  

Why Small Wastewater Systems Aren’t Number 2

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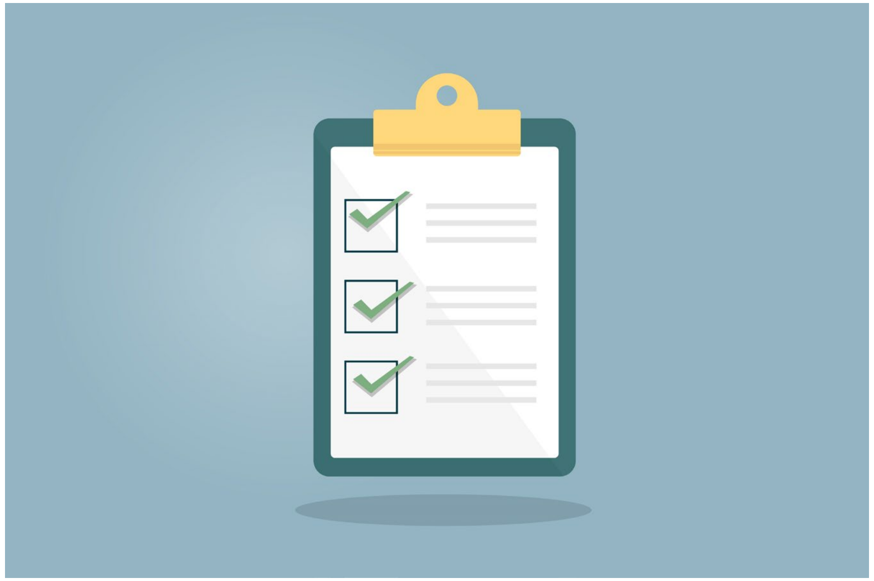
November 14, 2023

Presentation Outline

- Small Systems – What and Why?
- Regulatory Considerations (BC)
- System Planning Considerations
- WWTP Design Considerations
- Project Implementation Considerations
- Case Study



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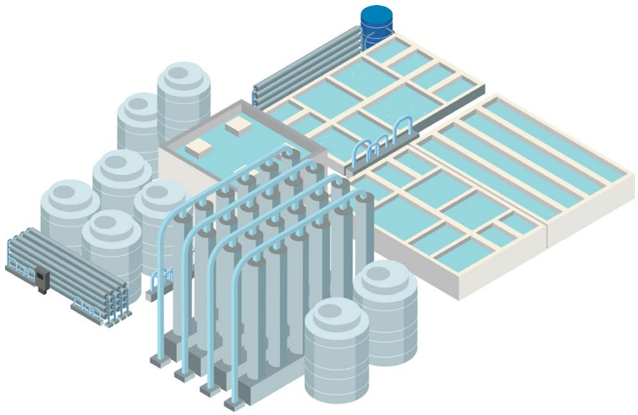
Small Systems – What and Why?

What is a Small Wastewater System?



Small WWTPs = treating less than 500 m^3/day

EOCP – servicing a population of 500 people or less

EPA – servicing a population of 10,000 or fewer people

Why Talk about Small Wastewater Systems?

- There are many small wastewater systems in BC
- Must meet same environmental performance objectives
- Getting it wrong = ongoing waste of time and money

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What Makes Small Systems Different?

- Remote and/or Residential Locations
- Reduced User Base
- Limited Resources
  - Capital
  - Operational

Must still meet the same regulatory requirements as conventional WWTPs

Regulatory Considerations

Regulatory Framework

- **Wastewater Systems Effluent Regulation** (WSER) - Federal
  - Influent flows>100 m^3/day (average)

- **Municipal Wastewater Regulation** (MWR) - BC
  - Discharge flows>22.7 m^3/day (maximum) if discharged to ground OR from more than one parcel/lot
  - Any discharge to water
  - Does not apply to single lot septic systems

Regulatory Challenges

- Nitrogen and phosphorus removal requirements
- Surface discharge – toxicity requirements (WSER)
- Increased sampling and reporting
- Registration timeline and resources

System Planning Considerations

Wastewater Production

- Reduced user base
- Variable growth
- Variable flow rates
- Climate change impacts

