DRAINAGE REPORT

For

PROPOSED

413 Main Street
Reading, Massachusetts
Middlesex County

Prepared by:

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BOHLER

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the proposed redevelopment for a raze and rebuild of an existing McDonald's Restaurant with Drive-Thru located at 413 Main Street in the Town of Reading, Massachusetts. The site, which consists of approximately 0.74 acres of land, contains an existing McDonald's restaurant with a playground area, drive-thru, existing paved parking areas, on-site utilities, and landscaping. The site is located within 100' of an existing open channel, however, no existing wetlands are present on-site. Furthermore, the entirety of the existing site is outside of all mapped areas of Estimated Habitat of Rare Wetlands Wildlife and Priority Habitats of Rare Species.

The proposed project includes the construction of a new ±3,970 SF McDonald's Restaurant with Drive-Thru along with new paved parking areas, landscaping, storm water management components and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at three (3) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards to the maximum extent practicable for a redevelopment as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP#1	1.00	0.92	**-0.08**	1.64	1.53	**-0.11**	2.03	1.91	**-0.12**	2.63	2.49	**-0.14**
DP#2	0.35	0.22	**-0.13**	0.56	0.37	**-0.19**	0.69	0.46	**-0.23**	0.90	0.59	**-0.31**
DP#3	1.02	0.76	**-0.26**	1.71	1.42	**-0.29**	2.13	1.84	**-0.29**	2.78	2.47	**-0.31**

**Flows are represented in cubic feet per second (cfs)*

II. EXISTING SITE CONDITIONS

Existing Site Description

The site consists of approximately 0.74 acres of land located at 413 East Main Street in the Town of Reading, Massachusetts. The site contains an existing McDonald's restaurant, with a playground area, drive-thru, paved parking areas, on-site utilities, and landscaping. No existing wetlands are present on-site. It is notable that there is a 4'x6' underground concrete box culvert which runs east to west through the center of the property and converts into an open channel at the east property boundary. Refer to **Appendix A** for the FEMA FIRM panel.

On-Site Soil Information

Soils within the analyzed area consist of the following as classified by the Natural Resource Conservation Service (NRCS):

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
602	Urban Land	C
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A

Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

Under existing conditions, runoff from the majority of the northern portion of the site sheet flows to one of three existing catch basins on-site. These catch basins convey stormwater to an existing underground box culvert which flows West to East through the site. A smaller area at the northwest corner of the property drains to a catch basin which connects directly to the municipal system within Main Street. The remaining area on the south side of the site sheet flows off-site out to Bolton Street and eventually into the existing stormwater system within Bolton Street. Slopes on the site range from 1%-8% with on-site elevations ranging from 95 adjacent to Bolton Street to 98.5 at the northeasterly portion of the property.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at three (3) "design points" as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into three (3) sub catchments, as

described below, to analyze existing and proposed flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP#1) is the existing underground culvert flowing West to East through the site that changes into on open channel past the east property boundary. Under existing conditions, this design point receives stormwater flows from approximately 0.34 acres of land, designated as watershed "EX-1". Refer to Table 2.2 below for additional detail.

Design Point #2 (DP#2) is existing municipal stormwater management system in Main Street. Under existing conditions, this design point receives stormwater flows from approximately 0.10 acres of land, designated as watershed "EX-2". Refer to Table 2.2 below for additional detail.

Design Point #3 (DP#3) is Bolton Street along the southerly property line. Under existing conditions, this design point receives stormwater flows from approximately 0.31 acres of land, designated as watershed "EX-3". Refer to Table 2.2 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
EX-1	0.34±	Rooftops, paved parking, grass	95	6.0
EX-2	0.10±	Rooftops, paved parking, grass	96	6.0
EX-3	0.31±	Paved parking, grass	93	6.0

Refer to **Table 1.1 and Table 5.1** for the existing conditions peak rates of runoff. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of a raze and rebuild for a new 3,970 SF McDonald's Restaurant with Drive-Thru including paved parking areas, landscaping, associated utilities, and new stormwater management system. The site has been designed to drain to deep-sump, hooded catch basins to the maximum extent practicable based on the existing topography and drainage conditions. The catch basins will capture and convey stormwater runoff, via an underground pipe system and drainage manholes, to the existing stormwater management system. Pretreatment of stormwater runoff will be provided to the maximum extent practicable by a combination of the deep-sump and hooded catch basins and a stormwater quality unit prior to discharge into the existing underground culvert and municipal stormwater management system. The existing underground culvert is proposed to be maintained which has constrained the proposed site layout and stormwater management system design.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the existing surface basins. Pipes have been designed for the 25-year storm using Rational Method and Pipe sizing calculations are included in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards for a redevelopment to the maximum extent practicable. Refer to **Section V** for additional information.

Proposed Watersheds and Design Point Information

The project has been designed to generally maintain the drainage patterns that existing on site today, with the same design points described in **Section II** above. The site was subdivided into five (5) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1, the underground culvert, receives stormwater flows from approximately 0.32 acres of land, designated as watershed "P-1", "P-4", and "P-5". Refer to Table 3.1 below for additional detail.

Under proposed conditions DP#2, the municipal system within Main Street, receives stormwater flows from approximately 0.08 acres of land, designated as watershed "P-2". Refer to Table 3.1 below for additional detail.

Under proposed conditions DP#3, the drainage system within Bolton Street, receives stormwater flows from approximately 0.34 acres of land, designated as watershed "P-3". Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P-1	0.10±	Paved parking, grass, landscaped areas	94	6.0	DP#1
P-2	0.08±	paved parking, grass, landscaped areas	94	6.0	DP#2
P-3	0.34±	paved parking, grass, landscaped areas	86	6.0	DP#3
P-4	0.13±	paved parking, grass, landscaped areas	90	6.0	DP#1
P-5	0.09±	Rooftops	98	6.0	DP#1

Refer to **Table 1.1 and Table 5.1** for the calculated proposed conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA. Refer to **Appendix F** for more information.

Table 4.1: NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.31	5.21	6.40	8.23

*Values derived from NOAA ATLAS on 03/28/2023

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The proposed redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage and no new untreated discharges are expected with the existing drainage patterns will generally be maintained.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1** and **Table 5.1**, the redevelopment of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The proposed project is a redevelopment and is required to meet Standard 3 to the maximum extent practicable. The project as proposed will reduce the overall impervious area on the site by approximately 3,775± square feet. As such, the annual recharge under post development conditions will exceed the annual recharge under predevelopment conditions.

Standard #4: Water Quality

The proposed redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage. To the maximum extent practicable, water quality treatment is provided via deep-sump and hooded catch basins and proprietary water quality treatment units prior to being discharged. Stormwater runoff generated that is being routed to the existing underground culvert will be treated by one of three water quality treatment units prior to discharge. Due to the design constraints based on the existing topography, intent to maintain the existing underground culvert, and lot configuration, a 14,980± square foot area will continue to sheet flow to Bolton Street through the full access driveway as it does under existing conditions today. The proposed stormwater management system for the redevelopment is anticipated to obtain a weighted TSS removal of ±45%. TSS removal calculations are included in **Appendix F** of this report.

The project is classified as a redevelopment; therefore, the project is required to meet the minimum requirement for Total Phosphorus (TP) removal to the maximum extent practicable. Under existing conditions, the site produces a phosphorus load export rate of 1.21 lbs/year. The

proposed redevelopment will result in a reduction of approximately 3,775± square feet of impervious coverage and will provide three (3) stormwater quality units. As such, the proposed redevelopment is anticipated to produce a phosphorus load export rate of 0.96 lbs/year. The three (3) proposed CDS-1515 stormwater quality units provide a 20% phosphorus removal rate for the paved areas conveyed to the proposed units and is calculated to remove 0.09 lbs/year of TP. The proposed redevelopment also receives phosphorus reduction credits for selected enhanced non-structural BMPs such as sweeping, catch basin cleaning, and enhanced organic waste and leaf litter collection resulting in an additional 0.03 lbs/year of TP being removed under post-development conditions. As a result, the proposed total weighted phosphorous removal rate is 11.3%. The reduction of Total Phosphorus from pre- to post-development conditions is 20.1%. Phosphorus removal calculations are included in **Appendix F** of this report.

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed project involves a "Land Use with Higher Potential Pollutant Loads". The existing drainage patterns are proposed to be generally maintained and the redevelopment is anticipated to result in a reduction of approximately 3,775± square feet of impervious coverage. The project will also implement a stormwater Operations and Maintenance Plan for ongoing cleaning and parking lot sweeping to further ensure water quality standards are met for this redevelopment project to the maximum extent practicable.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

The project is a redevelopment and has been designed to meet the Massachusetts Stormwater Management regulations to the maximum extent practicable.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparisons are contained in **Table 5.1** below:

Table 5.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP#1	1.00	0.92	**-0.08**	1.64	1.53	**-0.11**	2.03	1.91	**-0.12**	2.63	2.49	**-0.14**
DP#2	0.35	0.22	**-0.13**	0.56	0.37	**-0.19**	0.69	0.46	**-0.23**	0.90	0.59	**-0.31**
DP#3	1.02	0.76	**-0.26**	1.71	1.42	**-0.29**	2.13	1.84	**-0.29**	2.78	2.47	**-0.31**

**Flows are represented in cubic feet per second (cfs)*

As outlined in the table above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein. The redevelopment project as proposed will reduce the overall impervious area on the site by approximately 3,775 square feet and has been designed to meet the Massachusetts Stormwater Management standards the maximum extent practicable for a redevelopment.

