AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act, as amended, (33 U.S.C. §§1251 et seq.; the "CWA"), and the Massachusetts Clean Waters Act, as amended, (M.G.L.Chap. 21,§§ 26-53)

Massachusetts Bay Transportation Authority	**Keolis Commuter Services LLC**	**Delaware North Corporation**
10 Park Plaza	**470 Atlantic Avenue**	**100 Legends Way**
Boston, MA 02116-3974	**5th Floor**	**Boston, MA 02114**
	Boston, MA 02210	

are authorized to discharge from the facility located at

North Station Railroad Terminal
135 Causeway Street
Boston, MA 02116

to receiving water named

Charles River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein. The co-Permittee Delaware North Corporation is responsible only for the requirements of Part I.B of this Permit for the portions of the stormwater collection system that it owns or operates.

This Permit shall become effective on the first day of the calendar month following sixty (60) days after signature. If no comments are received, this Permit shall become effective upon signature.

This Permit and the authorization to discharge expire at midnight, five (5) years from the last day of the month preceding the effective date.

This Permit supersedes the permit issued on April 7, 2010.

This Permit consists of 18 pages in Part I including effluent limitations, monitoring requirements, 8 pages in Attachment A – Freshwater Acute Toxicity Test Procedure and Protocol (February 28, 2011), 7 pages in Attachment B, Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs, 70 pages in Attachment C, Methods to Calculate Phosphorus Load Reductions for Structural Stormwater Controls, and 25 pages in Part II, the Standard Conditions.

Signed this day of , 2017

Lynne A. Hamjian, Acting Director	Lealdon Langley, Director
Office of Ecosystem Protection	Massachusetts Wetlands and Wastewater Programs
U.S. Environmental Protection Agency	Department of Environmental Protection
Region 1	Commonwealth of Massachusetts
Boston, MA	Boston, MA

PART I.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date and lasting through the expiration date, the Permittees are authorized to discharge treated stormwater runoff (from the MBTA commuter rail track area, the TD Garden roof, and a Massachusetts Department of Transportation Building), treated garage sump water (consisting of stormwater runoff from cars in the parking garage and groundwater), and treated non-stormwater discharges (discharges from emergency/unplanned firefighting activities, fire hydrant flushing, uncontaminated air conditioning condensate, routine external building wash down (with no detergents or hazardous cleaning products), wash water from periodic platform wash-downs (with no detergents or hazardous cleaning products), uncontaminated groundwater, wash water from track bay drain flushing, and foundation and footing drains where flows are not contaminated by contact with soils where spills or leaks of toxic or hazardous materials have occurred), through **Outfall Serial Number 001** to the Charles River. Such discharges shall be limited and monitored by the Permittees as specified below.

Effluent Characteristic	**Discharge Limitation**		**Monitoring Requirements** [1,2,3,4]	
	Average Monthly	**Maximum Daily**	**Measurement Frequency** [5]	**Sample Type**
Effluent Flow [6]	Report MGD	16 MGD	1/Month	Estimate
pH [7]	6.5 – 8.3 S.U.		1/Month	Grab
Oil & Grease	----------	15 mg/L	1/Month	Grab
Escherichia coli, dry weather [8]	----------	Report cfu/100 ml	1/Month	Grab
Escherichia coli	----------	Report cfu/100 ml	1/Quarter	Grab
Total Suspended Solids (TSS)	----------	100 mg/L	1/Month	Grab
Total Phosphorus	----------	Report mg/L	1/Month	Grab
Chemical Oxygen Demand (COD)	----------	Report mg/L	1/Quarter	Grab
Total Iron	----------	Report mg/L	1/Quarter	Grab
Total Magnesium	----------	Report mg/L	1/Quarter	Grab
Total Manganese	----------	Report mg/L	1/Quarter	Grab

See pages 5 and 6 for footnotes

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Effluent Characteristic	**Discharge Limitation**	**Monitoring Requirements [1,2,3,4]**	
	Maximum Daily	**Measurement Frequency [5]**	**Sample Type**
Whole Effluent Toxicity [9,10,11]			
Acute LC_{50}	Report %	1/year	Composite [12]
Chronic C-NOEC	Report %	1/year	Composite [12]
Hardness	Report mg/L	1/year	Composite [12]
Total Residual Chlorine	Report mg/L	1/year	Grab
Alkalinity	Report mg/L	1/year	Composite [12]
pH	Report S.U.	1/year	Grab
Specific Conductance	Report µmhos/cm	1/year	Composite [12]
Total Solids	Report mg/L	1/year	Composite [12]
Ammonia	Report mg/L	1/year	Composite [12]
Total Organic Carbon	Report mg/L	1/year	Composite [12]
Cadmium, Total Recoverable	Report mg/L	1/year	Composite [12]
Lead, Total Recoverable	Report mg/L	1/year	Composite [12]
Copper, Total Recoverable	Report mg/L	1/year	Composite [12]
Zinc, Total Recoverable	Report mg/L	1/year	Composite [12]
Nickel, Total Recoverable	Report mg/L	1/year	Composite [12]
Aluminum, Total Recoverable	Report mg/L	1/year	Composite [12]
Total Dissolved Solids	Report mg/L	1/year	Composite [12]

See pages 5 and 6 for footnotes

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The receiving water shall be monitored by the Permittees as specified below as required by the Whole Effluent Toxicity (WET) testing requirement. This sample shall be taken at a point immediately upstream of the permitted discharge's zone of influence at a reasonably accessible location. Refer to WET protocol, Attachment A, Part VI.

Ambient Characteristic	Ambient Reporting Requirements	Monitoring Requirements [1,2,3,4]	
	Daily Maximum	Measurement Frequency [5]	Sample Type
Hardness	Report mg/L	1/year	Grab
Total Residual Chlorine	Report mg/L	1/year	Grab
Alkalinity	Report mg/L	1/year	Grab
pH	Report S.U.	1/year	Grab
Specific Conductance	Report µmhos/cm	1/year	Grab
Total Solids	Report mg/L	1/year	Grab
Ammonia	Report mg/L	1/year	Grab
Total Organic Carbon	Report mg/L	1/year	Grab
Cadmium, Total Recoverable	Report mg/L	1/year	Grab
Lead, Total Recoverable	Report mg/L	1/year	Grab
Copper, Total Recoverable	Report mg/L	1/year	Grab
Zinc, Total Recoverable	Report mg/L	1/year	Grab
Nickel, Total Recoverable	Report mg/L	1/year	Grab
Aluminum, Total Recoverable	Report mg/L	1/year	Grab
Total Dissolved Solids	Report mg/L	1/year	Grab

See pages 5 and 6 for footnotes

Footnotes:

1. Samples taken in compliance with the monitoring requirements specified above shall be taken from the final chamber of the oil/water separator, prior to mixing with the receiving water. All samples shall be tested in accordance with the procedures in 40 CFR 136, unless specified elsewhere in the permit.

2. All samples (with the exception of dry weather sampling for *Escherichia coli* and sampling for WET testing) shall be taken during wet weather, during the first thirty (30) minutes of the discharge. Wet weather discharges are those resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least seventy-two (72) hours from the previously measureable (greater than 0.1 inch rainfall) storm event. Hourly rainfall depth for the 24-hour period preceding sampling events and any conditions that resulted in sufficient or insufficient flow for sampling shall be reported and supplied with appropriate sampling results. If collection of grab sample(s) during the first thirty minutes is impracticable, grab sample(s) shall be taken as soon after thirty (30) minutes as possible, and the Permittees shall submit with the monitoring report a description of why the collection of the grab sample(s) during the first thirty minutes was impracticable.

3. In accordance with 40 C.F.R. § 122.44(i)(1)(iv), the Permittees shall use sufficiently sensitive test procedures (i.e., methods) approved under 40 C.F.R. Part 136 or required under 40 C.F.R. Chapter I, Subchapter N or O, for the analysis of pollutants or pollutant parameters limited in this permit (except WET limits). A method is considered "sufficiently sensitive" when either (1) the method minimum level (ML) is at or below the level of the effluent limit established in this permit for the measured pollutant or pollutant parameter; or (2) the method has the lowest ML of the analytical methods approved under 40 C.F.R. Part 136 or required under 40 C.F.R. Chapter I, Subchapter N or O for the measured pollutant or pollutant parameter. The ML is not the minimum level of detection, but rather the lowest level at which the test equipment produces a recognizable signal and acceptable calibration point for a pollutant or pollutant parameter, representative of the lowest concentration at which a pollutant or pollutant parameter can be measured with a known level of confidence.

4. When a parameter is not detected above the minimum level of detection the Permittees must report the data qualifier signifying less than the minimum level of detection for that parameter (i.e. <50 µg/L, if the minimum level of detection for a parameter is 50 µg/L). For the purposes of this permit, the minimum level of detection is the lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions (i.e., the level above which an actual value is reported for an analyte, and the level below which an analyte is reported as non-detect).

5. Sampling frequency of 1/month is defined as the sampling of one (1) discharge event in each calendar month, when a discharge occurs. Sampling frequency of quarterly is defined as the sampling of one (1) discharge event in each calendar quarter (January to March; April to June; July to September; and October to December), when a discharge occurs. Sampling frequency of 1/year is defined as sampling of one (1) discharge event in each calendar year, when a discharge occurs. The Permittees shall submit the results to EPA of any additional testing done to that required herein, if it is conducted in accordance with EPA approved methods consistent with the provisions of 40 C.F.R. §122.41(l)(4)(ii). If no sampling result can be reported during one or more of the measurement frequencies defined above, the Permittees must report the appropriate No Data Indicator Code (e.g., "C" for "No Discharge").

6. Effluent flow shall be estimated for each monitoring event using accepted engineering techniques.

7. The pH of the effluent shall not be less than 6.5 standard units (S.U.) nor greater than 8.3 SU at any time. For effluent samples which fall outside the permitted pH range, the Permittees may collect stormwater samples from the same storm event from rain water or a site location not subject to contamination and record the pH. This will provide data documenting the pH of the stormwater, and potentially demonstrate pH exceedences due to sources other than the Permittees. If this sampling is performed, documentation of such conditions must be submitted by the Permittees with the discharge monitoring reports (DMRs).

8. *Escherichia coli* shall be sampled once per month during dry weather conditions. Dry weather conditions are defined as any time when there is no precipitation and no snow melt, and that is at least 48 hours after a storm event that was greater than 0.1 inches in magnitude. Also see Part B.6 below.

9. The Permittees shall conduct one WET test annually during the month of May, if practicable. WET test sampling shall be conducted during dry weather conditions, which are defined in footnote 8. The Permittees shall test the daphnid, Ceriodaphnia dubia, and the fathead minnow, Pimephales promelas. Toxicity test samples shall be collected during the month of May. The test results shall be submitted no later than the last day of the month following the completion of the test. If this WET test indicates toxicity (i.e.; LC50 < 100%), the Permittees shall conduct another WET test no later than the end of the following calendar quarter. In the event there is no dry weather discharge during the month of May or sampling in May is impracticable for another reason, the Permittees shall sample as soon as practicable thereafter, and submit the test results by the last day of the month following completion of the test, along with a statement attached to the DMR of why earlier WET sampling was impracticable. This toxicity testing must be performed in accordance with test procedures and protocols specified in Attachment A of the permit (Freshwater Acute Toxicity Test Procedure and Protocol).

10. If the toxicity test uses receiving water as diluent and the receiving water is found to be toxic or unreliable, the Permittees shall follow procedures outlined in Section IV (Dilution Water) of Attachment A in order to obtain permission to use an alternate dilution water. In lieu of individual approvals for alternate dilution water required in Attachment A, EPA-New England has developed a Self-Implementing Alternative Dilution Water Guidance document (called "Guidance Document") which may be used to obtain automatic approval of an alternate dilution water, including the appropriate species for use with that water. This guidance may be found at: https://www3.epa.gov/region1/npdes/permits/generic/Alternatedilutionwaterguidance.pdf. If this Guidance Document is revoked, the Permittees shall revert to obtaining approval as outlined in Attachment A. However, at any time, the Permittees may choose to contact EPA-New England directly using the approach outlined in Attachment A.

11. For each WET test, the Permittees shall report on the appropriate DMR the concentrations of the Hardness, Total Residual Chlorine, Alkalinity, pH, Specific Conductance, Total Solids, Total Dissolved Solids, Ammonia, Total Organic Carbon, Total Cadmium, Total Lead, Total Copper, Total Zinc, Total Nickel, and Total Aluminum found in the 100 percent effluent sample and the receiving water sample. Metals shall be reported as total recoverable concentrations. The Permittee should note that all chemical parameter results must still be reported in the appropriate toxicity report.

12. A composite sample shall consist of at least four (4) equal volume grab samples collected at 15 to 30 minute intervals, from the final chamber of the oil/water separator, during a normal discharge.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (continued)

2. The discharge shall not cause a violation of the water quality standards of the receiving water.

3. The discharge shall not contain floating, suspended or settleable solids.

4. The discharge shall not cause objectionable color or turbidity, or taste or odor.

5. The discharge shall be free from oil, grease, and petrochemicals that produce a visible film on the surface of the water.

6. The discharge shall not contain pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife.

7. The discharge of stormwater runoff from the orange line MBTA track area is prohibited.

8. The Permittees shall properly operate and maintain the pollution control equipment, including the removal of solids from the oil/water separator, catch basins, and other structures as warranted, at a frequency which will ensure proper operation at all times.

9. The Permittees shall not use fungicides or slimicides containing trichlorophenol or pentachlorophenol.

10. Routine external building wash down and wash water from periodic platform wash downs shall contain no detergents or added hazardous cleaning products (e.g., those containing bleach, hydrofluoric acid, muriatic acid, sodium hydroxide, or nonylphenols).

11. All existing manufacturing, commercial, mining and silvicultural dischargers must notify the Director as soon as they know or have reason to believe (40 C.F.R. §122.42):

    a. That any activity has occurred or will occur which would result in the discharge, on a routine basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

        (1) One hundred micrograms per liter (100 µg/l);
        (2) Two hundred micrograms per liter (200 µg/l) for acrolein and acrylonitrite; five hundred micrograms per liter (500 µg/l) for 2,4-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;
        (3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 C.F.R. §122.21(g)(7); or
        (4) Any other notification level established by the Director in accordance with 40 C.F.R. §122.44(f).

b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(1) 500 µg/l;
(2) One milligram per liter (1 mg/l) for antimony;
(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 C.F.R.§122.21(g)(7);
(4) Any other notification level established by the Director in accordance with 40 C.F.R. § 122.44(f).

12. This permit may be modified in accordance with 40 C.F.R. §122.62(a)(3) if the standards or regulations on which the permit is based have been changed by promulgation of amended standards or regulations or by judicial decision after the permit is issued in accordance with 40 C.F.R. §122.62(a)(3).

13. The use of chemicals at the facility which have the potential to discharge to the stormwater drainage system leading to the oil/water separator and discharging to Outfall 001 is prohibited except for the following chemical applications and activities:

a. Nitro Thermal Ice Melt® (potassium acetate-based) and/or other deicing compounds are applied to the platform areas during freezing weather conditions where build-up of ice or snow as a result of storm events may pose a safety hazard to passengers and operating personnel;
b. TD Garden staff apply Environmelt® (sodium chloride-based) in its service areas;
c. Gasoline in five-gallon containers is stored temporarily on-site during the winter months for use in snow removal equipment;
d. Soytrak® is applied as a dry lubricant to track switches (replaced the use of graphite);
e. Platform areas are periodically washed down with water. The discharge from this activity is directed to the storm drain system;
f. Storage and unloading of solid waste and refuse associated with food service activities at TD Garden takes place in the site's northeast, ground-level loading/unloading area; and
g. Diesel fuel is stored in a 2,000-gallon double walled aboveground storage tank (AST) which is housed in a small building structure located near the drainage system along the entrance to the facility garage. The tank is equipped with secondary containment having a capacity greater than the volume of the tank. The diesel is used to fuel an electric generator owned and operated by the MassDOT, servicing emergency power to the highway tunnels.

A listing of the specific chemicals and products used in the chemical applications and activities listed above shall be included in the Stormwater Pollution Prevention Plan (SWPPP) described in Part I.B.3.d below. To the extent that the SWPPP does not include all of the information listed below for existing chemicals used on the site, it shall be revised to do so within ninety (90) days of the effective date of the permit. If the Permittees propose to use other chemicals at this facility which have the potential to discharge to the stormwater drainage system leading to the oil/water separator and discharging to Outfall 001, the Permittees must notify the EPA and the SWPPP plan shall be updated to include the following information about each chemical:

- Product name, chemical formula, and manufacturer of the material;
- Purpose or use of the material;
- Safety Data Sheet (SDS) and Chemical Abstracts Service (CAS) Registry number for each material;
- The frequency (e.g., hourly, daily), duration (e.g., hours, days), quantity (e.g., maximum and average), and method of application for the material;
- The vendor's reported aquatic toxicity (NOAEL and/or LC50 in percent for aquatic organism(s)), when available; and
- An explanation which demonstrates that the addition of such chemicals: 1) will not add any pollutants in concentrations which exceed permit effluent limitations; 2) will not exceed any applicable water quality standard; and 3) will not add any pollutants that would justify the application of permit conditions that are different from or absent in this permit; or 4) an operator may demonstrate through sampling and analysis using sufficiently sensitive test methods that each of the 126 priority pollutants in CWA Section 307(a) and 40 CFR Part 423.15(j)(1) are non-detect in discharges with the addition of chemicals and/or additives.

B. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

Two of the co-Permittees, MBTA and Keolis, shall continue to jointly implement a Stormwater Pollution Prevention Plan (SWPPP). A separate SWPPP shall also be developed by the third co-Permittee, Delaware North Corporation (DNC), for property under its control which drains to the oil/water separator and discharges to Outfall 001. Alternatively, DNC can adopt the portions of the Keolis/MBTA SWPPP that apply to its operations and discharges.

1. The Permittees shall continue to implement and maintain a SWPPP designed to reduce, or prevent, the discharge of pollutants in stormwater to the receiving water identified in this permit. The SWPPP shall be a written document that is consistent with the terms of this permit. Additionally, the SWPPP shall serve as a tool to document the Permittees compliance with the terms of this permit.

2. The SWPPP shall be updated and certified by the Permittees within ninety (90) days after the effective date of this permit. The permittees shall certify that their SWPPP has been updated as necessary and shall be signed in accordance with the requirements identified in 40 C.F.R. §122.22. A copy of this initial certification shall be sent to EPA and MassDEP within one hundred and twenty (120) days of the effective date of this permit.

3. The SWPPP shall be designed in accordance with good engineering practices and shall be consistent with the general provisions for SWPPPs included in the most current version of the MSGP. In the current MSGP (effective June 4, 2015), the general SWPPP provisions are included in Part 5. Additionally, the Permittees shall incorporate into the SWPPP all the specific pollution control activities and other requirements found in the MSGP's Industrial

Sector P, Land Transportation and Warehousing, which apply to this site. Specifically, the SWPPP shall document the selection, design, and installation of control measures and contain the elements listed below:

a. A pollution prevention team with collective and individual responsibilities for developing, implementing, maintaining, revising and ensuring compliance with the SWPPP.
b. A site description which includes the activities at the facility; a general location map showing the facility, receiving waters, and outfall locations; and a site map showing the extent of significant structures and impervious surfaces, directions of stormwater flows, and locations of all existing structural control measures, stormwater conveyances, pollutant sources (identified in Part 3.c. below), stormwater monitoring points, stormwater inlets and outlets, and industrial activities exposed to precipitation such as, storage, disposal, material handling.
c. A summary of all pollutant sources which includes a list of activities exposed to stormwater, the pollutants associated with these activities, a description of where spills have occurred or could occur, a description of non-stormwater discharges, and a summary of any existing stormwater discharge sampling data.
d. A listing of all chemicals and products used on the site which have the potential to be discharged to the stormwater drainage system, with the information listed in Part I.A.13 above provided for each chemical and product.
e. A description of all stormwater controls, both structural and non-structural.
f. A schedule and procedure for implementation and maintenance of the control measures described above and for the quarterly inspections and best management practices (BMPs) described below.
g. Sector-specific SWPPP provisions included in Sector P- Land Transportation and Warehousing of the MSGP.

4. The SWPPP shall describe and document the BMPs implemented or to be implemented at the facility to comply with the provisions of Parts I.A.7, I.A.8, I.A.9, I.A.10, and I.B. of this permit to minimize the discharge of pollutants in stormwater to waters of the United States. At a minimum, these BMPs shall be consistent with the control measures described in the most current version of the MSGP. In the current MSGP (effective June 4, 2015), these control measures are described in Part 2.1.2. and Part 8.P. BMPs must be selected and implemented to satisfy the following effluent limitations:

   a. Minimize exposure of manufacturing, processing, and material storage areas to stormwater discharges.
   b. Implement good housekeeping measures designed to maintain areas that are potential sources of pollutants.
   c. Conduct routine preventative maintenance to avoid leaks, spills, and other releases of pollutants in stormwater discharged to receiving waters.
   d. Implement spill prevention and response procedures to ensure effective response to spills and leaks if or when they occur.
   e. Control erosion and sediment pollution by stabilizing exposed areas and containing runoff using structural and/or non-structural control measures to minimize onsite erosion and sedimentation, and the resulting discharge of pollutants.

f. Implement runoff management practices to divert, infiltrate, reuse, contain, or otherwise reduce stormwater runoff.
g. Implement proper handling procedures for salt, materials containing chlorides, or other commercial products that are used for snow and ice control.
h. Conduct training for all employees who work in areas where industrial materials or activities are exposed to stormwater, or who are responsible for implementing activities necessary to meet the conditions of this permit (e.g., inspectors, maintenance personnel).
i. Implement the sector specific BMPs included in Sector P – Land Transportation and Warehousing

5. All areas with industrial materials or activities exposed to stormwater and all structural controls used to comply with effluent limits in this permit shall be inspected, at least once per quarter, by qualified personnel with one or more members of the stormwater pollution prevention team. These shall include facility maintenance and seasonal activities. These inspections shall begin during the 1st full quarter after the effective date of this permit. EPA considers quarters to be the following: January to March; April to June; July to September; and October to December. Each inspection must include a visual assessment of stormwater samples from Outfall 001, which shall be collected within the first 30 minutes of discharge from a storm event, stored in a clean, clear glass or plastic container, and examined in a well-lit area for the following water quality characteristics: color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of pollution. The Permittees shall document the following information for each inspection and maintain the records along with the SWPPP:

a. The date and time of the inspection and at which any samples were collected;
b. The name(s) and signature(s) of the inspector(s)/sample collector(s);
c. If applicable, why it was not possible to take samples within the first 30 minutes;
d. Weather information and a description of any discharges occurring during the inspection;
e. Results of observations of stormwater discharges, including any observed discharges of pollutants and the probable sources of those pollutants;
f. Any control measures needing maintenance, repairs or replacement; and,
g. Any additional control measures needed to comply with the permit requirements.

6. A geometric mean of all *E. coli* samples taken within the most recent six months of 126 colony forming units (cfu) per 100 ml for *E.coli*, which is found in the Massachusetts State Water Quality Standards (MASWQS), shall serve as the benchmark to trigger additional source identification, source reduction and/or treatment to attempt to reduce the discharge levels of *E. coli*. Upon becoming aware of an exceedance of this *E. coli* benchmark, the Permittee must re-sample Outfall 001 for *E.coli* within three weeks, reassess the SWPPP within 30 days, and implement additional measures to further identify and/or reduce the effluent levels of *E. coli* within 60 days. By March 1 of each year, the Permittee shall submit as a DMR attachment, a Bacteria Reduction Report that includes the following information:

a. All wet and dry weather sampling results for *E.coli* at the facility for the previous calendar year, including any sampling not conducted at Outfall 001.

b. An information summary of these sampling results, including monthly maximums and ranges, the geometric mean of all applicable samples taken at Outfall 001; any exceedances of the *E. coli* benchmark; trends within the previous calendar year and since the effective date of the permit.
c. The additional source identification, source reduction and/or treatment to attempt to reduce the discharge of *E. coli*.
d. An assessment of the results and effectiveness of possible additional source identification, source reduction, and/or treatment to attempt to reduce the discharge of *E. coli*.

7. The Permittees shall amend and update the SWPPP within fourteen (14) days of any changes at the facility that result in a significant effect on the potential for the discharge of pollutants to the waters of the United States. Such changes may include, but are not limited to: a change in design, construction, operation, or maintenance, materials storage, or activities or chemicals used at the facility; a release of a reportable quantity of pollutants as described in 40 CFR §302; or a determination by the Permittees or EPA that the BMPs included in the SWPPP are ineffective in achieving the general objective of controlling pollutants in stormwater discharges associated with industrial activity.

8. Any amended, modified, or new versions of the SWPPP shall be re-certified and signed by the Permittees in accordance with the requirements identified in 40 C.F.R. §122.22. The Permittees shall also certify, at least annually, that the previous year's inspections and maintenance activities were conducted, results recorded, records maintained, and that the facility is in compliance with this permit. If the facility is not in compliance with any aspect of this permit, the annual certification shall state the non-compliance and the remedies which are being undertaken. Such annual certifications also shall be signed in accordance with the requirements identified in 40 C.F.R. §122.22. The Permittees shall maintain at the facility a copy of their current SWPPP and all SWPPP certifications (the initial certification, re-certifications, and annual certifications) signed during the effective period of this permit, and shall make these available for inspection by EPA and MassDEP upon request. In addition, the Permittees shall document in the SWPPP any violation of numerical or non-numerical stormwater effluent limits with a date and description of the corrective actions taken.

9. The Permittees shall develop and implement site specific BMPs, consistent with the sector specific BMPs in Sector P (Land Transportation and Warehousing) of the MSGP. At a minimum, the Permittees shall inspect and maintain the absorbent pads for track areas where locomotives stop (to capture incidental drips of oil from the trains) and the oil/water separator, both on a weekly basis.

C. Dry Weather Outfall and Stormwater Drainage System Screening

1. All outfalls and interconnections to the stormwater drainage system shall be inspected for the presence of dry weather flow within three (3) years of the effective date of the permit. This screening program and all relevant data and findings shall be summarized in a report and attached to the DMR for the particular month when it is completed, no later than three (3) years of the effective date of the permit.

2. The Permittees (MBTA and Keolis) shall develop an outfall and stormwater drainage system screening and sampling program within one (1) year of the permit's effective date. This program shall include procedures for sample collection, use of field kits, and storage and conveyance of samples, including relevant hold times.

3. Dry weather screening and sampling shall proceed only when no more than 0.1 inches of rainfall has occurred in the previous 48-hour period and no significant snow melt is occurring.

4. If an outfall or drainage system connection is inaccessible or submerged, the Permittees shall proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results.

5. If no flow is observed, but evidence of illicit flow exists, the Permittees shall revisit the outfall or connection during dry weather within one (1) week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow.

6. Where dry weather flow is found at an outfall or connection, at least one (1) sample shall be collected and analyzed at a minimum for:

   - ammonia,
   - chlorine,
   - conductivity,
   - salinity,
   - *E. coli*,
   - surfactants (such as MBAS), and
   - temperature

   All analyses for these parameters, with the exception of *E. coli*, can be performed with field test kits or field instrumentation and are not subject to 40 CFR part 136 requirements. Sampling for *E. coli* shall be conducted using the analytical methods found in 40 C.F.R. §136, or alternative methods approved by EPA in accordance with the procedures in 40 C.F.R. §136. Sampling for ammonia and surfactants must use sufficiently sensitive methods to detect those parameters at or below the threshold indicator concentrations of 0.5 mg/L for ammonia and 0.25 mg/L for surfactants. Sampling for residual chlorine must use a method with a detection limit of 0.02 mg/L or 20 ug/L.

7. Upon detection of an illicit discharge, the Permittees shall locate, identify and eliminate the illicit discharge as expeditiously as possible. Upon identification of the illicit source, the Permittees shall notify any other responsible parties for any such discharge. The identified improper disposal practices shall cease immediately to the extent allowable by law and feasibility in accordance with such party's legal authority, if applicable. Where elimination of an illicit discharge within sixty (60) days of its identification as an illicit discharge is not possible, the Permittees shall establish an expeditious schedule for its elimination and report the dates of identification and schedule(s) for removal in the Permittees's report described in Part I.C.1, or as a NetDMR attachment. The Permittees shall immediately commence actions necessary for elimination and shall diligently pursue elimination of all illicit discharges.

D. Source Identification and Reduction Plan (SIRP)

The Permittees (MBTA and Keolis) shall continue to implement the Source Identification and Reduction Plan (SIRP) that was required by the 2010 permit for the pollutants iron, magnesium, manganese, pathogenic bacteria, and COD. The goal of the SIRP is to reduce, to the maximum extent possible, the discharge of these pollutants from the facility. The BMPs that were developed in conjunction with the SIRP shall continue to be implemented and are as follows, at a minimum:

1. The Permittees shall minimize the exposure of significant materials to stormwater. To the extent practicable, the Permittees shall store all material indoors or protect such material with weather resistant covers, to minimize exposure to rain and wind.

2. The Permittees shall clean all storm sewer lines and appurtenances discharging to Outfall 001 on an annual basis, or more frequently if necessary. This includes the cleaning of pipes, culverts, catch basins, or other structures located along the entire alignment of the storm sewer system discharging to Outfall 001. The Permittees shall utilize equipment and methods designed to capture all liquids and solids generated during the cleaning process and dispose of all accumulated wastewater and solid waste in accordance with Massachusetts solid waste regulations. The Permittees shall maintain records detailing the accounting of the material removed from each cleaning operation.

3. The Permittees shall maintain the silt sacks that were installed into catch basins leading to the oil/water separator discharging to Outfall 001 or implement an equivalent measure which minimizes the discharge of solids to the storm drainage system leading to this discharge. The Permittees shall maintain records documenting the inspection, cleaning and replacement practices for the installed silt sacks or other measures that are employed.

4. The Permittees shall use vacuum equipment to sweep all paved or impervious areas of its property draining to Outfall 001 where solids deposition may occur, including roads, driveways, parking areas, sidewalks, and loading areas. At a minimum, sweeping shall be completed monthly during the months of March through November. During the months of December, January, and February, when weather conditions prevent fulfillment of the required minimum sweeping frequency, the Permittees may adjust or lengthen its scheduled frequency to accommodate sweeping during available periods of acceptable thaw. The Permittees shall ensure that sweepings collected at its facility are reused or disposed in a manner consistent with MassDEP's Policy #BWP-94-092: Reuse and Disposal of Street Sweepings.[1]

5. The Permittees shall use reasonable efforts to mitigate potential water quality impacts of deicing chemicals that may be discharged to the receiving water. This shall include, but not be limited to, reasonable adjustments to the type and application (i.e., materials, mode, and timing) of deicing chemicals, minimizing the use of deicing chemicals, and the placement of snow piles in accordance with MassDEP's Snow Disposal Guidance No. BRPG01-01.[2] The Permittees shall continue to implement, and revise as necessary, the deicing technical memorandum that was submitted by the Permittees pursuant to the 2010 permit and that was dated September 10, 2010.

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[1] http://www.mass.gov/eea/docs/dep/recycle/laws/stsweep.pdf

[2] http://www.mass.gov/eea/agencies/massdep/water/regulations/snow-disposal-guidance.html

E. Phosphorous Control Plan (PCP)

The Permittees shall develop and implement the following site-specific BMPs for phosphorus:

1. The Permittees shall estimate the average annual phosphorus load to the permitted outfall using the export rates that are provided in Attachment C.

2. The Permittees shall develop a Phosphorous Control Plan (PCP) and update the PCP as necessary during the permit term. The PCP shall describe measures the Permittees will undertake to reduce the average annual baseline phosphorus load (calculated above in Part E.1. above, using Attachment C) by at least 62%.

    a. Non-structural controls: The Permittees shall describe the non-structural stormwater control measures to be implemented, in conjunction with the structural controls below, to support the achievement of the required phosphorus reductions. The description of non-structural controls shall include the planned measures, the areas where the measures will be implemented, and the annual phosphorus reductions that are expected to result from their implementation. Annual phosphorus reduction from non-structural BMPs shall be calculated consistent with Attachment B, Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs.

    b. Planned structural controls: The Permittees shall describe the structural stormwater control practices necessary to support achievement of the required phosphorus reduction, in conjunction with the non-structural controls above. The description of structural controls shall include the planned controls, the drainage areas tributary to where the controls will be implemented, and the annual phosphorus reductions in units of mass per year that are expected to result from their implementation. Annual phosphorus reduction from structural BMPs shall be calculated consistent with Attachment C.

3. Within one (1) year of the effective date of the permit, the Permittees shall complete the estimation of the average annual phosphorus load to the permitted outfall using the export rates that are provided in Attachment C, using the same method for calculating the BMP phosphorus load for all tributary drainage area discharging through Outfall 001. Within 1.5 years of the effective date of the permit, the Permittees shall complete the PCP. Within 2.5 years of the effective date of the permit, the Permittees shall complete implementation of the identified non-structural practices. Within 3.5 years of the effective date of the permit, the Permittees shall complete construction, installation and inspection of the structural practices. Within 4.5 years of the effective date of the permit, the Permittees shall begin certification of annual inspection and O&M associated with these practices. Also within 4.5 years of the effective date of the permit, the Permittees shall submit a PCP Implementation Report to EPA and MassDEP detailing compliance with the requirements of the PCP and describing ongoing activities and schedules such as for those regarding annual inspections, O&M of BMPs, and updates of the annual phosphorus loading estimates for the permitted outfall.

F. REPORTING REQUIREMENTS

The monitoring program in the permit specifies sampling and analysis, which will provide continuous information on compliance and the reliability and effectiveness of the installed pollution abatement equipment. The approved analytical procedures found in 40 C.F.R. §136 are required unless other procedures are explicitly required in the permit. The Permittees are obligated to monitor and report sampling results to EPA and the MassDEP within the time frames specified within the permit.

Unless otherwise specified in this permit, the Permittees shall submit reports, requests, and information and provide notices in the manner described in this section.

1. Submittal of DMRs and the Use of NetDMR

   Beginning the effective date of the permit, the Permittees must submit their monthly monitoring data in discharge monitoring reports (DMRs) to EPA and MassDEP no later than the 15th day of the month following the completed reporting period using NetDMR. NetDMR is a web-based tool that allows Permittees to electronically submit DMRs and other required reports via a secure internet connection and can be accessed at: http://www.epa.gov/netdmr.

2. Submittal of Reports as NetDMR Attachments

   The Permittees shall electronically submit all reports to EPA as NetDMR attachments rather than as hard copies, unless otherwise specified in this permit. The Permittees shall continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP. (See Part I.F.5. below for more information on state reporting.) Because the due dates for reports described in this permit may not coincide with the due date for submitting DMRs (which is no later than the 15th day of the month), a report submitted electronically as a NetDMR attachment shall be considered timely if it is electronically submitted to EPA using NetDMR with the next DMR due following the particular report due date specified in this permit.

3. Submittal of Requests and Reports to EPA/Office of Ecosystem Protection (OEP)

   The following requests, reports, and information described in this permit shall be submitted to the EPA/OEP NPDES Applications Coordinator in the EPA's OEP:

   (1) Transfer of Permit Notice;

   (2) Request for changes in sampling location;

   (3) Report on unacceptable dilution water/request for alternative dilution water for WET testing.

   These reports, information, and requests shall be submitted to EPA/OEP electronically at R1NPDES.Notices.OEP@epa.gov or by hard copy mail to the following address:

U.S. Environmental Protection Agency
Office of Ecosystem Protection
EPA/OEP NPDES Applications Coordinator
5 Post Office Square - Suite 100 (OEP06-03)
Boston, MA 02109-3912

4. Submittal of Reports in Hard Copy Form

The following notifications and reports shall be signed and dated originals, submitted in hard copy, with a cover letter describing the submission:

(1) Written notifications required under Part II;

(2) Notice of unauthorized discharges.

This information shall be submitted to EPA/OES at the following address:

U.S. Environmental Protection Agency
Office of Environmental Stewardship (OES)
Water Technical Unit
5 Post Office Square, Suite 100 (OES4-SMR)
Boston, MA 02109-3912

5. State Reporting

Transfer or termination of permit notices shall be submitted to:

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Wastewater Management Program
1 Winter Street, 5th Floor
Boston, MA 02108

Unless otherwise specified in this permit, duplicate signed copies of all reports, information, requests or notifications described in this permit, including the reports, information, requests or notifications described in Parts I.F.3, and I.F.4 also shall be submitted to the State at the following address:

Massachusetts Department of Environmental Protection
Northeast Regional Office
Bureau of Air and Waste
205B Lowell Street
Wilmington, Massachusetts 01887

Copies of WET test reports ONLY shall be submitted to:

Massachusetts Department of Environmental Protection
Watershed Planning Program
8 New Bond Street
Worcester, Massachusetts 01606

6. Verbal Reports and Verbal Notifications

Any verbal reports or verbal notifications, if required in Parts I and/or II of this permit, shall be made to both EPA and to MassDEP. This includes verbal reports and notifications which require reporting within 24 hours. (As examples, see Part II.B.4.c.(2), Part II.B.5.c.(3), and Part II.D.1.e.) Verbal reports and verbal notifications shall be made to EPA's Office of Environmental Stewardship at: **617-918-1510**

G. STATE PERMIT CONDITIONS

1. This authorization to discharge includes two separate and independent permit authorizations. The two permit authorizations are (i) a federal National Pollutant Discharge Elimination System permit issued by the U.S. Environmental Protection Agency (EPA) pursuant to the Federal Clean Water Act, 33 U.S.C. §§1251 et seq.; and (ii) an identical state surface water discharge permit issued by the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP) pursuant to the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and 314 C.M.R. 3.00. All of the requirements contained in this authorization, as well as the standard conditions contained in 314 CMR 3.19, are hereby incorporated by reference into this state surface water discharge permit.

2. This authorization also incorporates the state water quality certification issued by MassDEP under § 401(a) of the Federal Clean Water Act, 40 C.F.R. 124.53, M.G.L. c. 21, § 27 and 314 CMR 3.07. All of the requirements (if any) contained in MassDEP's water quality certification for the permit are hereby incorporated by reference into this state surface water discharge permit as special conditions pursuant to 314 CMR 3.11.

3. Each agency shall have the independent right to enforce the terms and conditions of this permit. Any modification, suspension or revocation of this permit shall be effective only with respect to the agency taking such action, and shall not affect the validity or status of this permit as issued by the other agency, unless and until each agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this permit is declared invalid, illegal or otherwise issued in violation of state law such permit shall remain in full force and effect under federal law as a NPDES permit issued by the U.S. Environmental Protection Agency. In the event this permit is declared invalid, illegal or otherwise issued in violation of federal law, this permit shall remain in full force and effect under state law as a permit issued by the Commonwealth of Massachusetts.

USEPA REGION 1 FRESHWATER ACUTE
TOXICITY TEST PROCEDURE AND PROTOCOL

I. GENERAL REQUIREMENTS

The permittee shall conduct acceptable acute toxicity tests in accordance with the appropriate test protocols described below:

- **Daphnid (Ceriodaphnia dubia) definitive 48 hour test.**
- **Fathead Minnow (Pimephales promelas) definitive 48 hour test.**

Acute toxicity test data shall be reported as outlined in Section VIII.

II. METHODS

The permittee shall use 40 CFR Part 136 methods. Methods and guidance may be found at:

http://water.epa.gov/scitech/methods/cwa/wet/disk2_index.cfm

The permittee shall also meet the sampling, analysis and reporting requirements included in this protocol. This protocol defines more specific requirements while still being consistent with the Part 136 methods. If, due to modifications of Part 136, there are conflicting requirements between the Part 136 method and this protocol, the permittee shall comply with the requirements of the Part 136 method.

III. SAMPLE COLLECTION

A discharge sample shall be collected. Aliquots shall be split from the sample, containerized and preserved (as per 40 CFR Part 136) for chemical and physical analyses required. The remaining sample shall be measured for total residual chlorine and dechlorinated (if detected) in the laboratory using sodium thiosulfate for subsequent toxicity testing. (Note that EPA approved test methods require that samples collected for metals analyses be preserved immediately after collection.) Grab samples must be used for pH, temperature, and total residual chlorine (as per 40 CFR Part 122.21).

Standard Methods for the Examination of Water and Wastewater describes dechlorination of samples (APHA, 1992). Dechlorination can be achieved using a ratio of 6.7 mg/L anhydrous sodium thiosulfate to reduce 1.0 mg/L chlorine. If dechlorination is necessary, a thiosulfate control (maximum amount of thiosulfate in lab control or receiving water) must also be run in the WET test.

All samples held overnight shall be refrigerated at 1- 6^{o}C.

IV. DILUTION WATER

A grab sample of dilution water used for acute toxicity testing shall be collected from the receiving water at a point immediately upstream of the permitted discharge's zone of influence at a reasonably accessible location. Avoid collection near areas of obvious road or agricultural runoff, storm sewers or other point source discharges and areas where stagnant conditions exist. In the case where an alternate dilution water has been agreed upon an additional receiving water control (0% effluent) must also be tested.

If the receiving water diluent is found to be, or suspected to be toxic or unreliable, an alternate standard dilution water of known quality with a hardness, pH, conductivity, alkalinity, organic carbon, and total suspended solids similar to that of the receiving water may be substituted **AFTER RECEIVING WRITTEN APPROVAL FROM THE PERMIT ISSUING AGENCY(S)**. Written requests for use of an alternate dilution water should be mailed with supporting documentation to the following address:

Director
Office of Ecosystem Protection (CAA)
U.S. Environmental Protection Agency-New England
5 Post Office Sq., Suite 100 (OEP06-5)
Boston, MA 02109-3912

and

Manager
Water Technical Unit (SEW)
U.S. Environmental Protection Agency
5 Post Office Sq., Suite 100 (OES04-4)
Boston, MA 02109-3912

Note: USEPA Region 1 retains the right to modify any part of the alternate dilution water policy stated in this protocol at any time. Any changes to this policy will be documented in the annual DMR posting.

See the most current annual DMR instructions which can be found on the EPA Region 1 website at http://www.epa.gov/region1/enforcement/water/dmr.html *for further important details on alternate dilution water substitution requests.*

It may prove beneficial to have the proposed dilution water source screened for suitability prior to toxicity testing. EPA strongly urges that screening be done prior to set up of a full definitive toxicity test any time there is question about the dilution water's ability to support acceptable performance as outlined in the 'test acceptability' section of the protocol.

V. TEST CONDITIONS

The following tables summarize the accepted daphnid and fathead minnow toxicity test conditions and test acceptability criteria:

EPA NEW ENGLAND EFFLUENT TOXICITY TEST CONDITIONS FOR THE DAPHNID, CERIODAPHNIA DUBIA 48 HOUR ACUTE TESTS[1]

1.	Test type	Static, non-renewal
2.	Temperature (^oC)	20 $\pm$ 1^oC or 25 $\pm$ 1^oC
3.	Light quality	Ambient laboratory illumination
4.	Photoperiod	16 hour light, 8 hour dark
5.	Test chamber size	Minimum 30 ml
6.	Test solution volume	Minimum 15 ml
7.	Age of test organisms	1-24 hours (neonates)
8.	No. of daphnids per test chamber	5
9.	No. of replicate test chambers per treatment	4
10.	Total no. daphnids per test concentration	20
11.	Feeding regime	As per manual, lightly feed YCT and Selenastrum to newly released organisms while holding prior to initiating test
12.	Aeration	None
13.	Dilution water[2]	Receiving water, other surface water, synthetic water adjusted to the hardness and alkalinity of the receiving water (prepared using either Millipore Milli-Q[R] or equivalent deionized water and reagent grade chemicals according to EPA acute toxicity test manual) or deionized water combined with mineral water to appropriate hardness.
14.	Dilution series	$\geq$ 0.5, must bracket the permitted RWC
15.	Number of dilutions	5 plus receiving water and laboratory water control and thiosulfate control, as necessary. An additional dilution at the permitted effluent concentration (% effluent) is required if it is not included in the dilution

		series.
16.	Effect measured	Mortality-no movement of body or appendages on gentle prodding
17.	Test acceptability	90% or greater survival of test organisms in dilution water control solution
18.	Sampling requirements	For on-site tests, samples must be used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples must first be used within 36 hours of collection.
19.	Sample volume required	Minimum 1 liter

Footnotes:

1. Adapted from EPA-821-R-02-012.
2. Standard prepared dilution water must have hardness requirements to generally reflect the characteristics of the receiving water.

EPA NEW ENGLAND TEST CONDITIONS FOR THE FATHEAD MINNOW (PIMEPHALES PROMELAS) 48 HOUR ACUTE TEST[1]

1.	Test Type	Static, non-renewal
2.	Temperature (^oC)	$20 \pm 1\ ^o$ C or 25 ± 1^oC
3.	Light quality	Ambient laboratory illumination
4.	Photoperiod	16 hr light, 8 hr dark
5.	Size of test vessels	250 mL minimum
6.	Volume of test solution	Minimum 200 mL/replicate
7.	Age of fish	1-14 days old and age within 24 hrs of each other
8.	No. of fish per chamber	10
9.	No. of replicate test vessels per treatment	4
10.	Total no. organisms per concentration	40
11.	Feeding regime	As per manual, lightly feed test age larvae using concentrated brine shrimp nauplii while holding prior to initiating test
12.	Aeration	None, unless dissolved oxygen (D.O.) concentration falls below 4.0 mg/L, at which time gentle single bubble aeration should be started at a rate of less than 100 bubbles/min. (Routine D.O. check is recommended.)
13.	dilution water[2]	Receiving water, other surface water, synthetic water adjusted to the hardness and alkalinity of the receiving water (prepared using either Millipore Milli-Q[R] or equivalent deionized and reagent grade chemicals according to EPA acute toxicity test manual) or deionized water combined with mineral water to appropriate hardness.
14.	Dilution series	$\geq$ 0.5, must bracket the permitted RWC

15.	Number of dilutions	5 plus receiving water and laboratory water control and thiosulfate control, as necessary. An additional dilution at the permitted effluent concentration (% effluent) is required if it is not included in the dilution series.
16.	Effect measured	Mortality-no movement on gentle prodding
17.	Test acceptability	90% or greater survival of test organisms in dilution water control solution
18.	Sampling requirements	For on-site tests, samples must be used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples are used within 36 hours of collection.
19.	Sample volume required	Minimum 2 liters

Footnotes:

1. Adapted from EPA-821-R-02-012
2. Standard dilution water must have hardness requirements to generally reflect characteristics of the receiving water.

VI. CHEMICAL ANALYSIS

At the beginning of a static acute toxicity test, pH, conductivity, total residual chlorine, oxygen, hardness, alkalinity and temperature must be measured in the highest effluent concentration and the dilution water. Dissolved oxygen, pH and temperature are also measured at 24 and 48 hour intervals in all dilutions. The following chemical analyses shall be performed on the 100 percent effluent sample and the upstream water sample for each sampling event.

Parameter	Effluent	Receiving Water	ML (mg/l)
Hardness[1]	x	x	0.5
Total Residual Chlorine (TRC)[2, 3]	x		0.02
Alkalinity	x	x	2.0
pH	x	x	--
Specific Conductance	x	x	--
Total Solids	x		--
Total Dissolved Solids	x		--
Ammonia	x	x	0.1
Total Organic Carbon	x	x	0.5
Total Metals			
Cd	x	x	0.0005
Pb	x	x	0.0005
Cu	x	x	0.003
Zn	x	x	0.005
Ni	x	x	0.005
Al	x	x	0.02
Other as permit requires			

Notes:

1. Hardness may be determined by:
   - APHA Standard Methods for the Examination of Water and Wastewater , 21st Edition
     - Method 2340B (hardness by calculation)
     - Method 2340C (titration)
2. Total Residual Chlorine may be performed using any of the following methods provided the required minimum limit (ML) is met.
   - APHA Standard Methods for the Examination of Water and Wastewater , 21st Edition
     - Method 4500-CL E Low Level Amperometric Titration
     - Method 4500-CL G DPD Colorimetric Method
3. Required to be performed on the sample used for WET testing prior to its use for toxicity testing.

VII. TOXICITY TEST DATA ANALYSIS

LC50 Median Lethal Concentration (Determined at 48 Hours)

Methods of Estimation:
- Probit Method
- Spearman-Karber
- Trimmed Spearman-Karber
- Graphical

See the flow chart in Figure 6 on p. 73 of EPA-821-R-02-012 for appropriate method to use on a given data set.

No Observed Acute Effect Level (NOAEL)

See the flow chart in Figure 13 on p. 87 of EPA-821-R-02-012.

VIII. TOXICITY TEST REPORTING

A report of the results will include the following:

- Description of sample collection procedures, site description
- Names of individuals collecting and transporting samples, times and dates of sample collection and analysis on chain-of-custody
- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests; light and temperature regime; other information on test conditions if different than procedures recommended. Reference toxicant test data should be included.
- All chemical/physical data generated. (Include minimum detection levels and minimum quantification levels.)
- Raw data and bench sheets.
- Provide a description of dechlorination procedures (as applicable).
- Any other observations or test conditions affecting test outcome.

ATTACHMENT B

Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs

The permittee shall use the following methods to calculate phosphorus 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 (if applicable)

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

The methods and annual phosphorus 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. Table 1-1 below provides annual phosphorus 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.

