Vancouver, BC Iona Island

SlurryCup™ / Grit Snail® / Hydro-Sludge® Screen

Hydro International

Sludge pretreatment solution brings plant into compliance with Canadian regulations

Objective

Canadian federal regulation changes required the plant to upgrade to provide secondary treatment by 2030. The existing plant's inadequate digester capacity and thickener overloading necessitated removal of screenings and grit to achieve mandated performance.

Solution

A combination sludge screening and degritting system was incorporated into a sludge pretreatment facility. Hydro-Sludge® screens receive primary sludge and remove screenings. Screened sludge is then pumped to a SlurryCup™/Grit Snail® degritting system.

Hydro Equipment

- Six (6) Hydro-Sludge® Screens
- Four (4) 56" (1.4 m) SlurryCup™ units
- Two (2) 6 yd^3 / hr (4.6 m^3 / hr) Grit Snail® units

Project Parameters

- Sludge flow rate of 2,774 gpm (175 L/s)
- 5mm sludge screen opening | 35-45% dry solids output
- 90-95% capture of grit ≥75 micron (µm) at 2.65 Specific Gravity (SG) with output grit >60% Total Solids (TS) and <20% Volatile Solids (VS)

Situation

Metro Vancouver operates five wastewater treatment plants that service 2.4 million people, at a total capacity of approximately 264 Mgal/d (1 billion liters per day). Iona Island WWTP provides primary treatment with seasonal chemically enhanced primary treatment (CEPT) for approximately 132 Mgal/d (500 ML/d).

The combined sewer system collects sewage and stormwater from approximately 600,000 residents. Fall wet weather events significantly increase grit volume entering the WWTP. The existing headworks screens and aerated grit chambers remove only a portion of the influent solids. Solids that are not captured accumulate in the plant's anaerobic digesters. Excess sediment and debris in the digesters reduce their capacity and can create solids loading and hydraulic issues in sludge thickening systems.

Changes to Canadian federal regulations require the plant to be upgraded to provide secondary treatment by 2030. The existing plant's inadequate digester capacity and thickener overloading necessitated effective removal of screenings and grit to eliminate these problems allowing them to achieve the performance required by their Operational Certificate through 2030.

Jacobs Engineering (formerly CH2M Hill) was contracted to evaluate options to address the excess solids issues. After evaluating several options, a new primary sludge screening and degritting facility was the recommended solution. Jacobs was also selected to design the new sludge pretreatment system that needed to tie into the existing infrastructure and underground piping.

Grit Removal Results

Grit removal performance testing was conducted in April 2018, resulting in the grit characterization profile shown in Figures 1 and 2, both indicating high capture rates. Grit performance results for the SlurryCup/Grit Snail system met the project requirements of 90-95% capture of grit ≥75 micron (2.65 SG).

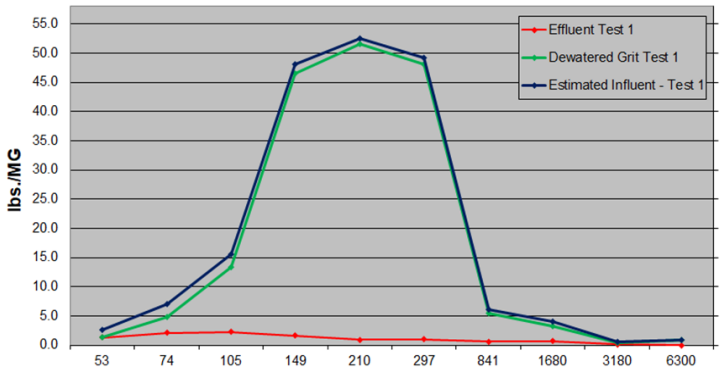

Fig. 1 Fractional Concentrations SlurryCup #1 – Test 1 Physical Size µm

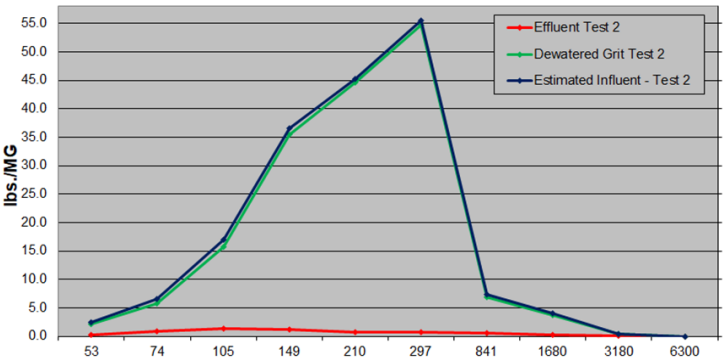

Fig. 2 Fractional Concentrations for SlurryCup #2 – Test 2 Physical Size µm

Screening Removal Results

Sludge screenings removal was excellent resulting in a significant increase in screenings volume hauled to landfill with the bulk of the material coming from the new sludge pretreatment facility, shown in Figure 3.

Sludge Pretreatment System Results

The new sludge pretreatment system demonstrated good removal of screenings and grit from primary sludge: combined improvement for grit and screenings is 2,094 tons (1,900 tonnes) above the 2013 values shown in Figures 4 and 5.

The plant is experiencing improved operations and reduced maintenance of the existing plant, as an example de-ragging of the primary sludge pumps was needed weekly and has not been required since installation of primary sludge screening and grit removal facility.

