SPECIALIST IN LAND CONDITION

Regeneration of Historic Landfills – One size Doesn't Fit all!

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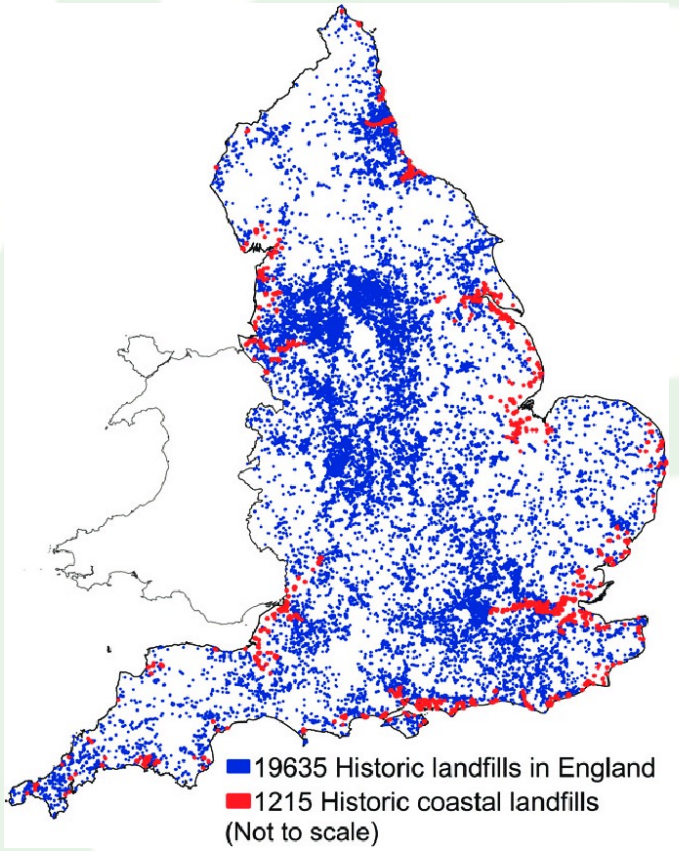
Why do we care about landfills

They are everywhere, the Environment Agency historic landfill dataset identifies ~20,000 sites in England;

They are in desirable locations - many historical landfills are on the peripheral towns and cities occupying valuable land, usually included in local development plans;

We have an acute housing need

Therefore, a key reclamation driver is emerging for this valuable brownfield land; need for housing and land value;



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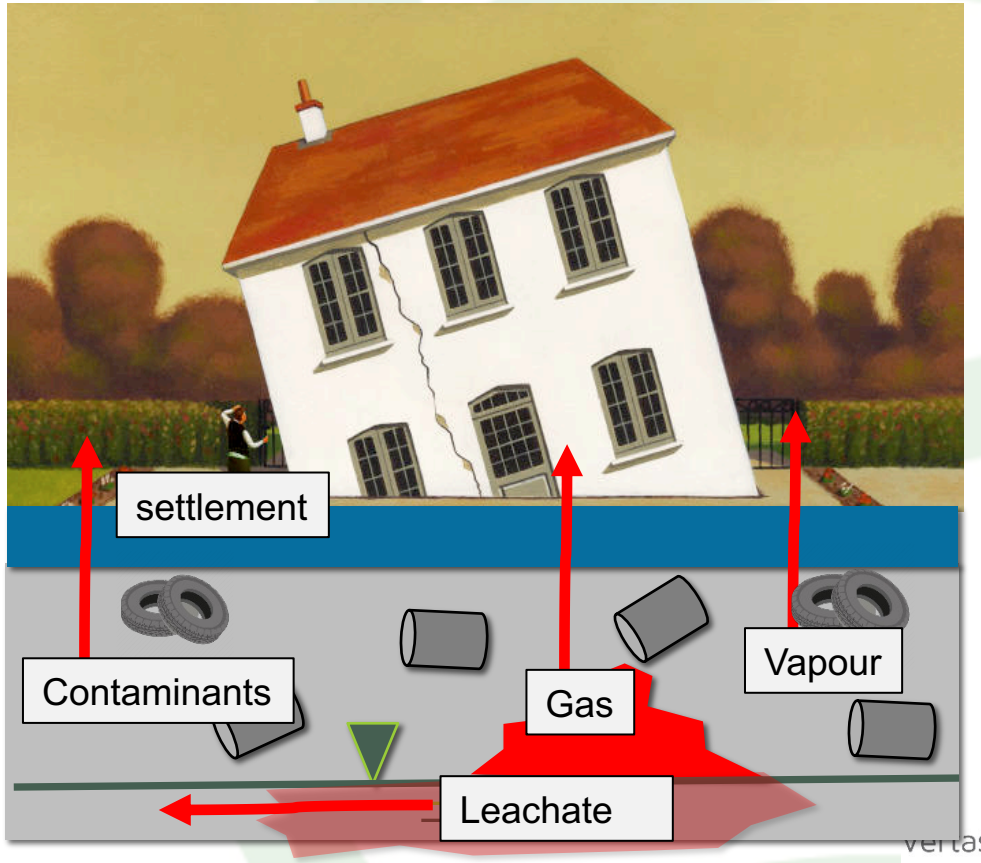
Perception!

