



BROWNFIELDS TO GOLD MINES

CONTAMINATED SITE REMEDIATION SYSTEMS

**A viable means to remove or treat contamination in soil, soil vapour
and groundwater in situ**

PROS OF REMEDIATION SYSTEMS

- Cost effective
- Lower carbon footprint
- Lower liability
- Safer (less injuries)

CONS OF REMEDIATION SYSTEMS

- Operation can be complicated
- Project typically takes longer
- Extended site work



10 QUESTIONS

to ask about your
remediation system

(Before it's installed!)



1. HAS THE SITE BEEN FULLY CHARACTERIZED?

Contaminants of Concern

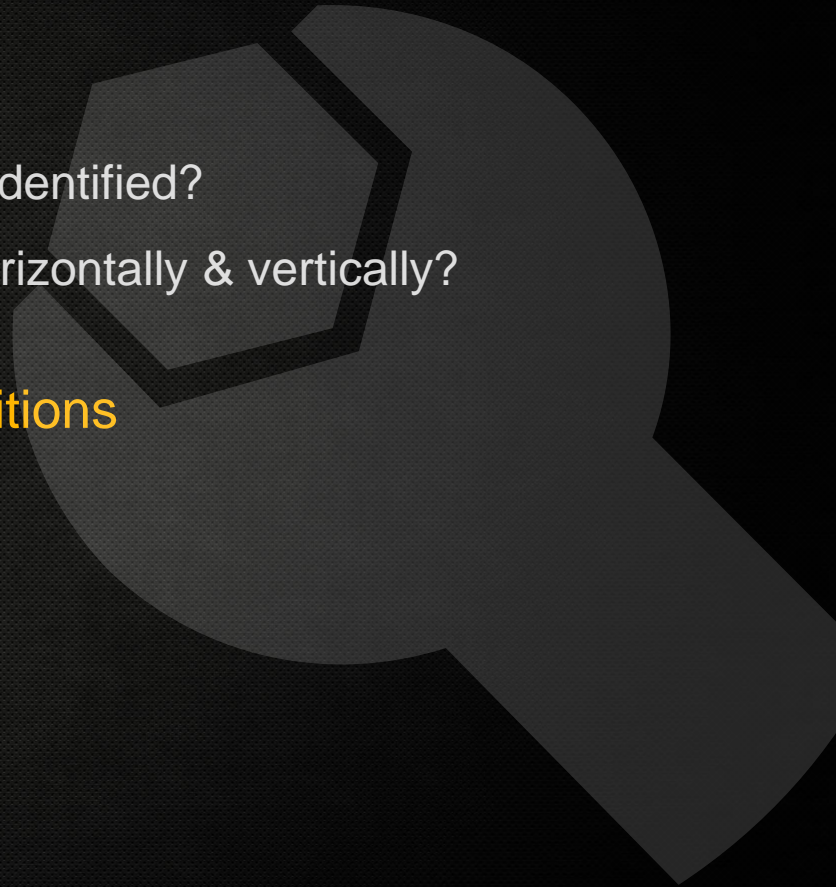
- Have the contaminants of concerns been identified?
- Has the contamination been delineated horizontally & vertically?

Stratigraphy & Groundwater Flow Conditions

- How well are they understood?

Historical Site Features

- Have they been identified or considered?





2. HAS THE SITE REMEDIAL OBJECTIVE BEEN CLEARLY DEFINED?

Site Remediation Standards

- Have they been properly identified?

Site Remediation Plan

- Is the end point for engineered remediation clearly defined?



