Southern Landfill Extension Piggyback Option (SLEPO) - An innovative ‘cradle’ landfill design

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Tonkin+Taylor

Outline

TOPIC	Speaker
Project Background	**Darren Hoskins**
Alternative Assessment	
Piggyback Option (SLEPO)	
Innovative ‘cradle’ landfill design	**Daniel Tan**
Challenges of a piggyback landfill	
‘Cradle’ design	
Investigations, field trials and numerical analysis	

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What's the issue?

June 2026:

- Landfill capacity and consents expire
- Need a solution for residual waste by this date

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Timeline

2009
Landfill extension approved in Long Term Plan

2013
Consent lodged, opposed

2017-2019
New landfill concept developed

2020-2021
Options analysis

2022
Annual Plan
Consultation -3 options

2023
Consent lodged

2024
Consent granted

2024-2026
Construction

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Selecting a preferred option - MCA

14 Options

(included resource recovery initiatives)

14 Criteria

plus

Three Absolute

Councillors added

'No landfill'

(send to another Landfill)

Three Options

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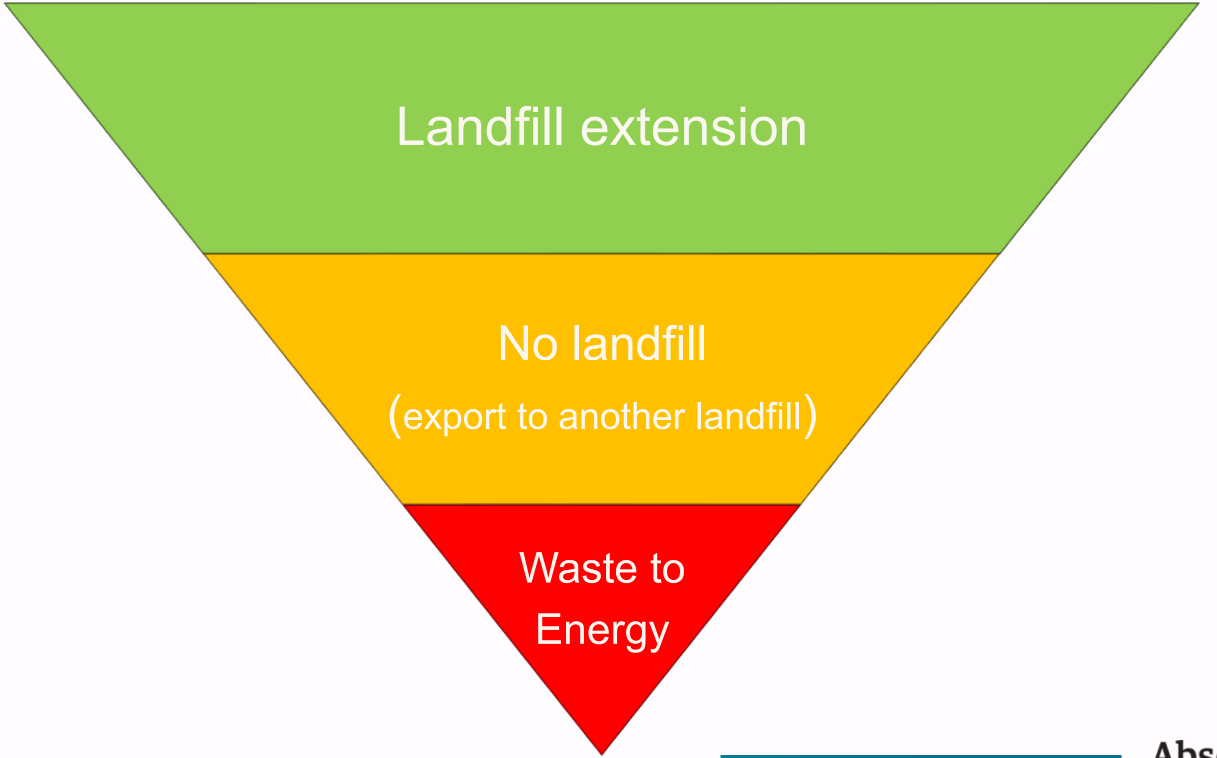
Criteria

Te Ao Māori alignment	1. Input from mana whenua for all criteria and Te Ao Maori alignment is still ongoing
Impact	2. Emission Levels 3. Environmental effects (waste, land and air)
Planning	4. Level of consent and planning risk 5. Size - ability to fit on existing site 6. Scalability (to support wate minimisation), 7. Timeframe for the solution
Community	8. Local community effects 9. Community connection 10.Resilience in cases of emergency
Technical	11.Technical maturity 12.Robustness/reliability of solution
Financial	13.Support for a circular economy 14.Value for money

