KEADBY
NEXT GENERATION
POWER STATION
Hydrogen-enabled flexible power
A collaboration between SSE Thermal and Equinor

The Keadby Next Generation Power Station Project

Document Ref: 6.2

Planning Inspectorate Ref: EN0110001

The Keadby Next Generation Power Station Development Consent Order [year]

Appendix 13A: Phase 1 Desk Based Assessment Addendum

Annex 4 – Fugro (2023) Keadby 3 Low Carbon Gas Power Station Project, Geotechnical Interpretive Report, March 2023

The Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Applicant: Keadby Next Generation Limited

Date: August 2025

Version: V0

ARUP DWD AECOM

KEADBY
NEXT GENERATION
POWER STATION
Hydrogen-enabled flexible power

Document History

Document Ref	6.3.19 / Appendix 13A – Annex 4
Version	V0
Document Owner	Arup

Keadby 3 Low Carbon Gas Power Station Project

Geotechnical Interpretative report | Keadby

F212561-GIR 03 | 7 March 2023

Final

Keadby Generation Limited

Document Control

Document Information

Project Title	Geotechnical Interpretative report
Document Title	Keadby 3 Low Carbon Gas Power Station Project
Fugro Project No.	F212561
Fugro Document No.	F212561-GIR
Issue Number	03
Issue Status	Final
Fugro Legal Entity	Fugro GeoServices Limited
Issuing Office Address	Fugro House, Hithercroft Road, WALLINGFORD, OX10 9RB

Client Information

Client	Keadby Generation Limited
Client Address	Keadby Power Station Trentside, Keadby, Scunthorpe, United Kingdom, DN17
Client Contact	Ashley White
Client Document No.	

Document History

Issue	Date	Status	Comments on Content	Prepared By	Checked By	Approved By
01	23 Jan 2023	For Review	Awaiting client comments	BK/SBP/SW	OY	OY
02	03 Mar 2023	Final	Revised based on comments	BK/SBP/SW	OY	OY
03	07 Mar 2023	Final	Addressing minor updates	BK/SBP/SW	OY	OY

Project Team

Initials	Name	Role
BK	Batuhan Kocak	Senior Geotechnical Engineer
SBP	Suleyman Bilge Parlak	Senior Engineering Geologist
SDW	Simon Wheeler	Principal Geotechnical Consultant
OY	Onder Yonlu	Principal Engineering Geologist – Manager Consultancy Land UK

Quality Assurance Record

Section	Description	Prepared By	Checked By	Approved By
Main Text		SBP/BK/SDW	NA/OY	OY
Appendix A	Maps	LD	OY	OY
Appendix B	Subsurface Cross Sections	LD	OY	OY
Appendix C	Thickness and Elevation Maps	LD	SBP	OY
Appendix D	Engineering Parameters	SBP	SBP	OY
Appendix E	Engineering Calculations	BK/SDW	GA/OY	OY
Appendix F	Geoenvironmental Assessment	JB	SDW	OY

FUGRO
Fugro GeoServices Limited
Fugro House
Hithercroft Road
WALLINGFORD
OX10 9RB

Keadby Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
United Kingdom
DN17

7 March 2023

Dear Ms White,

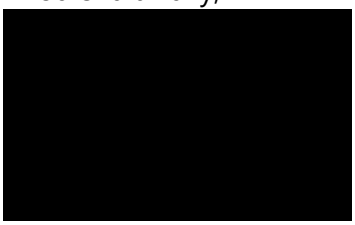
Keadby Generation Limited are actively developing the Front End Engineering Design (FEED) for the proposed Keadby 3 Power Station, and Fugro has been retained to assist them with the geotechnical, geoenvironmental and geophysical site investigations, in situ and laboratory testing services to assist with the evaluations of the proposed site. Fugro's work scope is as outlined in our contract, dated 28 July 2022.

As part of the above program, Fugro conducted site investigations and laboratory testing. In order to support the design works, settlement analyses, shallow foundation calculations and pile analyses were provided in separate interim reports previously. This report supersedes all previous interim reports.

This interpretive and engineering report presents findings, ground parameters, interpretations and engineering analyses for Main Area, Ash Fill and Access Roads.

It has been a pleasure working with you through this phase of the project. We look forward to receiving your comments regarding this report, as well as the opportunity to provide continued support as the project progresses.

Yours faithfully,



Onder Yonlu PhD.
Consulting Manager, Land UK



Executive Summary

Fugro has performed a multidisciplinary ground investigation for the Keadby 3 Power Plant project. This report integrates all the data, interprets the ground conditions, provides engineering analyses for foundations and access roads and an assessment of the geoenvironmental data obtained during the investigation.

According to the site investigation data, the ground conditions in the project consists of Mercia Mudstone as bedrock overlain by a 13-14m thickness of superficial deposits. The Mercia Mudstone is characterized by nearly horizontal medium thick to thick inter-bedded, very weak to weak claystone and mudstone. There is an approximately 2m thick residual soil layer over the bedrock. A specific layer in the mudstone, about 1-1.5m thick which has a very high strength (45MPa on average) while the average rock strength is 6MPa. The superficial deposits are divided into 3 main units based on their origin and names as Made Ground, Alluvium and Glaciofluvial deposits from top to bottom respectively. Made Ground is observed all across the project area in various thicknesses and it is predominantly made up of gravelly, silty, clayey medium dense sands. The Alluvium includes an alternation of clay and sand layers, where the sands are thicker. The average shear strength of the upper clay is 27-103kpa and the lower clay is 101-194kpa on average, and the sands are medium dense to dense. The Glaciofluvial deposits consist of a single thick layer of dense sands. The above is summarised in Table S.1.

Table S.1: Summary of ground conditions for the Main Area

Unit Name	Unit Code	Layer Description	Top Elevation (m OD)		Bottom Elevation (m OD)		Thickness* (m)		
			Min	Max	Min	Max	Min	Max	Mean
Made Ground	0	Clayey Sand	-0.61	2.81	-1.51	0.87	0.00	2.93	1.00
Alluvium	1a	Sand & silty Sand	-1.51	0.87	-2.85	-1.44	0.34	3.18	2.10
	2a	Clay	-2.85	-1.44	-4.05	-2.58	0.21	1.40	0.77
	1a	Sand & silty sand	-4.05	-2.58	-5.28	-4.35	0.80	2.19	1.69
	2b	Clay & Silty Clay	-5.28	-4.35	-6.29	-5.27	0.60	1.39	0.82
Glaciofluvial	1b	Sand & silty Sand	-6.29	-5.27	-13.59	-11.48	6.20	7.70	7.38
Residual	2c	Clay	-13.59	-11.48	-17.94	-12.73	0.02	5.53	2.28
Bedrock	3	Mercia Mudstone	-17.94	-12.73	-	-	-	-	-

Notes:
*Included only where full thickness has been proven

Engineered Fill

As part of the development, it is proposed to raise the ground level for the footprint of the new power station by the placement of an Engineered Fill. The settlement analyses were performed based on CPT and laboratory testing data for 3 different sub areas which indicates very limited settlement occurs after placement of the Engineering Fill. The immediate, consolidation and total settlement amounts are presented Table S.2.

Table S.2: Expected settlement values in project area

Area	Max. Immediate Settlement (mm)	Max. Consolidation Settlement (mm)	Total Settlement (mm)
Area – A Main Process Plot Ground	20.4	10.2	28
Area -B Admin/Control Room	11.6	5.5	16
Area - C Entrance / Car Park	10.6	5.0	16

Based on that data and ground conditions, it is anticipated that most of the settlement occurs during and after the construction of engineering fill, prior to the construction of any of the foundations. If this is to expedited, then it is recommended that surcharging with groundwater monitoring and extensometers to monitor settlement with the identified soil profile is carried out.

Shallow Spread Foundations

Bearing capacity for shallow foundations have been calculated for the three areas of the Main Site. It was found that the total settlements for the design bearing capacities were too high, so these have been reduced by limiting the total settlement with 25mm providing an allowable bearing pressure for the 6 different foundation sizes. This has then been further adjusted by removing the weight soil to be replaced to provide a net allowable bearing pressure these are presented Table S.3.

Table S.3: Summary of net allowable bearing pressures for all areas

Area Name	Foundation Size (m)	Net Allowable Bearing Pressure (kPa)
Main Area-A	1.5x1.5	246
	3.0x3.0	276
	4.0x6.0	167
	5.0x10.0	128
	7.5x12.5	101
	10x20	83
Main Area-B	1.5x1.5	253
	3.0x3.0	276
	4.0x6.0	181
	5.0x10.0	142
	7.5x12.5	111
	10x20	99
Main Area-C	1.5x1.5	176
	3.0x3.0	137

Area Name	Foundation Size (m)	Net Allowable Bearing Pressure (kPa)
	4.0x6.0	93
	5.0x10.0	75
	7.5x12.5	61
	10x20	52

It should be noted that the above have been calculated using assumed parameters for the Engineered Fill and a structural load of 50kPa. These will likely need to be reviewed once the proposed Fill material is identified and structural layout and loads confirmed to ensure they are appropriate. Consideration should also be given to some additional plate load tests following placement of the Fill so that cyclic loading and sliding can be assessed.

The Modulus of Subgrade Reaction was obtained as part of the plate load testing giving K762 values, but these relate to the soils at the existing ground level. Following the placement of the Engineering Fill and preferably at foundation level this should also be obtained from the plate loads suggested above.

Pile Design

The pile design analyses were performed for 6 different pile types to calculate the required pile lengths under given loads. According to these analyses maximum 20m length is sufficient for type A and B piles. The pile length and settlement details are provided in Table S.4. No negative skin friction from the Engineering Fill as it is envisaged that the associated settlements will be completed shortly after placement.

Table S.4: SWL capacities and settlements for piles

Pile	Diameter	Skin Resistance	Base Resistance	Safe Working Load Capacity	Allowable Tensile Capacity	Pile Length	Pile Settlement
A	750mm	1765kN	2186kN	3952kN	1238kN	20m	4.4mm
B	600mm	1342kN	1399kN	2742kN	942kN	20m	3.7mm
C	600mm	688kN	462kN	1151kN	483kN	15m	2.5mm
Da	600mm	512kN	383kN	895kN	359kN	12m	2.3mm
Db	450mm	346kN	216kN	562kN	243kN	12m	1.7mm
Dc	300mm	432kN	392kN	782kN	303kN	19m	2.1mm

The lateral capacities of the piles were also assessed and these are summarised in Table S.5. The horizontal Modulus of Subgrade Reaction (k_h) from the calculations has been summarised in a table and plotted against depth. The plot is presented in Figure S.1 and highlights that there is a relationship between the diameter of the pile, k_h and the soil type.

Table S.5: Allowable lateral capacities and lateral deflections of the piles

Pile	Diameter	Flexure Bearing Capacity, Mu	Horizontal Load Capacity, Qu	Pile Length	Applied Lateral Load	Deflection of the pile at the ground level
A	750mm	290kNm	711kN	20m	125kN	0.5mm
B	600mm	153kNm	364kN	20m	125kN	0.0mm
C	600mm	153kNm	364kN	15m	75kN	1.8mm
Da	600mm	74kNm	364kN	12m	75kN	3.5mm
Db	450mm	67kNm	153kN	12m	75kN	2.8mm
Dc	300mm	36kNm	45.22kN	19m	75kN	Not Satisfactory

The weathering profile on rock varies across the site. The pile calculations were performed using the idealized soil profile. Therefore, the proposed piles lengths may need to be reassessed once the final structural layout and loads are known. Fugro recommend pile testing is considered to check the carrying capacity of the piles before construction, to ensure the proposed method is appropriate and better assess the performance of the Engineered Fill.

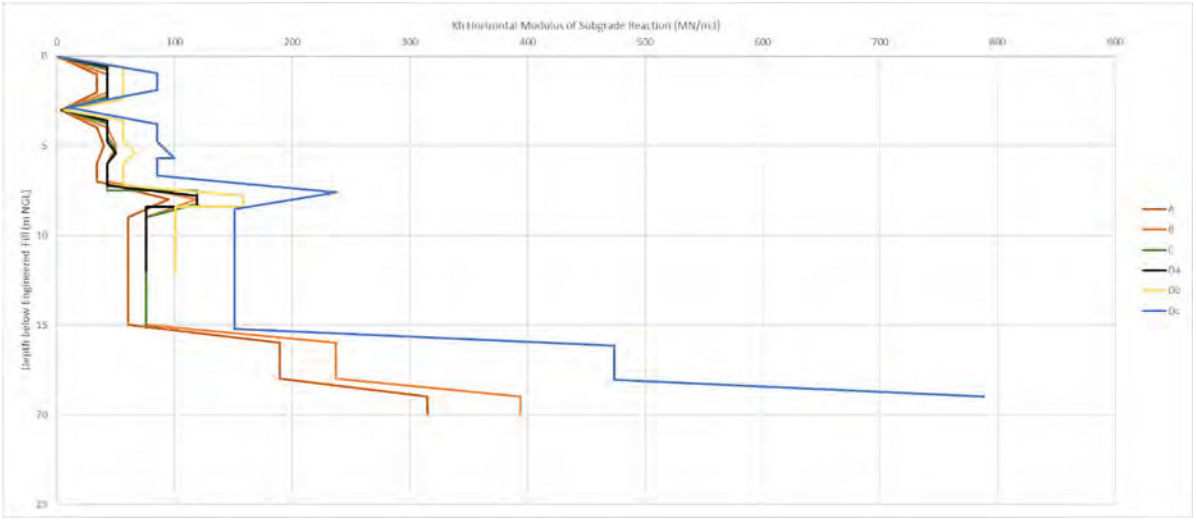


Figure S.1: Plot of all k_h values vs depth below Engineered Fill [m NGL]

Ground Improvement

It is considered unlikely that ground improvement techniques will be required for improving founding conditions on the main site, unless a very limited settlement is considered in the design.

CBR's

CBR values have been obtained as part of this investigation however it is recommended that prior to pavement construction the subgrade is checked to ensure the most appropriate CBR is used. Localised ground improvement may be required if CBR values at subgrade level are not adequate.

Slope Stability

According to the slope stability analyses the factor of safety on ash tip slopes is greater than 1.5. Notwithstanding the above, small, localised, shallow local failures can be expected in the future. These areas can be repaired, if necessary, by the removal of slipped material and its replacement with suitable granular free draining slide material.

Dynamic Parameters

The turbine and some of the associated plant will produce vibrations which will mean that the underlying ground conditions will be subject to dynamic loading.

It is recommended that if soil and pile spring stiffnesses are to be considered this is to be undertaken as an interactive analysis between the geotechnical and structural engineers once the structural loading and layouts have been confirmed.

Table S.6 provides the mean values of Small Strain Shear Modulus (Go) and Elastic Secant Modulus (Es) per layer code and Table S.7 and Table S.8 summarise the Shear and Elastic Moduli for different strain levels ranging between 0.1 to 1% obtained from the Cone Pressuremeter testing (CPM) and High Pressure Dilatometer (HPD) assuming a poisons ratio of 0.33.

Table S.6: Summary of mean Engineering Parameters obtained CPT data – Main Site

Strata	Layer Code	Layer Description	Mean qt (MPa)	Mean fs (kPa)	Mean Es (MPa)	Mean Dr (%)	φ (°)	Mean M (MPa)	Mean Go (MPa)	Mean Su (kPa)	Unit Weight (kN/m^3)
AD	1a	Sand & silty sand	7.1	67.3	49.4	59.8	34-38	60.8	61.0	0.0	18.3
	2a	Clay	1.1	29.4	0.0	0.0	28	13.8	22.4	58	16.6
	1a	Sand & silty sand	7.1	67.3	49.4	59.8	34-38	60.8	61.0	0.0	18.3
	2b	Clay & Silty clay	2.6	66.8	0.0	0.0	30	34.9	49.7	125	18.1
GD	1b	Sand & silty sand	11.4	114.2	84.7	57.4	36-40	105.4	109.8	0.0	19.3
RMM	2c	Clay	3.5	133.8	0.0	0.0	30	42.7	93.7	190	18.8

Notes:
AD – Alluvium Deposits
GD – Glaciofluvial Deposits
RMM – Residual Mercia Mudstone

Table S.7: Summary of parameters from the Cone Pressuremeter testing

Layer Code	No tests	MPa Gy	No loops	MPa alpha	- beta	[a] MPa Gs 0.01%	[b] MPa Gs 0.1%	[c] MPa Gs 1%	[d] MPa E's 0.01%	[e] MPa E's 0.1%	[f] MPa E's 1%
0	-	-	-	-	-	-	-	-	-	-	-
1a	5	122	16	9.777	0.725	113	61	33	300	161	87
2a	1	15	4	1.201	0.663	25	12	5	67	30	14
2b	3	63	11	3.498	0.626	109	46	20	290	122	52
1b	6	133	20	18.106	0.761	157	88	50	417	233	134
2c	-	-	-	-	-	-	-	-	-	-	-

Table S.8: Summary of parameters from the High Pressure Dilatometer

Layer Code	No tests	MPa Gi	MPa Gy	No loops	- k0	[a] MPa Gur	[b] MPa E'	% epsilon_c	kPa Pc	f[a,b] - ν
3	19	927	575	19	1.701	2373	6311	0.5862	5220	0.33

Poissons ratio has been obtained from the P-S Logging seismic tests. These are presented in Table S.9 and for the from the CPM testing using elastic theory and these are summarised in

Table S.9: Summary of P & S Wave velocities of Rock Units

Area	Unit	Count	P-wave Velocity (m/s)			S-wave Velocity (m/s)			Poisson's Ratio		
			Average	Min	Max	Average	Min	Max	Average	Min	Max
Main Site	3	127	2852	1945	4056	1232	618	1944	0.38	0.30	0.46
	3a	5	3208	2872	3479	1308	1118	1450	0.40	0.40	0.41

Table S.10: Summary of Poisson's ratio for each strain

Unit	No. of tests	f[a,d] - ν 0.01%	f[b,e] - ν 0.1%	f[c,f] - ν 1%
0	-			
1a	5	0.14	0.14	0.14
2a	1	0.10	0.04	0.20
2b	3	0.08	0.09	0.05
1b	6	0.15	0.16	0.18
2c	-			

Several coefficients were requested to be provided, which are specific to machine foundations in dynamic analysis these are summarised in Table S.11 these values are based on an assumed Young Modulus of 50MPa and Poisson Ratio of 0.33 for the Engineered Fill

Table S.11: Summary of possible values for the machine foundation coefficients

m Length	m Breadth	alpha	ν	MPa E	kg/cm³ cu	kg/cm³ cphi	kg/cm³ cr	kg/cm³ cpsi
1.5	1.5	1	0.33	50	3.9525	7.4357	3.1715	4.7573
3	3	1	0.33	50	1.976272	3.717828	1.585751	2.378626
4	6	0.6666667	0.33	50	1.222307	2.062872	1.00007	1.500105
5	10	0.5	0.33	50	0.862969	1.360589	0.715657	1.073485
7.5	12.5	0.6	0.33	50	0.62204	1.022959	0.511491	0.767236
10	20	0.5	0.33	50	0.431485	0.680294	0.357828	0.536743

Notes:
cu - coefficient of uniform compression
cphi - coefficient of nonuniform compression
cr - coefficient of uniform shear
cpsi - coefficient of nonuniform shear

m	m			MPa	kg/cm^3	kg/cm^3	kg/cm^3	kg/cm^3
Length	Breadth	alpha	ν	E	cu	cphi	cr	cpsi
To convert kg/cm3 to KN/m3 multiply by 10,000								

It is recommended that once the Engineering Fill has been confirmed and placed a cyclic plate load and horizontal test are undertaken to determine these coefficients.

Geoenvironmental Assessment

It is proposed to remove 300mm of the existing Made Ground. However, within these soils elevated levels of PAH's have been identified across the Main Site, it is recommended that this is discussed with the Local Authorities Environmental Health Officer to determine an appropriate course of action.

With the groundwater Arsenic, Nickel and PAH's were identified as having levels above the WQS Threshold levels. It was noted that these results reduced as the monitoring and sampling programme continued. It is considered that these may be locally elevated. It is recommended that further investigation is carried out to determine if remedial measures are required.

Contents

Executive Summary		**i**
1.	**Introduction**	**1**
1.1	Project Overview	1
1.2	Scope of Work	1
1.3	Sources of Information	2
1.4	Reporting	3
1.5	Report Organization	3
1.6	Limitations and Use of Data	3
2.	**Geology of Project Area**	**5**
2.1	Previous Investigations at the Site	7
3.	**Site Characterization**	**9**
3.1	Integrated Site Characterization	9
3.1.1	Basis of Characterization	9
3.1.2	Data integration	9
3.1.3	Exploration spacing	10
3.2	Site topography	10
3.3	Subsurface Cross Sections	12
3.4	Summary of Ground Conditions	17
3.4.1	Made Ground	17
3.4.2	Alluvium	18
3.4.3	Glaciofluvial deposits	18
3.4.4	Mercia Mudstone	18
3.4.5	Visual and Olfactory Evidence of Contamination	19
3.4.6	Soil Headspace Screening	19
3.4.7	Unit Thicknesses	19
3.5	Engineering Properties of Primary Units	20
3.5.1	In situ Testing	21
3.5.2	Laboratory Test Data	24
3.5.3	Rock mass properties	29
3.6	Strength Parameters	31
4.	**Groundwater**	**33**
5.	**Geotechnical Assessments**	**37**
5.1	Engineered Fill	37
5.2	Shallow Spread Foundations	42
5.3	Modulus of Subgrade Reaction	46
5.4	Pile Design calculations	47
5.5	Axial Load Capacity	48

5.5.1 Axial Load Capacity of Bored Piles in Cohesionless Soils 48
5.5.2 Axial Load Capacity of Bored Piles in Cohesive Soils 49
5.5.3 Axial Load Capacity of Bored Piles in Rock 50
5.6 Settlement of Piles 51
5.6.1 Analyses Results 51
5.7 Lateral Load Capacity 53
5.8 Ground improvement 57
5.9 Pavement Design 57
5.9.1 Access Road (AR) 57
5.9.2 Bonyhale Road (BR) 58
5.9.3 Haulage Road (HR) 58
5.10 Slope Stability Analyses 59
5.11 Dynamic Properties 60
5.11.1 Soil and Pile Spring stiffnesses (X,Y,Z) direction (static and dynamic) 60
5.11.2 Modulus of elasticity/ elastic modulus (including dynamic), Elastic Shear modulus and Elastic compression modulus. 61
5.11.3 Poisson ratio 62
5.11.4 Coefficient of uniform compression, Coefficient of non-uniform compression, Coefficient of uniform shear, Coefficient of non-uniform shear 62

6. Geoenvironmental Assessment 64
6.1 Environmental Assessment Framework 64
6.2 Preliminary Conceptual Site Model 65
6.2.1 Methodology 65
6.2.2 Preliminary Conceptual Site Model 67
6.3 Background Soil Chemistry 70
6.4 Results for Soil Analysis 70
6.4.1 Asbestos 70
6.4.2 Organics PAH/TPH's 71
6.4.3 Metals 71
6.4.4 pH and SO_4 72
6.4.5 Organic Matter 73
6.5 Results for Groundwater Analysis 75
6.6 Generic Quantitative Risk Assessments (GQRA) 75
6.6.1 Methodology 75
6.9.1 Methodology 78
6.9.2 Results 79
6.10 Ground Gas Discussion 80

7. Recommendations 82

8. References 84

Appendices

Appendix A	**Site Location and Exploration Maps**	**0**
A.1	Site Location Map	1
A.2	Overall Exploration Map	1
A.3	Main Area and Ash Tip Area Exploration Map	1
A.4	Southwest Access Road Exploration Map	1
A.5	East Road Exploration Map	1
Appendix B	**Subsurface Cross Sections**	**0**
B.1	A-A' Cross Section (Main Area)	1
B.2	B-B' Cross section (Main Area)	1
B.3	C-C' Cross section (Main Area)	1
B.4	D-D' Cross section (Main Area)	1
B.5	E-E' Cross section (Main Area)	1
B.6	F-F' Cross section (Main Area)	1
B.7	G-G' Cross section (Ash Tip)	1
B.8	H-H' Cross section (Ash Tip))	1
B.9	I-I' Cross section (Ash Tip))	1
B.10	J-J' Cross section (Ash Tip))	1
B.11	K1-K1' Cross section (Southwest Access Road)	1
B.12	K2-K2' Cross section (Southwest Access Road)	1
B.13	L-L' Cross section (East Access Road)	1
Appendix C	**Bedrock Top Elevation and Thickness Maps**	**0**
C.1	Soil Thickness Map	1
C.2	Destructed & Residual Soil Thickness Map	1
C.3	Bedrock Head Elevation Map	1
Appendix D	**Engineering Parameters**	**0**
D.1	Summary Tables	1
D.2	Parameter Plots	22
Appendix E	**Engineering Calculations Outputs**	**0**
E.1	Settlement Calculations	1
E.2	Bearing Capacity Calculations	2
E.3	Pile design Calculations	9
Appendix F	**Geo-environmental Data**	**10**
F.1	Soil Risk Assessment Analysis	11
F.2	Groundwater Risk assessment Analysis	12

Figures in the Main Text

Figure 1-1: Site Location Plan 1
Figure 2.1: Extent of Lake Humber (after Bateman et al). Project area is shown by red arrow. 6
Figure 3.1: Digital elevation model of the Main Area and Ash Tip generated from the topographical data provided by Client. 11
Figure 3.2: Map showing all cross-section layouts across the project area 13
Figure 3.3: The cross section lines and the site investigation locations at Main Site and Ash Tip areas. 14
Figure 3.4: Exploration locations and the subsurface cross section map of Southwest Access Road. 15
Figure 3.5: Exploration locations and the subsurface cross section map of East Access Road. 16
Figure 3.6: Axial point load test results vs diametral point load test results 28
Figure 3.7: Correlation plots between corrected point load strength index and uniaxial compressive strength 29
Figure 3.8: GSI Estimation for Mercia Mudstone 31
Figure 3.9: Rock data plot for Mercia Mudstone in the project area. 32
Figure 5.1: Vertical stress increment due to the engineering fill 40
Figure 5.2: Plan View of Immediate Settlement 41
Figure 5.3: Plan View of Consolidation Settlement 41
Figure 5.4: Plan View of Total Settlement 42
Figure 5.5: Foundation location according to the Finished Grade Level 43
Figure 5.6: Design curves for unit side resistance and adhesion factor versus strength 51
Figure 5.7: Soil Profile for Piled Foundations 52
Figure 5.8: Plot of all piles k_h values vs depth below Engineered Fill [m NGL] 54
Figure 5.9: Cohesionless soil – lateral deflection at ground surface (Brom's, 1964b). 55
Figure 5.10: Slope stability analysis showing geometry and lowest critical slip surface. 60
Figure 5.11: Implications of using springs for geotechnical design. 61

Tables in the Main Text

Table S.1: Summary of ground conditions for the Main Area i
Table S.2: Expected settlement values in project area ii
Table S.3: Summary of net allowable bearing pressures for all areas ii
Table S.4: SWL capacities and settlements for piles iii
Table S.5: Allowable lateral capacities and lateral deflections of the piles iv
Table S.6: Summary of mean Engineering Parameters obtained CPT data – Main Site v
Table S.7: Summary of parameters from the Cone Pressuremeter testing v
Table S.8: Summary of parameters from the High Pressure Dilatometer vi
Table S.9: Summary of P & S Wave velocities of Rock Units vi
Table S.10: Summary of Poisson's ratio for each strain vi
Table S.11: Summary of possible values for the machine foundation coefficients vi
Table 2.1: Record of Seismic Events 7
Table 2.2: Anticipated Geology 8
Table 3.1: Idealized ground profile of Main Area. 17

Table 3.2: Summary of Index Laboratory Testing 20
Table 3.3: Laboratory Testing Method Standards and Statements 24
Table 3.4: Input parameters and estimated GSI values for Mercia Mudstone 30
Table 3.5: Rock Mass Classification Input Parameters 32
Table 4.1: Water Monitoring Installation Details 33
Table 4.2: Summary of Manual Water Level Readings 35
Table 5.1: Ground profile and Unit thicknesses in Area-A 38
Table 5.2: Ground profile and Unit thicknesses in Area-B 38
Table 5.3: Ground profile and Unit thicknesses in Area-C 39
Table 5.4: Expected settlement values in project area 42
Table 5.5: Design bearing capacities for all areas (settlement not limited) 44
Table 5.6: Allowable Bearing pressures and settlement assessment for Area-A 45
Table 5.7: Allowable Bearing pressures and settlement assessment for Area-2 45
Table 5.8: Allowable bearing pressures and settlement assessment for Area-3 45
Table 5.9: Net allowable bearing pressures for all areas 46
Table 5.10: Summary of Modulus of Subgrade Reaction (K762) values from plate load tests 47
Table 5.11: Applied Serviceability States 48
Table 5.12: Bearing capacity factors (Nq) for driven and bored piles 49
Table 5.13: Empirical adhesion coefficient α 49
Table 5.14: SWL Capacities and Settlements of Piles 52
Table 5.15: Pile Lengths for Applied Loads 53
Table 5.16: Allowable lateral capacities and lateral deflections of the piles 55
Table 5.17: Summary of k_h values from pile analyses 56
Table 5.18: Summary of Subgrade Surface Modulus for the Access Road 58
Table 5.19: Summary of Foundation Surface Modulus for Bonyhale Road 58
Table 5.20: Summary of Surface Modulus for the Haulage Road 58
Table 5.21: Summary of material parameters 59
Table 5.22: Summary of critical slips for the various analytical methods 59
Table 5.23: Summary of parameters from the Cone Pressuremeter testing 62
Table 5.24: Summary of parameters from the High Pressure Dilatometer 62
Table 5.25: Summary of possible values for the machine foundation coefficients 63
Table 6.1: Severity of the Risk 65
Table 6.2: Probability of Risk Occurrence 66
Table 6.3: Comparison of Severity and Risk 66
Table 6.4: Qualitative Risk Assessment – Classification of Consequence 66
Table 6.5: Preliminary Conceptual Site Model 68
Table 6.6: Summary of indicative background 70
Table 6.7: Summary of samples where asbestos was identified. 71
Table 6.8: Concrete Classification 74
Table 6.9: Summary of PAH's 78
Table 6.10: Characteristics Gas Situation Classification Table 79
Table 6.11: Revised Conceptual Site Model 81
Table D.1: Summary of Engineering Parameters from CPT Data – Main Site 2
Table D.2: Summary Table of Range of Engineering Parameters from CPT Data – Main Site 3
Table D.3: Summary of Standard Penetration Test Results 4
Table D.4: Standard Penetration Tests – Summary of Refusal on Mercia Mudstone 5

Table D.5: Summary of CBR values from In situ testing 7
Table D.6: Summary of Variable Head Permeability Test Results 8
Table D.7: Summary of Shear Wave Velocity of Soil Units 9
Table D.8: Summary of P & S Wave Velocities of Rock Units 10
Table D.9: Summary of Moisture Content Results 11
Table D.10: Summary of Bulk and Dry Density Results 12
Table D.11: Summary of Atterberg Limits 13
Table D.12: Summary of Non Plastic Atterberg Limits Results 14
Table D.13: Summary of Fines Content 15
Table D.14: Summary of Compaction Test Results 16
Table D.15: Summary of UU-Triaxial Test Results 17
Table D.16: Summary of Direct Shear Test Results 18
Table D.17: Summary of Water Content of Rock Samples 19
Table D.18: Summary of Point Load Test Results 20
Table D.19: Summary of Uniaxial Compressive Strength Results 21

Abbreviations

AGS	Association of Geotechnical and Geoenvironmental Specialists
AOD	Above Ordnance Datum
AR	Access Road
BR	Bonyhale Road
BOD	Below Ordnance Datum
BSI	British Standard Institution
BGL	Below Existing Ground Level
BGS	British Geological Survey
CCGT	Combined Cycle Gas Turbine
CPT	Cone Penetration Test
CBR	California Bearing Ratio
CP	Cable Percussion
DCP	Dynamic Cone Penetrometer
Ei	Young's modulus
FEED	Front End Engineering Design
GIS	Geographical Information Systems
GSI	Geological Strength Index
GIR	Ground Investigation Report
GWL	Ground Water Level
GWT	Ground Water Table
HPD	High Pressure Dilatometer

HR	Haulage Road
LWD	Lightweight Deflectometer
OD	Ordnance Datum
SCPT	Seismic Cone Testing
SPT	Standard penetration test
SCR	Solid Core Recovery
SWL	Safe Working Load
PLT	Plate Load Test
UU	Unconsolidated Undrained
UCS	Uniaxial Compressive Strength
RQD	Rock Quality Designation
PGA	Peak ground acceleration
PSD	Particle Size Distribution
PLT	Plate Load Test

1. Introduction

1.1 Project Overview

Keadby Generation Limited are actively developing the Front End Engineering Design (FEED) for the proposed Keadby 3 Power Station, which could become the UK's first power station equipped with carbon capture technology by the mid-2020s. Fugro has been retained to assist them with the geotechnical, geoenvironmental and geophysical site investigations, laboratory testing and geotechnical evaluations.

The site is located in North Lincolnshire, on the western side of the River Trent near the existing power stations Keadby 1 and Keadby 2 (Appendix A). The main site is a 0.19 km^2 area of open land, of which the northern and central areas are the historical Keadby Power Station landfill. Figure 1-1 shows that the main site is bound to the east by the existing Keadby Power Station's infrastructure, notably an electricity distribution site. To the south of the site are various watercourses, including the Stainforth and Keadby Canal and to the north and west is agricultural land.



Figure 1-1: Site Location Plan

1.2 Scope of Work

The overall project involves the construction of a new Keadby Low Carbon Combined Cycle Gas Turbine (CCGT) Generating Station and its associated infrastructure, with the key infrastructure and access roads being situated on the main investigation site.

The site investigation includes the FEED Contractor requirements for information to assess the geotechnical, geo-environmental, geological and hydrogeological ground conditions. This will facilitate the development of the various design elements of the project and construction of the access roads and bridges to the site.

Additional ground investigation is also being performed to investigate the Ash Tip Site (historical landfill area) situated to the west of the development site. The objective of the investigations at the Ash Tip Site is to provide information to characterise the identified potential risks posed by the Ash Tip Site to the Keadby 3 Proposed Development Site.

Fugro's work scope in support of the Keadby 3 project includes a series of geotechnical, geophysical, geoenvironmental and hydrogeological site investigations as well as laboratory testing, geotechnical engineering analyses and reporting. The site investigation (drilling) was started on 22 August 2022 and completed on 14 November 2022.

Fugro's scope of work involves the following:

- Percussion and rotary core drilling,
- Static Cone Penetration Testing (CPT) and Seismic Cone Testing (SCPT),
- Dynamic windowless sampling,
- High Pressure Dilatometer testing in 4 boreholes,
- Cone Pressuremeter testing
- PSSL logging in 4 boreholes,
- Plate load and dynamic penetrometer testing,
- Installation of standpipes and measurement of groundwater and gas levels,
- Geotechnical laboratory testing,
- Geoenvironmental sampling and laboratory testing,
- Data integration, geotechnical analyses, factual and interpretive reporting.

Details of the site investigations scope and the data can be found in Fugro's Factual Report submitted separately.

Data recovered from the investigation were integrated to characterise the ground conditions at the project area (Main Area, Ash Tip and two access roads) and measured and derived in situ and laboratory test results were used to assess the engineering properties of the soils and rock that were subsequently used in engineering calculations.

1.3 Sources of Information

During the tendering stage several reports were made available to Fugro (See Section 2.1). These were used during the investigation stage help identify the ground conditions and modify the scope of the investigation.

1.4 Reporting

This interpretative report forms part of a suit of reports which have been produced for the Client. These comprised:

- F212561 - Ground Investigation Report (GIR) Factual Account
- F212561-01 – Interim Report | Ground Conditions and Preliminary Settlement calculations
- F212561-02 – Interim Report | Shallow Foundation and Pavement Design
- F212561-03 – Interim Report | Pile Design Analyses

The interim reports were produced to assist the Client and their project team in advancing the design process using preliminary data obtained during the investigation. These will be superseded on issue of this report.

The report has been provided in PDF format. The exploratory location records and the field and laboratory test data have also been provided in AGS (Association of Geotechnical and Geoenvironmental Specialists) 4.0.4 format and the photographs in JPEG format.

Guidelines on the limitations of the use of the report and the data provided within it are given in Section 1.6.

1.5 Report Organization

This report is organized into 7 main sections and 6 appendices. Following this introductory section:

- Section 2 summarizes the regional geologic setting and site surface geology,
- Section 3 overviews the data integration processes, presents interpretations of the subsurface conditions and summarize engineering characteristics of the subsurface units,
- Section 4 provides the groundwater information,
- Section 5 provides the geotechnical engineering analyses including settlement, shallow and deep foundation analyses, pavement analyses and slope stability calculations,
- Section 6 summarises the geoenvironmental data,
- Section 7 provides recommendations,
- Section 8 lists the references.

1.6 Limitations and Use of Data

This report (the 'Report') was prepared as part of the services (the 'Services') provided by Fugro GeoServices Limited ('Fugro') for its client (the 'Client') under the terms of the relevant contract between the two parties (the 'Contract'). The Services were per-formed by Fugro based on requirements of the Client set out in the Contract or otherwise made known by the Client to Fugro at the time.

Fugro's obligations and liabilities to the Client or any other party in respect of the Services and this Report are limited in time and value as defined in Contract (or in the absence of any

express provision in the Contract as implied by the law of the Contract) and Fugro provides no other representation or warranty whether express or implied, in relation to the Services or for the use of this Report for any other purpose. Further-more, Fugro has no obligation to update or revise this Report based on changes in conditions or information which emerge following issue of this Report unless expressly required by the Contract.

The Services were performed by Fugro exclusively for the Client and any other party identified in the Contract for the purpose set out therein. Any use and/or reliance on the Report or the Services for purposes not expressly stated in the Contract, by the Client or any other party is that party's risk and Fugro accepts no liability whatsoever for any such use and/or reliance.

2. Geology of Project Area

Data provided by the British Geological Survey (BGS) viewer (https://geologyviewer.bgs.ac.uk/?_ga=2.163222396.1957252627.1674399036-1924844456.1674399036) suggest the site is underlain by Warp (silts and clays). Bedrock comprises of the Mercia Mudstone Group.

The GeoIndex (onshore) BGS Map Viewer (https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSBoreholes&_ga=2.156992377.352533466.1674399205-1805479206.1674399205) shows that the site lies within a "Lowland Basin Quaternary Domain". Below the low to very low relief ground, the area is underlain by thick, stratified sequences of Devensian to Flandrian age, dominated by glaciofluvial sand and gravel and glaciolacustrine silt and clay resting on bedrock.

The GeoIndex Map Viewer shows the lines of three schematic cross sections located close to the study area.

The section extending from North Moor Farm in the west to Scarborough in the east, suggests the presence of the following sequence.

Alluvium – clay, silt, peat and sand.

Alluvium – sand with some gravel.

Alluvium - clays, silts and sands of the "25 ft drift of the Vale of York".

Alluvium - older sand and river gravel.

The Alluvium extends down to between about 10 m below Ordnance Datum (BOD) and 19 m BOD.

During the Last Glacial Maximum, the University of Sheffield's BRITICE Glacial Map v2.0 (https://shefuni.maps.arcgis.com/apps/webappviewer/index.html?id=fd78b03a74bb477c906c5d4e0ba9abaf) suggests, the area was the site of an ice and moraine-dammed north-south trending proglacial lake, Lake Humber. At its maximum extent, Lake Humber extended from Northallerton in the north to Cambridge in the South.

Studies by Bateman *et al*, and others indicate the lake was present between 21 ka and 15 ka and covered an area of up to ~4500 km2, its size fluctuating as a result of the advancing and regressing ice sheet. Their work also indicates that about 19 ka years ago the edge of the ice sheet lay coincident to the study area (See Figure 2.1).

The distribution of sediments within the former Lake Humber are complex ranging from beach and littoral deposits close to the edge of the lake and/or ice sheet, to distal sands and glacio-lacustrine and other glacigenic deposits. Given the above, it is considered that the

"older river sand and gravel" referred to GeoIndex Map Viewer section between North Moor Farm and Scarborough represent glacio-lacustrine deposits.

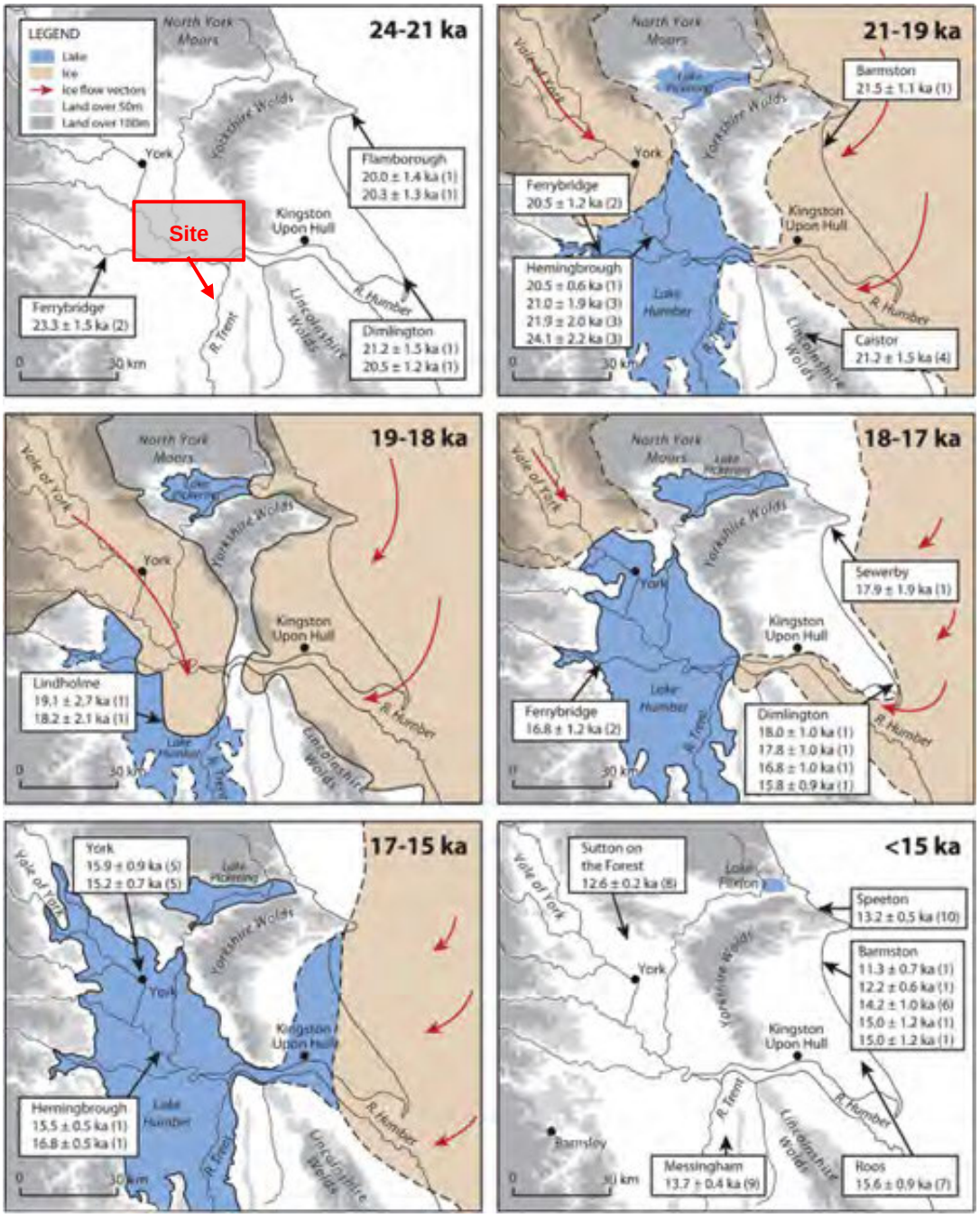


Figure 2.1: Extent of Lake Humber (after Bateman et al). Project area is shown by red arrow.

Hobbs *et al*, describes the Mercia Mudstone to consist mainly of red and, less commonly, green and grey finely laminated to almost totally structureless commonly gypsiferous dolomitic mudstones and argillaceous. In its fully weathered state, the Mercia Mudstone it is a reddish-brown, 'very soft' to 'hard' silty clay, with lithorelicts of less-weathered mudrock. Hobbs *et al* inform that the depth of weathering can be considerable, exceeding 30 m Below Ground Level (BGL) in some areas, however, it is more typically 10 m BGL to 15 m BGL.

Data held by the British Geological Survey (sheet 88, scale 1:63.360, published 1969) suggests that the regional dip is less than 5 degrees to the east. There is no evidence of major faulting or folding within the study area.

The 2020 seismic hazard map for the United Kingdom intended for use with the National Annex for the revised edition of Eurocode 8 gives guidance on the levels of peak ground acceleration (PGA). http://www.earthquakes.bgs.ac.uk/hazard/uk_hazard_map.html

The PGA for the site is shown to be 0.02 g to 0.04 g.

The GeoIndex (onshore) BGS Map Viewer provides modern instrumented earthquake records. https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSModernEq&_ga=2.236179202.2081560202.1674467677-559702586.1674467677.

Records of events recorded close to the site are set out below.

Table 2.1: Record of Seismic Events

Site Name	Year	Event Depth (km BGL)	Maximum European macroseismic scale Intensity	Richter Local Magnitude
Grey Green	2000	0.3	0	1.7
Hunters Lodge, Scutter	2010	9.3	0	1.9
Black Walk Plantation, Scutter	2000	19	0	1.8
Low Farm, Scutter	2000	18.8	0	1.9
Westwood Site	2017	4.8	0	1.7

2.1 Previous Investigations at the Site

Reports on previous investigations carried out at or near the site were made available to Fugro by the client. Details are set out below:

1. Project Phoenix. Keadby Power Station Phase 1 Site Investigation, Interpretive Report. Mott MacDonald, 1991
2. Structural Soils Report No .764052. Keadby Power Station, Interpretative Geotechnical Assessment on Ground Investigation, 2016
3. Keadby Power Station Preliminary Risk Assessment, RSK, 2016.
4. Keadby Power Station Geotechnical Interpretative Report LG Mouchel and Partners Ltd, 1992.
5. Keadby Power Station Phase 1, Site Investigation, Report on Ground Investigation, Wimpey Geotech Limited, 1991.

Information presented in these reports provided with other Contract documentation provided by the Client indicates the following soils and rock are present across the site.

Table 2.2: Anticipated Geology

Geology	Expected Location	Typical Description
Made Ground	Although not mapped at the site, made ground is expected across the Proposed Development Site A given the historical phases of development that have taken place. The Ash Tip Site B is confirmed Made Ground.	Mixed nature in both Site A and Site B. Expected to be composed of a mixture of clay/silt, sand, gravel with occasional rubble, ash, glass, slag etc. The Ash Tip Site is expected to be dominated by silt and sandy silty with variably abundant clinker/slag. Records on historical landfill composition unavailable. Historical landfill anticipated to comprise approximately 20m of made ground at its thickest locations (above ground).
Warp (artificially induced alluvium)	Across the majority of the Proposed Development Site Potentially Site B (Ash Tip)	Clay and silt.
Cohesive Alluvium	Across the Proposed Development Site. potentially Site B (Ash Tip)	Normally consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.
Granular Alluvium	Beneath the Cohesive Alluvium. (May potentially be divided into more than one distinctive stratum), potentially Site B (Ash Tip)	Sands, silts and clays, with occasional peat layers.
Mercia Mudstone Group	Across the proposed development site and Site B, beneath the superficial deposits	Mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum widespread. Sandstones are also present. The top of the strata is likely to be weathered.

The Mercia Mudstone Group strata were encountered between 12 m and 19 m BGL.

Historical records indicate a groundwater level between 0.9 m and 3.0 m BGL, but these readings are out of the Keadby-3 project area. Previous investigations at Keadby 2 (within the main Keadby Power Station Site) found two shallow groundwater systems; one within the Made Ground and the other in permeable layers in the Alluvium.

3. Site Characterization

As described in Section 1.2, geotechnical, geoenvironmental and geophysical investigations were conducted to help characterize the surface and subsurface conditions in the project area (Appendix B). All of the data have been input into a proprietary project-specific database to allow synthesis, comparison, analysis and output of the data. The stratigraphy observed at the exploratory locations have (where feasible) been compared and integrated with stratigraphic relationships imaged by the geophysical surveys, in situ and laboratory testing data. That integrated effort was used to prepare: 1) a series of subsurface cross sections for the main area, ash tip and along the access roads to illustrate subsurface conditions in the project area, and 2) summarise some of the engineering properties of the soils and rocks that underlie the site.

3.1 Integrated Site Characterization

3.1.1 Basis of Characterization

An integrated approach to site characterization was adopted for the Keadby Power Plant project. All of the data in the geotechnical and geophysical explorations were captured in a proprietary Geographic Information System (GIS) database to allow synthesis, comparison, analyses and output of the data. The borehole, in situ and laboratory test results were entered to a custom HoleBase SI database which can be read by the GIS software. In addition, all site and laboratory data was incorporated into a 3D ground model using Leapfrog software. The use of Leapfrog allowed the shortening of the overall timeframe for the site characterization, improvements in the accuracy of data interpretation and permitted data review to proceed concurrently with the site investigation.

The basic data sets used for the integrated site characterization included:

- Topographical data provided by Client,
- Geotechnical borehole data from the drilling survey,
- Soil parameters from CPT soundings,
- In situ testing data, SPT, HPD test, cone pressuremeter test, measurement of P&S wave velocities,
- Geotechnical laboratory test results,
- Groundwater level and ground gas measurements from the standpipes installed in boreholes.

In addition to above, data presented in previous geotechnical and geoenvironmental ground investigation reports for the Keadby 2 power plant were used as background information.

3.1.2 Data integration

A series of subsurface cross sections were prepared to display the various data sets collected during the study. The cross sections show: topography where available, lithology identified in

borings and interpreted from CPT data; engineering properties such as CPT tip resistance and friction ratio; estimates of fines contents; and measured/interpreted shear strengths, SPT blow counts and derived rock strength values. Where available, measured compression (P-) wave velocity and shear (S-) wave velocity data are also superimposed on the cross sections. Stratigraphic interpretations were based on the integrated evaluation of all of the above data sets. Primary importance was given to the CPT and borehole data since they clearly identify the specific changes in lithology and engineering properties. In soils CPT data was taken into account as it much accurately delineates the cohesive and non-cohesive unit boundaries. As we didn't have any surface geophysical data to compare, the interpolation was made visually and with some engineering judgment based on the CPT and borehole data.

As described subsequently, the primary stratigraphic feature identified in the subsurface cross sections is the boundary between the alluvial units and the underlying Mercia Mudstone. The stratigraphic contact between these units as interpreted on the cross sections was used to develop isopach (thickness) maps for the superficial deposits.

3.1.3 Exploration spacing

Site exploration locations are provided in Appendix A. The spacing of the exploratory locations varies between 35m to 85m in the main Area-A; there is a very limited number of investigation points at Area-C. However, the ground conditions are quite homogeneous across the site with horizontal and continuous layers.

It should be noted that the weathering profile on the Mercia Mudstone varies across the site; thus additional foundation-specific site investigations may be considered once final facility layouts are available.

3.2 Site topography

The topography data was provided by client in dwg. format on 28th November 2022. This data includes the Main Area and the Ash Tip, but does not cover the access roads.

The topography of the main area is relatively flat around 0.0 m to 1.6 m Above Ordnance Datum (AOD) (Figure 3.1) with ground levels gently increasing towards the south. The mean ground elevations in the project area measured as 0.63 m AOD, 1.09 m AOD and 1.59m AOD for the Areas 1, 2 and 3, respectively. The Ash Tip generates a topographical high in the area with a maximum elevation of 19.6 m AOD. The sides of the ash fill are quite steep, and the top is flat. There are several borrow pits to the west and south of the Ash Tip of various sizes.

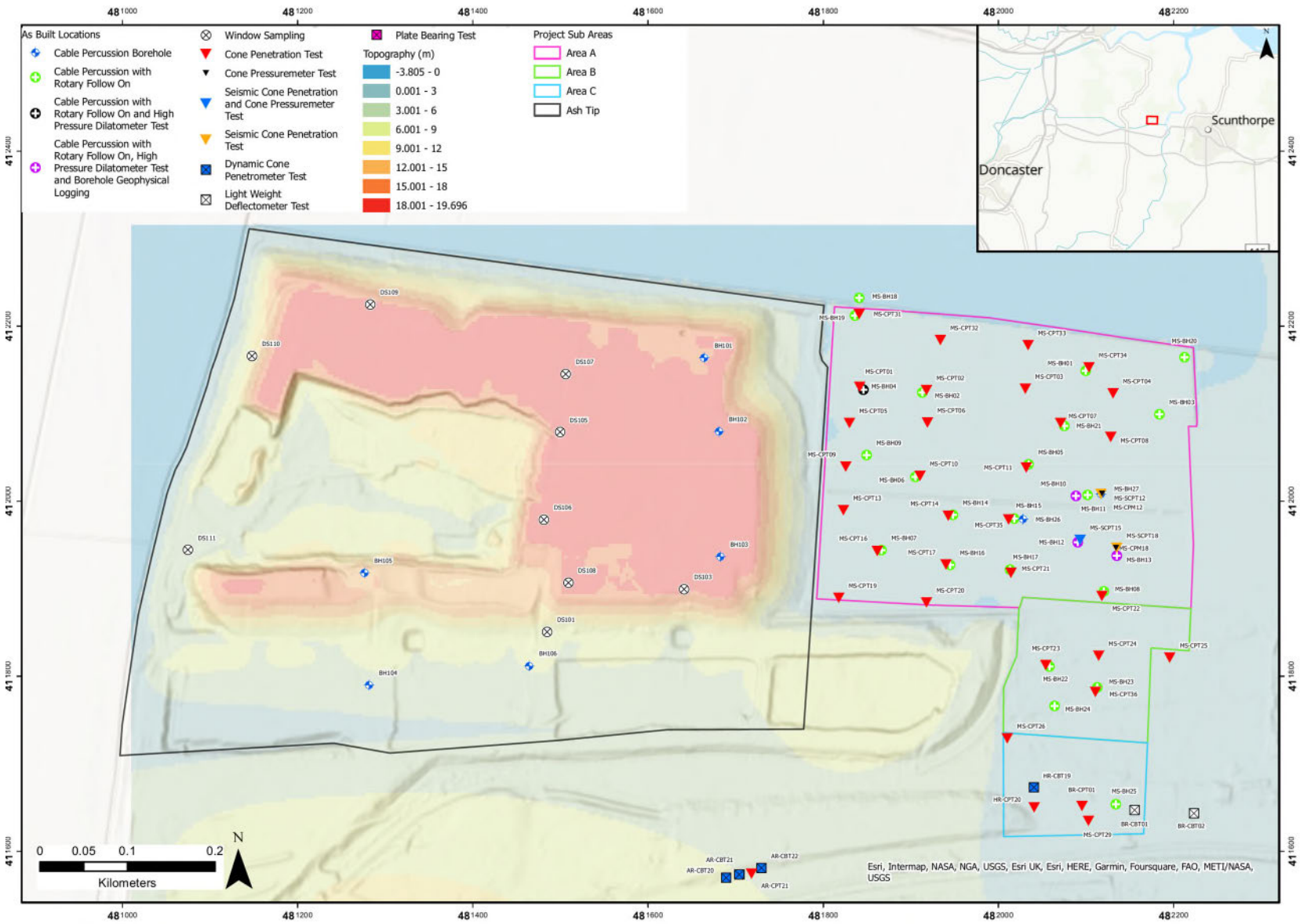


Figure 3.1: Digital elevation model of the Main Area and Ash Tip generated from the topographical data provided by Client.

3.3 Subsurface Cross Sections

A series of 13 cross sections were generated to illustrate the subsurface conditions in the project area. Subsurface cross sections were prepared to facilitate integration of the multi-disciplinary data set collected at the project site. The CPT, borehole, in situ and laboratory testing data are presented on the cross sections and are used to evaluate the subsurface conditions. Figure 3.2 presents the locations of the subsurface panels and cross sections relative to the site explorations. A key to the colours, symbols and terms shown on the cross sections is provided on each figure. Lithology is represented by a coloured column at the borehole locations as patterns. Where CPTs were conducted, the data is presented next to the borehole lithological data. The velocity measurements from the boreholes and seismic CPT's, in situ test data and core measurements such as SPT and RQD, elastic modulus, and the results of soil/rock strength laboratory tests are plotted next to the relevant borehole log. Groundwater measurements from the boreholes are also shown on the cross sections.

To help illustrate the potential stratigraphic connections between explorations the sublayers in the soil units, clay rich layers are shown as a reddish colour and sand units are shown as yellow.

The cross-section locations in the Main Area and Ash Tip are shown on Figure 3.3. Four cross sections are oriented N-S and 2 cross sections are in an E-W direction, covering all of the site investigation locations in the Main Area. Cross section D is extended through Area B and Area C to the south. The sections are provided in Appendix B, subsections B.1 to B.6, inclusive.

Four cross sections (G, H, I, J) are generated to illustrate the subsurface conditions at the Ash Tip site (Figure 3.3). The sections are oriented to cover the boreholes which extend down into the natural soil. Section H and I are extended towards the Area 1 to allow comparison of the ground conditions encountered in the two areas. The Ash Tip cross sections are provided in Appendix B subsections B.1.7 to Appendix B.1.10, inclusive.

Three cross sections (K1, K2 and L) are taken along the access roads. Southwest Road cross section is presented in Figure 3.4 and East Road is in Figure 3.5. Since topographic data along these sections were not available at the time of writing this report, the as-built coordinates of exploratory locations are used to illustrate the topography. The cross sections along the access roads are presented in Appendix B, subsections B.1.11 to Appendix B.1.13, inclusive.

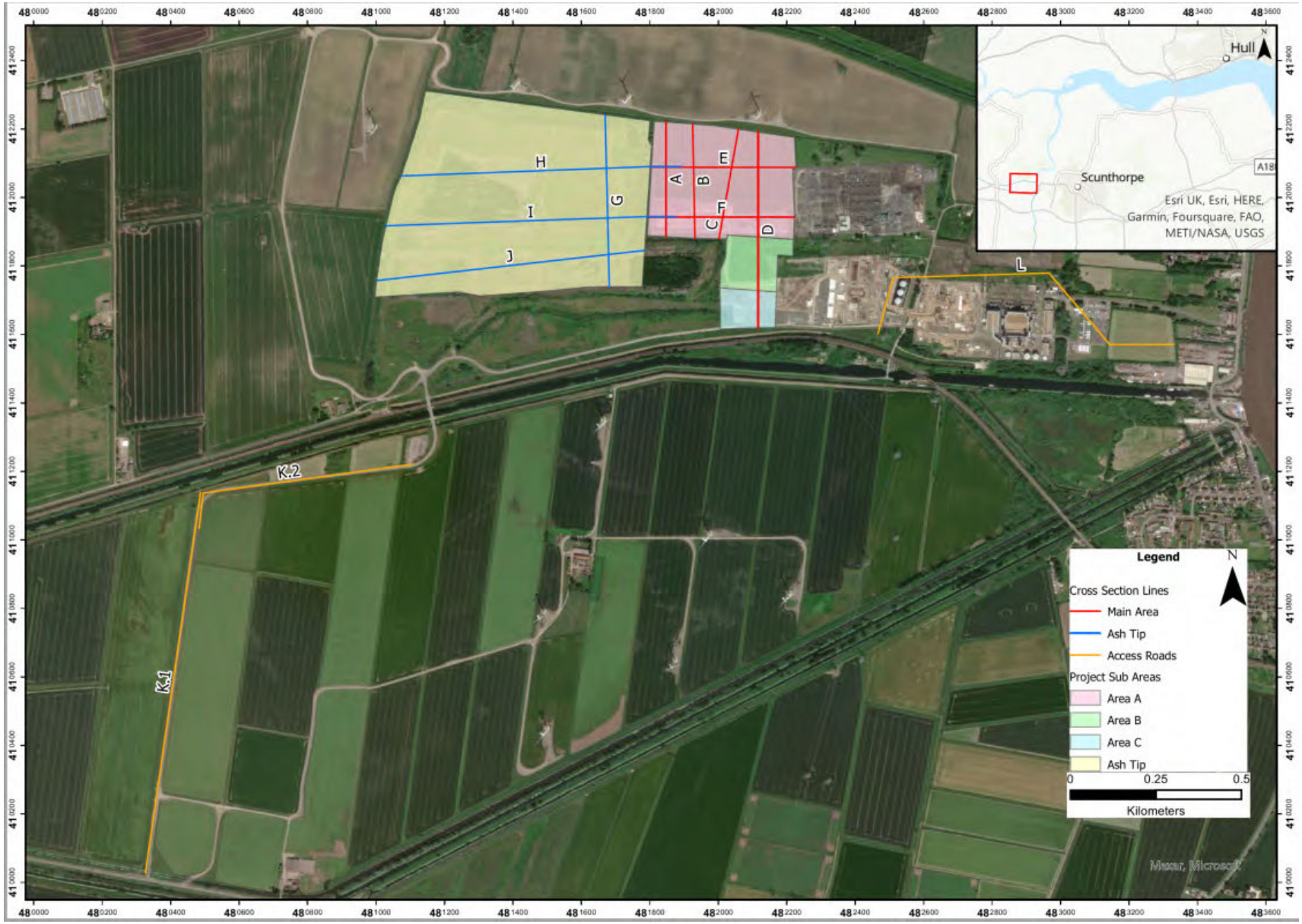


Figure 3.2: Map showing all cross-section layouts across the project area

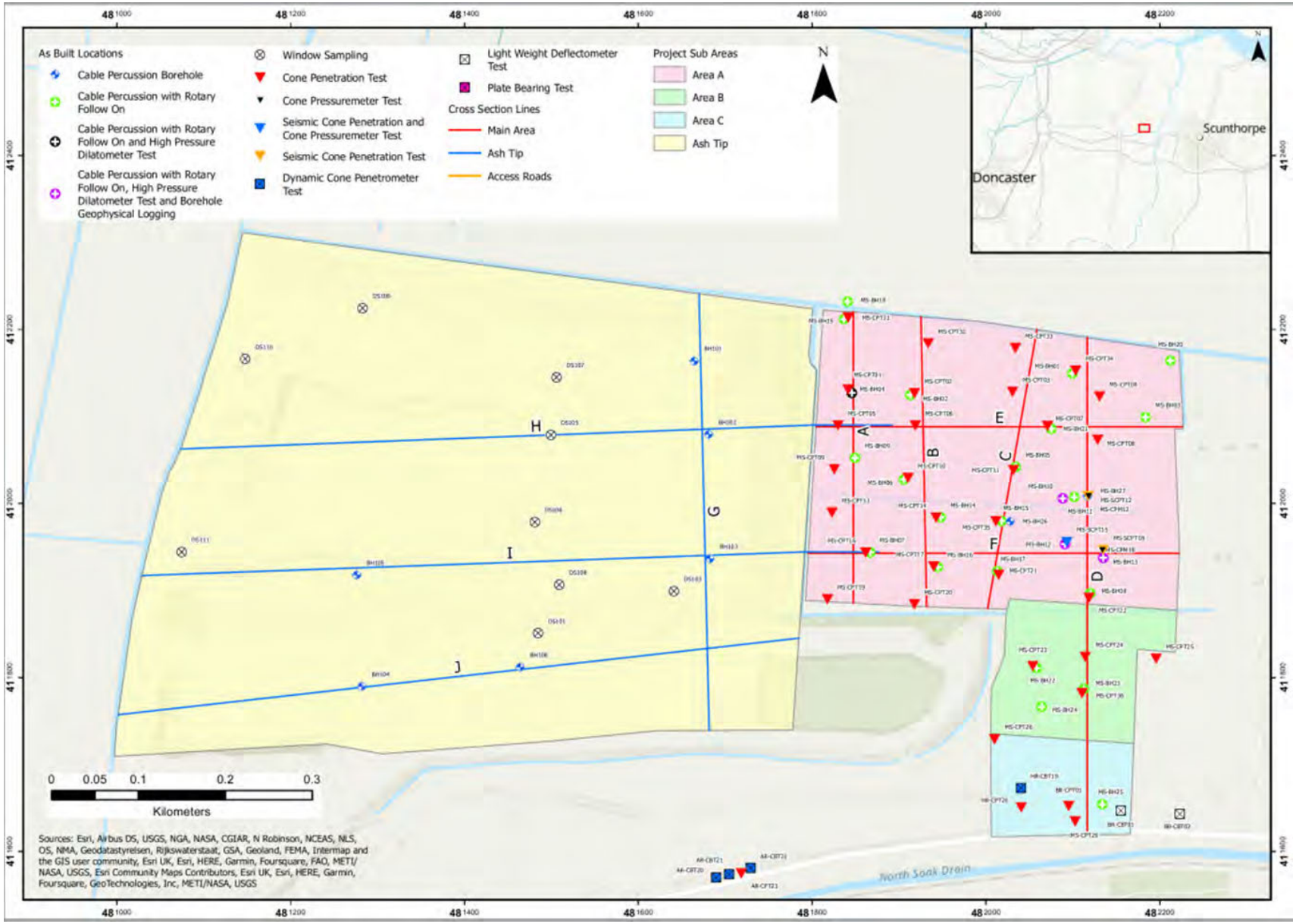


Figure 3.3: The cross section lines and the site investigation locations at Main Site and Ash Tip areas.

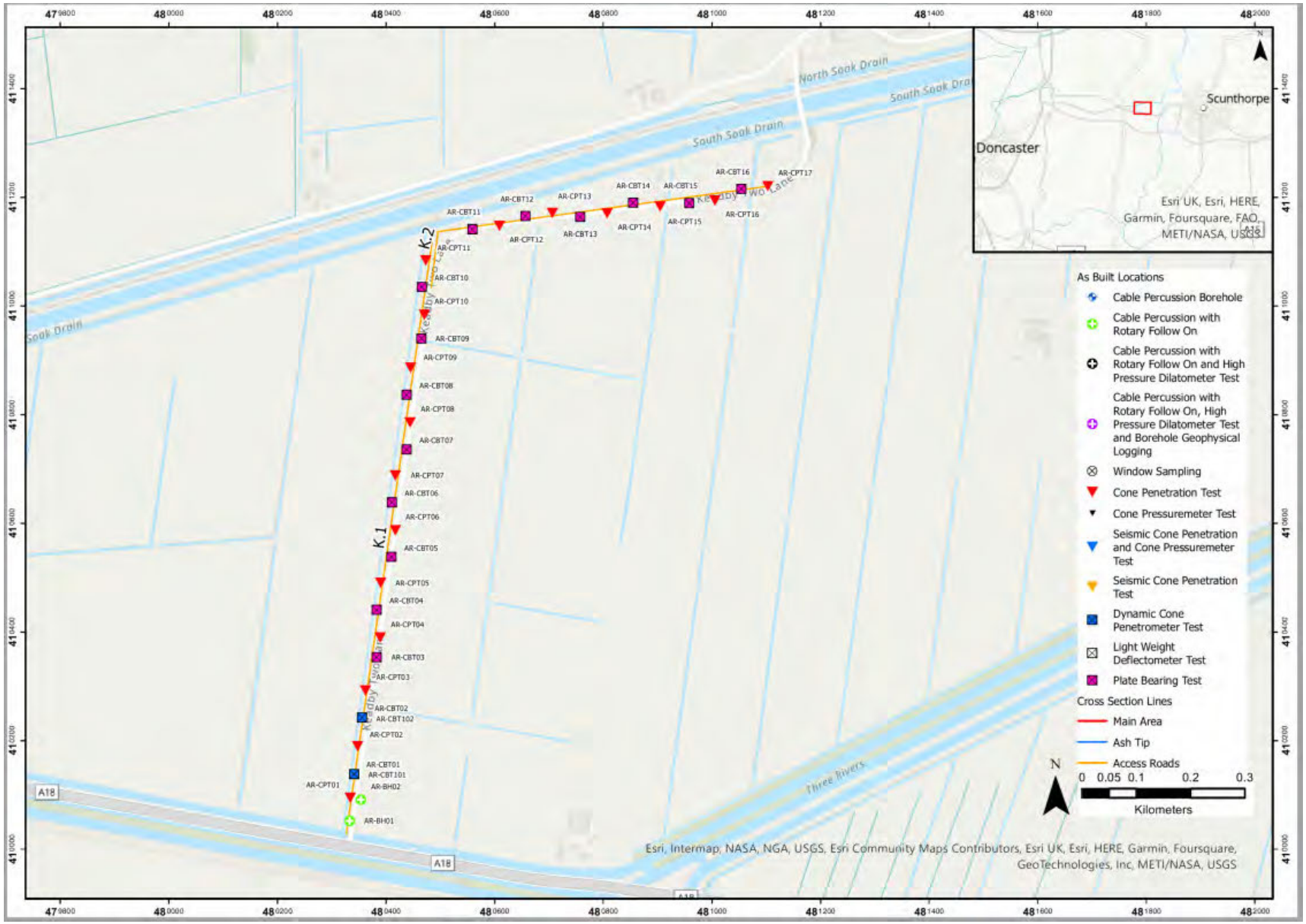


Figure 3.4: Exploration locations and the subsurface cross section map of Southwest Access Road.

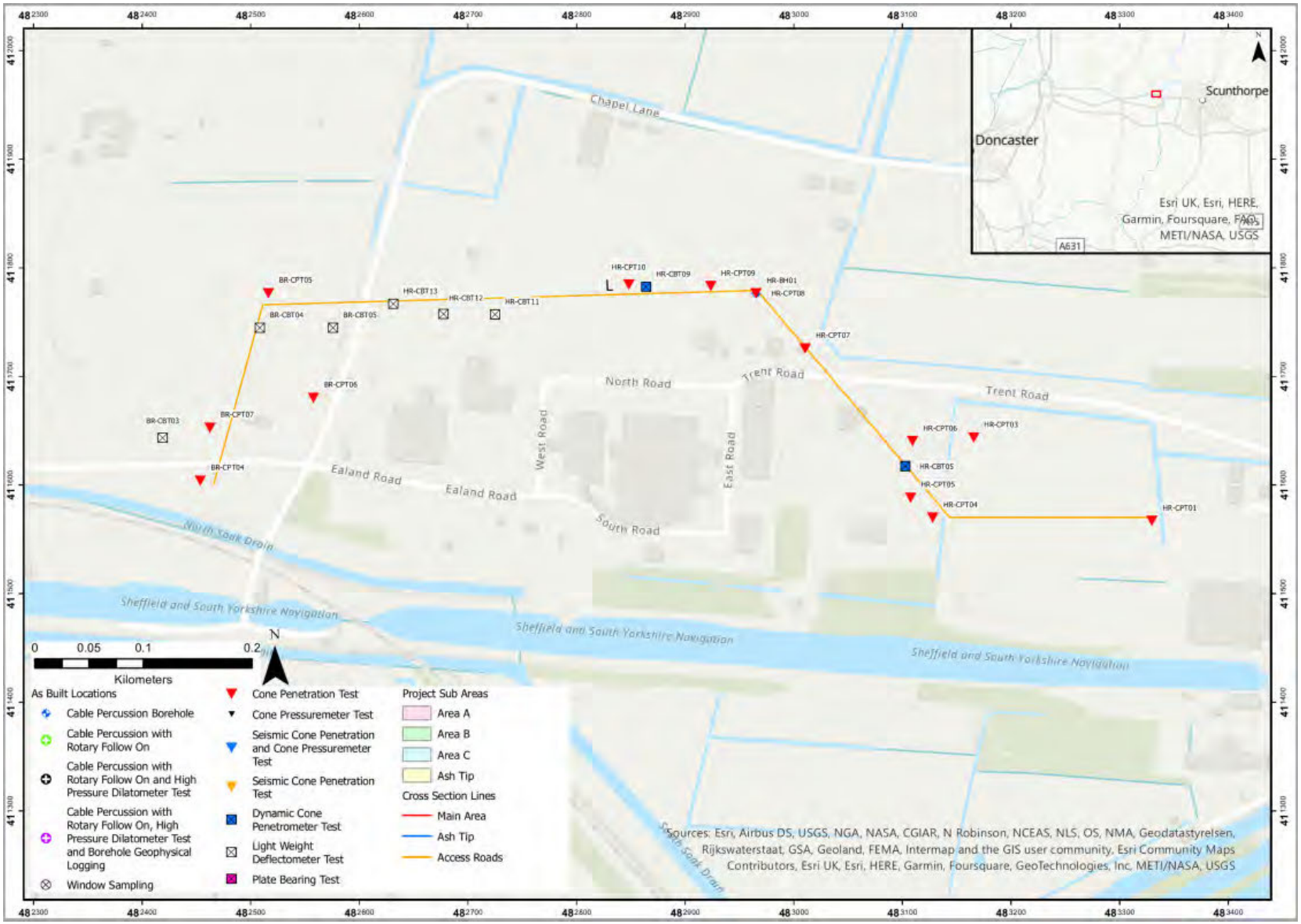


Figure 3.5: Exploration locations and the subsurface cross section map of East Access Road.

3.4 Summary of Ground Conditions

The subsurface conditions at Main Site were characterised by integrating the available intrusive information in a 3D ground model using Leapfrog software. During data review the borehole and CPT data were compared and any contradicting data (if any) corrected in the quality review process.

Borehole disturbance associated with the cable percussion boring method makes it difficult to identify some "thin" individual layers in the soil sequence. However, CPT data provides a continuous soil profile allowing such "thin" soil layers to be identified. Therefore, the soil sequence was mainly modelled using the lithologies identified during the CPT testing, while the rock section of the model is based on the borehole data.

The borehole and CPT data indicates near-homogenous ground condition across the site which comprised Mercia Mudstone (Residual and Bedrock units) overlaid by various soil units. The soil units are separated into three main groups, the Alluvium (Cohesive and Granular), the Glaciofluvial deposits (Granular) and Made Ground.

The ground conditions encountered in the Main Area are summarised in Table 3.1 and discussed further in the following sections.

Table 3.1: Idealized ground profile of Main Area.

Unit Name	Unit Code	Layer Description	Top Elevation (m OD)		Bottom Elevation (m OD)		Thickness* (m)		
			Min	Max	Min	Max	Min	Max	Mean
Made ground	0	Clayey Sand	-0.61	2.81	-1.51	0.87	0.00	2.93	1.00
Alluvium	1a	Sand & silty Sand	-1.51	0.87	-2.85	-1.44	0.34	3.18	2.10
	2a	Clay	-2.85	-1.44	-4.05	-2.58	0.21	1.40	0.77
	1a	Sand & silty sand	-4.05	-2.58	-5.28	-4.35	0.80	2.19	1.69
	2b	Clay & Silty Clay	-5.28	-4.35	-6.29	-5.27	0.60	1.39	0.82
Glaciofluvial	1b	Sand & silty Sand	-6.29	-5.27	-13.59	-11.48	6.20	7.70	7.38
Residual	2c	Clay	-13.59	-11.48	-17.94	-12.73	0.02	5.53	2.28
Bedrock	3	Mercia Mudstone	-17.94	-12.73	-	-	-	-	-
Notes: *Included only where full thickness has been proven									

3.4.1 Made Ground

Made Ground (Unit - 0) comprised dark brown slightly gravelly clayey Sand, with fragments of brick, glass, wood, ash and coal. The Made Ground is observed as an uppermost unit across the site. The thickness varies between 0 m and 2.9 m with an average of 1.0 m. The thickness of the unit increases towards the south. The thickest deposits were recorded in

Main Area-C. Made Ground is an inherently variable material and the thickness of the unit may vary over short distances.

3.4.2 Alluvium

Alluvium extends across the site and consists of clays, silts and sands. It is normally consolidated detrital material deposited as a sorted or semi-sorted sediment in the bed of streams, rivers or their associated floodplain. The unit overlays the glaciofluvial deposits.

Based on the CPT data, the Alluvium can be divided into four sub-layers which are identified in all CPT locations. The unit starts with sand at the top which is then followed by clay, sand and silty clay layers. The thickness of the individual clay layers varies between 0.4 m and 1.2 m. These units are named separately according their lithological and mechanical properties where unit-1a is Sand and silty Sand, Unit-2a is Clay, Unit-2b is Clay and silty Sand.

At the north-eastern end of southwest access road (Appendix B, subsection B1.12) and the eastern section of East Access Road (Appendix B, subsection B1.13) there is a thick clay layer identified from the CPT data which exhibits a very low shear strength. It is thicker to the east of the existing Keadby 2 power station and according to the ground model, it uncomformably overlays the other alluvium layers. Therefore, this unit is considered as a separate subunit of alluvium and coded as Unit-2d.

3.4.3 Glaciofluvial deposits

Glaciofluvial deposits (Unit-1b) was identified in each exploratory location below the alluvial deposits. It is mainly differentiated by its high tip resistance and sleave friction in CPT data and high SPT values. Considering the sand is fine and does not include coarse gravels, it is anticipated that the unit is deposited into a proglacial lake which is away from the ice margin.

Glaciofluvial deposits are about ~7.4 m thick in average across the site and it consists of medium dense to dense dark brown silty fine to medium Sand. It also includes occasional subangular pebbles and carbonaceous fragments.

3.4.4 Mercia Mudstone

The Mercia Mudstone (Unit 3) was observed in all boreholes extending below the Glaciofluvial deposts. When unweathered, it is characterized by, medium thickly to thickly bedded, sometimes laminated. dark greyish grey mottled reddish brown, extremely weak to weak Mudstone. The bedding is nearly horizontal, The Mercia Mudstone beds include variously oriented very closely to closely spaced gypsum veins in various thicknesses up to 40 mm. In some boreholes a relatively highly cemented layer including clear syn-sedimentary depositional features was observed. The cementation gives a higher compressive strength (defined as medium strong to strong) than other layers in Mercia Mudstone. The medium strong to strong mudstone is identified on the cross sections. The layer is about 1.0 m to 1.5 m thick and observed between elevations of 15 m AOD and 20 m AOD. The unit was encountered in some boreholes located in central and south-eastern parts of the Main Area.

Zones of weathered unlithified Mercia Mudstone were encountered throughout the sequence. Often recovered as clay, the weathering causes the overall rock mass to lose its strength.

Residual Mercia Mudstone (Unit 2c) at the top of the unit was encountered at all borehole and CPT locations. It comprised variegated soft to very stiff clay with lithorelicts of less-weathered mudrock. The thickness of the residual mudstone ranges between 0.5 m and 4 m, locally increasing to 8 m to the southeast of the project area.

3.4.5 Visual and Olfactory Evidence of Contamination

During the investigations, the supervising environmental consultant made the following observations: No odours indicative of contamination (e.g. hydrocarbon odours) were identified during the investigation.

In addition, no visual evidence of Asbestos containing material was noted.

3.4.6 Soil Headspace Screening

Out of 339 soil samples subject to headspace testing, the majority of the samples recorded a measurement below the instrument limit of detection of 0.1ppm. Of the concentrations measured above 0.1 ppm, the highest was 0.7 ppm in MS-BH07 at 1.00 m BGL and MS-BH14 at 3.8 m BGL, which is not considered significant.

3.4.7 Unit Thicknesses

The 3D ground model established on Leapfrog software based on the CPT and borehole data was used to generate unit thickness maps. It is important to note that the accuracy of the results is directly related with exploratory location spacing and the resolution of the measurements. While the surface elevations and unit thicknesses are accurate at CPT and borehole locations the accuracy of the interpolations between the exploration locations is dependent on the spacing between the explorations.

The thickness of the soil units is presented in Appendix C, subsection C.1. The Made Ground is also included as a soil unit on thickness maps. The soil thickness is quite uniform between 13.0 m to 14.0 m across the Main Site. It reduces to 12.0 m to the southwestern corner of Area-A and it reaches up to 15.6 m along the western edge of Area-B and Area-C in a narrow strip due increase of thickness of made ground in that area.

Three CPT's located in Area-C did not reach to the bedrock level due to shallow refusals around 1m depth. The soil thickness is calculated based on 1 CPT and 1 borehole in Area-C so the accuracy is relatively lower than other areas due to the wide exploratory location spacing.

The thickness of the weathered (residual) Mercia Mudstone is variable (Appendix C, subsection C.2). Its average thickness is about 2 m in Area-A, gradually increasing towards the south to reach 5 m in the south-eastern part of Area-C.

The bedrock top elevation map was generated by subtracting the soil thickness from the surface elevation in Appendix C, subsection C.3. So, it is lower in elevation where the soil and residual mudstone increases. In Area-A, the bedrock top elevation varies between -16 m AOD to -13 m AOD, and it is shallower in the eastern half of Area-A. As the bedrock elevation is one of the most important inputs of pile design, the spatial changes on bedrock top elevation should be considered in the pile analyses.

3.5 Engineering Properties of Primary Units

The following sections present a discussion of the tests performed and the associated geotechnical assessment.

Each parameter has been assessed and minimum. maximum and average values for each formation per area have been determined. These are presented in summary tables in Appendix D. Table 3.2 details each table that is presented.

The parameter plots are presented in Appendix D and are presented against elevation where applicable and separated by section and geology.

Table 3.2: Summary of Index Laboratory Testing

Table Title	Table Number
Summary of Engineering Parameters from CPT Data – Main Site	Table D.1
Summary Table of Range of Engineering Parameters from CPT Data – Main Site	Table D.2
Summary of Standard Penetration Test Results	Table D.3
Standard Penetration Tests – Summary of Refusal on Mercia Mudstone	Table D.4
Summary of CBR values from In situ testing	Table D.5
Summary of Variable Head Permeability Test Results	Table D.6
Summary of Shear Wave Velocity of Soil Units	Table D.7
Summary of P & S Wave Velocities of Rock Units	Table D.8
Summary of Moisture Content Results	Table D.9
Summary of Bulk and Dry Density Results	Table D.10
Summary of Atterberg Limits	Table D.11
Summary of Non Plastic Atterberg Limits Results	Table D.12
Summary of Fines Content	Table D.13
Summary of Compaction Test Results	Table D.14
Summary of UU-Triaxial Test Results	Table D.15
Summary of Direct Shear Test Results	Table D.16
Summary of Water Content of Rock Samples	Table D.17
Summary of Point Load Test Results	Table D.18
Summary of Uniaxial Compressive Strength Results	Table D.19

3.5.1 In situ Testing

3.5.1.1 Cone Penetration Test

A total of 68 cone penetration tests were completed. The test results and profiles are provided in the factual data report (Fugro, 2022a). Interpreted parameters discussed below are included in Appendix D.

Cone penetration tests (CPTs) were performed using a tracked truck mounted CPT system. Cones with a projected area of 15 cm^2 (CP15) were used for testing.

Digital signals from the cones were transmitted from the cone and stored for subsequent computer processing that included:

- Penetration corrected in both X (horizontal) and Y (horizontal) directions;
- Cone resistance (q_c);
- Sleeve friction (f_s);
- Pore-water pressure (u_2).

Tests were terminated at the discretion of the operator. When deciding to stop a test, the senior operator took into account the total thrust applied to the cone, the tip resistance and the soil conditions through which the cone had passed.

A manual assessment of the estimated soil type has been made using the measured CPT data, the appropriate method for calculating SBT and the associated geotechnical borehole records obtained during the investigation.

The relative density of coarse-grained cohesionless soils was estimated using the relationship proposed by Jamiolkowski et al. (2003) and presented in Equation 3.1 and Equation 3.2.

$$D_r(dry) = \frac{1}{0.0296} \cdot ln\left[q_c \Big/ 2.494 \cdot \left[\frac{\sigma'_{v0} \cdot \left[\frac{1 + 2 \cdot K_0}{3}\right]}{100} \right]^{0.46} \right]$$

Equation 3.1

$$D_r(saturated) = \left[\frac{-1.87 + 2.32 \cdot ln \frac{1000 \cdot q_c}{(100 \cdot \sigma'_{v0})^{0.5}}}{100} + 1 \right] \cdot D_r(dry)$$

Equation 3.2

Where:

D_r (dry)	= Estimated relative density [%]
D_r (saturated)	= Estimated saturated relative density [%]
q_c	= Measured cone resistance [MPa]
σ'_{v0}	= Vertical effective overburden stress [kPa]

K_0 = Coefficient of lateral earth pressure

Values of K_0 of 0.5 and 1.0 were used to estimate the relative density D_r (saturated).

The undrained shear strength has been estimated for the soil profiles using the relationships proposed by Rad and Lunne (1988) as below in Equation 3.3.

$$c_u = (1000q_n)/N_{kt}$$

Equation 3.3

Where:

c_u = the inferred undrained shear strength [kPa]

q_n = the net cone resistance [MPa]

N_{kt} = an empirical factor relating cone resistance to undrained shear strength

Values of N_{kt} of 15 and 20 were used to estimate the undrained shear strength of fine-grained units. Graphical presentations of the interpreted values are presented in Plates 3.6.1.1a to 3.6.1.1d.

The idealised site parameters of the geological units of Main Site are determined by Twenty nine CPT results in CPeT-IT software. The Mean values of engineering parameters are presented in Table D.1, and minimum-maximum values are presented at Table D.2.

Additionally, the formulas and the description of the codes in the table also given below. Those formulas are taken from software itself.

Corrected cone resistance, q_t (MPa): corrected value of cone resistance q_c for pore water pressure.

$$q_t = q_c + u_2(1 - a)$$

Sleeve Friction Resistance, f_s (kPa): the friction force acting on the friction sleeves divided by its surface area. This value comes from the CPT probe directly.

Young's Modulus, Es (MPa): The constant of soil behaviour (Ic) ranges between 1.8 – 3.0 depend on the soil type and determined via software to eliminate the errors on the transition zones.

$$Es = (q_t - \sigma_v) \times 0.015 \times 10^{0.55 \times I_c + 1.68}$$

Relative Density, Dr (%): Q_{tn} is normalized cone resistance value that taking account of the in-situ vertical stress in the point of cone resistance value taken.

$$D_r = 100 \times \sqrt{\frac{Q_{tn}}{350}}$$

Friction Angle, Φ (°): The constant volume friction angle (φ'_{cv}) is a constant that can be considered between 30-33 in sand.

$$\varphi = \varphi'_{cv} + 15.94 \times \log(Q_{tn}) - 26.88$$

1-D Constrained Modulus, M (MPa):

$$M = \propto \times (q_t - \sigma_{vo})$$

$If\ I_c > 2.20\ (fine\ grained\ soil)$:
$\alpha = Q_t\ when\ Q_t < 14$
$\alpha = 14\ when\ Q_t > 14$
$If\ I_c < 2.20\ (coarse\ grained\ soil)$
$\propto = 0.0188 \times \left[10^{(0.55 \times I_c + 1.68)}\right]$

Small Strain Shear Modulus, Go (MPa):

$$G_o = (q_t - \sigma_v) \times 0.0188 \times \left[10^{(0.55 \times I_c + 1.68)}\right]$$

Undrained Shear Strength, Su (kPa): Undrained shear strengths were interpreted from CPT tip resistances using empirical cone bearing factor (Nk) of 14.

$$S_U = \frac{(q_t - \sigma_v)}{N_{kt}}$$

3.5.1.2 Standard Penetration Test

A total of three hundred and ninety six tests were undertaken, the results of test results used in later analysis are summarised in Table D.3.

The SPT test is split up into a series of 75 mm penetrations. Two form the seating blows and four form the test itself. Sometimes an SPT test will reach 50 before the associated penetration and the driller will record this as follows 40, 10/50mm, -, - test blows. In order to address this and determine what the full 'N' value was a simple assumption is used that penetration is linear and therefore higher SPT 'N' values can be determined using the following formula, Equation 3.4.

$$Predicted\ SPT\ 'N'\ Value = \frac{Blow\ Count}{Penetration} \times 300$$

Equation 3.4

Table D.4 details the tests which were omitted from analysis due to test being performed to prove rockhead only. The results are presented on the borehole logs. Plots of the results against elevation is presented in Plates 3.6.1.2a to 3.6.1.2c.

3.5.1.3 In situ CBR's

CBR values were obtained during the fieldwork period using various techniques, which included:

- Determination from plate bearing tests
- Dynamic Cone Penetrometers (DCP's)
- Lightweight Deflectometer

These were taken along the existing access roads (AR), the proposed haul roads (HR) and around the existing site access bridge (BR). The values obtained to date have been summarised in Table D.5. CBR values are subjective and can be affected by the depth of the test, weather conditions, moisture content of the soil at the time of the test and groundwater level. Groundwater has been taken 0m bgl according to monitoring data.

3.5.1.4 Variable Head Permeability Testing

A total number of eight rising head permeability tests were performed during development activities. The details of the tests were presented in Factual Data Report (Fugro 2022a) and are summarised in Table D.6.

3.5.1.5 P & S Wave Velocity Measurements

Seismic Cone Penetration Tests (SCPT) were carried out at 3 positions using the CPT truck. S wave velocities are summarized per unit in Table D.7.

Geophysical logging operations were carried out at three exploratory locations to measure P and S wave velocities within rock units. Collected measurements are summarised in Table D.8.

3.5.1.6 Cone Pressuremeter and High-Pressure Dilatometers

Cone Pressuremeter tests were carried out in three CPT locations. These are discussed and results presented in the factual report (Fugro, 2022a).

Nineteen High Pressure Dilatometers were carried out in 4 boreholes. These are discussed and results presented in the factual report (Fugro, 2022a).

3.5.2 Laboratory Test Data

Table 3.3 lists laboratory testing standards and statements of the testing that has been scheduled and completed and total number of tests done.

The test results are presented in the factual data report (Fugro, 2022a) and summarised and discussed further in the following sections. Tables providing details of Average, minimum (min) and maximums (max) are presented in Appendix D.

Table 3.3: Laboratory Testing Method Standards and Statements

Laboratory Tests	Laboratory Test Method(s)	Number of Tests Reported
Classification		
Moisture content	BS 1377-2:1990 BS EN ISO 17892-1:2014	90
Liquid limit, plastic limit, plasticity index	BS 1377-2:1990 BS EN ISO 17892-12:2018	93
Linear shrinkage	BS 1377-2:1990	3
Density by linear measurement	BS 1377-2:1990 BS EN ISO 17892-2:2014	5
Particle size distribution including	BS 1377-2:1990 BS EN ISO 17892-4:2016	145

Laboratory Tests	Laboratory Test Method(s)	Number of Tests Reported
Sedimentation by pipette	BS 1377-2:1990 BS EN ISO 17892-4:2016	91
Shear Strength (Total Stress)		
Undrained shear strength of a single 100 mm diameter specimen in triaxial compression without the measurement of pore pressure	BS 1377-7:1990 BS EN ISO 17892-8:2018	**2**
Shear strength of a set of three 60 mm x 60 mm square specimens by direct shear	BS 1377-7:1990	**2**
Chemical and Electrochemical		
Organic matter content *	Lab in-house method	19
Mass loss on ignition *	Lab in-house method	3
BRE SD1 A	Lab in-house method	7
BRE SD1 B	Lab in-house method	5
BRE SD1 C	Lab in-house method	64
Compaction related		
Dry density/moisture content relationship using 2.5 kg rammer (5 stages inclusive)	BS 1377-4:1990	8
Compressibility, Permeability and Durability		
One-dimensional consolidation properties/Incremental loading oedometer test	BS 1377-5:1990 BS EN ISO 17892-5:2017	7
Rock/Aggregate Testing		
Natural water content of rock sample	ISRM Suggested Methods 1974-2006.	72
Uniaxial compressive strength	ISRM Suggested Methods 1974-2006. End preparation to ASTM D4543-19.	58
Measurement of point load strength index of rock specimen	ISRM Suggested Methods 1974-2006	380

3.5.2.1 Soil Classification Testing

3.5.2.1.1 Moisture Content and Density

Water content (w) and bulk density (ρ) were measured in representative samples. The dry density (ρ_d) was then inferred from the measured ρ and w content values.

Ninety water content tests were performed in accordance with BS EN ISO 17892-1:2014 (BSI, 2014-18). Table D.9 presents a summary of the w values obtained for each stratum. Plate 3.6.2.1a to 3.6.2.1c presents plots of moisture content versus elevation.

Five bulk density (ρ) tests were performed in the laboratory in accordance with BS EN ISO 17892-2:2014 (BSI, 2014-18) and the dry density (ρ_d) was then inferred from the measured ρ

and w content values. Table D.10 provides a summary of the ρ and $\rho_d$values obtained for each stratum. Plate 3.6.2.2a to 3.6.2.2b presents bulk and dry density versus elevation.

3.5.2.1.2 Plasticity Index

Ninety three liquid and plastic limit tests were performed on selected specimens in accordance with BS EN ISO 17892-12:2018 (BSI, 2018) to assess plasticity. Table D.11 summarises the liquid limit, plastic limit and plasticity index values. Plates 3.6.2.3a to 3.6.2.3c present plots of plasticity index versus liquid limit and Plates 3.6.2.3d to 3.6.2.3f present plots of plasticity index versus elevation. Samples classified as non-plastic are summarised in Table D.12.

3.5.2.1.3 Particle Size Distribution

One hundred and forty five sieve and forty five sedimentation tests were performed on selected samples to confirm the geotechnical descriptions made during fieldwork.

The PSD results generally confirm the visual descriptions made during fieldwork; adjustments were made regarding the primary and secondary soil constituent where necessary. No changes have been made where the soil description indicates a heterogeneous (lamination or pockets of sand and/or clay etc.) constitution, as this would not be considered representative.

Plates 3.6.2.4a to 3.6.2.4p present the PSD gradings for each unit per area and Plates 3.6.2.4q to 3.6.2.4s presents plots of fines content versus elevation. Table D.13 presents a summary of the fines content.

3.5.2.2 Compaction Tests

Eight 2.5 Kg compaction tests were performed in accordance BS 1377-4: 1990 (BSI, 1990-2018). Table D.14 presents a summary of the compaction test results.

3.5.2.3 Shear Strength of Fine-Grained Soils

3.5.2.3.1 Total Stress Unconsolidated Undrained Triaxial Tests

Two undisturbed unconsolidated undrained (UU) triaxial tests were performed on undisturbed samples in accordance with BS 1377-7:1990 (BSI, 1990).

Failure was taken at 20 % axial strain unless the deviator stress peaked at a lower strain. Table D.15 summarizes the obtained values of undrained shear strength.

3.5.2.4 Direct Shear Tests

Two direct shear tests with small shearbox apparatus were performed on reconstituted samples of Ash Tip area. Test results are summarised in Table D.16.

3.5.2.5 Engineering properties of Intact Rock

3.5.2.5.1 Water Content

Water content measurements were taken for seventy two rock specimen. Results are summarized in Table D.17 and plotted versus elevation in Plates 3.6.3.1a and 3.6.3.1b.

3.5.2.5.2 Rock Strength

Three hundred and eighty Point Load tests determinations were carried out, on one hundred and forty nine samples, in accordance with ISRM (2007). Tests were carried out on range of samples taken axially, diametrically and irregular in shape and the Point Load Index (I_s) was recorded.

Due to the impact of size effects on samples the I_s value is converted to I_{s50} using Equation 3.5 and Equation 3.6 to obtain a unique point load strength index that can be used for rock strength classification.

$$I_{s50} = F\ x\ I_s$$

Equation 3.5

Where:

I_{s50} = Size-corrected point load strength index

F = Size correction factor, defined in Equation 4.2

I_s = Uncorrected point load strength

$$F = (D_e/50)^{0.45}$$

Equation 3.6

Where:

F = Size correction factor

D_e = Equivalent core diameter

Table D.18 provides a summary of the I_{s50} for each test type.

Fifty five uniaxial compressive strength (UCS) tests were completed on core samples. Table D.19 summarises the results.

The most frequent discontinuity types within the Mercia mudstone unit are bedding fractures (horizontal to subhorizontal). The point load tests (PLT) undertaken in the mudstone may have been affected by these bedding fractured dependant on whether the loading direction was taken perpendicular or parallel to the beddings. Figure 3.6 presents the axial point load index results vs. the diametral point load index results using one hundred and three samples loaded both axially and diametrically. The trends show that the size corrected axial point load index results ($I_{s(50)-axial}$) are generally higher than the size corrected diametral point load index results ($I_{s(50)-diametral}$) as shown in Equation 3.7 where the linear regression (R^2) for these tests is 0.6.

$$I_{s(50)-diametral} = 0.55\ x\ I_{s(50)-axial}$$

Equation 3.7

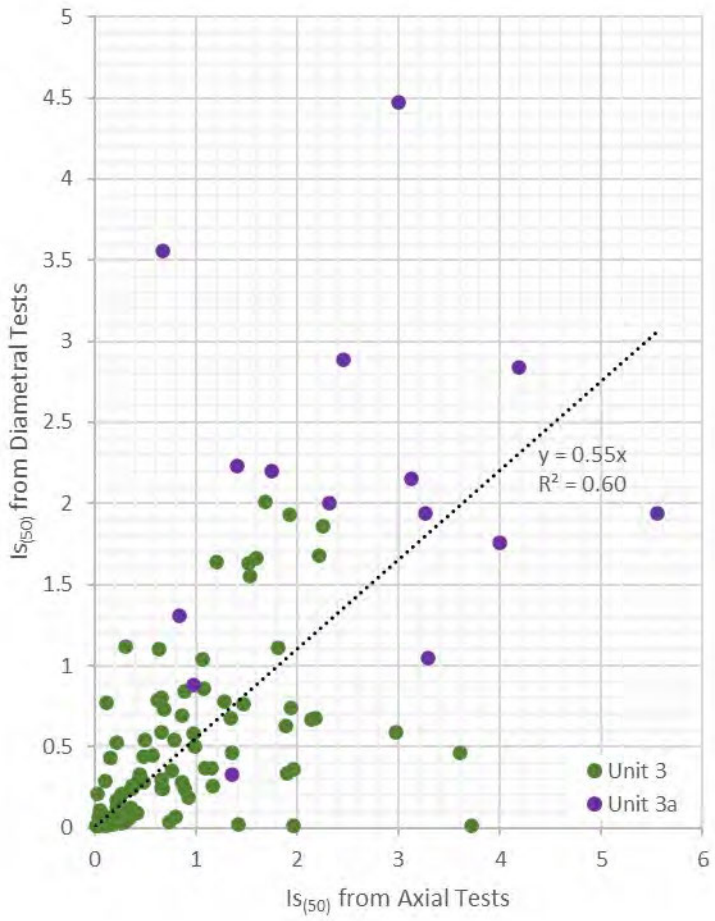


Figure 3.6: Axial point load test results vs diametral point load test results

The objective of undertaking point load tests (PLT) on the Mercia mudstone samples was to obtain a site-specific correlation between uniaxial compressive strength (UCS) and the corrected point load strength index and facilitate the estimation of UCS from the PLT data as shown in Equation 3.8.

$$q_u = I_{s(50)}\ x\ C$$

Equation 3.8

Where:

q_u = uniaxial compressive strength

$I_{s(50)}$ = corrected point load strength index

C = empirical factor to correlate between q_u and $Is_{(50)}$

The site-specific "C" was interpreted for two mudstone units (Units 3 and 3a) based on data from thirty five test sets for mudstone group (Unit 3) and seven test sets for medium strong

to strong mudstone (Unit 3a) having both UCS and $Is_{(50)}$ results. The average point load indices of each sample were calculated by removing results interpreted as having been affected by discontinuities and calculating average $Is_{(50)}$ values of the remaining axial, diametrical or irregular lump tests. Figure 3.7 presents the correlation between $Is_{(50)}$ and UCS results where values of 9 for Unit 3 and 18 for Unit 3a were selected as project specific empirical factors providing reasonable estimates of UCS values compared to the laboratory test results.

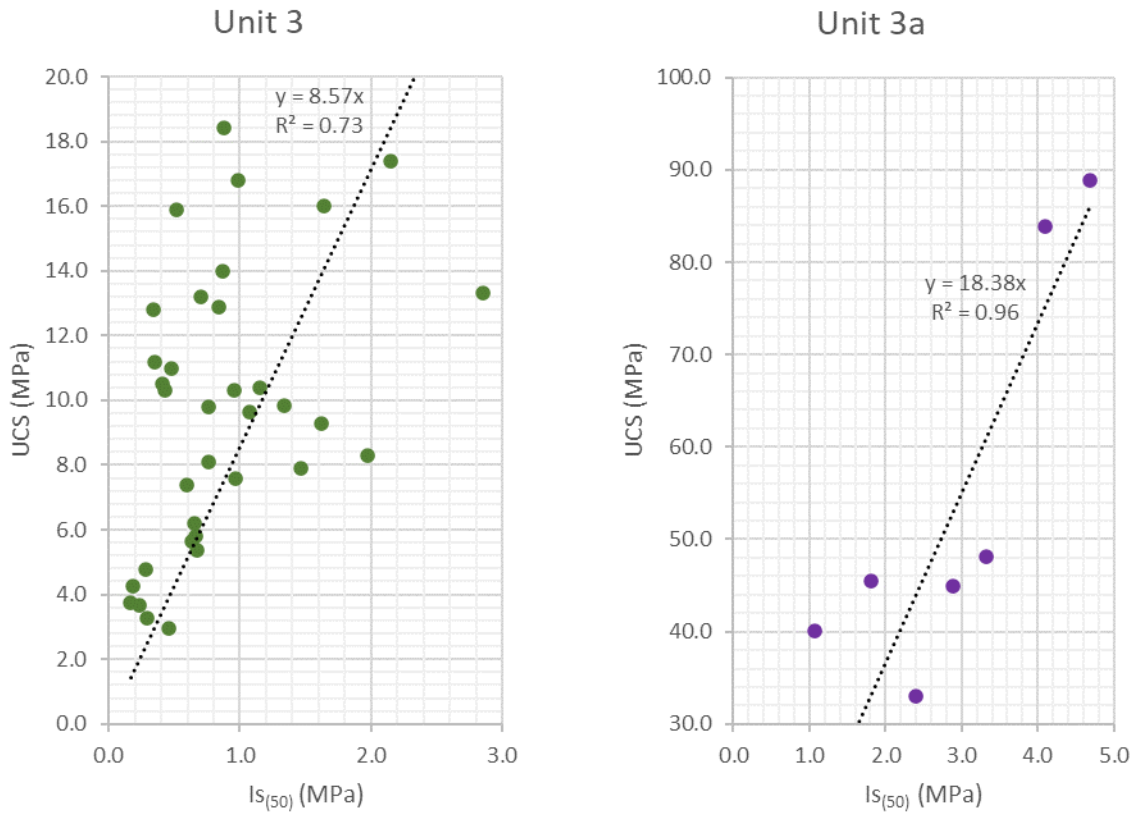


Figure 3.7: Correlation plots between corrected point load strength index and uniaxial compressive strength

Plates 3.6.3.2a and 3.6.3.2b presents the interpreted uniaxial compressive strength of the Mercia mudstone samples from PLTs and the corresponding UCS values from laboratory UCS tests of the same mudstone units. As shown on the figures, selected C factors produce a correlation of unconfined strengths similar to the correlation obtained from the laboratory UCS test data.

3.5.3 Rock mass properties

Input parameters for rock mass properties are Geological Strength Index (GSI), Uniaxial Compressive Strength (UCS), Young's modulus (Ei) and material constant (mi) for a specific rock unit.

Geological strength index (GSI) is a function of rock mass structural properties and discontinuity surface properties. The rock mass characterization is based upon visual

impression of the rock structure, in terms of blockiness, and the surface condition of the discontinuities indicated by joint roughness and alteration. Visual descriptions on cores as well as the surface conditions (SCR) of joint sets and the volumetric joint counts (Jv) were considered to estimate GSI values of rock units at each exploration location in accordance with the modified GSI classification by Sönmez and Ulusoy (2002). The low, high and median values are presented in Table 3.4.

The average GSI value for Mercia Mudstone in the project area was calculated as 35.

Table 3.4: Input parameters and estimated GSI values for Mercia Mudstone

Mercia Mudstone (Unit-3)	Volumetric joint count, Jv (RQD=115-3.3(Jv)) (Jv)	Structure Rating, SR (SR=-17.5 ln(Jv)+79.8	Surface Condition Rating, SCR (SCR=Rr,Rw,Rf)	GSI
Low	35	18	6	25
Median	23	25	9	35
High	11	38	12	45

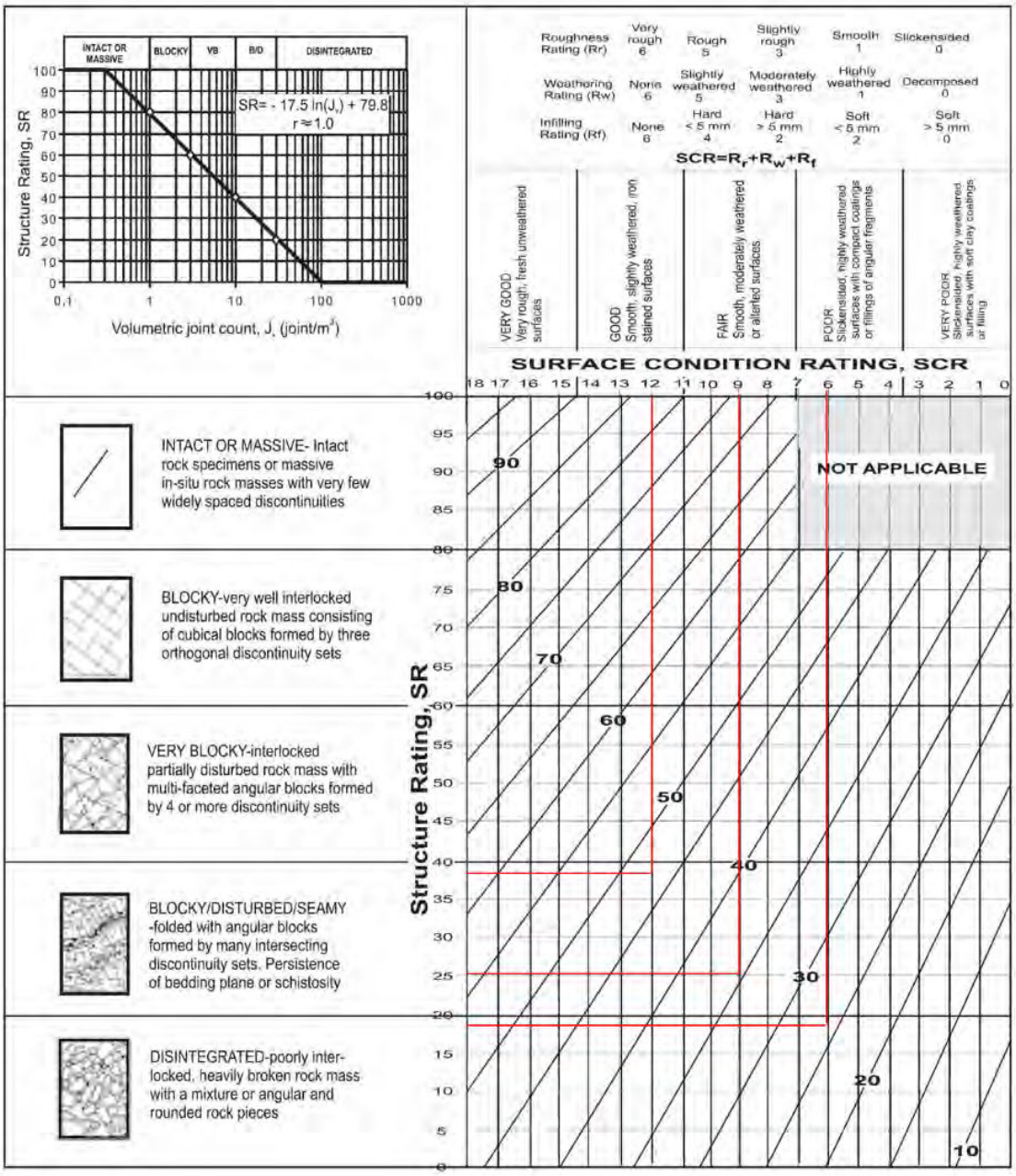


Figure 3.8: GSI Estimation for Mercia Mudstone

3.6 Strength Parameters

Estimation of in situ rock mass strength and modulus were developed using the Hoek-Brown criterion (Hoek et al., 2002), an empirically-based approach to derive non-linear shear strength envelopes for an in-situ rock mass. The Hoek-Brown criterion has been used to evaluate rock mass conditions for a range of structures and is a common method to characterize in situ rock for engineering purposes (e.g. (Zang and Einstein, 1998; Hoek, 2000; Wyllie, 1992). The criterion accounts for the strength and modulus-reducing influences of discontinuities (joints, bedding planes, faults), mineralogy and cementation effects, rock origin (e.g., sedimentary or igneous), and weathering.

Hoek-Brown method uses three input parameters to estimate rock mass strength: (1) uniaxial compressive strength (qu) of intact rock blocks; (2) material index (mi) related to rock mineralogy, cementation, and origin; and, (3) GSI that factors the intensity and surface characteristics of rock mass discontinuities and is estimated from visual examination of recovered rock core and correlations to RQD. Table 3.5 presents a summary of low, high and median values for the input data for estimating rock mass characteristics of the rock units.

Mi value was obtained from Hoek et al., 2002 for Claystone – Mudstone. The elastic modulus of rock was calculated based on the HPD testing test performed in several boreholes.

Table 3.5: Rock Mass Classification Input Parameters

Mercia Mudstone	GSI	Compressive Strength (Mpa)	mi	Ei (Mpa)
Low	25	1.5	4	3565
Median	35	6.0		
High	45	13.0		

The results of Rock Data plots are provided in Figure 3.9.

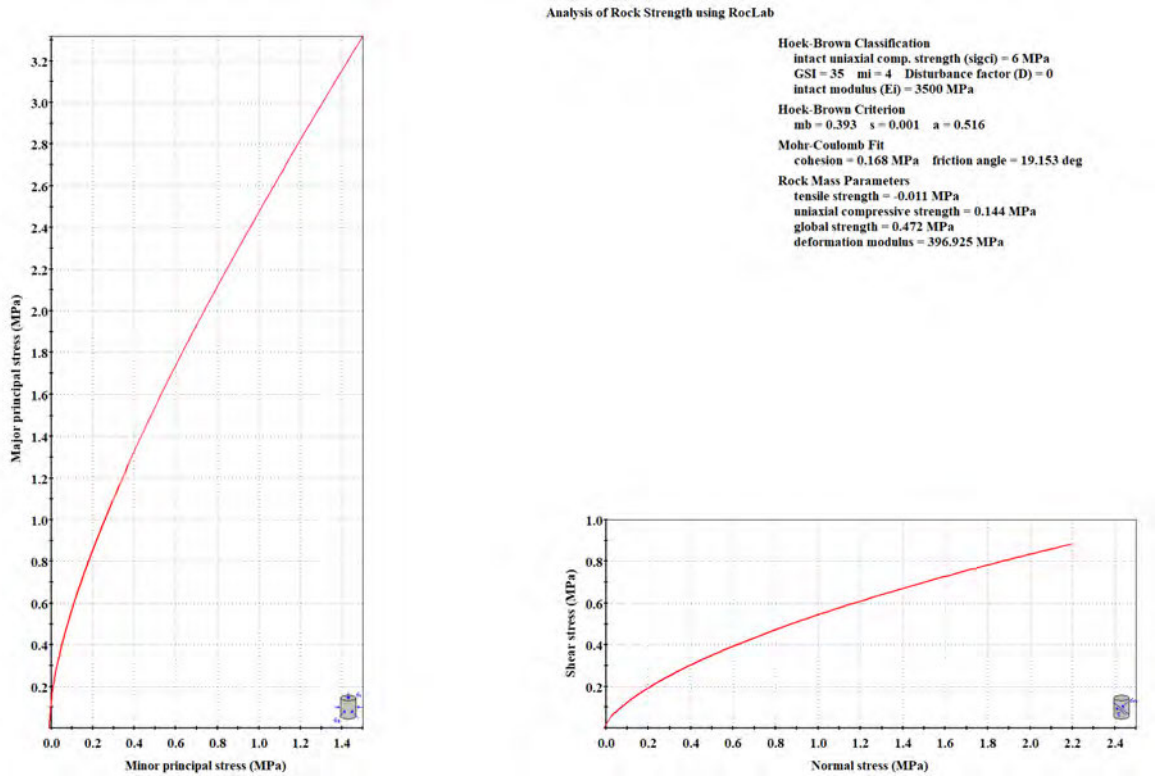


Figure 3.9: Rock data plot for Mercia Mudstone in the project area.

4. Groundwater

Thirty two locations were installed with gas/water monitoring standpipes in the project area. The details of the standpipes with geological descriptions are presented in Table 4.1.

Table 4.1: Water Monitoring Installation Details

Area	Borehole	Pipe Top Depth [mbgl]	Pipe Base Depth [mbgl]	Pipe Type	Geology
Main Site	MS-BH01	0	7	PLAIN	Made ground, Alluvium Deposits, Glaciofluvial Deposits
		7	10	SLOTTED	Glaciofluvial Deposits
	MS-BH02	0	9	PLAIN	Made ground, Alluvium Deposits, Glaciofluvial Deposits
		9	12	SLOTTED	Glaciofluvial Deposits
	MS-BH03	0	3	PLAIN	Made ground, Alluvium Deposits
		3	6	SLOTTED	Alluvium Deposits
		6	7	PLAIN	Alluvium Deposits
	MS-BH05	0	3	PLAIN	Made ground, Alluvium Deposits
		3	6	SLOTTED	Alluvium Deposits
	MS-BH07	0	9.5	PLAIN	Made ground, Alluvium Deposits, Glaciofluvial Deposits
		9.5	12.5	SLOTTED	Glaciofluvial Deposits
	MS-BH09	0	3	PLAIN	Made ground, Alluvium Deposits
		3	9	SLOTTED	Alluvium Deposits, Glaciofluvial Deposits
	MS-BH10	0	7	PLAIN	Made ground, Alluvium Deposits, Glaciofluvial Deposits
		7	10	SLOTTED	Glaciofluvial Deposits
	MS-BH12	0	5	PLAIN	Made ground, Alluvium Deposits
		5	8	SLOTTED	Alluvium Deposits, Glaciofluvial Deposits
	MS-BH13	0	7	PLAIN	Made ground, Alluvium Deposits
		7	10	SLOTTED	Glaciofluvial Deposits
	MS-BH17	0	3	PLAIN	Made ground, Alluvium Deposits
		3	6	SLOTTED	Alluvium Deposits
	MS-BH19	0	3	PLAIN	Made ground
		3	6	SLOTTED	Alluvium Deposits
	MS-BH20	0	9	PLAIN	Made ground, Alluvium Deposits
		9	12	SLOTTED	Glaciofluvial Deposits
	MS-BH21	0	14.5	PLAIN	Made ground, Alluvium Deposits, Glaciofluvial Deposits, Mercia Mudstone
		14.5	17.5	SLOTTED	Mercia Mudstone

Area	Borehole	Pipe Top Depth [mbgl]	Pipe Base Depth [mbgl]	Pipe Type	Geology
	MS-BH23	0	1	PLAIN	Alluvium Deposits
		1	6	SLOTTED	Alluvium Deposits
	MS-BH25	0	3	PLAIN	Made Ground
		3	5	SLOTTED	Made Ground, Alluvium Deposits, Glaciofluvial Deposits
Ash Tip	BH101	0.2	18	PLAIN	Made Ground
		18	21	SLOTTED	Alluvium Deposits
	BH102	0	18	PLAIN	Made Ground
		18	30	SLOTTED	Alluvium Deposits
	BH103	0	17.2	PLAIN	Made Ground
		17.2	29.2	SLOTTED	Made Ground, Alluvium Deposits
	BH104	0	4.5	PLAIN	Made Ground
		4.5	9	SLOTTED	Made Ground
	BH106	0	1	PLAIN	Made Ground
		1	5.5	SLOTTED	Made Ground
	DS101	0	0.5	PLAIN	Made Ground
		0.5	5	SLOTTED	Made Ground
	DS103	0	0.5	PLAIN	Made Ground
		0.5	5	SLOTTED	Made Ground
	DS105	0	0.5	PLAIN	Made Ground
		0.5	4.5	SLOTTED	Made Ground
	DS106	0	0.5	PLAIN	Made Ground
		0.5	4.5	SLOTTED	Made Ground
	DS107	0	0.5	PLAIN	Made Ground
		0.5	4.5	SLOTTED	Made Ground
	DS108	0	0.5	PLAIN	Made Ground
		0.5	5	SLOTTED	Made Ground
	DS109	0	0.5	PLAIN	Made Ground
		0.5	5	SLOTTED	Made Ground
	DS110	0	0.5	PLAIN	Made Ground
		0.5	5	SLOTTED	Made Ground
	DS111	0	0.5	PLAIN	Made Ground
		0.5	4.7	SLOTTED	Made Ground
Access Roads	AR-BH01	0	2	PLAIN	Made Ground
		2	5	SLOTTED	Alluvium Deposits
	AR-BH02	0	7	PLAIN	Made Ground, Alluvium Deposits, Glaciofluvial Deposits

Area	Borehole	Pipe Top Depth [mbgl]	Pipe Base Depth [mbgl]	Pipe Type	Geology
		7	10	SLOTTED	Glaciofluvial Deposits
	HR-BH01	0	2	PLAIN	Made Ground
		2	5	SLOTTED	Made Ground, Alluvium Deposits
Note: m bgl refers to existing ground level					

Table 4.2 summarises the water level readings taken from manual dips in both depth below ground level and relative to Ordnance Datum. It can be seen from the summary below that there is not a large variation in the water level readings with respect to the average value. The results indicate that in general groundwater is relatively stable with some seasonal variation.

Table 4.2: Summary of Manual Water Level Readings

Area	Borehole	Depth to Groundwater (m bgl)			Groundwater Level (mOD)		
		Average	Minimum	Maximum	Average	Minimum	Maximum
Main Site	MS-BH01	0.69	0.50	1.04	-0.27	-0.75	0.03
	MS-BH02	0.69	0.56	0.88	-0.28	-0.62	-0.08
	MS-BH03	0.90	0.72	1.17	-0.32	-1.40	0.00
	MS-BH05	0.76	0.61	1.01	-0.23	-0.97	0.04
	MS-BH07	0.72	0.60	0.83	-0.16	-0.47	0.02
	MS-BH09	0.57	0.44	0.74	-0.15	-0.65	0.04
	MS-BH10	0.81	0.73	0.96	-0.14	-0.39	-0.01
	MS-BH12	0.77	0.61	0.89	-0.08	-0.65	0.13
	MS-BH13	0.57	0.50	0.71	0.10	-0.12	0.21
	MS-BH17	1.05	0.89	1.21	-0.37	-3.22	0.02
	MS-BH19	0.78	0.48	1.01	-0.37	-2.14	0.12
	MS-BH20	1.07	0.95	1.20	-0.19	-1.64	0.03
	MS-BH21	0.83	0.72	0.80	-0.16	-0.95	0.09
	MS-BH23	0.51	0.01	0.55	0.44	-0.60	0.97
	MS-BH25	1.66	1.50	1.63	0.64	-0.06	0.80
Ash Tip	BH101	16.17	16.02	16.25	-0.01	-1.75	0.33
	BH102	16.80	16.58	17.12	0.02	-0.18	0.24
	BH103	17.81	17.58	18.02	1.52	-0.79	1.99
	BH104	6.28	6.08	6.47	0.88	-1.02	1.37
	BH106	Dry	Dry	Dry	Dry	Dry	Dry
	DS101	Dry	Dry	Dry	Dry	Dry	Dry
	DS103	Dry	Dry	Dry	Dry	Dry	Dry
	DS105	Dry	Dry	Dry	Dry	Dry	Dry
	DS106	Dry	Dry	Dry	Dry	Dry	Dry

Area	Borehole	Depth to Groundwater (m bgl)			Groundwater Level (mOD)		
		Average	Minimum	Maximum	Average	Minimum	Maximum
	DS107	Dry	Dry	Dry	Dry	Dry	Dry
	DS108	Dry	Dry	Dry	Dry	Dry	Dry
	DS109	Dry	Dry	Dry	Dry	Dry	Dry
	DS110	Dry	Dry	Dry	Dry	Dry	Dry
	DS111	2.46	2.25	2.78	2.55	1.59	2.91
Access Roads	AR-BH01	2.13	1.99	2.30	-0.01	-1.75	0.33
	AR-BH02	1.32	1.21	1.53	0.02	-0.18	0.24
	HR-BH01	1.51	1.37	1.60	-0.07	-0.97	0.13
Note: m bgl refers to existing ground level							

5. Geotechnical Assessments

This section presents the geotechnical engineering calculations for the Main Area it discusses the calculations associated with:

- Placement of the Engineered Fill
- Shallow and deep foundations (constructed after placement of the fill)
- Ground Improvement
- Pavement Design for the associated access roads
- Slope stability analysis, to assess the impact of the Ash Tips on the main site
- Dynamic properties due to vibrations from the turbine and associated plant

No details on the Engineering Fill have been provided by the Client to date so the Following assumptions has made for the calculations:

- The engineering fill materials' internal friction angle and Young's Modulus were assumed as 35° and 50 MPa respectively.
- Unit weight of the engineering fill was taken 20kN/m^3 which was agreed with client's design engineers during the meeting on 28th October.

The above parameters should be reviewed once the material to be used for the fill has been identified as these may vary dependent on several factors, such as grading, angular and particle size. A ground water level of 0.0m AOD was used across all areas. This was determined based on the ground water level measurements from the piezometers.

5.1 Engineered Fill

As part of the development, it is proposed to raise the ground level for the footprint of the new power station. Drawing CIV-DSB-DRW-SIT-GA-KEAD3-00002-001 (Rev 1) was provided to Fugro and this was used as the basis for the provision of the settlement calculations following the placement of the fill. It should be noted that should this drawing be updated or new levels determined then it is recommended that these calculations are revised, to present the conditions at construction.

Three areas were identified on the plan:

- Main Area A – Main Process Plot Ground,
- Main Area B – Admin / Control room,
- Main Area C – Entrance / Car Park.

The thickness of the engineering fill is based on the general finished ground level taken as 2.8m AOD for all three areas and estimated formation grade levels of 0.293m AOD, 0.65m AOD and 0.9m AOD respectively based on the topographical map (107695 - SSE - Keadby 3 Substation.dwg) provided by Client on 20.01.2023.

Ground Profiles presenting the unit thicknesses and top & bottom elevations of the units in the Main Area is provided in Table 5.1, Table 5.2, Table 5.3 for Area-A, B and C, respectively.

Table 5.1: Ground profile and Unit thicknesses in Area-A

Unit	Unit Code	Layer Description	Top Elevation (m AOD)	Bottom Elevation (m AOD)	Thickness (m)
Engineering Fill	EF	Engineering fill	2.8	0.3	2.5
Made ground	0	Manmade fill	0.3	-0.4	0.7
Alluvium	1a	Sand & silty Sand	-0.4	-2.1	1.7
	2a	Clay	-2.1	-2.9	0.8
	1a	Sand & silty Sand	-2.9	-4.7	1.8
	2b	Clay & silty Clay	-4.7	-5.6	0.9
Glaciofluvial Deposits	1b	Sand & silty Sand	-5.6	-13	7.4
Residual Mudstone	2c	Clay	-13	-15.5	2.5
Bedrock	3	Mercia Mudstone	-15.5	-	-

Table 5.2: Ground profile and Unit thicknesses in Area-B

Unit	Unit Code	Layer Description	Top Elevation (m AOD)	Bottom Elevation (m AOD)	Thickness (m)
Engineering Fill	EF	Engineering fill	2.8	0.8	2.0
Made ground	0	Manmade fill	0.8	0.3	0.5
Alluvium	1a	Sand&silty Sand	0.3	-2.1	2.4
	2a	Clay	-2.1	-2.8	0.7
	1a	Sand&silty Sand	-2.8	-4.5	1.7
	2b	Clay&silty Clay	-4.5	-5.3	0.8
Glaciofluvial Deposits	1b	Sand&silty Sand	-5.3	-12.9	7.6
Residual Soil	2c	Clay	-12.9	-16.6	3.7
Bedrock	3	Mercia Mudstone	-16.6		

The settlement analyses were performed using Settle3 software to consider the 3-dimensional effect of the soil strata under fill loading. The settlement calculations were initially performed using just the CPT data in the construction field. Following completion of the laboratory testing some of the parameters used were reviewed and updated based on the results. The CPT measurements are assessed to obtain the engineering parameters of each unit then according to the calculated parameters the settlement calculations are presented. The heterogenous characteristic of the manmade fill reveals weak zones in the soil profile and it may cause a reduction in bearing capacity and increased differential settlements.

Table 5.3: Ground profile and Unit thicknesses in Area-C

Unit	Unit Code	Layer Description	Top Elevation (m AOD)	Bottom Elevation (m AOD)	Thickness (m)
Engineering Fill	EF	Engineering fill	2.8	1.3	1.5
Made ground	0	Manmade fill	1.3	-0.6	1.9
Alluvium	1a	Sand & silty Sand	-0.6	-1.5	0.9
	2a	Clay	-1.5	-2.3	0.8
	1a	Sand & silty Sand	-2.3	-3.7	1.4
	2b	Clay & silty Clay	-3.7	-4.6	0.9
Glaciofluvial Deposits	1b	Sand & silty Sand	-4.6	-12.1	7.5
Residual Mudstone	2c	Clay	-12.1	-16.2	4.1
Bedrock	3	Mercia Mudstone	-16.2	-	-

From discussions with the Client, it is understood that the Made Ground will be partially removed. Therefore, the settlement calculations are performed assuming half of the manmade fill (0.3m average) will be replaced by Engineering Fill. The estimated formation levels for Area-A, Area-B, and Area-C are accepted as 0.3m, 0.8m, and 1.3m OD respectively. The total stress increment for each area was calculated separately and represented in Figure 5.1. Each CPT was modelled using the existing elevation, which provided more realistic stress increments.

Following a period of groundwater monitoring the water table was confirmed as standing at 0.0m AOD.

As the ground is dominantly made by Sand, the total settlement is governed by the immediate settlement followed by consolidation settlement on relatively thin Clay rich layers (Units 2a, 2b, 2c). Each component was calculated separately, then the total settlements are obtained.

The vertical stress increment was calculated considering the Westergaard stress computation method and that increment was determined by:

$$\sigma_z = \frac{Q}{z^2} \frac{\frac{1}{2\pi}\sqrt{\frac{1-2\nu}{2-2\nu}}}{\left[\left(\frac{1-2\nu}{2-2\nu}\right)+\left(\frac{r}{z}\right)^2\right]^{\frac{3}{2}}}$$

The immediate settlement occurs instantly after load is applied and is assumed to be linear elastic. For that reason, the strain for each element in a string was calculated from the 1D modulus and the total stress.

