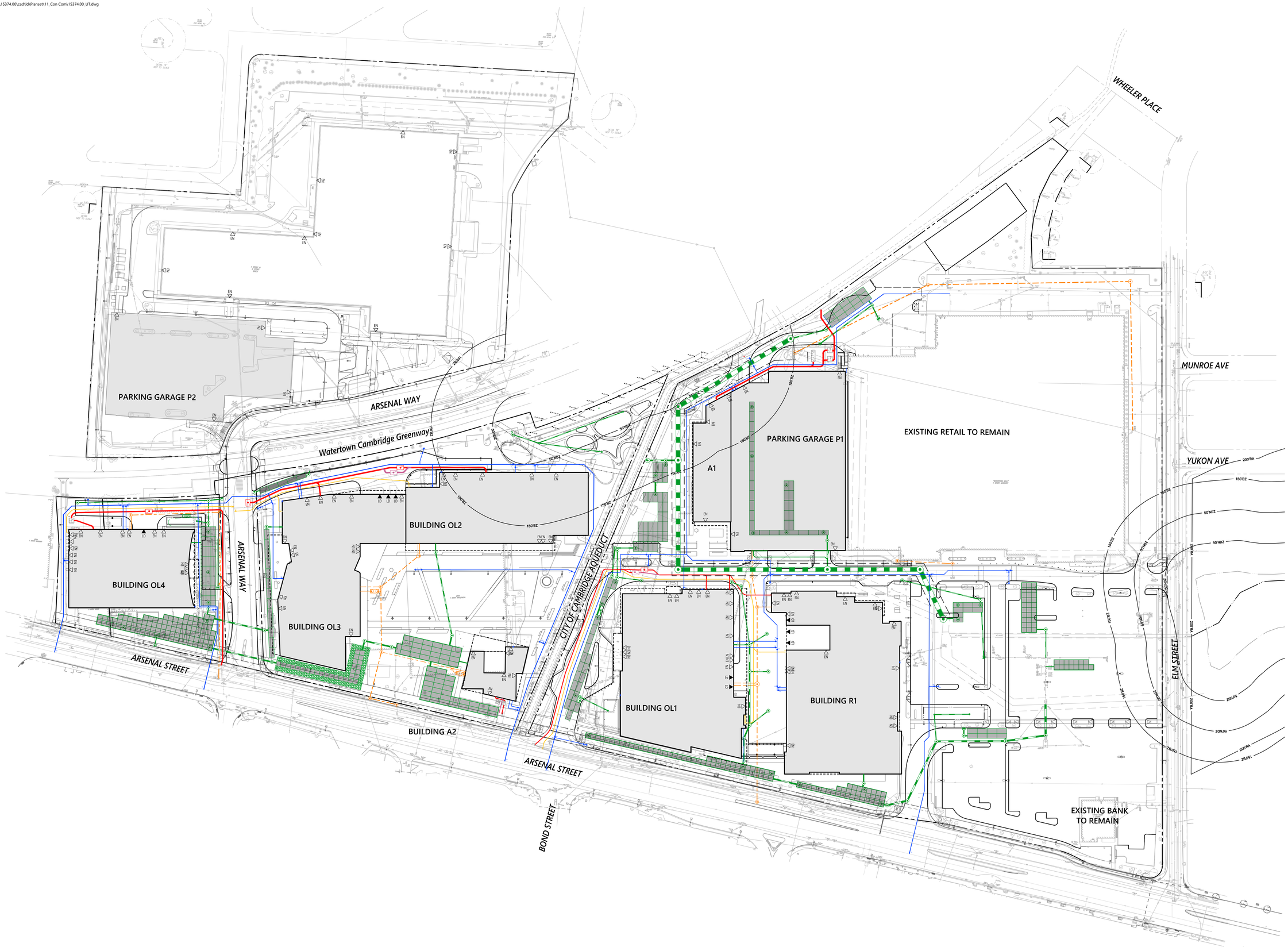

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Watertown Mall Transformation

480-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.
1	MPSP REV	11/03/2023	CPN

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

Drawing Title: Overall Utility Plan

Drawing Number: C7.00

Scale: 1" = 50'

Project Number: 15374.00

COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
CIVIL
No. 46302
PROFESSIONAL ENGINEER
06/28/2024

Saved Wednesday, June 5, 2024 1:53:38 PM WOLZMANN1ANS Plotted Wednesday, June 5, 2024 2:37:04 PM Vanessa Guzman Tang

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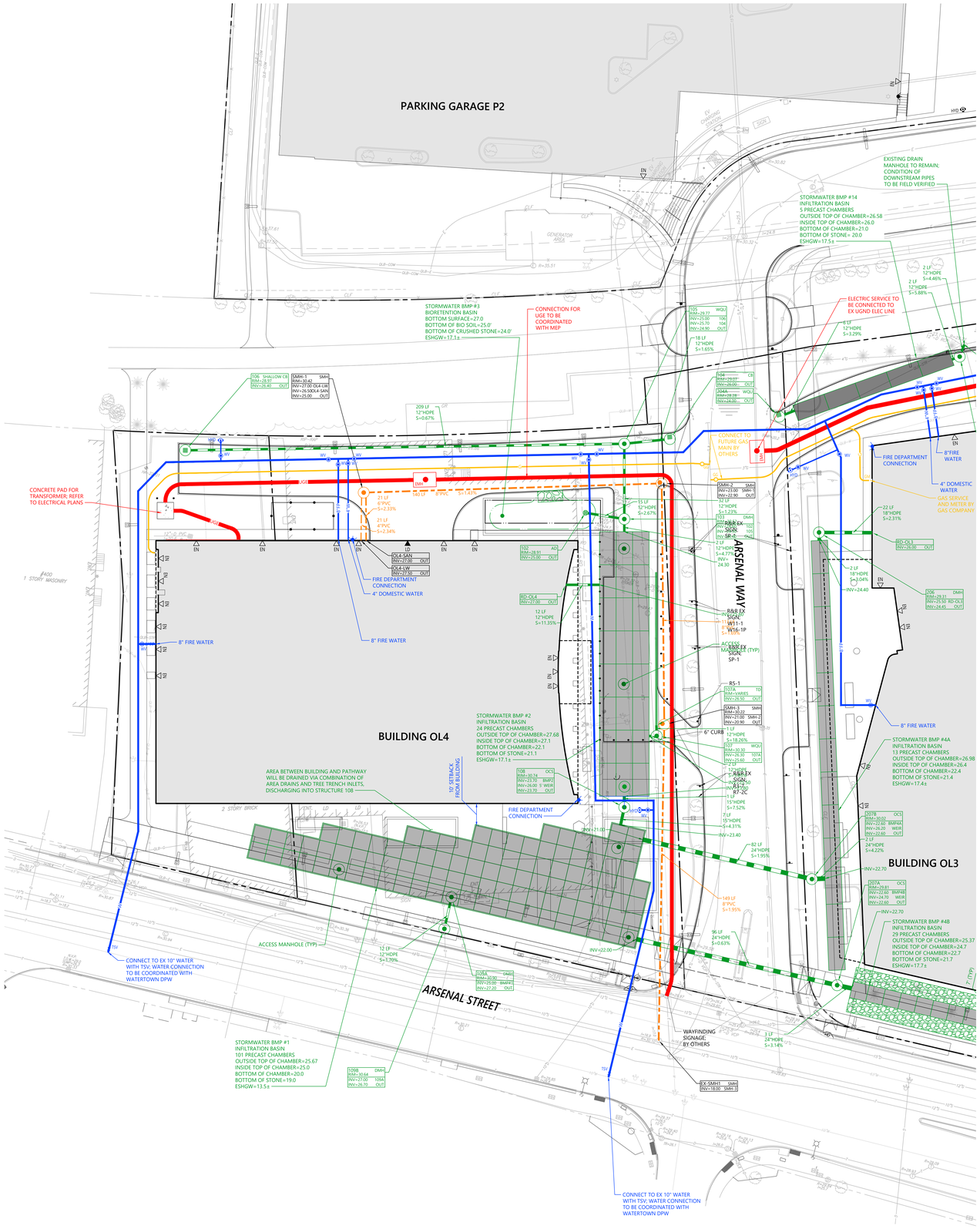

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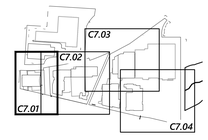

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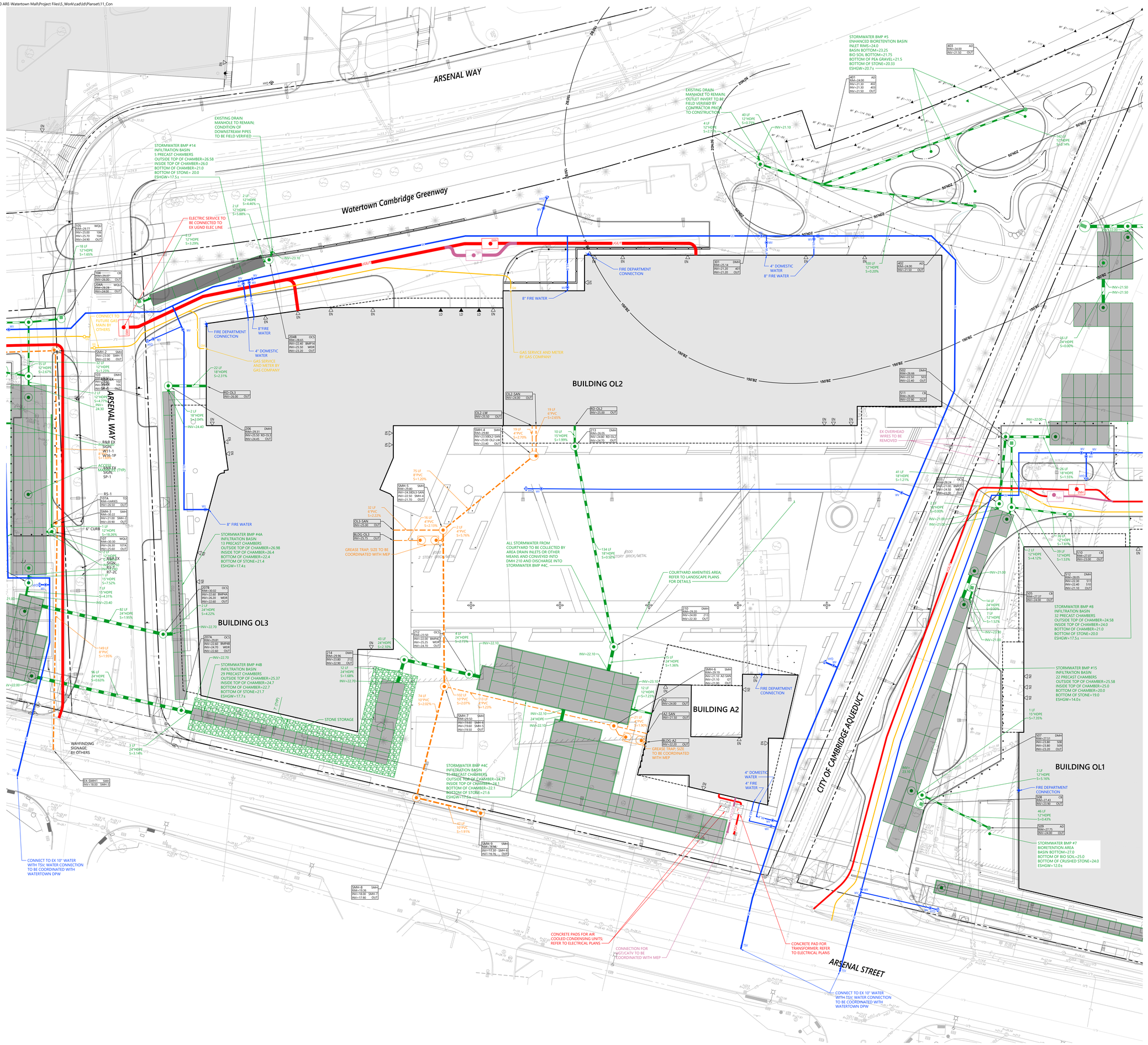

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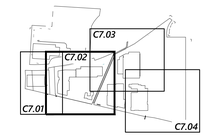

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title
Utility Plan
500 Arsenal Street

Drawing Number
C7.02

Scale
1" = 20'

Project Number
15374.00

COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
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REGISTERED PROFESSIONAL ENGINEER
06/18/2024

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STORMWATER BMP #10
INFILTRATION BASIN
15 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER=21.58
INSIDE TOP OF CHAMBER=21.0
BOTTOM OF CHAMBER=19.0
BOTTOM OF STONE=18.0
ESHGW=15.0±
SOILS BELOW SYSTEM SHALL BE EXCAVATED AND REPLACED TO NATURAL SOILS

STORMWATER BMP #5
ENHANCED BIORETENTION BASIN
INLET RIMS=24.0
BASIN BOTTOM=23.25
BIO SOIL BOTTOM=21.75
BOTTOM OF PEA GRAVEL=21.5
BOTTOM OF STONE=20.33
ESHGW=20.7 ±

STORMWATER BMP #8
INFILTRATION BASIN
32 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER=24.58
INSIDE TOP OF CHAMBER=24.0
BOTTOM OF CHAMBER=21.0
BOTTOM OF STONE=20.0
ESHGW=17.5 ±

STORMWATER BMP #9
INFILTRATION BASIN
31 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER=23.25
INSIDE TOP OF CHAMBER=23.0
BOTTOM OF CHAMBER=20.0
BOTTOM OF STONE=19.0
ESHGW=15.0 ±

STORMWATER BMP #12
SAND FILTER
OUTSIDE TOP OF STRUCTURE=20.08
INSIDE TOP OF STRUCTURE=19.5
TOP OF INTERNAL WEIR=17.5
TOP OF SAND FILTER MEDIA=14.5
INSIDE BOTTOM OF STRUCTURE=11.83
OUTSIDE BOTTOM OF STRUCTURE=11.25

PARKING GARAGE P1

EXISTING RETAIL TO REMAIN

"WATERTOWN MALL"
1 STORY MASONRY

CONNECT TO EX 8" WATER LINE

CONNECT TO EX 6" WATER

RELOCATE EX GENERATOR

EXISTING UTILITIES IN THIS AREA TO BE FIELD VERIFIED BY TEST PITTING PRIOR TO CONSTRUCTION

8" FIRE WATER
4" DOMESTIC WATER

CONCRETE ENCASED ELECTRICAL CONDUITS

FIRE DEPARTMENT CONNECTION

ROOF DRAIN CONNECTIONS INTO BMP TO BE COORDINATED WITH MEP; PRETREATMENT WITH WQU PRIOR TO INLET

TRENCH DRAIN

EX OVERHEAD WIRES TO BE REMOVED

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152 Hampden Street
Boston, MA 02119
617.357.9740

C7.01 C7.02 C7.03 C7.04

Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: Utility Plan 550 Arsenal Street

Drawing Number: C7.03

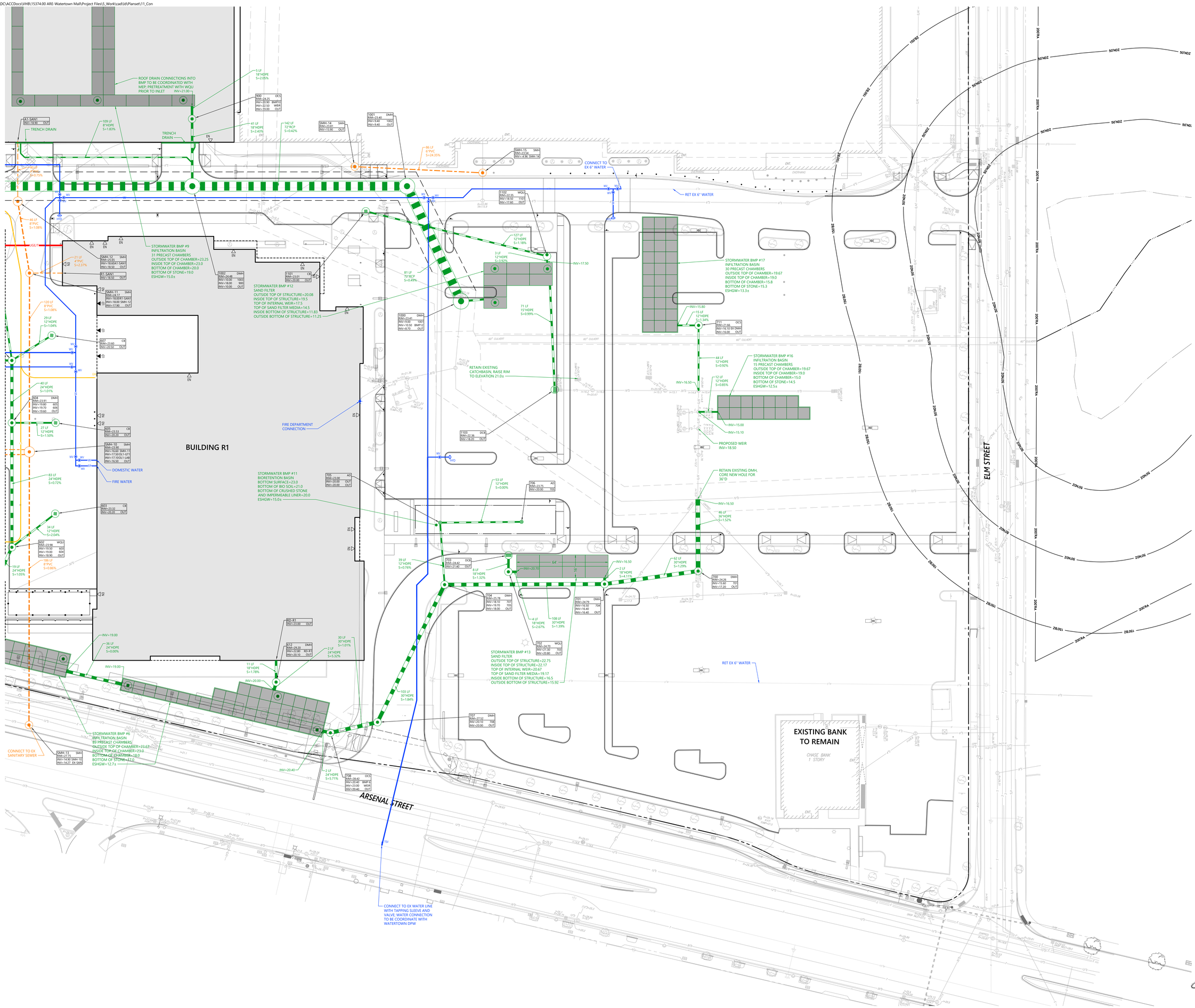
Scale: 1" = 20'

Project Number: 15374.00

COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE — CIVIL — No. 40302 — REGISTERED PROFESSIONAL ENGINEER
06/12/2024

Saved Monday, June 17, 2024 3:52:12 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:05:47 PM Vanessa Guzman Tang

C:\Users\vguzmantang\DC\ACCDocs\VHB\15374.00 ARE-Watertown Mall\Project Files\5_Work\cad\dt\Planset\11_Con Com\15374.00_UT.dwg



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617.923.2422

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617.619.5700

nbbj
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617.378.4800

Höweler+Yoon Architecture
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Third Floor
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617.517.4101

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617.419.2284

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Key
1" = 600'

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by VGT | Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: Utility Plan 550 Arsenal Street

CONOR P. NAGLE CIVIL No. 46302 COMMONWEALTH OF MASSACHUSETTS REGISTERED PROFESSIONAL ENGINEER
06/12/2024

Drawing Number: C7.04

Scale: 1"=20'

Project Number: 15374.00

Saved Monday, June 17, 2024 3:52:12 PM VGUZMANTANG Plotted Monday, June 17, 2024 4:06:37 PM Vanessa Guzman Tang

DETAIL "A"
NOT TO SCALE

DETAIL "B"
NOT TO SCALE

CONNECT TO
EX WATER LINE

LIMIT OF WORK

EX-SMH
RIM=34.10
INV=25.00 SMH-2
INV=25.00 OUT

SMH-2
RIM=34.18
INV=26.50 SMH-1
INV=26.40 OUT

SMH-1
RIM=33.35
INV=27.50 BLDG
INV=27.40 OUT

23 LF
12"HDPE
S=0.00%

110
RIM=32.60 AD
INV=27.00 OUT

109
RIM=32.60 AD
INV=27.00 110
INV=27.00 OUT

108
RIM=33.70 DMH
INV=26.80 109
INV=26.70 OUT

107 C8
RIM=32.80
INV=27.50 OUT

AREA FOR RELOCATED GENERATORS; CONDUIT ROUTING TO BE CONFIRMED BY MEP

CONCRETE PAD FOR GENERATOR

SITE ELECTRICAL ROUTING SUBJECT TO FURTHER COORDINATION WITH UTILITY COMPANY AND MEP

RELOCATED ELEC EQUIPMENT; CONDUIT ROUTING TO BE CONFIRMED BY MEP

CONCRETE PAD FOR GARAGE TRANSFORMER

ELECTRICAL CONDUITS; CONNECTION TO BE COORDINATED WITH MEP

STORMWATER BMP #3
BIORETENTION BASIN

14 LF
15"HDPE
S=1.46%

STORMWATER BMP #6
SUBSURFACE INFILTRATION SYSTEM
8 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 27.57
INSIDE TOP OF CHAMBER = 26.90
BOTTOM OF CHAMBER= 23.40
BOTTOM OF STONE = 22.40
ESHGW = 18.4±

5 LF
12"HDPE
S=3.66%

106 OCS
RIM=33.10
INV=25.90 BMP#6
INV=25.90 WEIR
INV=25.90 OUT

INV=26.00

CONNECT TO
EX WATER LINE

93 LF
24"HDPE
S=0.97%

480 Arsenal (Existing)

602 DMH
RIM=29.25
INV=26.80 601
INV=26.70 OUT

101 DMH
RIM=33.80
INV=23.00 102
INV=22.90 OUT

100 DMH
RIM=33.50
INV=22.50 101
INV=22.45 OUT

22 LF
24"HDPE
S=1.81%

118 LF
15"HDPE
S=1.02%

603 DMH
RIM=34.90
INV=28.00 EX RD
INV=28.00 OUT

EX ROOF DRAIN INVERT AT THIS LOCATION TO BE CONFIRMED BY CONTRACTOR PRIOR TO CONSTRUCTION

ELECTRIC/TEL CONDUIT CONNECTION TO BIKE PARKING STRUCTURE

STORMWATER BMP #1
SUBSURFACE INFILTRATION SYSTEM
28 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 24.98
INSIDE TOP OF CHAMBER = 25.40
BOTTOM OF CHAMBER= 22.40
BOTTOM OF STONE = 21.40
ESHGW = 18.4±
SOILS BELOW SYSTEM SHALL BE EXCAVATED AND REPLACED TO GLACIAL SAND/ TILL LAYER

CONNECT TO
EX WATER LINE

104 WQU
RIM=33.20
INV=25.90 105
INV=25.10 OUT

105 CB
RIM=33.10
INV=30.00 OUT

21 LF
12"HDPE
S=4.29%

111 LF
18"HDPE
S=0.99%

5 LF
15"HDPE
S=4.38%

6 LF
15"HDPE
S=3.29%

PARKING GARAGE P2

GGI(S-1 DMH
RIM=34.10
INV=28.80 GARAGE
INV=28.70 OUT

GAS, OIL AND SAND INTERCEPTOR, REFER TO MEP PLANS FOR DETAIL

GARAGE
INV=29.00 OUT

83 LF
15"HDPE
S=0.97%

INV=25.10

103 DMH
RIM=34.20
INV=24.90 104
INV=28.60 EX RD
INV=28.50 GGI(S-1
INV=23.90 OUT

58 LF
15"HDPE
S=1.03%

102 WQU
RIM=33.50
INV=25.00 OUT

ACCESS MANHOLE FOR MAINTENANCE (TYP)

INV=26.10

11 LF
12"HDPE
S=6.17%

2 LF
24"HDPE
S=2.56%

INV=22.40

STORMWATER BMP #5
SUBSURFACE INFILTRATION SYSTEM
46 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 30.07
INSIDE TOP OF CHAMBER = 29.40
BOTTOM OF CHAMBER= 22.40
BOTTOM OF STONE = 21.40
ESHGW = 18.4±

INV=24.00
10 LF
24"HDPE
S=0.00%
INV=24.00

8" FIRE WATER
4" DOMESTIC WATER

STORMWATER BMP #4
BIORETENTION BASIN

401 AD
RIM=32.65
INV=28.00 OUT

INV=
28.70

40 LF
12"HDPE
S=0.75%

INV=24.00
33 LF
24"HDPE
S=0.00%

INV=24.50

9 LF
12"HDPE
S=5.33%

INV=25.48

2 LF
6"HDPE
S=0.83%

6 LF
6"HDPE
S=5.19%

602 TO
RIM=33.80
INV=29.80 OUT

600 WQU
RIM=33.20
INV=29.50 601
INV=27.50 601
INV=25.00 OUT

ARSENAL WAY

14 LF
6"HDPE
S=3.66%

501 OCS
RIM=32.20
INV=25.40 WEIR
INV=24.00 BMP#4
INV=24.00 OUT

601 AD
RIM=31.50
INV=28.00 OUT

24 LF
12"HDPE
S=2.08%

706 OCS
RIM=34.80
INV=27.40 BMP#5
INV=26.40 WEIR
INV=23.40 OUT

105 TO
RIM=31.50
INV=28.00 OUT

704 WQU
RIM=35.50
INV=27.00 705
INV=23.50 OUT

700 WQU
RIM=33.50
INV=29.00 701
INV=27.00 705
INV=23.50 OUT

701 CO
RIM=33.34
INV=29.50 702
INV=29.40 OUT

702 AD
RIM=33.80
INV=30.00 OUT

27 LF
12"HDPE
S=1.87%

500 DMH
RIM=32.05
INV=25.50 501
INV=25.50 OUT

300 WQU
RIM=31.15
INV=25.00 OUT

59 LF
30"HDPE
S=1.19%

FIRE DEPARTMENT CONNECTION

EX TRANSFORMERS, CABINETS, AND METER TO BE RELOCATED IN COORDINATION WITH UTILITY PROVIDER

PRIOR TO CONSTRUCTION, CONTRACTOR TO TEST PIT FOR EX UTILITY DEPTHS ALONG PROPOSED UTILITIES WITHIN ARSENAL WAY TO CONFIRM INVERTS

500 DMH
RIM=30.44
INV=23.90 501

10 LF
8"HDPE
S=4.02%

28 LF
8"HDPE
S=1.92%

25 LF
12"HDPE
S=0.40%

8"HDPE
S=1.89%

43 LF
8"HDPE
S=1.92%

AD

RET EX HYDRANT

103 TO
RIM=31.54
INV=28.00 OUT

STORMWATER BMP #2
SUBSURFACE INFILTRATION SYSTEM
12 PRECAST CHAMBERS
OUTSIDE TOP OF CHAMBER = 29.07
INSIDE TOP OF CHAMBER = 28.40
BOTTOM OF CHAMBER= 23.40
BOTTOM OF STONE = 22.40
ESHGW = 18.4±
SOILS BELOW SYSTEM SHALL BE EXCAVATED AND REPLACED TO GLACIAL SAND/TILL LAYER

WOOD SOUND BARRIER WALL

EXISTING UTILITY EASEMENT
BOOK 14161, PAGE 196

TREE GRATE

SHED

1 STORY & 2 STORY BRICK

SB/DH FOUND HELD

IRON ROD FOUND

S89°36'43"W
451.22'

TRANS

EXISTING UTILITY EASEMENT 93-106
BOOK 14161, PAGE 196

COMMON AREA CONNECTING EASEMENT ACCESS AND UTILITY EASEMENT 3 BOOK 33088, PAGE 507

Watertown Cambridge Greenway

Z8/05

Z9/05

Z10/05

Z11/05

Z12/05

Z13/05

Z14/05

Z15/05

Z16/05

Z17/05

Z18/05

Z19/05

Z20/05

Z21/05

Z22/05

50'NOZ

0 10 20 40 Feet

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT
Checked by: CPN

Issued for: Notice of Intent
Date: 06/07/2024

Not Issued for Construction

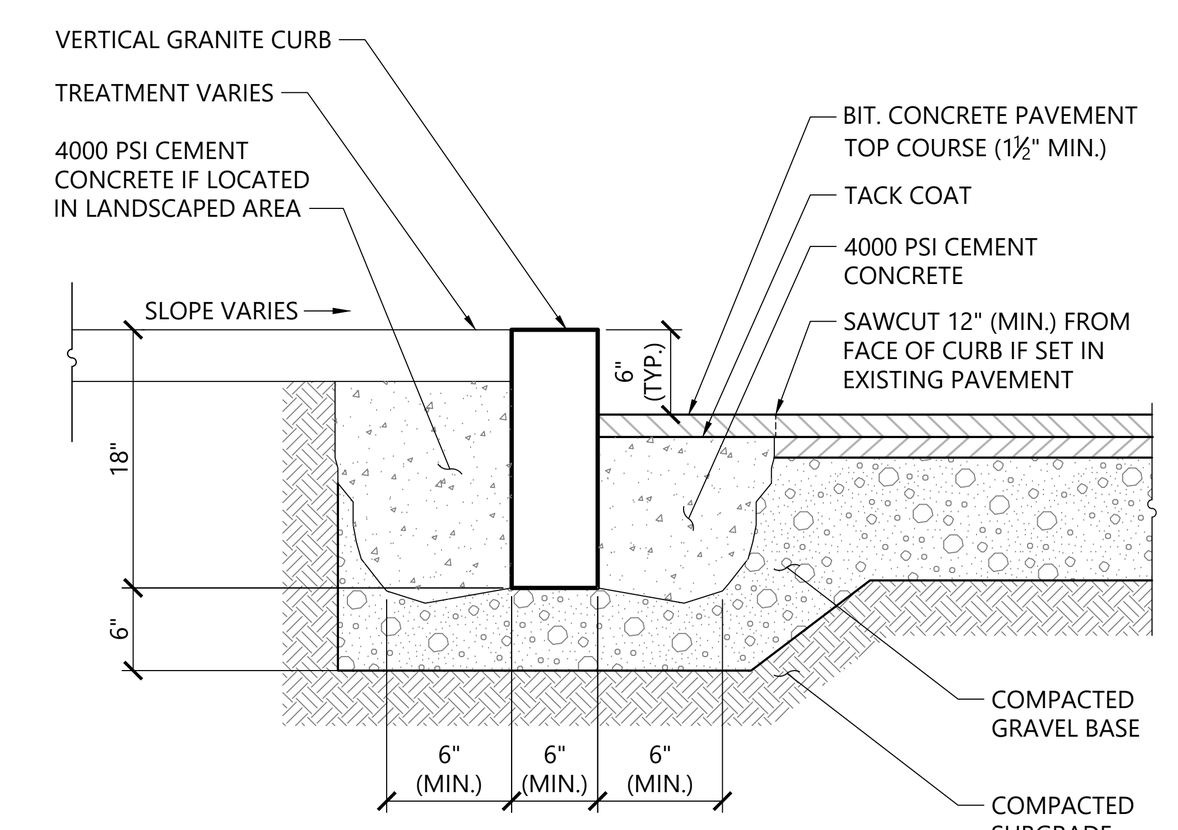
Drawing Title:
Utility Plan
480 Arsenal Way

Drawing Number: C7.05

Scale: 1" = 20'

Project Number: 15374.00

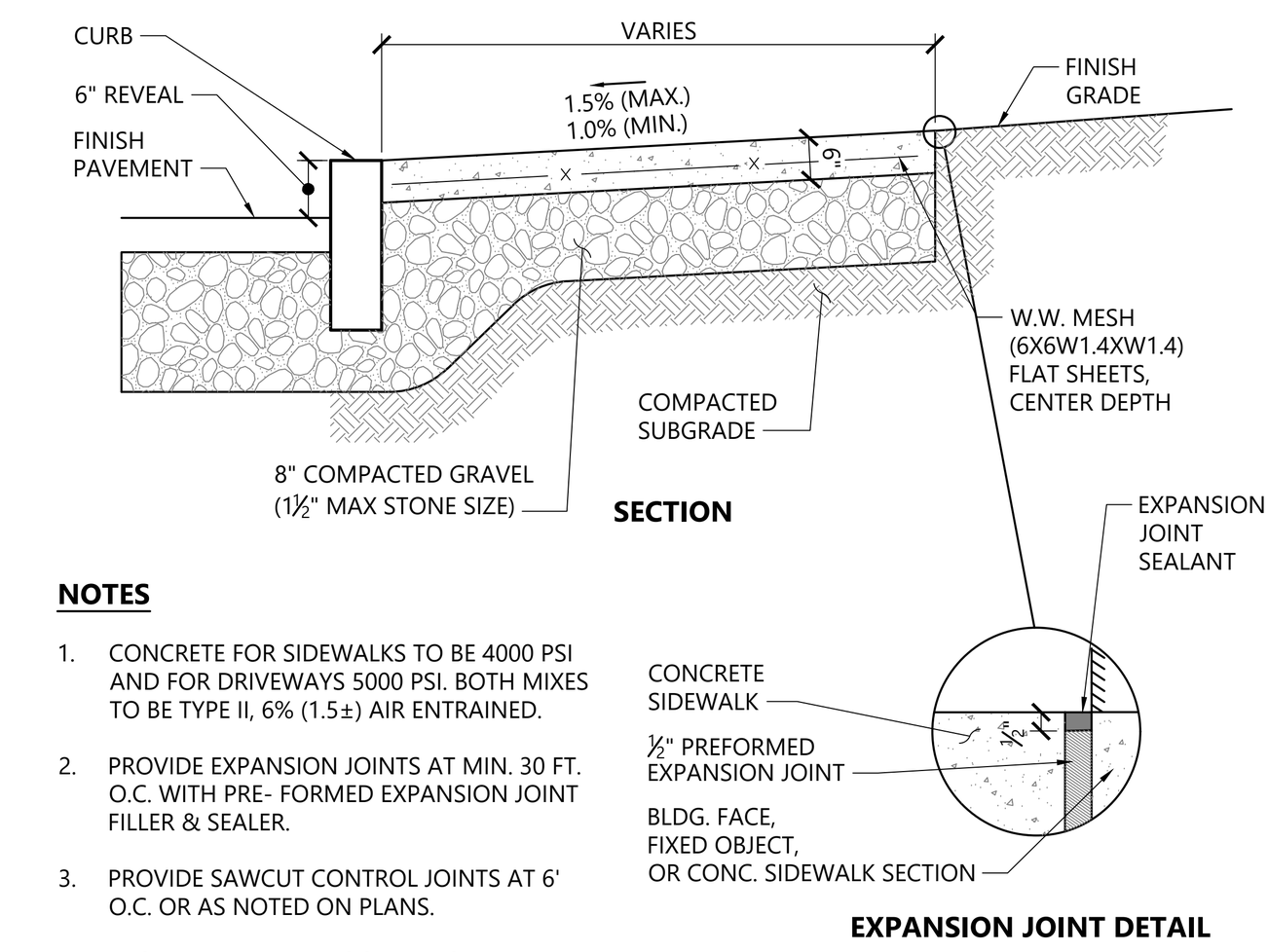
CONOR P. NAGLE
CIVIL
No. 46302
COMMONWEALTH OF MASSACHUSETTS
REGISTERED PROFESSIONAL ENGINEER
06/13/2024



Vertical Granite Curb (VGC)

3/20

N.T.S. Source: VHB LD_402



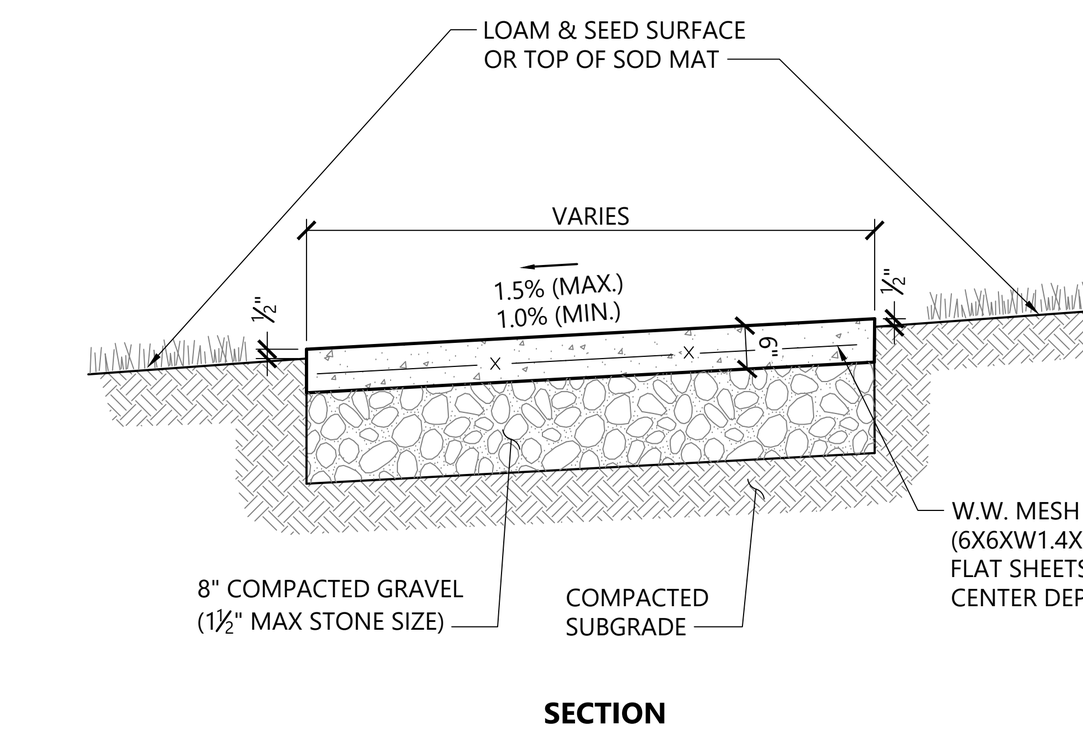
NOTES

1. CONCRETE FOR SIDEWALKS TO BE 4000 PSI AND FOR DRIVEWAYS 5000 PSI. BOTH MIXES TO BE TYPE II, 6% (1.5±) AIR ENTRAINED.
2. PROVIDE EXPANSION JOINTS AT MIN. 30 FT. O.C. WITH PRE- FORMED EXPANSION JOINT FILLER & SEALER.
3. PROVIDE SAWCUT CONTROL JOINTS AT 6' O.C. OR AS NOTED ON PLANS.
4. PROVIDE MEDIUM BROOM FINISH IN DIRECTION PERPENDICULAR TO CURB.
5. ALL EXPOSED CONCRETE SURFACES SHALL BE SEALED WITH A SILANE-SILOXANE PRODUCT.

Concrete Sidewalk

3/20

N.T.S. Source: VHB LD_420



NOTES

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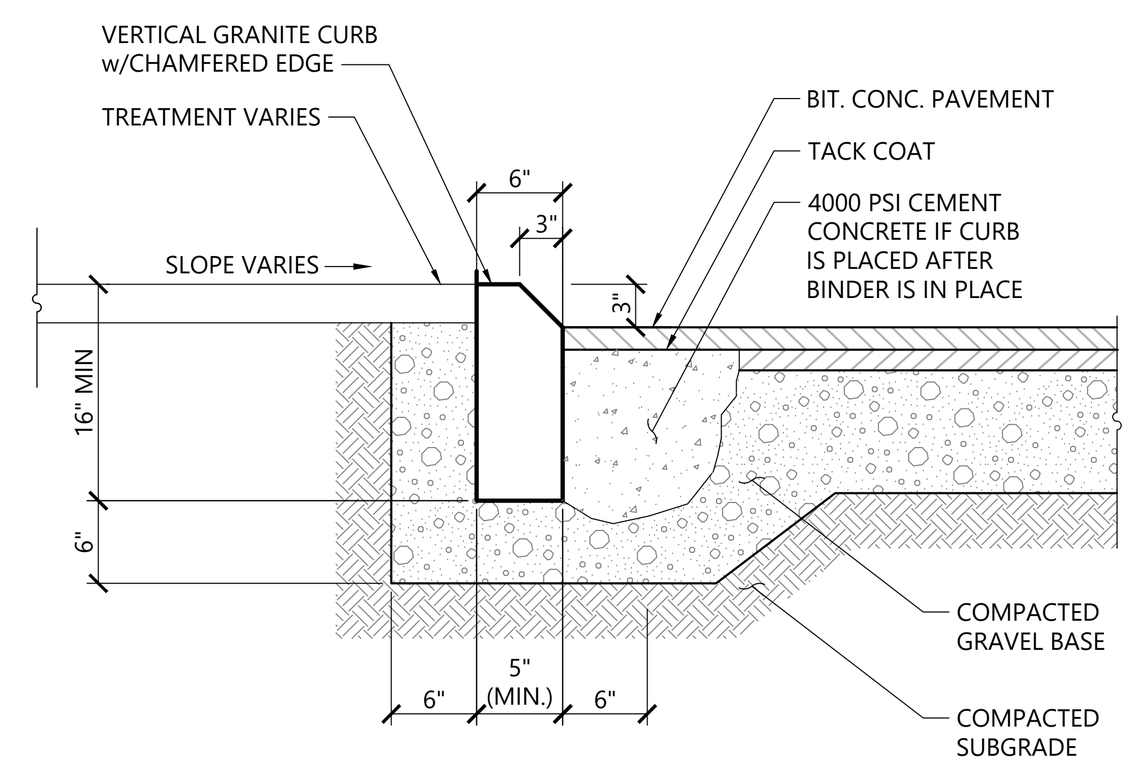
2. PROVIDE EXPANSION JOINTS AT MIN. 30 FT. O.C. WITH PRE- FORMED EXPANSION JOINT FILLER & SEALER.
3. PROVIDE SAWCUT CONTROL JOINTS AT 6' O.C. OR AS NOTED ON PLANS.
4. PROVIDE MEDIUM BROOM FINISH IN DIRECTION PERPENDICULAR TO CURB.
5. ALL EXPOSED CONCRETE SURFACES SHALL BE SEALED WITH A SILANE-SILOXANE PRODUCT.

Concrete Sidewalk in Landscape Area

3/21

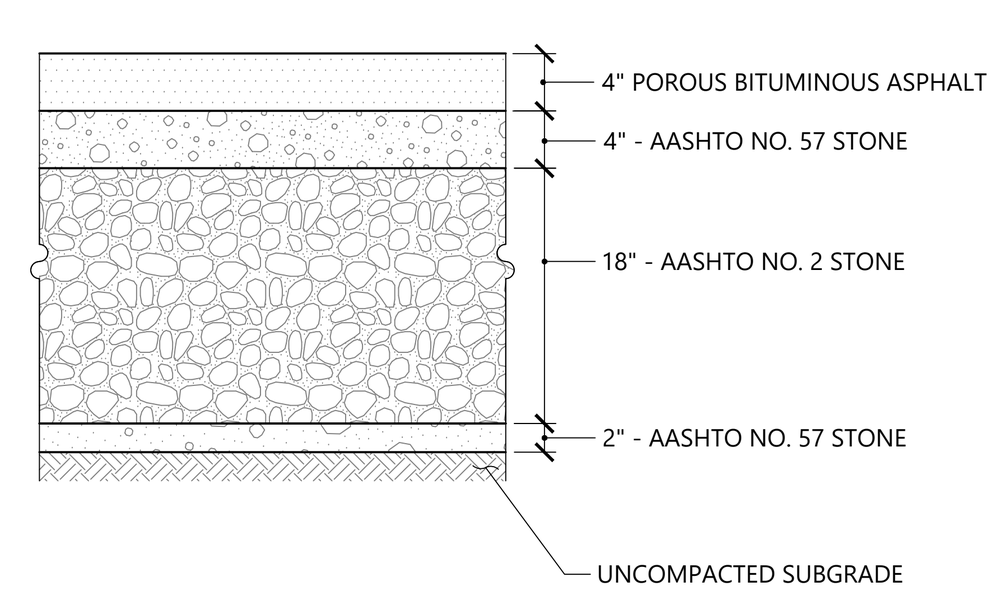
N.T.S. Source: VHB LD_426



Mountable Granite Curb

1/17

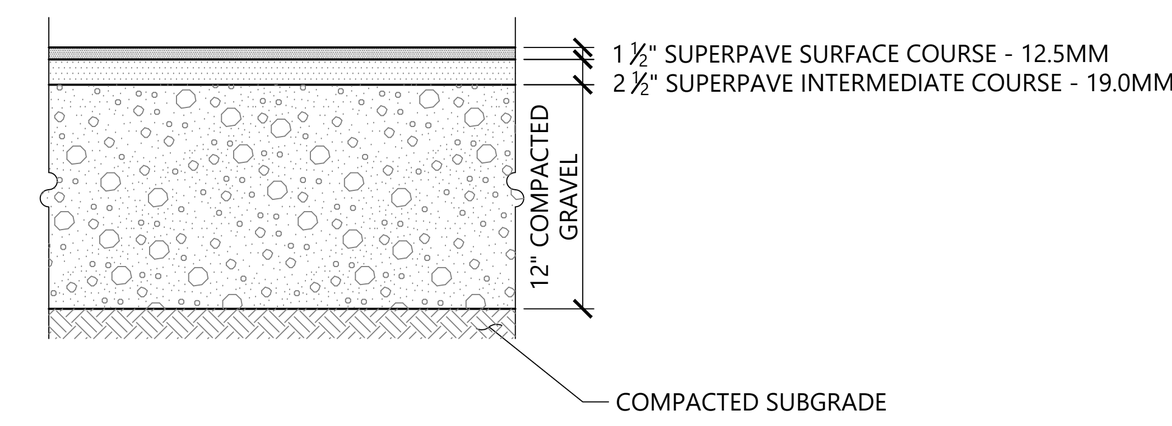
N.T.S. Source: VHB REV LD_402-Mountable



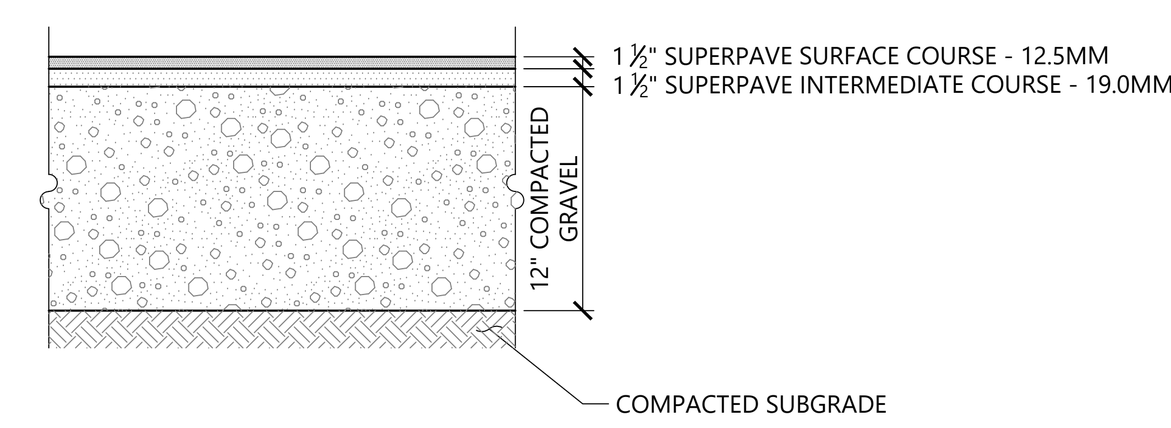
Porous Bituminous Asphalt Pavement Section

10/20

N.T.S. Source: VHB



HEAVY DUTY FLEXIBLE PAVEMENT



STANDARD DUTY FLEXIBLE PAVEMENT

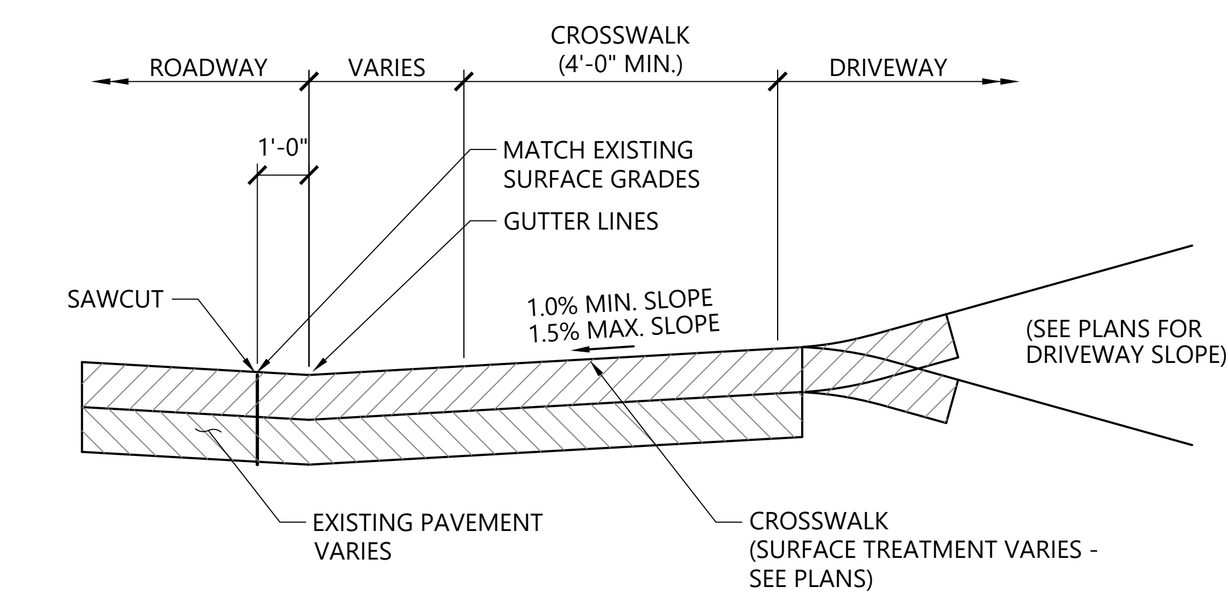
NOTES

PAVEMENT SECTIONS ARE SUBJECT TO CHANGE AND WILL BE BASED ON THE RESULTS OF FURTHER GEOTECHNICAL INVESTIGATIONS.

