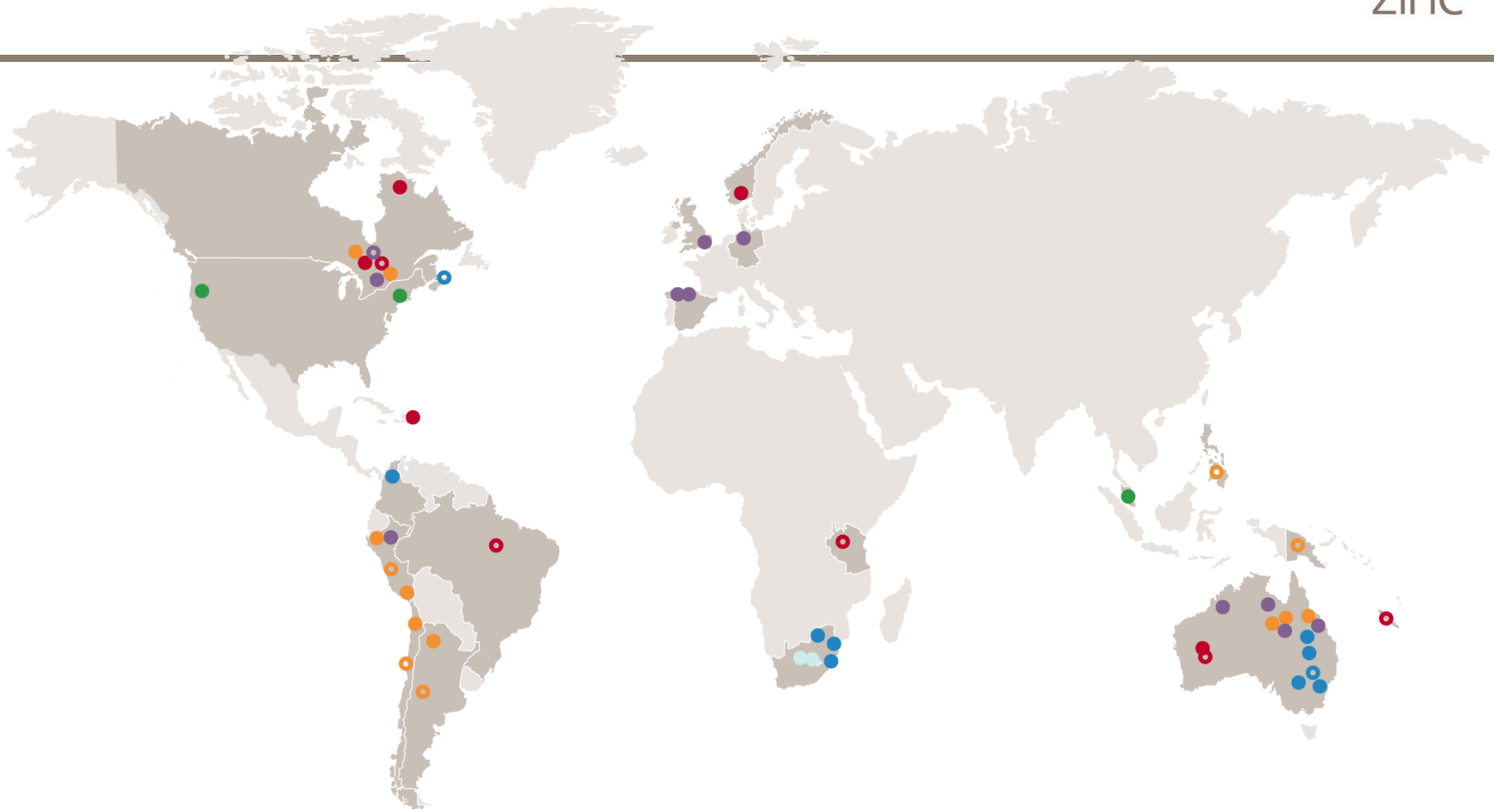
Using AMD to eliminate risk and reduce operating costs

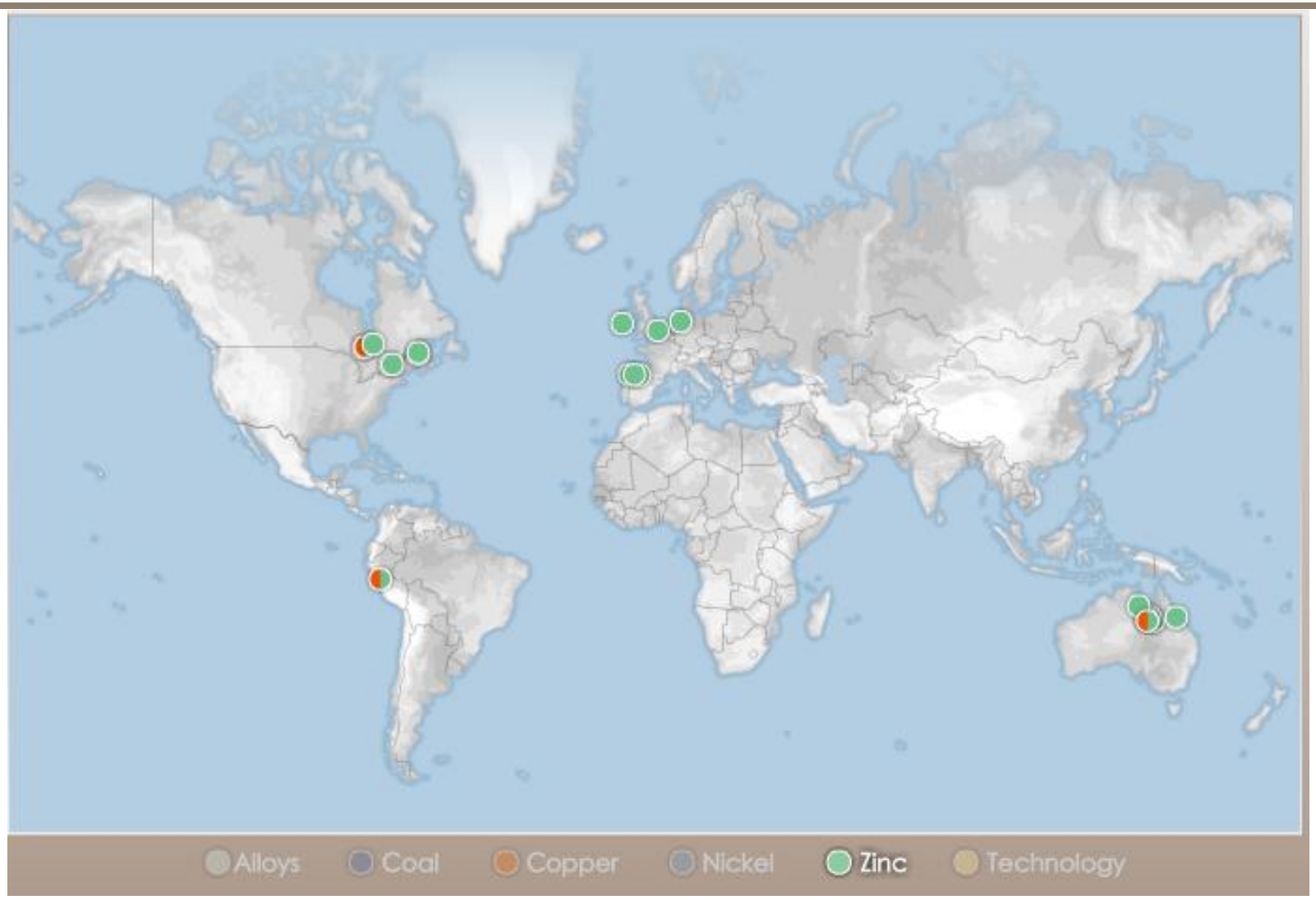
James Cormier
Xstrata Zinc Canada – Brunswick Mine
December, 2010

