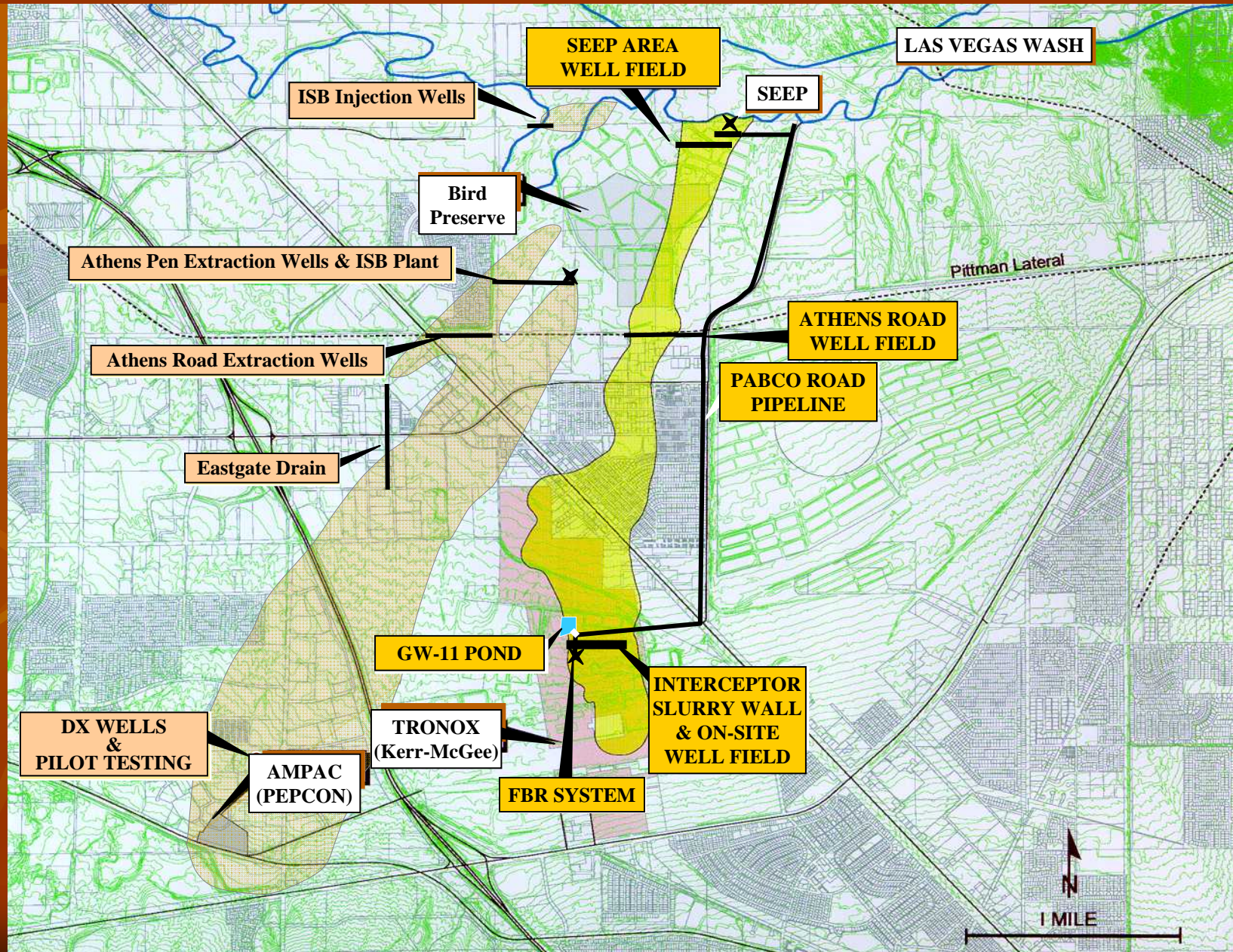


**LAS VEGAS VALLEY
PERCHLORATE
REMEDIATION EFFORTS**
Significant Benchmarks Achieved

Prepared for:
LMWQF
October 2007
Las Vegas, NV

Shannon Harbour
Nevada Division of Environmental Protection
(702) 486-2850 x 240, sharbour@ndep.nv.gov

