

# UPDATES ON PERCHLORATE REMEDICATION, BLACK MOUNTAIN INDUSTRIAL AREA, HENDERSON, NEVADA

Prepared for:  
Las Vegas Wash Tour

May 1, 2014

Bureau of Corrective Actions  
Nevada Division of Environmental Protection

# Perchlorate Manufacturing Operations Henderson, NV



## Pepcon (AMPAC): 1958 – 1988

- May 1988: Destroyed in Explosion
- March 1998: Purchased Manufacturing Line & Customer Base from Kerr-McGee



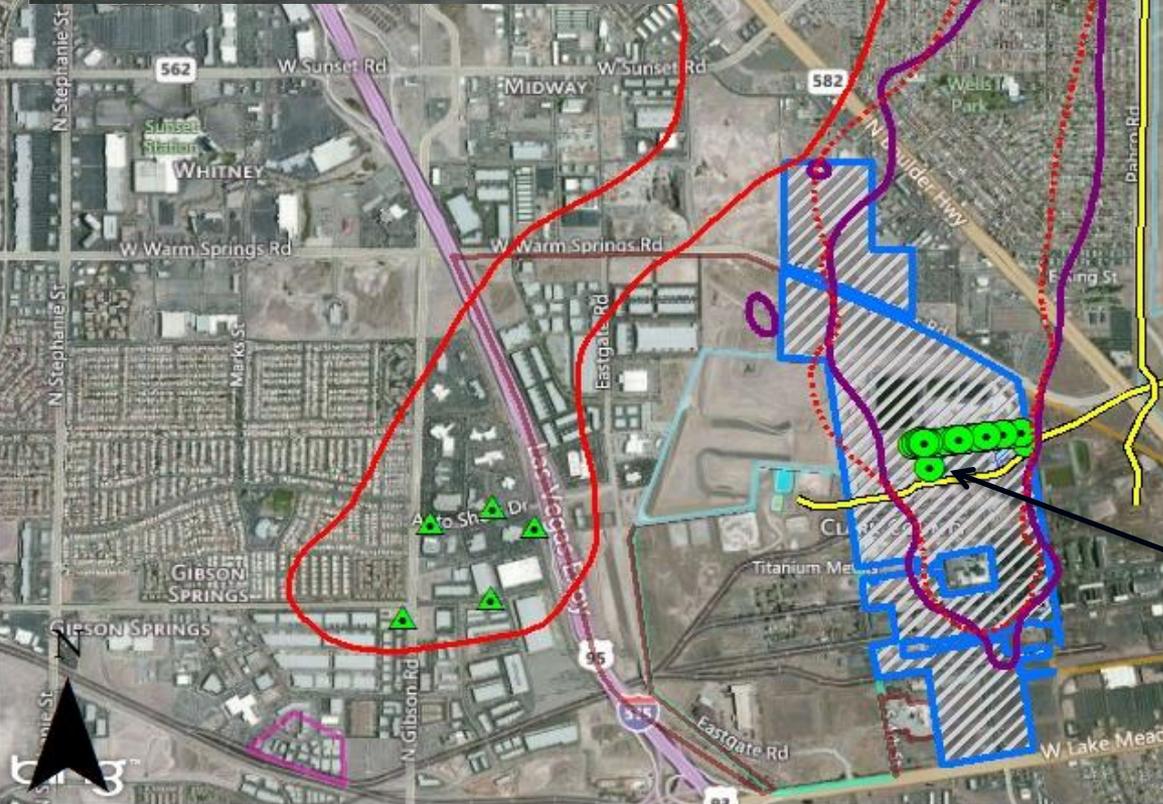
## US Government – Navy (1945 – 1962) Tronox (previously Kerr-McGee) & Predecessors (1945 – 1998)

- July 1998: Curtailed Perchlorate Production
- March 2002: Process Shut Down

# Perchlorate Plumes & Remediation Infrastructure



- AMPAC
- Tronox 2002
- NERT 2012
- Ditches
- ▲ AMPAC Extraction Wells
- NERT Extraction Wells
- NERT/Tronox
- BMI
- Chem star
- Former Pepon
- Henderson
- MultiEntitles
- OSSM
- Tim et



