Bioreactor Landfills – An Innovative Technology for Biostabilization of Municipal Solid Waste

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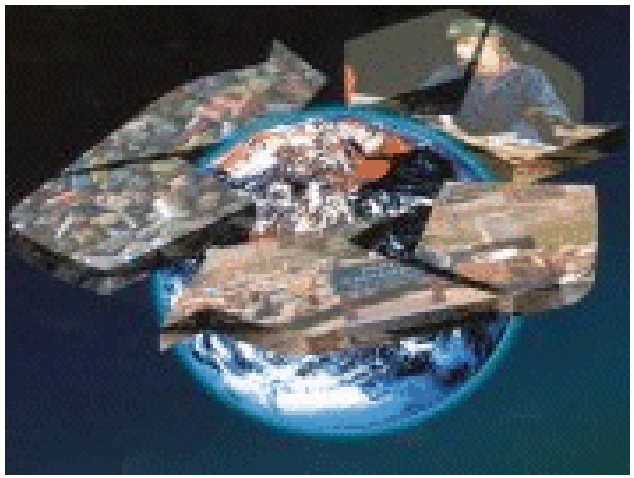
Outline

- Municipal Solid Waste
- Waste biostabilization in a landfill
- Bioreactor Landfills - Introduction
- Conventional vs. Bioreactor Landfills
- Case Study – City of Calgary Sustainable Landfill Bio-cell
  - Design
  - Construction
  - Cell filling
  - Operation/monitoring



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Municipal Solid Waste

- Approximately 70% of the waste currently landfilled is organic

  - Yard waste (24%), Food waste (20%), Paper (27%)

- Up to 75% of MSW generated in the region is disposed to landfills
- Decomposition of organic component of MSW in landfills- landfill gas and leachate are generated
- Landfills try to reduce impacts from leachate and landfill gas
- Conventional landfills use dry tomb approach

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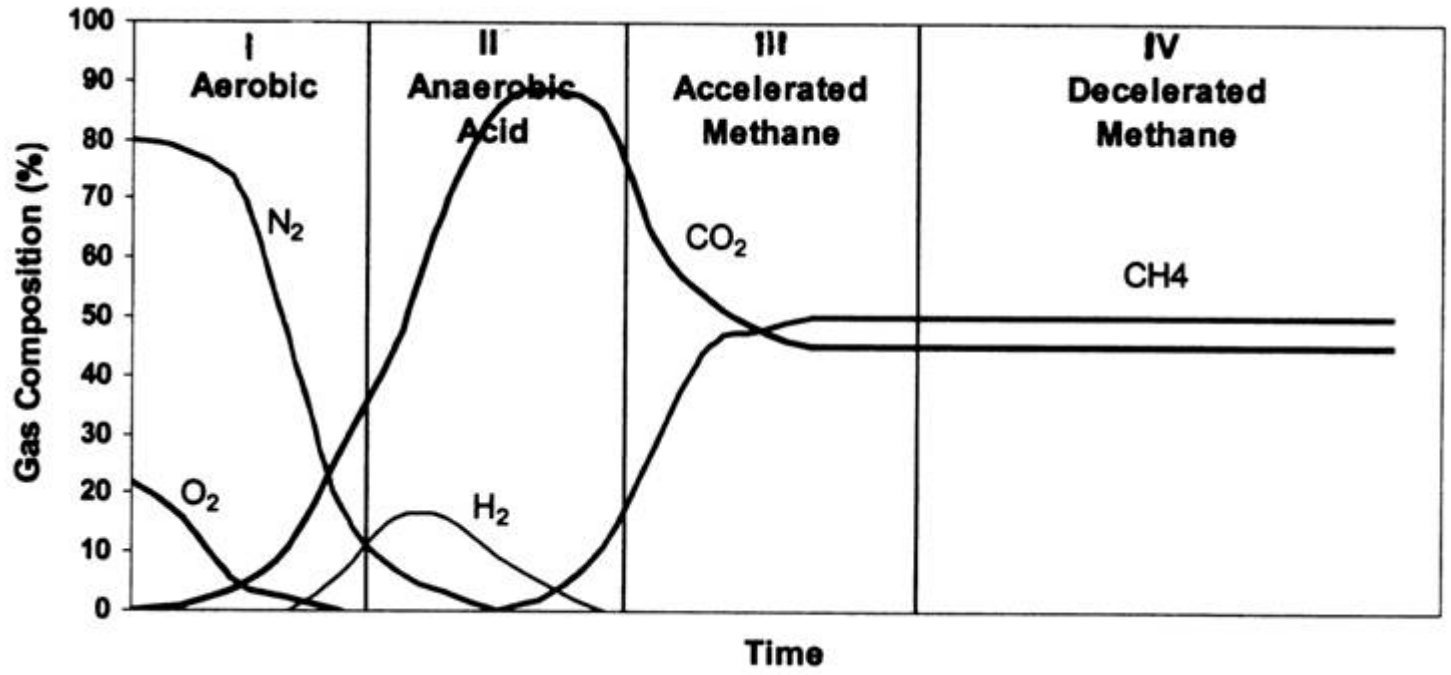
Waste Biostabilization



