CReDiT

A tool to evaluate the carbon footprint of brownfield remediation

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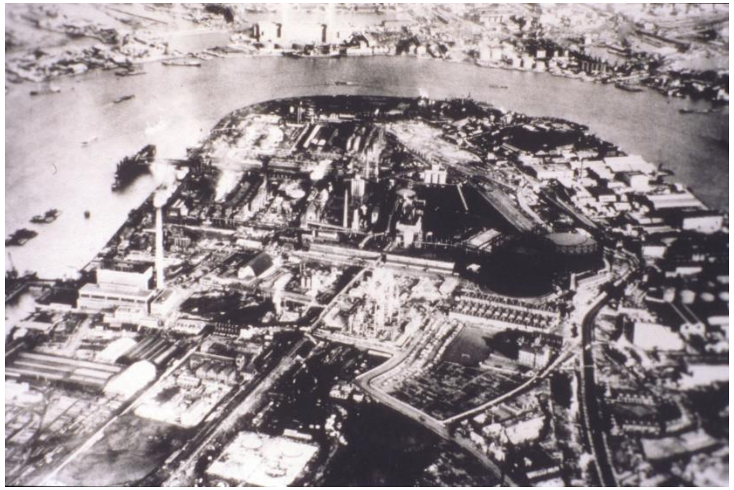
Introduction

Housing shortage

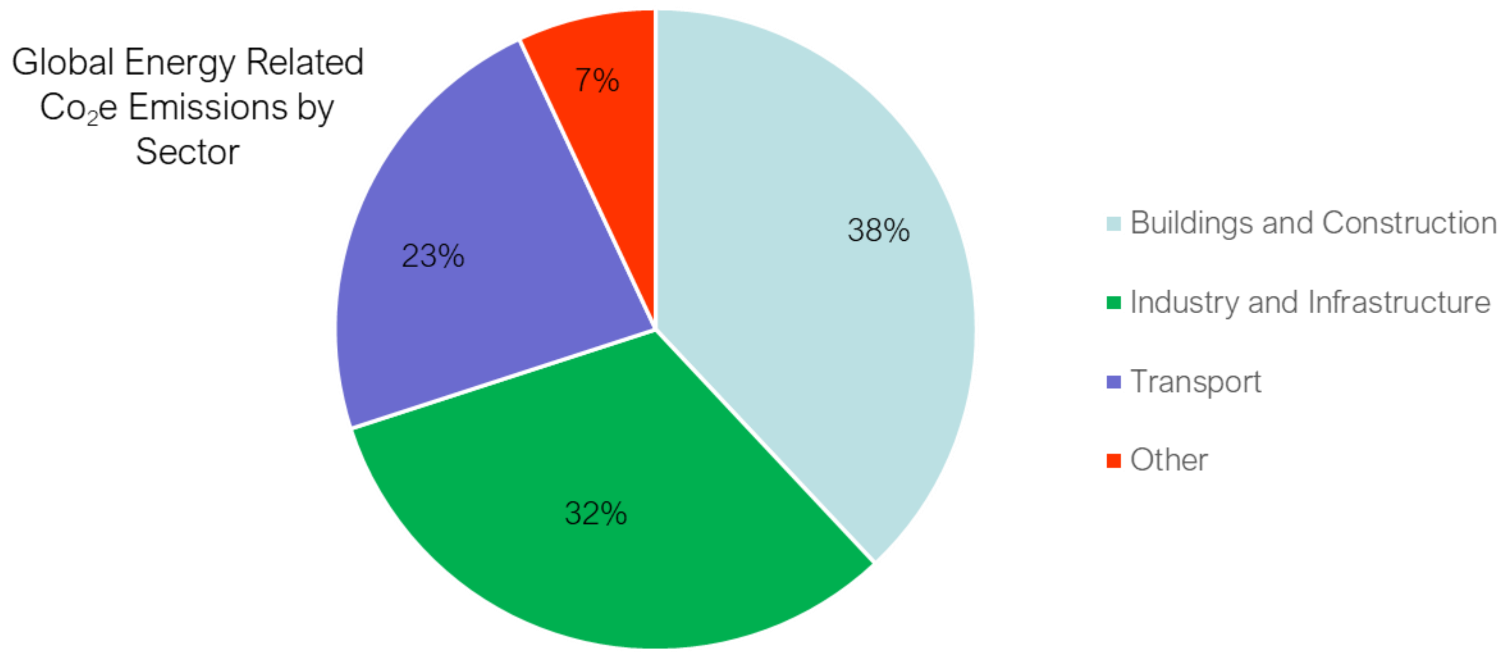
Edge of towns is protected 'greenbelt'