Xstrata plc
Locations

xstrata
zinc



Xstrata Zinc



Brunswick Mine
Location and Statistics

Estimated Ore Reserves (12/31/2009)

7.5 Million Tonnes

Pb 3.08%, Zn 7.92%,

Cu 0.43%, 97 g/t Ag

Historical Production

139,701,543 Tonnes

Forecast Production 2010

3,357,700 tonnes

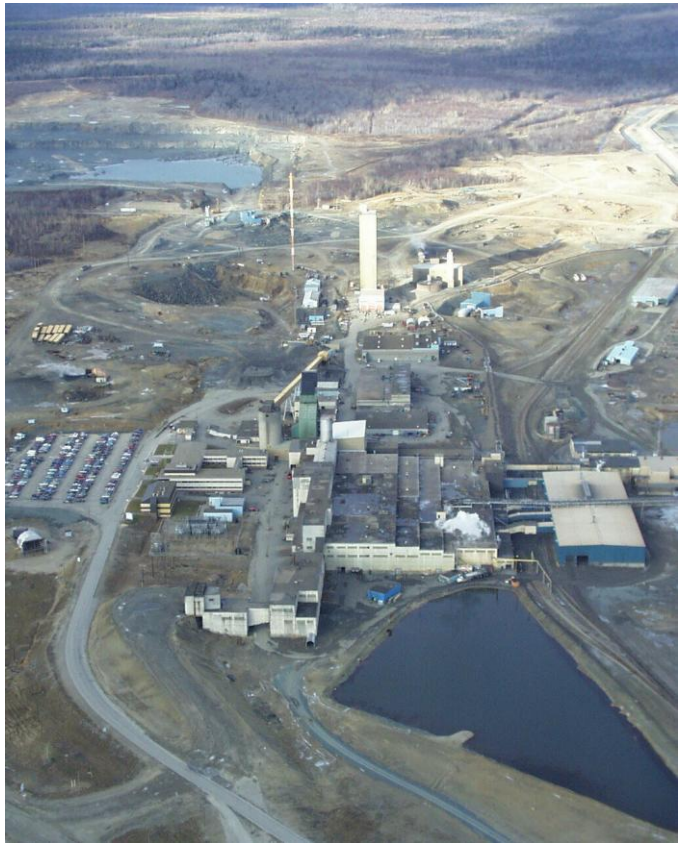
