MEND BC December 1, 2016 Vancouver, Canada

Beneficial use of Springer Pit Lake at Mount Polley Mine

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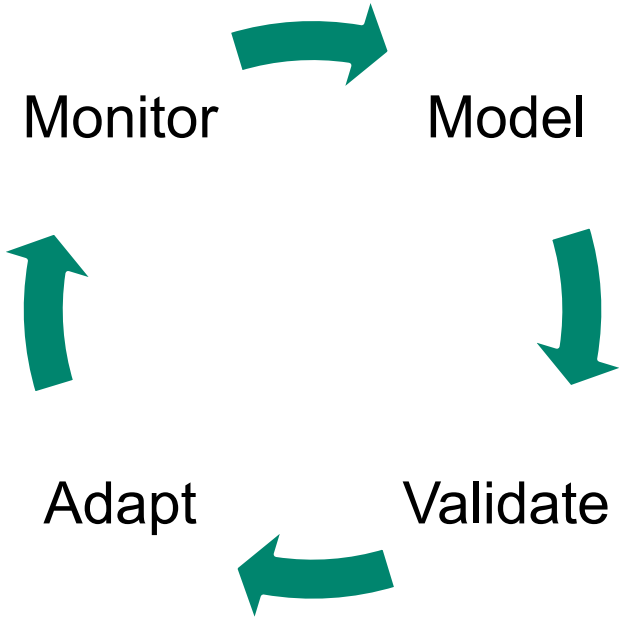
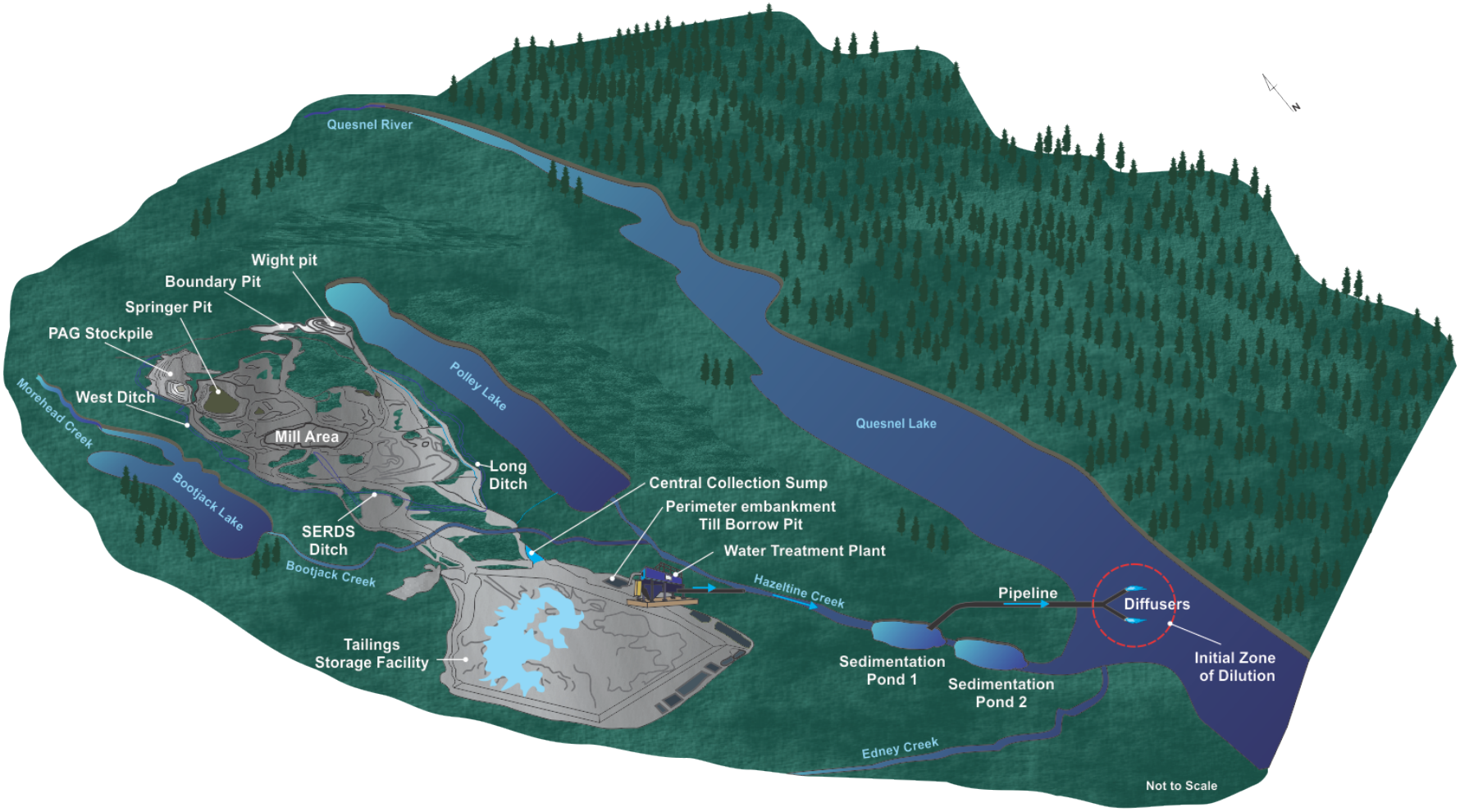
Golder Associates

Overview

- Chronology of Springer Pit Lake
- Lines of evidence of passive water treatment
  - Pit lake model
  - Monitoring
  - Design criteria
- Removal of particulate metals
- Use of water treatment plant in ‘passive’ mode



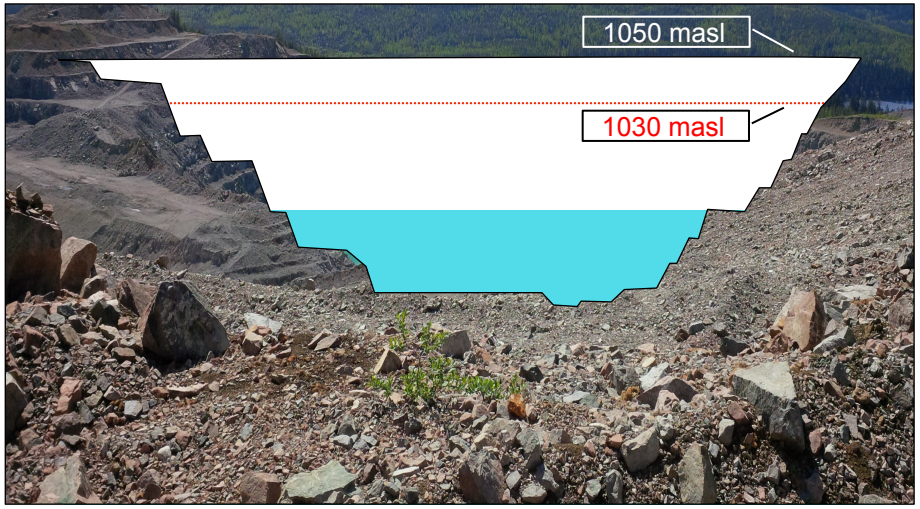
Water Management at Mount Polley Mine

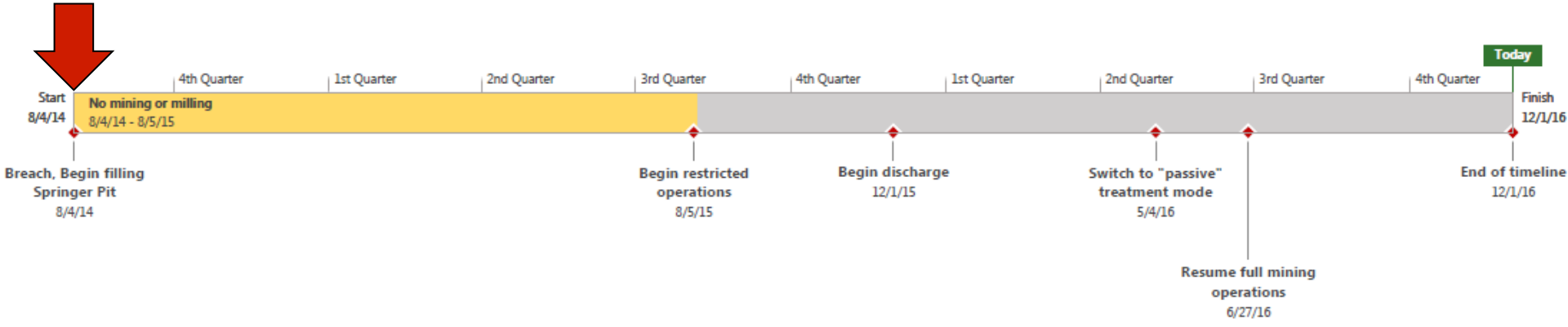


MOUNT POLLEY - SHORT TERM (2016)

