RBL WEBINAR

Brownfield Development in Practice:
Piling, Geotechnics & Risk Management at Thurrock

ROGER BULLIVANT

Dunton ENVIRONMENTAL
Restoring Our Environment

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RBL'S PRESENTERS

Nicola Carr MSc CEng MICE

RBL's Design Estimating Manager

Nelson Tanyanyiwa MBA FCMI

Dunton's Pre-Construction Director

Megan Goodchild

RBL's Marketing Manager

WHAT ARE WE COVERING?

ROGER BULLIVANT LIMITED
AT A GLANCE

Total employees.

500+

Linear metres of precast beam manufactured annually.

>250,000 LM

Providing piling and foundation solutions in the residential sector.

Residential

RBL has the capacity to manufacture over 1 million metres of precast pile every year.

1M

Fleet of piling rigs.

50+

100% of precast products manufactured with low carbon concrete.

100%

Providing piling and foundation solutions for various commercial projects.

Commercial

Dunton ENVIRONMENTAL
Restoring Our Environment

ROGER BULLIVANT

OUR PRODUCTS

WHAT WE DO

PILING

- Driven Precast Concrete Piles
- Driven Steel Tubular Piles
- RB Combipile
- Continuous Helical Displacement Piles (CHD)
- Continuous Displacement Auger Piles (CDA)
- Continuous Helical Auger Displacement Piles (CHAD)
- Continuous Flight Auger Piles (CFA)
- Contiguous Piled Retaining Walls

GROUND IMPROVEMENT

- Vibro Stone Columns
- Rigid Inclusions

FOUNDATION SYSTEMS

- RBeam Precast Concrete Ground Beams
- Precast Caps

RESTRICTED ACCESS

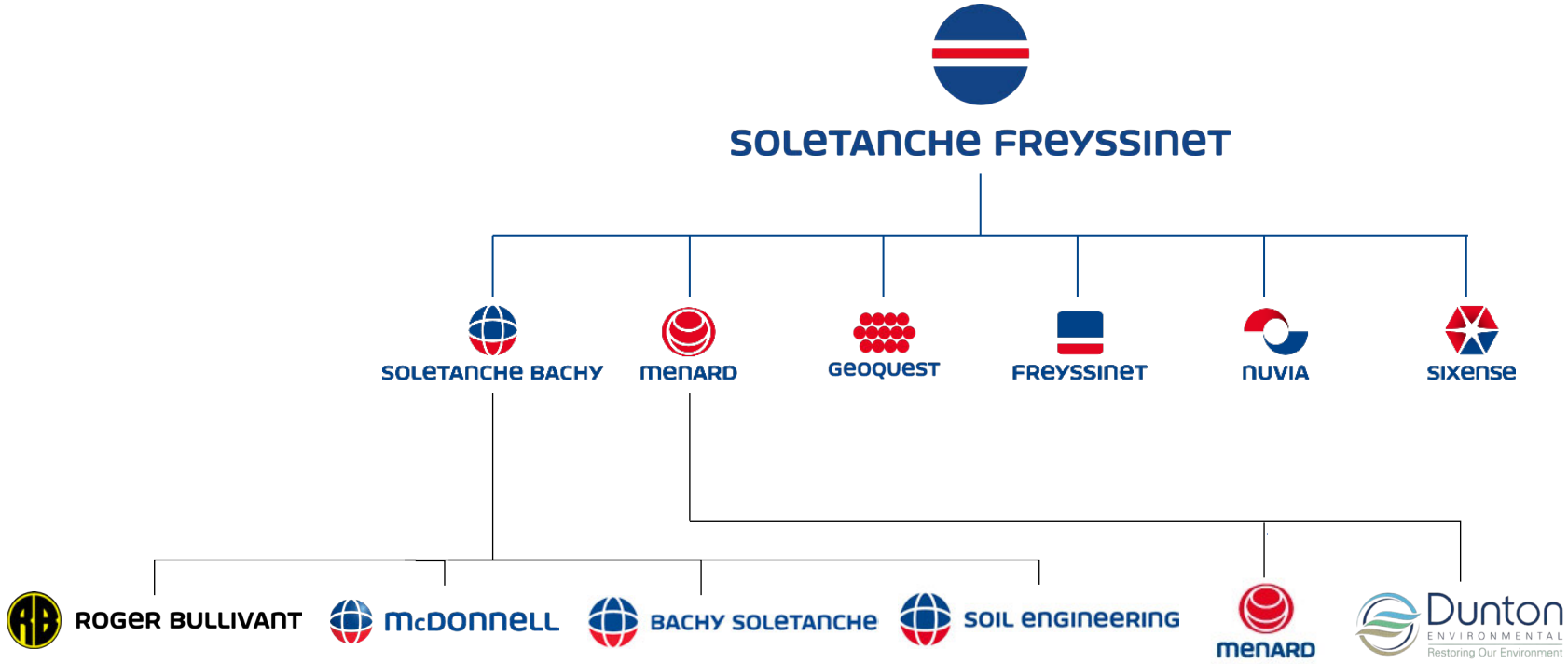
- Sectional Flight Auger (SFA)
- Bottom Driven Minipiles
- Overburden Drilling System
- Jack Piles & Jack Pile Raft
- Grundomat Piles
- Drill Bar Piles
- Underpinning

LOCAL KNOWLEDGE
NATIONAL SUPPORT

International expertise

WHO WE ARE

PART OF A GLOBAL ENGINEERING GROUP



COMPLEMENTARY CAPABILITIES

FROM REMEDIATION TO FOUNDATIONS

Dunton Environmental – Restoring Our Environment	Roger Bullivant
Enabling works and site preparation	Piling and foundation design and delivery
Remediation, earthworks and ground improvement	Geotechnical input and early contractor involvement
Drainage, attenuation ponds and retaining structures	Testing, validation and optimisation
Piling platforms to support heavy foundation operations	Sustainable foundation solutions for all sectors

WHY WORKING TOGETHER MATTERS

INTEGRATED DELIVERY REDUCES RISK

Early alignment between enabling works and piling design

Better understanding of ground behaviour and constraints

Fewer interfaces and assumptions between packages

Improved buildability and safer working platforms

Reduced risk of redesign, delays and cost escalation during construction

ONE TEAM. ONE STRATEGY.
ONE OUTCOME.

