



Stormwater Filtration System

Technical Brief





Fundamentals

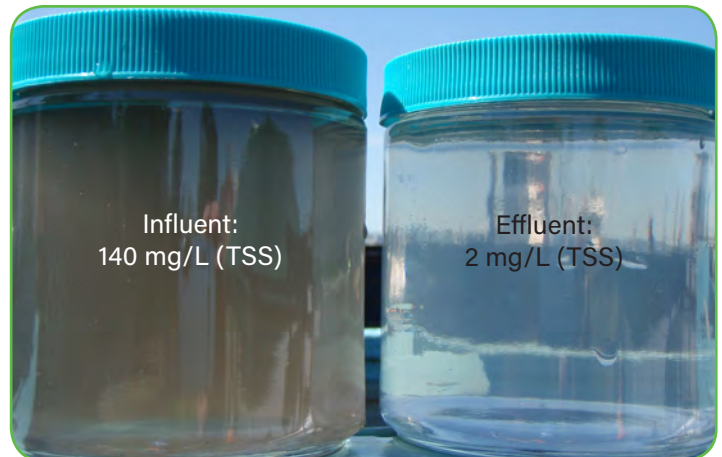
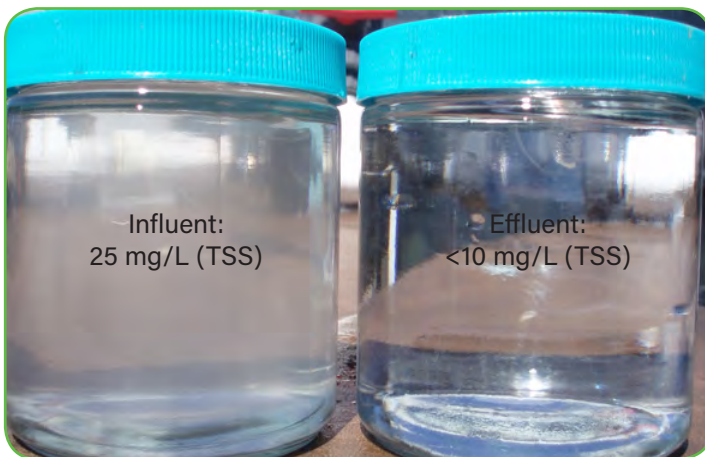
► **AquiP® (uh-kwip)** is a patented, multi-media filtration system for stormwater applications.

This robust stormwater treatment Best Management Practice (BMP) produces good stand-alone stormwater quality for a wide range of industries, is easy to retrofit to existing stormwater collection and conveyance infrastructure, and requires no operator attention during rain events.¹

AquiP uses passive adsorptive filtration technology designed specifically for reduction of stormwater pollutants such as suspended solids, turbidity, heavy metals, nutrients and organics from runoff. The system uses no chemicals and has no moving parts, making operation simple and

safe. AquiP's pre-treatment chamber in sequence with inert and adsorptive filtration media effectively trap pollutants in a media package that is flexible and reliable. Compliance samples are collected from a sample port at the outlet of the filter. AquiP has received a coveted third-party regulatory approval² for removal of particulates, dissolved metals and phosphorus from stormwater.

Below are photographs of samples taken before and after running through the AquiP filtration system. AquiP is an effective filter, producing good quality effluent under a range of influent stormwater quality conditions.



Actual full-scale AquiP influent and effluent samples



Installation of an AquiP 50 system



Aerial view of an AquiP 400 system

¹ When properly maintained.

² The Washington Department of Ecology has conditionally approved (CULD) the AquiP enhanced stormwater filtration system for use for basic, enhanced and phosphorus treatment. The CULD was granted as a part of the Technology Assessment Protocol Ecology (TAPE) process upon review by a Board of External Reviewers consisting of stormwater experts from across the United States. According to Ecology, "...several other states, counties, and cities use TAPE certification to determine whether a technology can be installed within their jurisdiction, including Sacramento CA, Denver CO, St. Louis MO, the State of New Hampshire, Portland OR, the Oregon Department of Transportation, and the State of Rhode Island. AquiP is arguably the first and only industrial stormwater treatment BMP approved for the treatment of solids, metals, and nutrients." The CULD approval means that AquiP can be specified and is approved for use on new and redevelopment projects in Washington as well as retrofits without additional review.

