Practical Ex-situ Remediation for Hydrocarbon Impacted Sites

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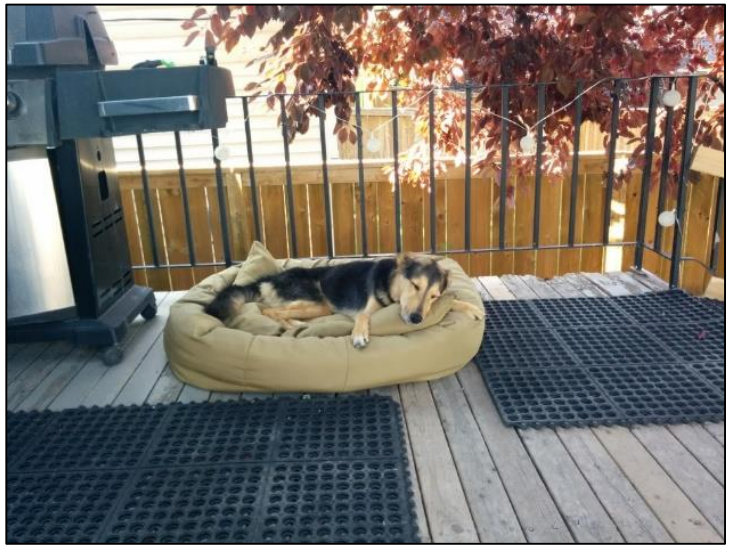
Regulatory Perspective and Focus

- 2018 Alberta Remediation Act is a game changer
- Formalizes new regulatory push in Alberta focuses on sites with difficult path to closure (aka “sleeping dog” sites) that have historically been risk managed
- Increased focus on groundwater, receptor risk, and remediation



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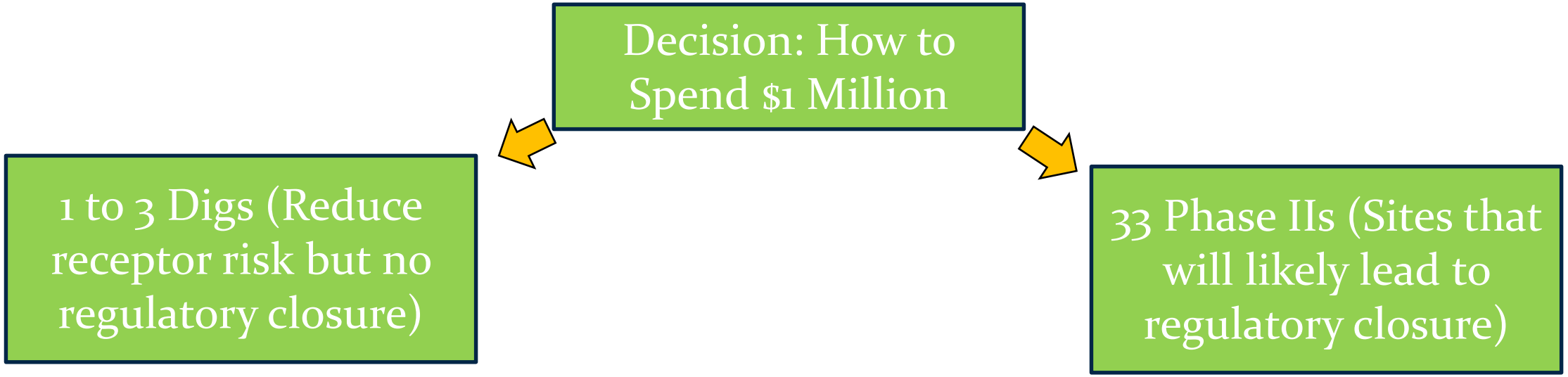
Barriers to Remediating the Sleeping Dogs



- Regulatory rewards for reclamation certificates are easy to understand corporate goals
- It is easy to put a priority on doing low-cost work with a clear path to closure

