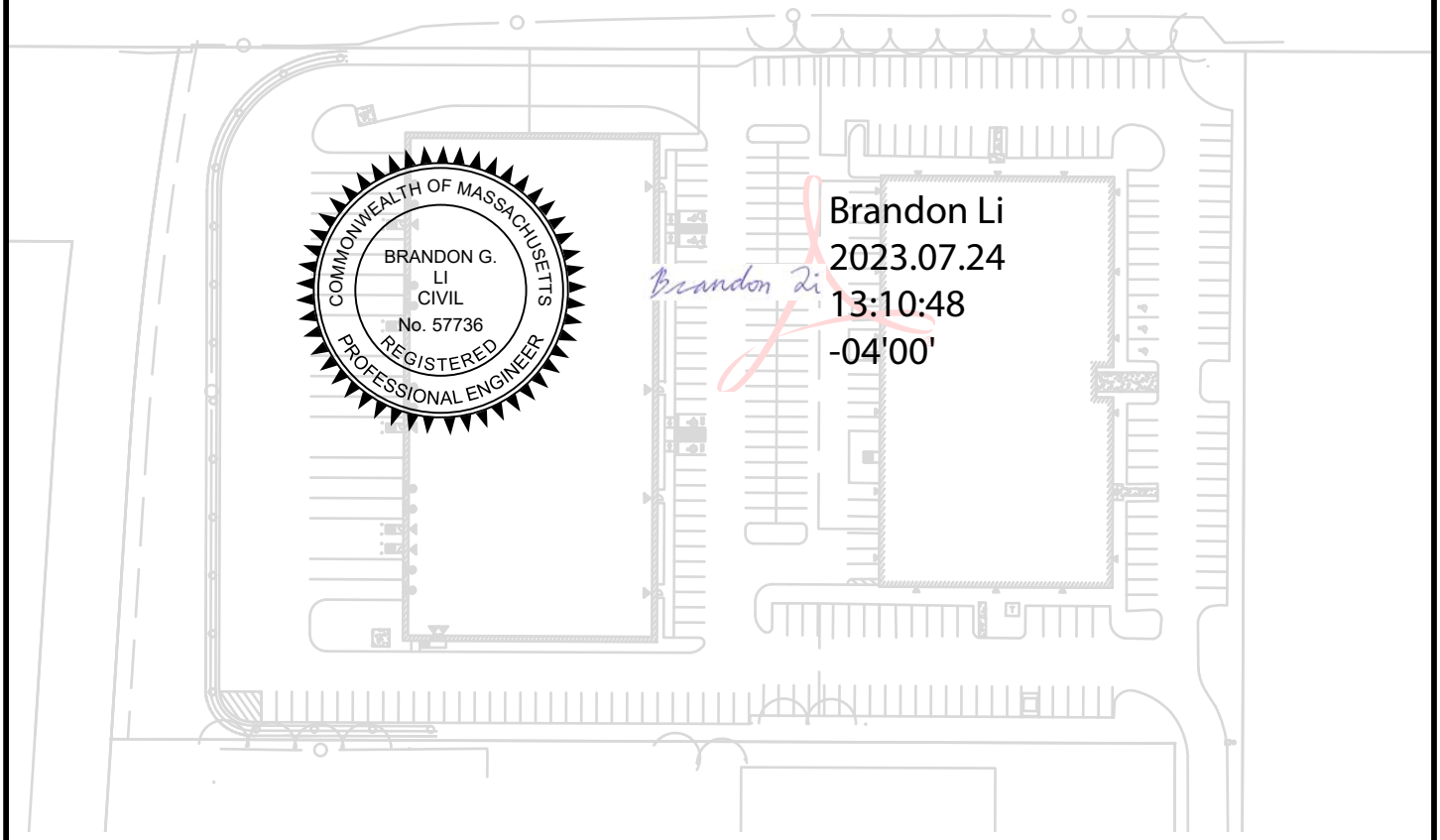
# ADDENDUM TO STORMWATER MANAGEMENT REPORT 07/06/2023

# 33 RIVERSIDE DRIVE PEMBROKE,MA




*PREPARED FOR:*

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80 WASHINGTON STREET, J-40
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# Pond Report





## Pond No. 3 - SYS 3

### Pond Data

**UG Chambers -**Invert elev. = 36.50 ft, Rise x Span = 3.00 x 5.00 ft, Barrel Len = 171.00 ft, No. Barrels = 8, Slope = 0.00%, Headers = No
**Encasement -**Invert elev. = 36.00 ft, Width = 5.75 ft, Height = 4.00 ft, Voids = 40.00%

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 36.00 | n/a | 0 | 0 |
| 0.40 | 36.40 | n/a | 1,259 | 1,259 |
| 0.80 | 36.80 | n/a | 2,488 | 3,747 |
| 1.20 | 37.20 | n/a | 2,877 | 6,624 |
| 1.60 | 37.60 | n/a | 2,824 | 9,447 |
| 2.00 | 38.00 | n/a | 2,737 | 12,184 |
| 2.40 | 38.40 | n/a | 2,609 | 14,794 |
| 2.80 | 38.80 | n/a | 2,428 | 17,222 |
| 3.20 | 39.20 | n/a | 2,159 | 19,381 |
| 3.60 | 39.60 | n/a | 1,620 | 21,001 |
| 4.00 | 40.00 | n/a | 1,259 | 22,260 |