The relationship between the 1D modulus and 3D Young's modulus (E) is:

$$E = E_s \frac{(1+\nu)(1-2\nu)}{1-\nu}$$

The vertical strain in each sublayer is calculated by:

$$\varepsilon = \frac{\Delta\sigma}{E_s}$$

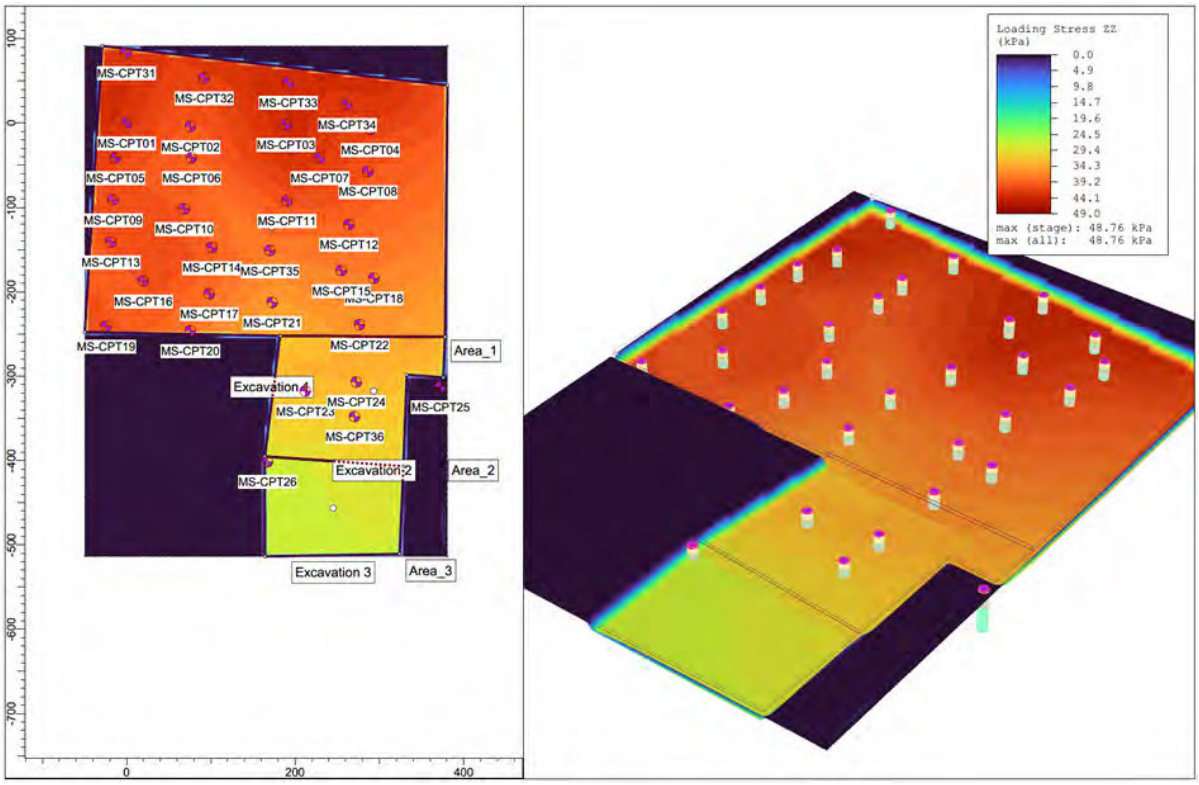


Figure 5.1: Vertical stress increment due to the engineering fill

The immediate settlement distribution on plan view Figure 5.2.

Settlement due to consolidation progresses gradually as pore pressures dissipate and effective stresses increase. The consolidation settlements are calculated via linear approach, the mv (one-dimensional compressibility) were calculated via the CPT measurement.

$$\Delta\varepsilon = mv\Delta\sigma'$$

The Compressibility coefficients were calculated for each cohesive unit and the consolidation settlement are calculated.

The consolidation settlement distribution is presented in Figure 5.3.

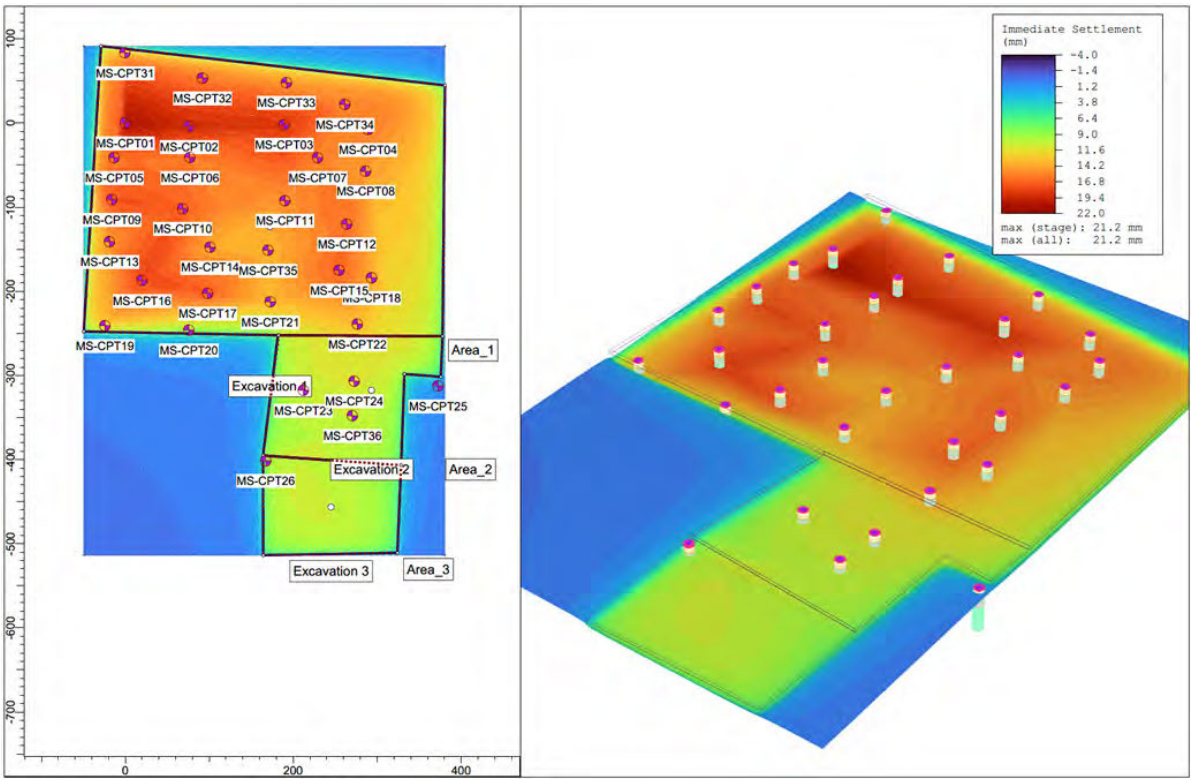


Figure 5.2: Plan View of Immediate Settlement

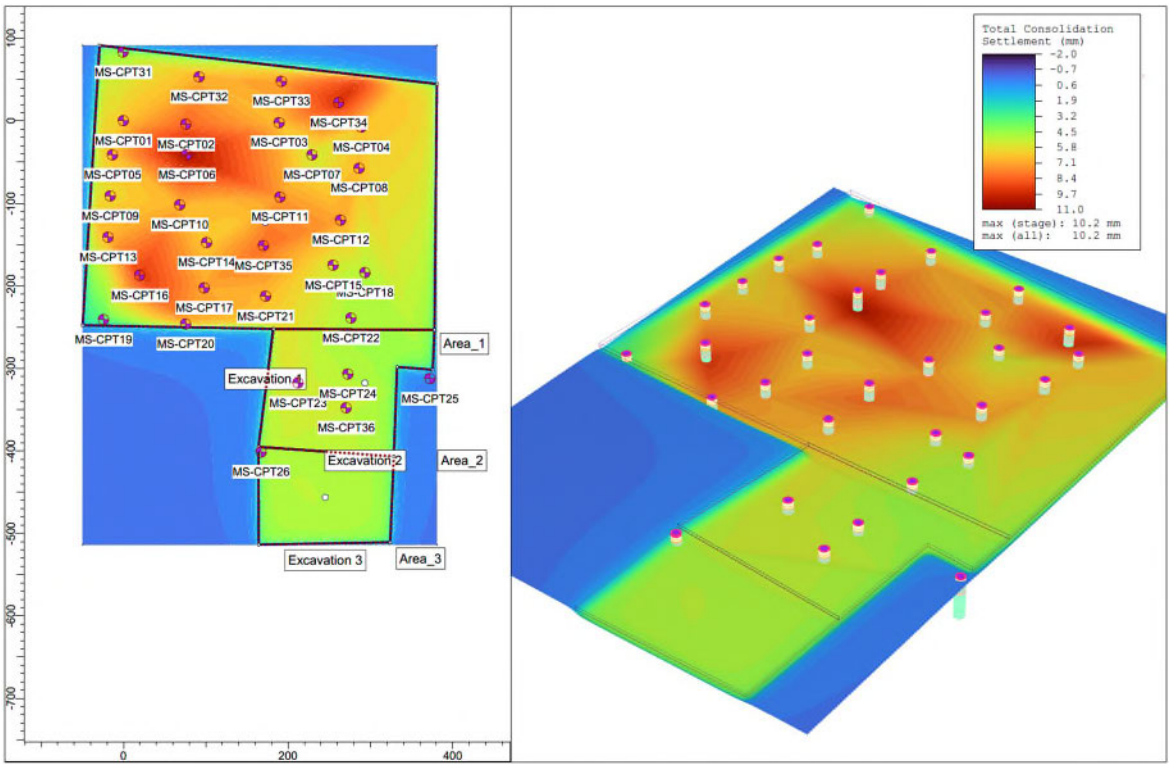


Figure 5.3: Plan View of Consolidation Settlement

The total settlement plan view is presented in Figure 5.4.

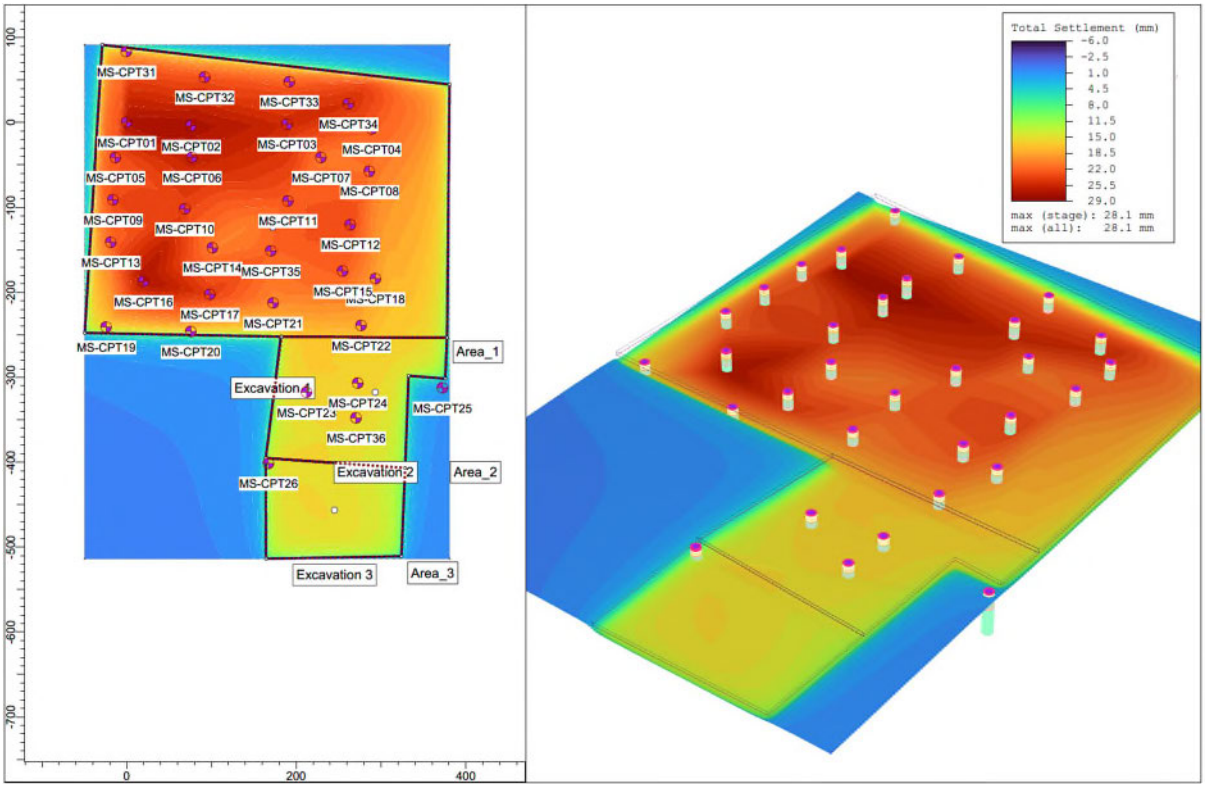


Figure 5.4: Plan View of Total Settlement

The calculated consolidation amounts for each area are presented in Table 5.4.

Table 5.4: Expected settlement values in project area

Area	Max. Immediate Settlement (mm)	Max. Consolidation Settlement (mm)	Total Settlement (mm)
Area – A Main Process Plot Ground	20.4	10.2	28
Area -B Admin/Control Room	11.6	5.5	16
Area - C Entrance/Car Park	10.6	5.0	16

Since the ground conditions in each area are homogeneous within themselves differential settlement is not expected. The maximum settlement occurs at different locations, so the total settlement is different from the total of the maximum immediate and consolidation settlement.

It is assumed that the placement of the Engineered fill will occur prior to the construction of the foundations and piles and therefore the majority of the immediate settlement will have occurred and most of the long-term settlement.

5.2 Shallow Spread Foundations

Shallow foundation bearing capacity were performed for three sub areas in the Main Area namely (Area-A, Area-B and Area-C) separately, considering the solution based on Eurocode 7 (2004) below.

$$q_u = c' * N_c * s_c * i_c * b_c + po' * N_q * s_q * i_q * b_q + \frac{1}{2} * B' * \gamma' * N_\gamma * s_\gamma * i_\gamma * b_\gamma$$

where:

$$N_c = (N_q - 1)/tan\phi' \qquad N_q = \tan^2\left(\frac{\pi}{4} + \frac{\phi'}{2}\right) * e^{\pi * tan\phi'} \qquad N_\gamma = 2 * (N_q - 1) * tan\phi'$$

$$s_c = \frac{s_q * N_q - 1}{N_q - 1} \qquad s_q = 1 + \frac{B}{L} * \sin\phi' \qquad s_\gamma = 1 - 0.3 * \frac{B}{L}$$

$$i_c = \frac{i_q * N_q - 1}{N_q - 1} \qquad i_q = \left(1 - \frac{H}{V + B * L * \frac{c'}{tan\phi'}}\right)^m \qquad i_\gamma = \left(1 - \frac{H}{V + B * L * \frac{c'}{tan\phi'}}\right)^{m+1}$$

$$b_c = \frac{b_q * N_q - 1}{N_q - 1} \qquad b_q = (1 - \alpha * tan\phi')^2 \qquad b_\gamma = (1 - \alpha * tan\phi')^2$$

$$m = m_L * \cos^2\theta + m_B * \sin^2\theta$$

$$m_L = \frac{2 + L/B}{1 + L/B} \;\&\; m_B = \frac{2 + B/L}{1 + B/L}$$

The soil profile for each area used in the bearing capacity calculations are given in Table 5.1, Table 5.2 and Table 5.3 for Area-A, B and C respectively.

The verification methodology was selected as EN 1997 - (DA2) and therefore the load factors and the resistance factors were determined as Eurocode-7 suggestions.

According to calculations based on the CPT data, the friction angle of Unit 1a and Unit 1b varies between 34-38 and 36-40 respectively. Therefore, the friction angle values of Units 1a and 1b were assumed as 34°, and 36° respectively to be on the safe side.

The design bearing capacity, calculated in accordance with Eurocode 7, was performed for various foundation dimensions and the results for each area are summarized in Table 5.5.

As indicated in Figure 5.5 the footing depth was taken as 0.45m below the finished grade level, based on the information provided by the client. Full calculations for the design bearing capacities are presented in Appendix E.2.

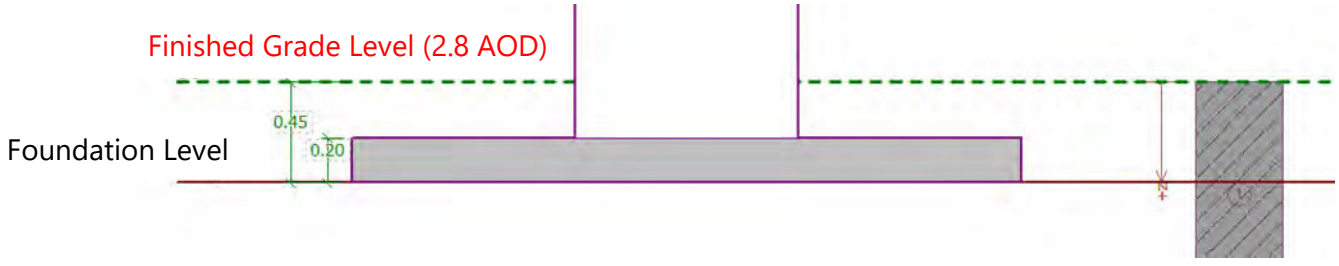


Figure 5.5: Foundation location according to the Finished Grade Level

From a review of the analysis, it was identified that settlements at some of these design capacities was considerable (Table 5.5). Therefore an allowable bearing pressure was determined where settlement was limited to 25mm.

Table 5.5: Design bearing capacities for all areas (settlement not limited)

Foundation Size (m)	Foundation Area (m^2)	Depth of Footing (m)	Design Bearing Capacity (kPa)
Area-A			
1.5x1.5	2.25	0.45	255
3.0x3.0	9	0.45	366
4.0x6.0	24	0.45	530
5.0x10.0	50	0.45	650
7.5x12.5	93.75	0.45	1042
10x20	200	0.45	1256
Area-B			
1.5x1.5	2.25	0.45	262
3.0x3.0	9	0.45	370
4.0x6.0	24	0.45	525
5.0x10.0	50	0.45	678
7.5x12.5	93.75	0.45	1063
10x20	200	0.45	1208
Area-C			
1.5x1.5	2.25	0.45	185
3.0x3.0	9	0.45	297
4.0x6.0	24	0.45	420
5.0x10.0	50	0.45	623
7.5x12.5	93.75	0.45	991
10x20	200	0.45	1094

For each foundation size, in each sub area, the allowable bearing pressures were calculated and these values and a settlement assessment for Area-A, Area-B and Area-C are presented in Table 5.6, Table 5.7 and Table 5.8 respectively.

respectively. It should be noted that the settlement for the foundation size of 1.5x1.5 does not exceed 25mm, therefore the design bearing capacity is equal to allowable bearing pressure for this foundation type.

The settlement presented in these calculations is in addition to the settlement of the Engineered Fill. It is considered that as the parameters used are those obtained from the current investigation, there is likely to be a beneficial increase in these following the placement of the Engineered Fill, which cannot be accounted for here. If there is concern that the combination of long term settlement (from the Engineered Fill) and the limited allowable

settlement from the Foundations could be detrimental to the proposed structures. Then an option could be to surcharge the Engineered Fill along with some monitoring of groundwater and extensometers to monitor settlement in each of the units.

Table 5.6: Allowable Bearing pressures and settlement assessment for Area-A

Foundation Size (m)	Foundation Area (m^2)	Depth of Footing (m)	Allowable Bearing Pressure (kPa)	Immediate Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
1.5x1.5	2.25	0.45	255	10	1	11
3.0x3.0	9	0.45	285	20	5	25
4.0x6.0	24	0.45	176	18	7	25
5.0x10.0	50	0.45	137	17	8	25
7.5x12.5	93.75	0.45	110	17	9	25
10x20	200	0.45	92	16	9	25

Table 5.7: Allowable Bearing pressures and settlement assessment for Area-2

Foundation Size (m)	Foundation Area (m^2)	Depth of Footing (m)	Allowable Bearing Pressure (kPa)	Immediate Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
1.5x1.5	2.25	0.45	262	10	1	11
3.0x3.0	9	0.45	285	20	5	25
4.0x6.0	24	0.45	190	18	7	25
5.0x10.0	50	0.45	151	17	8	25
7.5x12.5	93.75	0.45	120	16	9	25
10x20	200	0.45	100	16	10	25

Table 5.8: Allowable bearing pressures and settlement assessment for Area-3

Foundation Size (m)	Foundation Area (m^2)	Depth of Footing (m)	Allowable Bearing Pressure (kPa)	Immediate Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
1.5x1.5	2.25	0.45	185	14	1	15
3.0x3.0	9	0.45	146	22	3	25
4.0x6.0	24	0.45	102	20	5	25
5.0x10.0	50	0.45	84	19	6	25
7.5x12.5	93.75	0.45	70	19	6	25
10x20	200	0.45	61	18	7	25

Following the allowable bearing pressures, the net allowable bearing pressures were calculated where the overburden pressure at foundation level (9kPa) is deducted from the allowable bearing pressures. These are presented in Table 5.9.

Table 5.9: Net allowable bearing pressures for all areas

Area Name	Foundation Size (m)	Net Allowable Bearing Pressure (kPa)
Main Area-A	1.5x1.5	246
	3.0x3.0	276
	4.0x6.0	167
	5.0x10.0	128
	7.5x12.5	101
	10x20	83
Main Area-B	1.5x1.5	253
	3.0x3.0	276
	4.0x6.0	181
	5.0x10.0	142
	7.5x12.5	111
	10x20	99
Main Area-C	1.5x1.5	176
	3.0x3.0	137
	4.0x6.0	93
	5.0x10.0	75
	7.5x12.5	61
	10x20	52

As it is seen on above table, as the thickness of the engineering filling increases, the bearing capacity increases accordingly.

5.3 Modulus of Subgrade Reaction

The Modulus of Subgrade Reaction (k) is a stiffness parameter used predominantly for the design of slab foundations. This parameter can be obtained from both vertical and horizontal loading.

For vertical values of the Modulus of Subgrade Reaction (k_v) the following equation is used:

$$k = p/s$$

Where:

k = Modulus of Subgrade Reaction
p = Applied pressure
s = Resultant Soil Displacement

This value can be determined using a plate load test and was obtained as part of the ground investigation. It is determined using the formula above for the applied stress at 0.00125m (or 1.25mm) plate penetration. This value is then multiplied by a conversion factor of 0.629 (this is the value for a 455mm plate) to obtain the k762 value, which is the Modulus of Subgrade

reaction corrected for plate size of 762mm. Table 5.10 summarises the locations, depths, stress at 1.25mm penetration and k762 values. These results apply to the existing ground level only and should not be used in the assessment of the Engineered Fill.

It can be seen from the results that the value of the Modulus of Subgrade Reaction is dependent on the applied load. It is recommended that these tests are carried out again once the Engineered Fill has been placed and ideally at founding level to obtain the most appropriate value for the assessment of any raft foundations. When designing the test more appropriate structural loads should be utilised.

For horizontal Moduli of Subgrade Reaction (k_h) calculations have been done as part of the pile analysis presented later in Section 5.5.

Table 5.10: Summary of Modulus of Subgrade Reaction (K762) values from plate load tests

Location No.	Depth (m BGL)	Applied Stress at 1.25mm plate penetration (kPa)	Modulus of Subgrade Reaction (k762) (kN/m^3)
AR_CBT01	0.2	34.828	17,528
AR_CBT02	0.2	52.101	26,221
AR_CBT03	0.2	40.312	20,228
AR_CBT04	0.2	22.627	11,387
AR_CBT05	0.2	22.195	11,170
AR_CBT06	0.2	36.165	18,201
AR_CBT07	0.2	20.878	10,508
AR_CBT08	0.2	27.916	14,049
AR_CBT09	0.2	24.594	12,378
AR_CBT10	0.2	24.864	12,514
AR_CBT11	0.2	28.095	14,139
AR_CBT12	0.2	31.734	15,971
AR_CBT13	0.4	29.912	15,054
AR_CBT14	0.2	38.682	19,468
AR_CBT15	0.2	19.163	9,644
AR_CBT16	0.2	36.965	18,604

Notes:
BGL – refers to existing ground level.

5.4 Pile Design calculations

The pile capacity calculations are performed for different pile dimensions and loading conditions provided by client which are summarized in Table 5.11.

Table 5.11: Applied Serviceability States

Pile	Type	Diameter	Axial Load	Lateral Load	Tensile Load
A	CFA	750mm	2700kN	125kN	125kN
B	CFA	600mm	1700kN	125kN	125kN
C	CFA	600mm	1150kN	75kN	75kN
Da	CFA	600mm	550kN	75kN	50kN
Db	CFA	450mm	550kN	75kN	50kN
Dc	CFA	300mm	550kN	75kN	50kN

Calculation of vertical and lateral pile resistance is performed according to the publication: NAVFAC DM 7.2, Foundation and Earth Structures, U.S. Department of the Navy 1984. For SWL calculations the reduction factors have been assumed as the following:

Reduction coeff. of shaft resistance, γ_s=2.0
Reduction coeff. of base resistance, γ_b=3.0
Coeff. of resistance tension, γ_{st}=0.7 (R_s*0.7)
Reduction coeff. of lateral bearing cap., γ_{Qu}=3.0

The calculation details are presented in the Appendix E3 and discussed further in sections 5.5 and 5.6. Whilst these calculations provide an assessment of the vertical and lateral capacities of the piles and settlements these are considered conservative. It is recommended that a test pile is installed after placement of the fill and prior to piling works to assess how the piles will perform, particularly if they are required to resist dynamic loading. This will also allow for better soil partial factors providing a more cost effective and accurate design.

5.5 Axial Load Capacity

The axial load capacities of the pile types were calculated according to the below approaches.

5.5.1 Axial Load Capacity of Bored Piles in Cohesionless Soils

Pile shaft resistance for cohesionless soils is given by:

$$R_s = \sum_{j=1}^{n} K_j . \sigma_{ef,j} . tg\delta_j . A_{s,j}$$

where:

K_j -coefficient of lateral earth pressure in the j^{th} layer
$\sigma_{ef,j}$ -effective strength of soil in the j^{th} layer
δ_j -pile skin friction angle (between pile material and surrounding soil in the j^{th} layer)
A_{sj} -area of the pile shaft in the j^{th} layer

Pile base resistance for cohesionless soils is given by:

$$R_b = \sigma_{efb} . N_q . A_b$$

where:

σ_{efb} -effective stress on the pile base
σ_{efb} -effective stress on the pile base
N_q -bearing capacity factor (see Table 5.12.)
A_b -area of pile base

Table 5.12: Bearing capacity factors (Nq) for driven and bored piles

Angle of internal friction φ[°]	26	28	30	31	32	33	34	35	36	37	38	39	40
Bearing capacity factor Nq for driven piles	10	15	21	24	29	35	42	50	62	77	86	120	145
Bearing capacity factor for bored piles	5	8	10	12	14	17	21	25	30	38	43	60	72

5.5.2 Axial Load Capacity of Bored Piles in Cohesive Soils

Pile shaft resistance for cohesive soils is given by:

$$R_s = \sum_{j=1}^{n} \alpha_j . c_{u,j} . A_{s,j}$$

where:

α_j -skin friction coefficient in the j^{th} layer
$c_{u,j}$ -undrained cohesion in the j^{th} layer
A_{sj} -area of the pile shaft in the j^{th} layer

Reference values of the adhesion coefficient α are listed in Table 5.13:

Table 5.13: Empirical adhesion coefficient α

Pile material	Soil consistency	Cohesion range c_u [kPa]	Adhesion coefficient α [-]
Timber and concrete piles	Very soft	0 - 12	0.00 - 1.00
	Soft	12 - 24	1.00 - 0.96
	Medium stiff	24 - 48	0.96 - 0.75
	Stiff	48 - 96	0.75 - 0.48
	Very stiff	96 - 192	0.48 - 0.33
Steel piles	Very soft	0 - 12	0.00 - 1.00
	Soft	12 - 24	1.00 - 0.92
	Medium stiff	24 - 48	0.92 - 0.70
	Stiff	48 - 96	0.70 - 0.36
	Very stiff	96 - 192	0.36 - 0.19

The adhesion coefficient has been selected for each cohesive layer respectively considering undrained shear strength, cu values.

Pile base resistance for cohesive soils is given by:

$$R_b = 9.c_u.A_b$$

where:

- **c_u** -undrained shear strength at the base
- **A_b** - area of pile base

5.5.3 Axial Load Capacity of Bored Piles in Rock

According to the FHWA-NHI 18-024 (Drilled Shafts: Construction Procedures and Design Methods) unit side resistance for shafts in rock may be evaluated on the basis of mean uniaxial compressive strength of the rock, as follows:

$$\frac{f_{SN}}{p_a} = C\sqrt{\frac{q_u}{p_a}}$$

where:

- **q_u** - mean value of uniaxial compressive strength for the rock layer,
- **p_a** -atmospheric pressure in the same units as q_u, and
- **C** - a regression coefficient used to analyse load test results.

Pile base resistance for rock is given by:

$$q_{BN} = N^*_{cr}\, q_u$$

Where:

- **q_u** - mean value of uniaxial compressive strength for the rock layer,
- **N_{cr}** - empirical bearing capacity factor for rock.

GEO5 software is used for the bearing capacity calculation of each pile type. Pile base resistance of rock is modelled as cohesive soil as the pile base resistance for rock is governed by the undrained shear strength. Therefore, the half of the minimum UCS (q_u) value is considered for input parameters which equals to undrained shear strength, c_u values.

The adhesion factor (α) is selected based on the graph presented in Figure 5.6.

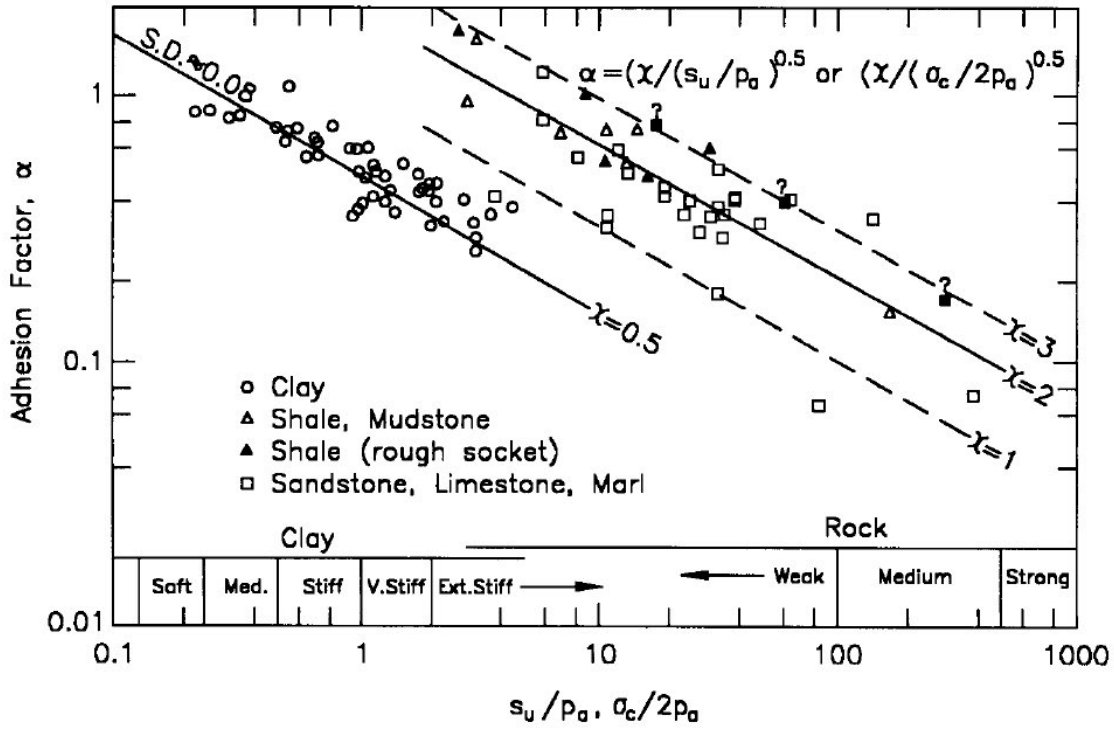


Figure 5.6: Design curves for unit side resistance and adhesion factor versus strength

5.6 Settlement of Piles

The settlement calculations of piles have been performed by Poulos Method and the settlements due to the Safe Working Load (SWL) are summarized in Table 5.14. Note that 0.3m soil strip and replacement with engineering fill was considered on calculations. The settlement curves are presented in the appendices E3.

5.6.1 Analyses Results

The calculations have been performed for the Area-A ground conditions. The ground profile used in the pile capacity calculations is presented in Figure 5.7. The GWT was at 0.0 AOD based on the GWL monitoring data.

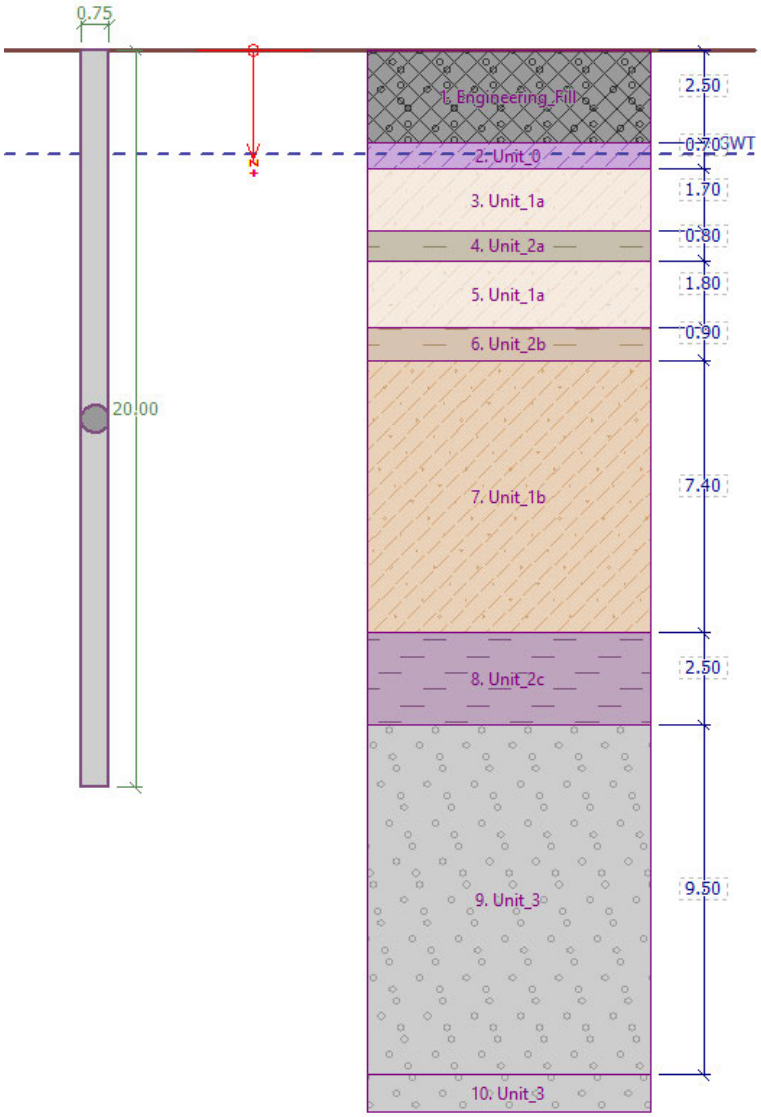


Figure 5.7: Soil Profile for Piled Foundations

According to the analysis results the skin, base and total bearing capacities and settlement under SWL for each pile dimension and loading conditions are summarized in the Table 5.14 below.

Table 5.14: SWL Capacities and Settlements of Piles

Pile	Diameter	Skin Resistance	Base Resistance	Safe Working Load Capacity	Allowable Tensile Capacity	Pile Length	Pile Settlement
A	750mm	1765kN	2186kN	3952kN	1238kN	20m	4.4mm
B	600mm	1342kN	1399kN	2742kN	942kN	20m	3.7mm
C	600mm	688kN	462kN	1151kN	483kN	15m	2.5mm
Da	600mm	512kN	383kN	895kN	359kN	12m	2.3mm
Db	450mm	346kN	216kN	562kN	243kN	12m	1.7mm
Dc	300mm	432kN	392kN	782kN	303kN	19m	2.1mm

According to the analysis results the required length for each pile dimension and loading conditions are presented in Table 5.15.

Table 5.15: Pile Lengths for Applied Loads

Pile	Type	Diameter	Axial load	Lateral Load	Tensile Load	Required Length
A	CFA	750mm	2700kN	125kN	125kN	20m
B	CFA	600mm	1700kN	125kN	125kN	20m
C	CFA	600mm	1150kN	75kN	75kN	15m
Da	CFA	600mm	550kN	75kN	50kN	12m
Db	CFA	450mm	550kN	75kN	50kN	12m
Dc	CFA	300mm	550kN	75kN	50kN	19m

As it is presented on Client drawings, the site will be raised to an elevation of 2.8 AOD (finished grade level) this has been included calculations to ensure the pile ca. In case of any change on engineering fill thickness, the pile lengths should be adjusted

Pile A and Pile B were extended through the rock layer to obtain the necessary end-bearing capacity with a minimum 2.5D (diameter) socket length. Additionally, for the same reason, Pile D's length has been calculated to a minimum of 12m to socket in Layer 1b enough.

The top elevation of the strong layer in Mercia mudstone varies between -15.0 to -20m AOD. It is higher to the west of the Main Area-A and gradually getting lower towards southeast. Note that the 20m long piles Type A and Type B (from 2.8 AOD) may not reach to the strong layer in the Mercia mudstone according to the ground model developed based on the current site data, however the pile designs should be checked site specifically.

5.7 Lateral Load Capacity

The lateral load capacity calculations have been performed according to the Brom's method. The pile head is assumed as fixed and the dominant soil type has been assumed as cohesionless. Therefore, the moment at failure caused by the lateral earth pressures and ultimate lateral resistance are calculated according to the equations below.

$$M_r = 0,5\gamma DL^3 k_p$$

$$P = \frac{0.5\gamma DL^3 k_p}{e + L}$$

Within the software used the lateral deflection of a pile was calculated using the horizontal Modulus of Subgrade Reaction (k_h) using Vesic's formula, which determines k_h from the modulus of elasticity for the pile and soil.

$$k_h = \frac{0.65}{d}\sqrt[12]{\frac{E_s}{E_p}\frac{d^4}{I_p}}\frac{E_s}{1-\nu^2}$$

Where:

Ep = modulus of elasticity of pile [MPa]

Ip = moment of inertia of pile [m^4]

Es = modulus of elasticity of soil [MPa]

d = pile diameter [m]

ν = Poisson's ratio [-]

K_h values calculated within the pile program are summarised in Table 5.17 and plotted in Figure 5.8. The figure shows that the value of k_h is impacted by the diameter of the pile and the soil type, with the smaller diameter piles presenting the largest kh values. The analysis found that the smallest diameter pile Dc could not resist the lateral loads.

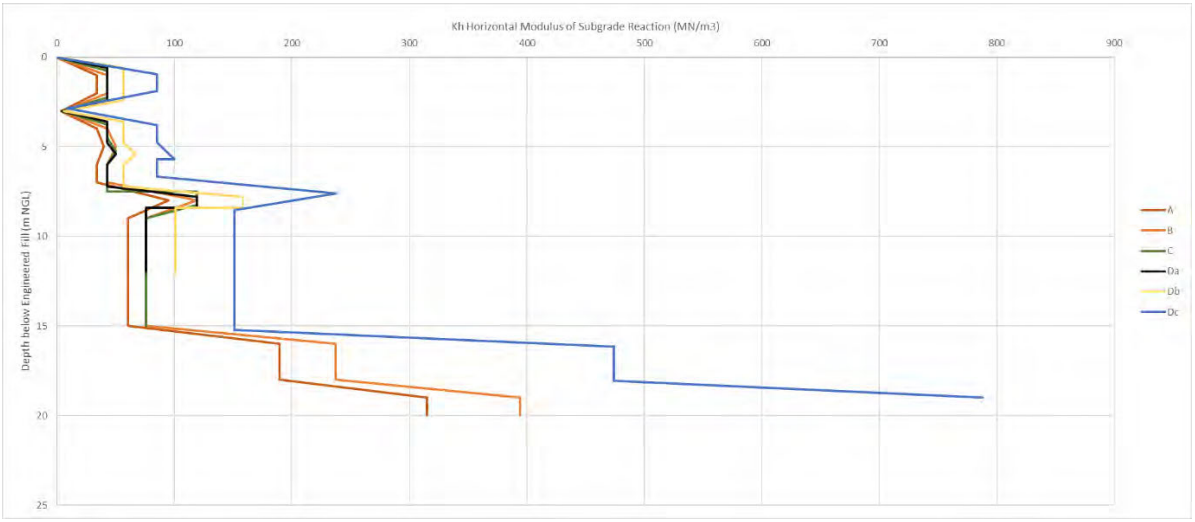


Figure 5.8: Plot of all piles k_h values vs depth below Engineered Fill [m NGL]

The dimensionless lateral deflections at the ground surface have been plotted in Figure 5.9 as a function of the dimensionless length ηL in which:

$$\eta = \sqrt[5]{\frac{n_h}{EI}}$$

The lateral deflections at the ground level are calculated from the figure below.

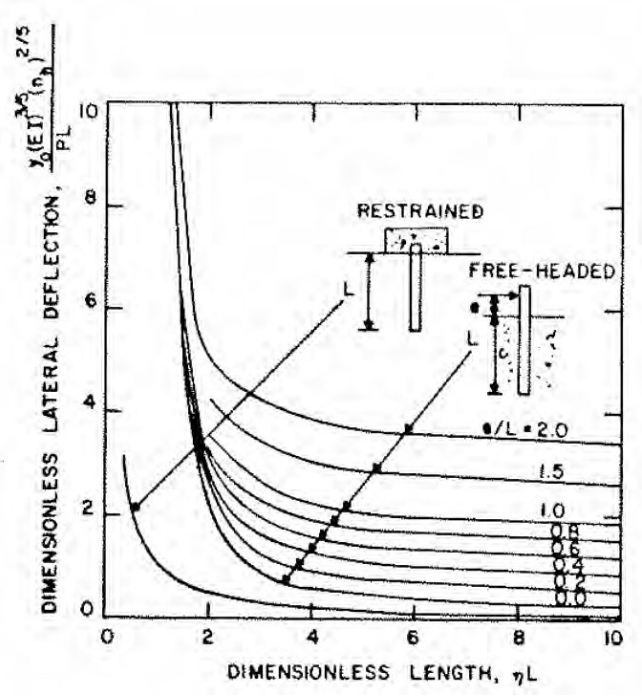


Figure 5.9: Cohesionless soil – lateral deflection at ground surface (Brom's, 1964b).

The allowable lateral load and bending moment capacities of each pile type were calculated according to the minimum steel ratio (ρ_{min}=0.005) for piles suggested in EC-7. The deflection of each pile the piles were calculated according to the applied lateral loads.

The calculations results are presented in Table 5.16.

Table 5.16: Allowable lateral capacities and lateral deflections of the piles

Pile	Diameter	Flexure Bearing Capacity, M_u	Horizontal Load Capacity, Q_u	Pile Length	Applied Lateral Load	Deflection of the pile at the ground level
A	750mm	290kNm	711kN	20m	125kN	0.5mm
B	600mm	153kNm	364kN	20m	125kN	0.0mm
C	600mm	153kNm	364kN	15m	75kN	1.8mm
Da	600mm	74kNm	364kN	12m	75kN	3.5mm
Db	450mm	67kNm	153kN	12m	75kN	2.8mm
Dc	300mm	36kNm	45.22kN	19m	75kN	Not Satisfactory

The top elevation of the piles is assumed at 2.8 AOD (finished grade level) and the length calculations were performed with that consideration.

Pile A and Pile B were extended through the rock layer to obtain the necessary end-bearing capacity with a minimum 2.5D (D: pile diameter) socket length. However, given that pile C and D caries less loads, the 14m and 12m pile lengths are sufficient to carry the load without need to socket these piles into Rock.

The calculations are presented in Appendix E.3.

Table 5.17: Summary of k_h values from pile analyses

Pile	A		B		C		Da		Db		Dc	
Diameter	0.75		0.6		0.6		0.6		0.45		0.3	
Length	20		20		15		12		12		19	
	Depth [m NGL]	Modulus k_h [MN/m^3]	Depth [m NGL]	Modulus k_h [MN/m^3]	Depth [m NGL]	Modulus k_h [MN/m^3]	Depth [m NGL]	Modulus k_h [MN/m^3]	Depth [m NGL]	Modulus k_h [MN/m^3]	Depth [m NGL]	Modulus k_h [MN/m^3]
	0	0	0	0	0	0	0	0	0	0	0	0
	1	34.05	1	42.56	0.75	42.56	0.6	42.56	0.6	56.75	0.95	85.13
	2	34.05	2	42.56	1.5	42.56	1.2	42.56	1.2	56.75	1.9	85.13
	3	3.42	3	4.28	2.25	42.56	1.8	42.56	1.8	56.75	2.85	8.56
	4	34.05	4	42.56	3	4.28	2.4	42.56	2.4	56.75	3.8	85.13
	5	39.99	5	49.99	3.75	42.56	3	4.28	3	5.71	4.75	85.13
	6	34.05	6	42.56	4.5	42.56	3.6	42.56	3.6	56.75	5.7	99.98
	7	34.05	7	42.56	5.25	49.99	4.2	42.56	4.2	56.75	5.7	85.13
	8	95.07	8	118.84	6	42.56	4.8	42.56	4.8	56.75	6.65	85.13
	9	60.5	9	75.63	6.75	42.56	5.4	49.99	5.4	66.65	7.6	237.68
	10	60.5	10	75.63	7.5	42.56	6	42.56	6	56.75	8.55	151.26
	11	60.5	11	75.63	7.5	118.84	6.6	42.56	6.6	56.75	9.5	151.26
	12	60.5	12	75.63	8.25	118.84	7.2	42.56	7.2	56.75	10.45	151.26
	13	60.5	13	75.63	9	75.63	7.8	118.84	7.8	158.45	11.4	151.26
	14	60.5	14	75.63	9.75	75.63	8.4	118.84	8.4	158.45	12.35	151.26
	15	60.5	15	75.63	10.5	75.63	8.4	75.63	8.4	100.84	13.3	151.26
	16	189.63	16	237.04	11.25	75.63	9	75.63	9	100.84	14.25	151.26
	17	189.63	17	237.04	12	75.63	9.6	75.63	9.6	100.84	15.2	151.26
	18	189.63	18	237.04	12.75	75.63	10.2	75.63	10.2	100.84	16.15	474.08
	19	315.18	19	393.98	13.5	75.63	10.8	75.63	10.8	100.84	17.1	474.08
	20	315.18	20	393.98	14.25	75.63	11.4	75.63	11.4	100.84	18.05	474.08
					15	75.63	12	75.63	12	100.84	19	787.95

Note:
m NGL – refers to new ground level following placement of Engineered Fill.

5.8 Ground improvement

Based on the ground conditions encountered at Keadby 3 site it is considered that ground improvement techniques will not be required at the main site. This is due to the presence of greater thicknesses of coarse stratum in the footprint and the placement of the engineered fill. Clay layers identified were generally thin and when loaded will drain relatively quickly.

The CBR results along the existing roads were quite variable and consideration could be given to using ground improvement techniques to provide local strength increases. This appeared to be mainly associated with the Access Road.

5.9 Pavement Design

In accordance with Highways England (2020) the CBR values were used to determine the subgrade surface modulus (E) using the formula:

$$E = 17.6(CBR)^{0.64}$$

The summary of CBR values are presented in Table D.5.

It should be noted that this formula is valid for CBR values in the Range of 2 to 12 per cent, but to provide the values of E presented in the tables below and to show the range it has been used for all CBR values.

5.9.1 Access Road (AR)

The majority of the CBR results for the access road were obtained using the plate load test at a depth of 0.2mbgl, with a few Dynamic cone penetrometer tests (DCP's). The E values determined from these results are presented in Table 5.18.

The results indicate that there is considerable variation, the design subgrade surface modulus would be the lowest value from the above 11.1MPa, which is lower than the recommended value of 30MPa Highways England (2020). Based on this value improvement works would be required which could consist of the following:

- Replacement of soft material to a depth of 500 to 1000mm with an appropriate granular fill
- Use of geogrids and geotextiles
- Ground improvement techniques such as lime stabilisation to improve the subgrade.

The DCP results when compared to the insitu CBR's indicate higher values, particularly at depths greater than the plate load test values and a deeper founding level could be considered of around 0.5mbgl with an appropriate build up. It is recommended that once subgrade level is identified some additional CBR's are carried out at this level prior to construction to confirm this is appropriate.

Table 5.18: Summary of Subgrade Surface Modulus for the Access Road

Depth (m BGL)	Access Road (AR) Subgrade Surface Modulus E (MPa)		
	Min.	Max.	Average
GL	72	177	103
0.10	91	242	172
0.20	11.1	127	27
0.30	135	229	182
0.40	18	255	136
0.60	138	138	138
Note: m BGL refers to existing ground level			

5.9.2 Bonyhale Road (BR)

The Bonyhale Road CBR's were performed using a Lightweight Deflectometer (LWD), these were done at surface as it was understood these materials would be suitable to act as a subbase layer for the pavement the E values determined from these results are summarised in Table 5.19.

Table 5.19: Summary of Foundation Surface Modulus for Bonyhale Road

Depth (m BGL)	Bonyhale Road (BR) Foundation Surface Modulus E (MPa)		
	Min.	Max	Average
Existing GL	144	2041	568

Based on the results a design value of 144MPa can be used for the Foundation Surface Modulus. Should a new foundation also be required, then additional CBR values will need to be carried at subgrade level.

5.9.3 Haulage Road (HR)

The CBR values for a new Haulage Road were determined using a combination of DCP's and LWD's and they are summarised in Table 5.20. The LWD's were done at surface at locations the DCP could not access due to the presence of underground services.

Table 5.20: Summary of Surface Modulus for the Haulage Road

Depth (m BGL)	Haulage Road (HR) Subgrade Surface Modulus E (MPa)		
	Min.	Max	Average
GL	91	455	240
0.1	55	624	316
0.75	72	72	72
1.1	187	187	187
Note: M BGL refers to existing ground level			

Based on the results obtained and a design value of Subgrade Surface Modulus for the Haulage Road is 55MPa.

5.10 Slope Stability Analyses

The existing ash tips sit at heights ranging between 18.01 - 19.08 m AOD next the main site which is sitting at heights ranging between 0.33 – 2.30 m AOD. Anecdotal evidence has indicated that there is evidence of very shallow surficial failures on these slopes. Based on this a slope stability analysis has been carried out to assess the potential for a more deep-seated failure to occur.

The analysis was carried out using a proprietary software called SLOPE/W. Based on a review of the available cross-sections this was done using the Cross-section H which had the greatest thickness of ash fill present.

For the purposes of the analysis the Alluvium is identified as a single unit. From Section H the clay layers appear to thin out under the tip, so the parameters presented in Table 5.21 assume lower values for each of the units based on the SPT results from the 100 series boreholes. Groundwater was based on monitoring data and ranged from 1.99 m AOD within the fill to 0.0m AOD under the main site, as indicated in Section 4.

Table 5.21: Summary of material parameters

Soil type	Pulverised Fuel Ash	Alluvium
Unit Weight (Mg/m^3)	16	16.6
Friction Angle φ (°)	28	28
Cohesion (kPa)	0	0

The program runs several analytical methods, as indicated in Table 5.22.

Table 5.22: Summary of critical slips for the various analytical methods

Analysis Method	Ordinary	Bishop	Janbu	Morgenstern-Price
Factor of Safety (FOS)	1.547	1.791	1.616	1.724

The lowest value was obtained using the ordinary method giving a factor of safety of 1.547. Normally, less than 1.2 would be considered to require remedial measures.

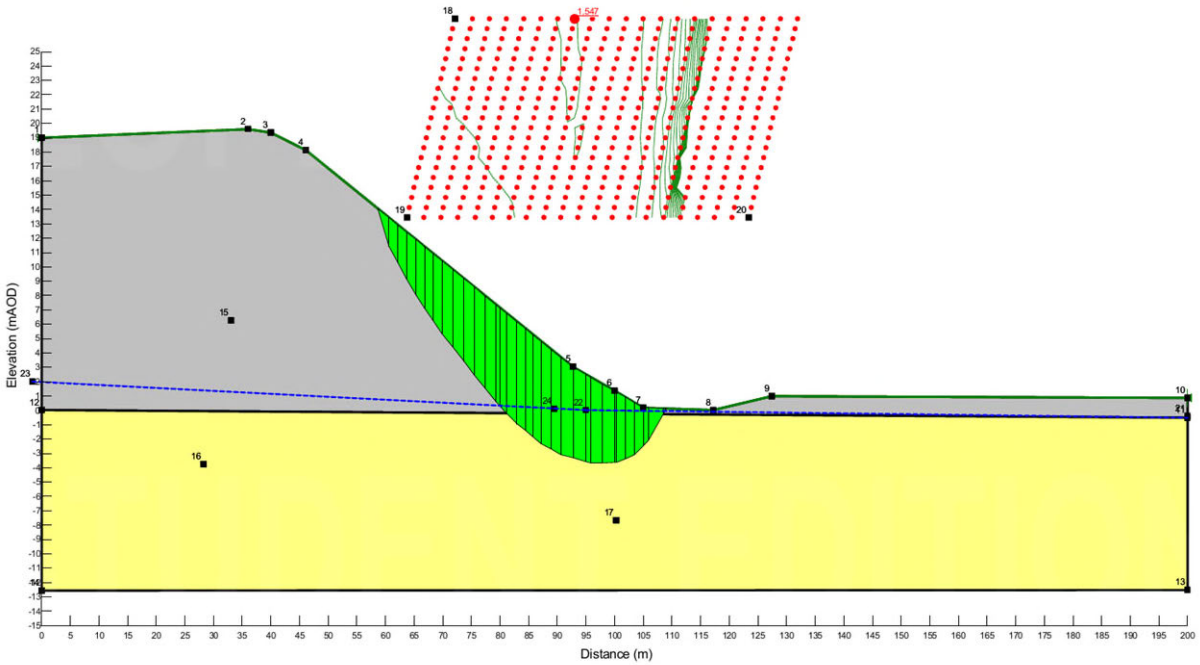


Figure 5.10: Slope stability analysis showing geometry and lowest critical slip surface.

Based on the above it is considered that in general the slopes are stable and that any slips seen are likely to be associated with burrowing animal activity.

5.11 Dynamic Properties

The turbine and some of the associated plant will produce vibrations which will mean that the underlying ground conditions will be subject to dynamic loading.

5.11.1 Soil and Pile Spring stiffnesses (X,Y,Z) direction (static and dynamic)

The client has requested that Fugro provide these, it is considered that the present calculations and assessments already reported the the vertical loads and corresponding settlements, which can be further derived as the stiffness of soil-structure system.

Figure 5.11 taken from the ICE (2013) indicates the problems associated with using soil springs is that the settlement is assumed to be uniform when a uniform load is placed on a uniform foundation. However, when assessed assuming a continuum it can be seen that settlement will more likely be greater in the centre of the foundation with increased contact stress towards the edges.

The best approach to using springs is to undertake an interactive analysis with the geotechnical and structural engineers once the structural loading and layouts have been confirmed. This will then ensure that the appropriate values have been determined.

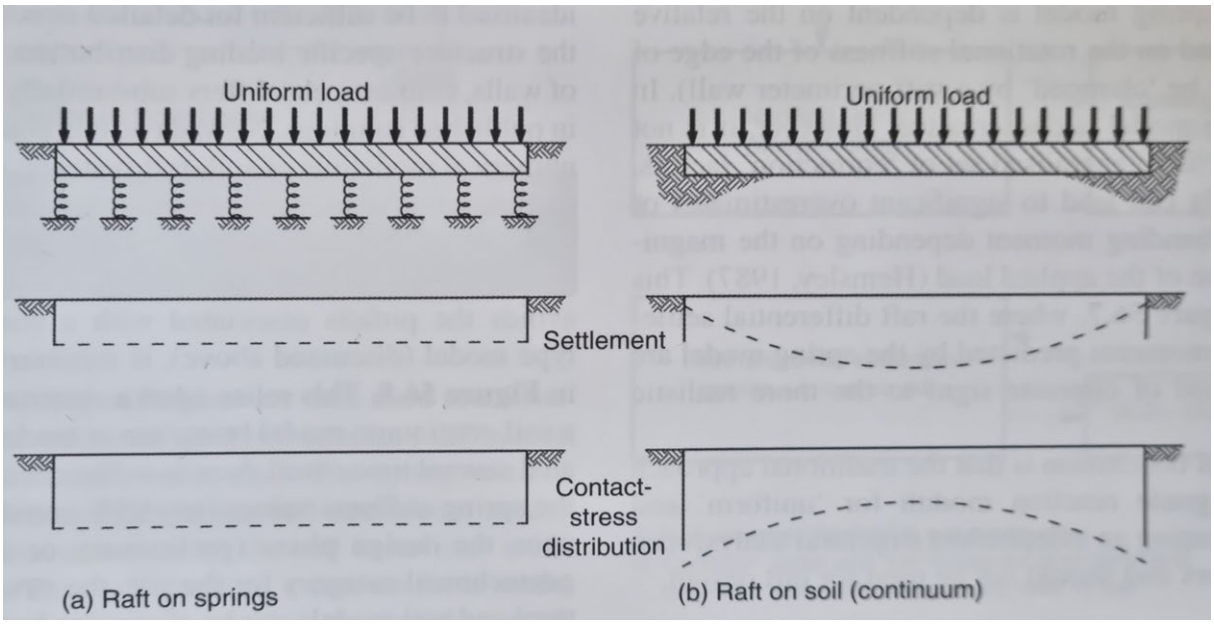


Figure 5.11: Implications of using springs for geotechnical design.

5.11.2 Modulus of elasticity/ elastic modulus (including dynamic), Elastic Shear modulus and Elastic compression modulus.

Table D.1 indicates mean values of Small Strain Shear Modulus (Go) and Elastic Secant Modulus (Es), respectively, per layer code, obtained by CPT correlations, amongst other parameters. Table D.2 presents a summary of the variation of those parameters, per layer code, including minimum, maximum and standard deviation for each, amongst other parameters.

In Fugro (2022a), Appendix H Section H.14, includes parameters obtained by in-situ High Pressure Dilatometer and Cone Pressuremeter tests, including due to cyclic intrinsic procedures, linear (HPD) and non-linear (CPM) interpretations. In general, values of Shear Modulus and Elastic Modulus have been reported for different strain levels, varying from 0.01% to 1%.

For the sake of understanding, some of these parameters have been interpreted to address the applicable geotechnical units and included in this dynamic analysis section. Note that there is a full range of reported parameters within each test, by depth, following the description in previous sections of the above-mentioned report.

Poisson ratio has been adopted as 0.33 for both HPD linear and CPM non-linear interpretations. Table 5.23 and Table 5.24 provides a summary of some of the data from the Cone Pressuremeter testing and the High Pressure Dilatometer.

Table 5.23: Summary of parameters from the Cone Pressuremeter testing

Unit No.	No tests	MPa Gy	No loops	MPa alpha	- beta	[a] MPa Gs 0.01%	[b] MPa Gs 0.1%	[c] MPa Gs 1%	[d] MPa E's 0.01%	[e] MPa E's 0.1%	[f] MPa E's 1%
0	-	-	-	-	-	-	-	-	-	-	-
1a	5	122	16	9.777	0.725	113	61	33	300	161	87
2a	1	15	4	1.201	0.663	25	12	5	67	30	14
2b	3	63	11	3.498	0.626	109	46	20	290	122	52
1b	6	133	20	18.106	0.761	157	88	50	417	233	134
2c	-	-	-	-	-	-	-	-	-	-	-

Table 5.24: Summary of parameters from the High Pressure Dilatometer

Unit No.	No tests	MPa Gi	MPa Gy	No loops	- k0	[a] MPa Gur	[b] MPa E'	% epsilon_c	kPa Pc	f[a,b] - ν
3	19	927	575	19	1.701	2373	6311	0.5862	5220	0.33

5.11.3 Poisson ratio

Table D.8 presents the Poisson ratio derived for P-S Logging seismic tests performed in the rock mass. They are presented in average, minimum and maximum values.

For the non-elastic analysis the CPM used the following formulae:

$Gs=\alpha*\gamma^{(\beta-1)}$

$Es=2*\alpha*(1+\nu)*(\gamma)^{(\beta-1)}$

Where γ is the correspondent shear strain.

For the layer units above the rock mass, Poisson Ratio was estimated as 0.33 and that correlates perfectly with the elastic theory E = 2G(1 + ν) at the same strain.

5.11.4 Coefficient of uniform compression, Coefficient of non-uniform compression, Coefficient of uniform shear, Coefficient of non-uniform shear

These coefficients are used specifically for machine foundations in dynamic analysis, and Fugro are not aware of the structural layout and design input. However, assuming it relates to a spread footing, intrinsically limited by the Engineering Fill support (parameters for which have been assumed by Fugro) and its interface with the footing (sliding check), Table 5.25 tentatively indicates the coefficients, based on the shape and dimensions of the footings. A Young Modulus of 50MPa and Poisson Ratio of 0.33 have been assumed, respectively.

Table 5.25: Summary of possible values for the machine foundation coefficients

m Length	m Breadth	alpha	ν	MPa E	kg/cm3 cu	kg/cm3 cphi	kg/cm3 cr	kg/cm3 cpsi
1.5	1.5	1	0.33	50	3.9525	7.4357	3.1715	4.7573
3	3	1	0.33	50	1.976272	3.717828	1.585751	2.378626
4	6	0.6666667	0.33	50	1.222307	2.062872	1.00007	1.500105
5	10	0.5	0.33	50	0.862969	1.360589	0.715657	1.073485
7.5	12.5	0.6	0.33	50	0.62204	1.022959	0.511491	0.767236
10	20	0.5	0.33	50	0.431485	0.680294	0.357828	0.536743

Notes:
cu - coefficient of uniform compression
cphi - coefficient of nonuniform compression
cr - coefficient of uniform shear
cpsi - coefficient of nonuniform shear
To convert kg/cm3 to KN/m3 multiply by 10,000

It is recommended that once the Engineering Fill has been obtained and placed, a cyclic plate load and horizontal test are undertaken to determine these coefficients.

6. Geoenvironmental Assessment

As part of the investigation geoenvironmental samples were taken to develop an understanding of the potential contaminants that may impact the site and to generate a geoenvironmental risk assessment.

6.1 Environmental Assessment Framework

The Land Contamination: Risk Management (LCRM) Guidance (EA, April 2021) outlines how to assess if there is unacceptable risk and to recommend which options are the most suitable to manage the risk through the implementation of remediation, if necessary. The guidance is based upon The Model Procedures for the Management of Land Contamination, CLR 11 (EA, 2004), and was originally developed to provide a technical framework for applying a risk management process when dealing with land potentially affected by contamination. The scope, framework and purpose remain the same, despite being archived in March 2014 (EA, 2004).

The process involves identifying, deciding on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. Environmental assessors use a Source-Pathway-Receptor (SPR) style Conceptual Site Model (CSM) when determining the risk posed by a potentially contaminated site. For probable risk to arise each stage of the SPR linkage must be present, plausible, and significant.

Our approach follows the framework provided in the new guidance, the stages and tiers of which can be briefly summarised as follows:

Stage 1 Risk Assessment (RA)

- Tier 1: Preliminary Risk Assessment (PRA, can include Exploratory Investigation)
- Tier 2: Site Investigation and Generic Quantitative Risk Assessment (GQRA)
- Tier 3: Detailed Quantitative Risk Assessment (DQRA)

Stage 2 Options Appraisal (OA)

Decide if sufficient up to date information is available.

- Tier 1: Identify feasible remediation options.
- Tier 2: Detailed evaluation of options.
- Tier 3: Selection of final remediation option.

Stage 3 Remediation Strategy (RS)

- Tier 1: Develop a Remediation Strategy.
- Tier 2: Remediation and Verification.
- Tier 3: Long term monitoring and maintenance (if required).

Based on the above, under the LCRM guidance this would be an exploratory investigation forming part of the Tier 1 Preliminary Risk Assessment.

6.2 Preliminary Conceptual Site Model

The client provided a previous geoenvironmental report, Structural Soils (2017) which provided a conceptual site model. Whilst this report is of use this was for the Keadby 2 site to the east of the Keadby 3 site.

6.2.1 Methodology

Utilising the method outlined in Section 6.1 an assessment has been made based on the information from Structural Soils (2017) and an understanding of the site to provide a Preliminary Conceptual Site Model (CSM). This CSM follows the Source-Pathway-Receptor model outlined within Land Contamination Risk Management (2021) and forms a Stage 1 Risk Assessment.

The risk assessment utilises the Source-Pathway-Receptor approach as outlined within the guidance, these are defined as the following.

- **Source** – a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution. Sources can also be defined as the origin of a hazard, such as pollutants and contaminants.
- **Pathway** – a route by which a receptor is or could be affected by a contaminant.
- **Receptor** – something that could be adversely affected by a contaminant, for example a person, controlled waters, an organism, an ecosystem, or Part 2A receptors such as buildings, crops or animals.

The over-riding principle of the source-pathway receptor model is to identify any potential contaminant linkages to assess the overall risk. The risks are assessed based on their potential severity and the probability of occurring, in an approach based on the guidance within the UK CIRIA report C552 (2001). For the CSM the grading for the severity of the risk and the probability of occurring are detailed respectively in Table 6.1and Table 6.2.

Table 6.1: Severity of the Risk

Grading	Classification
Severe	Acute risks to Human Health Major pollution of Controlled Waters (Surface Waters or Aquifers)
Moderate	Chronic (long term) risks to human health; Pollution of sensitive controlled waters (surface waters and aquifers)
Low	Pollution of non-sensitive water resources
Minor	Requirement for PPE and specialist equipment during site works to mitigate health effects. Damage to non-sensitive ecosystems or species.
Nominal	Risks are around the day to day life levels (Human health).

Table 6.2: Probability of Risk Occurrence

Likelihood	Classification
High Likelihood	Contaminant linkage may be present, and risk is almost certain to occur in the longer term with evidence that it will impact and cause harm to the receptor.
Likely	Contaminant linkage may be present and it is probable that the risk will occur over the long term.
Low Likelihood	Contaminant linkages may be present and there is the possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but circumstance under which harm would occur are improbable.

The overall evaluation of the level of risk is determined from the comparison of the severity of the risk and the probability of occurrence. This is presented in Table 6.3.

Table 6.3: Comparison of Severity and Risk

		Severity				
		Severe	Moderate	Low	Minor	Nominal
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Likelihood	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk	Nominal Risk

Table 6.4 provides a Qualitative description of the typical consequences and potential actions required for each risk once identified.

Table 6.4: Qualitative Risk Assessment – Classification of Consequence

Classification	Definition
Very High Risk	Severe harm to the receptor, which could already be occurring, or a high likelihood of severe harm arising to a receptor. Will require immediate remedial works and mitigations measures to be completed.
High Risk	Harm is likely to arise to receptor and is likely to be severe unless appropriate remedial action and mitigation measures are undertaken. Remedial works may be required in the short term but may also be required over the longer term.
Moderate Risk	Possible harm could arise to a receptor, but unlikely to be severe. Har is likely to be mild with the possibility that some remedial works may be required in the longer term.
Moderate / Low Risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence result in a risk that is above low, but not sufficient to be to be classified as moderate. Limited further targeted investigation works may be required to clarify the risk, if necessary, remediation works are likely to be limited in extent.
Low Risk	Possible that harm could arise to a receptor. Such harm, at worst, would normally be mild.
Very Low Risk	Low Likelihood that harm could arise to a receptor. Such harm is unlikely to be any worse than mild and for a short time.

Classification	Definition
Nominal Risk	Very low likelihood of harm occurring, very unlikely to occur. No remedial measures to be required.

6.2.2 Preliminary Conceptual Site Model

Table 6.5 presents a Preliminary Conceptual Site Model based on the limited understanding of the history of the site and previous investigation data provided This will been used as the basis for the review of the findings from the current investigation.

Table 6.5: Preliminary Conceptual Site Model

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
Contamination within Made Ground or natural soils associated with current or historic industrial/commercial land use including as nearby power stations Former agricultural land use.	Dermal contact, ingestion and inhalation of dusts and/or fibres	Construction workers during construction phase and decommissioning phase. Maintenance workers during the operational phase. Neighbouring site users/ members of the public nearby during the construction phase	Medium	Low	MODERATE / LOW RISK Main source of contamination would be the PFA tips which could contain various materials. A ground investigation targeting the identified sources should be undertaken to qualify and quantify potential risks to future site users during operation. This data should be utilised to produce the risk assessment and method statements for construction workers during the construction phase. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures before undertaking maintenance on the pipeline. Prior the construction phase a suitable Remediation Strategy (if required) to detail the removal and disposal of any soil/ groundwater and a Construction Environmental Management Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation.
	Inhalation of hazardous ground gases/vapours.	Construction workers during construction phase and decommissioning phase. Future site users Neighbouring site users (if contamination is mobilised during the construction phase)	Medium	Low	
	Overland flow. Leaching of contaminants through the unsaturated zone and subsequent impact on groundwater. Impact to groundwater via poor quality drainage. Vertical migration to underlying superficial and bedrock aquifers.	Underlying groundwater On and off-site surface water features Flora and fauna	Medium	Low	MODERATE / LOW RISK Surface waters courses drains and the River Trent. A targeted ground investigation to establish the baseline groundwater and immediately adjacent surface water course conditions prior to the construction of the Proposed Development should be undertaken. Should significant existing groundwater or surface impact be identified then suitable remediation and mitigation measures will be required during construction (within the remediation strategy and CEMP) and operation (within the design of drainage)

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review
					to prevent the mobilisation and migration of this impact. The CEMP should detail the proposed dewatering methods and mitigation measures for prevention of construction drainage or spillages from impacting nearby water courses or the groundwater.
	Direct contact with corrosive substances (e.g., sulphates and hydrocarbons) in the soil and shallow groundwater; and accumulation of hazardous gases within structures (explosive risk).	Buildings and infrastructure during the operational phase.	Medium	Low	MODERATE / LOW RISK There is potential for contaminants within Made Ground / natural strata that could impact the proposed below ground infrastructure. The ground investigation should include analysis of an appropriate selection of samples, both targeted and to provide general coverage, for potential contaminants which could be corrosive to infrastructure i.e., sulphate and hydrocarbons.
Naturally occurring organic rich peat deposits.	Inhalation of hazardous ground gases/vapours.	Future site users (within buildings) Neighbouring site users during construction where construction processes could cause gas migration	Severe	Low	MODERATE RISK Naturally occurring Peat deposits have been identified in previous investigations which could also present a ground gas source. The ground investigation should include the provision of gas wells and appropriate monitoring if an identified source of ground gas is within 50m of the Proposed Development. The results of the ground gas monitoring should be used to inform the design of gas protection measures or remedial works.

6.3 Background Soil Chemistry

The background soil chemistry has been collated from UKSO (2022) to aid assessment of Generic Quantitative Risk Assessment for the revised conceptual site model. Based on the conceptual site model (CSM) produced by WSP - Volume II (2022), the background readings have been screened against Generic Assessment Criteria for commercial land use. The background concentrations were screened against the most conservative criteria and none of the published background soil metal concentrations exceeded the GAC.

Table 6.6: Summary of indicative background

Analyte	GAC for Commercial Use (mg/kg)	Main Site	Ash Tip	Access Road	Readings Exceeding GAC Concentrations
Arsenic	640	18.42	18.42	21.25	No
Cadmium	190	0.41	0.41	0.50	No
Chromium III	8600	73.27	73.27	82.19	No
Copper	68000	22.81	22.81	23.93	No
Lead	1100	87.42	87.42	129.79	No
Nickel	980	30.45	30.45	36.51	No
Selenium	12000	0.37	0.37	0.36	No
Reference – background readings taken from UKSO (2022) interactive map for the centre point of the identified area					

6.4 Results for Soil Analysis

One hundred and twenty seven soil samples were sent for environmental testing. To assist with the analysis with the appropriate GAC's (particularly for organics) the results were split based on their organic matter content using the values of 1%, 2.5% and 6% in accordance with the relevant guidance.

6.4.1 Asbestos

Eighty-six samples of Made Ground were subject to asbestos screening. Three had asbestos identified in them two were associated with the main site the other the ash tip. The remainder of the results were No Asbestos Detected (NAD). Where asbestos was identified the samples were quantified and the type of asbestos was identified, these results are presented in Table 6.7.

Table 6.7: Summary of samples where asbestos was identified.

Sample ID	BH103	MS-BH25	MS-BH17
Depth (m BGL)	5.80-5.80	0.75-0.75	0.50-0.50
Sample No.	ES 21	ES 9	ES 4
Asbestos Quantification - Gravimetric - %	<0.001	<0.001	<0.001
Asbestos Quantification - PCOM Evaluation - %	<0.001	<0.001	<0.001
Additional Asbestos Components (Using TM048)	None	None	None
Analysts Comments	N/A	-	N/A
Asbestos Quantification - Total - %	<0.001	<0.001	<0.001
Chrysotile (White) Asbestos	Detected	Detected	-
Amosite (Brown) Asbestos	-	-	Detected
Comments	Fibre bundle in soil	Fibre bundle in soil	Loose fibres in soil

6.4.2 Organics PAH/TPH's

Concentrations of PAHs ranged from the Laboratory's Limit of Detection (LOD) or <118, with the highest concentration detected in a sample from MS-BH13 at 0.40mbgl (14,900µg/kg total PAH).

Petroleum Hydrocarbon (TPH or EPH) concentrations were mostly below the Laboratory's LOD of 35mg/kg. The highest concentration was detected in MS-BH02 at 0.85mbgl (630mg/kg Made Ground,).

6.4.3 Metals

Arsenic concentrations ranged from just above the LOD to a maximum of 149mg/kg (BH102 at 1.0mbgl).

Cadmium concentrations in ranged between the LOD to 0.736mg/kg where the maximum concentration was identified in MS-BH09 at 0.10mbgl.

Chromium III concentrations ranged between 2.44mg/kg to 46.7mg/kg. Chromium VI was not detected above the LOD of <0.6mg/kg.

Copper concentrations ranged between 3.61mg/kg to 122mg/kg. The highest copper concentration detected was identified in DS101 at 0.40mbgl.

The highest lead concentration of 86.2mg/kg was detected in MS-BH21 at 0.10mbgl, which is a relatively low concentration for Made Ground.

Mercury concentrations were all <0.1mg/kg, nickel concentrations were all below 61.5mg/kg, selenium concentrations did not exceed 10.4mg/kg and zinc concentrations did not exceed 323mg/kg.

6.4.4 pH and SO_4

Fifty four pH, fifty six sulphate aqueous extract as SO4, five acid-soluble sulphate as SO4 and five total potential sulphur tests were performed on selected soil samples to determine the risk they pose to any future buried concrete structures. Testing and classification was completed in line with the BRE guidance, notably BRE Special Digest 1: Concrete in Aggressive Grounds (2005). For natural strata a greenfield setting has been assumed, for made ground a brownfield setting has been assumed. Ground water has been assumed as mobile in all locations. Acid-soluble sulphate as SO4 and total potential sulphur tests were undertaken in MS-BH09 and MS-BH17 to detect the presence of pyrite, it was not detected, therefore the procedure for determining ACEC classification without pyrite was used. Table 6.8 presents a summary of the results.

Concrete classification testing was undertaken in the Alluvium and Mercia Mudstone Formation in AR-BH01 and AR-BH02 to the southwest of the site. A DS class of DS2 and ACEC class of AC-1d can be used for shallow concrete structures to 4.8m BGL (refers to existing ground level). Deep concrete structures such as piled foundations are not anticipated in this area of the site, however if required a DS class of DS3 and ACEC class of AC-3 should be used.

It is understood that material from the Ash Tip is unlikely to be used in construction or constructed on. However, concrete classification testing was undertaken in the Made Ground and the Alluvium have been provided in case this is considered for use. Generally, the materials indicated a DS class of DS1 and ACEC class of AC-1d, although a couple of outliers were identified in the Made Ground at 4 m and 15 m BGL (refers to existing ground level) in BH103. Based on these outliers and the varied nature and thickness of the Made Ground a DS class of DS-2 and ACEC class ACEC-2 should be used.

Concrete classification testing was undertaken in the Topsoil, Made Ground, Alluvium and Mercia Mudstone Formation at Area A. Generally, for shallow concrete structures a DS class of DS-2 and ACEC class of AC-2 should be used in the Made Ground, Topsoil and Alluvium to 13.30 m BGL (refers to existing ground level). For deeper concrete structures in the Alluvium and Mercia Mudstone Formation a DS class of DS-3 and ACEC class of AC-3 should be used. Acid-soluble sulphate as SO4 and total potential sulphur tests were undertaken in MS-BH09 and MS-BH17 to detect the presence of pyrite which may oxidise if ground if disturbed. The presence of pyrite was not detected within the selected samples and does not effect the DS or ACEC class.

Concrete classification testing was undertaken in the Topsoil, Made Ground, Alluvium and Mercia Mudstone Formation at Area B and C. A DS class off DS-2 and a ACEC class of AC-2 should be used for shallow concrete structures in the Topsoil Made Ground and Alluvium. A

DS class of DS-3 and a ACEC class of AC-3 should be used in the Murcia Mudstone Formation.

6.4.5 Organic Matter

Made Ground samples ranged between <0.35% and 76.2% soil organic matter. The highest value was associated with a sample with decomposing wood fragments identified within it.

Table 6.8: Concrete Classification

Area	Strata	Locations	Count	pH values			SO_4 Values (mg/l)			Design SO_4 Class	ACEC Class
				Min	Mean	Max	Min	Mean	Max		
AR	Alluvium	AR-BH01, AR-BH02	6	7.4	8.1	8.7	37	688	1997	DS-1, DS-3	AC-1d / AC-3
	Mercia Mudstone	AR-BH01	1	N/A	8.2	N/A	N/A	2082	N/A	DS-3	AC-3
Ash Tip	Made Ground	BH103, BH104, BH105, DS101	7	7.9	8.8	9.9	22	450	1489	DS-2	AC-2
	Alluvium	BH103, BH104	4	8.1	8.4	9.1	130	177	230	DS-1	AC-1d
Main Area-A	Made Ground	MS-BH17	1	N/A	8.2	N/A	N/A	489	N/A	DS-1	AC-1d
	Topsoil	MS-BH22	1	N/A	7.6	N/A	N/A	30	N/A	DS-1	AC-1d
	Alluvium	MS-BH11, MS-BH12 MS-BH17, MS-BH18 MS-BH22	13	7.4	8.1	8.6	28	526	1628	DS-2 / DS-3	AC-2 / AC-3
	Mercia Mudstone	MS-BH09, MS-BH11 BH-BH12, MS-BH17 MS-BH18	6	8.0	8.4	8.6	87	1651	2183	DS-3	AC-3
Main Area-B	Topsoil	MS-BH23	1	N/A	7.7	N/A	N/A	53	N/A	DS-1	AC-1d
	Alluvium	MS-BH23, MS-BH24	5	7.8	8.2	8.9	44	164	568	DS-2	AC-2
	Mercia Mudstone	MS-BH23, MS-BH24	2	8.0	10.3	8.1	366	284	2490	DS-3	AC-3
Main Area-C	Made Ground	MS-BH25	4	8.0	8.9	10.5	366	1285	2490	DS-2	AC-2
	Alluvium	MS-BH25	2	9.7	11.4	10.8	368	494	200	DS-1	AC-1d
	Mercia Mudstone	MS-BH25	1	N/A	8.9	N/A	N/A	1743	N/A	DS-3	AC-3

6.5 Results for Groundwater Analysis

Three rounds of water sampling were carried out during the monitoring phase following completion of the site works.

6.6 Generic Quantitative Risk Assessments (GQRA)

6.6.1 Methodology

This section contains the generic Quantitative Risk Assessments for Human health and controlled waters in accordance with the guidance outlined within Land Contamination Risk Management (2020) and forms part of a Stage 1 Risk Assessment. The generic Quantitative Risk Assessment used the site specific information acquired during the ground investigation to estimate the risks posed to a site.

The risk assessment utilises the Source-Pathway-Receptor approach as outlined within the guidance, as explained in Section 6.1.

This methodology has been used to complete the Risk Assessments and is key in the revision of the Conceptual Site Model. Contamination screening was undertaken on samples recovered from the site to assess the risks posed to human health and controlled waters.

6.6.1.1 Pathways

When considering the proposed end use, and without considering treatment, removal or protection measures, there are some potential plausible pathways available. Pathways are defined in Land Contamination Risk management as "a route by which a receptor is or could be affected by a contaminant". From the ground investigation and proposed development plan, the following pathways have been identified.

- ingestion, inhalation, dermal contact for human health receptors
- infiltration and contaminant migration through permeable strata such as the unsaturated zone for groundwater
- a secondary pathway from groundwater contamination to surface water
- migration of ground gases and vapours such as permanent gases, landfill gas and volatile hydrocarbons into buildings
- direct contact and uptake by plants

In addition, the CLEA Risk Assessment Model for Human Health, there are 3 exposure mediums considered for on site receptors, comprising ingestion of soil containing contaminants, inhalation of contaminated dust/vapours and dermal contact, with up to 10. exposure pathways considered, as shown below.

- Ingestion of soil and indoor dust
- Consumption of homegrown produce and attached soil
- Dermal contact (indoor)
- Dermal contact (outdoor)

- Inhalation of dust (indoor)
- Inhalation of dust (outdoor)
- Inhalation of vapour (indoor)
- Inhalation of vapour (outdoor)
- Oral background intake
- Inhalation background intake.

Where the future site has hard cover and below new structures, many of these pathways will not be available.

When considering the potential pathways for leachate migration, where either hard cover and/or future surface water drainage systems are present, the potential effects of surface infiltration or contaminated surface water runoff will be greatly reduced. Similarly, when considering the construction work force, exposure pathways through direct contact, ingestion and dust inhalation will be available during part of the construction process, and therefore adequate PPE should be provided to protect the work force during this period.

6.6.1.2 Receptors

Within the CLEA Risk Assessment Model for Human Health, the potential receptors are assessed initially on site end use, followed by a delineation of age category (i.e. child or adult), with default settings for Residential, Allotment and Public Open Space (Park) end uses based on a child aged 0 to 6 years, Public Open Space (Residential) based on a child aged 3 to 9 and Commercial end uses based upon a working exposure period of up to 49 years (i.e. 16 to 65).

Key generic assumptions for Residential and Public Open Space (Residential) are based upon a typical residential property, consisting of a two-storey small, terraced house, with private garden, and a Commercial end use based upon a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970). No buildings are anticipated for Allotment or Public Open Space (Park) end uses. Within the CLEA Risk Assessment Model for Human Health there are 6 no. generic end use categories presently in use detailed below

1. Residential - with home grown produce,
2. Residential - without home grown produce,
3. Allotments,
4. Commercial
5. Public Open Space – Residential,
6. Public Open Space - Park

For the Stage 1 Risk Assessment, the end use categories have been selected as follows.

7. Commercial – for all service buildings and ancillary pipe infrastructure along the route

Soil Organic Matter (SOM) is a percentage representation of the organic matter present in the materials sampled. SOM is used as an aid in determining the correct GAC to assess the

screening results to. Typically, GACs include different Critical Concentrations for different analytes depending on the SOM percentage. The typical SOM divisions are 1%, 2.5% and 6% with a best fit approach being utilised when determining the assessment criteria.

6.6.1.3 Controlled Waters Screening Methodology

Potential risks to groundwater and surface water from dissolved contaminants in groundwater have been assessed by screening against a hierarchy of generic water quality standards (WQS).

The WQS are protective of the environmental quality of surface waters (EQS) or of human health (via Drinking Water Standards (DWS)). Results above the WQS do not necessarily indicate significant contamination but may require further assessment.

The screening criteria are selected from the following list with EQS and UK DWS typically considered in the first instance:

- EQS – derived from toxicity data, noting chronic effects after long-term exposure or at sensitive life stages of target aquatic species. The EQS quoted are based on The Water Framework Directive (Standards and Classification) Directions (England and Wales), 2015.
- UK DWS – derived from the Water Supply (Water Quality) Regulations 2018.
- World Health Organisation Guidelines (WHO Health) protect health and derive from the World Health Organisation Guidelines for Drinking Water Quality, 4th edition, 2017.

6.7 Generic Quantitative Risk Assessment (Human Health)

The assessments of the soil samples are presented in Appendix F and as previously identified compared to the GAC values for commercial use.

None of the 127 samples taken from across the site exceeded the GAC values for metal associated with commercial sites.

Elevated concentrations of PAHs were found in three samples with less than 1% organic matter, five samples with upto 2.5% organic matter and twenty-one samples with upto 6% and greater. These are summarised in Table 6.9 providing totals and minimum and maximum values and are associated with the Made Ground.

Four samples with elevated Petroleum Hydrocarbon (TPH or EPH) concentrations were recorded. All four had Aromatics EC21-EC35 ranging between 31,500µg/kg to 130,000µg/kg. and two also had Aromatics EC40-EC44 ranging between 28,900mg/kg to 68,800mg/kg.

Table 6.9: Summary of PAH's

Soil Organic matter (SOM) %	1			2.5			6		
Determinand	Total	Min	Max	Total	Min	Max	Total	Min	Max
Benz(a)anthracene	1		183	2	326	416	4	181	1240
Chrysene	-	-	-	1		393	3	464	1140
Benzo(b)fluoranthene	3	63.7	156	5	46.5	475	21	47.7	1780
Benzo(a)pyrene	-	-	-	5	35.3	307	15	37.5	1290
indeno(123cd)pyrene	3	52.5	119	-	-	-	1		834
dibenzo(ah)anthracene				2	35.1	39.7	2	55.5	205
Minimum and maximum values are in mg/kg									

6.8 Generic Quantitative Risk Assessment (Controlled Waters)

Groundwater was compared to Water Quality Standards (WQS) values to determine if there the state of the existing groundwater. These are presented in Appendix XX

Twenty two of the locations had arsenic levels exceeding the threshold value with a minimum of 10.2µg/l and a maximum of 277µg/l.

Thirteen locations had elevated levels of nickel including one surface water sample (SWD107, 5.58µg/l) values ranged between 4.13µg/l and 15.5µg/l

Eight samples had elevated levels of phenols this included two surface water samples (SWD104, 0.64µg/l and SWD105, 0.78µg/l) values ranged between 0.64µg/l and 25.9µg/l.

Four samples had PAH values which exceeded the threshold level, the main determinand was Benzo(a)pyrene with values ranging between 0.0119µg/l and 0.993µg/l. The highest was for Benzo(b)fluoranthene with a value of 1.46µg/l.

Based on the above, it is apparent that some of the groundwater samples detected concentrations of contaminants above the WQS. In most cases the values decreased with each sampling round, it is recommended that some more monitoring is undertaken to confirm the results and make a more robust assessment.

6.9 Preliminary Ground Gas Risk Assessment

6.9.1 Methodology

The data obtained from the gas monitoring completed following the site investigation works has been assessed in line with the current process outlined within BS8485:2015+A1:2019. From the data obtained, an empirical, semi-quantitative method was selected. Guidance from CIRIA C665:2007 was also used to assist with the risk assessment.

The principle of the assessment is a Gas Screening Value or GSV which are calculated for both Carbon Dioxide (CO2) and Methane (CH4). This is generated by the following simplified formula:

GSV= (Peak Gas/100) X Peak Flow.

The GSV values will be assessed against the Characteristic Gas Situation (CS) thresholds as outlined within Table 2 in BS8485:2015+A1:2019. This has been summarised in Table 6.10.

Table 6.10: Characteristics Gas Situation Classification Table

CS	Hazard Potential	Site Characteristics (GSV) (L/Hr)	Additional Factors
CS1	Very Low	<0.07	Typically <1% CH_4 and <5% CO_2 concentrations, otherwise upgrade to CS2
CS2	Low	0.07 to <0.7	Typically measured flow rate of <70 L/Hr, otherwise upgrade to CS3
CS3	Low / Moderate	0.7 to <3.5	
CS4	Moderate	3.5 to <15	
CS5	High	15 to <70	
CS6	Very High	>70	

6.9.2 Results

This report will not form a comprehensive ground gas risk assessment due to the limited data available. Data is limited due to the monitoring wells being multi-purpose as opposed to well installations targeted at ground gas assessment. The majority of the installation response zone are below the groundwater level. As a result, the ground gas measurements are largely reading headspace in the upper plain pipe (sealed) section of the monitoring wells. Three ground gas monitoring visits were undertaken at a fortnightly interval between 14/11/2022 to 16/12/2022.. Gas and ground water monitoring records are presented in the factual report (Fugro, 2022).

6.9.2.1 Barometric Pressure

Atmospheric pressure ranged from 977mb (low pressure, recorded 17/11/2022) to 1028 (high pressure, recorded 01/12/2022).

6.9.2.2 Gas Flow

Measurements ranged from -0.1 l/hr (negative flow into the well) to 2.1 l/hr (positive flow out of the well). The flow readings may represent variations in pressure due to groundwater variations in the plain (sealed) top section of the well pipe.

6.9.2.3 Methane

82 out of 85 measurements of methane were below the instrument level of detection of 0.1% by volume. Monitoring wells BH104, BH105 and MS-BH07 detected methane concentrations between 0.2% and 0.4%.

6.9.2.4 Other Determinands

Oxygen concentrations ranged from 0.6% to 21.2%, and 55 out of 85 readings were above 19% which is indicative of the entrainment of atmospheric air into the well during measurement.

Carbon dioxide concentrations ranged from 0.1% (the instrument level of detection) to 5.8% for 80 out of 85 readings. The highest reading was 14%, measured in BH103 on 15/11/2022 which is the same monitoring event as the lowest oxygen concentration reading for the same well.

Carbon monoxide concentrations were generally low and less than 5ppm in 80 out of 85 readings. The highest reading was 21ppm, measured in AR-BH02 on 14/12/2022.

All 85 measurements of hydrogen sulphide concentrations were below the instrument level of detection of 0.1% by volume.

6.10 Ground Gas Discussion

The results of the preliminary ground gas assessment were affected by the monitoring well installations which resulted in most of the ground gas measurements being representative of the gas in the well headspace as opposed to measuring gas concentrations in the unsaturated zone. However, the following conclusions can be drawn from the results:

- The results indicate a low gas risk.
- The relatively high groundwater table may be a barrier to the migration of gas.
- A more detailed study of the ground gas data is recommended to determine an appropriate ground gas risk assessment.

6.11 Revised Conceptual Site Model

Following the results of the intrusive investigation works, the Conceptual Site Model (CSM) has been revised. This revision includes both the preliminary information and the results of all the completed site works. The revised CSM has been prepared in line with the guidance outlined in Land Contamination Risk Management (2020), and forms part of the generic quantitative risk assessment.

It summarises the various contaminant sources, plausible migration pathways and potentially sensitive receptors identified for this site, assuming no remediation, additional protection measures and/or removal of the sources of contamination takes place. More details on the assessment approach and how the risks are categorised is available in Section 4.

Table 6.11: Revised Conceptual Site Model

Potential Contaminant Source	Pathway	Receptor	Severity of Risk	Probability of Risk	Qualitative Review	RISK
On Site: Contamination within Made Ground or natural soils associated with current or historic industrial facilities, Power Station	Human Health: Direct contact, inhalation, ingestion.	Human Health: Construction/ maintenance workers, adjacent users	Human Health: Moderate.	Human Health: Likely (acute/construction workers)..	Geoenvironmental testing indicates that elevated levels of some PAH's have been identified within the material this ties-in with contaminants associated with PFA. This data should be incorporated into the risk assessment and method statements for construction workers during the construction phase, to ensure appropriate hazard control measures e.g. control of vapour/gas in confined spaces, use of PPE. Future site maintenance workers should undertake risk assessments and use appropriate PPE and mitigation procedures. Prior to the construction phase a Construction Phase Environmental Plan (CEMP) should detail the mitigation measures to prevent neighbouring site users from exposure to potential contamination via direct contact, ingestion or inhalation.	L / M
	Aquifer: Leaching / lateral migration. Surface Water: lateral migration.	Aquifer: Superficial: Secondary - Undifferentiated (Alluvium). **Bedrock: Principal Mercia Mudstone.** Surface Water: Field Drains, River trent	Aquifer: Moderate. Surface Water: Low.	Aquifer: Low likelihood. Surface water: Low likelihood	Elevated Arsenic, Phenols and PAH's were identified in the water. Further investigation is recommended comprising of further water sampling and leachate testing on Made Ground samples to confirm source.	L / M
	Structures: direct contact / gas ingress through permeable unsaturated strata.		Severe.	Low	No elevated levels of methane were identified during the monitoring period however oxygen was on occasion low it is recommended further investigation is carried out in to ground gas to provide a more comprehensive ground gas risk assessment, particularly if foundations are to go to depths	L / M

Notes:
L / M – low to medium risk

7. Recommendations

Based on the ground investigation, the in situ and lab testing data, geoenvironmental testing and groundwater monitoring, the ground conditions at the Keadby 3 site have been characterized to allow a ground model to be produced. This has identified that the ground conditions associated with this site are generally more favourable than those encountered in previous investigations carried out for Keadby1 and 2. These comprise Made Ground (predominantly identified as a clayey SAND with varying proportions of man-made detritus) near surface with superficial deposits comprising of Alluvium (coarse materials (SAND / silty SAND) and two thin layers of fine materials (CLAY / silty CLAY)), overlying Glaciofluvial Deposits (SAND, silty SAND). Bedrock is the Mercia Mudstone which can be subdivided into a residual soil (CLAY) before the unweathered mudstone is encountered.

As part of the development, it is proposed to raise the ground level for the footprint of the new power station. Settlement calculations have been carried out and it has been assumed that the placement of the Engineered Fill will be carried out prior to the construction of any of the foundations. If this is to be expedited, then it is recommended that surcharging with groundwater monitoring and extensometers to monitor settlement with the identified soil profile is carried out.

The calculations for shallow foundations have used assumed parameters for the Engineered Fill and a structural load of 50kPa. These will need to be reviewed once the proposed Fill material is identified and structural layout confirmed to ensure they are appropriate. Consideration should also be given to some additional plate load tests following placement of the fill so that cyclic loading and sliding can be assessed to improve the understanding of dynamic loading.

The weathering profile on rock varies across the site. The pile calculations were performed using the idealized soil profile. Therefore, the proposed piles lengths may need to be reassessed once the final building layout is known. Fugro recommend pile testing is considered to check the carrying capacity of the piles before construction, to ensure the proposed method is appropriate and better assess the performance of the Engineered Fill.

It is considered unlikely that ground improvement techniques will be required for improving founding conditions on the main site, unless a very limited settlement is considered in the design.

CBR values have been obtained as part of this investigation however it is recommended that prior to pavement construction the subgrade is checked to ensure the most appropriate CBR is used. Localised ground improvement may be required if CBR values at subgrade level are not adequate.

According to the slope stability analyses the factor of safety on ash tip slopes is greater than 1.5. Notwithstanding the above, small, localised, shallow local failures can be expected in the

future. These areas can be repaired, if necessary, by the removal of slipped material and its replacement with suitable granular free draining slide material.

It is proposed to remove 300mm of the existing Made Ground. However, within these soils elevated levels of PAH's have been identified across the Main Site, it is recommended that this is discussed with the Local Authorities Environmental Health Officer to determine an appropriate course of action.

With the groundwater Arsenic, Nickel and PAH's were identified as having levels above the WQS Threshold levels. It was noted that these results reduced as the monitoring and sampling programme continued. It is considered that these may be locally elevated. It is recommended that further investigation is carried out to determine if remedial measures are required.

8. References

Bateman MD, Evans DJA, Buckland PC et al. 2015. Last Glacial dynamics of the Vale of York and North Sea Lobes of the British and Irish Ice Sheet. Proceedings of the Geologists' Association 126: 712–730.

BATTAGLIO, M., BRUZZI, D., JAMIOLKOWSKI, M. AND LANCELLOTTA, R., 1986. "Interpretation of CPTs and CPTUs, 1st Part: Undrained Penetration of Saturated Clays", in Field Instrumentation and In-Situ Measurements: Proceedings of the 4th International Geotechnical Seminar, 25-27 November 1986, Singapore, Nanyang Technological Institute, Singapore, pp. 129-143.

BSI. (1990-2018). *Methods of test for soils for civil engineering purposes. Parts 1 to 9: General requirements and sample preparation* (BS 1377-1 to 9:1990 to 2018). http://www.bsigroup.com

BS EN ISO. (2014-2018). *Geotechnical investigation and testing. Laboratory testing of soil. Parts 1 to 12* (BS EN ISO 17892:2014 to 2018). http://www.bsigroup.com

BS EN 12457–3. (2002). Characterisation of waste. Leaching. Compliance test for granular waste materials and sludges. Two stage batch test at a liquid to solid of 2 l/kg and 8 l/kg for materials with a high solid content and with a particle size below 4mm (without or with size reduction). British Standards Institution.

Environment Agency, EA. (April, 2021). Land contamination risk management (LCRM); Guidance; How to assess and manage the risks from land contamination. https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm Accessed 14 July 2022

Environment Agency, EA. (2004). The Model Procedures for the Management of Land Contamination, CLR 11. Environment Agency; Bristol. https://webarchive.nationalarchives.gov.uk/ukgwa/20140328084622/http://publications.environment-agency.gov.uk/pdf/SCHO0804BIBR-e-e.pdf

FUGRO (2022a). Keadby 3 Low Carbon Gas Power Station Project Ground Investigations. Ground Investigation Report (GIR) Factual Account.

Hobbs, P.R.N., Hallam, J.R., Forster, A., Entwisle, D.C., Jones, L.D., Cripps, A.C., Northmore, K.J., Self, S.J., and Meakin, J.L. Engineering geology of British rocks and soils: Mudstones of the Mercia Mudstone Group, BGS Report RR/01/02, 2002

Highways England (2020). CD 225 'Design for new pavement foundations'

Institution of Civil Engineers (2012). ICE Manual of Geotechnical Engineering. Volume II – Geotechnical Design, Construction and Verification. Pg. 853-885.

JAMIOLKOWSKI, M., LO PRESTI, D.C.F. AND MANASSERO, M., 2003. "Evaluation of relative density and shear strength of sands from CPT and DMT", Germaine, J.T et al (Eds), Soil 85 including and soft ground construction: proceedings of the symposium, October 5–6, 2001, Cambridge, Massachusetts, Geotech Special Publication, No. 119, American Society of Civil Engineers, Reston, pp. 201–238.

KULHAWY, F. AND MAYNE, P., 1990. Manual on estimating soil properties for foundation design, EPRI, Palo alto, California, 1 vol. (EPRI Report; EL-6800).

MAYNE, P.W. (1995), "CPT determination of OCR and lateral stresses in clean quartz sands", Proceedings, International Symposium on Cone Penetration Testing, Vol. 2, Linköping, Swedish Geotechnical Society, pp. 215-220

MAYNE, P.W., 2007. "In-Situ Test Calibrations for Evaluating Soil Parameters", in Tan, T.S., Phoon, K.K., Hight, D.W. and Leroueil, S. (Eds.), Characterisation and Engineering Properties of Natural Soils Volume 3, Taylor & Francis, London, pp. 1601-1652.

MAYNE, P.W. AND RIX, G.J., 1993. "Gmax-qc Relationships for Clays", Geotechnical Testing Journal, Vol. 16, No. 1, pp 54-60.

MEIGH, A.C., 1987. CIRIA Ground Engineering Report: In situ Testing. Cone penetration testing methods and interpretation.

RAD N.S. AND LUNNE, T., 1988. Direct Correlations between Piezocone Test Results and Undrained Shear Strength of Clay" in De Ruiter, J. (Ed.) Penetration Testing 1988: Proceedings of the First International Symposium on Penetration Testing, ISOPT-1, Orlando, 20-24 March 1988, Vol. 2, A.A. Balkema, Rotterdam, pp. 911-917.

RIX, G.J. AND STOKOE, K.H., 1991. "Correlation of initial tangent modulus and cone penetration resistance", Huang, A.B. (Ed.), Calibration Chamber Testing: Proceedings of the First International Symposium on Calibration Chamber Testing ISOCCTI, Potsdam, New York, 28-29 June 1991, Elsevier Science Publishing Company, New York, pp. 351-362.

ROBERTSON P.K., & CABAL (ROBERTSON) K.L., 2015. Guide to Cone Penetration Testing for Geotechnical Engineering 6th Edition, Gregg Drilling & Testing, Inc.

ROBERTSON, P.K., (1990). Soil Classification using the Cone Penetration Test. Canadian Geotechnical Journal, 27 (1), pp. 151–158.

ROBERTSON. P.K., CAMPANELLA, R.G., GILLESPIE, D., AND GREIG, J., 1986. Use of Piezometer Cone data. In: In-Situ'86 Use of In-situ testing in Geotechnical Engineering, GSP 6, ASCE, Reston, VA, Specialty Publication, SM 92, pp. 1263-1280.

ULSAY, R & HUDSON, J.A. 2007. The ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring: 1974–2006.

ULSAY, R (Ed.). 2015. The ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring: 2007-2014.

Wilson, S., 2007. Assessing risks posed by hazardous ground gases to buildings (C665). London: CIRIA.

Appendix A

Site Location and Exploration Maps

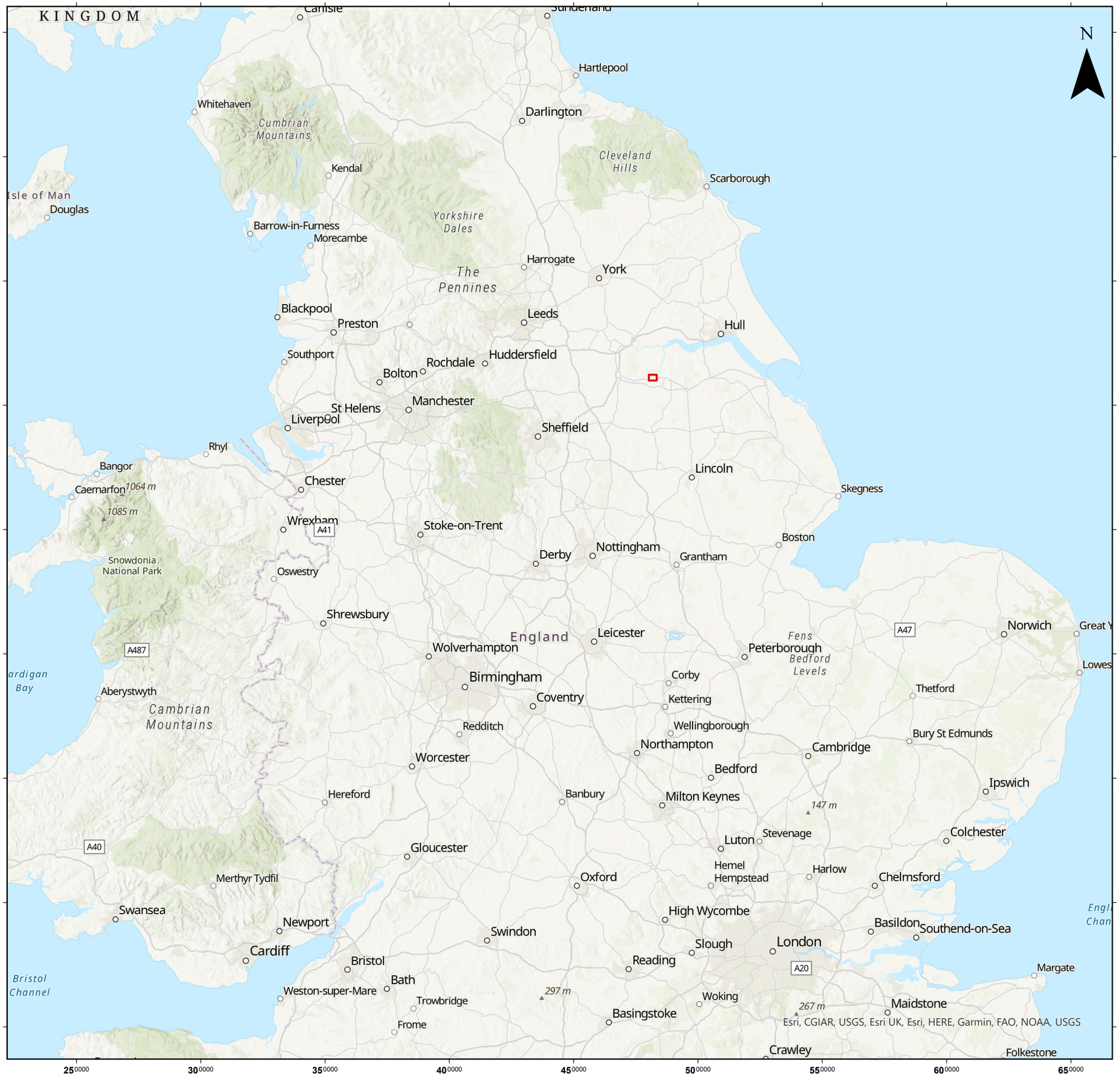
A.1 Site Location Map

A.2 Overall Exploration Map

A.3 Main Area and Ash Tip Area Exploration Map

A.4 Southwest Access Road Exploration Map

A.5 East Road Exploration Map



Location



Scale: 1:500,000

0 5 10 20 30 40 Kilometers

Legend

Project Area

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:1,500,000

0 15 30 60 90 120 Kilometers

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

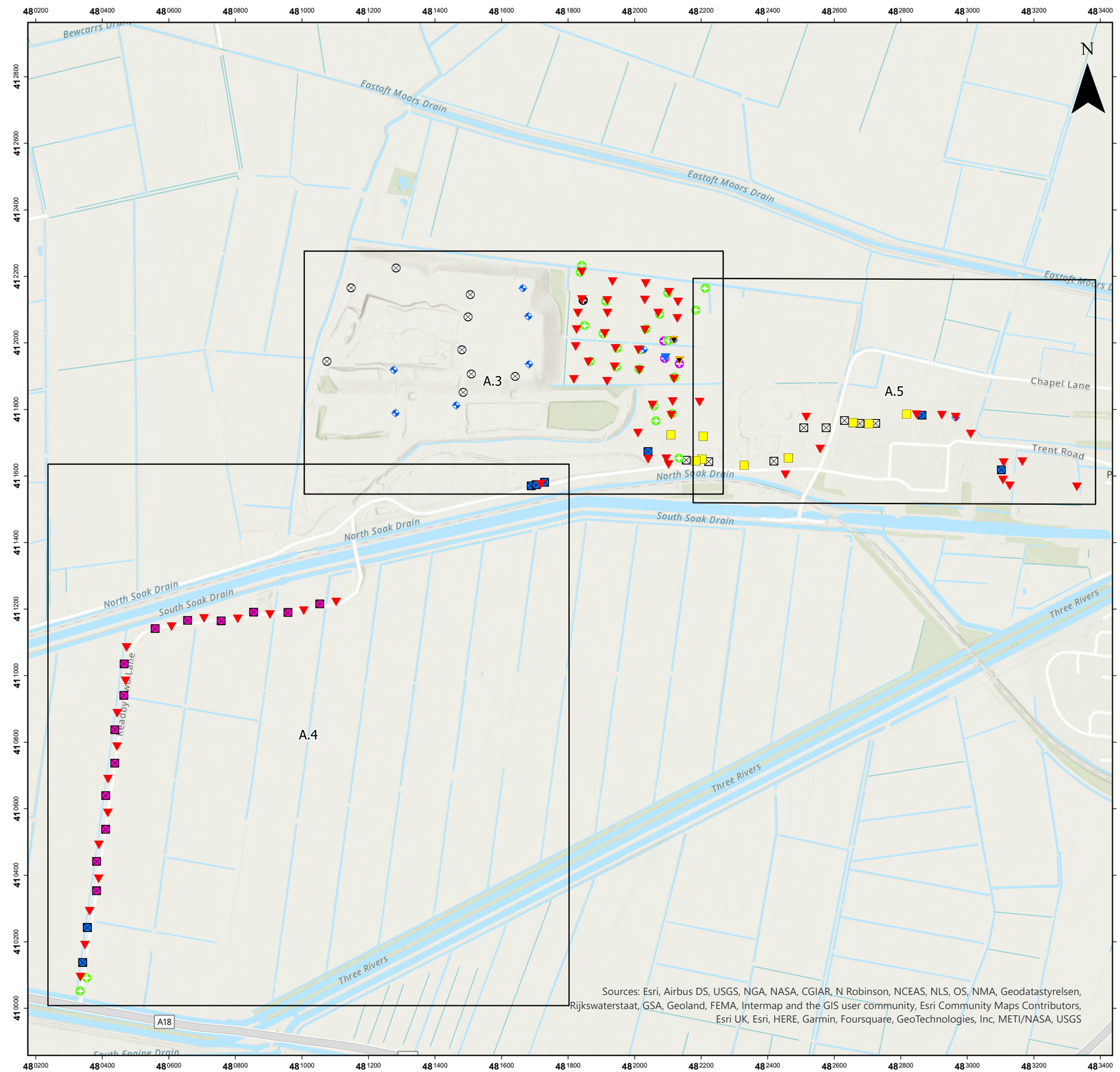
Figure Title

Project Location Plan

Figure Number

A.1

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	SBP	21/02/2023	F212561	A3	1



Location



Scale: 1:500,000

0 5 10 20 30 40 Kilometers

Legend

- Map Extents

Exploration Type

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Inspection Pit
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Plate Bearing Test

Note: Borehole and CPT locations include an Inspection Pit.

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:11,000

0 125 250 500 750 1,000 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford, Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

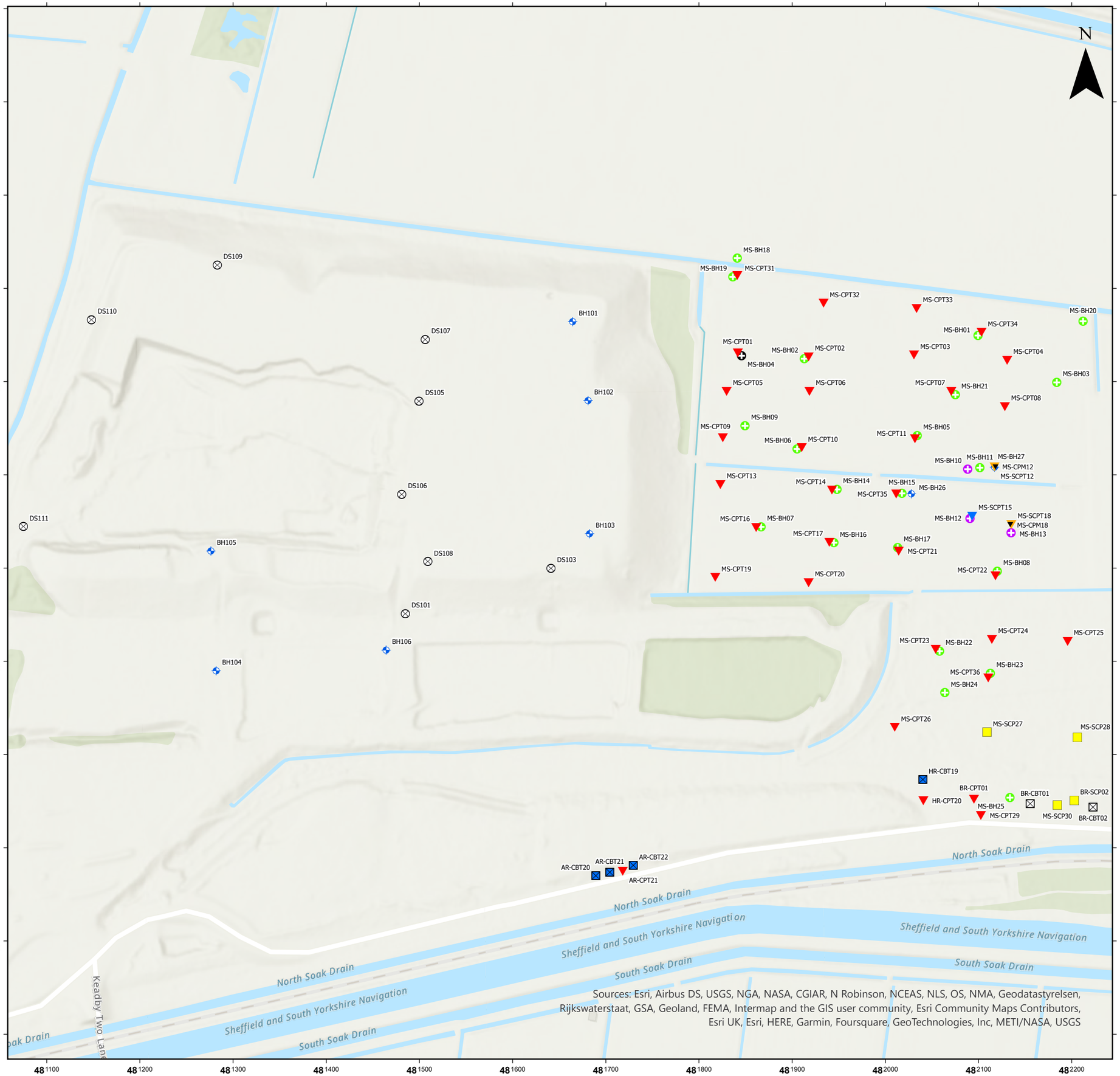
Figure Title

Overall Exploration Map

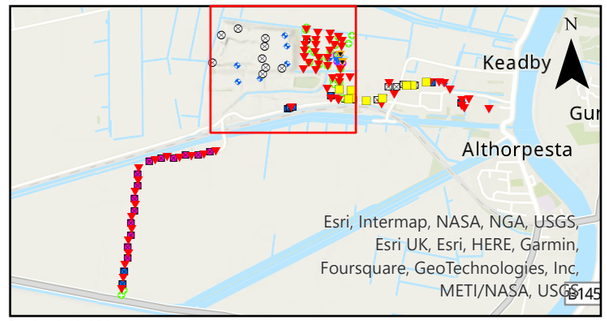
Figure Number

A.2

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	A3	1



Location



Scale: 1:50,000

0 0.5 1 2 3 4 Kilometers

Legend

Exploration Type

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Inspection Pit
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Plate Bearing Test

Note: Borehole and CPT locations include an Inspection Pit.

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:4,000

0 40 80 160 240 320 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford, Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

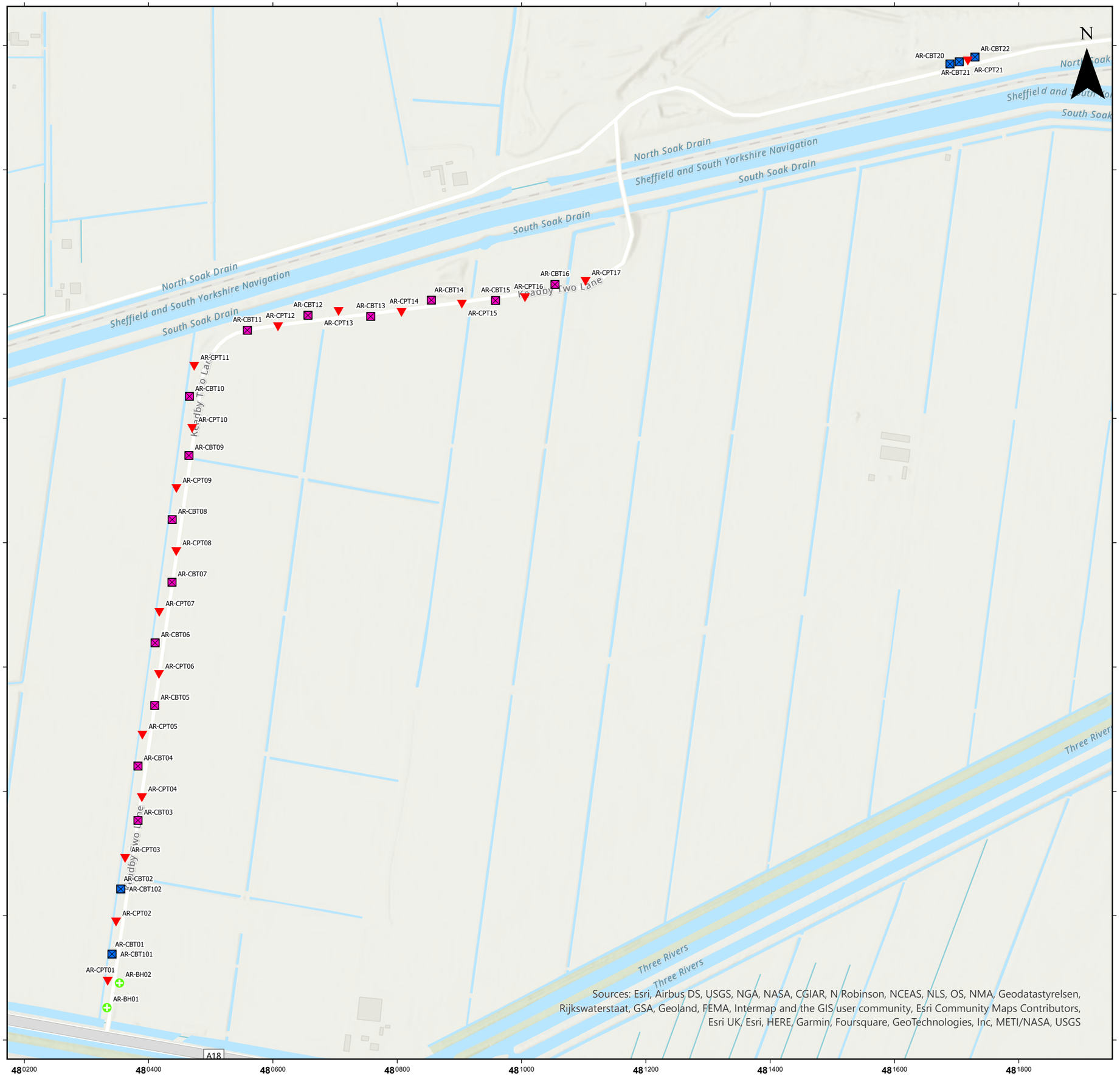
Figure Title

Main Area and Ash Fill Area Exploration Map

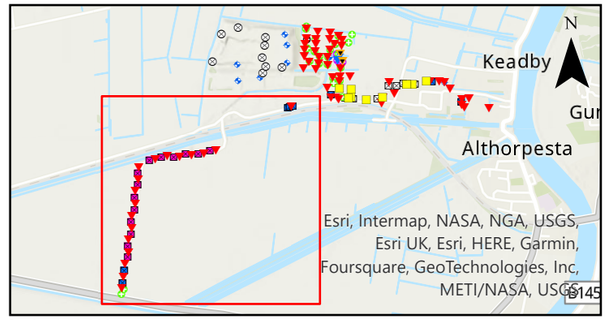
Figure Number

A.3

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	A3	1



Location



Scale: 1:50,000

0 0.5 1 2 3 4 Kilometers

Legend

Exploration Type

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Inspection Pit
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Plate Bearing Test

Note: Borehole and CPT locations include an Inspection Pit.

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:6,000

0 50 100 200 300 400 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford, Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

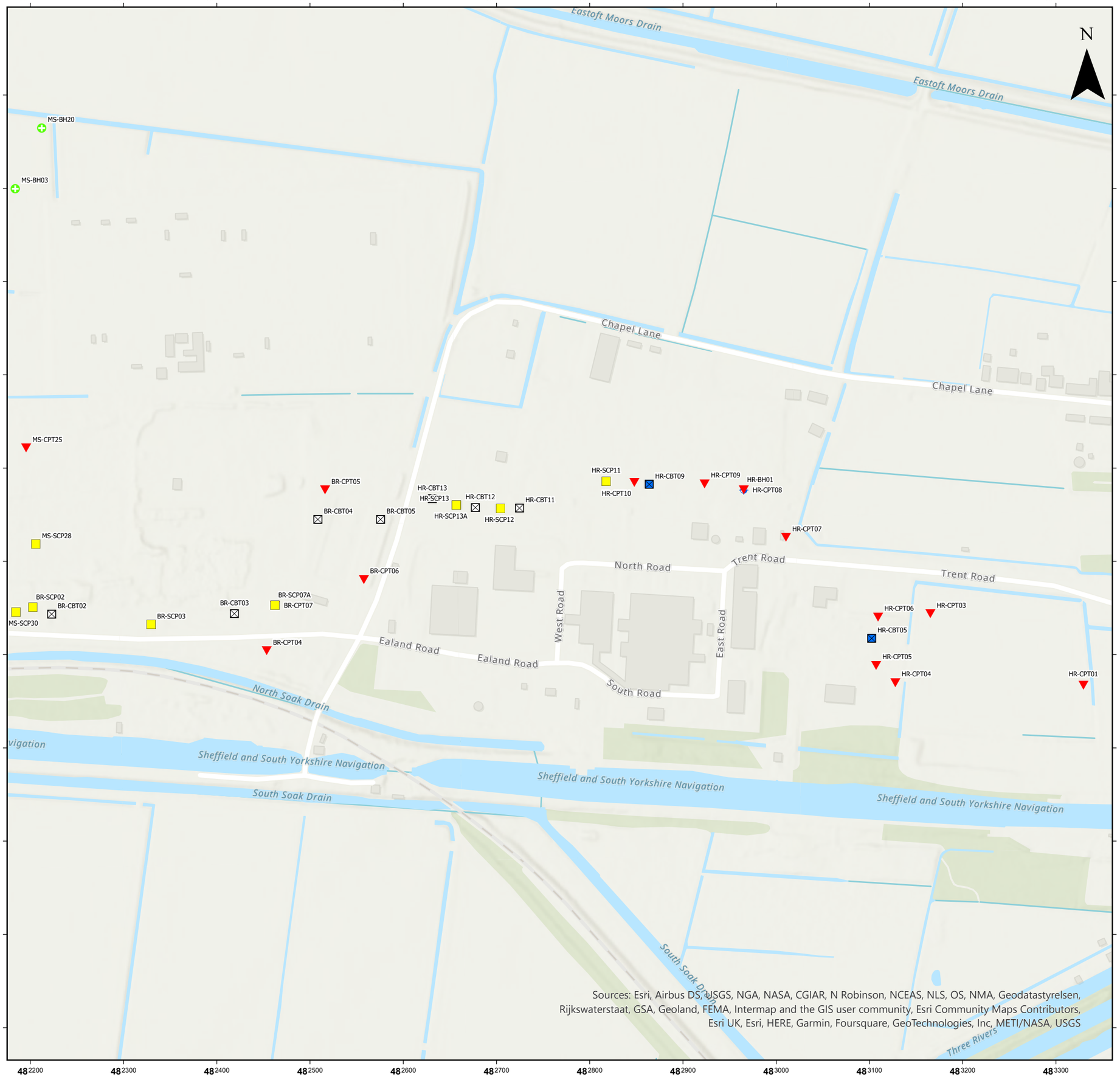
Figure Title

Southwest Access Road Exploration Map

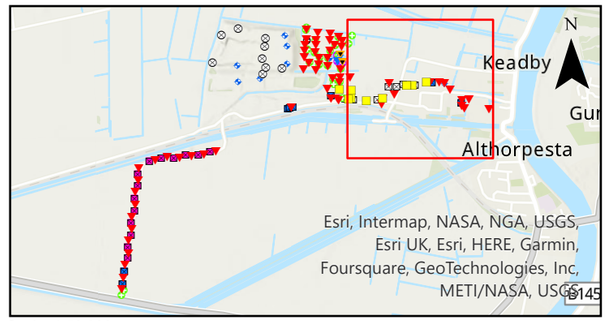
Figure Number

A.4

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	A3	1



Location



Scale: 1:50,000

0 0.5 1 2 3 4 Kilometers

Legend

Exploration Type

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Inspection Pit
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Plate Bearing Test

Note: Borehole and CPT locations include an Inspection Pit.

