Mine Water Pinch

Increasing Reuse/Recycle efficiency While Optimising Water Treatment on Mine Sites

Priyal Dama-Fakir
Grace Yungwirth
Peter Wille
Trevor Coleman

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Agenda

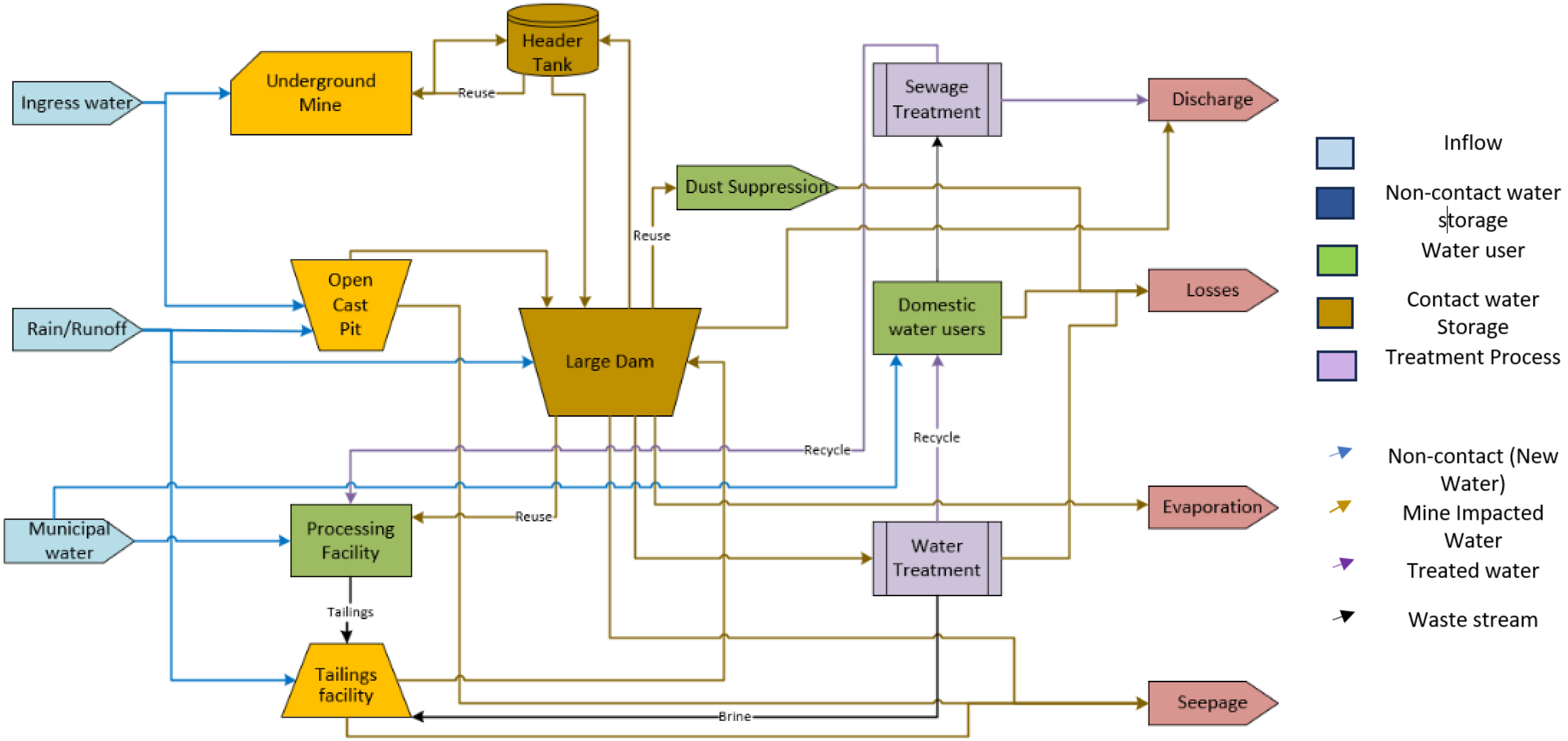
INTRODUCTION

What is Water Pinch?

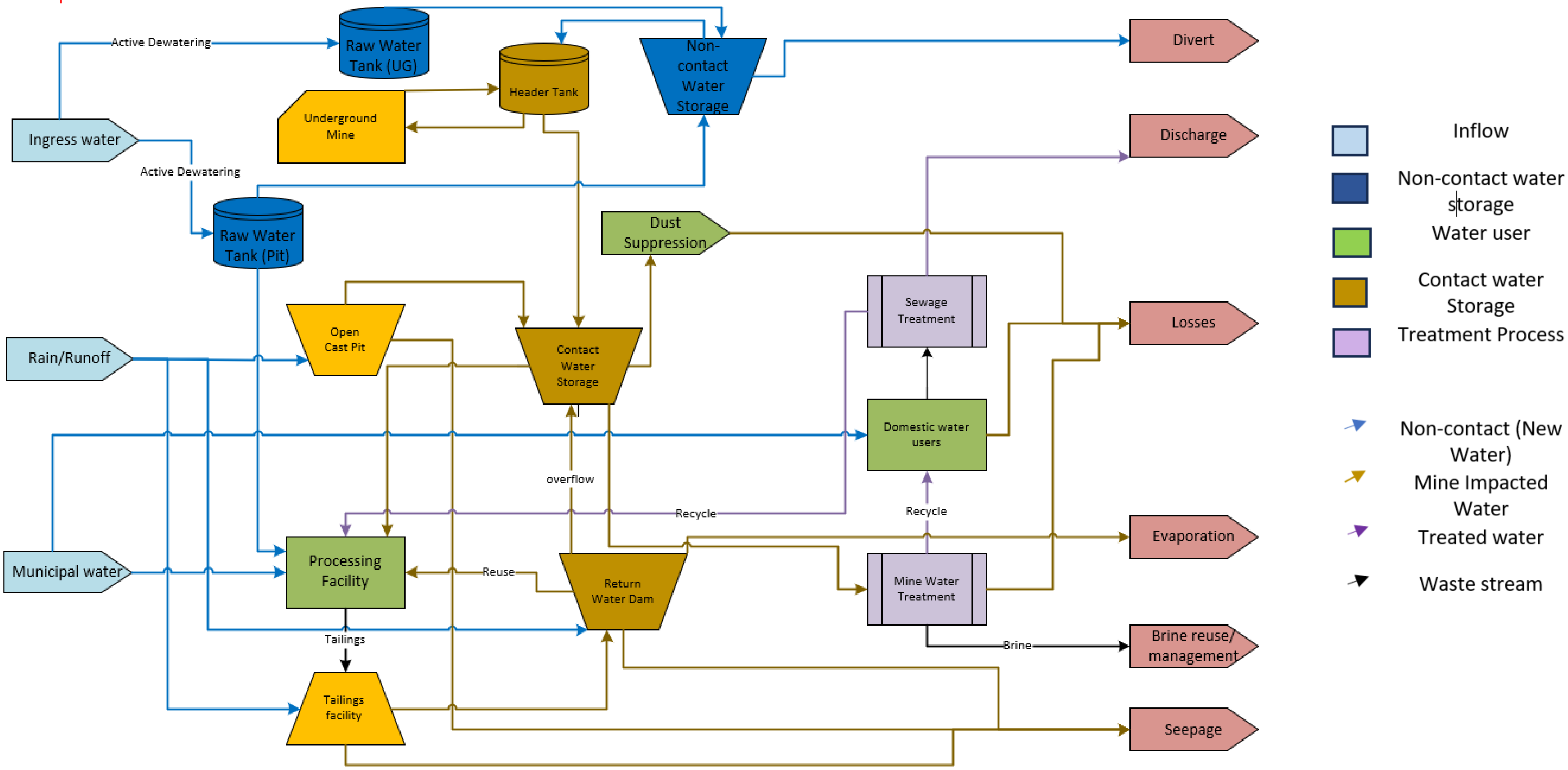
"Water pinch involves a set of **systematic formal techniques** to handle the complex problem of **hierarchical water allocation** to a system consisting of a **number of processes** and choosing the **best combination of strategies**" (Brouckaert, et al, 2005).

