Commercial Considerations for Landfill Construction



Sam Butler | WMRR

Agenda

1. Introduction
2. Overview of landfill cell construction costing
3. Case study of recent construction projects & drivers of construction cost for each project
4. Key points

Overview – Why consider landfill construction cost?

Site Owners & Operators

Site and cell viability – Cell $/m^3 of airspace

Engineers

Appreciation of cost of engineering design controls – pragmatic design decisions

Overview - What drives landfill construction cost?

Site and foundation

Ground conditions: Natural ground, historical waste, mine waste

Groundwater proximity

Rock excavation

Construction Materials

Earthworks - Site-won versus imported materials

Geosynthetics

Leachate Collection System

Delivery and Regulation

Cell staging, weather, CQA, tie-ins and on-going active operations.

Regulatory requirements – lining system, leachate collection

Case study 1 – Metropolitan landfill cell

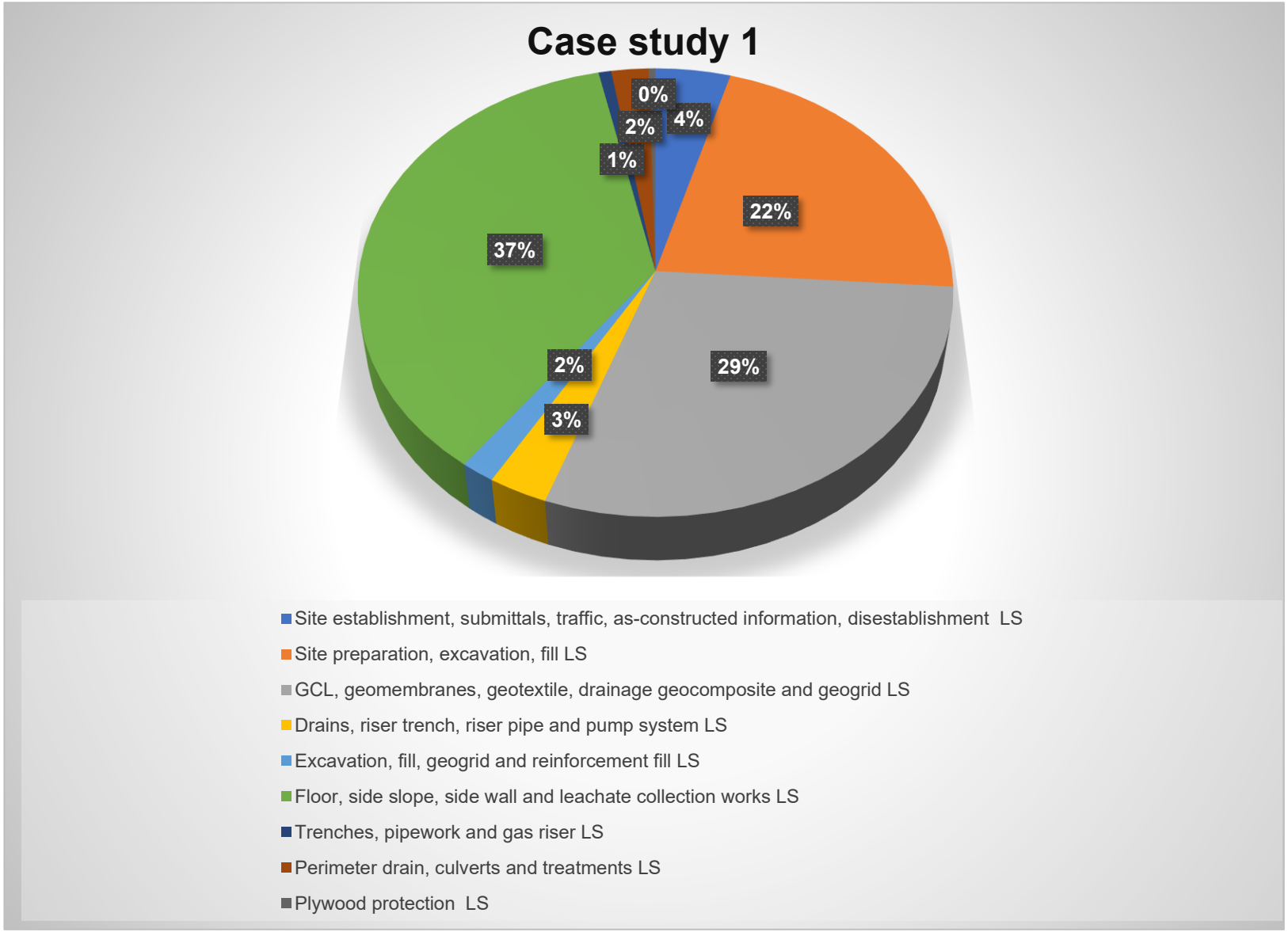
Cell Basal Liner System

- Groundwater drainage system
- Reinforcement system
- Clay subgrade
- Geosynthetic lining system – GCL, HDPE, Cushion Geotextile
- Geocomposite drainage (on sidewall)

Site conditions

- Poor ground conditions requiring reinforcement
- High groundwater table

Case study 1 – Metropolitan landfill cell



Primary Costs

- Leachate collection system (37%)
- Geosynthetic Lining system (29%)
- Bulk earthworks (22%)

Key Site Conditions, Cost Drivers

Poor ground conditions
Inclusion of reinforcement system ~$12/m2

High groundwater
Inclusion of groundwater drainage system ~$7/m2

Imported Earthen Materials
Import of Clay liner ~$17/m2 (7%)

Summary
Challenging ground conditions and groundwater system results in an additional 8% to total cost of project