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:4,000

0 50 100 200 300 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

Figure Title

East Road Exploration Map

Figure Number

A.5

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	A3	1

Appendix B

Subsurface Cross Sections

B.1 A-A′ Cross Section (Main Area)

B.2 B-B′ Cross section (Main Area)

B.3 C-C′ Cross section (Main Area)

B.4 D-D′ Cross section (Main Area)

B.5 E-E′ Cross section (Main Area)

B.6 F-F′ Cross section (Main Area)

B.7 G-G′ Cross section (Ash Tip)

B.8 H-H′ Cross section (Ash Tip))

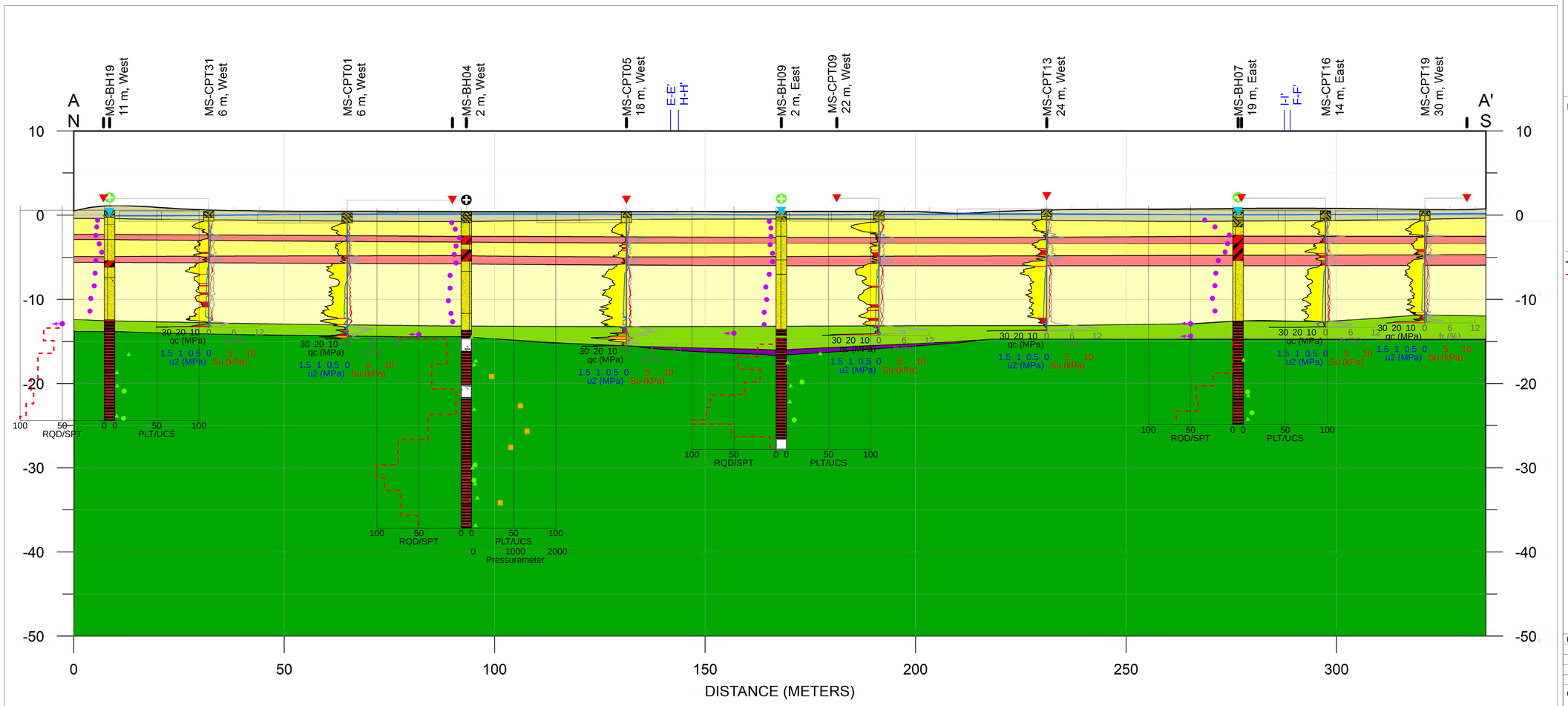
B.9 I-I′ Cross section (Ash Tip))

B.10 J-J′ Cross section (Ash Tip))

B.11 K1-K1′ Cross section (Southwest Access Road)

B.12 K2-K2′ Cross section (Southwest Access Road)

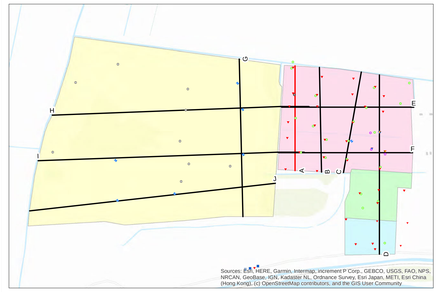
B.13 L-L′ Cross section (East Access Road)



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

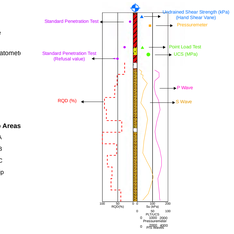
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometr Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

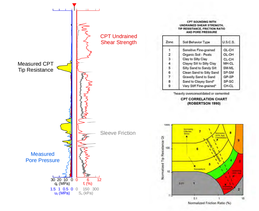
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

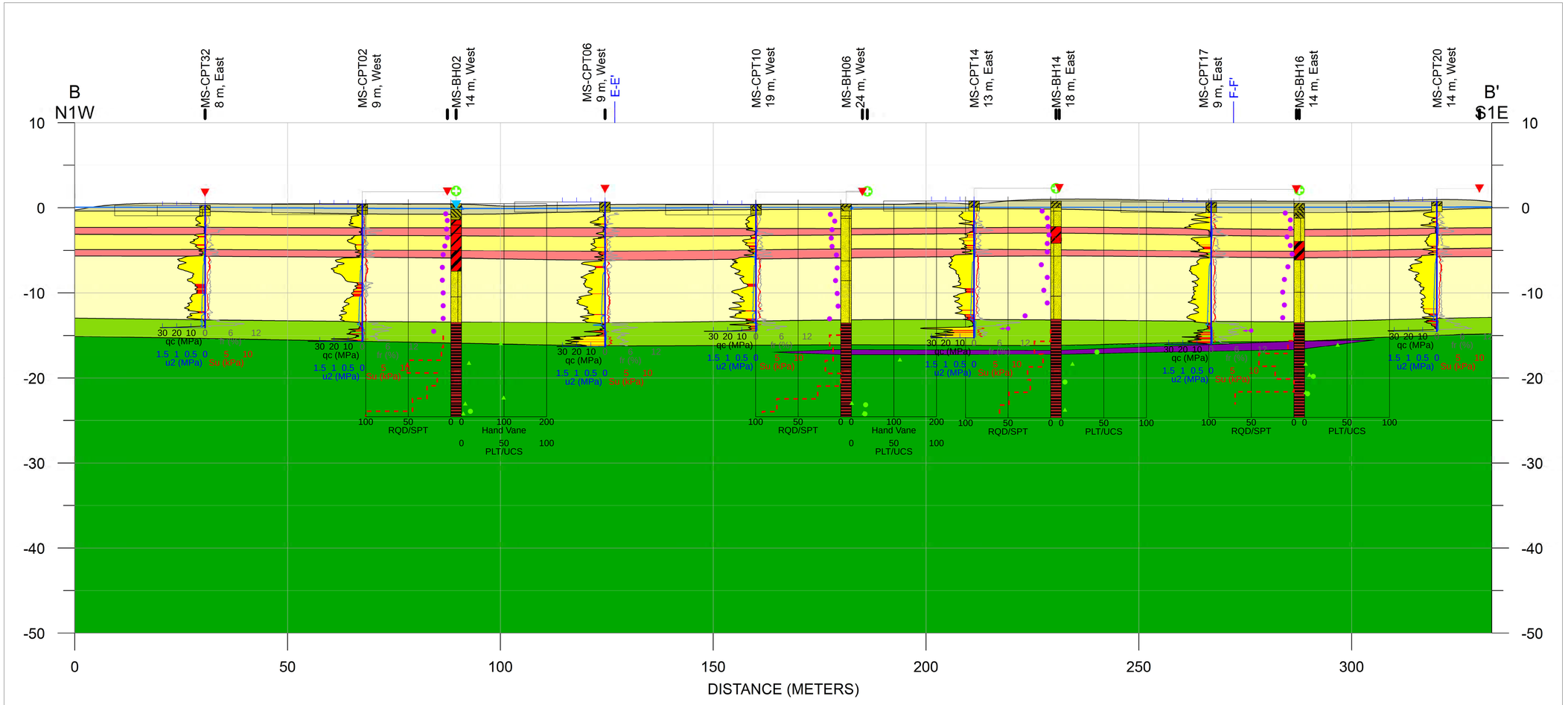
Figure Title

Geotechnical Cross Section Line A

Figure Number

B.1.1

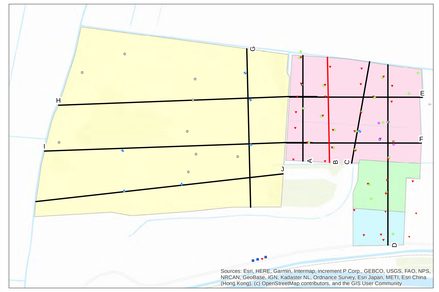
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

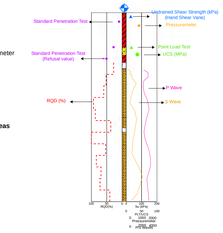
N

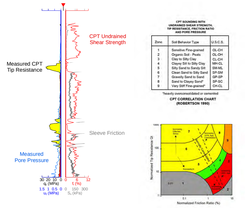
Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip





Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone

Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

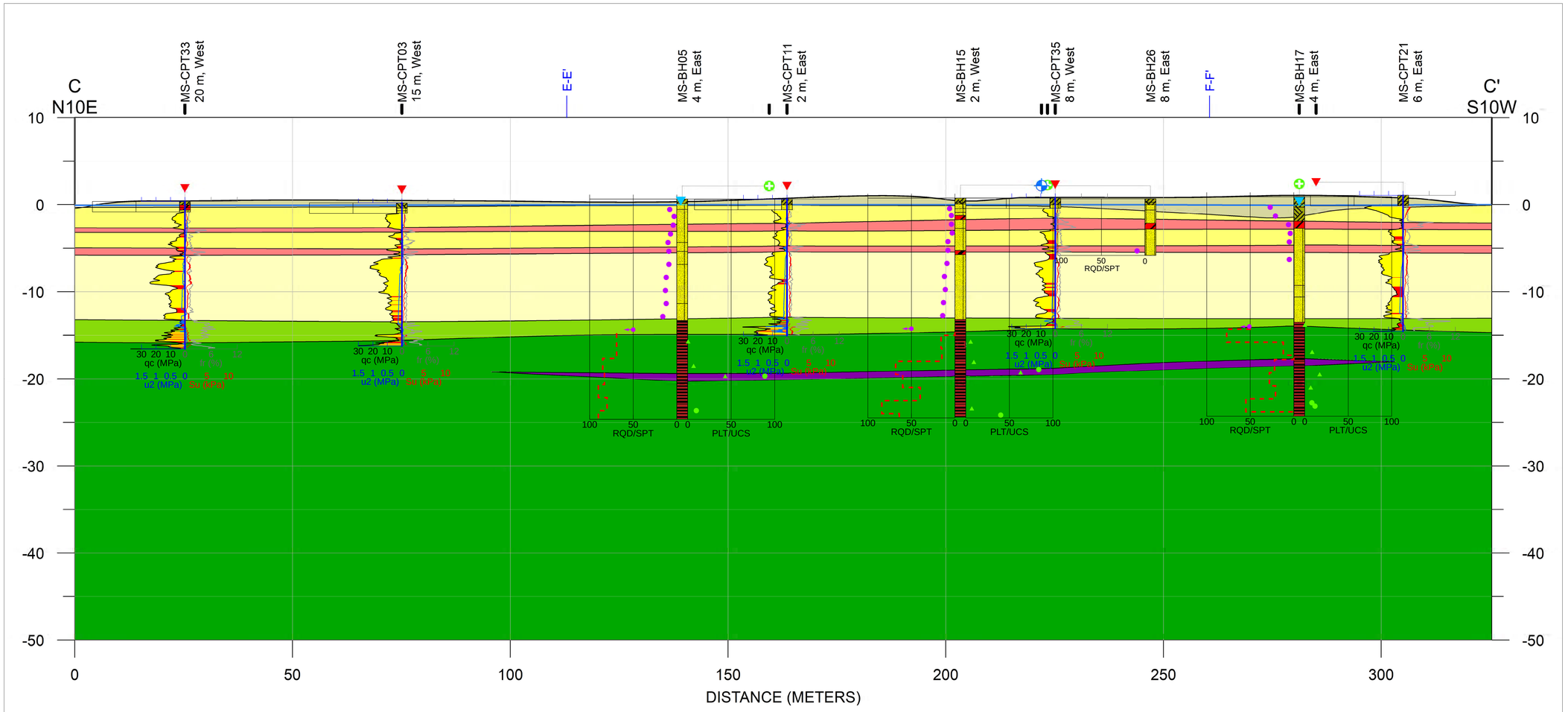
Figure Title

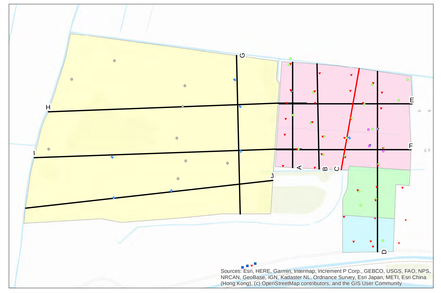
Geotechnical Cross Section Line B

Figure Number

B.1.2

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1





Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

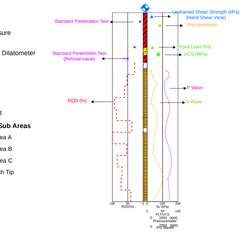
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

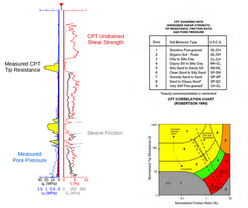
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

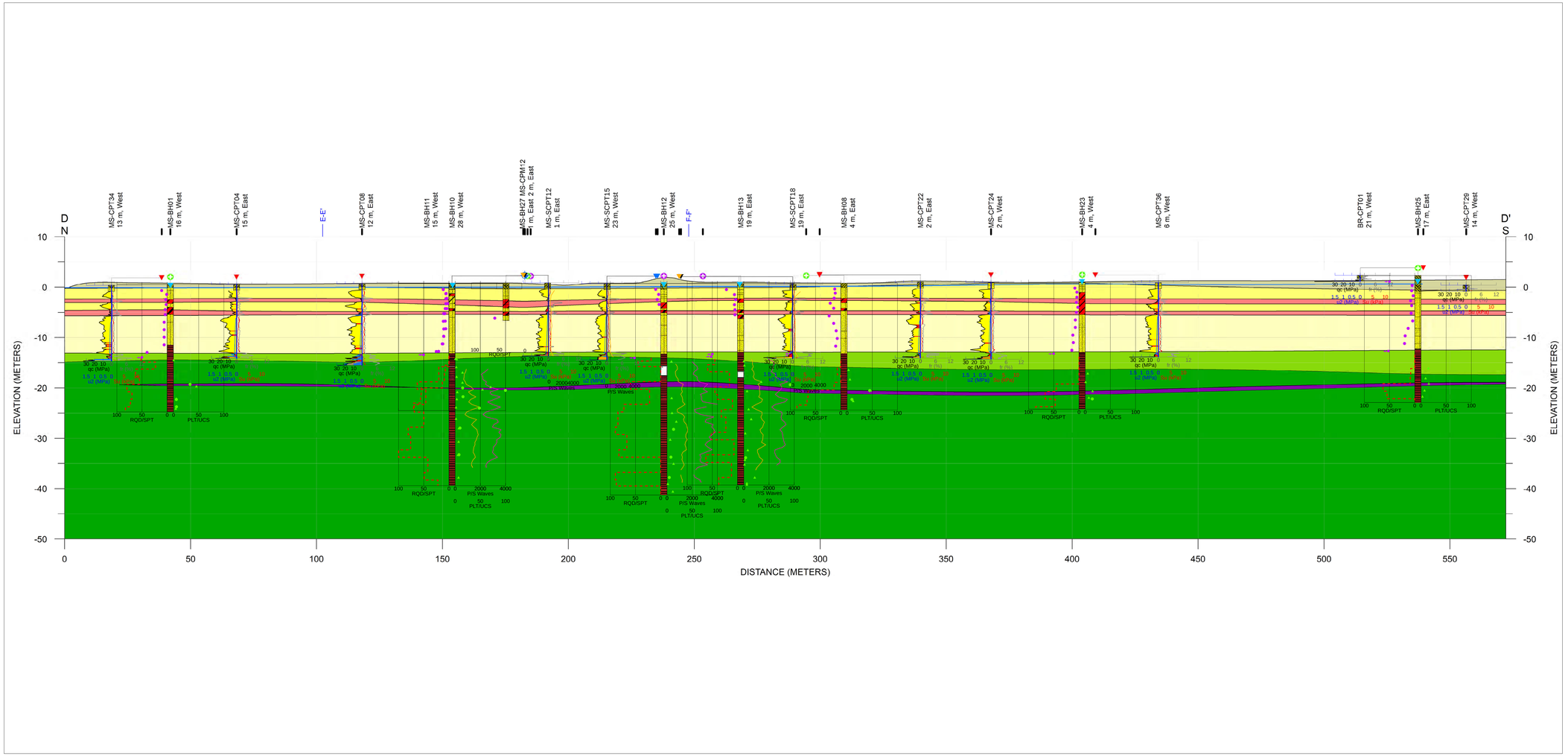
Figure Title

Geotechnical Cross Section Line C

Figure Number

B.1.3

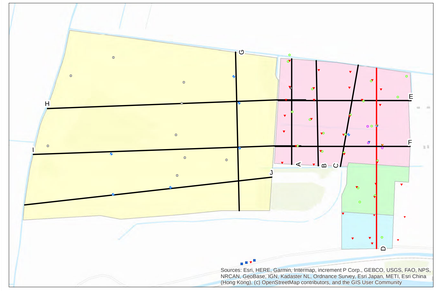
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:16,000

0 0.125 0.25 0.5 0.75 1 km

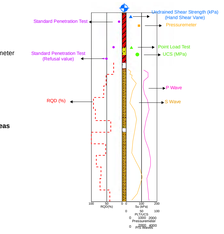
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

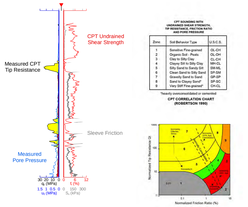
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

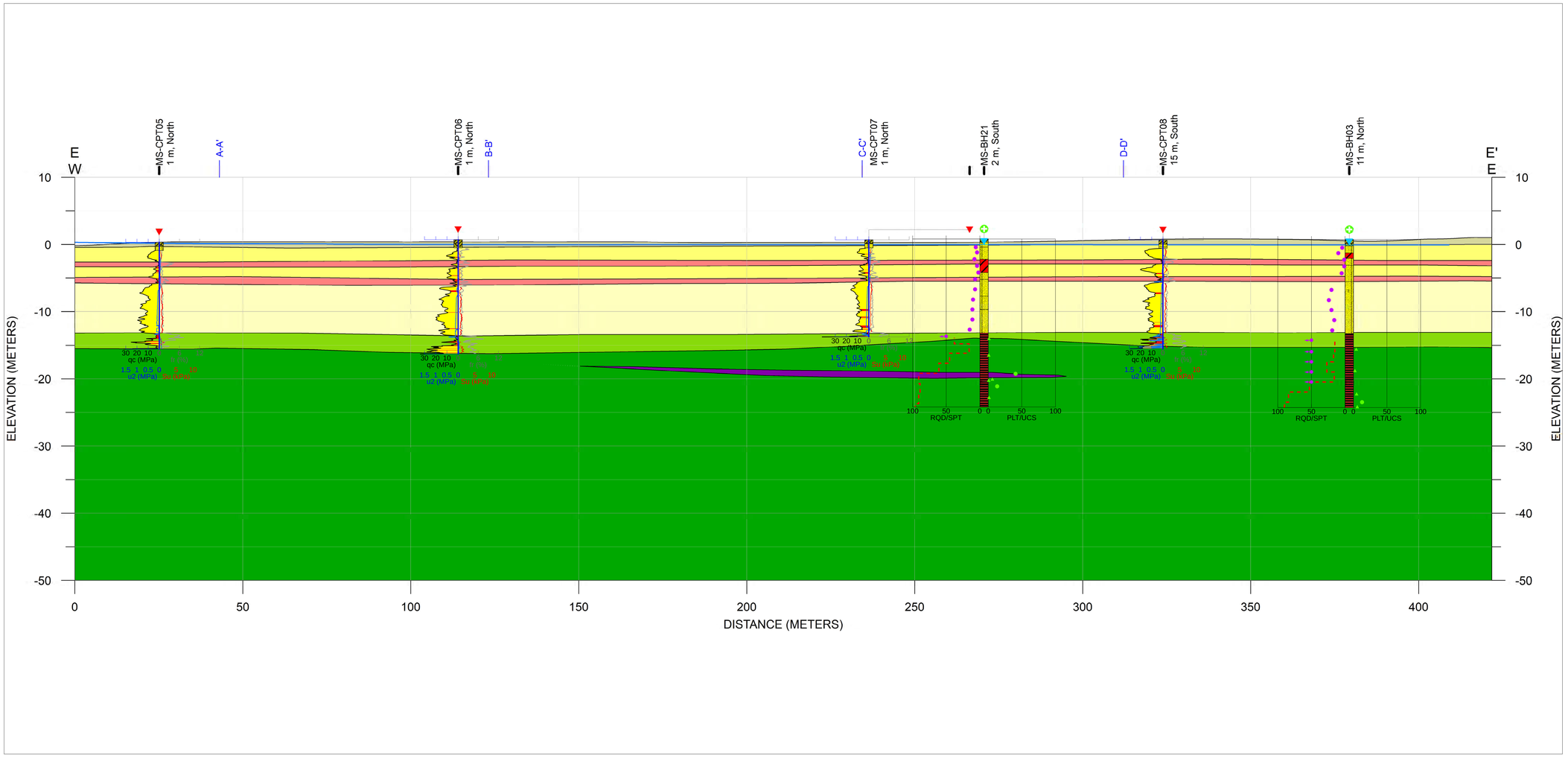
Figure Title

Geotechnical Cross Section Line D

Figure Number

B.1.4

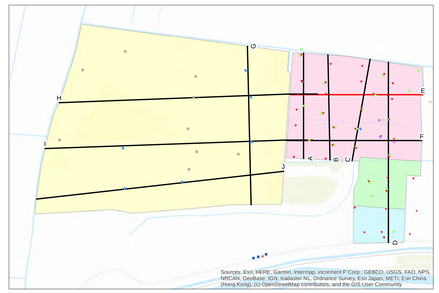
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

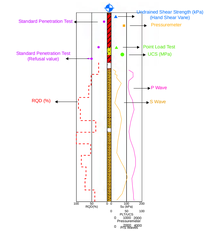
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

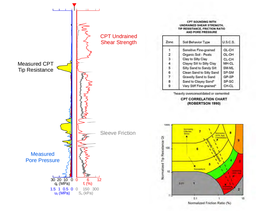
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

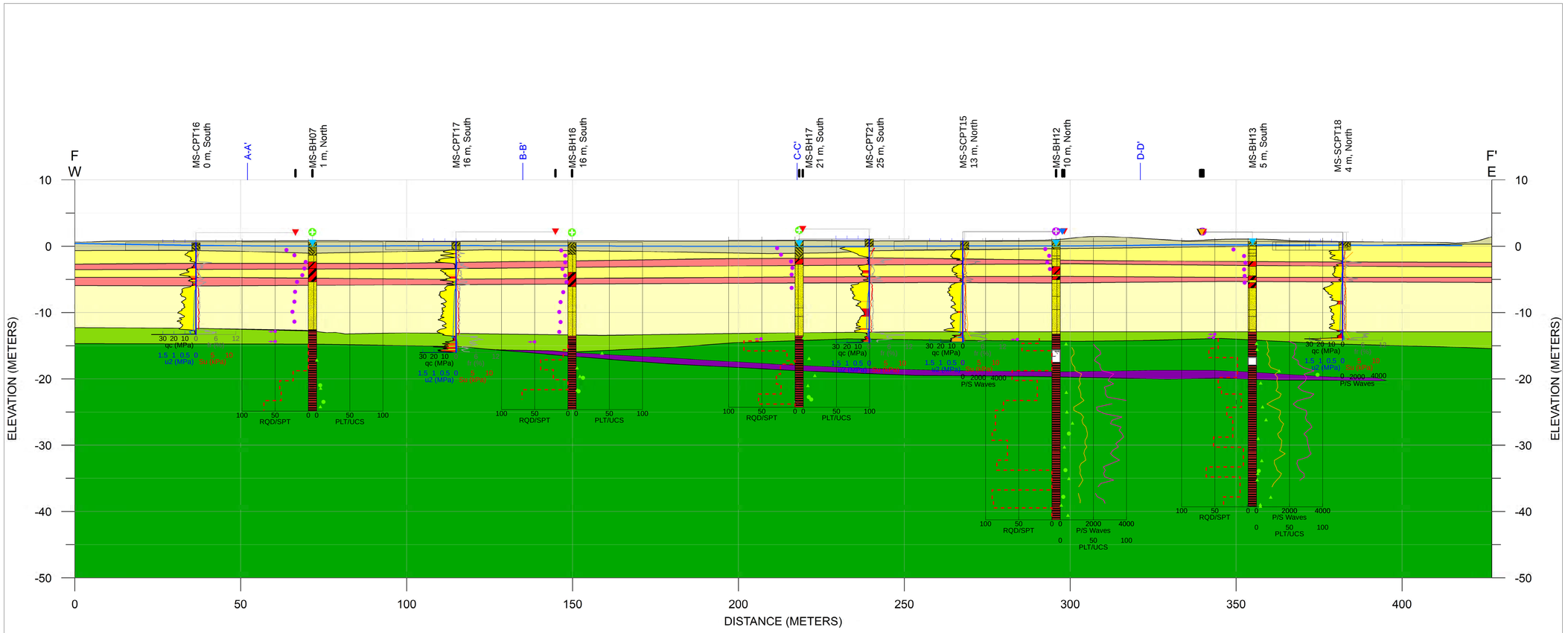
Figure Title

Geotechnical Cross Section Line E

Figure Number

B.1.5

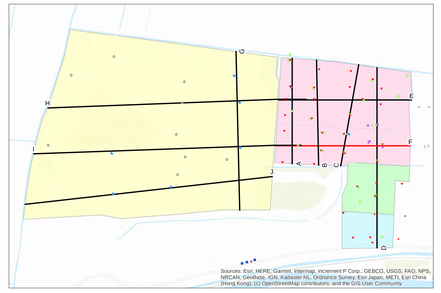
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

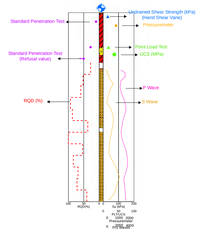
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

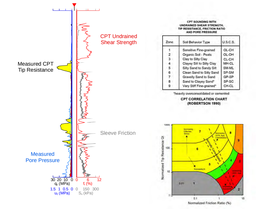
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

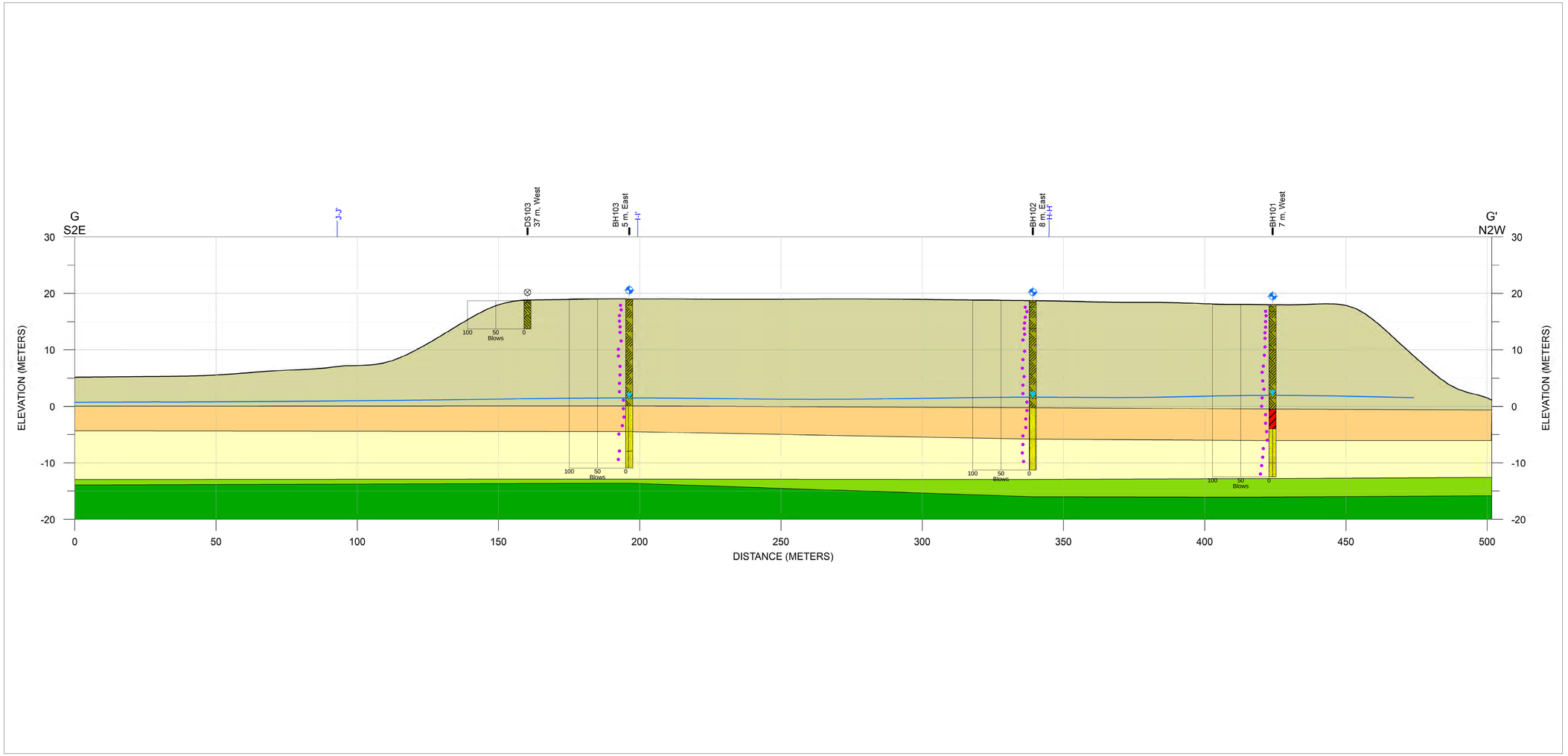
Figure Title

Geotechnical Cross Section Line F

Figure Number

B.1.6

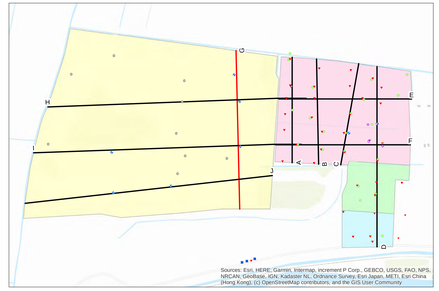
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

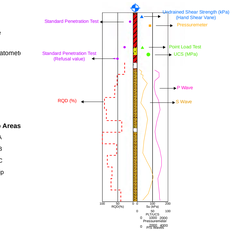
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

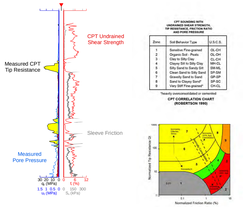
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium Deposits
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

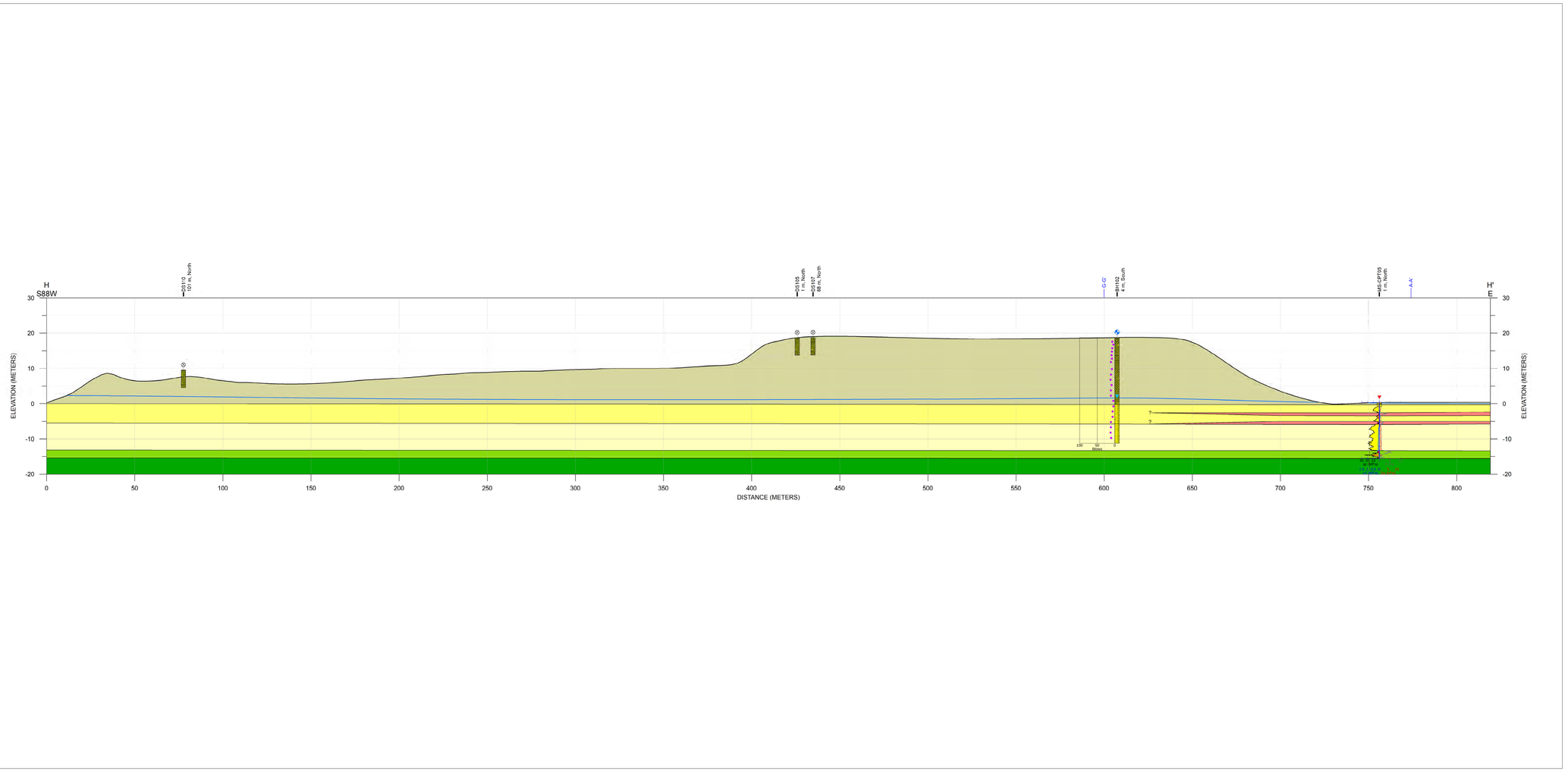
Figure Title

Geotechnical Cross Section Line G

Figure Number

B.1.7

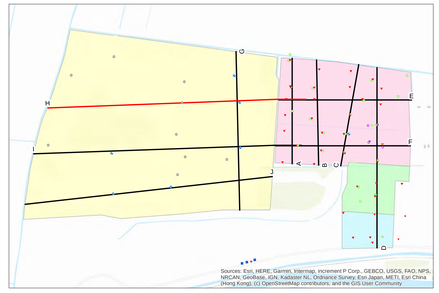
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

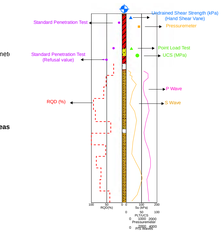
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

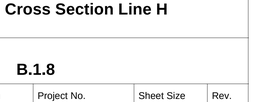
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

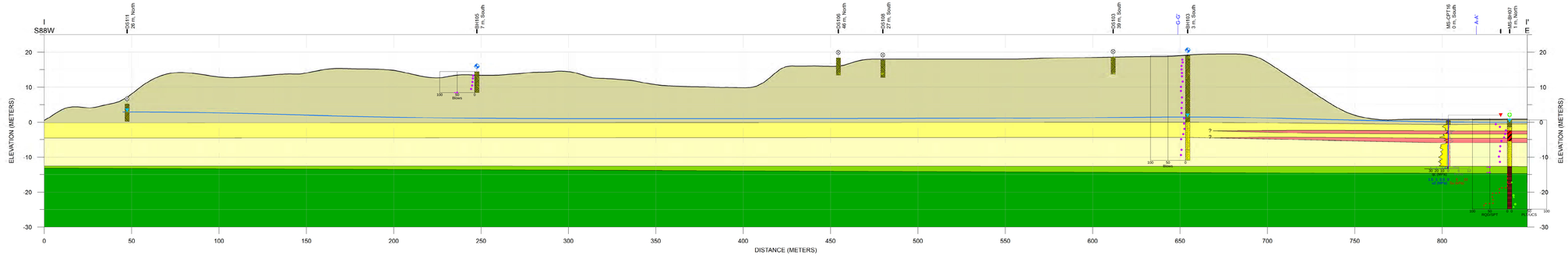
Figure Title

Geotechnical Cross Section Line H

Figure Number

B.1.8

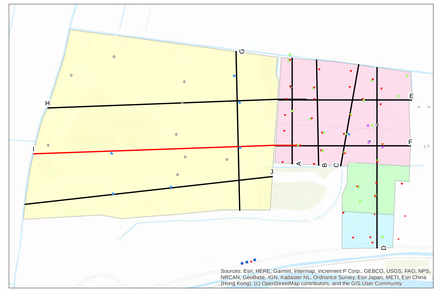
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

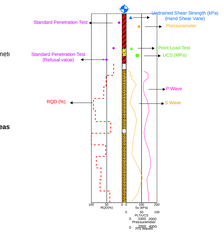
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometr Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

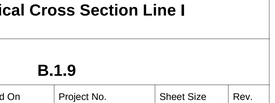
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

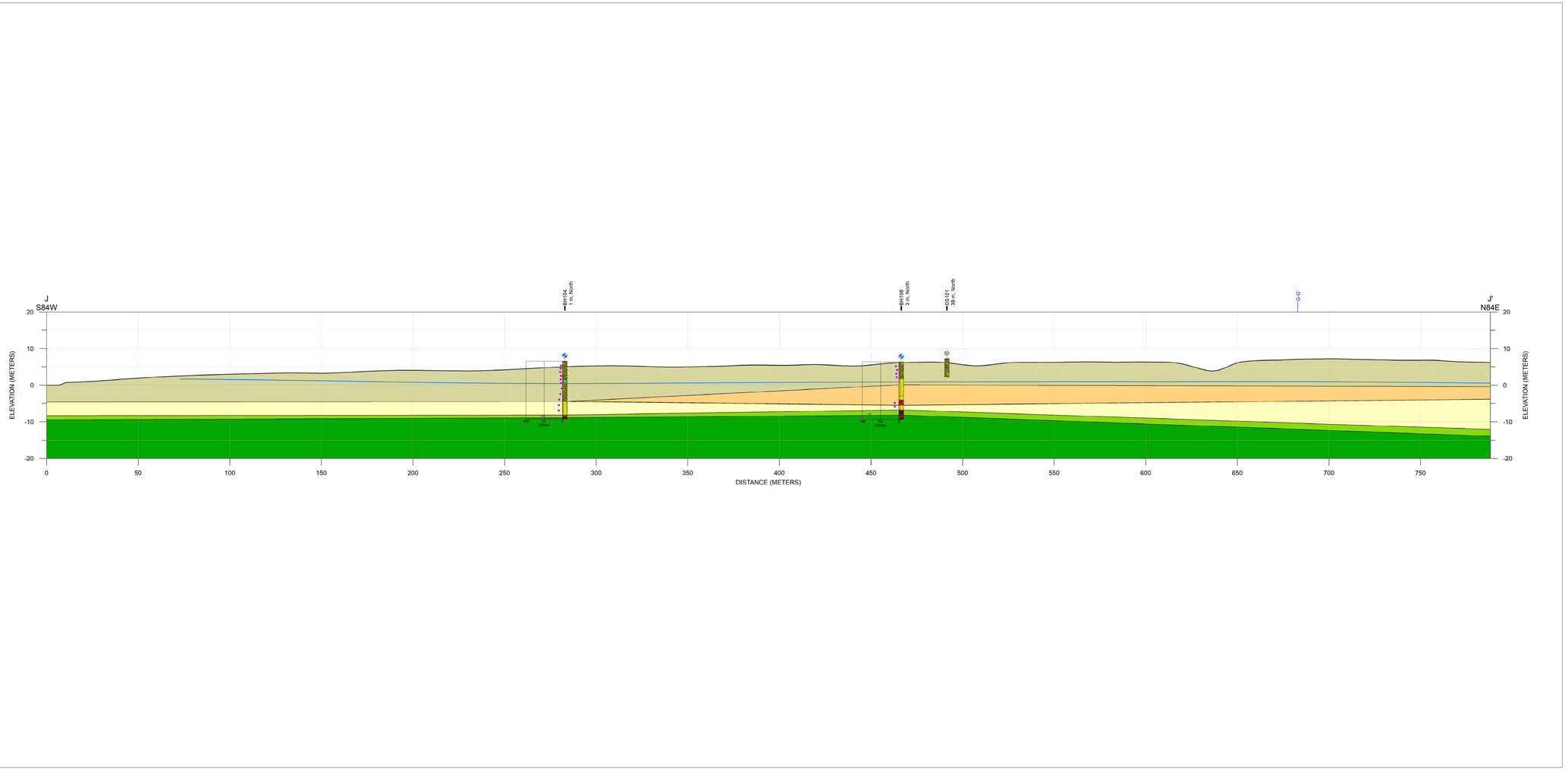
Figure Title

Geotechnical Cross Section Line I

Figure Number

B.1.9

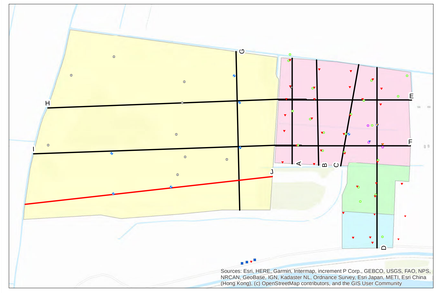
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:6,000

0 0.125 0.25 0.5 0.75 1 km

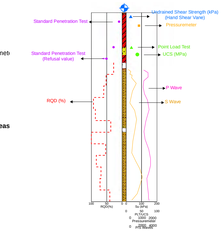
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

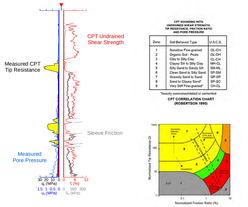
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium Deposits
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

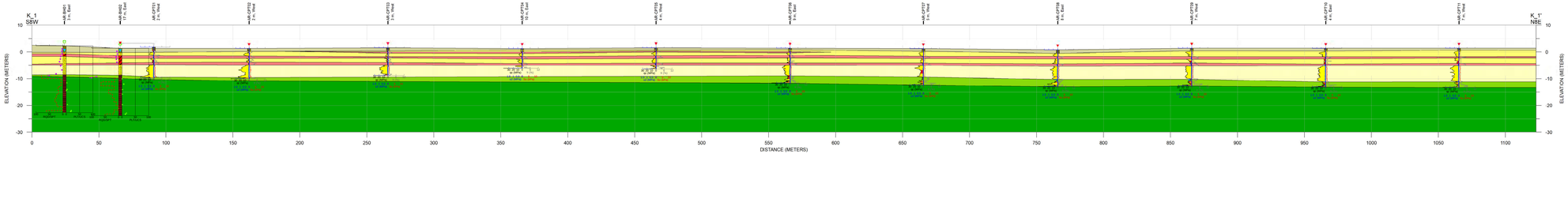
Figure Title

Geotechnical Cross Section Line J

Figure Number

B.1.10

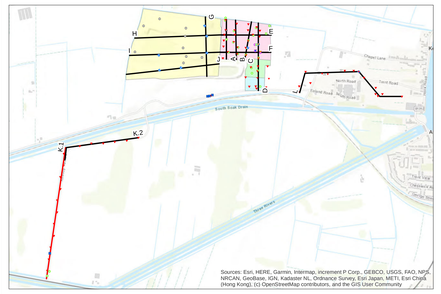
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:16,000

0 0.5 1 2 3 km

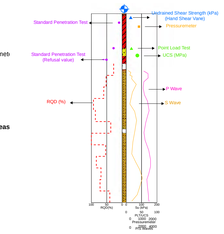
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometr Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

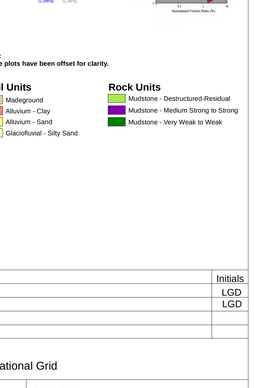
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

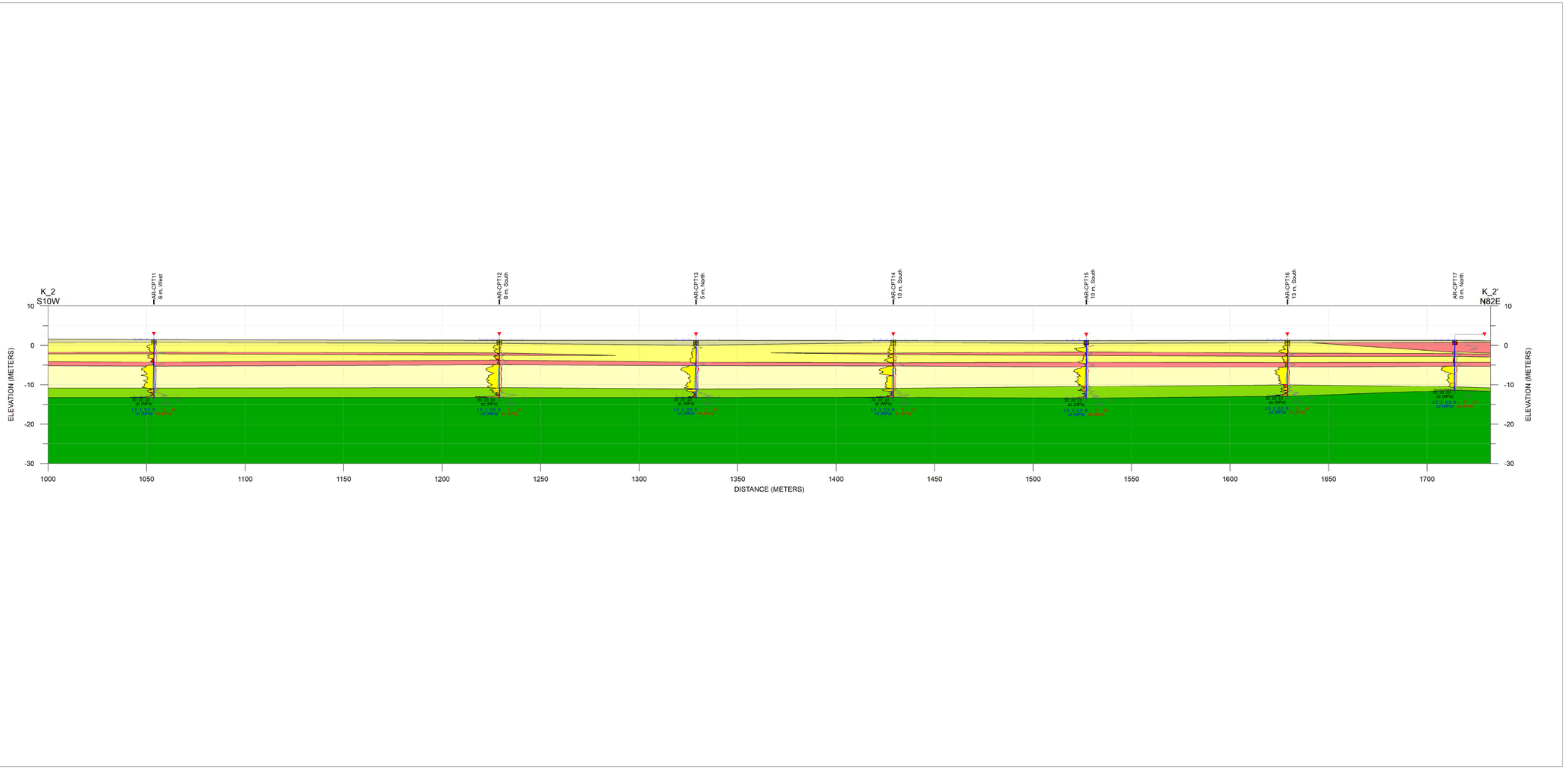
Figure Title

Geotechnical Cross Section Line K.1

Figure Number

B.1.11

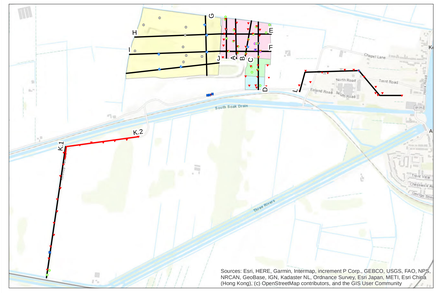
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:16,000

0 0.5 1 2 3 km

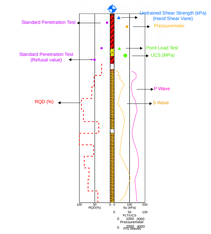
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometer Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

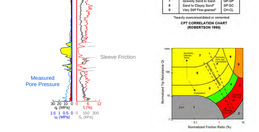
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

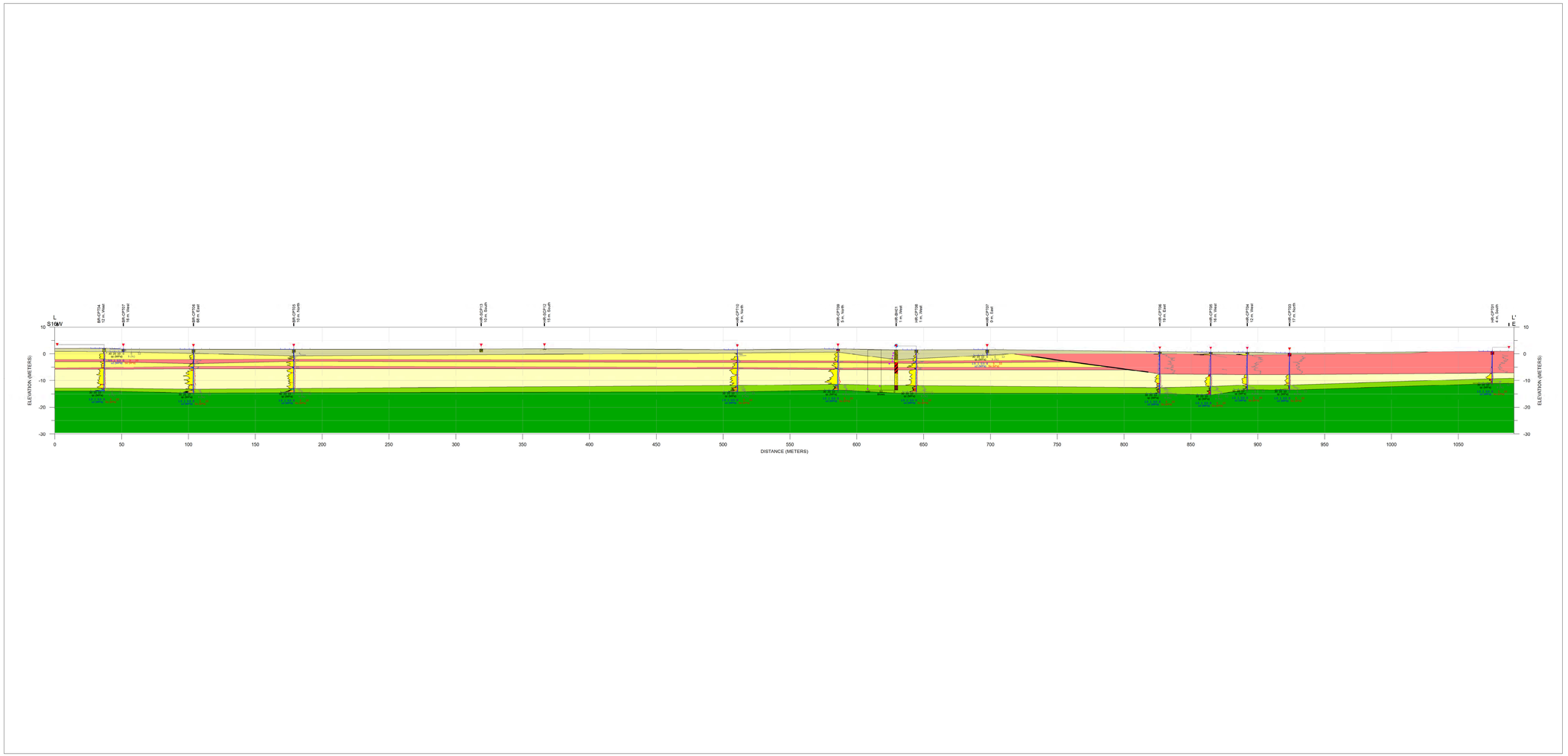
Figure Title

Geotechnical Cross Section Line K.2

Figure Number

B.1.12

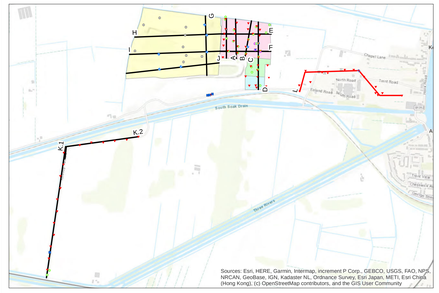
Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1



2 m

10 m

Vertical Exaggeration = 5.0X



Scale: 1:16,000

0 0.5 1 2 3 km

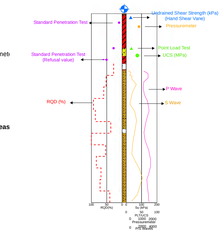
N

Legend

- Cable Percussion Borehole
- Cable Percussion with Rotary Follow On
- Cable Percussion with Rotary Follow On and High Pressure Dilatometer Test
- Cable Percussion with Rotary Follow On, High Pressure Dilatometr Test and Borehole Geophysical Logging
- Window Sampling
- Cone Penetration Test
- Cone Pressuremeter Test
- Seismic Cone Penetration and Cone Pressuremeter Test
- Seismic Cone Penetration Test
- Dynamic Cone Penetrometer Test
- Light Weight Deflectometer Test
- Ground Water Level
- Interpolated Ground Water Level
- Cross Section
- Related Cross Section Line

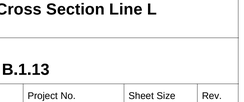
Project Sub Areas

- Area A
- Area B
- Area C
- Ash Tip



Soil/Rock Descriptions

- NoRecovery
- Top Soil
- Made Ground
- Concrete
- Clay
- Silty clay
- Silty sandy clay
- Sandy clay
- Sandy gravelly clay
- Gravelly clay
- Silt
- Sand
- Gravelly sand
- Clayey sand
- Silty Sand
- Gravel
- Sandy gravel
- Clayey sandy gravel
- Organic clay
- Peat
- Gravelly peat
- Shale
- Mudstone
- Sandstone



Note:
Some plots have been offset for clarity.

Soil Units

- Madeground
- Alluvium - Clay
- Alluvium - Sand
- Glaciofluvial - Silty Sand

Rock Units

- Mudstone - Destructured-Residual
- Mudstone - Medium Strong to Strong
- Mudstone - Very Weak to Weak

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

Figure Title

Geotechnical Cross Section Line L

Figure Number

B.1.13

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
LGD	SBP	03/03/2023	F212561	80 x 136 cm	1

Appendix C

Bedrock Top Elevation and Thickness Maps

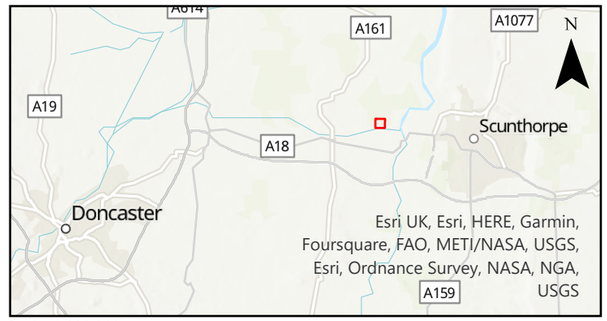
C.1 Soil Thickness Map

C.2 Destructed & Residual Soil Thickness Map

C.3 Bedrock Head Elevation Map



Location



Scale: 1:800,000

0 5 10 20 30 40 Kilometers

Legend

Locations

- Borehole
- CPT

Project Sub Areas

- Area A
- Area B
- Area C

Contour

- 0.5 m
- 1 m

Soil Thickness (m)

- 12.065 - 13
- 13.001 - 14
- 14.001 - 15
- 15.001 - 15.692

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:2,500

0 50 100 200 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

Figure Title

Soil Thickness Map

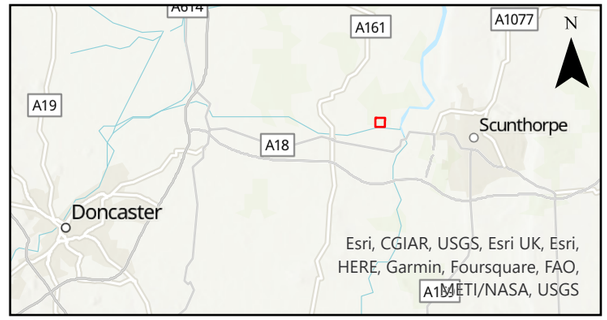
Figure Number

Appendix C.1

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	OY	03/03/2023	F212561	A3	1



Location



Scale: 1:800,000

0 5 10 20 30 40 Kilometers

Legend

Locations

- Borehole
- CPT

Project Sub Areas

- Area A
- Area B
- Area C

Contour

- 0.5 m
- 1 m

Destructured Thickness (m)

- 0.725 - 1
- 1.001 - 2
- 2.001 - 3
- 3.001 - 4
- 4.001 - 5.58

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:2,500

0 50 100 200 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

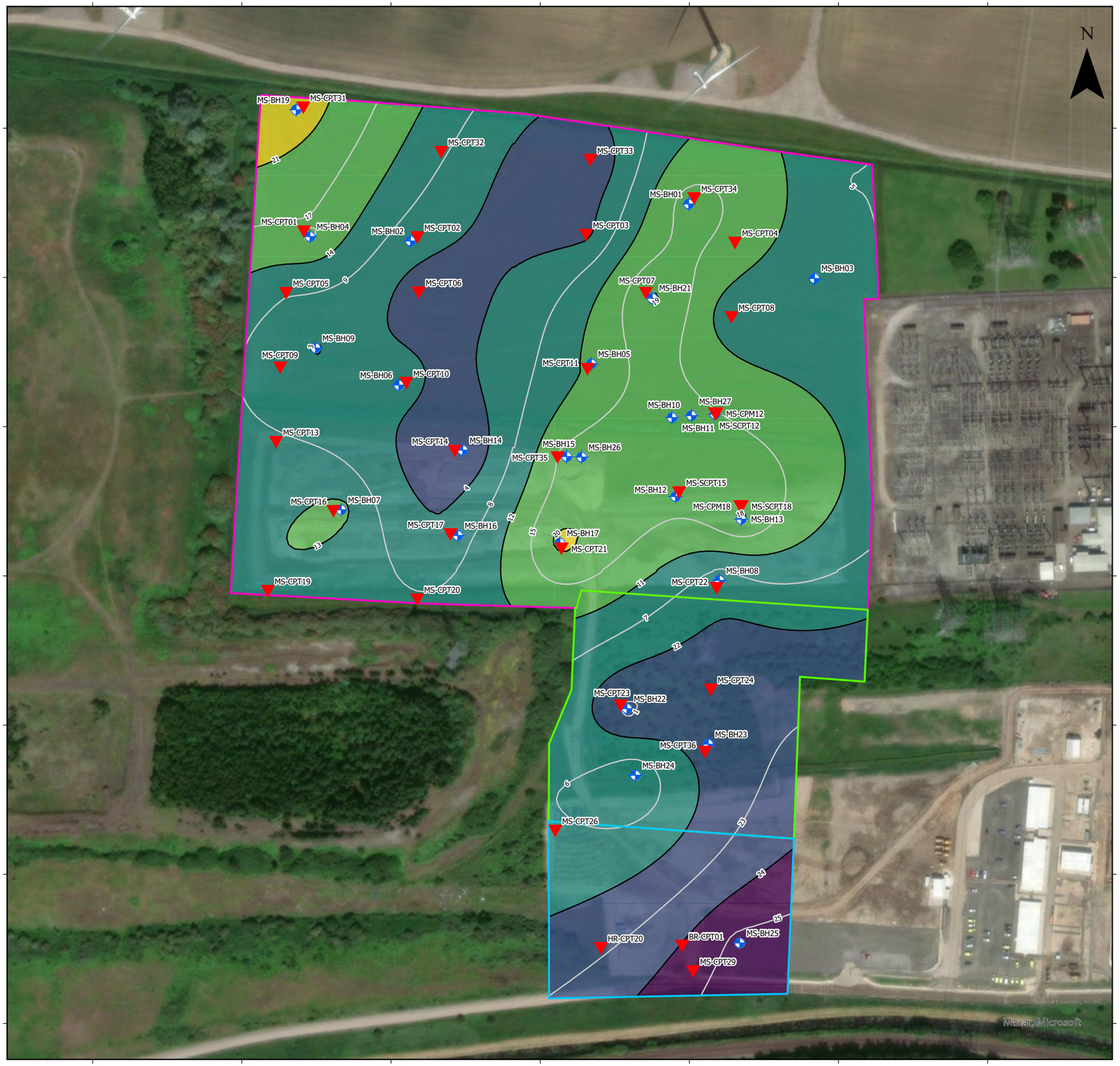
Figure Title

Destructed & Residual Soil Thickness Map

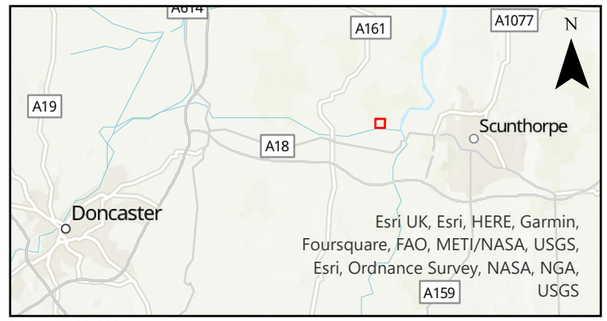
Figure Number

Appendix C.2

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	OY	03/03/2023	F212561	A3	1



Location



Scale: 1:800,000

0 5 10 20 30 40 Kilometers

Legend

Locations

- Borehole
- CPT

Project Sub Areas

- Area A
- Area B
- Area C

Contour

- 0.5 m
- 1 m

Bedrock Head (m)

- -17.965 - -17
- -16.999 - -16
- -15.999 - -15
- -14.999 - -14
- -13.999 - -13.557

Rev.	Date	Description	Initials
0	20/01/2023	Draft Issue	LGD
1	03/03/2023	Final Issue	LGD

Scale: 1:2,500

0 50 100 200 Meters

Coordinate System

British National Grid

Client

SSE Generation Limited
Keadby Power Station Trentside
Keadby
Scunthorpe
DN17

Consultant

Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Keadby 3 Low Carbon Gas Power Station Project

Figure Title

Bedrock Head Elevation Map

Figure Number

Appendix C.3

Drawn by	Checked by	Issued On	Project no.	Sheet Size	Rev.
LGD	OY	03/03/2023	F212561	A3	1

Appendix D

Engineering Parameters

D.1 Summary Tables

Title	Reference
Summary of Engineering Parameters from CPT Data – Main Site	Table D.1
Summary Table of Range of Engineering Parameters from CPT Data – Main Site	Table D.2
Summary of Standard Penetration Test Results	Table D.3
Standard Penetration Tests – Summary of Refusal on Mercia Mudstone	Table D.4
Summary of CBR values from In situ testing	Table D.5
Summary of Variable Head Permeability Test Results	Table D.6
Summary of Shear Wave Velocity of Soil Units	Table D.7
Summary of P & S Wave Velocities of Rock Units	Table D.8
Summary of Moisture Content Results	Table D.9
Summary of Bulk and Dry Density Results	Table D.10
Summary of Atterberg Limits	Table D.11
Summary of Non Plastic Atterberg Limits Results	Table D.12
Summary of Fines Content	Table D.13
Summary of Compaction Test Results	Table D.14
Summary of UU-Triaxial Test Results	Table D.15
Summary of Direct Shear Test Results	Table D.16
Summary of Water Content of Rock Samples	Table D.17
Summary of Point Load Test Results	Table D.18Table D.18
Summary of Uniaxial Compressive Strength Results	Table D.19

Table D.1: Summary of Engineering Parameters from CPT Data – Main Site

Strata	Layer Code	Layer Description	Mean qt (MPa)	Mean f_s (kPa)	Mean Es (MPa)	Mean D_r (%)	φ (°)	Mean M (MPa)	Mean Go (MPa)	Mean Su (kPa)	Unit Weight (kN/m^3)
Alluvium Deposits	1a	Sand & silty sand	7.1	67.3	49.4	59.8	34-38	60.8	61.0	0.0	18.3
	2a	Clay	1.1	29.4	0.0	0.0	28	13.8	22.4	58	16.6
	1a	Sand & silty sand	7.1	67.3	49.4	59.8	34-38	60.8	61.0	0.0	18.3
	2b	Clay & Silty clay	2.6	66.8	0.0	0.0	30	34.9	49.7	125	18.1
Glaciofluvial Deposits	1b	Sand & silty sand	11.4	114.2	84.7	57.4	36-40	105.4	109.8	0.0	19.3
Residual Mercia Mudstone	2c	Clay	3.5	133.8	0.0	0.0	30	42.7	93.7	190	18.8

Table D.2: Summary Table of Range of Engineering Parameters from CPT Data – Main Site

Unit Code	Layer Description	Mean qt (MPa)			Mean fs (kPa)			Mean Es (MPa)			Mean D_r (%)			Mean φ (°)		
		Min	Max	St.Dev	Min	Max	St.Dev	Min	Max	St.Dev	Min	Max	St.Dev	Min	Max	St.Dev
1a	Sand & silty sand	2.0	14.6	2.3	32.4	158.5	26.0	33.9	80.4	10.1	31.8	64.9	7.1	33	40	2
2a	Clay	0.5	1.7	0.3	5.9	75.6	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
1a	Sand & silty sand	2.0	10.1	1.4	12.8	121.9	21.9	21.9	71.4	9.0	31.8	64.9	5.7	33	40	1
2b	Clay & Silty clay	1.8	4.1	0.5	42.1	106.1	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
1b	Sand & silty sand	9.1	13.2	1.0	77.8	143.1	15.4	72.2	94.4	6.2	51.7	62.4	2.5	38	40	0
2c	Clay	0.9	6.7	1.4	34.4	269.8	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0

Layer Code	Layer Description	Mean M (MPa)			Mean G_o (MPa)			Mean S_u (kPa)			Mean Unit Weight (kN/m^3)		
		Min	Max	St.Dev	Min	Max	St.Dev	Min	Max	St.Dev	Min	Max	St.Dev
1a	Sand & silty sand	39.5	100.6	12.9	38.4	107.2	14.6	0.0	0.0	0.0	16.9	19.7	0.6
2a	Clay	5.0	21.8	3.8	8.7	38.7	5.9	27.3	103.1	14.4	14.7	18.1	0.7
1a	Sand & silty sand	24.2	88.5	11.8	23.2	91.9	12.8	0.0	0.0	0.0	16.0	19.2	0.6
2b	Clay & Silty clay	24.1	52.2	6.2	36.0	70.8	7.8	100.1	194.2	19.4	17.5	18.8	0.3
1b	Sand & silty sand	90.1	118.3	7.7	91.6	124.3	9.1	0.0	0.0	0.0	18.9	19.6	0.2
2c	Clay	6.2	84.1	19.5	32.5	153.5	26.9	41.2	392.8	86.4	16.9	19.8	0.6

Table D.3: Summary of Standard Penetration Test Results

Area	Strata	Unit	SPT N			Count
			Average	Min	Max	
Main Site	Made Ground	0	15	5	33	8
	Alluvium Deposits	1a	7	1	22	85
		2a	5	1	13	28
		2b	7	1	14	18
	Glaciofluvial Deposits	1b	11	1	30	108
	Residual Mercia Mudstone*	2c	22	6	40	3
Ash Tip	Made Ground	0	8	2	13	60
	Alluvium Deposits	1a	8	3	15	14
		2a	6	6	6	2
	Glaciofluvial Deposits	1b	11	11	11	2
	Residual Mercia Mudstone**	2c	-	-	-	-
Access Roads	Made Ground	0	5	2	8	6
	Alluvium Deposits	1a	6	2	9	4
		2a	11	6	19	4
		2b	7	7	7	1
	Glaciofluvial Deposits	1b	12	3	25	4
	Residual Mercia Mudstone***	2c	-	-	-	-

* Twenty two tests "refused" and excluded from average, min, max calculations

** Four tests "refused" and excluded from average, min, max calculations

*** Five tests "refused" and excluded from average, min, max calculations

Table D.4: Standard Penetration Tests – Summary of Refusal on Mercia Mudstone

Area	Borehole	Test Depth (m BGL))	Surface Elevation (m AOD)	Test Level (m AOD)
Main Site	MS-BH01	14.50	0.54	-13.96
	MS-BH03	15.00	0.72	-14.28
	MS-BH03	21.20	0.72	-20.48
	MS-BH03	16.70	0.72	-15.98
	MS-BH03	18.20	0.72	-17.48
	MS-BH03	19.70	0.72	-18.98
	MS-BH04	14.50	0.33	-14.17
	MS-BH05	15.00	0.65	-14.35
	MS-BH07	13.50	0.62	-12.88
	MS-BH07	15.00	0.62	-14.38
	MS-BH08	14.00	0.80	-13.20
	MS-BH08	14.35	0.80	-13.55
	MS-BH09	14.50	0.48	-14.02
	MS-BH10	14.10	0.71	-13.39
	MS-BH11	14.20	0.74	-13.46
	MS-BH12	14.80	0.74	-14.06
	MS-BH13	14.00	0.71	-13.29
	MS-BH13	14.50	0.71	-13.79
	MS-BH14	15.00	0.81	-14.19
	MS-BH15	15.00	0.76	-14.24
	MS-BH16	15.00	0.57	-14.43
	MS-BH17	14.90	0.91	-13.99
	MS-BH18	12.60	0.68	-11.92
	MS-BH18	13.80	0.68	-13.12
	MS-BH19	13.50	0.60	-12.90
	MS-BH20	15.00	0.98	-14.02
	MS-BH21	14.50	0.81	-13.69
	MS-BH22	14.50	1.02	-13.48
	MS-BH23	14.20	0.98	-13.22
	MS-BH24	14.70	0.98	-13.72
	MS-BH25	15.00	2.30	-12.70
Ash Tip	BH104	15.00	6.52	-8.48
	BH104	15.70	6.52	-9.18
	BH106	14.20	6.33	-7.87
	BH106	15.20	6.33	-8.87
Access Roads	AR-BH01	11.20	2.32	-8.88
	AR-BH02	10.60	1.40	-9.20

Area	Borehole	Test Depth (m BGL))	Surface Elevation (m AOD)	Test Level (m AOD)
	AR-BH02	11.05	1.40	-9.65
	HR-BH01	13.60	1.50	-12.10
	HR-BH01	14.60	1.50	-13.10

Table D.5: Summary of CBR values from In situ testing

Depth (mbgl)	Access roads (AR) CBR (%)			Bonyhale Road (BR) CBR (%)			Haulage Road (HR) CBR (%)		
	Min.	Max.	Ave	Min.	Max.	Ave	Min.	Max.	Ave
GL	9	37	17	27	1681	373	13	161	66
0.10	13	60	37	NA	NA	NA	6	264	114
0.20	0.5	22	3	NA	NA	NA	-	-	-
0.30	24	55	40	NA	NA	NA	-	-	-
0.40	1.1	65	33	NA	NA	NA	-	-	-
0.60	25	25	25	NA	NA	NA	-	-	-
0.75	NA	NA	NA	NA	NA	NA	9	9	9
1.10	NA	NA	NA	NA	NA	NA	40	40	40

Notes:
NA – Not Assessed

Table D.6: Summary of Variable Head Permeability Test Results

Area	Borehole	Top Depth (m BGL)	Base Depth (m BGL)	Unit	Permeability (m/s)	Note
Main Site	MS-BH12	5	8	1a, 2b, 1b	4.38×10^{-5}	
	MS-BH17	3	6	2a, 1a, 2b	$4.4 \times 10_{-5}$	
Ash Tip	BH101	18	21	0, 2a	7.39×10^{-6}	Unit-0 base depth at 18.50 m BGL. Most of the test is in Unit-2a
	BH102	18	30	0, 1a, 1b	4.54×10^{-8}	Unit-0 base depth at 19.00 m BGL
	BH103	18	30	0, 1a, 1b	1.15×10^{-7}	Unit-0 base depth at 19.00 m BGL
	BH104	4.5	9	0	N/A	
Access Roads	AR-BH01	7	10	1b	1.39×10^{-5}	
	HR-BH01	2	5	0, 2a, 2b	4.25×10^{-5}	Unit-0 base depth at 3.65m. Unit-2b is from 4.70 m to 5.00 m BGL

Table D.7: Summary of Shear Wave Velocity of Soil Units

Area	Strata	Unit	Shear Wave Velocity (m/s)			Count
			Average	Min	Max	
Main Site	Alluvium	1a	254.3	155.0	617.0	12
		2a	141.0	141.0	141.0	1
		2b	185.5	170.0	201.0	2
	Glaciofluvial	1b	222.0	178.0	308.0	23
	Residual Mercia Mudstone	2c	381.5	206.0	497.0	4

Table D.8: Summary of P & S Wave Velocities of Rock Units

Area	Unit	Count	P-wave Velocity (m/s)			S-wave Velocity (m/s)			Poisson's Ratio		
			Average	Min	Max	Average	Min	Max	Average	Min	Max
Main Site	3	127	2852	1945	4056	1232	618	1944	0.38	0.30	0.46
	3a	5	3208	2872	3479	1308	1118	1450	0.40	0.40	0.41

Table D.9: Summary of Moisture Content Results

Area	Strata	Unit	Moisture Content (%)			Count
			Average	Min	Max	
Main Site	Made Ground	0	28.0	12.9	41.6	4
	Alluvium Deposits	1a	21.7	6.0	36.5	37
		2a	27.4	15.5	43.7	24
		2b	24.0	17.5	31.7	14
	Glaciofluvial Deposits	1b	18.4	16.3	22.7	34
	Residual Mercia Mudstone	2c	20.5	5.9	27.8	20
Ash Tip	Made Ground	0	24.8	7.6	50.2	14
	Alluvium Deposits	1a	21.2	16.1	27.5	5
		2a	25.5	23.0	28.0	2
	Glaciofluvial Deposits	1b	19.3	17.4	22.9	4
	Residual Mercia Mudstone	2c	23.1	22.2	24.0	3
Access Roads	Made Ground	0	20.6	12.1	25.0	3
	Alluvium Deposits	1a	25.6	25.5	25.7	2
		2a	25.9	21.4	29.9	5
		2b	27.5	21.4	32.6	4
	Glaciofluvial Deposits	1b	21.0	15.4	28.7	3
	Residual Mercia Mudstone	2c	20.3	14.5	24.2	5

Table D.10: Summary of Bulk and Dry Density Results

Area	Strata	Unit	Bulk Density (Mg/m^3)			Dry Density (Mg/m^3)			Count
			Average	Min	Max	Average	Min	Max	
Main Site	Alluvium	1a	2.03	1.92	2.09	1.68	1.75	1.75	7
		2a	2.02	1.89	2.12	1.61	1.73	1.73	3
		2b	2.11	2.11	2.11	1.71	1.71	1.71	1
	Residual Mercia Mudstone	2c	2.09	2.09	2.09	1.70	1.70	1.70	1

Table D.11: Summary of Atterberg Limits

Area	Strata	Unit	Plastic Limit (%)			Liquid Limit (%)			Plasticity Index (%)			Count
			Average	Min	Max	Average	Min	Max	Average	Min	Max	
Main Site	Made Ground	0	35.5	35.0	36.0	72.0	69.0	75.0	36.5	34.0	39.0	2
	Alluvium Deposits	1a	17.4	13.0	20.0	27.4	21.0	34.0	10.0	5.0	15.0	5
		2a	19.7	13.0	26.0	38.8	25.0	55.0	19.1	9.0	32.0	14
		2b	18.8	14.0	21.0	30.3	23.0	42.0	11.5	6.0	21.0	6
	Glaciofluvial Deposits	1b	17.0	17.0	17.0	26.0	26.0	26.0	9.0	9.0	9.0	1
	Residual Mercia Mudstone	2c	20.0	17.0	23.0	33.6	28.0	39.0	13.6	11.0	17.0	16
Ash Tip	Made Ground	1a	15.0	15.0	15.0	23.0	15.0	15.0	8.0	8.0	8.0	1
	Alluvium Deposits	2a	17.0	16.0	18.0	29.5	16.0	18.0	12.5	6.0	19.0	2
	Glaciofluvial Deposits	1b	17.0	17.0	17.0	36.0	17.0	17.0	19.0	19.0	19.0	1
	Residual Mercia Mudstone	2c	24.0	24.0	24.0	47.0	24.0	24.0	23.0	23.0	23.0	1
Access Roads	Made Ground	1a	13.0	13.0	13.0	22.0	13.0	13.0	9.0	9.0	9.0	1
	Alluvium Deposits	2a	20.3	20.0	21.0	40.7	20.0	21.0	20.3	18.0	24.0	3
		2b	17.0	16.0	18.0	31.7	16.0	18.0	14.7	10.0	18.0	3
	Residual Mercia Mudstone	2c	18.5	16.0	21.0	37.0	16.0	21.0	18.5	18.0	19.0	2

Table D.12: Summary of Non Plastic Atterberg Limits Results

Area	Strata	Unit	Borehole	Depth (m)	Sample Number	Type
Main Site	Alluvium Deposits	1a	MS-BH01	5.0	22	D
		1a	MS-BH05	3.0	16	D
		1a	MS-BH06	5.0	20	D
		1a	MS-BH12	2.2	13	D
		1a	MS-BH19	4.0	21	B
		1a	MS-BH22	5.5	19	D
		2a	MS-BH02	4.5	19	D
		2a	MS-BH04	4.0	20	D
		2a	MS-BH08	3.5	15	D
		2a	MS-BH10	3.5	17	D
		2a	MS-BH12	4.2	19	D
		2a	MS-BH21	3.0	16	D
		2a	MS-BH23	2.5	14	D
		2a	MS-BH23	6.0	22	D
		2a	MS-BH27	4.5	18	UT#B
		2b	MS-BH02	6.5	23	D
		2b	MS-BH04	4.8	22	D
		2b	MS-BH13	5.2	21	D
		2b	MS-BH13	6.8	25	D
	Glaciofluvial Deposits	1b	MS-BH04	9.0	32	D
		1b	MS-BH06	10.5	28	D
		1b	MS-BH07	5.0	22	D
		1b	MS-BH15	6.7	23	D
		1b	MS-BH21	6.0	25	D
	Residual Mercia Mudstone	2c	MS-BH01	12.0	38	B
		2c	MS-BH14	14.0	39	D
		2c	MS-BH18	12.6	38	D
Ash Tip	Residual Mercia Mudstone	2c	BH106	13.2	41	D
		2c	BH106	14.2	45	D
Access Roads	Alluvium Deposits	2a	HR-BH01	4.8	19	D
		2a	HR-BH01	5.2	21	D
		2b	HR-BH01	3.8	16	D
	Glaciofluvial Deposits	1b	AR-BH01	6.7	20	D
	Residual Mercia Mudstone	2c	AR-BH01	10.9	26	D
		2c	AR-BH02	10.5	36	D

Table D.13: Summary of Fines Content

Area	Strata	Unit	Fines Content (%)			Count
			Average	Min	Max	
Main Site	Made Ground	0	15.0	7.3	30.5	6
	Alluvium Deposits	1a	21.2	4.6	56.4	32
		2a	64.5	34.0	92.9	17
		2b	61.9	39.9	89.7	12
	Glaciofluvial Deposits	1b	14.0	2.0	35.7	40
	Residual Mercia Mudstone	2c	47.2	11.8	75.6	9
Ash Tip	Made Ground	0	46.3	8.6	66.2	5
	Alluvium Deposits	1a	23.2	7.7	40.4	5
		2b	63.3	55.2	71.3	2
	Glaciofluvial Deposits	1b	15.1	9.6	19.1	3
Access Roads	Made Ground	0	20.4	7.6	35.5	3
	Alluvium Deposits	1a	15.9	11.2	20.5	2
		2a	65.7	35.4	96.0	2
		2b	37.6	37.6	37.6	1
	Glaciofluvial Deposits	1b	20.8	9.8	48.3	5
	Residual Mercia Mudstone	2c	83.1	83.1	83.1	1

Table D.14: Summary of Compaction Test Results

Area	Strata	Unit	Optimum Moisture Content (%)			Maximum Dry Density (Mg/m^3)			Count
			Average	Min	Max	Average	Min	Max	
Main Site	Made Ground	0	16.2	16.2	16.2	1.67	1.67	1.67	1
Ash Tip	Made Ground	0	25.4	14.0	32.6	1.37	1.16	1.63	6
	Alluvium Deposits	1a	14.0	14.0	14.0	1.82	1.82	1.82	1

Table D.15: Summary of UU-Triaxial Test Results

Area	Strata	Unit	Count	Failure Type	Undrained Shear Strength (kPa)
Main Site	Alluvium	2a	1	Brittle	180
	Residual Mercia Mudstone	2c	1	Plastic	140

Table D.16: Summary of Direct Shear Test Results

Area	Strata	Unit	Count	Peak Shear Strength Parameters		Residual Shear Strength Parameters	
				Cohesion, c' (kPa)	Friction Angle, ϕ' (degrees)	Cohesion, c'_R (kPa)	Friction Angle, ϕ'_R (degrees)
Ash Tip	Made Ground	0	1	8.2	31.5	0	30.5
	Alluvium Deposits	1a	1	0	36.5	0	34.5

Table D.17: Summary of Water Content of Rock Samples

Area	Strata	Unit	Water Content (%)			Count
			Average	Min	Max	
Main Site	Mercia Mudstone	3	12.5	6.1	23.4	57
	Medium Strong to Strong Mercia Mudstone	3a	5.4	3.8	6.5	8
Access Roads	Mercia Mudstone	3	12.0	7.7	14.9	6

Table D.18: Summary of Point Load Test Results

Area	Strata	Unit	Test Type	The size-corrected point load strength index, $I_{s(50)}$ (MPa)			Count
				Average	Min	Max	
Main Site	Mercia Mudstone	3	A	0.84	0.01	3.60	123
			D	0.56	0.01	4.47	91
			I	0.55	0.01	2.56	99
	Medium Strong to Strong Mercia Mudstone	3a	A	2.55	0.67	5.55	13
			D	1.84	0.33	3.56	12
			I	2.49	0.58	4.69	11
Access Road	Mercia Mudstone	3	A	0.89	0.07	3.72	11
			D	0.50	0.01	1.63	4
			I	0.60	0.01	2.71	16
Note: A: Axial determination, D: Diametrical determination, I: Irregular lump determination.							

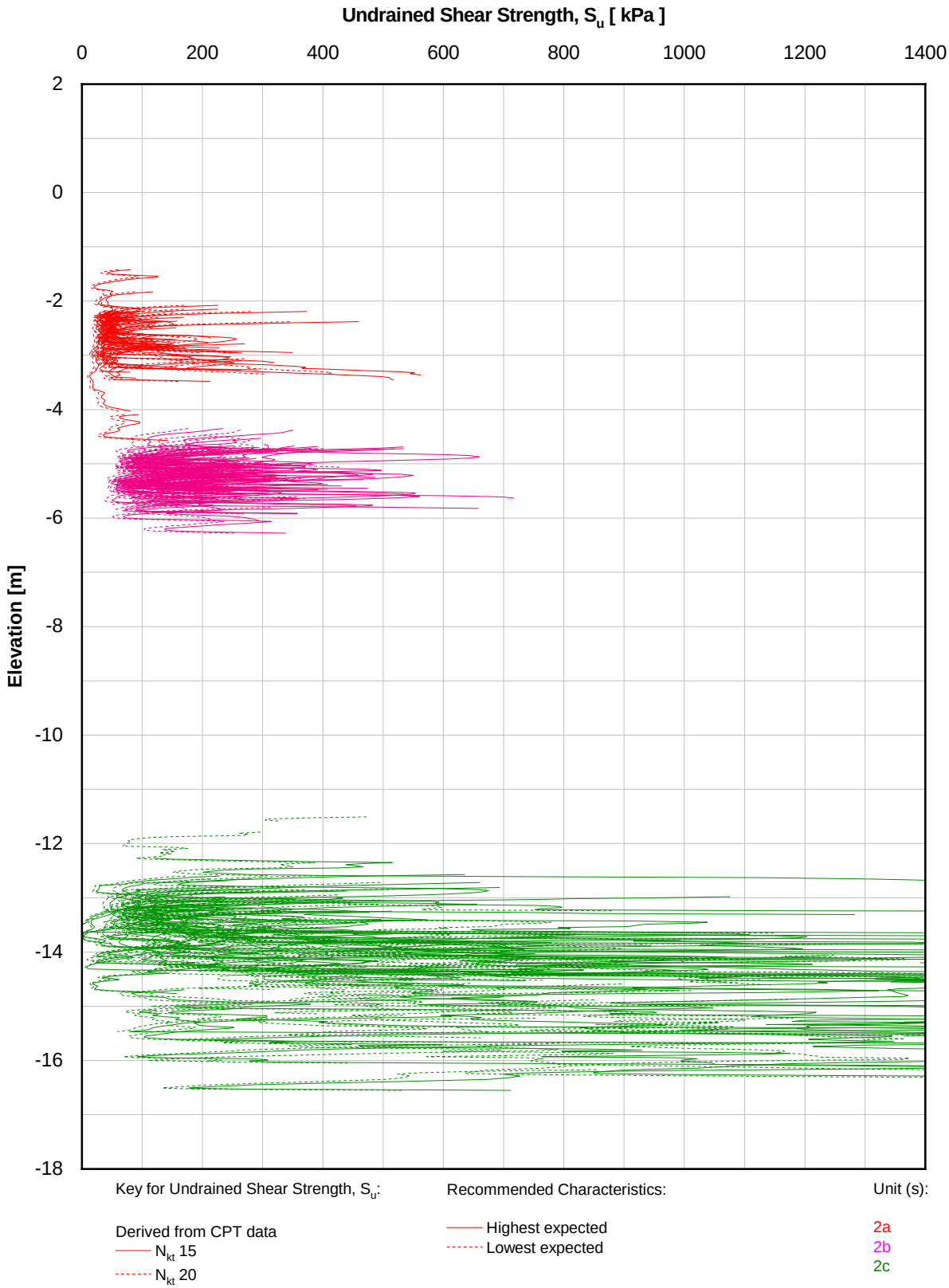
Table D.19: Summary of Uniaxial Compressive Strength Results

Area	Strata	Unit	Uniaxial Compressive Strength, UCS (MPa)			Count
			Average	Min	Max	
Main Site	Mercia Mudstone	3	9.8	3.0	18.4	40
	Medium Strong to Strong Mercia Mudstone	3a	60.4	33.0	105.0	11
Access Road	Mercia Mudstone	3	10.2	3.3	17.4	4

D.2 Parameter Plots

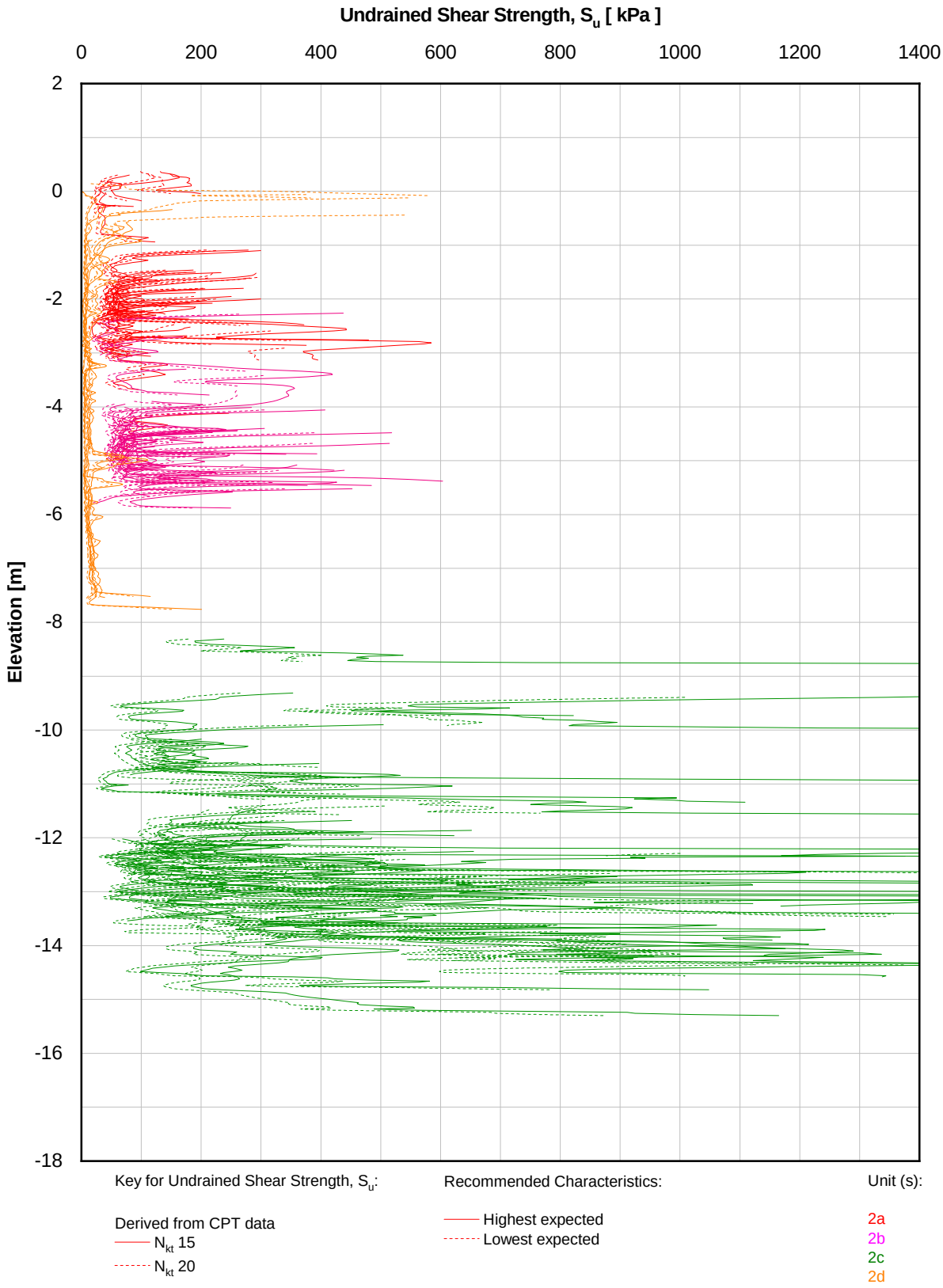
Title	Reference
Interpreted Undrained Shear Strength from CPT Data versus Elevation – Main Site	3.6.1.1a
Interpreted Undrained Shear Strength from CPT Data versus Elevation – Access Roads	3.6.1.1b
Interpreted Relative Density from CPT Data versus Elevation – Main Site	3.6.1.1c
Interpreted Relative Density from CPT Data versus Elevation – Access Roads	3.6.1.1d
Standard Penetration Tests versus Elevation – Main Site	3.6.1.2a
Standard Penetration Tests versus Elevation – Ash Tip	3.6.1.2b
Standard Penetration Tests versus Elevation – Access Roads	3.6.1.2c
Moisture Content versus Elevation – Main Site	3.6.2.1a
Moisture Content versus Elevation – Ash Tip	3.6.2.1b
Moisture Content versus Elevation – Access Roads	3.6.2.1c
Bulk Density versus Elevation – Main Site	3.6.2.2a
Dry Density versus Elevation – Main Site	3.6.2.2b
Plasticity Chart – Main Site	3.6.2.3a
Plasticity Chart – Ash Tip	3.6.2.3b
Plasticity Chart – Access Roads	3.6.2.3c
Plasticity Index versus Elevation – Main Site	3.6.2.3d
Plasticity Index versus Elevation – Ash Tip	3.6.2.3e
Plasticity Index versus Elevation – Access Roads	3.6.2.3f
Particle Size Distribution of Unit 0 – Main Site	3.6.2.4a
Particle Size Distribution of Unit 1a – Main Site	3.6.2.4b
Particle Size Distribution of Unit 2a – Main Site	3.6.2.4c
Particle Size Distribution of Unit 2b – Main Site	3.6.2.4d
Particle Size Distribution of Unit 1b – Main Site	3.6.2.4e
Particle Size Distribution of Unit 2c – Main Site	3.6.2.4f
Particle Size Distribution of Unit 0 – Ash Tip	3.6.2.4g
Particle Size Distribution of Unit 1a – Ash Tip	3.6.2.4h
Particle Size Distribution of Unit 2b – Ash Tip	3.6.2.4i
Particle Size Distribution of Unit 1b – Ash Tip	3.6.2.4j
Particle Size Distribution of Unit 0 – Access Roads	3.6.2.4k
Particle Size Distribution of Unit 1a – Access Roads	3.6.2.4l
Particle Size Distribution of Unit 2a – Access Roads	3.6.2.4m
Particle Size Distribution of Unit 2b – Access Roads	3.6.2.4n
Particle Size Distribution of Unit 1b – Access Roads	3.6.2.4o
Particle Size Distribution of Unit 2c – Access Roads	3.6.2.4p
Fines Content versus Elevation – Main Site	3.6.2.4q

Title	Reference
Fines Content versus Elevation – Ash Tip	3.6.2.4r
Fines Content versus Elevation – Access Roads	3.6.2.4s
Water Content versus Elevation – Main Site	3.6.3.1a
Water Content versus Elevation – Access Roads	3.6.3.1b
Uniaxial Compressive Strength versus Elevation – Main Site	3.6.3.2a
Uniaxial Compressive Strength versus Elevation – Access Roads	3.6.3.2b



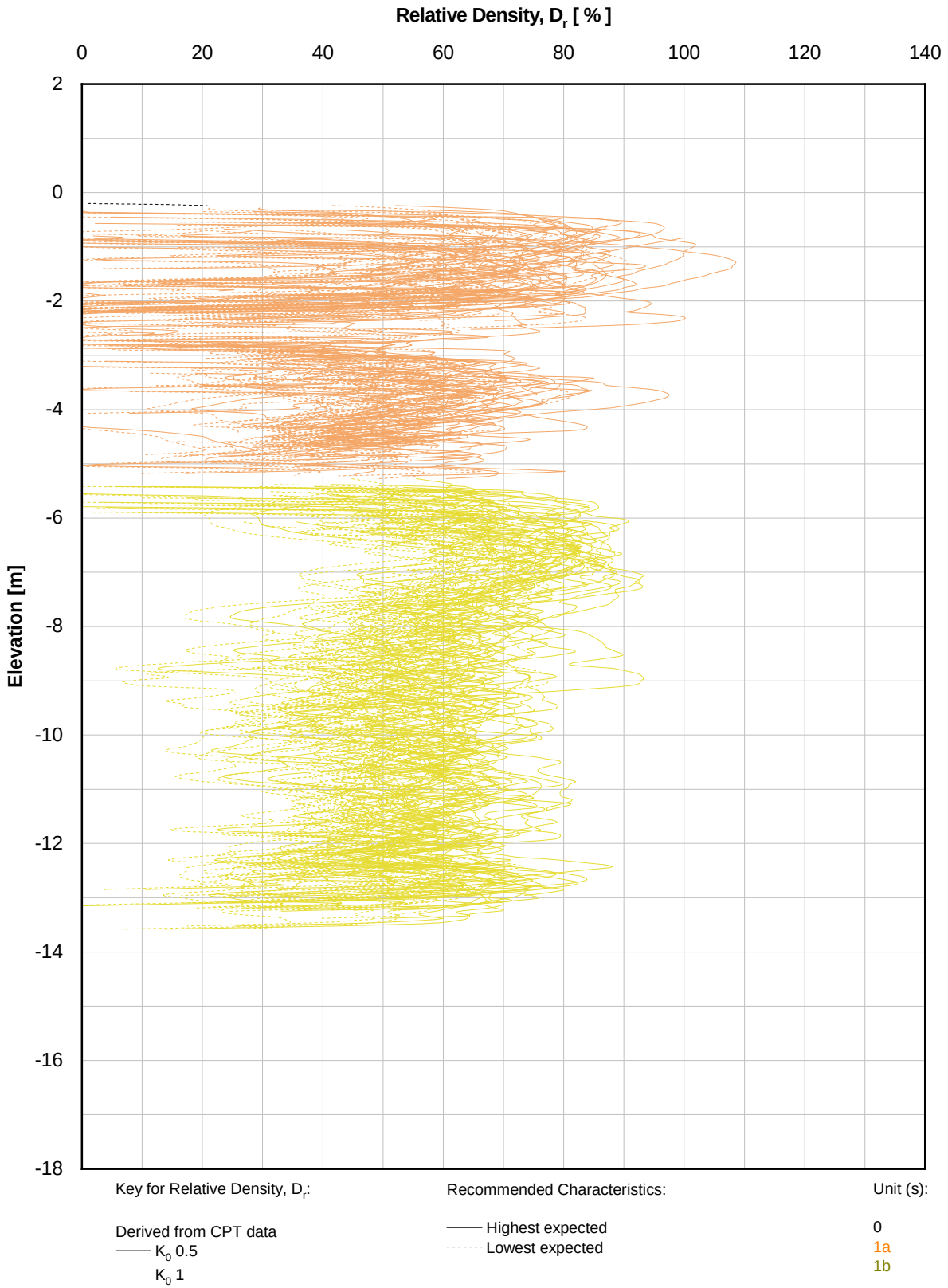
UNDRAINED SHEAR STRENGTH versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Origin v7.03./ / 1/25/2023 12:02:59



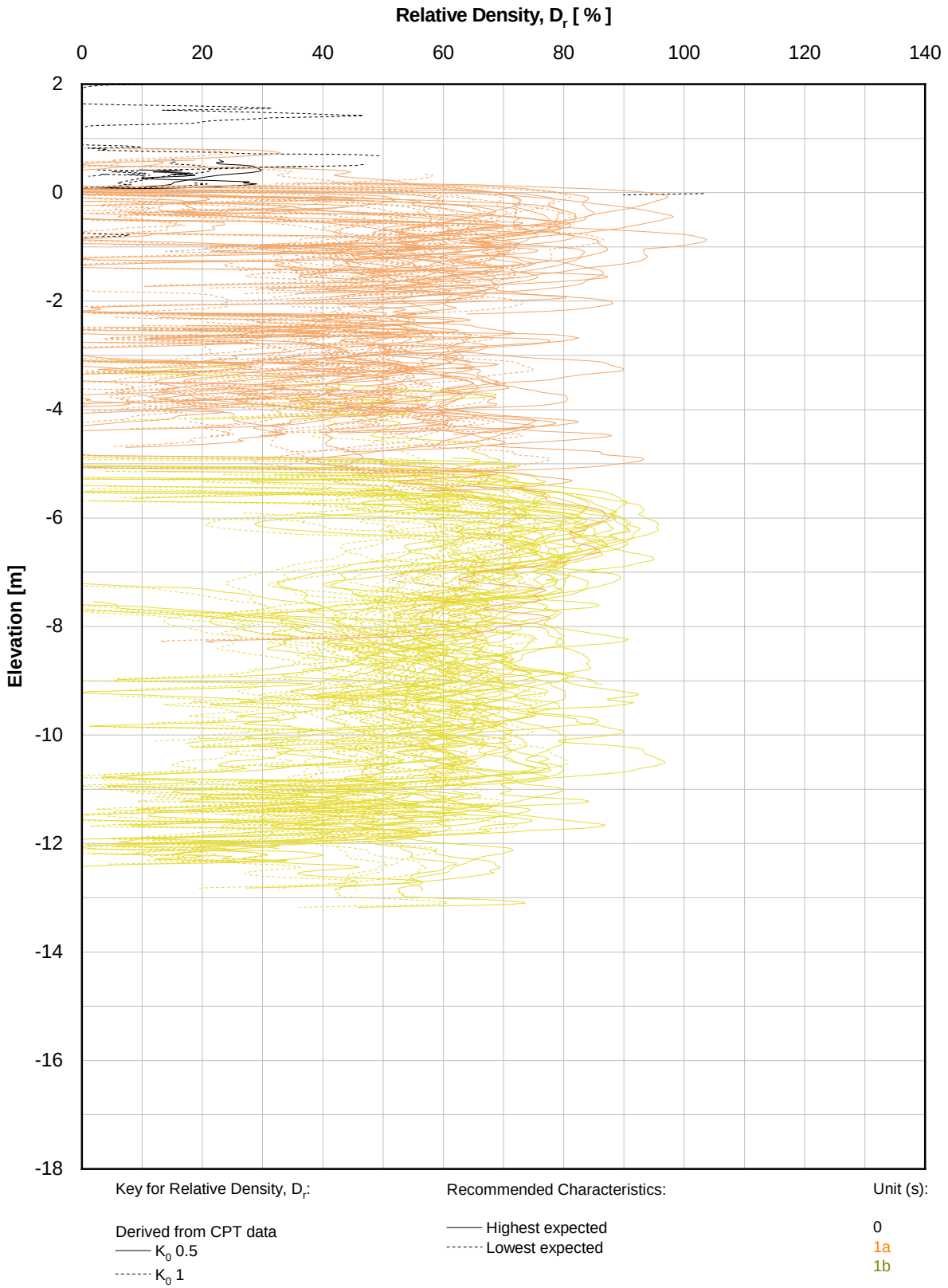
UNDRAINED SHEAR STRENGTH versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

Origin v7.03./ / 1/25/2023 12:11:38



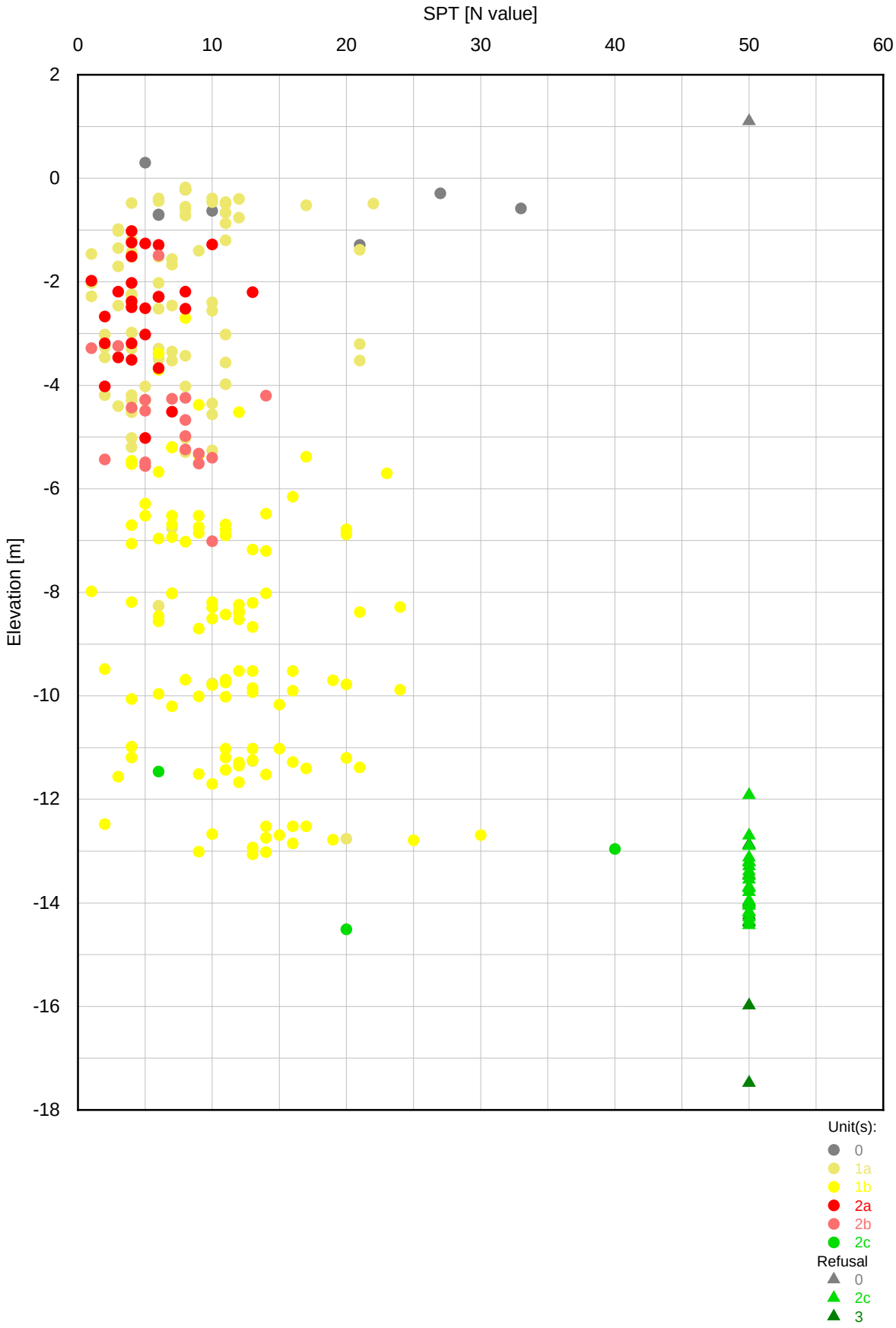
RELATIVE DENSITY versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Origin v7.03./ / 1/25/2023 12:08:17



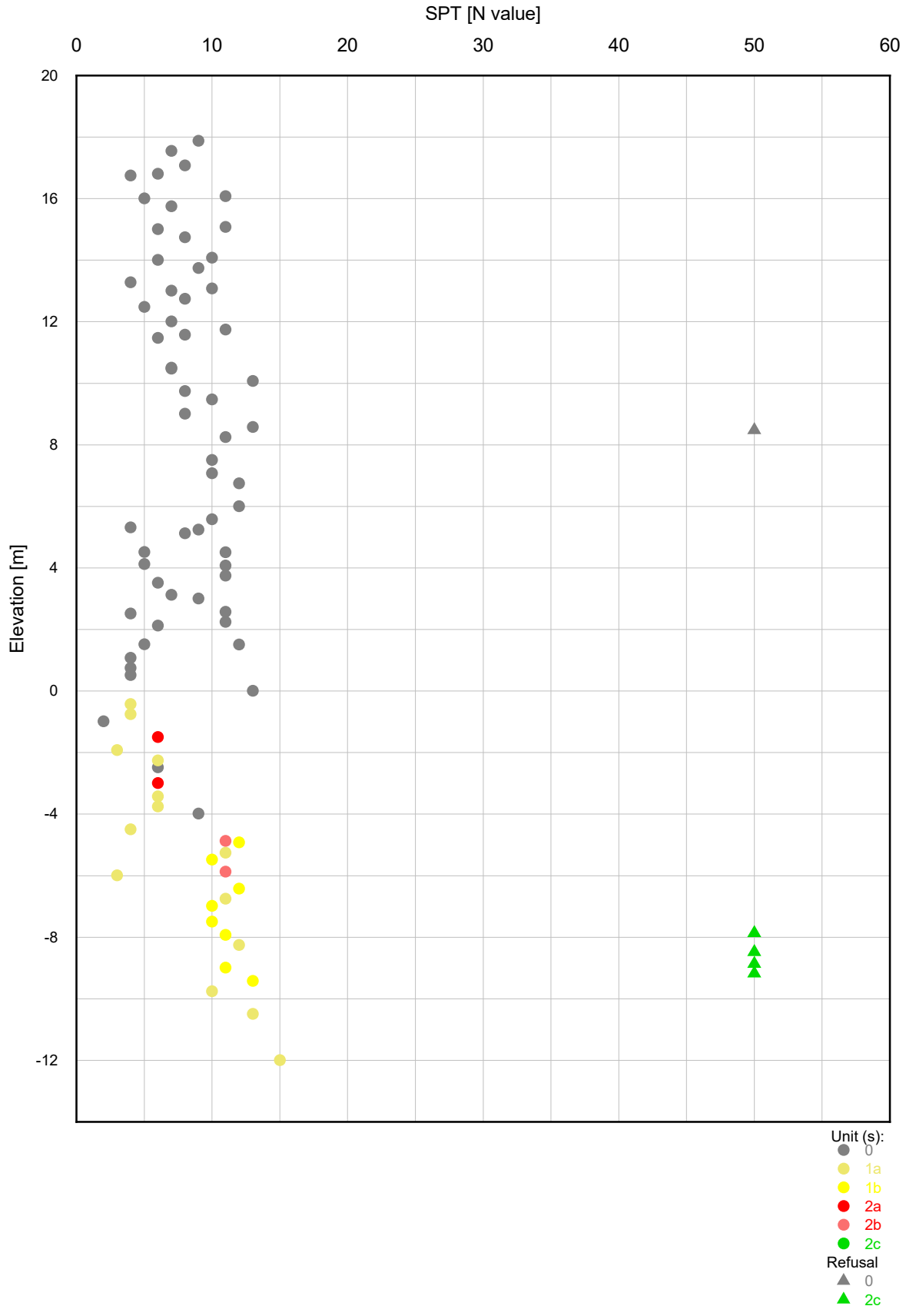
RELATIVE DENSITY versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

Origin v7.03./ / 1/25/2023 12:10:36



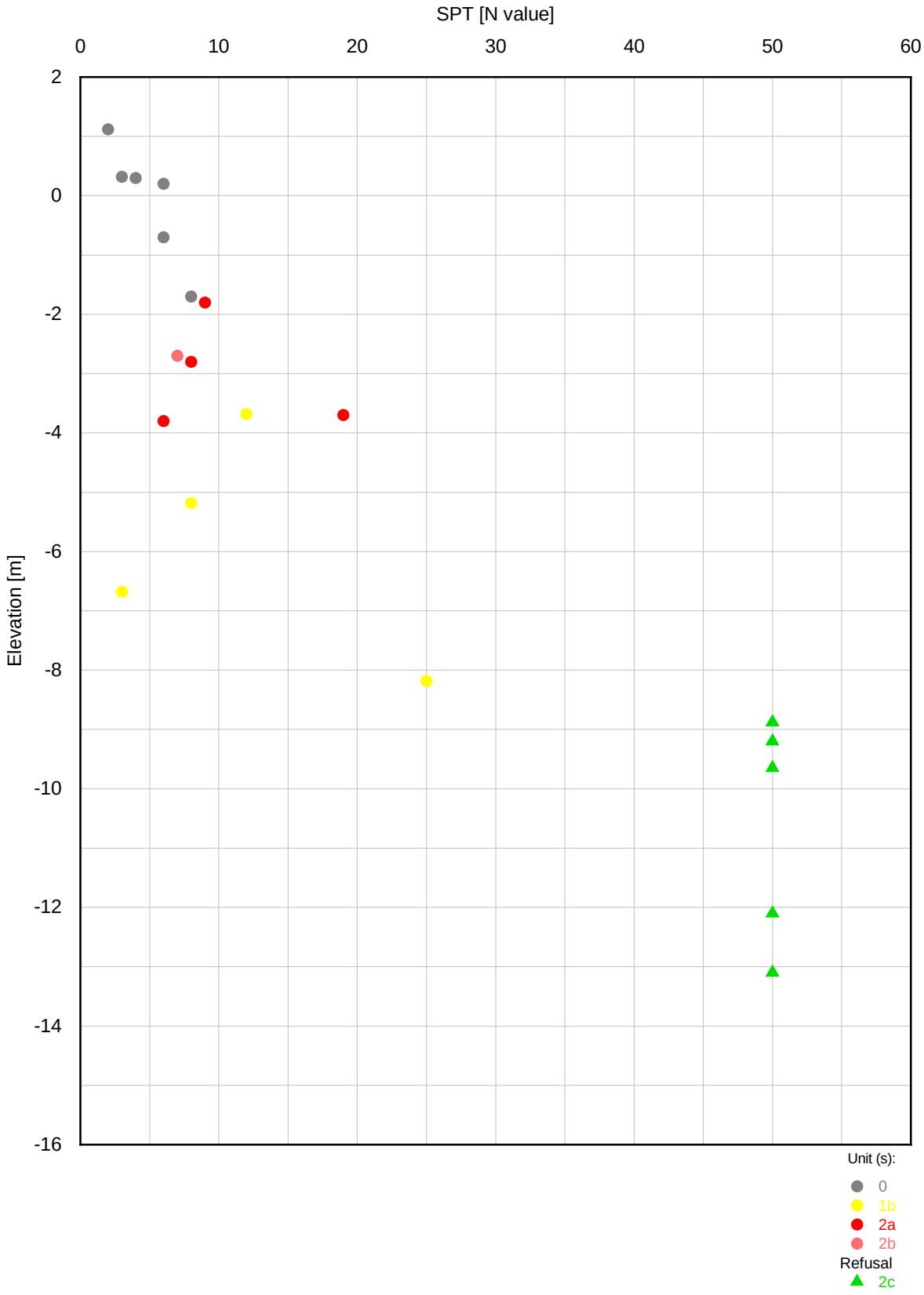
STANDARD PENETRATION TEST versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Origin v7.03./ PI vs Depth.OPJ / 2/10/2023 11:13:51



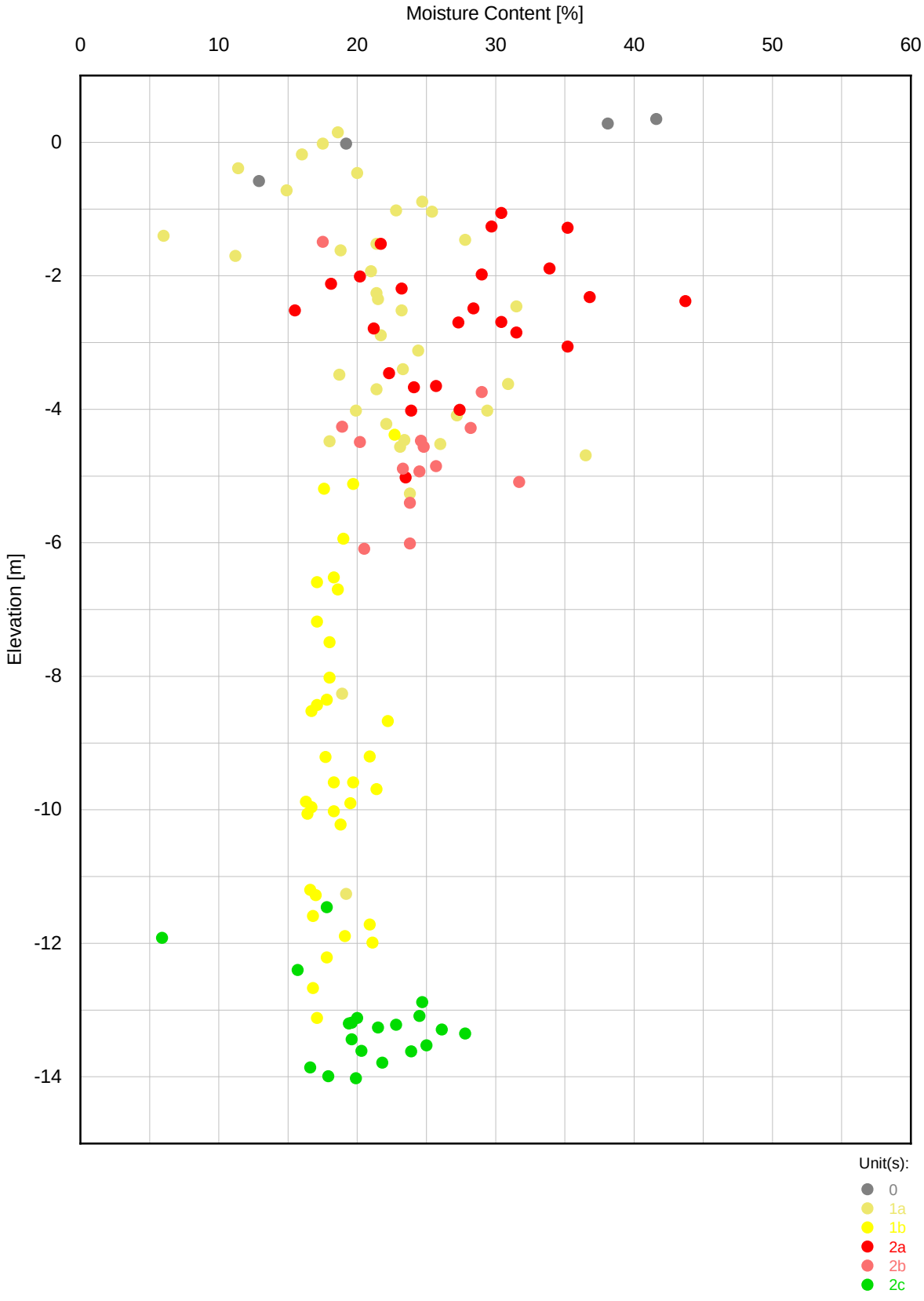
STANDARD PENETRATION TEST versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ASH TIP

Origin v7.03./ PI vs Depth.OPJ / 3/3/2023 10:46:04



STANDARD PENETRATION TEST versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

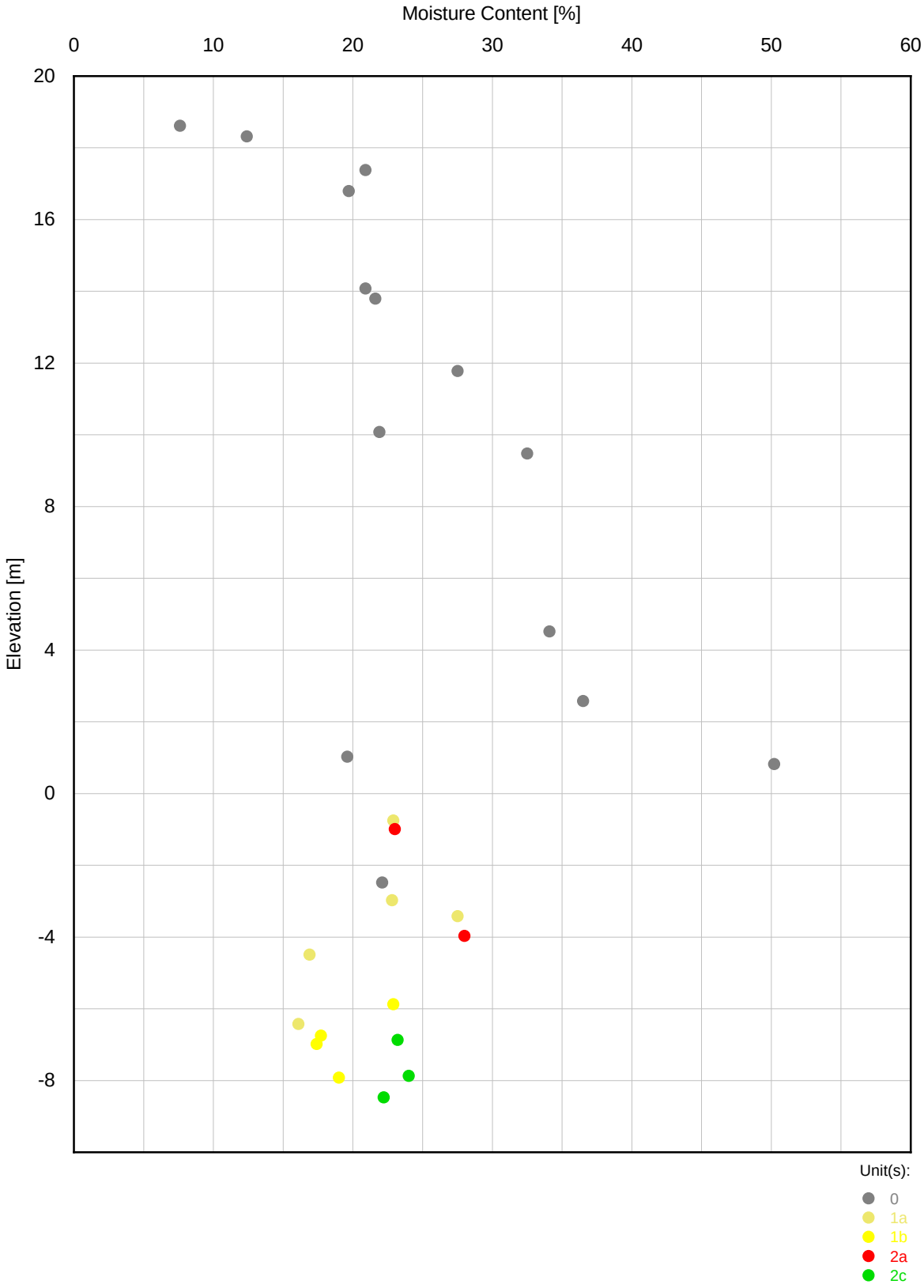
Origin v7.03./ PI vs Depth.OPJ / 2/14/2023 10:29:26



MOISTURE CONTENT versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

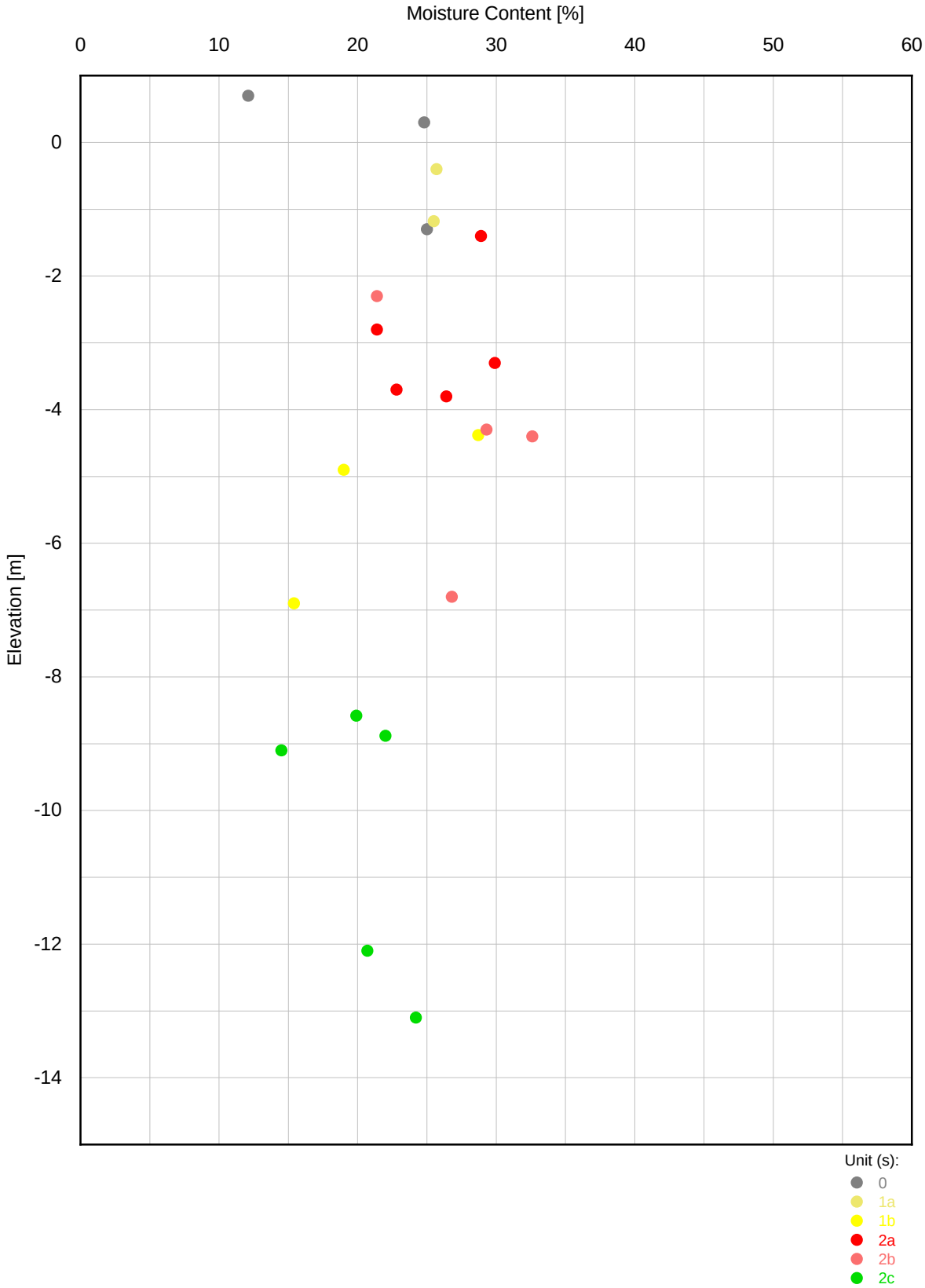
Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 11:40:27

Plate 3.6.2.1a



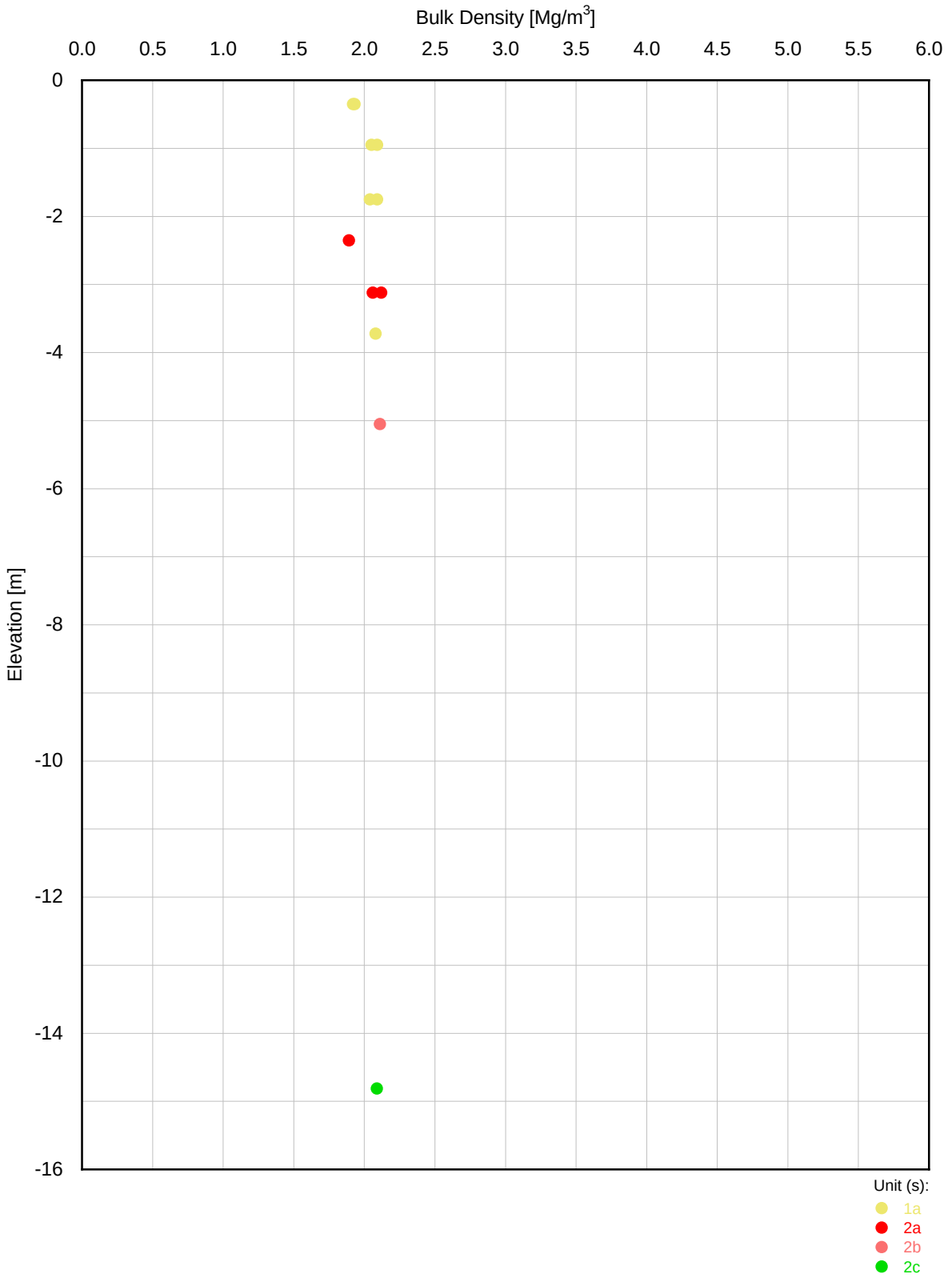
MOISTURE CONTENT versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ASH TIP

