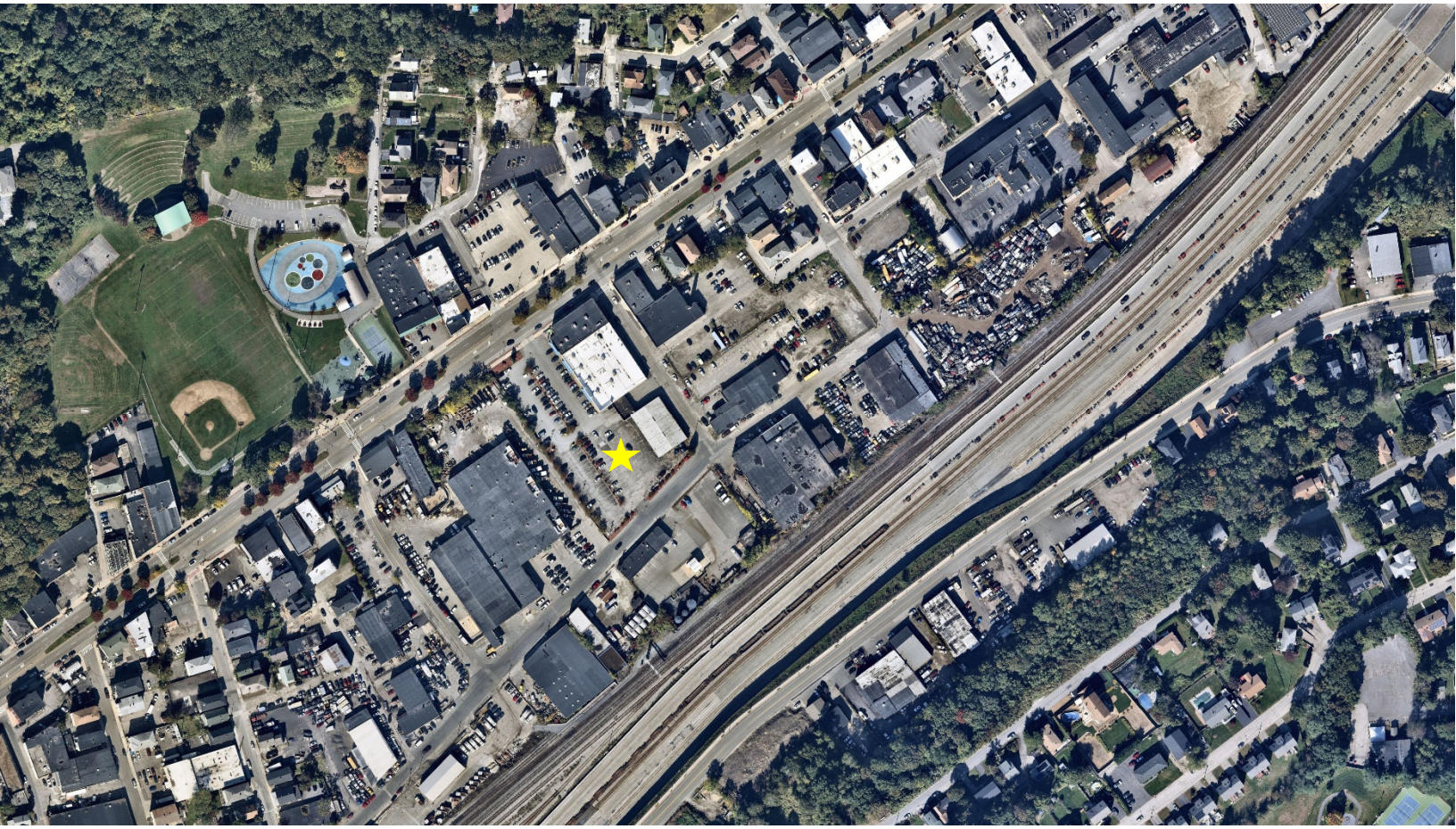
CONSTRUCTION-PHASE OPERATION & MAINTENANCE PLAN

DCU / Retail Expansion Project
225 Shrewsbury | Worcester, MA

Project Address:	225 Shrewsbury Street Worcester, MA 01604
Date Prepared:	June 6, 2024
Project Number:	24009
Prepared for:	Lundgren Equity Partners 163 Washington Street Auburn, MA 01501
Prepared by:	**Highpoint Engineering Inc.** Dedham Executive Center 980 Washington Street, Suite 216 Dedham, MA 02026 www.highpointeng.com



Date: June 06, 2024

I. OWNER:

Lundgren Equity Partners
163 Washington Street
Auburn, MA 01501
(508) 749-4255
Attn : Patrick Lundgren

II. RESPONSIBLE PARTY:

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163 Washington Street
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(508) 749-4255
Attn : Patrick Lundgren

III. PROJECT OVERVIEW:

Prevention of offsite flooding and improvements to existing runoff, water quality, and groundwater recharge characteristics are the main priorities of the project with respect to the drainage design. The project will construct a 15,375 commercial building within the property at 225 Shrewsbury Street which is currently connected to municipal stormwater management facilities. Runoff generated by the project will not result in an increase in overall runoff onsite; therefore, runoff will be mitigated by installing a new stormwater management system comprising various Best Management Practices (BMPs) to mitigate water quality impacts associated with the proposed site development. Water quality BMPs to mitigate the runoff generated by the site improvements during construction include compost filter sock sedimentation control barriers, temporary Siltsack® drainage inlet inserts (or similar product) in adjacent street drainage and new on-site catch basins (as installed), a construction entrance with anti-tracking pad, and periodic street sweeping along the site frontage.

It is the intent of the stormwater management design to achieve an 80% Total Suspended Solids (TSS) removal efficiency or 44% removal efficiency prior to discharge as outlined in the DEP Stormwater Management Standards.

