

THE SILVER PRODUCER

FINANCIAL OVERVIEW

SILVER MARKET

HECLA PROPERTIES



# Hecla Greens Creek 2012 Tailings Annual Report

July 9, 2013



# Presentation Outline

- Placement data
- Stability
  - Compaction
  - Inspections
- Water level data
- Precipitation data
- Water quality at internal monitoring sites
- Dust sample results
- Sulfate Reduction Monitoring Program (SRMP) update
- Acid Base Accounting (ABA) data
- General site management

# Tailings Facility (2011)



# East Ridge Expansion (2011)



## Table 2.1 Tailings Placement Data

	All Materials	All Materials Cumulative	All Materials	All Materials Cumulative	Rock from Site 23	All Other Materials	Tailings
	yd <sup>3</sup>	yd <sup>3</sup>	tons	tons	tons	tons	tons
	survey	survey	calculated	calculated	truck count	truck count	calculated
2010	222,363	3,301,020	402,736	5,980,458	30,796	105,076	266,983
2011	198,363	3,499,383	359,374	6,339,832	7,665	33,332	318,377
2012	188,285	3,675,213	341,116	6,680,948	43,650	8,976	288,490
<p>Tons calculated at 134.2 pounds per cubic foot for tailings            Remaining capacity: 2.9 million tons</p>							

# Tailings Facility Stability Compaction

- High degree of achieving >90% compaction
- Average dry density: 137 pcf
- Average Standard Proctor dry density: 133 pcf
- Average optimum percent moisture: 12.9%
- HGCMC on-site lab 1-point Proctors
  - Average dry density: 143 pcf
  - Average percent moisture: 11.8%

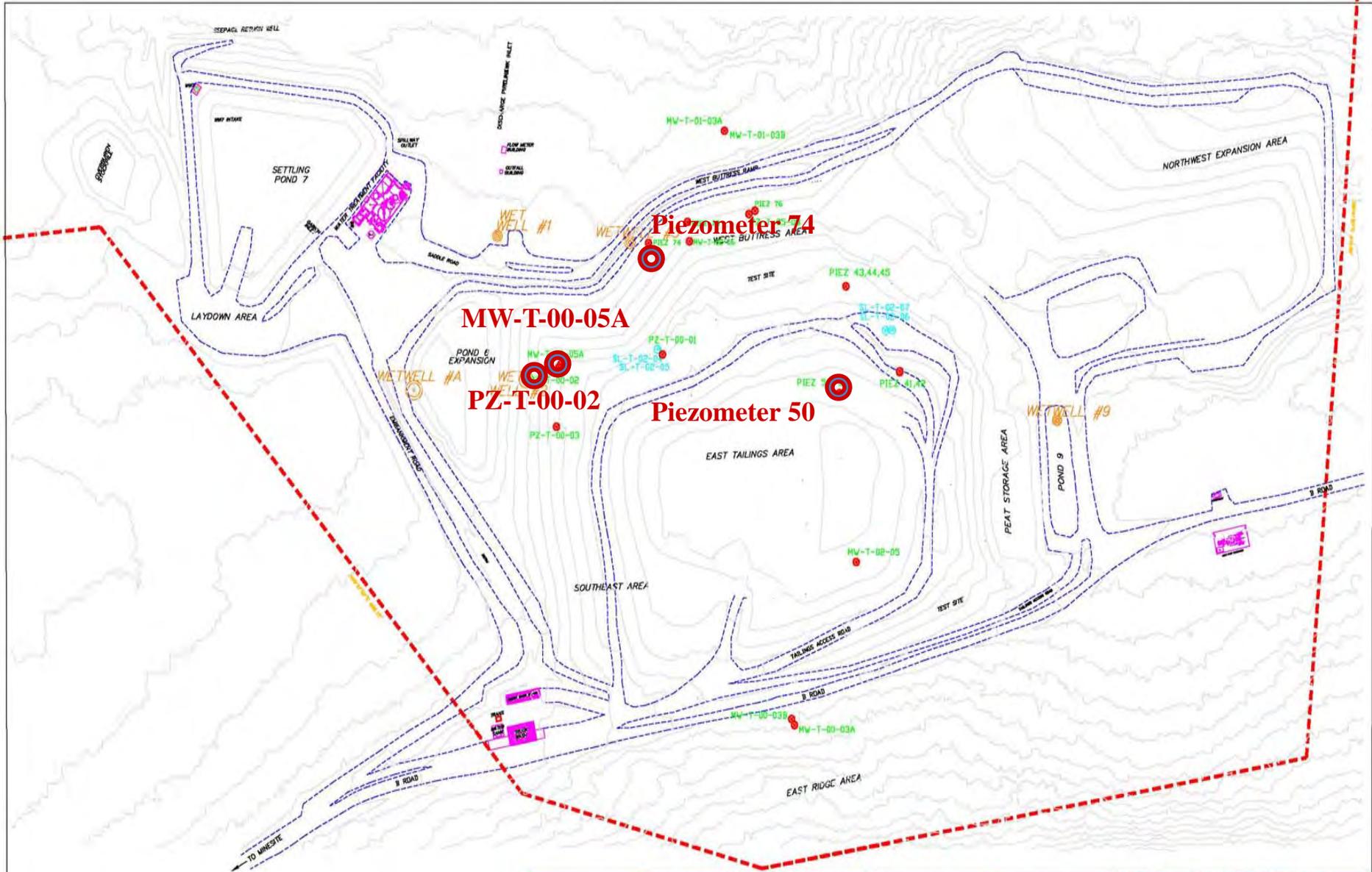
# Tailings Facility Stability - Inspections

- Results of operator, engineering, environmental department, and regulatory inspections revealed no signs of instability
- Agency Inspections in 2012
  - USFS - 6
  - ADEC - 3



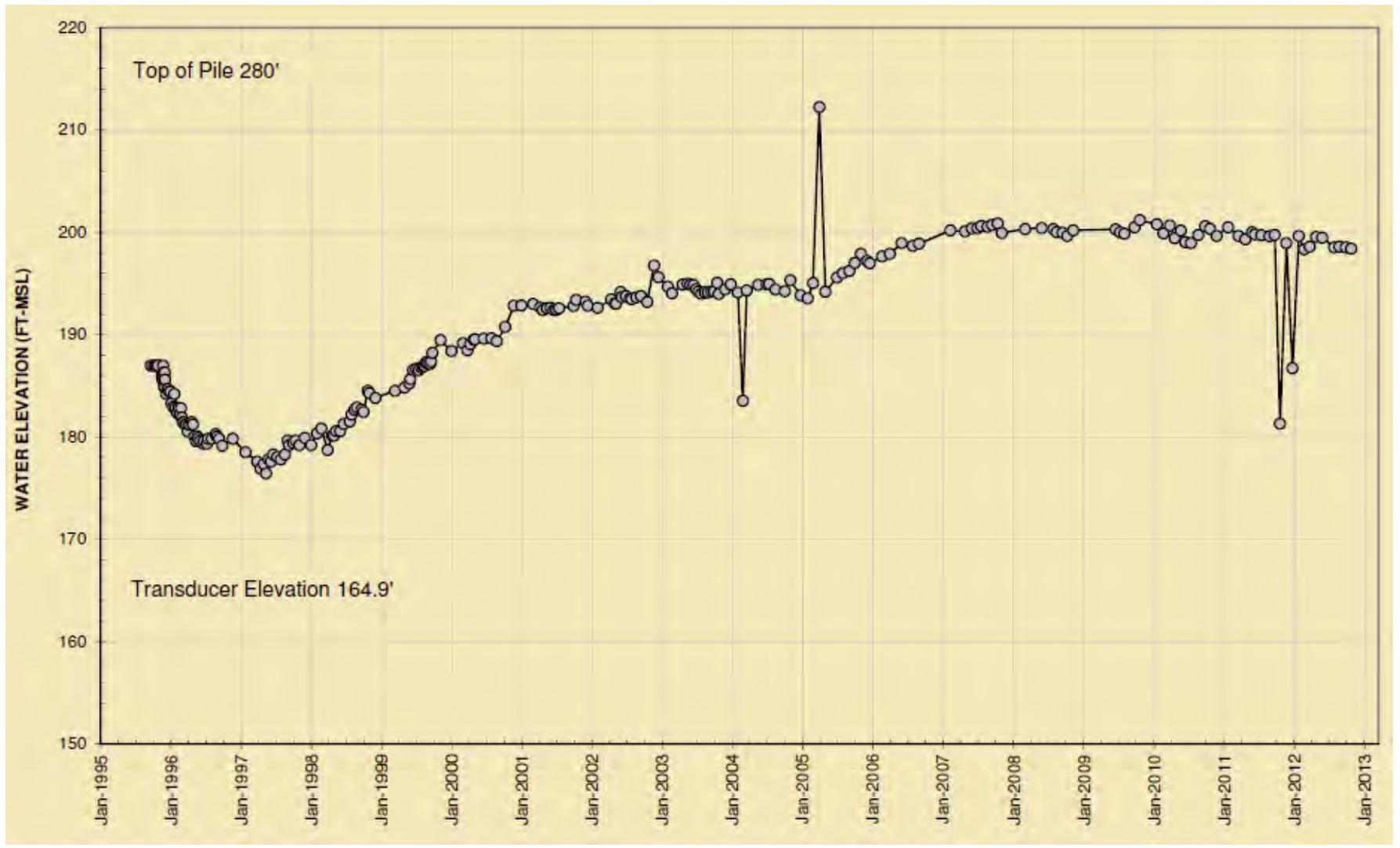
## Tailings Facility Monitoring Well and Piezometer Water Level Data

- Maximum saturated thickness 35 feet
- Toe foundations are well drained
- Water perches approximately 12 feet above the unsaturated under drains

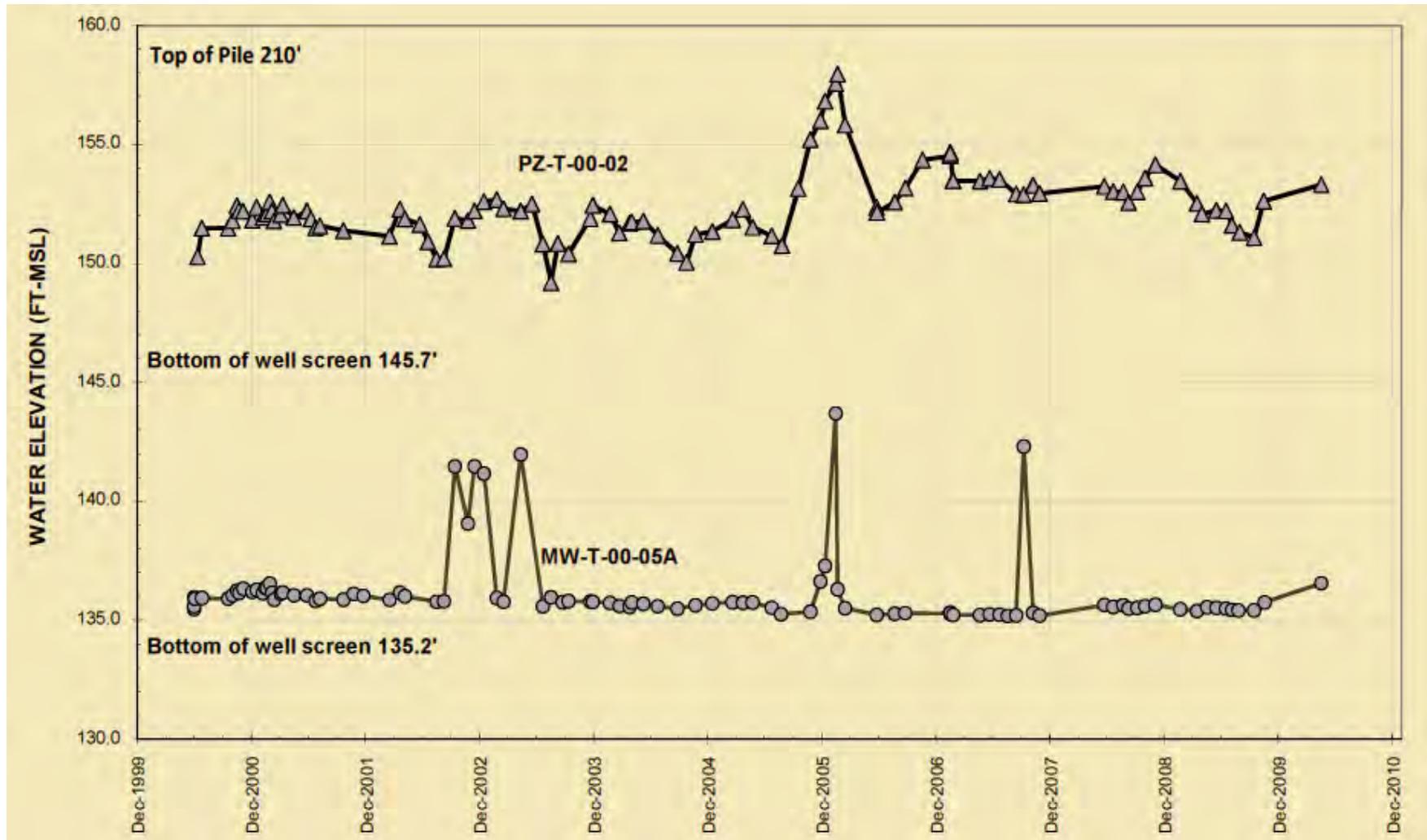


	<b>LEGEND</b> ROADS/DITCHES: ——— WATER LINES: - - - - BOUNDARY: - - - - MONITORING WELL: ● PIEZOMETER: ○ WET WELL: ○	DATE: 11-31-08 DRAWING BY: Shelby Edwards DESIGN BY: _____ REVIEWED BY: _____ PREP OR REV: _____	HECLA GREENS CREEK MINING CO. P.O. BOX 32199 JUNEAU, ALASKA 99803 PHONE (907)790-0441 FAX (907)790-0440
			TITLE: Tailings Asbuilt Annual Report Instruments GRAPHIC SCALE 1" = 50' 