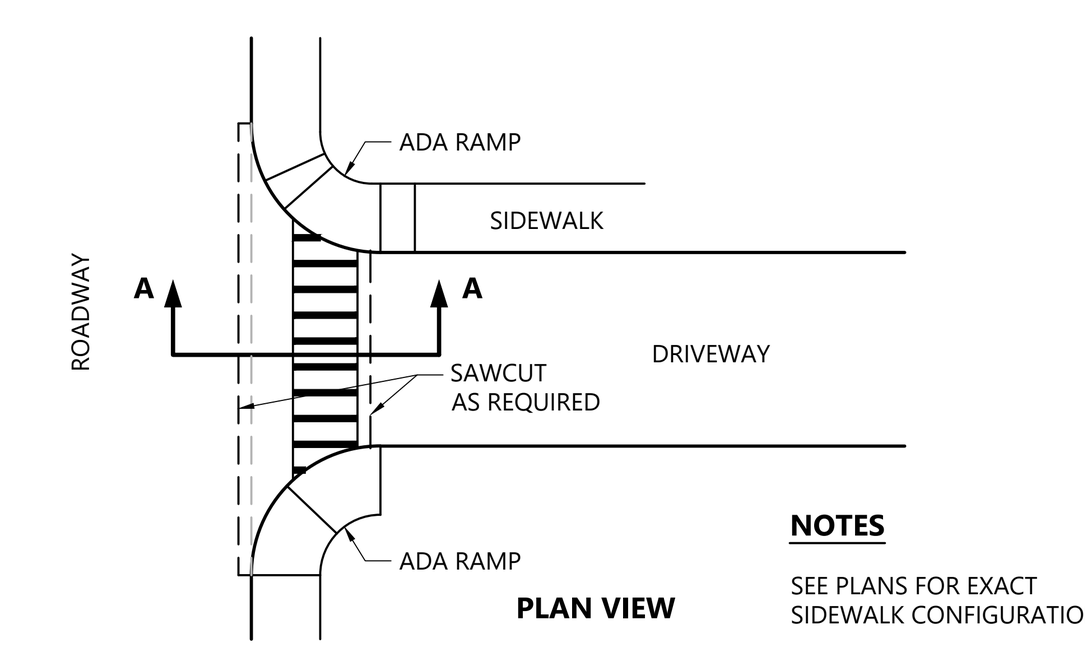
Bituminous Concrete Pavement Sections

11/19

N.T.S. Source: VHB LD_430



SECTION A-A



PLAN VIEW

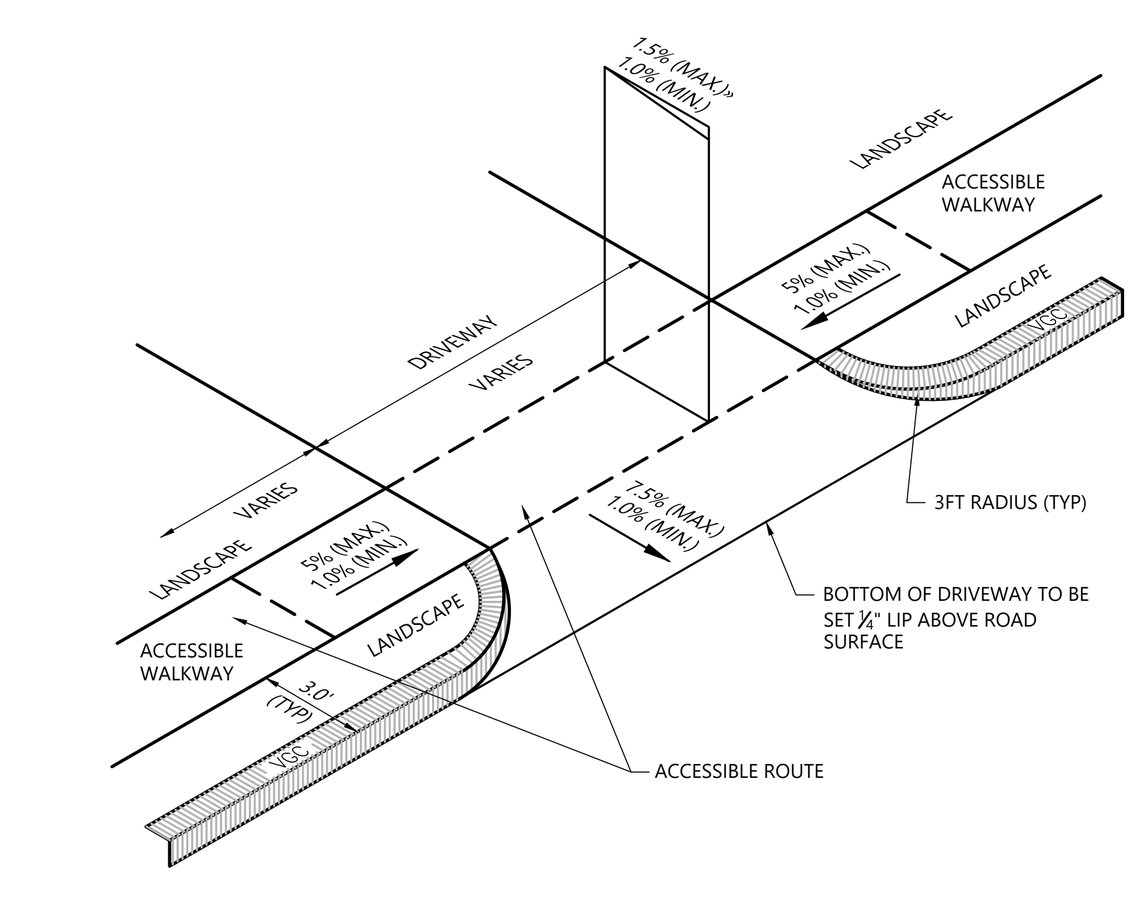
NOTES

SEE PLANS FOR EXACT SIDEWALK CONFIGURATION

Driveway Entrance/Crosswalk Section Detail

1/16

N.T.S. Source: VHB LD_423



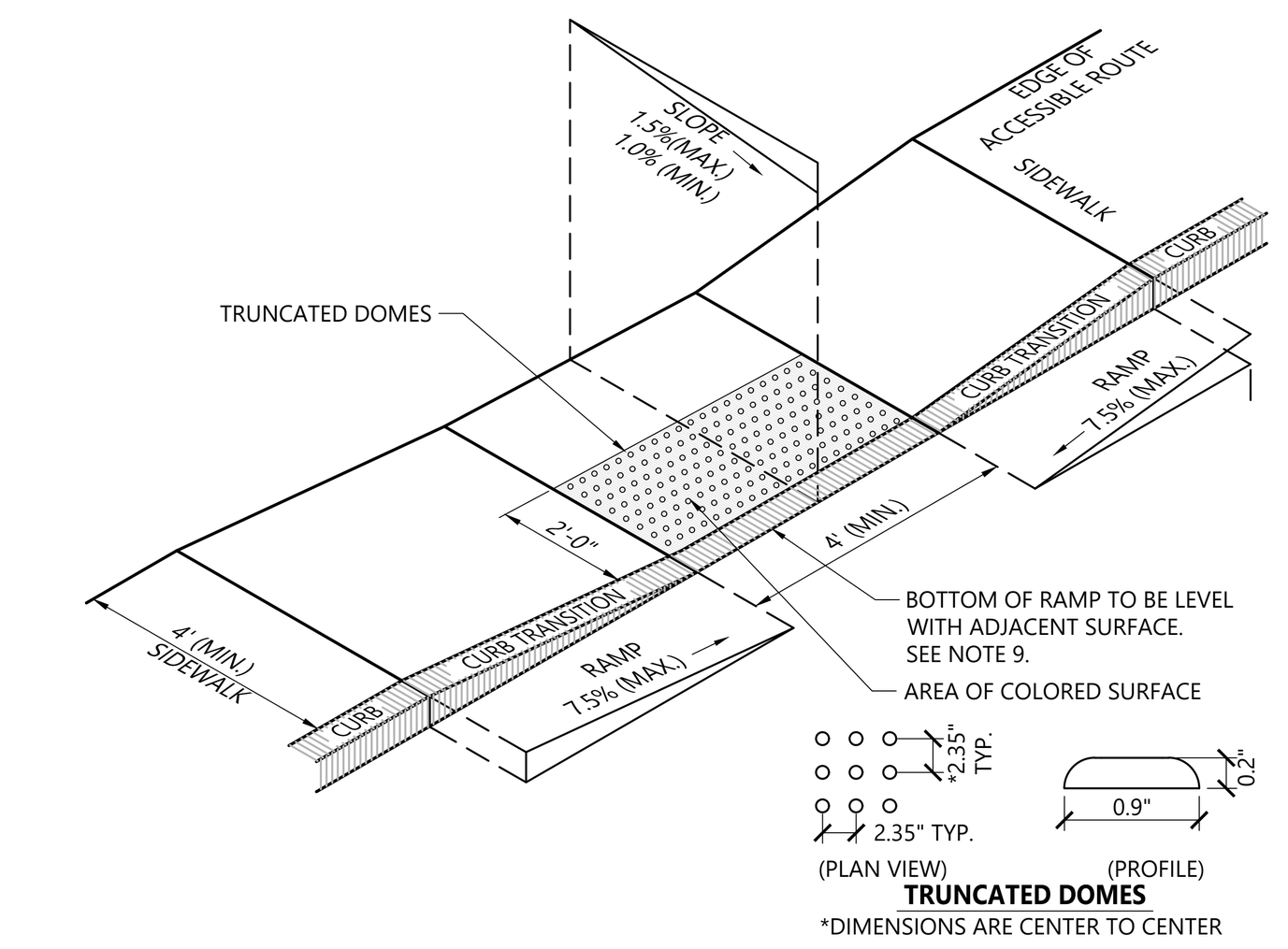
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.

Sidewalk Through Driveway

12/04

N.T.S. Source: VHB



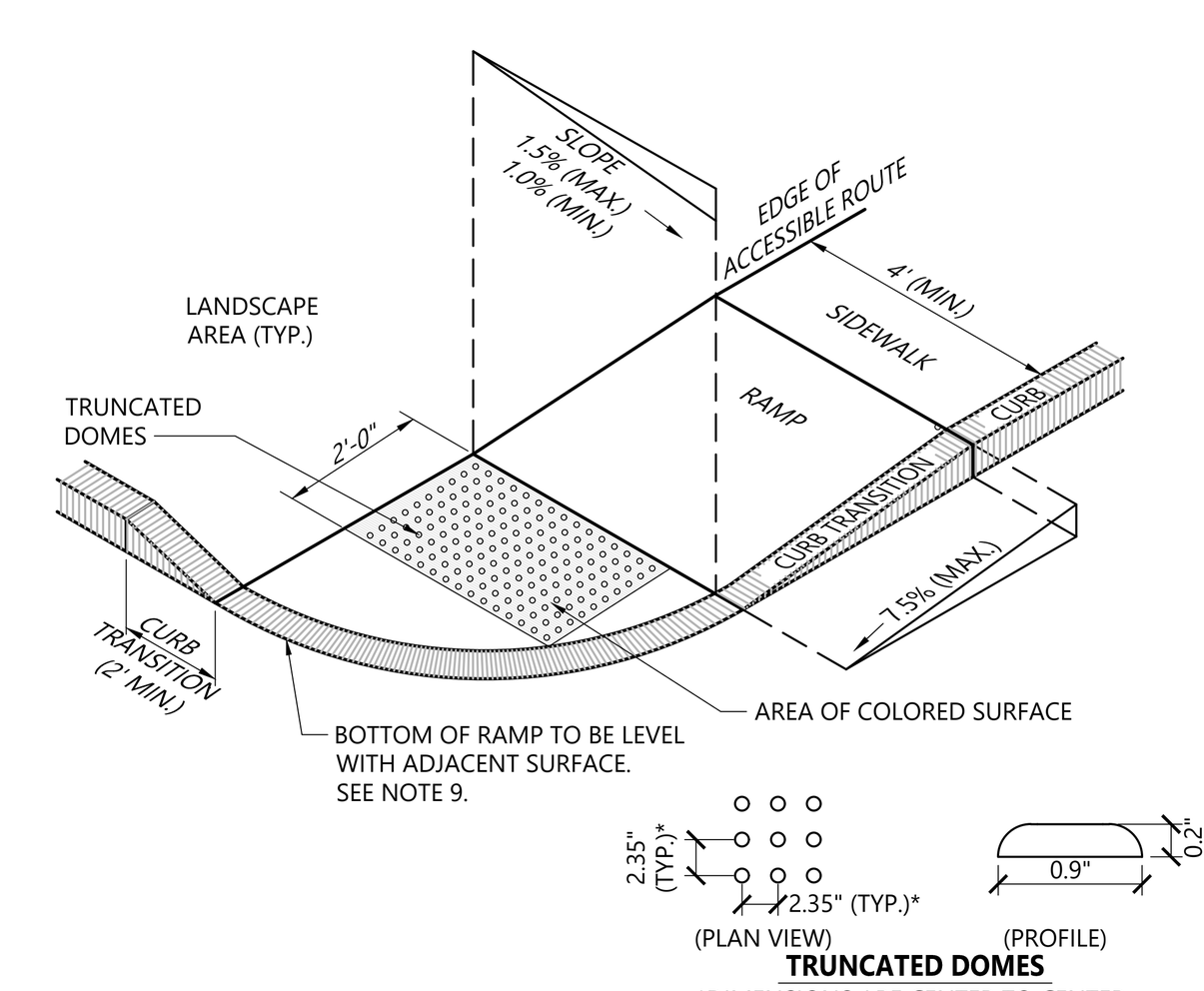
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE AT CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. RAMP, CURB, AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE CURBING AT RAMP (OTHER THAN VERTICAL CURBING, WHICH SHALL BE SET FLUSH) WHERE IT ABUTS ROADWAY.
10. DETECTABLE WARNINGS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES.
11. DETECTABLE WARNINGS SHALL BE INSTALLED PERPENDICULAR TO ACCESSIBLE ROUTE.

Accessible Curb Ramp (ACR) Type 'A-D'

12/20

N.T.S. Source: VHB LD_500



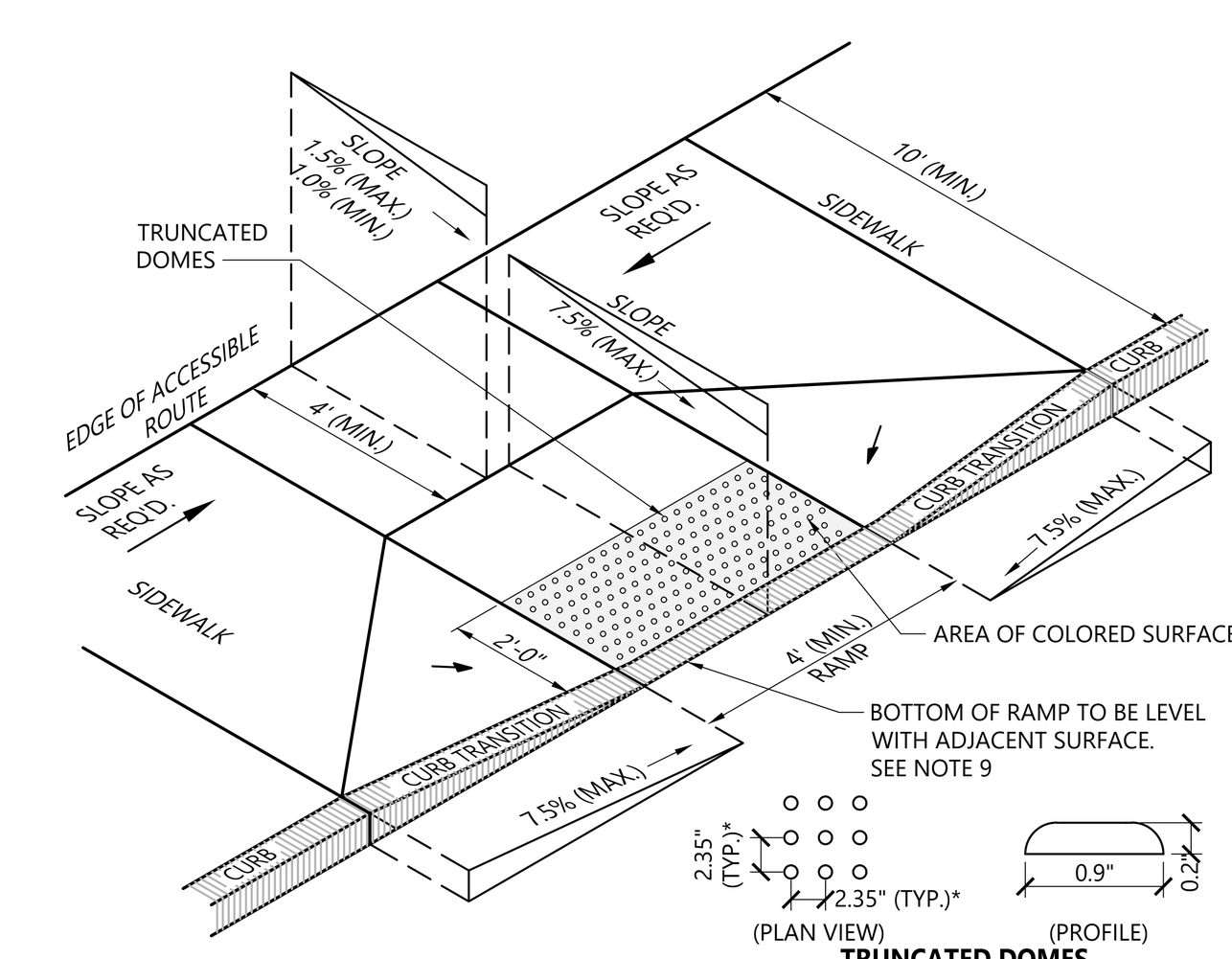
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE AT CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE CURBING AT RAMP WHERE IT ABUTS ROADWAY, EXCEPT WHERE VERTICAL CURBING IS INDICATED ON THE DRAWINGS TO BE INSTALLED AND SET FLUSH.
10. DETECTABLE WARNINGS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES.
11. DETECTABLE WARNINGS SHALL BE INSTALLED PERPENDICULAR TO THE ACCESSIBLE ROUTE.
12. CONTRACTOR TO SUBMIT R.F.I. FOR THIS TYPE OF ACCESSIBLE CURB RAMP FOR APEX ROADWAY CROSSINGS.

Accessible Curb Ramp (ACR) - Type 'B-D'

12/20

N.T.S. Source: VHB LD_501



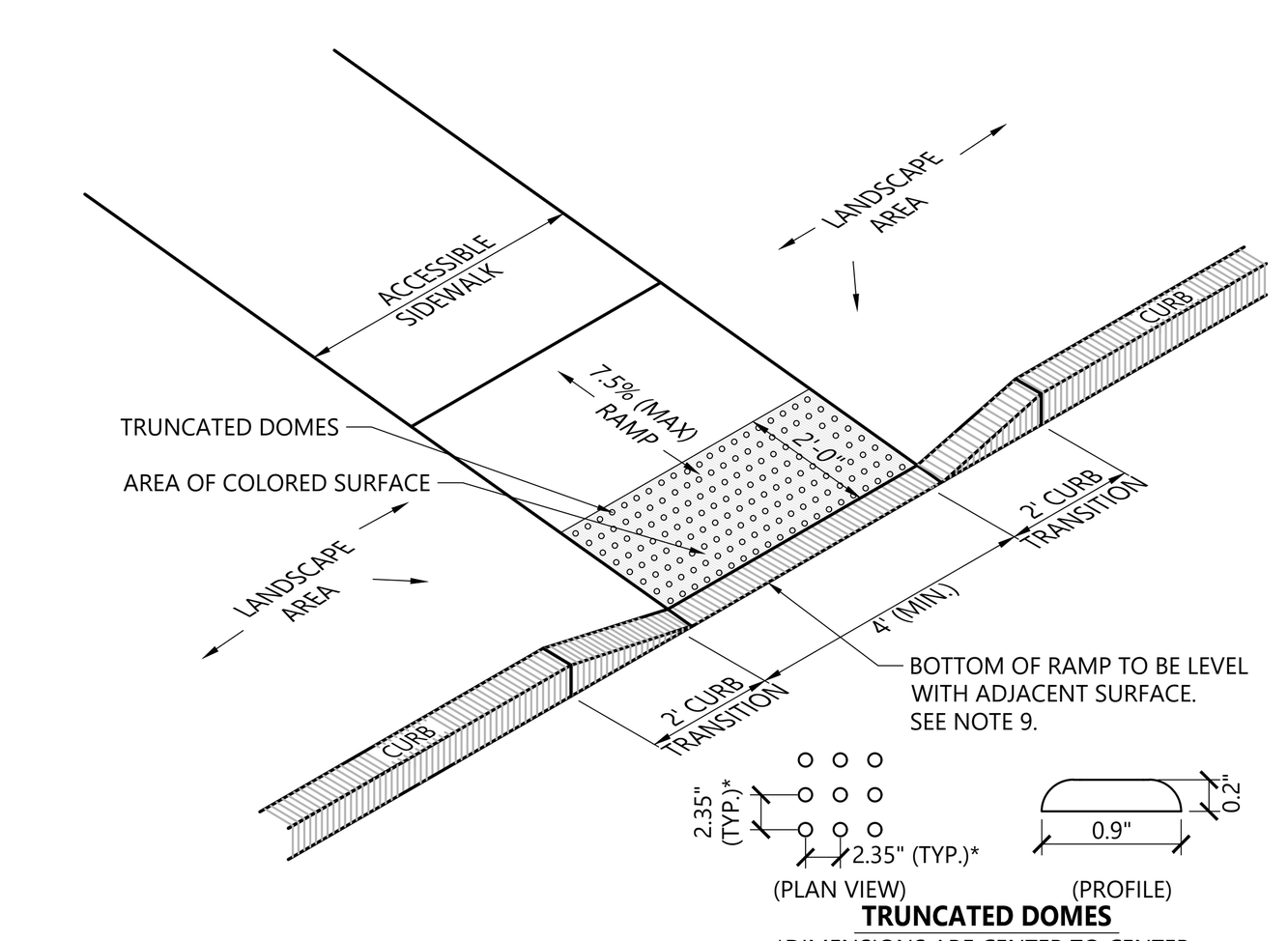
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE AT CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE CURBING AT RAMP WHERE IT ABUTS ROADWAY, EXCEPT WHERE VERTICAL CURBING IS INDICATED ON THE DRAWINGS TO BE INSTALLED AND SET FLUSH.
10. DETECTABLE WARNINGS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES.
11. DETECTABLE WARNINGS SHALL BE INSTALLED PERPENDICULAR TO THE ACCESSIBLE ROUTE.

Accessible Curb Ramp (ACR) Type 'D-D'

12/20

N.T.S. Source: VHB LD_503



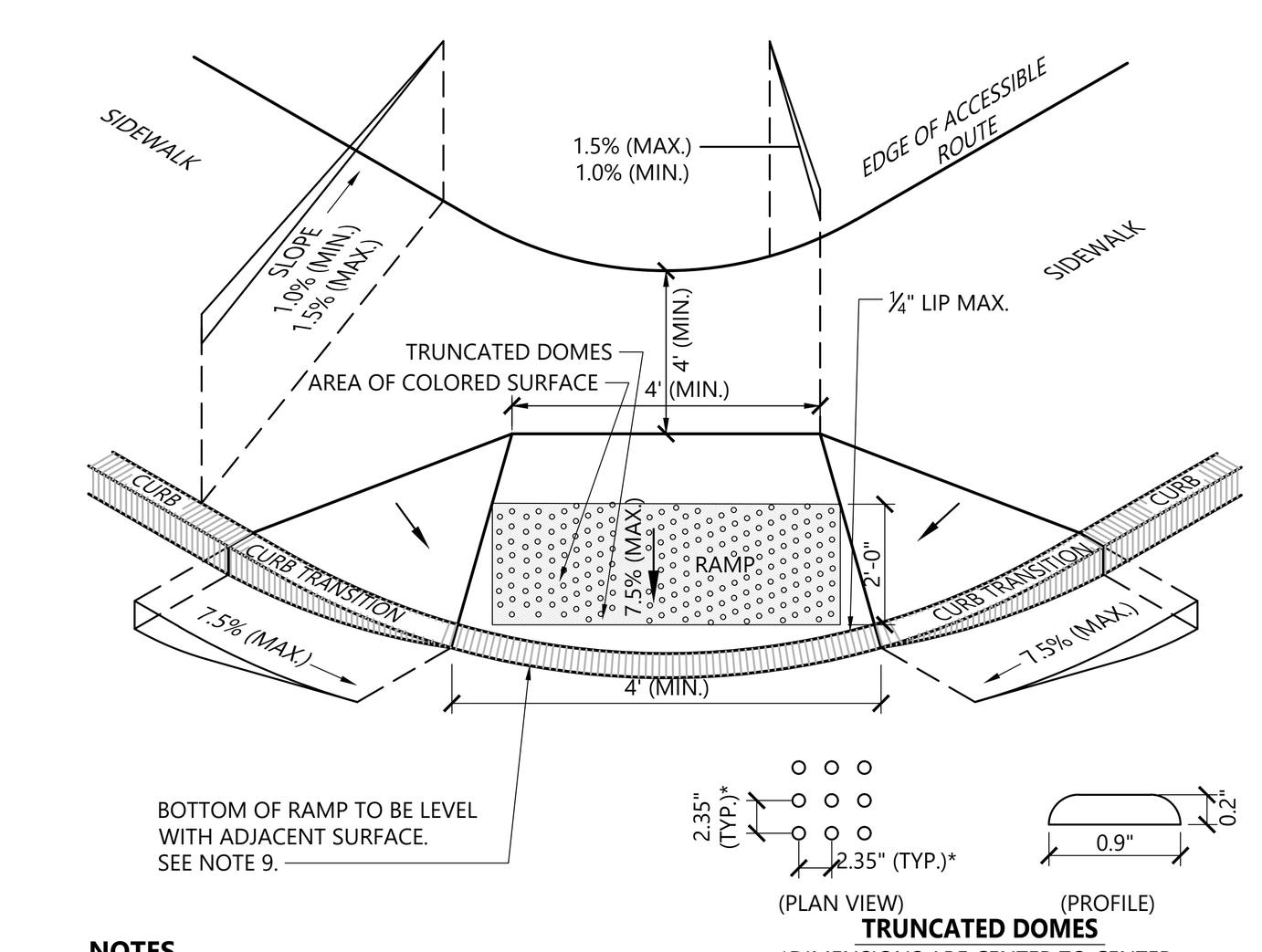
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE AT CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE CURBING (OTHER THAN VERTICAL CURBING, WHICH SHALL BE SET FLUSH) WHERE IT ABUTS ROADWAYS.
10. DETECTABLE WARNINGS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES.
11. DETECTABLE WARNINGS SHALL BE INSTALLED PERPENDICULAR TO THE ACCESSIBLE ROUTE.

Accessible Curb Ramp (ACR) Type 'M-D'

12/20

N.T.S. Source: VHB LD_512



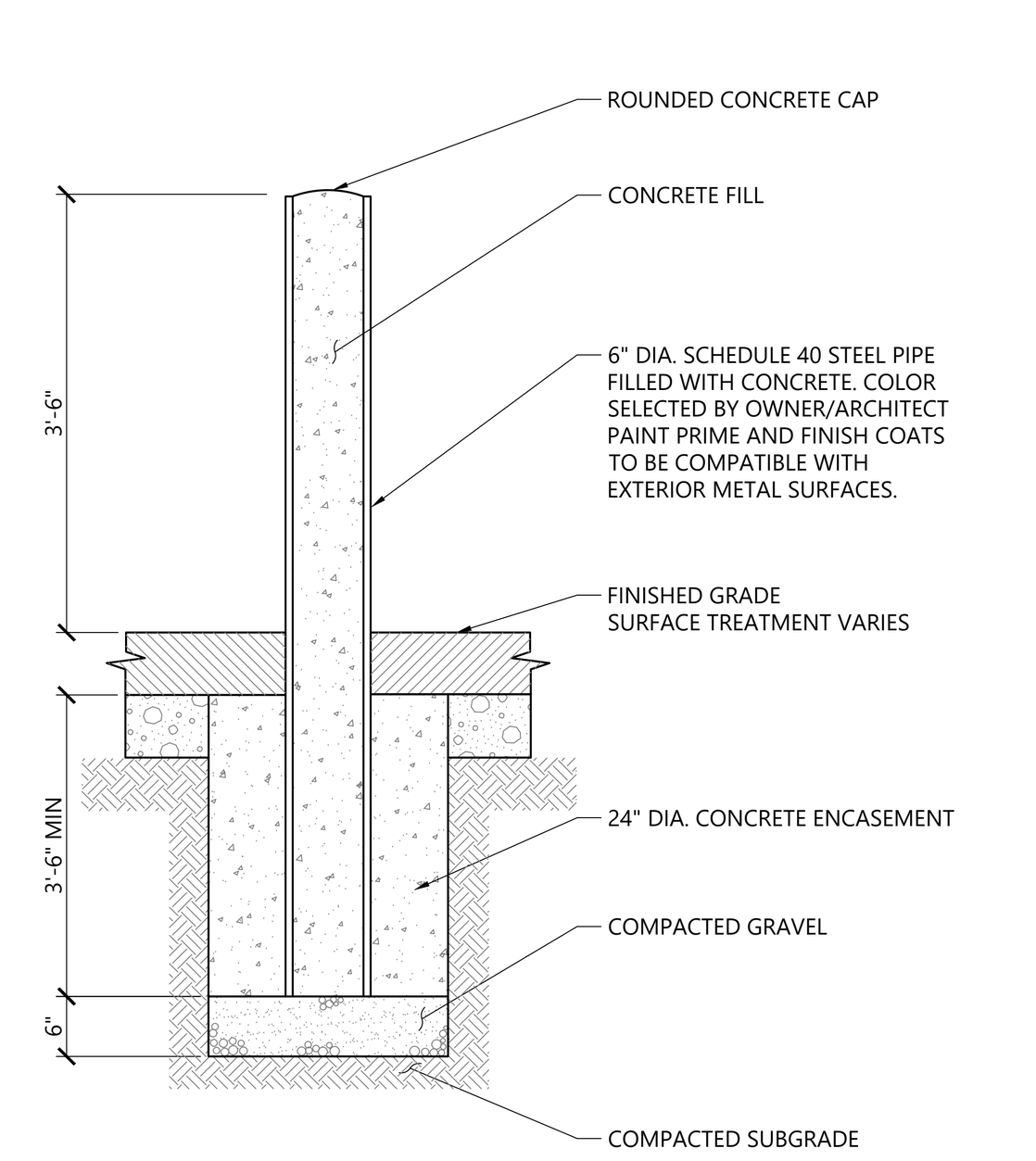
NOTES

1. THE MAXIMUM ALLOWABLE SIDEWALK AND CURB RAMP CROSS SLOPES SHALL BE 1.5 (1% MIN.).
2. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE AT CURB RAMPS SHALL BE 7.5%.
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E., HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. CURB TREATMENT VARIES, SEE PLANS FOR CURB TYPE.
6. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
7. SEE TYPICAL SIDEWALK SECTION FOR RAMP CONSTRUCTION.
8. WHERE ACCESSIBLE ROUTES ARE LESS THAN 5' IN WIDTH (EXCLUDING CURBING) A 5' x 5' PASSING AREA SHALL BE PROVIDED AT INTERVALS NOT TO EXCEED 200 FEET.
9. ELIMINATE CURBING AT RAMP WHERE IT ABUTS ROADWAY, EXCEPT WHERE VERTICAL CURBING IS INDICATED ON THE DRAWINGS TO BE INSTALLED AND SET FLUSH.
10. DETECTABLE WARNINGS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES.
11. DETECTABLE WARNINGS SHALL BE INSTALLED PERPENDICULAR TO THE ACCESSIBLE ROUTE.
12. CONTRACTOR TO SUBMIT R.F.I. FOR THIS TYPE OF ACCESSIBLE CURB RAMP FOR APEX ROADWAY CROSSINGS.

Accessible Curb Ramp (ACR) Type 'E-D'

12/20

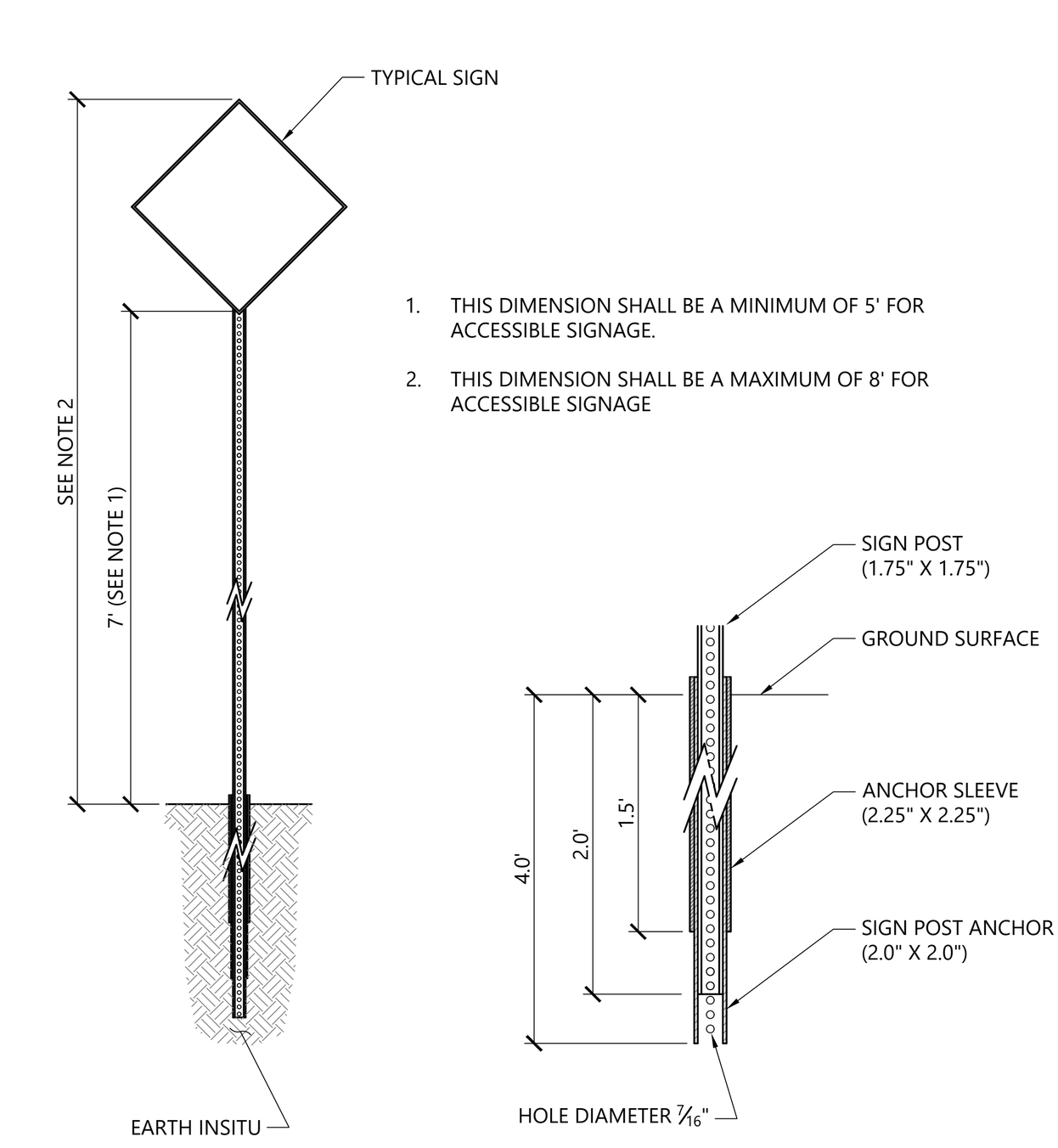
N.T.S. Source: VHB LD_504



Bollard

12/19

N.T.S. Source: VHB LD_700

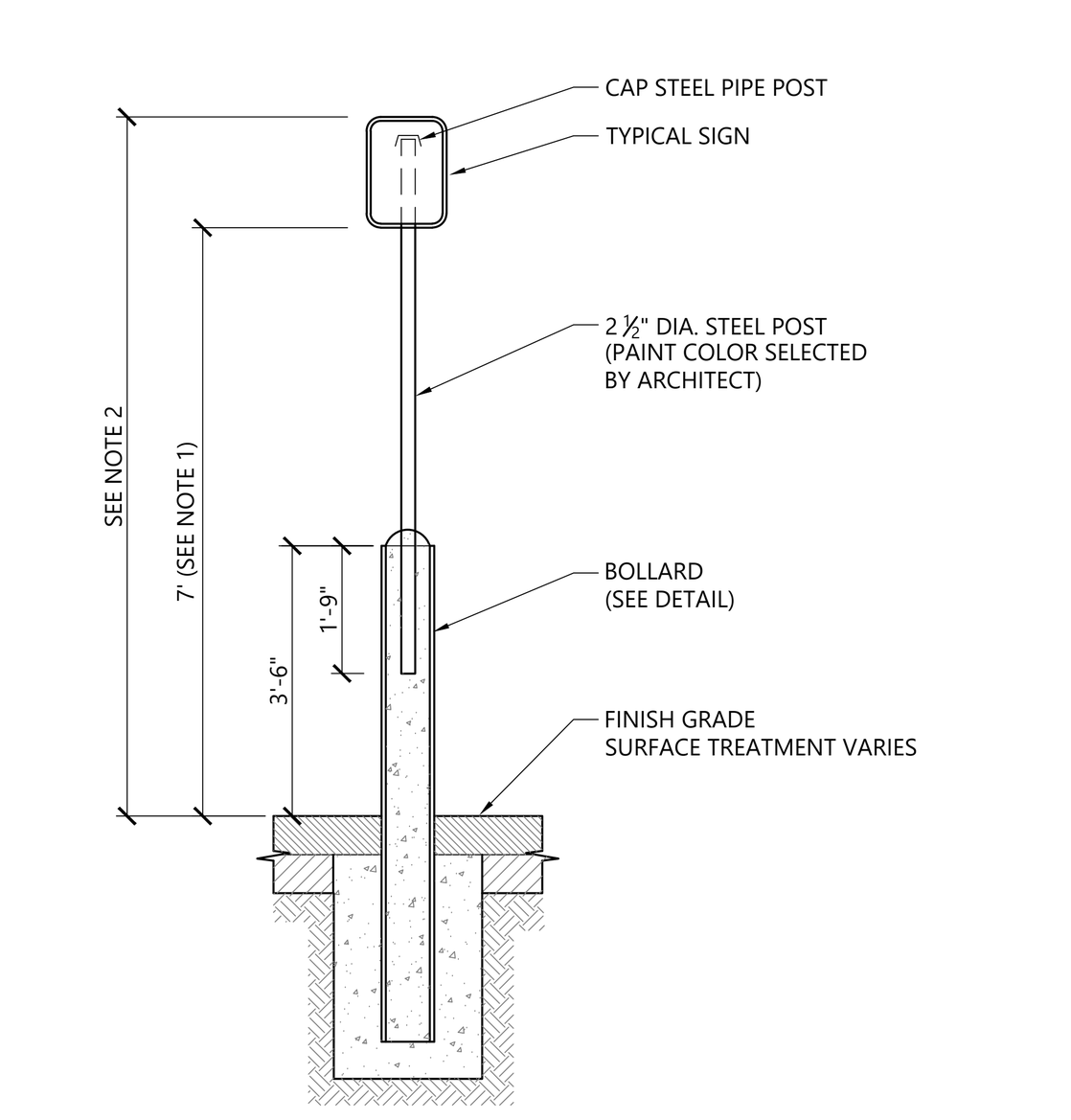


1. THIS DIMENSION SHALL BE A MINIMUM OF 5' FOR ACCESSIBLE SIGNAGE.
2. THIS DIMENSION SHALL BE A MAXIMUM OF 8' FOR ACCESSIBLE SIGNAGE

Sign Post - Type 'B'

3/19

N.T.S. Source: VHB LD_702

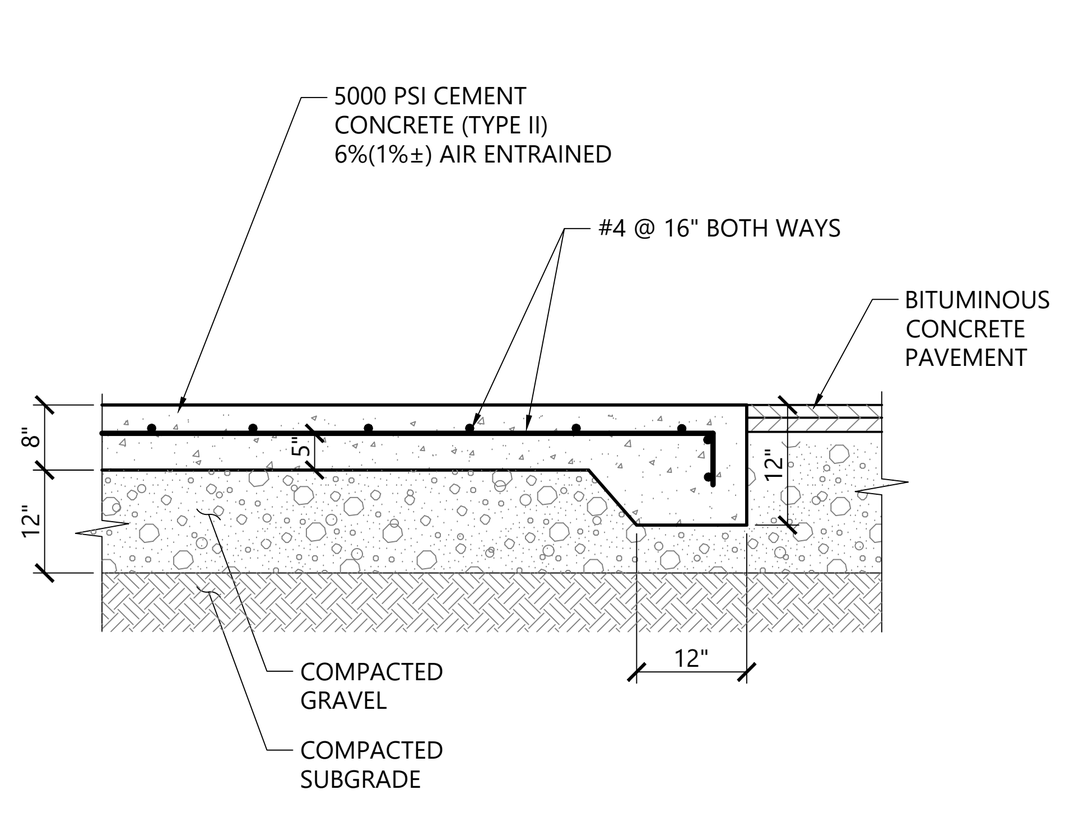


1. THIS DIMENSION SHALL BE A MINIMUM OF 5' FOR ACCESSIBLE SIGNAGE.
2. THIS DIMENSION SHALL BE A MAXIMUM OF 8' FOR ACCESSIBLE SIGNAGE

Bollard Mounted Sign

2/20

N.T.S. Source: VHB LD_703



NOTES

1. SIZE OF PAD TO BE AS INDICATED ON PLANS.
2. CONSTRUCTION JOINTS SHALL BE SPACED NO MORE THAN 30 FEET ON CENTER AND SHALL BE EQUALLY SPACED OVER THE LENGTH AND WIDTH OF THE PAD.

Loading Dock Pad / Compactor Pad

1/20

N.T.S. Source: VHB LD_711

ALEXANDRIA.
215 First Street, Suite 100
Cambridge, MA 02142
617.661.6962

vhb
101 Walnut Street
PO Box 9151
Watertown, MA 02471
617.924.1770

REED HILDERBRAND
130 Bishop Allen Drive
Cambridge, MA 02139
617.923.2422

Gensler
One Beacon Street
Third Floor
Boston, MA 02108
617.619.5700

nbbj
One Center Plaza
Suite 800
Boston, MA 02108
617.378.4800

Höweler+Yoon Architecture
150 Lincoln Street
Third Floor
Boston, MA 02111
617.517.4101

BURO HAPPOLD
11 Beacon Street
Suite 400
Boston, MA 02108
617.419.2284

FELDMAN GEOSPATIAL
152 Hampden Street
Boston, MA 02119
617.357.9740

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

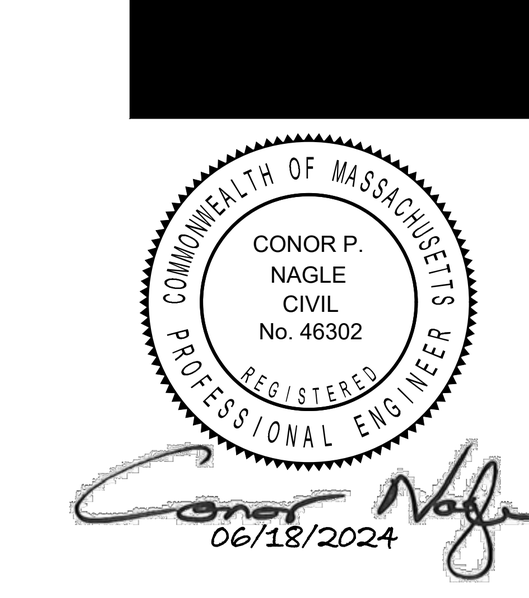
No.	Revision	Date	Appvd.

Designed by VGT — Checked by CPN

Issued for: Notice of Intent — Date: 06/07/2024

Not Issued for Construction

Drawing Title: **Site Details**



Drawing Number: **C8.01**

Scale: N/A

Project Number: 15374.00

Saved Tuesday, June 4, 2024 3:50:16 PM VGUZMANTANG Plotted Wednesday, June 5, 2024 2:40:10 PM Vanessa Guzman Tang

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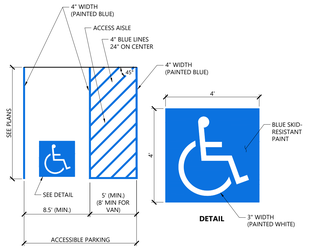
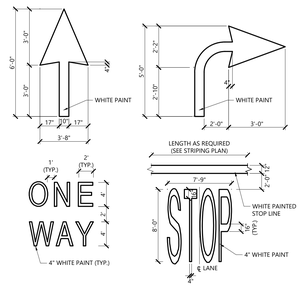


NOTES

1. ALL DIMENSIONS TO CENTER OF 4" PAVEMENT STRIPING.
2. ALL SLOPES THROUGHOUT THE ACCESSIBLE PARKING AND AISLE AREAS SHALL NOT EXCEED 1.5%.

