



February 2019

**GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) AND
PHOSPHORUS TREATMENT**

For

Hydro International, Inc.

Up-Flo® Filter

Using Filter Ribbons

Ecology's Decision:

- 1. Based on Hydro International's application submissions, Ecology hereby issues general use level designation (GULD) for Basic and Phosphorus Treatment for the Up-Flo® Filter using Filter Ribbons:**
 - Sized at a hydraulic loading rate of no greater than 15 gallons per minute (gpm) per filter module or 0.8 gpm per sq. ft. of filter ribbon surface area.**
- 2. Ecology approves use of the Up-Flo® Filter using Filter Ribbons for treatment at the above flow rates per filter module, and sized based on the water quality design flow rate. Calculate the water quality design flow rates using the following procedures:**
 - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.**
 - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.**
 - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.**
- 3. The GULD has no expiration date, but may be amended or revoked by Ecology.**

Ecology's Conditions of Use:

Up-Flo® Filters using Filter Ribbons shall comply with these conditions:

- 1. Design, assemble, install, operate, and maintain Up-Flo® Filter units in accordance with Hydro International's applicable manuals and documents and the Ecology Decision.**
- 2. Each site plan must undergo Hydro International's review and approval before site installation. This ensures that site grading and slope are appropriate for use of an Up-Flo® Filter.**
- 3. Up-Flo® Filter ribbons shall conform to the specifications submitted to and approved by Ecology.**
- 4. Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.**
 - The Up-Flo® Filter using Filter Ribbons is designed for a target maintenance interval of 8-12 months. Maintenance includes floatables removal, oil removal, sediment removal, and Ribbons washing or replacement.**
 - An Up-Flo® system tested at the Lake Union Ship Canal Test Facility in Seattle, WA required servicing after 4 months or 12.7% of a water year. Monitoring personnel observed similar cases of early blinding with other systems evaluated at the Test Facility. The runoff from the Test Facility may be unusual and service needs of systems installed at the Test Facility may not be indicative of other, more typical, sites.**
 - Test results provided to Ecology from an Up-Flo® Filter System evaluated in a lab following New Jersey Department of Environmental Protection Laboratory Protocol for Filtration MTDs have indicated the Up-Flo® Filter System is capable of longer maintenance intervals.**
 - Owners/operators must inspect Up-Flo® systems for a minimum of twelve months from the start of post-construction operation to determine site-specific service needs of the system. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.**
 - Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.**

5. Install the Up-Flo® Filter in such a manner that you bypass flows exceeding the maximum operating rate and you will not resuspend captured sediment.
6. Discharges from the Up-Flo® Filter using Filter Ribbons shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Hydro International
Applicant's Address: 94 Hutchins Drive
Portland, ME 04102-1930

Application Documents:

Technical Evaluation Report Hydro International Up-Flo® Filter Stormwater Treatment System Verification Project, Prepared for Hydro International Inc., Prepared by Herrera Environmental Consultants, Inc. December 2018

Technical Memorandum: Up-Flo® Filter Post TER Hydraulic Monitoring Proposal, Hydro International Inc. and Herrera Environmental Consultants, Inc., February 2019

NJCAT Technology Verification Up-Flo® Filter (with Filter Ribbon Media), Hydro International, December 2016

Applicant's Use Level Request:

- General Use Level Designation as a Basic and Phosphorus Treatment device in accordance with Ecology's *Stormwater Management Manual for Western Washington*.

Applicant's Performance Claims:

Based on laboratory testing, at a hydraulic loading rate of 15 gpm per filter module using Filter Ribbons, the Up-Flo® Filter is able to remove:

- 80% of total suspended solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 50% or greater total phosphorus for influent concentrations 0.1 to 0.5 mg/L.

Recommendations:

Ecology finds that:

- Hydro International has shown Ecology, through laboratory and field testing, that the Up-Flo® Filter using Filter Ribbons is capable of attaining Ecology's Basic and Phosphorus treatment goals.

Findings of Fact:

Field Testing

- Herrera Environmental Consultants, Inc. conducted monitoring of the Up-Flo® Filter using Filter Ribbons following TAPE protocol between April 2017 and March 2018. Herrera collected flow-weighted composite samples during 18 separate storm events for TSS analysis and 10 separate storm events for total phosphorus analysis. They also collected peak flow grab samples from an additional two storm events for both TSS and total phosphorus analysis. The system was sized at a hydraulic loading rate of 15 gpm per filter module.

- The D₅₀ of the influent PSD ranged from 2 to 106 microns, with an average D₅₀ of 11 microns.
- Influent TSS concentrations ranged from 20 to 98 mg/L, with a mean concentration of 39.4 mg/L. The bootstrap estimate of the upper 95 percent confidence limit (UCL95) of the mean TSS effluent concentration was 15.5 mg/L.
- Total phosphorus influent concentrations ranged from 0.105 to 0.360 mg/L, with a mean concentration of 0.111 mg/L. The bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 50%.
- The system was subjected to atypical sediment loading and needed to be serviced after 4 months, or 12.7% of a water year. Monitoring personnel observed similar sediment loading and blinding issues with other systems evaluated at the Test Facility. The runoff from the Test Facility is not expected to be characteristic of other urban runoff applications. Future inspections will be used to supplement these findings regarding ribbon longevity.

Laboratory Testing

- Hydro International conducted laboratory testing of the sediment removal efficiency of the Up-Flo® Filter using Filter Ribbons at their full-scale hydraulic testing facility in Portland Maine in August 2016. Hydro International contracted with FB Environmental to provide third party oversight of the testing.
 - The test unit was comprised of a full-scale six filter module Up-Flo® Filter installed in a 4-foot diameter concrete manhole.
 - The Up-Flo® Filter was evaluated at a hydraulic loading rate of 15 gpm per filter module, in complete accordance with the New Jersey Department of Environmental Protection (NJDEP) Protocol to Assess Total Suspended Solids Removal of a Filtration Manufacture Treatment Device.
 - Hydro International tested the Up-Flo® Filter over 10 runs with each run lasting 30-minutes. Hydro International collected 6 grab samples during each run.
 - Flows during the 10 runs ranged from 90.0 to 92.2 gpm, with an average of 91.7 gpm. This corresponds to a hydraulic loading rate of 15.3 gpm per filter module.
 - The test sediment was a blend of commercially available silica sand grades that met the specification requirements of the NJDEP laboratory protocol for evaluating filter technologies. Influent concentrations ranged from 190 mg/L to 211 mg/L, with an average concentration of 203 mg/L.
 - TSS removal efficiency during the 10 runs ranged from 81% to 84%, with an average removal efficiency of 82.2%.

Other Up-Flo® Filter using Filter Ribbons matters to be addressed by the company:

1. Conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest.

Technology Description: Download at: www.hydro-int.com/us/products/up-flo-filter

Contact Information:

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Ecology web link: <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

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Revision History

Date	Revision
February 2018	PULD Granted
February 2019	GULD Granted