### Culvert / Orifice Structures

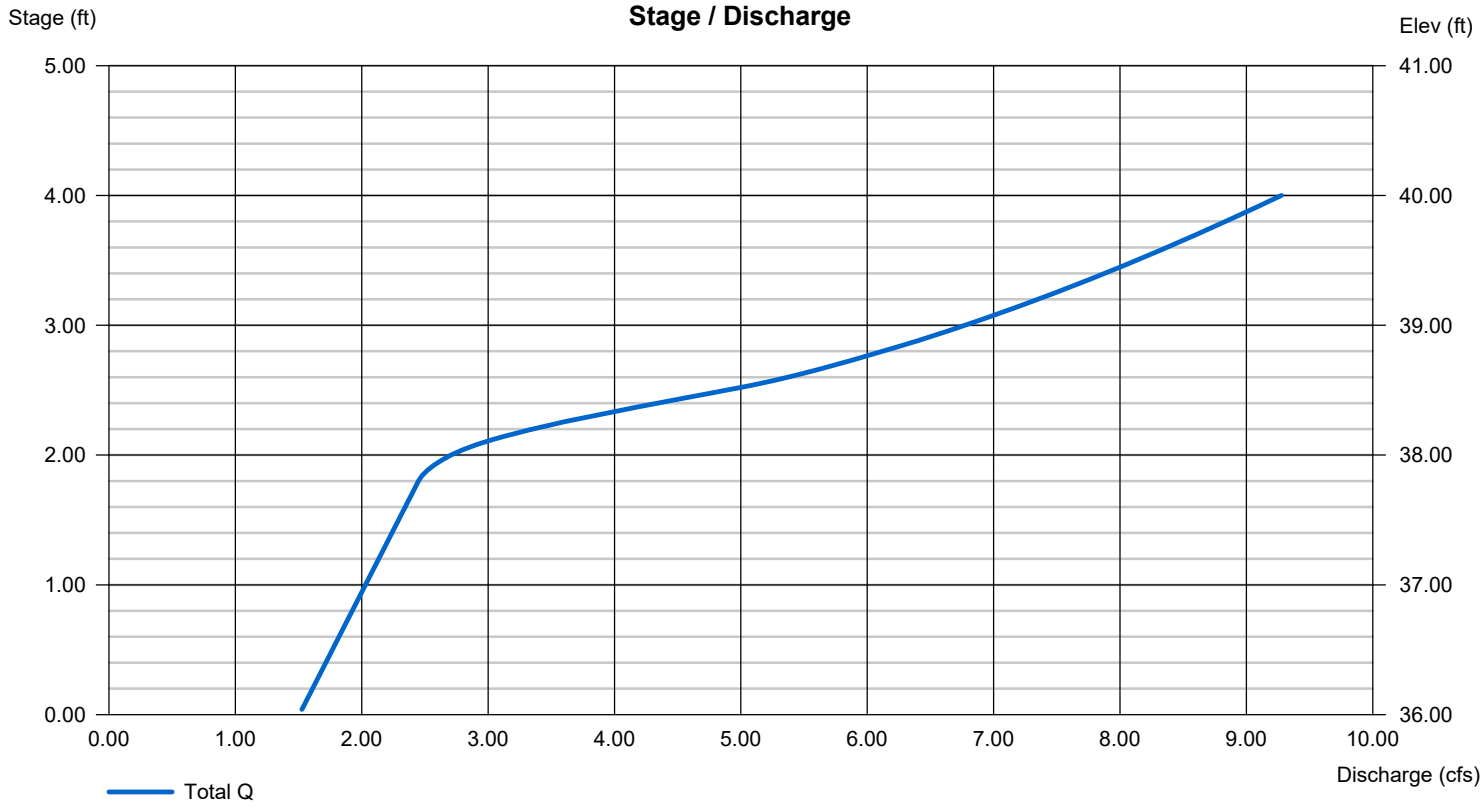
| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 10.00 | 8.00 | 0.00 | 0.00 |
| **Span (in)** | = 10.00 | 8.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 0 | 0 |
| **Invert El. (ft)** | = 37.80 | 38.00 | 0.00 | 0.00 |
| **Length (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.00 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = --- | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 8.270 (by Wet area)
**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



INSTRUCTIONS:

*Version 1, Automated: Mar. 4, 2008*

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: 33 Riverside Drive, Pembroke, MA

## TSS Removal Calculation Worksheet

| B<br>BMP[1] | C<br>TSS Removal Rate[1] | D<br>Starting TSS Load* | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| **Proprietary Treatment Practice** | **0.50** | **1.00** | **0.50** | **0.50** |
| **Subsurface Infiltration Structure** | **0.80** | **0.50** | **0.40** | **0.10** |
| | **0.00** | **0.20** | **0.00** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |
| | **0.00** | **0.20** | **0.00** | **0.20** |

**Total TSS Removal =** **80%**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project: 2023-026

Prepared By: Kelly Engineering Group,Inc.

