

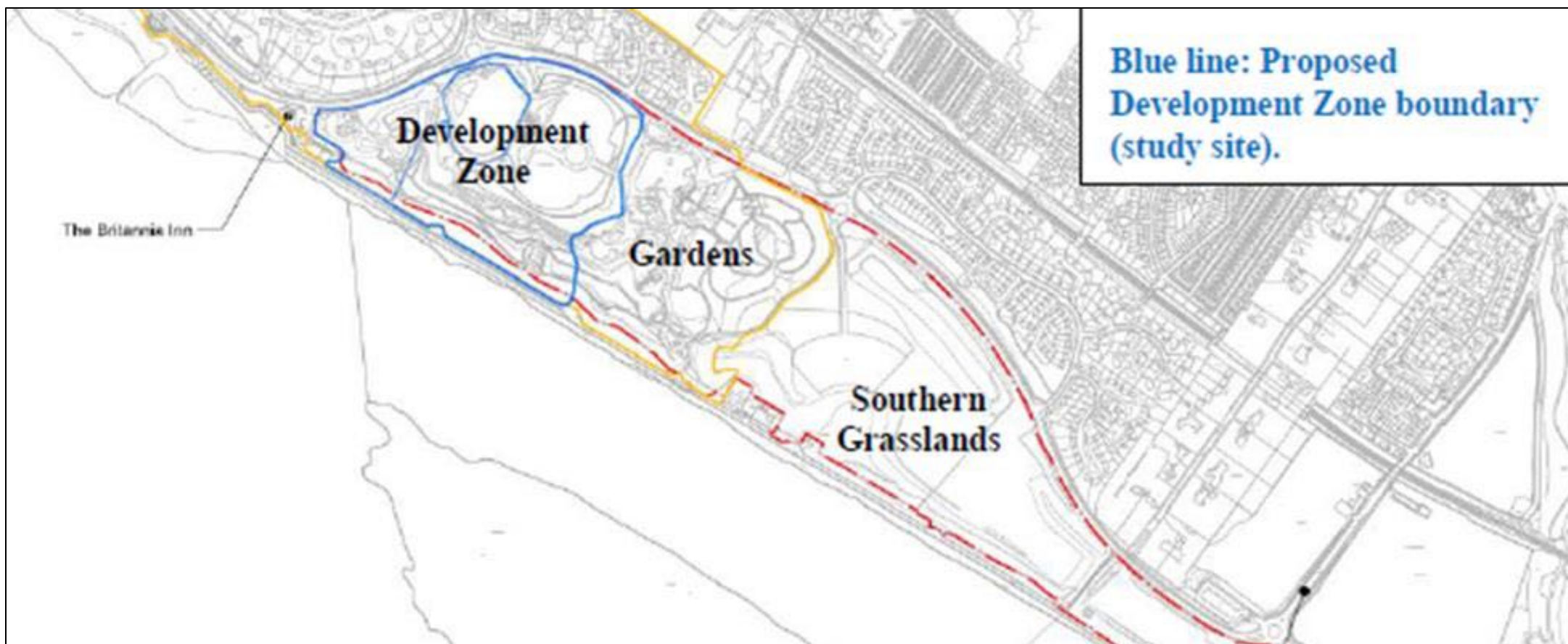


# Liverpool Festival Gardens site

Assessment and remediation to enable site redevelopment: the story so far



# Liverpool Festival Gardens site





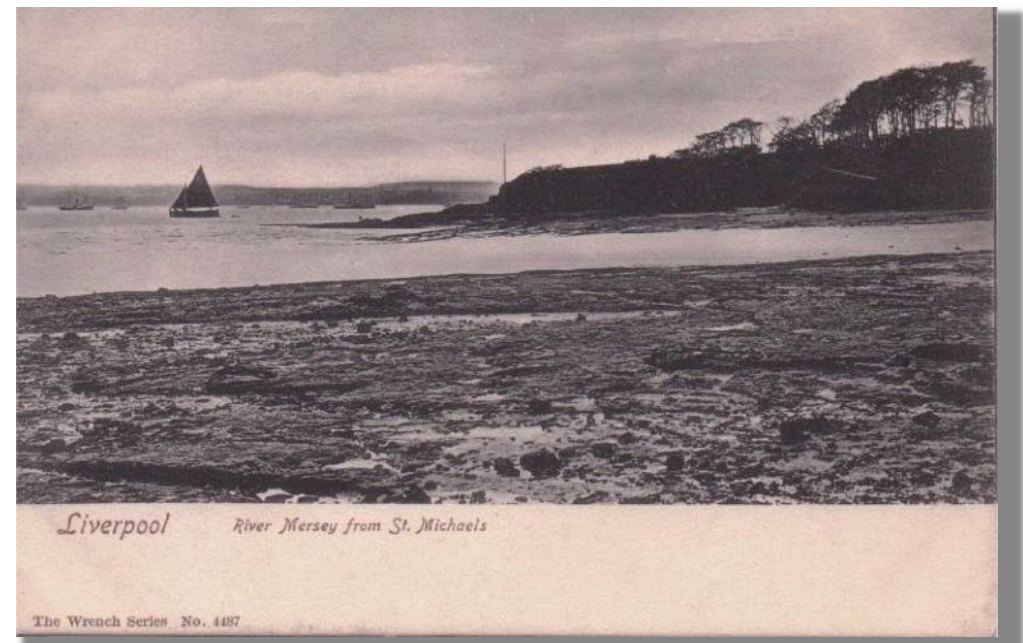
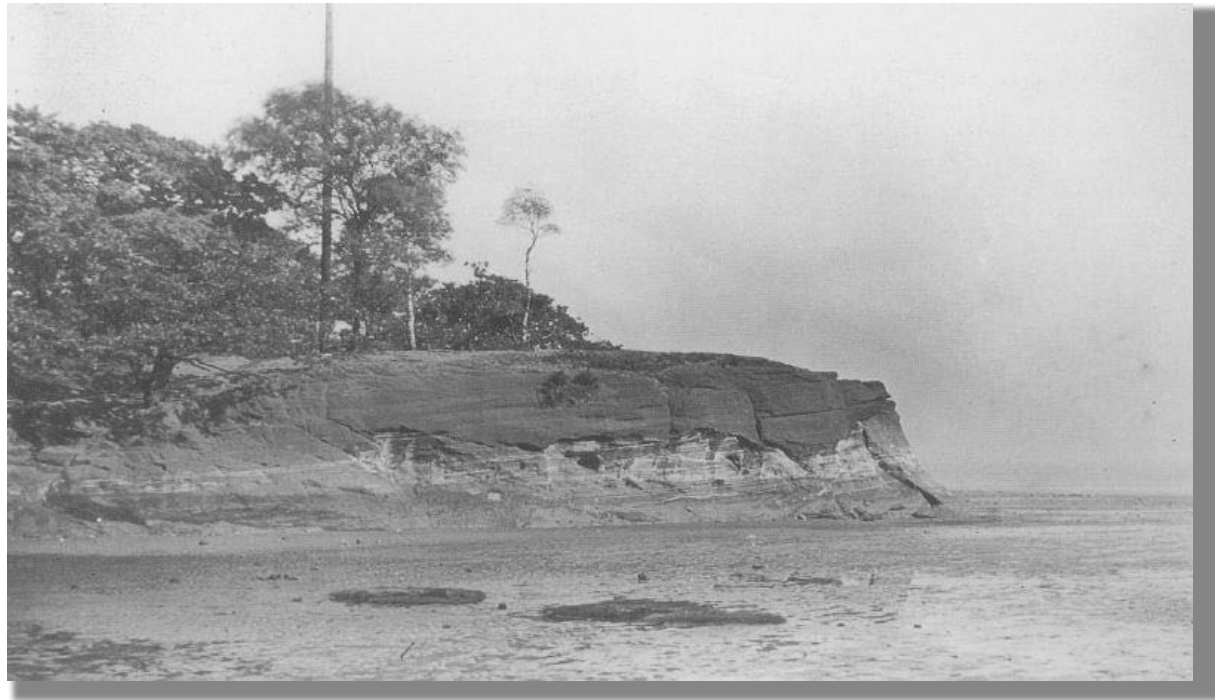
the new festival gardens  
residential development



