

Agreement for Stormwater System Maintenance

This Agreement is made on SEPTEMBER 17, 2018 by First State Bank, a Michigan banking corporation of 24300 Little Mack, Saint Clair Shores, MI 48080, ("Developer"), and the CITY OF ROCHESTER HILLS (the "City"), whose address is 1000 Rochester Hills Drive, Rochester Hills, MI 48309.

WHEREAS, Developer owns and proposes to develop the Property described in attached Exhibit A; and

WHEREAS, the proposed development of the Property will alter the natural flow of surface and storm water drainage; and

WHEREAS, Developer has proposed, and the City has approved, a storm water drainage and detention system (the "System") comprised of storm water detention and water quality treatment facilities and devices, storm sewer pipe, catch basins, manholes, and swales for the Property as described and depicted in the Storm Water System Plan attached as Exhibit B; and

WHEREAS, the parties will benefit from the proper operation, use and maintenance of the System and enter into this agreement to provide for the same.

THEREFORE, the parties agree:

1. Use of the System:

Components of the System, including any and all water conveyance, detention and water quality treatment facilities and devices, storm sewer pipe catch basins, manholes, end-sections, ditches, swales, open water courses, and rip-rap, shall be used solely for the purpose of conveying, detaining and treating storm and surface drainage on the property until such time as: (i) The City determines and notifies Developer or Developer's successors, grantees or assigns, in writing, that it is no longer necessary to convey, detain or treat the storm and surface drainage has been provided which is acceptable to the City and which includes the granting of any easements to the City or third parties as may be required or necessary for the alternative drainage system.

2. Maintenance:

- a. Developer shall be responsible for the proper maintenance, repair and replacement of the System and all parts thereof as detailed in the Maintenance Plan attached as Exhibit C.
- b. Proper maintenance of the System shall include, but is not limited to: (i) Removing accumulated sediment, trash and debris from the detention system and at inlet pipes; (ii) Managing deleterious vegetative growth; (iii) Maintaining storm sewer, structures, end-sections and safety features; (iv) Controlling the effects of erosion; (v) Inspection and cleaning of the water quality treatment device; (vi) Inspection of inlet and outlet pipes for structural integrity; (vii) Inspection and cleaning of the storm sewer and catch basins upstream from the detention system; and (viii) Any other maintenance that is reasonable and necessary to facilitate and continue the proper operation and use of the System.

3. Action by City:

If, at any time, Developer or Developer's successors, grantees or assigns neglect or fail to properly maintain the System or any part thereof, the City may notify Developer or

Developer's successors, grantees or assigns. The notice shall be in writing and shall list and describe maintenance deficiencies and demand that they be corrected within thirty (30) days.

The notice shall further specify a date and place for hearing to be held at least fourteen (14) days after the date of the notice before the City council, or such other board or official as the City Council may designate. At the hearing, the City Council (or other designated board of official) may affirm or modify the list and description or maintenance deficiencies and, for good cause shown, may extend the time for the deficiencies to be corrected.

Thereafter, if the maintenance deficiencies are not corrected within the time allowed, the City may undertake the necessary corrective actions, and the City may maintain the System for up to one (1) year. Such maintenance of the System by the City shall not be construed to be a trespass or a taking of the Property, nor shall the City's actions vest in the public any right to enter or use the Property. Thereafter, if Developer or Developer's successors, grantees or assigns do not properly maintain the System, the City may, after providing similar written notice, schedule and hold another hearing to determine whether the City should maintain the System for another year, and subject to a similar notice, hearing and determination in subsequent years.

In the event the City determines an Emergency condition caused by or relating to the System threatens the public health, safety or general welfare, the City shall have the right to immediately and without notice enter the Property and undertake appropriate corrective action.

4. Charges:

The City shall charge to the current owner of the Property the cost of maintenance or other corrective action undertaken by the City under this agreement, plus a ten percent (10%) administrative fee. If not timely paid, the City may place the charges on the City's tax roll, which charges shall be a lien on the real property and shall be collectable and enforceable in the same manner general property taxes are collected and enforced.

5. Notice:

Any notices required under this agreement shall be sent by certified mail to the address for each party set forth below, or to such other addresses as such party may notify the other parties in writing:

To First State Bank	24300 Little Mack Saint Clair Shores, MI 48080 Attention: Gene Lovell
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To the City	City of Rochester Hills 1000 Rochester Hills Drive Rochester Hills, MI 48304 Attention: City Clerk
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6. Successors and Assigns:

This agreement shall bind and inure to the benefit of the parties and their respective successors, grantees and assigns. The benefits, burdens, rights, obligations and responsibilities hereunder shall run within the land and shall bind all current and future owners of the Property and any divisions thereof.

7. Recording of Agreement:

The agreement shall be recorded at the Oakland County Register of Deeds.

First State Bank
A Michigan Banking Corporation

By: [Signature]
Printed Name: ROBERT KIRK
Its: DIRECTOR / ATTORNEY

CITY OF ROCHESTER HILLS

By: _____
Bryan K. Barnett, Mayor

By: _____
Tina Barton, Clerk

STATE OF MICHIGAN
COUNTY OF OAKLAND

This agreement was acknowledged before me on SEPTEMBER 17, 2018, by ROBERT W. KIRK, who is the DIRECTOR / ATTORNEY of First State Bank, a Michigan banking corporation, on behalf of the corporation.

[Signature]
RENATA GARBARINO Notary Public
NOTARY PUBLIC - STATE OF MICHIGAN
COUNTY OF MACOMB
My Commission Expires June 29, 2024 Macomb County, Michigan
Acting in the County of Macomb My commission expires: 06-29-2026

STATE OF MICHIGAN
COUNTY OF OAKLAND

This agreement was acknowledged before me on _____, Bryan K. Barnett, the Mayor, and Tina Barton, the Clerk, of the City of Rochester Hills, on behalf of the City.