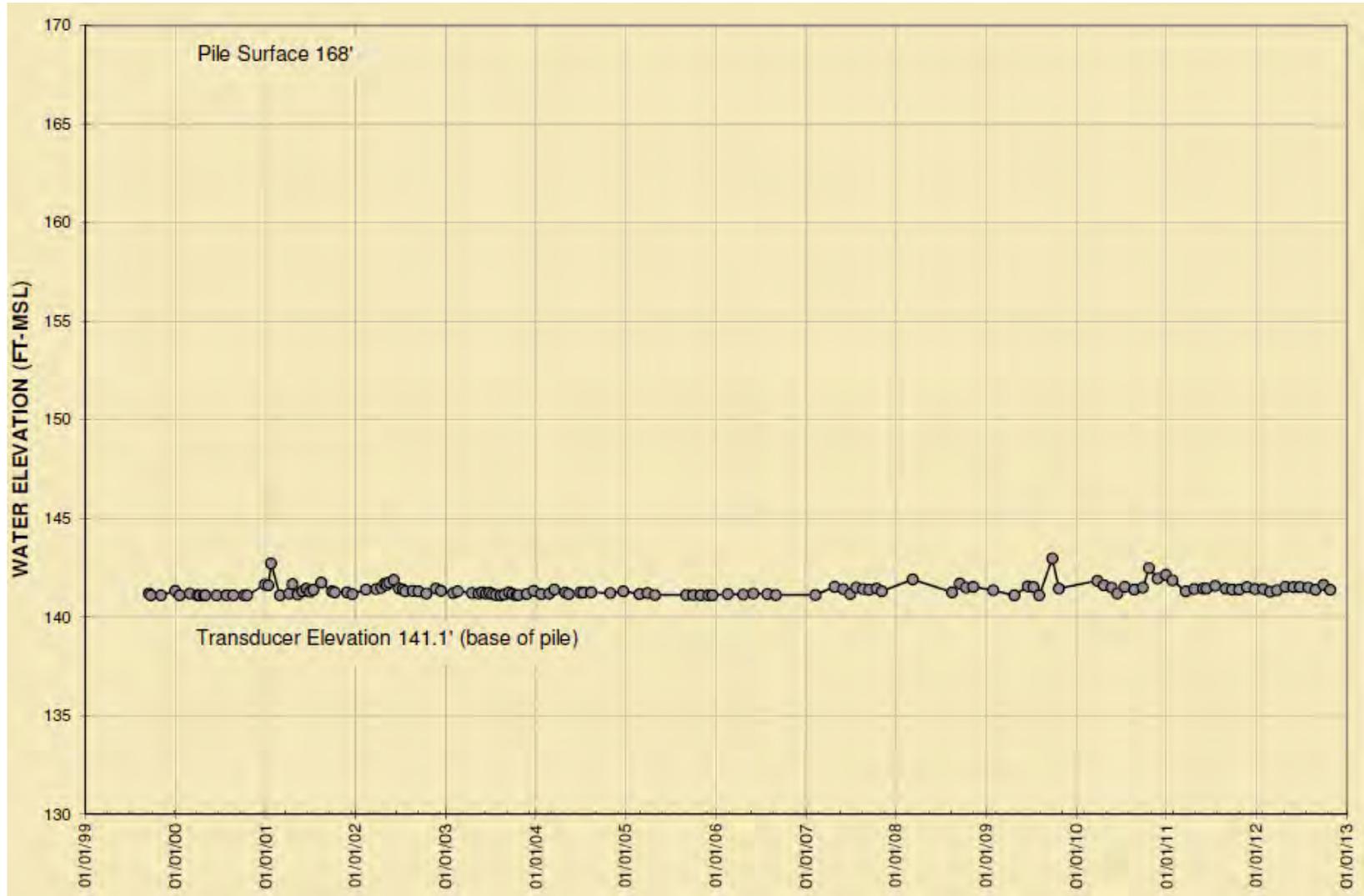
# Figure 2.6 Water Level Data for Piezometer 50



# PZ-T-00-02 and MW-T-00-05A Data Figures 2.12 and 2.14



# Figure 2.8 Water Level Data for Piezometer 74



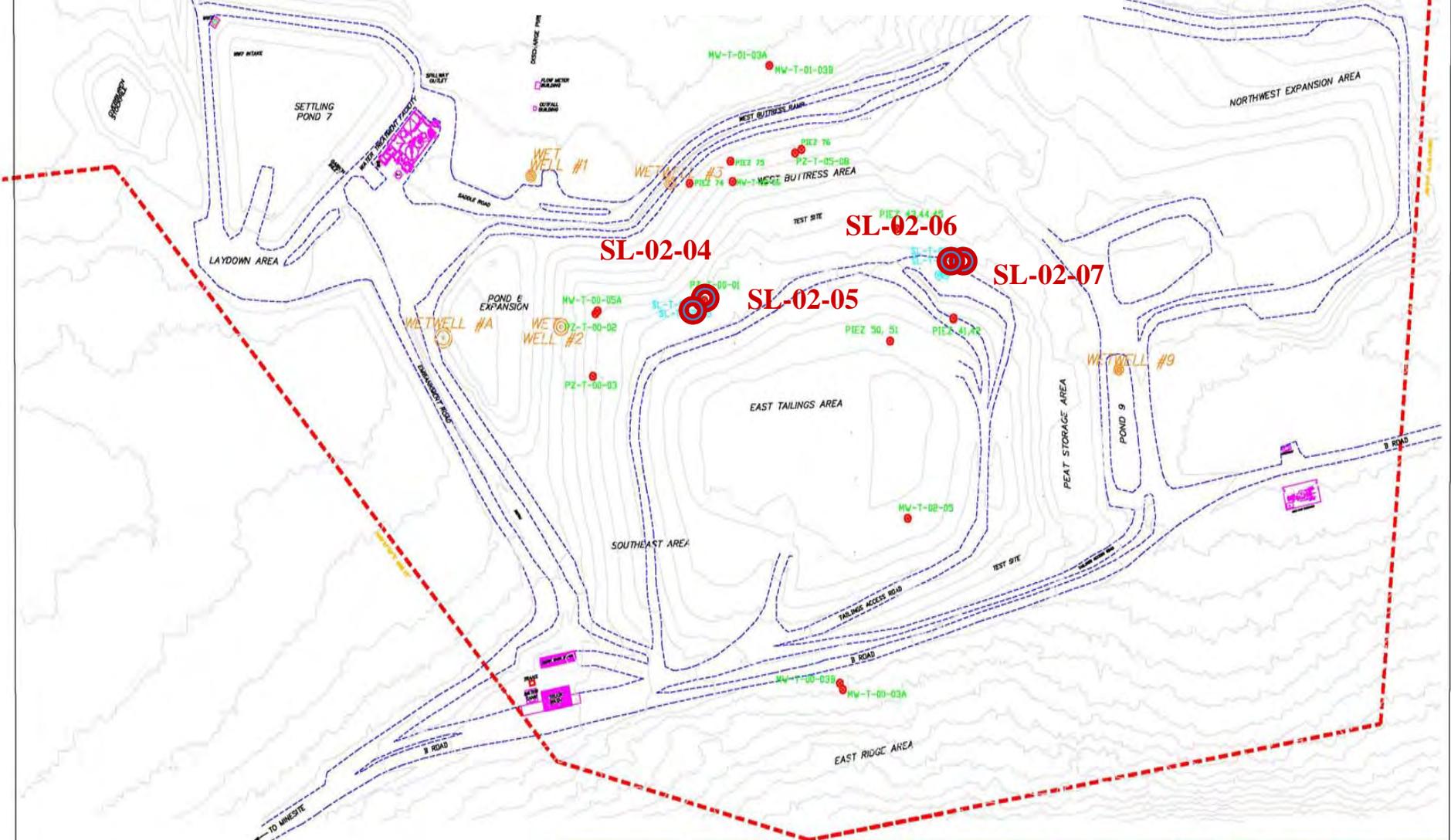
## Table 2.4 Monthly Summary of Tailings Area Climate Data

Month	Avg Temp (°C)	Precipitation (in)
January	-2.45	3.38
February	2.05	1.48
March	1.51	1.55
April	5.19	0.86
May	6.47	3.43
June	10.10	3.96
July	12.43	1.43
August	12.43	5.08
September	9.61	10.2
October	4.40	4.77
November	0.08	4.03
December	-3.15	3.02
<b>2012</b>	<b>4.89</b>	<b>43.19</b>

## Tailings Facility Internal Monitoring Sites: Water Quality Data

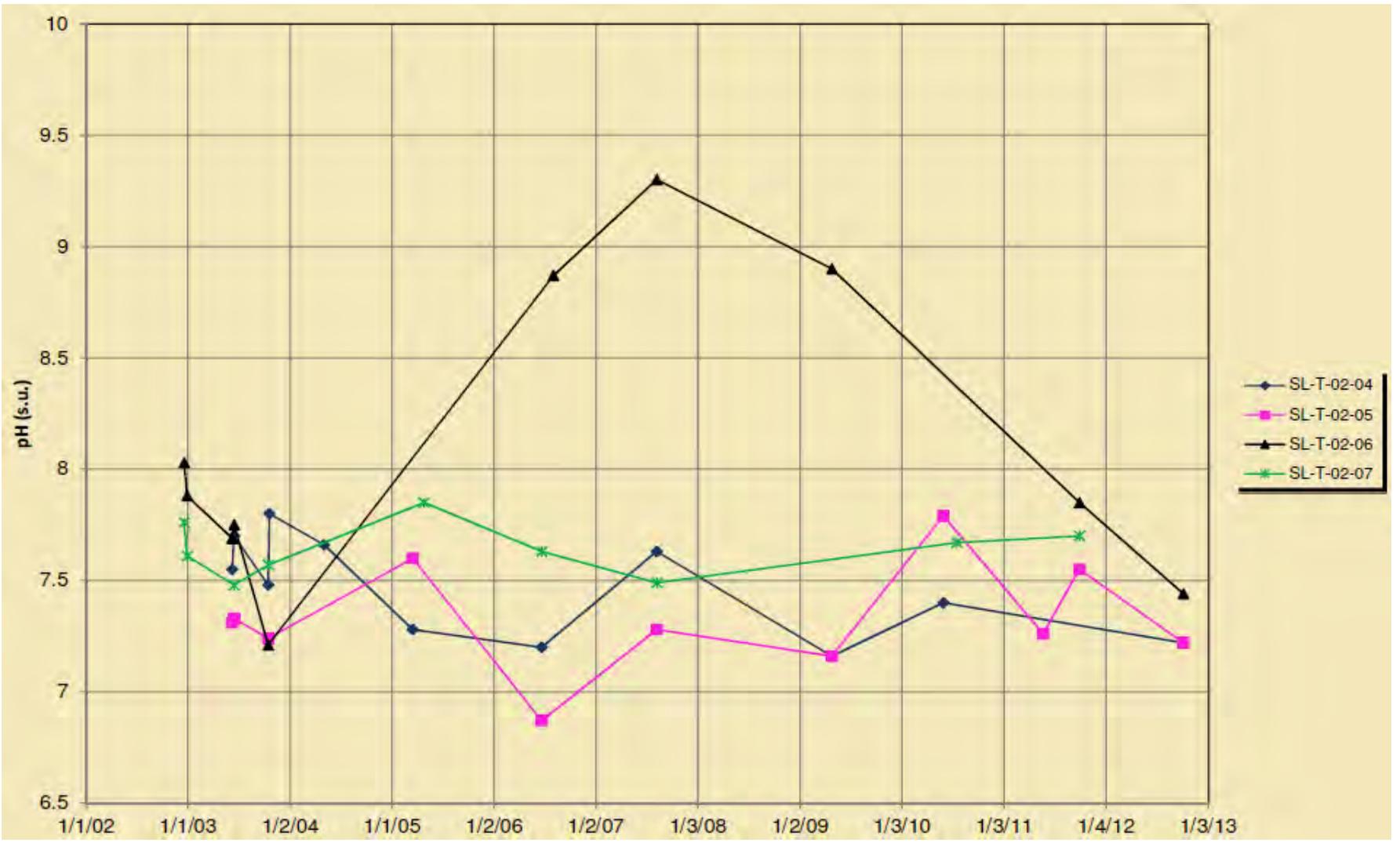
- Internal site waters captured, treated, and discharged per NPDES/APDES permit
- pH between 6.0 and 8.5
- Alkalinity between 150 and 500 mg/L
- Conductivity in wet wells and tailings completion wells between 2000 and 4100 uS/cm
- Conductivity in suction lysimeters between 1400 and 5000 uS/cm
- Sulfate and hardness correlate with conductivity

# SUCTION LYSIMETERS

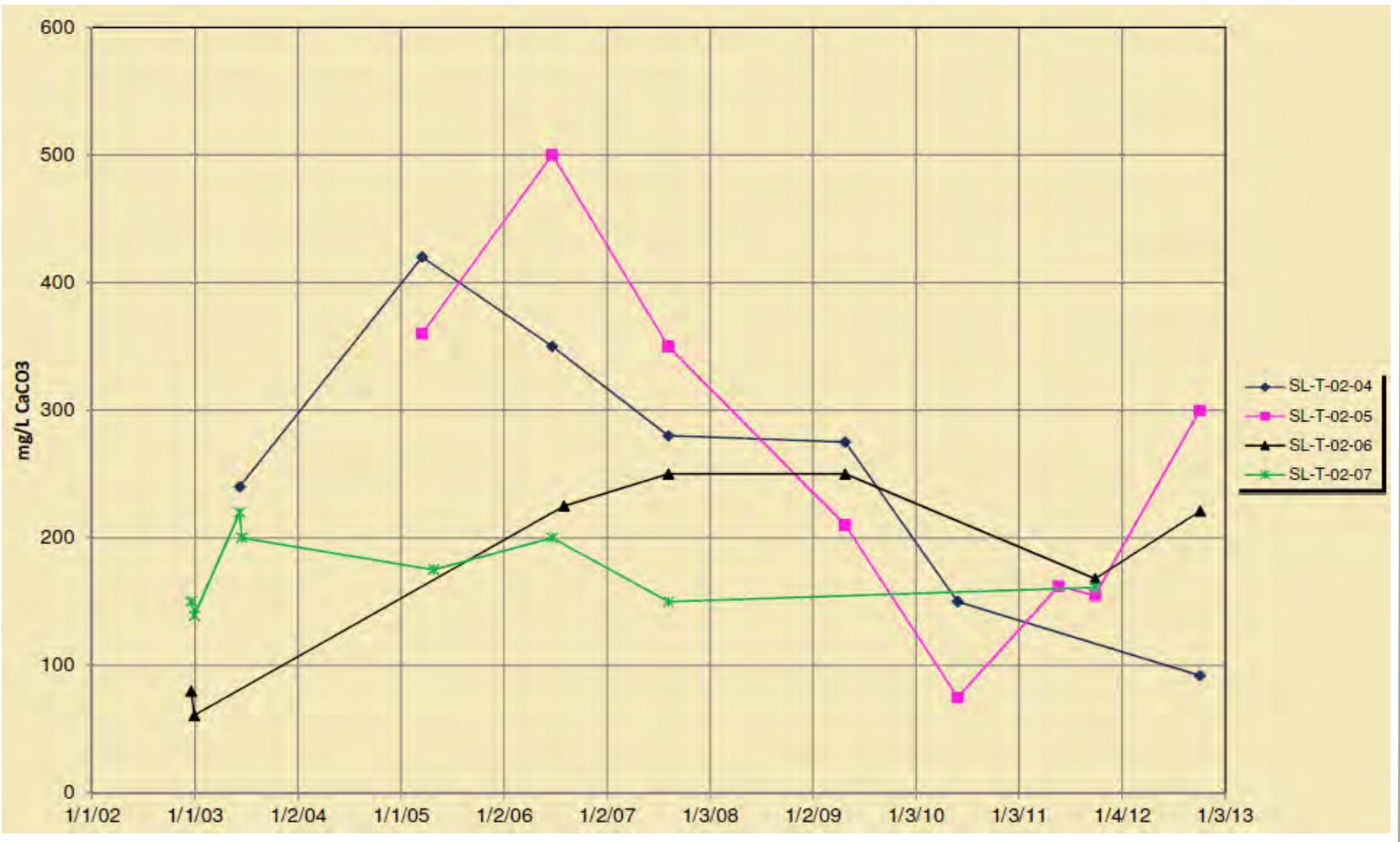


	<b>LEGEND</b> ROADS/DITCHES: ——— WATER UTILITY: - - - - BOUNDARY: - - - - MONITORING WELL: ● PIEZOMETER: ● WET WELL: ●	DATE: 11-31-08 DRAWING BY: Shelby Edwards DESIGN BY: _____ CHECKED BY: _____ PROJ. OR REF.: _____	HECLA GREENS CREEK MINING CO. P.O. BOX 32199 JUNEAU, ALASKA 99803 PHONE: (907)790-0441 FAX: (907)790-0440 TITLE: Tailings Asbuilt Annual Report Instruments GRAPHIC SCALE: 1" = 50' 
	SHEET: 1 OF 1		