400 ktonnes Zn Conc

120 ktonnes Pb Conc

60 ktonnes Zn-Pb Conc

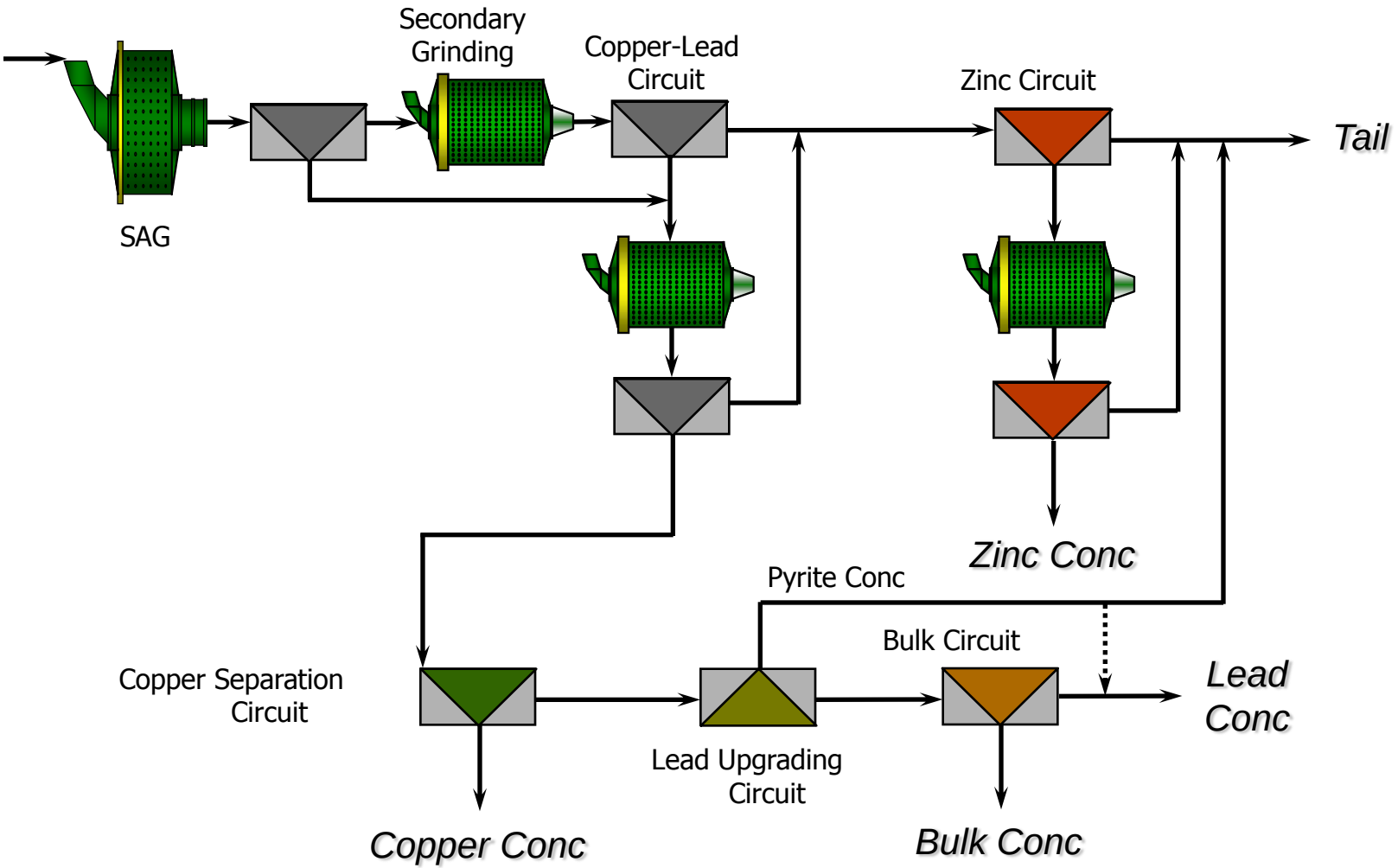
30 ktonnes Cu Conc

Average Mill Feed Analysis

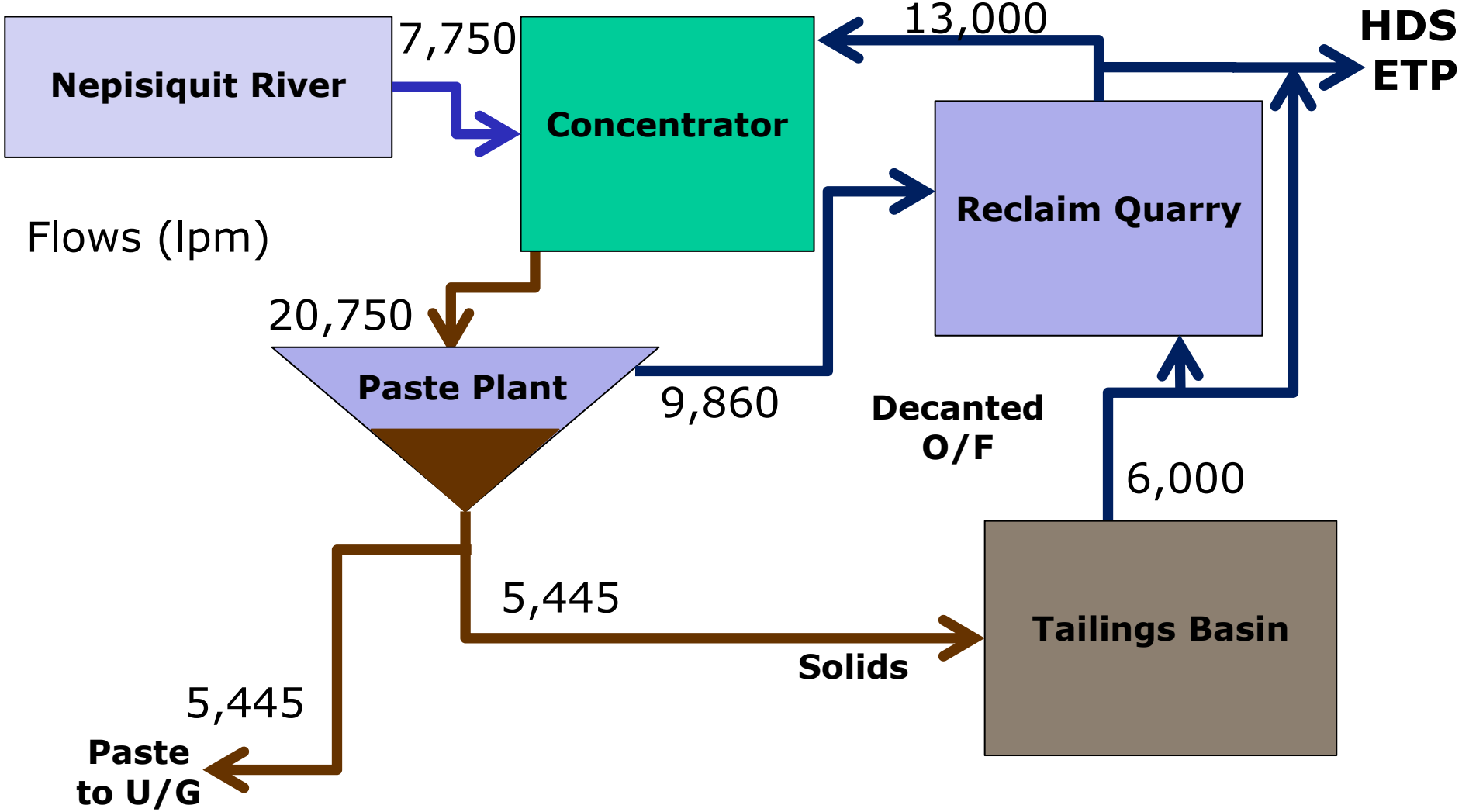


Mineral	Distribution, %Wt
Sphalerite	15.5
Galena	4.2
Chalcopyrite	1.0
Pyrite	57.1
Pyrrohotite	1.0
Quartz	12.0
Chlorite	7.0
Calcite	1.0
Other	1.2