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 10:59:39



MOISTURE CONTENT versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

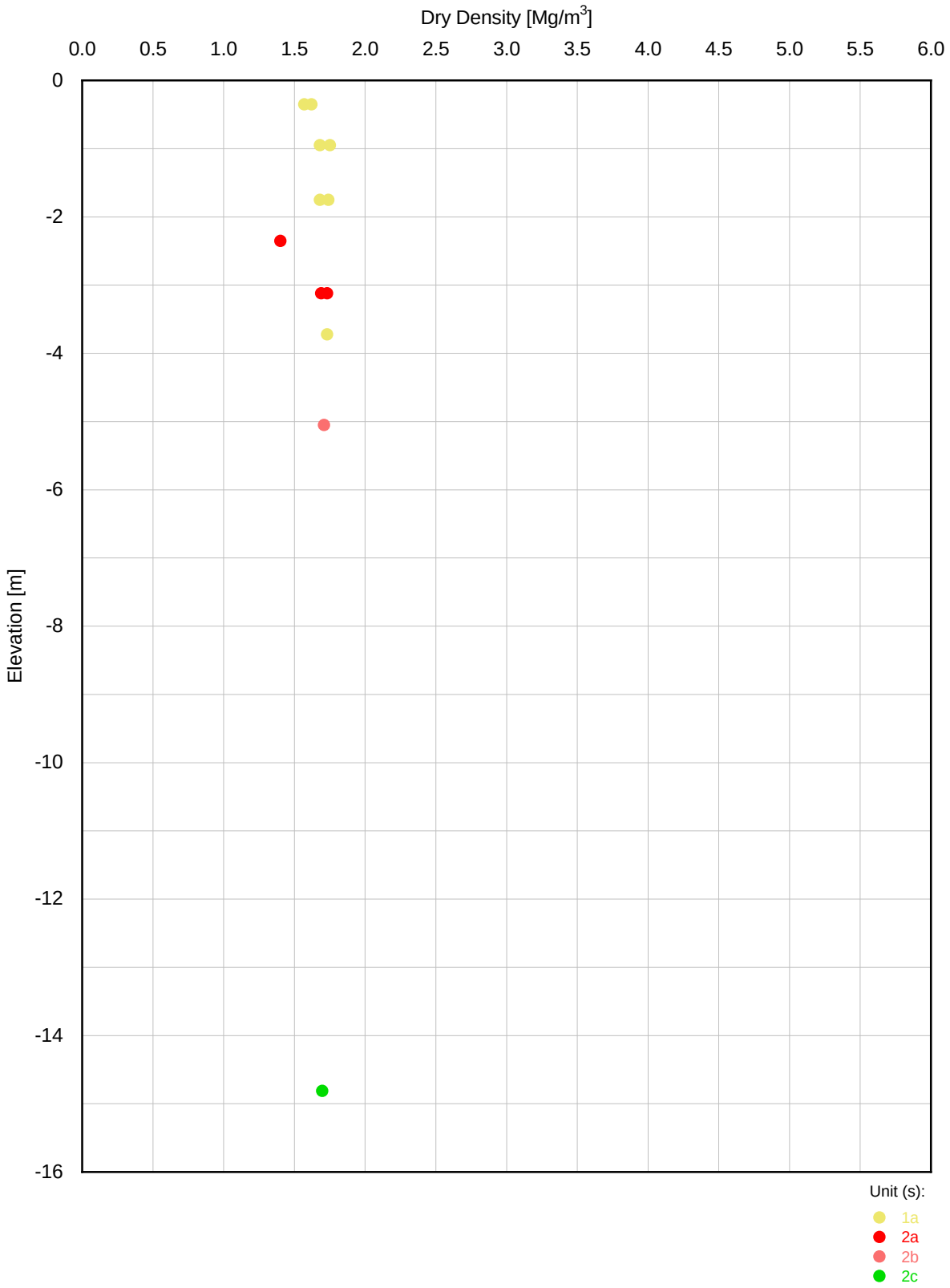
Origin v7.03./ PI vs Depth.OPJ / 2/10/2023 13:42:31



BULK DENSITY versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 10:50:55

Plate 3.6.2.2a



DRY DENSITY versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

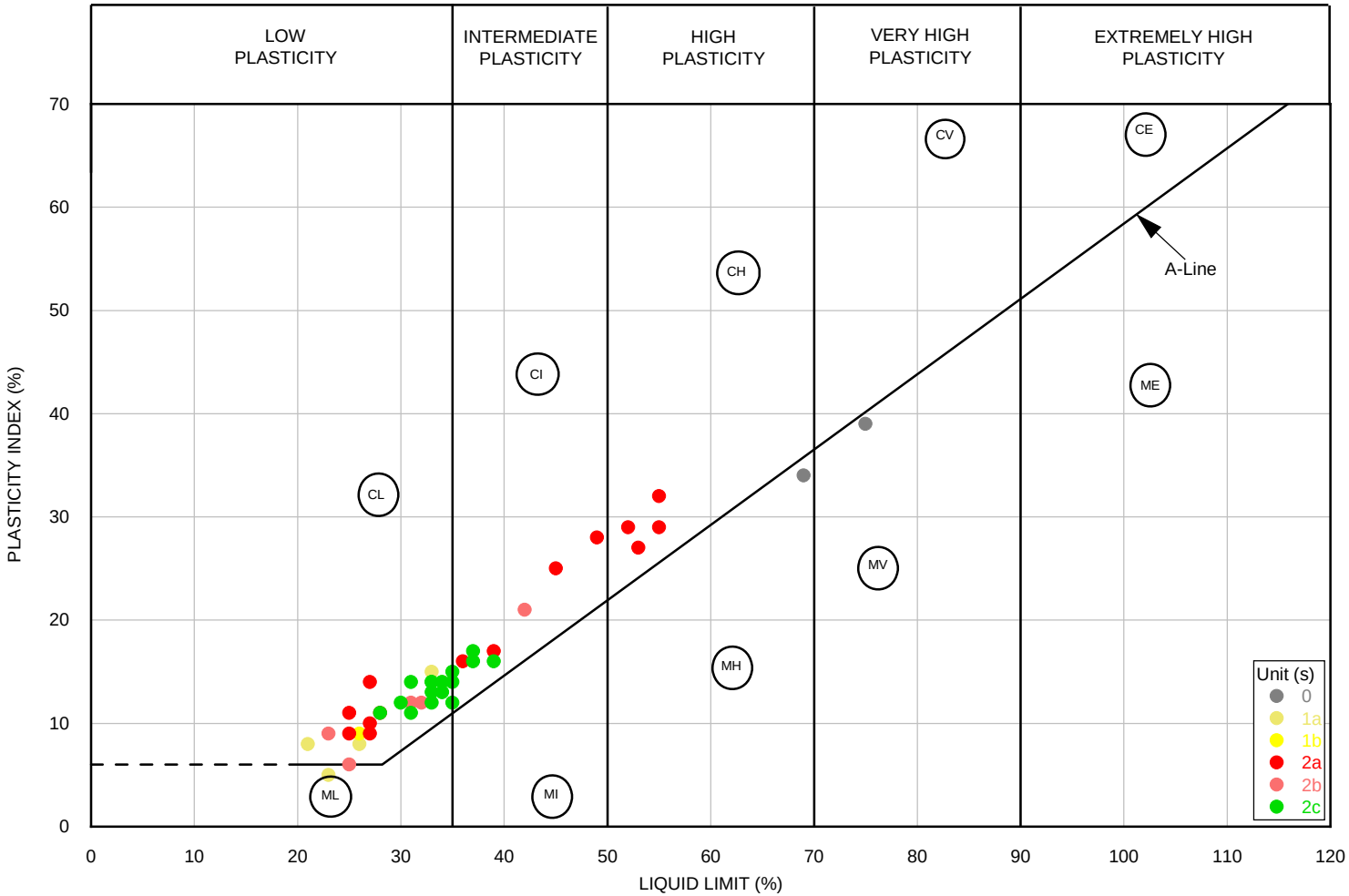
Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 10:45:13

KEY TO TERMS USED :

Soil Types :
C = Clay
M = Silt

Plasticity :
L = Low
I = Intermediate
H = High
V = Very high
E = Extremely High

NOTE: The letter O is added to the symbol of any material containing a significant amount of organic material; e.g. : MHO



PLASTICITY CHART (BS 5930)

KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Plate 3.6.2.3a

KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ASH TIP

PLASTICITY CHART (BS 5930)

KEY TO TERMS USED :

Soil Types :
C = Clay
M = Silt

Plasticity :
L = Low
I = Intermediate
H = High
V = Very high
E = Extremely High

NOTE: The letter O is added to the symbol of any material containing a significant amount of organic material; e.g. : MHO

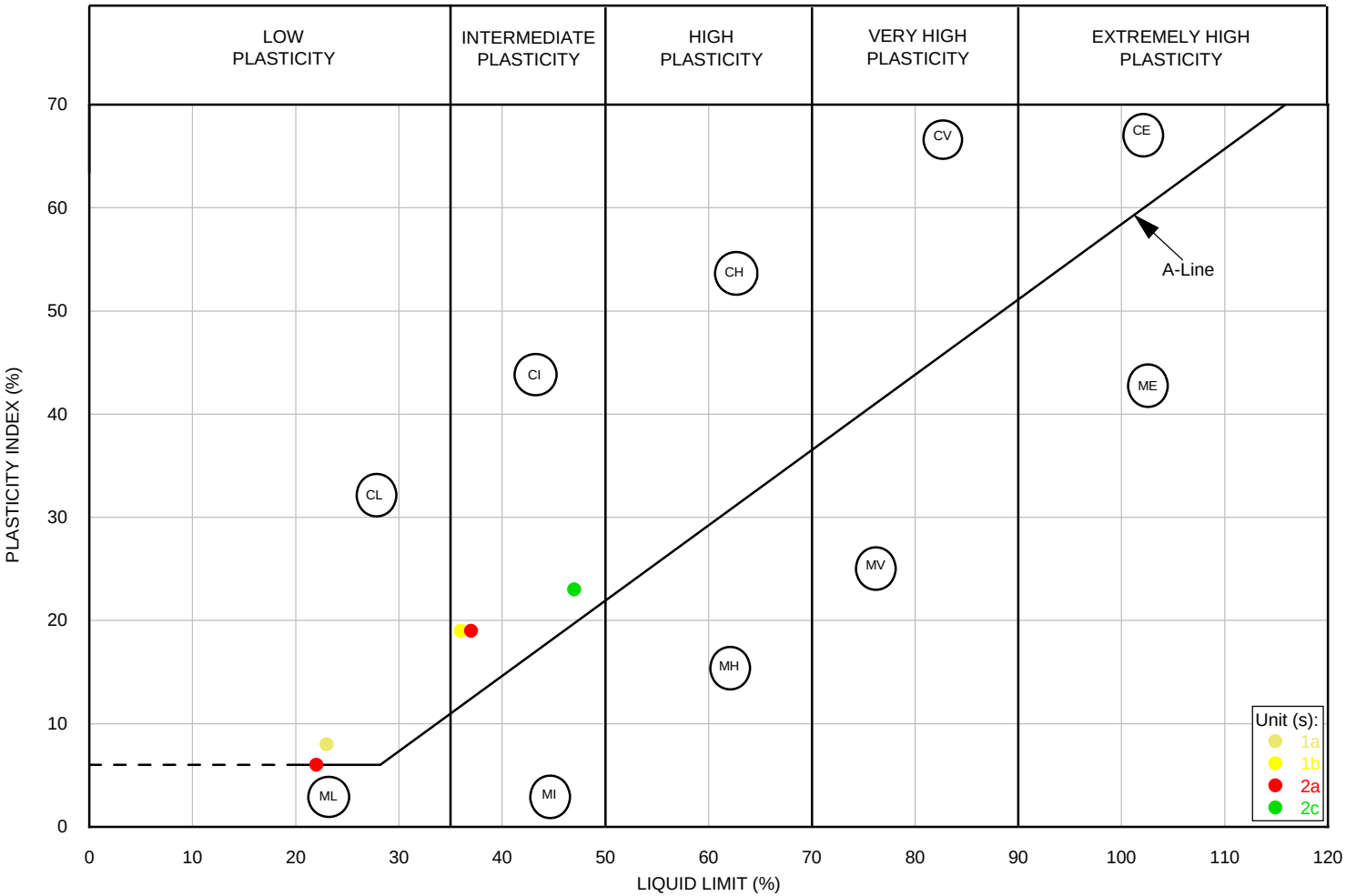


Plate 3.6.2.3b

KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

PLASTICITY CHART (BS 5930)

KEY TO TERMS USED :

Soil Types :
C = Clay
M = Silt

Plasticity :
L = Low
I = Intermediate
H = High
V = Very high
E = Extremely High

NOTE: The letter O is added to the symbol of any material containing a significant amount of organic material; e.g. : MHO

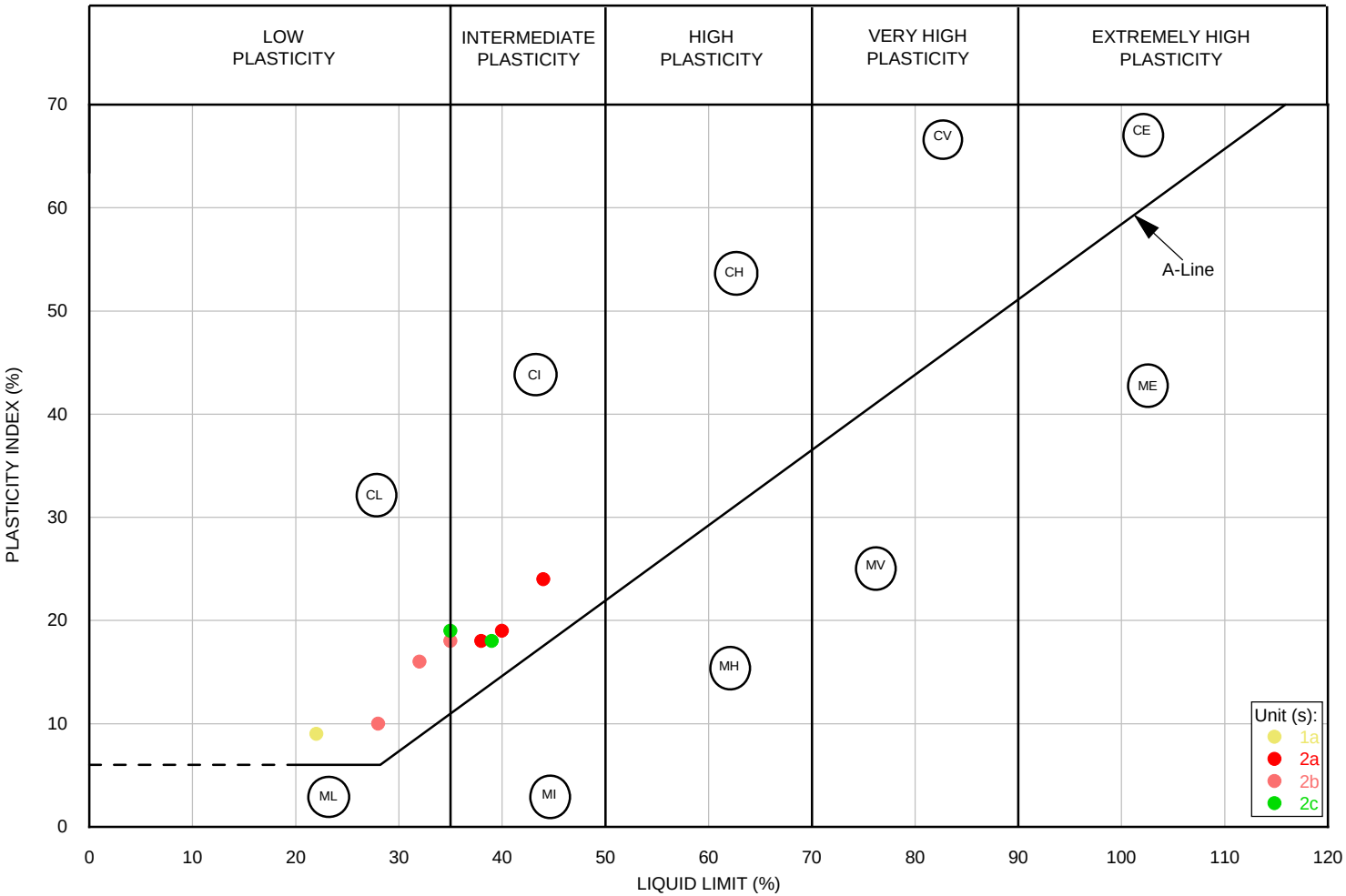
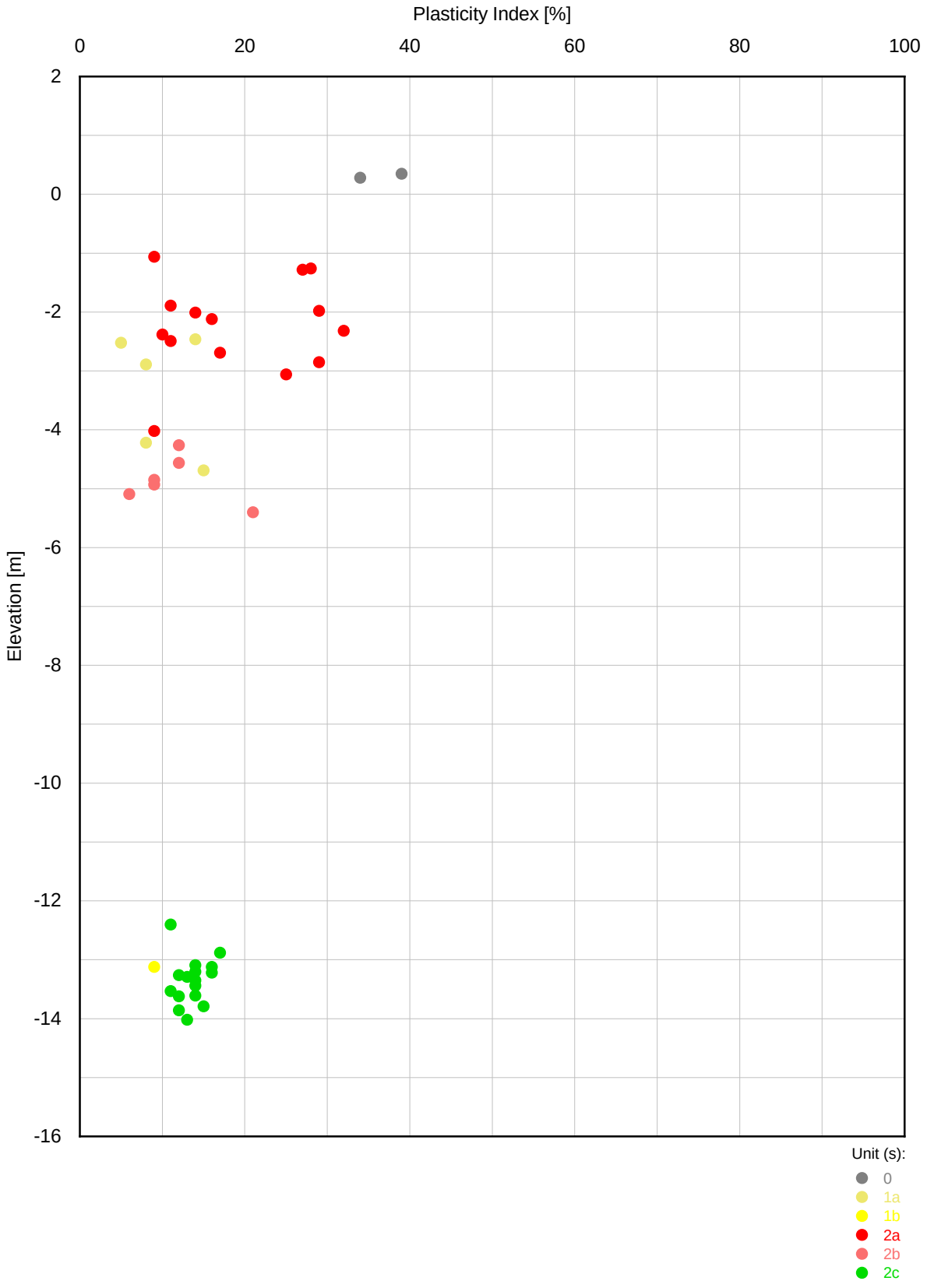
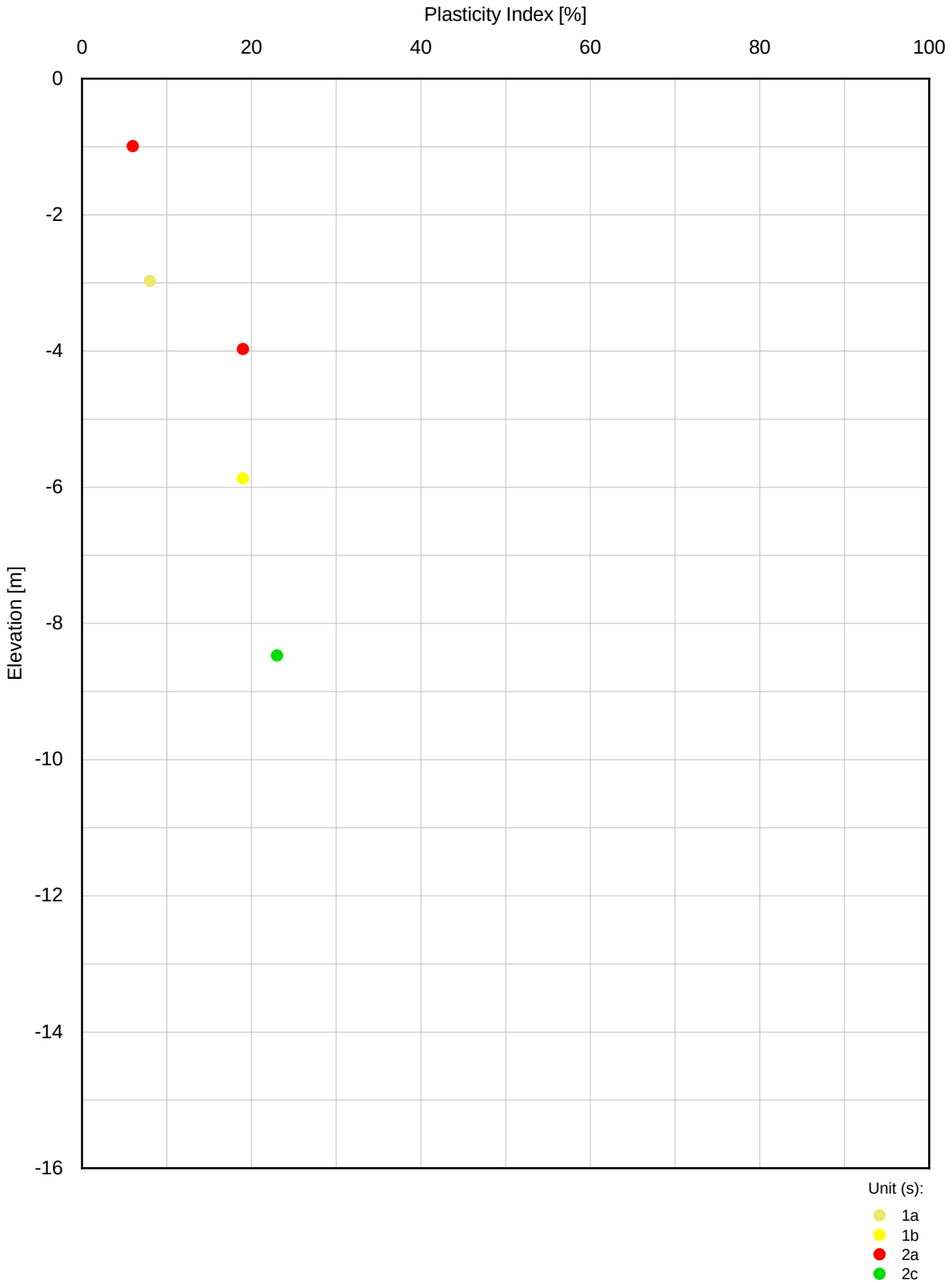


Plate 3.6.2.3c



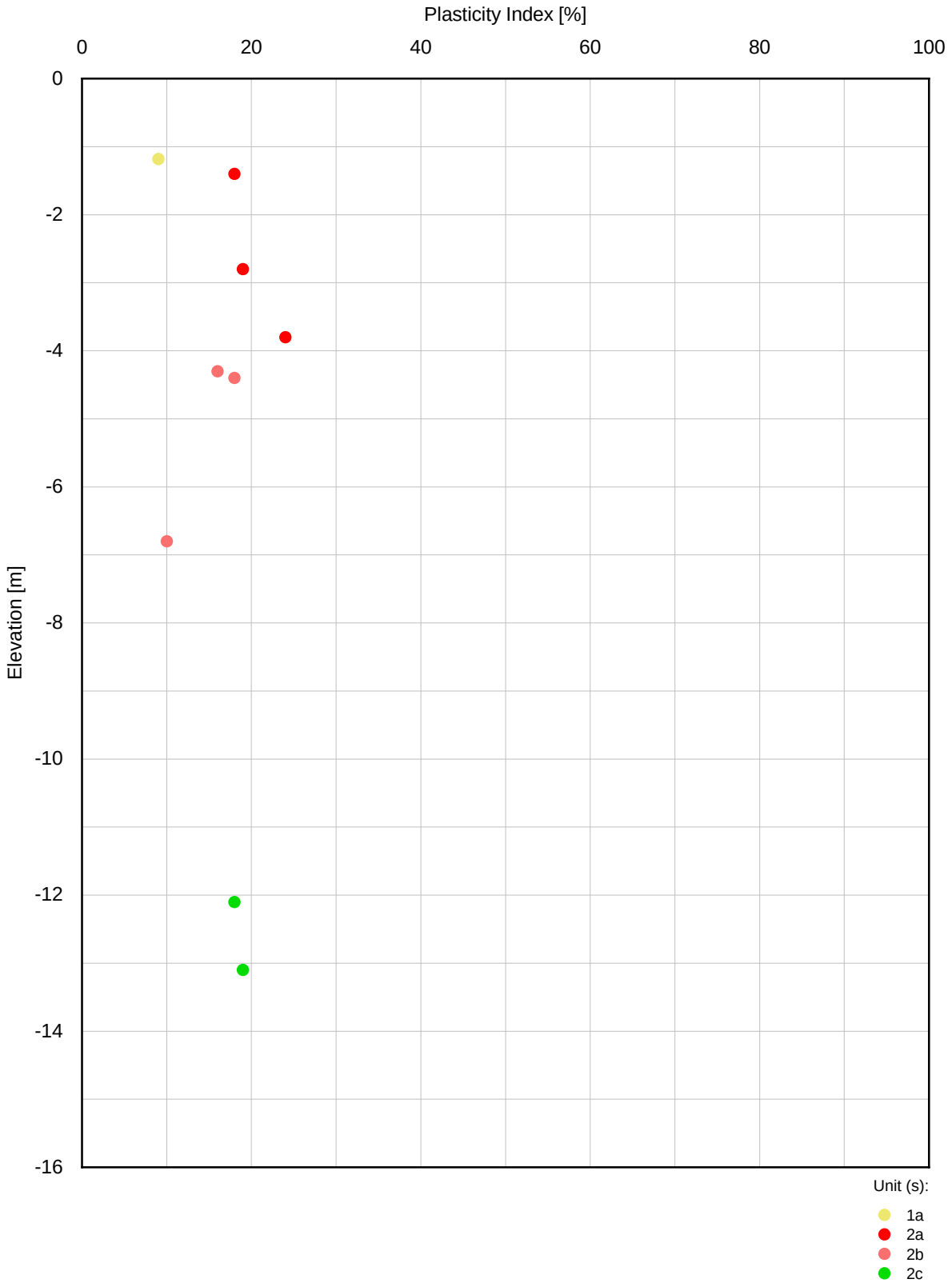
PLASTICITY INDEX versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 12:55:41



PLASTICITY INDEX versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ASH TIP

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 12:08:19



PLASTICITY INDEX versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 11:50:00

PARTICLE SIZE DISTRIBUTION RANGE

Unit 0 (Main Site)

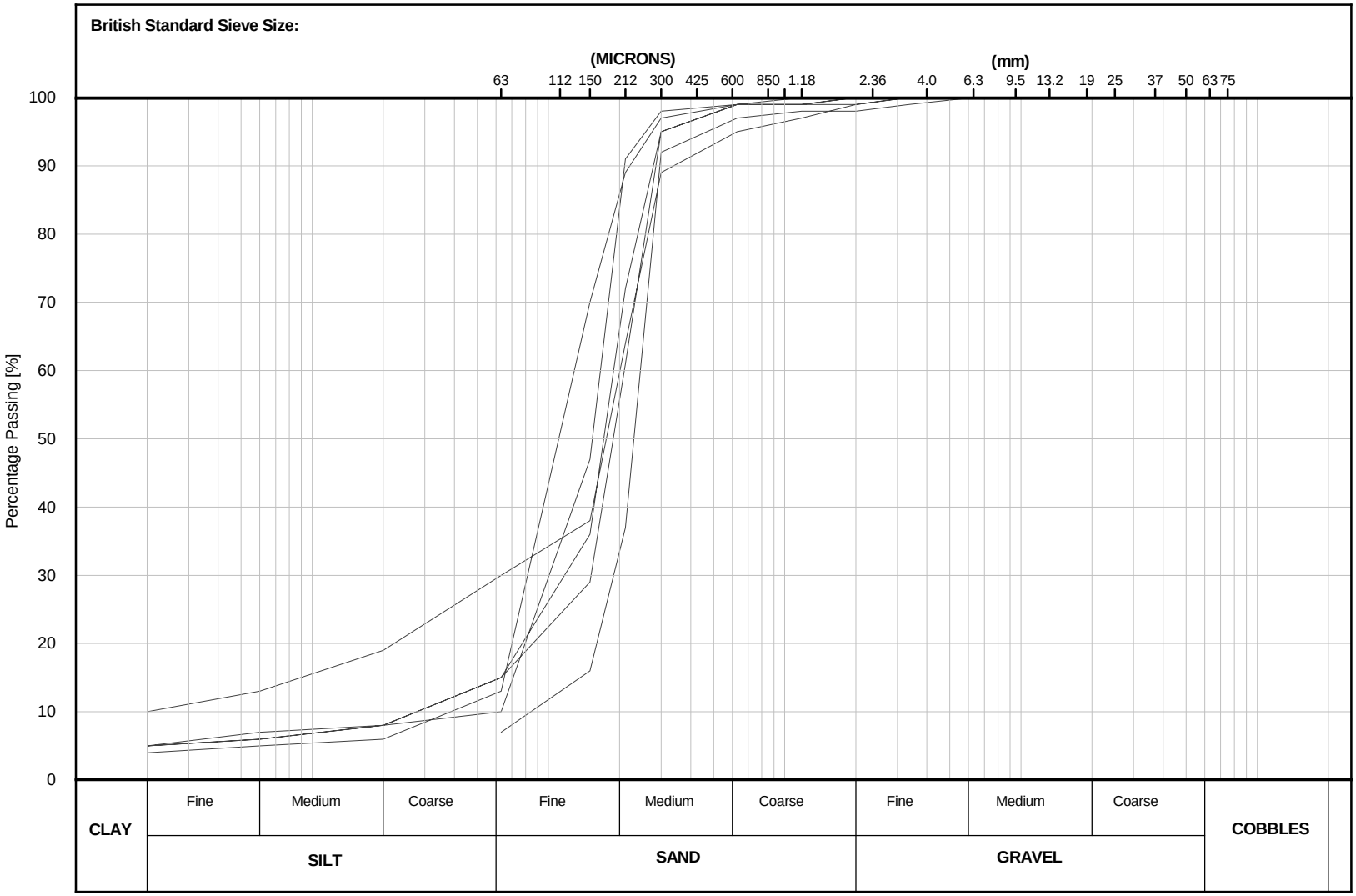
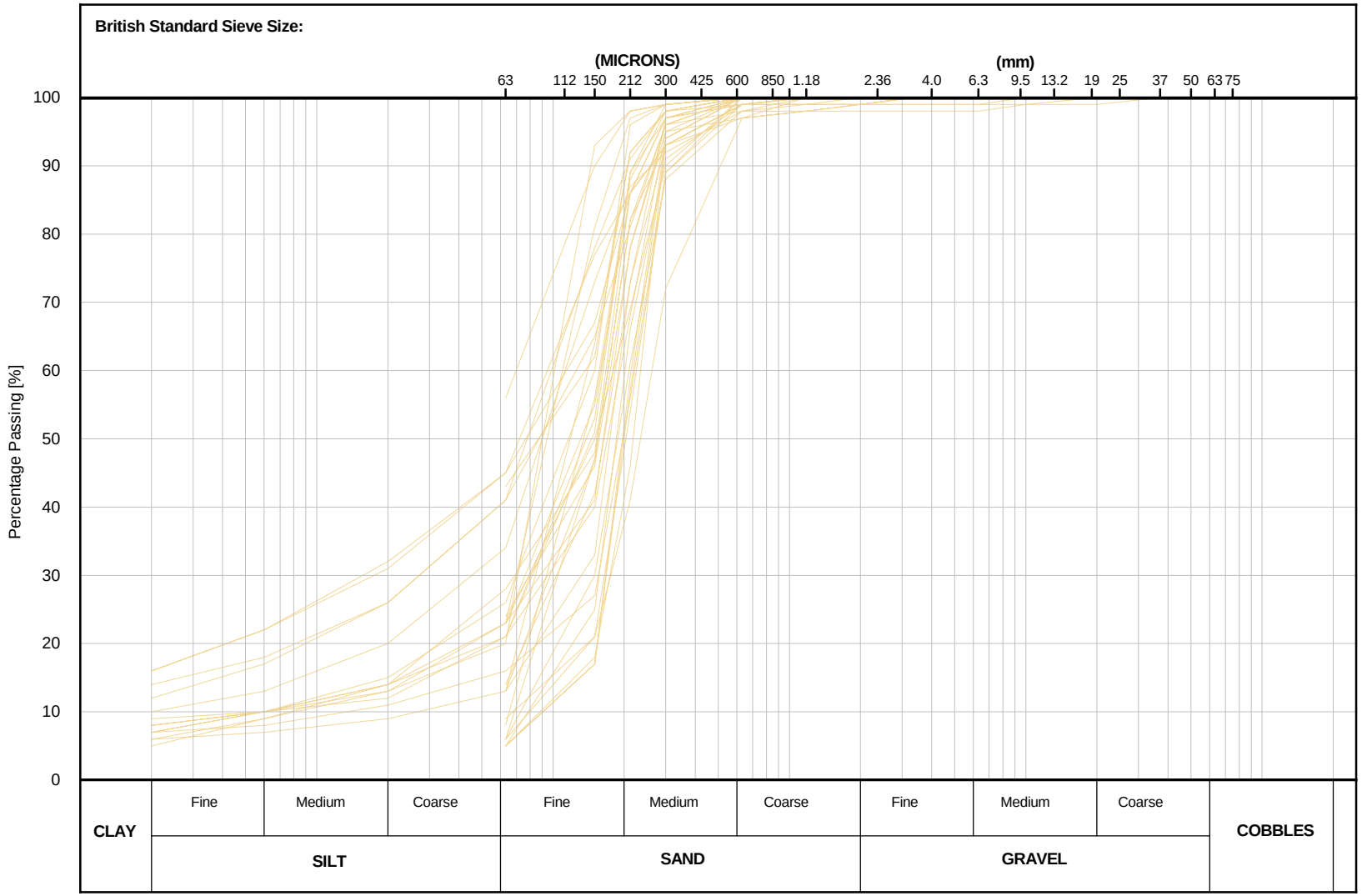


Plate 3.6.2.4a

PARTICLE SIZE DISTRIBUTION RANGE

Unit 1a (Main Site)



PARTICLE SIZE DISTRIBUTION RANGE
Unit 2a (Main Site)

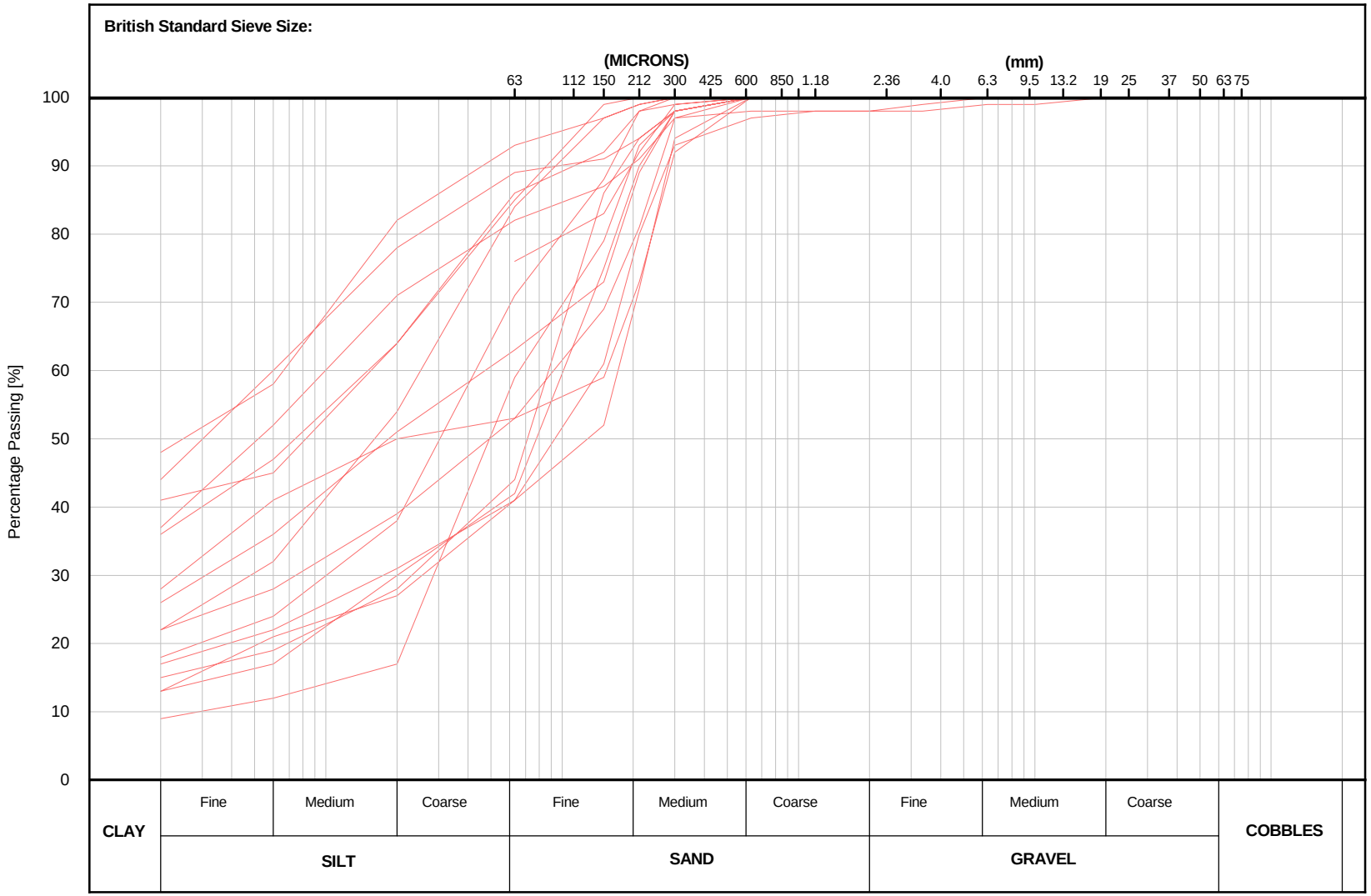


Plate 3.6.2.4c

PARTICLE SIZE DISTRIBUTION RANGE

Unit 2b (Main Site)

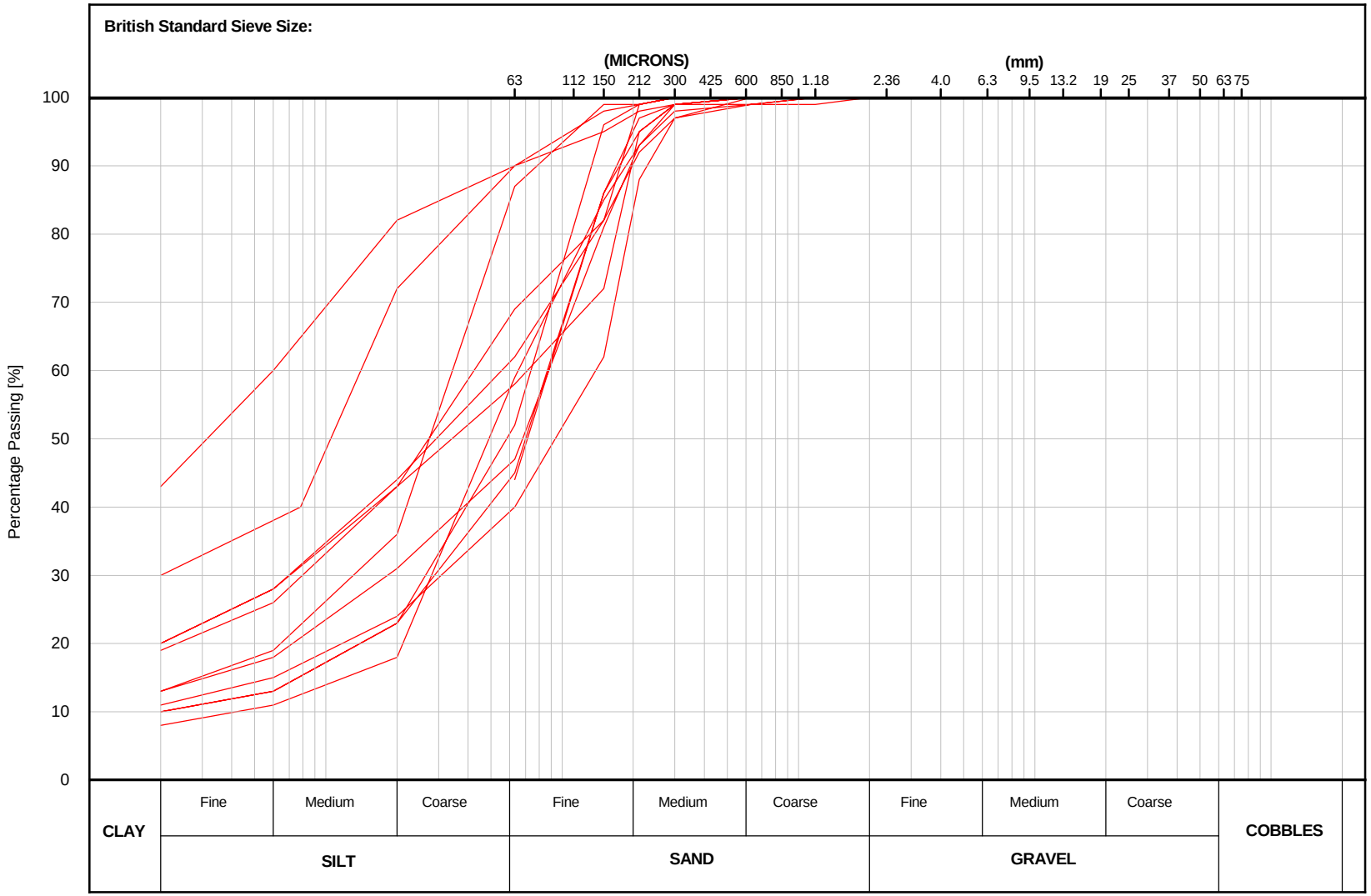


Plate 3.6.2.4d

PARTICLE SIZE DISTRIBUTION RANGE
Unit 1b (Main Site)

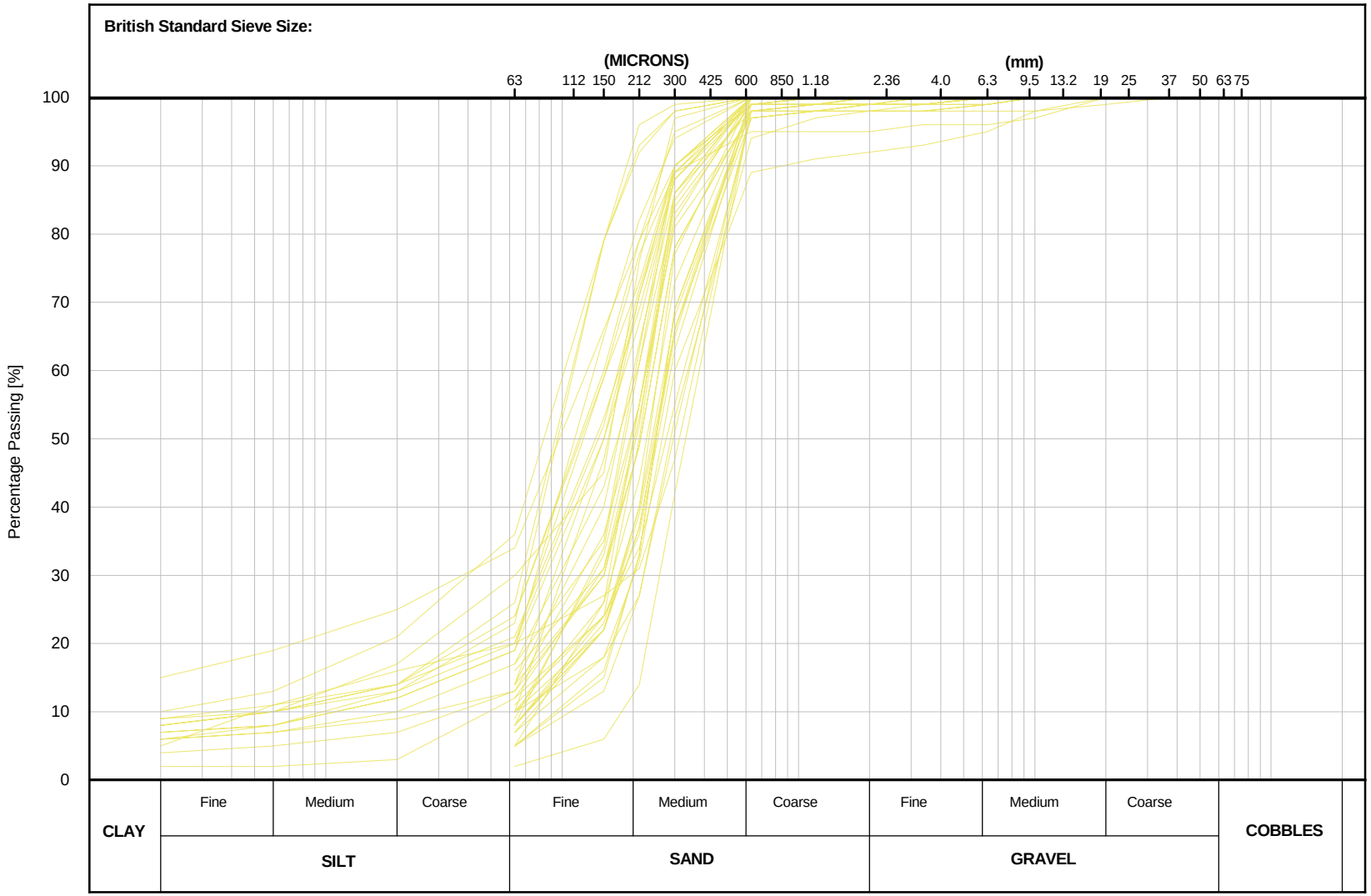
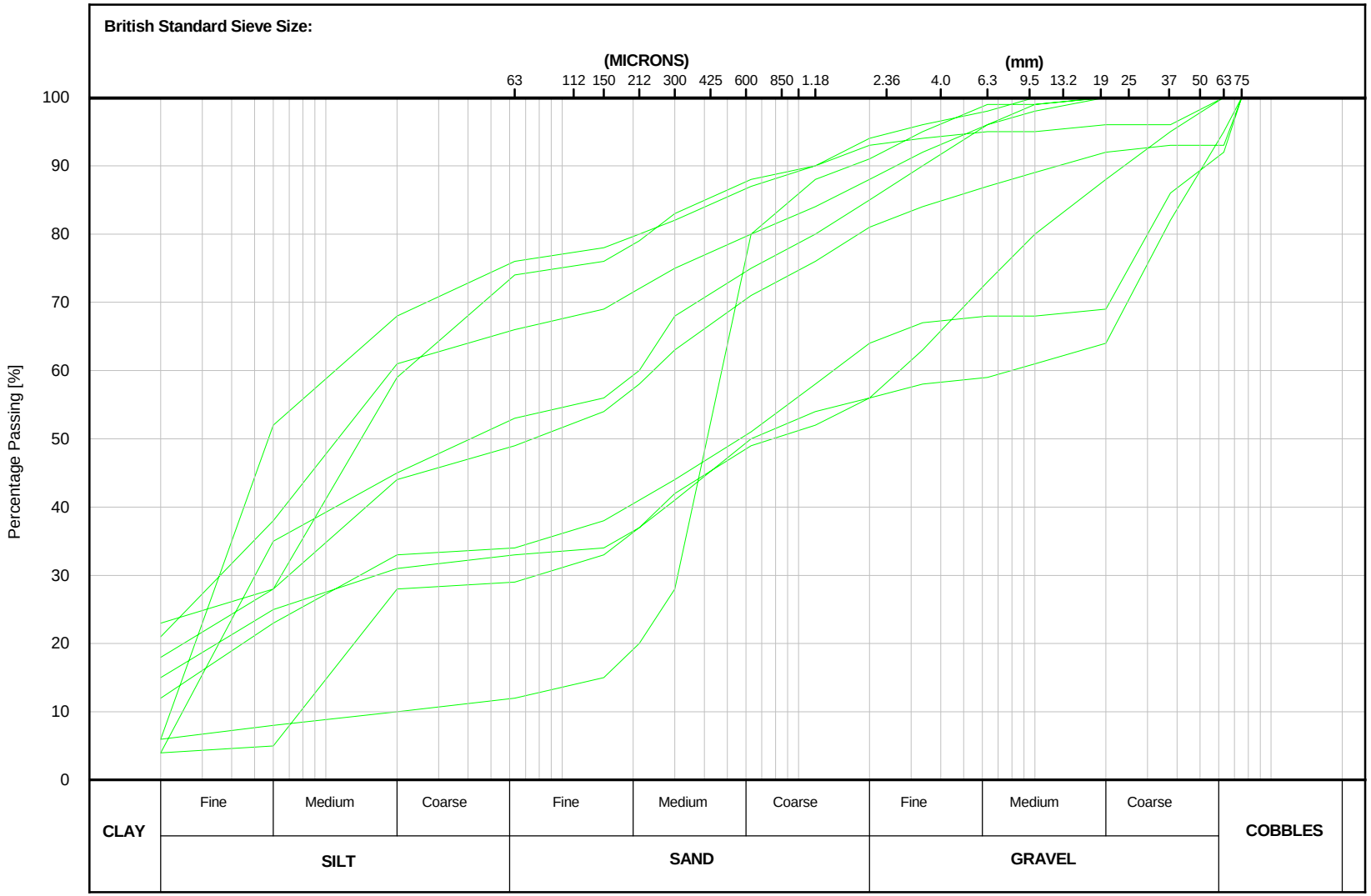


Plate 3.6.2.4e

PARTICLE SIZE DISTRIBUTION RANGE
Unit 2c (Main Site)



PARTICLE SIZE DISTRIBUTION RANGE

Unit 0 (ASH TIP)

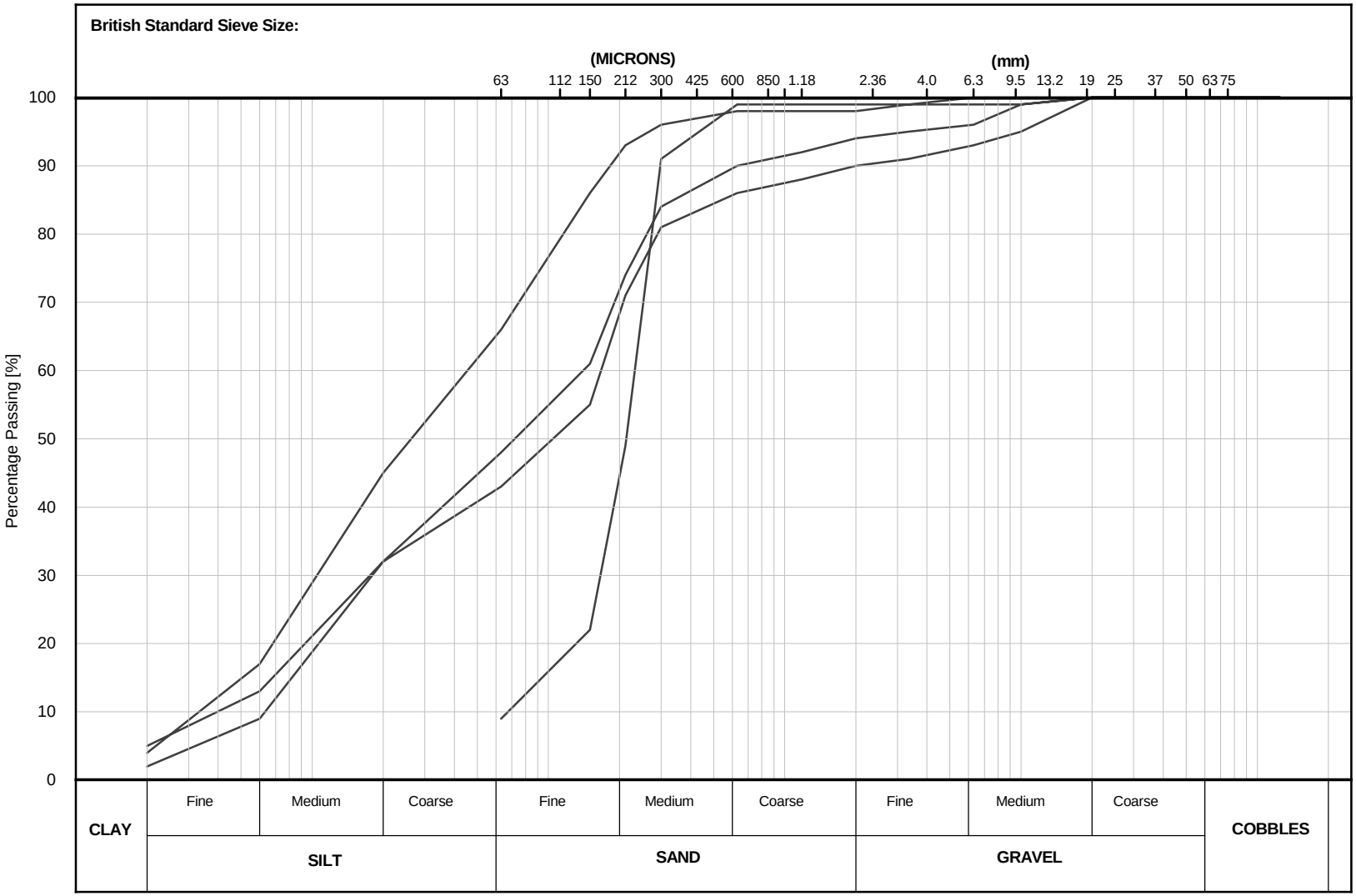
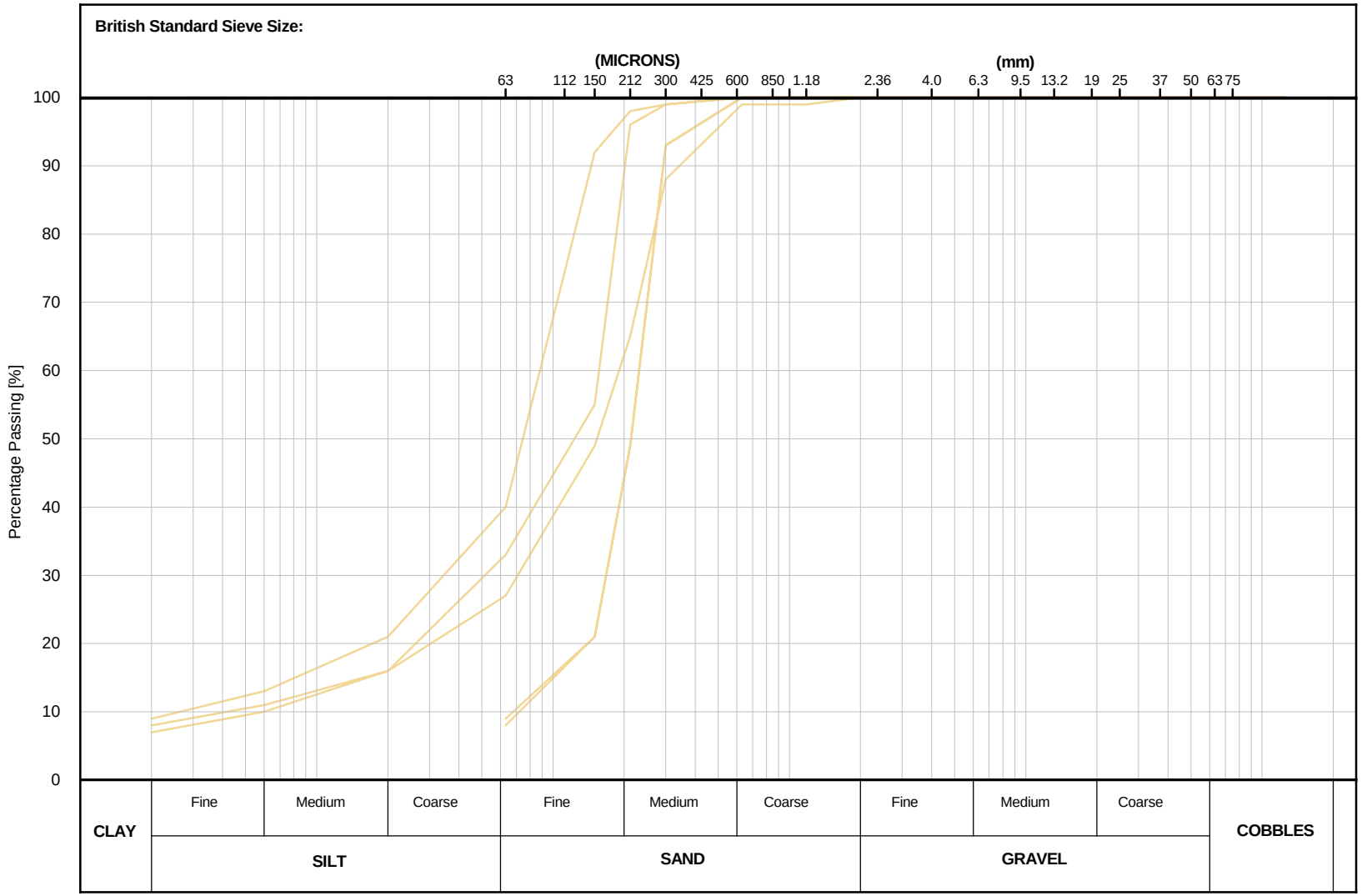


Plate 3.6.2.4g

PARTICLE SIZE DISTRIBUTION RANGE
Unit 1a (ASH TIP)



PARTICLE SIZE DISTRIBUTION RANGE
Unit 2b (ASH TIP)

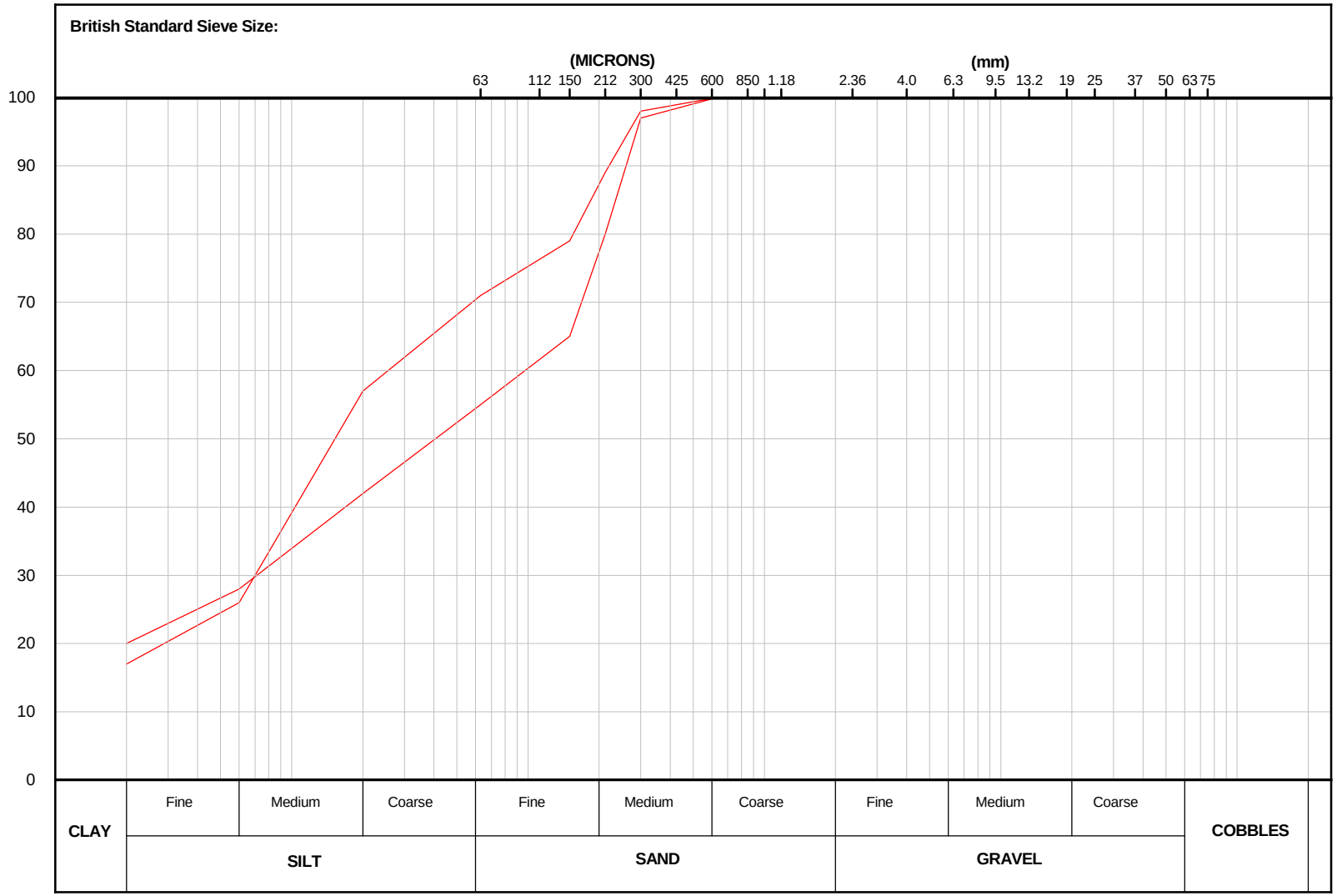
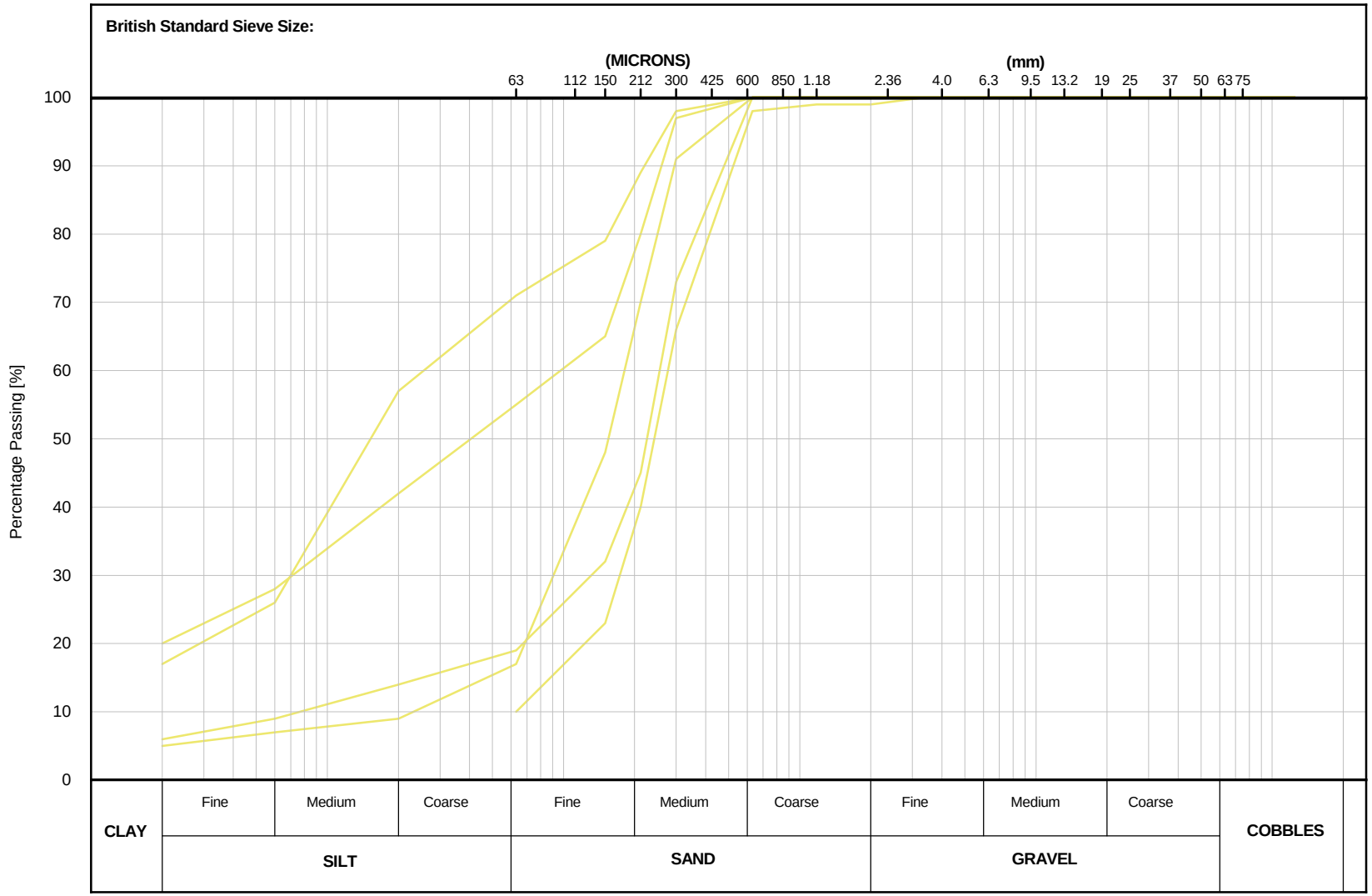


Plate 3.6.2.4i

PARTICLE SIZE DISTRIBUTION RANGE
Unit 1b (ASH TIP)



PARTICLE SIZE DISTRIBUTION RANGE
UNIT 0 (ACCESS ROAD)

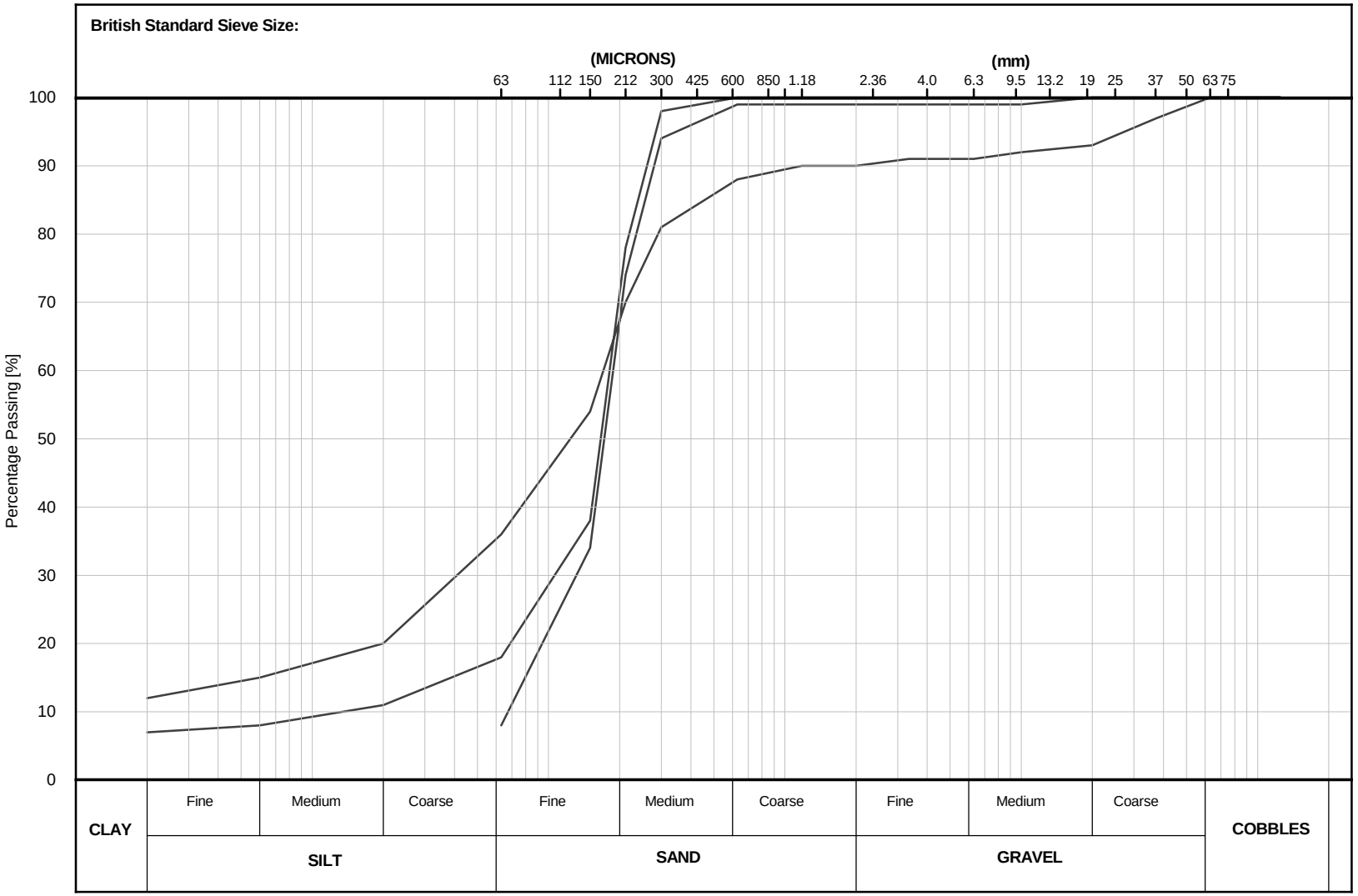
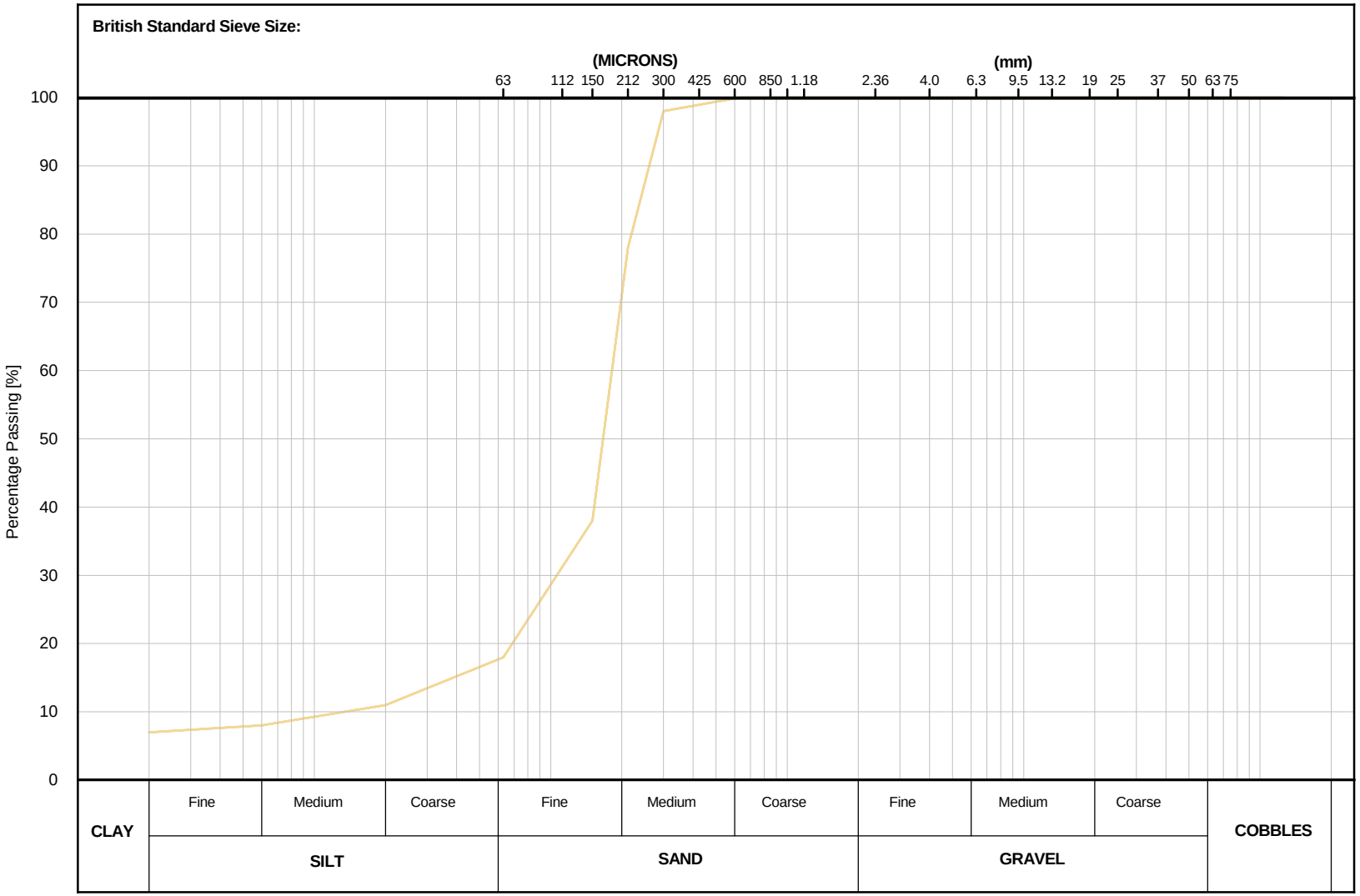


Plate 3.6.2.4k

PARTICLE SIZE DISTRIBUTION RANGE
Unit 1a (ACCESS ROAD)



PARTICLE SIZE DISTRIBUTION RANGE
Unit 2a (ACCESS ROAD)

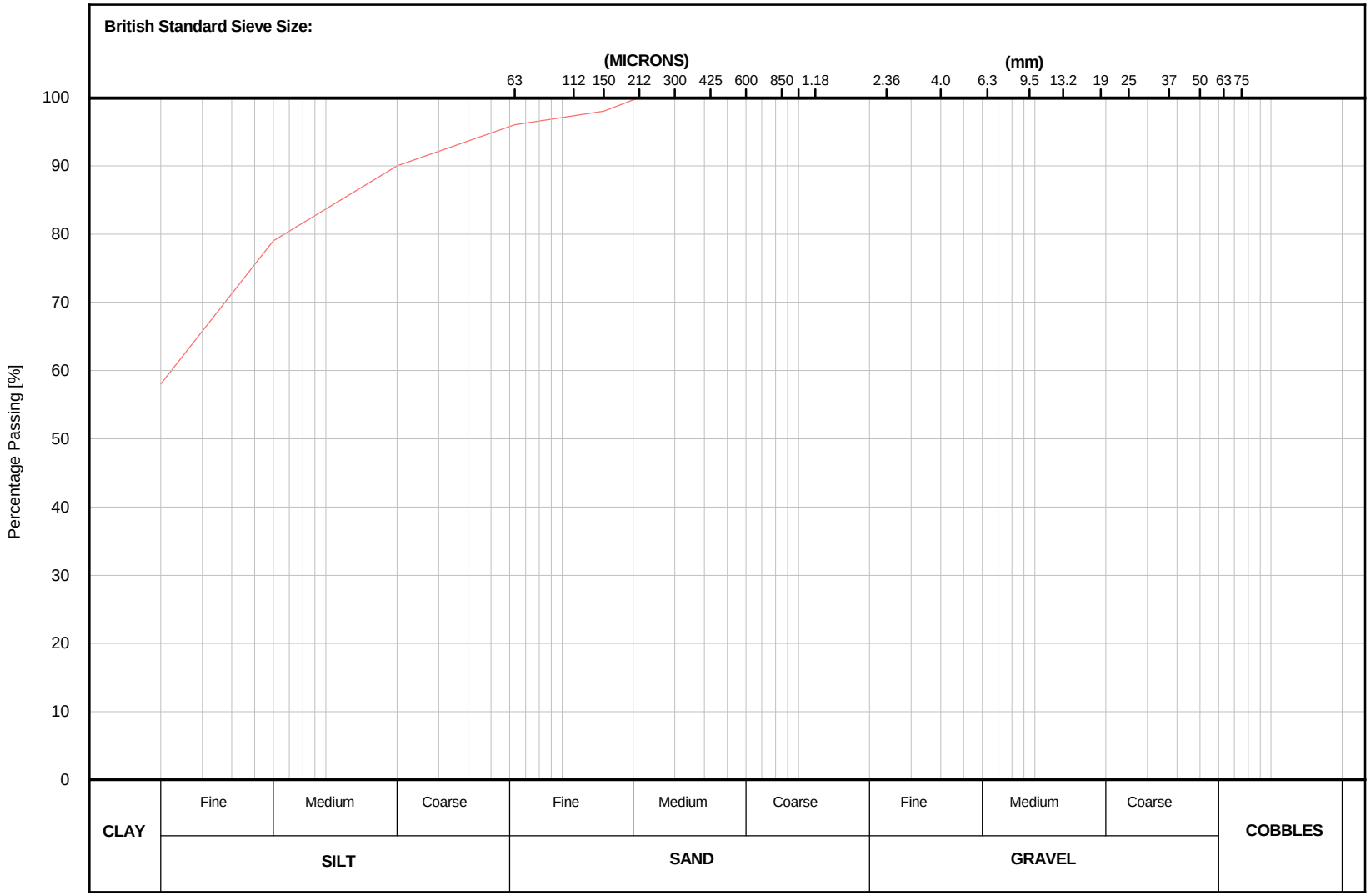
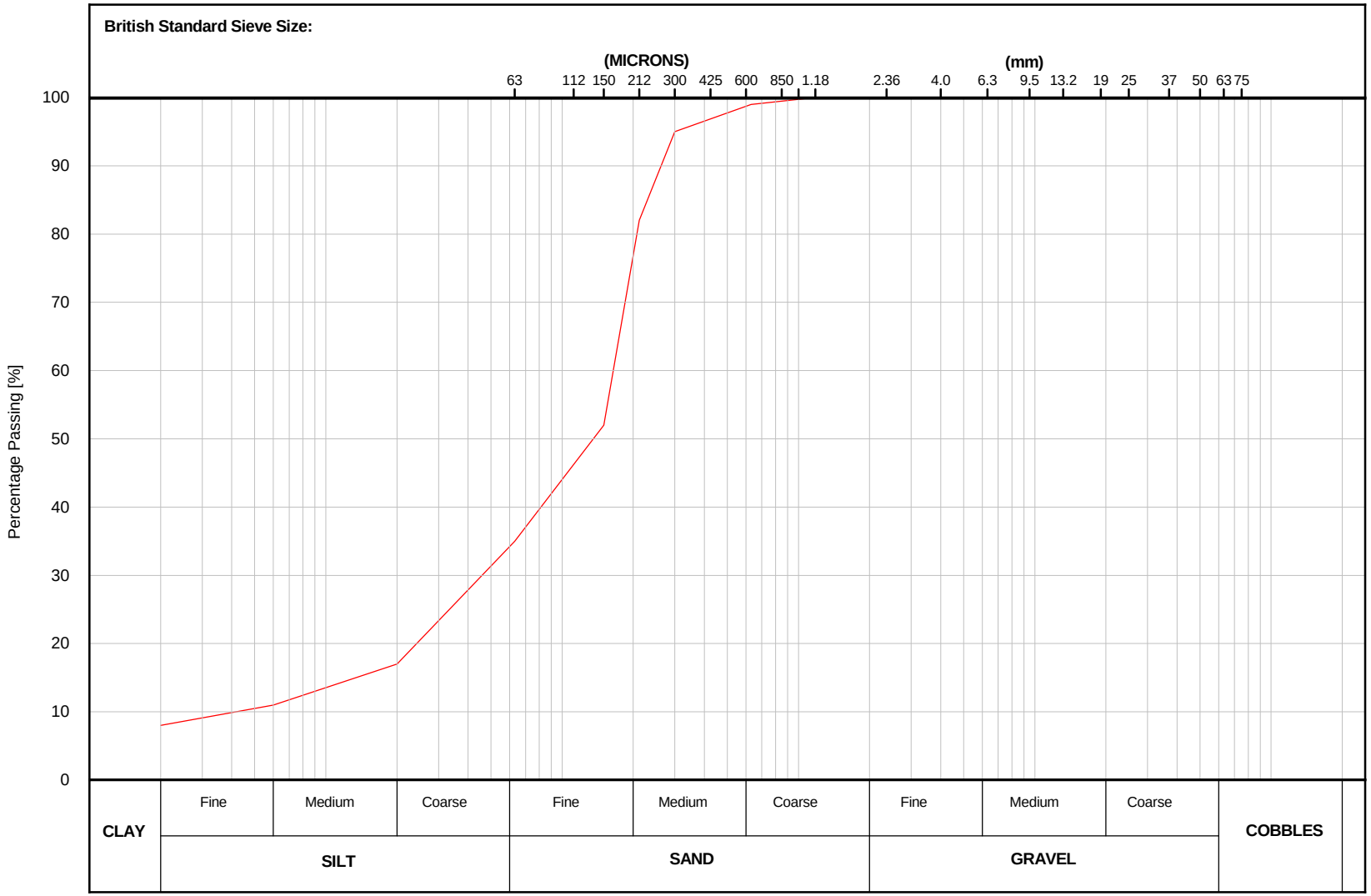
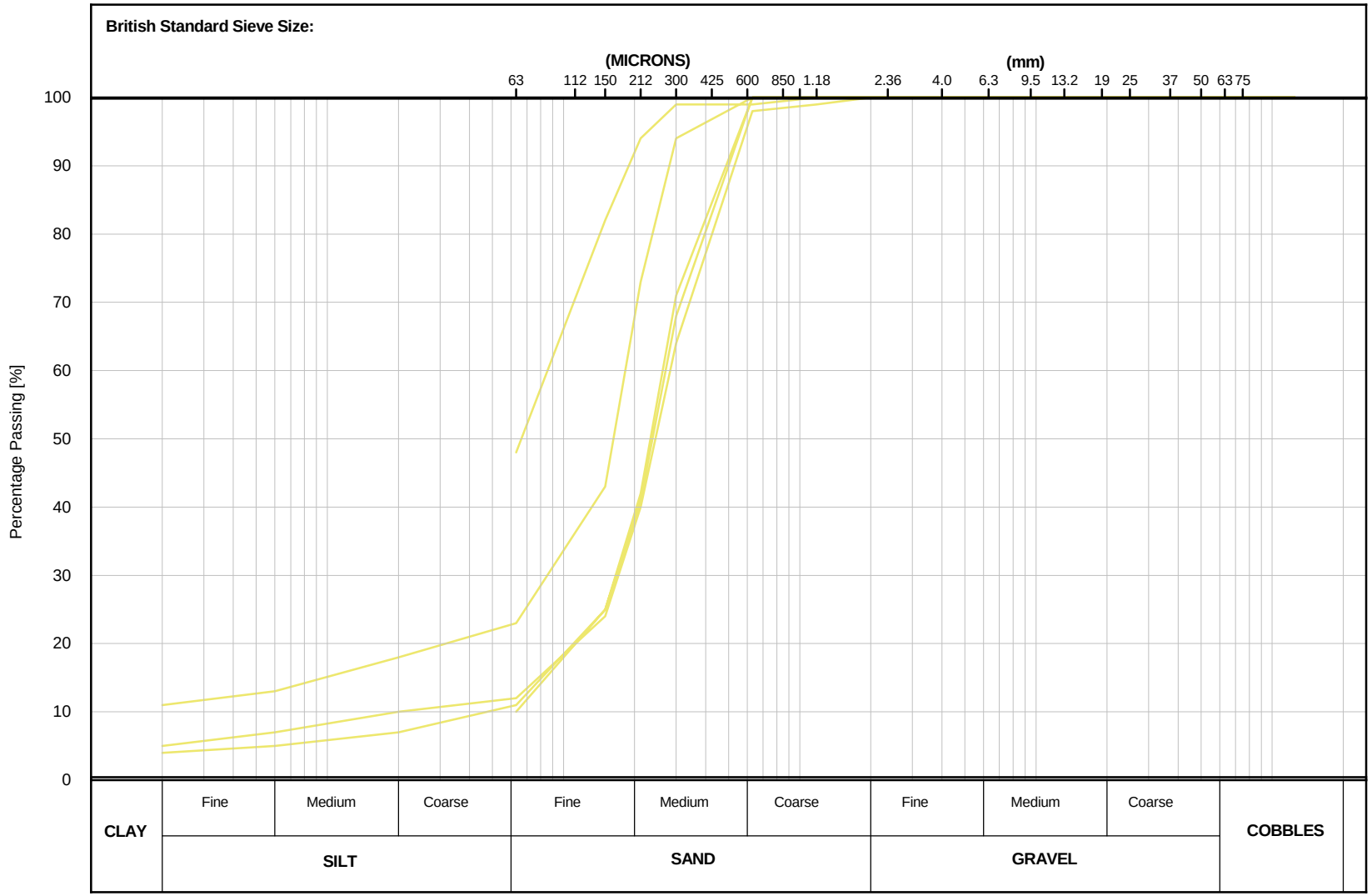


Plate 3.6.2.4m

PARTICLE SIZE DISTRIBUTION RANGE
Unit 2b (ACEES ROAD AR)



PARTICLE SIZE DISTRIBUTION RANGE
Unit 1b (ACCESS ROAD)



PARTICLE SIZE DISTRIBUTION RANGE
Unit 2c (ACCESS ROAD)

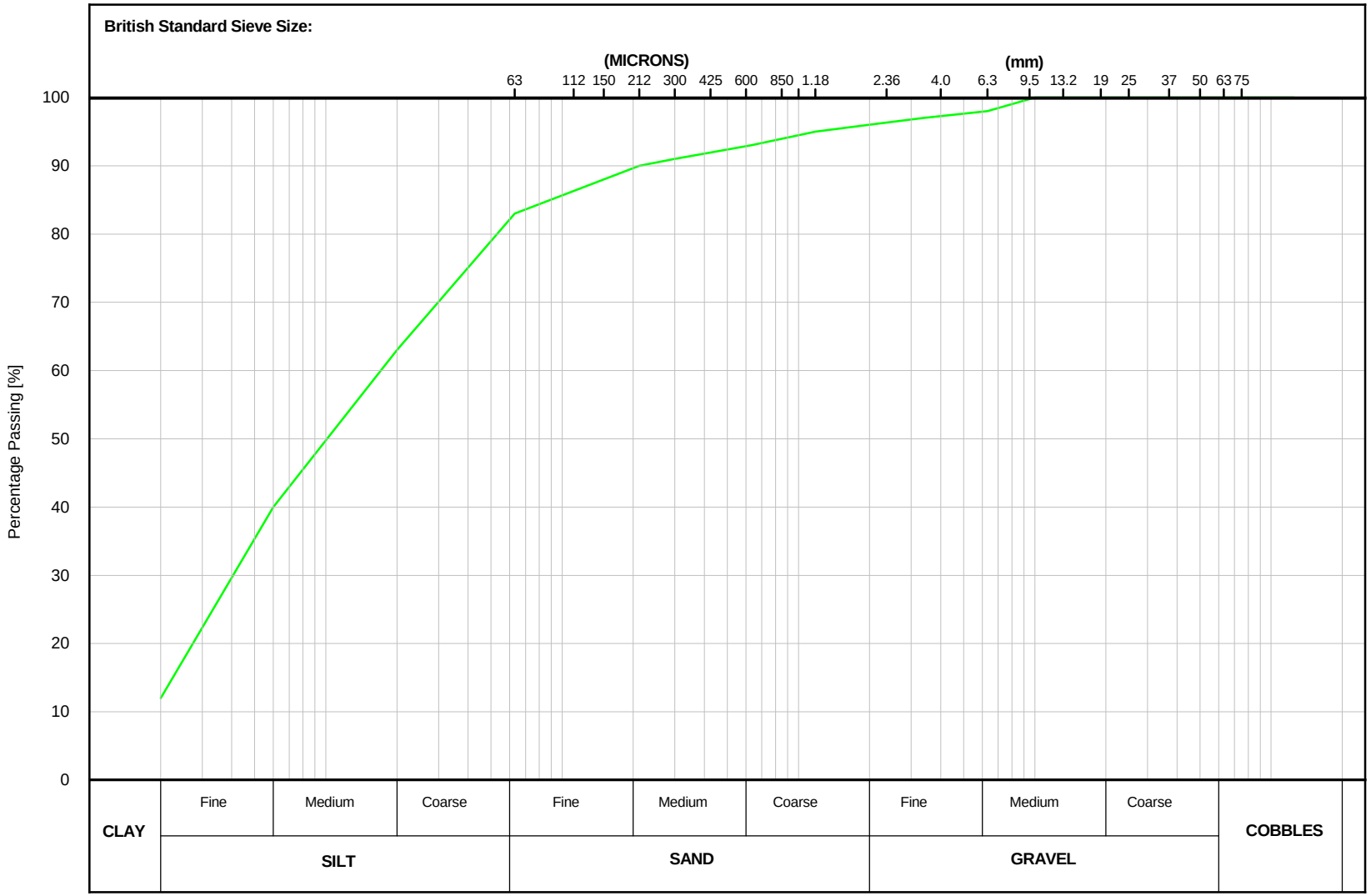
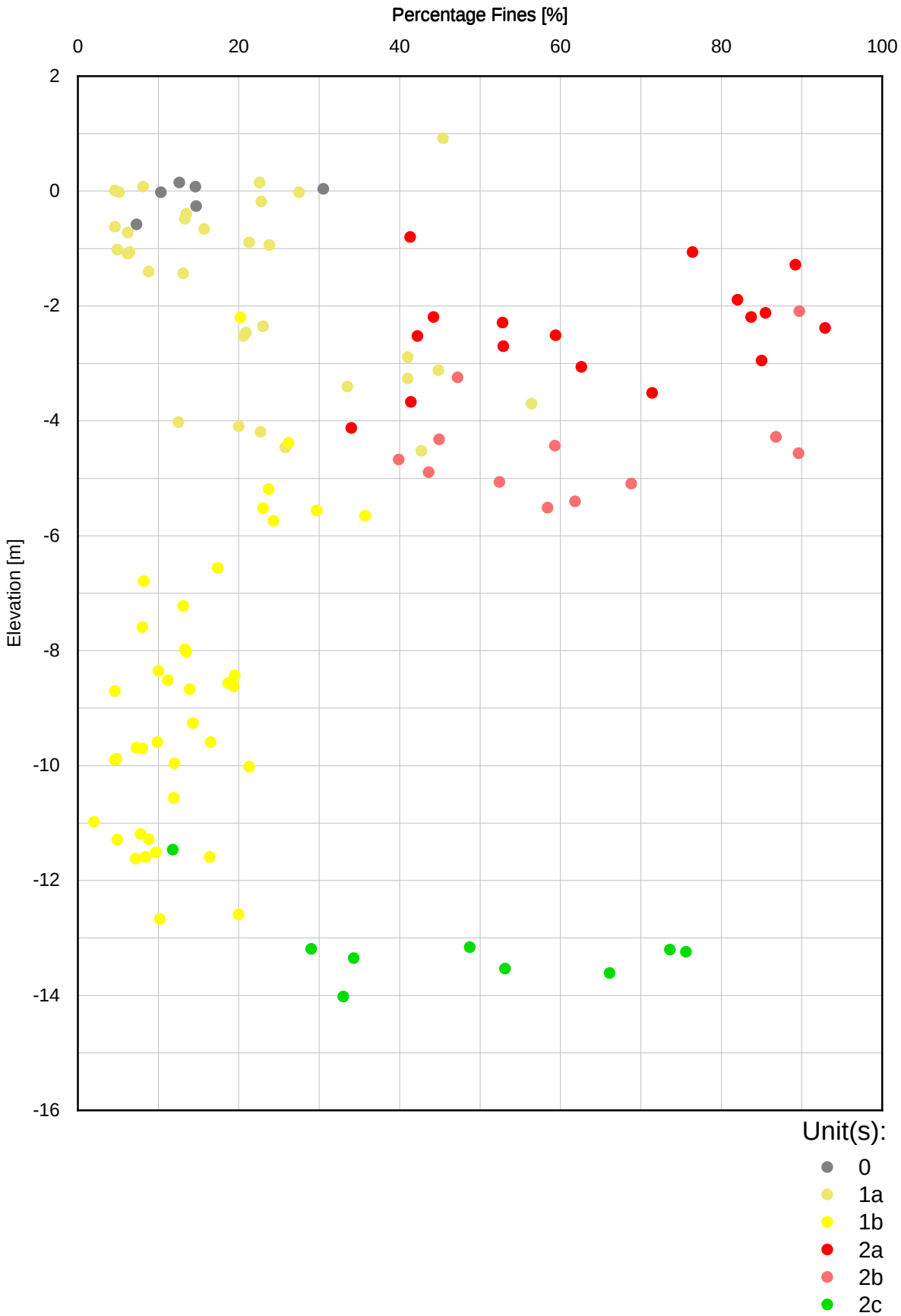
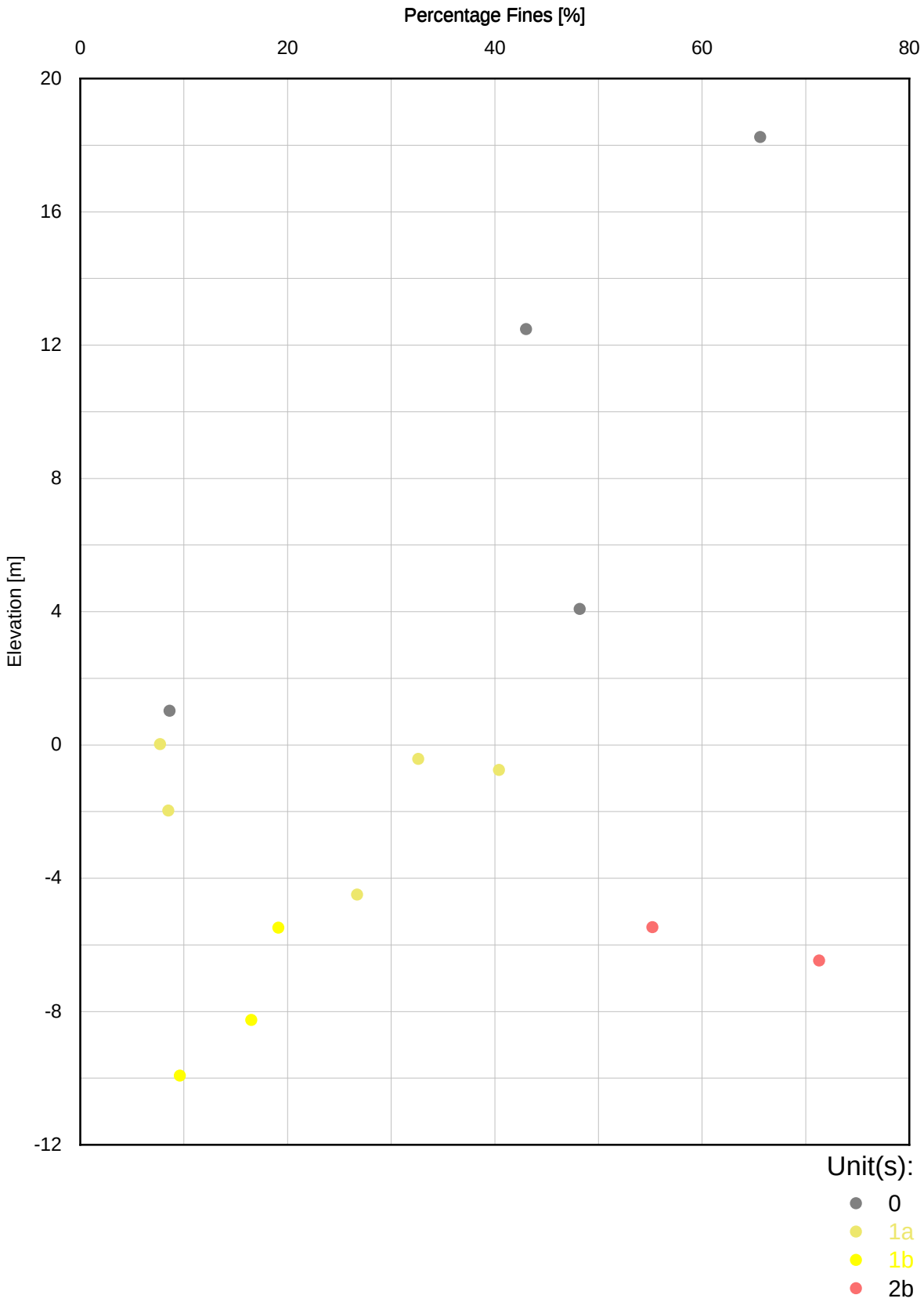


Plate 3.6.2.4p



PERCENTAGE FINES versus DEPTH
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE

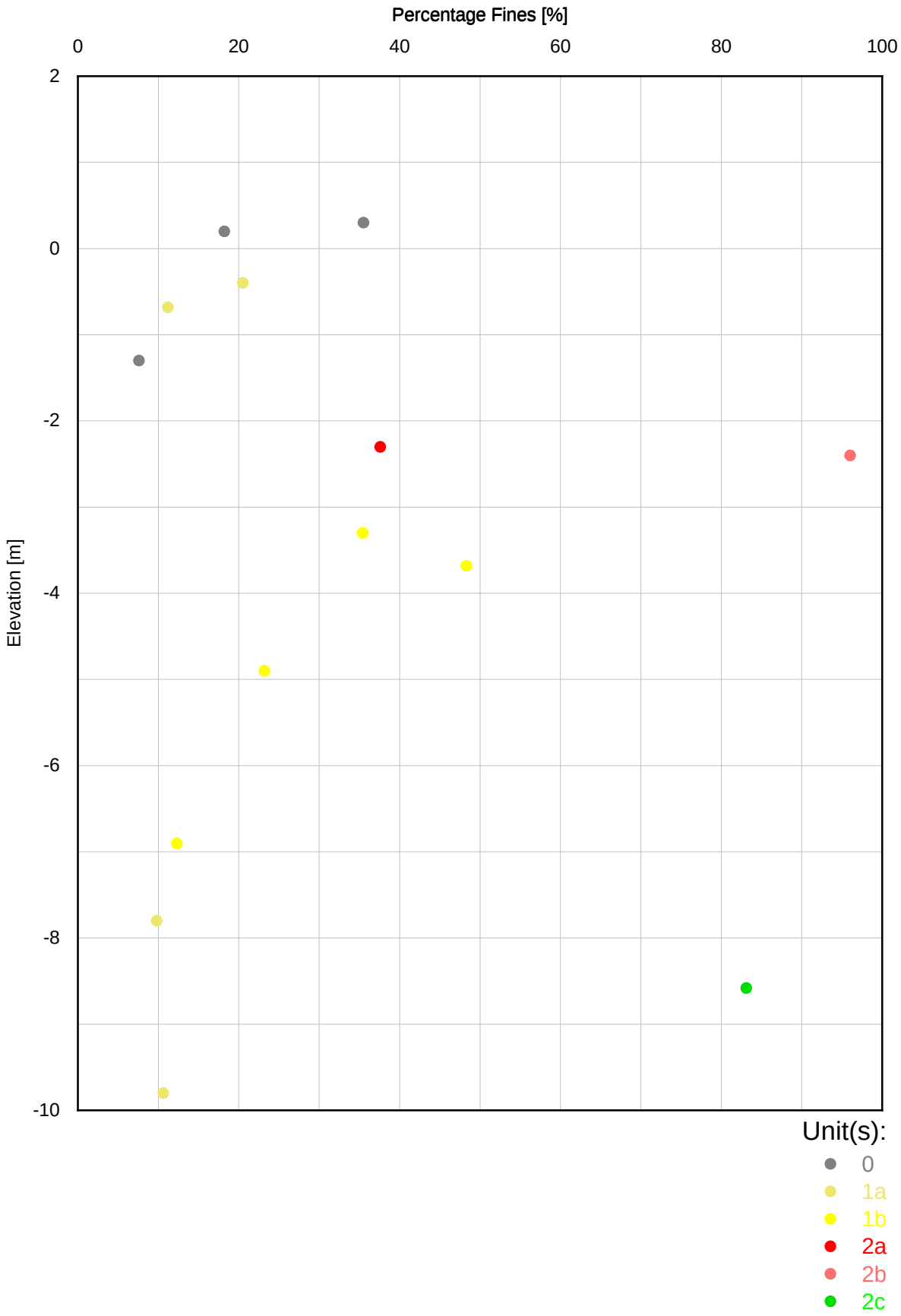
Origin v7.03./ PI vs Depth.OPJ / 1/25/2023 16:06:14



PERCENTAGE FINES versus DEPTH
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ASH TIP

Origin v7.03./ PI vs Depth.OPJ / 1/25/2023 16:06:32

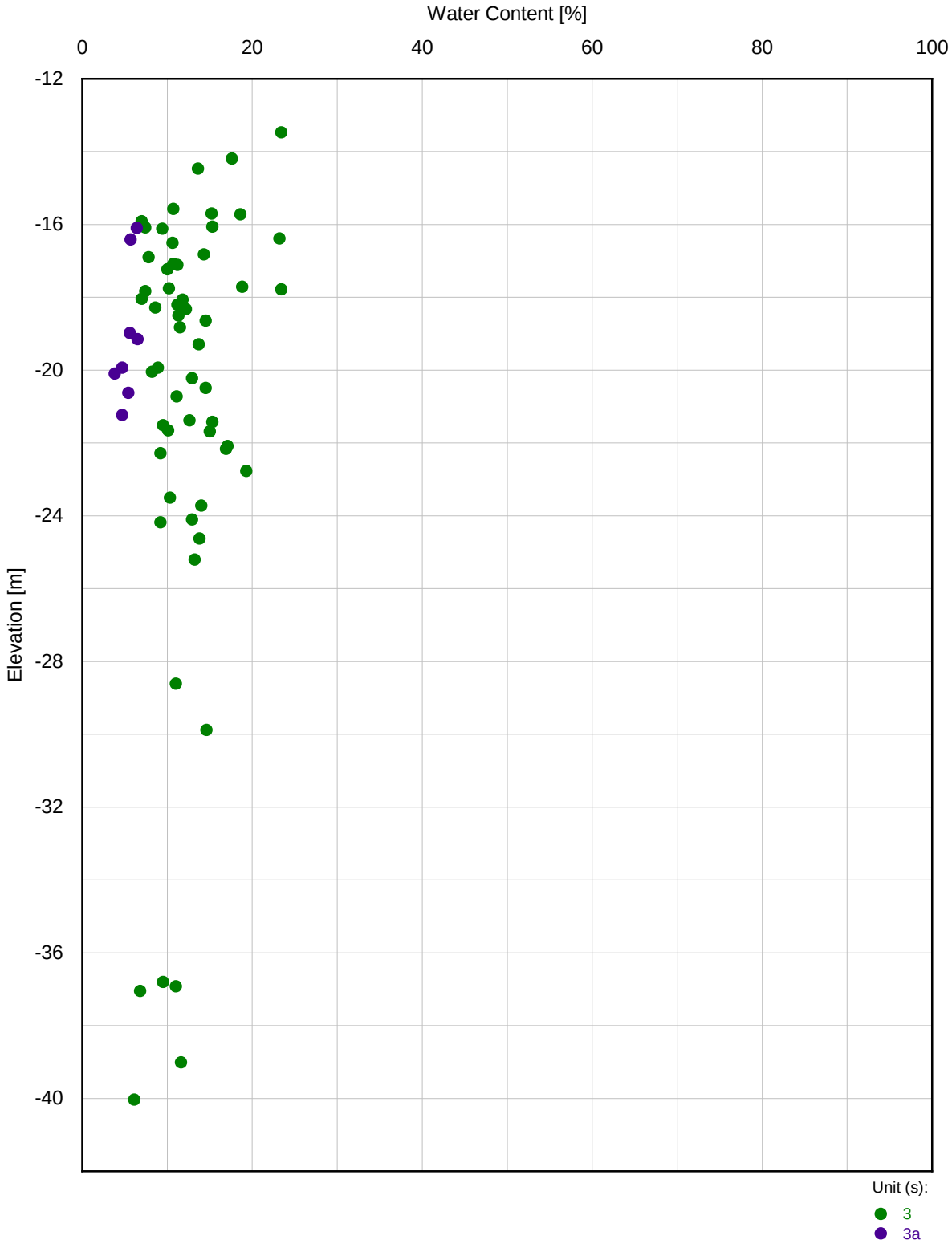
Plate 3.6.2.4r



PERCENTAGE FINES versus DEPTH
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

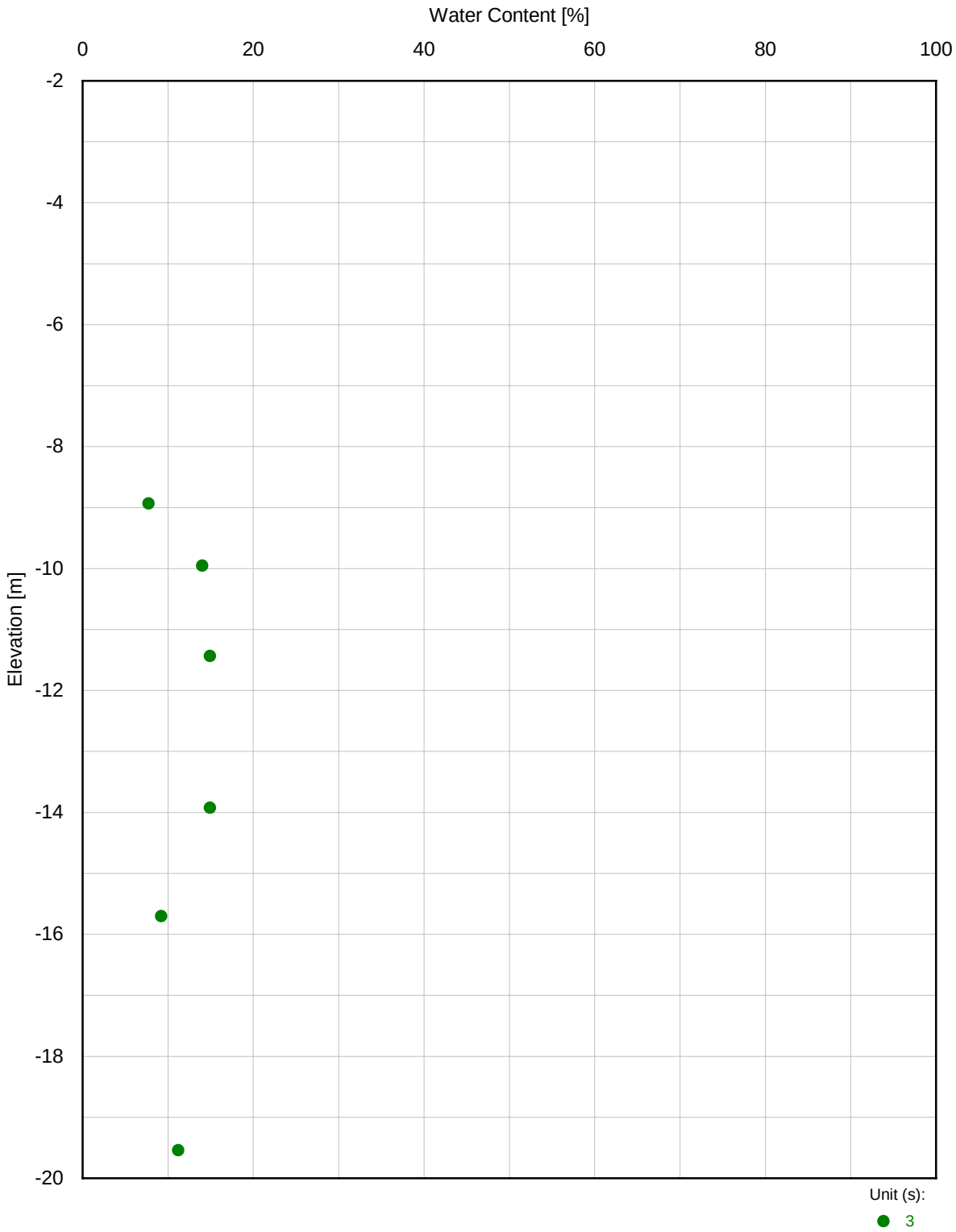
Origin v7.03./ PI vs Depth.OPJ / 1/25/2023 16:06:50

Plate 3.6.2.4s



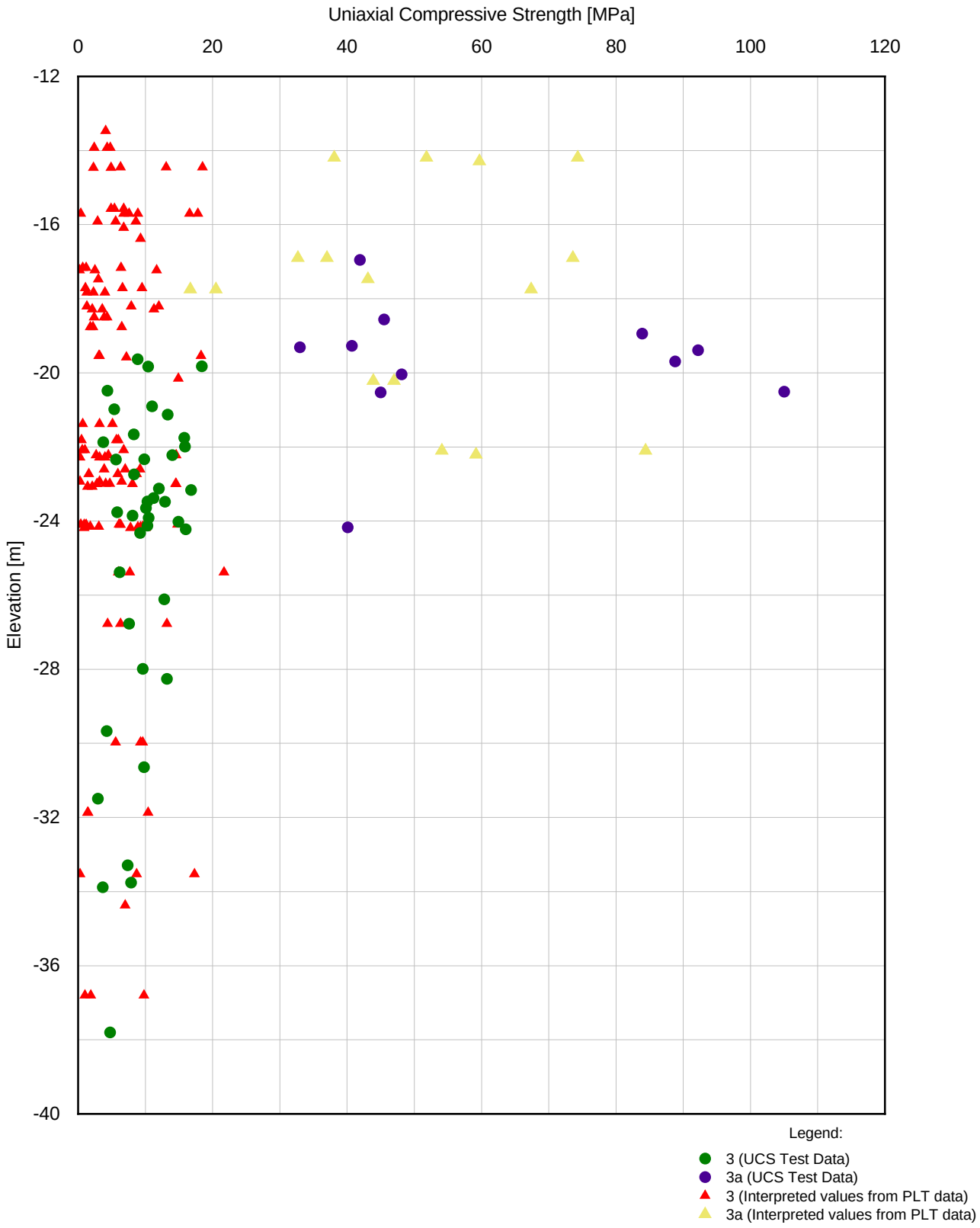
Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 15:04:59

WATER CONTENT versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE



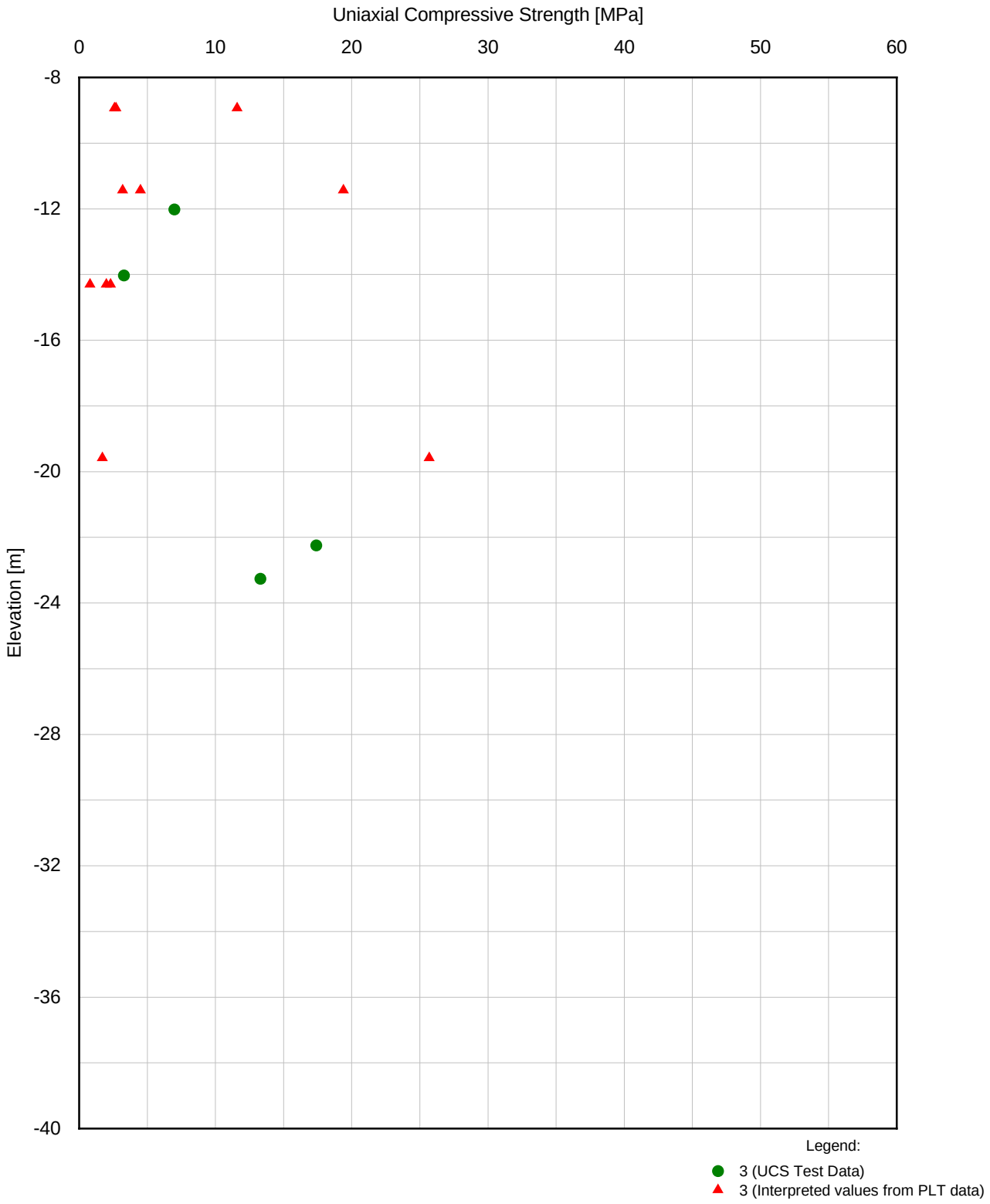
WATER CONTENT versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 14:47:24



Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 14:35:37

UCS versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
MAIN SITE



Origin v7.03./ PI vs Depth.OPJ / 2/1/2023 14:41:24

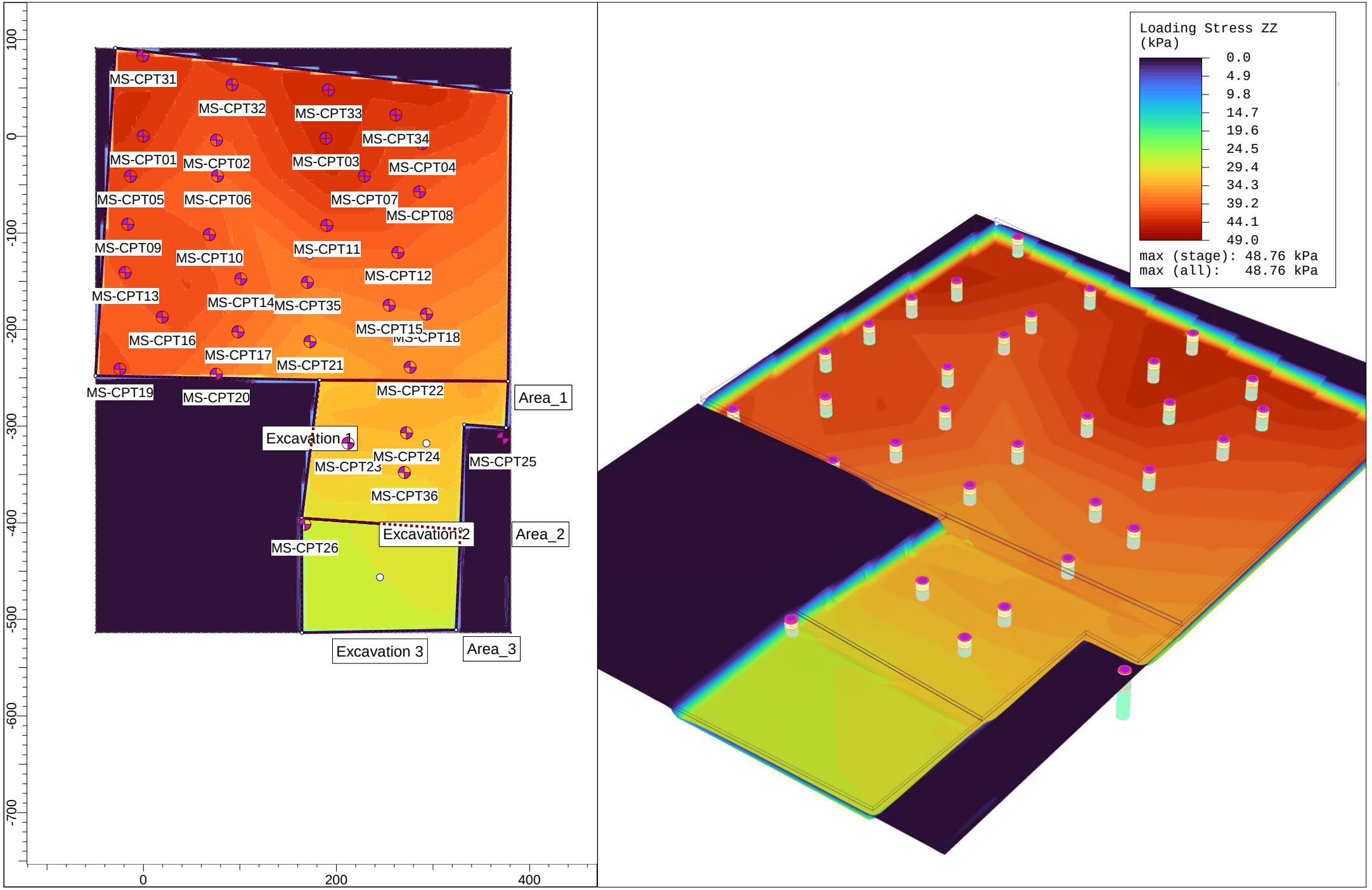
PLT & UCS versus ELEVATION
KEADBY 3 GEOTECHNICAL SITE INVESTIGATION
ACCESS ROADS

