GRAHAM LAKE IMPROVEMENT DISTRICT
REPORT NUMBER: 18P-00209-00

PILOT PLANT STUDY

DIRECT FILTRATION USING NEXTSAND™ FILTRATION MEDIUM

SEPTEMBER 11, 2020 CONFIDENTIAL

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GRAHAM LAKE IMPROVEMENT DISTRICT

CONFIDENTIAL

PROJECT NO.: 18P-00209-99
CLIENT REF:CLIENT REF. NO
DATE: SEPTEMBER 11, 2020

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September 23, 2020

Confidential

Graham Lake Improvement District
3567 East Road
Denman Island, BC   V0R 1T0

Attention: Blake Hanna, Trustee

Dear Sir:

Subject:

Client ref.:

Enclosed please find our report with our evaluation on your NextSand^{TM} pilot testing.

Yours sincerely,

Thomas Munding, P.Eng.
Senoir Process Engineer, Infrastructure

TM/LP
Encl.
cc:
WSP ref.:

REVISION HISTORY

FIRST ISSUE

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Sept 23, 2020
Date

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Name, Designation
Carol Campbell, Senior Project Manager

Sept 23, 2020
Date

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ABBREVIATIONS

GLID	Graham Lake Improvement District
mg/L	Milligrams per Litre
NTU	Nephelometric Turbidity Unit
WTP	Water Treatment Plant

1 INTRODUCTION - GRAHAM LAKE IMPROVEMENT DISTRICT

The Graham Lake Improvement District (GLID) is located on Denman Island, BC. They are currently operating a small community water supply system that consists primarily of a submerged intake screen in Graham Lake with gravity flow through a pipeline to a WTP.

In the WTP the lake water is treated by:

- Inlet mesh strainer followed by,
- Duplex sand media filtration (without coagulation) followed by,
- Duplex UV reactors for UV disinfection followed by,
- Chlorination with sodium hypochlorite followed by,
- 3,200 L chlorine contact tank followed by,
- Chloramination with liquid ammonium sulphate.

The chloraminated water is then discharged into a 20,000 L clear well from where it is supplied to the water distribution network by distribution pumps.

This treatment is not sufficient to meet the *Canadian Drinking Water Quality Guidelines* (CDWQG) for protozoa treatment, turbidity, and colour based on the historical data. In the past, the treated water experienced elevated disinfection by-products formation (DBPs) due to colour and natural organic matter (NOM) present in the lake source water. This has been partially addressed by the introduction of chloramination as part of the overall water treatment process. The treated water also experiences seasonal elevated turbidity from heavy precipitation runoff into the lake. The Improvement District is committed to provide additional treatment to comply with the CDWQG and the BC Surface Water Treatment Objectives (SWTO) through a rigorous evaluation of the best available treatment technologies to meet the particular challenges of this application. Some of these challenges include; remote island location, small community with limited budget, no sewer connection for disposal of filtration residuals, restricted availability of land requiring small WTP footprint, and high variability in flow demand.

1.1 WATER TREATMENT OPTIONS – BACKGROUND

In 2018 GLID retained WSP to conduct a marketplace scan and assessment of proven and emerging water treatment technologies that had the potential to achieve SWTO. One of the deliverables from that project was WSP's final report – *Water Treatment System Options Assessment - November 2019*. The report set out 6 options for consideration. Each option took into consideration the specific characteristics of Graham Lake water as well as the various constraints associated with upgrading GLID's existing WTP and with the District's current operating model (e.g. the availability of financial resources to acquire, implement and support the ongoing operation of the upgraded WTP).

A portion of Table 4-2 from the *Water Treatment Systems Option Assessment* report summarizing the six (6) options has been included below. The Direct Filtration option has been highlighted.