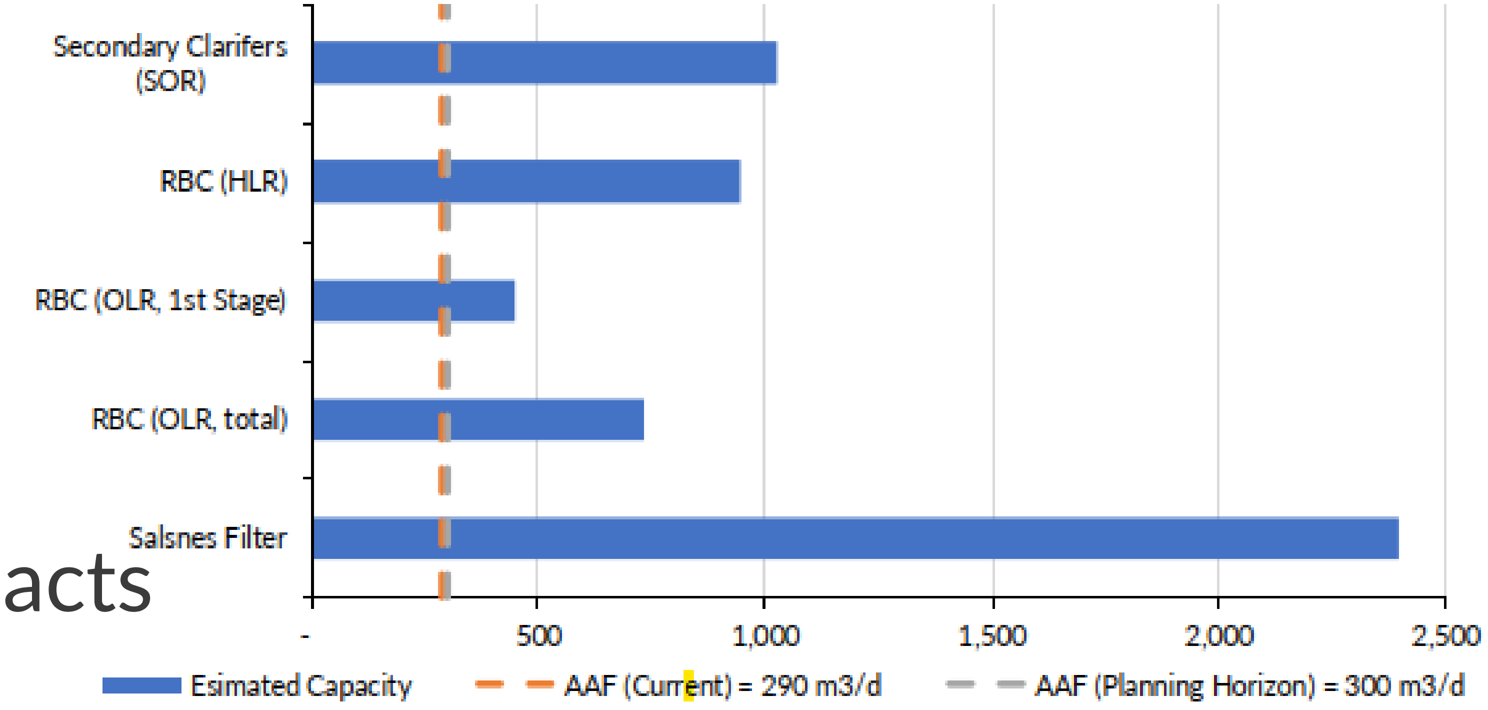
