GMP Lab Facility
298 Concord Road
Billerica, MA
Bohler Job Number: MAB220093
January 24, 2023

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - P2P	
Volume below outlet pipe (Rv) (cf)	14,672
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	11,271
Drawdown time (Hours)*	**6.5**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

Prepared By:
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45 Franklin Street, Floor 5
Boston, MA 02110
(617) 849-8040

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MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	174,301
Required Water Quality Volume (cf)	**14,525**
*Water Quality volume runoff is equal to 0.5 to 1.0 inches of runoff times the total impervious area of the post development project site.	

Water Quality Volume Provided*	
P2P	14,672
0	0
0	0
0	0
0	0
Total Provided Water Quality Volume (cf)	**14,672**

Required Recharge Provided

*Volume provided below lowest outlet pipe in cubic feet (cf)
**Assuming the existing pond will handle the existing impervious area and the proposed pond will handle the i

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: WQU-1,2,3,4,&5

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS Water Quality Unit	**0.82**	**1.00**	**0.82**	**0.18**
		Total TSS Removal =	**82%**	

*Equals remaining load from previous BMP (E) which enters BMP

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MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)
DP-1 -WQU-1,2,3,4,&5	82%	1.190
DP-1 - Untreated (Driveway Apron)	0%	0.019
Weighted TSS Removal Rate	**81%**	

*Excludes roof runoff

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January 24, 2023

Rational Pipe Sizing Calculations

Design Period Storm:		25	Year	Design Period Intensity*			6	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										
WQI-01	P2P	0.16	0.95	0.15	0.11	0.30	0.03	0.19	6	6	1.11	12	0.010	HDPE	0.012	3.86	4.91
WQI-02	P2P	0.16	0.95	0.15	0.11	0.30	0.03	0.19	6	6	1.11	12	0.010	HDPE	0.012	3.86	4.91
WQI-03	P2P	0.31	0.95	0.29	0.05	0.30	0.02	0.31	6	6	1.86	12	0.010	HDPE	0.012	3.86	4.91
WQI-04	P2P	0.35	0.95	0.33	0.10	0.30	0.03	0.36	6	6	2.18	12	0.010	HDPE	0.012	3.86	4.91
RD-01	DMH-02	1.60	0.95	1.52	0.00	0.30	0.00	1.52	6	6	9.12	15	0.020	HDPE	0.012	9.90	8.06
DMH-02	DMH-03	1.60	0.95	1.52	0.00	0.30	0.00	1.52	6	6	9.12	15	0.030	HDPE	0.012	12.12	9.88
RD-02	DMH-01	1.20	0.95	1.14	0.00	0.30	0.00	1.14	6	6	6.84	15	0.020	HDPE	0.012	9.90	8.06
DMH-01	DMH-03	1.20	0.95	1.14	0.00	0.30	0.00	1.14	6	6	6.84	15	0.010	HDPE	0.012	7.00	5.70
DMH-03	P2P	2.80	0.95	2.66	0.00	0.30	0.00	2.66	6	6	15.96	18	0.020	HDPE	0.012	16.09	9.11

*Rainfall intensity provided by Cornell University's NRCC Atlas of Precipitation Extremes for the North Eastern United States and Canada

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This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.4340	*R*	**Recharge (infiltration) rate (feet/day)**
0.350	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.34	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
92.400	x	**1/2 length of basin (x direction, in feet)**
30.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
20.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

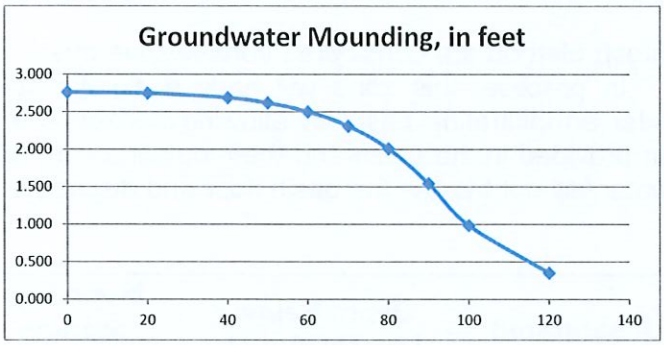
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

