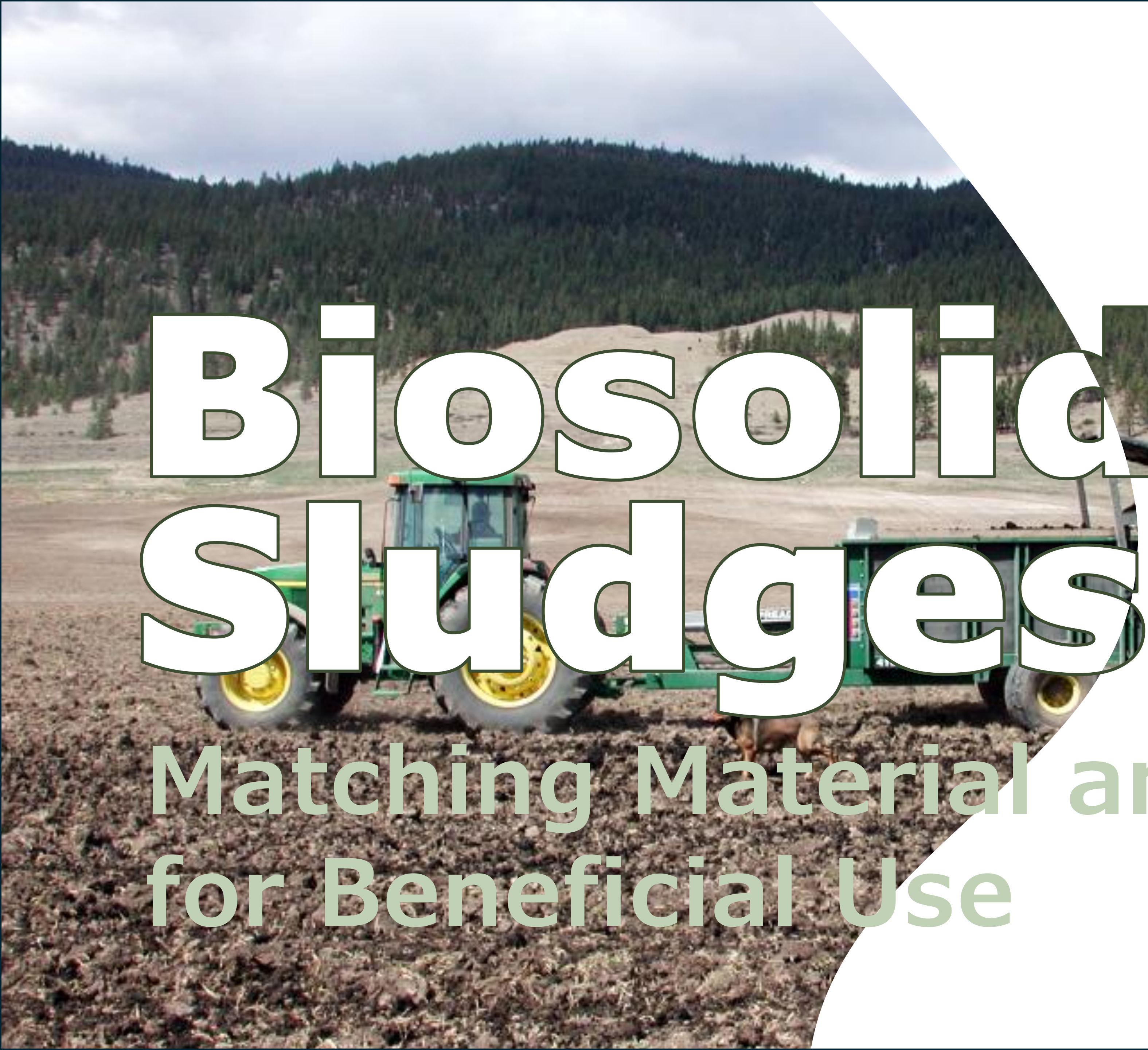

Biosolids & Sludges

Matching Material and Land for Beneficial Use

Katie Beecroft

LOWE Environmental Impact

Purpose and Technical Framing

- Biosolids and sludges are **heterogeneous products** applied to **heterogeneous environments**
- Risk and benefit are largely determined by **matching product quality to receiving environment**

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Moving from **"Can we apply?"** to
"What product, where, and why?"

Biosolids and Sludge Products: The Spectrum

1

2

3

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1 Stabilised biosolids (various grades)