Within towns we have former industrial areas - development back >100 years

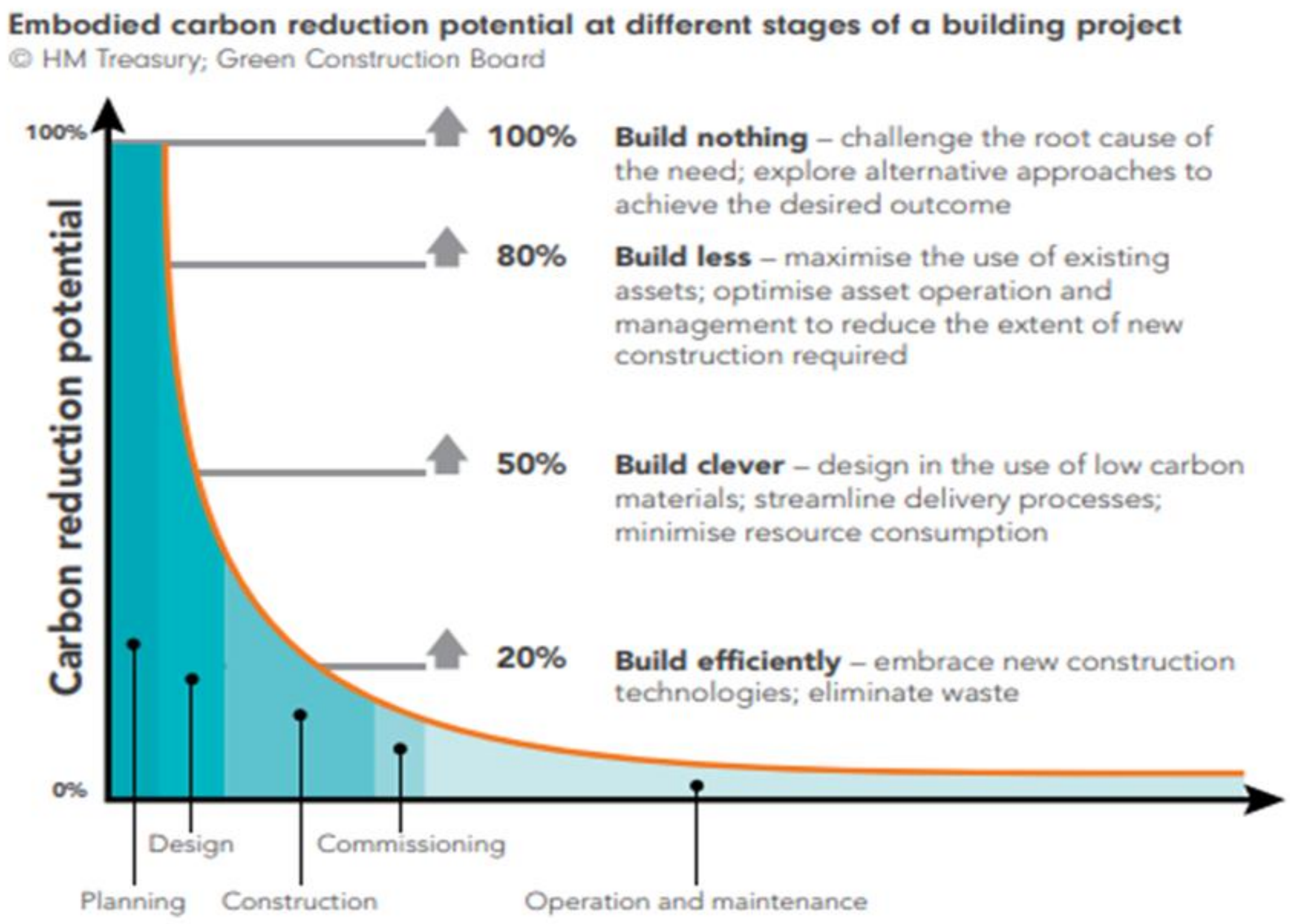
Solution = remediate and reuse the brownfield sites.

Why Zero Carbon?



Construction is the single biggest consumer of resources in the UK with the largest accompanying waste stream

Carbon Reduction

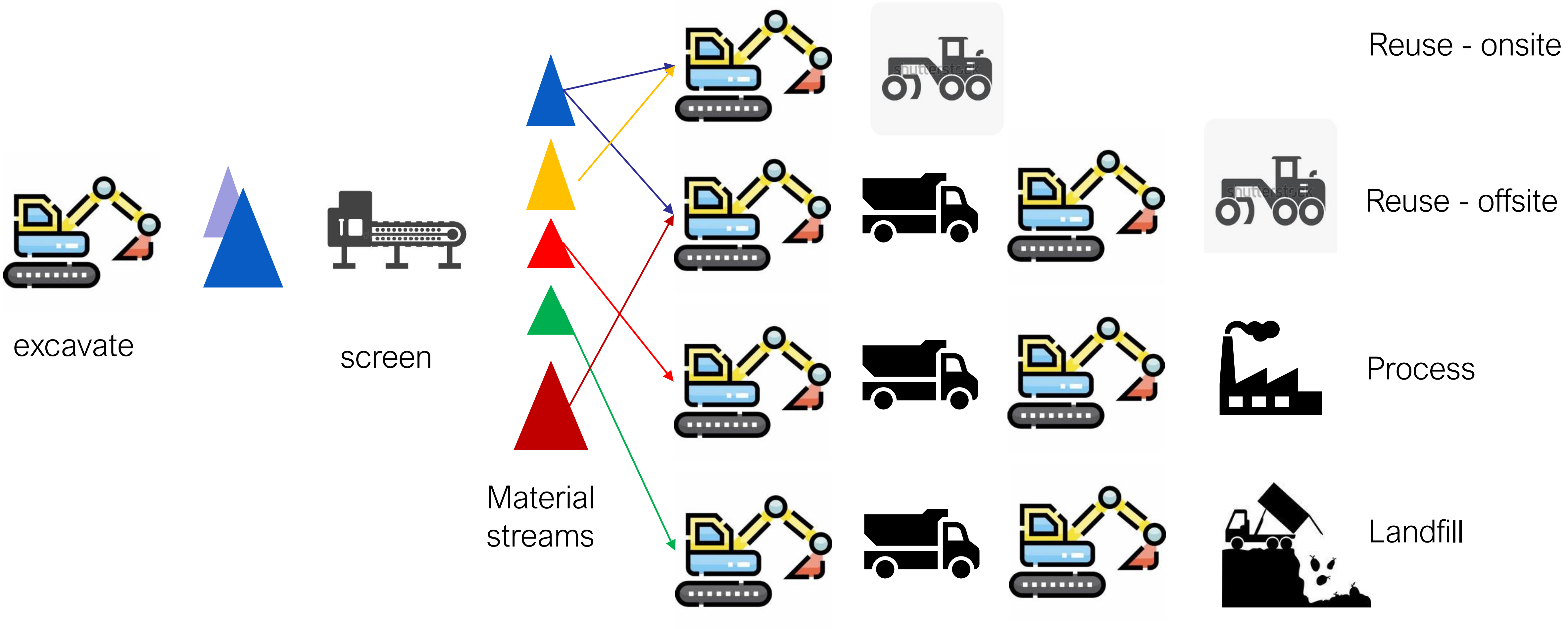


CReDiT

Carbon Reduction Model

CReDiT – carbon reduction model

Brownfield Remediation – UK – most common process on UK sites is as follows:



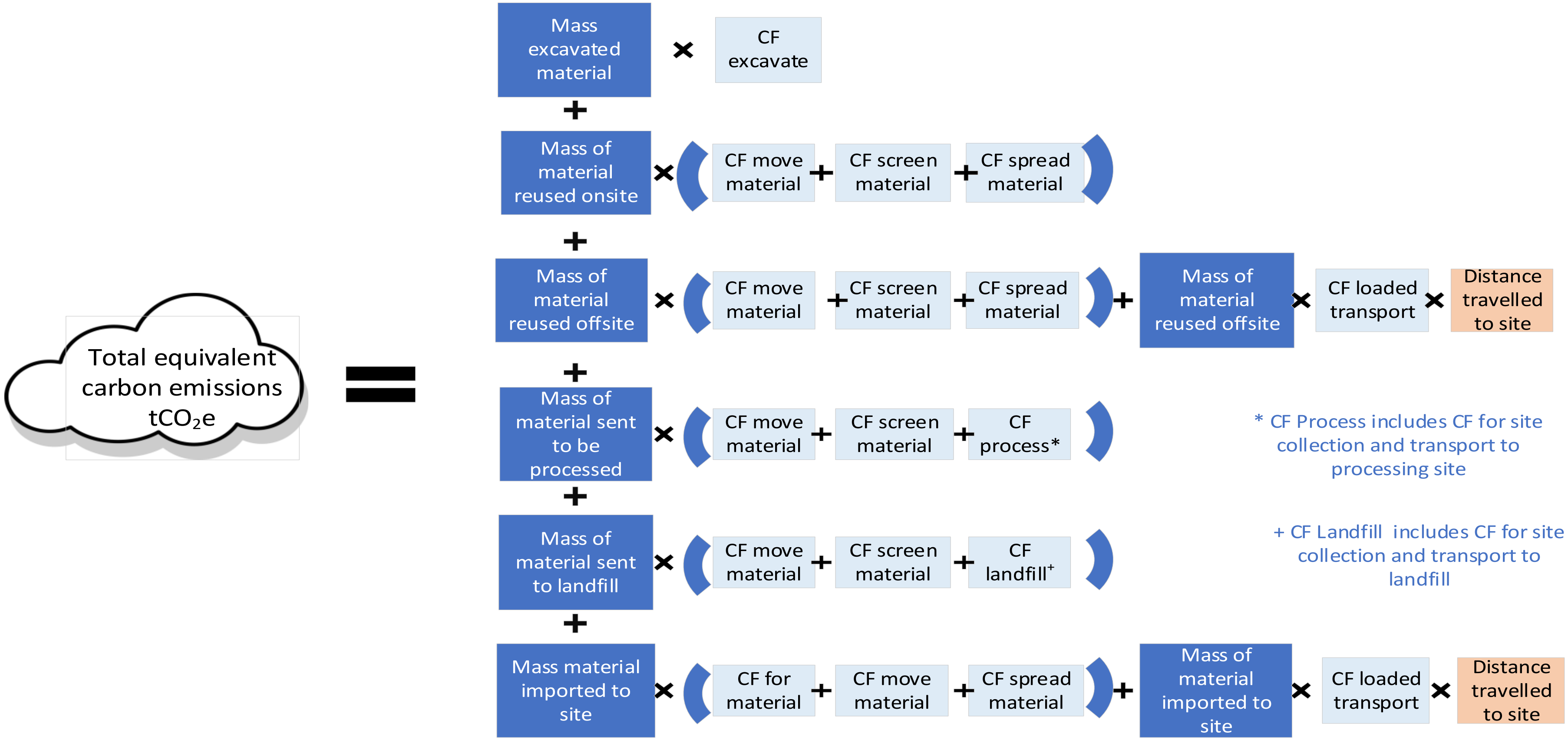
Calculation of embodied carbon

Embodied carbon = Material quantity (kg) x carbon factor (kgCO_2e/kg)

Need a carbon factor for each activity.

Straightforward for some – carbon factors published for topsoil, waste disposal, others have to be calculated from diesel use of equipment.