22.760	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.760	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.760	0
2.747	20
2.687	40
2.617	50
2.500	60
2.309	70
2.007	80
1.541	90
0.983	100
0.350	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

GROUNDWATER MOUNDING CALCULATIONS

"298 Concord Road"
Billerica, MA
Project #MAB220093.00

Methodology

The infiltration basin identified as P2P this project is designed with less than 4 feet of groundwater separation. It is also designed to attenuate the 10-year storm event or larger. Therefore, groundwater mounding calculations are required according to MA DEP Stormwater Management Guidelines. The purpose of the calculations is to ensure that the mound will not prevent the full draining of the basin. The mounding analysis must show that the recharge volume will exfiltrate within seventy-two (72) hours. Additionally, it should be verified that the mounding effect will not cause stormwater to surge above the lowest discharge point out of a basin (during the 24-hour storm event) or raise the water elevation in a nearby resource area.

The groundwater mounding analysis was performed by a proprietary program using the Hantush Method with Glover's Solution. Input parameters are site specific and determined based on existing and proposed conditions. The required input parameters are the following: application rate; duration of application; fillable porosity; hydraulic conductivity; initial saturated thickness; length of application area; width of application area; and distance to closest resource area (constant head boundary).

Calculations using the Hantush Method are considered conservative due to the fact that the unsaturated soil zone is not incorporated. In practice, this zone will have a significant positive effect on reducing the groundwater mounding under an infiltration basin by allowing horizontal migration. A minimum of a 2-foot unsaturated zone has been provided in the basin and the mounding (Δh) falls below the lowest outlet in the basin ensuring that stormwater will not bypass the basin floor and discharge though the outlet device. Please refer to the table below:

Stormwater Basin	Unsaturated Zone (FT)	Depth Below Lowest Outlet (FT)	Mounding Storage Provided (FT)	Groundwater Mounding - Δh (FT)
2P2	2.0	0.37	2.37	1.16

The application rate used for each pond is determined by the rate at which the volume of runoff below the lowest outlet will draw down in the requisite 72 hours. The duration of application used for the analysis is the 24-hour based duration of the storm event. The fillable porosity, hydraulic conductivity, and initial saturated thickness used for the analysis are based on the existing soil conditions.

Results

Based on the criteria mentioned above, the analysis (see attached) indicates the mound in the stormwater basin falls below the mounding storage provided. Given these results, we feel as though the basins recharge the stormwater volume within 72 hours as required.

BOHLER

JOB NO. **MAB220093.00**
CALCULATED BY **AJH** DATE **01-20-23**
CHECKED BY **ZLR**

Phosphorus Removal Calculations

The proposed Site consists of approximately 10.5 acres of land with a post construction impervious area of 174,301 SF. The project includes one (1) subsurface infiltration system that has a total volume of 14,525 CF for stormwater treatment. This storage volume results in an equivalent of 1.0 in of runoff from the post construction impervious area.

Based on the EPA BMP performance curve for infiltration basins (Figure 1), 1.0 inches of runoff from the impervious area will result in an average pollutant removal of 95% for the Site.

Figure 3- 10: BMP Performance Curve: Infiltration Basin (Soil infiltration rate = 1.02 in/hr)

