Town of Whitecourt WWTP Master Plan

November 28th, 2016





Safety Moment Winter Driving





It's not the weather that causes accidents, it's the driving. Always plan and prepare for the weather

- Adjust your speed and following distance
- Clear windshields
- Gentle, graceful and gradual:
- Be prepared
- Winter tires!



Agenda Background 2 Future Demand Assessment **3** Existing Treatment Assessment 4 Proposed Upgrades D Implementation Plan and Cost Estimate 6 Recommendations and Next Steps



Background



Background

Odour Complaints

- New home developments closer to WWTP
- Nearby residents experiencing odours excursions from WWTP

Previous Study

- Identified Biosolids Holding Ponds (BHP) as main source of offensive odours
- Root cause: overloading of system with inert solids
 - Septage haulers from outside of Whitecourt (uncontrolled)
 - Unusually high fraction of inert solids in raw wastewater (source control issue)
 - Accumulation of inerts in process tanks (robs capacity)
 - Reduced aerobic sludge digestion (inadequately stabilization)
 - More undigested sludge and grit to BHP (robs capacity)
 - Anaerobic digestion in BHP (more and frequent H_2S emissions)
- Nuisance odours highest in summer, tapering off into the fall (ice cover).
- Annual biosolids removal and disposal
 - Short-duration, can result in odours ranging from marginal to offensive



Background

Actions Taken by Whitecourt

- Discontinue accepting septage from outside of Town
- Add chemicals to mitigate odours from BHP
- Maintain water cap over digested sludge in BHP
- Initiate "green belt" around BHP
- Conduct odour survey
- Develop Sewer Use Bylaw for control and enforcement

Public Consultation

- Public open house and plant tour conducted in early June 2016
- Odour diaries Received from Residents
- Odour survey completed by Town Staff



Project Scope

Stantec retained to complete a Master Plan for WWTP Upgrades

- Assess influent characteristics, plant operations, and processing capacity
- Determine major factors contributing to odours from BHP
- Develop load projections to determine future expansion needs
- Identify options to mitigate odours and future upgrade requirements
- Prepare a Class 5 Opinion of Probable Cost:
 - Ranking of alternatives;
 - Recommended plant expansion and upgrades; and
 - Capital planning and program development.



Future Demand Assessment



Compliance Requirements

Current Operating Approval #1303 02-00

Parameter	Limit	Maximum Month 2011-15 Inclusive
BOD5	≤ 25 mg/L	16.3
CBOD	≤ 25 mg/L	8.0
TSS	≤ 25 mg/L	22.0

Possible Future Compliance Requirements (Population >20,000)

Parameter	Limit
CBOD	≤ 20 mg/L
TSS	≤ 20 mg/L
Phosphorus	≤ 1.0 mg/L
Ammonia (Dec 1 to May 31)	≤ 10 mg/L as N
Ammonia (Jun 1 to Nov 31)	≤ 5.0 mg/L as N
E. Coli	≤ 126 counts per 100 mL



Future Demand Assessment



- 1.5% growth rate used for flow projections
- Determines basis for assessing WWTP process capacities and identifying upgrades



Population

Projected Flows and Loads

	Year					
Description	2016	2021	2026	2036	2046	2056
Population Projection	10,513	11,326	12,201	14,160	16,433	19,071
Design Flows						
Annual Average (m ³ /d)	4,205	4,530	4,880	5,664	6,573	7,628
Max Month (m ³ /d)	6,308	6,796	7,321	8,496	9,860	11,443
Peak Hour Flow (m ³ /hour)	1,136	1,207	1,279	1,395	1,521	1,658
Digested Sludge Generation						
Annual Average (kg/d)	2,208	2,378	2,562	2,974	3,451	4,005
Max Month (kg/d)	3,312	3,568	3,843	4,460	5,176	6,007