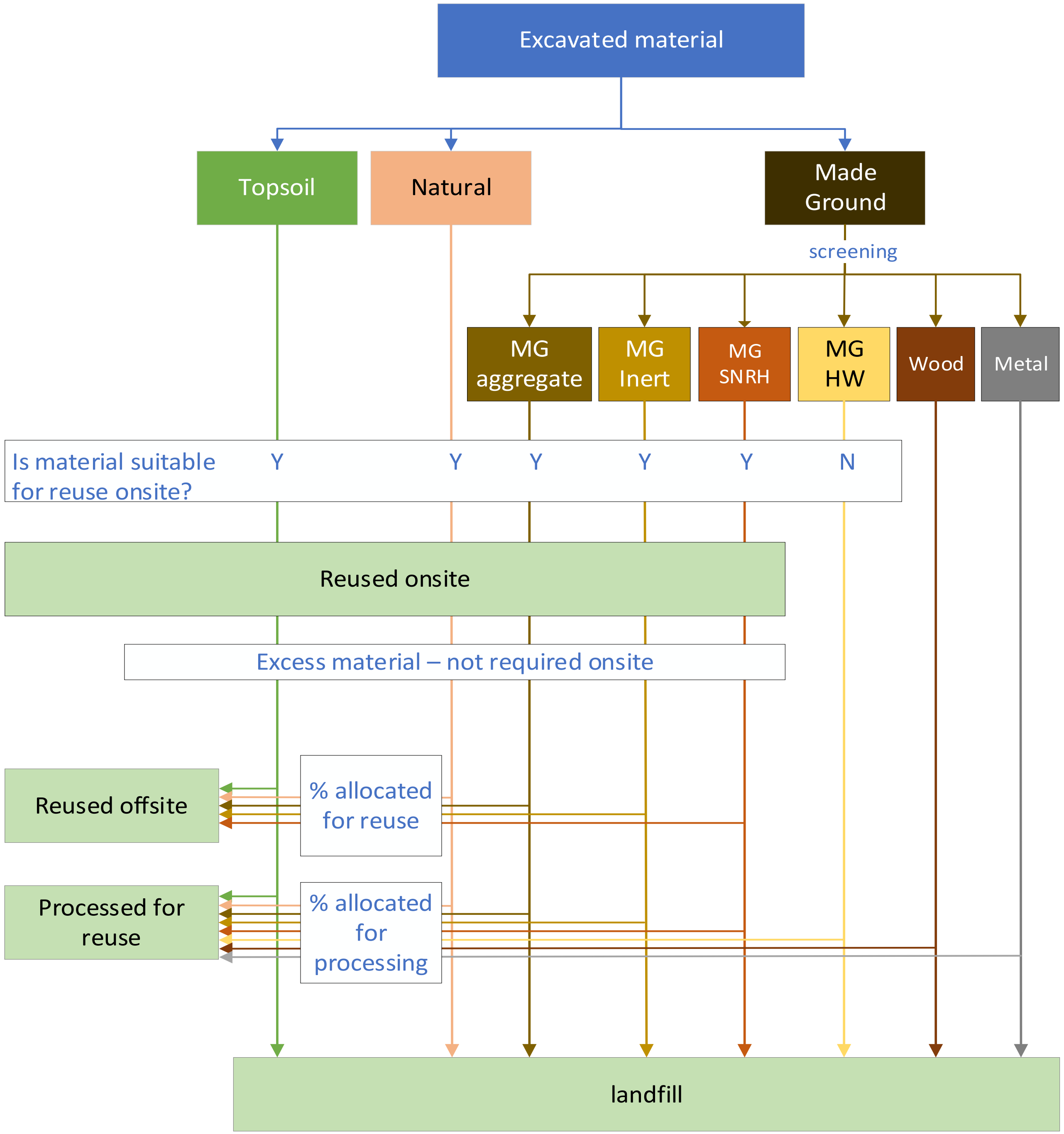
Overall calculation

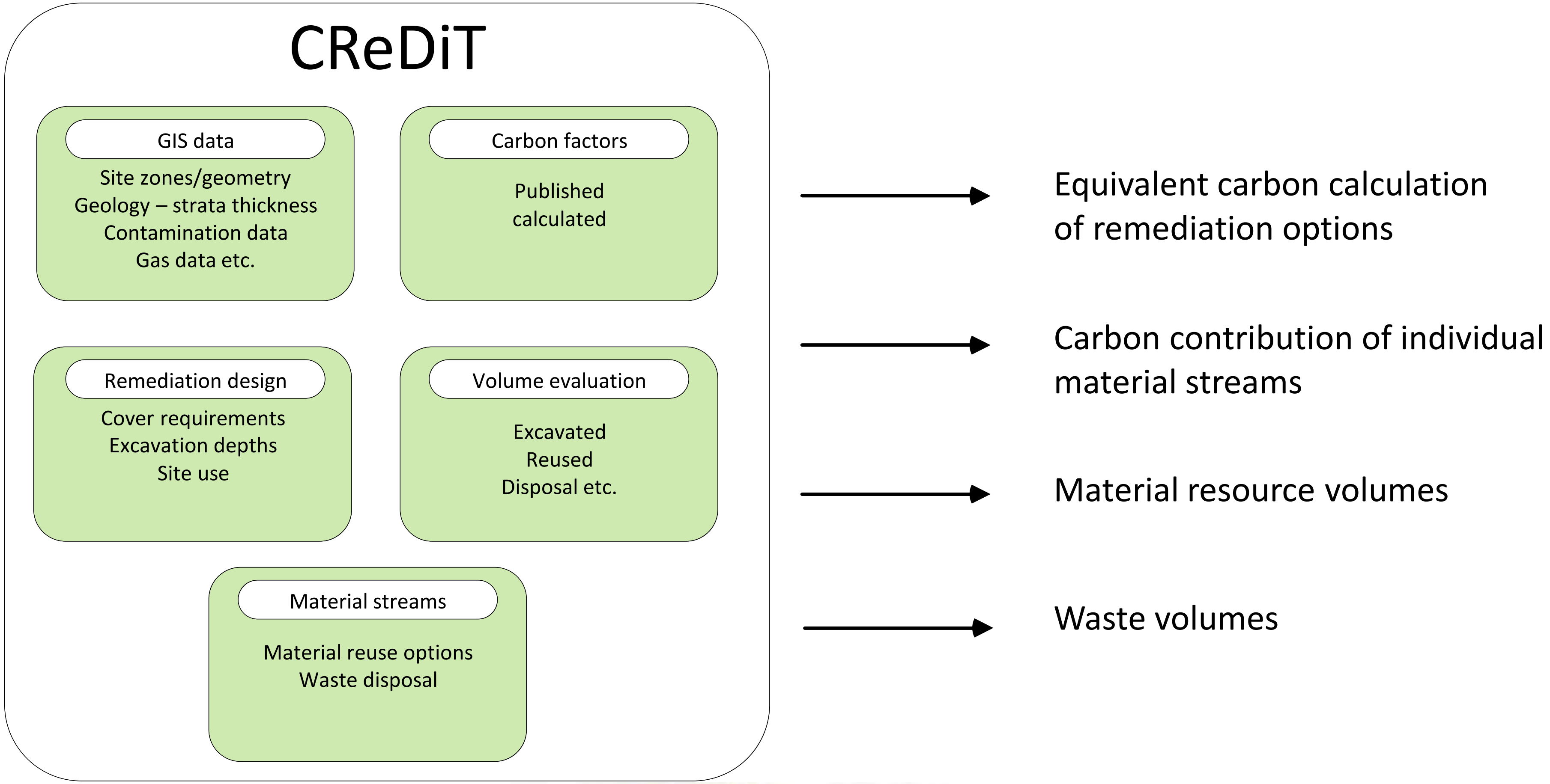


CF = Carbon Factor

Obtained from literature e.g. ICE V3, Government Carbon Factors 2021 or calculated from diesel use of machinery.

