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Public Meeting for Former Varian Facility

150 Sohier Road
Beverly, Massachusetts
April 3, 2024

Documents Available for Public Comment (April 4-23, 2024)

- Temporary Solution Statement and Phase IV Status Report
- Release Abatement Measure (RAM) Completion Report
- Public Involvement Plan Update

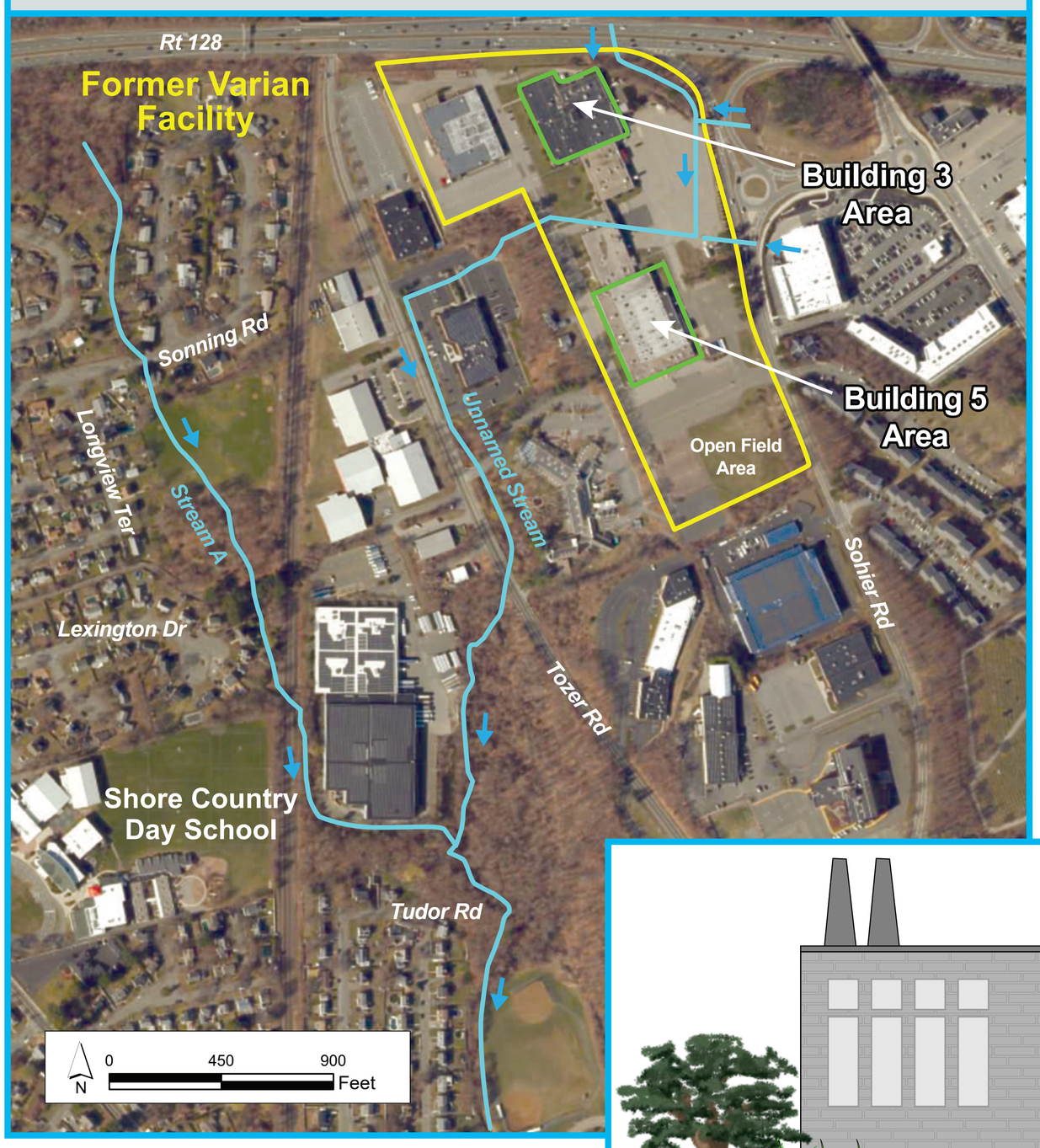
To submit public comments, use one of the following methods:

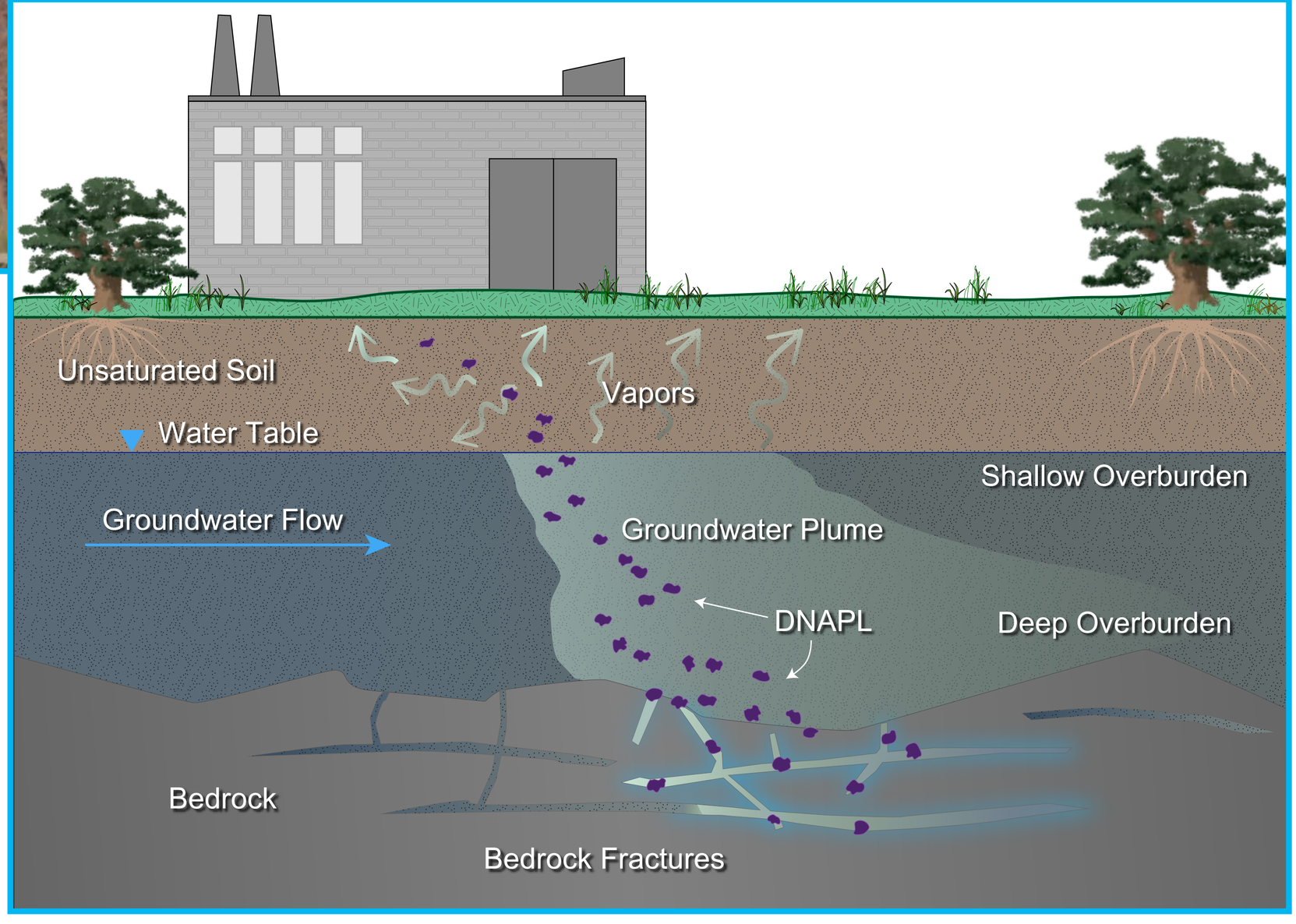
- Scan the QR code to access the on-line comment form
- Email comments to Raymond.Cadorette@jacobs.com
- Mail comments to this address: Jacobs Solutions, Attn: Raymond Cadorette, 120 St. James Avenue, 5th Floor, Boston, MA 02116
- Comment forms are also available at the welcome table