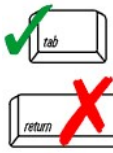
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

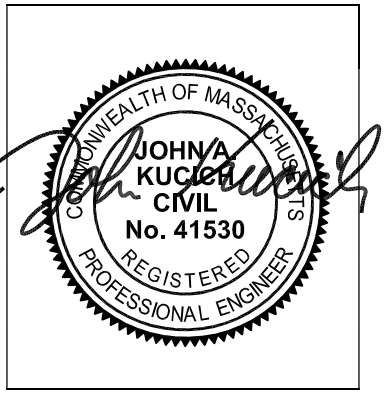
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



07/28/2023

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☒ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

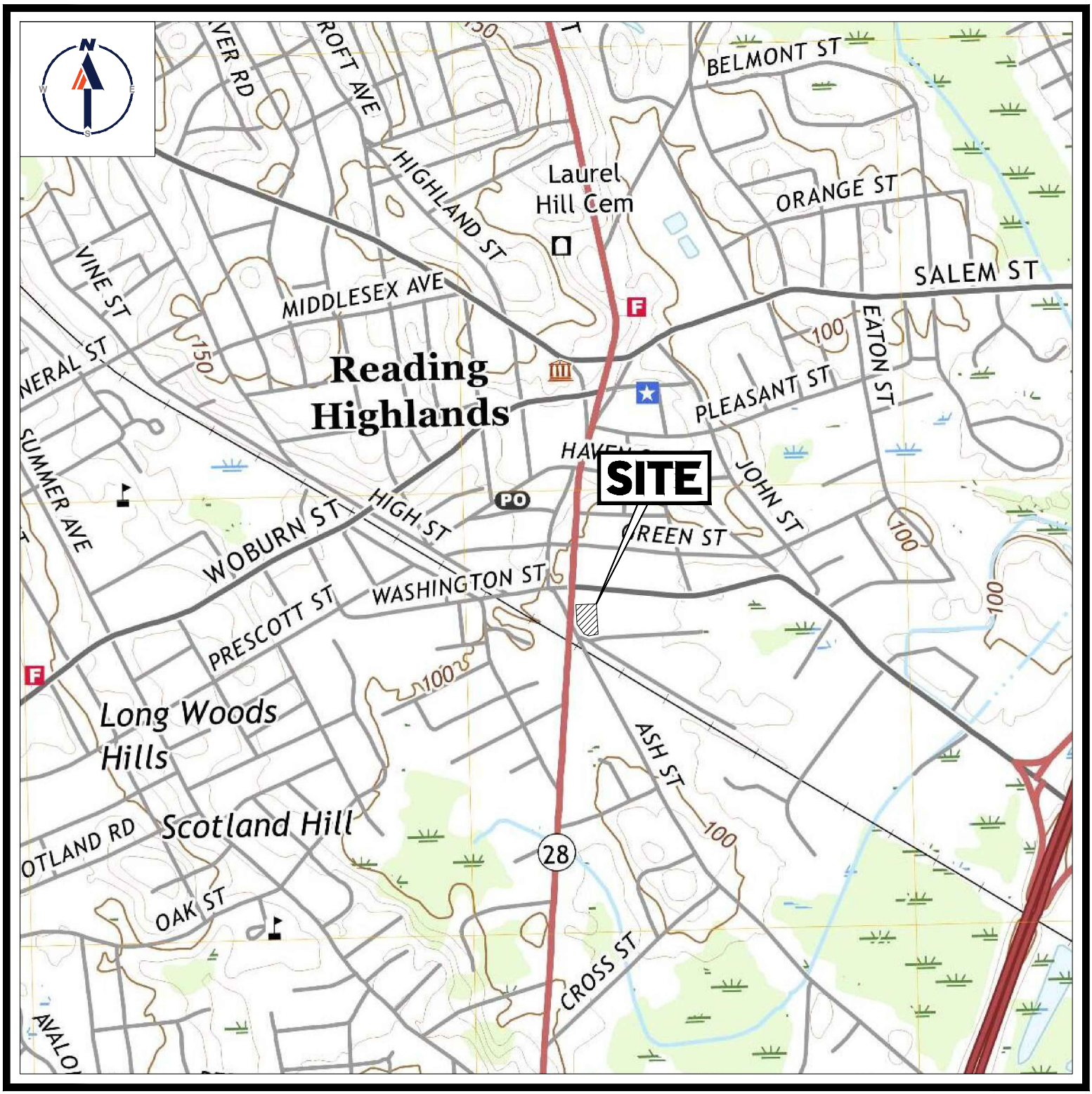
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*



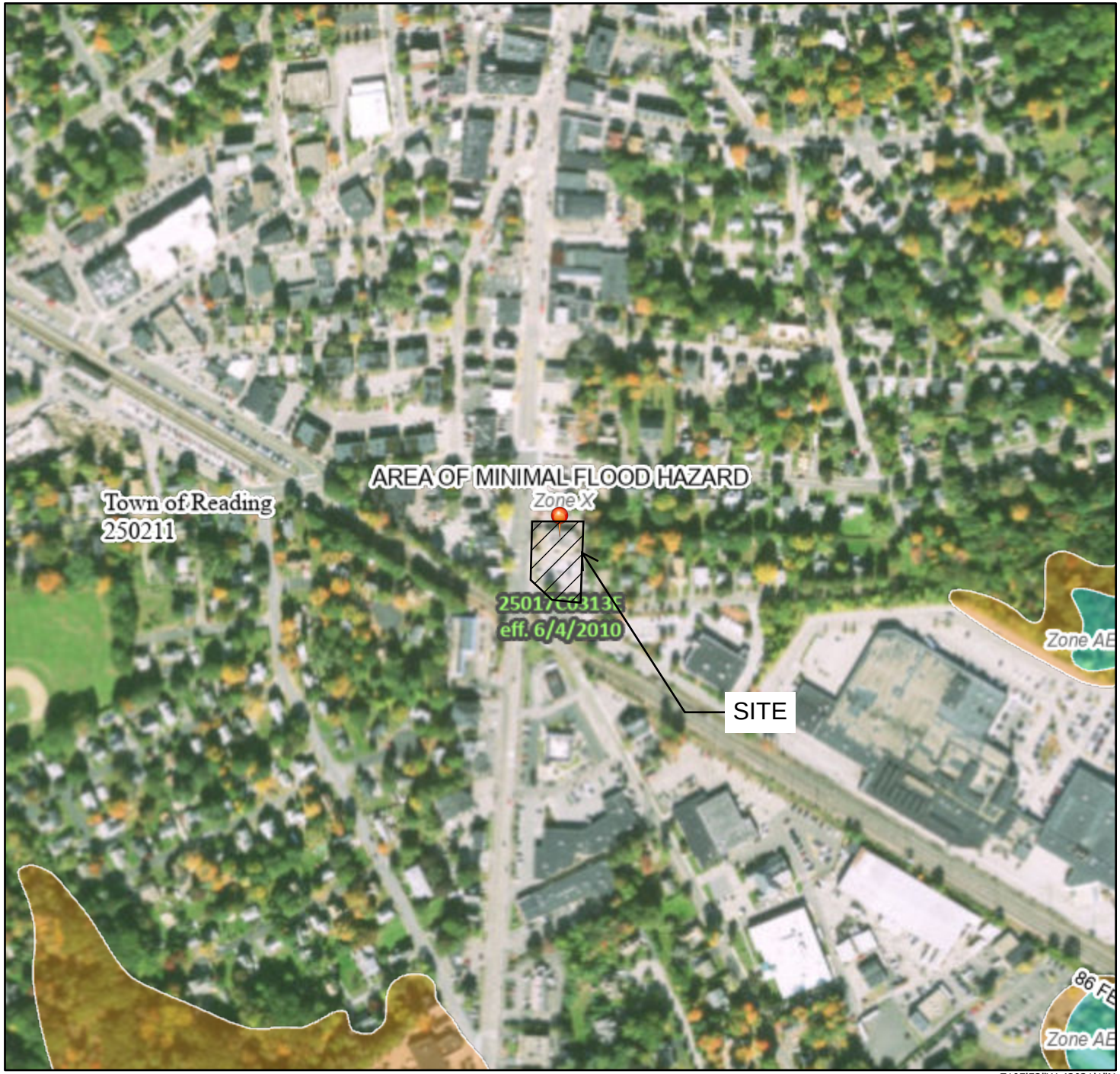
USGS MAP

SCALE: 1" = 1,000'
SOURCE: USGS READING
QUADRANGLE

National Flood Hazard Layer FIRMette

FEMA

71°6'29"W 42°31'27"N



71°5'52"W 42°31'1"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/28/2023 at 10:19 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*

Custom Soil Resource Report
Soil Map

Map Scale: 1:500 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	0.9	92.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.1	7.7%
Totals for Area of Interest		**1.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

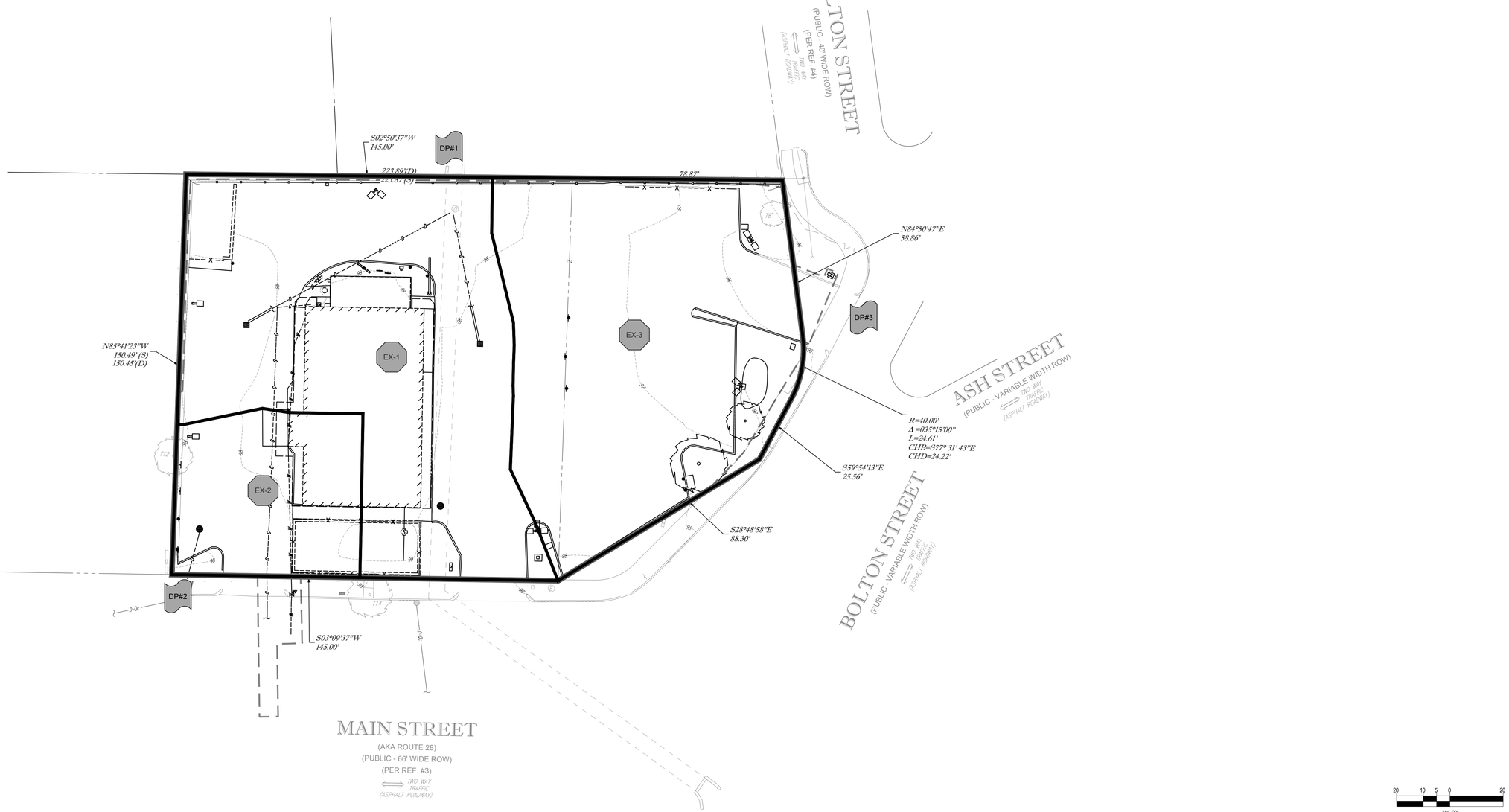
Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*