The construction-phase BMPs used in this design were chosen for their effectiveness and ease of maintenance. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality and peak attenuation. This plan will be provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

IV. CONSTRUCTION PERIOD – BEST MANAGEMENT PRACTICES:

a) MONITORING

During construction operations, the stormwater management system will be inspected at least once every seven (7) calendar days, or once every fourteen (14) calendar days and within twenty-four (24) hours after a storm event of one quarter inch (0.25") or greater. Sediment accumulation shall be removed once a depth of one-third the height of perimeter sedimentation control devices is achieved unless stated otherwise. Damaged or underperforming sedimentation controls shall be replaced, modified, or otherwise supplemented immediately.

b) WASTE AND RECYCLING DISPOSAL

Metal dumpster type waste and recycling disposal receptacles will be located on-site and kept covered when not in active use. The project site will be policed daily by a person appointed by the general contractor to be kept the project site free of construction debris.

c) DUST MONITORING PLAN

A dust monitoring plan will be established prior to the start of construction and kept on site at all times. This will reduce the particulate levels in the air and reduce impacts to surrounding areas. Recommended methods for controlling dust include:

- Provide vegetative cover to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Apply a mulch layer to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Cover stockpiles unused for a maximum of 7 days with poly sheeting or tarps.
- Water surface materials and soil stockpiles.
- Use covered trucks.
- Minimize spoils stockpiled on site.
- Monitor construction practices to minimize unnecessary disturbance/ transfer of soils.
- Conduct periodic street cleaning along the site frontage during excavation activities.
- Pave driveways and parking surfaces as early as possible (where applicable and feasible).
- Assign personnel to remove windblown debris daily.
- Limit the idling of engines or stopped vehicles (except asphalt and cement concrete mixing trucks and equipment) to five minutes.

d) SPILL PREVENTION, CONTAINMENT, AND CLEANUP

Construction activities for this project will necessitate the use of equipment fuels, engine fluids, paints, and adhesives on the construction site and must be considered in the spill prevention and response practices for the project.

The general contractor will ensure areas where potential pollutants can occur are well protected with erosion control barriers and clean up equipment to prevent discharge of wastewater, fuels, and oil from vehicles and any other toxic or hazardous spills from the project site.

Spill kits comprising equipment necessary to attend to spills or leaks shall be stored on site in equipment sheds or similar covered enclosures and shall consist of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Containers suitable for storage of site-specific materials.
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

In the event of a spill, all materials used for containment and cleanup shall be replaced in kind in the spill kits immediately. The following describes specific preventative methods to be employed for materials used on site.

Fuels, Antifreeze, and Coolant for Construction Equipment and Generators:

In the case of a fuel spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil shall be excavated and stored in an impervious, bermed area, and the Licensed Site Professional shall be contacted to coordinate next steps regarding soil management. In the case of a fuel spill on an impervious surface, the spill shall be contained to prevent runoff and treated with absorbent material.

Adhesives and Paints:

Adhesive and paint materials shall be transferred to the site on an as needed basis. Any containers to be stored on site shall be clearly labeled and stored in non-flammable lockers. Wash water from paints shall be containerized; washing of paints into storm drainage systems shall be prohibited. Water-based and latex paints shall either be recycled or dried up and thrown out with the regular household trash, and oil-based paints and thinners shall be removed from the site by a local professional hazardous material removal company.

City of Worcester Emergency Contacts are as Follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Fire Department: (508) 799-1822

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617)-792-7653 and a professional emergency response contractor. Information that shall be provided to the said contractor is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The contractor shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during construction, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.
- Date and circumstances of the release.
- Measures taken to prevent future releases.

The report shall be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Frequent inspections of areas where potential spill could occur is key to prevention. Inspection shall take place, at a minimum of once every calendar days, or once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater or the occurrence of runoff from snowmelt sufficient to cause a discharge.

An inspection report shall be completed within 24 hours of completing any site inspection. Each inspection report must include, at minimum, the following:

- The inspection date and time.
- The weather and temperature.

- Names and titles of personnel making the inspection.
- A summary of inspection findings, covering at a minimum the observations made in accordance with Part 4.6 of the 2022 Construction General Permit, including any necessary maintenance or corrective actions.
- If inspecting because of rainfall measuring 0.25 inches or greater, include the applicable rain gauge or weather station readings that triggered the inspection.
- If determined that it is unsafe to inspect a portion of the site, describe the reason found to be unsafe and specify the locations to which the conditions apply.

e) STATE & LOCAL SANITARY LAWS

Portable sanitary units will be placed on-site during construction and will be serviced weekly.

V. CONSTRUCTION PERIOD - STRUCTURAL BEST MANAGEMENT PRACTICES

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance, promote longevity, and decrease operator maintenance costs. The structural BMPs selected for the proposed site development include compost filter sock sedimentation control barriers, temporary Siltsack® drainage inlet inserts in adjacent existing parking lot drainage and new on-site catch basins (as installed), and a construction entrance with anti-tracking pad.

a) COMPOST FILTER SOCK BARRIERS

Compost filter sock sedimentation control barriers shall be installed as specified on the "Site Preparation, Demolition, & Sedimentation Control Plan" (plan sheet C100) prior to commencing construction activities. The filter sock barriers shall be inspected daily and maintained throughout construction. Accumulated sediment shall be removed before it has accumulated to one-third of the above ground height of the filter sock. Any breach in the barriers shall be repaired within 24 hours or before next rainfall, whichever is sooner. Filter sock barriers shall remain in place for the duration of construction and may be supplemented and/or modified at any time. The general contractor shall maintain a stockpile of surplus compost filter sock materials equivalent to 10 percent of the overall sedimentation control barrier length as depicted on plan sheet C100.

b) SILTSACK® DRAINAGE INLET INSERTS FOR EXISTING CATCH BASINS

The existing catch basin located in the public right of way adjacent to the construction entrance, as well as all new catch basins upon installation, shall be equipped with Siltsacks® as shown on the "Site Preparation, Demolition, & Erosion Control Plan" (plan sheet C100).

Siltsacks® shall be regular flow units installed below grate castings and be equipped with internal emergency bypass devices. Siltsacks® are to remain in place until the end of the

construction and the site is stabilized. During construction, all catch basins and Siltsacks® shall be inspected every fourteen (14) calendar days and after a storm of a quarter inch (0.25") or greater. Sediment accumulation shall be removed once sediment accumulates above the expansion restraint within the bag. Damaged Siltsacks® shall be replaced immediately. The contractor shall keep a minimum of two (2) extra Siltsacks® on site in case damaged units need to be replaced. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state, and federal guidelines and regulations. Upon completion of the work, contractor is responsible for inspection and cleaning of units to ensure delivery of clean units to owner prior to completion of project.

c) **CONSTRUCTION ENTRANCE ANTI-TRACKING PAD**

A construction entrance anti-tracking pad shall be installed at the existing driveway entrances as shown on the "Site Preparation, Demolition, & Sedimentation Control Plan" (plan sheet C100) to minimize the track-out of sediment onto the street and sidewalk surfaces from vehicles leaving the construction site. The sub-base for the pad will be compacted and covered with a filter cloth. Crushed stone ranging in aggregate size from 1.5 to 3 inches will be placed on top of the filter cloth at a minimum thickness of 6 inches. The anti-tracking pad will remain in place and maintained until parking and loading areas receive an asphalt binder course or concrete slab-on-grade, depending on location.