CASE STUDIES



SVE/Sparge System



Groundwater Pumping System



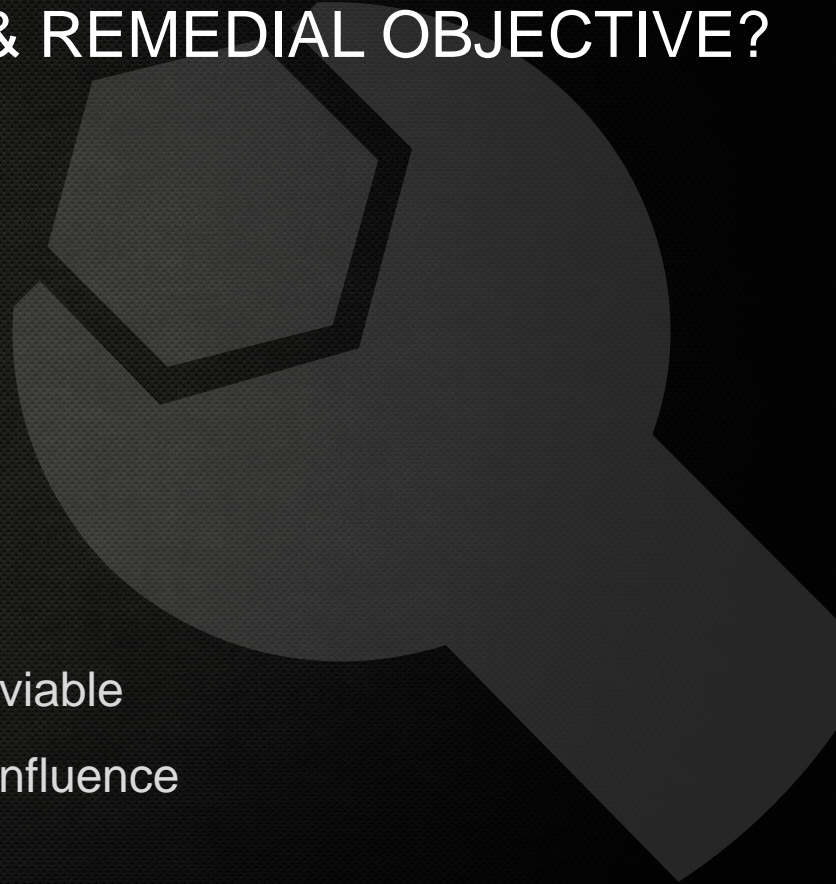
3. HAS THE RIGHT TYPE OF SYSTEM BEEN SELECTED FOR THE SITE & REMEDIAL OBJECTIVE?

Factors for evaluating remedial options

- Contaminant type and distribution
- Site hydrogeology
- Remedial objectives & timeframe
- Cost
- Green and sustainable?

Pilot Tests

- Confirms a type of system or design will be viable
- Assists with design by confirming radius of influence





CASE STUDY

- Bench tests produced a gel and white precipitate
- Scale issues attributed to high pH and salinity



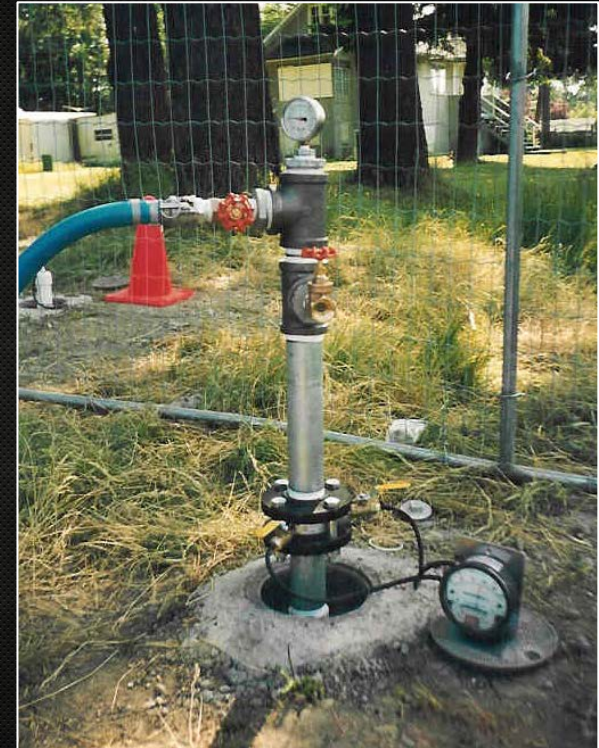
Groundwater Circulation Well Technology Pilot Test at a Chlor Alkali Plant