Material streams




CReDiT
GIS data
Site zones/geometry
Geology – strata thickness
Contamination data
Gas data etc.
Carbon factors
Published
calculated
Remediation design
Cover requirements
Excavation depths
Site use
Volume evaluation
Excavated
Reused
Disposal etc.
Material streams
Material reuse options
Waste disposal
Equivalent carbon calculation of remediation options
Carbon contribution of individual material streams
Material resource volumes
Waste volumes

Case Study

Development site

Proposed Residential development

1800-1900 Brickworks

↓

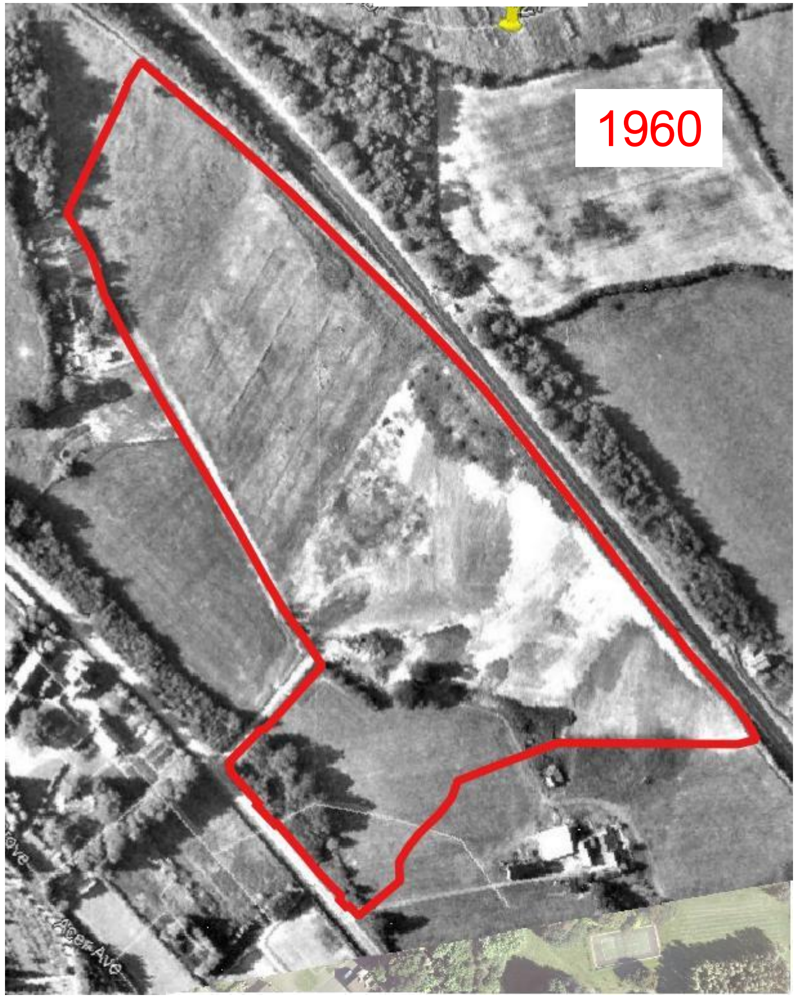
Early infill ~ 1900 in north

↓

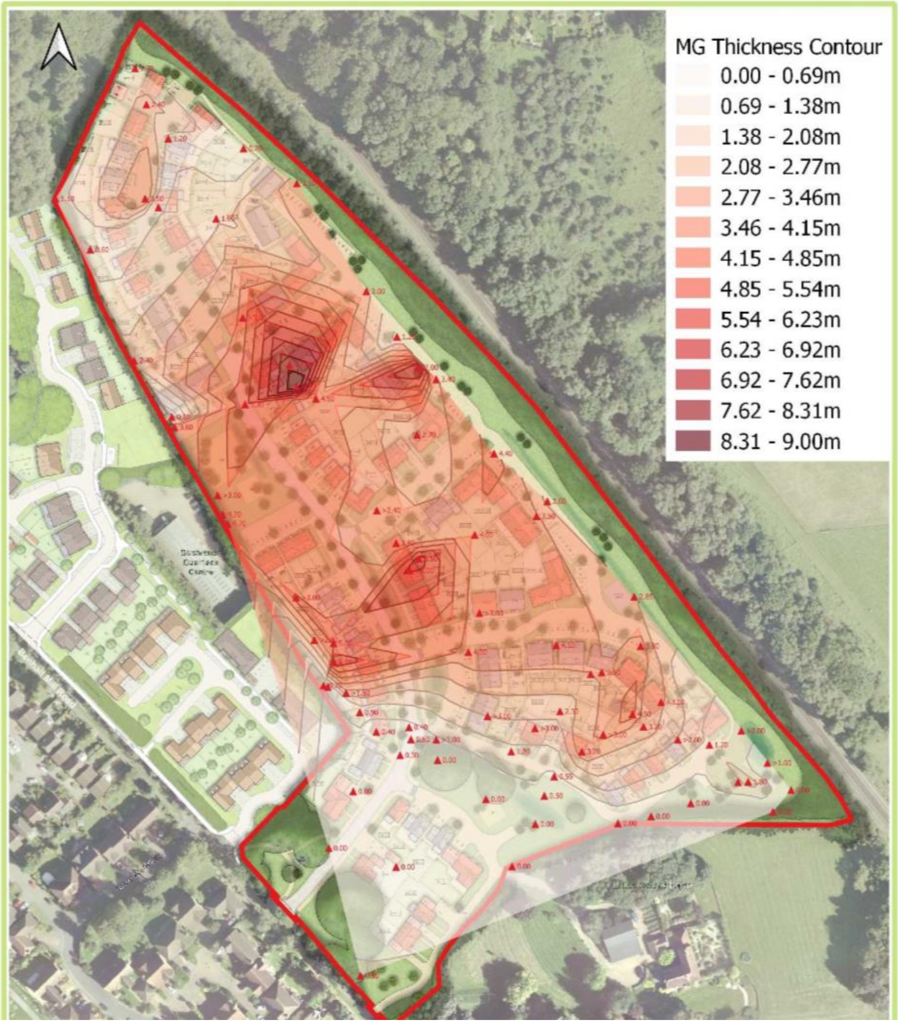
Commercial landfill 1950s

↓

Landfill capped 1990.