*in the park and on the waterfront*



# 1800s and early 1900s



Early 1900s

ARUP



# 1950s – Development Zone





# 1950s – Gardens and Grasslands

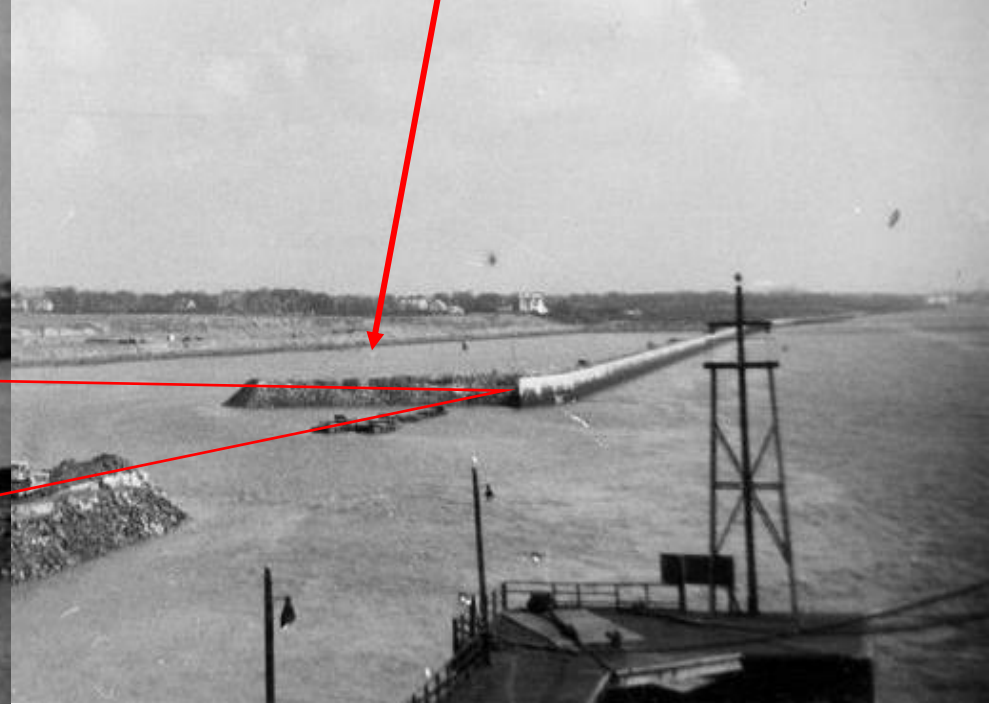
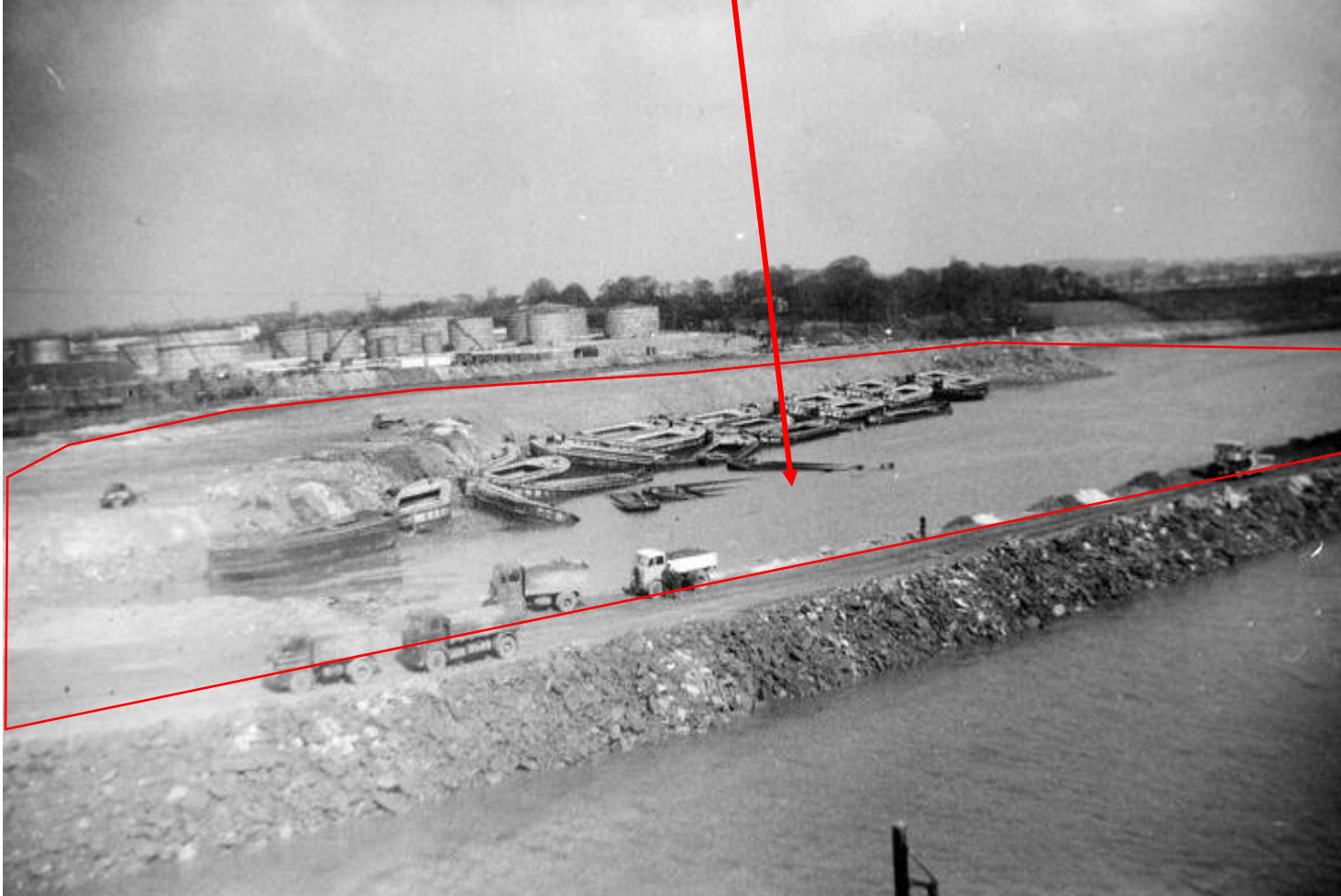