Lessons Learned

Removing nearly all of the screenings and grit had an unanticipated impact on some downstream processes. With significantly less grit and screenings in the sludge, plant staff noticed FOG accumulated in some process piping and pumps. As a result, hot water flushing and clean-out access to sludge pumps have been added to the process design.

Also, floating sludge was seen on two of the three sludge thickeners. It is thought that the lack of screenings and grit lead to some buoyancy which resulted in floating sludge in those two thickeners. Polymer addition proved effective at improving settling / thickening.

The new facility has helped extend the life of the digesters and overall WWTP through 2030.

Conclusions

- SlurryCup™ / Grit Snail® system met the project performance requirements of 90-95% capture of grit ≥75 micron (2.65 SG) with output grit containing Total Solids >60% and Volatile Solids <20%.
- Grit and screening removal quantities increased over 7 times since installation; removal of screenings and grit from primary sludge of 1,874 tons (1,700 tonnes) of screenings and up to 220 tons (200 tonnes) of grit above 2013 values.
- Grit and screenings removal from primary sludge is a viable alternative to retrofitting headworks solids removal equipment.

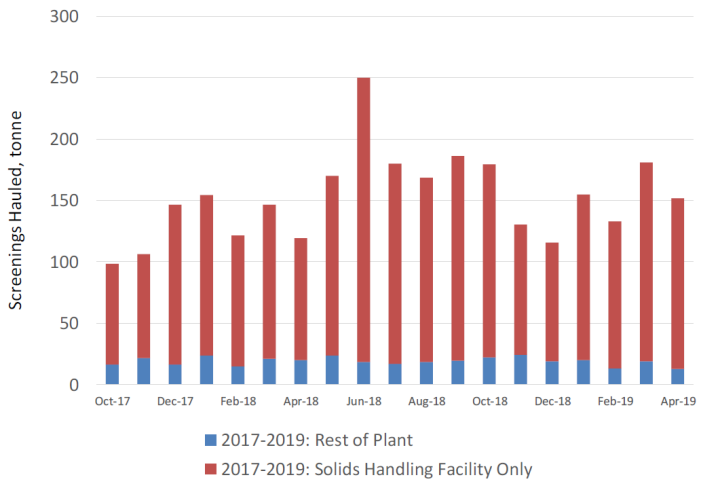

Fig. 3 2017-19 Screenings Removal (Solids Handling Facility vs. rest of plant)

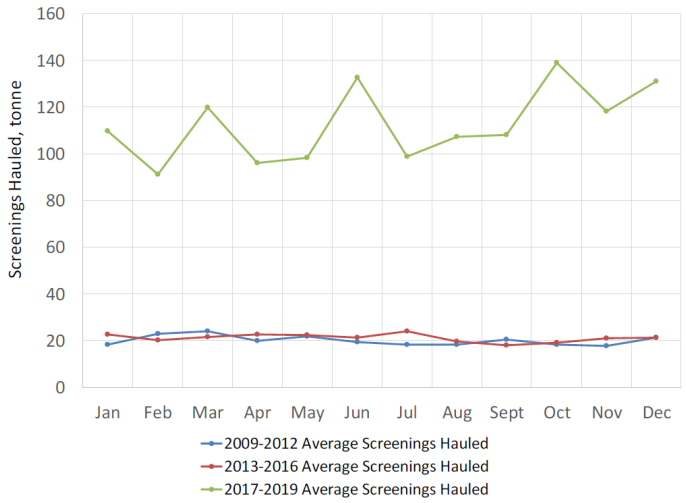

Fig. 4 Screenings Hauled (2009 to 2019)

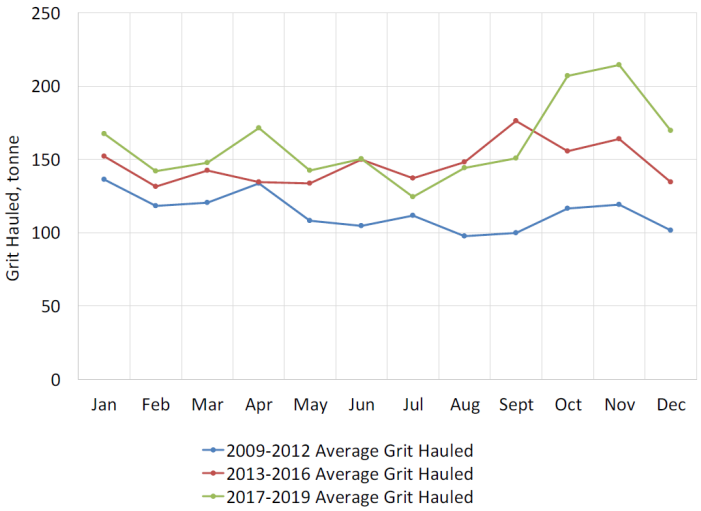

Fig. 5 Grit Hauled (2009 to 2019)

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Americas
+1 (866) 615 8130
questions@hydro-int.com

Asia Pacific
+61 436 433 686
enquiries@hydro-int.com

Europe & RoW
+44 (0)1353 645700
enquiries@hydro-int.com

Middle East
+971 506 026 400
enquiries@hydro-int.com