

CLEAN UP OF 1,4-DIOXANE USING PROPANE BIOSPARGING RACER TRUST SITE LANSING, MICHIGAN

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Overview

- What is Propane Biosparging?
- How Does Propane Biosparging Work?
- How Does Propane Biosparging Clean up 1,4-Dioxane?
- What will the Propane Biosparge System Look Like?
- How do we know the Propane Biosparge System is Working?
- Clean up Objectives



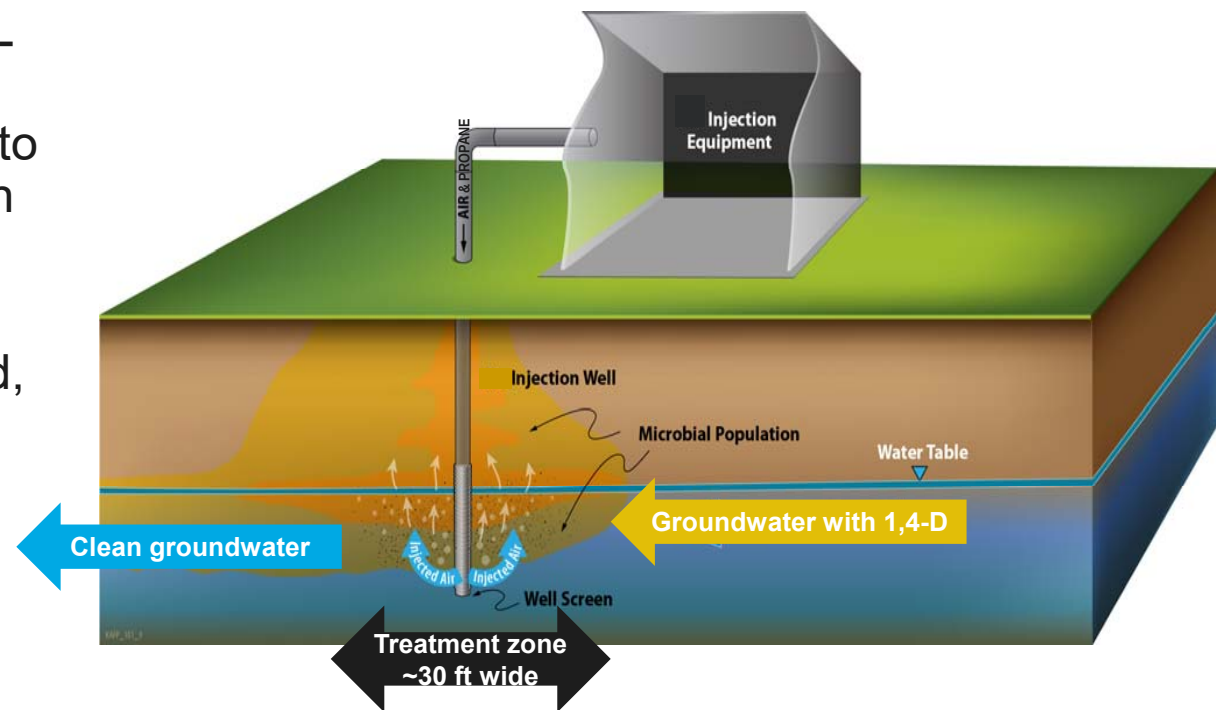
What is Propane Biosparging?

- Microbes present in groundwater can break down 1,4-dioxane into carbon dioxide and water under certain conditions
- Conditions required for microbes to break down 1,4-dioxane:
 - Propane - food source for the microbes
 - Oxygen – microbes need oxygen for the break down process
 - Nutrients – just like us, microbes need proper nutrients to be healthy
- The propane biosparge system will be designed and operated to maintain the conditions required for the microbes to break down 1,4-dioxane in the plume in the weathered bedrock
- Propane biosparging has been tested at the Lansing Site and has successfully treated 1,4-dioxane in groundwater