Date: 7/10/2023

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

# RADER PROPERTIES, INC

**33 Riverside Drive, Pembroke, MA**

# STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN & LONG-TERM POLLUTION PREVENTION PLAN

Revised 07/06/2023

***Prepared by:***

**KELLY ENGINEERING GROUP, INC.**
Zero Campanelli Drive
Braintree, Massachusetts 02184

OWNER AND RESPONSIBLE PARTY:
RADER PROPERTIES, INC
80 Washington Street, J-40
Norwell, MA 02061

Note: If ownership of this property changes then the new owner becomes the responsible party. The Owner may assign responsibility to a tenant on the property.

**Introduction**

Considerable time, effort and cost has been spent in the design and construction of the stormwater management system for this development. The stormwater management system consists of a number of Best Management Practices (BMP's). These BMP's combine to ensure that storm runoff from the site will not damage the sensitive environmental resources surrounding the site. In order to ensure that these BMP's operate as designed it is very important that the procedures in this operation and maintenance plan be followed. Most of these operation procedures require observation and measurement; however, at certain times more extensive maintenance measures may be needed. The following is an itemization of each of these BMP's and their maintenance needs.

The party responsible for maintenance should contract with a maintenance organization capable of performing the more extensive measures such as pumping of catch basin sumps, etc.

***BMP No. 1 - Deep Sump Catch Basins:***

- Basins are to be inspected 4 times per year.
  1. Verify that tees are secure and free-flowing.
  2. Measure depth of sediment below water line.

- Basins are to be cleaned whenever sediment and hydrocarbons are observed. Basins are to be cleaned a minimum of twice per year. One of these cleanings shall occur before April 15th of each year and one shall occur before September 15th of each year. Basins may be cleaned either using a clamshell or a vacuum pump.

- All liquid shall be pumped from the sump of each basin at least once per year.

- All sediments and hydrocarbons should be properly handled and disposed of, in accordance with local, state and federal guidelines and regulations.

***Note: See catch basin detail for explanation of terms***.

***BMP No. 2 – Proprietary Separators:***

***Contech CDS:***

- Twice a year inspect the Units to ensure that it is operating correctly and to measure the sediment depth using a "dip stick". The floatables should be removed and the sump cleaned when the sump is above 85% full. At least once a year, the unit should be pumped down and the screen carefully inspected for damage and to ensure that it is properly fastened. Ideally, the screen should be power washed for the inspection.

***BMP No. 3 - Subsurface Recharge Systems:***

- The inlet pipe and observation basin shall be inspected 4 times a year. Any accumulated debris shall be removed.

- Inspect recharge facilities following a rainfall event greater than 2.5 inches in a 24 hour period.

- If standing water is observed for more than 48 hours following a storm event, immediately retain a qualified professional to assess whether infiltration function has been lost and develop recommended corrective actions.

***BMP No. 4 – Flared end section and rip rap***

- **Inlet and outlet structures.**
  On a regular basis, the inlet pipe and outlet structure shall be checked for debris and removed as necessary to ensure unobstructed flow of water through the water quality pond. Impoundment embankments and outlet structures should be inspected at least once annually by a qualified professional for structural integrity and for any conditions which could adversely affect their function.

- **Flared end section and rip rap**.
  Level spreader should be inspected at least once annually for any conditions which could adversely affect their function.

***Snow Removal:***

- There shall be no plowing or stock piling of snow within all resource areas without the prior written permission from state or local approving authority.
- Road salts and de-icing materials shall be stored on impervious pads and covered to protect from wind and precipitation.
- No de-icing materials shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- No de-icing materials shall be stored within Zone I, Zone II, Zone A, and 200 feet from a river or estuary.

***Storage and Use of Chemicals:***

- No pesticides, herbicides, nor insecticides shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Chemical storage on site shall be limited. Any chemicals that must be stored shall be stored in a secure area in accordance with Local and State regulations.

***Spill prevention response and containment:***

- Containment – In the event of a discharge or spill of oil or another hazardous material, , the following procedures are to be followed to mitigate or prevent the release of hazardous waste;
  1. Secure the Area
  2. Halt / shut down the operation
  3. Keep unauthorized people away from the release area by using physical barriers (ie. caution tape)
  4. Determine the source material involved
  5. Refer to the 2020 Emergency Response Guidebook for properties of the material including any potential evacuation distances.
  6. Utilize appropriate chemical protective clothing
  7. Attempt to locate the source of the release and the extent of the contamination
  8. Undertake initial response actions to halt the release of oil or other material and contain its spread using absorbent materials, physical barriers, containment pail, etc.
  9. Look for storm drains, manhole covers and other vertical access points and dike off or dam to prevent material from entering these areas. Outlets to stormwater management ponds shall be plugged so that hazardous material do not enter resource areas.
  10. Take those actions to protect public health, safety and the environment that can be taken without compromising your safety or the safety of others.