# Geology

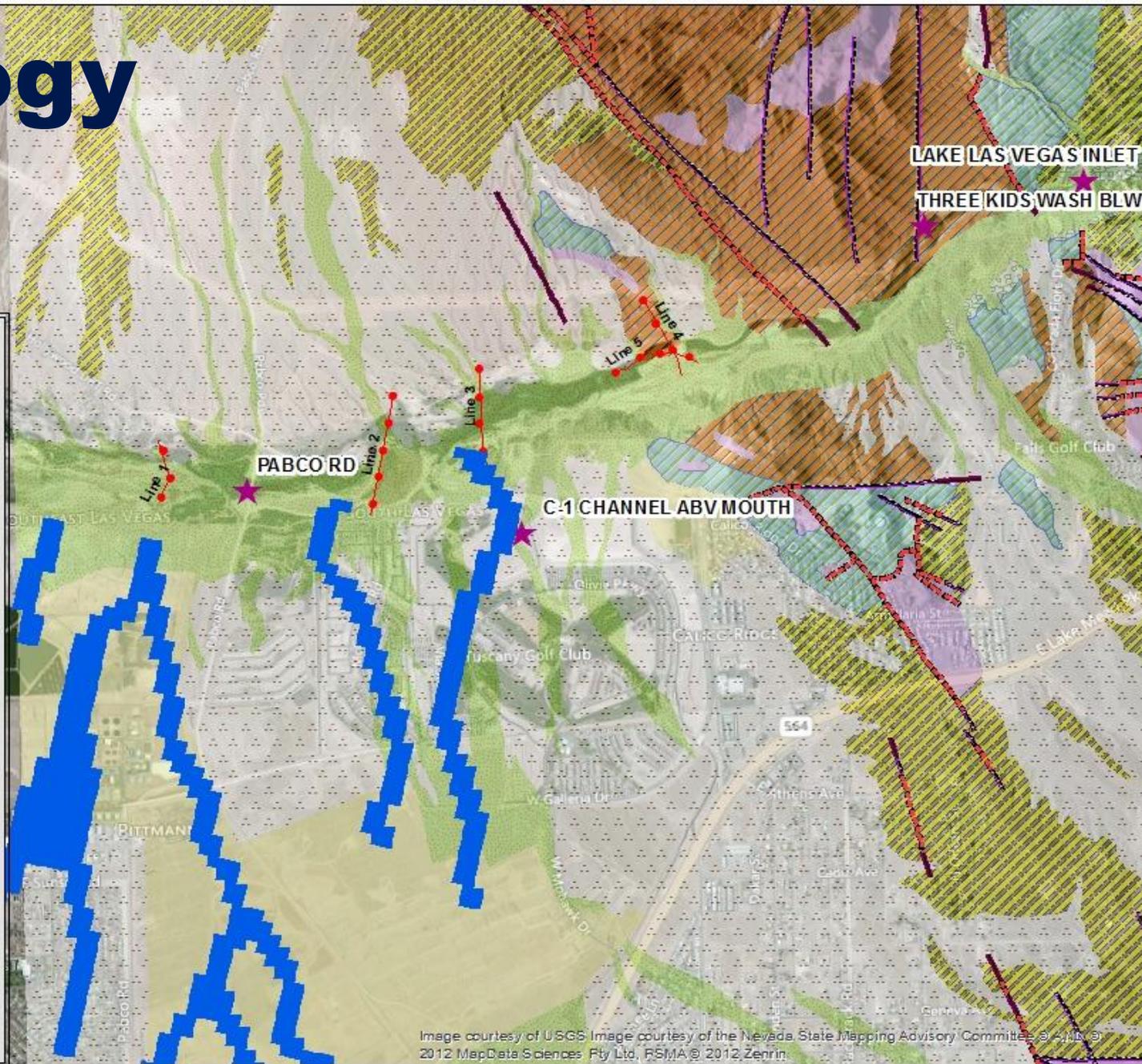
## Henderson Quadrangle

### HGU

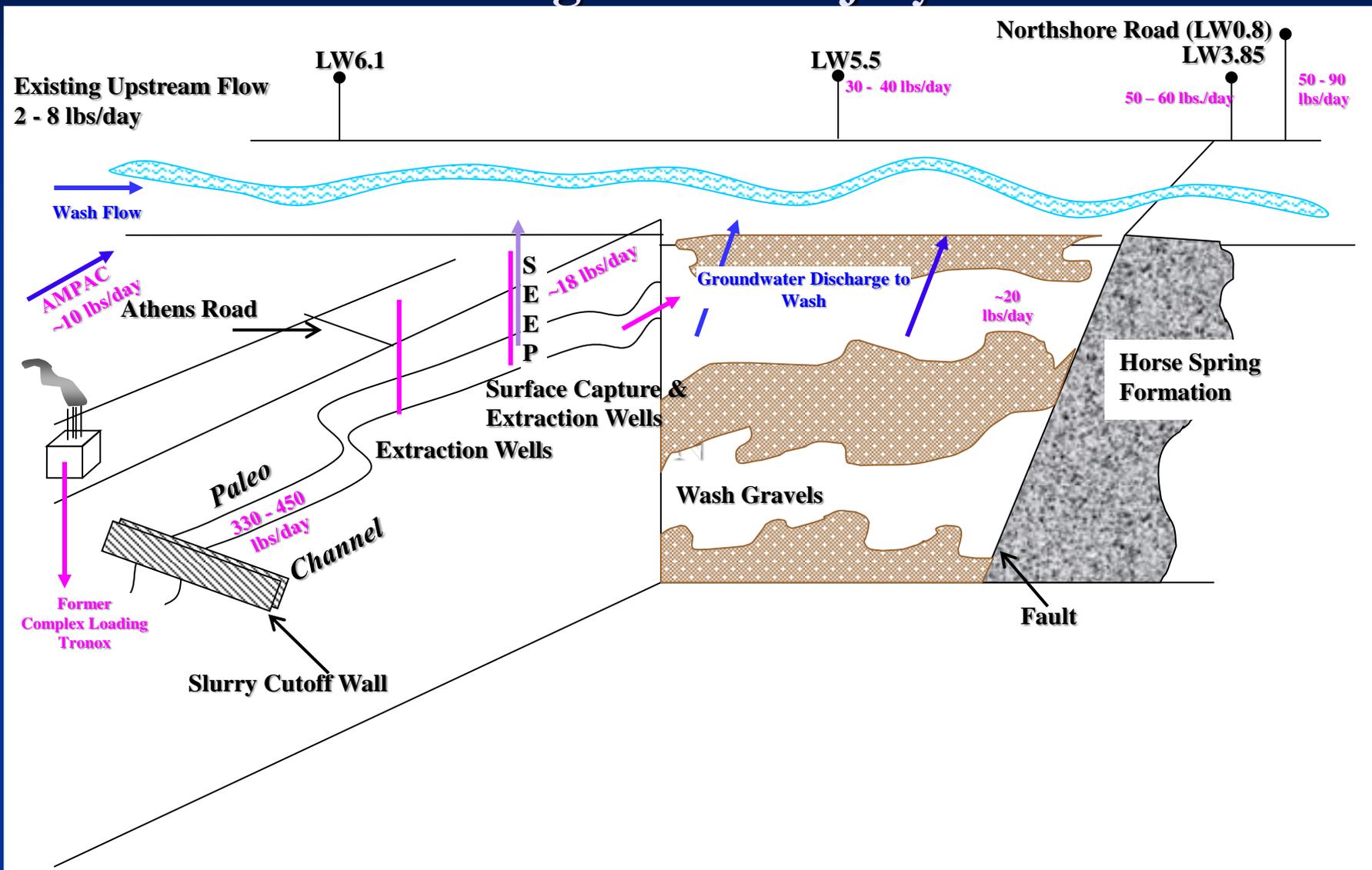
-  Artificial fill
-  Dikes
-  Fan Deposits
-  Fanglomerate
-  Horse Spring Fm
-  Kaibab and Toroweap Fm
-  LVW Conglomerate
-  Mn Rocks
-  Modern Wash Deposits
-  Moenkopi Fm
-  Muddy Creek Fm
-  Thumb Fm
-  Volcanic Rocks