The anti-tracking pad shall be installed prior to material and heavy equipment hauling commences. Maintenance requirements include:

- Construction vehicles will be restricted to using only the designated entrance/exit armored with the tracking pad until the site has been stabilized with asphalt binder course. The removed stone and sediment from the pad will be hauled off site and disposed in accordance with all applicable local, state, and federal regulations.

- The exit will be maintained in a condition that will prevent tracking or flowing of sediment off-site. This could require additional crushed stone to be placed within the exit. Sediment shall be swept form the anti-tracking pads at least weekly, or more often if necessary. If excess sediment has clogged the pads, they shall be top dressed using new crushed stone and re-leveled. Replacement of the entire pad may be necessary if it becomes completely inundated with sediment. The pad will be reshaped as needed for drainage and runoff control depending on site conditions.

- Where sediment has been tracked into the public right of way from the construction site, the deposited sediment shall be removed by the end of the same workday. Sediment shall be removed by sweeping, shoveling, or vacuuming of these surfaces. Hosing or sweeping tracked-out sediment into a public or private stormwater system is prohibited.

- The exit will be inspected once every seven (7) calendar days and within 24 hours of storm events of 0.25 inches or greater, or the occurrence of runoff from snowmelt sufficient to cause a discharge.

LONG-TERM OPERATION & MAINTENANCE PLAN

DCU / Retail Expansion Project
225 Shrewsbury | Worcester, MA

Project Address:	225 Shrewsbury Street Worcester, MA 01604
Date Prepared:	June 6, 2024
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O&M UPDATE FORM

DATE OF UPDATE	DATE OF LAST UPDATE TO O&M PLAN

SECTIONS OUT OF DATE / REQUIRED UPDATES

MAINTENANCE LOG REVIEW

BMP	INSPECTION AND MAINTENANCE FREQUENCY		ACTION REQ'D?* (CIRCLE ONE)
	REQUIRED	ACTUAL	
DEEP SUMP/ HOODED CATCH BASINS			Y N
PROPRIETARY WATER QUALITY UNITS			Y N

*See next page for corrective action and training requirement updates (if applicable)

CORRECTIVE ACTION TO SCHEDULE(S) REQUIRED (IF YES TO ANY OF ABOVE)
EMPLOYEE AND CONTRACTOR TRAINING UPDATES (ATTACH BROCHURES AS NEEDED)

ANNUAL SITE INSPECTION AND UPDATE

OVERALL SITE CONDITION

_____
_____
_____
_____
_____

INSPECTION RESULTS

_____
_____
_____
_____
_____

EXCEPTIONAL CIRCUMSTANCES OBSERVED? _____

IF YES, DESCRIBE CIRCUMSTANCES AND CORRECTIVE ACTIONS NEEDED.

_____
_____
_____
_____
_____

OVERALL O&M PLAN EFFECTIVENESS (DESCRIBE)

_____
_____
_____
_____
_____

Reproduce update forms as necessary over the life of this Operation and Maintenance Plan.

SECTION 1 TABLE OF CONTENTS

APPENDIX

Proprietary BMP Information

- Deep-sump/Hooded Catch Basins
- Water Quality Unit

Date: June 06, 2024

I. OWNER:

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II. RESPONSIBLE PARTY:

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(508) 749-4255
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PROJECT OVERVIEW

Prevention of offsite flooding and implementation of stormwater runoff, water quality, and groundwater recharge improvements where none currently exist on-site are the main priorities of the project with respect to drainage design. The project will improve existing stormwater management within the property with respect to the existing site condition, which currently includes conveyance to a municipal stormwater collection system, by installing a stormwater management system comprising various Best Management Practices (BMPs). Long-term water quality BMPs to mitigate the runoff generated by the site improvements includes installation of deep-sump hooded catch basins, a water quality unit in-line with the proposed drainage collection system, as well as periodic mechanical sweeping to remove sand and sediment from paved surfaces.

It is the intent of the stormwater management design to achieve an 80% Total Suspended Solids (TSS) removal efficiency or 44% removal efficiency prior to discharge as outlined in the DEP Stormwater Management Standards.

The permanent BMPs used in this design were chosen for their effectiveness and ease of maintenance. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality, and peak attenuation. This plan will be provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

POST-CONSTRUCTION BEST MANAGEMENT PRACTICES

a) NON-STRUCTURAL BEST MANAGEMENT PRACTICES

Implementing source controls can aid in reducing the types and concentrations of contaminants in stormwater runoff. This principle for pollution prevention and non-structural controls, or BMPs, is to minimize the volume of runoff and to minimize contact of stormwater with potential pollutants. Measures such as street sweeping, managing snow removal, and educating the owner/operator of good maintenance practices are examples of non-structural BMPs.

i. PUBLIC AWARENESS

The responsible party shall issue periodic reminders to the building tenants to avoid dumping or releasing pollutants into the storm drains and onto the ground.

ii. STREET SWEEPING

Parking lot, driveway, and loading area sweeping is an integral part of the stormwater management plan as a fundamental component of source reduction efforts. Sweeping activities shall begin on or around April 1. However, sweeping may be done after winter thaw and the onset of early spring. It is critical to remove the accumulated sediment in the parking, loading, and driveway areas from the winter months as soon as possible before spring precipitation.

Sweeping activities should be performed a minimum of two times annually (April 1 and September 1).

iii. SNOW AND SNOWMELT MANAGEMENT

The removal contractor shall avoid stockpiling snow directly on top of catch basin grates and avoid stockpiled snow within the paved parking lot to allow normal vehicular maneuverability.

It is suggested that during snowfall events, the snow be stockpiled in areas consistent with the currently utilized stockpile areas onsite. During significant snow fall event, six (6) inches or greater, accumulated snow shall be stockpiled in the lawn areas to the south of the proposed parking lot expansion and/or removed from the site by a snow removal contractor. It is the responsibility of the owner to make sure the snow removal contractor utilizes previously approved areas. The owner shall remove sediment from snow storage areas every spring.