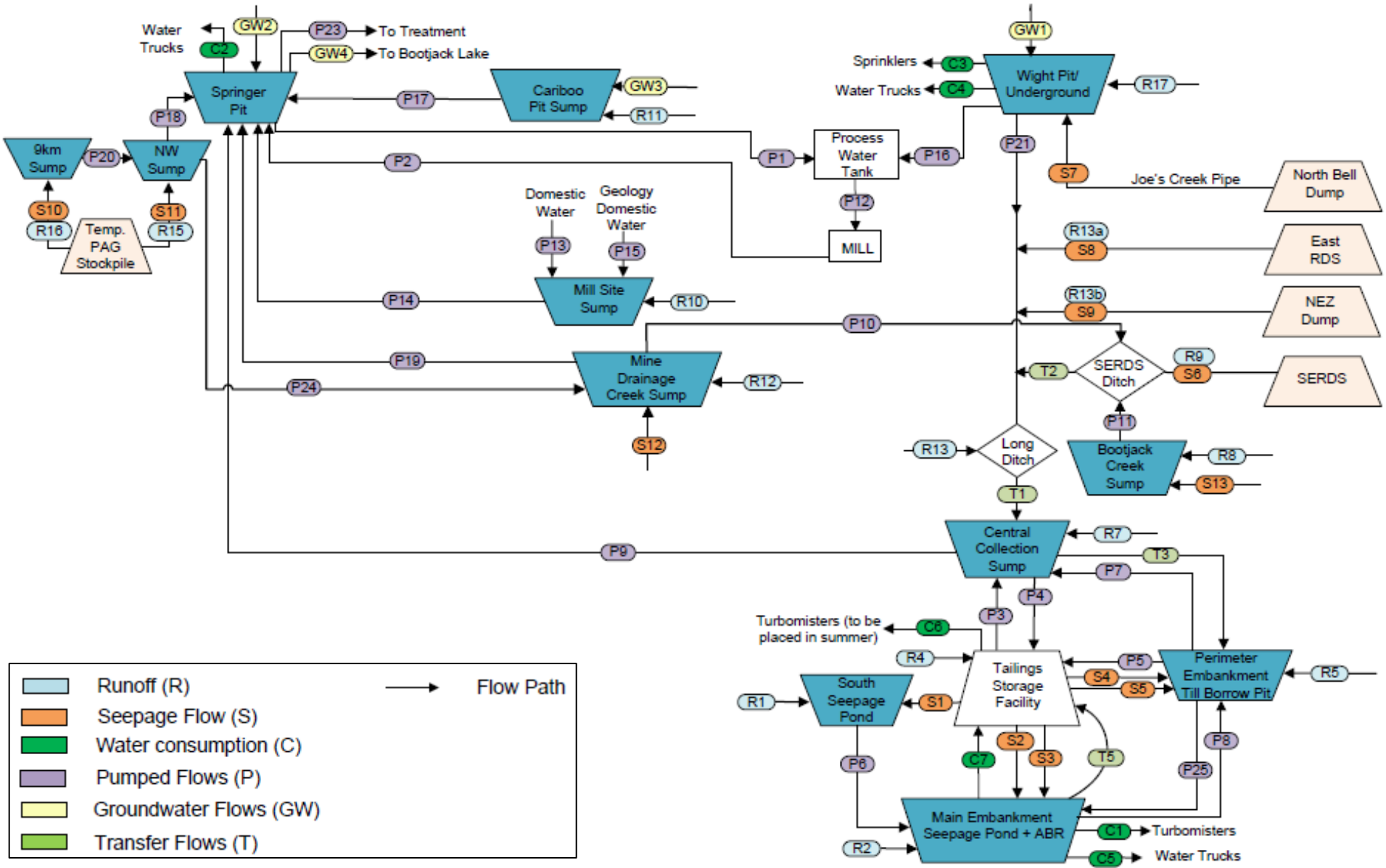
Springer Pit Barges

Chronology of Springer Pit Lake

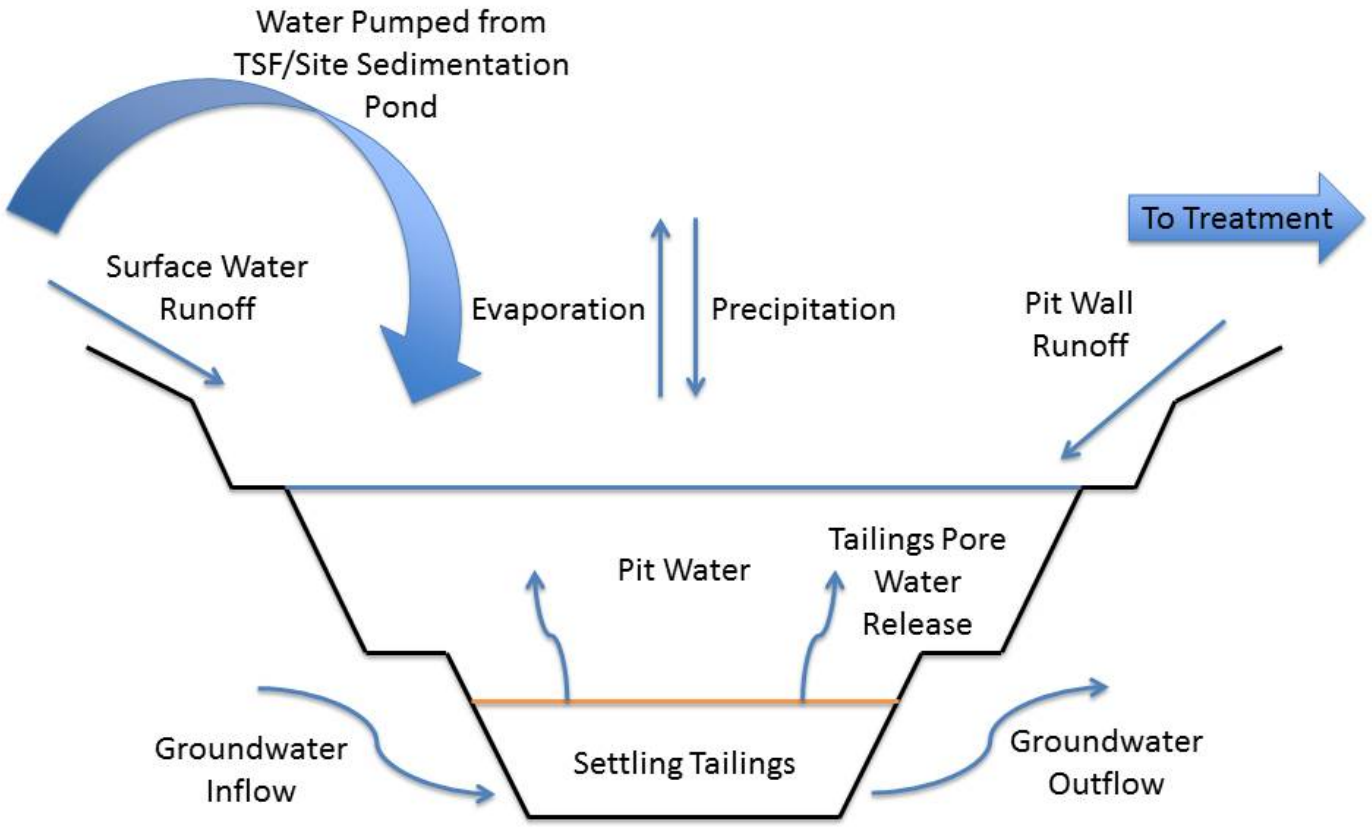




Water Balance – Dec 1, 2015 – Jun 27, 2016



Pit Lake Conceptual Model



Water Quality Comparison

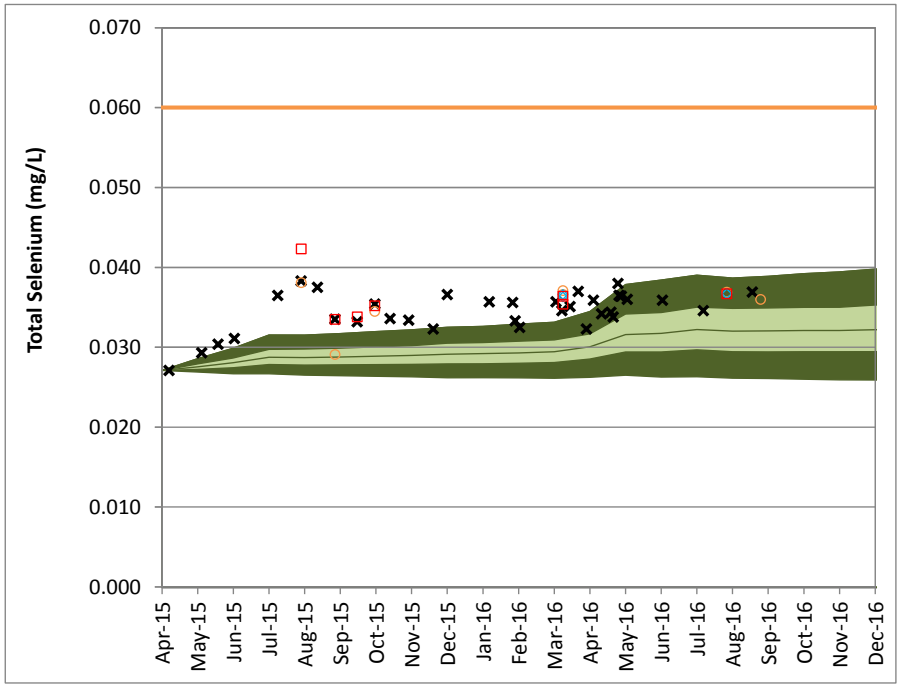
- **Under-predicted**: measured data above 95th percentile predictions
  - Mg, NO_3^-
  - Total As, Se*
- **Accurate**: measured data between 5th and 95th percentile predictions
  - TDS, Ca, SO_4^{2-}*
  - Dissolved Sb, B, Cr, Fe, Mo, Ag
  - Total Sb, B, Mo*
- **Over-predicted**: measured data below 5th percentile predictions
  - Cl^-, NH_4^+
  - Dissolved Al, As, Cd, Co, Cu, Mn, Zn
  - Total Al, Cd, Cr, Co, Cu*, Mn, Ag, V, Zn, PO_4^{3-}*

