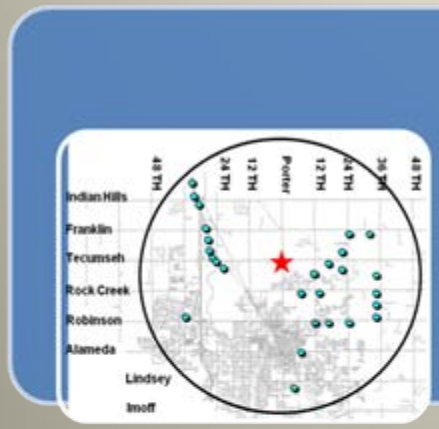
Other Water Supply Options

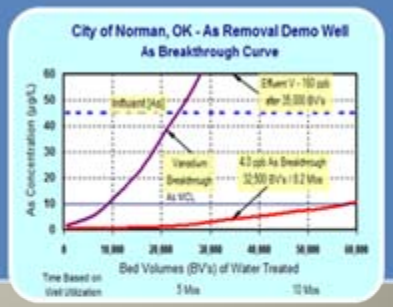
Garber-Wellington Arsenic Removal

City of Norman Sustainable Water Resource Forum

February 4, 2010

Tonight's Agenda





Existing System Conditions

Project Objectives

Project Execution

Results and Conclusions

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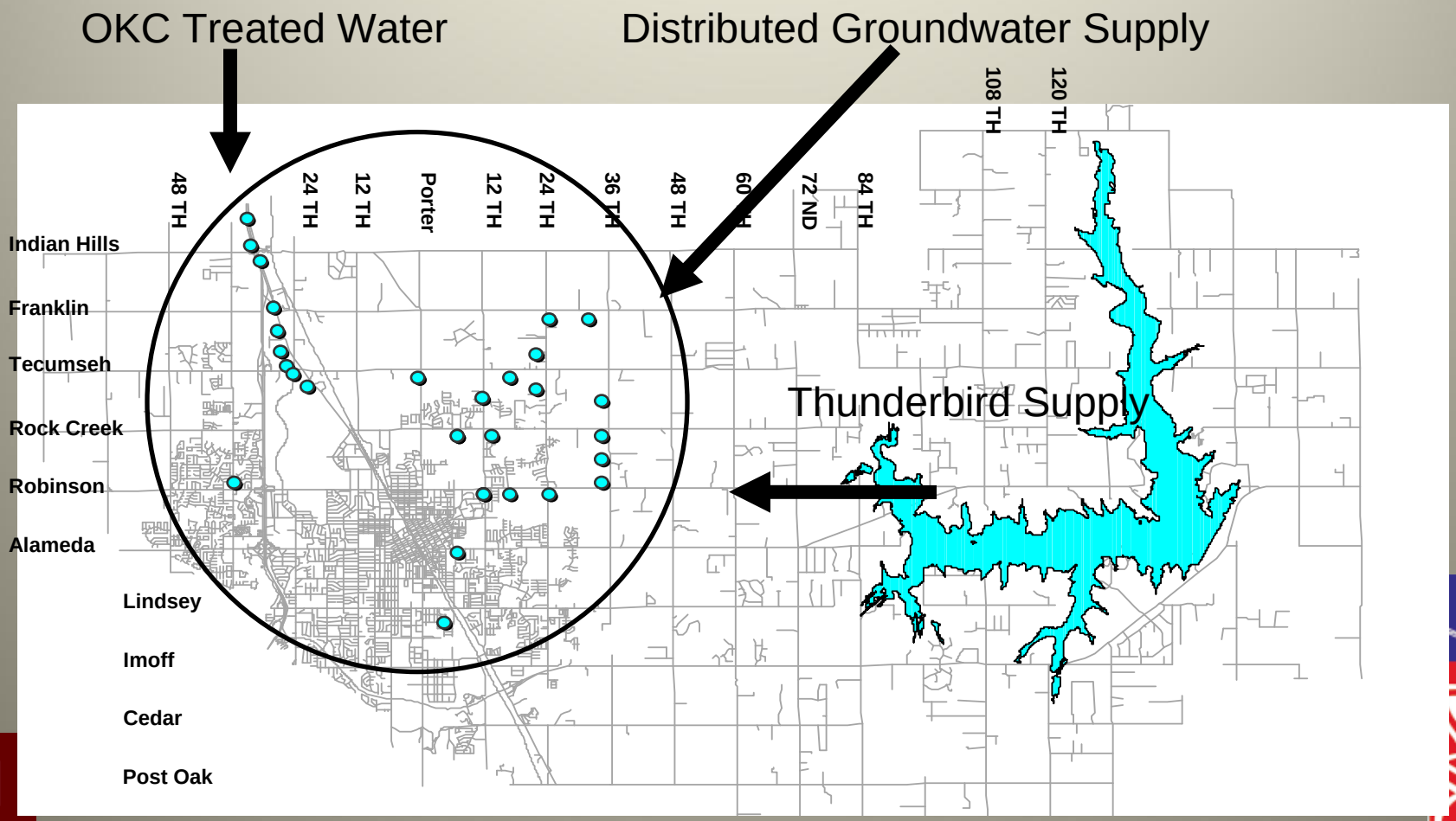
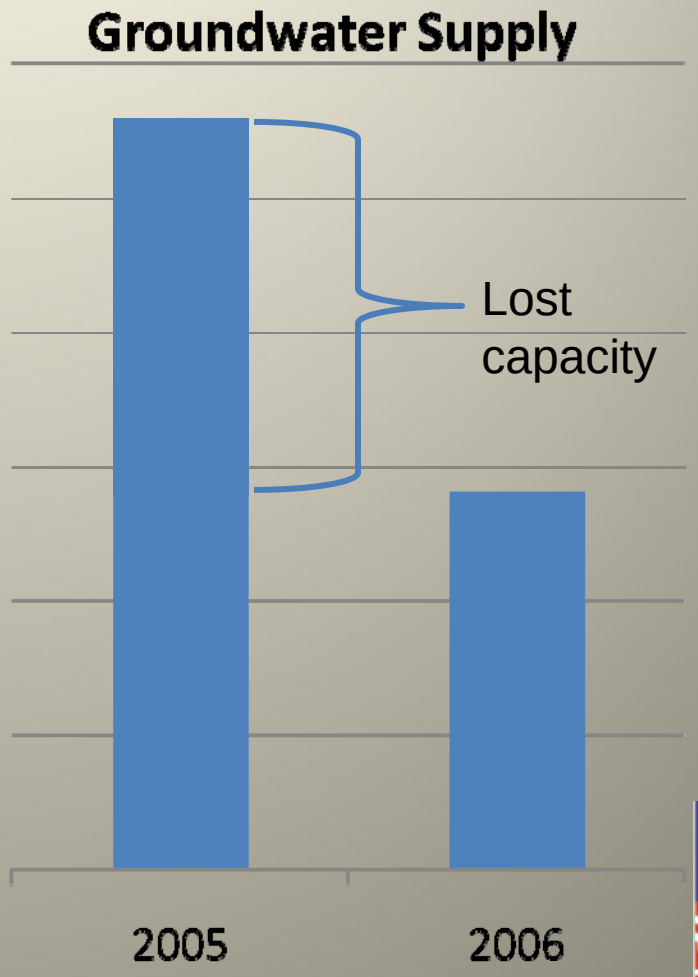
Existing Conditions