Accessible Parking Space 12/19

N.T.S. Source: VHB LD_552B

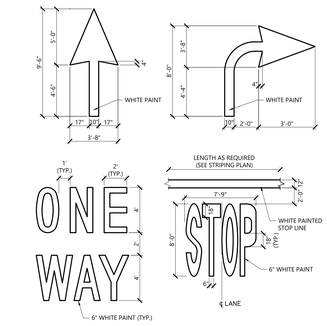


NOTES

1. PAVEMENT MARKINGS TO BE INSTALLED FOR ON SITE WORK IN LOCATIONS SHOWN.

Painted Pavement Markings - On Site 1/16

N.T.S. Source: VHB LD_554

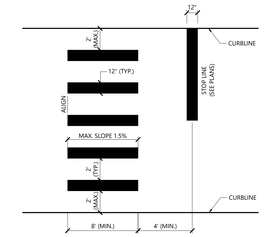


NOTES

1. PAVEMENT MARKINGS TO BE INSTALLED FOR ON SITE WORK IN LOCATIONS SHOWN.

Painted Pavement Markings - Roadway 12/19

N.T.S. Source: VHB LD_555

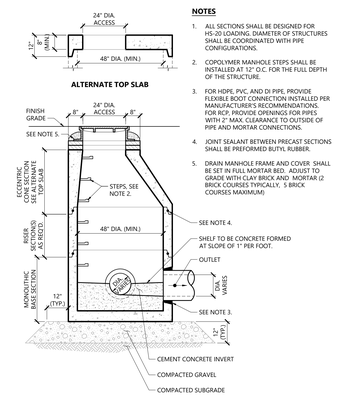


NOTES

1. TWELVE INCH (12") LINES SHALL BE APPLIED IN ONE APPLICATION, NO COMBINATION OF LINES (TWO - 6 INCH LINES) WILL BE ACCEPTED.
2. LONGITUDINAL CROSSWALK LINES TO BE PARALLEL TO CURBLINE.
3. ALL LONGITUDINAL CROSSWALK LINES SHALL BE THE SAME LENGTH AND PROPERLY ALIGNED.
4. CROSS WALK SIDESLOPE SHALL NOT EXCEED 1.5%.

Crosswalk 12/19

N.T.S. Source: VHB LD_553A

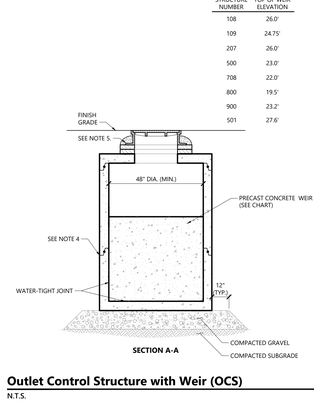


NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING. DIAMETER OF STRUCTURES SHALL BE COORDINATED WITH PIPE CONFIGURATIONS.
2. COPOLYMER MANHOLE STEPS SHALL BE INSTALLED AT 12" O.C. FOR THE FULL DEPTH OF THE STRUCTURE.
3. FOR HDPE, PVC, AND DI PIPE, PROVIDE FLEXIBLE BOOT CONNECTION INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. FOR RCP, PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE AND MORTAR CONNECTIONS.
4. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
5. DRAIN MANHOLE FRAME AND COVER SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM).

Drain Manhole (DMH) 11/19

N.T.S. Source: VHB LD_115

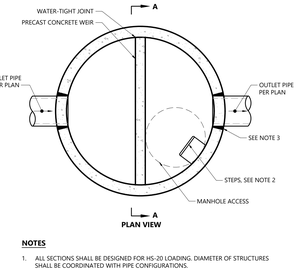


NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. COPOLYMER MANHOLE STEPS SHALL BE INSTALLED AT 12" O.C. FOR THE FULL DEPTH OF THE STRUCTURE.
3. FOR HDPE, PVC, AND DI PIPE, PROVIDE FLEXIBLE BOOT CONNECTION INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. FOR RCP, PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE AND MORTAR CONNECTIONS.
4. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
5. DRAIN MANHOLE FRAME AND COVER SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM).

Drain Manhole (DMH) with Oil Debris/Trap 1/16

N.T.S. Source: VHB LD_116

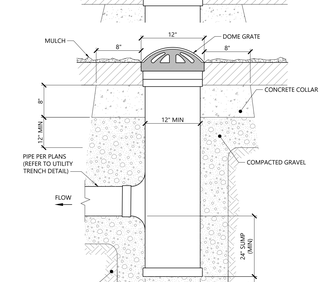


NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. PROVIDE DOGHOUSE OPENING FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE. TOP SLAB SHALL NOT REST DIRECTLY ON PIPE. GROUT ALL PIPE CONNECTIONS (NON-SHRINK GROUT).
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME AND GRATE (4"DEPTH) SHALL BE SET IN FULL MORTAR BED.
5. ADJUST TO FINISH GRADE WITH CLAY BRICK AND MORTAR AS REQUIRED.

Double Grate Catch Basin (DCB) Shallow Cover with Oil/Debris Trap

N.T.S. Source: VHB REV LD_106

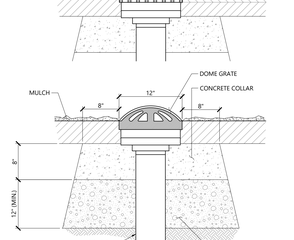


NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. FOR HDPE, PVC, AND DI PIPE, PROVIDE FLEXIBLE BOOT CONNECTION INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. FOR RCP, PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE AND MORTAR CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE BUTYL RUBBER.
4. DOUBLE CATCH BASIN FRAME AND GRATE SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICKS TYPICALLY, 5 BRICK COURSES MAXIMUM).

Double Grate Catch Basin (DCB) with Oil/Debris Trap 11/19

N.T.S. Source: VHB LD_103

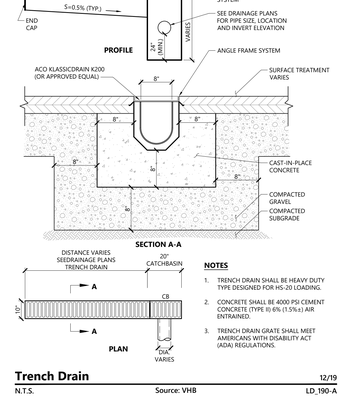


NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. PROVIDE DOGHOUSE OPENING FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE. TOP SLAB SHALL NOT REST DIRECTLY ON PIPE. GROUT ALL PIPE CONNECTIONS (NON-SHRINK GROUT).
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME AND GRATE (4"DEPTH) SHALL BE SET IN FULL MORTAR BED.
5. ADJUST TO FINISH GRADE WITH CLAY BRICK AND MORTAR AS REQUIRED.

Catch Basin (CB) Shallow Cover with Oil/Debris Trap 1/16

N.T.S. Source: VHB LD_105



NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. FOR HDPE, PVC, AND DI PIPE, PROVIDE FLEXIBLE BOOT CONNECTION INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. FOR RCP, PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE AND MORTAR CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME AND GRATE SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM).

Catch Basin (CB) With Oil/Debris Trap 3/21

N.T.S. Source: VHB LD_101

NOTES

1. INSTALL UNDERDRAINS AT 10 FEET ON CENTER. CONNECT TO DRAINS PER PLAN.
2. SIDE SLOPES SHALL BE 3:1 MAX. 2% MIN.

Bioretention Basin with Filter Strip 3/20

N.T.S. Source: VHB LD_199-REV

DIMENSIONS

SYSTEM #	A	B	C	D	E	F	G
	INSIDE TOP OF STRUCTURE	INLET INVERT	TOP OF SAND FILTER SECTION	INSIDE BOTTOM OF STRUCTURE	SETTLING AREA FOOTPRINT (SF)	SAND FILTER MEDIA FOOTPRINT (SF)	WEIR HEIGHT ABOVE FILTER MEDIA (FT)
BMP #12	19.50	17.50	14.50	11.83	290	500	3.0
BMP #13	22.17	20.70	19.17	16.50	180	400	1.5

Notes:

1. STRUCTURE SHALL BE DESIGNED FOR HS-20 LOADING.
2. EXTERIOR SURFACES SHALL BE GIVEN TWO COATS OF BITUMINOUS WATER-PROOFING MATERIAL.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. STANDARD 24-INCH DRAINAGE MANHOLE FRAME AND COVER SHALL BE LOCATED OVER CROSSES AND SET IN FULL MORTAR BED. ADJUST TO GRADE WITH BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM)
5. PRECAST SECTIONS SHALL BE STORMTRAP DOUBLE TRAP SYSTEMS OR APPROVED EQUAL.
6. MIN AREAS PROVIDED WITHIN TANK SHALL EXCLUDE INTERIOR AREA USED FOR STRUCTURAL INTEGRITY OF TANK
7. AT LEAST ONE ACCESS MANHOLE SHALL BE LOCATED OVER FOREBAY/SETTLING BASIN, SAND FILTER AND OUTLET.

Sand Filter 9/21

N.T.S. Source: VHB

Flared End Section (FES) with Stone Protection 3/19

N.T.S. Source: VHB REV LD_134

NOTES

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING. DIAMETER OF STRUCTURES SHALL BE COORDINATED WITH PIPE CONFIGURATIONS.
2. COPOLYMER MANHOLE STEPS SHALL BE INSTALLED AT 12" O.C. FOR THE FULL DEPTH OF THE STRUCTURE.
3. FOR HDPE, PVC, AND DI PIPE, PROVIDE FLEXIBLE BOOT CONNECTION INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. FOR RCP, PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE AND MORTAR CONNECTIONS.
4. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
5. DRAIN MANHOLE FRAME AND COVER SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM)

Outlet Control Structure with Weir (OCS) 3/20

N.T.S. Source: VHB REV LD_162A

NOTES:

1. AREA DRAINS SHALL BE NYLOPLAST 12" DIAMETER DRAIN BASIN, OR APPROVED EQUAL.
2. GRATES SHALL BE NYLOPLAST 12" PEDESTRIAN MODEL 1299CGP OR 12" DOME GRATE MODEL 1299CGD (OR APPROVED EQUAL).

Area Drain (AD) Type 1 12/19

N.T.S. Source: VHB LD_193

NOTES:

1. AREAS DRAINS SHALL BE NYLOPLAST INLINE DRAIN, OR APPROVED EQUAL.
2. GRATES SHALL BE NYLOPLAST 12" PEDESTRIAN MODEL 1299CGP OR 12" DOME GRATE MODEL 1299CGD (OR APPROVED EQUAL).

Area Drain (AD) Type 2 12/19

N.T.S. Source: VHB LD_194

NOTES

1. TRENCH DRAIN SHALL BE HEAVY DUTY TYPE DESIGNED FOR HS-20 LOADING.
2. CONCRETE SHALL BE 4000 PSI CEMENT CONCRETE (TYPE II) 6% (1.5%±) AIR ENTRAINED.
3. TRENCH DRAIN GRATE SHALL MEET AMERICANS WITH DISABILITY ACT (ADA) REGULATIONS.

Trench Drain 12/19

N.T.S. Source: VHB LD_190-A

ALEXANDRIA.
215 First Street, Suite 100
Cambridge, MA 02142
617.661.6962

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PO Box 9151
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130 Bishop Allen Drive
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Gensler
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Third Floor
Boston, MA 02108
617.619.5700

nbbj
One Center Plaza
Suite 800
Boston, MA 02108
617.378.4800

Höweler+Yoon Architecture
150 Lincoln Street
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617.517.4101

BURO HAPPOLD
11 Beacon Street
Suite 400
Boston, MA 02108
617.419.2284

FELDMAN GEOSPATIAL
152 Hampden Street
Boston, MA 02119
617.357.9740

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by: VGT Checked by: CPN

Issued for: Notice of Intent Date: 06/07/2024

Not Issued for Construction

Drawing Title: Site Details

Drawing Number: C8.02

Scale: N/A

Project Number: 15374.00

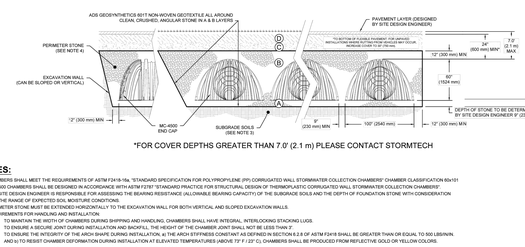
COMMONWEALTH OF MASSACHUSETTS — CONOR P. NAGLE — CIVIL — No. 46302 — REGISTERED PROFESSIONAL ENGINEER
06/28/2024

Saved Tuesday, June 4, 2024 3:50:16 PM VGUZMAN7ANG Plotted Wednesday, June 5, 2024 2:40:22 PM Vanessa Guzman Tang

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE (9" MIN) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145* A-1, A-2-4, A-3 OR AASHTO M43* 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. OF 95% RELATIVE DENSITY FOR WELL-GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ON LAYER'S TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43* 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43* 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE[3,4]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. THE USE OF GEOTEXTILES IS REQUIRED AS A SEPARATION BARRIER BETWEEN THE NATIVE SOIL AND THE AGGREGATE MATERIALS.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR GRADING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



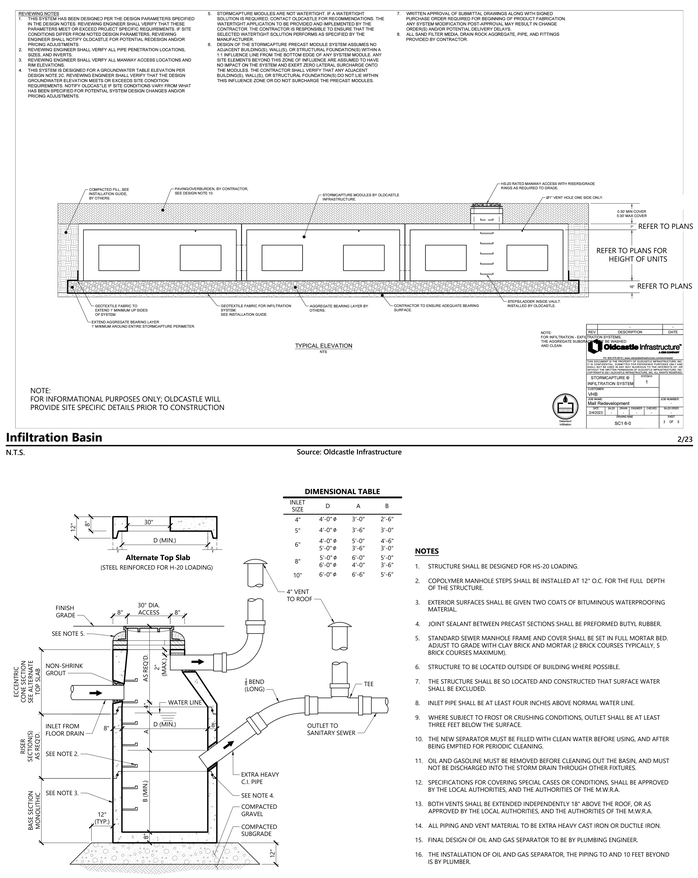
*FOR COVER DEPTHS GREATER THAN 7.0' (2.1 m) PLEASE CONTACT STORMTECH

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-19a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTOR CHAMBERS"
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL INTERLOCKING STACKING LUGS
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN.
   - AND ALTO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

Infiltration System (StormTech MC-4500)

N.T.S. Source: Stormtech



TYPICAL ELEVATION
NTS

NOTE:
FOR INFILTRATION - EXFILTRATION SYSTEMS, THE BOTTOM AND SIDES ARE OPEN.

REV	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	12/22/2022

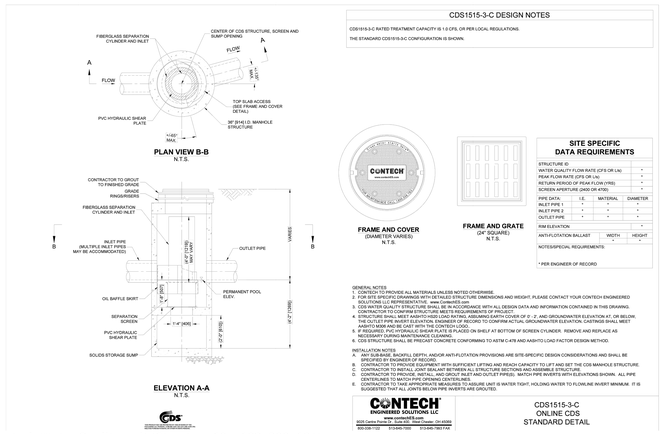
Oldcastle Infrastructure
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF OLDCASTLE INFRASTRUCTURE, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF OLDCASTLE INFRASTRUCTURE, INC. IS PROHIBITED.

STORMCAPTURE® INFILTRATION SYSTEM	1
VNS	
Project Number	
Date/Initials	Date/Initials
SHT 1 OF 1	SCI 6-0

NOTE:
FOR INFORMATIONAL PURPOSES ONLY; OLDCASTLE WILL PROVIDE SITE SPECIFIC DETAILS PRIOR TO CONSTRUCTION

Infiltration Basin

N.T.S. Source: Oldcastle Infrastructure 2/23



CDS1515-3-C DESIGN NOTES

CDS1515-3-C RATED TREATMENT CAPACITY IS 1.0 CFS, OR PER LOCAL REGULATIONS.

THE STANDARD CDS1515-3-C CONFIGURATION IS SHOWN.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*
NOTES/SPECIAL REQUIREMENTS:		

* PER ENGINEER OF RECORD

FRAME AND COVER (DIAMETER VARIES) N.T.S.

FRAME AND GRATE (24" SQUARE) N.T.S.

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
4. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. CDS WATER QUALITY STRUCTURE SHALL BE LOCATED OFFLINE WITH A BYPASS DESIGNED FOR 0'- 2'- AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CARTRIDGE SHALL MEET AASHTO M288 AND BE CAST WITH THE CONTECH LOGO.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
7. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

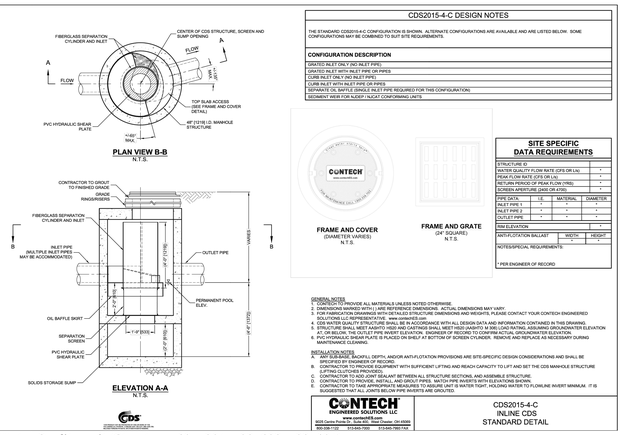
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO PLACE, COMPACT, AND GROUT FOUNDATION/BASE UNDER WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
9025 Centre Pointe Dr. Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX
www.conteches.com

CDS1515-3-C
INLINE CDS
STANDARD DETAIL

Contech Water Quality Unit (Structure 107, 102, 300, 104)

N.T.S. Source: Contech 2/23



CDS2015-4-C DESIGN NOTES

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE DOCUMENTED TO BUT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE SKIRNG INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (4700 OR 2400)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*
NOTES/SPECIAL REQUIREMENTS:		

* PER ENGINEER OF RECORD

FRAME AND COVER (DIAMETER VARIES) N.T.S.

FRAME AND GRATE (24" SQUARE) N.T.S.

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH (-) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
6. CDS WATER QUALITY STRUCTURE SHALL BE LOCATED OFFLINE WITH A BYPASS DESIGNED FOR 0'- 2'- AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CARTRIDGE SHALL MEET AASHTO M288 AND BE CAST WITH THE CONTECH LOGO.
7. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
8. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO PLACE, COMPACT, AND GROUT FOUNDATION/BASE UNDER WATER TIGHT, HOLDING WATER TO ONLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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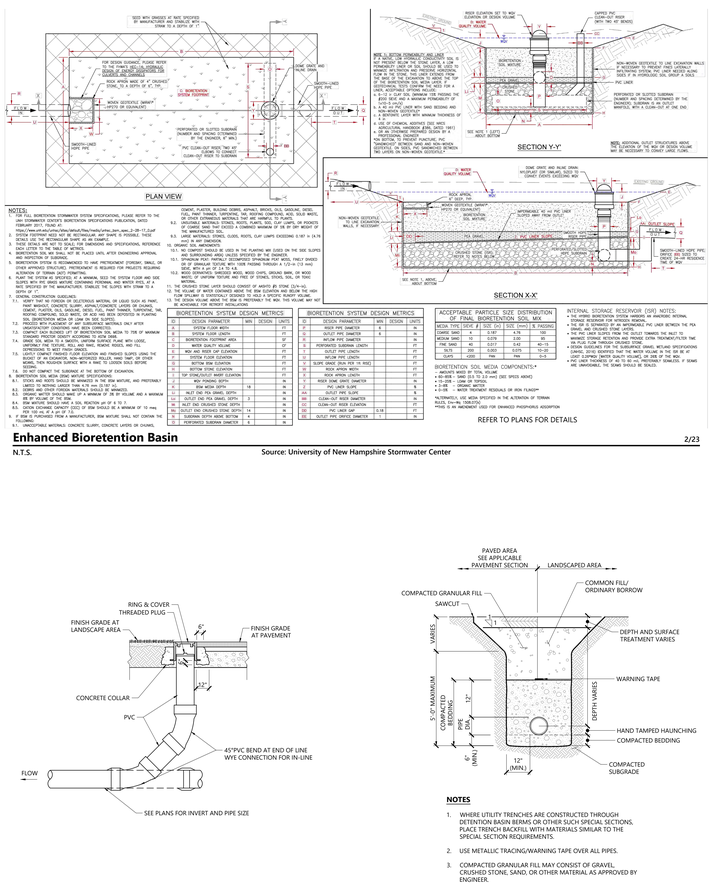
CDS2015-4-C
INLINE CDS
STANDARD DETAIL

Contech Water Quality Unit (Structures 105, 204, 502, 602, 702, 104)

N.T.S. Source: Contech 2/23



NOTES:

1. ALL BIORETENTION STORMWATER SYSTEM SPECIFICATIONS, PLEASE REFER TO THE LID STORMWATER CONTROL BIORETENTION SPECIFICATIONS PUBLICATION, DATED FEBRUARY 2017, FOUND AT https://www.njstormwater.org/bmp_manual2.htm
2. SYSTEM FOOTPRINT NEED NOT BE RECTANGULAR, ANY SHAPE IS POSSIBLE.THESE DETAILS USE THE RECTANGULAR SHAPE AS AN EXAMPLE.
3. ALL MATERIALS SHALL BE IN ACCORDANCE WITH NJDEP SPECIFICATIONS, REFERENCED UNDER LETTER G, THE "BIBLE" OF METHOD.
4. BIORETENTION SOIL MIX SHALL NOT BE PLACED UNTIL AFTER ENGINEERING APPROVAL OF THE CONSTRUCTED DRAINAGE AREA.
5. BIORETENTION SYSTEM IS RECOMMENDED TO HAVE PRETREATMENT (FOREBAY, SMALL OR OTHER APPROVED STRUCTURE). PRETREATMENT IS REQUIRED FOR PROJECTS REQUIRING NJDEP TSS REMOVAL CALCULATIONS.
6. PLANT THE OPTION AS SPECIFIED AT A MINIMUM, SEED THE SYSTEM FLOOR AND SIDE SLOPES WITH PFG BINDS MIXTURE (DROPPING PERENNIAL AND WINTER RYE) AT A RATE SPECIFIED OF THE MANUFACTURER. CHANGE THE SLOPES WITH STRAW TO A DEPTH OF 2".
7. GENERAL CONSTRUCTION GUIDELINES:
   7.1. DO NOT INSTALL BIORETENTION SYSTEMS MATERIAL OR LOADS SUCH AS PAVING MATERIALS UNTIL CONSTRUCTION IS COMPLETE. APPROPRIATE LAYERS OF DRAINAGE, COMPOST, PLANTING SOIL, GRAVELAND, DECKS, RAILS, PAINT THINNERS, SUPPORTING, SAW CUTTING, AND OTHER MATERIALS SHALL NOT BE ALLOWED TO DEPOSITED IN PLANTING SOIL.(BIORETENTION MIX OR LOAM OR SAND SLOPES).
   7.2. PROCEED WITH PLACEMENT OF ANY SUBSURFACE MATERIALS ONLY AFTER CONSTRUCTED DRAINAGE AREA IS STABILIZED.
   7.3. COMPACT SAND BLOWED LIFT OF BIORETENTION SOIL MEDIA TO 85% OF MAXIMUM STANDARD PROCTOR DENSITY ACCORDING TO ASTM D698.
   7.4. PLACE SOIL MIX IN 12" LIFTS AND LIGHTLY COMPACT EACH LIFT WITH LOOSE, LIMITSNOV FREE-TEXTURAL WILL AND RAKE, ROADWAY ROLLER, AND FILL (DEPRESSIONS TO MEET FINISH GRADES).
   7.5. DO NOT COMPACT SOIL MIX BELOW ELEVATION AND PREMIXED SLOPES USING THE BUCKET OF AN EXCAVATOR. NON-VIBRATORY ROLLER, HAND TAMP, OR OTHER METHOD, THEN ROUGHEN SURFACE WITH 6 RAKE TO LOOSEN SOILS BEFORE PLANTING.
   7.6. DO NOT COMPACT THE SUBGRADE AT THE BOTTOM OF EXCAVATION.
   7.7. DO NOT PLACE SOIL MIX WHEN FROZEN, WET, OR EXCESSIVELY DRY.
   8.1. STONES AND ROOTS SHOULD BE APPARENT IN THE SOIL MIXTURE, AND PREFERABLY LIMITED TO NUMBER LARGER THAN 4 mm (0.157 inch).
   8.2. ORGANIC MATTER SHOULD BE APPARENT IN THE SOIL MIXTURE.
   8.3. ORGANIC MATTER SHOULD MAKE UP A MINIMUM OF 28 BY VOLUME AND A MAXIMUM OF 55 BY VOLUME.
   8.4. IRON MATTER SHOULD MAKE A SOIL MIXTURE OF 8 TO 3.
   8.5. CATION EXCHANGE CAPACITY (CEC) OF SOIL MIX SHOULD BE A MINIMUM OF 10 meq. PER 100 GRAMS OF DRY SOIL.
   8.6. IF SOIL IS PURCHASED FROM A MANUFACTURER, IRON MATERIAL SHALL NOT CONTAIN THE FOLLOWING:
   8.1. UNACCEPTABLE MATERIALS: CONCRETE SLURRY, CONCRETE LAYERS OR CHUNKS, CEMENT, PLASTER, BUILDING DEBRIS, ASPHALT, BRICKS, OILS, GASOLINE, DIESEL FUEL, PAINT THINNERS, SURFACTANT, TAR, WASTE MATERIALS, OR OTHER DELETERIOUS MATERIALS. SOLID WASTE OR OTHER EXTRANEOUS MATERIALS THAT ARE HARMFUL TO PLANTS.
   8.2. UNSUITABLE MATERIALS: STONES, ROOTS, PLANTS, SOD, CLAY LUMPS, OR PEBBLES LARGER THAN 2 INCHES (50 mm) IN ANY DIMENSION, OR TOXIC MATERIALS.
   8.3. LARGE MATERIALS: STONES, CLODS, ROOTS, CLAY LUMPS EXCEEDING 6.187 in 24.76 cm IN ANY DIMENSION.
   8.3.1. NO COMPOST SHOULD BE USED IN THE PLANTING MIX EXCEPT ON THE SIDE SLOPES WHERE IT SHOULD BE PLACED AT A MAXIMUM DEPTH OF 2 INCHES.
   8.3.1. SYNDROM POST, PARTIALLY DESTROYED SYNDROM POST WOOD, FANCY GRADE COMPOST, OR OTHER COMPOST NOT MEETING PASSING 0.5 IN (12.7 mm) SIEVE, WITH A pH OF 5.5 TO 8.5.
   8.3.1. MULCH SHOULD BE APPLIED AT A RATE OF 2 TO 3 INCHES (50 TO 75 mm).
   8.3.1. PLANT THE OPTION AS SPECIFIED AT A MINIMUM, SEED THE SYSTEM FLOOR AND SIDE SLOPES WITH PFG BINDS MIXTURE (DROPPING PERENNIAL AND WINTER RYE) AT A RATE SPECIFIED OF THE MANUFACTURER. CHANGE THE SLOPES WITH STRAW TO A DEPTH OF 2".
   11.1. STONE STONE LAYER SHOULD CONSIST OF #57STS BY STONE (1½ in).
   11.2. THE USE OF WATER STANDING ABOVE THE RAW ELEVATION AND BELOW THE HIGH FLOW SPILLWAY IS STRATEGICALLY DESIGNED TO HOLD A SPECIFIC RUNOFF VOLUME. THIS VOLUME IS CALCULATED BY MULTIPLYING THE WATER QUALITY FLOW RATE (WQ) TIMES THE WQ ADVISABLE FOR NEWEST REGULATIONS.

Enhanced Bioretention Basin

N.T.S. Source: University of New Hampshire Stormwater Center 2/23

BIORETENTION SYSTEM DESIGN METRICS

ID	DESIGN PARAMETER	MIN.	DESIGN	UNITS
A	BIORETENTION FOOTPRINT AREA			SF
B	SYSTEM FLOOR LENGTH			FT
C	BIORETENTION FOOTPRINT AREA			SF
D	WATER QUALITY VOLUME			CF
E	MOW AND RIDER CAP ELEVATION			FT
F	SYSTEM FLOOR ELEVATION			FT
G	BOTTOM BOW ELEVATION			FT
H	SYSTEM FLOOR WIDTH			FT
I	TOP SOIL/OUTLET WEIR ELEVATION			FT
J	MOW PONDING DEPTH			IN
K	AVG. LAND SLOPE		15	%
L	OUTLET END PEA GRAVEL DEPTH	2		IN
M	OUTLET END PEA GRAVEL WIDTH	2		FT
N	INLET END CROWNED STONE DEPTH			IN
O	INLET END PEA GRAVEL WIDTH	14		IN
P	SUBDRAIN DEPTH ABOVE BOTTOM	6		IN
Q	PERFORATED SUBDRAIN DIAMETER	6		IN

BIORETENTION SYSTEM DESIGN METRICS

ID	DESIGN PARAMETER	MIN.	DESIGN	UNITS
R	SUBDRAIN SPACING	6		FT
S	WYE/PW PIPE DIAMETER			IN
T	WYE/PW PIPE DIAMETER			IN
U	PERFORATED SUBDRAIN LENGTH			FT
V	OUTLET PIPE LENGTH			FT
W	WYE/PW PIPE LENGTH			FT
X	OUTLET PIPE SLOPE			%
Y	ROCK APRON LENGTH			FT
Z	ROCK SIZING DIAMETER			IN
AA	PVC LINER SLOPE			%
BB	OUTLET PIPE SLOPE			%
CC	CLEAN-OUT ROCK DIAMETER			IN
DD	CLEAN-OUT ROCK ELEVATION			FT
EE	CLEAN-OUT ROCK DIAMETER	0.5Ø		IN
FF	OUTLET PIPE ORIFICE DIAMETER			IN

ACCEPTABLE PARTICLE SIZE DISTRIBUTION OF FINAL BIORETENTION SOIL MIX

MEDIA TYPE	SIEVE #	SIZE (in.)	SIZE (mm)	% PASSING
COARSE SAND	4	0.187	4.75	100
MEDIUM SAND	10	0.079	2.00	85
FINE SAND	40	0.017	0.43	40–10
SILTS	200	0.003	0.075	10–35
CLAYS	<200	n/a	n/a	0–5

BIORETENTION SOIL MEDIA COMPONENTS:*

- AMENDED MIXED BY TOTAL VOLUME
- 40–60% – SAND (U.S. T.S.D. and (ND) SPECS ABOVE)
- 2–25 – ORGANIC MATTER
- 2–25 – ORGANIC MATTER, CHEMICALS OR OTHER FILLER**

*ALTERNATELY, USE MEDIA SPECIFIED BY LOCAL ACTIVATION OF TERMAN RULES, if no info, CONSULT.
**PEAT IS #5 INADVISABLE USED FOR ENHANCED PHOSPHORUS ADSORPTION

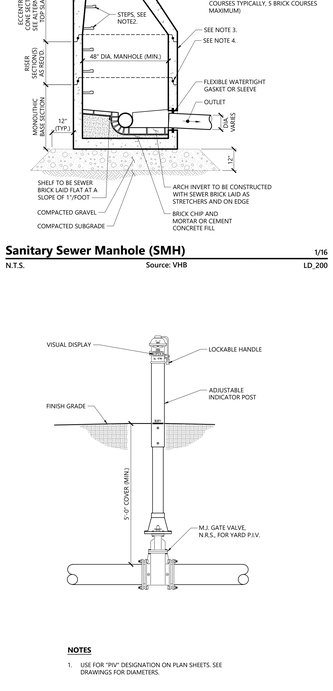
REFER TO PLANS FOR DETAILS

INTERNAL STORAGE RESERVOIR (ISR) NOTES:

1. THIS HYBRID BIORETENTION SYSTEM HARBORS AN INNOVATIVE INTERNAL STORAGE RESERVOIR FOR WINTER REMOVAL.
2. THE ISR IS CREATED BY PLACING A PVC LINER BETWEEN THE PEA GRAVEL AND THE SOIL MIX.
3. THE ISR IS DESIGNED TO HOLD THE WATER QUALITY VOLUME THAT INFILTRATES THROUGH THE SOIL MIX. THE WATER IS HELD IN THE ISR UNTIL IT CAN BE REMOVED THROUGH AN UNDERDRAIN SYSTEM.
4. DESIGN ELEVATIONS FOR THE SUBSURFACE STORAGE RESERVOIR (SSRS) ARE DEFINED THAT THE WATER VOLUME IN THE ISR WE AT THE DESIGNED ELEVATION IS EQUAL TO THE WATER QUALITY VOLUME.
5. PVC LINER THICKNESS OF 40 TO 60 mil, PREFERABLY 60 MILLS. IF SEAMS ARE UNAVOIDABLE, THE SEAMS SHOULD BE SEALED.

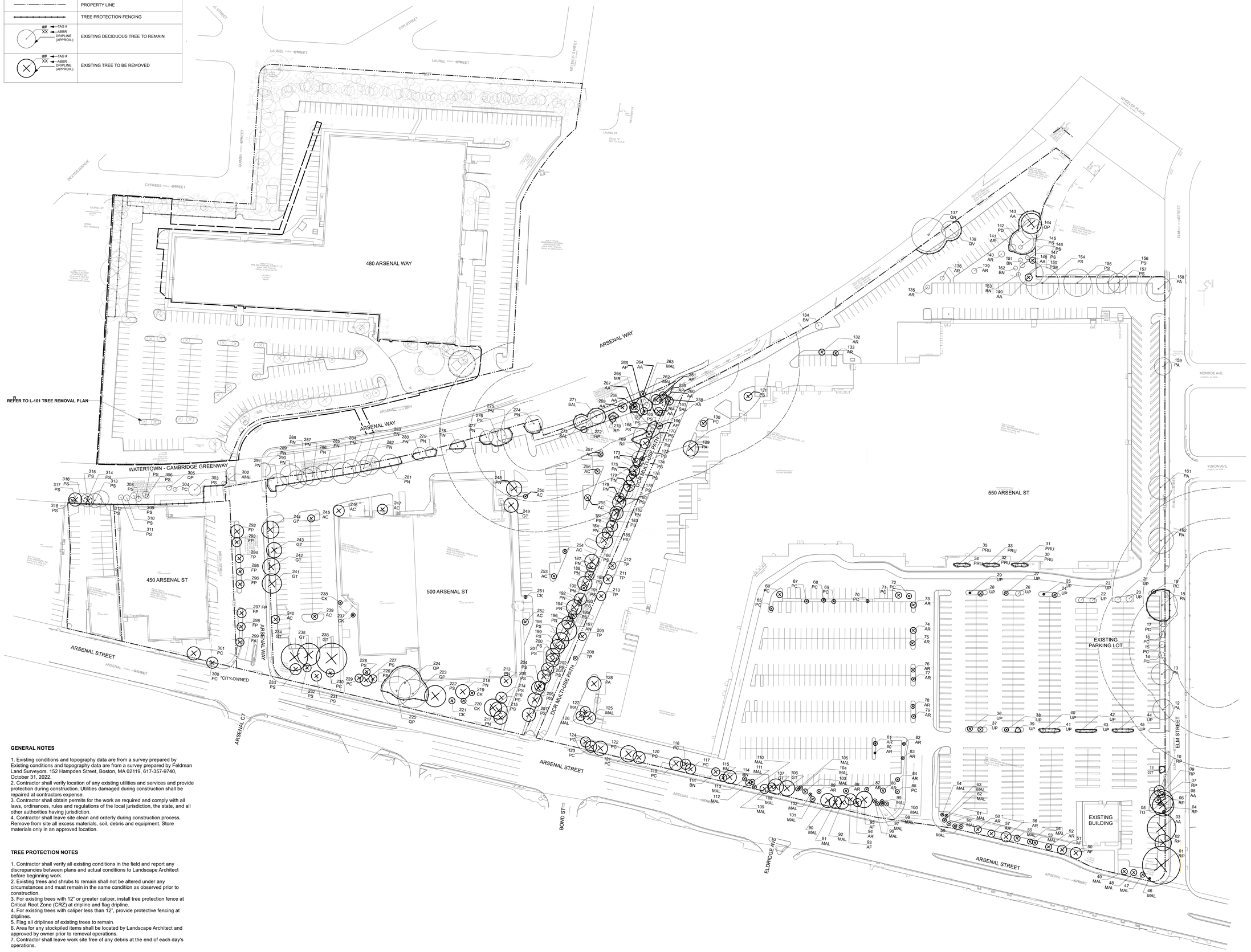
Sanitary Sewer Manhole (SMH)

N.T.S. Source: VHB 1/16 LD_200


30" DIA. ACCESS
12"
48" DIA. MANHOLE
ALTERNATE TOP SLAB
(STEEL REINFORCED FOR HS-20 LOADING)
FINISH GRADE
30" DIA. ACCESS
8"

\\vhb\gbl\proj\Wat-LD\15374.00\cad\id\Planset\2_Master Plan Special Permit\15374.00_TB.dwg

TREE REMOVALS LEGEND	
SYMBOL	DESCRIPTION
	LIMIT OF WORK
	PROPERTY LINE
	TREE PROTECTION FENCING
## XX ← TAG # ← ABBR DRIPLINE (APPROX.)	EXISTING DECIDUOUS TREE TO REMAIN
## XX ← TAG # ← ABBR DRIPLINE (APPROX.)	EXISTING TREE TO BE REMOVED



GENERAL NOTES

1. Existing conditions and topography data are from a survey prepared by Existing conditions and topography data are from a survey prepared by Feldman Land Surveyors. 152 Hampden Street, Boston, MA 02119, 617-357-9740, October 31, 2022.
2. Contractor shall verify location of any existing utilities and services and provide protection during construction. Utilities damaged during construction shall be repaired at contractors expense.
3. Contractor shall obtain permits for the work as required and comply with all laws, ordinances, rules and regulations of the local jurisdiction, the state, and all other authorities having jurisdiction.
4. Contractor shall leave site clean and orderly during construction process. Remove from site all excess materials, soil, debris and equipment. Store materials only in an approved location.

TREE PROTECTION NOTES

1. Contractor shall verify all existing conditions in the field and report any discrepancies between plans and actual conditions to Landscape Architect before beginning work.
2. Existing trees and shrubs to remain shall not be altered under any circumstances and must remain in the same condition as observed prior to construction.
3. For existing trees with 12" or greater caliper, install tree protection fence at Critical Root Zone (CRZ) at dripline and flag dripline.
4. For existing trees with caliper less than 12", provide protective fencing at driplines.
5. Flag all driplines of existing trees to remain.
6. Area for any stockpiled items shall be located by Landscape Architect and approved by owner prior to removal operations.
7. Contractor shall leave work site free of any debris at the end of each day's operations.

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Cambridge, MA 02142
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nbbj
One Center Plaza
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Höweler+Yoon Architecture
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Third Floor
Boston, MA 02111
617.517.4101

BURO HAPPOLD
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Suite 400
Boston, MA 02108
617.419.2284

FELDMAN GEOSPATIAL
152 Hampden Streereett
Boston, MA 02119
617.357.9740

0 25 50 100 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** | Date: **06/07/2024**

Not Issued for Construction

Drawing Title
L-100
EXISTING TREE PROTECTION AND REMOVALS PLAN (446-550 ARSENAL ST)

Drawing Number
L-100

Scale: **1" = 50'**

Project Number: **15374.00**

Saved Wednesday, March 15, 2023 2:16:35 PM \\GUZMANTANG Plotted Wednesday, March 15, 2023 2:16:13 PM Vanessa Guzman Tang

TREE REMOVALS LEGEND

SYMBOL	DESCRIPTION
	LIMIT OF WORK
	PROPERTY LINE
	TREE PROTECTION FENCING
## XX —TAG # —ABBR —DRIPLINE (APPROX.)	EXISTING DECIDUOUS TREE TO REMAIN
## XX —TAG # —ABBR —DRIPLINE (APPROX.)	EXISTING TREE TO BE REMOVED

TREE PROTECTION NOTES

1. Contractor shall verify all existing conditions in the field and report any discrepancies between plans and actual conditions to Landscape Architect before beginning work.
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3. For existing trees with 12" or greater caliper, install tree protection fence at Critical Root Zone (CRZ) at dripline and flag dripline.
4. For existing trees with caliper less than 12", provide protective fencing at driplines.
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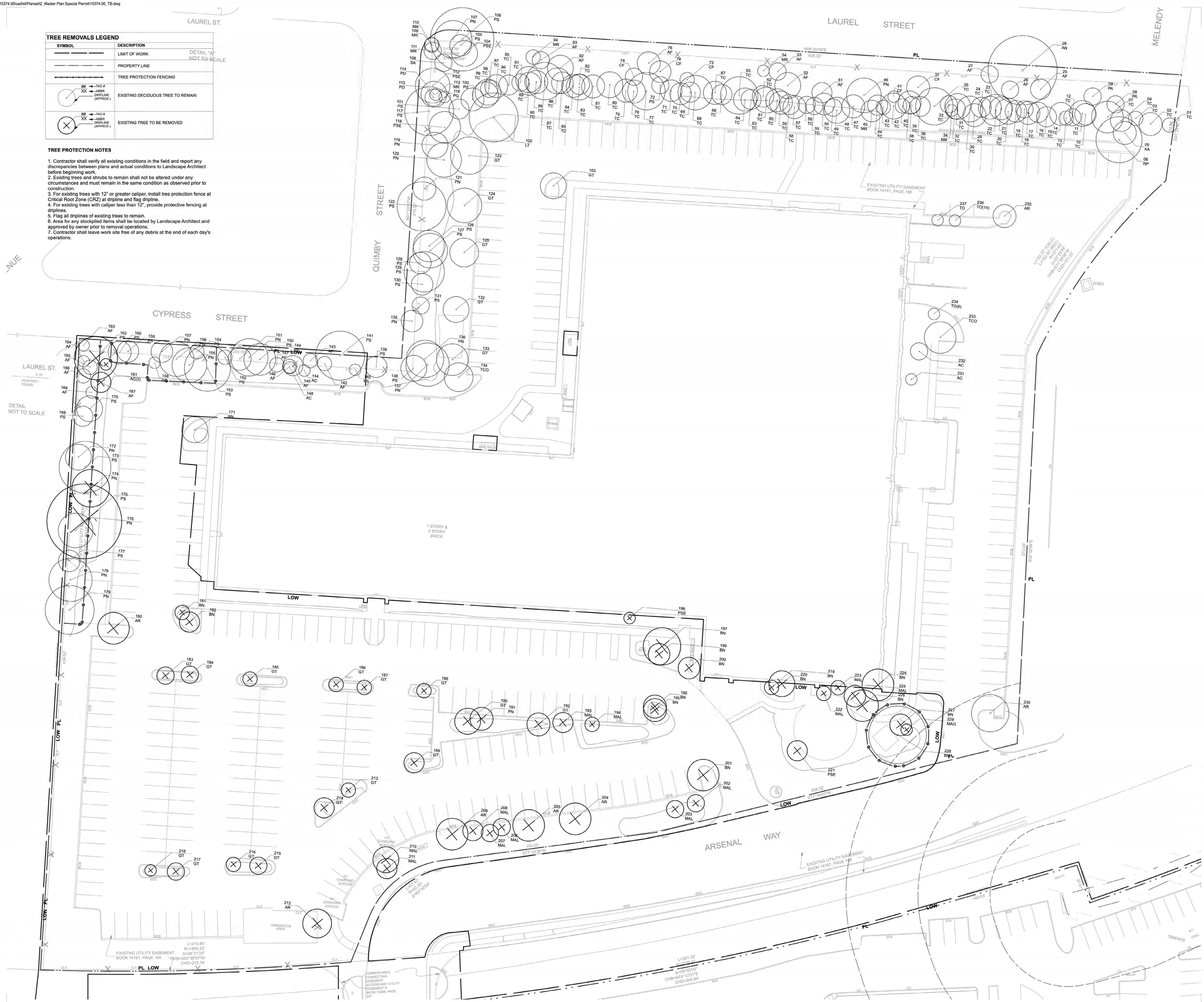

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nbbj

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Höweler+Yoon Architecture

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Boston, MA 02111
617.517.4101

BURO HAPPOLD

11 Beacon Street
Suite 400
Boston, MA 02108
617.419.2284

FELDMAN GEOSPATIAL

152 Hampden Streereett
Boston, MA 02119
617.357.9740

0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** — Date: **06/07/2024**

Not Issued for Construction

Drawing Title: **L-101 EXISTING TREE PROTECTION AND REMOVALS PLAN (480 ARSENAL WAY)**

Drawing Number: **L-101**

Scale

Project Number: **15374.00**

Saved Wednesday, March 15, 2023 2:16:35 PM \\GUZMANTANG Plotted Wednesday, March 15, 2023 2:16:13 PM Vanessa Guzman Tang