Table 4-2: Comparison of Filtration Options

CRITERION	HFNF PENTAIR	CERAMIC ULTRA-FILTRATION	ION EXCHANGE	DIRECT FILTRATION	OZONE + BIOFILTER	CARTRIDGE FILTER
System Complexity	Moderate	Moderate	Low	Moderate	Moderate	Low
Technology	Established	Established	Established	Established	Emerging	Established
Process Risk	Negligible	Negligible	Low	Need to establish and adjust coagulation and assess	May need regular attention to assess bio activity and adjust	High
Maintenance	Low (highly automated)	Low (highly automated)	Low	High	High	Low
Reliability	High likelihood of frequent membrane breakage & repair	Robust	High	Proven reliability, but requires attention	High	Robust
Residuals	25% reject water direct discharge to environment, spent cleaning chemicals	Thickened sludge, dispose at landfill, or possibly to land	Backwash and rinse water / Brine waste from regeneration	Thickened sludge with DeWRS, dispose at landfill, or possibly to land	Backwash with concentrated water and biomass	None
Disinfection Requirements	Chlorine (+ UV if no integrity testing)	Chlorine + UV	Chlorine + UV	Chlorine + UV	Chlorine + UV	Chlorine + Ammonia + UV

Source: *Water Treatment System Options Assessment - November 2019*.

1.2 INITIAL PILOT TESTING PROJECT – ION EXCHANGE AND CARTRIDGE FILTRATION

An evaluation of the six water treatment options was conducted and a determination was made to pilot test two of the options – ion exchange (resin organics trap) and cartridge filtration.

The pilot testing of these two options took place in late 2018 – early 2019, during a period when Graham Lake water was subject to high levels of colour and turbidity. A detailed description of the pilot testing project along with the results from the pilot testing of the ion exchange and the cartridge filtration technologies were captured in a report prepared by WSP – *Pilot Plant Study – Cartridge Filtration and Resin Organics Trap – November 2019.*

The key findings from the pilot testing project were that:

1 Cartridge filtration (whether operated as a stand-alone technology or whether combined with ion exchange technology) was unable to reduce water turbidity to below the drinking water guideline of 1.0 NTU

2 Ion exchange technology was effective in removing dissolved organics but had no impact on turbidity (i.e. turbidity was not reduced)
3 The ion exchange technology (if operating at normal WTP production levels) would generate a substantial volume of saline wastewater that would result in significant treatment and/or disposal costs.

Based on the result from the pilot testing project it was determined that the ion exchange and cartridge filtration technologies – in and of themselves – would be removed from consideration as candidates for GLID's WTP Upgrade project.

1.3 DIRECT FILTRATION – BROWN'S BAY

Direct filtration with coagulation was one of the six options identified in the report prepared by WSP - *Water Treatment System Options Assessment - November 2019.* Direct filtration relies on untreated water being dosed with a suitable coagulant to destabilize the charge on fine particulate and colloidal solids in the water thus allowing them to agglomerate into larger flocs that can be removed when they come into contact with some form of filtration medium (e.g. sand, activated charcoal, other filtration material – including the combination of multiple filtration mediums) to trap and retain material suspended in the water.

A direct filtration-based WTP is used by Brown's Bay Resort ('Brown's Bay') located approximately 20 km north of Campbell River on Vancouver Island that uses NextSand™ filtration media without any coagulation. The source of raw water for Brown's Bay is nearby lake (i.e. surface water - the same type of water source that GLID makes use of). This means that like GLID, Brown's Bay must also comply with SWTO.

While there are a number of similarities between GLID's and Brown's Bay's operating environments, there are also a number of important differences. Some of the differences include:

- **Ready Access to a Septic System** - Brown's Bay WTP has access to a septic tank system for the disposal of the wastewater stream generated by the backwashing of the direct filtration chambers
- **Larger Demand** – Brown's Bay supplies a small residential community, a marina complex, an RV Park and a commercial fish processing plant (which is in and of itself a major consumer of treated water)
- **Larger Accessible Real Estate 'Footprint'** – Brown's Bay Resort owns the property that the WTP sits on and all of the surrounding property (so there is no limitation with respect to size and configuration of the WTP)
- **Smaller Distribution System** – While Brown's Bay has a larger demand for treated water, it has no storage for treated water as well as a much smaller distribution system than GLID. As a result, Brown's Bay does not have to have a secondary water treatment process (such as GLID's chloramination system) to guard against the formation of undesirable water treatment bi-products in the distribution system