Allocating the best source waters (water quality) to the most sensitive processes

Typical Mine Water Management



Optimised Mine Water Management



Information Required for a Fit-for-Purpose Assessments

Water Balance Information:

- ✓ Water sources e.g. municipal water, river water, wellfields, ingress water
- ✓ Water sinks – particularly the main water consumers
- ✓ Alternative sources available e.g. PCD, stormwater, TSF
- ✓ Potable/fresh water users
- ✓ Discharges

Technical Information:

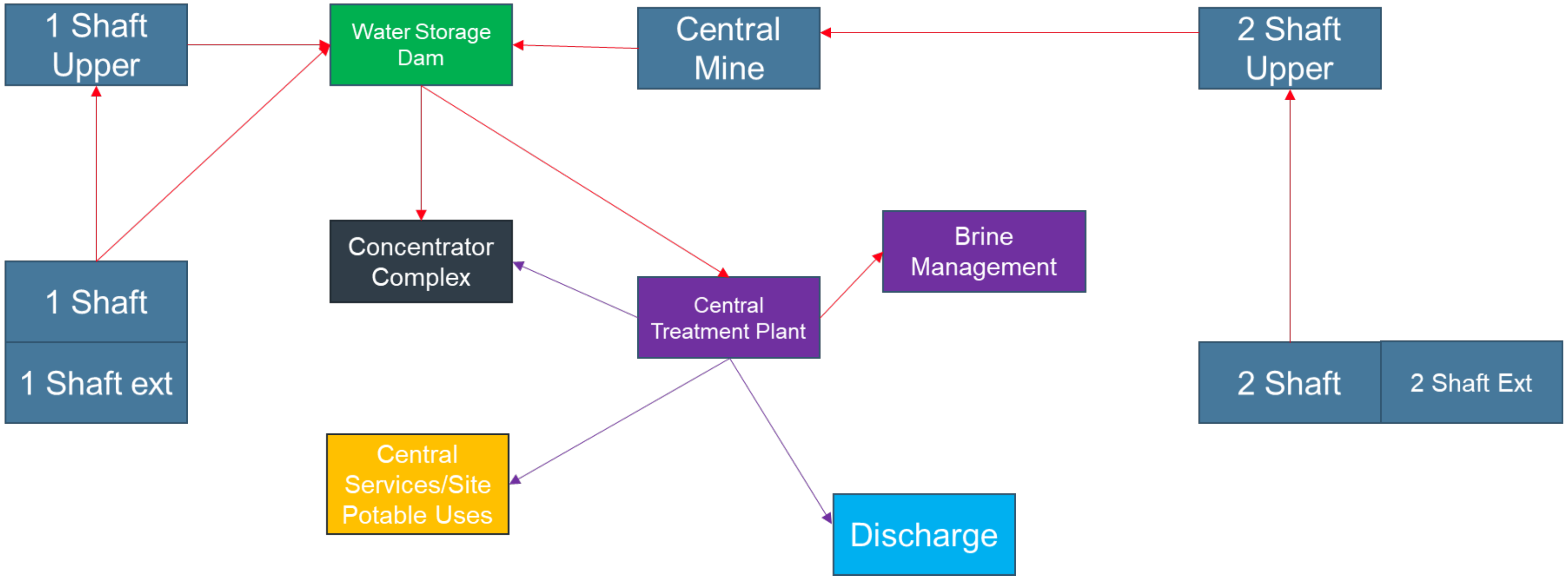
- ✓ Engineering drawings
- ✓ Measured flows
- ✓ Water quality database
- ✓ Planned projects
- ✓ Equipment datasheets / OEM data
- ✓ Predictive water balance model if available
- ✓ Salt/Chemistry balance model