1950s

ARUP

Owned initially by MDHB. Initial filling was 'docks waste'.

Owned by LCC from outset, filling with municipal waste



1950s

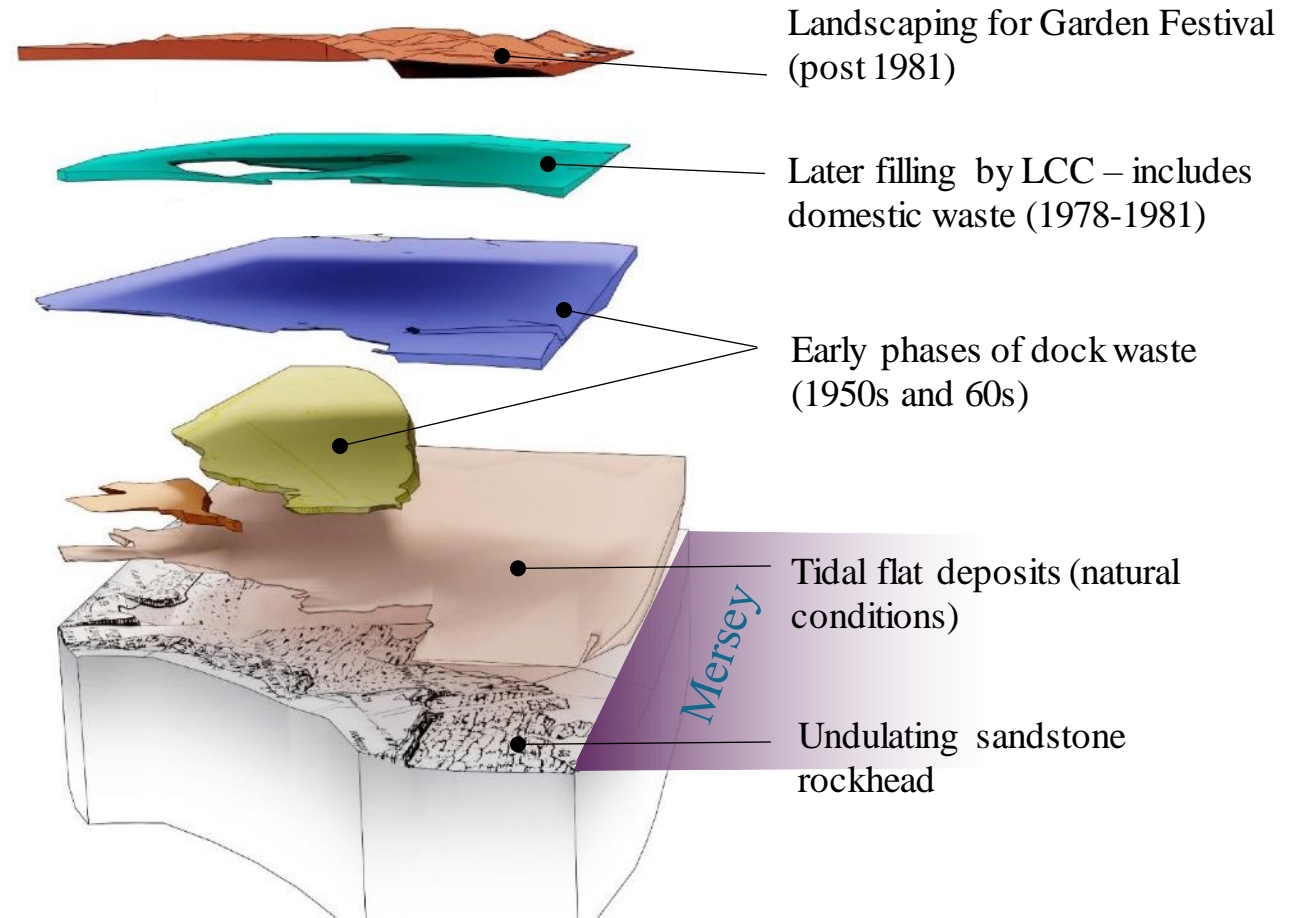
1960s and 70s