• Forecast population of 20,000 reached in ~ 2060



Projected Treatment Needs

		Year					
Process Unit	Estimated Capacity	2016	2026	2036	2046	2056	
PIOCESS UTIN		Forecast Population					
		10,574	12,201	14,160	16,433	19,071	
Peak Hour Flow	1,556 m³/h (total)	1,136	1,279	1,395	1,521	1,658	
Bioreactor* Train No.1	1 850 ka BOD/d	1,498	1,739	2,018	2,342	2,718	
Bioreactor* Train No.2	1,000 kg DOD/ d						
Extended Aeration* (CBOD & NBOD)	Firm 5,100 CFM Total 7,500 CFM	4630	5374	6237	7238	8400	
Digesters Volume Requirements	1,750 m ³	1,344	1,560	1,810	2,101	2,438	
Biosolids Holding Ponds (@ 9% DS)	14,620 m ³ (allow 0.3 m H2O cap)	9,209	10,688	12,404	14,395	16,706	

* - very sensitive to air diffuser assumptions, conservative.



Existing Treatment Assessment



Existing Treatment Processes





Aerobic Digestion



Note, majority of sludge under well operated conditions less than 50% stabilized, high potential for odours.

- Difficult to increase SRT, temperature a key parameter
 - 30d x 8°C = 240 (32%)
 - 30d x 18°C = 540 (42%)



Biosolids Handling Assessment

Biosolids Holding Ponds

- Insufficient sludge stabilization from digesters increases potential for odour excursions
- Less Stabilized sludge in winter months stored in BHP
- Anaerobic conditions develop in BHP during summer
- Generation of off gases, namely H₂S

Biosolids Disposal

- Each BHP has a total storage volume of 8,000 m³
- Net volume 7310 m³ (- 0.3 m water cap)
- 2015 volume of biosolids disposed = 7,400 m³ ?
 - One cell should be sufficient to hold a full year of biosolids
 - Sludge calculations ~ 6000 m³ ?
- Suspect grit accumulation in BHP, loss of storage volume
- BHP cleaned annually



Benefits of Head End Improvements Screening and Grit Removal

Parameter	Unit	Existing Grit Removal	Upgraded Grit Removal	Response	
ISS in the influent	mg/L	343	343		
ISS after grit removal	mg/L	310	104	70% ISS reduction	
TSS loading after grit removal	kg/d	2,179	1,357	38% TSS loading reduction	
Population capacity equivalent (PE)	people		6,850	PE based on TSS reduction	
BOD after grit	mg/L	261	261	No change	
MLSS	mg/L	4,705	2,518	Reduced 47%	
MLVSS	mg/L	1,351	1,350	Better O ₂ transfer	
Clarifier solids loading rate	Kg/m².d	65	36	45% more capacity	
Digester TSS loading rate	kg/m³.d	1.6	0.47	70% more capacity	
Grit generation @ 50% solids	m3/d	0.3	3	10 times more removed	
Digested sludge	Kg/d	1,400	700	50% more capacity	



Proposed Upgrades



Proposed Process Upgrades

- 1. Headworks Upgrades
- 2. Biosolids Handling & Disposal
- 3. Secondary Treatment Upgrades



1. Headworks Upgrades - Fine Screens



- Opening size ranges from 2 to 6 mm
- Protects downstream equipment
- Removes junk sent to bioreactors
- Improves quality of biosolids for reuse



1. Headworks Upgrades - Grit Removal and Washing



- Significantly reduces:
 - Inert solids in treatment processes recovers treatment capacity
 - Grit accumulation in tanks reduces maintenance, sustains capacity
 - Amount of sludge for handling and disposal reduces operating costs
- Improves biosolids quality for reuse
- New recovered resource clean grit for beneficial reuse



2. Biosolids Upgrades – BHP Relocation

- Move BHP away from residential development
- New pipelines required to and from holding ponds
- Access road required to
 new holding ponds
- Major engineering design
 for storage cells
- Requires regulatory and environmental permitting
- Seen as an interim odour mitigation measure as development may encroach in the future
- Odour issue remains





2. Biosolids Upgrades - Mechanical Dewatering

- Replaces BHP, digested sludge pumped to dewatering equipment
- Small footprint, co-locate with grit equipment
- Significantly increases solids content, less water to be hauled
- May require polymer to achieve desired solids content
- Dewatered biosolids disposed more frequently
- Enclosed in building to mitigate odour emissions from process
 - Dewatering fresh aerobic digested sludge has low odour profile
- HVAC and odour control system required for building
- Simple to operate , low maintenance
- Easy start up and shut down
- High reliability, can run automated
- Proven technology, widely used.