Environmental Site History

- Used since the 1950s as an industrial manufacturing facility
- Solvent releases occurred due to historical chemical handling and disposal practices, resulting in migration to soil and groundwater
- Trichloroethene (TCE) and perchloroethene (PCE, also known as tetrachloroethene) are industrial solvents that are heavier than water and have low solubility when mixed with water
  - TCE and PCE are often referred to as “volatile organic compounds” (VOCs)

Main Release Areas





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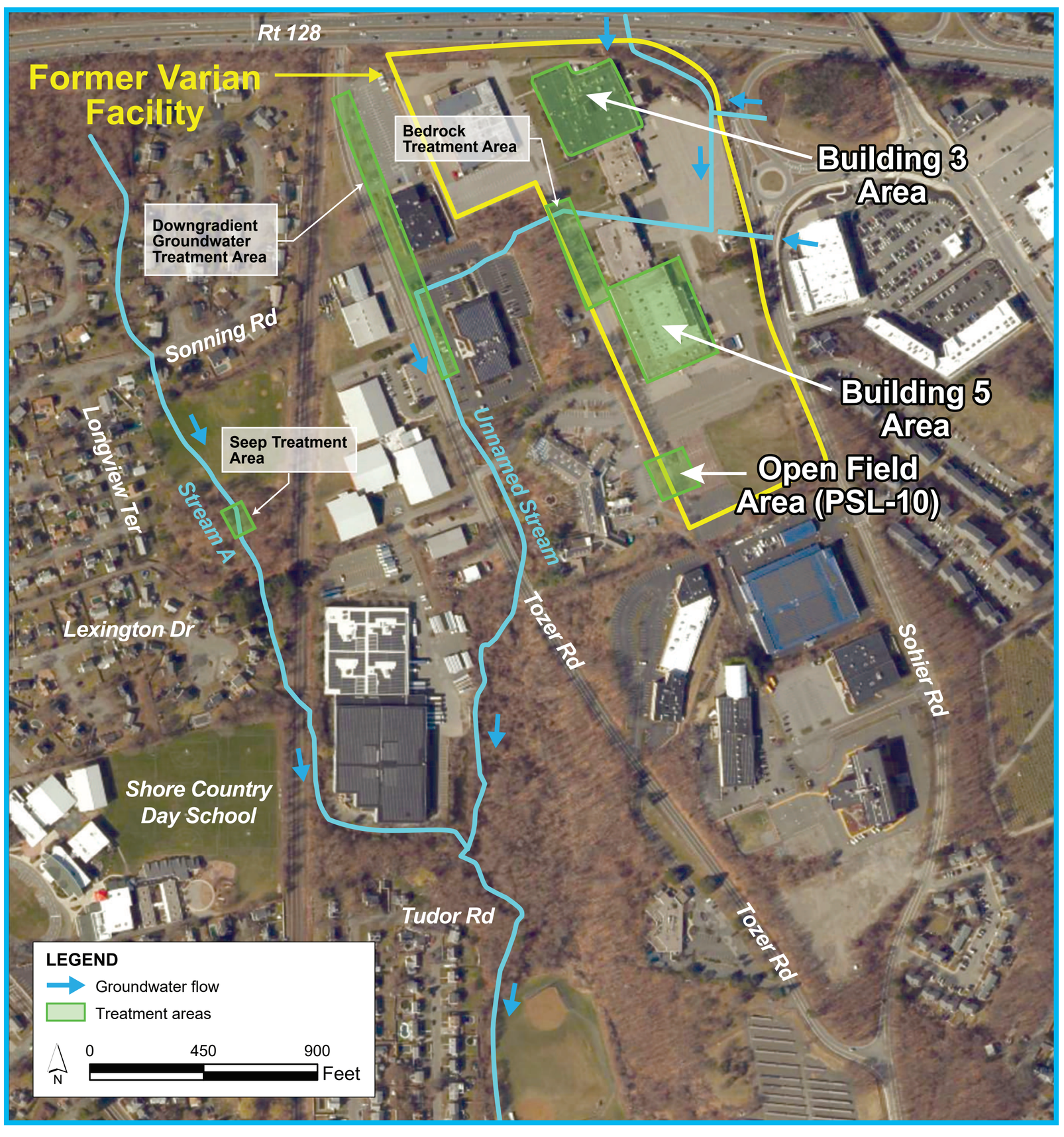
Remedial Action Objectives and Proposed Treatment Locations

Treatment Area	Primary Proposed Treatment	Objective	Status
Building 5 Source Area	Expanded in situ bioremediation treatment	To address elevated VOC concentrations remaining in the overburden	Pre-design investigation to be completed, followed by installation of treatment wells
Bedrock	In situ chemical oxidation treatment using new application techniques	To address elevated VOC concentrations, indicative of dense non-aqueous phase liquid (DNAPL) in bedrock between Buildings 3 and 5	Pre-design investigation to be completed, followed by installation of treatment wells
Potential Source Location (PSL) 10 (Open Field) Source Area	Soil excavation with permeable treatment zone (subgrade biogeochemical reactor)	To address elevated VOC concentrations remaining in the overburden	Design in progress, followed by installation of treatment system
Building 3 Source Area	Additional source area treatment using thermal remediation	To address DNAPL in the overburden	Remedy design and installation in progress
Downgradient Groundwater (Tozer Road)	Permeable barrier treatment	To limit downgradient migration of VOCs in groundwater	Remedy design and installation in progress
Seeps to Stream A	Adsorptive barrier treatment	To limit potential seep-related contribution of VOCs to the stream	Treatment system installed and being monitored