### Faults

-  Concealed
-  Inferred
-  Known
-  Geophysical\_survey\_line
-  Paleochannel



# Conceptual Model of Perchlorate Loading to Las Vegas Wash – July 2013



\* The numbers in this slide are estimation and for illustration only

# TRONOX

# AMPAC

• Initial Discovery 1997

• Initial Discovery

• Initial Characterization  
• On-Site Well Field 1998  
• GW-11 Pond

• ISB Pilot Test  
• UIC Permit - Pilot

• Seep Capture  
• Temporary IX 1999  
• Perchlorate Cleanup Plan

• Continued Characterization

• Pilot Plants  
• NPDES Permit 2000

• Lab Bench Scale Tests

• On-Site Slurry Wall  
• All Well Fields 2001  
• Extraction Infrastructure

• In-Situ Bioremediation Studies  
• Groundwater Modeling

• Full-Scale GW Treatment (ISEP-PDM) 2002  
• Expanded Once-Through IX

• Continued Characterization

# TRONOX

# AMPAC

- Expansion of Seep Area Well Field
- Full-Scale FBR System Constructed

2003

- Phase I & II Characterization

- Transition from IX to FBR

2004

- Aquifer Testing

- Continued FBR Operation

2005

- ISB Area Modeling
- ISB System Installation Initiated

- FBR System Expansion
- Athens Rd Well Field Optimization
- FBR System Optimization

2006

- UIC Permit
- ISB System Operational
  - Interim (Jun – Dec)
  - Permanent (Dec – current)

- Athens Rd Modeling
- FBR Operation

2007

- ISB System Optimization

- Groundwater Capture Analysis

2008

- Re-injection Optimization
- ISB System Reconfiguration (GAC Filters)

# TRONOX

# AMPAC

- Source Area Characterization
- Continued FBR Operation
- Bankruptcy

2009

- Re-injection Trench Installation
- Groundwater / Contaminant Modeling

## • Optimization:

2010

- Edible Oil Substrate Bench-scale Project Completed (Off-site)
- Capture Zone Analysis
- Excavation of Perchlorate-Impacted Soils (On-site)

## • Bankruptcy:

- NDEP Focused at Maintaining Operating Remediation System

## • Expanding Remediation:

- Source Area Well Field
- Existing Facility Tie In

## • Change in Remediation Approach:

- Transition from ISB to Ex-Situ
- Evaluating FBR vs. Fixed-Bed
- Continue with ISB thru Transition

# TRONOX

# AMPAC

- Nevada Environmental Response Trust (NERT):

- On-going Operation of GWTS (On-site & Off-site)

2011

- Development of Remedial Action Objectives

- Development of FS WP:

- Soil Flushing (On-site)

- Edible Oil Pilot Study (Off-site)

- Bankruptcy:

- Creation of NERT

- 02/14/11 Bankruptcy Finalized

2012

- RI/FS Work Plan

- Optimization of GWETS

2013

- Design of FBR:

- Source Area Well Field

- Existing Facility Tie In

- Permitting of FBR

- Bid FBR System

- Continue with ISB thru Transition

- ISB shut down (6/2012)

- FBR start (9/2012)

# Tronox Perchlorate Remediation System: Fluidized Bed Reactor



# AMPAC Perchlorate FBR



# Capture & Treatment

NERT/  
TRONOX

Full-Scale System: ~ 1,895 lb/day equivalent Loading

- Athens Road Well Field
- On-Site Ponds (GW-11 & AP5)
- On-Site Well Field / Slurry Wall
- Seep Area Collection - GW & Surface
- Fluidized Bed Reactor (FBR) Treatment System

AMPAC

Full-Scale System: ~ 1000 lb/day equivalent

- Athens Road Well Field
- Athens Pen Well Field
- Auto Mall Well Field
- Performance Monitoring Wells

**NERT/Tronox  
Perchlorate Removal Rate:  
November 2013**

<b>Location</b>	<b>Extraction (gpm)</b>	<b>Mass (Pounds per Day)</b>
<b>Seep Area</b>	<b>478</b>	<b>46</b>
<b>Athens Road</b>	<b>285</b>	<b>451</b>
<b>On-Site</b>	<b>72</b>	<b>799</b>
<b>Total</b>	<b>835</b>	<b>1,296</b>