4. HAVE THE SYSTEM COMPONENTS BEEN PROPERLY DESIGNED?

System Wells

- Depth
- Diameter
- Screen size
- Screen length
- Materials





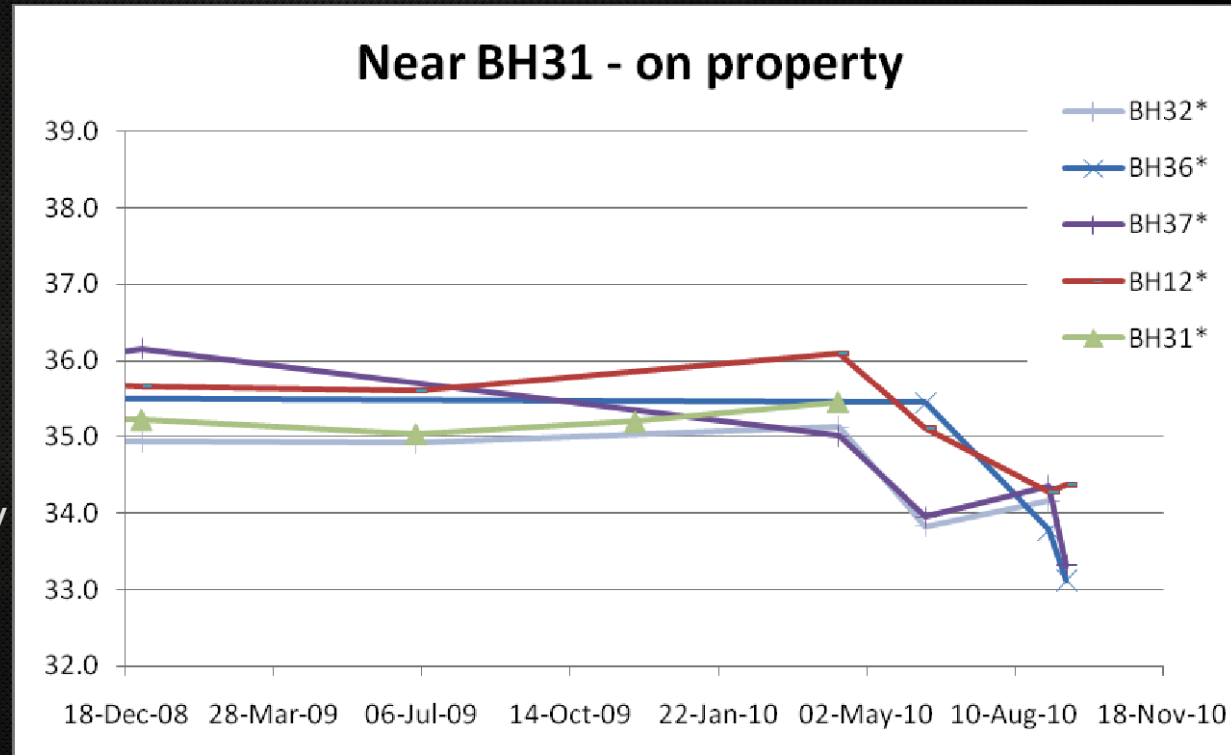
4. HAVE THE SYSTEM COMPONENTS BEEN PROPERLY DESIGNED?