How the options stacked up



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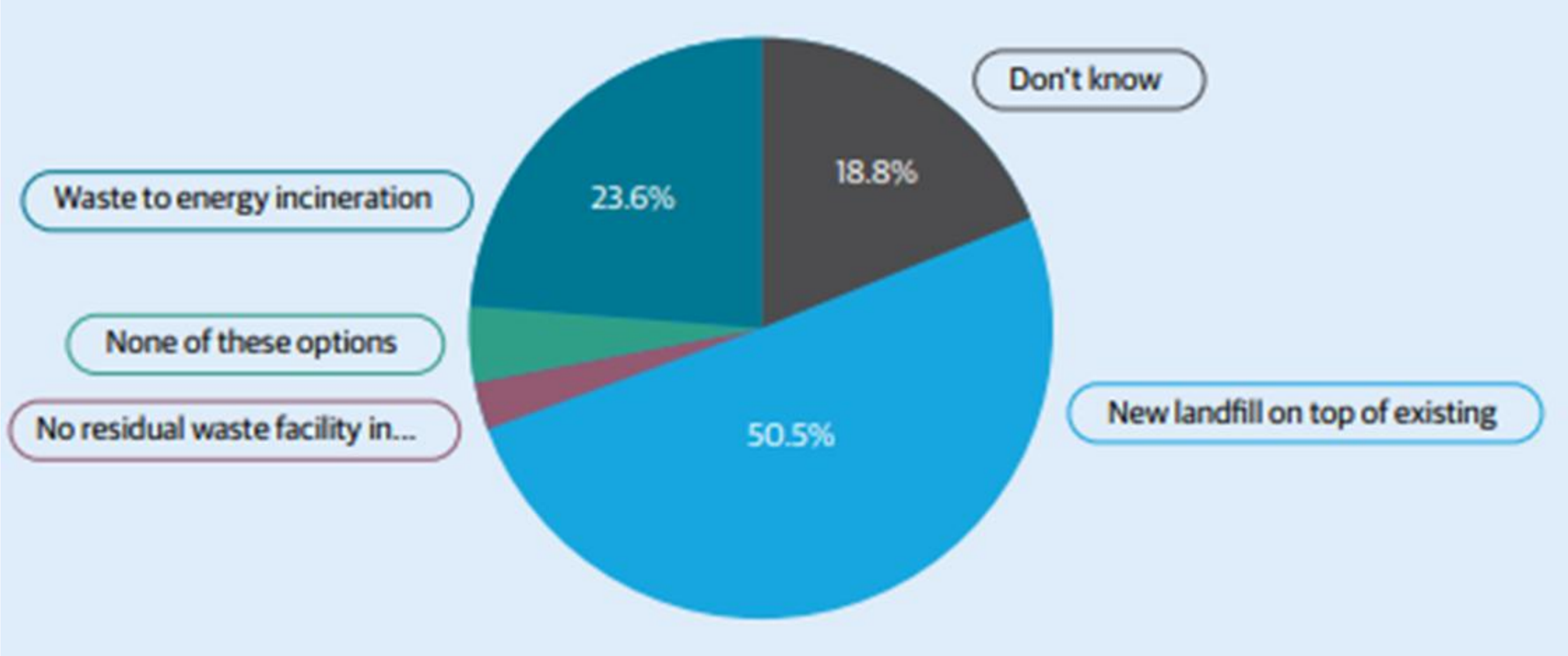
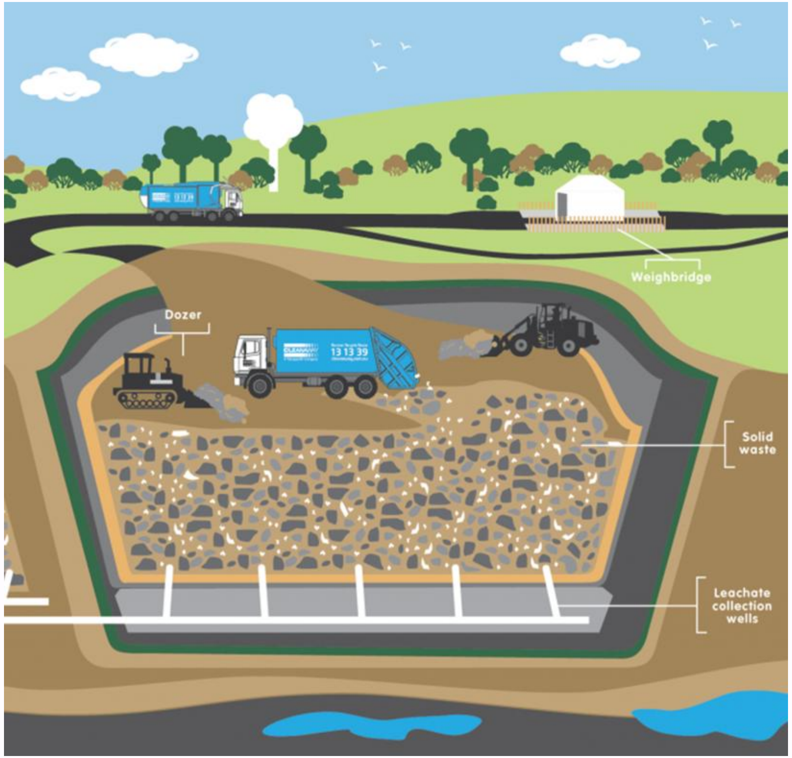
Annual Plan Public Consultation - outcome



Sludge

- 15,000 tonnes per year
- Mixed 1:4 with waste
- New Moa Point Sludge Minimisation Facility
- Enables resource recovery



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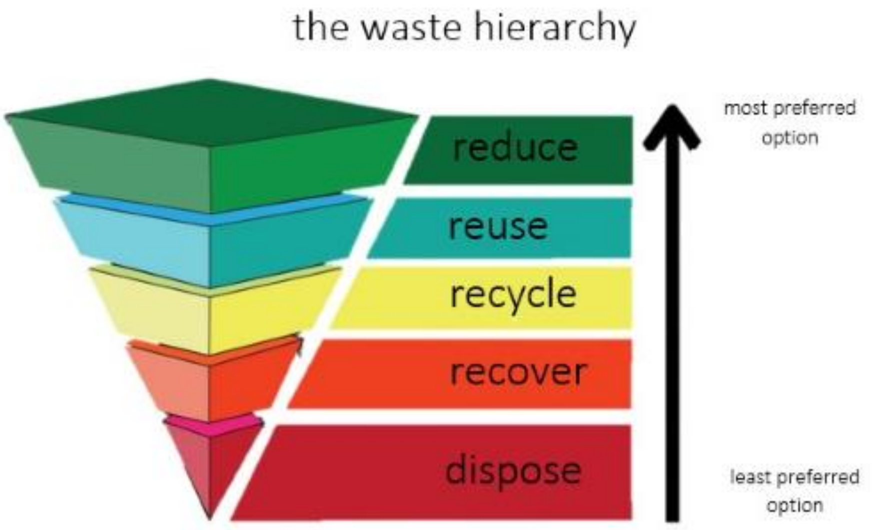
Waste Minimisation

- Reduce waste to landfill
- Resource Recovery initiatives



Source: Zero Waste

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Residual Waste Working Group

- Community representatives
- Building trust & integrity
- Supported resource consent

