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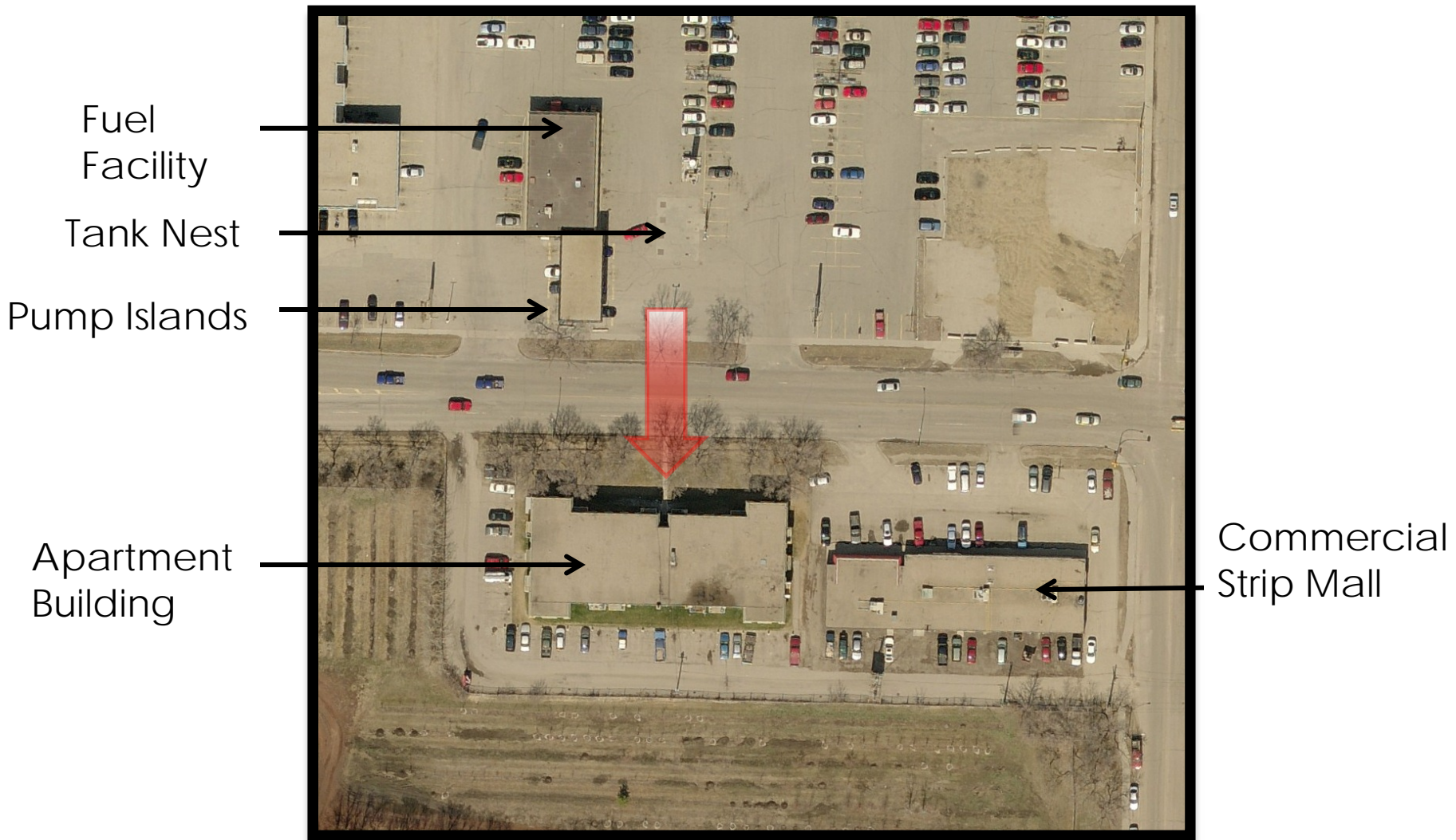
Blind Horizontally Bored Remediation Well Concepts -
Siltation Assessment and Cost Comparison

Presentation Overview

- Background
- Remediation System Layout
- Well Installation
- Dewatering Well Concepts
- Dewatering Well Assessment
- Remediation Results