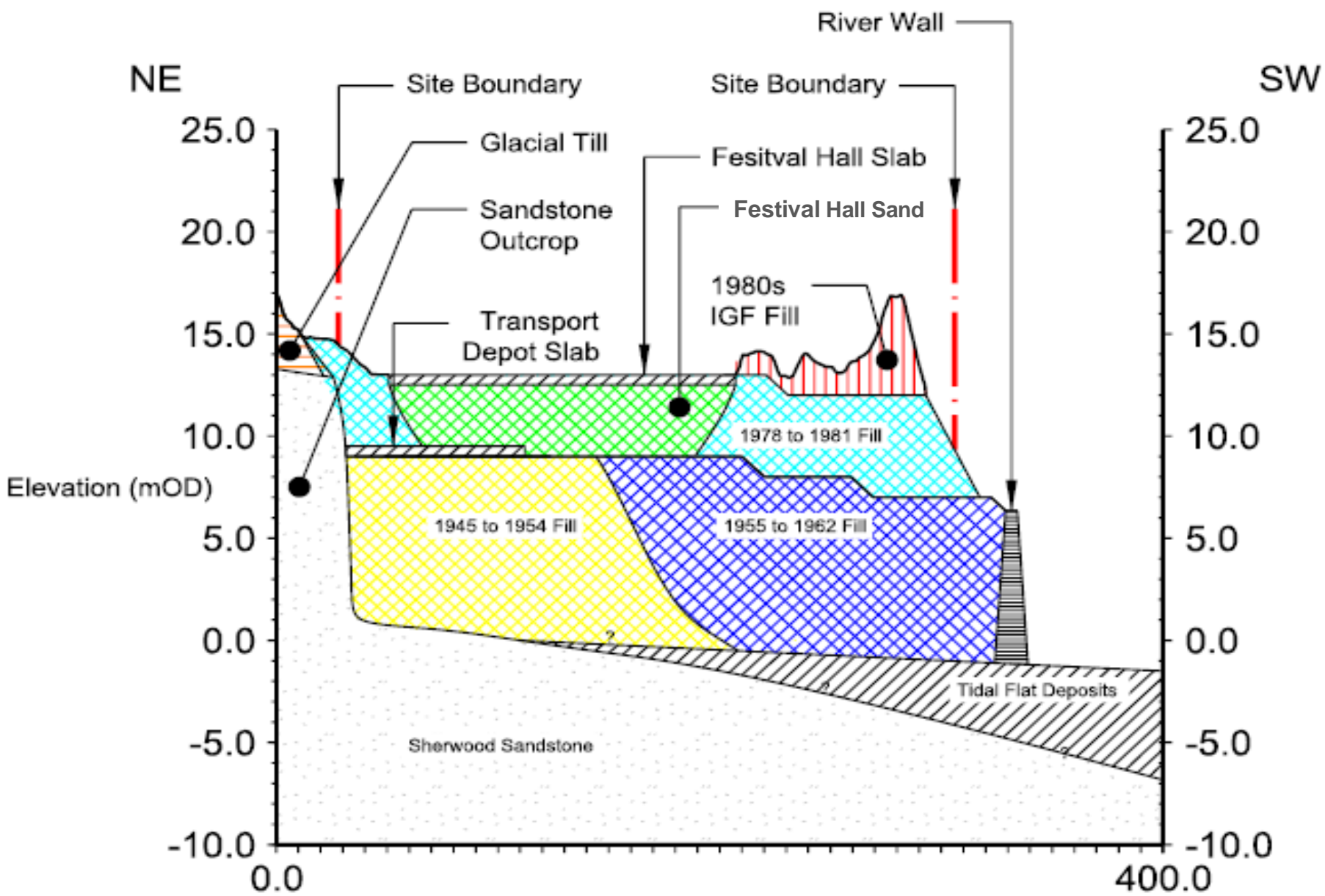
ARUP



# Characterisation and assessments

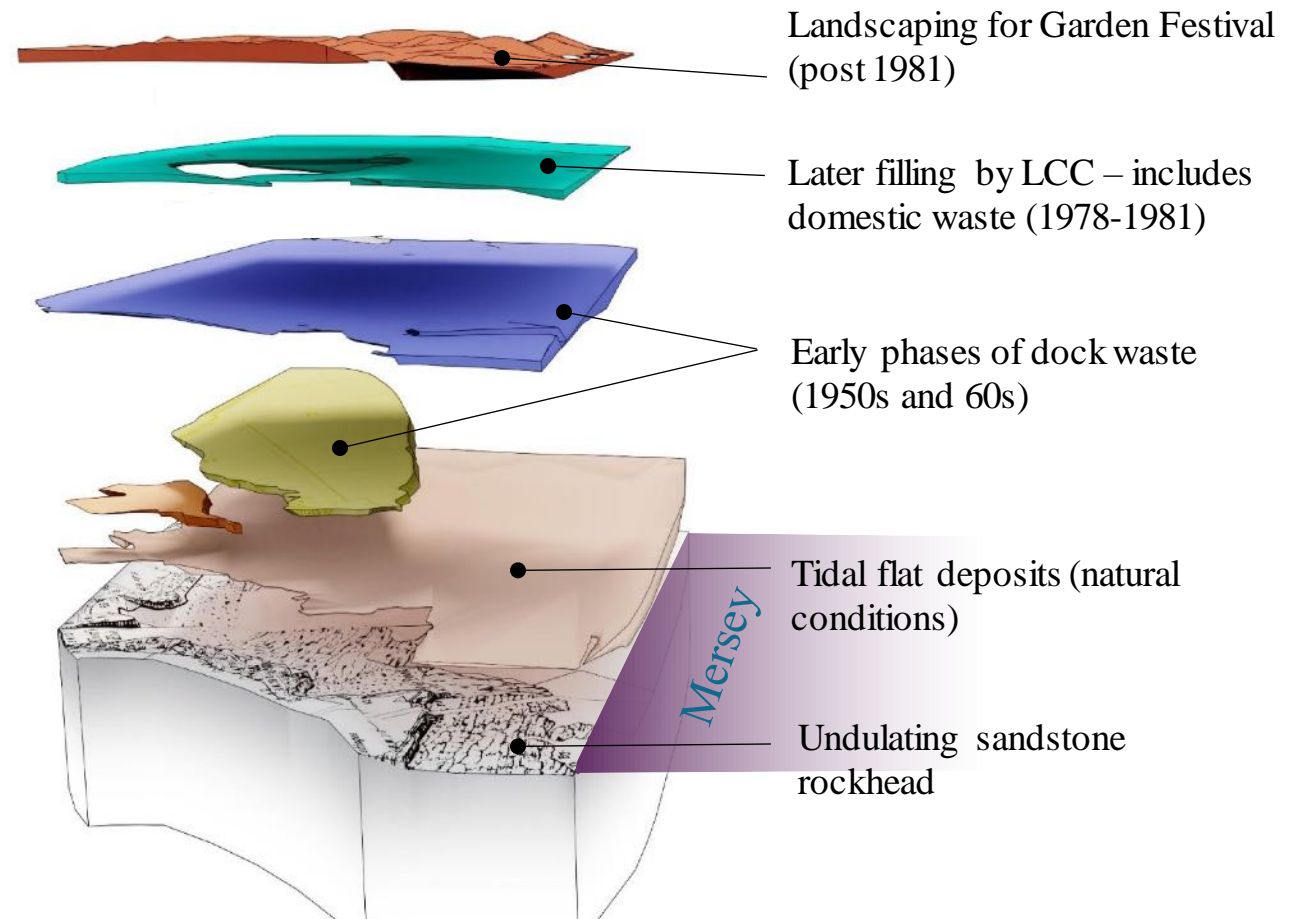
- Multiple phases of GI
- Continuous gas monitoring
- CSM and risk assessments
- Geotechnical assessment





