



Case Study: Installing Landfill Gas Controls Within a Redeveloped Inactive Landfill

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Acknowledgements

- EBA Engineering Consultants
- Province of Alberta
- Calgary Zoological Society

Presentation Outline

- Site and Project Background
- Conceptual Site Model
- LFG Controls – Selection and Design
- LFG Controls – Implementation
- Conclusions

Background

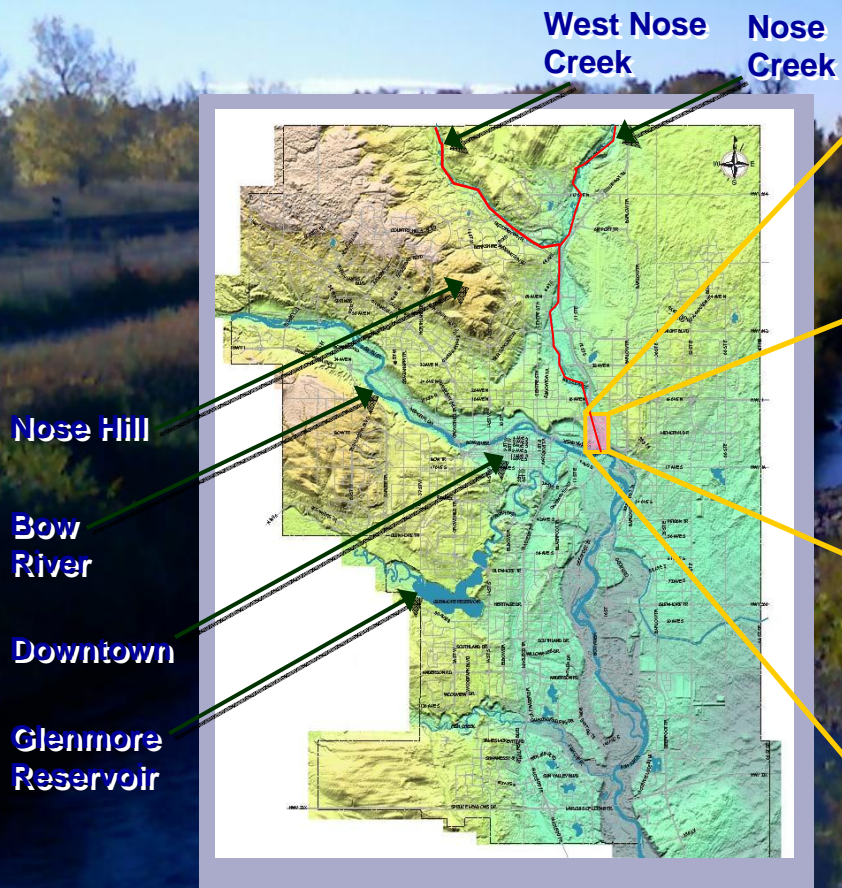


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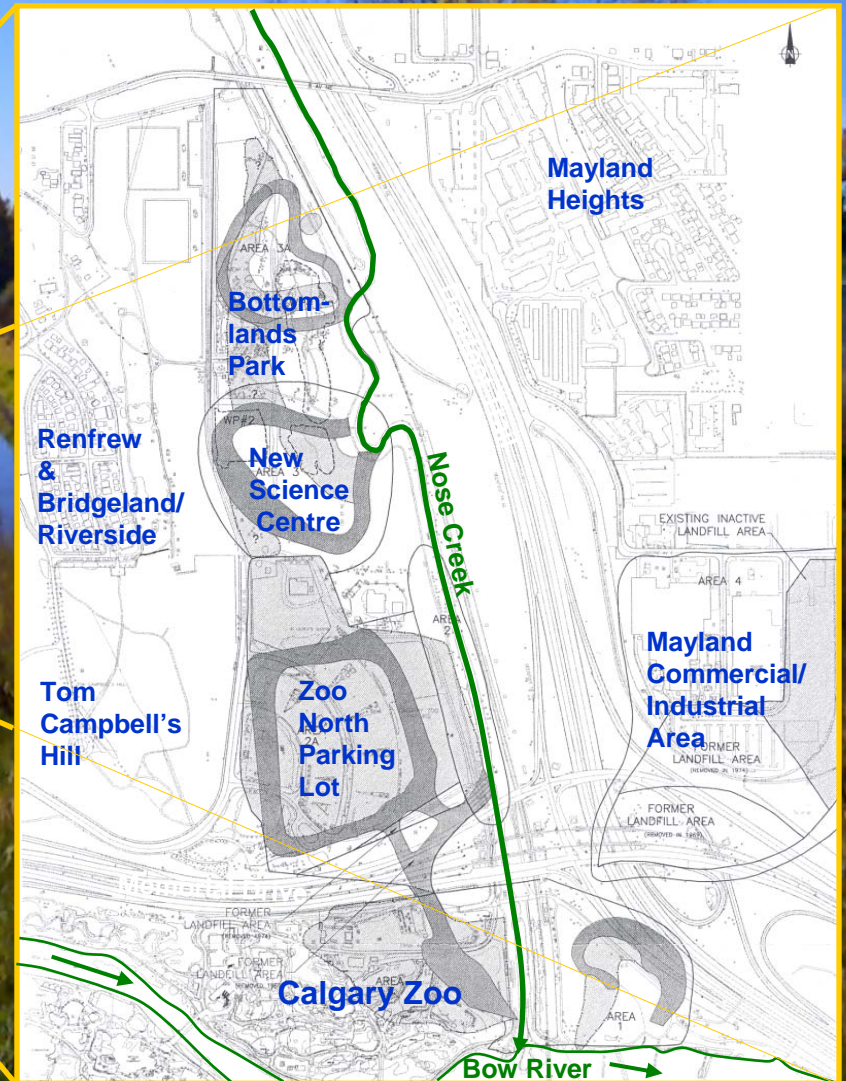