Phases of MSW Decomposition in a Landfill

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Bioreactor Landfills – An Introduction

- Designed/operated to ensure favourable conditions are created for rapid biodegradation of organic waste, landfills as “treatment vessels”
- The most significant factor affecting waste biodegradation - moisture
- Leachate recirculation
- Operated near the field capacity of the waste
- Could be anaerobic, aerobic or a combination

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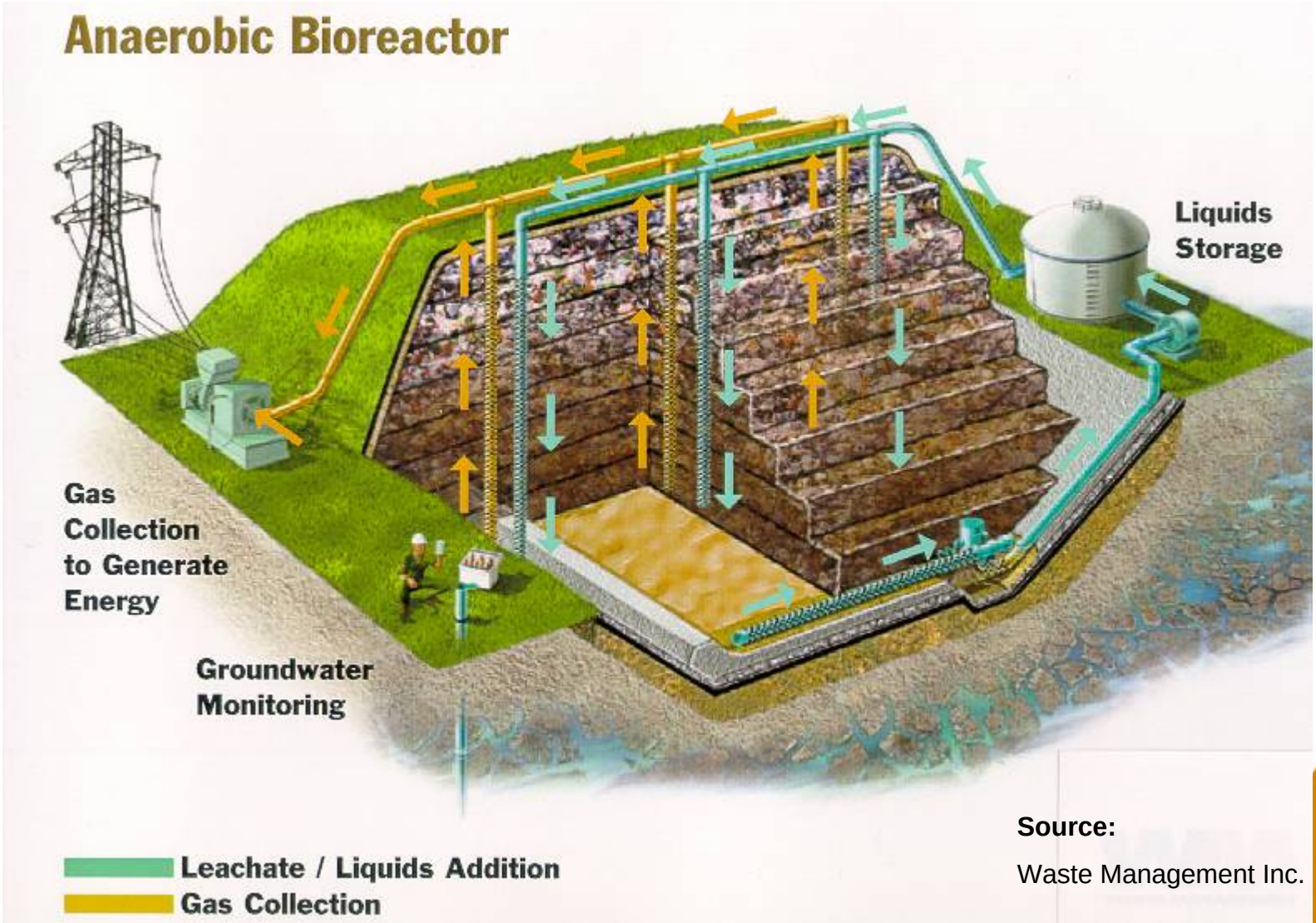
Anaerobic Bioreactor Landfill



Source:

Waste Management Inc.