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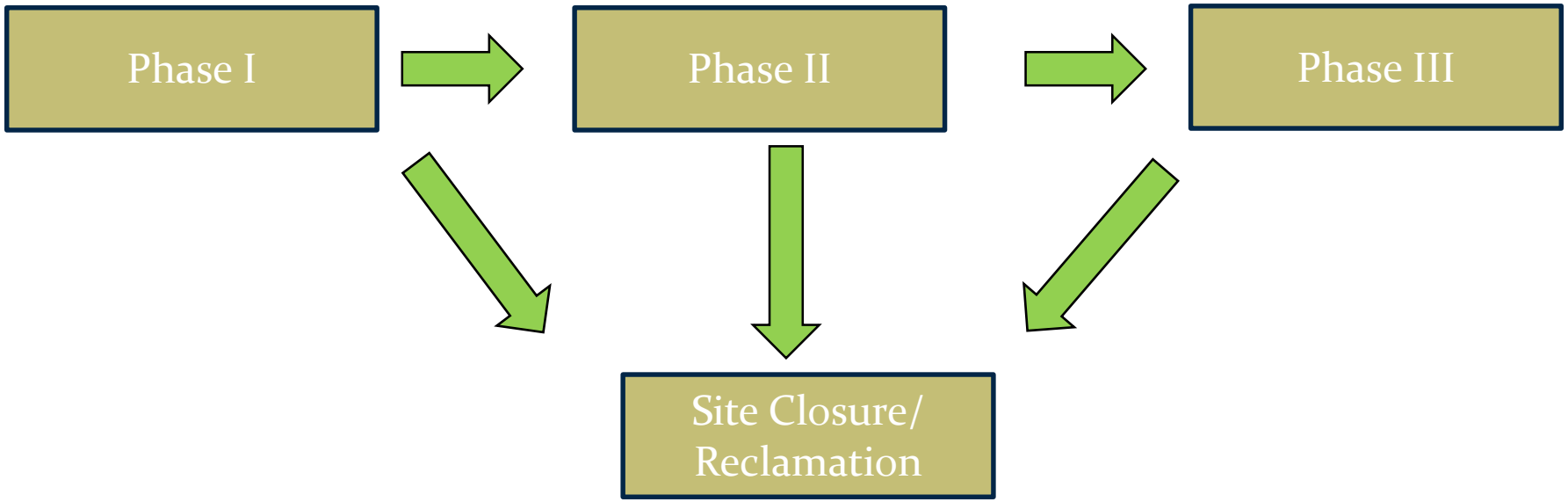
Remediation/Reclamation Work Flow: The Easy Path to Site Closure



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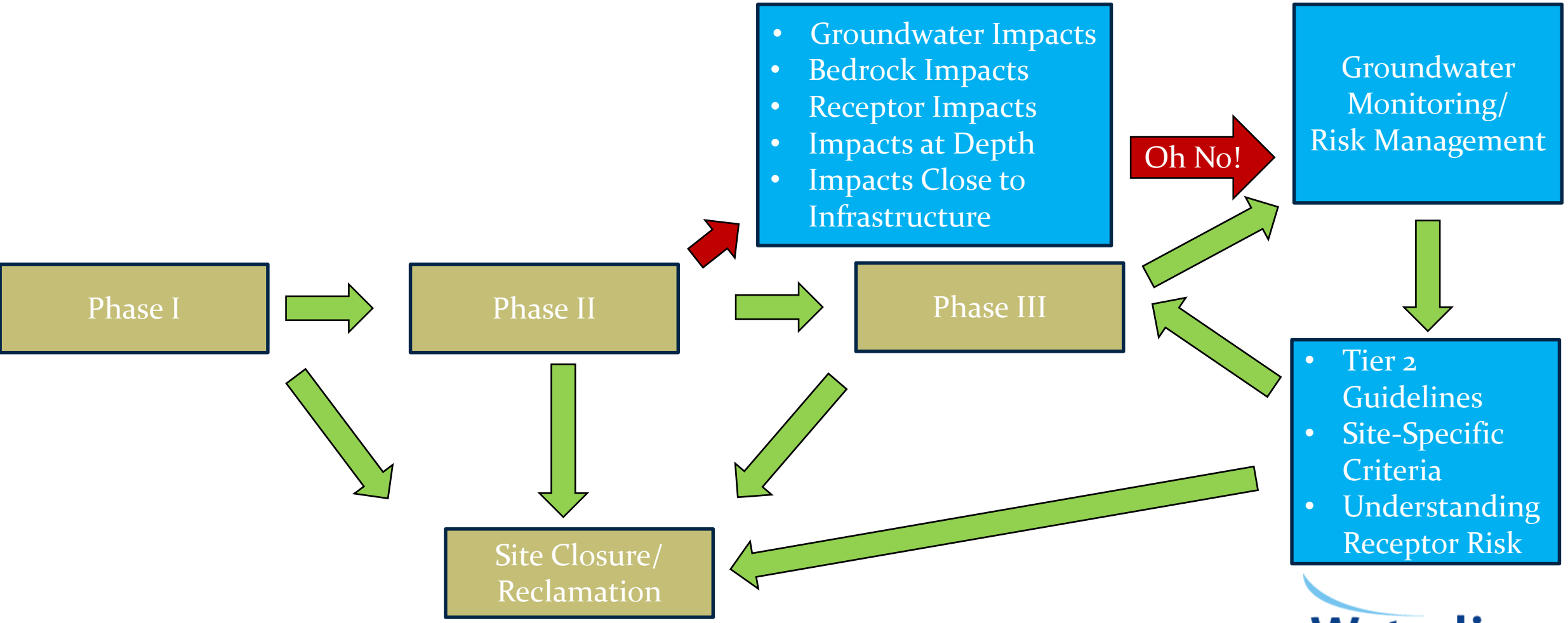
Wrenches in the Work Flow: Risk Management Sites



