The London Resort Development Consent Order

BC080001

Environmental Statement
Volume 2: Appendices

Appendix 18.17 – Preliminary Tunnel Impact Assessment

Document reference: 6.2.18.17
Revision: 00

December 2020

Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(a)
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Regulation 12(1)

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NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
Document reference	0042936_LR_BUR_DCO_GEO_1009	Revision	00	
GRIP Stage		Date	02/10/2020	

Project Title	The London Resort		
Project Nr	042936		
Location	Swanscombe Peninsular, Kent		
ELR	TRL2	Mileage	34200 to 34875
Asset Nr	TBC	OS grid ref	TQ 60217 75703
RRD Reference Nr			*Revision & date*
DRRD Reference Nr			*Revision & date*
CR-T Reference Nr			*Revision & date*
Other AiP documents associated with this submission	Appendix B - London Resort Preliminary Tunnel Impact Assessment (Doc. No. 042936-BH-DCO-GE-1008 Rev P01, dated 29 September) Appendix C – Drawing Number 320-DCA-03360-00012-AA, Drawing Number 014-HS1-1D000-00248-00		

PART 1: DETAILS

1.1 Proposed works

Buro Happold has been appointed by London Resorts Company Holdings Limited to provide civil and geotechnical advice in connection with the development of a new entertaining resort on Swanscombe Peninsula, on the south bank of the River Thames.

Some excavation and filling works are required in connection with the proposed development. Although these works will be undertaken near the existing HS1 tunnels, preliminary analyses suggest that the imposed tunnel deflections and changes of stress are within tolerable limits.

1.2 Assets affected

Refer to Appendix A.

PART 2: DESIGNER'S SUBMISSION

I confirm that the criteria specified in NR/L2/CIV/003 have been considered and that the Design is submitted for Approval in Principle on behalf of BuroHappold Limited, 17 Newman Street, London W1T 1PD, UK.

Signed [redacted]	Title Director
Name (print) Rachel Monteith	Date 02/10/2020
To be signed by the **Contractor's Responsible Engineer for the Design Phase**.	

NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
Document reference	0042936_LR_BUR_DCO_GEO_1009	Revision	00	
GRIP Stage		Date	02/10/2020	

PART 3: SUPPLEMENTARY NETWORK RAIL REVIEWS AND ENDORSEMENT

NOT REQUIRED

~~**Security, Emergency and Contingency Review**~~

~~My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse the Approval in Principle of the above proposals regarding the physical security, emergency and contingency arrangements of railway infrastructure.~~

~~Signed~~	~~Title~~
~~Name (print)~~	~~Date~~
~~To be signed by the **Security and contingency planning specialist**~~	

~~**Station Pedestrian Capacity and Evacuation Review**~~

~~My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse Approval in Principle of the above proposals regarding Station capacity and evacuation.~~

~~Signed~~	~~Title~~
~~Name (print)~~	~~Date~~
~~To be signed by the **Network Rail Capacity Engineer**~~	

~~**Fire Safety Review**~~

~~My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse Approval in Principle of the above proposals regarding Fire Safety.~~

~~Signed~~	~~Title~~
~~Name (print)~~	~~Date~~
~~To be signed by the **Network Rail Fire Engineer**~~	

NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
Document reference	0042936_LR_BUR_DCO_GEO_1009	Revision	00	
GRIP Stage		Date	02/10/2020	

PART 4: PROJECT ENGINEER'S COMMENTS

I have considered this submission for Approval in Principle and I am satisfied that this has adequately addressed the criteria specified in NR/L2/CIV/003 and confirm that the Design of the Permanent Works is to be checked in accordance with the Design Check Categories listed in **Error! Reference source not found.** of NR/L2/CIV/003.

My comments on the submission are given below. Provided that these comments are addressed, I hereby give Approval in Principle to the proposals.

Signed	Title
Name (print)	Date
To be signed by the **NR Asset Protection Engineer (Building and Civil Engineering)**	

Signed	Title
Name (print)	Date
To be signed by **other responsible person for other disciplines** *(if applicable)* **(*Project Engineer (Building Services) for example*)**	

PART 5: ASSET MANAGER'S APPROVAL

I have considered the submission and confirm that this is approved subject to the comments given below being addressed within the Detailed Design.

Signed	Title
Name (Print)	Date
To be signed by the **Asset Manager (Structures)**	

Signed	Title
Name (Print)	Date
To be signed by the **Asset Manager (Geotechnical)**	

Signed	Title
Name (Print)	Date
To be signed by the **Asset Manager (Drainage)**	

Signed	Title
Name (Print)	Date
To be signed by the **Asset Manager (Buildings)**	

NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
Document reference	0042936_LR_BUR_DCO_GEO_1009	Revision	00	
GRIP Stage		Date	02/10/2020	

APPENDIX A

A1 LIST OF BUILDINGS AND CIVILS ENGINEERING ASSETS AFFECTED BY THE PROPOSAL

1. Asset No 1

Asset No 1

Description	Twin Bored Tunnels		
Location	Refer to Figure 2-3 in Appendix B and the Drawings attached in Appendix C		
ELR	TRL2	Mileage	34200 to 34875
Asset Nr	TBC	OS grid ref	TQ 60217 75703

A1.1 DRAWINGS AND MODELS OF PROPOSALS

The proposed development comprises the construction of a new theme park, together with associated transport, accommodation, and back-of-house infrastructure.

In addition to the building and infrastructure works, extensive earthworks comprising both cut and fill are required to provide a development platform. The impact of the earthworks on the bored tunnels is the focus of this AIP.

Further details can be found in Section 3 of Appendix B.

A1.2 DESIGN CRITERIA

- ~~Design Life~~
- ~~Operational requirements~~
- ~~Loading requirements~~
- ~~Fire resistance and escape times~~
- ~~Diversity and Inclusion requirements arising from a DIA~~
- ~~Station pedestrian capacity assessment~~
- ~~Environmental requirements~~

Change of vertical stress and settlement along the bored tunnels resulting from the proposed excavation and filling works have been evaluated using the Oasys programme PDISP, with associated impacts to the tunnel lining being evaluated in accordance with BS EN 1991, Duddeck & Erdmann (1982), and Morgan (1961).

The details of the analysis and the results are provided in Sections 5 and 6 of Appendix B.

NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
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GRIP Stage		Date	02/10/2020	

A1.3 ANTICIPATED DEVIATIONS FROM STANDARDS (with justification)

Not anticipated.

A1.4 GEOTECHNICAL CONSIDERATIONS

Geotechnical considerations are given in Section 4 of Appendix B.

The earthworks are anticipated to fall under Geotechnical Category 2 (BS EN 1997-1).

A1.5 ACCOMPANYING DRAWINGS AND OTHER DOCUMENTS

Appendix B - London Resort Preliminary Tunnel Impact Assessment (Doc. No. 042936-BH-DCO-GE-1008 Rev P01, dated 29 September)

Appendix C – Drawing Number 320-DCA-03360-00012-AA, Drawing Number 014-HS1-1D000-00248-00.

A1.6 OTHER RELEVANT INFORMATION

- ~~Details of existing parts/elements of structures/services to be retained and incorporated into the Design~~
- ~~Unusual features~~
- ~~Novel or unusual use of materials and/or structural components~~
- ~~Details of capacity assessments (for example, pedestrian modelling)~~
- ~~Designers' Risk Assessments~~
- ~~Indicative description of the construction sequence~~

Not applicable.

A1.7 REQUIREMENTS FOR OPERATION, INSPECTION, MAINTENANCE, REPAIR, RENEWAL OR REMOVAL INCLUDING SPECIAL ACCESS ARRANGEMENTS.

Pre and post condition surveys of the bored tunnels will be required.

A1.8 CHECKING CATEGORY

~~The Design of the Permanent Works is proposed to be checked in accordance with the following Categories in NR/L2/CIV/003.~~

~~Description of asset~~	~~Permanent or Temporary Works~~	~~Design Check Category~~

This AIP refers to earthworks only.

A1.9 TEMPORARY WORKS

The effects of temporary dewatering will need to be considered at the later stage should it be required.

NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
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APPENDIX B –

London Resort Preliminary Tunnel Impact Assessment (Doc. No. 042936-BH-DCO-GE-1008 Rev P01, dated 29 September)

BURO HAPPOLD

London Resort

Preliminary Tunnel Impact Assessment

042936-BH-DCO-GE-1008

042936

29 September 2020

Revision P01

Revision	Description	Issued by	Date	Checked
P01	First issue	J. Schoor	29 Sept 20	R. Monteith

https://burohappold.sharepoint.com/sites/042936/Shared Documents/F9 Ground Eng- Site Inv/03 Reports/Preliminary Tunnel Impact Assessment/Preliminary HSI assessment - REV0.docx

Author	**Jesse Schoor**
Date	**09 Sept 2020**
Approved	**Rachel Monteith**
Signature	[redacted]
Date	**29 Sept 2020**

Contents

Table of Tables

Table of Figures

Introduction

Buro Happold has been appointed by London Resorts Company Holdings Limited to provide civil and geotechnical advice in connection with the development of a new entertaining resort on Swanscombe Peninsula, on the south bank of the River Thames.

This report summarises potential impacts of excavation and filling on existing High Speed 1 (HS1) infrastructure and provides a set of ground rules for future development in the vicinity of existing tunnel infrastructure. Although this report is intended to support initial discussions with HS1, additional analyses will be required for individual construction packages at the appropriate stage of design.

The Site

Site Location

The site is located on the Swanscombe Peninsula, Kent, on the south bank of the River Thames, and is approximately centred on National Grid Reference TQ 60657 76055. A site location plan is presented as Figure 2-1.