446 - 550 ARSENAL STREET

TOTAL NUMBER OF TREES: 318

NUMBER OF TREES REMOVED: 216

WITHIN WETLAND ZONES: 30

TREE REMOVALS SCHEDULE

ID	DBH	Abbrv.	Scientific Name	Common Name	Action	Rationale
1	37	RP	Robinia pseudoacacia	Black Locust	Remove	
2	16	RP	Robinia pseudoacacia	Black Locust	Remove	
3	28	AA	Ailanthus altissima	Tree of Heaven	Remove	
4	3	RP	Robinia pseudoacacia	Black Locust	Remove	
5	3	TO	Thuja occidentalis	Eastern Arborvitae	Remove	
6	21	RP	Robinia pseudoacacia	Black Locust	Remove	
7	6	RP	Robinia pseudoacacia	Black Locust	Remove	
8	23	AA	Ailanthus altissima	Tree of Heaven	Remove	
9	6	RP	Robinia pseudoacacia	Black Locust	Remove	
10	10	RP	Robinia pseudoacacia	Black Locust	Remove	
11	6	GT	Gleditsia triacanthos	Honeylocust	Protect	
12	20	PA	Platanus _ acerifolia	London Planetree	Protect	
13	21	PA	Platanus _ acerifolia	London Planetree	Protect	
14	6	PC	Pyrus calleryana	Callery Pear	Protect	
15	6	PC	Pyrus calleryana	Callery Pear	Protect	
16	6	PC	Pyrus calleryana	Callery Pear	Protect	
17	7	PC	Pyrus calleryana	Callery Pear	Protect	
18	30	PA	Platanus _ acerifolia	London Planetree	Protect	
19	4	PC	Pyrus calleryana	Callery Pear	Remove	
20	6	UP	Ulmus parvifolia	Chinese Elm	Protect	
21	6	UP	Ulmus parvifolia	Chinese Elm	Protect	
22	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
23	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
24	5	UP	Ulmus parvifolia	Chinese Elm	Remove	
25	2	UP	Ulmus parvifolia	Chinese Elm	Remove	
26	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
27	4	UP	Ulmus parvifolia	Chinese Elm	Remove	
28	5	UP	Ulmus parvifolia	Chinese Elm	Remove	
29	2	UP	Ulmus parvifolia	Chinese Elm	Remove	
30	5	PRU	Prunus	Flowering Cherry	Protect	
31	5	PRU	Prunus	Flowering Cherry	Protect	
32	5	PRU	Prunus	Flowering Cherry	Protect	
33	5	PRU	Prunus	Flowering Cherry	Protect	
34	5	PRU	Prunus	Flowering Cherry	Protect	
35	5	PRU	Prunus	Flowering Cherry	Protect	
36	5	UP	Ulmus parvifolia	Chinese Elm	Remove	
37	5	UP	Ulmus parvifolia	Chinese Elm	Remove	
38	4	UP	Ulmus parvifolia	Chinese Elm	Remove	
39	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
40	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
41	5	UP	Ulmus parvifolia	Chinese Elm	Protect	
42	2	UP	Ulmus parvifolia	Chinese Elm	Protect	
43	4	UP	Ulmus parvifolia	Chinese Elm	Protect	
44	2	UP	Ulmus parvifolia	Chinese Elm	Protect	
45	4	UP	Ulmus parvifolia	Chinese Elm	Protect	
46	2	MAL	Malus	Crabapple	Remove	
47	5	MAL	Malus	Crabapple	Remove	
48	6	MAL	Malus	Crabapple	Remove	
49	6	MAL	Malus	Crabapple	Remove	
50	11	AF	Acer _ freemanii	Freeman's Maple	Remove	
51	9	AF	Acer _ freemanii	Freeman's Maple	Remove	
52	6	AR	Acer rubrum	Red Maple	Remove	
53	5	MAL	Malus	Crabapple	Remove	
54	5	MAL	Malus	Crabapple	Remove	
55	6	MAL	Malus	Crabapple	Remove	
56	10	AR	Acer rubrum	Red Maple	Remove	
57	7	AR	Acer rubrum	Red Maple	Remove	
58	7	AR	Acer rubrum	Red Maple	Remove	
59	4	MAL	Malus	Crabapple	Remove	
60	4	MAL	Malus	Crabapple	Remove	
61	4	MAL	Malus	Crabapple	Remove	
62	4	MAL	Malus	Crabapple	Remove	
63	3	MAL	Malus	Crabapple	Remove	
64	3	MAL	Malus	Crabapple	Remove	
65	4	PC	Pyrus calleryana	Callery Pear	Remove	
66	6	PC	Pyrus calleryana	Callery Pear	Remove	
67	4	PC	Pyrus calleryana	Callery Pear	Remove	
68	4	PC	Pyrus calleryana	Callery Pear	Remove	
69	4	PC	Pyrus calleryana	Callery Pear	Remove	
70	3	PC	Pyrus calleryana	Callery Pear	Remove	
71	6	PC	Pyrus calleryana	Callery Pear	Remove	
72	5	PC	Pyrus calleryana	Callery Pear	Remove	
73	6	AR	Acer rubrum	Red Maple	Remove	
74	4	AR	Acer rubrum	Red Maple	Remove	
75	5	AR	Acer rubrum	Red Maple	Remove	
76	4	AR	Acer rubrum	Red Maple	Remove	
77	4	AR	Acer rubrum	Red Maple	Remove	
78	4	AR	Acer rubrum	Red Maple	Remove	
79	4	AR	Acer rubrum	Red Maple	Remove	
80	2	AR	Acer rubrum	Red Maple	Remove	
81	4	AR	Acer rubrum	Red Maple	Remove	
82	3	AR	Acer rubrum	Red Maple	Remove	
83	3	AR	Acer rubrum	Red Maple	Remove	
84	4	AR	Acer rubrum	Red Maple	Remove	
85	4	PC	Pyrus calleryana	Callery Pear	Remove	
86	5	AR	Acer rubrum	Red Maple	Remove	
87	4	AR	Acer rubrum	Red Maple	Remove	
88	5	AR	Acer rubrum	Red Maple	Remove	
89	4	AR	Acer rubrum	Red Maple	Remove	
90	14	MAL	Malus	Crabapple	Remove	
91	12	MAL	Malus	Crabapple	Remove	
92	13	MAL	Malus	Crabapple	Remove	
93	11	AF	Acer _ freemanii	Freeman's Maple	Remove	
94	8	AR	Acer rubrum	Red Maple	Remove	
95	16	AF	Acer _ freemanii	Freeman's Maple	Remove	
96	4	MAL	Malus	Crabapple	Remove	
97	4	MAL	Malus	Crabapple	Remove	
98	4	MAL	Malus	Crabapple	Remove	
99	4	MAL	Malus	Crabapple	Remove	
100	4	MAL	Malus	Crabapple	Remove	
101	5	MAL	Malus	Crabapple	Remove	
102	3	MAL	Malus	Crabapple	Remove	
103	5	MAL	Malus	Crabapple	Remove	
104	4	MAL	Malus	Crabapple	Remove	
105	4	MAL	Malus	Crabapple	Remove	
106	15	GT	Gleditsia triacanthos	Honeylocust	Remove	
107	15	GT	Gleditsia triacanthos	Honeylocust	Remove	
108	8	MAL	Malus	Crabapple	Remove	
109	9	MAL	Malus	Crabapple	Remove	
110	4	MAL	Malus	Crabapple	Remove	
111	5	MAL	Malus	Crabapple	Remove	
112	6	MAL	Malus	Crabapple	Remove	
113	4	MAL	Malus	Crabapple	Remove	
114	13	BN	Betula nigra	River Birch	Remove	
115	7	BN	Betula nigra	River Birch	Remove	
116	8	BN	Betula nigra	River Birch	Remove	
117	10	PC	Pyrus calleryana	Callery Pear	Remove	
118	10	PC	Pyrus calleryana	Callery Pear	Remove	
119	13	PC	Pyrus calleryana	Callery Pear	Remove	
120	12	PC	Pyrus calleryana	Callery Pear	Remove	
121	16	PC	Pyrus calleryana	Callery Pear	Remove	
122	14	PC	Pyrus calleryana	Callery Pear	Remove	Shared-Use-Path conflict
123	11	PC	Pyrus calleryana	Callery Pear	Remove	Shared-Use-Path conflict
124	10	PC	Pyrus calleryana	Callery Pear	Remove	Shared-Use-Path conflict
125	12	MAL	Malus	Crabapple	Remove	Landscape configuration conflict
126	9	MAL	Malus	Crabapple	Remove	Road alignment conflict
127	10	MAL	Malus	Crabapple	Remove	Road alignment conflict
128	14	PA	Platanus _ acerifolia	London Planetree	Remove	Road alignment conflict
129	15	PA	Platanus _ acerifolia	London Planetree	Remove	Building conflict
130	6	PC	Pyrus calleryana	Callery Pear	Remove	Building conflict
131	8	PS	Pinus strobus	Eastern White Pine	Remove	Building conflict
132	6	AR	Acer rubrum	Red Maple	Remove	Road alignment conflict
133	5	AR	Acer rubrum	Red Maple	Remove	Road alignment conflict
134	7	BN	Betula nigra	River Birch	Protect	
135	4	AR	Acer rubrum	Red Maple	Protect	
136	4	AR	Acer rubrum	Red Maple	Protect	
137	33	QR	Quercus rubra	Northern Red Oak	Protect	
138	17	QV	Quercus velutina	Black Oak	Protect	
139	5	AR	Acer rubrum	Red Maple	Protect	
140	6	AR	Acer rubrum	Red Maple	Protect	
141	6	AR	Acer rubrum	Red Maple	Protect	
142	22	PD	Populus deltoides	Eastern Poplar	Protect	
143	20	AA	Ailanthus altissima	Tree of Heaven	Protect	
144	20	QP	Quercus palustris	Pin Oak	Protect	
145	4	PS	Pinus strobus	Eastern White Pine	Protect	
146	4	PS	Pinus strobus	Eastern White Pine	Protect	
147	5	PS	Pinus strobus	Eastern White Pine	Protect	
148	6	AA	Ailanthus altissima	Tree of Heaven	Protect	
149	7	AA	Ailanthus altissima	Tree of Heaven	Protect	
150	24	PSE	Prunus serotina	Black Cherry	Protect	
151	4	BN	Betula nigra	River Birch	Protect	
152	4	BN	Betula nigra	River Birch	Protect	
153	4	BN	Betula nigra	River Birch	Protect	
154	32	PS	Pinus strobus	Eastern White Pine	Protect	
155	27	PS	Pinus strobus	Eastern White Pine	Protect	
156	23	PS	Pinus strobus	Eastern White Pine	Protect	
157	19	PS	Pinus strobus	Eastern White Pine	Protect	
158	25	PA	Platanus _ acerifolia	London Planetree	Protect	
159	17	PA	Platanus _ acerifolia	London Planetree	Protect	
160	28	PA	Platanus _ acerifolia	London Planetree	Protect	
161	23	PA	Platanus _ acerifolia	London Planetree	Protect	
162	25	PA	Platanus _ acerifolia	London Planetree	Protect	
163	15	SAL	Salix	Willow	Protect	Community requested protection, Poor condition
164	8	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
165	7	PS	Pinus strobus	Eastern White Pine	Protect	
166	6	AP	Acer platanoides	Norway Maple	Remove	Invasive
167	4	PS	Pinus strobus	Eastern White Pine	Remove	
168	6	PS	Pinus strobus	Eastern White Pine	Remove	Poor condition
169	27	RP	Robinia pseudoacacia	Black Locust	Protect	Community requested protection, Poor condition
170	10	PS	Pinus strobus	Eastern White Pine	Remove	Poor condition
171	15	PS	Pinus strobus	Eastern White Pine	Protect	
172	4	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
173	7	PN	Pinus nigra	Austrian Pine	Protect	Landscape configuration conflict, >50% root infringement, Buried root collar
174	10	PS	Pinus strobus	Eastern White Pine	Protect	Landscape configuration conflict, >50% root infringement, Buried root collar
175	7	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
176	11	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
177	11	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
178	14	PS	Pinus strobus	Eastern White Pine	Protect	
179	9	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
180	13	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, >50% root infringement
181	13	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, Buried root collar
182	11	PN	Pinus nigra	Austrian Pine	Protect	
183	11	PS	Pinus strobus	Eastern White Pine	Remove	Poor condition
184	11	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
185	16	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
186	14	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
187	9	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
188	9	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
189	14	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
190	5	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
191	12	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
192	4	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
193	15	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
194	8	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
195	5	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
196	12	PN	Pinus nigra	Austrian Pine	Remove	Plaza conflict
197	20	AN	Acer negundo	Boxelder Maple	Remove	Plaza conflict
198	16	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
199	14	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
200	13	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
201	13	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
202	12	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
203	13	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
204	10	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
205	13	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
206	14	PS	Pinus strobus	Eastern White Pine	Remove	Plaza conflict
207	13	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
208	13	TP	Thuja plicata	Western Redcedar	Remove	Road alignment conflict
209	13	TP	Thuja plicata	Western Redcedar	Remove	Landscape configuration conflict, dead branches > 3, Buried root collar
210	13	TP	Thuja plicata	Western Redcedar	Remove	Road alignment conflict
211	13	TP	Thuja plicata	Western Redcedar	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
212	13	TP	Thuja plicata	Western Redcedar	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
213	11	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, >50% root infringement, Buried root collar
214	11	PS	Pinus strobus	Eastern White Pine	Remove	Building conflict
215	17	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
216	17	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
217	13	PN	Pinus nigra	Austrian Pine	Remove	Shared-Use-Path conflict
218	14	PN	Pinus nigra	Austrian Pine	Remove	Landscape configuration conflict, Buried root collar
219	5	CK	Cornus kousa	Kousa Dogwood	Remove	Building conflict
220	5	CK	Cornus kousa	Kousa Dogwood	Remove	Shared-Use-Path conflict
221	6	CK	Cornus kousa	Kousa Dogwood	Remove	Shared-Use-Path conflict
222	21	PS	Pinus strobus	Eastern White Pine	Remove	Landscape configuration conflict, Buried root collar
223	28	QP	Quercus palustris	Pin Oak	Protect	Community requested protection, Fair condition, Proximity to new Shared-Use-Path
224	30	QP	Quercus palustris	Pin Oak	Protect	Community requested protection, Good condition, Proximity to new Shared-Use-Path
225	28	QP	Quercus palustris	Pin Oak	Protect	Community requested protection, Good condition, Proximity to new Shared-Use-Path
226	8	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
227	12	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
228	7	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
229	8	PC	Pyrus calleryana	Callery Pear	Remove	Poor condition
230	8	PC	Pyrus calleryana	Callery Pear	Remove	Building conflict
231	10	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
232	8	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
233	11	PS	Pinus strobus	Eastern White Pine	Remove	Shared-Use-Path conflict
234	26	GT	Gleditsia triacanthos	Honeylocust	Remove	Building conflict
235	22	GT	Gleditsia triacanthos	Honeylocust	Remove	Building conflict
236	30	GT	Gleditsia triacanthos	Honeylocust	Remove	Building conflict
237	4	CK	Cornus kousa	Kousa Dogwood	Remove	Building conflict
238	4	CK	Cornus kousa	Kousa Dogwood	Remove	Building conflict
239	6	AC	Acer campestre	Hedge Maple	Remove	Building conflict
240	8	AC	Acer campestre	Hedge Maple	Remove	Sidewalk conflict
241	19	GT	Gleditsia triacanthos	Honeylocust	Remove	Drop-off conflict
242	17	GT	Gleditsia triacanthos	Honeylocust	Remove	Drop-off conflict
243	15	GT	Gleditsia triacanthos	Honeylocust	Remove	Drop-off conflict
244	17	GT	Gleditsia triacanthos	Honeylocust	Remove	Sidewalk conflict
245	7	AC	Acer campestre	Hedge Maple	Remove	Building conflict
246	11	AC	Acer campestre	Hedge Maple	Remove	Building conflict
247	10	AC	Acer campestre	Hedge Maple	Remove	Building conflict
248	15	PN	Pinus nigra	Austrian Pine	Remove	Building conflict
249	14	GT	Gleditsia triacanthos	Honeylocust	Remove	Building conflict
250	4	AC	Acer campestre	Hedge Maple	Remove	Building conflict
251	3	CK	Cornus kousa	Kousa Dogwood	Remove	Plaza conflict
252	6	AC	Acer campestre	Hedge Maple	Remove	Plaza conflict
253	5	AC	Acer campestre	Hedge Maple	Remove	Plaza conflict
254	4	AC	Acer campestre	Hedge Maple	Remove	Plaza conflict
255	6	AC	Acer campestre	Hedge Maple	Remove	Building conflict
256	5	AC	Acer campestre	Hedge Maple	Remove	Path conflict
257	5	AC	Acer campestre	Hedge Maple	Remove	Path conflict
258	8	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
259	7	AP	Acer platanoides	Norway Maple	Remove	Invasive
260	4	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
261	10	AP	Acer platanoides	Norway Maple	Remove	Invasive
262	6	MAL	Malus	Crabapple	Remove	
263	6	MAL	Malus	Crabapple	Remove	
264	5	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
265	7	AP	Acer platanoides	Norway Maple	Remove	Invasive
266	12	MR	Morus rubra	Red Mulberry	Remove	
267	10	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
268	6	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
269	9	AA	Ailanthus altissima	Tree of Heaven	Remove	Invasive
270	5	RP	Robinia pseudoacacia	Black Locust	Remove	
271	13	SAL	Salix	Willow	Remove	
272	4	RP	Robinia pseudoacacia	Black Locust	Remove	
273	11	SAL	Salix	Willow	Remove	
274	17	PN	Pinus nigra	Austrian Pine	Protect	
275	14	PN	Pinus nigra	Austrian Pine	Protect	
276	17	PS	Pinus strobus	Eastern White Pine	Protect	
277	13	PN	Pinus nigra	Austrian Pine	Protect	
278	13	PN	Pinus nigra	Austrian Pine	Protect	
279	10	PN	Pinus nigra	Austrian Pine	Protect	
280	13	PN	Pinus nigra	Austrian Pine	Protect	
281	19	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Fair condition
282	19	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Good condition
283	16	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Fair condition
284	18	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Fair condition
285	21	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Good condition
286	18	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Good condition
287	19	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Good condition
288	16	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Good condition
289	18	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Fair condition
290	21	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Fair condition
291	18	PN	Pinus nigra	Austrian Pine	Protect	Community requested protection, Poor condition
292	13	FP	Fraxinus pennsylvanica	White Ash	Remove	Landscape configuration conflict, >75% root infringement, Buried root collar
293	9	FP	Fraxinus pennsylvanica	White Ash	Remove	Landscape configuration conflict, >75% root infringement, Buried root collar
294	8	FP	Fraxinus pennsylvanica	White Ash	Remove	Landscape configuration conflict, >75% root infringement, Buried root collar
295	7	FP	Fraxinus pennsylvanica	White Ash	Remove	Poor condition
296	8	FP	Fraxinus pennsylvanica	White Ash	Remove	Landscape configuration conflict, >75% root infringement
297	9	FP	Fraxinus pennsylvanica	White Ash	Remove	Poor condition
298	8	FP	Fraxinus pennsylvanica	White Ash	Remove	Poor condition
299	8	FA	Fraxinus americana	White Ash	Remove	Landscape configuration conflict, >75% root infringement
300	11	PC	Pyrus calleryana	Callery Pear	Remove	Poor condition
301	13	PC	Pyrus calleryana	Callery Pear	Remove	Poor condition
302	4	AME	Amelanchier	Serviceberry	Protect	
303	12	PS	Pinus strobus	Eastern White Pine	Protect	
304	4	PC	Pyrus calleryana	Callery Pear	Protect	
305	5	QP	Quercus palustris	Pin Oak	Protect	
306	4	PS	Pinus strobus	Eastern White Pine	Protect	
307	6	PS	Pinus strobus	Eastern White Pine	Protect	
308	5	PS	Pinus strobus	Eastern White Pine	Protect	
309	6	PS	Pinus strobus	Eastern White Pine	Protect	
310	6	PS	Pinus strobus	Eastern White Pine	Protect	
311	5	PS	Pinus strobus	Eastern White Pine	Protect	
312	16	PS	Pinus strobus	Eastern White Pine	Protect	
313	14	PS	Pinus strobus	Eastern White Pine	Protect	
314	13	PS	Pinus strobus	Eastern White Pine	Protect	
315	8	PS	Pinus strobus	Eastern White Pine	Protect	Poor condition
316	12	PS	Pinus strobus	Eastern White Pine	Protect	
317	13	PS	Pinus strobus	Eastern White Pine	Remove	Community path conflict
318	6	PS	Pinus strobus	Eastern White Pine	Remove	Dead

NOTE:
Existing trees data are from a tree inventory report prepared by Bartlett Tree Experts, 50 Bear Hill Road Waltham, Massachusetts 02451, (781) 622-5980 , February 2022.

480 ARSENAL WAY

TOTAL NUMBER OF TREES: 237

NUMBER OF TREES REMOVED: 55

WITHIN WETLAND ZONES: 0

Tree ID	Inventory ID	ABBR	ScientName	CommonName	Action
1	319	TC	Tsuga canadensis	Hemlock-Canadian	Protect
2	320	TC	Tsuga canadensis	Hemlock-Canadian	Protect
3	321	TC	Tsuga canadensis	Hemlock-Canadian	Protect
4	322	TC	Tsuga canadensis	Hemlock-Canadian	Protect
5	323	AA	Ailanthus altissima	Tree of Heaven	Protect
6	324	RP	Robinia pseudoacacia	Locust-Black	Protect
7	325	TC	Tsuga canadensis	Hemlock-Canadian	Protect
8	326	PA	Picea abies	Spruce-Norway	Protect
9	327	PA	Picea abies	Spruce-Norway	Protect
10	328	TC	Tsuga canadensis	Hemlock-Canadian	Protect
11	329	TC	Tsuga canadensis	Hemlock-Canadian	Protect
12	330	TC	Tsuga canadensis	Hemlock-Canadian	Protect
13	331	TC	Tsuga canadensis	Hemlock-Canadian	Protect
14	332	TC	Tsuga canadensis	Hemlock-Canadian	Protect
15	333	TC	Tsuga canadensis	Hemlock-Canadian	Protect
16	334	TC	Tsuga canadensis	Hemlock-Canadian	Protect
17	335	TC	Tsuga canadensis	Hemlock-Canadian	Protect
18	336	TC	Tsuga canadensis	Hemlock-Canadian	Protect
19	337	TC	Tsuga canadensis	Hemlock-Canadian	Protect
20	338	TC	Tsuga canadensis	Hemlock-Canadian	Protect
21	339	TC	Tsuga canadensis	Hemlock-Canadian	Protect
22	340	TC	Tsuga canadensis	Hemlock-Canadian	Protect
23	341	TC	Tsuga canadensis	Hemlock-Canadian	Protect
24	342	TC	Tsuga canadensis	Hemlock-Canadian	Protect
25	343	AF	Abies fraseri	Fir-Fraser	Protect
26	344	AF	Abies fraseri	Fir-Fraser	Protect
27	345	AF	Abies fraseri	Fir-Fraser	Protect
28	346	AN	Acer negundo	Maple-Boxelder	Protect
29	347	TC	Tsuga canadensis	Hemlock-Canadian	Protect
30	348	TC	Tsuga canadensis	Hemlock-Canadian	Protect
31	349	TC	Tsuga canadensis	Hemlock-Canadian	Protect
32	350	TC	Tsuga canadensis	Hemlock-Canadian	Protect
33	351	TC	Tsuga canadensis	Hemlock-Canadian	Protect
34	352	MR	Morus rubra	Mulberry-Red	Protect
35	353	TC	Tsuga canadensis	Hemlock-Canadian	Protect
36	354	TC	Tsuga canadensis	Hemlock-Canadian	Protect
37	355	CF	Cornus florida	Dogwood-Flowering	Protect
38	356	TC	Tsuga canadensis	Hemlock-Canadian	Protect
39	357	TC	Tsuga canadensis	Hemlock-Canadian	Protect
40	358	TC	Tsuga canadensis	Hemlock-Canadian	Protect
41	359	CF	Cornus florida	Dogwood-Flowering	Protect
42	360	TC	Tsuga canadensis	Hemlock-Canadian	Protect
43	361	TC	Tsuga canadensis	Hemlock-Canadian	Protect
44	362	TC	Tsuga canadensis	Hemlock-Canadian	Protect
45	363	MR	Morus rubra	Mulberry-Red	Protect
46	364	PN	Pinus nigra	Pine-Austrian	Protect
47	365	TC	Tsuga canadensis	Hemlock-Canadian	Protect
48	366	TC	Tsuga canadensis	Hemlock-Canadian	Protect
49	367	TC	Tsuga canadensis	Hemlock-Canadian	Protect
50	368	TC	Tsuga canadensis	Hemlock-Canadian	Protect
51	369	AF	Abies fraseri	Fir-Fraser	Protect
52	370	AF	Abies fraseri	Fir-Fraser	Protect
53	371	AF	Abies fraseri	Fir-Fraser	Protect
54	372	MR	Morus rubra	Mulberry-Red	Protect
55	373	TC	Tsuga canadensis	Hemlock-Canadian	Protect
56	374	TC	Tsuga canadensis	Hemlock-Canadian	Protect
57	375	TC	Tsuga canadensis	Hemlock-Canadian	Protect
58	376	TC	Tsuga canadensis	Hemlock-Canadian	Protect
59	377	TC	Tsuga canadensis	Hemlock-Canadian	Protect
60	378	TC	Tsuga canadensis	Hemlock-Canadian	Protect
61	379	TC	Tsuga canadensis	Hemlock-Canadian	Protect
62	380	TC	Tsuga canadensis	Hemlock-Canadian	Protect
63	381	TC	Tsuga canadensis	Hemlock-Canadian	Protect
64	382	TC	Tsuga canadensis	Hemlock-Canadian	Protect
65	383	TC	Tsuga canadensis	Hemlock-Canadian	Protect
66	384	TC	Tsuga canadensis	Hemlock-Canadian	Protect
67	385	TC	Tsuga canadensis	Hemlock-Canadian	Protect
68	386	TC	Tsuga canadensis	Hemlock-Canadian	Protect
69	387	TC	Tsuga canadensis	Hemlock-Canadian	Protect
70	388	TC	Tsuga canadensis	Hemlock-Canadian	Protect
71	389	TC	Tsuga canadensis	Hemlock-Canadian	Protect
72	390	PS	Pinus strobus	Pine-Eastern White	Protect
73	391	CF	Cornus florida	Dogwood-Flowering	Protect
74	392	CF	Cornus florida	Dogwood-Flowering	Protect
75	393	CF	Cornus florida	Dogwood-Flowering	Protect
76	394	AF	Abies fraseri	Fir-Fraser	Protect
77	395	TC	Tsuga canadensis	Hemlock-Canadian	Protect
78	396	TC	Tsuga canadensis	Hemlock-Canadian	Protect
79	397	TC	Tsuga canadensis	Hemlock-Canadian	Protect
80	398	TC	Tsuga canadensis	Hemlock-Canadian	Protect
81	399	TC	Tsuga canadensis	Hemlock-Canadian	Protect
82	400	TC	Tsuga canadensis	Hemlock-Canadian	Protect
83	401	TC	Tsuga canadensis	Hemlock-Canadian	Protect
84	402	TC	Tsuga canadensis	Hemlock-Canadian	Protect
85	403	TC	Tsuga canadensis	Hemlock-Canadian	Protect
86	404	TC	Tsuga canadensis	Hemlock-Canadian	Protect
87	405	TC	Tsuga canadensis	Hemlock-Canadian	Protect
88	406	TC	Tsuga canadensis	Hemlock-Canadian	Protect
89	407	TC	Tsuga canadensis	Hemlock-Canadian	Protect
90	408	TC	Tsuga canadensis	Hemlock-Canadian	Protect
91	409	TC	Tsuga canadensis

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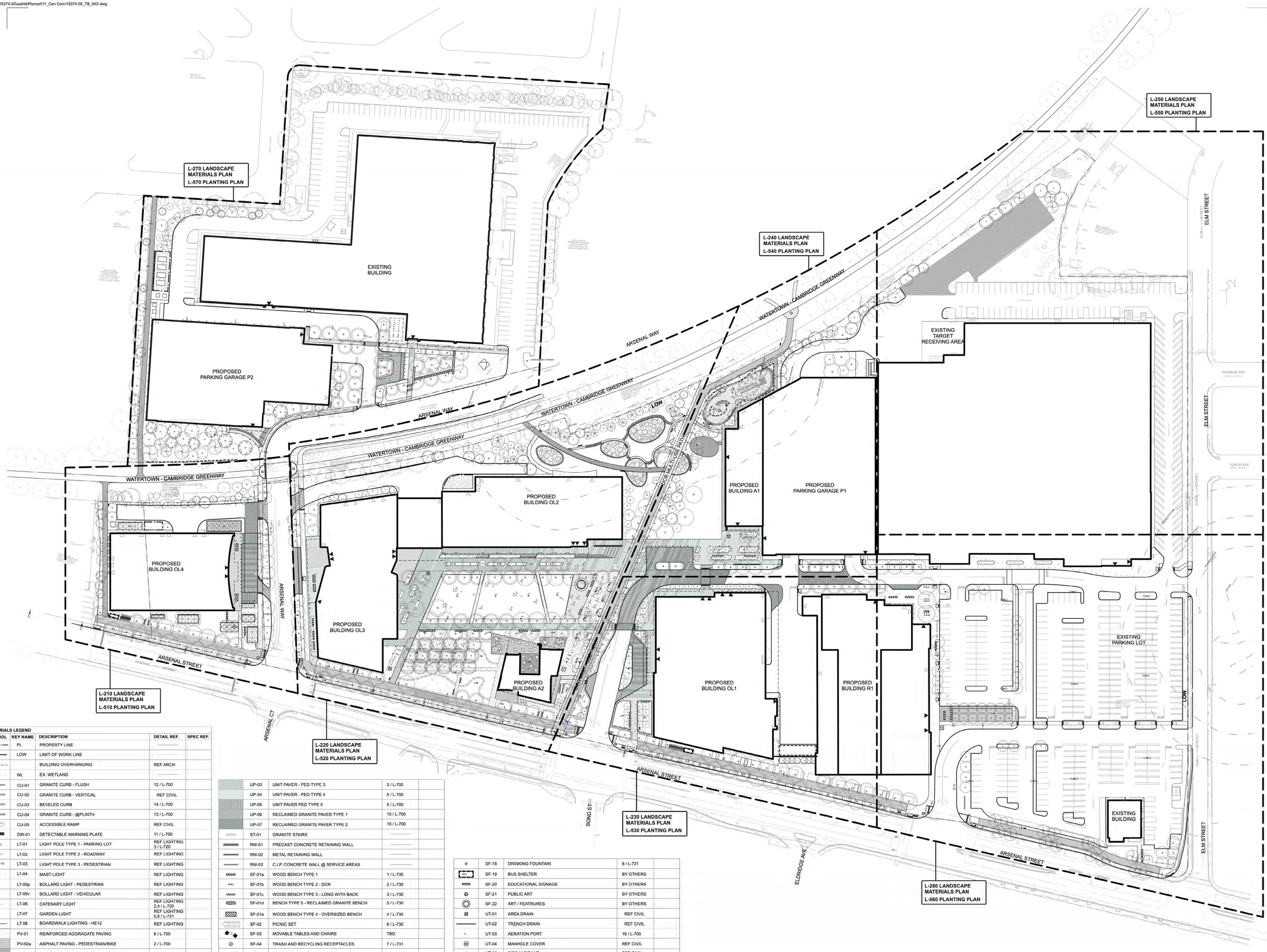

MATERIALS LEGEND

SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.	SPEC REF.
	PL	PROPERTY LINE		
	LOW	LIMIT OF WORK LINE		
		BUILDING OVERHANGING	REF ARCH	
	WL	EX. WETLAND		
	CU-01	GRANITE CURB - FLUSH	12 / L-700	
	CU-02	GRANITE CURB - VERTICAL	REF CIVIL	
	CU-03	BEVELED CURB	14 / L-700	
	CU-04	GRANITE CURB - @PLINTH	13 / L-700	
	CU-05	ACCESSIBLE RAMP	REF CIVIL	
	DW-01	DETECTABLE WARNING PLATE	11 / L-700	
	LT-01	LIGHT POLE TYPE 1 - PARKING LOT	REF LIGHTING 3 / L-720	
	LT-02	LIGHT POLE TYPE 2 - ROADWAY	REF LIGHTING	
	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING	
	LT-04	MAST LIGHT	REF LIGHTING	
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING	
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING	
	LT-06	CATENARY LIGHT	REF LIGHTING 2,4 / L-720	
	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731	
	LT-08	BOARDWALK LIGHTING - HE12	REF LIGHTING	
	PV-01	REINFORCED AGGRAGATE PAVING	6 / L-700	
	PV-02a	ASPHALT PAVING - PEDESTRIAN/BIKE	2 / L-700	
	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700	
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL	
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700	
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700	
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700	
	PV-07	WOOD BOARDWALK	1-7 / L-710	
	PV-08	WOOD DECKING		
	PV-09	PEASTONE PAVING	7 / L-700	
	PV-10	STEEL EDGE	8 -10 / L-700	
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700	
	PV-12	TUMBLED STONE PAVERS		
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700	
	UP-02	UNIT PAVER - PED TYPE 2	5 / L-700	
	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700	
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700	
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700	
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700	
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700	
	ST-01	GRANITE STAIRS		
	RW-01	PRECAST CONCRETE RETAINING WALL		
	RW-02	METAL RETAINING WALL		
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS		
	SF-01a	WOOD BENCH TYPE 1	1 / L-730	
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730	
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730	
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730	
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730	
	SF-02	PICNIC SET	6 / L-730	
	SF-03	MOVABLE TABLES AND CHAIRS	TBD	
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731	
	SF-06	BIKE RACK	1 / L-731	
	SF-06C	CARGO BIKE RACK	3 / L-731	
	SF-07	BLUEBIKE STATION	BY OTHERS	
	SF-08	BIKE REPAIR STATION	2 / L-731	
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731	
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL	
	SF-11	GUARDRAIL	7 / L-710	
WF1	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS	
	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS	
	SF-14	CHAIN LINK FENCE	4 / L-740	
	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740	
	SF-16	LOUVER FENCE	5 / L-740	
	SF-17	HANDRAIL	1,2 / L-740	
	SF-18	DRINKING FOUNTAIN	8 / L-731	
BUS	SF-19	BUS SHELTER	BY OTHERS	
	SF-20	EDUCATIONAL SIGNAGE	BY OTHERS	
	SF-21	PUBLIC ART	BY OTHERS	
	SF-22	ART / FEATRURES	BY OTHERS	
	UT-01	AREA DRAIN	REF CIVIL	
	UT-02	TRENCH DRAIN	REF CIVIL	
	UT-03	AERATION PORT	16 / L-700	
	UT-04	MANHOLE COVER	REF CIVIL	
	UT-05	FIRE HYDRANT	REF CIVIL	
	UT-06	VEHICULAR SIGNAGE	REF CIVIL	
	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL	
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL	
	UT-09	UTILITY BOX	REF CIVIL	
G.R.T.	UT-10	GREASE TRAP	BY OTHERS	
	UT-11	TRANSFORMER	REF CIVIL	
PP	UT-12	POWER PEDESTAL	BY OTHERS	
	UT-13	ROOT BARRIER		
	UT-14	CONDENSER UNIT	BY OTHERS	
	UT-15	FUTURE CONDENSER UNIT	BY OTHERS	
	UT-16	SCREEN	TBD	
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL	

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** — Date: **06/07/2024**

Not Issued for Construction

Drawing Title
L-200 OVERALL LANDSCAPE MATERIALS PLAN

Drawing Number
L-200

Scale
1" = 50'

Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM VIDUDMANTAS Plotted: Wednesday, April 12, 2023 9:25:55 AM Vanessa Guzman Tong

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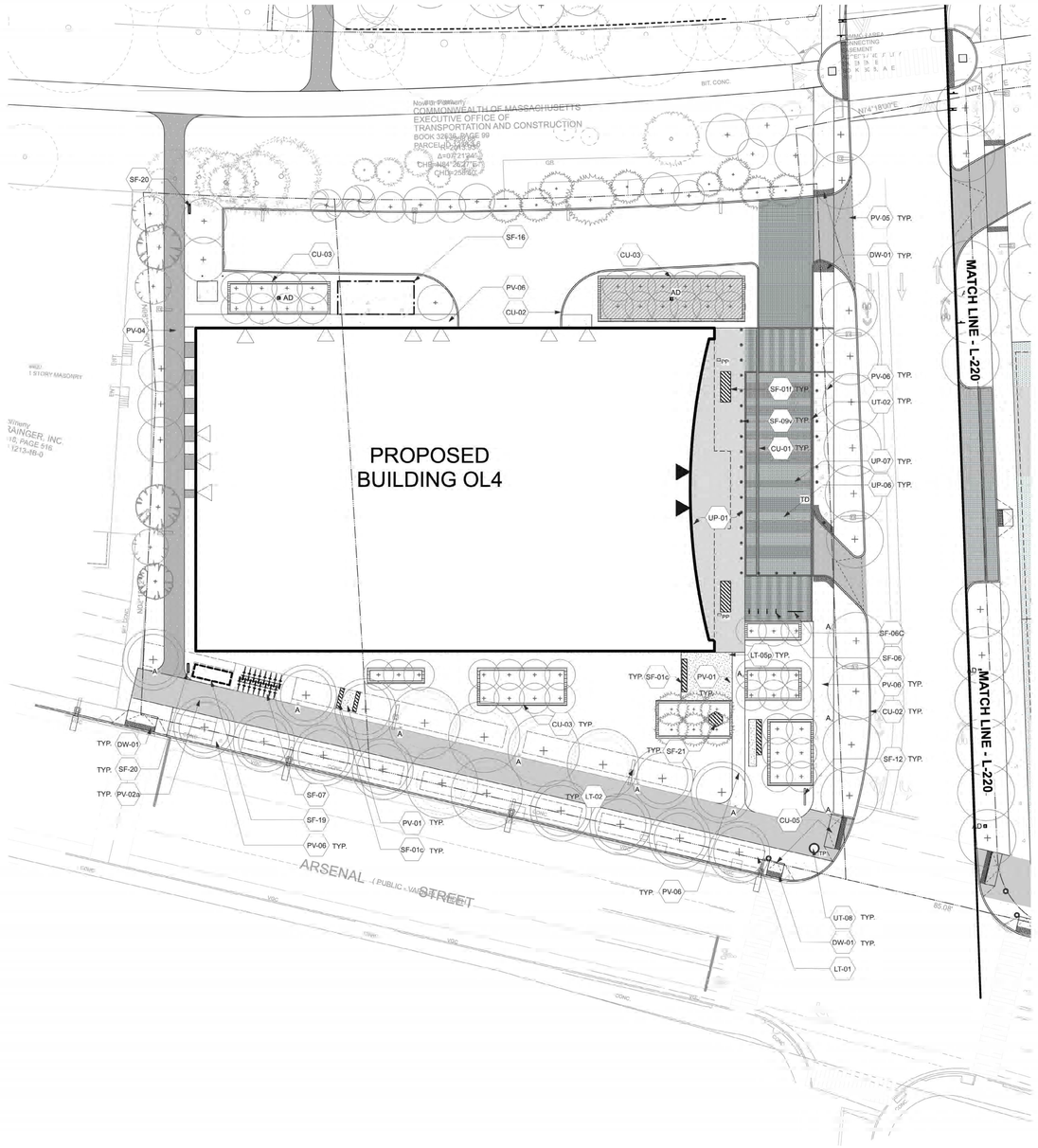

MATERIALS LEGEND			
SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.
	PL	PROPERTY LINE	
	LOW	LIMIT OF WORK LINE	
		BUILDING OVERHANGING	REF ARCH
	WL	EX. WETLAND	
	CU-01	GRANITE CURB - FLUSH	12 / L-700
	CU-02	GRANITE CURB - VERTICAL	REF CIVIL
	CU-03	BEVELED CURB	14 / L-700
	CU-04	GRANITE CURB - @PLINTH	13 / L-700
	CU-05	ACCESSIBLE RAMP	REF CIVIL
	DW-01	DETECTABLE WARNING PLATE	11 / L-700
	LT-01	LIGHT POLE TYPE 1 - PARKING LOT	REF LIGHTING 3 / L-720
	LT-02	LIGHT POLE TYPE 2 - ROADWAY	REF LIGHTING
	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING
	LT-04	MAST LIGHT	REF LIGHTING
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING
	LT-06	CATENARY LIGHT	REF LIGHTING 2,4 / L-720
	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731
	LT-08	BOARDWALK LIGHTING - HE12	REF LIGHTING
	PV-01	REINFORCED AGGRAGATE PAVING	6 / L-700
	PV-02a	ASPHALT PAVING - PEDESTRIAN/BIKE	2 / L-700
	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700
	PV-07	WOOD BOARDWALK	1-7 / L-710
	PV-08	WOOD DECKING	
	PV-09	PEASTONE PAVING	7 / L-700
	PV-10	STEEL EDGE	8 -10 / L-700
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700
	PV-12	TUMBLED STONE PAVERS	18 / L-700
	PV-13	PLAYGROUND SURFACING - RUBBER	17/L-700
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700
	UP-02	UNIT PAVER - PED TYPE 2	5 / L-700
	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700
	ST-01	GRANITE STAIRS	1 / L-750
	RW-01	PRECAST CONCRETE RETAINING WALL	1 / L-750
	RW-02	METAL RETAINING WALL	1 / L-750
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS	1 / L-750
	SF-01a	WOOD BENCH TYPE 1	1 / L-730
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730
	SF-02	PICNIC SET	6 / L-730
	SF-03	MOVABLE TABLES AND CHAIRS	TBD
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731
	SF-06	BIKE RACK	1 / L-731
	SF-06C	CARGO BIKE RACK	3 / L-731
	SF-07	BLUEBIKE STATION	BY OTHERS
	SF-08	BIKE REPAIR STATION	2 / L-731
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL
	SF-11	GUARDRAIL	7 / L-710
WF1	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS
WF2	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS
	SF-14	CHAIN LINK FENCE	4 / L-740
	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740
	SF-16	LOUVER FENCE	5 / L-740
	SF-17	HANDRAIL	1,2 / L-740
	SF-18	DRINKING FOUNTAIN	8 / L-731
BUS SHELTER	SF-19	BUS SHELTER	BY OTHERS
	SF-20	EDUCATIONAL SIGNAGE	BY OTHERS
	SF-21	PUBLIC ART	BY OTHERS
	SF-22	ART / FEATRURES	BY OTHERS
	SF-22	LOG FENCING	TBD
	SF-23	METAL FENCING	TBD
	SF-24	GATE	TBD
	SF-25	SAND PIT	TBD
	SF-26	CLIMBING NET	TBD
	SF-27	WOOD LOGS/STUMPS	TBD
	SF-28	BOULDERS	TBD
	UT-01	AREA DRAIN	REF CIVIL
	UT-02	TRENCH DRAIN	REF CIVIL
A	UT-03	AERATION PORT	16 / L-700
	UT-04	MANHOLE COVER	REF CIVIL
	UT-05	FIRE HYDRANT	REF CIVIL
	UT-06	VEHICULAR SIGNAGE	REF CIVIL
	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL
	UT-09	UTILITY BOX	REF CIVIL
	UT-10	GREASE TRAP	BY OTHERS
	UT-11	TRANSFORMER	REF CIVIL
	UT-12	POWER PEDESTAL	BY OTHERS
	UT-13	ROOT BARRIER	2 / L-800
	UT-14	CONDENSER UNIT	BY OTHERS
	UT-15	FUTURE CONDENSER UNIT	BY OTHERS
	UT-16	SCREEN	TBD
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL
	PS-1	PLAY STRUCTURE TYPE 1	TBD
	PS-2	PLAY STRUCTURE TYPE 2	TBD
	PS-3	PLAY STRUCTURE TYPE 3	TBD
	PS-4	PLAY LOGS	TBD

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

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Date
06/07/2024

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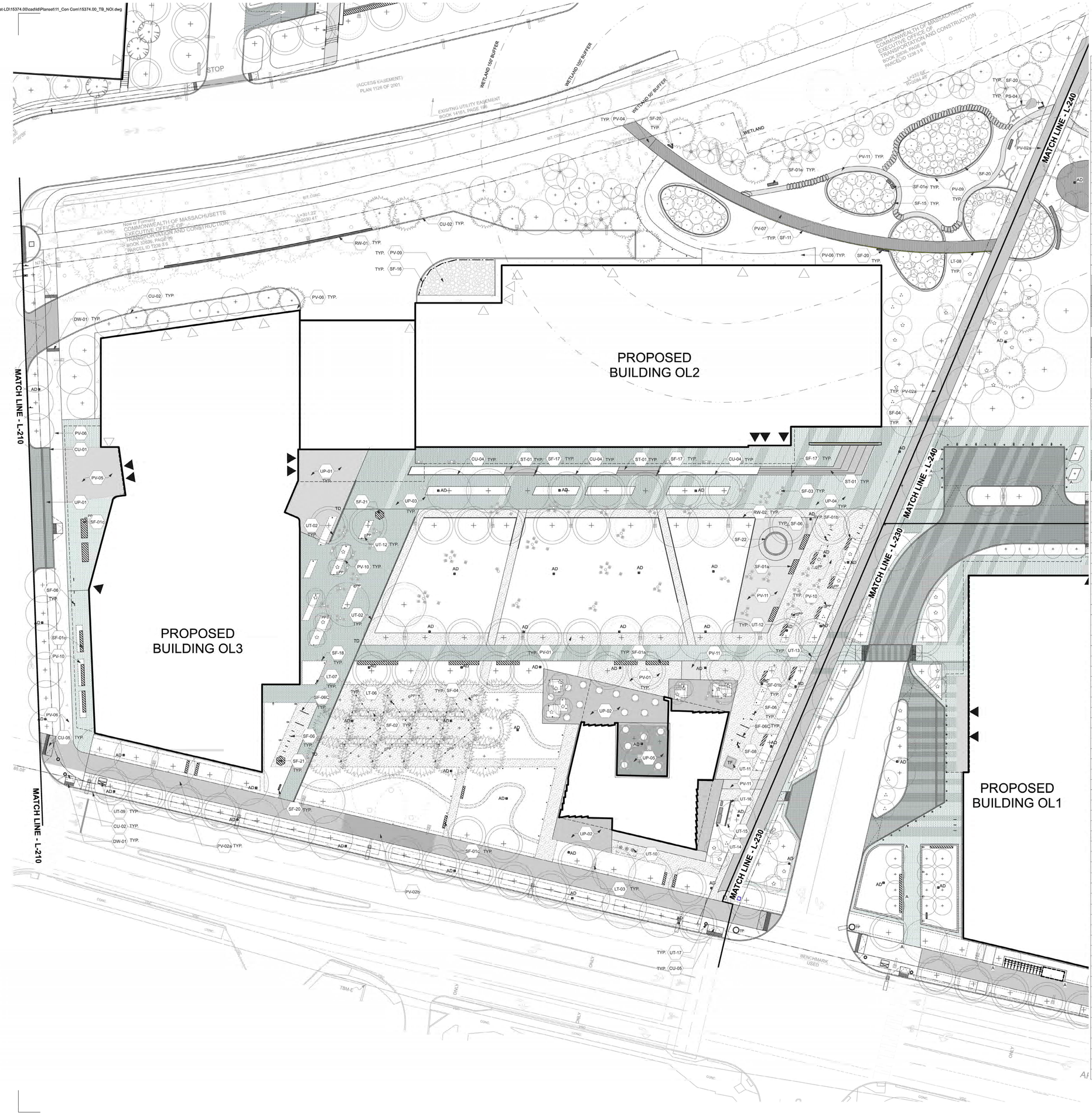
Drawing Title
L-210
LANDSCAPE MATERIALS PLAN

Drawing Number
L-210

Scale
1" = 20'

Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM \\GUZMAN.TANG Plotted: Wednesday, April 12, 2023 9:25:55 AM Vanessa Guzman Tang



MATERIALS LEGEND			
SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.
	PL	PROPERTY LINE	
	LOW	LIMIT OF WORK LINE	
		BUILDING OVERHANGING	REF ARCH
	WL	EX. WETLAND	
	CU-01	GRANITE CURB - FLUSH	12 / L-700
	CU-02	GRANITE CURB - VERTICAL	REF CIVIL
	CU-03	BEVELED CURB	14 / L-700
	CU-04	GRANITE CURB - @PLINTH	13 / L-700
	CU-05	ACCESSIBLE RAMP	REF CIVIL
	DW-01	DETECTABLE WARNING PLATE	11 / L-700
	LT-01	LIGHT POLE TYPE 1 - PARKING LOT	REF LIGHTING 3 / L-720
	LT-02	LIGHT POLE TYPE 2 - ROADWAY	REF LIGHTING
	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING
	LT-04	MAST LIGHT	REF LIGHTING
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING
	LT-06	CATENARY LIGHT	REF LIGHTING 2,4 / L-720
	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731
	LT-08	BOARDWALK LIGHTING - HE12	REF LIGHTING
	PV-01	REINFORCED AGGRAGATE PAVING	6 / L-700
	PV-02a	ASPHALT PAVING - PEDESTRIAN/BIKE	2 / L-700
	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700
	PV-07	WOOD BOARDWALK	1-7 / L-710
	PV-08	WOOD DECKING	
	PV-09	PEASTONE PAVING	7 / L-700
	PV-10	STEEL EDGE	8 -10 / L-700
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700
	PV-12	TUMBLED STONE PAVERS	18 / L-700
	PV-13	PLAYGROUND SURFACING - RUBBER	17/L-700
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700
	UP-02	UNIT PAVER - PED TYPE 2	5 / L-700
	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700
	ST-01	GRANITE STAIRS	1 / L-750
	RW-01	PRECAST CONCRETE RETAINING WALL	1 / L-750
	RW-02	METAL RETAINING WALL	1 / L-750
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS	1 / L-750
	SF-01a	WOOD BENCH TYPE 1	1 / L-730
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730
	SF-02	PICNIC SET	6 / L-730
	SF-03	MOVABLE TABLES AND CHAIRS	TBD
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731
	SF-06	BIKE RACK	1 / L-731
	SF-06C	CARGO BIKE RACK	3 / L-731
	SF-07	BLUEBIKE STATION	BY OTHERS
	SF-08	BIKE REPAIR STATION	2 / L-731
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL
	SF-11	GUARDRAIL	7 / L-710
	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS
	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS
	SF-14	CHAIN LINK FENCE	4 / L-740
	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740
	SF-16	LOUVER FENCE	5 / L-740
	SF-17	HANDRAIL	1,2 / L-740
	SF-18	DRINKING FOUNTAIN	8 / L-731
	SF-19	BUS SHELTER	BY OTHERS
	SF-20	EDUCATIONAL SIGNAGE	BY OTHERS
	SF-21	PUBLIC ART	BY OTHERS
	SF-22	ART / FEATRURES	BY OTHERS
	SF-22	LOG FENCING	TBD
	SF-23	METAL FENCING	TBD
	SF-24	GATE	TBD
	SF-25	SAND PIT	TBD
	SF-26	CLIMBING NET	TBD
	SF-27	WOOD LOGS/STUMPS	TBD
	SF-28	BOULDERS	TBD
	UT-01	AREA DRAIN	REF CIVIL
	UT-02	TRENCH DRAIN	REF CIVIL
	UT-03	AERATION PORT	16 / L-700
	UT-04	MANHOLE COVER	REF CIVIL
	UT-05	FIRE HYDRANT	REF CIVIL
	UT-06	VEHICULAR SIGNAGE	REF CIVIL
	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL
	UT-09	UTILITY BOX	REF CIVIL
	UT-10	GREASE TRAP	BY OTHERS
	UT-11	TRANSFORMER	REF CIVIL
	UT-12	POWER PEDESTAL	BY OTHERS
	UT-13	ROOT BARRIER	2 / L-800
	UT-14	CONDENSER UNIT	BY OTHERS
	UT-15	FUTURE CONDENSER UNIT	BY OTHERS
	UT-16	SCREEN	TBD
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL
	PS-1	PLAY STRUCTURE TYPE 1	TBD
	PS-2	PLAY STRUCTURE TYPE 2	TBD
	PS-3	PLAY STRUCTURE TYPE 3	TBD
	PS-4	PLAY LOGS	TBD