- Norman has three water supply alternatives



Existing Conditions

- In 2006, a new EPA standard lowered arsenic from 50 ppb to 10 ppb.
- City of Norman lost 14 wells, 50 % loss of well production
- A Capital Project was funded to abandon all high arsenic wells



Existing Conditions

- Lost Ground Water = Lost Revenue
  - How Much?
- Increase in Annual Operating Cost
  - More WTP usage
    - Requires WTP capital projects
  - More OKC usage
    - Very expensive rates

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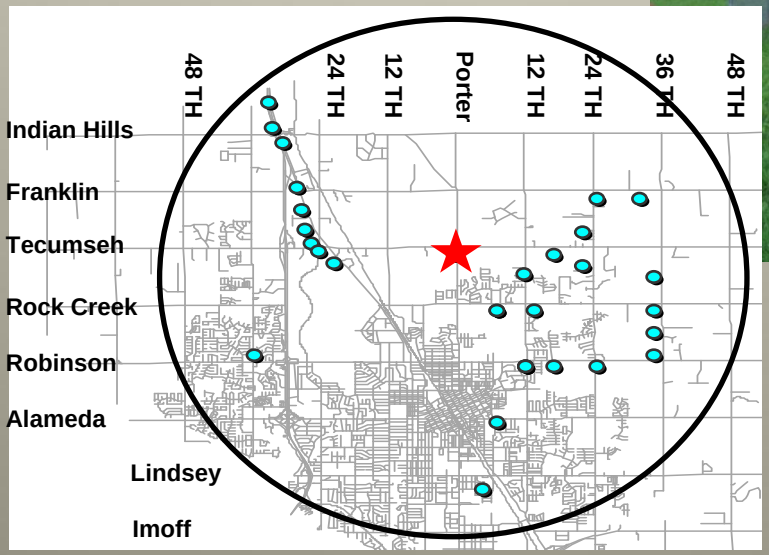
Existing Conditions

- Norman took a proactive approach to:
  - Preserve WTP capacity
  - Reduce purchased water from OKC
  - Re-commission the lost well field capacity (Owned Assets)

Well Site No. 31



Project Objectives

Project Objective

Verify Performance

- Demonstrate As removal technology can be implemented at well-head locations to reliably and consistently meet the revised arsenic MCL of less than 10-ug/L

Verify Disinfection Needs

- Sample and record microbial growth in the treatment process.
- Provide primary and secondary disinfection processes during demonstration to produce safe drinking water.

Verify O&M

- Demonstrate the operational requirements of the As removal technology, including media life, backwashing, chemical use, reliability, and flexibility.

Determine Unit Costs

- Generate data to be used by the City to compare the cost and benefits of implementing City-wide wellhead treatment.