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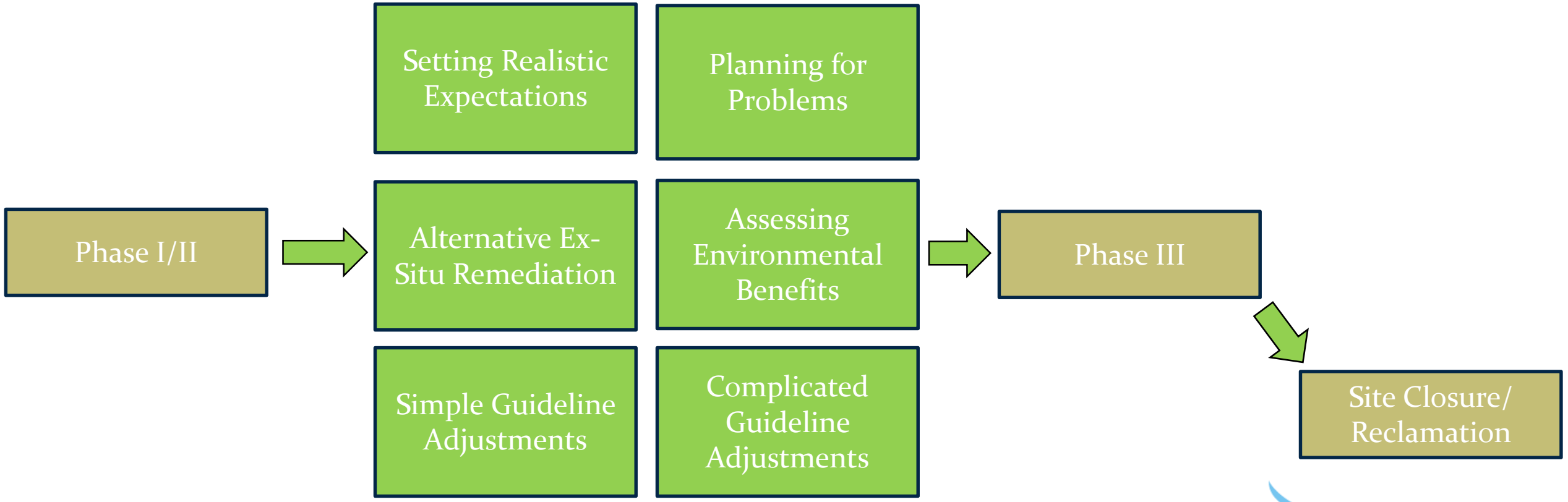
Remediation/Reclamation Work Flow: The Better Path to Site Closure



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Setting Realistic Expectations and Doing Your Homework

- Build a multi-year path to closure
- Set realistic timelines
- Establish the objective: regulatory closure or source removal/risk management?
- Do guideline adjustments before you dig
  - Guideline adjustments are economic for most remediation programs >$100k and can be scaled to suit the budget