A comparative analysis of untreated water from Brown's Bay and Graham Lake was conducted by an independent water testing laboratory. The results of that comparative analysis identified several notable differences in raw water characteristics between Brown's Bay and Graham Lake, including:

True Colour	Graham Lake water had 1.5 times the level measured at Brown's Bay • Graham Lake = 20.6 true colour units • Brown's Bay = 13.9 true colour units
Total Dissolved Solids	Graham Lake water had 1.9 times the level measured at Brown's Bay • Graham Lake = 46 mg/l • Brown's Bay = 24 mg/l
Turbidity	Brown's Bay water had approx. 1.6 times the level measured in Graham Lake • Graham Lake = 1.19 NTU • Brown's Bay = 1.87 NTU

During the period from 2018 through 2020 there were numerous interactions between representatives from GLID and Brown's Bay Resort. These interactions included but aren't limited to:

Site visit to Brown's Bay Resort by GLID Trustees

- Conversations and email exchanges between representatives from GLID and Brown's Bay
- Conversations between GLID and the WTP supplier for Brown's Bay (EDS Pumps and Water Treatment Ltd)
- Conversations between GLID representatives and Brown's Bay's contracted WTP operator (Core Water Management)
- Sharing of laboratory results from the analysis of raw water samples from Brown's Bay and Graham Lake

The pictures below show some of the direct filtration components operating within the WTP at Brown's Bay.

2 DIRECT FILTRATION PILOT TESTING PROJECT

Direct filtration water treatment systems (such as the one in use at Brown's Bay) have a number of advantages when compared to certain other treatment options. Examples of these advantages include:

- Low-to-moderate capital costs related to the acquisition and implementation of the system components
- Simple, proven treatment processes and technologies
- Potential for 'lights-out' operation (i.e. reduced need for operator intervention)
- Low demand for operating consumables (i.e. water treatment chemicals)
- No significant waste products generated by treatment process

Given these factors, along with the fact that there are some similarities between Brown's Bay and Graham Lake untreated water, a decision was made by GLID in late 2019 to conduct a pilot test of the direct filtration technology that is operating in Brown's Bay WTP.

2.1 DIRECT FILTRATION PILOT TESTING SYSTEM DESCRIPTION

In January 2020, WSP provided GLID the design specifications for a pilot treatment test platform based on the direct filtration system operating in Brown's Bay. The direct filtration pilot test platform was assembled by EDS Pumps and Water Treatment and installed by GLID in the WTP. The pilot test system consisted of:

- one 1.67 CU FT water filtration tower with Tahoe head with 1" PVC connections
- 1.5 CU FT of NextSand ™ filtration medium (housed within the filtration tower)

The pilot system incorporated the appropriate valves, pressure port and sample taps used for operating the pilot and collecting the operating data.

Figure 1 shows the process flow schematic of the direct filtration pilot system arrangement.

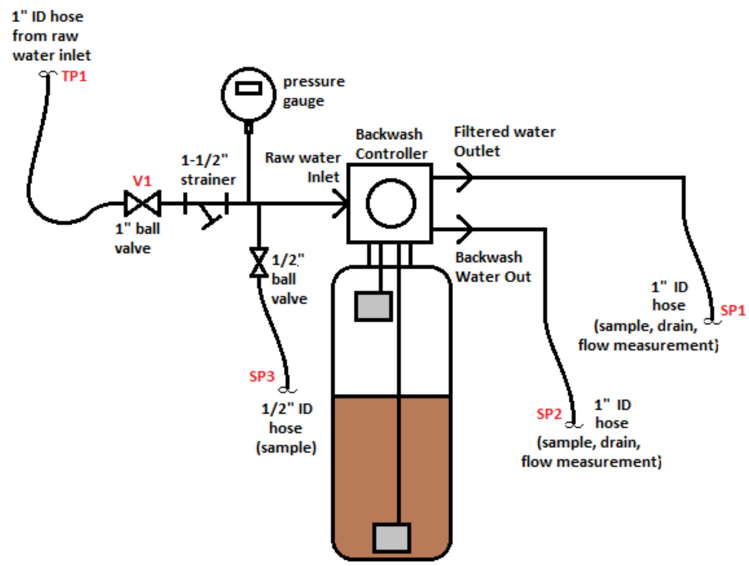


Fig. 1 - Pilot System Arrangement

Figure 2 is a picture of the direct filtration pilot system using the NextSand™ filtration medium installed in the GLID WTP.