Methodology

Step 1

Flow Diagrams

- High level spatially orientated block flow diagrams

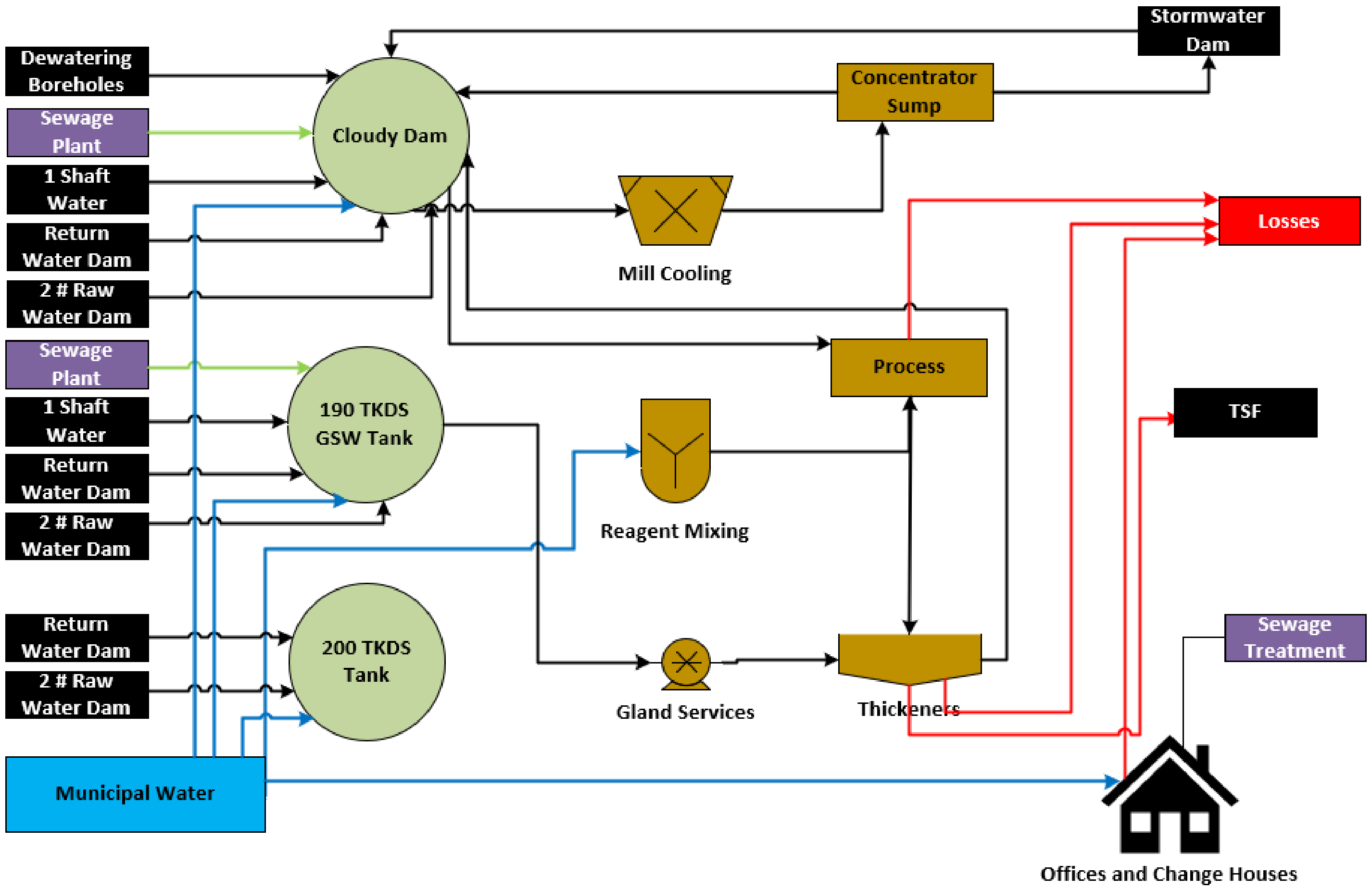


Methodology

Step 1

Flow Diagrams

- High level spatially orientated block flow diagrams
- Detailed area specific diagrams indicating sources and sinks

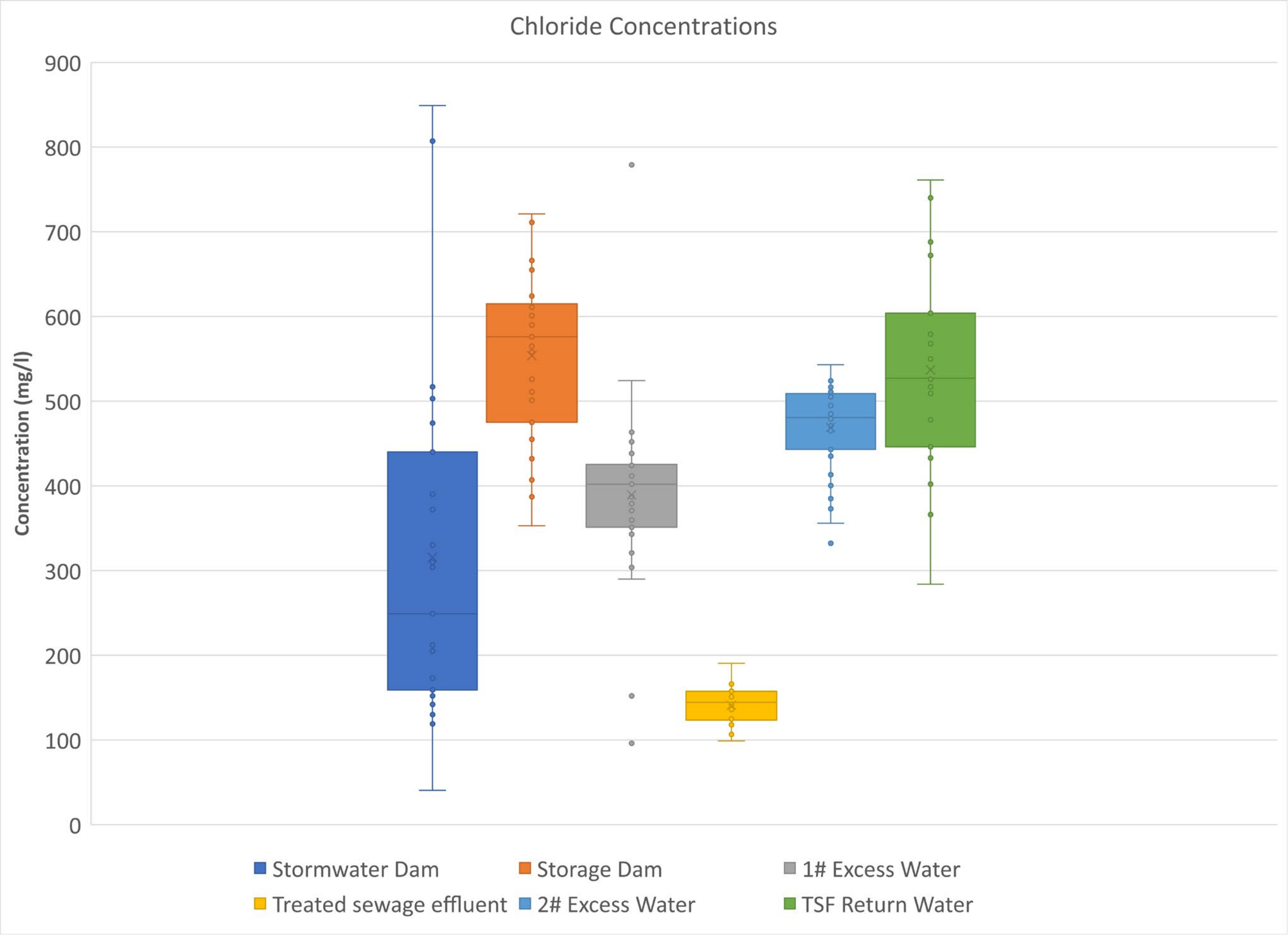


Methodology

Step 2

Flow and quality assessment

- Quantify water requirements. Where possible, group water uses.
- Quantify water available using the water balance
- Assess water quality for water sources.
- Confirm water quality constraints for water uses
- Communicate information gaps and recommendations on addressing these gaps for the 1st phase assessment.



