

Municipality of South Huron Exeter Wastewater Treatment Facility Intermittent Sand Filter Investigation and Rehabilitation



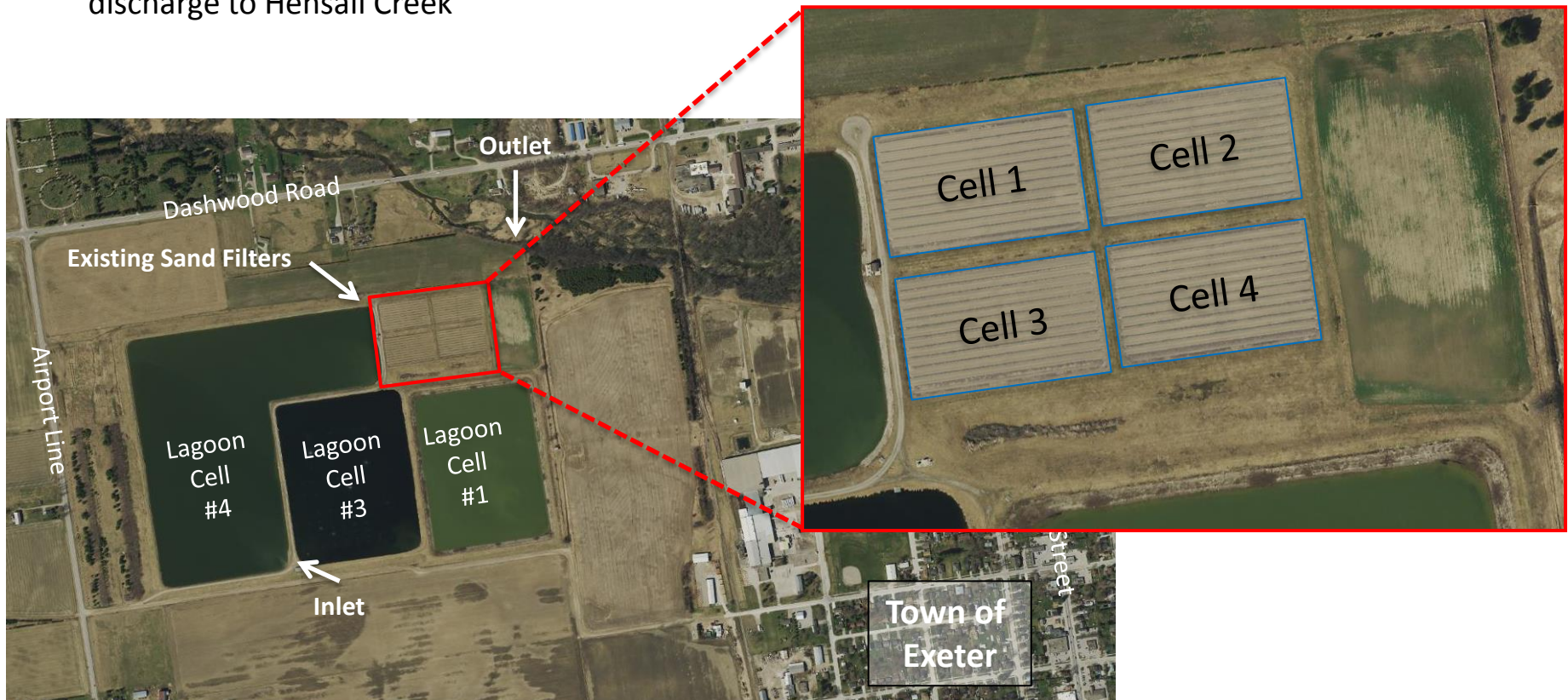
South Huron Town Hall - Carling Room, Exeter
February 5, 2018