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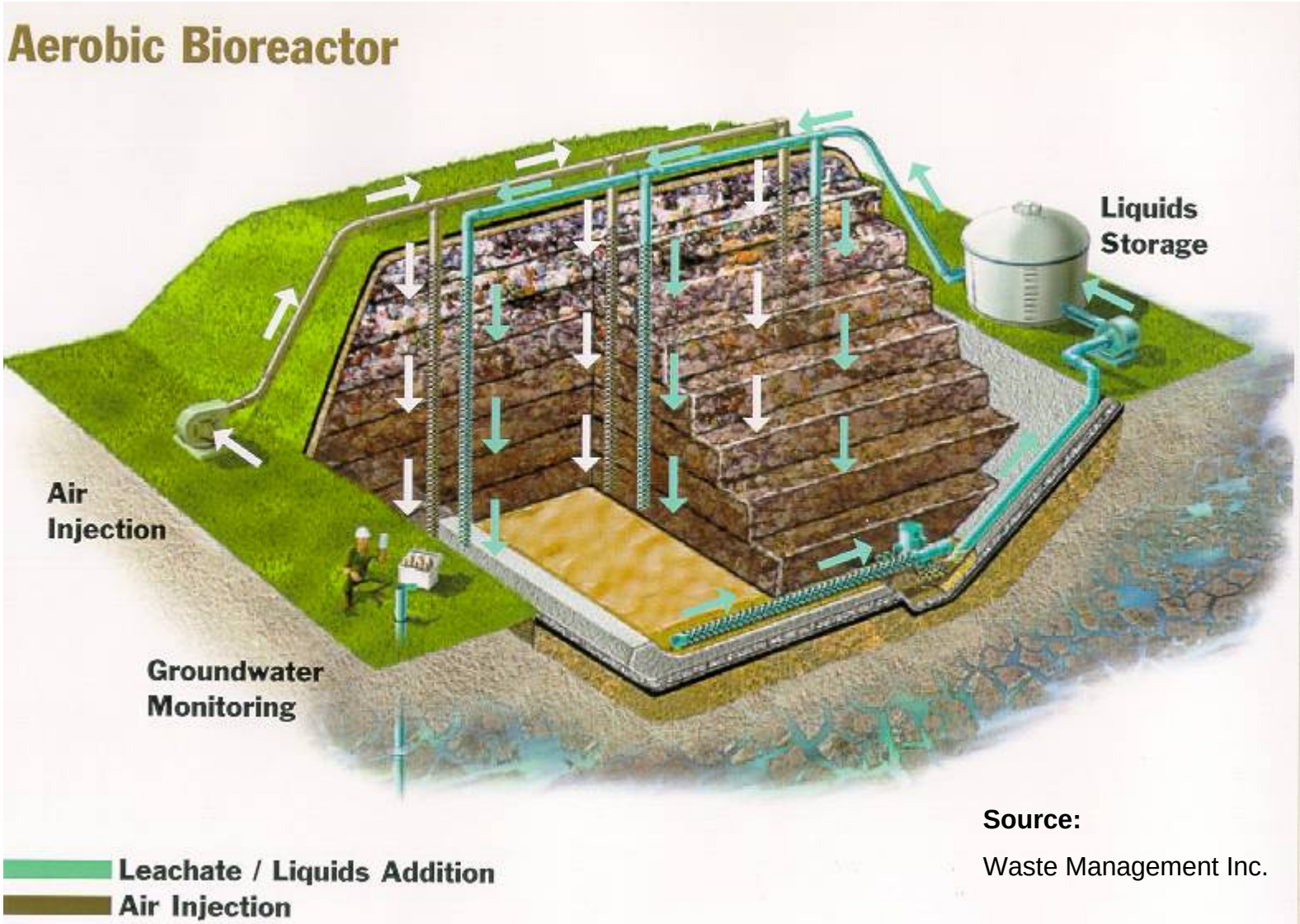
Aerobic Bioreactor Landfill



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Conventional vs. Bioreactor Landfills

- Conventional landfills - “dry tomb” philosophy
- Could take 100 or more years for biostabilization in drier climates
- Conventional landfills could potentially pose long term risks
- Bioreactor landfills – decomposition occurs in a shorter period
- Bioreactor landfills are designed and operated to minimize the short term risks

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Why Bioreactor Landfills?

