



HOWARD STEIN HUDSON

Engineers + Planners

## STORMWATER MANAGEMENT REPORT

# The Tantallon Proposed Multifamily Redevelopment Project 7 Tantallon Road

Andover, Massachusetts

Prepared by:

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## Existing Conditions

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The subject site is comprised of  $\pm$ .38 acres located in the General Business (GB) zoning district known as 7 Tantallon Road (Assessor's Map 35 Lots 5A & 6). This parcel is located to the east of the Shawsheen River and north of Haverhill Street. The site currently contains a vacant existing building on the western property edge that will be demolished and reconstructed. To the south is the Bank of New England. The property consists of mostly paved impervious surfaces with small areas of trees and grass surrounding the existing building and a small grass area surrounding the bank.

Site topography on the parcel shows that the site is relatively flat. On the western border, there are wetlands leading up to the Shawsheen River, where the topography begins to have a steeper slope.

Stormwater from the subject site currently flows off to two different locations. The majority of stormwater will cross the site from East to West and flow down the riverbank eventually making its way to the Shawsheen River (AP1). The remaining stormwater will overland flow to Haverhill Street and enter the street drainage (AP2).

Utilities exist within Tantallon Road; including water, sewer, gas, overhead electric, cable, and telephone which are accessible to the existing building and the adjacent parcel. The existing sewer main will be utilized pending a camera inspection determining it is feasible to use.



## Proposed Conditions

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The project proposes to improve the site with a multifamily residential building, fifty-eight (58) total parking spaces, site utilities, drainage, landscaping, and lighting improvements. Access to the site is proposed through the existing one-way entrance and access easement off Haverhill Street through the abutting lot. The one-way exit is through Tantallon Road (a private way) and exits to Haverhill Street.

Fifty-eight (58) total parking spaces are proposed in accordance with the dimensional standards of the Andover Zoning Bylaw. Adequate parking has been provided for both residents and visitors of the project location with 24 spaces at grade below the units and 34 spaces outside including two visitor spaces on an adjacent site for overnight use for the residents.

Site topography has been designed to mimic the existing conditions to the maximum extent practicable, while also allowing for the installation of curb to collect stormwater for adequate drainage design including increased TSS removal. Additionally, the proposed site grading provides increased flood storage when compared to the existing condition. Site topography on the parcel remains relatively flat except on the western border, where there is a steeper slope in the topography due to the wetlands bordering the site and the Shawsheen River.

Existing utilities within Tantallon Road will be utilized for the proposed building where they are determined to be in good condition. The existing water line has been determined to be unusable and will be replaced in kind with a new 8" CLDI water main. Electrical services will come off the infrastructure mains existing in Tantallon Road and the existing sewer main will be utilized pending a camera inspection determining if it is feasible to use.

A stormwater management system has been proposed as further outlined in the Hydrology section of this report.



# Zoning

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## General Business (GB)

<u>Dimensional Requirements</u>	<u>Required</u>	<u>Proposed</u>
Minimum Lot Area	48,000* sf	49,432 ± sf
Minimum Front Yard (A)	152.3 ± ft	152.6 ± ft
Minimum Side/Read Yard (B)	3 ± ft	4 ± ft
Building Coverage (C)	66%	21% ft
Maximum Stories	4	4
Maximum Building Height	50 ft	50 ± ft

\*2,000 square feet of lot area is required per dwelling unit. Twenty-four (24) units are proposed.

(A) In the General Business District, the front setback shall be the average front setback of existing buildings on the block.

(B) No building in a business district shall be erected or expanded within 15 feet of a building containing a residential use, regardless of the zoning district which said building containing a residential use is located.

(C) In a General Business District, an existing structure occupying more than 2/3 of the lot area shall not be expanded. New structures shall not exceed 2/3 of the lot area within the General Business District.



# Hydrology

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The parcel currently does not have a drainage infrastructure network, aside from the catch basins within Haverhill Street. The proposed project reduces the overall impervious onsite by 3,400± sf and therefore is considered a redevelopment project under the Massachusetts Stormwater Standards. All stormwater runoff from the existing site is currently directed to two main analysis points. The first analysis point AP1 is the Shawsheen River. This analysis point currently accepts much of the stormwater runoff associated with the property. A small portion of the site is directed to the drainage infrastructure within Haverhill Street and is identified as AP2.

The proposed project consists of a new drainage infrastructure network that is meant to capture and treat stormwater and direct to the analysis points while also decreasing the overall runoff and volume of stormwater runoff to these analysis points. A deep sump hooded catch basin to a CDS water quality unit is proposed to help with the removal of total suspended solids (TSS) prior to discharge. The water quality unit will treat runoff to the greatest extent practicable prior to discharge to the existing drainage infrastructure within Haverhill Street. This will vastly improve stormwater runoff treatment from what currently exists on site by providing treatment of paved surfaces where currently none exist. The only area of runoff that remains with limited treatment is that which flows overland directly to Haverhill Street.

# Stormwater Management Standards

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## Standard 1: No new untreated discharges

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The Massachusetts Stormwater Handbook requires that the project demonstrates that no new stormwater conveyances (e.g. outfalls) discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed project proposed to upgrade and reuse the existing discharge to the Shawsheen River at the existing retaining wall.



## Standard 2: Post-development peak discharge rates not to exceed pre-development peak discharge rates.

Post-development peak discharge rates do not exceed the pre-development peak discharge rates for all storms. The proposed condition reduces rates and volumes by controlling the stormwater runoff within the stormwater management system and reducing the amount of impervious surface onsite.

Storm Event	2-year	10-year	25-year	100-year
Pre-development rates (cfs) AP1	3.18	5.32	6.70	8.39
Volume (cf) to Shawsheen River	10,042	17,038	21,692	27,475
Post-development rates (cfs) AP1	2.92	4.79	6.04	7.60
Volume (cf) to Shawsheen River	10,015	16,392	20,700	26,113
<b>Rate reductions (cfs)</b>	<b>-0.26</b>	<b>-0.53</b>	<b>-0.66</b>	<b>-0.79</b>
<b>Volume Reductions (cf)</b>	<b>-27</b>	<b>-646</b>	<b>-992</b>	<b>-1,362</b>
Pre-development rates (cfs) AP2	0.02	0.08	0.12	0.18
Volume (cf) to Haverhill Street	106	275	408	588
Post-development rates (cfs) AP2	0.01	0.06	0.09	0.14
Volume (cf) to Haverhill Street	74	212	324	477
<b>Rate reductions (cfs)</b>	<b>-0.01</b>	<b>-0.02</b>	<b>-0.03</b>	<b>-0.04</b>
<b>Volume Reductions (cf)</b>	<b>-32</b>	<b>-63</b>	<b>-84</b>	<b>-111</b>

## Standard 3: Minimize or eliminate loss of annual recharge to groundwater.

The site currently does not recharge stormwater or groundwater. All paved areas sheet flow offsite.

It is not feasible to provide recharge due to the large amount of existing utility infrastructure within Tantallon Road, there is no available space for subsurface drainage detention and recharge.

The proposal calls for the decrease in impervious areas on site and therefore provides additional vegetated areas to promote surface infiltration.

The standard has been met to the maximum extent practicable and has improved the existing conditions.



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## **Standard 4: Stormwater management system to remove 80% of the average annual load of Total Suspended Solids (TSS)**

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### **TSS Removal Calculation – Treatment Train**

#### **Treatment Train #1 (to Shawsheen)**

- Street Sweeping: 10% TSS Removal  
Initial TSS: 100%  
Amount Removed: 10%  
Amount Remaining:  $(100\% - 10\%) = 90\%$
- Deep Sump Hooded Catch Basin: 25% TSS Removal  
Initial TSS: 90%  
Amount Removed:  $(90\% \times 25\%) = 22.5\%$   
Amount Remaining:  $(90\% - 22.5\%) = 67.5\%$
- Contech CDS 2015-4 separator: 87.3% TSS Removal  
Initial TSS: 67.5%  
Amount Removed:  $(67.5\% \times 87.3\%) = 58.9\%$   
Amount Remaining:  $(67.5\% - 58.9\%) = 8.5\%$

**TSS Treatment Chain removes  $(100\% - 8.5\%) = 91.5\%$   
Site impervious percentage = 74%**

#### **Treatment Train #2 (to Haverhill Street)**

- Street Sweeping: 10% TSS Removal  
Initial TSS: 100%  
Amount Removed: 10%  
Amount Remaining:  $(100\% - 10\%) = 90\%$

**TSS Treatment Chain removes  $(100\% - 90\%) = 10\%$   
Site impervious percentage = 26%**



**Total TSS removal for the site = (91.5%) \* (74%) + (10%) \* (26%) = 70.3% TSS removal. This is a significant removal increase given that the existing site currently does not have any form of stormwater management in place at all to remove TSS from entering the Shawsheen River.**

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## **Standard 5: Land uses with higher potential pollutant loads**

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The development is not considered a land use that generally produces higher potential pollutant loads.

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## **Standard 6: Stormwater discharges to critical areas**

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The proposed stormwater system does not discharge to a critical area.

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## **Standard 7: Redevelopment projects**

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The project is considered a redevelopment project. Stormwater controls have been implemented to the maximum extent practicable in accordance with Section 7 of the Massachusetts Stormwater Handbook.

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## **Standard 8: Control construction-related impacts**

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The project will install erosion and sediment controls prior to any earthwork activity. Erosion control barriers will be placed down slope from the proposed construction to prevent erosion and sedimentation into the surrounding areas.

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## **Standard 9: Long-term operation and maintenance plan**

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See Appendix A for the operation and maintenance requirements of the stormwater management system.

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## **Standard 10: No illicit discharges**

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An illicit discharge compliance statement will be provided by the property owner under separate cover.



# Appendix A: Operation and Maintenance Plan

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## OPERATIONS AND MAINTENANCE PLAN

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Signed:

NRJP, LLC

Neil Rosenberg



# CGP Pollution Prevention Requirements

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## 2.3 POLLUTION PREVENTION REQUIREMENTS<sup>47</sup>

You must implement pollution prevention controls in accordance with the following requirements to minimize the discharge of pollutants in stormwater and to prevent the discharge of pollutants from spilled or leaked materials from construction activities.

### 2.3.1 For equipment and vehicle fueling and maintenance:

- a. Provide an effective means of eliminating the discharge of spilled or leaked chemicals, including fuels and oils, from these activities;<sup>48</sup>
- b. If applicable, comply with the Spill Prevention Control and Countermeasures (SPCC) requirements in 40 CFR part 112 and Section 311 of the CWA;
- c. Ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used liquids;
- d. Use drip pans and absorbents under or around leaky vehicles;
- e. Dispose of or recycle oil and oily wastes in accordance with other Federal, State, Tribal, or local requirements; and
- f. Clean up spills or contaminated surfaces immediately, using dry clean up measures (do not clean contaminated surfaces by hosing the area down), and eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.

### 2.3.2 For equipment and vehicle washing:

- a. Provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of wash waters;<sup>49</sup>
- b. Ensure there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water; and
- c. For storage of soaps, detergents, or solvents, provide either (1) cover (e.g., *plastic sheeting, temporary roofs*) to minimize the exposure of these detergents to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.

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<sup>47</sup> Under this permit, you are not required to minimize exposure for any products or materials where the exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

<sup>48</sup> Examples of effective means include:

- Locating activities away from receiving waters, storm drain inlets, and constructed or natural site drainage feature so that stormwater coming into contact with these activities cannot reach waters of the U.S.;
- Providing secondary containment (e.g., *spill berms, dikes, spill containment pallets*) and cover where appropriate; and
- Having a spill kit available on site and ensuring personnel are available to respond expeditiously in the event of a leak or spill.

<sup>49</sup> Examples of effective means include locating activities away from receiving waters and storm drain inlets or constructed or natural site drainage features and directing wash waters to a sediment basin or sediment trap, using filtration devices, such as filter bags or sand filters, or using other similarly effective controls.

**2.3.3 For equipment and vehicle washing:**

- a. Provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of wash waters;<sup>49</sup>
- b. Ensure there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water; and
- c. For storage of soaps, detergents, or solvents, provide either (1) cover (e.g., *plastic sheeting, temporary roofs*) to minimize the exposure of these detergents to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.

**2.3.4 For storage, handling, and disposal of building products, materials, and wastes:<sup>50</sup>**

- a. *For building materials and building products,<sup>51</sup> provide either (1) cover (e.g., plastic sheeting, temporary roofs) to minimize the exposure of these products to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.*

Exception: Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

- b. *For pesticides, herbicides, insecticides, fertilizers, and landscape materials:*
  - i. In storage areas, provide either (1) cover (e.g., *plastic sheeting, temporary roofs*) to minimize the exposure of these chemicals to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas; and
  - ii. Comply with all application and disposal requirements included on the registered pesticide, herbicide, insecticide, and fertilizer label (see also Part 2.3.5).
- c. *For diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals:* The following requirements apply to the storage and handling of chemicals on your site. If you are already implementing controls as part of an SPCC or other spill prevention plan that meet or exceed the requirements of this Part, you may continue to do so and be considered in compliance with these provisions provided you reference the applicable parts of the SPCC or other plans in your SWPPP as required in Part 7.2.6b.viii.
  - i. If any chemical container has a storage capacity of less than 55 gallons:
    - (a) The containers must be water-tight, and must be kept closed, sealed, and secured when not being actively used;
    - (b) If stored outside, use a spill containment pallet or similar device to capture small leaks or spills; and

<sup>50</sup> Compliance with the requirements of this permit does not relieve compliance requirements with respect to Federal, State, or local laws and regulations governing the storage, handling, and disposal of solid, hazardous, or toxic wastes and materials.