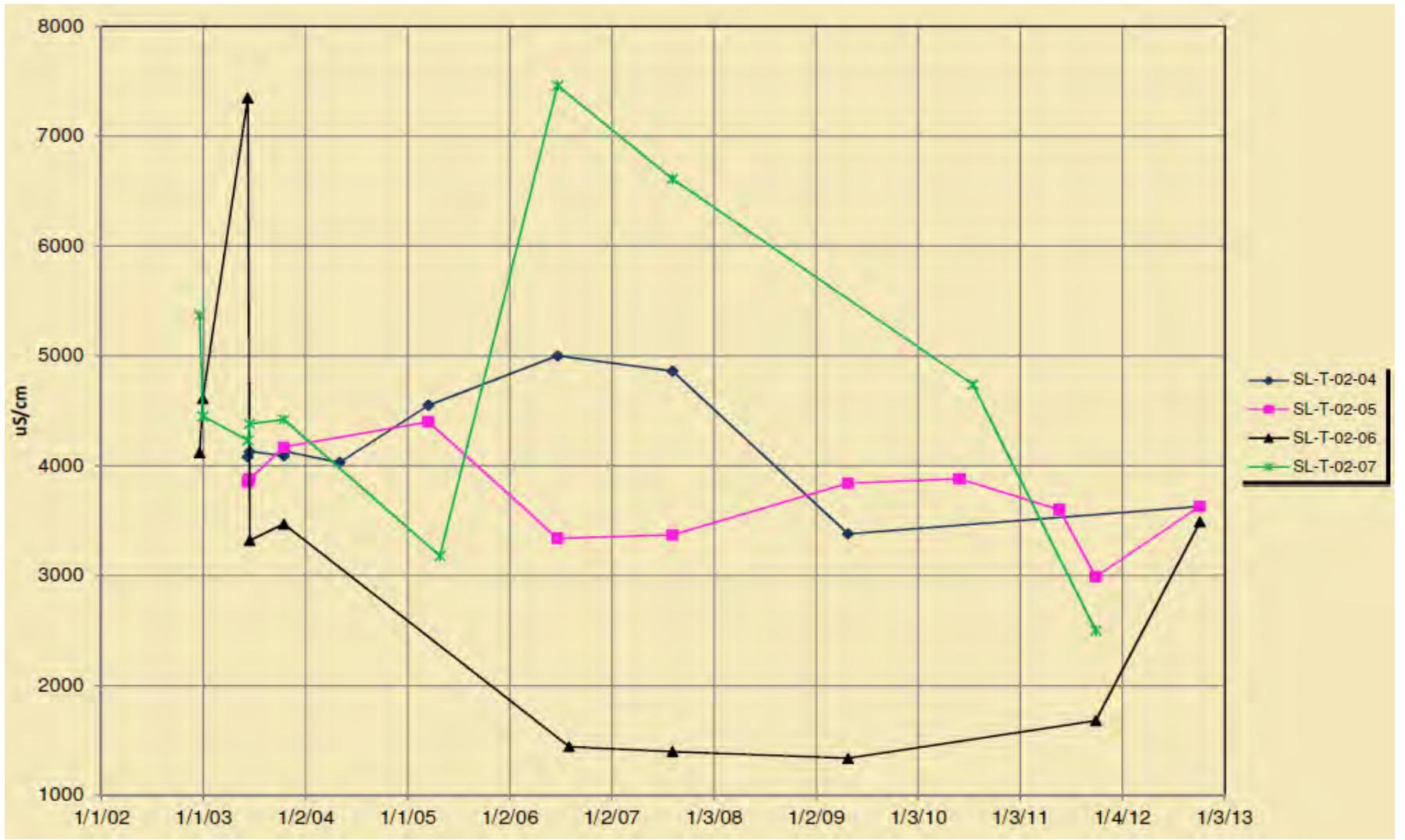
# Tailings Area Internal Sites pH - Figure 2.20c



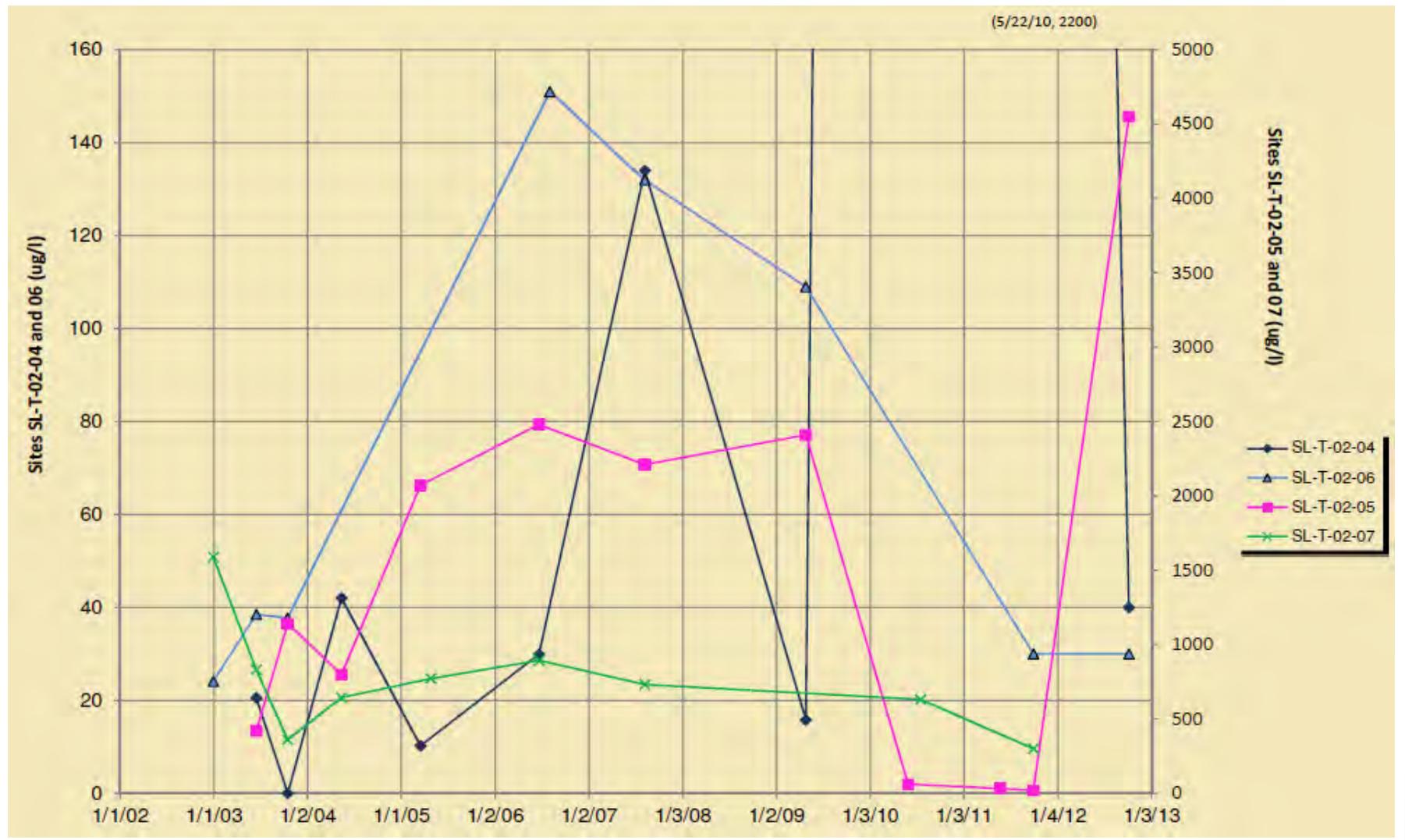
# Tailings Area Internal Sites Alkalinity - Figure 2.21c



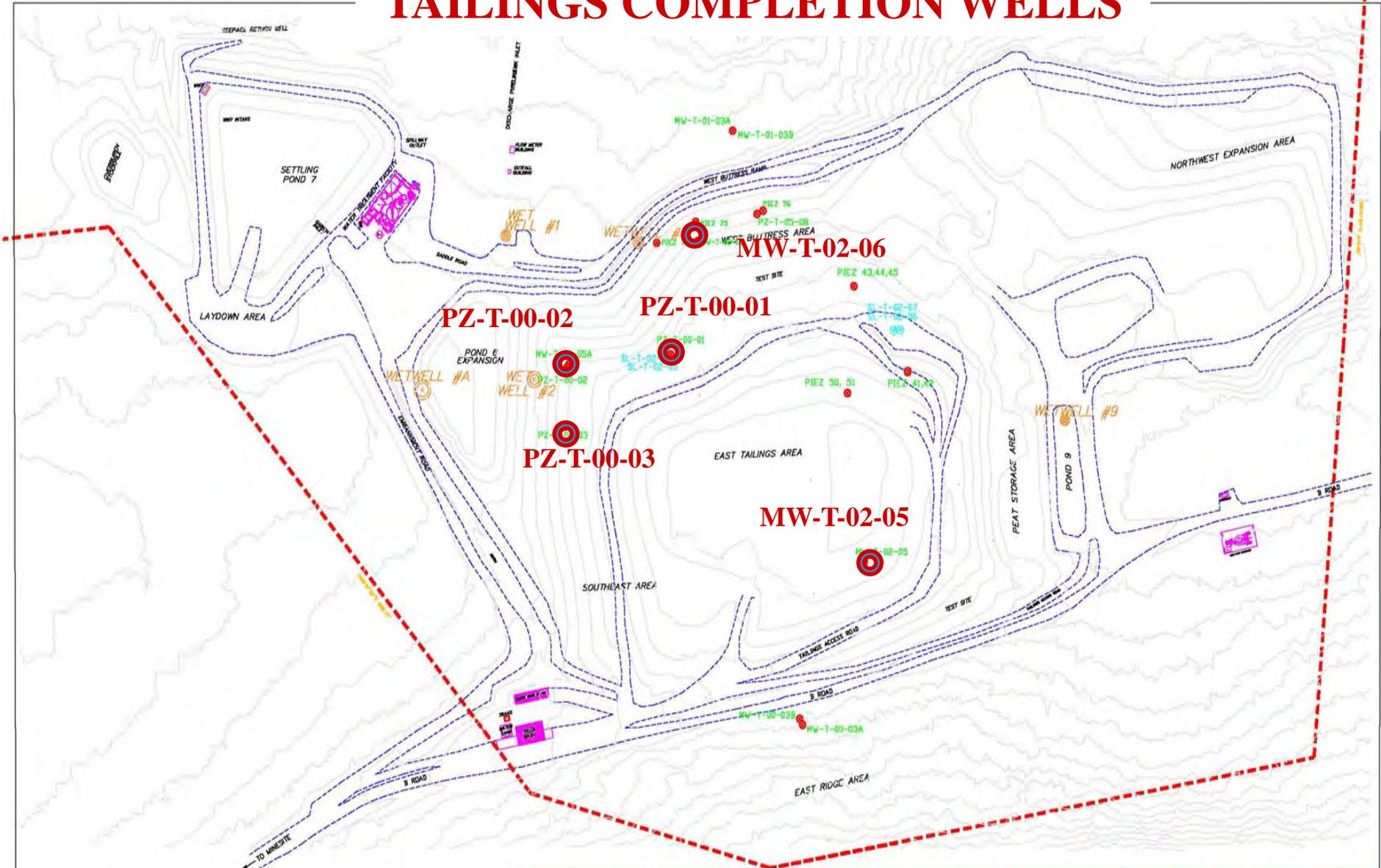
# Tailings Area Internal Sites Conductivity - Figure 2.22c