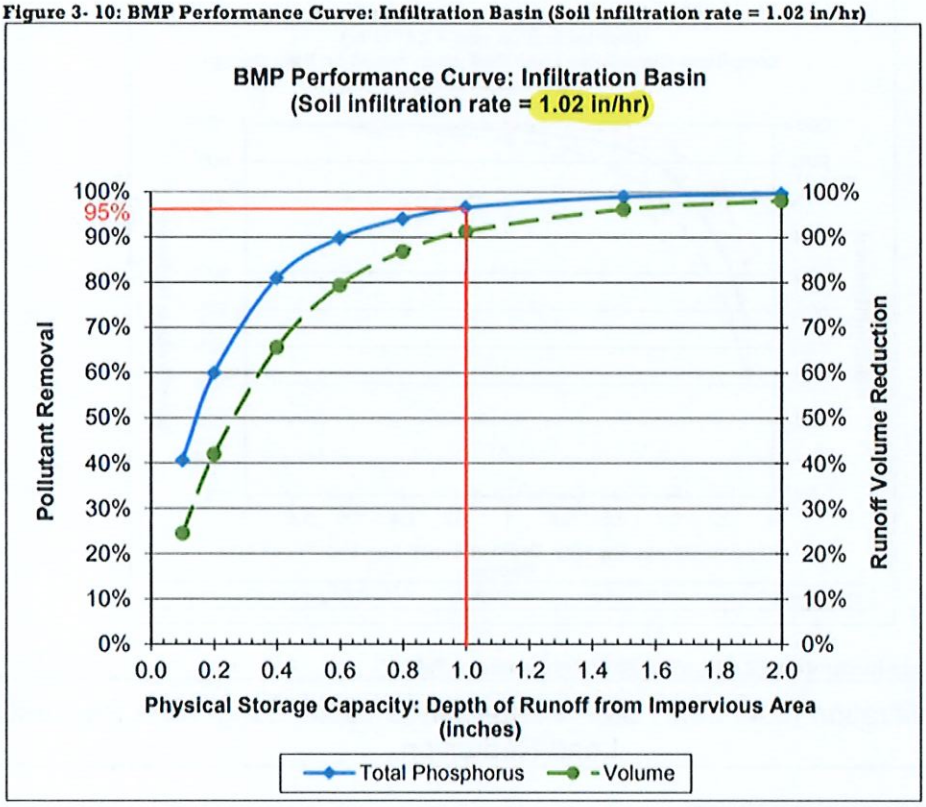


Figure 1

Source:
Methods to Calculate Phosphorus Load Reductions for Structural Stormwater Best Management Practices in the Watershed
https://www3.epa.gov/region1/npdes/stormwater/ma/2014AppendixF-Attachment3.pdf

BOHLER

JOB NO. **MAB220093.00**
CALCULATED BY **WNG** DATE **01-20-23**
CHECKED BY **ZLR**

Nitrogen Removal Calculations

The proposed Site has a post construction impervious area of 174,301 SF. The project includes one (1) subsurface infiltration system that has a total volume of 14,672 CF for stormwater treatment. This storage volume results in an equivalent of 1.0 in of runoff from the post construction impervious area.

Based on the EPA BMP performance curve for infiltration basins (Figure 1), 1.0 inches of runoff from the impervious area will result in an average pollutant removal of 100% for the Site.

Figure 3- 11: BMP Performance Curve: Infiltration Basin (Infiltration rate = 2.41 in/hr)

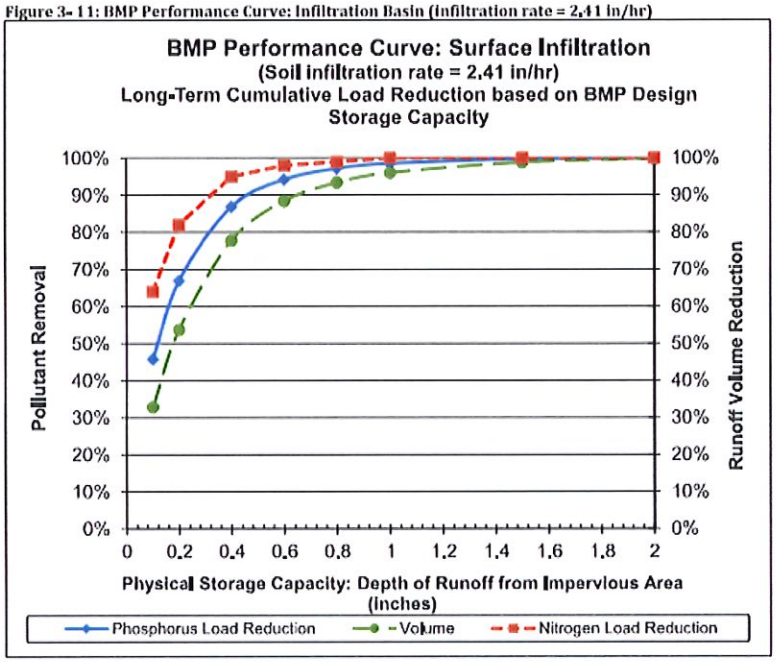


Table 3- 16: Surface Infiltration (2.41 in/hr) BMP Performance Table

Surface Infiltration (2.41 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	32.8%	53.8%	77.8%	88.4%	93.4%	96.0%	98.8%	99.8%
Cumulative Phosphorus Load Reduction	46%	67%	87%	94%	97%	98%	100%	100%
Cumulative Nitrogen Load Reduction	64%	82%	95%	98%	99%	100%	100%	100%