For the client

- Reduced ground risk
- Fewer handovers and gaps in responsibility
- More predictable outcomes on brownfield sites

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- Earlier, better-quality technical input
- Safety, Quality and Sustainability can be integral from early stages
- Designs informed by real construction constraints

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For us

- Aligned sequencing & methodologies
- Shared understanding of site risk
- Safer, more efficient delivery

Project Overview

Asphalt Plant & Green Aggregates Building, Grays

Key issues/requirements

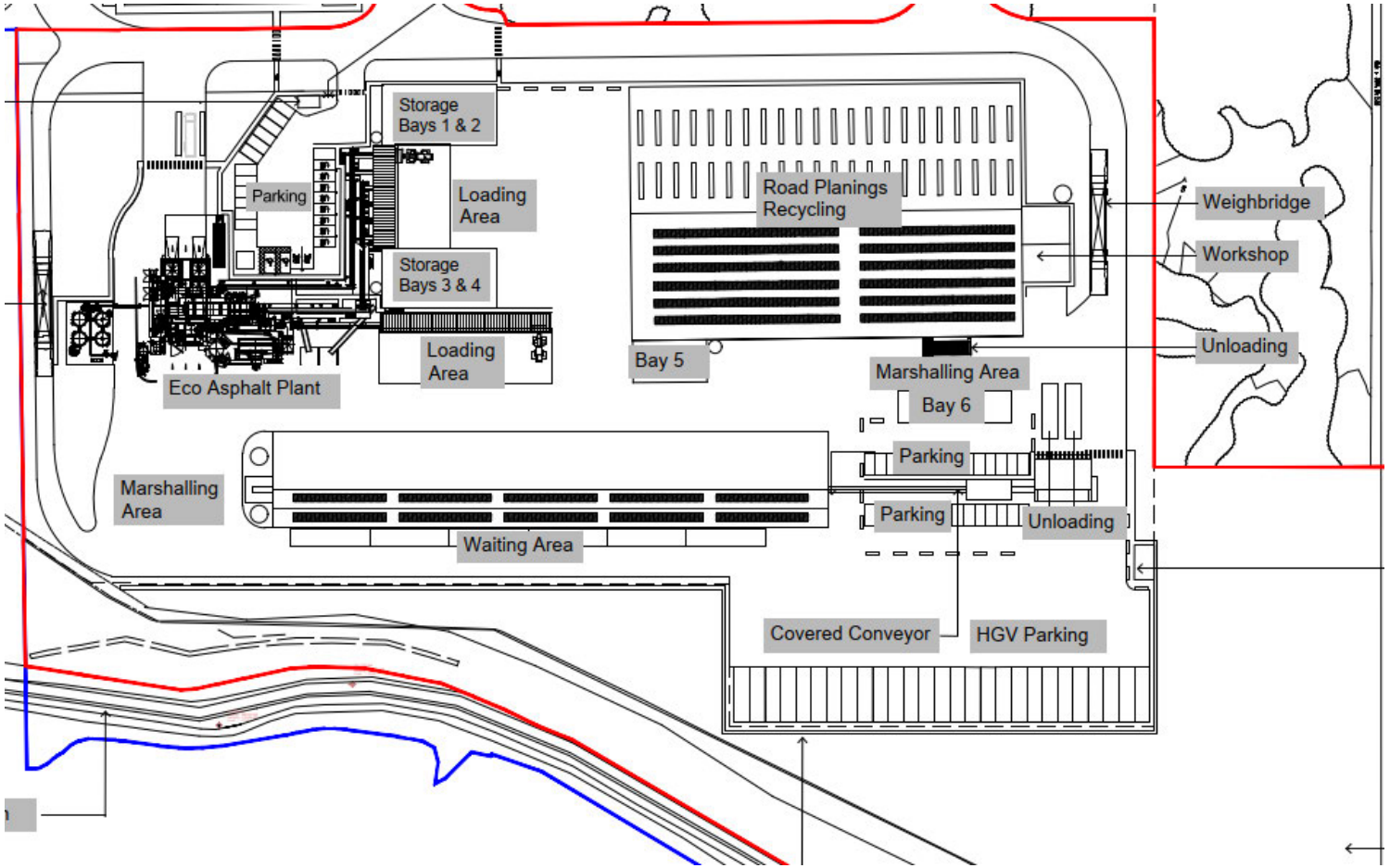
- Soft deposits overlaying gravel and chalk
- Insufficient soil data
- Changes in levels
- Tight project schedule
- Strict environmental & durability requirements
- Must support varying loads

Project Solution

- Early collaboration
- Proactive design approach
- Preliminary pile testing
- Local knowledge of ground conditions
- Efficient mobilisation & material supply

SITE OVERVIEW & DEVELOPMENT CONTEXT

ASPHALT PLANT & GREEN AGGREGATES BUILDING



Industrial development including:

- Aggregate storage bays
- Hoppers, tanks and weighbridges

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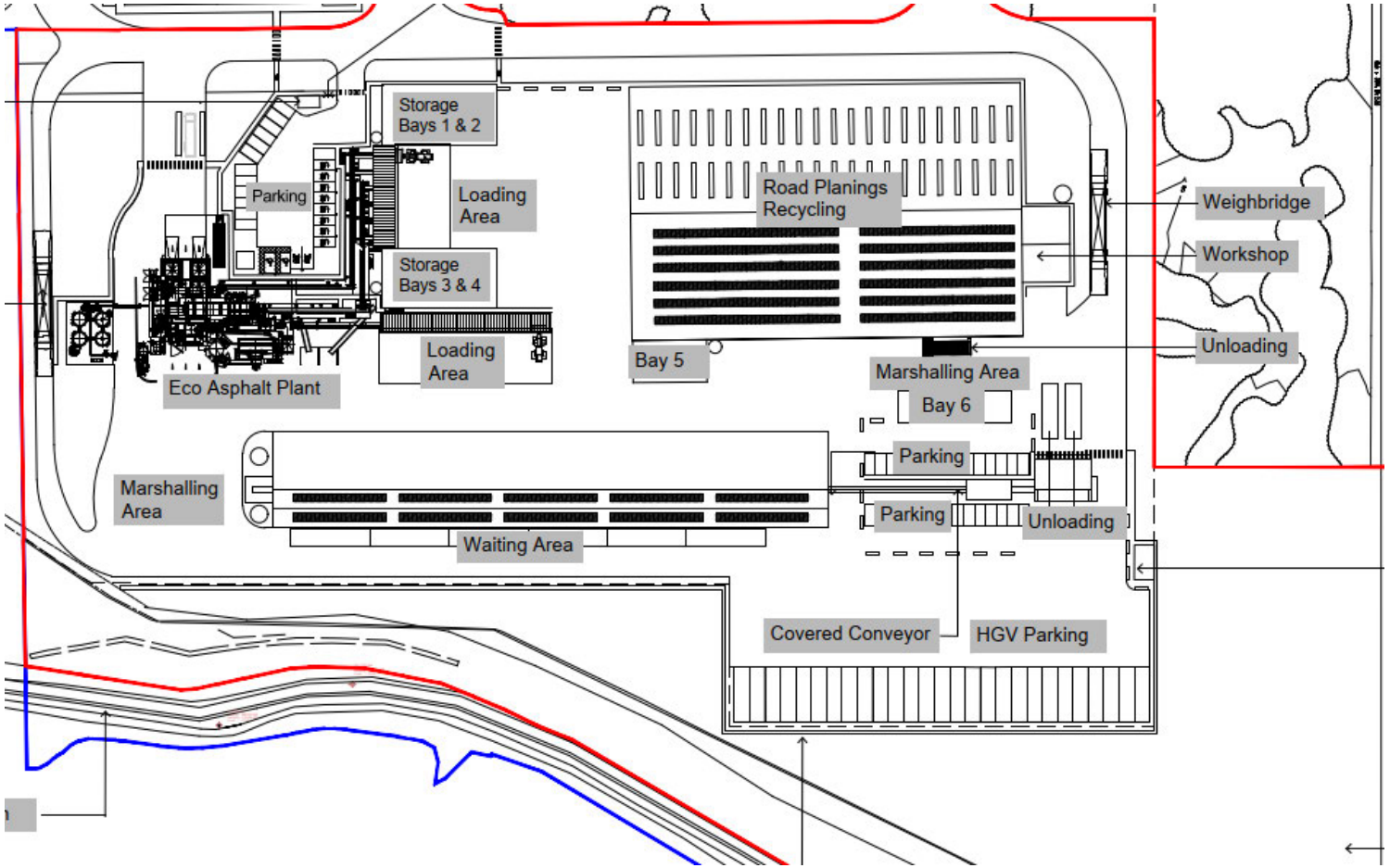