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Site Location



City of Calgary



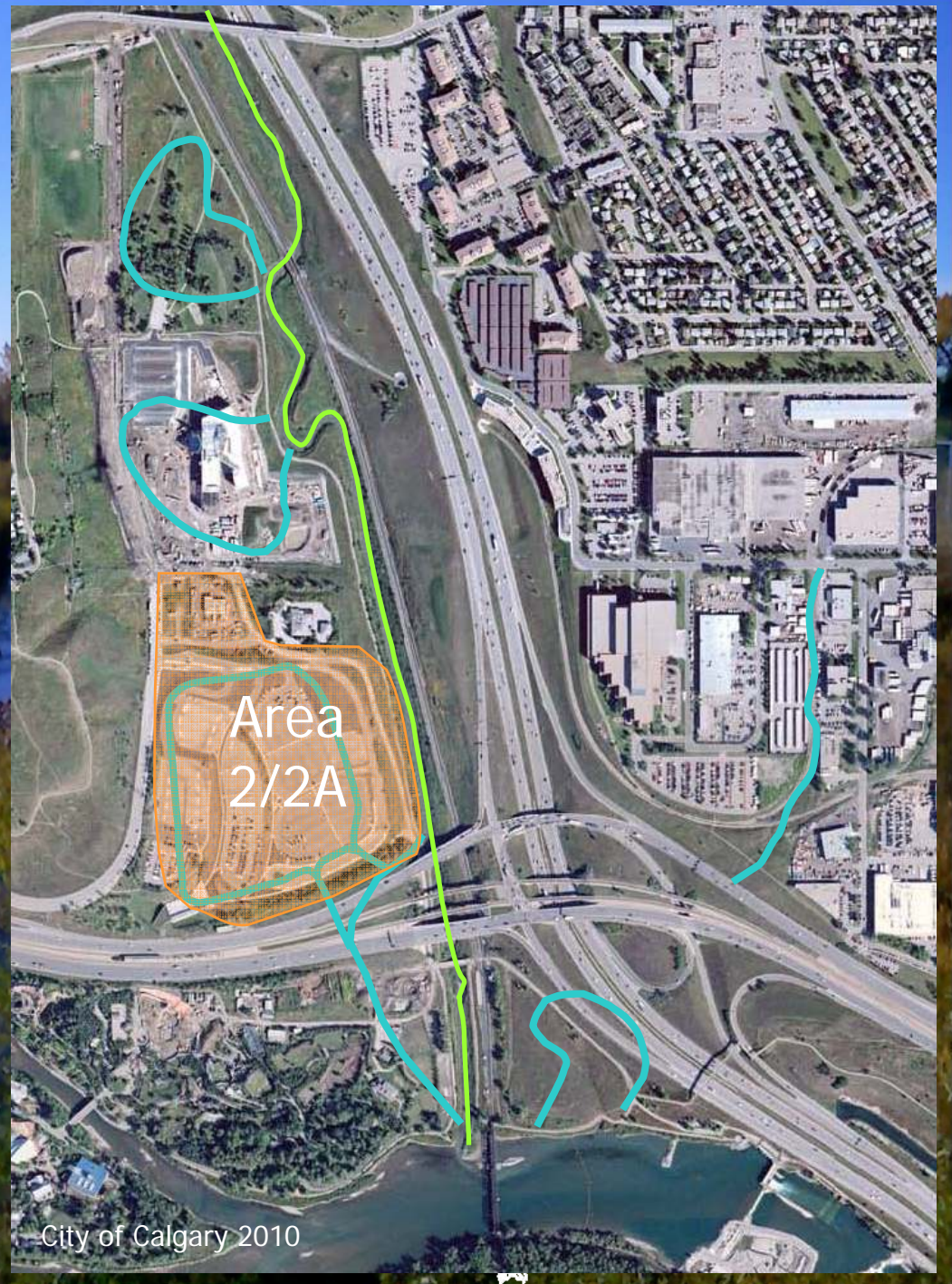
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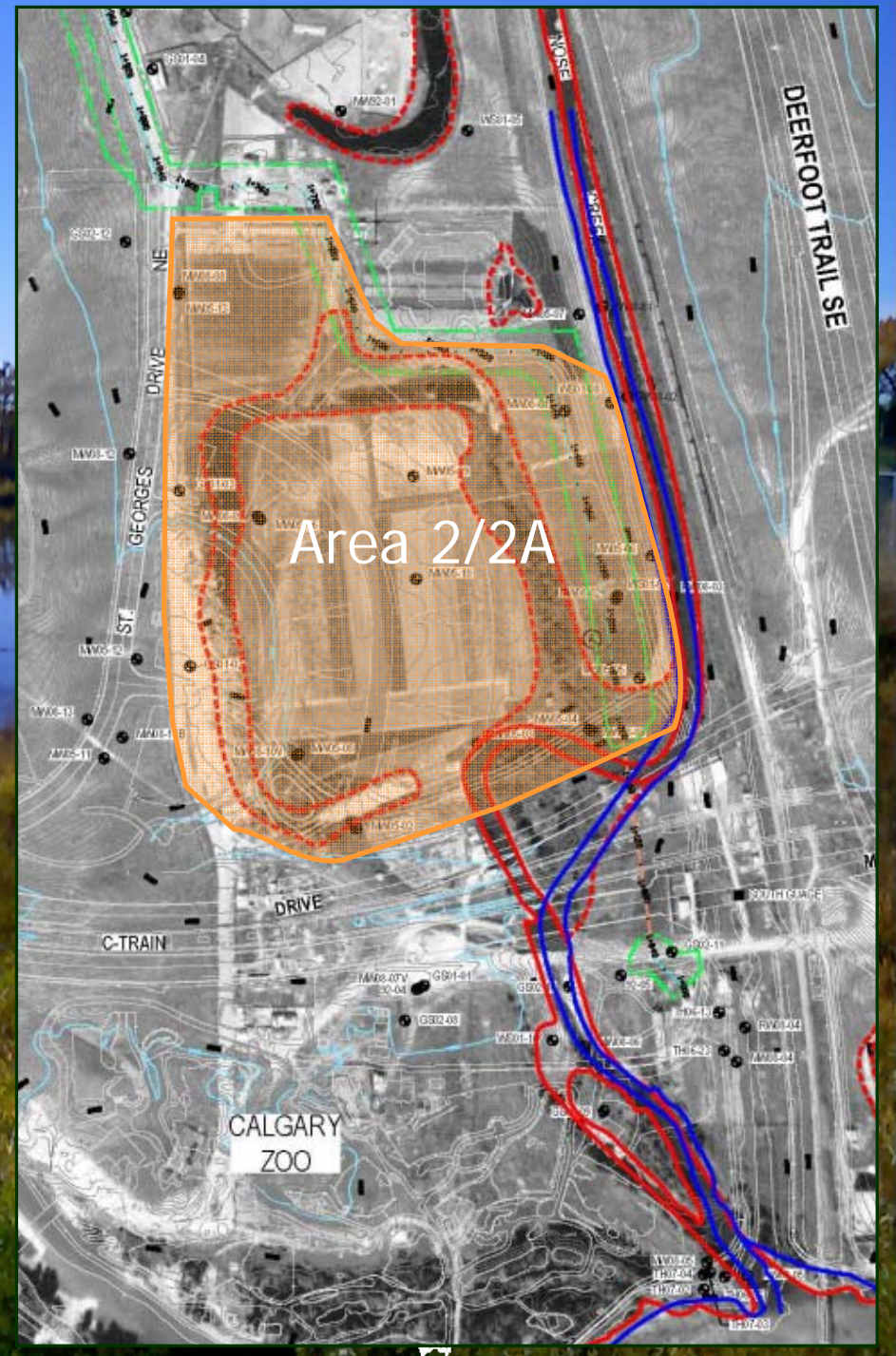
Nose Creek Landfill History