## Drivers for remediation

- Limiting future settlement
- Managing ground gas risk
- Preventing deterioration in groundwater quality
- Leaving the site in a suitable interim state (prior to follow on resi)
- Manage exposure of future site users



# Remediation Strategy

Decommission the Gas Extraction System in the DZ

Risk assessment and further boundary monitoring. If required, installation of passive venting along the site boundary

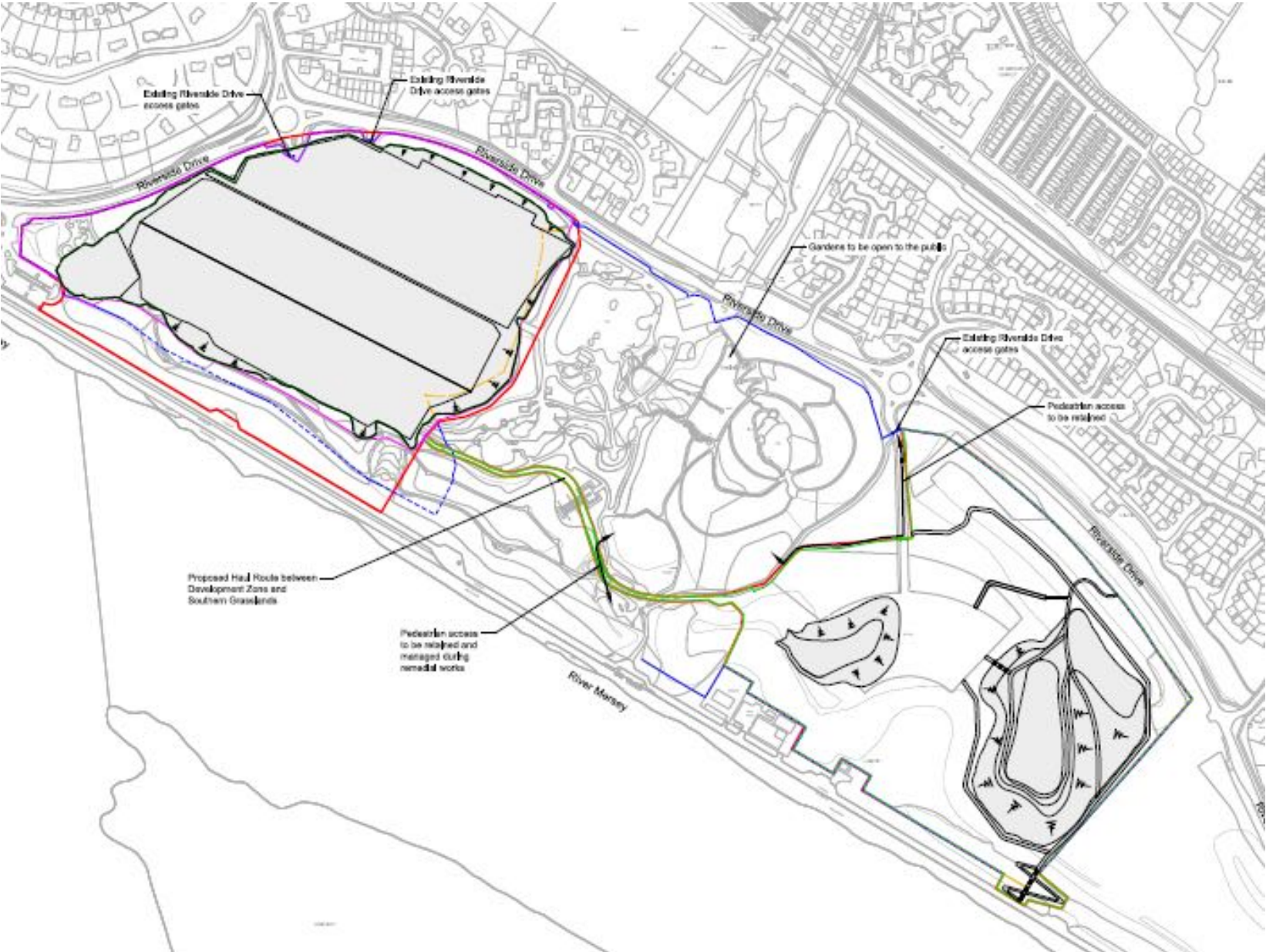
Excavation, processing and segregation of the IGF and 1978-1981 fill – fTOC control

Reuse of suitable engineering material within DZ

Reuse of material that does not meet an engineering specification in a new programme of landscaping in the Southern Grasslands