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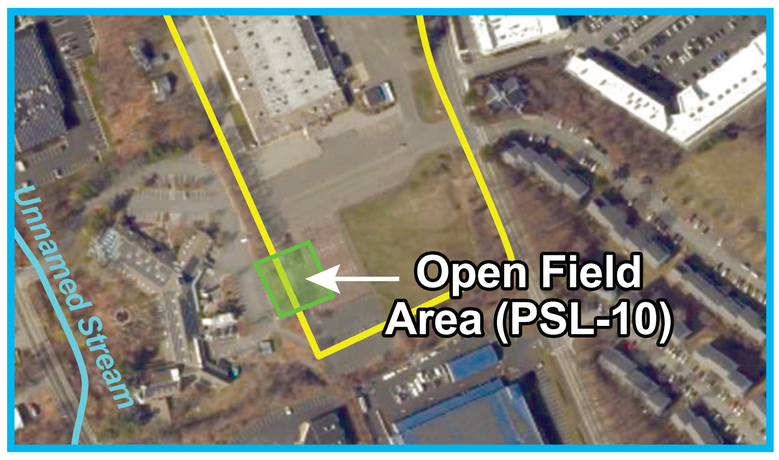
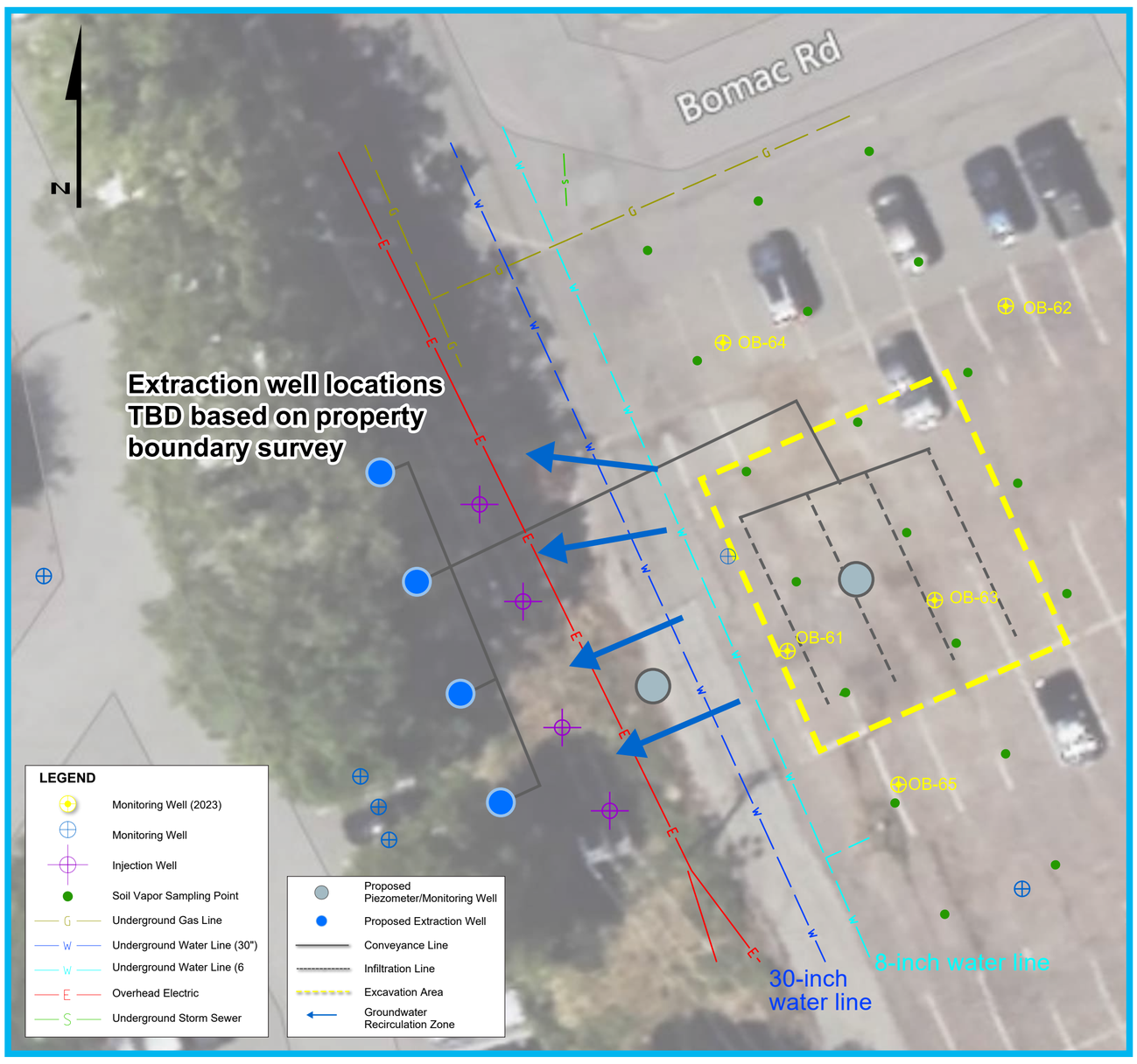
Open Field (PSL-10) Source Area

Selected Treatment:

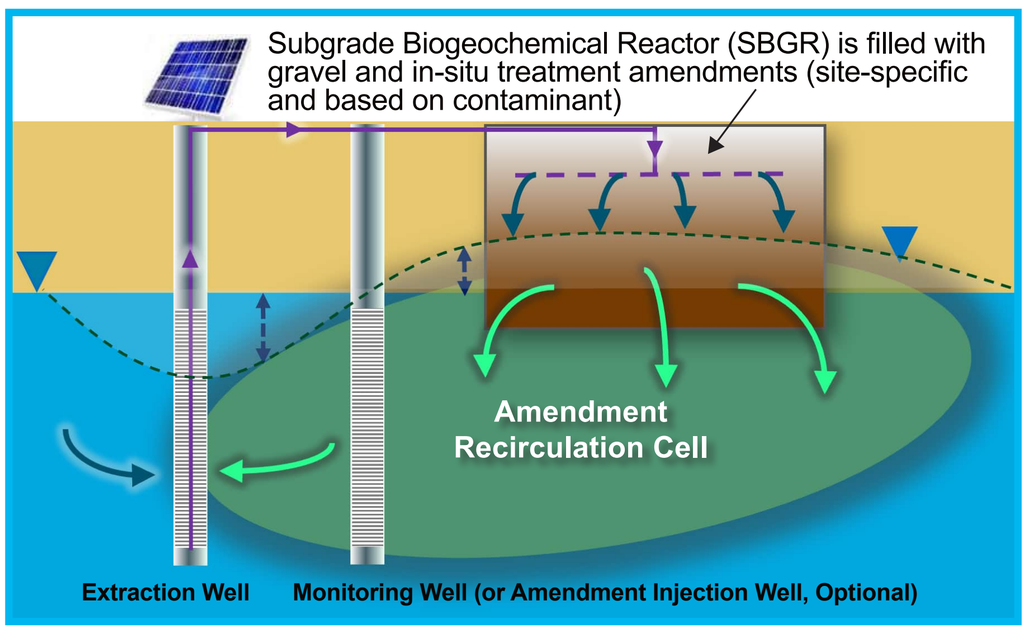
- Permeable treatment zone



- Prior treatment by in situ chemical oxidation has measurably reduced contaminant concentrations
- Pre-design investigation conducted to
  - Confirm details of source area
  - Select preferred permeable treatment zone approach consistent with Phase III Plan
- Implementation of a permeable treatment zone - **Subgrade Biogeochemical Reactor (SBGR)**
- Source area and groundwater treatment
  - Excavation of accessible contaminant source area
  - Backfill with a mixture of gravel and other amendments (contaminant specific)
  - Recirculate contaminated groundwater through the SBGR (preferably using solar power)
- Contaminant removal occurs through three mechanisms
  - Physical removal
  - Biological degradation
  - Chemical degradation