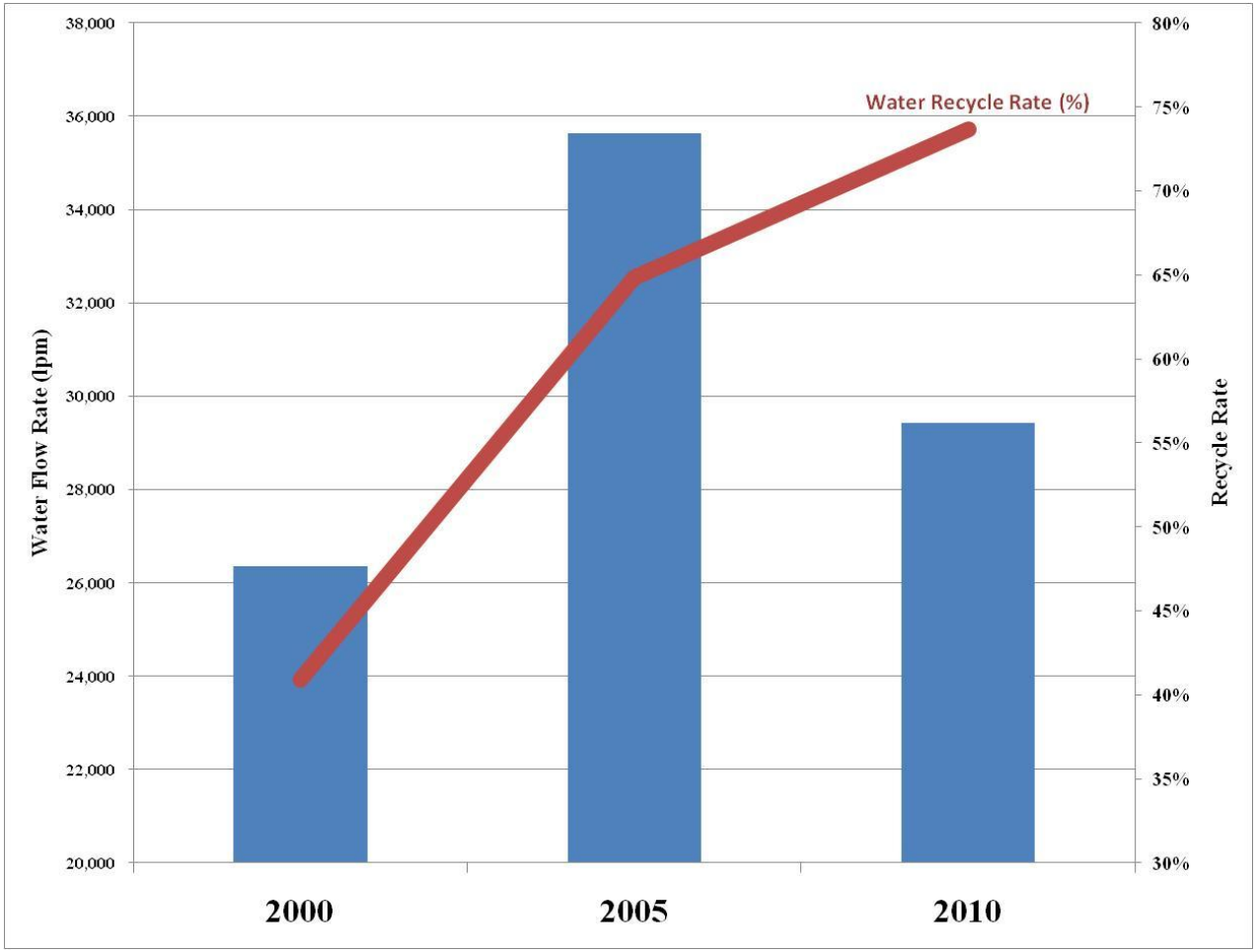
General Process Flow



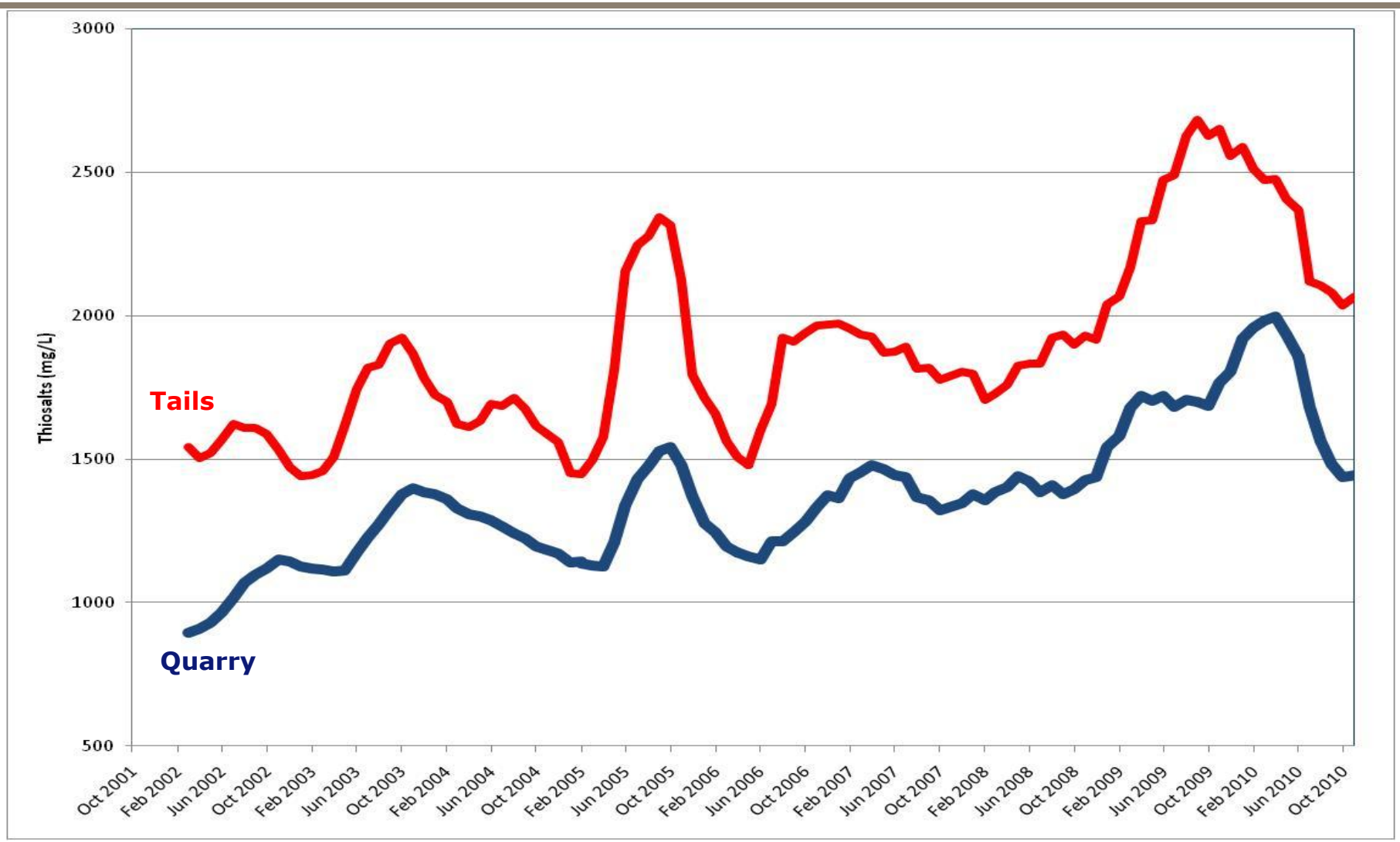
Simplified Water Balance



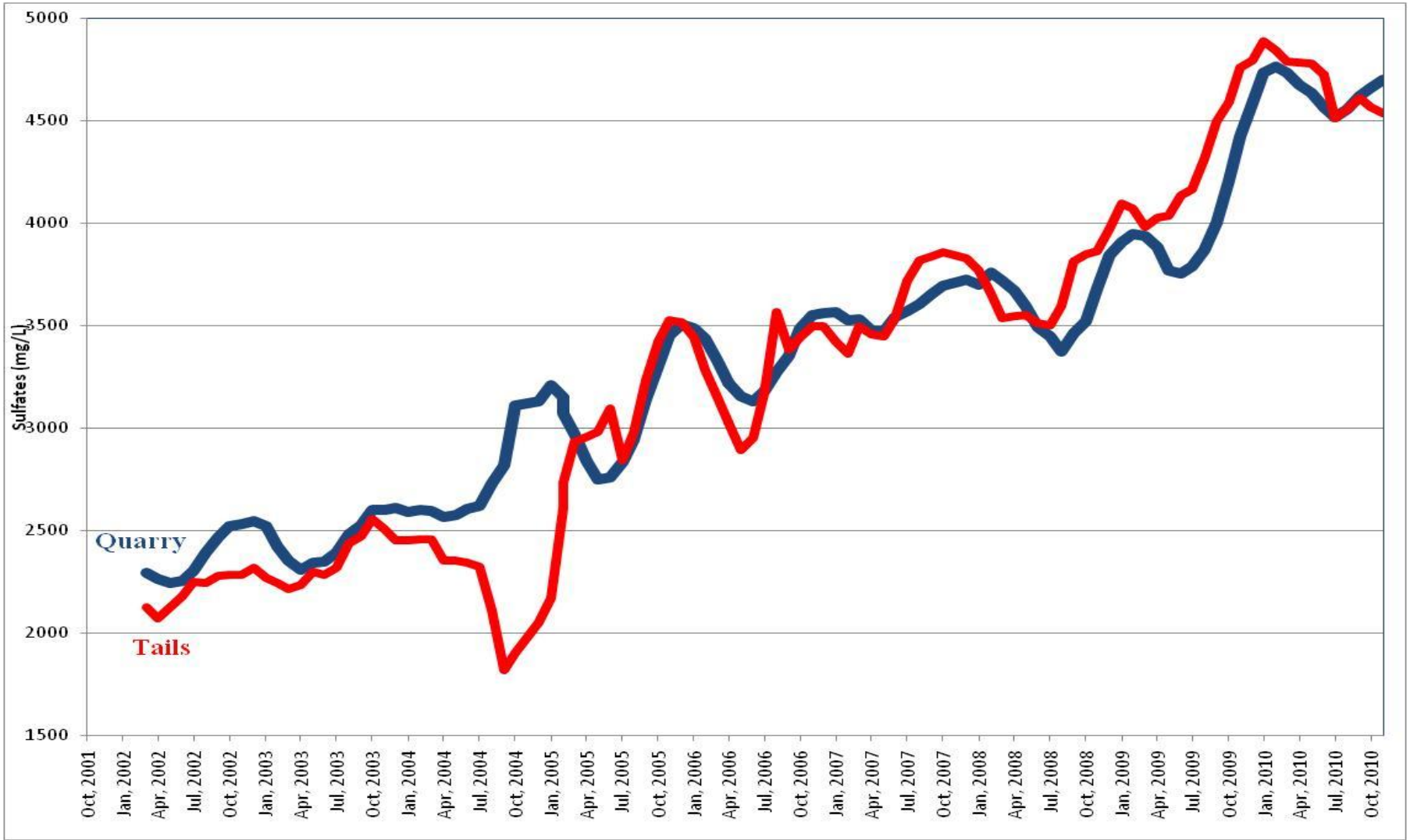
Water Consumption



Thiosulphate Concentrations



Sulfate Concentrations



Disproportioning of Thiosulfate

Disproportioning of Thiosulfate is the dominant process for thiosulfate transformation.

$$S_2O_3^{2-} + H_2O \longrightarrow SO_4^{2-} + HS^- + H^+$$

Product is one mol of sulfate and one mol of sulfide.

Aerial Photo 2007

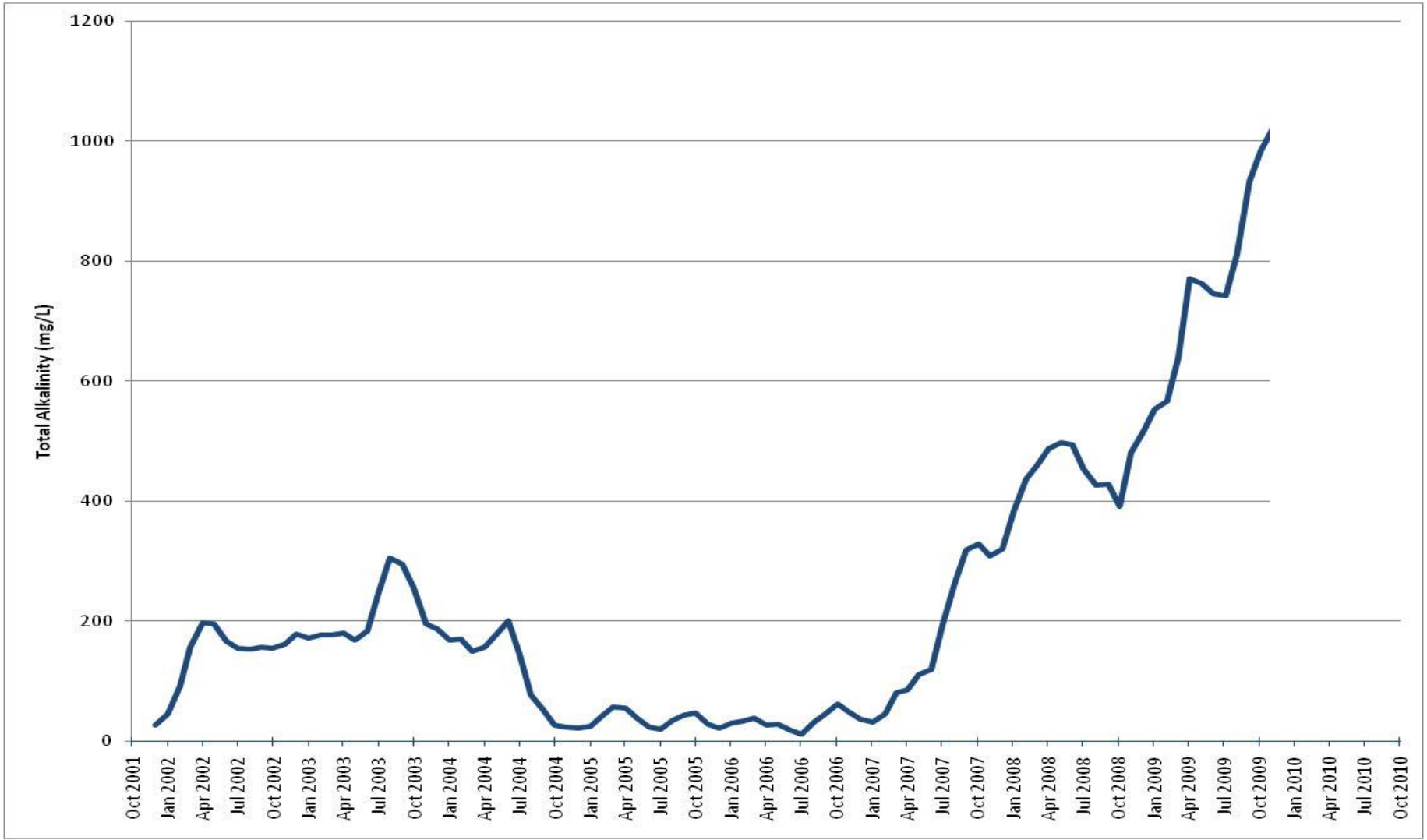
SO_2 and Na_2CO_3 Consumption

xstrata zinc

- Since 2005, consumption of pH modifiers used the mill (SO_2 and Na_2CO_3) has increased.

	Na_2CO_3	SO_2
2003	17,031	2,011
2004	17,856	2,167
2005	27,020 + 55 %	2,575 + 23 %
2006	24,019 + 38 %	2,582 + 23 %
2007	26,600 + 52 %	2,632 + 26 %
2008	28,781 + 63 %	2,769 + 33 %
2009	34,743 + 99 %	3,203 + 53 %

Alkalinity in the Reclaim Quarry



Production of Sulfides

The effect of disproportioning of Thiosulfate (and sulfate reduction) was an increase in sulfide concentrations.

The production rate was likely limited in the growth phase, by the lack of organic material.

Increased production rates occurred over time, as concentrations increased and biomass increased.

Eventually these concentrations exceeded the solubility in water, and began de-gassing.

Sulfide Concentrations in water

In 2007, Low level concentrations of Total Reduced Sulfur (TRS) Odors were detected at the Mine Site (Brief Episode in Late Summer)

In 2008, Low level concentrations of TRS Odors were again detected at the Mine Site (Brief Episode in Late Summer)

In 2009, TRS Odors were detected at the Mine Site in ppm levels for an extended period of time. This resulted in community inquiries (complaints), Employee Health & Safety issues, environmental issues, and Mine production was constrained.