11. Initiate notification procedures. Notifications to local, State and Federal agencies (including National Emergency Response Center when applicable)

- Local Police / Fire – 911
- Municipal Department of Public Works
- Applicable State authority: MASS DEP 1-888-304-1133
- Environmental Contractor: Clean Harbors 1-800-645-8265
- National Emergency Response Center (if release exceeds US DOT "reportable quantity" amount): 1-800-424-8802
- CHEMTREC: 1-800-424-9300
- AIG PIER 1-877-743-7669
- Once the emergency response crew arrives at the scene, the following actions will be taken:
- Material that has been released to impervious surface (ie. concrete or pavement) will be absorbed using a suitable absorbent such as Speedi Dry or diatomaceous earth. This material will then be containerized and sent to a fully licensed waste management facility for disposal.
- Material that has reached any pervious surface such as soil will result in the remediation of the affected area to the extent that all contamination is removed. All material collected as a result of remediation will be containerized and sent for disposal at a fully licensed waste management facility. In addition, analytics will be conducted when necessary to determine if all contamination has been removed.
- Prior to leaving any site, appropriate backfill will be used to replace any ground cover removed during the clean-up process.
- Any damaged container involved in an accident will be placed into a suitable salvage drum and shipped to a fully licensed waste management facility for disposal.

- The first priority of any emergency response is life and health. If you do not have adequate information or personal protective equipment, do not approach the release.

***Hazardous Waste:***

- Hazardous Waste – All hazardous waste materials will be disposed of in the manner specified by local, state and/or federal regulations and by the manufacturer of such products.
- There shall be no illicit discharges to the stormwater management system.

***Material and Waste Storage, Handling and Management:***

- All waste materials will be collected and stored in a securely lidded metal dumpster from a solid waste management company licensed to do business by the state and the town. The dumpster will comply with all local and state solid waste management regulations.

***Training for Long Term Pollution Prevention Plan:***

- All staff or personnel involved and responsible for implementing the Stormwater Management System Operations and Maintenance Plan and the Long-Term Pollution Prevention Plan shall be properly trained as required under the DEP Stormwater Management Regulations. Training shall be documented with records kept with other stormwater maintenance records.

***Pet Waste Management:***

- Pooper-scooper laws for pets shall be followed.
- Never dump pet waste into storm drains, catch basins, or the drainage system.
- Pet waste shall be scooped up and disposed of properly in the garbage.

***Lawn and Garden activities:***

- There shall be no exterior storage of fertilizers, pesticides, herbicides, or insecticides. No pesticides, herbicides, nor insecticides shall be stored nor used within any resource areas its buffers, and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Fertilizers and pesticides shall be applied properly, sparingly, and outside any resource areas and its buffers.

To reduce the impact of fertilizers, consider the following tips;

- Don't fertilize before a rain storm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Test soils before applying fertilizers. Some soils may not need fertilizers. A standard soil test costs $9.00. (Call the UMass Extension Soil Testing Lab at 413-545-2311 or download a soil test order form at http://www.umass.edu/plsoils/soiltest/.)

***Illicit Discharges:***

Illicit discharges that are not allowed to the stormwater management system include;

- wastewater discharges
- discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease

Allowable Non-Stormwater Discharges;

- firefighting,
- water line flushing,
- landscape irrigation,
- uncontaminated groundwater,
- potable water sources,
- foundation drains,
- air conditioning condensation,
- footing drains, individual resident car washing,
- flows from riparian habitats and wetlands,
- dechlorinated water from swimming pools
- water used for street washing and water used to clean residential buildings without detergents.

CONTECH®
ENGINEERED SOLUTIONS

# CDS® Inspection and Maintenance Guide


CDS TECHNOLOGIES

## Maintenance

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

## Inspection

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

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

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

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

## Cleaning

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

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

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

| CDS Model | Diameter | | Distance from Water Surface to Top of Sediment Pile | | Sediment Storage Capacity | |
|---|---|---|---|---|---|---|
| | ft | m | ft | m | yd3 | m3 |
| CDS2015-4 | 4 | 1.2 | 3.0 | 0.9 | 0.9 | 0.7 |
| CDS2015 | 5 | 1.5 | 3.0 | 0.9 | 1.3 | 1.0 |
| CDS2020 | 5 | 1.5 | 3.5 | 1.1 | 1.3 | 1.0 |
| CDS2025 | 5 | 1.5 | 4.0 | 1.2 | 1.3 | 1.0 |
| CDS3020 | 6 | 1.8 | 4.0 | 1.2 | 2.1 | 1.6 |
| CDS3030 | 6 | 1.8 | 4.6 | 1.4 | 2.1 | 1.6 |
| CDS3035 | 6 | 1.8 | 5.0 | 1.5 | 2.1 | 1.6 |
| CDS4030 | 8 | 2.4 | 4.6 | 1.4 | 5.6 | 4.3 |
| CDS4040 | 8 | 2.4 | 5.7 | 1.7 | 5.6 | 4.3 |
| CDS4045 | 8 | 2.4 | 6.2 | 1.9 | 5.6 | 4.3 |
| CDS5640 | 10 | 3.0 | 6.3 | 1.9 | 8.7 | 6.7 |
| CDS5653 | 10 | 3.0 | 7.7 | 2.3 | 8.7 | 6.7 |
| CDS5668 | 10 | 3.0 | 9.3 | 2.8 | 8.7 | 6.7 |
| CDS5678 | 10 | 3.0 | 10.3 | 3.1 | 8.7 | 6.7 |

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

**Support**

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.