It is suggested that no de-icing compounds such as calcium chloride ($CaCl_2$), calcium magnesium acetate (CMA) or the like be used on the site. The snow removal contractor shall store all sand off-site. No quantities of sand compounds shall be stored on site.

iv. PUBLIC SAFETY FEATURES

The project has been designed with consideration for public safety and does not require any specific features as part of the stormwater management system.

b) STRUCTURAL BEST MANAGEMENT PRACTICES:

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance and promote longevity of the structure and may decrease operator maintenance costs.

i. DEEP-SUMP/HOODED CATCH BASINS

All proposed catch basins shall be a minimum of four feet in diameter and equipped with four-foot-deep sumps to trap sediments and any debris/trash. The pipe outlets shall be hooded to prevent floating debris and oils from entering the subsurface drainage conveyance system. The actual removal of sediments, trash, and associated pollutants only occurs when the deep sumps are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged downstream. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance.

The recommended inspection frequency of the deep sumps is every three months, and cleaning two to three times per year, if necessary, post-construction. Disposal of accumulated sediment and trash is to be in accordance with all applicable local, state, and federal guidelines and regulations.

ii. CONTECH CDS® WATER QUALITY UNIT

Contech CDS© water quality units are proposed to prevent sediments and oils from entering the underground detention basin in the north loading area. The actual removal of sediments, trash, and associated pollutants only occurs when the structures are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance. Contech CDS structures are an approved means of BMP for storm water management. See the TSS Removal Calculation Worksheet included in the Appendix C for the specific TSS removals rate of the CDS © unit for this project.

Post-construction, the units shall be inspected every six months for the first year of operation to determine the oil and sediment accumulation rate. After the first year, inspections can be based on the first-year observations or local requirements. Cleaning, by full pump out, is recommended on an annual basis or when 15% of the units' storage

capacity is filled with solids. Inspect the units immediately after an oil, fuel, or chemical spill. Maintenance shall be performed by conventional vacuum truck. Disposal of accumulated sediment, trash, and hydrocarbons shall be in accordance with all applicable local, state, and federal guidelines and regulations. Refer to product brochure in the Appendix for more information.

SITE FURNISHINGS BEST MANAGEMENT PRACTICES

Site furnishings, as they pertain to this Operation and Maintenance Plan, comprise driveways and parking lots; walkways and hardscape areas; fences, walls, and guardrails; landscape areas; and solid waste management facilities.

i. DRIVEWAYS AND PARKING LOTS

All driveways, parking lots, loading areas, and emergency access ways shall be inspected twice annually (early Spring and Fall) to assess damage, cracking, differential settlement, and fading of pavement markings. Deteriorated asphalt and damaged curbs and signage shall be repaired as needed based on observation. Faded striping shall be re-painted in kind as needed.

Landscape vegetation around the perimeter and in the interior of the parking areas and within the proposed expanded lawn area to the south of the project area shall be inspected for overgrowth twice annually (early Spring and Summer) and pruned as needed based on inspection.

ii. WALKWAYS AND HARDSCAPE AREAS

All concrete walkways, landings, pads, and driveways shall be inspected annually for spalling, cracking, and heaving. Cracked or spalled concrete shall be patched and repaired with cement or grout as needed based on inspection. In the case of widespread structural damage to concrete surfaces, slabs shall be demolished and reconstructed in kind and sub-base shall be inspected for settlement or heaving and corrected and/or re-compacted as needed.

iii. FENCES, WALLS, AND GUARDRAILS

All chain link fences, retaining walls, guardrails, and galvanized steel pipe bollards shall be inspected annually.

Bollards adjacent to parking areas, concrete loading pads, electrical and heating equipment and throughout the site shall be inspected for damage and rust upon observation. In the event of damage, pipes and concrete bases shall be replaced in kind immediately. In the event of rust, affected areas shall be smoothed manually and pipes shall be re-painted with emergency yellow paint to prevent further deterioration.

iv. LANDSCAPE AREAS

Spring clean-up shall be conducted twice annually in the months of March and April. Spring clean-up comprises removal of winter wraps from trees, lawn raking/ leaf blowing, weeding, and fertilization as needed. Landscape edges shall also be inspected and re-established as needed during Spring clean-up activities.

Mulch areas shall be inspected once annually during the month of April. New mulch shall be added to planting beds as needed and washed-out mulch shall be removed from adjacent areas. Subgrade in washout areas shall be checked for erosion and re-graded as needed prior to replacement of mulch. Pre-emergent weed control shall be applied to planting beds concurrently with inspection activities.

Shrub and tree planting fertilization activities shall be limited to twice annually between April 15 and October 15 as needed. Fertilizer use shall be minimized to the extent practicable and shall never be applied before a heavy rainfall event, on frozen ground, or within vegetated stormwater management BMPs. Insect and disease sprays shall be used as needed on shrub and tree plantings throughout the Summer and never during frozen ground conditions or before heavy rainfall events.

The irrigation system shall operate between April and October. The irrigation system shall be winterized in advance of cold-weather months to prevent freeze damage.

Mowing shall be conducted as necessary between the months of May and October. Excess lawn clippings shall be removed from mowed surfaces prior to next rainfall, and no excess lawn clippings are to be left within vegetated surface BMPs. Shrub and ornamental tree pruning shall be conducted twice annually during the months of July and August. Structural tree pruning shall be conducted twice annually during the months of August and September.

Fall cleanup shall be conducted twice annually during the months of October and November. Fall cleanup activities comprise application of winter wraps to trees, raking/leaf blowing lawn areas, and weeding. Lawn fertilization, if conducted during fall cleanup, shall not occur after October 15. Lime application treatment for lawn areas shall be conducted once annually in the month of November.

v. SOLID WASTE MANAGEMENT FACILITIES

Dumpster enclosures shall be inspected weekly for damage, rust, leaks, and loose hardware. Any such defects shall be repaired immediately upon observation.

Concrete dumpster and compactor pads shall be inspected quarterly. Staining and accumulated spillage shall be managed by manual removal/sweeping and power washing. Power washing runoff shall be directed to catch basin inlets located in loading and waste disposal areas.

The site perimeter and the stormwater outfalls shall be inspected monthly for wind-blown trash and debris. Such trash and debris shall be hand collected and disposed of in the on-site dumpster containers.

SPILL PREVENTION, CONTAINMENT, AND COUNTERMEASURE PLAN

Landscape maintenance and parking and loading operations which occur on site necessitate the use of various materials and must be considered in the spill prevention and response practices. The following is a summary of pollutants and the respective property use and maintenance activities generating each:

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site**
Landscaping Maintenance Operations	Gasoline (from lawnmowers), fertilizers	Lawn and landscape areas throughout site
Parking and Loading Operations	Hydraulic oil/fluid, Antifreeze, diesel/gasoline (all from automobiles)	Driveway, parking, and loading areas throughout site

The Owner/Responsible Party shall be responsible for coordinating necessary containment and cleanup efforts in the event of a spill at any location on site. Should a spill occur, equipment necessary to attend to spills or leaks shall be stored on site in a designated storage area within the building and shall consist, at minimum, of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Proprietary compact spill containment berms.
- Containers suitable for storage of site-specific materials.
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

The following describes specific preventative methods to be employed for materials to be used on site.