- Potential for air space recovery
- Less leachate treatment costs
- Energy recovery
- Lower long-term risks
- Lower post closure costs
- Potential for resource recovery and recycling
- Potential for GHG emission reduction

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Challenges

- Higher initial capital/operating costs
- Supplementary moisture sources
- Increased landfill gas and leachate generation
- Leachate seeps and slope stability issues
- Large settlements
- Shift from “dry tomb” philosophy

Bioreactor Landfills are designed/operated to address these challenges

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Case Study: City of Calgary Sustainable Landfill Bio-cell

- Pilot study for a full-scale bioreactor landfill
- Cell #1 - 55,000 tonnes of residential and commercial organic waste
- Incorporates the advantages of both anaerobic and aerobic processes
- Sustainable waste management solution for the City
- Unique project – developed the term landfill bio-cell (LBC)
- Research – University of Calgary is involved

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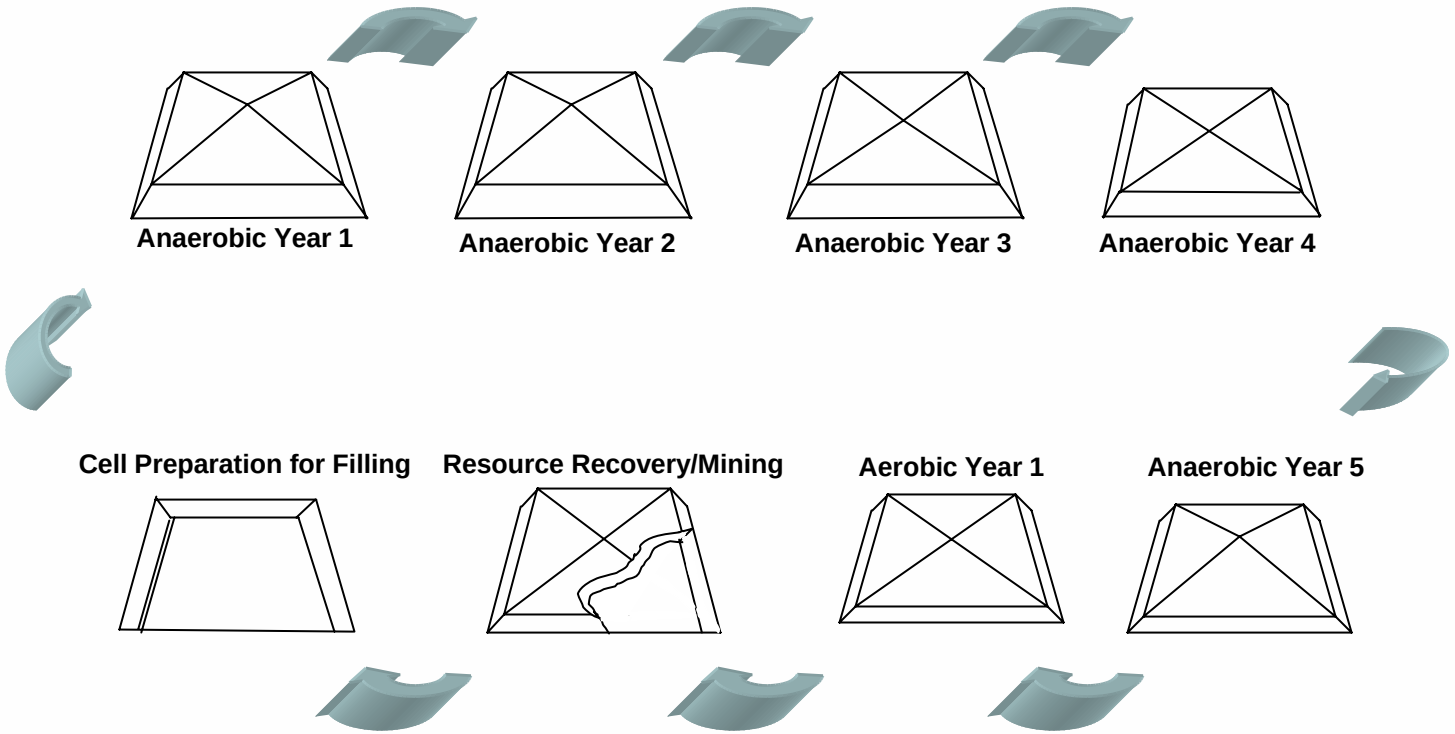
Sustainable Landfill Concept - LBC