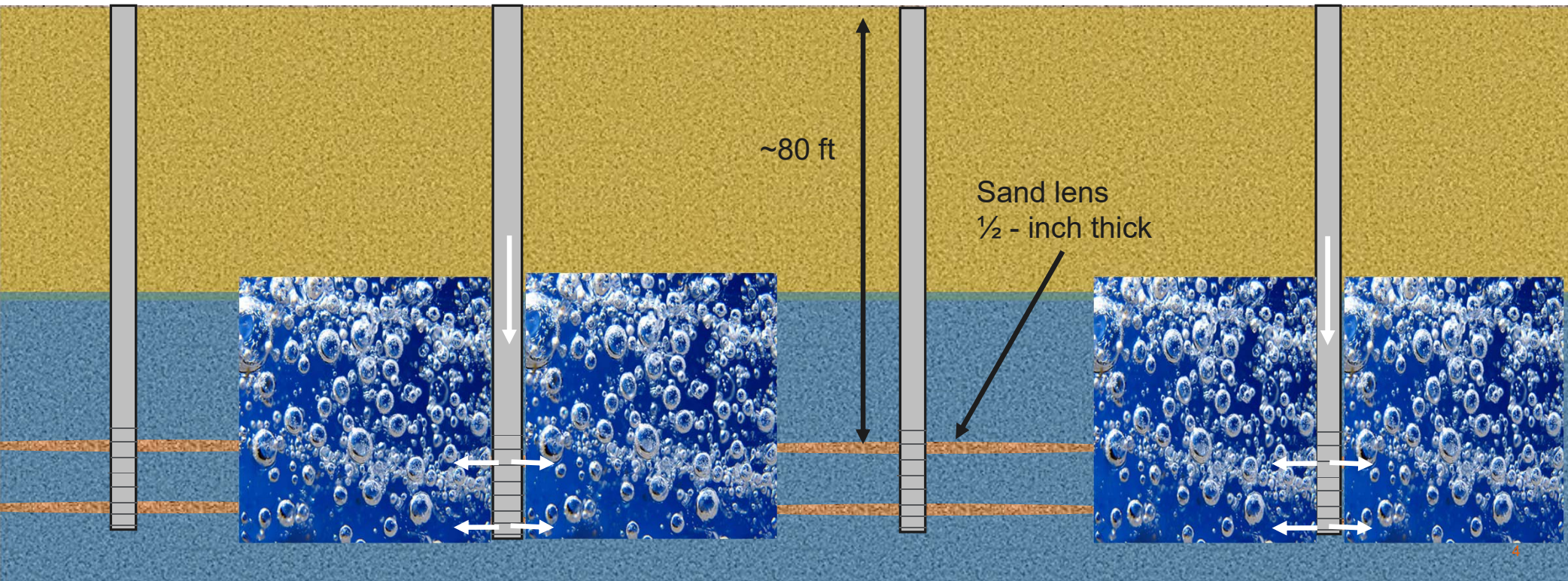
How Does the Propane Biosparge System Work?

- Bubble air (oxygen) and small amounts of propane into the 1,4-dioxane groundwater plume through injection wells – similar to air injected to a fish tank through a bubbler
- Utilize same injection wells to apply liquid nutrients (as needed, approx. 1 per year)
- Multiple injection wells, spaced about 30 feet apart, will be installed in lines (aka “treatment transects”) across the plume to create a treatment zone for groundwater to flow through