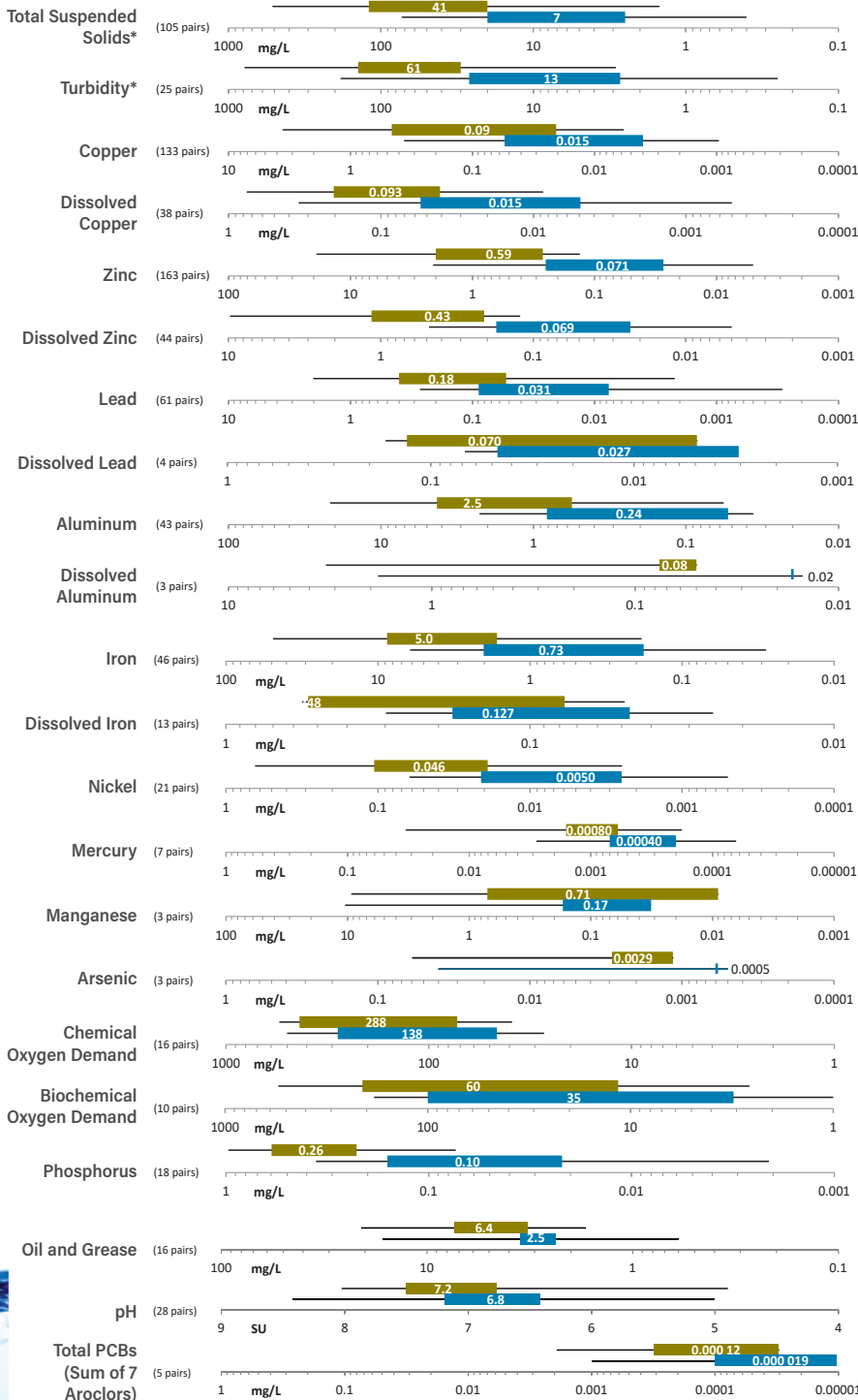


Performance

► Aqip performance has been demonstrated at a wide range of industrial sites...

