Landfill Gas Design and Management Practices

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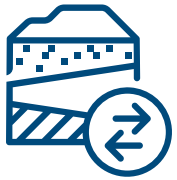
Challenges of Landfill Gas Collection

Landfills are **engineered biological structures**

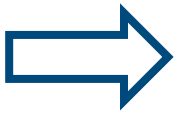


Dynamic and complex environments

~~One Size Fits All~~

Different situations require different approaches. **Not all landfills are the same.**

Need flexibility to apply the most appropriate solutions.



We Keep Pushing

Industry's goal is constant improvement. We are innovating.

We also need the space to iterate and try new things without being boxed in so we can continue to evolve the state of practice.

Multiple Tools in the Toolbox

Lots of different ways to get to the desired endpoint.

Design Innovations

Slope Collectors

Vertical communication

Bottom-up gas collectors

New gas well liquid pump designs

Renewable natural gas and other LFGTE end uses

Avoid Unintended Consequences

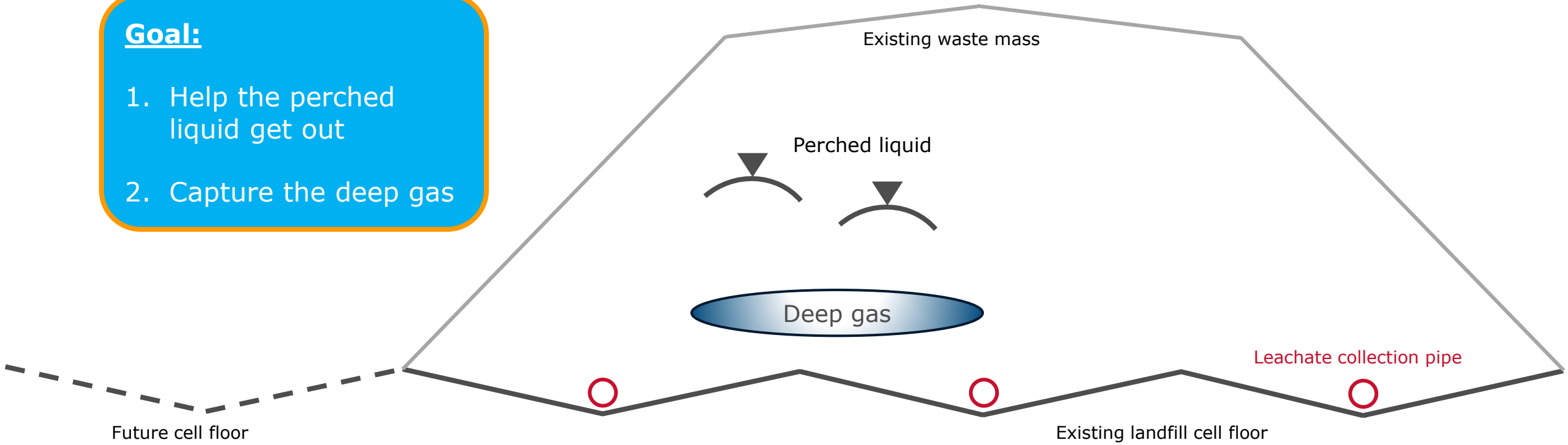
Some things sound good or look good on paper but are not necessarily the best solution.