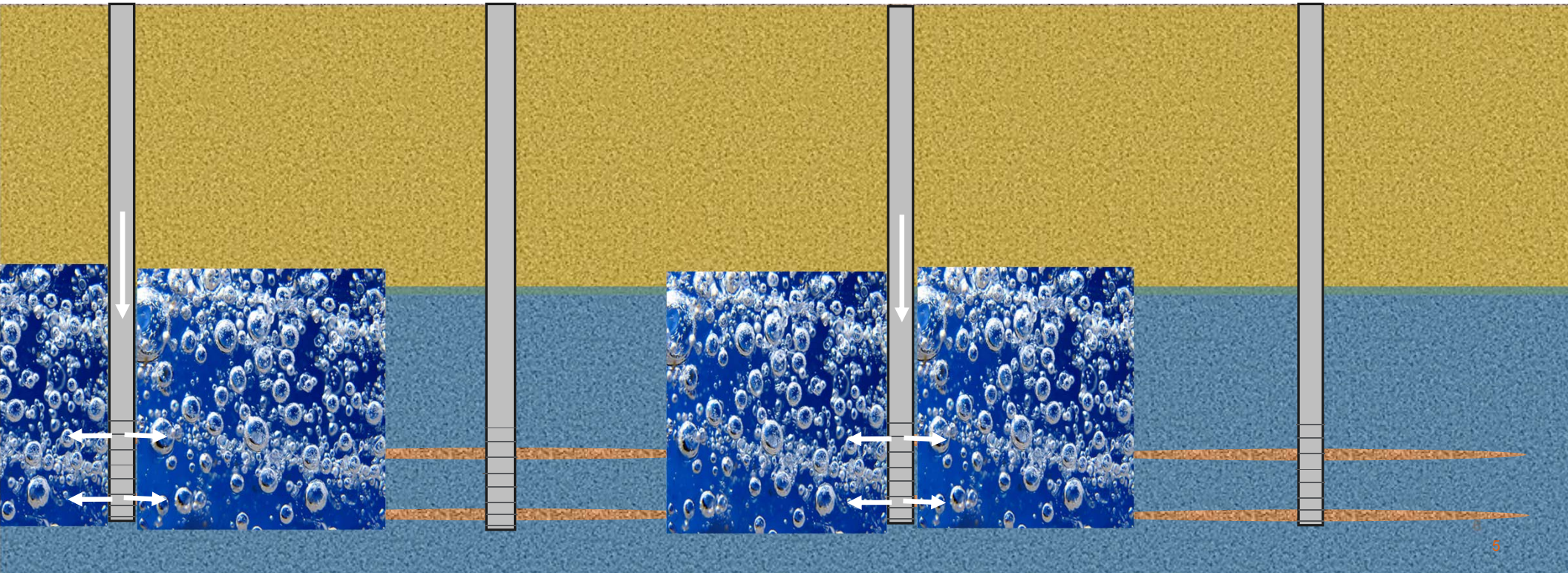


Injection Well (aka Biosparge Well) Operation

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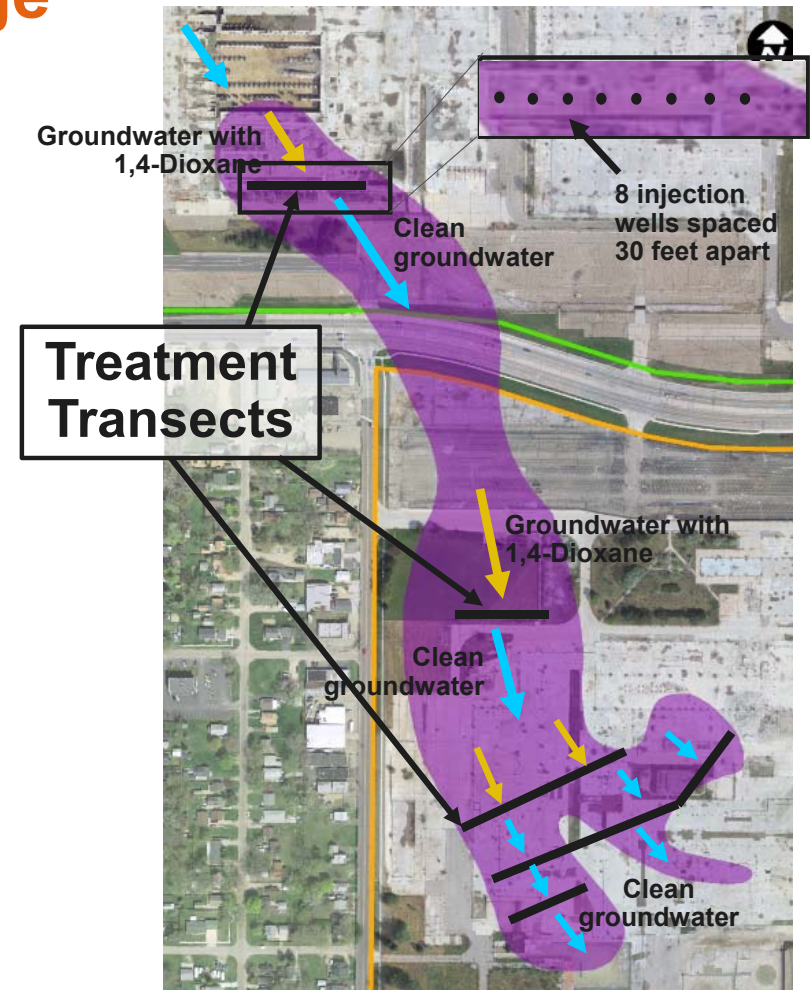
Injection Well (aka Biosparge Well) Operation



How Does the Propane Biosparge System Clean Up 1,4-Dioxane?