Wellheads

- Good wellhead design can overcome limitations

Drop tube

- Diameter, length & placement can significantly impact contaminant recovery





4. HAVE THE SYSTEM COMPONENTS BEEN PROPERLY DESIGNED?

Piping Diameter and Material

- Meets flow & pressure requirements
- Chemical compatibility





5. IS SYSTEM NETWORK LARGE ENOUGH AND WELL SPACING ADEQUATE?

System well network

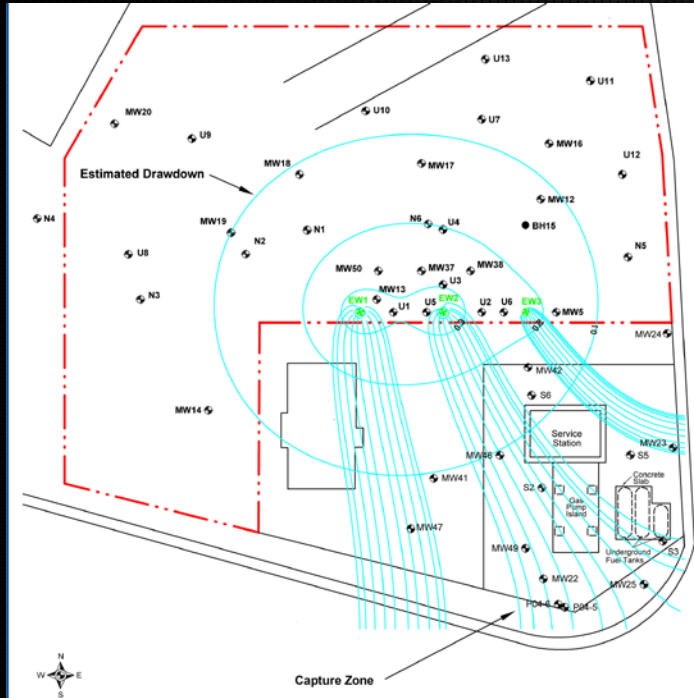
- Provide coverage of the entire plume

Well spacing

- Provide overlapping radii of influence to prevent pockets of contamination and to prevent contamination from migrating



CASE STUDY



Dual Phase Extraction System Without Overlapping ROI



5. IS SYSTEM NETWORK LARGE ENOUGH AND IS WELL SPACING ADEQUATE?

Historical & Pilot Test Data

- Used to determine the system network and well spacing

Remedial Objective and Timeframe

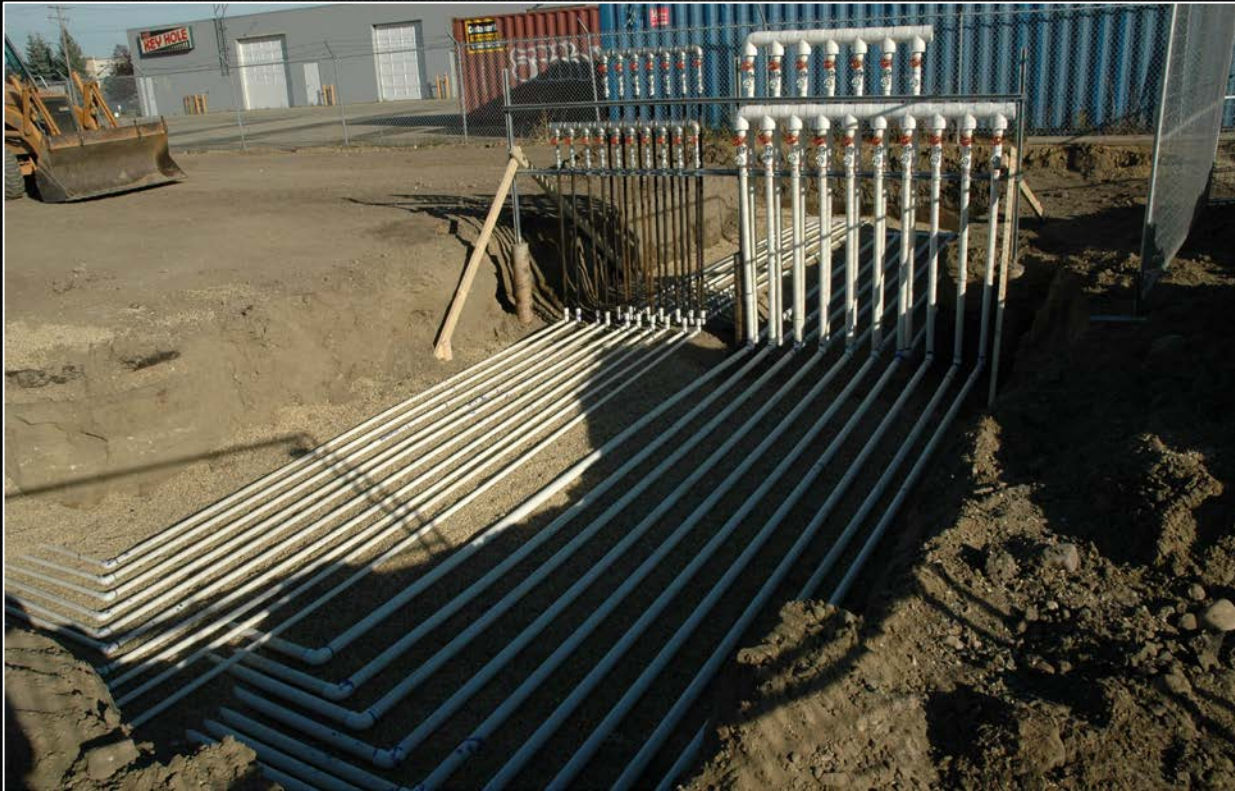
- A denser network can expedite remedial timeframes in the long run