Incident Management

A communication plan was developed and delivered.

Employee information sessions were held.

A list of solutions was developed.

AMD treatment was selected as the most sustainable solution.

Risk Assessment was conducted.

Temporary system was installed.

Temporary System

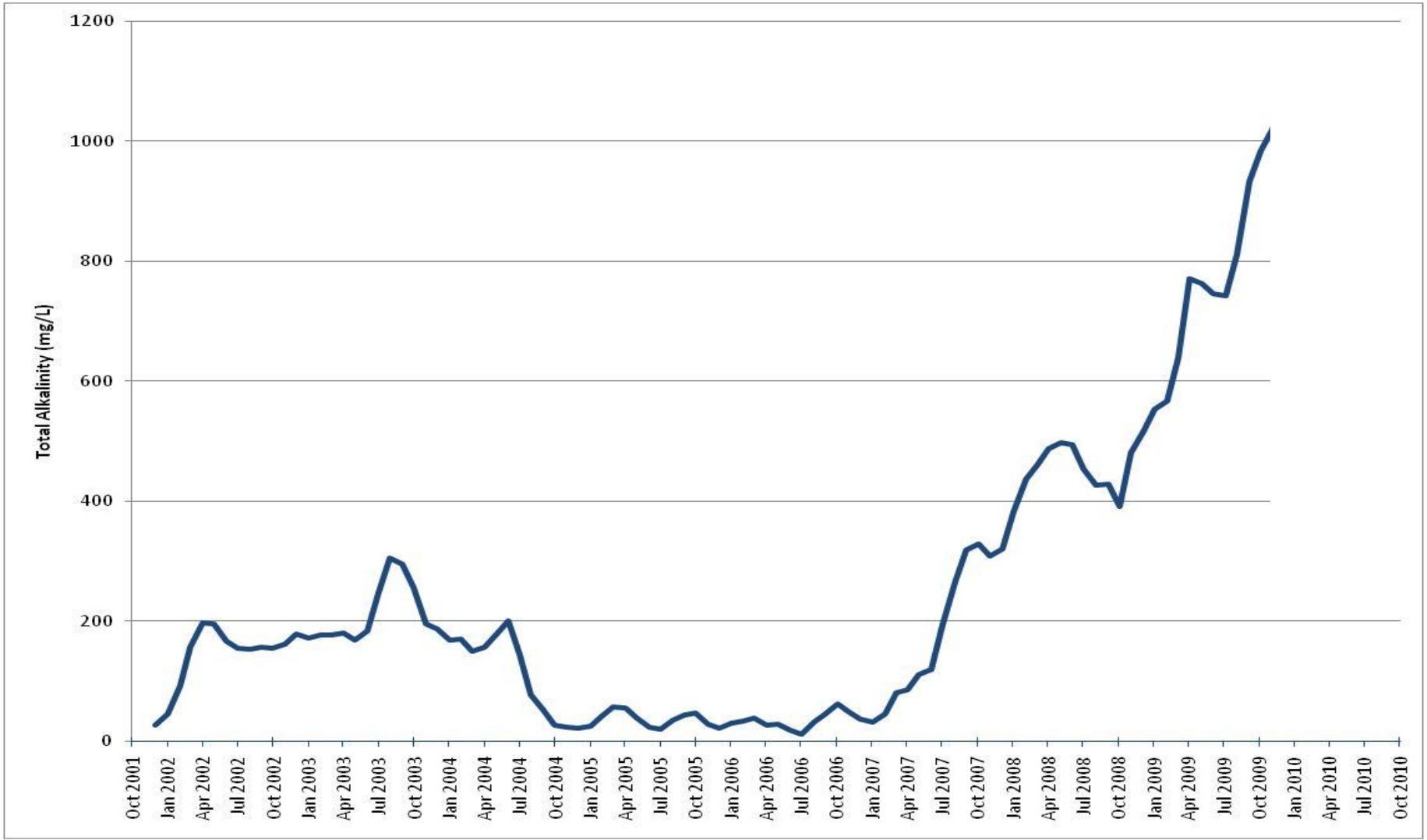
Mixing Limitations

AMD Treatment - Results

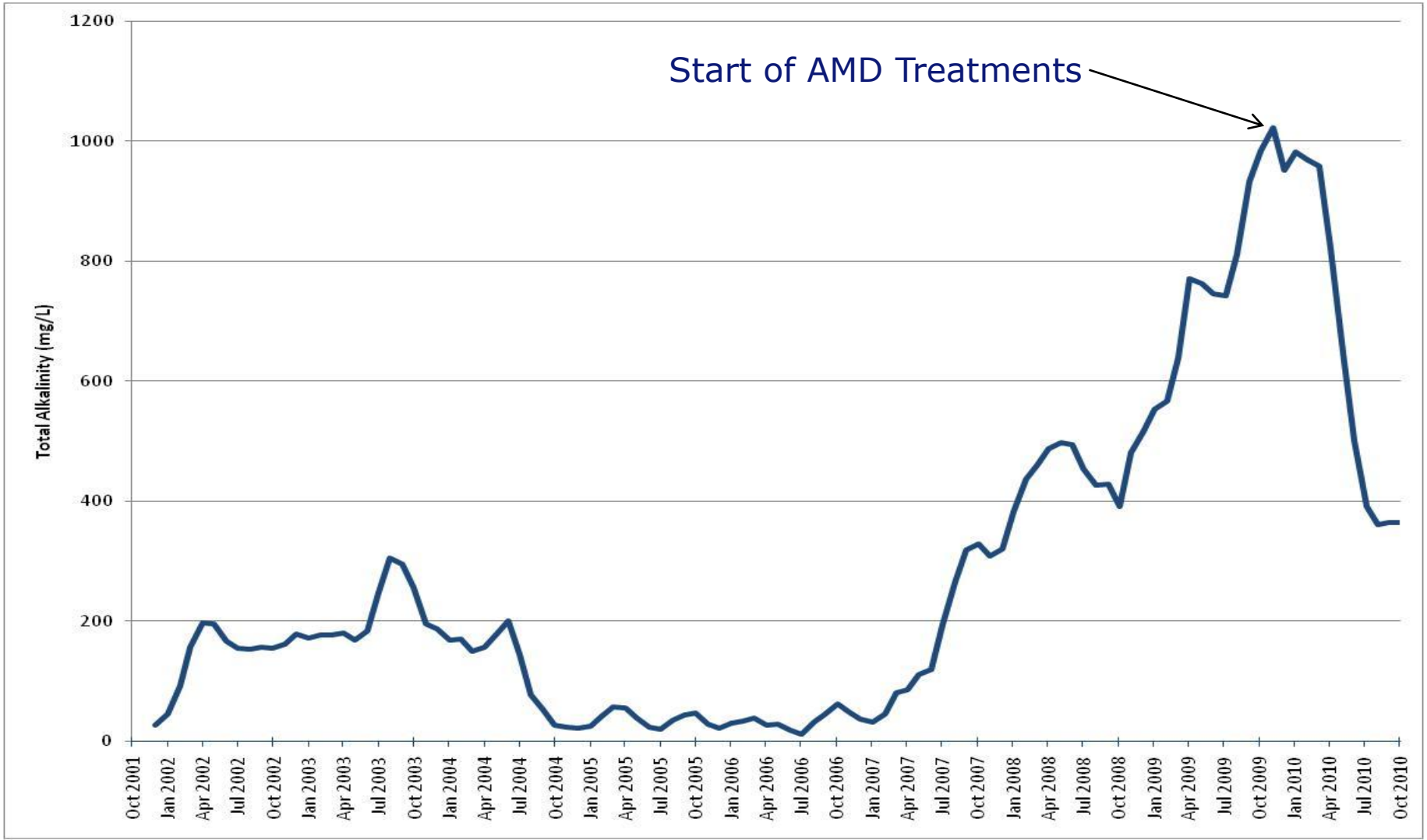
- Dissolved Ferrous Iron and Zinc present in the AMD reacted with dissolved sulfides to form insoluble metal sulfides (FeS and ZnS).
- TRS Odors were virtually eliminated with a few days.
- Water color went from Black to Light Orange
- pH remained constant
- Alkalinity of water decreased