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** — Date: **06/07/2024**

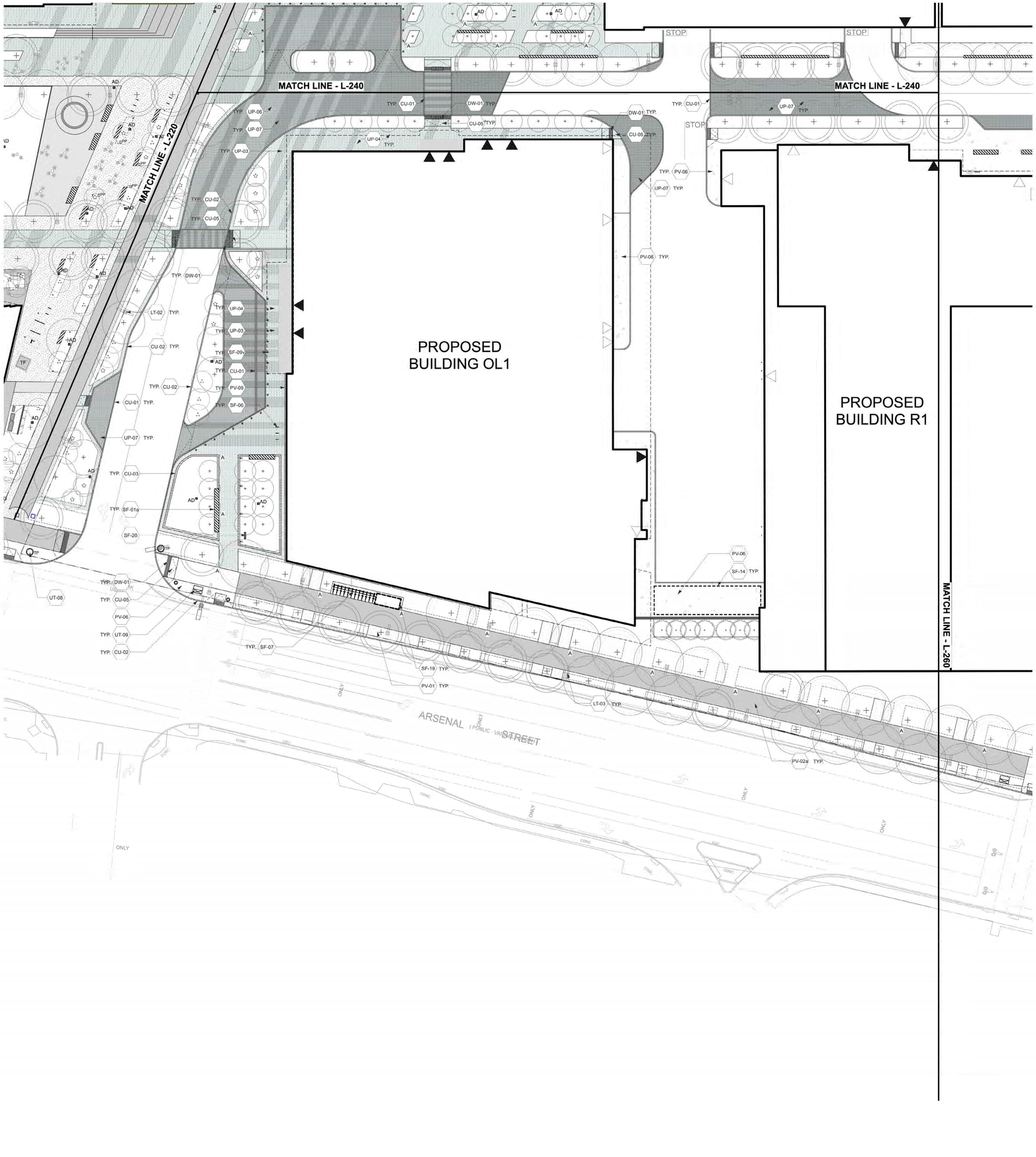
Not Issued for Construction

Drawing Title
L-220 LANDSCAPE MATERIALS PLAN

Drawing Number
L-220

Scale: **1" = 20'**

Project Number: **15374.00**



MATERIALS LEGEND			
SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.
	PL	PROPERTY LINE	
	LOW	LIMIT OF WORK LINE	
		BUILDING OVERHANGING	REF ARCH
	WL	EX. WETLAND	
	CU-01	GRANITE CURB - FLUSH	12 / L-700
	CU-02	GRANITE CURB - VERTICAL	REF CIVIL
	CU-03	BEVELED CURB	14 / L-700
	CU-04	GRANITE CURB - @PLINTH	13 / L-700
	CU-05	ACCESSIBLE RAMP	REF CIVIL
	DW-01	DETECTABLE WARNING PLATE	11 / L-700
	LT-01	LIGHT POLE TYPE 1 - PARKING LOT	REF LIGHTING 3 / L-720
	LT-02	LIGHT POLE TYPE 2 - ROADWAY	REF LIGHTING
	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING
	LT-04	MAST LIGHT	REF LIGHTING
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING
	LT-06	CATENARY LIGHT	REF LIGHTING 2,4 / L-720
	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731
	LT-08	BOARDWALK LIGHTING - HE12	REF LIGHTING
	PV-01	REINFORCED AGGRAGATE PAVING	6 / L-700
	PV-02a	ASPHALT PAVING - PEDESTRIAN/BIKE	2 / L-700
	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700
	PV-07	WOOD BOARDWALK	1-7 / L-710
	PV-08	WOOD DECKING	
	PV-09	PEASTONE PAVING	7 / L-700
	PV-10	STEEL EDGE	8 -10 / L-700
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700
	PV-12	TUMBLED STONE PAVERS	18 / L-700
	PV-13	PLAYGROUND SURFACING - RUBBER	17/L-700
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700
	UP-02	UNIT PAVER - PED TYPE 2	5 / L-700
	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700
	ST-01	GRANITE STAIRS	1 / L-750
	RW-01	PRECAST CONCRETE RETAINING WALL	1 / L-750
	RW-02	METAL RETAINING WALL	1 / L-750
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS	1 / L-750
	SF-01a	WOOD BENCH TYPE 1	1 / L-730
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730
	SF-02	PICNIC SET	6 / L-730
	SF-03	MOVABLE TABLES AND CHAIRS	TBD
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731
	SF-06	BIKE RACK	1 / L-731
	SF-06C	CARGO BIKE RACK	3 / L-731
	SF-07	BLUEBIKE STATION	BY OTHERS
	SF-08	BIKE REPAIR STATION	2 / L-731
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL
	SF-11	GUARDRAIL	7 / L-710
WF1	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS
WF2	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS
	SF-14	CHAIN LINK FENCE	4 / L-740
	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740
	SF-16	LOUVER FENCE	5 / L-740
	SF-17	HANDRAIL	1,2 / L-740
	SF-18	DRINKING FOUNTAIN	8 / L-731
BUS	SF-19	BUS SHELTER	BY OTHERS
	SF-20	EDUCATIONAL SIGNAGE	BY OTHERS
	SF-21	PUBLIC ART	BY OTHERS
	SF-22	ART / FEATRURES	BY OTHERS
	SF-22	LOG FENCING	TBD
	SF-23	METAL FENCING	TBD
	SF-24	GATE	TBD
	SF-25	SAND PIT	TBD
	SF-26	CLIMBING NET	TBD
	SF-27	WOOD LOGS/STUMPS	TBD
	SF-28	BOULDERS	TBD
	UT-01	AREA DRAIN	REF CIVIL
	UT-02	TRENCH DRAIN	REF CIVIL
	UT-03	AERATION PORT	16 / L-700
	UT-04	MANHOLE COVER	REF CIVIL
	UT-05	FIRE HYDRANT	REF CIVIL
	UT-06	VEHICULAR SIGNAGE	REF CIVIL
	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL
	UT-09	UTILITY BOX	REF CIVIL
	UT-10	GREASE TRAP	BY OTHERS
	UT-11	TRANSFORMER	REF CIVIL
	UT-12	POWER PEDESTAL	BY OTHERS
	UT-13	ROOT BARRIER	2 / L-800
	UT-14	CONDENSER UNIT	BY OTHERS
	UT-15	FUTURE CONDENSER UNIT	BY OTHERS
	UT-16	SCREEN	TBD
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL
	PS-1	PLAY STRUCTURE TYPE 1	TBD
	PS-2	PLAY STRUCTURE TYPE 2	TBD
	PS-3	PLAY STRUCTURE TYPE 3	TBD
	PS-4	PLAY LOGS	TBD

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Notice of Intent **06/07/2024**

Not Issued for Construction

Drawing Title

L-230
LANDSCAPE MATERIALS PLAN

Drawing Number

L-230

Scale
1" = 20'

Project Number
15374.00

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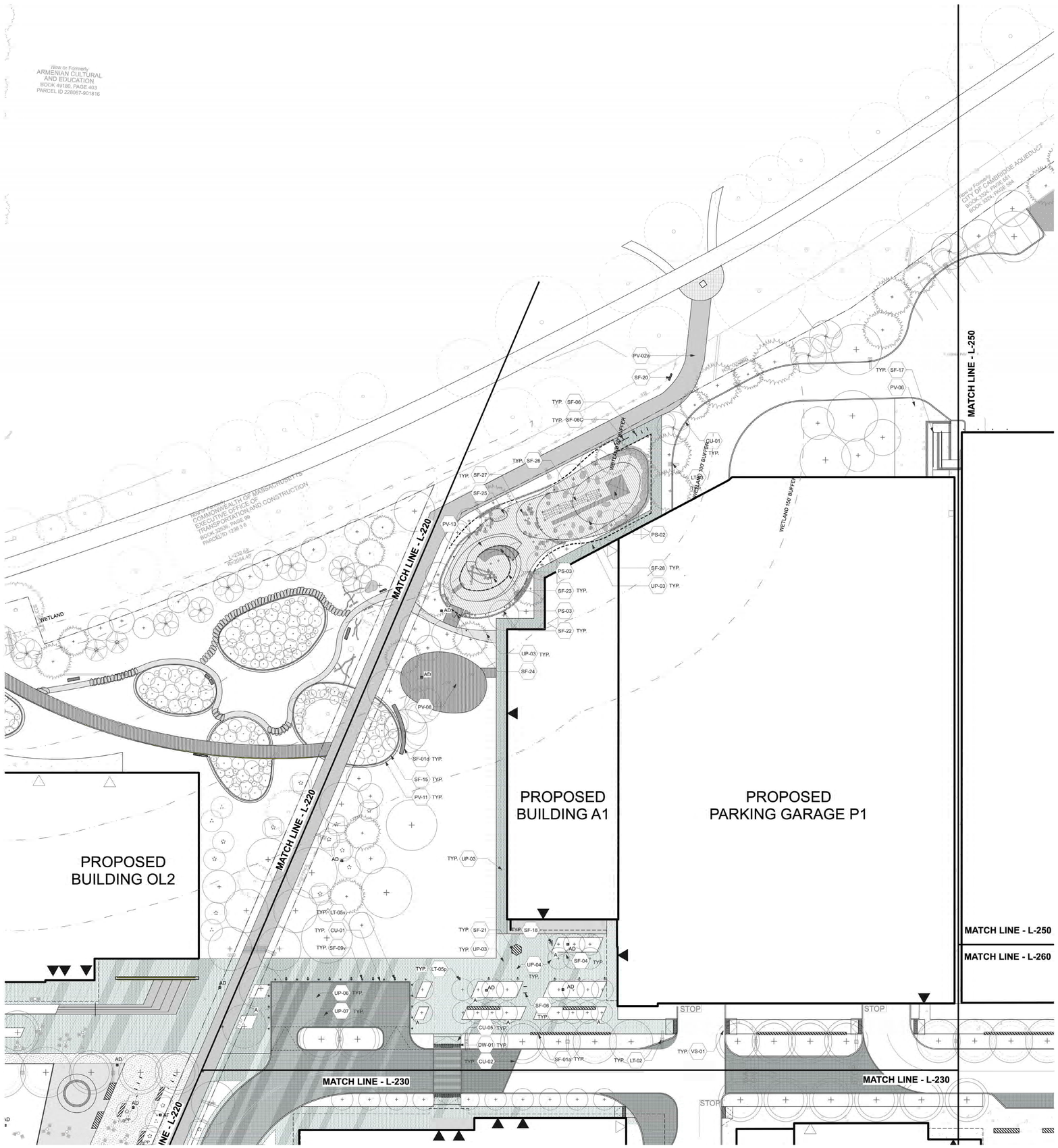
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ARMENIAN CULTURAL AND EDUCATION
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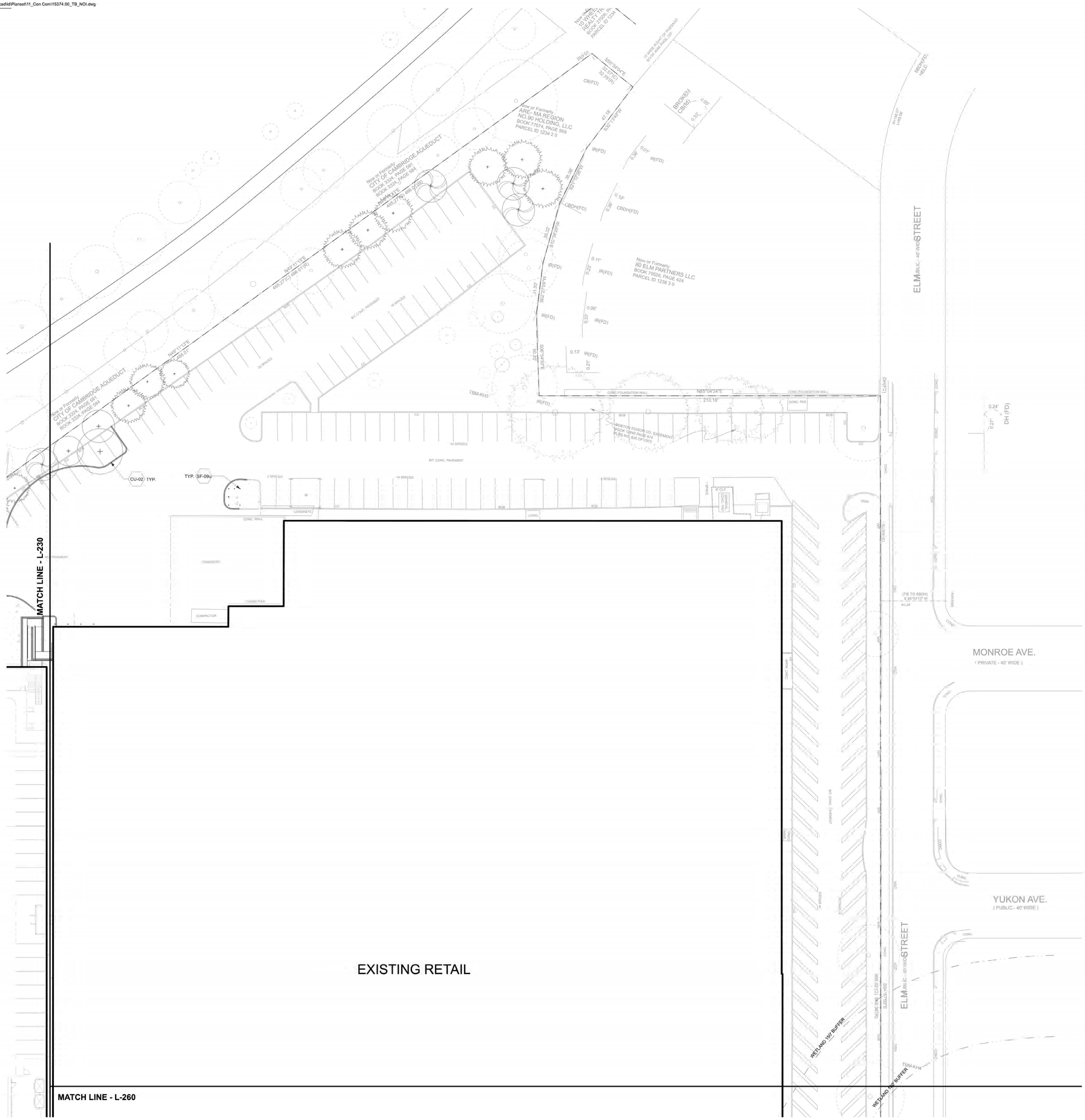
PARCEL ID 228067-901816
Now or Formerly
COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION
BOOK 28636, PAGE 99
PARCEL/ID 1238 3 6
Now or Formerly
CITY OF CAMBRIDGE AQUEDUCT
BOOK 3324, PAGE 564
BOOK 3324, PAGE 564
MATCH LINE - L-220
MATCH LINE - L-250
MATCH LINE - L-260
MATCH LINE - L-230
PROPOSED BUILDING A1
PROPOSED PARKING GARAGE P1
PROPOSED BUILDING OL2
WETLAND
WETLAND 100' BUFFER
WETLAND 150' BUFFER
STOP
PV-02a
SF-20
TYP. SF-06
TYP. SF-06C
TYP. SF-26
TYP. SF-27
SF-25
PV-13
PS-02
PS-03
SF-23 TYP.
SF-22 TYP.
UP-03 TYP.
SF-24
PV-08
SF-01d TYP.
SF-15 TYP.
PV-11 TYP.
TYP. UP-03
TYP. LT-05v
TYP. CU-01
TYP. SF-09v
TYP. SF-21
TYP. SF-18
TYP. UP-03
TYP. LT-05p
UP-04 TYP.
SF-04 TYP.
SF-06 TYP.
UP-06 TYP.
UP-07 TYP.
CU-05 TYP.
DW-01 TYP.
TYP. CU-02
SF-01a TYP.
TYP. LT-02
TYP. VS-01
TYP. SF-17
PV-06
CU-01 TYP.
LT-02
SF-28 TYP.
UP-03 TYP.
AD
A
LT-05p
LT-05v
SF-09v
SF-01d
SF-15
PV-11
UP-03
SF-18
SF-21
SF-04
SF-06
UP-04
UP-06
UP-07
CU-05
DW-01
CU-02
SF-01a
LT-02
VS-01
SF-17
PV-06
CU-01
SF-28
UP-03
PS-02
PS-03
SF-23
SF-22
SF-24
PV-08
SF-01d
SF-15
PV-11
UP-03
SF-20
PV-02a
SF-06
SF-06C
SF-26
SF-27
SF-25
PV-13
LT-02
SF-04
SF-18
SF-21
LT-05p
LT-05v
SF-09v
CU-01
UP-04
UP-06
UP-07
CU-05
DW-01
CU-02
SF-01a
VS-01
SF-17
PV-06



MATERIALS LEGEND			
SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.
	PL	PROPERTY LINE	
	LOW	LIMIT OF WORK LINE	
		BUILDING OVERHANGING	REF ARCH
	WL	EX. WETLAND	
	CU-01	GRANITE CURB - FLUSH	12 / L-700
	CU-02	GRANITE CURB - VERTICAL	REF CIVIL
	CU-03	BEVELED CURB	14 / L-700
	CU-04	GRANITE CURB - @PLINTH	13 / L-700
	CU-05	ACCESSIBLE RAMP	REF CIVIL
	DW-01	DETECTABLE WARNING PLATE	11 / L-700
	LT-01	LIGHT POLE TYPE 1 - PARKING LOT	REF LIGHTING 3 / L-720
	LT-02	LIGHT POLE TYPE 2 - ROADWAY	REF LIGHTING
	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING
	LT-04	MAST LIGHT	REF LIGHTING
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING
	LT-06	CATENARY LIGHT	REF LIGHTING 2,4 / L-720
	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731
	LT-08	BOARDWALK LIGHTING - HE12	REF LIGHTING
	PV-01	REINFORCED AGGRAGATE PAVING	6 / L-700
	PV-02a	ASPHALT PAVING - PEDESTRIAN/BIKE	2 / L-700
	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700
	PV-07	WOOD BOARDWALK	1-7 / L-710
	PV-08	WOOD DECKING	
	PV-09	PEASTONE PAVING	7 / L-700
	PV-10	STEEL EDGE	8 -10 / L-700
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700
	PV-12	TUMBLED STONE PAVERS	18 / L-700
	PV-13	PLAYGROUND SURFACING - RUBBER	17/L-700
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700
	UP-02	UNIT PAVER - PED TYPE 2	5 / L-700
	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700
	ST-01	GRANITE STAIRS	1 / L-750
	RW-01	PRECAST CONCRETE RETAINING WALL	1 / L-750
	RW-02	METAL RETAINING WALL	1 / L-750
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS	1 / L-750
	SF-01a	WOOD BENCH TYPE 1	1 / L-730
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730
	SF-02	PICNIC SET	6 / L-730
	SF-03	MOVABLE TABLES AND CHAIRS	TBD
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731
	SF-06	BIKE RACK	1 / L-731
	SF-06C	CARGO BIKE RACK	3 / L-731
	SF-07	BLUEBIKE STATION	BY OTHERS
	SF-08	BIKE REPAIR STATION	2 / L-731
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL
	SF-11	GUARDRAIL	7 / L-710
WFT	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS
WF2	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS
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	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740
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	SF-22	LOG FENCING	TBD
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	SF-24	GATE	TBD
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	UT-01	AREA DRAIN	REF CIVIL
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	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL
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	UT-11	TRANSFORMER	REF CIVIL
	UT-12	POWER PEDESTAL	BY OTHERS
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	UT-16	SCREEN	TBD
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL
	PS-1	PLAY STRUCTURE TYPE 1	TBD
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Watertown Mall Transformation

500-550 Arsenal Street
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No.	Revision	Date	Appvd.

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Notice of Intent **06/07/2024**

Not Issued for Construction

Drawing Title

L-250
LANDSCAPE MATERIALS PLAN

Drawing Number

L-250

Scale
1" = 20'

Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM \\GUSMANTANG Plotted Wednesday, April 12, 2023 9:25:55 AM Vanessa Guzman Tang

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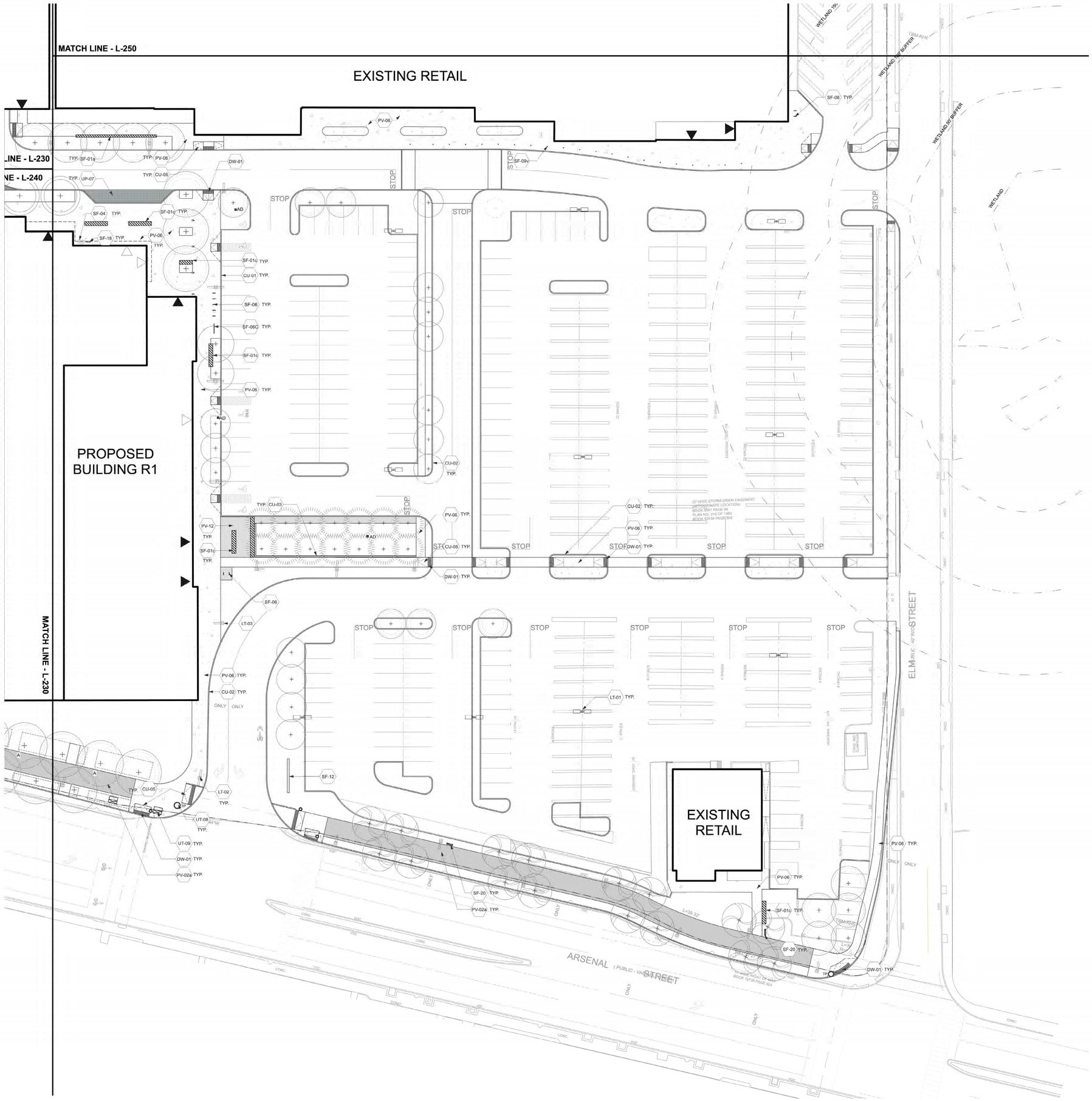

MATERIALS LEGEND			
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	LOW	LIMIT OF WORK LINE	
		BUILDING OVERHANGING	REF ARCH
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	CU-02	GRANITE CURB - VERTICAL	REF CIVIL
	CU-03	BEVELED CURB	14 / L-700
	CU-04	GRANITE CURB - @PLINTH	13 / L-700
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	LT-03	LIGHT POLE TYPE 3 - PEDESTRIAN	REF LIGHTING
	LT-04	MAST LIGHT	REF LIGHTING
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING
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	LT-07	GARDEN LIGHT	REF LIGHTING 5,6 / L-731
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	PV-02b	ASPHALT PAVING - PED/BIKE SHALLOW	3 / L-700
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL
	PV-04	POROUS ASPHALT PAVING - PEDESTRIAN	4 / L-700
	PV-05	C.I.P. CONCRETE PAVING - VEH	1 / L-700
	PV-06	C.I.P. CONCRETE PAVING - PEDESTRIAN	1 / L-700
	PV-07	WOOD BOARDWALK	1-7 / L-710
	PV-08	WOOD DECKING	
	PV-09	PEASTONE PAVING	7 / L-700
	PV-10	STEEL EDGE	8 -10 / L-700
	PV-11	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700
	PV-12	TUMBLED STONE PAVERS	18 / L-700
	PV-13	PLAYGROUND SURFACING - RUBBER	17/L-700
	UP-01	UNIT PAVER - PED TYPE 1	5 /L-700
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	UP-03	UNIT PAVER - PED TYPE 3	5 / L-700
	UP-04	UNIT PAVER - PED TYPE 4	5 / L-700
	UP-05	UNIT PAVER PED TYPE 5	5 / L-700
	UP-06	RECLAIMED GRANITE PAVER TYPE 1	15 / L-700
	UP-07	RECLAIMED GRANITE PAVER TYPE 2	15 / L-700
	ST-01	GRANITE STAIRS	1 / L-750
	RW-01	PRECAST CONCRETE RETAINING WALL	1 / L-750
	RW-02	METAL RETAINING WALL	1 / L-750
	RW-03	C.I.P. CONCRETE WALL @ SERVICE AREAS	1 / L-750
	SF-01a	WOOD BENCH TYPE 1	1 / L-730
	SF-01b	WOOD BENCH TYPE 2 - DCR	2 / L-730
	SF-01c	WOOD BENCH TYPE 3 - LONG WITH BACK	3 / L-730
	SF-01d	BENCH TYPE 5 - RECLAIMED GRANITE BENCH	5 / L-730
	SF-01e	WOOD BENCH TYPE 4 - OVERSIZED BENCH	4 / L-730
	SF-02	PICNIC SET	6 / L-730
	SF-03	MOVABLE TABLES AND CHAIRS	TBD
	SF-04	TRASH AND RECYCLING RECEPTACLES	7 / L-731
	SF-06	BIKE RACK	1 / L-731
	SF-06C	CARGO BIKE RACK	3 / L-731
	SF-07	BLUEBIKE STATION	BY OTHERS
	SF-08	BIKE REPAIR STATION	2 / L-731
	SF-09v	FIXED BOLLARD - VEHICULAR DROPOFF	4 / L-731
	SF-09u	FIXED BOLLARD - UTILITY AREA	REF CIVIL
	SF-11	GUARDRAIL	7 / L-710
WF1	SF-12	WAYFINDING SIGNAGE - TYPE 1	BY OTHERS
WF2	SF-13	WAYFINDING SIGNAGE - TYPE 2	BY OTHERS
	SF-14	CHAIN LINK FENCE	4 / L-740
	SF-15	LOW GUARDRAIL - MICRO FOREST	3 / L-740
	SF-16	LOUVER FENCE	5 / L-740
	SF-17	HANDRAIL	1,2 / L-740
	SF-18	DRINKING FOUNTAIN	8 / L-731
BUS SHELTER	SF-19	BUS SHELTER	BY OTHERS
	SF-20	EDUCATIONAL SIGNAGE	BY OTHERS
	SF-21	PUBLIC ART	BY OTHERS
	SF-22	ART / FEATRURES	BY OTHERS
	SF-22	LOG FENCING	TBD
	SF-23	METAL FENCING	TBD
	SF-24	GATE	TBD
	SF-25	SAND PIT	TBD
	SF-26	CLIMBING NET	TBD
	SF-27	WOOD LOGS/STUMPS	TBD
	SF-28	BOULDERS	TBD
	UT-01	AREA DRAIN	REF CIVIL
	UT-02	TRENCH DRAIN	REF CIVIL
	UT-03	AERATION PORT	16 / L-700
MH	UT-04	MANHOLE COVER	REF CIVIL
	UT-05	FIRE HYDRANT	REF CIVIL
	UT-06	VEHICULAR SIGNAGE	REF CIVIL
	UT-07	PEDESTRIAN RAPID-FLASHING BEACON SIGNAGE	REF CIVIL
	UT-08	TRAFFIC SIGNAL AND PED POLE	REF CIVIL
	UT-09	UTILITY BOX	REF CIVIL
	UT-10	GREASE TRAP	BY OTHERS
	UT-11	TRANSFORMER	REF CIVIL
PPI	UT-12	POWER PEDESTAL	BY OTHERS
	UT-13	ROOT BARRIER	2 / L-800
	UT-14	CONDENSER UNIT	BY OTHERS
	UT-15	FUTURE CONDENSER UNIT	BY OTHERS
	UT-16	SCREEN	TBD
	VS-01	PEDESTRIAN CROSSWALK STRIPING	REF CIVIL
	PS-1	PLAY STRUCTURE TYPE 1	TBD
	PS-2	PLAY STRUCTURE TYPE 2	TBD
	PS-3	PLAY STRUCTURE TYPE 3	TBD
	PS-4	PLAY LOGS	TBD

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No.	Revision	Date	Appvd.

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Date
06/07/2024

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Drawing Title
L-260
LANDSCAPE MATERIALS PLAN

Drawing Number
L-260

Scale
1" = 20'

Project Number
15374.00

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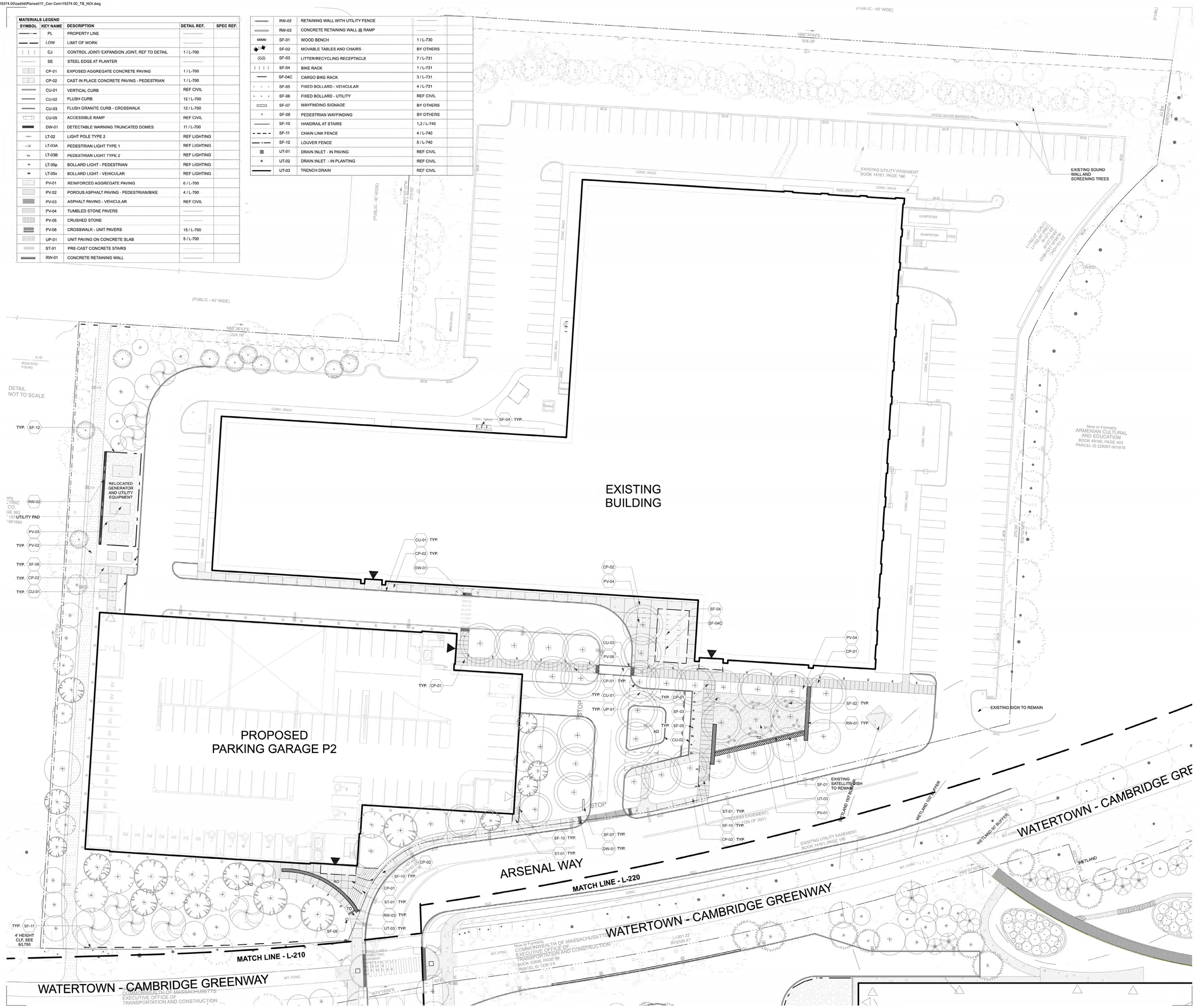
MATERIALS LEGEND				
SYMBOL	KEY NAME	DESCRIPTION	DETAIL REF.	SPEC REF.
	PL	PROPERTY LINE		
	LOW	LIMIT OF WORK		
	CJ	CONTROL JOINT/ EXPANSION JOINT, REF TO DETAIL	1 / L-700	
	SE	STEEL EDGE AT PLANTER		
	CP-01	EXPOSED AGGREGATE CONCRETE PAVING	1 / L-700	
	CP-02	CAST IN PLACE CONCRETE PAVING - PEDESTRIAN	1 / L-700	
	CU-01	VERTICAL CURB	REF CIVIL	
	CU-02	FLUSH CURB	12 / L-700	
	CU-03	FLUSH GRANITE CURB - CROSSWALK	12 / L-700	
	CU-05	ACCESSIBLE RAMP	REF CIVIL	
	DW-01	DETECTABLE WARNING TRUNCATED DOMES	11 / L-700	
	LT-02	LIGHT POLE TYPE 2	REF LIGHTING	
	LT-03A	PEDESTRIAN LIGHT TYPE 1	REF LIGHTING	
	LT-03B	PEDESTRIAN LIGHT TYPE 2	REF LIGHTING	
	LT-05p	BOLLARD LIGHT - PEDESTRIAN	REF LIGHTING	
	LT-05v	BOLLARD LIGHT - VEHICULAR	REF LIGHTING	
	PV-01	REINFORCED AGGREGATE PAVING	6 / L-700	
	PV-02	POROUS ASPHALT PAVING - PEDESTRIAN/BIKE	4 / L-700	
	PV-03	ASPHALT PAVING - VEHICULAR	REF CIVIL	
	PV-04	TUMBLED STONE PAVERS		
	PV-05	CRUSHED STONE		
	PV-06	CROSSWALK - UNIT PAVERS	15 / L-700	
	UP-01	UNIT PAVING ON CONCRETE SLAB	5 / L-700	
	ST-01	PRE-CAST CONCRETE STAIRS		
	RW-01	CONCRETE RETAINING WALL		
	RW-02	RETAINING WALL WITH UTILITY FENCE		
	RW-03	CONCRETE RETAINING WALL @ RAMP		
	SF-01	WOOD BENCH	1 / L-730	
	SF-02	MOVABLE TABLES AND CHAIRS	BY OTHERS	
	SF-03	LITTER/RECYCLING RECEPTACLE	7 / L-731	
	SF-04	BIKE RACK	1 / L-731	
	SF-04C	CARGO BIKE RACK	3 / L-731	
	SF-05	FIXED BOLLARD - VEHICULAR	4 / L-731	
	SF-06	FIXED BOLLARD - UTILITY	REF CIVIL	
	SF-07	WAYFINDING SIGNAGE	BY OTHERS	
	SF-08	PEDESTRIAN WAYFINDING	BY OTHERS	
	SF-10	HANDRAIL AT STAIRS	1,2 / L-740	
	SF-11	CHAIN LINK FENCE	4 / L-740	
	SF-12	LOUVER FENCE	5 / L-740	
	UT-01	DRAIN INLET - IN PAVING	REF CIVIL	
	UT-02	DRAIN INLET - IN PLANTING	REF CIVIL	
	UT-03	TRENCH DRAIN	REF CIVIL	



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Drawing Number: **L-270**

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Project Number: **15374.00**

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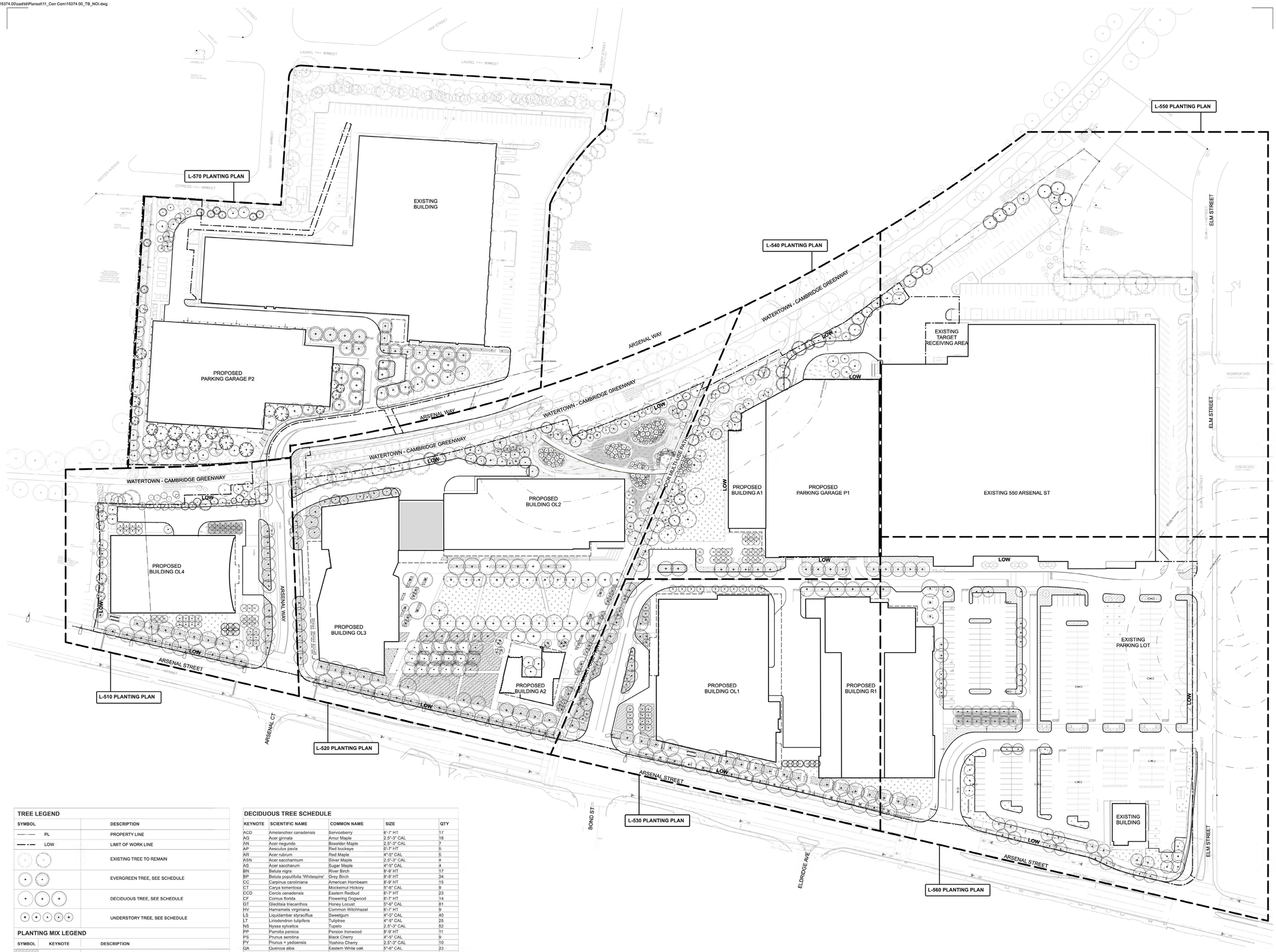

TREE LEGEND

SYMBOL		DESCRIPTION
PL		PROPERTY LINE
LOW		LIMIT OF WORK LINE
		EXISTING TREE TO REMAIN
		EVERGREEN TREE, SEE SCHEDULE
		DECIDUOUS TREE, SEE SCHEDULE
		UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
	MF	MIYAWAKI FOREST MIX
	LN	LAWN

NOTE: REFER TO ENLARGEMENT PLANS FOR SHRUB AND GROUNDCOVER PLANTING MIX SCHEDULE

DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
ACD	Amelanchier canadensis	Serviceberry	6'-7' HT	17
AG	Acer ginnala	Amur Maple	2.5"-3" CAL	16
AN	Acer negundo	Boxelder Maple	2.5"-3" CAL	7
AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
AS	Acer saccharum	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus occinrea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	58
SA	Sassafras albidium	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	83
PR	Pinus resinosa	Red Pine	5"-6" CAL	18

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L - 500
OVERALL PLANTING PLAN

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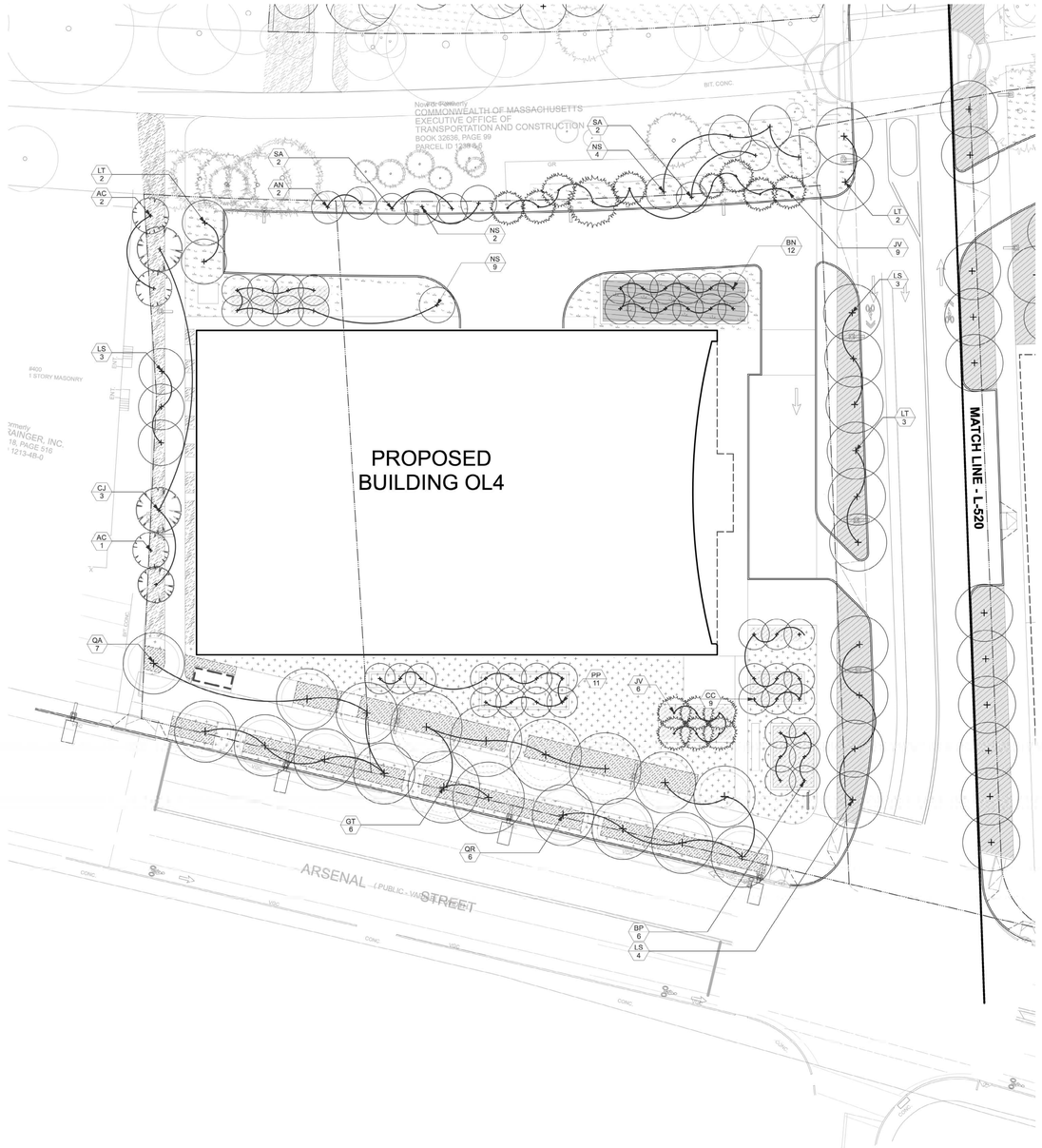