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Located in a brownfield, estuarine environment

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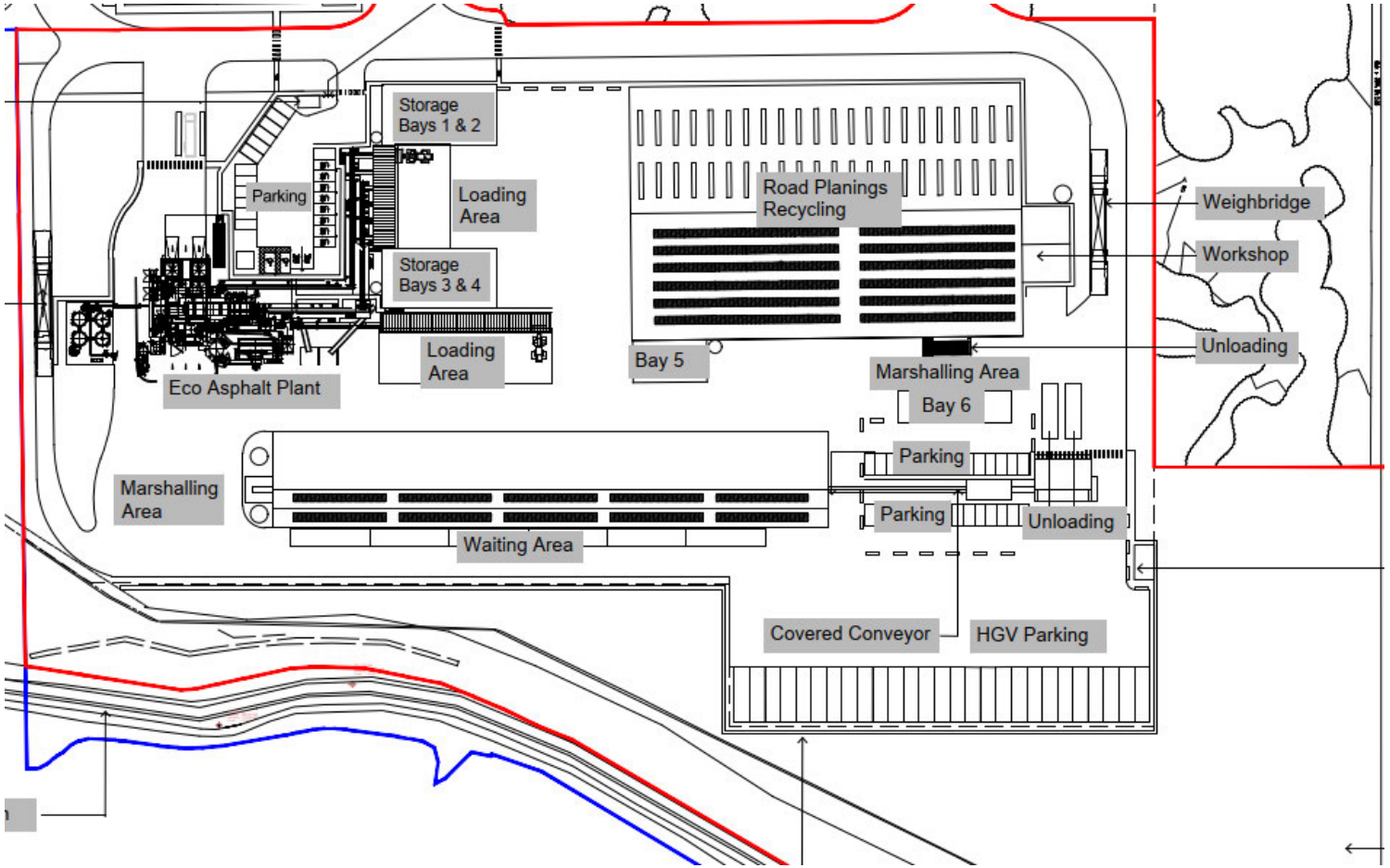

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Raised site levels and interaction with enabling works

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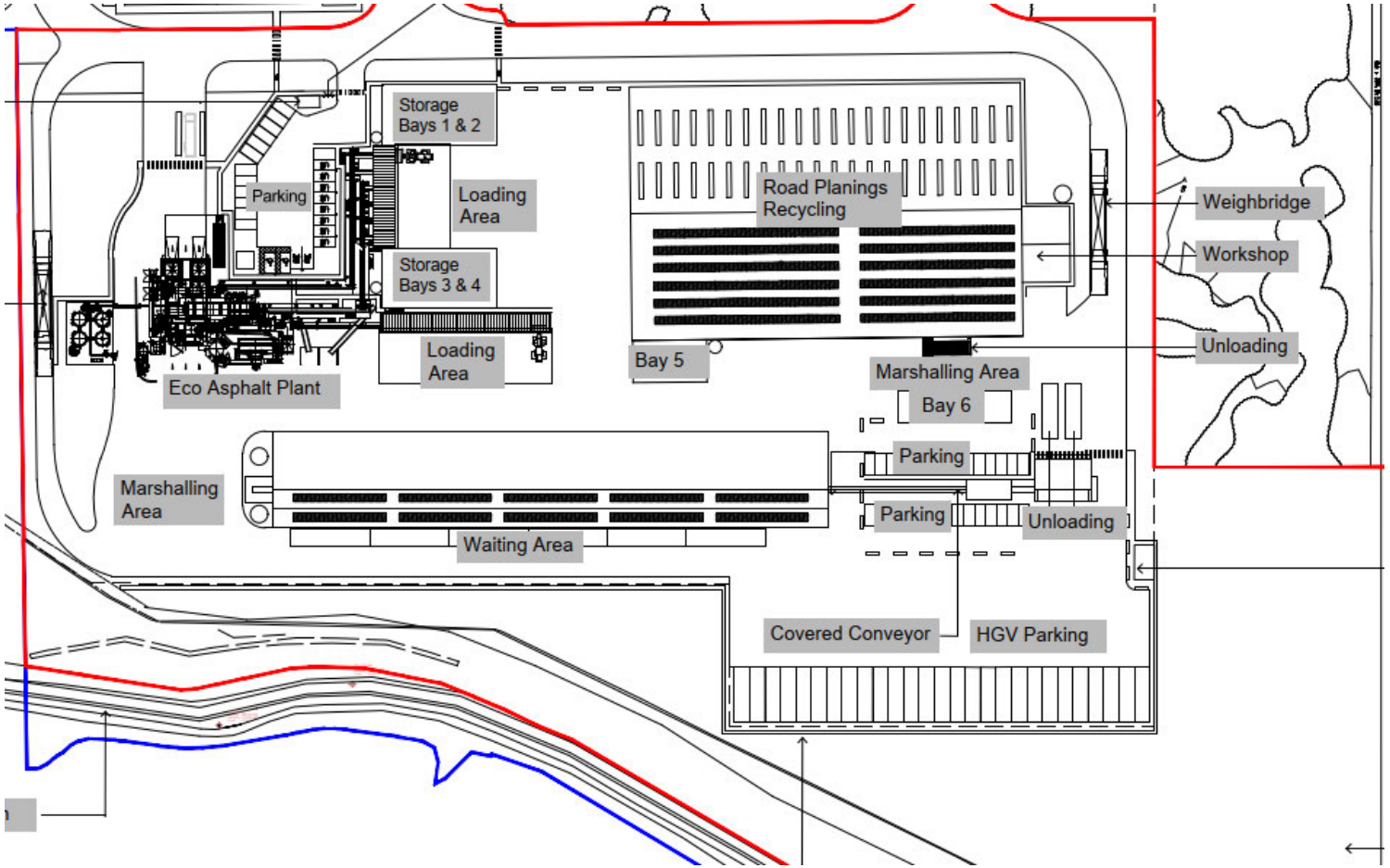