<sup>51</sup> Examples of building materials and building products typically present at construction sites include asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, and gravel and mulch stockpiles.

- (c) Have a spill kit available on site that is in good working condition (i.e., not damaged, expired, or used up) and ensure personnel are available to respond immediately in the event of a leak or spill.
  - ii. If any chemical container has a storage capacity of 55 gallons or more:
    - (a) The containers must be water-tight, and must be kept closed, sealed, and secured when not being actively used;
    - (b) Store containers a minimum of 50 feet from receiving waters, constructed or natural site drainage features, and storm drain inlets. If infeasible due to site constraints, store containers as far away from these features as the site permits. If site constraints prevent you from storing containers 50 feet away from receiving waters or the other features identified, you must document in your SWPPP the specific reasons why the 50-foot setback is infeasible, and how you will store containers as far away as the site permits;
    - (c) Provide either (1) cover (e.g., temporary roofs) to minimize the exposure of these containers to precipitation and to stormwater, or (2) secondary containment (e.g., curbing, spill berms, dikes, spill containment pallets, double-wall, above-ground storage tank); and
    - (d) Have a spill kit available on site that is in good working condition (i.e., not damaged, expired, or used up) and ensure personnel are available to respond immediately in the event of a leak or spill. Additional secondary containment measures are listed at 40 CFR § 112.7(c)(1).
  - iii. Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. You are prohibited from hosing the area down to clean surfaces or spills. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.
- d. *For hazardous or toxic wastes:*<sup>52</sup>
- i. Separate hazardous or toxic waste from construction and domestic waste;
  - ii. Store waste in sealed containers, constructed of suitable materials to prevent leakage and corrosion, and labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable Federal, State, Tribal, or local requirements;
  - iii. Store all outside containers within appropriately-sized secondary containment (e.g., *spill berms, dikes, spill containment pallets*) to prevent spills from being discharged, or provide a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., *storing chemicals in a covered area, having a spill kit available on site*);
  - iv. Dispose of hazardous or toxic waste in accordance with the manufacturer's recommended method of disposal and in compliance with Federal, State, Tribal, and local requirements;
  - v. Clean up spills immediately, using dry clean-up methods, and dispose of used materials properly. You are prohibited from hosing the area down to clean surfaces or spills. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge; and
  - vi. Follow all other Federal, State, Tribal, and local requirements regarding hazardous or toxic waste.

- e. *For construction and domestic wastes:*<sup>53</sup>
- i. Provide waste containers (e.g., *dumpster, trash receptacle*) of sufficient size and number to contain construction and domestic wastes;
    - (a) For waste containers with lids, keep waste container lids closed when not in use, and close lids at the end of the business day and during storm events. For waste containers without lids, provide either (1) *cover (e.g., a tarp, plastic sheeting, temporary roof)* to minimize exposure of wastes to precipitation, or (2) a similarly effective means designed to minimize the discharge of pollutants (e.g., *secondary containment*);
    - (b) On business days, clean up and dispose of waste in designated waste containers; and
    - (c) Clean up immediately if containers overflow, and if there is litter elsewhere on the site from escaped trash.
  - ii. Waste containers are not required for the waste remnant or unused portions of construction materials or final products that are covered by the exception in Part 2.2.3a provided that:
    - (a) These wastes are stored separately from other construction or domestic wastes addressed by Part 2.3.3e.i (i.e., wastes not covered by the exception in Part 2.3.3a). If the wastes are mixed, they must be stored in waste containers as required in Part 2.3.3e.i; and
    - (b) These wastes are stored in designated areas of the site, the wastes are described in the SWPPP (see Part 7.2.6b.ix), and identified in the site plan (see Part 7.2.4i).
  - f. *For sanitary waste*, position portable toilets so they are secure and will not be tipped or knocked over, and are located away from receiving waters, storm drain inlets, and constructed or natural site drainage features.

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<sup>52</sup> Examples of hazardous or toxic waste that may be present at construction sites include paints, caulks, sealants, fluorescent light ballasts, solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.

<sup>53</sup> Examples of construction and domestic wastes include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, demolition debris; and other trash or discarded materials.

**2.3.5 For washing applicators and containers used for stucco, paint, concrete, form release oils, curing compounds, or other materials:**

- a. Direct wash water into a leak-proof container or leak-proof and lined pit designed so no overflows can occur due to inadequate sizing or precipitation;
- b. Handle washout or cleanout wastes as follows:
  - i. For liquid wastes:
    - (a) Do not dump liquid wastes or allow them to enter into constructed or natural site drainage features, storm inlets, or receiving waters;
    - (b) Do not allow liquid wastes to be disposed of through infiltration or to otherwise be disposed of on the ground;
    - (c) Comply with applicable State, Tribal, or local requirements for disposal
  - ii. Remove and dispose of hardened concrete waste consistent with your handling of other construction wastes in Part 2.3.3e; and
- c. Locate any washout or cleanout activities as far away as possible from receiving waters, constructed or natural site drainage features, and storm drain inlets, and, to the extent feasible, designate areas to be used for these activities and conduct such activities only in these areas.

**2.3.6 For the application of fertilizers:**

- a. Apply at a rate and in amounts consistent with manufacturer's specifications, or document in the SWPPP departures from the manufacturer specifications where appropriate in accordance with Part 7.2.6b.x;
- b. Apply at the appropriate time of year for your location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth;
- c. Avoid applying before heavy rains that could cause excess nutrients to be discharged;
- d. Never apply to frozen ground;
- e. Never apply to constructed or natural site drainage features; and
- f. Follow all other Federal, State, Tribal, and local requirements regarding fertilizer application.

**2.3.7 Emergency Spill Notification Requirements**

Discharges of toxic or hazardous substances from a spill or other release are prohibited, consistent with Part 1.3.5. Where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR part 110, 40 CFR part 117, or 40 CFR part 302 occurs during a 24-hour period, you must notify the National Response Center (NRC) at (800) 424-8802 or, in the Washington, DC metropolitan area, call (202) 267-2675 in accordance with the requirements of 40 CFR part 110, 40 CFR part 117, and 40 CFR part 302 as soon as you have knowledge of the release. You must also, within seven (7) calendar days of knowledge of the release, provide a description of the release, the circumstances leading to the release, and the date of the release. State, Tribal, or local requirements may necessitate additional reporting of spills or discharges to local emergency response, public health, or drinking water supply agencies.

## 2.4 CONSTRUCTION DEWATERING REQUIREMENTS

Comply with the following requirements to minimize the discharge of pollutants from dewatering<sup>54</sup> operations.

- 2.4.1 Route dewatering water through a sediment control (e.g., sediment trap or basin, pumped water filter bag) designed to prevent discharges with visual turbidity;<sup>55</sup>
- 2.4.2 Do not discharge visible floating solids or foam;
- 2.4.3 The discharge must not cause the formation of a visible sheen on the water surface, or visible oily deposits on the bottom or shoreline of the receiving water. Use an oil-water separator or suitable filtration device (such as a cartridge filter) designed to remove oil, grease, or other products if dewatering water is found to or expected to contain these materials;
- 2.4.4 To the extent feasible, use well-vegetated (e.g., grassy or wooded), upland areas of the site to infiltrate dewatering water before discharge.<sup>56</sup> You are prohibited from using receiving waters as part of the treatment area;
- 2.4.5 To prevent dewatering-related erosion and related sediment discharges:
  - a. Use stable, erosion-resistant surfaces (e.g., well-vegetated grassy areas, clean filter stone, geotextile underlayment) to discharge from dewatering controls;
  - b. Do not place dewatering controls, such as pumped water filter bags, on steep slopes (as defined in Appendix A); and
  - c. At all points where dewatering water is discharged, comply with the velocity dissipation requirements of Part 2.2.11.
- 2.4.6 For backwash water, either haul it away for disposal or return it to the beginning of the treatment process;
- 2.4.7 Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications; and
- 2.4.8 Comply with dewatering-specific inspection requirements in Part 4.

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<sup>54</sup> "Dewatering" is defined in Appendix A as "the act of draining accumulated stormwater and/or ground water from building foundations, vaults, and trenches, or other similar points of accumulation."

<sup>55</sup> For the purposes of this permit, visual turbidity is present where there is a sediment plume in the discharge or the discharge appears cloudy, or opaque, or has a visible contrast that can be identified by an observer.

<sup>56</sup> See footnote 19.

### **3 WATER QUALITY-BASED EFFLUENT LIMITATIONS**

#### **3.1 GENERAL EFFLUENT LIMITATION TO MEET APPLICABLE WATER QUALITY STANDARDS**

Discharges must be controlled as necessary to meet applicable water quality standards. Discharges must also comply with any additional State or Tribal requirements that are in Part 9.

In the absence of information demonstrating otherwise, EPA expects that compliance with the conditions in this permit will result in stormwater discharges being controlled as necessary to meet applicable water quality standards. If at any time you become aware, or EPA determines, that discharges are not being controlled as necessary to meet applicable water quality standards, you must take corrective action as required in Parts 5.1 and 5.2, and document the corrective actions as required in Part 5.4.

EPA may insist that you install additional controls (to meet the narrative water quality-based effluent limit above) on a site-specific basis, or require you to obtain coverage under an individual permit, if information in your NOI or from other sources indicates that your discharges are not controlled as necessary to meet applicable water quality standards. This includes situations where additional controls are necessary to comply with a wasteload allocation in an EPA-established or approved TMDL.

If during your coverage under a previous permit, you were required to install and maintain stormwater controls specifically to meet the assumptions and requirements of an EPA-approved or established TMDL (for any parameter) or to otherwise control your discharge to meet water quality standards, you must continue to implement such controls as part of your coverage under this permit.

#### **3.2 WATER QUALITY-BASED CONDITIONS FOR SITES DISCHARGING TO CERTAIN IMPAIRED AND HIGH QUALITY RECEIVING WATERS**

For any portion of the site that discharges to a sediment or nutrient-impaired water or to a water that is identified by your State, Tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes,<sup>57</sup> you must comply with the inspection frequency specified in Part 4.3 and you must comply with the stabilization deadline specified in Part 2.2.14b.iii.<sup>58</sup>

If you discharge to a water that is impaired for a parameter other than a sediment-related parameter or nutrients, EPA will inform you if any additional controls are necessary for your discharge to be controlled as necessary to meet water quality standards. These controls might include those necessary for your discharge to be consistent with the assumptions of any available wasteload allocation in any applicable TMDL. In addition, EPA may require you to apply for and obtain coverage under an individual NPDES permit.

<sup>57</sup> Refer to Appendix A for definitions of "impaired water" and "Tier 2," "Tier 2.5," and "Tier 3" waters. For assistance in determining whether your site discharges to impaired waters, EPA has developed a tool that is available at <https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools>. For assistance in determining whether your site discharges to a Tier 2, 2.5, or 3 water, refer to the list of such waters at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>.

<sup>58</sup> If you qualify for any of the reduced inspection frequencies in Part 4.4, you may conduct inspections in

In addition, on a case-by-case basis, EPA may notify operators of new sites or operators of existing sites with increased discharges that additional analyses, stormwater controls, and/or other measures are necessary to comply with the applicable antidegradation requirements, or notify you that an individual permit application is necessary.

If you discharge to a water that is impaired for polychlorinated biphenyls (PCBs) and are engaging in demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, you must:

- a.** Implement controls<sup>59</sup> to minimize the exposure of PCB-containing building materials, including paint, caulk, and pre-1980 fluorescent lighting fixtures, to precipitation and to stormwater; and
- b.** Ensure that disposal of such materials is performed in compliance with applicable State, Federal, and local laws.

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accordance with Part 4.4 for any portion of your site that discharges to a sensitive water.

<sup>59</sup> Examples of controls to minimize exposure of PCBs to precipitation and stormwater include separating work areas from non-work areas and selecting appropriate personal protective equipment and tools, constructing a containment area so that all dust or debris generated by the work remains within the protected area, and using tools that minimize dust and heat (<212°F). For additional information, refer to Part 2.3.3 of the CGP Fact Sheet.





## Deep Sump Catch Basins (CB-1, CB-2, CB-3, DMH-4, DMH-6)

Responsible Party: NRJP, LLC – Neil Rosenberg  
 (603) 490-5038  
 16 Haverhill Street, Suite 16  
 Andover, MA 01810

Inspect or clean post-construction prior to being put into service. Inspections shall take place three (3) times per year (April, August, and December) in perpetuity. Catch basins within Tantallon Road, easement areas in use by vehicles for and by the property owners, its successors and assigns, and its tenants will be included in each inspection and cleaning along with the above listed catch basins. Vehicle washing will be prohibited on the property to ensure no runoff will be discharged to the stormwater management system. A sump will be installed in Drain Manhole #6 and will be included with the above listed Catch basins for all cleanings and inspections. Cleaning of each structure shall take place after every inspection unless there is no accumulated material within the structure. Units are to be cleaned using a vacuum truck.

Date	Inspector	Condition	Maintenance Performed (Specify quantity of sediment removed)

*\*Evidence of maintenance (ie. receipts) must be provided.*















# Contech CDS Maintenance Guide

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## CDS<sup>®</sup> Inspection and Maintenance Guide

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## Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allow both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

## Cleaning

Cleaning of a CDS system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y <sup>3</sup>	m <sup>3</sup>
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities



**Support**

- Drawings and specifications are available at [www.contechstormwater.com](http://www.contechstormwater.com).
- Site-specific design support is available from our engineers.