Examples are provided to illustrate use of the methods. In calculating phosphorus 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 loads. Table 1-2 provides a crosswalk table of land use codes between land use groups in Table 1-1 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.

<u>Alternative Methods and/or Phosphorus Reduction Factors</u>: A permittee may propose alternative methods and/or phosphorus reduction factors for calculating phosphorus load reduction credits for these non-structural practices. EPA will consider alternative methods and/or phosphorus 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 phosphorus 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 phosphorus reduction credit other than a reduction credit calculated by the permittee following the methods in this attachment for the identified practices.

Table 1-1: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits

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 1-2: 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
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

<u>(1) Enhanced Sweeping Program</u>: The permittee may earn a phosphorus reduction credit for conducting an enhanced sweeping program of impervious surfaces. Table 1-2 below outlines the default phosphorus removal factors for enhanced sweeping programs. The credit shall be calculated by using the following equation:

$$Credit_{sweeping} = IA_{swept} \times PLE_{IC\text{-}land\ use} \times PRF_{sweeping} \times AF \qquad \textbf{(Equation 1-1)}$$

<u>Where:</u>

$Credit_{sweeping}$	=	Amount of phosphorus load removed by enhanced sweeping program (lb/year)
IA_{swept}	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
$PLE_{IC\text{-}land\ use}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 1-1)
$PRF_{sweeping}$	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 1-3).
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 using long-term local rainfall data.

Table 1-3: Phosphorus reduction efficiency factors ($PRF_{sweeping}$) for sweeping impervious areas

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02
Monthly	Mechanical Broom	0.03
Monthly	Vacuum Assisted	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08
Weekly	Mechanical Broom	0.05
Weekly	Vacuum Assisted	0.08
Weekly	High Efficiency Regenerative Air-Vacuum	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 1-1: Calculation of enhanced sweeping program credit (Credit $_{sweeping}$): 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 is:

IA_{swept} = 20.3 acres
$PLE_{IC\text{-}HDR}$ = 2.32 lb/acre/yr (from Table 1-1)
$PRF_{sweeping}$ = 0.08 (from Table 2-3)
AF = (9 months / 12 months) = 0.75

Substitution into equation 1-1 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

(2) Catch Basin Cleaning: The permittee may earn a phosphorus reduction credit, Credit $_{CB}$, 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 credit shall be calculated by using the following equation:

$$Credit_{CB} = IA_{CB} \times PLE_{IC\text{-}land\ use} \times PRF_{CB} \quad \textbf{(Equation 1-2)}$$

Where:

$Credit_{CB}$ = Amount of phosphorus load removed by catch basin cleaning (lb/year)
IA_{CB} = Impervious drainage area to catch basins (acres)
$PLE_{IC\text{-}and\ use}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 1-1)
PRF_{CB} = Phosphorus Reduction Factor for catch basin cleaning (see Table 1-4)

Table 1-4: Phosphorus reduction efficiency factor (PRF $_{CB}$) for semi-annual catch basin cleaning

Frequency	Practice	PRF $_{CB}$
Semi-annual	Catch Basin Cleaning	0.02

<u>Example 1-2: Calculation for catch basin cleaning credit (Credit $_{CB}$):</u>
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 is:

IA_{CB} = 15.3 acre
$PLE_{IC\text{-}MDR}$ = 1.96 lbs/acre/yr (from Table 1-1)
PRF_{CB} = 0.02 (from Table 1-4)

Substitution into equation 1-2 yields a Credit $_{CB}$ of 0.6 pounds of phosphorus removed per year:

$$\text{Credit}_{CB} = IA_{CB} \times PLE_{IC\text{-}MDR} \times PRF_{CB}$$
$$= 15.3 \text{ acre} \times 1.96 \text{ lbs/acre/yr} \times 0.02$$
$$\mathbf{= 0.6\ lbs/yr}$$

<u>(3) Enhanced Organic Waste and Leaf Litter Collection program</u>: The permittee may earn a phosphorus reduction credit 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 $_{\text{leaf litter}}$), 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 $_{\text{leaf litter}}$ shall be determined by the following equation:

$$\text{Credit}_{\text{leaf litter}} = (\text{Watershed Area}) \times (PLE_{IC\text{-land use}}) \times (0.05) \qquad \textbf{(Equation 1-3)}$$

<u>Where:</u>
Credit $_{\text{leaf litter}}$ = Amount of phosphorus load reduction credit for organic waste and leaf litter collection program (lb/year)
Watershed Area = All impervious area (acre) from which runoff discharges to the TMDL waterbody or its tributaries in the Watershed
$PLE_{IC\text{-land use}}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs/acre/yr) (see Table 1-1)
0.05 = 5% phosphorus reduction factor for organic waste and leaf litter collection program in the Watershed

Example 1-3: 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 $Credit_{leaf\ litter}$ is:

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

Substitution into equation 2-4 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

The permittee also may earn a phosphorus reduction 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:

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

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

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

ATTACHMENT C

Methods to Calculate Phosphorus Load Reductions for Structural Stormwater Controls (SWSCs)

List of Tables

List of Figures

Methods to Calculate Phosphorus Load Reductions for Structural Stormwater Controls

This attachment provides methods to determine design storage volume capacities and to calculate phosphorus load reductions for the following structural stormwater controls (structural SWCs):

1) Infiltration Trench;
2) Surface Infiltration Practices (i.e., basins, rain gardens and bio-retention);
3) Bio-filtration Practice;
4) Gravel Wetland System;
5) Enhanced Bio-filtration with Internal Storage Reservoir (ISR);
6) Sand Filter;
7) Porous Pavement;
8) Wet Pond or wet detention basin;
9) Dry Pond or detention basin; and
10) Dry Water Quality Grass Swale with Detention.

Additionally, this attachment provides methods to design and quantify associated phosphorus load reduction credits for the following four types of semi-structural SWCs

11) Impervious Area Disconnection through Storage (e.g., rain barrels, cisterns, etc.);
12) Impervious Area Disconnection;
13) Conversions of Impervious Area to Permeable Pervious Area; and
14) Soil Amendments to Enhance Permeability of Pervious Areas.

Methods and examples are provided in this Attachment to calculate phosphorus load reductions for structural SWCs for the four following purposes:

1) To determine the design volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area is 100% impervious;
2) To determine the phosphorus load reduction for a structural SWC with a known design volume capacity when the contributing drainage area is 100% impervious;
3) To determine the design volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces; and
4) To determine the phosphorus load reduction for a structural SWC with a known design volume capacity when the contributing drainage area has impervious and pervious surfaces.

Examples are also provided for estimating phosphorus load reductions associated with the four semi-structural/non-structural SWCs.

Also, this attachment provides the methodology for calculating the annual stormwater phosphorus load that will be delivered to SWCs for treatment (SWC Load) and to be used for quantifying phosphorus load reduction credits. The methods and annual phosphorus export load rates presented in this Attachment are for the purpose of calculating load reductions for various SWCs treating storm water runoff from varying site conditions (i.e., impervious or pervious surfaces) and different land uses (e.g. commercial and institutional). The estimates of annual phosphorus load and load reductions resulting from SWC implementation are intended for use by the permittee to demonstrate compliance with its Phosphorus Reduction Requirements.

Structural SWC performance credits: For each structural SWC type identified above (SWCs 1-10), long-term cumulative performance information is provided to calculate phosphorus load reductions or to determine needed design storage volume capacities to achieve a specified reduction target (e.g., 65% phosphorus load reduction). The performance information is expressed as cumulative phosphorus load removed (% removed) depending on the physical storage capacity of the structural SWC (expressed as inches of runoff from impervious area) and is provided at the end of this Attachment (see Tables 3-4 through 3-25 and performance curves Figures 3-1 through 3-20). Multiple tables and performance curves are provided for the infiltration practices to represent cumulative phosphorus load reduction performance for six infiltration rates (IR), 0.17, 0.27, 0.53, 1.02, 2.41, and 8.27 inches/hour. These infiltration rates represent the saturated hydraulic conductivity of the soils. The permittee may use the performance curves provided in this attachment to interpolate phosphorus load removal reductions for field measured infiltration rates that are different than the infiltration rates used to develop the performance curves. Otherwise, the permittee shall use the performance curve for the IR that is nearest, but less than, the field measured rate.

The Design Storage Volume or physical storage capacity (as referred to on the x-axis of performance curves) equals the total physical storage volume of the control structure to contain water at any instant in time. Typically, this storage capacity is comprised of the surface ponding storage volume prior to overflow and subsurface storage volumes in storage units and pore spaces of coarse filter media. Table 3-4 provides the formulae to calculate physical storage capacities for the structural control types for using the performance curves.

Semi-Structural/Non-structural SWC performance credits: For each semi-structural/non-structural SWC type identified above (SWCs 11-14), long-term cumulative performance information is provided to calculate phosphorus load reductions or to determine needed design specifications to achieve a desired reduction target (e.g., 50% phosphorus load reduction). The performance information is expressed as cumulative runoff volume reduction (% removed) depending on the design specifics and actual field conditions. Cumulative percent runoff volume reduction is being used as a surrogate to estimate the cumulative phosphorus load reduction credits for these SWCs.

To represent a wide range of potential conditions for implementing these types of SWCs, numerous performance tables and curves have been developed to reflect a wide range of potential conditions and designs such as varying storage volumes (expressed in terms of varying ratios of storage volume to impervious area (0.1 to 2.0 inches)); varying ratios of impervious source area to receiving pervious area based on hydrologic soil groups (HSGs) A, B, C and D (8:1, 6:1, 4:1, 2: 1 and 1:1); and varying discharge time periods for temporary storage (1, 2 or 3 days). The credits are provided at the end of this Attachment (see Tables 3-26 through 3-33 and performance curves Figures 3-21 through 3-41).

EPA will consider phosphorus load reductions calculated using the methods provided below to be valid for the purpose of demonstrating compliance with the terms of this permit for SWCs that have not been explicitly modeled, if the desired SWC has functionality that is similar to one of the simulated SWC types. Regarding functionality, only the surface infiltration, the infiltration trench and the four semi-structural/non-structural SWC types were simulated to direct storm water runoff into the ground (i.e., infiltration). All other simulated SWCs represent practices that are not hydraulically connected to the sub-surface soils (i.e., no infiltration) and have either under-drains or impermeable liners. Following are some simple guidelines for selecting the SWC type and/or determining whether the results of any of the SWC types provided are appropriate for another SWC of interest.

Infiltration Trench is a practice that provides temporary storage of runoff using the void spaces within the soil/sand/gravel mixture that is used to backfill the trench for subsequent infiltration into the surrounding sub-soils. Performance results for the infiltration trench can be used for all subsurface infiltration practices including systems that include pipes and/or chambers that provide temporary storage. Also, the results for this SWC type can be used for bio-retention systems that rely on infiltration when the majority of the temporary storage capacity is provided in the void spaces of the soil filter media and porous pavements that allow infiltration to occur. General design specifications for various infiltration systems are provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf

Surface Infiltration represents a practice that provides temporary surface storage of runoff (e.g., ponding) for subsequent infiltration into the ground. Appropriate practices for use of the surface infiltration performance estimates include infiltration basins, infiltration swales (not conveyance swales), rain gardens and bio-retention systems that rely on infiltration and provide the majority of storage capacity through surface-ponding. If an infiltration system includes both surface storage through ponding and a lessor storage volume within the void spaces of a coarse filter media, then the physical storage volume capacity used to determine the long-term cumulative phosphorus removal efficiency from the infiltration basin performance curves would be equal to the sum of the surface storage volume and the void space storage volume. General design specifications for various surface infiltration systems are provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf

Bio-filtration is a practice that provides temporary storage of runoff for filtering through an engineered soil media. The storage capacity is typically made of void spaces in the filter media and temporary ponding at the surface of the practice. Once the runoff has passed through the filter media it is collected by an under-drain pipe for discharge. The performance curve for this control practice assumes zero infiltration. If a filtration system has subsurface soils that are suitable for infiltration, then user should use the either performance curves for the infiltration trench or the infiltration basin depending on the predominance of storage volume made up by free standing storage or void space storage. Depending on the design of the filter media manufactured or packaged bio-filter systems such as tree box filters may be suitable for using the bio-filtration performance results. Design specifications for bio-filtration systems are provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf).

Gravel Wetland performance results should be used for practices that have been designed in accordance or share similar features with the design specifications for subsurface gravel wetland systems provided in the report prepared by the University of New Hampshire Stormwater Center entitled *Design and Maintenance of Subsurface Gravel Wetland Systems* and dated February 4, 2015 (https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/NHDOT_SGW_02-06-15_Final_Report.pdf).

Enhanced Bio-filtration for phosphorus with Internal Storage Reservoir (ISR) for nitrogen is a practice that provides temporary storage of runoff for filtering through an engineered soil media, augmented for enhanced phosphorus removal, followed by detention and denitrification in a subsurface internal storage reservoir (ISR) comprised of gravel. Runoff flows are routed through filter media and directed to the underlying ISR via an impermeable membrane for temporary storage. An elevated outlet control at the top of the ISR is designed to provide a retention time of at least 24 hours in the system to allow for sufficient time for denitrification reduction to occur prior to discharge. The design storage capacity for using the cumulative performance curves is comprised of void spaces in the filter media, temporary ponding at the surface of the practice and the void spaces in the gravel ISR.
The cumulative phosphorus load reduction curve for this control is intended to be used for systems in which the filter media has been augmented with materials designed and/or known to be effective at capturing phosphorus. If the filter media is not augmented to enhance phosphorus capture, then the phosphorus performance curve for the Bio-Filter should be used for estimating phosphorus load reductions. The University of New Hampshire Stormwater Center (UNHSC) developed the design of this control practice and a design template can be found at UNHSC's website (https://www.unh.edu/unhsc/news/unhsc-innovative-bioretention-template-pollutant-reductions-great-bay-estuary-watershed).

Sand Filter performance results should be used for practices that have been designed in accordance or share similar features with the design specifications for sand filter systems provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf).

Porous Pavement performance results represent systems with an impermeable under-liner and an under-drain. *If porous pavement systems do not have an impermeable under-liner so that filtered runoff can infiltrate into sub-soils, then the performance results for an infiltration trench may be used for these systems.* Design specifications for porous pavement systems are provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf).

Extended Dry Detention Pond performance results should only be used for practices that have been designed in accordance with the design specifications for extended dry detention ponds provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf).

Water Quality Grass Swale with Detention performance results should only be used for practices that have been designed in accordance with the design specifications for a water quality swale with check dams to temporarily store the target storage volume capture provided in the most recent version of *the Massachusetts Stormwater Handbook, Volume 2/Chapter2* (http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf)

Impervious Area Disconnection using Storage (e.g., rain barrels, cistern, etc.) performance results are for collecting runoff volumes from impervious areas such as roof tops, providing temporary storage of runoff volume using rain barrels, cisterns or other storage containers, and discharging stored volume to adjacent permeable pervious surfaces over an extended period of time. Such practices should be designed in accordance with the design specifications for applicable buffers (e.g., developed area buffers) provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm)

Impervious Area Disconnection performance results are for diverting runoff volumes from impervious areas such as roadways, parking lots and roof tops, and discharging it to adjacent vegetated permeable surfaces that are of sufficient size with adequate soils to receive the runoff without causing negative impacts to adjacent down-gradient properties. Careful consideration must be given to the ratio of impervious area to the pervious area that will receive the discharge. Also, devices such as level spreaders to disperse the discharge and provide sheet flow should be employed whenever needed to increase recharge and avoid flow concentration and short circuiting through the pervious area. Soil testing is needed to classify the permeability of the receiving pervious area in terms of HSG. Such practices should be designed in accordance with the design specifications for applicable buffers (e.g., developed area buffers) provided in the most recent version of *the New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*. (http://des.nh.gov/organization/divisions/water/stormwater/manual.htm)

Conversion of Impervious Area to Permeable Pervious Area phosphorus load reduction credits are for replacing existing impervious surfaces (such as traditional pavements and buildings with roof tops) with permeable surfaces. To be eligible for credit, it is essential that the area previously covered with impervious surface be restored to provide natural or enhanced hydrologic functioning so that the surface is permeable. Sub-soils beneath pavements are typically highly compacted and will require reworking to loosen the soil and the possible addition of soil amendments to restore permeability. Soil testing is needed to classify the permeability (in terms of HSG) of the restored pervious area.

Soil Amendments to Increase Permeability of Pervious Areas performance results are for the practice of improving the permeability of pervious areas through incorporation of soil amendments, tilling and establishing dense vegetation. This practice may be used to compliment other practices such as impervious area disconnection to improve overall performance and increase reduction credits earned. Soil testing is needed to classify the permeability (in terms of HSG) of the restored pervious area.

Alternative Methods:

A permittee may propose alternative long-term cumulative performance information or alternative methods to calculate phosphorus load reductions for the structural SWCs identified above or for other structural SWCs not identified in this Attachment.

EPA will consider alternative long-term cumulative performance information and alternative methods to calculate phosphorus and/or load reductions for structural SWCs provided that the permittee provides EPA with adequate supporting documentation. At a minimum, the supporting documentation shall include:

- Results of continuous SWC model simulations representing the structural SWC, using a verified SWC model and representative long-term (i.e., 10 years) climatic data including hourly rainfall data;
- Supporting calculations and model documentation that justify use of the model, model input parameters, and the resulting cumulative phosphorus load reduction estimate;
- If pollutant removal performance data are available for the specific SWC, model calibration results should be provided; and
- Identification of references and sources of information that support the use of the alternative information and method.

If EPA determines that the long-term cumulative phosphorus load reductions developed based on alternative information are not adequately supported, EPA will notify the permittee in writing, and the permittee may receive no phosphorus reduction credit other than a reduction credit calculated by the permittee using the default phosphorus reduction factors provided in this Attachment for the identified practices. The permittee is required to submit to EPA valid phosphorus load reductions for structural SWCs in the PCP area in accordance with the submission schedule requirements specified in the permit.

Method to Calculate Annual Phosphorus Load Delivered to SWCs (SWC Load)

The **SWC Load** is the annual phosphorus load from the drainage area to each proposed or existing SWC used by permittee to claim credit against its stormwater phosphorus load reduction requirement. The SWC Load is the starting point from which the permittee calculates the reduction in phosphorus load achieved by each existing and proposed SWC.

Examples are provided to illustrate use of the methods. Table 3-1 below provide annual phosphorus load export rates (PLERs) by land use category for impervious and pervious areas. The permittee shall select the land use categories that most closely represents the actual uses of the drainage areas tributary to SWC. For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate. For drainage areas with institutional type uses, such as government properties, hospitals, and schools, the permittee shall use the commercial/industrial land use category for the purpose of calculating phosphorus loads. Table 3-2 provides a crosswalk table of phosphorus load export rate (PLER) land use categories in Tables 3-1, and the corresponding land use category codes used in MassGIS.

Table 3-1: Average annual distinct phosphorus (P) load export rates for use in estimating P load reduction credits

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 3-2. MassGIS land-use categories with associated land-use groups for phosphorus load calculations

Mass GIS Land Use LU_CODE	Description	Land Use group for calculating P Load - 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

SWC Load: To estimate the annual phosphorus load reduction for a given stormwater SWC, it is first necessary to estimate the amount of annual stormwater phosphorus load that will be directed to the SWC (SWC Load).

For a given SWC:

1) Determine the total drainage area to the SWC;

2) Distribute the total drainage area into impervious and pervious subareas by land use category as defined by Tables 3-1and 3-2;

3) Calculate the phosphorus load for each land use-based impervious and pervious subarea by multiplying the subarea by the appropriate phosphorus load export rate provided in Tables 3-1; and

4) Determine the total annual phosphorus load to the SWC by summing the calculated impervious and pervious subarea phosphorus loads.

<u>Example 3-1 to determine phosphorus loads to a proposed SWC:</u> A permittee is proposing a surface stormwater infiltration system that will treat runoff from an industrial site covered by the permit and that has a total drainage area of 12.87 acres comprised of 10.13 acres of impervious cover (e.g., roadways, parking areas and rooftops), 1.85 acres of landscaped pervious area and 0.89 acres of wooded area both with HSG C soils. The drainage area information for the proposed SWC is:

SWC Subarea ID	Land Use Category	Cover Type	Area (acres)	PLER (lb/acre/yr)*
1	Industrial	impervious	10.13	1.78
2	Landscaped (HSG C)	pervious	1.85	0.21
3	Forest (HSG C)	pervious	0.89	0.12

*From Table 3-1

The phosphorus load to the proposed SWC (SWC Load $_P$) is calculated as:

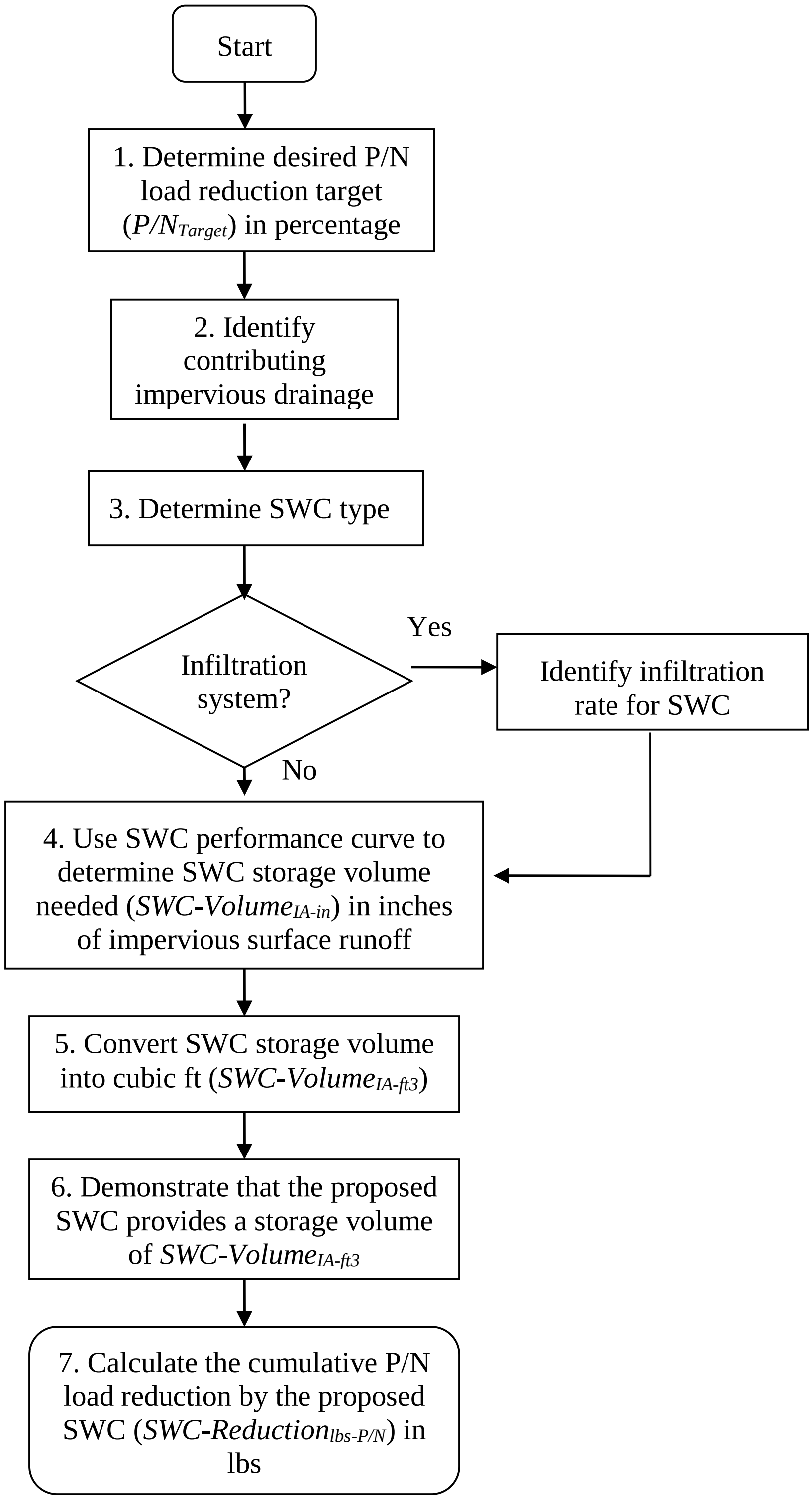
SWC Load $_P$ $= (IA_{Ind} \text{ x } PLER_{Ind}) + (PA_{Ind} \text{ x } PLER_{Ind}) + (PA_{FOREST} \text{ x } PLER_{For})$

$= (10.13 \text{ x } 1.78) + (1.85 \text{ x } 0.21) + (0.89 \text{ x } 0.12)$

= 18.53 lbs P/year

<u>(1) Method to determine the design volume of a structural SWC to achieve a known phosphorus (P) load reduction target when the contributing drainage area is 100% impervious:</u>

Flow Chart 1 illustrates the steps to determine the design volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area is 100% impervious.



Flow Chart 1: Method to determine SWC design volume to achieve a known phosphorous load reduction when contributing drainage area is 100% impervious.

1) Determine the desired cumulative phosphorus load reduction target (P_{target}) in percentage for the structural SWC;

2) Determine the contributing impervious drainage area (IA) in acres to the structural SWC;

3) Determine the structural SWC type (e.g., infiltration trench, gravel wetland). For infiltration systems, determine the appropriate infiltration rate for the location of the SWC in the Watershed;

4) Using the cumulative phosphorus removal performance curves for the selected structural SWC (Figures 3-1 through 3-20), determine the storage volume for the SWC (SWC-Volume $_{IA\text{-}in}$), in inches of runoff, needed to treat runoff from the contributing IA to achieve the reduction target;

5) Calculate the corresponding SWC storage volume in cubic feet (SWC-Volume $_{IA\text{-}ft^3}$) using SWC-Volume $_{IA\text{-}in}$ determined from step 4 and equation 3-1:

SWC-Volume $_{IA\text{-}ft^3}$ = IA (acre) x SWC-Volume $_{IA\text{-}in}$ x 3630 ft^3/ac-in **(Equation 3-1)**

6) Provide supporting calculations using the dimensions and specifications of the proposed structural SWC showing that the necessary storage volume capacity, SWC-Volume $_{IA\text{-}ft^3}$, determined from step 5 will be provided to achieve the P $_{Target}$; and

7) Calculate the cumulative P load reduction in pounds of P (SWC-Reduction $_{lbs\text{-}P}$) for the structural SWC using the SWC Load (as calculated from the procedure in Attachment 1 to Appendix F) and P $_{target}$ by using equation 3-2:

SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P $_{target}$ /100) **(Equation 3-2)**

Example 3-2 to determine design storage volume capacity of a structural SWC for a 100% impervious drainage area to achieve a known phosphorus load reduction target*:
*Note: The approach used in this example is for phosphorus and is equally applicable for nitrogen.

A permittee is considering a surface infiltration practice to capture and treat runoff from 2.57 acres (1.04 ha) of commercial impervious area in the drainage area that will achieve a 70% reduction in average annual phosphorus load. The infiltration practice would be located adjacent to the impervious area. The permittee has measured an infiltration rate (IR) of 0.39 inches per hour (in/hr) in the vicinity of the proposed infiltration practice. Determine the:

A) Design storage volume needed for a surface infiltration practice to achieve a 70% reduction in annual phosphorus load from the contributing drainage area (SWC-Volume $_{IA\text{-}ft^3}$); and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the SWC (SWC-Reduction $_{lbs\text{-}P}$)

Solution continued:

1) Phosphorus load reduction target (P_{target}) = 70%

2) Contributing impervious drainages area (IA) = 2.57 acres;

3) SWC type is a surface infiltration practice (i.e., basin) with an infiltration rate (IRSWC type is a surface infiltration practice (i.e., basin) with an infiltration rate (IR) of 0.39 in/hr

4) The performance curve for the infiltration basin (i.e., surface infiltration practice), Figure 3-8, IR = 0.27 in/hr is used to determine the design storage volume of the SWC (SWC-Volume $_{IA\text{-}in}$) needed to treat runoff from the contributing IA and achieve a P_{target} = 70%. The curve for an infiltration rate of 0.27 in/hr is chosen because 0.27 in/hr is the nearest simulated IR that is less than the field measured IR of 0.39 in/hr. From Figure 3-8, the SWC-Volume $_{IA\text{-}in}$ for a P_{target} = 70% is 0.36 in.

5) The SWC-Volume $_{IA\text{-}in}$ is converted to cubic feet (SWC-Volume $_{IA\text{-}ft^3}$) using Equation 3-1:

SWC-Volume $_{IA\text{-}ft^3}$ = IA (acre) x SWC-Volume $_{IA\text{-}in}$ x 3,630 ft^3/acre-in
SWC-Volume $_{IA\text{-}ft^3}$ = 2.57 acre x 0.36 in x 3,630 ft^3/acre-in
= **3,359 ft^3**

6) A narrow trapezoidal infiltration basin with the following characteristics is proposed to achieve the P_{Target} of 70%. As indicated in Table 3-5, the Design Storage Volume (DSV) of a surface infiltration practice is equal to the volume of surface ponding:

DSV = (L x ((W_{bottom}+$W_{top@Dmax}$)/2) x D) (Table 3-5: Surface Infiltration)

Length (ft)	Design Depth (ft)	Side Slopes	Bottom area (ft^2)	Pond surface area (ft^2)	Design Storage Volume (ft^3)
355	1.25	3:1	1,387	4,059	3,404

The proposed DSV of 3,404 ft^3 exceeds the SWC-Volume $_{IA\text{-}ft^3}$ needed, 3,359 ft^3 and therefore is sufficient to achieve the P Target of 70%.

7) The cumulative phosphorus load reduction in pounds of phosphorus for the infiltration practice (SWC-Reduction $_{lbs\text{-}P}$) is calculated using Equation 3-2. The SWC Load is first determined using the method described above.

SWC Load = IA x impervious cover PLER for commercial use (see Table 3-1)
= 2.57 acres x 1.78 lbs/acre/yr
= 4.58 lbs/yr

SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P_{target} /100)
SWC-Reduction $_{lbs\text{-}P}$ = 4.58 lbs/yr x (70/100)
= **3.21 lbs/yr**

Solution continued:

Alternate Solution: Alternatively, the permittee could determine the design storage volume needed for an IR = 0.39 in/hr by performing interpolation of the results from the surface infiltration performance curves for IR = 0.27 in/hr and IR = 0.52 in/hr as follows (replacing steps 3 and 4 on the previous page):

Using the performance curves for the infiltration basin (i.e., surface infiltration practice), Figures 3-8, IR = 0.27 in/hr and 3-9, IR = 0.52 in/hr, interpolate between the curves to determine the design storage volume of the SWC (SWC-Volume $_{IA\text{-}in}$) needed to treat runoff from the contributing IA and achieve a P $_{target}$ = 70%.

First calculate the interpolation adjustment factor (IAF) to interpolate between the infiltration basin performance curves for infiltration rates of 0.27 and 0.52 in/hr:

$$IAF = (0.39 - 0.27)/ (0.52 – 0.27) = 0.48$$

From the two performance curves, develop the following table to estimate the general magnitude of the needed storage volume for an infiltration swale with an IR = 0.39 in/hr and a P $_{target}$ of 70%.

Table Example 3-2-1: Interpolation Table for determining design storage volume of infiltration basin with IR = 0.39 in/hr and a phosphorus load reduction target of 70%

SWC Storage Volume	% Phosphorus Load Reduction IR = 0.27 in/hr ($PR_{IR=0.27}$)	% Phosphorus Load Reduction IR = 0.52 in/hr ($PR_{IR=0.52}$)	Interpolated % Phosphorus Load Reduction IR = 0.39 in/hr ($PR_{IR=0.39}$) **$PR_{IR=0.39}$= IAF($PR_{IR=0.52}$ – $PR_{IR=0.27}$) + $PR_{IR=0.27}$**
0.3	64%	67%	65%
0.4	74%	77%	75%
0.5	79%	82%	80%

As indicated from Table Example 3-1, the SWC-Volume $_{IA\text{-}in}$ for $PR_{IR=0.39}$ of 70% is between 0.3 and 0.4 inches and can be determined by interpolation:

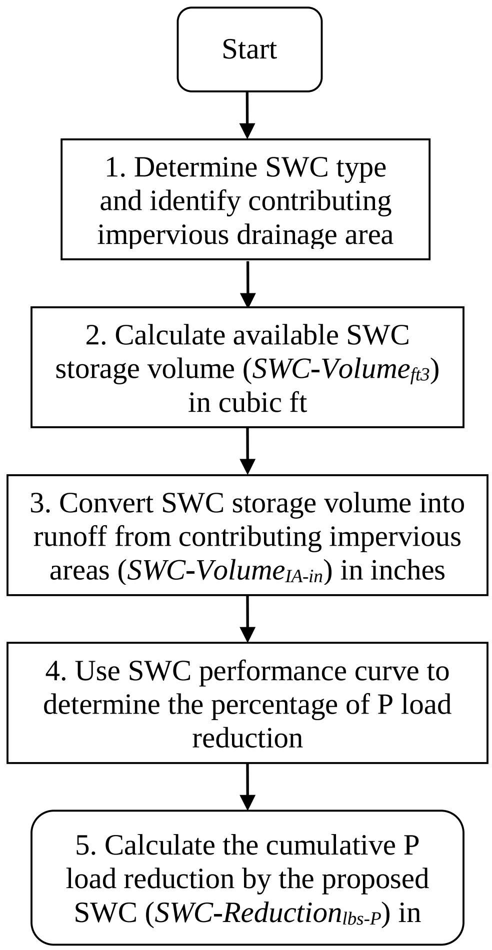
$$\text{SWC-Volume}_{IA\text{-}in} = (70\% - 65\%)/ (75\% - 65\%) \times (0.4 \text{ in} – 0.3 \text{ in}) + 0.3 \text{ in}$$
$$= 0.35 \text{ inches}$$

5 alternative) Convert the resulting SWC-Volume $_{IA\text{-}in}$ to cubic feet (SWC-Volume $_{IA\text{-}ft^3}$) using equation 3-1:

$$\text{SWC-Volume}_{IA\text{-}ft^3} = 2.57 \text{ acre} \times 0.35 \text{ in} \times 3{,}630 \text{ ft}^3/\text{acre-in}$$
$$\mathbf{= 3{,}265\ ft^3}$$

(2) Method to determine the phosphorus (P) load reduction credit for a structural SWC with a known design storage volume when the contributing drainage area is 100% impervious:

Flow Chart 2 illustrates the steps to determine the phosphorus load reduction for a structural SWC with a known design volume when the contributing drainage area is 100% impervious.



Flow Chart 2: Method to determine the phosphorus load reduction for a SWC with a known design volume when contributing drainage area is 100% impervious.

1) Identify the structural SWC type and contributing impervious drainage area (IA);

2) Document the available storage volume (ft^3) of the structural SWC (SWC-Volume $_{ft^3}$) using the SWC dimensions and design specifications (e.g., maximum storage depth, filter media porosity);

3) Convert SWC-Volume $_{ft^3}$ into inches of runoff from the contributing impervious area (SWC-Volume $_{IA\text{-}in}$) using equation 3-3:

$\text{SWC-Volume}_{\text{IA-in}} = \text{SWC-Volume}_{\text{ft}}{}^3$/ IA (acre) x 12 in/ft x 1 acre/43560 ft^2 **(Equation 3-3)**

4) Determine the % P load reduction for the structural SWC (SWC Reduction $_{\text{%-P}}$) using the appropriate SWC performance curve (Figures 3-1 through 3-20) and the SWC-Volume $_{\text{IA-in}}$ calculated in step 3; and

5) Calculate the cumulative P load reduction in pounds for the structural SWC (SWC Reduction $_{\text{lbs-P}}$) using the SWC Load as calculated from the procedure described above and the percent P load reduction determined in step 4 by using equation 3-4:

SWC Reduction $_{\text{lbs-P}}$ = SWC Load x (SWC Reduction $_{\text{%-P}}$/100) **(Equation 3-4)**

Example 3-3: Determine the phosphorus load reduction for a structural SWC with a known storage volume capacity when the contributing drainage area is 100% impervious*:
*The approach used in this example is for nitrogen and is equally applicable for phosphorus.

A permittee is considering an Enhanced Bio-filtration system with phosphorus sorption media to treat runoff from 1.49 acres of high density residential (HDR) impervious area. Site constraints would limit the enhanced bio-filtration system to have a surface area of 1200 ft^2 and the system would have to be located next to the impervious drainage area to be treated. The design parameters for the enhanced bio-filtration w/ ISR system are presented in Table Example 3-2-1.

Table Example 3-3-1: Design parameters for bio-filtration system for Example 3-2

Components of representation	Parameters	Value
Ponding	Maximum depth	0.5 ft
	Surface area	1200 ft^2
	Vegetative parameter[a]	85-95%
Soil mix	Depth	2.0 ft
	Porosity	0.35
	Hydraulic conductivity	4 inches/hour
Gravel layer	Depth	2.0 ft
	Porosity	0.45
Orifice #1	Diameter	0.08 ft

[a] Refers to the percentage of surface covered with vegetation

Determine the:

A) Percent phosphorus load reduction (SWC Reduction $_{\text{%-P}}$) for the specified enhanced bio-filtration w/ISR system and contributing impervious HDR drainage area; and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the system (SWC-Reduction $_{\text{lbs-P}}$)

<u>**Solution:**</u>

1) The SWC is an enhanced bio-filtration w/ISR system that will treat runoff from 1.49 acres of HDR impervious area (IA = 1.49 acre);

2) The available storage volume capacity (ft^3) of the enhanced bio-filtration system (SWC-Volume $_{\text{SWC-ft}^3}$) is determined using the surface area of the system, depth of ponding, and the porosities of the filter media and subsurface gravel ISR:

Solution continued:

SWC-Volume $_{SWC\text{-}ft^3}$ = (surface area x pond maximum depth) + (surface area x ((soil mix depth x soil layer porosity) + (gravel layer depth x gravel layer porosity))
= (1,200 ft^2 x 0.5 ft) + (1,200 ft^2 x ((2.0 x 0.35) + (2.0 x 0.45))
= 600 + 1920
= 2,520 ft^3

3) The available storage volume capacity of the enhanced bio-filtration system in inches of runoff from the contributing impervious area (SWC-Volume $_{IA\text{-}in}$) is calculated using equation 3-3:

SWC-Volume $_{IA\text{-}in}$ = (SWC-Volume $_{ft^3}$/ IA (acre) x 12 in/ft x 1 acre/43560 ft^2
SWC-Volume $_{IA\text{-}in}$ = (2520 ft^3/1.49 acre) x 12 in/ft x 1 acre/43560 ft^2
= 0.47 in

4) Using the enhanced bio-filtration performance curve shown in Figure 3-15, a 57% P load reduction (SWC Reduction %-P) is determined for the system with a design storage capacity of 0.47 inches for treating runoff from 1.49 acres of impervious area; and

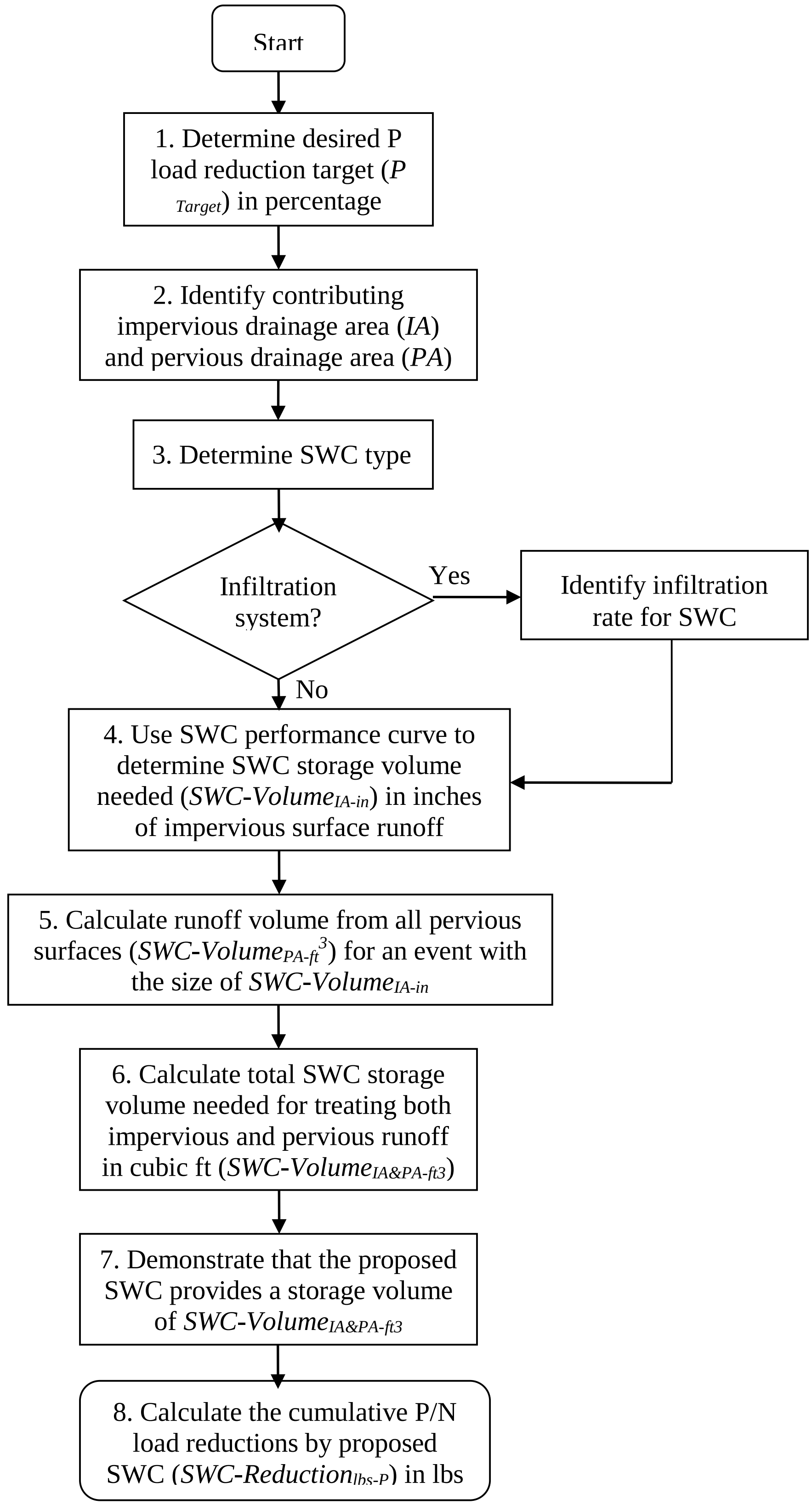
5) Calculate the cumulative phosphorus load reduction in pounds of for the enhanced bio-filtration system (SWC Reduction $_{lbs\text{-}P}$) using the SWC Load as calculated from the procedure described above and the SWC Reduction $_{\%\text{-}P}$ determined in step 4 by using equation 3-4. First, the SWC Load is determined as specified above:

SWC Load $_P$ = IA x impervious cover phosphorus export loading rate for HDR (see Table 3-1)
= 1.49 acres x 2.32 lbs/acre/yr
= 3.46 lbs/yr

SWC Reduction $_{lbs\text{-}P}$ = SWC Load x (SWC Reduction $_{\%\text{-}P}$/100)
SWC Reduction $_{lbs\text{-}N}$ = 3.46 lbs/yr x (57/100)
= **1.98 lbs/yr**

(3) Method to determine the design storage volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces:

Flow Chart 3 illustrates the steps to determine the design storage volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces.


Start
1. Determine desired P load reduction target (P_{Target}) in percentage
2. Identify contributing impervious drainage area (*IA*) and pervious drainage area (*PA*)
3. Determine SWC type
Infiltration system?
Yes
Identify infiltration rate for SWC
No
4. Use SWC performance curve to determine SWC storage volume needed ($SWC\text{-}Volume_{IA\text{-}in}$) in inches of impervious surface runoff
5. Calculate runoff volume from all pervious surfaces ($SWC\text{-}Volume_{PA\text{-}ft^3}$) for an event with the size of $SWC\text{-}Volume_{IA\text{-}in}$
6. Calculate total SWC storage volume needed for treating both impervious and pervious runoff in cubic ft ($SWC\text{-}Volume_{IA\&PA\text{-}ft3}$)
7. Demonstrate that the proposed SWC provides a storage volume of $SWC\text{-}Volume_{IA\&PA\text{-}ft3}$
8. Calculate the cumulative P/N load reductions by proposed SWC ($SWC\text{-}Reduction_{lbs\text{-}P}$) in lbs

Flow Chart 3: Method to determine the design storage volume of a SWC to reach a known P load reduction when both impervious and pervious drainage areas are present.

1) Determine the desired cumulative P load reduction target (P_{target}) in percentage for the structural SWC;
2) Characterize the contributing drainage area to the structural SWC by identifying the following information for the impervious and pervious surfaces:
   Impervious area (IA) - Area (acre) and land use (e.g., commercial)
   Pervious area (PA) – Area (acre), land use and hydrologic soil group (HSG).
3) Determine the structural SWC type (e.g., infiltration trench, gravel wetland). For infiltration systems, determine the appropriate infiltration rate for the location of the SWC in the Watershed;
4) Using the cumulative P removal performance curve for the selected structural SWC, determine the storage volume capacity of the SWC in inches needed to treat runoff from the contributing impervious area (SWC-Volume $_{IA\text{-}in}$);
5) Using Equation 3-5 below and the pervious area runoff depth information from Table 3-4, below, determine the total volume of runoff from the contributing pervious drainage area in cubic feet (SWC Volume $_{PA\text{-}ft^3}$) for a rainfall size equal to the sum of SWC Volume $_{IA\text{-}in}$, determined in step 4. The runoff volume for each distinct pervious area must be determined;
   SWC-Volume $_{PA\ ft^3} = \sum$ (PA x (runoff depth) x 3,630 ft^3/acre-in)$_{(PA1,\ PAn)}$ **(Equation 3-5)**

> Table 3-4 provides values of runoff depth from pervious areas for various rainfall depths and HSGs. Soils are assigned to an HSG on the basis of their permeability. HSG A is the most permeable, and HSG D is the least permeable. HSG categories for pervious areas in the drainage area shall be estimated by consulting local soil surveys prepared by the National Resource Conservation Service (NRCS) or by a storm water professional evaluating soil testing results from the drainage area. If the HSG condition is not known, a HSG C soil condition should be assumed.

6) Using equation 3-6 below, calculate the SWC storage volume in cubic feet (SWC-Volume $_{IA\&PA\text{-}ft^3}$) needed to treat the runoff depth from the contributing impervious (IA) and pervious areas (PA);

   SWC-Volume $_{IA\&PA\text{-}ft^3}$ = SWC Volume $_{PA\text{-}ft^3}$ + (SWC Volume $_{IA\text{-}in}$ x IA (acre) x 3,630 ft^3/acre-in) **(Equation 3-6)**

7) Provide supporting calculations using the dimensions and specifications of the proposed structural SWC showing that the necessary storage volume determined in step 6, SWC-Volume $_{IA\&PA\text{-}ft^3}$, will be provided to achieve the P_{Target}; and
8) Calculate the cumulative phosphorus load reduction in pounds of phosphorus (SWC-Reduction $_{lbs\text{-}P}$) for the structural SWC using the SWC Load (as calculated in example 1) and the P_{target} by using equation 3-2:

   SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P_{target} /100) **(Equation 3-2)**

Table 3- 3: Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups (HSGs)

Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups					
Rainfall Depth, Inches	Runoff Depth, inches				
	Pervious HSG A	Pervious HSG B	Pervious HSG C	Pervious HSG C/D	Pervious HSG D
0.10	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.01	0.02	0.02
0.40	0.00	0.00	0.03	0.05	0.06
0.50	0.00	0.01	0.05	0.07	0.09
0.60	0.01	0.02	0.06	0.09	0.11
0.80	0.02	0.03	0.09	0.13	0.16
1.00	0.03	0.04	0.12	0.17	0.21
1.20	0.04	0.05	0.14	0.27	0.39
1.50	0.08	0.11	0.39	0.55	0.72
2.00	0.14	0.22	0.69	0.89	1.08

Notes: Runoff depths derived from combination of volumetric runoff coefficients from Table 5 of *Small Storm Hydrology and Why it is Important for the Design of Stormwater Control Practices*, (Pitt, 1999), and using the Stormwater Management Model (SWMM) in continuous model mode for hourly precipitation data for Boston, MA, 1998-2002.

Example 3-4: Determine the design storage volume of a structural SWC to achieve a known phosphorus load reduction target when the contributing drainage area has impervious and pervious surfaces*:

*The approach used in this example for phosphorus is equally applicable for nitrogen.

A permittee is considering a gravel wetland system to treat runoff from a high-density residential (HDR) site. The site is 7.5 acres of which 4.0 acres are impervious surfaces and 3.50 acres are pervious surfaces. The pervious area is made up of 2.5 acres of lawns in good condition surrounding cluster housing units and 1.0 acre of stable unmanaged woodland. Soils information indicates that all of the woodland and 0.5 acres of the lawn is hydrologic soil group (HSG) B and the other 2.0 acres of lawn are HSG C. The permittee wants to size the gravel wetland system to achieve a cumulative phosphorus load reduction (P_{Target}) of 55% from the entire 7.5 acres.