**NERT/Tronox  
Perchlorate Removed from the Environment:  
December 1998 Through December 2013**

<b>Location</b>	<b>Mass (Tons)</b>
<b>Seep Area</b>	<b>439</b>
<b>Athens Road</b>	<b>1,423</b>
<b>On-Site</b>	<b>2,248</b>
<b>Total</b>	<b>4,110</b>

**AMPAC**  
**Perchlorate Removal Rate:**  
**December, 2013**

<b>Location</b>	<b>Extraction (gpm)</b>	<b>Mass (Pounds per Day)</b>
<b>APEW</b>	<b>68</b>	<b>18</b>
<b>AREW</b>	<b>257</b>	<b>42</b>
<b>AMEW</b>	<b>353</b>	<b>1,379</b>
<b>Total</b>	<b>678</b>	<b>1,439</b>

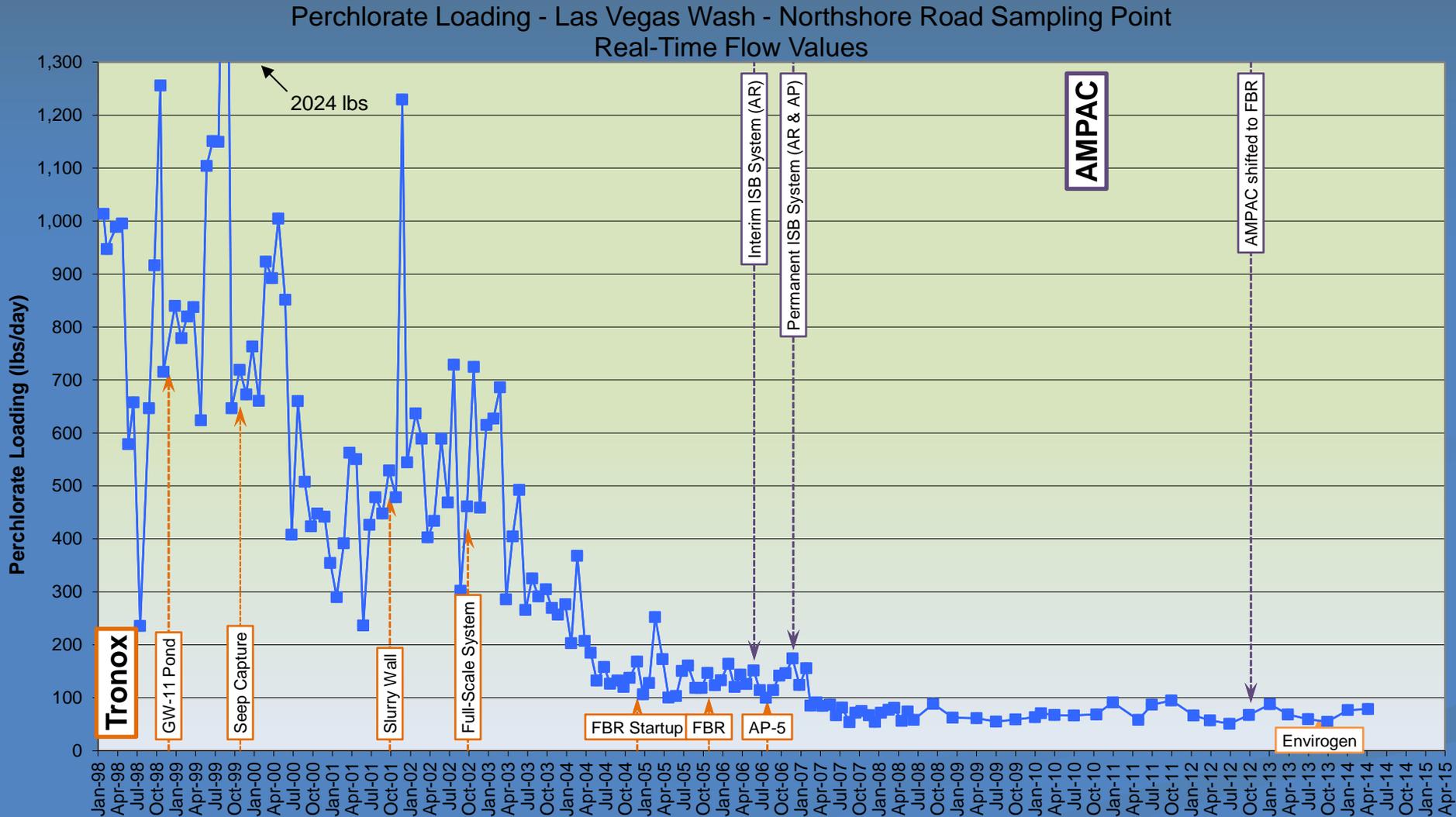
**AMPAC**  
**Perchlorate Removed from the Environment:**

<b>Location</b>	<b>Mass (Metric Tons, 2006 to Oct. 2012)</b>	<b>Mass (Metric Tons, Oct. 2012 to December 2013)</b>
<b>APEW</b>	<b>6</b>	<b>9</b>
<b>AREW</b>	<b>19</b>	<b>26</b>
<b>AMEW</b>	<b>0</b>	<b>143</b>
<b>Total</b>	<b>25</b>	<b>178</b>