Import for clay liner added 7% to total cost of project

Case study 2 – Regional landfill cell

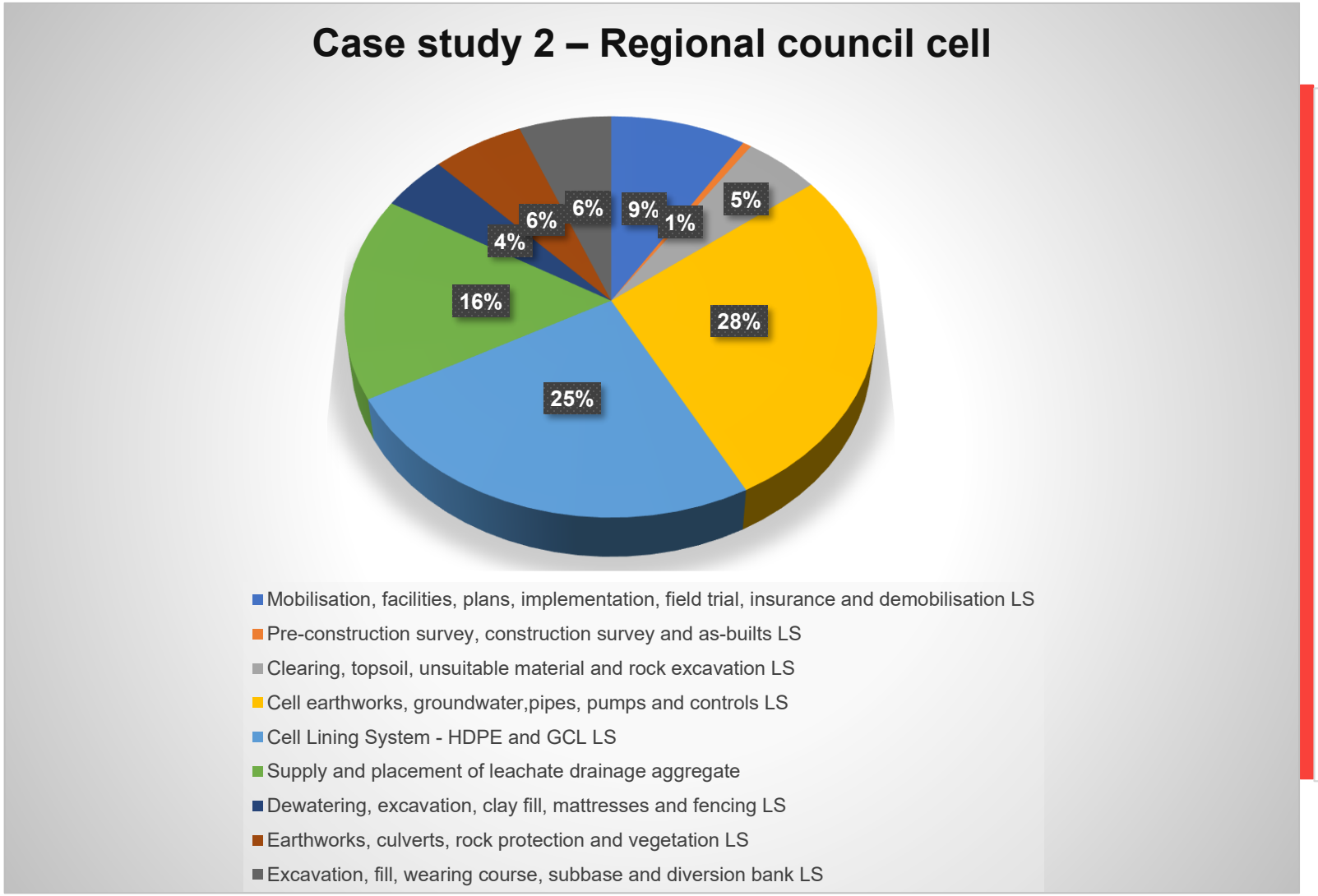
Cell Basal Liner System

- Groundwater drainage system
- Ground improvement system
- Clay subgrade
- Geosynthetic lining system – GCL, HDPE, Cushion Geotextile

Site conditions

Poor ground conditions requiring replacement with select fill
Regional site

Case study 2 – Regional QLD Council Cell



Primary Costs

- Cell earthworks (28%)
- Geosynthetic Lining system (25%)
- Leachate drainage aggregate (16%)

Key Site Conditions, Cost Drivers

Regional Site

Mobilisation and demobilization ~9% of total cost of project

Select fill

Significant cost difference between site won and import ($75/m3)