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





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# CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

| Date | Water depth to sediment[1] | Floatable Layer Thickness[2] | Describe Maintenance Performed | Maintenance Personnel | Comments |
|---|---|---|---|---|---|
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1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

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

# Contactor® & Recharger®
## Stormwater Chambers The Chamber With The Stripe®


# Operation and Maintenance Guidelines

CULTEC™

# Operation & Maintenance

*This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.*

## Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

## Operation and Maintenance Requirements

### I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

### II. Inspection and Maintenance Options

**A.** The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.

**B.** If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

**1. Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

**2. StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

**C.** The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

## III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

**A.** The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

**B.** The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

**C.** Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

**D.** Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

## IV. Suggested Maintenance Schedules

**A. Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

| Frequency | Action |
|---|---|
| Monthly in first year | Check inlets and outlets for clogging and remove any debris as required. |
| Spring and Fall | Check inlets and outlets for clogging and remove any debris as required. |
| One year after commissioning and every third year following | Check inlets and outlets for clogging and remove any debris as required. |

**B. Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

**Major Maintenance** *(continued)*

| | Frequency | Action |
|---|---|---|
| Inlets and Outlets | Every 3 years | • Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended. |
| | Spring and Fall | • Check inlet and outlets for clogging and remove any debris as required. |
| CULTEC Stormwater Chambers | 2 years after commissioning | • Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. |
| | 9 years after commissioning every 9 years following | • Clean stormwater management chambers and feed connectors of any debris.<br>• Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. |
| | 45 years after commissioning | • Clean stormwater management chambers and feed connectors of any debris.<br>• Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.<br>• Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. |
| | 45 to 50 years after commissioning | • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.<br>• Attain the appropriate approvals as required.<br>• Establish a new operation and maintenance schedule. |
| Surrounding Site | Monthly in 1st year | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Spring and Fall | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Yearly | • Confirm that no unauthorized modifications have been performed to the site. |

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

CULTEC™
Chamber of Choice™

CULTEC, Inc.
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| **Rader Properties** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PROJECT LOCATION: 33 Riverside Drive, Pembroke, MA** | | | | | | | |
| **STORMWATER ANAGEMENT** | | **BEST MANAGEMENT PRACTICES - INSPECTION SCHEDULE AND EVALUATION CHECKLIST** | | | | | |
| | | | | | | | |
| Best Management Practice | Inspection Frequency (1) | Date I | Inspector | Minimum Maintenance and Key Items to Check (1) | Cleaning/Repair Needed yes__ no__ (list items) | Date of Cleaning /Repair | Perform ed By |
| Deep Sump and Hooded Catch Basins | 4x per year | | | Remove sediment 1x per year or if >6” | | | |
| Flared end section and rip rap | 2x per year first year, annually thereafter | | | Inspect inlets and outlets | | | |
| Recharge Chambers | 4x per year | | | Inspect after 2.5” rain in 24 hours, drain time less than 3 days | | | |
| CDS Water Quality Devices | 4x per year | | | Per manufacturer Requirements | | | |
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**(1) Refer to the Operation and Maintenance Plan for recommendations regarding frequency of inspections and maintenance of specific BMP's.**

**recommendations regarding frequency for inspection and maintenance of specific BMPs.**

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**Stormwater Control Manager/Environmental Monitor:** **Stamp/Signature**

**Rational Method Calculations**

33 Riverside Drive Pembroke, MA

*i = Rainfall Intensity 6.5 in/hr (25 year storm) @ a time of concentration of 5 minutes*

*C = 0.4 (green Area)*

*C = 0.9 (Impervious Area)*

| Area | Pavement (s.f.) | Roof (s.f.) | Sidewalk (s.f.) | Total Impervious (s.f.) | Green (s.f.) | Total Area (s.f.) |
|---|---|---|---|---|---|---|
| WQD #1 | 6096 | 0 | 0 | 6096 | 10098 | 16194 |
| WQD #2 | 21124 | 0 | 0 | 21124 | 0 | 21124 |
| WQD #3 | 14743 | 0 | 0 | 14743 | 7977 | 22720 |
| WQD #4 | 19755 | 0 | 0 | 19755 | 1357 | 21112 |
| WQD #5 | 26027 | 0 | 0 | 26027 | 0 | 26027 |
| ROOF | 0 | 11250 | 0 | 11250 | 0 | 11250 |

| Area | Impervious (acres) | Green (acres) | C (Imp.) | Intensity (in/hr) | C(Green) | Total Area (acres) | Q = CiA (cfs) |
|---|---|---|---|---|---|---|---|
| WQD #1 | 0.1399 | 0.232 | 0.9 | 6.5 | 0.4 | 0.3718 | 1.421 |
| WQD #2 | 0.4849 | 0.000 | 0.9 | 6.5 | 0.4 | 0.4849 | 2.837 |
| WQD #3 | 0.3385 | 0.183 | 0.9 | 6.5 | 0.4 | 0.5216 | 2.456 |
| WQD #4 | 0.4535 | 0.031 | 0.9 | 6.5 | 0.4 | 0.4847 | 2.734 |
| WQD #5 | 0.5975 | 0.000 | 0.9 | 6.5 | 0.4 | 0.5975 | 3.495 |
| ROOF | 0.2583 | 0.000 | 0.9 | 6.5 | 0.4 | 0.2583 | 1.511 |