Agenda

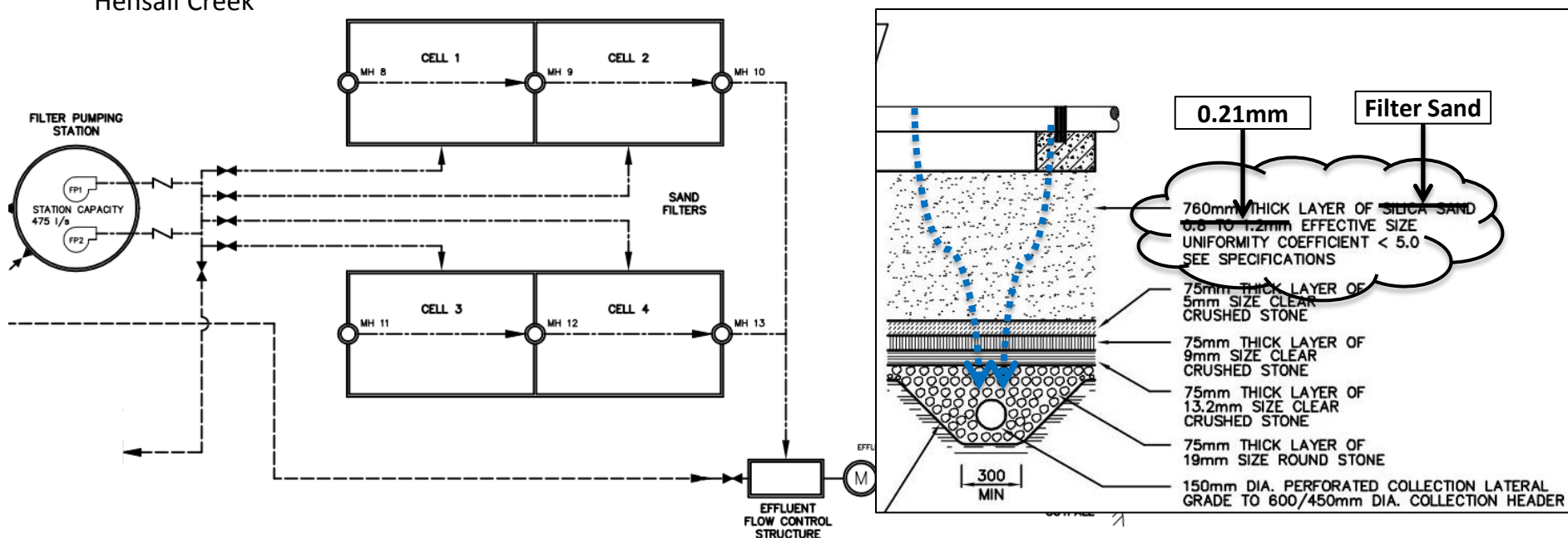
- Project Overview
- Investigation
- Options for Rehabilitation/Replacement
- Recommendations and Estimated Cost
- Future Lifecycle of Sand Filters
- Budgeting
- Future Planning Considerations
- Summary

- GM BluePlan was retained by the Municipality of South Huron through a competitive Request for Proposal process (RFP ESD-001) to complete an investigation and design for the rehabilitation or replacement of the intermittent sand filters at the Exeter Wastewater Treatment Facility
- GM BluePlan began work on this assignment in June 2017
- The intermittent sand filters form an integral part of the wastewater treatment process providing final polishing of the outgoing waters prior to discharge into receiving water body (Hensall Creek)
- GM BluePlan primary objective for this assignment is to investigate the ongoing issues with the sand filters and implement rehabilitation measures to address them

- The existing four (4) intermittent Sand Filters were originally constructed in the year 2000 as part of the last major upgrade at the existing Exeter Wastewater Treatment Facility
- Each sand filter is approximately 63 m x 102m in size
- Water enters the Treatment Facility at the Lagoon and is pumped through the sand filters prior to discharge to Hensall Creek



- The Intermittent sand filters are constructed of a 760mm thick sand filter (more uniform grain size) media on top of a layered 300mm thick granular base
- Through the wastewater treatment process water is pumped from the Lagoon and sprayed uniformly over the top of the sand filter
- As the wastewater percolates through the sand filter it is treated for the following:
 - Nitrification (Ammonia to Nitrate conversion)
 - Additional BOD Removal
 - Total Suspended Solids (TSS) removal
 - Pathogen (E.Coli) Removal
- The treated water is collected through underdrain pipes at the base of the sand filter and is ultimately discharged to Hensall Creek



- In consultation with South Huron Operations Staff, GMBP has identified the following:
 - Sand Filters has been performing well in regards to water quality but they can only operate between April through October

Primary Concern: Gradual long-term reduction in the hydraulic capacity of the sand filters during summer month operation.