Network Design and Planned Operation

- Can economize on drilling and/or equipment requirements



CASE STUDY



Air Sparge SVE System



6. HAS THE REMEDIAL EQUIPMENT BEEN SIZED PROPERLY?

Proper-sized Equipment

- Ensures the desired effect on subsurface conditions
- Ensures the equipment lasts



Sparge Blower



7. IS THE EQUIPMENT BEING MAINTAINED PROPERLY?

Regular Maintenance

- Ensures warranties are maintained
- Uptime is maximized
- Costs are controlled



Use A Qualified Contractor!



7. IS THE EQUIPMENT BEING MAINTAINED PROPERLY?

Systems don't like to be "OFF"

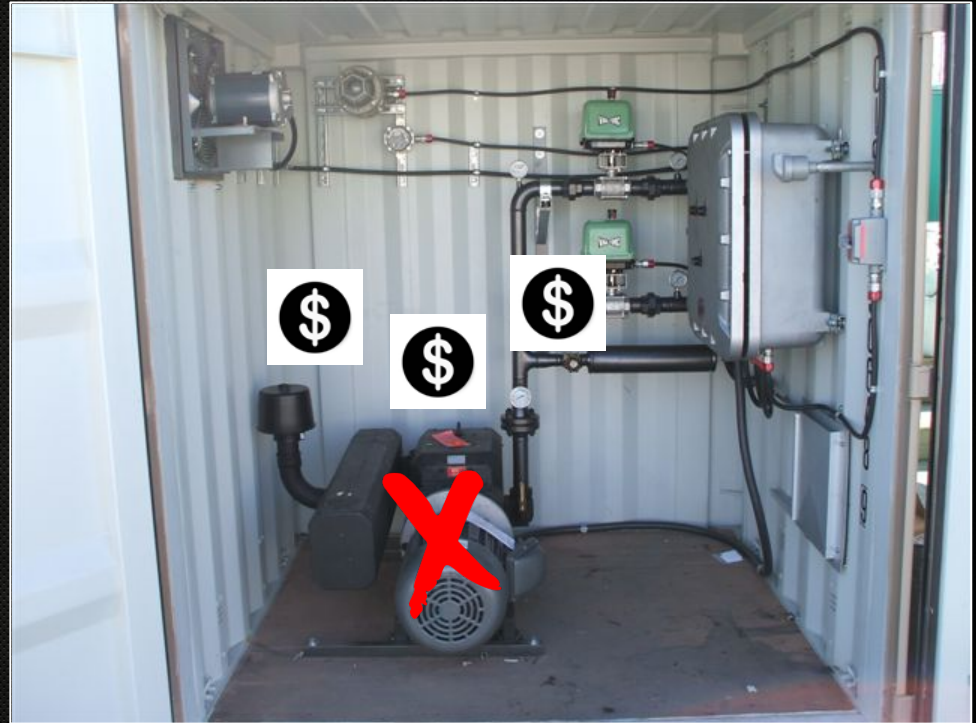
- A problem to get them running smoothly again

Sampling Programs

- Consider doing more sampling programs with the system running

Procurement

- Consider annual maintenance contracts



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8. ARE THE RIGHT SITE & SYSTEM PERFORMANCE MONITORING DATA BEING COLLECTED & REVIEWED?