Drafted By:
Briana Simon
Stonefield Engineering & Design, LLC
28454 Woodward Ave.
Royal Oak, MI 48067

Notary Public

County, Michigan
My commission expires: _____

When Recorded Return to:
City Clerk
City of Rochester Hills
1000 Rochester Hills Drive
Rochester Hills, MI 48309

John Staran
Approved 9/27/18

EXHIBIT 'A'

LEGAL DESCRIPTION-

LAND SITUATED IN THE CITY OF ROCHESTER HILLS, COUNTY OF OAKLAND, STATE OF MICHIGAN, AND DESCRIBED AS FOLLOWS:

TOWN 3 NORTH, RANGE 11 EAST, SECTION 23. PART OF THE SOUTHWEST $\frac{1}{4}$ OF SECTION 23 BEGINNING AT A POINT DISTANT NORTH 01 DEGREES 50 MINUTES 00 SECONDS WEST 2.36 FEET AND NORTH 85 DEGREES 52 MINUTES 55 SECONDS EAST 66.05 FEET AND SOUTH 01 DEGREES 48 MINUTES 43 SECONDS EAST 498.70 FEET FROM WEST $\frac{1}{4}$ CORNER OF SECTION 23, THENCE NORTH 88 DEGREES 11 MINUTES 17 SECONDS EAST 124.90 FEET, THENCE ALONG A CURVE TO LEFT, RADIUS 650 FEET, CHORD BEARS NORTH 83 DEGREES 37 MINUTES 30 SECONDS EAST 103.42 FEET, DISTANCE OF 103.53 FEET, THENCE ALONG A CURVE TO RIGHT. RADIUS 535 FEET, CHORD BEARS NORTH 83 DEGREES 05 MINUTES 51 SECONDS EAST 75.30 FEET, DISTANCE OF 75.37 FEET, THENCE SOUTH 01 DEGREES 48 MINUTES 43 SECONDS EAST 199.55 FEET, THENCE SOUTH 88 DEGREES 11 MINUTES 17 SECONDS WEST 303.03 FEET, THENCE NORTH 01 DEGREES 48 MINUTES 43 SECONDS WEST 184.64 FEET TO THE POINT OF BEGINNING.

PARCEL ID #: 15-23-300-039

Scott W.
Approved 10/1/18

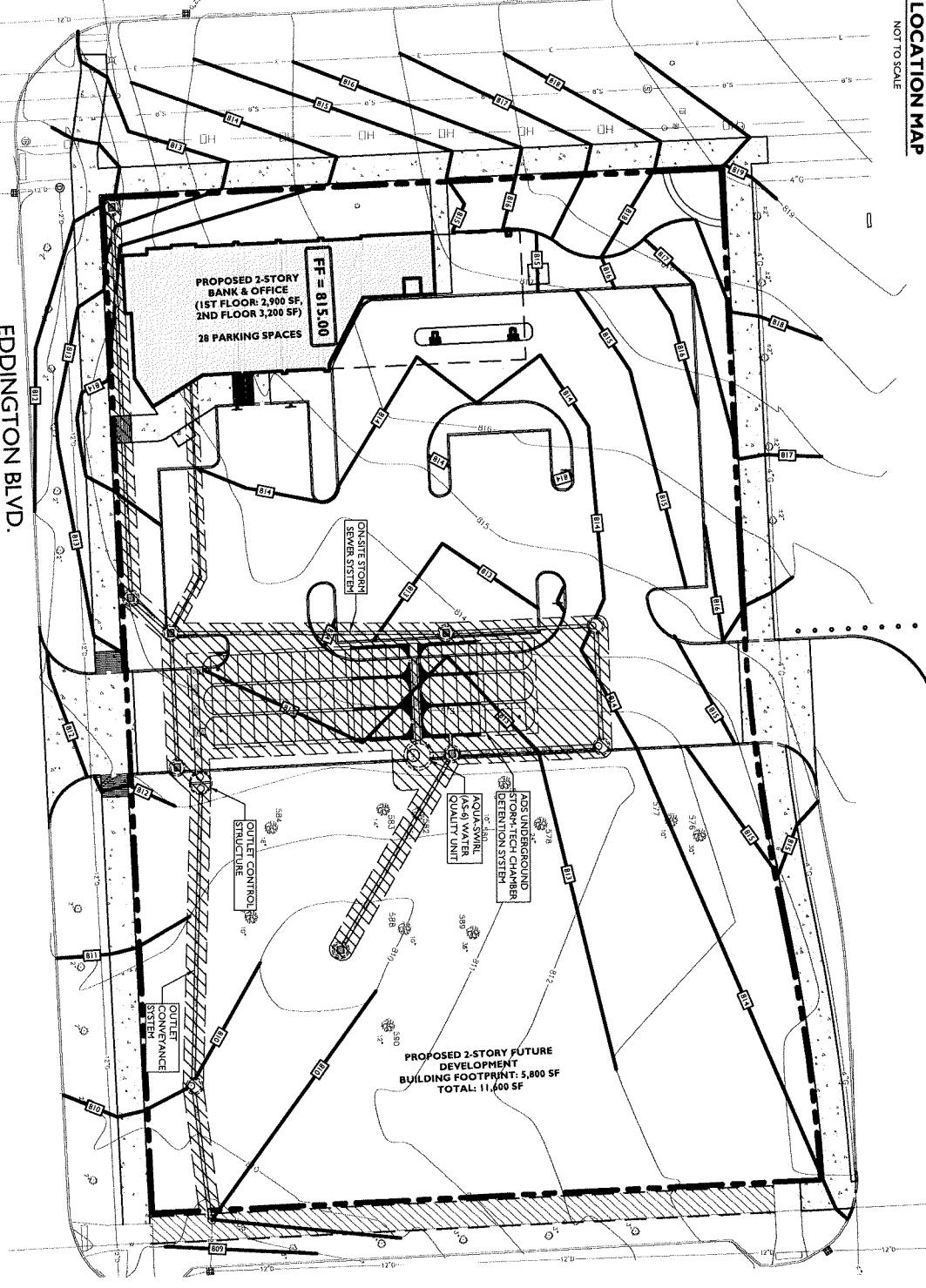
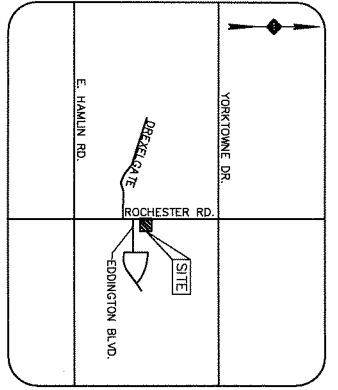
EXHIBIT "B"