Agreement with Environment Agency via DoWCoP, with additional field trial

# DZ remediation and landscaping works





# DZ remediation and landscaping works



ARUP

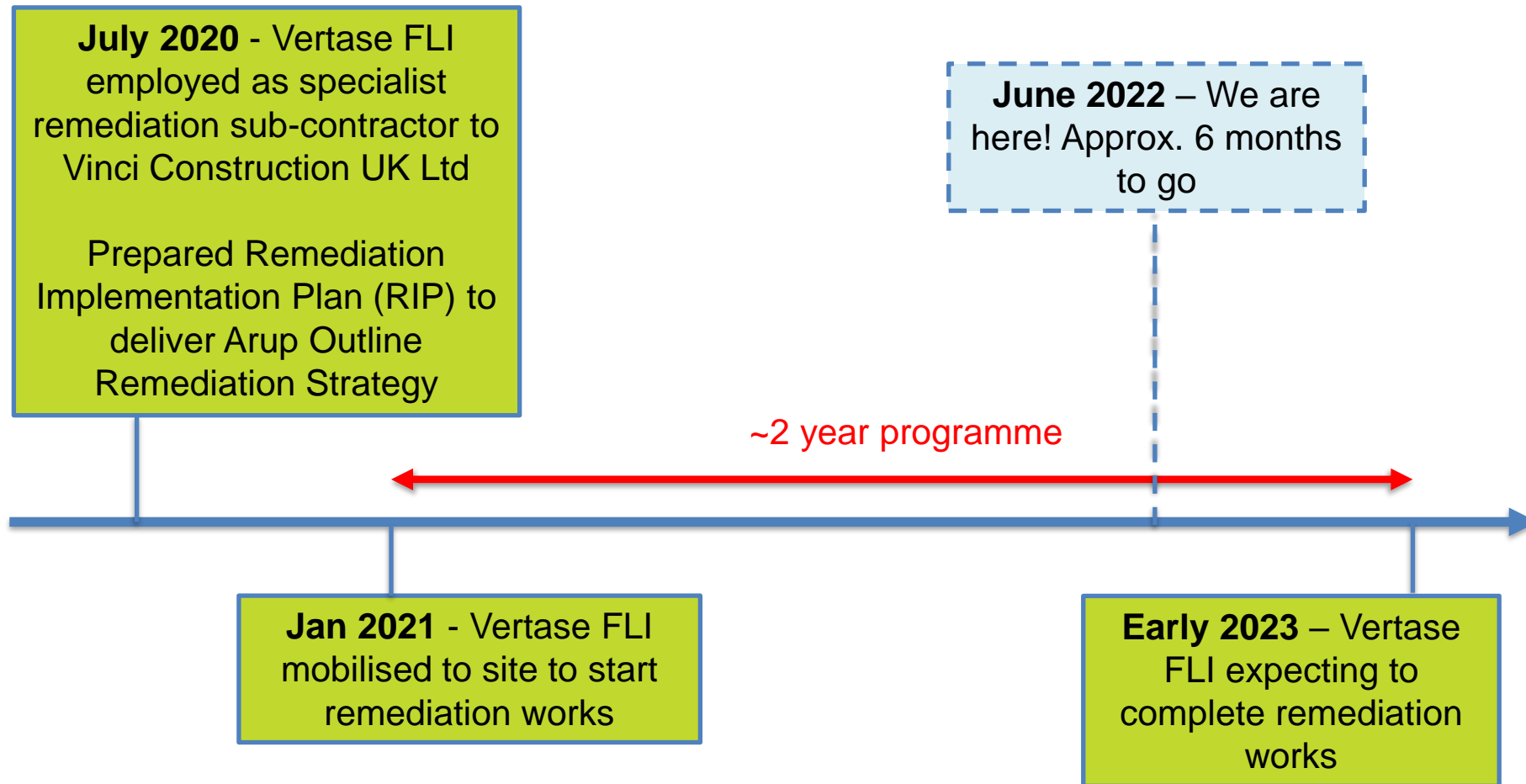
# Assessment and Remediation of the Liverpool Festival Gardens Site – the Story So Far

**Duncan Scott**

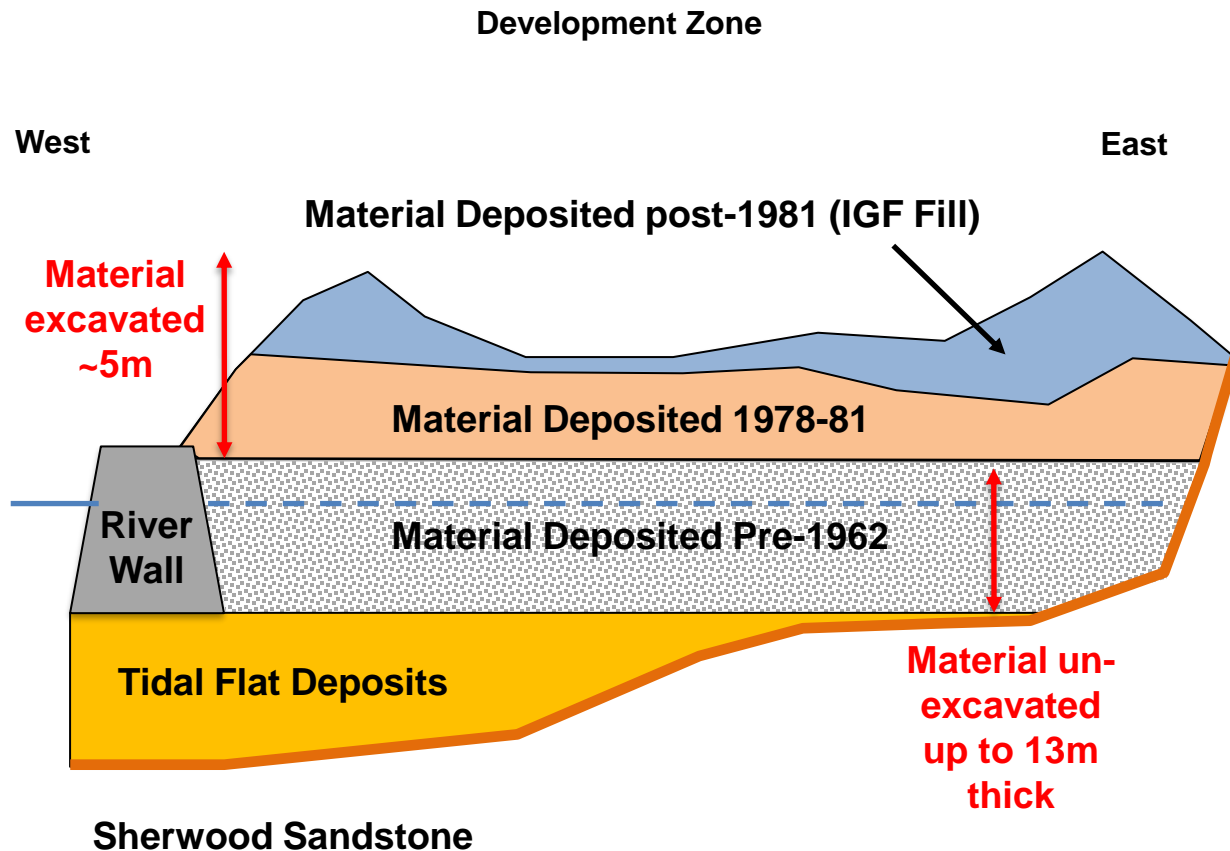
1 July 2022



# Timeline of Remediation



# Remediation Strategy: Partial Excavation Approach



## Advantages

- Less material to excavate
- Less requirement for deep excavation support
- No excavation below water table

## Disadvantages

- Assumes underlying ground will not excessively settle, generate gas or release pollution

## Material Deposited Pre-1962



“Dock Waste” placed behind a granular bund by Mersey Docks & Harbour Board (MDHB)

Construction and demolition waste, ships waste, warehouse debris

**Was it compacted??**

**Potential for long-term creep settlement??**

**Estimates ranged up to 320mm settlement over development lifetime!!**

# Remediation Implementation Plan



Decommission the existing gas extraction system in the DZ

Undertake boundary gas monitoring to inform the need for passive venting along site boundary

Additional characterisation of pre-1962 fill to inform long-term settlement potential by creep