* *Time series shown in following slides*

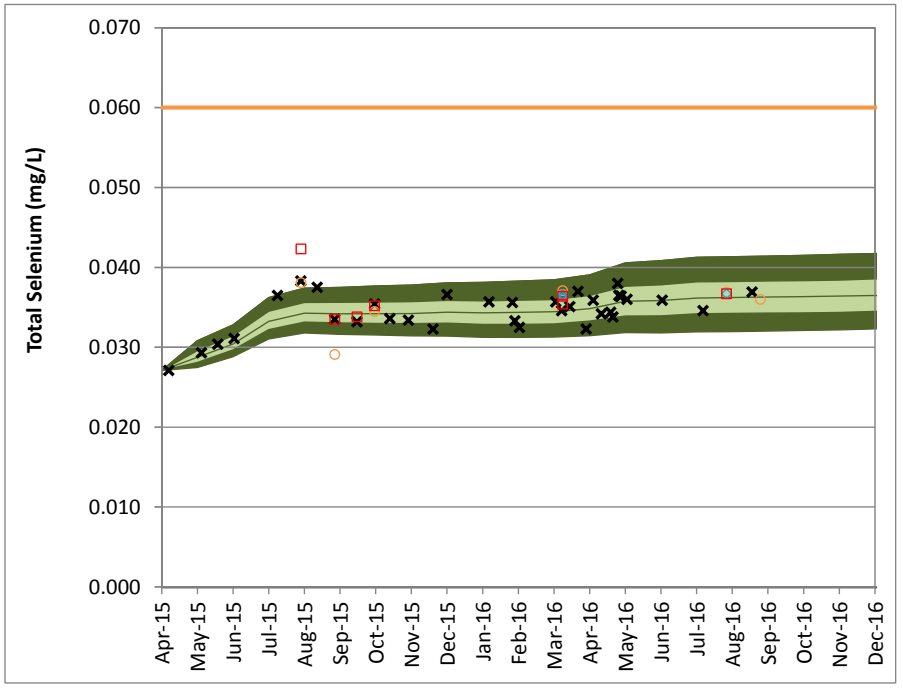
Golder Associates

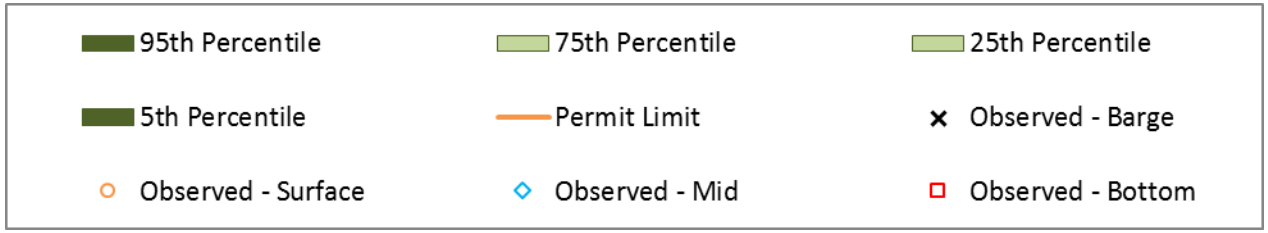
Under-predicted: Total Selenium

Initial Model Predictions



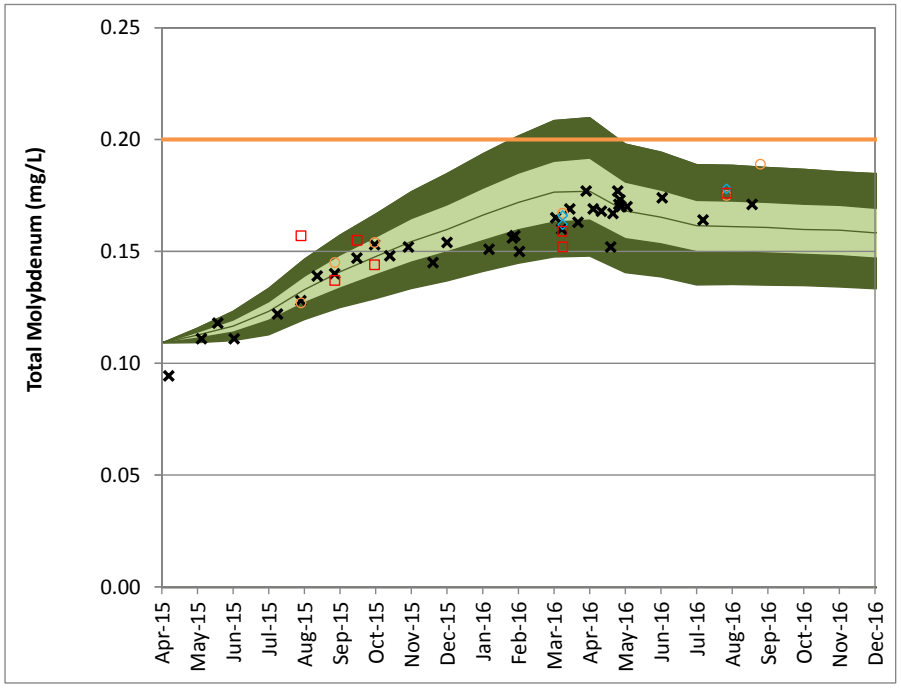
Updated Model Predictions



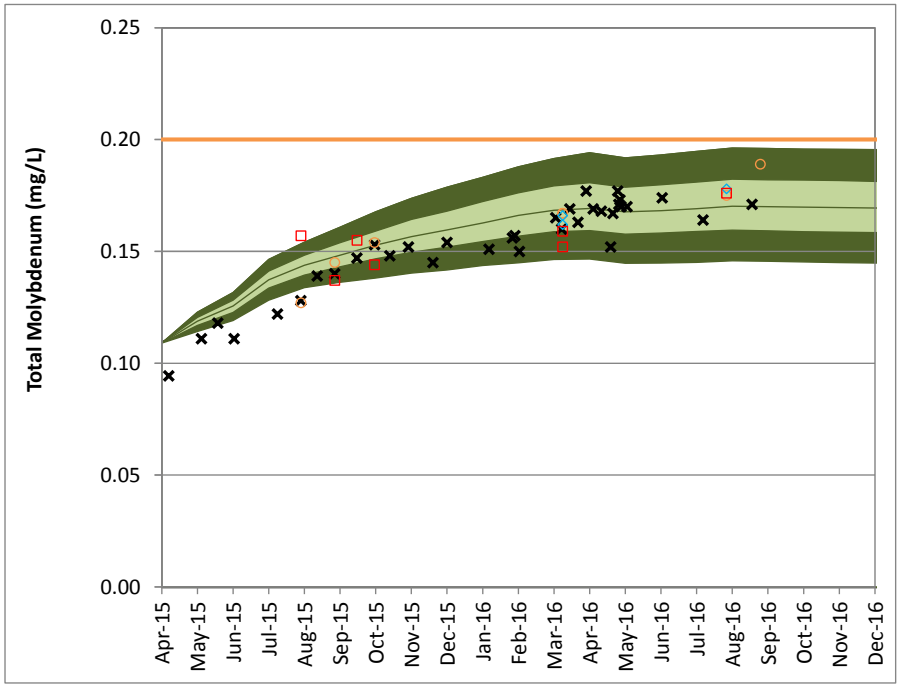


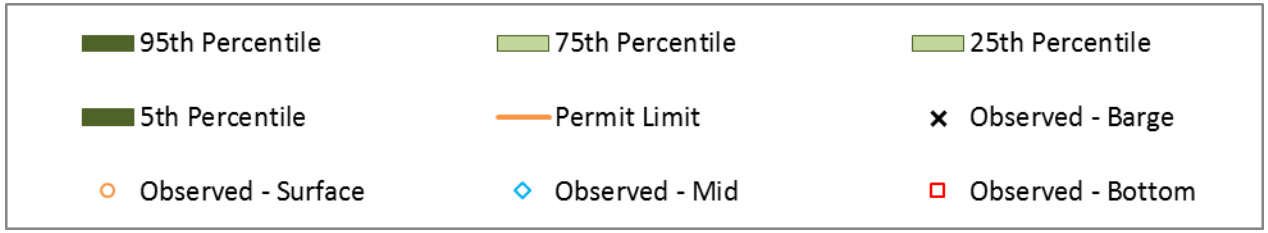