V:\M20\1714-17262-Kum-Tec-Rochester Road and Dredgate Parkway, Rochester Hills, MI\CADD\Exhibits\2018-09-10 (LEGAL)-Stormwater Maintenance Exhibits.dwg

S. ROCHESTER RD.
150' WIDTH RIGHT OF WAY

EDDINGTON BLVD.
86' WIDTH RIGHT OF WAY

SITE LOCATION MAP
NOT TO SCALE



PROPOSED 2-STORY BANK & OFFICE
(1ST FLOOR: 2,900 SF,
2ND FLOOR 2,200 SF)
28 PARKING SPACES
FF = 815.00

PROPOSED 2-STORY FUTURE DEVELOPMENT
BUILDING FOOTPRINT: 5,800 SF
TOTAL: 11,600 SF

*OK APS
9/2/18*



SYMBOL	DESCRIPTION
	PROPOSED STORMWATER STRUCTURES
	PROPOSED STORMWATER PIPING
	CITY OF LIVONIA STORM MAINTENANCE RESPONSIBILITY



STORMWATER MAINTENANCE EXHIBITS

FIRST STATE BANK PROPOSED BANK WITH DRIVE-UP ATM

PARCEL ID: 15-23-300-039
SOUTH ROCHESTER ROAD & EDDINGTON BOULEVARD
CITY OF ROCHESTER HILLS
OAKLAND COUNTY, MICHIGAN

ISSUE	DATE	BY
2	09/10/2018	MTP
1	09/06/2018	MTP

NOT APPROVED FOR CONSTRUCTION

MICHIGAN LICENSE No. 021038123
LICENSED PROFESSIONAL ENGINEER

SCALE: (1/4)" = 50'

PROJECT ID: M-17262

TITLE:
STORM WATER SYSTEM PLAN

SHEET: 1 OF 2

First State Bank
Rochester Hills, Michigan

EXHIBIT 'C'

OPERATIONS AND MAINTENANCE MANUAL

FIRST STATE BANK
STORMWATER MAINTENANCE PLAN
ROCHESTER HILLS, MICHIGAN

PROPERTY OWNER:

First State Bank
24300 Little Mack
Saint Clair Shores, MI, 48080
Phone: (586) 445-4769
Contact: Gene Lovell

Prepared by:
Stonefield Engineering & Design, LLC
28454 Woodward Avenue,
Royal Oak, MI 48067
Phone: (248) 247-1115
Contact: Michael Pannell, P.E.

*JK ARS
9/20/18*

September 05, 2018

OPERATION AND MAINTENANCE MANUAL

INTRODUCTION:

This manual identifies the ownership, operation and maintenance responsibilities for all stormwater management systems including the underground detention system, underground storm sewer system, outlet control structures and mechanical pre-treatment devices as incorporated into detailed on approved Site Development Plans as prepared by Stonefield Engineering and Design, LLC. In order to comply with the local best management practices (BMP) and requirements, this manual should serve as a minimum performance standard. This manual should be retained intact and read in its entirety by all parties responsible for the operations and maintenance of the on-site BMP's.

OWNER:

First State Bank
24300 Little Mack
Saint Clair Shores, MI 48080
Phone: (586) 445-4769
Contact: Gene Lovell

PROPERTY INFORMATION:

This Operations and Maintenance Manual covers the storm water systems located at the following subject property:

land situated in the city of Rochester hills, county of Oakland, state of Michigan, and described as follows:

Town 3 North, Range 11 East, Section 23. Part of the Southwest ¼ Beginning at point distance North 01 degrees 50 minutes 00 seconds West 2.36 feet and North 85 degrees 52 minutes 55 seconds East 66.05 feet and South 01 degrees 48 minutes 43 seconds East 498.70 feet from West ¼ corner, thence North 88 degrees 11 minutes 17 seconds East 124.90 feet, thence along curve to left, radius 650 feet, chord bears North 83 degrees 37 minutes 30 seconds East 103.42 feet, distance of 103.53 feet, thence along curve to right, radius 535 feet, chord bears North 83 degrees 05 minutes 51 seconds East 75.30 feet, distance of 75.37 feet, thence South 01 degrees 48 minutes 43 seconds East 199.55 feet, thence South 88 degrees 11 minutes 17 seconds West 303.03 feet, thence North 01 degrees 48 minutes 43 seconds West 184.64 feet to beginning.

TAX ITEM NO. 15-23-300-039

STORMWATER MAINTENANCE EXHIBIT:

Exhibit 'B' of the Storm Water Maintenance Agreements the Storm Water System Plan which provides a clear presentation of all components of the storm water system. This system is subject to the long-term operation and maintenance responsibilities detailed in this manual. The system includes:

- Storm sewer pipes
- Stormwater detention chambers (ADS-Storm Tech)
- Storm sewer structures (manholes, inlets, catch basins etc.)
- Outlet control structures
- Pre-Treatment Devices (Aqua Shield-Aqua-Swirl)

INSPECTIONS:

The frequency of system inspections outlined in the manual and attached exhibits should be considered the minimum, if no events warrant additional inspections. The frequency of inspections should be fine-tuned over time as system specific conditions are better known and the rate at which certain maintenance operations need to be performed is better understood. Maintenance Inspection Checklists are provided for each of the BMP's in this system. Inspections should be performed by personnel responsible for maintenance and may need to be certified for confined space entry, depending on the component being inspected. Operation of the detention system, outlet control structures and pre-treatment devices may need to be inspected by practicing civil engineer familiar with their operation.

Records of all routine inspections and any work performed on the system for maintenance, repair or replacement should be maintained by the owner and kept for a minimum of ten (10 years). A copy of all

records should be provided to the City of Rochester Engineering Division. The records should include this manual, all inspection sheets, approved construction plans and as-built documents, a maintenance log of work performed to the system(s) and contact information for the system inspector, civil engineer, landscape architect, geotechnical engineer and contractor involved with the system.