\*AMEW started to operate in Oct., 2012

# Perchlorate Loading - Las Vegas Wash - Northshore Road Sampling Point

## Real-Time Flow Values



**Notes:**\* Perchlorate concentration sampled during the first full week of the first month of the quarter.

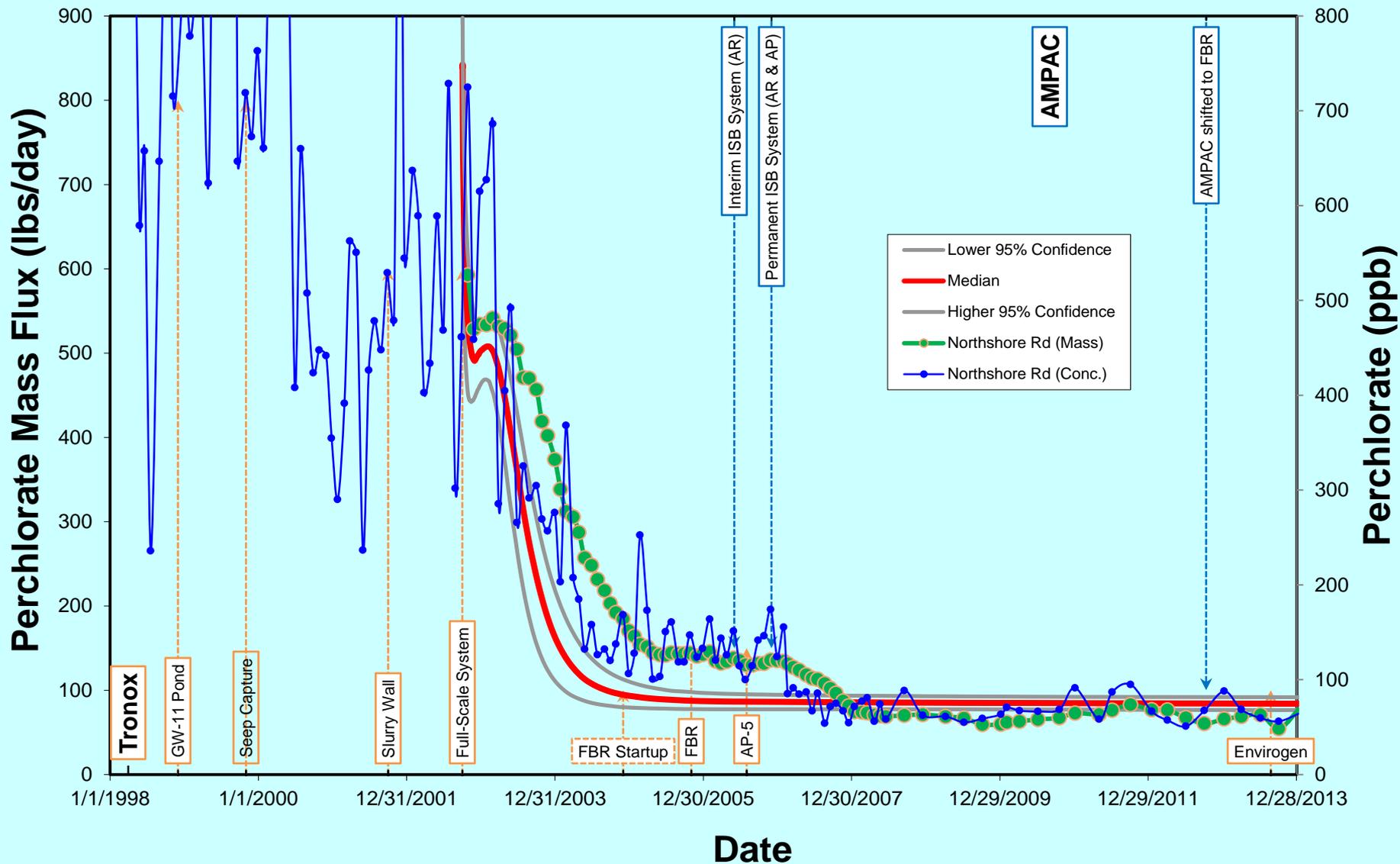
\* Northshore Road sampling point positioned approximately one-half mile upstream from confluence of Las Vegas Wash and Lake Mead.

\* Northshore Road sampling point should measure all perchlorate inputs entering the Colorado River System from the Las Vegas Valley via Las Vegas Wash.