Accurate: Total Molybdenum

Initial Model Predictions



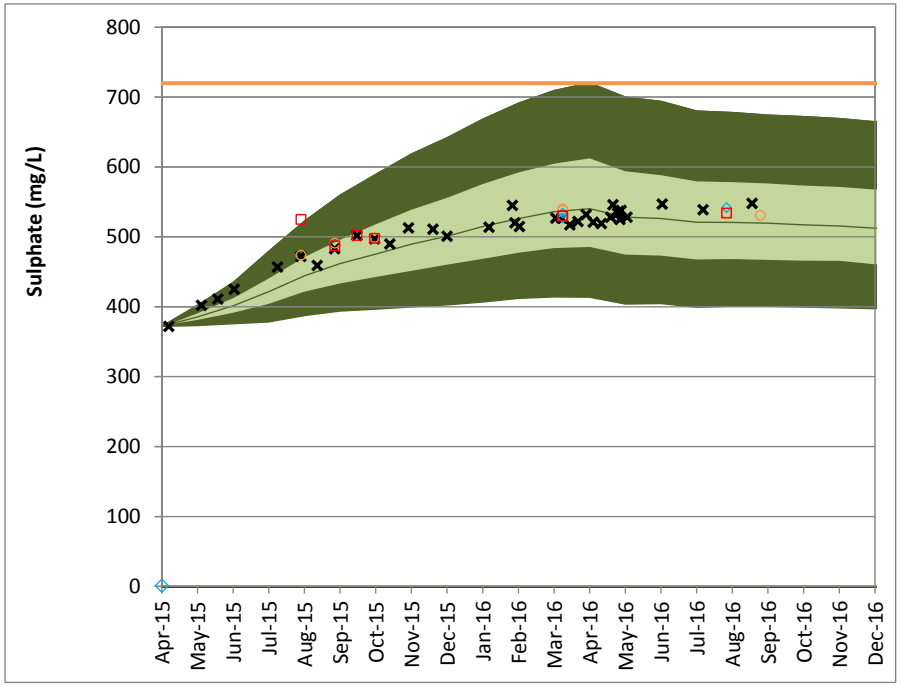
Updated Model Predictions



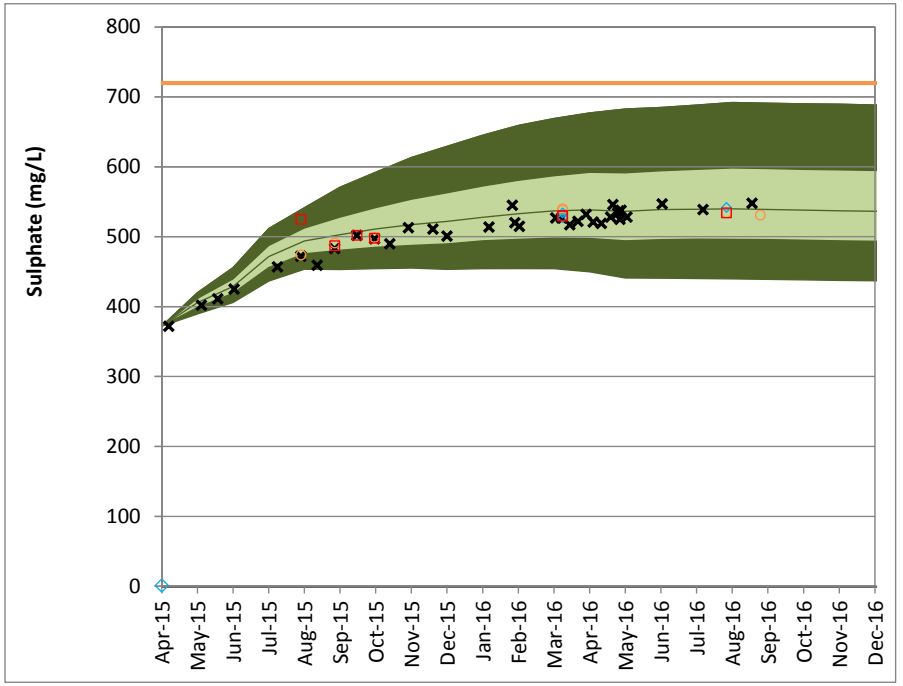


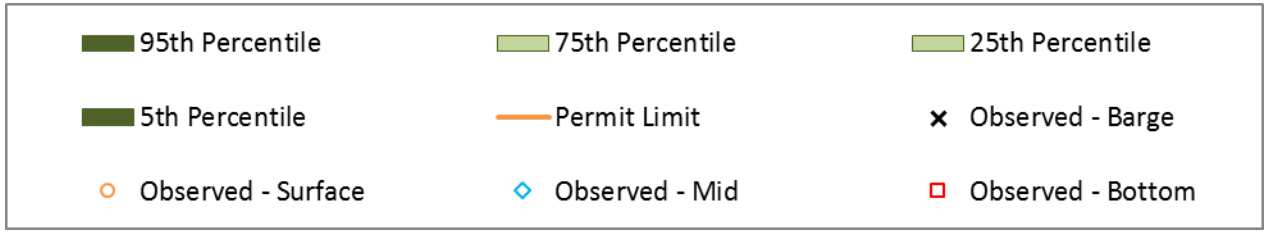
Accurate: Sulphate

Initial Model Predictions



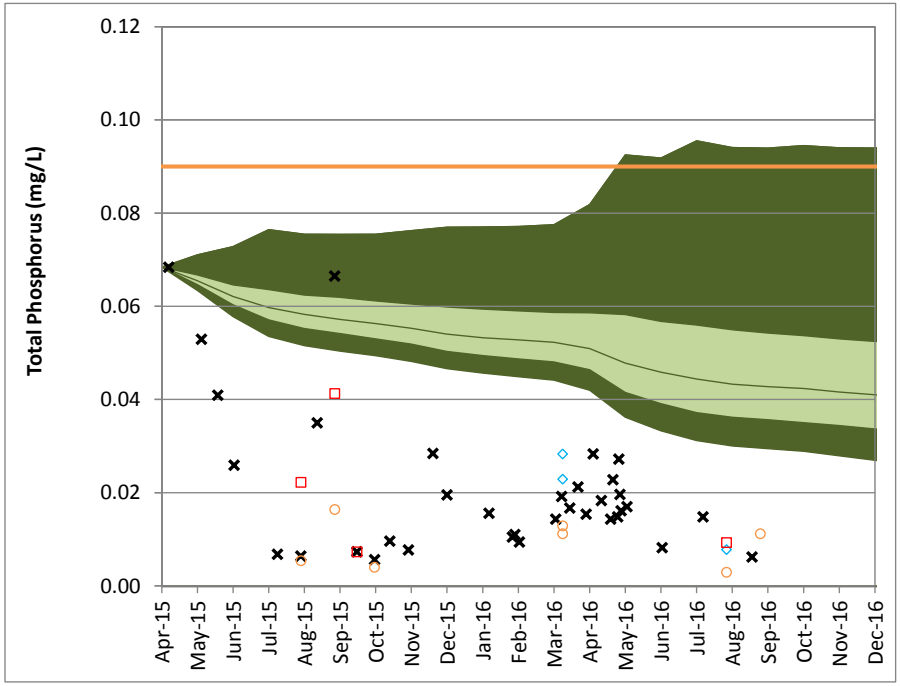
Updated Model Predictions



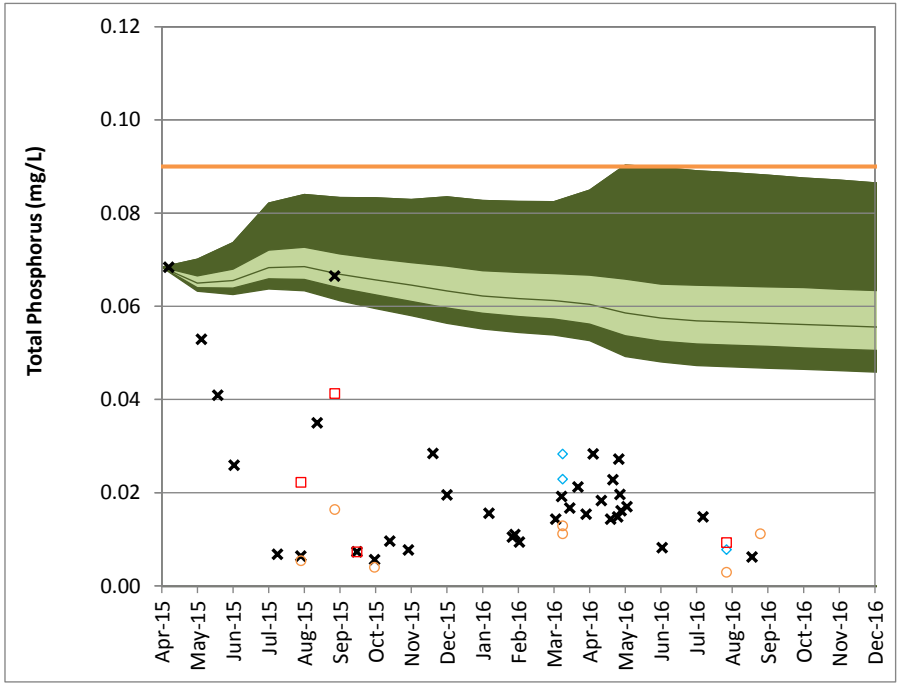