Inability to drain the lagoons in the summer months prior to the winter season



During the winter months the lagoons continue to fill and approach capacity, resulting in periodic winter discharge directly to Hensall Creek to avoid overtopping



Winter Discharging (without the sand filter) is resulting in MOECC water quality exceedances for E.Coli, Total Suspended Solids (TSS), Total Ammonium Nitrogen (TAN)

- GM BluePlan staff conducted a site visit on July 19, 2017 in order to inspect and complete a condition inspection and sample collection of the existing sand filter media
- GM BluePlan confirmed South Huron staff comments as significant ponding was observed during operation as well as localized discharges due to pipe joint failures and settlement
- During the site visit, GM BluePlan observed the sand filters in operation as seen below:



July 2017 – During the Site Visit GMBP was completed 12 test pits of the sand media and completed a visual inspection of the material to document any signs of clogging or fouling

- Minor discolouration was noted within the top 150mm of several test pits
- Sand samples were taken from the top 150mm and bottom 300mm and sent to V.A. Wood Geotechnical for Sieve Analysis

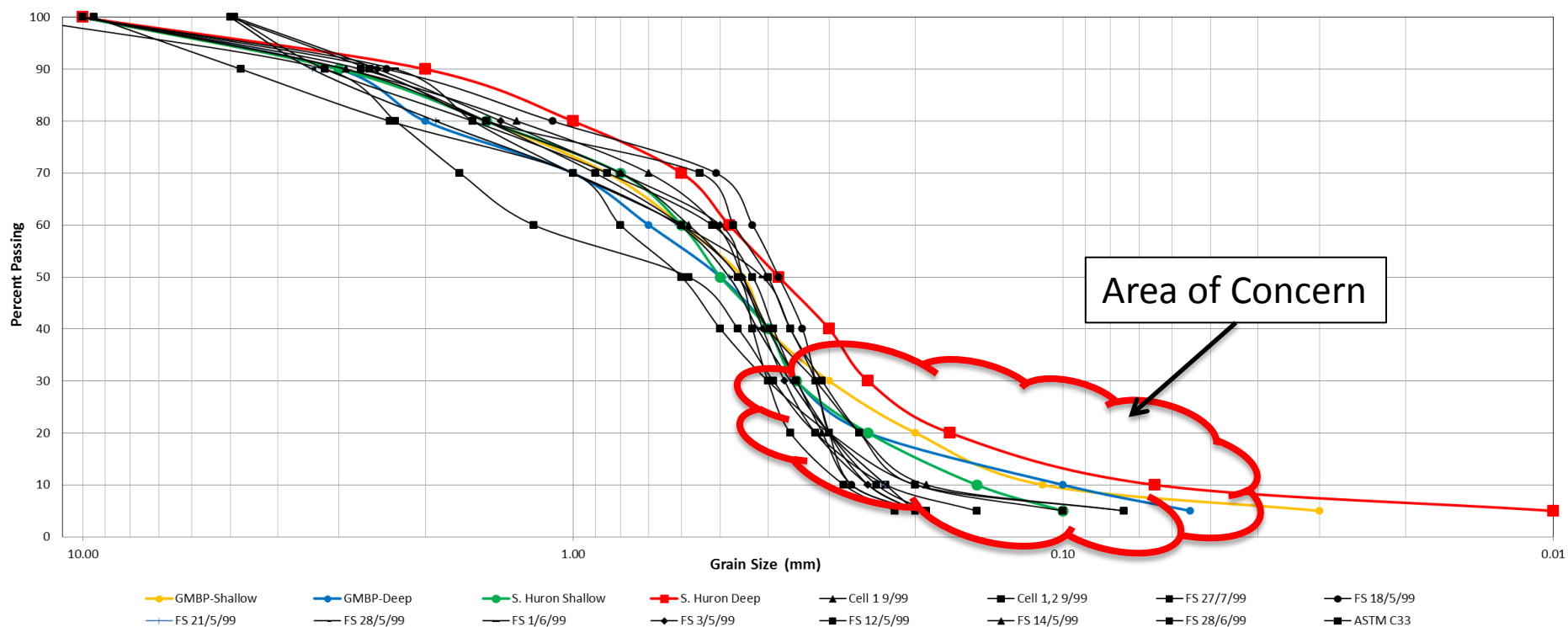
September 2017 – South Huron staff collected 2 additional sand samples for further testing