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jul 12 2023

## ROOF

**Circular**

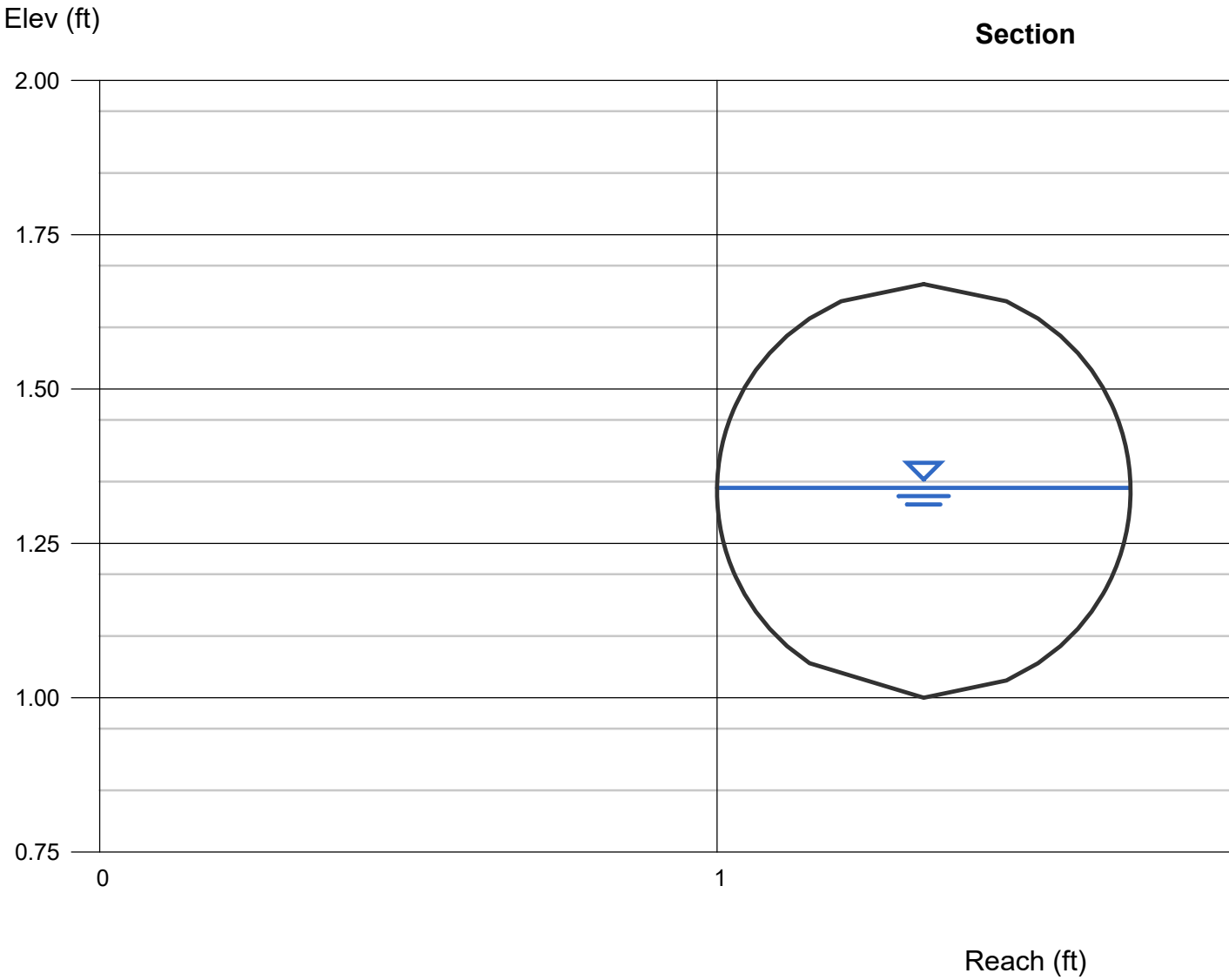
| | |
|---|---|
| Diameter (ft) | = 0.67 |
| Invert Elev (ft) | = 1.00 |
| Slope (%) | = 5.00 |
| N-Value | = 0.012 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 1.51 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.34 |
| Q (cfs) | = 1.510 |
| Area (sqft) | = 0.18 |
| Velocity (ft/s) | = 8.36 |
| Wetted Perim (ft) | = 1.07 |
| Crit Depth, Yc (ft) | = 0.58 |
| Top Width (ft) | = 0.67 |
| EGL (ft) | = 1.43 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jul 24 2023