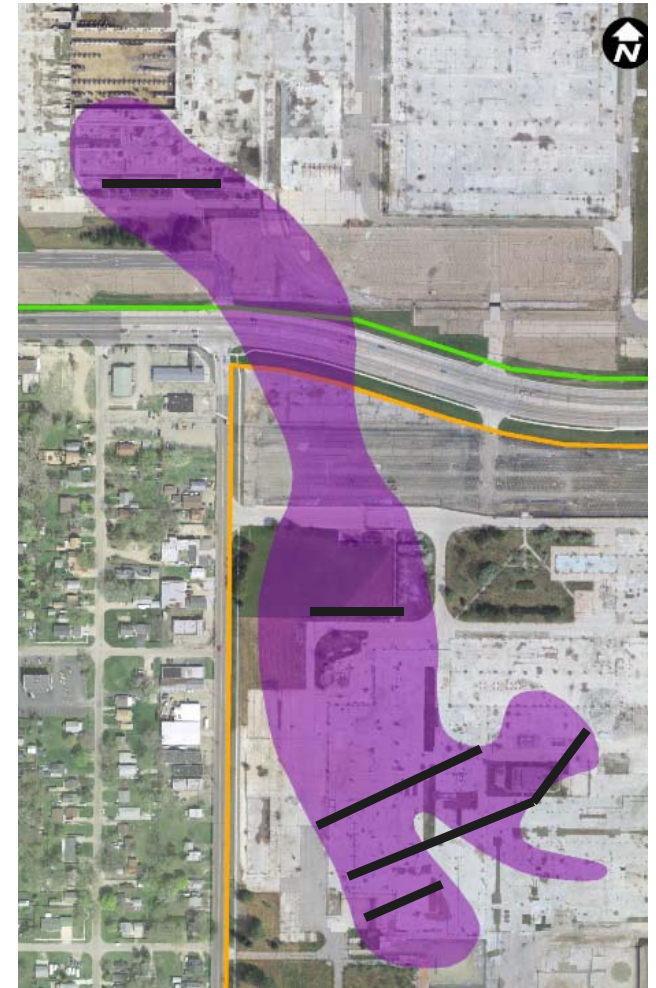
- 1,4-dioxane in the groundwater is treated in the treatment transect, then clean water will flow downstream toward the next treatment transect, cleaning up groundwater between transects
- Groundwater moves faster in the northern part of the plume and slower in the southern part of the plume.
 - Faster moving groundwater will flow more quickly between transects, therefore the treatment transects can be spaced further apart.
 - Slower moving groundwater requires treatment transects to be closer together
- Estimated time to meet clean up objective, 6 to 12 years

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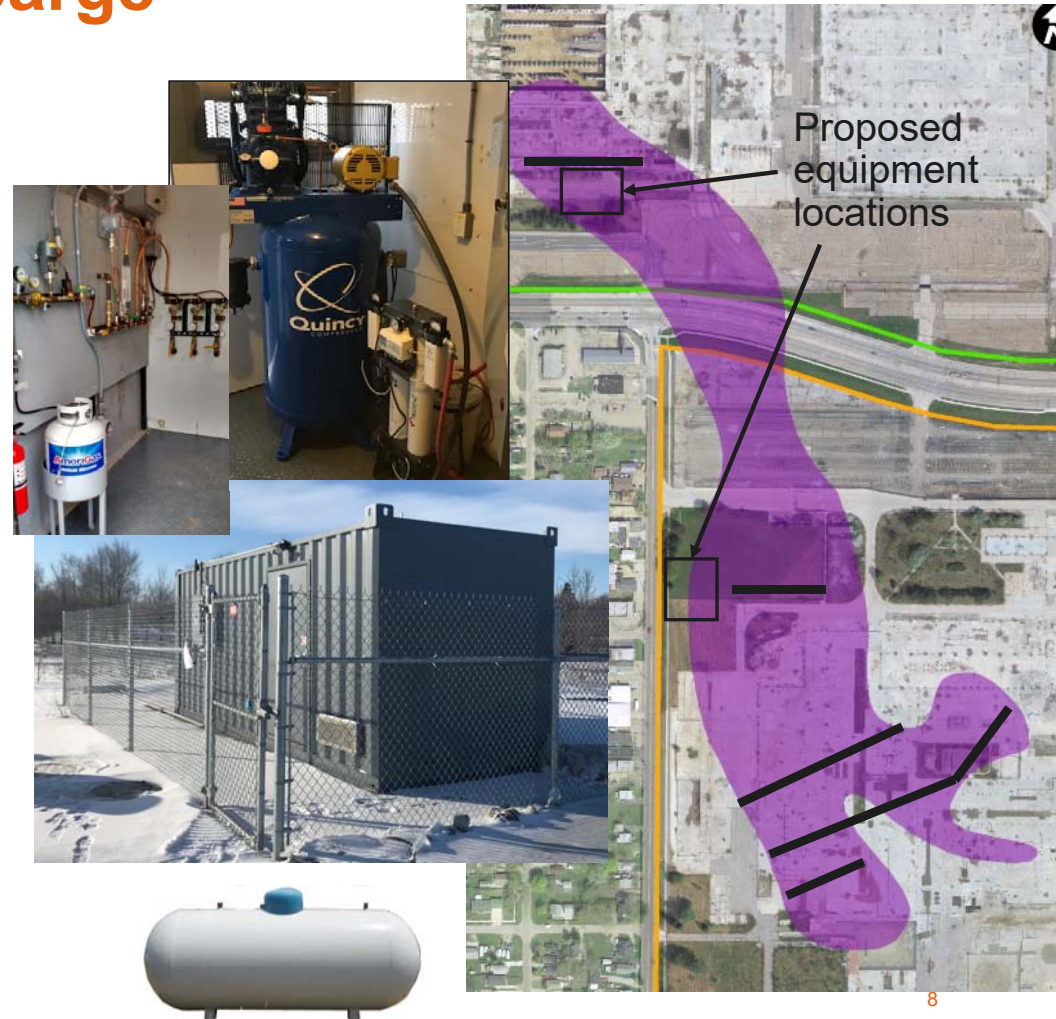
Summary of Propane Biosparge