- Landfilling from as early as 1914 to early 1980s
 - Facility closed in 1967
 - Early activity and post-1967 activity lacks documentation
- Oxbows, stream channel, valley ravines, general low lying areas were filled
- Deposits of household and construction waste



Landfill Area 2/2A

- Environmental investigations undertaken from early-1990s
 - (and ongoing)
- ~40 investigation locations across Area 2/2A
 - 35 monitoring wells at 19 locations, 10 vapour probes
- Studying
 - Landfill Waste
 - Soil
 - Soil vapour / landfill gas
 - Groundwater
 - Surface water
 - GW / SW interaction





Risk Assessments

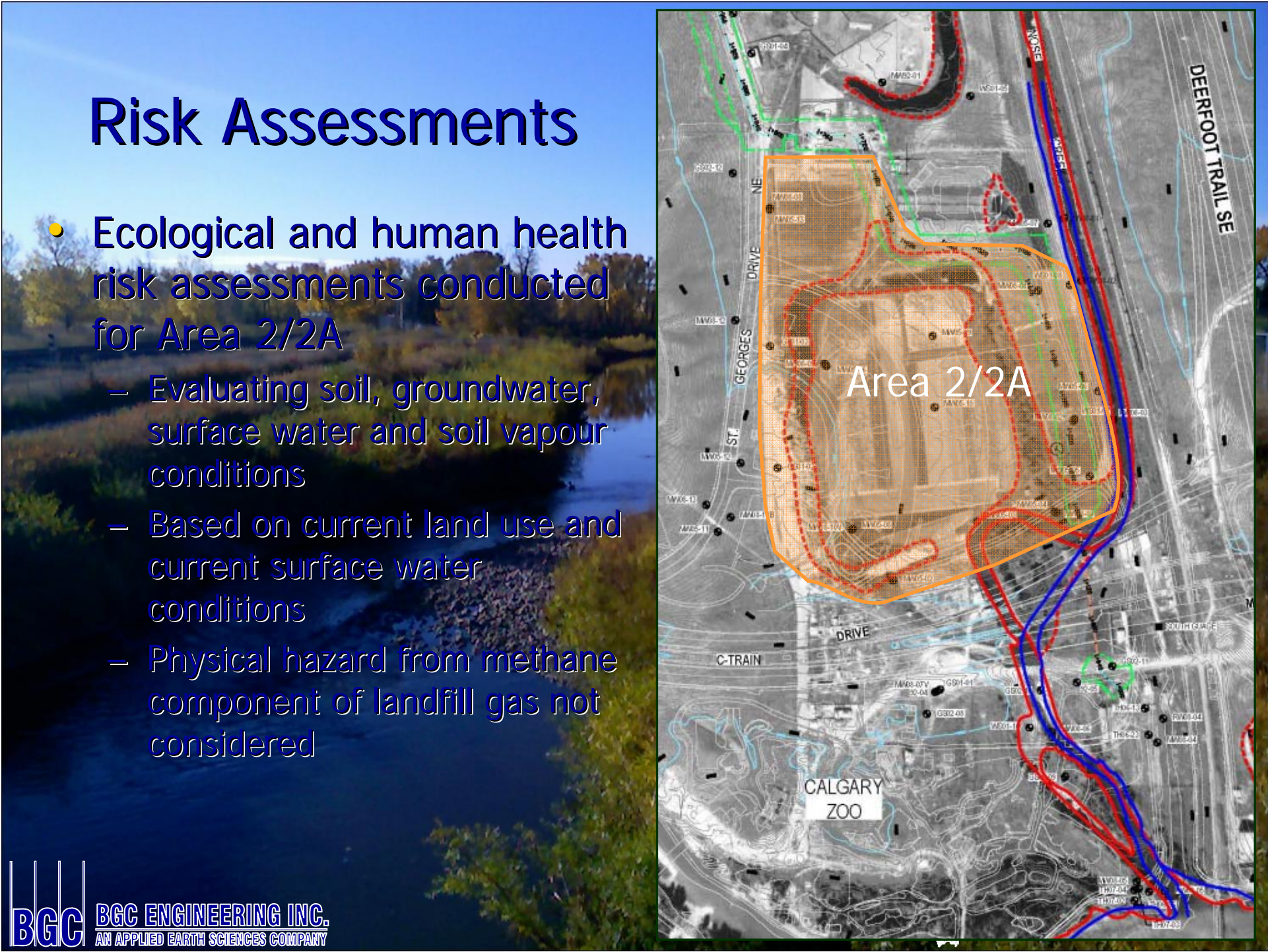
- Ecological and human health risk assessments conducted for Area 2/2A
 - Evaluating soil, groundwater, surface water and soil vapour conditions
 - Based on current land use and current surface water conditions
 - Physical hazard from methane component of landfill gas not considered