Many of these sites were operated by controlled tipping into former quarries or depressions in natural topography

Typically, “dilute & disperse” (no engineering to manage leachate and ground gas).

Often filled pre permitting so records scarce as to the composition of the landfill.

Some pose significant risk to the environment via gas / leachate migration although typically human health risk for future users on site can be managed



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The importance of SI

Landfills are tricky things!!

They are extremely variable, need to think outside of the box vs a conventional SI.

Its not like logging soils. SI terminology can have a significant impact on cost during the remediation design.

Very easy to produce over engineered solutions.

Depth, extent and nature of the material in the landfill key.

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Borehole Logs vs Trial Pits

Dry			(0.85)	metal fragments. Gravel is angular to subangular fine to coarse brick and concrete fragments. Cobbles are brick and concrete. (MADE GROUND)		
Dry		11.31	1.50		1.50	
				Very dense dark brown to dark grey clayey sandy GRAVEL with occasional glass and wood fragments. Gravel comprises angular to subrounded fine to coarse brick slate sandstone clinker and concrete fragments. Sand is fine to coarse (MADE GROUND)	1.50	D02A
	100				2.20-2.50	ES03
			(3.00)	3.00 - 4.50 ... with occasional metal plastic and fabric fragments		
	100				4.00-4.30	ES04
Dry		8.31	4.50		4.50	
Dry				No Recovery.		
			(0.70)			
	100	7.61	5.20			
		7.41	5.40	Medium dense dark brown sandy clayey angular to subangular fine to coarse brick GRAVEL with	5.50	B04A
		7.31	5.50	occasional wood and plastic fragments. Sand is fine	5.60-5.80	ES05

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Impact of waste streams on cost

Cost Comparison of waste streams

Landfill Material	Disposal Cost	Impact of a 1% volume change based on a nominal 100,000m3 landfill
Textiles	£145 p/t	£261,000
Timber	£45 p/t	£81,000
Plastic	£145 p/t	£261,000
Metal	175 p/t credit	£261,000
Concrete Stone	£7.50 p/t	£13,500
Asbestos	£225 p/t	£405,000