SPILLS FROM VEHICLES ACCESSING PARKING AND LOADING AREAS

Spills due to vehicular operations are not anticipated on pervious surfaces. In the case of a spill in the driveway, parking or loading areas, the spill shall be contained using spill berms and/or adhesive drain seals at all vulnerable catch basin inlets to prevent entering the subsurface drainage system, and the spill shall then be treated with absorbent material.

SPILLS FROM LANDSCAPE AND LAWN MAINTENANCE EQUIPMENT

In the case of a spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil, mulch, and/or planted vegetation shall be excavated and stored in a proprietary spill containment berm (by Ultratech or the like) for removal by a professional hazardous material removal company.

City of Worcester Emergency Contacts are as follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Fire Department: (508) 799-1822

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617) 792-7653 and a professional emergency response contractor (ERC). Information that shall be provided to the said ERC is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The Owner/Responsible Party shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during site maintenance and access activities, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.

- Date and circumstances of the release.
- Measures taken to prevent future releases.

This Spill Prevention Plan shall then be updated to document any such preventive measures implemented. The report shall then be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Any inspection reports generated in accordance with a RQ spill shall be completed within 24 hours of completing any site inspection. A hard or electronic copy of the report must be retained on site for at least three (3) years from the date of reporting at the Responsible Party's office.

MAINTENANCE AGREEMENT

I, the undersigned, hereby certify that we understand and accept the terms specified in the Worcester Wetlands Protection Ordinance and Regulations and acknowledge the following:

1. I am responsible for the maintenance of permanent BMPs on this Site.
2. During a transfer of ownership, I am responsible for informing prospective new owner(s) of the requirements of the Long-Term Operation and Maintenance Plan and of the requirement to amend the Maintenance Agreement with the City Stormwater Authority (Worcester Conservation Commission or its authorized Agent).
3. I am responsible for allocating and making funds available to perform the required operation and maintenance functions on site.
4. The City Stormwater Authority may conduct inspections whenever deemed necessary to enforce any provision of the City of Worcester Wetlands Protection Ordinance and Regulations to determine compliance therewith.

I understand that failure to comply with the requirements of the approved Long-Term Operation and Maintenance Plan may result in fines and penalties in accordance with the City of Worcester Stormwater Management Bylaw and Regulations.

Owner

(signature) (date)

Lundgren Equity Partners
163 Washington Street
Auburn, MA 01501
(508) 749-4255

Responsible Party

(signature) (date)

Lundgren Equity Partners
163 Washington Street
Auburn, MA 01501
(508) 749-4255

SECTION 2: INSPECTION AND MAINTENANCE LOGS

APPENDIX

Logs and Checklists

- BMP Maintenance Log
- Inspection Form: Deep Sump/ Hooded Catch Basin 1 (225 Shrewsbury)
- Inspection Form: Deep Sump/ Hooded Catch Basin 2 (225 Shrewsbury)
- Inspection Form: Deep Sump/ Hooded Catch Basin 3 (225 Shrewsbury)
- Inspection Form: Deep Sump/ Hooded Catch Basin 3 (225 Shrewsbury)
- Inspection Form: Existing Catch Basin 1 (225 Shrewsbury)
- Inspection Form: Existing Catch Basin 2 (225 Shrewsbury)
- Inspection Form: Existing Catch Basin 3 (225 Shrewsbury)
- Inspection Form: Existing Catch Basin 4 (225 Shrewsbury)
- Inspection Form: Water Quality Unit (DMH-4)

BMP MAINTENANCE LOG

DATE	NAME OF MAINTENANCE PERSONNEL/COMPANY	TYPE OF MAINTENANCE PERFORMED	ISSUES/NEED FOR FOLLOW-UP	WORK ORDER PROVIDED?

DATE	NAME OF MAINTENANCE PERSONNEL/COMPANY	TYPE OF MAINTENANCE PERFORMED	ISSUES/NEED FOR FOLLOW-UP	WORK ORDER PROVIDED?

Reproduce log sheets as necessary over the life of this Operation and Maintenance Plan.

INSPECTION FORM: DEEP SUMP/ HOODED CATCH BASIN 1 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: DEEP SUMP/ HOODED CATCH BASIN 2 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: DEEP SUMP/ HOODED CATCH BASIN 3 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: DEEP SUMP/ HOODED CATCH BASIN 4 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: EXISTING CATCH BASIN 1 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: EXISTING CATCH BASIN 2 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: EXISTING CATCH BASIN 3 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: EXISTING CATCH BASIN 4 (225 SHREWSBURY)

Unit Number: CB _____ (Refer to Site Grading and Drainage Plan)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Three Months)
	Annual
	Post-Storm (Rainfall Depth =_____inches)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check sediment depth (Sediment Depth =_____inches)
	Check for settlement/ cracking of pavement around frame and grate
	Remove floating trash and sediment
	Confirm water level in sump is at invert elevation
	Confirm oil/gas hood is secure and functioning
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

INSPECTION FORM: WATER QUALITY UNIT (DMH-4)

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Six Months)
	Annual
	Post-Storm (Depth =_____inches; Storm Duration =_____hrs; Storm End Date =_____)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Check for settlement/ cracking of pavement
	Check for ground settlement at inspection port locations
	Check for sediment accumulation at inlets/outlet via inspection ports
	Confirm dry condition within system
	Clean out Isolator Row using the JetVac Process (refer to proprietary O&M manual)
	Inspect and clean catch basins and manholes upstream of the system
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

SECTION 1 APPENDIX - PROPRIETARY BMP IMFORMATION

CONTECH®
ENGINEERED SOLUTIONS

CDS®
Hydrodynamic Separator

The experts you need to solve your stormwater management challenges

Contech is the leader in stormwater management solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Unique screening technology for stormwater runoff – CDS®

The CDS hydrodynamic separator uses swirl concentration and continuous deflective separation to screen, separate and trap trash, debris, sediment, and hydrocarbons from stormwater runoff.

At the heart of the CDS system is a unique screening technology used to capture and retain trash and debris. The screen face is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder. This results in a screen that is self-cleaning and provides 100% removal of floatables and neutrally buoyant material debris 4.7 mm or larger, without blinding.