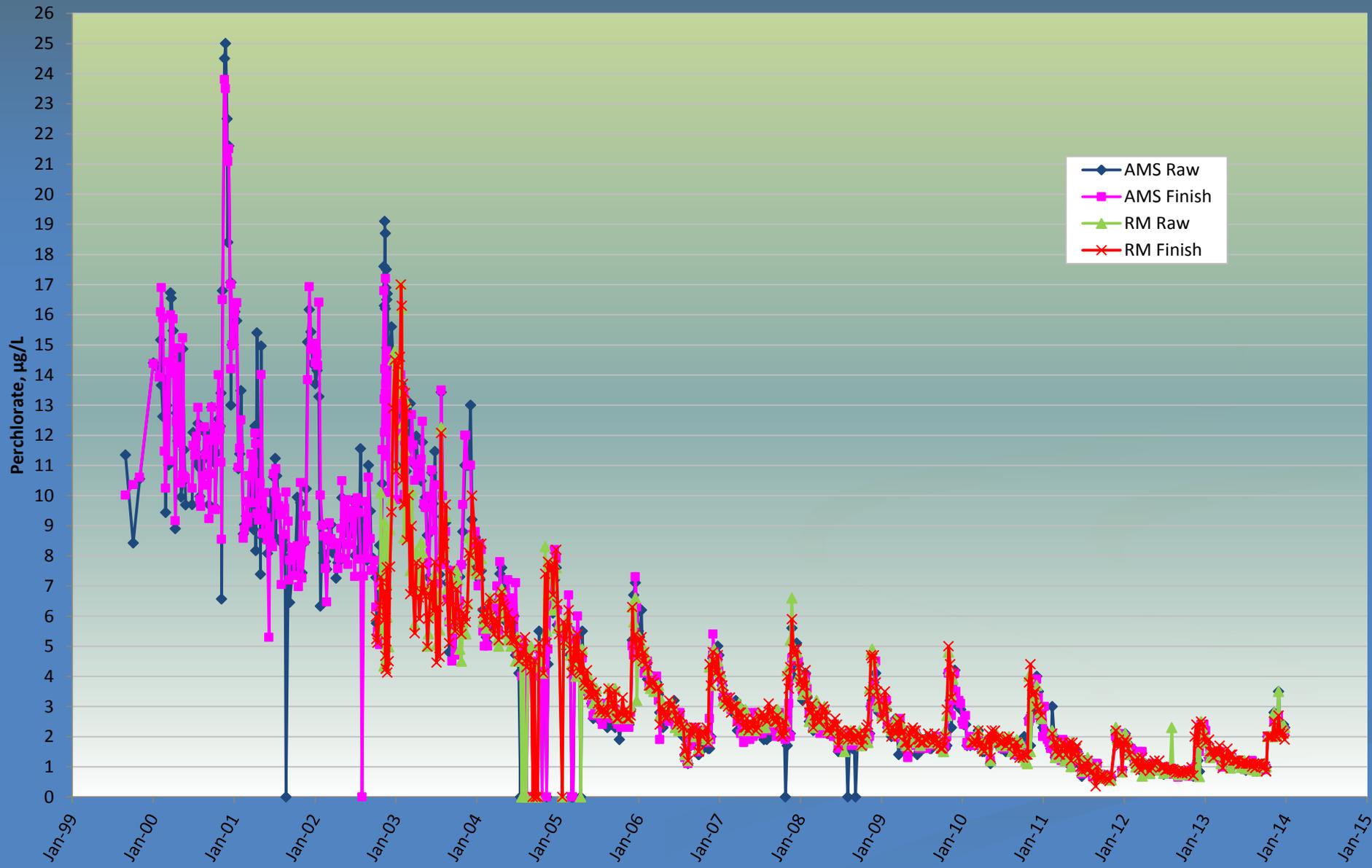
\* Approximate Location: 36°07' 20" N by 114°54' 15" W