Perchlorate Plumes & Remediation Infrastructure



TRONOX

AMPAC

- Initial Discovery

1997

- Initial Discovery

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

1998

- Initial Characterization

- Seep Capture
- Temporary IX
- Perchlorate Cleanup Plan

1999

- Continued Characterization

- Pilot Plants
- NPDES Permit

2000

- Lab Bench Scale Tests

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

2001

- In Situ Bioremediation Studies
- Groundwater Modeling

TRONOX

AMPAC

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

2002

- ISB Pilot Test
- UIC Permit - Pilot

- Expansion of Seep Area Well Field

2003

- Phase I & II Characterization

- Full-Scale FBR System Constructed

2004

- Aquifer Testing

- Transition from IX to FBR

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

Capture & Treatment

TRONOX

Full-Scale System: ~ 950 - 1,000 gpm @ ~ 260 ppm

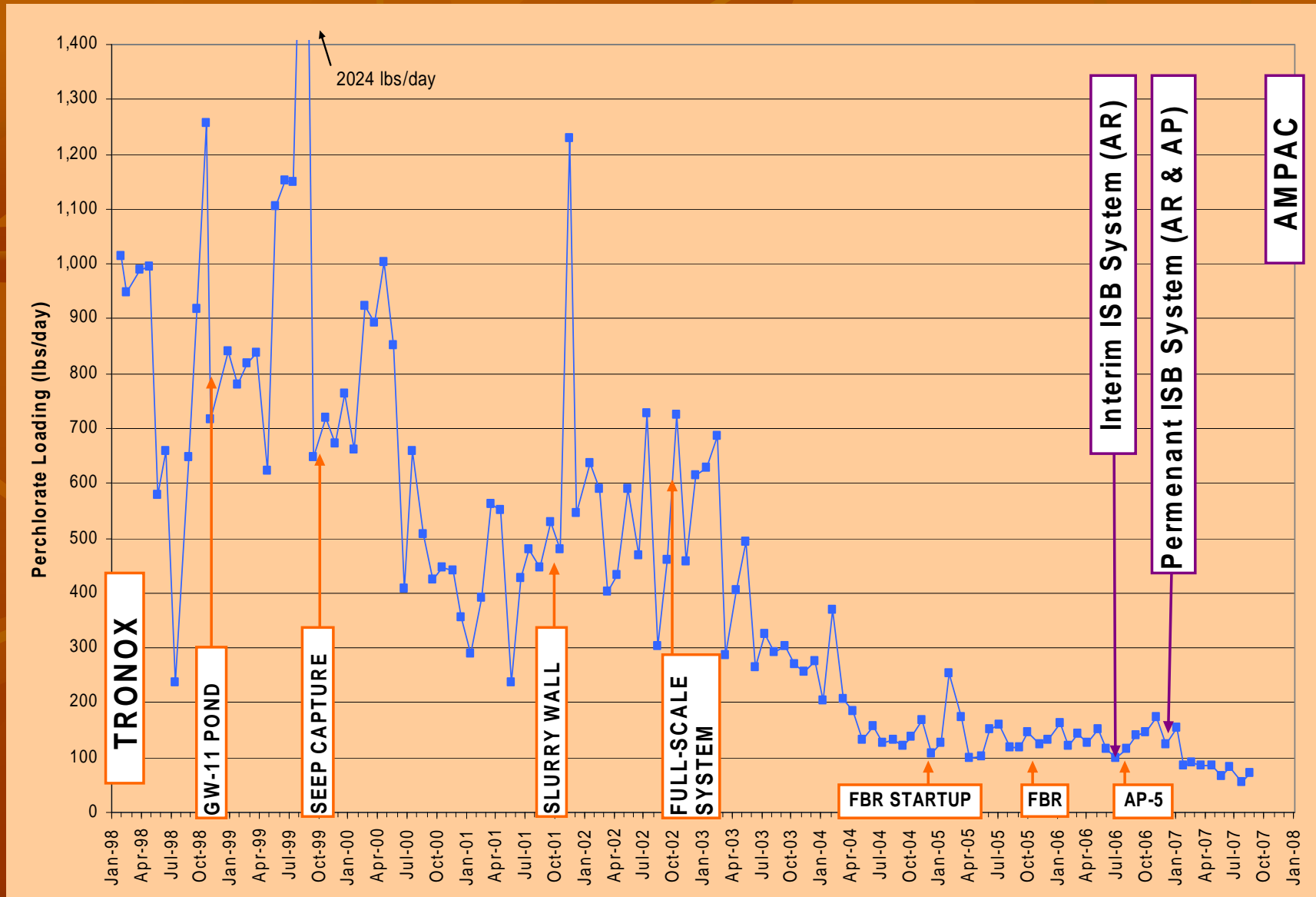
- Athens Road Well Field
- On-Site Ponds (GW-11 & AP5)
- On-Site Well Field / Slurry Wall
- Seep Area Collection - GW & Surface
- Fluidized Bed Reactor (FBR) Treatment System