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.





# Floor Drain Variance

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CHARLES D. BAKER  
GOVERNOR

KARYN E. POLITO  
LIEUTENANT GOVERNOR

JAY ASH  
SECRETARY OF HOUSING AND  
ECONOMIC DEVELOPMENT

Commonwealth of Massachusetts  
Division of Professional Licensure  
BOARD OF STATE EXAMINERS OF PLUMBERS  
AND GAS FITTERS

1000 Washington Street • Boston • Massachusetts • 02118

JOHN C. CHAPMAN  
UNDERSECRETARY OF  
CONSUMER AFFAIRS AND  
BUSINESS REGULATION

CHARLES BORSTEL  
COMMISSIONER DIVISION OF  
PROFESSIONAL LICENSURE

March 16, 2018

Mr. Kenneth R. Feyl  
1 Elm Square, 3<sup>rd</sup> Floor  
Andover, MA. 01810

Re: Variance PV128 – NRJP LLC – 7 Tantallon Rd. – Andover

Dear Mr. Feyl,

Please be advised on March 7, 2018 in the Board Meeting Room, 1000 Washington Street in Boston Massachusetts, the Board of the State Examiners of Plumbers and Gas Fitters deliberated on and voted to **Grant a variance from 248 CMR 10.09**. The Board voted to allow the following: *To Install floor Drains tied into the existing storm system to be treated with the existing stormceptors.*

This variance decision is, based on the presentation, information and documentation provided by the applicant and is applicable to this end user and this site only. All other plumbing and gas fitting work if applicable shall comply with the rules and regulations of 248 CMR 3.00 through 10.00 and all other applicable statutes and codes.

Sincerely,  
For the Board,

Charles Kilb, Board Counsel  
Board of State Examiners of Plumbers and Gasfitters

Cc: Richard Danforth  
Plumbing and Gas Inspector





# Maintenance Plan Sketch

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**HOWARD STEIN HUDSON**

114 Turnpike Road, Suite 2C  
Chelmsford, MA 01824  
www.hshassoc.com

PREPARED FOR:  
Neil Rosenberg  
7 Tantalion Road  
Andover, MA 01810

**THE TANTALLON  
PROPOSED MULTIFAMILY  
REDEVELOPMENT PROJECT  
7 TANTALLON ROAD  
ANDOVER, MA, 01810**

REVISIONS:

NO	BY	DATE	DESCRIPTION
1	MB	8/03/20	ISSUED FOR REVIEW
2	MB	8/17/22	NOI SUBMISSION

SITE PLAN

**OPERATION AND  
MAINTENANCE  
PLAN**

DATE: 10-24-2017

PROJECT NUMBER: 17024

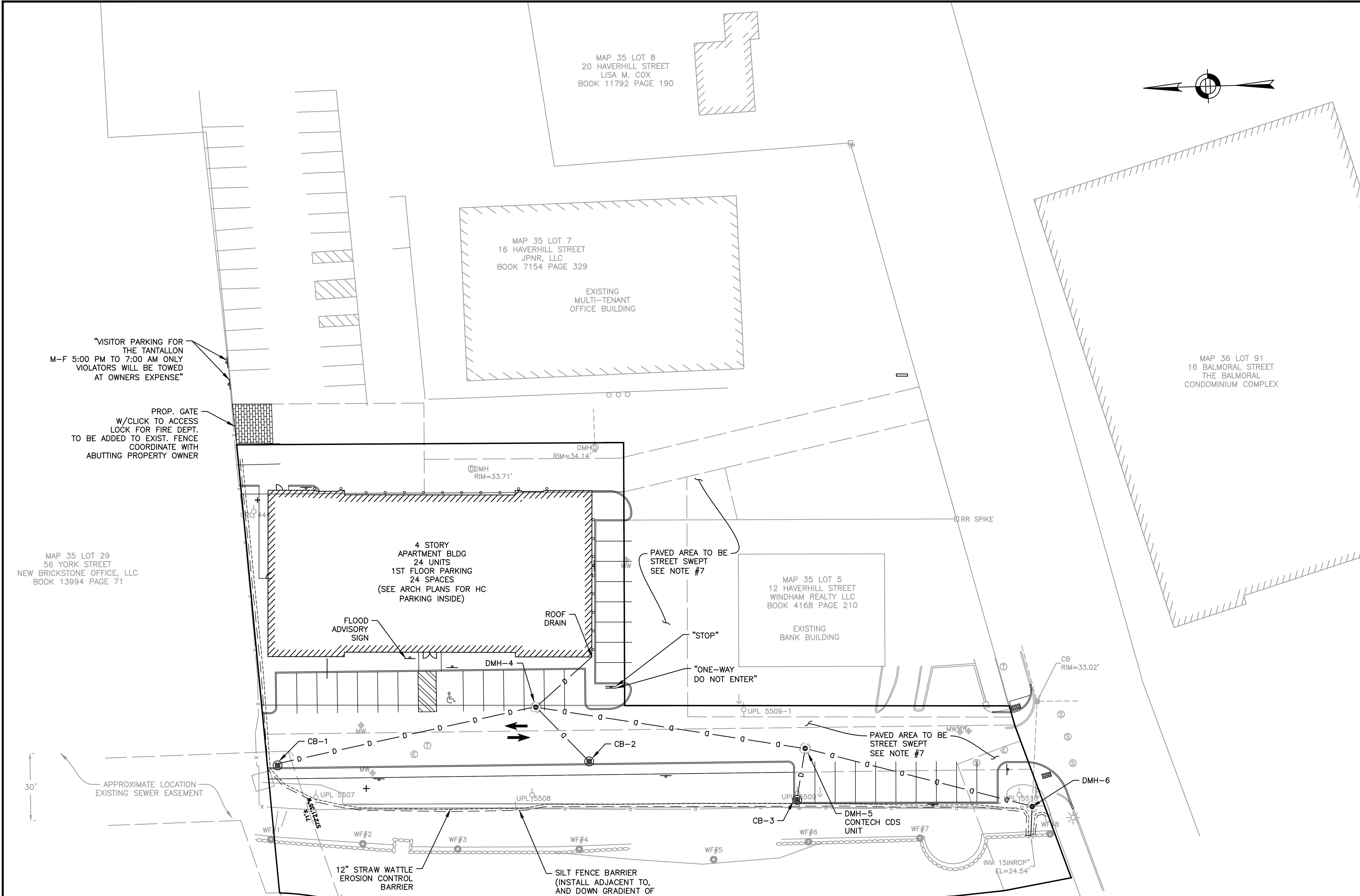
DESIGNED BY: TM

DRAWN BY: TM

CHECKED BY: KE

1

SHEET 1 OF 1



NOTES:  
 1. DMH-5 SHALL BE EQUIPPED WITH A BACKFLOW PREVENTION DEVICE. REFER TO DETAIL SHEET 4 OF 4 FOR ADDITIONAL INFORMATION.  
 2. DMH-6 SHALL BE EQUIPPED WITH A SUMP.  
 3. NO STORMWATER SHALL BE DISCHARGED THROUGH THE STORMWATER MANAGEMENT SYSTEM UNTIL OUTLET IS STABILIZED.  
 4. NO SALT, SAND, FERTILIZERS, PET WASTE, HAZARDOUS CHEMICALS, ETC., SHALL BE STORED IN THE GARAGE WHERE FLOOD WATERS COULD REACH.  
 5. THERE WILL BE NO VEHICLE WASHING PERMITTED ON SITE.  
 6. ALL SNOW SHALL BE DISPOSED OF OFF-SITE IN A MANNER CONSISTENT WITH LOCAL AND STATE REGULATIONS.  
 7. MECHANICAL STREET SWEEPING SHALL OCCUR ON ALL PAVED SURFACES (INCLUDING INSIDE THE GARAGE) FOUR (4) TIMES A YEAR (MARCH, JUNE, SEPTEMBER, AND DECEMBER) IN PERPETUITY.



8/12/2022, L:\17024\CURRENT\17024\_Site Plan.dwg  
Matthew Baker



# Appendix B: Erosion and Sediment Control Notes and General Construction Sequence

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## Erosion and Sediment Control Notes

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- 1) Erosion and sediment control measures must be installed prior to the start of construction and maintained and upgraded as necessary during construction by the contractor. It is the contractor's responsibility to inspect and install additional control measures as needed during construction.
- 2) All catch basins receiving drainage from the project site must be provided with a catch basin filter.
- 3) Stabilization of all re-graded and soil stockpile areas must be maintained during all phases of construction. Stockpiled material should be kept to a minimum for short periods of time and should consist of clean fill.
- 4) Sediment removed from erosion and sediment control devices must be properly removed and disposed. All damaged controls must be removed and replaced.
- 5) The contractor is responsible for implementing the erosion and sediment control plan. This includes the installation and maintenance of control measures, informing all parties engaged on the construction site of the requirements and objectives of the plan, and notifying the proper city agency of any transfer of this responsibility.
- 6) The contractor shall be responsible for controlling wind erosion and dust throughout the life of his contract. Dust control may include, but is not limited to, sprinkling of water on exposed soils and street sweeping adjacent roadways.
- 7) Final grading cannot be delayed. The contractor will prepare a detailed plan and approach for keeping the site stabilized. Once existing pavement is removed final grading, repaving, or immediate stabilization will commence with temporary vegetation. No mulch shall be used on site.
- 8) If a disturbed area will be exposed for greater than one-year, permanent grasses or other approved cover must be installed.
- 9) The contractor must keep on-site at all times additional silt fence and hay bales for the installation at the direction of the engineer or the city to mitigate any emergency condition.
- 10) The construction fencing and erosion and sediment controls as shown may not be practical during all stages of construction. Earthwork activity on-site must be done in a manner such that runoff is directed to a sediment control device such as the devices listed above, sediment traps, infiltration, or active treatment systems.
- 11) Demolition and construction debris must be properly contained and disposed of.



- 12) Disposal of all demolished materials is the responsibility of the contractor and must be hauled off-site in accordance with all federal, state, and local requirements.
- 13) The contractor is responsible for the inspection of the slope along the Shawsheen River Reservoir. Any trash shall be removed, and erosion gullies repaired.
- 14) Vehicle washing shall be prohibited on site.
- 15) All catch basin spoils shall be disposed of in a manner consistent with all Local, State, and Federal regulations.

---

## General Construction Sequence

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- 1) Install erosion and sediment controls prior to starting any earthworks activity.
- 2) Begin clearing, grubbing and demolition.
- 3) Begin utility installations.
- 4) Construct building foundation.
- 5) Install site furnishings.
- 6) Install landscaping.
- 7) Erosion and sediment controls shall be maintained until permanent cover is established.



# Appendix C: Flood Storage Calculations

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## Flood Storage Calculations - Pre- vs. Post-Development



Site Location: Tantallon Road, Andover, MA

*These calculations are updated to reflect the building shift outside the floodway. Storage inside the footprint of the proposed building has NOT been included.*

Date: 02/07/2020

**rev. 08/31/2022**

By: MB

Checked: KE

Elevation	Pre-Development		Post-Development		Incremental Increase (Decrease) (cf)	Cumulative Increase (Decrease) (cf)
	Storage Area (sf)	Vol. Between Elevations (cf)	Storage Area (sf)	Vol. Between Elevations (cf)		
29	7697		7697			
		8113.5		8113.5	0	<b>0</b>
30	8530		8530			
		8948		8948	0	<b>0</b>
31	9366		9366			
		10089		10142.5	53.5	<b>53.5</b>
32	10812		10919			
		16080.5		16555	474.5	<b>528</b>
33	21349		22191			
		28790.5		30367	1576.5	<b>2104.5</b>
34	36232		38543			
		38254		39077.5	823.5	<b>2928</b>
35	40276		39612			
		40276		39612	-664	<b>2264</b>
36	40276		39612			
		40276		39612	-664	<b>1600</b>
37	40276		39612			
		40276		39612	-664	<b>936</b>
38	40276		39612			

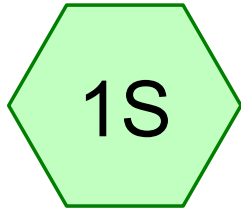
Post El. 34 Adjustment for Building:

Contour area (SF)	48887	
Subtract: Building Footprint (SF)	10344	
Subtract: Ground Above El. 34 (SF)	0	(LS area adj. to front entry)
Adjusted value for Post El. 34:	38543	



# Appendix D: HydroCAD

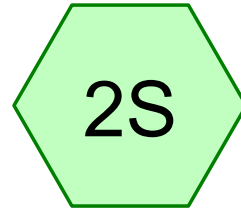
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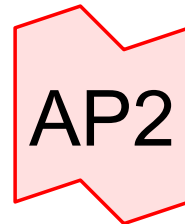
Area to Shawsheen  
River



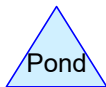
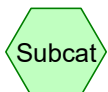
Offsite Shawsheen  
River Wetlands



Area to Haverhill Street



Offsite Haverhill Street



# 17024 PRE-DRAINAGE

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## Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.40	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

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### Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,408	39	>75% Grass cover, Good, HSG A (1S, 2S)
1,641	30	Brush, Good, HSG A (1S)
43,316	98	Paved parking, HSG A (1S, 2S)
12,934	98	Roofs, HSG A (1S)
5,624	30	Woods, Good, HSG A (1S)
<b>68,923</b>	<b>86</b>	<b>TOTAL AREA</b>