Biosolids Upgrades Evaluation

Evaluation Factors	Mechanical Sludge Dewatering	Biosolids Holding Ponds
Dewatering Performance	High	Fair
Biosolids Stabilization	N/A	Fair
Nuisance Impacts (odour, insects, etc.)	Very low	High
Reliability - Robustness	High	Fair
Climate Constraints	Low	High
Footprint	Small	Large
Process Complexity	Average	Simple
Operator Skill Level	Average	Minimum
Sludge Disposal	Continuous	Annual



3. Secondary Treatment Upgrades

Digester Covering

- Increase temperature to improve sludge stabilization in winter months
- Ventilation and operations considerations
- Odour control could be added if required

Secondary Treatment System

- Upgrades likely required by 2026
 - onsite testing to confirm actual equipment capacity
- Consider upgrading aeration system (e.g. fine bubble)
- New third train located to replicate last expansion

Outfall Hydraulic capacity

- Risk that it could be exceed within 5 years.
- 1200 to 1400 m³/h depending on its condition, study required.

Additional Regulatory Requirements (>20,000 people)

- Phosphorous Reduction
- Disinfection



Proposed Process Upgrades





Implementation Plan and Cost Estimate



Near-term Implementation Plan

Item	Project	Opinion of Probable Cost	Timeline
1.0	Headworks Upgrade		
1.1	Fine Screens		
1.2	Grit Removal	\$4,800,000	2 years
1.3	Grit Washing		
1.4	Influent Pumps Upgrade	\$500,000	2 years
2.0	Biosolids Handling and Disposal		
2.1	Mechanical Dewatering of Biosolids	\$2,500,000	< 10 years
3	Secondary Treatment		
3.1	Digesters covering	\$400,000	< 5 years
	Total*	8,200,000	



Recommendations & Next Steps



Summary

- Existing WWTP meets effluent compliance requirements.
- Root cause of nuisance odours from BHP due to excessive amount of inert solids in wastewater
 - Reduces liquid treatment capacity
 - Negatively impacts solids treatment
- Upgrades to address:
 - Nuisance odour excursions
 - Plant performance/capacity recovery
 - Operating issues and cost
 - Reduce biosolids, improve quality
 - Resource recovery
- Plan for future treatment upgrades, 40 year horizon



Recommendations

Headworks Upgrade

- Fine screens, and grit removal and washing
- Influent pumps

Biosolids Handling and Disposal

- Decommission existing biosolids holding ponds
- Implement mechanical dewatering system
- Cover digesters

New Building (with HVAC and Odor control)

• Co-locate dewatering system and grit removal system



Next Steps



Initiate Preliminary Design

- Headworks Upgrades
 - Characterization of grit material
 - Selection of fine screen, grit removal and washing equipment
- Biosolids Upgrades
 - Selection of mechanical dewatering equipment
 - Cover digesters
 - Decommissioning planning for holding ponds
- Building Expansion for new Equipment
- Regulatory/Permitting



Questions?

2016 Master Business Plan and Odour Mitigation Report Timeline

The Town of Whitecourt is completing a master plan for the Wastewater Treatment Plant which involves two components

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April 2016. The report will incide

Process

The Whitecourt Wastewater Treatment Plant is an extended aeration activated sludge treatment facility that runs two parallel clarifiers.

Wastewater Treatment



The sludge captured by the clarifiers is further processed in two aero-The stabilized sludge (referred to as biosolids) is deposited in the two on-site storage cells (located west of the facility). Each year before freeze up, the cells are dredged and the removed biosolids are land applied to fields for beneficial reuse.

ut, we will be able to:

ess of existing mit path valuate the s identify and implement possible mitigation strategies to add

I odour tracking clanes must be completed by Joly 31 and returned the Town of Whitecourt by August 15, 2016 to allow sufficient time or the data to be analyzed and incorporated into the master plan

weather and air monitoring stationa will be installed at addition, weather and an increasing electronic to the addition of presentative locations in the east valley area. The eventies and all inforced data will be cross-inferenced with the data contained in the scking diaries to assess trends. The inform ster plan report recommendations

Wastewater Treatment Plant -Components and Operational Changes to Mitigate Od

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