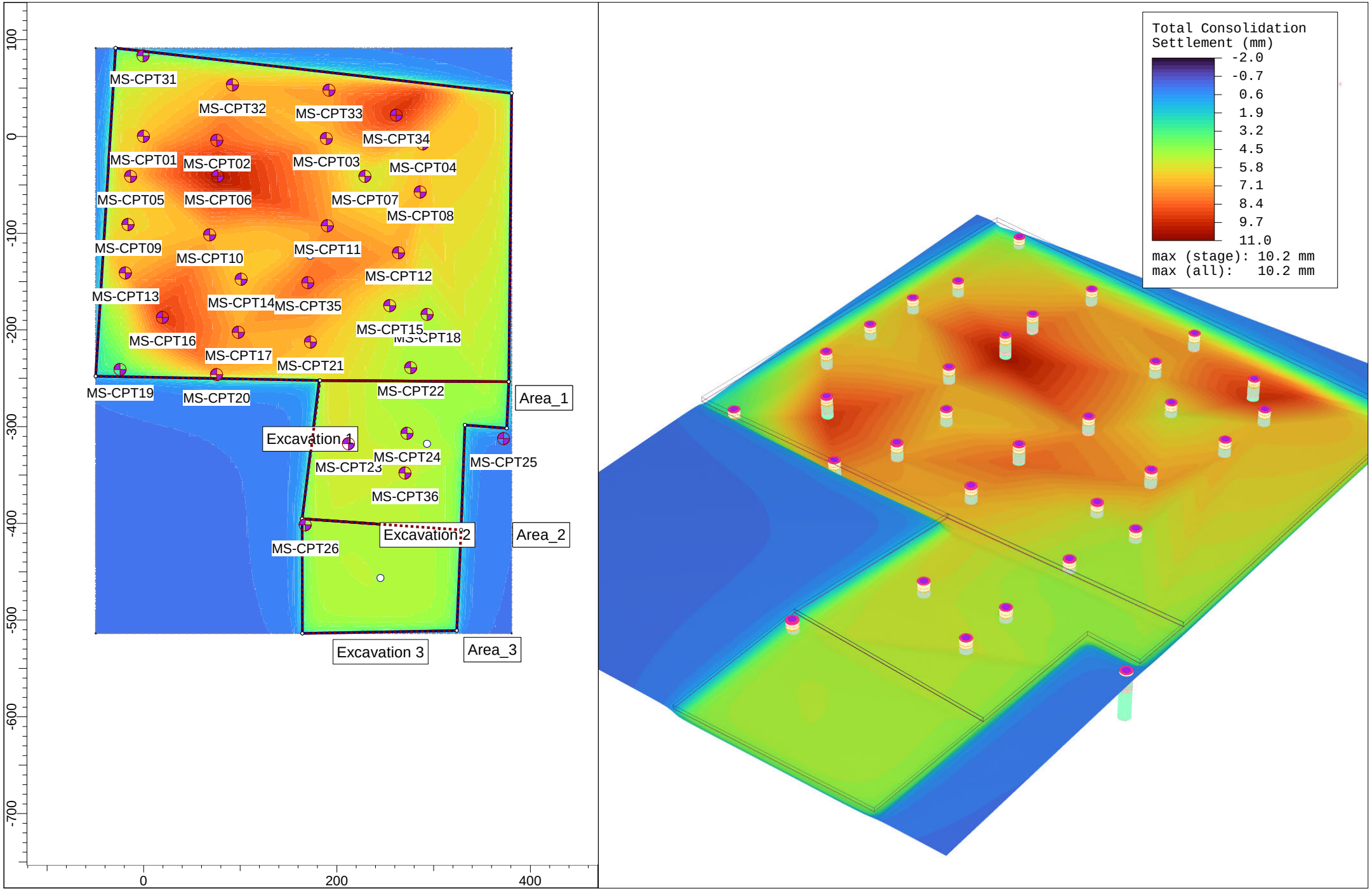
Appendix E

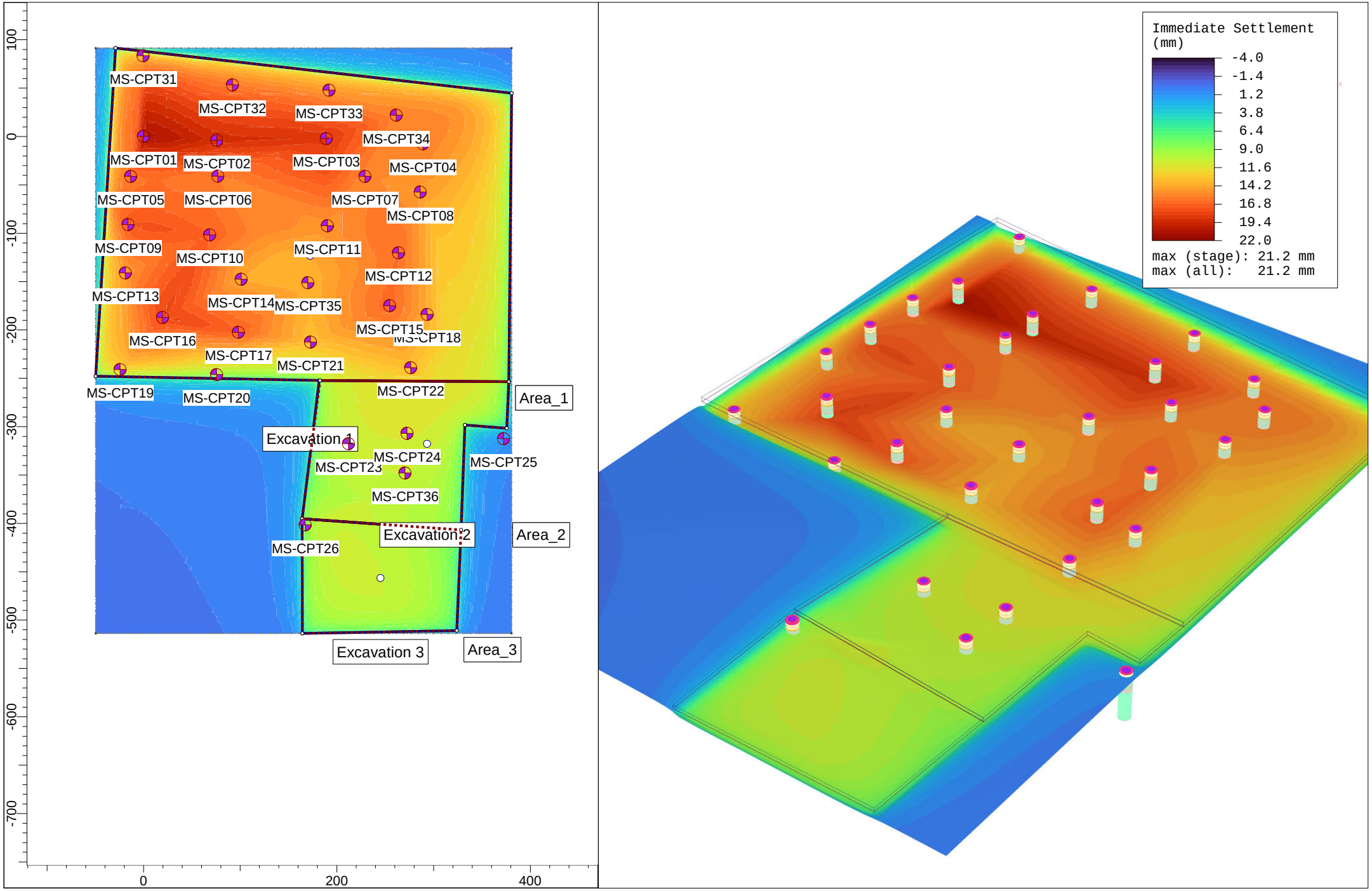
Engineering Calculations

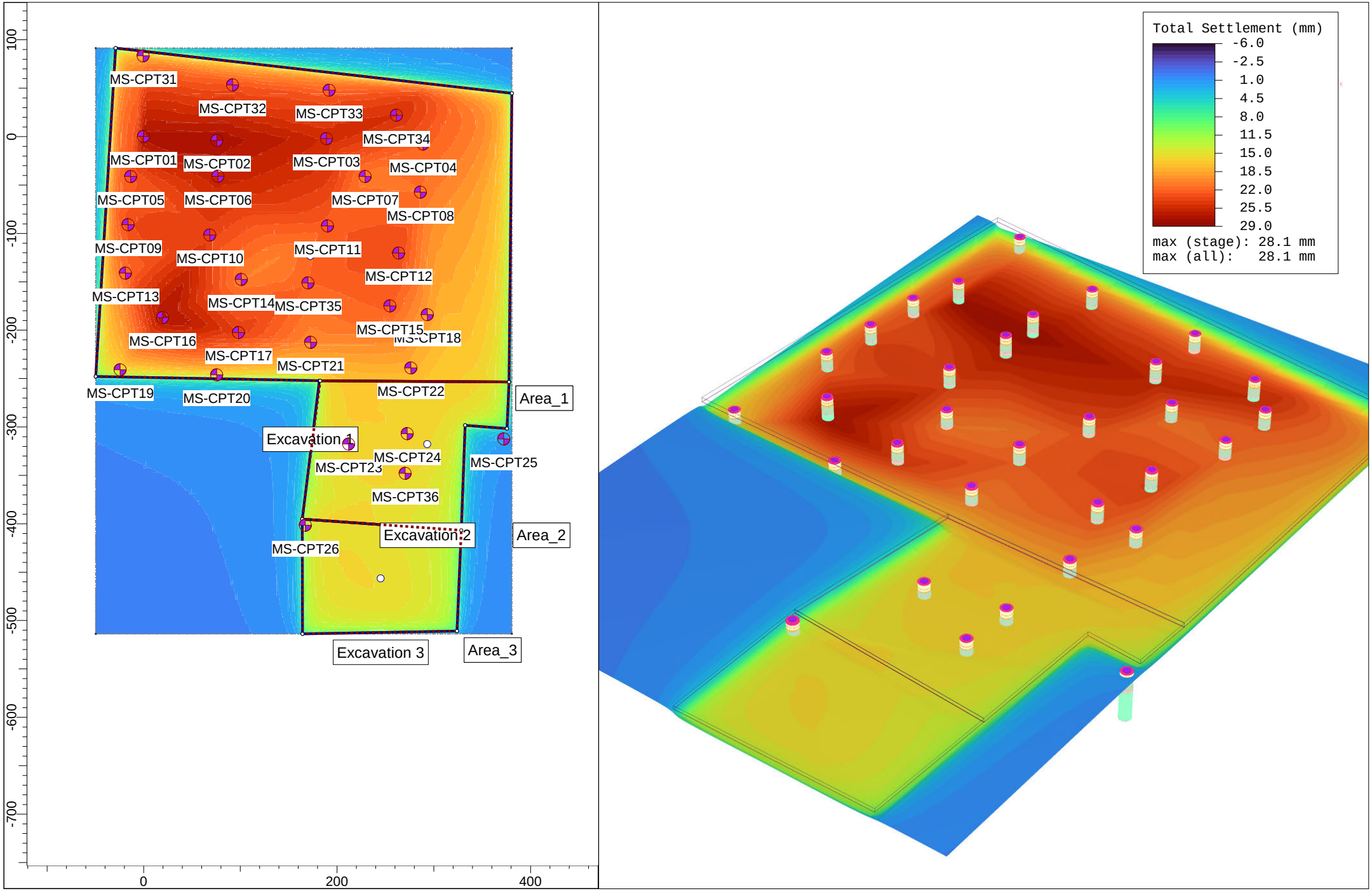
Outputs

E.1 Settlement Calculations


MS-CPT31
MS-CPT32
MS-CPT33
MS-CPT34
MS-CPT01
MS-CPT02
MS-CPT03
MS-CPT04
MS-CPT05
MS-CPT06
MS-CPT07
MS-CPT08
MS-CPT09
MS-CPT10
MS-CPT11
MS-CPT12
MS-CPT13
MS-CPT14
MS-CPT35
MS-CPT15
MS-CPT16
MS-CPT18
MS-CPT17
MS-CPT21
MS-CPT19
MS-CPT20
MS-CPT22
Area_1
Excavation 1
MS-CPT24
MS-CPT23
MS-CPT25
MS-CPT36
Excavation 2
Area_2
MS-CPT26
Excavation 3
Area_3
100
0
-100
-200
-300
-400
-500
-600
-700
0
200
400
Loading Stress ZZ
(kPa)
0.0
4.9
9.8
14.7
19.6
24.5
29.4
34.3
39.2
44.1
49.0
max (stage): 48.76 kPa
max (all): 48.76 kPa


MS-CPT31
MS-CPT32
MS-CPT33
MS-CPT34
MS-CPT01
MS-CPT02
MS-CPT03
MS-CPT04
MS-CPT05
MS-CPT06
MS-CPT07
MS-CPT08
MS-CPT09
MS-CPT10
MS-CPT11
MS-CPT12
MS-CPT13
MS-CPT14
MS-CPT35
MS-CPT15
MS-CPT16
MS-CPT18
MS-CPT17
MS-CPT21
MS-CPT19
MS-CPT20
MS-CPT22
Area_1
Excavation 1
MS-CPT24
MS-CPT23
MS-CPT25
MS-CPT36
Excavation 2
Area_2
MS-CPT26
Excavation 3
Area_3
100
0
-100
-200
-300
-400
-500
-600
-700
0
200
400
Total Consolidation Settlement (mm)
-2.0
-0.7
0.6
1.9
3.2
4.5
5.8
7.1
8.4
9.7
11.0
max (stage): 10.2 mm
max (all): 10.2 mm


MS-CPT31
MS-CPT32
MS-CPT33
MS-CPT34
MS-CPT01
MS-CPT02
MS-CPT03
MS-CPT04
MS-CPT05
MS-CPT06
MS-CPT07
MS-CPT08
MS-CPT09
MS-CPT10
MS-CPT11
MS-CPT12
MS-CPT13
MS-CPT14
MS-CPT35
MS-CPT15
MS-CPT16
MS-CPT18
MS-CPT17
MS-CPT21
MS-CPT19
MS-CPT20
MS-CPT22
Area_1
Excavation 1
MS-CPT24
MS-CPT23
MS-CPT25
MS-CPT36
Excavation 2
Area_2
MS-CPT26
Excavation 3
Area_3
100
0
-100
-200
-300
-400
-500
-600
-700
0
200
400
Immediate Settlement (mm)
-4.0
-1.4
1.2
3.8
6.4
9.0
11.6
14.2
16.8
19.4
22.0
max (stage): 21.2 mm
max (all): 21.2 mm


MS-CPT31
MS-CPT32
MS-CPT33
MS-CPT34
MS-CPT01
MS-CPT02
MS-CPT03
MS-CPT04
MS-CPT05
MS-CPT06
MS-CPT07
MS-CPT08
MS-CPT09
MS-CPT10
MS-CPT11
MS-CPT12
MS-CPT13
MS-CPT14
MS-CPT35
MS-CPT15
MS-CPT16
MS-CPT18
MS-CPT17
MS-CPT21
MS-CPT19
MS-CPT20
MS-CPT22
Area_1
Excavation 1
MS-CPT24
MS-CPT23
MS-CPT25
MS-CPT36
Excavation 2
Area_2
MS-CPT26
Excavation 3
Area_3
100
0
-100
-200
-300
-400
-500
-600
-700
0
200
400
Total Settlement (mm)
-6.0
-2.5
1.0
4.5
8.0
11.5
15.0
18.5
22.0
25.5
29.0
max (stage): 28.1 mm
max (all): 28.1 mm

E.2 Bearing Capacity Calculations

E.2.1 Area-A Bearing Capacity Calculations

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

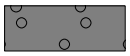
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 1.50$ m
Spread footing width $y = 1.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 1.50$ m
Column width in the direction of y $c_y = 1.50$ m

Spread footing volume = 0.45 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	112.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	255.26	19.59	Yes
50 kPa	No	0.00	0.00	50.00	255.26	19.59	Yes

Analysis of bearing capacity - partial results

φ_d = 33.398 °
c_d = 0.000 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 19.577 kN/m^3
b_{ef} = 1.500 m
N_q = 27.368
N_c = 39.993
N_γ = 34.770
s_q = 1.550
s_c = 1.571
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 357.366 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 2.69 m
Length of slip surface l_{sp} = 8.60 m

Design bearing capacity of found.soil R_d = 255.26 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 71.61 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

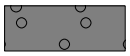
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 3.00$ m
Spread footing width $y = 3.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 3.00$ m
Column width in the direction of y $c_y = 3.00$ m

Spread footing volume = 1.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	450.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	366.54	13.64	Yes
50 kPa	No	0.00	0.00	50.00	366.54	13.64	Yes

Analysis of bearing capacity - partial results

φ_d = 32.651 °
c_d = 0.205 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 15.499 kN/m^3
b_{ef} = 3.000 m
N_q = 25.029
N_c = 37.500
N_γ = 30.795
s_q = 1.540
s_c = 1.562
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 513.161 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 5.22 m
Length of slip surface l_{sp} = 16.50 m

Design bearing capacity of found.soil R_d = 366.54 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 286.45 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

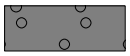
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 4.00$ m
Spread footing width $y = 6.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 4.00$ m
Column width in the direction of y $c_y = 6.00$ m

Spread footing volume = 4.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	1200.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	530.15	9.43	Yes
50 kPa	No	0.00	0.00	50.00	530.15	9.43	Yes

Analysis of bearing capacity - partial results

φ_d = 33.157 °
c_d = 0.130 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 13.744 kN/m^3
b_{ef} = 4.000 m
N_q = 26.587
N_c = 39.165
N_γ = 33.432
s_q = 1.365
s_c = 1.379
s_γ = 0.800
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 742.204 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 7.11 m
Length of slip surface l_{sp} = 22.66 m

Design bearing capacity of found.soil R_d = 530.15 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 763.86 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

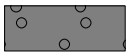
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 5.00$ m
Spread footing width $y = 10.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 5.00$ m
Column width in the direction of y $c_y = 10.00$ m

Spread footing volume = 10.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	2500.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	650.15	7.69	Yes
50 kPa	No	0.00	0.00	50.00	650.15	7.69	Yes

Analysis of bearing capacity - partial results

φ_d = 33.109 °
c_d = 0.231 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 12.747 kN/m^3
b_{ef} = 5.000 m
N_q = 26.435
N_c = 39.004
N_γ = 33.174
s_q = 1.273
s_c = 1.284
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 910.206 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 8.86 m
Length of slip surface l_{sp} = 28.22 m

Design bearing capacity of found.soil R_d = 650.15 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 1591.38 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

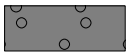
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 7.50$ m
Spread footing width $y = 12.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 7.50$ m
Column width in the direction of y $c_y = 12.50$ m

Spread footing volume = 18.75 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	4687.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	1042.15	4.80	Yes
50 kPa	No	0.00	0.00	50.00	1042.15	4.80	Yes

Analysis of bearing capacity - partial results

φ_d = 34.465 °
c_d = 0.113 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 11.406 kN/m^3
b_{ef} = 7.500 m
N_q = 31.164
N_c = 43.947
N_γ = 41.408
s_q = 1.340
s_c = 1.351
s_γ = 0.820
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1459.013 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 14.00 m
Length of slip surface l_{sp} = 45.68 m

Design bearing capacity of found.soil R_d = 1042.15 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 2983.84 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

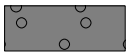
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 10.00$ m
Spread footing width $y = 20.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 10.00$ m
Column width in the direction of y $c_y = 20.00$ m

Spread footing volume = 40.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	5.00	18.30 .. 23.30	Unit_3	
10	-	23.30 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	10000.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	1256.75	3.98	Yes
50 kPa	No	0.00	0.00	50.00	1256.75	3.98	Yes

Analysis of bearing capacity - partial results

φ_d = 33.520 °
c_d = 2.203 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 10.912 kN/m^3
b_{ef} = 10.000 m
N_q = 27.773
N_c = 40.420
N_γ = 35.468
s_q = 1.276
s_c = 1.286
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1759.453 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 18.00 m
Length of slip surface l_{sp} = 57.73 m

Design bearing capacity of found.soil R_d = 1256.75 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

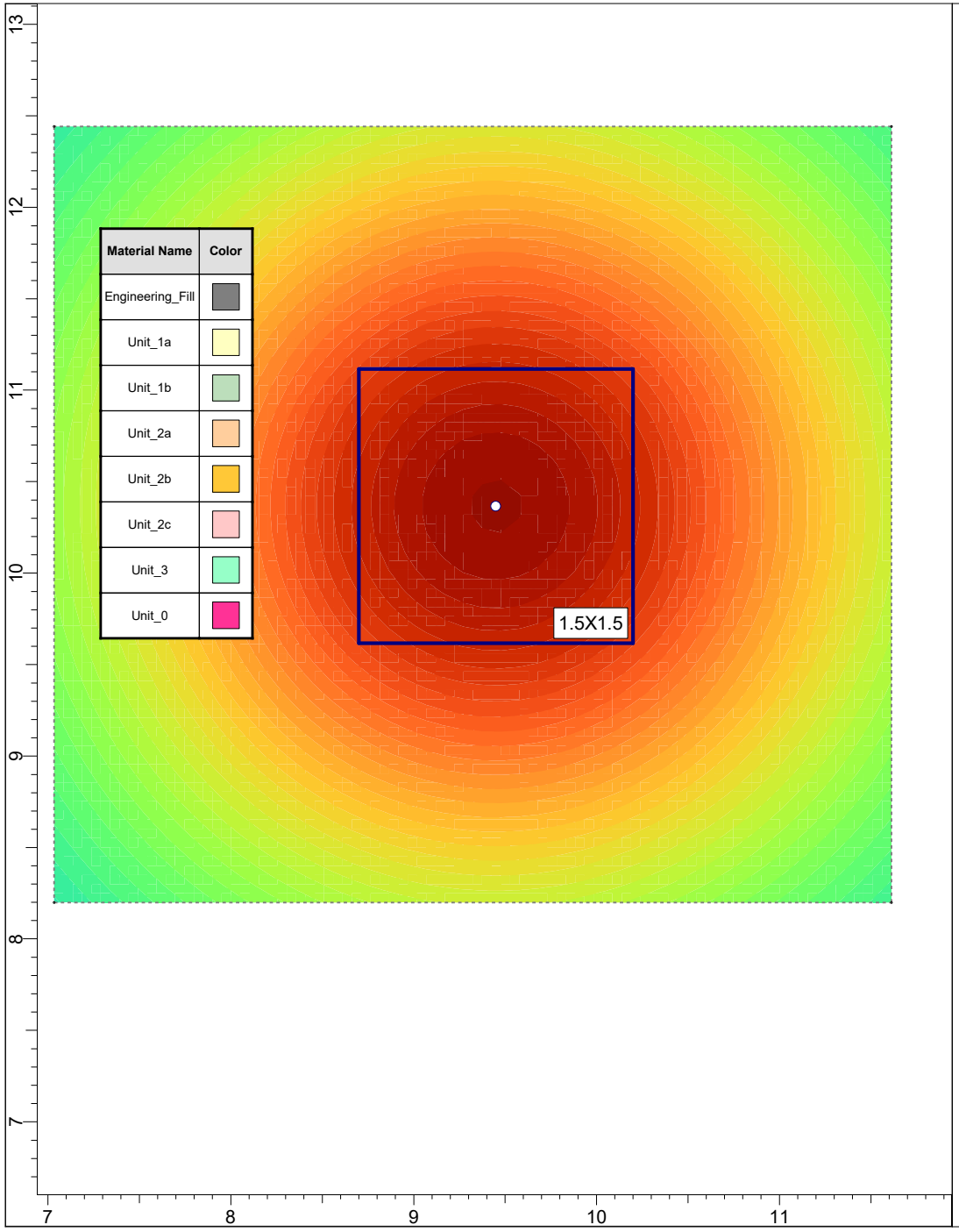
Horizontal bearing capacity R_{dh} = 6365.52 kN
Extreme horizontal force H = 0.00 kN

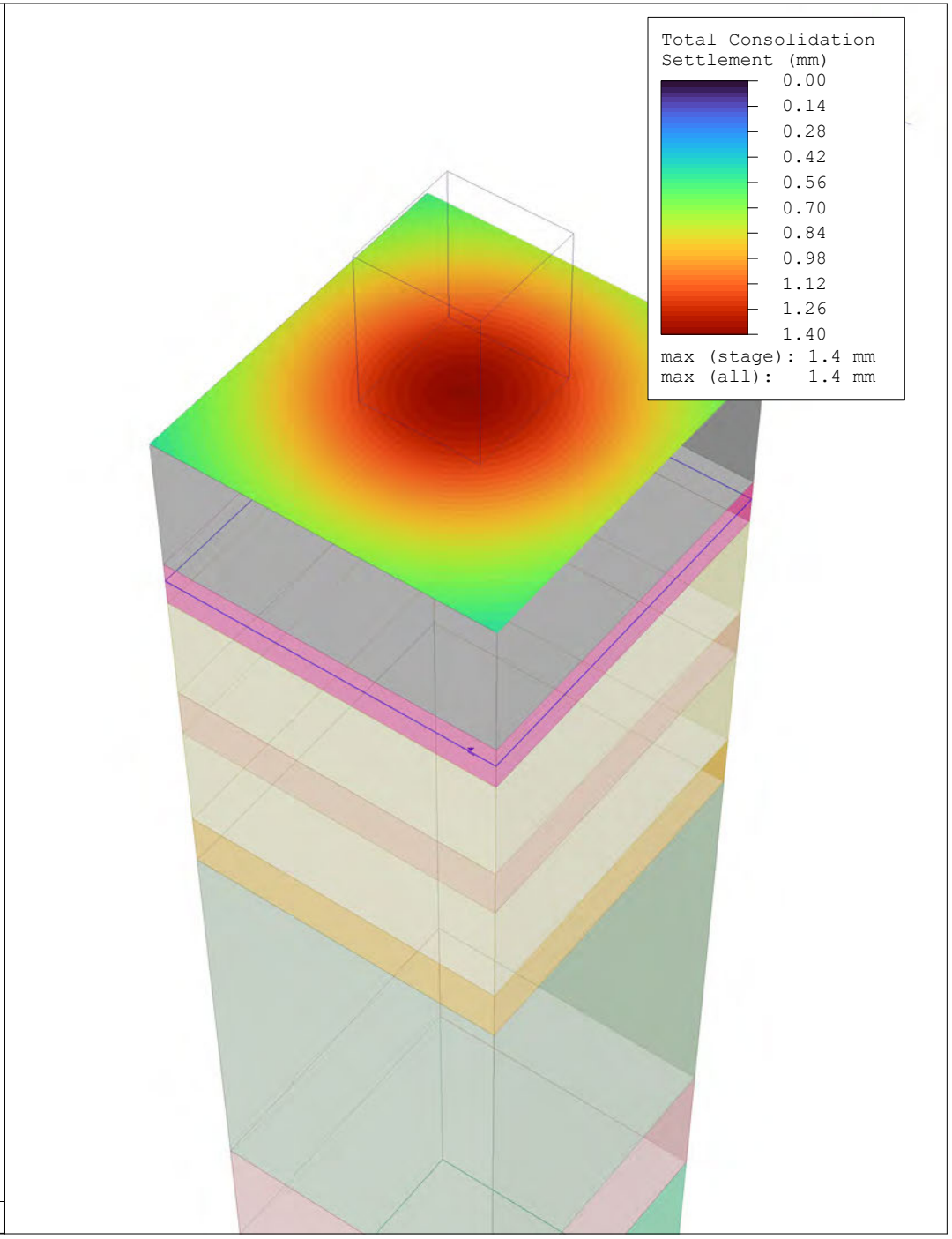
Bearing capacity in the horizontal direction is SATISFACTORY

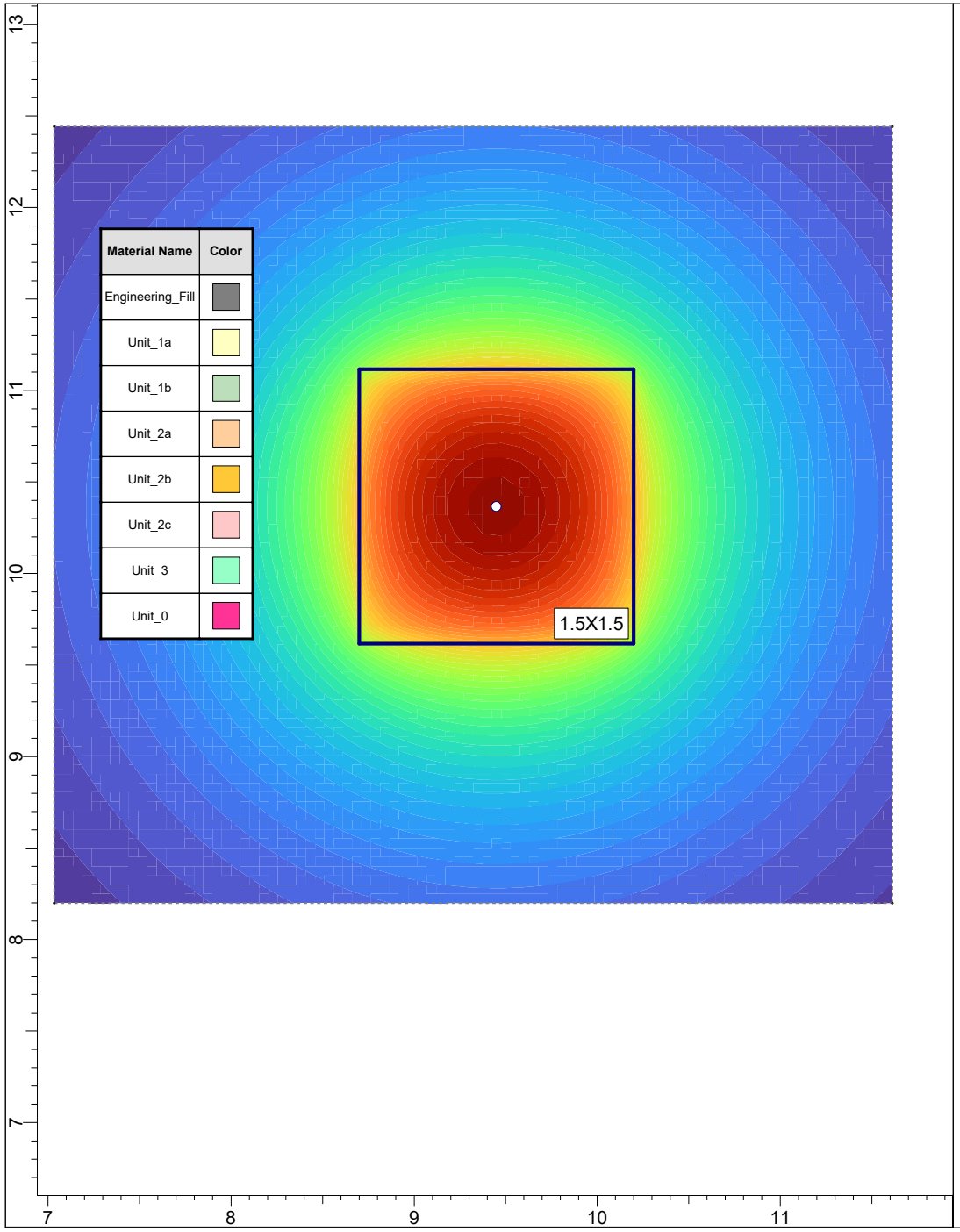
Bearing capacity of foundation is SATISFACTORY

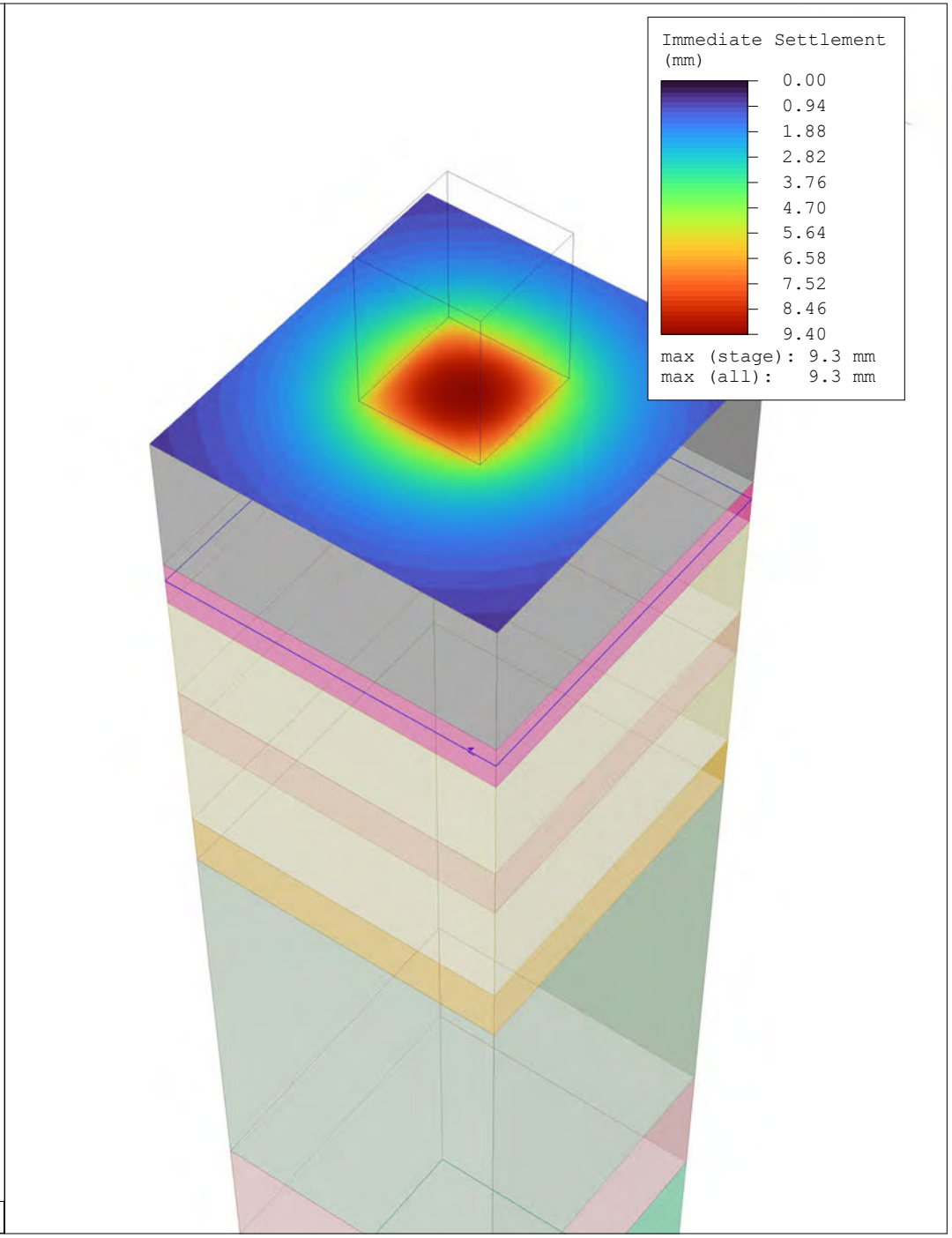
[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

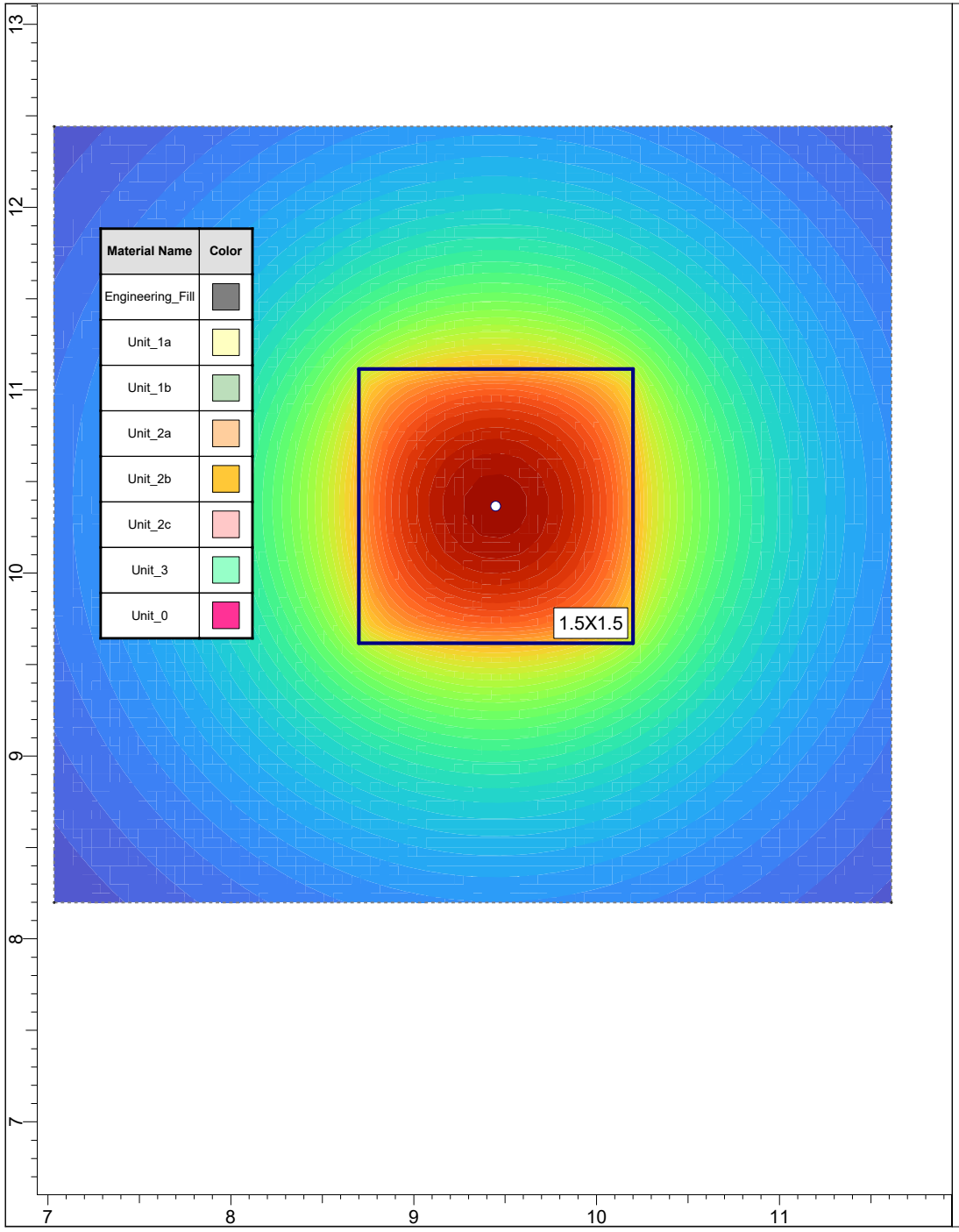
E.2.2 Area-A Foundation Settlement Diagrams

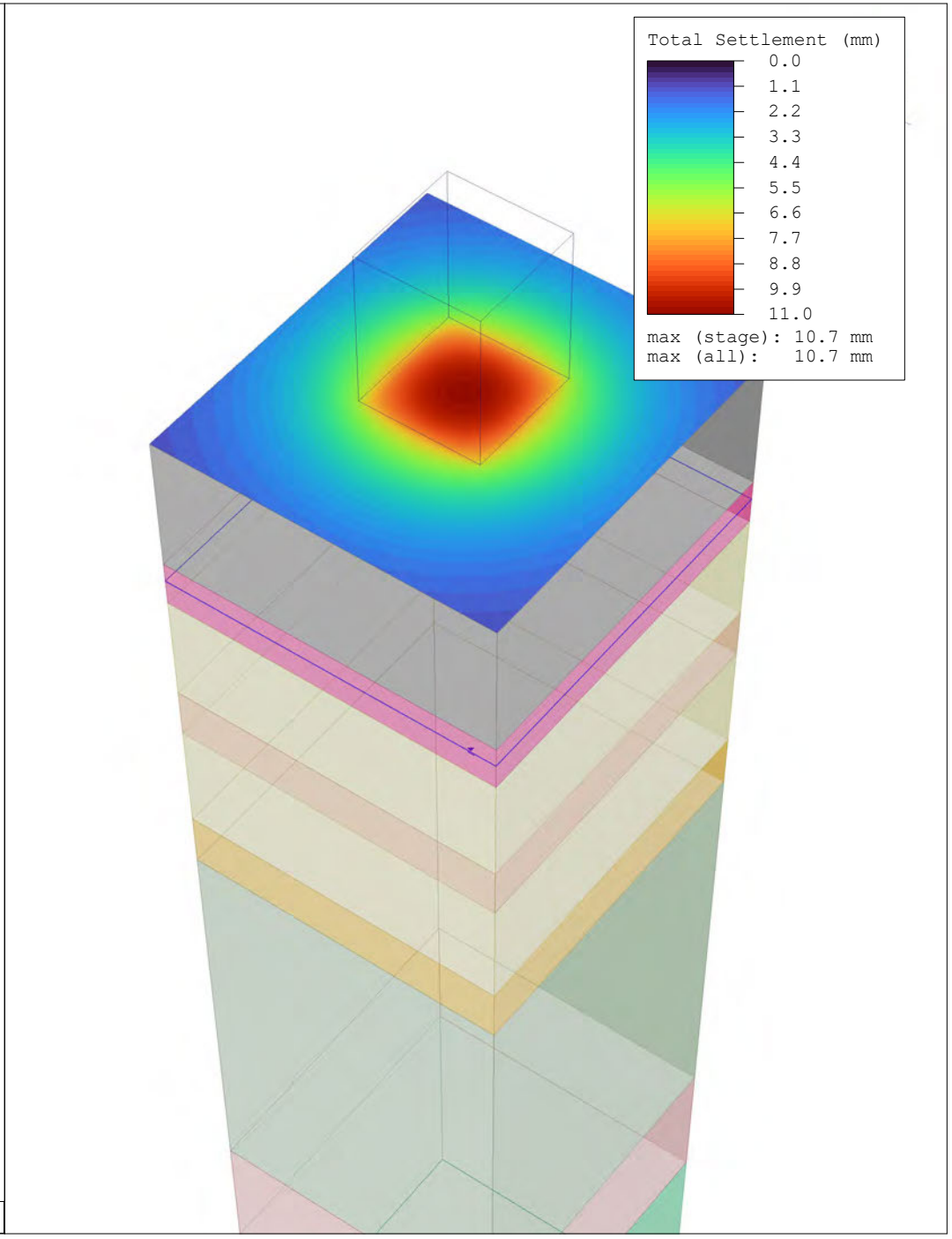

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
1.5X1.5
13
12
11
10
9
8
7
7
8
9
10
11

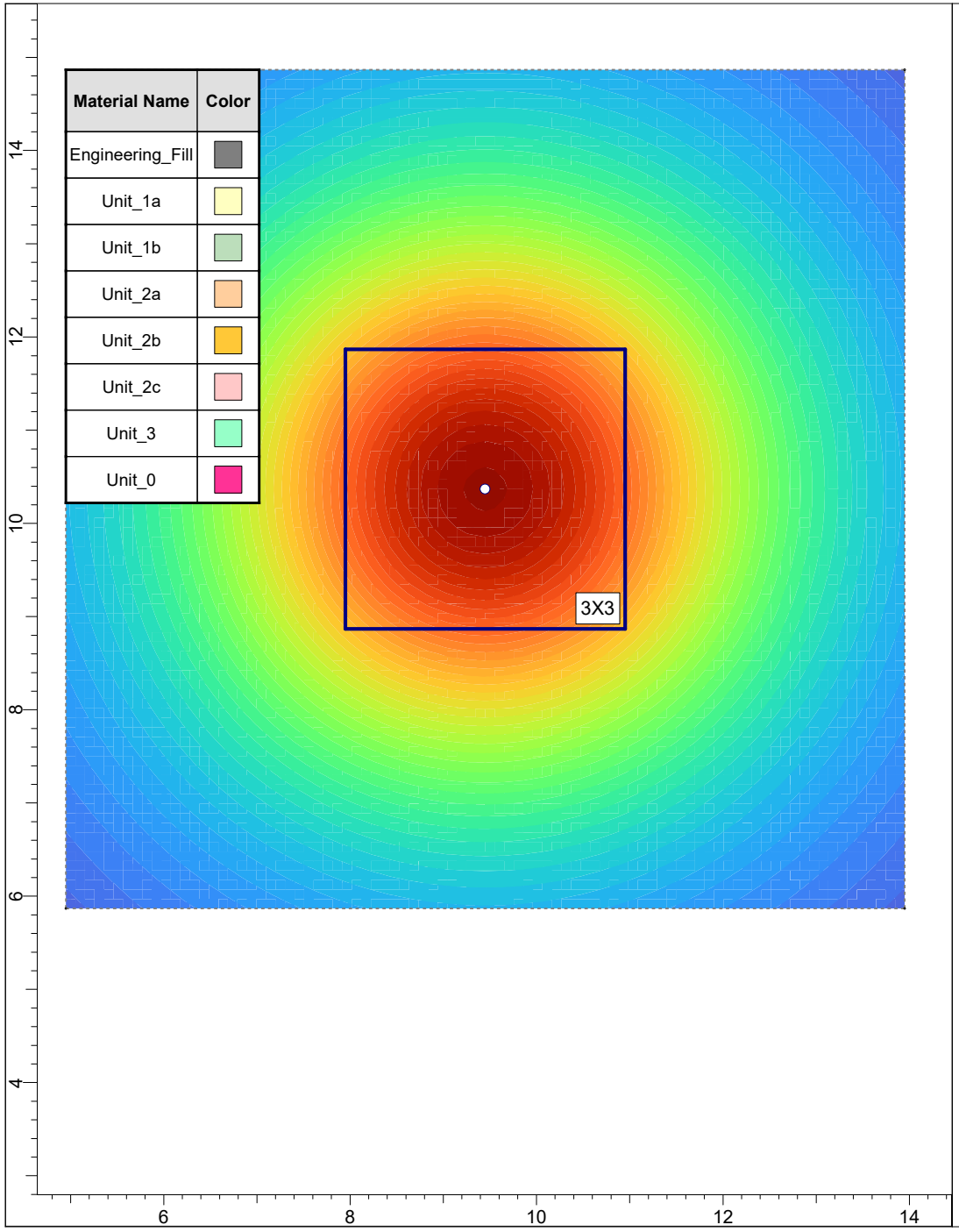

Total Consolidation
Settlement (mm)
0.00
0.14
0.28
0.42
0.56
0.70
0.84
0.98
1.12
1.26
1.40
max (stage): 1.4 mm
max (all): 1.4 mm

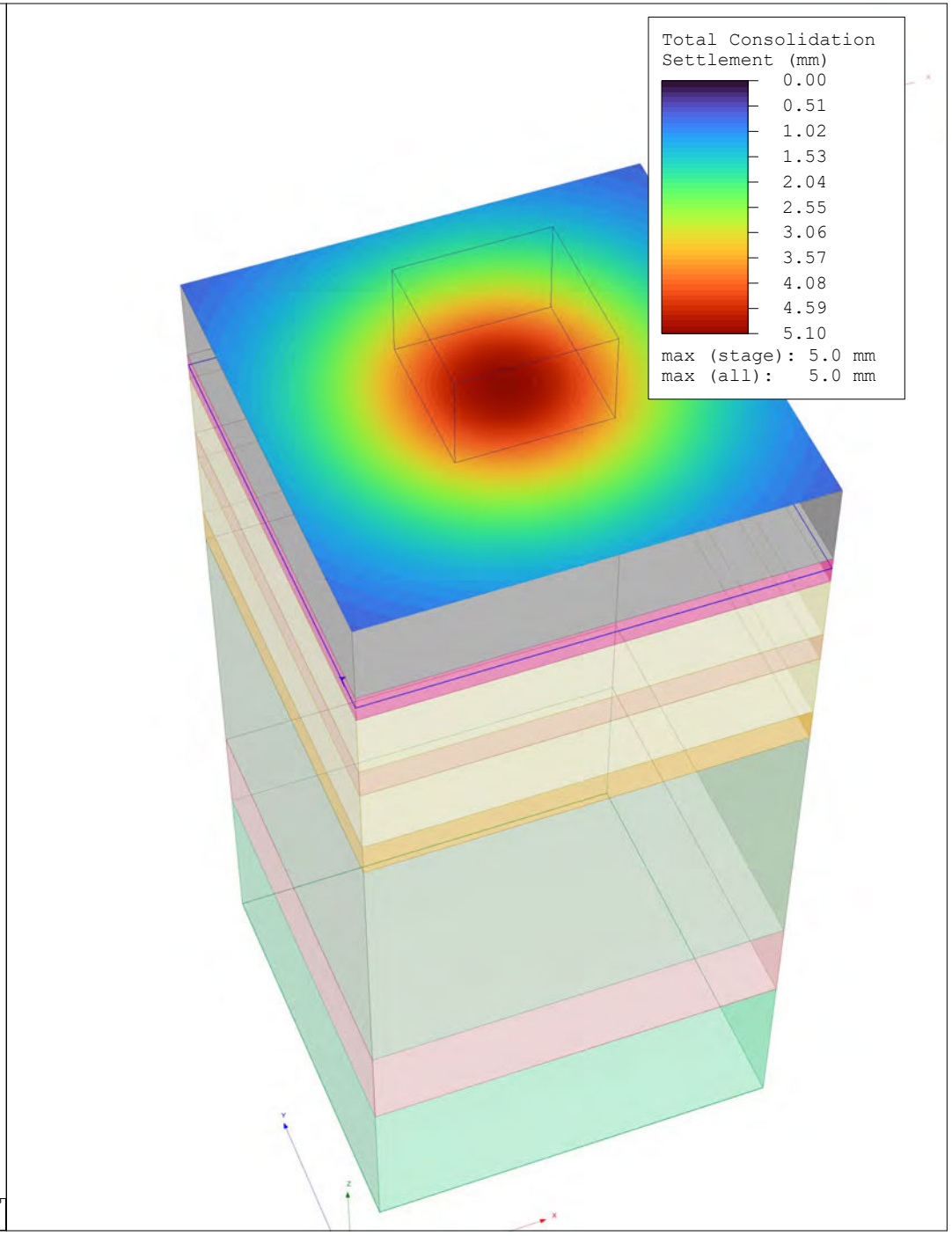

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
1.5X1.5
13
12
11
10
9
8
7
7
8
9
10
11

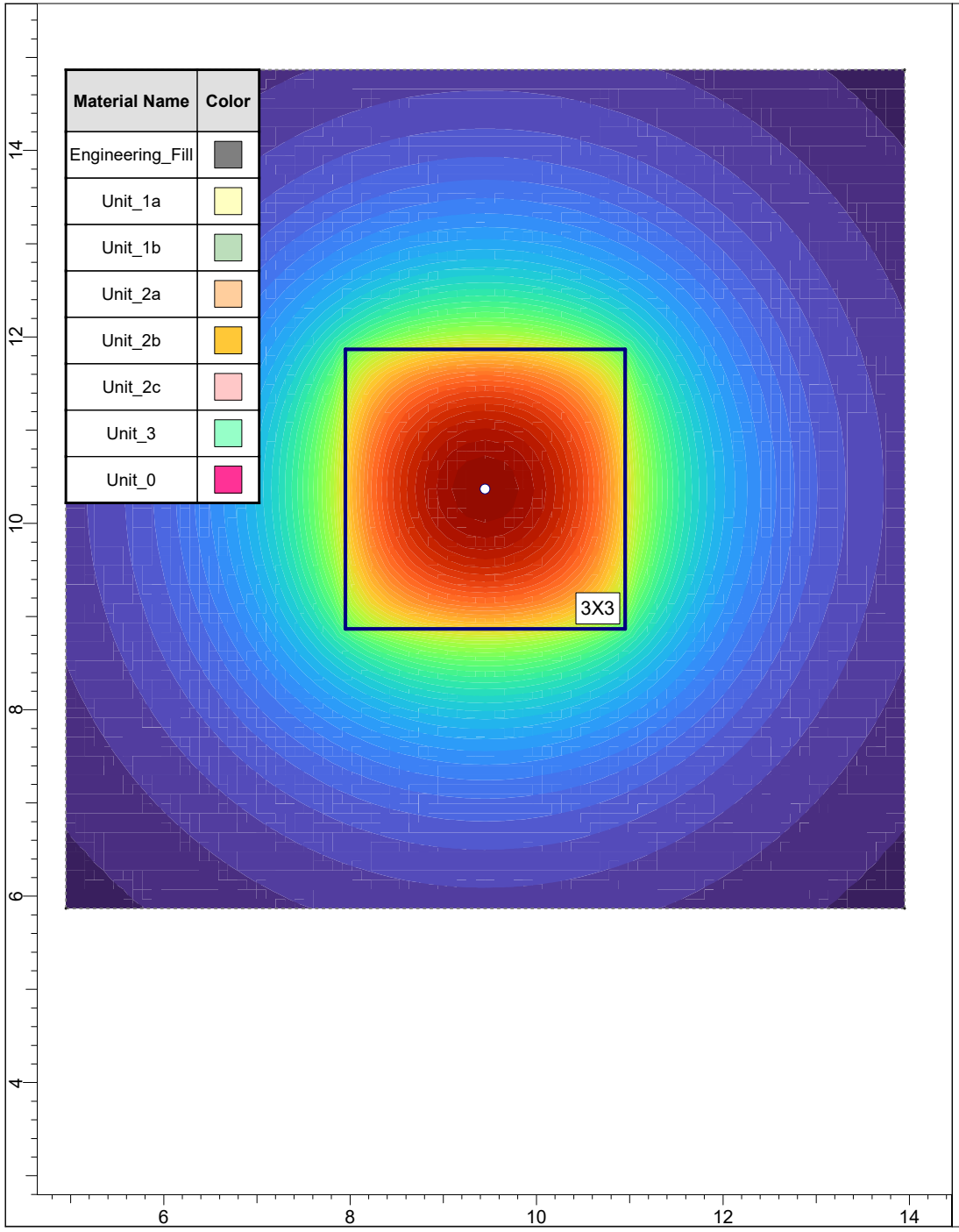

Immediate Settlement
(mm)
0.00
0.94
1.88
2.82
3.76
4.70
5.64
6.58
7.52
8.46
9.40
max (stage): 9.3 mm
max (all): 9.3 mm

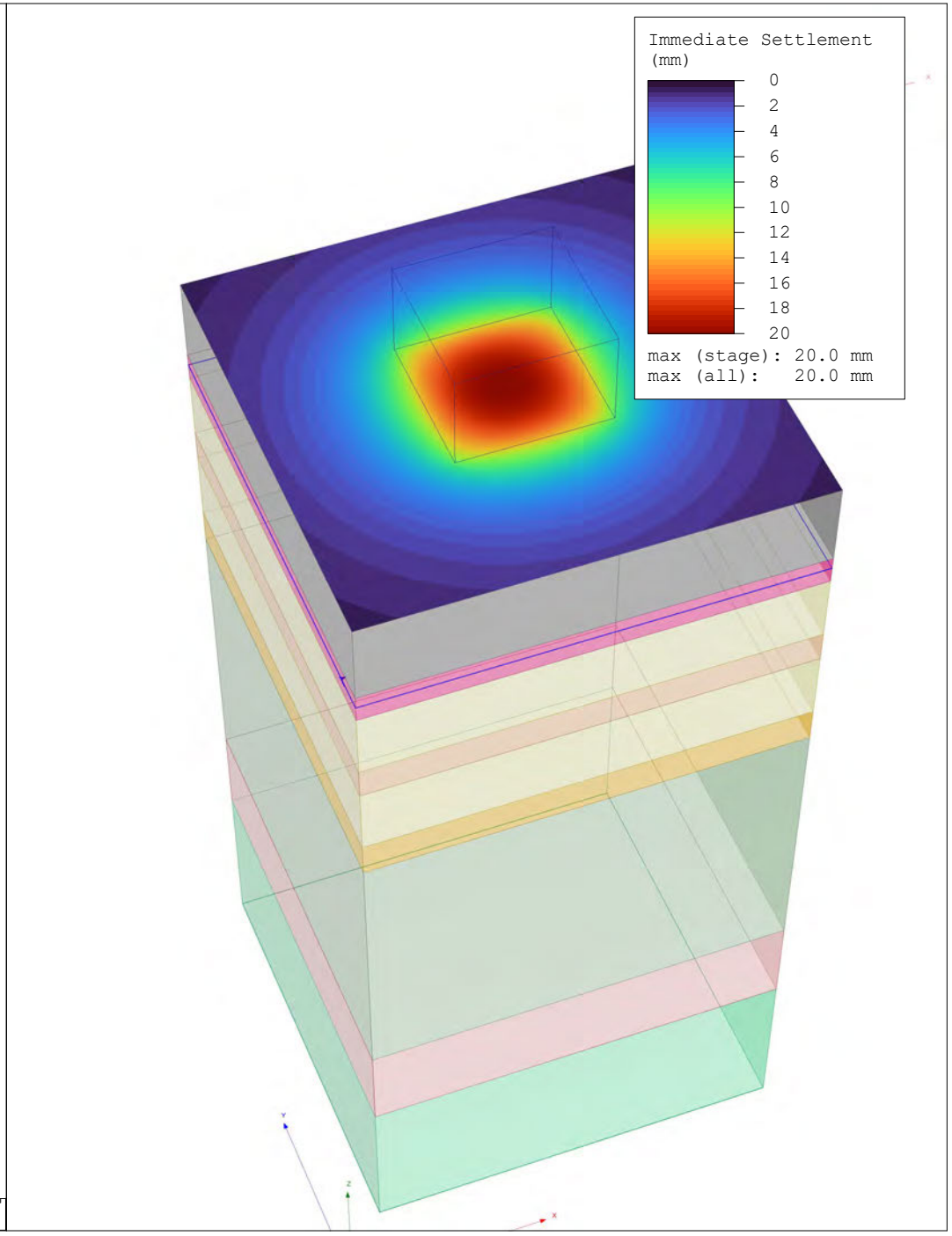

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
1.5X1.5
13
12
11
10
9
8
7
7
8
9
10
11

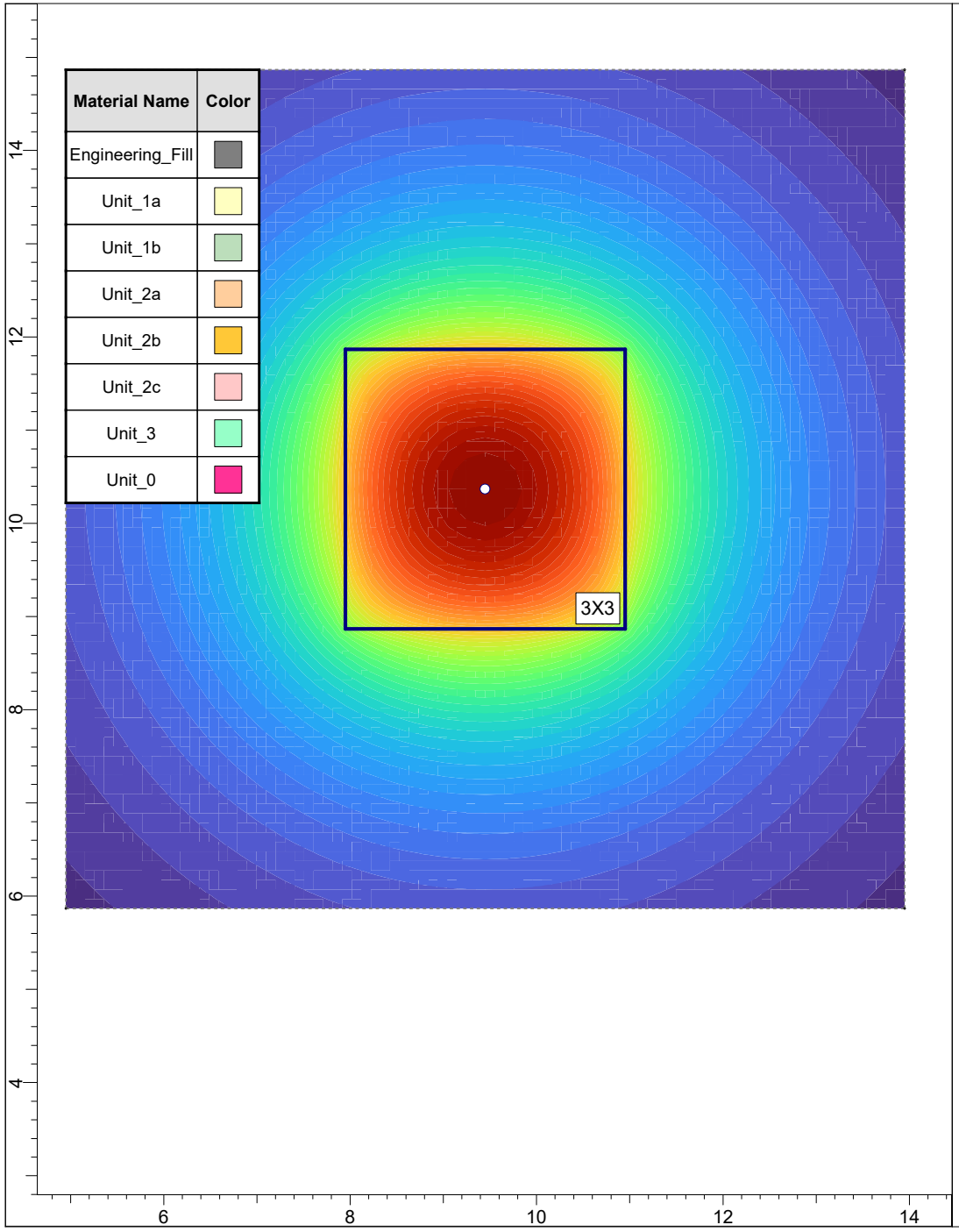

Total Settlement (mm)
0.0
1.1
2.2
3.3
4.4
5.5
6.6
7.7
8.8
9.9
11.0
max (stage): 10.7 mm
max (all): 10.7 mm

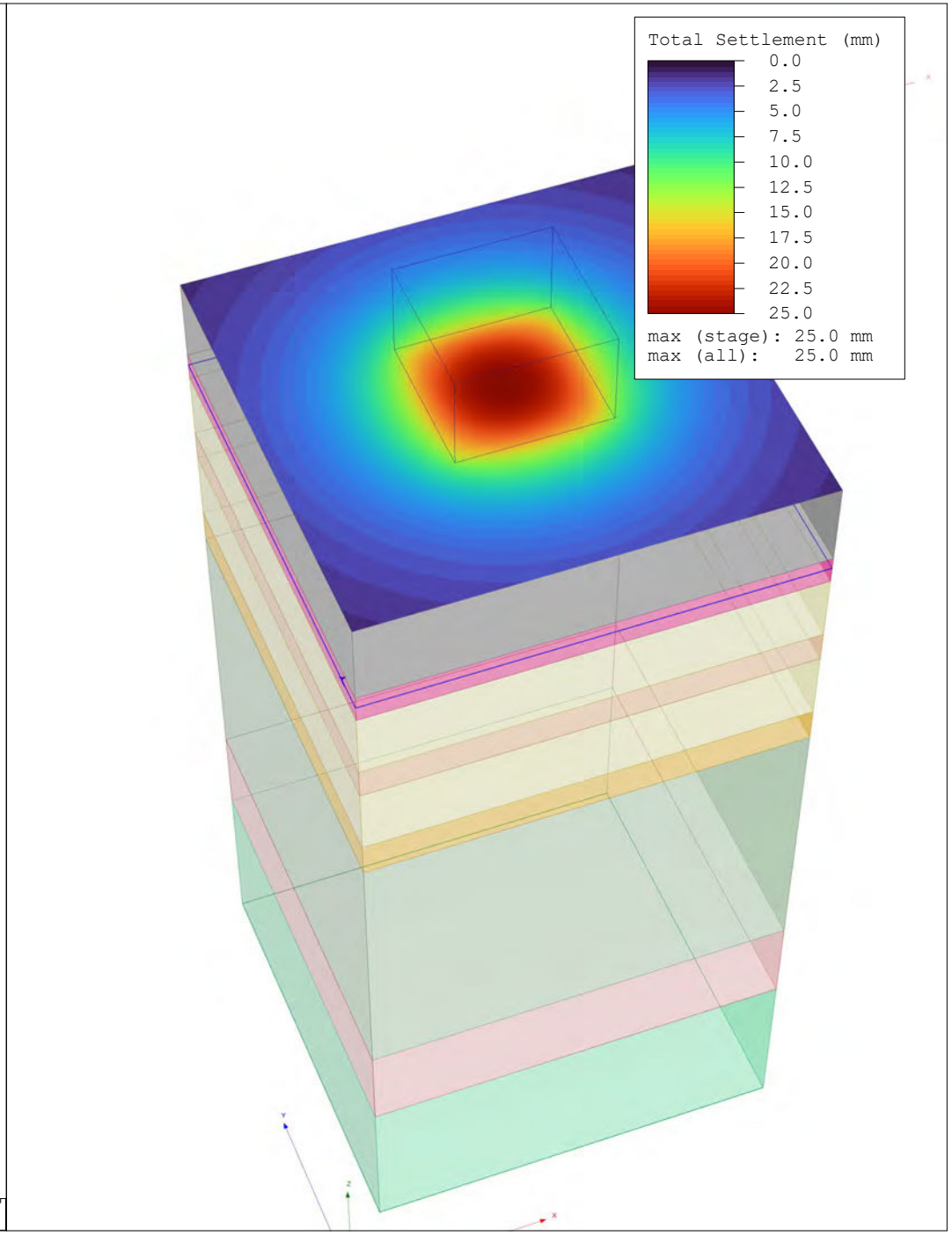

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
3X3
4
6
8
10
12
14
6
8
10
12
14

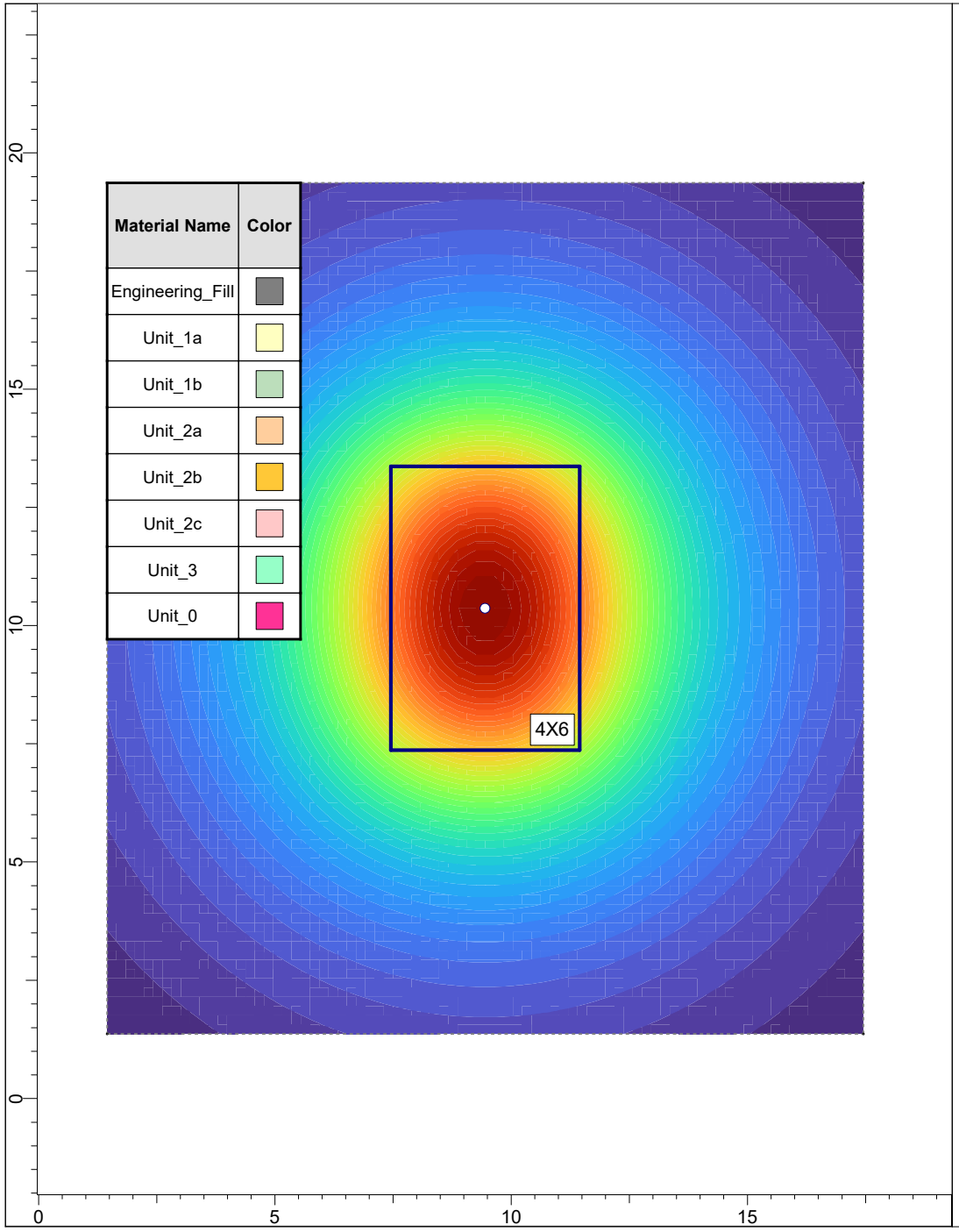

Total Consolidation
Settlement (mm)
0.00
0.51
1.02
1.53
2.04
2.55
3.06
3.57
4.08
4.59
5.10
max (stage): 5.0 mm
max (all): 5.0 mm

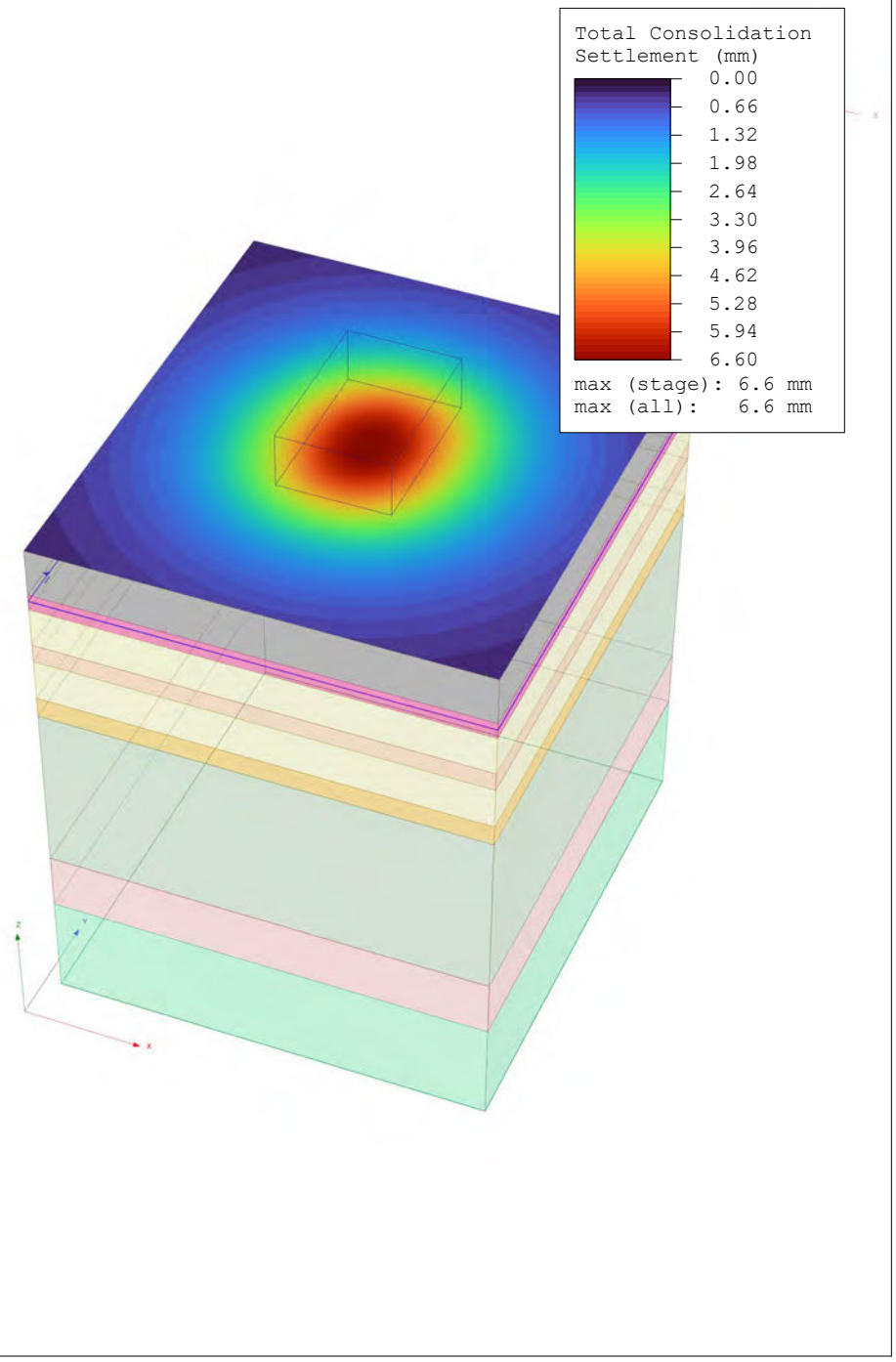

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
3X3
4
6
8
10
12
14
6
8
10
12
14

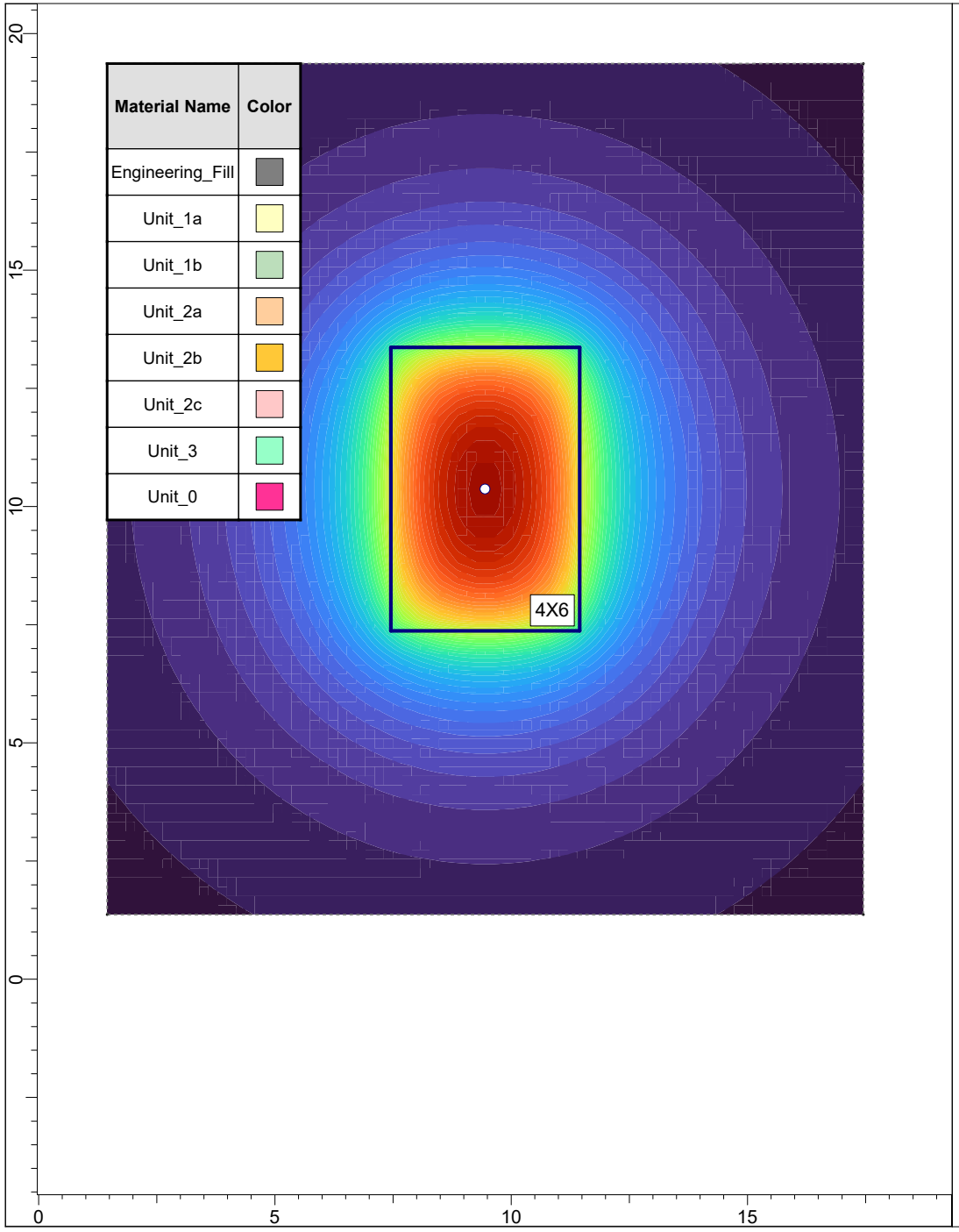

Immediate Settlement
(mm)
0
2
4
6
8
10
12
14
16
18
20
max (stage): 20.0 mm
max (all): 20.0 mm

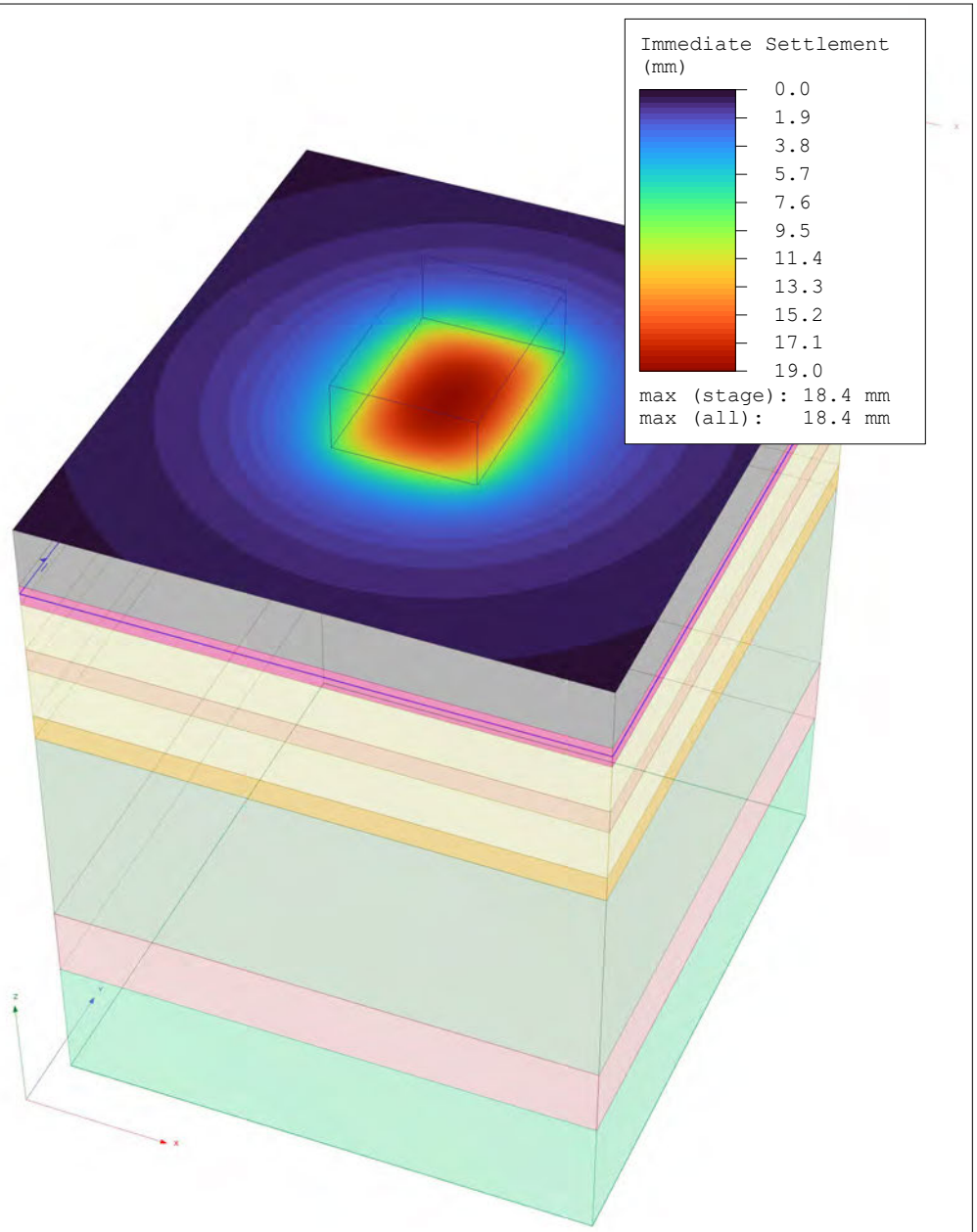

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
3X3
4
6
8
10
12
14
6
8
10
12
14

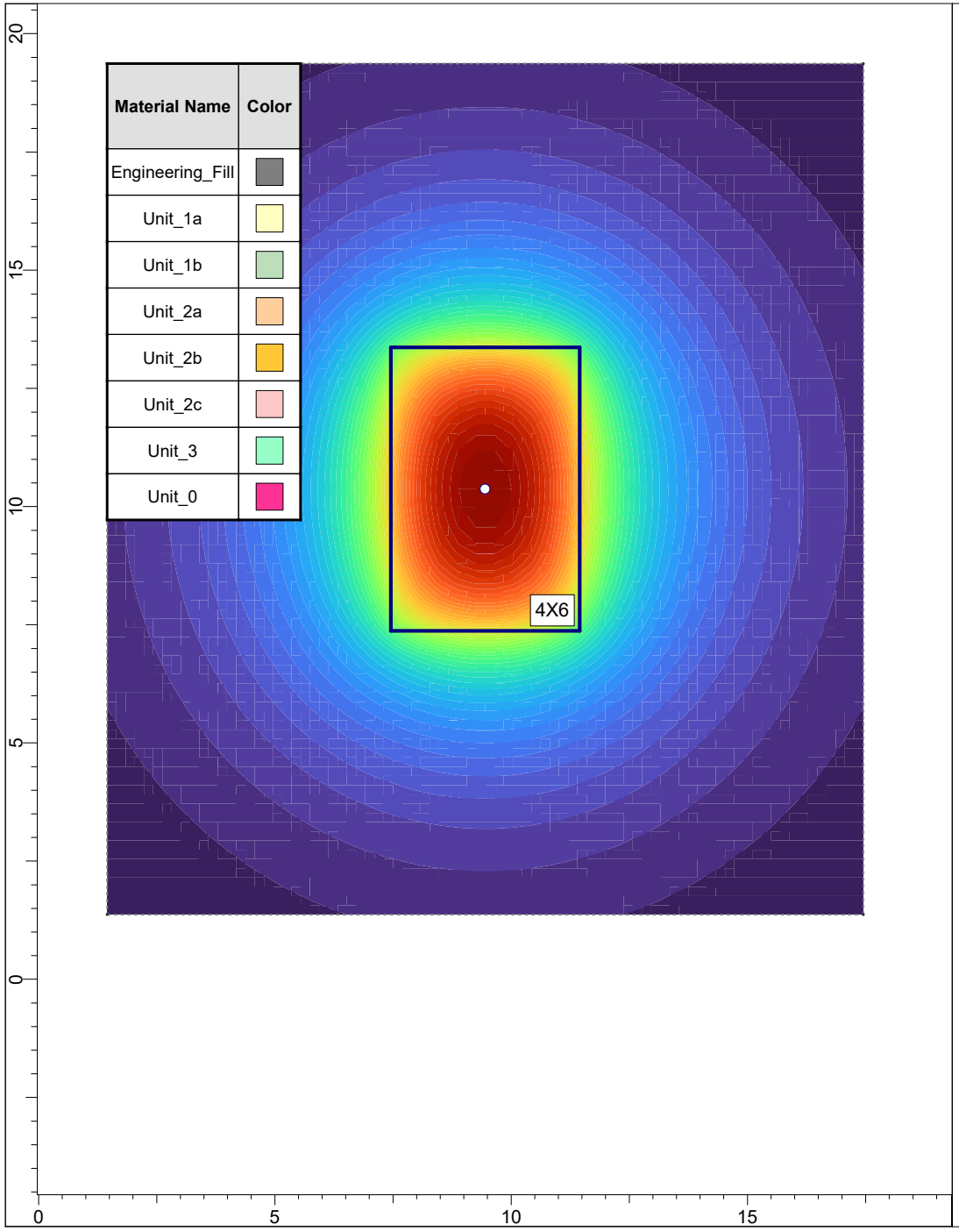

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

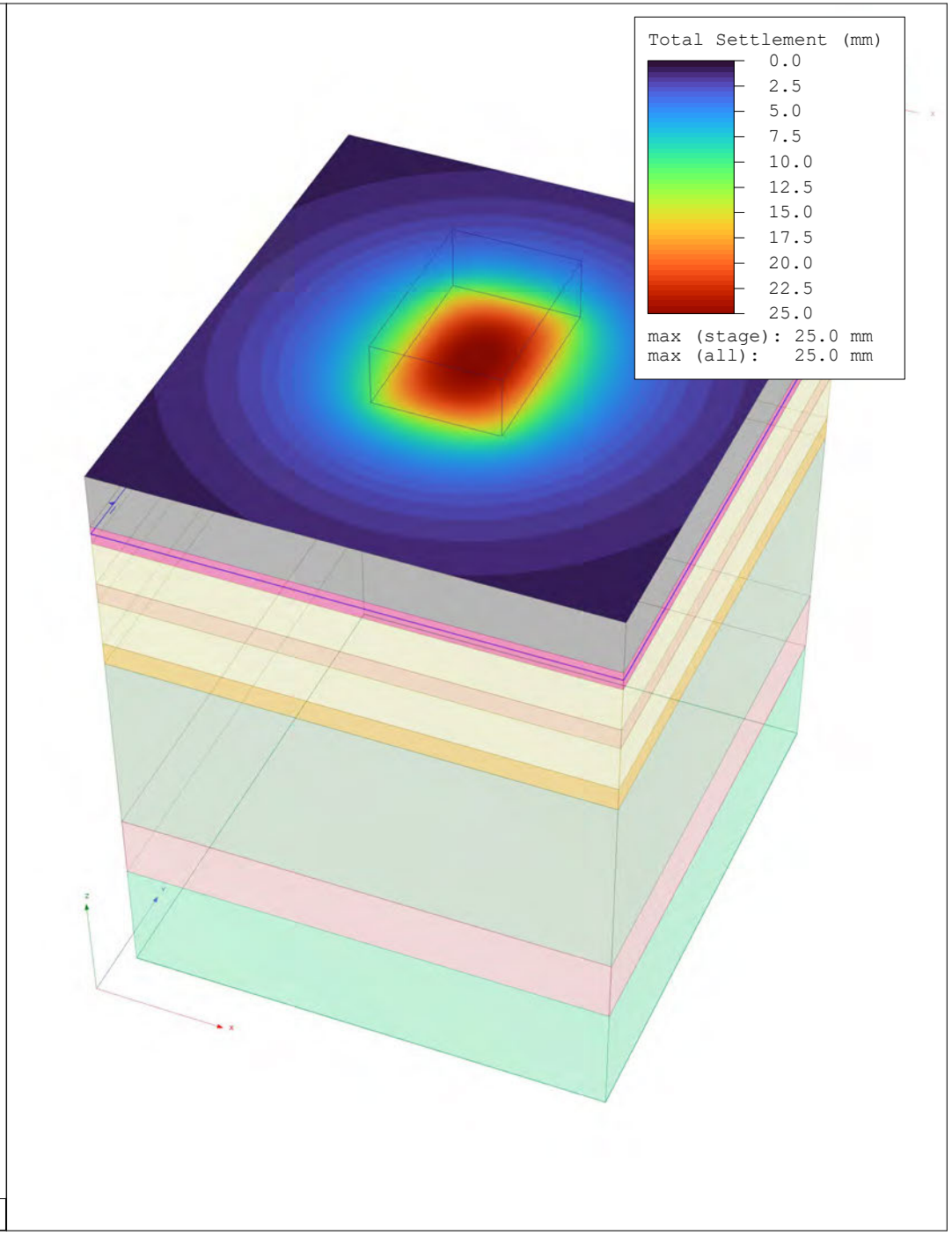

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
4X6
0
5
10
15
20

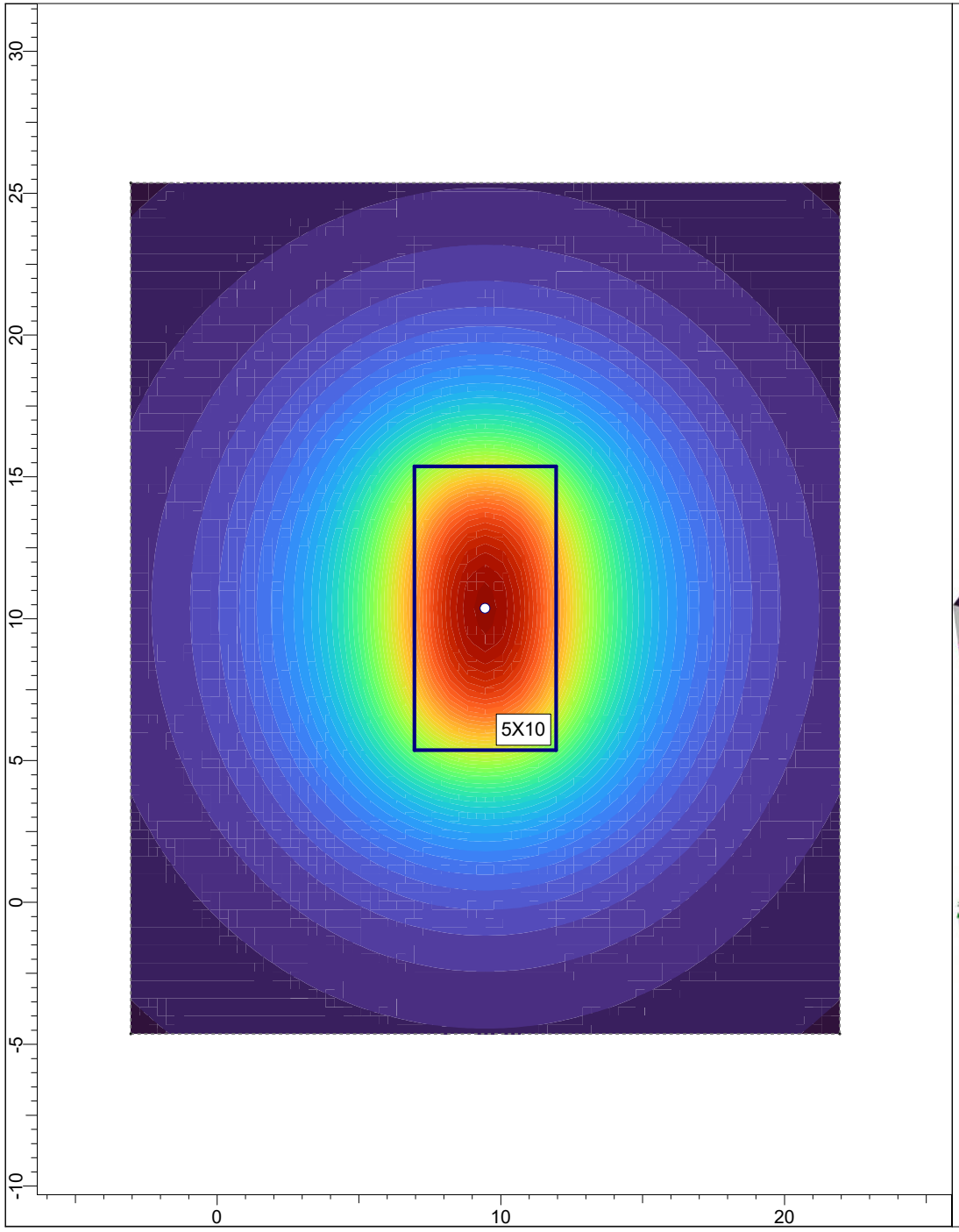

Total Consolidation
Settlement (mm)
0.00
0.66
1.32
1.98
2.64
3.30
3.96
4.62
5.28
5.94
6.60
max (stage): 6.6 mm
max (all): 6.6 mm

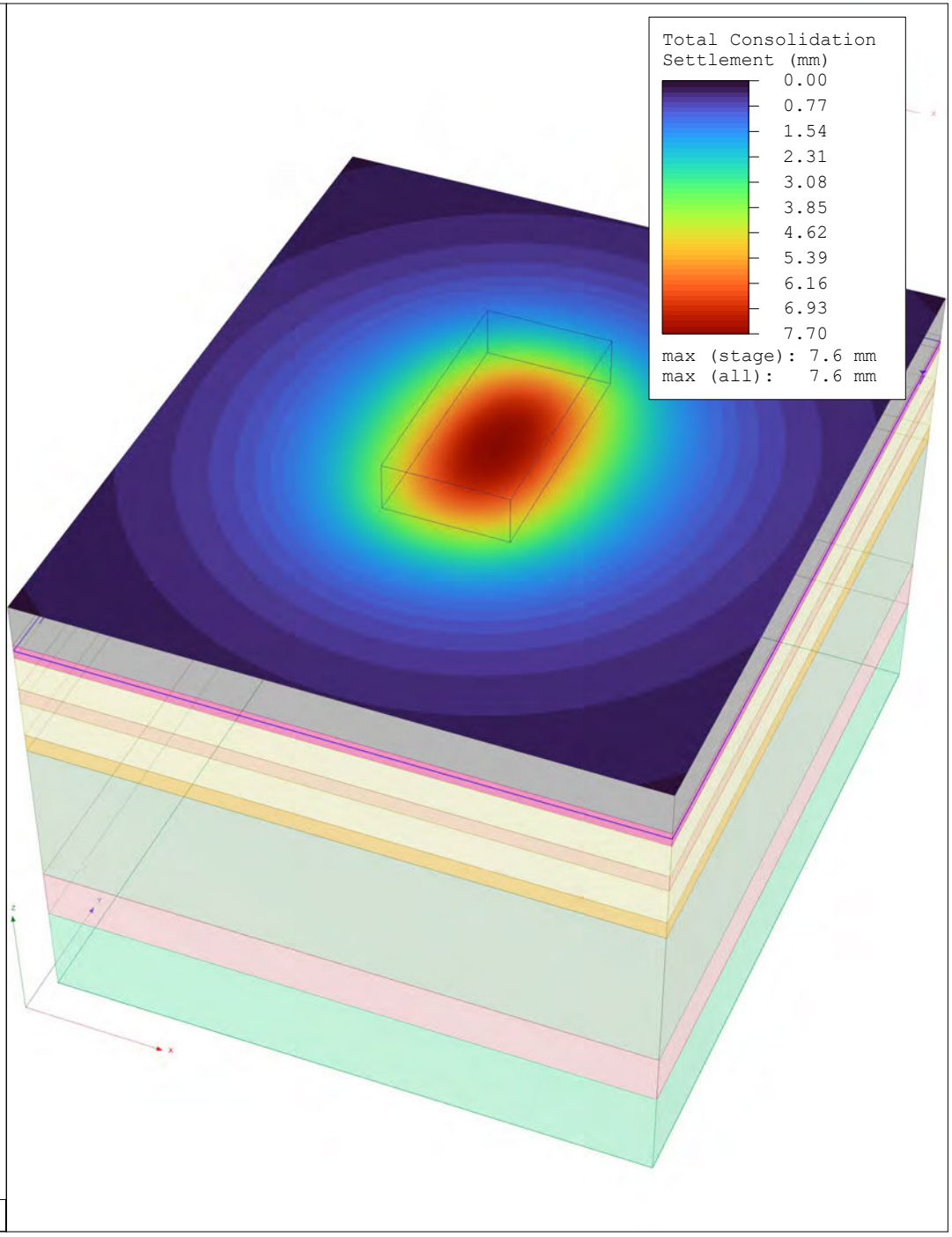

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
4X6
0
5
10
15
20
0
5
10
15

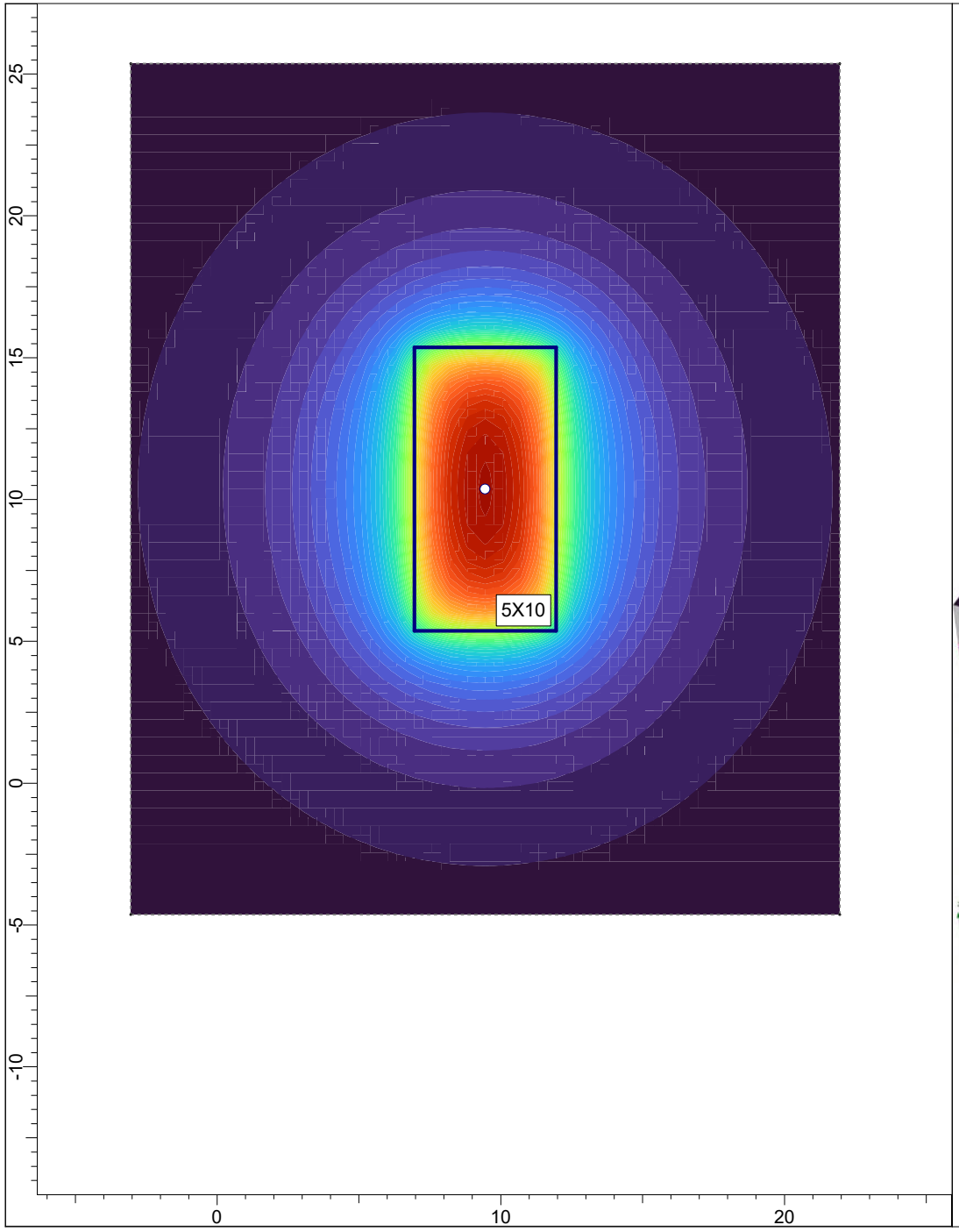

Immediate Settlement
(mm)
0.0
1.9
3.8
5.7
7.6
9.5
11.4
13.3
15.2
17.1
19.0
max (stage): 18.4 mm
max (all): 18.4 mm

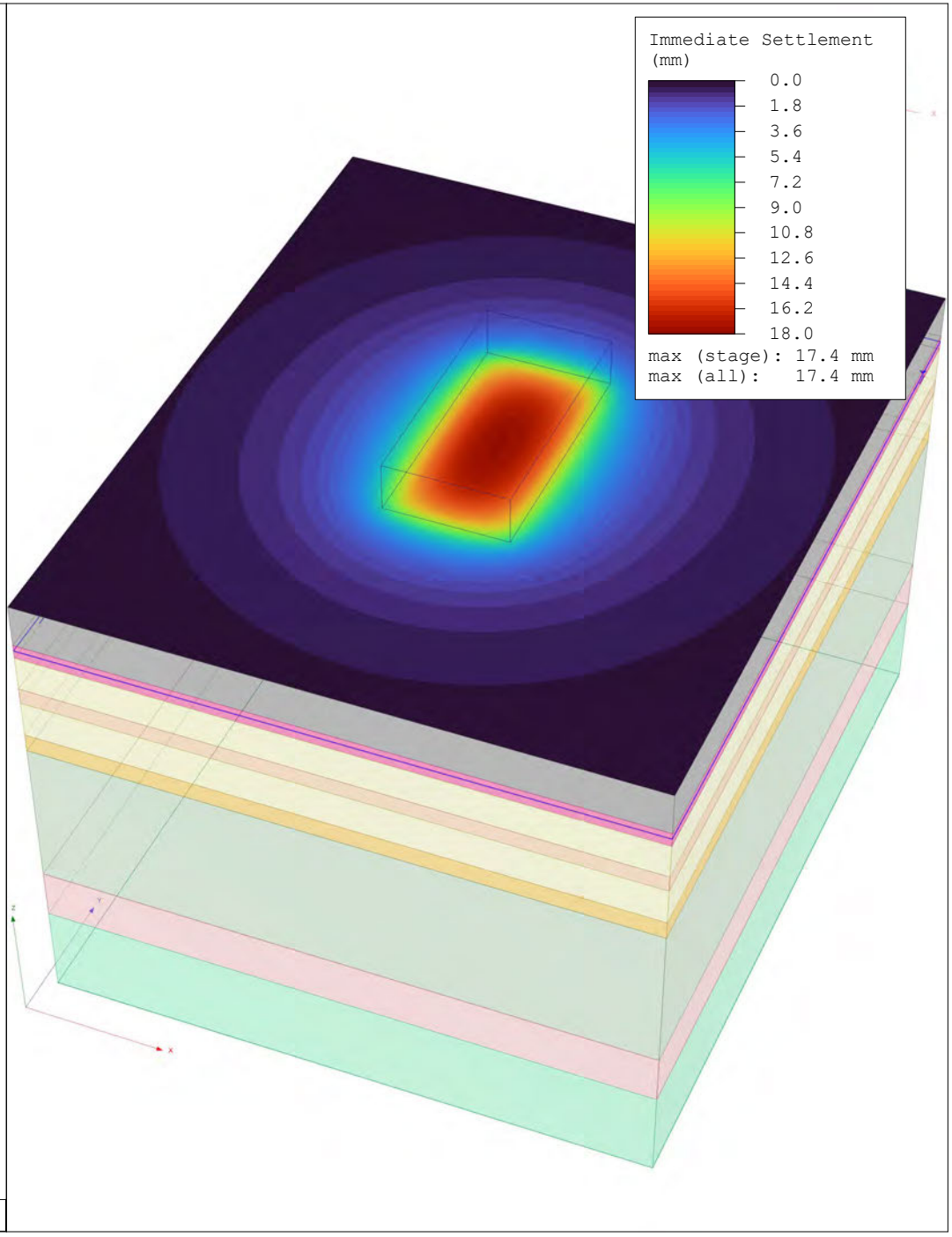

Material Name
Color
Engineering_Fill
Unit_1a
Unit_1b
Unit_2a
Unit_2b
Unit_2c
Unit_3
Unit_0
4X6
0
5
10
15
20
0
5
10
15

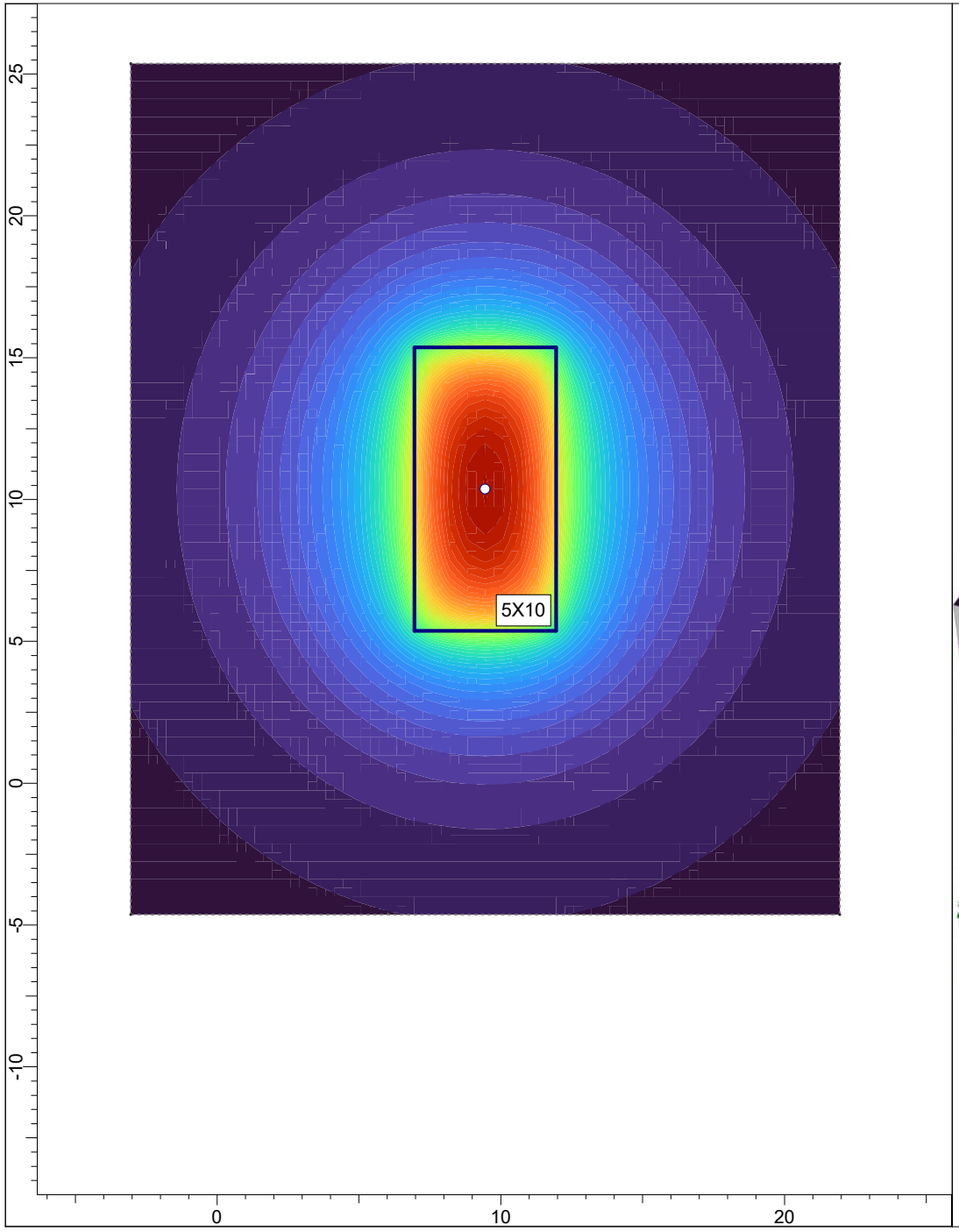

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

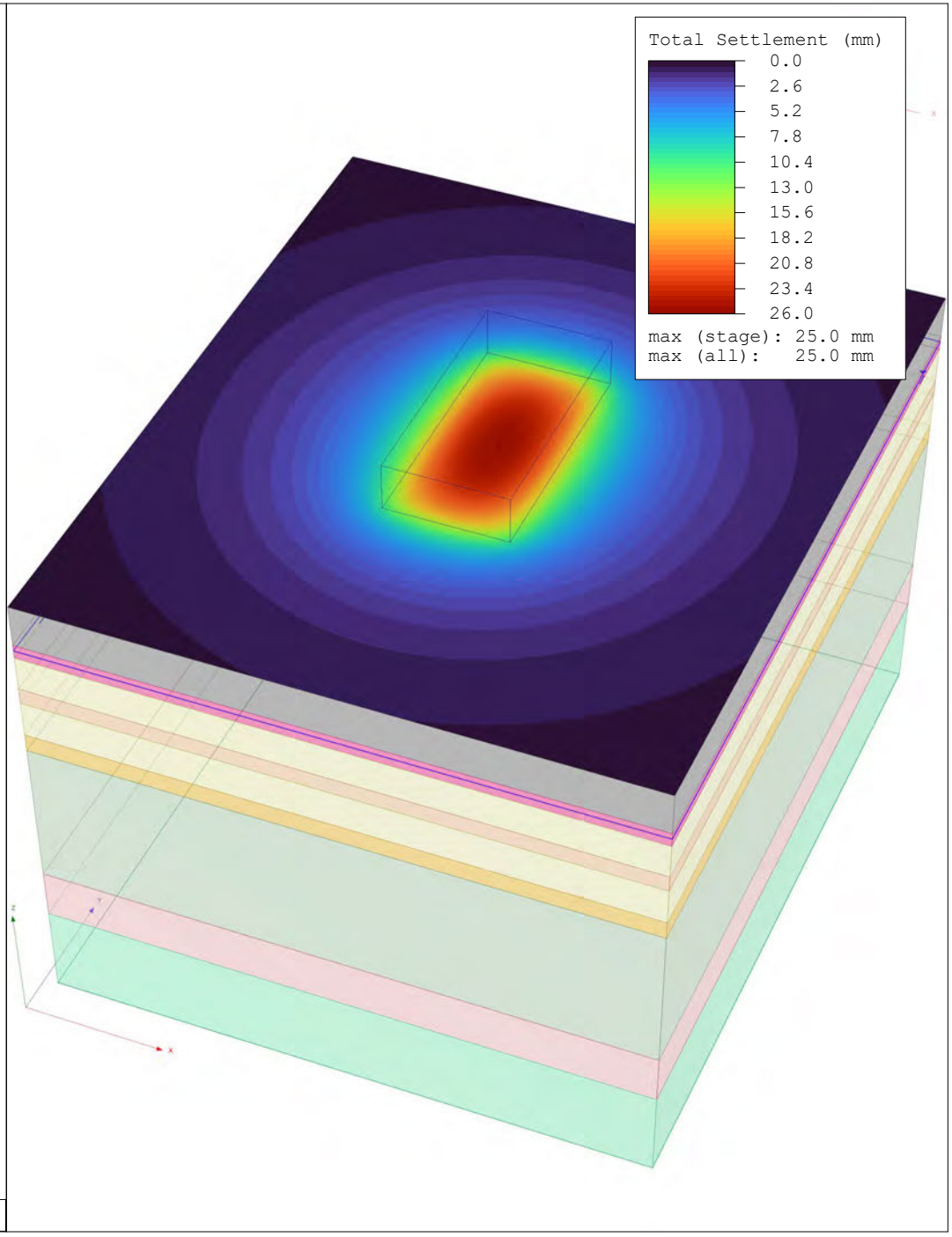

30
25
20
15
10
5
0
-5
-10
0
10
20
5X10

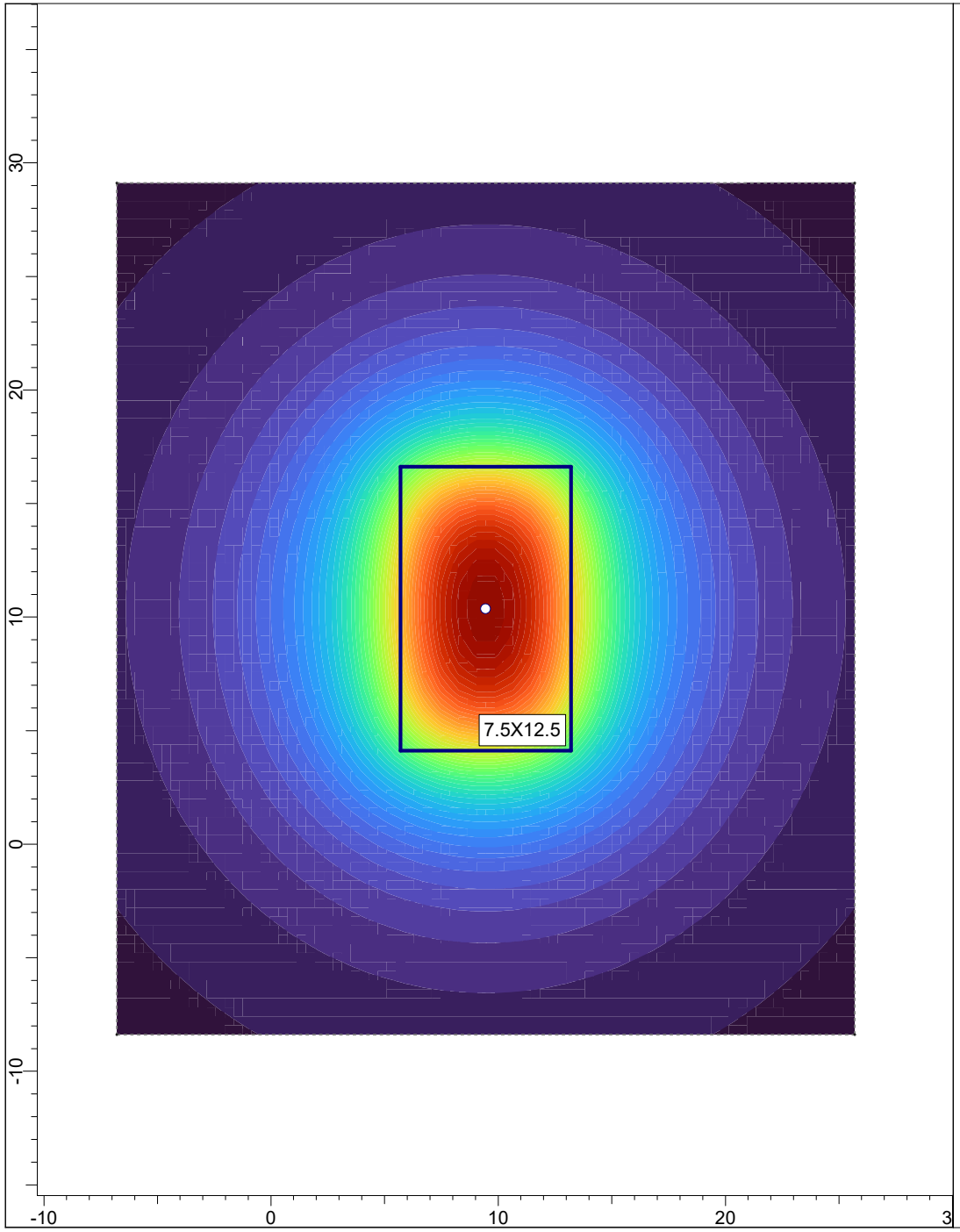

Total Consolidation
Settlement (mm)
0.00
0.77
1.54
2.31
3.08
3.85
4.62
5.39
6.16
6.93
7.70
max (stage): 7.6 mm
max (all): 7.6 mm

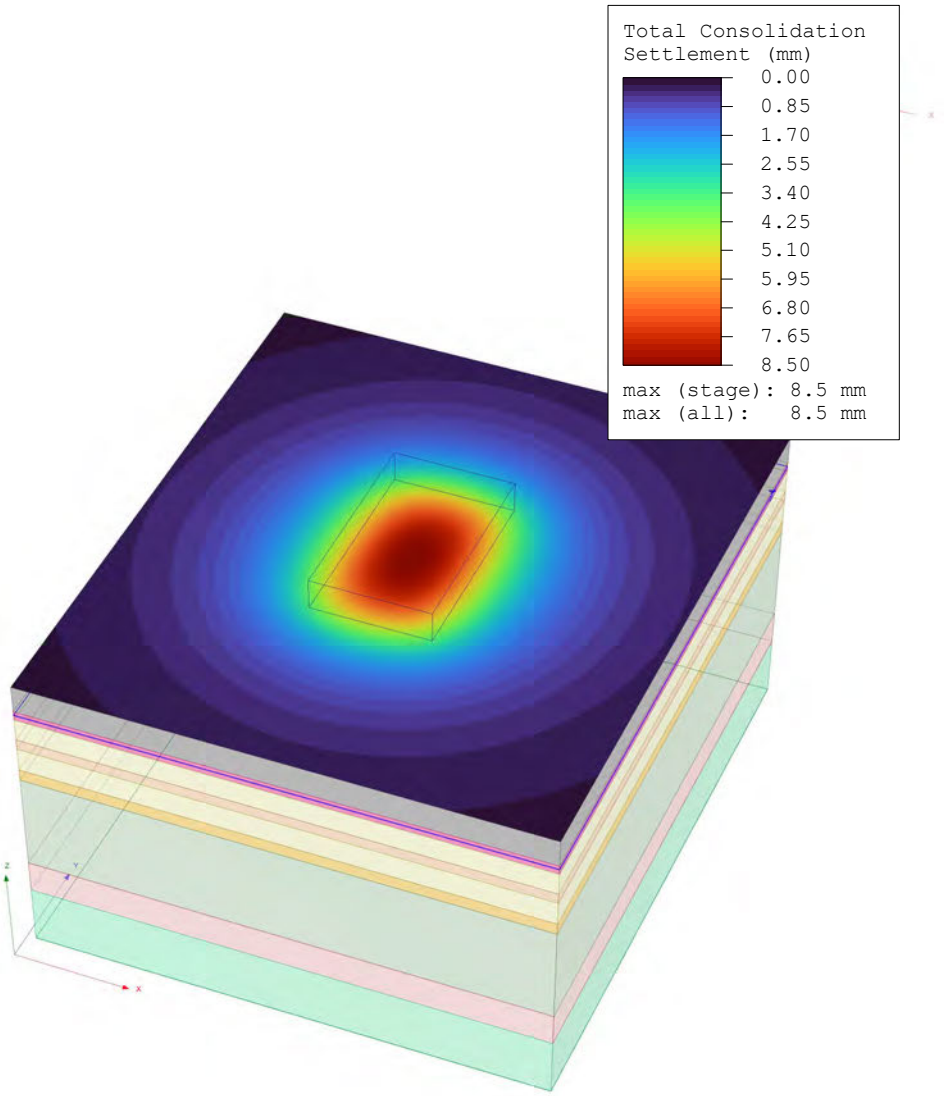

25
20
15
10
5
0
-5
-10
0
10
20
5X10

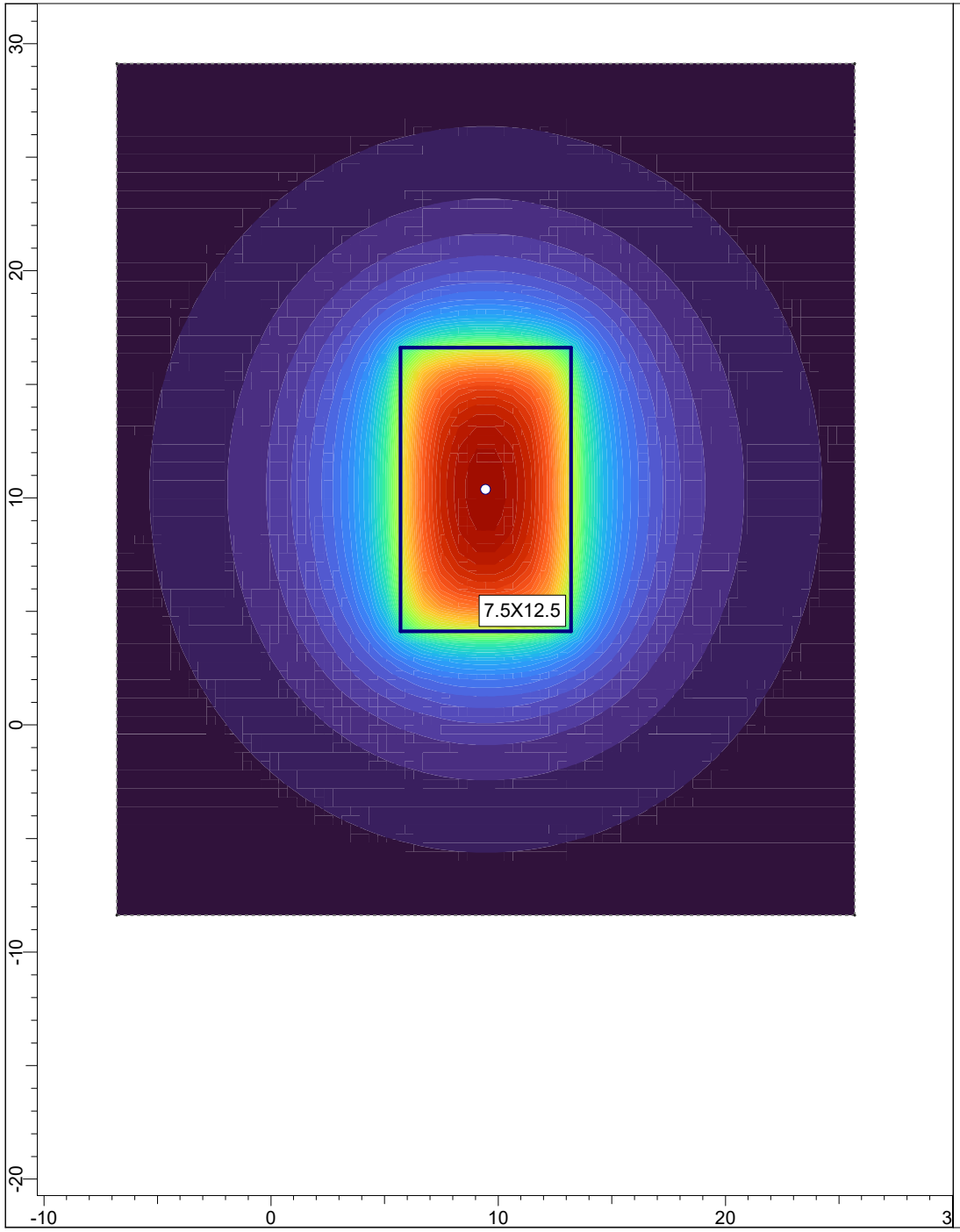

Immediate Settlement
(mm)
0.0
1.8
3.6
5.4
7.2
9.0
10.8
12.6
14.4
16.2
18.0
max (stage): 17.4 mm
max (all): 17.4 mm

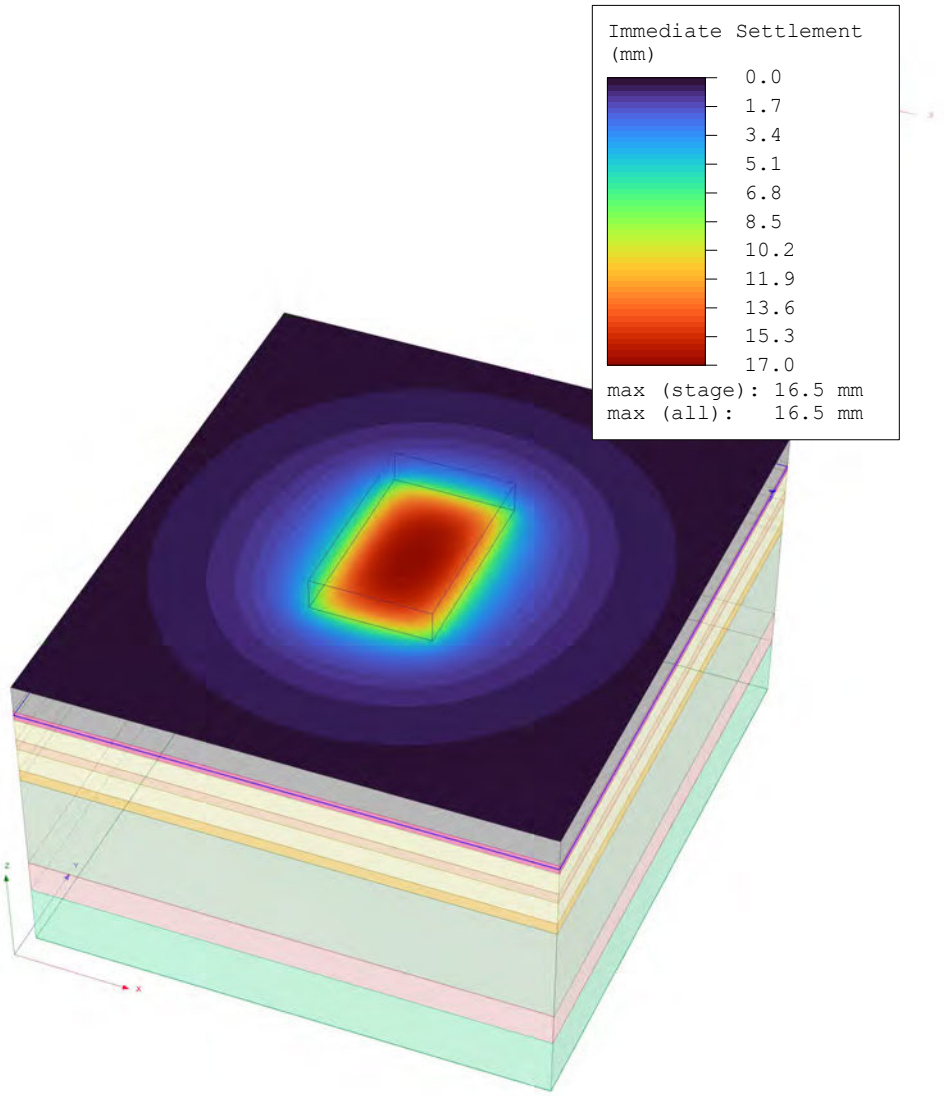

25
20
15
10
5
0
-5
-10
0
10
20
5X10

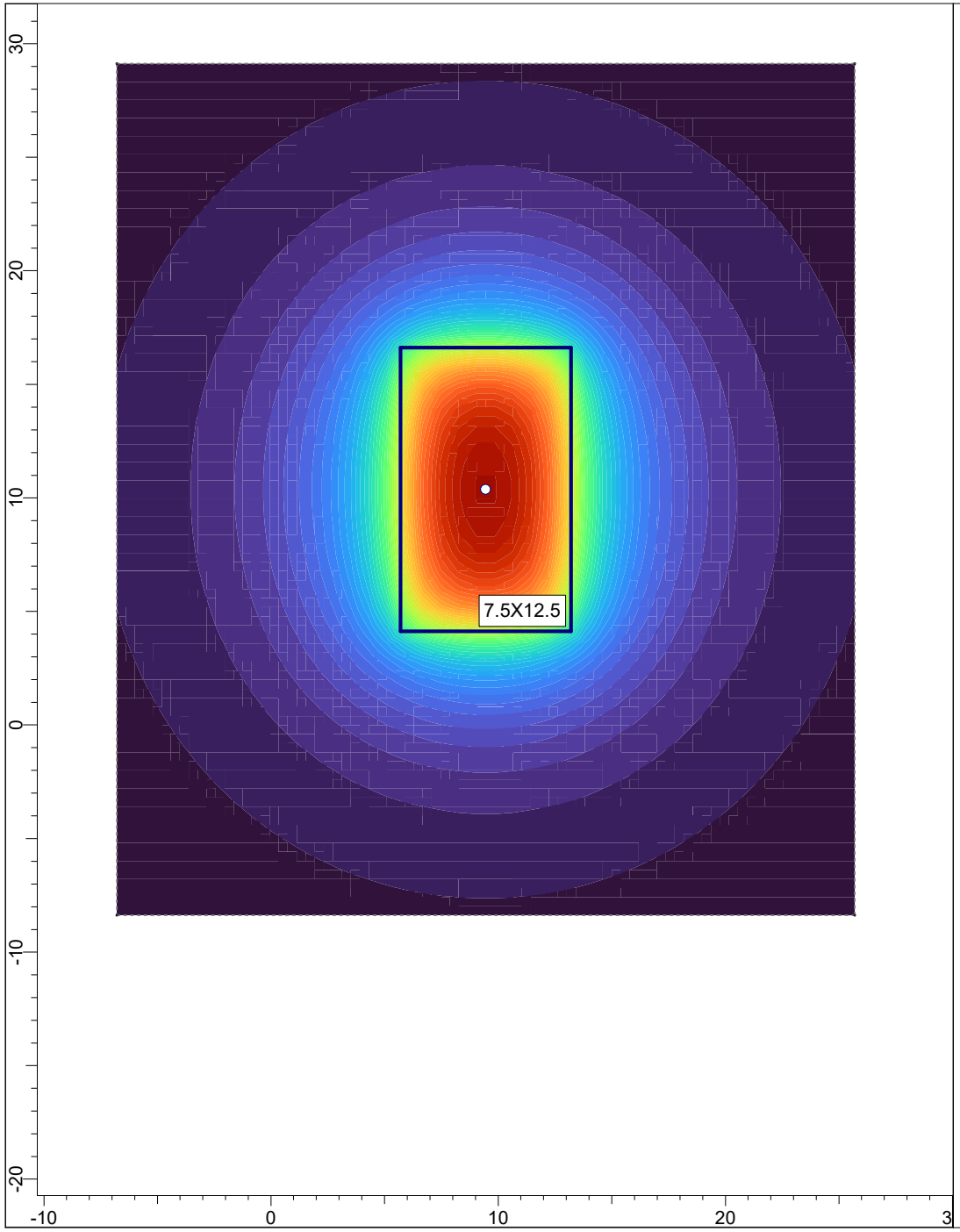

Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.0 mm
max (all): 25.0 mm

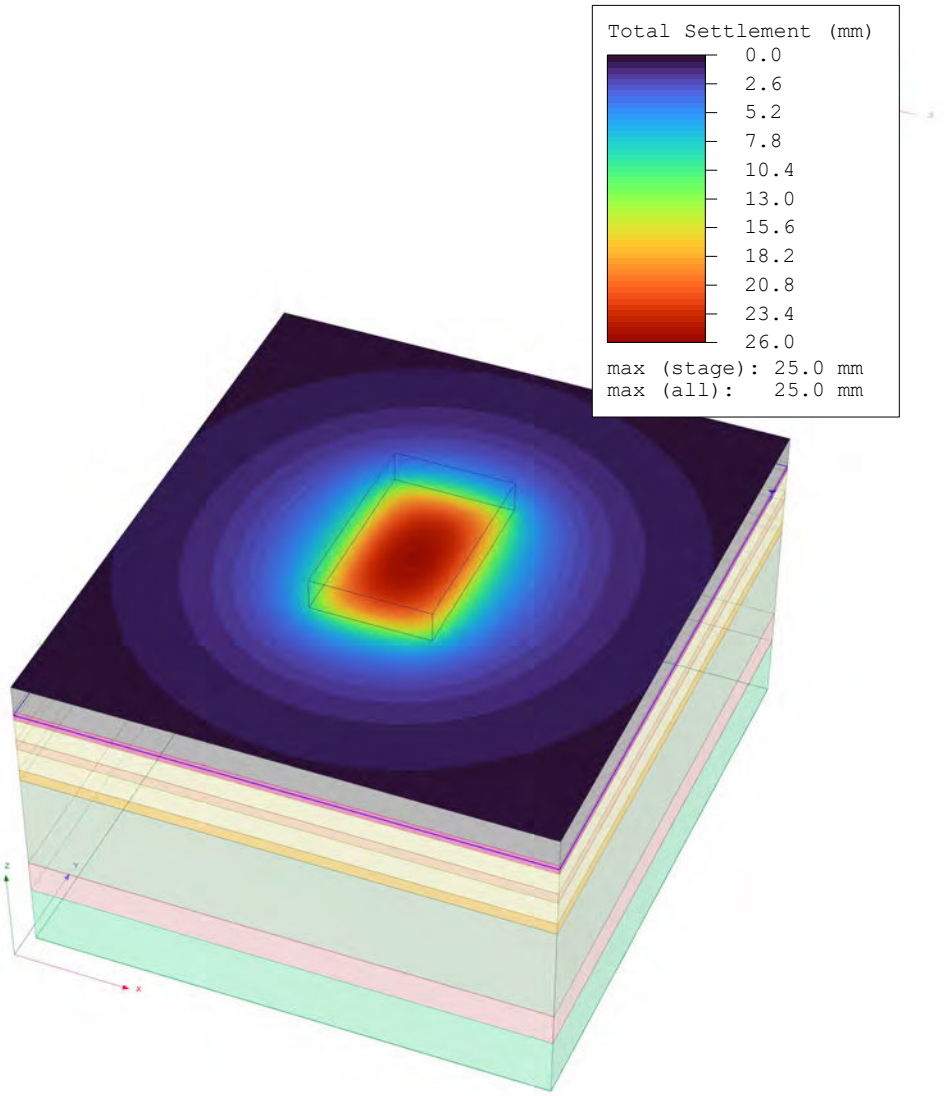

30
20
10
0
-10
-10
0
10
20
3
7.5X12.5

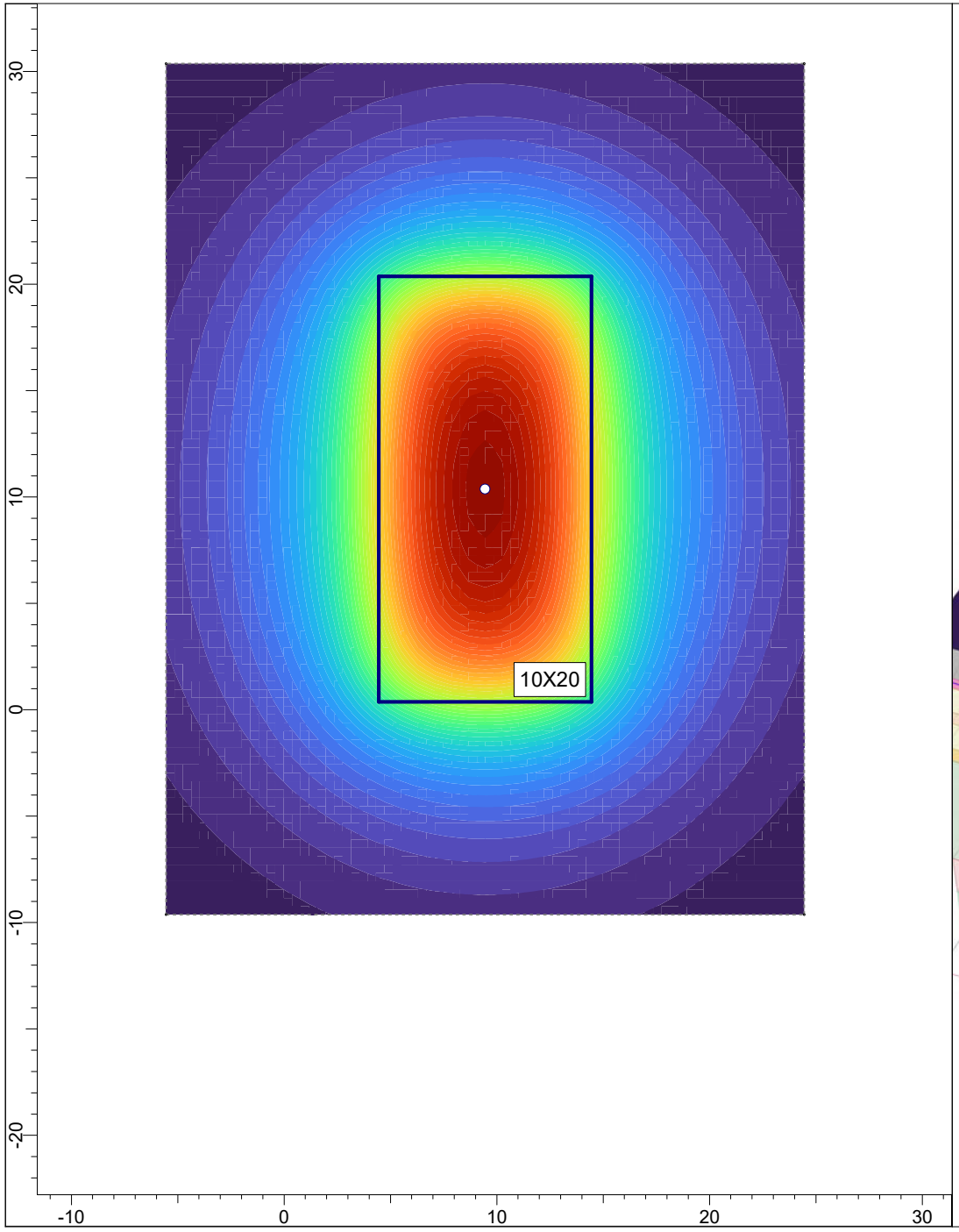

Total Consolidation
Settlement (mm)
0.00
0.85
1.70
2.55
3.40
4.25
5.10
5.95
6.80
7.65
8.50
max (stage): 8.5 mm
max (all): 8.5 mm