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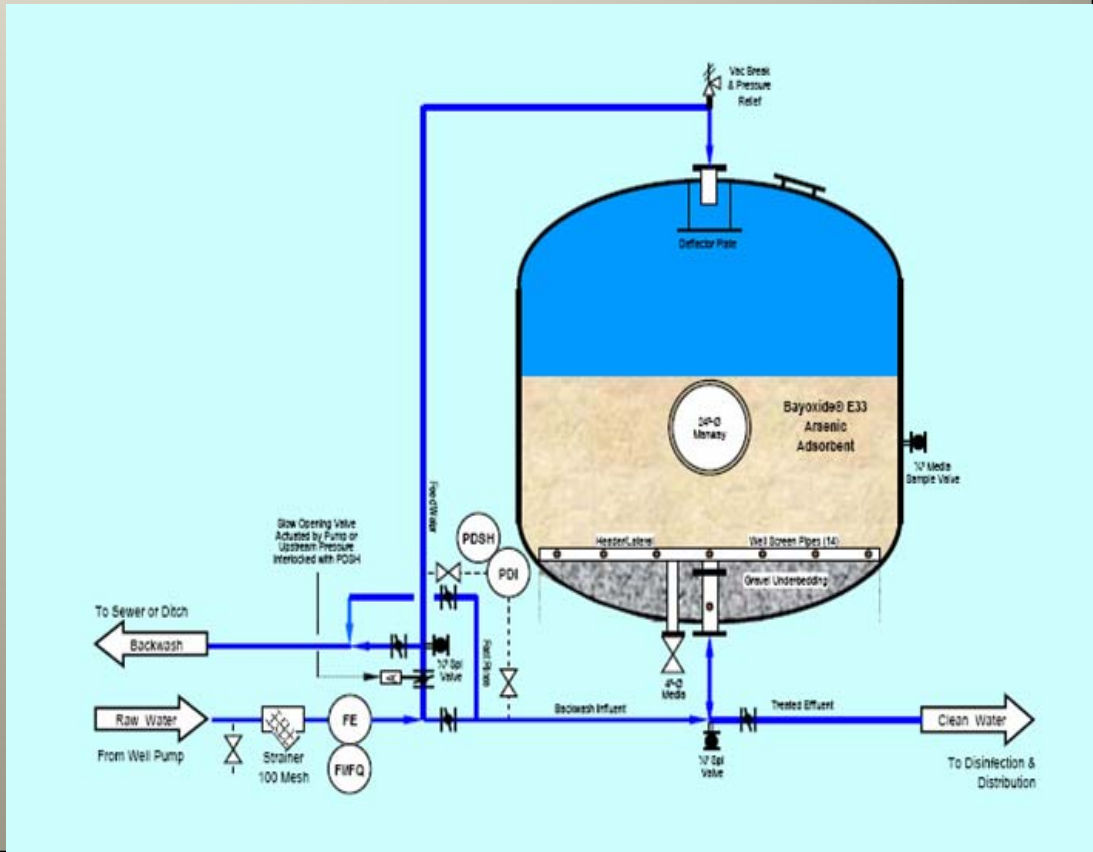
Project Execution

Project Execution

- Adsorption Process
  - Pump and treat technology
    - pressurized water
    - fixed bed vessel
    - ferric oxide media



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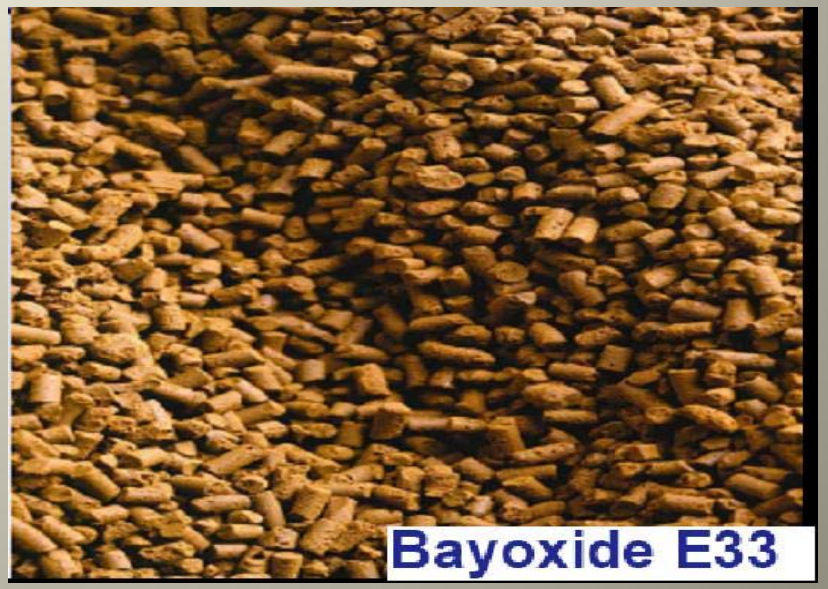
Project Execution

- Adsorptive Media
  - Dry, crystalline granular media
    - high capacity for arsenic
    - low pressure drop
    - long operating cycles – lower costs



  - NSF Standard 61 Approved
  - Media is non-hazardous and can be landfilled.