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LBC Design

Components of the LBC

- Groundwater Control System
- Composite Liner
- Leachate Collection and Removal System
- Liquid Injection system
- Gas Collection / Air Injection System
- Bio-cap Intermediate Covers
- Final Cover

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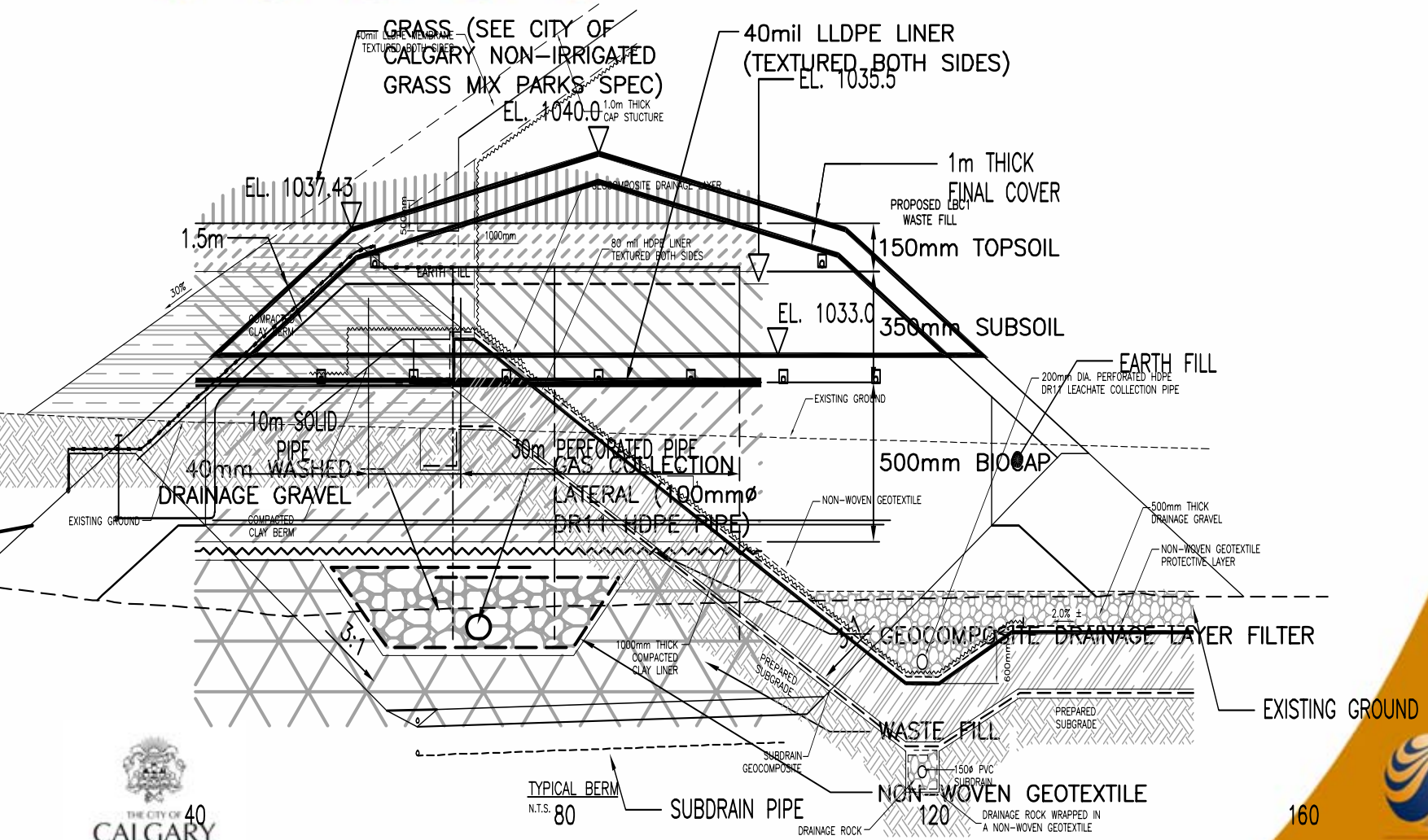
LBC Design ctd.



CAP STRUCTURE DETAIL

LBC Construction

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LBC Construction ctd.