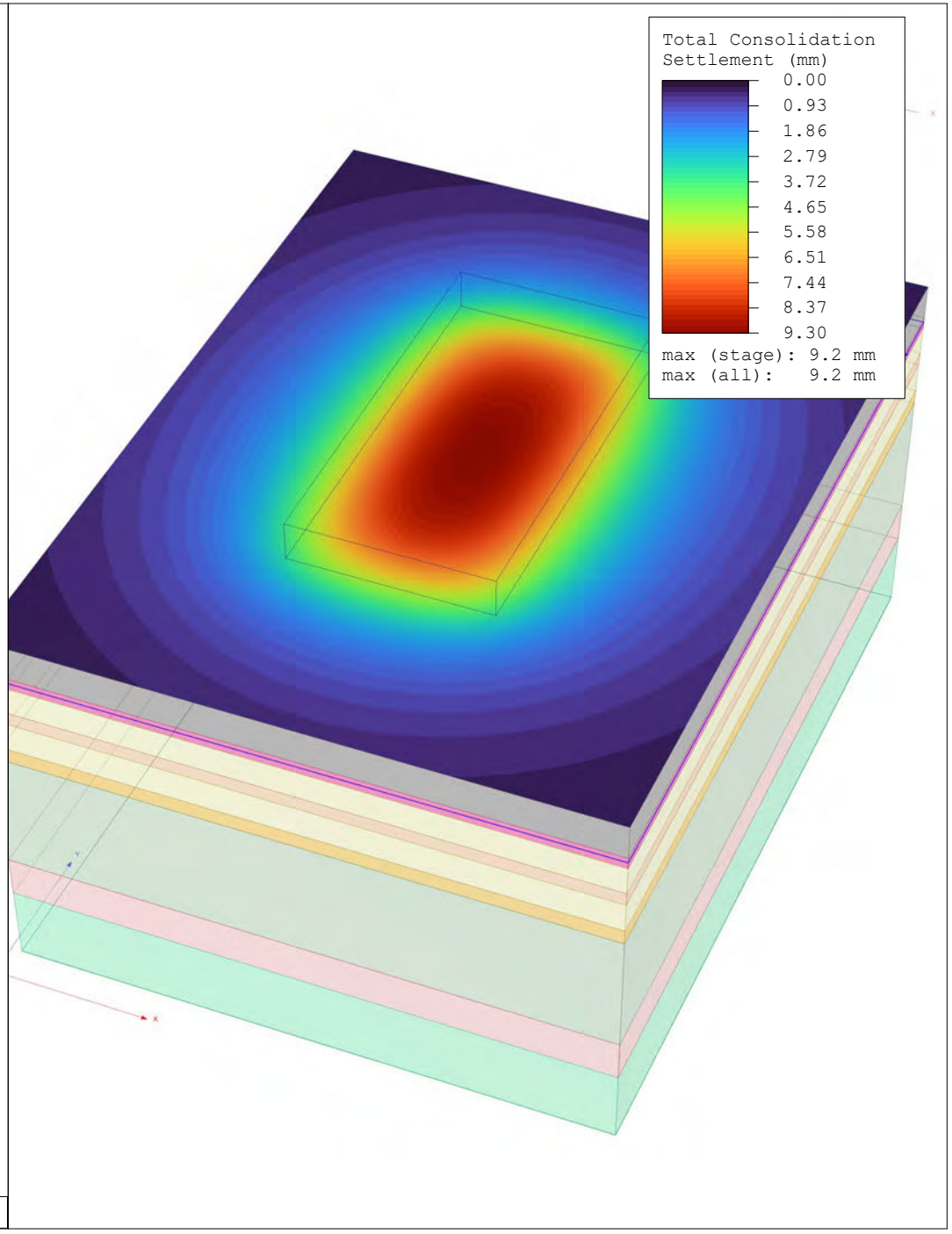

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

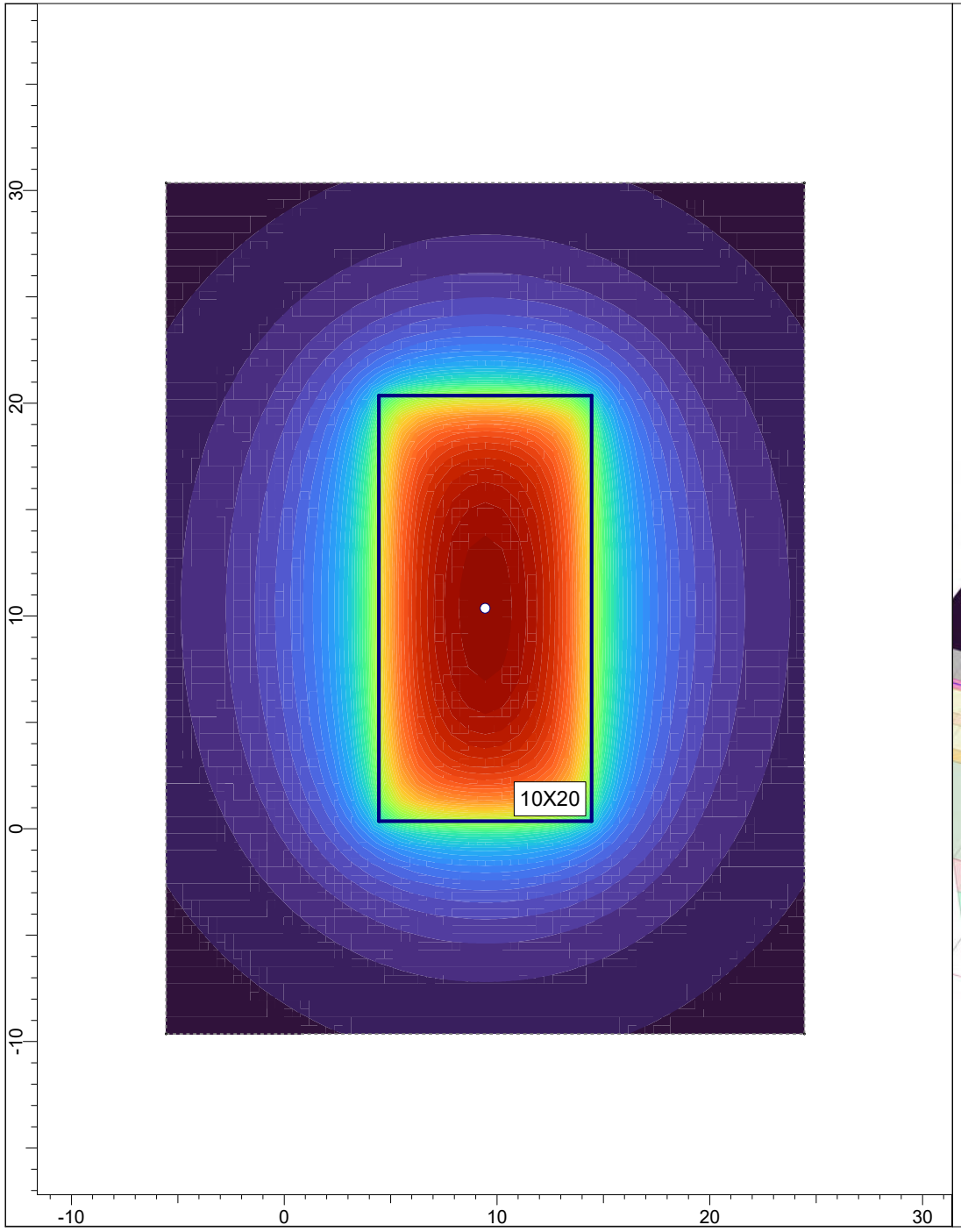

Immediate Settlement
(mm)
0.0
1.7
3.4
5.1
6.8
8.5
10.2
11.9
13.6
15.3
17.0
max (stage): 16.5 mm
max (all): 16.5 mm

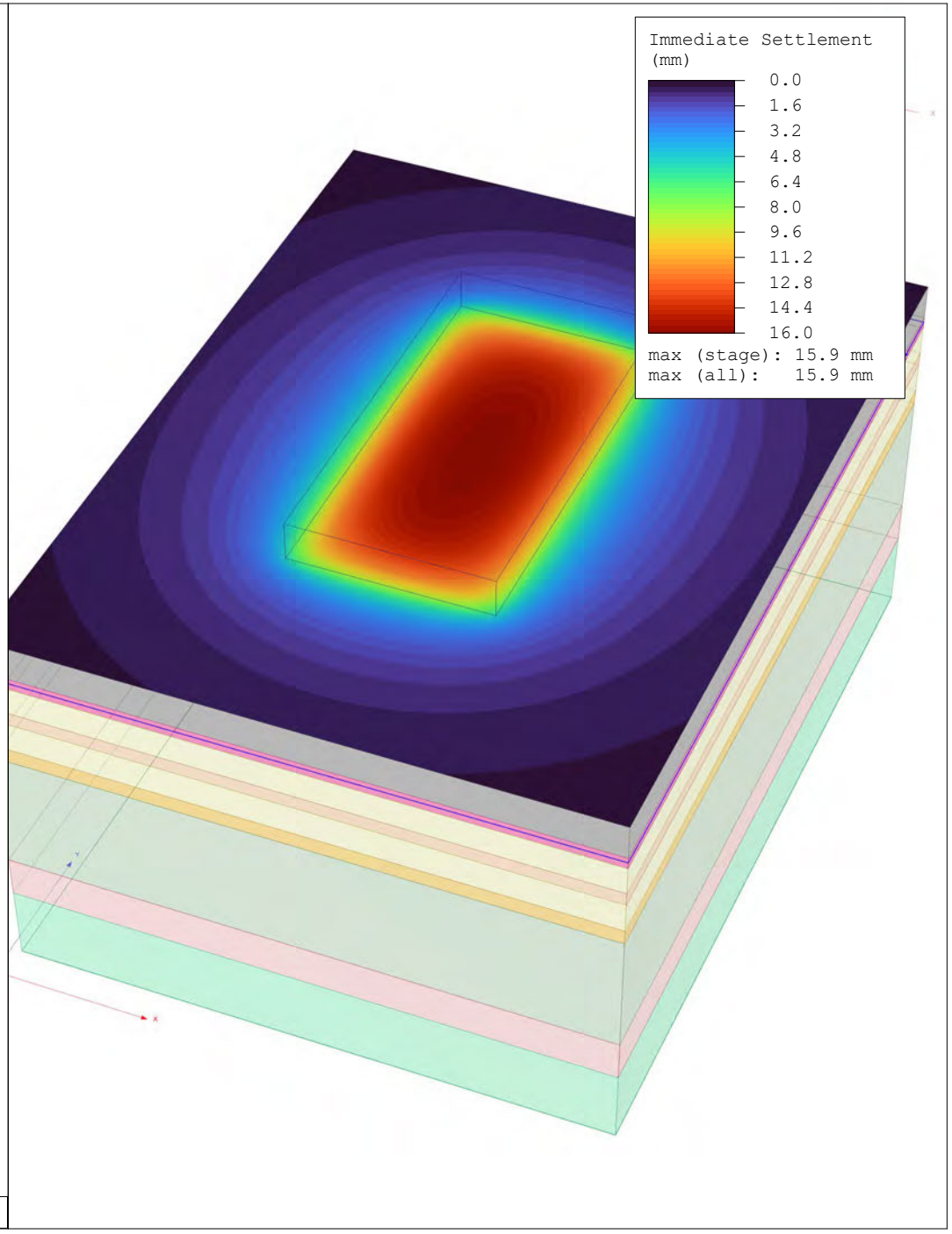

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

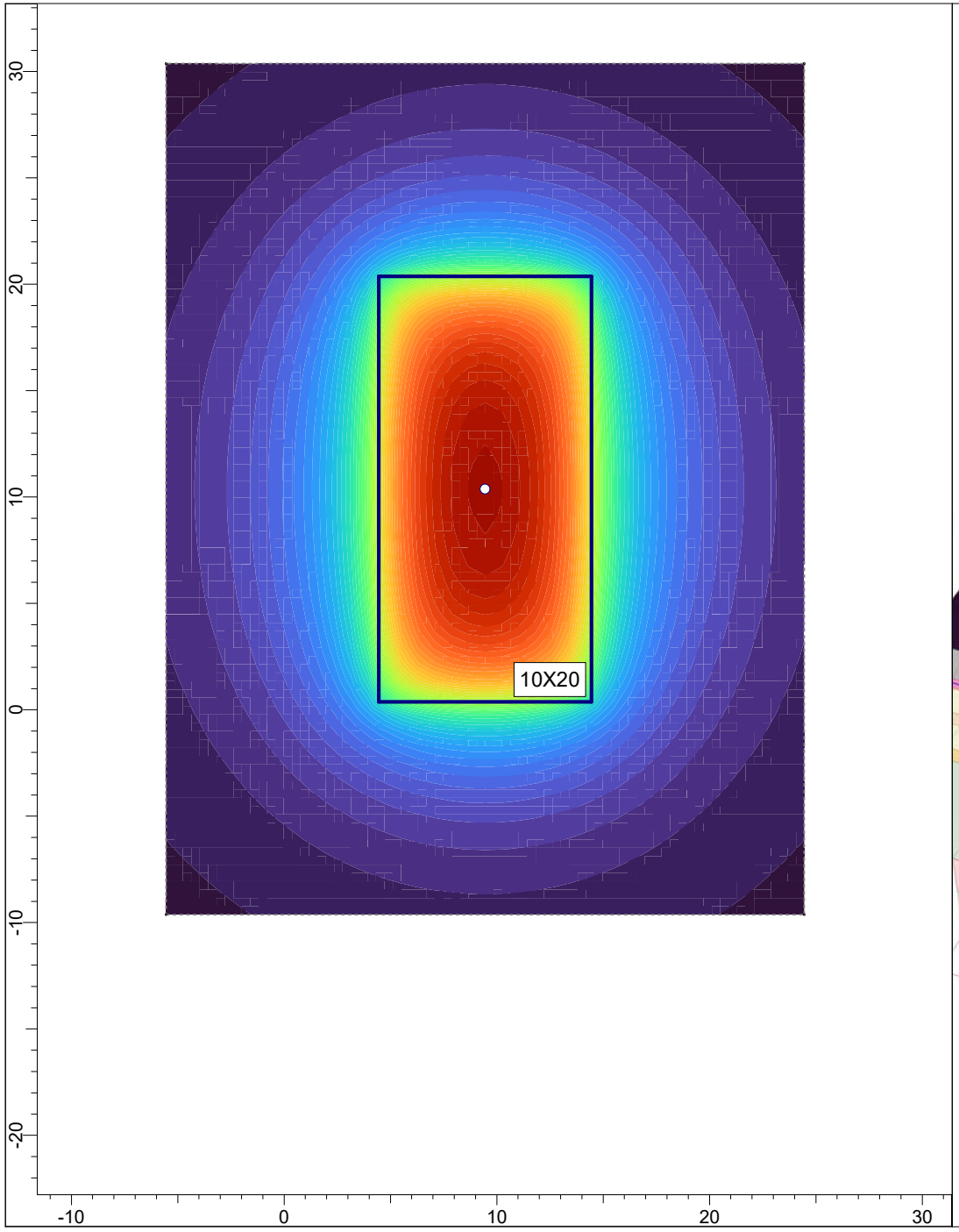

Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.0 mm
max (all): 25.0 mm

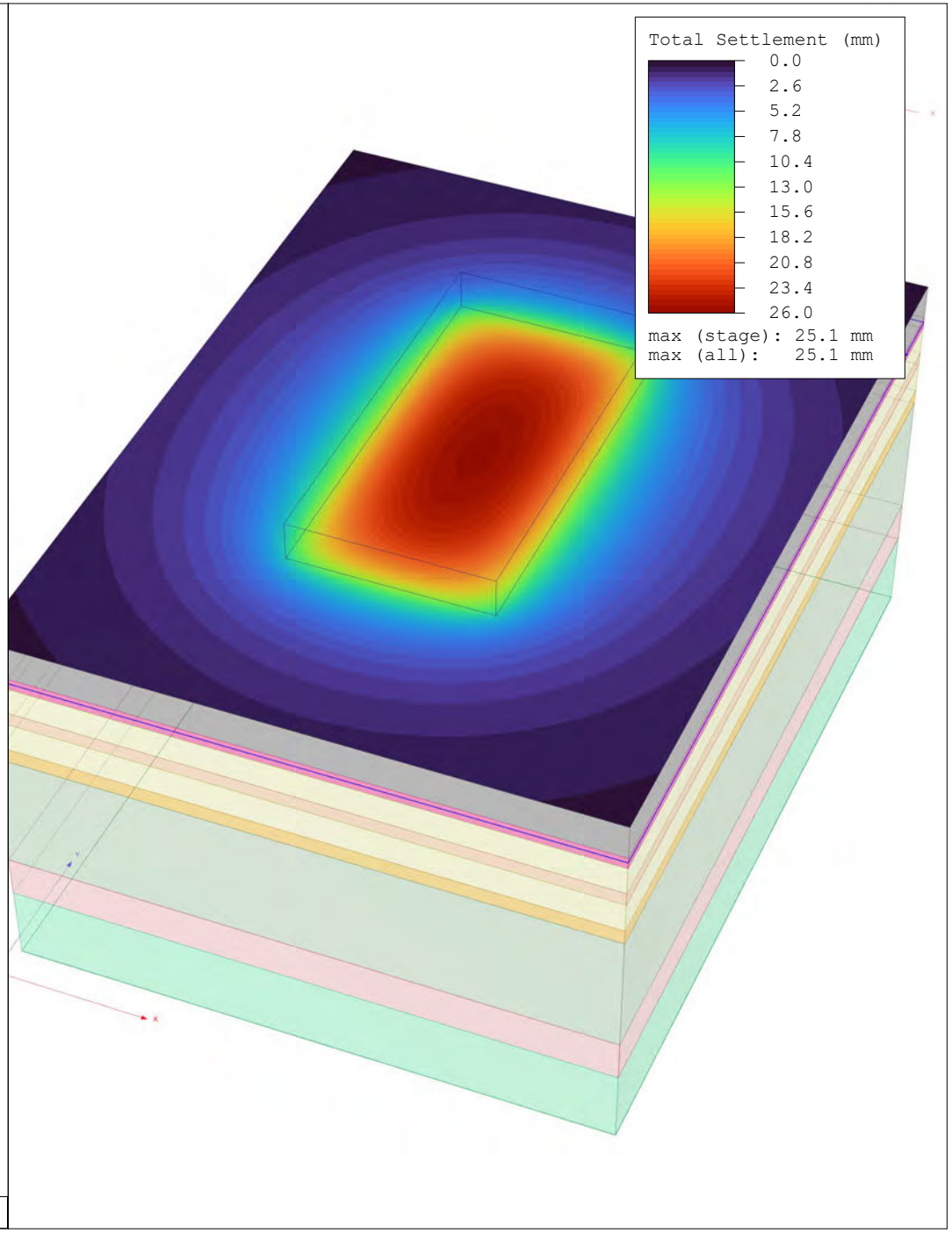

30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Total Consolidation
Settlement (mm)
0.00
0.93
1.86
2.79
3.72
4.65
5.58
6.51
7.44
8.37
9.30
max (stage): 9.2 mm
max (all): 9.2 mm


30
20
10
0
-10
-10
0
10
20
30
10X20


Immediate Settlement
(mm)
0.0
1.6
3.2
4.8
6.4
8.0
9.6
11.2
12.8
14.4
16.0
max (stage): 15.9 mm
max (all): 15.9 mm


30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.1 mm
max (all): 25.1 mm

E.2.3 Area-B Bearing Capacity Calculations

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

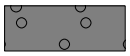
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 1.50$ m
Spread footing width $y = 1.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 1.50$ m
Column width in the direction of y $c_y = 1.50$ m

Spread footing volume = 0.45 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	112.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	262.89	19.02	Yes
50 kPa	No	0.00	0.00	50.00	262.89	19.02	Yes

Analysis of bearing capacity - partial results

φ_d = 33.702 °
c_d = 0.000 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 19.186 kN/m^3
b_{ef} = 1.500 m
N_q = 28.393
N_c = 41.071
N_γ = 36.540
s_q = 1.555
s_c = 1.575
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 368.051 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 2.72 m
Length of slip surface l_{sp} = 8.76 m

Design bearing capacity of found.soil R_d = 262.89 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 71.61 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

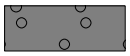
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 3.00$ m
Spread footing width $y = 3.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 3.00$ m
Column width in the direction of y $c_y = 3.00$ m

Spread footing volume = 1.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	450.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	370.92	13.48	Yes
50 kPa	No	0.00	0.00	50.00	370.92	13.48	Yes

Analysis of bearing capacity - partial results

φ_d = 32.826 °
c_d = 0.184 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 15.282 kN/m^3
b_{ef} = 3.000 m
N_q = 25.554
N_c = 38.064
N_γ = 31.680
s_q = 1.542
s_c = 1.564
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 519.293 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 5.26 m
Length of slip surface l_{sp} = 16.68 m

Design bearing capacity of found.soil R_d = 370.92 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 286.45 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

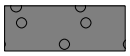
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 4.00$ m
Spread footing width $y = 6.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 4.00$ m
Column width in the direction of y $c_y = 6.00$ m

Spread footing volume = 4.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	1200.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	525.28	9.52	Yes
50 kPa	No	0.00	0.00	50.00	525.28	9.52	Yes

Analysis of bearing capacity - partial results

φ_d = 33.136 °
c_d = 0.151 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 13.642 kN/m^3
b_{ef} = 4.000 m
N_q = 26.521
N_c = 39.095
N_γ = 33.319
s_q = 1.364
s_c = 1.379
s_γ = 0.800
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 735.389 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 7.09 m
Length of slip surface l_{sp} = 22.58 m

Design bearing capacity of found.soil R_d = 525.28 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 763.86 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

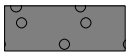
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 5.00$ m
Spread footing width $y = 10.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 5.00$ m
Column width in the direction of y $c_y = 10.00$ m

Spread footing volume = 10.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	2500.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	678.36	7.37	Yes
50 kPa	No	0.00	0.00	50.00	678.36	7.37	Yes

Analysis of bearing capacity - partial results

φ_d = 33.445 °
c_d = 0.193 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 12.622 kN/m^3
b_{ef} = 5.000 m
N_q = 27.523
N_c = 40.156
N_γ = 35.037
s_q = 1.276
s_c = 1.286
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 949.700 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 8.98 m
Length of slip surface l_{sp} = 28.76 m

Design bearing capacity of found.soil R_d = 678.36 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 1591.38 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

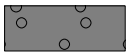
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 7.50$ m
Spread footing width $y = 12.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 7.50$ m
Column width in the direction of y $c_y = 12.50$ m

Spread footing volume = 18.75 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	4687.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	1063.53	4.70	Yes
50 kPa	No	0.00	0.00	50.00	1063.53	4.70	Yes

Analysis of bearing capacity - partial results

φ_d = 34.616 °
c_d = 0.095 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 11.363 kN/m^3
b_{ef} = 7.500 m
N_q = 31.748
N_c = 44.546
N_γ = 42.448
s_q = 1.341
s_c = 1.352
s_γ = 0.820
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1488.940 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 14.07 m
Length of slip surface l_{sp} = 46.03 m

Design bearing capacity of found.soil R_d = 1063.53 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 2983.84 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

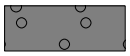
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 10.00$ m
Spread footing width $y = 20.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 10.00$ m
Column width in the direction of y $c_y = 20.00$ m

Spread footing volume = 40.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.00	0.00 .. 2.00	Engineering_Fill	
2	0.50	2.00 .. 2.50	Unit_0	
3	2.40	2.50 .. 4.90	Unit_1a	
4	0.70	4.90 .. 5.60	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.70	5.60 .. 7.30	Unit_1a	
6	0.80	7.30 .. 8.10	Unit_2b	
7	7.60	8.10 .. 15.70	Unit_1b	
8	3.70	15.70 .. 19.40	Unit_2c	
9	5.00	19.40 .. 24.40	Unit_3	
10	-	24.40 .. ∞	Unit_3	

Load

No.	Load new	Load change	Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
1	Yes		50 kPa	Design	10000.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	1208.17	4.14	Yes
50 kPa	No	0.00	0.00	50.00	1208.17	4.14	Yes

Analysis of bearing capacity - partial results

φ_d = 33.654 °
c_d = 0.285 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 10.881 kN/m^3
b_{ef} = 10.000 m
N_q = 28.227
N_c = 40.896
N_γ = 36.252
s_q = 1.277
s_c = 1.287
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1691.444 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 18.09 m
Length of slip surface l_{sp} = 58.17 m

Design bearing capacity of found.soil R_d = 1208.17 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

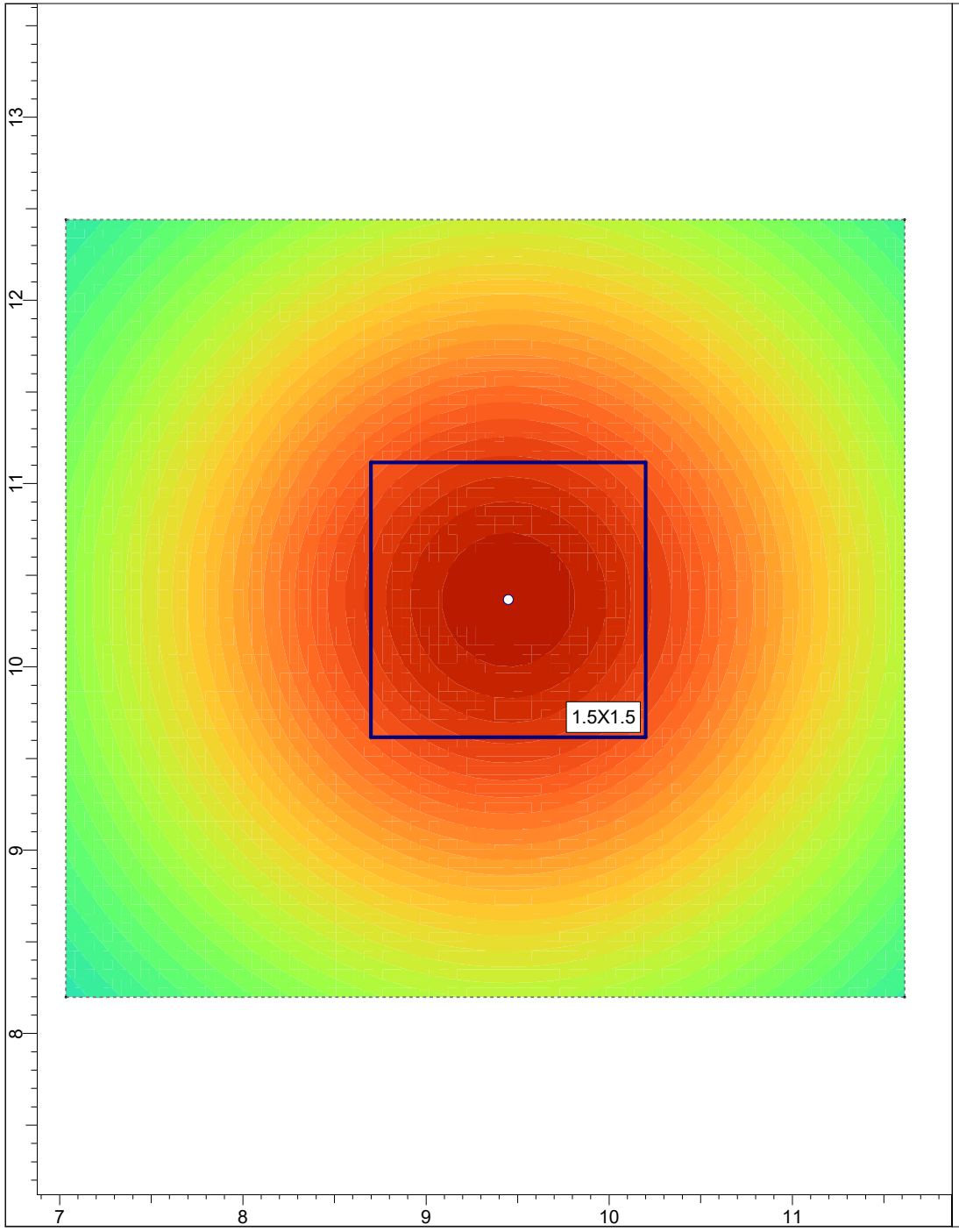
Horizontal bearing capacity R_{dh} = 6365.52 kN
Extreme horizontal force H = 0.00 kN

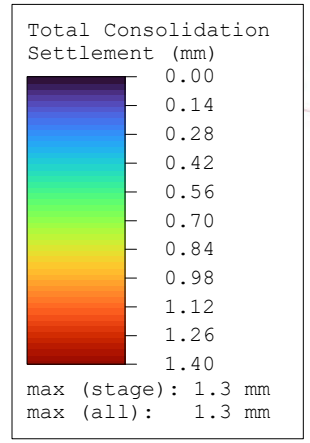
Bearing capacity in the horizontal direction is SATISFACTORY

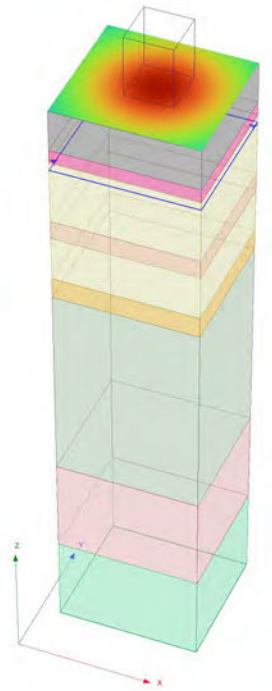
Bearing capacity of foundation is SATISFACTORY

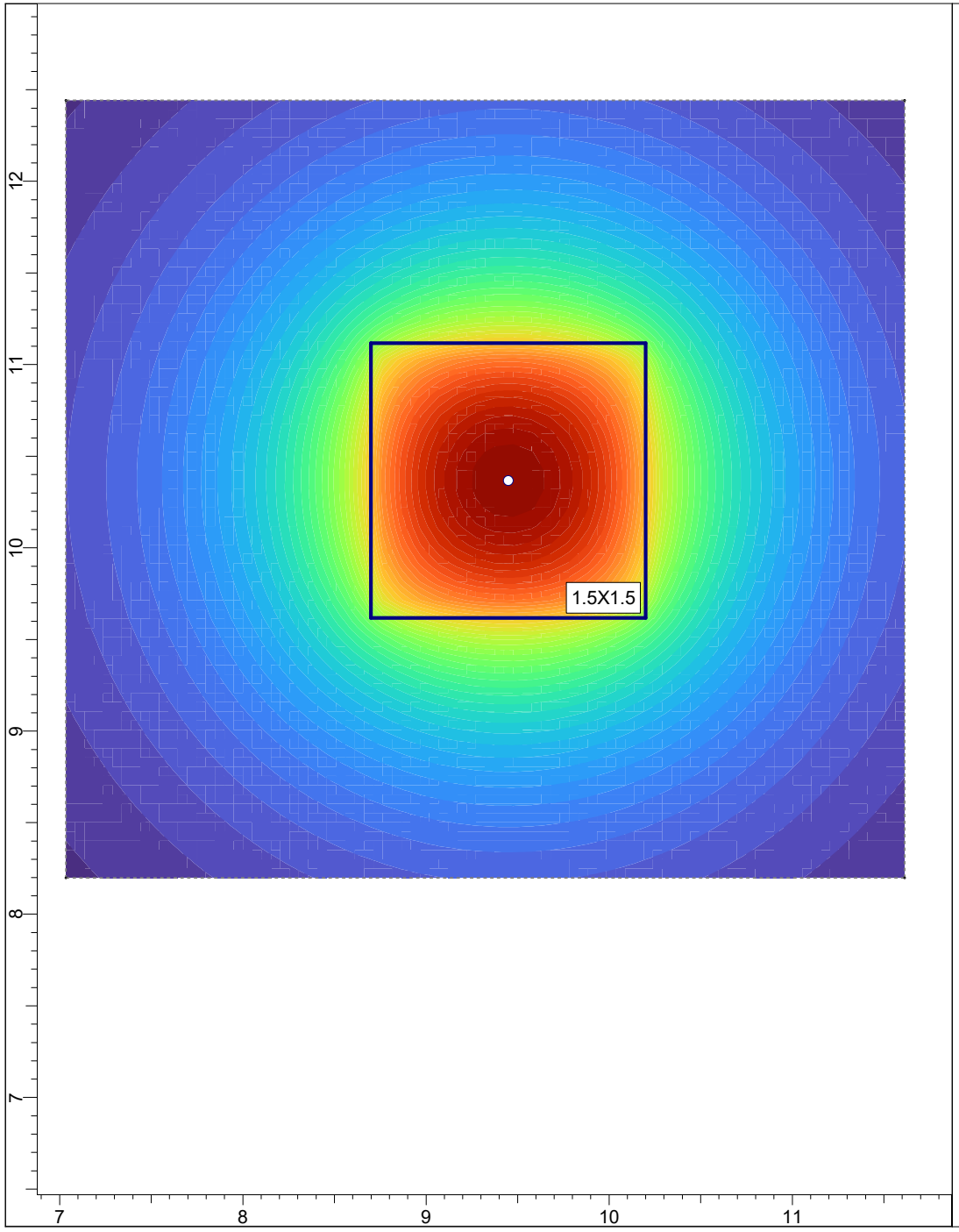
[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

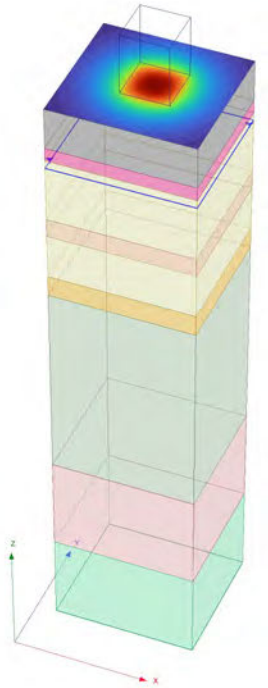
E.2.4 Area-B Foundation Settlement Diagrams


13
12
11
10
9
8
7
8
9
10
11
1.5X1.5


Total Consolidation
Settlement (mm)
0.00
0.14
0.28
0.42
0.56
0.70
0.84
0.98
1.12
1.26
1.40
max (stage): 1.3 mm
max (all): 1.3 mm



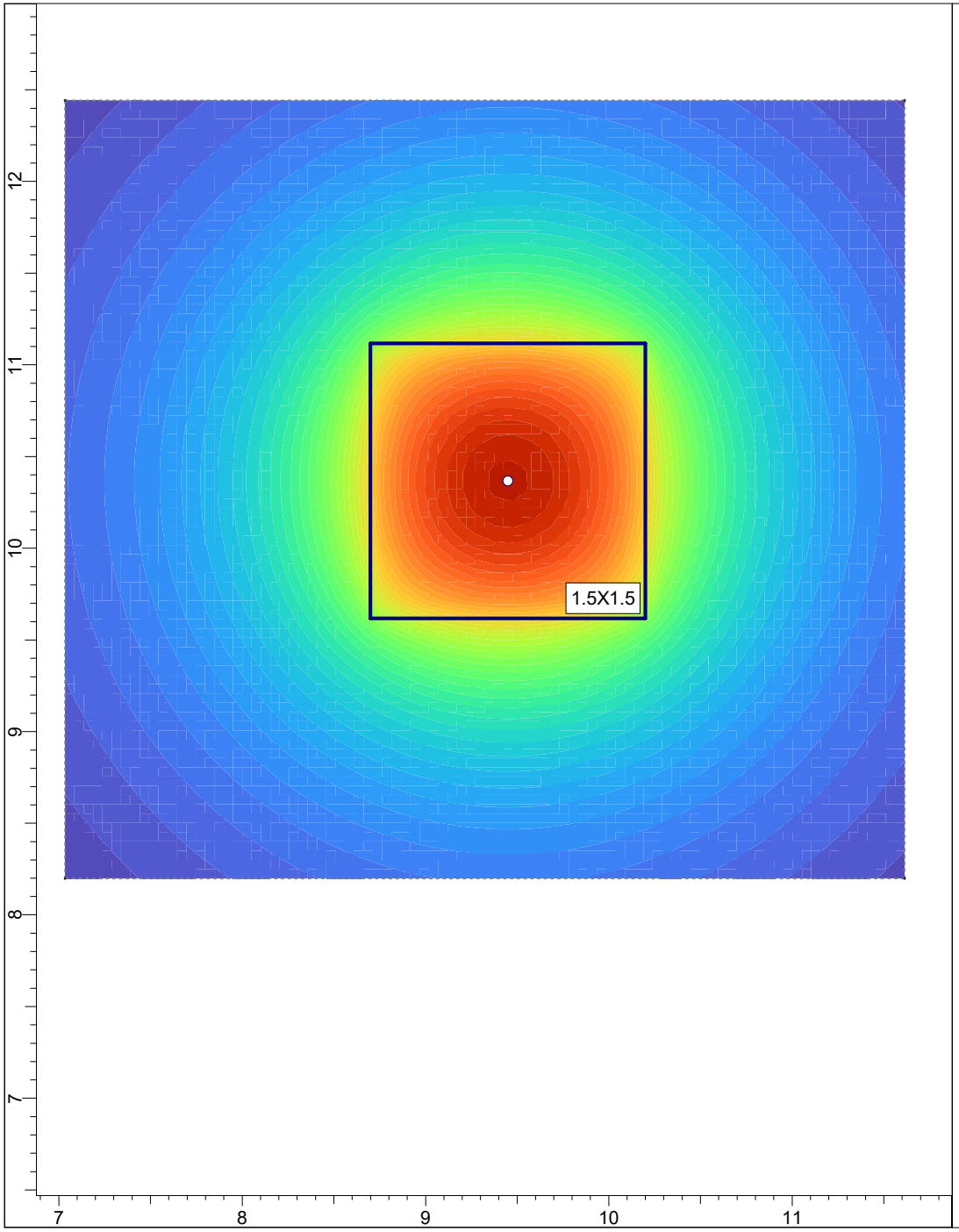


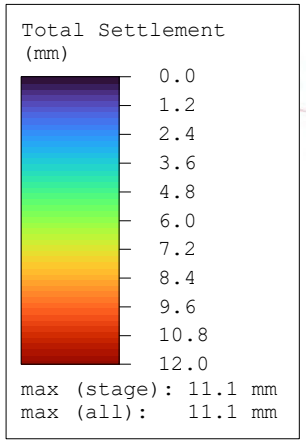


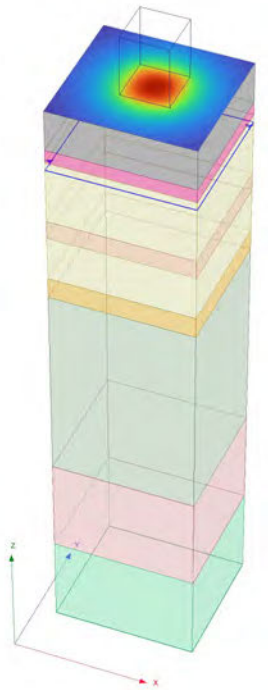
Immediate Settlement (mm)

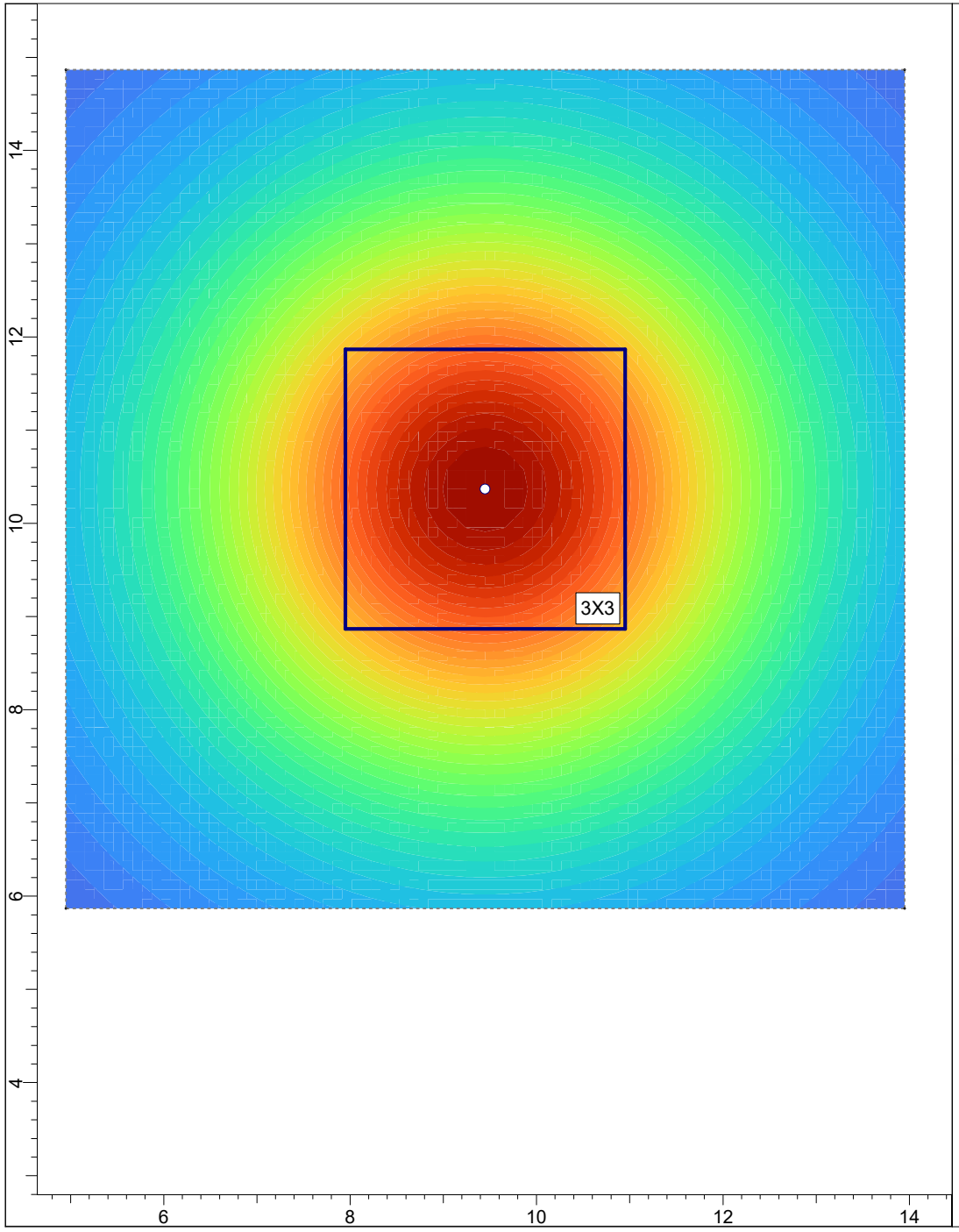
0.00
0.98
1.96
2.94
3.92
4.90
5.88
6.86
7.84
8.82
9.80

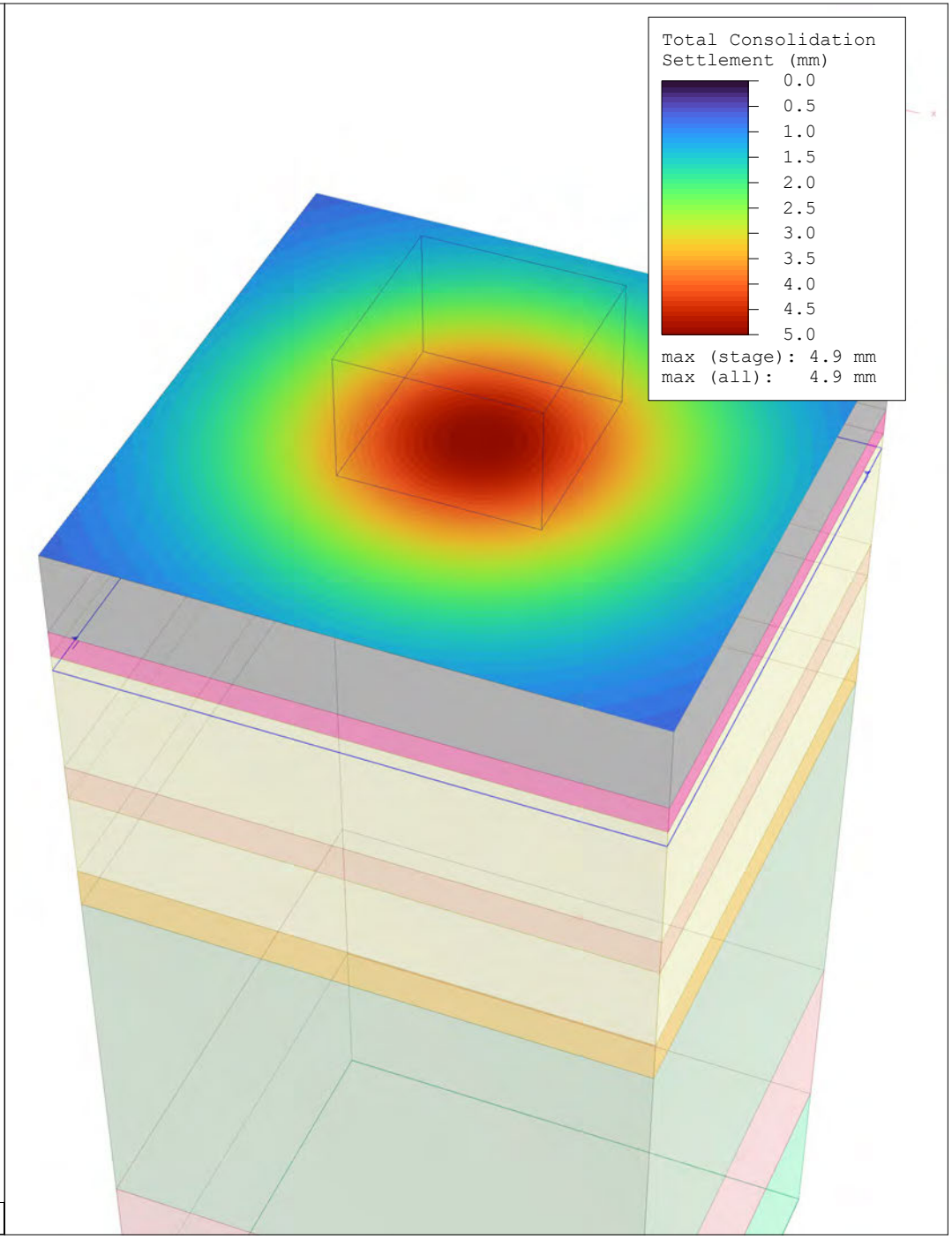
max (stage): 9.8 mm
max (all): 9.8 mm

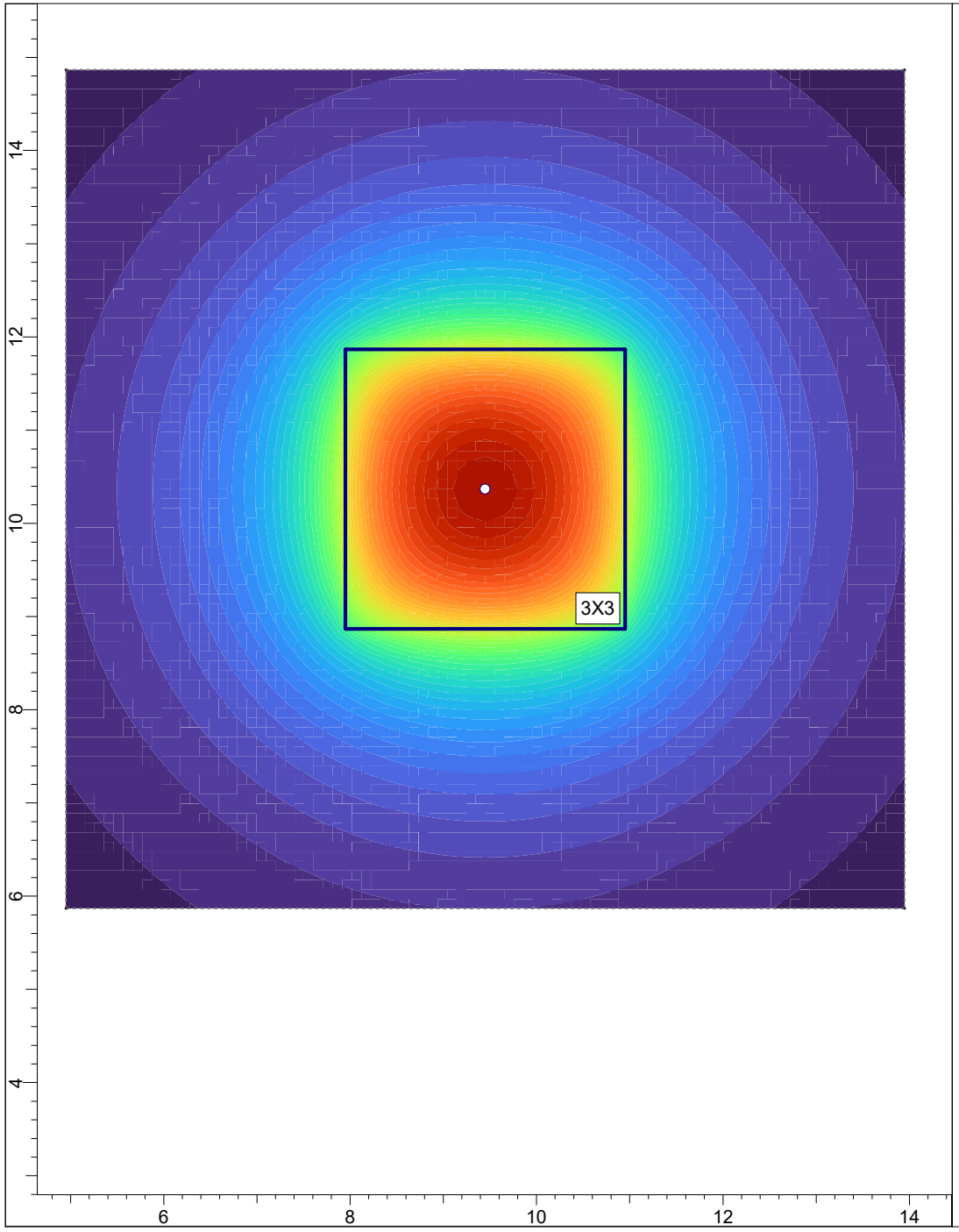

12
11
10
9
8
7
7
8
9
10
11
1.5X1.5

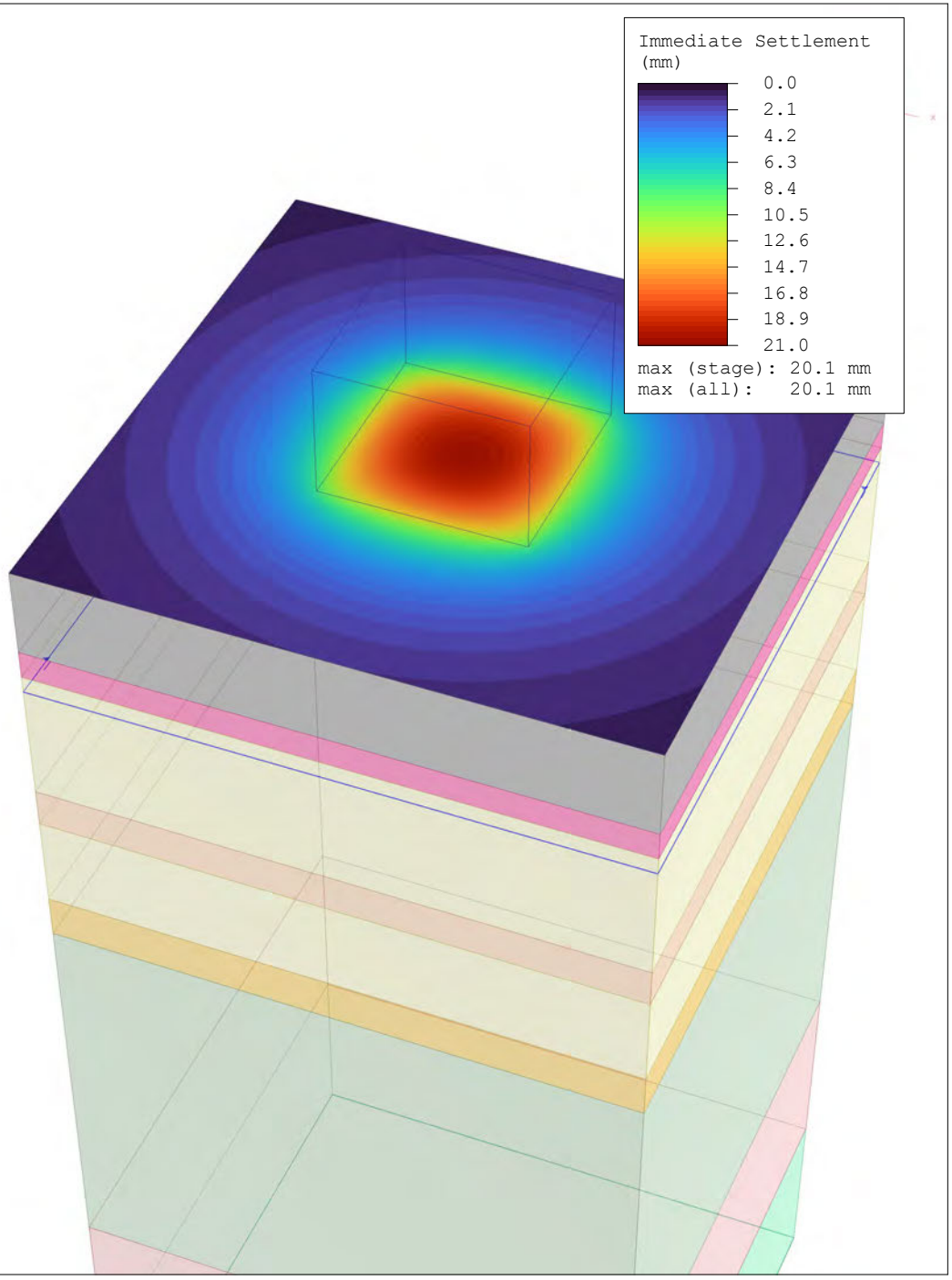

Total Settlement
(mm)
0.0
1.2
2.4
3.6
4.8
6.0
7.2
8.4
9.6
10.8
12.0
max (stage): 11.1 mm
max (all): 11.1 mm

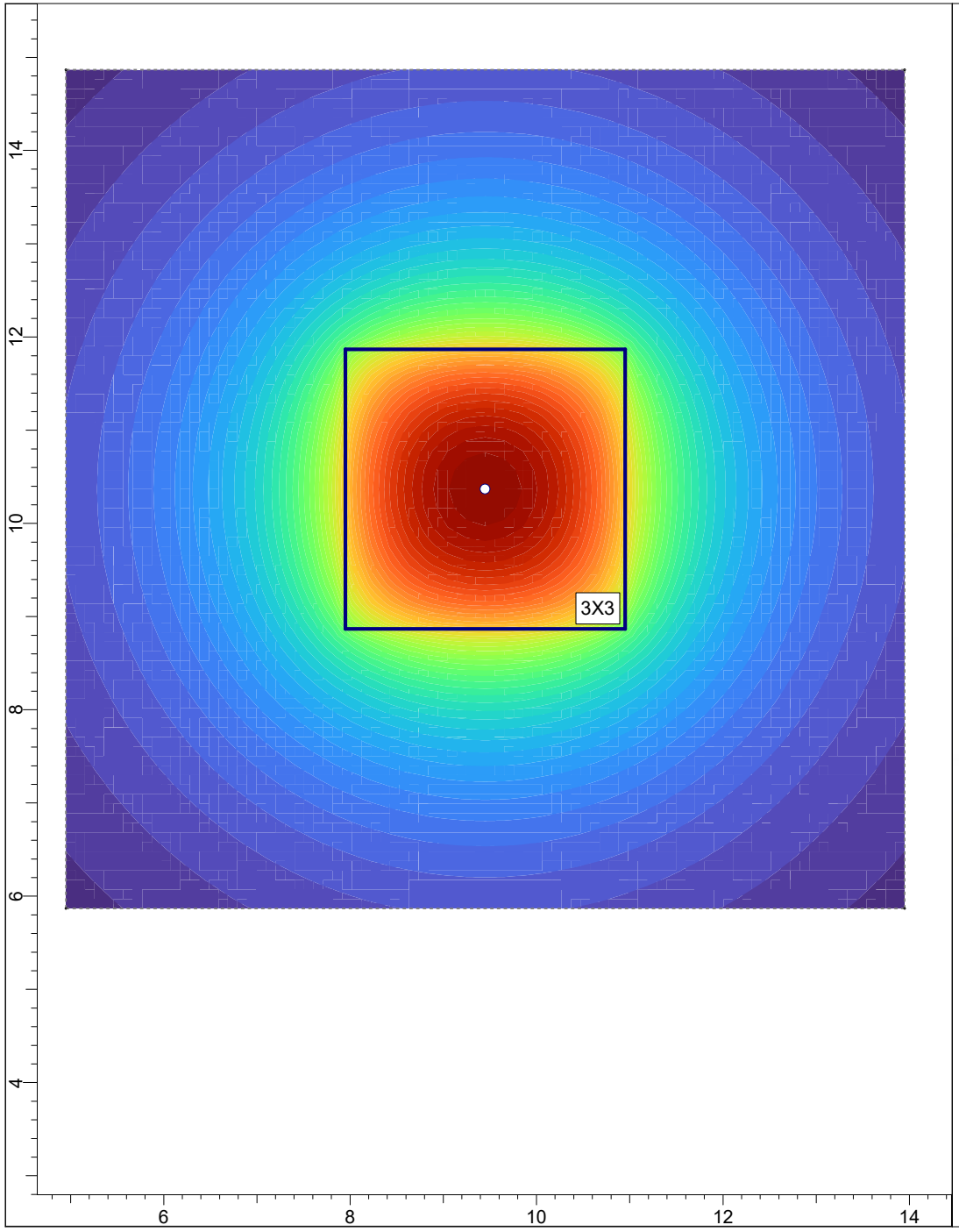


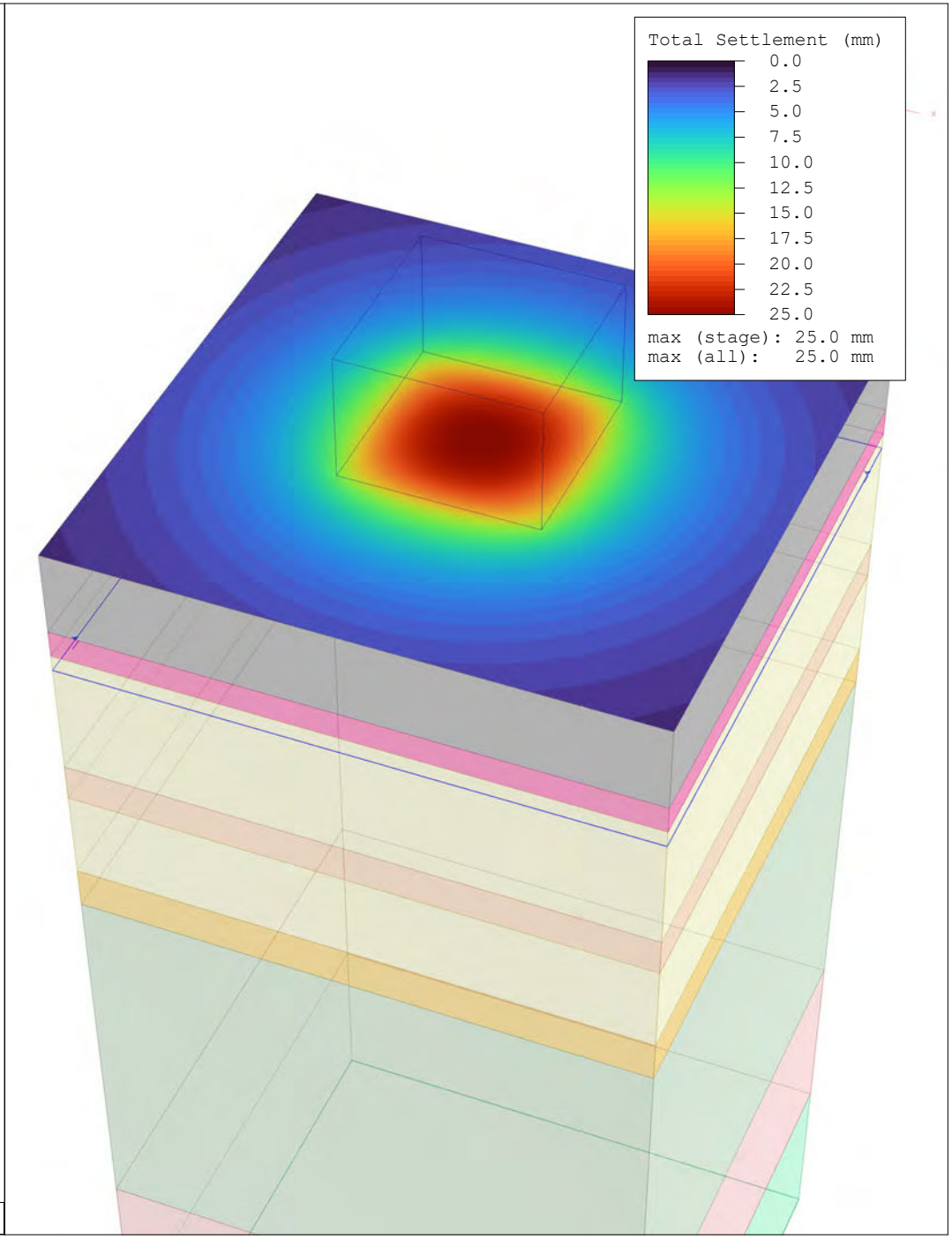

14
12
10
8
6
4
6
8
10
12
14
3X3


Total Consolidation
Settlement (mm)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
max (stage): 4.9 mm
max (all): 4.9 mm

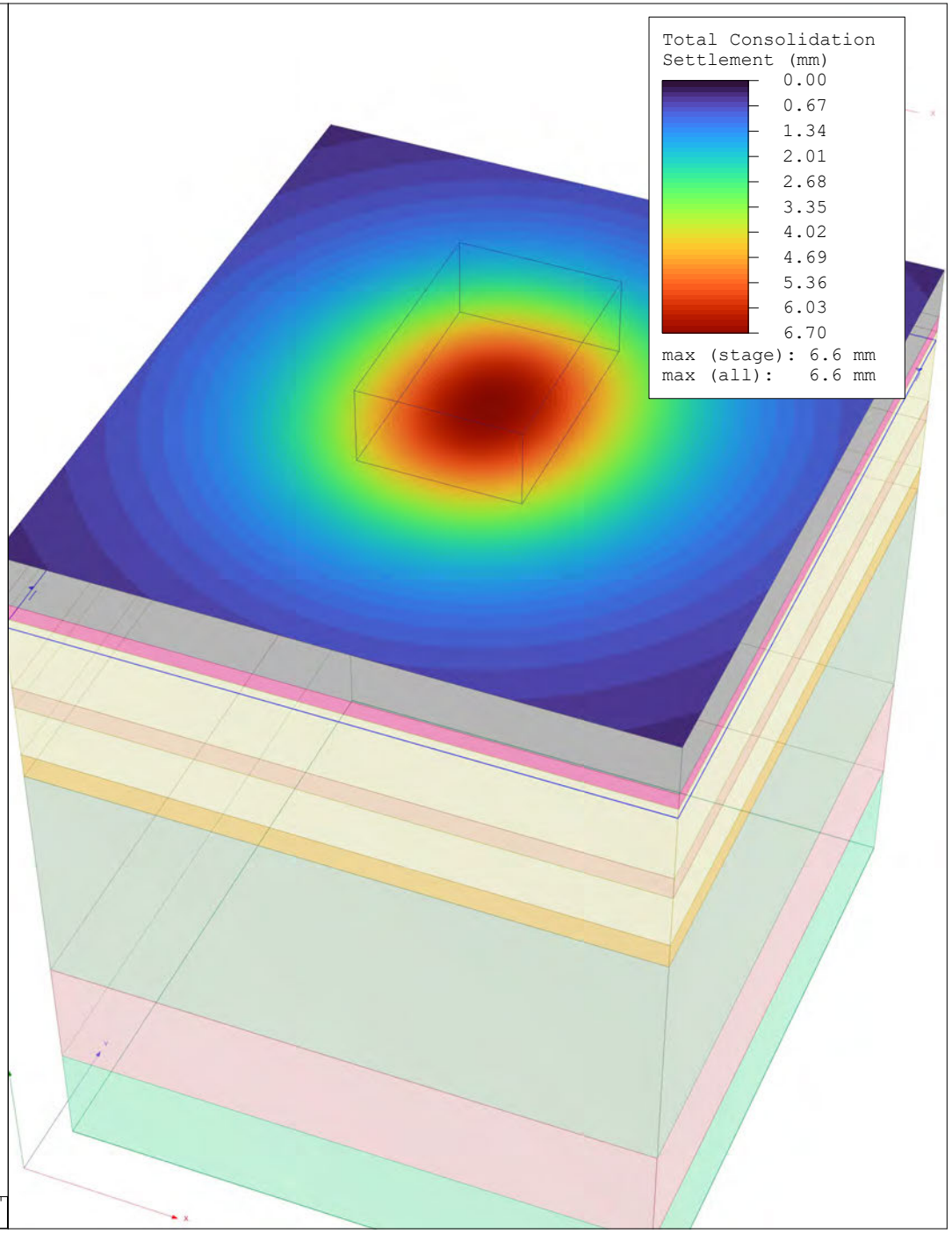

3X3
4
6
8
10
12
14
6
8
10
12
14

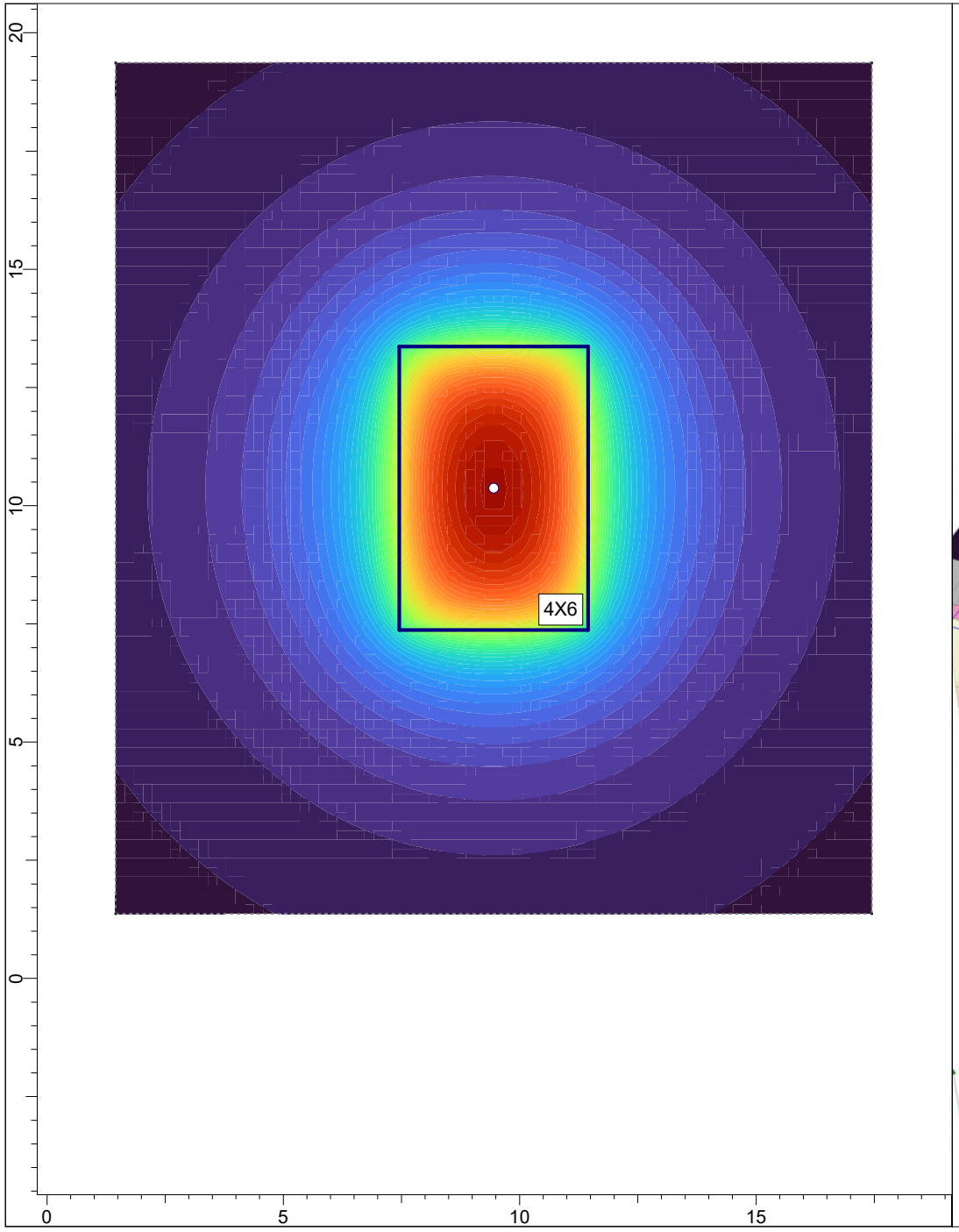

Immediate Settlement
(mm)
0.0
2.1
4.2
6.3
8.4
10.5
12.6
14.7
16.8
18.9
21.0
max (stage): 20.1 mm
max (all): 20.1 mm

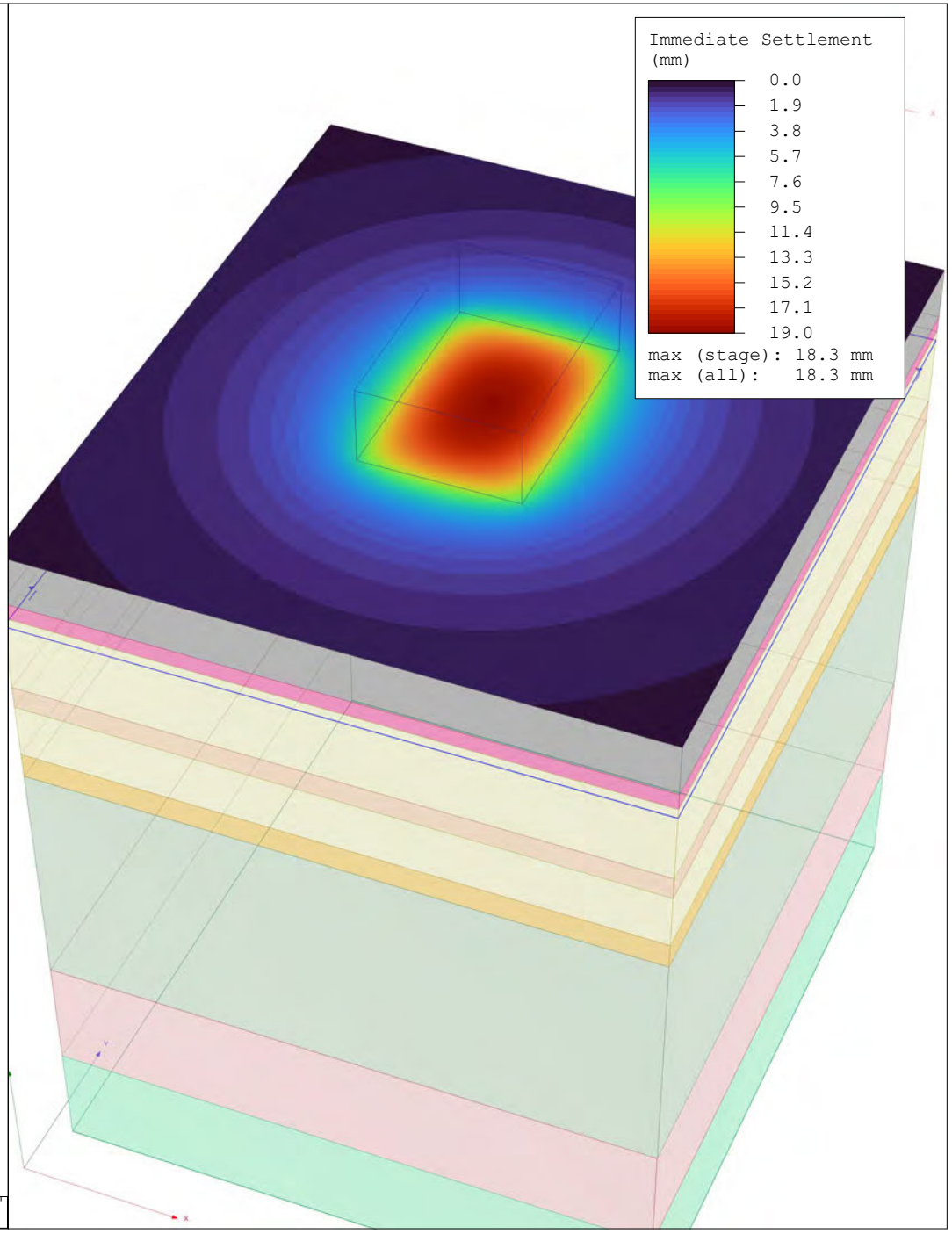

14
12
10
8
6
4
6
8
10
12
14
3X3

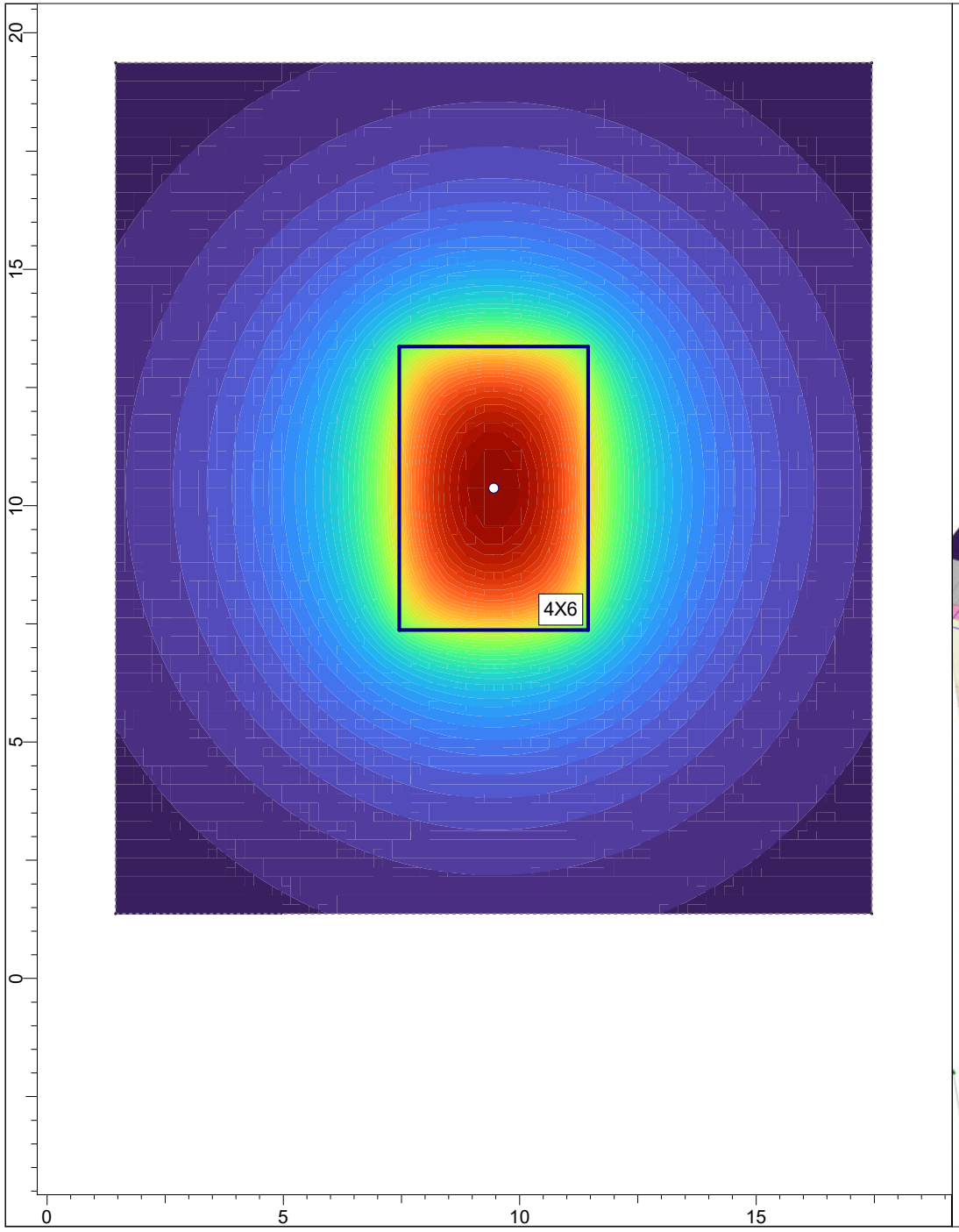

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

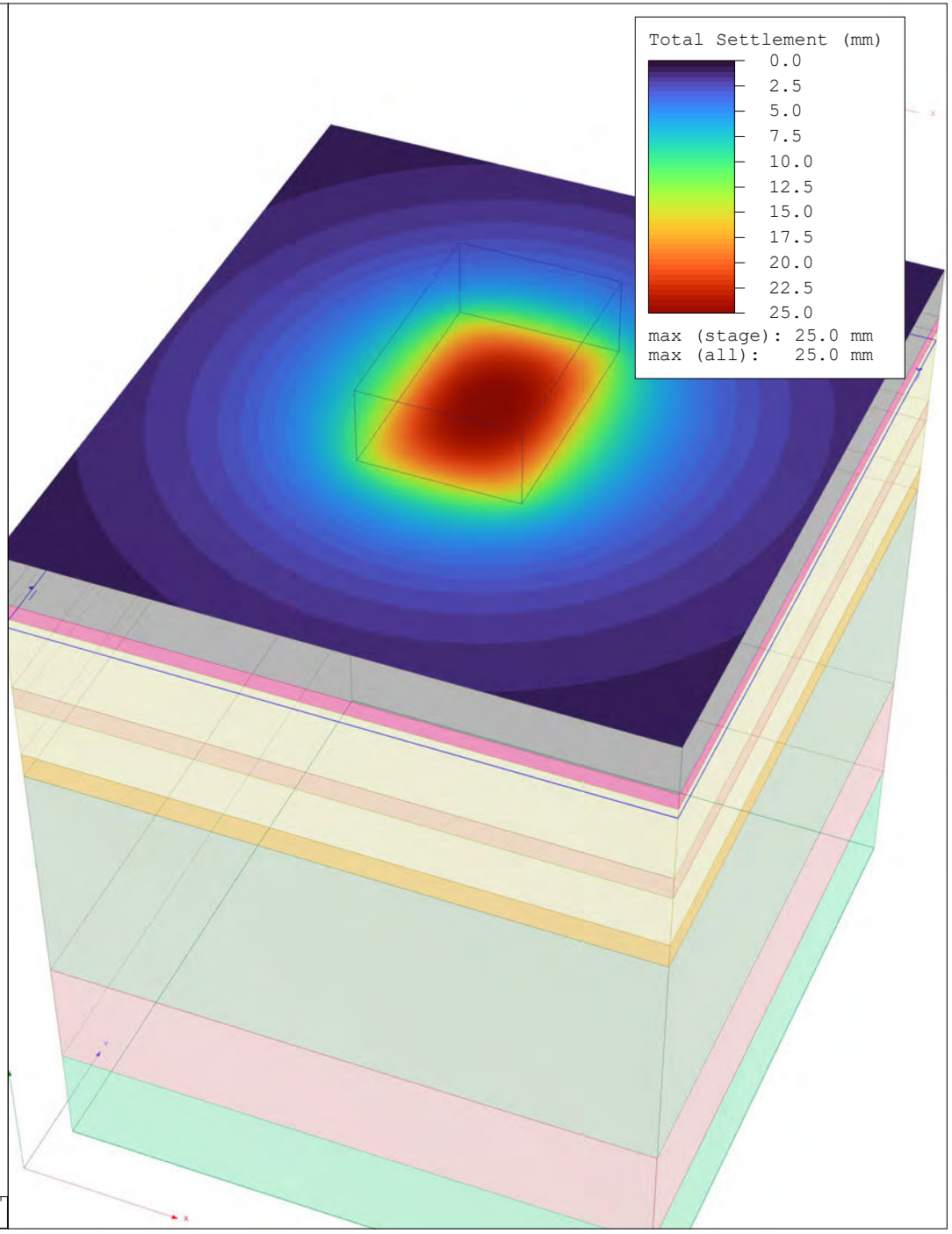

20
15
10
5
0
0
5
10
15
4X6

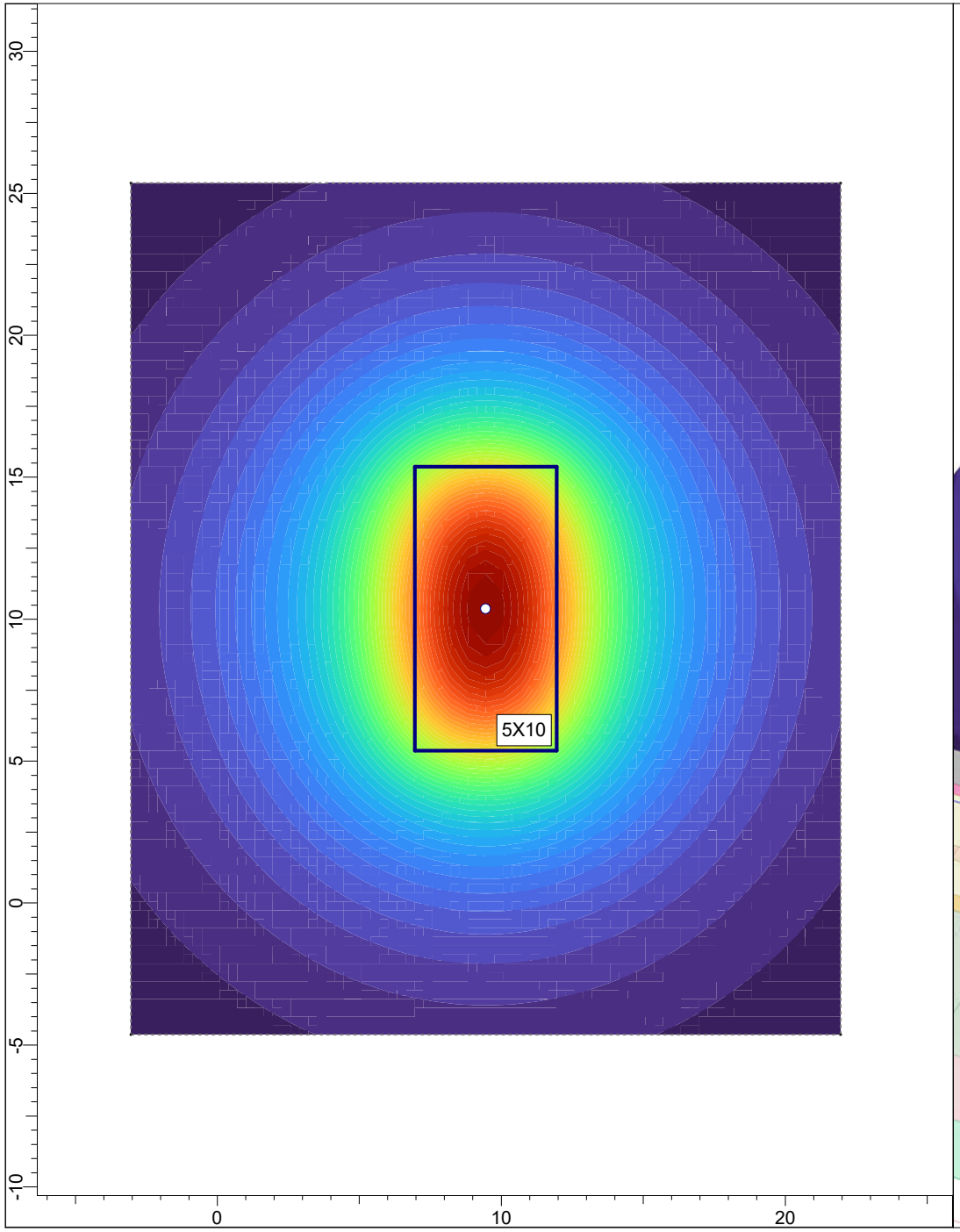

Total Consolidation
Settlement (mm)
0.00
0.67
1.34
2.01
2.68
3.35
4.02
4.69
5.36
6.03
6.70
max (stage): 6.6 mm
max (all): 6.6 mm

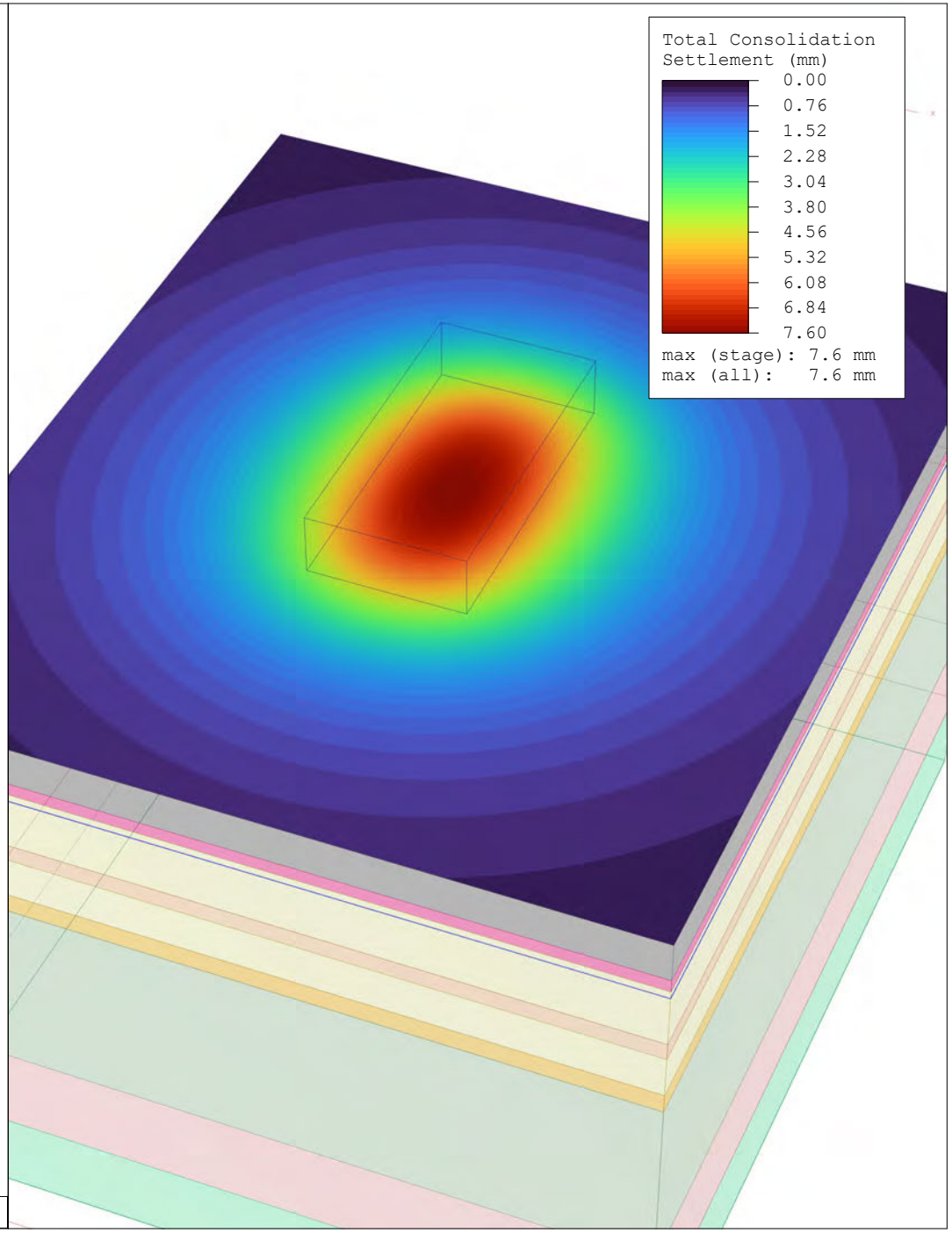

20
15
10
5
0
0
5
10
15
4X6

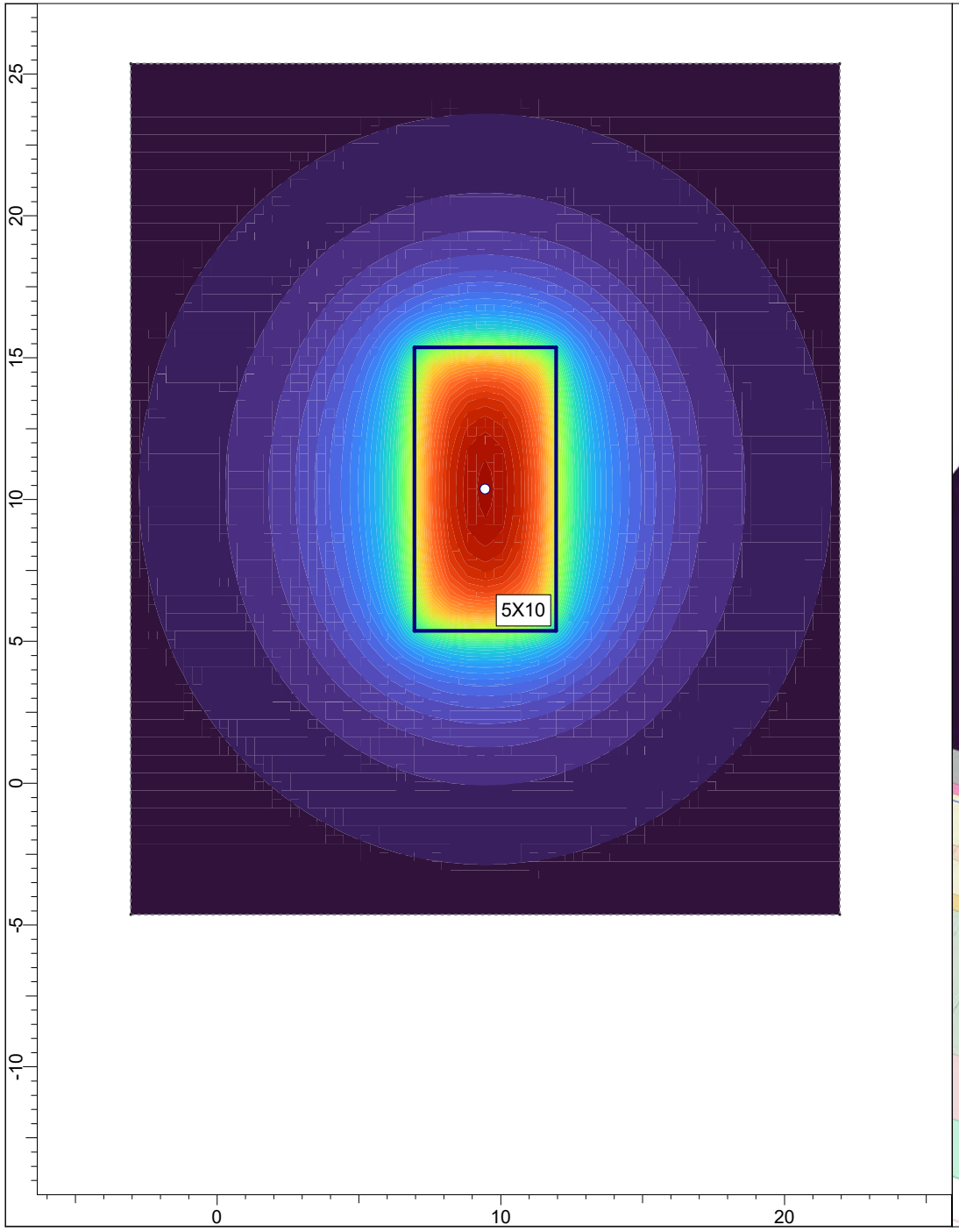

Immediate Settlement
(mm)
0.0
1.9
3.8
5.7
7.6
9.5
11.4
13.3
15.2
17.1
19.0
max (stage): 18.3 mm
max (all): 18.3 mm

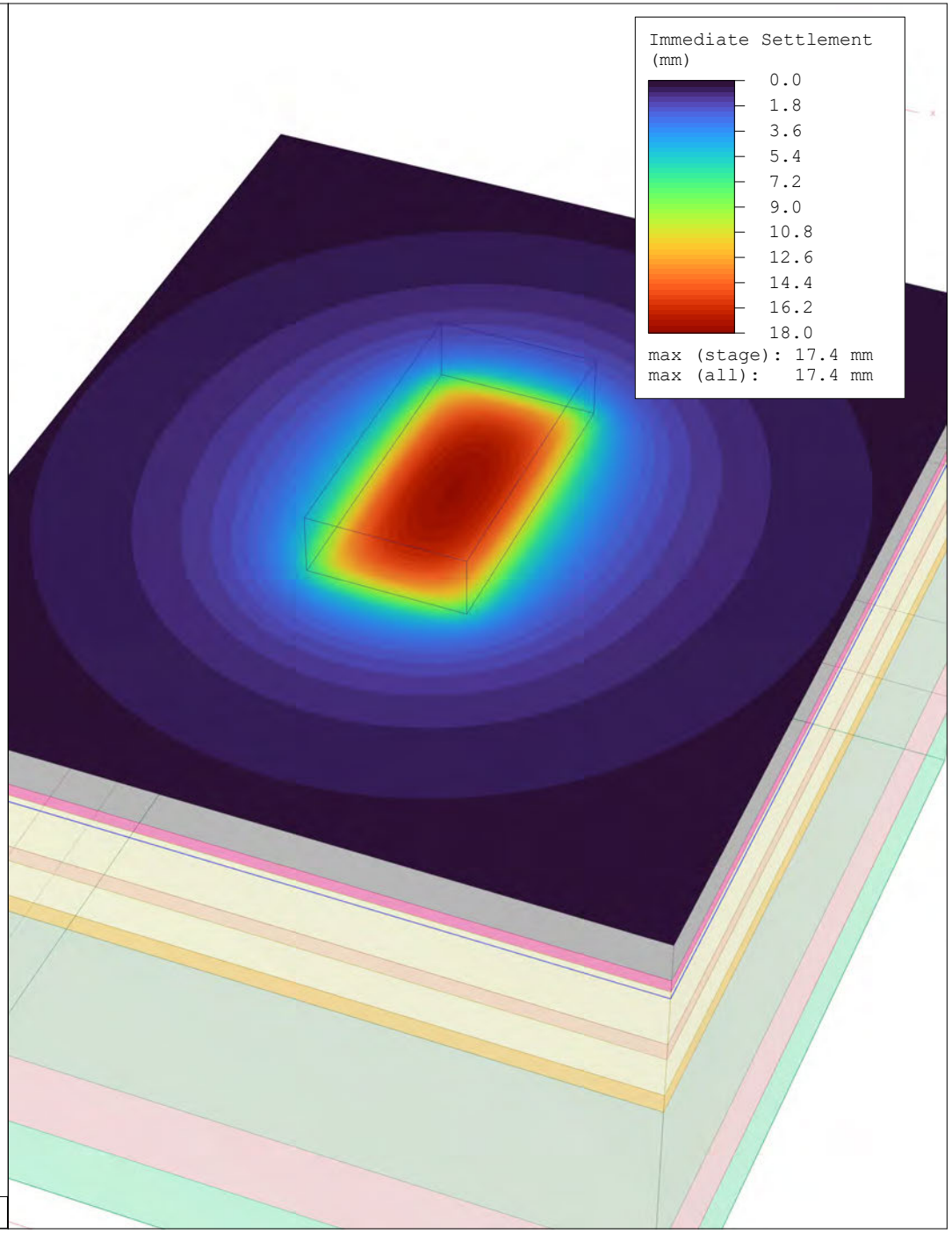

20
15
10
5
0
0
5
10
15
4X6

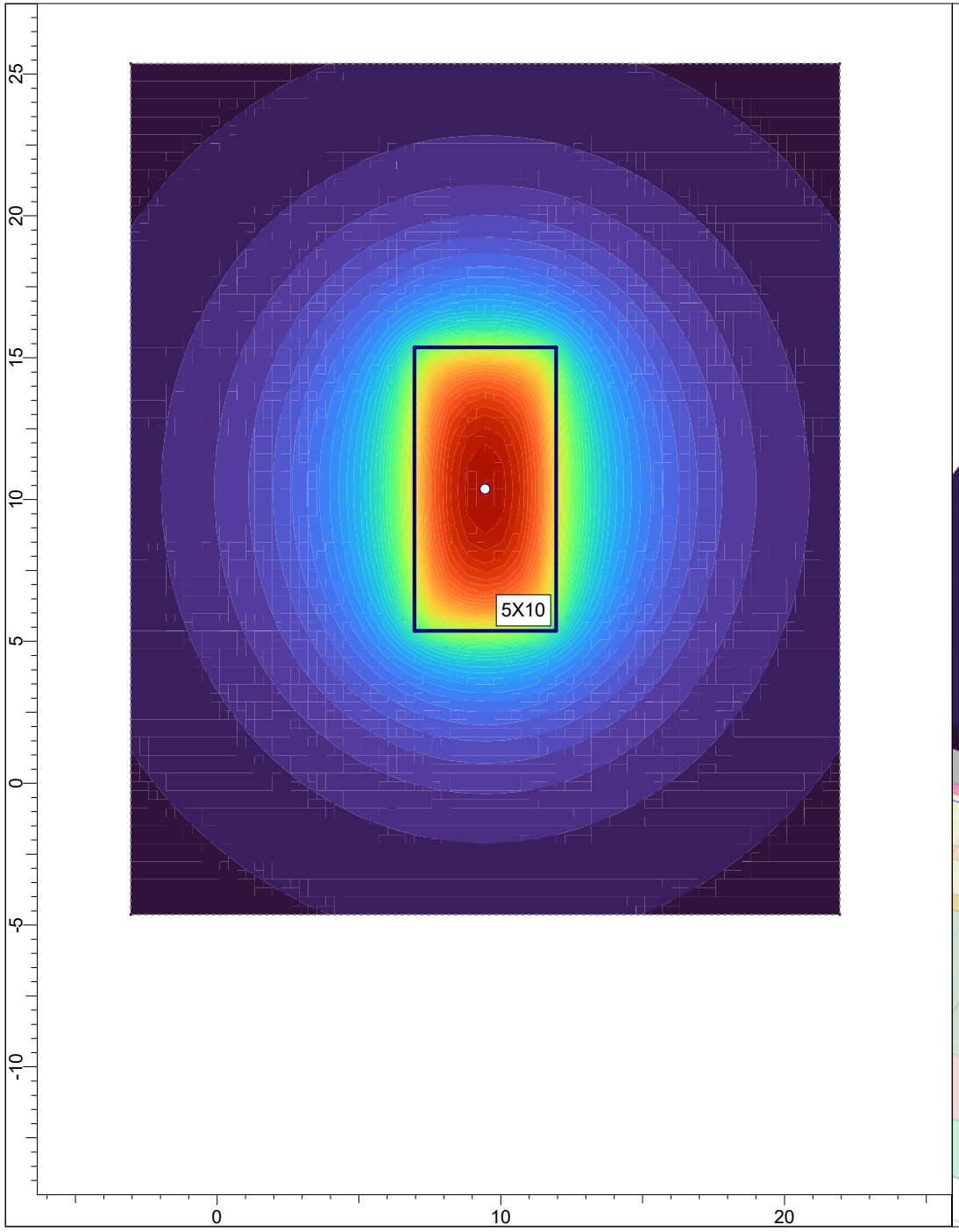

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

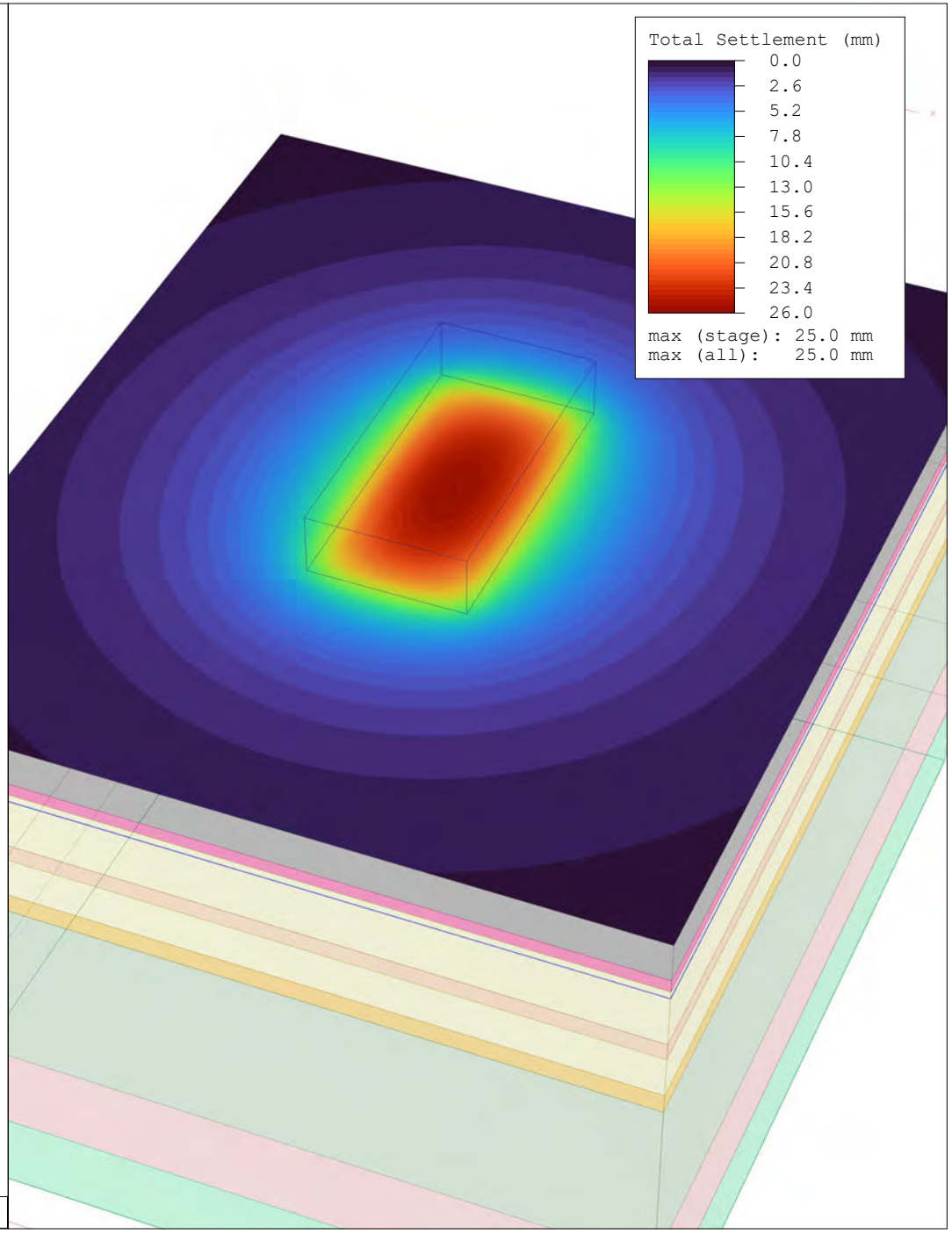

30
25
20
15
10
5
0
-5
-10
0
10
20
5X10

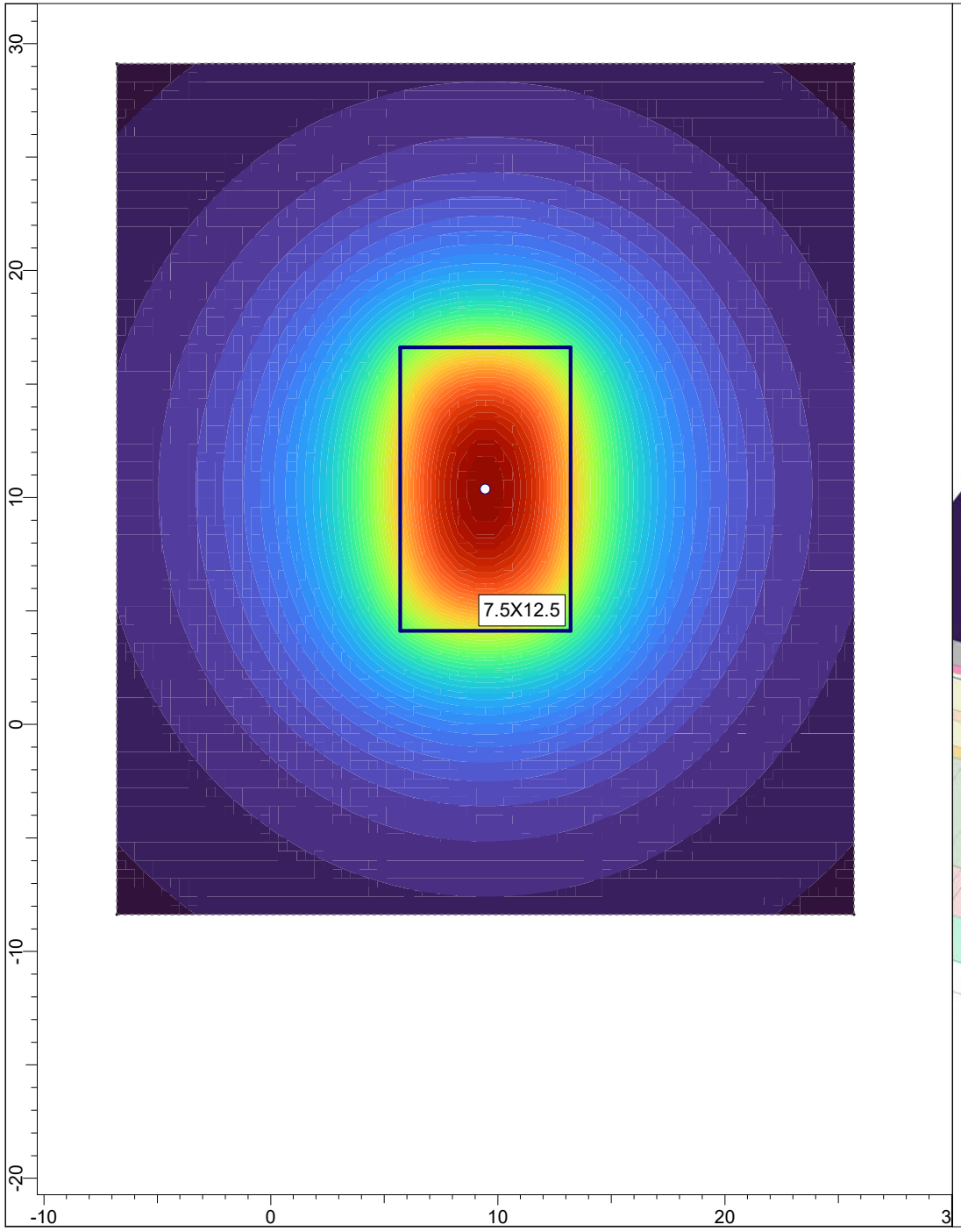

Total Consolidation
Settlement (mm)
0.00
0.76
1.52
2.28
3.04
3.80
4.56
5.32
6.08
6.84
7.60
max (stage): 7.6 mm
max (all): 7.6 mm

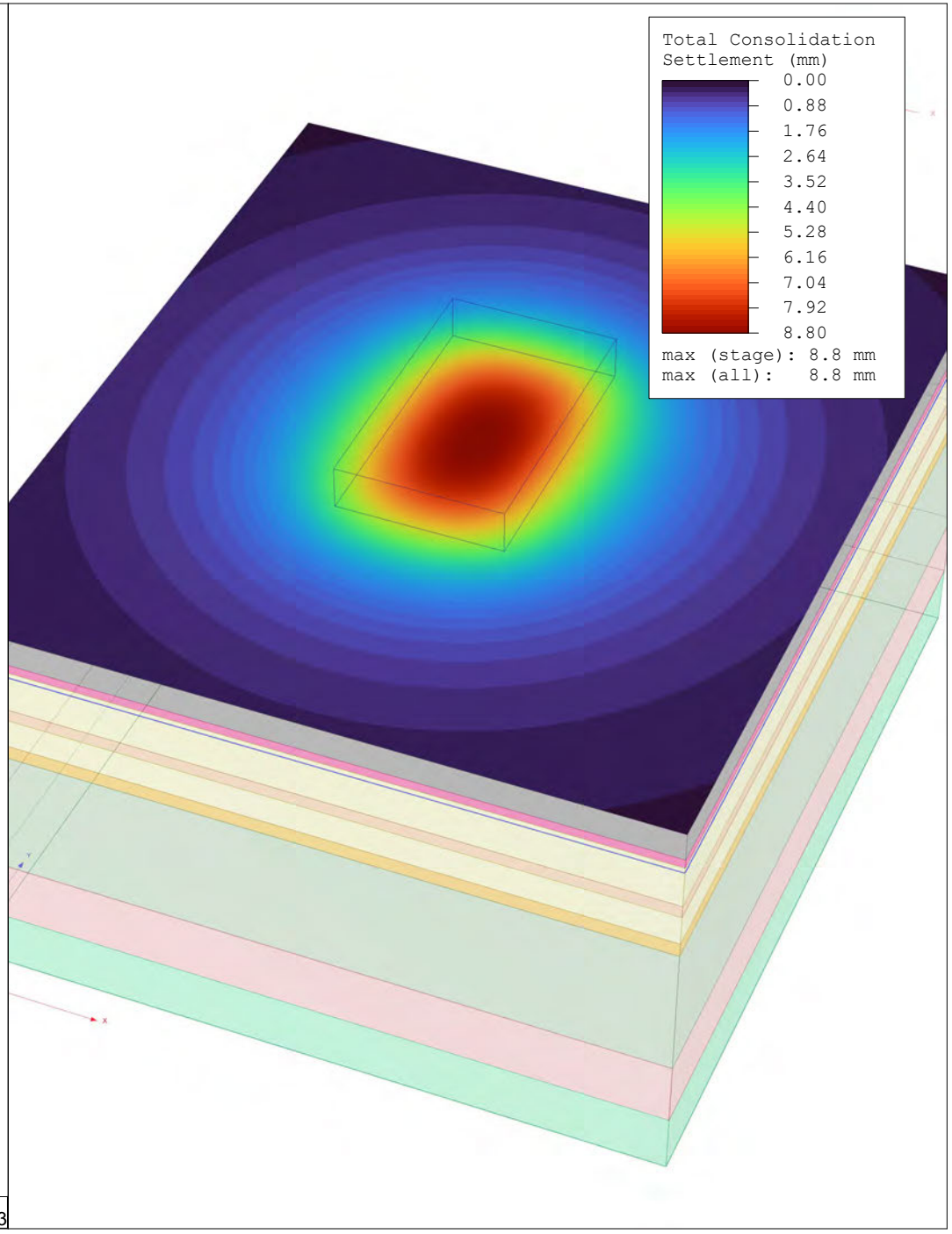

25
20
15
10
5
0
-5
-10
0
10
20
5X10

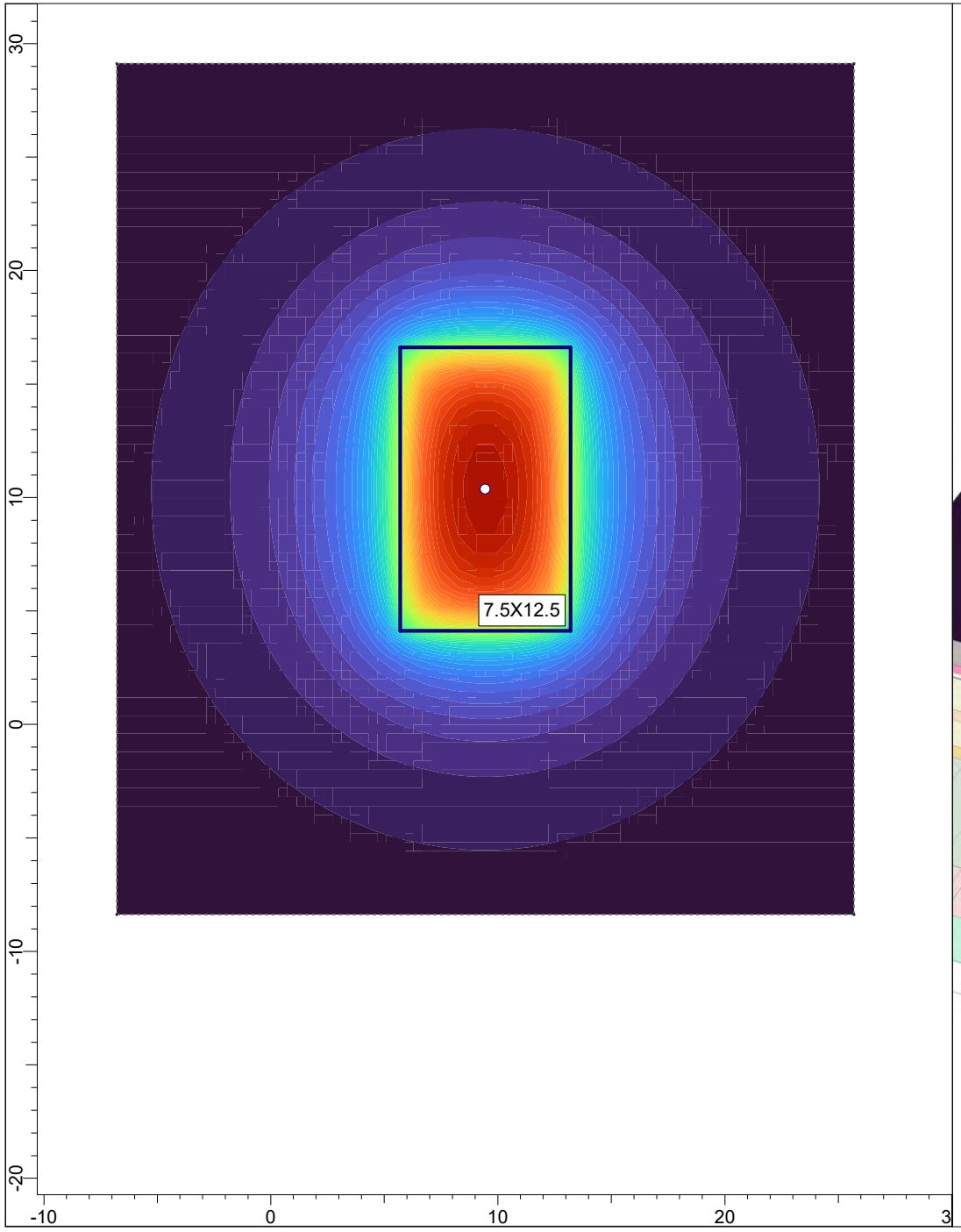

Immediate Settlement
(mm)
0.0
1.8
3.6
5.4
7.2
9.0
10.8
12.6
14.4
16.2
18.0
max (stage): 17.4 mm
max (all): 17.4 mm

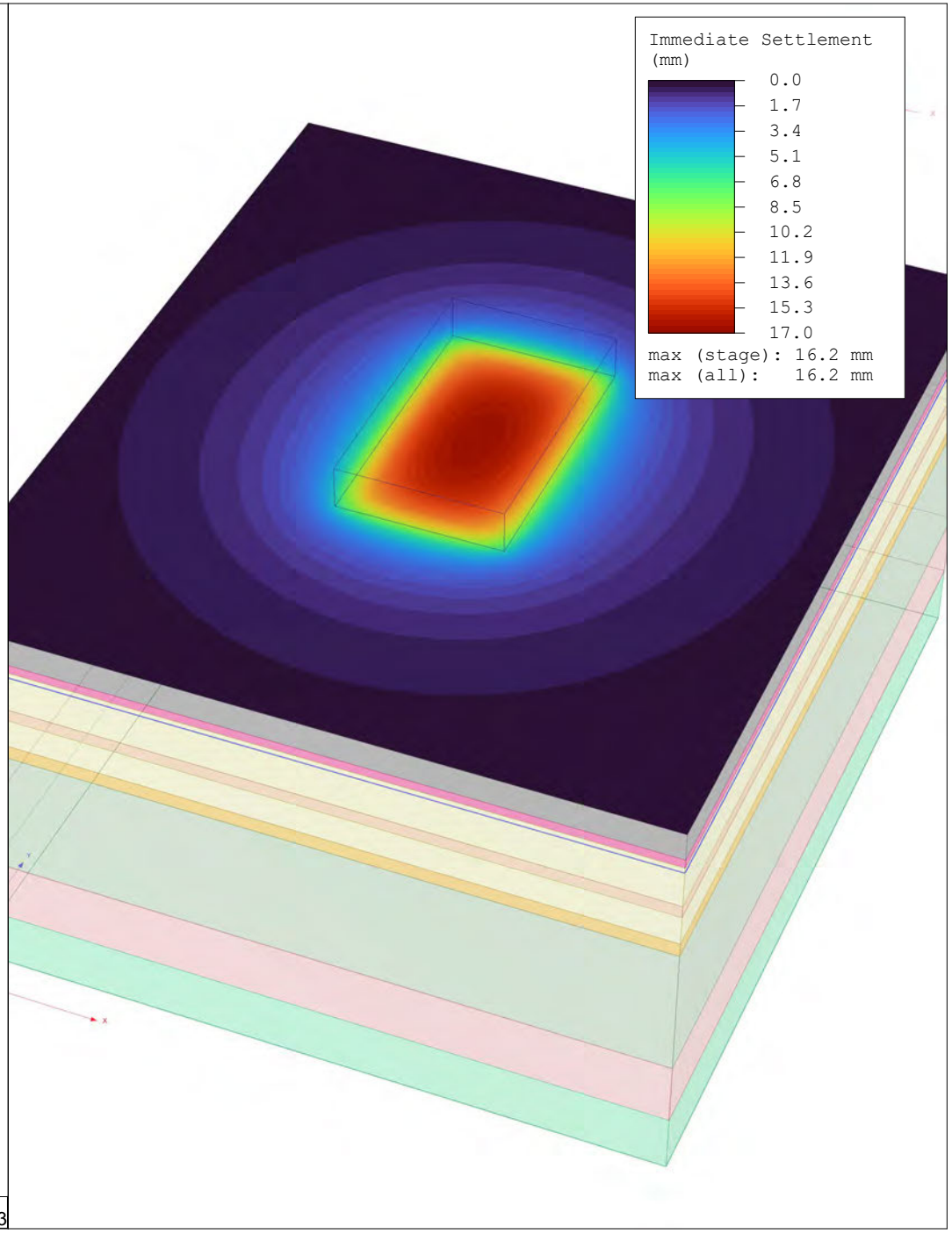

25
20
15
10
5
0
-5
-10
0
10
20
5X10

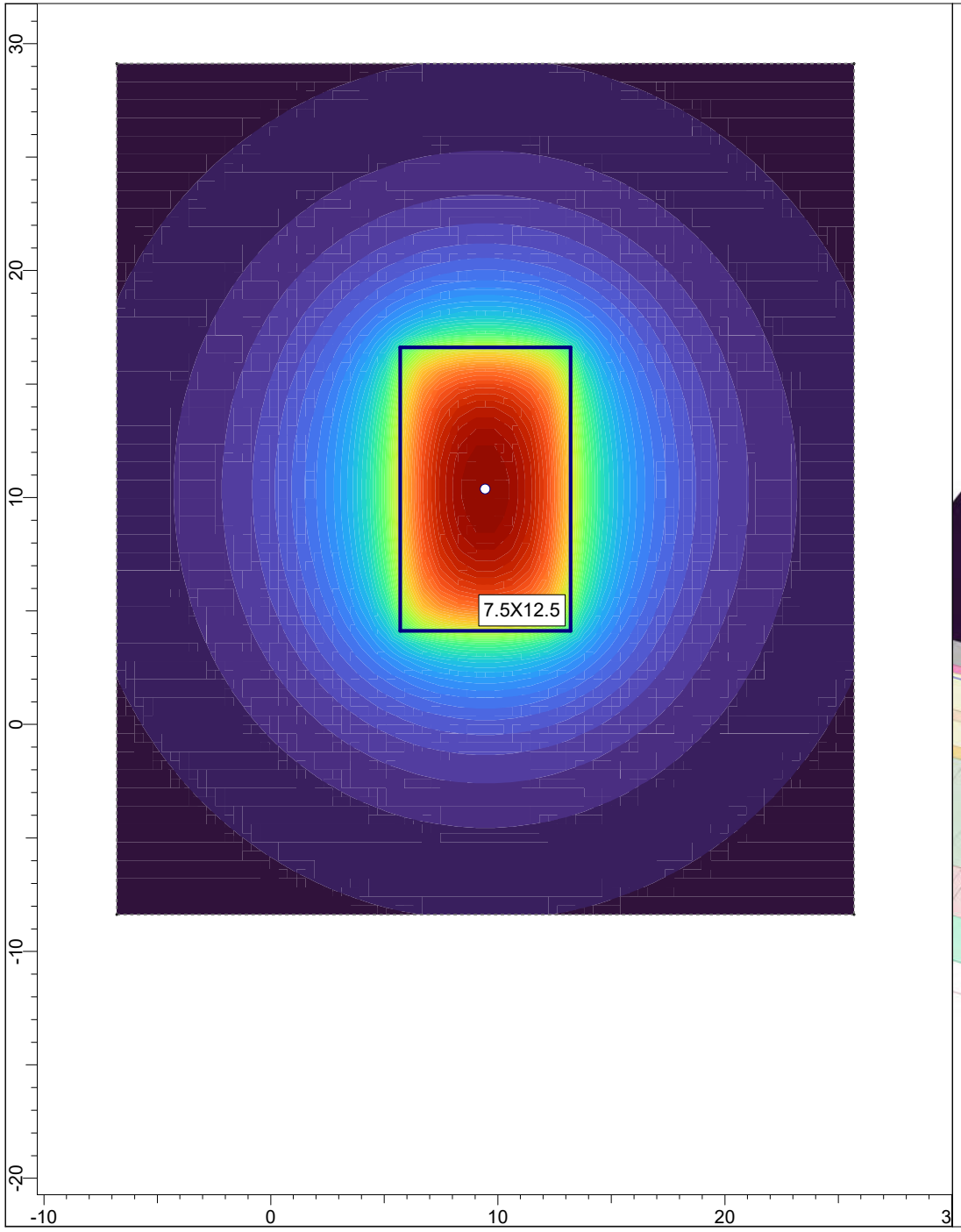

Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.0 mm
max (all): 25.0 mm

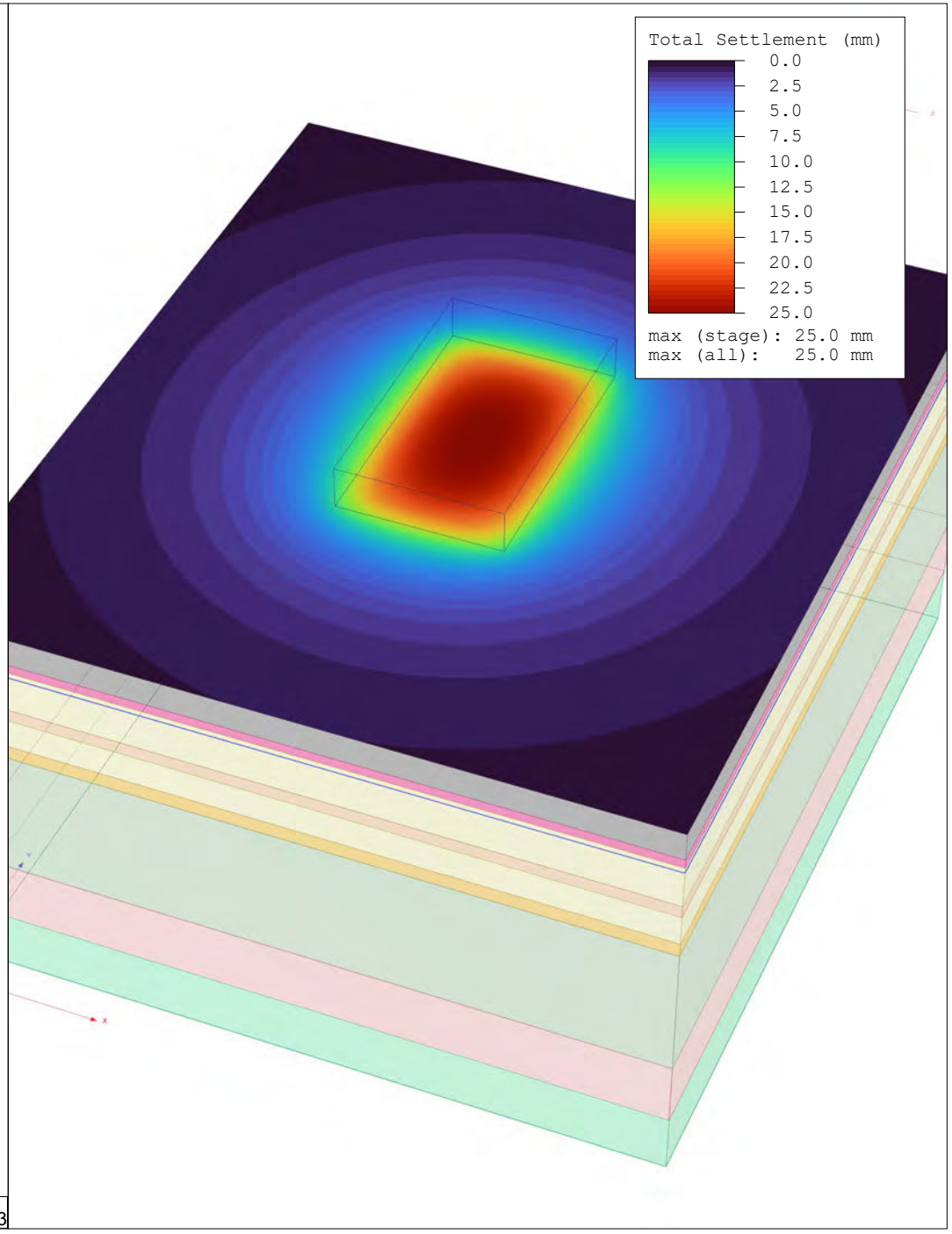

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

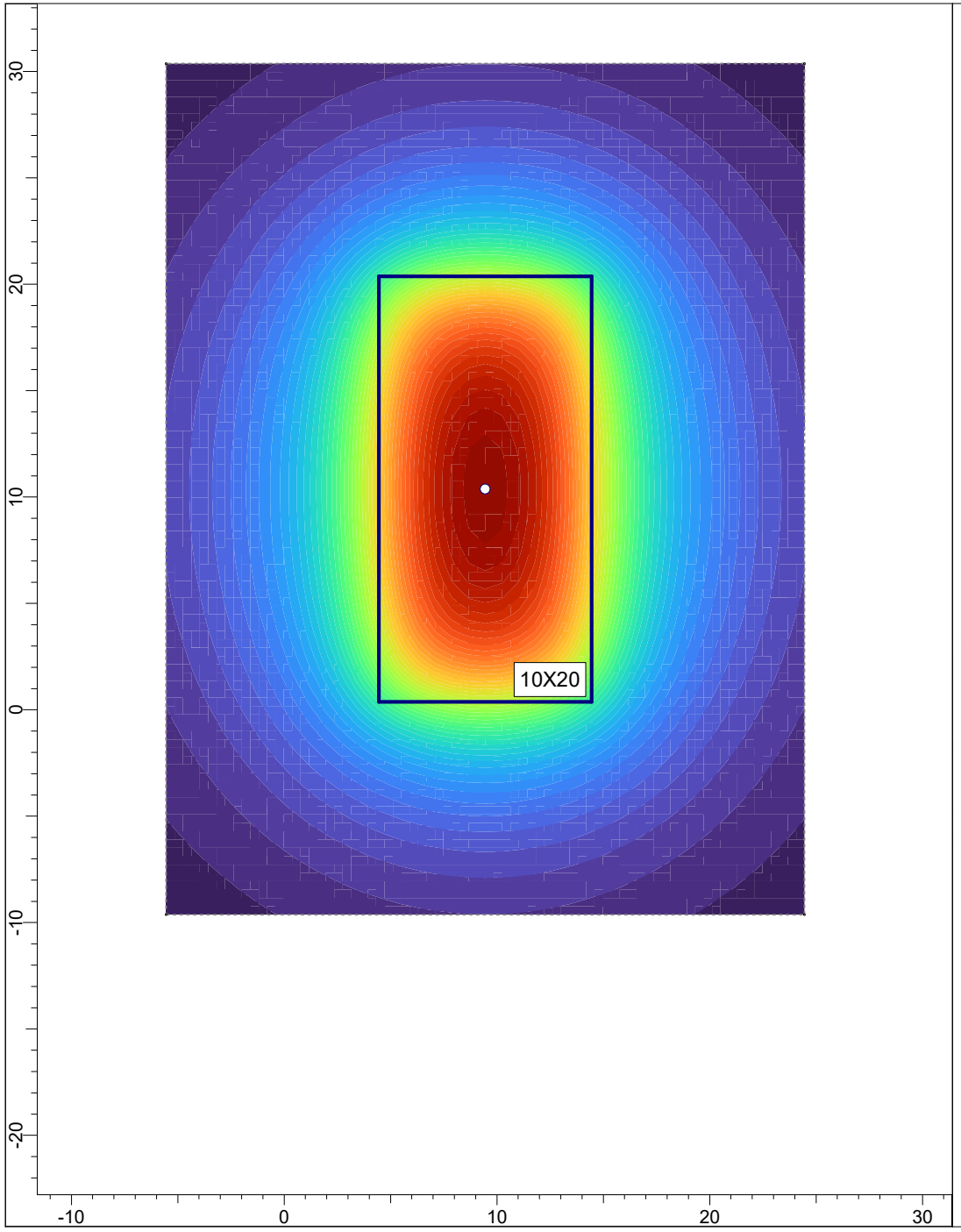

Total Consolidation
Settlement (mm)
0.00
0.88
1.76
2.64
3.52
4.40
5.28
6.16
7.04
7.92
8.80
max (stage): 8.8 mm
max (all): 8.8 mm