Typical SBGR Construction



SBGR Installation at PSL-10

- Up to two excavation areas (~30 ft x 20 ft) with contaminated soil disposal offsite
- East excavation into the top of groundwater; backfilled with organic amendments to support microbial community growth
- Installation of four groundwater extraction wells and piping recirculation system
- Monitoring well system to monitor groundwater levels and VOC concentration reductions

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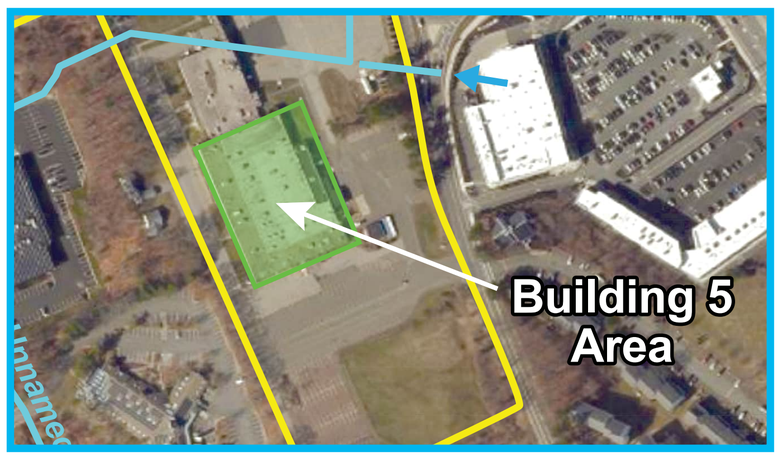
Building 5 Source Area Overburden

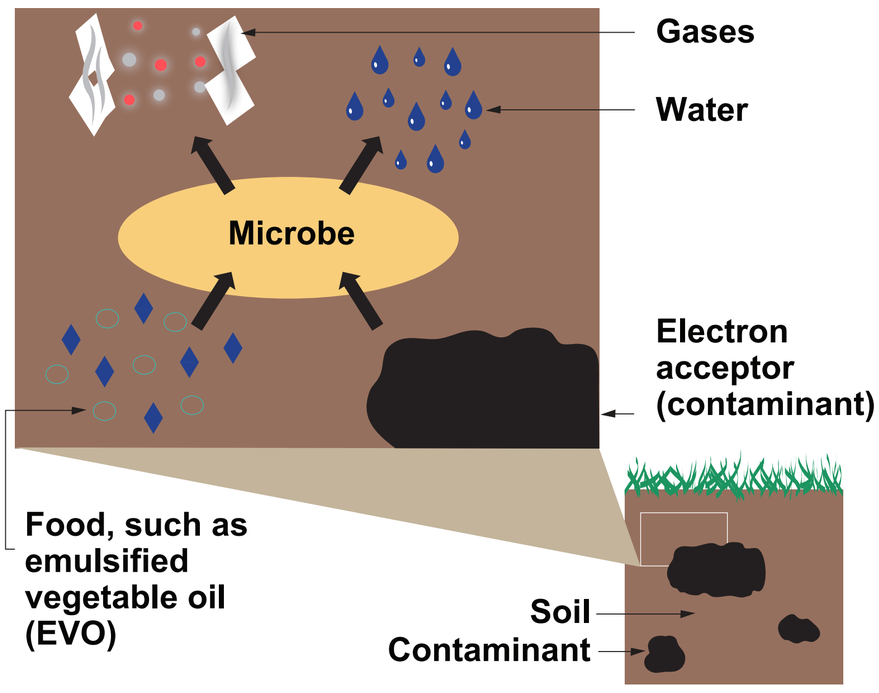
Selected Treatment:

- In situ bioremediation via enhanced reductive dechlorination
- Continued soil vapor extraction



- Bioremediation
  - Involves injecting carbon amendments (like vegetable oil) that natural microbes use as a food source
  - Promotes breakdown (or "dechlorination") of contaminants by the microbes
- Bioremediation was previously successful where applied at Building 5 and is appropriate for the contaminant concentrations beneath Building 5
- Treatment will be expanded to new locations with new application methods to address deep overburden beneath the building
  - Adaptive implementation approach – enables treatment approach to be modified or further expanded
  - Green benefits
- The current soil vapor extraction system will continue to protect current workers until remedial objectives are attained