CDS is used to meet trash Total Maximum Daily Load (TMDL) requirements, for stormwater quality control, inlet and outlet pollution control, and as pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and a variety of green infrastructure practices.

CDS® Features and Benefits

FEATURE	BENEFIT
Captures and retains 100% of floatables and neutrally buoyant debris 4.7mm or larger	Superior pollutant removal
Self-cleaning screen	Ease of maintenance
Isolated storage sump eliminates scour potential	Excellent pollutant retention
Internal bypass	Eliminates the need for additional structures
Multiple pipe inlets and 90-180º angles	Design flexibility
Clear access to sump and stored pollutants	Fast, easy maintenance

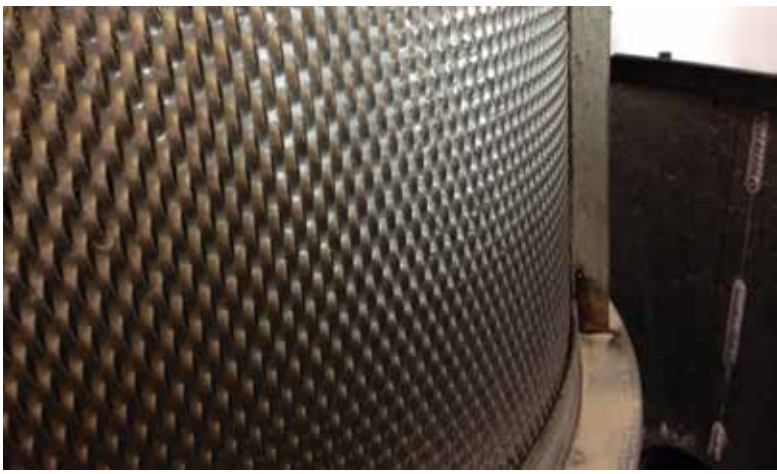
APPLICATION TIPS

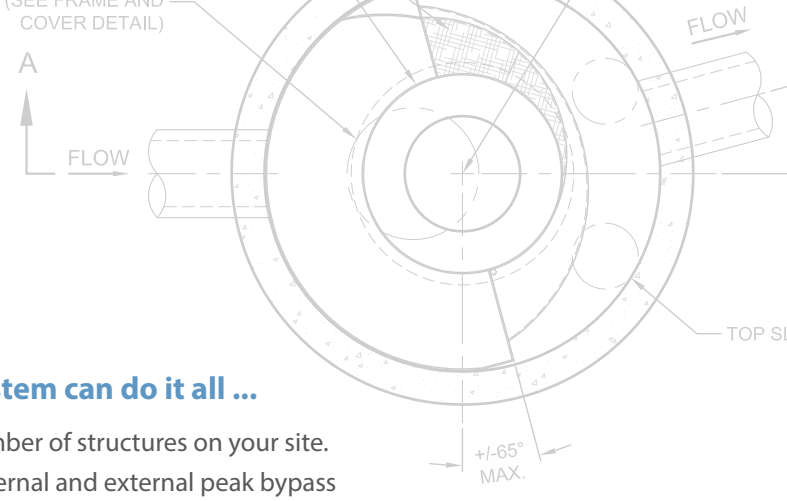
- Because of its internal peak bypass weirs, CDS systems can provide cost savings by eliminating the need for additional structures.
- Pretreating detention, infiltration, and green infrastructure practices with CDS can protect downstream structures and provide for easy maintenance.
- The CDS an ideal solution for retrofit applications due to its compact footprint and configuration flexibility.

The CDS® Screen

A fundamentally different approach to trash control ...

Traditional approaches to trash control typically involve "direct screening" that can easily become clogged, as trash is pinned to the screen as water passes through. Clogged screens can lead to flooding as water backs up. The design of the CDS screen is fundamentally different. Flow is introduced to the screen face which is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder.

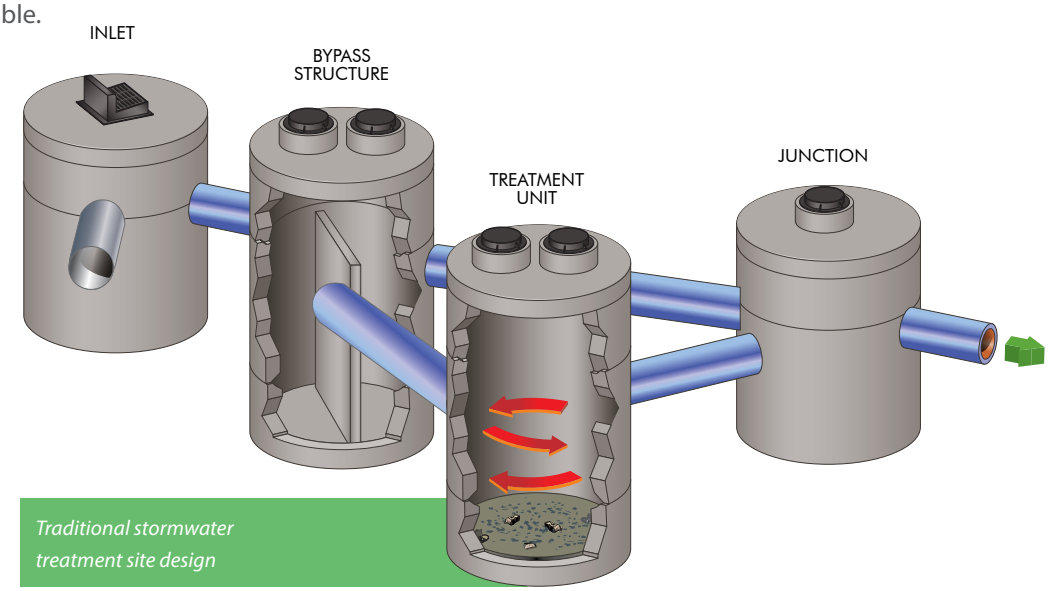




CDS® Design Configuration

Why use traditional stormwater design when ONE system can do it all ...

The CDS effectively treats stormwater runoff while reducing the number of structures on your site. Inline, offline, grate inlet, and drop inlet configurations available. Internal and external peak bypass options also available.