Methodology

Step 2.1 Identifying water quality constraints

- **Discussions with Suppliers**
- **Corrosion or scalability indices**
- **Cooling systems – back calculating based on cycles of concentration**

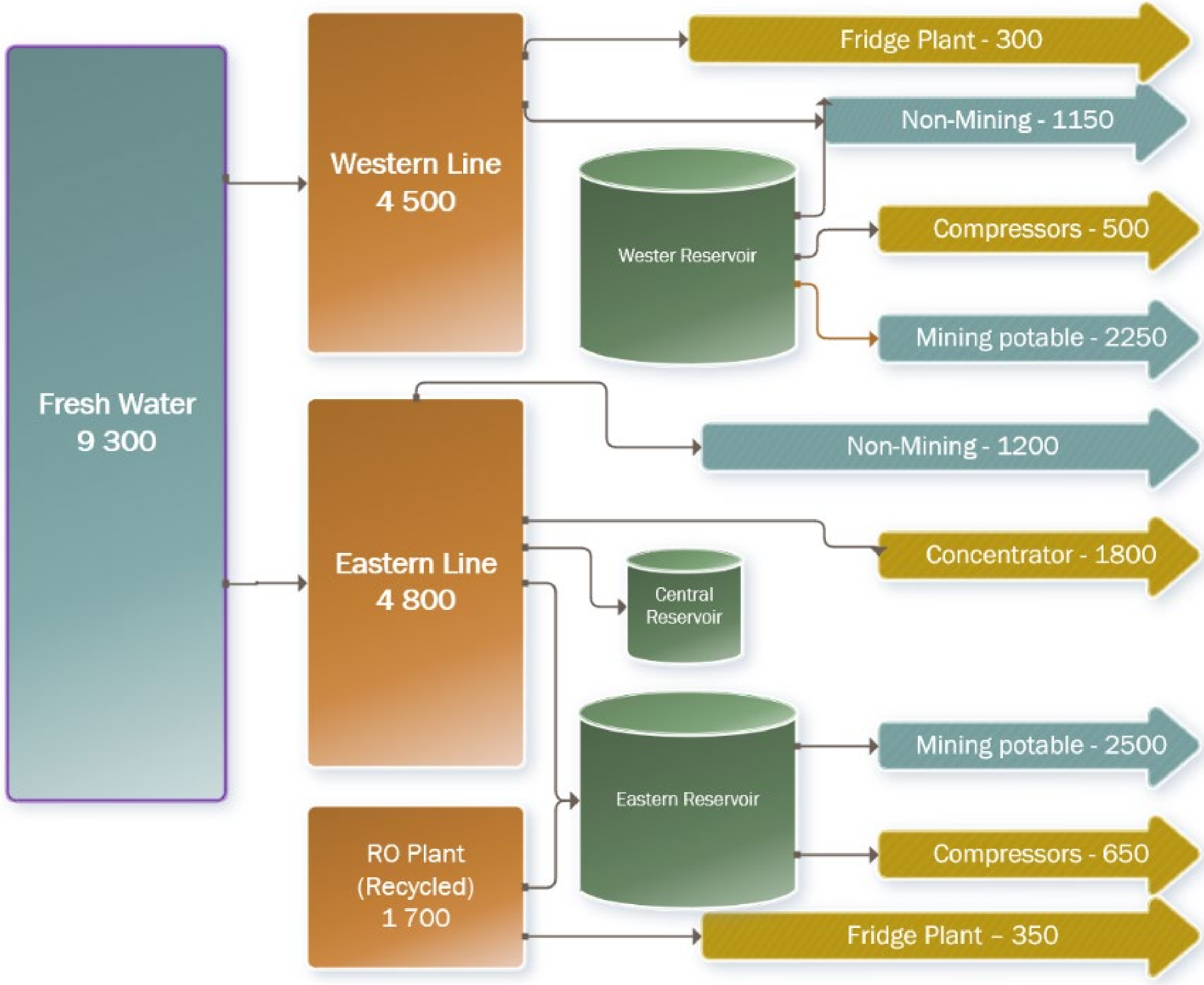
Langelier Saturation Index		Ryznar Index		Larson Skold Index		Puckorius Index	
LSI < 1	Tendency for corrosion	RSI > 9	Intolerable corrosion	LaI > 1.2	Severe pitting corrosion	PSI > 7	Highly corrosive
LSI = 0	Chemical balance	7.5 < RSI < 9	Heavy corrosion	1 < LaI < 1.2	Significant pitting corrosion	6 < PSI < 7	Low corrosivity
LSI > 1	Tendency for limescale formation	7.0 < RSI < 7.5	Corrosion significant	0.8 < LaI < 1	Mild corrosion	PSI < 6	Scale Forming
		6.0 < RSI < 7.0	Little limescale formation or corrosion	LaI < 0.8	Minimal corrosion		
		5.0 < RSI < 6.0	Light limescale formation				
		4.0 < RSI < 5.0	Heavy limescale formation				

Methodology

Step 3

Identify Focus Areas

- Client requests
- Larger water sinks
- Sensitive processes / Sensitive equipment
- Fresh Water (good quality water sourced from external supply) usage / Potable water users
- Storages that are discharging to the environment
- Prepare separate flow diagrams for the focus areas.