Summary

Regional projects have higher mobilization and material importation costs

Case study 3 – Regional landfill piggyback cell

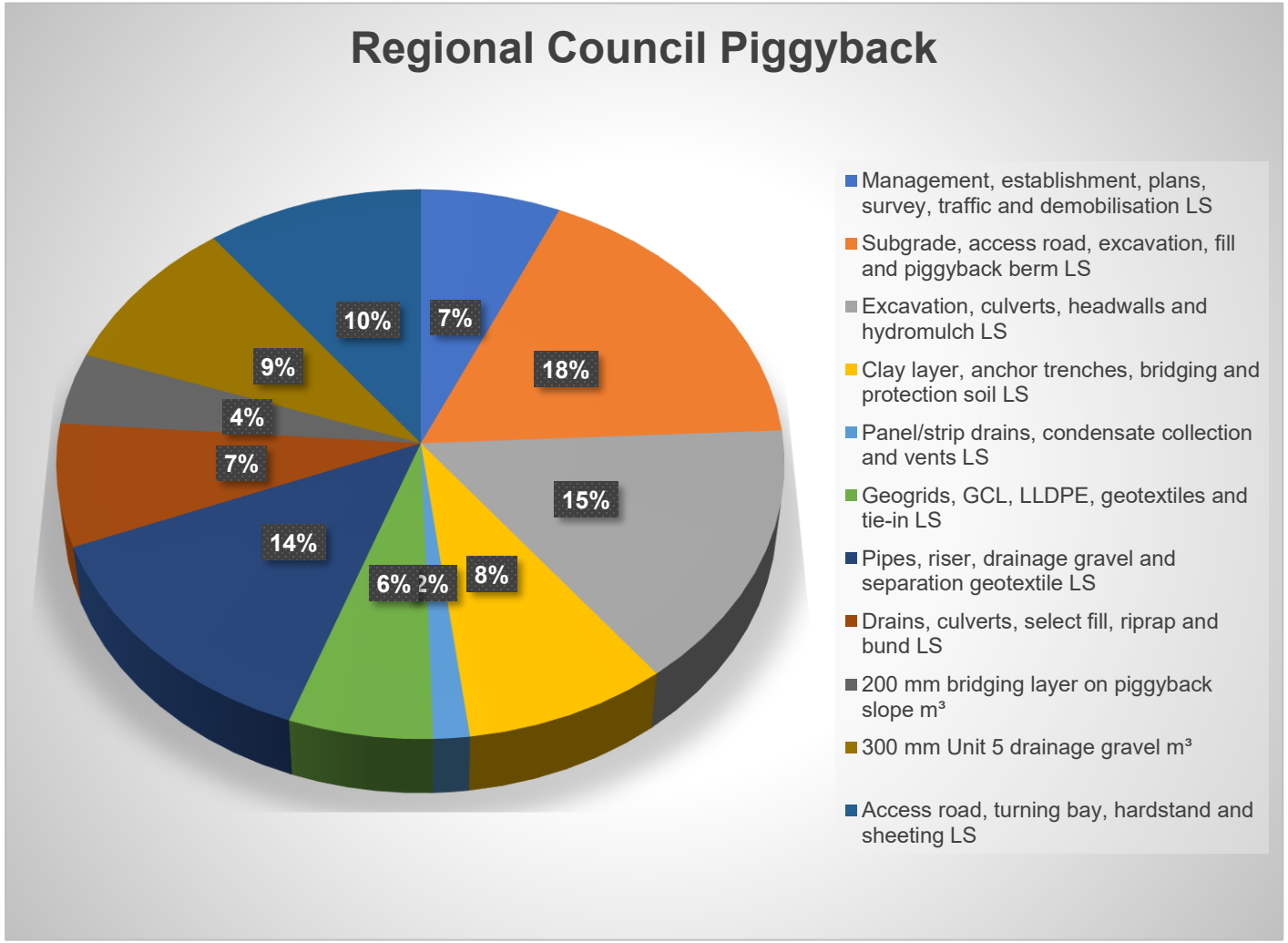
Piggyback Liner System

- Landfill gas drainage system
- Ground reinforcement system – Geogrid and sub-base
- Geosynthetic lining system – GCL, LLDPE, Cushion Geotextile, Uniaxial Geogrid
- Protection soil and erosion protection system

Site conditions

Poor ground conditions - landfill waste
Stormwater management
Regional site

Case study 3 – Regional QLD Council Piggyback Cell



Primary Costs

- Cell earthworks (18%)
- Stormwater management (15%)
- Leachate drainage aggregate (14%)
- Geosynthetics (6%)

Key Site Conditions, Cost Drivers

Regional Site
Mobilisation and demobilization ~5% of total cost of project

Geosynthetic Procurement
Council procured materials prior to Contractor engagement

Stormwater
High cost for re-routing stormwater (large upstream catchment)
~10% cost of project

Poor ground conditions
Inclusion of reinforcement system ~4% cost of project

Supplementary leachate drainage gravel
Additional gravel placement across cell floor (3%)