Source:
Methods to Calculate Phosphorus and Nitrogen Load Reductions for Structural Stormwater Best Management Practices in the Watershed
https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-f-attach-3-2016-ma-sms4-gp-mod.pdf

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*
- *PROPOSED OPERATION AND MAINTENANCE MAP*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

GMP Lab Facility
298 Concord Road
Billerica, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

KS Partners
130 New Boston Street – Suite 303
Woburn, MA 01801

RESPONSIBLE PARTY POST CONSTRUCTION:

KS Partners
130 New Boston Street – Suite 303
Woburn, MA 01801

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). 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: Sweep 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.

   Approximate Maintenance Budget: $1,000/year

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.

Approximate Maintenance Budget: $500/year per structure.

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

   Approximate Maintenance Budget: $1,000/year per unit.

4. Underground Infiltration/Detention Basins: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. The outlet of the basin, if any, shall be inspected for erosion and sedimentation, and rip-rap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: Cleaning - $1,000/year, Inspection - $200/year

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

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

GMP Lab Facility
298 Concord Road
Billerica, MA

RESPONSIBLE PARTY:

KS Partners
130 New Boston Street – Suite 303
Woburn, MA 01801

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

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

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

GMP Lab Facility
298 Concord Road - Billerica, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

GMP Lab Facility
298 Concord Road
Billerica, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

KS Partners
130 New Boston Street – Suite 303
Woburn, MA 01801

RESPONSIBLE PARTY POST CONSTRUCTION:

KS Partners
130 New Boston Street – Suite 303
Woburn, MA 01801

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.
- 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 commercial cleaning 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.
- Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time. Clippings shall not be disposed of within stormwater management areas or adjacent resource areas.
- Plants shall be pruned as necessary.

- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter into the soil, leaving behind sand and debris which can be removed in the springtime.

- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams, or other water bodies).

- In no case shall snow be disposed of or stored in the detention basins, infiltration basins or bioretention areas.

- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.

- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.

- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate (CaCO3) or potassium chloride (KCl) or sodium chloride.

- Deliveries shall be monitored by owner or owner's representative to ensure proper delivery and in the event that a spillage occurs it shall be contained and cleaned up immediately in accordance with the spill prevention program for the project.

- Recycle materials whenever possible. Provide separate containers for recycle materials. Recycling products will be removed by a certified waste hauler.

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

GMP Lab Facility
298 Concord Road
Billerica, Massachusetts

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

1. Immediately notify Billerica 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 Billerica Health Department at (978) 671-0931 and the Town Conservation Commission at (978) 671-0966.
4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Billerica Health Department and 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

CONTECH®
ENGINEERED SOLUTIONS

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

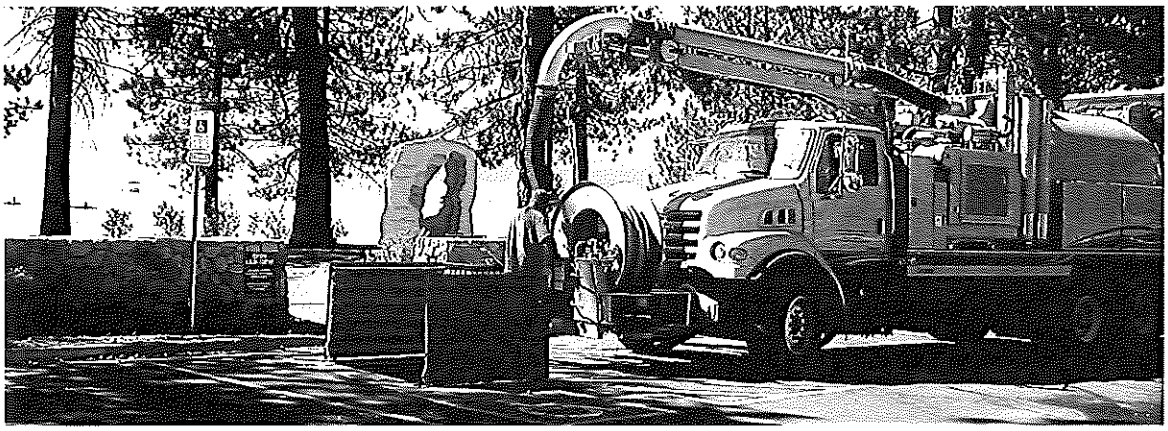
Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. 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