## DMH #3 OCS #1 to FES

**Circular**

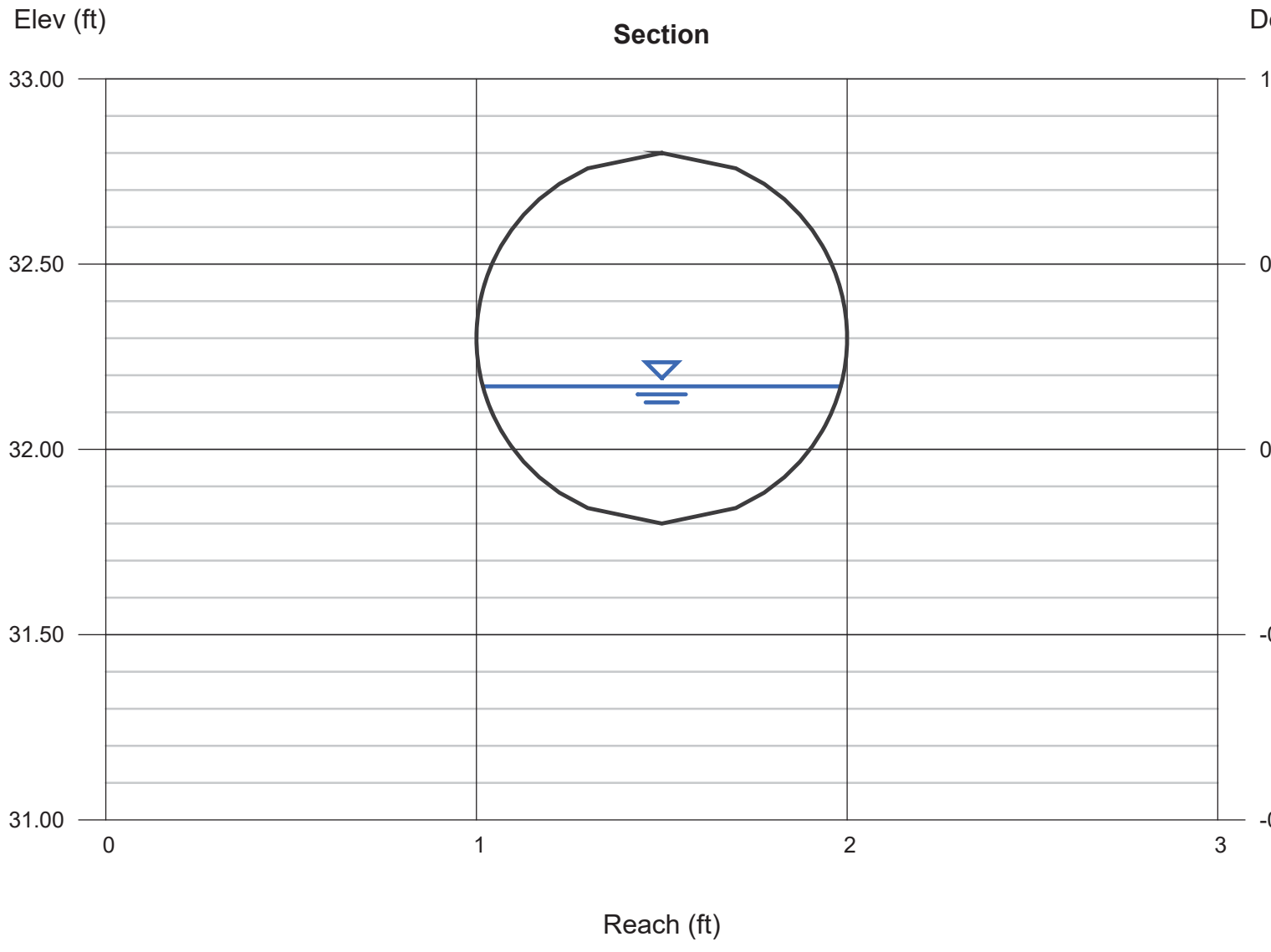
| | |
|---|---|
| Diameter (ft) | = 1.00 |
| Invert Elev (ft) | = 31.80 |
| Slope (%) | = 2.00 |
| N-Value | = 0.012 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 1.56 |

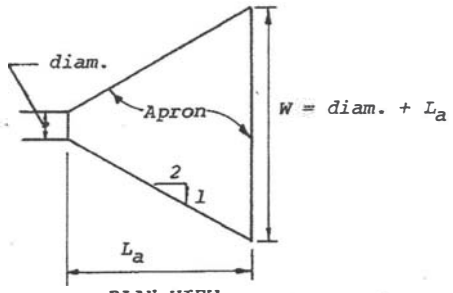
**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.37 |
| Q (cfs) | = 1.560 |
| Area (sqft) | = 0.27 |
| Velocity (ft/s) | = 5.88 |
| Wetted Perim (ft) | = 1.31 |
| Crit Depth, Yc (ft) | = 0.53 |
| Top Width (ft) | = 0.97 |
| EGL (ft) | = 0.91 |



Design Guide MD#6 Riprap Design Methods
NRCS Engineering, Maryland
October, 2003

# DESIGN OF OUTLET PROTECTION
## MINIMUM TAILWATER CONDITION (Tw <0.5 diam.)




*Median stone diameter, $d_{50}$, is the stone size which 50% of the riprap mixture, by weight, is larger than.*

*Velocities shown are for pipes flowing full.*

DMH#3 to FES
Q = 1.56 cfs
v = 5.88 ft/s
D = 12"

Rip Rap #3
Length = 10.0'
Width = 11.0'
Median Stone Diameter = 0.3'