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## Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
68,923	HSG A	1S, 2S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>68,923</b>		<b>TOTAL AREA</b>

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## Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
5,408	0	0	0	0	5,408	>75% Grass cover, Good
1,641	0	0	0	0	1,641	Brush, Good
43,316	0	0	0	0	43,316	Paved parking
12,934	0	0	0	0	12,934	Roofs
5,624	0	0	0	0	5,624	Woods, Good
<b>68,923</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>68,923</b>	<b>TOTAL AREA</b>

**17024 PRE-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Area to Shawsheen**      Runoff Area=66,027 sf   83.45% Impervious   Runoff Depth>1.83"  
Tc=6.0 min   CN=87   Runoff=3.18 cfs   10,042 cf

**Subcatchment2S: Area to Haverhill Street**      Runoff Area=2,896 sf   39.81% Impervious   Runoff Depth>0.44"  
Tc=6.0 min   CN=62   Runoff=0.02 cfs   106 cf

**Link AP1: Offsite Shawsheen River Wetlands**      Inflow=3.18 cfs   10,042 cf  
Primary=3.18 cfs   10,042 cf

**Link AP2: Offsite Haverhill Street**      Inflow=0.02 cfs   106 cf  
Primary=0.02 cfs   106 cf

**Total Runoff Area = 68,923 sf   Runoff Volume = 10,148 cf   Average Runoff Depth = 1.77"**  
**18.39% Pervious = 12,673 sf   81.61% Impervious = 56,250 sf**

# 17024 PRE-DRAINAGE

Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Subcatchment 1S: Area to Shawsheen River

Runoff = 3.18 cfs @ 12.09 hrs, Volume= 10,042 cf, Depth> 1.83"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
42,163	98	Paved parking, HSG A
12,934	98	Roofs, HSG A
3,665	39	>75% Grass cover, Good, HSG A
5,624	30	Woods, Good, HSG A
1,641	30	Brush, Good, HSG A
66,027	87	Weighted Average
10,930		16.55% Pervious Area
55,097		83.45% Impervious Area

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

## Summary for Subcatchment 2S: Area to Haverhill Street

Runoff = 0.02 cfs @ 12.12 hrs, Volume= 106 cf, Depth> 0.44"

Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,153	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,896	62	Weighted Average
1,743		60.19% Pervious Area
1,153		39.81% Impervious Area

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

## Summary for Link AP1: Offsite Shawsheen River Wetlands

Inflow Area = 66,027 sf, 83.45% Impervious, Inflow Depth > 1.83" for 2-Year event

Inflow = 3.18 cfs @ 12.09 hrs, Volume= 10,042 cf

Primary = 3.18 cfs @ 12.09 hrs, Volume= 10,042 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

*Type III 24-hr 2-Year Rainfall=3.10"*

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,896 sf, 39.81% Impervious, Inflow Depth > 0.44" for 2-Year event  
Inflow = 0.02 cfs @ 12.12 hrs, Volume= 106 cf  
Primary = 0.02 cfs @ 12.12 hrs, Volume= 106 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Area to Shawsheen** Runoff Area=66,027 sf 83.45% Impervious Runoff Depth>3.10"  
Tc=6.0 min CN=87 Runoff=5.32 cfs 17,038 cf

**Subcatchment2S: Area to Haverhill Street** Runoff Area=2,896 sf 39.81% Impervious Runoff Depth>1.14"  
Tc=6.0 min CN=62 Runoff=0.08 cfs 275 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=5.32 cfs 17,038 cf  
Primary=5.32 cfs 17,038 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.08 cfs 275 cf  
Primary=0.08 cfs 275 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 17,312 cf Average Runoff Depth = 3.01"**  
**18.39% Pervious = 12,673 sf 81.61% Impervious = 56,250 sf**

# 17024 PRE-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Subcatchment 1S: Area to Shawsheen River

Runoff = 5.32 cfs @ 12.09 hrs, Volume= 17,038 cf, Depth> 3.10"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
42,163	98	Paved parking, HSG A
12,934	98	Roofs, HSG A
3,665	39	>75% Grass cover, Good, HSG A
5,624	30	Woods, Good, HSG A
1,641	30	Brush, Good, HSG A
66,027	87	Weighted Average
10,930		16.55% Pervious Area
55,097		83.45% Impervious Area

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

## Summary for Subcatchment 2S: Area to Haverhill Street

Runoff = 0.08 cfs @ 12.10 hrs, Volume= 275 cf, Depth> 1.14"

Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,153	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,896	62	Weighted Average
1,743		60.19% Pervious Area
1,153		39.81% Impervious Area

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

## Summary for Link AP1: Offsite Shawsheen River Wetlands

Inflow Area = 66,027 sf, 83.45% Impervious, Inflow Depth > 3.10" for 10-Year event

Inflow = 5.32 cfs @ 12.09 hrs, Volume= 17,038 cf

Primary = 5.32 cfs @ 12.09 hrs, Volume= 17,038 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

*Type III 24-hr 10-Year Rainfall=4.50"*

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,896 sf, 39.81% Impervious, Inflow Depth > 1.14" for 10-Year event  
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 275 cf  
Primary = 0.08 cfs @ 12.10 hrs, Volume= 275 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Area to Shawsheen** Runoff Area=66,027 sf 83.45% Impervious Runoff Depth>3.94"  
Tc=6.0 min CN=87 Runoff=6.70 cfs 21,692 cf

**Subcatchment2S: Area to Haverhill Street** Runoff Area=2,896 sf 39.81% Impervious Runoff Depth>1.69"  
Tc=6.0 min CN=62 Runoff=0.12 cfs 408 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=6.70 cfs 21,692 cf  
Primary=6.70 cfs 21,692 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.12 cfs 408 cf  
Primary=0.12 cfs 408 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 22,100 cf Average Runoff Depth = 3.85"**  
**18.39% Pervious = 12,673 sf 81.61% Impervious = 56,250 sf**

**17024 PRE-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 1S: Area to Shawsheen River**

Runoff = 6.70 cfs @ 12.09 hrs, Volume= 21,692 cf, Depth&gt; 3.94"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
42,163	98	Paved parking, HSG A
12,934	98	Roofs, HSG A
3,665	39	>75% Grass cover, Good, HSG A
5,624	30	Woods, Good, HSG A
1,641	30	Brush, Good, HSG A
66,027	87	Weighted Average
10,930		16.55% Pervious Area
55,097		83.45% Impervious Area

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

**Summary for Subcatchment 2S: Area to Haverhill Street**

Runoff = 0.12 cfs @ 12.10 hrs, Volume= 408 cf, Depth&gt; 1.69"

Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,153	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,896	62	Weighted Average
1,743		60.19% Pervious Area
1,153		39.81% Impervious Area

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

**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,027 sf, 83.45% Impervious, Inflow Depth &gt; 3.94" for 25-Year event

Inflow = 6.70 cfs @ 12.09 hrs, Volume= 21,692 cf

Primary = 6.70 cfs @ 12.09 hrs, Volume= 21,692 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

*Type III 24-hr 25-Year Rainfall=5.40"*

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,896 sf, 39.81% Impervious, Inflow Depth > 1.69" for 25-Year event  
Inflow = 0.12 cfs @ 12.10 hrs, Volume= 408 cf  
Primary = 0.12 cfs @ 12.10 hrs, Volume= 408 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: Area to Shawsheen** Runoff Area=66,027 sf 83.45% Impervious Runoff Depth>4.99"  
Tc=6.0 min CN=87 Runoff=8.39 cfs 27,475 cf

**Subcatchment2S: Area to Haverhill Street** Runoff Area=2,896 sf 39.81% Impervious Runoff Depth>2.44"  
Tc=6.0 min CN=62 Runoff=0.18 cfs 588 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=8.39 cfs 27,475 cf  
Primary=8.39 cfs 27,475 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.18 cfs 588 cf  
Primary=0.18 cfs 588 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 28,063 cf Average Runoff Depth = 4.89"**  
**18.39% Pervious = 12,673 sf 81.61% Impervious = 56,250 sf**

**17024 PRE-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 1S: Area to Shawsheen River**

Runoff = 8.39 cfs @ 12.09 hrs, Volume= 27,475 cf, Depth&gt; 4.99"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
42,163	98	Paved parking, HSG A
12,934	98	Roofs, HSG A
3,665	39	>75% Grass cover, Good, HSG A
5,624	30	Woods, Good, HSG A
1,641	30	Brush, Good, HSG A
66,027	87	Weighted Average
10,930		16.55% Pervious Area
55,097		83.45% Impervious Area

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

**Summary for Subcatchment 2S: Area to Haverhill Street**

Runoff = 0.18 cfs @ 12.10 hrs, Volume= 588 cf, Depth&gt; 2.44"

Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,153	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,896	62	Weighted Average
1,743		60.19% Pervious Area
1,153		39.81% Impervious Area

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

**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,027 sf, 83.45% Impervious, Inflow Depth &gt; 4.99" for 100-Year event

Inflow = 8.39 cfs @ 12.09 hrs, Volume= 27,475 cf

Primary = 8.39 cfs @ 12.09 hrs, Volume= 27,475 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PRE-DRAINAGE**

*Type III 24-hr 100-Year Rainfall=6.50"*

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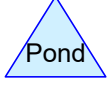
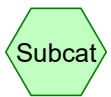
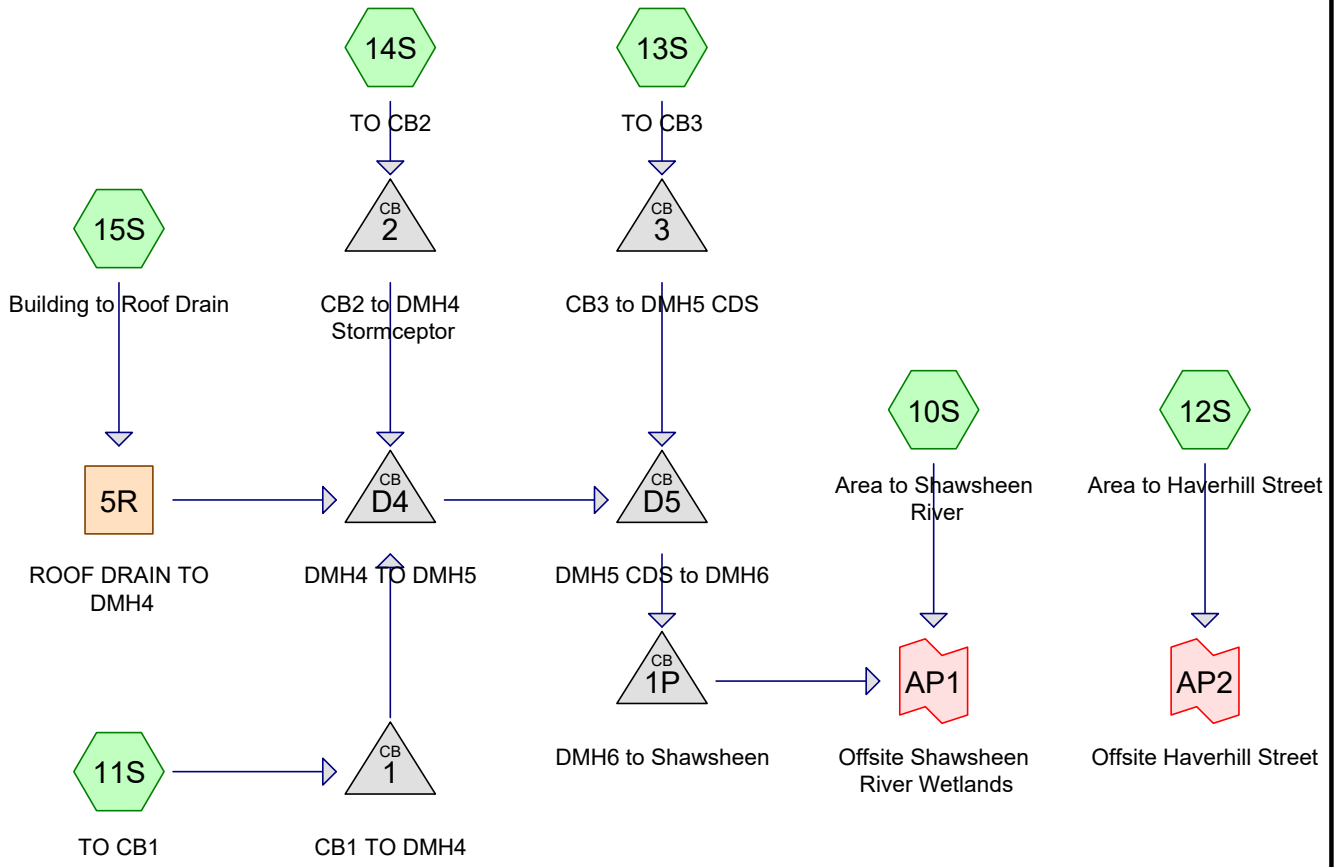
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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,896 sf, 39.81% Impervious, Inflow Depth > 2.44" for 100-Year event  
Inflow = 0.18 cfs @ 12.10 hrs, Volume= 588 cf  
Primary = 0.18 cfs @ 12.10 hrs, Volume= 588 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs



**Routing Diagram for 17024 PR-DRAINAGE**  
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## Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.40	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