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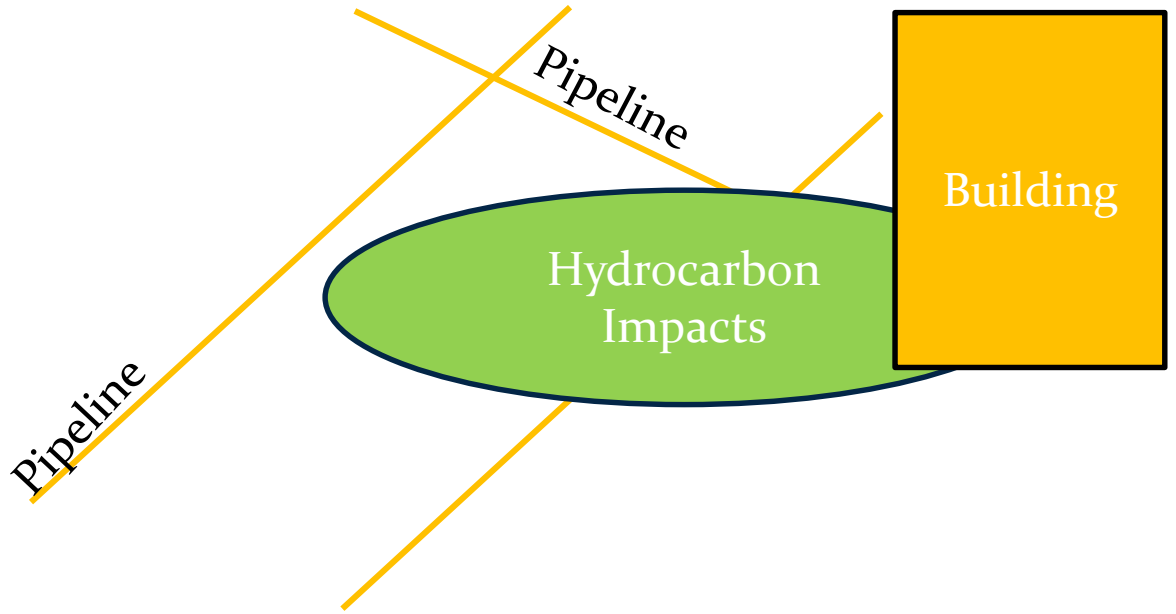
Planning for Problems: Infrastructure



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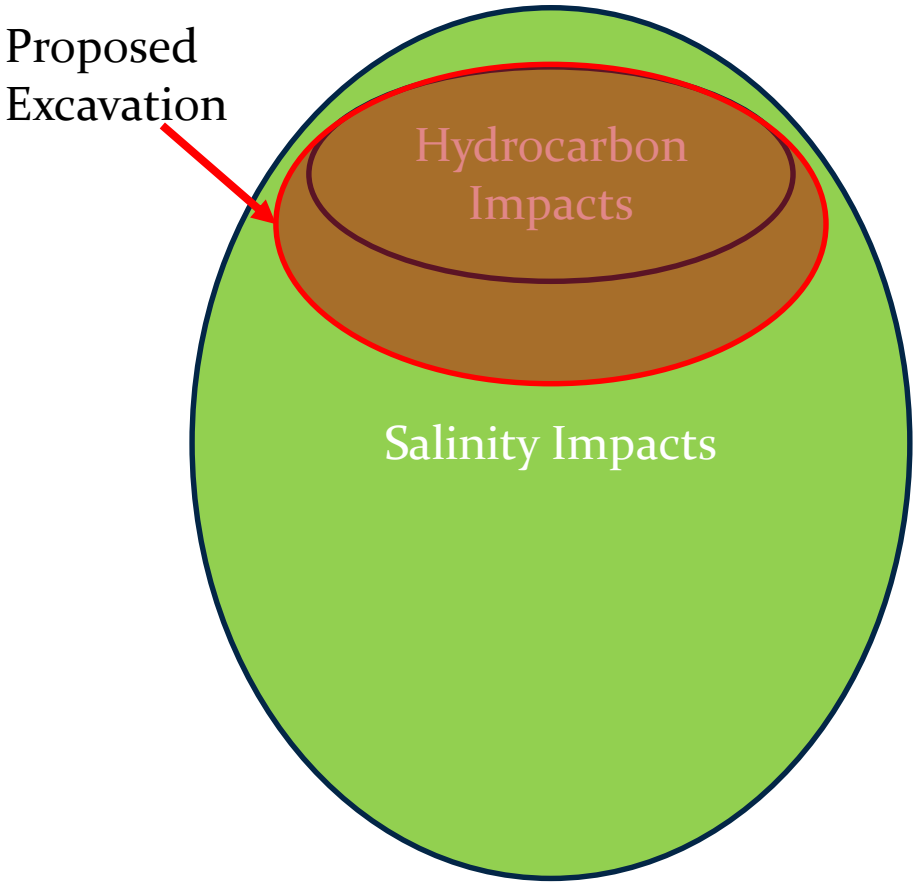
Planning for Problems: Accounting for Contaminants and Pathways That Will Dictate the Path to Closure



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Planning for Problems: Over-Assessment

- It’s counter-intuitive but focusing on additional assessment to address minor details (e.g., secondary contaminants derived from primary contaminants) takes away from funds that could be used for remediation

Alternative Ex-Situ Remediation: Are Landfills the Only Way?