LEGEND

- DP# — DESIGN POINT
- EX-# — EXISTING SUBCATCHMENT
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY

20 10 5 0 20

1"= 20'

REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE

J.A. KUCICH
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 41539
NEW HAMPSHIRE LICENSE No. 15426
CONNECTICUT LICENSE No. 28127
RHODE ISLAND LICENSE No. 9616
MAINE LICENSE No. 12553

McDonald's

BOSTON REGION
OFFICE
110 N CARPENTER ST
ADDRESS
CHICAGO, IL 60607

PLAN APPROVALS

SIGNATURE	DATE	APPROVED McDONALD'S AGENT

BOHLER™

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK — DATE
CONSTRUCTION CHECK — DATE
CONSTRUCTION CHECK — DATE

PROJECT No.: W222000

CAD I.D. #: W222000-SPPD-1b.dwg

-

STREET ADDRESS
413 MAIN STREET

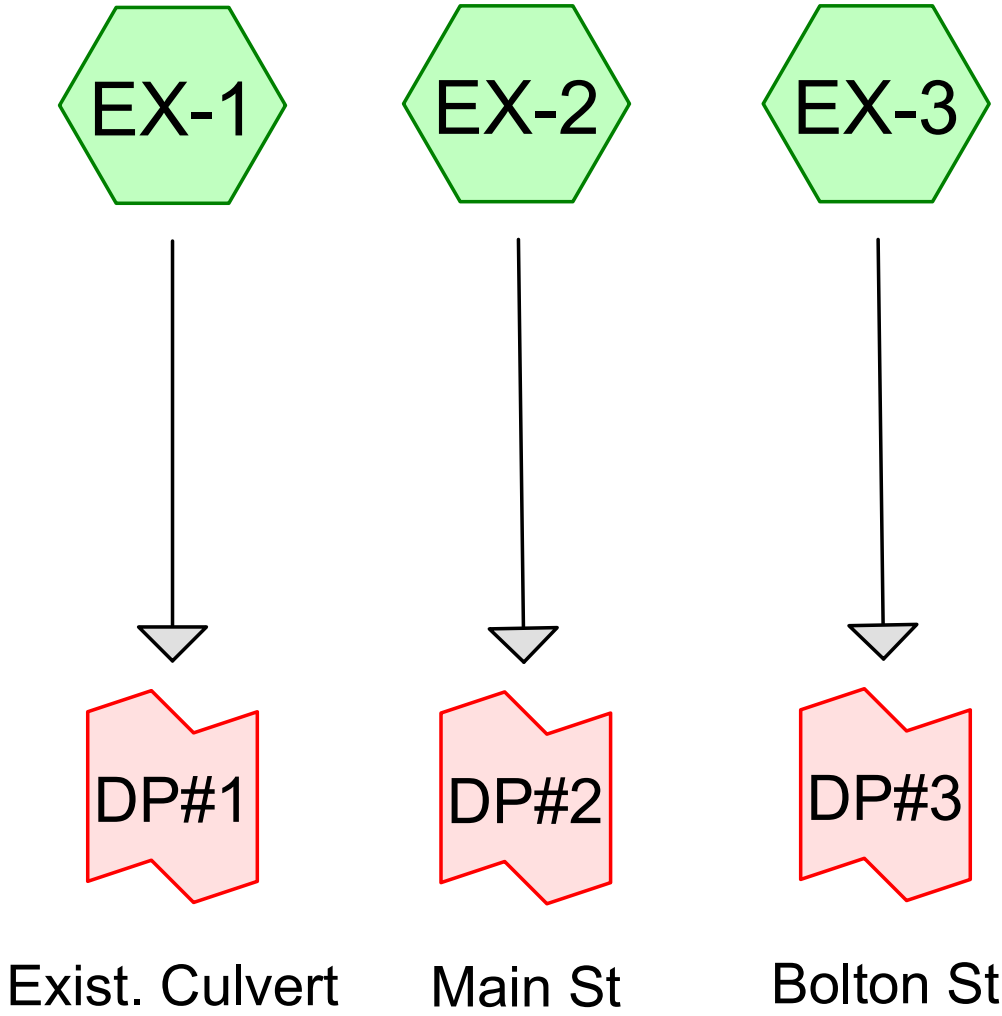
CITY: READING
STATE: MA
COUNTY: MIDDLESEX

SITE I.D.: 20-0015

PLAN DESCRIPTION
EXISTING CONDITIONS DRAINAGE AREA MAP

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO.
EXDAM
OF 14



Subcat Reach Pond Link

Routing Diagram for Pre-Development Analysis
Prepared by Bohler Engineering, Printed 4/25/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.073	61	>75% Grass cover, Good, HSG B (EX-1, EX-2, EX-3)
0.592	98	Paved parking, HSG B (EX-1, EX-2, EX-3)
0.078	98	Roofs, HSG B (EX-1, EX-2)
0.743	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.743	HSG B	EX-1, EX-2, EX-3
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.743		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.073	0.000	0.000	0.000	0.073	>75% Grass cover, Good	EX-1, EX-2, EX-3
0.000	0.592	0.000	0.000	0.000	0.592	Paved parking	EX-1, EX-2, EX-3
0.000	0.078	0.000	0.000	0.000	0.078	Roofs	EX-1, EX-2
0.000	**0.743**	**0.000**	**0.000**	**0.000**	**0.743**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=95 Runoff=1.00 cfs 0.077 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=2.86"
Tc=0.0 min CN=96 Runoff=0.35 cfs 0.023 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=2.55"
Tc=0.0 min CN=93 Runoff=1.02 cfs 0.066 af

Link DP#1: Exist. Culvert Inflow=1.00 cfs 0.077 af
Primary=1.00 cfs 0.077 af

Link DP#2: Main St Inflow=0.35 cfs 0.023 af
Primary=0.35 cfs 0.023 af

Link DP#3: Bolton St Inflow=1.02 cfs 0.066 af
Primary=1.02 cfs 0.066 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.166 af Average Runoff Depth = 2.68"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

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

Summary for Subcatchment EX-2:

Runoff = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 2.75" for 2 Year event
Inflow = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af
Primary = 1.00 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 2.86" for 2 Year event
Inflow = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af
Primary = 0.35 cfs @ 12.00 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 2.55" for 2 Year event
Inflow = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af
Primary = 1.02 cfs @ 12.00 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=4.63"
Tc=6.0 min CN=95 Runoff=1.64 cfs 0.130 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=4.74"
Tc=0.0 min CN=96 Runoff=0.56 cfs 0.039 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=4.40"
Tc=0.0 min CN=93 Runoff=1.71 cfs 0.113 af

Link DP#1: Exist. Culvert Inflow=1.64 cfs 0.130 af
Primary=1.64 cfs 0.130 af

Link DP#2: Main St Inflow=0.56 cfs 0.039 af
Primary=0.56 cfs 0.039 af

Link DP#3: Bolton St Inflow=1.71 cfs 0.113 af
Primary=1.71 cfs 0.113 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.282 af Average Runoff Depth = 4.55"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

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

Summary for Subcatchment EX-2:

Runoff = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 4.63" for 10 Year event
Inflow = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af
Primary = 1.64 cfs @ 12.09 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 4.74" for 10 Year event
Inflow = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af
Primary = 0.56 cfs @ 12.00 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 4.40" for 10 Year event
Inflow = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af
Primary = 1.71 cfs @ 12.00 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=5.81"
Tc=6.0 min CN=95 Runoff=2.03 cfs 0.163 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=96 Runoff=0.69 cfs 0.048 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=5.58"
Tc=0.0 min CN=93 Runoff=2.13 cfs 0.143 af

Link DP#1: Exist. Culvert Inflow=2.03 cfs 0.163 af
Primary=2.03 cfs 0.163 af

Link DP#2: Main St Inflow=0.69 cfs 0.048 af
Primary=0.69 cfs 0.048 af

Link DP#3: Bolton St Inflow=2.13 cfs 0.143 af
Primary=2.13 cfs 0.143 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.355 af Average Runoff Depth = 5.73"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af, Depth= 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

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

Summary for Subcatchment EX-2:

Runoff = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af, Depth= 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af, Depth= 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 5.81" for 25 Year event
Inflow = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af
Primary = 2.03 cfs @ 12.09 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 5.93" for 25 Year event
Inflow = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af
Primary = 0.69 cfs @ 12.00 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 5.58" for 25 Year event
Inflow = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af
Primary = 2.13 cfs @ 12.00 hrs, Volume= 0.143 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 EX-1: Runoff Area=14,701 sf 92.23% Impervious Runoff Depth=7.63"
Tc=6.0 min CN=95 Runoff=2.63 cfs 0.215 af

Subcatchment EX-2: Runoff Area=4,256 sf 93.73% Impervious Runoff Depth=7.75"
Tc=0.0 min CN=96 Runoff=0.90 cfs 0.063 af

Subcatchment EX-3: Runoff Area=13,421 sf 86.77% Impervious Runoff Depth=7.39"
Tc=0.0 min CN=93 Runoff=2.78 cfs 0.190 af

Link DP#1: Exist. Culvert Inflow=2.63 cfs 0.215 af
Primary=2.63 cfs 0.215 af

Link DP#2: Main St Inflow=0.90 cfs 0.063 af
Primary=0.90 cfs 0.063 af

Link DP#3: Bolton St Inflow=2.78 cfs 0.190 af
Primary=2.78 cfs 0.190 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.467 af Average Runoff Depth = 7.55"
9.84% Pervious = 0.073 ac 90.16% Impervious = 0.670 ac

Summary for Subcatchment EX-1:

Runoff = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
11,003	98	Paved parking, HSG B
1,143	61	>75% Grass cover, Good, HSG B
2,555	98	Roofs, HSG B
14,701	95	Weighted Average
1,143		7.77% Pervious Area
13,558		92.23% Impervious Area

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

Summary for Subcatchment EX-2:

Runoff = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af, Depth= 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
267	61	>75% Grass cover, Good, HSG B
843	98	Roofs, HSG B
3,146	98	Paved parking, HSG B
4,256	96	Weighted Average
267		6.27% Pervious Area
3,989		93.73% Impervious Area

Summary for Subcatchment EX-3:

Runoff = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af, Depth= 7.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
1,775	61	>75% Grass cover, Good, HSG B
11,646	98	Paved parking, HSG B
13,421	93	Weighted Average
1,775		13.23% Pervious Area
11,646		86.77% Impervious Area

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.337 ac, 92.23% Impervious, Inflow Depth = 7.63" for 100 Year event
Inflow = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af
Primary = 2.63 cfs @ 12.09 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.098 ac, 93.73% Impervious, Inflow Depth = 7.75" for 100 Year event
Inflow = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af
Primary = 0.90 cfs @ 12.00 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

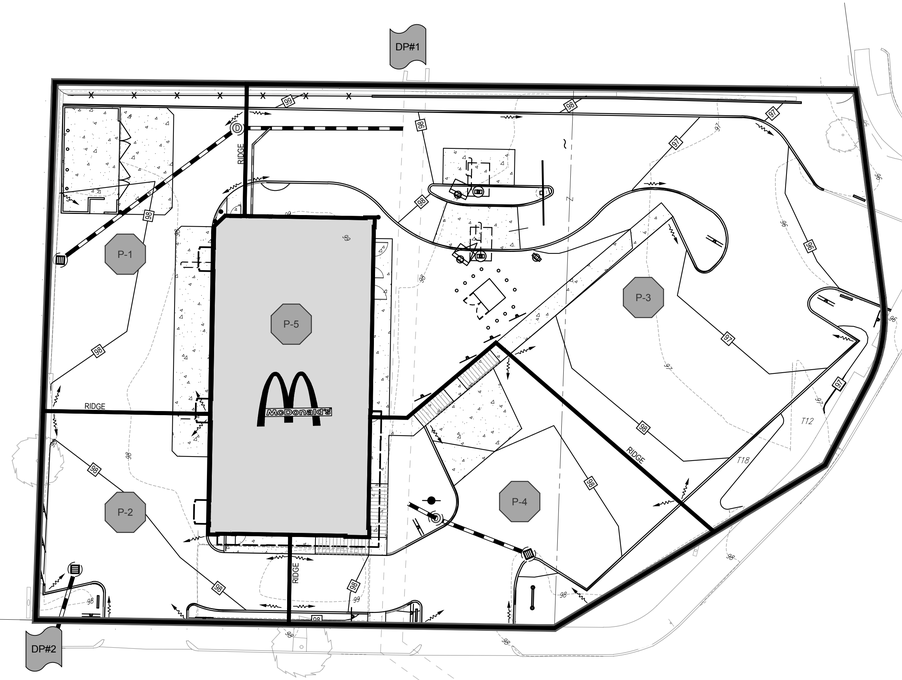
Summary for Link DP#3: Bolton St

Inflow Area = 0.308 ac, 86.77% Impervious, Inflow Depth = 7.39" for 100 Year event
Inflow = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af
Primary = 2.78 cfs @ 12.00 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



BOLTON STREET
(PUBLIC - 40' WIDE ROW)
(PER REF. #4)
TWO WAY TRAFFIC (ASPHALT ROADWAY)

ASH STREET
(PUBLIC - VARIABLE WIDTH ROW)
TWO WAY TRAFFIC (ASPHALT ROADWAY)

BOLTON STREET
(PUBLIC - VARIABLE WIDTH ROW)
TWO WAY TRAFFIC (ASPHALT ROADWAY)

MAIN STREET
(AKA ROUTE 28)
(PUBLIC - 66' WIDE ROW)
(PER REF. #3)
TWO WAY TRAFFIC (ASPHALT ROADWAY)

LEGEND

- DP# — DESIGN POINT
- P-# — PROPOSED SUBCATCHMENT
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY

20 10 5 0 20
1"= 20'

REV	DATE	DESCRIPTION	BY
1	06/12/2023	REV. PER ZBA & ABUTTERS FEEDBACK	CSE

J.A. KUCICH
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 41539
NEW HAMPSHIRE LICENSE No. 15426
CONNECTICUT LICENSE No. 28127
RHODE ISLAND LICENSE No. 9616
MAINE LICENSE No. 12553

BOSTON REGION
OFFICE
110 N CARPENTER ST
ADDRESS
CHICAGO, IL 60607

PLAN APPROVALS

SIGNATURE	DATE
APPROVED McDONALD'S AGENT	

BOHLER™

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

COMPLIANCE CHECK DATE

CONSTRUCTION CHECK DATE

CONSTRUCTION CHECK DATE

PROJECT No.:
W222000

CAD I.D. #:
W222000-SPPD-1b.dwg

-

STREET ADDRESS
413 MAIN STREET

CITY
READING

STATE
MA

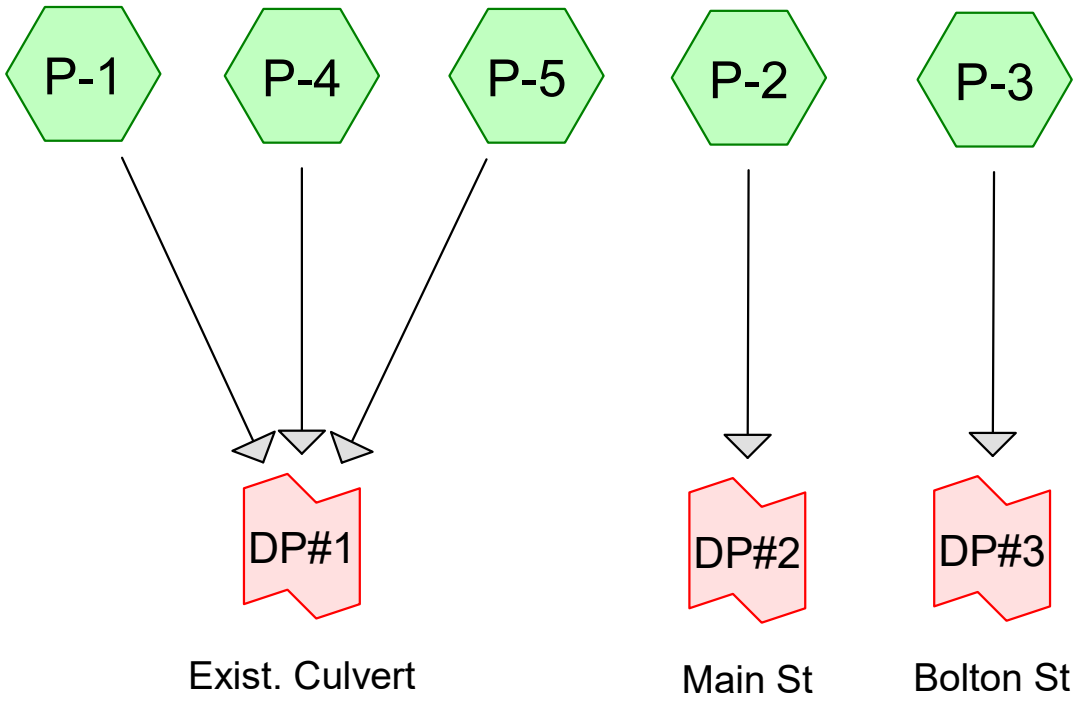
COUNTY
MIDDLESEX

SITE I.D.
20-0015

PLAN DESCRIPTION
PROPOSED CONDITIONS DRAINAGE AREA MAP

STATUS	DATE	BY
DRAWN BY:	04/28/2023	CSE
PLAN CHECKED	-	-
AS-BUILT		

SHEET NO.
PRDAM
OF 14



Subcat Reach Pond Link

Routing Diagram for Post-Development Analysis
Prepared by Bohler Engineers, Printed 7/28/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.160	61	>75% Grass cover, Good, HSG B (P-1, P-2, P-3, P-4)
0.492	98	Paved parking, HSG B (P-1, P-2, P-3, P-4)
0.091	98	Roofs, HSG B (P-5)
0.743	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.743	HSG B	P-1, P-2, P-3, P-4, P-5
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.743		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.160	0.000	0.000	0.000	0.160	>75% Grass cover, Good	P-1, P-2, P-3, P-4
0.000	0.492	0.000	0.000	0.000	0.492	Paved parking	P-1, P-2, P-3, P-4
0.000	0.091	0.000	0.000	0.000	0.091	Roofs	P-5
0.000	**0.743**	**0.000**	**0.000**	**0.000**	**0.743**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=94 Runoff=0.30 cfs 0.023 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=94 Runoff=0.22 cfs 0.017 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=1.93"
Tc=6.0 min CN=86 Runoff=0.76 cfs 0.055 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=2.27"
Tc=6.0 min CN=90 Runoff=0.33 cfs 0.024 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=3.08"
Tc=6.0 min CN=98 Runoff=0.29 cfs 0.023 af