System Performance Monitoring

- Include: run times, inlet & discharge flow rates, equipment, piping pressure and temperatures
- Aging equipment can be tested to ensure it is still operating within the manufacturer's performance curve

Site Monitoring

- Include: groundwater elevations, well headspace vapour levels, inferred vacuum/pressure, dissolved oxygen, REDOX parameters



8. ARE THE RIGHT SITE & SYSTEM PERFORMANCE MONITORING DATA BEING COLLECTED & REVIEWED?

Review the data

- Function of the equipment
- Impact of the system on site
- Impact of the operation on site environmental conditions



“The lights are on but nobody’s home”



9. IS THE SYSTEM OPERATION CONTINUOUSLY BEING UPDATED AND OPTIMIZED BASED ON THE MONITORING DATA?

Changes in Site Conditions

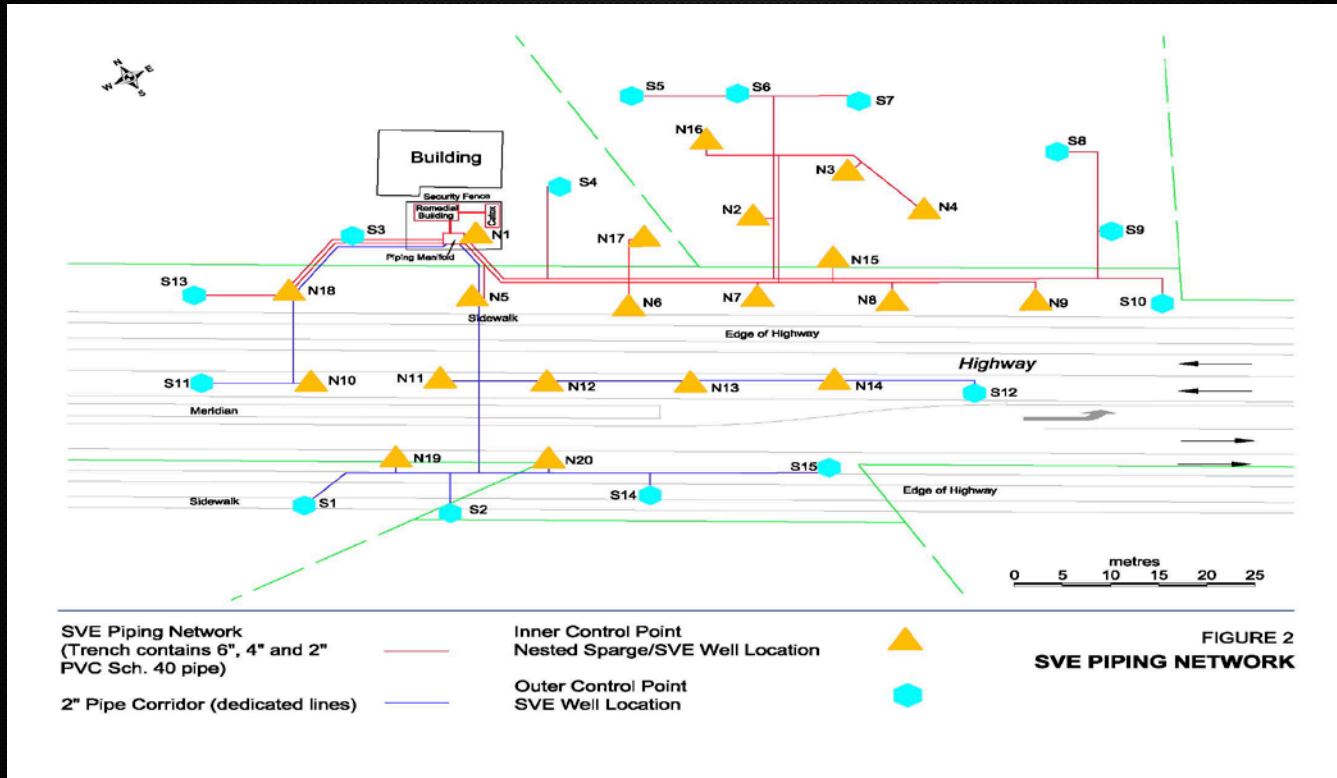
- Contaminant distribution and composition change
- Adjustments are needed to meet changes



Site Adjustments



CASE STUDY





10. ARE THE SITE REMEDIAL OBJECTIVE AND END POINT PERIODICALLY BEING REVIEWED?

Does the plan still make sense given the changes in legislation, site conditions, future land use plans etc?



Mixed Use Development

CONCLUSION



Remediation Technologies



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