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

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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.

Stormceptor® STC

Stormceptor® is an underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention. With thousands of systems operating worldwide, Stormceptor delivers protection every day in every storm.

With patented technology, optimal treatment occurs by allowing free oil to rise and sediment to settle. The Stormceptor design prohibits scour and release of previously captured pollutants, ensuring superior treatment and protection during even the most extreme storm events.

Stormceptor is very easy to design and provides flexibility under varying site constraints such as tight right-of-ways, zero lot lines and retrofit projects. Design flexibility allows for a cost-effective approach to stormwater treatment. Stormceptor has proven performance backed by the longest record of lab and field verification in the industry.

Tested Performance

- Fine particle capture
- Prevents scour or release
- 95%+ Oil removal

Massachusetts – Water Quality (Q) Flow Rate

Stormceptor STC Model	Inside Diameter (ft)	Typical Depth Below Inlet Pipe Invert [1] (in)	Water Quality Flow Rate Q [2] (cfs)	Peak Conveyance Flow Rate [3] (cfs)	Hydrocarbon Capacity [4] (Gallons)	Maximum Sediment Capacity [4] (ft^3)
STC 450i	4	68	0.40	5.5	86	46
STC 900	6	63	0.89	22	251	89
STC 2400	8	104	1.58	22	840	205
STC 4800	10	140	2.47	22	909	543
STC 7200	12	148	3.56	22	1,059	839
STC 11000	2 x 10	142	4.94	48	2,792	1,086
STC 16000	2 x 12	148	7.12	48	3,055	1,677

[1] Depth Below Pipe Inlet Invert to the Bottom of Base Slab, and Maximum Sediment Capacity can vary to accommodate specific site designs and pollutant loads. Depths can vary to accommodate special designs or site conditions. Contact your local representative for assistance.
[2] Water Quality Flow Rate (Q) is based on 80% annual average TSS removal of the OK110 particle size distribution.
[3] Peak Conveyance Flow Rate is based upon ideal velocity of 3 feet per second and outlet pipe diameters of 18-inch, 36-inch, and 54-inch diameters.
[4] Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

Project:	**298 Concord Road**
Location:	**Billerica, MA**
Prepared For:	**Bohler Eng / Alex Horgan**

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

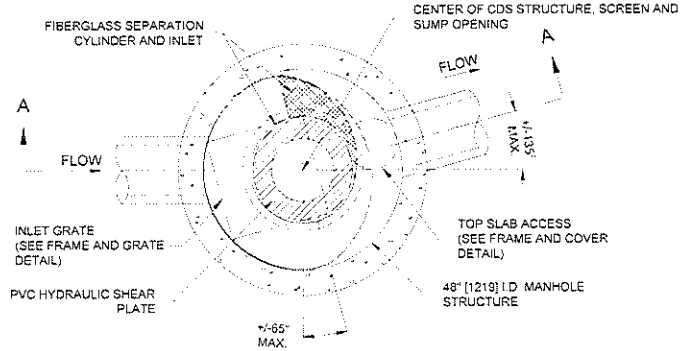
Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