e.g., caisson wells, automated wellheads

Design Innovations – Slope Collectors

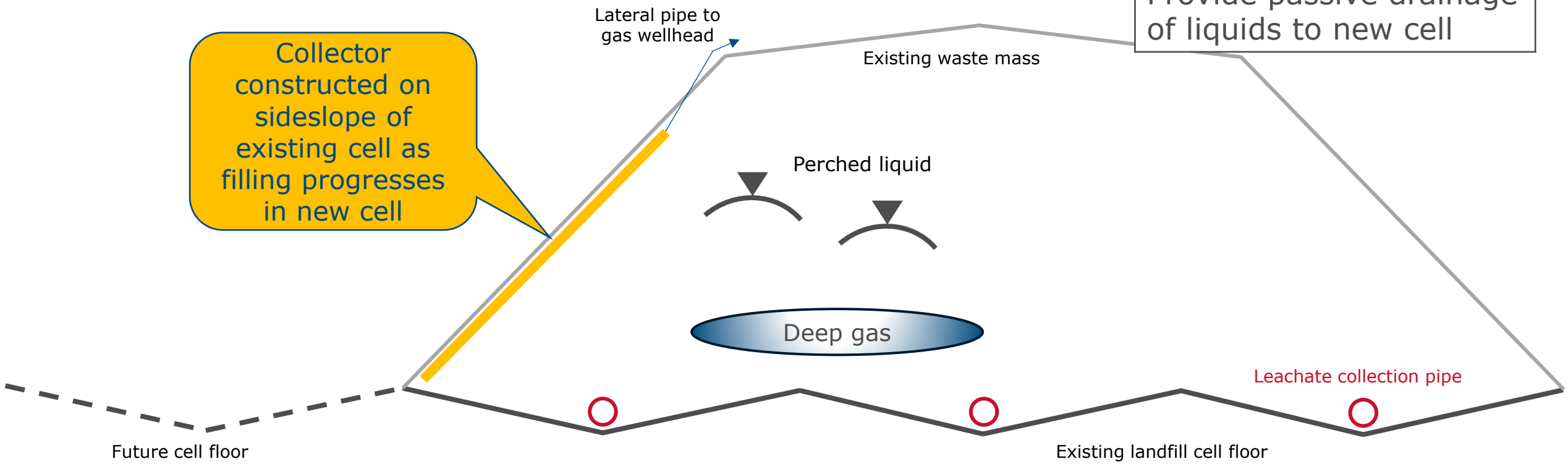
Goal:

1. Help the perched liquid get out
2. Capture the deep gas



Design Innovations – Slope Collectors

Goal
Capture deep gas while filling adjacent cell
Provide passive drainage of liquids to new cell



Advantages: (1) Will not "water in", (2) not in the way of filling operations, (3), captures deep gas from existing waste, (4) passive drainage for trapped liquids