Figure 2-1 Site Location Plan

Site Description

The overall development area comprises 326 hectares covering much of the Swanscombe Peninsula. The red line boundary is presented as Figure 2-2 and indicates the development area to contain:

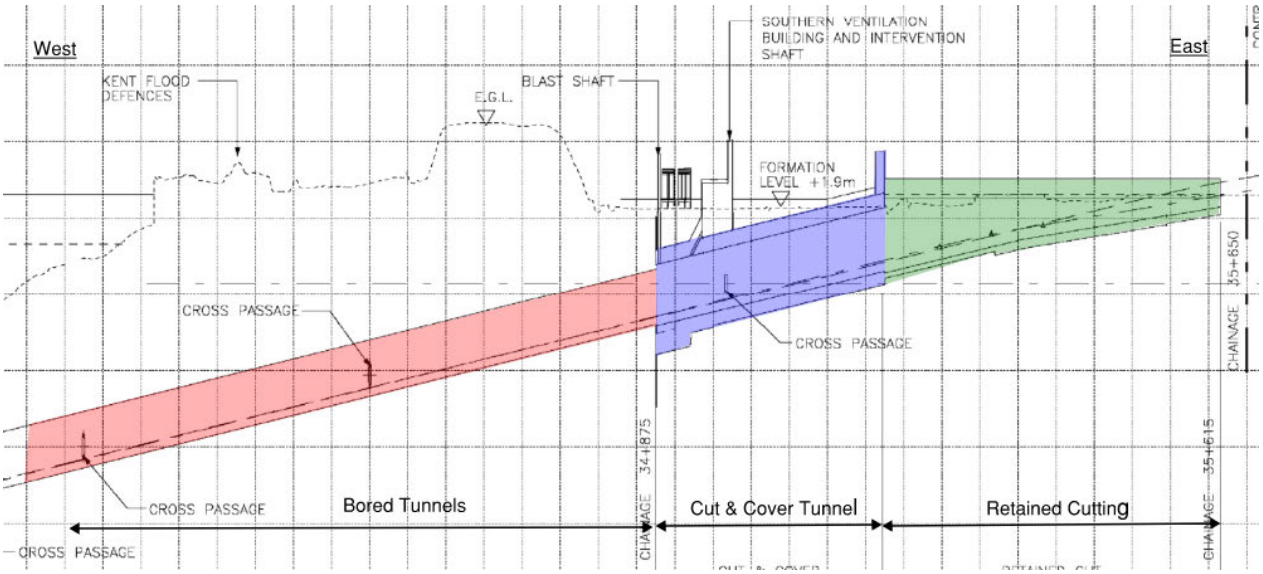
- Ebbsfleet Station, overland track, retained cuttings, and tunnels associated with the Channel Tunnel Rail Link (CTRL);
- Overland track associated with Network Rail;
- An industrial estate;
- Disused chalk quarries; and
- Disused chalk quarries which have been in-filled with inert, industrial, and commercial waste.

Figure 2-2 Site Layout Plan

Existing HS1 Tunnel Infrastructure

As outlined above, the site contains a number of HS1 tunnel assets. These include a retained cutting, a cut-and-cover tunnel, and twin bored tunnels. Details of the retained cutting and tunnel infrastructure are provided in the following sections.

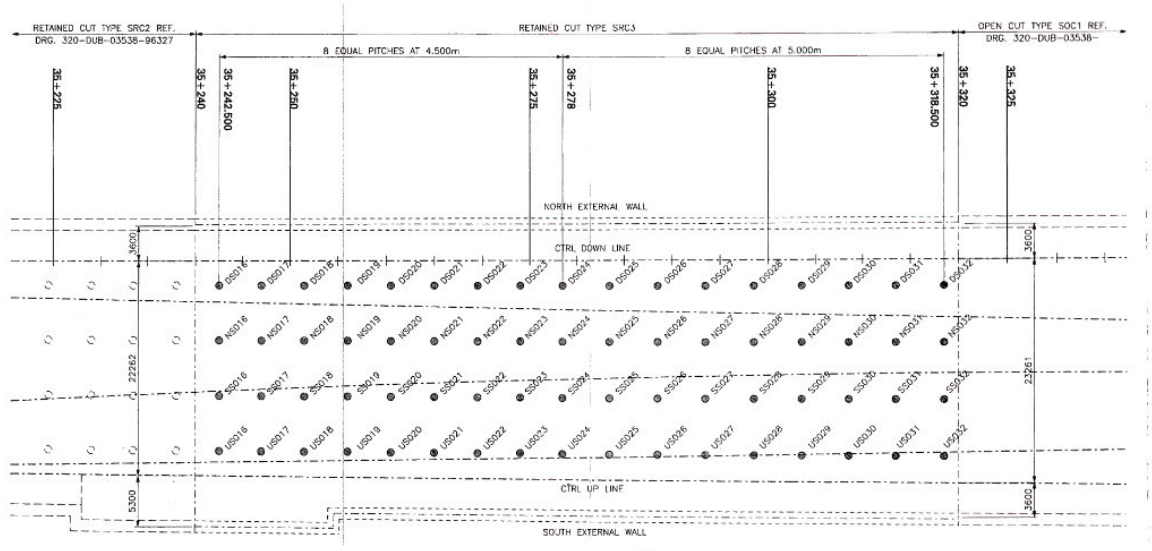
Figure 2-3 General Arrangement of Existing HS1 Infrastructure



Retained Cutting

A retained cutting is present to the immediate south of the cut & cover tunnel section and is formed by twin diaphragm walls, together with a reinforced concrete base slab. As illustrated on Figure 2-4, a series of tension piles are also provided to resist hydrostatic uplift.

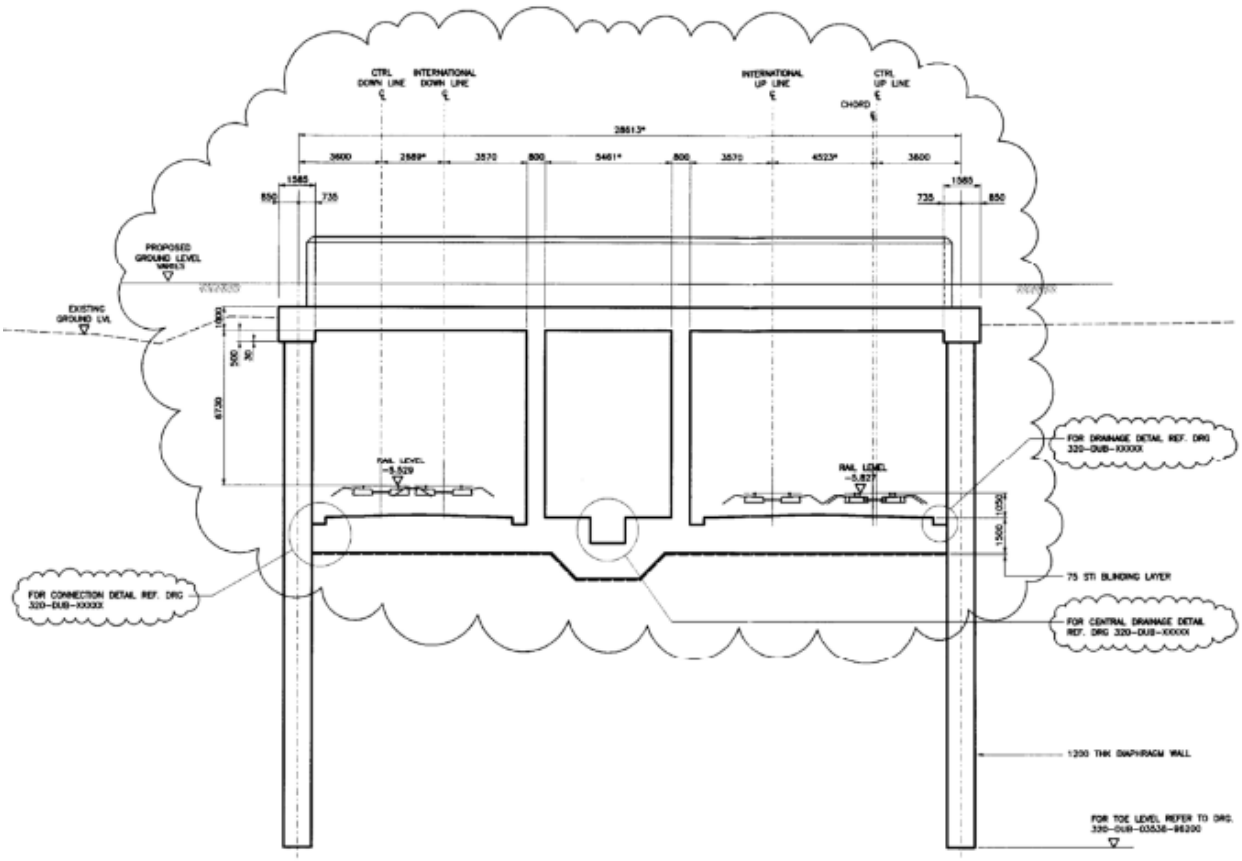
Figure 2-4 Retained Cutting Tension Pile Location Plan



Cut-and-Cover Tunnel

A cut & cover tunnel is situated between the retaining cutting and bored tunnels and comprises twin diaphragm walls, together with base and roof slabs (see Figure 2-5).

Figure 2-5 Indicative Cross Section for Cut & Cover Tunnel



Bored Tunnels

Two bored tunnels extend northward of the cut & cover tunnels. These features plunge downward to the River Thames and are spaced approximately ten metres apart. Further details are presented as Figure 2-6 and Table 2-1.