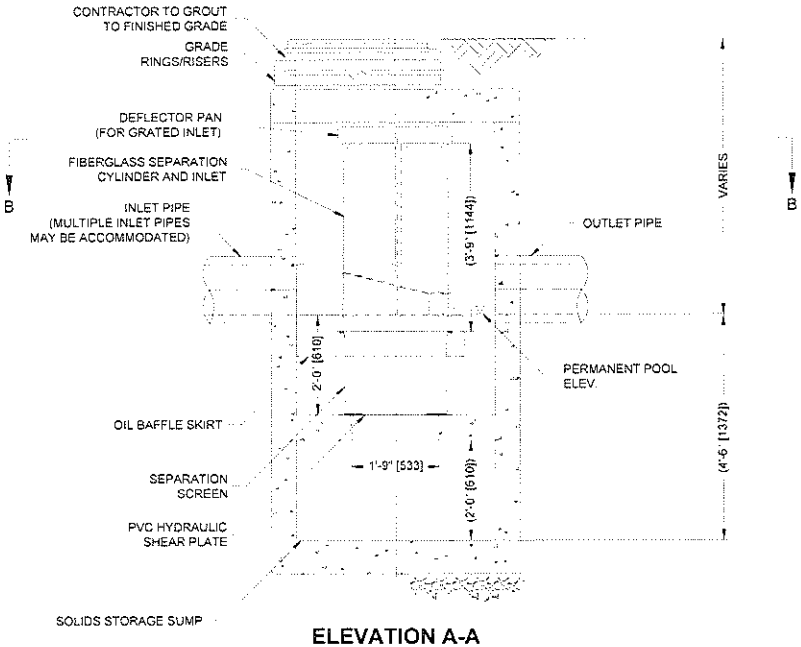
where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
WQO-01	0.16	0.0002500	5.0	0.083	1.00	795.00	0.20
WQI-01	0.35	0.0005469	5.0	0.083	1.00	795.00	0.43
WQI-02	0.15	0.0002344	5.0	0.083	1.00	795.00	0.19



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.

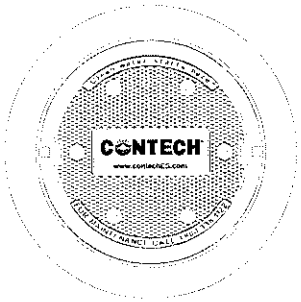
CDS2015-4G DESIGN NOTES

CDS2015-4G RATED TREATMENT CAPACITY IS 1.4 CFS, OR PER LOCAL REGULATIONS

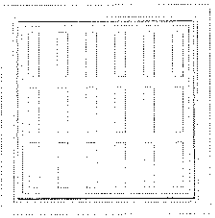
THE STANDARD CDS2015-4G CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.



FRAME AND GRATE
(24" SQUARE)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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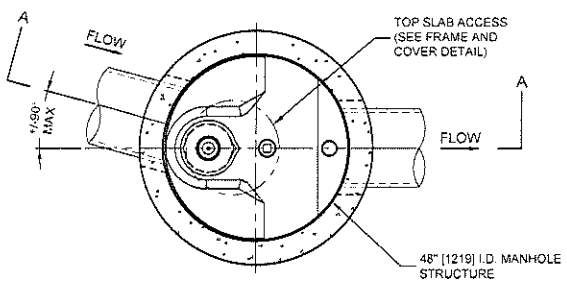
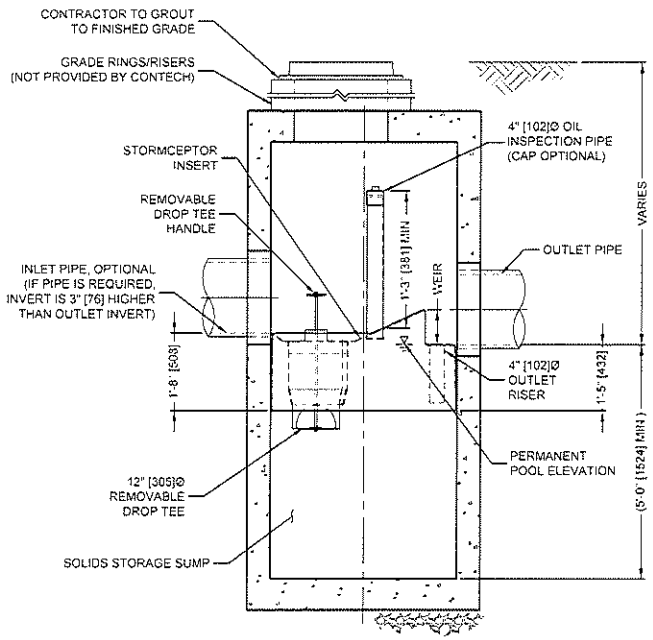
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4G
ONLINE CDS
STANDARD DETAIL