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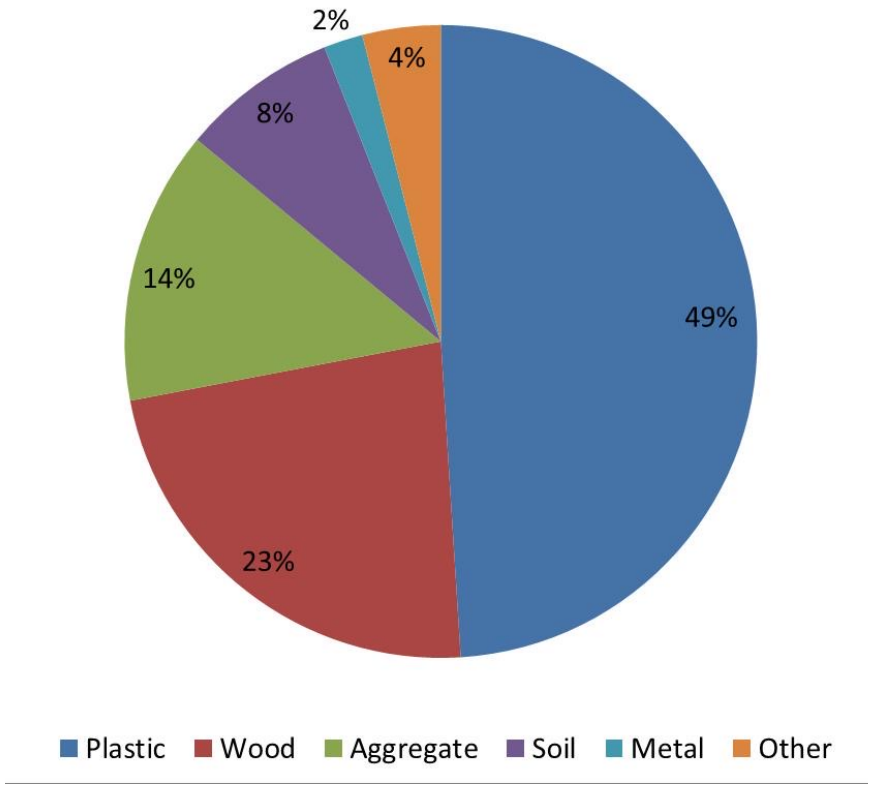
Typical Landfill Waste Components



Typical biodegradable materials:

- Wood
- Vegetation
- Textiles
- Paper/cardboard

Typical non-biodegradable materials

- Plastics
- Metal
- Rubber/tyres
- Brick/concrete
- Granular soils
- Cohesive soils
- Possible asbestos
- Ash/clinker

Early Contractor Involvement

Landfills are tricky things!!

Having a multidisciplinary team in place early allows some of the obstacles / issues to be identified and addressed:

- Use the experience of contractors to input into.
  - Sequencing;
  - Input into design process – don't waste time on unbuildable schemes;
  - Identification of construction risks;

Landfill reclamations are high risk projects, risk need to be understood by all parties at an early stage and managed. If a client wants to place all of the risk onto a contractor, they will not be getting best value.

Regulator confidence

- Having a team in place early provide confidence and allows relationships to develop;

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ECI Example - Site Trials

Effective site trials reduce uncertainty (risk) on a project;

Can target areas of risk for the contractor to reduce “costs risks or exclusion”

Provides confidence scheme is buildable to all parties.

Programme improvement when on site by refining techniques at an early stage.

Demonstrate to regulators, stakeholders, funders that the scheme is viable.

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The Reclamation Concept

Do nothing and lose valuable brownfield land, or remediate / manage.

Essentially three main families of landfill reclamation strategy.

No Waste Excavation	Full Waste Excavation	Partial Waste Excavation
Land is reclaimed by improving the geotechnical properties of the waste in-situ and installing engineered measures to manage health risks and environmental risks	Land is reclaimed by excavating all the waste and filling the void with materials that are suitable for re-use (geochemically and geotechnically) to manage health risks, environmental risks and geotechnical risks	A combination of the two – typically involving excavation of shallow waste only and filling the void with materials that are suitable for re-use

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No Waste Excavation - Geotechnical Improvement

Variety of methods can be used to improve landfill material on site and drive out deep settlement. Surcharging is one of the simplest options although other compaction techniques targeting deeper soils such as rolling dynamic compaction, drop weight compaction or the use of vibro stone columns may also be effective, depending upon the site characterics and performance requirements.