- The results of the sieve analysis tests were compared to the original shop drawings/sand sieve analysis

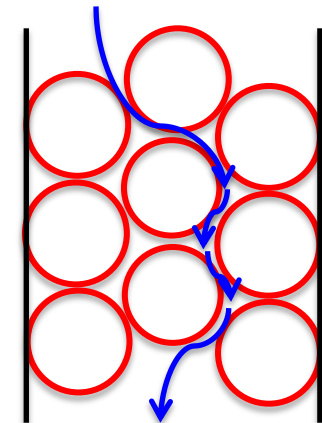


- Grain size analysis of the samples collected in 2017 vs. the original 2000 shop drawings were compared and the samples collected showed a noticeable variation from the original specifications
- It appears that the grain size of the sand present has become smaller/finer than originally specified and the sand was becoming less uniform and “well” graded

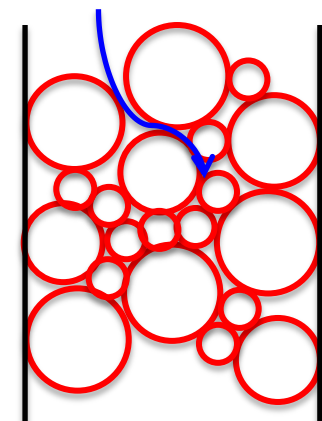
Exeter WWTP - Filter Sand Analysis



- Poorly graded sand (more uniform in size) allows for flow paths for the treated water.
- Sand becoming less uniform is impacting the infiltration/hydraulic capacity of the sand filter and is restricting the amount of water that can be treated
- Over 17 years in operation, the distribution of the sand grain size has changed so that smaller grains have filled in the voids. This is suspected to be a combination of:
 - Sand Material breaking down, eroding and dissolving overtime.
 - Foreign sand, dirt, suspended soils entering the cell from years of operation.
- The filters are essentially becoming clogged
- South Huron Operations staff have made continual efforts over previous years to maintain the top section of sand with limited improvement.
- These filters are not designed to be backwashed and based on available literature have an expected life of 15 – 20 years prior to rehabilitation being required.



“Poorly Graded”
(More Uniform & Ideal for Sand Filters)

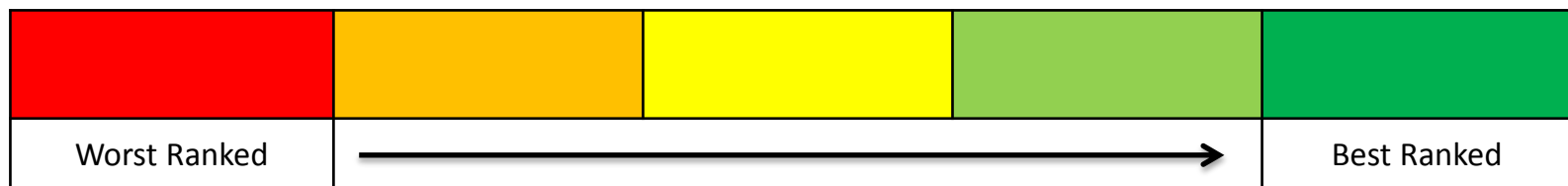


“Well Graded”
(Less Uniform & Less Ideal)