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Project Execution

- Widely Used and Accepted Process
  - 150 full-scale municipal sites
  - Permitted and operating in 21 states
  - In the United Kingdom
    - over 46-mgd annually
    - operation since 1999
  - First in Oklahoma!

Project Execution

- Norman's System
  - Three vessel process
  - Each vessel
    - 60-inch in diameter
    - 3-feet of media depth
    - Flow rate of 160 gpm
    - No waste discharge

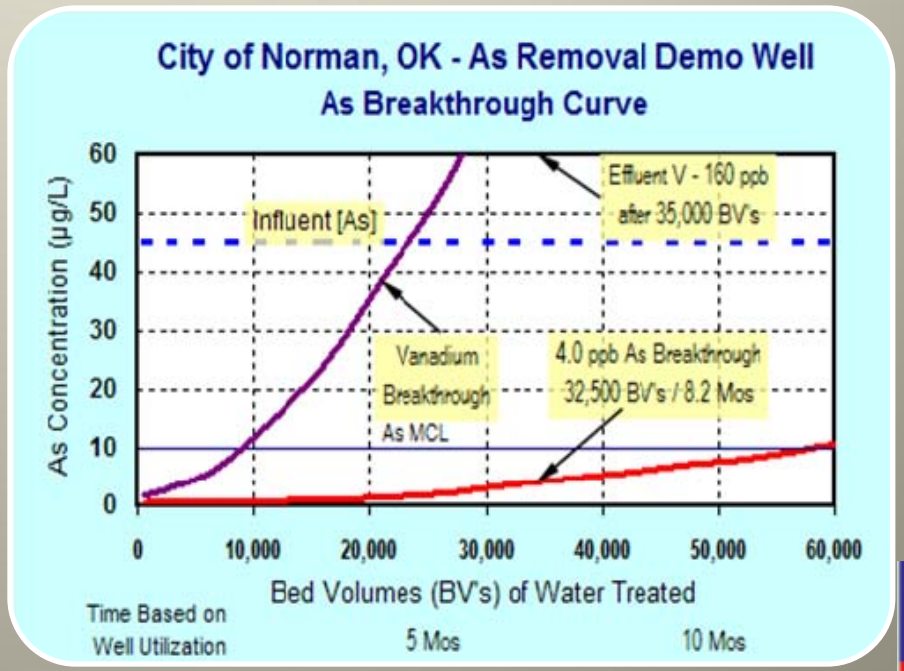
Construction Progress

Construction Progress

Construction Progress

Operator Training

Results and Conclusions



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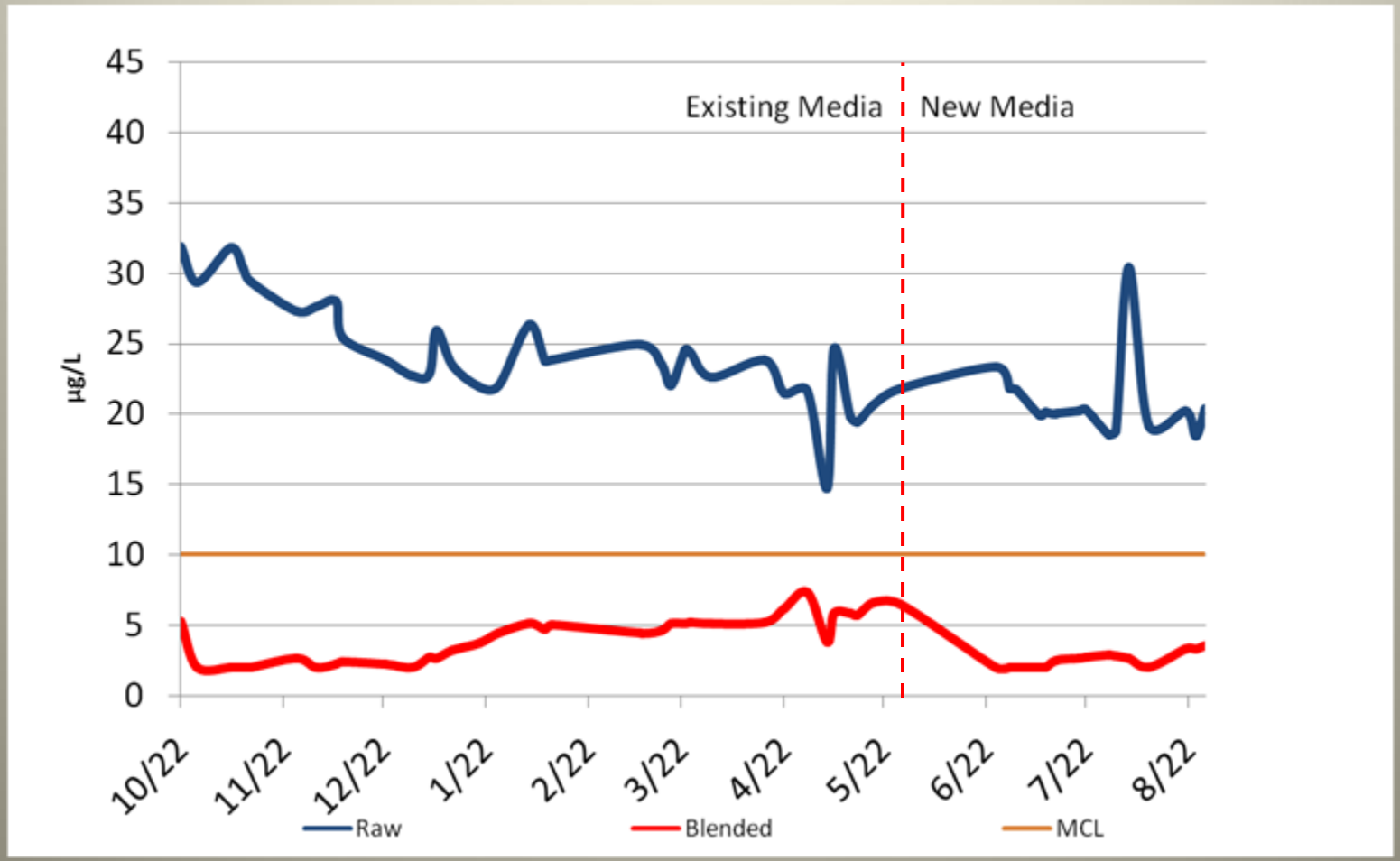
Arsenic Removal Data