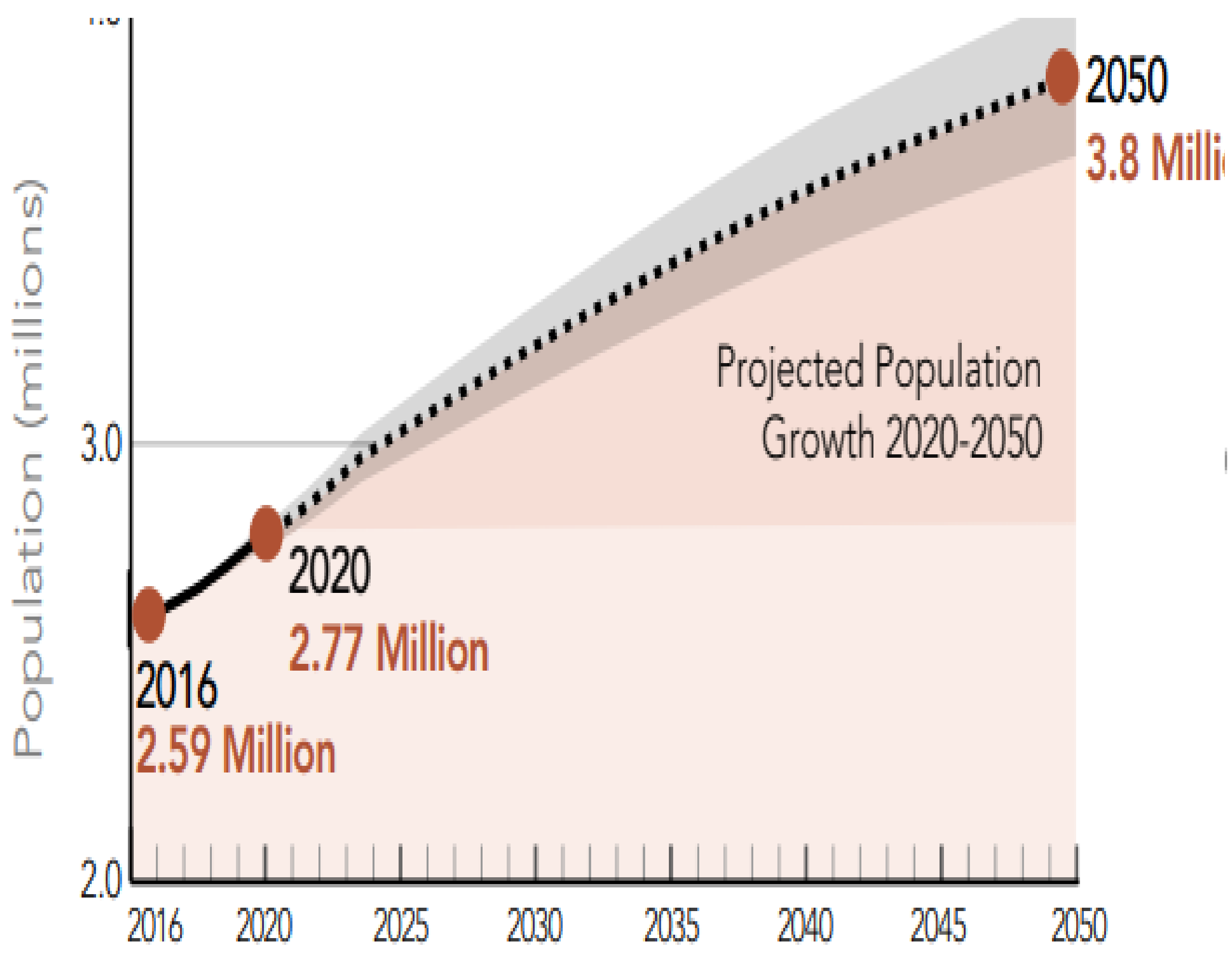