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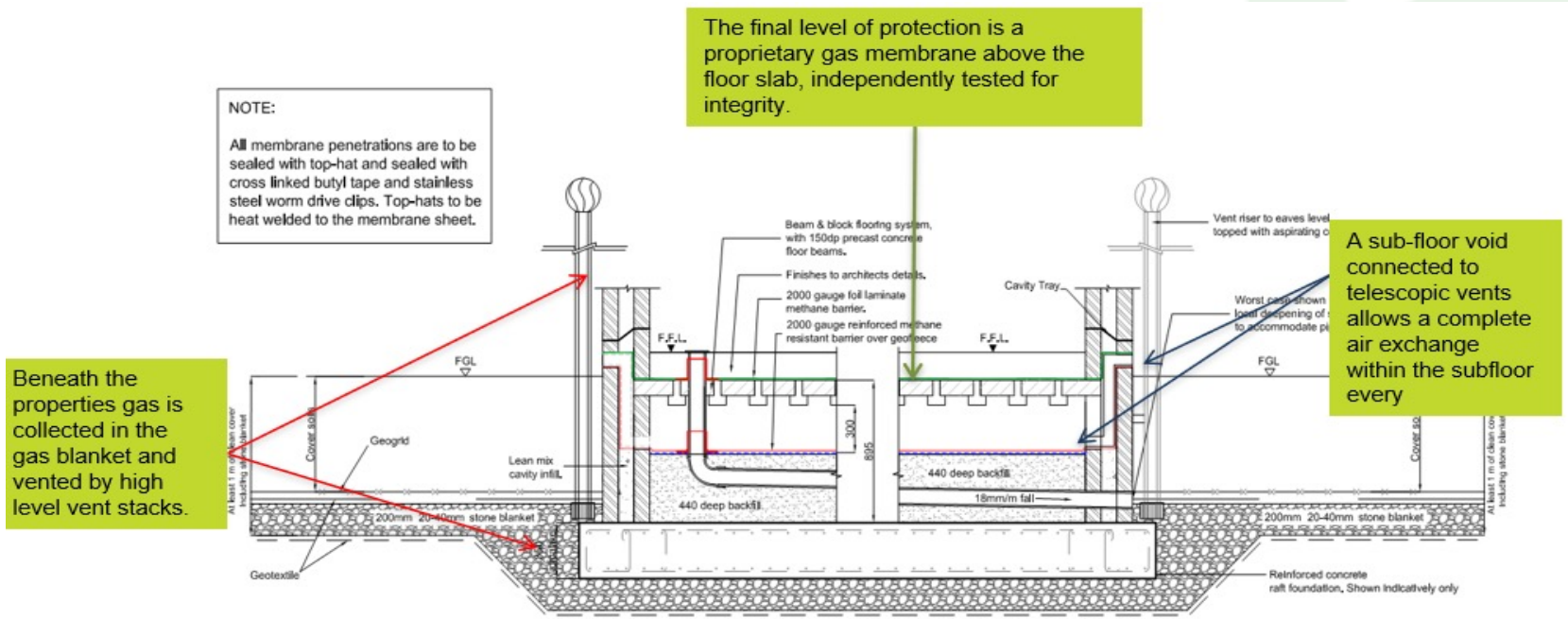