STORMWATER SYSTEMS MAINTENANCE:

Regular inspections and maintenance of BMP's are necessary if these facilities are to consistently perform up to expectations. Stormwater systems are expected to perform quality and quantity control functions as long as the land use they serve exists. Failure to maintain the systems can create the following adverse impacts:

- Increased pollutants to surrounding surface water features
- Potential loss of life or property resulting from catastrophic failure of the facility
- Aesthetic or nuisance conditions, such as mosquitoes or reduced property values due to a degraded facility appearance.

Most of these impacts can be avoided through proper and timely inspection and maintenance. A major concern associated with these impacts is the general public's expectations related to the quality of life provided, in part, by construction of these systems. Inadequate maintenance means the general public may have a false sense of security. The most common cause of stormwater system failure is the lack of adequate and proper operation, inspection, maintenance and management.

Good design and construction can reduce subsequent maintenance needs and costs, but they can not eliminate the need for maintenance altogether. Maintenance requires a long-term commitment of time, money, personnel and equipment. Monitoring the overall performance of the stormwater management system is a major aspect of any maintenance program.

The maintenance responsibilities for these systems lie with the current property owner transfer with the property in perpetuity. If maintenance of the system is not performed, the City of Rochester Hills reserves the right to enter the property and perform all necessary work at the property owners' cost. Refer to *the Agreement for Storm Water System Maintenance* for additional Details.

General Maintenance Items:

Parking Lot Sweeping:

Routine sweeping of all paved surfaces provides a more attractive appearance and removes accumulations of sediment and trash that tend to migrate into stormwater management systems during rainfall events. Parking lot sweeping should be performed quarterly or as necessary to limit sediment and trash build-up.

Grass Mowing and Maintenance:

Mowing requirements at a facility should be designed to the specific site conditions, grass types and seasonal variations in climate. Requirements for grasses in bioswales will vary see the applicable section below. Grasses areas require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth. Provisions will need to be made to reseed and reestablish grass cover in areas damaged by sediment accumulation, stormwater flow, erosion or other causes. Dead turf will need to be replaced after being discovered. Inspection of the grass areas and other landscaping features should be made annually.

Trash and Debris Removal:

Removal of trash and debris from all areas of the property should be performed monthly. Removal of these items will prevent damage to vegetated areas and eliminate their potential to inhibit the operation of any of the stormwater management systems. Sediment, debris and trash that are removed and collected should be disposed of according to local, State Federal regulations at suitable disposal and/or/recycling centers.

Stormwater System Maintenance Items:

The following narratives give an overview of the maintenance requirements of the different components of the stormwater system. The inspection checklists attached to this report offer a more complete listing of what should be inspected, when inspection should occur and the likely frequency of maintenance activities.

Storm Sewer, Chambers and Structures:

Catch basins, inlets, manholes, outlet control structures, detention chambers and storm sewer pipes should be inspected to check for sediment accumulation and clogging, floatable debris, dead vegetation etc. the structures and sewers should also be observed during a wet weather event to ensure their proper operation. Accumulated sediment and debris should be removed on an annual basis or as needed based on observed conditions. Structural repairs or maintenance should occur as needed based on observed conditions such as cracks, spalling, joint failure, leakage, misalignment or settlement of structures. A civil engineer should be retained if problems are thought to exist.

Stormwater Pre-Treatment Devices:

Refer to the attached maintenance manuals from the manufacturer of all inspection and maintenance requirements for the pre-treatment structures.

The following pages include inspection checklists for the various devices and components listed above as well as the manufacturer's manuals for the stormwater pre-treatment structures.

STORM WATER MANAGEMENT SYSTEM – PERMANENT MAINTANANCE

DATE/TIME OF INSPECTION: _____

INSPECTOR: _____

MAINTENANCE ACTIVITIES	SYSTEM COMPONENTS						FREQUENCY	COMMENTS
	Catch Basins, Inlets, Manholes, Outlet Control Structures	Water Quality Unit	Storm Sewer and Detention Chambers	Buffer Strip	Pavement Areas			
Inspect for Sediment Accumulation/Clogging	X	X	X	X	X	X	Annually	
Inspect For Floatables, Dead Vegetation & Debris	X	X	X	X	X	X	Annually & After Major Events	
Inspect For Erosion				X	X		Annually & After Major Events	
Inspect All Components During Wet weather & Compare to As-Built Plans	X	X	X				Annually	
Inspect Inside of Structures and Pipes for Cracks Spalling, Joint Failure, Settlement, Sagging and Misalignment	X	X	X				Annually	
Inspect for Invasive Plant Species				X			Annually	
Remove Accumulated Sediments	X	X	X	X	X	X	Annually or As Needed (See Note Below)	
Remove Floatables, Dead Vegetation & Debris	X	X	X	X	X	X	Annually or As Needed	
Professional Application of Herbicide for Invasive Species				X			Annually or As Needed	
Sweeping of Paved Surfaces					X		As Needed	
Repair/Stabilize Areas of Erosion				X	X		As Needed	
Replace Dead Plantings & Reseed Bare Areas				X			As needed	
Structural Repairs	X	X	X				As Needed	
Make Adjustments/Repairs to Ensure Proper Functioning	X	X	X	X	X	X	As Needed	

NOTE: Manufactured treatment system and underground detention system to be cleaned according to the manufacturer's recommendations; at a minimum, whenever sediments accumulate to a depth of 6-12 inches, or if sediment resuspension is observed.