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Resource consent

- 35-year consent granted
- 200 conditions
- Community Advisory Group established
- Construction underway

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Construction of SLEPO

Construction of SLEPO

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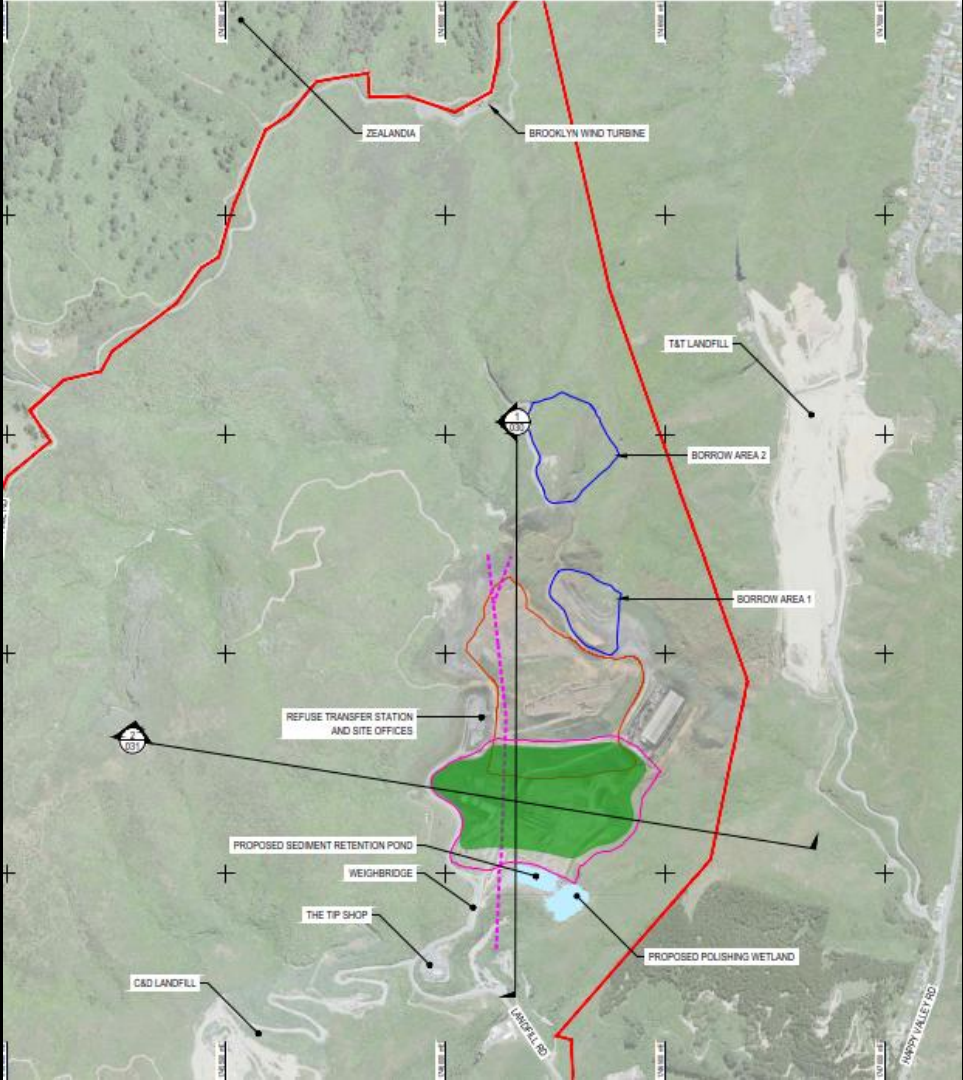
Note: Green shows the landform only and not the final use.

Innovative 'Cradle' Landfill Design

Daniel Tan,
Tonkin & Taylor



Challenges

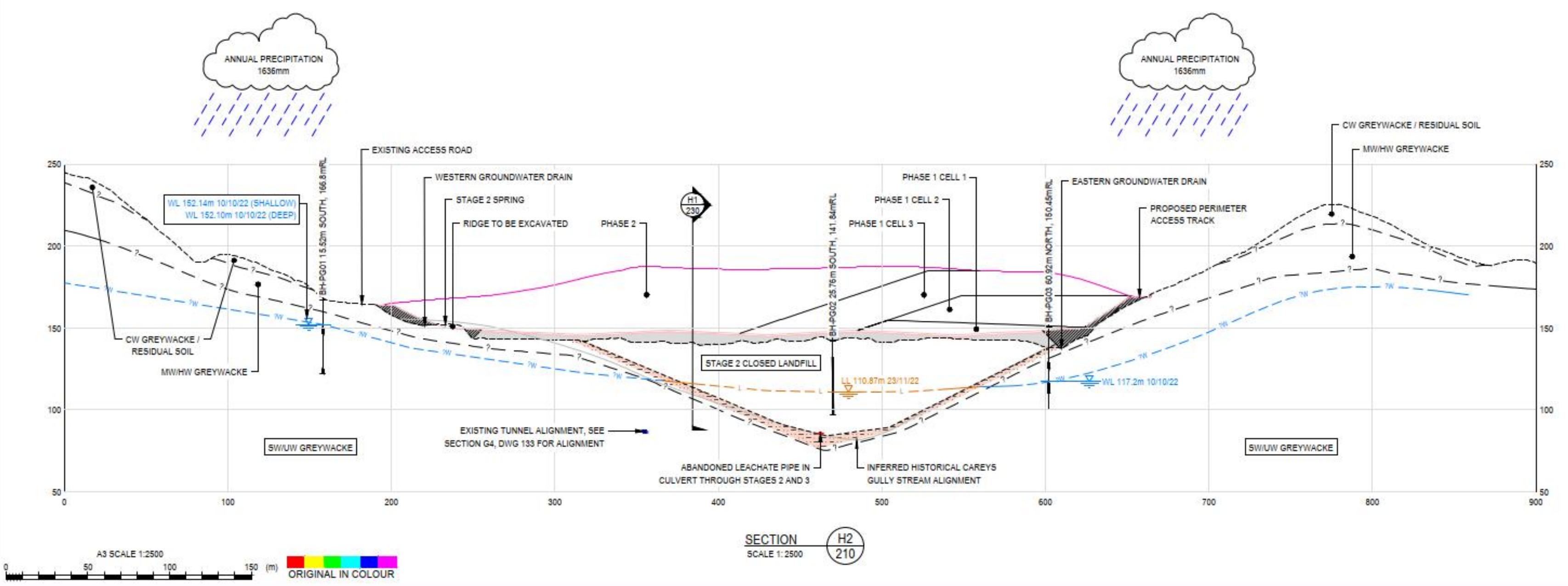
- **“Piggyback” Over existing closed landfill**