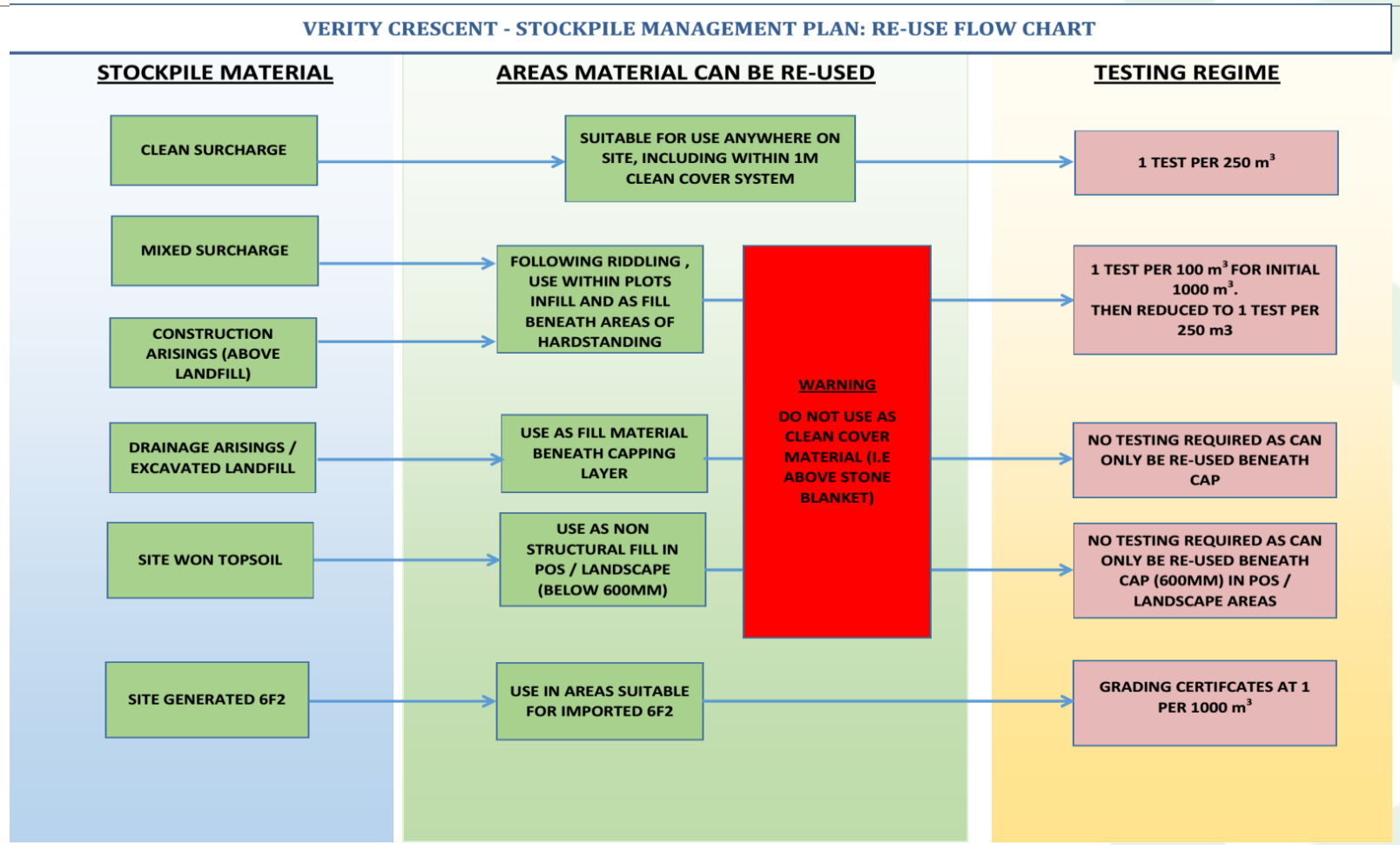
No Waste Excavation - Structural Gas Protection