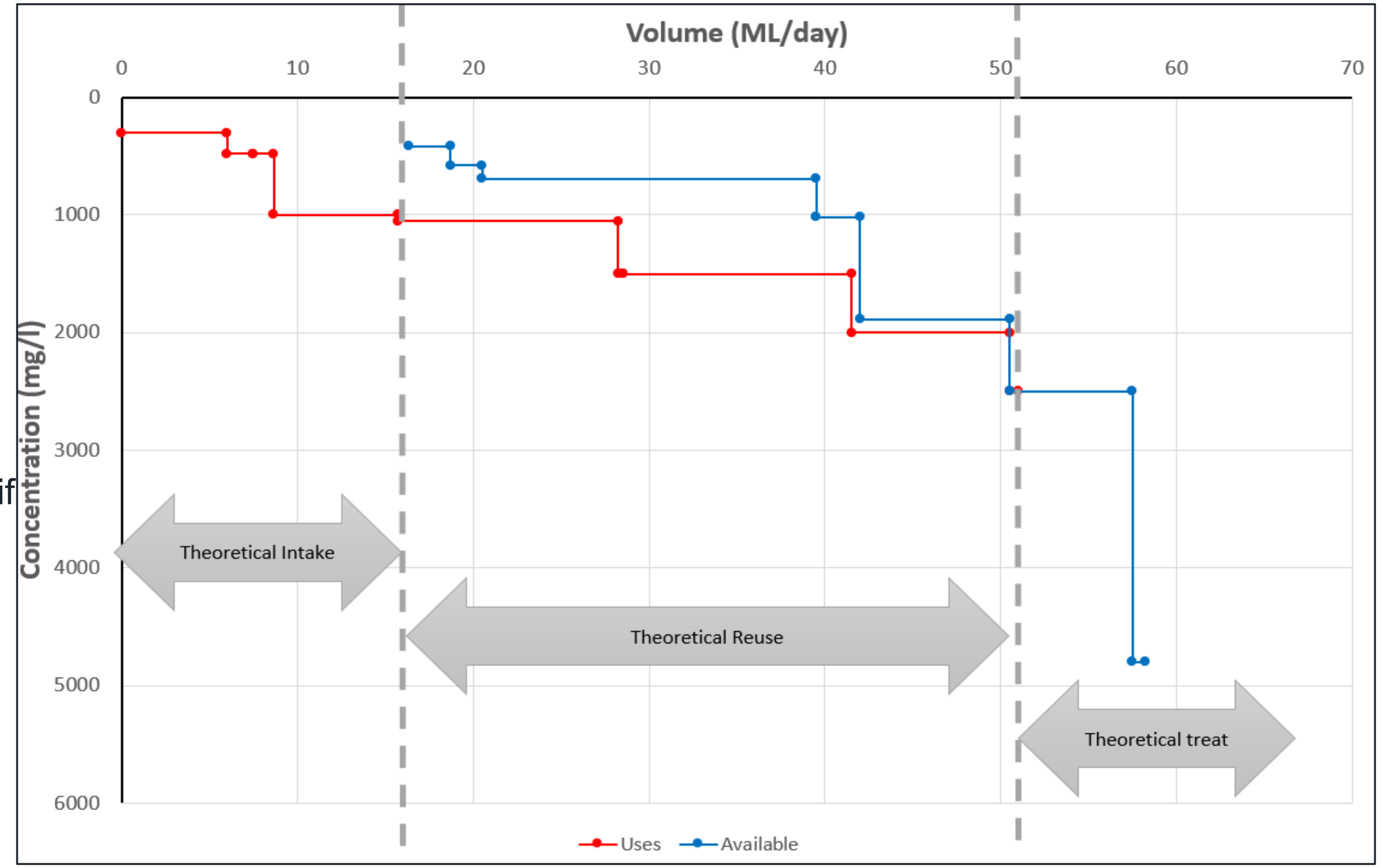


Methodology

Step 4

Data Analysis

- High level load balances
- Pinch Charts
- Identifying pollutant sources
- Identify streams that can be isolated if required

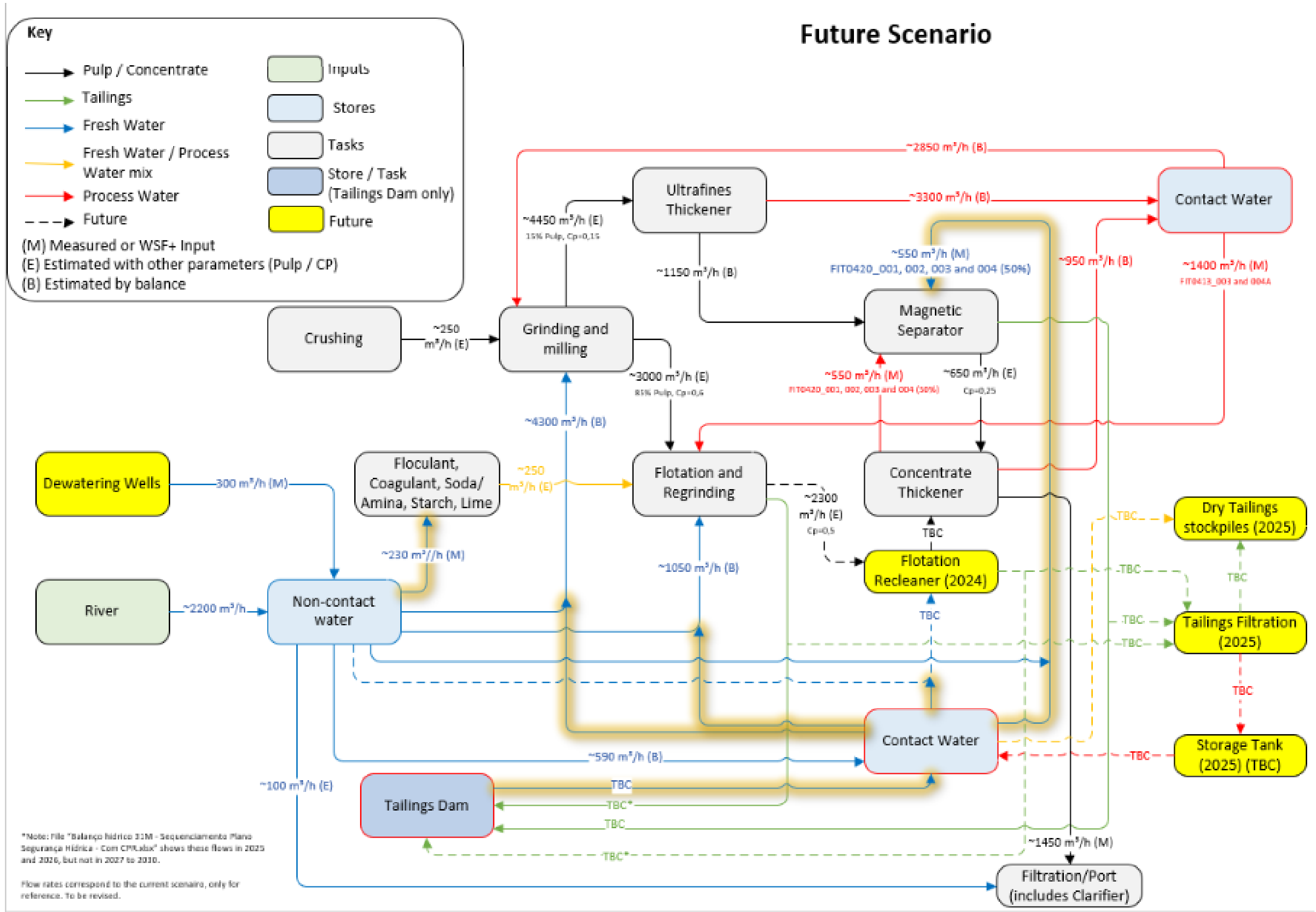


Methodology

Step 5

Identify opportunities

- Revisit water quality constraints
- Identify opportunities for substitution of source waters
- Investigate blending opportunities
- Prepare high level flow diagrams demonstrating opportunities–client discussion



Methodology

Step 6

Opportunity Assessment

- Concept level designs
- Cost estimates
- Water balances ~~-~~ surety of supply, available storages, treatment requirements
- Salt balances