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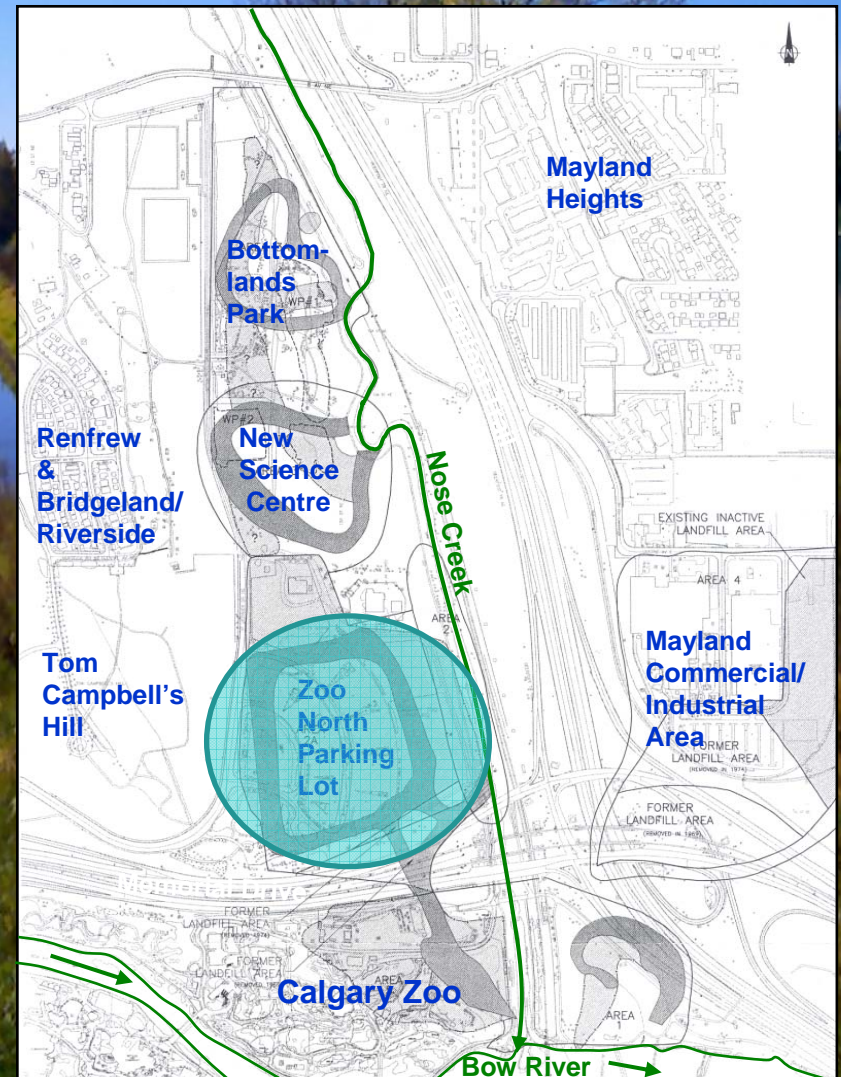
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Conceptual Site Model / Environmental Management Plan

Environmental Management Plan

- Comprehensive plan being developed
 - Active exposure scenarios identified
 - Maintenance of inactive exposure scenarios
 - Mitigation of active exposure scenarios
 - Contingency plans
- LFG controls planned for Area 2/2A