Appendix A – Direct Filtration Pilot Testing Data Log sets out the processes and data associated with the pilot testing program.

2.2 DIRECT FILTRATION PILOT TESTING RESULTS

Table 1 – Direct Filtration Using NextSand™ Filtration Medium: Turbidity Results shows that "turbidity out" (i.e. SP1 - the turbidity level measured after treatment through the direct filtration system filled with NextSand™) was not significantly different than "turbidity in" (i.e. SP3 – the turbidity level measured before being processed through the direct filtration system). In other words, direct filtration using the NextSand™ filtration medium was not able to achieve the SWTO standards that GLID must comply with.

Table 2-1: Direct Filtration Using NextSand™ Filtration Medium: Turbidity Results

	Flow Rate	Pressure	Turbidity		pH		Temperature	
YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
2020-03-12 11:59	5.90	1.38	1.44	1.37	7.23	7.17	7.10	7.00
2020-03-13 9:31	5.40	1.41	1.44	1.34	7.04	7.09	6.90	6.90
2020-03-13 20:02	5.50	1.95	1.26	1.20	7.06	7.10	7.06	7.04
2020-03-14 9:13	5.20	3.88	1.39	1.31	7.18	7.23	6.70	6.80

2.3 DIRECT FILTRATION PILOT TESTING CONCLUSIONS

Information that was derived from GLID's initial ion exchange and cartridge filtration pilot testing (Nov 2018-Feb 2019) indicated that the material(s) contributing to the turbidity level of untreated water in Graham Lake is less than 0.5µm in size. Based on this information WSP and EDS Pumps and Water Treatment Ltd advised GLID (in advance of GLID conducting the direct filtration pilot test program) that it would be unlikely that direct filtration without coagulation (using NextSand™ as the filtration medium) would reduce turbidity levels to acceptable levels as set out in the SWTO (i.e. less than 1.0 NTU). This advice was based on the fact that information contained in NextSand™ product specification information sheet highlighted that it is most effective in filtering out material in the 3-5µ*m* size range (see Appendix B – NextSand™ Product Specification Sheet).

While there are a number of similarities between the surface water of Graham Lake and the lake supplying the Brown's Bay Resort, there are enough differences in the composition and characteristics of the two water bodies such that the direct filtration water treatment system used by Brown's Bay can not be used by GLID in order to meet SWTO standards.