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jul 24 2023

## DMH #4 OCS #2 to FES

**Circular**

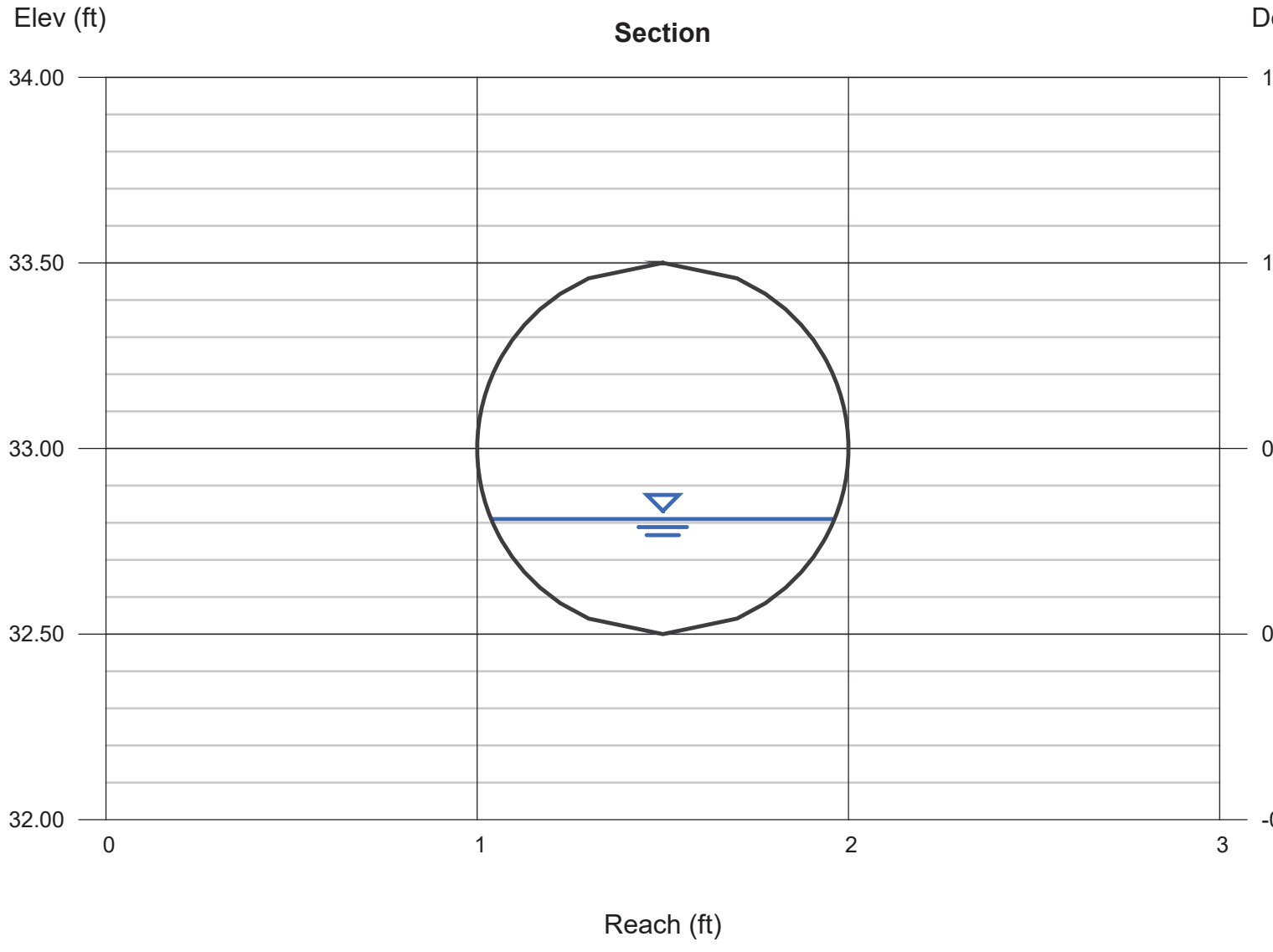
| | |
|---|---|
| Diameter (ft) | = 1.00 |
| Invert Elev (ft) | = 32.50 |
| Slope (%) | = 2.00 |
| N-Value | = 0.012 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 1.10 |

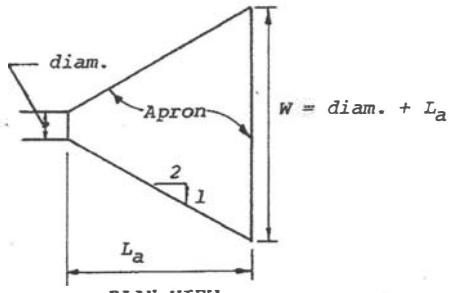
**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.31 |
| Q (cfs) | = 1.100 |
| Area (sqft) | = 0.21 |
| Velocity (ft/s) | = 5.26 |
| Wetted Perim (ft) | = 1.18 |
| Crit Depth, Yc (ft) | = 0.44 |
| Top Width (ft) | = 0.93 |
| EGL (ft) | = 0.74 |



Design Guide MD#6 Riprap Design Methods
NRCS Engineering, Maryland
October, 2003

DESIGN OF OUTLET PROTECTION
MINIMUM TAILWATER CONDITION (Tw <0.5 diam.)




*Median stone diameter, d50, is the stone size which 50% of the riprap mixture, by weight, is larger than.*

*Velocities shown are for pipes flowing full.*

DMH#4 to FES
Q = 1.10 cfs
v = 5.26 ft/s
D = 12"

Rip Rap #4
Length = 10.0'
Width = 11.0'
Median Stone Diameter = 0.3'