Key site information



Soils Encountered:
- Made ground 0-9m thick

Contamination found:
- Heavy metals
- PAH
- Localised asbestos fibres

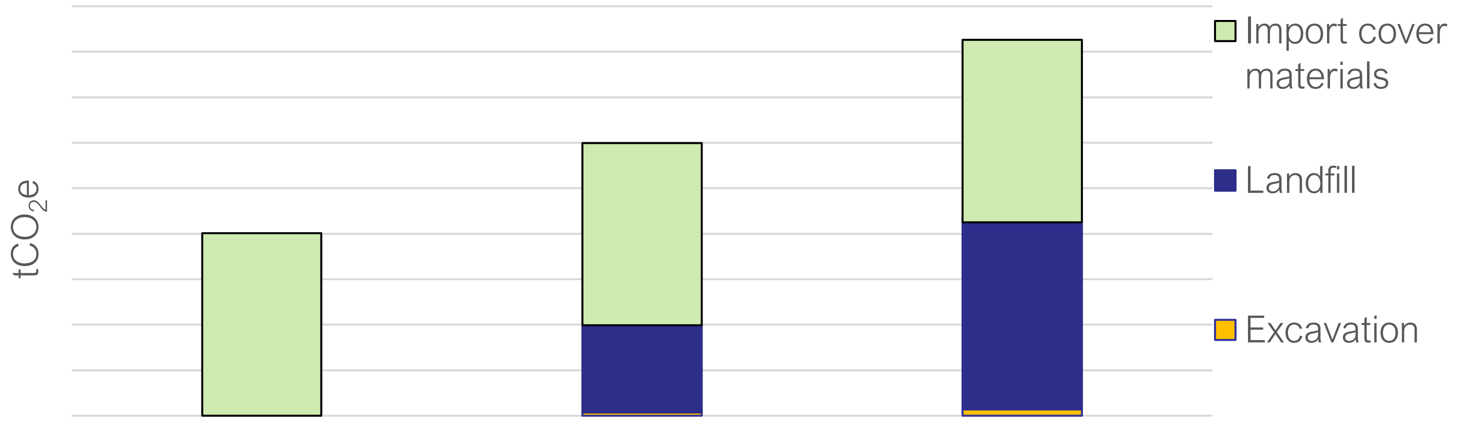
Gas:
- Methane (maximum 5%)

Preliminary Remediation Assessment

For the landfill area:

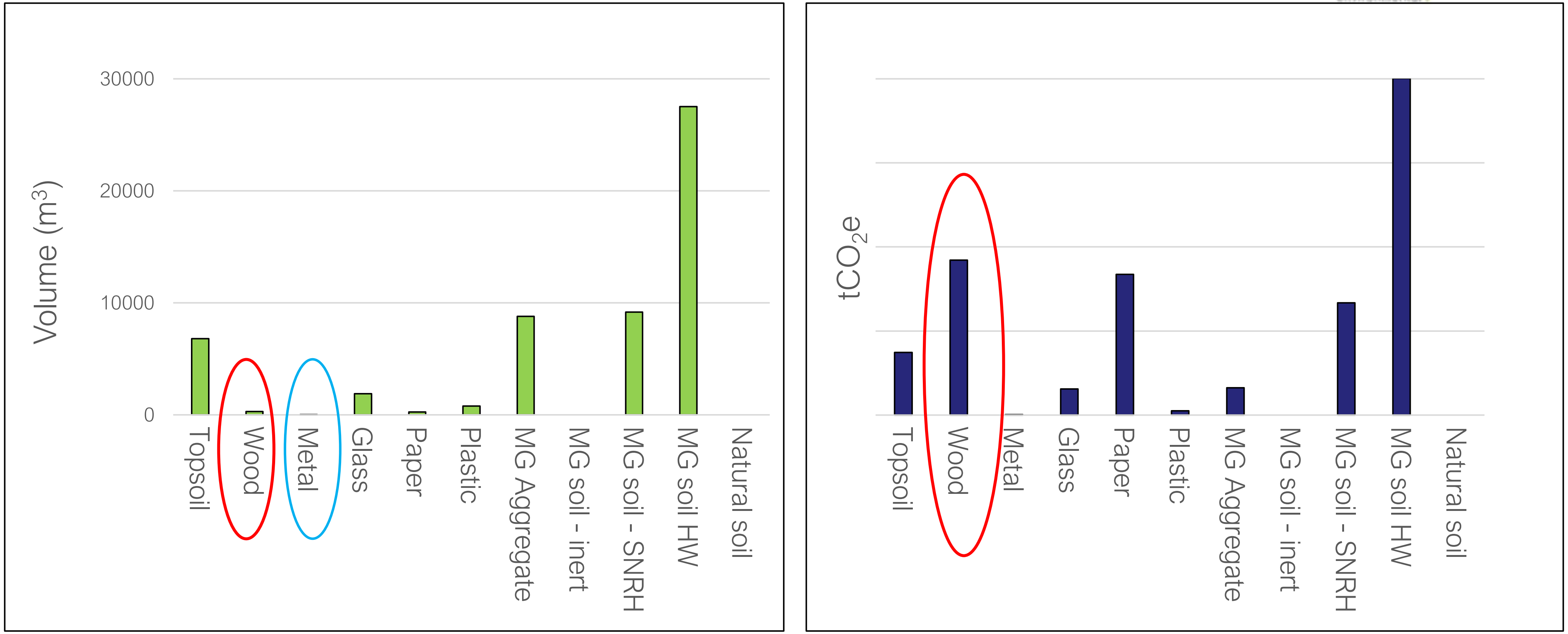
1. 1m cover
2. Excavate/remove 0.5m with 1m of cover
3. Excavate/remove 1.0m with 1m cover

Preliminary results



Remediation Option	1	2	3
Summary	1m cover on landfill area	Excavate 0.5m and 1m cover in landfill area	Excavate 1m with 1m cover in landfill area

Excess material



Small volume of wood – but major contribution to carbon

Potential valuable material – can be processed and embodied carbon ‘gained’

Refined Remediation Assessment

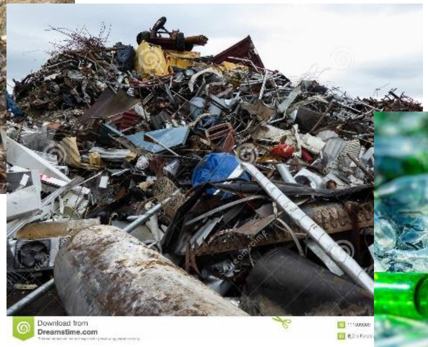
leap environmental

Include the following:

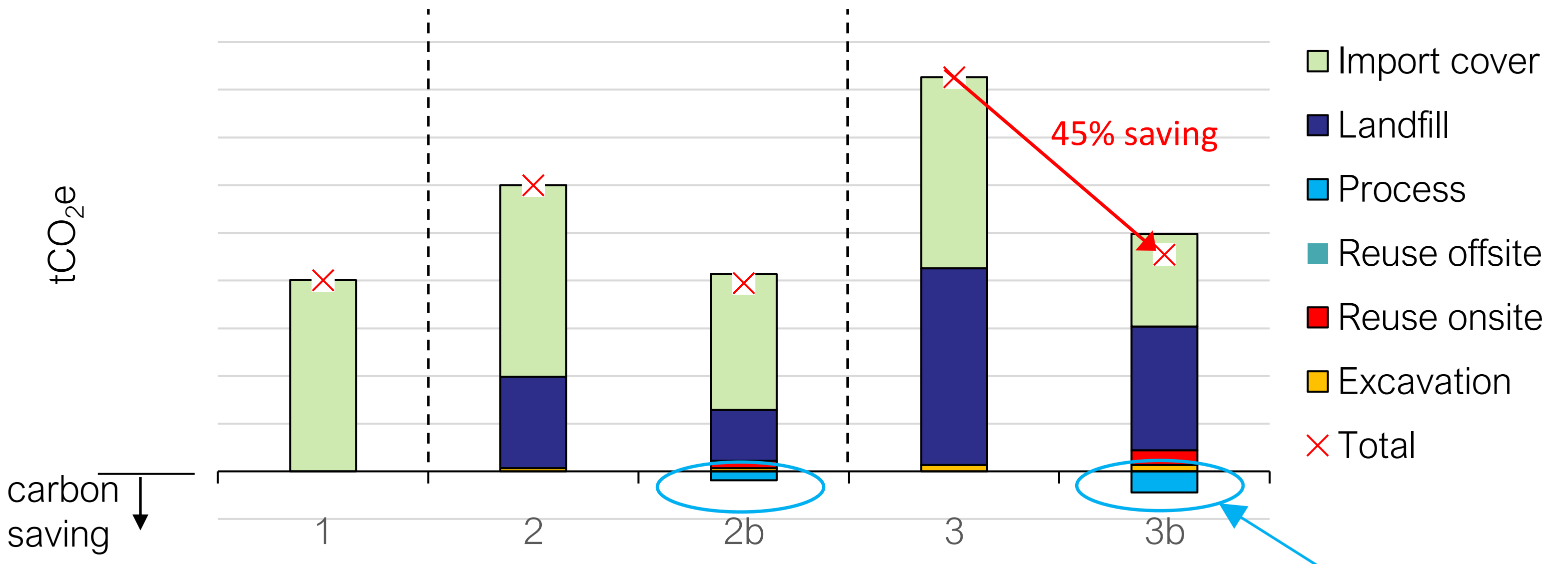
1. Reuse of maximum reusable material onsite (in cover)
   - topsoil
   - suitable screened material.

2. Reuse any material offsite (this was limited for this site)

3. Processing of :
   - Wood
   - Metal
   - Glass



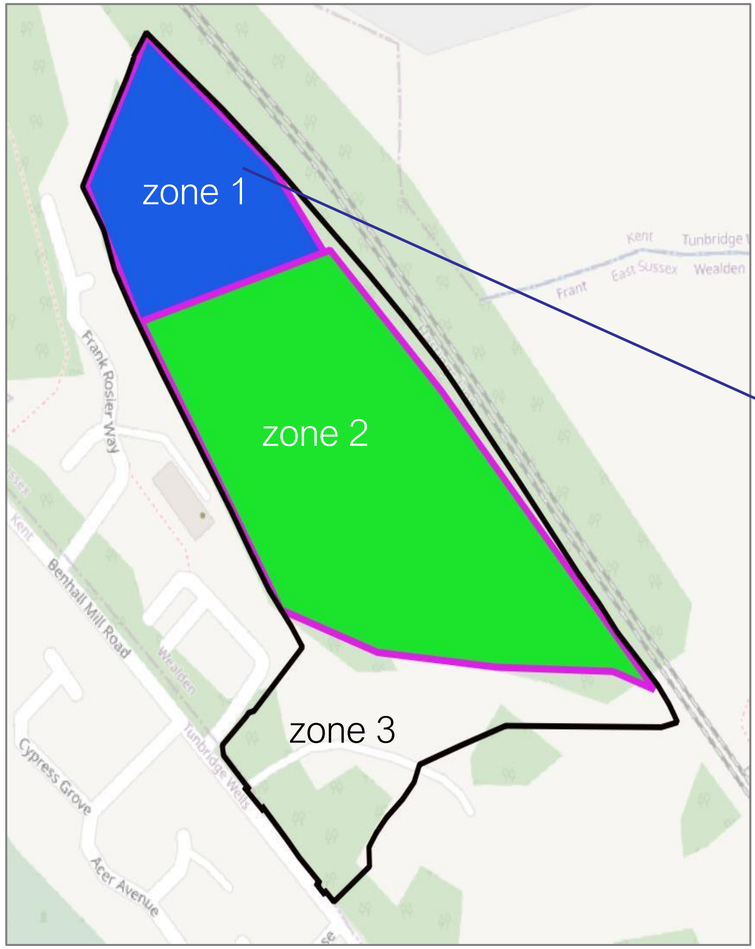
Refined results



Remediation Option	1	2	3
Summary	1m cover on landfill area	Excavate 0.5m and 1m cover in landfill area	Excavate 1m with 1m cover in landfill area

Note carbon saving
For processing some materials

Further refinements



Site subdivided into 3 zones:

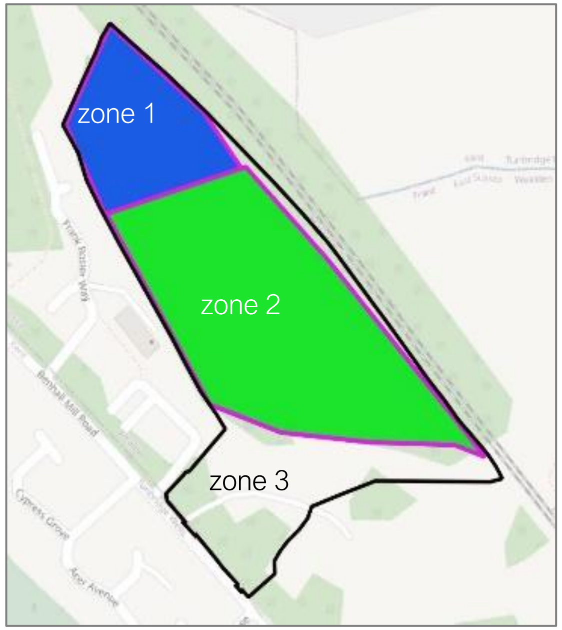
Zone1: Shallow landfill
Zone 2: Deep landfill
Zone 3: Outside landfill

Information on zones entered into CReDiT (from QGIS)

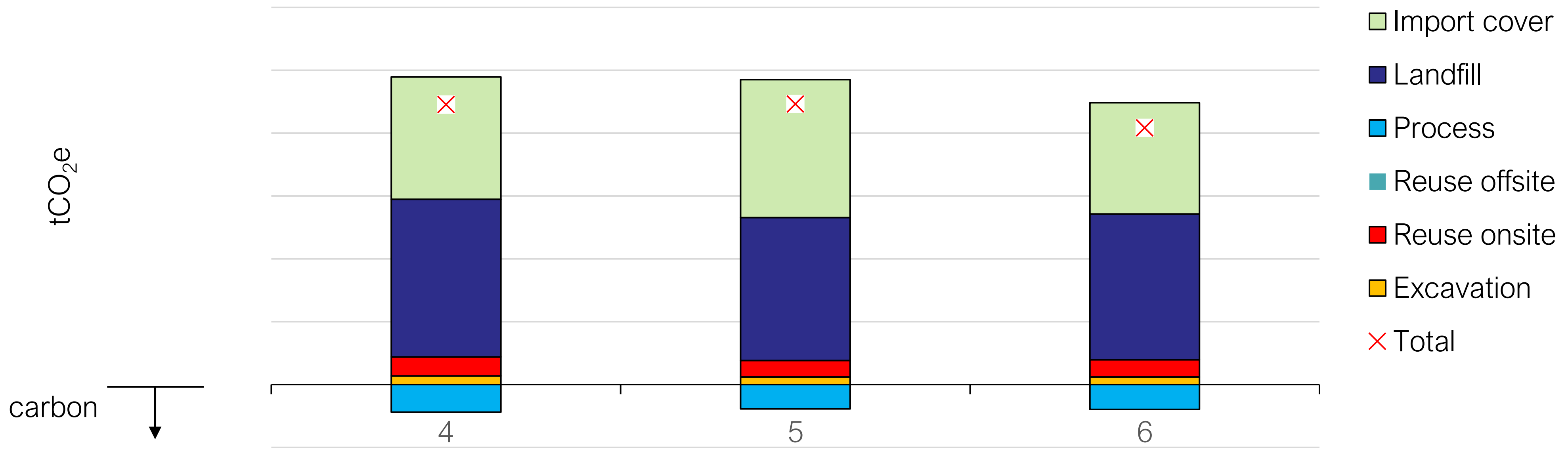
Geology	Geology 1	Zone 1	Geology 2	Zone 2	Geology 3	Zone 3
Label/ name	shallow landfill		deep landfill		outside landfill	
Area	10774	m2	31633	m2	18212	m2
Soil Properties (site)	Type	Average depth (m)	Type	Average depth (m)	Type	Average depth (m)
Ground level		0		0		0
Topsoil _base	Topsoil	0.106	Topsoil	0.136	Topsoil	0.28
Made Ground base	Clay and Gravel	2.17	Clay and Gravel	3.69	Clay and Gravel	0.633
Natural soil #1_base	Sand	20	Sand	20	Clay (High PI)	20

3 zoned remediation options shown

Remediation Options	4	5	6
Description	remove 1m landfill area with 1m cover	remove 0.5m shallow landfill, 1m deep with 1m cover	remove 0.5m shallow landfill, 1m deep, 1m cover in landfill.
Zone 1	Geology 1	Geology 1	Geology 1
Area (m2)	10774	10774	10774
Depth of excavation (m)	1	0.5	0.6
Depth of cover (m)	1	1	0.6
Depth of topsoil	0.15	0.15	0.15
Depth of infill	0.85	0.85	0.45
Marker geomembrane	yes	yes	yes
Zone 2	Geology 2	Geology 2	Geology 2
Area (m2)	31633	31633	31633
Depth of excavation (m)	1	1	1
Depth of cover (m)	1	1	1
Depth of topsoil	0.15	0.15	0.15
Depth of infill	0.85	0.85	0.85
Marker geomembrane	yes	yes	yes
Zone 3	Geology 3	Geology 3	Geology 3
Area (m2)	18212	18212	18212
Depth of excavation (m)	0	0	0
Depth of cover (m)	0	0	0
Depth of topsoil	0.15	0.15	0.15
Depth of infill	0	0	0
Marker geomembrane	no	no	no



Refined results



Remediation Option	4	5	6
Summary	Zone 1,2 - 1m excavation and 1m cover on landfill area	Zone 1, 0.5m excavation for Zone2, 1m excavation 1m cover in landfill area	Zone 1: 0.6m excavation, 0.6m cover Zone 2: 1m excavation, 1m cover

Conclusions

Conclusions

- Carbon model for remediation developed and demonstrated.
- Key outcomes from using the model:
  - onsite materials need to be considered a resource rather than a ‘waste’
  - rethink material streams and reuse options
  - need to maximise reuse of material onsite and minimise material sent to landfill

Similar carbon tools can be included in many aspects of site development, e.g. Earthworks / foundation design etc….

Any questions ?