Figure 2-6 Typical Lining Construction Detail

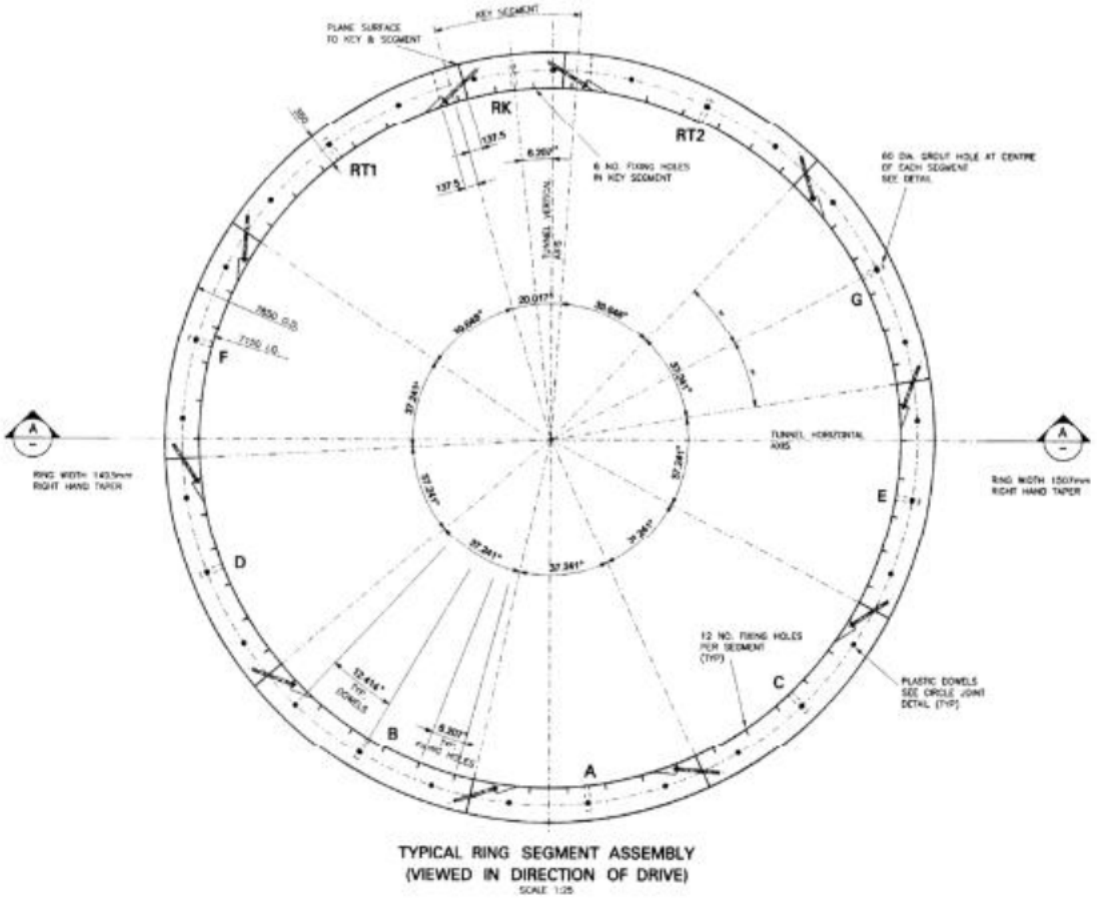


Table 2-1 Details of Existing Bored Tunnel Construction

Parameter	Details
Internal Diameter	7,150mm
Lining Thickness	350mm
Ring Width	1,493 to 1,507mm
Reinforcement	Steel fibres at 30kg/m^3 Polypropylene fibres at 1kg/m^3
Concrete Grade	50/60 MPa
Number of Segments	10

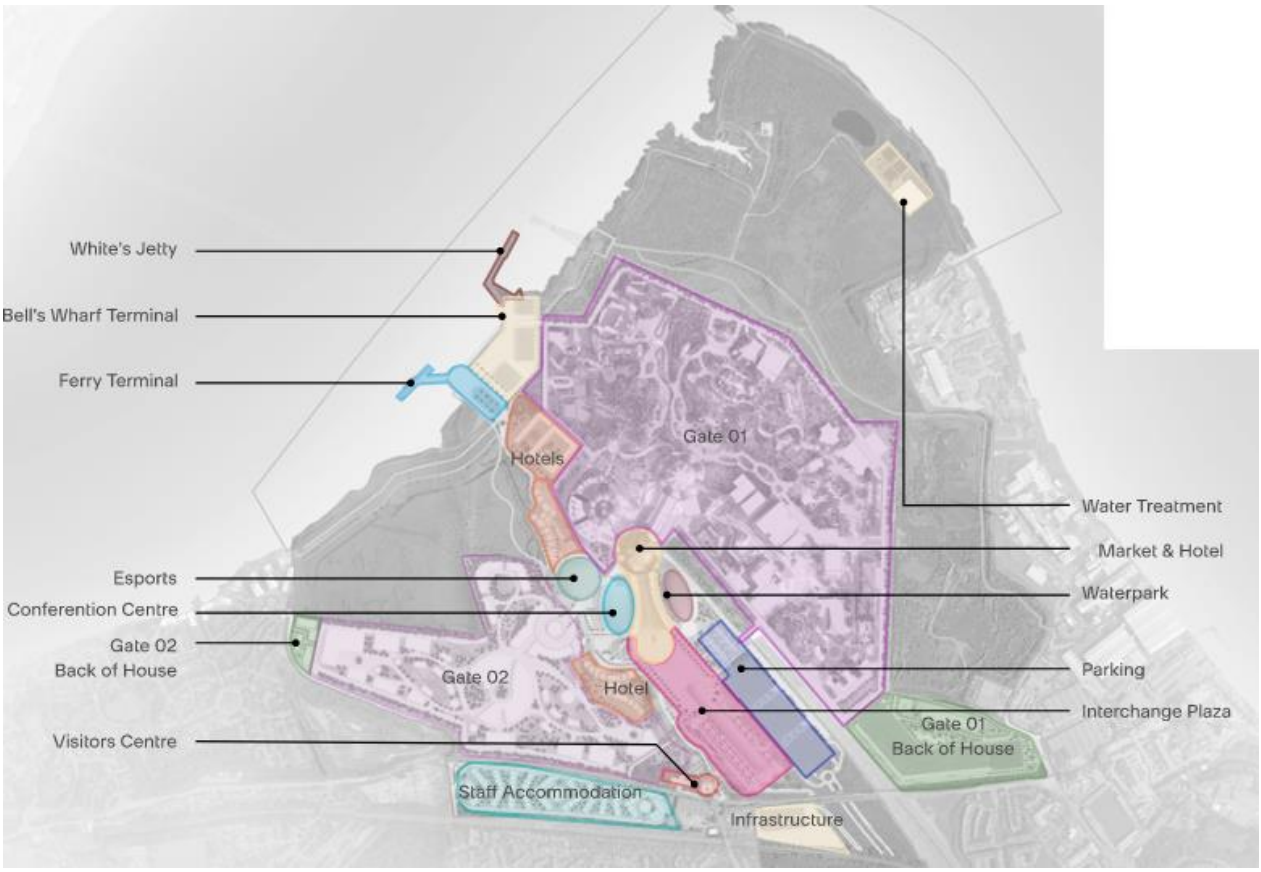
Proposed Development

General

The proposed development comprises the construction of a new theme park, together with associated transport, accommodation, and back-of-house infrastructure. Further details of the works are provided on Figures 3-1 and 3-2.

Figure 3-1 Proposed Development Plan

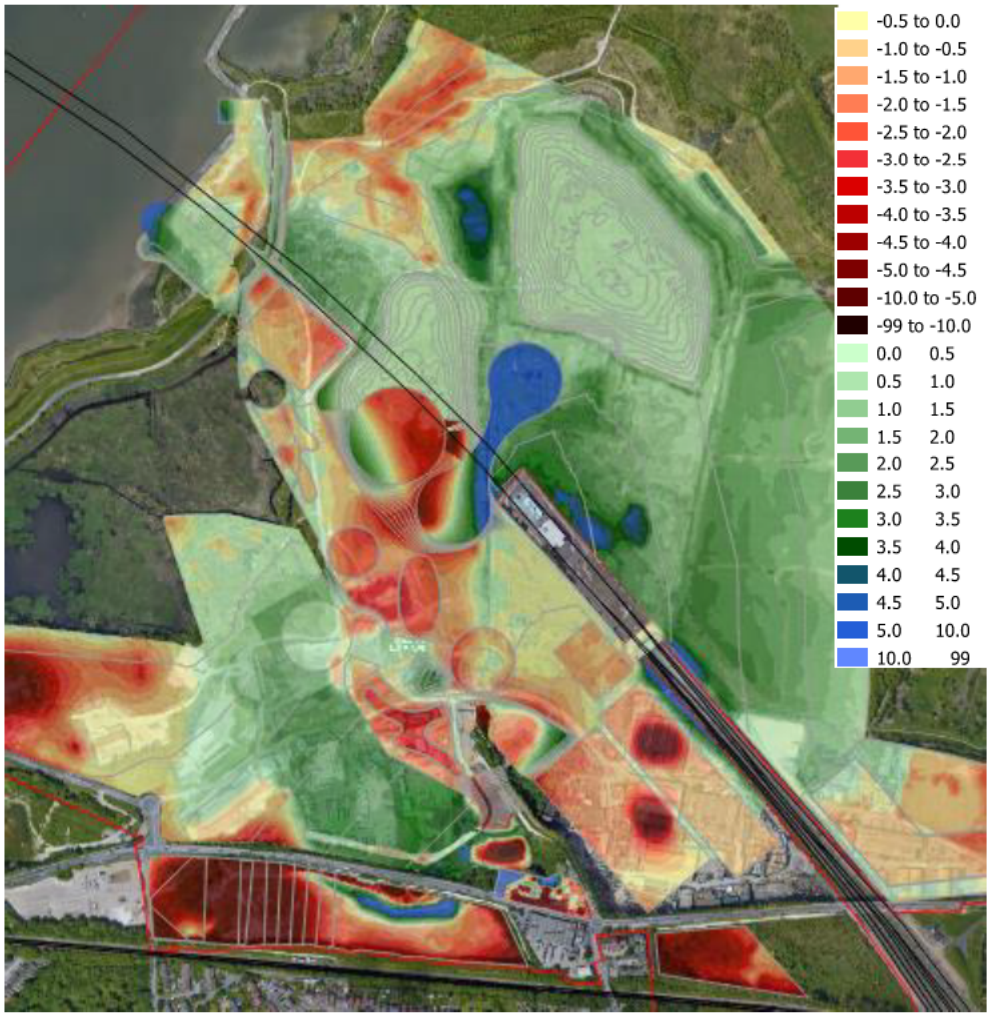
Figure 3-2 Proposed Development Plan, Main Park



Excavation and Filling Works

In addition to the building and infrastructure works described previously, extensive cutting and filling works are required to provide a development platform. Indicative depth of excavation and filling works are summarised on the figure below.

