



# **TECHNICAL OPERATIONS MANUAL**

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## Technical Operations Manual

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## **Description**

retain-it<sup>®</sup> is a subsurface Storm Water Management system constructed of precast concrete structures. They are installed in a side by side configuration creating a continuous internal flow channel integrated throughout the system. Systems are constructed with designated inlet and outlet modules, some with multiple inlets and outlets depending on the site storm water system layout. Infiltration systems typically have an inlet and sidewalls/ base constructed on a stone infiltration blanket with geofabric installed at the native soil interface. Other systems incorporate outlet flow control devices. Detention systems are typically lined with a watertight membrane and have inlet and outlet control devices.

The retain-it<sup>®</sup> system can consist of multiple varying layouts, with no two the same. Given this, it should be noted that the operation and maintenance requirements are very similar regardless of the intended layout. It is important that the end user know the specific elements of each system so as to understand how best to optimize it's operation.

## **Engineering Design Specifications**

The maintenance staff should be familiar with the engineering design specifications. Staff should obtain the approved drawings, specifications and calculations for review. Although, most systems are similar in design and installation, some have design specifics that may require special operation and maintenance procedures.

## System components

The systems are broken down into modules designed for various applications. The following generally describes the basic modules and related functions. See plan for system layout.

**Standard Structure modules:** consist of varying configurations of a similar precast concrete structure. In general, the footprint of all modules is 8' x 8'. The height is determined by the hydraulic design requirements and is manufactured in 3', 4' & 5' or custom ordered sizes (inside height dimension) increments. The roof/base is an H-20 loading, 8" thick (roof)/6" thick (base), in some cases cast into the legs (walls) of the structure. In other cases, the unit will be specified to be installed "upside down" with a separate 8" thick slab applied as a roof section. It is not uncommon for an access hole to be specified in the units' roof sections. Wall sections typically include some combination of solid or perforated sections with beams, weirs, orifices or an open window section developing internal flow channels within the system. Depending on the design, any possible combination can be found, and shall be referenced on the design drawing.

Typically, the modules are placed on 6" of structural stone leveling pad wrapped in a Mirafi 140 N (or 160 N) geofabric. Detention systems require a minimum of a 30 mil HDPE water tight liner with padded material to protect against rips or tears.

**Inlet/Outlet modules:** consist of a modified standard structure designed to receive the on-site drain pipes, directing flows into or out of the system. They may also consist of a structure with an inlet grate installed on top of the roof slab. In some cases the module shall be installed “upside down” with a separate roof slab.

Depending on the design application, the modules may specify additional “sump” depths at a lower elevation than the rest of the system or the installation of precast concrete splash pads, outlet elbows and tees, or flow splitter devices. Other modules may have a trash rack grate or filter installed. Outlet modules typically have flow control devices such as riser pipes with orifices and overflow weirs. Some have connections to under drain systems installed in the stone base.

Typically the inlet/outlet pipes will be installed in precast holes with size, location and elevation as determined by design. On watertight systems (detention) a rubber boot shall be supplied for a watertight connection between the structures, the water tight membrane and the pipe. On recharge systems (infiltration) a hole will be supplied and a masonry filled joint will suffice. On internal elbows and tees a hole will be supplied per specification and a masonry filled joint or an optional rubber boot may be used for installing pipes. Additional pipe straps may be specified.

These modules generally are supplied with a minimum 24” diameter access manhole to grade for inspection and maintenance purposes. Design options may specify alternative access methods, including larger diameter manholes, hatchways, ladders and safety features. Please note that entering a completed system is considered a “confined space” governed by all pertinent OSHA requirements for entry.

**Storage and Attenuation Channel modules:** consist of a standard structure with varying configurations of solid/perforated walls, internal beams, weirs, and open “windows” as per design specification. All internal flow control devices’ sizes, locations, shapes, elevations and general configurations shall be per design specifications. Internal flow channel configuration shall be per hydraulic design. Storage modules number and size are designed to contain a given volume, whereas the schematic layout configuration determines the hydraulic flow routing.

In general, the storage and attenuation channel modules dictate the average module height. Note that the “base” of the system is thus designated as the bottom of the module structure, where additional depth below the “base” indicates the structural stone leveling layer with the fabric wrap and shall be credited for additional storage volume. All elevations above the “base” describe the module storage volume, the structure column and cover requirements to finish grade.

**Treatment and Specialized modules:** consist of standard structures that have been modified to perform some form of water quality treatment or the conditioning of flow characteristics for a specific application. Configurations including elevation and dimensional specific locations, hydraulically sized control piping, under drains, pumps, flow control devices, or solids/liquid storage areas specified to design.