APPENDIX

A

DIRECT FILTRATION PILOT TESTING DATA LOG

APPENDIX

Graham Lake Improvement District, Denman Island, BC

Nextsand Filtration Pilot Testing Data Log

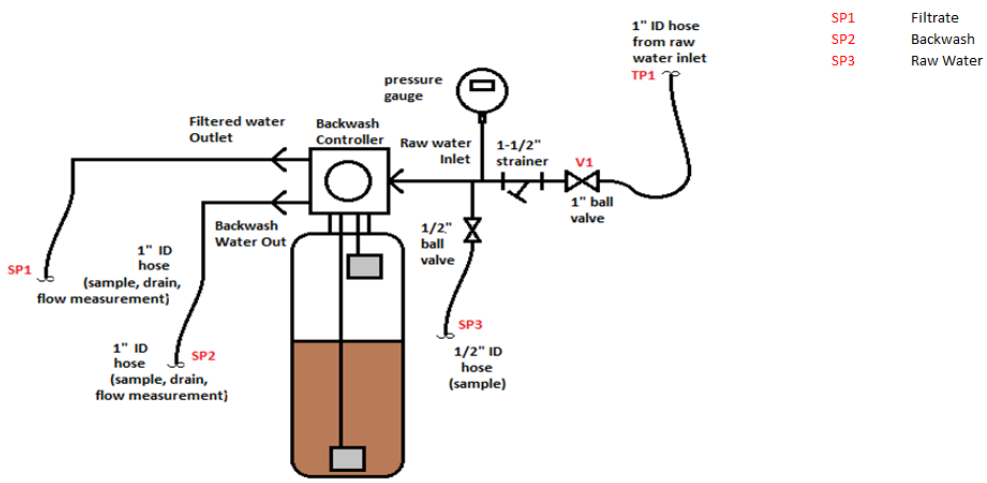


Fig. 1 - Pilot System Arrangement

STEP 1 The NextSand filter should then be backwashed to remove all media "fines". This may take several backwashes until the backwash water discharge (SP2) from the filter looks as clean as the raw water supply (TP1). If possible, run the WTP during one of the NextSand initial backwashes and confirm the backwash flow rate through the filter at the WTP reduced supply pressure.

Record the results; date & time of backwash start & stop and backwash flow rate (WTP off and WTP running).

FLOW TEST - This is the maximum flow I could get with the valve wide open

WTP not filling

YYYY-MM-DD HH:MM	SP1 flow rate	PG1 Pressure
2020-02-14 16:10	15 gpm	10.9 psi

WTP filling

YYYY-MM-DD HH:MM	SP1 flow rate	PG1 Pressure
2020-02-14 16:58	10.00	6.2 psi

BACKWASH TEST

WTP not filling

YYYY-MM-DD HH:MM	SP2 flow rate	PG1 Pressure
2020-02-14 17:19	1.45	0.93

APPENDIX

STEP 2 Put the NextSand filter into filtration and adjust the influent valve (V1) to provide approximately 10 GPM filtration flow rate at (SP1). Use bucket test to confirm the filtration flow
Measure and record; date & time of filtration start, flow rate, filter inlet pressure, raw water turbidity and pH, filtrate turbidity and pH. Also record the temperature of the water.
After 6, 12,, and 24 hours of filtration, measure and record; date & time, flow rate, filter inlet pressure, raw water turbidity, filtrate turbidity.

	Flow Rate	Pressure	Turbidity		pH		Temperature	
YYYY-MM-DD HH:MM	SP1	PG1	SP3 (RAW)	SP1	SP3 (RAW)	SP1	SP3 (RAW)	SP1
2020-02-16 8:50	10.00	6.02	1.57	1.57	6.34	6.42	6.90	6.70
2020-02-16 15:00	10.00	6.25	1.46	1.46	7.01	6.94	7.70	6.70
2020-02-16 21:00	10.00	6.31	1.63	1.60	7.04	7.20	7.00	7.00
2020-02-17 9:30	10.00	6.85	1.61	1.54	6.73	6.69	6.60	6.70

YYYY-MM-DD HH:MM	Activity	Drain Turbidity (SP2)
2020-02-17 10:15	Backwash Start	
2020-02-17 10:22	Backwash	3.65
2020-02-17 10:23	Backwash End	2.79
2020-02-17 10:24	Rinse Start	2.21
2020-02-17 10:28	Rinse End	1.61
2020-02-17 10:36	Backwash Start	2.37
2020-02-17 10:38	Backwash	2.90
2020-02-17 10:51	Backwash Start	
2020-02-17 10:56	Backwash	1.93
2020-02-17 10:59	Backwash End	1.83
2020-02-17 10:04	Rinse End	1.66