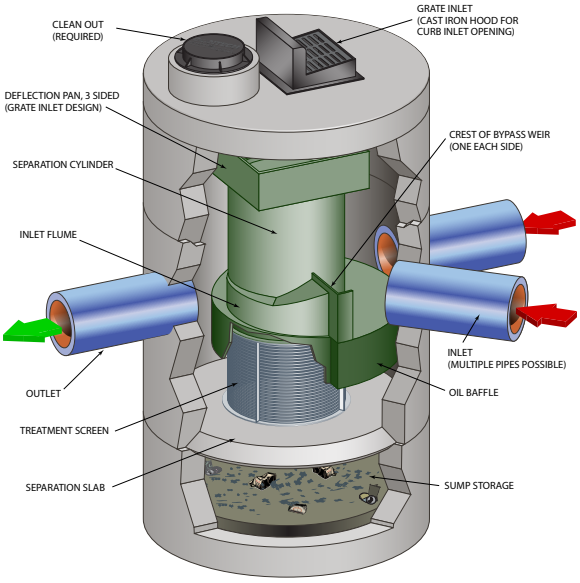


Traditional stormwater treatment site design

A Traditional Stormwater Treatment Site Design would require several structures on your site. With CDS, one system can do it all!

CDS® Advantages

- Grate inlet option available
- Internal bypass weir
- Accepts multiple inlets at a variety of angles
- Advanced hydrodynamic separator
- Captures and retains 100% of floatables and neutrally buoyant debris 4.7 mm or larger
- Indirect screening capability keeps screen from clogging
- Retention of all captured pollutants, even at high flows
- Performance verified by NJCAT, WA Ecology, and ETV Canada



Learn More:
www.ContechES.com/cds

CDS® Applications

CDS is commonly used in the following stormwater applications:

- Stormwater quality control – trash, debris, sediment, and hydrocarbon removal
- Urban retrofit and redevelopment
- Inlet and outlet protection
- Pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and Low Impact Development designs

CDS® provides trash control

CDS® pretreats a bioswale

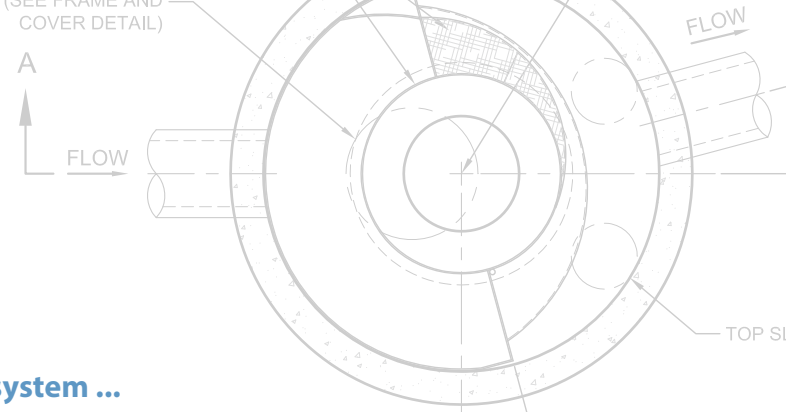
Select CDS® Certifications and Verifications

CDS has been verified by some of the most stringent stormwater technology evaluation organizations in North America, including:

- Washington State Department of Ecology (GULD) - Pretreatment
- Canadian Environmental Technology Verification (ETV)
- California Statewide Trash Amendments Full Capture System Certified*

**The CDS System has been certified by the California State Water Resources Control Board as a Full Capture System provided that it is sized to treat the peak flow rate from the region specific 1-year, 1-hour design storm, or the peak flow capacity of the corresponding storm drain, whichever is less.*

Save time, space and money with CDS



CDS® Maintenance

Select a cost-effective and easy-to-access treatment system ...

Systems vary in their maintenance needs, and the selection of a cost-effective and easy-to-access treatment system can mean a huge difference in maintenance expenses for years to come.

A CDS unit is designed to minimize maintenance and make it as easy and inexpensive as possible to keep our systems working properly.

Most CDS® units can easily be cleaned within thirty minutes.

INSPECTION

Inspection is the key to effective maintenance. Pollutant deposition and transport may vary from year to year and site to site. Semi-annual inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed more frequently where site conditions may cause rapid accumulation of pollutants.

RECOMMENDATIONS FOR CDS MAINTENANCE

The recommended cleanout of solids within the CDS unit's sump should occur at 75% of the sump capacity. Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber and sump, and another allows inspection and cleanout of sediment captured and retained behind the screen. A vacuum truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30 minutes for most installations.

Hydrodynamic Separator Selection & Sizing Tool

Quickly prepare designs for estimates and project meetings ...

Part of the Contech Design Center, this free, online tool fully automates the layout process for identifying the proper hydrodynamic separator for your site.

- Multiple sizing methods available.
- Site-specific questions ensure the selected unit will comply with site constraints.
- Multiple treatment options may be available based on regulations and site parameters.
- Follow up reports contain a site-specific design, sizing summary, standard detail, and specification.

Learn More:
www.ContechES.com/designcenter

A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

TAKE THE NEXT STEP

For more information: www.ContechES.com

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CONTECH® ENGINEERED SOLUTIONS

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Revision 09/22

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CONTECH®
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

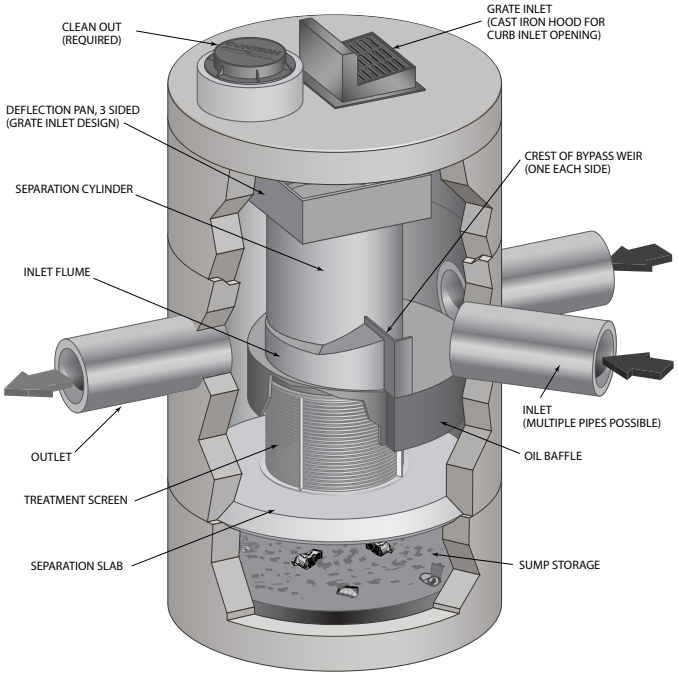
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