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## Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,059	39	>75% Grass cover, Good, HSG A (10S, 11S, 12S, 13S, 14S)
39,222	98	Paved parking, HSG A (10S, 11S, 12S, 13S, 14S)
13,596	98	Roofs, HSG A (13S, 14S, 15S)
7,046	30	Woods, Good, HSG A (10S)
<b>68,923</b>	<b>83</b>	<b>TOTAL AREA</b>

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## Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
68,923	HSG A	10S, 11S, 12S, 13S, 14S, 15S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>68,923</b>		<b>TOTAL AREA</b>

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## Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
9,059	0	0	0	0	9,059	>75% Grass cover, Good
39,222	0	0	0	0	39,222	Paved parking
13,596	0	0	0	0	13,596	Roofs
7,046	0	0	0	0	7,046	Woods, Good
<b>68,923</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>68,923</b>	<b>TOTAL AREA</b>

# 17024 PR-DRAINAGE

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## Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	5R	29.77	29.15	31.0	0.0200	0.013	0.0	10.0	0.0
2	1	28.72	28.15	114.0	0.0050	0.013	0.0	12.0	0.0
3	1P	24.74	24.54	11.0	0.0182	0.013	0.0	18.0	0.0
4	2	27.85	27.39	31.0	0.0148	0.013	0.0	15.0	0.0
5	3	28.85	28.66	19.0	0.0100	0.013	0.0	15.0	0.0
6	D4	27.28	26.70	117.0	0.0050	0.012	0.0	18.0	0.0
7	D5	26.59	25.09	100.0	0.0150	0.013	0.0	18.0	0.0

# 17024 PR-DRAINAGE

Type III 24-hr 2-Year Rainfall=3.10"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10S: Area to Shawsheen** Runoff Area=20,799 sf 45.00% Impervious Runoff Depth>0.44"  
Tc=6.0 min CN=62 Runoff=0.16 cfs 759 cf

**Subcatchment 11S: TO CB1** Runoff Area=3,917 sf 87.08% Impervious Runoff Depth>2.07"  
Tc=6.0 min CN=90 Runoff=0.21 cfs 677 cf

**Subcatchment 12S: Area to Haverhill Street** Runoff Area=2,649 sf 34.20% Impervious Runoff Depth>0.34"  
Tc=6.0 min CN=59 Runoff=0.01 cfs 74 cf

**Subcatchment 13S: TO CB3** Runoff Area=11,724 sf 92.20% Impervious Runoff Depth>2.35"  
Tc=6.0 min CN=93 Runoff=0.70 cfs 2,294 cf

**Subcatchment 14S: TO CB2** Runoff Area=19,490 sf 92.29% Impervious Runoff Depth>2.35"  
Tc=6.0 min CN=93 Runoff=1.17 cfs 3,814 cf

**Subcatchment 15S: Building to Roof** Runoff Area=10,344 sf 100.00% Impervious Runoff Depth>2.87"  
Tc=6.0 min CN=98 Runoff=0.70 cfs 2,471 cf

**Reach 5R: ROOF DRAIN TO DMH4** Avg. Flow Depth=0.27' Max Vel=4.58 fps Inflow=0.70 cfs 2,471 cf  
10.0" Round Pipe n=0.013 L=31.0' S=0.0200 '/ Capacity=3.10 cfs Outflow=0.70 cfs 2,470 cf

**Pond 1: CB1 TO DMH4** Peak Elev=28.98' Inflow=0.21 cfs 677 cf  
12.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/ Outflow=0.21 cfs 677 cf

**Pond 1P: DMH6 to Shawsheen** Peak Elev=25.59' Inflow=2.78 cfs 9,255 cf  
18.0" Round Culvert n=0.013 L=11.0' S=0.0182 '/ Outflow=2.78 cfs 9,255 cf

**Pond 2: CB2 to DMH4 Stormceptor** Peak Elev=28.40' Inflow=1.17 cfs 3,814 cf  
15.0" Round Culvert n=0.013 L=31.0' S=0.0148 '/ Outflow=1.17 cfs 3,814 cf

**Pond 3: CB3 to DMH5 CDS** Peak Elev=29.28' Inflow=0.70 cfs 2,294 cf  
15.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/ Outflow=0.70 cfs 2,294 cf

**Pond D4: DMH4 TO DMH5** Peak Elev=28.03' Inflow=2.08 cfs 6,961 cf  
18.0" Round Culvert n=0.012 L=117.0' S=0.0050 '/ Outflow=2.08 cfs 6,961 cf

**Pond D5: DMH5 CDS to DMH6** Peak Elev=27.37' Inflow=2.78 cfs 9,255 cf  
18.0" Round Culvert n=0.013 L=100.0' S=0.0150 '/ Outflow=2.78 cfs 9,255 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=2.92 cfs 10,015 cf  
Primary=2.92 cfs 10,015 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.01 cfs 74 cf  
Primary=0.01 cfs 74 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 10,089 cf Average Runoff Depth = 1.76"**  
**23.37% Pervious = 16,105 sf 76.63% Impervious = 52,818 sf**

**17024 PR-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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**Summary for Subcatchment 10S: Area to Shawsheen River**

Runoff = 0.16 cfs @ 12.12 hrs, Volume= 759 cf, Depth> 0.44"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,046	30	Woods, Good, HSG A
9,359	98	Paved parking, HSG A
20,799	62	Weighted Average
11,440		55.00% Pervious Area
9,359		45.00% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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**Summary for Subcatchment 11S: TO CB1**

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 677 cf, Depth> 2.07"

Routed to Pond 1 : CB1 TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,411	98	Paved parking, HSG A
506	39	>75% Grass cover, Good, HSG A
3,917	90	Weighted Average
506		12.92% Pervious Area
3,411		87.08% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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**Summary for Subcatchment 12S: Area to Haverhill Street**

Runoff = 0.01 cfs @ 12.16 hrs, Volume= 74 cf, Depth> 0.34"  
Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
906	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,649	59	Weighted Average
1,743		65.80% Pervious Area
906		34.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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**Summary for Subcatchment 13S: TO CB3**

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 2,294 cf, Depth&gt; 2.35"

Routed to Pond 3 : CB3 to DMH5 CDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
9,155	98	Paved parking, HSG A
1,655	98	Roofs, HSG A
914	39	>75% Grass cover, Good, HSG A
11,724	93	Weighted Average
914		7.80% Pervious Area
10,810		92.20% Impervious Area

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

**17024 PR-DRAINAGE**

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**Summary for Subcatchment 14S: TO CB2**

Runoff = 1.17 cfs @ 12.09 hrs, Volume= 3,814 cf, Depth&gt; 2.35"

Routed to Pond 2 : CB2 to DMH4 Stormceptor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
16,391	98	Paved parking, HSG A
1,502	39	>75% Grass cover, Good, HSG A
1,597	98	Roofs, HSG A
19,490	93	Weighted Average
1,502		7.71% Pervious Area
17,988		92.29% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 2-Year Rainfall=3.10"

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**Summary for Subcatchment 15S: Building to Roof Drain**

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 2,471 cf, Depth> 2.87"

Routed to Reach 5R : ROOF DRAIN TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
10,344	98	Roofs, HSG A
10,344		100.00% Impervious Area

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

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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Reach 5R: ROOF DRAIN TO DMH4

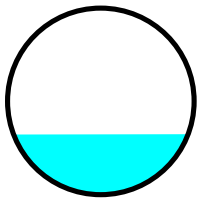
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 10,344 sf, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event  
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 2,471 cf  
Outflow = 0.70 cfs @ 12.09 hrs, Volume= 2,470 cf, Atten= 0%, Lag= 0.1 min  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Max. Velocity= 4.58 fps, Min. Travel Time= 0.1 min  
Avg. Velocity= 1.52 fps, Avg. Travel Time= 0.3 min

Peak Storage= 5 cf @ 12.09 hrs  
Average Depth at Peak Storage= 0.27' , Surface Width= 0.78'  
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.10 cfs

10.0" Round Pipe  
n= 0.013 Corrugated PE, smooth interior  
Length= 31.0' Slope= 0.0200 '/'  
Inlet Invert= 29.77', Outlet Invert= 29.15'



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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Pond 1: CB1 TO DMH4

Inflow Area = 3,917 sf, 87.08% Impervious, Inflow Depth > 2.07" for 2-Year event  
Inflow = 0.21 cfs @ 12.09 hrs, Volume= 677 cf  
Outflow = 0.21 cfs @ 12.09 hrs, Volume= 677 cf, Atten= 0%, Lag= 0.0 min  
Primary = 0.21 cfs @ 12.09 hrs, Volume= 677 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.98' @ 12.09 hrs

Flood Elev= 31.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.72'	<b>12.0" Round Culvert</b> L= 114.0' Ke= 0.500 Inlet / Outlet Invert= 28.72' / 28.15' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.21 cfs @ 12.09 hrs HW=28.98' TW=28.02' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 0.21 cfs @ 1.91 fps)

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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Pond 1P: DMH6 to Shawsheen

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 2.44" for 2-Year event  
Inflow = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf  
Outflow = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf, Atten= 0%, Lag= 0.0 min  
Primary = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf  
Routed to Link AP1 : Offsite Shawsheen River Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 25.59' @ 12.09 hrs  
Flood Elev= 33.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	24.74'	<b>18.0" Round Culvert</b> L= 11.0' Ke= 0.500 Inlet / Outlet Invert= 24.74' / 24.54' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.71 cfs @ 12.09 hrs HW=25.57' TW=0.00' (Dynamic Tailwater)  
↑1=Culvert (Barrel Controls 2.71 cfs @ 3.89 fps)

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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Pond 2: CB2 to DMH4 Stormceptor

Inflow Area = 19,490 sf, 92.29% Impervious, Inflow Depth > 2.35" for 2-Year event  
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 3,814 cf  
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 3,814 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.17 cfs @ 12.09 hrs, Volume= 3,814 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.40' @ 12.10 hrs

Flood Elev= 31.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.85'	<b>15.0" Round Culvert</b> L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 27.85' / 27.39' S= 0.0148 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.05 cfs @ 12.09 hrs HW=28.39' TW=28.02' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 1.05 cfs @ 3.04 fps)

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## Summary for Pond 3: CB3 to DMH5 CDS

Inflow Area = 11,724 sf, 92.20% Impervious, Inflow Depth > 2.35" for 2-Year event  
Inflow = 0.70 cfs @ 12.09 hrs, Volume= 2,294 cf  
Outflow = 0.70 cfs @ 12.09 hrs, Volume= 2,294 cf, Atten= 0%, Lag= 0.0 min  
Primary = 0.70 cfs @ 12.09 hrs, Volume= 2,294 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.28' @ 12.09 hrs

Flood Elev= 32.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.85'	<b>15.0" Round Culvert</b> L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 28.85' / 28.66' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=0.69 cfs @ 12.09 hrs HW=29.27' TW=27.36' (Dynamic Tailwater)

↑1=Culvert (Barrel Controls 0.69 cfs @ 2.82 fps)

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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Pond D4: DMH4 TO DMH5

Inflow Area = 33,751 sf, 94.05% Impervious, Inflow Depth > 2.48" for 2-Year event  
Inflow = 2.08 cfs @ 12.09 hrs, Volume= 6,961 cf  
Outflow = 2.08 cfs @ 12.09 hrs, Volume= 6,961 cf, Atten= 0%, Lag= 0.0 min  
Primary = 2.08 cfs @ 12.09 hrs, Volume= 6,961 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.03' @ 12.10 hrs

Flood Elev= 32.81'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.28'	<b>18.0" Round Culvert</b> L= 117.0' Ke= 0.500 Inlet / Outlet Invert= 27.28' / 26.70' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=1.96 cfs @ 12.09 hrs HW=28.02' TW=27.36' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 1.96 cfs @ 3.30 fps)

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Type III 24-hr 2-Year Rainfall=3.10"

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## Summary for Pond D5: DMH5 CDS to DMH6

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 2.44" for 2-Year event  
Inflow = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf  
Outflow = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf, Atten= 0%, Lag= 0.0 min  
Primary = 2.78 cfs @ 12.09 hrs, Volume= 9,255 cf  
Routed to Pond 1P : DMH6 to Shawsheen

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 27.37' @ 12.09 hrs

Flood Elev= 33.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	26.59'	<b>18.0" Round Culvert</b> L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 26.59' / 25.09' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.71 cfs @ 12.09 hrs HW=27.36' TW=25.57' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 2.71 cfs @ 2.98 fps)

**17024 PR-DRAINAGE**

*Type III 24-hr 2-Year Rainfall=3.10"*

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**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,274 sf, 78.33% Impervious, Inflow Depth > 1.81" for 2-Year event  
Inflow = 2.92 cfs @ 12.09 hrs, Volume= 10,015 cf  
Primary = 2.92 cfs @ 12.09 hrs, Volume= 10,015 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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*Type III 24-hr 2-Year Rainfall=3.10"*

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,649 sf, 34.20% Impervious, Inflow Depth > 0.34" for 2-Year event  
Inflow = 0.01 cfs @ 12.16 hrs, Volume= 74 cf  
Primary = 0.01 cfs @ 12.16 hrs, Volume= 74 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PR-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10S: Area to Shawsheen** Runoff Area=20,799 sf 45.00% Impervious Runoff Depth>1.14"  
 Tc=6.0 min CN=62 Runoff=0.56 cfs 1,973 cf

**Subcatchment 11S: TO CB1** Runoff Area=3,917 sf 87.08% Impervious Runoff Depth>3.39"  
 Tc=6.0 min CN=90 Runoff=0.34 cfs 1,108 cf