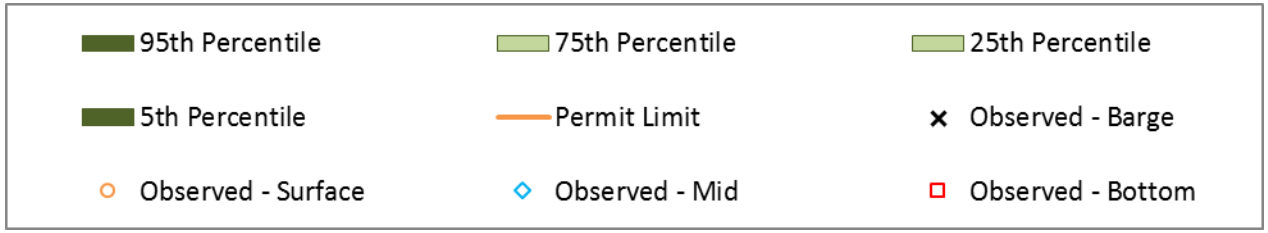
Over-predicted: Total Phosphorus

Initial Model Predictions



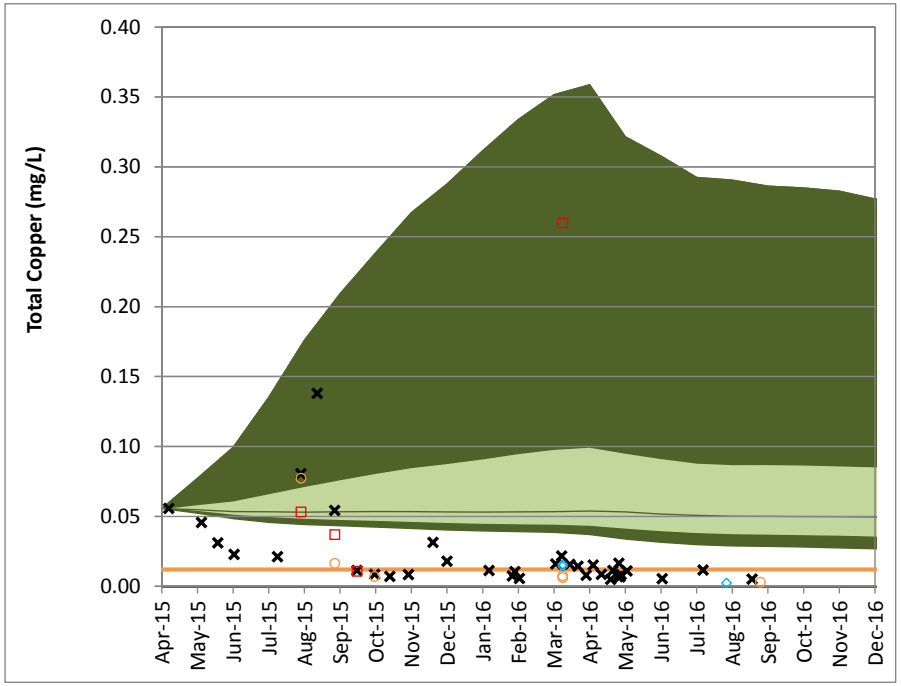
Updated Model Predictions



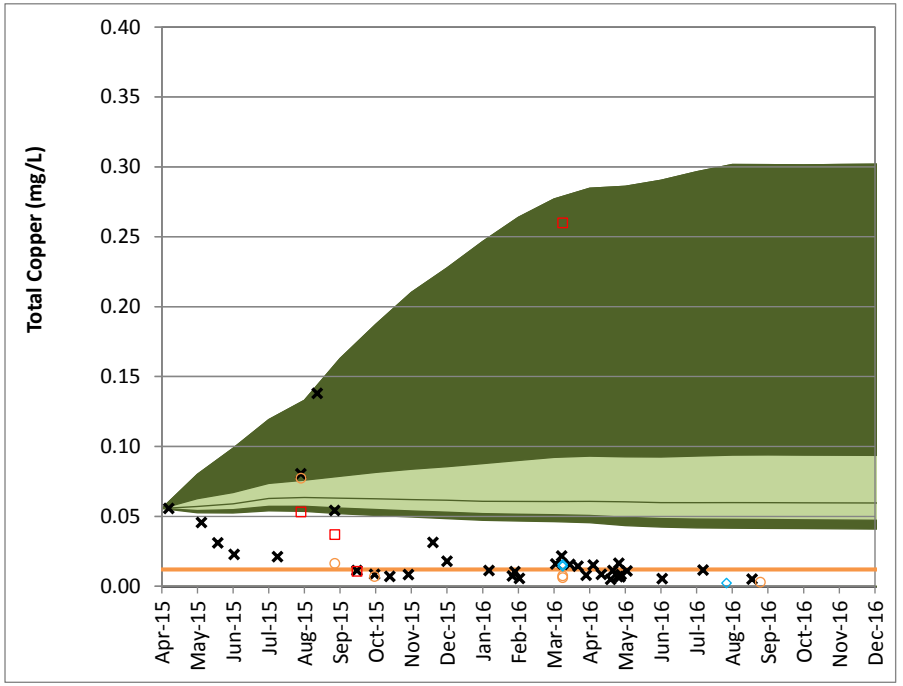


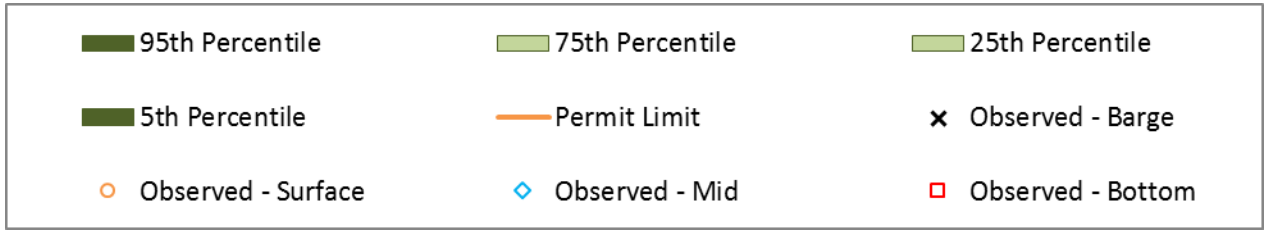
Over-predicted: Total Copper

Initial Model Predictions



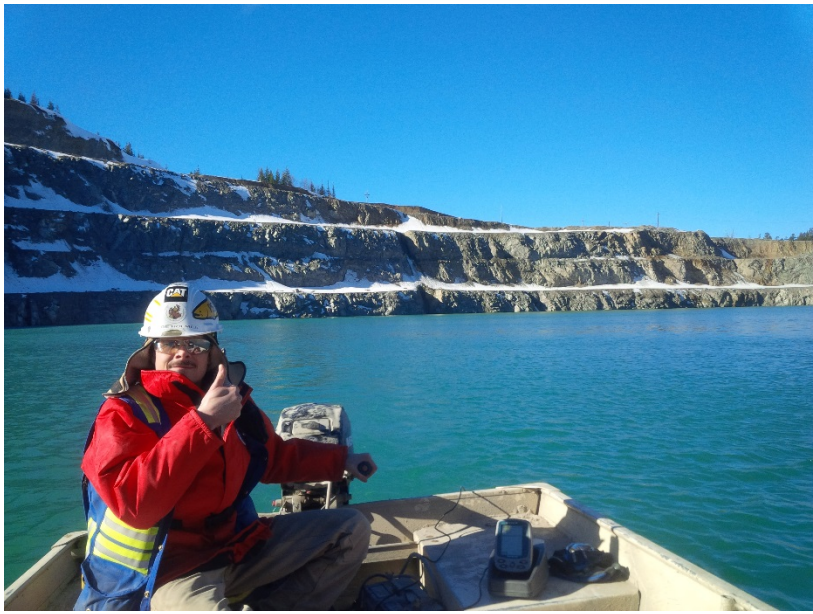
Updated Model Predictions