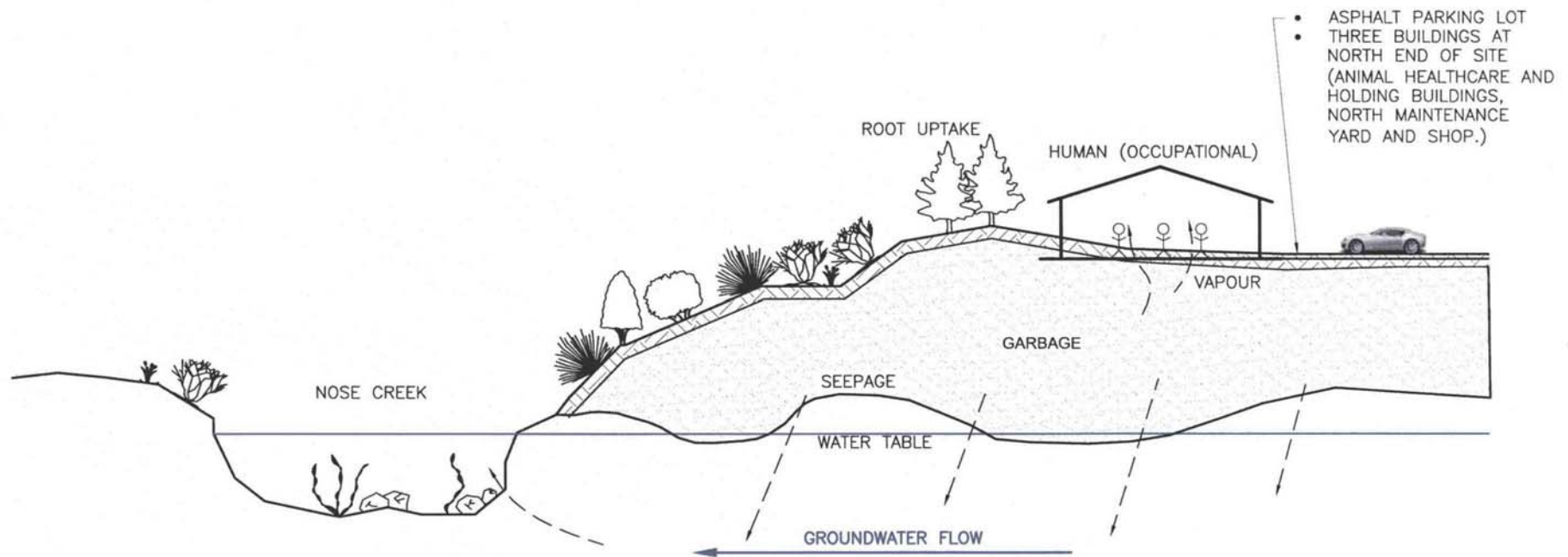
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Conceptual Site Model

- Exposure scenarios
 - Intersection of source, pathway and receptor
 - Soil contact, surface water contact/ingestion (incl. subsurface soil/waste leaching to groundwater), groundwater contact/ingestion, soil vapour inhalation



AMEC 2007

Landfill Gas Controls

- **Impetus**

- Methane not fully considered in HHERA, elevated levels present in areas of high activity
- Vapour inhalation pathway exposure scenario potential concern in future development

- **Precautionary measures planned**

- Mitigate methane accumulations in subsurface
- Prevent potential migration off site or into on-site enclosed spaces
- Also beneficial to control of NMOC

LFG Source

- Municipal Sanitary Waste
 - Area 2/2A ~700,000 m³
- LFG Composition
 - Methane
 - From ppmv range to ~70% CH₄
 - Higher levels at south end
 - NMOC
 - Volatile organic compounds
 - Hydrocarbons
 - Chlorinated solvents
 - CO₂, H₂S
 - Elevated CO₂, H₂S relatively low