**Subcatchment 12S: Area to Haverhill Street** Runoff Area=2,649 sf 34.20% Impervious Runoff Depth>0.96"  
 Tc=6.0 min CN=59 Runoff=0.06 cfs 212 cf

**Subcatchment 13S: TO CB3** Runoff Area=11,724 sf 92.20% Impervious Runoff Depth>3.71"  
 Tc=6.0 min CN=93 Runoff=1.08 cfs 3,620 cf

**Subcatchment 14S: TO CB2** Runoff Area=19,490 sf 92.29% Impervious Runoff Depth>3.71"  
 Tc=6.0 min CN=93 Runoff=1.80 cfs 6,018 cf

**Subcatchment 15S: Building to Roof** Runoff Area=10,344 sf 100.00% Impervious Runoff Depth>4.26"  
 Tc=6.0 min CN=98 Runoff=1.02 cfs 3,673 cf

**Reach 5R: ROOF DRAIN TO DMH4** Avg. Flow Depth=0.33' Max Vel=5.08 fps Inflow=1.02 cfs 3,673 cf  
 10.0" Round Pipe n=0.013 L=31.0' S=0.0200 '/ Capacity=3.10 cfs Outflow=1.02 cfs 3,673 cf

**Pond 1: CB1 TO DMH4** Peak Elev=29.06' Inflow=0.34 cfs 1,108 cf  
 12.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/ Outflow=0.34 cfs 1,108 cf

**Pond 1P: DMH6 to Shawsheen** Peak Elev=25.84' Inflow=4.24 cfs 14,419 cf  
 18.0" Round Culvert n=0.013 L=11.0' S=0.0182 '/ Outflow=4.24 cfs 14,419 cf

**Pond 2: CB2 to DMH4 Stormceptor** Peak Elev=28.59' Inflow=1.80 cfs 6,018 cf  
 15.0" Round Culvert n=0.013 L=31.0' S=0.0148 '/ Outflow=1.80 cfs 6,018 cf

**Pond 3: CB3 to DMH5 CDS** Peak Elev=29.39' Inflow=1.08 cfs 3,620 cf  
 15.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/ Outflow=1.08 cfs 3,620 cf

**Pond D4: DMH4 TO DMH5** Peak Elev=28.25' Inflow=3.16 cfs 10,799 cf  
 18.0" Round Culvert n=0.012 L=117.0' S=0.0050 '/ Outflow=3.16 cfs 10,799 cf

**Pond D5: DMH5 CDS to DMH6** Peak Elev=27.59' Inflow=4.24 cfs 14,419 cf  
 18.0" Round Culvert n=0.013 L=100.0' S=0.0150 '/ Outflow=4.24 cfs 14,419 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=4.79 cfs 16,392 cf  
 Primary=4.79 cfs 16,392 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.06 cfs 212 cf  
 Primary=0.06 cfs 212 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 16,604 cf Average Runoff Depth = 2.89"**  
**23.37% Pervious = 16,105 sf 76.63% Impervious = 52,818 sf**

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 10S: Area to Shawsheen River**

Runoff = 0.56 cfs @ 12.10 hrs, Volume= 1,973 cf, Depth> 1.14"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,046	30	Woods, Good, HSG A
9,359	98	Paved parking, HSG A
20,799	62	Weighted Average
11,440		55.00% Pervious Area
9,359		45.00% Impervious Area

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

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 11S: TO CB1**

Runoff = 0.34 cfs @ 12.09 hrs, Volume= 1,108 cf, Depth> 3.39"

Routed to Pond 1 : CB1 TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,411	98	Paved parking, HSG A
506	39	>75% Grass cover, Good, HSG A
3,917	90	Weighted Average
506		12.92% Pervious Area
3,411		87.08% Impervious Area

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

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 12S: Area to Haverhill Street**

Runoff = 0.06 cfs @ 12.11 hrs, Volume= 212 cf, Depth> 0.96"  
Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
906	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,649	59	Weighted Average
1,743		65.80% Pervious Area
906		34.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 13S: TO CB3**

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 3,620 cf, Depth> 3.71"

Routed to Pond 3 : CB3 to DMH5 CDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
9,155	98	Paved parking, HSG A
1,655	98	Roofs, HSG A
914	39	>75% Grass cover, Good, HSG A
11,724	93	Weighted Average
914		7.80% Pervious Area
10,810		92.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 14S: TO CB2**

Runoff = 1.80 cfs @ 12.09 hrs, Volume= 6,018 cf, Depth> 3.71"

Routed to Pond 2 : CB2 to DMH4 Stormceptor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
16,391	98	Paved parking, HSG A
1,502	39	>75% Grass cover, Good, HSG A
1,597	98	Roofs, HSG A
19,490	93	Weighted Average
1,502		7.71% Pervious Area
17,988		92.29% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment 15S: Building to Roof Drain**

Runoff = 1.02 cfs @ 12.09 hrs, Volume= 3,673 cf, Depth> 4.26"

Routed to Reach 5R : ROOF DRAIN TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
10,344	98	Roofs, HSG A
10,344		100.00% Impervious Area

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

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Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Reach 5R: ROOF DRAIN TO DMH4

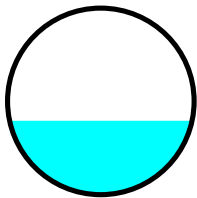
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 10,344 sf, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event  
Inflow = 1.02 cfs @ 12.09 hrs, Volume= 3,673 cf  
Outflow = 1.02 cfs @ 12.09 hrs, Volume= 3,673 cf, Atten= 0%, Lag= 0.1 min  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Max. Velocity= 5.08 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 1.72 fps, Avg. Travel Time= 0.3 min

Peak Storage= 6 cf @ 12.09 hrs  
Average Depth at Peak Storage= 0.33' , Surface Width= 0.81'  
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.10 cfs

10.0" Round Pipe  
n= 0.013 Corrugated PE, smooth interior  
Length= 31.0' Slope= 0.0200 '/'  
Inlet Invert= 29.77', Outlet Invert= 29.15'



# 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond 1: CB1 TO DMH4

Inflow Area = 3,917 sf, 87.08% Impervious, Inflow Depth > 3.39" for 10-Year event  
Inflow = 0.34 cfs @ 12.09 hrs, Volume= 1,108 cf  
Outflow = 0.34 cfs @ 12.09 hrs, Volume= 1,108 cf, Atten= 0%, Lag= 0.0 min  
Primary = 0.34 cfs @ 12.09 hrs, Volume= 1,108 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.06' @ 12.09 hrs

Flood Elev= 31.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.72'	<b>12.0" Round Culvert</b> L= 114.0' Ke= 0.500 Inlet / Outlet Invert= 28.72' / 28.15' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.33 cfs @ 12.09 hrs HW=29.05' TW=28.23' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 0.33 cfs @ 2.18 fps)

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Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond 1P: DMH6 to Shawsheen

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 3.80" for 10-Year event  
Inflow = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf  
Outflow = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf, Atten= 0%, Lag= 0.0 min  
Primary = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf  
Routed to Link AP1 : Offsite Shawsheen River Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 25.84' @ 12.09 hrs  
Flood Elev= 33.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	24.74'	<b>18.0" Round Culvert</b> L= 11.0' Ke= 0.500 Inlet / Outlet Invert= 24.74' / 24.54' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.13 cfs @ 12.09 hrs HW=25.82' TW=0.00' (Dynamic Tailwater)  
↑1=Culvert (Barrel Controls 4.13 cfs @ 4.24 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond 2: CB2 to DMH4 Stormceptor

Inflow Area = 19,490 sf, 92.29% Impervious, Inflow Depth > 3.71" for 10-Year event  
Inflow = 1.80 cfs @ 12.09 hrs, Volume= 6,018 cf  
Outflow = 1.80 cfs @ 12.09 hrs, Volume= 6,018 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.80 cfs @ 12.09 hrs, Volume= 6,018 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.59' @ 12.11 hrs

Flood Elev= 31.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.85'	<b>15.0" Round Culvert</b> L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 27.85' / 27.39' S= 0.0148 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.54 cfs @ 12.09 hrs HW=28.57' TW=28.23' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 1.54 cfs @ 3.05 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond 3: CB3 to DMH5 CDS

Inflow Area = 11,724 sf, 92.20% Impervious, Inflow Depth > 3.71" for 10-Year event  
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 3,620 cf  
Outflow = 1.08 cfs @ 12.09 hrs, Volume= 3,620 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.08 cfs @ 12.09 hrs, Volume= 3,620 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.39' @ 12.09 hrs

Flood Elev= 32.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.85'	<b>15.0" Round Culvert</b> L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 28.85' / 28.66' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.05 cfs @ 12.09 hrs HW=29.39' TW=27.57' (Dynamic Tailwater)

↑1=Culvert (Barrel Controls 1.05 cfs @ 3.09 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond D4: DMH4 TO DMH5

Inflow Area = 33,751 sf, 94.05% Impervious, Inflow Depth > 3.84" for 10-Year event  
Inflow = 3.16 cfs @ 12.09 hrs, Volume= 10,799 cf  
Outflow = 3.16 cfs @ 12.09 hrs, Volume= 10,799 cf, Atten= 0%, Lag= 0.0 min  
Primary = 3.16 cfs @ 12.09 hrs, Volume= 10,799 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.25' @ 12.10 hrs

Flood Elev= 32.81'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.28'	<b>18.0" Round Culvert</b> L= 117.0' Ke= 0.500 Inlet / Outlet Invert= 27.28' / 26.70' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.92 cfs @ 12.09 hrs HW=28.23' TW=27.57' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 2.92 cfs @ 3.53 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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## Summary for Pond D5: DMH5 CDS to DMH6

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 3.80" for 10-Year event  
Inflow = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf  
Outflow = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf, Atten= 0%, Lag= 0.0 min  
Primary = 4.24 cfs @ 12.09 hrs, Volume= 14,419 cf  
Routed to Pond 1P : DMH6 to Shawsheen

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 27.59' @ 12.09 hrs

Flood Elev= 33.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	26.59'	<b>18.0" Round Culvert</b> L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 26.59' / 25.09' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.13 cfs @ 12.09 hrs HW=27.57' TW=25.82' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 4.13 cfs @ 3.37 fps)

**17024 PR-DRAINAGE**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,274 sf, 78.33% Impervious, Inflow Depth > 2.97" for 10-Year event  
Inflow = 4.79 cfs @ 12.09 hrs, Volume= 16,392 cf  
Primary = 4.79 cfs @ 12.09 hrs, Volume= 16,392 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## 17024 PR-DRAINAGE

Type III 24-hr 10-Year Rainfall=4.50"

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### Summary for Link AP2: Offsite Haverhill Street

Inflow Area = 2,649 sf, 34.20% Impervious, Inflow Depth > 0.96" for 10-Year event  
Inflow = 0.06 cfs @ 12.11 hrs, Volume= 212 cf  
Primary = 0.06 cfs @ 12.11 hrs, Volume= 212 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10S: Area to Shawsheen** Runoff Area=20,799 sf 45.00% Impervious Runoff Depth>1.69"  
 Tc=6.0 min CN=62 Runoff=0.88 cfs 2,928 cf

**Subcatchment 11S: TO CB1** Runoff Area=3,917 sf 87.08% Impervious Runoff Depth>4.26"  
 Tc=6.0 min CN=90 Runoff=0.42 cfs 1,391 cf

**Subcatchment 12S: Area to Haverhill Street** Runoff Area=2,649 sf 34.20% Impervious Runoff Depth>1.47"  
 Tc=6.0 min CN=59 Runoff=0.09 cfs 324 cf

**Subcatchment 13S: TO CB3** Runoff Area=11,724 sf 92.20% Impervious Runoff Depth>4.59"  
 Tc=6.0 min CN=93 Runoff=1.32 cfs 4,483 cf

**Subcatchment 14S: TO CB2** Runoff Area=19,490 sf 92.29% Impervious Runoff Depth>4.59"  
 Tc=6.0 min CN=93 Runoff=2.20 cfs 7,452 cf

**Subcatchment 15S: Building to Roof** Runoff Area=10,344 sf 100.00% Impervious Runoff Depth>5.16"  
 Tc=6.0 min CN=98 Runoff=1.23 cfs 4,447 cf

**Reach 5R: ROOF DRAIN TO DMH4** Avg. Flow Depth=0.36' Max Vel=5.34 fps Inflow=1.23 cfs 4,447 cf  
 10.0" Round Pipe n=0.013 L=31.0' S=0.0200 '/ Capacity=3.10 cfs Outflow=1.23 cfs 4,447 cf

**Pond 1: CB1 TO DMH4** Peak Elev=29.10' Inflow=0.42 cfs 1,391 cf  
 12.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/ Outflow=0.42 cfs 1,391 cf

**Pond 1P: DMH6 to Shawsheen** Peak Elev=25.99' Inflow=5.17 cfs 17,772 cf  
 18.0" Round Culvert n=0.013 L=11.0' S=0.0182 '/ Outflow=5.17 cfs 17,772 cf

**Pond 2: CB2 to DMH4 Stormceptor** Peak Elev=28.70' Inflow=2.20 cfs 7,452 cf  
 15.0" Round Culvert n=0.013 L=31.0' S=0.0148 '/ Outflow=2.20 cfs 7,452 cf

**Pond 3: CB3 to DMH5 CDS** Peak Elev=29.46' Inflow=1.32 cfs 4,483 cf  
 15.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/ Outflow=1.32 cfs 4,483 cf