# Tailings Area Internal Sites Zinc - Figure 2.26c

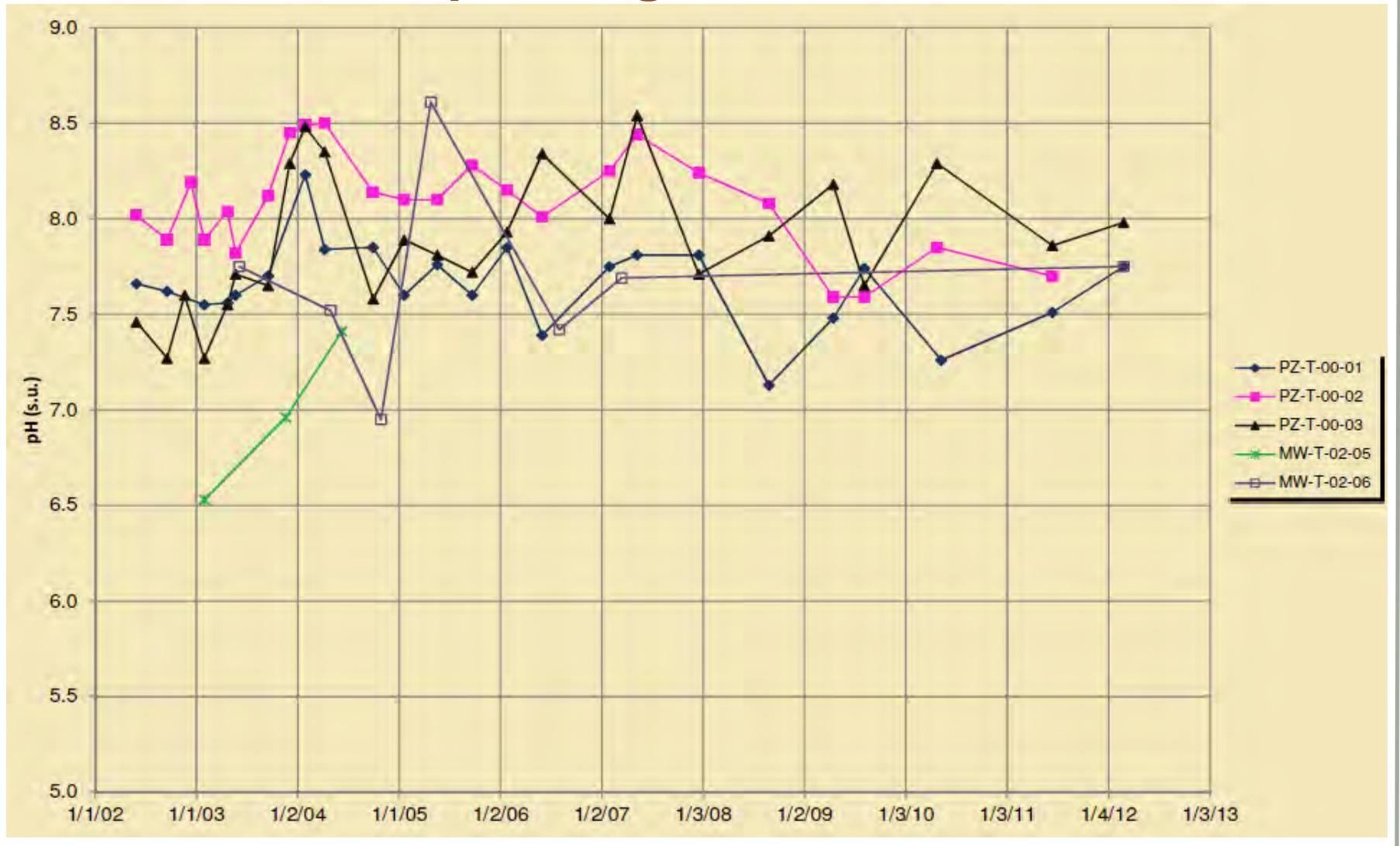


# TAILINGS COMPLETION WELLS

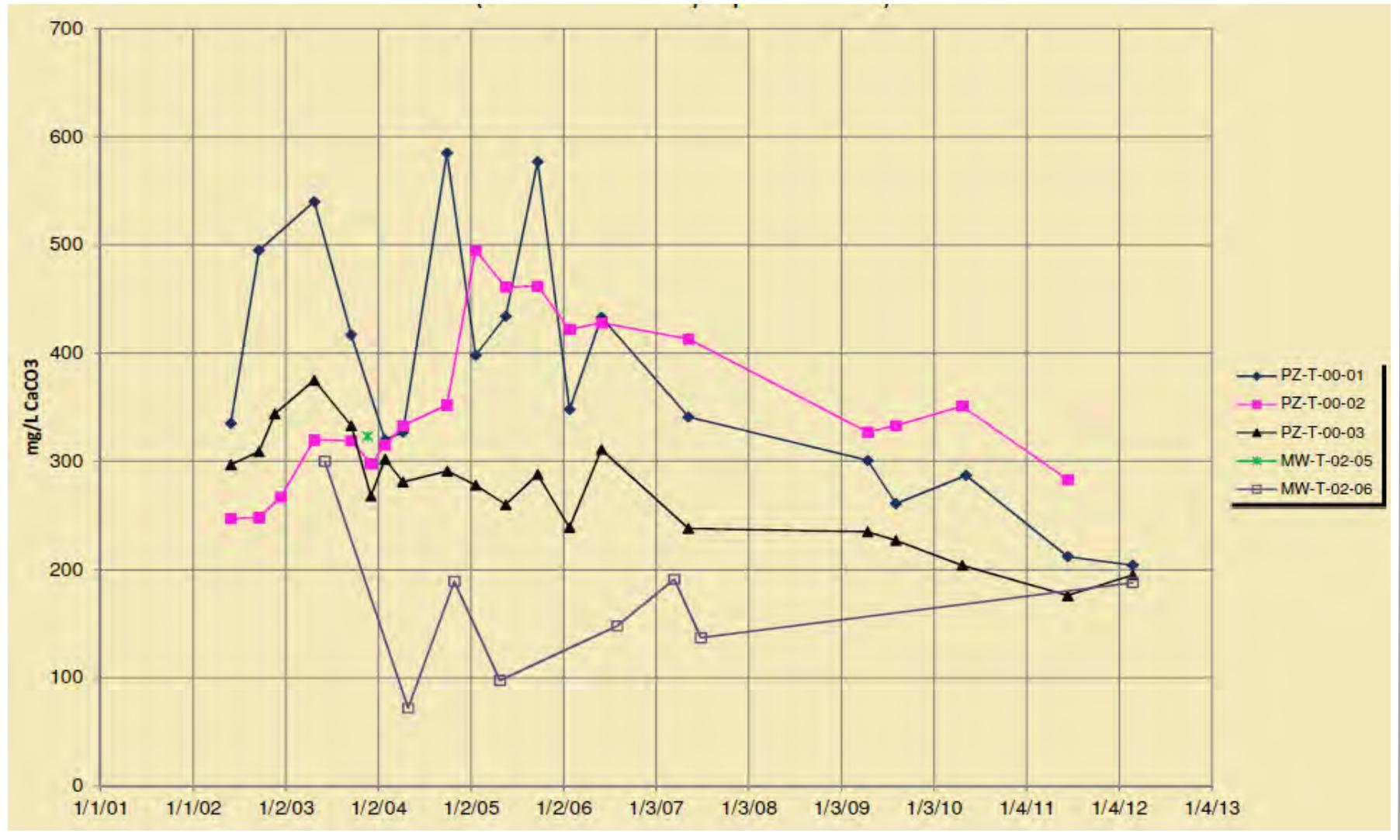


	<b>LEGEND</b> ROADS/DITCHES: ——— WATER UTILITY: - - - - BOUNDARY: - - - - MONITORING WELL: ● PIEZOMETER: ○ WET WELL: ○				
DATE: 11-31-08 DRAWING BY: Shelby Edwards DESIGN BY: _____ REVIEWED BY: _____ PREP OR REV: _____			HECLA GREENS CREEK MINING CO. P.O. BOX 32199 JUNEAU, ALASKA 99803 PHONE (907)790-0441 FAX (907)790-0440		
			TITLE: Tailings Asbuilt Annual Report Instruments		GRAPHIC SCALE 1" = 50' 
					SHEET: 1 OF 1

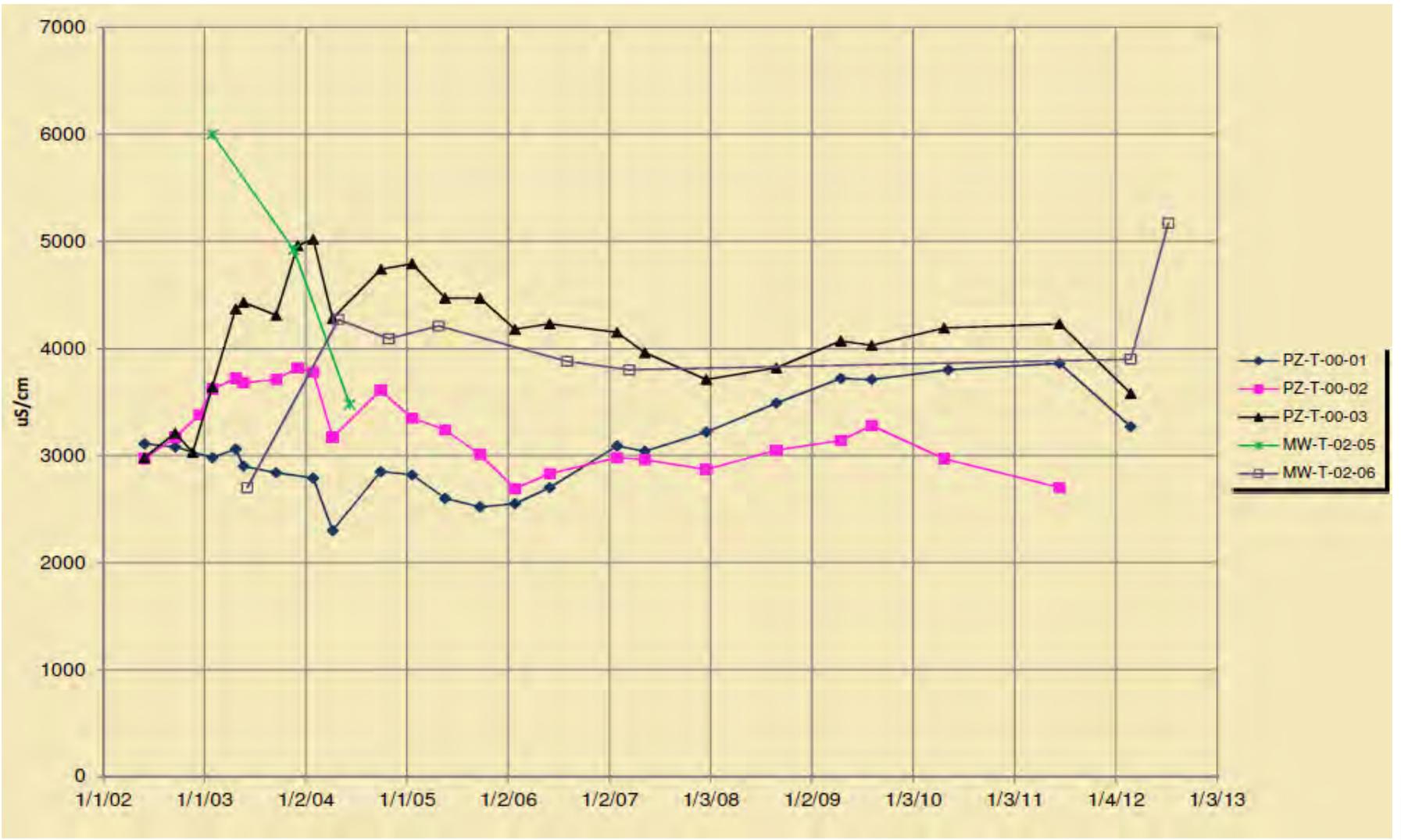
# Tailings Area Internal Sites pH – Figure 2.20b



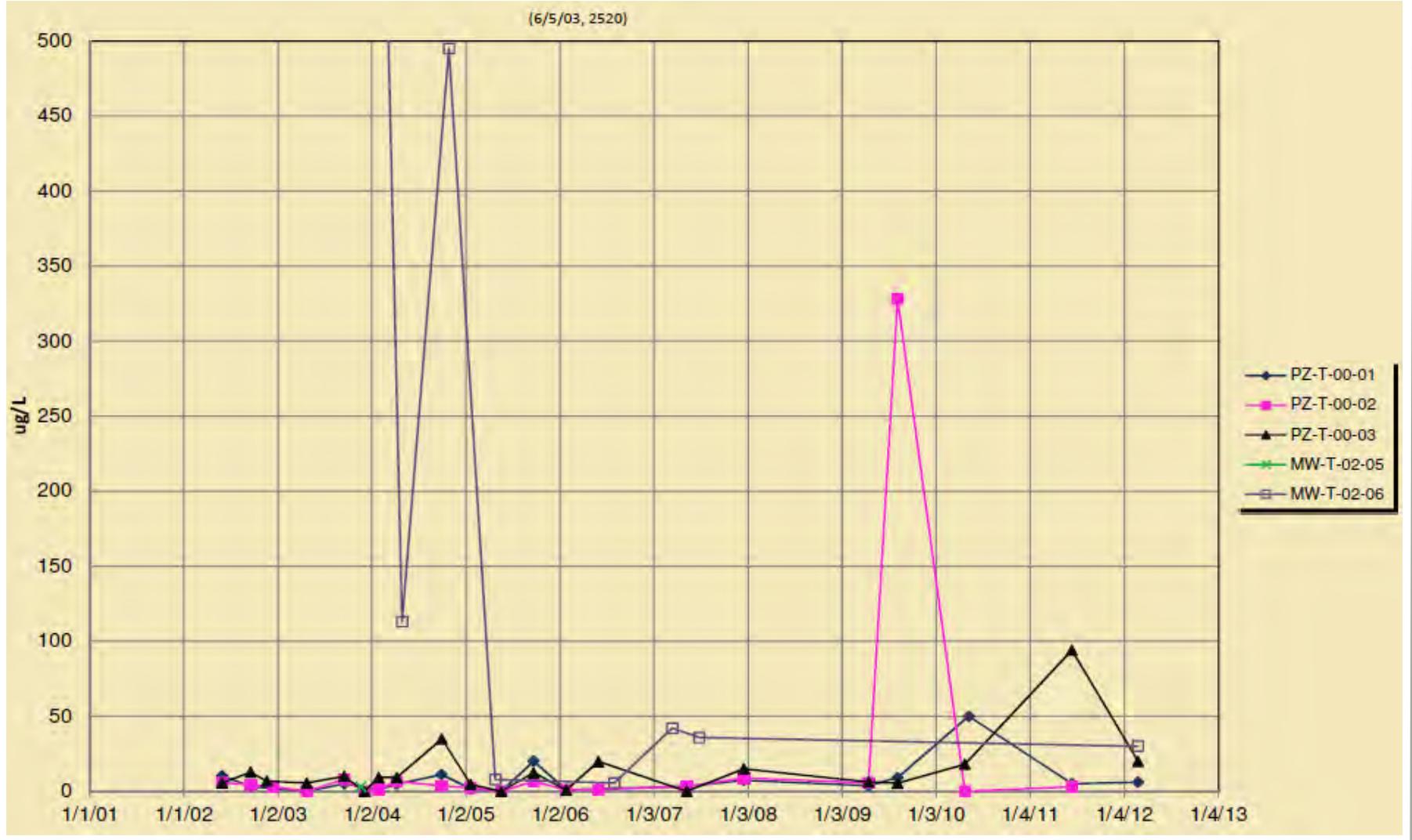
# Tailings Area Internal Sites Alkalinity – Figure 2.21b