The structural gas protection was based upon multi-layer approach, that would allow for redundancy of one of the layers without compromising the protection to the properties.

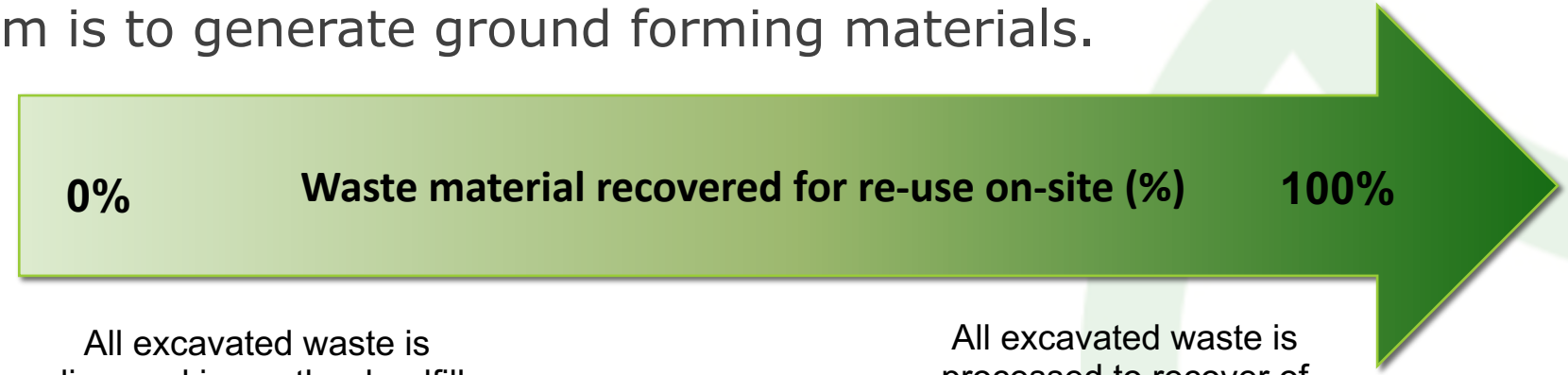
Validation / Verification Record



Waste Excavation

Where landfill reclamation involves waste excavation, maximising material re-use is key.

The aim is to generate ground forming materials.



All excavated waste is disposed in another landfill coupled with import of clean materials to backfill void