Design Innovations – Slope Collectors

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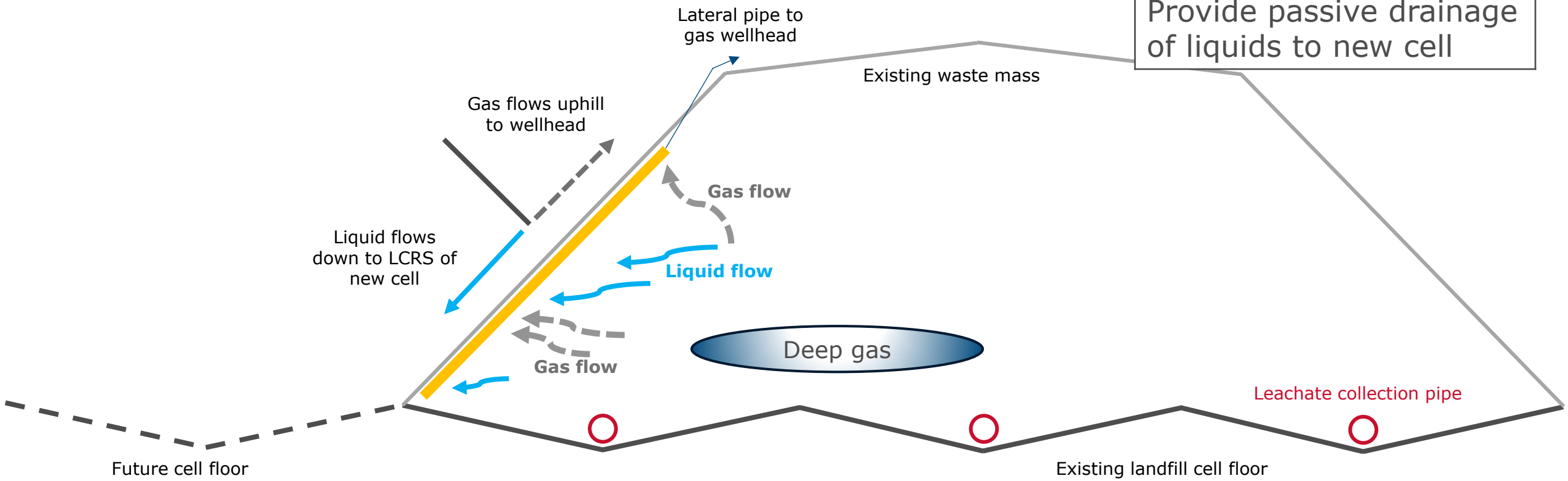
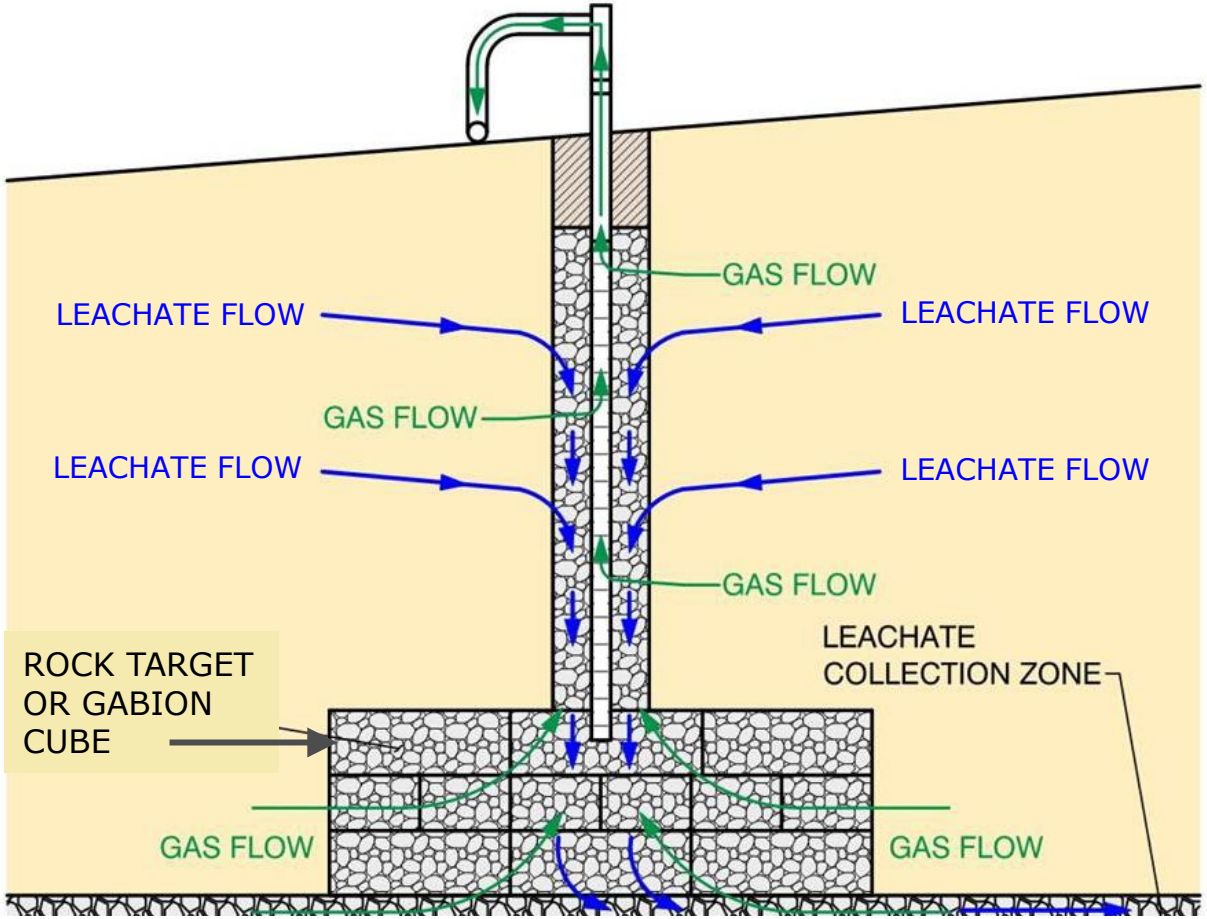


