Water Treatment Process Optimization Benefits

CWWA - National Water & Wastewater Conference, Halifax NS

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Acknowledgement

Calgary
Red Deer
Okotoks

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Why Optimization?

- Making the best use of existing assets
- Deferral of major capital investment for expansion
- Minor retrofits to accommodate additional treatment objectives
- Incorporating newer technologies within the footprint
- Additional capacity within the existing footprint
- Improve treatment performance
- Reduce operational costs
- Other site-specific drivers

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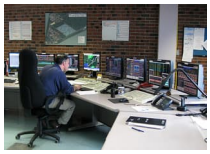
Optimization Team



- Technical team
- Operations (historical knowledge, plant issues)
- Maintenance (PM schedules, ongoing equipment issues, upgrades)
- Management (Resourcing, costs, awareness of risks)

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Setting Optimization Goals

- Master planning
- Capacity targets
- Operational Targets

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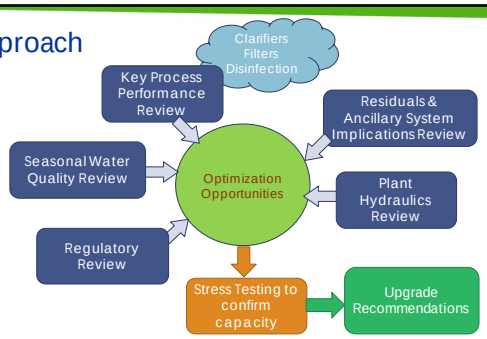
Approach



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Full-scale Stress Testing

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Why Stress Testing?

- Estimates for optimization need to be validated through actual operation
- Some issues are unpredictable and only seen at full scale
- Test drive?
- Stress testing can be an effective tool

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Pilot vs Full-scale Tests

- Piloting: Less risks
- Could be first step in a staged approach
- Piloting won't reveal all potential issues
- Full scale is preferred whenever possible

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Stress Test Planning

	Low Temperature	Moderate Temperature	High Temperature
Low Turbidity	Nov, Dec, Jan, Feb, Mar	n/a	n/a
Moderate Turbidity	n/a	Apr, May, Oct	n/a
High Turbidity	n/a	n/a	June

- Target flows?
- Capturing seasonal variation
- Risk assessment
- Resourcing, scheduling
- Regulatory notifications
- Sampling & testing

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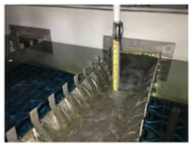
Okotoks WTP Actiflo® Stress Test

- Target Flow Rate: 128 L/s (54 m/h rise rate)
- Operate under typical flow-through operations:
  - Rapid/coagulation mixer and injection mixer on
  - Sludge recirculation pumps off
- Issues noted at 120 L/s

Actiflo® 1 Weir hydraulics maxed out at 120 L/s



Actiflo® 2 Effluent Collection Trough – Flow Test at 120 L/s

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City of Red Clarifier & Filter Retrofit

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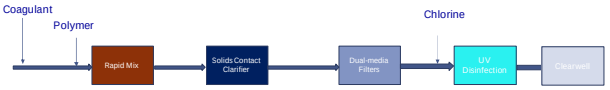
Pre-Optimization Water treatment



Process Retrofit Optimization in lieu of Expansion

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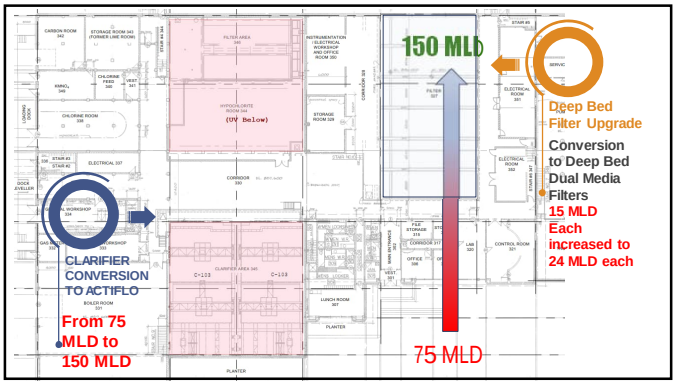

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Calgary WTPs Optimization

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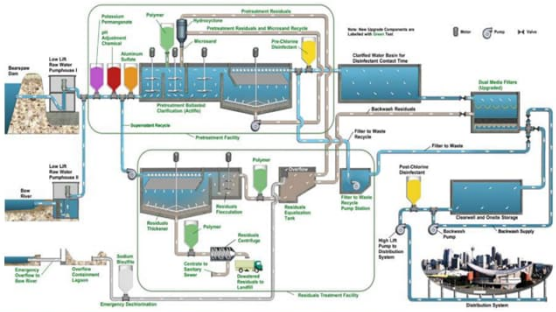
Bearspaw WTP Process Scheme