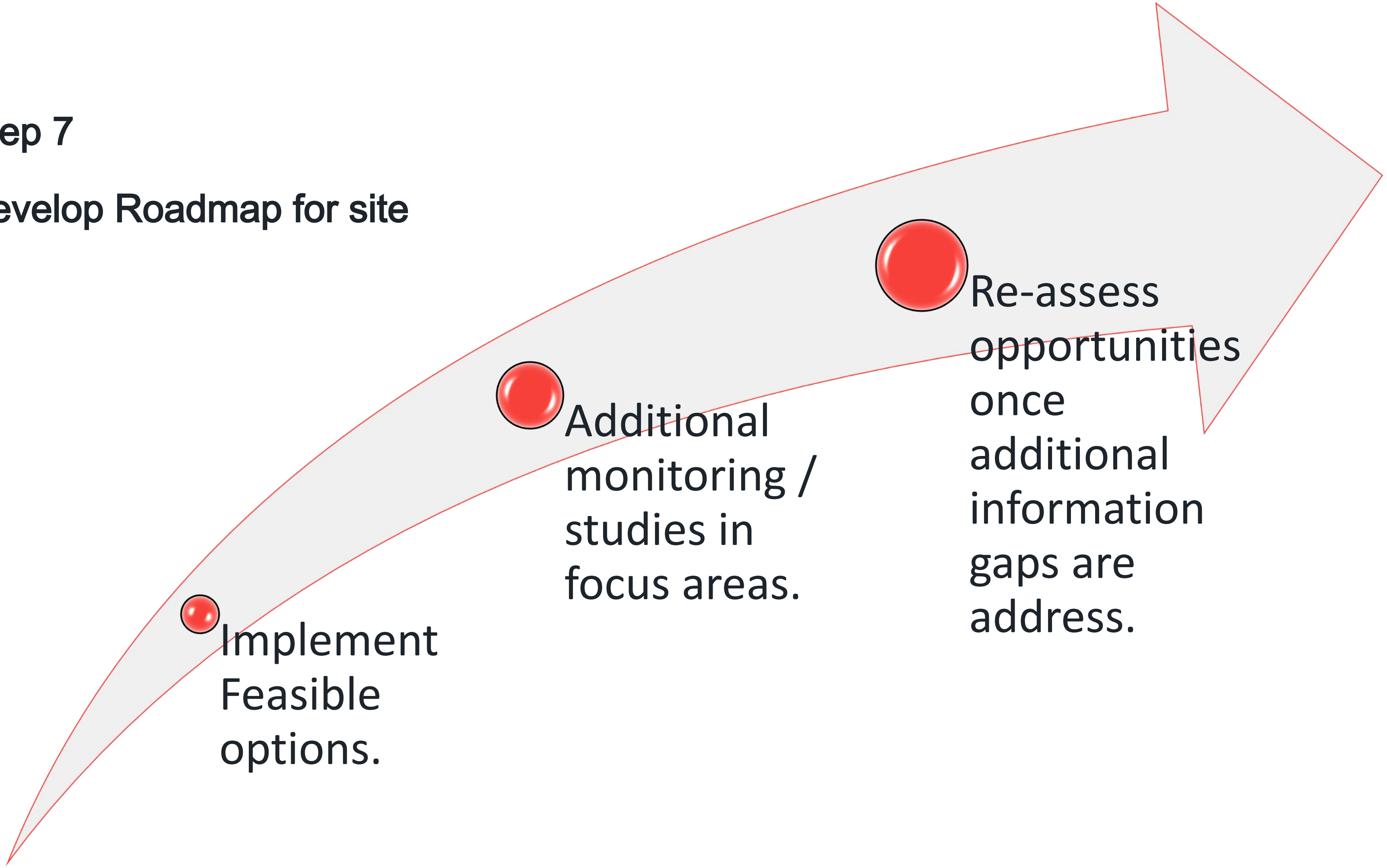
CAPEX	USD M	R$ M
Clarifier	1,6	8,0
RO	7,4	37,0
Pipeline	2,3	11,4
Total	11,3	56,4

OPEX	USD M	R$ M
Power	0,08	0,41
Chemicals	0,60	3,00
Labor	0,04	0,19
Membrane replacement	0,37	1,85
Total	1,09	5,45