- The majority (>90%?) of contaminated soil is being landfilled in Alberta (and BC)
- Are we playing a game of environmental hot potato? What will happen to landfills 100 years from now?
- Are we addressing environmental liability or will landfill liability eventually fall into the hands of the waste generators or province?

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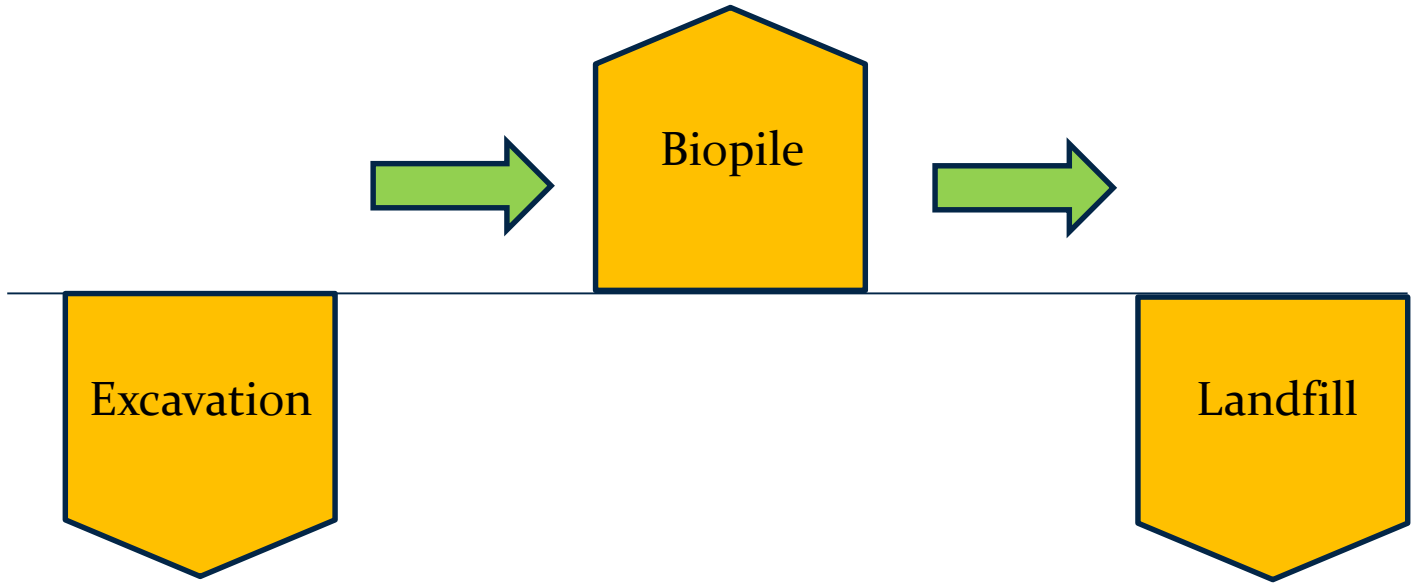
Alternative Ex-Situ Remediation: An Uncertain World

- Uncertainty about whether ex-situ remediation will be successful
  - May have to haul soil to landfill after completing alternative approaches (e.g., biopiles)