Link DP#1: Exist. Culvert Inflow=0.92 cfs 0.071 af
Primary=0.92 cfs 0.071 af

Link DP#2: Main St Inflow=0.22 cfs 0.017 af
Primary=0.22 cfs 0.017 af

Link DP#3: Bolton St Inflow=0.76 cfs 0.055 af
Primary=0.76 cfs 0.055 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.143 af Average Runoff Depth = 2.31"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 2.65"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af, Depth= 2.65"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

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

Summary for Subcatchment P-3:

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 1.93"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

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

Summary for Subcatchment P-4:

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.024 af, Depth= 2.27"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

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

Summary for Subcatchment P-5:

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 3.08"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.31"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

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

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 2.62" for 2 Year event
Inflow = 0.92 cfs @ 12.09 hrs, Volume= 0.071 af
Primary = 0.92 cfs @ 12.09 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 2.65" for 2 Year event
Inflow = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af
Primary = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 1.93" for 2 Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af
Primary = 0.76 cfs @ 12.09 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=4.52"
Tc=6.0 min CN=94 Runoff=0.50 cfs 0.039 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=4.52"
Tc=6.0 min CN=94 Runoff=0.37 cfs 0.029 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=3.66"
Tc=6.0 min CN=86 Runoff=1.42 cfs 0.105 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=4.08"
Tc=6.0 min CN=90 Runoff=0.57 cfs 0.043 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=4.97"
Tc=6.0 min CN=98 Runoff=0.45 cfs 0.038 af

Link DP#1: Exist. Culvert Inflow=1.53 cfs 0.120 af
Primary=1.53 cfs 0.120 af

Link DP#2: Main St Inflow=0.37 cfs 0.029 af
Primary=0.37 cfs 0.029 af

Link DP#3: Bolton St Inflow=1.42 cfs 0.105 af
Primary=1.42 cfs 0.105 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.254 af Average Runoff Depth = 4.10"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.039 af, Depth= 4.52"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af, Depth= 4.52"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

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

Summary for Subcatchment P-3:

Runoff = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af, Depth= 3.66"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

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

Summary for Subcatchment P-4:

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 4.08"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

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

Summary for Subcatchment P-5:

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 4.97"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.21"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

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

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 4.47" for 10 Year event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.120 af
Primary = 1.53 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 4.52" for 10 Year event
Inflow = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af
Primary = 0.37 cfs @ 12.09 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 3.66" for 10 Year event
Inflow = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af
Primary = 1.42 cfs @ 12.09 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.62 cfs 0.050 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.46 cfs 0.036 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=86 Runoff=1.84 cfs 0.137 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=5.24"
Tc=6.0 min CN=90 Runoff=0.72 cfs 0.055 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.56 cfs 0.047 af

Link DP#1: Exist. Culvert Inflow=1.91 cfs 0.152 af
Primary=1.91 cfs 0.152 af

Link DP#2: Main St Inflow=0.46 cfs 0.036 af
Primary=0.46 cfs 0.036 af

Link DP#3: Bolton St Inflow=1.84 cfs 0.137 af
Primary=1.84 cfs 0.137 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.326 af Average Runoff Depth = 5.25"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 5.69"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af, Depth= 5.69"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

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

Summary for Subcatchment P-3:

Runoff = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af, Depth= 4.79"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

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

Summary for Subcatchment P-4:

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 5.24"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

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

Summary for Subcatchment P-5:

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 6.16"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.40"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

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

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 5.65" for 25 Year event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 0.152 af
Primary = 1.91 cfs @ 12.09 hrs, Volume= 0.152 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 5.69" for 25 Year event
Inflow = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af
Primary = 0.46 cfs @ 12.09 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 4.79" for 25 Year event
Inflow = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af
Primary = 1.84 cfs @ 12.09 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 P-1: Runoff Area=4,561 sf 89.52% Impervious Runoff Depth=7.51"
Tc=6.0 min CN=94 Runoff=0.81 cfs 0.066 af

Subcatchment P-2: Runoff Area=3,336 sf 88.34% Impervious Runoff Depth=7.51"
Tc=6.0 min CN=94 Runoff=0.59 cfs 0.048 af

Subcatchment P-3: Runoff Area=14,982 sf 67.18% Impervious Runoff Depth=6.55"
Tc=6.0 min CN=86 Runoff=2.47 cfs 0.188 af

Subcatchment P-4: Runoff Area=5,529 sf 78.68% Impervious Runoff Depth=7.03"
Tc=6.0 min CN=90 Runoff=0.95 cfs 0.074 af

Subcatchment P-5: Runoff Area=3,971 sf 100.00% Impervious Runoff Depth=7.99"
Tc=6.0 min CN=98 Runoff=0.72 cfs 0.061 af

Link DP#1: Exist. Culvert Inflow=2.49 cfs 0.201 af
Primary=2.49 cfs 0.201 af

Link DP#2: Main St Inflow=0.59 cfs 0.048 af
Primary=0.59 cfs 0.048 af

Link DP#3: Bolton St Inflow=2.47 cfs 0.188 af
Primary=2.47 cfs 0.188 af

Total Runoff Area = 0.743 ac Runoff Volume = 0.436 af Average Runoff Depth = 7.05"
21.50% Pervious = 0.160 ac 78.50% Impervious = 0.583 ac

Summary for Subcatchment P-1:

Runoff = 0.81 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 7.51"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,083	98	Paved parking, HSG B
478	61	>75% Grass cover, Good, HSG B
4,561	94	Weighted Average
478		10.48% Pervious Area
4,083		89.52% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 7.51"
Routed to Link DP#2 : Main St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
389	61	>75% Grass cover, Good, HSG B
2,947	98	Paved parking, HSG B
3,336	94	Weighted Average
389		11.66% Pervious Area
2,947		88.34% Impervious Area

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

Summary for Subcatchment P-3:

Runoff = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af, Depth= 6.55"
Routed to Link DP#3 : Bolton St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
10,065	98	Paved parking, HSG B
14,982	86	Weighted Average
4,917		32.82% Pervious Area
10,065		67.18% Impervious Area

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

Summary for Subcatchment P-4:

Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 7.03"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
4,350	98	Paved parking, HSG B
1,179	61	>75% Grass cover, Good, HSG B
5,529	90	Weighted Average
1,179		21.32% Pervious Area
4,350		78.68% Impervious Area

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

Summary for Subcatchment P-5:

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.061 af, Depth= 7.99"
Routed to Link DP#1 : Exist. Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.23"

Area (sf)	CN	Description
3,971	98	Roofs, HSG B
3,971		100.00% Impervious Area

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

Summary for Link DP#1: Exist. Culvert

Inflow Area = 0.323 ac, 88.22% Impervious, Inflow Depth = 7.46" for 100 Year event
Inflow = 2.49 cfs @ 12.09 hrs, Volume= 0.201 af
Primary = 2.49 cfs @ 12.09 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#2: Main St

Inflow Area = 0.077 ac, 88.34% Impervious, Inflow Depth = 7.51" for 100 Year event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af
Primary = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link DP#3: Bolton St

Inflow Area = 0.344 ac, 67.18% Impervious, Inflow Depth = 6.55" for 100 Year event
Inflow = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af
Primary = 2.47 cfs @ 12.09 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #4 –TSS REMOVAL*
- *WEIGHTED TOTAL PHOSPHORUS REMOVAL RATE*
- *CONTINUOUS DEFLECTIVE SEPARATOR (CDS) STORMWATER TREATMENT DEVICE DEQ LETTER*
- *MA MS4 GENERAL PERMIT APPENDIX F ATTACHMENT 2*
- *NOAA RAINFALL DATA*
- *PIPE AND INLET SIZING*

McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
October 18, 2023

MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)	TSS Removal (%)	Untreated Imp. Area (ac)	Total Area
Deep-sump hooded CB to Water Quality Units	85	0.261	0	0.231	0.492
Weighted TSS Removal Rate	**45**				

*Excludes roof runoff

Prepared By:
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McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
November 20, 2023

Weighted Total Phosphorus Removal Rate

Phosphorus Loading Summary - Existing Conditions

Land Use	Area (Acres)	Phosphorus Loading (lbs/year)
Commercial	0.670	1.19
Developed Land - HSG C/D	0.073	0.02
Total	**0.743**	**1.21**

Phosphorus Loading Summary - Proposed Conditions

Land Use	Area (Acres)	Phosphorus Loading (lbs/year)
Commercial	0.583	1.04
Developed Land - HSG C/D	0.160	0.05
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
Total	**0.743**	**1.08**

Structural BMP Phosphorus Removal

Credit	TP Removal (lbs/year)
Credit #1: CDS-1515 Stormwater Quality Units	0.09
Total	**0.09**

Non-Structural BMP Phosphorus Removal

Credit	TP Removal (lbs/year)
Credit #2: Enhanced Sweeping Program	0.00
Credit #3: Catch Basin Cleaning	0.01
Credit #4: No Application of Fertilizers Containing Phosphorus	0.00
Credit #5: Enhanced Organic Waste and Leaf Litter Collection Program	0.02
Total	**0.03**

Adjusted Proposed Phosphorus Loading (lbs/year)	**0.96**

Proposed Total Weighted Phosphorous Removal Rate	**11.3%**

Proposed Weighted Total Phosphorus reduction vs. Existing Conditions	**20.1% (0.25 lbs/yr)**

Notes:
1. Land Use phosphorus load export rates obtained from MA MS4 General Permit Appendix F Attachment 2 (enclosed for reference).
2. Non-structural BMP phosphorous removal efficincies obtained from MA MS4 General Permit Appendix F Attachment 2 (enclosed for reference).
3. Please refer to supporting calculations included with this document for additional information with respect to the calculated TP removal rates.
4. Mechanical treatment phosphorus removal efficiencies obtained from the enclosed department of environmental Quality (DEQ) CDS Phosphorus removal efficiencies for total phosphorus, continuous deflector separator stormwater treatment device