AMPAC

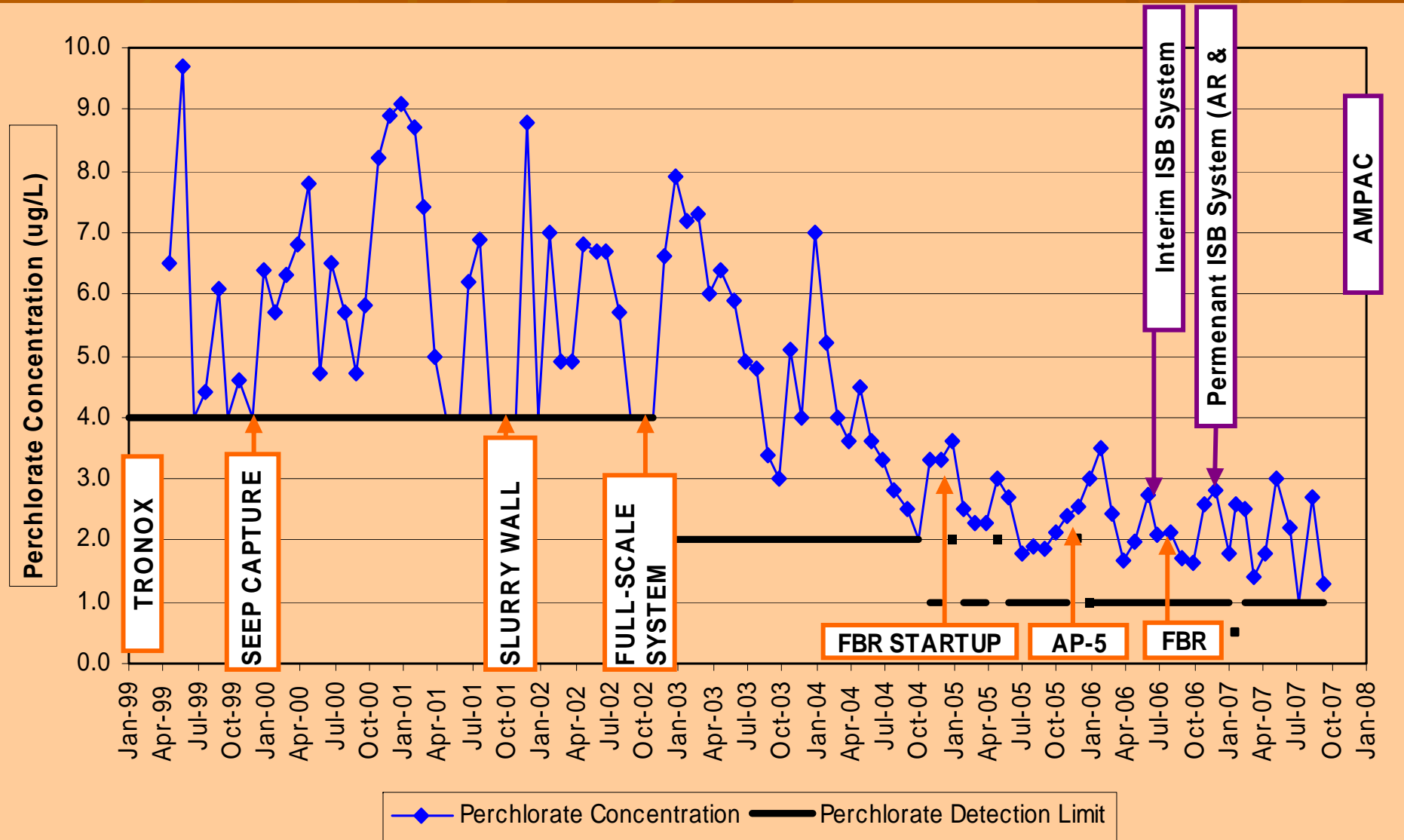
Mitigation System: ~ 220 – 400 gpm @ ~ 8 - 12 ppm