# Tailings Area Internal Sites Conductivity - Figure 2.22b

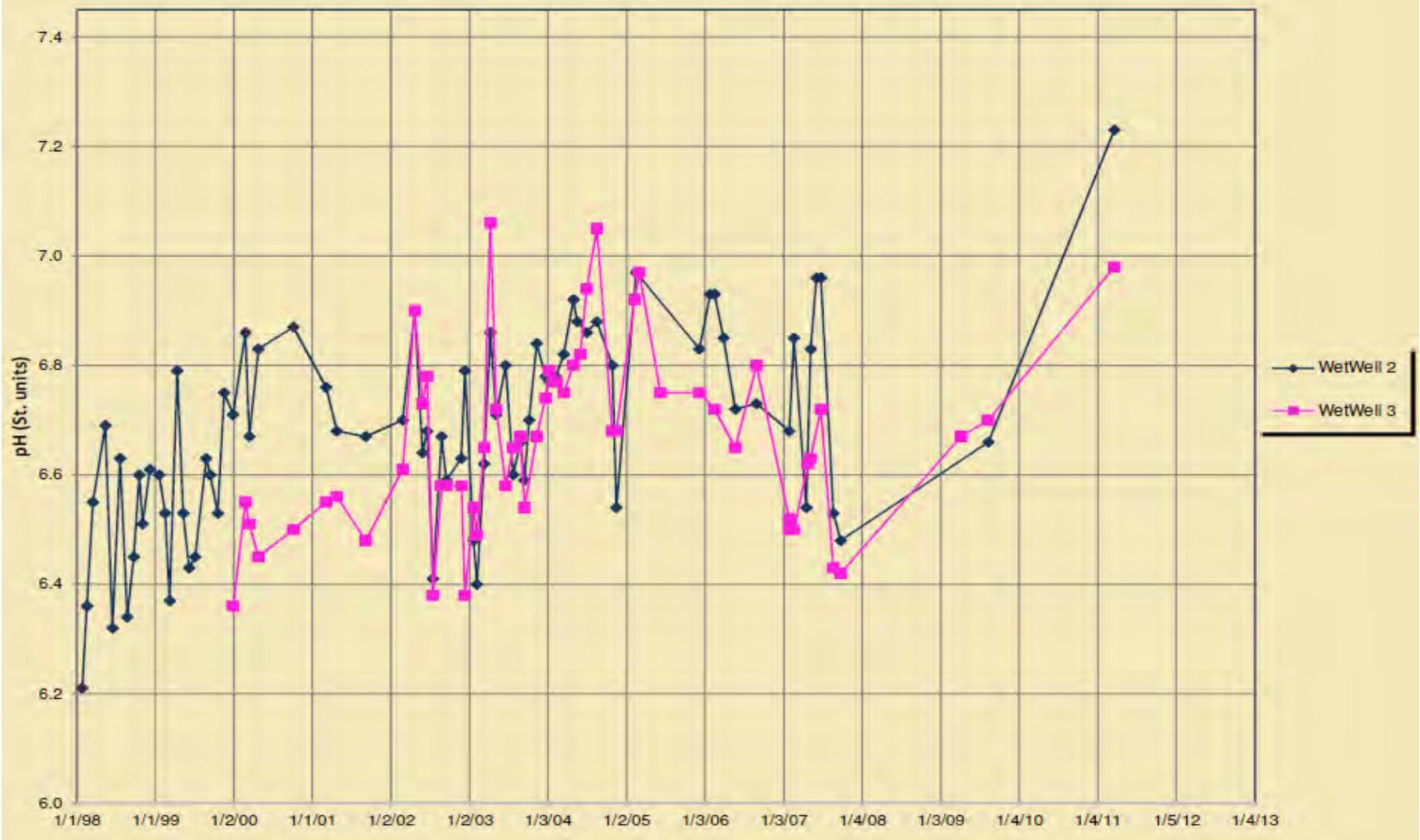


# Tailings Area Internal Sites Zinc - Figure 2.26b

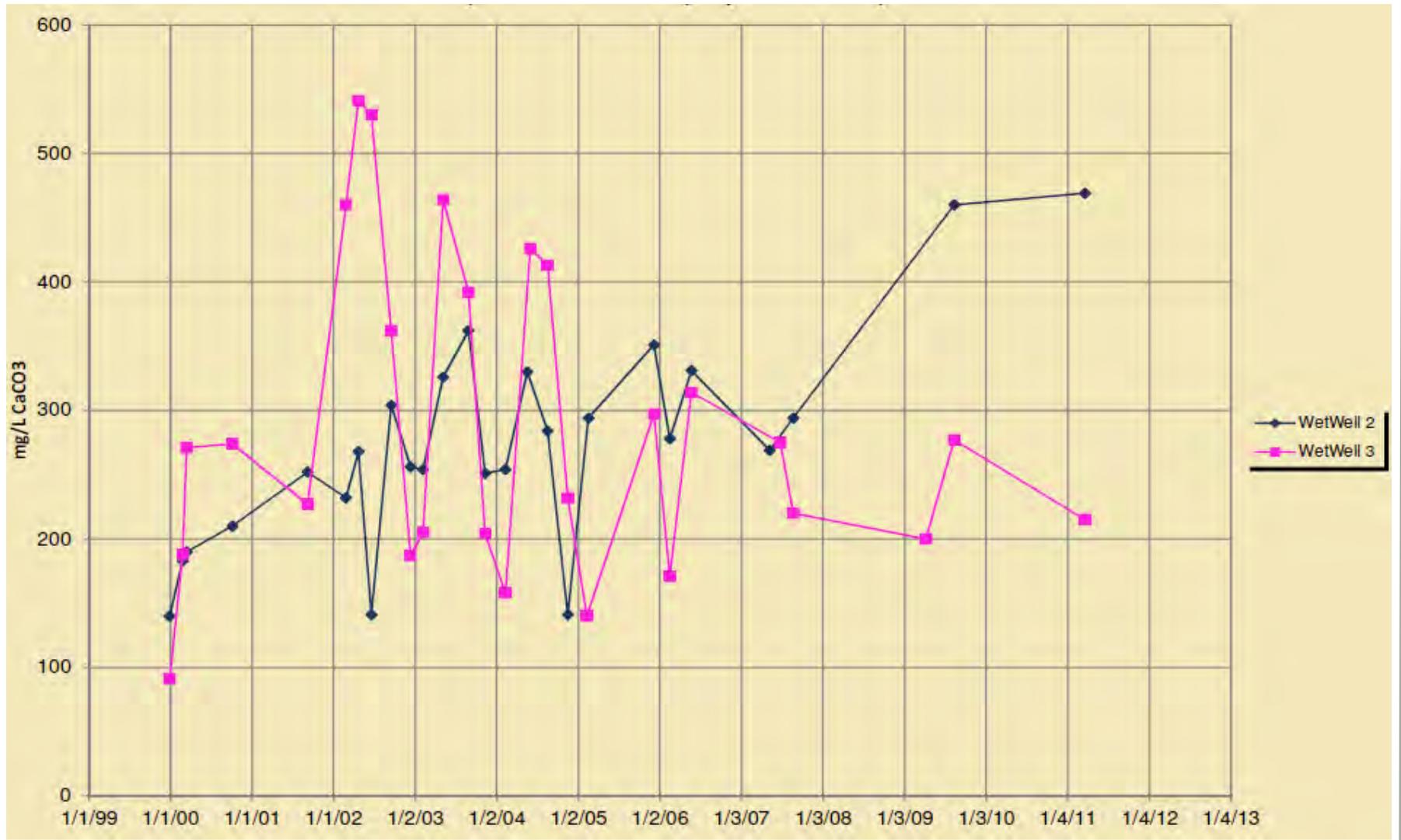




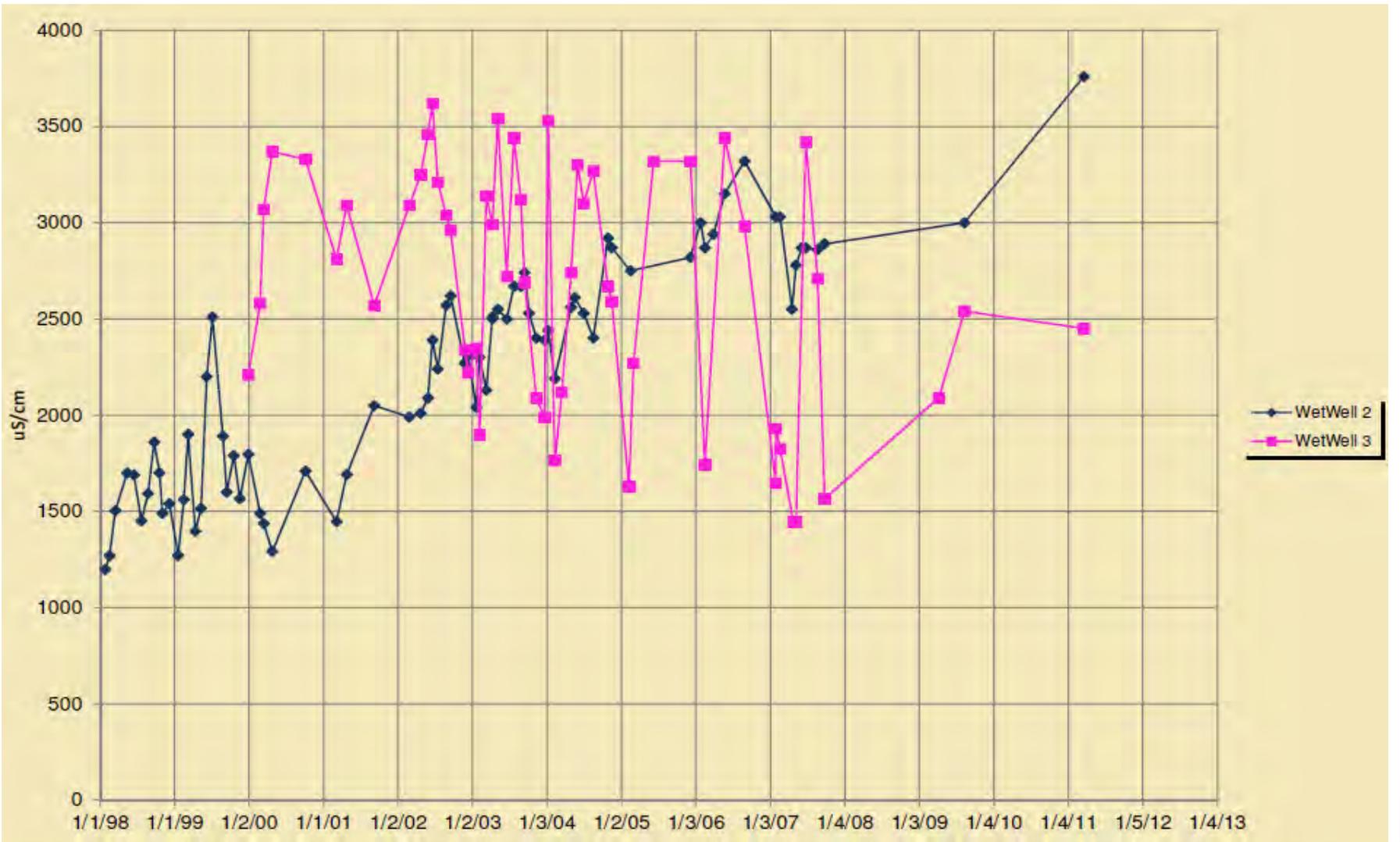
# Tailings Area Internal Sites pH - Figure 2.20a



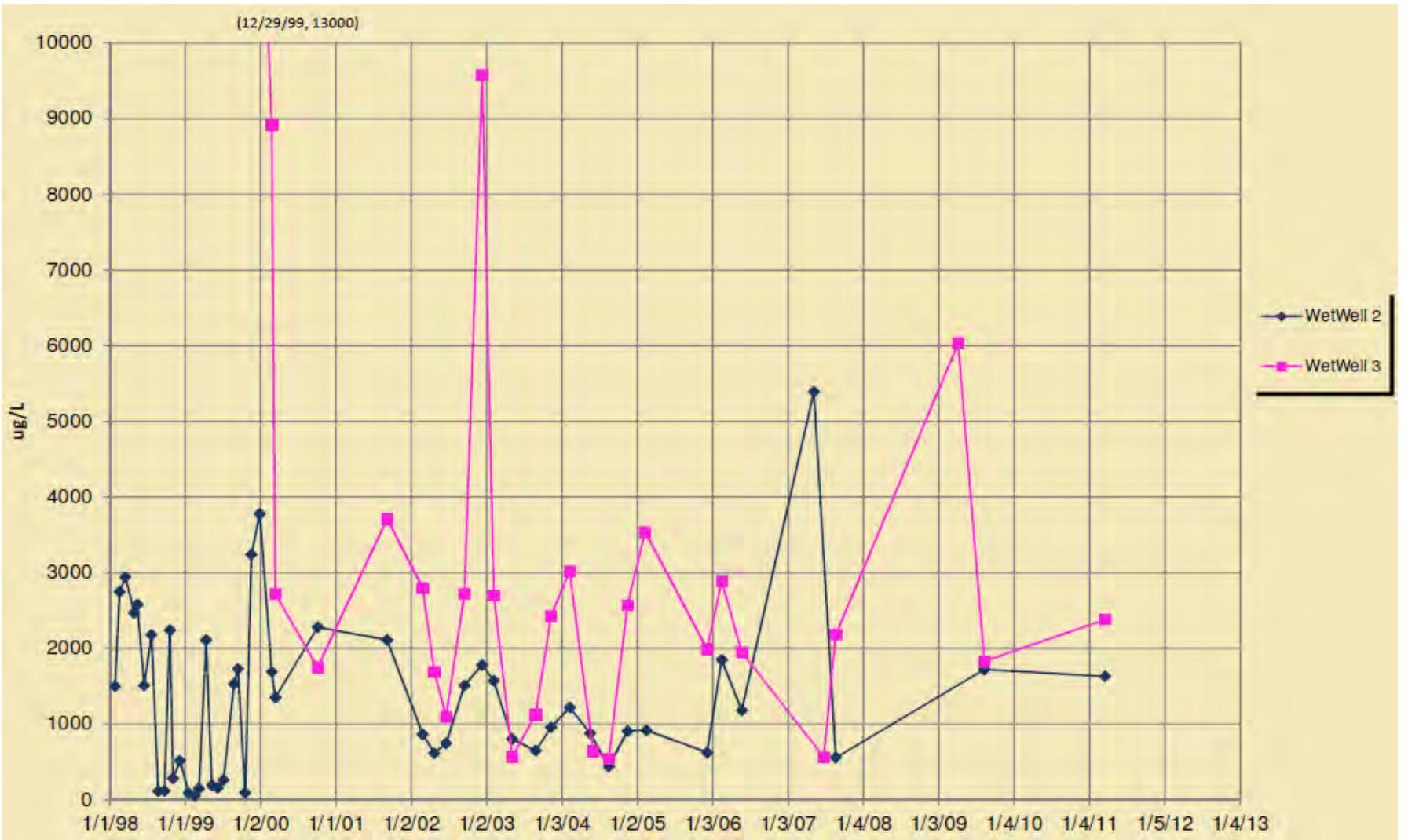
# Tailings Area Internal Sites Alkalinity - Figure 2.21a