SUMMARY

INSPECTORS REMARKS:

OVERALL CONDITION OF FACILITY: _____

RECOMMENDED ACTIONS NEEDED: _____

DATES ANY MAINTENANCE MUST BE COMPLETED BY: _____

SHEET: 2 OF 2 STORM WATER SYSTEM INSPECTION CHECKLIST	MICHIGAN LICENSE NO. 0018382 EXPIRES 12/31/2018	STORMWATER MAINTENANCE EXHIBITS FIRST STATE BANK PROPOSED BANK WITH DRIVE-UP ATM					
	NOT APPROVED FOR CONSTRUCTION	SCALE: (H) NTS PROJECT ID: M17262 TITLE:			2	09/10/2018	MTP
	PARCEL ID: 15-23-300-039 SOUTH ROCHESTER ROAD & EDDINGTON BOULEVARD CITY OF ROCHESTER HILLS OAKLAND COUNTY, MICHIGAN			1	09/06/2018	MTP	
				ISSUE	DATE	BY	



Aqua-Swirl[®]
Stormwater Treatment System
Inspection and Maintenance Manual



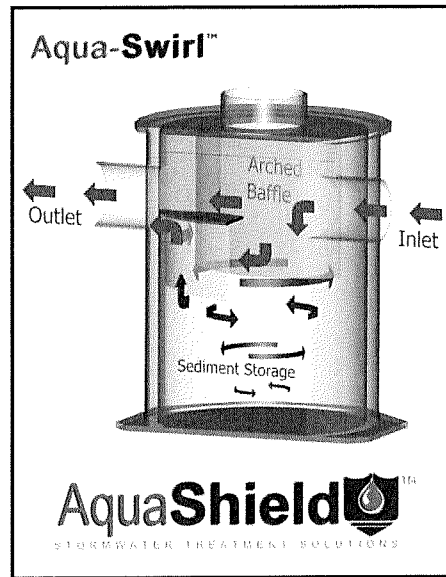
AquaShield[™], Inc.
2733 Kanasita Drive
Suite 111
Chattanooga, TN 37343
Toll free (888) 344-9044
Phone: (423) 870-8888
Fax: (423) 826-2112
Email: info@aquashieldinc.com
www.aquashieldinc.com

November 2016



Aqua-Swirl[®] Stormwater Treatment System

The Aqua-Swirl[®] Stormwater Treatment System (Aqua-Swirl[®]) is a vortex-type hydrodynamic separator designed and supplied by AquaShield[™], Inc. (AquaShield[™]). Aqua-Swirl[®] technology removes pollutants including suspended solids, debris, floatables and free-floating oil from stormwater runoff. Both treatment and storage are accomplished in the single swirl chamber without the use of multiple or hidden, blind access chambers.



Aqua-Swirl[®] Stormwater Treatment System



Floatable debris in the Aqua-Swirl[®]



System Operation

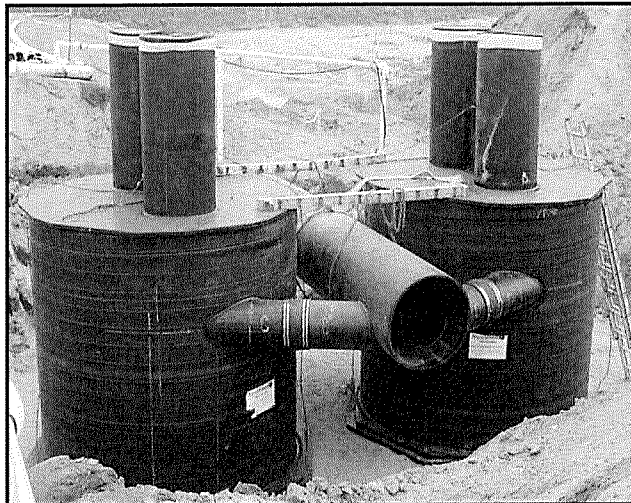
The treatment operation begins when stormwater enters the Aqua-Swirl[®] through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminants to settle to the base of the unit. Since stormwater flow is intermittent by nature, the Aqua-Swirl[®] retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms. A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest.

The treated flow then exits the Aqua-Swirl[®] behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.



Custom Applications

The Aqua-Swirl[®] system can be modified to fit a variety of purposes in the field, and the angles for inlet and outlet lines can be modified to fit most applications. The photo below demonstrates the flexibility of Aqua-Swirl[®] installations using a “twin” configuration in order to double the water quality treatment capacity. Two Aqua-Swirl[®] units were placed side by side in order to treat a high volume of water while occupying a small amount of space.



Custom designed AS-9 Twin Aqua-Swirl[®]



Retrofit Applications

The Aqua-Swirl[®] system is designed so that it can easily be used for retrofit applications. With the invert of the inlet and outlet pipe at the same elevation, the Aqua-Swirl[®] can easily be connected directly to the existing storm conveyance drainage system. Furthermore, because of the lightweight nature and small footprint of the Aqua-Swirl[®], existing infrastructure utilities (i.e., wires, poles, trees) would be unaffected by installation.



Aqua-Swirl[®] System Maintenance

The long term performance of any stormwater treatment structure, including manufactured or land based systems, depends on a consistent maintenance plan. Inspection and maintenance functions are simple and easy for the Aqua-Swirl[®] allowing all inspections to be performed from the surface.

It is important that a routine inspection and maintenance program be established for each unit based on: (a) the volume or load of the contaminants of concern, (b) the frequency of releases of contaminants at the facility or location, and (c) the nature of the area being drained.

In order to ensure that our systems are being maintained properly, AquaShield[™] offers a maintenance solution to all of our customers. We will arrange to have maintenance performed.



Aqua-Swirl[®] manhole cover



Inspection

The Aqua-Swirl[®] can be inspected from the surface, eliminating the need to enter the system to determine when cleanout should be performed. In most cases, AquaShield[™] recommends a quarterly inspection for the first year of operation to develop an appropriate schedule of maintenance. Based on experience of the system's first year in operation, we recommend that the inspection schedule be revised to reflect the site-specific conditions encountered. Typically, the inspection schedule for subsequent years is reduced to semi-annual inspection.



Maintenance

The Aqua-Swirl[®] has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free-floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

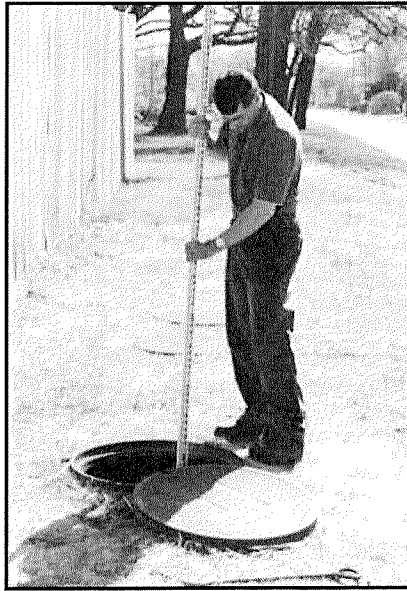
Aqua-Swirl[®] Inspection Procedure

To inspect the Aqua-Swirl[®], a hook is typically needed to remove the manhole cover. AquaShield[™] provides a customized manhole cover with our distinctive logo to make it easy for maintenance crews to locate the system in the field. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl[®] model size, and serial number.