Determine the:

A) Design storage volume needed for a gravel wetland system to achieve a 55% reduction in annual phosphorus load from the contributing drainage area (SWC-Volume $_{IA\&PA\text{-}ft^3}$); and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the SWC (SWC-Reduction $_{lbs\text{-}P}$)

Example 3-4 continued:

Solution:

1) The SWC type is gravel wetland system.

2) The phosphorus load reduction target (P_{Target}) = 55%.

3) Using the cumulative phosphorus removal performance curve for the gravel wetland system shown in Figure 3-14, the storage volume capacity in inches needed to treat runoff from the contributing impervious area (SWC Volume $_{IA-in}$) is 0.71 in;

Using equation 3-5 and the pervious runoff depth information from Table 3-4, the volume of runoff from the contributing pervious drainage area in cubic feet (SWC Volume $_{PA-ft^3}$) for a rainfall size equal to 0.71 in is summarized in Table Example 3-3-A. As indicated from Table 3-4, the runoff depth for a rainfall size equal to 0.71 inches is between 0.6 and 0.8 inches and can be determined by interpolation (example shown for runoff depth of HSG C):

Runoff depth (HSG C) = (0.71 – 0.6)/ (0.8 – 0.6) x (0.09 in – 0.06 in) + 0.06 in
= 0.07 inches

Table Example 3-4-A: Runoff contributions from pervious areas for HDR site

ID	Type	Pervious Area (acre)	HSG	Runoff (in)	Runoff = (runoff) x PA (acre-in)	Runoff = Runoff (acre-in) x 3630 ft^3/acre-in (ft^3)
PA1	Grass	2.00	C	0.07	0.14	508
PA2	Grass	0.50	B	0.01	0.0	0.0
PA3	Woods	1.00	B	0.01	0.0	0.0
Total	-----	**3.50**	-----	-----	**0.14**	**508**

4) Using equation 3-6, determine the SWC storage volume in cubic feet (SWC-Volume $_{IA\&PA-ft^3}$) needed to treat 0.71 inches of runoff from the contributing impervious area (IA) and the runoff of 0.14 acre-in from the contributing pervious areas, determined in step 5 is:

SWC Volume$_{IA\&PA-ft^3}$ = SWC Volume $_{PA\ ac-in}$ + (SWC Volume $_{IA-in}$ x IA (acre)) x 3,630 ft^3/acre-in)

SWC Volume$_{IA\&PA-ft^3}$ = (508 ft^3+ ((0.71 in x 4.00 acre) x 3,630 ft^3/acre-in)
= 10,817 ft^3

5) Table Example 3-3-B provides design details for of a potential gravel wetland system

Solution continued:

Table Example 3-4-B: Design details for gravel wetland system

Gravel Wetland System Components	Design Detail	Depth (ft)	Surface Area (ft^2)	Volume (ft^3)
Sediment Forebay	**10% of Treatment Volume**			
Pond area	----	1.33	896	1,192
Wetland Cell #1	**45% of Treatment Volume**	---------------	-------------------	---------------
Pond area	----	2.00	1,914	3,828
Gravel layer	porosity = 0.4	2.00	1,914	1,531
Wetland Cell #2	**45% of Treatment Volume**	---------------	------------------	---------------
Pond area	----	2.00	1,914	3,828
Gravel layer	porosity = 0.4	2.00	1,914	1,531

The total design storage volume for the proposed gravel wetland system identified in Table Example 3-3-C is 11,910 ft^3. This volume is greater than 11,834 ft^3 ((SWC-Volume $_{IA\&PA\text{-}ft}{}^3$), calculated in step 4) and is therefore sufficient to achieve a P $_{Target}$ of 55%.

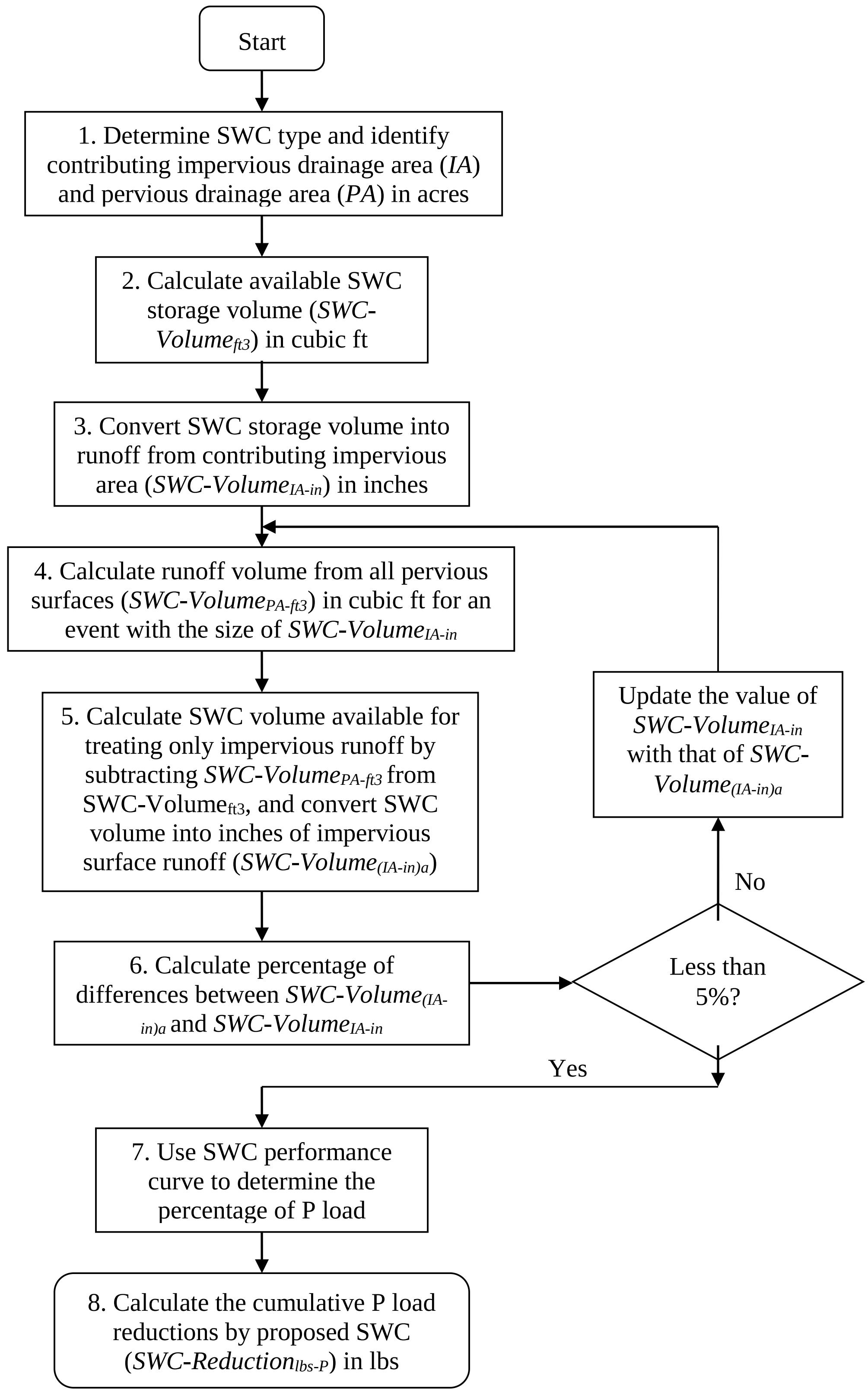
6) The cumulative phosphorus load reduction in pounds of phosphorus (SWC-Reduction $_{lbs\text{-}P}$) for the proposed gravel wetland system is calculated by using equation 3-2 with the SWC Load and the P $_{target}$ = 55%.

SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P $_{target}$ /100) (**Equation 3-2**)

Using Table 3-1, the SWC Load is calculated:
SWC Load = (IA x PLER $_{IC\ HDR}$) + (PA lawn $_{HSG\ B}$ x PLER $_{HSG\ B}$) + (PA lawn $_{HSG\ C}$ x PLER $_{HSG\ C}$) + (PA forest x PA PLER $_{For}$)
= (4.00 acre x 2.32 lbs/acre/yr) + (0.50 acres x 0.12 lbs/acre/yr) + (2.00 acre x 0.21 lbs/acre/yr) + (1.00 acres x 0.13)
= 9.68 lbs/yr
SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P $_{target}$ /100)
SWC-Reduction $_{lbs\text{-}P}$ = 9.68 lbs/yr x 55/100
= **5.32 lbs/yr**

<u>(4) Method to determine the phosphorus load reduction for a structural SWC with a known storage volume when the contributing drainage area has impervious and pervious surfaces:</u>

Flow Chart 4 illustrates the steps to determine the phosphorus load reduction for a structural SWC with a known storage volume when the contributing drainage area has impervious and pervious surfaces.


Start
1. Determine SWC type and identify contributing impervious drainage area (IA) and pervious drainage area (PA) in acres
2. Calculate available SWC storage volume (SWC-Volume_ft3) in cubic ft
3. Convert SWC storage volume into runoff from contributing impervious area (SWC-Volume_IA-in) in inches
4. Calculate runoff volume from all pervious surfaces (SWC-Volume_PA-ft3) in cubic ft for an event with the size of SWC-Volume_IA-in
5. Calculate SWC volume available for treating only impervious runoff by subtracting SWC-Volume_PA-ft3 from SWC-Volume_ft3, and convert SWC volume into inches of impervious surface runoff (SWC-Volume_(IA-in)a)
6. Calculate percentage of differences between SWC-Volume_(IA-in)a and SWC-Volume_IA-in
Less than 5%?
No
Update the value of SWC-Volume_IA-in with that of SWC-Volume_(IA-in)a
Yes
7. Use SWC performance curve to determine the percentage of P load
8. Calculate the cumulative P load reductions by proposed SWC (SWC-Reduction_lbs-P) in lbs

Flow Chart 4: Method to determine the P load reduction for a SWC with known storage volume when both pervious and impervious drainage areas are present.

1) Identify the type of structural SWC and characterize the contributing drainage area to the structural SWC by identifying the following information for the impervious and pervious surfaces:

   Impervious area (IA) – Area (acre) and land use (e.g., commercial)

   Pervious area (PA) – Area (acre), land use, and hydrologic soil group (HSG

2) Determine the available storage volume (ft^3) of the structural SWC (SWC-Volume $_{ft^3}$) using the SWC dimensions and design specifications (e.g., maximum storage depth, filter media porosity);

3) To estimate the P load reduction of a SWC with a known storage volume capacity, it is first necessary to determine the portion of available SWC storage capacity (SWC-Volume $_{ft^3}$) that would treat the runoff volume generated from the contributing impervious area (IA) for a rainfall event with a depth of *i* inches (in). This will require knowing the corresponding amount of runoff volume that would be generated from the contributing pervious area (PA) for the same rainfall event (depth of *i* inches). Using equation 3-6a below, solve for the SWC capacity that would be available to treat runoff from the contributing imperious area for the unknown rainfall depth of *i* inches (see equation 3-6b):

$$\text{SWC-Volume}_{ft^3} = \text{SWC-Volume}_{(IA\text{-}ft^3)i} + \text{SWC-Volume}_{(PA\text{-}ft^3)i} \quad \textbf{(Equation 3-6a)}$$

Where:

SWC-Volume $_{ft^3}$= the available storage volume of the SWC;

SWC-Volume $_{(IA\text{-}ft^3)i}$ = the available storage volume of the SWC that would fully treat runoff generated from the contributing impervious area for a rainfall event of size *i* inches; and

SWC-Volume $_{(PA\text{-}ft^3)i}$ = the available storage volume of the SWC that would fully treat runoff generated from the contributing pervious area for a rainfall event of size *i* inches

Solving for SWC-Volume $_{(IA\text{-}ft^3)i}$:

$$\text{SWC-Volume}_{(IA\text{-}ft^3)i} = \text{SWC-Volume}_{ft^3} - \text{SWC-Volume}_{(PA\text{-}ft^3)i} \quad \textbf{(Equation 3-6b)}$$

To determine SWC-Volume $_{(IA\text{-}ft^3)i}$, requires performing an iterative process of refining estimates of the rainfall depth used to calculate runoff volumes until the rainfall depth used results in the sum of runoff volumes from the contributing IA and PA equaling the available SWC storage capacity (SWC-Volume $_{ft^3}$). For the purpose of estimating SWC performance, it will be considered adequate when the IA runoff depth (in) is within 5% IA runoff depth used in the previous iteration.

For the first iteration (1), convert the SWC-Volume $_{ft^3}$ determined in step 2 into inches of runoff from the contributing impervious area (SWC Volume $_{(IA\text{-}in)1}$) using equation 3-7a.

SWC-Volume $_{(IA\text{-}in)1}$ = (SWC-Volume$_{ft^3}$/ IA (acre)) x (12 in/ft /43,560 ft^2/acre) **(Equation 3-7a)**;

For iterations 2 through n (2…n), convert the SWC Volume $_{(IA\text{-}ft^3)2\ldots n}$, determined in step 6) below, into inches of runoff from the contributing impervious area (SWC Volume $_{(IA\text{-}in)2\ldots n}$) using equation 3-7b.

SWC-Volume $_{(IA\text{-}in)2\ldots n}$ = (SWC-Volume $_{(IA\text{-}ft^3)2\ldots n}$ / IA (acre)) x (12 in/ft /43,560 ft^2/acre) **(Equation 3-7b)**;

4) For 1 to n iterations, use the pervious runoff depth information from Table 3-4 (repeated below) and equation 3-8 to determine the total volume of runoff (ft^3) from the contributing PA (SWC Volume $_{PA\text{-}ft^3}$) for a rainfall size equal to the sum of SWC-Volume $_{(IA\text{-}in)1}$, determined in step 3. The runoff volume for each distinct pervious area must be determined.

SWC Volume $_{(PA\text{-}ft^3)1\ldots n}$ = ∑ ((PA x (runoff depth$_{)\,(PA1,\ PA2..PAn)}$ x (3,630 ft^3/acre-in) **(Equation 3-8)**

Table 3-4 provides values of runoff depth from pervious areas for various rainfall depths and HSGs. Soils are assigned to an HSG on the basis of their permeability. HSG A is the most permeable, and HSG D is the least permeable. HSG categories for pervious areas in the drainage area shall be estimated by consulting local soil surveys prepared by the National Resource Conservation Service (NRCS) or by a storm water professional evaluating soil testing results from the drainage area. If the HSG condition is not known, a HSG C soil condition should be assumed.

Table 3- 4: Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups (HSGs) (reprinted for ease of use in example)

Developed Land Pervious Area Runoff Depths based on Precipitation depth and Hydrological Soil Groups					
Rainfall Depth, Inches	Runoff Depth, inches				
	Pervious HSG A	Pervious HSG B	Pervious HSG C	Pervious HSG C/D	Pervious HSG D
0.10	0.00	0.00	0.00	0.00	0.00
0.20	0.00	0.00	0.01	0.02	0.02
0.40	0.00	0.00	0.03	0.05	0.06
0.50	0.00	0.01	0.05	0.07	0.09
0.60	0.01	0.02	0.06	0.09	0.11
0.80	0.02	0.03	0.09	0.13	0.16
1.00	0.03	0.04	0.12	0.17	0.21

1.20	**0.04**	**0.05**	**0.14**	**0.27**	**0.39**
1.50	**0.08**	**0.11**	**0.39**	**0.55**	**0.72**
2.00	**0.14**	**0.22**	**0.69**	**0.89**	**1.08**
Notes: Runoff depths derived from combination of volumetric runoff coefficients from Table 5 of *Small Storm Hydrology and Why it is Important for the Design of Stormwater Control Practices*, (Pitt, 1999), and using the Stormwater Management Model (SWMM) in continuous model mode for hourly precipitation data for Boston, MA, 1998-2002.					

5) For iteration 1, estimate the portion of SWC Volume that is available to treat runoff from only the IA by subtracting SWC-Volume $_{PA\text{-}ft^3}$, determined in step 4, from SWC-Volume $_{ft^3}$, determined in step 2, and convert to inches of runoff from IA (see equations 3-9a and 3-9b):

SWC-Volume $_{(IA\text{-}ft^3)2}$ = ((SWC-Volume$_{ft^3}$- SWC Volume $_{(PA\text{-}ft^3)1}$) **(Equation 3-9a)**

SWC-Volume $_{(IA\text{-}in)2}$ = (SWC-Volume $_{(IA\text{-}ft^3)2}$/IA (acre)) x (12 in/ft x 1 acre/43,560 ft^2) **(Equation 3-9b)**

If additional iterations (i.e., 2 through n) are needed, estimate the portion of SWC volume that is available to treat runoff from only the IA (SWC-Volume $_{(IA\text{-}in)3..n+1}$) by subtracting SWC Volume $_{(PA\text{-}ft^3)2..n}$, determined in step 4, from SWC Volume $_{(IA\text{-}ft^3)3..n+1}$, determined in step 5, and by converting to inches of runoff from IA using equation 3-9b):

6) For iteration a (an iteration between 1 and n+1), compare SWC Volume $_{(IA\text{-}in)a}$ to SWC Volume $_{(IA\text{-}in)a-1}$ determined from the previous iteration (a-1). If the difference in these values is greater than 5% of SWC Volume $_{(IA\text{-}in)a}$ then repeat steps 4 and 5, using SWC Volume $_{(IA\text{-}in)a}$ as the new starting value for the next iteration (a+1). If the difference is less than or equal to 5 % of SWC Volume $_{(IA\text{-}in)a}$ then the permittee may proceed to step 7;

7) Determine the % P load reduction for the structural SWC (SWC Reduction $_{\%\text{-}P}$) using the appropriate SWC performance curve and the SWC-Volume $_{(IA\text{-}in)n}$ calculated in the final iteration of steps 5 and 6; and

8) Calculate the cumulative P load reduction in pounds for the structural SWC (SWC Reduction $_{lbs\text{-}P}$) using the SWC Load as calculated Example 3-1 above and the percent P load reduction (SWC Reduction $_{\%\text{-}P}$) determined in step 7 by using equation 3-4:

SWC Reduction $_{lbs\text{-}P}$ = SWC Load x (SWC Reduction $_{\%\text{-}P}$/100) **(Equation 3-4)**

Example 3-5: Determine the phosphorus load reduction for a structural SWC with a known design volume when the contributing drainage area has impervious and pervious surfaces:

A permittee is considering an infiltration basin to capture and treat runoff from a portion of the medium density residential area (MDR). The contributing drainage area is 16.55 acres and has 11.75 acres of impervious area and 4.8 acres of pervious area (PA) made up mostly of lawns and landscaped areas that is 80% HSG D and 20% HSG C. An infiltration basin with the following specifications can be placed at the down-gradient end of the contributing drainage area where soil testing results indicates an infiltration rate (IR) of 0.28 in/hr:

Table Example 3-5-A: Infiltration basin characteristics

Structure	Bottom area (acre)	Top surface area (acre)	Maximum pond depth (ft)	Design storage volume (ft^3)	Infiltration Rate (in/hr)
Infiltration basin	0.65	0.69	1.65	48,155	0.28

Determine the:

A) Percent phosphorus load reduction (SWC Reduction $_{\%-P}$) for the specified infiltration basin and the contributing impervious and pervious drainage area; and

B) Cumulative phosphorus reduction in pounds that would be accomplished by the SWC (SWC-Reduction $_{lbs-P}$)

Solution:

1) A surface infiltration basin is being considered. Information for the contributing impervious (IA) and pervious (PA) areas are summarized in Tables Example 3-4-A and Example 3-4-B, respectively.

Table Example 3-5-B: Impervious area characteristics

ID	Land use	Area (acre)
IA1	MDR	11.75

Table Example 3-5-C: Pervious area characteristics

ID	Area (acre)	Hydrologic Soil Group (HSG)
PA1	3.84	D
PA2	0.96	C

2) The available storage volume (ft^3) of the infiltration basin (SWC-Volume $_{ft^3}$) is determined from the design details and basin dimensions; SWC-Volume $_{ft^3}$ = 48,155 ft^3.

3) To determine what the SWC design storage volume is in terms of runoff depth (in) from IA, an iterative process is undertaken:

Solution Iteration 1

For the first iteration (1), the SWC-Volume$_{ft^3}$ is converted into inches of runoff from the contributing impervious area (SWC Volume $_{(IA-in)1}$) using equation 3-7a.

SWC Volume $_{(IA-in)1}$ = (48,155 ft^2/ 11.75 acre) x (12 in/ft /43,560 ft^2/acre)
= 1.13 in

4-1) The total volume of runoff (ft^3) from the contributing PA (SWC Volume $_{PA-ft^3}$) for a rainfall size equal to the sum of SWC Volume $_{(IA-in)1}$ determined in step 3 is determined for each distinct pervious area identified in Table Example 3-4-C using the information from Table 3-4 and equation 3-5. Interpolation was used to determine runoff depths.

SWC Volume $_{(PA-ft^3)1}$ = ((3.84 acre x (0.33 in) + (0.96 acre x (0.13 in)) x 3,630 ft^3/acre-in
= 5052 ft^3

5-1) For iteration 1, the portion of SWC Volume that is available to treat runoff from only the IA is estimated by subtracting the SWC Volume $_{(PA-ft^3)1}$, determined in step 4-1, from SWC Volume$_{ft^3}$, determined in step 2, and converted to inches of runoff from IA:

SWC Volume $_{(IA-ft^3)\,2}$ = 48,155 ft^3 – 5052 ft^3
= 43,103 ft^3

SWC Volume $_{(IA-in)\,2}$ = (43,103 ft^3/11.75 acre) x (12 in/ft x 1 acre/43,560 ft^2)
= 1.01 in

6-1) The % difference between SWC Volume $_{(IA-in)\,2}$, 1.01 in, and SWC Volume $_{(IA-in)1}$, 1.13 in is determined and found to be significantly greater than 5%:

% Difference = ((1.13 in – 1.01 in)/1.01 in) x 100
= 12%

Therefore, steps 4 through 6 are repeated starting with SWC Volume $_{(IA-in)\,2}$ = 1.01 in.

Solution Iteration 2

4-2) SWC-Volume $_{(PA-ft^3)2}$ = ((3.84 acre x 0.21 in) + (0.96 acre x 0.12 in)) x 3,630 ft^3/acre-in
= 3,345 ft^3

5-2) SWC-Volume $_{(IA-ft^3)\,3}$ = 48,155 ft^3 – 3,345 ft^3
= 44,810 ft^3

SWC-Volume $_{(IA-in)\,3}$ = (44,810 ft^3/11.75 acre) x (12 in/ft x 1 acre/43,560 ft^2)
= 1.05 in

6-2) % Difference = ((1.05 in – 1.01 in)/1.05 in) x 100
= 4%

The difference of 4% is acceptable.

7) The % phosphorus load reduction for the infiltration basin (SWC Reduction $_{\%-P}$) is determined by using the infiltration basin performance curve for an infiltration rate of

0.27 in/hr and the treatment volume (SWC-Volume $_{Net\ IA\text{-}in}$ = 1.05 in) calculated in step 5-2 and is **SWC Reduction $_{\%\text{-}P}$ = 93%**.

The performance curve for IR = 0.27 is used rather than interpolating between the performance curves for IR = 0.27 in/hr and 0.52 in/hr to estimate performance for IR = 0.28 in/hr. An evaluation of the performance curves for IR = 0.27 in/hr and IR = 0.52 in/hr for a design storage volume of 1.05 in indicate a small difference in estimated performance (SWC Reduction $_{\%\text{-}P}$ = 93% for IR = 0.27 in/hr and SWC Reduction $_{\%\text{-}P}$ = 95% for IR = 0.52 in/hr).

8) The cumulative phosphorus load reduction in pounds of phosphorus (SWC-Reduction $_{lbs\text{-}P}$) for the proposed infiltration basin is calculated by using equation 3-2 with the SWC Load and the P $_{target}$ of 93%.

SWC-Reduction $_{lbs\text{-}P}$ = SWC Load x (P $_{target}$ /100) **(Equation 3-2)**

Using Table 3-1, the SWC load is calculated:
SWC Load = (IA x impervious cover phosphorus export loading rate for industrial)
+ (PA $_{HSG\ D}$ x pervious cover phosphorus export loading rate for HSG D)
+ (PA $_{HSG\ C}$ x pervious cover phosphorus export loading rate for HSG C)

SWC Load = (11.75 acre x 1.96 lbs/acre/yr) + (3.84 acre x 0.37 lbs/acre/yr)
+ (0.96 acre x 0.21 lbs/acre/yr)
= 24.65 lbs/yr

SWC-Reduction $_{lbs\text{-}P}$ = 24.65 lbs/yr x 93/100 = **22.92 lbs/yr**

Example 3-6: Determine the phosphorus load reductions for disconnecting impervious area using storage with delayed release:

A commercial operation has an opportunity to divert runoff from 0.75 acres of impervious roof top to a 5000 gallon (668.4 ft^3) storage tank for temporary storage and subsequent release to 0.09 acres of pervious area (PA) with HSG C soils.
Determine the:

A) Percent phosphorus load reduction rates (SWC Reduction $_{\%\text{-}P}$) for the specified impervious area (IA) disconnection and storage system assuming release times of 1, 2 and 3 days for the stored volumes to discharge to the pervious area; and
B) Cumulative phosphorus load reductions in pounds that would be accomplished by the system (SWC-Reduction $_{lbs\text{-}P}$) for the three storage release times, 1, 2 and 3 days.

Solution:

1. Determine the storage volume in units of inches of runoff depth from contributing impervious area:
Storage Volume $_{IA\text{-}in}$ = (668.4 ft^3/(0.75 acre x 43.560 ft^2/acre)) x 12 inch/ft
= 0.25 inches

2. Determine the ratio of the contributing impervious area to the receiving pervious area:
   IA:PA = 0.75 acres/0.09 acres
   = 8.3
3. Using Table 3-26 or Figure 3-23 for a IA:PA ratio of 8:1, determine the phosphorus load reduction rates for a storage volume of 0.25 inches that discharges to HSG C with release rates of 1, 2 and 3 days: Using interpolation the reduction rates are shown in Table 3-5-A:

Table Example 3-6-A: P&N Reduction Rates

Percent Phosphorus load reduction for IA disconnection with storage to PA HSG C			
Storage Volume $_{IA\text{-}in}$	Storage release rate, days		
	1	2	3
0.25	39%	42%	43%

4. The cumulative phosphorus load reductions in pounds of phosphorus for the IA disconnection with storage (SWC-Reduction $_{lbs\text{-}P}$) is calculated using Equation 3-2. The SWC Loads for phosphorus are first determined using the method presented in Example 3-1.

   Phosphorus:

   SWC Load $_P$ = IA (acre) x PLER $_{IC\text{-}Com}$ (see Table 3-1)
   = 0.75 acres x 1.78 lbs/acre/yr
   = 1.34 lbs/yr

   SWC Reduction $_{lbs\text{-}P}$ = SWC Load x (SWC Reduction $_{\%\text{-}P}$/100)
   SWC Reduction $_{lbs\text{-}P}$ = 1.34 lbs/yr x (39/100)
   = **0.53 lbs/yr**

   Table Example 3-5-B presents the SWC Reduction $_{lbs\text{-}P}$ for each of the release rates:

Table Example 3-6-B: P Reduction Loads

Phosphorus load reduction for IA disconnection with storage to PA HSG C, lbs			
Storage Volume $_{IA\text{-}in}$	Storage release rate, days		
	1	2	3
0.25	0.53	0.56	0.58

Example 3-7: Determine the phosphorus load reduction for disconnecting impervious area with and without soil augmentation in the receiving pervious area:*

*The approach used in this example for phosphorus is equally applicable for nitrogen

The same commercial property as in Example 3-5 wants to evaluate disconnecting drainage from the 0.75 acre impervious roof top and discharging it directly to 0.09 acres of pervious area (PA) with HSG C. Also, the property has the opportunity to purchase a small adjoining area (0.06 acres), also HSG C, to increase the size of the receiving PA from 0.09 to 0.15 acres and to allow the property owner to avoid having to install a drainage structure to capture overflow runoff from the PA. The property owner has been informed that the existing PA soil can be tilled and augmented with soil amendments to support denser vegetative growth and improve hydrologic function to approximate HSG B.

Determine the:

A) Percent phosphorus load reduction rates (SWC Reduction $_{\%\text{-P}}$) for the specified impervious area (IA) disconnection to both the 0.09 and 0.15 acre receiving PAs with and without soil augmentation; and
B) Cumulative phosphorus reductions in pounds that would be accomplished by the IA disconnection for the various scenarios (SWC-Reduction $_{\text{lbs-P}}$).

Solution:

1. Determine the ratio of the contributing impervious area to the receiving pervious area:

   IA:PA = 0.75 acres/0.09 acres
   = 8.3
   IA:PA = 0.75 acres/0.15 acres
   = 5.0

2. Using Table 3-31 and Figure 3-41 for a IA:PA ratios of 8:1 and 5:1, respectively, determine the phosphorus load reduction rates for IA disconnections to HSG C and HSG B:

Table Example 3-7-A: Reduction Rates

Percent Phosphorus load reduction rates for IA disconnection		
Receiving PA	**IA:PA**	
	8:1	5:1
HSG C	7%	14%
HSG B (soil augmentation)	14%	22%

3. The cumulative phosphorus load reduction in pounds of phosphorus for the IA disconnection with storage (SWC-Reduction $_{\text{lbs-P}}$) is calculated using Equation 3-2. The SWC Load was calculated in example 3-5 and is 1.34 lbs/yr.

   SWC Reduction $_{\text{lbs-P}}$ = SWC Load x (SWC Reduction $_{\%\text{-P}}$/100)
   For PA of 0.09 acres HSG C the SWC Reduction $_{\text{lbs-P}}$ is calculated as follows:
   SWC Reduction $_{\text{lbs-P(0.09ac- HSG C)}}$ = 1.34 lbs/yr x (7/100)
   = **0.09 lbs/yr**
   Table Example 3-7-B presents the SWC Reduction $_{\text{lbs-P}}$ for each of the scenarios:

Table Example 3-7-B: Reduction

Pounds Phosphorus load reduction for IA disconnection, lbs/yr		
Receiving PA	**Area of Receiving PA, acres**	
	0.09	**0.15**
HSG C	0.09	0.19
HSG B (soil augmentation)	0.19	0.29

Example 3-8: Determine the phosphorus load reduction for converting impervious area to permeable/pervious area:

A municipality is planning upcoming road reconstruction work in medium density residential (MDR) neighborhoods, and has identified an opportunity to convert impervious surfaces to permeable/pervious surfaces by narrowing the road width of 3.7 miles (mi) of roadway from 32 feet (ft) to 28 ft and eliminating 3.2 miles of 4 ft wide paved sidewalk (currently there are sidewalks on both sides of the roadways targeted for restoration). The newly created permeable/pervious area will be tilled and treated with soil amendments to support vegetated growth in order to restore hydrologic function to at least HSG B.

Determine the:

A) Percent phosphorus load reduction rate (SWC Reduction $_{\%\text{-P}}$) for the conversion of impervious area (IA) to permeable/pervious area (PA); and
B) Cumulative phosphorus reduction in pounds that would be accomplished by the project (SWC-Reduction $_{\text{lbs-P}}$).

Solution:

1. Determine the area of IA to be converted to PA:

   New PA = (((3.7 mi x 4 ft) + (3.2 mi x 4 ft)) x 5280 ft/mi)/43,560 ft^2/acre
   = 3.35 acres

2. Using Table 3-32, the phosphorus load reduction rate for converting IA to HSG B is 94.1%
3. The SWC Load is first determined using the method described above.

   SWC Load = IA x phosphorus export loading rate for MDR IA (see Table 3-1)
   = 3.35 acres x 1.96 lbs/acre/yr
   = 6.57 lbs/yr

4. The cumulative phosphorus load reduction in pounds of phosphorus for the IA conversion (SWC-Reduction $_{\text{lbs-P}}$) is calculated using Equation 3-2.

   SWC Reduction $_{\text{lbs-P}}$ = SWC Load x (SWC Reduction $_{\%\text{-P}}$/100)
   SWC Reduction $_{\text{lbs-P}}$ = 6.57 lbs/yr x (94.1/100)
   = 6.18 lbs/yr

Table 3-4 Method for determining stormwater control design volume (DSV) (i.e., capacity) using long-term cumulative performance curves

Stormwater Control Type	Description	Applicable Structural Stormwater Control Performance Curve	Equation for calculating Design Storage Capacity for Estimating Cumulative Reductions using Performances Curves
Infiltration Trench	Provides temporary storage of runoff using the void spaces within the soil/sand/gravel mixture that is used to backfill the trench for subsequent infiltration into the surrounding sub-soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = void space volumes of gravel and sand layers DSV = (L x W x D_{stone} x n_{stone})+ (L x W x D_{sand} x n_{sand})
Subsurface Infiltration	Provides temporary storage of runoff using the combination of storage structures (e.g., galleys, chambers, pipes, etc.) and void spaces within the soil/sand/gravel mixture that is used to backfill the system for subsequent infiltration into the surrounding sub-soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Water storage volume of storage units and void space volumes of backfill materials. Example for subsurface galleys backfilled with washed stone: DSV = $(L \text{ x } W \text{ x } D)_{galley}$ + (L x W x D_{stone} x n_{stone})
Surface Infiltration	Provides temporary storage of runoff through surface ponding storage structures (e.g., basin or swale) for subsequent infiltration into the underlying soils.	Infiltration Basin (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Water volume of storage structure before bypass. Example for linear trapezoidal vegetated swale DSV = (L x ((W_{bottom}+$W_{top@Dmax}$)/2) x D)
Rain Garden/Bio-retention (no underdrains)	Provides temporary storage of runoff through surface ponding and possibly void spaces within the soil/sand/gravel mixture that is used to filter runoff prior to infiltration into underlying soils.	Infiltration Basin (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Ponding water storage volume and void space volumes of soil filter media. Example for raingarden: DSV = (A_{pond} x D_{pond}) + (A_{soil} x D_{soil} x $n_{soil\ mix}$)
Tree Filter (no underdrain)	Provides temporary storage of runoff through surface ponding and void spaces within the soil/sand/gravel mixture that is used to filter runoff prior to infiltration into underlying soils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = Ponding water storage volume and void space volumes of soil filter media. DSV = (L x W x $D_{ponding}$) + (L x W x D_{soil} x $n_{soil\ mix}$)
Bio-Filtration (w/underdrain)	Provides temporary storage of runoff for filtering through an engineered soil media. The storage capacity includes void spaces in the filter media and temporary ponding at the surface. After runoff has passed through the filter media it is collected by an under-drain pipe for discharge. Manufactured or packaged bio-filter systems such as tree box filters may be suitable for using the bio-filtration performance results.	Bio-filtration	DSV = Ponding water storage volume and void space volume of soil filter media. Example of a linear biofilter: DSV = (L x W x $D_{ponding}$)+ (L x W x D_{soil} x n_{soil})
Enhanced Bio-filtration w/ Internal Storage Reservoir (ISR) (no infiltration)	Based on design by the UNH Stormwater Center (UNHSC). Provides temporary storage of runoff for filtering through an engineered soil media, augmented for enhanced phosphorus removal, followed by detention and denitrification in a subsurface internal storage reservoir (ISR) comprised of gravel. An elevated outlet control at the top of the ISR is designed to provide a retention time of at least 24 hours in the system to allow for sufficient time for denitrification reduction to occur prior to discharge. The design storage capacity for using the cumulative performance curves is comprised of void spaces in the filter media, temporary ponding at the surface of the practice and the void spaces in the gravel ISR.	Enhanced Bio-filtration w/ISR	DSV = Ponding water storage volume and void space volume of soil filter media and gravel ISR. DSV =(A_{bed} x $D_{ponding}$)+(A_{bed} x D_{soil} x n_{soil})+(A_{ISR} x D_{gravel} x n_{gravel})
Gravel Wetland	Provides temporary surface ponding storage of runoff in a vegetated wetland cell that is eventually routed to an underlying saturated gravel internal storage reservoir (ISR) for nitrogen treatment. Outflow is controlled by an elevated orifice that has its invert elevation equal to the top of the ISR layer and provides a retention time of at least 24 hours.	Gravel Wetland	DSV = pretreatment volume + ponding volume + void space volume of gravel ISR. DSV = ($A_{pretreatment}$ x $D_{preTreatment}$)+ ($A_{wetland}$ x $D_{ponding}$)+(A_{ISR} x D_{gravel} x n_{gravel})
Porous Pavement with subsurface infiltration	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces of a subsurface gravel reservoir prior to infiltration into subsoils.	Infiltration Trench (6 infiltration rates: 0.17, 0.27, 0.52, 1.02, 2.41 and 8.27 inches per hour)	DSV = void space volumes of gravel layer DSV = (L x W x D_{stone} x n_{stone})
Porous pavement w/ impermeable underliner w/underdrain	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces prior to discharge by way of an underdrain.	Porous Pavement	Depth of Filter Course = D_{FC}
Sand Filter w/underdrain	Provides filtering of runoff through a sand filter course and temporary storage of runoff through surface ponding and within void spaces of the sand and washed stone layers prior to discharge by way of an underdrain.	Sand Filter	DSV = pretreatment volume + ponding volume + void space volume of sand and washed stone layers. DSV = ($A_{pretreatment}$ x $D_{preTreatment}$)+ (A_{bed} x $D_{ponding}$)+ (A_{bed} x D_{sand} x n_{sand}) + (A_{bed} x D_{stone} x n_{stone})
Wet Pond	Provides treatment of runoff through routing through permanent pool.	Wet Pond	DSV= Permanent pool volume prior to high flow bypass DSV=A_{pond} x D_{pond} (does not include pretreatment volume)
Extended Dry Detention Basin	Provides temporary detention storage for the design storage volume to drain in 24 hours through multiple out let controls.	Dry Pond	DSV= Ponding volume prior to high flow bypass DSV=A_{pond} x D_{pond} (does not include pretreatment volume)
Dry Water Quality Swale/Grass Swale	Based on MA design standards. Provides temporary surface ponding storage of runoff in an open vegetated channel through permeable check dams. Treatment is provided by filtering of runoff by vegetation and check dams and infiltration into subsurface soils.	Water Quality Grass swale	DSV = Volume of swale at full design depth DSV=L_{swale} x W_{swale} x $D_{ponding\ swale}$

Definitions: DSV= Design Storage Volume = physical storage capacity to hold water; **VSV** = Void Space Volume; **L** = length, **W** = width, **D** = depth at design capacity before bypass, **n** = porosity fill material, **A**= average surface area for calculating volume; **Infiltration rate** = saturated soil hydraulic conductivity

Table 3- 6: Infiltration Trench (IR = 0.17 in/hr) SWC Performance Table

Infiltration Trench (IR = 0.17 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	15%	28%	49%	64%	75%	82%	92%	95%
Cumulative Phosphorus Load Reduction	18%	33%	57%	73%	83%	90%	97%	99%

Figure 3- 1: SWC Performance Curve: Infiltration Trench (infiltration rate = 0.17 in/hr)

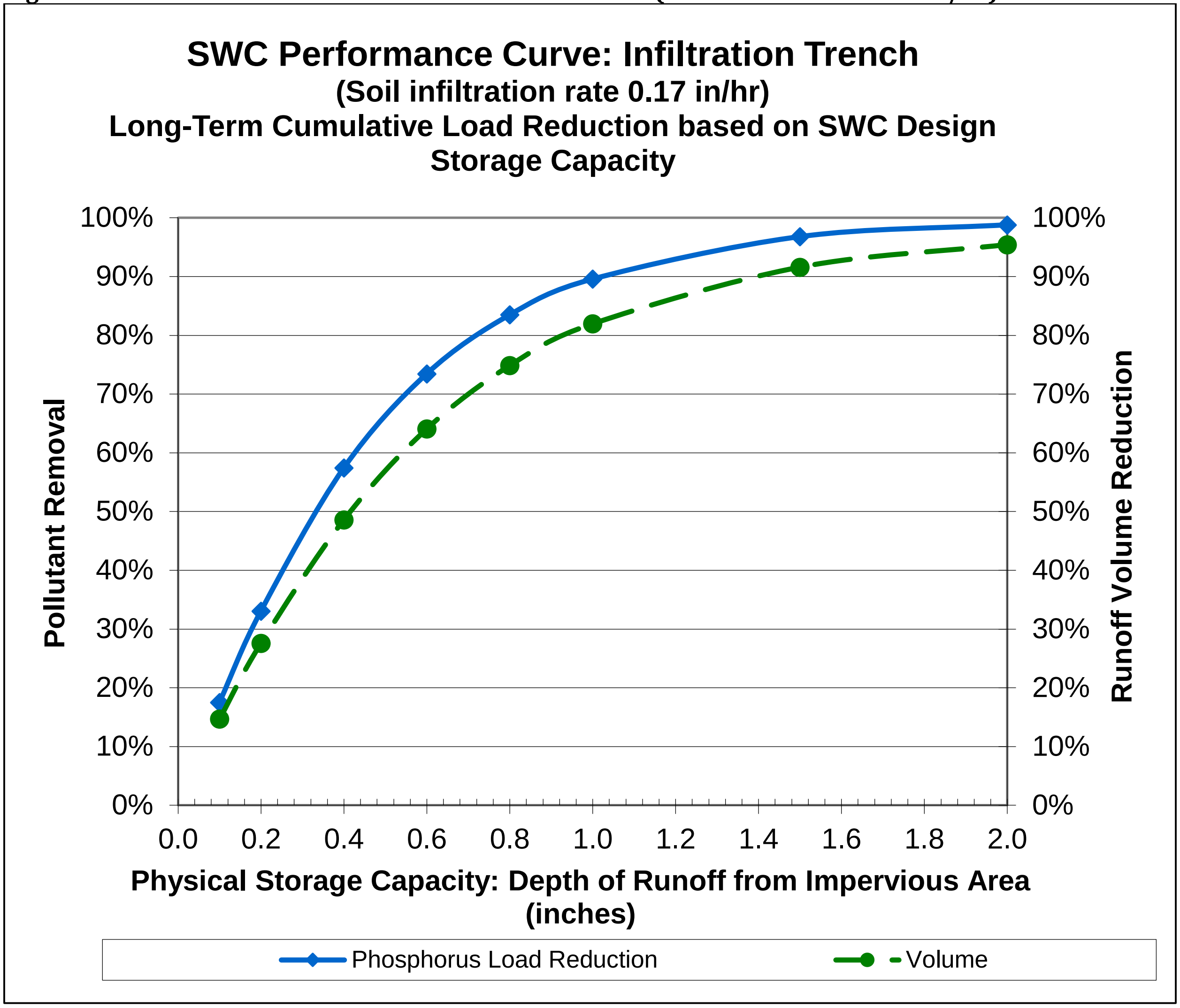


Table 3- 7: Infiltration Trench (IR = 0.27 in/hr) SWC Performance Table

Infiltration Trench (IR = 0.27 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	17.8%	32.5%	55.0%	70.0%	79.3%	85.2%	93.3%	96.3%
Cumulative Phosphorus Load Reduction	20%	37%	63%	78%	86%	92%	97%	99%

Figure 3- 2: SWC Performance Curve: Infiltration Trench (infiltration rate = 0.27 in/hr)

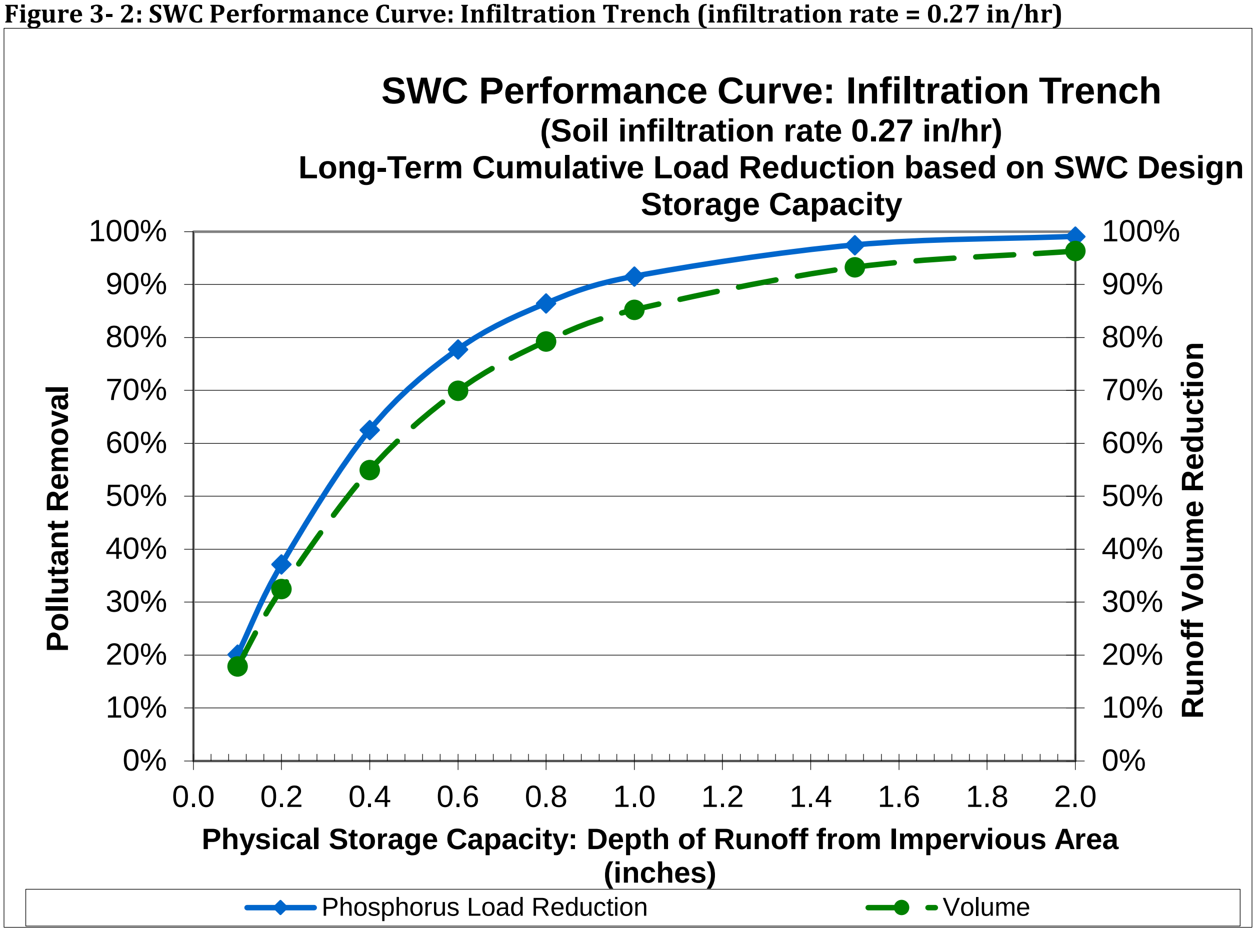


Table 3- 8: Infiltration Trench (IR = 0.52 in/hr) SWC Performance Table

Infiltration Trench (IR = 0.52 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	22.0%	38.5%	61.8%	75.7%	83.7%	88.8%	95.0%	97.2%
Cumulative Phosphorus Load Reduction	23%	42%	68%	82%	89%	94%	98%	99%

Figure 3- 3: SWC Performance Curve: Infiltration Trench (infiltration rate = 0.52 in/hr)