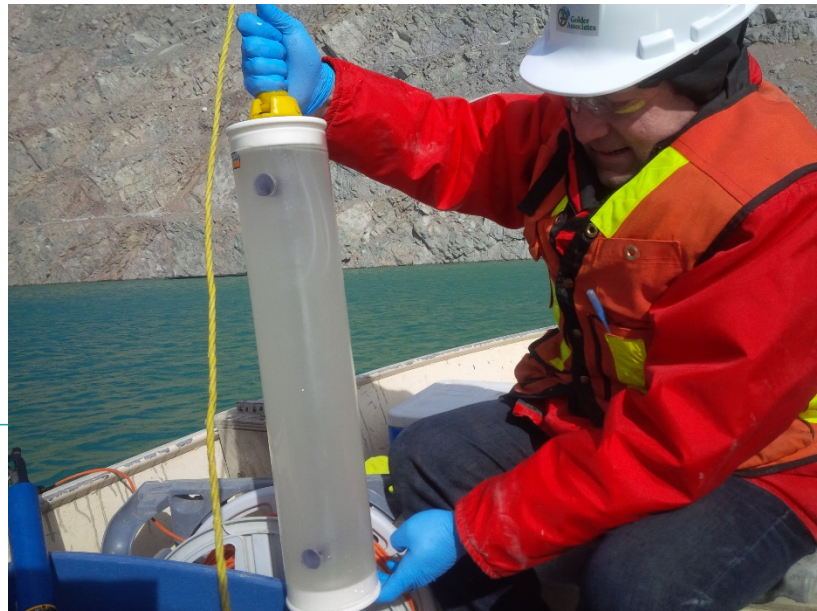




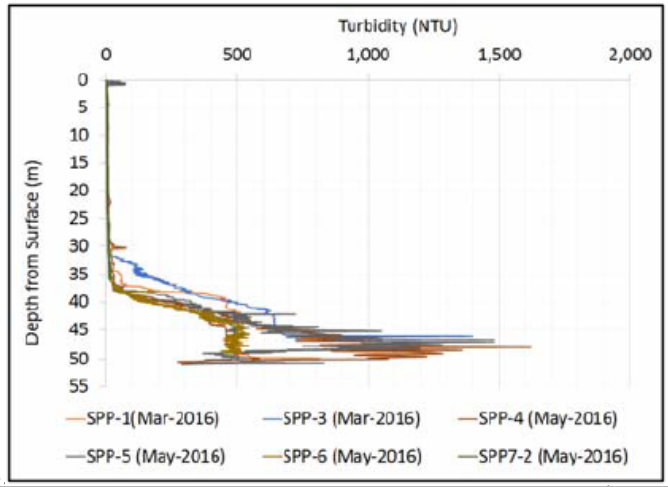
Pit Lake Monitoring

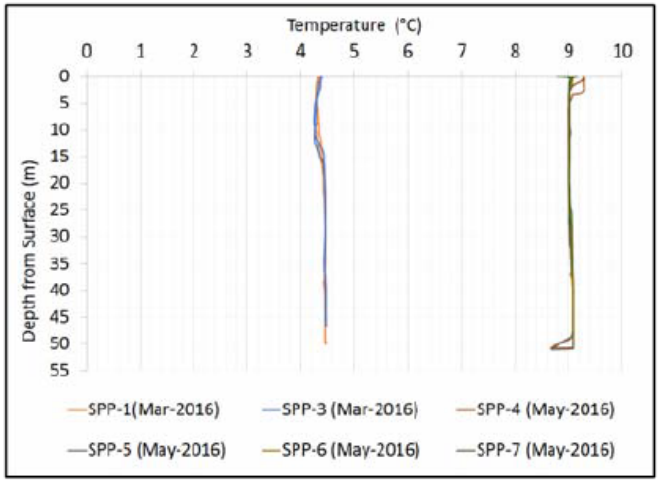
- Profile monitoring between tailings inflow and barge
- Weekly compliance monitoring of water treatment feed water
- Parameters
  - Field parameters
  - Total and dissolved metals
  - Anions and nutrients
  - TSS and turbidity