Figure 3-3 Proposed Excavation and Filling Works



Ground Conditions

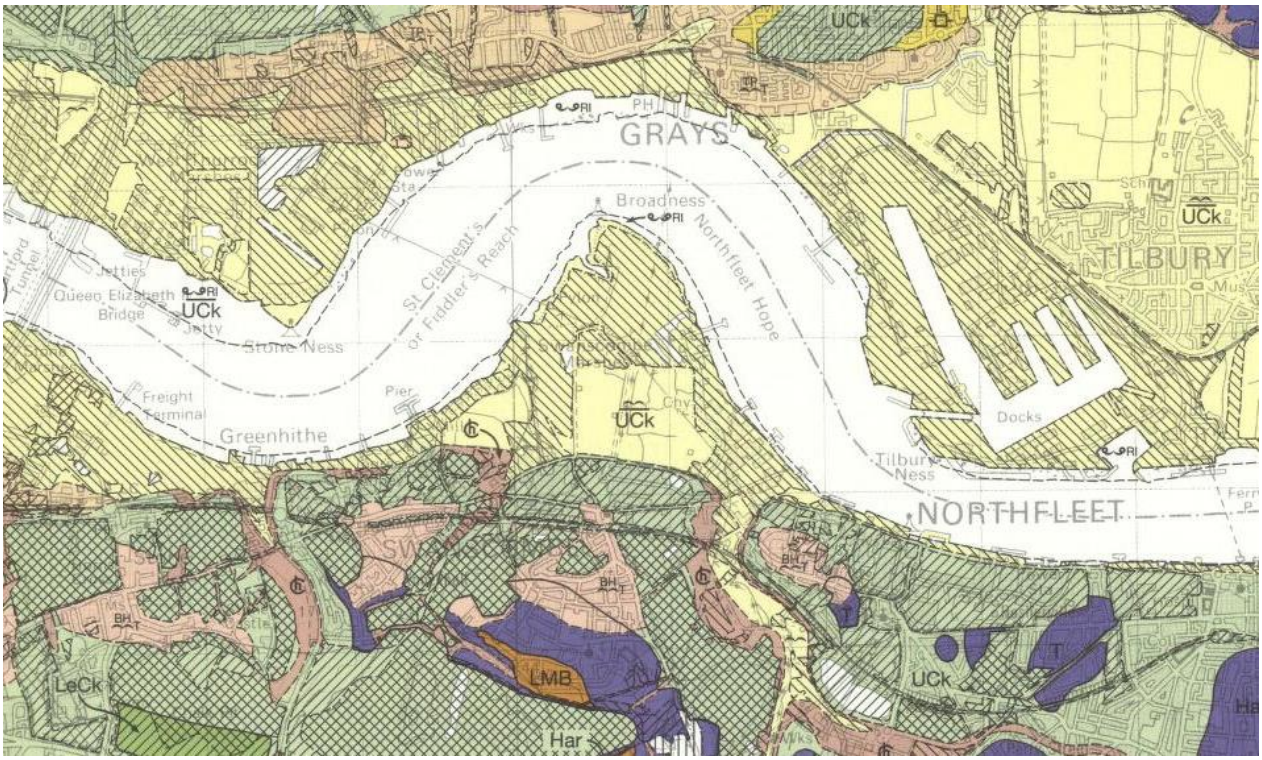
Published Geology

Sheet 271 of the British Geological Survey (England & Wales, Solid & Drift Edition) indicates the site to be underlain by the following downward sequence:

- Made Ground;
- Alluvium;
- River Terrace; and
- Upper Chalk

An extract of the BGS sheet is presented as Figure 4-1.

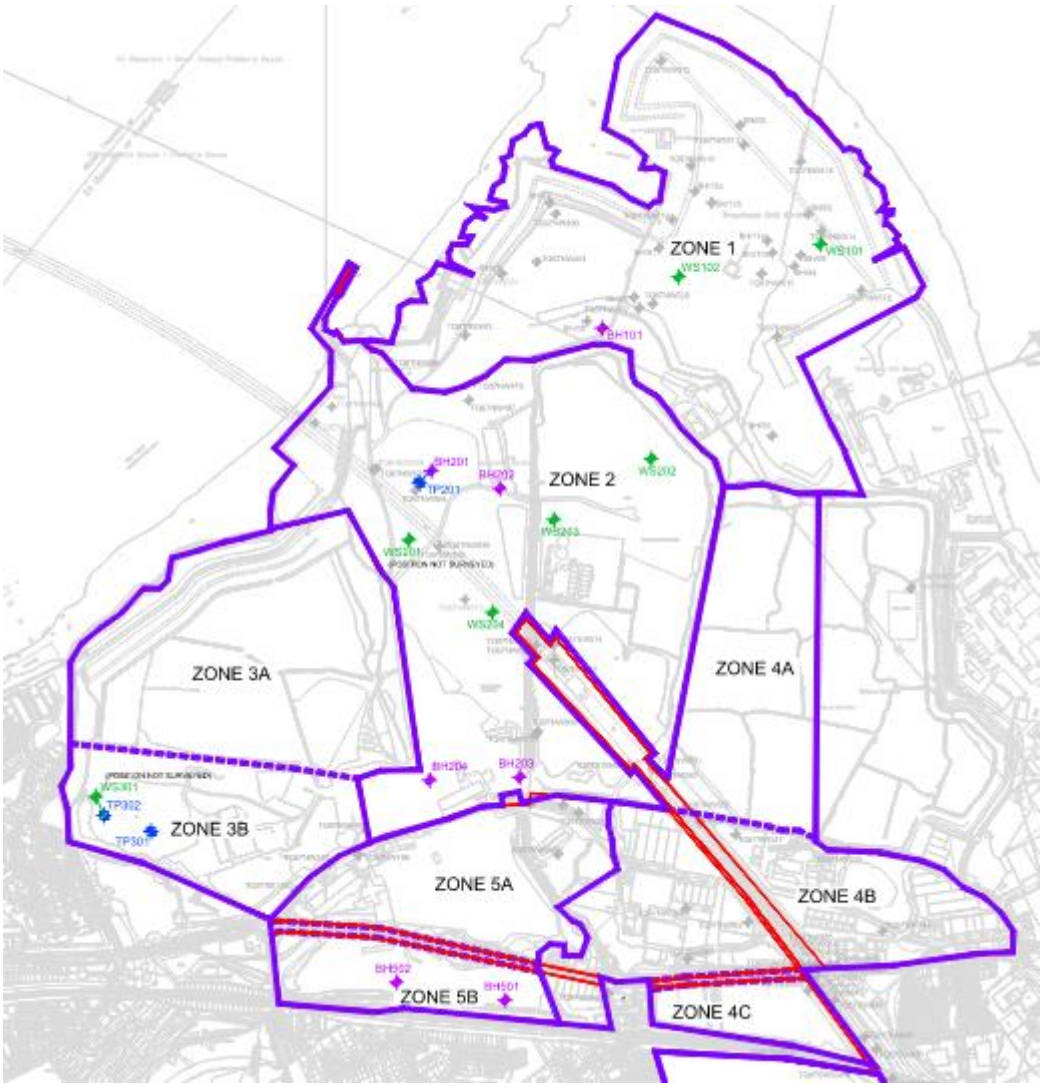
Figure 4-1 Extract of BGS Sheet 271



Existing Ground Investigation Data

Several phases of ground investigation have been undertaken in connection with potential development at the site and the HS1 infrastructure. Indicative exploratory hole locations in the immediate vicinity of the CTRL tunnel infrastructure are presented as Figure 4-2 below.

Figure 4-2 Indicative Exploratory Hole Location Plan



Soil Stratigraphy

Details of the soil stratigraphy in the immediate vicinity of the HS1 tunnel portal are presented as Table 4-1, with an indicative geological cross section being presented as Figure 4-3.

Figure 4-3 Indicative Geological Profile

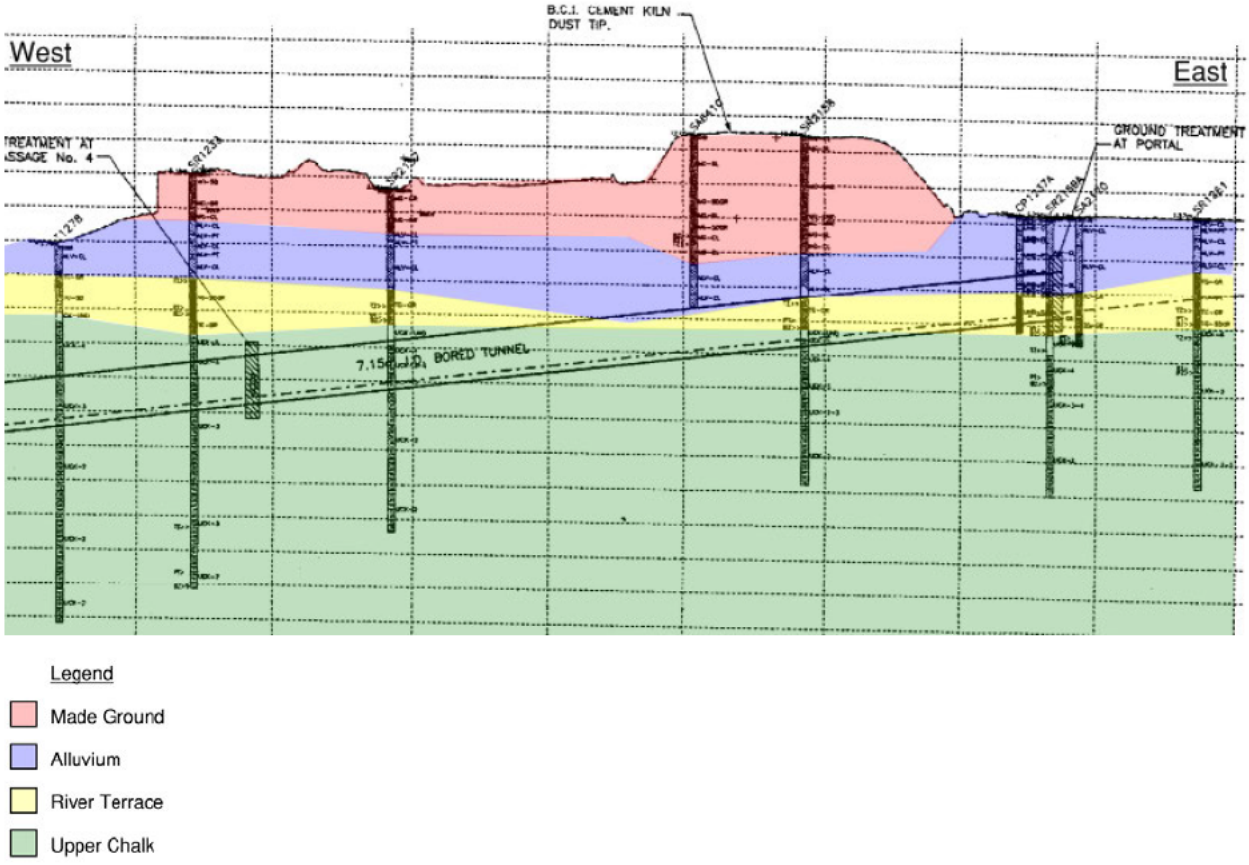


Table 4-1 Encountered Soil Stratigraphy

Stratum	Description	Observed Stratigraphy		Design Stratigraphy	
		Elevation of Top of Stratum (m OD)	Stratum Thickness (m)	Elevation of Top of Stratum (m OD)	Stratum Thickness (m)
Made Ground	Landfill comprising variable cement kiln dust, clayey gravel, and cobble-sized brick and concrete fragments	+12.5 to +0.0	7.5 to 17.5	+12.5	10.0
Alluvium	Variable soft to firm clay and soft amorphous peat	+6.0 to -5.0	5.0 to 15.0	+2.5	14.5
River Terrace Deposits	Medium dense sandy gravel	-10.0 to -15.0	1.0 to 7.5	-12.0	4.0
Upper Chalk	Chalk with flints	-16.0 to -20	Not proven	-16.0	Not proven

Geotechnical Parameters

Geotechnical parameters relevant to the evaluation of vertical displacement and changes of vertical stress are summarised as Table 4-2 below.

