Group C1.03 – Rust Busters

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Background

Regional growth in Central Texas has increased the demand on water supply systems. Many providers such as Bobcat City seek new sources to supplement existing systems. Bobcat City has recently obtained rights to groundwater from a local aquifer and requests help designing a portion of a treatment plant capable of providing 40MGD.

This project aims to address the primary problem associated with this new groundwater source, high concentrations of iron (6-10 mg/L) and manganese (0.1 – 0.3 mg/L). This project focuses on evaluating potential alternatives to achieve aesthetic secondary treatment standards and attempt to match water quality characteristics of Bobcat City's existing supplies.

Three phases of the treatment process were identified and evaluated for capital & life-cycle costs as well as sustainability using ISI's Envision Sustainable Infrastructure framework.

Alternatives Analysis

Phase 1 – Mixing & Oxidation

Oxidation Alternative Options (requires pilot testing)
A. Chlorine
B. Potassium Permanganate

Mixing Alternative Options:
A. Mechanical rapid (flash) mix basins
B. In-line / static mixers

Phase 2 – Coagulation & Flocculation

Mechanical Flocculation Alternatives:
A. Horizontal / Vertical Paddles
B. Use Phase 3 solids-contact clarifiers for flocculation

Primary Coagulant Alternatives:
A. Fe(III) salts introduced as chlorides or sulfates
B. Pre-hydrolyzed alum (PACl) and polymers

Phase 3 – Sedimentation & Clarification
A. Solids-contact Clarifiers / Slurry Recirculation
B. Plate (lamella) Settlers

3 Phase Treatment Train Recommendations

Phase 1 – Mixing & Oxidation

Oxidation Recommendation: Future pilot testing required for matching compatibility
Mixing Recommendation: Mechanical Rapid Mixing Basins

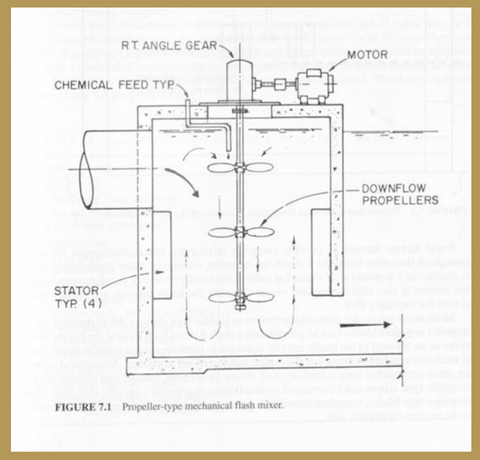

Figure 1: Impeller Type Flash Mixer (ASCE, 2022)

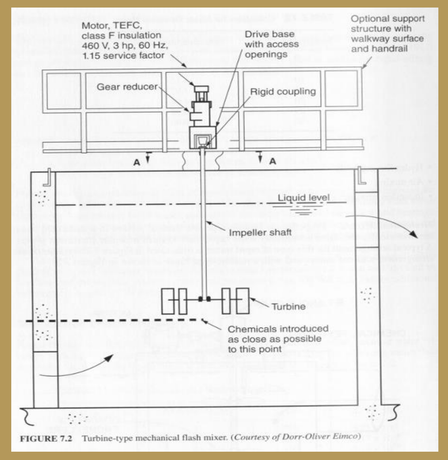

Figure 2: Turbine Type Flash Mixer (ASCE, 2022)

Phase 2 – Coagulation

Coagulation Recommendation: Pre-hydrolyzed alum (PACl) and assisting polymers
Flocculation Recommendation: Rely on Phase 3 Solids-contact clarifiers for flocculation

Phase 3 – Sedimentation & Clarification

Recommendation: Solids-contact Rotating Clarifiers

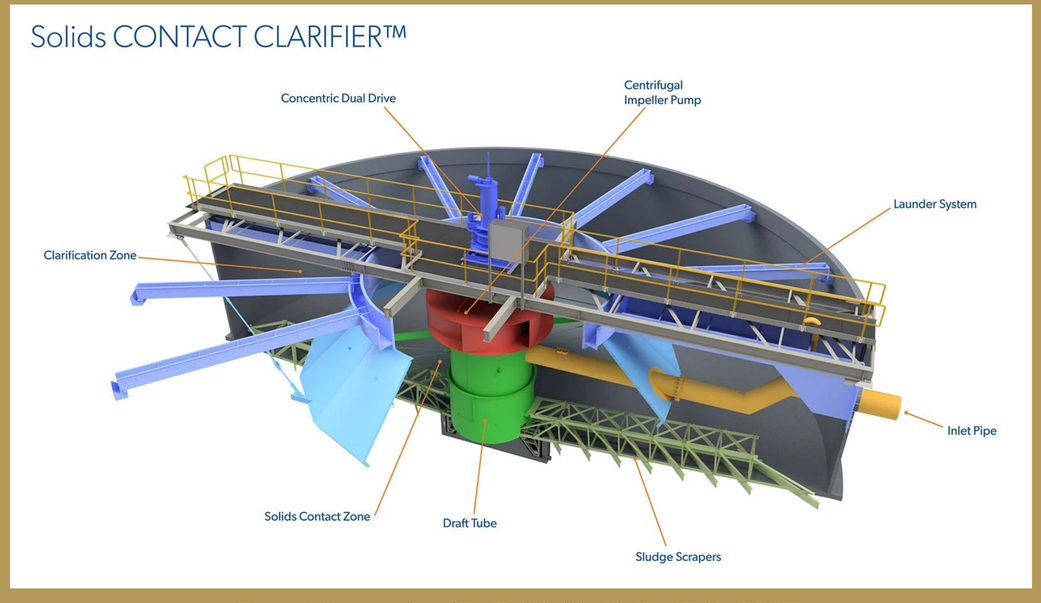

Figure 3: Cross-section of WesTech Solids CONTACT CLARIFIER

Costs & Sustainability

Table 1: ISI Envision Sustainability Framework Summary

	Applicable	Submitted	Percentage
Quality of Life	92	30	33%
Well Being / Mobility / Community			
Leadership	182	77	43%
Collaboration / Planning / Economy			
Resource Allocation	196	95	48%
Materials / Energy / Water			
Natural World	114	41	36%
Siting / Conservation / Ecology			
Climate & Resilience	146	48	33%
Emissions / Resilience			
Totals	**730**	**291**	**40%**

Table 2: Capital & Life-cycle Costs Summary

Phase / Alternative	Total Capital Cost Estimate	Total 30-yr Life-Cycle Cost (NPV) Estimate
Phase 1 Flash-Mix Tanks w/ Mechanical Agitators (4 basins)	$0.45M – $1.25M	$0.75M – $1.85M
Phase 2 Pre-hydrolyzed Alum + Polymer Feed Systems	≈ $1.40M	≈ $2.75M
Phase 3 Solids-Contact Clarifiers (3 circular basins)	$1.25M – $2.0M	≈ $5.65M
TOTAL (Phases 1–3)	**$3.0M – $4.75M**	**≈ $9.0M – $10.25M**

Location & References

Figure 4: Bobcat City's Future Water Treatment Location

Bobcat City's new water treatment is planned to be built near the existing wastewater treatment plant near the Bobcat City River. Sustainability and construction considerations will take these proximities into account.

References
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