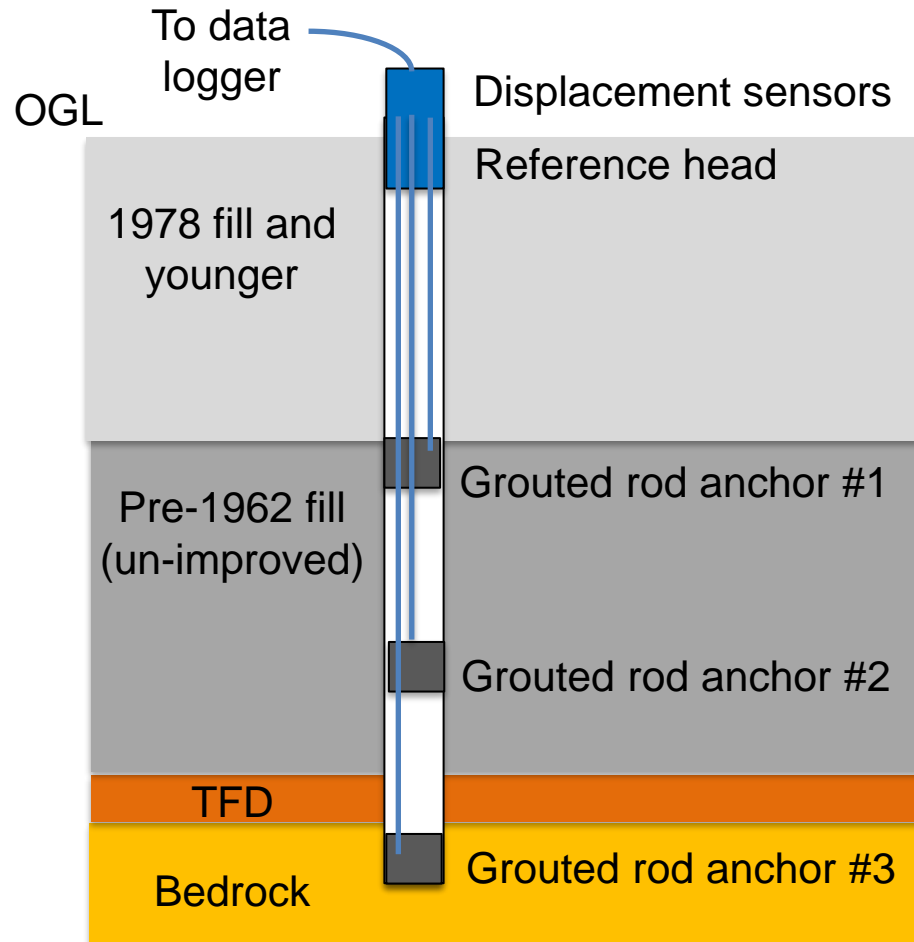
Excavate and process the post-1981 fill and 1978-81 fill to separate desirable/undesirable materials for re-use

RDC on the top of the pre-1962 fill to reduce settlement potential

Re-use of suitable engineering material in the DZ (low gas, settlement and pollution potential)

Re-use of material that does not meet an engineering specification to construct landscaping in southern grasslands

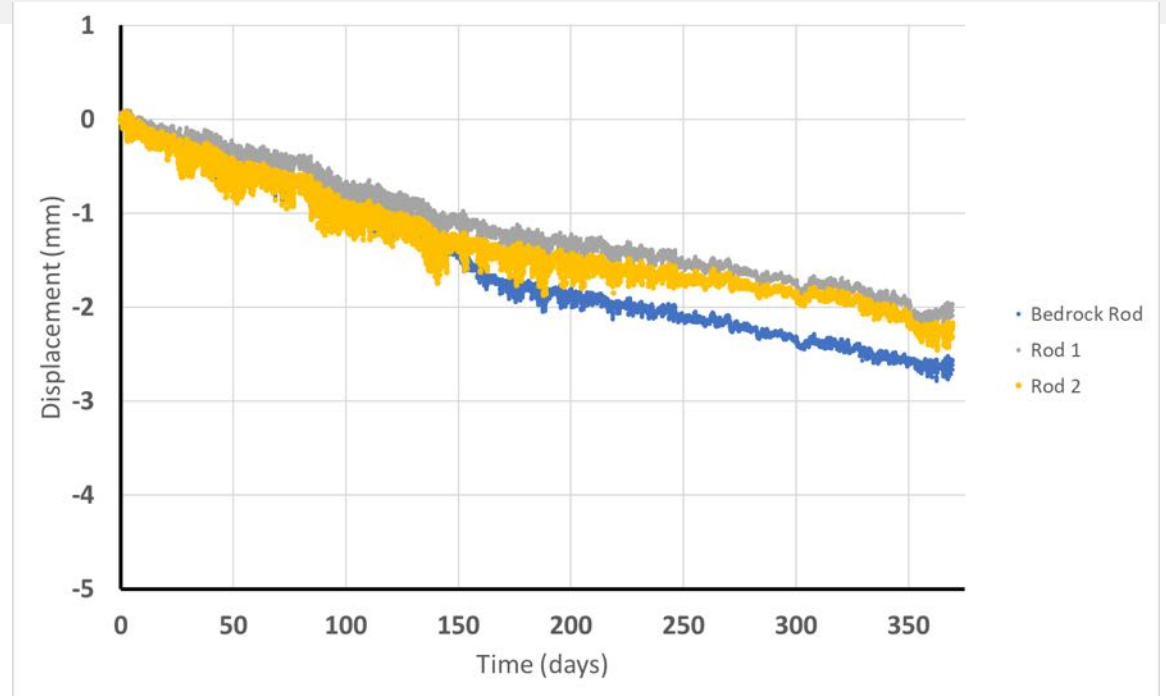
# Additional Characterisation of Material Deposited Pre-1962



- VFLI designed and implemented a method of using borehole rod-type extensometers to measure displacements in pre-1962 fill
- 9 extensometers installed pre-remediation and monitored during works
- Decommissioned when extensometer was in the way of excavation progress
- Measured displacements used to estimate the rate of creep settlement in pre-1962 materials



# Additional Characterisation of Material Deposited Pre-1962



■ Current estimates of the rate of creep in pre-1962 fill suggest creep settlement will be <75mm over development lifetime (60 years)