TREE LEGEND

SYMBOL		DESCRIPTION
——·——	PL	PROPERTY LINE
—— · ——	LOW	LIMIT OF WORK LINE
		EXISTING TREE TO REMAIN
		EVERGREEN TREE, SEE SCHEDULE
		DECIDUOUS TREE, SEE SCHEDULE
		UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
	MF	MIYAWAKI FOREST MIX
	LN	LAWN

DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
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AG	*Acer ginnala*	Amur Maple	2.5"-3" CAL	16
AN	*Acer negundo*	*Boxelder Maple*	2.5"-3" CAL	7
AP	*Aesculus pavia*	Red buckeye	6'-7' HT	5
AR	*Acer rubrum*	Red Maple	4"-5" CAL	5
ASN	*Acer saccharinum*	Silver Maple	2.5"-3" CAL	4
AS	*Acer saccharum*	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus x yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus ocoinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	63
PR	Pinus resinosa	Red Pine	5'-6" CAL	18

SHRUB AND GROUNDCOVER MIX SCHEDULE

Planting Mix 1: Street/Arrival

PL-1	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nigra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nigra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millennium'	Millenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's h	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	liatris microcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	Aruncus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Goldtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudszus'	Purple moor grass	#1	18
	Allium cernuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Carex eburnea	Bristle leaf sedge	#1	12
	Carex appalachia	Fine sedge appalachia	#1	12
	Phlox divaricata 'Blue Moon'	Blue Moon woodland phlox	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium maculatum & G. x 'Cranlodge Gerwat'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (lov	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Goldtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Peterson'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Penstamon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Boutelous curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardlongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Zizia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

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0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** | Date: **06/07/2024**

Not Issued for Construction

Drawing Title
L - 510
PLANTING PLAN

Drawing Number
L-510

Scale
1" = 20'

Project Number
15374.00

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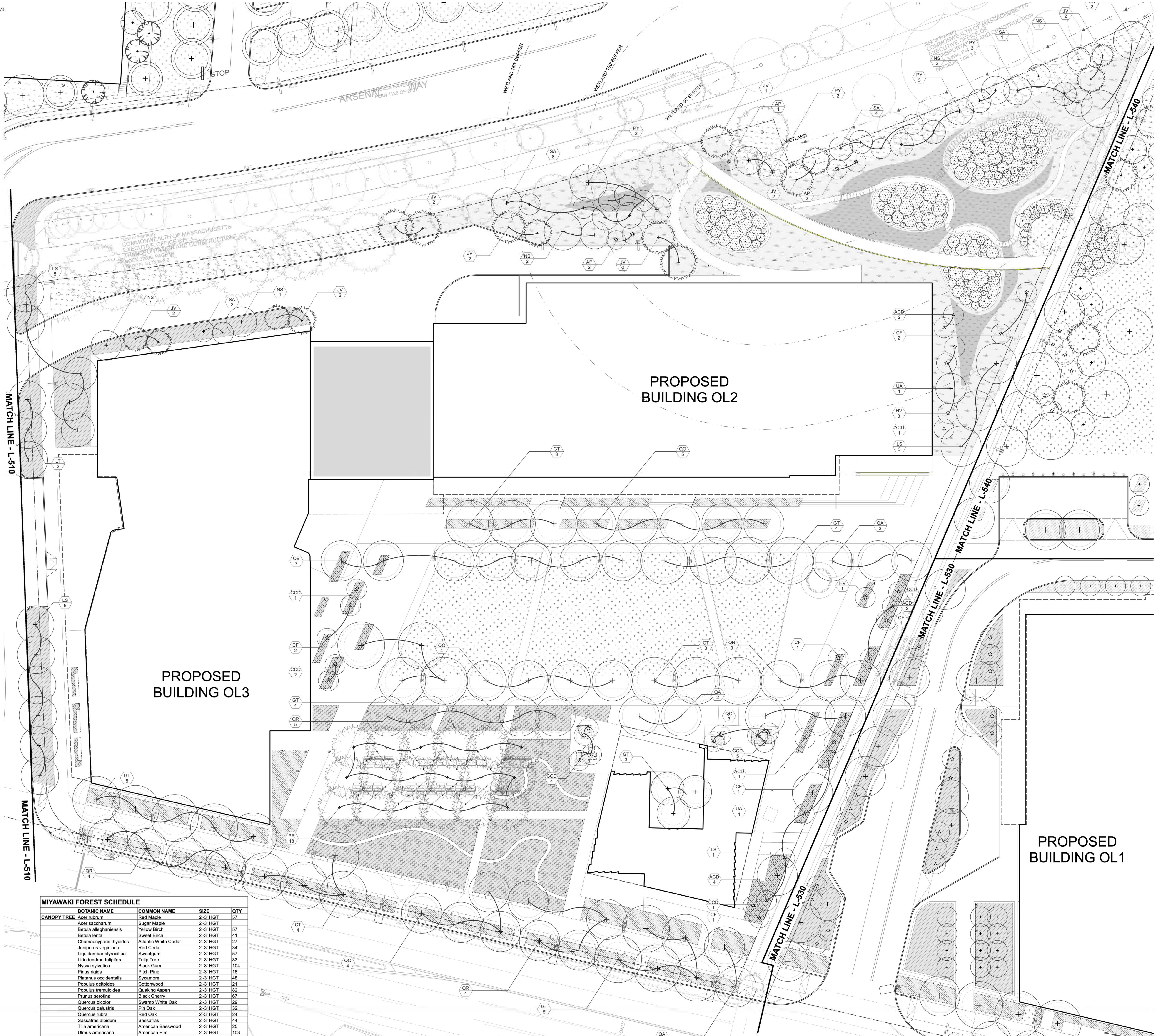

DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
ACD	Amelanchier canadensis	Serviceberry	6'-7' HT	17
AG	Acer ginnala	Amur Maple	2.5"-3" CAL	16
AN	Acer negundo	Boxelder Maple	2.5"-3" CAL	7
AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
AS	Acer saccharum	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus occinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	63
PR	Pinus resinosa	Red Pine	5"-6" CAL	18

SHRUB AND GROUNDCOVER MIX SCHEDULE

Planting Mix 1: Street/Arrival

PL-1	Scientific Name	Common Name	Size	Spacing (inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millennium'	Millenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's ha	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	liatris microcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	Aruncus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Goldtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudszus'	Purple moor grass	#1	18
	Allium cernuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Carex eburnea	Bristle leaf sedge	#1	12
	Carex appalachia	Fine sedge appalachia	#1	12
	Phlox divaricata 'Blue Moon'	Blue Moon woodland phlox	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium macalatum & G. x 'Claridge Druce'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact' Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (lov	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Goldtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Peterson'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Penstamon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Bouteloua curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardtongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Zizia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

MIYAWAKI FOREST SCHEDULE

	BOTANIC NAME	COMMON NAME	SIZE	QTY
CANOPY TREE	Acer rubrum	Red Maple	2'-3' HGT	57
	Acer saccharum	Sugar Maple	2'-3' HGT	
	Betula alleghaniensis	Yellow Birch	2'-3' HGT	57
	Betula lenta	Sweet Birch	2'-3' HGT	41
	Chamaecyparis thyoides	Atlantic White Cedar	2'-3' HGT	27
	Juniperus virginiana	Red Cedar	2'-3' HGT	34
	Liquidambar styraciflua	Sweetgum	2'-3' HGT	57
	Liriodendron tulipifera	Tulip Tree	2'-3' HGT	33
	Nyssa sylvatica	Black Gum	2'-3' HGT	104
	Pinus rigida	Pitch Pine	2'-3' HGT	18
	Platanus occidentalis	Sycamore	2'-3' HGT	48
	Populus deltoides	Cottonwood	2'-3' HGT	21
	Populus tremuloides	Quaking Aspen	2'-3' HGT	82
	Prunus serotina	Black Cherry	2'-3' HGT	67
	Quercus bicolor	Swamp White Oak	2'-3' HGT	29
	Quercus palustris	Pin Oak	2'-3' HGT	32
	Quercus rubra	Red Oak	2'-3' HGT	24
	Sassafras albidum	Sassafras	2'-3' HGT	44
	Tilia americana	American Basswood	2'-3' HGT	25
	Ulmus americana	American Elm	2'-3' HGT	103
SUBTREE	Abies balsamea	Balsam Fir	2'-3' HGT	65
	Alnus incana (rugosa)	Speckled Alder	2'-3' HGT	19
	Baccharis halimifolia	Groundsel Tree	2'-3' HGT	26
	Cercis canadensis	Eastern Redbud	2'-3' HGT	74
	Cornus alternifolia	Alternate-leaved Dogwood	2'-3' HGT	32
	Cornus florida	Flowering Dogwood	2'-3' HGT	77
	Corylus americana	American Hazelnut	2'-3' HGT	79
	Hamamelis virginiana	Common Witchhazel	2'-3' HGT	43
	Prunus virginiana	Chokecherry	2'-3' HGT	34
	Rhus typhina	Staghorn Sumac	2'-3' HGT	58
	Sambucus canadensis	Common Elderberry	2'-3' HGT	36
	Viburnum lentago	Nannyberry	2'-3' HGT	19
SHRUB	Cephalanthus occidentalis	Buttonbush	1-2' HGT	95
	Cornus sericea	Red-osier Dogwood	1-2' HGT	86
	Ilex verticillata	Winterberry	1-2' HGT	15
	Kalmia angustifolia	Sheep Laurel	1-2' HGT	38
	Lyonia ligustrina	Maleberry	1-2' HGT	75
	Prunus maritima	Beach Plum	1-2' HGT	21
	Rosa caroliniana	Carolina Rose	1-2' HGT	19
	Rosa virginiana	Virginia Rose	1-2' HGT	151
	Vaccinium angustifolium	Low Bush Blueberry	1-2' HGT	9
	Viburnum dentatum	Arrowwood	1-2' HGT	75

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
	MF	MIYAWAKI FOREST MIX
	LN	LAWN

TREE LEGEND

SYMBOL	DESCRIPTION
PL	PROPERTY LINE
LOW	LIMIT OF WORK LINE
	EXISTING TREE TO REMAIN
	EVERGREEN TREE. SEE SCHEDULE
	DECIDUOUS TREE, SEE SCHEDULE
	UNDERSTORY TREE, SEE SCHEDULE

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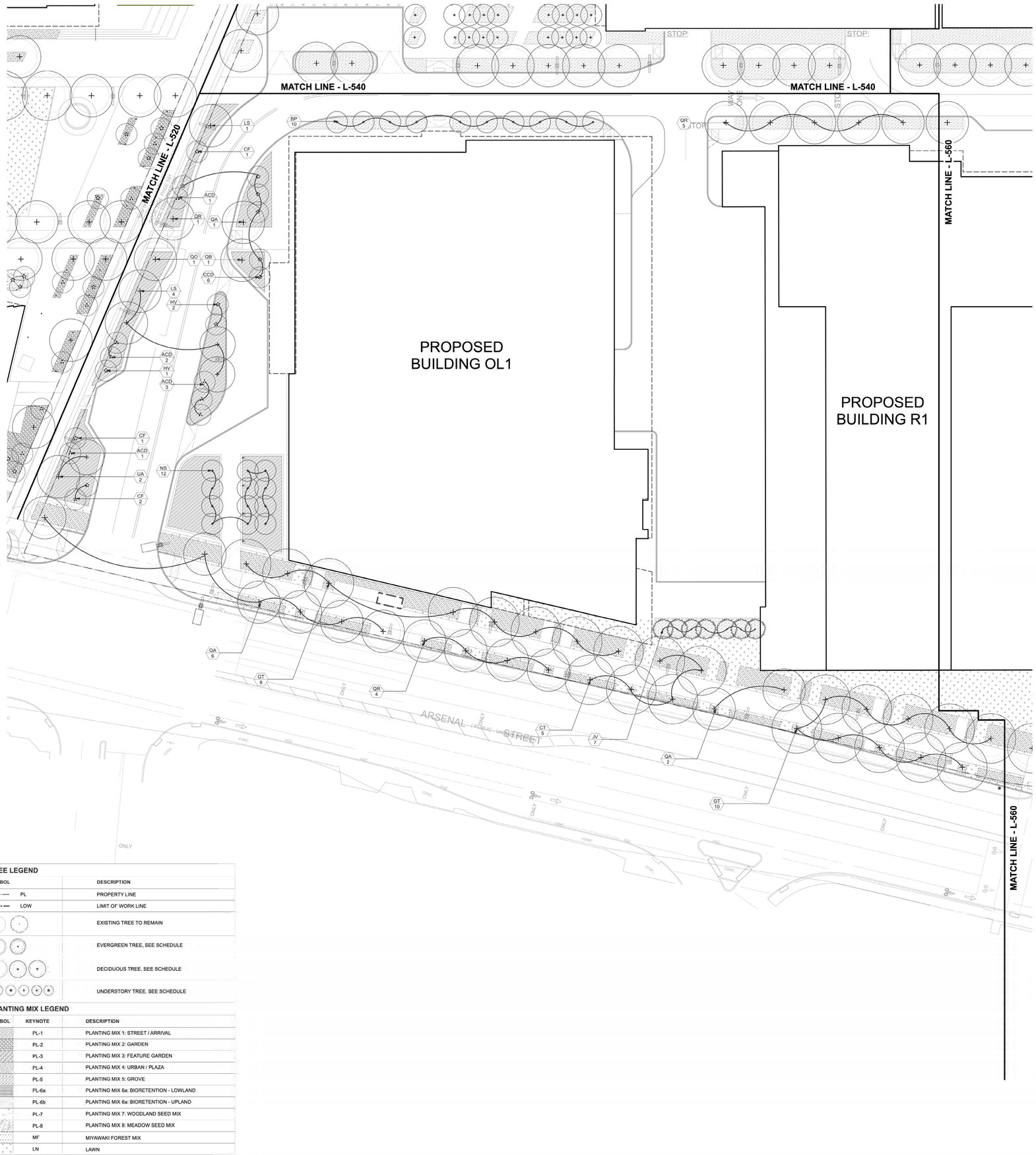

TREE LEGEND

SYMBOL	DESCRIPTION
PL	PROPERTY LINE
LOW	LIMIT OF WORK LINE
	EXISTING TREE TO REMAIN
	EVERGREEN TREE, SEE SCHEDULE
	DECIDUOUS TREE, SEE SCHEDULE
	UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
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	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
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	LN	LAWN

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AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
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BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya lomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
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HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QQ	Quercus occinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	83
PR	Pinus resinosa	Red Pine	5"-6" CAL	18

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	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millennium'	Milenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's h	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	Liatris mironcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	Anuncus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Golddtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudszus'	Purple moor grass	#1	18
	Allium cernuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Carex eburnea	Bristle leaf sedge	#1	12
	Carex appalachia	Fine sedge appalachia	#1	12
	Phlox divaricata 'Blue Moon'	Blue Moon woodland phlox	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium macalatum & G. x 'Claridge Druce'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (low	Scientific Name	Common Name	Size	Spacing (inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Golddtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Petersen'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Penstemon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Boutelous curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardtongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Zizia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

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0 10 20 40 Feet

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by — Checked by —

Issued for — Date

Notice of Intent **06/07/2024**

Not Issued for Construction

Drawing Title

L - 530
PLANTING PLAN

Drawing Number

L-530

Scale

1" = 20'

Project Number

15374.00

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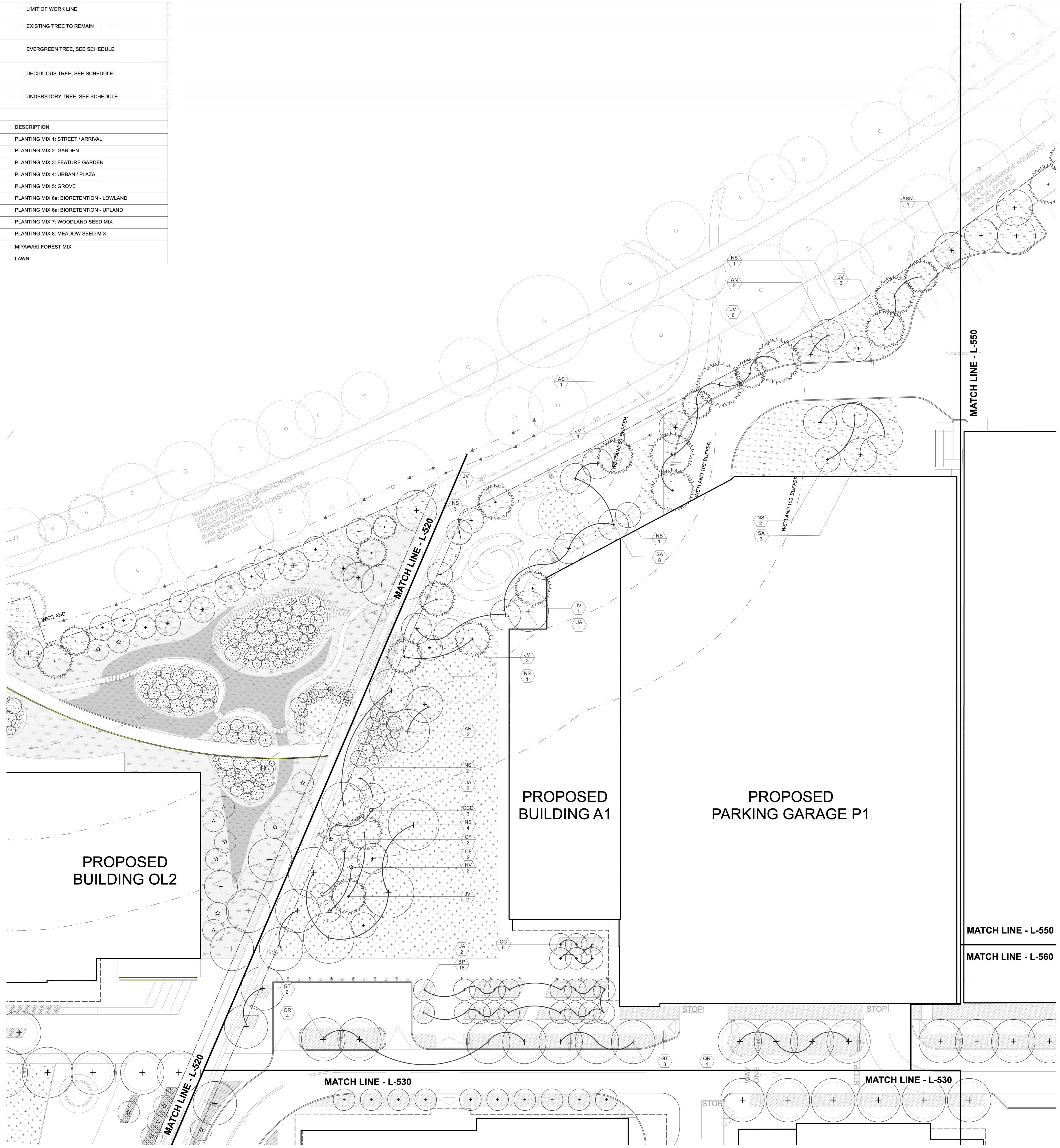
TREE LEGEND

SYMBOL		DESCRIPTION
	PL	PROPERTY LINE
	LOW	LIMIT OF WORK LINE
		EXISTING TREE TO REMAIN
		EVERGREEN TREE, SEE SCHEDULE
		DECIDUOUS TREE, SEE SCHEDULE
		UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
	MF	MIYAWAKI FOREST MIX
	LN	LAWN



DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
ACD	Amelanchier canadensis	Serviceberry	6'-7' HT	17
AG	Acer ginnala	Amur Maple	2.5"-3" CAL	16
AN	Acer negundo	Boxelder Maple	2.5"-3" CAL	7
AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
AS	Acer saccharum	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus occinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	63
PR	Pinus resinosa	Red Pine	5"-6" CAL	18

SHRUB AND GROUNDCOVER MIX SCHEDULE

Planting Mix 1: Street/Arrival

PL-1	Scientific Name	Common Name	Size	Spacing (inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millennium'	Millenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's ha	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	liatris microcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	Aruncus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Goldtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudszus'	Purple moor grass	#1	18
	Allium cernuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Carex eburnea	Bristle leaf sedge	#1	12
	Carex appalachia	Fine sedge appalachia	#1	12
	Phlox divaricata 'Blue Moon'	Blue Moon woodland phlox	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium macalatum & G. x 'Claridge Druce'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact' Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (lov	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Goldtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Peterson'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Penstamon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Bouteloua curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardtongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Zizia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** Date: **06/07/2024**

Not Issued for Construction

Drawing Title
L - 540
PLANTING PLAN

Drawing Number
L-540

Scale
1" = 20'

Project Number
15374.00

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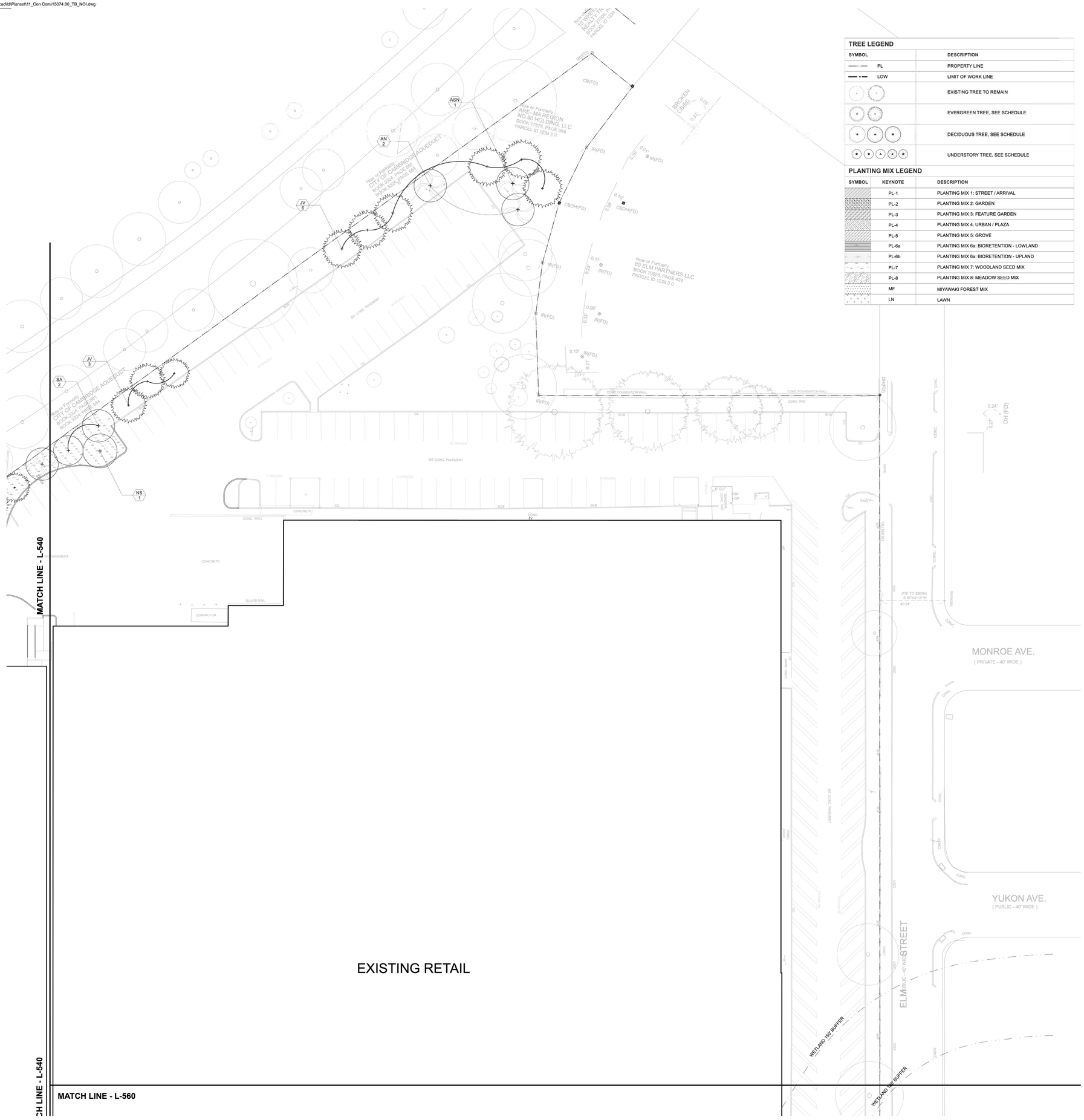

TREE LEGEND

SYMBOL	DESCRIPTION
PL	PROPERTY LINE
LOW	LIMIT OF WORK LINE
	EXISTING TREE TO REMAIN
	EVERGREEN TREE, SEE SCHEDULE
	DECIDUOUS TREE, SEE SCHEDULE
	UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
	MF	MIYAWAKI FOREST MIX
	LN	LAWN

DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
ACD	Amelanchier canadensis	Serviceberry	6'-7' HT	17
AG	Acer ginnala	Amur Maple	2.5"-3" CAL	16
AN	Acer negundo	Boxelder Maple	2.5"-3" CAL	7
AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
AS	Acer saccharum	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus occinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperus virginiana	Redcedar	8'-9' HT	63
PR	Pinus resinosa	Red Pine	5'-6" CAL	18

SHRUB AND GROUNDCOVER MIX SCHEDULE

Planting Mix 1: Street/Arrival

PL-1	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millennium'	Millenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's h	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	liatris microcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	ArunCus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Goldtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudzsus'	Purple moor grass	#1	18
	Allium cernuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Carex eburnea	Bristle leaf sedge	#1	12
	Carex appalachia	Fine sedge appalachia	#1	12
	Phlox divaricata 'Blue Moon'	Blue Moon woodland phlox	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium maculatum & G. x 'Orange Dream'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact' Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (lov	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Goldtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Peterson'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Pensternon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus hetenslepis	Prairie dropseed	#1	18
	Pensternon hirsutus	Hairy beardtongue	#1	12
	Penstamon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Boutolous curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardtongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Ztzia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

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Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Apprvd.

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Issued for: **Notice of Intent** | Date: **06/07/2024**

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Drawing Title: **L - 550 PLANTING PLAN**

Drawing Number: **L-550**

Scale: **1" = 20'**

Project Number: **15374.00**

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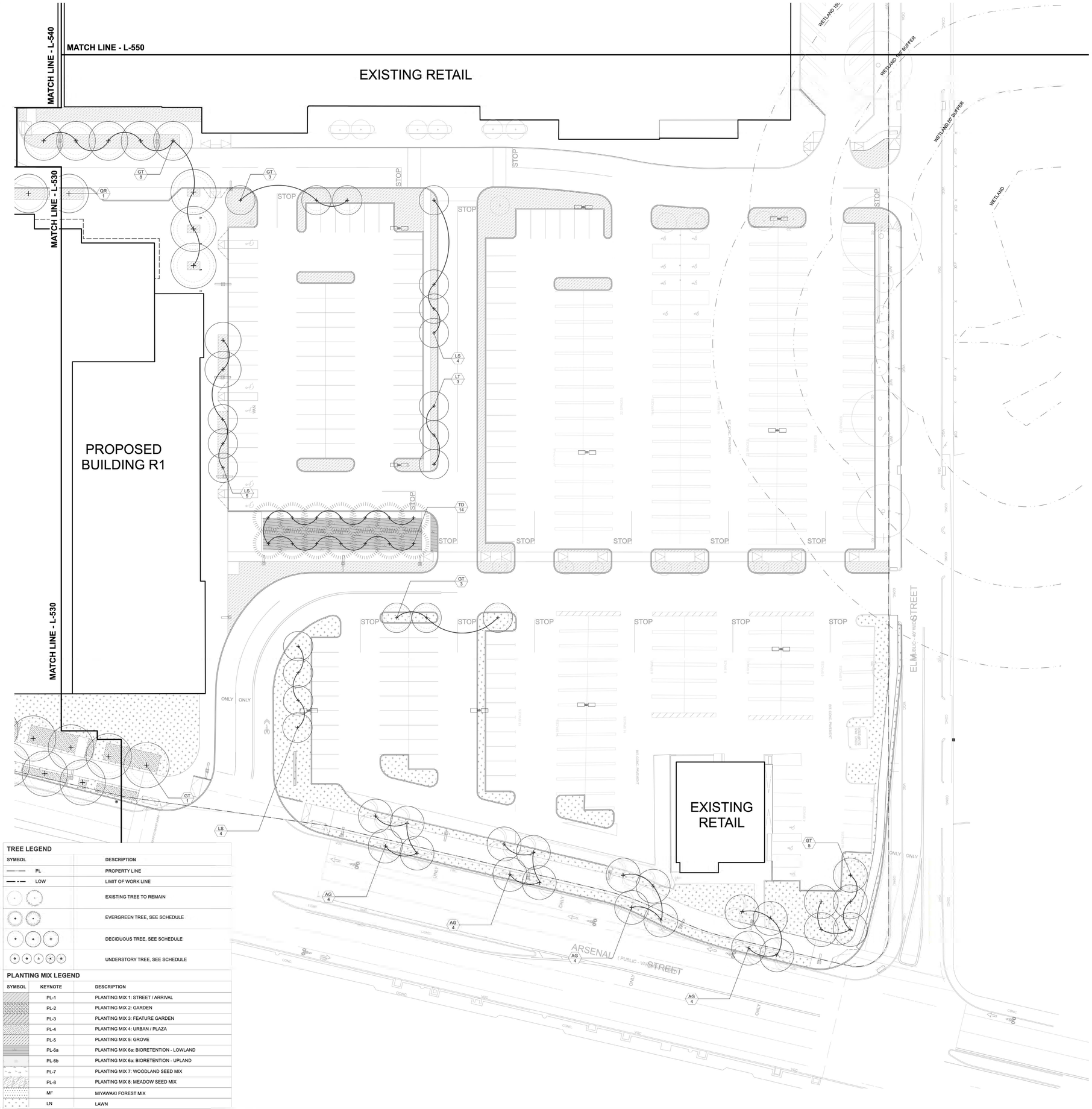

TREE LEGEND

SYMBOL	DESCRIPTION
PL	PROPERTY LINE
LOW	LIMIT OF WORK LINE
	EXISTING TREE TO REMAIN
	EVERGREEN TREE, SEE SCHEDULE
	DECIDUOUS TREE, SEE SCHEDULE
	UNDERSTORY TREE, SEE SCHEDULE

PLANTING MIX LEGEND

SYMBOL	KEYNOTE	DESCRIPTION
	PL-1	PLANTING MIX 1: STREET / ARRIVAL
	PL-2	PLANTING MIX 2: GARDEN
	PL-3	PLANTING MIX 3: FEATURE GARDEN
	PL-4	PLANTING MIX 4: URBAN / PLAZA
	PL-5	PLANTING MIX 5: GROVE
	PL-6a	PLANTING MIX 6a: BIORETENTION - LOWLAND
	PL-6b	PLANTING MIX 6a: BIORETENTION - UPLAND
	PL-7	PLANTING MIX 7: WOODLAND SEED MIX
	PL-8	PLANTING MIX 8: MEADOW SEED MIX
MF		MIYAWAKI FOREST MIX
LN		LAWN

DECIDUOUS TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
ACD	Amelanchier canadensis	Serviceberry	6'-7' HT	17
AG	Acer ginnala	Amur Maple	2.5"-3" CAL	16
AN	Acer negundo	Boxelder Maple	2.5"-3" CAL	7
AP	Aesculus pavia	Red buckeye	6'-7' HT	5
AR	Acer rubrum	Red Maple	4"-5" CAL	5
ASN	Acer saccharinum	Silver Maple	2.5"-3" CAL	4
AS	Acer saccharum	Sugar Maple	4"-5" CAL	4
BN	Betula nigra	River Birch	8'-9' HT	17
BP	Betula populifolia 'Whitespire'	Grey Birch	8'-9' HT	34
CC	Carpinus caroliniana	American Hornbeam	8'-9' HT	15
CT	Carya tomentosa	Mockernut Hickory	5"-6" CAL	9
CCD	Cercis canadensis	Eastern Redbud	6'-7' HT	23
CF	Cornus florida	Flowering Dogwood	6'-7' HT	14
GT	Gleditsia triacanthos	Honey Locust	5"-6" CAL	81
HV	Hamamelis virginiana	Common Witchhazel	6'-7' HT	9
LS	Liquidambar styraciflua	Sweetgum	4"-5" CAL	40
LT	Liriodendron tulipifera	Tuliptree	4"-5" CAL	25
NS	Nyssa sylvatica	Tupelo	2.5"-3" CAL	52
PP	Parrotia persica	Persion Ironwood	8'-9' HT	11
PS	Prunus serotina	Black Cherry	4"-5" CAL	9
PY	Prunus × yedoensis	Yoshino Cherry	2.5"-3" CAL	10
QA	Quercus alba	Eastern White oak	5"-6" CAL	23
QB	Quercus bicolor	Swamp White Oak	5"-6" CAL	8
QMA	Quercus macrocarpa	Bur oak	5"-6" CAL	13
QO	Quercus occinea	Scarlet oak	5"-6" CAL	17
QR	Quercus rubra	Northern Red Oak	5"-6" CAL	56
SA	Sassafras albidum	Sassafras	2.5"-3" CAL	36
TD	Taxodium distichum	Bald Cypress	5"-6" CAL	14
UA	Ulmus americana	American Elm	4"-5" CAL	11

EVERGREEN TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	QTY
AC	Abies concolor	White Fir	4"-5" CAL	14
CJ	Cryptomeria japonica	Japanese Cedar	4"-5" CAL	18
JV	Juniperous virginiana	Redcedar	8'-9' HT	63
PR	Pinus resinosa	Red Pine	5'-6" CAL	18

SHRUB AND GROUNDCOVER MIX SCHEDULE

Planting Mix 1: Street/Arrival

PL-1	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18

Planting Mix 2: Garden

PL-2	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Ilex glabra 'nirgra' or 'densa'	Inkberry	#5	48
	Amsonia hubrichtii ' String Theory'	Threadleaf bluestar	#3	18
	Symphyotrichum oblongifolium 'October Skies'	Aromatic Aster	#3	18
	Dryopteris erythrosora 'Brilliance'	Brilliance Autumn Fern	#1	12
	Carex pennsylvanica	Pennsylvania Sedge	#1	12
	Symphyotrichum cordifolium	Bluewood aster	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Allium 'Millenium'	Millenium Allium	#1	12
	Hydrangea quercifolia 'Snow Queen'	Oakleaf hydrangea	#7	48
	Hydrangea arborescens 'Haas Halo'	Smooth hydrangea "Haas's h	#7	48

Planting Mix 3: Feature Garden

PL-3	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Pycnanthemum tenuifolium	Narrowleaf mountain mint	#1	18
	Dalea purpurea	Purple Prairie clover	#1	18
	Ratibida columnifera	Mexican coneflower	#1	18
	liatris microcephala	smallhead blazing star	#1	18
	Dianthus carthusianorum	Carthusian pink	#1	18
	Allium sphaerocephalon	Drumstick allium	#1	18
	Allium 'Windy City'	Windy City allium	#1	18
	Amorpha canescens	lead plant	#1	18
	Aruncus "horatio"	Goatsbeard	#1	18
	Amsonia hubrichtii	Threadleaf bluestar	#1	18
	Schizachyrium scoparium	Little blue stem	#1	18
	Deschampsia cespitosa	Goldtau tufted hairgrass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Shenandoah'	Switchgrass	#1	24
	Panicum virgatum 'Purple Tear'	Switchgrass	#1	24
	Panicum virgatum 'Short Orient'	Switchgrass	#1	24
	Molinia caerulea 'Edith Dudszus'	Purple moor grass	#1	18
	Allium cornuum	Nodding onion	#1	18
	Sesleria autumnalis	Autum moor grass	#1	18
	Eurybia divaricata	White wood aster	#1	18
	Geranium macrorrhizum 'Ingwersen's Variety'	Cranesbill	#1	18

Planting Mix 4: Urban/Plaza

PL-4	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sarcococca hookeriana 'Sarsid 1'	Fragrant Valley Sweet Box	#5	48
	Clethra alnifolia 'Compacta'	Compact' Summersweet	#5	36
	Rhus aromatica 'Gro-low'	Gro-low Fragrant Sumac	#5	24
	Juniperus conferta	Shoreland Juniper	#5	48

Planting Mix 5: Grove

PL-5	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Liriope muscari	Lily Turf	#1	8

Planting Mix 6: Bioretention

PL-6a (low	Scientific Name	Common Name	Size	Spacing (Inch OC)
	Sesleria autumnalis	Autumn moor grass	#1	18
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Panicum virgatum 'Purple tears'	Switchgrass	#1	24
	Panicum virgatum ' Shenandoah'	Switchgrass	#1	24
	Deschampsia cespitosa ' Goldtau'	Goldtau tufted hairgrass	#1	18
	Molinia caerulea 'Poul Peterson'	Purple moor grass	#1	18
	Schizachyrium scoparium	Little bluestem	#1	18
	Juncus effusus	Soft rush	#1	18
	Eutrochium dubium ' Little Joe'	Joe Pye Weed	#1	18
	Asclepias incarnata	Swamp milkweed	#1	18
	Monarda fistulosa	Wild bergamot	#1	18
	Verbena hastata	Blue vervain	#1	12
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Iris versicolor	Northern blue flag	#1	12
PL-6b (upland)				
	Carex bervior	Shortbeak sedge	#1	12
	Carex muskingumensis "little midge"	Palm sedge	#1	12
	Sesleria autumnalis	Autumn moor grass	#1	12
	Sporobolus heterolepis	Prairie dropseed	#1	18
	Penstemon hirsutus	Hairy beardtongue	#1	12
	Penstamon laevigatus	Eastern beardtongue	#1	18
	Pycnanthem tenuifolium	Narrowleaf mountain mint	#1	12
	Baptisia tinctoria	Horsefly weed	#1	12
	Monarda punctata	Spotted beebalm	#1	12

Planting Mix 7: Woodland Seed Mix

PL-7	Description	Note
	Ernst Native/Naturalized Solar Farm Seed Mix ERNMX-186-1	Apply 6 lbs/1,000 sq ft. See Mix Schedule

Planting Mix 8: Meadow Seed Mix

PL-8	Description	Note
	Ernst Custom Seed Mix	Apply this mix 8 lbs PLS/acre with 30 lbs/acre of a cover crop. For a cover crop use either oats (1 Jan to 31 Jul) or grain rye (1 Aug to 31 Dec).

% of mix by weight	Latin Name	Common Name	Ecotype	Height (FT)
0.4	*Agastache foeniculum*	Lavender Hyssop	Any	3.3
2.5	*Asclepias tuberosa*	Butterfly Milkweed	Any	2.9
0.6	*Aster divaricatus*	White Wood Aster	PA	3.3
2.5	*Aster oblongifolius*	Aromatic Aster	PA	2.8
46.3	*Boutoloua curtipendula*	Sideoats Grama	Any	3
7.5	*Coreopsis lanceolata*	Lance Leaf Coreopsis	Any	3.3
2.5	*Dalea candida*	White Prairie Clover	Any	3.3
5	*Echinacea pallida*	Pale Purple Coneflower	Any	3.3
13.1	*Gaillardia pulchella*	Annual Gaillardia	Any	2
1.3	*Liatris spicata*	Spiked Gayfeather	Any	6.5
1.3	*Monarda punctata*	Dotted Mint	Any	3.3
0.3	*Penstemon canescens*	Eastern Gray Beartongue	WV	2.6
2	*Penstemon digitalis*	Tall White Beardtongue	PA	4.9
0.3	*Penstemon hirsutus*	Hairy Beardtongue	PA	2.8
1.3	*Pycnanthemum tenuifolium*	Narrow Leaved Mountain Mint	PA	3
0.8	*Rudbeckia fulgida*	Orange Coneflower	VA	3.4
7.5	*Rudbeckia hirta*	Black Eyed Susan	Any	3.3
1.3	*Solidago nemoralis*	Gray Goldenrod	PA	3.7
0.1	*Veronicastrum virginicum*	Culver's Root	PA	5.9
3.8	*Ztzia aurea*	Golden Alexanders	PA	3
100	Total			
16.9	% Grass-like Species by seed count			
83.1	% Wildflower by seed count			

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Watertown Mall Transformation

500-550 Arsenal Street
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Drawing Title: **L - 560 PLANTING PLAN**

Drawing Number: **L-560**

Scale: **1" = 20'**

Project Number: **15374.00**

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TREE SCHEDULE

KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	SPACING	QUANTITY	REMARK
AC	*Abies concolor*	WHITE FIR	6'-8' HT	SEE PLAN	11	NOT SHEARED, FULL TO THE GROUND
CJ	*Cryptomeria japonica*	CRYPTOMERIA	6'-8' HT	SEE PLAN	15	
PS	*Pinus strobus*	EASTERN WHITE PINE	6'-8' HT	SEE PLAN	9	2,3/L-800
AN	*Acer negundo*	BOXELDER MAPLE	2"-2.5" CAL	SEE PLAN	1	2,3/L-800
AS	*Acer saccharum*	SUGAR MAPLE	2"-2.5" CAL	SEE PLAN	3	2,3/L-800
AR	*Acer rubrum*	RED MAPLE	2"-2.5" CAL	SEE PLAN	3	2,3/L-800
ASN	*Acer saccharinum*	SILVER MAPLE	2"-2.5" CAL	SEE PLAN	2	2,3/L-800
BN	*Betula nigra*	RIVER BIRCH	10' HT	SEE PLAN	5	2,3/L-800
GT	*Gleditsia triacanthos*	HONEY LOCUST	3.5"-4" CAL	SEE PLAN	5	2,3/L-800
LT	*Liriodendron tulipifera*	TULIPTREE	2"-2.5" CAL	SEE PLAN	9	2,3/L-800
NS	*Nyssa sylvatica*	TUPELO	2"-2.5" CAL	SEE PLAN	2	2,3/L-800
QMA	*Quercus macrocarpa*	BUR OAK	3.5"-4" CAL	SEE PLAN	13	2,3/L-800
QR	*Quercus rubra*	NORTHERN RED OAK	3.5"-4" CAL	SEE PLAN	15	2,3/L-800

GROUNDCOVER

SYMBOL	KEYNOTE	DESCRIPTION	EXEMPLARY SPECIES/CHARACTER	SIZE	SPACING	QTY	DETAIL
	GC-W	GROUNDCOVER MIX 1 (WOODLAND)	Woodland seed mix	SEED	-	17200 SF	5,6,7/L-800
	GC-M	GROUNDCOVER MIX 2 (MEADOW)	Meadow seed mix	SEED	-	5300 SF	5,6,7/L-800
	GC-G	GROUNDCOVER MIX 3 (GARDEN)	*Chasmanthium latifolium*, Northern Sea Oats *Sarcococca ruscifolia*, Sweetbox *Tiarella cordifolia*, Foamflower *Helleborus foetidus*, Hellebore *Liriope spicata*, Lilyturf	PLUGS	16" O.C.	6000 SF	5,6,7/L-800
	GC-R	GROUNDCOVER MIX 4 (RAIN GARDEN)	Rain garden seed mix, reference New England Wetland Plants, Inc.	SEED	-	1400 SF	10/L-800
	LN	LAWN		SOD	-	14500 SF	8/L-800

VINES

SYMBOL	KEYNOTE	SCIENTIFIC NAME	COMMON NAME	SIZE	SPACING	QUANTITY	DETAIL
•••••	VN	*Parthenocissus quinquefolia*	VIRGINIA CREEPER	1 QT	SEE PLAN	40	11/L-800
		Parthenocissus tricuspidata	BOSTON IVY	1 QT	SEE PLAN	40	
		Hedera helix	BALTIC IVY	1 QT	SEE PLAN	40	

SYMBOL	KEY NAME	DESCRIPTION
——·——	PL	PROPERTY LINE
——— ———	LOW	LIMIT OF WORK

TREE LEGEND

SYMBOL	
	EXISTING DECIDUOUS TREE TO REMAIN
	EVERGREEN TREE, SEE SCHEDULE
	DECEDUOUS TREE, SEE SCHEDULE

DETAIL NOT TO SCALE

MATCH LINE - L-510

MATCH LINE - L-520

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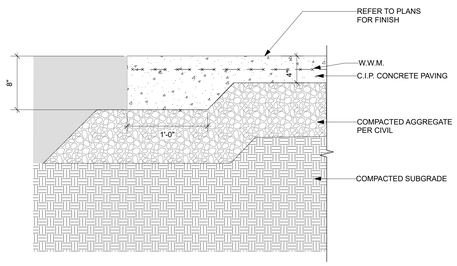
Drawing Title: **L-570 PLANTING PLAN**

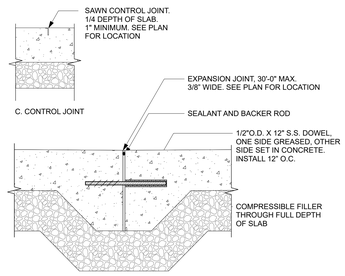
Drawing Number: **L-570**

Scale: **1" = 20'**

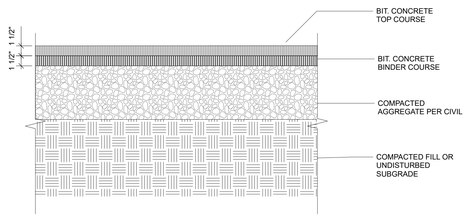
Project Number: **15374.00**

Saved Monday, June 3, 2024 3:40:22 PM VOLZMANTANG Plotted Wednesday, April 12, 2023 9:25:55 AM Vanessa Guzman Tang

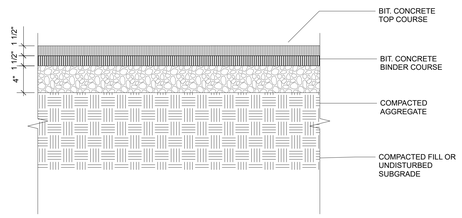




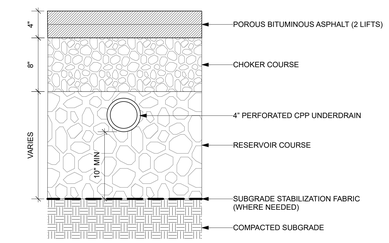
1 C.I.P. CONCRETE PAVING
Scale: 1 1/2" = 1'-0"



2 ASPHALT PAVING - PEDESTRIAN/BIKE
Scale: 1 1/2" = 1'-0"

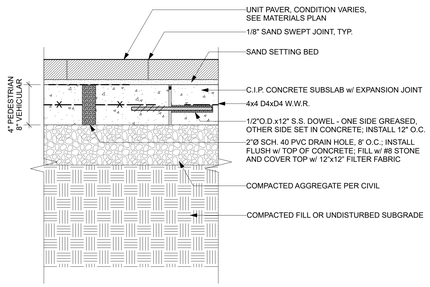


3 ASPHALT PAVING ABOVE TREE ROOTS - PEDESTRIAN/BIKE
Scale: 1 1/2" = 1'-0"

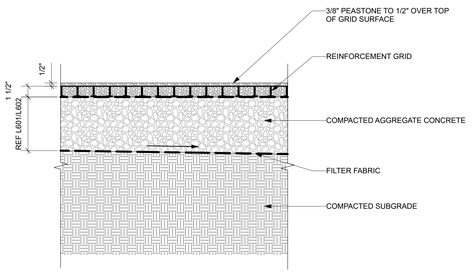


NOTES:
ENGINEER TO CONFIRM JOINT INSTALLATION OF GEOTEXTILE ALONG SIDES OF PROFILE.
ENGINEER TO CONFIRM NEED FOR SUBGRADE STABILIZATION FABRIC.