# Tailings Area Internal Sites Conductivity – Figure 2.22a

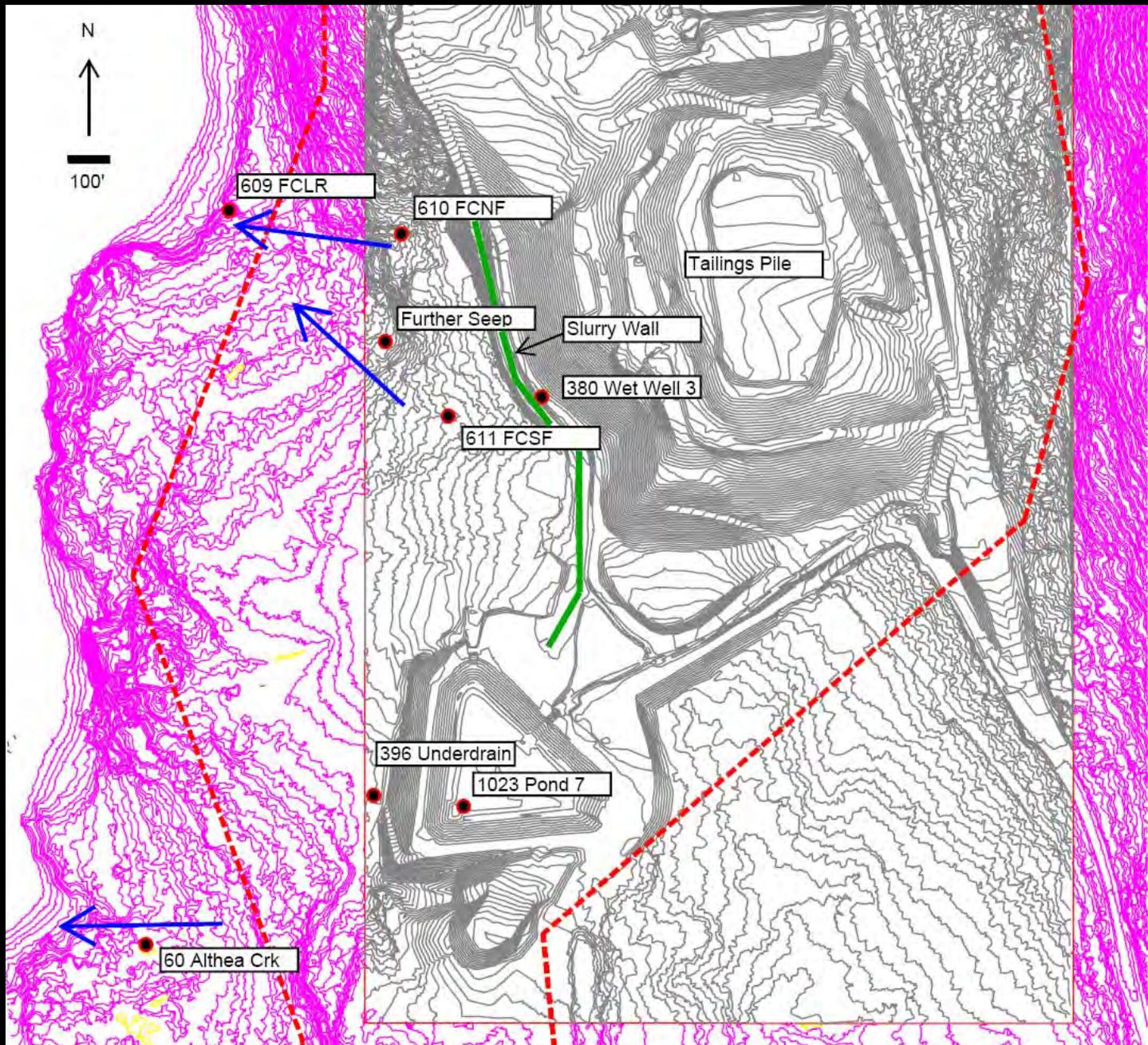


# Tailings Area Internal Sites Zinc – Figure 2.26a



## Tailings Facility Internal Monitoring Sites: Water Quality Data

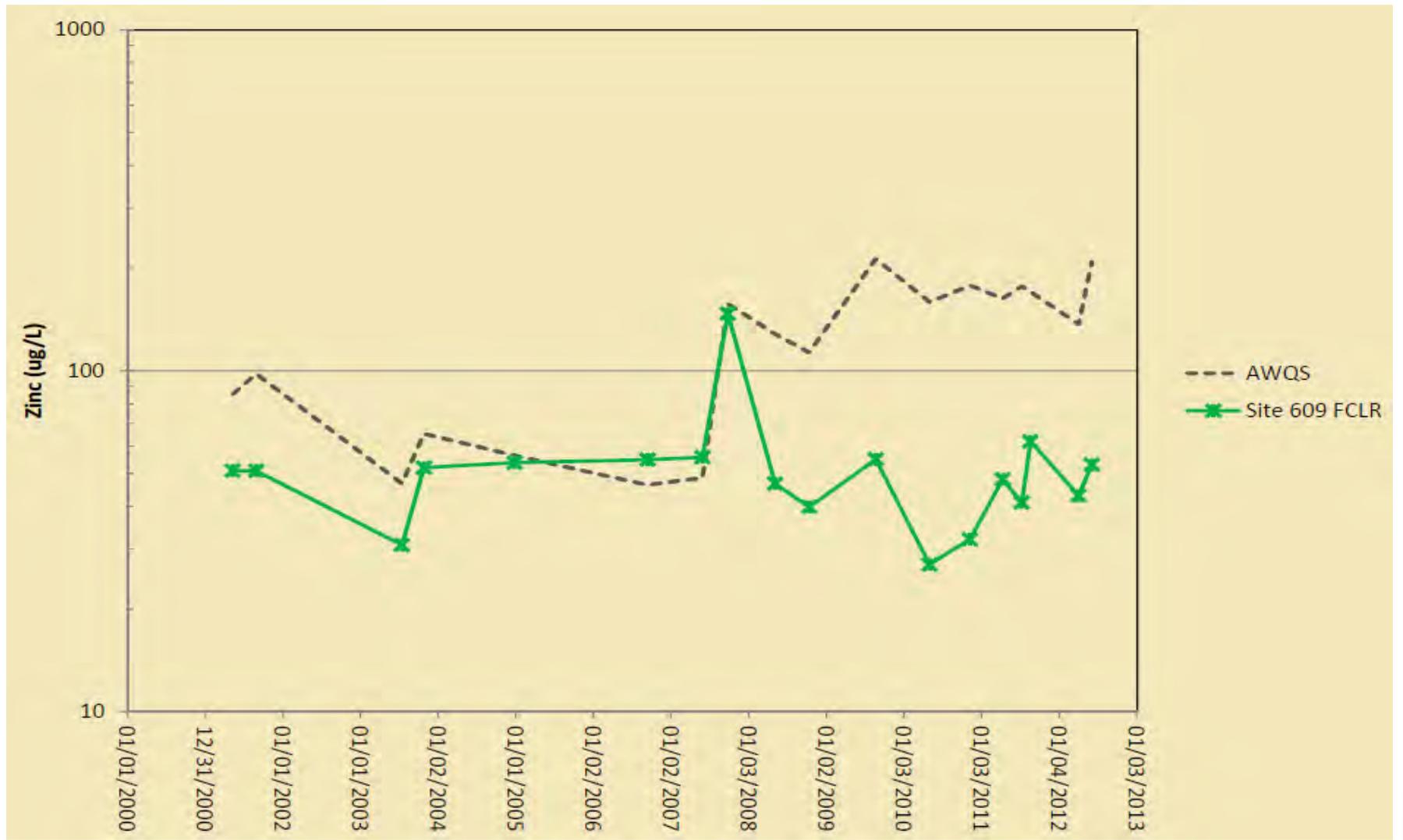
- Fluctuations in saturated zone thickness and associated redox conditions influence arsenic and iron concentrations
- Zinc is considerably more mobile than other metals
- Thiosulfate disproportionation, sulfate reduction and base metal sulfide precipitation produces low metal concentrations in most saturated zone wells
- Shallow unsaturated zone and Wet Well 3 have higher metal concentrations
- Iron and manganese concentrations are elevated in wet wells, groundwater, and most of the suction lysimeters due to oxidation/reduction and buffering reactions



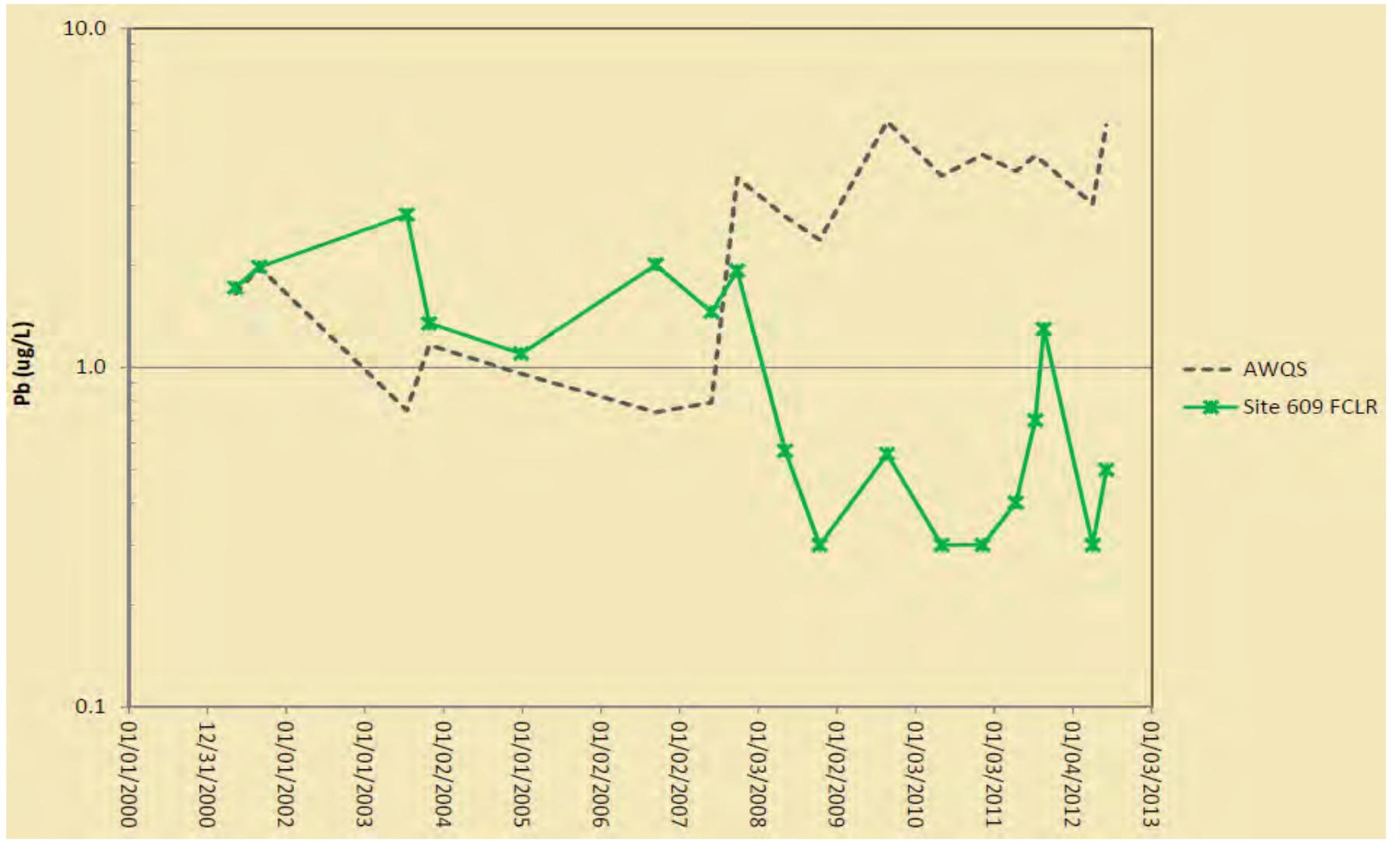
## Tailings Facility Additional Monitoring

- Most perimeter wells exhibit chemistry comparable to background waters
- Pyritic rock used locally for access roads produced acidic drainage in two areas (the pyritic rock was removed from both locations)
  - Water quality shows improvement in response to remediation efforts
- Residual sulfate and metal concentrations are very low relative to contact waters but higher than background levels in localized areas
- West Tailings Facility Monitoring Action Plan submitted to regulatory agencies 12-15-2009