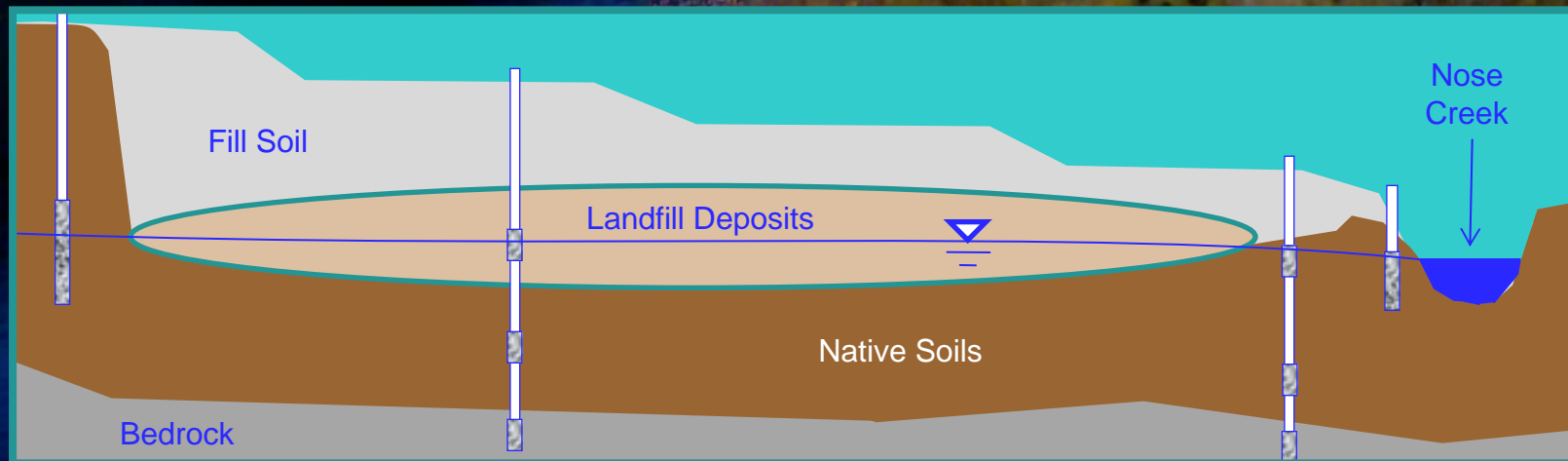
LFG Pathways

- Site Geology

- Fill soil (silt), waste (with soil), silt/sand, sands and gravels, bedrock

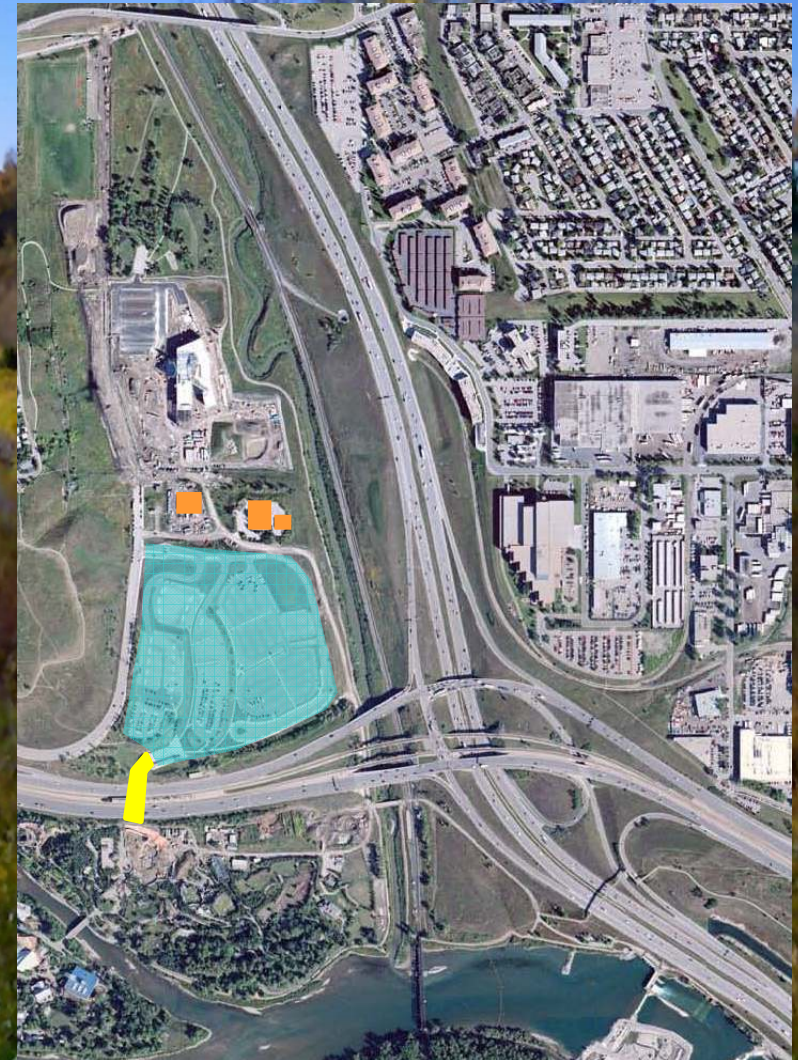
- Topography and ground cover

- Ground highest in west, decreasing toward creek in east
 - Primarily asphalt cover, except landscaping islands and natural vegetation around buildings in north, road and tunnel in south



LFG Receptors

- Indoor Environments and Enclosed Spaces
 - Maintenance shop and animal hospital in north
 - Zoo workers
 - Admissions facility and tunnels in south
 - Public access
 - Storm sewers and utility manholes across site
 - Utility workers
- Outdoor spaces
 - Emission control



Area 2/2A LFG Controls – Selection & Design

LFG Controls - Objectives

Precautionary measures

- Mitigate methane accumulations in subsurface
- Prevent potential migration off site or into on-site enclosed spaces

Stakeholder Considerations

- Current leaseholder with significant existing development on lands
- Ongoing public access daily, throughout year and across the area
- Worker exposure
- System design must consider structures and infrastructure
- Installation activity must consider access restrictions
- System selection must consider long term impact

Development Opportunity

- Major redevelopment of parking lot in 2009
- Opportunity to coordinate installation
- Design testing
- Coordinate design with parking lot design and tendering
- Coordinate installation with parking lot construction