In Situ Bioremediation

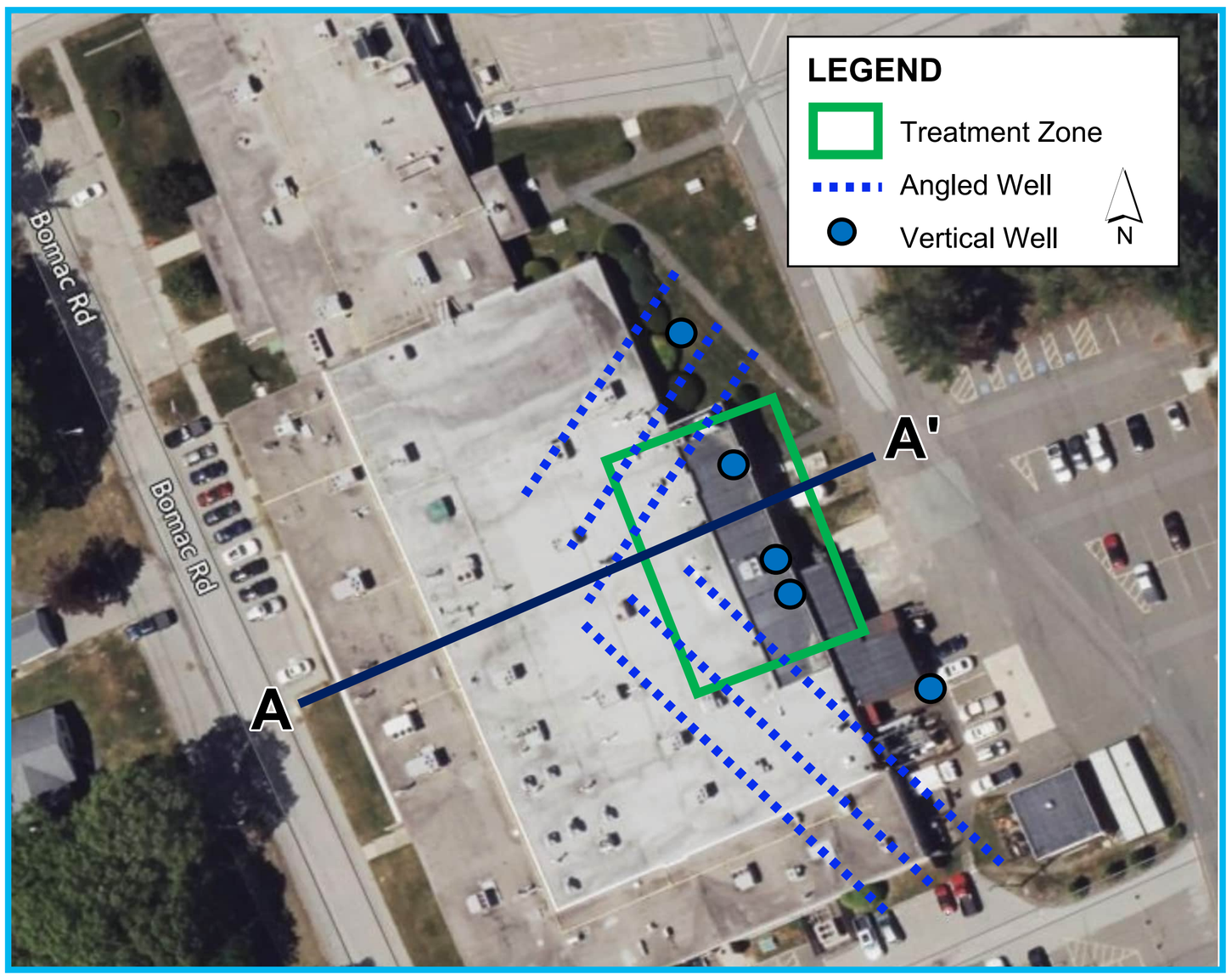


In bioremediation, microbes consume nutrients and contaminants, and release gases and water.

Source: Adapted from Community Guide to Bioremediation (USEPA, 2021)
https://semspub.epa.gov/work/HQ/401583.pdf

Based on test results:

- Injection depths and locations will be selected
- Additional treatment wells will be installed
- Monitoring will be conducted at wells not used for injection



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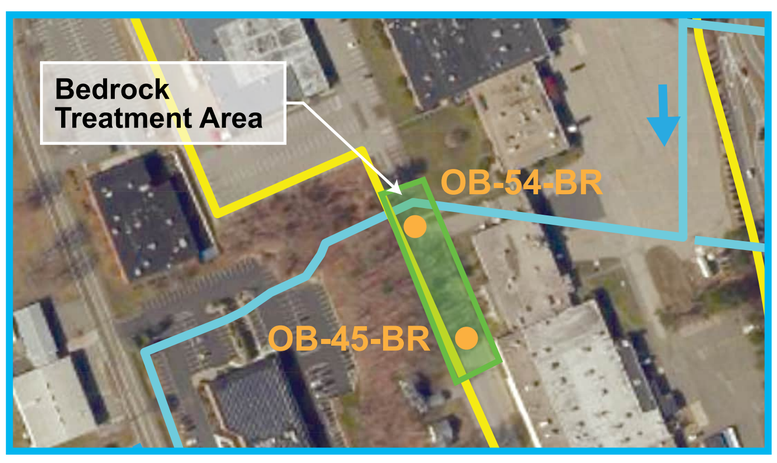
Bedrock

Selected Treatment:

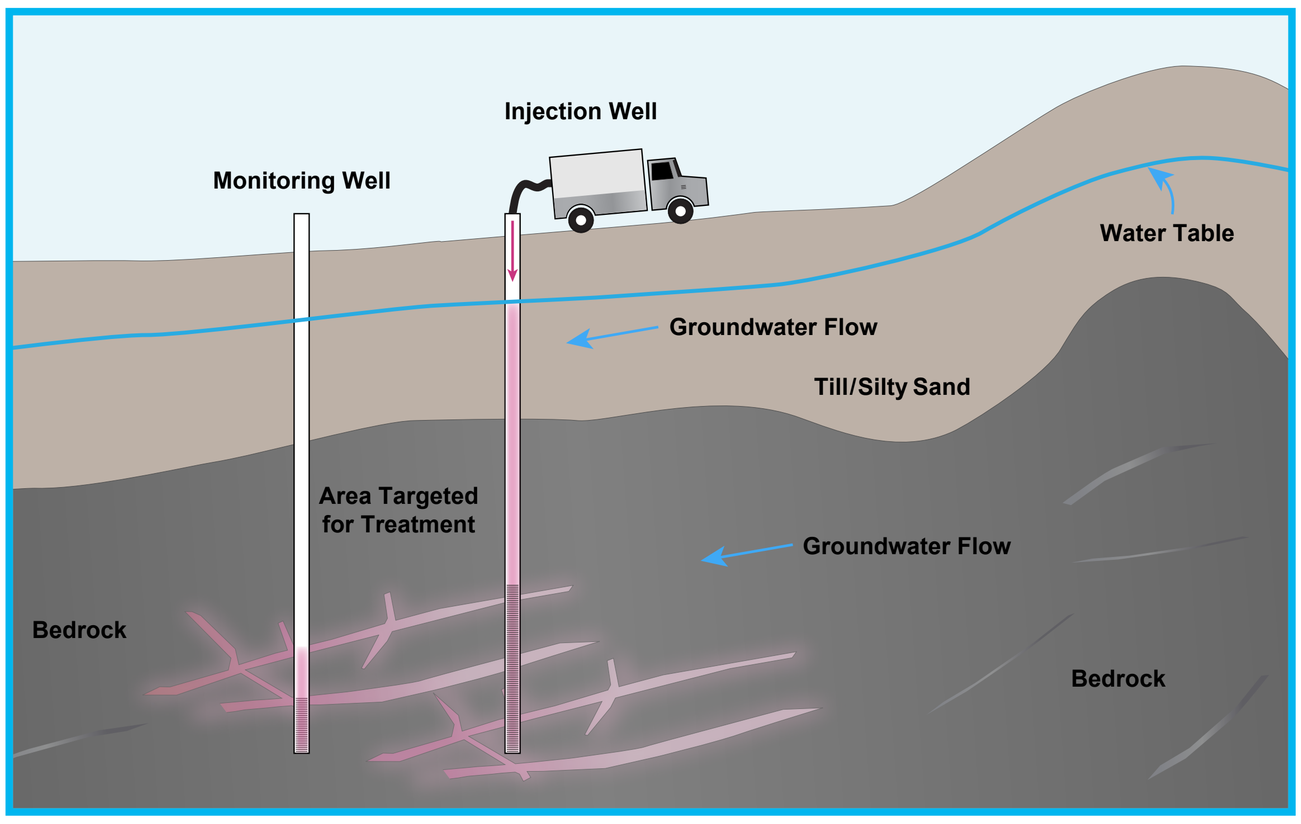
- In situ chemical oxidation

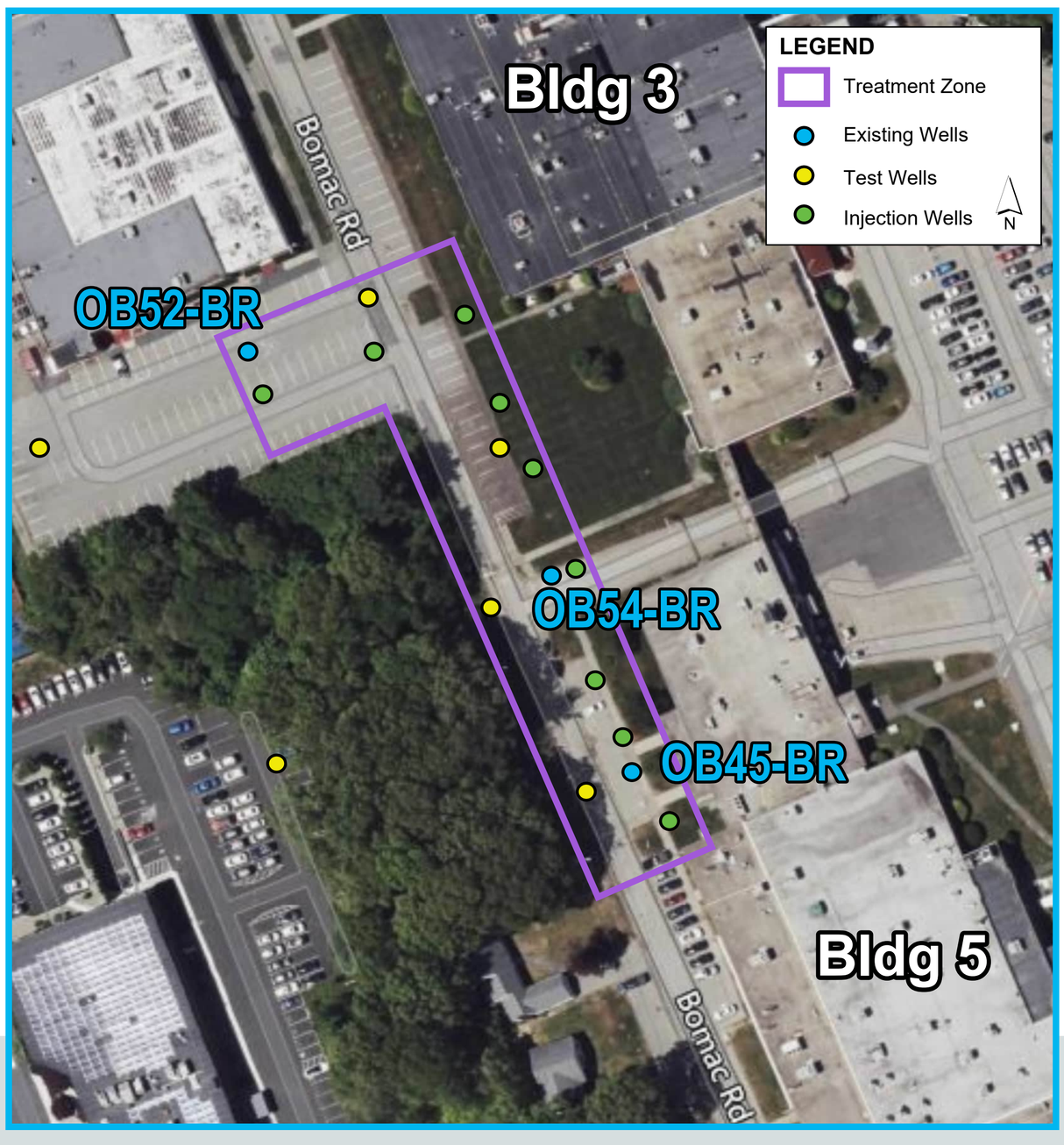


- Chemical oxidation refers to the use of oxidants to convert contaminants to non-hazardous or less toxic compounds
- In situ chemical oxidation was selected given elevated groundwater concentrations and potential presence of DNAPL
  - Treatment will use new application methods (e.g., push/pull injection)
  - Increased post-injection monitoring period to verify long-term remedy effectiveness

Components of the Treatment System:

- Permanganate holding tanks and hoses
- Pumps
- Downgradient non-injection test wells
- Regular field monitoring (real time)
- Regular groundwater analytical testing





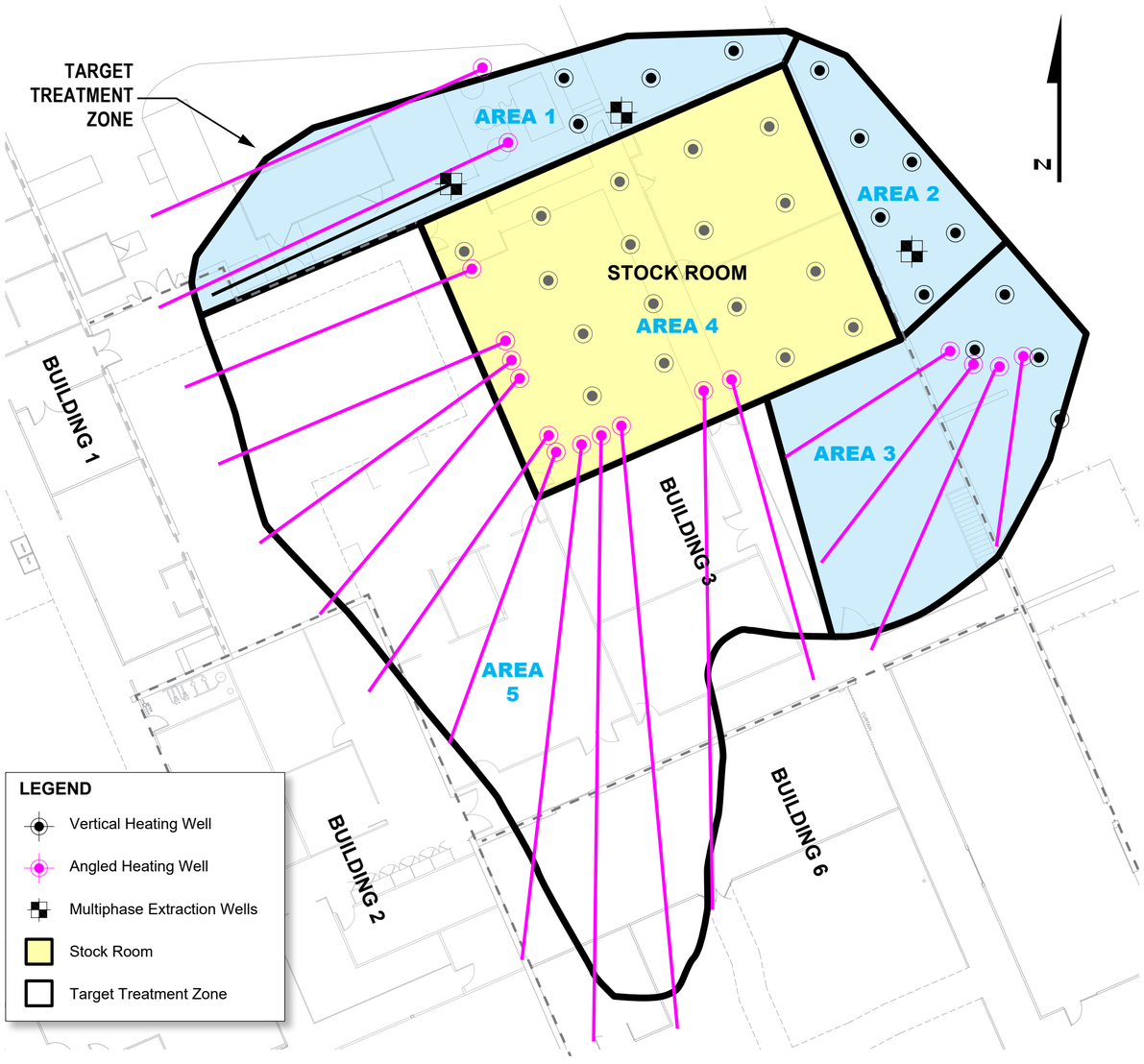
Implementation activities will include:

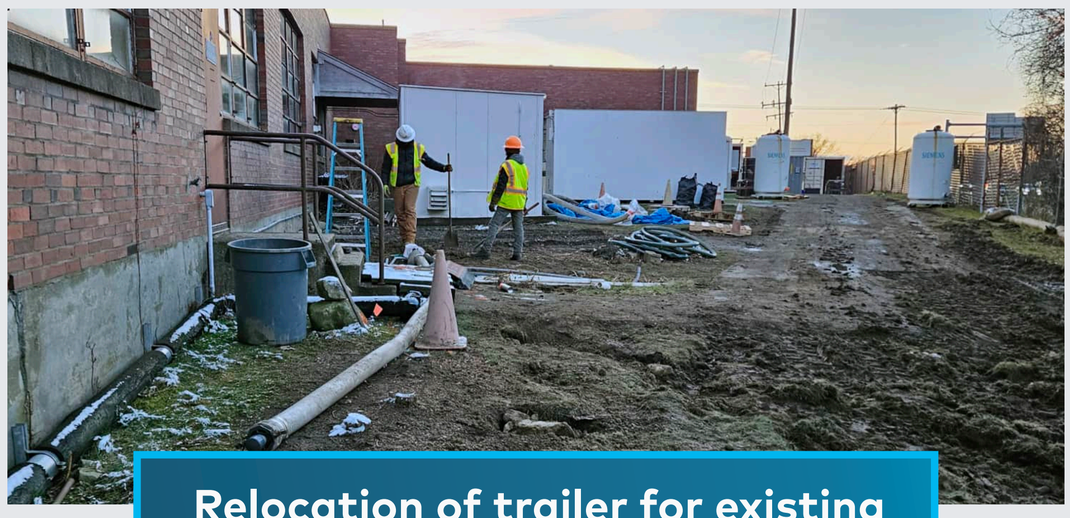
- Advancing vertical borings into bedrock
- Sampling groundwater and conducting tests to confirm connections in fractures
- Install monitoring and injection wells
- Injection of permanganate (an oxidant) to chemically oxidize contaminants
- Monitoring during injection

Building 3 Source Area

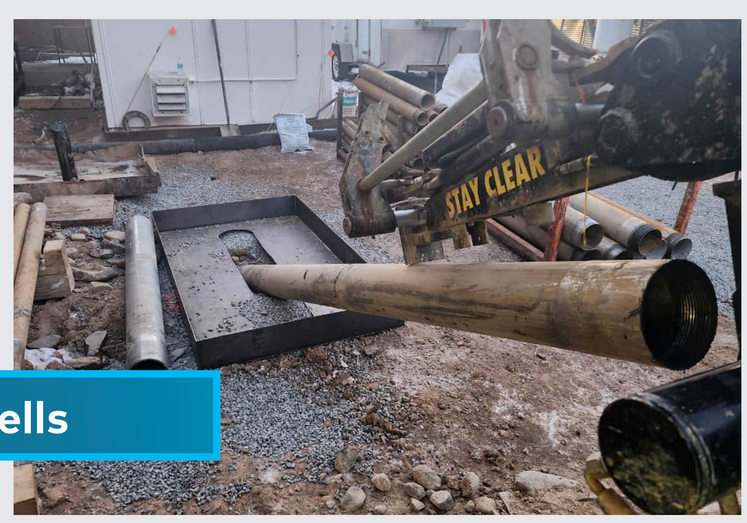
Selected Treatment:

- In situ thermal treatment
- In situ bioremediation polish
- Continued soil vapor extraction





Relocation of trailer for existing soil vapor extraction system



Drilling and installing angled heating wells

Determining the depth needed for heating wells

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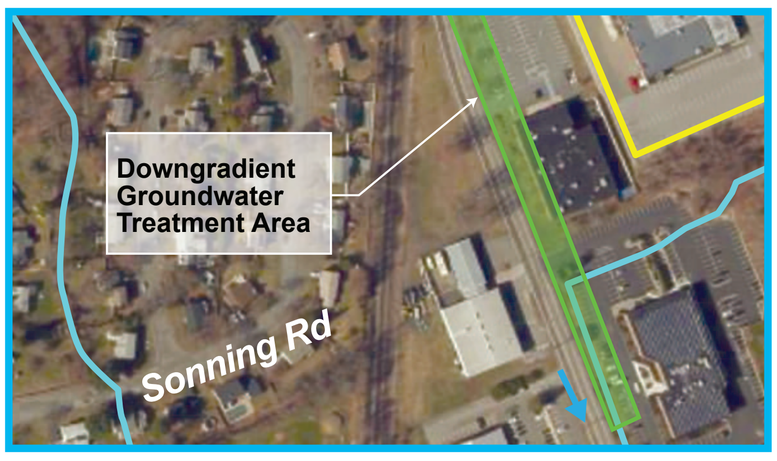
Downgradient Groundwater (Tozer Road)

Selected Treatment:

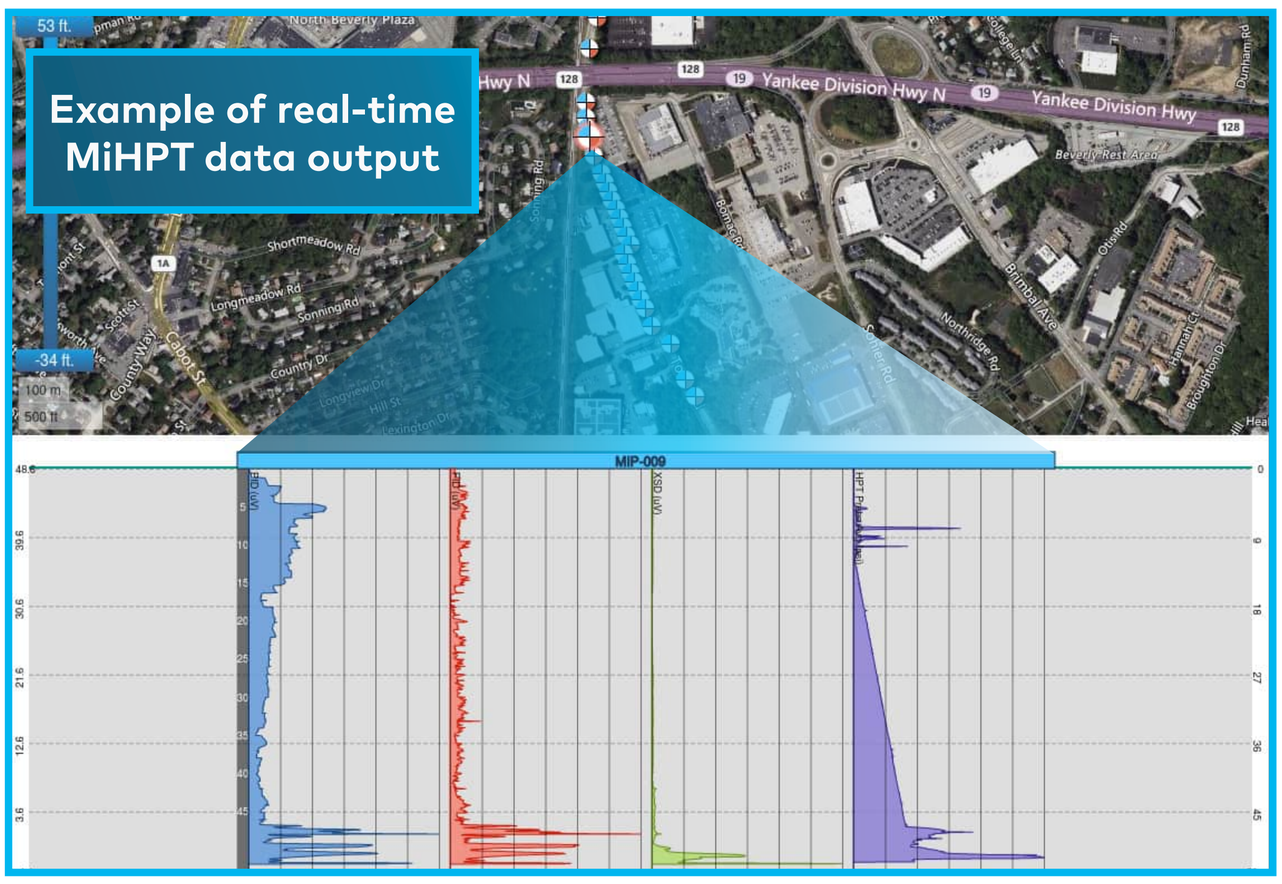
- Permeable reactive and adsorptive barrier



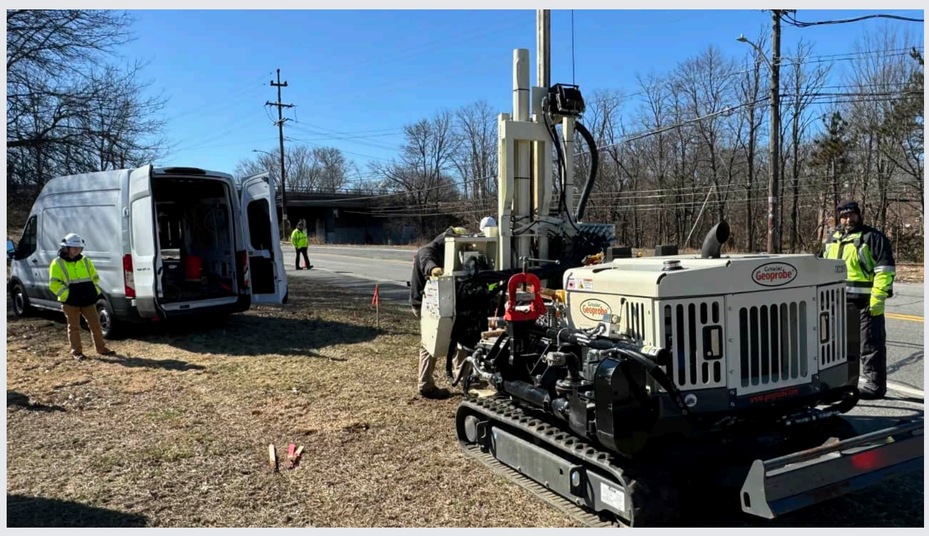
MiHPT Investigation

- Supports design of a permeable reactive and adsorptive barrier using sulfidated microscale zero-valent iron and colloidal activated carbon

Work along the edge of Tozer Road required lane closures and police detail.



A drill rig and data-collection van were used to obtain real-time data at multiple locations along Tozer Road.



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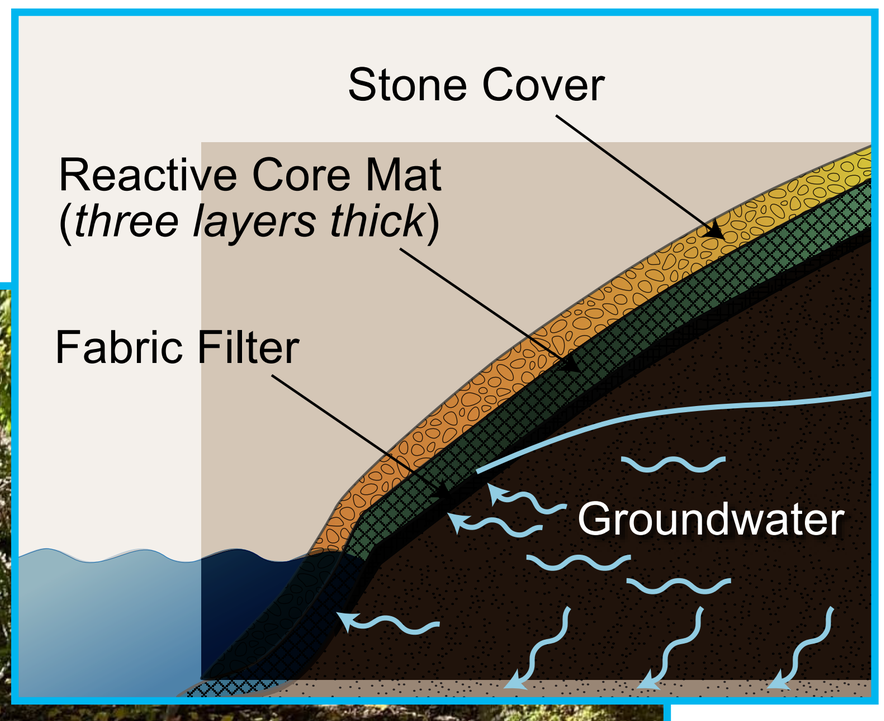
Stream A Seeps

Treatment in Progress:

- Permeable adsorptive barrier

- Installation completed
  - Designed to intercept and capture contaminants before water discharges to the stream
  - Installation included erosion controls to protect the stream during construction
  - Mats are covered to limit washout and tampering
  - Monthly inspections will be completed for the first six months
  - Additional inspections following major rain event will also be completed

Stream A Mat Installation



Reactive Carbon Core Mats Protected with Stone Cover

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