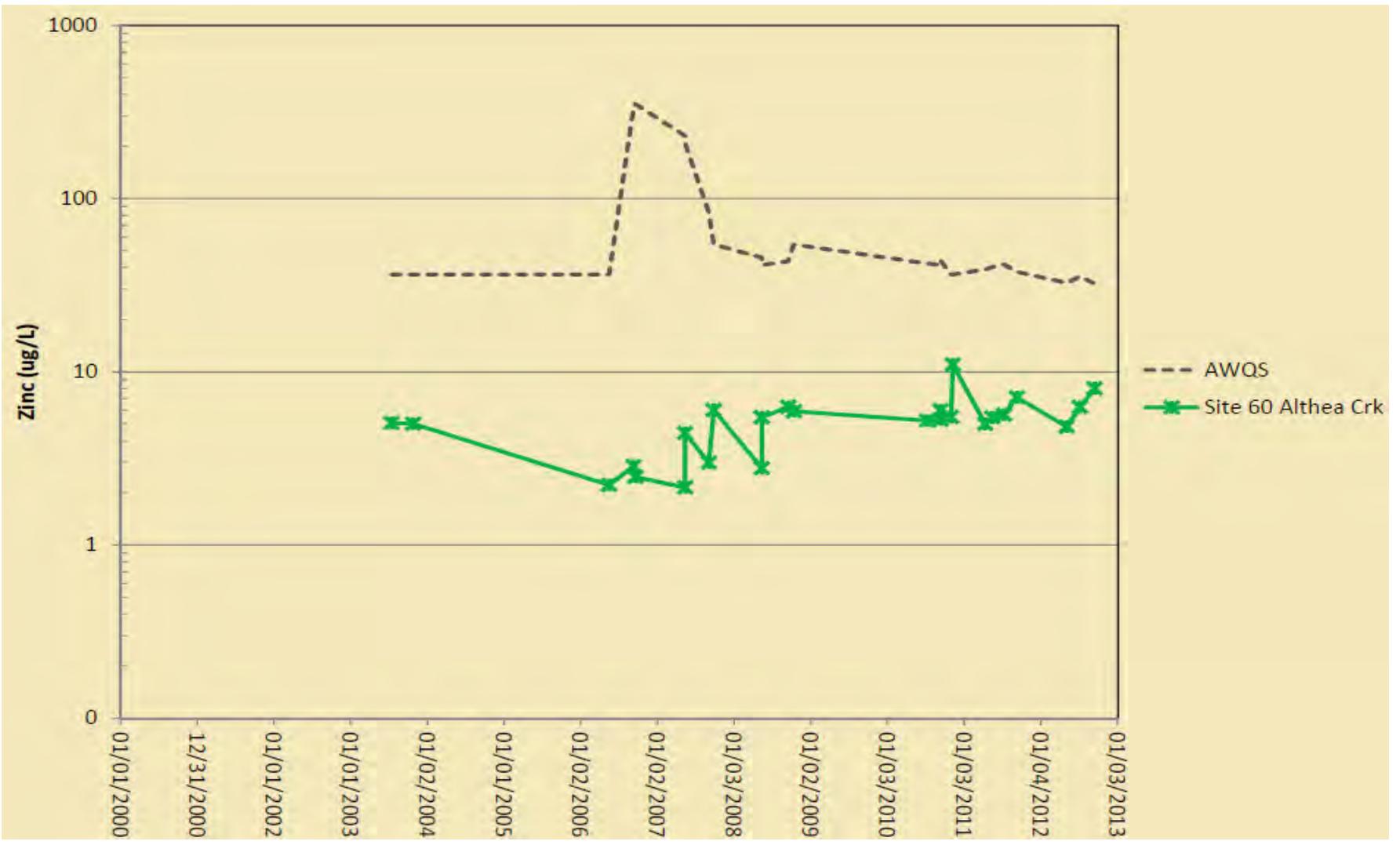
# Figure 2.40 Site 609 Zinc



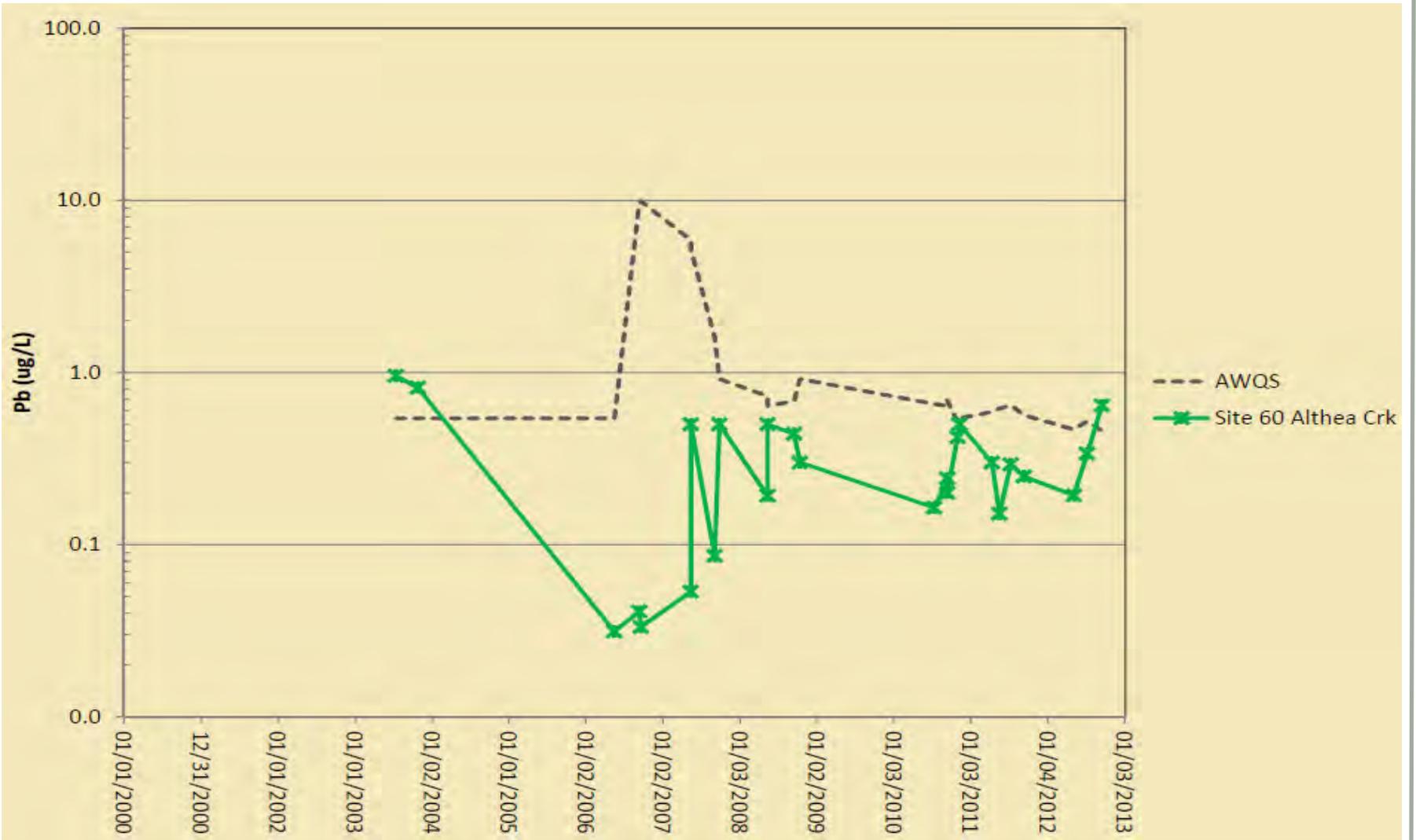
# Figure 2.41 Site 609 Lead



# Figure 2.42 Site 60 Zinc



# Figure 2.43 Site 60 Lead



## Tailings Facility Additional Monitoring

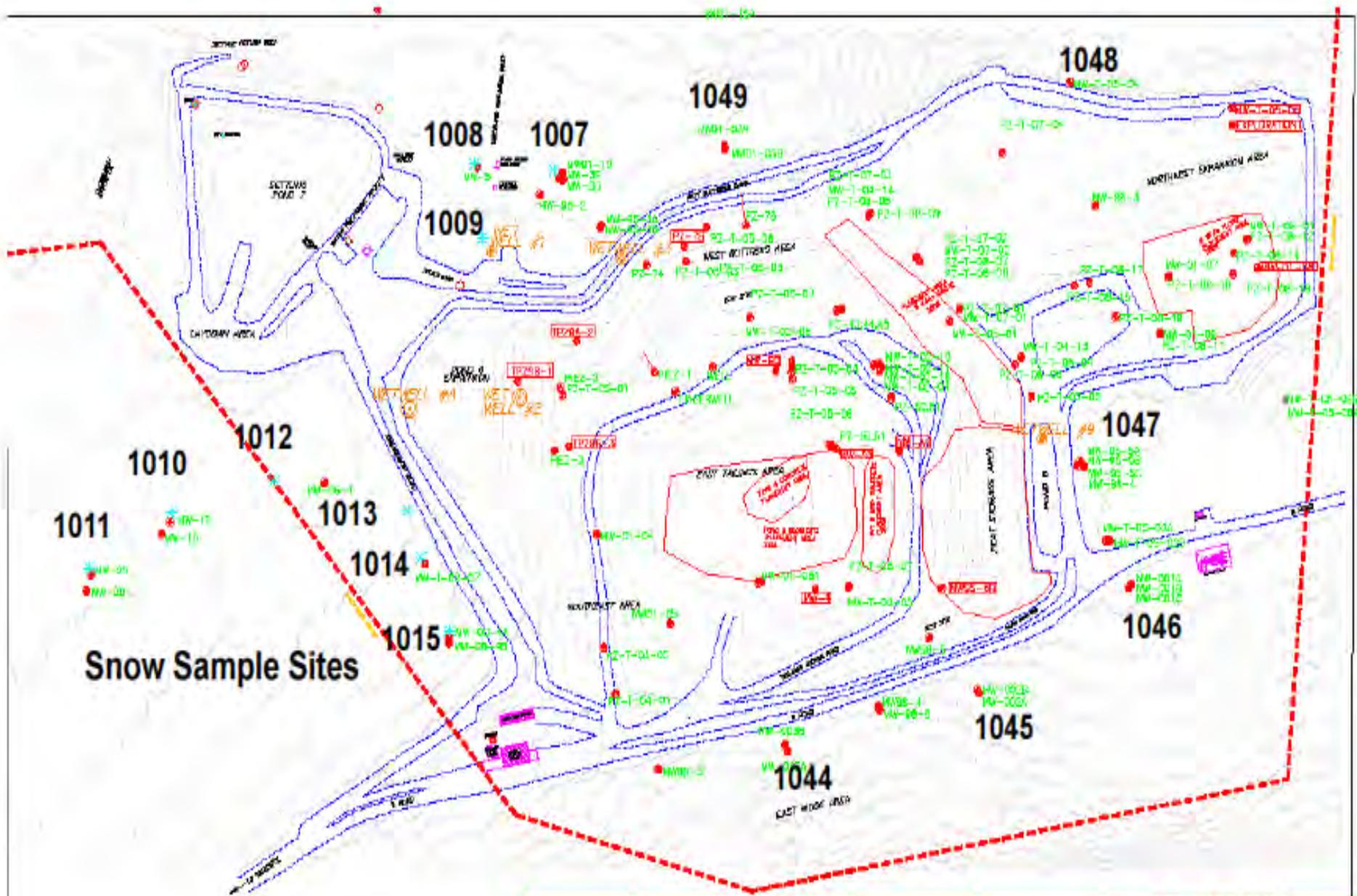
- A complex history of disturbance poses challenges to identifying potential leakage from the facility
- Zinc in the drainage is an order of magnitude or more lower than contact water, suggesting that effects from seepage, if any, from the tailings pile are minimal
- Zinc at sites 610 and 609 increased with construction and tailings placement activity
- Zinc at site 611 increased from 2004 to 2009 but decreased in 2010 and 2011. The absence of manganese suggests the source of the increase was not tailings leachate
- Further Creek drainage is expected to improve. Some element concentrations may temporarily increase as the drainage returns to its naturally acidic, dilute condition

## Tailings Facility Additional Monitoring

- Quarrying and construction of Pond 7 influenced Althea Creek chemistry and collection of foundation drainage caused a return toward pre-construction conditions
- Comparison of zinc concentrations above and below the liner suggests that the liner is intact and functioning as designed. The lack of an increase in metals from Pond 7 suggests that the small increase in zinc and lead in 2010 at Site 60 was not from Pond 7.
- Background conditions typical of muskeg drainages preclude compliance with AWQS for pH, alkalinity, aluminum, and iron at sites 60 and 609
- Pb, Zn, Cd, Hg, Mn are expected to exceed background levels and may not meet AWQS as pH and hardness decrease to background levels. The magnitude of the exceedance is expected to be small and temporary