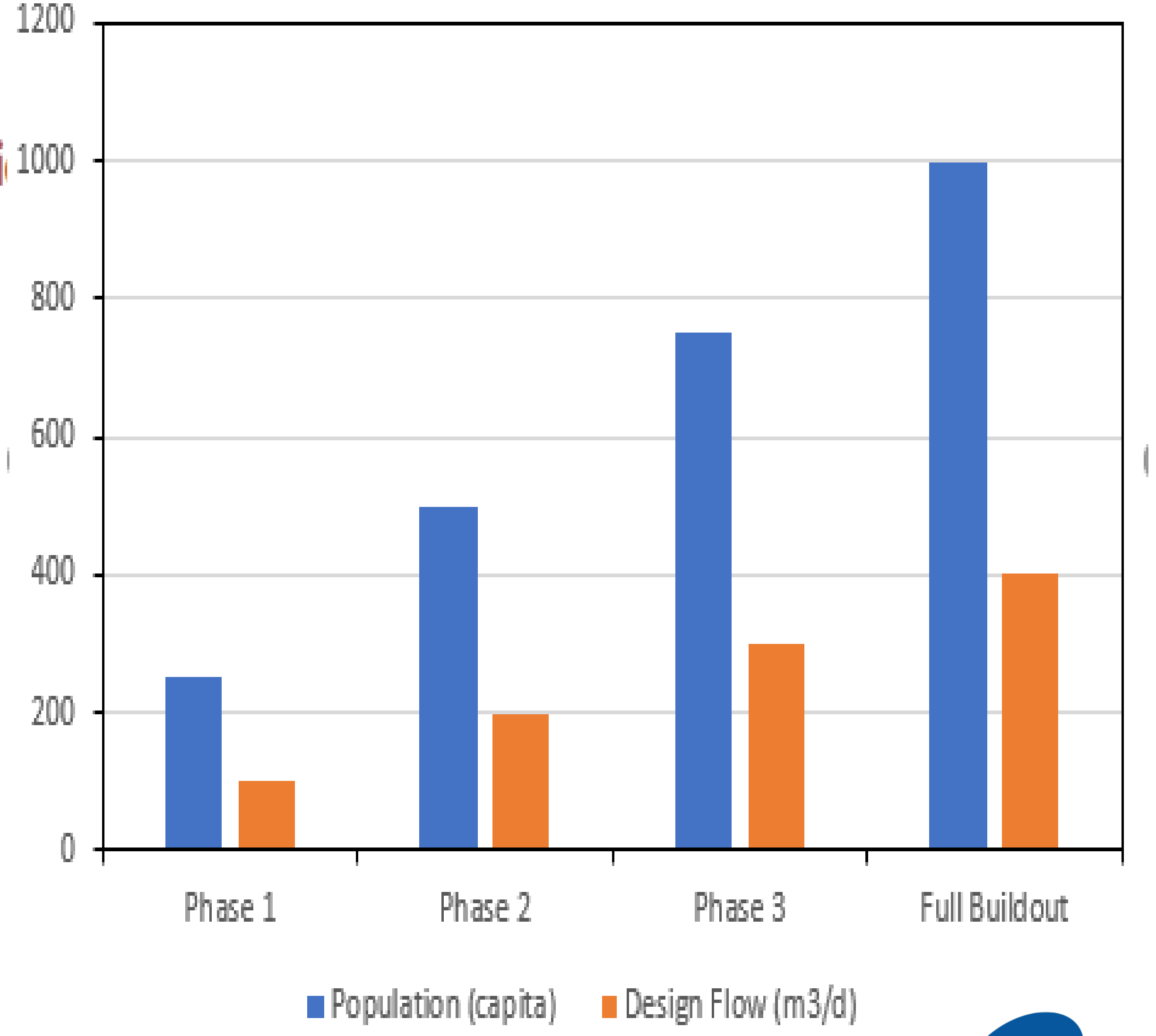