Low Sustainability
High cost

All excavated waste is processed to recover of materials that can be re-used on site to backfill void (with minimal off-site disposal)

Higher Sustainability
Lower cost

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Excavation of Waste – The easy part!

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Waste Segregation - Treatment Train

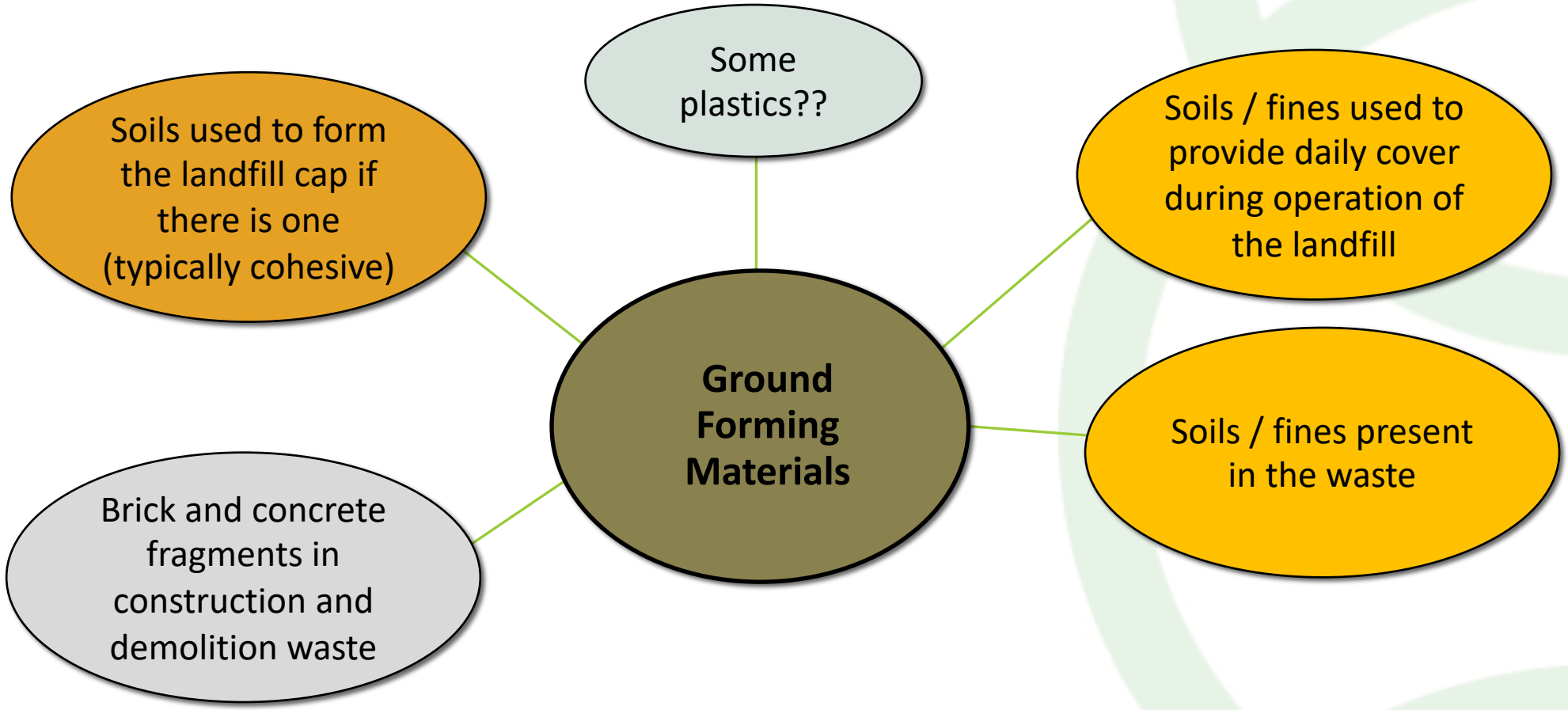
Waste processing commenced in accordance with a site specific treatment train;