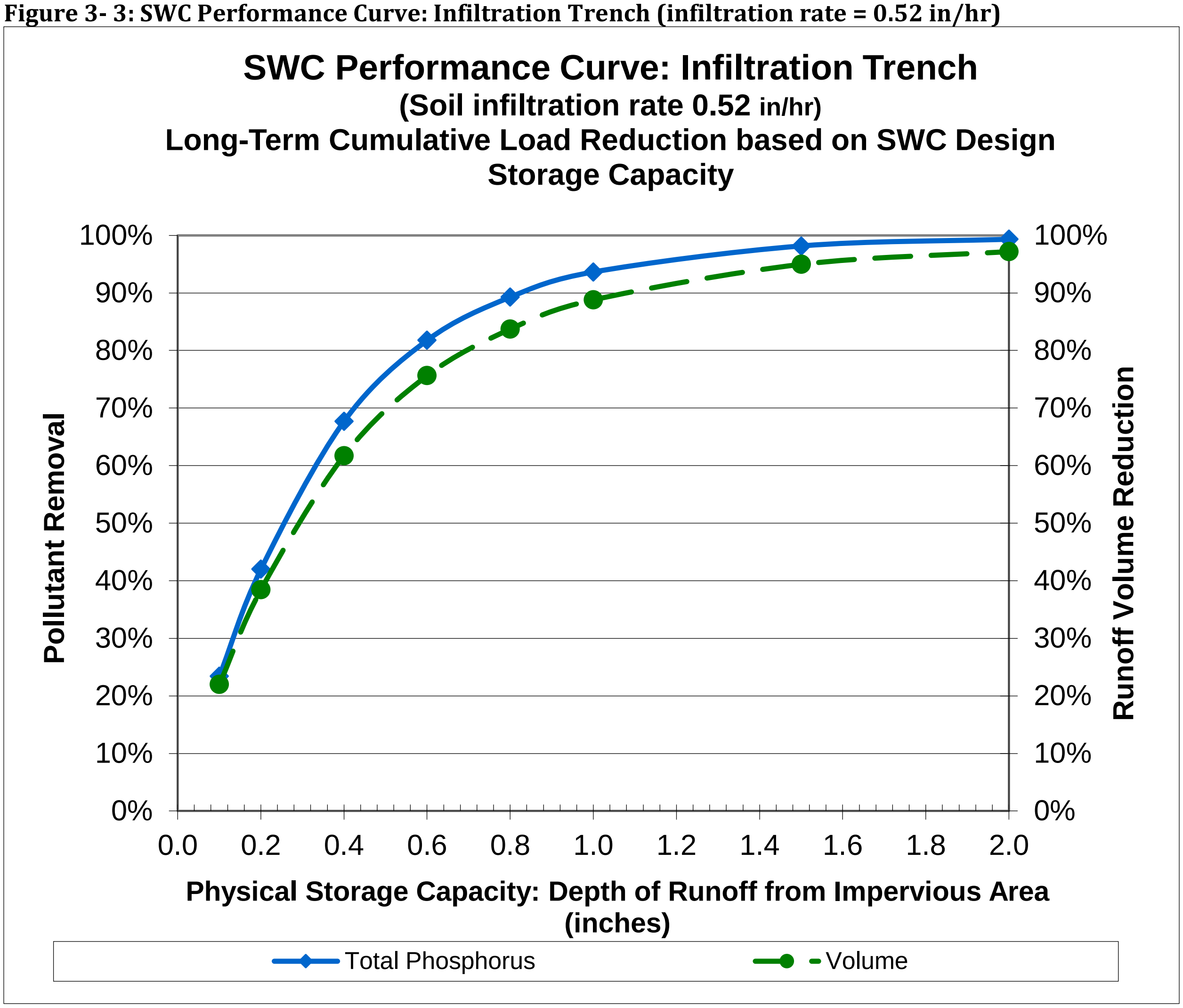


Table 3- 9: Infiltration Trench (IR = 1.02 in/hr) SWC Performance Table

Infiltration Trench (IR = 1.02 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	26.3%	44.6%	68.2%	81.0%	88.0%	92.1%	96.5%	98.3%
Cumulative Phosphorus Load Reduction	27%	47%	73%	86%	92%	96%	99%	100%

Figure 3- 4: SWC Performance Curve: Infiltration Trench (infiltration rate = 1.02 in/hr)

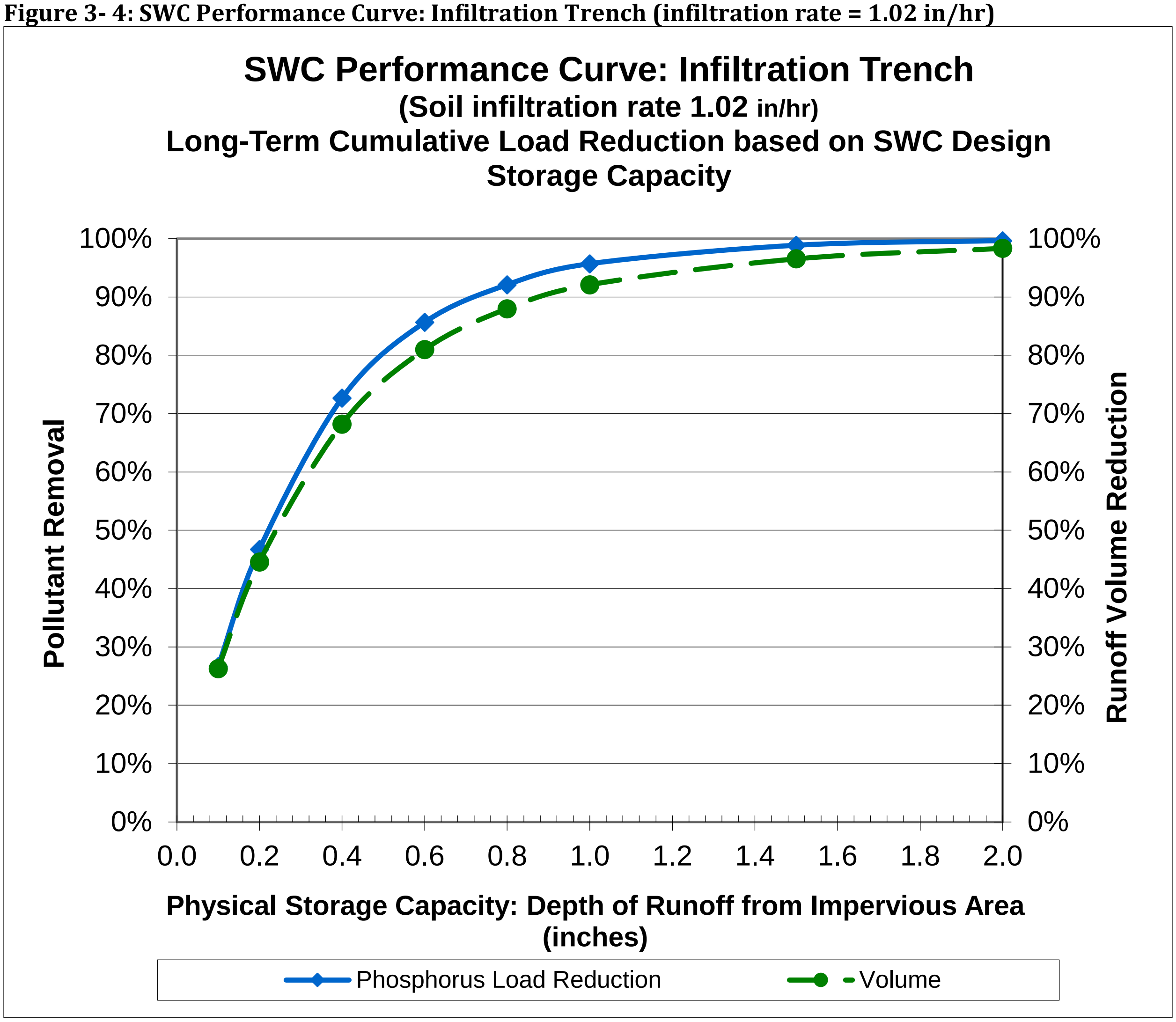


Table 3- 10: Infiltration Trench (IR = 2.41 in/hr) SWC Performance Table

Infiltration Trench (IR = 2.41 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	34%	55%	78%	88%	93%	96%	99%	100%
Cumulative Phosphorus Load Reduction	33%	55%	81%	91%	96%	98%	100%	100%

Figure 3- 5: SWC Performance Curve: Infiltration Trench (infiltration rate = 2.41 in/hr)

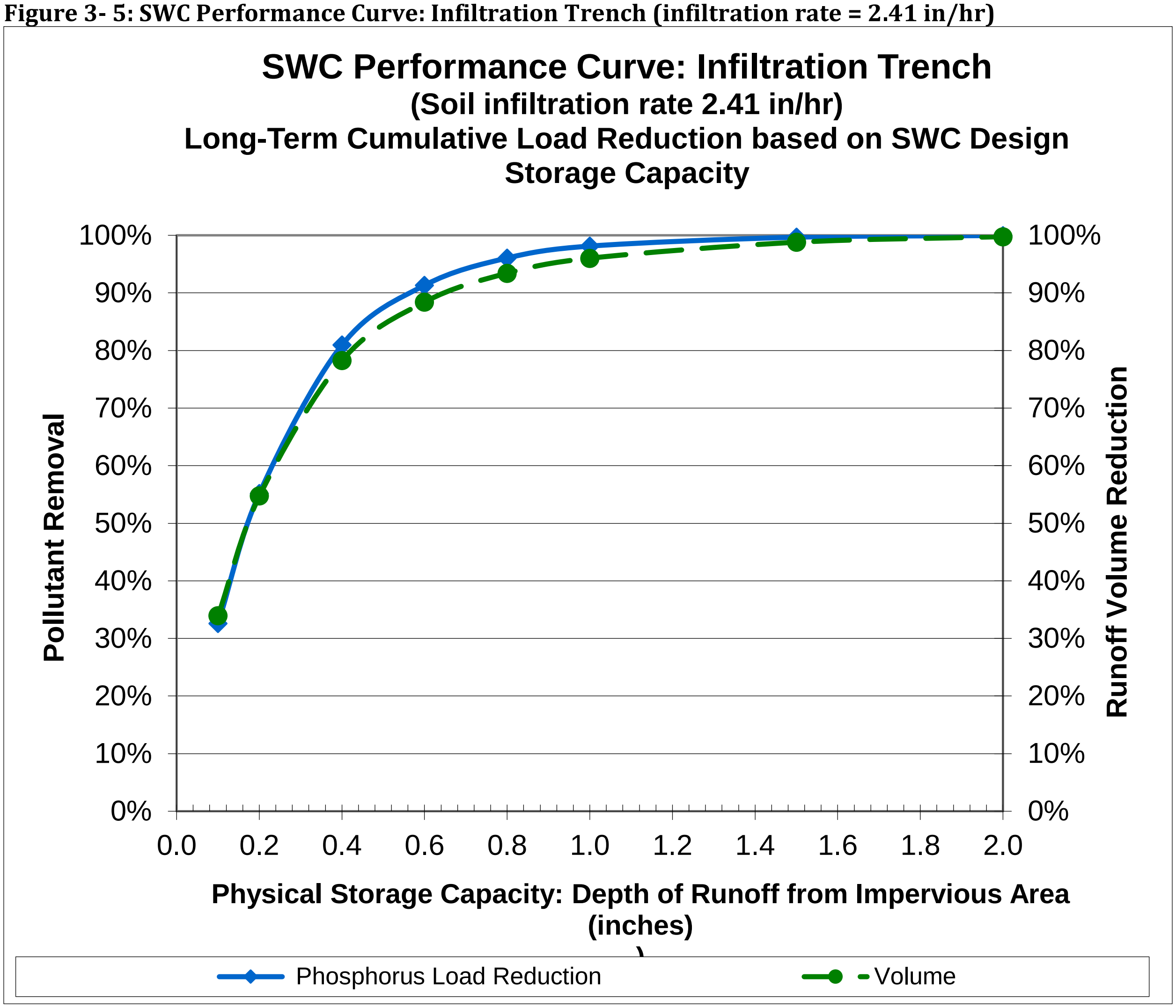


Table 3- 11: Infiltration Trench (8.27 in/hr) SWC Performance Table

Infiltration Trench (8.27 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	53.6%	76.1%	92.6%	97.2%	98.9%	99.5%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	50%	75%	94%	98%	99%	100%	100%	100%

Figure 3- 6: SWC Performance Curve: Infiltration Trench (infiltration rate = 8.27 in/hr)

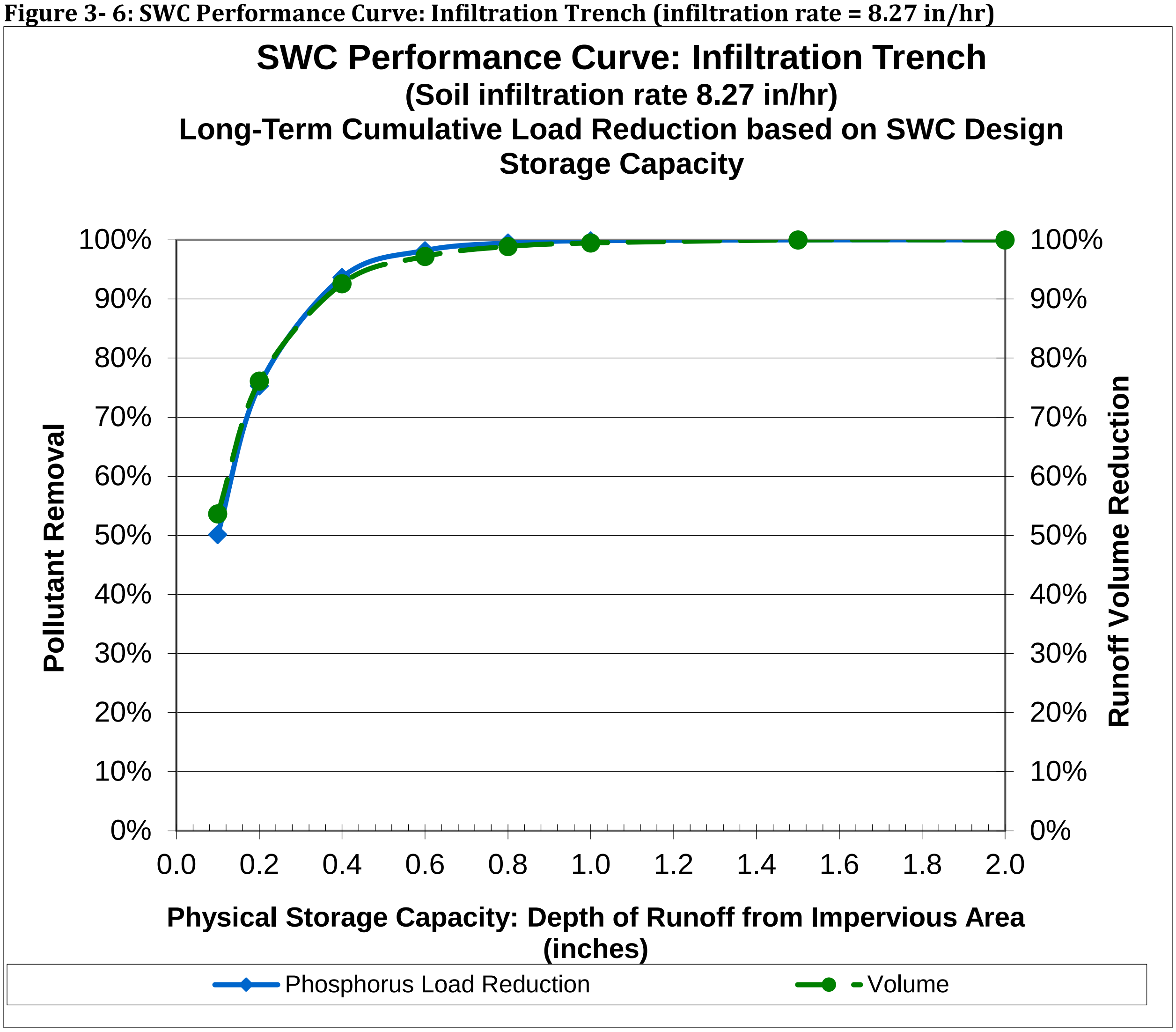


Table 3- 12: Surface Infiltration (0.17 in/hr) SWC Performance Table

Surface Infiltration (0.17 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	13%	25%	44%	59%	71%	78%	89%	94%
Cumulative Phosphorus Load Reduction	35%	52%	72%	82%	88%	92%	97%	99%

Figure 3- 7: SWC Performance Curve: Infiltration Basin (infiltration rate = 0.17 in/hr)

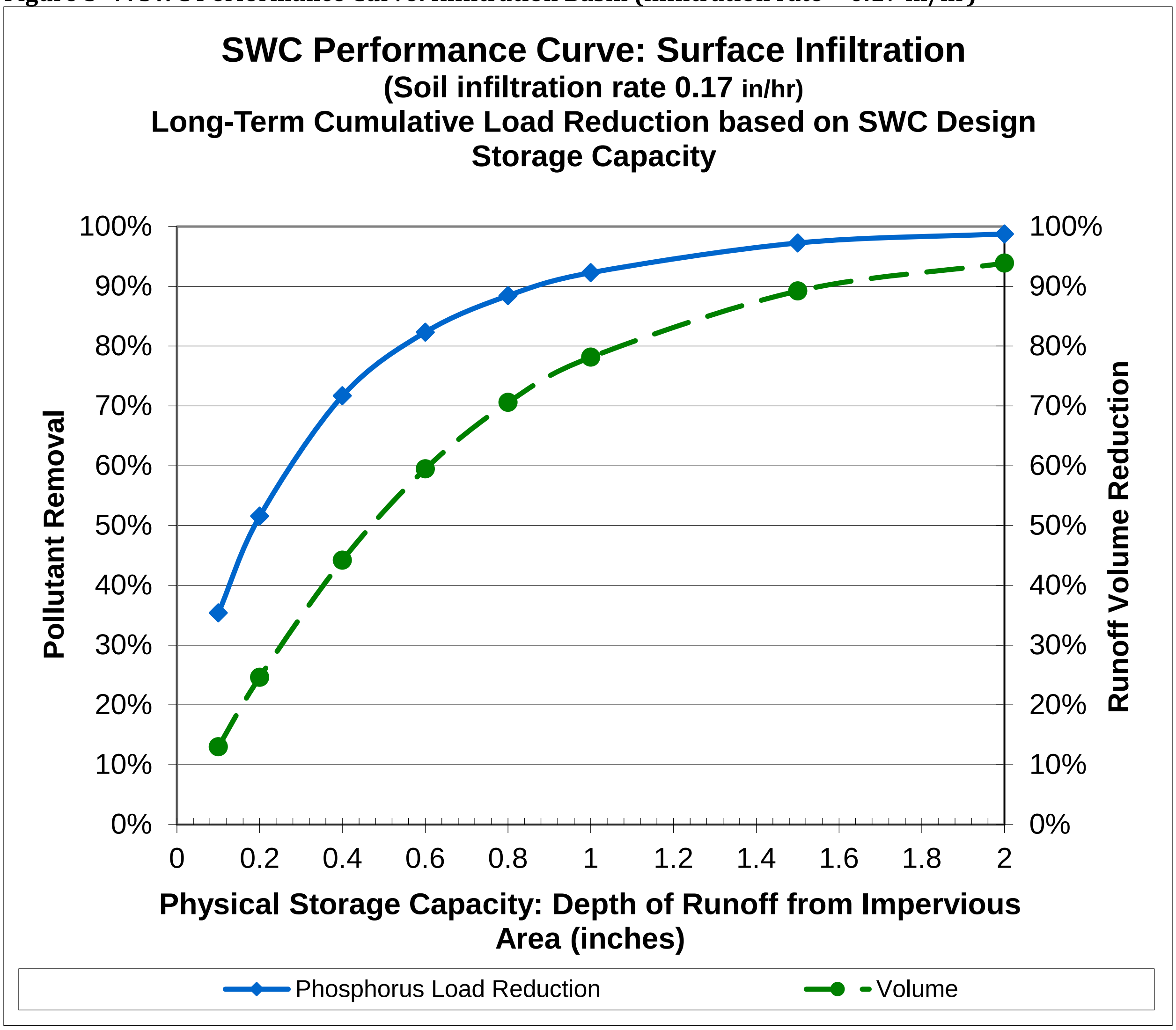


Table 3- 13: Infiltration Basin (0.27 in/hr) SWC Performance Table

Surface Infiltration (0.27 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	16%	30%	51%	66%	76%	82%	91%	95%
Cumulative Phosphorus Load Reduction	37%	54%	74%	85%	90%	93%	98%	99%

Figure 3- 8: SWC Performance Curve: Surface Infiltration (infiltration rate = 0.27 in/hr)

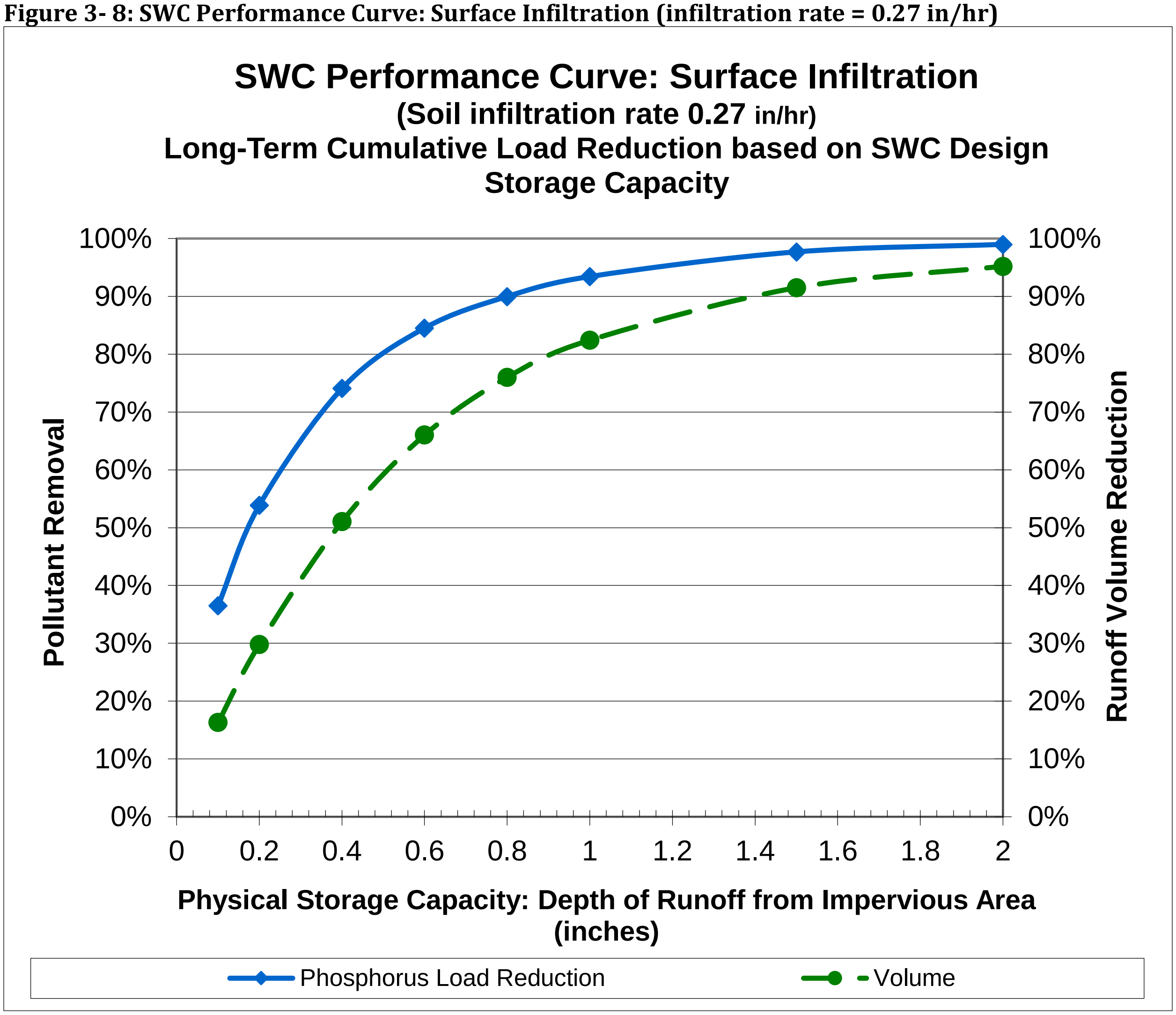


Table 3- 14: Infiltration Basin (0.52 in/hr) SWC Performance Table

Surface Infiltration (0.52 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	20%	36%	58%	73%	81%	87%	94%	97%
Cumulative Phosphorus Load Reduction	38%	56%	77%	87%	92%	95%	98%	99%

Figure 3- 9: SWC Performance Curve: Surface Infiltration (infiltration rate = 0.52 in/hr)

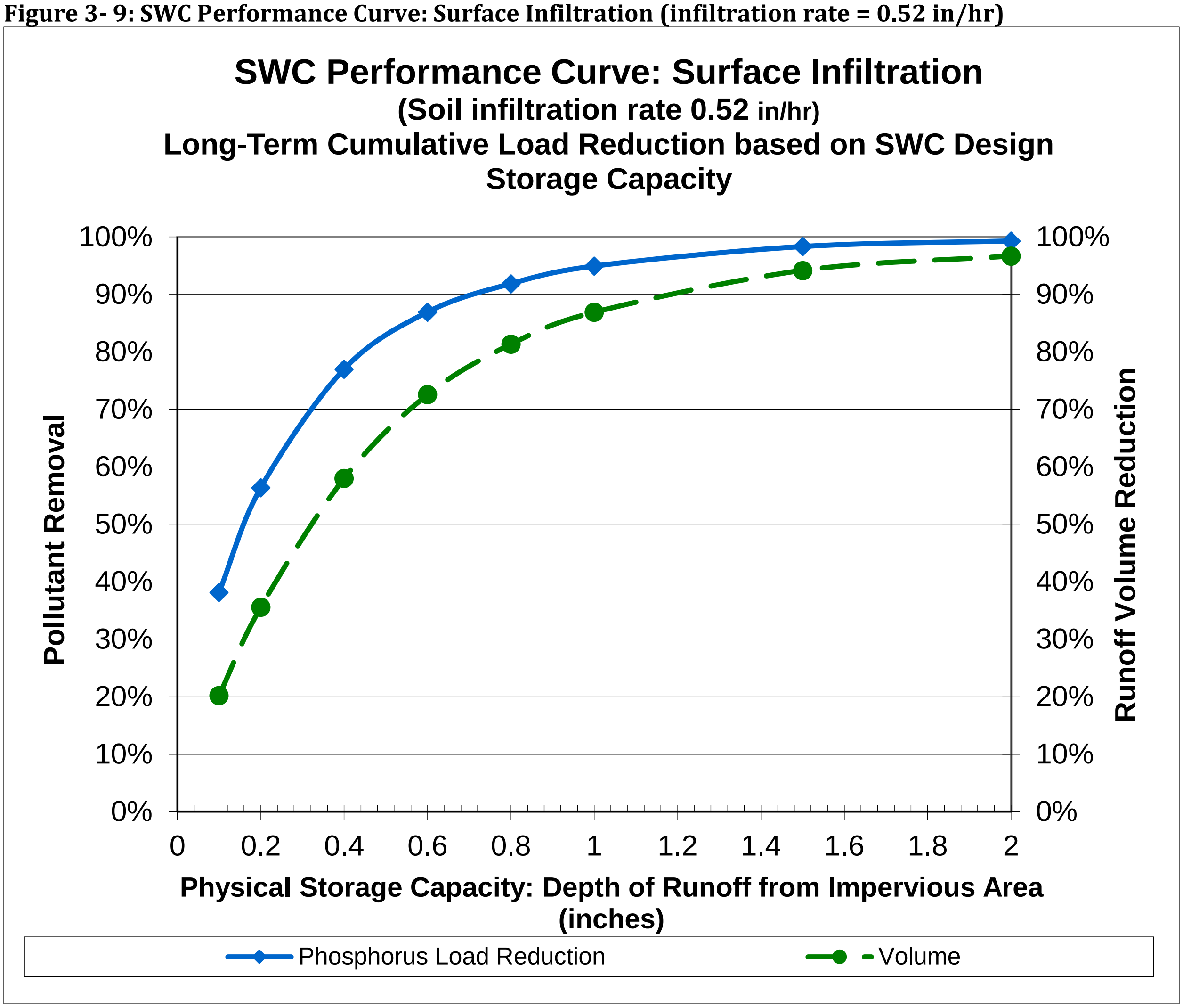


Table 3-15: Infiltration Basin (1.02 in/hr) SWC Performance Table

Surface Infiltration (1.02 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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	24.5%	42.0%	65.6%	79.4%	86.8%	91.3%	96.2%	98.1%
Cumulative Phosphorus Load Reduction	41%	60%	81%	90%	94%	97%	99%	100%

Figure 3- 10**: SWC Performance Curve: Surface Infiltration (Soil infiltration rate = 1.02 in/hr)**

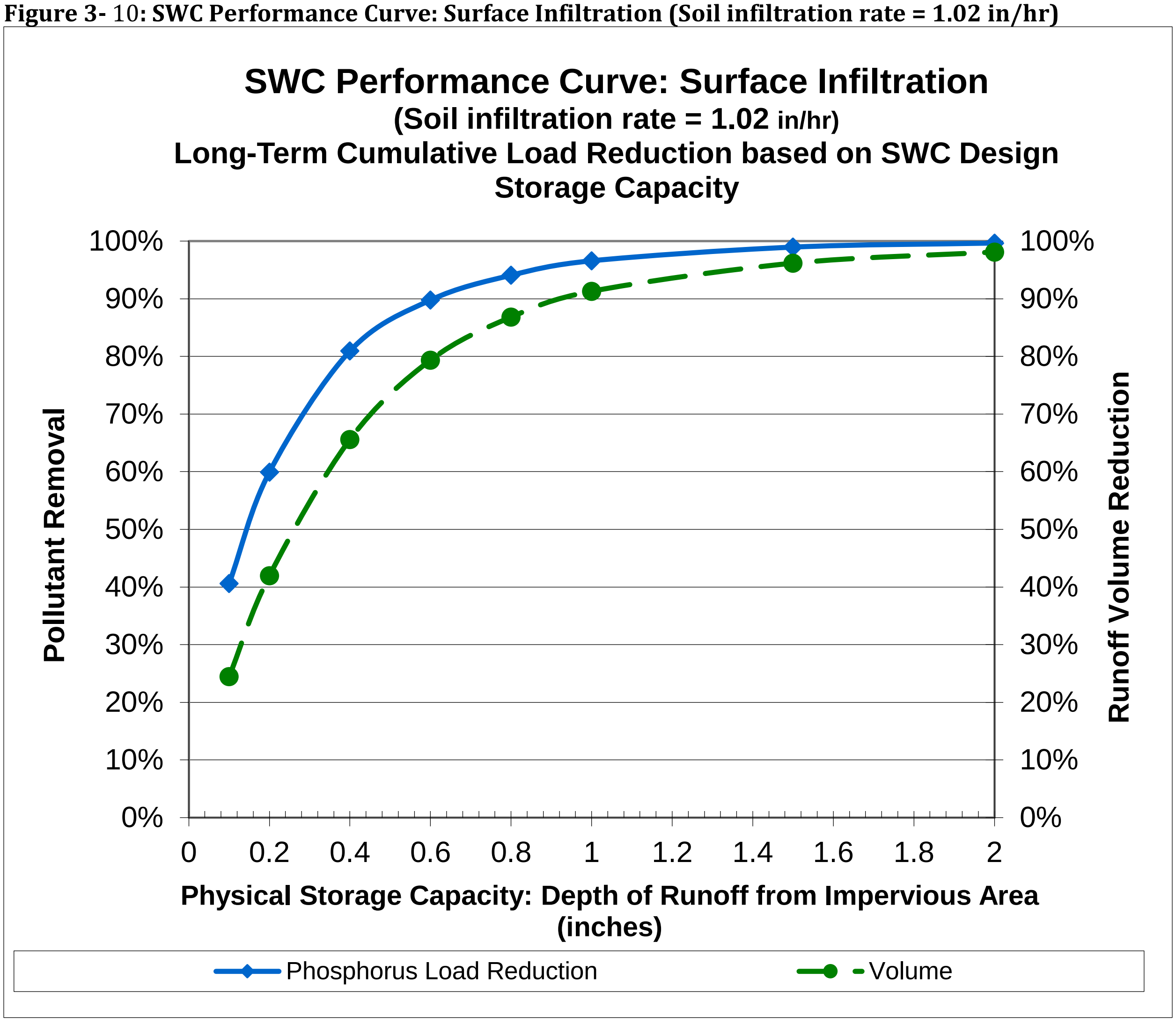


Table 3- 16: Surface Infiltration (2.41 in/hr) SWC Performance Table

Surface Infiltration (2.41 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC 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%

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

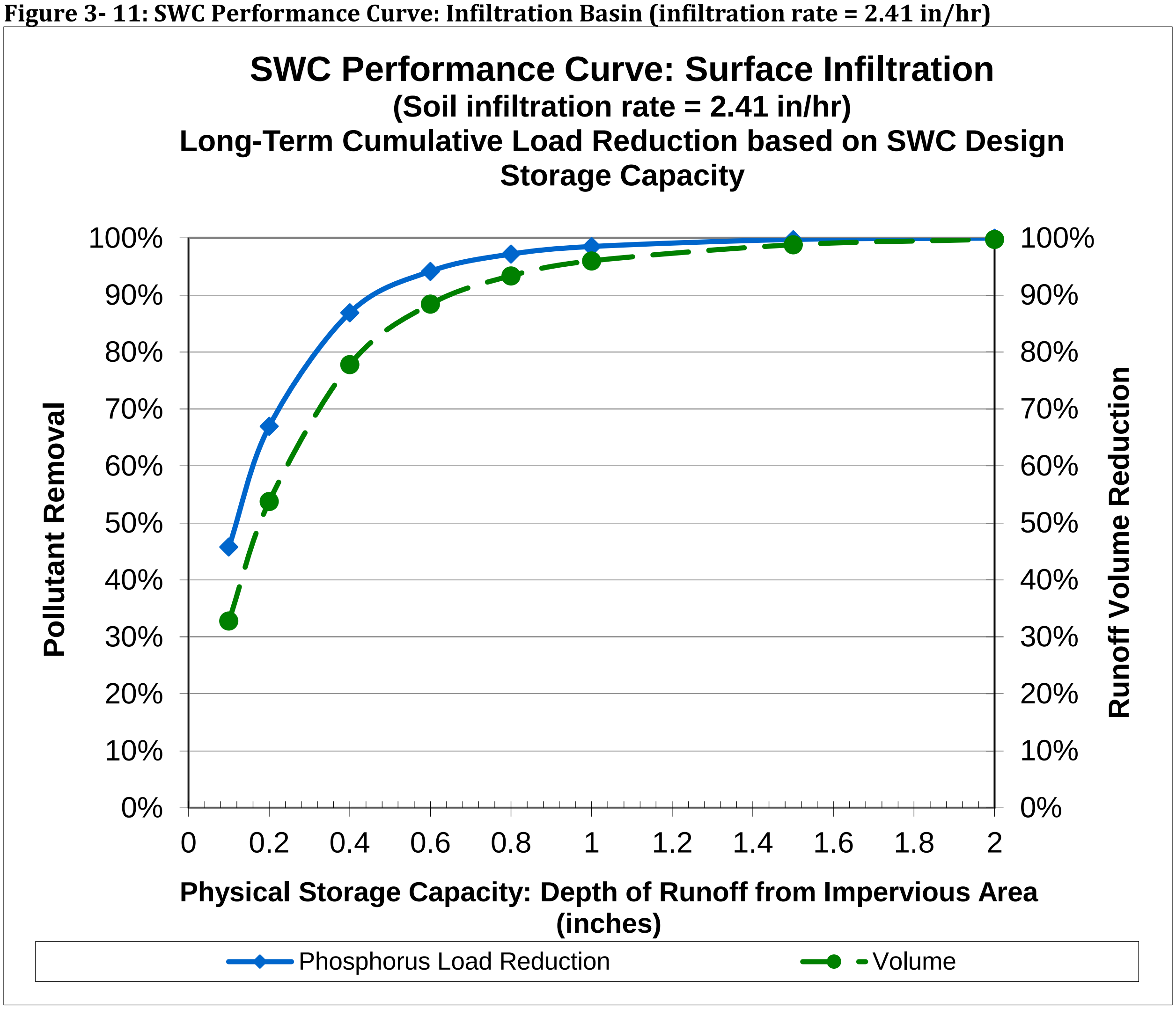


Table 3- 17: Surface Infiltration (8.27 in/hr) SWC Performance Table

Surface Infiltration (8.27 in/hr) SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	54.6%	77.2%	93.4%	97.5%	99.0%	99.6%	100.0%	100.0%
Cumulative Phosphorus Load Reduction	59%	81%	96%	99%	100%	100%	100%	100%

Figure 3- 12: SWC Performance Curve: Surface Infiltration (infiltration rate = 8.27 in/hr)

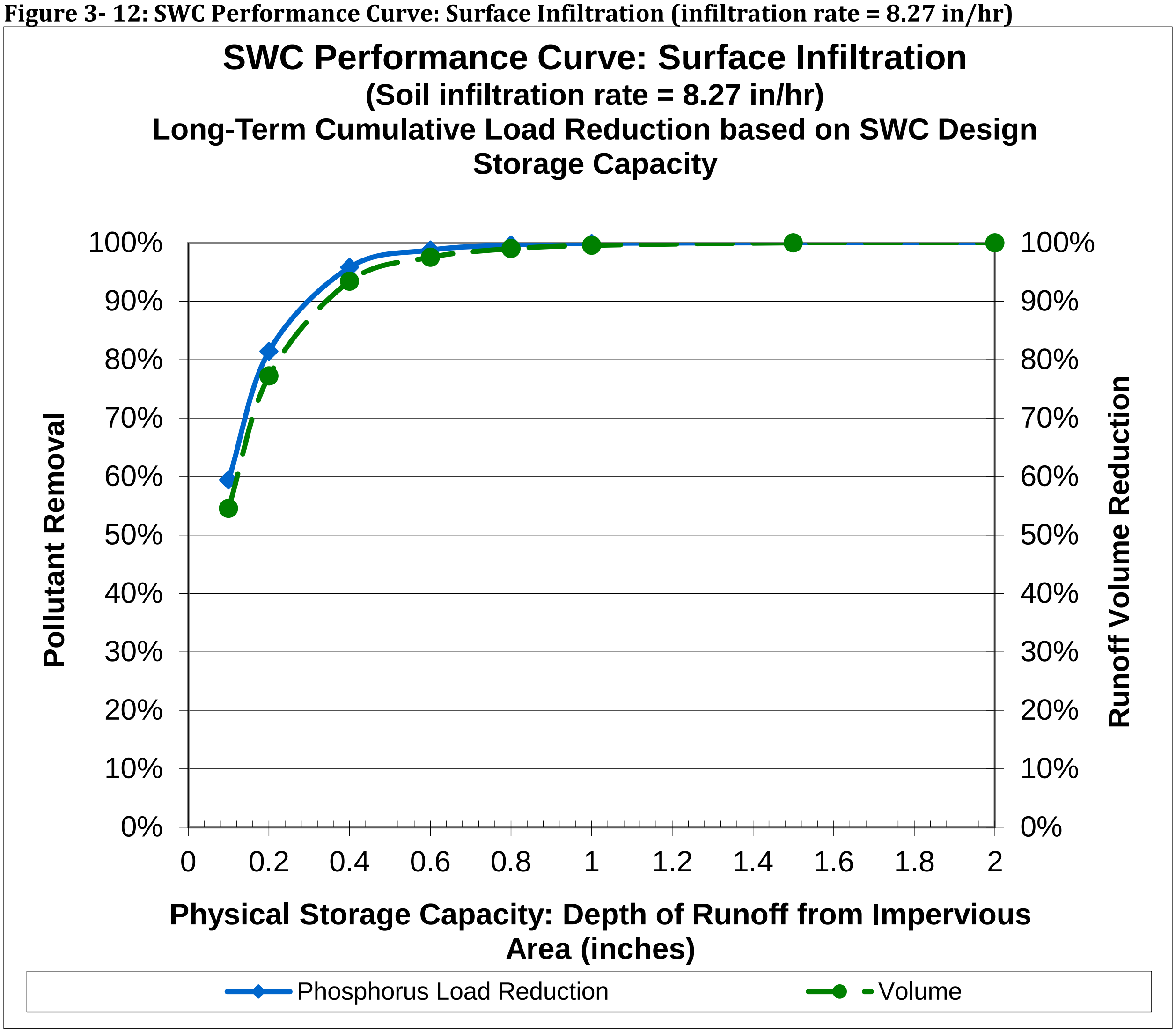


Table 3-18: Bio-filtration SWC Performance Table

Bio-filtration SWC Performance Table: Long-Term Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%

Figure 3- 13: SWC Performance Curve: Bio-filtration

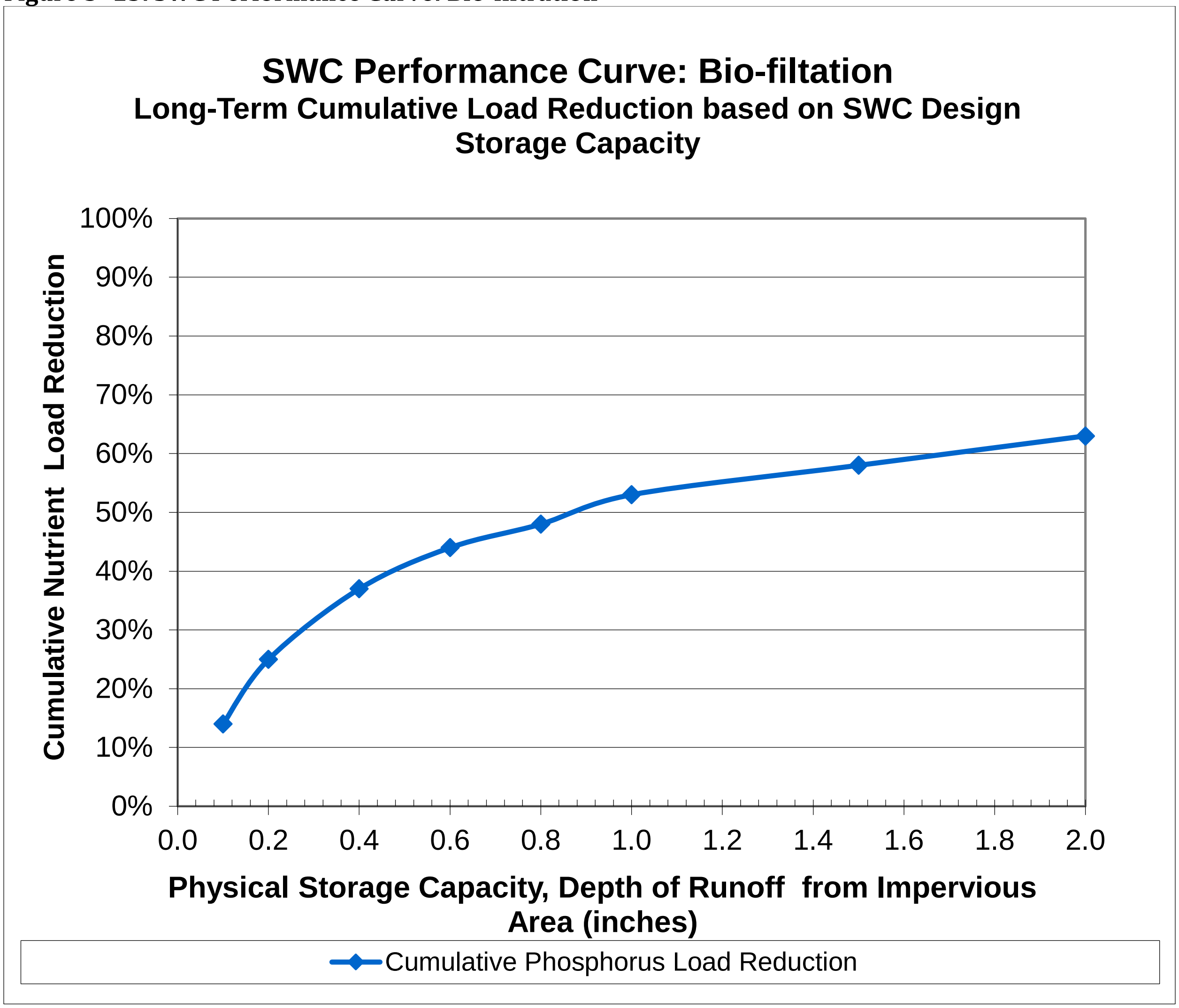


Table 3- 19: Gravel Wetland SWC Performance Table

Gravel Wetland SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	19%	26%	41%	51%	57%	61%	65%	66%
Cumulative Nitrogen Load Reduction	22%	33%	48%	57%	64%	68%	74%	79%

Figure 3- 14: SWC Performance Curve: Gravel Wetland

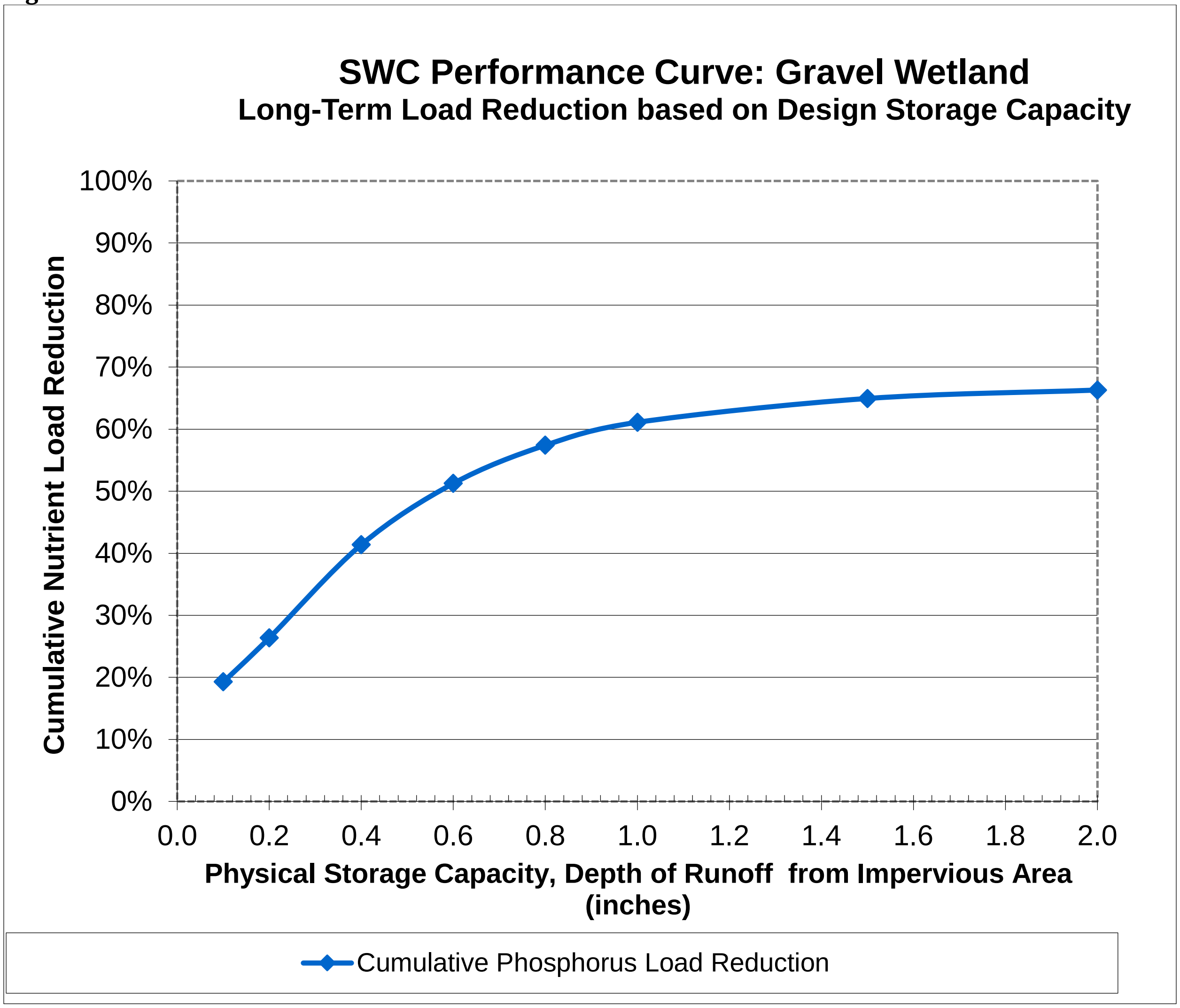


Table 3- 20: Enhanced Bio-filtration* with Internal Storage Reservoir (ISR) SWC Performance Table

Enhanced Bio-filtration* w/ ISR SWC Performance Table: Long-Term Phosphorus Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	19%	34%	53%	64%	71%	76%	84%	89%

***Filter media augmented with phosphorus sorbent materials to enhance phosphorus removal.**

Figure 3-15: SWC Performance Curve: Enhanced Bio-filtration with Internal Storage Reservoir (ISR) SWC Performance Table