i. Old unlined landfill

ii. Complex hydrogeology

iii. Settlement of old waste

iv. Landfill gas from old landfill



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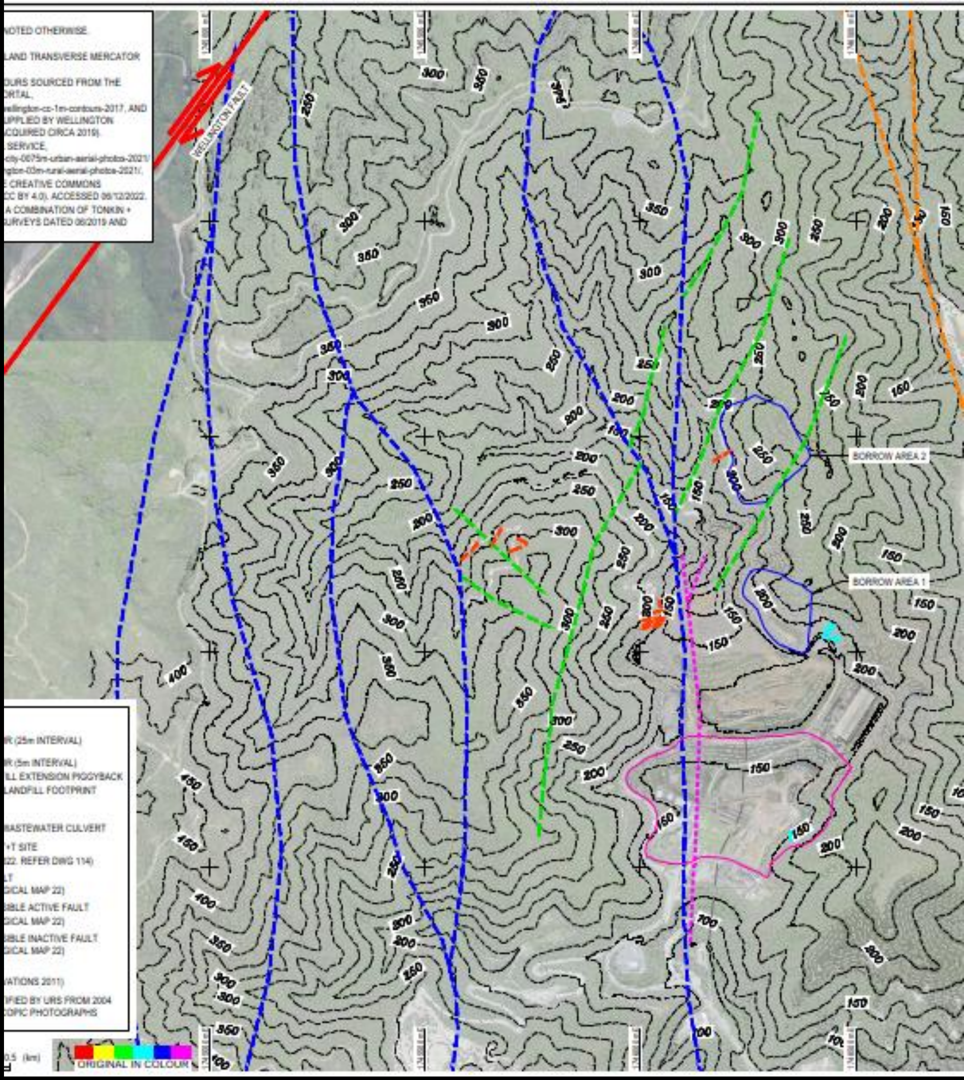
Challenges