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Phosphorus Reduction Credits for Selected Enhanced Structural BMPs in the Watershed

Credit #1: CDS-1515 Stormwater Quality Units

Credit $_{CB}$ = IA $_{CB}$ * PLE * PRF $_{CB}$

Credit $_{CB}$ =	Amount of phosphorus load removed by catch basin cleaning (lb/yr)
IA $_{CB}$ =	Impervious area to catch basins (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
PRF $_{CB}$ =	Phosphorus reduction factor (PRF) for catch basin cleaning as seen in DEQ Letter

IA $_{CB}$ =	0.26	(Impervious paved area flowing to SWQUs - does not include roof)
PLE =	1.78	(Commercial)
PRF $_{CB}$ =	0.2	(Semi-annual CB Cleaning)

Credit $_{CB}$ =	0.09	lb/yr phosphorus removed

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Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs in the Watershed

Credit #2: Enhanced Sweeping Program

Credit (Sweeping) = $IA_{sweeping} * PLE * PRF_{sweeping} * AF$

$Credit_{sweeping}$ =	Amount of phosphorus load removed by enhanced sweeping (lb/yr)
$IA_{sweeping}$ =	Impervious Area swept (acres)
PLE =	PLE/R from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
$PRF_{sweeping}$ =	Phosphorus reduction factor (PRF) for sweeping base on sweeping frequency as seen in Table 2-3
AF =	Annual frequency of sweeping or months per year streets are swept (Ex: 3 mo./12 mo. = 0.25)

$IA_{sweeping}$ =	0.49	(Total impervious paved area - excluding roof)
PLE =	1.78	(Commercial)
$PRF_{sweeping}$ =	0.02	(Mechanical Broom, 2/year)
AF =	0.17	(2 Months - Spring & Fall)

$Credit_{sweeping}$ =	0.00	lb/yr phosphorus removed

Credit #3: Catch Basin Cleaning

Credit $_{CB} = IA_{CB} * PLE * PRF_{CB}$

$Credit_{CB}$ =	Amount of phosphorus load removed by catch basin cleaning (lb/yr)
IA_{CB} =	Impervious area to catch basins (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
PRF_{CB} =	Phosphorus reduction factor (PRF) for catch basin cleaning as seen in Table 2-4

IA_{CB} =	0.26	(Impervious paved area flowing to onsite CBs to be maintained - does not include roof)
PLE =	1.78	(Commercial)
PRF_{CB} =	0.02	(Semi-annual CB Cleaning)

$Credit_{CB}$ =	0.01	lb/yr phosphorus removed

Credit #4: No Application of Fertilizers Containing Phosphorus

$Credit_{fertilizer}$ =	0.00	lb/yr phosphorus removed

Credit #5: Enhanced Organic Waste and Leaf Litter Collection Program

Credit $_{leaf\ litter} = IA_{swept} * PLE * PRF_{sweeping}$

$Credit_{leaf\ litter}$ =	Amount of phosphorus load removed by collection of organic waste and leaf little collection (lb/yr)
$IA_{sweeping}$ =	Impervious Area swept (acres)
PLE =	PLER from MA MS4 General Permit Appendix F, Attachment 2, Table 2-1 based on land use (lb/acre/yr)
$PRF_{sweeping}$ =	Phosphorus reduction factor (PRF) for sweeping base on sweeping frequency as seen in Table 2-3

$IA_{sweeping}$ =	0.49	(Total impervious paved area - excluding roof)
PLE =	1.78	(Commercial)
$PRF_{sweeping}$ =	0.02	(Mechanical Broom, 2/year)

$Credit_{leaf\ litter}$ =	0.02	lb/yr phosphorus removed

Prepared By:
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Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Michael S. Rolband, PE, PWD, PWS Emeritus
Director
(804) 698-4020

April 20, 2022

Mr. Jacob Dorman
Contech Engineered Solutions LLC
7037 Ridge Road, Suite 350
Hanover, MD 21076

Transmitted electronically jdorman@conteches.com

Re: Assignment of Percent Removal Efficiencies for Total Phosphorus
Continuous Deflective Separator (CDS) Stormwater Treatment Device

Dear Mr. Dorman:

The Department of Environmental Quality (Department or DEQ) received the Proprietary Best Management Practice (BMP) Registration Statement and supporting documentation for the **Continuous Deflective Separator (CDS) Stormwater Treatment Device** on December 29, 2021. The Department has reviewed the application and supporting documentation in accordance with § 62.1-44.15:28 of the Code of Virginia, 9VAC25-870-65 D of the Virginia Stormwater Management Program (VSMP) Regulation, and DEQ Guidance Memo No. 21-2006.

Section 65 D 2 of the VSMP Regulation states, "Any proprietary BMP approved for use after July 1, 2020, must meet the requirements of § 62.1-44.15:28 A 9 of the Code of Virginia." The Department received the current general use level designation (GULD) certificate from Washington State's Technology Assessment Protocol – Ecology (TAPE) program or the current certification from the New Jersey Department of Environmental Protection (NJDEP) for the **Continuous Deflective Separator (CDS) Stormwater Treatment Device**.

The **Continuous Deflective Separator (CDS) Stormwater Treatment Device** is approved for use in Virginia to meet the VSMP water quality design criteria requirements and has been assigned a total phosphorus pollutant removal efficiency of **20%**. This information will be posted on the Virginia Stormwater BMP Clearinghouse website. This device and the assigned removal efficiency can be manually added into the Virginia Runoff Reduction Method spreadsheet to demonstrate compliance with VSMP water quality design criteria requirements.

If you have any questions regarding this letter, please contact Robert E. Cooper, P.E. at (804) 965-4875 or e-mail at Robert.Cooper@deq.virginia.gov.

Sincerely

Erin Ervin Belt

Erin Ervin Belt
Office of Stormwater Management

ATTACHMENT 2 TO APPENDIX F

Phosphorus and Nitrogen Reduction Credits for Selected Enhanced Non-Structural BMPs

The permittee shall use the following methods to calculate phosphorus and nitrogen (nutrients) load reduction credits for the following enhanced non-structural control practices implemented in the Watershed:

1) Enhanced Sweeping Program;
2) Catch Basin Cleaning;
   and
3) Organic Waste and Leaf Litter Collection program

The methods include the use of default nutrient reduction factors that EPA has determined are acceptable for calculating nutrient load reduction credits for these practices.

The methods and annual nutrient load export rates presented in this attachment are for the purpose of counting load reductions for various BMPs treating storm water runoff from varying site conditions (i.e., impervious or pervious surfaces) and different land uses (e.g. industrial and commercial) within the impaired watershed. Tables 2-1 and 2-2 below provide annual phosphorus and nitrogen load export rates by land use category for impervious and pervious areas. The estimates of annual phosphorus load and load reductions resulting from BMP implementation are intended for use by the permittee to measure compliance with its Phosphorus Reduction Requirement under the permit. The estimates of annual nitrogen load and load reduction resulting from BMP implementation are intended for use by the permittee to track and account for nitrogen load reductions in accordance with Appendices F and H in the permit.

Examples are provided to illustrate use of the methods. In calculating phosphorus and nitrogen export rates, the permittee shall select the land use category that most closely represents the actual use for the area in question. For watersheds with institutional type uses, such as government properties, hospitals, and schools, the permittee shall use the commercial land use category for the purpose of calculating phosphorus and nitrogen loads. Table 2-3 provides a crosswalk table of land use codes between land use groups in Tables 2-1 and 2-2, and the codes used by Mass GIS. For pervious areas, permittees should use the appropriate value for the hydrologic soil group (HSG) if known, otherwise, assume HSG C conditions.

Alternative Methods and/or Nutrient Reduction Factors: A permittee may propose alternative methods and/or nutrient reduction factors for calculating nutrient load reduction credits for these non-structural practices. EPA will consider alternative methods and/or nutrient reduction factors, provided that the permittee submits adequate supporting documentation to EPA. At a minimum, supporting documentation shall consist of a description of the proposed method, the technical basis of the method, identification of alternative nutrient reduction factors, supporting calculations, and identification of references and sources of information that support the use of the

alternative method and/or factors in the Watershed. If EPA determines that the alternative methods and/or factors are not adequately supported, EPA will notify the permittee and the permittee may receive no nutrient reduction credit other than a reduction credit calculated by the permittee following the methods in this attachment for the identified practices.

Table 2-1: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits in the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs/acre/year	P Load Export Rate, kg/ha/yr
Commercial (Com) and Industrial (Ind)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (For)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (Open)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (Ag)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.

- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the MA MS4 Permit

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year	N Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	15.0	16.9
	Pervious	See* DevPERV	See* DevPERV
All Residential	Directly connected impervious	14.1	15.8
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	10.5	11.8
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	11.3	12.7
	Pervious	0.5	0.6
Open Land (OPEN)	Directly connected impervious	11.3	12.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	11.3	12.7
	Pervious	2.6	2.9
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.3	0.3
*Developed Land Pervious (DevPERV) – HSG B	Pervious	1.2	1.3
*Developed Land Pervious (DevPERV) – HSG C	Pervious	2.4	2.7
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	3.1	3.5
*Developed Land Pervious (DevPERV) – HSG D	Pervious	3.6	4.1

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the nitrogen load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating nitrogen loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-3: Crosswalk of Mass GIS land use categories to land use groups for P load calculations

Mass GIS Land Use LU_CODE	Description	Land Use group for calculating P Load - 2013/14 MA MS4
1	Crop Land	Agriculture
2	Pasture (active)	Agriculture
3	Forest	Forest
4	Wetland	Forest
5	Mining	Industrial
6	Open Land includes inactive pasture	open land
7	Participation Recreation	open land
8	spectator recreation	open land
9	Water Based Recreation	open land
10	Multi-Family Residential	High Density Residential
11	High Density Residential	High Density Residential
12	Medium Density Residential	Medium Density Residential
13	Low Density Residential	Low Density Residential
14	Saltwater Wetland	Water
15	Commercial	Commercial
16	Industrial	Industrial
17	Urban Open	open land
18	Transportation	Highway
19	Waste Disposal	Industrial
20	Water	Water
23	cranberry bog	Agriculture
24	Powerline	open land
25	Saltwater Sandy Beach	open land
26	Golf Course	Agriculture
29	Marina	Commercial
31	Urban Public	Commercial
34	Cemetery	open land
35	Orchard	Forest
36	Nursery	Agriculture
37	Forested Wetland	Forest
38	Very Low Density residential	Low Density Residential
39	Junkyards	Industrial
40	Brush land/Successional	Forest

(1) Enhanced Sweeping Program: The permittee may earn a phosphorus and/or nitrogen reduction credit(s) for conducting an enhanced sweeping program of impervious surfaces. Table 2-4 below outlines the default nutrient removal factors for enhanced sweeping programs. The credit shall be calculated by using the following equations:

$$\text{Phosphorus Credit}_{\text{P sweeping}} = \text{IA}_{\text{swept}} \times \text{PLER}_{\text{IC-land use}} \times \text{PRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-1)}$$

$$\text{Nitrogen Credit}_{\text{N sweeping}} = \text{IA}_{\text{swept}} \times \text{NLER}_{\text{IC-land use}} \times \text{NRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-2)}$$

Where:

$\text{Credit}_{\text{sweeping}}$	=	Amount of nutrient load removed by enhanced sweeping program (lb/year)
IA_{swept}	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
$\text{PLER}_{\text{IC-land use}}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$\text{NLER}_{\text{IC-land use}}$	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
$\text{PRF}_{\text{sweeping}}$	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
$\text{NRF}_{\text{sweeping}}$	=	Nitrogen Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
AF	=	Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo./12 mo. = 0.75. For year-round sweeping, AF=1.0[1]

As an alternative, the permittee may apply a credible sweeping model of the Watershed and perform continuous simulations reflecting build-up and wash-off of phosphorus or nitrogen using long-term local rainfall data.

Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$	$NFR_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

[1]For full credit for monthly and weekly frequency, sweeping must be conducted year round. Otherwise, the credit should be adjusted proportionally based on the duration of the sweeping season (using AF factor).

[2] In order to earn credit for semi-annual sweeping the sweeping must occur in the spring following snow-melt and road sand applications to impervious surfaces and in the fall after leaf-fall and prior to the onset to the snow season.

Example 2-1: Calculation of enhanced sweeping program credit (Credit $_{P\ sweeping}$): A permittee proposes to implement an enhanced sweeping program and perform weekly sweeping from March 1 – December 1 (9 months) in their Watershed, using a vacuum assisted sweeper on 20.3 acres of parking lots and roadways in a high-density residential area of the Watershed. For this site the needed information to calculate the phosphorus load reduction credit is:

IA_{swept}	= 20.3 acres
$PLER_{IC\text{-}HDR}$	= 2.32 lb/acre/yr (from Table 2-1)
$PRF_{sweeping}$	= 0.08 (from Table 2-4)
AF	= (9 months / 12 months) = 0.75

Substitution into equation 2-1 yields a Credit $_{sweeping}$ of 3.2 pounds of phosphorus removed per year.

Credit $_{sweeping}$	= IA_{swept} x $PLE_{land\ use}$ x $PRF_{sweeping}$ x AF
	= 20.3 acres x 2.32 lbs/acre/yr x 0.08 x 0.75
	= 2.8 lbs/yr

The corresponding **<u>nitrogen</u>** load reduction credit (Credit $_{N\ sweeping}$) for the same sweeping program in the specified LPCP area is calculated as follows:

IA_{swept}	= 20.3 acres
$NLER_{IC\text{-}HDR}$	= 14.1 lb./acre/yr. (from Table 2-2)
$NRF_{sweeping}$	= 0.08 (from Table 2-4)
AF	= (9 months / 12 months) = 0.75

Substitution into equation 2-2 yields a Credit $_{sweeping}$ of 17.2 pounds of nitrogen removed per year.

Credit $_{N\ sweeping}$	= IA_{swept} x $NLER_{land\ use}$ x $NRF_{sweeping}$ x AF
	= 20.3 acres x 14.1 lbs./acre/yr. x 0.08 x 0.75
	= 17.2 lbs./yr.

(2) Catch Basin Cleaning: The permittee may earn phosphorus and/or nitrogen reduction credit(s) by removing accumulated materials from catch basins (i.e., catch basin cleaning) in the Watershed such that a minimum sump storage capacity of 50% is maintained throughout the year. The credits shall be calculated by using the following equations:

$$\text{Credit}_{\text{P CB}} = IA_{CB} \times PLER_{\text{IC-land use}} \times PRF_{CB} \quad \textbf{(Equation 2-3)}$$

$$\text{Credit}_{\text{N CB}} = IA_{CB} \times NLER_{\text{IC-land use}} \times NRF_{CB} \quad \textbf{(Equation 2-4)}$$

Where:

Credit_{CB}	=	Amount of nutrient load removed by catch basin cleaning (lb/year)
IA_{CB}	=	Impervious drainage area to catch basins (acres)
$PLER_{\text{IC-and use}}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$NLER_{\text{IC-land use}}$	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
PRF_{CB}	=	Phosphorus Reduction Factor for catch basin cleaning (see Table 2-5)
NRF_{CB}	=	Nitrogen Reduction Factor for catch basin cleaning (See Table 2-5)

Table 2-5: Nutrient reduction efficiency factors for semi-annual catch basin cleaning

Frequency	Practice	PRF_{CB}	NRF_{CB}
Semi-annual	Catch Basin Cleaning	0.02	0.06

Example 2-2: Calculation for catch basin cleaning credit (Credit_{CB}):

A permittee proposes to clean catch basins in their Watershed (i.e., remove accumulated sediments and contaminants captured in the catch basins) that drain runoff from 15.3 acres of medium-density residential impervious area. For this site the needed information to calculate the phosphorus load reduction credit is:

IA_{CB} = 15.3 acre
$PLER_{IC\text{-}MDR}$ = 1.96 lbs/acre/yr (from Table 2-1)
PRF_{CB} = 0.02 (from Table 2-5)

Substitution into equation 2-3 yields a $Credit_{P\,CB}$ of 0.6 pounds of phosphorus removed per year:

$Credit_{P\,CB}$ = IA_{CB} x $PLE_{IC\text{-}MDR}$ x PRF_{CB}
= 15.3 acre x 1.96 lbs/acre/yr x 0.02
= 0.6 lbs/yr

Note: the same methodology is applicable for calculating the nitrogen load reduction credit (Credit $_{N\,CB}$).

(3) Enhanced Organic Waste and Leaf Litter Collection program: The permittee may earn a phosphorus and/or nitrogen reduction credit(s) by performing regular gathering, removal and disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces from which runoff discharges to the TMDL waterbody or its tributaries. In order to earn this credit (Credit $_{leaf\ litter}$), the permittee must gather and remove all landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots at least once per week during the period of September 1 to December 1 of each year. Credit can only be earned for those impervious surfaces that are cleared of organic materials in accordance with the description above. The gathering and removal shall occur immediately following any landscaping activities in the Watershed and at additional times when necessary to achieve a weekly cleaning frequency. The permittee must ensure that the disposal of these materials will not contribute pollutants to any surface water discharges. The permittee may use an enhanced sweeping program (e.g., weekly frequency) as part of earning this credit provided that the sweeping is effective at removing leaf litter and organic materials. The Credit $_{leaf\ litter}$ shall be determined by the following equation:

$Credit_{P\,leaf\ litter} = (IA_{leaf\ litter}) \times (PLER_{IC\text{-}land\ use}) \times (0.05)$ **(Equation 2-5)**

$Credit_{N\,leaf\ litter} = (IA_{leaf\ litter}) \times (NLER_{IC\text{-}land\ use}) \times (0.05)$ **(Equation 2-6)**

Where:

$Credit_{leaf\ litter}$ = Amount of nutrient load reduction credit for organicwaste and leaf litter collection program (lb/year)
$IA_{leaf\ litter}$ = Impervious area (acre) in applicable watersheds that are subject to enhanced organic waste and leaf litter collection program
$PLER_{IC\text{-}land\ use}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1)

$NLER_{IC\text{-}land\ use}$ = Nitrogen Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-2)
0.05 = 5% nutrient reduction factor for organic waste and leaf litter collection program in the Watershed

Example 2-3: Calculation for organic waste and leaf litter collection program credit ($Credit_{leaf\ litter}$): A permittee proposes to implement an organic waste and leaf litter collection program by sweeping the parking lots and access drives at a minimum of once per week using a mechanical broom sweeper for the period of September 1 to December 1 over 12.5 acres of impervious roadways and parking lots in an industrial/commercial area of the Watershed. Also, the permittee will ensure that organic materials are removed from impervious areas immediately following all landscaping activities at the site. For this site the needed information to calculate the $Credit_{leaf\ litter}$ for phosphorus is:

Watershed Area = 12.5 acres; and
$PLER_{IC\text{-}commercial}$ = 1.78 lbs/acre/yr (from Table 2-1)

Substitution into equation 2-5 yields a $Credit_{leaf\ litter}$ of 1.1 pounds of phosphorus removed per year:

$Credit_{leaf\ litter}$ = (12.5 acre) x (1.78 lbs/acre/yr) x (0.05)
= 1.1 lbs/yr

Note: The same methodology is applicable for calculating the nitrogen load reduction credit ($Credit_{N\ leaf\ litter}$) for the specified organic waste leaf litter collection program.

Associated Street/Pavement Cleaning Credit:
The permittee also may earn a nutrientreduction credit for enhanced sweeping of roads and parking lot areas (i.e., $Credit_{sweeping}$) for the three months of use. Using equation 2-1, $Credit_{sweeping}$ is:

$Credit_{sweeping} = IA_{swept} \times PLER_{IC\text{-}land\ use} \times PRF_{sweeping} \times AF$ **(Equation 2-1)**
IA_{swept} = 12.5 acre
$PLE_{IC\text{-}commercial}$ = 1.78 lbs/acre/yr (from Table 2-1)
$PRF_{sweeping}$ = 0.05 (from Table 2-3)
AF = 3 mo./12 mo. = 0.25

Substitution into equation 2-1 yields a $Credit_{P\ sweeping}$ of 0.28 pounds of phosphorus removed per year.