# Tailings Facility Dust Sampling



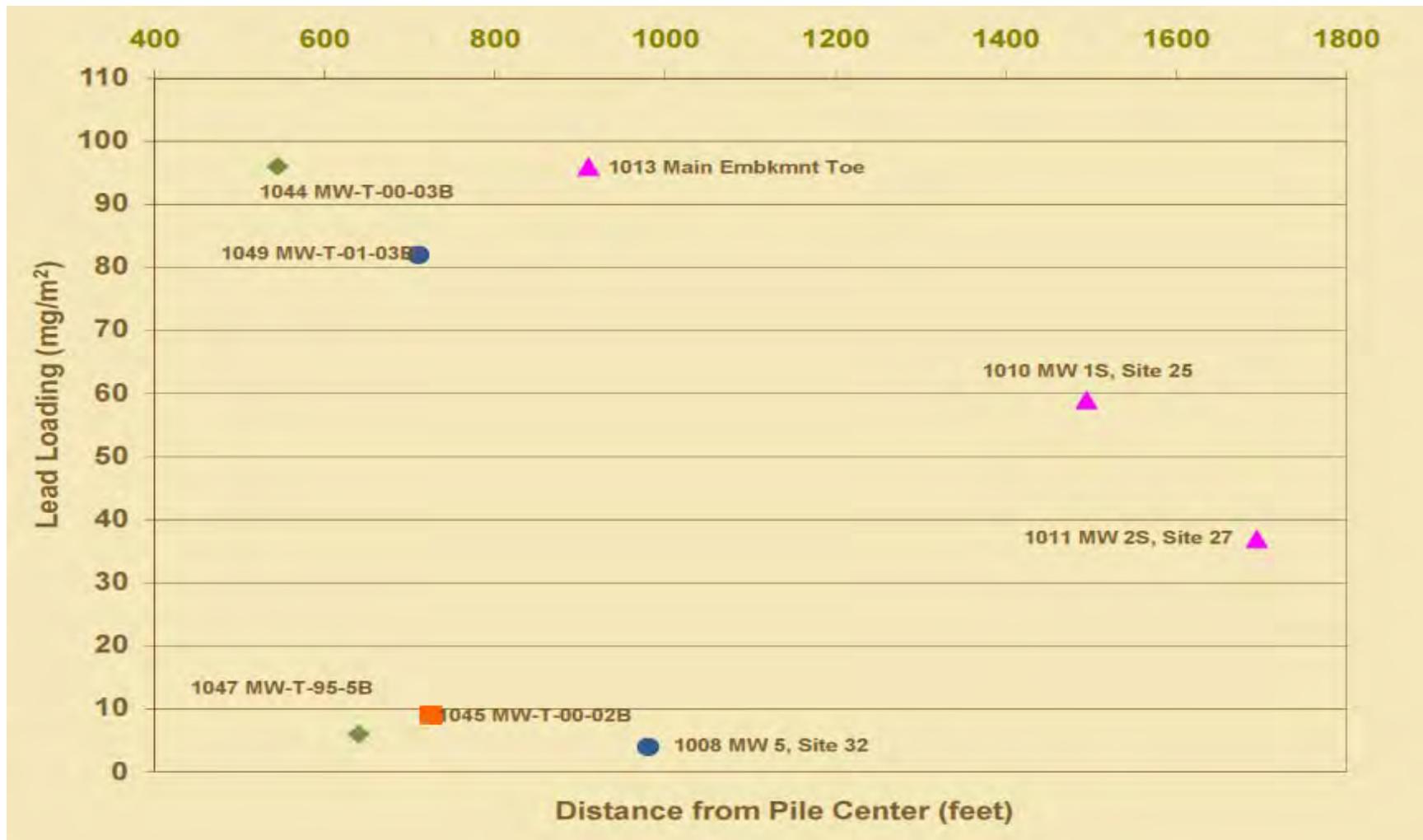


**Snow Sample Sites**

	<p><b>LEGEND</b></p> <p><b>WELLS</b></p> <p>MONITORING WELL (red dot)</p> <p>PIEZOMETER (blue dot)</p> <p>WELL HEAD (red circle)</p> <p>PIEZOMETER HEAD (blue circle)</p> <p><b>BOUNDARIES</b></p> <p>WELL HEAD BOUNDARY (red dashed line)</p> <p>PIEZOMETER HEAD BOUNDARY (blue dashed line)</p>	<p><b>DATE</b></p> <p>DATE: 11-2-08</p> <p>DRAWN BY: Daley Clark</p> <p>CHECK BY:</p> <p>SCALE: 1" = 100'</p> <p>SHEET 1 OF 1</p>	<p><b>WELL DRILLS CROSS WIND 10</b></p> <p>P.O. BOX 25199 JUNEAU ALASKA 99803</p> <p>PHONE (907) 451-4441 FAX (907) 451-4440</p> <p><b>Tailings Abutment</b></p> <p><b>Wells and Piezometers</b></p> <p>SCALE: 1" = 100'</p> <p>SHEET 1 OF 1</p>
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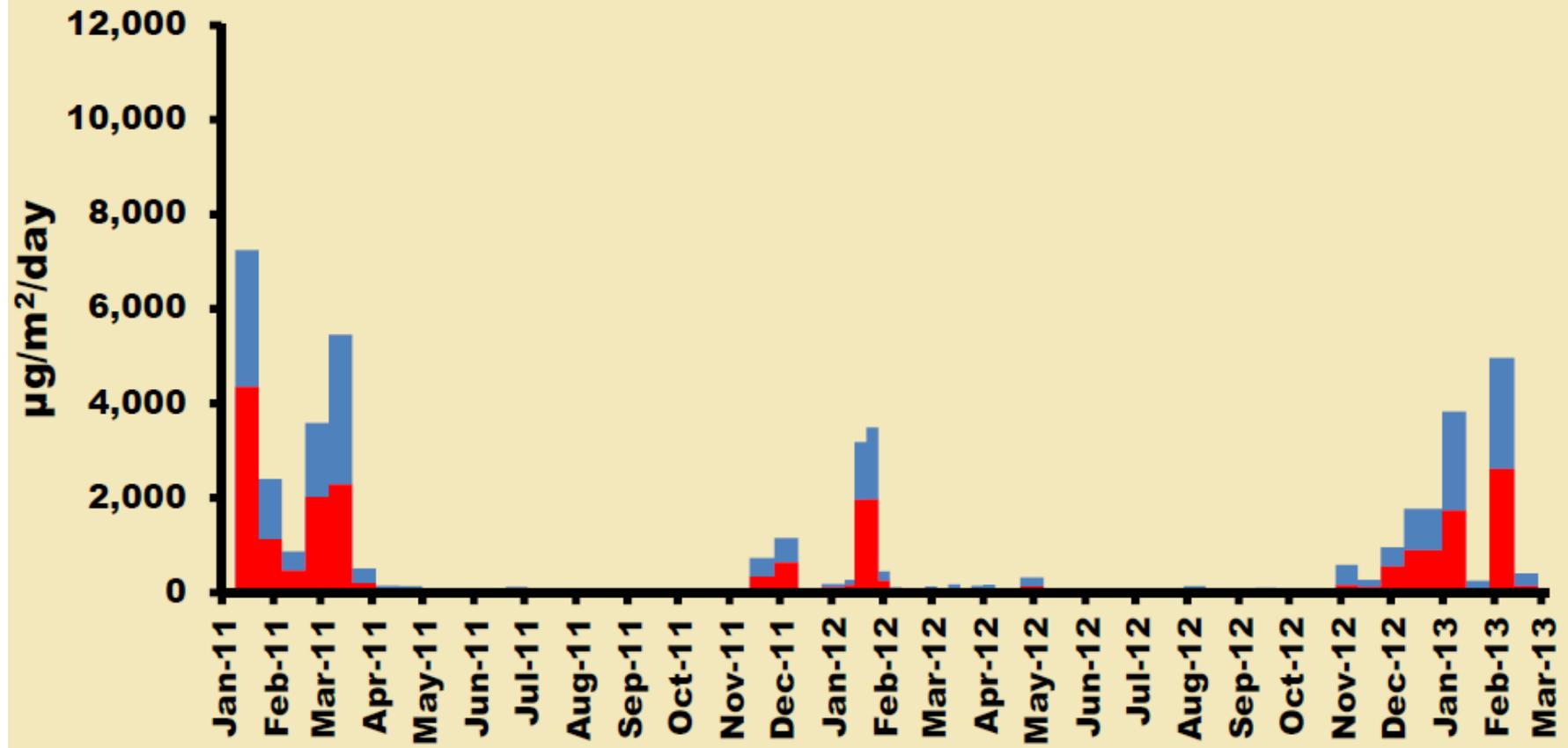


# Figure 2.3X Snow Survey Analysis



# Figure 2.37

Average **lead** and **zinc** daily loading of the ADP on the western side of the tailings disposal facility over a 2 year period.



# Tailings Facility Dust Sampling

- Mitigation
  - Snow Fences
  - Eco Blocks
  - Snow removal only in active placement area
- Lead levels in water do not directly correlate to lead loading values
- Observable up to approximately 1700 feet away
- Significant decrease in lead load relative to 2006. Variability due to location of active placement areas

## Sulfate Reduction Monitoring Program (SRMP) Update

- Tailings Expansion EIS ROD required a study to determine if long term sulfate reduction is achievable and will meet closure needs; evaluate existing and additional carbon sources and application methods
- Seven field test plots (5 carbon amendments; 2 controls) were constructed, instrumented (suction lysimeters, tensiometers, moisture access probes), and sampled
- Laboratory batch and column test were performed to support field tests and constrain reaction rates
- Analyses of enzymes related to cellulose degradation were performed in support of field and laboratory testing

# Sulfate Reduction Monitoring Program (SRMP) Update

## Field Test Cell Amendment Mixtures

	<b>Tailings (vol %)</b>	<b>Peat (vol %)</b>	<b>Brewery Grain (vol %)</b>	<b>Bio- Solids (vol %)</b>	
<b>Cell 1</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Unexcavated</b>
<b>Cell 2</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Excavated</b>
<b>Cell 3</b>	<b>95</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>Amended</b>
<b>Cell 4</b>	<b>95</b>	<b>2.5</b>	<b>2.5</b>	<b>0</b>	<b>Amended</b>
<b>Cell 5</b>	<b>95</b>	<b>2.5</b>	<b>0</b>	<b>2.5</b>	<b>Amended</b>
<b>Cell 6</b>	<b>95</b>	<b>2.5</b>	<b>1.25</b>	<b>1.25</b>	<b>Amended</b>
<b>Cell 7</b>	<b>90</b>	<b>5</b>	<b>2.5</b>	<b>2.5</b>	<b>Amended</b>

# Sulfate Reduction Monitoring Program (SRMP) Update

- Key findings 2004-2011
  - Microbially mediated sulfate reduction in cells 4-7
  - No significant sulfate reduction in control cells or peat-amended cell
  - Precipitation of metal sulfides contributes to a decrease in sulfate and metal concentrations. Thiosulfate reduction/disproportionation is also significant.
  - Increase in iron reducers, elevated dissolved Fe and As
  - Organic carbon from biosolids is rapidly consumed
  - Cells containing spent brewing grain show best performance
  - Laboratory batch and column test results support field results
  - Carbon amendment to oxidized tailings is not recommended
  - High concentrations of DOC should be avoided to minimize iron reduction and arsenic mobility
  - Laboratory analysis of enzymes related to cellulose degradation supports water chemistry and microbiology results

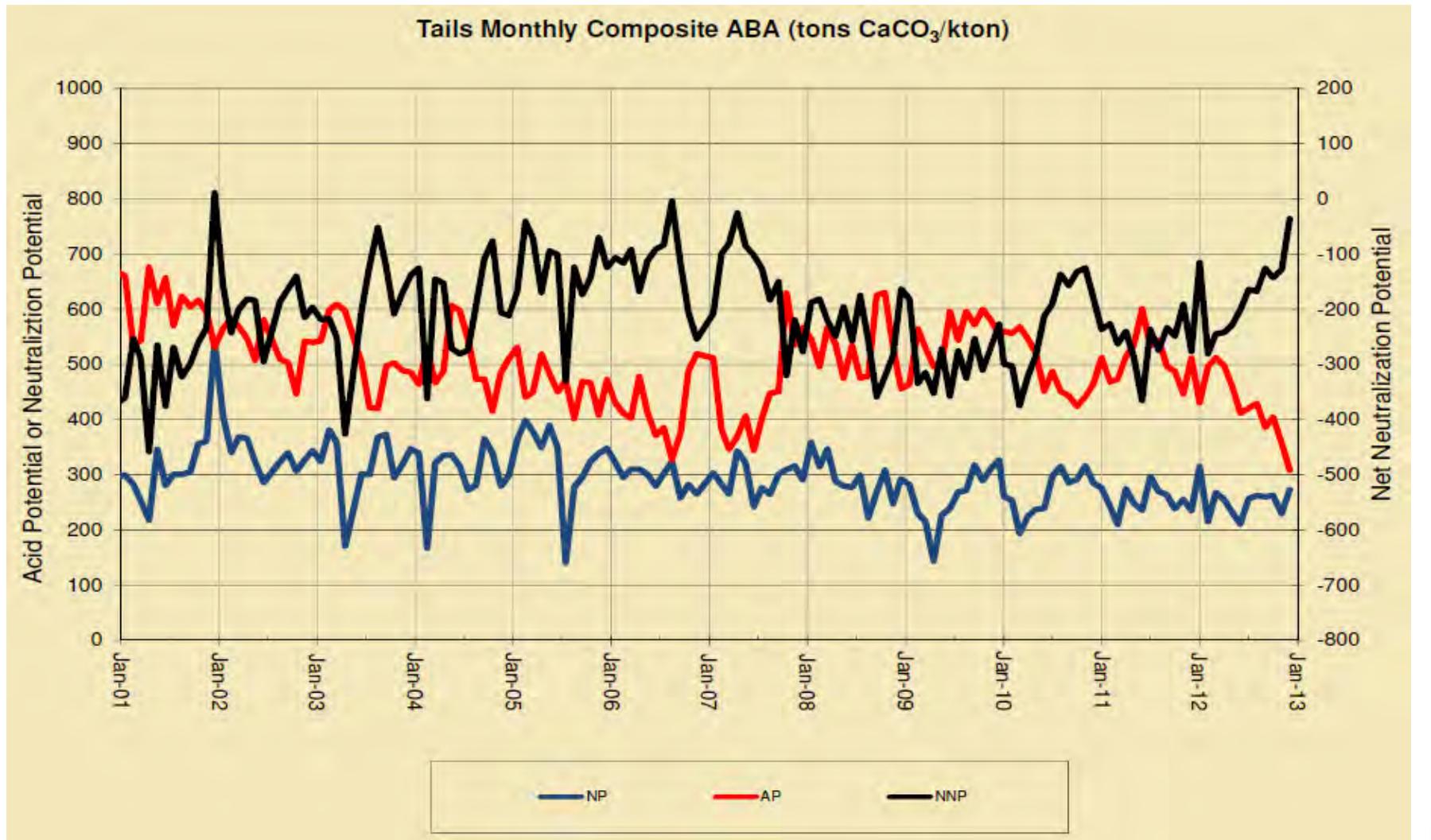
## Sulfate Reduction Monitoring Program (SRMP) Update

- HGCMC has determined that the potential risk of mobilizing iron, arsenic and other metal(oid)s and the limitations posed by co-disposal of oxidized waste rock outweigh the potential benefits of carbon amendment. HGCMC will continue to place tailings in accordance with the methods described in GPO Appendix 3.

## Tailings Facility Acid Base Accounting (ABA) Analyses

- Tailings have the potential to generate acidic drainage if the buffering capacity of the tailings is consumed
- High carbonate content supports a long lag time for depletion of buffering capacity
- Long lag time (decades) allows time for construction and closure of the facility, including construction of an oxygen-inhibiting composite soil cover

# Figure 2.32 Monthly Tailings Acid Base Accounting (ABA) Data



# Tailings Facility General Site Management

- Operations per GPO Appendix 3 and Waste Management Permit
- Most placement occurred in northwest expansion area
- Tailings facility activities in 2012
  - Cleaned sediment from the lined degrit basins that were installed in 2009
  - Preparation of tailings placement in the East Ridge

# Tailings Facility General Site Management

## 2013 Planned Tailings and Closure Planning Activities

- Continue Site E / 1350 removal and co-disposal
- Stage III tailings preparation
- East Ridge expansion tailings placement
- Cover monitoring continues
- Underground hydrology study continues
- Install tailings wind break
- Install new tailings wind anemometer / R.H. sensor

# Tailings Facility General Site Management