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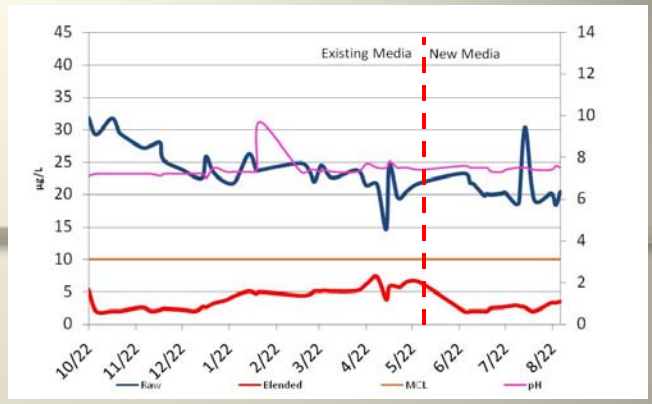
Observations from Well No. 31



- Arsenic is removed below the MCL for the entire demonstration period
- Breakthrough Curve:
  - A linear-like, low slope curve
  - Allows for good prediction of future breakthroughs
- New media results in an immediate response in arsenic concentration

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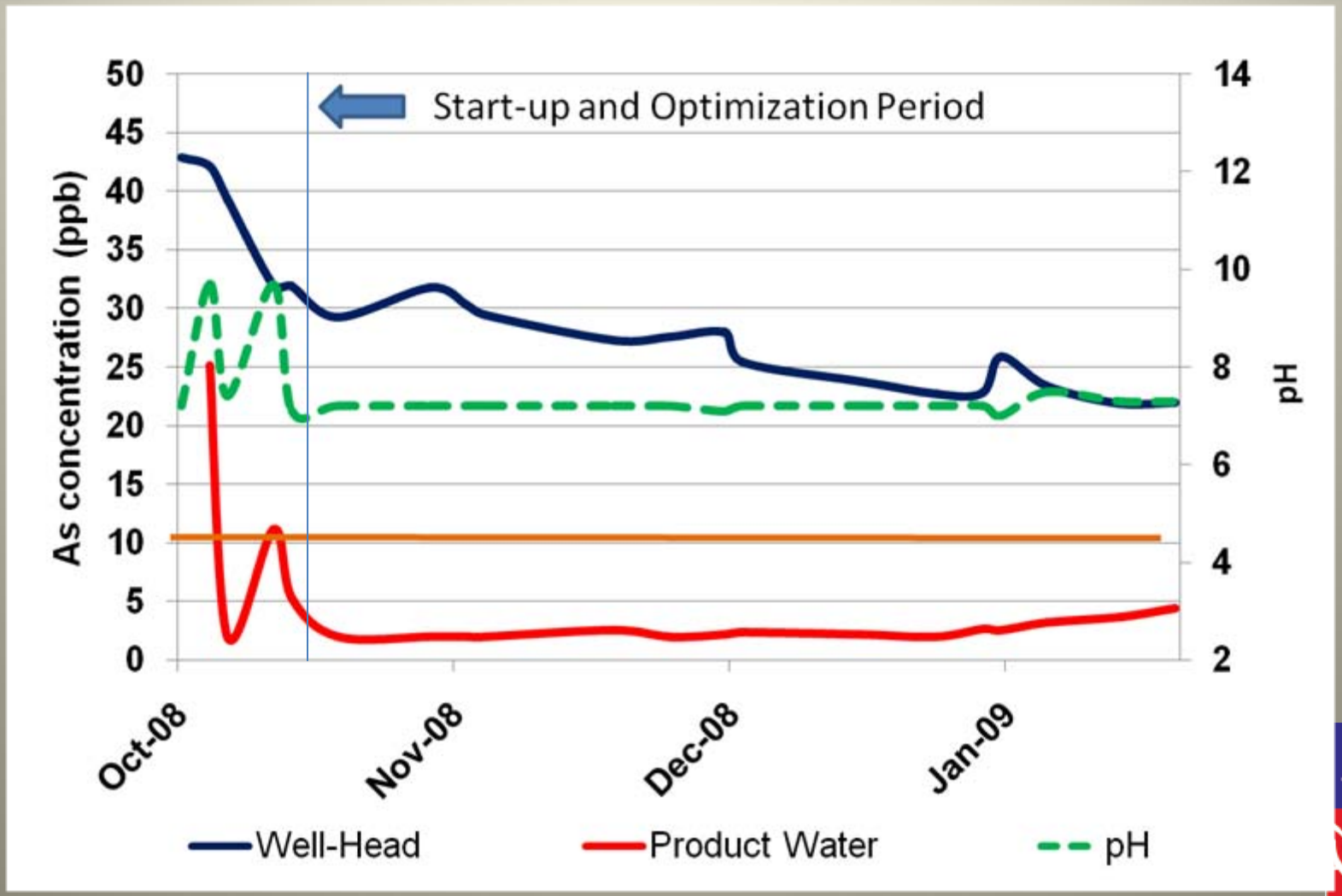
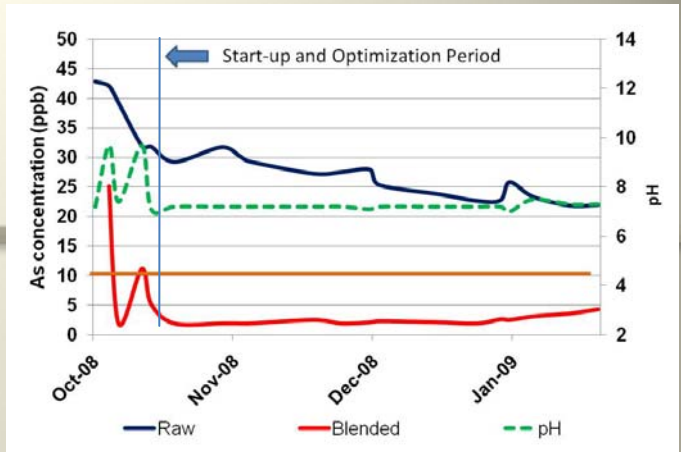
pH Control is Critical to Performance