...including scrap and recycling, galvanizing, metal fabrication, wood treating, automobile salvage, transportation equipment, food processing, power generation, marine and a host of others. Representative performance data from Aqip are

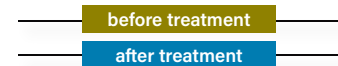
presented in the figure below. As the data show, Aqip produces good quality stormwater effluent for the regulated stormwater pollutants as well as for many pollutants that are not currently regulated, but may be in the future.



Median values reported for each sample set:

"Box" Range = 25th - 75th percentile

"Whisker" Range = 5th - 95th percentile



Data set includes some non detected (ND) values reported at ½ the detection limit for purposes of statistical ranges.



*Particle size cutoff for Aqip filtration system is approximately 3 microns. Third-party sampling and analysis of influent and effluent stormwater from an Aqip 160SBE filtration system at design flow rates showed influent particle size ranging from 0-200 microns (mean particle size 42 microns) and effluent particle size ranging from 0-2.8 microns (mean particle size 1 micron). The results verified that Aqip filtration system removes a range of particle sizes from sand and silt to medium/fine clays.



Operation



- 1 Inlet:** Polluted stormwater flows into Aquip via the inlet pipe, then into the pretreatment chamber. In most cases stormwater is pumped to Aquip using a simple float-actuated stormwater pump. To assist with predictive maintenance, a totalizing flow meter on the system lets owners track the rate and volume of stormwater treated.
- 2 Pretreatment Chamber:** This chamber is customized to naturally balance the water chemistry and improve the removal efficiency of the treatment. The pretreatment process works synchronously with Aquip's filtration media to settle solids, remove free oil, and to create metal complexes that are more easily removed in the filtration chamber. A pretreatment pump may be included on certain models to encourage aerobic conditions and to draw down the standing water level between storm events. A mosquito barrier is provided for systems without a pretreatment pump.
- 3 Inlet Distributor:** Water from the pretreatment chamber flows by gravity into the inlet distributor and is dispersed along the full length of the filter media bed, optimizing the contact area of stormwater with filtration media. Energy dissipation fabric lies beneath the distributor to prevent scouring of the media bed.
- 4 Filtration Chamber:** Layers of inert and adsorptive media remove stormwater pollutants such as metals, particulates, oil, organics and nutrients. Within the filtration chamber, pollutant removal occurs through

a combination of straining, filtration, complexing, adsorption, absorption, micro-sedimentation, and biological degradation, producing excellent stormwater quality. Once passed through the media bed, clean stormwater flows into the high efficiency underdrain and out of the system, leaving the targeted pollutants permanently trapped in the filter bed. The filter bed drains down between storm events. Integrated ladders, filter maintenance tools and an external filter bed drain-down make routine maintenance without special equipment simple.

- 5 Adjustable Head Control:** Clean stormwater leaving the system passes through the adjustable head control. This device can be adjusted in the field and assures optimal water/filter media contact under a range of operating conditions.
- 6 Emergency Overflow:** In the event that the filter bed becomes plugged during a rain event, the emergency overflow allows the stormwater to bypass. Filter bed plugging is avoided by maintaining the system per StormwaterRx recommendations.
- 7 Outlet:** Clean stormwater discharges from the Aquip unit by gravity through the outlet.
- 8 Outlet Sample Port:** This port provides safe and easy access to system effluent for stormwater compliance sampling.



Product Configurations

► *Aquip is available in a number of modular configurations.*

Whether the structure is steel, plastic, concrete, fiberglass, earthen, or owner-supplied, Aquip owners can expect the same high level of performance and reliability

StormwaterRx products are known for. Available upgrades for Aquip include freeze protection, covers and seismic tie-downs.

Retrofit

Our most popular Aquip configuration, Aquip in a steel or recyclable plastic configuration for above-ground applications, can be moved into place quickly and can be operational in as little as one day.

- Easy to install with a forklift
- Open top for easy access and simple inspection
- Built-in ladders allow simple maintenance
- Nine sizes available for flow rates up to 600 gpm



New Construction

Suitable for buried or full gravity applications, this Aquip configuration is designed as a pre-cast concrete vault or panel-vault. The below-ground configuration can be supplied with a solid lid for traffic-rated applications or with an open top for easy inspection and maintenance.