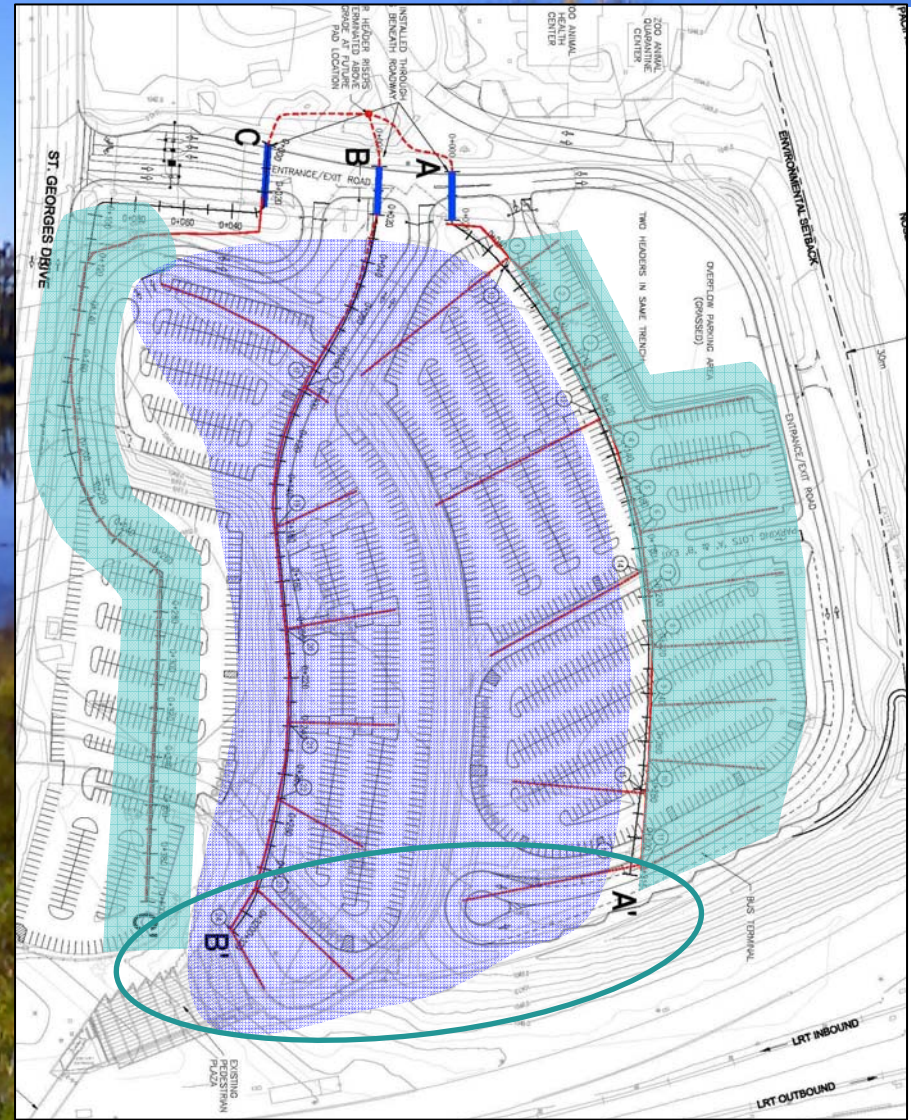
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LFG Controls Layout

- Four headers installed
- Horizontal extraction vents on headers A_{east}, A_{west} and B
 - Lower elevations, closer to waste deposits
- Vertical extraction wells on header C
 - Higher elevation, deeper waste deposits
- Perimeter control



Project Staging

- Assessment of available site information
- Focused testing to obtain design parameters
- Preliminary design for parking lot tender docs
 - Eastern vent spacing based on pilot tests
 - Central vent spacing based on redevelopment opportunity
- Header installation during parking lot redevelopment
- Pilot extraction well installation and pilot testing
- Vertical vent design & installation
- Long term pilot test of piping network
- Extraction treatment system design and installation

Project Implementation



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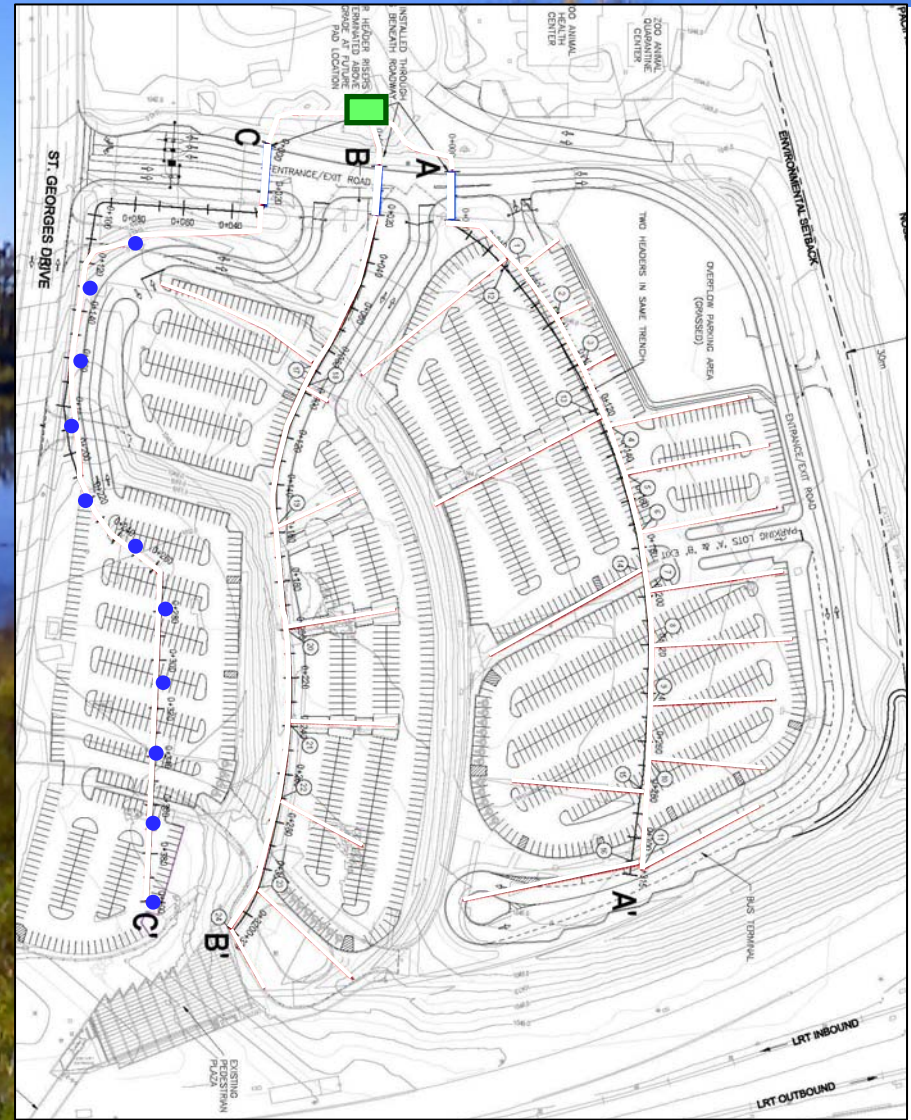
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Coordination