Observations of Arsenic and pH



- Optimization period proved:
  - pH adjustment is critical to Arsenic removal
- Automatic Controls put in place to shut down system if pH rose above pH set point
- System performed consistently and accurately once controls were in place

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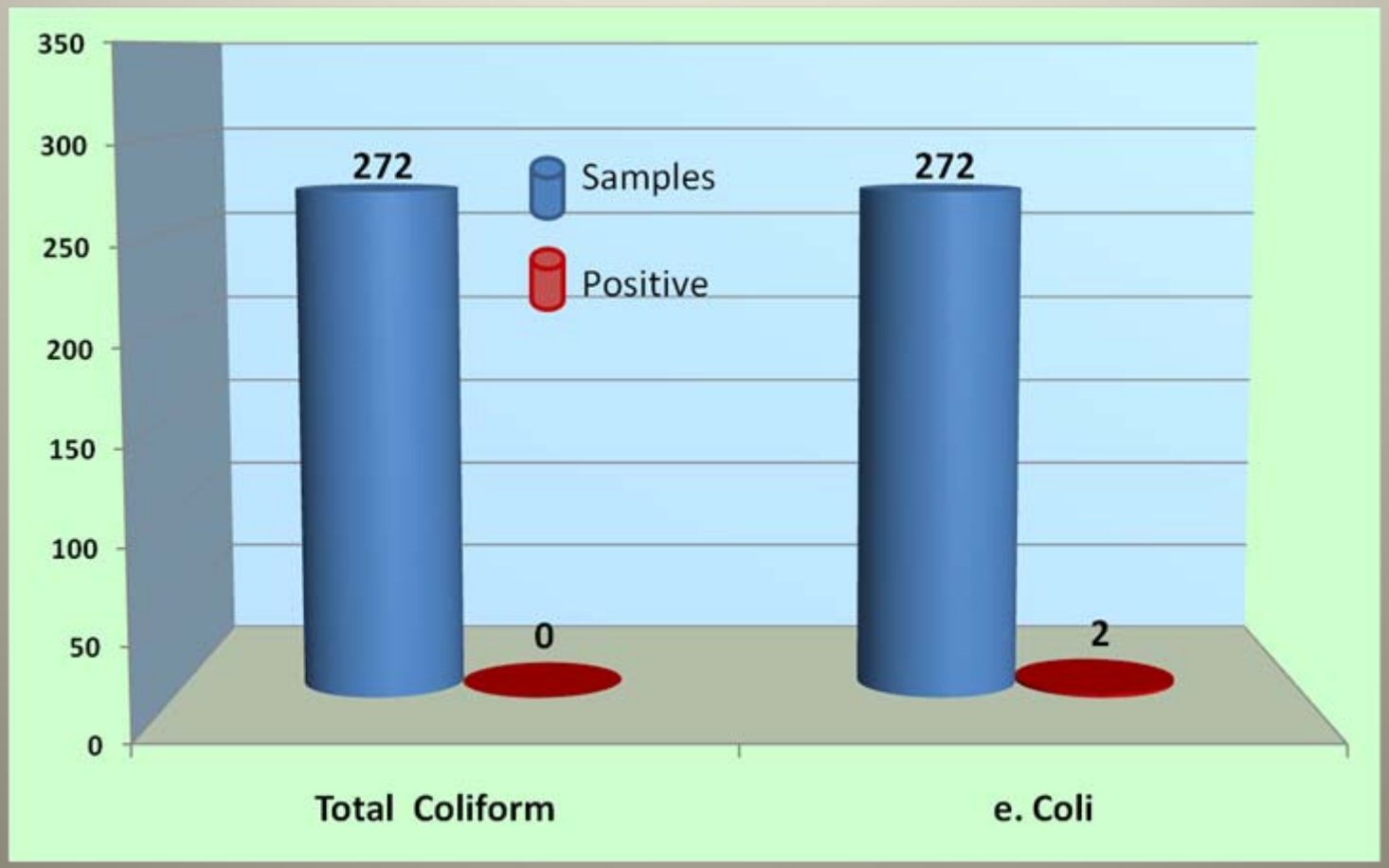
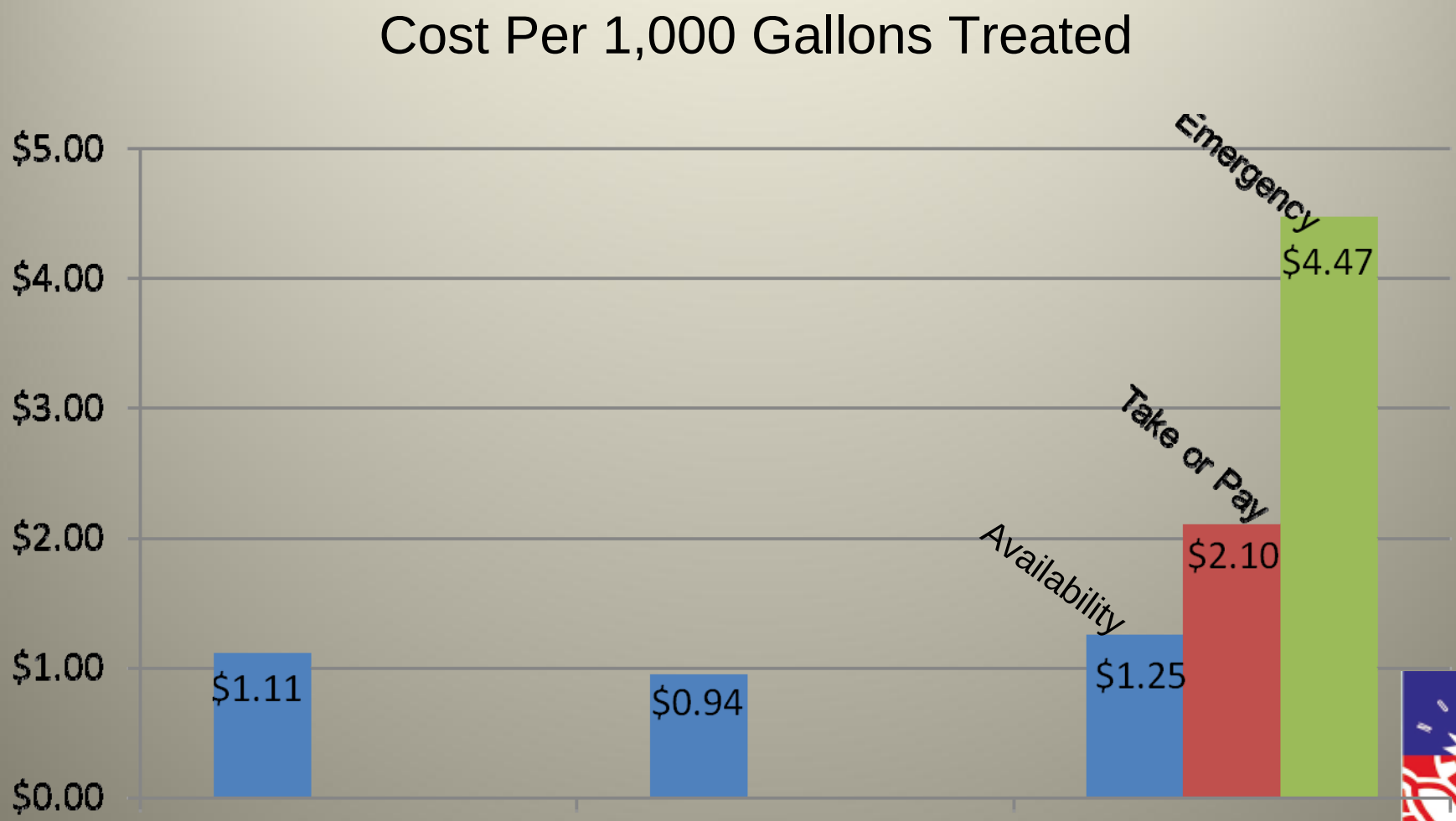
Project Reporting