By reducing the concentrations of Sulphides, we were able to reduce the alkalinity, which resulted in a reduced consumption of pH modifiers.

Alkalinity in the Reclaim Quarry



Alkalinity in the Reclaim Quarry



Reclaim Water Sulfide Concentrations

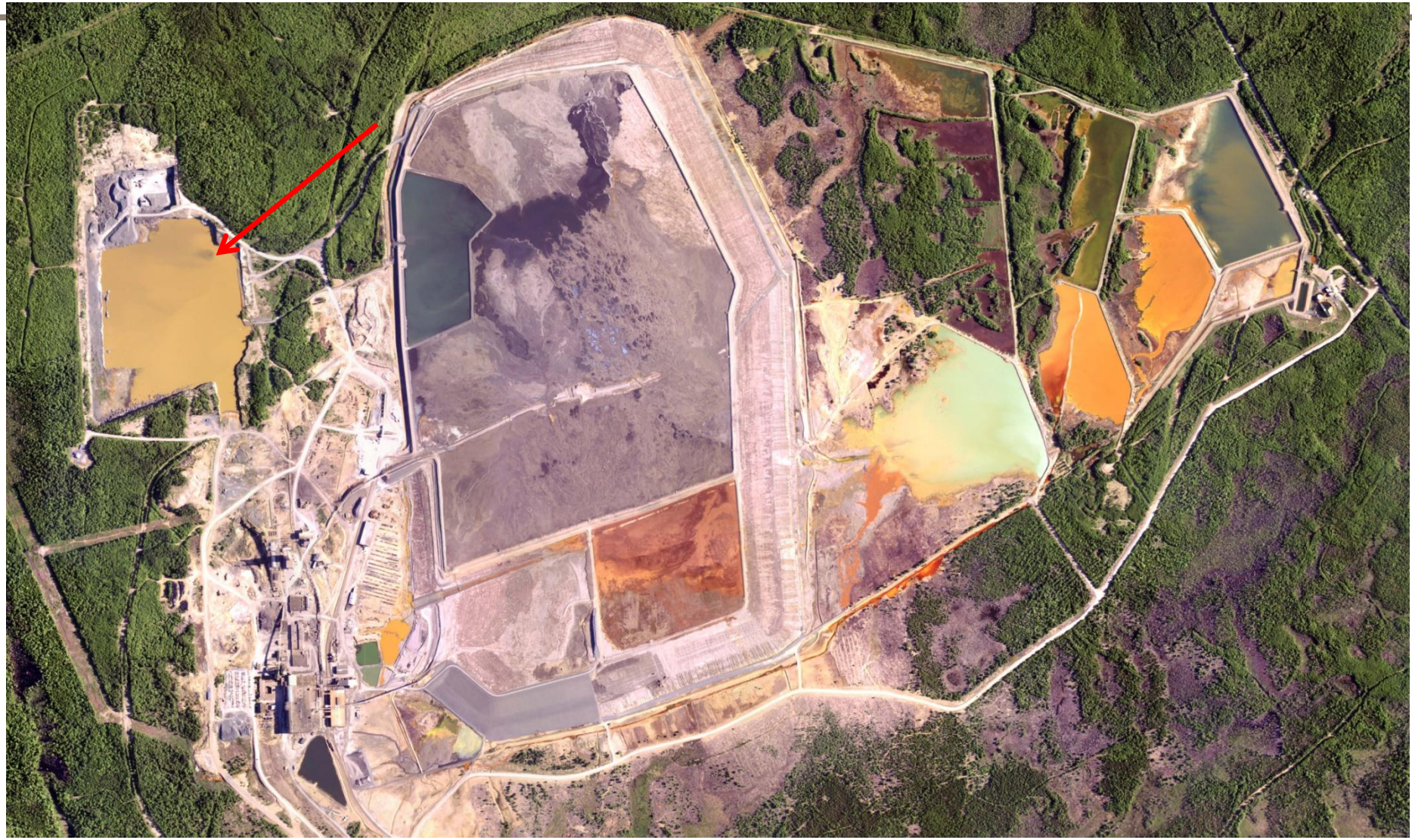
- Measurement of dissolved Sulfide Concentrations were implemented after the Trial AMD Additions was implemented.

	Alkalinity (mg/L)	Dissolved Sulfide (mg/L)
September 2009	**1051**	**264**
Q4 2009	**986**	**231**
Q1 2010	**901**	**228**
Q2 2010	**507**	**186**
Q3 2010	**412**	**168**
Q4 2010	**326**	**144**