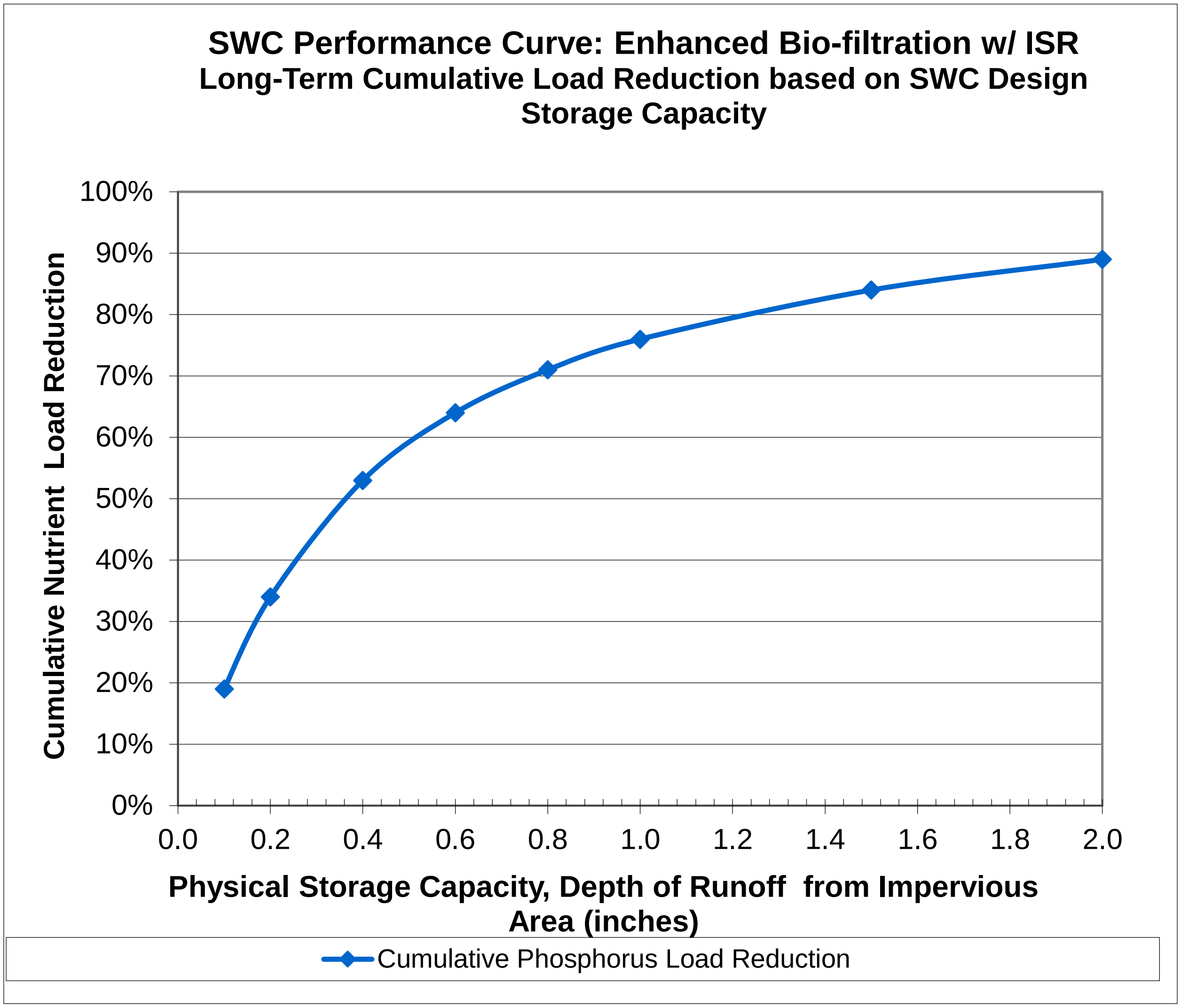


Table 3-21: Sand Filter SWC Performance Table

Sand Filter SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%

Figure 3-16: SWC Performance Curve: Sand Filter

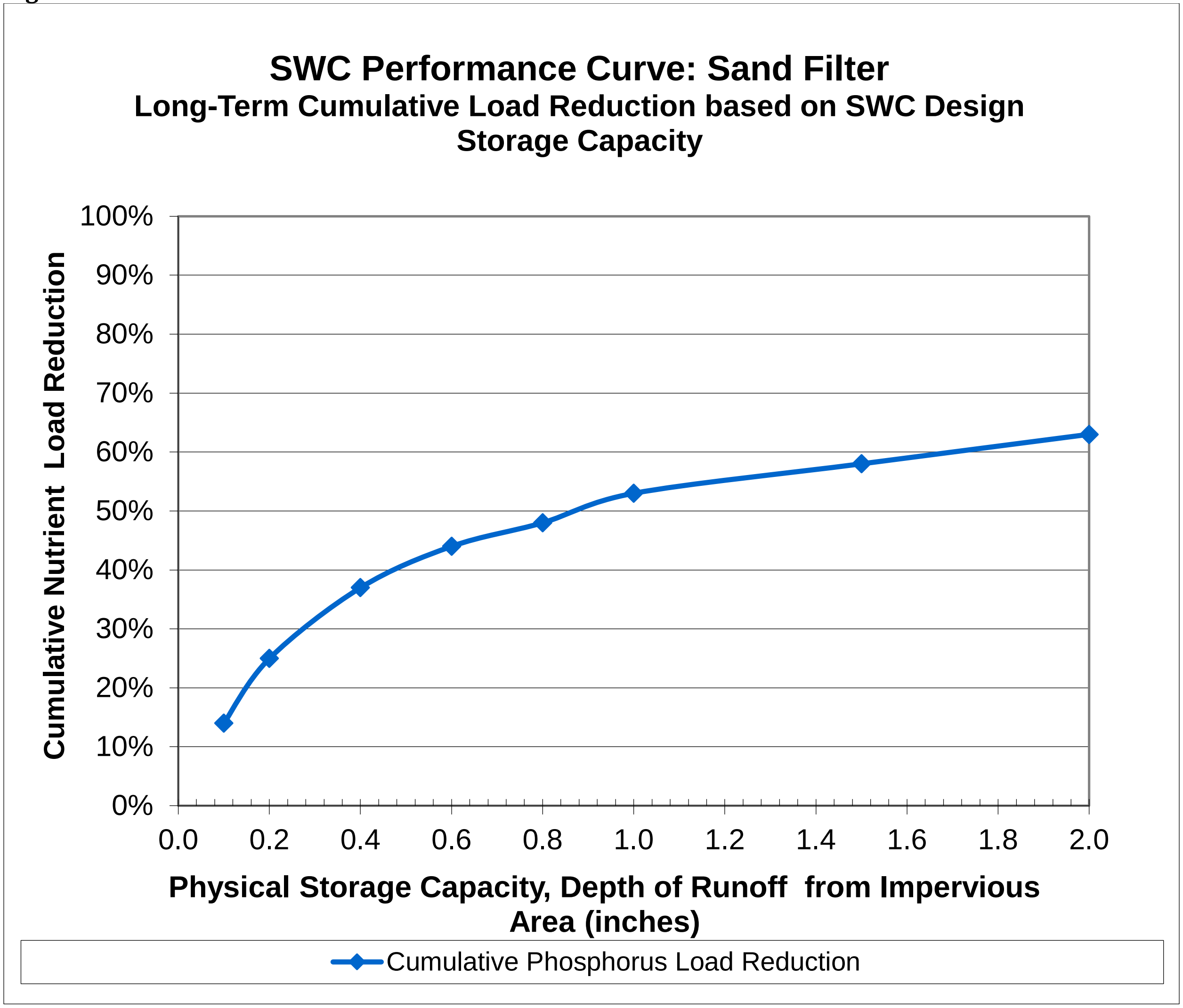


Table 3- 22 Porous Pavement SWC Performance Table

Porous Pavement SWC Performance Table: Long-Term Phosphorus Load Reduction				
SWC Capacity: Depth of Filter Course Area (inches)	12.0	18.0	24.0	32.0
Cumulative Phosphorus Load Reduction	62%	70%	75%	78%

Figure 3- 17: SWC Performance Curve: Porous Pavement

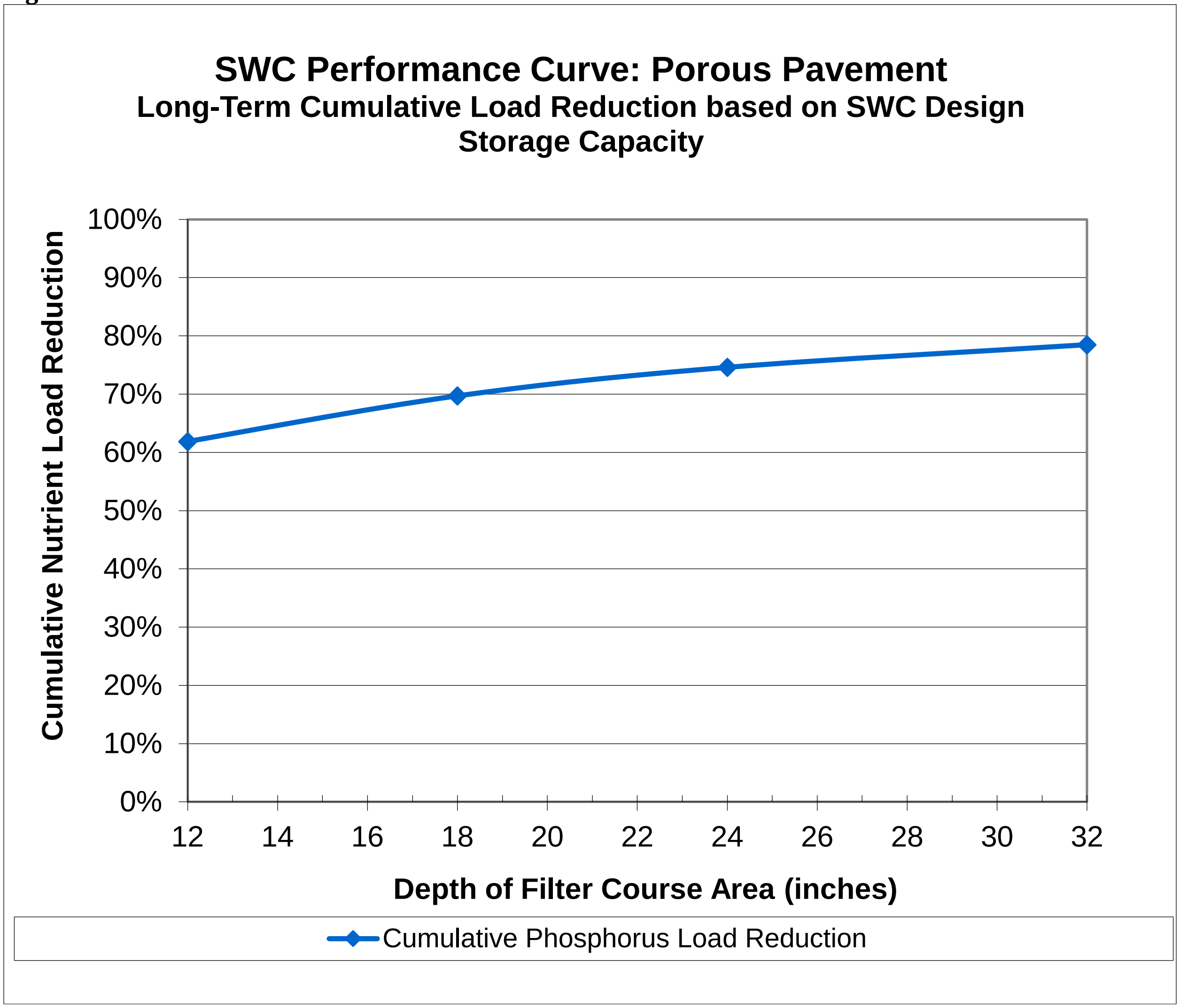


Table 3- 23: Wet Pond SWC Performance Table

Wet Pond SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%

Figure 3-18: SWC Performance Curve: Wet Pond

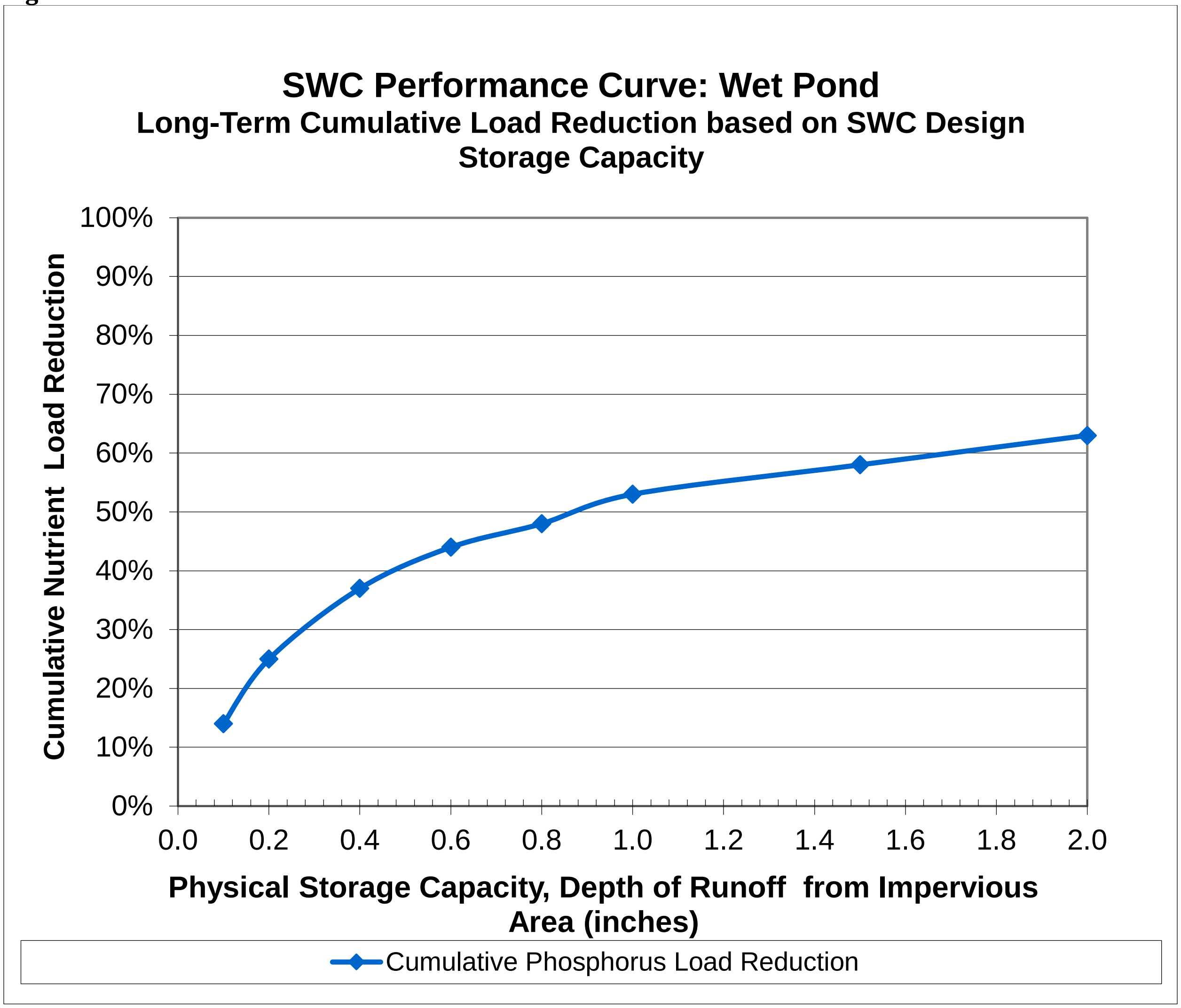


Table 3-24: Dry Pond SWC Performance Table

Dry Pond SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%

Figure 3- 19: SWC Performance Curve: Dry Pond

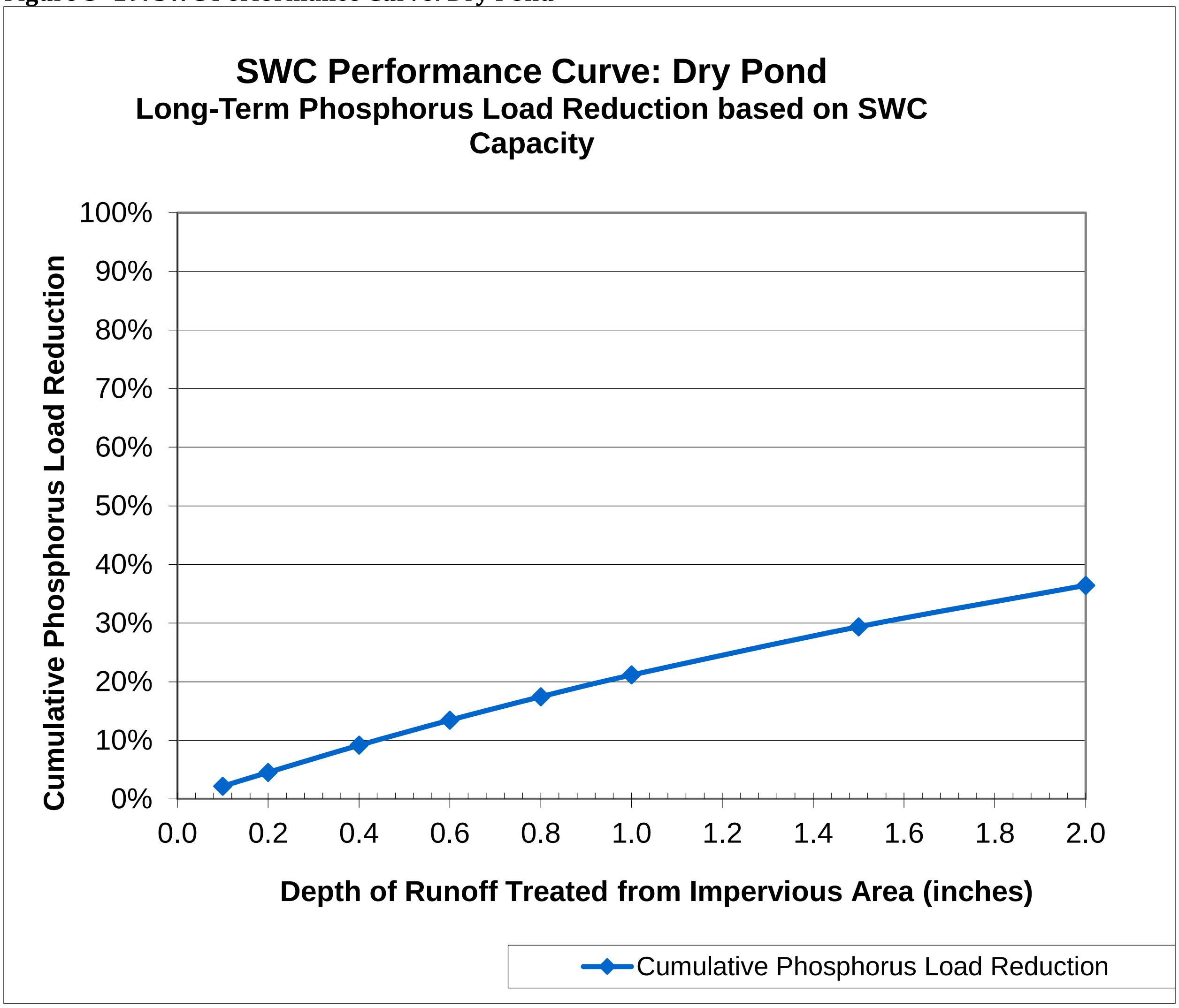


Table 3- 25: Water Quality Grass Swale with Detention SWC Performance Table

Water Quality Grass Swale with Detention SWC Performance Table: Long-Term Phosphorus Load Reduction								
SWC Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%

Figure 3-20: SWC Performance Curve: Water Quality Grass Swale with Detention

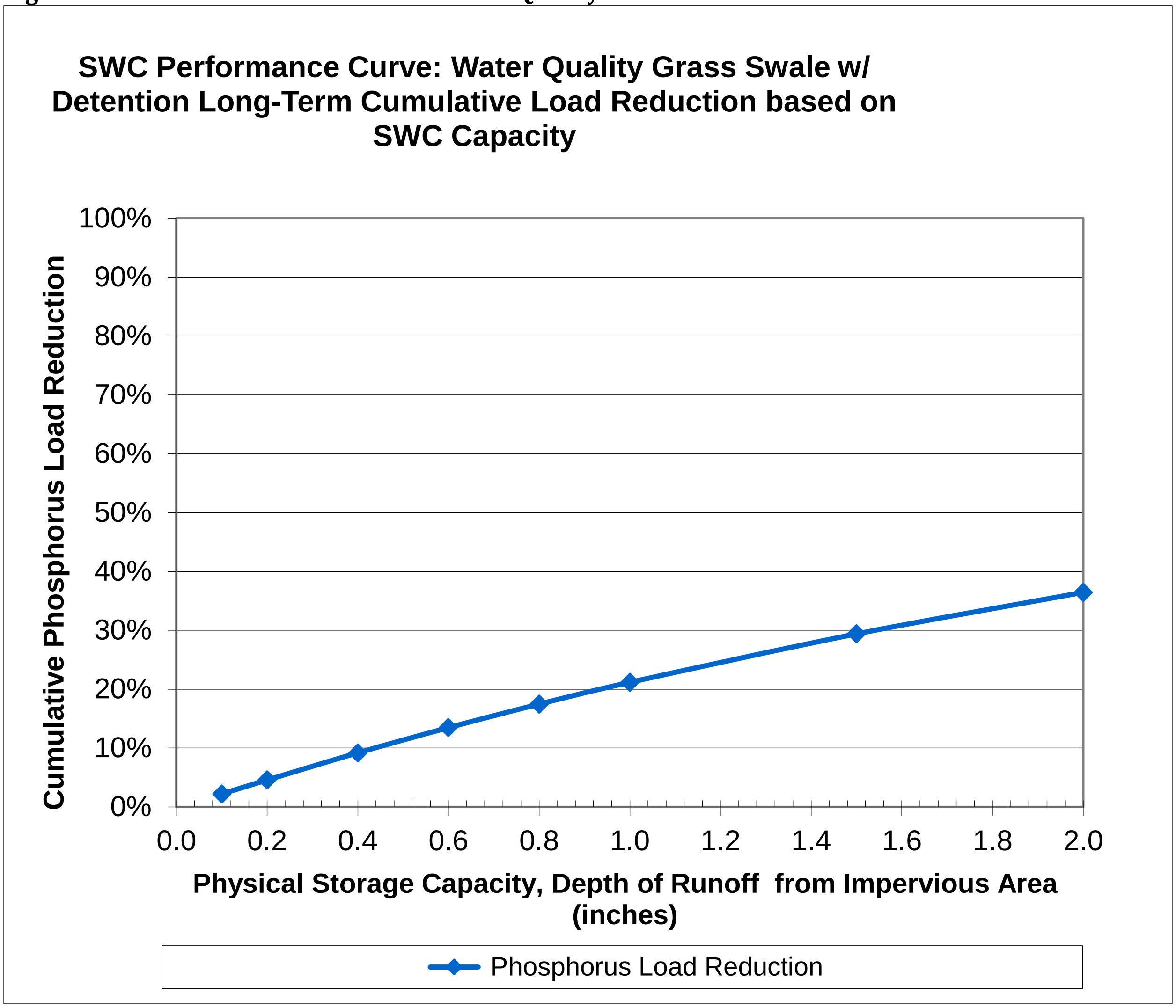


Table 3- 26: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1

Impervious Area Disconnection through Storage : Impervious Area to Pervious Area Ratio = 8:1												
Storage volume to impervious area ratio	Total Runoff Volume (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	22%	22%	21%
0.2 in	40%	38%	37%	40%	38%	37%	37%	38%	37%	24%	26%	27%
0.3 in	52%	50%	49%	52%	50%	49%	40%	46%	49%	24%	26%	27%
0.4 in	61%	59%	58%	59%	59%	58%	40%	48%	54%	24%	26%	27%
0.5 in	67%	66%	64%	62%	66%	64%	40%	48%	56%	24%	26%	27%
0.6 in	70%	71%	70%	62%	70%	70%	40%	48%	56%	24%	26%	27%
0.8 in	71%	78%	77%	62%	73%	77%	40%	48%	56%	24%	26%	27%
1.0 in	71%	80%	80%	62%	73%	79%	40%	48%	56%	24%	26%	27%
1.5 in	71%	81%	87%	62%	73%	81%	40%	48%	56%	24%	26%	27%
2.0 in	71%	81%	88%	62%	73%	81%	40%	48%	56%	24%	26%	27%

Figure 3- 21: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG A Soils

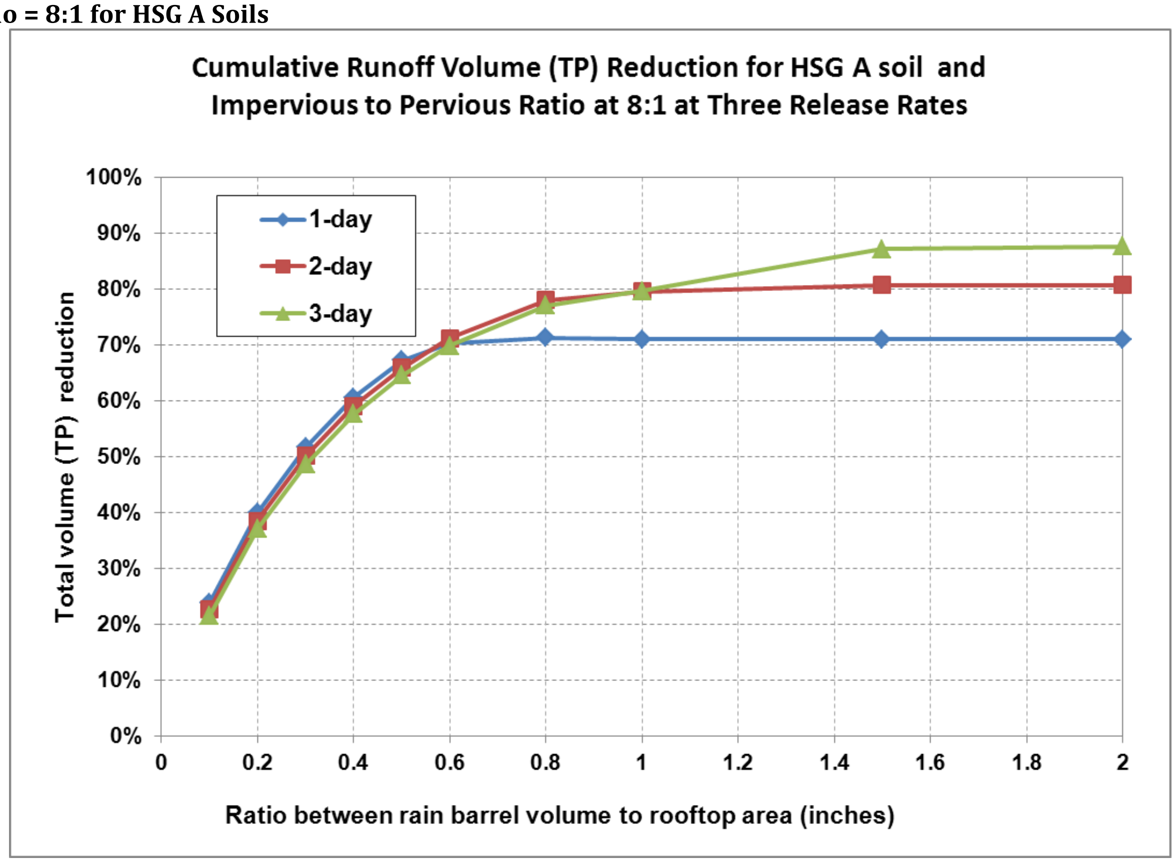


Figure 3- 22: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG B Soils

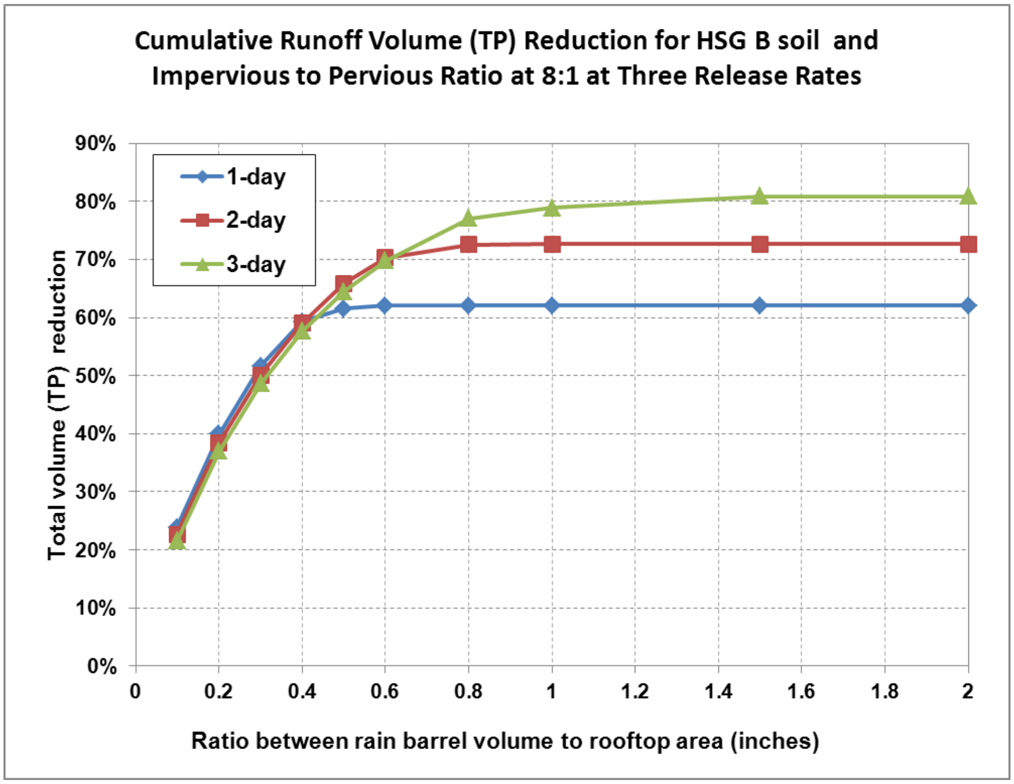


Figure 3- 23: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG C Soils

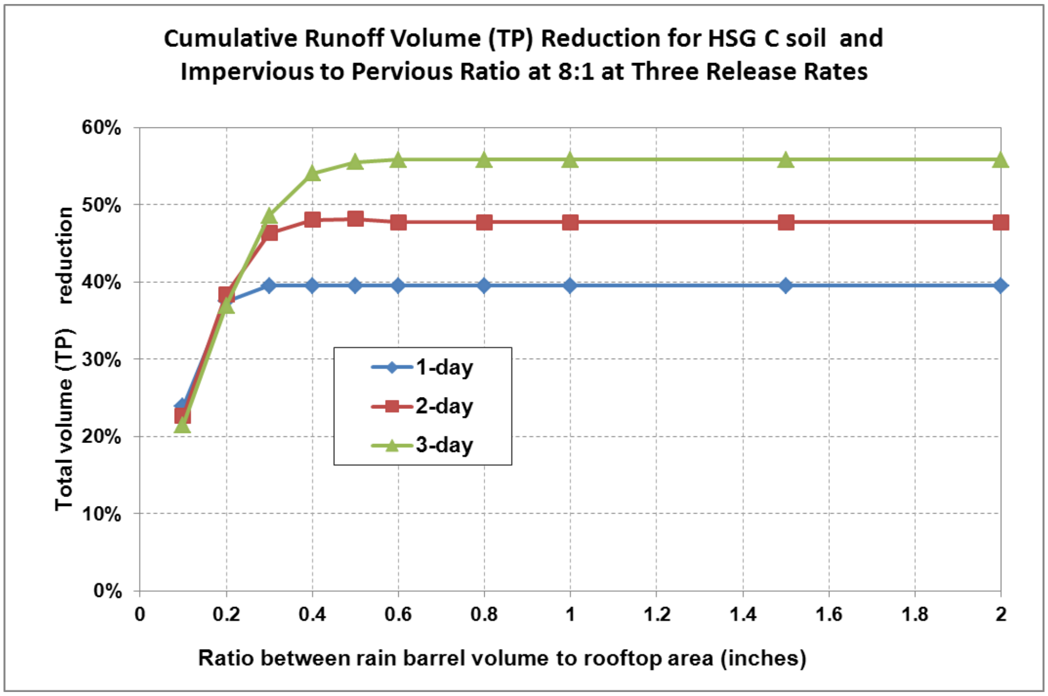


Figure 3- 24: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 8:1 for HSG D Soils

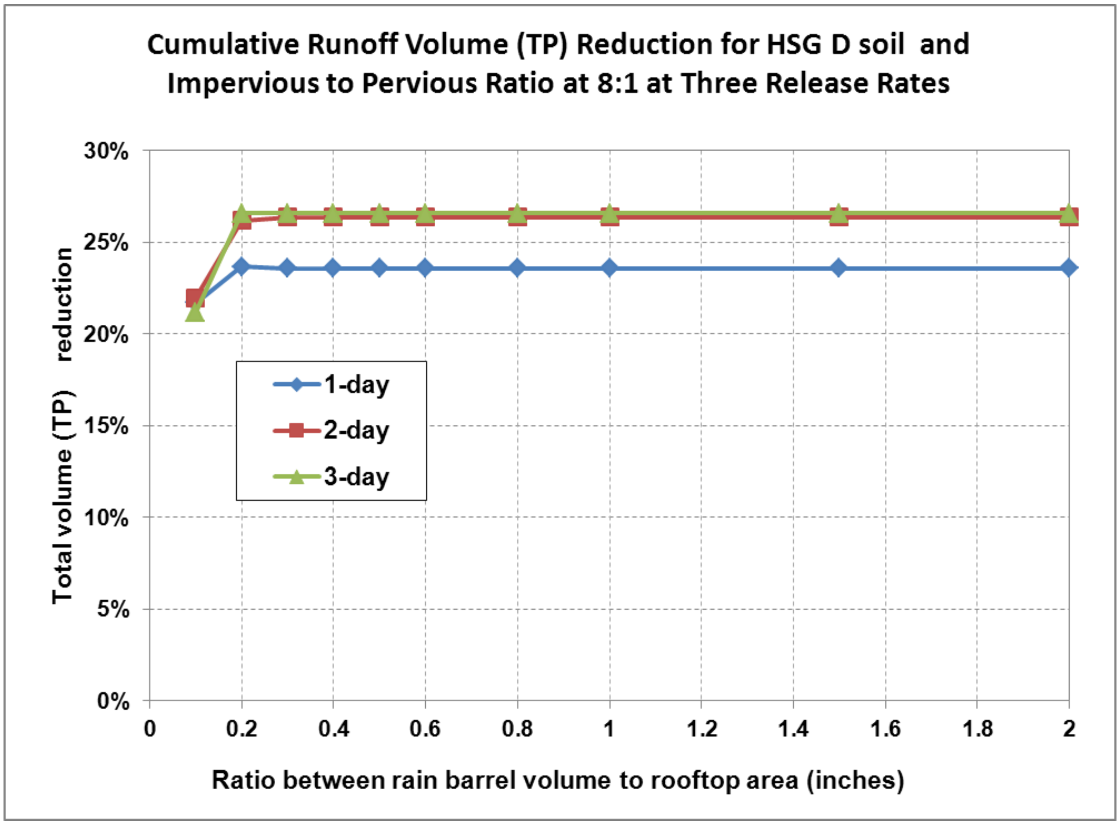


Table 3- 27: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1												
Rain barrel volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	23%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	28%	30%	33%
0.3 in	52%	50%	49%	52%	50%	49%	47%	50%	49%	29%	31%	34%
0.4 in	61%	59%	58%	61%	59%	58%	48%	55%	58%	29%	31%	34%
0.5 in	67%	66%	64%	67%	66%	64%	48%	57%	63%	29%	31%	34%
0.6 in	73%	71%	70%	70%	71%	70%	48%	57%	65%	29%	31%	34%
0.8 in	78%	78%	77%	71%	78%	77%	48%	57%	66%	29%	31%	34%
1.0 in	79%	81%	80%	71%	79%	80%	48%	57%	66%	29%	31%	34%
1.5 in	79%	87%	88%	71%	80%	87%	48%	57%	66%	29%	31%	34%
2.0 in	79%	87%	91%	71%	80%	87%	48%	57%	66%	29%	31%	34%

Figure 3- 25: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG A Soils

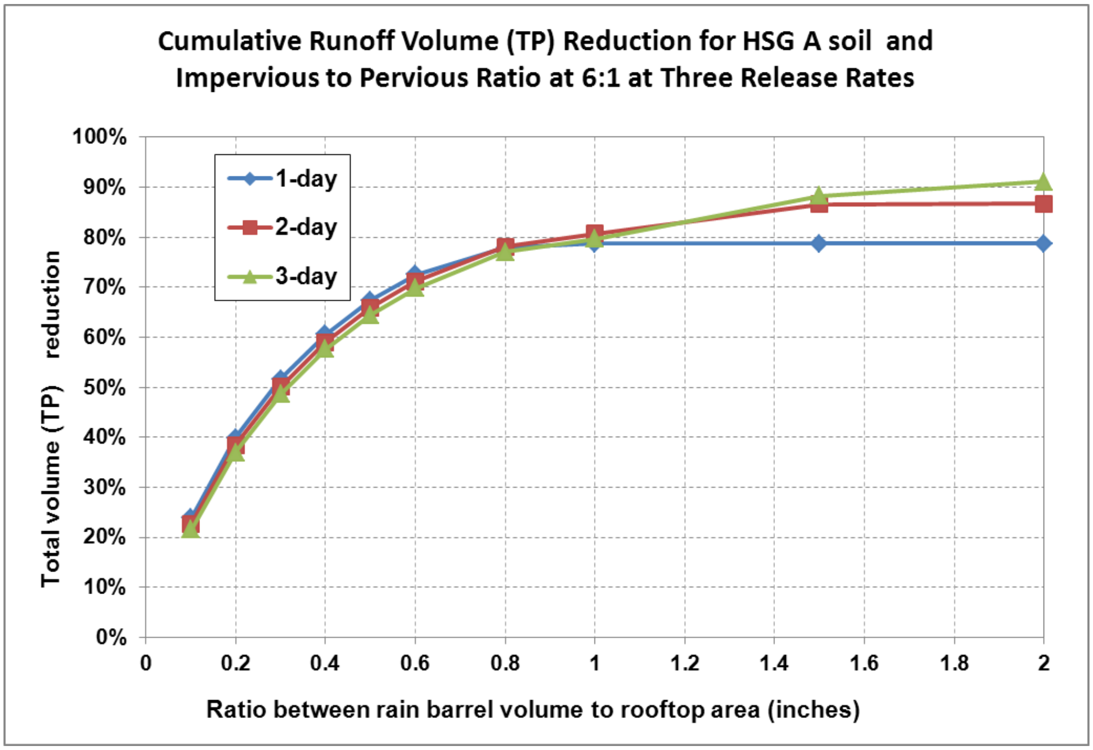


Figure 3- 26: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG B Soils

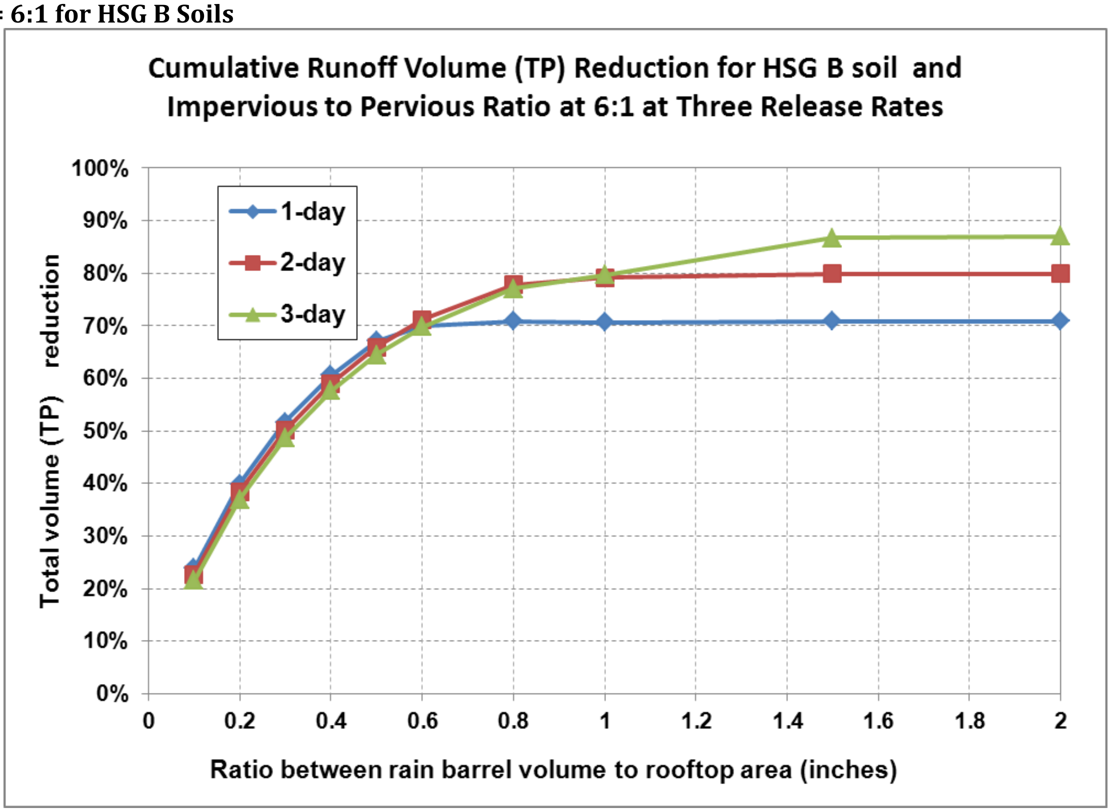


Figure 3- 27: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG C Soils

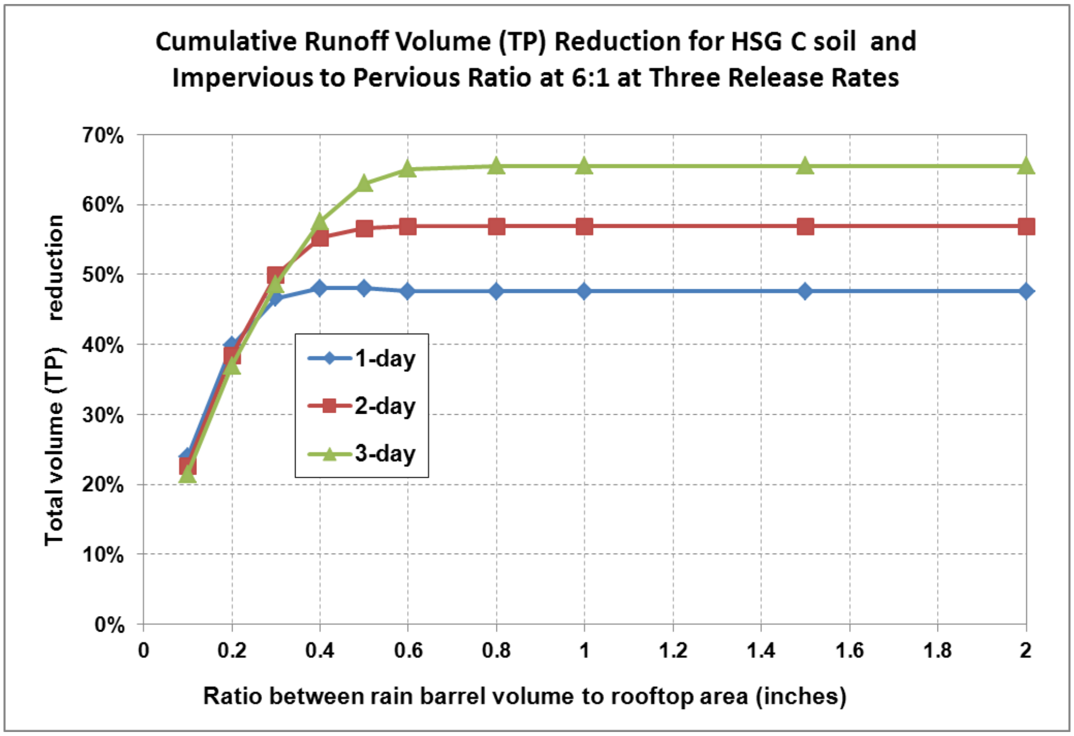


Figure 3- 28: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 6:1 for HSG D Soils

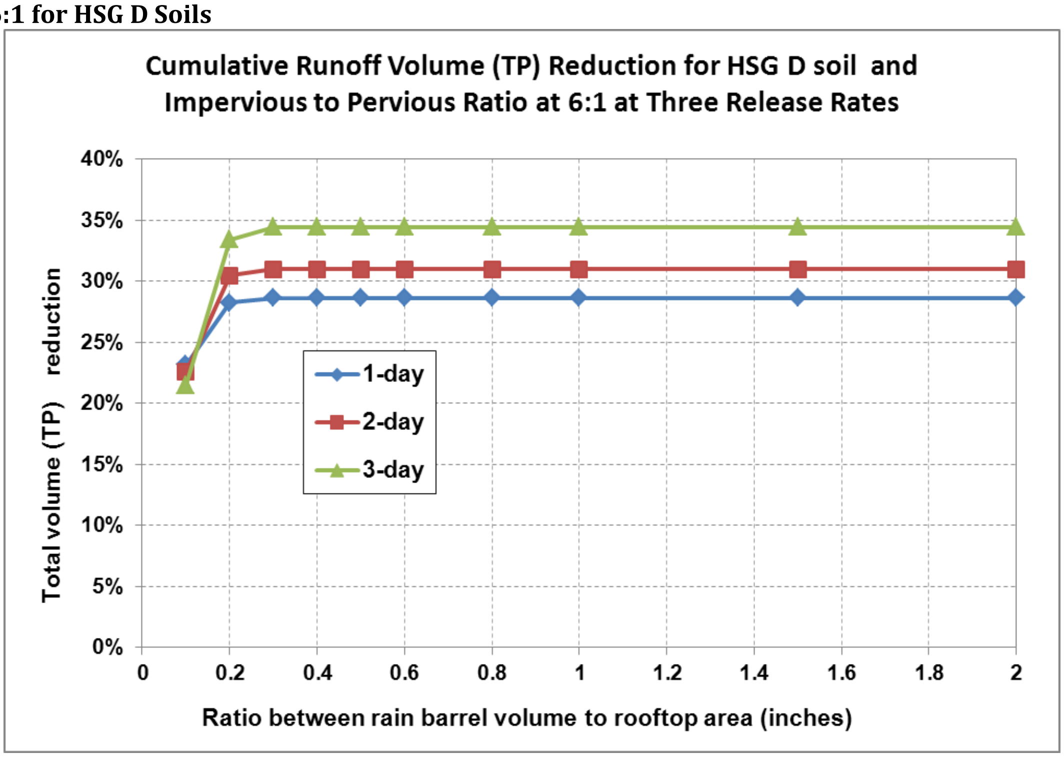


Table 3- 28: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	37%	37%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	39%	42%	45%
0.4 in	61%	59%	58%	61%	59%	58%	58%	59%	58%	39%	42%	47%
0.5 in	67%	66%	64%	67%	66%	64%	60%	65%	64%	40%	42%	47%
0.6 in	73%	71%	70%	73%	71%	70%	61%	68%	70%	40%	42%	47%
0.8 in	79%	78%	77%	79%	78%	77%	61%	69%	75%	40%	42%	47%
1.0 in	82%	81%	80%	80%	81%	80%	61%	69%	76%	40%	42%	47%
1.5 in	87%	89%	88%	80%	87%	88%	61%	69%	76%	40%	42%	47%
2.0 in	87%	91%	91%	80%	88%	91%	61%	69%	76%	40%	42%	47%