Background



Background

Objectives

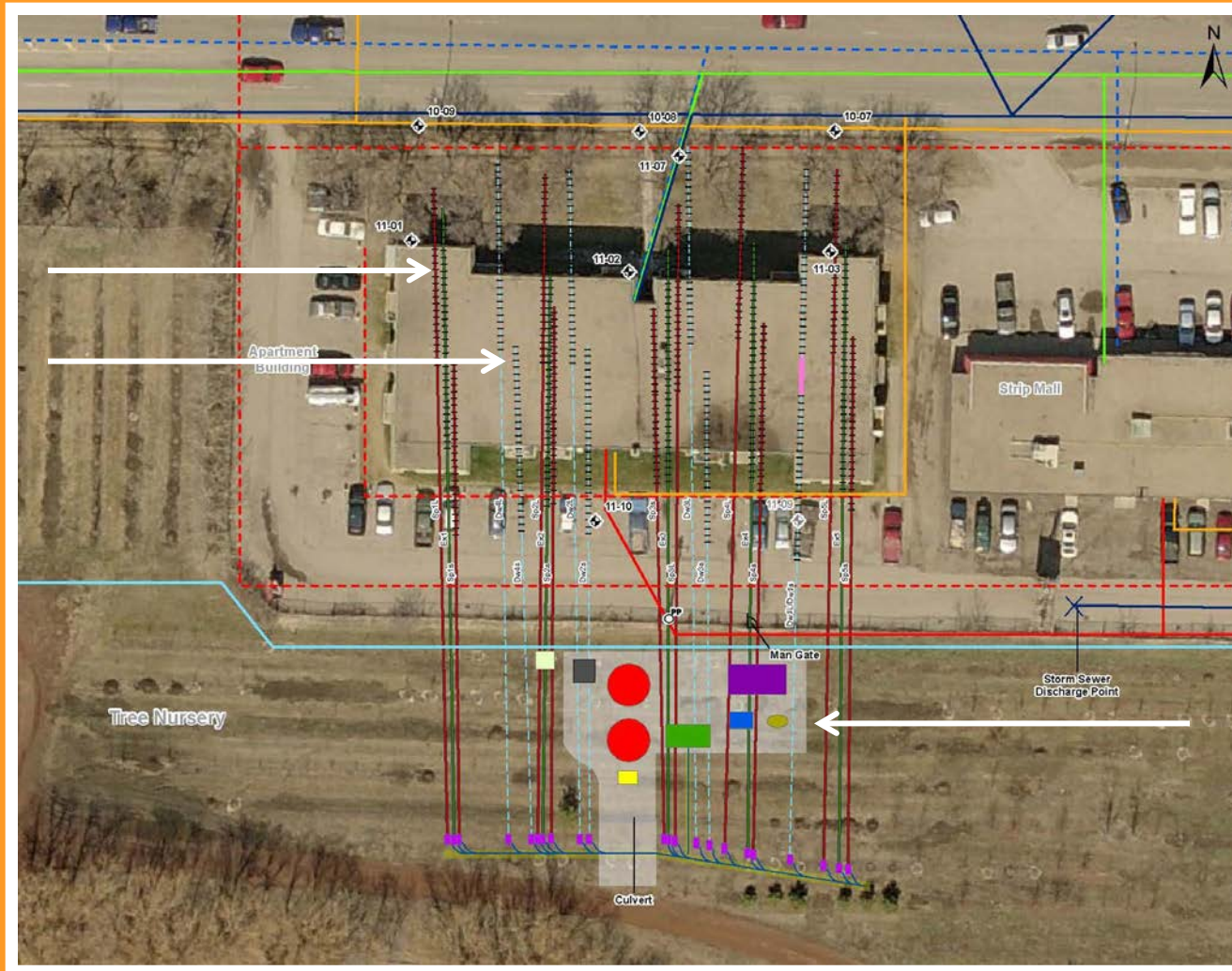
- Remediate impacts at the apartment property
- Provide vapour intrusion control
- Minimize disturbance to the tenants
- Reduce property devaluation
- Environmental stewardship

Challenges

- Impacts were located beneath the apartment building
- Limited access to the property
- Blind horizontal remediation well installations were uncommon in area