In storm water management applications, treatment units are used for oil and water separation, trash and debris collection or suspended solids separation. But configurations for advance treatment may incorporate chemical additive pumps, recirculation pumps, screens, filters, absorbent pads, sand or media filters or other design specifications.

Others system types include pumps for water harvesting, sumps, flow splitters, velocity reduction inducers or other configurations per design specification.

These modules shall all be equipped with a minimum 24" diameter access manhole for inspection and maintenance.

## **General Operations Guide**

**Installation per Design:** Operation is simple to follow where the installation was performed in accordance with the design specifications, drawings and calculations. Specifics shall be identified in the design drawings. As-built drawings will benefit the locating of specific design modules where the system has been buried below a parking lot area. Optional access manholes or removable grates may be installed above every inlet/outlet pipe and at critical design elements designated by the design.

**Daily Operation and Long Term Maintenance:** In general, daily usage of the system is self sufficient and will operate without requiring any outside assistance, except for periodic inspection to verify optimal performance and maintenance for removal of collected pollutants. A longer term maintenance program should incorporate a more thorough inspection of the all elements of the system to verify proper operating condition. This is more important with the infiltration type of systems where the soil infiltration surface may become restricted due to fine particle build up. Long term maintenance should include provisions for cleaning and removal of collected solids, oils and debris from the system.



**System Operation:** The system operational function is initiated according to rainfall runoff flows entering the structure. Internally, the runoff flows in a set pattern or sequence throughout the module layout in accordance with the hydraulic design conditions. The flows primarily operate on system head derived from the changes in elevation from the internal water surface and the outlet invert elevation. Some designs incorporate internal flow controls to satisfy hydraulic conditions that enhance water quality treatment or other intended purposes. Modified systems may incorporate a pump, but in general there are no mechanical apparatus required.

End user operations primarily consist of inspection and maintenance of the system over time.

**Periodic Inspection:** Important note - All storm water management systems react differently depending on the conditions that are characteristic to the contributing water shed. Variables such as storm intensity, runoff flow rates, site geology, surface stabilization and pollution load will affect the system operation. As does the inspection and maintenance frequency to ensure optimum effectiveness.

Inspections should be done periodically, with a greater number scheduled during the system start up and less frequently as the operator becomes familiar with the system performance characteristics. It is recommended that the end user keep records of the performance using the inspection log record sheet found in the back of this manual. These records shall identify the cycle of maintenance “system calibration” required for the specific applications based on the contributing water shed variables operating under “normal” conditions.

Please note that immediate maintenance may be required during “non-normal” events such as during adverse weather conditions or emergency fuel spills. See information on emergency spills in this manual.

Visual inspection of all assessable components shall be performed throughout the lifetime of the system. Access has been supplied at critical points to monitor hydraulic performance and removed pollutants buildup.

**Standard Maintenance:**

After construction has been completed and all disturbed surfaces have been stabilized by means of vegetation, asphalt or concrete surfaces, and all drainage system components have been constructed and are free of construction debris and sediments; then the storm water management system can be considered in an operational status.

Periodic visual inspections will help to identify issues of concern. The usual indicators are signs of slow flows, backed up water, visible oil, trash and debris or an excessive amount of sediment in the storage area.

Normal operational flows can be observed to flow freely at the predicted design elevations, from the inlet to the outlet module, following a serpentine path thru the storage and attenuation modules. Note that some modules are designed to permanently retain water where others may hold water and slowly release it over a typical 24 hour period. During a storm water event, the flows and water surface elevations will fluctuate from a low flow to a high flow/ storage status. The storage modules should fill during the event and drain down within a 24 hour period after the event has stopped. All pipes, orifices, weirs and standpipes should pass flows freely and at optimum capacity.

Standard maintenance is performed using a vacuum truck to suction the accumulated sediments, oils and greases and trash and debris from the system. Whereas an on-site maintenance staff can remove these items by hand, it is preferred that the vacuum truck be used as dictated by specific system conditions. When a specialized module designed to have a permanent water level is used, the vacuum truck should pump the liquid level down to inspect the below water elevation structures and sump storage areas.

Oils and greases can be handled by on-site staff by utilizing absorbent products that soak up the oils (and not) converting the oils from a liquid into a manageable solid form. These oil soaked absorbent materials should be disposed of in an approved manner.

Sediments, trash and debris shall be removed and disposed of in an approved manner.

Any indications of hazardous material, determined by visual inspection, testing, smell or abnormality, should be reported and handled per appropriate regulations.

## **Flow Conditions**

System operators should familiarize themselves with proper hydraulic flow condition indicators, acceptable depths of sedimentation, debris and trash build up, and concentrations of oils and greases.

*Hydraulic flow conditions* are those that are established by the design as either a flow/storage or as a water quality treatment function. Both have performance characteristics that can be visually identified so as to determine the effective and efficient operation of the system.