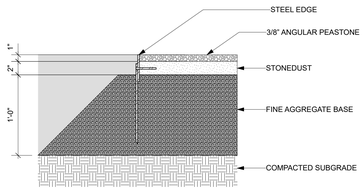
4 POROUS ASPHALT PAVING - PEDESTRIAN/BIKE
Scale: 1 1/2" = 1'-0"



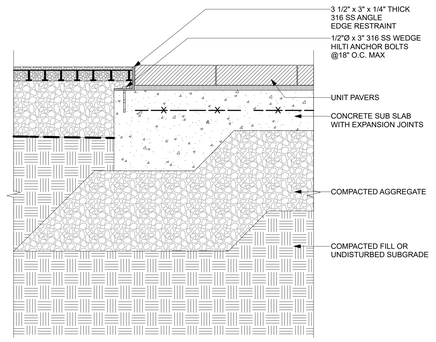
5 UNIT PAVER - PED/VEH
Scale: 1 1/2" = 1'-0"



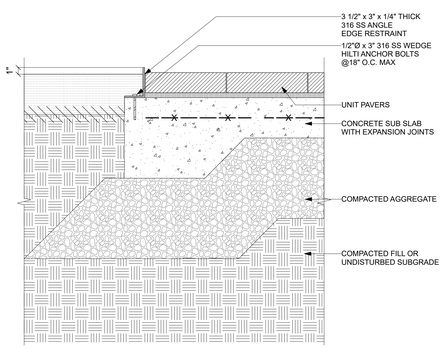
6 REINFORCED AGGREGATE PAVING
Scale: 1 1/2" = 1'-0"



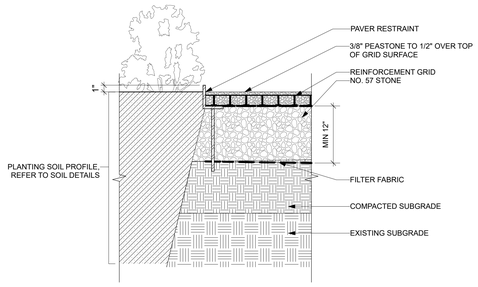
7 PEASTONE PAVING
Scale: 1 1/2" = 1'-0"



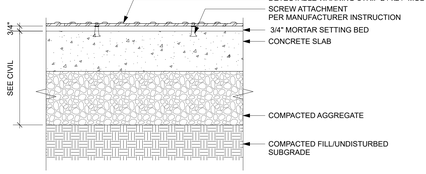
8 STEEL EDGE AT UNIT PAVER ON SLAB & PEASTONE PAVING
Scale: 1 1/2" = 1'-0"



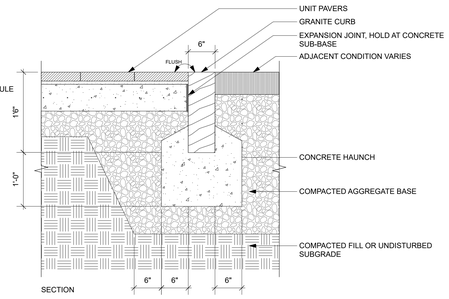
9 STEEL EDGE AT UNIT PAVER ON SLAB AT PLANTING
Scale: 1 1/2" = 1'-0"



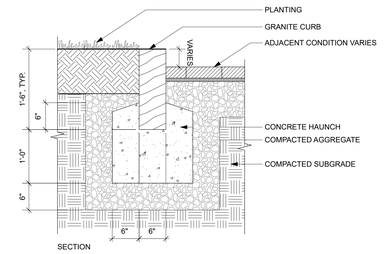
10 STEEL EDGE AT PLANTING BEDS & PEASTONE PAVING
Scale: 1 1/2" = 1'-0"



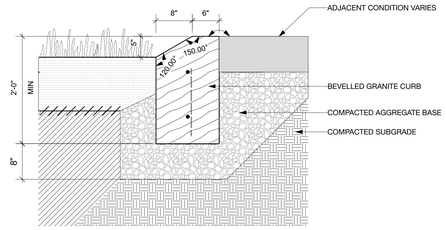
11 DETECTABLE WARNING PLATE
Scale: 1 1/2" = 1'-0"



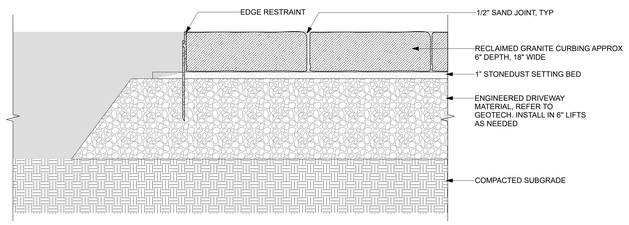
12 GRANITE CURB-FLUSH
Scale: 1" = 1'-0"



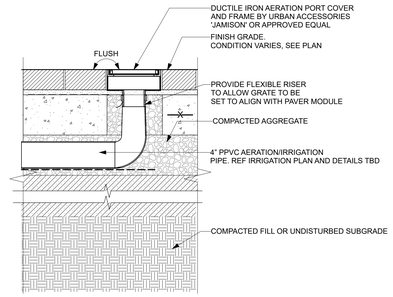
13 GRANITE CURB AT PLINTH
Scale: 1" = 1'-0"



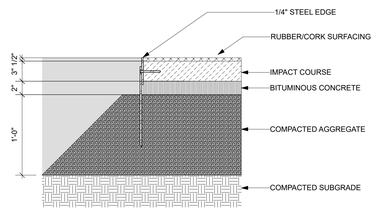
14 GRANITE BEVELED CURB AT PLANTING
Scale: 1" = 1'-0"



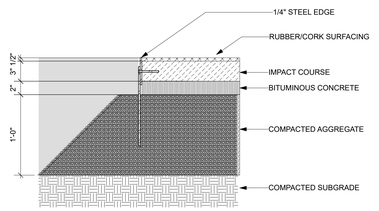
15 RECLAIMED GRANITE CURBING RUBBLE STRIP
Scale: 1 1/2" = 1'-0"



16 AERATION PORT
Scale: 1 1/2" = 1'-0"



17 PLAYGROUND SURFACING-RUBBER
Scale: 1 1/2" = 1'-0"



18 TUMBLED STONE PAVERS
Scale: 1 1/2" = 1'-0"

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No.	Revision	Date	Appvd.

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Notice of Intent
Date
06/07/2024

Not Issued for Construction

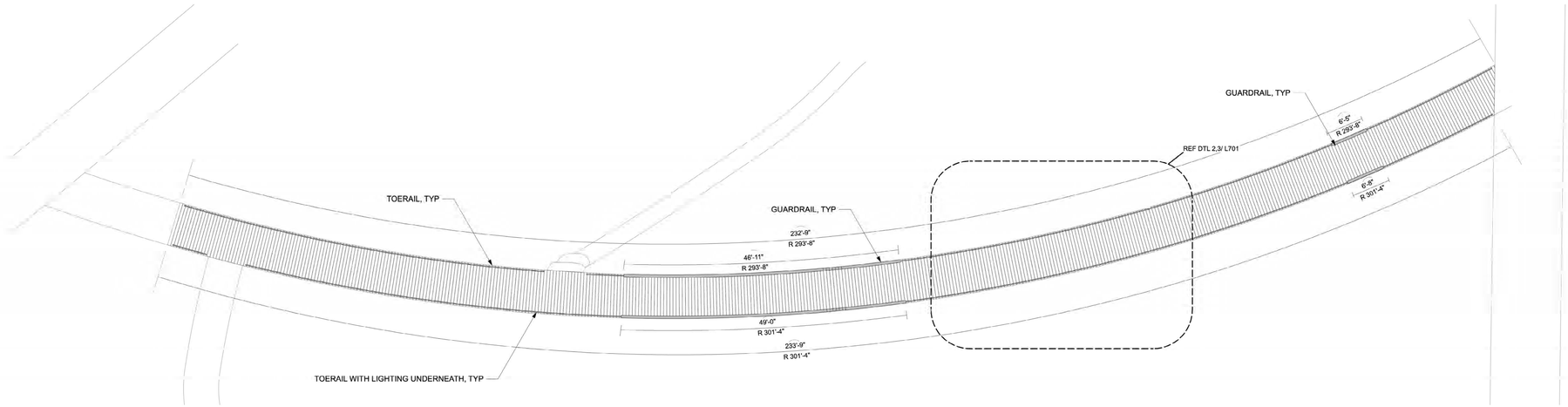
Drawing Title
L-700
PAVING DETAILS

Drawing Number
L-700

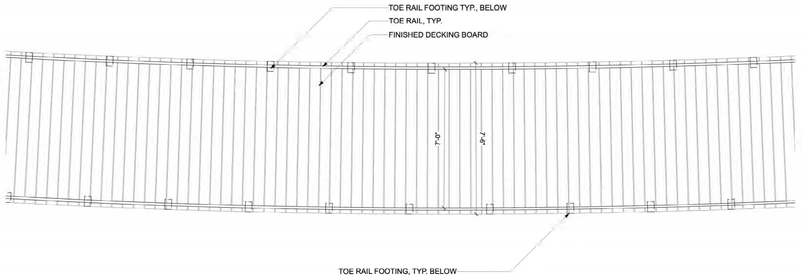
Scale
AS SHOWN

Project Number
15374.00

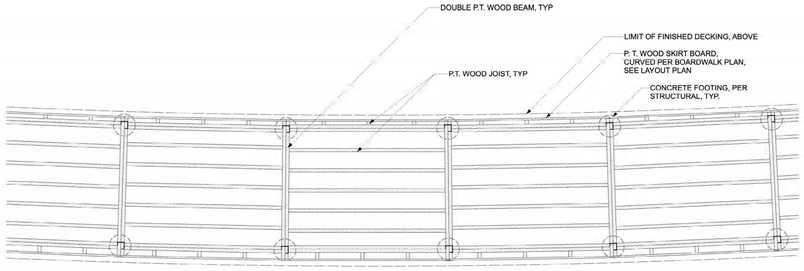
Saved Monday, June 3, 2024 3:40:22 PM \\QUISMANTANG Plotted Wednesday, April 12, 2023 9:25:59 AM Vanessa Guzman Tang



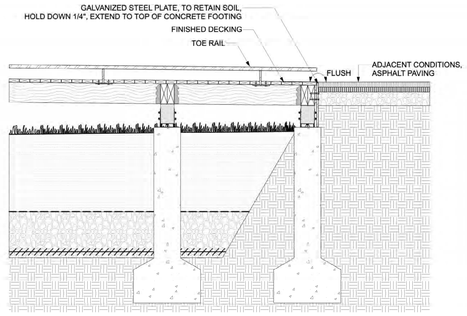
1 BOARDWALK LAYOUT PLAN
Scale: 1/8" = 1'-0"



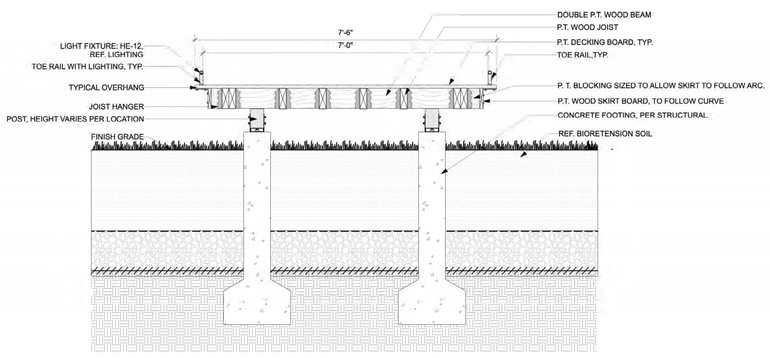
2 BOARDWALK DECKING PLAN
Scale: 3/8" = 1'-0"



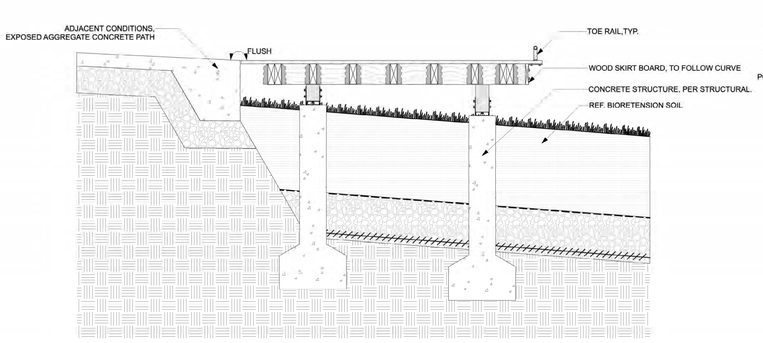
3 BOARDWALK FRAMING PLAN
Scale: 3/8" = 1'-0"



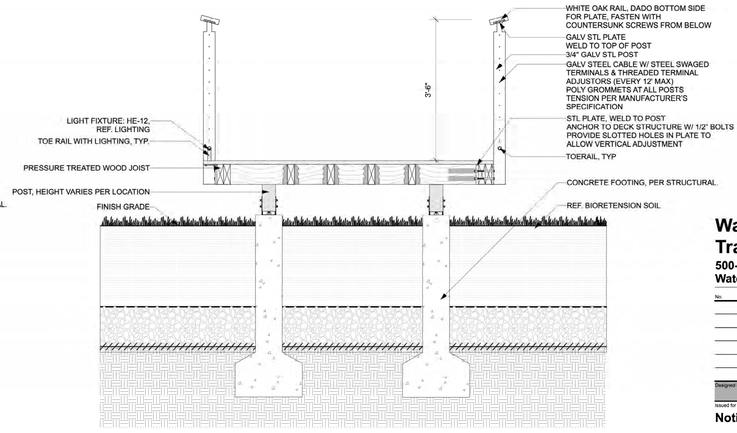
4 BOARDWALK SECTION AT EDGE
Scale: 3/4" = 1'-0"



5 BOARDWALK STANDARD SECTION
Scale: 3/4" = 1'-0"



6 BOARDWALK CONNECT TO TERRACE
Scale: 3/4" = 1'-0"



7 BOARDWALK W/ GUARDRAIL SECTION
Scale: 3/4" = 1'-0"

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No.	Revision	Date	Appvd.

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Issued for
Notice of Intent **06/07/2024**

Not Issued for Construction

Drawing Title
L-710
BOARDWALK DETAILS

Drawing Number
L-710

Scale
AS SHOWN

Project Number
15374.00

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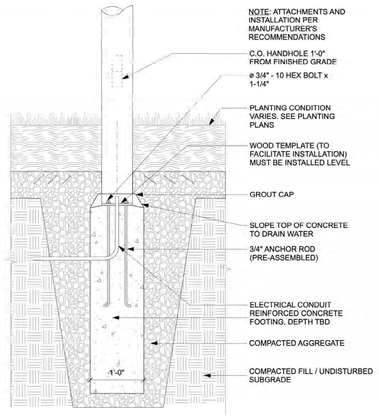
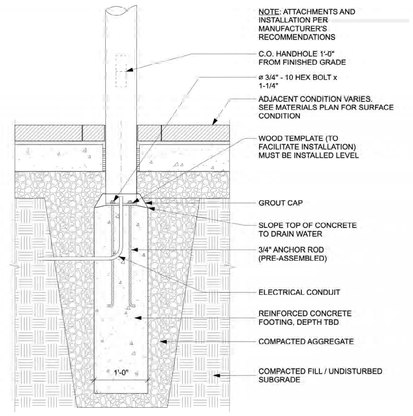
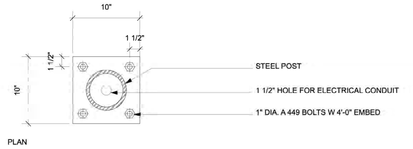


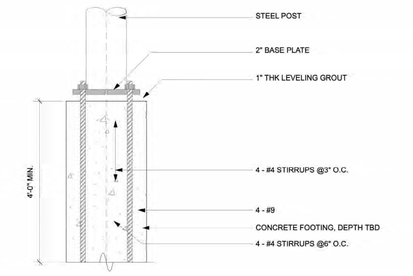


NOTE: STRUCTURAL COORDINATION PENDING

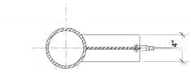
1 LIGHTPOLE FOOTING DIRECT BURIAL
Scale: 1" = 1'-0"



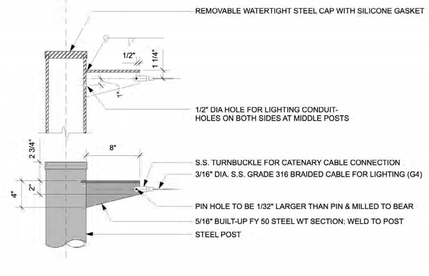
PLAN



SECTION



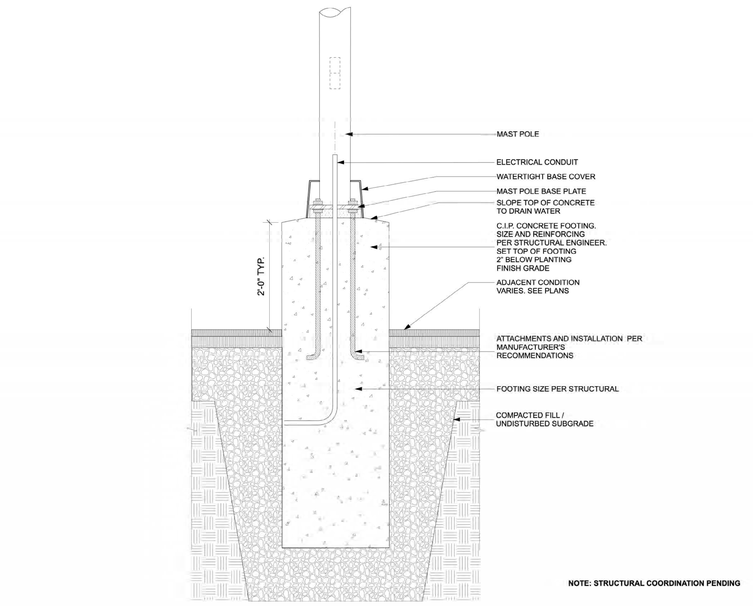
PLAN



SECTION

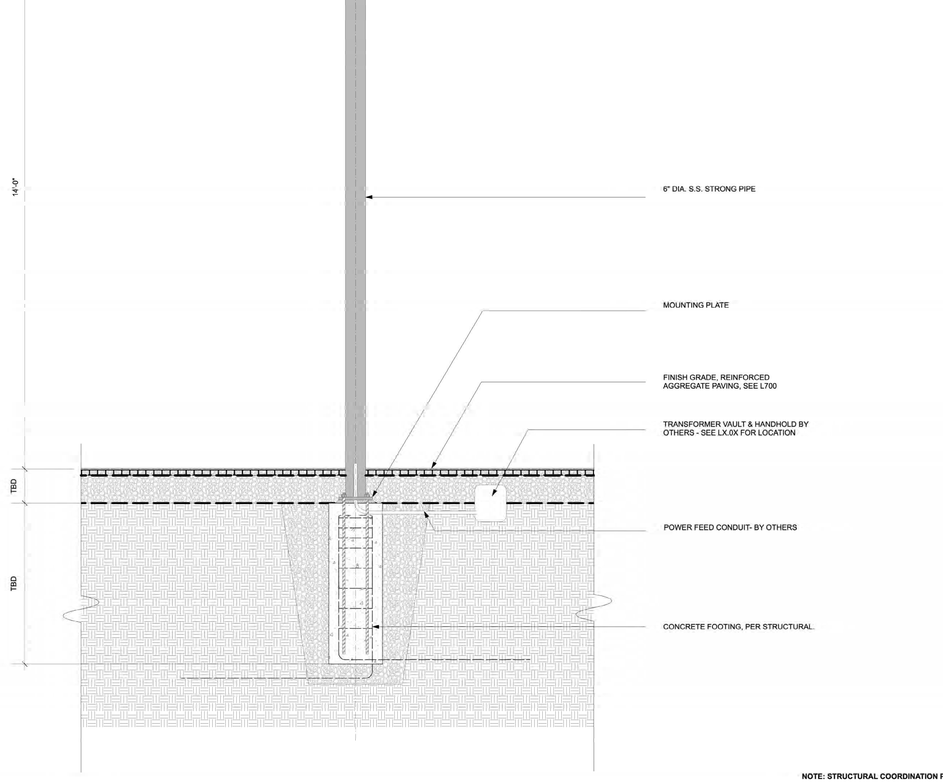
NOTE: STRUCTURAL COORDINATION PENDING

2 CATENARY LIGHTING POLE DETAILS
Scale: 1 1/2" = 1'-0"



NOTE: STRUCTURAL COORDINATION PENDING

3 LIGHTPOLE EXPOSED FOOTING IN PARKING
Scale: 1" = 1'-0"



NOTE: STRUCTURAL COORDINATION PENDING

4 CATENARY LIGHTING POLE FOOTING
Scale: 3/4" = 1'-0"

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Issued for: **Notice of Intent** — Date: **06/07/2024**

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Drawing Title: **L-720 LIGHT POLE FOOTING DETAILS**

Drawing Number: **L-720**

Scale: AS SHOWN

Project Number: **15374.00**

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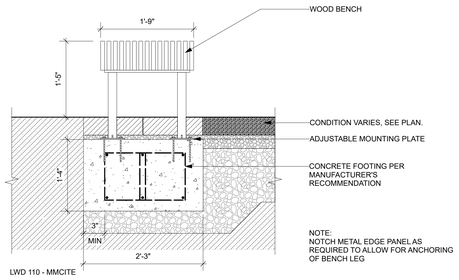
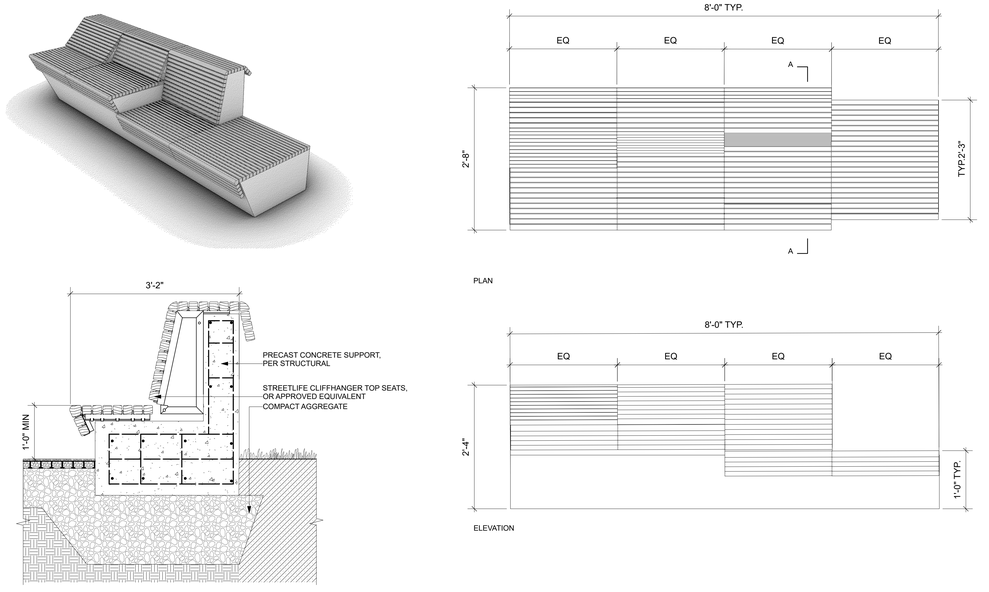
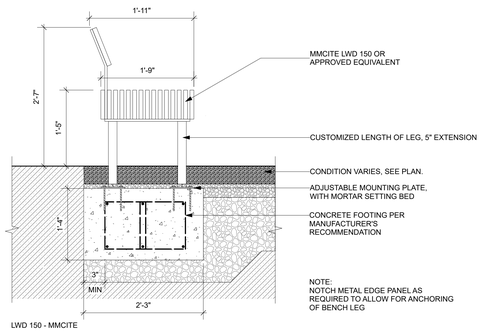


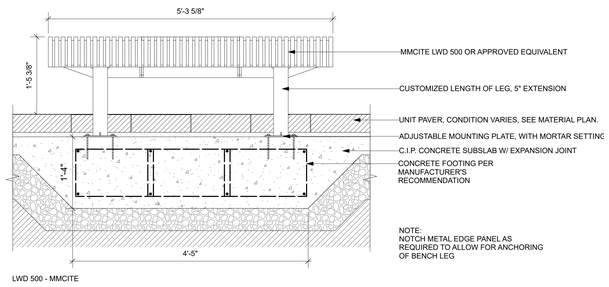
1 WOOD BENCH TYPE 1
Scale: 1" = 1'-0"



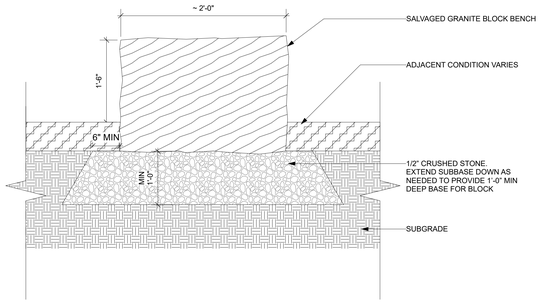
2 WOOD BENCH TYPE 2 - DCR
Scale: 1" = 1'-0"



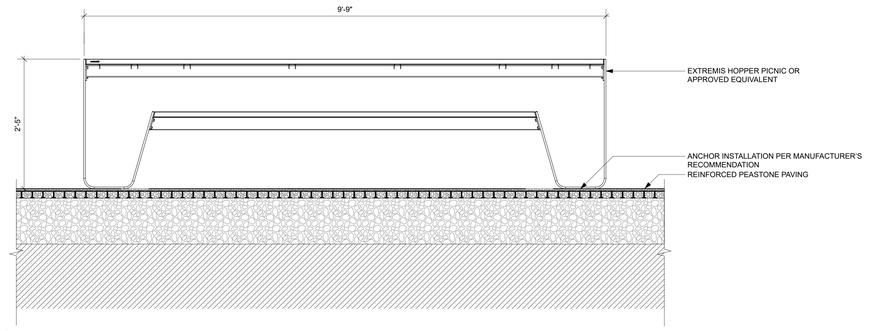
3 WOOD BENCH TYPE 3 - LONG WITH BACK
Scale: 1" = 1'-0"



4 WOOD BENCH TYPE 4 - OVERSIZED BENCH
Scale: 1" = 1'-0"



5 BENCH TYPE 5 - RECLAIMED GRANITE BENCH
Scale: 1" = 1'-0"



6 PICNIC SET
Scale: 1" = 1'-0"

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No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: **Notice of Intent** Date: **06/07/2024**

Not Issued for Construction

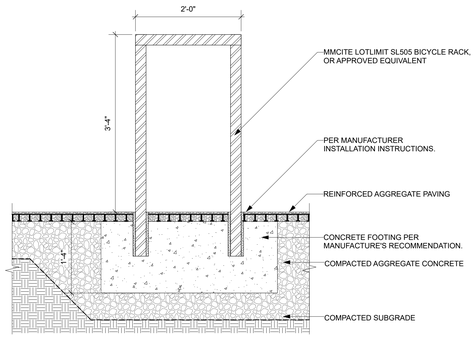
Drawing Title
L-730
SITE FURNISHING DETAILS

Drawing Number
L-730

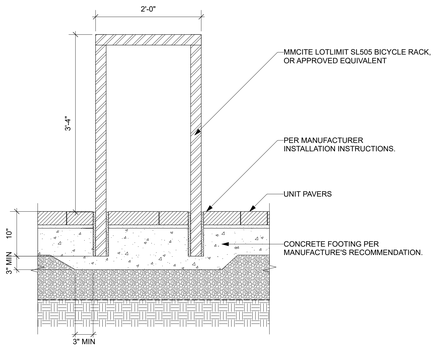
Scale
AS SHOWN

Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM \\GLZMANTANG Plotted Wednesday, April 12, 2023 9:25:59 AM Vanessa Guzman Tang

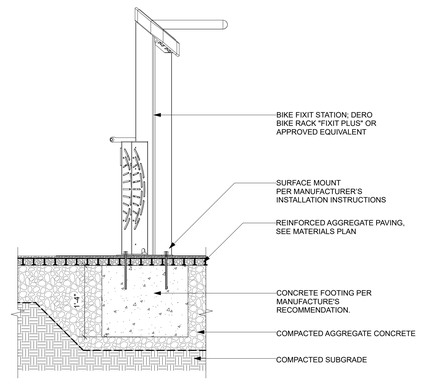


SECTION TYPE 1: AT REINFORED AGGREGATED PAVING



SECTION TYPE 2: AT UNIT PAVERS

1 BIKE RACK
Scale: 1" = 1'-0"



2 BIKE REPAIR STATION
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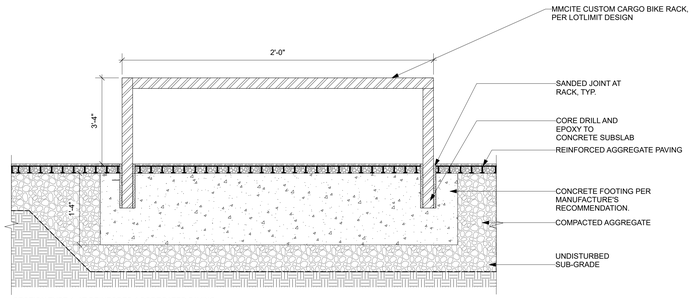

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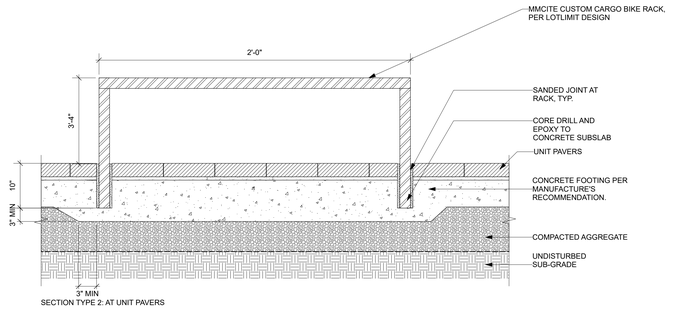
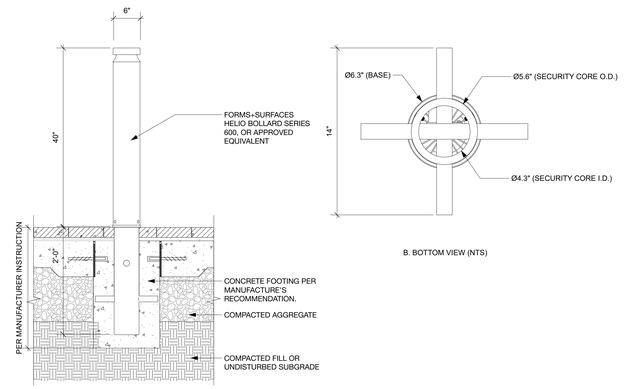


SECTION TYPE 2: AT UNIT PAVERS

3 CARGO BIKE RACK
Scale: 1" = 1'-0"



A. SECTION

B. BOTTOM VIEW (NTS)

4 FIXED BOLLARD - DROP OFF AREAS
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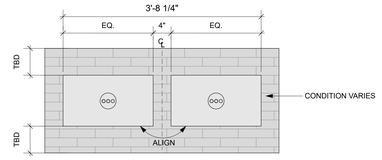
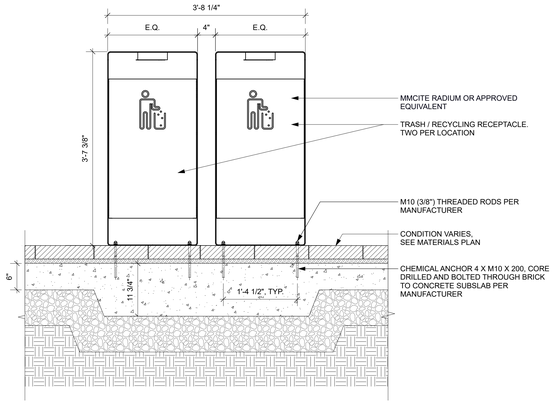


A. PLAN



B. SECTION

7 TRASH AND RECYCLING RECEPTACLES
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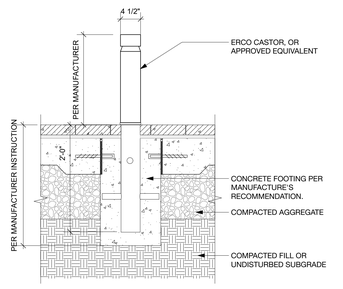
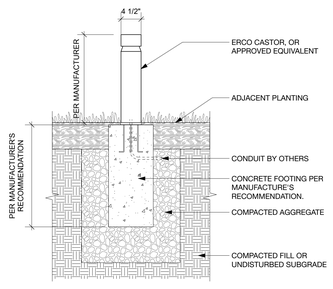
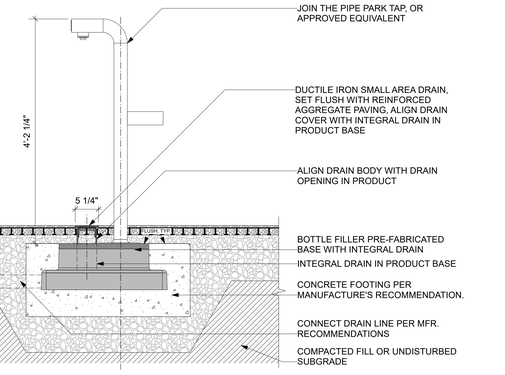


5 GARDEN BOLLARD
Scale: 1" = 1'-0"



6 GARDEN BOLLARD IN PLANTING
Scale: 1" = 1'-0"



8 DRINKING FOUNTAIN
Scale: 1" = 1'-0"

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Watertown Mall Transformation
500-550 Arsenal Street
Watertown, MA

No.	Revision	Date	Apprd.

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Notice of Intent | **06/07/2024**

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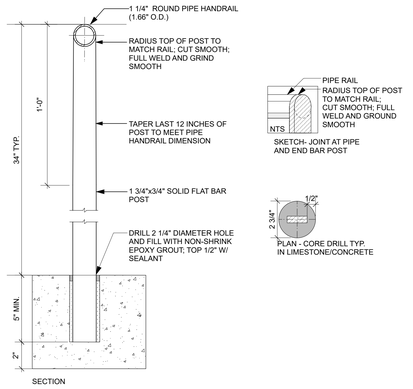
Drawing Title
L-731
SITE FURNISHING DETAILS

Drawing Number
L-731

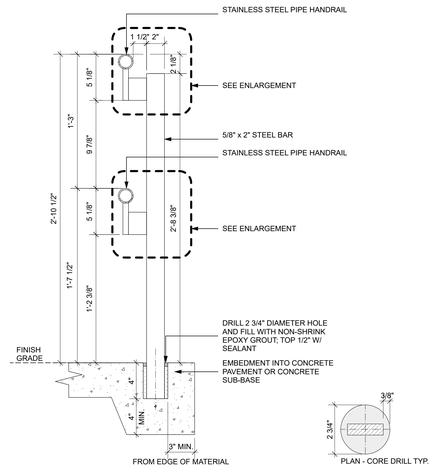
Scale
AS SHOWN

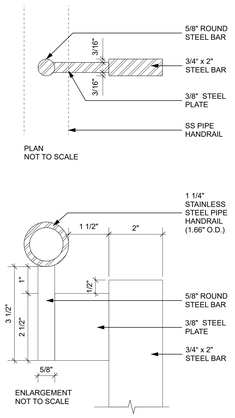
Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM VGUZMAN\FNG Plotted Wednesday, April 12, 2023 9:25:59 AM Vanessa Guzman Tong

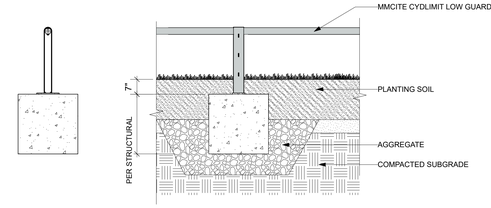


1 ROUND PIPE HANDRAIL ENLARGEMENT
SCALE: 3" = 1'-0"

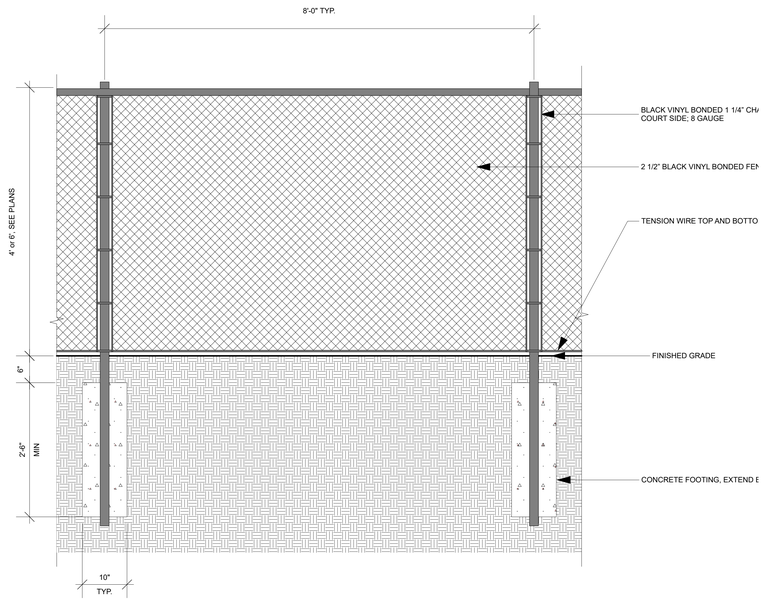




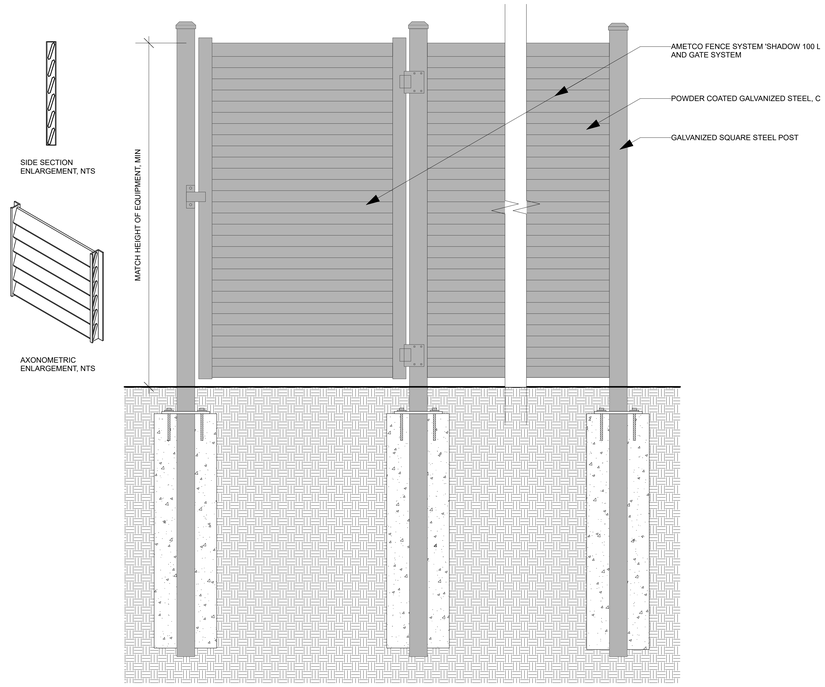
2 ROUND PIPE HANDRAIL AT ADA RAMP
SCALE: 3" = 1'-0"



3 LOW GUARDRAIL AT MICROFOREST
SCALE: 3" = 1'-0"



4 CHAIN LINK FENCE
Scale: 1" = 1'-0"



5 LOUVRE SCREENING FENCE AND GATE
Scale: 1" = 1'-0"

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Watertown Mall Transformation

500-550 Arsenal Street
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No.	Revison	Date	Apprvd

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Date
06/07/2024

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Drawing Title
L-740
SITE FURNISHING DETAILS

Drawing Number
L-740

Scale
AS SHOWN

Project Number
15374.00

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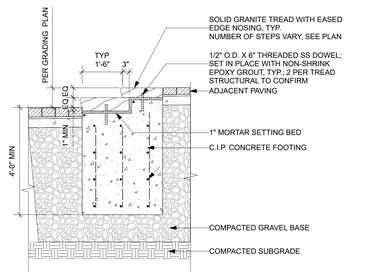

1 GRANITE STAIRS AT PLINTH
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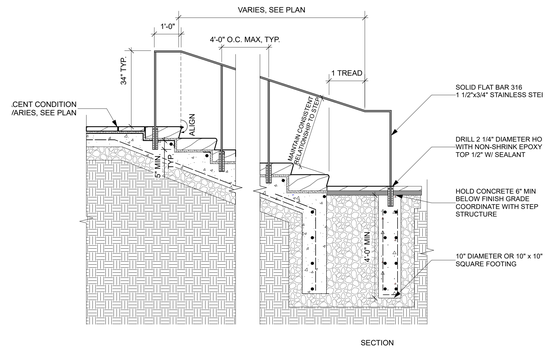
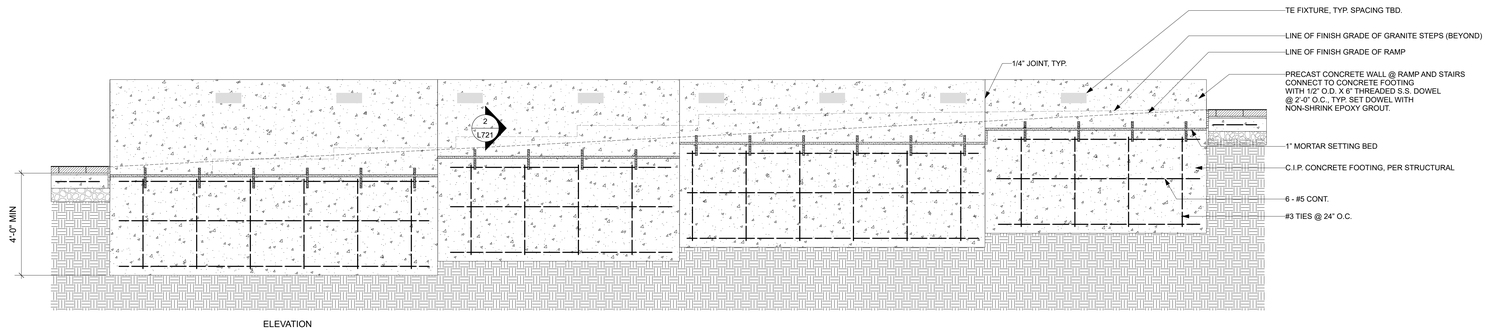
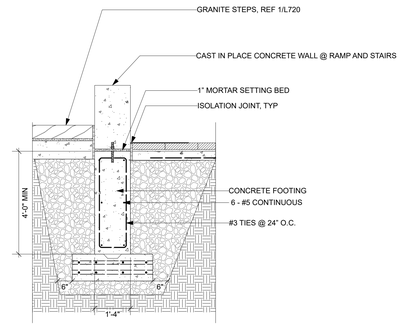


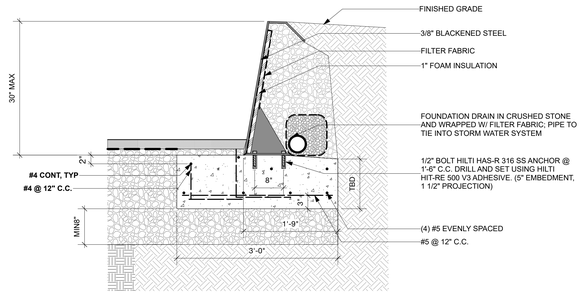
2 HANDRAIL
Scale: 1/2" = 1'-0"



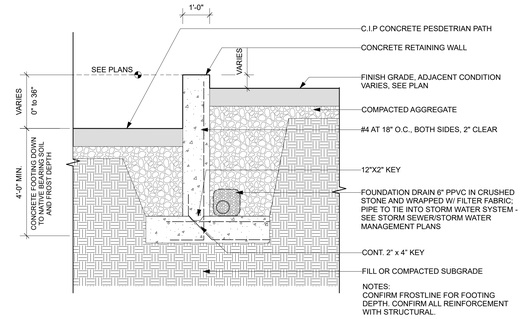
ELEVATION



3 PRECAST CONCRETE WALL
Scale: 1/2" = 1'-0"



4 METAL RETAINING WALL
Scale: 1" = 1'-0"



5 CIP CONCRETE WALL AT SERVICE AREAS
Scale: 1/2" = 1'-0"

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L-750
SITE DETAILS

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L-750

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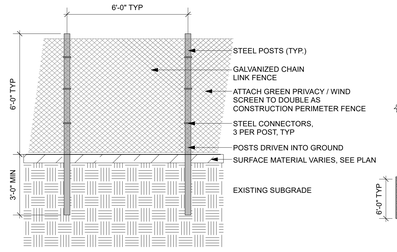
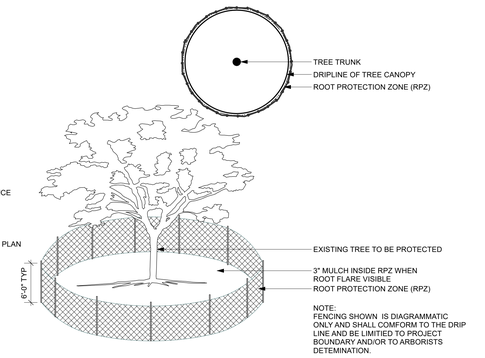
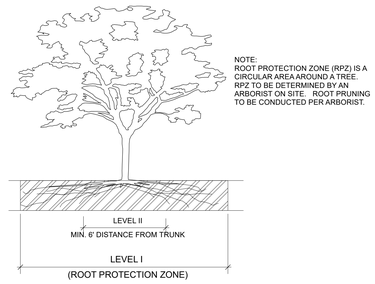
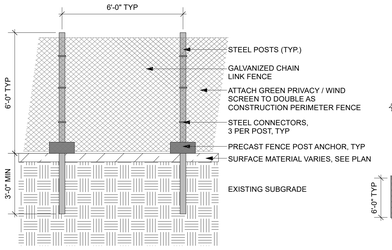


TREE PROTECTION FENCE - TYPE I

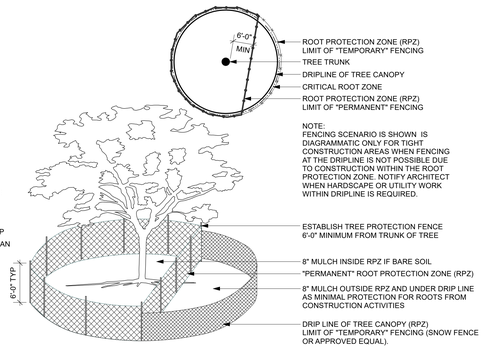


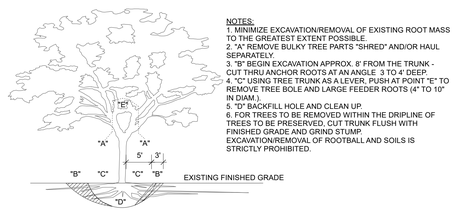


ROOT PROTECTION ZONE



TREE PROTECTION FENCE - TYPE II

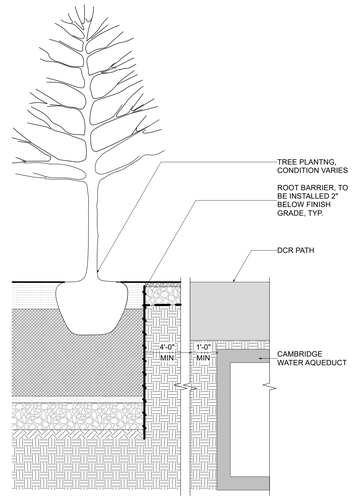




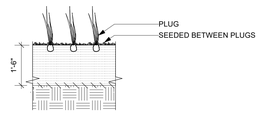
NOTES:
1. MINIMIZE EXCAVATION/REMOVAL OF EXISTING ROOT MASS TO THE GREATEST EXTENT POSSIBLE.
2. "A" REMOVE BULKY TREE PARTS "SHRED" AND/OR HAUL SEPARATELY.
3. "B" BEGIN EXCAVATION APPROX. 8' FROM THE TRUNK - CUT THRU ANCHOR ROOTS AT AN ANGLE 3 TO 4' DEEP.
4. "C" USING TREE TRUNK AS A LEVER, PUSH AT POINT "E" TO REMOVE TREE BOLE AND LARGE FEEDER ROOTS (4" TO 10" IN DIAM.).
5. "D" BACKFILL HOLE AND CLEAN UP.
6. FOR TREES TO BE REMOVED WITHIN THE DRIPLINE OF TREES TO BE PRESERVED, CUT TRUNK FLUSH WITH FINISHED GRADE AND GRIND STUMP.
EXCAVATION/REMOVAL OF ROOTBALL AND SOILS IS STRICTLY PROHIBITED.