- Ideal for large sites subject to freezing weather or where space is at a premium
- Often used for new or redeveloped industrial sites
- Flexible layout to accommodate varying site orientations
- Flow rate virtually unlimited



Portable

Aquip 10P and 25S are small-scale, passive water treatment technologies ideal for enhanced filtration of stormwater runoff from small sites, or for use in washwater pre-treatment applications. The 10P (available in plastic) and the 25S (made of steel) are both easily moved with a forklift and come ready to install and operate: simply connect to your pump and outlet.

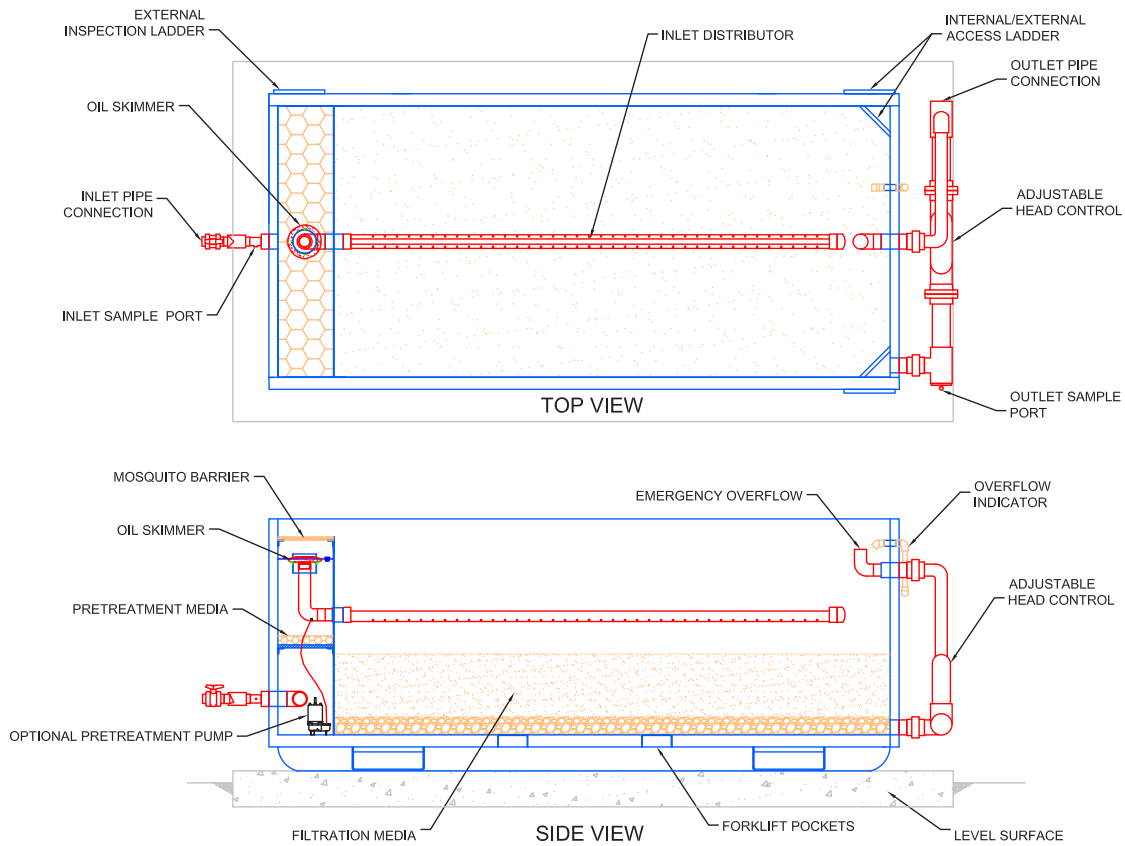




Sizing

Aquip Model	Treatment Rate (gpm)*		Sizing Guideline (acres)*	Footprint (ft x ft)
	Standard	Range		
10	10	5 - 15	< 0.25	3' x 9'
25	25	12 - 40	0.25 - 0.5	5' x 9'
50	50	25 - 75	0.5 - 1	7' x 12'
80	80	40 - 120	1 - 2	7' x 16'
110	110	60 - 170	2 - 3	8' x 18'
160	160	80 - 240	3 - 4	8' x 27'
210	210	100 - 320	4 - 5	8' x 32'
300	300	150 - 450	5 - 8	13' x 36'
400	400	200 - 600	6 - 10	13' x 47'