# Breakthrough Curve: 90% Efficient Model Results

## Breakthrough Curve: 90% Efficient Model Results, Mass



# Perchlorate Concentrations Lake Mead Source Water

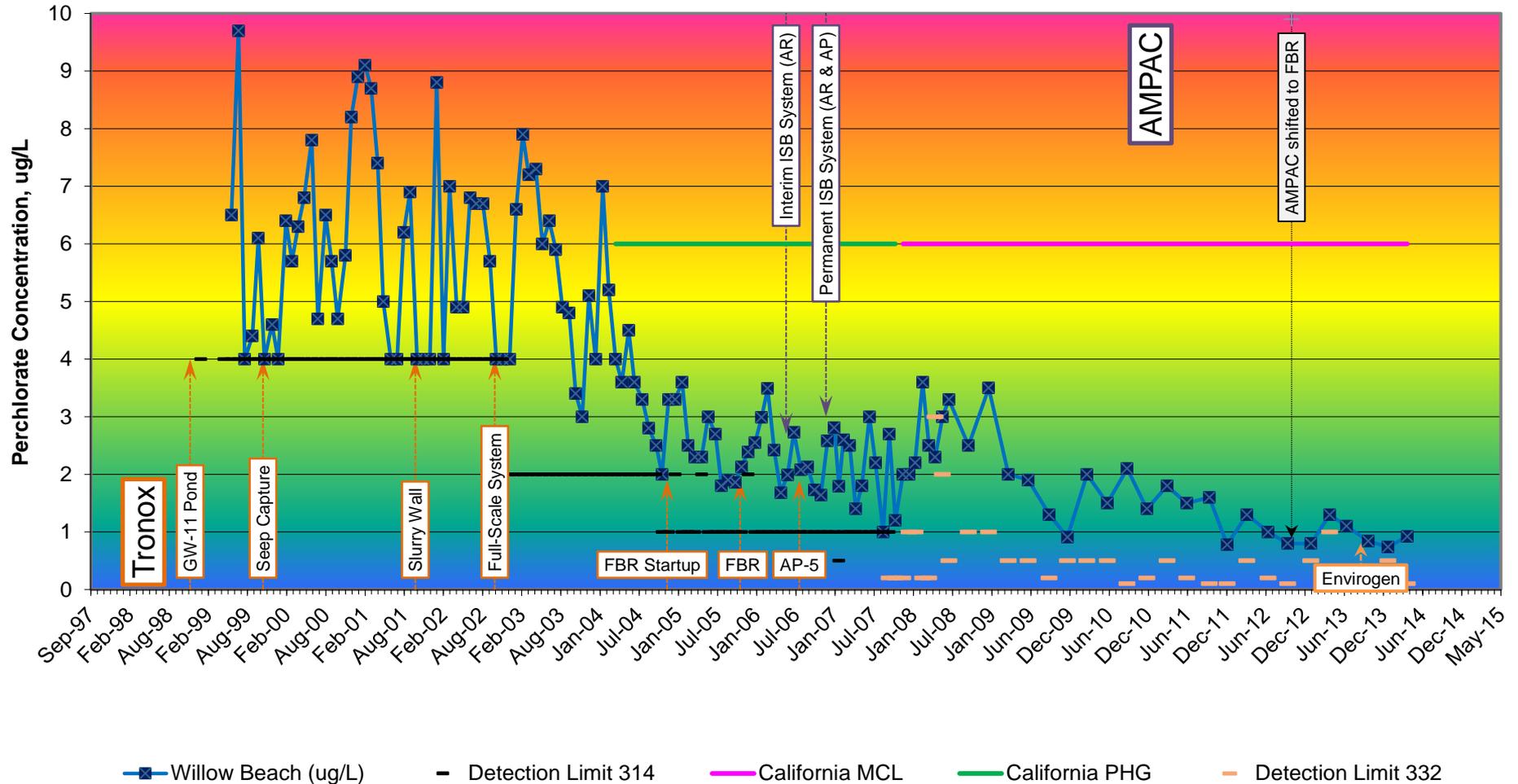


SNWS Perchlorate Data: Alfred Merritt Smith Treatment Plant (AMS) and river Mountain Treatment Plant (RM) Raw and Finish Water Concentrations  
The analysis for the period from 10/14/2013 to 11/25/2013 had a MRL of 2.0.

# Willow Beach Sampling Point

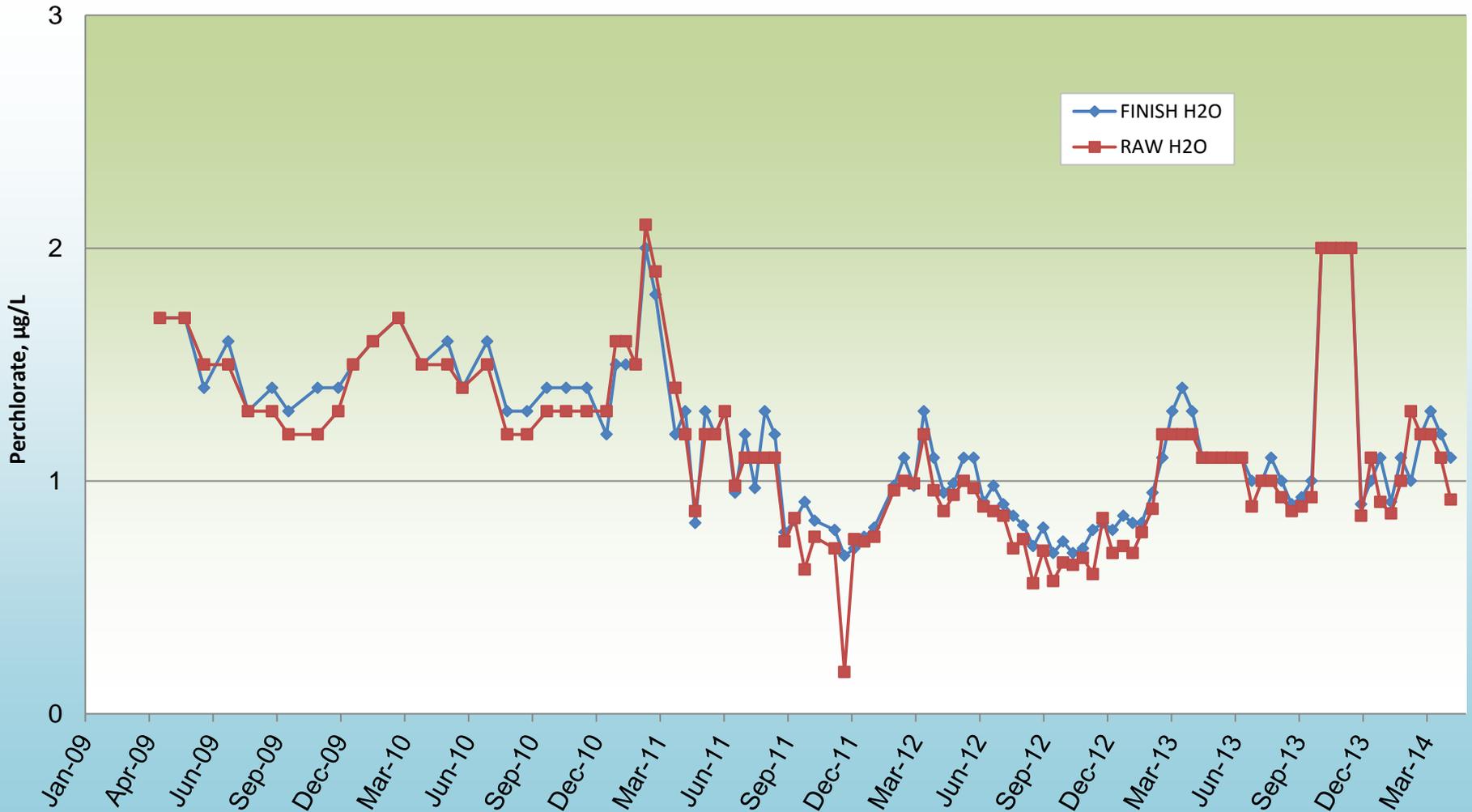
## Perchlorate Concentration ( $\mu\text{g/L}$ )