The treatment train allowed for different processing methodologies dependant on materials encountered;

Processing methods are continually reviewed and are amended where material types change throughout the landfills;

Large processing area needed to store and treat waste streams.

What Materials can be Re-Used?



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Physical Waste Processing

Segregation of waste streams comprising screens, blowers and picking stations.

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Handpicking Wood & Textiles

Handpicking waste

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Reinstatement

NOT to be confused with landfilling / disposal

Can undergo compaction as General Fill using methods in SHW Series 600

Can achieve end-product specifications

- ≥95% relative compaction
- ≤5% air voids

Typically capable of CBRs in the range 2 – 5%

Suitable beneath buildings with appropriate foundation designs

Environmental Permitting – Fitting a square peg…

The EA started to become inconsistent in their advice and enforcement.

Treating as an active landfill, rather the contaminated land.

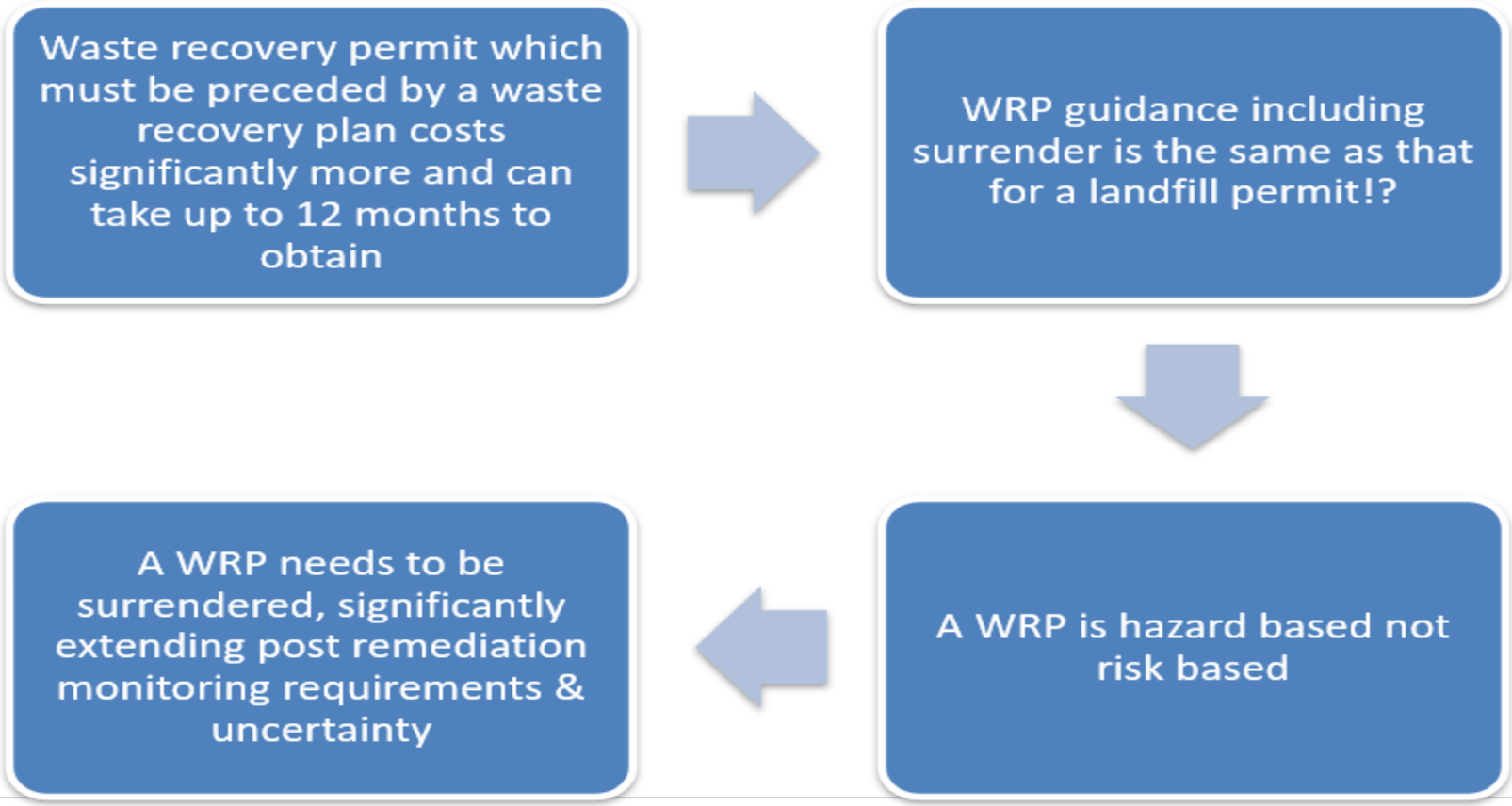
Sometimes the MTP / MMP route was acceptable, other times it was not.

The only alternatives were a landfill permit, end of waste position, or a waste recovery permit for permanent deposit to land

Landfill permit is generally a non-starter

However, a Waste recovery permit for permanent deposit to land was never intended for this scenario

Environmental Permitting – The Process



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Waste recovery permit

- Guidance is inappropriate and clumsy appearing to relate primarily to landfill disposal permit and surrender (never intended for landfill reclamation schemes)
- Significant up-front costs and time to obtain
- Significant operating costs and permit fees
- Significant surrender requirements leading to uncertainty, exceptional costs, exceptional post remediation monitoring periods,
- Inconsistencies in permitting and enforcement

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…we still have far to go

The EA has not provided further or new guidance on alternative or existing permitting options….yet!

Inconsistencies are again creeping in, in respect of assessment of waste recovery plans and the surrender expectations

Resource level and ability to make quick decisions continue to be lacking causing further constraint

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Environmental Permitting – Constraints

Site acquisition, site reclamation, re-developing on reclaimed sites is not a constraint

No confidence on permitting route….

No confidence on likelihood or timing for permit issue….

No confidence on timing of permit surrender….

No confidence…. No DEVELOPMENT

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Thank You!

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