Figure 4-1
Performance Potential Graph

Wastewater Production





Siting Restrictions

- Residential neighborhoods
- Aesthetics
- Odor Control
- NIMBY
- Limited expansion room

Stakeholder Consultation

- System may not be owned/operated by a utility
  - Owned by residents
  - Owned by contractor
- Operator may be resident
- May also need to consider:
  - Homeowner associations
  - Developers
  - Community members

WWTP Design Considerations

Data Collection

Typically, we like to use historical data to inform our decisions

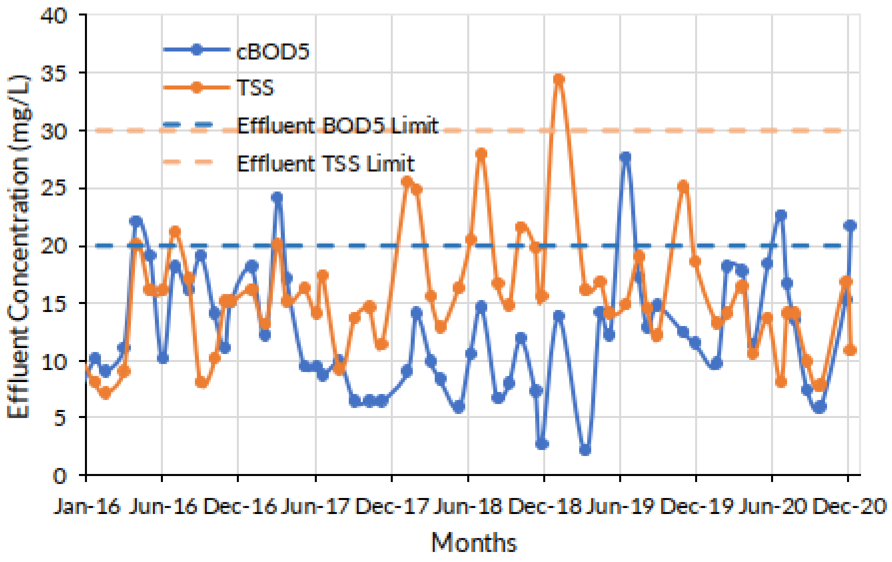
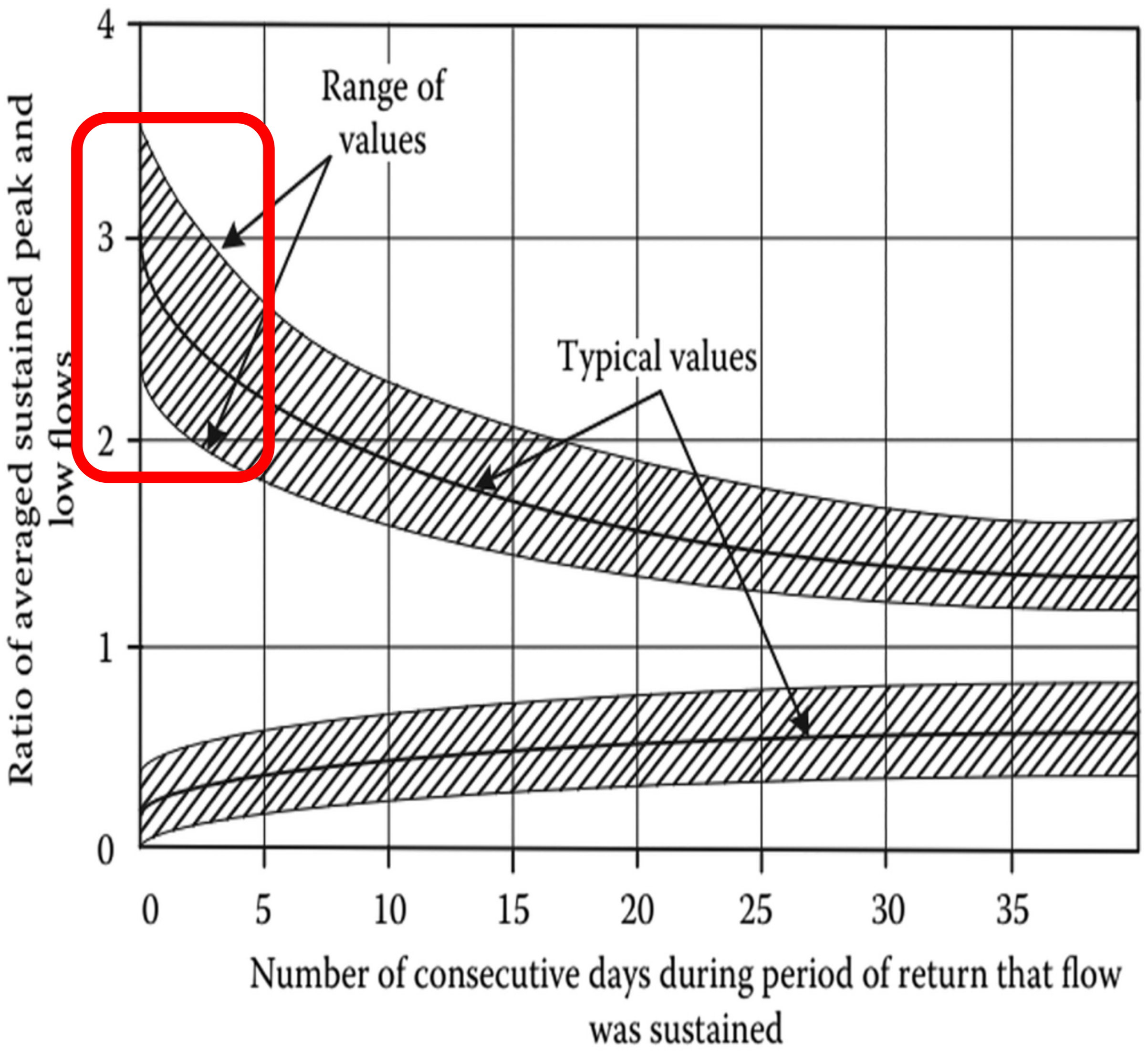