Case study 3 – Regional landfill piggyback cell

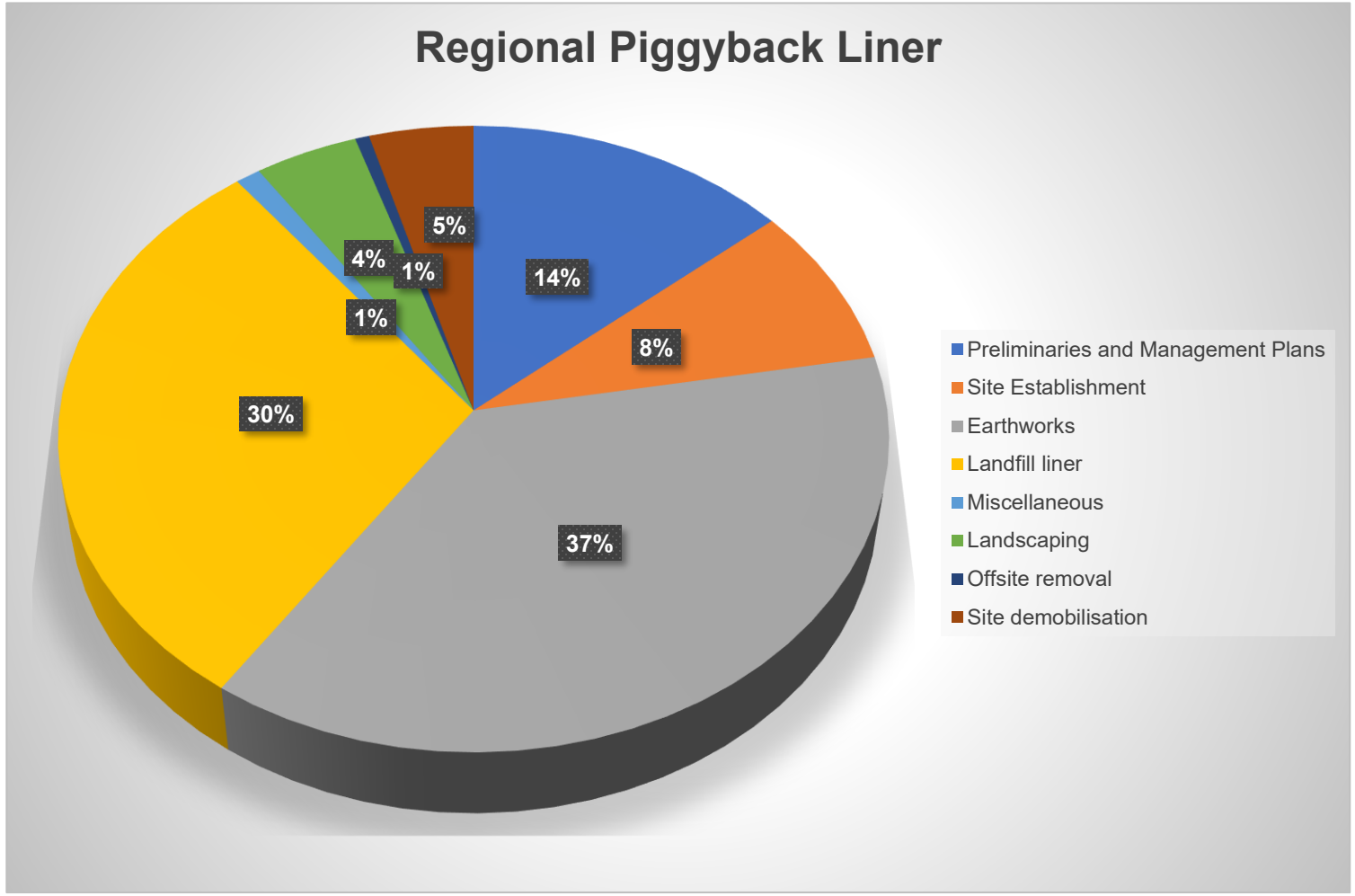
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- Protection soil and erosion protection geotextile

Site conditions

Poor ground conditions - landfill waste
Regional site

Case study 4 – Regional QLD Council Piggyback Cell



Primary Costs

- Cell earthworks (37%)
- Landfill liner (30%)
- Preliminaries / site mobilization / demobilization (19%)

Key Site Conditions, Cost Drivers

Regional Site

Mobilisation and demobilization ~19% of total cost of project

Import Cost of Clay

Clay rich fill $130/m3

Protection layer $115/m3

Key Points

Earthworks

Earthworks / Ground conditions is the largest uncontrolled commercial risk during construction:

- Rock
- Unsuitable material
- On-Site Borrow availability
- Imported fill – source availability
- Existing waste removal

- Drainage aggregate is one of the key primary costs and quite comparable unit rates between projects



Key Points

Geosynthetics

- The cost variance of geosynthetics across projects is often smaller than the variation in earthworks, drainage aggregate, groundwater treatment, access & stormwater infrastructure.
- The actual supply and install cost of GCL only varies by around 25-35% between projects, whereas earthworks costs vary by several hundred percent.
- Geomembrane rates varied 35%, ($17-26/m²) installed - a relatively narrow band across different projects
- Protection geotextile between projects shows more variability because of mass per unit area changes
- Separation geotextile: ~$6-$7/m² consistent between projects



Key Points

Other

- Installation location (regional / metropolitan) , contractor mobilization and demobilization are key CAPEX cost influences for regional locations.
- As part of the design process it is recommended that the Owner & Designer compare alternatives during concept design for optimising airspace ($/m3).
- The greatest commercial opportunity to manage cost is delivering a mature design, understanding ground conditions, defined material sources and clear scope before tender.



Thank you



Sam Butler

Senior Associate Civil Engineer

Mobile 0409 320 247

Email sam.butler2@wsp.com