* *Varies by region*

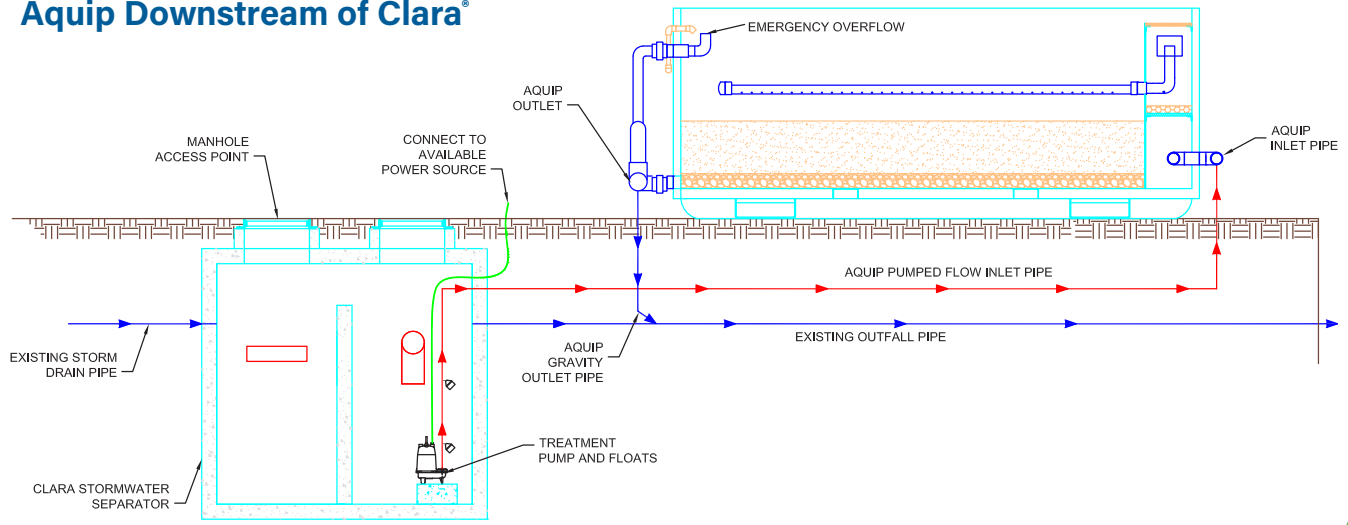


Reclaiming the World's Water.®

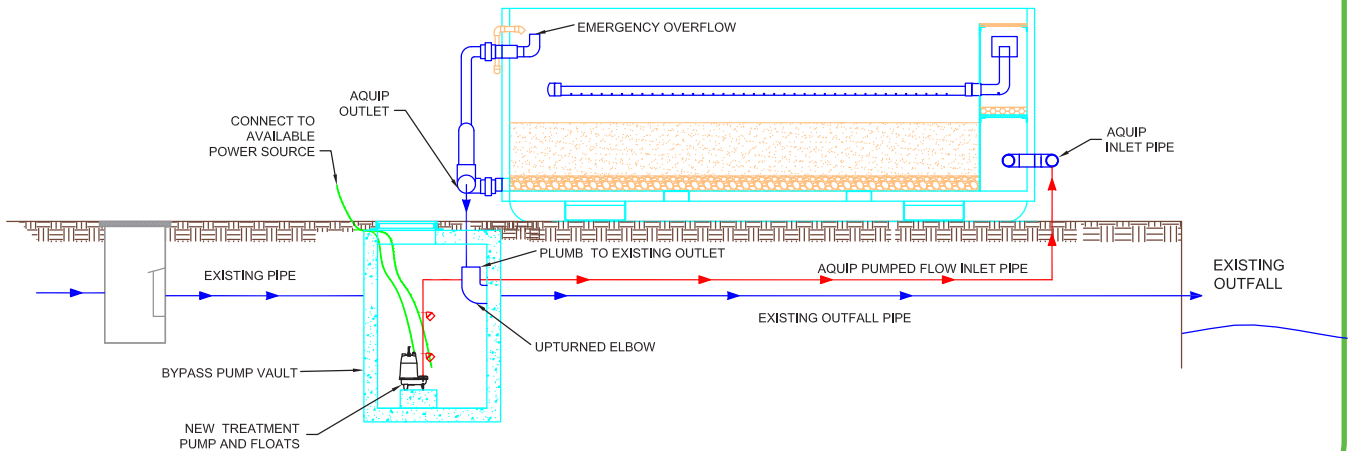


Site Configurations

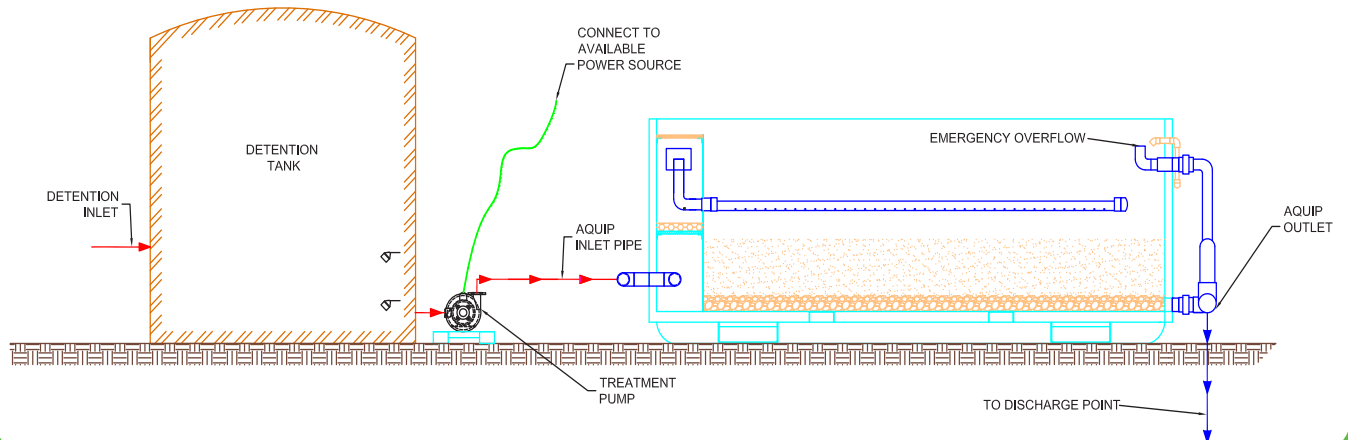
Aqip Downstream of Clara®



Aqip Downstream of Bypass Pump Vault



Aqip Downstream of Detention





Testimonials



"StormwaterRx represents best-of-class solutions that provide a ROI every manager will appreciate. Given the choice to proactively make a capital investment versus being subject to third party lawsuits, I will always choose to invest in the future of our business. This is why we partnered with StormwaterRx."

— Edward Kangeter IV, CEO, CASS, Inc., Oakland, California, USA

"Canal Boatyard is known as one of the cleanest facilities on the waterfront. We are proud to be at the forefront of the effort to keep runoff pollution to a minimum. The 2009 installation of the StormwaterRx system filters runoff water from the entire yard; ensuring contaminants don't make it into the waterway."

— Ivaylo Minkov, Manager, Canal Boatyard, Seattle, Washington, USA

"Locally-available treatment systems seemed to offer a short-term solution, but we wanted to future-proof our site for generations to come, and we found the ability to do so with the systems we invested in from StormwaterRx."

— Trevor Munro, Managing Director, Metalcorp NZ Ltd., Christchurch, New Zealand

"We are always looking for ways to improve the efficiency and sustainability of our operations, and making sure we have the best stormwater treatment equipment is part of that commitment. The StormwaterRx treatment train has put Davis Industries at the forefront of environmental technology for the scrap metal recycling industry and we are proud to own one of the most environmentally protective systems on the East Coast."

— Bill Bukevicz, Executive Vice President, Davis Industries, Lorton, Virginia, USA



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