Advantages: (1) Will not "water in", (2) not in the way of filling operations, (3), captures deep gas from existing waste, (4) passive drainage for trapped liquids

Design Innovations – Vertical Communication

Goal
Provide passive drainage of liquids to LCRS
Capture deep gas



Does not require gabion cube; other methods also appropriate.

Concept

1. Install "target" on cell floor during cell construction.
2. Fill waste
3. Drill to target
4. Promote liquid movement downward and robust gas collection

Downsides

1. Cannot "retrofit" existing waste to incorporate these. Must tie into leachate collection zone.
2. **<u>Large emitters of gas if vacuum lines fail</u>** (chimneys)
3. Expensive

Design Innovations – Bottom-Up Gas Collection

Concept being tested

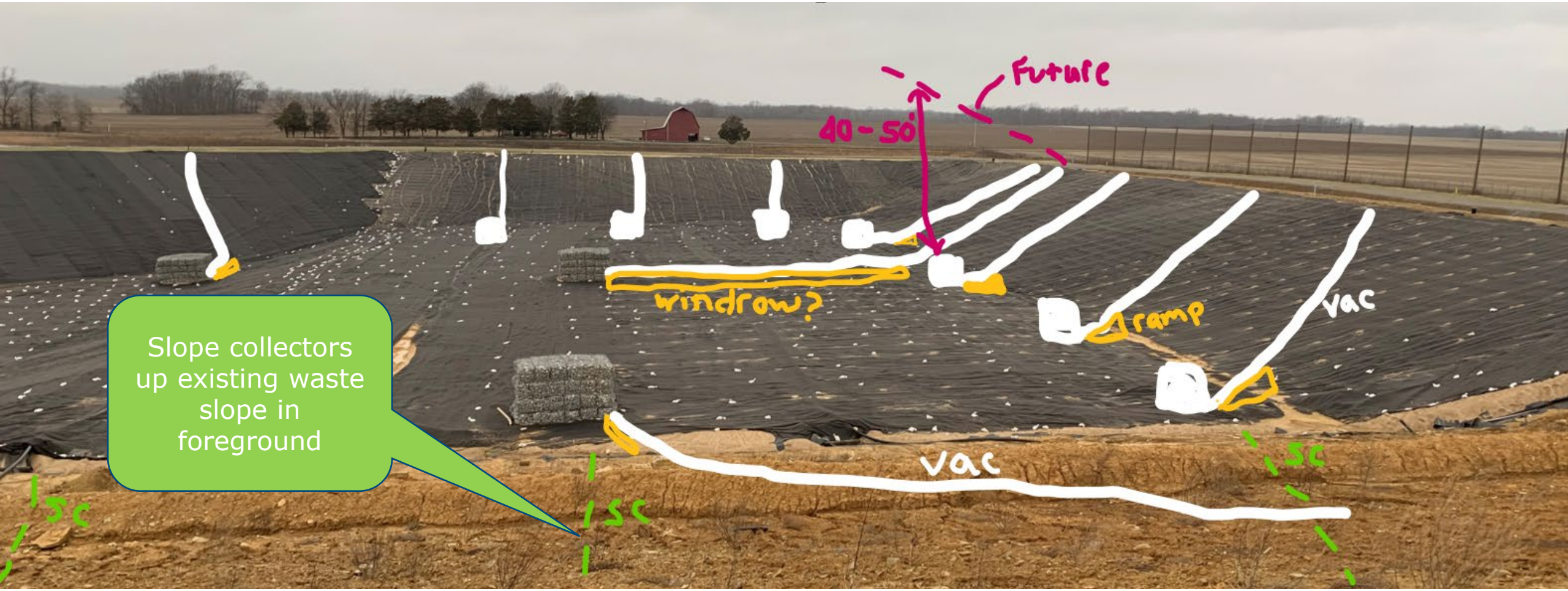
- Imagine flipping the well upside down
- Pull the gas to the cell floor where vacuum lines are installed
- Multiple types of collectors involved