- Treatment transects placed across the plume
- Total of approximately 60 biosparge wells
- Two sand lenses will be installed at each biosparge well to make sure the air and propane extend at least 15 feet from the well
- Injection of air and propane will be cycled on and off to create optimal conditions for the microbes to break down 1,4-dioxane
- Concentrations of propane injected will be a fraction of what could be considered dangerous
- Significant safety controls and safety monitoring will be in place to turn off the system if unsafe conditions are encountered



What Will the Propane Biosparge System Look Like?

- Equipment (air compressor, air filters, piping, valves, etc.) will be housed in a shipping container
- Plant 2 propane biosparge system will be located on the west side of Plant 2. Residential style propane tank will sit outside the shipping container
- Plant 3 propane biosparge system will be located south end of Plant 3. Will use a BBQ grill size propane tank housed in the shipping container
- Shipping containers and exterior propane tank will be fenced in and secure.
- System controls will allow for remote operation and monitoring of the biosparge system



What Will the Propane Biosparge System Look Like?

- Pipes that deliver air and propane to the injection wells will be buried in the ground
- Injection wells will have protective covers flush with grade
- Larger boxes will be present on the Plant 2 western property line for pipe connections and valves



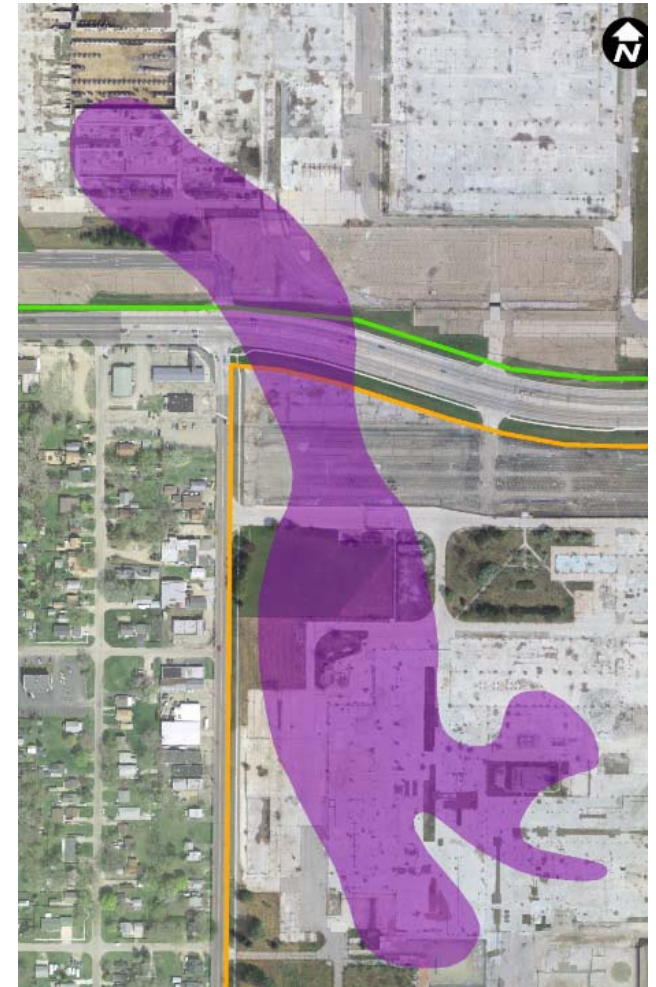
How Do We Know if the Propane Biosparge System is Working?