Methodology

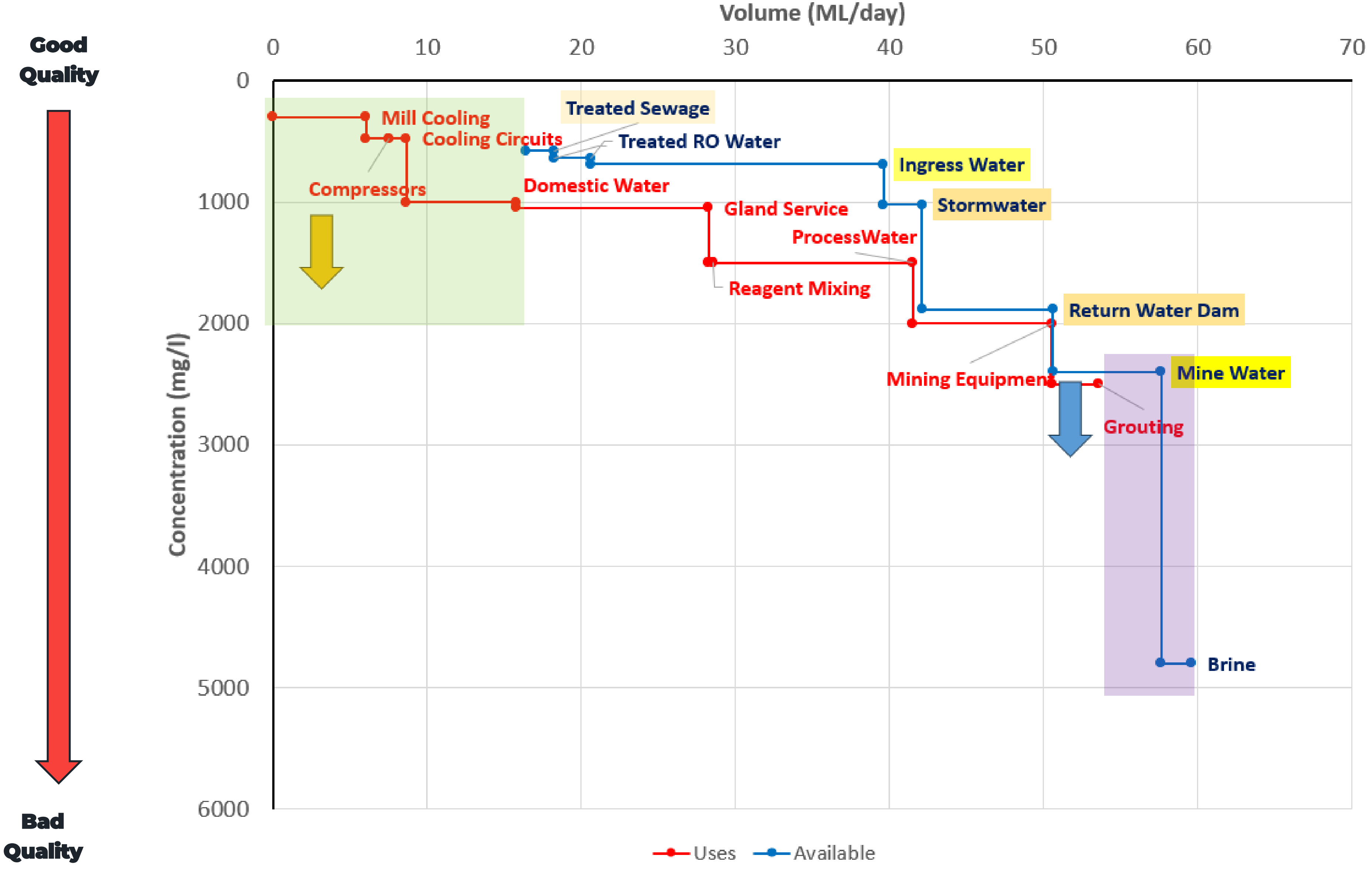
Step 7

Develop Roadmap for site



Case Studies

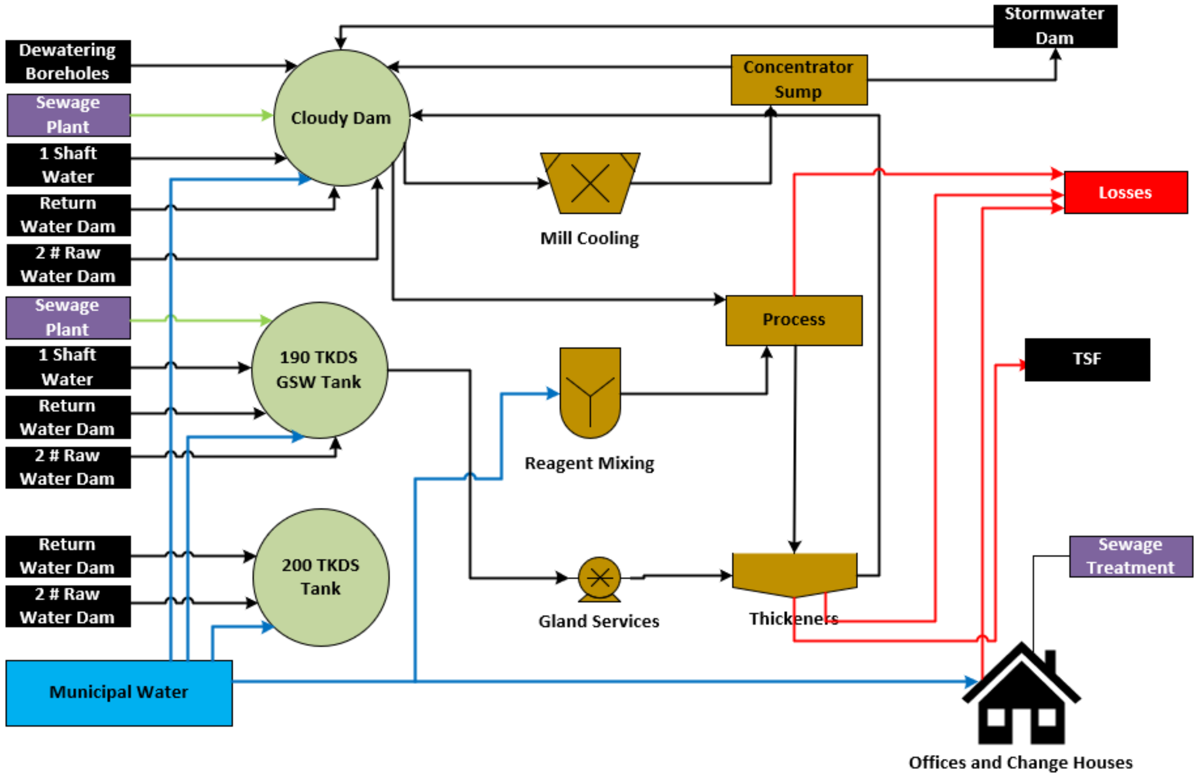
Pinch Chart



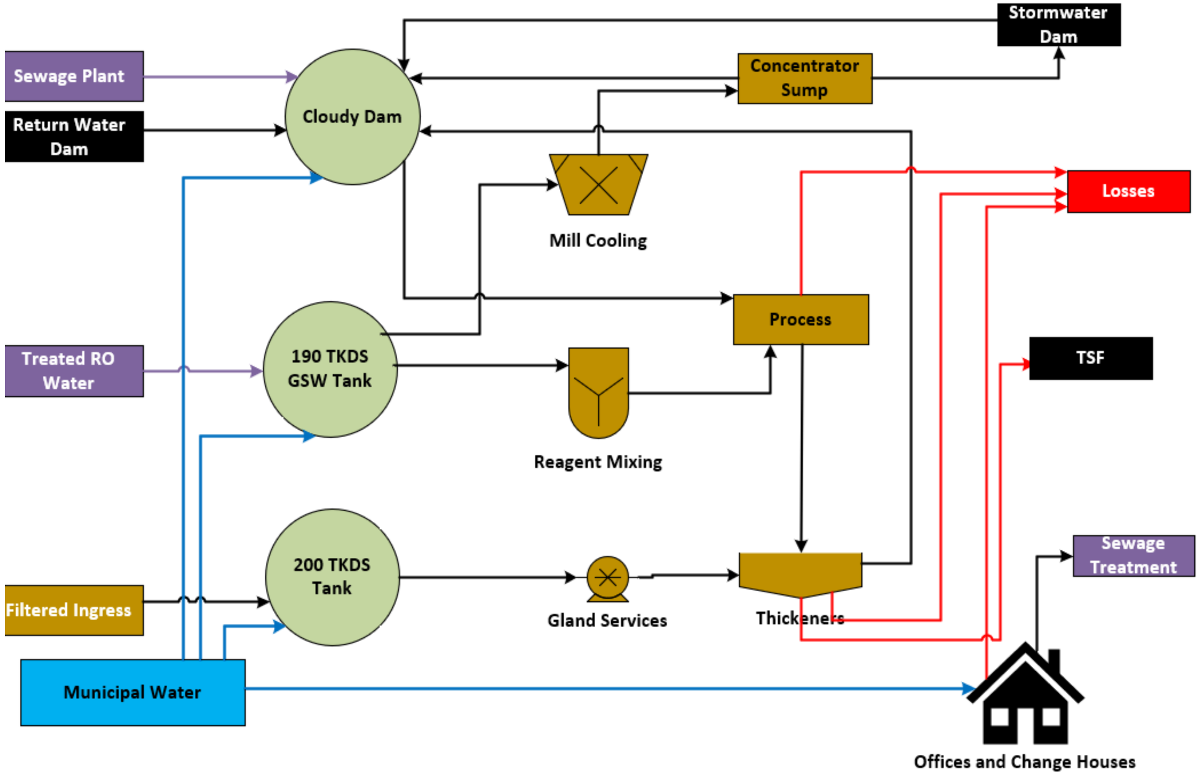
Good Quality
Bad Quality
Volume (ML/day)
0
10
20
30
40
50
60
70
Concentration (mg/l)
0
1000
2000
3000
4000
5000
6000
Mill Cooling
Cooling Circuits
Compressors
Treated Sewage
Treated RO Water
Domestic Water
Ingress Water
Stormwater
Gland Service
ProcessWater
Reagent Mixing
Return Water Dam
Mining Equipment
Mine Water
Grouting
Brine
Uses
Available