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Raised site levels and interaction with enabling works

Interface between remediation, earthworks, piling and structures

Challenges of Brownfield Developments

WHY BROWNFIELD SITES DEMAND
A DIFFERENT APPROACH

1. Legacy land uses and historical modifications
2. Variable and unpredictable ground condition
3. Incomplete or inconsistent site records
4. Tight programme and budget constraints
5. Increasing sustainability and carbon pressures

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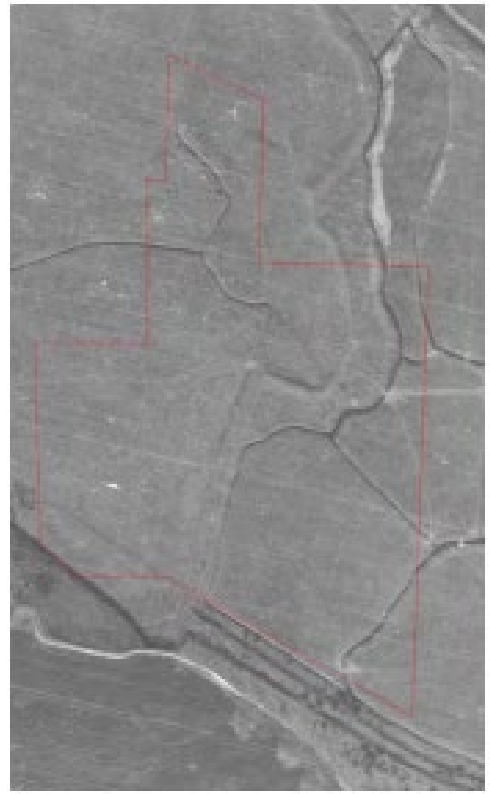
DATA GAPS

WHAT THE SI TELLS US

Site was historically part of West Thurrock Marshes as shown in 1897 and 1940 extracts.



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Earthworks taking place on the west of the site from 1990.

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A levelled site devoid of previous features by 1999.

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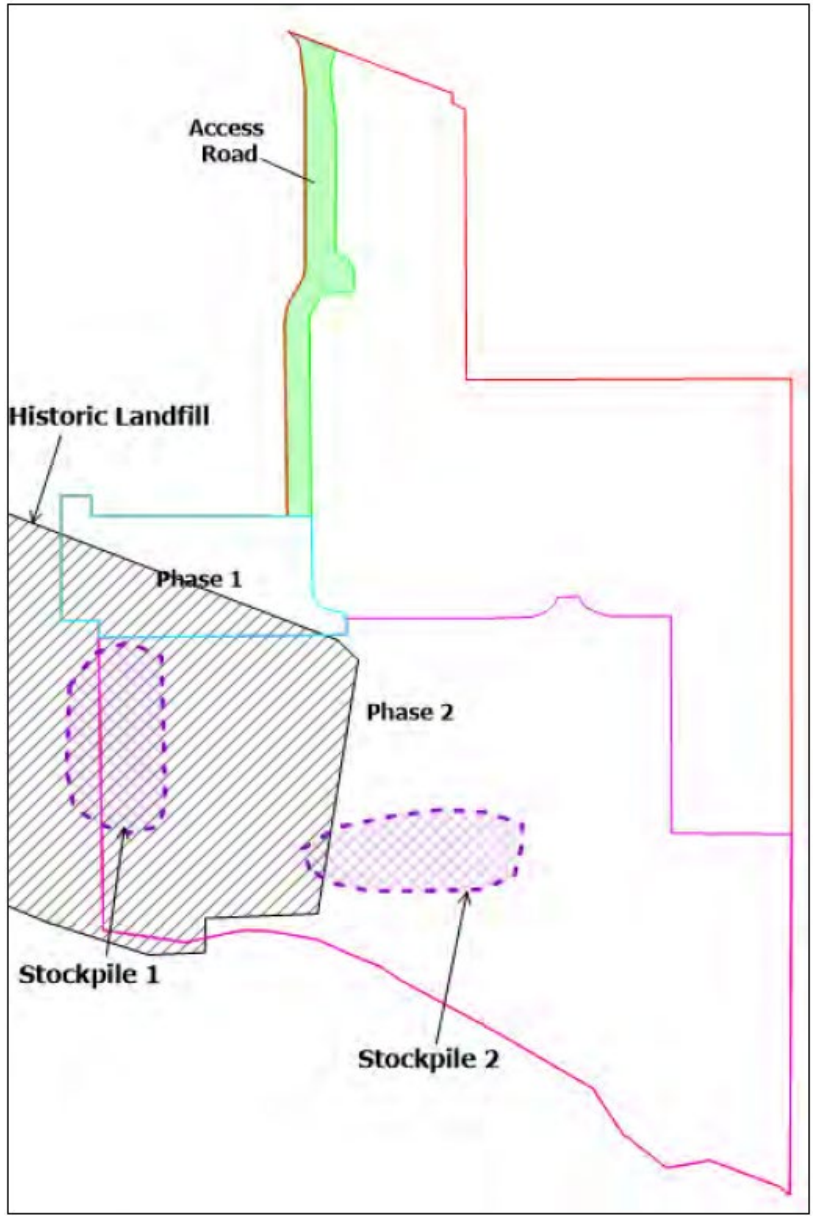
Earthworks taking place on the west of the site from 1990.

A levelled site devoid of previous features by 1999.