- Athens Road Well Field
- Athens Pen Well Field
- Injection Well Field
- Performance Monitoring Wells
- In-Situ Bioremediation System (ISB)
- Eastgate Drain Sealing Project

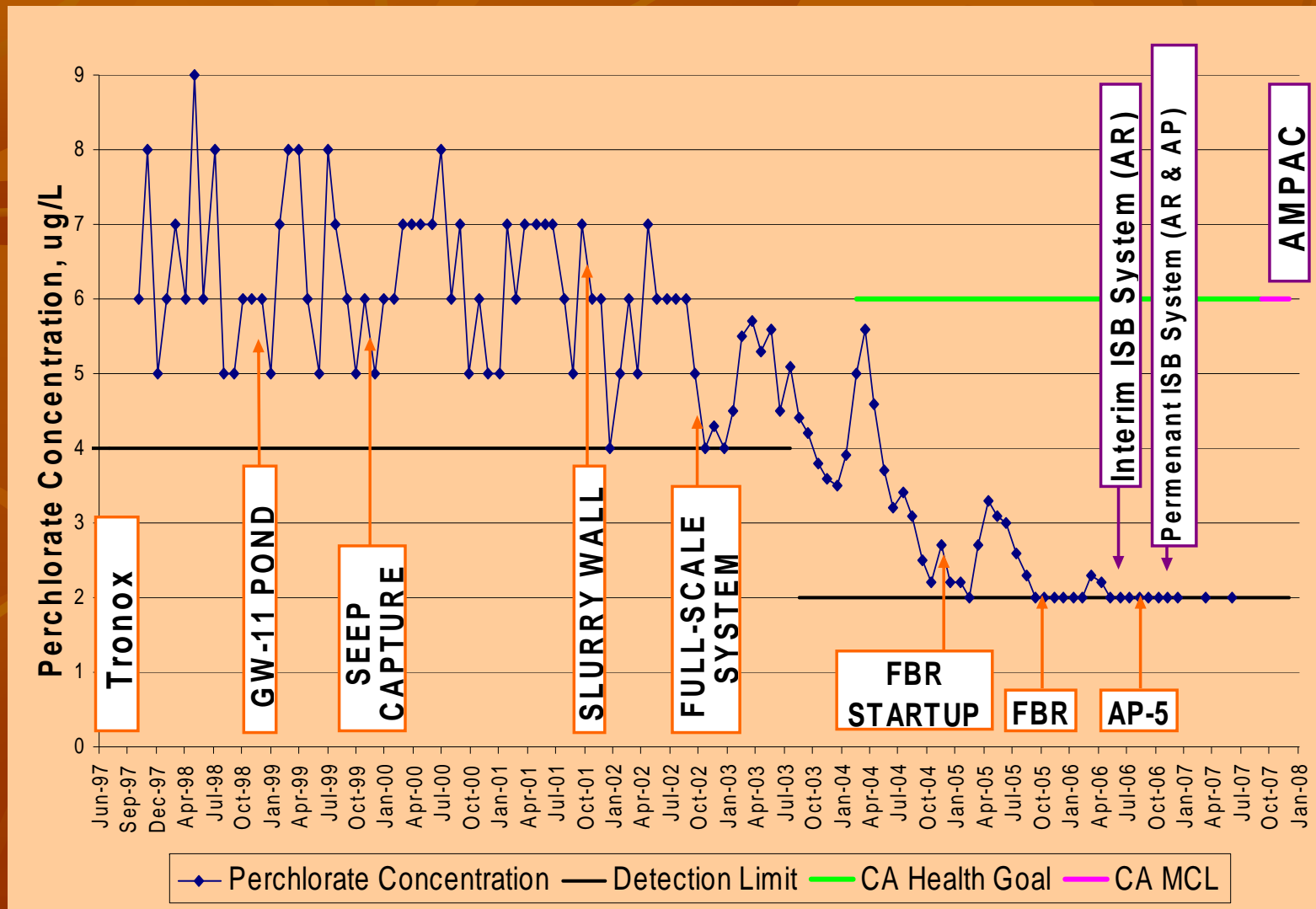
Perchlorate Loading - Las Vegas Wash - Northshore Road Sampling Point Real-Time Flow Values