Figure 3-1
Secondary Effluent Concentrations

What if data isn't available?

Peaking Factors



For small wastewater systems

- Typical Peak hour flow: 4–5
  - Flow data limited
- Consider the effect of:
  - Flexible work arrangements
  - Climate change

Technology Choice

- Is the technology suitable for the application given industry experience?
- Can the technology fit into the available footprint?
- What is the operational capacity available and how much effort is required?

Table 4-10
Summary of Candidate Process Ratings as Technologies

Criteria	Rotating Belt Filter	Cloth Media Filtration	RBC	MABR	MBBR	SBR	CAS
Is the technology suitable for the application given industry experience	Used in multiple installations across the world, including a few in Canada, with successful results.	Successful pilot and full-scale installations in Canada and in the US. Case studies available for reference.	Used in multiple installations across the world with successful results. Typically used in small, remote places due to lower daily operations requirements.	Piloted in multiple installations across the world with successful results, but only a few full-scale installations. Provides stable nitrification/ denitrification at low temperatures.	Proven technology with many full-scale installations operating around the world since 1990. Provides stable nitrification at low temperatures.	Proven technology with many full-scale installations operating around the world for more than 50 years; established design and operating parameters.	Proven technology with many full-scale installations operating around the world for more than 100 years; established design and operating parameters.
Can the technology fit into the available footprint?	Yes. Small footprint. Fits easily on the side of the existing screen.	Yes. Small footprint. Fits easily on the side of the existing screen.	No. RBC unit is large to fit in front of the O&M building or on the side of the existing RBC. Locating the new unit behind the existing O&M building would require additional pumping and complex piping.	No. The large container with the MABR can only be fit behind the O&M building, which would require additional pumping and potentially complex piping.	Yes. Smallest footprint of all technologies evaluated. Biological tanks fit well in front of the existing O&M building. Effluent tank will be located on the side of the existing RBC unit.	No. Pre-equalization and SBR units are too big to fit into the available footprint. SBR tank block the entrance site and Pre-equalization tank blocks access to O&M building. Locating one of the units behind the O&M tank might be possible but would require additional pumping and potentially complex piping.	Yes. Aeration tank can be fit in front of the O&M building and the clarifier on the side of the existing RBC unit.
Ease of Operation and Maintenance Effort	Facility is typically well automated, but operation can be challenging because of the high number of moving parts. The belt may experience clogging during high loads and frequent washing with hot water and air is required. The belt may need to be replaced periodically (every two to three years).	Facility is well automated, but discs need to be cleaned periodically with hypochlorite (on a monthly or bi-monthly basis); cloth filters have a great number of moving parts associated with them; cloth media needs to be replaced every 5-10 years.	Lower maintenance requirements, though prone to breaking. More frequent replacement of equipment parts required (i.e. shaft, bearings, media every 5-10 years).	Self-contained units that are easy to maintain and operate.	Facility is typically well automated. Excessive foam, scum and media management can cause setbacks.	Facility is typically well automated but requires additional knowledge that is not always properly transferred to operators.	Facility is typically well automated. Foam and bulking sludge can cause setbacks.
Ability to meet current effluent requirements	Unit should be able to reduce the load to biological treatment. It would also help reduce the BOD and TSS loads when flows are higher than 100 m^3/d.	Unit should be able to reduce the load to biological treatment significantly. It would also help reduce the BOD and TSS loads when flows are higher than 100 m^3/d.	Currently installed at the Maliview WWTF and cannot consistently meet BOD and TSS effluent targets. BOD reduction upfront and additional units are required to nitrify consistently.	Can meet current effluent requirements as well as provide a nitrified effluent.	Can meet current effluent requirements as well as provide a nitrified effluent.	Can meet current effluent requirements as well as provide a nitrified effluent.	Can meet current effluent requirements as well as provide a nitrified effluent.