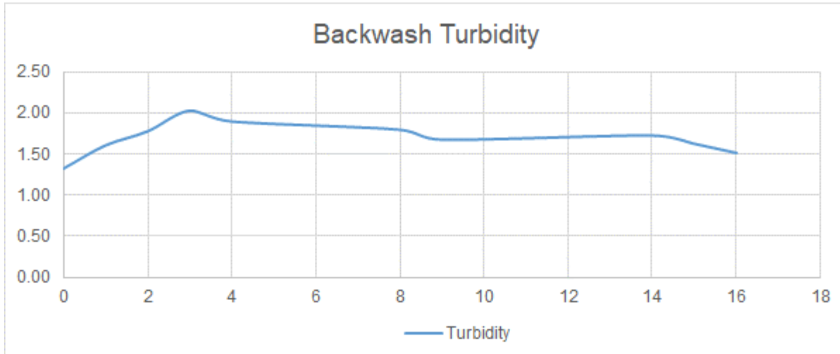
STEP 3 After about 24 hours of filtration, backwash the filter.
Note and record; date & time of backwash start & stop, the backwash flow rate and the approximate backwash time required before the backwash water flows clean (ie. dirt has been displaced from the NextSand media).

	Flow Rate	Pressure	Turbidity		pH		Temperature	
YYYY-MM-DD HH:MM	SP1	PG1	SP3 (RAW)	SP1	SP3 (RAW)	SP1	SP3 (RAW)	SP1
2020-02-19 9:37	10.20	5.93	1.37	1.36	6.63	6.52	6.80	7.30

		Flow Rate	Pressure	Turbidity	Minutes
	YYY-MM-DD HH:MI	SP2	PG1	SP2	
Backwash Start	2020-02-19 9:56	1.07	0.93	1.32	0.00
	2020-02-19 9:57			1.60	1.00
	2020-02-19 9:58			1.77	2.00
	2020-02-19 9:59			2.02	3.00
	2020-02-19 10:00			1.89	4.00
	2020-02-19 10:04			1.79	8.00
	2020-02-19 10:05			1.67	9.00
	2020-02-19 10:10			1.72	14.00
	2020-02-19 10:11			1.62	15.00
Backwash Stop	2020-02-19 10:12			1.51	16.00
Rinse Start	2020-02-19 10:14	2.70		1.69	
	2020-02-19 10:15			1.67	
Rinse Stop	2020-02-19 10:18			1.51	

APPENDIX

Turbidity (NTU)



Backwashing Process (elapsed time in minutes)

STEP 4 Allow the NextSand filter to run through four (4) additional filtration & backwash cycles at high filtration flow rate (10 GPM).
At about mid-way through each filtration cycle, measure and record; date & time, flow rate, filter inlet pressure, raw water turbidity, filtrate turbidity. For the third filtration run, also measure and record the raw water pH and the filtrate pH.

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3 (RAW)	SP1	SP3 (RAW)	SP1	SP3 (RAW)	SP1
Start	2020-02-28 8:49	10.00	4.91	1.64	1.80	6.29	6.27	7.00	7.00
Mid-Way	2020-02-27 21:05	9.30	6.60	1.69	1.58	6.47	6.58	7.00	6.90
End	2020-02-28 9:03	8.40	8.89	1.87	1.81	6.56	6.47	6.90	7.40

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-02-28 10:37	10.00	4.76	1.86	1.90	6.82	6.85	6.80	7.10
Mid-Way	2020-02-28 20:24	9.70	5.26	1.84	1.90	6.68	6.71	6.90	6.60
End	2020-02-29 9:00	9.80	5.24	1.44	1.18	6.96	7.04	6.60	6.40

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-02-29 9:49	10.00	4.88	1.89	1.83	7.23	7.04	6.80	6.80
Mid-Way	2020-02-29 20:46	9.70	5.85	1.54	1.61	7.21	7.12	6.60	6.80
End	2020-03-01 8:24	9.40	7.37	1.41	1.51		7.06	6.80	6.80

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-03-01 8:55	10.00	4.85	1.74	1.74	6.90	6.90	6.80	6.80
Mid-Way	2020-03-01 20:09	9.70	5.53	1.70	1.71	6.84	6.87	6.90	6.90
End	2020-03-02 10:55	9.00	7.31		1.61	7.40	7.53	6.70	7.00

STEP 5 & For the next filtration run, adjust the influent valve (V1) to provide approximately 8 GPM filtration flow rate. Use bucket test to confirm the filtration flow rate.