Table 4-2 Geotechnical Parameters

Stratum	Bulk Unit Weight, Y (kN/m^3)	Poisson's Ratio, μ		Undrained Shear Strength, c_u (kPa)	Young's Modulus, E (kPa)		Coefficient of Lateral Earth Pressure at Rest, k_o
		Short Term	Long Term		Short Term	Long Term	
Made Ground	18	0.2	0.2	--	15,000	15,000	0.6
Alluvium	16	0.5	0.2	See Figure 4-5	500cu	300cu	0.6
River Terrace Deposits	20	0.2	0.2	--	35,000 (1)	35,000 (1)	0.4
Upper Chalk	20	0.2	0.2	--	300,000 (2)	300,000 (2)	1.0

Notes:

1. Young's Modulus for River Terrace is equal to 1,500 times SPT N value
2. CIRIA C574 suggests the secant modulus (E_S) for low density Grade B and C chalk to vary between 200 and 700MPa at 200kPa vertical stress . The corresponding E_S value for medium to high density Grade B / C chalk is noted to vary between 300 and 1,500MPa. For the purpose of this assessment, an E_S value of 300MPa is assumed.

Figure 4-4 Results of SPTs

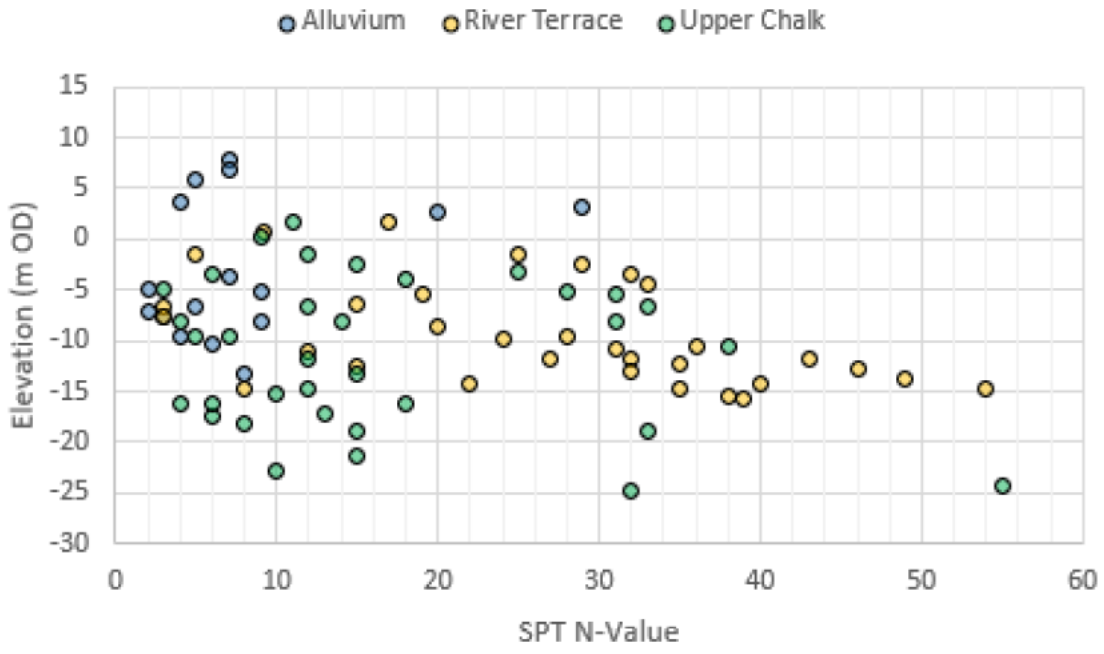
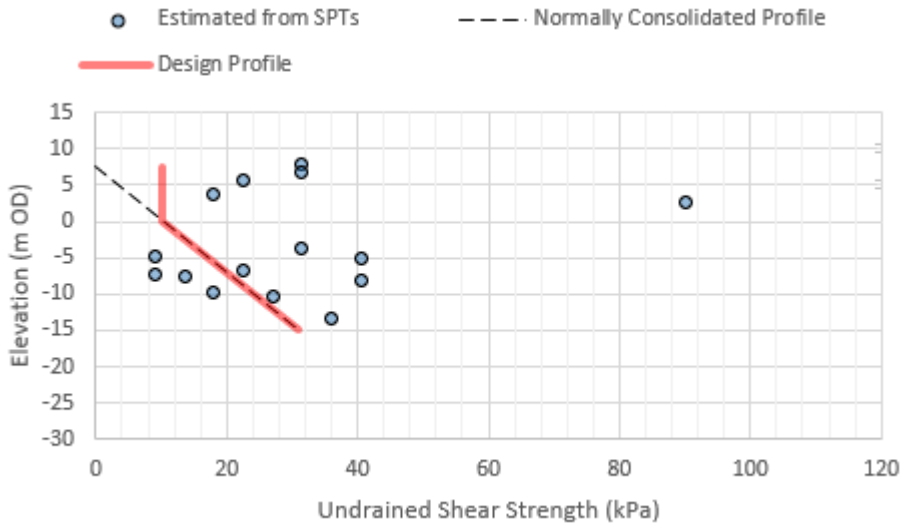


Figure 4-5 Estimated Undrained Shear Strength for Alluvium



It is noted that SPT in soft or loose soils will underestimate the mass stiffness so further focussed investigations will be useful for future analyses.

Hydrogeology

Groundwater is contained within the Alluvium, River Terrace Deposits, and Upper Chalk and is in hydraulic connectivity with the River Thames. Monitoring undertaken in the summer of 2015 (see Atkins 2015) confirms site groundwater level to vary between -0.2 and +3.9m OD, with the direction of groundwater flow being generally towards the north (the River Thames).

For the purpose of this assessment, groundwater is assumed to be situated at +0.0m OD.

Method of Analysis

General

Change of vertical stress and settlement resulting from the proposed excavation and filling works have been evaluated using the Oasys programme PDISP, with associated impacts to the tunnel lining being evaluated in accordance with BS EN 1991, Duddeck & Erdmann (1982), and Morgan (1961). These analyses have been undertaken in accordance with the 'worst case' set of parameters.

Additional analyses will be required for individual construction packages at the appropriate stage of design.

Assumptions

The analyses have been undertaken in accordance with the following assumptions:

- The rigid boundary is located ten metres below the Upper Chalk surface;
- In accordance with elastic theory, the change of horizontal stress is equal to $\frac{v}{(1-v)}$ times the change of vertical stress;
- Any grouting pressures associated with the original tunnel construction have long since dissipated; and
- The tunnels are constructed entirely within River Terrace gravels.

Applied Loading and Model Geometry

Details of the applied loading and the PDISP model geometry are provided on Figures 5-1 and 5-2.

Figure 5-1 Details of Applied Loading for Excavation and Filling Works

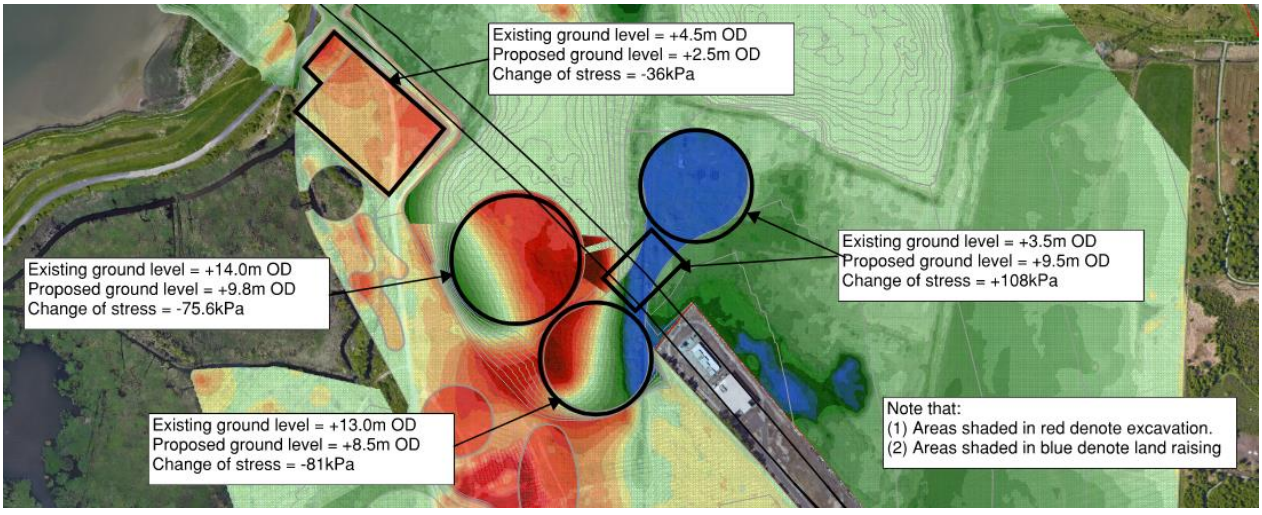


Figure 5-2 Graphical Representation of PDISP Model

Analysis Results

Tunnel Displacement and Change of Vertical Stress

Vertical displacement and change of vertical stress along the southernmost HS1 tunnel are summarised on the figures below. It should be noted that vertical displacements have been calculated at tunnel invert level and that change of vertical stress has been calculated at tunnel axis level.