# Excavation of Post-1981 Fill



# Excavation of 1978-81 Fill



Clear demarcation  
between fill types

# Excavation of 1978-81 Fill

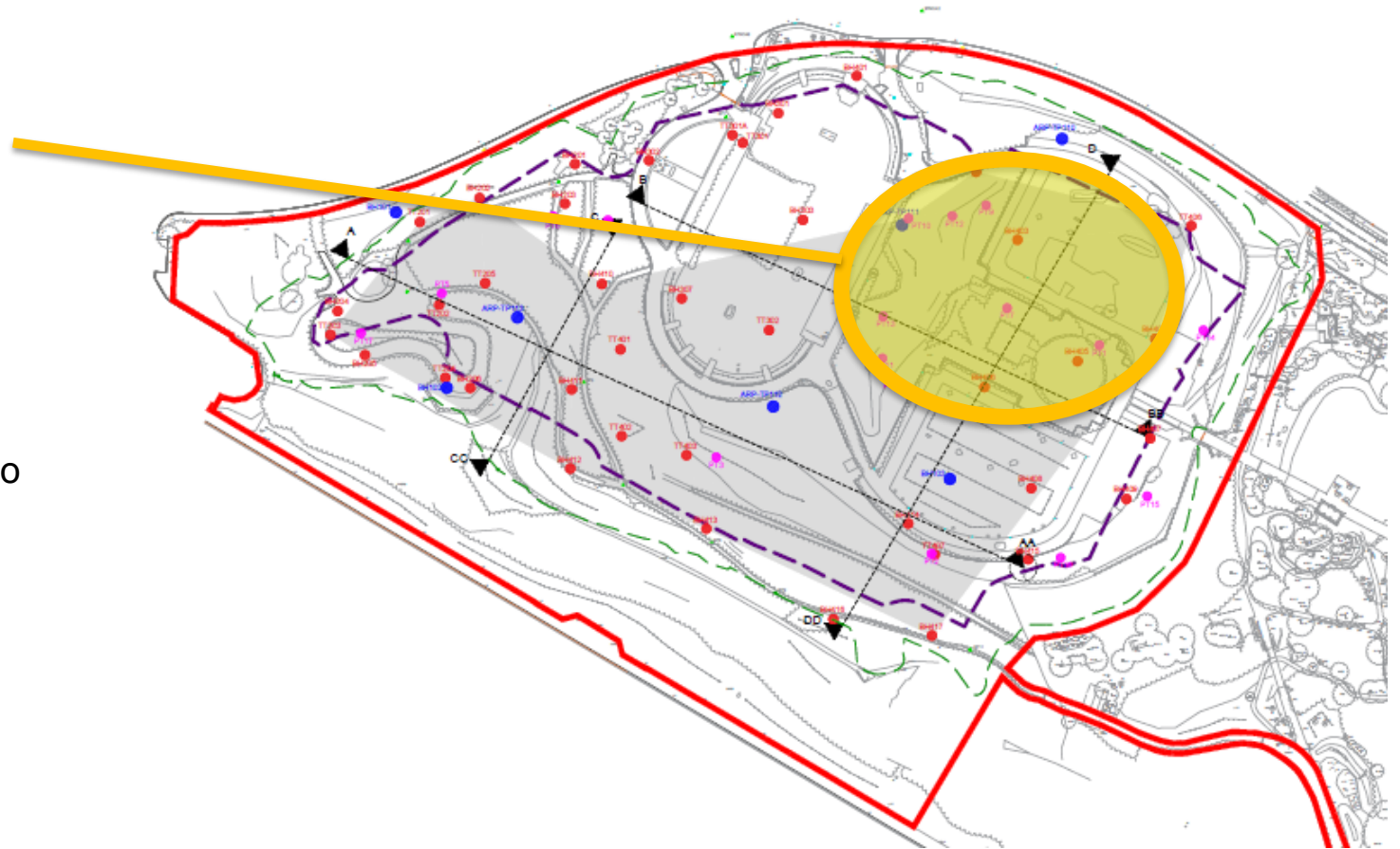


# Excavation of 1978-81 Fill



■ Finding 1978-81 fill extends deeper than expected based on site investigation

- **Advantage** = lesser thickness of underlying pre-1962 materials to contribute to future settlement
- **Disadvantage** = More 1978-81 fill to excavate, process, dispose



# Processing to Separate Desirable/Undesirable



- What is desirable?? (for re-use on-site as fill)

| Desirable                   | Undesirable   |
|-----------------------------|---|
| Soil, sand, concrete, brick | Everything else!!<br>Wood, plastic, paper, metal,<br>rubber, textiles etc |

- Material deposited post 1981 – little processing required as most of the material is desirable (screening to remove oversize)
- Materials deposited 1978-81 – significant processing required as it contains a lot of undesirables (mechanical and manual separation)



# Processing to Separate Desirable/Undesirable



Manual sorting of larger materials to separate by material type



Feedstock waste

Two-way Mechanical screening

Screened Fines

# Validation Testing (Prior to Re-Use)



- Chemical validation against risk-based criteria
- Degradable organic carbon content testing using CL:AIRE RB17 forensic description methodology
- Geotechnical classification testing (gradings, OMC, average particle density)





# Sub-Formation Improvement by RDC in DZ



Polygonal drum to impart compactive effort by impact

# Reinstatement above Sub-Formation in DZ



- Granular layer (site-won) to aid pore-water drainage



# Reinstatement above Sub-Formation in DZ



- Placement and compaction of site-won General Fill above



Desirable material with low organic carbon content (<4%)

Placed and compacted to an end product specification

Geochemically tested prior to placement

Strength and stiffness verified during up-filling

# Landform Construction in SG



- Constructed using site-won Landscape Fill



Higher organic carbon  
content material

Placed and compacted to  
achieve un-drained shear  
strength of 50kPa

Tested during up-filling

# Off-Site Disposal of Undesirable Material



- Where the big cost is!!



Material used to create  
Refuse Derived Fuel for  
export to Energy from  
Waste plants

Must maximise removal  
of adhering soil to  
manage weight and cost

# Headline Quantities



- Volume excavated to date – 330,000m<sup>3</sup> (80% complete – including the additional 78-81 fill)
  
- Volumes processed:
  - Approximately 150,000m<sup>3</sup> has undergone full processing
  - Approximately 180,000m<sup>3</sup> has undergone screening only (to remove oversize)
  
- Volume disposed off-site:
  - 26,000 tonnes for energy from waste
  - 1.4 tonnes of asbestos

# The Future



- Vertase FLI on course to complete early 2023
- Planning application to be submitted for ~1,500 eco-homes very soon
- Construction of first homes could commence late 2023 subject to all necessary approvals



**INDICATIVE ILLUSTRATION ONLY**

**Thank You**

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