8 GPM

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-03-03 9:14	8.00	2.91	1.74	1.66	7.13	7.23	6.80	6.70
Mid-Way	2020-03-03 20:10	7.70	3.07	1.66	1.61	6.98	6.94	6.98	6.90
End	2020-03-04 8:35	7.30	4.06	1.62	1.53	7.20	7.09	6.90	6.70

6 GPM

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-03-04 9:03	6.00	1.40	1.62	1.61	6.78	6.77	6.60	6.50
Mid-Way	2020-03-04 20:30	6.00	1.79	1.67	1.55	7.53	7.60	7.00	7.10
End	2020-03-05 8:10	5.90	2.38	1.62	1.56	7.07	7.02	6.90	6.70

4 GPM

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-03-05 8:48	4.00	0.04	1.54	1.52	7.14	7.08	6.80	6.60
Mid-Way	2020-03-05 20:49	3.50	0.73	1.70	1.51	7.20	7.10	6.80	6.80
End	2020-03-06 8:48	3.30	2.00	1.58	1.41	7.05	7.00	6.70	6.70

2 GPM

		Flow Rate	Pressure	Turbidity		pH		Temperature	
	YYYY-MM-DD HH:MM	SP1	PG1	SP3	SP1	SP3	SP1	SP3	SP1
Start	2020-03-06 9:25	2.20	-0.69	1.67	1.61	6.60	6.66	6.80	6.70
Mid-Way	2020-03-06 20:45	2.10	-0.40	1.61	1.44	7.12	missed	6.80	7.00
End	2020-03-07 8:42	1.98	0.18	1.47	1.32	6.91	6.88	6.70	6.70

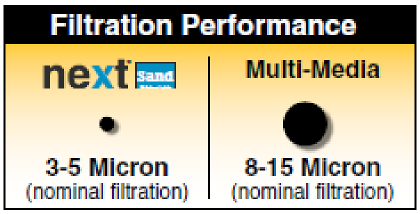
APPENDIX

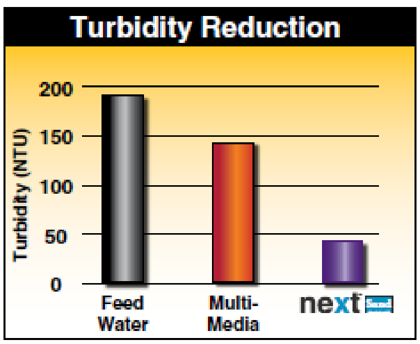
B

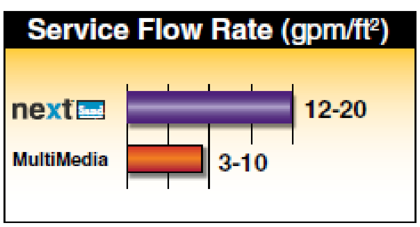
NEXTSAND™ PRODUCT SPECIFICATION SHEET

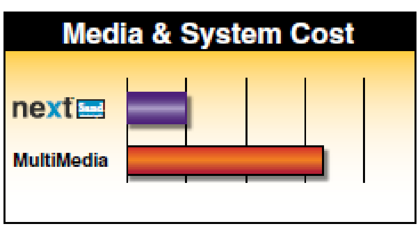
APPENDIX

nextSand — A radically high performance silt, sediment and turbidity media.









Introduction

nextsand is based on a rare natural mineral that is highly processed and graded. It's unique properties allow it to radically alter the performance and cost of media filtration. The hardness, stability and microporous character of **nextsand** makes it a perfect filtration media for virtually every application in the water and wastewater treatment industry.

Features

- High filtration performance-3-5 micron removal.
- High capacity filtration throughout the entire **nextsand** bed depth provides more than twice the capacity of multimedia filtration.
- High flow- 3-4 times that of multimedia with superior filtration.
- Long lasting media (>5 years) not consumed in the process.
- Simple periodic backwash keeps the media clean and operating efficiently.