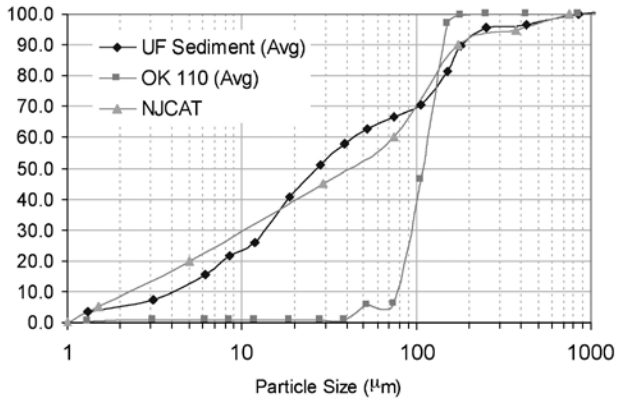


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

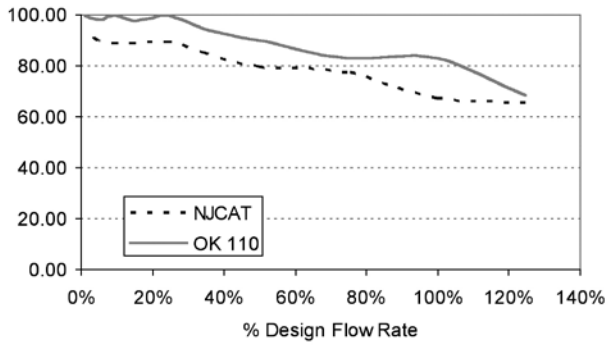


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

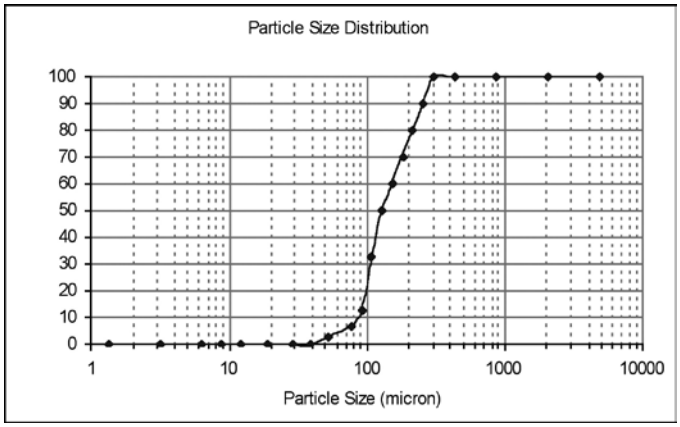


Figure 3. WASDOE PSD

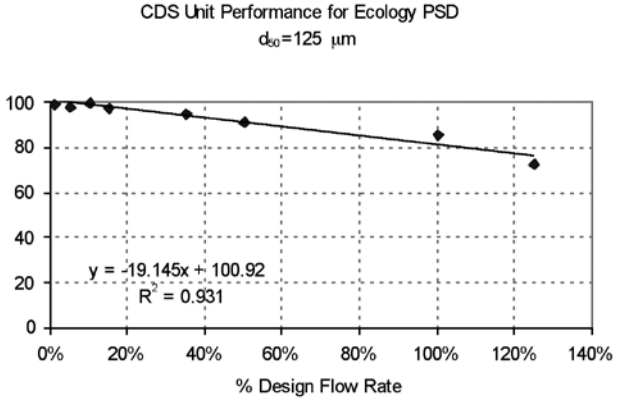


Figure 4. Modeled performance for WASDOE PSD.

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.

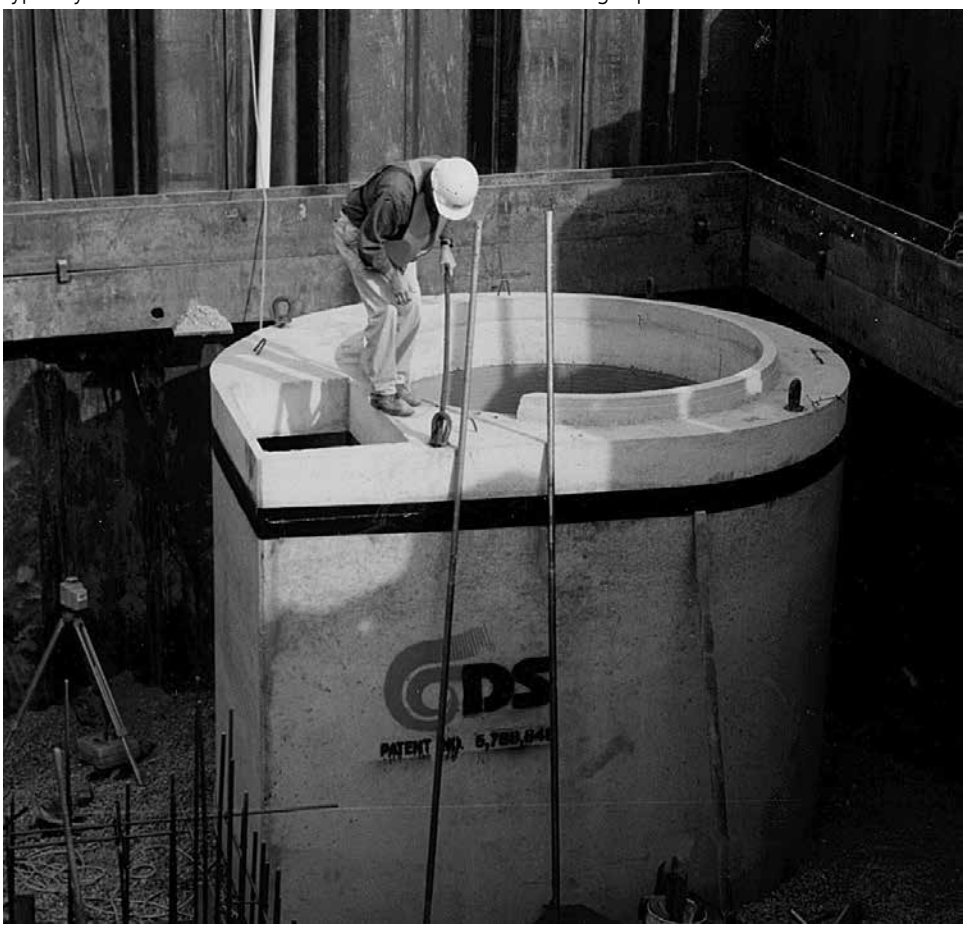
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should 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 cleaned 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. Check your local regulations for specific requirements on disposal.

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

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

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

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

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

SUPPORT

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

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