Legend			
Legend	Fatal Flaw – Does not meet CRD's Objectives	Proceed with Caution –Meet CRD's Objectives, however additional investigation is required	Good– Meet's CRD's Objectives, no additional investigation required

Operational Capacity

Consider:

- Level of complexity of system
- Safety and maintenance planning
- Amount of time staff needs to spend on site
- What level of certification staff has
- How familiar staff are with technology
- How many staff are available/backup operational staff
- Time for staff to reach site

Operational Costs

Ongoing operations and maintenance costs are often more impactful to the stakeholders, and include:

- Replacement costs
- Power costs
- Chemical costs
- Monitoring program costs
- Pumping costs

Redundancy and Power Requirements

General component and reliability requirements

35 (1) A qualified professional must

(a) determine, based on an environmental impact study, which reliability category applies to a proposed wastewater facility, and

(b) ensure that the design of the wastewater facility meets the applicable requirements of Table 1 and section 36 *[additional component and reliability requirements]*.

(2) For the purposes of Table 1, the remaining capacity with the largest unit out of service must be at least

(a) 50% of the design maximum flow where the notation "[a]" appears, or

(b) 75% of the design maximum flow where the notation "[b]" appears.

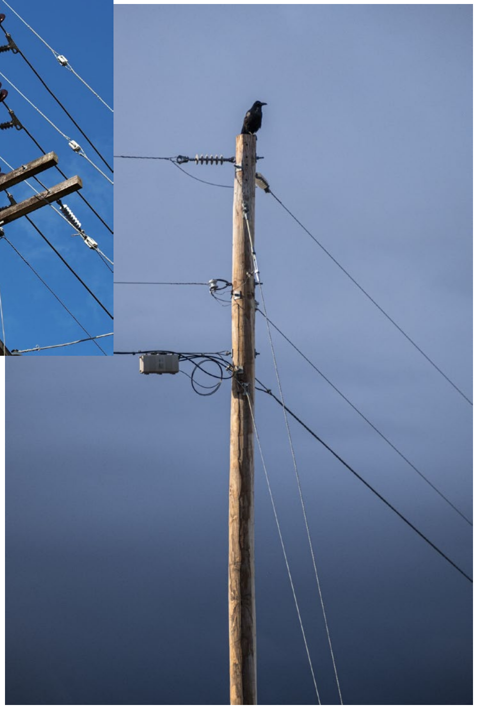


Table 1 — Component and Reliability Requirements for Wastewater Facilities

	Reliability Category					
	I		II		III	
Components	**Treatment System**	**Power Source**	**Treatment System**	**Power Source**	**Treatment System**	**Power Source**
blowers or mechanical aerators	multiple units	yes	multiple units	optional	2 minimum	no
aeration basins	multiple units[b]	yes	multiple units[b]	optional	single unit	no
disinfection basins	multiple units[b]	yes	multiple units[a]	yes	multiple units[a]	no
trickling filters	multiple units[b]	yes	multiple units[b]	optional	no backup	no
primary sedimentation	multiple units[a]	yes	multiple units[a]	yes	2 minimum[a]	yes
chemical sedimentation	multiple units[b]	optional	no backup	optional	no backup	no
final sedimentation	multiple units[b]	yes	multiple units[a]	optional	2 minimum[a]	no
degritting	n/a	optional	n/a	no	n/a	no
chemical flash mixer	2 minimum or backup	optional	no backup	optional	no backup	no
flocculation	2 minimum[a]	optional	no backup	optional	no backup	no
aerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	single unit	no
anaerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	2 minimum	no
effluent filters	2 minimum[b]	yes	2 minimum[b]	yes	2 minimum[b]	yes
facultative lagoons	2 cells[b]	n/a	2 cells	n/a	2 cells	n/a
aerated lagoons	2 cells[b]	yes	2 cells	optional	2 cells	no
package treatment plants	multiple unitsb or ability to repair within 48 hours	yes	2 units or ability to repair within 48 hours	yes	single unit	no