TREE REMOVAL

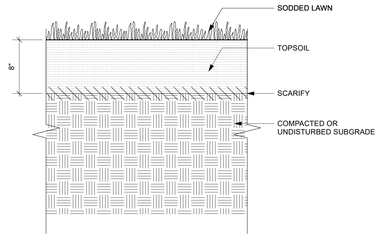
1 TREE PROTECTION AND REMOVALS DETAIL
SCALE: 1-1/2" = 1'-0"



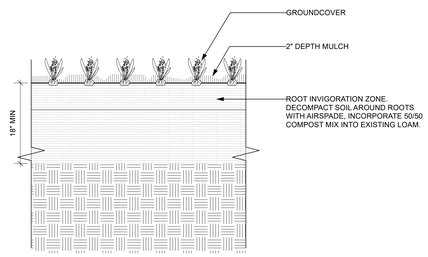
2 ROOT BARRIER AT AQUEDUCT
Scale: 1/2" = 1'-0"



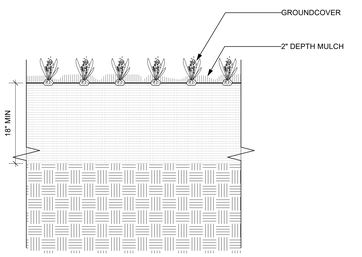
3 PLUG PLANTING
Scale: 1/2" = 1'-0"



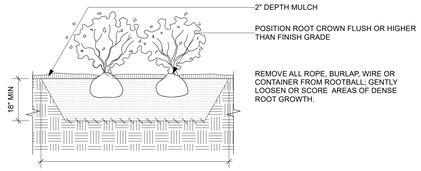
4 SODDED LAWN
SCALE: 1-1/2" = 1'-0"



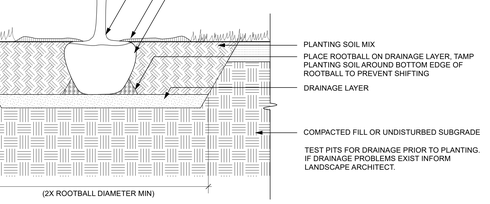
5 GROUNDCOVER PLANTING @ EXISTING TREES
SCALE: 1-1/2" = 1'-0"



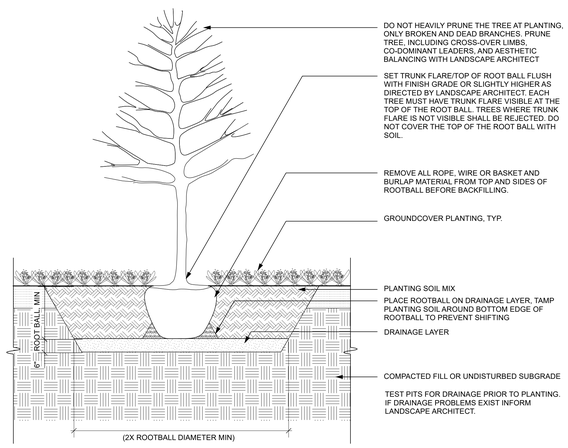
6 GROUNDCOVER PLANTING
SCALE: 1-1/2" = 1'-0"



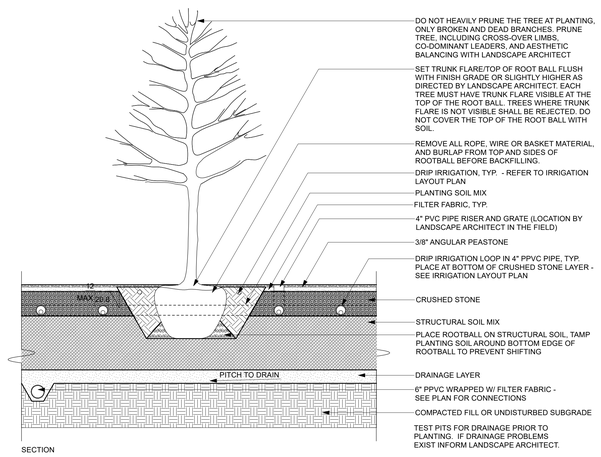
7 SHRUB PLANTING
SCALE: 1/2" = 1'-0"



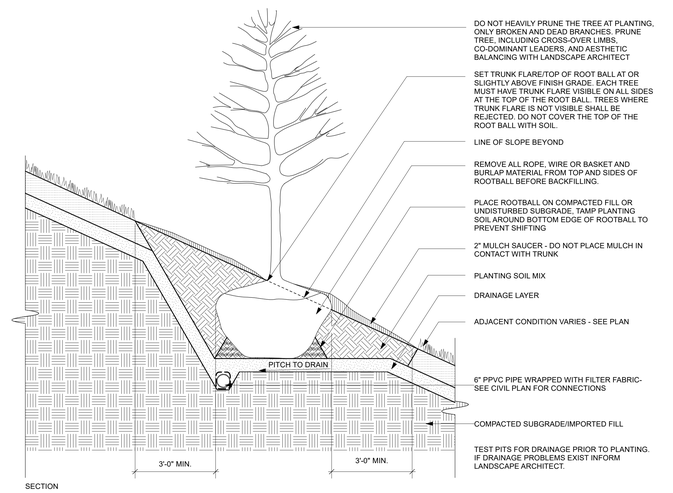
8 TREE PLANTING IN LAWN
SCALE: 1-1/2" = 1'-0"



9 TREE PLANTING IN PLANT BED
SCALE: 1-1/2" = 1'-0"



10 TREE PLANTING IN PEASTONE PAVING
SCALE: 1-1/2" = 1'-0"



11 TREE PLANTING ON SLOPE
SCALE: 1-1/2" = 1'-0"

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Watertown, MA

No	Revision	Date	Apprvd

Designed by | Checked by

Issued for | Date

Notice of Intent **06/07/2024**

Not Issued for Construction

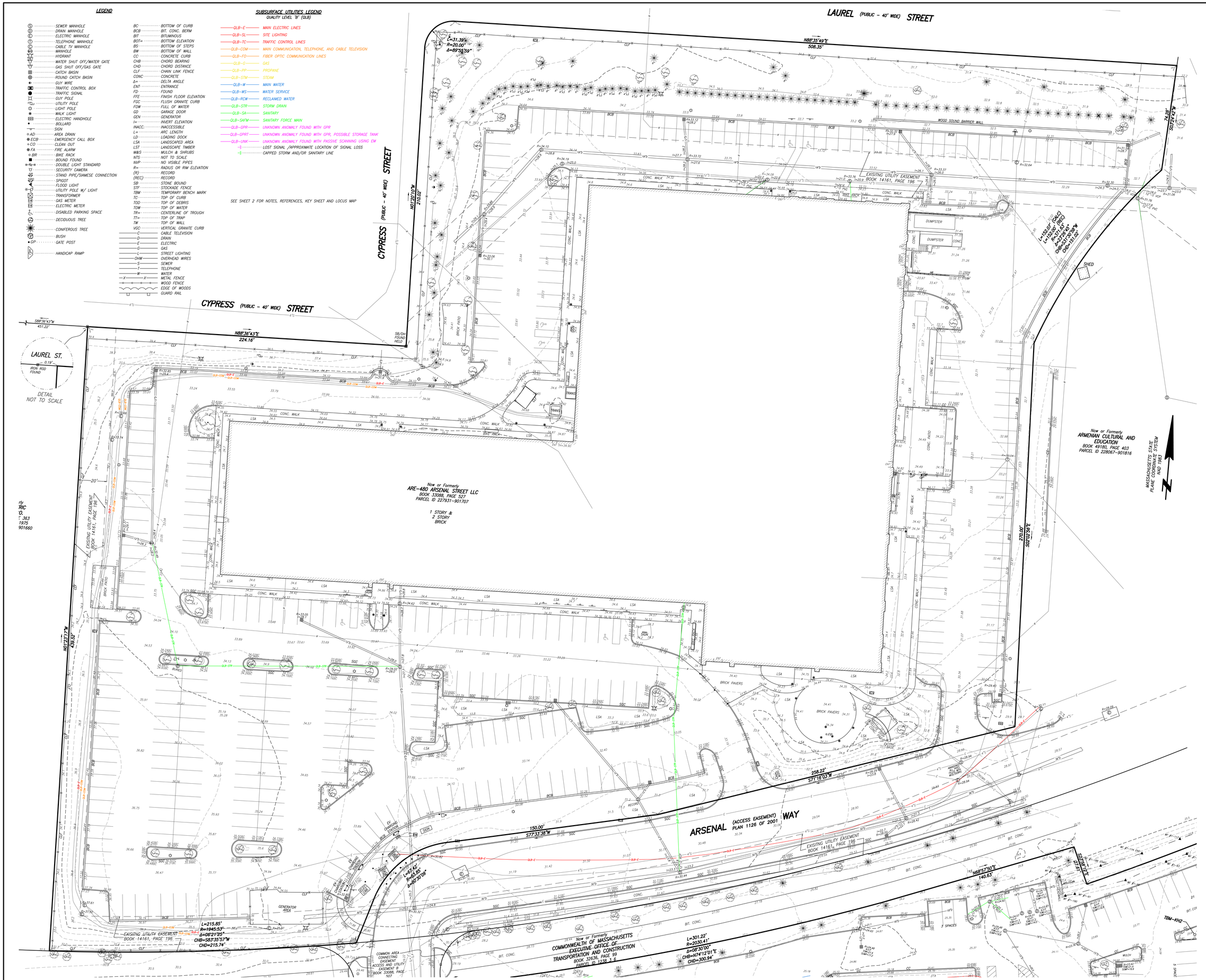
Drawing Title
L-800
PLANTING DETAILS

Drawing Number
L-800

Scale
AS SHOWN

Project Number
15374.00

Saved Monday, June 3, 2024 3:40:22 PM \\GLZ\MAINTANG Plotted Wednesday, April 12, 2023 9:25:59 AM Vanessa Guzman Tang



FELDMAN GEOSPATIAL

BOSTON HEADQUARTERS
152 HAMPDEN STREET
BOSTON, MA 02119

WORCESTER OFFICE
27 MECHANIC STREET
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(617)357-9740
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I CERTIFY THAT THIS PLAN IS BASED ON AN ACTUAL FIELD SURVEY AND THE LATEST PLANS AND DEEDS OF RECORD.

COMMONWEALTH OF MASSACHUSETTS KEVIN D. ARSENAULT No.45286 REGISTERED PROFESSIONAL LAND SURVEYOR

4/13/2023

KEVIN ARSENAULT, PLS (MA# 45286) DATE
KARSENAULT@FELDMANGEO.COM

DRAWING NAME:

EXISTING CONDITIONS PLAN OF LAND

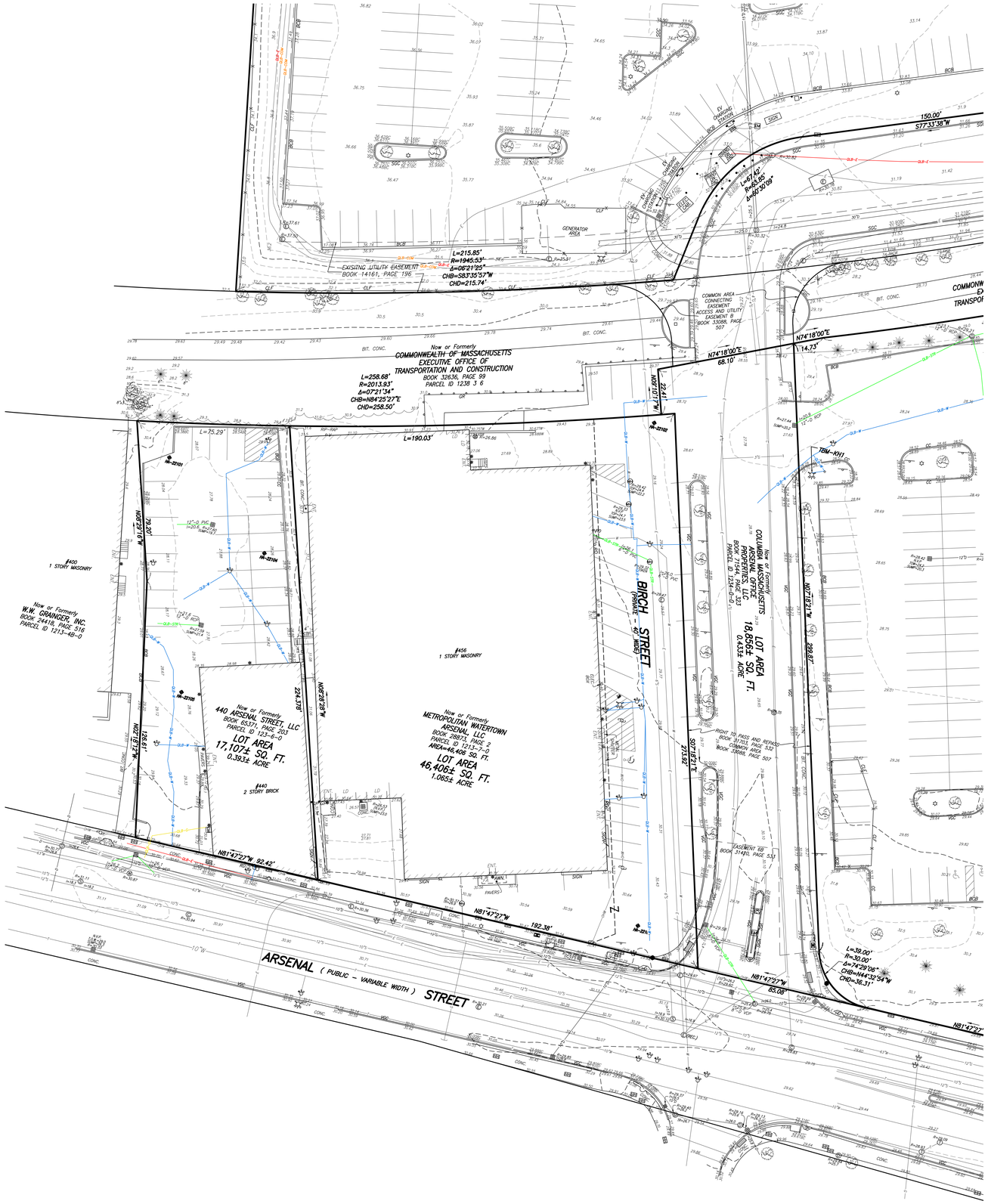
480 ARSENAL WAY WATERTOWN, MASS.

DATE:	MARCH 10, 2022
REVISIONS:	
8/25/2022	ADDITIONAL SURVEY AT 480 ARSENAL WAY
9/20/2022	SUBSURFACE UTILITY ENGINEERING
1/3/2023	SUBSURFACE UTILITY ENGINEERING
FILENAME:	2200012-EC-VHB PLOT.dwg
RESEARCH: TI/KDA	FIELD CHIEF: CA/KH/SB
PROJ. MGR: KDA	APPROVED: KDA
CALC: TI	CADD: TI
FIELD CHK:	CRD FILE: 2200012

20 0 10 20 40

SCALE: 1"=20'

SHEET NO. 1 OF 8



LOCUS MAP NOT TO SCALE

KEY SHEET
NOT TO SCALE

REFERENCES

MIDDLESEX (SOUTH DISTRICT) REGISTRY OF DEEDS

BOOK 15102 PAGE 161 (LOCUS)
BOOK 2677 PAGE 396
BOOK 3324 PAGES 581, 582, 584 & 585
BOOK 3335 PAGES 458 & 462
BOOK 3864 PAGES 269 & 273
BOOK 4086 PAGE 328
BOOK 9561 PAGE 94
BOOK 10035 PAGE 173
BOOK 12737 PAGE 637
BOOK 12739 PAGE 603
BOOK 12848 PAGE 674
BOOK 14850 PAGE 378 (HIGHWAY EASEMENTS)
BOOK 14850 PAGE 397 (HIGHWAY TAKING)

PLAN REFERENCES

MIDDLESEX (SOUTH DISTRICT) REGISTRY OF DEEDS

BOOK 12475 PAGE 83 (LOCUS)
PLAN BOOK 166 PLAN 13
PLAN BOOK 181 PLAN 50
BOOK 3673 PAGE END
BOOK 9561 PAGE 94 (DRAINAGE EASEMENT)
BOOK 10035 PAGE 173 (DRAINAGE EASEMENT)
BOOK 12848 PAGE 674
BOOK 14850 PAGE 368 (HIGHWAY TAKING)

NOTES:

1. BENCH MARK INFORMATION:

   BENCH MARK USED:
   SQUARE CUT ON CORNER OF CONCRETE BASE OF TRAFFIC SIGNAL BOX BEHIND BEST BUY ENTRANCE TO THE MALL.
   ELEVATION=29.296 (NAVD88)

   TEMPORARY BENCH MARKS SET:
   TBM-KH1: X-CUT ON NORTH MOST HYDRANT BOLT ON THE EASTERLY SIDE OF ARSENAL WAY.
   ELEVATION=30.69

   TBM-KH2: SQUARE CUT ON CONCRETE LIGHT POLE BASE IN #500 ARSENAL STREET PARKING LOT.
   ELEVATION=26.75

   TBM-KH3: X-CUT ON HYDRANT BOLT BEHIND TARGET PARKING LOT
   ELEVATION=26.04

   TBM-KH4: X-CUT ON HYDRANT BOLT ACROSS FROM #49 ELM STREET.
   ELEVATION=23.92

   TBM-KH5: SPIKE SET ON UP #1 AT NORTHWESTERLY INTERSECTION OF ELM STREET AND ARSENAL STREET.
   ELEVATION=31.47

   TBM-KH6: SPIKE SET ON UP#VZ17 ON NORTHERLY SIDELINE OF ARSENAL STREET, IN FRONT OF #500 ARSENAL STREET.
   ELEVATION=29.93

2. ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAD88)

3. CONTOUR INTERVAL EQUALS ONE (1) FOOT.

6. BY GRAPHIC PLOTTING ONLY, THE PARCEL SHOWN HEREON LIES WITHIN A ZONE "X" (UNSHADED), AN AREA OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOOD, AS SHOWN ON THE FEDERAL EMERGENCY MANAGEMENT AGENCY (F.E.M.A) FLOOD INSURANCE RATE MAP (F.I.R.M.) FOR MIDDLESEX COUNTY, MASSACHUSETTS, MAP NUMBER 25017C0556E, HAVING AN EFFECTIVE DATE OF JUNE 4, 2010, AND MAP NUMBER 25017C0557E, HAVING AN EFFECTIVE DATE OF JUNE 4, 2010.

7. UTILITY INFORMATION SHOWN IS BASED ON BOTH A FIELD SURVEY AND PLANS OF RECORD. THE LOCATIONS OF UNDERGROUND PIPES AND CONDUITS HAVE BEEN DETERMINED FROM THE AFOREMENTIONED RECORD PLANS AND ARE APPROXIMATE ONLY. WE CANNOT ASSUME RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES THAT ARE OMITTED OR INACCURATELY SHOWN ON SAID RECORD PLANS. SINCE SUBSURFACE UTILITIES CANNOT BE VISIBLY VERIFIED, BEFORE PLANNING FUTURE CONNECTIONS, THE PROPER UTILITY ENGINEERING DEPARTMENT SHOULD BE CONSULTED AND THE ACTUAL LOCATION OF SUBSURFACE STRUCTURES SHOULD BE DETERMINED IN THE FIELD. CALL TOLL FREE, THE DIG SAFE CALL CENTER AT 1-888-344-7233 SEVENTY-TWO HOURS PRIOR TO EXCAVATION.

8. THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF FELDMAN GEOSPATIAL ISSUED TO OUR CLIENT FOR PURPOSES RELATED DIRECTLY AND SOLELY TO FELDMAN GEOSPATIAL'S SCOPE OF SERVICES UNDER CONTRACT TO OUR CLIENT FOR THIS PROJECT. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN CONSENT IS PROVIDED BY FELDMAN GEOSPATIAL.

9. FIELD SURVEY WAS PERFORMED WITH SITE UNDER PARTIAL SNOW COVER.

10. THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND IS SUBJECT TO ANY FINDINGS SUCH A REPORT MIGHT DISCLOSE.

LEGEND

SEWER MANHOLE	BC ..... BOTTOM OF CURB
DRAIN MANHOLE	BCB ..... BIT. CONC. BERM
ELECTRIC MANHOLE	BIT ..... BITUMINOUS
TELEPHONE MANHOLE	BOT= ..... BOTTOM ELEVATION
CABLE TV MANHOLE	BS= ..... BOTTOM OF STEPS
MANHOLE	BW ..... BOTTOM OF WALL
HYDRANT	CC ..... CONCRETE CURB
WATER SHUT OFF/WATER GATE	CHB ..... CHORD BEARING
GAS SHUT OFF/GAS GATE	CHD ..... CHORD DISTANCE
CATCH BASIN	CLF ..... CHAIN LINK FENCE
ROUND CATCH BASIN	CONC ..... CONCRETE
GUY WIRE	Δ= ..... DELTA ANGLE
TRAFFIC CONTROL BOX	ENT ..... ENTRANCE
TRAFFIC SIGNAL	FD ..... FOUND
GUY POLE	FFE ..... FINISH FLOOR ELEVATION
UTILITY POLE	FGC ..... FLUSH GRANITE CURB
LIGHT POLE	FOW ..... FULL OF WATER
WALK LIGHT	GD ..... GARAGE DOOR
ELECTRIC HANDHOLE	GEN ..... GENERATOR
BOLLARD	I= ..... INVERT ELEVATION
SIGN	INACC. ..... INACCESSIBLE
AD ..... AREA DRAIN	L= ..... ARC LENGTH
ECB ..... EMERGENCY CALL BOX	LD ..... LOADING DOCK
CO ..... CLEAN OUT	LSA ..... LANDSCAPED AREA
FA ..... FIRE ALARM	LST ..... LANDSCAPE TIMBER
BR ..... BIKE RACK	M&S ..... MULCH & SHRUBS
BOUND FOUND	NTS ..... NOT TO SCALE
DOUBLE LIGHT STANDARD	NVP ..... NO VISIBLE PIPES
SECURITY CAMERA	R= ..... RADIUS OR RIM ELEVATION
STAND PIPE/SIAMESE CONNECTION	(R) ..... RECORD
SPIGOT	(REC) ..... RECORD
FLOOD LIGHT	SB ..... STONE BOUND
UTILITY POLE W/ LIGHT	STF ..... STOCKADE FENCE
TRANSFORMER	TBM ..... TEMPORARY BENCH MARK
GAS METER	TC ..... TOP OF CURB
ELECTRIC METER	TOD ..... TOP OF DEBRIS
DISABLED PARKING SPACE	TOW ..... TOP OF WATER
DECIDUOUS TREE	TR= ..... CENTERLINE OF TROUGH
CONIFEROUS TREE	TT= ..... TOP OF TRAP
BUSH	TW ..... TOP OF WALL
GP ..... GATE POST	VGC ..... VERTICAL GRANITE CURB
HANDICAP RAMP	C ..... CABLE TELEVISION
	D ..... DRAIN
	E ..... ELECTRIC
	G ..... GAS
	L ..... STREET LIGHTING
	OHW ..... OVERHEAD WIRES
	S ..... SEWER
	T ..... TELEPHONE
	W ..... WATER
	X ..... X ..... METAL FENCE
	WOOD FENCE
	EDGE OF WOODS
	GUARD RAIL

SUBSURFACE UTILITIES LEGEND
QUALITY LEVEL "B" (QLB)

QLB-E	MAIN ELECTRIC LINES
QLB-SL	SITE LIGHTING
QLB-TC	TRAFFIC CONTROL LINES
QLB-COM	MAIN COMMUNICATION, TELEPHONE, AND CABLE TELEVISION
QLB-FO	FIBER OPTIC COMMUNICATION LINES
QLB-G	GAS
QLB-PP	PROPANE
QLB-STM	STEAM
QLB-W	MAIN WATER
QLB-WS	WATER SERVICE
QLB-RCW	RECLAIMED WATER
QLB-STR	STORM DRAIN
QLB-SA	SANITARY
QLB-SAFM	SANITARY FORCE MAIN
QLB-GPR	UNKNOWN ANOMALY FOUND WITH GPR
QLB-GPRT	UNKNOWN ANOMALY FOUND WITH GPR, POSSIBLE STORAGE TANK
QLB-UNK	UNKNOWN ANOMALY FOUND WITH PASSIVE SCANNING USING EM
	LOST SIGNAL /APPROXIMATE LOCATION OF SIGNAL LOSS
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COMMONWEALTH OF MASSACHUSETTS
KEVIN D. ARSENAULT No.45286 PROFESSIONAL LAND SURVEYOR

4/13/2023

KEVIN ARSENAULT, PLS (M# 45286) DATE
KARSENAULT@FELDMANGEO.COM

DRAWING NAME:

EXISTING CONDITIONS PLAN OF LAND

446 - 458 ARSENAL STREET WATERTOWN, MASS.

DATE:	MARCH 10, 2022
REVISIONS:	
8/25/2022	ADDITIONAL SURVEY AT 480 ARSENAL WAY
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CALC: TI	CADD: TI
FIELD CHK:	CRD FILE: 2200012

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SCALE: 1"=20'

SHEET NO. 2 OF 8

FILENAME: S:\PROJECTS\2022\2200012\DWG\emp and bacher\2200012-EC-VHB PLOT.dwg



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SEE SHEET 2 FOR NOTES, REFERENCES, KEY SHEET AND LOCUS MAP

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COMMONWEALTH OF MASSACHUSETTS
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REGISTERED PROFESSIONAL LAND SURVEYOR

4/13/2023
KEVIN ARSENAULT, PLS (MA# 45286) DATE
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DRAWING NAME:

EXISTING CONDITIONS PLAN OF LAND

500 ARSENAL STREET WATERTOWN, MASS.

DATE: MARCH 10, 2022

REVISIONS:	
8/25/2022	ADDITIONAL SURVEY AT 480 ARSENAL WAY
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FILENAME:	2200012-EC-VHB PLOT.dwg		
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20 0 10 20 40
SCALE: 1"=20'

SHEET NO. 3 OF 8

FILENAME: S:\PROJECTS\2022\2200012\Cad\Land Desktop\2200012-EC-VHB PLOT.dwg



LEGEND

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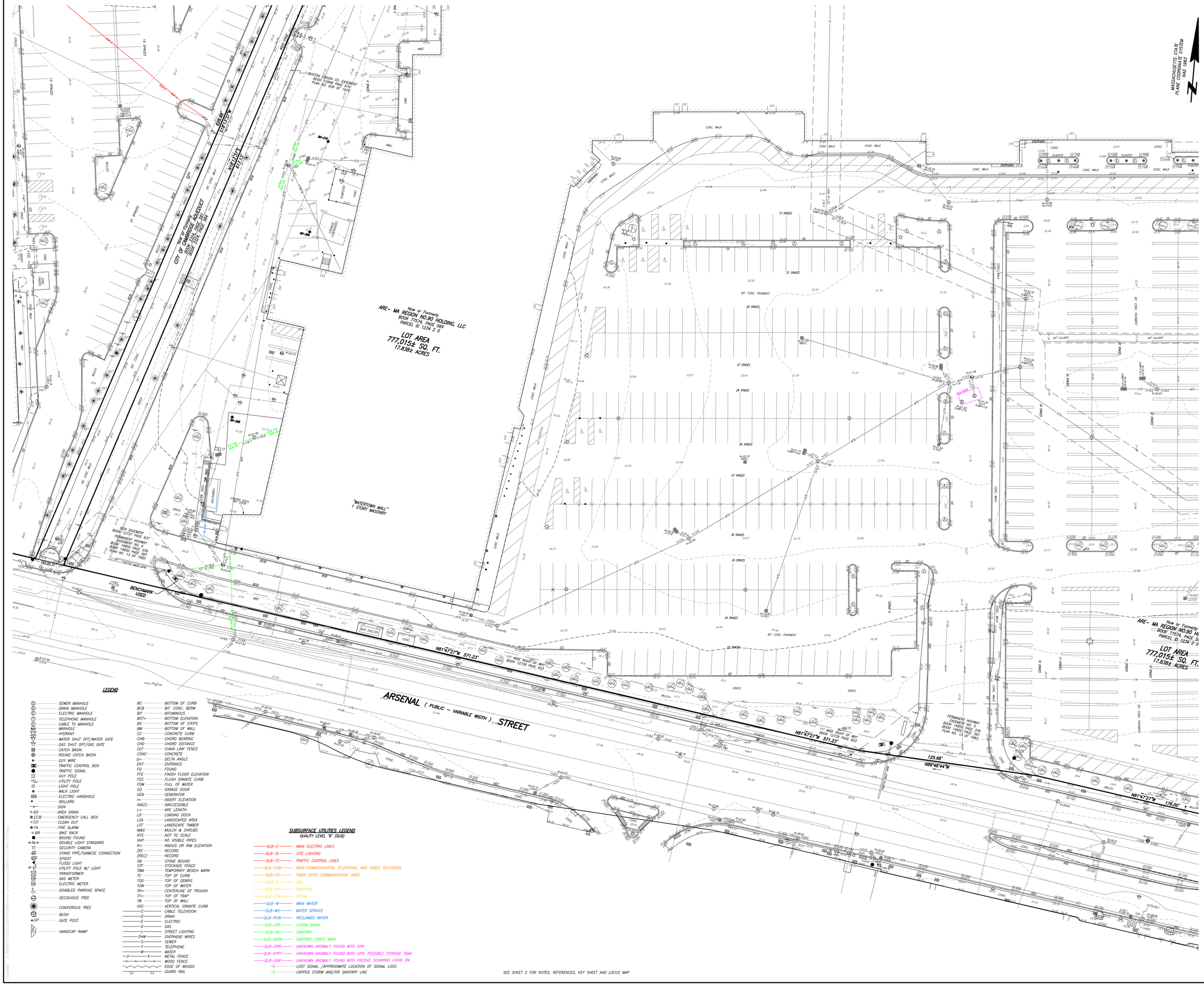
40 0 20 40 80

SCALE: 1"=40'

SHEET NO. 4 OF 8



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Right. From the Ground Up

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KEVIN D. ARSENAULT No.45286 REGISTERED PROFESSIONAL LAND SURVEYOR COMMONWEALTH OF MASSACHUSETTS

4/13/2023
KEVIN ARSENAULT, PLS (MA# 45286) DATE
KARSENAULT@FELDMANGEO.COM

DRAWING NAME:

EXISTING CONDITIONS PLAN OF LAND

550 ARSENAL STREET WATERTOWN, MASS.

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PROJ MGR: KDA	APPROVED:
CALC: TI	CADD: TI
FIELD CHK:	CRD FILE: 2200012

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SCALE: 1"=20'

SHEET NO. 5 OF 8

FILENAME: S:\PROJECTS\2022\2200012\CAD\comp and lookup\2200012-EC-VHB PLOT.dwg

LEGEND

- SEWER MANHOLE
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MASSACHUSETTS STATE PLANE COORDINATE SYSTEM NAD 1983

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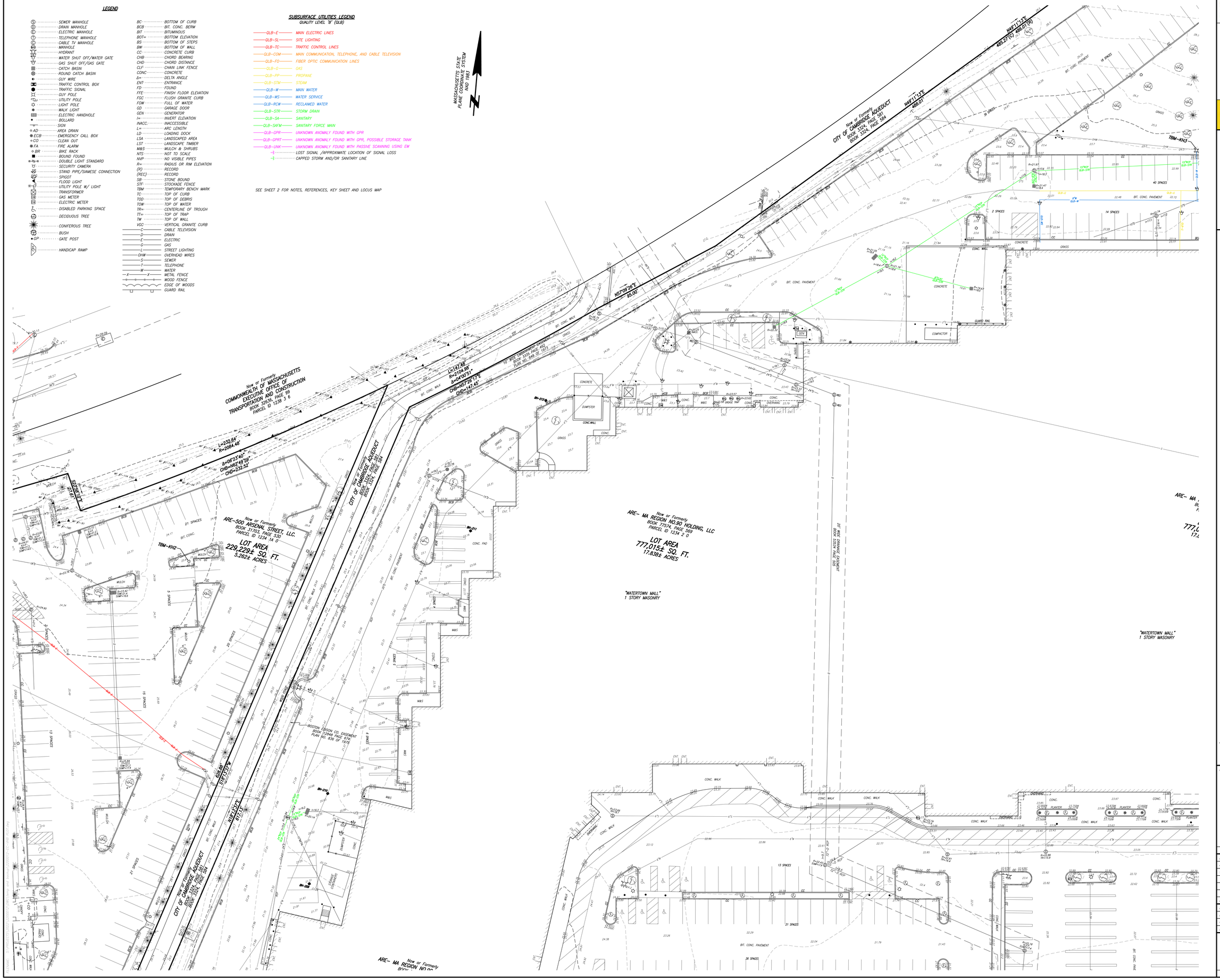

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KEVIN ARSENAULT, PLS (MA# 45286) — 4/13/2023 DATE
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SHEET NO. 6 OF 8

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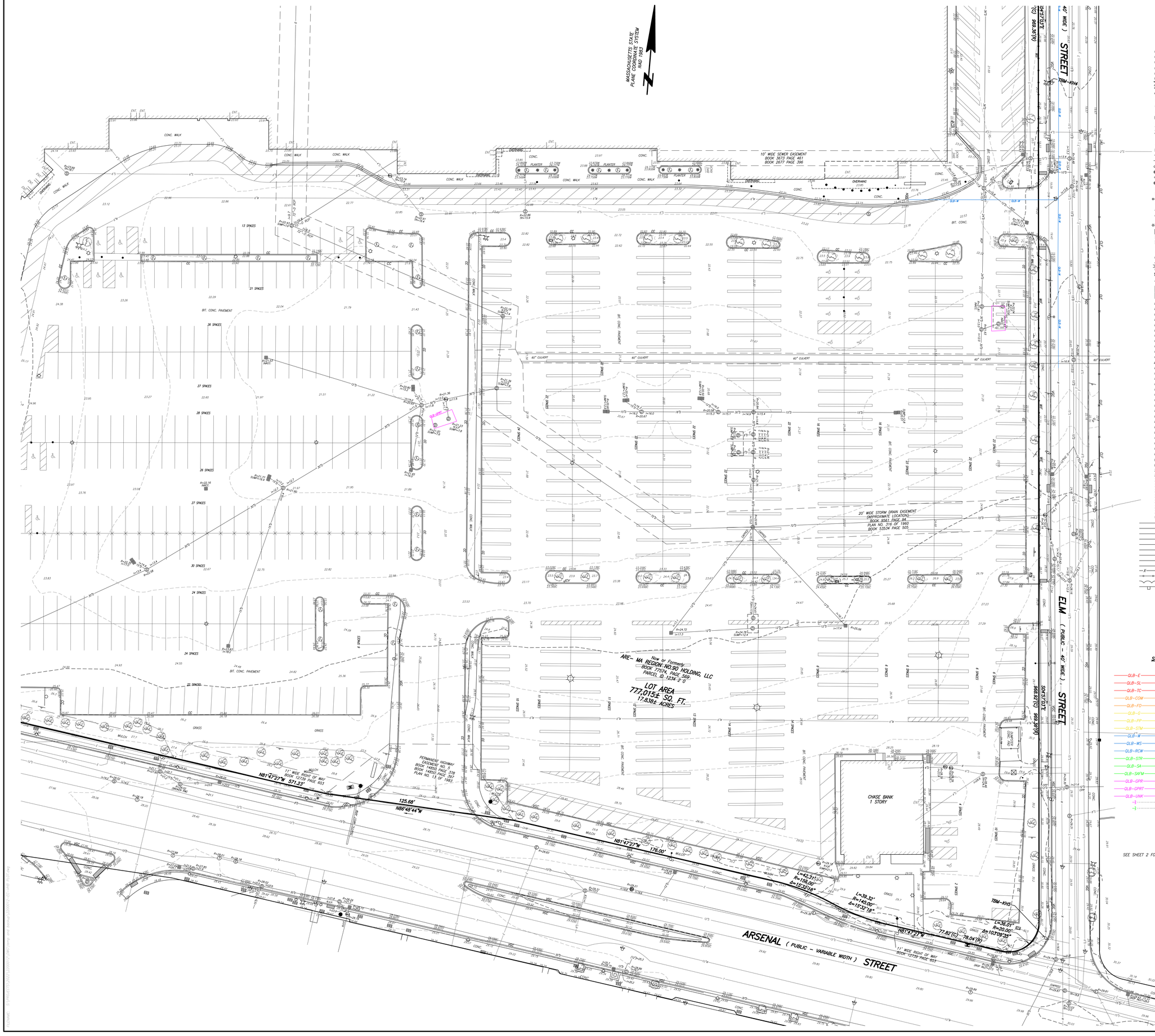
SHEET NO. 7 OF 8

FILENAME: S:\PROJECTS\2022\2200012\CAD\1Survey and Design\2200012-EC-VHB PLOT.dwg



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SHEET NO. 8 OF 8

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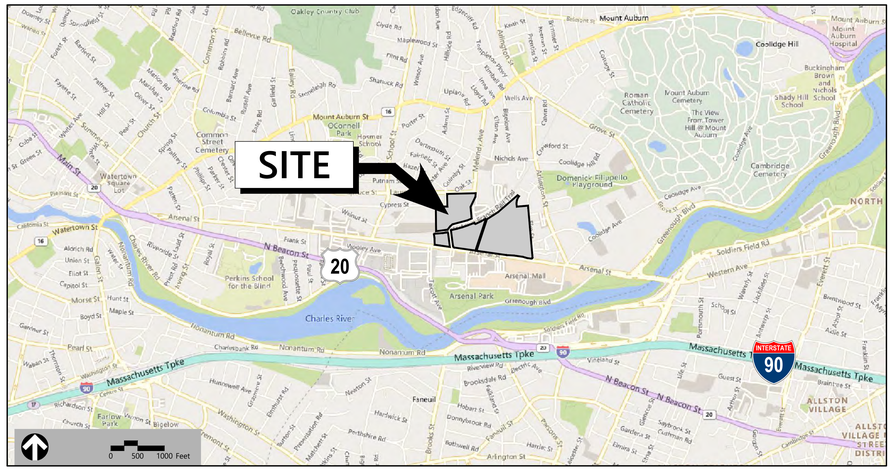
Site Plans

Issued for	Notice of Intent
Date Issued	June 07, 2024
Latest Issue	June 07, 2024

Watertown Mall Transformation

500-550 Arsenal Street
Watertown, MA



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C2.02	Site Preparation and Demolition Plan - 480 Arsenal Way	June 07, 2024
C3.00	Approval Master Plan	June 07, 2024
C4.00	Key Plan	June 07, 2024
C5.00	Site Plan - Overall	June 07, 2024
C5.01	Site Plan - 446/458 Arsenal Street	June 07, 2024
C5.02	Site Plan - 500 Arsenal Street	June 07, 2024
C5.03	Site Plan - 550 Arsenal Street	June 07, 2024
C5.04	Site Plan - 550 Arsenal Street	June 07, 2024
C5.05	Site Plan - 480 Arsenal Way	June 07, 2024
C6.00	Grading and Drainage Plan - Overall	June 07, 2024
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C6.02	Grading and Drainage Plan - 500 Arsenal Street	June 07, 2024
C6.03	Grading and Drainage Plan - 550 Arsenal Street	June 07, 2024
C6.04	Grading and Drainage Plan - 550 Arsenal Street	June 07, 2024
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C7.00	Utility Plan - Overall	June 07, 2024
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C7.05	Utility Plan - 480 Arsenal Way	June 07, 2024
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L-101	Tree Protection and Removals Plan - 480 Arsenal Way	June 07, 2024
L-102	Tree Protection and Removals Schedule	June 07, 2024
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L-240	Materials Plan - 550 Arsenal Street	June 07, 2024
L-250	Materials Plan - 550 Arsenal Street	June 07, 2024
L-260	Materials Plan - 550 Arsenal Street	June 07, 2024
L-270	Materials Plan - 480 Arsenal Way	June 07, 2024
L-500	Planting Plan - Overall	June 07, 2024
L-510	Planting Plan - 446/458 Arsenal Street	June 07, 2024
L-520	Planting Plan - 500 Arsenal Street	June 07, 2024
L-530	Planting Plan - 550 Arsenal Street	June 07, 2024
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L-560	Planting Plan - 550 Arsenal Street	June 07, 2024
L-570	Planting Plan - 480 Arsenal Way	June 07, 2024
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L-710	Details - Boardwalk	June 07, 2024
L-720	Details - Light Pole Footings	June 07, 2024
L-730	Details - Site Furnishings	June 07, 2024
L-731	Details - Site Furnishings	June 07, 2024
L-740	Details - Site Furnishings	June 07, 2024
L-750	Details - Site	June 07, 2024
L-800	Details - Planting	June 07, 2024

Reference Drawings

No.	Drawing Title	Latest Issue
1 - 8	Existing Conditions Plans	February 27, 2023

*File size too large - full plan set will be emailed to Conservation Agent.

ALEXANDRIA.
Owner/Applicant
ARE-MA Region No. 91, LLC
ARE-500 Arsenal Street, LLC
ARE-MA Region No. 90, LLC
c/o Alexandria Real Estate Equities, Inc.
215 First Street, Suite 100
Cambridge, MA 02142

Parcel Identification Numbers:
1234-2-0, 1234-1A-0, 1213-7-0, 123-6-0

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vhb
101 Walnut Street
PO Box 9151
Watertown, MA 02471
617.924.1770

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Landscape Architect
Reed Hilderbrand, LLC
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Gensler, Inc.
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Suite 5200
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Höweler+Yoon Architecture
Architect
Howeler + Yoon, LLP
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Third Floor
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BURO HAPPOLD
MEP Engineer
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COMMONWEALTH OF MASSACHUSETTS
CONOR P. NAGLE
CIVIL
No. 46302
PROFESSIONAL ENGINEER
06/13/2024

VHB Project: 15374.00
Issued for: Notice of Intent

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COM\15374.00_COV 18 June 2024

July 2, 2024

Ms. Katie Swan
Watertown Conservation Commission
149 Main Street
Watertown, MA 02472-4410

Subject: MassDEP File No. 321-0181 WWO-2021-09
Arsenal Park Improvements Project, Phase B (551 Rear Arsenal Park)
Modifications to existing athletic field

Dear Ms. Katie Swan:

The project team including representatives from the City's DPW, Recreation Department, CDM Smith and Quirk Construction met to review comments received by the Commission at the June 5th hearing. The team will pursue the option recommended by the Commission to utilize excess fill generated from construction activities in the existing athletic field area. We will develop a grading plan for review which will include the removal of the the existing baseball infield. The field area will be graded to potentially accommodate a minimum size 11v11 field (55 yards wide by 110 yards long) oriented in the East-West direction which is the preferred field size of the recreation department. Mature trees located along the north and south edges of the field will not be impacted but will ultimately determine the field width that can be accommodated. We have requested pricing from Quirk Construction for a new irrigation system. The total quantity of excess fill is fluid as currently stockpiled material is being utilized as backfill in excavations and filling of areas in accordance with the project documents. Fill is being generated and stockpiled from continuous excavation of the rain gardens.

The existing field does not have a uniform slope and the elevations vary potentially due to historic settlement. We anticipate the final grading of the athletic field will provide a more uniform slope across the field and result in a raise in elevation of approximately 16-20 inches depending on the final excess fill volume we need to distribute.

At this time we will not be pursuing additional mounding or removal of existing trees.

Please feel free to contact me with any question or comments.

Sincerely,

Glen Howard, RLA Massachusetts #1119

75 State Street, Suite 701, Boston, Massachusetts 02109 | tel: 617 452-6000

Project Manager
CDM Smith Inc.



NOTES:

1. SEE SITE ACCESS NOTES, EROSION AND SEDIMENT CONTROL NOTES, AND GENERAL NOTES ON SHEET G-1
2. (7) RELOCATED CENTRAL POST MOUNTED PICNIC TABLES SHALL BE REINSTALLED WITH MATCHING FOOTINGS TO 42" BELOW FINISH GRADE (MIN)
3. (7) RELOCATED POST MOUNTED GRILLS SHALL BE REINSTALLED WITH MATCHING FOOTINGS TO 42" BELOW FINISH GRADE (MIN) AS LOCATED ADJACENT TO RELOCATED PICNIC TABLES IN THE FIELD BY LANDSCAPE ARCHITECT

LEGEND:

- LIMIT OF WORK
- BITUMINOUS CONCRETE WALKWAY PAVEMENT
- CONCRETE PAVEMENT
- PLANTER AREA MIN. 24-IN DEPTH PLANTING SOIL
- EROSION CONTROL INFILTRATION AREA
- STONE INFILTRATION TRENCH
- VERTICAL CONCRETE CURB
- BIG BELLY WASTE RECEPTACLE

REV. NO.	DATE	DRWN	CHKD	REMARKS
2	5/30/24	NPW	GDH	ELECTRICAL FIXTURES ADDED
1	5/1/24	MRC	SWL	ADDITION OF EXISTING 24" BRICK DRAIN

DESIGNED BY: N.WATKINS
DRAWN BY: N.WATKINS
SHEET CHK'D BY: G.HOWARD
CROSS CHK'D BY: S.LANDGREN
APPROVED BY: G.HOWARD
DATE: OCTOBER 2023

CDM Smith
75 State Street
Boston, MA 02109
Tel: (617) 452-6000

CITY OF WATERTOWN, MASSACHUSETTS

ARSENAL PARK IMPROVEMENTS PROJECT PHASE B

LAYOUT AND MATERIALS PLAN IV

PROJECT NO. 56318-253750
FILE NAME: CSTPL003

SHEET NO.
L-9

COMMONWEALTH OF MASSACHUSETTS
DIANNE E. VELARDOCCHIA
CIVIL
No. 40748
REGISTERED PROFESSIONAL ENGINEER
10/27/23

COMMONWEALTH OF MASSACHUSETTS
GLENN D. HOWARD
No. 1119
REGISTERED LANDSCAPE ARCHITECT
10/26/2023

CONFORMED DRAWINGS - MAY 6, 2024