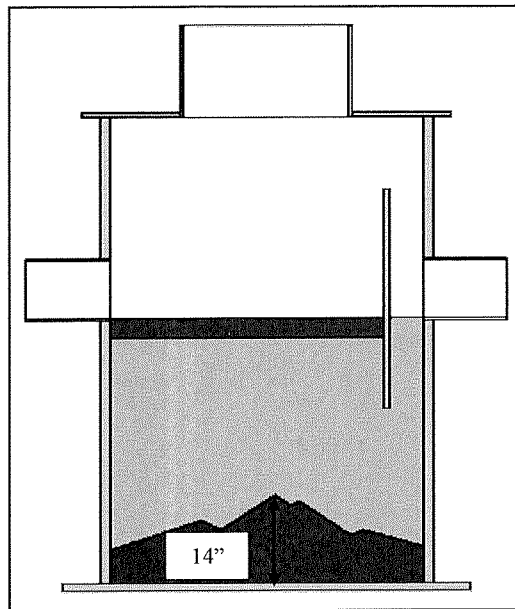
The only tools needed to inspect the Aqua-Swirl[®] system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water.

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the *top* of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl[®] design allows for the sediment to accumulate in a semi-conical fashion as illustrated below. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.



Sediment inspection using a stadia rod



Maximum recommended sediment depth prior to cleanout is 14 inches for all Aqua-Swirl® models

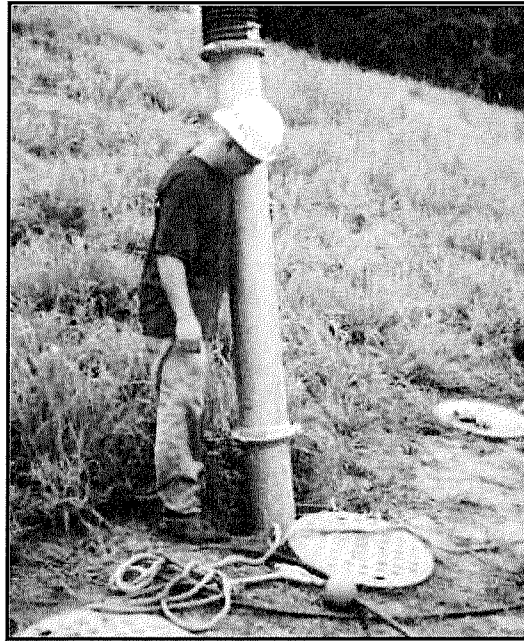
Aqua-Swirl® Cleanout Procedure

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose

from the surface reaching all the sides. Since there are no multiple or limited (blind) access chambers in the Aqua-Swirl[®], there are no restrictions to impede on-site maintenance tasks.

Disposal of Recovered Materials

AquaShield[™] recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used. AquaShield[™] also recommends that all materials removed from the Aqua-Swirl[®] and any external structures (e.g, bypass features) be handled and disposed in full accordance with any applicable local and state requirements.



Vacuum (vactor) truck quickly cleans the single open access swirl chamber

***Aqua-Swirl[®] Inspection and Maintenance Work Sheets
on following pages***

Aqua-Swirl[®] Inspection and Maintenance Manual

Work Sheets

SITE and OWNER INFORMATION

Site Name: _____

Site Location: _____

Date: _____ Time: _____

Inspector Name: _____

Inspector Company: _____ Phone #: _____

Owner Name: _____

Owner Address: _____

Owner Phone #: _____ Emergency Phone #: _____

INSPECTIONS

I. Floatable Debris and Oil

1. Remove manhole lid to expose liquid surface of the Aqua-Swirl[®].
2. Remove floatable debris with basket or net if any present.
3. If oil is present, measure its depth. Clean liquids from system if one half (½) inch or more oil is present.

Note: Water in Aqua-Swirl[®] can appear black and similar to oil due to the dark body of the surrounding structure. Oil may appear darker than water in the system and is usually accompanied by oil stained debris (e.g. Styrofoam, etc.). The depth of oil can be measured with an oil/water interface probe, a stadia rod with water finding paste, a coliwasa, or collect a representative sample with a jar attached to a rod.

II. Sediment Accumulation

1. Lower measuring device (e.g. stadia rod) into swirl chamber through service access provided until top of sediment pile is reached.
2. Record distance to top of sediment pile from top of standing water: _____ inches.
3. Maximum recommended sediment depth prior to cleanout is 14 inches for all models. Consult system shop drawing for treatment chamber depth as measured from the inlet pipe invert to base of the unit.

III. Diversion Structures (External Bypass Features)

If a diversion (external bypass) configuration is present, it should be inspected as follows:

1. Inspect weir or other bypass feature for structural decay or damage. Weirs are more susceptible to damage than off-set piping and should be checked to confirm that they are not crumbling (concrete or brick) or decaying (steel).
2. Inspect diversion structure and bypass piping for signs of structural damage or blockage from debris or sediment accumulation.
3. When feasible, measure elevations on diversion weir or piping to ensure it is consistent with site plan designs.
4. Inspect downstream (convergence) structure(s) for sign of blockage or structural failure as noted above.

CLEANING

Schedule cleaning with local vacor company or AquaShield™ to remove sediment, oil and other floatable pollutants. The captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate that appropriate actions be taken to clean and dispose of materials captured and retained by the Aqua-Swirl®. All cleaning activities should be performed in accordance with property health and safety procedures.

AquaShield™ always recommends that all materials removed from the Aqua-Swirl® during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements.

MAINTENANCE SCHEDULE

I. During Construction

Inspect the Aqua-Swirl® every three (3) months and clean the system as needed. The Aqua-Swirl® should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance trigger.