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LBC Filling

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LBC Operation

- Optimum conditions will be maintained
- Main parameters for process evaluation – temperature, gas concentration and moisture content
- Automated monitoring system
- Liquid injection and gas collection/air injection will be controlled

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LBC Operation/Monitoring

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Conclusion

- Even with aggressive organic diversion, there will still be the organic component remaining in the MSW waste stream
- Bioreactor landfills reduces long term risks associated with conventional landfills and treats waste as a resource
- Bioreactor landfills could provide a sustainable way of solid waste management

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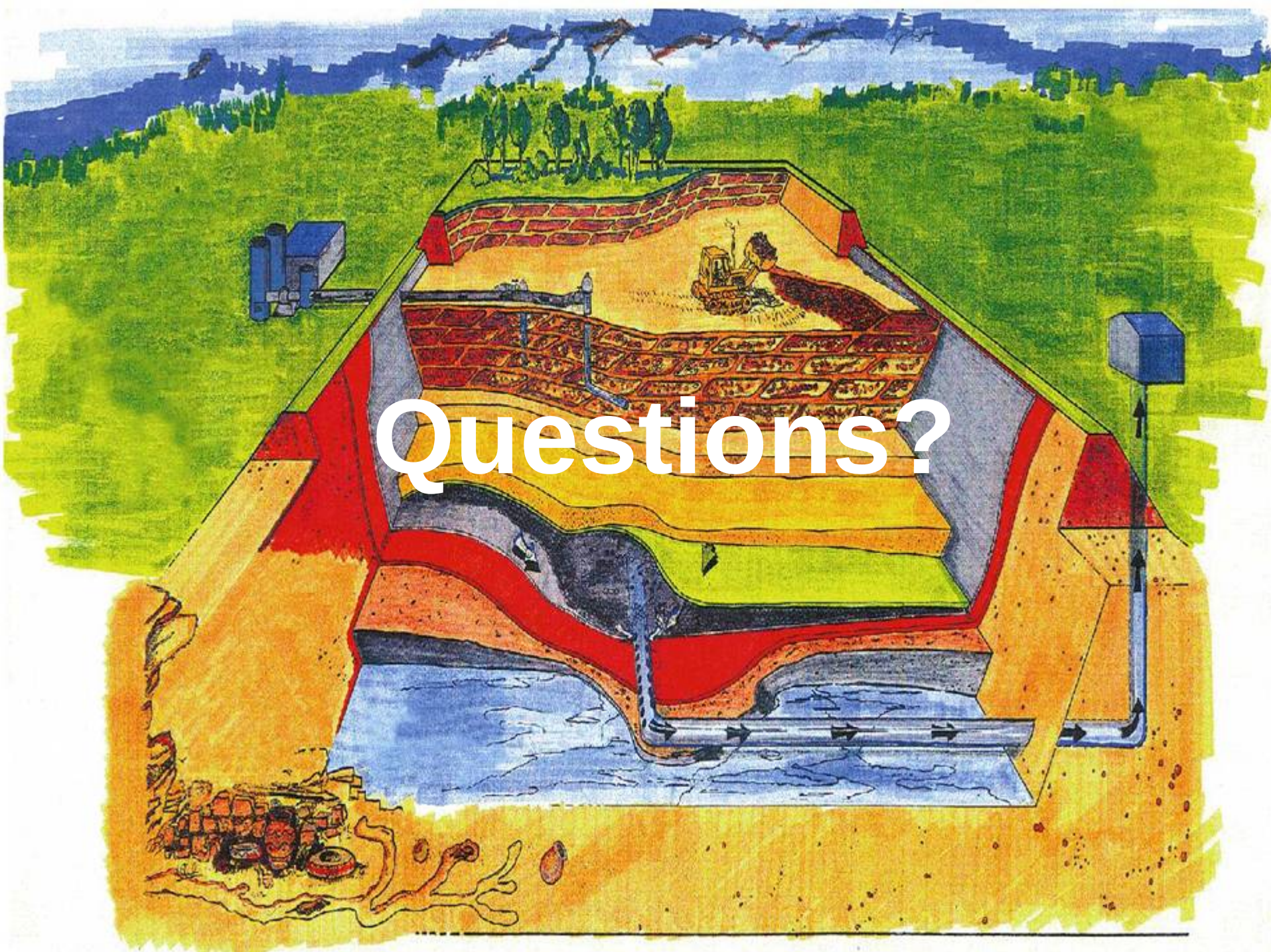
Questions?