Historic Landfill to the west of the site

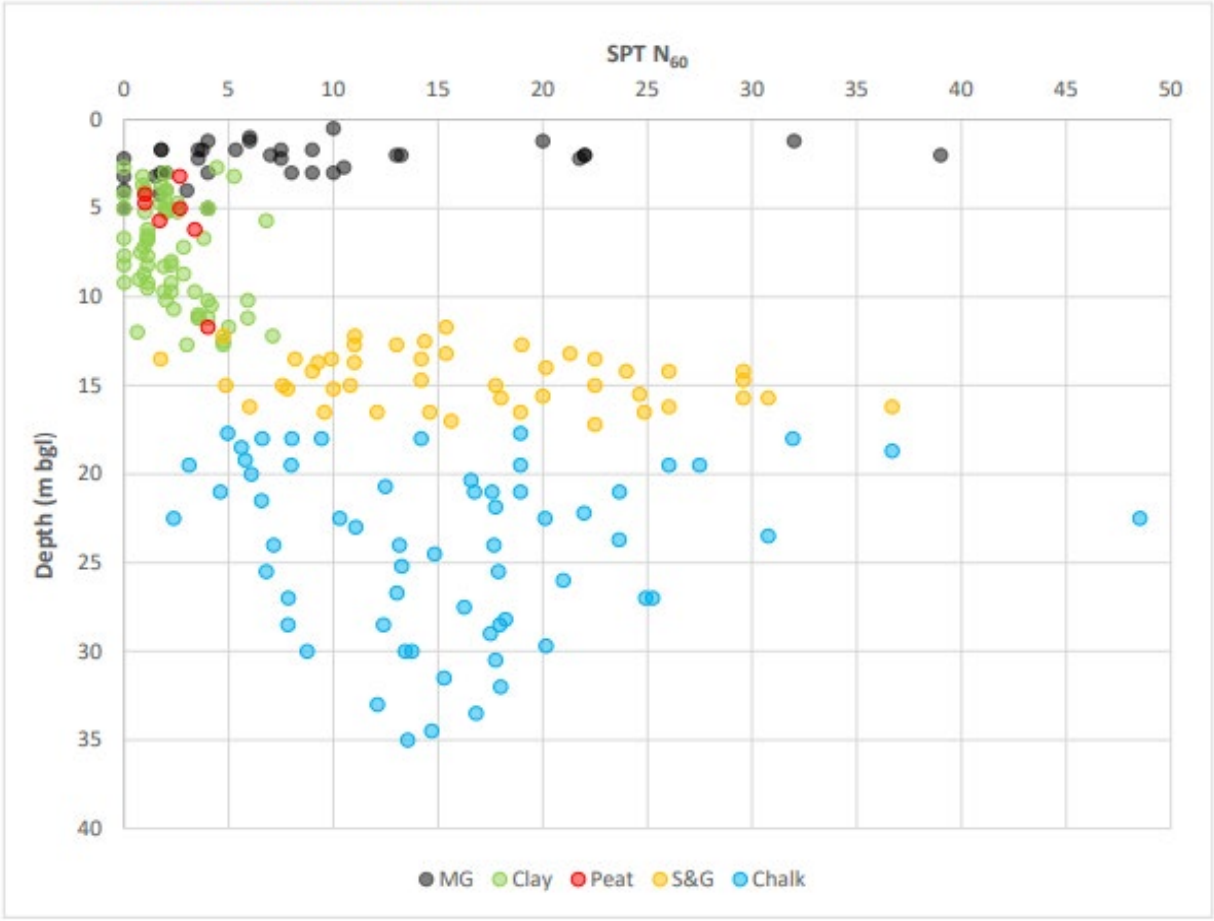


DATA GAPS
WHAT THE SI DOESN'T SHOW

Lacking data on near surface soils as we wanted to consider options for:

1. Rigid inclusions
2. Soil Stabilisation
3. Re-engineering existing soils
4. Enough data within chalk and gravel layers for RBL design

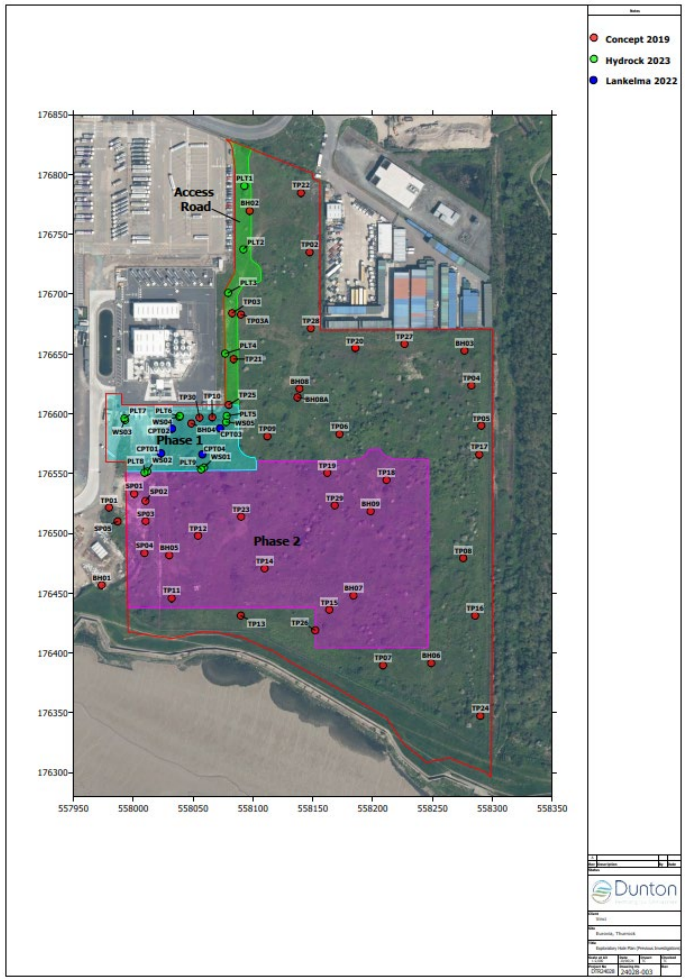
Figure 2: SPT N_{60} vs Depth

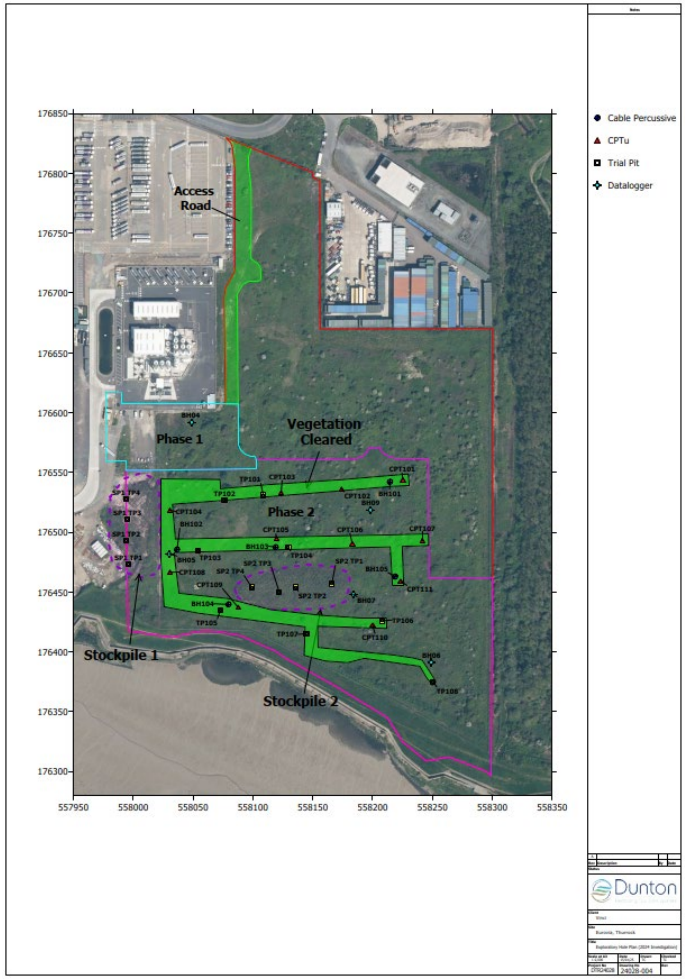


WHY IS COLLABORATION CRITICAL

CLOSING THE GAP BETWEEN DATA, DESIGN & DELIVERY

- **Concept 2019**
- **Hydrock 2023**
- **Lankelma 2022**





- Cable Percussive
- CPTu
- Trial Pit
- Datalogger

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BALANCING BUDGET,
PROGRAMME & PERFORMANCE