II. First Year Post-Construction

Inspect the Aqua-Swirl® every three (3) months and clean the system as needed.

Inspect and clean the system once annually regardless of whether it has reached its sediment or floatable pollutant storage capacity.

III. Second and Subsequent Years Post-Construction

If the Aqua-Swirl® did not reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl[®] reached full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months and cleaned as needed. The Aqua-Swirl[®] should be cleaned annually regardless of whether it reaches its sediment or floatable pollutant capacity.

IV. Bypass Structures

Bypass structures should be inspected whenever the Aqua-Swirl[®] is inspected. Maintenance should be performed on bypass structures as needed.

MAINTENANCE COMPANY INFORMATION

Company Name: _____

Street Address: _____

City: _____ State/Prov.: _____ Zip/Postal Code: _____

Contact: _____ Title: _____

Office Phone: _____ Cell Phone: _____

ACTIVITY LOG

Date of Cleaning: _____ (Next inspection should be 3 months from this data for first year).

Time of Cleaning: Start: _____ End: _____

Date of Next Inspection: _____

Floatable debris present: Yes No

Notes: _____

Oil present: Yes No Oil depth (inches): _____

Measurement method and notes: _____

STRUCTURAL CONDITIONS and OBSERVATIONS

Structural damage: Yes No Where: _____

Structural wear: Yes No Where: _____

Odors present: Yes No Describe: _____

Clogging: Yes No Describe: _____

Other Observations: _____

NOTES

Additional Comments and/or Actions To Be Taken	Time Frame

ATTACHMENTS

- Attach site plan showing Aqua-Swirl[®] location.
- Attach detail drawing showing Aqua-Swirl[®] dimensions and model number.
- If a diversion configuration is used, attach details showing basic design and elevations (where feasible).

Aqua-Swirl®

TABULAR MAINTENANCE SCHEDULE

Date Construction Started: _____

Date Construction Ended: _____

During Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity. In addition, the system should be cleaned at the **end of construction** regardless of whether it has reach full pollutant storage capacity.

First Year Post-Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity.

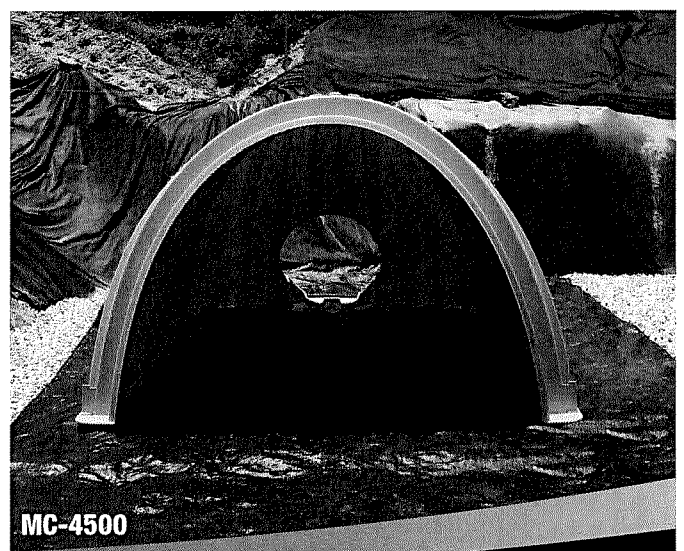
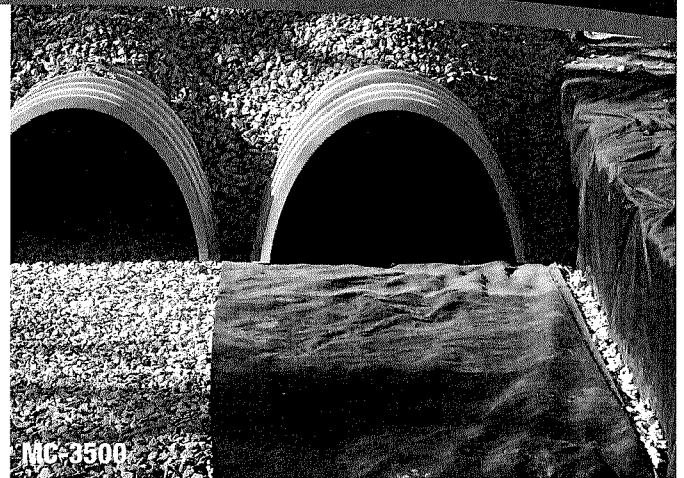
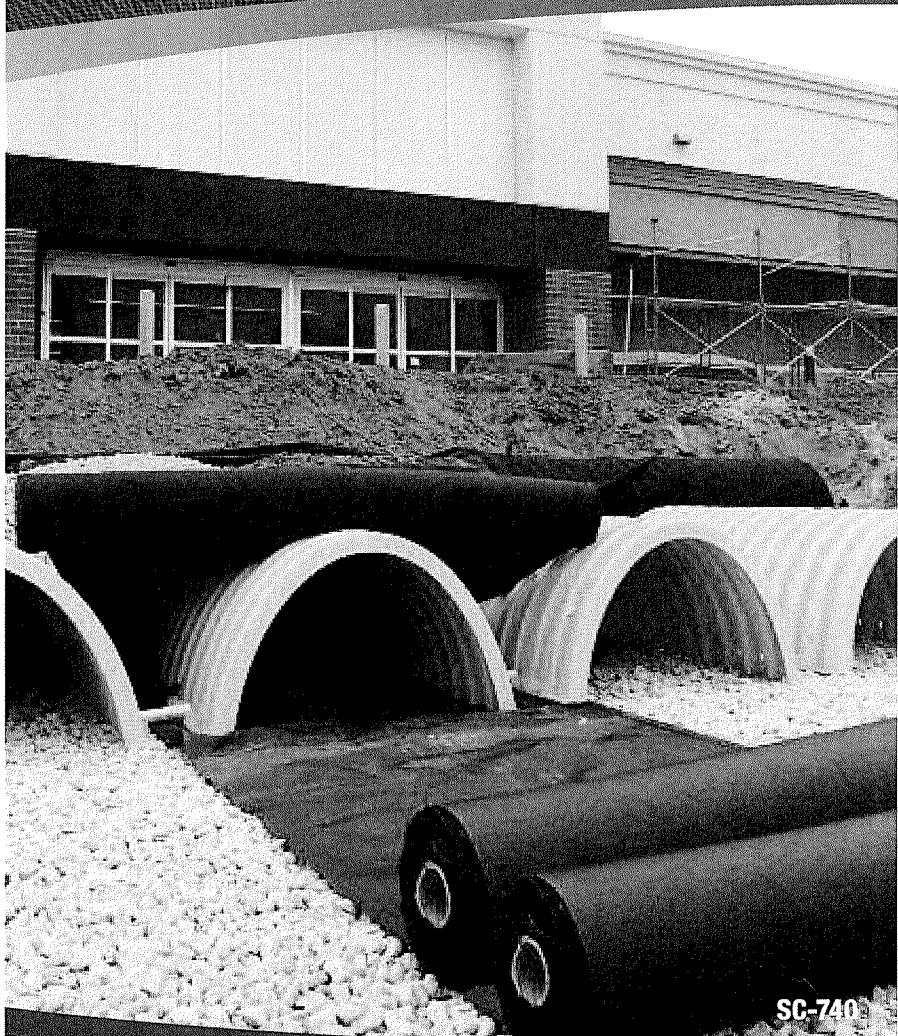
Second and Subsequent Years Post-Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed												X*
Inspect Bypass, maintain as needed												X*
Clean System*												X*