- Samples of groundwater will be collected from monitoring wells in the 1,4-dioxane plume to confirm that concentrations of 1,4-dioxane are going down
- Monitoring wells will be located upstream of the treatment transects, in treatment transects, and downstream of the transects
- Oxygen, propane, and nutrient levels will also be checked routinely to make sure conditions are best for the microbes to breakdown 1,4-dioxane
- As monitoring shows that 1,4-dioxane concentrations meet the clean up goal in particular areas, the associated treatment transects may be turned off. Monitoring of groundwater after the transects are turned off will continue to ensure clean up goals are maintained.



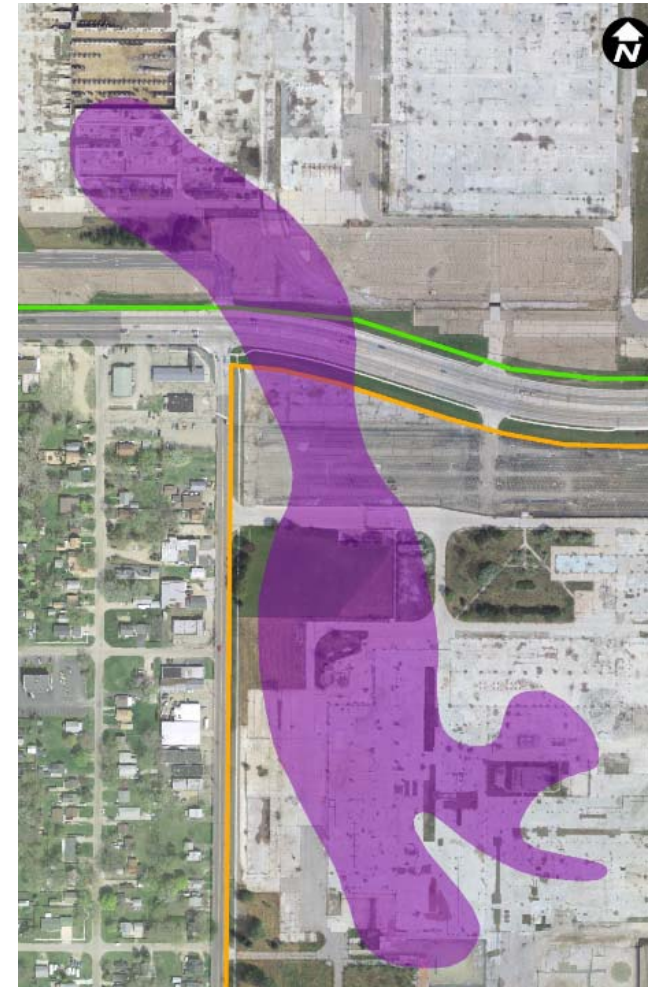
Clean Up Goals

- Short-term objective: Install propane biosparge system to breakdown/destroy 1,4-dioxane in the weathered bedrock plume
- Long-term objective: Continued protection of the municipal drinking water supply by continuing to prevent Site related 1,4-dioxane impacted groundwater from migrating off-site at concentrations greater than 7.2 µg/L (Part 201 Drinking Water Cleanup Criteria)
- Biosparge system performance will be evaluated on an ongoing basis to optimize performance



Propane Biosparge Approval Process

- MDEQ consideration of work plan - ongoing
- Public meeting
- Address MDEQ/Public comments on propane biosparge plan
- Upon MDEQ approval:
 - Install and start up Plant 3 biosparge in first half of 2019
 - Install and start up Plant 2 biosparge in late 2019/2020



Thank you!



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