Budget

Pressure to control foundation costs

Risk allowances driven by uncertainty

Programme

Early works often on the critical path

Delays to foundations impact all follow on trades

Performance

Heavy industrial loading

Durability & long design life requirements

Compliance with Eurocodes & specifications

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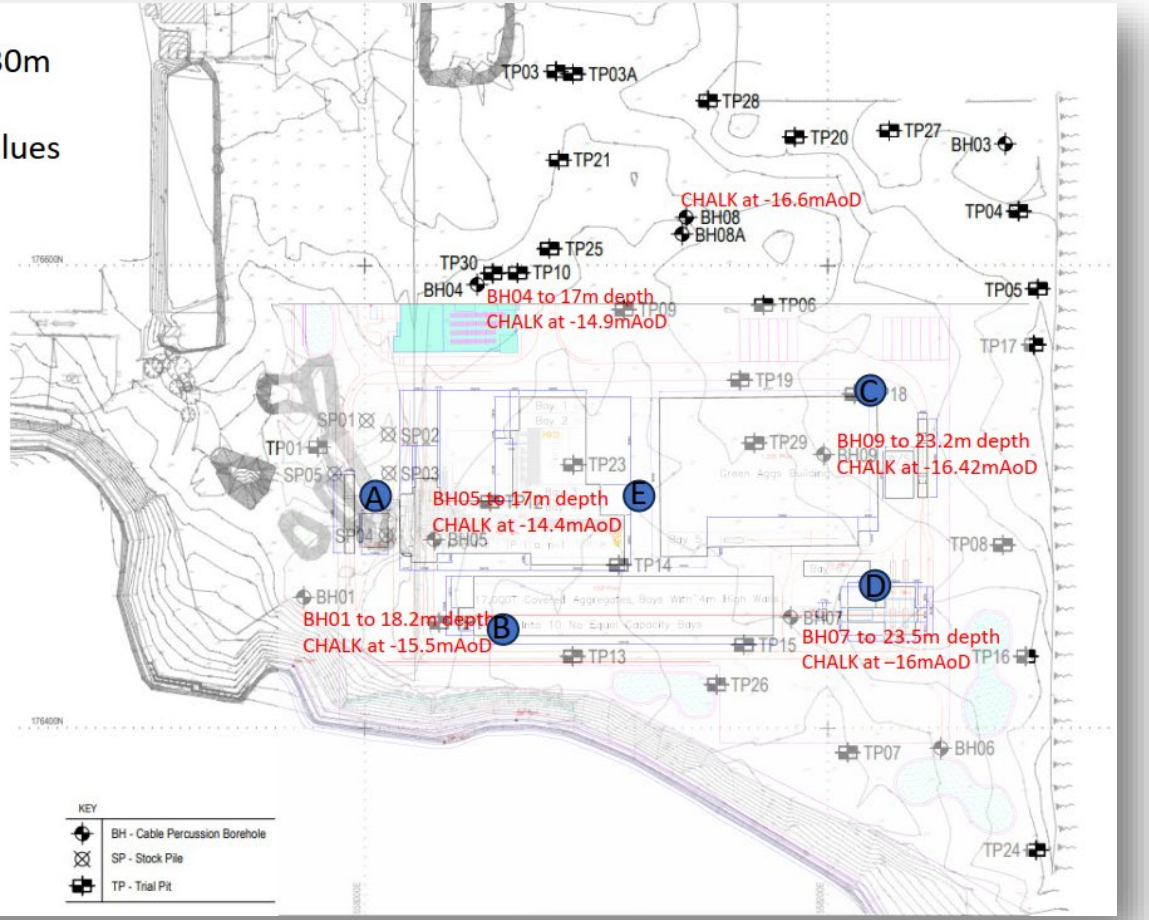
Engineering challenge – deliver certainty without over-design.

WHY IS COLLABORATION CRITICAL

CLOSING THE GAP BETWEEN DATA, DESIGN & DELIVERY

- Proposed BH location A-D- 30m depth.
  All strata recorded, SPT N values in Gravel and Chalk only (as nearby existing boreholes contain shallow data)

- Proposed BH location E – 30m depth
  All strata recorded SPT N values in all strata.
  No existing boreholes nearby



Existing Information:

- 17-23.5m depth
- 5m into chalk
- Limited coverage

Proposed Information:

- 17-34m depth
- 16m into chalk
- Better Coverage

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BROWNFIELD INDUSTRIAL DEVELOPMENT

RISK, SCALE & CERTAINTY

Heavy industrial loading with long-term performance requirements.

Brownfield site with complex, variable ground conditions.

Tight programme driven by asphalt plant delivery dates.

Environmental, durability and sustainability constraints.

Requirement for buildable, low-risk foundation solutions.

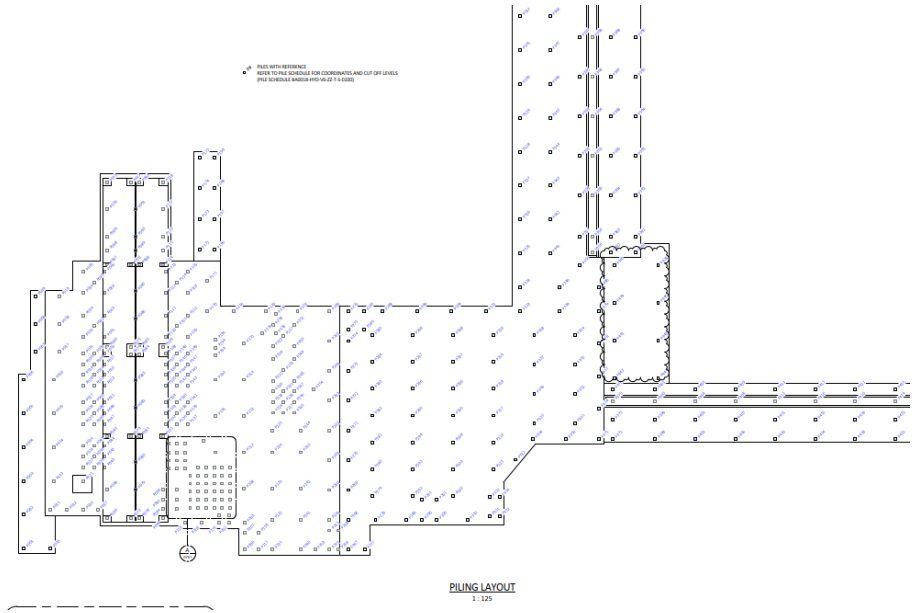
KEY GEOTECHNICAL & DESIGN CHALLENGES

ASPHALT PLANT & GREEN AGGREGATES BUILDING

Insufficient early ground data for finalised design

Theoretical chalk design methods producing conservative capacities

Raised site levels introducing negative skin friction



Requirement for DC4 for 50-year design life and Eurocode compliance

Heavy industrial loads:

- Up to 656kN compression (DA1C1)
- Horizontal loads up to 23kN (DA1C1)

TAILORED GROUND INVESTIGATION STRATEGY

ASPHALT PLANT & GREEN AGGREGATES BUILDING

Bespoke SI approach advised by RBL

- Verifying chalk and continuity
- Reducing reliance on assumptions
- Inform pile length optimisation
- Support testing strategy
- Improve design confidence

Solutions

EARLY CONTRACTOR INVOLVEMENT

ASPHALT PLANT & GREEN AGGREGATES BUILDING

1. RBL and Dunton engaged early with VINCI Building and designers
2. Had input into foundation feasibility, pile type selection and ground investigation strategy
3. The team focused on reducing uncertainty, avoiding over-design and improving programme certainty

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Dunton’s Approach

THE DUNTON APPROACH

ASPHALT PLANT & GREEN AGGREGATES BUILDING

- Extensive Cut and Fill works & Piling Mat Installation
- Processed c. 7,000m3 stockpile materials to enable re-use
- Turnover c. 20,000m3 of made ground to remove obstructions
- Removed c.3000m3 of obstruction waste (typically construction waste).
- Treated Japanese knotweed onsite before removed
- Gabion wall installation (c.500m) and pavers to all lorry parking bays
- Installation of 3nr. Drainage ponds, lined with reno mats

RBL’s Approach

VALIDATING PERFORMANCE

ASPHALT PLANT & GREEN AGGREGATES BUILDING

Objectives

Actual Pile performance

Quantify 250mm piles

Provide surety to all parties

Most economic design

Results

Higher than theoretical capacity in chalk

Data driven approach

Outcome

250mm over 300mm Sq.

Reduced pile lengths

Material efficiency

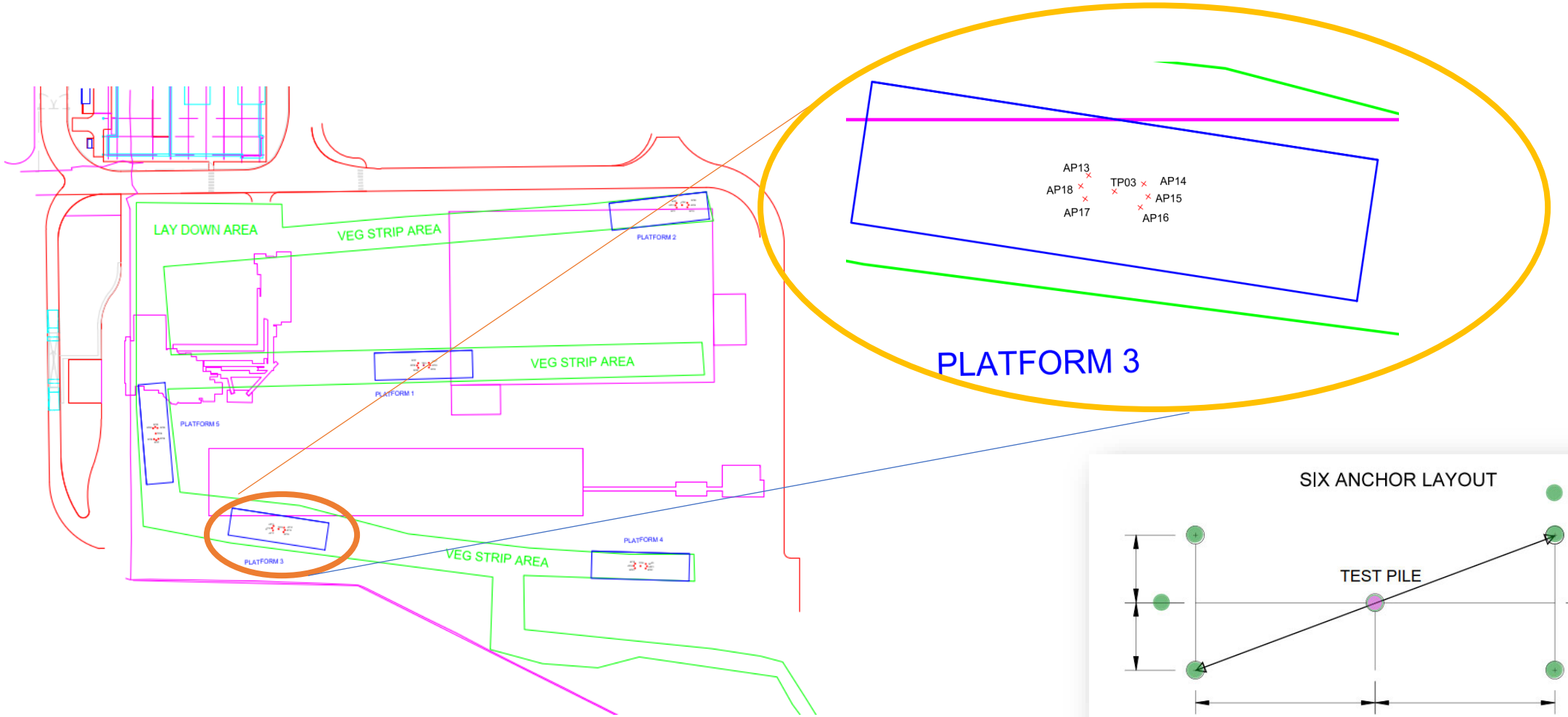
Lower embodied carbon

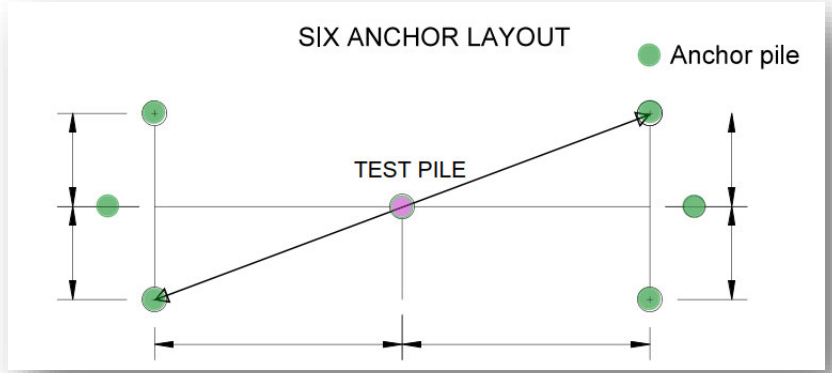
Reduced cost

‘Sustainability in Design’