Figure 6-1 Vertical Displacement

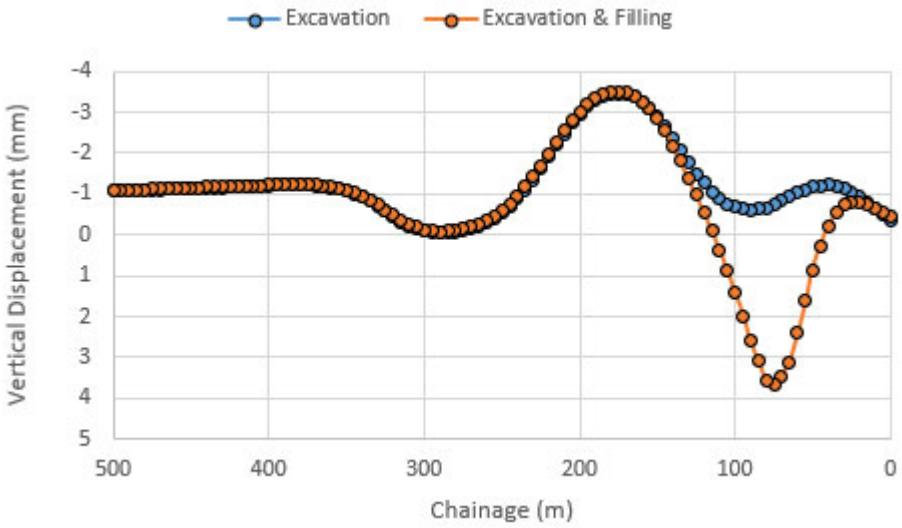
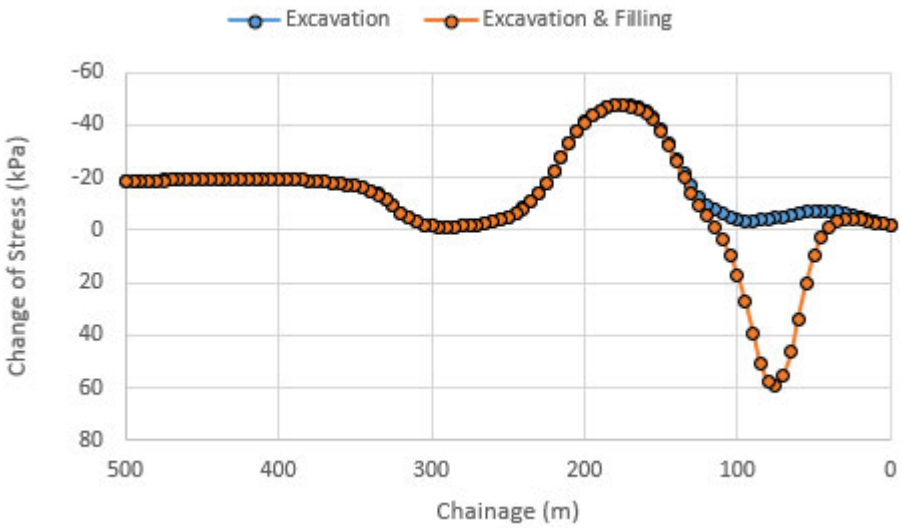


Figure 6-2 Change of Vertical Stress



As illustrated on Figures 6-1, vertical movement associated with the excavation and filling works is anticipated to be less than 5mm. This value is very small and is unlikely to affect the serviceability of the existing tunnel infrastructure.

As illustrated on Figure 6-3, the maximum increase of vertical stress is estimated to be of the order of 60 kPa. Although HS1 guidance suggests that a tunnel lining assessment be undertaken for any increase of vertical stress beyond 50kPa, stresses can limited to this value by incorporating lightweight fill into the land-raising works. For this reason, the effects of vertical stress increase have not been considered further.

As illustrated on Figure 6-3, the maximum reduction of vertical stress is estimated to be of the order of 50kPa. The impact of this unloading stress is evaluated further in Section 6.3.

Imposed Radius of Curvature and Gap Width Opening

As indicated on the figures below, the minimum imposed radius of curvature is of the order of 80km and the associated gap width opening is less than 0.2mm. These values are very small and unlikely to affect the serviceability and/or water-tightness of the tunnel lining.

Figure 6-3 Imposed Radius of Curvature

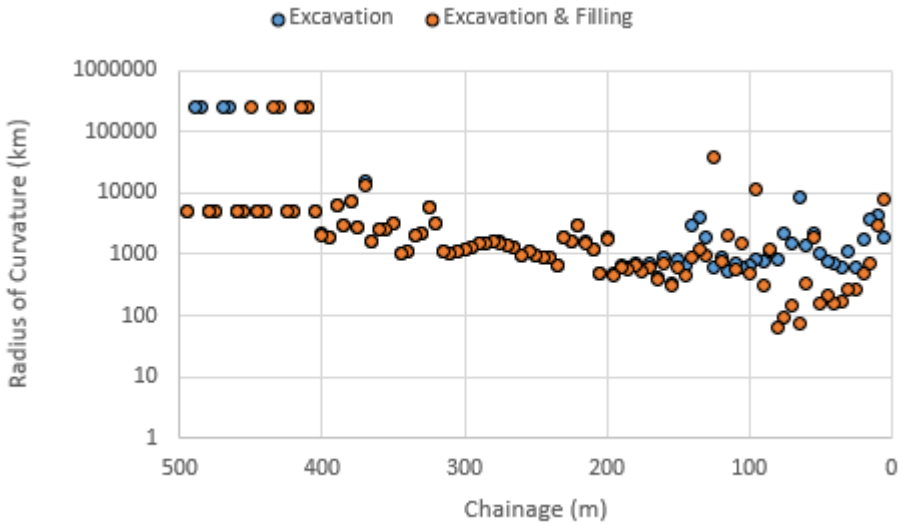
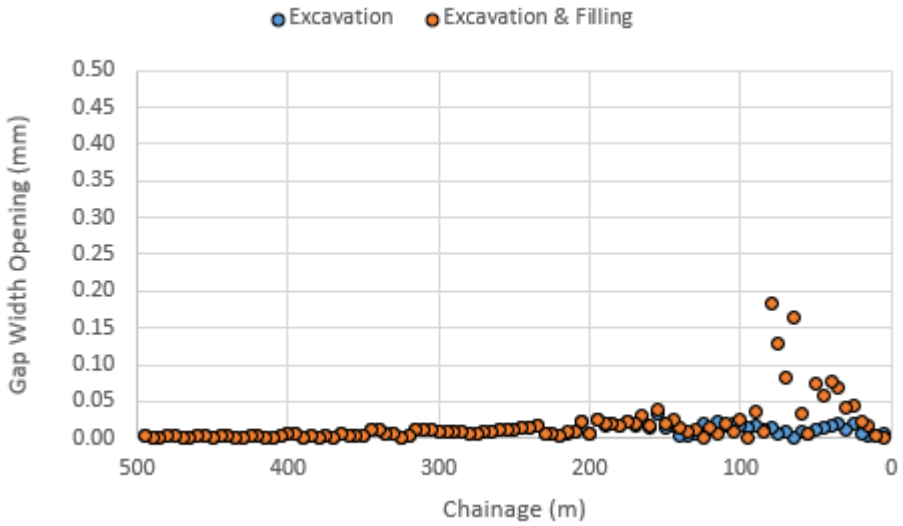


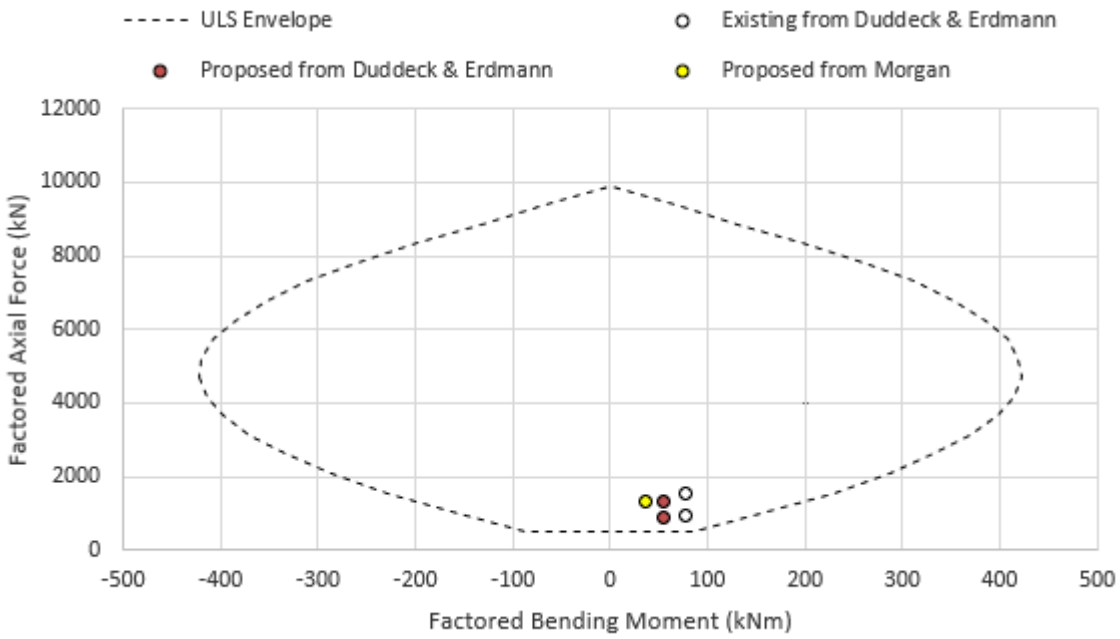
Figure 6-4 Gap Width Opening



Tunnel Lining Assessment

The results of the tunnel lining assessment for the worst case excavation unloading are summarised as Figure 6-5. The analyses confirm that the associated internal normal forces and bending moments are within the ULS envelope for the tunnel lining. These analyses ignore any contribution from the steel fibre reinforcement and assume a maximum radial distortion of 6.5mm (as taken from the PDISP assessment).

Figure 6-5 Tunnel Lining Assessment for 50kPa Excavation Unloading



Conclusions and Recommendations

Summary and Conclusions

Buro Happold has been appointed by London Resorts Company Holdings Limited to provide civil and geotechnical advice in connection with the development of a new entertaining resort on Swanscombe Peninsula, on the south bank of the River Thames.

Some excavation and filling works are required in connection with the proposed development. Although these works will be undertaken in close proximity to the existing HS1 tunnels, preliminary analyses show that the imposed tunnel deflections and changes of stress are within tolerable limits.

Additional analyses will be undertaken in connection with various construction packages at the appropriate stage of design.