The engineering design drawings should note the various expected water surface level elevations that are achieved during different design storms within the various modules. Since it is difficult for a visual inspection to coincide with the exact time given water elevations are predicted, the following guidelines are given for evaluation.

## **Visual Inspection Guide:**

### Internal Flow Evaluation

Low flow: water should flow freely from the inlet to the outlet, travelling the intended attenuation path thru the system with the water surface elevation below the structure beam height (12" deep), the system should drain completely 24 hours after a storm event,

Medium flow: the system should hold and maintain a water level during the 24 hour storm event and yet continually fill as the storm increases or drain downward as the event recedes. Flow within the system should occur freely from inlet to outlet only being restricted when a flow control structure has been integrally designed in place. Flow control devices may result in a water level backing up either temporarily or permanently; noting devices such as water quality modules may require a permanent water level to operate properly (see water quality treatment). Other system applications should drain completely 24 hours after a storm event.

High flow: the system should fill to the maximum design storm water level elevation (hydraulic grade line) per design. In most cases, that is the highest storage elevation available in the system, at the underside of the module top slab, or the invert of the overflow pipe. As the storm event recedes, the water level should begin to drain down via flow thru the system and discharge. The system should drain completely within 24 hours after a storm event.

## **Pollutant Storage Capacities**

### Oil and Grease

Oil and Grease Collection (with optional Oil water separator module specified) - Oil and grease accumulation is generally a function related to vehicle parking lot and drive areas, oil generating land uses or emergency spill conditions. It is important to maintain the system from accumulating excessive volumes of oils in that they may wash over into other sections of the system potentially clogging and reducing the infiltration capacity, blocking control devices and contaminating the overall system. The following standards apply.

Oil should not accumulate more than a visible sheen on the water surface in the oil water separation module only. A sheen is described as a fine, thin oil layer on the water surface identified by the glossy rainbow colors. A dipstick (dry wooden stick) can be used as a probe to determine the thickness of oil on the surface.

Accumulated oils could be associated with insufficient maintenance or a potential large volume oil resource. Any accumulation of oil should be promptly maintained by an experienced waste handler. Emergency spills such as those generated by an accidental spill shall be contained and removed immediately before the next storm event. Spills shall be handled in accordance with local environmental regulations. See spill and accumulated oil maintenance procedures.

## Sediments

Sediments (with optional primary grit module or sedimentation modules specified) - Sediments shall be periodically removed from the system as they accumulate within the designated storage modules. The inlet modules are generally equipped with a sediment storage sump located in the base of the inlet structure. Inspection should be performed after major storm events or a minimum of annually, unless a different inspection cycle has been determined to be sufficient. Inspection shall consist of using a probe to determine the presence of and depth of the accumulated solids. Access is via the 24" manhole.

Note that excessive volumes of sediments will reduce the performance and efficiency of the system. Regional accumulations of solids such as those associated with ice and snow, may result in large springtime volumes of sand and gravels used for traction and ice control.

## Trash and Debris

Trash and Debris (with optional trash and debris module specified) - Trash and debris accumulates in the inlet module in three forms; floating debris, neutrally buoyant, and heavy material. The floating debris is visible from the access manhole floating on the water surface in the form of but not limited to wood, paper, plastic, foam, bottles and cans. The neutrally buoyant material resides below the surface and combines with the natural flow regime of the system. It is hard to detect and can only be recognized when at a high concentration appears as a thickening of the water viscosity. Heavier material will simply settle to the sump base and combine with the sediments.

Note that trash and debris typically cause the most problems when they become lodged in a flow control device such as an outlet elbow, riser pipe, and orifice or weir structure. This can be detected visibly when the system is pumped down during maintenance. It can also be evaluated as a condition when flow is impeded and the water level backs up higher than the design elevations.

## **Emergency Spill Conditions (with optional emergency spill control module specified):**

Emergency spill conditions are defined as an excessive accumulation of hydrocarbons such as oil, gasoline, diesel fuel, transmission oil or antifreeze usually resulting from an accidental discharge. Excessive accumulation is described as any amount larger than a thin "sheen" visible on the water surface.

Care should be given in handling these types of fluids. The incident should be reported to the appropriate authorities and should be mitigated by a hazardous waste consultant approved for such matters.

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Maintenance Log

Storm Water Management System

Location:

ID #:

Date

Inspection Notes

Inspector

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**Note the following conditions:**

Inlet Module

Outlet Module

Water Quality Module

Oil Elbow

Oil Accumulation

Sedimentation Accumulation

Trash and Debris Quantity

Flow Conditions

Flow Control Outlet Structure

Overflow Pipe