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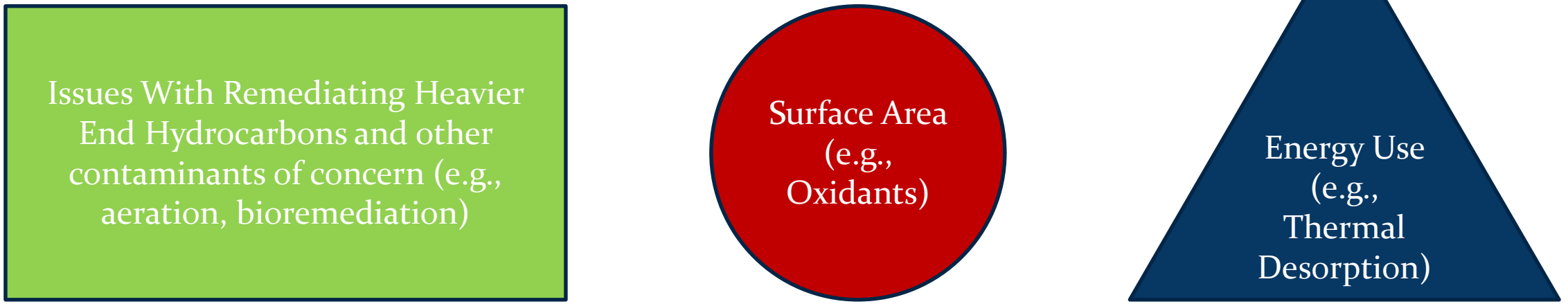
Alternative Ex-Situ Remediation: Road Blocks

- Difficult for alternative methods to be economic compared to apparent certainty and obvious simplicity of landfills (similar to the renewable energy vs. conventional energy debate?)



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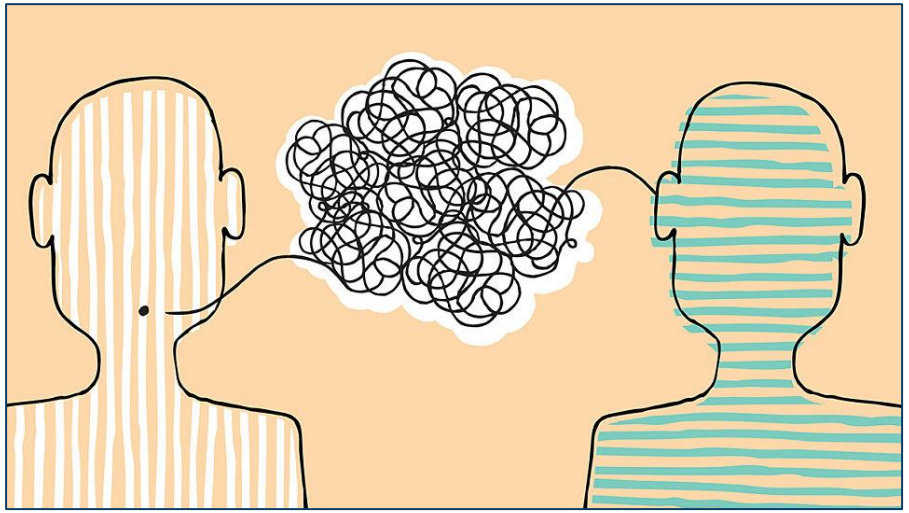
Critically Assessing Environmental Benefits of Remediation

- Net Environmental Benefit Analysis and Sustainable Remediation are formalized frameworks or a semi-quantitative approach can be used

Answer Questions Such As:

- Have guideline adjustments been considered to understand receptor risks, conserve soil, and conserve landfill space?
- How do I minimize the amount of soil that is being needlessly landfilled?
- What is the long-term legacy of landfilling soil?
- What are the ecological effects of remediation?
- What are the energy requirements of remediation?



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Guideline Adjustments

- Generic (and arbitrary) guidelines are often being applied when there are easy guideline adjustments that take minimal additional effort and cost
- Why use guidelines that are protective of receptors that don't exist or aren't representative of reality?