Recommendations

Additional Ground Investigation

Additional ground investigation works ae required in connection with the design and construction of the proposed development. Although detailed requirements will be specified at a later stage of design, these works are principally required to confirm:

- Strength and stiffness of the locally occurring Alluvium;
- Existing groundwater conditions and susceptibility to tidal influence; and
- Stiffness of Upper Chalk stratum.

Ground Rules for Development Near HS1 Infrastructure

Ground rules for development near CTRL infrastructure are provided in the network Rail (High Speed) Asset Protection Development Handbook dated July 2016. Minimum requirements pertaining to tunnels are summarised as follows:

- Existing tunnel infrastructure has been designed to accommodate a 50kPa increase of vertical stress at tunnel axis level. Any increase of vertical stress beyond this value will require an assessment of the tunnel lining capacity. In a meeting dated 12 August 2012, Network Rail (who are responsible for HS1 asset protection) confirmed that additional tunnel lining assessments will also be required where the tunnels are subject to a reduction of vertical stress at tunnel axis level.
- Where temporary dewatering works are required in connection with the proposed development, the impact of these activities on existing tunnel infrastructure will need to be considered.
- As part of the original CTRL development, HS1 was granted ownership of all subsoil located within three metres of the existing tunnels. Importantly, this ownership forms a rectangular section and includes the subsoil located between the twin bored tunnels (see Figure 7-1).
- Although pile exclusion zones are not referenced in the guidance, a license is required prior to undertaking any works within the HS1 subsoil ownership boundary (as defined on Figure 7-1). These licenses are unlikely to be granted for any piles located within three metres of existing tunnels.
- All designs which have the potential to affect existing tunnel infrastructure will be subject to independent (Category 3) checking.

- HS1 consultation is required in connection with any development within the HS1 'safeguarding' zone (see Figure 7-2).

Figure 7-1 Extent of HS1 Subsoil Ownership

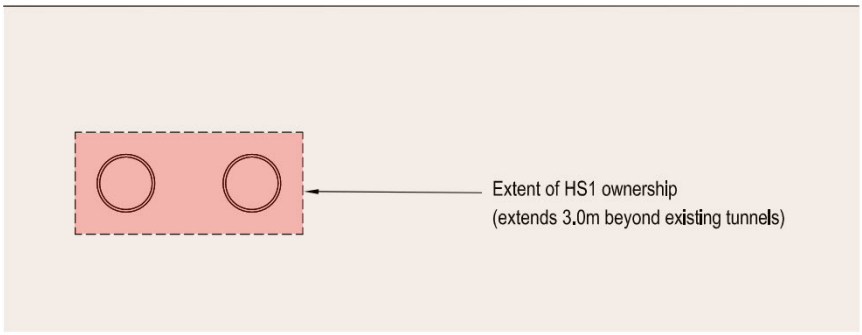
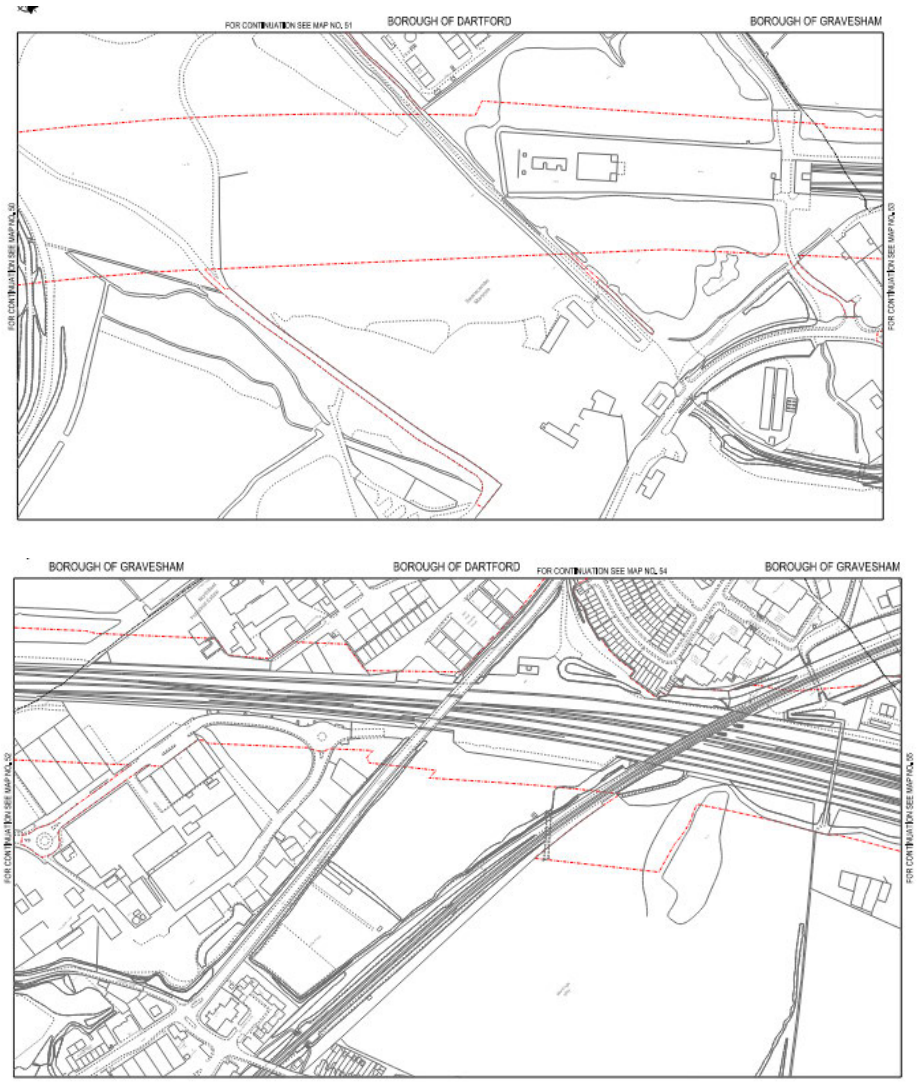


Figure 7-2 Indicative Extents of HS1 Safeguarding Zone



Plans and Drawings

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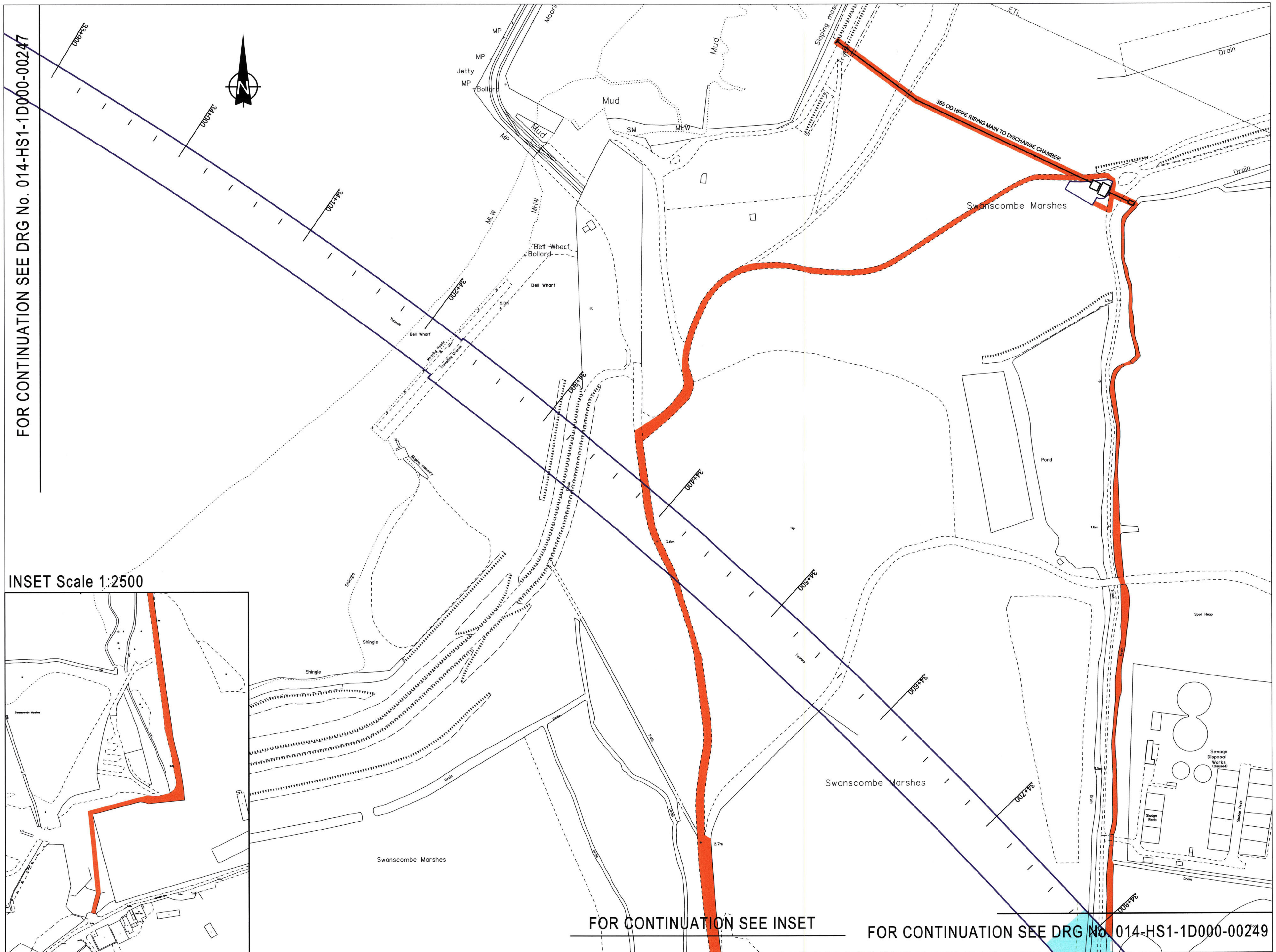
NR/L2/CIV/003/F001: APPROVAL IN PRINCIPLE				
Document reference	0042936_LR_BUR_DCO_GEO_1009	Revision	00	
GRIP Stage		Date	02/10/2020	

APPENDIX C

Drawing Number 320-DCA-03360-00012-AA

Drawing Number 014-HS1-1D000-00248-00



Department for Transport

[redacted] Date

Signed with the authority of the Secretary of State for Transport as Landlord

HIGH SPEED

Date

Signed on behalf of HS1 Limited as Tenant

Notes

Produced by LONDON & CONTINENTAL RAILWAYS LIMITED as agents for the Secretary of State for Transport.
Based upon Ordnance Survey large scale digital mapping with the permission of The Controller of Her Majesty's Stationery Office.
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- HS1 Lease Boundary
- Rights for the benefit of HS1
- Maintenance strip width 5 metres
- Maintenance strip width 3 metres
- Maintenance strip width 2 metres
- Maintenance strip width 1 metre
- Rights which burden HS1 (Private Rights of Access)
- HS1 Surface water drainage