Remediation System Layout

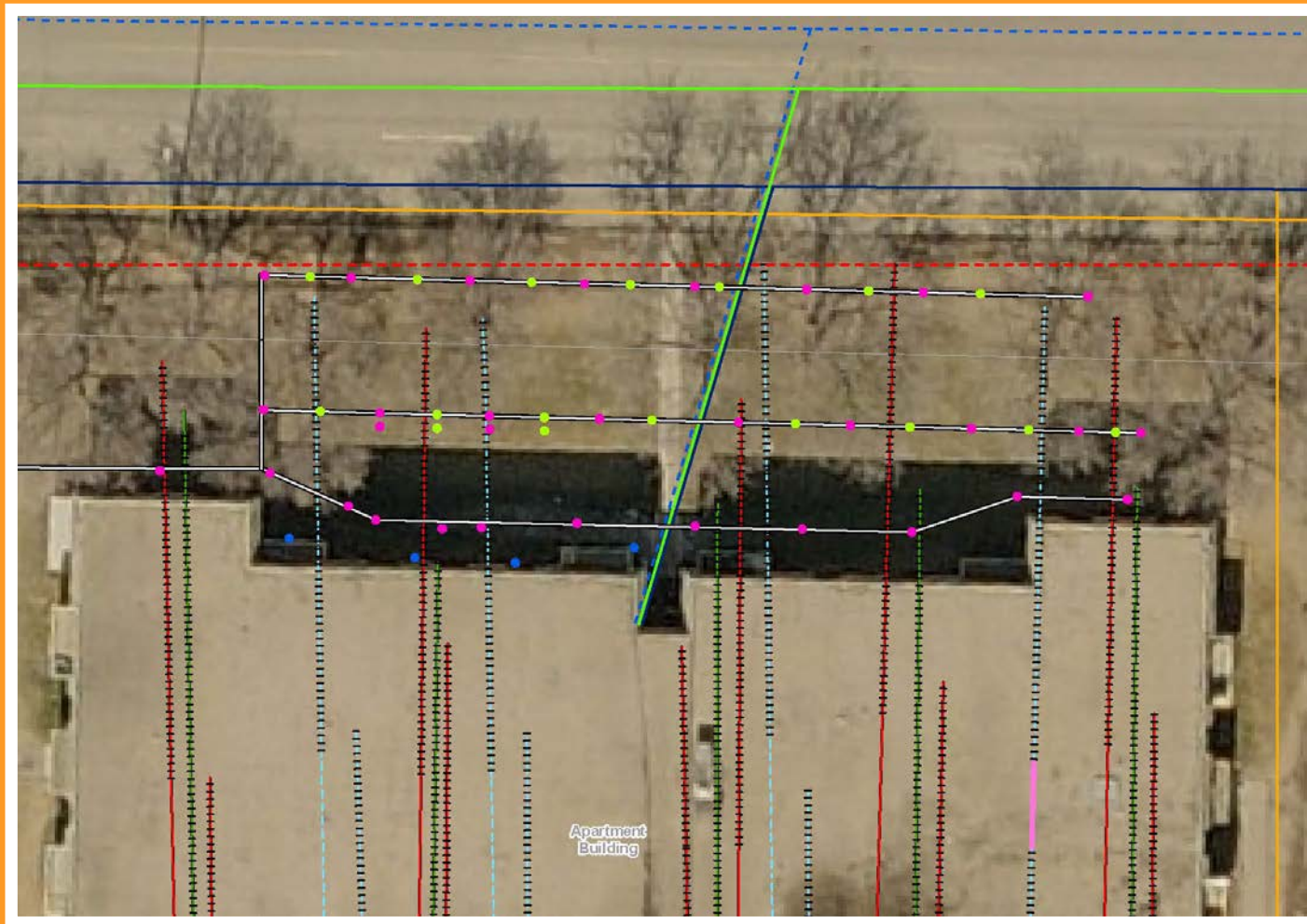


Horizontal Wells

Remediation System Components



Remediation System Layout



Vertical Recovery and Injection Wells



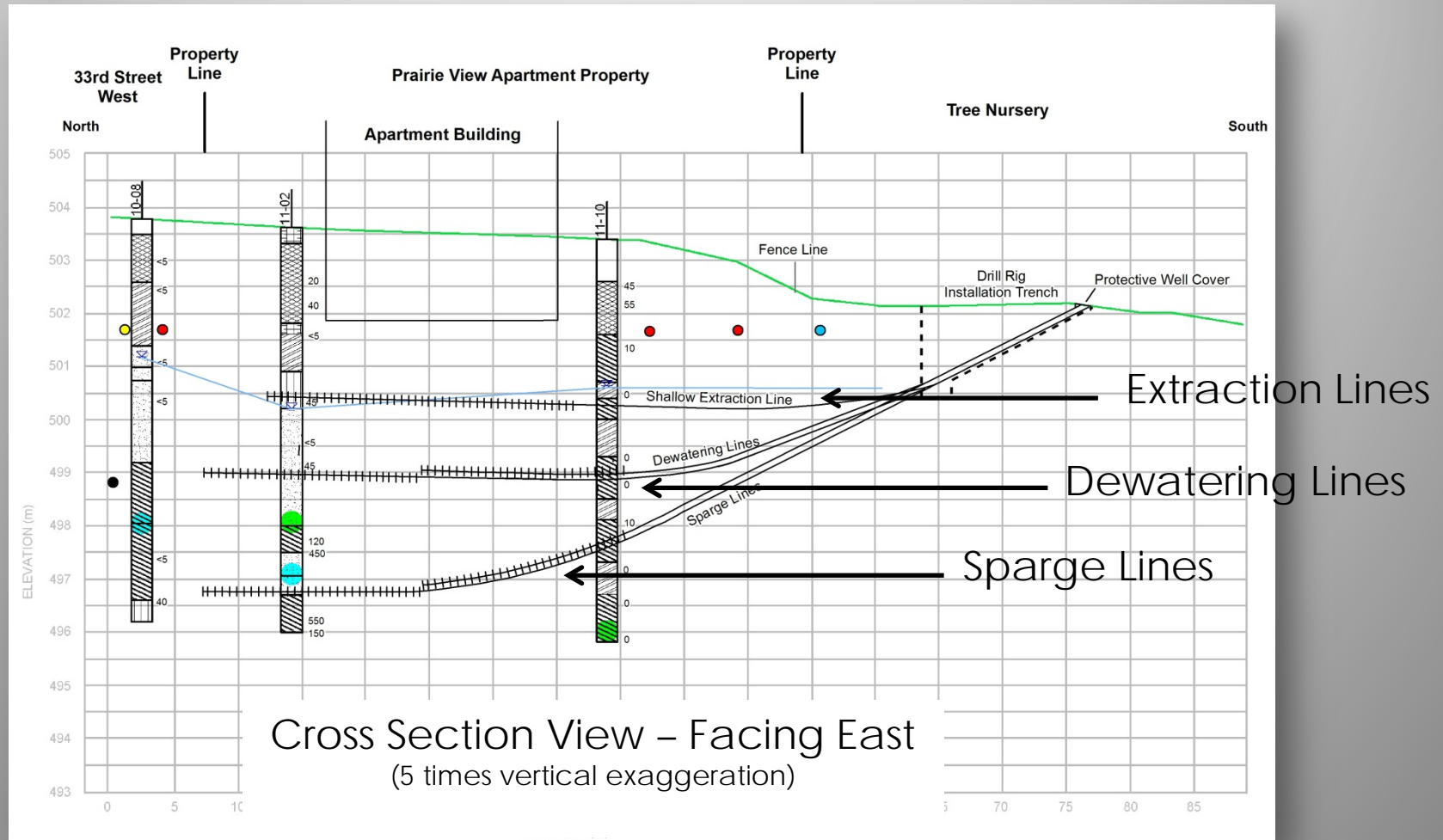
Remediation System Layout

Project Attributes