- GMBP developed the following options for the rehabilitation or replacement of the
- Option #1 – Do Nothing
 - Continue to operate sand filters as currently running
- Option #2 – Partial Sand Replacement
 - Partial sand replacement of the top 300mm and depth of the sand layer as this layer is subject to the most suspended solids and clogging
- Option #3 – Full Sand Depth Replacement
 - Full 760mm sand depth replacement.
- Option #4 – Build new sand filter
 - Build a 5th sand filter to account for hydraulic loss
- Option #5 – Mechanical Filtration
 - Install a series of mechanical filtration units complete with a stand alone building and electrical upgrades

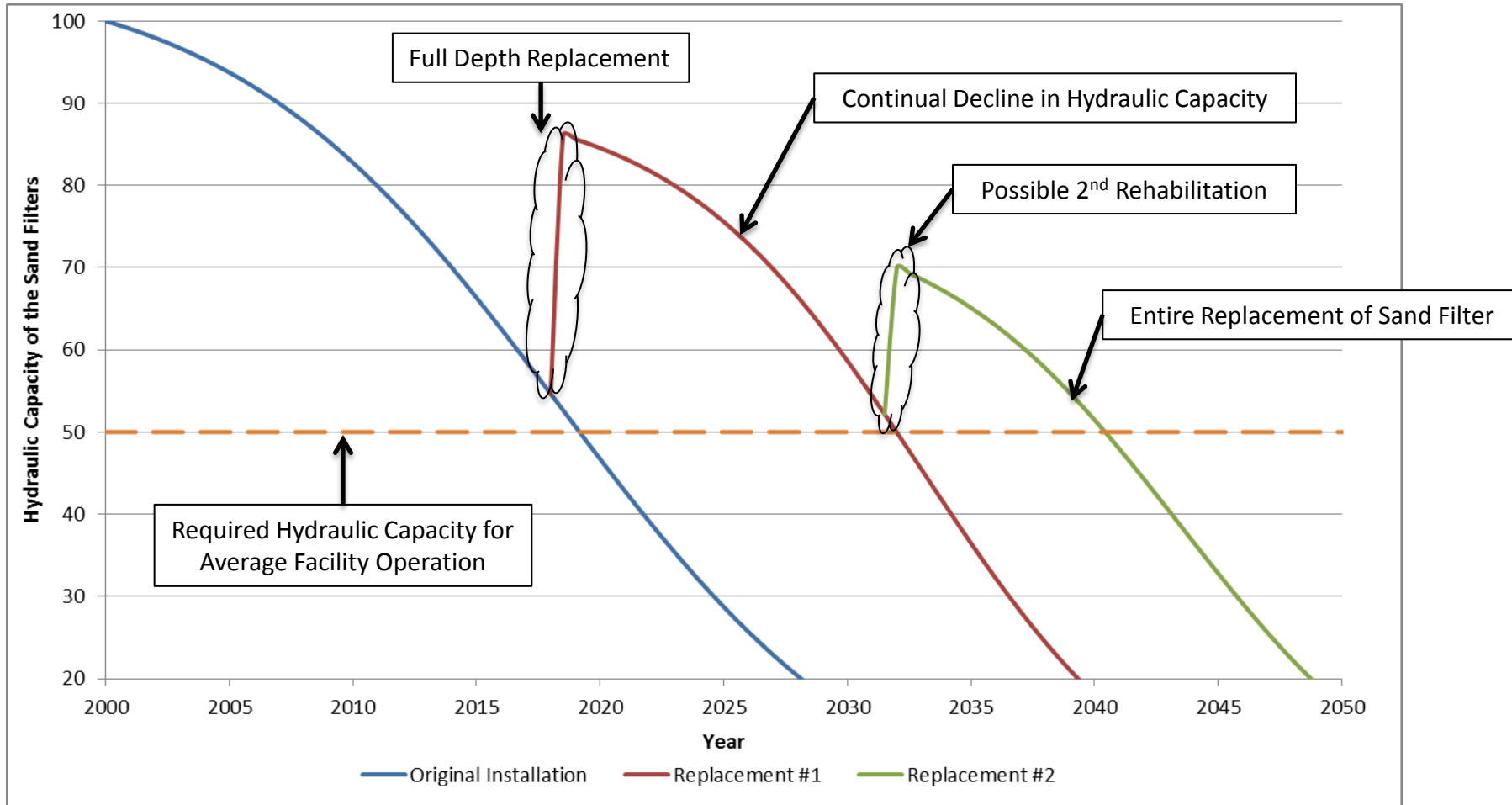
Options for Rehabilitation/Replacement Comparison Matrix