Figure 3- 29: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG A Soils

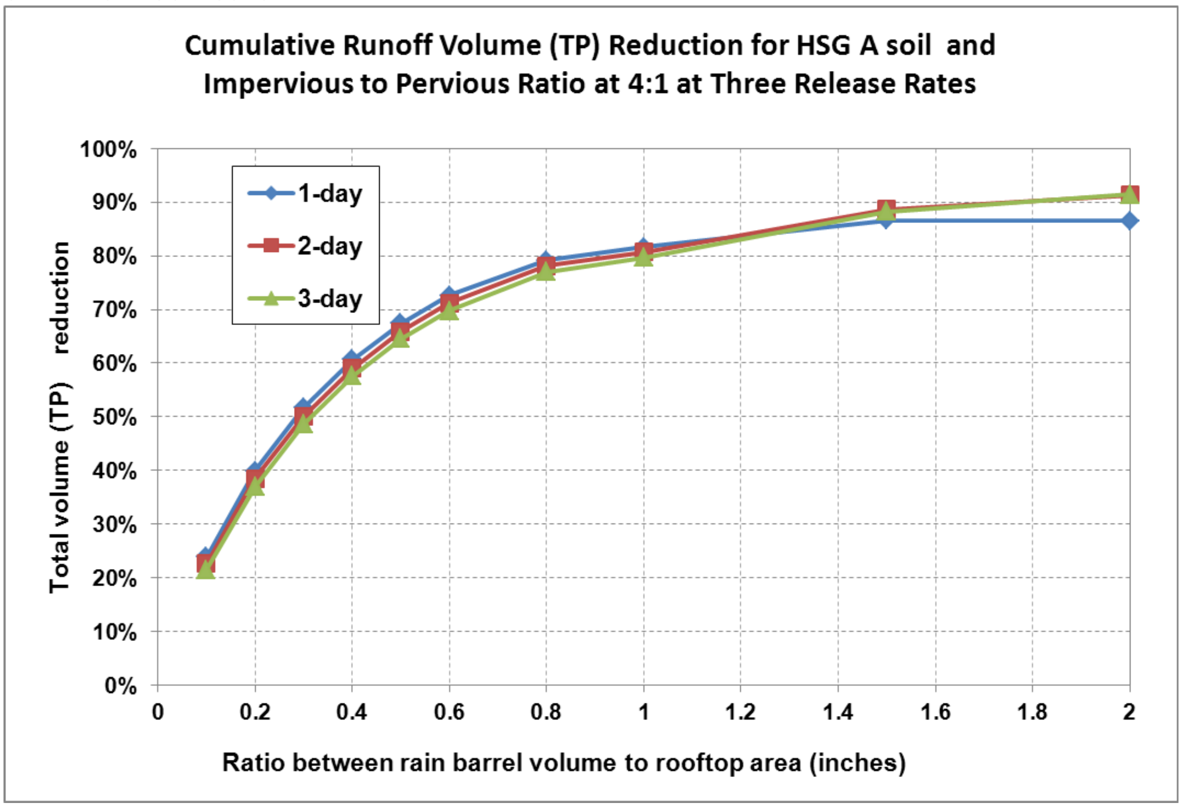


Figure 3- 30: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG B Soils

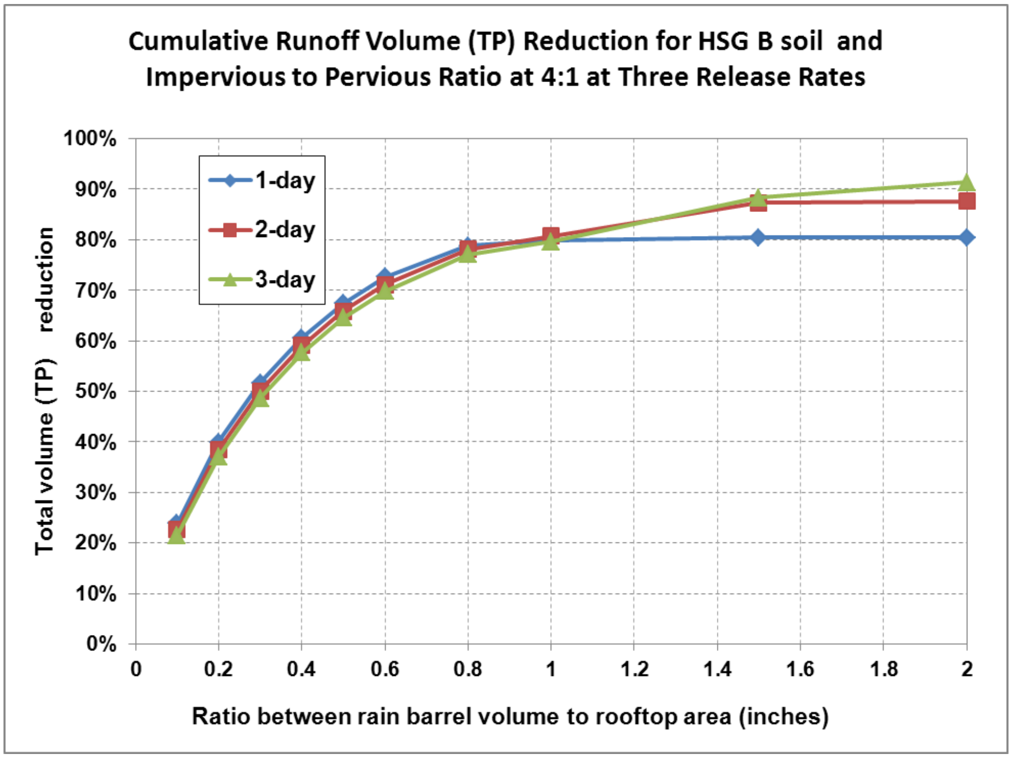


Figure 3- 31: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG C Soils

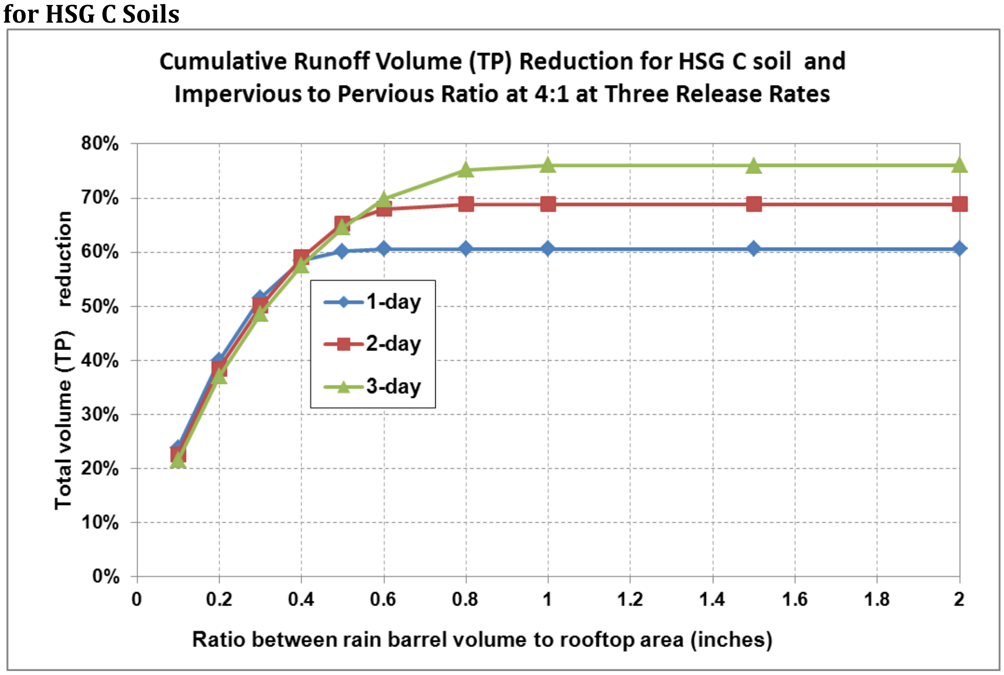


Figure 3- 32: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 4:1 for HSG D Soils

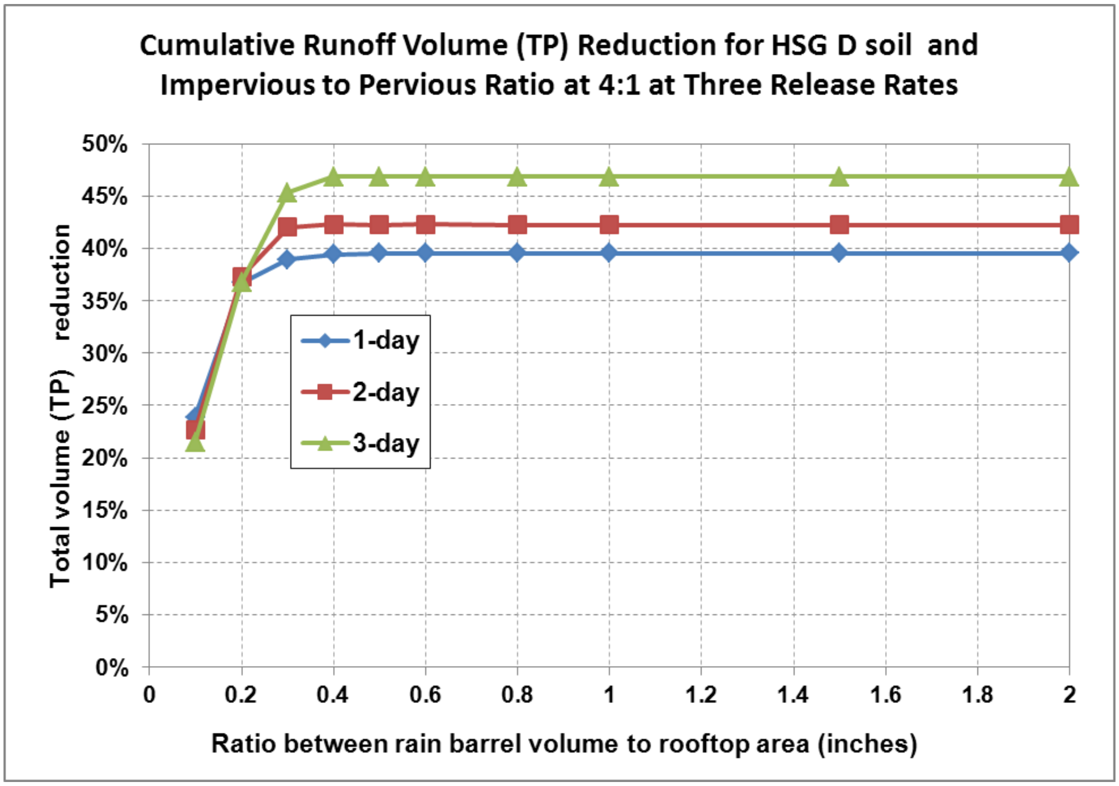


Table 3- 29: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 2:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 2:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	40%	38%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	51%	50%	49%
0.4 in	61%	59%	58%	61%	59%	58%	61%	59%	58%	57%	58%	57%
0.5 in	67%	66%	64%	67%	66%	64%	67%	66%	64%	59%	62%	63%
0.6 in	73%	71%	70%	73%	71%	70%	72%	71%	70%	59%	62%	67%
0.8 in	79%	78%	77%	79%	78%	77%	77%	78%	77%	59%	62%	67%
1.0 in	82%	81%	80%	82%	81%	80%	78%	81%	80%	59%	62%	67%
1.5 in	89%	89%	88%	89%	89%	88%	78%	84%	88%	59%	62%	67%
2.0 in	92%	92%	91%	91%	92%	91%	78%	84%	89%	59%	62%	67%

Figure 3- 33: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG A Soils

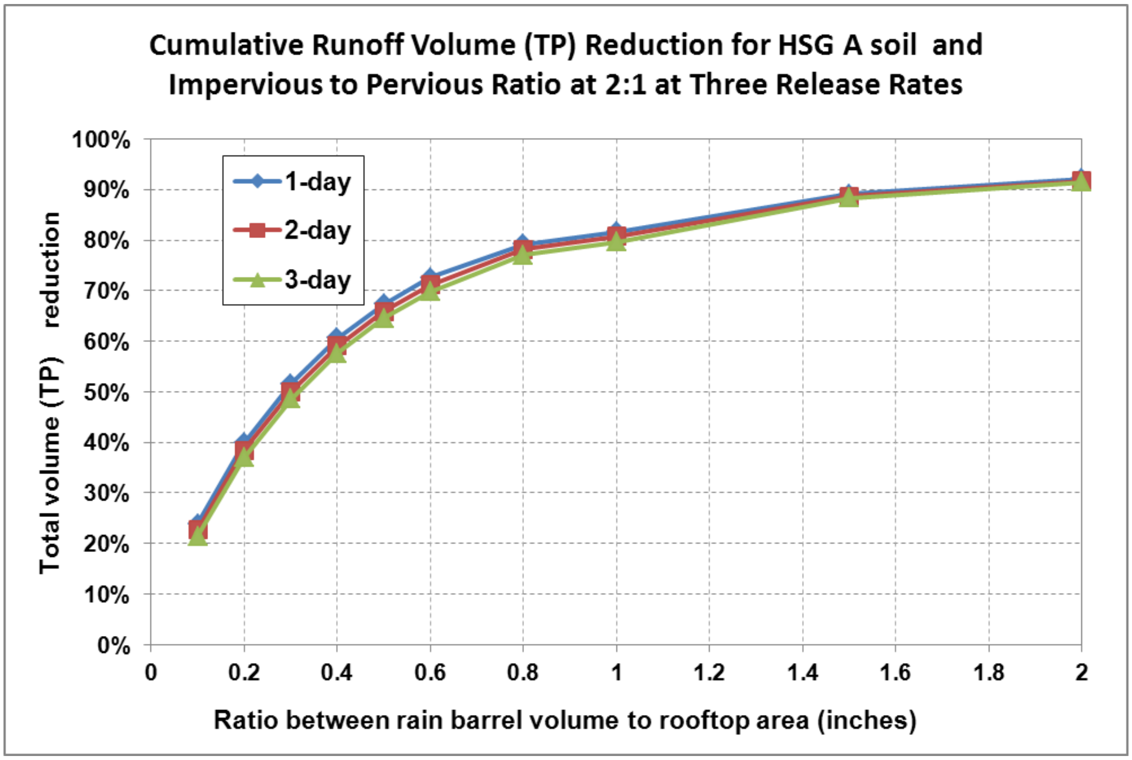


Figure 3- 34: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG B Soils

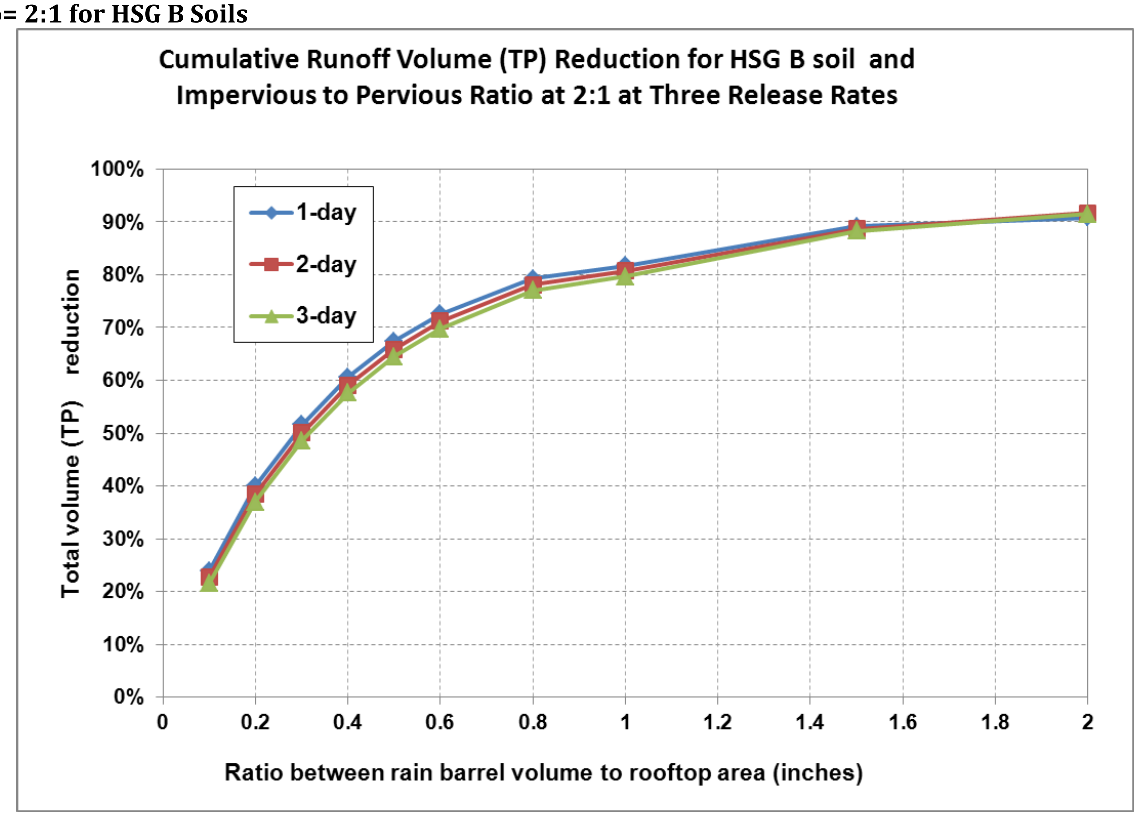


Figure 3- 35: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG C Soils

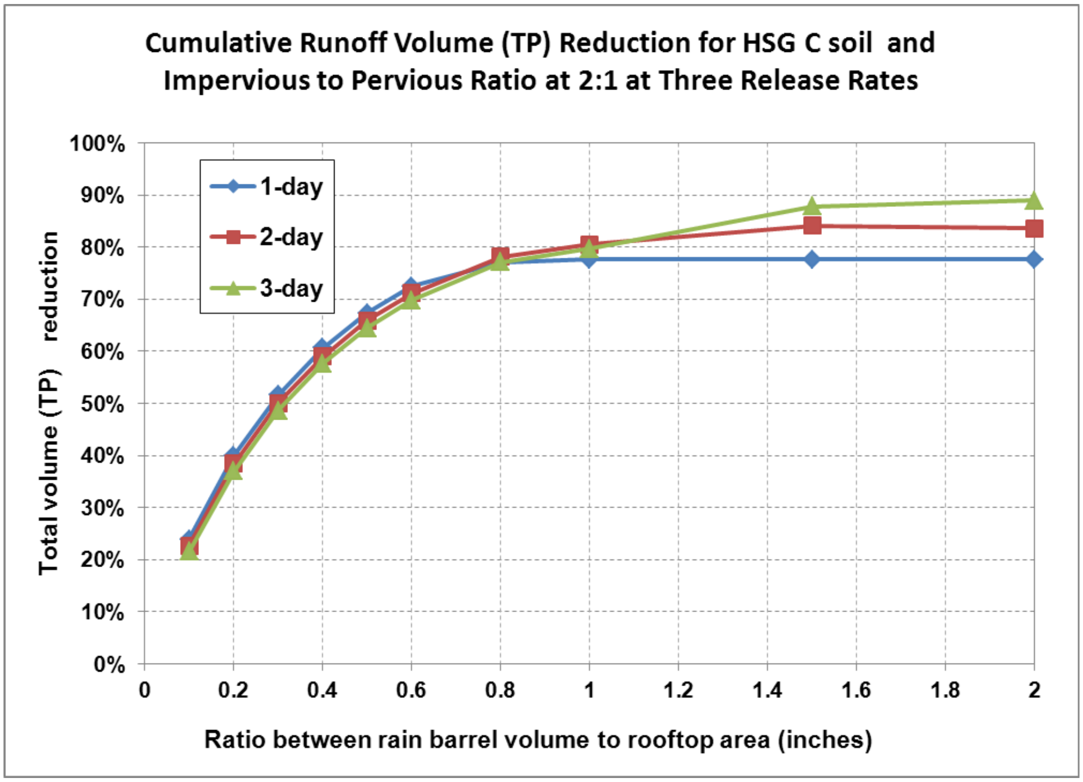


Figure 3- 36: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio= 2:1 for HSG D Soils

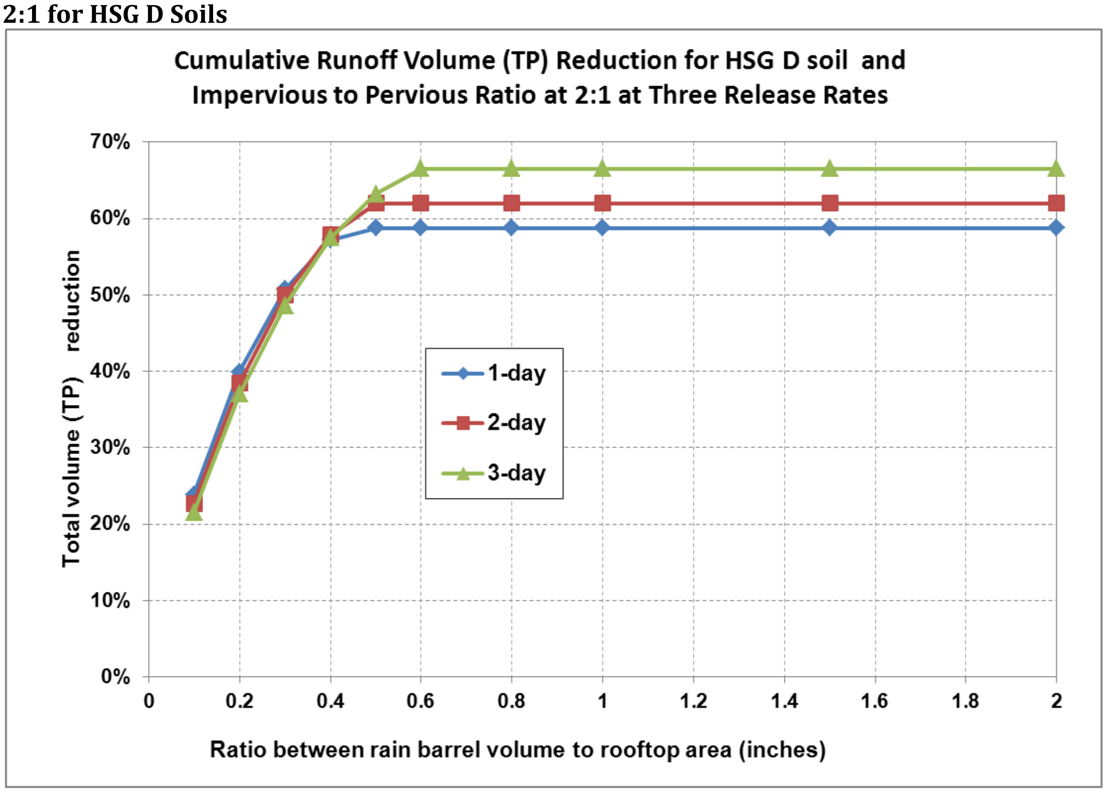


Table 3- 30: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1

Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1												
Storage volume to impervious area ratio	Total Runoff Volume and Phosphorus Load (TP) Reduction Percentages											
	HSG A			HSG B			HSG C			HSG D		
	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day	1-day	2-day	3-day
0.1 in	24%	23%	22%	24%	23%	22%	24%	23%	22%	24%	23%	22%
0.2 in	40%	38%	37%	40%	38%	37%	40%	38%	37%	40%	38%	37%
0.3 in	52%	50%	49%	52%	50%	49%	52%	50%	49%	52%	50%	49%
0.4 in	61%	59%	58%	61%	59%	58%	61%	59%	58%	61%	59%	58%
0.5 in	67%	66%	64%	67%	66%	64%	67%	66%	64%	67%	66%	64%
0.6 in	73%	71%	70%	73%	71%	70%	73%	71%	70%	72%	71%	70%
0.8 in	79%	78%	77%	79%	78%	77%	79%	78%	77%	78%	78%	77%
1.0 in	82%	81%	80%	82%	81%	80%	82%	81%	80%	79%	80%	80%
1.5 in	89%	89%	88%	89%	89%	88%	89%	89%	88%	80%	82%	86%
2.0 in	92%	92%	91%	92%	92%	91%	91%	92%	91%	80%	82%	86%

Figure 3- 37: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG A Soils

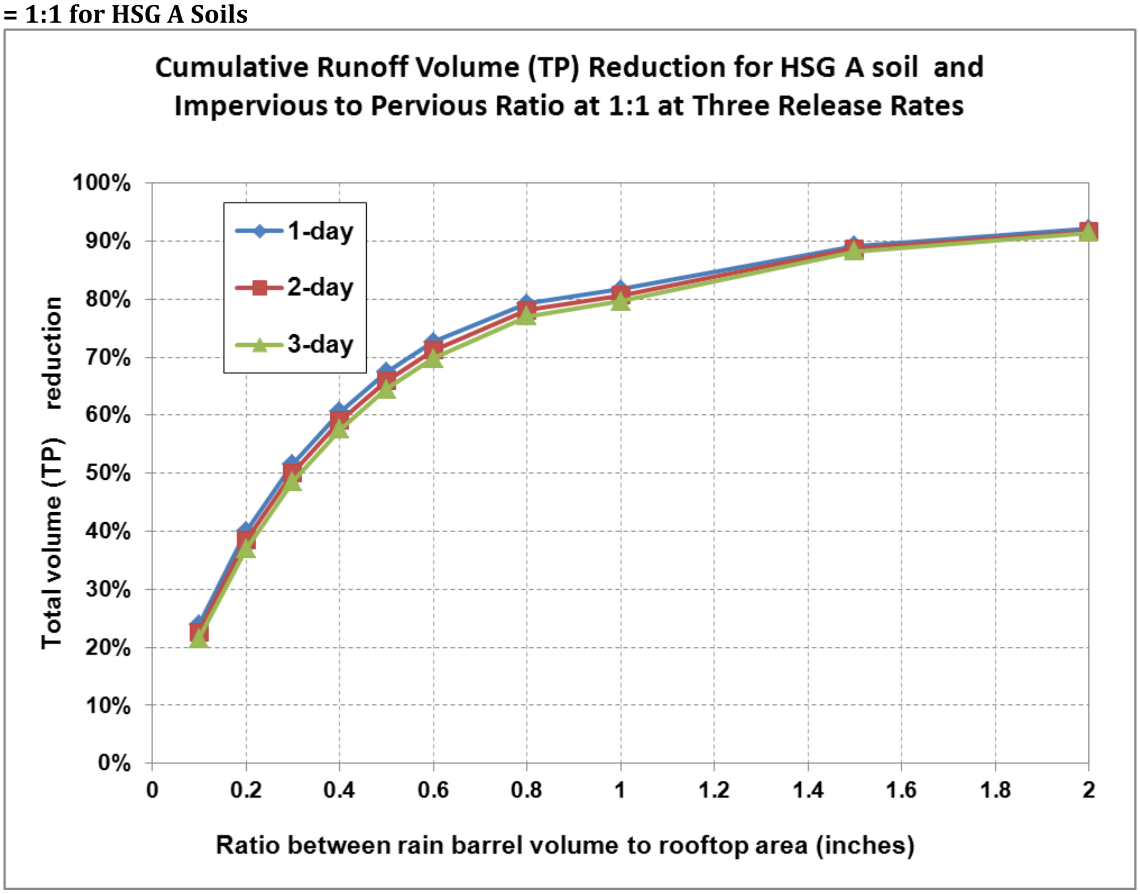


Figure 3- 38: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG B Soils

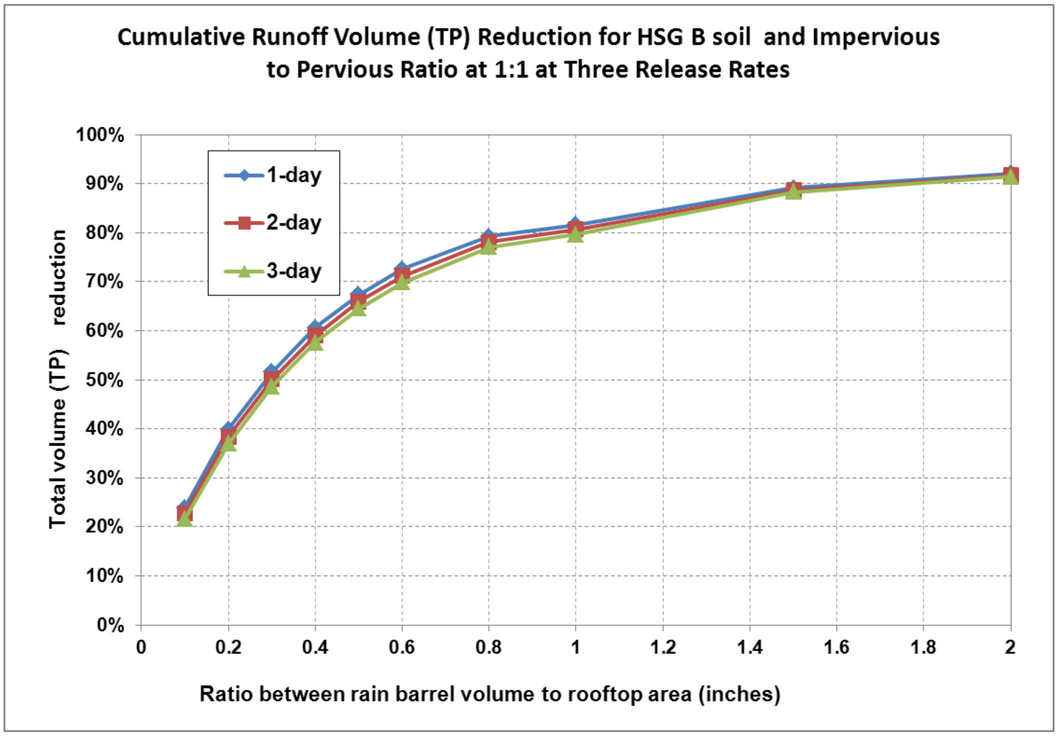


Figure 3- 39: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG C Soils

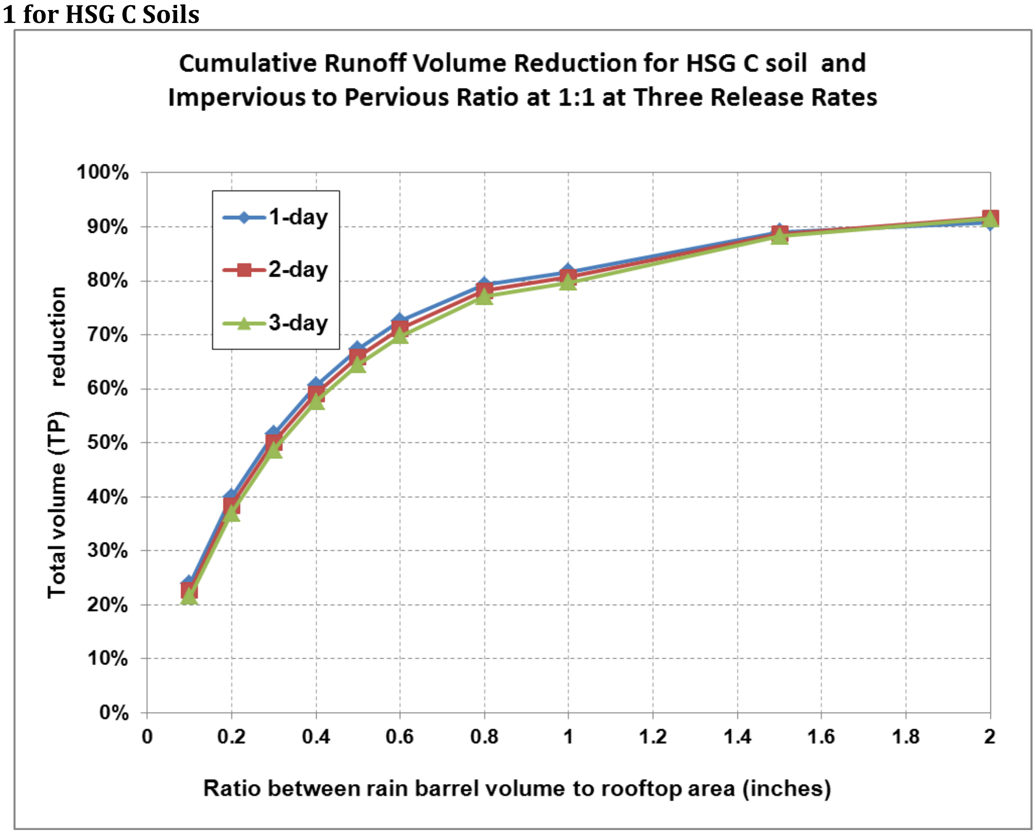


Figure 3- 40: Impervious Area Disconnection through Storage: Impervious Area to Pervious Area Ratio = 1:1 for HSG D Soils

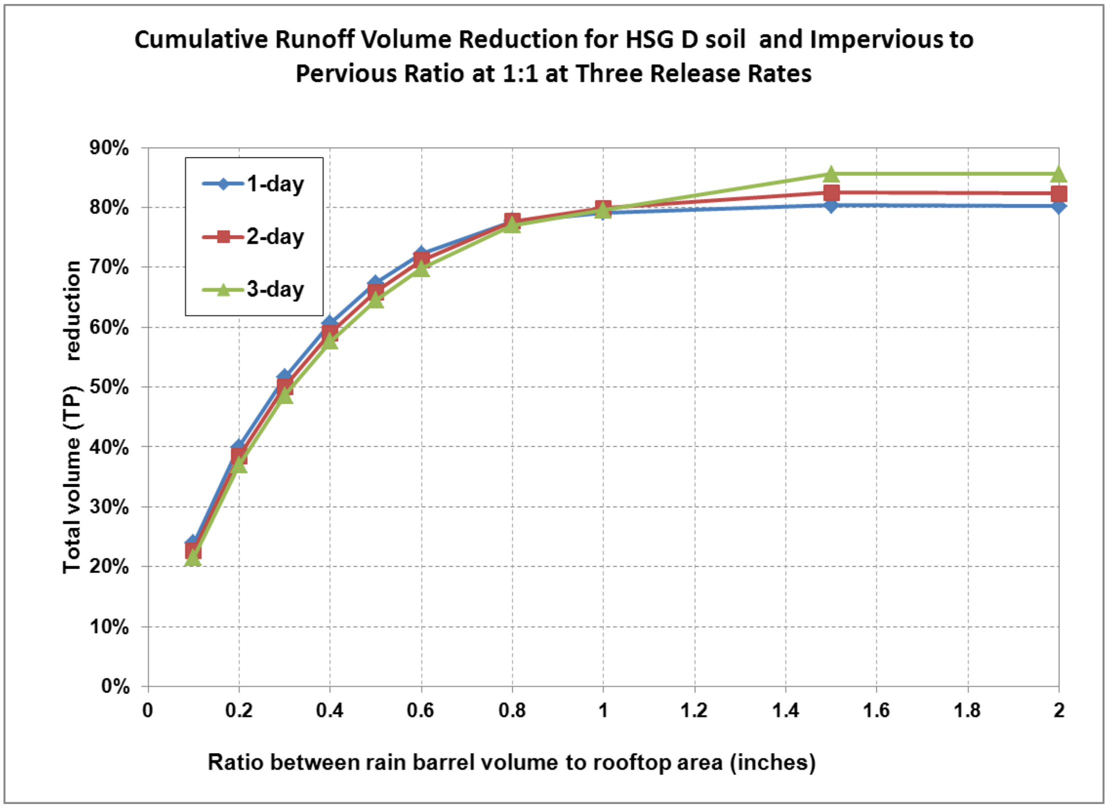


Table 3- 31: Impervious Area Disconnection Performance Table

Impervious area to pervious area ratio	Soil type of Receiving Pervious Area			
	HSG A	HSG B	HSG C	HSG D
8:1	30%	14%	7%	3%
6:1	37%	18%	11%	5%
4:1	48%	27%	17%	9%
2:1	64%	45%	33%	21%
1:1	74%	59%	49%	36%
1:2	82%	67%	60%	49%
1:4	85%	72%	67%	57%

Figure 3- 41: Impervious Area Disconnection Performance Curves

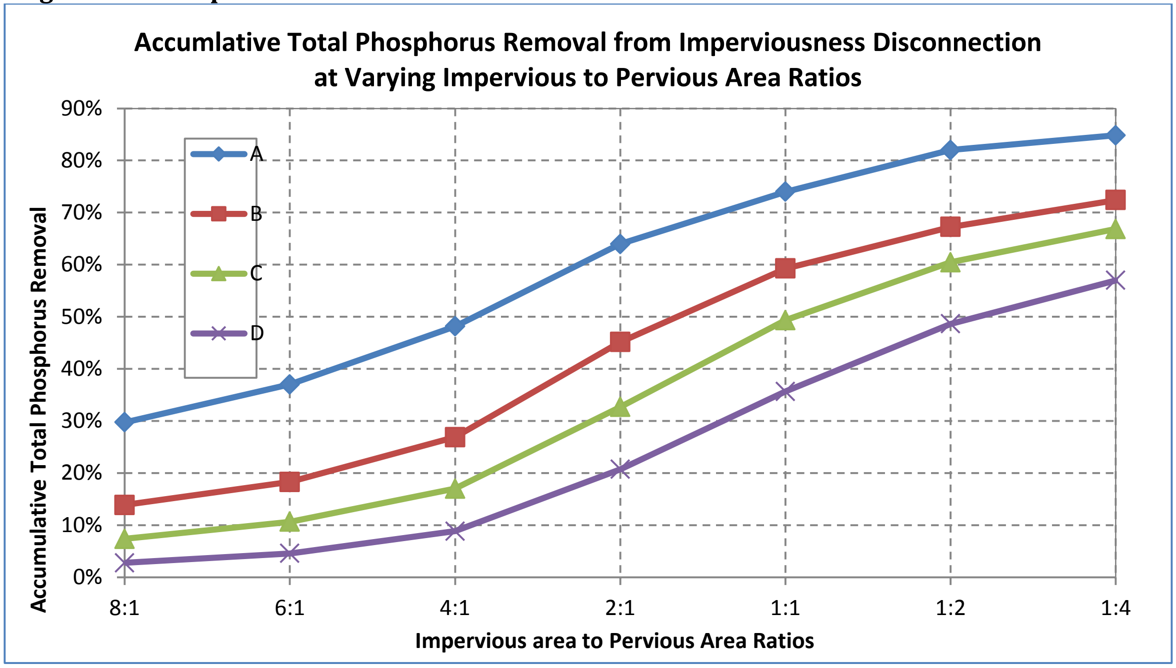


Table 3- 32: Performance Table for Conversion of Impervious Areas to Pervious Area based on Hydrological Soil Groups

Land-Use Group	Cumulative Reduction in Annual Stormwater Phosphorus Load				
	Conversion of impervious area to pervious area-HSG A	Conversion of impervious area to pervious area-HSG B	Conversion of impervious area to pervious area-HSG C	Conversion of impervious area to pervious area-HSG C/D	Conversion of impervious area to pervious area-HSG D
Commercial (Com) and Industrial (Ind)	98.5%	93.5%	88.0%	83.5%	79.5%
Multi-Family (MFR) and High-Density Residential (HDR)	98.8%	95.0%	90.8%	87.3%	84.2%
Medium -Density Residential (MDR)	98.6%	94.1%	89.1%	85.0%	81.4%
Low Density Residential (LDR) - "Rural"	98.2%	92.4%	85.9%	80.6%	75.9%
Highway (HWY)	98.0%	91.3%	84.0%	78.0%	72.7%
Forest (For)	98.2%	92.4%	85.9%	80.6%	75.9%
Open Land (Open)	98.2%	92.4%	85.9%	80.6%	75.9%
Agriculture (Ag)	70.6%	70.6%	70.6%	70.6%	70.6%

Table 3- 33: Performance Table for Conversion of Low Permeable Pervious Area to High Permeable Pervious Area based on Hydrological Soil Group

Land Cover	Cumulative Reduction in Annual SW Phosphorus Load from Pervious Area				
	Conversion of pervious area HSG D to pervious area-HSG A	Conversion of pervious area HSG D to pervious area-HSG B	Conversion of pervious area HSG D to pervious area-HSG C	Conversion of pervious area HSG C to pervious area-HSG A	Conversion of pervious area HSG C to pervious area-HSG B
Developed Pervious Land	92.7%	68.3%	41.5%	83.5%	79.5%

NPDES PART II STANDARD CONDITIONS
(January, 2007)

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PART II. A. GENERAL REQUIREMENTS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

a. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the sludge use or disposal established under Section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

b. The CWA provides that any person who violates Section 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any of such sections in a permit issued under Section 402, or any requirement imposed in a pretreatment program approved under Section 402 (a)(3) or 402 (b)(8) of the CWA is subject to a civil penalty not to exceed $25,000 per day for each violation. Any person who negligently violates such requirements is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both. Any person who knowingly violates such requirements is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both.

c. Any person may be assessed an administrative penalty by the Administrator for violating Section 301, 302, 306, 307, 308, 318, or 405 of the CWA, or any permit condition or limitation implementing any of such sections in a permit issued under Section 402 of the CWA. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

Note: See 40 CFR §122.41(a)(2) for complete "Duty to Comply" regulations.

2. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or notifications of planned changes or anticipated noncompliance does not stay any permit condition.

3. Duty to Provide Information

The permittee shall furnish to the Regional Administrator, within a reasonable time, any information which the Regional Administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Regional Administrator, upon request, copies of records required to be kept by this permit.

4. Reopener Clause

The Regional Administrator reserves the right to make appropriate revisions to this permit in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the CWA in order to bring all discharges into compliance with the CWA.

For any permit issued to a treatment works treating domestic sewage (including "sludge-only facilities"), the Regional Administrator or Director shall include a reopener clause to incorporate any applicable standard for sewage sludge use or disposal promulgated under Section 405 (d) of the CWA. The Regional Administrator or Director may promptly modify or revoke and reissue any permit containing the reopener clause required by this paragraph if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or contains a pollutant or practice not limited in the permit.

Federal regulations pertaining to permit modification, revocation and reissuance, and termination are found at 40 CFR §122.62, 122.63, 122.64, and 124.5.

5. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from responsibilities, liabilities or penalties to which the permittee is or may be subject under Section 311 of the CWA, or Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

6. Property Rights

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges.

7. Confidentiality of Information

a. In accordance with 40 CFR Part 2, any information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission in the manner prescribed on the application form or instructions or, in the case of other submissions, by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information).

b. Claims of confidentiality for the following information will be denied:

(1) The name and address of any permit applicant or permittee;
(2) Permit applications, permits, and effluent data as defined in 40 CFR §2.302(a)(2).

c. Information required by NPDES application forms provided by the Regional Administrator under 40 CFR §122.21 may not be claimed confidential. This includes information submitted on the forms themselves and any attachments used to supply information required by the forms.

8. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Regional Administrator. (The Regional Administrator shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)

9. State Authorities

Nothing in Part 122, 123, or 124 precludes more stringent State regulation of any activity covered by these regulations, whether or not under an approved State program.

10. Other Laws

The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, or local laws and regulations.

PART II. B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of storm water pollution prevention plans. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

4. Bypass

a. Definitions

(1) *Bypass* means the intentional diversion of waste streams from any portion of a treatment facility.

(2) *Severe property damage* means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can be reasonably expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provision of Paragraphs B.4.c. and 4.d. of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph D.1.e. of this part (Twenty-four hour reporting).

d. Prohibition of bypass

Bypass is prohibited, and the Regional Administrator may take enforcement action against a permittee for bypass, unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(3) i) The permittee submitted notices as required under Paragraph 4.c. of this section.
ii) The Regional Administrator may approve an anticipated bypass, after considering its adverse effects, if the Regional Administrator determines that it will meet the three conditions listed above in paragraph 4.d. of this section.

5. <u>Upset</u>

a. Definition. *Upset* means an exceptional incident in which there is an unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph B.5.c. of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;
(2) The permitted facility was at the time being properly operated;
(3) The permittee submitted notice of the upset as required in paragraphs D.1.a. and 1.e. (Twenty-four hour notice); and
(4) The permittee complied with any remedial measures required under B.3. above.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

PART II. C. MONITORING REQUIREMENTS

1. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

b. Except for records for monitoring information required by this permit related to the permittee’s sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application except for the information concerning storm water discharges which must be retained for a total of 6 years. This retention period may be extended by request of the Regional Administrator at any time.

c. Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;
(2) The individual(s) who performed the sampling or measurements;
(3) The date(s) analyses were performed;
(4) The individual(s) who performed the analyses;
(5) The analytical techniques or methods used; and
(6) The results of such analyses.

d. Monitoring results must be conducted according to test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, unless other test procedures have been specified in the permit.

e. The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

2. Inspection and Entry

The permittee shall allow the Regional Administrator or an authorized representative (including an authorized contractor acting as a representative of the Administrator), upon presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the CWA, any substances or parameters at any location.

PART II. D. REPORTING REQUIREMENTS

1. Reporting Requirements

a. Planned Changes. The permittee shall give notice to the Regional Administrator as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is only required when:

(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR§122.29(b); or
(2) The alteration or addition could significantly change the nature or increase the quantities of the pollutants discharged. This notification applies to pollutants which are subject neither to the effluent limitations in the permit, nor to the notification requirements at 40 CFR§122.42(a)(1).
(3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition or change may justify the application of permit conditions different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

b. Anticipated noncompliance. The permittee shall give advance notice to the Regional Administrator of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

c. Transfers. This permit is not transferable to any person except after notice to the Regional Administrator. The Regional Administrator may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the CWA. (See 40 CFR Part 122.61; in some cases, modification or revocation and reissuance is mandatory.)

d. Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by the Director for reporting results of monitoring of sludge use or disposal practices.

(2) If the permittee monitors any pollutant more frequently than required by the permit using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, or as specified in the permit, the results of the monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Director.

(3) Calculations for all limitations which require averaging or measurements shall utilize an arithmetic mean unless otherwise specified by the Director in the permit.

e. Twenty-four hour reporting.

(1) The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances.

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(2) The following shall be included as information which must be reported within 24 hours under this paragraph.

(a) Any unanticipated bypass which exceeds any effluent limitation in the permit. (See 40 CFR §122.41(g).)
(b) Any upset which exceeds any effluent limitation in the permit.
(c) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Regional Administrator in the permit to be reported within 24 hours. (See 40 CFR §122.44(g).)

(3) The Regional Administrator may waive the written report on a case-by-case basis for reports under Paragraph D.1.e. if the oral report has been received within 24 hours.

f. Compliance Schedules. Reports of compliance or noncompliance with, any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

g. Other noncompliance. The permittee shall report all instances of noncompliance not reported under Paragraphs D.1.d., D.1.e., and D.1.f. of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D.1.e. of this section.

h. Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Administrator, it shall promptly submit such facts or information.

2. Signatory Requirement

a. All applications, reports, or information submitted to the Regional Administrator shall be signed and certified. (See 40 CFR §122.22)

b. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 2 years per violation, or by both.

3. Availability of Reports.

Except for data determined to be confidential under Paragraph A.8. above, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the CWA, effluent data shall not be considered confidential. Knowingly making any false statements on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the CWA.

PART II. E. DEFINITIONS AND ABBREVIATIONS

1. Definitions for Individual NPDES Permits including Storm Water Requirements

Administrator means the Administrator of the United States Environmental Protection Agency, or an authorized representative.

Applicable standards and limitations means all, State, interstate, and Federal standards and limitations to which a “discharge”, a “sewage sludge use or disposal practice”, or a related activity is subject to, including “effluent limitations”, water quality standards, standards of performance, toxic effluent standards or prohibitions, “best management practices”, pretreatment standards, and “standards for sewage sludge use and disposal” under Sections 301, 302, 303, 304, 306, 307, 308, 403, and 405 of the CWA.

Application means the EPA standard national forms for applying for a permit, including any additions, revisions, or modifications to the forms; or forms approved by EPA for use in "approved States", including any approved modifications or revisions.

Average means the arithmetic mean of values taken at the frequency required for each parameter over the specified period. For total and/or fecal coliforms and Escherichia coli, the average shall be the geometric mean.

Average monthly discharge limitation means the highest allowable average of "daily discharges" over a calendar month calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

Average weekly discharge limitation means the highest allowable average of "daily discharges" measured during the calendar week divided by the number of "daily discharges" measured during the week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Best Professional Judgment (BPJ) means a case-by-case determination of Best Practicable Treatment (BPT), Best Available Treatment (BAT), or other appropriate technology-based standard based on an evaluation of the available technology to achieve a particular pollutant reduction and other factors set forth in 40 CFR §125.3 (d).

Coal Pile Runoff means the rainfall runoff from or through any coal storage pile.

Composite Sample means a sample consisting of a minimum of eight grab samples of equal volume collected at equal intervals during a 24-hour period (or lesser period as specified in the section on Monitoring and Reporting) and combined proportional to flow, or a sample consisting of the same number of grab samples, or greater, collected proportionally to flow over that same time period.

Construction Activities - The following definitions apply to construction activities:

(a) Commencement of Construction is the initial disturbance of soils associated with clearing, grading, or excavating activities or other construction activities.

(b) Dedicated portable asphalt plant is a portable asphalt plant located on or contiguous to a construction site and that provides asphalt only to the construction site that the plant is located on or adjacent to. The term dedicated portable asphalt plant does not include facilities that are subject to the asphalt emulsion effluent limitation guideline at 40 CFR Part 443.

(c) Dedicated portable concrete plant is a portable concrete plant located on or contiguous to a construction site and that provides concrete only to the construction site that the plant is located on or adjacent to.

(d) Final Stabilization means that all soil disturbing activities at the site have been complete, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

(e) Runoff coefficient means the fraction of total rainfall that will appear at the conveyance as runoff.

Contiguous zone means the entire zone established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

Continuous discharge means a "discharge" which occurs without interruption throughout the operating hours of the facility except for infrequent shutdowns for maintenance, process changes, or similar activities.

CWA means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, and Pub. L. 97-117; 33 USC §§1251 et seq.

Daily Discharge means the discharge of a pollutant measured during the calendar day or any other 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Director normally means the person authorized to sign NPDES permits by EPA or the State or an authorized representative. Conversely, it also could mean the Regional Administrator or the State Director as the context requires.

Discharge Monitoring Report Form (DMR) means the EPA standard national form, including any subsequent additions, revisions, or modifications for the reporting of self-monitoring results by permittees. DMRs must be used by "approved States" as well as by EPA. EPA will supply DMRs to any approved State upon request. The EPA national forms may be modified to substitute the State Agency name, address, logo, and other similar information, as appropriate, in place of EPA's.

Discharge of a pollutant means:

(a) Any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source", or

(b) Any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation (See "Point Source" definition).

This definition includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances leading into privately owned treatment works.

This term does not include an addition of pollutants by any "indirect discharger."

Effluent limitation means any restriction imposed by the Regional Administrator on quantities, discharge rates, and concentrations of "pollutants" which are "discharged" from "point sources" into "waters of the United States", the waters of the "contiguous zone", or the ocean.

Effluent limitation guidelines means a regulation published by the Administrator under Section 304(b) of CWA to adopt or revise "effluent limitations".

EPA means the United States "Environmental Protection Agency".

Flow-weighted composite sample means a composite sample consisting of a mixture of aliquots where the volume of each aliquot is proportional to the flow rate of the discharge.

Grab Sample – An individual sample collected in a period of less than 15 minutes.

Hazardous Substance means any substance designated under 40 CFR Part 116 pursuant to Section 311 of the CWA.

Indirect Discharger means a non-domestic discharger introducing pollutants to a publicly owned treatment works.

Interference means a discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

(a) Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and

(b) Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act (CWA), the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resources Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of the SDWA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection Research and Sanctuaries Act.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile.

Land application unit means an area where wastes are applied onto or incorporated into the soil surface (excluding manure spreading operations) for treatment or disposal.

Large and Medium municipal separate storm sewer system means all municipal separate storm sewers that are either: (i) located in an incorporated place (city) with a population of 100,000 or more as determined by the latest Decennial Census by the Bureau of Census (these cities are listed in Appendices F and 40 CFR Part 122); or (ii) located in the counties with unincorporated urbanized populations of 100,000 or more, except municipal separate storm sewers that are located in the incorporated places, townships, or towns within such counties (these counties are listed in Appendices H and I of 40 CFR 122); or (iii) owned or operated by a municipality other than those described in Paragraph (i) or (ii) and that are designated by the Regional Administrator as part of the large or medium municipal separate storm sewer system.