$Credit_{P\ sweeping} = IA_{swept} \times PLE_{IC\text{-}commercial} \times PRF_{sweeping} \times AF$
= 12.5 acre x 1.78 lbs/acre/yr x 0.05 x 0.25
= 0.3 lbs/yr

NOAA Atlas 14, Volume 10, Version 3
Location name: Reading, Massachusetts, USA*
Latitude: 42.5206°, Longitude: -71.1029°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.309 (0.238-0.390)	0.373 (0.287-0.471)	0.478 (0.367-0.605)	0.565 (0.431-0.720)	0.685 (0.508-0.915)	0.774 (0.564-1.06)	0.869 (0.618-1.24)	0.980 (0.658-1.42)	1.15 (0.741-1.72)	1.28 (0.813-1.97)
10-min	0.438 (0.338-0.552)	0.529 (0.407-0.667)	0.677 (0.520-0.857)	0.800 (0.611-1.02)	0.970 (0.720-1.30)	1.10 (0.799-1.50)	1.23 (0.875-1.75)	1.39 (0.932-2.01)	1.62 (1.05-2.44)	1.82 (1.15-2.79)
15-min	0.516 (0.397-0.650)	0.622 (0.479-0.785)	0.797 (0.612-1.01)	0.942 (0.719-1.20)	1.14 (0.847-1.53)	1.29 (0.940-1.77)	1.45 (1.03-2.06)	1.63 (1.10-2.37)	1.91 (1.24-2.87)	2.14 (1.35-3.28)
30-min	0.709 (0.546-0.893)	0.856 (0.659-1.08)	1.10 (0.842-1.39)	1.30 (0.990-1.65)	1.57 (1.17-2.10)	1.78 (1.30-2.43)	2.00 (1.42-2.84)	2.25 (1.51-3.27)	2.64 (1.71-3.96)	2.96 (1.87-4.54)
60-min	0.902 (0.695-1.14)	1.09 (0.839-1.38)	1.40 (1.07-1.77)	1.65 (1.26-2.10)	2.00 (1.49-2.68)	2.26 (1.65-3.10)	2.54 (1.81-3.63)	2.87 (1.93-4.17)	3.36 (2.18-5.06)	3.78 (2.39-5.79)
2-hr	1.17 (0.906-1.46)	1.42 (1.10-1.78)	1.84 (1.42-2.31)	2.18 (1.67-2.75)	2.65 (1.98-3.53)	3.00 (2.20-4.09)	3.38 (2.43-4.82)	3.85 (2.59-5.54)	4.57 (2.96-6.82)	5.20 (3.30-7.91)
3-hr	1.36 (1.06-1.69)	1.66 (1.29-2.07)	2.14 (1.66-2.68)	2.55 (1.97-3.21)	3.11 (2.33-4.12)	3.51 (2.60-4.78)	3.96 (2.86-5.64)	4.53 (3.05-6.49)	5.40 (3.51-8.03)	6.17 (3.92-9.34)
6-hr	1.75 (1.38-2.17)	2.14 (1.68-2.66)	2.78 (2.17-3.45)	3.30 (2.56-4.13)	4.03 (3.04-5.31)	4.56 (3.39-6.16)	5.14 (3.74-7.27)	5.87 (3.98-8.36)	7.02 (4.58-10.3)	8.02 (5.11-12.0)
12-hr	2.23 (1.76-2.74)	2.73 (2.15-3.36)	3.54 (2.78-4.37)	4.21 (3.29-5.23)	5.13 (3.90-6.72)	5.82 (4.34-7.80)	6.56 (4.78-9.19)	7.48 (5.09-10.6)	8.90 (5.83-13.0)	10.1 (6.49-15.1)
24-hr	2.67 (2.13-3.27)	3.31 (2.63-4.05)	4.35 (3.44-5.34)	5.21 (4.10-6.44)	6.40 (4.90-8.33)	7.28 (5.46-9.70)	8.23 (6.04-11.5)	9.44 (6.44-13.2)	11.3 (7.43-16.4)	13.0 (8.31-19.1)
2-day	3.03 (2.43-3.68)	3.83 (3.06-4.65)	5.14 (4.09-6.26)	6.22 (4.93-7.63)	7.71 (5.94-9.99)	8.80 (6.67-11.7)	10.0 (7.43-14.0)	11.6 (7.93-16.1)	14.1 (9.29-20.3)	16.4 (10.5-24.0)
3-day	3.32 (2.67-4.01)	4.18 (3.35-5.06)	5.58 (4.47-6.78)	6.75 (5.37-8.24)	8.36 (6.47-10.8)	9.52 (7.25-12.6)	10.8 (8.07-15.1)	12.5 (8.61-17.4)	15.3 (10.1-21.9)	17.8 (11.5-25.9)
4-day	3.59 (2.90-4.33)	4.48 (3.61-5.41)	5.93 (4.76-7.18)	7.13 (5.69-8.68)	8.79 (6.82-11.3)	9.99 (7.62-13.2)	11.3 (8.47-15.7)	13.1 (9.01-18.1)	16.0 (10.6-22.8)	18.5 (12.0-26.9)
7-day	4.36 (3.54-5.23)	5.28 (4.28-6.34)	6.79 (5.48-8.18)	8.04 (6.45-9.73)	9.76 (7.60-12.5)	11.0 (8.43-14.4)	12.4 (9.28-17.0)	14.2 (9.82-19.5)	17.1 (11.4-24.3)	19.7 (12.8-28.5)
10-day	5.06 (4.12-6.05)	6.01 (4.89-7.19)	7.56 (6.12-9.07)	8.85 (7.12-10.7)	10.6 (8.29-13.5)	11.9 (9.12-15.5)	13.3 (9.96-18.1)	15.2 (10.5-20.7)	18.0 (12.0-25.5)	20.6 (13.3-29.6)
20-day	7.04 (5.77-8.35)	8.09 (6.62-9.60)	9.79 (7.98-11.7)	11.2 (9.08-13.4)	13.2 (10.3-16.4)	14.6 (11.2-18.6)	16.2 (12.0-21.4)	17.9 (12.5-24.2)	20.5 (13.7-28.7)	22.7 (14.8-32.4)
30-day	8.69 (7.15-10.3)	9.81 (8.06-11.6)	11.6 (9.53-13.8)	13.1 (10.7-15.7)	15.2 (11.9-18.9)	16.8 (12.9-21.2)	18.4 (13.6-24.1)	20.2 (14.1-27.1)	22.6 (15.1-31.4)	24.5 (15.9-34.7)
45-day	10.8 (8.91-12.7)	12.0 (9.89-14.1)	13.9 (11.5-16.5)	15.5 (12.7-18.5)	17.8 (14.0-21.8)	19.5 (14.9-24.4)	21.2 (15.6-27.3)	22.9 (16.1-30.6)	25.1 (16.9-34.7)	26.7 (17.4-37.7)
60-day	12.6 (10.4-14.8)	13.8 (11.4-16.2)	15.9 (13.1-18.7)	17.6 (14.4-20.8)	19.9 (15.7-24.3)	21.7 (16.6-27.0)	23.5 (17.2-30.0)	25.1 (17.7-33.4)	27.2 (18.3-37.4)	28.6 (18.7-40.3)

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

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

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

McDonald's
413 Main Street
Reading, MA
Bohler Job Number: W222000
July 28, 2023

Rational Pipe Sizing Calculations

Design Period Storm:		25	Year	Design Period Intensity*			6.4	in/hr									
LOCATION		IMPERVIOUS			OTHER			SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
FROM	TO	A	C	CA	A	C	CA										
CB-1	SWQU-1	0.100	0.95	0.10	0.027	0.30	0.01	0.10	6	6.4	0.66	12	0.011	HDPE	0.012	4.05	5.15
SWQU-1	Culvert	0.100	0.95	0.10	0.027	0.30	0.01	0.10	6	6.4	0.66	12	0.012	HDPE	0.012	4.23	5.38
CB-2	Exist. CB	0.070	0.95	0.07	0.007	0.30	0.00	0.07	6	6.4	0.44	12	0.006	HDPE	0.012	2.99	3.81
CB-3	SWQU-2	0.094	0.95	0.09	0.011	0.30	0.00	0.09	6	6.4	0.59	12	0.006	HDPE	0.012	2.99	3.81
ROOF	Culvert	0.091	0.95	0.09	0.000	0.30	0.00	0.09	6	6.4	0.55	8	0.037	HDPE	0.012	2.52	7.21
SWQU-2	Culvert	0.185	0.95	0.18	0.011	0.30	0.00	0.18	6	6.4	1.15	12	0.005	HDPE	0.012	2.73	3.47

*Rainfall intensity provided by NOAA Atlas 14, Volume 10, Version 3 on 3/28/2023

Prepared By:
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APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

McDonald's
413 Main Street
Reading, MA 01867

RESPONSIBLE PARTY DURING CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY POST CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots: Mechanical Broom Sweeping at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

3. Regular removal and disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces at least once per week during the period of September 1 through December 1 and immediately following landscape activities.

4. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Stormwater Quality Units:	
Other:	

Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins:
Stormwater Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

McDonald’s
413 Main Street - Reading, MA 01867

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

McDonald's
413 Main Street
Reading, MA 01867

RESPONSIBLE PARTY DURING CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

RESPONSIBLE PARTY POST CONSTRUCTION:

McDonald's USA, LLC
110 N. Carpenter Street
Chicago, IL 60607

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc. and as noted in the "O&M Plan".
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a Mechanical Broom Sweeping Unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

McDonald's
413 Main Street
Reading, Massachusetts 01867

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Reading Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Reading Public Health Department at (781) 942-9061 and the Reading Conservation Commission at (781) 942-6616.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Reading Public Health Department and Reading Conservation Commission

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

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 allows 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 weather 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 systems 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^3	m^3
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.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.