**Pond D4: DMH4 TO DMH5** Peak Elev=28.38' Inflow=3.85 cfs 13,290 cf  
 18.0" Round Culvert n=0.012 L=117.0' S=0.0050 '/ Outflow=3.85 cfs 13,290 cf

**Pond D5: DMH5 CDS to DMH6** Peak Elev=27.72' Inflow=5.17 cfs 17,772 cf  
 18.0" Round Culvert n=0.013 L=100.0' S=0.0150 '/ Outflow=5.17 cfs 17,772 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=6.04 cfs 20,700 cf  
 Primary=6.04 cfs 20,700 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.09 cfs 324 cf  
 Primary=0.09 cfs 324 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 21,023 cf Average Runoff Depth = 3.66"**  
**23.37% Pervious = 16,105 sf 76.63% Impervious = 52,818 sf**

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 10S: Area to Shawsheen River**

Runoff = 0.88 cfs @ 12.10 hrs, Volume= 2,928 cf, Depth> 1.69"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,046	30	Woods, Good, HSG A
9,359	98	Paved parking, HSG A
20,799	62	Weighted Average
11,440		55.00% Pervious Area
9,359		45.00% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 11S: TO CB1**

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,391 cf, Depth> 4.26"

Routed to Pond 1 : CB1 TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,411	98	Paved parking, HSG A
506	39	>75% Grass cover, Good, HSG A
3,917	90	Weighted Average
506		12.92% Pervious Area
3,411		87.08% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 12S: Area to Haverhill Street**

Runoff = 0.09 cfs @ 12.10 hrs, Volume= 324 cf, Depth> 1.47"  
Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
906	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,649	59	Weighted Average
1,743		65.80% Pervious Area
906		34.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 13S: TO CB3**

Runoff = 1.32 cfs @ 12.09 hrs, Volume= 4,483 cf, Depth> 4.59"

Routed to Pond 3 : CB3 to DMH5 CDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
9,155	98	Paved parking, HSG A
1,655	98	Roofs, HSG A
914	39	>75% Grass cover, Good, HSG A
11,724	93	Weighted Average
914		7.80% Pervious Area
10,810		92.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 14S: TO CB2**

Runoff = 2.20 cfs @ 12.09 hrs, Volume= 7,452 cf, Depth> 4.59"

Routed to Pond 2 : CB2 to DMH4 Stormceptor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
16,391	98	Paved parking, HSG A
1,502	39	>75% Grass cover, Good, HSG A
1,597	98	Roofs, HSG A
19,490	93	Weighted Average
1,502		7.71% Pervious Area
17,988		92.29% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Subcatchment 15S: Building to Roof Drain**

Runoff = 1.23 cfs @ 12.09 hrs, Volume= 4,447 cf, Depth> 5.16"

Routed to Reach 5R : ROOF DRAIN TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
10,344	98	Roofs, HSG A
10,344		100.00% Impervious Area

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

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Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Reach 5R: ROOF DRAIN TO DMH4

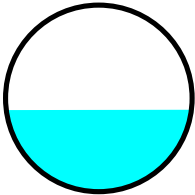
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 10,344 sf, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event  
Inflow = 1.23 cfs @ 12.09 hrs, Volume= 4,447 cf  
Outflow = 1.23 cfs @ 12.09 hrs, Volume= 4,447 cf, Atten= 0%, Lag= 0.1 min  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Max. Velocity= 5.34 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 1.82 fps, Avg. Travel Time= 0.3 min

Peak Storage= 7 cf @ 12.09 hrs  
Average Depth at Peak Storage= 0.36' , Surface Width= 0.83'  
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.10 cfs

10.0" Round Pipe  
n= 0.013 Corrugated PE, smooth interior  
Length= 31.0' Slope= 0.0200 '/'  
Inlet Invert= 29.77', Outlet Invert= 29.15'



# 17024 PR-DRAINAGE

Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond 1: CB1 TO DMH4

Inflow Area = 3,917 sf, 87.08% Impervious, Inflow Depth > 4.26" for 25-Year event  
Inflow = 0.42 cfs @ 12.09 hrs, Volume= 1,391 cf  
Outflow = 0.42 cfs @ 12.09 hrs, Volume= 1,391 cf, Atten= 0%, Lag= 0.0 min  
Primary = 0.42 cfs @ 12.09 hrs, Volume= 1,391 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.10' @ 12.09 hrs

Flood Elev= 31.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.72'	<b>12.0" Round Culvert</b> L= 114.0' Ke= 0.500 Inlet / Outlet Invert= 28.72' / 28.15' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.41 cfs @ 12.09 hrs HW=29.09' TW=28.36' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 0.41 cfs @ 2.31 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond 1P: DMH6 to Shawsheen

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf  
Outflow = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf, Atten= 0%, Lag= 0.0 min  
Primary = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf  
Routed to Link AP1 : Offsite Shawsheen River Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 25.99' @ 12.09 hrs  
Flood Elev= 33.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	24.74'	<b>18.0" Round Culvert</b> L= 11.0' Ke= 0.500 Inlet / Outlet Invert= 24.74' / 24.54' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=5.04 cfs @ 12.09 hrs HW=25.97' TW=0.00' (Dynamic Tailwater)  
↑1=Culvert (Barrel Controls 5.04 cfs @ 4.42 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond 2: CB2 to DMH4 Stormceptor

Inflow Area = 19,490 sf, 92.29% Impervious, Inflow Depth > 4.59" for 25-Year event  
Inflow = 2.20 cfs @ 12.09 hrs, Volume= 7,452 cf  
Outflow = 2.20 cfs @ 12.09 hrs, Volume= 7,452 cf, Atten= 0%, Lag= 0.0 min  
Primary = 2.20 cfs @ 12.09 hrs, Volume= 7,452 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.70' @ 12.11 hrs

Flood Elev= 31.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.85'	<b>15.0" Round Culvert</b> L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 27.85' / 27.39' S= 0.0148 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.82 cfs @ 12.09 hrs HW=28.67' TW=28.36' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 1.82 cfs @ 3.02 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond 3: CB3 to DMH5 CDS

Inflow Area = 11,724 sf, 92.20% Impervious, Inflow Depth > 4.59" for 25-Year event  
Inflow = 1.32 cfs @ 12.09 hrs, Volume= 4,483 cf  
Outflow = 1.32 cfs @ 12.09 hrs, Volume= 4,483 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.32 cfs @ 12.09 hrs, Volume= 4,483 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.46' @ 12.09 hrs

Flood Elev= 32.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.85'	<b>15.0" Round Culvert</b> L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 28.85' / 28.66' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.29 cfs @ 12.09 hrs HW=29.45' TW=27.70' (Dynamic Tailwater)

↑1=Culvert (Barrel Controls 1.29 cfs @ 3.23 fps)

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Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond D4: DMH4 TO DMH5

Inflow Area = 33,751 sf, 94.05% Impervious, Inflow Depth > 4.73" for 25-Year event  
Inflow = 3.85 cfs @ 12.09 hrs, Volume= 13,290 cf  
Outflow = 3.85 cfs @ 12.09 hrs, Volume= 13,290 cf, Atten= 0%, Lag= 0.0 min  
Primary = 3.85 cfs @ 12.09 hrs, Volume= 13,290 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.38' @ 12.10 hrs

Flood Elev= 32.81'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.28'	<b>18.0" Round Culvert</b> L= 117.0' Ke= 0.500 Inlet / Outlet Invert= 27.28' / 26.70' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=3.52 cfs @ 12.09 hrs HW=28.36' TW=27.70' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 3.52 cfs @ 3.63 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 25-Year Rainfall=5.40"

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## Summary for Pond D5: DMH5 CDS to DMH6

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 4.69" for 25-Year event  
Inflow = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf  
Outflow = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf, Atten= 0%, Lag= 0.0 min  
Primary = 5.17 cfs @ 12.09 hrs, Volume= 17,772 cf  
Routed to Pond 1P : DMH6 to Shawsheen

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 27.72' @ 12.09 hrs

Flood Elev= 33.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	26.59'	<b>18.0" Round Culvert</b> L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 26.59' / 25.09' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=5.04 cfs @ 12.09 hrs HW=27.70' TW=25.97' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 5.04 cfs @ 3.59 fps)

**17024 PR-DRAINAGE**

*Type III 24-hr 25-Year Rainfall=5.40"*

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**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,274 sf, 78.33% Impervious, Inflow Depth > 3.75" for 25-Year event  
Inflow = 6.04 cfs @ 12.09 hrs, Volume= 20,700 cf  
Primary = 6.04 cfs @ 12.09 hrs, Volume= 20,700 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PR-DRAINAGE**

Type III 24-hr 25-Year Rainfall=5.40"

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,649 sf, 34.20% Impervious, Inflow Depth > 1.47" for 25-Year event  
Inflow = 0.09 cfs @ 12.10 hrs, Volume= 324 cf  
Primary = 0.09 cfs @ 12.10 hrs, Volume= 324 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10S: Area to Shawsheen** Runoff Area=20,799 sf 45.00% Impervious Runoff Depth>2.44"  
 Tc=6.0 min CN=62 Runoff=1.30 cfs 4,223 cf

**Subcatchment 11S: TO CB1** Runoff Area=3,917 sf 87.08% Impervious Runoff Depth>5.33"  
 Tc=6.0 min CN=90 Runoff=0.52 cfs 1,740 cf

**Subcatchment 12S: Area to Haverhill Street** Runoff Area=2,649 sf 34.20% Impervious Runoff Depth>2.16"  
 Tc=6.0 min CN=59 Runoff=0.14 cfs 477 cf

**Subcatchment 13S: TO CB3** Runoff Area=11,724 sf 92.20% Impervious Runoff Depth>5.67"  
 Tc=6.0 min CN=93 Runoff=1.62 cfs 5,542 cf

**Subcatchment 14S: TO CB2** Runoff Area=19,490 sf 92.29% Impervious Runoff Depth>5.67"  
 Tc=6.0 min CN=93 Runoff=2.69 cfs 9,214 cf

**Subcatchment 15S: Building to Roof** Runoff Area=10,344 sf 100.00% Impervious Runoff Depth>6.26"  
 Tc=6.0 min CN=98 Runoff=1.48 cfs 5,394 cf

**Reach 5R: ROOF DRAIN TO DMH4** Avg. Flow Depth=0.41' Max Vel=5.60 fps Inflow=1.48 cfs 5,394 cf  
 10.0" Round Pipe n=0.013 L=31.0' S=0.0200 ' /' Capacity=3.10 cfs Outflow=1.48 cfs 5,394 cf

**Pond 1: CB1 TO DMH4** Peak Elev=29.14' Inflow=0.52 cfs 1,740 cf  
 12.0" Round Culvert n=0.013 L=114.0' S=0.0050 ' /' Outflow=0.52 cfs 1,740 cf

**Pond 1P: DMH6 to Shawsheen** Peak Elev=26.17' Inflow=6.30 cfs 21,890 cf  
 18.0" Round Culvert n=0.013 L=11.0' S=0.0182 ' /' Outflow=6.30 cfs 21,890 cf

**Pond 2: CB2 to DMH4 Stormceptor** Peak Elev=28.84' Inflow=2.69 cfs 9,214 cf  
 15.0" Round Culvert n=0.013 L=31.0' S=0.0148 ' /' Outflow=2.69 cfs 9,214 cf

**Pond 3: CB3 to DMH5 CDS** Peak Elev=29.54' Inflow=1.62 cfs 5,542 cf  
 15.0" Round Culvert n=0.013 L=19.0' S=0.0100 ' /' Outflow=1.62 cfs 5,542 cf

**Pond D4: DMH4 TO DMH5** Peak Elev=28.55' Inflow=4.69 cfs 16,347 cf  
 18.0" Round Culvert n=0.012 L=117.0' S=0.0050 ' /' Outflow=4.69 cfs 16,347 cf

**Pond D5: DMH5 CDS to DMH6** Peak Elev=27.89' Inflow=6.30 cfs 21,890 cf  
 18.0" Round Culvert n=0.013 L=100.0' S=0.0150 ' /' Outflow=6.30 cfs 21,890 cf

**Link AP1: Offsite Shawsheen River Wetlands** Inflow=7.60 cfs 26,113 cf  
 Primary=7.60 cfs 26,113 cf

**Link AP2: Offsite Haverhill Street** Inflow=0.14 cfs 477 cf  
 Primary=0.14 cfs 477 cf

**Total Runoff Area = 68,923 sf Runoff Volume = 26,591 cf Average Runoff Depth = 4.63"**  
**23.37% Pervious = 16,105 sf 76.63% Impervious = 52,818 sf**

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Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 10S: Area to Shawsheen River**

Runoff = 1.30 cfs @ 12.10 hrs, Volume= 4,223 cf, Depth> 2.44"

Routed to Link AP1 : Offsite Shawsheen River Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
4,394	39	>75% Grass cover, Good, HSG A
7,046	30	Woods, Good, HSG A
9,359	98	Paved parking, HSG A
20,799	62	Weighted Average
11,440		55.00% Pervious Area
9,359		45.00% Impervious Area

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

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Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 11S: TO CB1**

Runoff = 0.52 cfs @ 12.09 hrs, Volume= 1,740 cf, Depth> 5.33"

Routed to Pond 1 : CB1 TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,411	98	Paved parking, HSG A
506	39	>75% Grass cover, Good, HSG A
3,917	90	Weighted Average
506		12.92% Pervious Area
3,411		87.08% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 12S: Area to Haverhill Street**