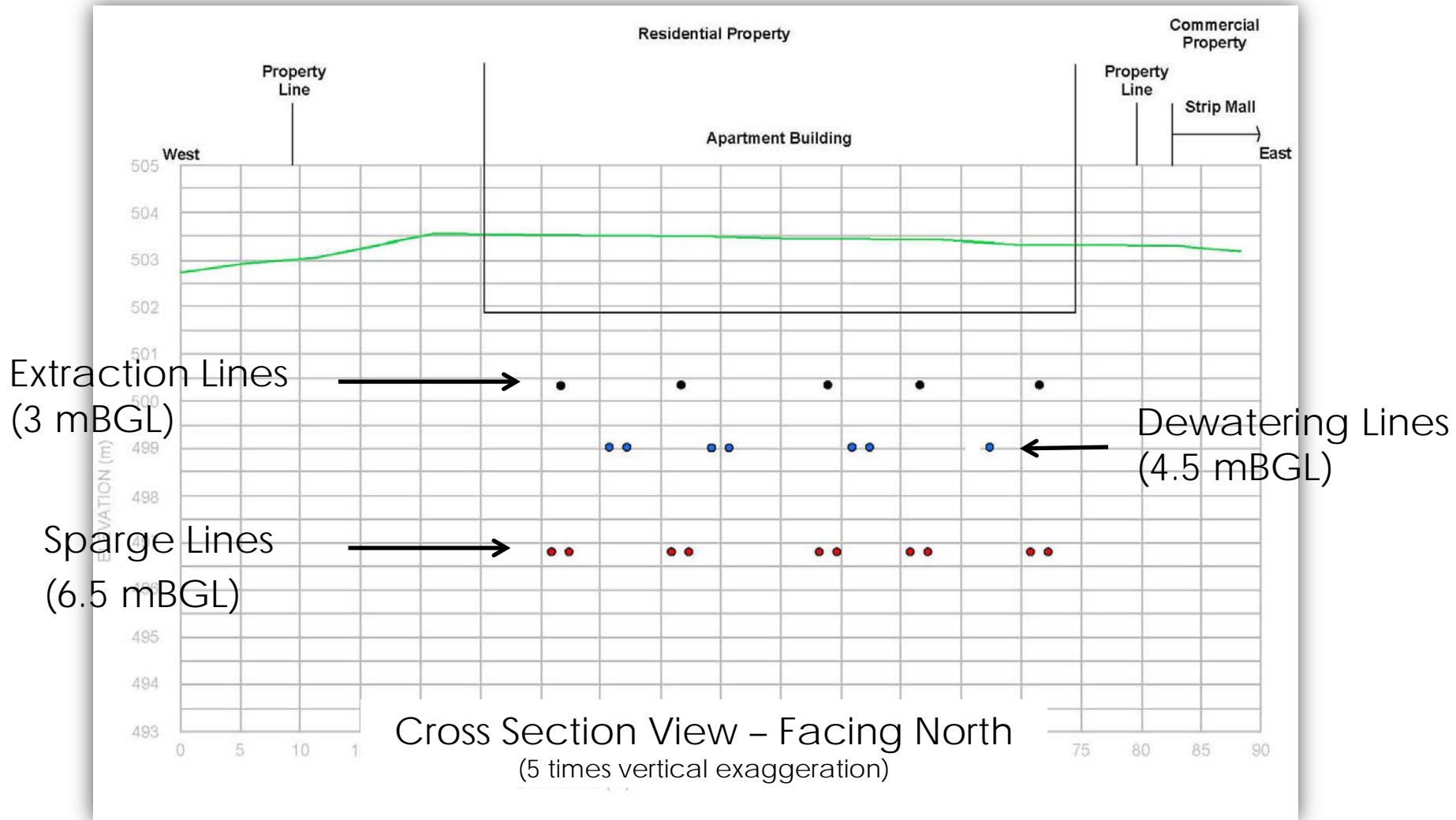
- 23 Blind Horizontal Wells Installed
- Over 1,500 m of Horizontal Borings
- 49 Vertical Recovery and Injection Wells
- Over 2,600 m of Dedicated Header Line



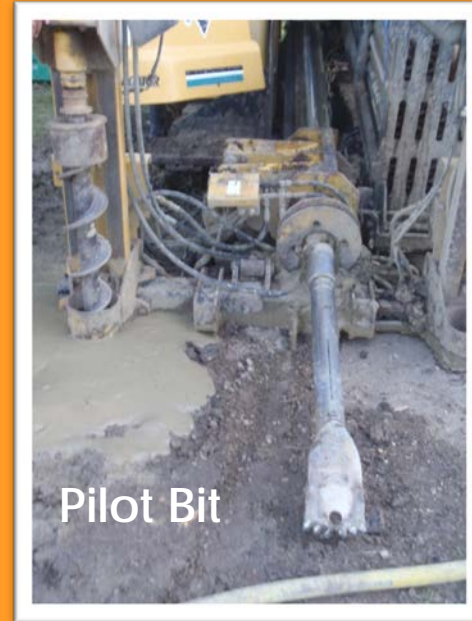
Remediation System Layout



Remediation System Layout



Well Installation



Well Installation



Specialty Tooling

Well Installation



Well Installation

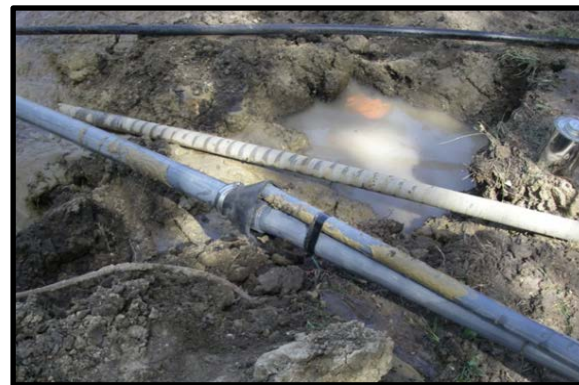
- Well Development
 - 1,000 L of water
 - 500 L of 3% - 5% Hydrogen Peroxide Solution
- Sand Tremme – 10/20 Filter Sand
- Bentonite/Cement Grout Seal