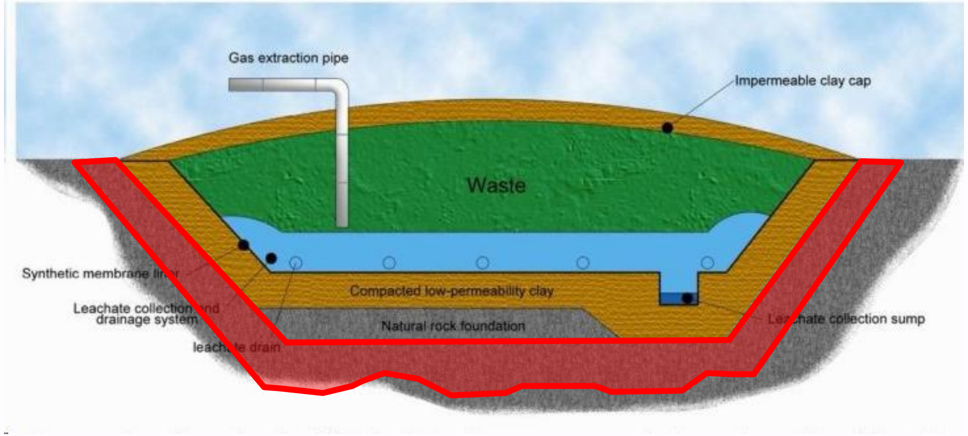
- 2km from Wellington Fault

i. Seismic consideration

ii. Landfill stability

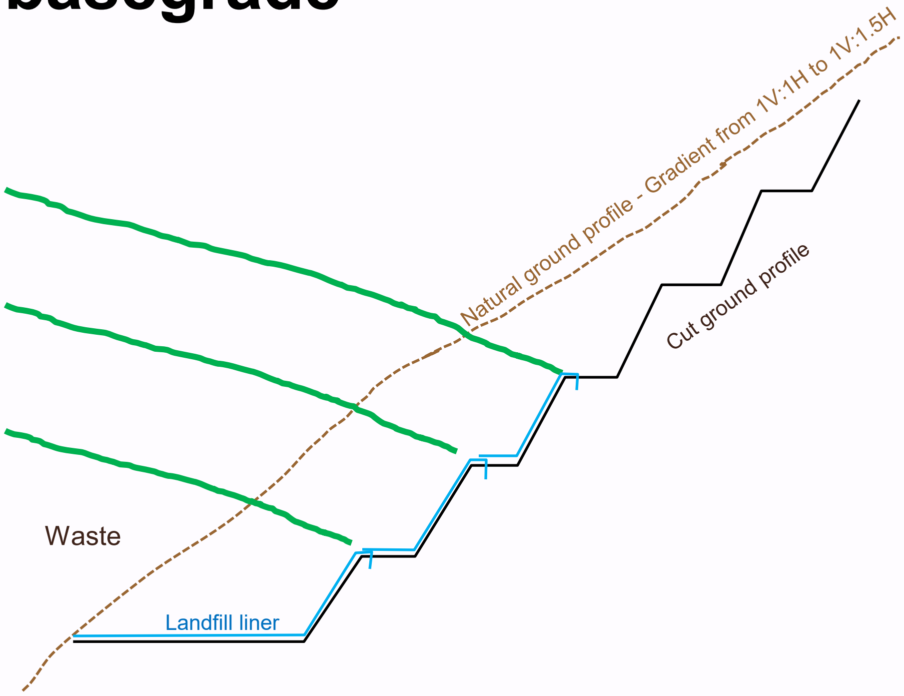


Innovative ‘Cradle’ Landfill Design



Earthworks to form landfill basegrade

Conventional	'Cradle' Design
Cut to form basegrade	Fill to form basegrade
Excavation of whole slope required from top to bottom	Fill from bottom up. Does not require unnecessary vegetation clearance and exposure of soil
Fix slope and bench height is required	Slope and bench height is flexible and can be varied subject to time, air space requirement and budget
Require significant vegetation clearance and soil exposure beyond landfill footprint.	Limited vegetation clearance and soil exposure beyond landfill footprint.



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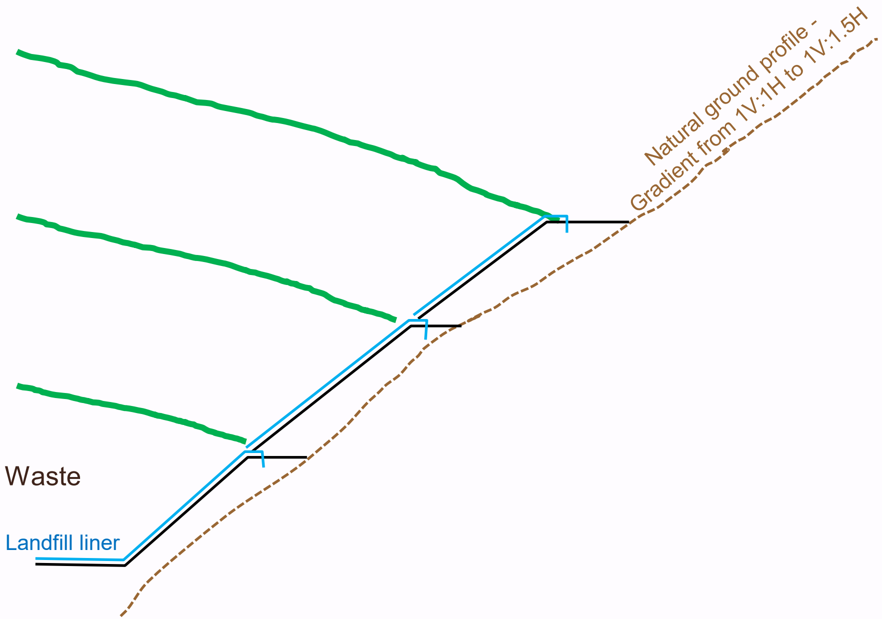

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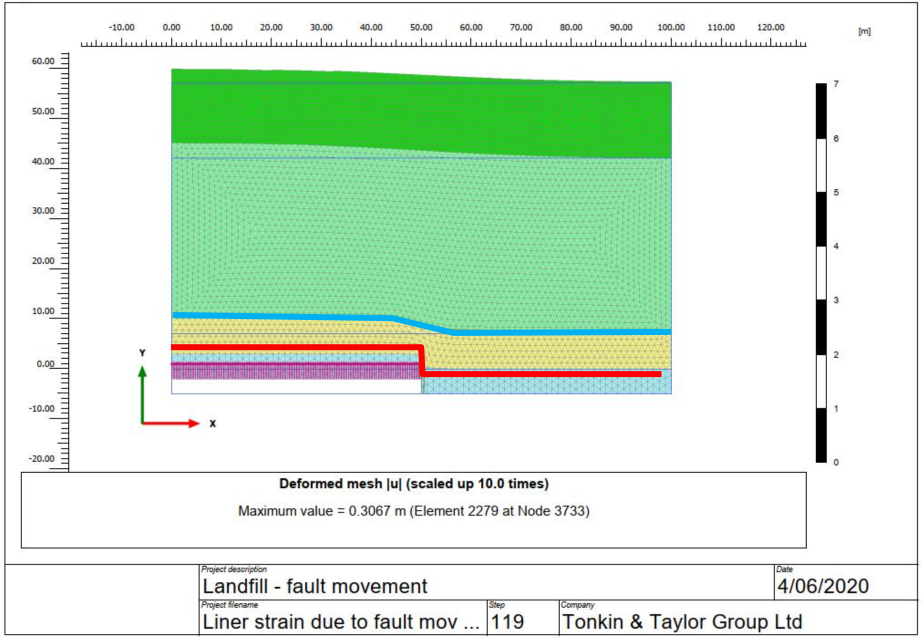
Protect landfill lining from seismic impact