Perchlorate Concentration - Willow Beach Sampling Point



# Big Bend Water District Raw and Finish Water Perchlorate Concentration ( $\mu\text{g/L}$ )

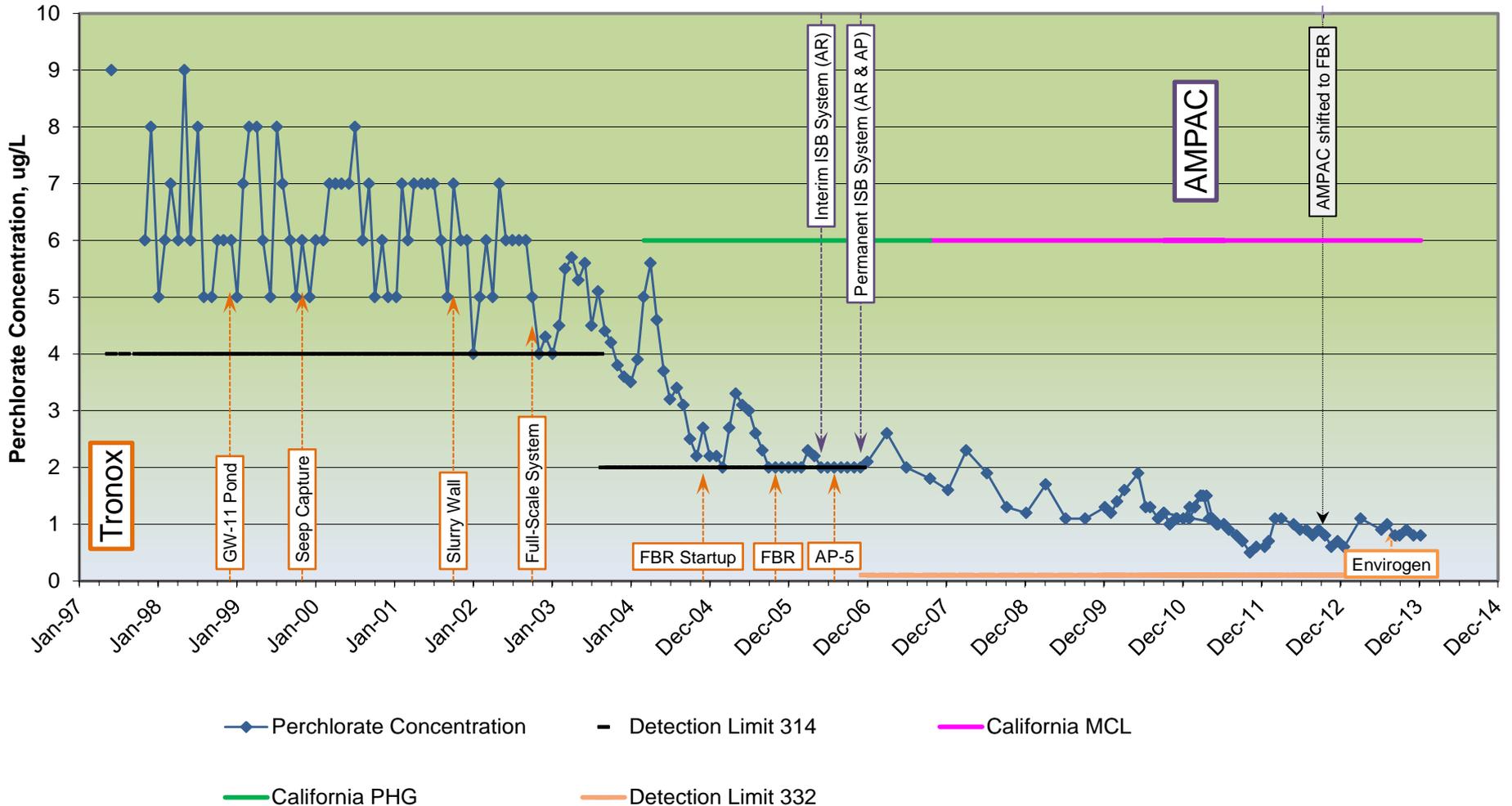
Big Bend Water District Perchlorate Concentration



\*The perchlorate < 2 ppb for the period of 11/08/2013 to 11/19/2013

# Perchlorate Concentration Colorado River Whitsett Intake Sampling Point

Perchlorate Concentration - Whitsett Sampling Point - MWD Data



# PERCHLORATE CONCENTRATION RANGES



## (1) LAKE MEAD

- Historic: 4 – 24 ppb
- Current: 0.35 – 3.5 ppb

## (2) WILLOW BEACH, AZ

- Historic: 4 – 10 ppb
- Current: 0.74 – 1.6 ppb

## (3) Big Bend

- Current: 0.18 – 2.1

## (4) WHITSETT

- Historic: 3.6 – 9 ppb
- Current: 0.5 – 1.5 ppb

\*Note: Historic: pre-2004  
Current: 01/11 - 01/14

## On-Going Activities

- Investigation of LV Wash & BMI Areas to Evaluate Other Potential Perchlorate Sources
- Continued Evaluation of Remedial Technologies
- Consideration of Opportunities to Further Refine Capture & Treatment

## Entities Involved

- NV Division of Environmental Protection
- US Environmental Protection Agency
- Southern Nevada Water Authority
- Metropolitan Water District
- Central Arizona Project
- City of Henderson
- NERT
- AMPAC
- BMI

# Future Work

- Tronox/NERT
  - Additional Remediation
    - Source Area
    - Down-gradient Area
    - Athens Road Well Field (Capture Zone Evaluation)
    - 2013 Optimization
  - Remediation System Operation – Post Bankruptcy
  - Recent United States Bankruptcy Court Southern District of New York On The Anadarko Litigation Trust
  - Record \$5.15 billion settlement of nationwide environmental and Torts Claims on the Anadarko Litigation. Approximate \$1.1 billion will be distributed to Nevada sites.
- AMPAC
  - Remediation Optimization
  - Transition to Sustainable, Long-term Remediation System

# Significant Benchmarks

- Full-Scale Remediation Systems
  - NERT – FBR
  - AMPAC – FBR
- More Than 90% Reduction in Perchlorate Loading to Las Vegas Wash
- Significant Improvement in Colorado River Water Quality
- Benchmarks Achieved Lacking Enforceable Standard