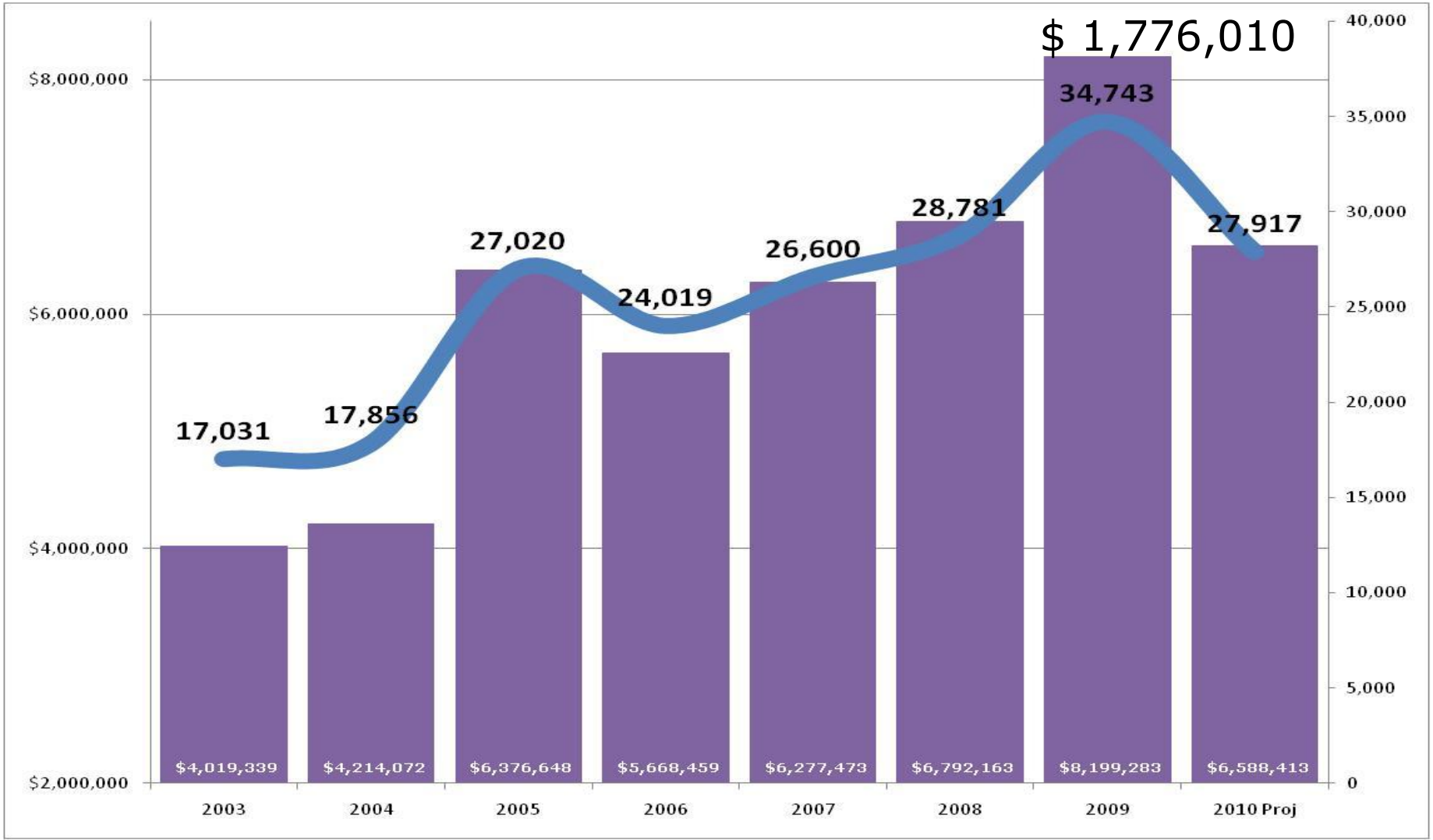
November 24th, 2010, Alkalinity 350 mg/L Dissolved Sulfides 144 mg/L

Aerial Photo 2007

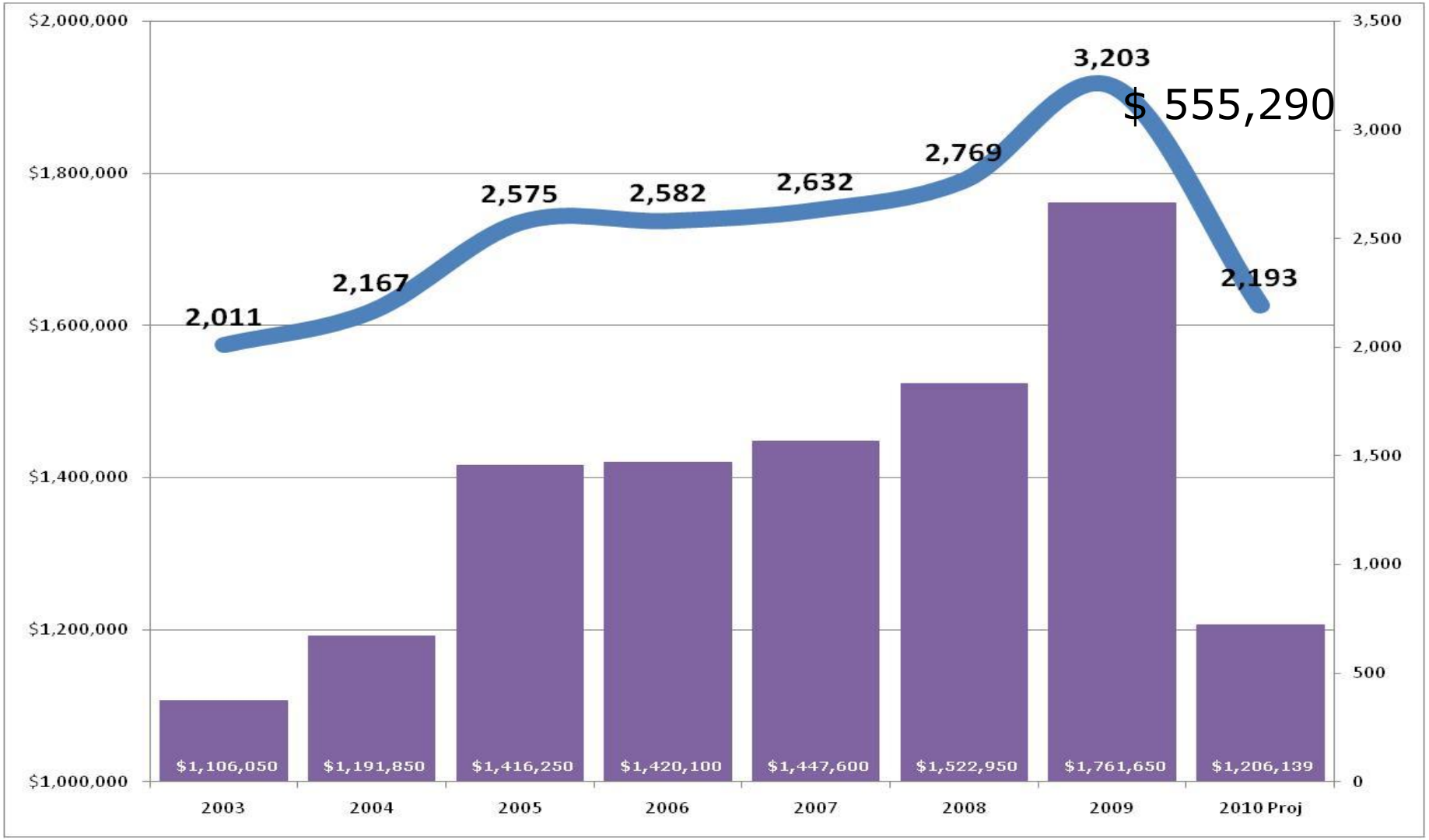
Aerial Photo 2010



pH Modifier Consumption Rates Na_2CO_3



pH Modifier Consumption Rates
Sulfur Dioxide



Summary

- A large bioreactor was created as a result of a water conservation initiative.

- A serious issue affecting environmental, health and Safety, production developed.

- Sustainable Development Management System provided a framework for solution development.

- AMD (Waste) was used to solve the issue, and enabled an opportunity to significantly reduce operating costs.

Acknowledgements

- **Xstrata Zinc**
- **Employees at Brunswick Mine**
- **Paul Deveau, Rick Schwenger, Xstrata Zinc Canada**
- **Florian Reher, Venture Engineering**
- **BT Thomas, CH2MHill**
- **Jan Gerits, LORAX Environmental**

Questions ?