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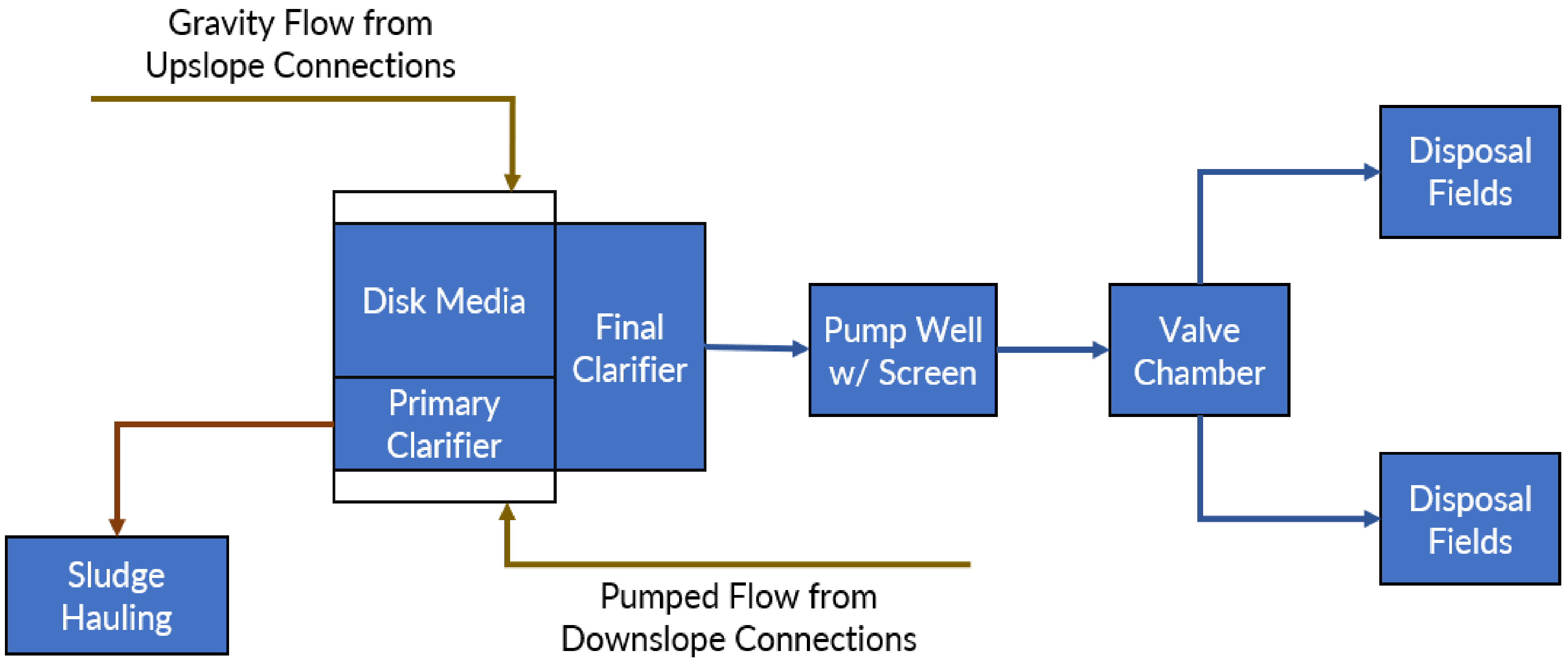
Project Implementation Considerations

Implementation

- Ongoing operation during construction
- Manual vs auto operation
- Construction procurement effort and support
- Training and support for operations

Case Study

Case Study – Small Okanagan WWTP



Process Flow Diagram of the existing WWTP

Case Study

Wastewater production – residential only, increase in 2020, recently discovered significant I&I

- Growth is developer dependent – hard to predict (developer is not owner, no master plan)
- Data availability is limited – influent flows and quality not monitored, only effluent

Operational considerations – looked at technologies familiar to operations team in order to reduce training and operational requirements – operations team is not local

Small systems are not "just" smaller versions of large systems.

They are complex and each is unique.

Questions?

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