Conventional	'Cradle' Design
Landfill liner sits directly on natural ground	There is a soil layer between the landfill liner and natural ground
Ground movement from secondary fault rupture or seismic shaking will have direct impact on the landfill liner	The soil layer acts as a buffer between ground movement and reduce the impact on the landfill liner limiting the strain on the HDPE liner to less than 3%



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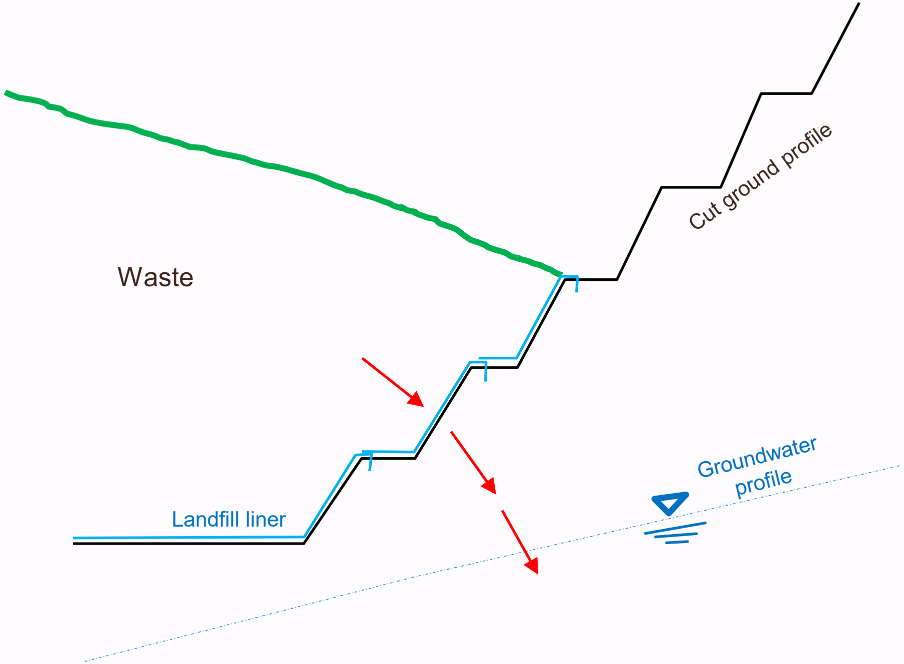
Leachate leak detection, collection and removal

Conventional	'Cradle' Design
Any potential leakage through the landfill liner will come into direct contact with natural ground and subsequently groundwater	The soil layer between the landfill liner and natural ground forms a preferential flow path for any potential leakage through the landfill liner, making its way downslope and collected in a groundwater drainage system that doubles as a leachate leak detection, collection and removal system



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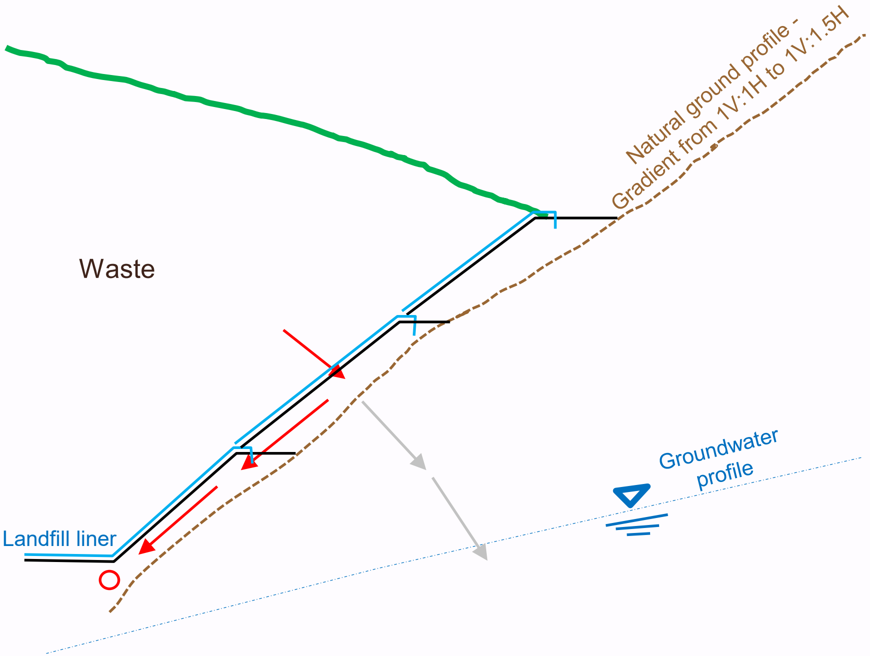
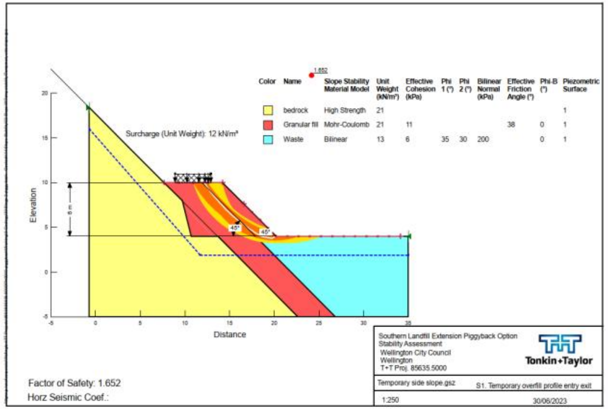