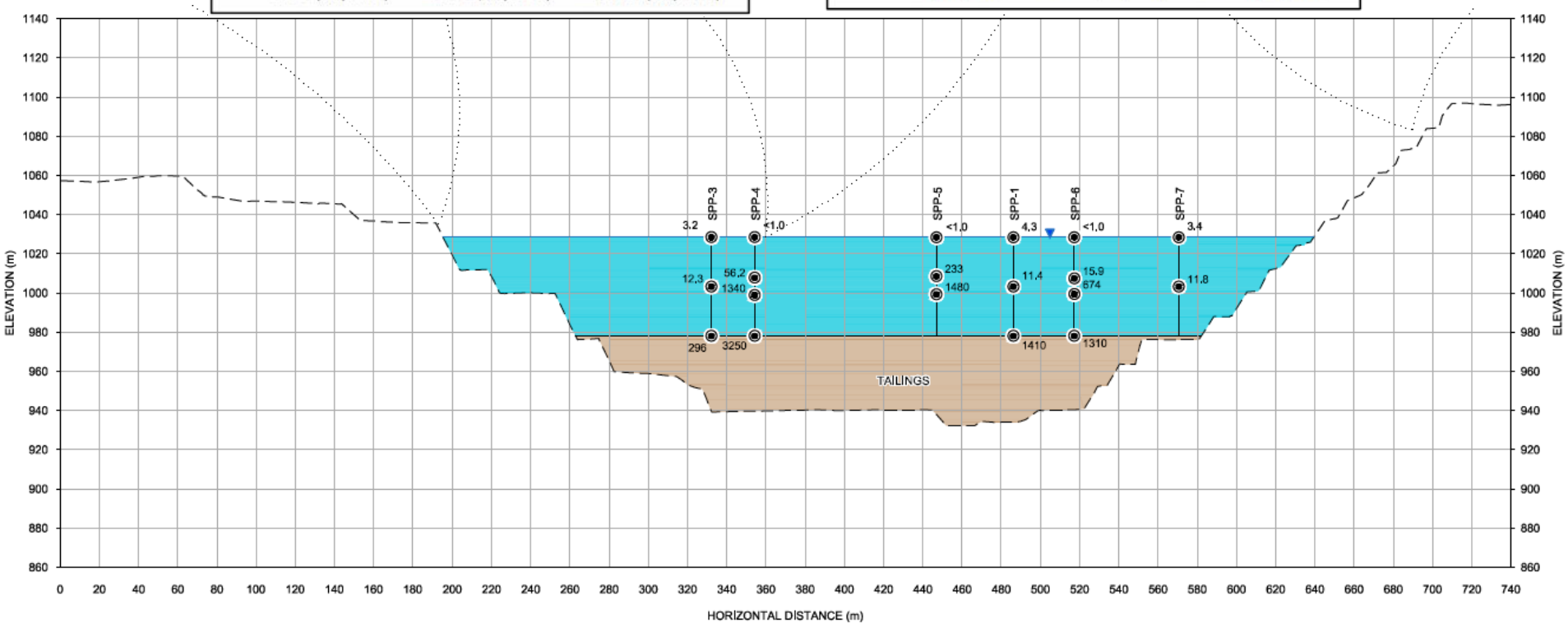




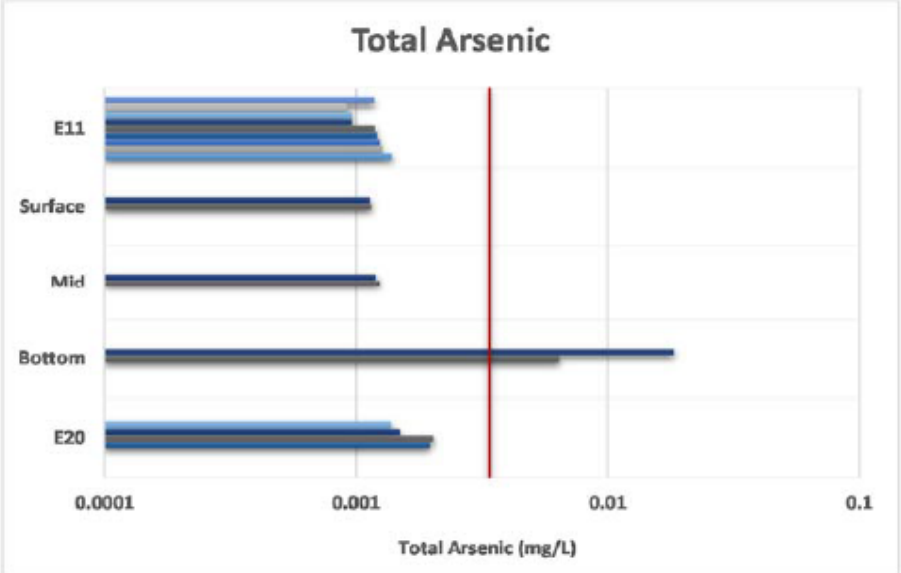
Turbidity, Temperature and TSS

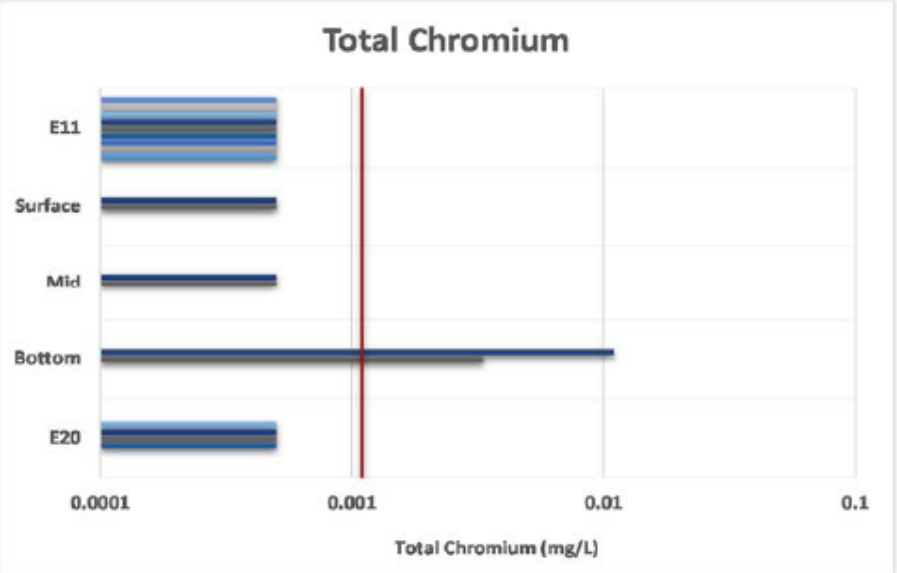


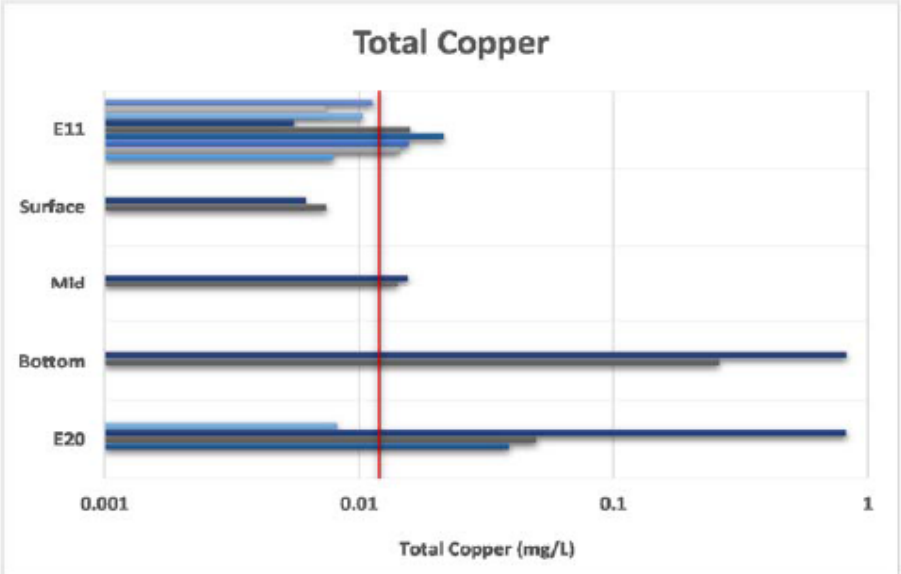


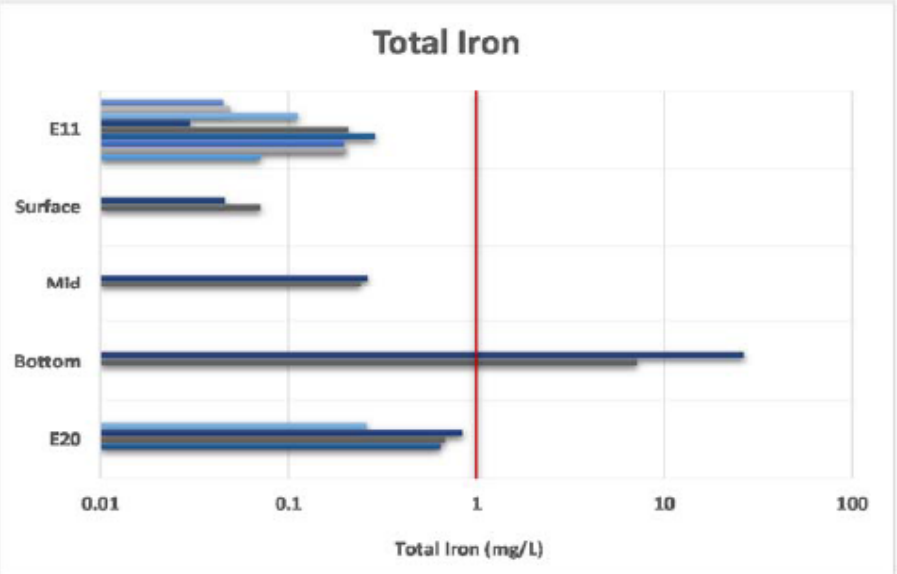


Metals in Inflow and at Depths









Coloured bars represent different sample dates

Sedimentation Pond Design Criteria

- Volume: 14 Mm^3
- Residence time: > 1 year
- Surface area: 220,000 m^2

- Sedimentation ponds typically designed to capture particles <5 µm
- Based on Stoke's Law, Springer Pit would remove particles <2 µm

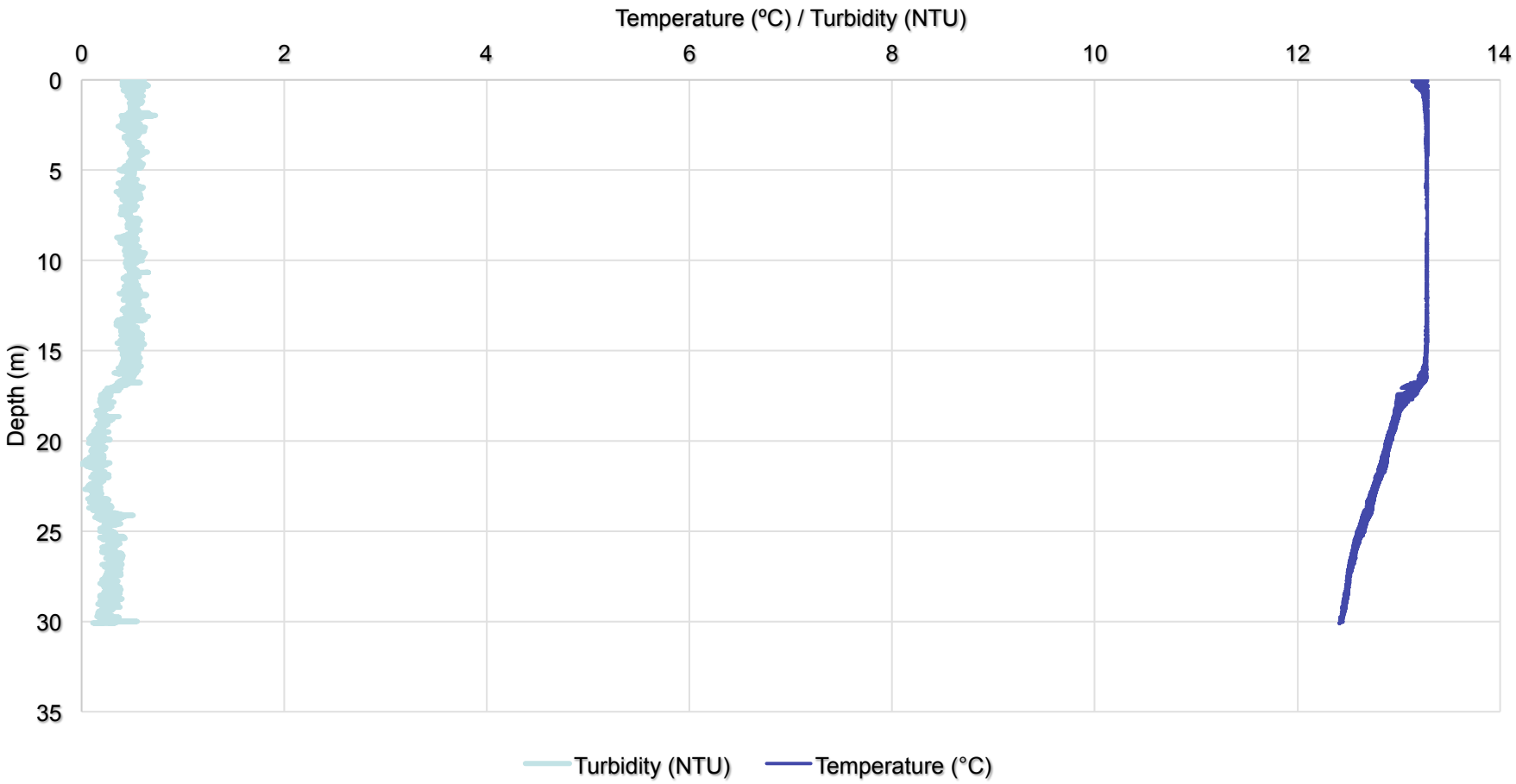
- Based on particle size distribution of tailings, Springer Pit would remove ~95% of particles
- Observed removal rate closer to 100% of particles

What was removed from water column?

- Total suspended solids
- Turbidity
- Total phosphorus
- Dissolved aluminum
- Total metals:

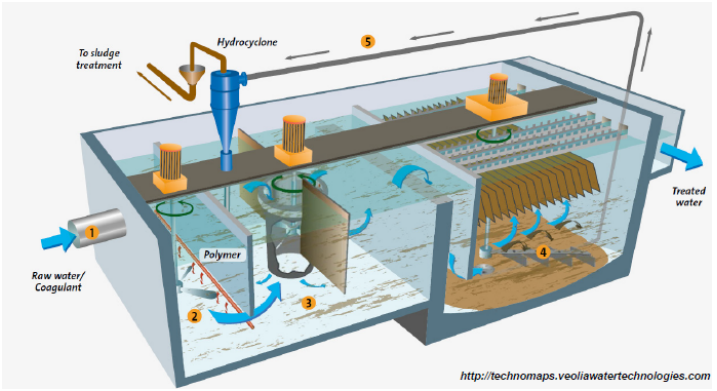
Alumium	Arsenic	Barium
Beryllium	Cadmium	Chromium
Cobalt	Copper	Iron
Lead	Manganese	Nickel
Silicon	Silver	Thallium
Tin	Titanium	Vanadium
	Zinc	

Recent Profile from Springer Pit



Passive Treatment Mode

- Since Springer Pit was effectively providing water treatment, a passive mode was programmed in the water treatment plant
- When turbidity and TSS are low in inflows, dosing of coagulant, flocculent and microsand stops
- Water continues to pass through water treatment plant
- Turbidity/TSS monitored continuously at inflow and outflow



Future beneficial use of Springer Pit Lake

- At Closure:
  - Subaqueous disposal of stockpiled potentially acid generating waste rock
  - Settling of metals and phosphorus in site drainage waters
  - Batch reactor for selenium removal?

Acknowledgements

- Mount Polley Mine
- Imperial Metals Corporation
- SRK (Geochemistry)
- Tetra Tech (Hydrodynamic modelling)

Questions?