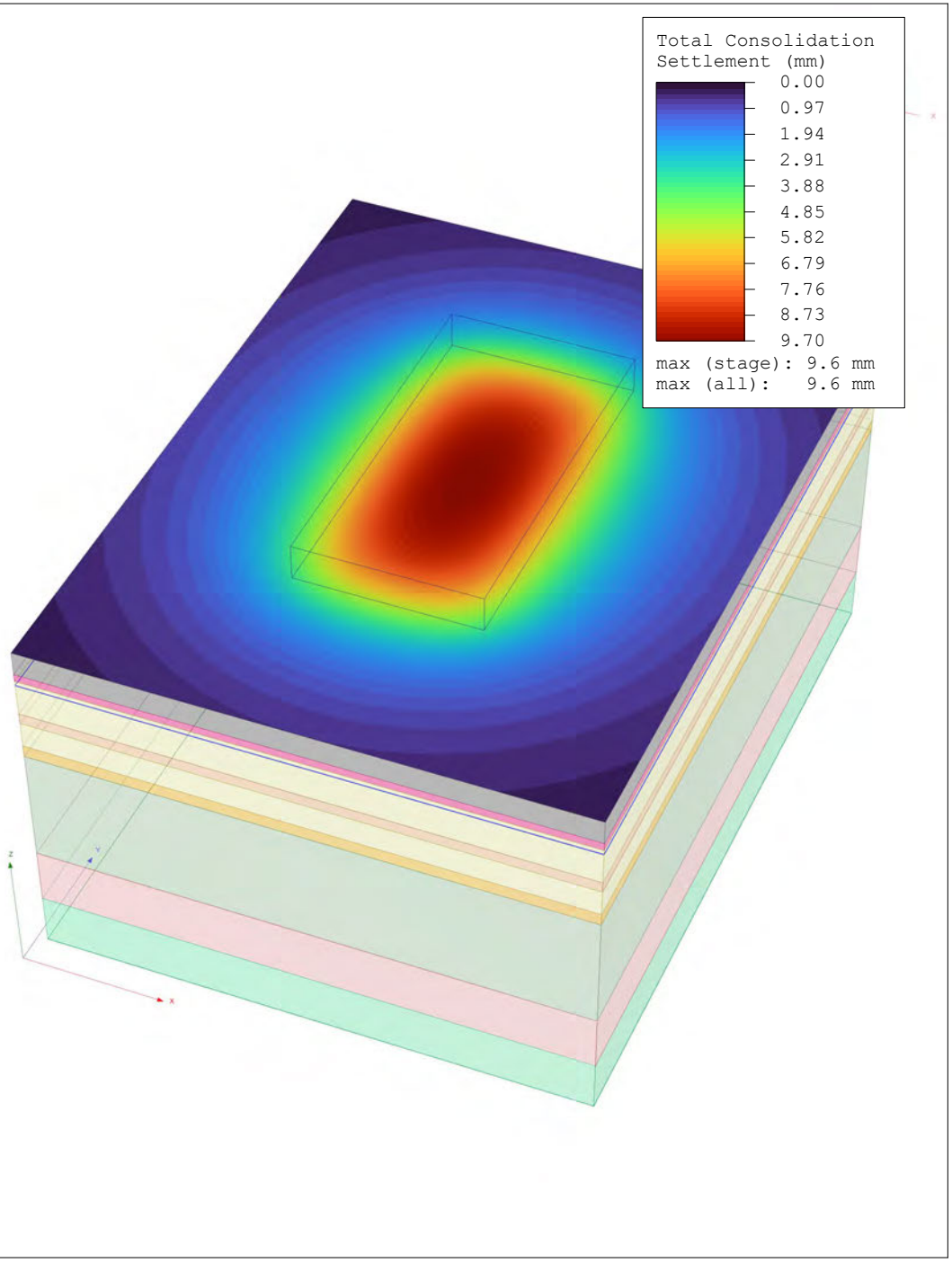

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

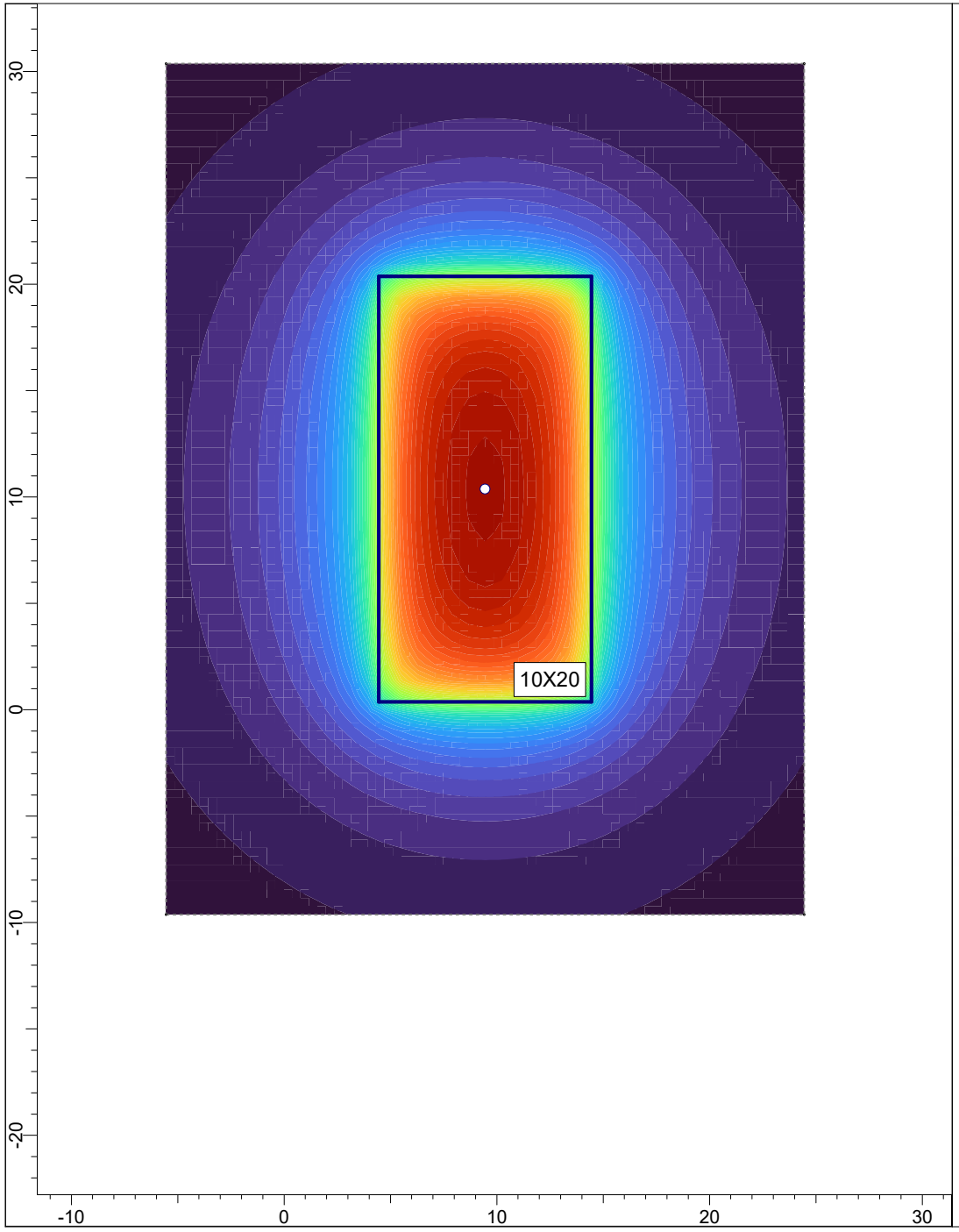

Immediate Settlement
(mm)
0.0
1.7
3.4
5.1
6.8
8.5
10.2
11.9
13.6
15.3
17.0
max (stage): 16.2 mm
max (all): 16.2 mm

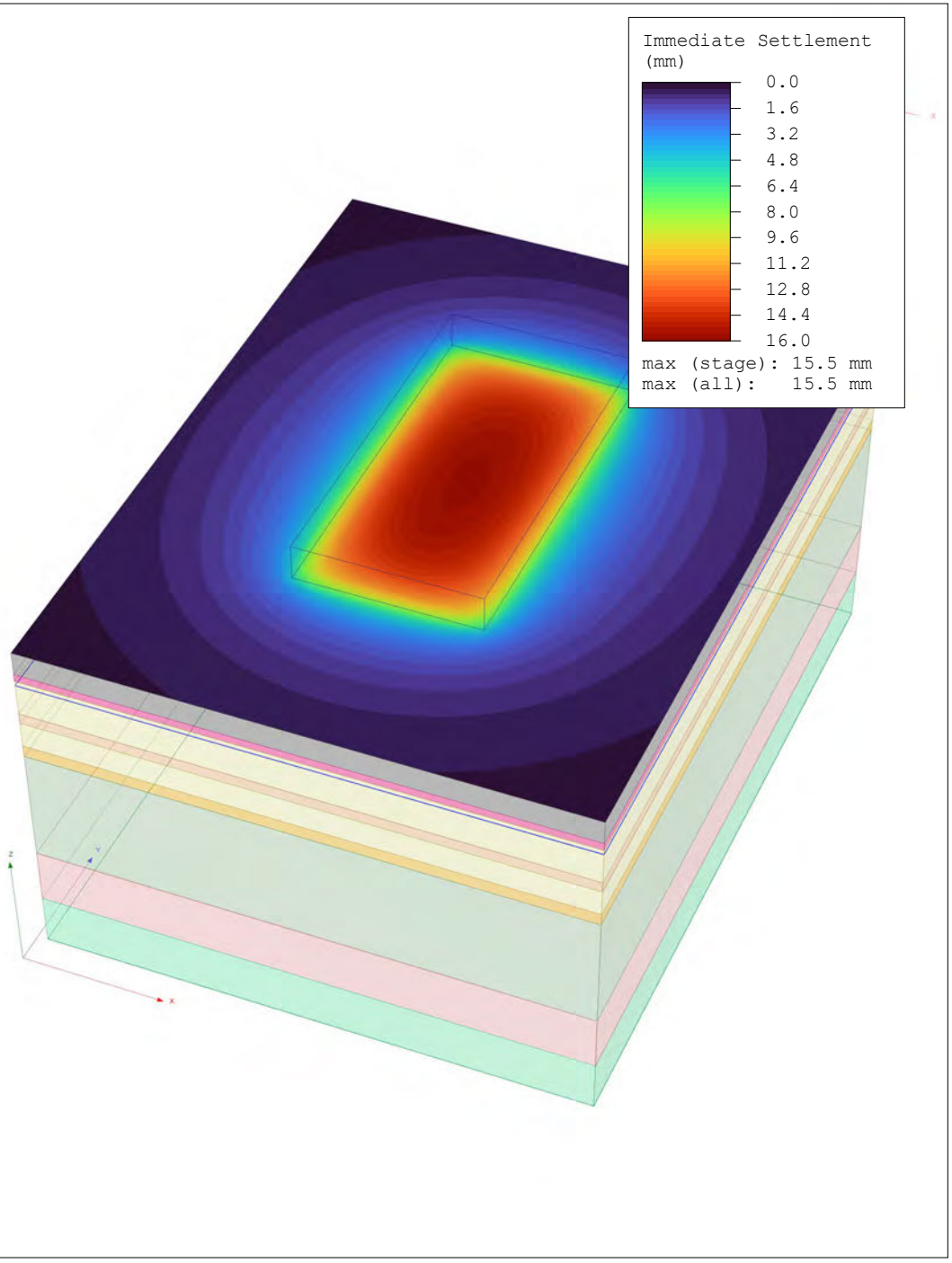

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

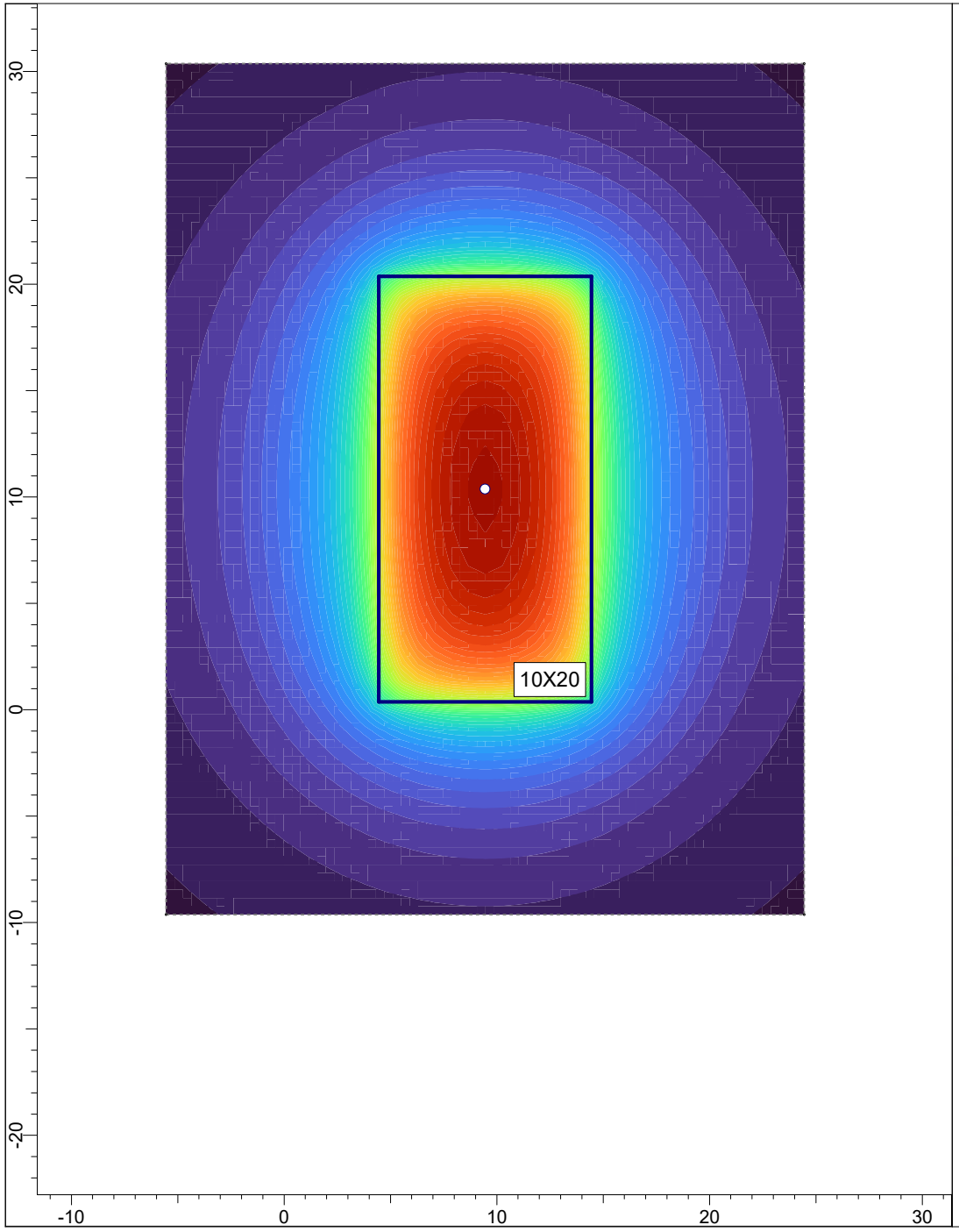

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

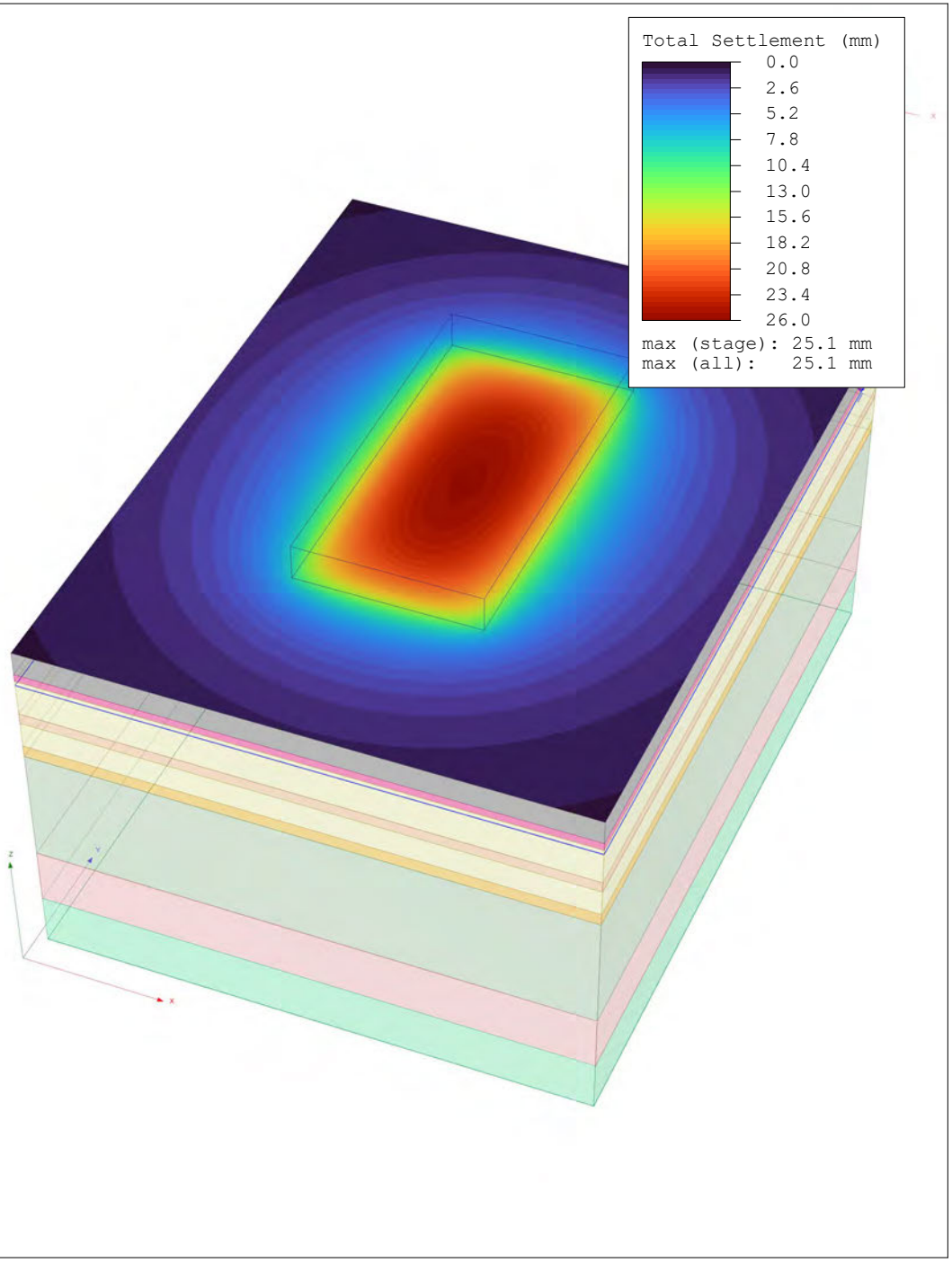

30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Total Consolidation
Settlement (mm)
0.00
0.97
1.94
2.91
3.88
4.85
5.82
6.79
7.76
8.73
9.70
max (stage): 9.6 mm
max (all): 9.6 mm


30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Immediate Settlement
(mm)
0.0
1.6
3.2
4.8
6.4
8.0
9.6
11.2
12.8
14.4
16.0
max (stage): 15.5 mm
max (all): 15.5 mm


30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.1 mm
max (all): 25.1 mm

E.2.5 Area-C Bearing Capacity Calculations

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

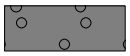
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 1.50$ m
Spread footing width $y = 1.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 1.50$ m
Column width in the direction of y $c_y = 1.50$ m

Spread footing volume = 0.45 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	112.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	185.75	26.92	Yes
50 kPa	No	0.00	0.00	50.00	185.75	26.92	Yes

Analysis of bearing capacity - partial results

φ_d = 31.700 °
c_d = 0.000 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 18.759 kN/m^3
b_{ef} = 1.500 m
N_q = 22.377
N_c = 34.612
N_γ = 26.406
s_q = 1.525
s_c = 1.550
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 260.052 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 2.52 m
Length of slip surface l_{sp} = 7.84 m

Design bearing capacity of found.soil R_d = 185.75 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 71.61 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

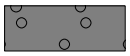
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 3.00$ m
Spread footing width $y = 3.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 3.00$ m
Column width in the direction of y $c_y = 3.00$ m

Spread footing volume = 1.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	450.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	297.00	16.84	Yes
50 kPa	No	0.00	0.00	50.00	297.00	16.84	Yes

Analysis of bearing capacity - partial results

φ_d = 31.605 °
c_d = 0.213 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 14.813 kN/m^3
b_{ef} = 3.000 m
N_q = 22.130
N_c = 34.339
N_γ = 26.003
s_q = 1.524
s_c = 1.549
s_γ = 0.700
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 415.798 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 5.03 m
Length of slip surface l_{sp} = 15.62 m

Design bearing capacity of found.soil R_d = 297.00 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 286.45 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

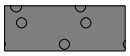
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 4.00$ m
Spread footing width $y = 6.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 4.00$ m
Column width in the direction of y $c_y = 6.00$ m

Spread footing volume = 4.80 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	1200.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	420.70	11.89	Yes
50 kPa	No	0.00	0.00	50.00	420.70	11.89	Yes

Analysis of bearing capacity - partial results

φ_d = 31.867 °
c_d = 0.273 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 13.267 kN/m^3
b_{ef} = 4.000 m
N_q = 22.819
N_c = 35.098
N_γ = 27.127
s_q = 1.352
s_c = 1.368
s_γ = 0.800
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 588.977 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 6.78 m
Length of slip surface l_{sp} = 21.13 m

Design bearing capacity of found.soil R_d = 420.70 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 763.86 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

0.00 m ≤ 0.10 m
Maximum offset of the foundation is smaller than 0.50 * thickness of foundation. Reinforcement is not requiered.

Verification of longitudinal reinforcement of foundation in the direction of y

0.00 m ≤ 0.10 m
Maximum offset of the foundation is smaller than 0.50 * thickness of foundation. Reinforcement is not requiered.

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing for punching shear failure check

Length of the critical section is equal to zero.

Spread footing for punching shear is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

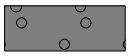
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 5.00$ m
Spread footing width $y = 10.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 5.00$ m
Column width in the direction of y $c_y = 10.00$ m

Spread footing volume = 10.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	2500.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	623.26	8.02	Yes
50 kPa	No	0.00	0.00	50.00	623.26	8.02	Yes

Analysis of bearing capacity - partial results

φ_d = 33.120 °
c_d = 0.182 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 12.227 kN/m^3
b_{ef} = 5.000 m
N_q = 26.470
N_c = 39.041
N_γ = 33.234
s_q = 1.273
s_c = 1.284
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 872.566 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 8.86 m
Length of slip surface l_{sp} = 28.22 m

Design bearing capacity of found.soil R_d = 623.26 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 1591.38 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

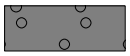
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 7.50$ m
Spread footing width $y = 12.50$ m
Column shape rectangle
Column width in the direction of x $c_x = 7.50$ m
Column width in the direction of y $c_y = 12.50$ m

Spread footing volume = 18.75 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	4687.50	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	991.45	5.04	Yes
50 kPa	No	0.00	0.00	50.00	991.45	5.04	Yes

Analysis of bearing capacity - partial results

φ_d = 34.320 °
c_d = 0.099 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 11.118 kN/m^3
b_{ef} = 7.500 m
N_q = 30.614
N_c = 43.380
N_γ = 40.432
s_q = 1.338
s_c = 1.350
s_γ = 0.820
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1388.034 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 13.93 m
Length of slip surface l_{sp} = 45.33 m

Design bearing capacity of found.soil R_d = 991.45 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

Horizontal bearing capacity R_{dh} = 2983.84 kN
Extreme horizontal force H = 0.00 kN

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Spread footing verification

Input data

Project

Date : 20-Oct-22

Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
Restriction of influence zone : by percentage of Sigma,Or
Coeff. of restriction of influence zone : 10.0 [%]

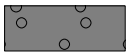
Spread Footing

Verification methodology : according to EN 1997
Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
Analysis of uplift : Standard
Allowable eccentricity : 0.333
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)					
Permanent design situation					
		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	γ_{Rvs} =	1.40	[–]
Partial factor on sliding resistance :	γ_{Rhs} =	1.10	[–]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Unit_1a		34.00	0.00	18.30	8.30	
2	Unit_1b		36.00	0.00	19.30	9.30	
3	Unit_2a		28.00	1.00	16.60	6.60	
4	Unit_2b		30.00	1.00	18.10	8.10	
5	Unit_2c		30.00	1.00	18.80	8.80	
6	Unit_3		19.00	170.00	19.90	9.90	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
7	Engineering_Fill		35.00	0.00	20.00	10.00	
8	Unit_0		30.00	0.00	17.00	7.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Unit_1a

Unit weight : γ = 18.30 kN/m^3
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 18.30 kN/m^3

Unit_1b

Unit weight : γ = 19.30 kN/m^3
Angle of internal friction : φ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.30 kN/m^3

Unit_2a

Unit weight : γ = 16.60 kN/m^3
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 16.60 kN/m^3

Unit_2b

Unit weight : γ = 18.10 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.10 kN/m^3

Unit_2c

Unit weight : γ = 18.80 kN/m^3
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 18.80 kN/m^3

Unit_3

Unit weight : γ = 19.90 kN/m^3
Angle of internal friction : φ_{ef} = 19.00 °
Cohesion of soil : c_{ef} = 170.00 kPa
Saturated unit weight : γ_{sat} = 19.90 kN/m^3

Engineering_Fill

Unit weight : γ = 20.00 kN/m^3
Angle of internal friction : φ_{ef} = 35.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Unit_0

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight : $\gamma = 17.00$ kN/m^3
Angle of internal friction : $\varphi_{ef} = 30.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Foundation

Foundation type: centric spread footing
Depth from original ground surface $h_z = 0.45$ m
Depth of footing bottom $d = 0.00$ m
Foundation thickness $t = 0.20$ m
Incl. of finished grade $s_1 = 0.00$ °
Incl. of footing bottom $s_2 = 0.00$ °

Overburden
Type: from geological profile

Geometry of structure

Foundation type: centric spread footing
Spread footing length $x = 10.00$ m
Spread footing width $y = 20.00$ m
Column shape rectangle
Column width in the direction of x $c_x = 10.00$ m
Column width in the direction of y $c_y = 20.00$ m

Spread footing volume = 40.00 m^3
Volume of excavation = 0.00 m^3
Volume of fill = 0.00 m^3

Material of structure

Unit weight $\gamma = 0.00$ kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25
Cylinder compressive strength $f_{ck} = 20.00$ MPa
Tensile strength $f_{ctm} = 2.20$ MPa
Elasticity modulus $E_{cm} = 30000.00$ MPa

Longitudinal steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Transverse steel: B500B
Yield strength $f_{yk} = 500.00$ MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.50	0.00 .. 1.50	Engineering_Fill	
2	1.90	1.50 .. 3.40	Unit_0	
3	0.90	3.40 .. 4.30	Unit_1a	
4	0.80	4.30 .. 5.10	Unit_2a	

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
5	1.40	5.10 .. 6.50	Unit_1a	
6	0.90	6.50 .. 7.40	Unit_2b	
7	7.50	7.40 .. 14.90	Unit_1b	
8	4.10	14.90 .. 19.00	Unit_2c	
9	5.30	19.00 .. 24.30	Unit_3	
10	-	24.30 .. ∞	Unit_3	

Load

No.	Load		Name	Type	N [kN]	M_x [kNm]	M_y [kNm]	H_x [kN]	H_y [kN]
	new	change							
1	Yes		50 kPa	Design	10000.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions
The settlement is not analyzed.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e_x [m]	e_y [m]	σ [kPa]	R_d [kPa]	Utilization [%]	Is satisfactory
50 kPa	Yes	0.00	0.00	50.00	1094.78	4.57	Yes
50 kPa	No	0.00	0.00	50.00	1094.78	4.57	Yes

Analysis of bearing capacity - partial results

φ_d = 33.140 °
c_d = 0.334 kPa
γ_{1prum} = 0.000 kN/m^3
γ_{2prum} = 10.698 kN/m^3
b_{ef} = 10.000 m
N_q = 26.533
N_c = 39.108
N_γ = 33.340
s_q = 1.273
s_c = 1.284
s_γ = 0.850
d_q = 1.000
d_c = 1.000

[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

d_γ = 1.000
i_q = 1.000
i_c = 1.000
i_γ = 1.000
b_q = 1.000
b_c = 1.000
b_γ = 1.000
g_q = 1.000
g_c = 1.000
g_γ = 1.000
R_d = 1532.695 kPa

Analysis carried out with automatic selection of the most unfavourable load cases.
Computed weight of spread footing G = 0.00 kN
Computed weight of overburden Z = 0.00 kN

Vertical bearing capacity check

Shape of contact stress : rectangle
Most unfavorable load case No. 1. (50 kPa)

Parameters of slip surface below foundation:
Depth of slip surface z_{sp} = 17.72 m
Length of slip surface l_{sp} = 56.45 m

Design bearing capacity of found.soil R_d = 1094.78 kPa
Extreme contact stress σ = 50.00 kPa

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length e_x = 0.000<0.333
Max. eccentricity in direction of base width e_y = 0.000<0.333
Max. overall eccentricity e_t = 0.000<0.333

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (50 kPa)
Earth resistance: at rest
Design magnitude of earth resistance S_{pd} = 0.00 kN

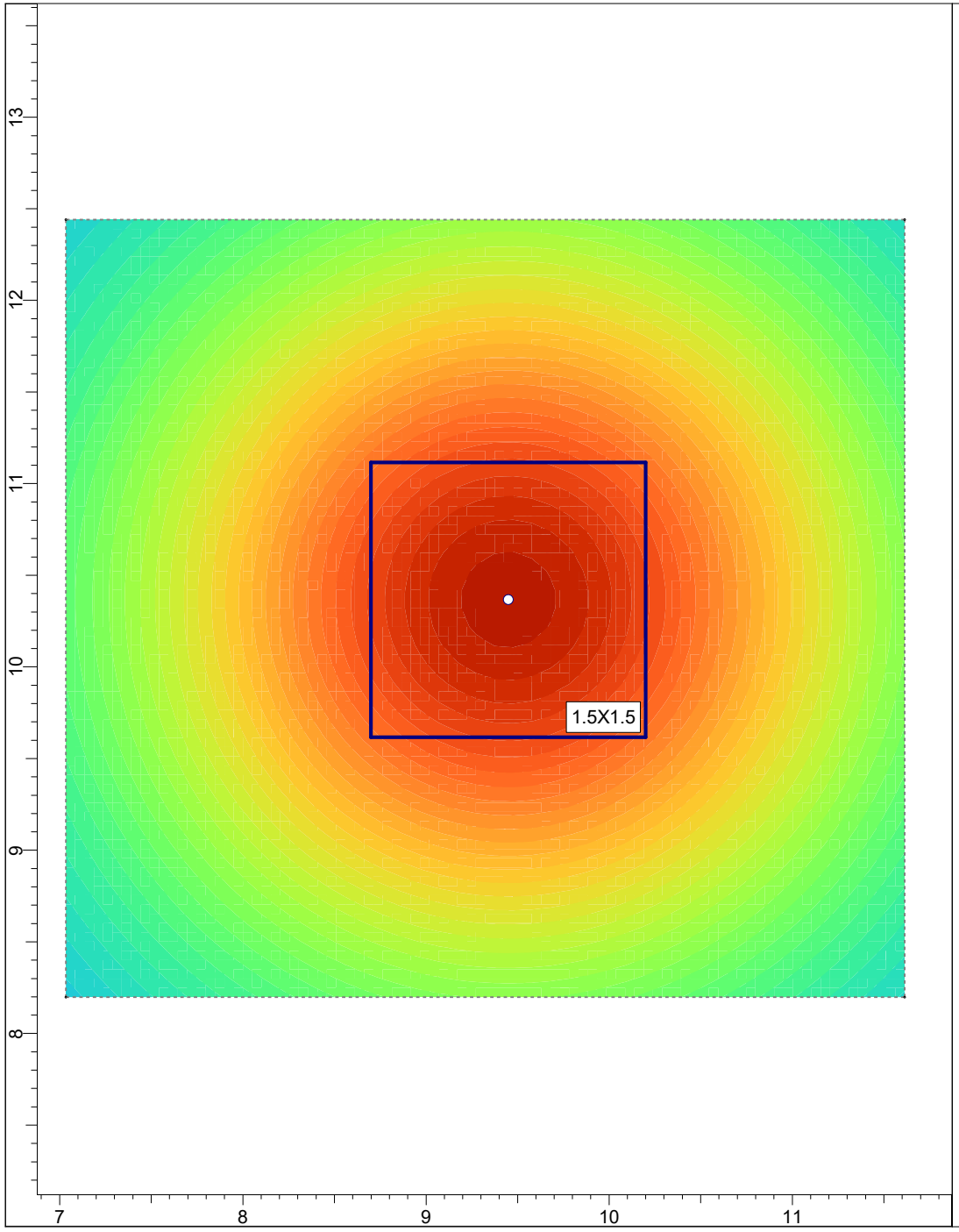
Horizontal bearing capacity R_{dh} = 6365.52 kN
Extreme horizontal force H = 0.00 kN

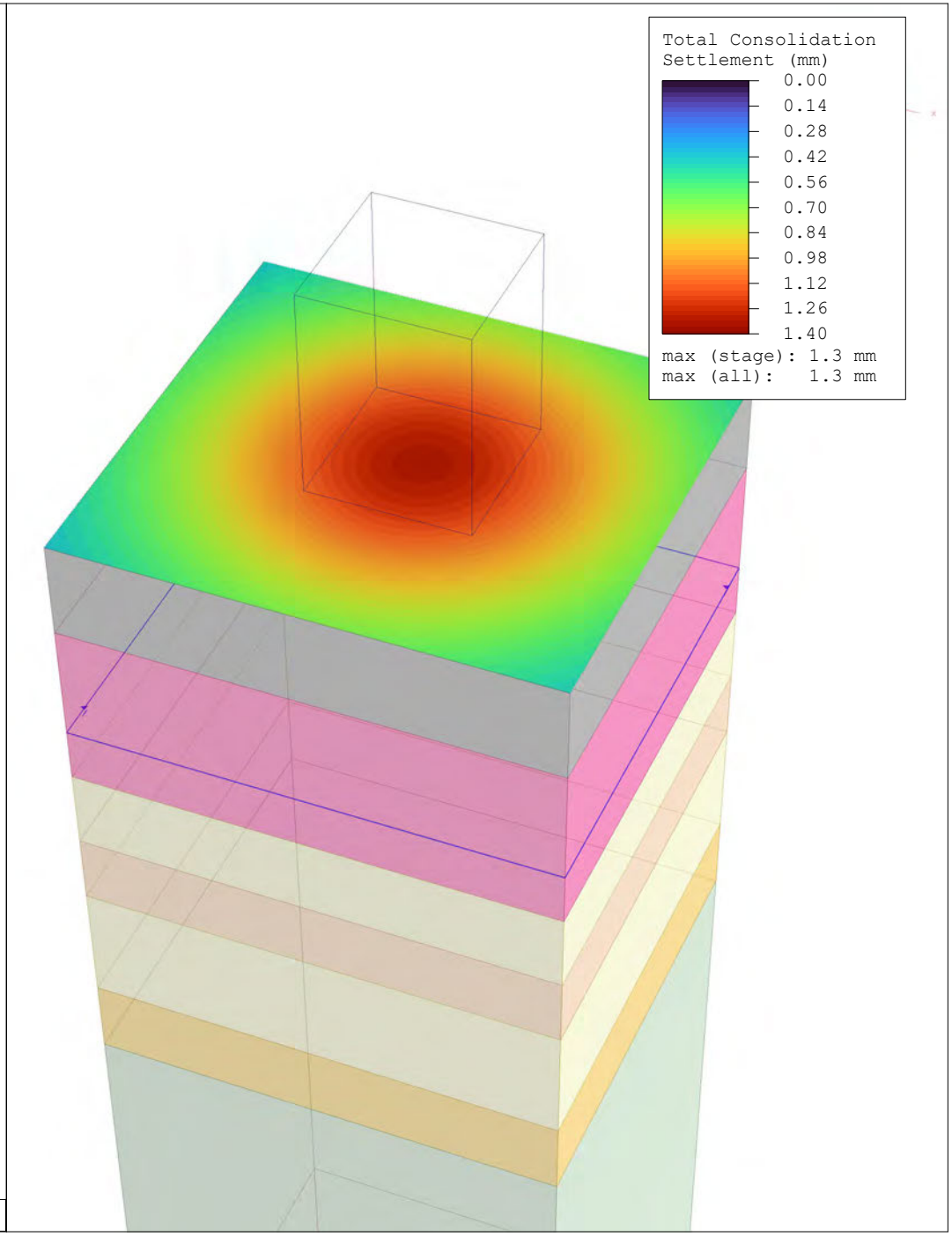
Bearing capacity in the horizontal direction is SATISFACTORY

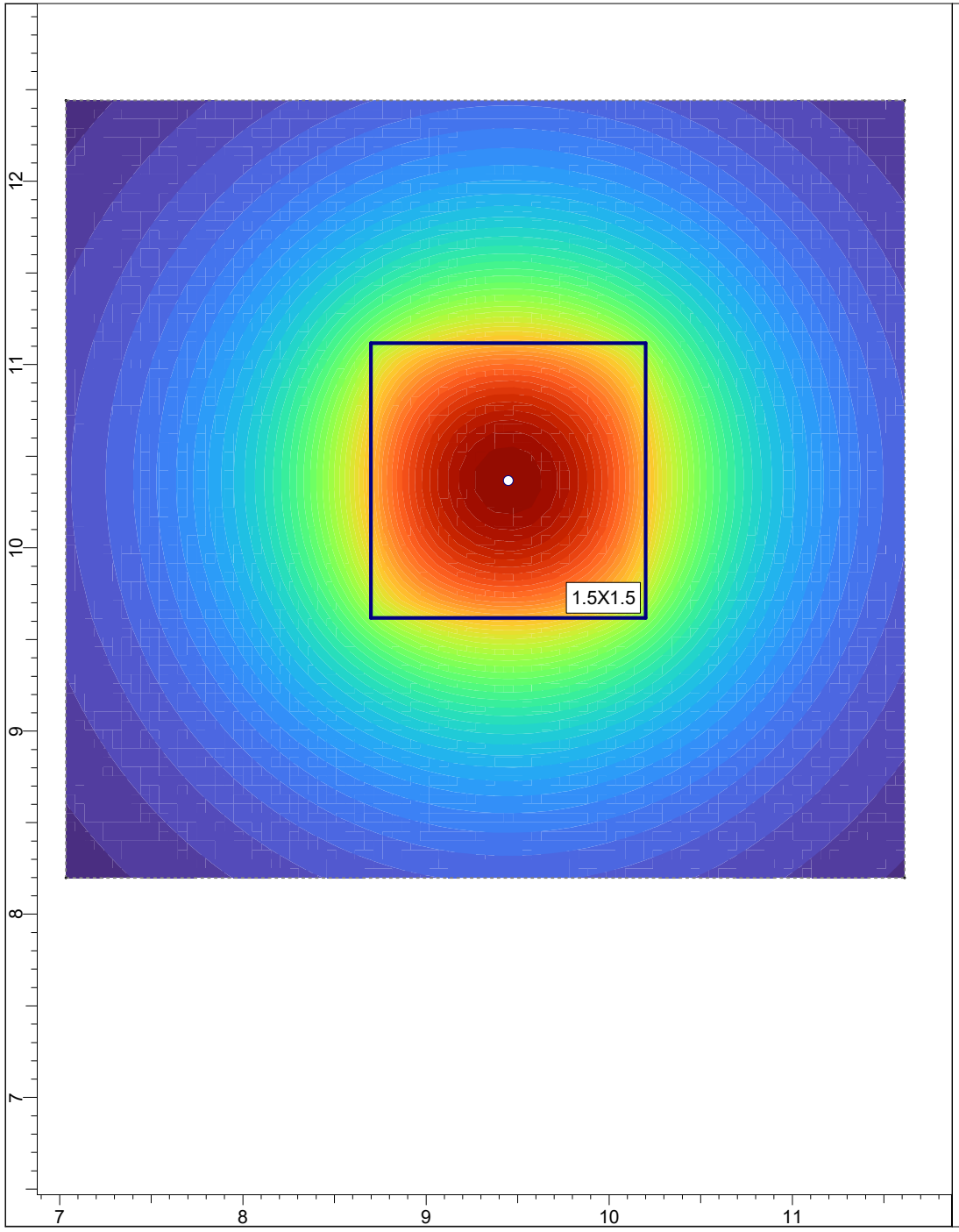
Bearing capacity of foundation is SATISFACTORY

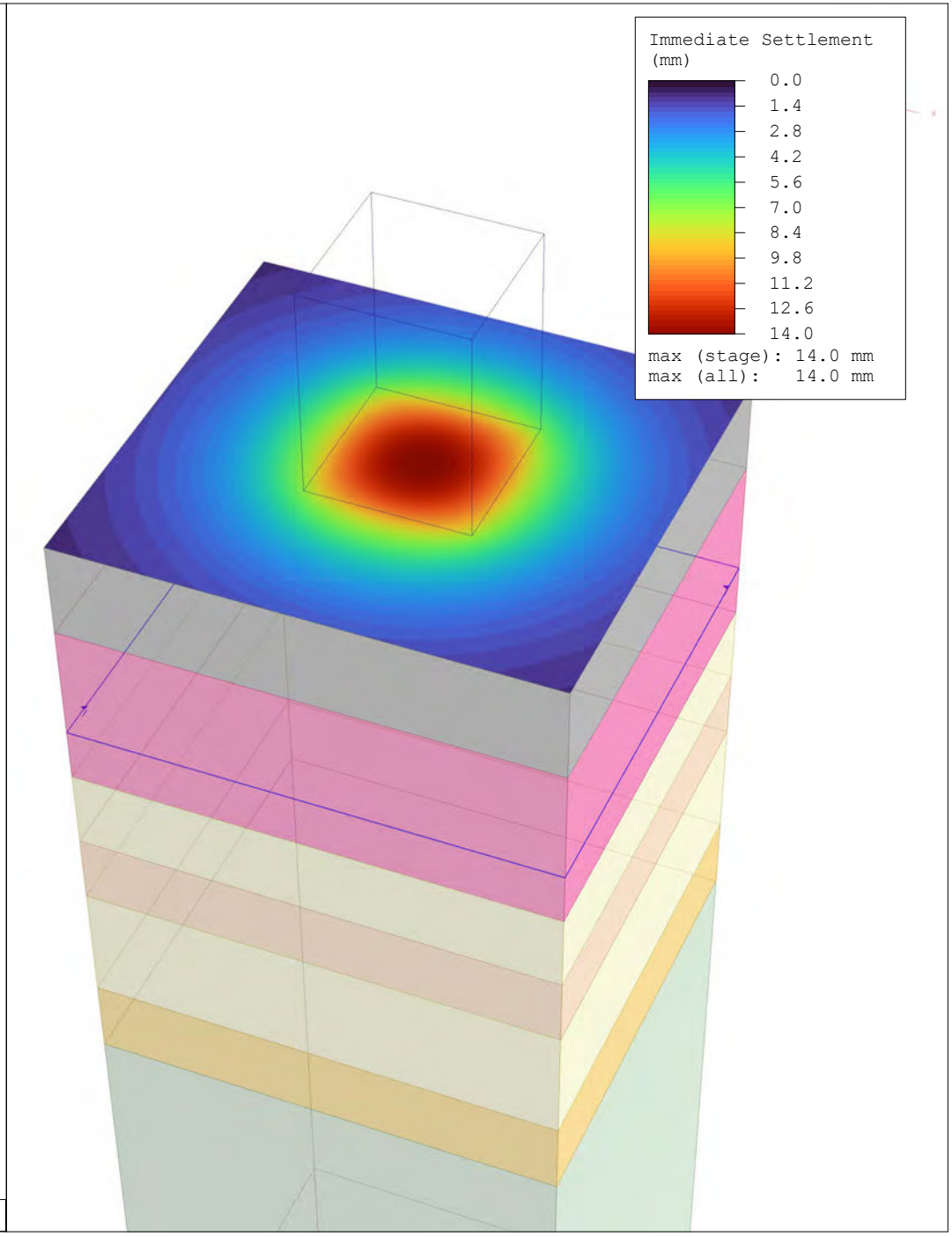
[GEO5 - Spread Footing (64 bit) | version 5.2022.66.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

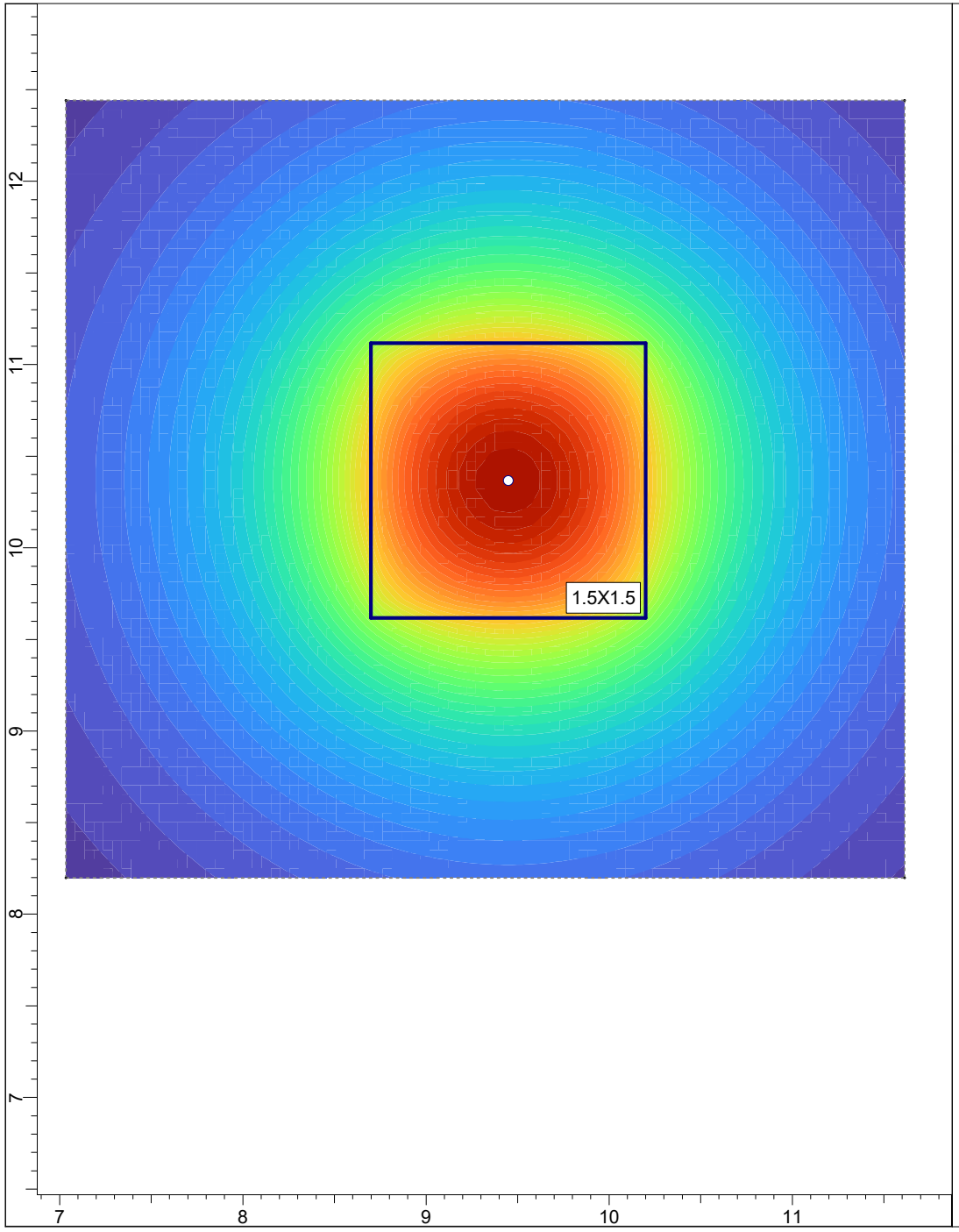
E.2.6 Area-C Foundation Settlement Diagrams

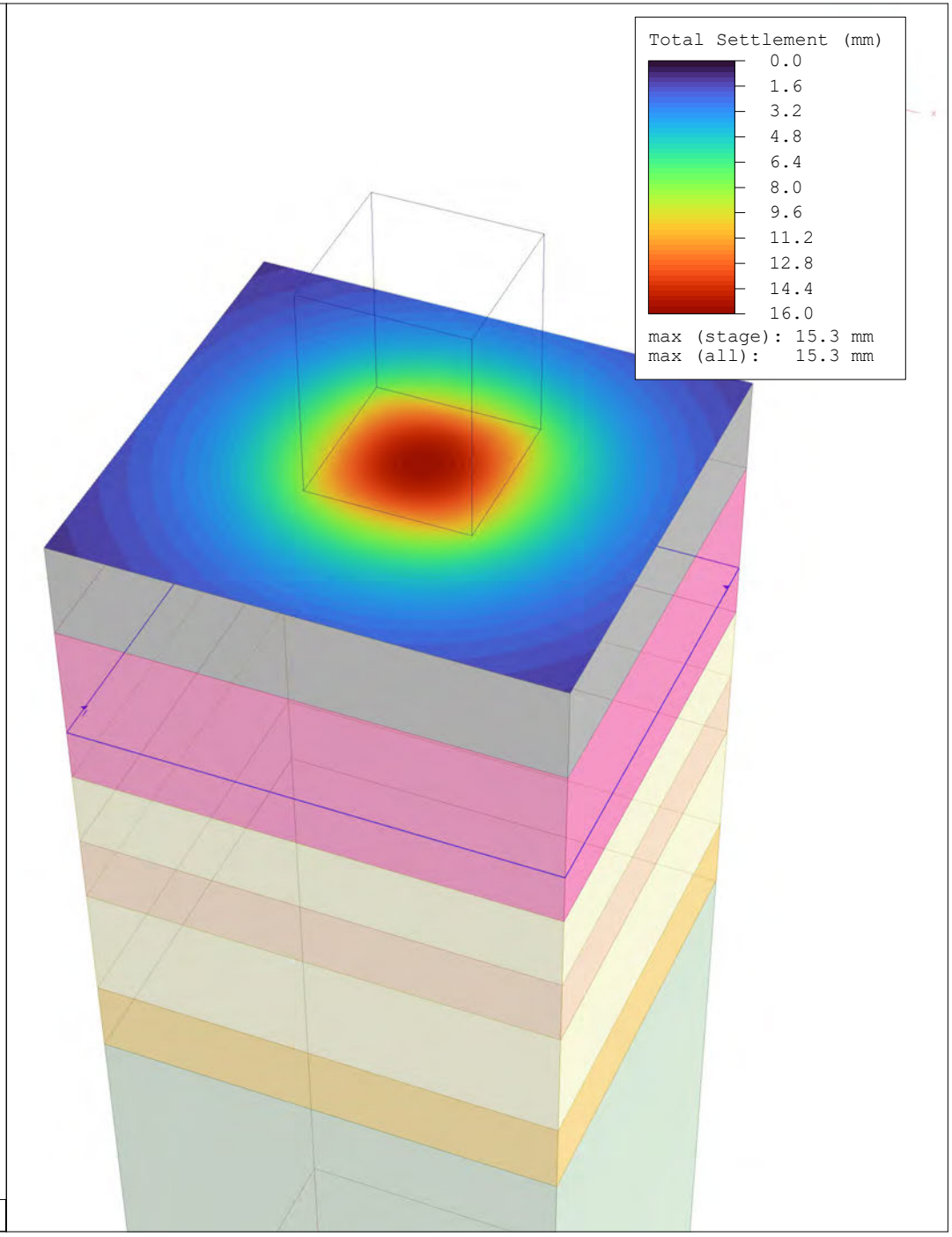

13
12
11
10
9
8
7
8
9
10
11
1.5X1.5

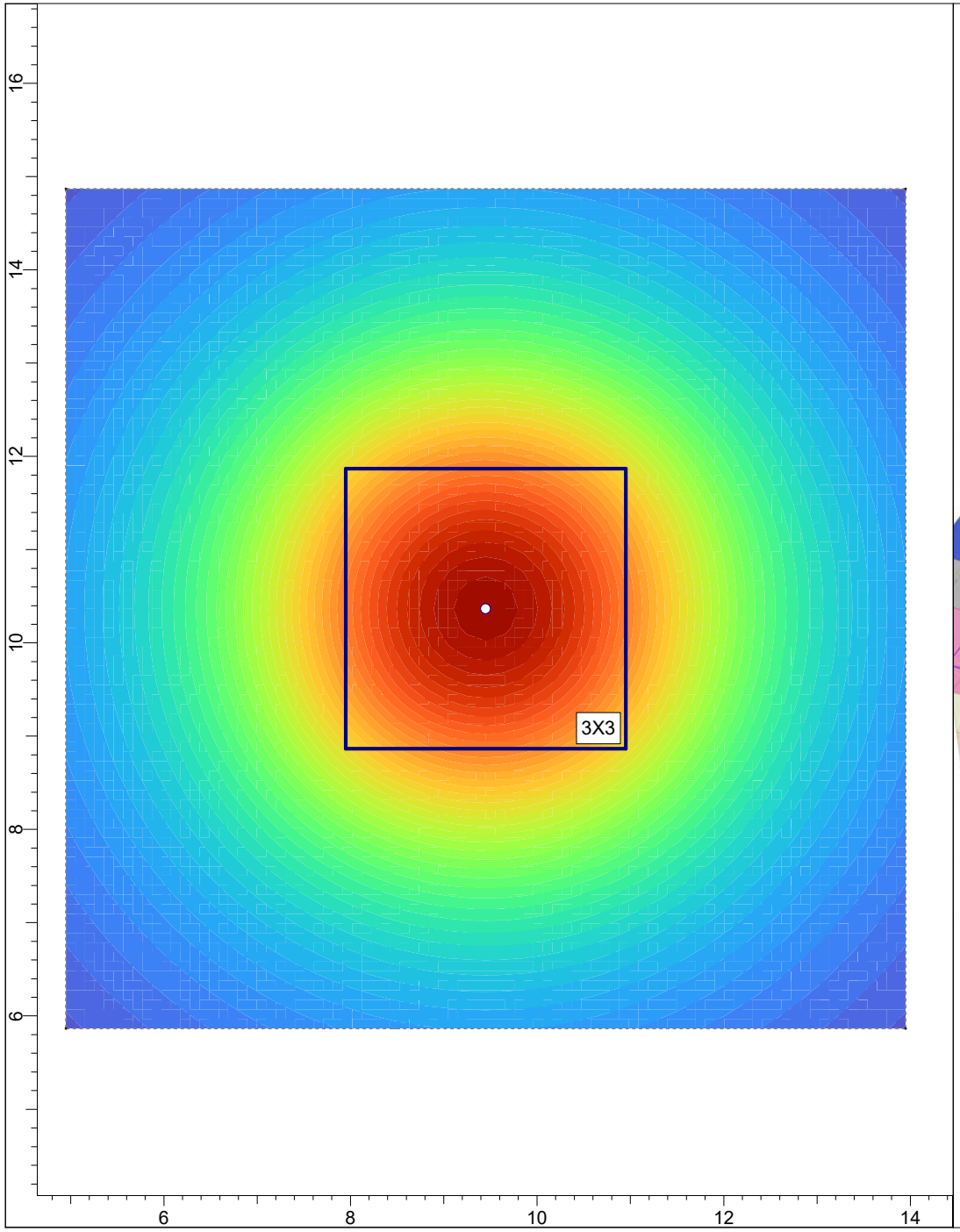

Total Consolidation
Settlement (mm)
0.00
0.14
0.28
0.42
0.56
0.70
0.84
0.98
1.12
1.26
1.40
max (stage): 1.3 mm
max (all): 1.3 mm

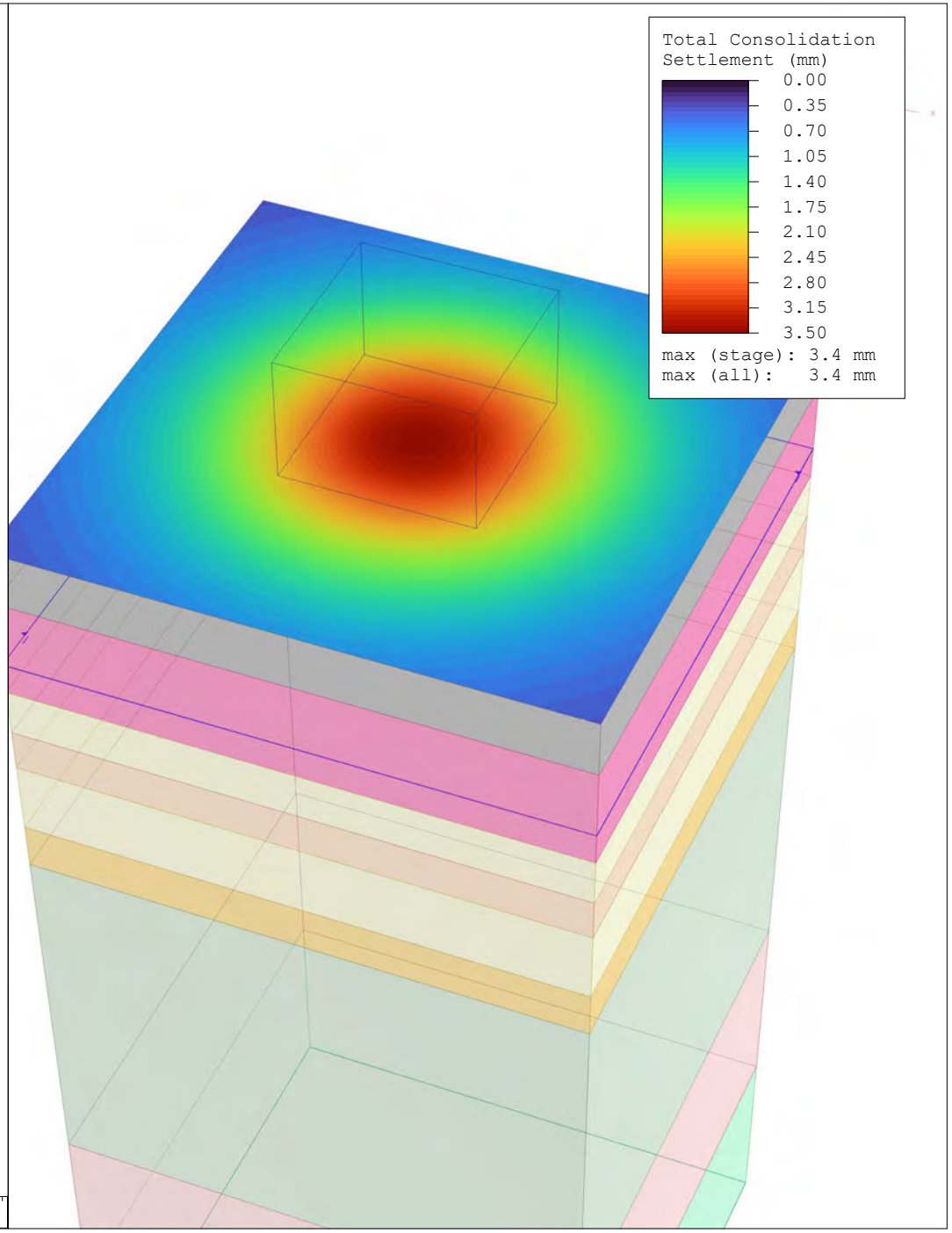

12
11
10
9
8
7
7
8
9
10
11
1.5X1.5

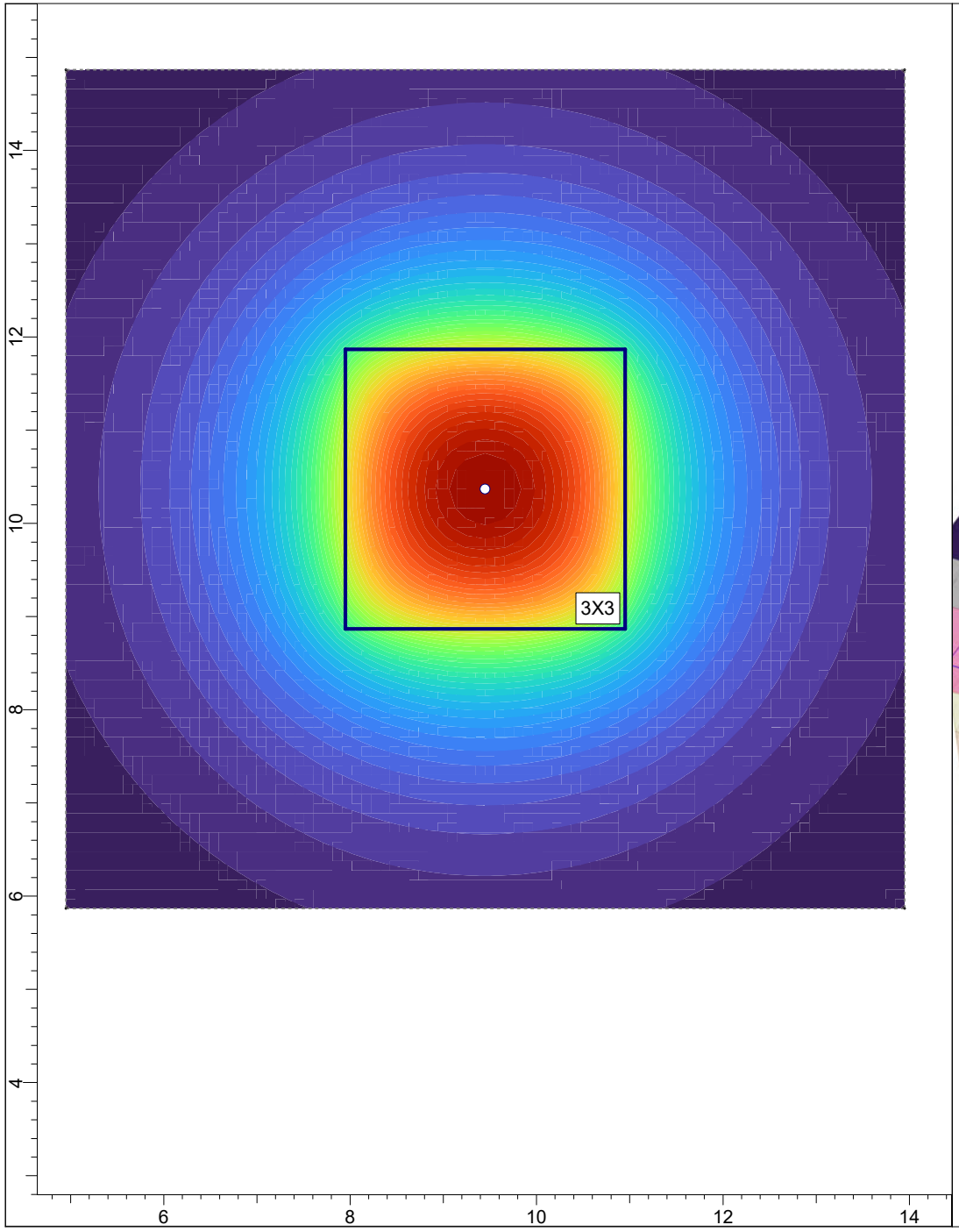

Immediate Settlement
(mm)
0.0
1.4
2.8
4.2
5.6
7.0
8.4
9.8
11.2
12.6
14.0
max (stage): 14.0 mm
max (all): 14.0 mm

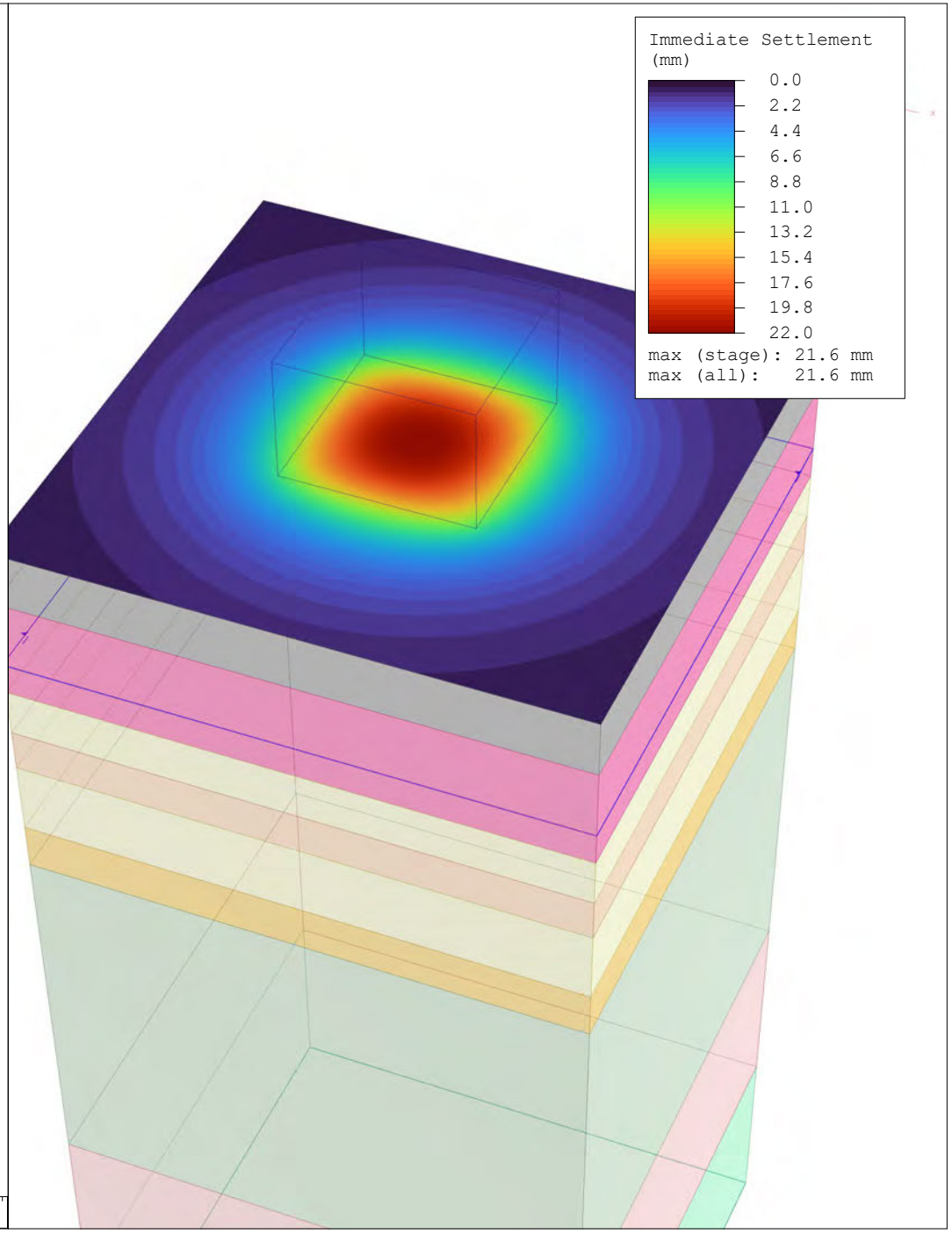

12
11
10
9
8
7
7
8
9
10
11
1.5X1.5

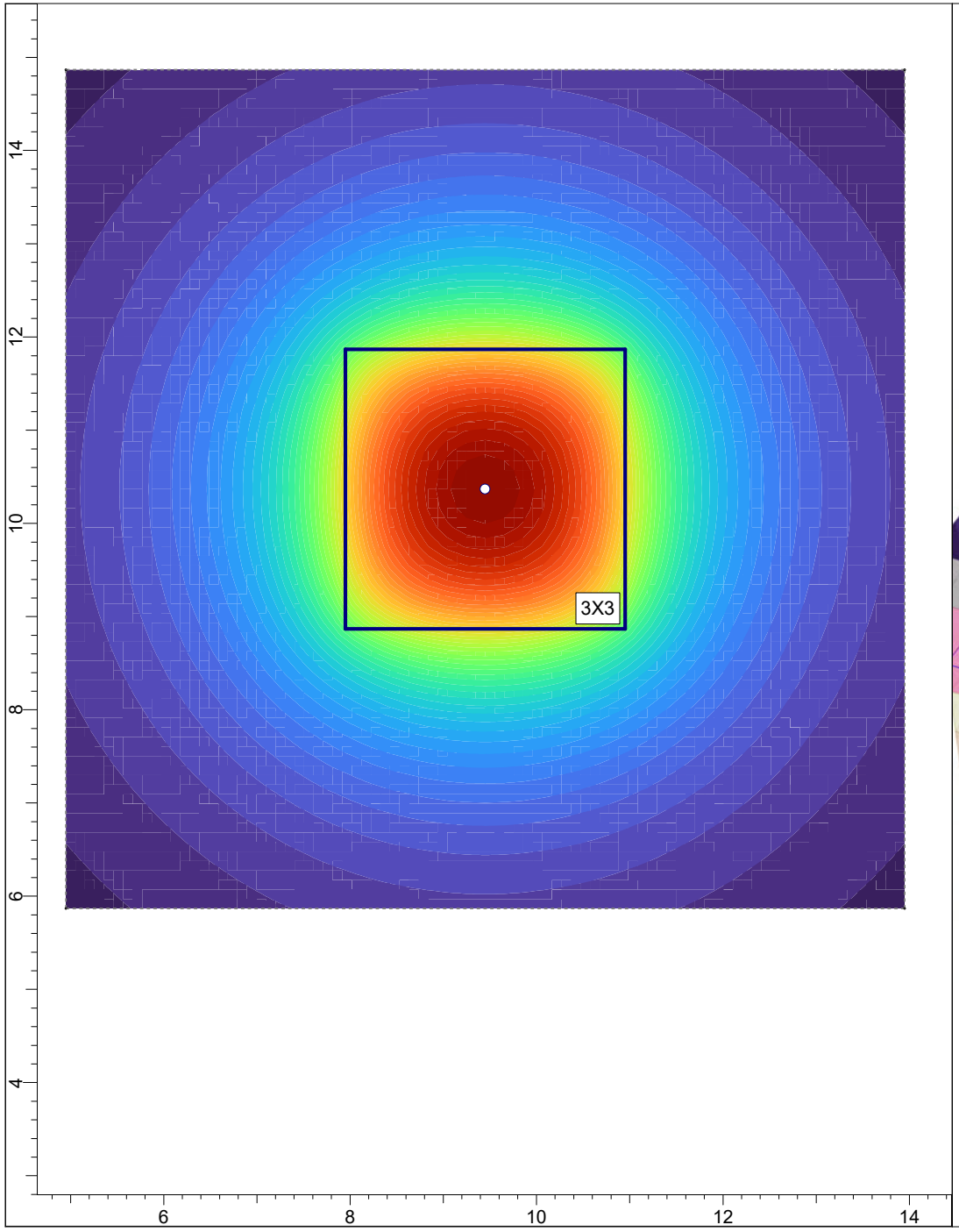

Total Settlement (mm)
0.0
1.6
3.2
4.8
6.4
8.0
9.6
11.2
12.8
14.4
16.0
max (stage): 15.3 mm
max (all): 15.3 mm

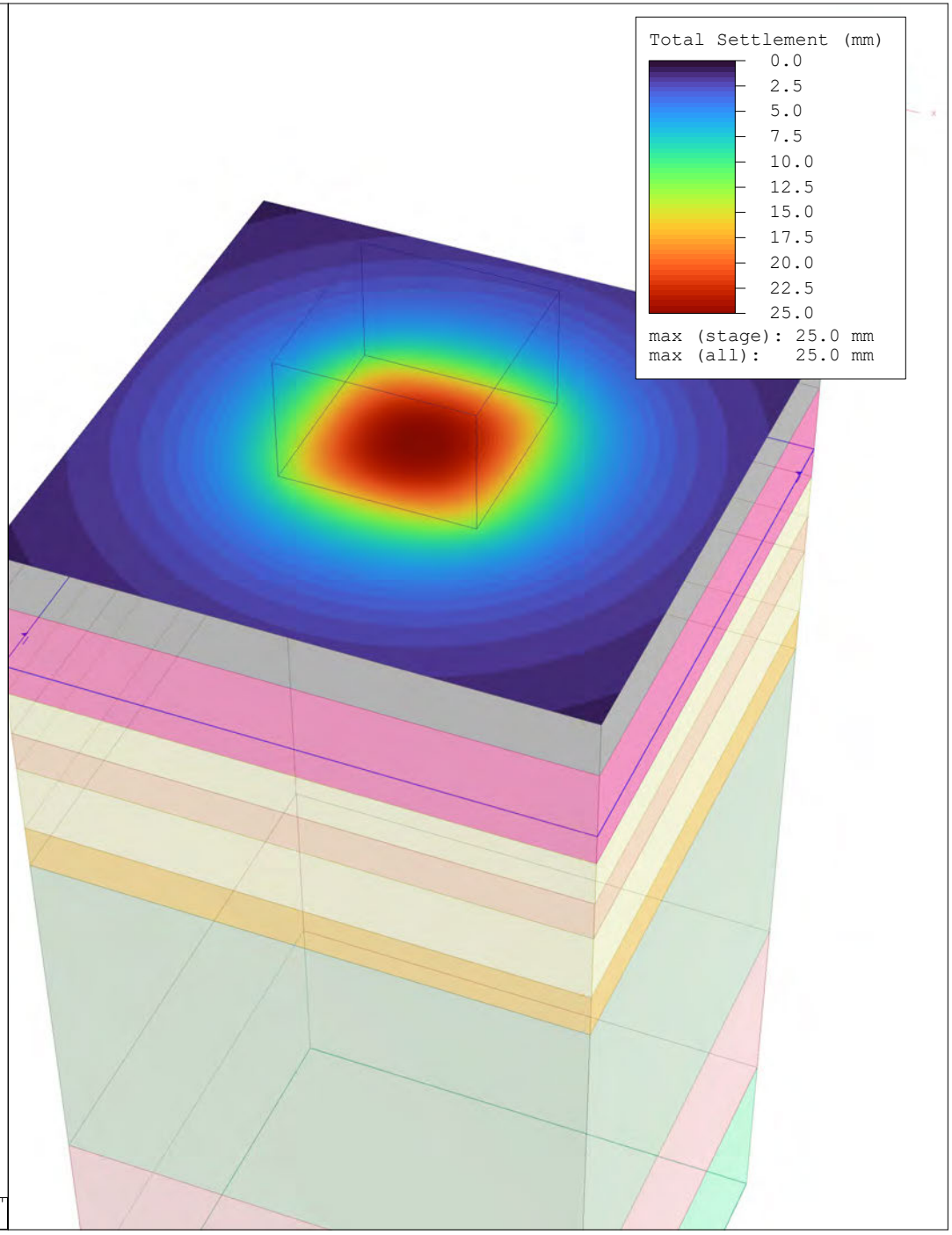

16
14
12
10
8
6
6
8
10
12
14
3X3

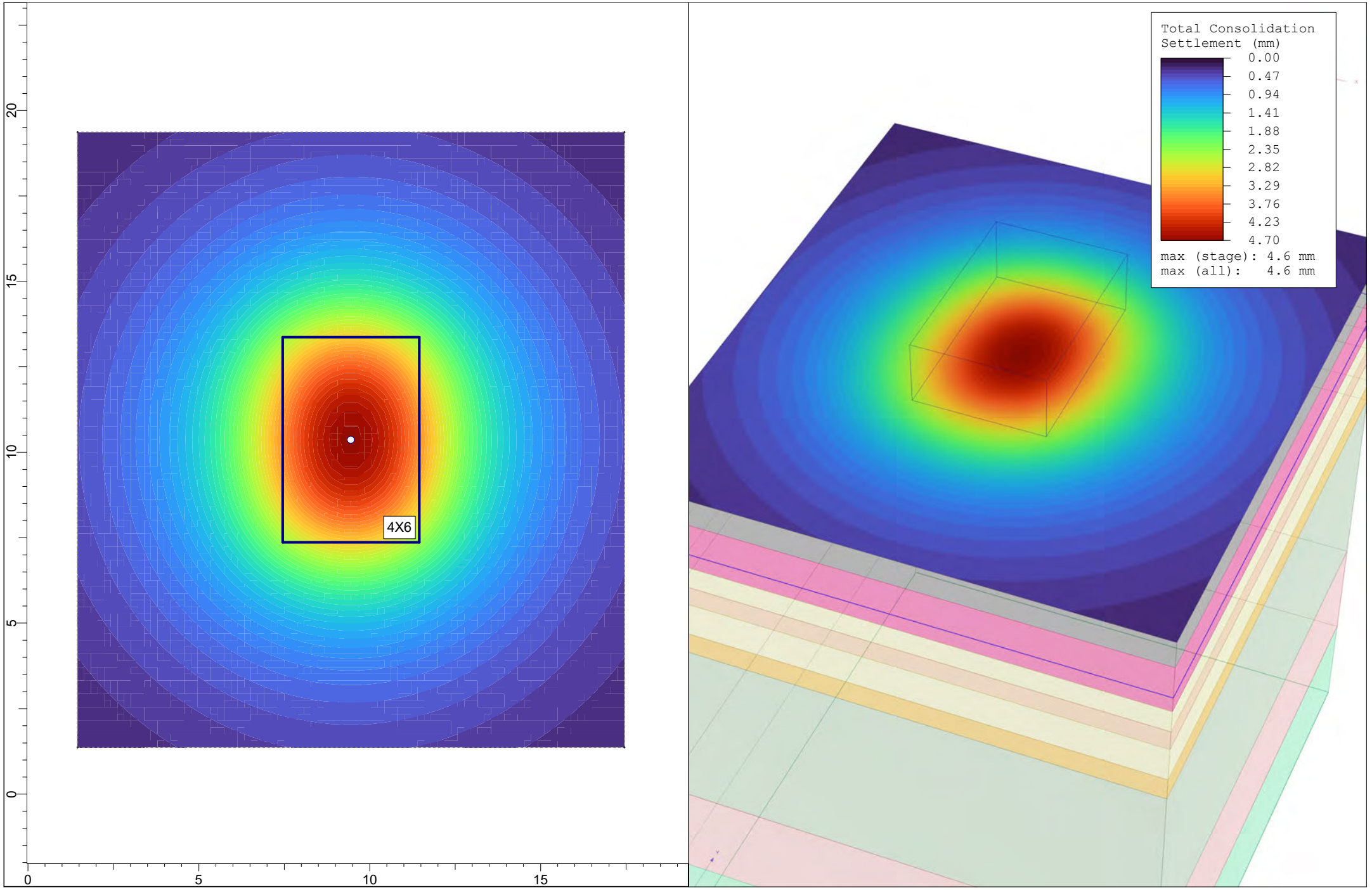

Total Consolidation
Settlement (mm)
0.00
0.35
0.70
1.05
1.40
1.75
2.10
2.45
2.80
3.15
3.50
max (stage): 3.4 mm
max (all): 3.4 mm

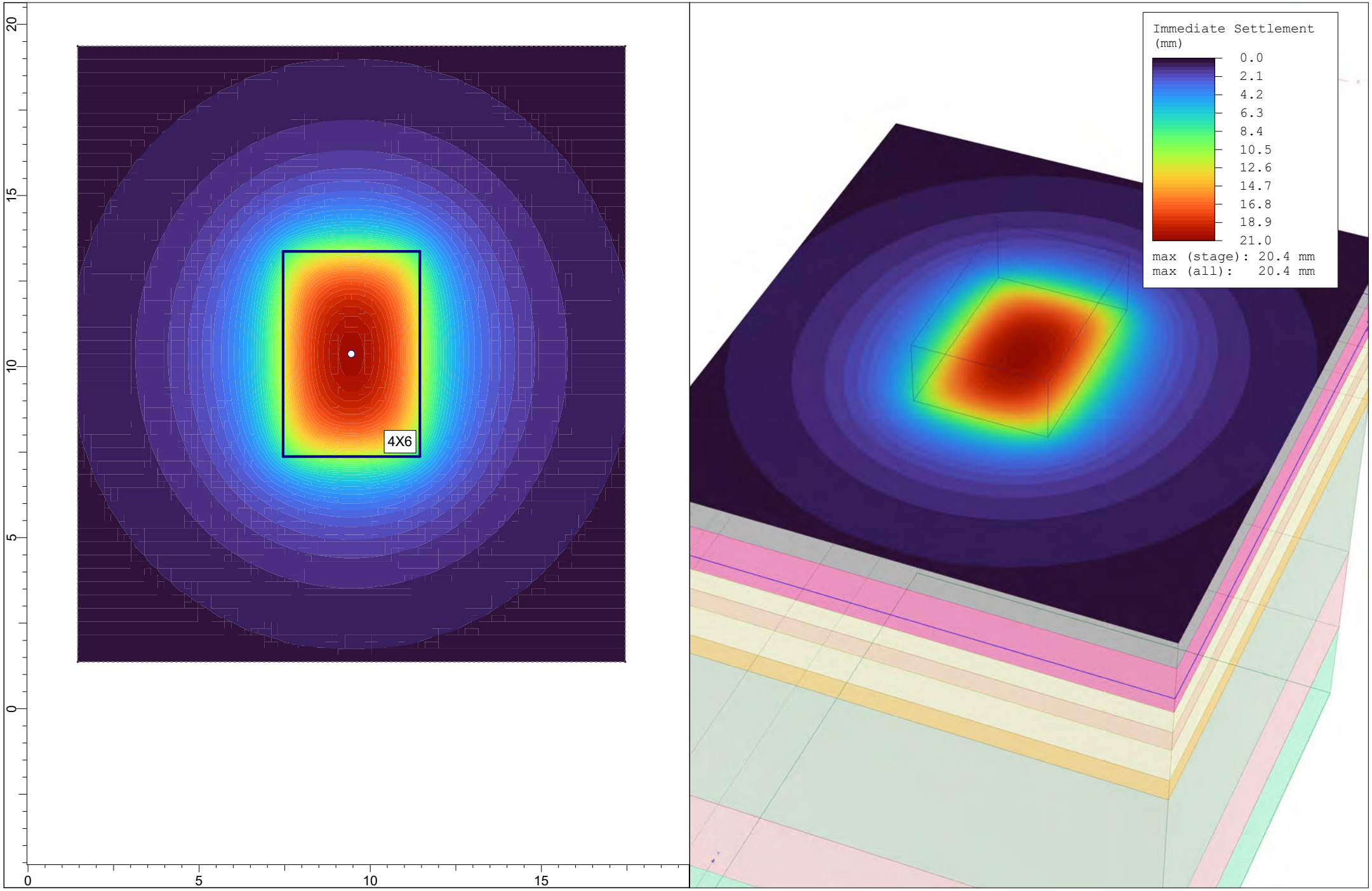

3X3
14
12
10
8
6
4
6
8
10
12
14

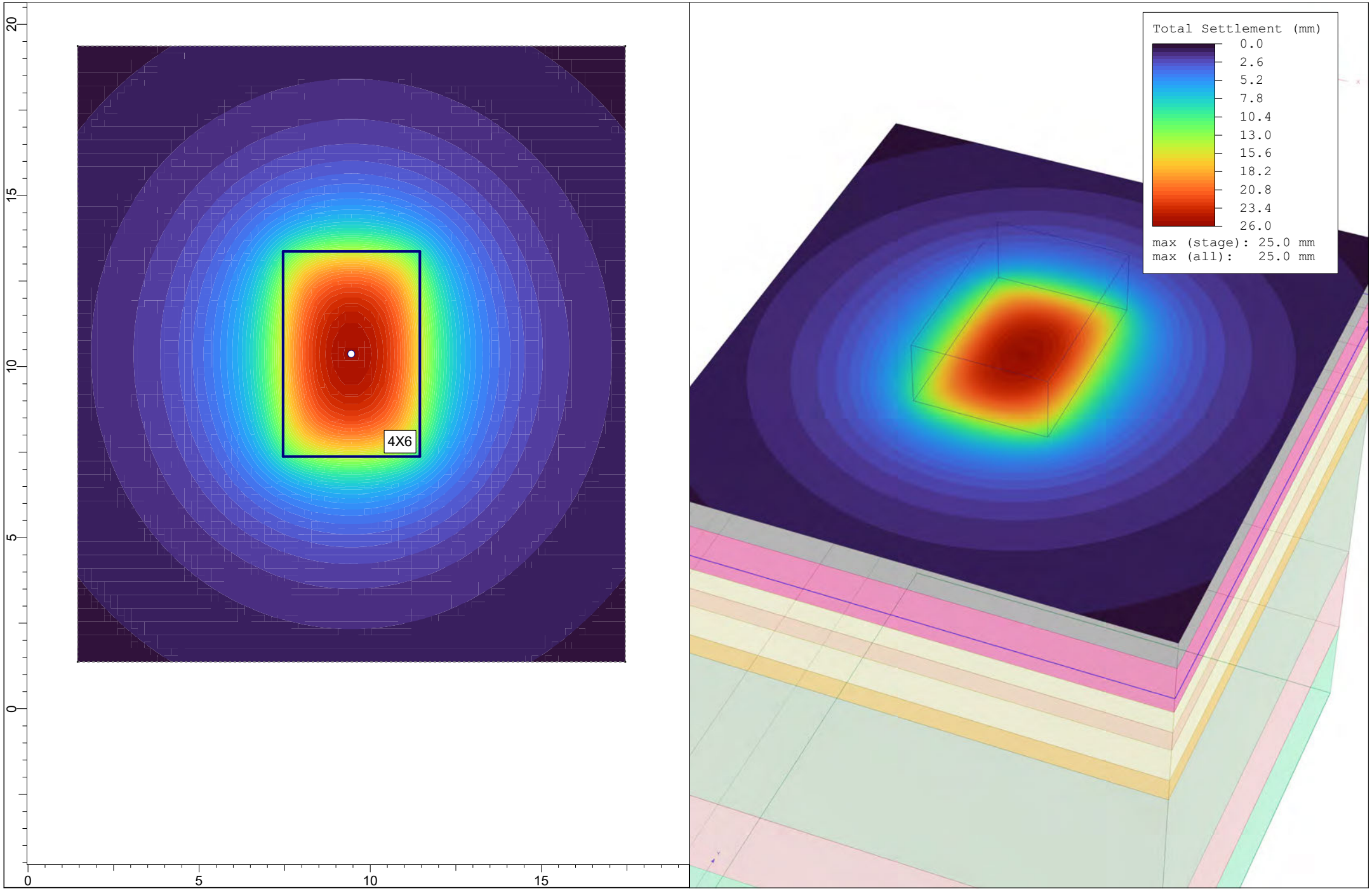

Immediate Settlement
(mm)
0.0
2.2
4.4
6.6
8.8
11.0
13.2
15.4
17.6
19.8
22.0
max (stage): 21.6 mm
max (all): 21.6 mm

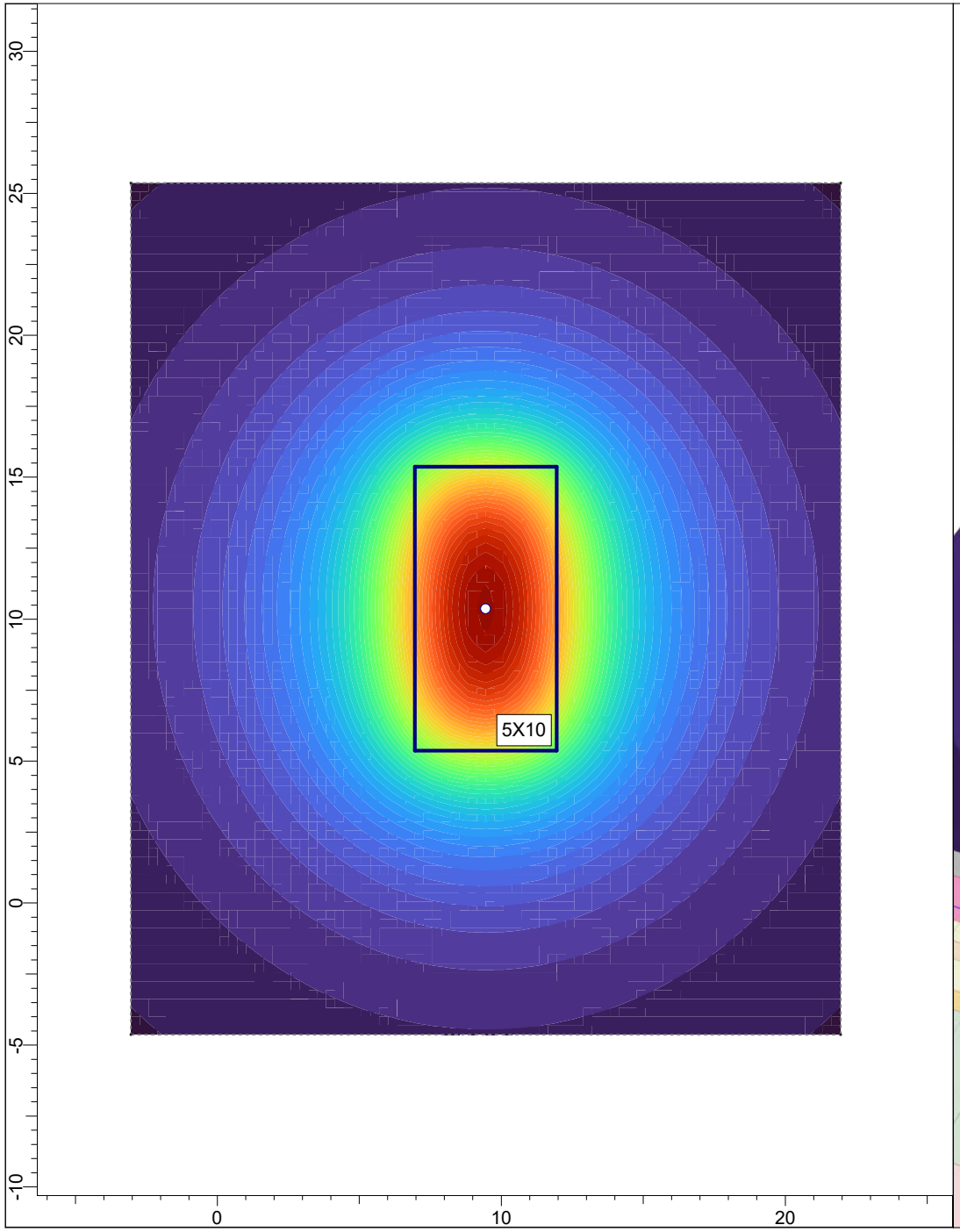

14
12
10
8
6
4
6
8
10
12
14
3X3

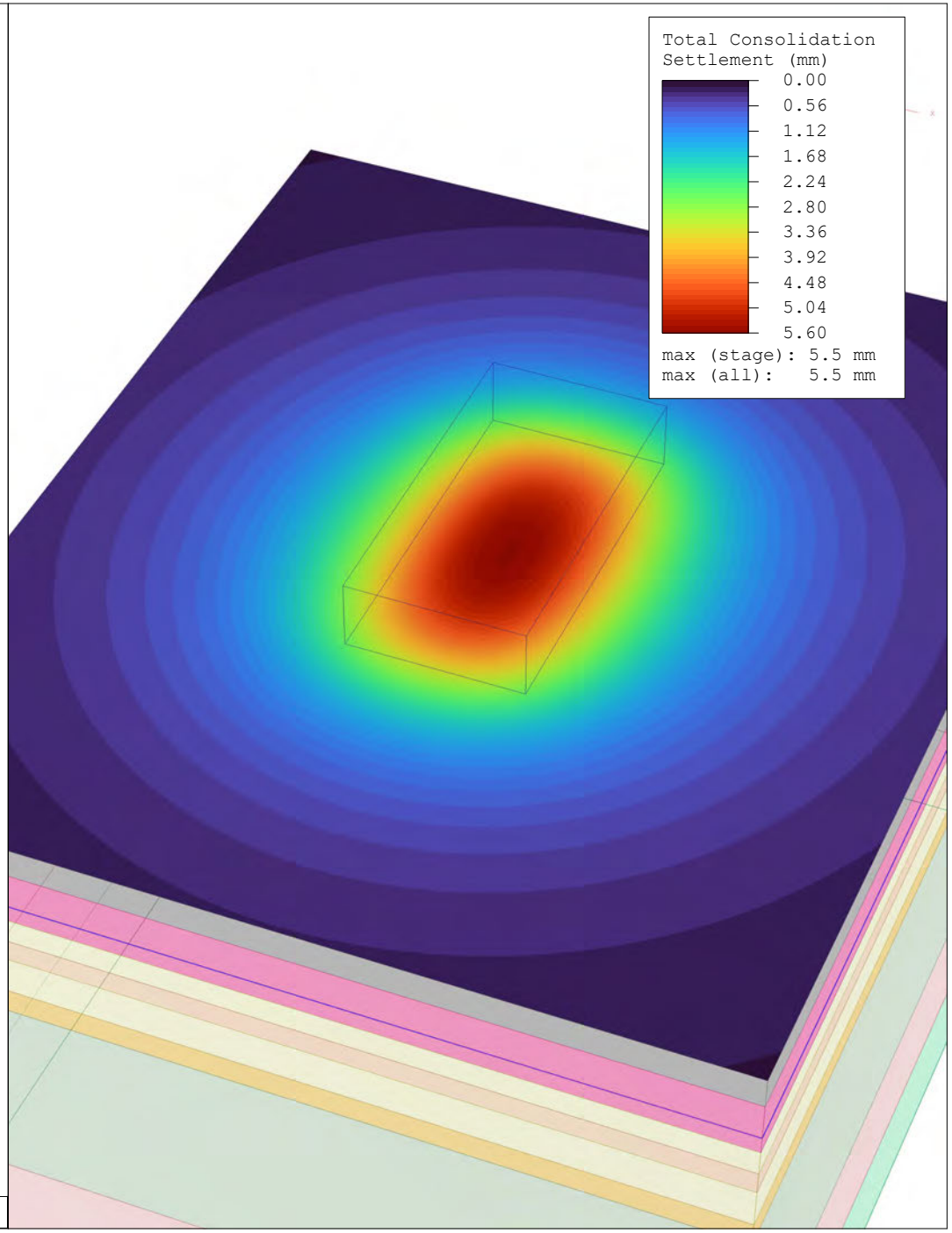

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 25.0 mm
max (all): 25.0 mm

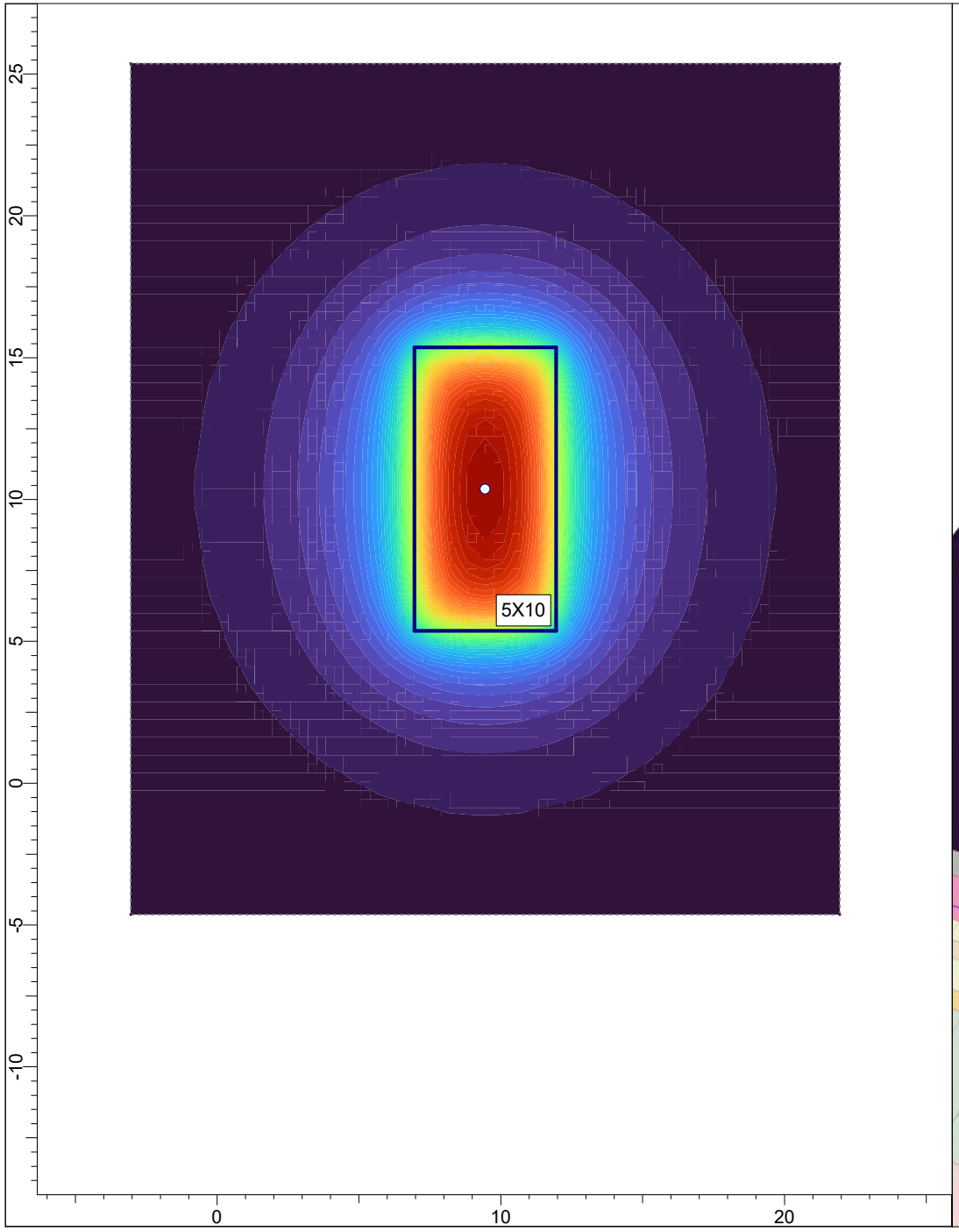

Total Consolidation
Settlement (mm)
0.00
0.47
0.94
1.41
1.88
2.35
2.82
3.29
3.76
4.23
4.70
max (stage): 4.6 mm
max (all): 4.6 mm
4X6
0
5
10
15
20
0
5
10
15

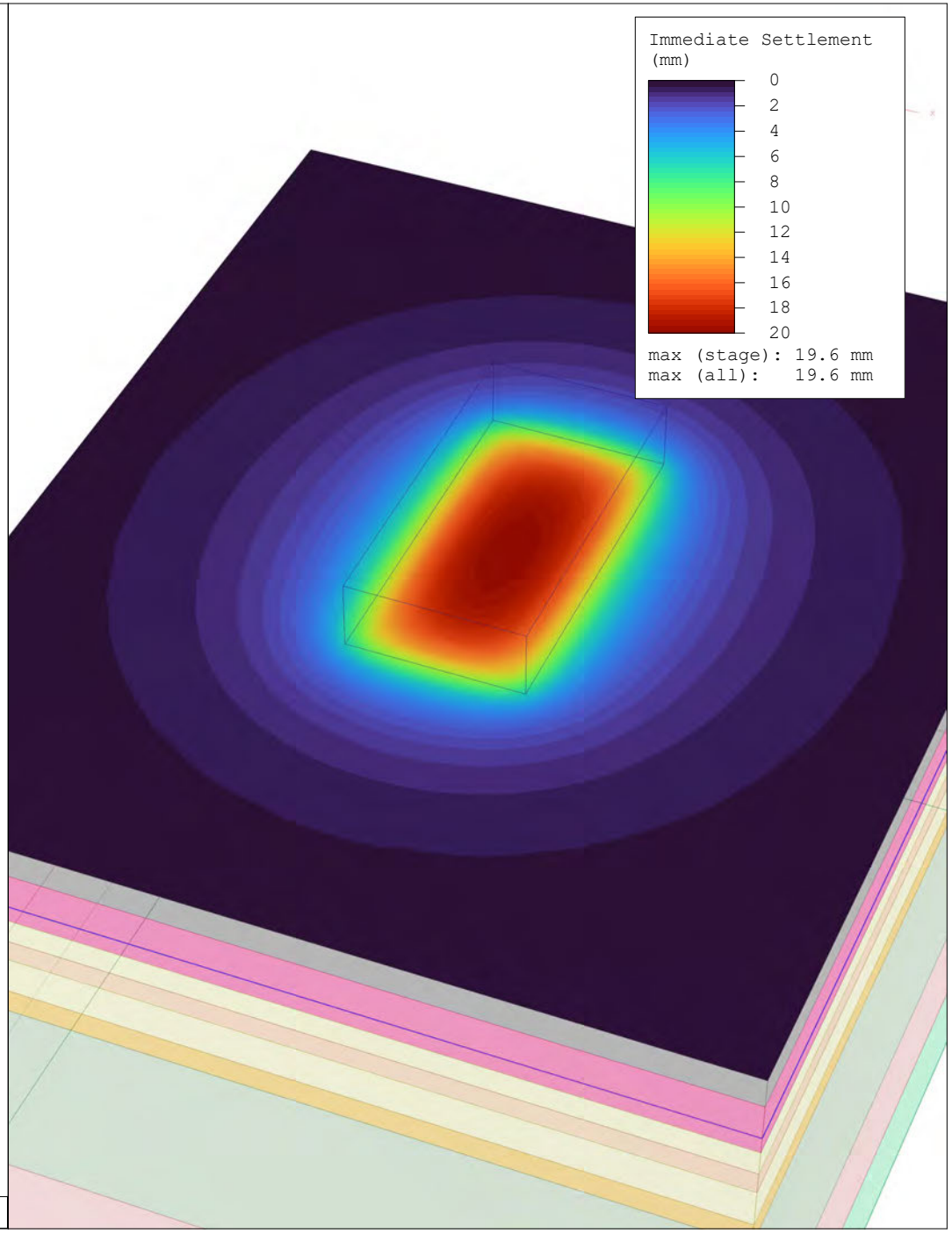

4X6
Immediate Settlement
(mm)
0.0
2.1
4.2
6.3
8.4
10.5
12.6
14.7
16.8
18.9
21.0
max (stage): 20.4 mm
max (all): 20.4 mm
0
5
10
15
20

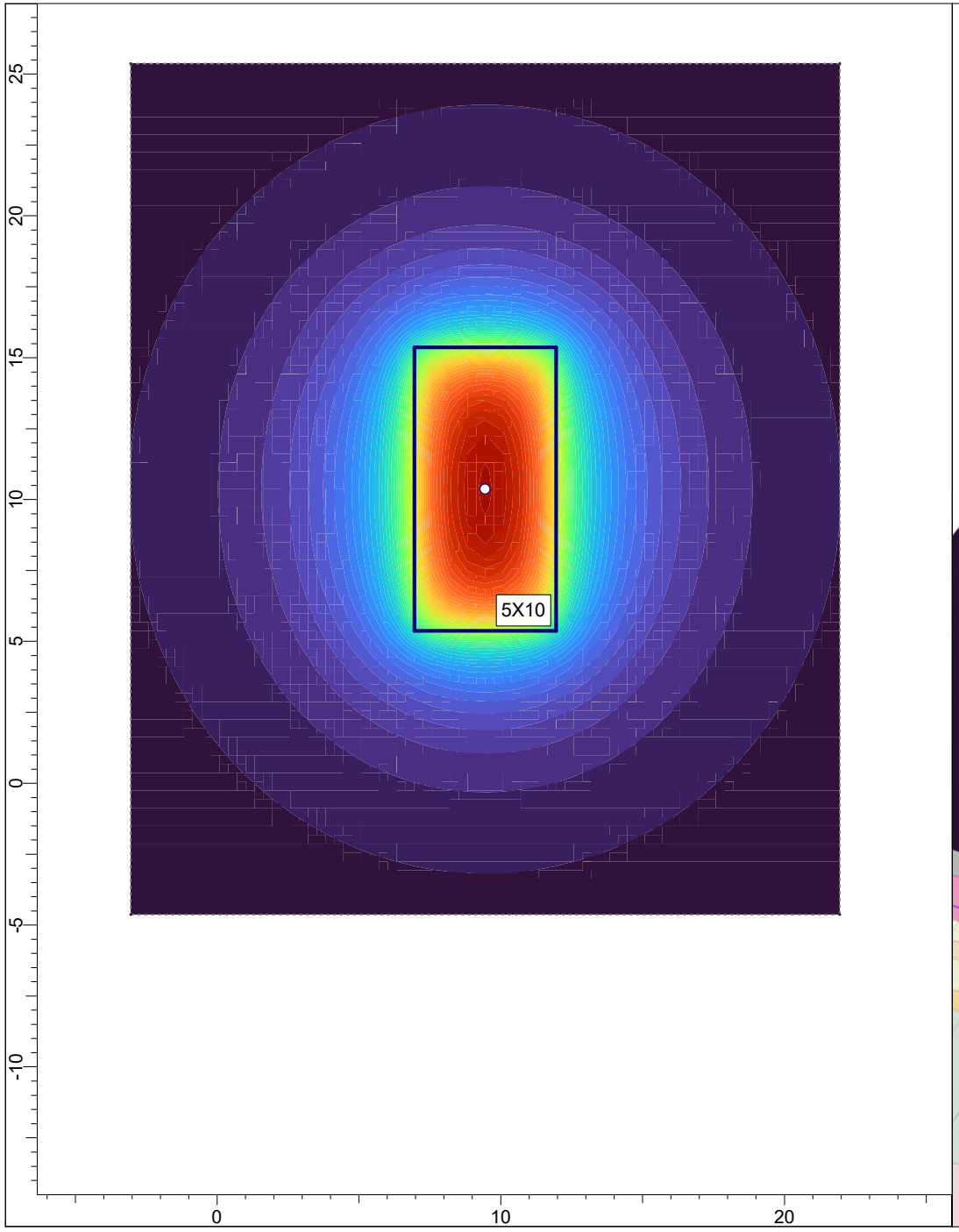

Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.0 mm
max (all): 25.0 mm
4X6
0
5
10
15
20
0
5
10
15

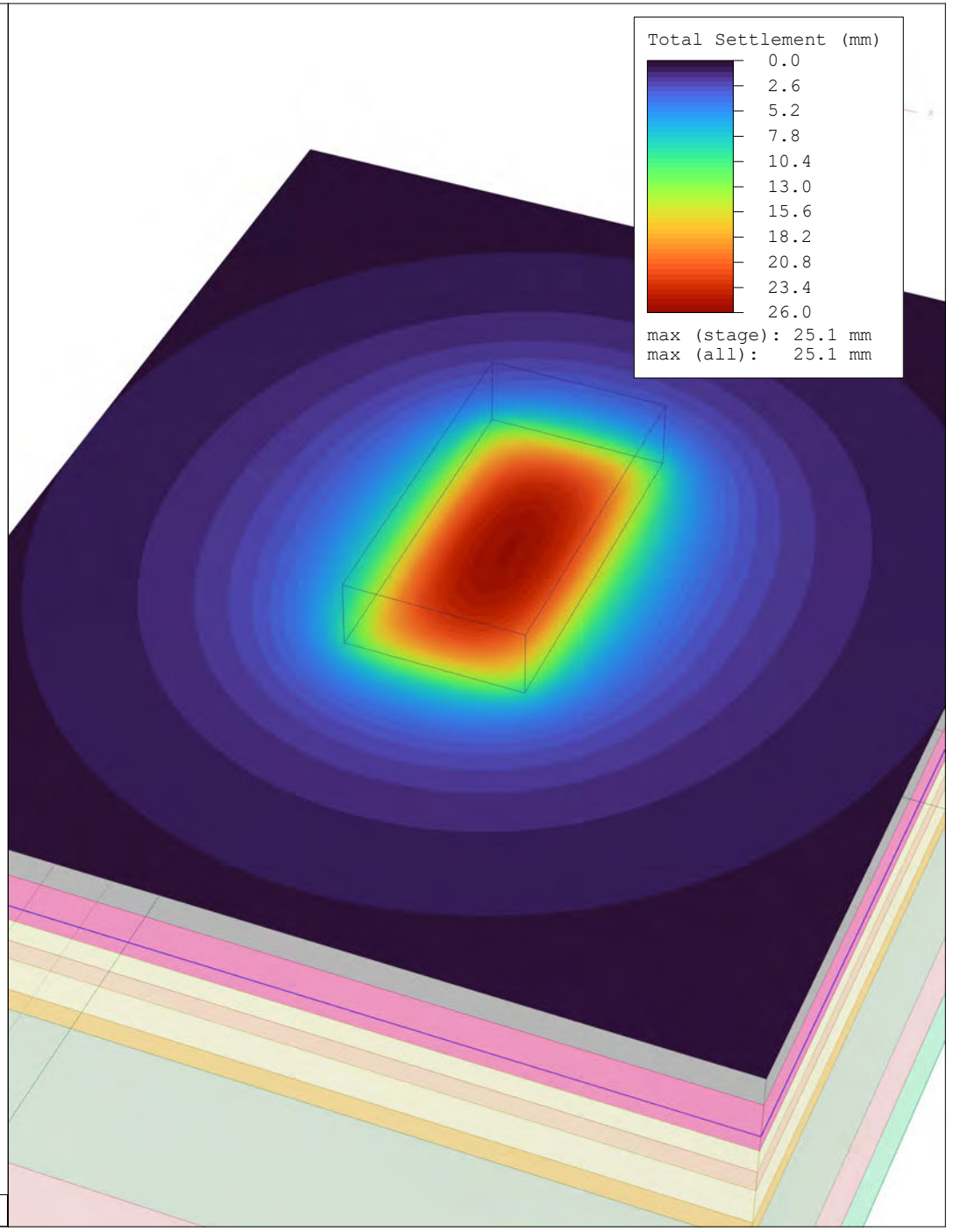

30
25
20
15
10
5
0
-5
-10
0
10
20
5X10

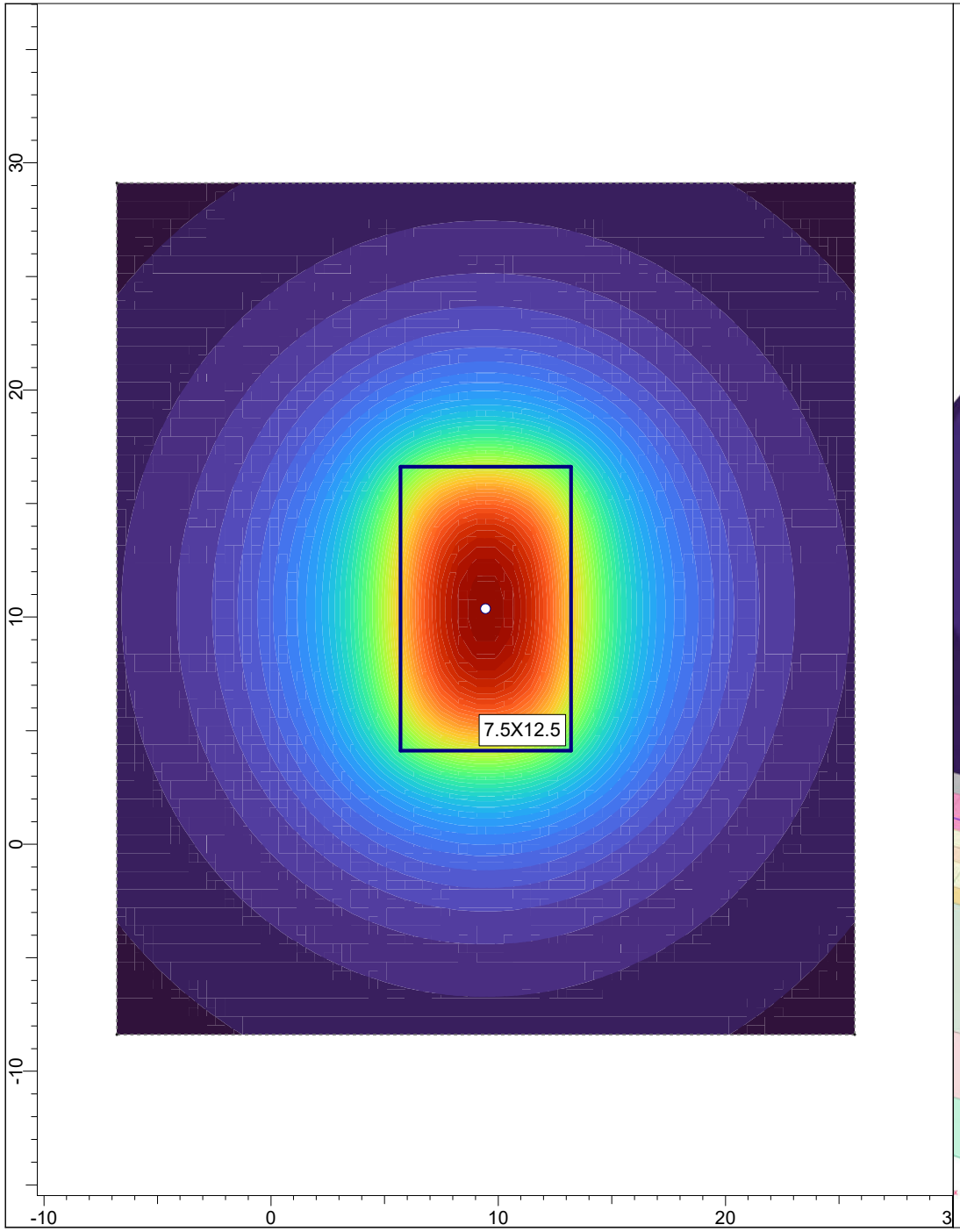

Total Consolidation
Settlement (mm)
0.00
0.56
1.12
1.68
2.24
2.80
3.36
3.92
4.48
5.04
5.60
max (stage): 5.5 mm
max (all): 5.5 mm

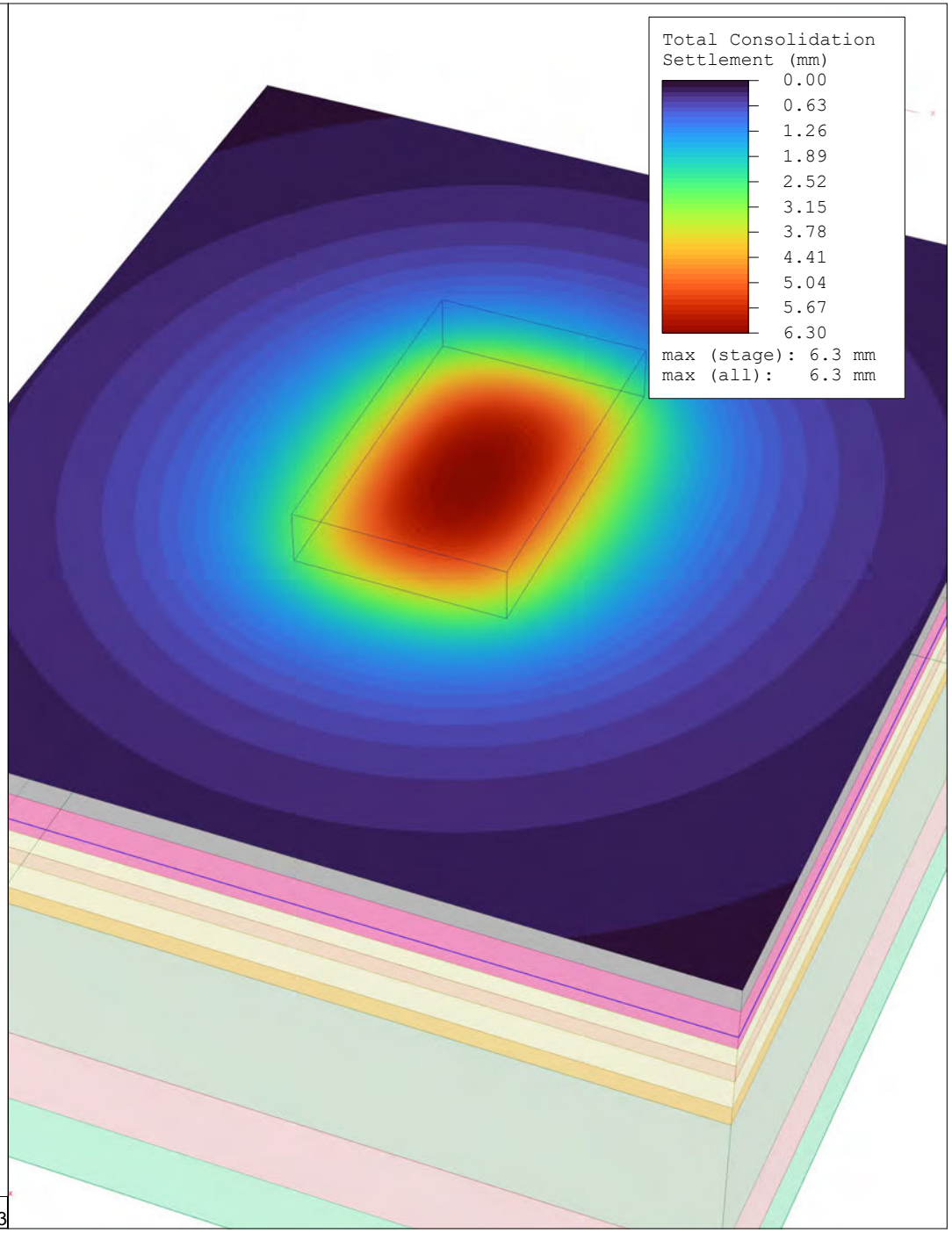

25
20
15
10
5
0
-5
-10
0
10
20
5X10

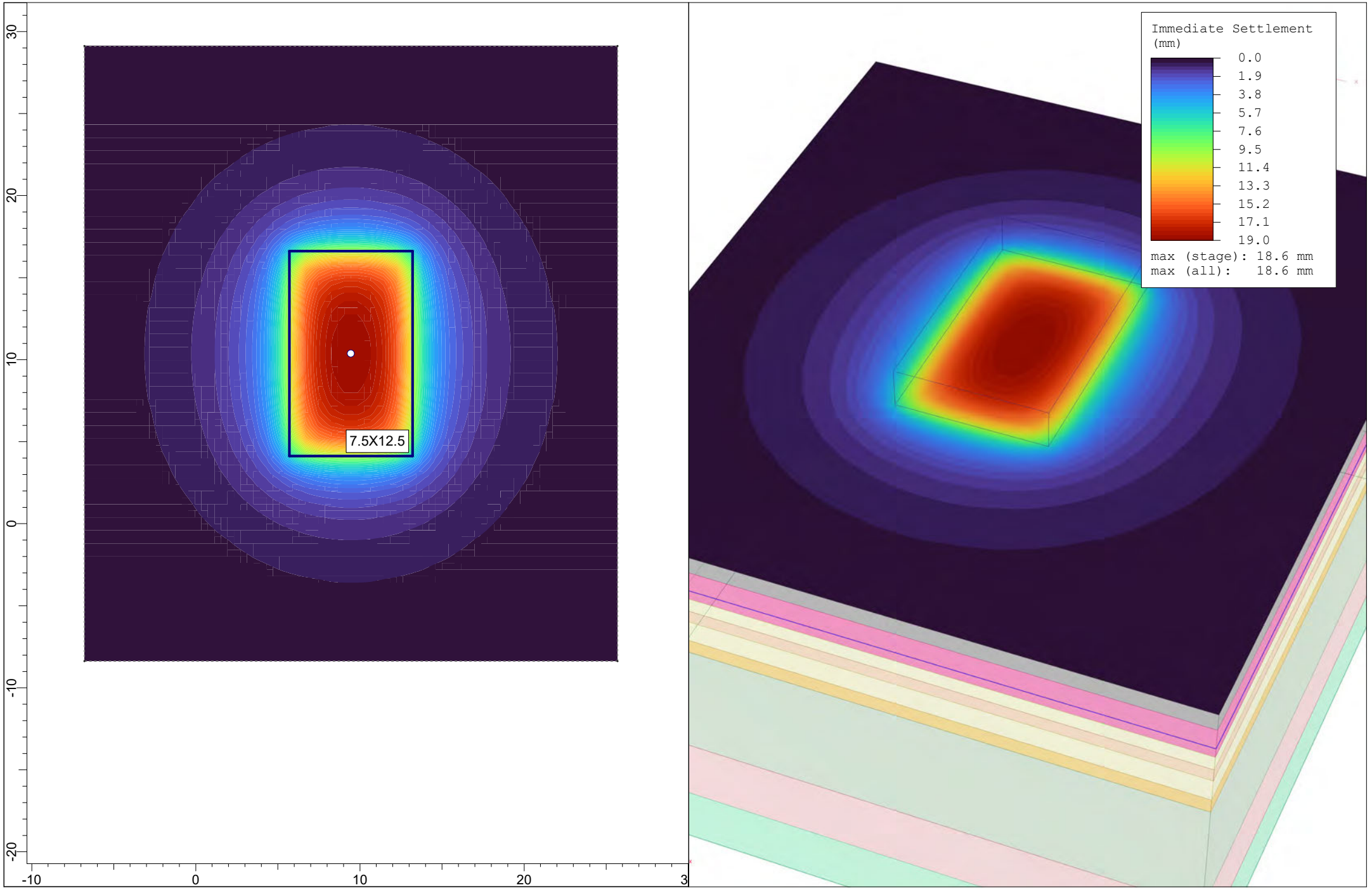

Immediate Settlement
(mm)
0
2
4
6
8
10
12
14
16
18
20
max (stage): 19.6 mm
max (all): 19.6 mm