Runoff = 0.14 cfs @ 12.10 hrs, Volume= 477 cf, Depth> 2.16"

Routed to Link AP2 : Offsite Haverhill Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
906	98	Paved parking, HSG A
1,743	39	>75% Grass cover, Good, HSG A
2,649	59	Weighted Average
1,743		65.80% Pervious Area
906		34.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 13S: TO CB3**

Runoff = 1.62 cfs @ 12.09 hrs, Volume= 5,542 cf, Depth> 5.67"

Routed to Pond 3 : CB3 to DMH5 CDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
9,155	98	Paved parking, HSG A
1,655	98	Roofs, HSG A
914	39	>75% Grass cover, Good, HSG A
11,724	93	Weighted Average
914		7.80% Pervious Area
10,810		92.20% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 14S: TO CB2**

Runoff = 2.69 cfs @ 12.09 hrs, Volume= 9,214 cf, Depth> 5.67"

Routed to Pond 2 : CB2 to DMH4 Stormceptor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
16,391	98	Paved parking, HSG A
1,502	39	>75% Grass cover, Good, HSG A
1,597	98	Roofs, HSG A
19,490	93	Weighted Average
1,502		7.71% Pervious Area
17,988		92.29% Impervious Area

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

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment 15S: Building to Roof Drain**

Runoff = 1.48 cfs @ 12.09 hrs, Volume= 5,394 cf, Depth> 6.26"

Routed to Reach 5R : ROOF DRAIN TO DMH4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
10,344	98	Roofs, HSG A
10,344		100.00% Impervious Area

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

# 17024 PR-DRAINAGE

Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Reach 5R: ROOF DRAIN TO DMH4

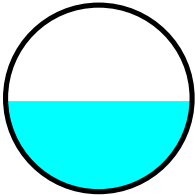
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 10,344 sf, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event  
Inflow = 1.48 cfs @ 12.09 hrs, Volume= 5,394 cf  
Outflow = 1.48 cfs @ 12.09 hrs, Volume= 5,394 cf, Atten= 0%, Lag= 0.1 min  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Max. Velocity= 5.60 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 1.93 fps, Avg. Travel Time= 0.3 min

Peak Storage= 8 cf @ 12.09 hrs  
Average Depth at Peak Storage= 0.41' , Surface Width= 0.83'  
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 3.10 cfs

10.0" Round Pipe  
n= 0.013 Corrugated PE, smooth interior  
Length= 31.0' Slope= 0.0200 '/'  
Inlet Invert= 29.77', Outlet Invert= 29.15'



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Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Pond 1: CB1 TO DMH4

Inflow Area = 3,917 sf, 87.08% Impervious, Inflow Depth > 5.33" for 100-Year event  
Inflow = 0.52 cfs @ 12.09 hrs, Volume= 1,740 cf  
Outflow = 0.52 cfs @ 12.09 hrs, Volume= 1,740 cf, Atten= 0%, Lag= 0.0 min  
Primary = 0.52 cfs @ 12.09 hrs, Volume= 1,740 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.14' @ 12.09 hrs

Flood Elev= 31.52'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.72'	<b>12.0" Round Culvert</b> L= 114.0' Ke= 0.500 Inlet / Outlet Invert= 28.72' / 28.15' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.49 cfs @ 12.09 hrs HW=29.13' TW=28.51' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 0.49 cfs @ 2.35 fps)

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Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Pond 1P: DMH6 to Shawsheen

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf  
Outflow = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf, Atten= 0%, Lag= 0.0 min  
Primary = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf  
Routed to Link AP1 : Offsite Shawsheen River Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 26.17' @ 12.09 hrs  
Flood Elev= 33.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	24.74'	<b>18.0" Round Culvert</b> L= 11.0' Ke= 0.500 Inlet / Outlet Invert= 24.74' / 24.54' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.14 cfs @ 12.09 hrs HW=26.15' TW=0.00' (Dynamic Tailwater)  
↑1=Culvert (Barrel Controls 6.14 cfs @ 4.63 fps)

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Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Pond 2: CB2 to DMH4 Stormceptor

Inflow Area = 19,490 sf, 92.29% Impervious, Inflow Depth > 5.67" for 100-Year event  
Inflow = 2.69 cfs @ 12.09 hrs, Volume= 9,214 cf  
Outflow = 2.69 cfs @ 12.09 hrs, Volume= 9,214 cf, Atten= 0%, Lag= 0.0 min  
Primary = 2.69 cfs @ 12.09 hrs, Volume= 9,214 cf  
Routed to Pond D4 : DMH4 TO DMH5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.84' @ 12.12 hrs

Flood Elev= 31.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.85'	<b>15.0" Round Culvert</b> L= 31.0' Ke= 0.500 Inlet / Outlet Invert= 27.85' / 27.39' S= 0.0148 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=2.12 cfs @ 12.09 hrs HW=28.80' TW=28.51' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 2.12 cfs @ 2.94 fps)

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Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Pond 3: CB3 to DMH5 CDS

Inflow Area = 11,724 sf, 92.20% Impervious, Inflow Depth > 5.67" for 100-Year event  
Inflow = 1.62 cfs @ 12.09 hrs, Volume= 5,542 cf  
Outflow = 1.62 cfs @ 12.09 hrs, Volume= 5,542 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.62 cfs @ 12.09 hrs, Volume= 5,542 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 29.54' @ 12.09 hrs

Flood Elev= 32.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	28.85'	<b>15.0" Round Culvert</b> L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 28.85' / 28.66' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.57 cfs @ 12.09 hrs HW=29.53' TW=27.86' (Dynamic Tailwater)

↑1=Culvert (Barrel Controls 1.57 cfs @ 3.37 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 100-Year Rainfall=6.50"

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## Summary for Pond D4: DMH4 TO DMH5

Inflow Area = 33,751 sf, 94.05% Impervious, Inflow Depth > 5.81" for 100-Year event  
Inflow = 4.69 cfs @ 12.09 hrs, Volume= 16,347 cf  
Outflow = 4.69 cfs @ 12.09 hrs, Volume= 16,347 cf, Atten= 0%, Lag= 0.0 min  
Primary = 4.69 cfs @ 12.09 hrs, Volume= 16,347 cf  
Routed to Pond D5 : DMH5 CDS to DMH6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 28.55' @ 12.10 hrs

Flood Elev= 32.81'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.28'	<b>18.0" Round Culvert</b> L= 117.0' Ke= 0.500 Inlet / Outlet Invert= 27.28' / 26.70' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.23 cfs @ 12.09 hrs HW=28.51' TW=27.86' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 4.23 cfs @ 3.70 fps)

# 17024 PR-DRAINAGE

Type III 24-hr 100-Year Rainfall=6.50"

Prepared by Howard Stein Hudson Associates

Printed 8/31/2022

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## Summary for Pond D5: DMH5 CDS to DMH6

Inflow Area = 45,475 sf, 93.57% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf  
Outflow = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf, Atten= 0%, Lag= 0.0 min  
Primary = 6.30 cfs @ 12.09 hrs, Volume= 21,890 cf  
Routed to Pond 1P : DMH6 to Shawsheen

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 27.89' @ 12.09 hrs

Flood Elev= 33.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	26.59'	<b>18.0" Round Culvert</b> L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 26.59' / 25.09' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.14 cfs @ 12.09 hrs HW=27.86' TW=26.15' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 6.14 cfs @ 3.84 fps)

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Link AP1: Offsite Shawsheen River Wetlands**

Inflow Area = 66,274 sf, 78.33% Impervious, Inflow Depth > 4.73" for 100-Year event  
Inflow = 7.60 cfs @ 12.09 hrs, Volume= 26,113 cf  
Primary = 7.60 cfs @ 12.09 hrs, Volume= 26,113 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**17024 PR-DRAINAGE**

Type III 24-hr 100-Year Rainfall=6.50"

Prepared by Howard Stein Hudson Associates

Printed 8/31/2022

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**Summary for Link AP2: Offsite Haverhill Street**

Inflow Area = 2,649 sf, 34.20% Impervious, Inflow Depth > 2.16" for 100-Year event  
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 477 cf  
Primary = 0.14 cfs @ 12.10 hrs, Volume= 477 cf, Atten= 0%, Lag= 0.0 min

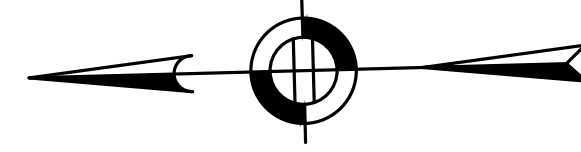
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs



# Appendix E: Pre-Development and Post-Development Watershed Maps

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MAP 35 LOT 8  
20 HAVERHILL STREET  
LISA M. COX  
BOOK 11792 PAGE 190



IP

MAP 35 LOT 7  
16 HAVERHILL STREET  
JPNR, LLC  
BOOK 7154 PAGE 329

EXISTING  
MULTI-TENANT  
OFFICE BUILDING

MAP 36 LOT 91  
16 BALMORAL STREET  
THE BALMORAL  
CONDOMINIUM COMPLEX

MAP 35 LOT 29  
56 YORK STREET  
NEW BRICKSTONE OFFICE, LLC  
BOOK 13994 PAGE 71

100' INNER  
RIPARIAN ZONE

EXISTING  
BUILDING

1S

MAP 35 LOT 5  
12 HAVERHILL STREET  
WINDHAM REALTY LLC  
BOOK 4168 PAGE 210

EXISTING  
BANK BUILDING

2S

RR SPIKE  
HAVERHILL STREET  
(PUBLIC - 60' WIDE)

RIM=33.02'

LIMIT OF FEMA  
FLOWWAY

25' NO DISTURB  
ZONE

EXISTING  
PAVEMENT

50' NO BUILD  
LINE

TANTALLON ROAD (PRIVATE WAY)

AP2

30'  
APPROXIMATE  
LOCATION  
EXISTING SEWER  
EASEMENT

WF#1

WF#2

WF#3

WF#4

WF#5

WF#6

WF#7

WF#8

INV. 15INRCP"  
FL=24.54'

SHAWSHEEN RIVER

AP1

**HOWARD STEIN HUDSON**  
114 Turnpike Road, Suite 2C  
Chelmsford, MA 01824  
www.hshassoc.com

PREPARED FOR:  
Neil Rosenberg  
7 Tantallon Road  
Andover, MA 01810

**PROPOSED MULTIFAMILY  
REDEVELOPMENT PROJECT  
7 TANTALLON ROAD  
ANDOVER, MA, 01810**

REVISIONS:

NO	BY	DATE	DESCRIPTION
1	TM	12/21/17	RESPONSE TO COMMENTS
2	TM	1/26/18	RESUBMIT TO TOWN
3	TM	2/5/18	RESPOND TO COMMENTS
4	SM	03/28/19	ADJ. DATUM & ELEVATIONS
5	SM	02/17/20	LAYOUT/DRAINAGE REVS.
6	PB	07/08/21	DRAINAGE REVS.
7	MB	08/31/22	DRAINAGE REVS.

SITE  
PLAN

**PRE-DEVELOPMENT  
DRAINAGE MAP**

DATE: 10-24-2017

PROJECT NUMBER: 17024

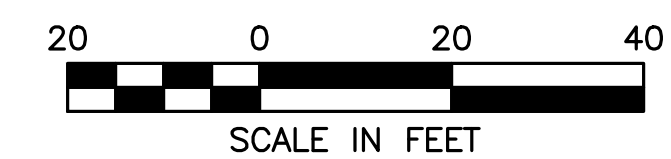
DESIGNED BY: TM

DRAWN BY: TM

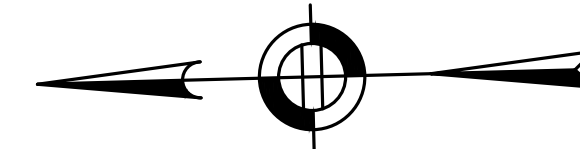
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1

SHEET 1 OF 2



MAP 35 LOT 8  
20 HAVERHILL STREET  
LISA M. COX  
BOOK 11792 PAGE 190



IP

MAP 35 LOT 7  
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JPNR, LLC  
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BOOK 13994 PAGE 71

LIMIT OF FEMA  
FLOODWAY

APPROXIMATE  
LOCATION  
EXISTING SEWER  
EASEMENT

10S

200' INNER  
RIPARIAN ZONE

DMH  
RIM=33.71'

DMH  
RIM=34.14'

14S

13S

12S

15S

100' INNER  
RIPARIAN ZONE

MAP 35 LOT 5  
12 HAVERHILL STREET  
WINDHAM REALTY LLC  
BOOK 418 PAGE 210

EXISTING  
BANK BUILDING

GM

GG

RR SPIKE  
HAVERHILL STREET  
(PUBLIC - 60' WIDE)

RIM=33.02'

AP2

50' NO BUILD  
LINE

TANTALON ROAD (PRIVATE WAY)

25' NO DISTURB  
ZONE

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INV 15INRCP"  
FL=24.54'

SHAWSHEEN RIVER

AP1

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6	PB	07/08/21	DRAINAGE REVS.
7	MB	08/31/22	DRAINAGE REVS.

SITE  
PLAN

**POST-DEVELOPMENT  
DRAINAGE MAP**

DATE: 10-24-2017  
PROJECT NUMBER: 17024  
DESIGNED BY: TM  
DRAWN BY: TM  
CHECKED BY: KE

2

SHEET 2 OF 2