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Master Planning Outcome

- A new WTP 300 ML/d
  - Phase 1: 250 Million
  - Phase 2: $150 Million
  - Total: $400 Million
- WTP Optimization Goal
  - to add 150 ML/d firm capacity if possible
  - Achievable at $15-20 Million
  - 5+ years deferral of major investment

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Seasonal Water Quality Characterization

Parameter	Target Condition		
	"Low"	"Moderate" / "Medium"	"High"
Turbidity	<2 NTU	2 – 4 NTU	>4 NTU
Temperature	<4°C	4 – 10°C	>10°C
pH	<8	8 – 8.2	>8.2
Total Organic Carbon (TOC)	<0.75	0.75 – 1.25	>1.25

Glenmore WTP

Period	Turbidity	pH	Temperature	TOC
February	Low	Low	Low	Low
April	Moderate	Moderate	Moderate	Moderate
June	Low	High	High	High
Nov-Dec	Low	High	Low	Moderate

Bearspaw WTP

Period	Turbidity	Temperature
Nov - Mar	Low	Low
April, May	Moderate	Moderate
June	High	High

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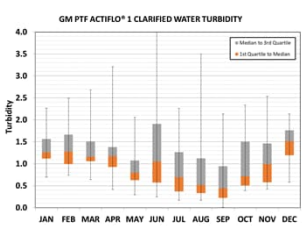
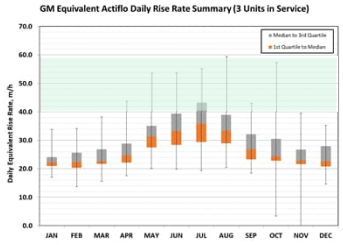
Actiflo Performance 2013-17





Increasing rise rates of Actiflo is likely feasible

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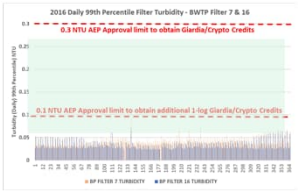
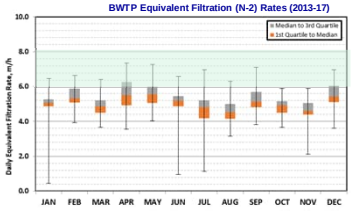
Filtration Performance





Increasing filtration rates is likely feasible

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Hydraulic Assessment

Desktop hydraulic model available

Hydraulic calibration exercise- Full scale tests

Plants were operated at progressively higher flows

Water levels measured throughout plant

Levels used to calibrate & Headlosses predicted

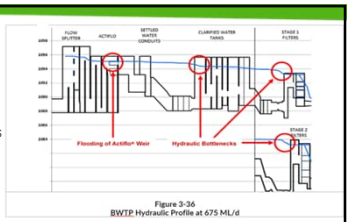

Figure 3-36
BWTP Hydraulic Profile at 675 ML/d

- Bearspaw WTP:
- Hydraulic capacity estimated = 675 ML/d
- Bottlenecks
  - Inlet to clarified water basins
  - Filter inlet piping into STG1 and STG2

- Glenmore WTP:
- Hydraulic capacity estimated = 575 ML/d
- Bottlenecks
  - Inlet to clarified water basin

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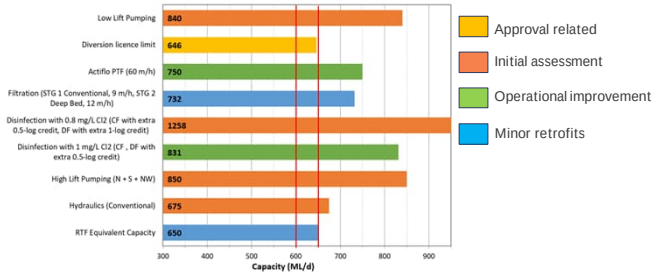
Optimization Opportunities- Bearspaw WTP



Process stress testing confirmed target flows

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Planning Goals Met?

- Combined firm capacity of all WTPs shall meet MDD within a 5-year Horizon
  - 650 + 450 ML/d (firm) to provide +150 ML/d additional capacity
    - the City's target of increasing 150ML/d is achievable,
    - it can defer the major WTP upgrades for 10+ years
- WTP Optimization for 150 ML/d ($15-20 M) If the target of 150 ML/d is achievable
    - Additional 150 ML/d firm capacity achieved with $15 M
    - Compared to Phase 1: 150 ML/d new WTP at $250 M

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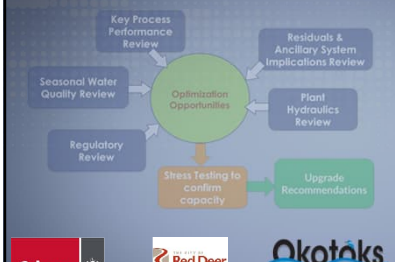
Questions?



Associated Engineering

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