2

3

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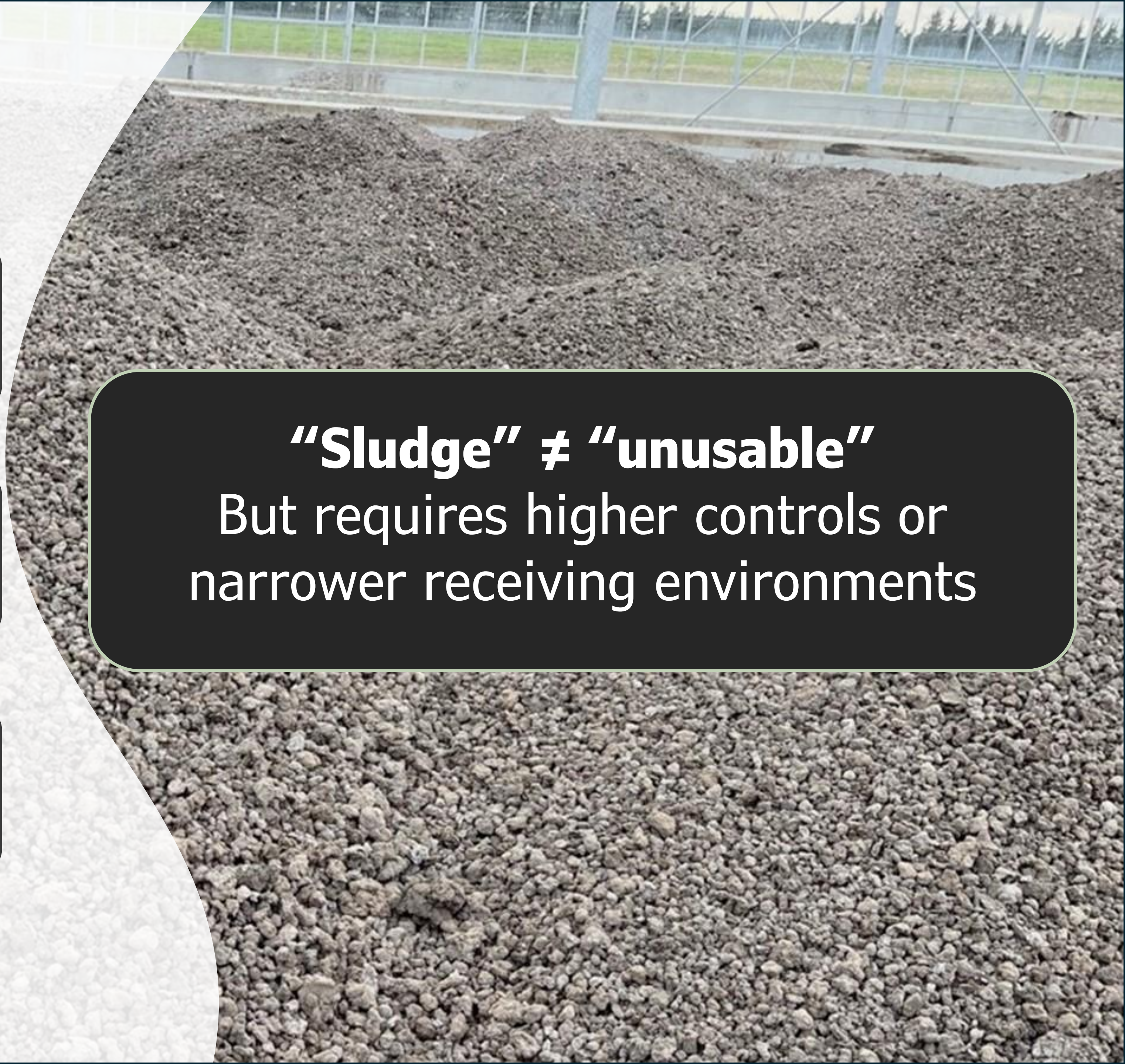

"Sludge" ≠ "unusable"
But requires higher controls or narrower receiving environments

NZ Regulatory Context (Risk Based)

- Graded and tiered approach under NZ Biosolids Guidelines
- Regional plan rules, RMA (?) consent pathways and WEPS
- Increasing scrutiny on contaminants and cumulative effects

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Regulation **supports site specific risk assessment**, not **one size fits all pathways**

Tailoring to Soil and Geology

Key Soil Factors

- Texture, structure, drainage class
- pH, Cation exchange capacity (CEC), Anion Storage (ASC)
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Neutral pH high CEC, high ASC, deep soils → greater buffering for metals

Poorly drained or shallow soils → limited suitability for high N or liquid products

Sludge products → only appropriate where pathogen die off, nutrient and contaminant retention, and monitoring can be demonstrated

Managing Risk

Hydroclimatic Controls (understand)

- Rainfall intensity and seasonality
- Evapotranspiration balance
- Depth to groundwater and aquifer vulnerability

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Product Alignment (mitigate)

- Liquid or low-stability products → dry seasons, low runoff risk
- Sludge products → locations with **large separation distances**, low recharge, and strong attenuation

Material Handling

Dry: >85% solids

- Fertiliser spreader or helicopter hopper
- Falls through foliage / established vegetation
- Cultivation not required
- Slow to incorporate and release nutrients

Spadeable: 15-30% solids

- Muck spreader
- Application at cultivation
- Flat to rolling sites
- Growing season release of nutrients

Wet: 2-8% solids

- Direct injection, discing
- Apply to growing crop
- Best suited to pasture
- Flat land
- Supply of water as well as rapidly available nutrients

Land Use, Receptors, and Community Context

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- Forestry, cropping, pastoral, rehabilitation land
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Social Licence

- Odour, traffic, visibility
- Sludge applications often require **higher engagement thresholds**

Case Study: Sludge Application to Dry Land

Material

- Minimally stabilised WAS, municipal wastewater plant
- Complies with contaminant grades
- Other wastes to be applied

Landscape Parameters

- Brown Soils
- Semi-arid climate
- Predominantly flat
- Fodder crop and low intensity drystock
- ~ 4 m groundwater depth

Case Study: Sludge Application to Dry Land

Adaptive Management

- Product characterisation frequency
- Soil and water trend monitoring
- Trigger levels and response actions

Operational Controls

- Setbacks, incorporation, application rates
- Integration with other site activities
- Contractor competence and QA/QC

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Site matched products + monitoring **= defensible risk management**

Key Conclusions

- Biosolids management success is driven by **contextual fit**
- Lower-grade products are not automatically excluded, but **their use is more restricted and needs higher management controls**
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LOOKING AHEAD

- Emerging contaminants and evolving consent conditions
- Increasing need for **bespoke product-site matching frameworks**

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