Well Development



Filter Sand and Grout Equipment



Grout Tremme

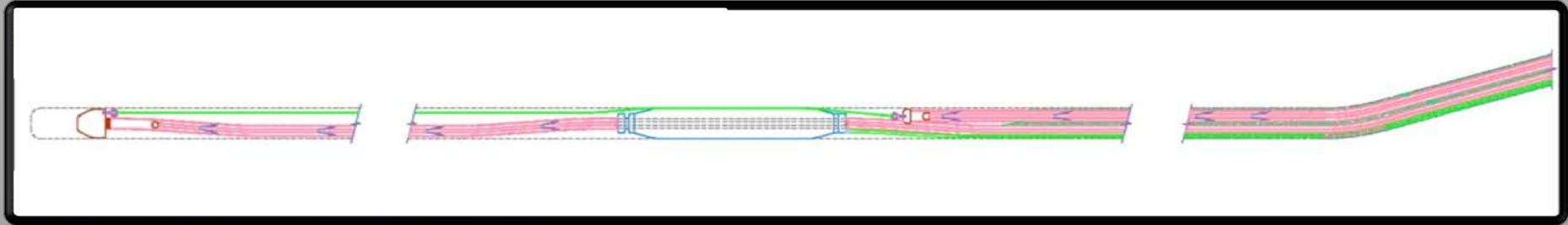
Dewatering Well Concepts

- Four different dewatering well concepts were assembled and installed
 - Nested well with inflatable packer
 - Geosynthetic well
 - Carrier casing well
 - Standard PVC well
- Evaluate the ability of the well to minimize siltation
- Evaluate the labour requirements for installation
- Evaluate the cost of the well materials