Maximum daily discharge limitation means the highest allowable "daily discharge" concentration that occurs only during a normal day (24-hour duration).

Maximum daily discharge limitation (as defined for the Steam Electric Power Plants only) when applied to Total Residual Chlorine (TRC) or Total Residual Oxidant (TRO) is defined as "maximum concentration" or "Instantaneous Maximum Concentration" during the two hours of a chlorination cycle (or fraction thereof) prescribed in the Steam Electric Guidelines, 40 CFR Part 423. These three synonymous terms all mean "a value that shall not be exceeded" during the two-hour chlorination cycle. This interpretation differs from the specified NPDES Permit requirement, 40 CFR § 122.2, where the two terms of "Maximum Daily Discharge" and "Average Daily Discharge" concentrations are specifically limited to the daily (24-hour duration) values.

Municipality means a city, town, borough, county, parish, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribe organization, or a designated and approved management agency under Section 208 of the CWA.

National Pollutant Discharge Elimination System means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of the CWA. The term includes an "approved program".

New Discharger means any building, structure, facility, or installation:

(a) From which there is or may be a "discharge of pollutants";

(b) That did not commence the "discharge of pollutants" at a particular "site" prior to August 13, 1979;

(c) Which is not a "new source"; and

(d) Which has never received a finally effective NPDES permit for discharges at that "site".

This definition includes an "indirect discharger" which commences discharging into "waters of the United States" after August 13, 1979. It also includes any existing mobile point source (other than an offshore or coastal oil and gas exploratory drilling rig or a coastal oil and gas exploratory drilling rig or a coastal oil and gas developmental drilling rig) such as a seafood processing rig, seafood processing vessel, or aggregate plant, that begins discharging at a "site" for which it does not have a permit; and any offshore rig or coastal mobile oil and gas exploratory drilling rig or coastal mobile oil and gas developmental drilling rig that commences the discharge of pollutants after August 13, 1979, at a "site" under EPA's permitting jurisdiction for which it is not covered by an individual or general permit and which is located in an area determined by the Regional Administrator in the issuance of a final permit to be in an area of biological concern. In determining whether an area is an area of biological concern, the Regional Administrator shall consider the factors specified in 40 CFR §§125.122 (a) (1) through (10).

An offshore or coastal mobile exploratory drilling rig or coastal mobile developmental drilling rig will be considered a "new discharger" only for the duration of its discharge in an area of biological concern.

New source means any building, structure, facility, or installation from which there is or may be a "discharge of pollutants", the construction of which commenced:

(a) After promulgation of standards of performance under Section 306 of CWA which are applicable to such source, or

(b) After proposal of standards of performance in accordance with Section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal.

NPDES means "National Pollutant Discharge Elimination System".

Owner or operator means the owner or operator of any "facility or activity" subject to regulation under the NPDES programs.

Pass through means a Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

Permit means an authorization, license, or equivalent control document issued by EPA or an "approved" State.

Person means an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

Point Source means any discernible, confined, and discrete conveyance, including but not limited to any pipe ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff (see 40 CFR §122.2).

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. §§2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well is used either to facilitate production or for disposal purposes is approved by the authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

Primary industry category means any industry category listed in the NRDC settlement agreement (Natural Resources Defense Council et al. v. Train, 8 E.R.C. 2120 (D.D.C. 1976), modified 12 E.R.C. 1833 (D. D.C. 1979)); also listed in Appendix A of 40 CFR Part 122.

Privately owned treatment works means any device or system which is (a) used to treat wastes from any facility whose operation is not the operator of the treatment works or (b) not a "POTW".

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Publicly Owned Treatment Works (POTW) means any facility or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature which is owned by a "State" or "municipality".

This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Regional Administrator means the Regional Administrator, EPA, Region I, Boston, Massachusetts.

Secondary Industry Category means any industry which is not a "primary industry category".

Section 313 water priority chemical means a chemical or chemical category which:

(1) is listed at 40 CFR §372.65 pursuant to Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) (also known as Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986);

(2) is present at or above threshold levels at a facility subject to EPCRA Section 313 reporting requirements; and

(3) satisfies at least one of the following criteria:

- (i) are listed in Appendix D of 40 CFR Part 122 on either Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols), or Table V (certain toxic pollutants and hazardous substances);
- (ii) are listed as a hazardous substance pursuant to Section 311(b)(2)(A) of the CWA at 40 CFR §116.4; or
- (iii) are pollutants for which EPA has published acute or chronic water quality criteria.

Septage means the liquid and solid material pumped from a septic tank, cesspool, or similar domestic sewage treatment system, or a holding tank when the system is cleaned or maintained.

Sewage Sludge means any solid, semisolid, or liquid residue removed during the treatment of municipal wastewater or domestic sewage. Sewage sludge includes, but is not limited to, solids removed during primary, secondary, or advanced wastewater treatment, scum, septage, portable toilet pumpings, Type III Marine Sanitation Device pumpings (33 CFR Part 159), and sewage sludge products. Sewage sludge does not include grit or screenings, or ash generated during the incineration of sewage sludge.

Sewage sludge use or disposal practice means the collection, storage, treatment, transportation, processing, monitoring, use, or disposal of sewage sludge.

Significant materials includes, but is not limited to: raw materials, fuels, materials such as solvents, detergents, and plastic pellets, raw materials used in food processing or production, hazardous substance designated under section 101(14) of CERCLA, any chemical the facility is required to report pursuant to EPCRA Section 313, fertilizers, pesticides, and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills includes, but is not limited to, releases of oil or hazardous substances in excess of reportable quantities under Section 311 of the CWA (see 40 CFR §110.10 and §117.21) or Section 102 of CERCLA (see 40 CFR § 302.4).

Sludge-only facility means any "treatment works treating domestic sewage" whose methods of sewage sludge use or disposal are subject to regulations promulgated pursuant to Section 405(d) of the CWA, and is required to obtain a permit under 40 CFR §122.1(b)(3).

State means any of the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands.

Storm Water means storm water runoff, snow melt runoff, and surface runoff and drainage.

Storm water discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. (See 40 CFR §122.26 (b)(14) for specifics of this definition.

Time-weighted composite means a composite sample consisting of a mixture of equal volume aliquots collected at a constant time interval.

Toxic pollutants means any pollutant listed as toxic under Section 307 (a)(1) or, in the case of "sludge use or disposal practices" any pollutant identified in regulations implementing Section 405(d) of the CWA.

Treatment works treating domestic sewage means a POTW or any other sewage sludge or wastewater treatment devices or systems, regardless of ownership (including federal facilities), used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated for the disposal of sewage sludge. This definition does not include septic tanks or similar devices.

For purposes of this definition, "domestic sewage" includes waste and wastewater from humans or household operations that are discharged to or otherwise enter a treatment works. In States where there is no approved State sludge management program under Section 405(f) of the CWA, the Regional Administrator may designate any person subject to the standards for sewage sludge use and disposal in 40 CFR Part 503 as a "treatment works treating domestic sewage", where he or she finds that there is a potential for adverse effects on public health and the environment from poor sludge quality or poor sludge handling, use or disposal practices, or where he or she finds that such designation is necessary to ensure that such person is in compliance with 40 CFR Part 503.

Waste Pile means any non-containerized accumulation of solid, non-flowing waste that is used for treatment or storage.

Waters of the United States means:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide;

(b) All interstate waters, including interstate “wetlands”;

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, “wetlands”, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purpose;

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in Paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) “Wetlands” adjacent to waters (other than waters that are themselves wetlands) identified in Paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA (other than cooling ponds as defined in 40 CFR §423.11(m) which also meet the criteria of this definition) are not waters of the United States.

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole Effluent Toxicity (WET) means the aggregate toxic effect of an effluent measured directly by a toxicity test. (See Abbreviations Section, following, for additional information.)

2. Definitions for NPDES Permit Sludge Use and Disposal Requirements.

Active sewage sludge unit is a sewage sludge unit that has not closed.

Aerobic Digestion is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

Agricultural Land is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

Agronomic rate is the whole sludge application rate (dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

Air pollution control device is one or more processes used to treat the exit gas from a sewage sludge incinerator stack.

Anaerobic digestion is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

Annual pollutant loading rate is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

Annual whole sludge application rate is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

Apply sewage sludge or sewage sludge applied to the land means land application of sewage sludge.

Aquifer is a geologic formation, group of geologic formations, or a portion of a geologic formation capable of yielding ground water to wells or springs.

Auxiliary fuel is fuel used to augment the fuel value of sewage sludge. This includes, but is not limited to, natural gas, fuel oil, coal, gas generated during anaerobic digestion of sewage sludge, and municipal solid waste (not to exceed 30 percent of the dry weight of the sewage sludge and auxiliary fuel together). Hazardous wastes are not auxiliary fuel.

Base flood is a flood that has a one percent chance of occurring in any given year (i.e. a flood with a magnitude equaled once in 100 years).

Bulk sewage sludge is sewage sludge that is not sold or given away in a bag or other container for application to the land.

Contaminate an aquifer means to introduce a substance that causes the maximum contaminant level for nitrate in 40 CFR §141.11 to be exceeded in ground water or that causes the existing concentration of nitrate in the ground water to increase when the existing concentration of nitrate in the ground water exceeds the maximum contaminant level for nitrate in 40 CFR §141.11.

Class I sludge management facility is any publicly owned treatment works (POTW), as defined in 40 CFR §501.2, required to have an approved pretreatment program under 40 CFR §403.8 (a) (including any POTW located in a state that has elected to assume local program responsibilities pursuant to 40 CFR §403.10 (e) and any treatment works treating domestic sewage, as defined in 40 CFR § 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved state programs, the Regional Administrator in conjunction with the State Director, because of the potential for sewage sludge use or disposal practice to affect public health and the environment adversely.

Control efficiency is the mass of a pollutant in the sewage sludge fed to an incinerator minus the mass of that pollutant in the exit gas from the incinerator stack divided by the mass of the pollutant in the sewage sludge fed to the incinerator.

Cover is soil or other material used to cover sewage sludge placed on an active sewage sludge unit.

Cover crop is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

Cumulative pollutant loading rate is the maximum amount of inorganic pollutant that can be applied to an area of land.

Density of microorganisms is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

Dispersion factor is the ratio of the increase in the ground level ambient air concentration for a pollutant at or beyond the property line of the site where the sewage sludge incinerator is located to the mass emission rate for the pollutant from the incinerator stack.

Displacement is the relative movement of any two sides of a fault measured in any direction.

Domestic septage is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

Domestic sewage is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

Dry weight basis means calculated on the basis of having been dried at 105 degrees Celsius (°C) until reaching a constant mass (i.e. essentially 100 percent solids content).

Fault is a fracture or zone of fractures in any materials along which strata on one side are displaced with respect to the strata on the other side.

Feed crops are crops produced primarily for consumption by animals.

Fiber crops are crops such as flax and cotton.

Final cover is the last layer of soil or other material placed on a sewage sludge unit at closure.

Fluidized bed incinerator is an enclosed device in which organic matter and inorganic matter in sewage sludge are combusted in a bed of particles suspended in the combustion chamber gas.

Food crops are crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

Forest is a tract of land thick with trees and underbrush.

Ground water is water below the land surface in the saturated zone.

Holocene time is the most recent epoch of the Quaternary period, extending from the end of the Pleistocene epoch to the present.

Hourly average is the arithmetic mean of all the measurements taken during an hour. At least two measurements must be taken during the hour.

Incineration is the combustion of organic matter and inorganic matter in sewage sludge by high temperatures in an enclosed device.

Industrial wastewater is wastewater generated in a commercial or industrial process.

Land application is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

Land with a high potential for public exposure is land that the public uses frequently. This includes, but is not limited to, a public contact site and reclamation site located in a populated area (e.g., a construction site located in a city).

Land with low potential for public exposure is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

Leachate collection system is a system or device installed immediately above a liner that is designed, constructed, maintained, and operated to collect and remove leachate from a sewage sludge unit.

Liner is soil or synthetic material that has a hydraulic conductivity of 1×10^{-7} centimeters per second or less.

Lower explosive limit for methane gas is the lowest percentage of methane gas in air, by volume, that propagates a flame at 25 degrees Celsius and atmospheric pressure.

Monthly average (Incineration) is the arithmetic mean of the hourly averages for the hours a sewage sludge incinerator operates during the month.

Monthly average (Land Application) is the arithmetic mean of all measurements taken during the month.

Municipality means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management agency under section 208 of the CWA, as amended. The definition includes a special district created under state law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201 (e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use or disposal of sewage sludge.

Other container is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

Pasture is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

Pathogenic organisms are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

Permitting authority is either EPA or a State with an EPA-approved sludge management program.

Person is an individual, association, partnership, corporation, municipality, State or Federal Agency, or an agent or employee thereof.

Person who prepares sewage sludge is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

pH means the logarithm of the reciprocal of the hydrogen ion concentration; a measure of the acidity or alkalinity of a liquid or solid material.

Place sewage sludge or sewage sludge placed means disposal of sewage sludge on a surface disposal site.

Pollutant (as defined in sludge disposal requirements) is an organic substance, an inorganic substance, a combination or organic and inorganic substances, or pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could on the basis on information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction) or physical deformations in either organisms or offspring of the organisms.

Pollutant limit (for sludge disposal requirements) is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of pollutant that can be applied to a unit of land (e.g., kilograms per hectare); or the volume of the material that can be applied to the land (e.g., gallons per acre).

Public contact site is a land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

Qualified ground water scientist is an individual with a baccalaureate or post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground water monitoring, pollutant fate and transport, and corrective action.

Range land is open land with indigenous vegetation.

Reclamation site is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

Risk specific concentration is the allowable increase in the average daily ground level ambient air concentration for a pollutant from the incineration of sewage sludge at or beyond the property line of a site where the sewage sludge incinerator is located.

Runoff is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off the land surface.

Seismic impact zone is an area that has 10 percent or greater probability that the horizontal ground level acceleration to the rock in the area exceeds 0.10 gravity once in 250 years.

Sewage sludge is a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to:, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in treatment works.

Sewage sludge feed rate is either the average daily amount of sewage sludge fired in all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located for the number of days in a 365 day period that each sewage sludge incinerator operates, or the average daily design capacity for all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located.

Sewage sludge incinerator is an enclosed device in which only sewage sludge and auxiliary fuel are fired.

Sewage sludge unit is land on which only sewage sludge is placed for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR §122.2.

Sewage sludge unit boundary is the outermost perimeter of an active sewage sludge unit.

Specific oxygen uptake rate (SOUR) is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in sewage sludge.

Stack height is the difference between the elevation of the top of a sewage sludge incinerator stack and the elevation of the ground at the base of the stack when the difference is equal to or less than 65 meters. When the difference is greater than 65 meters, stack height is the creditable stack height determined in accordance with 40 CFR §51.100 (ii).

State is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

Store or storage of sewage sludge is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

Surface disposal site is an area of land that contains one or more active sewage sludge units.

Total hydrocarbons means the organic compounds in the exit gas from a sewage sludge incinerator stack measured using a flame ionization detection instrument referenced to propane.

Total solids are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

Treat or treatment of sewage sludge is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

Treatment works is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature.

Unstable area is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

Unstabilized solids are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Vector attraction is the characteristic of sewage sludge that attracts rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents.

Volatile solids is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

Wet electrostatic precipitator is an air pollution control device that uses both electrical forces and water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

Wet scrubber is an air pollution control device that uses water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

3. Commonly Used Abbreviations

BOD	Five-day biochemical oxygen demand unless otherwise specified
CBOD	Carbonaceous BOD
CFS	Cubic feet per second
COD	Chemical oxygen demand
Chlorine	
Cl_2	Total residual chlorine
TRC	Total residual chlorine which is a combination of free available chlorine (FAC, see below) and combined chlorine (chloramines, etc.)

TRO	Total residual chlorine in marine waters where halogen compounds are present
FAC	Free available chlorine (aqueous molecular chlorine, hypochlorous acid, and hypochlorite ion)
Coliform	
Coliform, Fecal	Total fecal coliform bacteria
Coliform, Total	Total coliform bacteria
Cont. (Continuous)	Continuous recording of the parameter being monitored, i.e. flow, temperature, pH, etc.
Cu. M/day or M^3/day	Cubic meters per day
DO	Dissolved oxygen
kg/day	Kilograms per day
lbs/day	Pounds per day
mg/l	Milligram(s) per liter
ml/l	Milliliters per liter
MGD	Million gallons per day
Nitrogen	
Total N	Total nitrogen
NH_3-N	Ammonia nitrogen as nitrogen
NO_3-N	Nitrate as nitrogen
NO_2-N	Nitrite as nitrogen
NO_3-NO_2	Combined nitrate and nitrite nitrogen as nitrogen
TKN	Total Kjeldahl nitrogen as nitrogen
Oil & Grease	Freon extractable material
PCB	Polychlorinated biphenyl
pH	A measure of the hydrogen ion concentration. A measure of the acidity or alkalinity of a liquid or material
Surfactant	Surface-active agent

Temp. °C	Temperature in degrees Centigrade
Temp. °F	Temperature in degrees Fahrenheit
TOC	Total organic carbon
Total P	Total phosphorus
TSS or NFR	Total suspended solids or total nonfilterable residue
Turb. or Turbidity	Turbidity measured by the Nephelometric Method (NTU)
ug/l	Microgram(s) per liter
WET	"Whole effluent toxicity" is the total effect of an effluent measured directly with a toxicity test.
C-NOEC	"Chronic (Long-term Exposure Test) – No Observed Effect Concentration". The highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specified time of observation.
A-NOEC	"Acute (Short-term Exposure Test) – No Observed Effect Concentration" (see C-NOEC definition).
LC_{50}	LC_{50} is the concentration of a sample that causes mortality of 50% of the test population at a specific time of observation. The LC_{50} = 100% is defined as a sample of undiluted effluent.
ZID	Zone of Initial Dilution means the region of initial mixing surrounding or adjacent to the end of the outfall pipe or diffuser ports.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 POST OFFICE SQUARE, SUITE 100 (OEP06-1)
BOSTON, MASSACHUSETTS 02109-3912

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES PURSUANT TO THE CLEAN WATER ACT (CWA)

NPDES PERMIT # MA0028941

PUBLIC NOTICE DATES: October 27, 2017 – November 25, 2017

NAMES AND ADDRESSES OF PERMITTEES:

Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA 02116-3974

Keolis Commuter Services, LLC
470 Atlantic Avenue – 5th Floor
Boston, MA 02210

Delaware North Corporation
100 Legends Way
Boston, MA 02114

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

North Station Railroad Terminal
135 Causeway Street
Boston, MA 02116

RECEIVING WATER: Charles River (Segment MA72-38)

RECIVING WATER CLASSIFICATION: B (Warm water, CSO)

NAICS CODE: 482111 (Line-Haul Railroads)

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Attachments:

I. Proposed Action, Type of Facility, and Discharge Location

A. Proposed Action

Two of the above named co-Permittees, Massachusetts Bay Transportation Authority (MBTA) and Keolis Commuter Services LLC, have applied to the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) for the reissuance of a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater and various process waters into the designated receiving water from the North Station Railroad Terminal (NSRT), which is also referred to as TD Garden, or the "Facility". The existing permit (current permit) was issued to the MBTA, Massachusetts Bay Commuter Railroad Company (MBCR), and the Delaware North Corporation on April 7, 2010 and became effective on July 1, 2010. In 2014, Keolis Commuter Services, LLC replaced MBCR as the contract operator of the commuter rail lines and therefore, replaced MBCR as a co-Permittee. Delaware North Corporation (DNC), which owns and operates the TD Garden facility (formerly the Fleet Center), is also a co-Permittee, but is only responsible for complying with the Stormwater Pollution Prevention Plan (SWPPP) requirement of this permit and has been determined to not need to file its own permit application for this permit.

EPA received a permit renewal application from MBTA and Keolis dated December 24, 2014 with a supplemental submission made on June 30, 2015. Since the permit renewal application was deemed complete and timely by EPA by letter of July 1, 2015, the current permit, issued in 2010, has been administratively continued.

B. Type of Facility and Discharge Location

NSRT is a public transportation railroad station used exclusively for the loading and unloading of passengers commuting to and from Boston. No maintenance, repair, or storage of trains occurs on site. Locomotive and passenger cars are serviced at a separate facility in Somerville, MA maintained by the MBTA. As NSRT is the terminus of the north and west bound commuter lines, passenger trains are not typically allowed to idle at the facility beyond the time necessary to unload and pick up passengers. See **Figure 1** for a site location map.

The facility discharges treated stormwater and various non-stormwater discharges described in the permit and in Section IV below from an oil/water separator through Outfall 001 to the Charles River. See **Figure 2** for a facility plan, which displays the site drainage patterns.

II. Receiving Water Description

The discharge from this facility is to segment MA72-38 of the Charles River, which encompasses the area from the Boston University Bridge (Boston/Cambridge) to the New Charles River Dam (Boston) (formerly part of segment MA72-08)]. This segment is a Class B water that is listed on the *Final Massachusetts Year 2014 Integrated List of Waters*[1] as a Category 5 waterbody, which are those classified as "waters requiring a TMDL". This waterbody is listed for the following impairments: chlorophyll-a, combined biota/habitat bioassessments, DDT, dissolved oxygen saturation, *Escherichia coli*, excess algal growth, oil and grease, other flow regime alterations, dissolved oxygen, salinity, secchi disk transparency, water temperature, nutrient/eutrophication biological indicators, taste and odor, phosphorus (total), sediment screening value (exceedance), and PCB in fish tissue.

Sections 305(b) and 303(d) of the CWA require that States complete a water quality inventory and develop a list of impaired waters. Specifically, Section 303(d) of the CWA requires States to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology-based controls, and as such, require the development of a Total Maximum Daily Load (TMDL) for each pollutant that is prohibiting a designated use(s) from being attained. In Massachusetts, these two evaluations have been combined into an Integrated List of Waters. The integrated list format provides the status of all assessed waters in a single, multi-part list.

Class B waters are described in the Massachusetts Surface Water Quality Standards (MASWQS) [314 CMR 4.05(3)(b)] as "designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06, they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply") and suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." A warm water fishery is defined in the MA SWQS as "waters in which the maximum mean monthly temperature generally exceeds 68° F (20° C) during the summer months and are not capable of sustaining a year-round population of cold water stenothermal aquatic life" (314 CMR 4.02).

A Phosphorus TMDL for the Lower Charles River Basin[2] and a Pathogen TMDL[3] for the Charles River Watershed have been completed. Many of the smaller drainage system discharges to the Lower Charles basin were grouped together into one allocation because there was limited data available to individually characterize each source that makes up this group. Therefore, the

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1 http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

2 MassDEP and USEPA, Total Maximum Daily Load for Nutrients In the Lower Charles River Basin, Massachusetts CN 301.0, Final Report, June 2007. Found at http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/charlesp.pdf

3 http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/charles1.pdf

Phosphorus TMDL that was finalized in 2007 specifies waste load allocations (WLA) and necessary phosphorus load reductions for stormwater drainage system discharges within the Charles River watershed. See 40 C.F.R. §130.7.

Although this TMDL does not provide an individual numerical WLA for the NSRT site, it does provide an overall WLA including a corresponding average annual phosphorus load reduction of 62 percent for the group of stormwater discharges within the Lower Chares drainage area which includes this site's drainage area (referred to as "other drainage area" in the TMDL). The development and implementation of a Source Identification and Reduction Plan (SIRP) in the 2010 permit, along with other requirements of the SWPPP, were intended to reduce effluent phosphorus concentrations and at that time may have been considered a phosphorus control plan (PCP) required to achieve the WLA of the TMDL.

The Pathogen TMDL reported that the NSRT drainage contributes high fecal coliform counts during wet weather, ranging from 60,000 to 100,000 colony forming units (cfu)/100mL, with a possible source attributable to gulls and pigeons. See Section V.D. below for the discussion on effluent bacteria.

III. Permit Basis: Statutory and Regulatory Authority

A. General Requirements

The CWA prohibits the discharge of pollutants to waters of the United States without a NPDES permit unless such a discharge is otherwise authorized by the CWA. The NPDES permit is the mechanism used to implement technology-based effluent limitations (TBELs), water quality-based effluent limitations (WQBELs) and other requirements including monitoring and reporting. The draft permit was developed in accordance with various statutory and regulatory requirements established pursuant to the CWA and applicable State regulations. During development, EPA considered the most recent technology-based treatment requirements and water quality-based requirements. The regulations governing the EPA NPDES permit program are generally found at 40 C.F.R. Parts 122, 124, 125, and 136. The general conditions of the draft permit are based on 40 C.F.R. §122.41 and consist primarily of management requirements common to all permits. For this permit, EPA considered: 1) technology-based requirements; 2) water quality-based requirements; and 3) limitations and conditions in the current/existing general permits when developing permit limits.

B. Technology-Based Requirements

Subpart A of 40 CFR §125 establishes criteria and standards for the imposition of technology-based treatment requirements in permits under Section 301(b) of the CWA, including the application of EPA promulgated Effluent Limitation Guidelines (ELGs) and case-by-case determinations of effluent limitations under Section 402(a)(1) of the CWA.

Technology-based treatment requirements represent the minimum level of control that must be imposed under Sections 301(b) and 402 of the CWA (*see* 40 CFR §125 Subpart A) to meet best practicable control technology currently available (BPT) for conventional pollutants and some metals, best conventional control technology (BCT) for conventional pollutants, and best available technology economically achievable (BAT) for toxic and non-conventional pollutants. In general, technology-based effluent guidelines for non-POTW facilities must be complied with as expeditiously as practicable but in no case later than three years after the date such limitations are established and in no case later than March 31, 1989 [See 40 CFR §125.3(a)(2)].

EPA has not promulgated technology-based ELGs for facilities that fall under NAICS code 482111 (Line-Haul Railroads). However, the 2015 Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) contains requirements applicable to facilities classified by this code. *See* 2015 MSGP, Sector P – Land Transportation and Warehousing, Subsector P1 - Railroad Transportation. In the absence of technology-based effluent guidelines, the permit writer is authorized under Section 402(a)(1)(B) of the CWA to establish effluent limitations on a case-by-case basis using Best Professional Judgement (BPJ). To the extent applicable to the facility, EPA has incorporated conditions from the 2015 MSGP into the Draft Permit.

C. Water Quality-Based Requirements

Section 301(b)(1)(C) of the CWA requires that effluent limitations based on water quality considerations be established for point source discharges when such limitations are necessary to meet state or federal water quality standards that are applicable to the designated receiving water. This is necessary when less stringent technology-based limitations would interfere with the attainment or maintenance of water quality in the receiving water.

Under Section 301(b)(1)(C) of the CWA and EPA regulations, NPDES permits must contain effluent limits more stringent than TBELs where more stringent limits are necessary to maintain or achieve state or federal water quality standards. Water quality standards generally consist of three parts: (1) beneficial designated uses for a water-body or a segment of a water-body; (2) numeric and/or narrative water quality criteria (WQC) sufficient to protect the assigned designated use(s); and (3) anti-degradation requirements to ensure that once a use is attained it will not be degraded. The MA SWQSs, found at 314 CMR 4.00, include these elements. The State will limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. These standards also include requirements for the regulation and control of toxic constituents and require that EPA criteria, established pursuant to Section 304(a) of the CWA, shall be used unless site specific criteria are established.

Receiving water requirements are established according to numerical and narrative standards in the State's water-quality standards adopted under state law for each stream classification. When using chemical-specific numeric criteria to develop permit limits, both the aquatic-life acute and chronic criteria, expressed in terms of maximum allowable in-stream pollutant concentration, are used. Aquatic-life acute criteria are considered applicable to daily time periods (maximum daily limit) and aquatic-life chronic criteria are considered applicable to monthly time periods (average monthly limit). Chemical-specific limits are allowed under 40 C.F.R. §122.44 (d)(1) and are implemented under 40 C.F.R. §§122.45(d) and (f). Therefore, the Region establishes maximum daily and average monthly limits for chemical specific toxic pollutants based, in part, on a reasonable measure of the facility's actual or projected flow rates on an average monthly and a maximum daily basis for all production-based facilities that have a continuous discharge. In addition, the dilution provided by the receiving water is factored into this process. Furthermore, narrative criteria from the state's water-quality standards are often used to limit toxicity in discharges where: (1) a specific pollutant can be identified as causing or contributing to the toxicity but the state has no numeric standard; or (2) toxicity cannot be traced to a specific pollutant.

1. Reasonable Potential

NPDES permits must include limitations to control all pollutants or pollutant parameters (conventional, non-conventional, and toxic) that are or might be discharged at levels that "cause, or have the reasonable potential to cause, or contribute" to an excursion above any State water quality standard, including both narrative and numeric criteria [40 C.F.R. §122.44(d)(1)(i)]. An excursion occurs if the projected or actual in-stream concentration exceeds an applicable water quality criterion. If the permitting authority determines that a discharge causes, has the reasonable potential to cause, or contributes to such an excursion, the permit must contain water quality-based effluent limitations (WQBELs) for the pollutant [40 C.F.R. 122.44(d)(1)(iii)].

In determining reasonable potential, EPA considers: 1) existing controls on point and non-point sources of pollution; 2) pollutant concentration and variability in the effluent and receiving water based on available information including, but not limited to, a permittee's NPDES application, monthly discharge monitoring reports (DMRs), whole effluent toxicity (WET) test reports, and State and Federal Water Quality Reports; 3) sensitivity of the indicator species used in toxicity testing; 4) known water quality impacts of processes on wastewaters; and 5) where appropriate, dilution of the effluent in the receiving water. EPA typically follows a quantitative approach based on the guidance in *Technical Support Document for Water Quality-based Toxics Control* (*TSD*) to determine if any pollutant or pollutant parameter (conventional, non-conventional, and toxic) is or may be discharged causes or has the reasonable potential to cause or contribute to an excursion above any water quality standard [40 CFR §122.44(d)].[4] EPA's quantitative approach statistically projects concentrations based on available effluent data, which are then compared to the applicable WQC.

2. Dilution Factor and Ambient Conditions

EPA considers the available dilution when determining water quality based limitations in NPDES permits. Massachusetts' SWQSs at 314 CMR 4.03(3)(a), which apply to rivers and streams, state that "*the lowest flow condition at and above which aquatic life criteria must be*

[4] EPA's *Technical Support Document for Water Quality-based Toxics Control:* EPA/505/2-90-001, 1991

applied is the lowest mean flow for seven consecutive days to be expected once in ten years [7Q10]. When records are not sufficient to determine this condition, the flow may be estimated using methods approved by the Department".

3. Anti-Degradation

Federal regulations found at 40 C.F.R. §131.12 require states to develop and adopt a statewide anti-degradation policy which maintains and protects existing in-stream water uses and the level of water quality necessary to protect these existing uses, and maintains the quality of waters which exceed levels necessary to support propagation of fish, shellfish, and wildlife and to support recreation in and on the waterbody. The Commonwealth of Massachusetts' anti-degradation provisions found in 314 CMR 4.04 apply to any new or increased discharge that would lower water quality or affect existing or designated uses, including increased loadings to a water body from an existing activity. The anti-degradation provisions focus on protecting high quality waters and maintaining water quality necessary to protect existing uses.

All existing in-stream uses and the level of water quality necessary to protect the existing uses of the Charles River shall be maintained and protected. As previously described, a Class B waterbody in Massachusetts is a habitat for fish, other aquatic life and wildlife, and used for primary and secondary contact recreation. This permit is being reissued with allowable effluent limits as stringent as or more stringent than the previous permit and accordingly will continue to protect the existing uses of the Charles River.

D. Anti-Backsliding

A permit may not be renewed, reissued or modified with less stringent limitations or conditions than those contained in a previous permit unless in compliance with the anti-backsliding requirements of the CWA. *See* §402(o) and §303(d)(4) of the CWA and 40 CFR §122.44(l)(1 and 2). Effluent limits based on BPJ, water quality, and state certification requirements must also meet the anti-backsliding provisions found at §402(o) and §303(d)(4) of the CWA.

All proposed limitations and conditions in the draft permit are at least as stringent as limitations included in the Facility's 2010 permit.

E. Monitoring Requirements

EPA has the authority in accordance with various statutory and regulatory requirements established pursuant to the CWA, 33 USC §1251 et seq., the NPDES program (see §402 and the implementing regulations generally found at 40 CFR Parts 122, 124, 125, and 136), CWA §308(a), 33 USC §1318(a), and applicable state regulations (generally including 314 CMR 3.00 and 314 CMR 4.00 in Massachusetts) to include effluent limitations and other requirements such as monitoring and reporting in NPDES permits. The monitoring requirements included in this permit have been established to yield data representative of the discharges under the authority of §308(a) and §402(a)(2) of the CWA, according to regulations set forth at 40 CFR §122.41(j), §122.44(i) and §122.48. The monitoring requirements included in this permit will provide the information needed to assess effluent characteristics, evaluate permit compliance, and determine if additional permit conditions are necessary to ensure compliance with technology-based and water quality-based requirements, including MA SWQSs. EPA or MassDEP may use the results of the chemical analyses conducted pursuant to this permit, as well as national water quality criteria developed pursuant to §304(a)(1) of the CWA, state water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for any pollutants, including, but not limited to, those pollutants listed in Appendix D of 40 CFR Part 122. Therefore, the monitoring requirements in this permit are included for specific regulatory use in carrying out the CWA.

1. Test Methods and Minimum Levels

NPDES permits require that the approved analytical procedures found in 40 CFR §136 be used for sampling and analysis unless other procedures are explicitly specified. Permits also include requirements necessary to comply with the *National Pollutant Discharge Elimination System (NPDES): Use of Sufficiently Sensitive Test Methods for Permit Applications and Reporting Rule*[5]. This Rule requires that where EPA-approved methods exist, NPDES permittees must use sufficiently sensitive EPA-approved analytical methods when quantifying the presence of pollutants in a discharge and the permitting authority must prescribe that only sufficiently sensitive EPA-approved methods be used for analyses of pollutants or pollutant parameters under the permit. The NPDES regulations at 40 CFR §122.21(e)(3) (completeness), 40 CFR §122.44(i)(1)(iv) (monitoring requirements) and/or as cross referenced at 40 CFR §136.1(c) (applicability) indicate that an EPA-approved method is sufficiently sensitive where:

- The method minimum level (ML) is at or below the level of the applicable water quality criterion or permit limitation for the measured pollutant or pollutant parameter; or
- In the case of permit applications, the ML is above the applicable water quality criterion, but the amount of the pollutant or pollutant parameter in a facility’s discharge is high enough that the method detects and quantifies the level of the pollutant or parameter in the discharge; or
- The method has the lowest ML of the EPA-approved analytical methods.

IV. Description of Discharge

This facility’s stormwater runoff and other non-stormwater flows are directed to an oil/water separator (Outfall 001), which discharges by gravity flow to the Charles River. The Permittees sample the final chamber of the separator, because the outlet of the oil/water separator is typically submerged below the surface of the river and therefore not accessible. The flows directed to the oil/water separator consist of the following:

5 Federal Register, Vol. 79, No. 160, Tuesday, August 19, 2014; FR Doc. 2014–19557.

- stormwater runoff from the MBTA commuter rail track area, the TD Garden Roof, a Massachusetts Department of Transportation (MassDOT) building, part of the orange line MBTA track area, and garage sump water (consisting of drainage in the parking garage and groundwater),

- non-stormwater discharges (runoff discharges from emergency/unplanned firefighting activities and fire hydrant flushing),

- uncontaminated air conditioning condensate,

- routine external building washdown (no detergents or hazardous cleaning products added [e.g., those containing bleach, hydrofluoric acid, muriatic acid, sodium hydroxide, nonylphenols]),

- wash water from periodic platform wash-downs (no detergents or hazardous cleaning products added),

- uncontaminated groundwater,

- wash water from track bay drain flushing, and

- foundation and footing drains where flows are not contaminated by contact with soils where spills or leaks of toxic or hazardous materials have occurred.

The oil/water separator is inspected on a monthly basis. Oil, grease, floating trash and debris are removed from the separator on a quarterly basis and the unit is completely drained and cleaned once a year. The oil, grease, debris, and sediments that are removed from the oil/water separator are disposed of off-site as solid wastes.

A drainage analysis performed in 2002 determined that the drainage area contributing to the oil/water separator is 8 acres, which includes the track area and the TD Garden roof. Additional flow is contributed from the TD Garden parking garage sump. The drainage system was analyzed for a 10 year, 24-hour storm event, having a rainfall intensity of 4.60 inches per hour. During the assumed 10-year storm event, the flow into the oil/water separator was estimated at 20 MGD, although this flow is limited by the hydraulic capacity of the storm drain system (and the oil/water separator) at about 16 MGD.

In 1993, the MBTA entered into an agreement with the Garden Corporation, the owner of the TD Garden facility at that time, granting it the right to discharge storm water from TD Garden roof leaders and from a sump pump located on the lower level of the TD Garden/North Station underground parking garage to the oil/water separator with eventual discharge at Outfall 001. The discharge from the sump is storm water runoff that has come into contact with vehicles entering and exiting the garage and groundwater. These discharges are intermittent.

No materials are treated, stored, or disposed of in a manner to normally allow exposure to storm water. Any materials or byproducts that are unloaded, loaded, and/or transferred at the site are done so in containers that prevent the contents from being exposed to storm water. No surfactants, solvents, pesticides, herbicides, or fertilizers are used or stored at the facility. However, the following chemical applications and activities take place within the drainage area and may contribute to the flow to the oil/water separator:

- Nitro Thermal Ice Melt® (potassium acetate-based) and/or other deicing compounds are applied to the platform areas during freezing weather conditions where build-up of ice or snow as a result of storm events may pose a safety hazard to passengers and operating personnel - TD Garden staff apply Environmelt® (sodium chloride-based) in its service areas;
- Gasoline in five-gallon containers is stored temporarily on-site during the winter months for use in snow removal equipment;
- Soytrak® is applied as a dry lubricant to track switches (replaced the use of graphite);
- Platform areas are periodically washed down with water. The discharge from this activity is directed to the storm drain system;
- Storage and unloading of solid waste and refuse associated with food service activities at TD Garden takes place in the site's northeast, ground-level loading/unloading area; and
- Diesel fuel is stored in a 2,000-gallon double walled aboveground storage tank (AST) which is housed in a small building structure located near the drainage system along the entrance to the facility garage. The tank is equipped with secondary containment having a capacity greater than the volume of the tank. The diesel fuel is for an electric generator owned and operated by the MassDOT, servicing emergency power to the nearby highway tunnels.

Discharge Monitoring Reports (DMRs) received during the time period of March 2011 to March 2016 were reviewed and used in the development of the draft NPDES permit (draft permit). This time period is referred to as the "monitoring period" in this Fact Sheet. A summary of the DMR data is provided in **Attachment 1** to this Fact Sheet.

V. Proposed Permit Effluent Limitations and Conditions

The bases for the effluent limitations and monitoring requirements, special conditions and standard conditions derived under the Federal Clean Water Act and Massachusetts' Surface Water Quality Standards are as follows:

A. Effluent Flow

Generally, effluent flow is one factor EPA considers in deriving effluent limitations that comply with the CWA in a NPDES permit. Often, flow is used to calculate the effluent limitations themselves. EPA practice includes use of design flow as a reasonable and important worst-case condition in EPA's calculation of certain TBELs, and in EPA's reasonable potential and WQBEL calculations that ensure compliance with WQSs under §301(b)(1)(C) of the CWA. Should the effluent flow exceed the flow assumed in these calculations, the in-stream dilution would decrease and the calculated effluent limitations may not be protective (i.e., meet WQSs). Further, pollutants that do not have the reasonable potential to exceed WQSs at the lower discharge flow may have reasonable potential at a higher flow due to the decreased dilution. In order to ensure that the assumptions underlying EPA's reasonable potential analyses and derivation of permit effluent limitations remain sound for the duration of the permit, EPA may ensure its maximum effluent flow assumption through imposition of permit conditions for effluent flow. In this regard, the flow limit included in this permit is a component of WQBELs because the WQBELs are premised on a maximum effluent flow. In addition, the flow limit is necessary to ensure that other pollutants remain at levels that do not have a reasonable potential to exceed WQSs.

The limitation on effluent flow is within EPA's authority to condition a permit in order to carry out the objectives of the CWA. See CWA §§ Sections 402(a)(2) and 301(b)(1)(C); 40 C.F.R. §§ 122.4(a) and (d); 122.43 and 122.44(d). A condition on the discharge designed to protect EPA's WQBEL and reasonable potential calculations is encompassed by the references to "condition" and "limitations" in CWA Sections 402 and 301 and implementing regulations, as they are designed to assure compliance with applicable water quality regulations, including anti-degradation. Regulating the quantity of pollutants in the discharge through a restriction on the quantity of effluent is consistent with the overall structure and purposes of the CWA.
In addition, as provided in Part II.B.1 of this permit and 40 C.F.R. § 122.41(e), the Permittees are required to properly operate and maintain all systems of treatment and control. In this instance, operating the facility's wastewater treatment systems as designed includes operating these systems within the design flow of each system. Thus, the permit's effluent flow limitation is necessary to ensure proper facility operation, which in turn is a requirement applicable to all NPDES permits. *See* 40 C.F.R. § 122.41.

From March of 2011 through March of 2016, the monitoring period, effluent flow has ranged from 0 MGD to 4.64 MGD, with an average of 0.16 MGD (See Attachment 1). The Facility's current permit limited the discharge to a maximum flow rate of 16 MGD, which is the hydraulic capacity of the stormwater drainage system discharging to the oil/water separator. The draft permit shall continue to require a maximum daily flow limit of 16 MGD, and the Permittees are required to report the estimated discharge flow monthly.

B. Oil and Grease (O&G)

The MA SWQS at 314 CMR 4.05(3)(b)7 require that Class B waters "shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life." In addition, a concentration of 15 mg/L is recognized as the level at which many oils produce a visible sheen and/or cause an undesirable taste in fish (USEPA; *The Red Book – Quality Criteria for Water*. July 1976).

The current permit includes a monthly monitoring requirement for O&G, with a daily maximum limit of 15 mg/L. Review of DMR data shows that O&G values have ranged from non-detect to 230 mg/L, with five (5) violations of the 15 mg/L effluent limit.

Absorbent pads on the commuter rail tracks collect oil which drips from train engines when the trains are loading or unloading passengers or are otherwise idling at this location. In order to minimize any migration of any spilled oil from the tracks to the site's drainage system, the current permit requires monthly inspection and maintenance of these absorbent pads, as outlined in the site specific best management practices (BMPs) of the Draft Permit's SWPPP. In addition, that current permit requires monthly inspection and maintenance of the oil/water separator. However, as outlined in the SWPPP, the draft permit increases this inspection frequency for both of these areas to weekly, due to the occasional high levels of oil & grease resulting in permit violations. See Part I.B.9 of the permit.

To ensure compliance with the MA SWQSs and anti-backsliding requirements found in 40 C.F.R. §122.44(l), the draft permit maintains the maximum daily limit for O&G of 15 mg/L, monitored at a frequency of once per month.

C. pH

The hydrogen-ion (H-) concentration in an aqueous solution is represented by the pH using a logarithmic scale of 0 to 14 standard units (SU). Solutions with pH 7.0 SU are neutral, while those with pH less than 7.0 SU are acidic and those with pH greater than 7.0 SU are basic. Although basic solutions are alkaline, basicity and alkalinity are not exactly the same. Basicity refers to the ratio of hydrogen and hydroxyl (OH-) ions in solution, and is directly related to pH. Alkalinity is related to the acid-neutralizing capacity of a solution. In aquatic ecosystems, biological processes (e.g., decomposition) that increase the amount of dissolved carbon dioxide or dissolved organic carbon decrease pH but have no effect on acid-neutralizing capacity. Effluent with pH values markedly different from the receiving water pH can have a detrimental effect on the environment. Sudden pH changes can kill aquatic life.

The current permit requires a pH effluent limitation range of 6.5 to 8.3 SU, monitored monthly. Review of DMR data from the monitoring period shows an effluent pH range of 6.59 to 8.02

SU with no violations of the permitted range.

The MA SWQS, for Class B, Inland Waters, at 314 CMR 4.05 (3)(b)3, require that the pH of Class B waters be in the range of 6.5 to 8.3 SU and no more than 0.5 units outside the background range and that there shall no change from background conditions that would impair any use assigned to this Class.

Therefore, the draft permit maintains a pH effluent limitation range of 6.5 to 8.3 SU, monitored at a frequency of once per month, based on MA SWQSs and anti-backsliding requirements found in 40 C.F.R. §122.44(l).

D. *Escherichia coli (E. coli)*

"Microorganisms that have the potential to cause disease in a host are called *pathogens*, and those that are capable of causing human diseases are known as human pathogens. Exposure to pathogens, for example in recreational water, may occur by ingestion, inhalation, or entry into the body through an open skin wound. Commonly documented illnesses from swimming in contaminated recreational waters include gastrointestinal illnesses, respiratory illnesses, skin rashes, and ear, eye, and wound infections. While the vast majority of these illnesses are self-limiting, in rare cases some infections can result in death." EPA, *FAQ: NPDES Water-Quality Based Permit Limits for Recreational Water Quality Criteria*, April 2, 2015, p. 1.[6]

E.coli is a fecal indicator bacteria that is used to measure the presence of fecal contamination in waterbodies and thereby the potential for adverse health outcomes. Storm water runoff can be a significant contributor of pathogen pollution. During rain events, fecal matter from domestic animals and wildlife is readily transported to surface waters via the storm water drainage systems and/or overland flow. The natural filtering capacity provided by vegetative cover and soils is dramatically reduced as urbanization occurs because of the increase in impervious areas (i.e., streets, parking lots, etc.) and stream channelization in the watershed.

The current permit requires monitoring for *E. coli*, monthly during dry weather and quarterly during wet weather. Review of DMR data during the monitoring period show that *E. coli* levels during dry weather ranging from non-detect to 21000 cfu/100 ml, averaging 695 cfu/100 ml, and with a geometric mean of 49.6 cfu/100 ml. During wet weather, the values averaged 727 cfu/100 ml, ranged from non-detect to 9000 cfu/100 ml, and with a geometric mean of 110 cfu/100 ml.

[6] https://www.epa.gov/sites/production/files/2015-09/documents/npdes-water-quality-based-permit-limits-for-recreational-water-quality-criteria-faqs_0.pdf

The Pathogen TMDL reports that the TD Garden drainage contributes high fecal coliform counts during wet weather, ranging from 60,000 to 100,000 cfu/100mL, with a possible bacterial source from gulls and pigeons. For Class B surface waters, the MASWQSs require that the geometric mean of all *E. coli* samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and that no single sample shall exceed 235 colonies/100 ml, based upon the recently updated water quality criteria for bacteria in Massachusetts. *See* 314 CMR 4.05(3)(b)4.b. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and BMPs to mitigate storm water runoff volume.

Therefore, the draft permit requires that the Permittees update and continue to implement their Source Identification and Reduction Plan (SIRP) to minimize the discharge of bacteria through the facility's stormwater drainage system. Since there continue to be occasional high levels of bacteria being discharged, this permit requires the Permittees to continue to implement BMPs to significantly reduce or minimize the bacteria loading to the receiving water.

In addition, if it is found that effluent levels of *E.coli* exceed the benchmark value of a geometric mean of 126 colonies per 100 ml of all (wet weather and dry weather) *E. coli* samples taken within the most recent six months discussed above, the draft permit's Stormwater Pollution Prevention Plan (SWPPP) requires the Permittees to resample the effluent for *E.coli*, reassess the SWPPP, and consider additional source identification, source reduction and/or treatment to attempt to reduce the discharge levels of *E. coli*. If there are continued exceedances of this benchmark value, this permit may be modified to include effluent limits for *E.coli* or such limits may be established in the subsequent permit. See Part I.B.6 of the draft permit.

Furthermore, Part I.C of the draft permit requires a one-time dry weather screening study in order for the Permittees to assess whether there are any illicit connections to the stormwater drainage system which could be a source of bacteria or other pollutants.

E. Total Suspended Solids (TSS)

Solids are the most common pollutant in storm water runoff and could include inorganic and organic matter. Suspended solids may settle to form bottom deposits in the receiving water, potentially causing benthic smothering. Suspended solids also increase turbidity in receiving waters and reduce light penetration through the water column, thereby limiting the growth of rooted aquatic vegetation that serves as a critical habitat for fish and other aquatic organisms and can clog fish gills, resulting in an increase in susceptibility to infection or asphyxiation. Suspended solids also provide a medium for the transport of other sorbed pollutants, including nutrients, pathogens, and metals, which may accumulate in settled deposits that may have a long-term impact on the water column through cycles of re-suspension.

The current permit contains a monthly monitoring requirement for TSS with a daily maximum effluent limit of 100 mg/L. During the monitoring period, TSS values have averaged from non-detect to 570 mg/L, with an average of 31.2 mg/L and two (2) violations of the effluent limit.

For Class B waters, the MA SWQS have a narrative standard for solids that states, "[t]hese waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this Class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom."