Applications

- RO Pretreatment-*superior SDI reduction*
- Cooling Towers-*unequalled Turbidity removal*
- Municipal Water Treatment, pressure and gravity filters-*higher flow, lower pressure drop and superior filtration performance*
- Wastewater Polishing-*exceptional TSS removal*
- Precipitated metals removal
- Carwash reclaim and recycling
- Irrigation

Physical Properties

Composition	High Purity Alumino-Silicate
Size	0.4-1.4 mm (approx. 14x40 mesh)
Color	Dark Gray
Surface Area	25 m^2/gram
Surface Absorption	Hydrophillic
Thermal Stability	Stable to 500° C
Coefficient of Uniformity	1.7
Bed Void Volume	55%
Surface Charge	Net Negative
Bulk Density	55 lbs per ft^3 (0.88 kg/L)
Packaging	1 ft^3 bags, 1 m^3 supersacks.

Performance Characteristics

Filtration (nominal)	3-5 micron
Surface Loading	16-20 gpm/ft^2 (Typical) 12 gpm/ft^2 (Optimized for silt, SDI and ultrafine particulates)

APPENDIX

next™ Sand

costs less : works better

Example 1. Service Flow: 15 gpm Filtration: <10 micron

	nextsand	MultiMedia
Surface loading	15 gpm/ft²	5 gpm/ft²
Surface area req'd	1.0 ft²	3.0 ft²
Tank Dimensions	14" x 65"	24" x 71"
Media volume req'd	3.2 ft³	10.8 ft³
Media weight	216 lbs	1057 lbs
BW flow req'd	17 gpm	51 gpm
Daily BW volume	179 gal	510 gal
Filtration	<5 micron	<10 micron
Comparative cost	1X	3 X

Example 2. Service Flow: 45 gpm Filtration: <10 micron

	nextsand	MultiMedia
Surface loading	15 gpm/ft²	5 gpm/ft²
Surface area req'd	3.0 ft²	9.0 ft²
Tank Dimensions	24"x72"	42"x72"
Media volume req'd	9.5 ft³	35.3 ft³
Media weight	672 lbs	3469 lbs
BW flow req'd	53 gpm	153 gpm
Daily BW volume	556 gal	1530 gal
Filtration	<5 micron	<10 micron
Comparative cost	1X	3.3 X

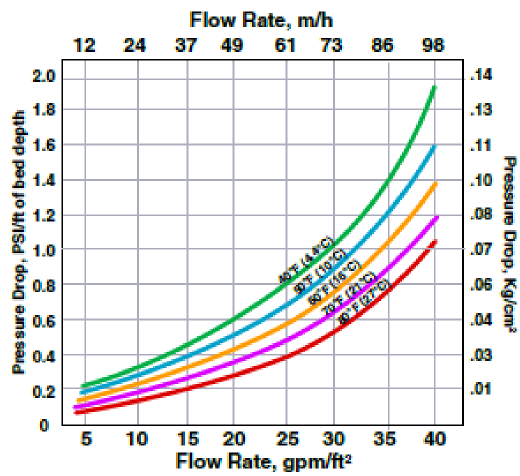
The tables above illustrate the advantages of **nextsand** by comparing two systems designed for the same service flow; one system based on **nextsand**, and one multimedia system (gravel, garnet, fine garnet, anthracite). Each system is based on best design practices for the respective media.

Specifications

Operating Characteristics

Service Flow	12-20 gpm/ft²
Backwash flow	13-22 gpm/ft²
Backwash duration	5-15 min
Backwash expansion	40-50%
Backwash frequency	Delta-P determined
Bed depth	30"-48" depending on application

Pressure Drop vs Flow



Typical Backwash Flow Requirement, vs Water Temp*

Flow	80°F (27° C)	70°F (21° C)	60°F (16° C)	50°F (10° C)	40°F (4.5° C)
U.S. gpm/ft²	22.3	19.8	17.2	14.8	12.5
m/h	54.5	48.4	42	36.2	30.6

*40% bed expansion.

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APPENDIX