Revision	Date	Description
00	27/09/10	Formerly 014-HS1-1D000-00248-AD (Endorsed)

Mott Parsons Gibb

[redacted] Date 27/09/10

Approved by Mott Parsons Gibb

LCR

Date 27/09/10

Approved by London & Continental Railways Limited

Drawn By	Date	Checked By	Date
AR	27-09-10		27/09/10

LCR

Title

HS1 LEASE AND LAND RIGHTS

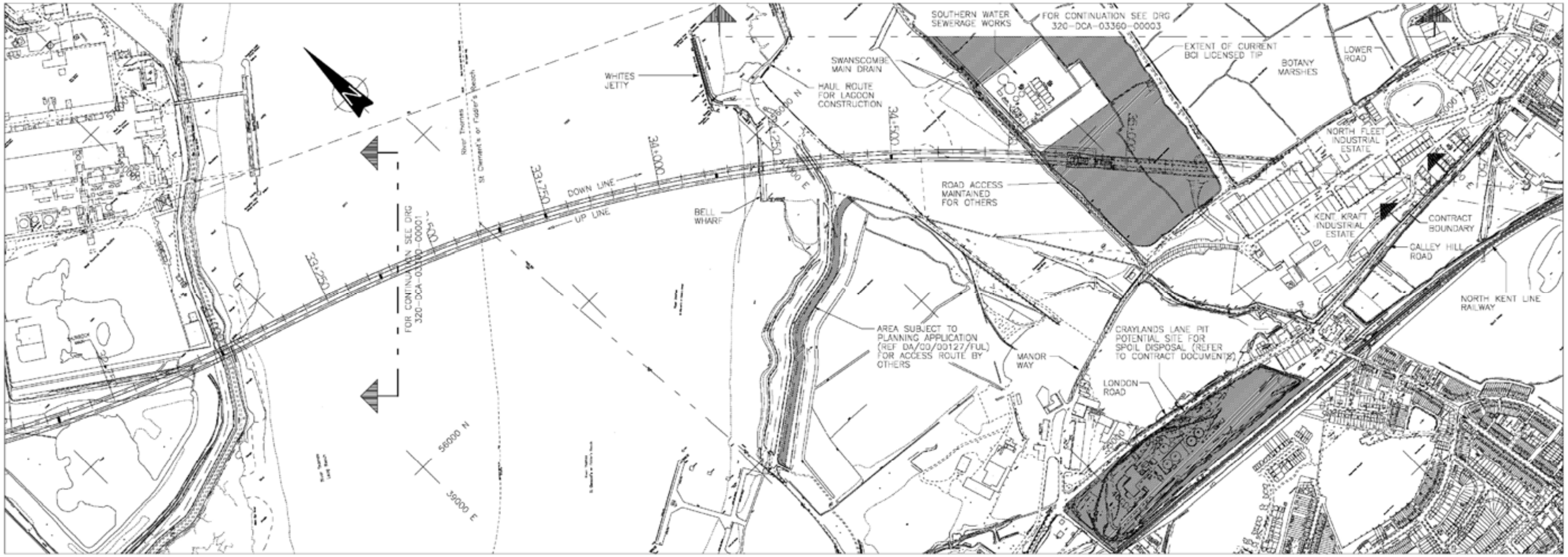
Chainage	Route Window	Original Scale	Original Size
N/A	5430 5431	1:1250	A1

Drawing Number

014-HS1-1D000-00248-00

A1

SCALE WITH CAUTION AS DISTORTION CAN OCCUR 0mm 100mm

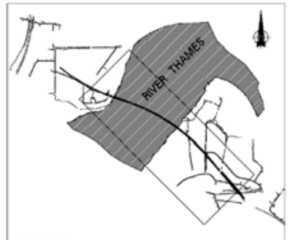


NOTES

1. FOR GENERAL NOTES REFER TO DRAWING No. 320-DTA-00000-90003
2. DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. 320-DCA-03360-00011.
3. THE TOPOGRAPHICAL INFORMATION SHOWN IS BASED ON A SURVEY CARRIED OUT BY UNION RAILWAYS LIMITED.
4. THE COORDINATE SYSTEM IS BASED ON LOCAL PROJECT GRID
5. ALL LEVELS ARE IN METRES RELATED TO THE ORDNANCE DATUM (NEWLYN)
6. THE CHAINAGE DATUM IS THE CENTRELINE OF THE DOWN TRACK.

ALIGNMENT INFORMATION FOR PLAN		
Filename:	s:\civil support\thames valley\(rail)\rclwtham.alg	
	HORIZONTAL ALIGNMENT	
	Name	Description
Down Line:	CTRL Down	sadoring 240500
Up Line:	CTRL Up1 CTRL Up2	ctrl up line pjn 29/9/98 sadoring 240500

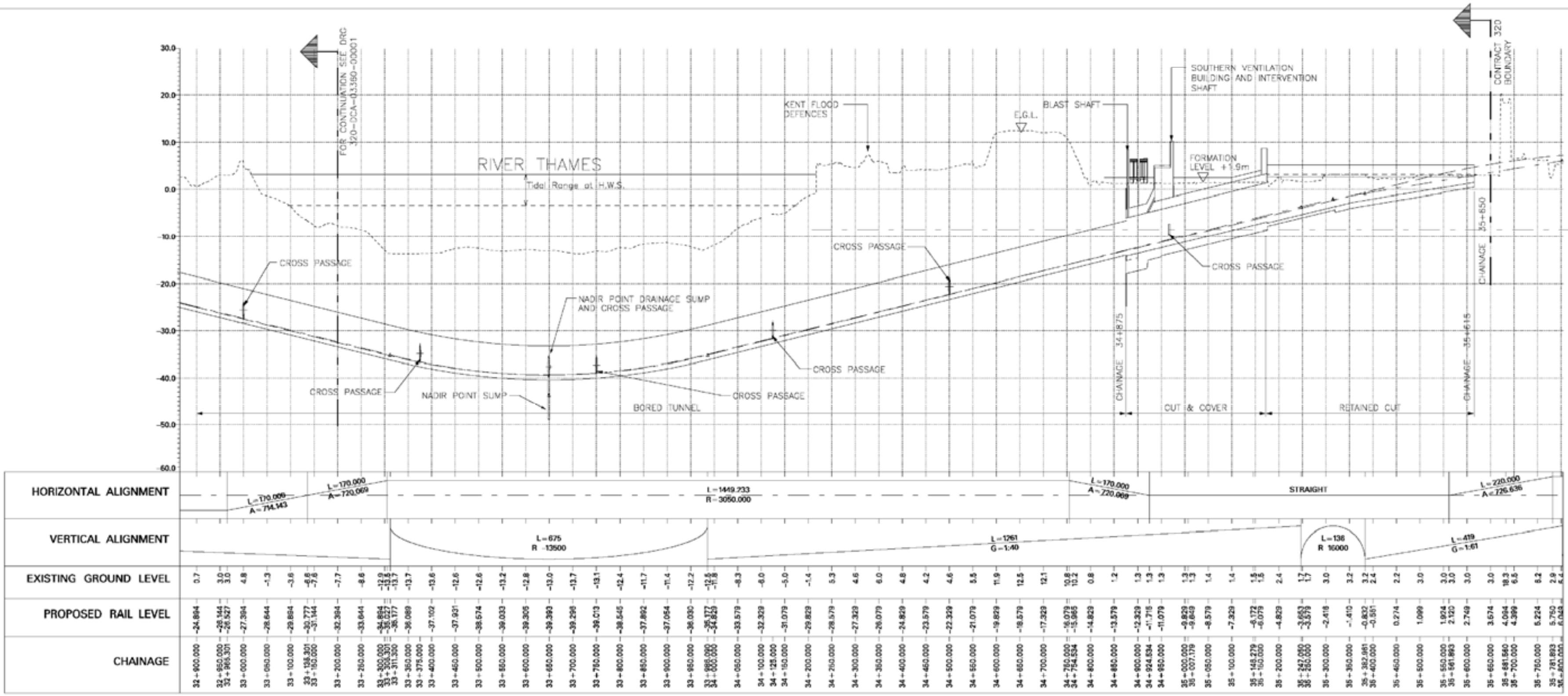
ALIGNMENT INFORMATION				
Filename:	s:\civil support\thames valley\(rail)\rclwtham.alg			
	HORIZONTAL ALIGNMENT (HCL)		VERTICAL ALIGNMENT (VCL)	
	Name	Description	Name	Description
Down Line:	CTRL Down	sadoring 240500	CTRL Down	sadoring 240500
Up Line:	CTRL Up1 CTRL Up2	ctrl up line pjn 29/9/98 sadoring 240500	CTRL Up1 CTRL Up2	9/1298 mccarthoys pr145 sadoring 240500



KEY PLAN

0 50 100 150 200 250 300 350 400 450 500m
SCALE 1:5000 HORIZONTAL

0 5 10 15 20 25 30 35 40 45 50m
SCALE 1:500 VERTICAL



AA		RS	ISSUED FOR TENDER	MG	ESW	RPM
Rev.	Date	By	Description	Ckd	Aprd PE	Aprd EM

Drawing Status
TENDER

unionRAILWAYS

RLE RAIL LINK ENGINEERING

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OVE ARUP & PARTNERS • BECHTEL LIMITED • HALCROW GROUP LTD • SYSTRA

106 Tottenham Court Road, London, W1P 9HF
Tel: 020 7681 5000 Fax: 020 7681 5555

Channel Tunnel Rail Link

Drawing Title

SECTION 2 – CONTRACT 320 OPTION 3 GENERAL ARRANGEMENT SHEET 2 OF 3

Drawn By	Date	Checked By	Date
R SORROY	09/12/00	M GARY	09/12/00
Approved By Project Engineer	Date	Approved By Eng. Manager / Manager of Const.	Date
E S WOODS	09/12/00	R P MAY	09/12/00

Scale	Sheet Size
1:5000 H, 1:500 V	A1

Drawing No.
320–DCA–03360–00012–AA

01-DEC-2000 M:11
For Issue