Proposed changes - Concentrator

Current



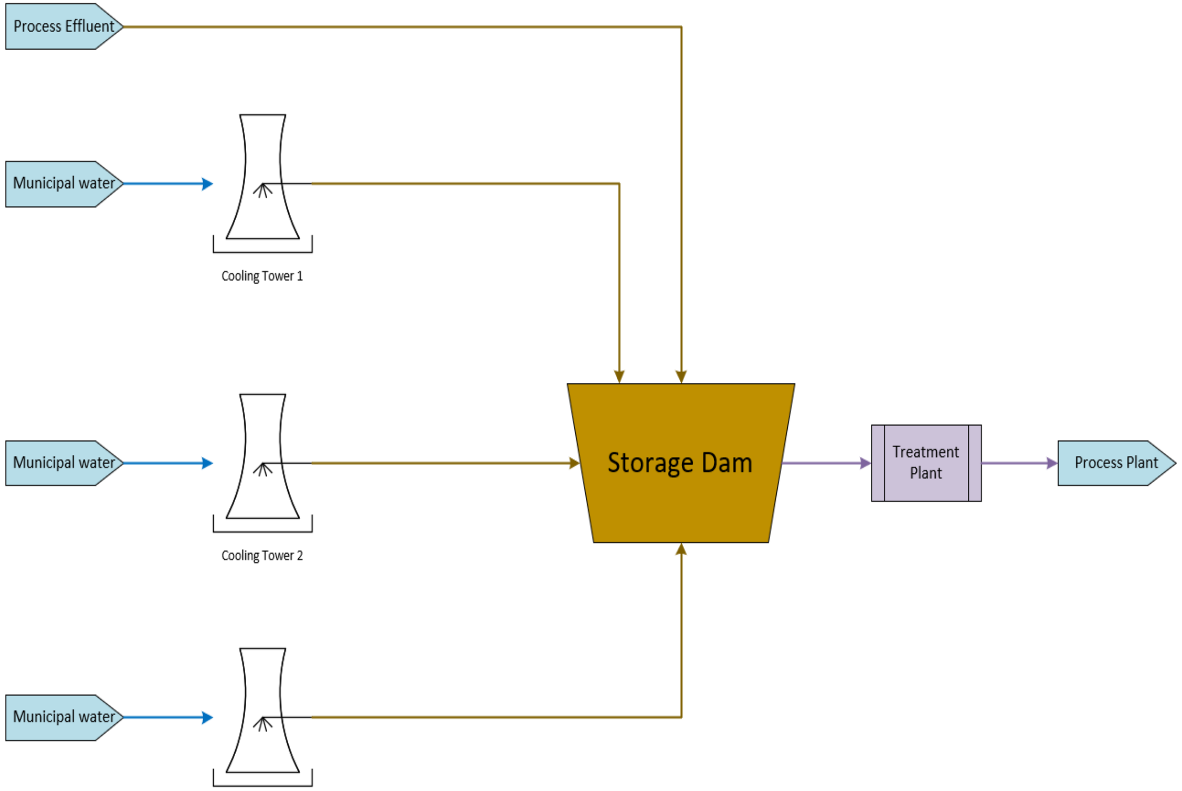
Proposed



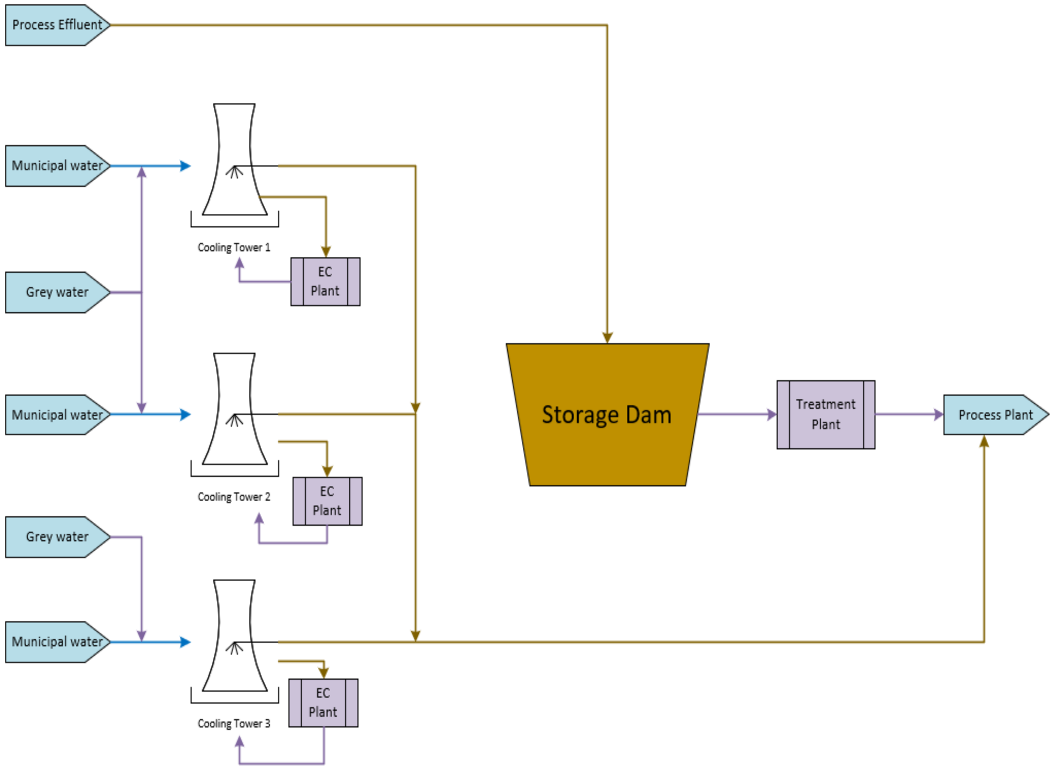
Isolating less contaminated water sources for the concentrator and using dedicated tanks for sensitive processes reduced the need to "dilute" water in tanks with municipal water.

Proposed changes – cooling systems

Current



Proposed



Introducing Electro-coagulation enabled the use of grey water. Capturing the washdown and bypassing the storage dam facilitated reuse without treatment.

Conclusions

Conclusions

- Water pinch can be applied successfully in the mining industry.
- A phased approach, identifying focus areas reduces the need for excessive data.
- Water Pinch charts provided a good tool for discussing reuse opportunities with sites.
- Isolating and diverting non-contact water can improve ESG reporting figures.

Thank you

Priyal Dama-Fakir – priyal.dama-fakir@wsp.com

wsp.com