VALIDATING PERFORMANCE

ASPHALT PLANT & GREEN AGGREGATES BUILDING





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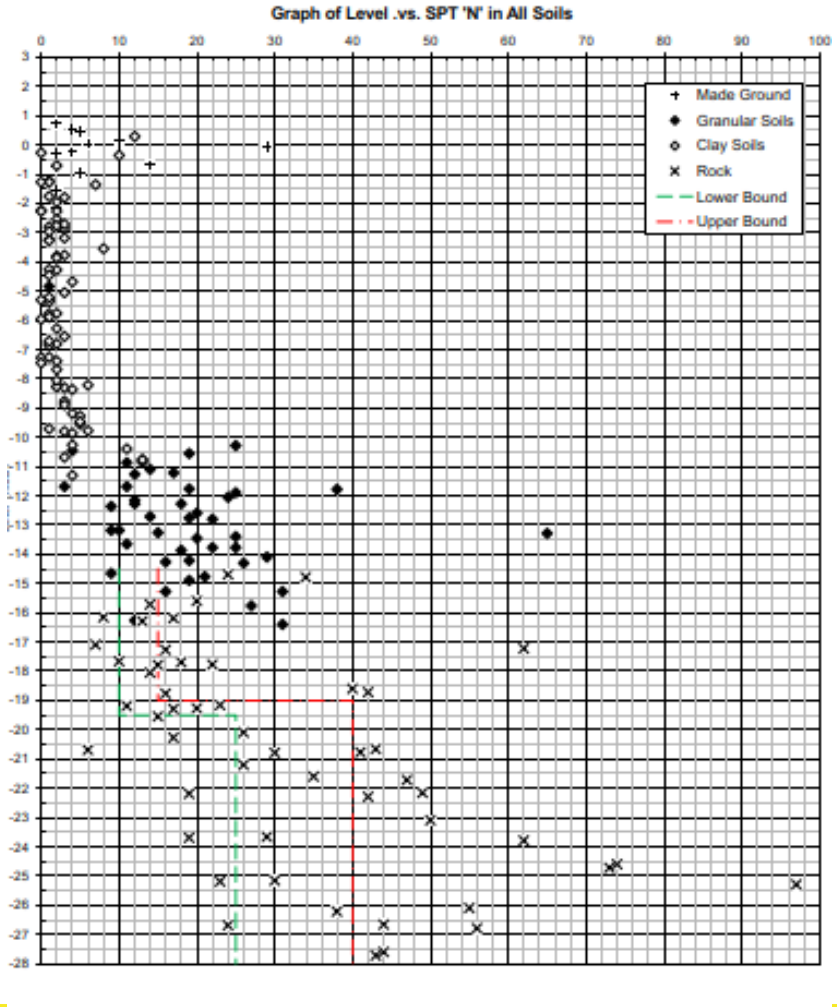
VALIDATING PERFORMANCE

ASPHALT PLANT & GREEN AGGREGATES BUILDING

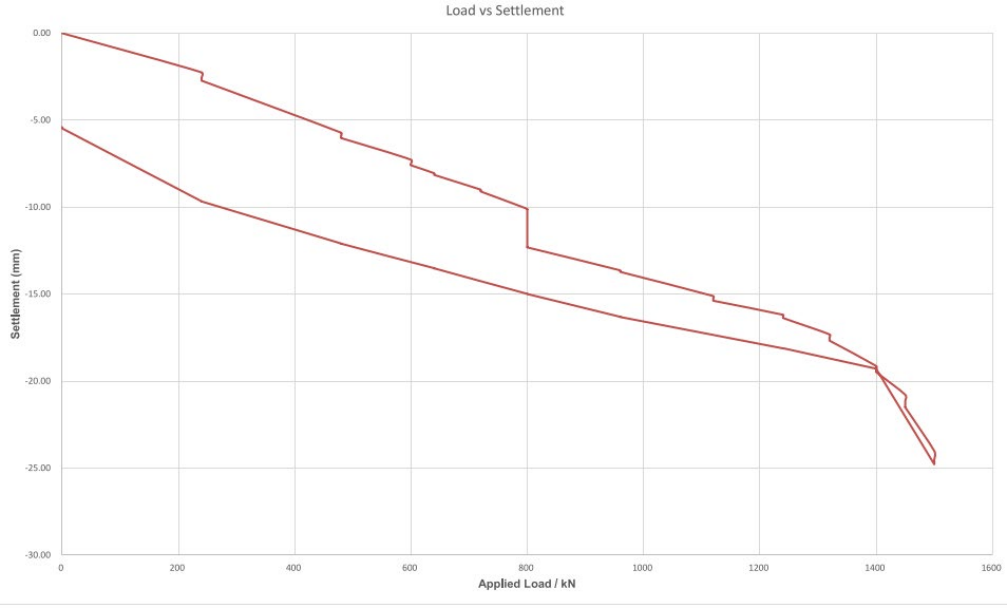


Target Test Pile Loads				
Test Reference	Target Pile Length (m)	1st Cycle (DVL) (kN)	2nd Cycle (MTL) (kN)	Rationale
TP01(1)	29.5	800	1500	Assess maximum pile capacity
TP02(2)	29.5	750	950	Assessment of settlement at DVL and DVL+0.5 F_{rep}
TP03(2)	29.5	800	1050	Assessment of settlement at DVL and DVL+0.5 F_{rep}
TP04(1)	29.5	800	1500	Assess maximum pile capacity
TP05(1)	29.5	800	1500	Assess maximum pile capacity

(1) Pile tests to be held overnight.
(2) Pile test to be multi-cycle test as per ICE SPERW.

VALIDATING PERFORMANCE

ASPHALT PLANT & GREEN AGGREGATES BUILDING



Static Pile Calculation Summary

Static Pile Calculation	Design Datum (m AOD)	Pile Length[1] (m)	Average Skin friction (kN/m²)	q_b SPT N (Base Resistance coefficient)	Ultimate Resistance [1] (kN)	Ultimate Shaft Resistance [1] (kN)	Ultimate Base Resistance (kN)	Negative Shaft Friction [2] (kN)	Design Resistance (DA1C2) [3] (kN)
Prelim Test	2.0m AOD	23.5m	50	300	1505	755	750	100	NA
Working Pile Test	3.2m AOD	24.5m	45*	300	1330	790	470	160[4]	NA
Contract Design	3.7m AOD	25m	45*	300	1330	850	470	180[5]	505

Notes

[1] Shaft friction calculated positively for all soils as calculating ultimate limit state
[2] Negative skin friction calculate shaft resistance of soils that will consolidate due to fill.
[3] Calculated design resistance (Negative shaft friction taken as an additional permanent design).
[4] Negative skin friction value for shaft resistance provided during the test for the soft compressible soils NSF_{Test}.
[5] Negative skin friction value for the long-term design situation NSF_{Des}.

PILING SOLUTION SELECTION

ASPHALT PLANT & GREEN AGGREGATES BUILDING

250mm sq Driven Precast Concrete Piles selected

- Proven performance in similar local ground conditions
- Predictable behaviour & Cost Certainty
- High quality, factory-controlled product
- Efficient installation rates
- Reduced spoil and waste

SUMMARY

ROGER BULLIVANT

Q & A

Thank you for listening

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