- Site access
 - Limitations due to site development = asphalt areas, sidewalks, access roads, topography, buildings, utilities
- Coordination with land use
 - Daily, weekly and seasonal limitations
- Zoo parking lot redevelopment program
 - One time opportunity for enhanced site access
 - Required staged approach to design and installation
- Sanitary sewer trunk line upgrade
 - Followed piping installation, required protection during program
 - Design considerations to sewer trunk line

Installation

- Culvert installation
- Header and vent installation during parking lot redevelopment
 - Eastern vent spacing
 - Central vent spacing
- Vertical vent installation and tie in
- System fabrication and installation



Header and Horizontal Vent Installation

- July – Nov. 2009



Vertical Extraction Well Installation

- Dec. 2010 – Feb. 2011



Extended Pilot Test & System Design

- October-November 2011
- Pilot Test Objectives
 - Obtain flow data and area of influence for extraction design
 - Obtain long term LFG quality data for treatment design
- System Design
 - Emissions threshold definition
 - Stakeholder input – land use considerations
 - Operational requirements



System Fabrication/Installation

- Anticipated: January – March 2012
- Commissioning: March 2012

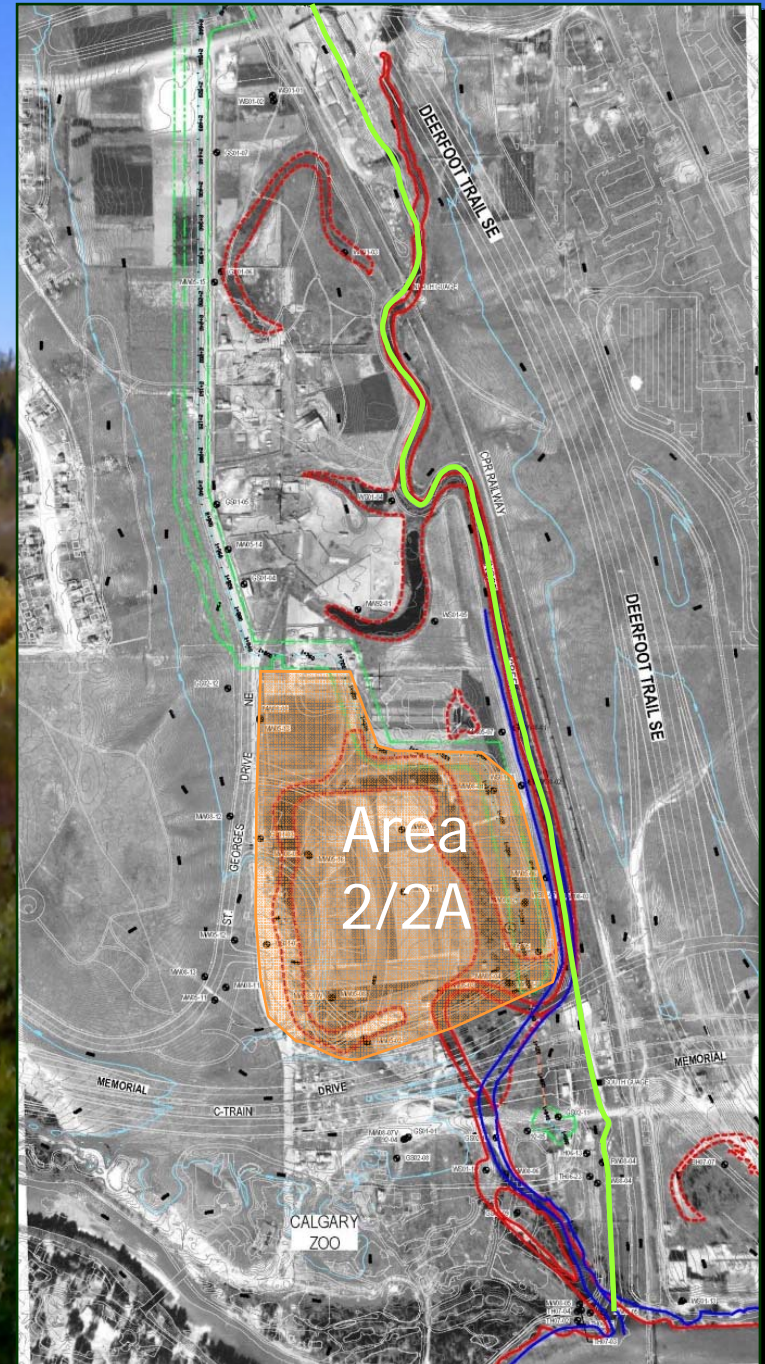
Conclusions

- Successful installation of subsurface infrastructure across a large, active facility
- Staging of both design and construction allowed this installation without major disruption to the facility
- Involvement and cooperation of the land user was key to attaining success
- Retrofitting a redeveloped landfill is possible if flexibility and stakeholder engagement are strongly applied
- Premium costs of system retrofit can be avoided through opportunistic design and installation

Questions?

Nose Creek Landfill

Area 2/2A



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