* If the Aqua-Swirl® did **not** reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® **reached** full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months or more frequently if past history warrants, and cleaned as needed. The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its full sediment or floatable pollutant capacity.

Isolator[®] Row O&M Manual



THE ISOLATOR[®] ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole provides access to the Isolator Row and typically includes a high flow weir. When flow rates or volumes exceed the Isolator Row weir capacity the water will flow over the weir and discharge through a manifold to the other chambers.

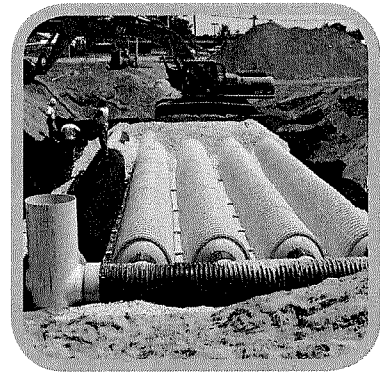
Another acceptable design uses one open grate inlet structure. Using a “high/low” design (low invert elevation on the Isolator Row and a higher invert elevation on the manifold) an open grate structure can provide the advantages of the Isolator Row by creating a differential between the Isolator Row and manifold thus allowing for settlement in the Isolator Row.

The Isolator Row may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

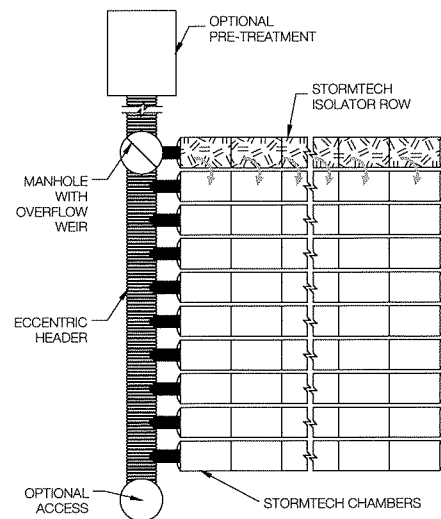
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

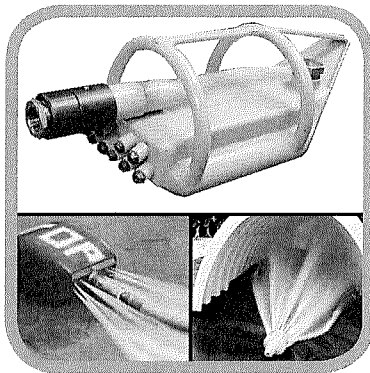


Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.



StormTech Isolator Row with Overflow Spillway (not to scale)





ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

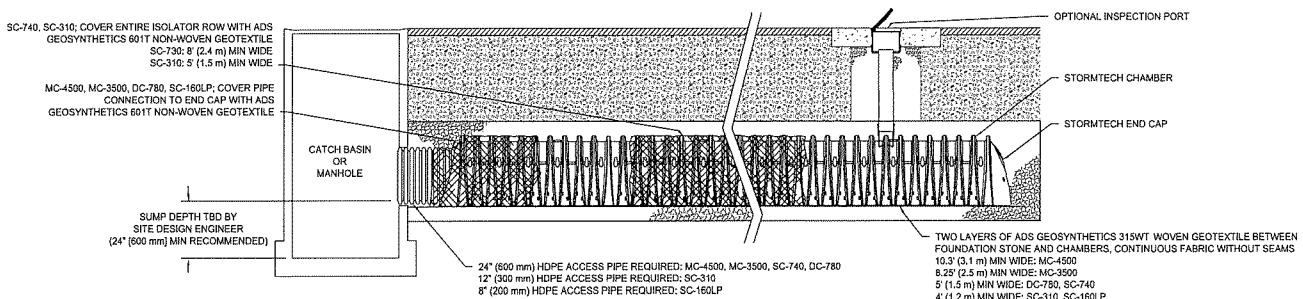
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
 - i. Remove cover from manhole at upstream end of Isolator Row
 - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
 - 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 - 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row using the JetVac process.

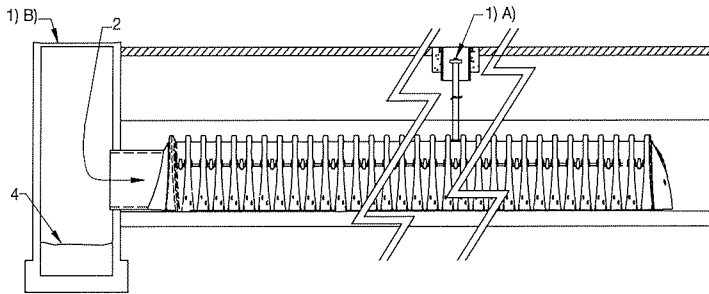
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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