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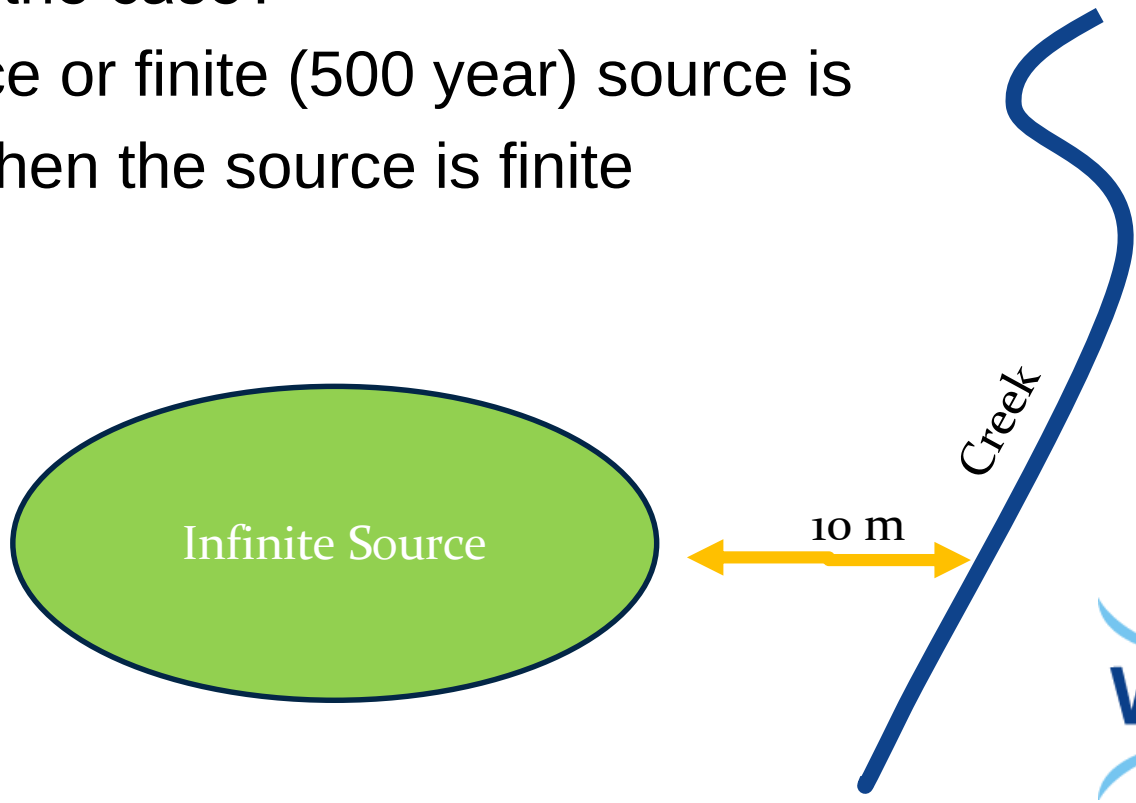
Guidelines

- Generic guidelines are based on conservative assumptions in generic conditions
  - e.g., 10 m from a surface water body. Can you think of sites that you've worked on where that's the case?
  - e.g., a continuous source or finite (500 year) source is

assumed to exist, even when the source is finite

(e.g., a one-time spill)



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Guideline Adjustments

- Benefits are cost savings but also environmental (conservation of soil, long-term legacy of needlessly landfilling soil, decreased fossil fuel use from trucking)
- Don’t remediate unless the guidelines are realistic. Plan ahead and do guideline adjustments before remediation!

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Hydrocarbon Guideline Adjustments: Easy Wins

Alberta Tier 1/2 Guideline Adjustments/Exclusions

- Distance to freshwater aquatic life water bodies
- Subsoil guidelines for hydrocarbons in soil and groundwater
- PHC subsoil guidelines within 5 m of a wellhead
- PHC F2 and F3 in soil guideline adjustments for management limits in natural land use areas
- Correctly selecting fine vs. coarse-grained guidelines based on pathway considerations

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Get Into a New Routine: Guideline Adjustments for Hydrocarbons (Big Wins)

Alberta Protection of Potable Water Pathway Assessments

1. Background geology review
2. Assess groundwater. Drill a background deep monitoring well and a shallow monitoring well (ok if it is dry) at each site while doing soil assessments
3. Collect additional, supplementary data before presenting Tier 2 guidelines to the regulators, as required

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Get Into a New Routine: Tier 2 Guideline Adjustments (Big Wins)

Guideline Adjustments and Simple Groundwater Modelling using Site-Specific Data

- Focus on low cost, simple approaches that are easy to discuss with regulators
- Incorporate site characteristics into the Tier 1 model (e.g., distance to water body)
- Use simple, alternative modelling (e.g., finite source that is more realistic to the situation)
- Economic for the average remediation program (i.e., an expensive Phase I to <cost of supplemental Phase II)

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Take Aways

- Plan, plan, plan! Develop a long-term site management plan and plan for problems in the field
- Support alternative ex-situ remediation
- Critically assess environmental benefits of remediation
- Guideline adjustments should be an integral part of every ex-situ remediation job. “Click Before You Dig” and “Adjust Guidelines Before you Dig”!

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Thank you!

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