‘Cradle’ design numerical analysis and field trial



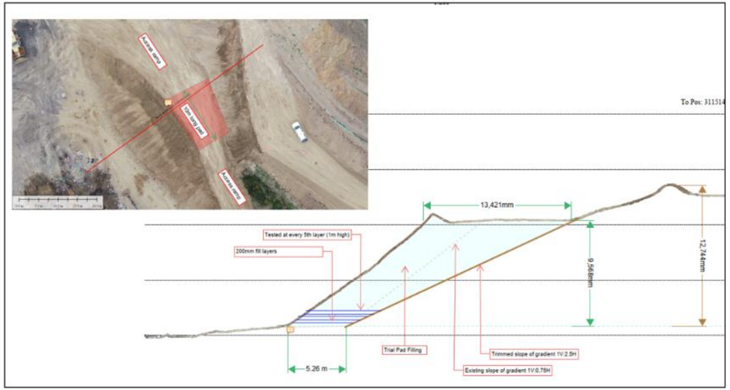
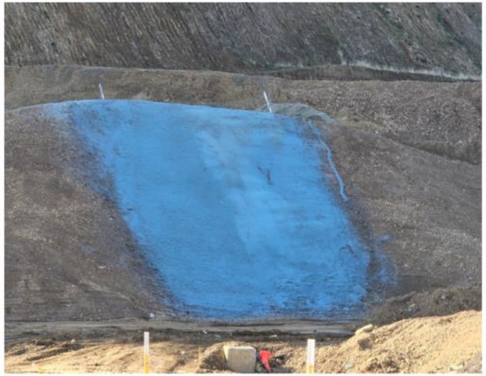
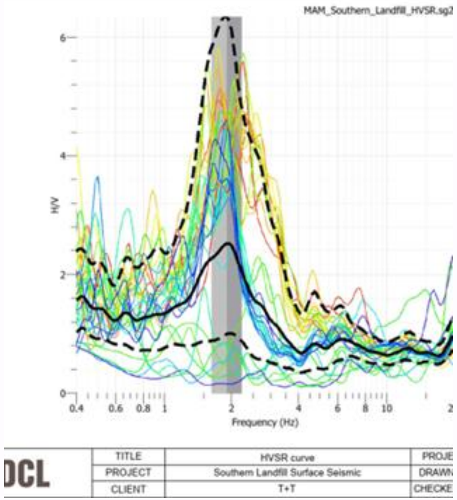
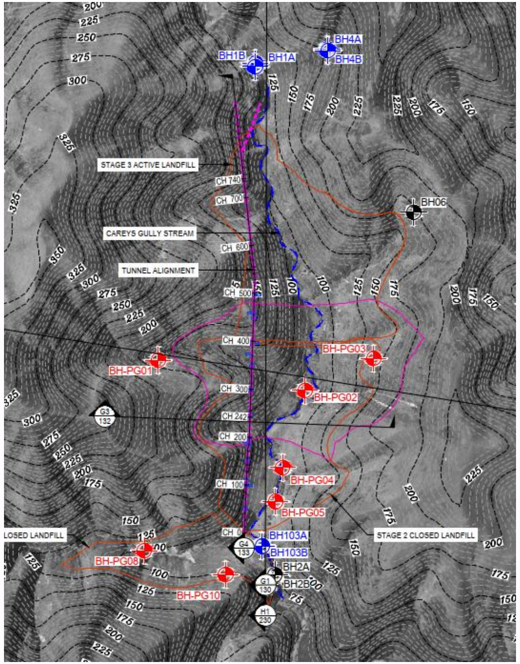


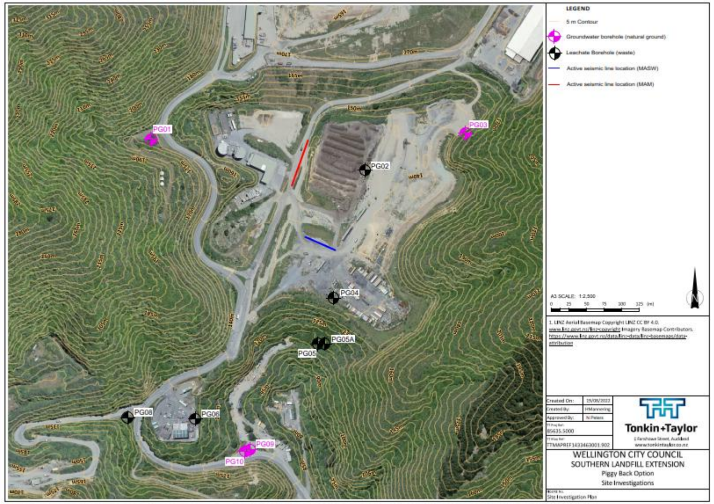
Figure 4.2: Type B sidewall liner trial construction