PLAN VIEW
TOP SLAB NOT SHOWN



SECTION A-A

Stormceptor®

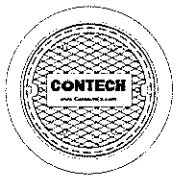
STORMCEPTOR DESIGN NOTES

THE STANDARD STC450i CONFIGURATION WITH ROUND, SOLID FRAME AND COVER, AND INLET PIPE IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

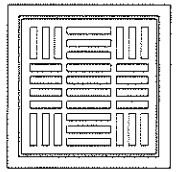
CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
NOTES / SPECIAL REQUIREMENTS:			



FRAME AND COVER
(MAY VARY)
NOT TO SCALE



FRAME AND GRATE
(MAY VARY)
NOT TO SCALE

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. STORMCEPTOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STORMCEPTOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. STORMCEPTOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMCEPTOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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STC450i
STORMCEPTOR
STANDARD DETAIL

CONTECH® ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

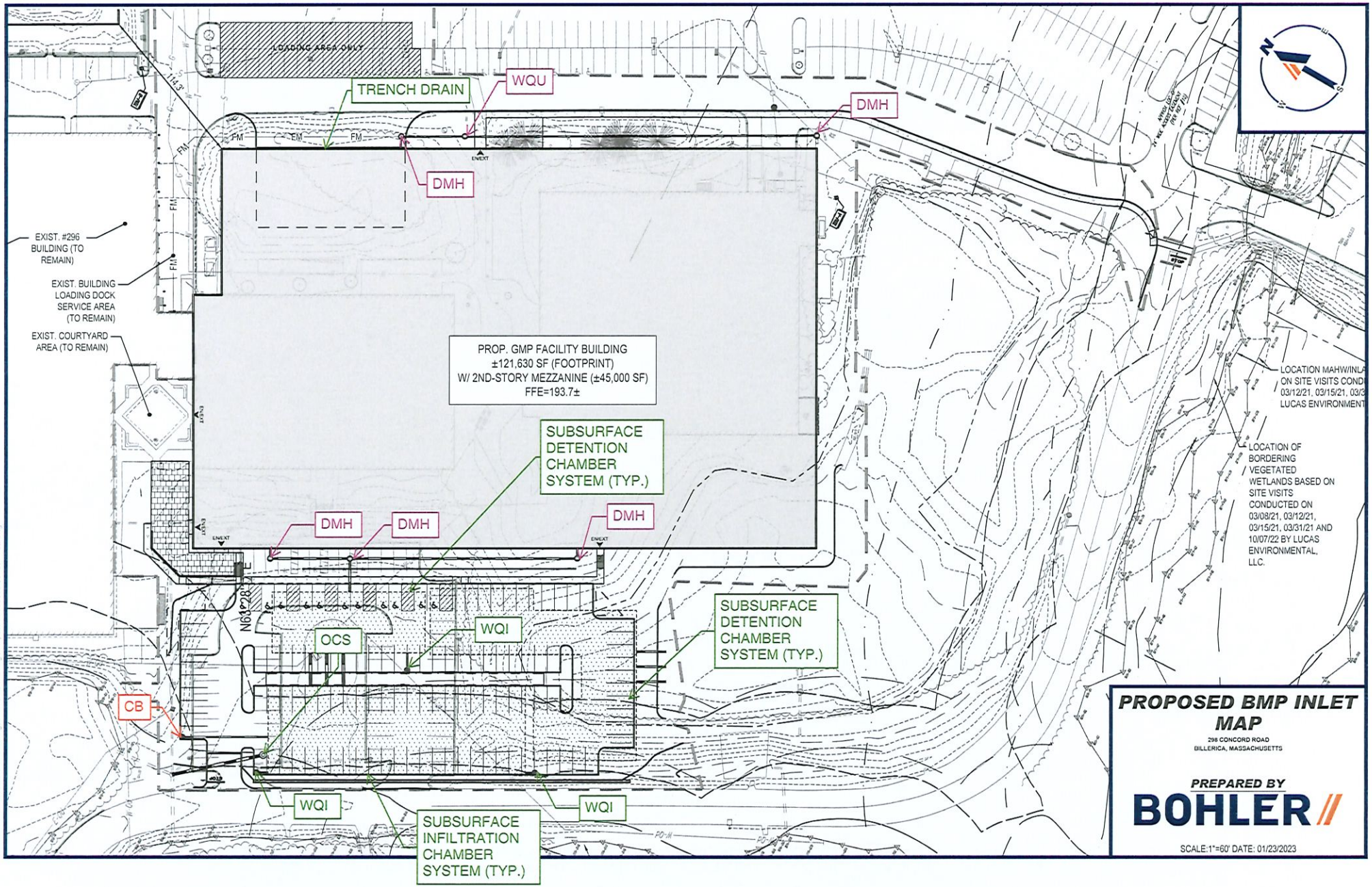
CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