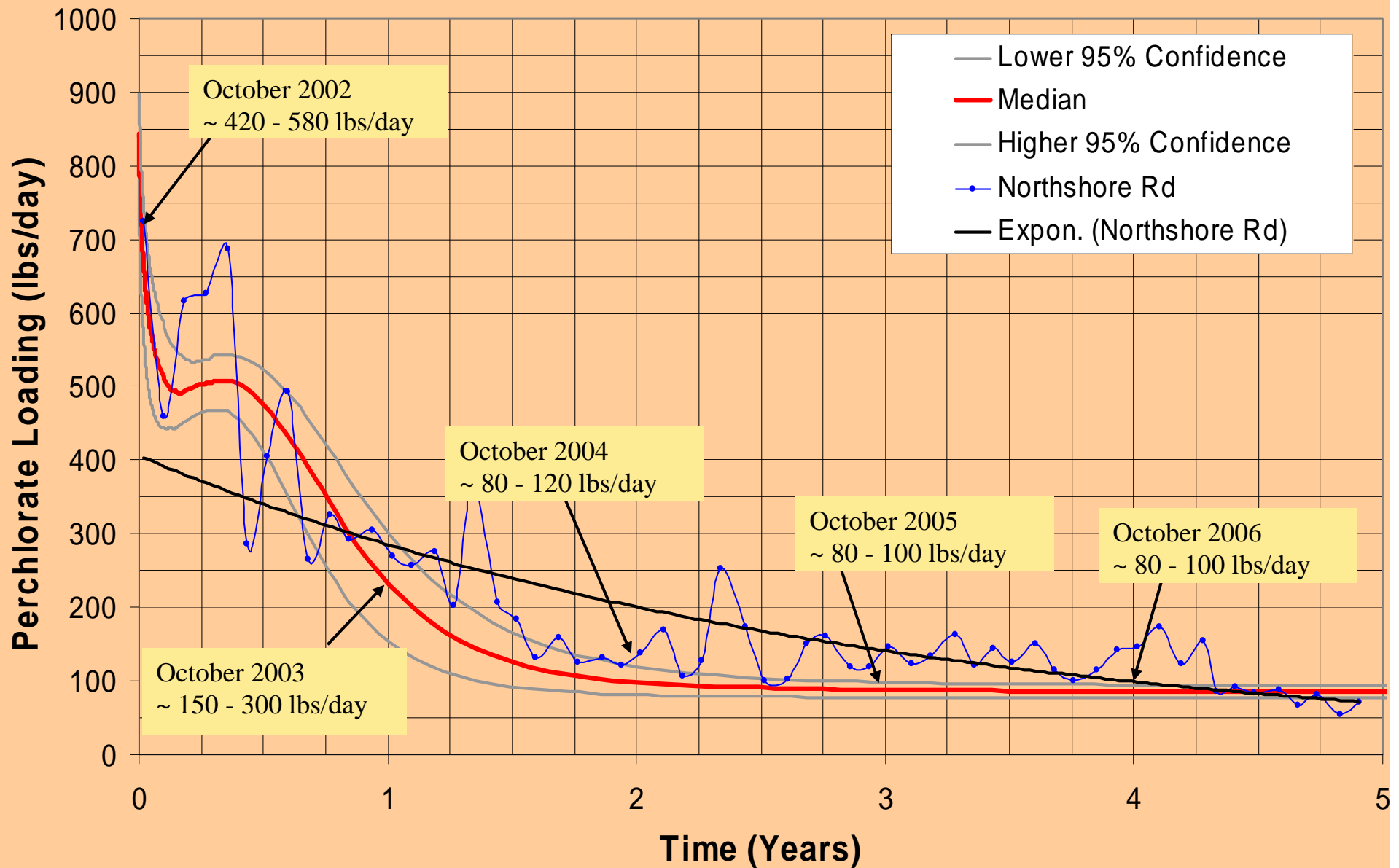
Willow Beach Sampling Point Perchlorate Concentration ($\mu\text{g/L}$)



Perchlorate Concentration Colorado River Whitsett Intake Sampling Point



Breakthrough Curve: 90% Efficient Model Results



Future Work

- Capture Zone Evaluation for Extraction Well Fields
 - Tronox
 - AMPAC
- Determine Strategies for Sustainable Re-Injection
 - AMPAC

Significant Benchmarks

- Full-Scale Remediation System
 - TRONOX – FBR
 - AMPAC – ISB
- 90% Reduction in Perchlorate Loading to Las Vegas Wash
- Benchmarks Achieved Lacking Enforceable Standard