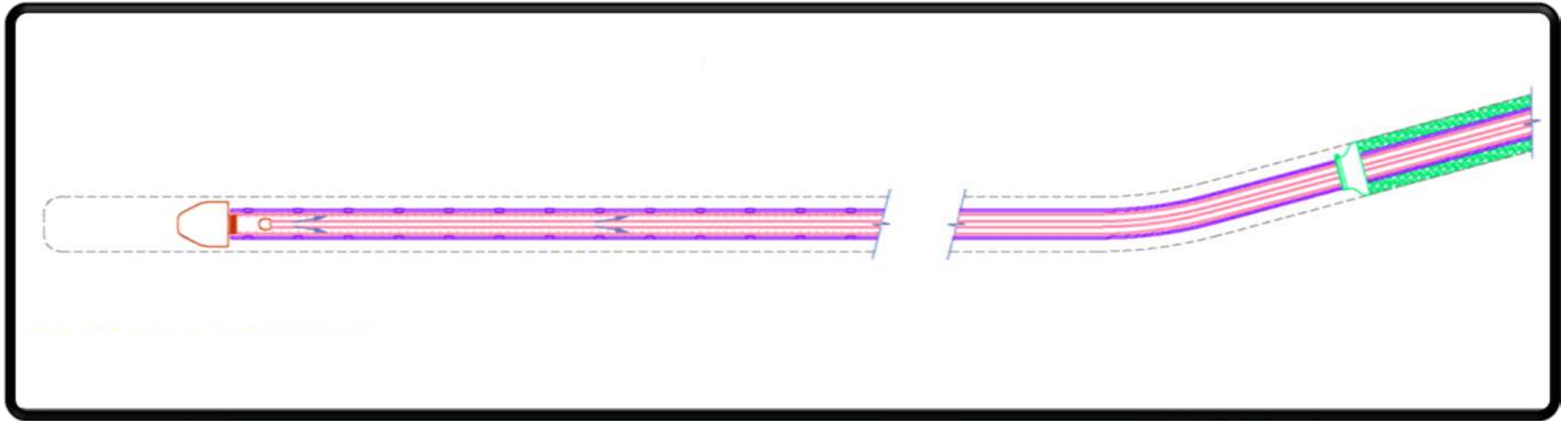
Dewatering Well Concepts

Nested Well with Inflatable Packer



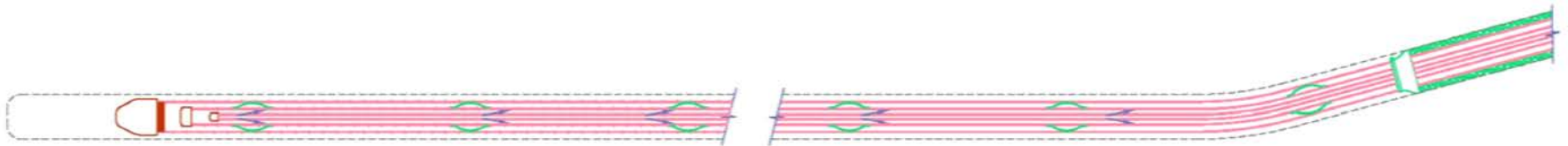
Dewatering Well Concepts

Geosynthetic Well



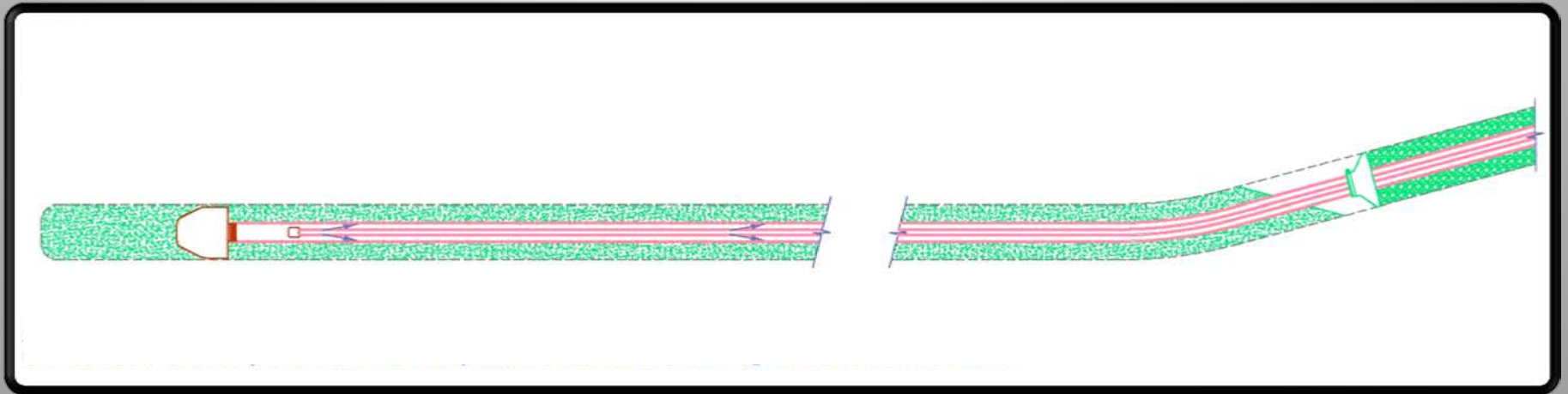
Dewatering Well Concepts

Carrier Casing Well



Dewatering Well Concepts

Standard PVC Well



Dewatering Well Assessment

- Similar silt load observed during the initial operation
- Silt diminished shortly after operation



Dewatering Well Assessment

- Cost of well screen material: \$37/m to \$124/m (additional costs for inflatable packer)
- Additional drilling time required for larger diameter wells
- Increase drill cutting disposal costs for larger boreholes

Well Type	Material Costs (per m of well screen)	Installation Time (hr)	Installation Considerations
Nested Well with Inflatable Packer	\$37 + \$3,900	11	-Drilling time reduced by half -well assembly time required
Geosynthetic Well	\$124	7	-easy to assemble -simple installation
Carrier Casing Well	\$114	7.5	-well assembly time required -additional drill time to advance larger diameter borehole
Standard PVC Well	\$37	5.5	-easy to assemble



Remediation Results

- Operational period: October 2013 to October 2014
- Total Groundwater Recovered – Over 1.5 M L
- Total PHC Mass Recovered – 12,000 Kg



Acknowledgements

This project was a collaborative effort between:

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