Results so far

- Inconclusive results, difficult to determine causes of failure at specific collectors
- Possibly too many collectors per acre
- Assessing vacuum influence between collectors
- Additional refinement needed

Example of one innovation being pursued. Need to ensure regulatory structure does not inhibit trials like this.

Design Innovations – Bottom-Up Gas Collection



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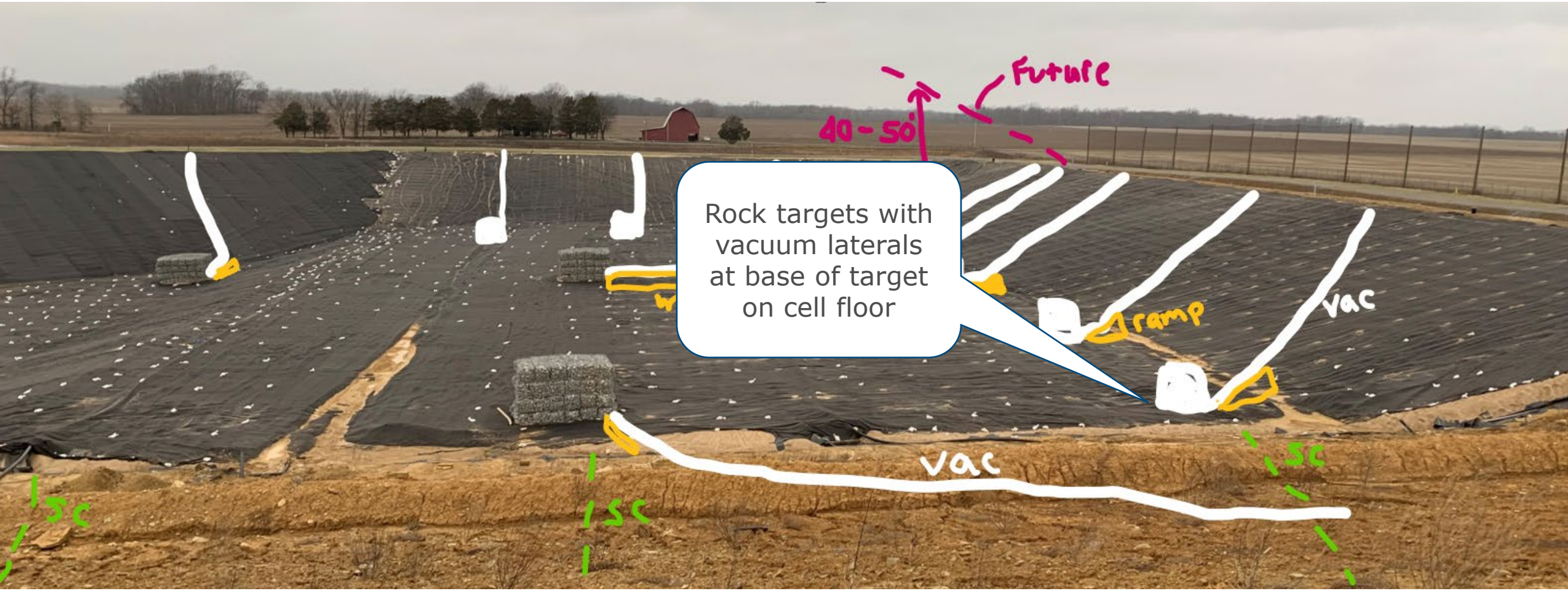
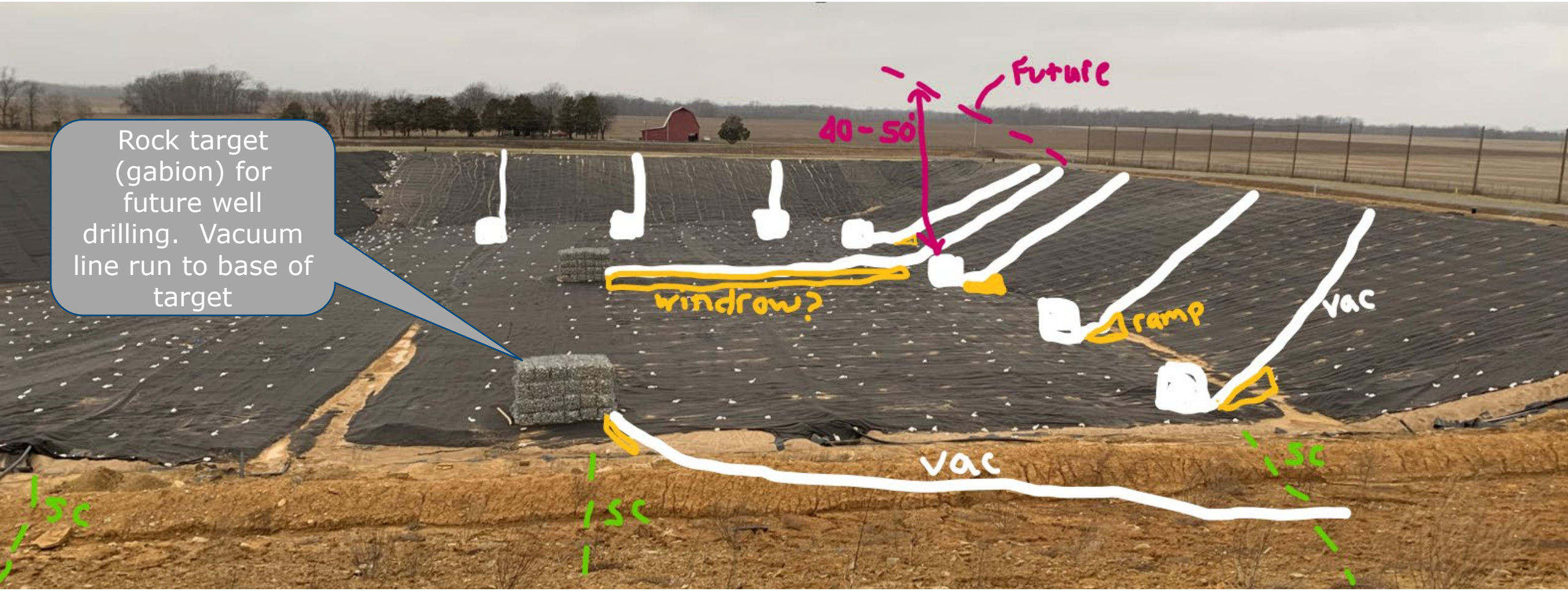
Design Innovations – Bottom-Up Gas Collection



Design Innovations – Bottom-Up Gas Collection



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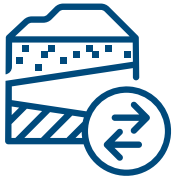
Final Thoughts

Additional factors affecting gas collection approaches

- Age and type of waste
- Geometry of landfill



Landfills act as a sponge

Decrease in observed gas flow does not equate to higher emission levels

Cannot let elevated gas temperatures dictate gas extraction. **Need regulatory agencies to issue higher operating value (HOV) approvals to allow warm gas to be removed from the waste mass.**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