Alternatives	Option #1	Option #2	Option #3	Option #4	Option #5
	Do Nothing	Partial Media Replacement	Full Media Replacement	Add New Filter Cell	Mechanical Filtration
Technical Considerations	Hydraulic capacity will continue to decline	Improves hydraulic capacity	Improves hydraulic capacity	Improves hydraulic capacity	Improves hydraulic capacity and provides year round discharge
Capital Cost	\$0.0	\$1.0 million	\$1.7 million	\$2.0 million	\$3.3 million
Operation and Maintenance Cost	Low	Low	Low	Low	Moderate
Winter Discharge?	Restricted (283,200m ³ /season)	Restricted (283,200m ³ /season)	Restricted (283,200m ³ /season)	Restricted (283,200m ³ /season)	Yes (MOECC to Determine)
Overall Ranking	5	2	<u>1</u>	4	3



- Upon review of the analysis it is recommended South Huron considers two (2) Options at present:
 - Option #2 – Partial Sand Replacement - \$1,000,000.00
 - May restore partial hydraulic capacity and prolong the life of the sand filters
 - Potential risk for lower clogging layers to hinder hydraulic capacity
 - Option #3 – Full Sand Replacement - \$1,700,000.00
 - Removes entire sand filter layer and replenishes
 - Predicted to increase the life of the filter before requiring additional rehabilitation
 - Will continue to provide similar effluent quality performance
- To provide the greatest hydraulic capacity and life span, GM BluePlan recommends Option #3
 - Some municipalities have successfully completed a partial (150mm – 300mm replacements) of the top sand and achieved near full hydraulic capacity returns
 - Option #2 poses some level of risk as the fines have migrated to the lower levels and therefore likely cannot achieve a long term restoration of hydraulic capacity

- It is predicted that the sand filters will require an additional rehabilitation to achieve maximum life cycle prior to requiring a full replacement/upgrade



- October 30th, 2017 South Huron Committee of the Whole meeting contained the 2018 Sewer Proposed Capital Budget

		2018 Proposed Capital Projects									
Project Name	ID	Project Cost	User Fees	Grant	Reserve	Debt	Other Sources	2019	2020	2021	2022*
Rehabilitate Sewage Lagoon Sand Filters	2018-S-01	15,000	0	-	15,000	-	-	250,000	250,000	250,000	

- \$250,000 has been budgeted in the five year forecast, starting in 2019 for a 4 year duration (\$1,000,000 in total)

- Based on the review of the existing system and future requirements, GMBP recommended the following future planning considerations

Short Term (0-5 years)

- Repair sand filters in order restore partial hydraulic capacity
- Proceed with a phased construction in order to allow for the manufacturing/grading of suitable sand material and to determine the effectiveness of the rehabilitation

Intermediate (5-10 years)

- Install partial UV treatment for winter discharge system in order to improve effluent quality and remain within the MOECC parameters and facilitate year round discharge

Long Term (15-20 years)

- Next major upgrade at the treatment plant. Council should plan for and implement the transition to a fully conventional mechanical treatment facility

- Intermittent Sand Filters are nearing the end of their useful service life and require rehabilitation in order to maintain hydraulic capacity
- Analysis completed shows a reduction in hydraulic capacity and anticipated further reduction into the future
- Recommendation for full sand filter replacement (estimate cost \$1,700,00)
- South Huron budgeted \$1,000,000 in the five year forecast
- Future Planning considerations

Thank You

GM BluePlan Team

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