The TSS effluent limit of 100 mg/L was established in the 2010 permit based on technology and BPJ, in consideration of the typical treatment effectiveness of an oil/water separator. An oil/water separator removes components of oils and grease and solid particles by slowing down the flow of the water. The slower flow allows lighter oils and greases to float and solids to sink. The oils are skimmed off the surface and the settled solids are periodically removed from the bottom during scheduled maintenance.

In re-evaluating the TBEL for this permit, EPA considered the TSS limits that are included in NPDES permits generally, as well as EPA-promulgated ELGs and their supporting documentation for certain industrial point source categories. Effective treatment technologies for TSS are well understood, and properly designed treatment units such as those utilizing sedimentation and/or filtration can readily remove TSS to low concentrations, at times below laboratory minimum detection levels (e.g., 4 mg/L for EPA Method 160.2). EPA has determined that control of TSS in this outfall is necessary both to ensure the removal of pollutants which are adsorbed to particulate matter and to comply with the state narrative on discharge of solids noted above.

The daily maximum effluent limit for TSS in the draft permit shall remain at 100 mg/L based on BPJ, in consideration of the proper operation of the oil/water separator being used at the facility. In addition, BMPs are included as part of the Permittee’s SWPPP for controlling solids and minimizing the introduction of solids into the stormwater drainage system. The technology-based 100 mg/L limit is believed to represent an appropriate indicator of the effectiveness of the facility’s BMPs in controlling the release of solids through Outfall 001. As part of its SWPPP, the Permittees routinely monitor and regularly clean out catch basins and other structures that trap or contain sediment as another means to minimize the discharge of solids. Moreover, the Permittees have installed silt sacks in catch basins leading to the oil/water separator. It is expected that the Permit’s TSS monitoring requirements and daily maximum limit will show that these and other BMPs that address solids are being effectively implemented.

In addition to the numeric TBEL for TSS, the draft permit contains narrative water quality requirements pertaining to solids consistent with MA SWQSs found at 314 CMR 4.05(3)(b) for a Class B waterbody and 4.05(5)(a) and (b) for all waterbodies. EPA believes the effluent limitation and other requirements for TSS are sufficiently stringent to achieve the MA SWQSs.

F. Chemical Oxygen Demand (COD)

Chemical oxygen demand is a parameter which measures the capacity of water or wastewater to consume oxygen during both the decomposition of organic matter and the oxidation of inorganic chemicals. Oxygen demanding substances found in urban and industrial stormwater can compete with aquatic organisms for oxygen, possibly killing or inhibiting life in the receiving water. Therefore, maintaining dissolved oxygen levels downstream of a discharge is one of the most important considerations for the protection of aquatic life.

The National Stormwater Quality Database (NSQD), Version 1.1. [7], Table 3, summarizes stormwater pollutant loads as derived from the extensive compilation of stormwater monitoring data from across the country. The table shows that the median concentration of COD in stormwater runoff from industrial land use is 58.6 mg/L. Accordingly, the current permit requires the Permittees to develop and implement a SIRP to eliminate or reduce the discharge of COD through the facility's storm water system. Review of the quarterly DMR data received during the 2011 through 2016 monitoring period shows that effluent COD ranged from 22 to 600 mg/L, and averaged 227 mg/L. The average and range of COD values over this period are similar to those evaluated during the development of the current permit, which included the review of data generated between April 2004 through March 2009.

The current permit includes the provision that in the event the source(s) of COD cannot be eliminated, BMPs would be required to significantly reduce or eliminate the COD loading to the receiving water. Consequently, the draft permit also requires that the SWPPP in Part I.D directs the Permittees to continue to implement the SIRP to reduce effluent COD levels. In addition, the draft permit maintains the quarterly monitoring requirement for COD.

G. Total Iron

Iron most commonly occurs as the ferrous (Fe2+) and ferric (Fe3+) iron ions. These ions readily combine with oxygen- and sulfur-containing compounds to form oxides, hydroxides, carbonates, and sulfides. Fe2+ (iron salts) are relatively unstable and precipitate as insoluble Fe3+ (iron hydroxide). Fe3+ settles out of the water column as a rust-colored silt.

The current permit requires quarterly monitoring of iron. Review of DMR data received

[7] Pitt R. and A. Maestre and the Center for Watershed Protection. 2005. The National Stormwater Quality Database, Version 1.1: A Compilation and Analysis of NPDES Stormwater Monitoring Information. Prepared for the U.S. EPA Office of Water, September 4, 2005.

during the monitoring period shows that the concentration of effluent iron ranged from 0.90 to 9.0 mg/l and averaged 1.74 mg/l. The National Recommended Water Quality Criteria for iron lists a freshwater chronic (CCC) concentration of 1,000 ug/L (1.0 mg/L).

The current permit required the development and implementation of a SWPPP to reduce the concentration of iron in the discharge as well as a SIRP to eliminate or reduce the discharge of iron into the facility's storm water drainage system. The current permit term's iron concentrations have been reduced considerably. The 2010 Fact Sheet reported effluent iron in the range of 1.4 to 3,700 mg/L with an average of 1,162 mg/L. Thus, the average iron concentration in the effluent has dropped from 1,162 mg/L to 1.74 mg/L. These reductions are believed to be due to a combination of BMPs implemented by the Permittees, including the use of silt sacks in catch basins, the cleaning of the storm water drainage system, and sweeping of areas of the site that accumulate solids.

This discharge is primarily stormwater and is intermittent in nature. In order to be consistent with EPA's stormwater permitting approach in the MSGP, this permit will continue to focus the Permittees' efforts to continue to reduce the concentration of iron and other pollutants in the discharge through the BMPs required in the SWPPP and the SIRP. Therefore, the draft permit requires that the Permittees update and continue to implement a SWPPP and SIRP, with specific measures to minimize the discharges of iron to the storm drainage system.

H. Total Magnesium

The current permit requires quarterly monitoring of total magnesium. Review of DMR data received during the monitoring period shows that the concentration of magnesium ranged from 0.41 to 400 mg/L and averaged 139 mg/L. These represent significant reductions from the last permit term, where the effluent values ranged from 1.2 to 390,000 mg/L and averaged 88,750 mg/L. There are no WQC established for magnesium.

As noted above, the SWPPP and SIRP requirements of the current permit were designed to eliminate or reduce the discharge of magnesium into the facility's storm water drainage system and ultimately reduce the concentration of magnesium in the discharge. The current permit term's magnesium concentrations have been reduced considerably. As noted above for iron, these reductions are believed to be due to a combination of BMPs implemented by the Permittees, including the use of silt sacks in catch basins, the cleaning of the storm water drainage system, and sweeping of areas of the site that accumulate solids.

Therefore, the draft permit requires that the Permittees continue to implement a SWPPP and SIRP, with specific measures to minimize the discharges of magnesium to the storm drainage system.

I. Total Manganese

The current permit requires quarterly monitoring of manganese. Review of DMR data received during the monitoring period shows that the concentration of manganese ranged from 0.026 to 1.61 mg/L and averaged 0.54 mg/L. These represent significant reductions from the last permit term, where the effluent values ranged from 0.18 – 1400 mg/L, and averaged 340 mg/L. There have been no WQC established for manganese.

As noted above the SWPPP and SIRP requirements of the current permit were designed to eliminate or reduce the discharge of manganese into the facility's storm water drainage system and ultimately reduce the concentration of manganese in the discharge. The current permit term's manganese concentrations have been reduced considerably. These reductions are believed to be due to a combination of BMPs implemented by the Permittees, as noted in the iron discussion above.

Therefore, the draft permit requires that the Permittees continue to implement a SWPPP and SIRP, with specific measures to minimize the discharges of manganese to the storm drainage system.

J. Total Phosphorus

Phosphorous promotes the growth of nuisance algae and rooted aquatic plants. Elevated levels of phosphorous can cause eutrophication, a condition in which algae and/or plant growth is excessive resulting in reduced water clarity and poor aesthetic quality. Through respiration, and the decomposition of plant matter, excessive algae and plant growth can reduce in-stream oxygen concentrations to levels that could adversely impact aquatic life and produce strong odors.

The urban and suburban landscape contains a variety of phosphorus sources. These include dust and dirt, atmospheric deposition, decaying organic matter (such as leaf litter and grass clippings), fertilizers, exhaust from internal combustion engines, detergents, and pet waste (*See* National Pollutant Removal Performance Database, V.3, Center for Watershed Protection (CWP), 2007 and *See also* Fundamentals of Urban Runoff Management: Technical and Institutional Issues, 2007(Shaver et al., 2007). Intensive uses, including high traffic volume (particularly of trucks and busses), increase pollutant loading to the impervious surfaces. Impervious surfaces collect phosphorus deposited on them from these sources.

Numerous scientific studies document that impervious cover both increases the volume of rainfall that becomes runoff and amplifies the loads of pollutants flowing to surface waters (CWP, 2007; Shaver et al., 2007; The National Stormwater Quality Database, Version 3.1, R. Pitt, 2011). Among the reasons for this are the following: 1) rain falling on impervious cover runs off without infiltrating into the ground, thus creating a higher volume of runoff per unit area; 2) unlike pervious areas that can trap and filter pollutants through soils and vegetation, impervious areas allow greater amounts of pollutants to be carried away by runoff; and 3) pollutants such as phosphorus on impervious surfaces are particularly susceptible to transport by runoff because of their tendency to adhere to very small particles, which are easily washed off hard surfaces by rainfall. These small particles (< 100 microns) account for much of the phosphorus stormwater load that discharges to receiving waters. These three factors operating simultaneously dramatically increase phosphorus loadings from impervious surfaces.

The discharge of phosphorus into a receiving water may exceed WQSs, especially if the waterbody is already phosphorus-impaired. The Massachusetts SWQSs at 314 CMR 4.05(5)(c) state "*Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00*".

The Phosphorus TMDL for the Lower Charles River Basin was finalized in 2007. The drainage system discharges to the Lower Charles River are grouped together into one WLA because there are presently very limited data available to characterize the sources that make up this group. Although the TMDL does not provide an individual numerical WLA for each facility in the Lower Charles drainage area, it does provide an overall WLA including a corresponding average annual phosphorus load reduction of 62 percent for each group of stormwater discharges. The NSRT is one of the contributors of stormwater discharge to this drainage area.

The current permit requires quarterly monitoring of total phosphorus. The DMR data during the monitoring period ranged from 0.05 to 0.49 mg/L with an average of 0.16 mg/L. During the previous permit term, the effluent phosphorus values ranged from 0.032 to 0.56 mg/L, similar to those of the current permit term up through March 2016.

Under the current permit, the implementation of the permit's SIRP and SWPPP are required for reducing phosphorus in accordance with the TMDL. For the draft permit, a phosphorus control plan (PCP) has been added to further the goal of achieving the WLA of the TMDL. Specifically, the Draft Permit requires that the Permittees develop and implement a targeted phosphorus control plan (PCP) to reduce the phosphorus discharges from this site by at least 62% on an average annual loading basis over the term of this permit. Credit for existing controls and BMPs may be applied toward the phosphorus load reduction goal of 62%. See Part I.E of the permit and Section L.4 of this Fact Sheet for more details of the PCP. The draft permit also requires monthly monitoring for effluent phosphorus, in order to track the reductions over the permit term.

K. Whole Effluent Toxicity (WET) Testing

EPA's Technical Support Document for Water Quality-Based Toxics Control, March 1991, EPA/505/2-90-001, recommends using an "integrated strategy" containing both pollutant-specific (chemical) approaches and whole effluent (biological) toxicity approaches to better control toxics in effluent discharges from entering the nation's waterways. EPA-New England adopted this "integrated strategy" on July 1, 1991, for use in permit development and issuance. These approaches are designed to protect aquatic life and human health. Pollutant-specific approaches, such as those in EPA's Gold Book (ambient water quality criteria) and state regulations, address individual pollutants, whereas whole effluent toxicity (WET) approaches evaluate interactions between pollutants, thus rendering an "overall" or "aggregate" toxicity assessment of the effluent. Since WET testing measures the "additive," "antagonistic" and/or "synergistic" effects of pollutants, which pollutant specific approaches do not, toxicity testing can be used in conjunction with pollutant specific control procedures to control the discharge of toxic pollutants

Section 101(a)(3) of the CWA states a national goal of prohibiting the discharge of toxic pollutants in toxic amounts. The MA SWQSs, in effect, prohibit such discharges, by stating that "all surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife." 314 CMR 4.05(5)(e). Sections 402(a)(2) and 308(a) of the CWA, further, provide EPA and States with the authority to require toxicity testing. Section 308 specifically describes biological monitoring methods as techniques that may be used to carry out the objectives of the Act. Under certain State narrative water quality standards and Sections 301, 303, and 402 of the CWA, EPA and the States may establish toxicity-based limits to implement the narrative "no toxics in toxic amounts" criterion.

The NPDES regulations at 40 C.F.R. § 122.44(d)(1)(v) require WET limits in permits when the permitting authority determines that a discharge causes, has the "reasonable potential" to cause, or contributes to an instream excursion above the State's narrative criterion for toxicity. The regulations at 40 C.F.R. § 122.44(d)(ii) state that"[w]hen determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution … [including] the sensitivity of the species to toxicity testing…"

The current permit requires that the Permittees conduct one, freshwater acute WET test per year for two species on the Outfall 001 effluent, reporting the LC_{50}. A lethal concentration (LC) is the statistical analysis used in acute WET tests to estimate the lethality of the effluent sample. The LC_{50} is the concentration of toxicant, or the percentage of effluent which causes mortality to 50% of the test organisms. The lower the LC_{50}, the more toxic the effluent. An LC_{50} = 50% means that half strength effluent killed 50% of the organisms. Therefore, a NPDES permit with a ≥100% limit for LC_{50} means that a sample of 100% effluent (no dilution) shall cause no greater than a 50% mortality rate in that effluent sample.

During the monitoring period, the LC_{50} readings were all 100%. See Attachment 1 for a summary of the WET testing results, including the associated chemical analyses that were conducted. While EPA believes that these WET test results do not warrant more frequent sampling, the draft permit has retained ongoing, annual WET testing to continue to assess the toxicity of the effluent. This annual WET testing is warranted due to the variable nature of the discharge and the allowance under the draft permit for the substitution of new specific chemicals and products during the term of the permit for specifically prescribed chemical applications and activities.

The Permittees shall conduct one acute WET test annually using the daphnid, *Ceriodaphnia dubia* and one acute WET test annually using the fathead minnow, *Pimephales promelas*. The WET test must be performed in accordance with test procedures and protocols specified in Attachment A of the permit and shall be conducted annually. The WET test shall be performed during the month of May each year if it is practicable. If a May sampling evert is impracticable. or there is no discharge during May, the WET testing shall occur during the next month when there is a discharge and sampling is practicable. In such a case, the Permittees shall submit an explanation for the sampling impracticability as a DMR attachment. The test report for a May sampling event shall be submitted with the July DMR, which will be due no later than August 15, 2021. If the sampling event is delayed due to impracticability, the reporting date is also delayed by the same number or months. If the annual WET test indicates toxicity, another WET test would need to be conducted during the following calendar quarter. In addition, the next permit may contain more frequent WET testing and toxicity limits if warranted to adequately protect receiving water quality.

In addition to the WET testing requirement, the draft permit contains non-numeric requirements consistent with MA SWQSs found at 314 CMR 4.05(3)(b) for a Class B waterbody and 314 CMR 4.05(5)(e) for toxic pollutants. If EPA and/or MassDEP determine that a discharge causes, has a reasonable potential to cause, or contributes to an excursion above Massachusetts' narrative criterion for toxicity, additional WET testing and/or limitations may be required, as authorized at 40 C.F.R. §122.44(d)(1)(v) which may result in permit modification. Federal regulations pertaining to permit modification, revocation and reissuance, and termination are found at 40 CFR §§122.62, 122.63, 122.64, and 124.5. EPA and the MassDEP may use the results of the toxicity tests and chemical analyses conducted in accordance with this permit, as well as national water quality criteria, state water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for pollutants.

L. Special Conditions

1. Stormwater Pollution Prevention Plan (SWPPP)

This facility's discharge is mainly a result of stormwater runoff from MBTA commuter rail track areas, building roofs, and parking garage areas. The following areas are also potentially exposed to precipitation or stormwater: material storage, deicing application, and material handling, loading, and unloading. Specifically, at this facility, storage of deicing chemicals, gasoline, oil, grease, diesel fuel, and solid waste and refuse, as well as unloading associated with food service activities, are examples of material storage and handling operations that shall continue to be included in the SWPPP.

The discharge of stormwater from the NSRT site results in the discharge of pollutants to waters the United States. To control potential pollutants to the receiving waters, potentially violating MA SWQSs, the draft permit requires the Permittees to continue to jointly implement and maintain a SWPPP containing best management practices (BMPs) appropriate for this specific facility (See Sections 304(e) and 402(a)(1) of the CWA and 40 C.F.R. §122.44(k)).

The goal of the SWPPP is to reduce, or prevent, the discharge of pollutants through the stormwater drainage system. As outlined in Part I.B of the draft permit, the SWPPP serves to document the selection, design and installation of control measures, including BMPs. Additionally, the SWPPP requirements in the draft permit are intended to facilitate a systematic approach for the Permittees to properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this permit.

The SWPPP shall be maintained in accordance with good engineering practices and identify potential sources of pollutants, which may reasonably be expected to affect the quality of stormwater discharges associated with industrial activity from the facility. The SWPPP documents the appropriate BMPs implemented or to be implemented at the facility to satisfy the non-numeric technology-based effluent limitations included in the draft permit. These non-numeric effluent limitations support, and are as equally enforceable as, the numeric effluent limitations included in the draft permit. A separate SWPPP shall also be developed by DNC for the portions of the stormwater collection system that it owns or operates which discharge to Outfall 001. Alternatively, DNC can choose to adopt relevant portions of the MBTA/Keolis SWPPP.

The continued implementation of the SWPPP involves the following four main steps:

a. Maintaining a team of qualified facility personnel who will be responsible for continuing to implement and update as necessary the SWPPP;
b. Assessing all potential stormwater pollution sources;
c. Selecting and implementing appropriate management practices and controls for these potential pollution sources; and
d. Periodically re-evaluating the effectiveness of the SWPPP in preventing stormwater contamination and in complying with the various terms and conditions of the draft permit.

In addition, the Permittees shall continue to implement site specific BMPs from Sector P (Land Transportation and Warehousing) of EPA’s 2015 Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activities. The draft permit BMPs include requirements, among others, to inspect and maintain the absorbent pads for track areas where locomotives stop (to capture incidental drips of oil from the trains) and the oil/water separator, both on a weekly basis.

2. Source Identification and Reduction Plan (SIRP)

The draft permit requires that the Permittees continue to implement and revise as necessary the SIRP, specifically addressing the discharges of pollutants of iron, magnesium, manganese, bacteria and COD. The focus of the SIRP is to eliminate or reduce, to the maximum extent practicable, the discharge of these pollutants from the site. Part I.D lists the minimum BMPs associated with the SIRP that must be conducted by the Permittees throughout the permit term.

3. Dry Weather Outfall and Stormwater Drainage System Screening

The Permittees are required to conduct a screening study for illicit connections by sampling dry weather discharges. This requirement was established due to the recurring discharge of several pollutants, occasionally at levels above those typically found in urban stormwater runoff.

4. Phosphorous Control Plan (PCP)

On October 17, 2007, EPA approved the *TMDL for Nutrients in the Lower Charles River Basin* (Lower Charles TMDL)[8]. The following phosphorus reduction requirements are consistent with the percentage load phosphorus reductions for stormwater drainage systems within the lower Charles River watershed. To address the discharge of phosphorus from this facility and to be consistent with the TMDL requirements, the Permittees are required to develop a PCP designed to reduce the amount of phosphorus in stormwater discharges in terms of average annual load from its storm drainage system to the Charles River. The PCP is to be completed in phases as detailed in Part I.E of the permit. The draft permit also requires that the PCP is developed and fully implemented during the permit term to meet the 62% phosphorus load reduction WLA set forth in the TMDL for stormwater discharges that drain to the lower Charles River.

5. Discharges of Chemicals and Additives

The Draft Permit allows the discharge only of those chemicals and additives used in the specific chemical applications and activities which are listed in Part I.A.13 of the permit, provided that such discharges do not violate Section 307 or 311 of the CWA or applicable MA SWQSs. Otherwise, the use of chemicals at the facility which have the potential to discharge to the stormwater drainage system leading to the oil/water separator and discharging to Outfall 001 is prohibited. The Permittees provided a list of the materials in use at the facility with their application and in subsequent communications with EPA, which are listed in Section IV of this Fact Sheet. However, EPA recognizes that materials in use at a facility may change during the term of the permit. As a result, the draft permit includes on-going annual WET testing and a provision that the Permittees maintain a listing of all currently used chemicals in their SWPPP. The Permittees are required and updates this listing as chemicals are added or removed. See Part

8 Massachusetts Department of Environmental Protection. 2007. *Final TMDL for Nutrients in the Lower Charles River Basin*. CN 301.1

I.A.13 of the draft permit. The Permittees must include the following information about each chemical used, at a minimum:

- Product name, chemical formula, and manufacturer of the material;
- Purpose or use of the material;
- Safety Data Sheet (SDS) and Chemical Abstracts Service (CAS) Registry number for each material;
- The frequency (e.g., hourly, daily), duration (e.g., hours, days), quantity (e.g., maximum and average), and method of application for the material;
- The vendor's reported aquatic toxicity (NOAEL and/or LC50 in percent for aquatic organism(s)), when available; and
- An explanation which demonstrates that the addition of such materials: 1) will not add any pollutants in concentrations which exceed permit effluent limitations; 2) will not exceed any applicable water quality standard; and 3) will not add any pollutants that would justify the application of permit conditions that are different from or absent in this permit; or 4) an operator may demonstrate through sampling and analysis using sufficiently sensitive test methods that each of the 126 priority pollutants in CWA Section 307(a) and 40 C.F.R. Part 423.15(j)(1) are non-detect in discharges with the addition of chemicals and/or additives.

M. Reporting Requirements

The Permittees are obligated to monitor and report sampling results to EPA and the MassDEP within the time specified within the permit. Timely reporting is essential for the regulatory agencies to expeditiously assess compliance with permit conditions.

The Draft Permit requires that the Permittees continue to electronically report monitoring results obtained during each calendar month as Discharge Monitoring Report (DMRs) to EPA and the state using NetDMR no later than the 15th day of the month following the completed reporting period.

NetDMR is a national web-based tool for regulated CWA permittees to submit DMRs electronically via a secure internet application to U.S. EPA through the Environmental Information Exchange Network. NetDMR allows participants to discontinue mailing in hard copy forms under 40 C.F.R. § 122.41 and § 403.12. NetDMR is accessed from the following url: http://www.epa.gov/netdmr. Further information about NetDMR can be found on the EPA Region 1 NetDMR website located at http://www.epa.gov/region1/npdes/netdmr/index.html. In most cases, reports required under the permit shall be submitted to EPA as an electronic attachment through NetDMR. Certain exceptions are provided in the permit such as for providing written notifications required under the Part II Standard Permit Conditions. With the use of NetDMR to transmit DMRs and reports, the Permittees are no longer be required to submit hard copies of DMRs or other reports to EPA and are no longer required to submit hard copies of DMRs to MassDEP. However, the Permittees must continue to send hard copies of reports other than DMRs to MassDEP until further notice from MassDEP. State reporting requirements are further explained in the Draft Permit.

VI. Other Requirements

A. Essential Fish Habitat

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq. (1998)), EPA is required to consult with the National Marine Fisheries Service (NMFS) if EPA's action or proposed actions that it funds, permits, or undertakes, "may adversely impact any essential fish habitat". The Amendments broadly define essential fish habitat (EFH) as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity," 16 U.S.C. §1802(10). "Adversely impact" means any impact which reduces the quality and/or quantity of EFH. *See* 50 C.F.R. 600.910 (a). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. Id.

Essential fish habitat is only designated for species for which federal fisheries management plans exist (16 U.S.C. §1855(b)(1)(A)). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

A review of available EFH information indicates that the Charles River is designated EFH for several federally managed species included within the Massachusetts Bay area (found at https://www.greateratlantic.fisheries.noaa.gov/hcd/ma1.html). However, EPA has concluded that the limits and conditions in this Draft Permit minimize adverse effects to EFH since the flow of the discharge is intermittent and low (averages 0.06 MGD) and the permit requires the continued implementation of a SWPPP and a SIRP, whose goals are to eliminate, or reduce to the maximum extent possible, the discharge of pollutants from the facility. In the event the source(s) cannot be eliminated, BMPs shall be developed to significantly reduce or eliminate the pollutant loading(s) to the receiving water.

If adverse effects are detected as a result of this permit action, NMFS will be notified and an EFH consultation will promptly be initiated. During the public comment period, EPA has provided a copy of the Draft Permit and Fact Sheet to NMFS.

B. Endangered Species Act

Section 7(a) of the Endangered Species Act (ESA) of 1973, as amended, grants authority to and imposes requirements upon federal agencies regarding endangered or threatened species of fish, wildlife, or plants, (i.e., listed species) and habitat of such species that have been designated as critical (i.e., critical habitat). EPA initiates consultation concerning listed species under their purviews with the United States Fish and Wildlife Service (USFWS) for freshwater species, and NMFS for marine species and anadromous fish.

EPA has reviewed the list of federal endangered or threatened species of fish and wildlife to see if any such listed species might potentially be impacted by the reissuance of this NPDES permit. The available ESA information indicates that there are no federally listed endangered species in the vicinity of the facility's discharge. The two endangered species of anadromous fish which occur in Massachusetts, shortnose sturgeon (*Acipenser brevirostrom*) and Atlantic sturgeon (*Acipenser oxyrinchus*), have not been identified in the Charles River.[9] Based on the expected normal distribution of these species, their presence in the vicinity of this discharge is not expected.

Therefore, consultation under Section 7 of the ESA with NMFS and USFWS is not required. During the public comment period, EPA has provided a copy of the Draft Permit and Fact Sheet to NMFS and USFWS.

C. State Certification Requirements

EPA may not issue a permit unless the MassDEP either certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate MA SWQSs or it is deemed that the State has waived its right to such certification. EPA has requested permit certification by the State pursuant to 40 C.F.R. § 124.53 and expects that the Draft Permit will be certified.

D. General Conditions

The general conditions of the permit are based on 40 C.F.R. §122, Subparts A and D and 40 C.F.R.§124, Subparts A, D, E, and F and are consistent with management requirements common to NPDES permits. *See* Part II, the Standard Conditions.

E. Comment Period Hearing Requests, and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the Draft Permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to George Papadopoulos, U.S. EPA, Office of Ecosystem Protection, Industrial Permits Section, 5 Post Office Square – Suite 100, OEP06-1, Boston, MA 02109-3912. Any person, prior to such date, may submit a request in writing for a public hearing to consider the Draft Permit to EPA and the State Agency. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public meeting may be held if the criteria stated in 40 C.F.R. §124.12 are satisfied. In reaching a final decision on the Draft Permit, the EPA will respond to all significant comments and make these responses available to the public at EPA's Boston office.

[9] See documents for shortnose sturgeon and Atlantic sturgeon at http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/mesa-list/list-of-rare-species-in-massachusetts.html

Following the close of the comment period, and after any public hearings, if such hearings are held, the EPA will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the final permit decision, any interested person may submit a petition for review of the permit to EPA's Environmental Appeals Board (EAB) consistent with 40 C.F.R. §124.19 and/or submit a request for an adjudicatory hearing to MassDEP's Office of Appeals and Dispute Resolution consistent with 310 CMR 1.00.

VII. EPA and MassDEP Contacts

Additional information concerning the Draft Permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays, from the EPA and MassDEP contacts below:

George Papadopoulos
EPA New England - Region 1
5 Post Office Square, Suite 100 (OEP06-1)
Boston, Massachusetts 02109-3912
Telephone: (617) 918-1579; FAX: (617) 918-0579
Email: papadopoulos.george@epa.gov

Xiaodan Ruan, MassDEP
Bureau of Water Resources
1 Winter Street, 5th Floor
Boston, Massachusetts 02108
Telephone: (617) 654-6517; FAX: (617) 292-5696
Email: xiaodan.ruan@state.ma.us

10/13/2017
Date

Lynne A. Hamjian, Acting Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

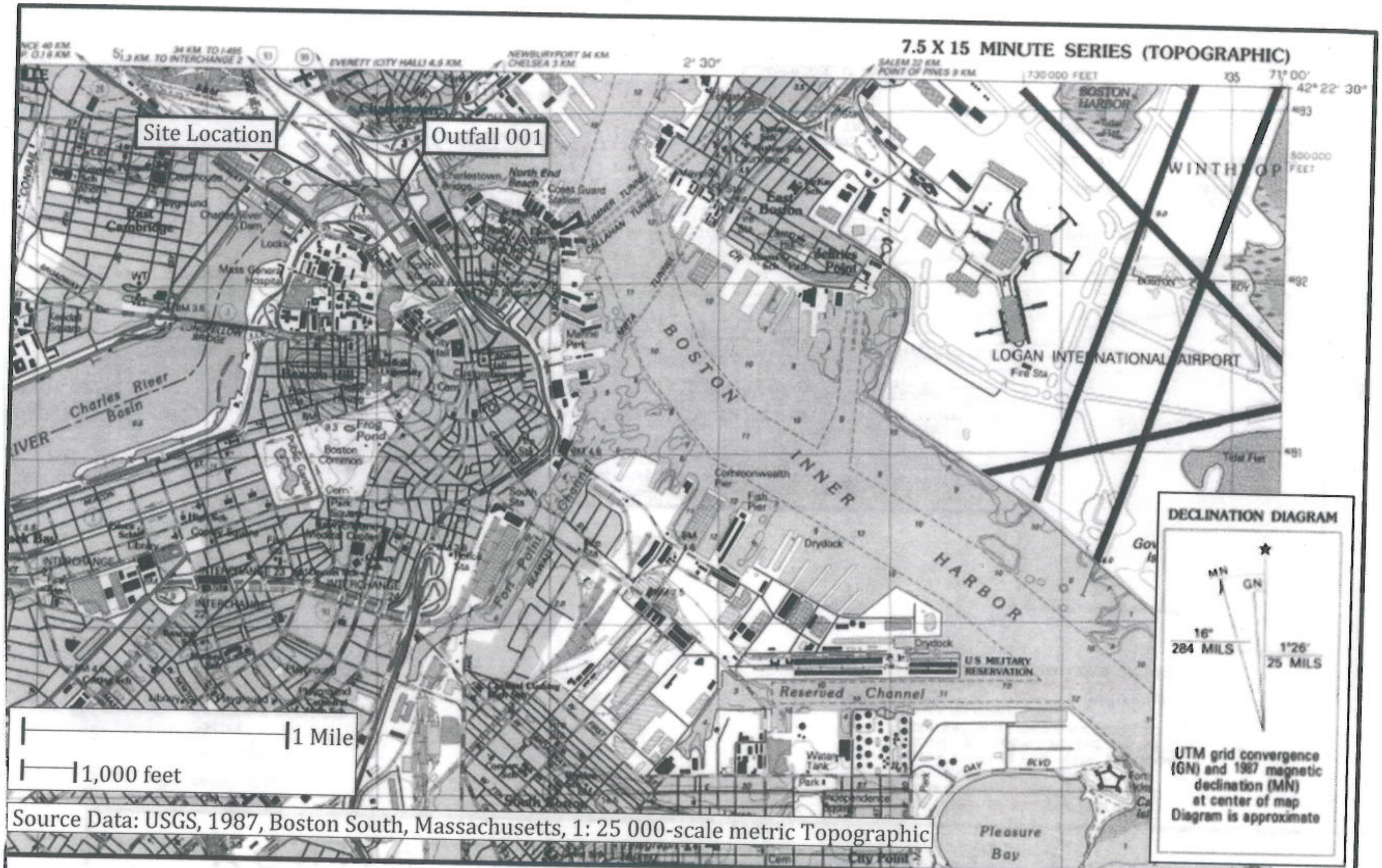
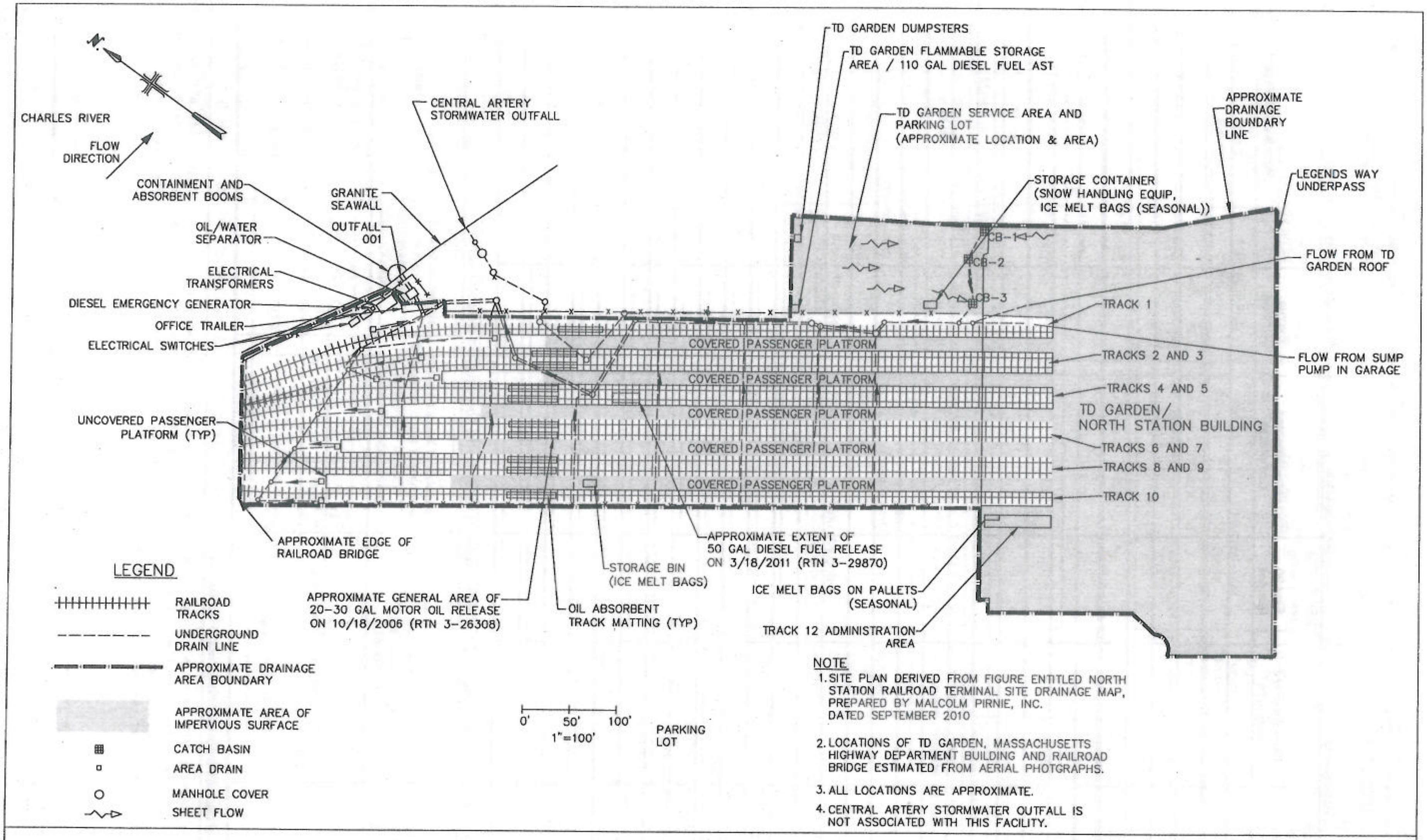


Figure 1 - Site Location Map
NPDES Permit Renewal Application
North Station Railroad Terminal
Boston, MA
December 2014

Keolis
Massachusetts Bay Transportation Authority

CDW CONSULTANTS, INC.
CIVIL & ENVIRONMENTAL ENGINEERS



Keolis | Massachusetts Bay Transportation Authority

Figure 2 - Facility Plan
Stormwater Pollution Prevention Plan
North Station Railroad Terminal
Boston, MA
June 2016

CDW CONSULTANTS, INC.
CIVIL & ENVIRONMENTAL ENGINEERS

Attachment 1: Discharge Monitoring Report Data

North Station Railroad Terminal - MA0028941 Outfall Serial Number 001							
Monitoring Period End Date	Flow		Total Suspended Solids	pH		*E. Coli* (dry weather)	*E. coli* (wet weather)
	MGD		mg/l	SU	SU	cfu/ 100 ml	cfu/ 100 ml
	MA	DM	DM	Min	Max	DM	DM
Mar-11	0.013	0.12	16	6.95	6.95	190	52
Apr-11	0.03	0.03	ND	6.82	6.82	11	
May-11	0.023	0.24	20	6.81	6.81	30	
Jun-11	0.035	0.404	56	6.81	6.81	58	9000
Jul-11	0.015	0.16	14	6.91	6.91	13	
Aug-11	0.06	0.27	28	6.78	6.78	30	
Sep-11	0.033	0.26	ND	6.69	6.69	80	15
Oct-11	0.05	0.26	26	6.93	6.93	60	
Nov-11	0.03	0.032	ND	6.93	6.93	120	
Dec-11	0.03	0.36	ND	6.93	6.93	50	500
Jan-12	0.02	0.2	25	7.28	7.28	100	
Feb-12	0.008	0.12	41	6.88	6.88	ND	
Mar-12	0.009	0.13	6.7	6.77	6.77	5	ND
Apr-12	0.023	0.33	25	6.98	6.98	31	
May-12	0.025	0.19	14	6.99	6.99	42	
Jun-12	0.035	0.26	10	7.1	7.1	150	7
Jul-12	0.03	0.39	34	7.12	7.12	15	
Aug-12	0.02	0.18	21	6.97	6.97	54	
Sep-12	0.03	0.18	21	7.08	7.08	68	54
Oct-12	0.02	0.24	ND	6.95	6.95	42	
Nov-12	0.008	0.07	42	6.98	6.98	3	
Dec-12	0.043	0.371	11	7.09	7.09	27	54
Jan-13	0.008	0.08	20	6.92	6.92	ND	
Feb-13	0.04	0.3	5.5	7.26	7.26	ND	
Mar-13	0.024	0.3	ND	7.18	7.18	28	ND
Apr-13	0.01	0.08	12	6.89	6.89	30	
May-13	0.023	0.19	28	7.11	7.11	2	
Jun-13	0.08	0.68	19	6.95	6.95	44	1100
Jul-13	0.03	0.39	4.1	7.11	7.11	230	
Aug-13	0.01	0.36	27	7.11	7.11	8	
Sep-13	0.02	0.13	16	6.9	6.9	33	1
Oct-13	0.004	0.07	ND	ND	ND	34	
Nov-13	0.02	0.4	37	6.61	6.61	44	

Dec-13	0.03	0.29	29	7.11	7.11	34	1800
Jan-14	0.02	0.18	29	6.74	6.74	3	
Feb-14	0.033	0.3	10	6.87	6.87	52	
Mar-14	0.032	0.5	20	6.97	6.97	11000	45
Apr-14	0.024	0.15	16	6.67	6.67	21	
May-14	0.02	0.14	21	7.25	7.25	28	
Jun-14	0.02	0.19	28	7.41	7.41	39	43
Jul-14	0.42	0.69	6.6	7.24	7.24	68	
Aug-14	0.76	4.64	8.6	7.35	7.35	33	
Sep-14	0.374	0.381	320	7.31	7.31	72	300
Oct-14	0.399	0.768	570	7.82	7.82	40	
Nov-14	0.395	0.615	27	7.37	7.37	320	
Dec-14	0.403	0.937	12	7.79	7.79	140	ND
Jan-15	0.386	0.508	11	7.39	7.39	2	
Feb-15	0.384	0.494	21	7.66	7.66	5	
Mar-15	0.382	0.478	11	8.02	8.02	21000	28
Apr-15	0.379	0.441	ND	7.04	7.04	64	
May-15	0.378	0.492	19	7.31	7.31	56	
Jun-15	0.397	0.673	10	7.09	7.09	50	42
Jul-15	0.381	0.51	7.9	6.69	6.69	42	
Aug-15	0.381	0.46	7.1	6.59	6.59	10	
Sep-15	0.397	1.018	15	6.8	6.8	70	940
Oct-15	0.48	0.38	7.9	6.7	6.7	140	
Nov-15	0.38	0.492	ND	7	7	40	
Dec-15	0.383	0.468	19	7.2	7.2	96	160
Jan-16	0.387	0.616	12	7.22	7.22	4200	
Feb-16	0.386	0.502	27	7.12	7.12	3000	
Mar-16	0.383	0.521	27	7.34	7.34	120	400
2010 Permit Limits	Report MGD	16 MGD	100 mg/l	6.5 min	8.3 max	Report cfu/100 ml	Report cfu/100 ml
Minimum	0.004	0.07	ND	6.59	6.59	ND	ND
Maximum	0.76	4.64	570	8.02	8.02	21000	9000
Average	0.16	0.42	31.2	7.06	7.06	695	727
Violations	-------	0	2	0	0	-----	-----
Measurements	61	61	60	60	60	61	20

MA = monthly average
DM = daily maximum
ND = not detected

North Station Railroad Terminal - MA0028941 Outfall Serial Number 001						
Monitoring Period End Date	COD	Total Iron	Total Magnesium	Total Manganese	Total Phosphorus	Oil and Grease
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	DM	DM	DM	DM	DM	DM
Mar-11	37	0.82	0.41	0.026	0.06	230
Apr-11						110
May-11						7.6
Jun-11	47	1.4	6.2	0.23	0.11	7.9
Jul-11						4.4
Aug-11						11
Sep-11	24	0.73	8.1	0.273	0.08	ND
Oct-11						ND
Nov-11						ND
Dec-11	400	9	12	0.933	0.267	ND
Jan-12						6.9
Feb-12						83
Mar-12	500	2.9	310	1.52	0.09	20
Apr-12						ND
May-12						ND
Jun-12	470	1.5	400	1.2	0.15	ND
Jul-12						9.1
Aug-12						ND
Sep-12	38	2.8	4.8	0.072	0.28	ND
Oct-12						ND
Nov-12						ND
Dec-12	100	1.2	85	0.322	0.19	ND
Jan-13						ND
Feb-13						ND
Mar-13	590	1.5	400	0.85	0.49	ND
Apr-13						6.4
May-13						ND
Jun-13	54	0.55	35	0.168	0.08	ND
Jul-13						9.9
Aug-13						ND
Sep-13	140	1.4	160	0.589	0.24	24
Oct-13						ND
Nov-13						ND
Dec-13	80	1.3	190	1.08	0.08	ND
Jan-14						ND
Feb-14						ND
Mar-14	140	2.4	36	0.536	0.26	ND

Apr-14						ND
May-14						ND
Jun-14	140	0.93	130	0.167	0.12	ND
Jul-14						ND
Aug-14						ND
Sep-14	22	0.38	11.6	0.0301	0.05	5.1
Oct-14						7.2
Nov-14						ND
Dec-14	ND	ND	ND	ND	ND	ND
Jan-15						ND
Feb-15						ND
Mar-15	180	1.2	150	0.259	0.11	ND
Apr-15						3
May-15						5.6
Jun-15	550	0.94	280	0.486	0.05	1
Jul-15						ND
Aug-15						ND
Sep-15	190	1	87	0.219	0.1	ND
Oct-15						ND
Nov-15						ND
Dec-15	230	0.29	130	0.297	0.1	ND
Jan-16						ND
Feb-16						5.8
Mar-16	600	2.6	340	1.61	0.33	ND
2010 Permit Limits	Report mg/l	Report mg/l	Report mg/l	Report mg/l	Report mg/l	15 mg/l
Minimum	22	0.29	0.41	0.026	0.05	0
Maximum	600	9	400	1.61	0.49	230
Average	227	1.74	139	0.54	0.16	9.3
Violations	-----	-----	-----	-----	------	5
Measurements	20	20	20	20	20	60

MA = monthly average
DM = daily maximum
ND = not detected

North Station Railroad Terminal - MA0028941 Outfall Serial Number 001 Whole Effluent Toxicity (WET) Testing Chemical Analysis Results*							
WET Testing Month	LC_{50} daphnid	LC_{50} minnow	pH	Hardness	Total Ammonia Nitrogen	Total Organic Carbon	Alkalinity
	%	%	S.U.	mg/l CaCO3	mg/l	mg/l	mg/l
Jul-11	100	100	6.67	97	0.31	8.7	29
Jul-12	100	100	6.68	340	0.13	7.5	67
Jul-13	100	100	6.92	480	0.32	10	89.3
Jul-14	100	100	7.05	190	0.14	7.43	44.5
Jul-15	100	100	6.93	280	0.08	5.84	61.4

North Station Railroad Terminal - MA0028941 Outfall Serial Number 001 Whole Effluent Toxicity (WET) Testing Chemical Analysis Results*						
WET Testing Month	Total Cadmium	Total Copper	Total Aluminum	Total Zinc	Total Solids	Total Dissolved Solids
	%	mg/l	mg/l	mg/l	mg/l	mg/l
Jul-11	0.006	ND	0.12	0.07	530	430
Jul-12	ND	0.01	ND	0.06	2000	1700
Jul-13	0.007	ND	ND	0.06	3100	2800
Jul-14	ND	0.02	0.18	0.16	960	870
Jul-15	ND	ND	ND	ND	1300	1300

MA = monthly average
DM = daily maximum
ND = not detected

* All values for total residual chlorine, total lead, and total nickel were non-detect

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMONWEALTH OF MASSACHUSETTS
1 WINTER STREET
BOSTON, MASSACHUSETTS 02108

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ECOSYSTEM PROTECTION
REGION I
BOSTON, MASSACHUSETTS 02109

JOINT PUBLIC NOTICE OF A DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE INTO THE WATERS OF THE UNITED STATES UNDER SECTION 301, 316(a), AND 402 OF THE CLEAN WATER ACT (THE "ACT"), AS AMENDED, AND REQUEST FOR STATE CERTIFICATION UNDER SECTION 401 OF THE ACT.

DATE OF NOTICE: October 27, 2017

PERMIT NUMBER: **MA0028941**

PUBLIC NOTICE NUMBER: MA-005-18

NAME AND MAILING ADDRESS OF PERMITTEE:

Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA 02116-3974

Keolis Commuter Services, LLC
470 Atlantic Avenue – 5th Floor
Boston, MA 02210

Delaware North Corporation
100 Legends Way
Boston, MA 02114

NAME AND ADDRESS OF THE FACILITY WHERE DISCHARGE OCCURS:

North Station Railroad Terminal
135 Causeway Street
Boston, MA 02116

RECEIVING WATER: **Charles River (Boston Harbor Watershed), Class B (CSO)**

PREPARATION OF THE DRAFT PERMIT:

The U.S. Environmental Protection Agency (“EPA”) and the Massachusetts Department of Environmental Protection (“MassDEP”) have cooperated in the development of a draft permit for the above identified facility. The effluent limits and permit conditions imposed have been drafted to assure compliance with the Clean Water Act (“CWA”), 33 U.S.C. sections 1251 et seq.,, the Massachusetts Clean Waters Act, G.L. c. 21, §§ 26-53, 314 CMR 3.00 and State Surface Water Quality Standards at 314 CMR 4.00.

INFORMATION ABOUT THE DRAFT PERMIT:

A fact sheet or a statement of basis (describing the type of facility; type and quantities of wastes; a brief summary of the basis for the draft permit conditions; and significant factual, legal and policy questions considered in preparing this draft permit) and the draft permit may be obtained at no cost at: http://www.epa.gov/region1/npdes/draft_permits_listing_ma.html or by writing or calling EPA's contact person named below:

George Papadopoulos, US EPA
5 Post Office Square
Suite 100 (OEP 06-1)
Boston, MA 02109-3912
Telephone: (617) 918-1579

The administrative record containing all documents relating to this draft permit is on file and may be inspected at the EPA Boston office mentioned above between 9:00 a.m. and 5:00 p.m., Monday through Friday, except holidays.

PUBLIC COMMENT AND REQUEST FOR PUBLIC HEARING:

All persons, including applicants, who believe any condition of this draft permit is inappropriate, must raise all issues and submit all available arguments and all supporting material for their arguments in full by **November 25, 2017**, to the U.S. EPA, George Papadopoulos, 5 Post Office Square, Suite 100, Mailcode OEP 06-1, Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing to EPA and the MassDEP for a public hearing to consider this draft permit. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least sixty (60) days public notice whenever the Regional Administrator finds that response to this notice indicates significant public interest. In reaching a final decision on this draft permit the Regional Administrator will respond to all significant comments and make the responses available to the public at EPA's Boston office.

FINAL PERMIT DECISION AND APPEALS:

Following the close of the comment period, and after a public hearing, if such hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the final permit decision any interested person may submit petition to the Environmental Appeals Board to reconsider or contest the final decision.

Lealdon Langley, Director	Lynne A. Hamjian, Acting Director
MASSACHUSETTS WETLANDS AND	OFFICE OF ECOSYSTEM PROTECTION
WASTEWATER PROGRAMS	ENVIRONMENTAL PROTECTION
MASSACHUSETTS DEPARTMENT OF	AGENCY
ENVIRONMENTAL PROTECTION	