298 CONCORD ROAD
BILLERICA, MA

Area	0.35 ac	Unit Site Designation	WQI-01
Weighted C	0.9	Rainfall Station #	146
t_c	5 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.1%	9.1%	0.01	0.01	9.1
0.04	8.9%	18.0%	0.01	0.01	8.9
0.06	9.8%	27.7%	0.02	0.02	9.8
0.08	8.2%	35.9%	0.03	0.03	8.2
0.10	7.7%	43.6%	0.03	0.03	7.7
0.12	5.5%	49.1%	0.04	0.04	5.5
0.14	5.0%	54.2%	0.04	0.04	5.0
0.16	4.9%	59.1%	0.05	0.05	4.9
0.18	4.3%	63.4%	0.06	0.06	4.2
0.20	4.8%	68.2%	0.06	0.06	4.7
0.25	7.4%	75.6%	0.08	0.08	7.3
0.30	5.8%	81.5%	0.09	0.09	5.6
0.35	4.5%	85.9%	0.11	0.11	4.3
0.40	2.4%	88.3%	0.13	0.13	2.3
0.45	2.0%	90.3%	0.14	0.14	1.9
0.50	1.9%	92.1%	0.16	0.16	1.7
0.75	5.0%	97.1%	0.24	0.24	4.5
1.00	1.6%	98.7%	0.32	0.32	1.4
1.50	0.8%	99.5%	0.47	0.47	0.7
2.00	0.0%	99.5%	0.63	0.63	0.0
2.50	0.5%	100.0%	0.79	0.79	0.3
					97.8
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**91.4%**

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.


LOADING AREA ONLY
TRENCH DRAIN
WQU
DMH
DMH
EXIST. #296 BUILDING (TO REMAIN)
EXIST. BUILDING LOADING DOCK SERVICE AREA (TO REMAIN)
EXIST. COURTYARD AREA (TO REMAIN)
PROP. GMP FACILITY BUILDING
±121,630 SF (FOOTPRINT)
W/ 2ND-STORY MEZZANINE (±45,000 SF)
FFE=193.7±
SUBSURFACE DETENTION CHAMBER SYSTEM (TYP.)
DMH
DMH
DMH
OCS
WQI
SUBSURFACE DETENTION CHAMBER SYSTEM (TYP.)
CB
WQI
WQI
SUBSURFACE INFILTRATION CHAMBER SYSTEM (TYP.)
LOCATION MAHW/INLA
ON SITE VISITS COND
03/12/21, 03/15/21, 03/3
LUCAS ENVIRONMENT
LOCATION OF BORDERING VEGETATED WETLANDS BASED ON SITE VISITS CONDUCTED ON 03/08/21, 03/12/21, 03/15/21, 03/31/21 AND 10/07/22 BY LUCAS ENVIRONMENTAL, LLC.
PROPOSED BMP INLET MAP
298 CONCORD ROAD
BILLERICA, MASSACHUSETTS
PREPARED BY
BOHLER
SCALE:1"=60' DATE: 01/23/2023