- **Bacterial Growth**

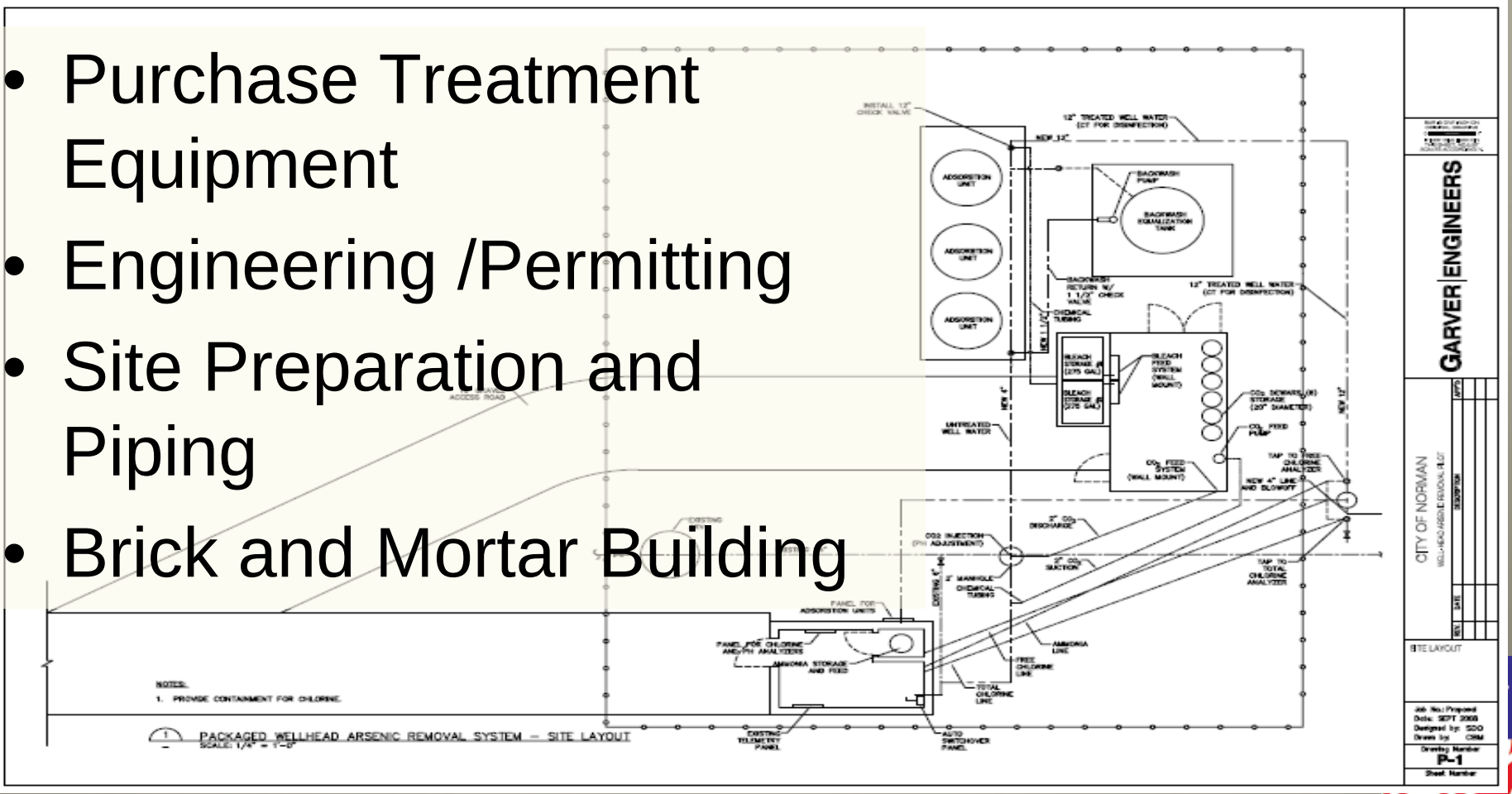


Operation and Maintenance Cost



Moving Forward With Permanent Site Improvements

- Purchase Treatment Equipment
- Engineering /Permitting
- Site Preparation and Piping
- Brick and Mortar Building



Conclusions

- Arsenic is removed
- No bacterial impacts
- Completely Self-Contained System
  - No Sewer or other infrastructure required
- Non-hazardous Waste
- OJT for operations staff
- As of October 27,2009:
  - 73.6 million gallons / $155,000 (revenue)

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Future Work

- Collective treatment
  - Locate high arsenic clusters
  - Realize economies of scale
    - Reduces the demonstrated O&M costs

Project Team

Owner: Project Manager, Site Selection, Laboratory Assistance, Operations Support, and Funding.

Engineer: Program Management, Site Design, Regulatory Assistance, System Start-up, and Project Reporting.

Contractor: Site Construction, Troubleshooting, and Bonding.

Supplier: Equipment and Media Provider, Technical Assistance, and Operations Support.

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