Overall Piggyback Landfill Stability Assessment - Investigations

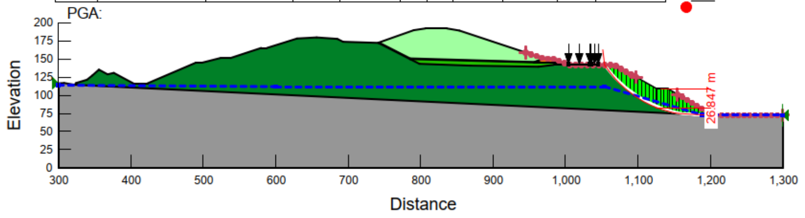


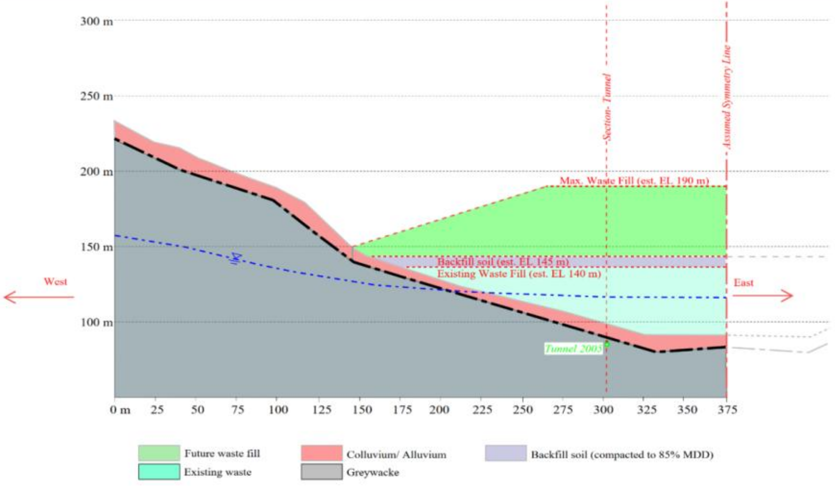


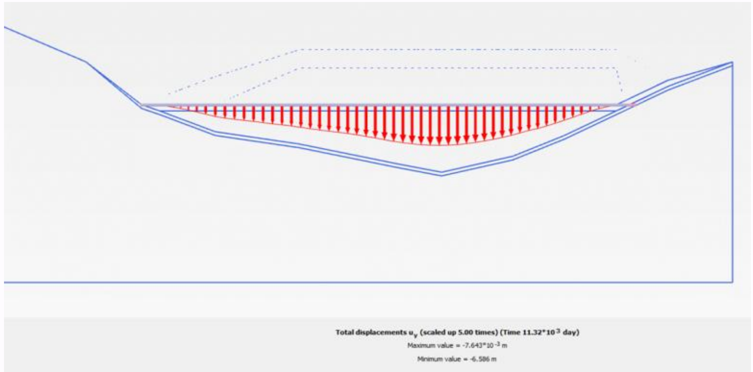


Overall Piggyback Landfill Stability Assessment - Numerical analysis

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Base liner - peak	Mohr-Coulomb	13	8				25	0	1
	Base liner - residual	Mohr-Coulomb	13	0				17	0	1
	Bedrock	Bedrock (Impenetrable)								1
	Engineered fill (new)	Mohr-Coulomb	21	11				38	0	1
	Engineered fill (old)	Mohr-Coulomb	18	1				36	0	1
	Lower (old) waste	Bilinear	13	6	35	30	200		0	1
	Waste	Bilinear	13	6	35	30	200		0	1
	Waste (soil)	Mohr-Coulomb	18	5				30	0	1



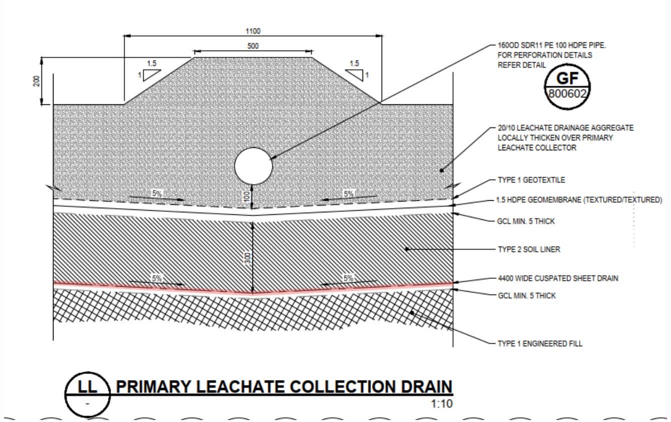


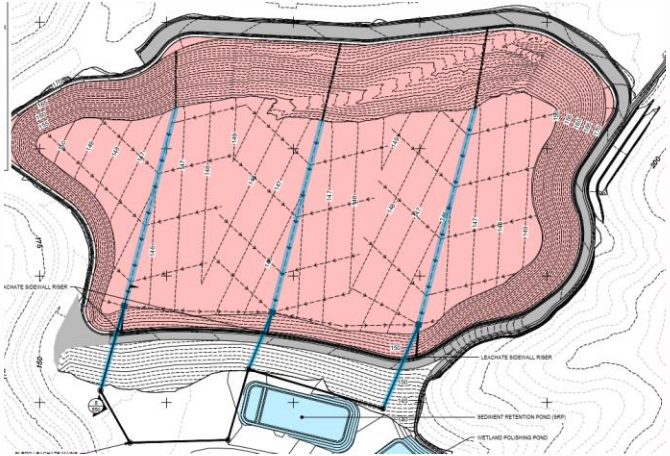


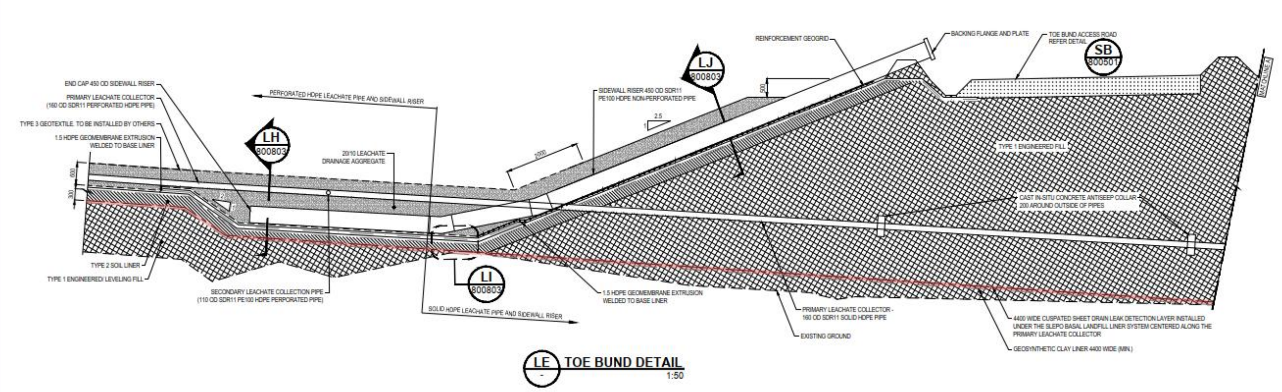
Overall Piggyback Landfill Stability Assessment - Leachate pumping trial

- 5 wells drilled for pumping trial
- Assess viability of leachate pumping of old / closed landfill
- Control leachate level within Stage 2 closed landfill
- Contingency plan to pump leachate if required (due to leakage or for stability requirement)
- Dual function as gas collection

Redundancy in leachate leak detection, collection and removal system







Q&A?