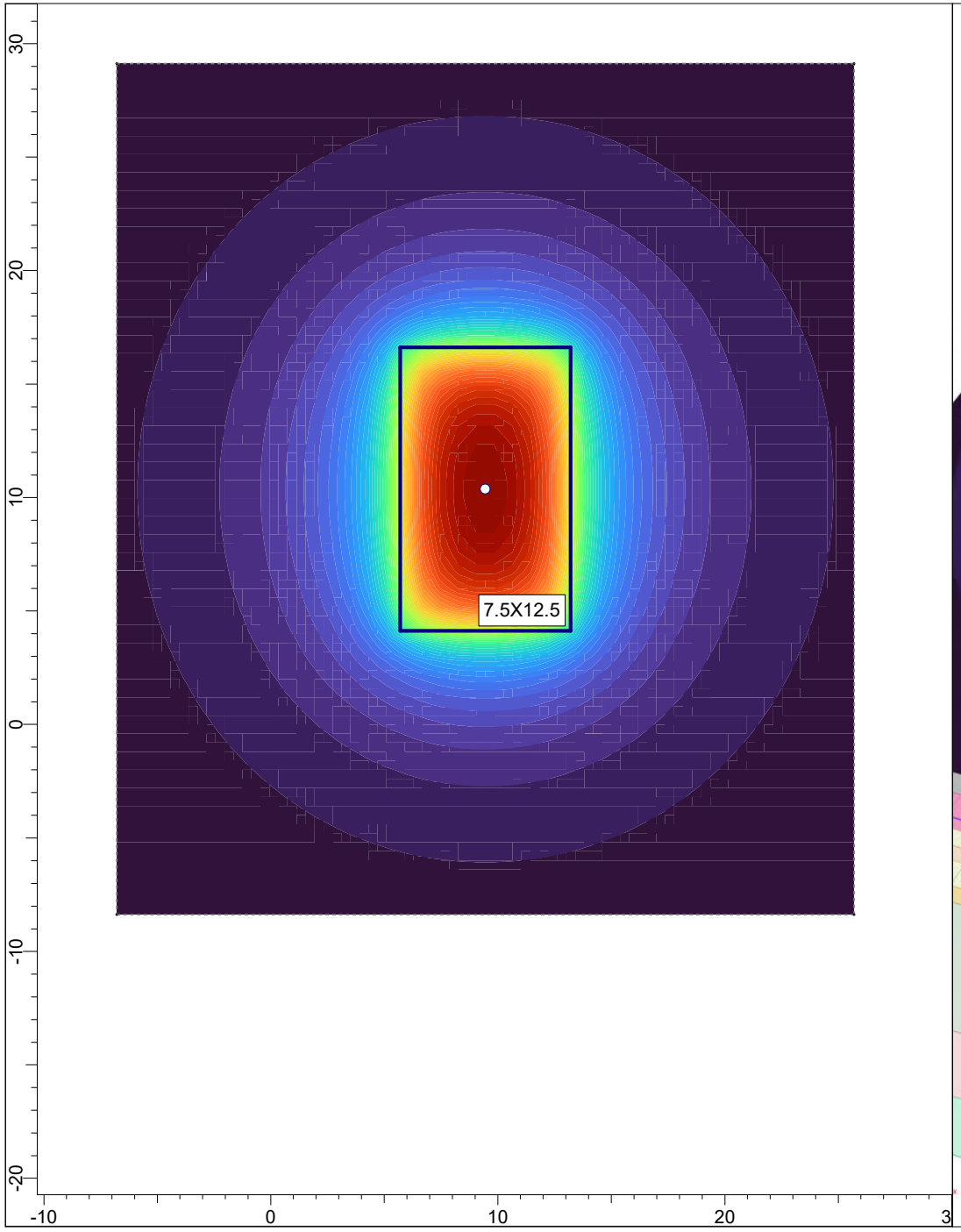

25
20
15
10
5
0
-5
-10
0
10
20
5X10

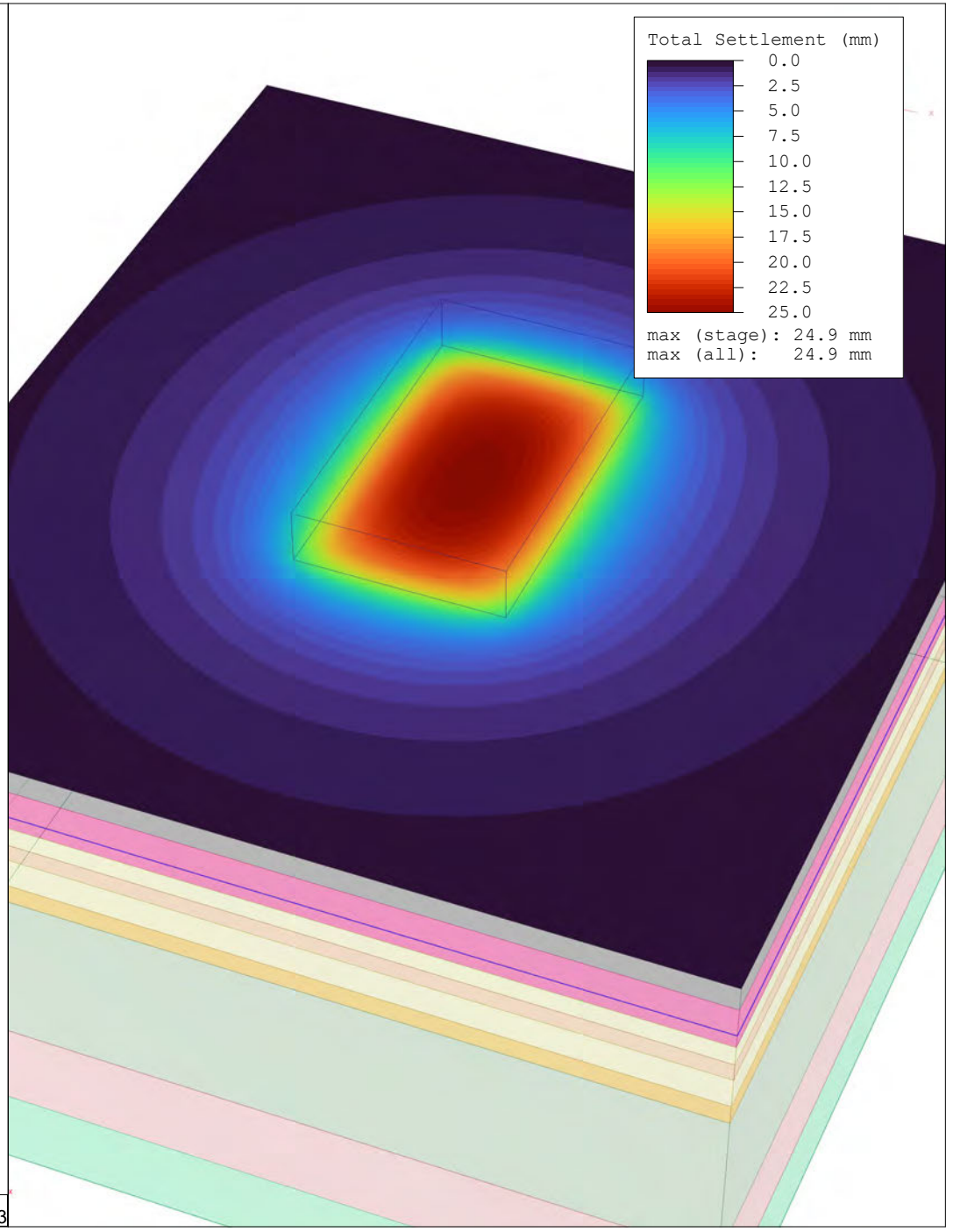

Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.1 mm
max (all): 25.1 mm

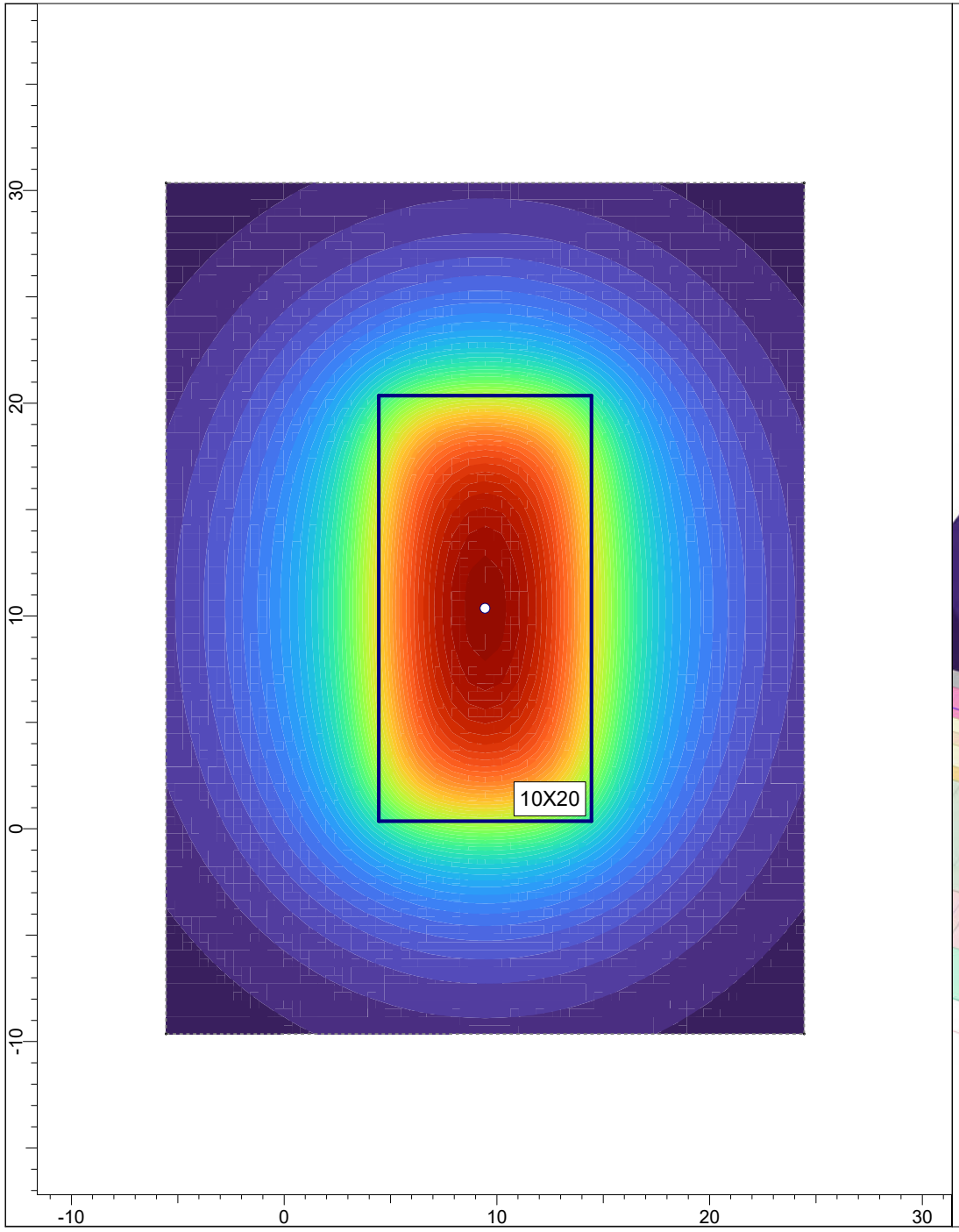

30
20
10
0
-10
-10
0
10
20
3
7.5X12.5

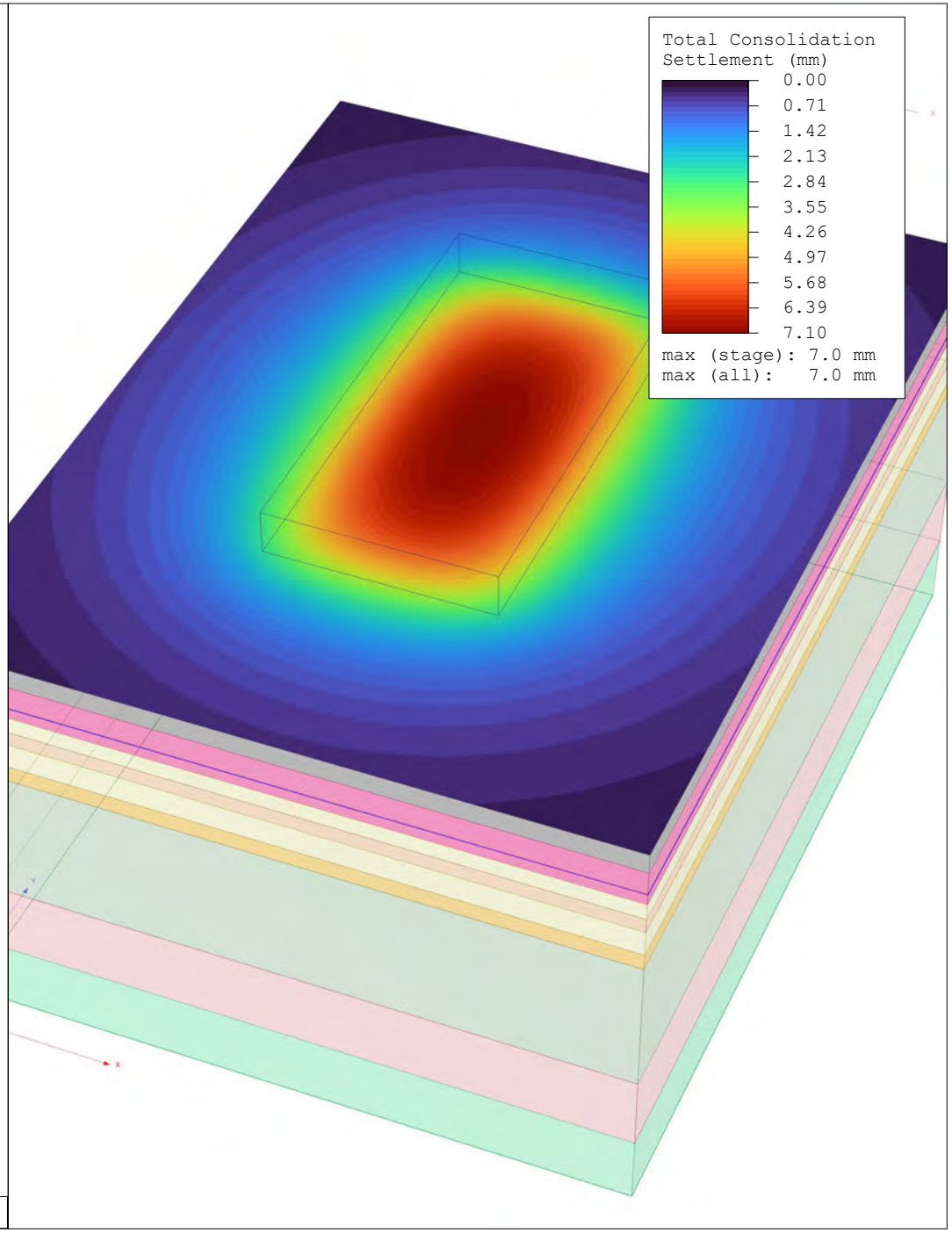

Total Consolidation
Settlement (mm)
0.00
0.63
1.26
1.89
2.52
3.15
3.78
4.41
5.04
5.67
6.30
max (stage): 6.3 mm
max (all): 6.3 mm

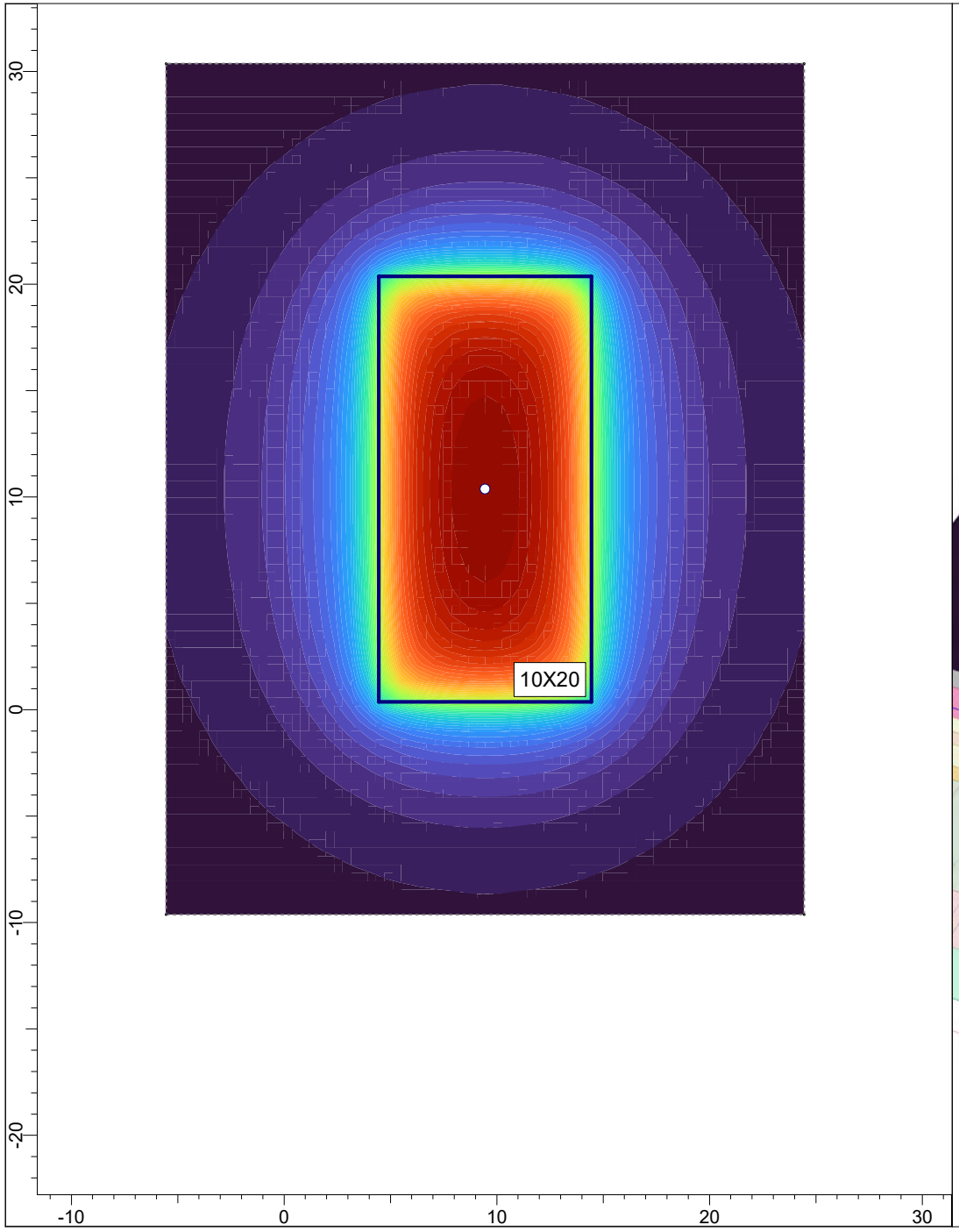

7.5X12.5
30
20
10
0
-10
-20
-10
0
10
20
Immediate Settlement
(mm)
0.0
1.9
3.8
5.7
7.6
9.5
11.4
13.3
15.2
17.1
19.0
max (stage): 18.6 mm
max (all): 18.6 mm

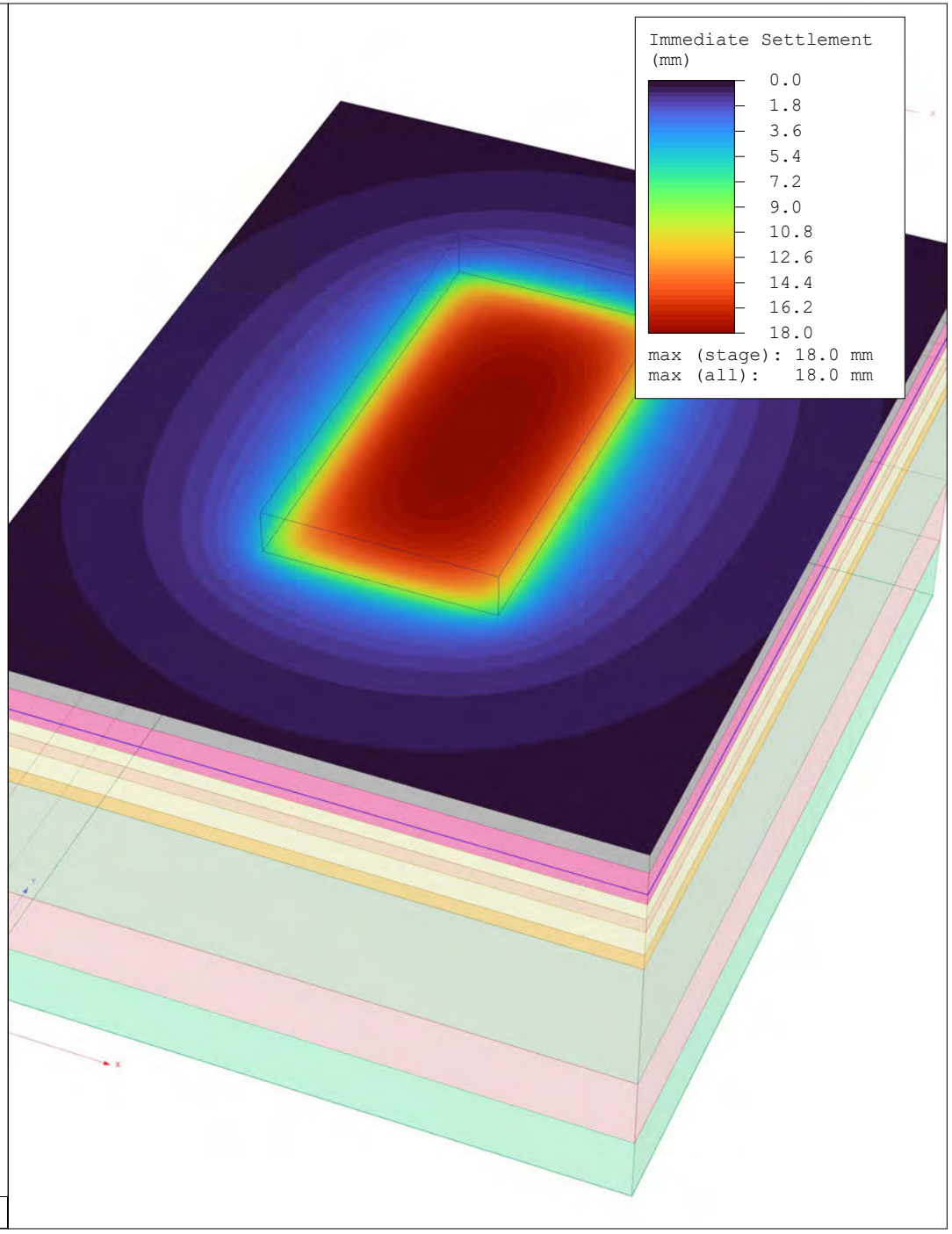

30
20
10
0
-10
-20
-10
0
10
20
7.5X12.5

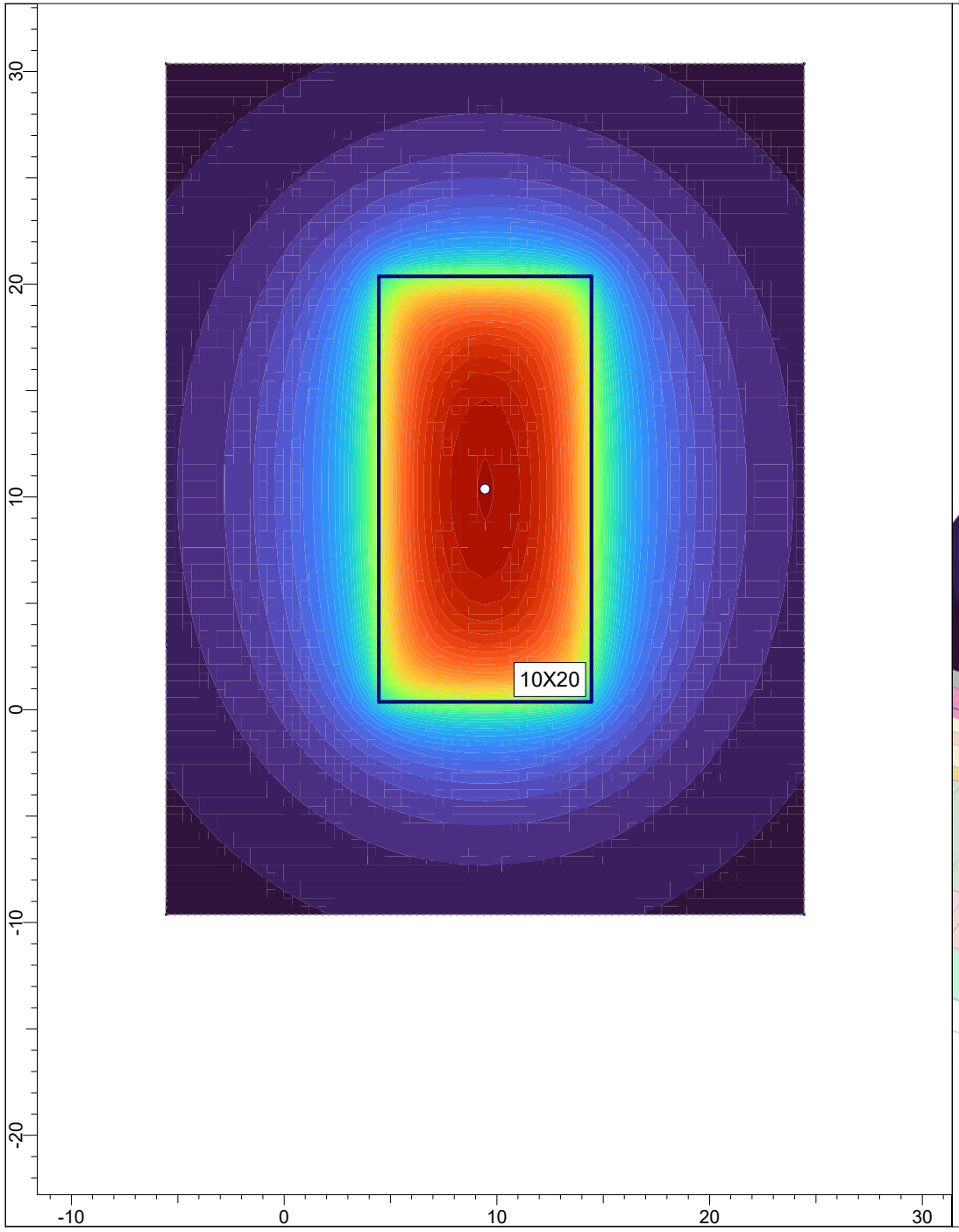

Total Settlement (mm)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
max (stage): 24.9 mm
max (all): 24.9 mm

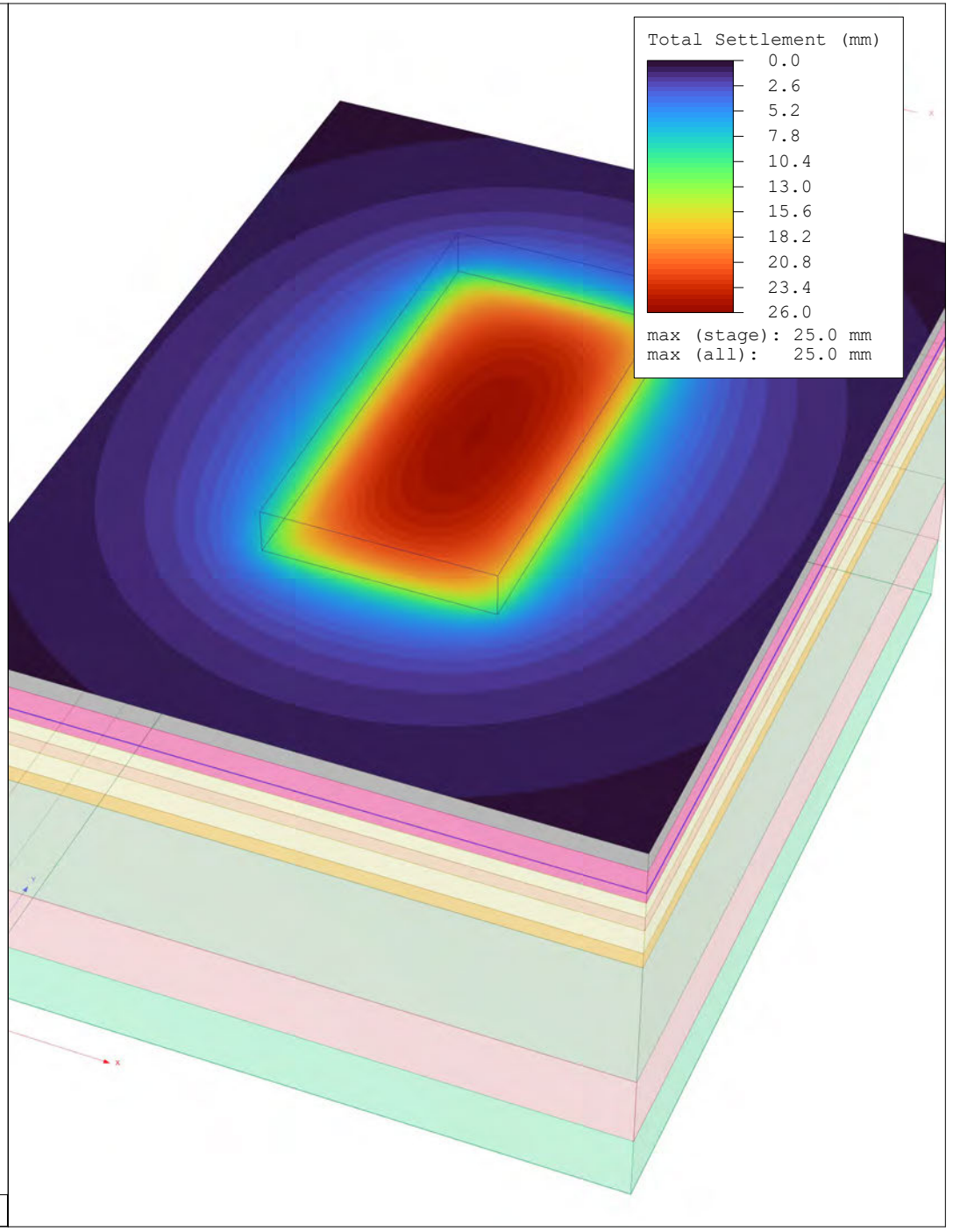

30
20
10
0
-10
-10
0
10
20
30
10X20


Total Consolidation
Settlement (mm)
0.00
0.71
1.42
2.13
2.84
3.55
4.26
4.97
5.68
6.39
7.10
max (stage): 7.0 mm
max (all): 7.0 mm


30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Immediate Settlement
(mm)
0.0
1.8
3.6
5.4
7.2
9.0
10.8
12.6
14.4
16.2
18.0
max (stage): 18.0 mm
max (all): 18.0 mm


30
20
10
0
-10
-20
-10
0
10
20
30
10X20


Total Settlement (mm)
0.0
2.6
5.2
7.8
10.4
13.0
15.6
18.2
20.8
23.4
26.0
max (stage): 25.0 mm
max (all): 25.0 mm

E.3 Pile design Calculations

PILE TYPE A

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

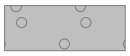
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		390.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	390.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.75 m
Length l = 20.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 4.42E-01 m^2
Moment of inertia I = 1.55E-02 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_A	Design	2700.00	0.00	0.00	125.00	0.00
2	Yes		Pile_A-Tensile	Design	-125.00	0.00	0.00	125.00	0.00
3	Yes		Pile_A - service	Service	2700.00	0.00	0.00	125.00	0.00
4	Yes		Pile_A-Tensile - service	Service	-125.00	0.00	0.00	125.00	0.00
5	Yes		SWL	Service	3950.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesive
Design undrained shear strength c_u = 1650.00 kPa
Area of pile transverse cross-section A_p = 4.42E-01 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	53.11
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	9.80
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	13.97
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	87.17
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	38.26
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	19.15
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	97.25
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	56.99
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	81.24	544.15
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	81.24	184.67
18.30	-	-	-	-	-	-	-
20.00	1.70	1650.00	0.20	-	-	81.24	660.91

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Bearing capacity of tensile pile:

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	106.21
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	19.60
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	27.93
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	174.35
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	76.53
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	38.30
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	194.50
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	113.98
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	81.24	1088.30
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	81.24	369.33
18.30	-	-	-	-	-	-	-
20.00	1.70	1650.00	0.20	-	-	81.24	1321.83

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 8.00

Verification of compressive pile:
Most unfavorable load case No. 5. (SWL)
Pile skin bearing capacity R_s = 1765.44 kN
Pile base bearing capacity R_b = 2186.84 kN

Pile bearing capacity R_c = 3952.28 kN
Ultimate vertical force V_d = 3950.00 kN

R_c = 3952.28 kN > 3950.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_A-Tensile - service)
Pile tensile resistance R_{sdt} = 1238.90 kN
Pile self-weight w_p = 127.23 kN
Maximum tensile load V_d = 0.00 kN

R_c = 1238.90 kN > 0.00 kN = V_d

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	10.00
3	3.20	4.90	49.40
4	4.90	5.70	58.00
5	5.70	7.50	49.40
6	7.50	8.40	129.00
7	8.40	15.80	84.70
8	15.80	18.30	244.00
9	18.30	20.00	390.00

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	= 0.60
Correction factor for Poisson's ratio of soil	C_v	= 0.75
Correction factor for stiffness of bearing stratum	C_b	= 4.77
Base-load proportion for incompressible pile	β_0	= 0.06
Proportion of applied load transferred to pile base	β	= 0.12

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	= 0.07
Correction factor for pile compressibility	R_k	= 1.59
Correction factor for finite depth of layer on a rigid base	R_h	= 1.00
Correction factor for Poisson's ratio of soil	R_v	= 0.90

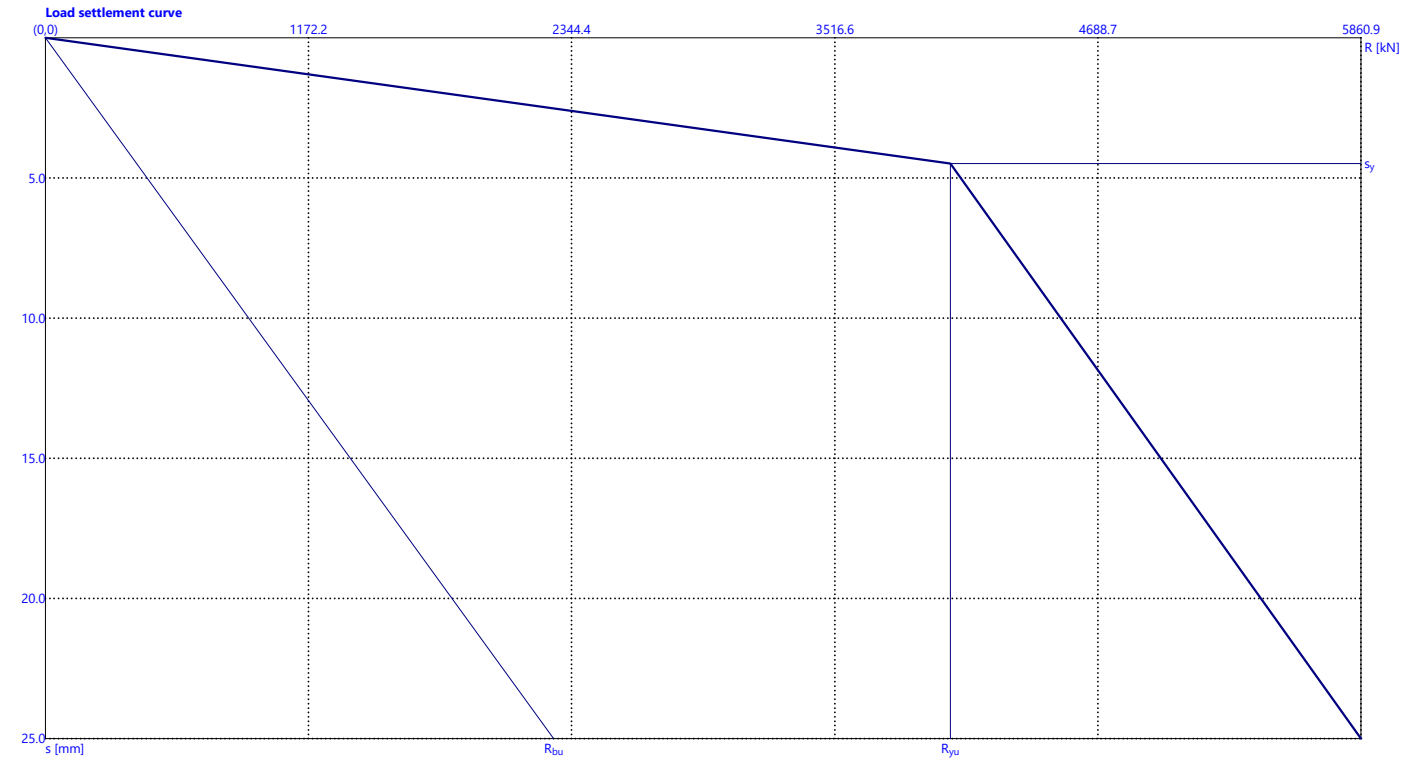
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	=	4031.58	kN
The settlement for the force R_{yu}	s_y	=	4.5	mm
Total resistance	R_c	=	5860.93	kN
Maximum settlement	s_{lim}	=	25.0	mm

The settlement for maximum service load V = 3950.00kN is 4.4mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Pile is fixed into a rock (translation at pile foot equals zero).
Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m³]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	1.13	116.22	0.00	0.00
1.00	34.05	0.00	1.02	79.06	0.00	86.17
2.00	34.05	0.00	0.80	47.84	0.00	112.67
3.00	3.42	0.00	0.56	2.48	11.74	105.43
4.00	34.05	0.00	0.35	9.10	20.87	89.39
5.00	39.99	0.00	0.19	0.07	23.96	66.42
6.00	34.05	0.12	0.07	0.00	22.02	43.18
7.00	34.05	0.15	0.00	0.00	18.39	22.91
8.00	95.07	0.13	0.00	0.00	11.56	7.20
9.00	60.50	0.09	0.00	0.00	5.16	0.00
10.00	60.50	0.06	0.00	0.00	1.76	0.00
11.00	60.50	0.03	0.00	0.00	0.00	0.00
12.00	60.50	0.01	0.00	0.00	0.00	0.00
13.00	60.50	0.00	0.00	0.03	0.00	0.00
14.00	60.50	0.00	0.00	0.28	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
15.00	60.50	0.00	0.00	0.30	0.00	0.00
16.00	189.63	0.00	0.00	0.69	0.00	0.00
17.00	189.63	0.00	0.00	0.38	0.00	0.24
18.00	189.63	0.00	0.00	0.16	0.05	0.27
19.00	315.18	0.00	0.00	0.08	0.15	0.17
20.00	315.18	0.00	0.00	0.00	0.18	0.00

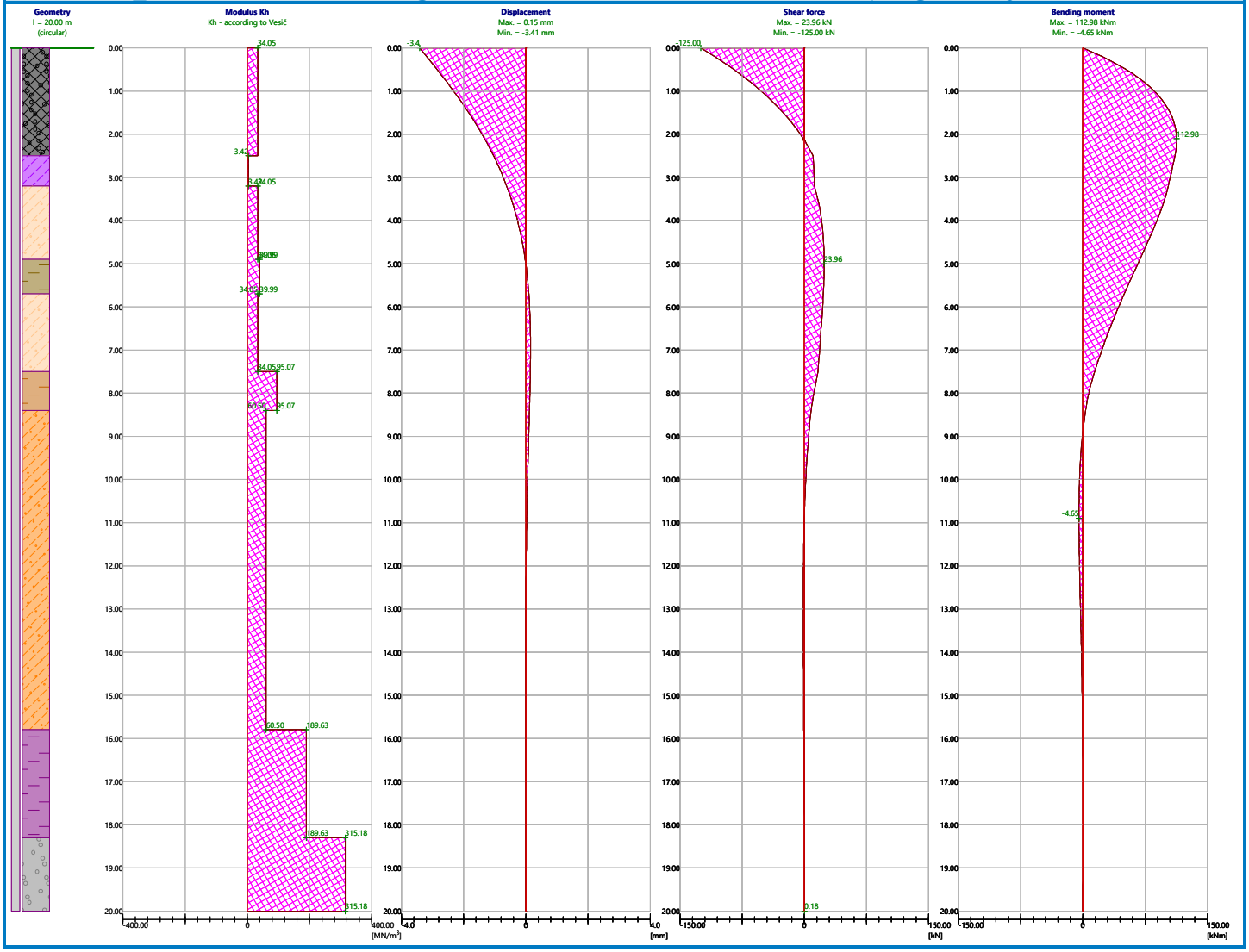
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-3.41	0.00	0.00	-125.00	0.00
1.00	34.05	-2.32	0.00	0.00	-52.00	0.00
2.00	34.05	-1.40	0.00	0.00	-4.89	0.00
3.00	3.42	-0.72	0.00	0.00	0.00	0.00
4.00	34.05	-0.27	0.00	0.00	0.00	0.00
5.00	39.99	-0.00	0.00	0.00	0.00	0.00
6.00	34.05	0.00	0.00	-4.13	0.00	0.00
7.00	34.05	0.00	-0.00	-5.14	0.00	0.00
8.00	95.07	0.00	-0.03	-12.44	0.00	0.00
9.00	60.50	0.00	-0.04	-5.67	0.00	-0.63
10.00	60.50	0.00	-0.03	-3.46	0.00	-3.95
11.00	60.50	0.00	-0.02	-1.74	-0.16	-4.64
12.00	60.50	0.00	-0.01	-0.60	-1.00	-3.99
13.00	60.50	-0.00	-0.01	0.00	-1.18	-2.87
14.00	60.50	-0.00	-0.00	0.00	-1.05	-1.74
15.00	60.50	-0.01	0.00	0.00	-0.82	-0.80
16.00	189.63	-0.00	0.00	0.00	-0.55	-0.09
17.00	189.63	-0.00	0.00	0.00	-0.15	0.00
18.00	189.63	-0.00	0.00	0.00	0.00	0.00
19.00	315.18	-0.00	0.00	0.00	0.00	0.00
20.00	315.18	0.00	0.00	0.00	0.00	-0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_A Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out for the load case number1. (Pile_A)
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained

Pile type criteria

Short pile	ηl	<	2.00
Intermediate pile	2.00 <	ηl <	4.00
Long pile	ηl	>	4.00

Reinforcement
6 prof. 22.0 mm, cover 40.0 mm

Results

Value ηl = 5.85 ---> Pile is long

Flexure bearing capacity	M_u	=	290.08	kNm
Value on horizontal axis		=	14.40	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	2133.57	kN

Analysis of deflection :

Value taken from chart		=	0.01	
Deflection of the pile at ground level.	y	=	0.5	mm
Maximum horizontal force	Q_{max}	=	125.00	kN
Reduced resistance of pile	Q_u	=	711.19	kN

Horizontal pile resistance is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

PILE TYPE B

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

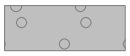
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		249.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	249.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.60 m
Length l = 20.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 2.83E-01 m^2
Moment of inertia I = 6.36E-03 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_B	Design	1700.00	0.00	0.00	125.00	0.00
2	Yes		Pile_B-Tensile	Design	-125.00	0.00	0.00	125.00	0.00
3	Yes		Pile_B - service	Service	1700.00	0.00	0.00	125.00	0.00
4	Yes		Pile_B-Tensile - service	Service	-125.00	0.00	0.00	125.00	0.00
5	Yes		Settlement	Service	2740.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesive
Design undrained shear strength c_u = 1650.00 kPa
Area of pile transverse cross-section A_p = 2.83E-01 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	42.48
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	7.84
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	11.17
3.20	-	-	-	-	-	-	-
4.80	1.60	-	-	1.42	25.50	63.84	65.21
4.80	-	-	-	-	-	-	-
4.90	0.10	-	-	1.42	25.50	70.48	4.50
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	70.48	30.61
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	70.48	81.00
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	70.48	45.59
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	70.48	377.66
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	70.48	147.73
18.30	-	-	-	-	-	-	-
20.00	1.70	1650.00	0.20	-	-	70.48	528.73

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Bearing capacity of tensile pile:

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	84.97
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	15.68
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	22.35
3.20	-	-	-	-	-	-	-
4.80	1.60	-	-	1.42	25.50	63.84	130.43
4.80	-	-	-	-	-	-	-
4.90	0.10	-	-	1.42	25.50	70.48	9.00
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	70.48	61.22
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	70.48	161.99
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	70.48	91.18
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	70.48	755.33
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	70.48	295.47
18.30	-	-	-	-	-	-	-
20.00	1.70	1650.00	0.20	-	-	70.48	1057.46

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 8.00

Verification of compressive pile:
Most unfavorable load case No. 5. (Settlement)
Pile skin bearing capacity R_s = 1342.54 kN
Pile base bearing capacity R_b = 1399.58 kN

Pile bearing capacity R_c = 2742.12 kN
Ultimate vertical force V_d = 2740.00 kN

R_c = 2742.12 kN > 2740.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_B-Tensile - service)
Pile tensile resistance R_{sdt} = 942.13 kN
Pile self-weight w_p = 81.43 kN
Maximum tensile load V_d = 43.57 kN

R_c = 942.13 kN > 43.57 kN = V_d

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	6.00
3	3.20	4.90	49.40
4	4.90	5.70	58.00
5	5.70	7.50	49.40
6	7.50	8.40	129.00
7	8.40	15.80	84.70
8	15.80	18.30	244.00
9	18.30	20.00	390.00

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	= 0.56
Correction factor for Poisson's ratio of soil	C_v	= 0.75
Correction factor for stiffness of bearing stratum	C_b	= 3.06
Base-load proportion for incompressible pile	β_0	= 0.05
Proportion of applied load transferred to pile base	β	= 0.06

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	= 0.06
Correction factor for pile compressibility	R_k	= 1.75
Correction factor for finite depth of layer on a rigid base	R_h	= 1.00
Correction factor for Poisson's ratio of soil	R_v	= 0.90

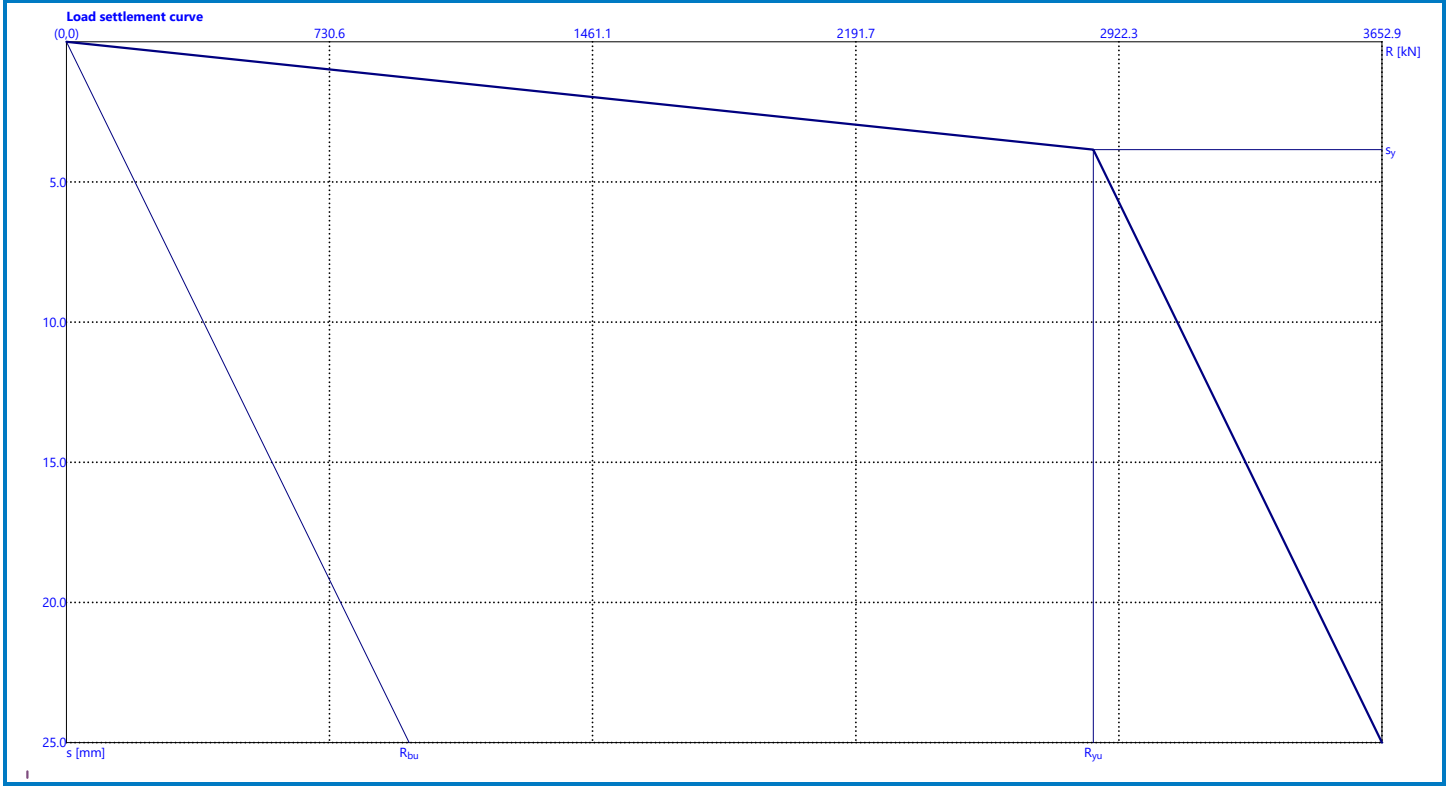
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	= 2851.61	kN
The settlement for the force R_{yu}	s_y	= 3.8	mm
Total resistance	R_c	= 3652.85	kN
Maximum settlement	s_{lim}	= 25.0	mm

The settlement for maximum service load V = 2740.00kN is 3.7mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Pile is fixed into a rock (translation at pile foot equals zero).
Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m³]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	1.77	179.24	0.00	0.00
1.00	42.56	0.00	1.52	107.73	0.00	78.63
2.00	42.56	0.00	1.06	52.56	7.64	91.77
3.00	4.28	0.00	0.62	1.74	21.03	74.19
4.00	42.56	0.04	0.29	0.00	23.45	51.67
5.00	49.99	0.21	0.07	0.00	19.81	29.64
6.00	42.56	0.22	0.00	0.00	13.45	13.08
7.00	42.56	0.16	0.00	0.00	8.52	2.22
8.00	118.84	0.09	0.00	0.00	2.90	0.00
9.00	75.63	0.04	0.00	0.00	0.00	0.00
10.00	75.63	0.00	0.00	0.00	0.00	0.00
11.00	75.63	0.00	0.00	0.61	0.00	0.00
12.00	75.63	0.00	0.00	0.79	0.00	0.00
13.00	75.63	0.00	0.00	0.62	0.00	0.00
14.00	75.63	0.00	0.00	0.37	0.00	0.13

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
15.00	75.63	0.00	0.00	0.17	0.00	0.21
16.00	237.04	0.00	0.00	0.13	0.06	0.19
17.00	237.04	0.00	0.00	0.00	0.08	0.11
18.00	237.04	0.00	0.00	0.00	0.05	0.04
19.00	393.98	0.00	0.00	0.00	0.01	0.00
20.00	393.98	0.00	0.00	0.00	0.00	0.00

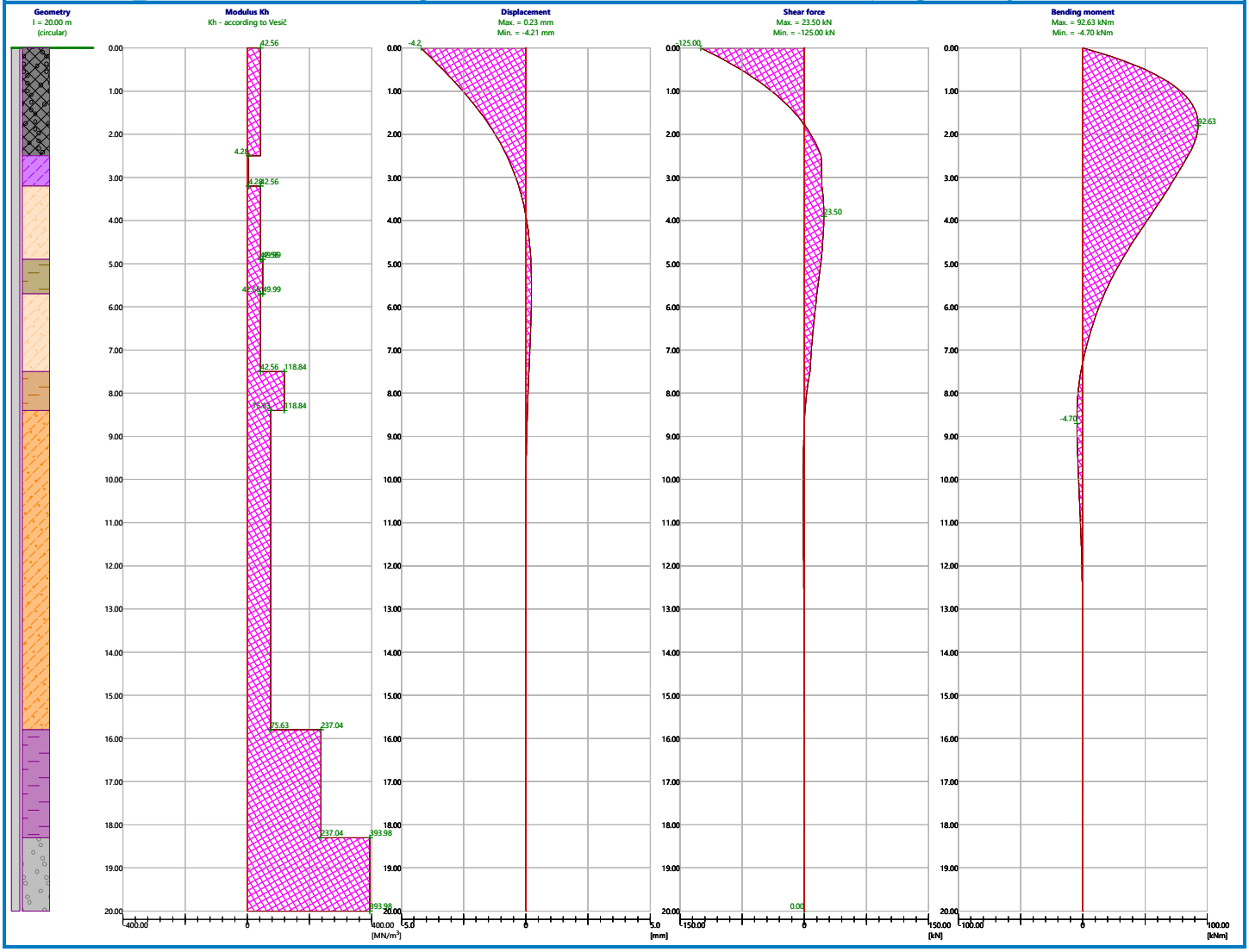
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-4.21	0.00	0.00	-125.00	-0.00
1.00	42.56	-2.53	0.00	0.00	-39.44	0.00
2.00	42.56	-1.23	0.00	0.00	0.00	0.00
3.00	4.28	-0.41	0.00	0.00	0.00	0.00
4.00	42.56	0.00	0.00	-1.53	0.00	0.00
5.00	49.99	0.00	0.00	-10.32	0.00	0.00
6.00	42.56	0.00	-0.03	-9.33	0.00	0.00
7.00	42.56	0.00	-0.07	-6.86	0.00	0.00
8.00	118.84	0.00	-0.07	-10.62	0.00	-3.91
9.00	75.63	0.00	-0.04	-2.68	-0.64	-4.59
10.00	75.63	0.00	-0.02	-0.36	-1.47	-3.42
11.00	75.63	-0.01	-0.01	0.00	-1.34	-1.97
12.00	75.63	-0.01	0.00	0.00	-0.89	-0.84
13.00	75.63	-0.01	0.00	0.00	-0.46	-0.17
14.00	75.63	-0.00	0.00	0.00	-0.17	0.00
15.00	75.63	-0.00	0.00	0.00	-0.01	0.00
16.00	237.04	-0.00	0.00	0.00	0.00	0.00
17.00	237.04	0.00	0.00	-0.03	0.00	0.00
18.00	237.04	0.00	-0.00	-0.06	0.00	0.00
19.00	393.98	0.00	-0.00	-0.05	0.00	0.00
20.00	393.98	0.00	-0.00	0.00	-0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_B Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained

Pile type criteria

Short pile		ηl	<	2.00
Intermediate pile	2.00	< ηl	<	4.00
Long pile		ηl	>	4.00

Reinforcement
6 prof. 18.0 mm, cover 40.0 mm

Results

Value ηl = 7.00 ---> Pile is long

Flexure bearing capacity	M_u	=	152.69	kNm
Value on horizontal axis		=	18.50	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	1092.39	kN

Analysis of deflection :

Value taken from chart		=	0.00
Deflection of the pile at ground level.	y	=	0.0 mm

Maximum horizontal force	Q_{max}	=	125.00	kN
Reduced resistance of pile	Q_u	=	364.13	kN

Horizontal pile resistance is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

PILE TYPE C

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

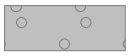
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		390.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	390.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.60 m
Length l = 15.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 2.83E-01 m^2
Moment of inertia I = 6.36E-03 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_C	Design	1150.00	0.00	0.00	75.00	0.00
2	Yes		Pile_C-Tensile	Design	-75.00	0.00	0.00	0.00	0.00
3	Yes		Pile_C - service	Service	1150.00	0.00	0.00	75.00	0.00
4	Yes		Pile_C-Tensile - service	Service	-75.00	0.00	0.00	0.00	0.00
5	Yes		Settlement	Service	1150.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesionless
Coefficient of bearing capacity N_q = 30.00
Area of pile transverse cross-section A_p = 2.83E-01 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	42.48
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	7.84
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	11.17
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	69.74
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	30.61
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	15.32
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	77.80
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	45.59
8.40	-	-	-	-	-	-	-
15.00	6.60	-	-	1.51	27.00	81.24	388.26

Bearing capacity of tensile pile:

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	84.97
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	15.68
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	22.35
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	139.48
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	61.22
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	30.64
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	155.60
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	91.18
8.40	-	-	-	-	-	-	-
15.00	6.60	-	-	1.51	27.00	81.24	776.52

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 10.00

Verification of compressive pile:
Most unfavorable load case No. 5. (Settlement)
Pile skin bearing capacity R_s = 688.82 kN
Pile base bearing capacity R_b = 462.12 kN

Pile bearing capacity R_c = 1150.94 kN
Ultimate vertical force V_d = 1150.00 kN

R_c = 1150.94 kN > 1150.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_C-Tensile - service)
Pile tensile resistance R_{sdt} = 483.39 kN
Pile self-weight w_p = 63.05 kN
Maximum tensile load V_d = 11.95 kN

R_c = 483.39 kN > 11.95 kN = V_d

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	6.00
3	3.20	4.90	49.40
4	4.90	5.70	58.00
5	5.70	7.50	49.40
6	7.50	8.40	129.00
7	8.40	15.00	84.70

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	= 0.73
Correction factor for Poisson's ratio of soil	C_v	= 0.75
Correction factor for stiffness of bearing stratum	C_b	= 1.82
Base-load proportion for incompressible pile	β_0	= 0.06
Proportion of applied load transferred to pile base	β	= 0.06

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	= 0.07
Correction factor for pile compressibility	R_k	= 1.43
Correction factor for finite depth of layer on a rigid base	R_h	= 1.00
Correction factor for Poisson's ratio of soil	R_v	= 0.87

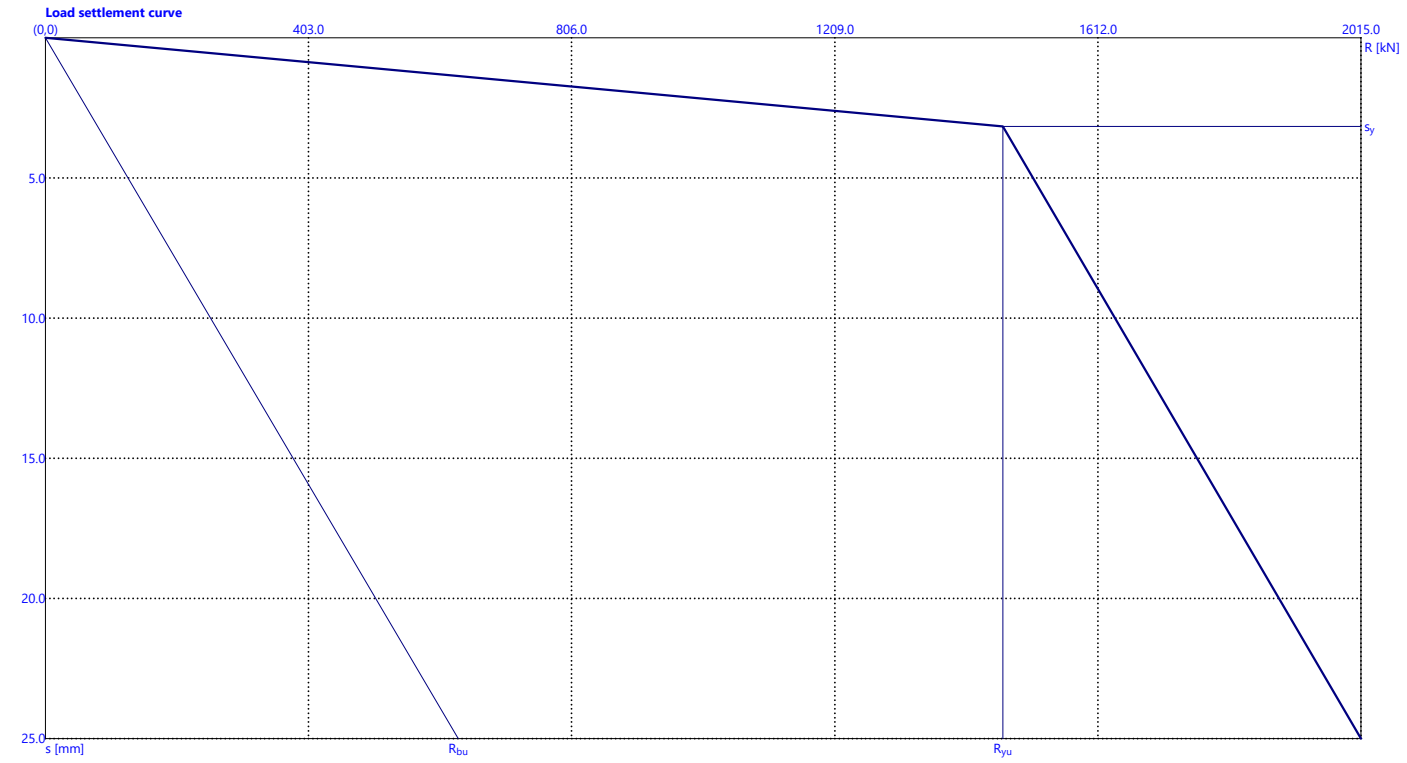
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	=	1466.60	kN
The settlement for the force R_{yu}	s_y	=	3.2	mm
Total resistance	R_c	=	2015.03	kN
Maximum settlement	s_{lim}	=	25.0	mm

The settlement for maximum service load V = 1150.00kN is 2.5mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m^3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	1.06	107.51	0.00	0.00
0.75	42.56	0.00	0.97	74.63	0.00	40.00
1.50	42.56	0.00	0.78	46.51	0.00	54.66
2.25	42.56	0.00	0.56	25.09	8.75	53.44
3.00	4.28	0.00	0.37	1.03	12.65	44.61
3.75	42.56	0.00	0.21	1.06	14.12	34.56
4.50	42.56	0.09	0.10	0.00	13.36	24.12
5.25	49.99	0.13	0.02	0.00	10.94	14.91
6.00	42.56	0.13	0.00	0.00	8.08	7.82
6.75	42.56	0.11	0.00	0.00	5.76	2.67
7.50	42.56	0.07	0.00	0.00	4.01	0.00
7.50	118.84	0.07	0.00	0.00	4.01	0.00
8.25	118.84	0.04	0.00	0.00	0.86	0.00
9.00	75.63	0.02	0.00	0.00	0.00	0.00
9.75	75.63	0.01	0.00	0.00	0.00	0.00
10.50	75.63	0.00	0.00	0.17	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
11.25	75.63	0.00	0.00	0.45	0.00	0.00
12.00	75.63	0.00	0.00	0.50	0.00	0.00
12.75	75.63	0.00	0.00	0.42	0.00	0.00
13.50	75.63	0.00	0.00	0.30	0.00	0.00
14.25	75.63	0.00	0.00	0.15	0.00	0.00
15.00	75.63	0.00	0.00	0.01	0.00	0.00

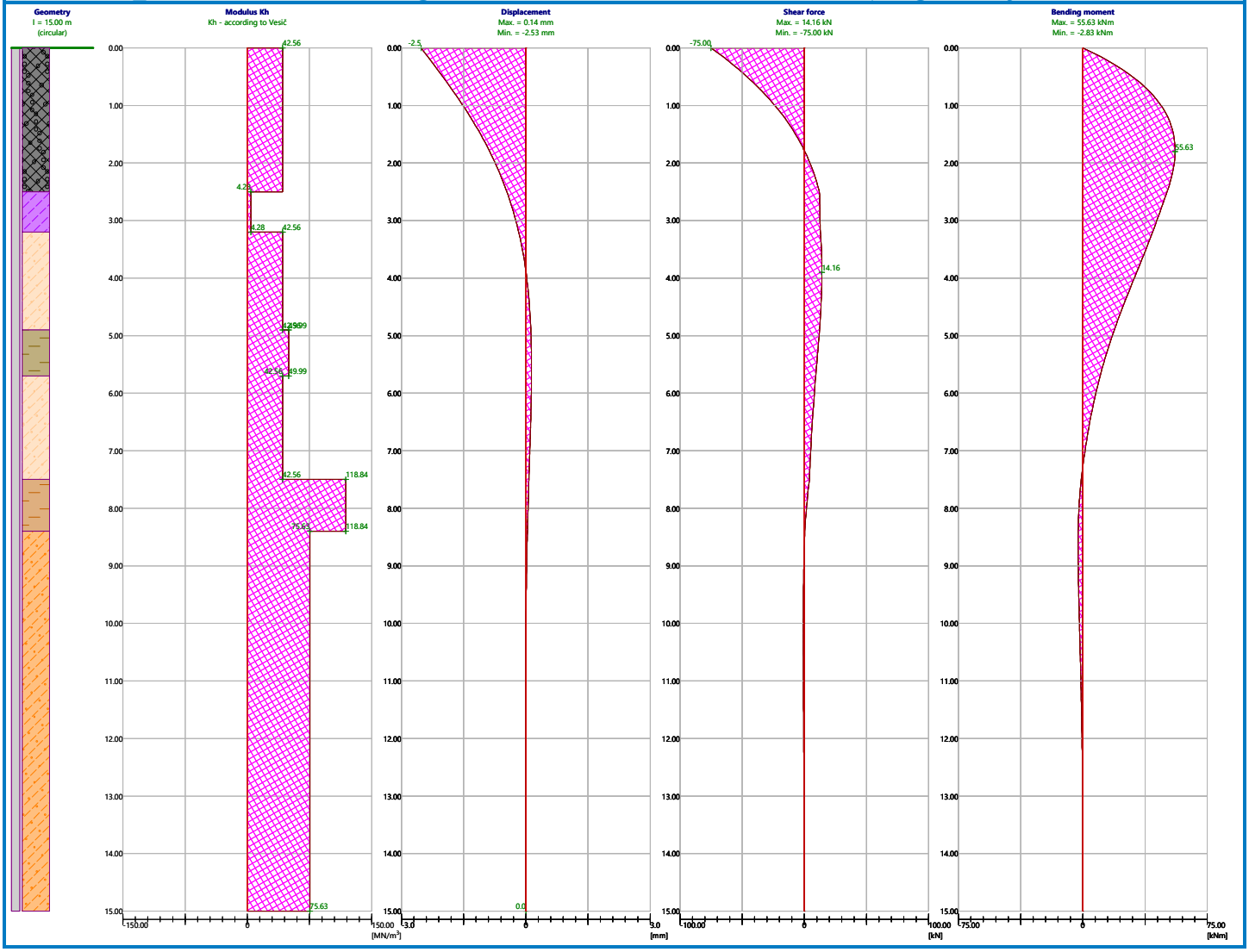
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-2.53	0.00	0.00	-75.00	-0.00
0.75	42.56	-1.75	0.00	0.00	-34.13	0.00
1.50	42.56	-1.09	0.00	0.00	-7.10	0.00
2.25	42.56	-0.59	0.00	0.00	0.00	0.00
3.00	4.28	-0.24	0.00	0.00	0.00	0.00
3.75	42.56	-0.02	0.00	0.00	0.00	0.00
4.50	42.56	0.00	0.00	-3.82	0.00	0.00
5.25	49.99	0.00	0.00	-6.66	0.00	0.00
6.00	42.56	0.00	-0.02	-5.62	0.00	0.00
6.75	42.56	0.00	-0.04	-4.58	0.00	0.00
7.50	42.56	0.00	-0.04	-6.03	0.00	-0.96
7.50	118.84	0.00	-0.04	-6.03	0.00	-0.96
8.25	118.84	0.00	-0.04	-5.25	0.00	-2.68
9.00	75.63	0.00	-0.03	-1.60	-0.39	-2.76
9.75	75.63	0.00	-0.02	-0.46	-0.83	-2.27
10.50	75.63	-0.00	-0.01	0.00	-0.88	-1.61
11.25	75.63	-0.01	-0.00	0.00	-0.73	-1.00
12.00	75.63	-0.01	0.00	0.00	-0.51	-0.53
12.75	75.63	-0.01	0.00	0.00	-0.30	-0.23
13.50	75.63	-0.00	0.00	0.00	-0.14	-0.07
14.25	75.63	-0.00	0.00	0.00	-0.04	-0.01
15.00	75.63	-0.00	0.00	0.00	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_C Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained

Pile type criteria

Short pile		ηl	<	2.00
Intermediate pile	2.00	< ηl	<	4.00
Long pile		ηl	>	4.00

Reinforcement
6 prof. 18.0 mm, cover 40.0 mm

Results

Value ηl = 5.25 ---> Pile is long

Flexure bearing capacity	M_u	=	152.69	kNm
Value on horizontal axis		=	18.50	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	1092.39	kN

Analysis of deflection :

Value taken from chart		=	0.04	
Deflection of the pile at ground level.	y	=	1.8	mm
Maximum horizontal force	Q_{max}	=	75.00	kN
Reduced resistance of pile	Q_u	=	364.13	kN

Horizontal pile resistance is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

PILE TYPE Da

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

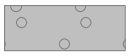
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		390.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	390.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.60 m
Length l = 12.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 2.83E-01 m^2
Moment of inertia I = 6.36E-03 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_Da	Design	550.00	0.00	0.00	75.00	0.00
2	Yes		Pile_Da-Tensile	Design	-50.00	0.00	0.00	0.00	0.00
3	Yes		Pile_Da- service	Service	550.00	0.00	0.00	75.00	0.00
4	Yes		Pile_Da-Tensile - service	Service	-50.00	0.00	0.00	75.00	0.00
5	Yes		Settlement	Service	895.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesionless
Coefficient of bearing capacity N_q = 30.00
Area of pile transverse cross-section A_p = 2.83E-01 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	42.48
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	7.84
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	11.17
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	69.74
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	30.61
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	15.32
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	77.80
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	45.59
8.40	-	-	-	-	-	-	-
12.00	3.60	-	-	1.51	27.00	81.24	211.78

Bearing capacity of tensile pile:

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	84.97
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	15.68
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	22.35
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	64.26	139.48
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	75.03	61.22
5.70	-	-	-	-	-	-	-
6.00	0.30	-	-	1.42	25.50	80.00	30.64
6.00	-	-	-	-	-	-	-
7.50	1.50	-	-	1.42	25.50	81.24	155.60
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	81.24	91.18
8.40	-	-	-	-	-	-	-
12.00	3.60	-	-	1.51	27.00	81.24	423.55

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 10.00

Verification of compressive pile:
Most unfavorable load case No. 5. (Settlement)
Pile skin bearing capacity R_s = 512.34 kN
Pile base bearing capacity R_b = 383.23 kN

Pile bearing capacity R_c = 895.57 kN
Ultimate vertical force V_d = 895.00 kN

R_c = 895.57 kN > 895.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_Da-Tensile - service)
Pile tensile resistance R_{sdt} = 359.54 kN
Pile self-weight w_p = 52.02 kN
Maximum tensile load V_d = 0.00 kN

R_c = 359.54 kN > 0.00 kN = V_d

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	6.00
3	3.20	4.90	49.40
4	4.90	5.70	84.70
5	5.70	7.50	49.40
6	7.50	8.40	84.70
7	8.40	12.00	84.70

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	=	0.80
Correction factor for Poisson's ratio of soil	C_v	=	0.75
Correction factor for stiffness of bearing stratum	C_b	=	1.96
Base-load proportion for incompressible pile	β_0	=	0.07
Proportion of applied load transferred to pile base	β	=	0.08

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	=	0.08
Correction factor for pile compressibility	R_k	=	1.32
Correction factor for finite depth of layer on a rigid base	R_h	=	1.00
Correction factor for Poisson's ratio of soil	R_v	=	0.87

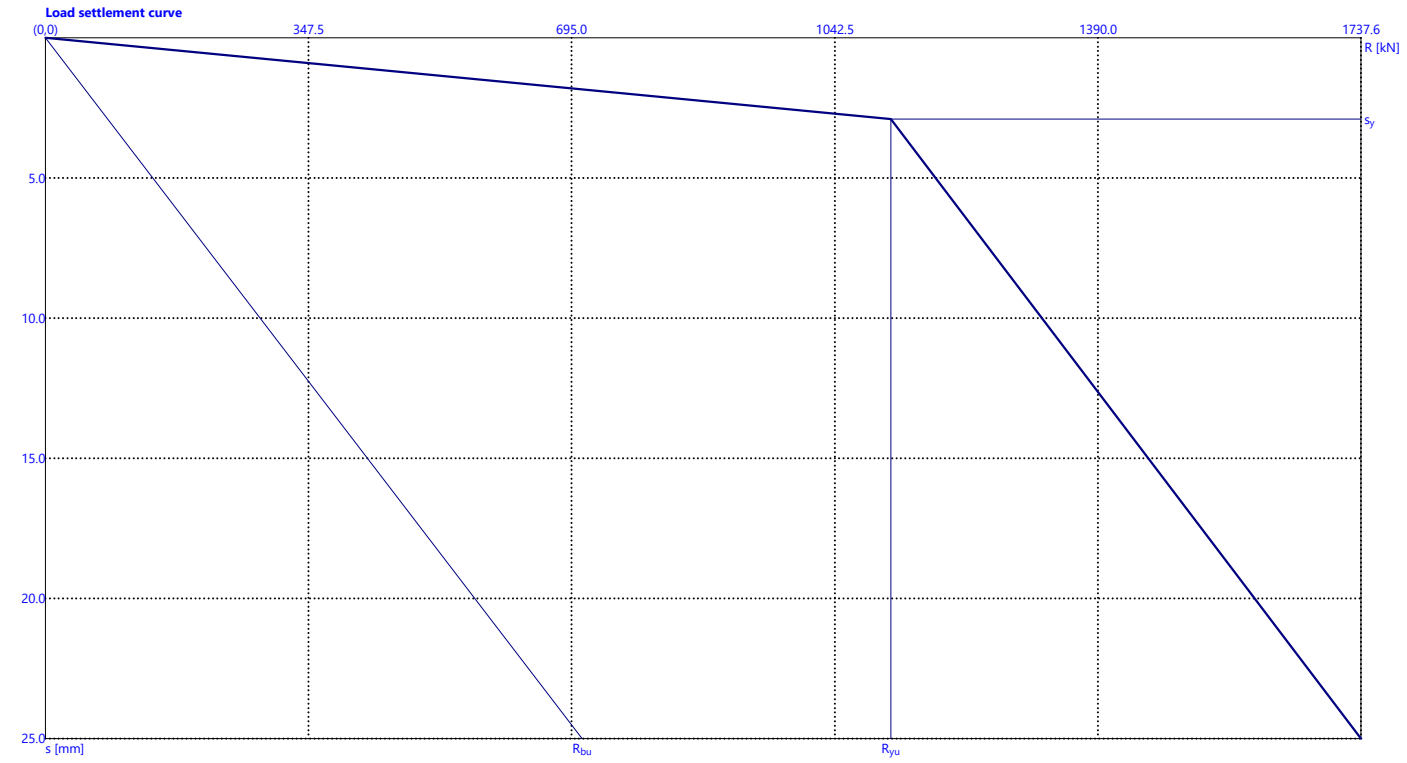
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	=	1116.79	kN
The settlement for the force R_{yu}	s_y	=	2.9	mm
Total resistance	R_c	=	1737.56	kN
Maximum settlement	s_{lim}	=	25.0	mm

The settlement for maximum service load V = 895.00kN is 2.3mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m^3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	1.06	107.58	0.00	0.00
0.60	42.56	0.00	1.00	81.04	0.00	34.35
1.20	42.56	0.00	0.86	57.13	0.00	51.15
1.80	42.56	0.00	0.69	37.24	0.53	55.53
2.40	42.56	0.00	0.52	21.76	11.02	51.79
3.00	4.28	0.00	0.37	1.05	12.59	44.43
3.60	42.56	0.00	0.24	2.63	13.84	36.56
4.20	42.56	0.05	0.14	0.00	13.84	28.17
4.80	42.56	0.11	0.07	0.00	12.52	20.21
5.40	49.99	0.14	0.01	0.00	10.29	13.34
6.00	42.56	0.13	0.00	0.00	8.03	7.87
6.60	42.56	0.11	0.00	0.00	6.13	3.64
7.20	42.56	0.09	0.00	0.00	4.56	0.45
7.80	118.84	0.06	0.00	0.00	2.44	0.00
8.40	118.84	0.04	0.00	0.00	0.23	0.00
8.40	75.63	0.04	0.00	0.00	0.23	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
9.00	75.63	0.02	0.00	0.00	0.00	0.00
9.60	75.63	0.01	0.00	0.00	0.00	0.00
10.20	75.63	0.00	0.00	0.16	0.00	0.00
10.80	75.63	0.00	0.00	0.76	0.00	0.00
11.40	75.63	0.00	0.00	1.28	0.00	0.00
12.00	75.63	0.00	0.00	1.77	0.00	0.00

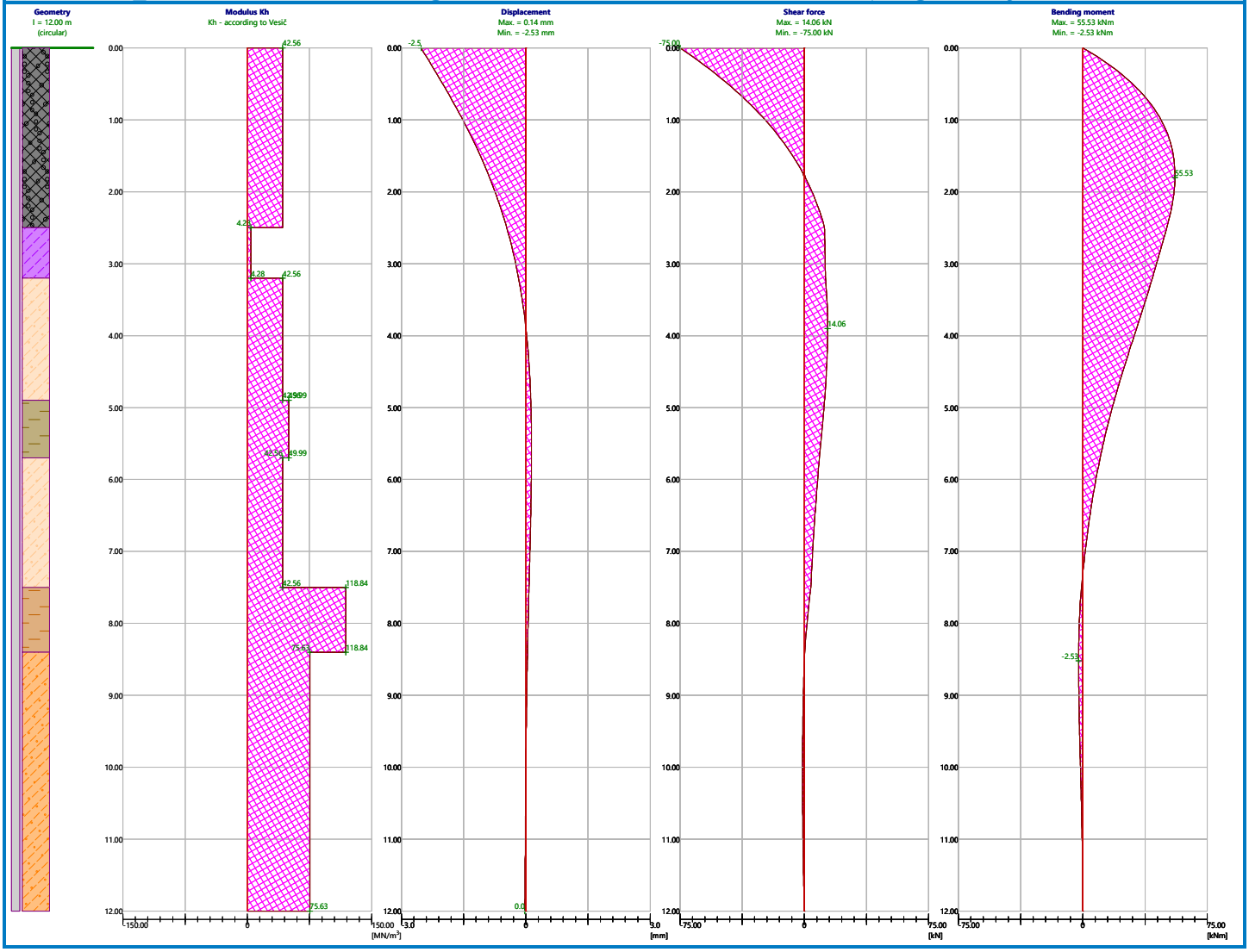
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-2.53	0.00	0.00	-75.00	-0.00
0.60	42.56	-1.90	0.00	0.00	-41.09	0.00
1.20	42.56	-1.34	0.00	0.00	-16.33	0.00
1.80	42.56	-0.88	0.00	0.00	0.00	0.00
2.40	42.56	-0.51	0.00	0.00	0.00	0.00
3.00	4.28	-0.24	0.00	0.00	0.00	0.00
3.60	42.56	-0.06	0.00	0.00	0.00	0.00
4.20	42.56	0.00	0.00	-2.22	0.00	0.00
4.80	42.56	0.00	0.00	-4.80	0.00	0.00
5.40	49.99	0.00	0.00	-6.76	0.00	0.00
6.00	42.56	0.00	-0.02	-5.63	0.00	0.00
6.60	42.56	0.00	-0.04	-4.87	0.00	0.00
7.20	42.56	0.00	-0.04	-3.80	0.00	0.00
7.80	118.84	0.00	-0.04	-7.53	0.00	-1.77
8.40	118.84	0.00	-0.03	-3.93	0.00	-2.52
8.40	75.63	0.00	-0.03	-3.93	0.00	-2.52
9.00	75.63	0.00	-0.03	-1.67	-0.61	-2.38
9.60	75.63	0.00	-0.02	-0.62	-1.01	-1.88
10.20	75.63	-0.00	-0.01	0.00	-1.09	-1.23
10.80	75.63	-0.01	-0.01	0.00	-0.92	-0.62
11.40	75.63	-0.02	-0.01	0.00	-0.55	-0.17
12.00	75.63	-0.02	-0.01	0.00	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_Da Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained

Pile type criteria

Short pile		ηl	<	2.00
Intermediate pile	2.00	< ηl	<	4.00
Long pile		ηl	>	4.00

Reinforcement
6 prof. 12.0 mm, cover 40.0 mm

Results

Value ηl = 4.20 ---> Pile is long

Flexure bearing capacity	M_u	=	74.36	kNm
Value on horizontal axis		=	9.01	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	1092.39	kN

Analysis of deflection :

Value taken from chart		=	0.09	
Deflection of the pile at ground level.	y	=	3.5	mm
Maximum horizontal force	Q_{max}	=	75.00	kN
Reduced resistance of pile	Q_u	=	364.13	kN

Horizontal pile resistance is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

PILE TYPE Db

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

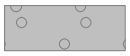
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		390.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	390.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.45 m
Length l = 12.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 1.59E-01 m^2
Moment of inertia I = 2.01E-03 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_Db	Design	550.00	0.00	0.00	75.00	0.00
2	Yes		Pile_Db-Tensile	Design	-50.00	0.00	0.00	0.00	0.00
3	Yes		Pile_Db - service	Service	550.00	0.00	0.00	75.00	0.00
4	Yes		Pile_Db-Tensile - service	Service	-50.00	0.00	0.00	75.00	0.00
5	Yes		Settlement	Service	560.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesionless
Coefficient of bearing capacity N_q = 30.00
Area of pile transverse cross-section A_p = 1.59E-01 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	31.86
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	5.88
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	8.38
3.20	-	-	-	-	-	-	-
4.50	1.30	-	-	1.42	25.50	62.60	38.96
4.50	-	-	-	-	-	-	-
4.90	0.40	-	-	1.42	25.50	67.99	13.02
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	67.99	22.96
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	67.99	58.60
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	67.99	34.19
8.40	-	-	-	-	-	-	-
12.00	3.60	-	-	1.51	27.00	67.99	132.93

Bearing capacity of tensile pile:

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.50	2.50	-	-	1.46	26.25	25.00	63.73
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	52.40	11.76
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	56.00	16.76
3.20	-	-	-	-	-	-	-
4.50	1.30	-	-	1.42	25.50	62.60	77.93
4.50	-	-	-	-	-	-	-
4.90	0.40	-	-	1.42	25.50	67.99	26.04
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	67.99	45.92
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	67.99	117.20
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	67.99	68.39
8.40	-	-	-	-	-	-	-
12.00	3.60	-	-	1.51	27.00	67.99	265.86

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 10.00

Verification of compressive pile:
Most unfavorable load case No. 5. (Settlement)
Pile skin bearing capacity R_s = 346.79 kN
Pile base bearing capacity R_b = 215.57 kN

Pile bearing capacity R_c = 562.36 kN
Ultimate vertical force V_d = 560.00 kN

R_c = 562.36 kN > 560.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_Db-Tensile - service)
Pile tensile resistance R_{sdt} = 243.36 kN
Pile self-weight w_p = 29.26 kN
Maximum tensile load V_d = 20.74 kN

R_c = 243.36 kN > 20.74 kN = V_d

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	6.00
3	3.20	4.90	49.40
4	4.90	5.70	84.70
5	5.70	7.50	49.40
6	7.50	8.40	84.70
7	8.40	12.00	84.70

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	= 0.74
Correction factor for Poisson's ratio of soil	C_v	= 0.75
Correction factor for stiffness of bearing stratum	C_b	= 2.02
Base-load proportion for incompressible pile	β_0	= 0.06
Proportion of applied load transferred to pile base	β	= 0.06

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	= 0.07
Correction factor for pile compressibility	R_k	= 1.43
Correction factor for finite depth of layer on a rigid base	R_h	= 1.00
Correction factor for Poisson's ratio of soil	R_v	= 0.87

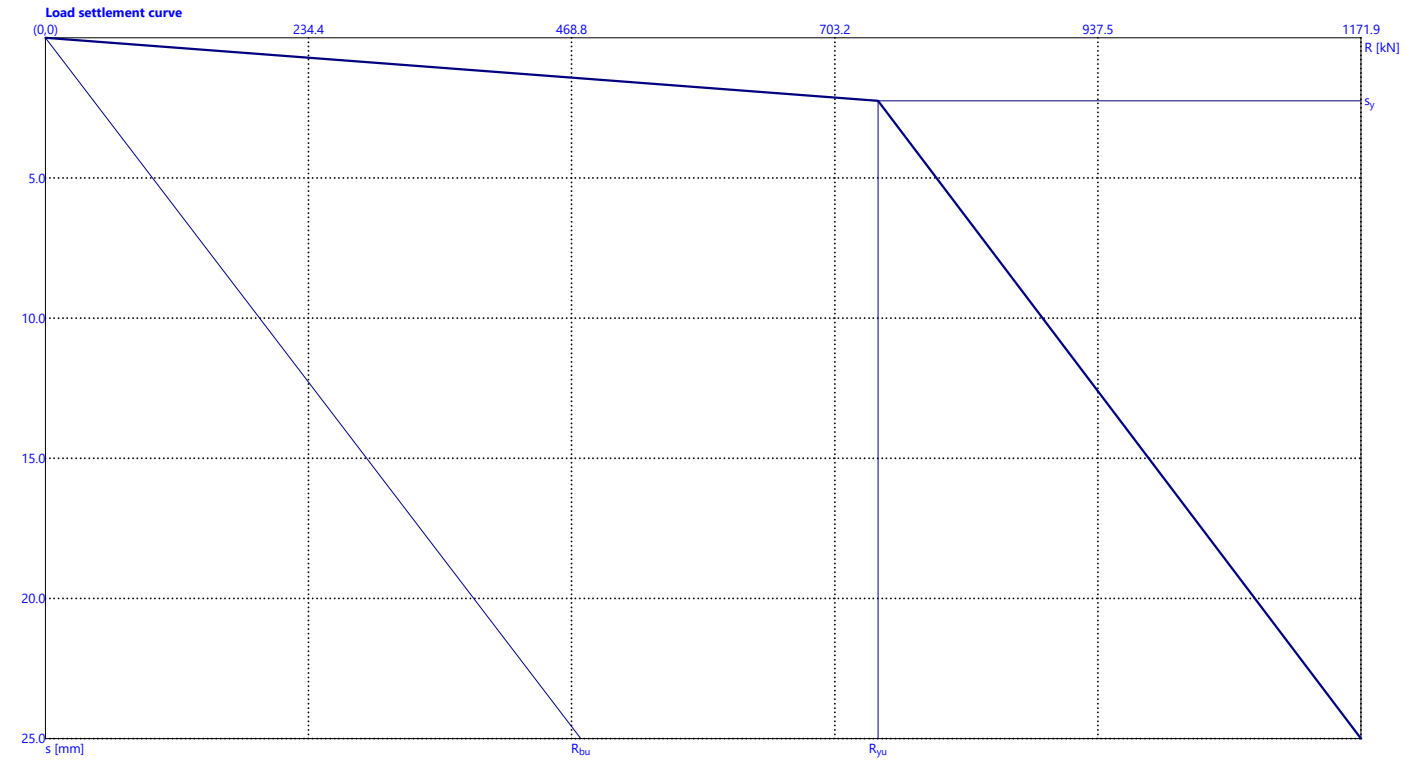
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	=	741.79	kN
The settlement for the force R_{yu}	s_y	=	2.2	mm
Total resistance	R_c	=	1171.93	kN
Maximum settlement	s_{lim}	=	25.0	mm

The settlement for maximum service load V = 560.00kN is 1.7mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m^3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	1.91	190.08	0.00	0.00
0.60	56.75	0.00	1.73	127.13	0.00	31.34
1.20	56.75	0.00	1.36	74.19	0.00	41.95
1.80	56.75	0.00	0.94	35.11	9.01	40.35
2.40	56.75	0.00	0.57	9.51	14.75	32.88
3.00	5.71	0.09	0.29	0.00	15.08	23.84
3.60	56.75	0.20	0.10	0.00	13.27	15.14
4.20	56.75	0.22	0.00	0.00	9.93	8.17
4.80	56.75	0.20	0.00	0.00	6.67	3.21
5.40	66.65	0.15	0.00	0.00	3.62	0.15
6.00	56.75	0.10	0.00	0.00	1.54	0.00
6.60	56.75	0.06	0.00	0.00	0.34	0.00
7.20	56.75	0.03	0.00	0.00	0.00	0.00
7.80	158.45	0.01	0.00	0.00	0.00	0.00
8.40	158.45	0.00	0.00	0.40	0.00	0.00
8.40	100.84	0.00	0.00	0.40	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
9.00	100.84	0.00	0.00	0.74	0.00	0.00
9.60	100.84	0.00	0.00	0.79	0.00	0.00
10.20	100.84	0.00	0.00	0.64	0.00	0.00
10.80	100.84	0.00	0.00	0.41	0.00	0.00
11.40	100.84	0.00	0.00	0.16	0.00	0.00
12.00	100.84	0.00	0.00	0.00	0.00	0.00

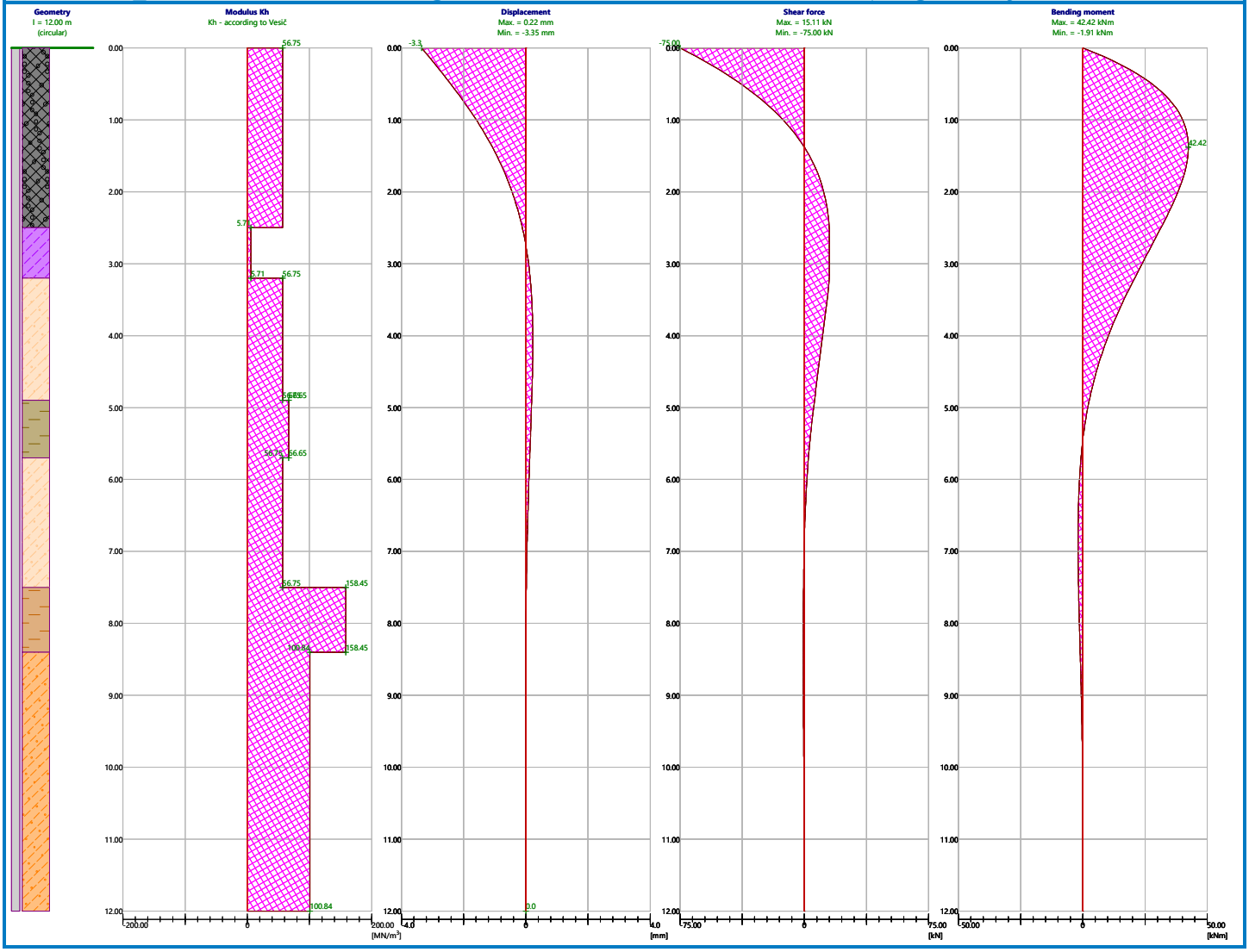
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-3.35	0.00	0.00	-75.00	0.00
0.60	56.75	-2.24	0.00	0.00	-32.32	0.00
1.20	56.75	-1.31	0.00	0.00	-5.43	0.00
1.80	56.75	-0.62	0.00	0.00	0.00	0.00
2.40	56.75	-0.17	0.00	0.00	0.00	0.00
3.00	5.71	0.00	0.00	-0.50	0.00	0.00
3.60	56.75	0.00	0.00	-11.44	0.00	0.00
4.20	56.75	0.00	-0.01	-12.70	0.00	0.00
4.80	56.75	0.00	-0.07	-11.15	0.00	0.00
5.40	66.65	0.00	-0.08	-9.93	0.00	0.00
6.00	56.75	0.00	-0.08	-5.67	0.00	-1.33
6.60	56.75	0.00	-0.06	-3.31	0.00	-1.87
7.20	56.75	0.00	-0.04	-1.56	-0.30	-1.85
7.80	158.45	0.00	-0.02	-1.21	-0.72	-1.55
8.40	158.45	-0.00	-0.01	0.00	-0.79	-1.07
8.40	100.84	-0.00	-0.01	0.00	-0.79	-1.07
9.00	100.84	-0.01	-0.00	0.00	-0.64	-0.64
9.60	100.84	-0.01	0.00	0.00	-0.43	-0.32
10.20	100.84	-0.01	0.00	0.00	-0.23	-0.12
10.80	100.84	-0.00	0.00	0.00	-0.09	-0.03
11.40	100.84	-0.00	0.00	0.00	-0.01	0.00
12.00	100.84	0.00	0.00	-0.08	-0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_Db Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained

Pile type criteria

Short pile		ηl	<	2.00
Intermediate pile	2.00	< ηl	<	4.00
Long pile		ηl	>	4.00

Reinforcement
6 prof. 14.0 mm, cover 40.0 mm

Results

Value ηl = 5.28 ---> Pile is long

Flexure bearing capacity	M_u	=	67.32	kNm
Value on horizontal axis		=	25.79	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	460.85	kN

Analysis of deflection :

Value taken from chart		=	0.04	
Deflection of the pile at ground level.	y	=	2.8	mm
Maximum horizontal force	Q_{max}	=	75.00	kN
Reduced resistance of pile	Q_u	=	153.62	kN

Horizontal pile resistance is SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

PILE TYPE Dc

Pile verification

Input data

Project

Date : 25-Nov-22

Settings

(input for current task)

Materials and standards

Concrete structures :	EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 :	standard
Steel structures :	EN 1993-1-1 (EC3)
Partial factor on bearing capacity of steel cross section :	γ_{M0} = 1.00
Timber structures :	EN 1995-1-1 (EC5)
Partial factor for timber property :	γ_M = 1.30
Modif. factor of load duration and moisture content :	k_{mod} = 0.50
Coeff. of effective width for shear stress :	k_{cr} = 0.67

Pile

Verification methodology :	Limit states (LSD)
Analysis for drained conditions :	NAVFAC DM 7.2
Load settlement curve :	linear (Poulos)
Horizontal bearing capacity :	Elastic subsoil (p-y method)

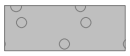
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1.00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1.00	[–]
Coefficient of unit weight :	$\gamma_{m\gamma}$ =	1.00	[–]

Reduction coeff. of bearing capacity			
Permanent design situation			
Reduction coeff. of shaft resistance :	γ_s =	2.00	[–]
Reduction coeff. of base resistance :	γ_b =	3.00	[–]
Reduction coeff. of total resistance :	γ_t =	1.00	[–]
Reduction coeff. of resistance in tension :	γ_{st} =	2.85	[–]

Basic soil parameters

No.	Name	Pattern	γ [kN/m³]	ν [–]
1	Unit_0		16.00	0.20
2	Engineering_Fill		20.00	0.20
3	Unit_1a		18.30	0.20
4	Unit_1b		19.30	0.20

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	γ [kN/m³]	ν [–]
5	Unit_2a		16.60	0.20
6	Unit_2b		18.10	0.20
7	Unit_2c		18.80	0.20
8	Unit_3		22.00	0.20

No.	Name	Pattern	E_{oed} [MPa]	E_{def} [MPa]	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
1	Unit_0		6.00	-	16.00	-	-
2	Engineering_Fill		50.00	-	20.00	-	-
3	Unit_1a		49.40	-	18.30	-	-
4	Unit_1b		84.70	-	19.30	-	-
5	Unit_2a		58.00	-	19.30	-	-
6	Unit_2b		129.00	-	19.30	-	-
7	Unit_2c		244.00	-	18.80	-	-
8	Unit_3		390.00	-	22.00	-	-

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
1	Unit_0		30.00	-	-	-	-
2	Engineering_Fill		35.00	-	-	-	-
3	Unit_1a		34.00	-	-	-	-
4	Unit_1b		36.00	-	-	-	-
5	Unit_2a		-	-	-	58.00	0.70
6	Unit_2b		-	-	-	125.00	0.43
7	Unit_2c		-	-	-	190.00	0.33

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

No.	Name	Pattern	φ_{ef} [°]	δ [°]	K [–]	c_u [kPa]	α [–]
8	Unit_3		-	-	-	1650.00	0.20

Parameters of soils to compute modulus of subsoil reaction

No.	Name	Pattern	E
1	Unit_0		6.00
2	Engineering_Fill		50.00
3	Unit_1a		50.00
4	Unit_1b		85.00
5	Unit_2a		58.00
6	Unit_2b		129.00
7	Unit_2c		244.00
8	Unit_3		390.00

Soil parameters

Unit_0

Unit weight : $\gamma = 16.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 6.00$ MPa
Saturated unit weight : $\gamma_{sat} = 16.00$ kN/m^3
Elastic modulus : $E = 6.00$ MPa
Angle of internal friction : $\varphi_{ef} = 30.00$ °

Engineering_Fill

Unit weight : $\gamma = 20.00$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 50.00$ MPa
Saturated unit weight : $\gamma_{sat} = 20.00$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 35.00$ °

Unit_1a

Unit weight : $\gamma = 18.30$ kN/m^3
Poisson's ratio : $\nu = 0.20$
Oedometric modulus : $E_{oed} = 49.40$ MPa
Saturated unit weight : $\gamma_{sat} = 18.30$ kN/m^3
Elastic modulus : $E = 50.00$ MPa
Angle of internal friction : $\varphi_{ef} = 34.00$ °

Unit_1b

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Unit weight :	γ	=	19.30 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	84.70 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	85.00 MPa
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2a

Unit weight :	γ	=	16.60 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	58.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	58.00 MPa
Cohesion of soil :	c_u	=	58.00 kPa
Adhesion factor :	α	=	0.70
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2b

Unit weight :	γ	=	18.10 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	129.00 MPa
Saturated unit weight :	γ_{sat}	=	19.30 kN/m^3
Elastic modulus :	E	=	129.00 MPa
Cohesion of soil :	c_u	=	125.00 kPa
Adhesion factor :	α	=	0.43
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_2c

Unit weight :	γ	=	18.80 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	244.00 MPa
Saturated unit weight :	γ_{sat}	=	18.80 kN/m^3
Elastic modulus :	E	=	244.00 MPa
Cohesion of soil :	c_u	=	190.00 kPa
Adhesion factor :	α	=	0.33
Angle of internal friction :	φ_{ef}	=	36.00 °

Unit_3

Unit weight :	γ	=	22.00 kN/m^3
Poisson's ratio :	v	=	0.20
Oedometric modulus :	E_{oed}	=	390.00 MPa
Saturated unit weight :	γ_{sat}	=	22.00 kN/m^3
Elastic modulus :	E	=	390.00 MPa
Cohesion of soil :	c_u	=	1650.00 kPa
Adhesion factor :	α	=	0.20
Angle of internal friction :	φ_{ef}	=	19.00 °

Geometry

Pile profile: circular

Dimensions

Diameter d = 0.30 m
Length l = 19.00 m

Calculated cross-sectional characteristics

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Area A = 7.07E-02 m^2
Moment of inertia I = 3.98E-04 m^4

Location
Off ground height h = 0.00 m
Depth of finished grade h_z = 0.00 m

Technology: CFA piles
Modulus of subsoil reaction considered according to Vesič.

Material of structure

Unit weight γ = 23.00 kN/m^3
Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	= 20.00	MPa
Tensile strength	f_{ctm}	= 2.20	MPa
Elasticity modulus	E_{cm}	= 30000.00	MPa
Shear modulus	G	= 12500.00	MPa

Longitudinal steel: B500B
Yield strength f_{yk} = 500.00 MPa

Transverse steel: B500B
Yield strength f_{yk} = 500.00 MPa

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.50	0.00 .. 2.50	Engineering_Fill	
2	0.70	2.50 .. 3.20	Unit_0	
3	1.70	3.20 .. 4.90	Unit_1a	
4	0.80	4.90 .. 5.70	Unit_2a	
5	1.80	5.70 .. 7.50	Unit_1a	
6	0.90	7.50 .. 8.40	Unit_2b	
7	7.40	8.40 .. 15.80	Unit_1b	
8	2.50	15.80 .. 18.30	Unit_2c	
9	9.50	18.30 .. 27.80	Unit_3	
10	-	27.80 .. ∞	Unit_3	

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Load

No.	Load		Name	Type	N	M_x	M_y	H_x	H_y
	new	change			[kN]	[kNm]	[kNm]	[kN]	[kN]
1	Yes		Pile_Dc	Design	550.00	0.00	0.00	75.00	0.00
2	Yes		Pile_Dc-Tensile	Design	-50.00	0.00	0.00	0.00	0.00
3	Yes		Pile_Dc - service	Service	550.00	0.00	0.00	75.00	0.00
4	Yes		Pile_Dc-Tensile - service	Service	-50.00	0.00	0.00	75.00	0.00
5	Yes		Settlement	Service	760.00	0.00	0.00	0.00	0.00

Ground water table

The ground water table is at a depth of 2.80 m from the original terrain.

Global settings

Analysis of vertical bearing capacity : analytical solution
Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent
Verification methodology : without reduction of soil parameters

Verification No. 1

Verification of pile bearing capacity according to NAVFAC DM 7.2 - partial results

Pile base bearing capacity:
The soil under the base is cohesive
Design undrained shear strength c_u = 1650.00 kPa
Area of pile transverse cross-section A_p = 7.07E-02 m^2

Pile shaft resistance:

Depth	Thickness	c_{ud}	α	K	δ	σ_{or}	R_{si}
[m]	[m]	[kPa]	[–]	[–]	[°]	[kPa]	[kN]
0.00	-	-	-	-	-	-	-
2.40	2.40	-	-	1.46	26.25	24.00	19.58
2.40	-	-	-	-	-	-	-
2.50	0.10	-	-	1.46	26.25	48.00	1.63
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	48.00	3.59
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	48.00	4.79
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	48.00	26.05
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	48.00	15.31
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	48.00	27.58
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	48.00	22.80
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	48.00	128.60
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	48.00	73.87
18.30	-	-	-	-	-	-	-
19.00	0.70	1650.00	0.20	-	-	48.00	108.86

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Bearing capacity of tensile pile:

Depth [m]	Thickness [m]	c_{ud} [kPa]	α [–]	K [–]	δ [°]	σ_{or} [kPa]	R_{si} [kN]
0.00	-	-	-	-	-	-	-
2.40	2.40	-	-	1.46	26.25	24.00	39.15
2.40	-	-	-	-	-	-	-
2.50	0.10	-	-	1.46	26.25	48.00	3.26
2.50	-	-	-	-	-	-	-
2.80	0.30	-	-	1.28	22.50	48.00	7.18
2.80	-	-	-	-	-	-	-
3.20	0.40	-	-	1.28	22.50	48.00	9.58
3.20	-	-	-	-	-	-	-
4.90	1.70	-	-	1.42	25.50	48.00	52.10
4.90	-	-	-	-	-	-	-
5.70	0.80	58.00	0.70	-	-	48.00	30.61
5.70	-	-	-	-	-	-	-
7.50	1.80	-	-	1.42	25.50	48.00	55.16
7.50	-	-	-	-	-	-	-
8.40	0.90	125.00	0.43	-	-	48.00	45.59
8.40	-	-	-	-	-	-	-
15.80	7.40	-	-	1.51	27.00	48.00	257.21
15.80	-	-	-	-	-	-	-
18.30	2.50	190.00	0.33	-	-	48.00	147.73
18.30	-	-	-	-	-	-	-
19.00	0.70	1650.00	0.20	-	-	48.00	217.71

Verification of bearing capacity : NAVFAC DM 7.2

Analysis carried out with automatic selection of the most unfavourable load cases.
Factor determining critical depth k_{dc} = 8.00

Verification of compressive pile:
Most unfavorable load case No. 5. (Settlement)
Pile skin bearing capacity R_s = 432.65 kN
Pile base bearing capacity R_b = 349.89 kN

Pile bearing capacity R_c = 782.54 kN
Ultimate vertical force V_d = 760.00 kN

R_c = 782.54 kN > 760.00 kN = V_d

Pile compressive resistance is SATISFACTORY

Verification of tensile pile:
Most unfavorable load case No. 4. (Pile_Dc-Tensile - service)
Pile tensile resistance R_{sdt} = 303.61 kN
Pile self-weight w_p = 19.44 kN
Maximum tensile load V_d = 30.56 kN

R_c = 303.61 kN > 30.56 kN = V_d

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile tensile resistance is SATISFACTORY

Pile bearing capacity is SATISFACTORY

Verification No. 1

Analysis of load settlement curve - input data

Layer No.	Origin [m]	End [m]	E_s [MPa]
1	0.00	2.50	50.00
2	2.50	3.20	6.00
3	3.20	4.90	49.40
4	4.90	5.70	84.70
5	5.70	7.50	49.40
6	7.50	8.40	84.70
7	8.40	15.80	84.70
8	15.80	18.30	135.00
9	18.30	19.00	135.00

Maximum pile settlement s_{lim} = 25.0 mm

Analysis of load settlement curve - partial results

Correction factor for pile compressibility	C_k	= 0.55
Correction factor for Poisson's ratio of soil	C_v	= 0.75
Correction factor for stiffness of bearing stratum	C_b	= 2.86
Base-load proportion for incompressible pile	β_0	= 0.04
Proportion of applied load transferred to pile base	β	= 0.04

Influence coefficients of settlement :

Basic - dependent on ratio l/d	I_0	= 0.04
Correction factor for pile compressibility	R_k	= 1.88
Correction factor for finite depth of layer on a rigid base	R_h	= 1.00
Correction factor for Poisson's ratio of soil	R_v	= 0.88

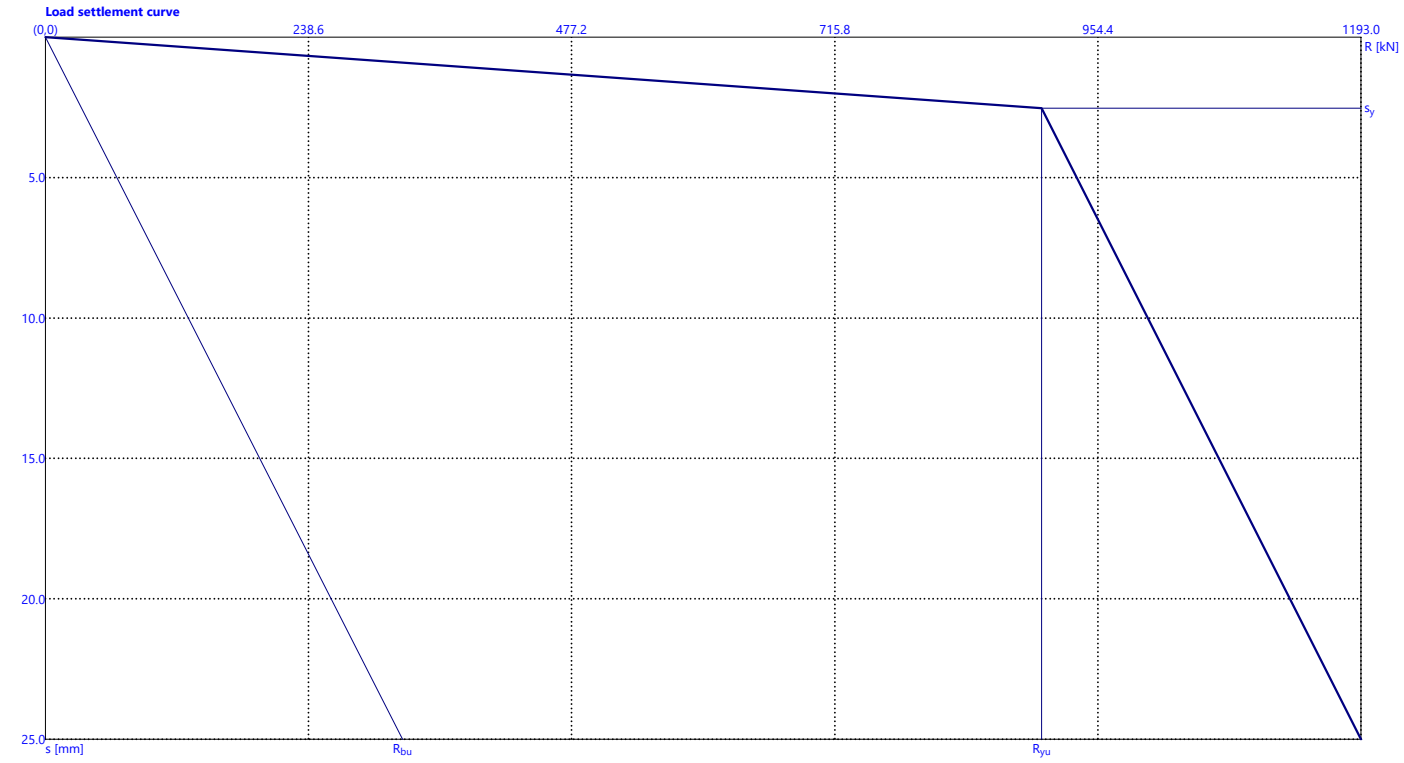
Analysis of load settlement curve - results

Load at the onset of mobilization of skin friction	R_{yu}	=	903.45	kN
The settlement for the force R_{yu}	s_y	=	2.5	mm
Total resistance	R_c	=	1193.05	kN
Maximum settlement	s_{lim}	=	25.0	mm

The settlement for maximum service load V = 760.00kN is 2.1mm.

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Settlement	Stage - analysis : 1 - 1



Verification No. 1

Input data to compute pile horizontal bearing capacity

Pile is fixed into a rock (translation at pile foot equals zero).
Analysis carried out with automatic selection of the most unfavourable load cases.
Horizontal bearing capacity verified in the direction of X.

Distributions of internal forces and displacement of pile

Pile displacements and internal forces distributions - maximum values

Dist. [m]	Modulus k [MN/m^3]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	0.00	4.34	430.13	0.00	0.00
0.95	85.13	0.00	2.75	129.01	1.43	28.09
1.90	85.13	0.13	0.86	0.00	14.62	17.34
2.85	8.56	0.45	0.00	0.00	9.32	6.41
3.80	85.13	0.26	0.00	0.00	3.63	0.00
4.75	85.13	0.07	0.00	0.00	0.00	0.00
5.70	99.98	0.00	0.00	0.70	0.00	0.00
5.70	85.13	0.00	0.00	0.70	0.00	0.00
6.65	85.13	0.00	0.01	1.49	0.00	0.00
7.60	237.68	0.00	0.01	1.71	0.00	0.08
8.55	151.26	0.00	0.00	0.06	0.07	0.08
9.50	151.26	0.00	0.00	0.00	0.04	0.02
10.45	151.26	0.00	0.00	0.00	0.01	0.00
11.40	151.26	0.00	0.00	0.00	0.00	0.00
12.35	151.26	0.00	0.00	0.01	0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Dist. [m]	Modulus k [MN/m³]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
13.30	151.26	0.00	0.00	0.00	0.00	0.00
14.25	151.26	0.00	0.00	0.00	0.00	0.00
15.20	151.26	0.00	0.00	0.00	0.00	0.00
16.15	474.08	0.00	0.00	0.00	0.00	0.00
17.10	474.08	0.00	0.00	0.00	0.00	0.00
18.05	474.08	0.00	0.00	0.00	0.00	0.00
19.00	787.95	0.00	0.00	0.00	0.00	0.00

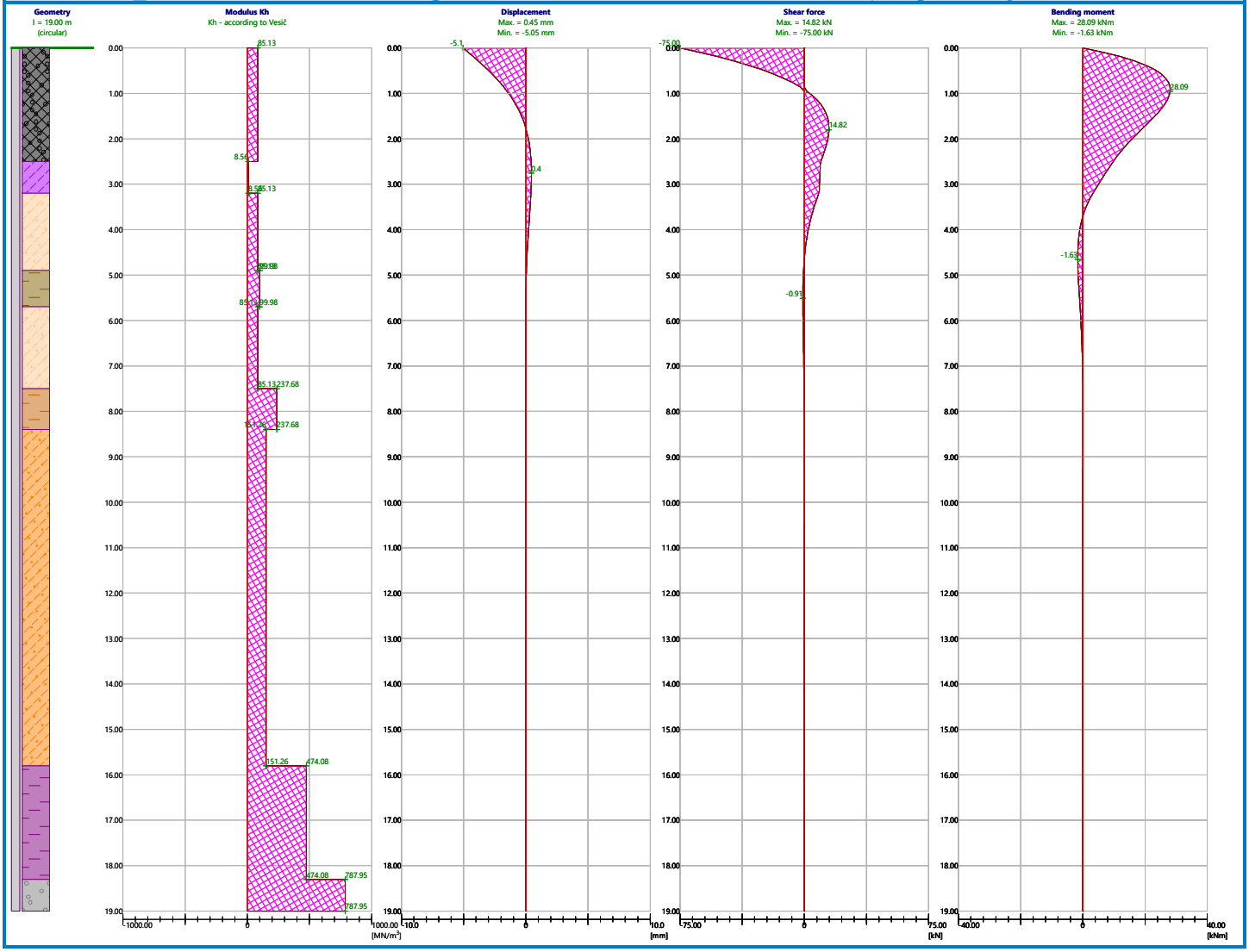
Pile displacements and internal forces distributions - minimum values

Dist. [m]	Modulus k [MN/m³]	Displacement [mm]	Rotat. [mRad]	Stress [kPa]	Shear Force [kN]	Moment [kNm]
0.00	0.00	-5.05	0.00	0.00	-75.00	0.00
0.95	85.13	-1.52	0.00	0.00	0.00	0.00
1.90	85.13	0.00	0.00	-10.80	0.00	0.00
2.85	8.56	0.00	-0.05	-3.82	0.00	0.00
3.80	85.13	0.00	-0.25	-22.45	0.00	-0.38
4.75	85.13	0.00	-0.14	-6.17	-0.24	-1.62
5.70	99.98	-0.01	-0.04	0.00	-0.89	-0.92
5.70	85.13	-0.01	-0.04	0.00	-0.89	-0.92
6.65	85.13	-0.02	0.00	0.00	-0.51	-0.24
7.60	237.68	-0.01	0.00	0.00	-0.15	0.00
8.55	151.26	-0.00	0.00	0.00	0.00	0.00
9.50	151.26	0.00	-0.00	-0.14	0.00	0.00
10.45	151.26	0.00	-0.00	-0.07	0.00	-0.00
11.40	151.26	0.00	-0.00	-0.01	-0.00	-0.00
12.35	151.26	-0.00	-0.00	0.00	-0.00	-0.00
13.30	151.26	-0.00	0.00	0.00	-0.00	-0.00
14.25	151.26	-0.00	0.00	0.00	0.00	0.00
15.20	151.26	0.00	0.00	-0.00	0.00	0.00
16.15	474.08	0.00	-0.00	-0.00	0.00	0.00
17.10	474.08	0.00	-0.00	-0.00	-0.00	-0.00
18.05	474.08	-0.00	-0.00	0.00	-0.00	-0.00
19.00	787.95	0.00	0.00	0.00	-0.00	0.00

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Name : Pile_Dc Shear and Moment Diag.

Stage - analysis : 1 - 1



[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Pile verification

Verification No. 1

Input data to compute pile horizontal bearing capacity

Analysis carried out with automatic selection of the most unfavourable load cases.
Type of soil : cohesionless

Angle of internal friction	φ	=	34.00	°
Unit weight	γ	=	18.00	kN/m^3
Coeff. of soil modulus variation	n_h	=	1.00	MN/m^3
Red. coeff. of cross-section strength	γ_k	=	1.00	
Red. coeff. of bearing capacity	γ_{Qu}	=	3.00	

Type of pile : restrained
Pile type criteria
Short pile $\eta l < 2.00$
Long pile $\eta l > 4.00$

Reinforcement
6 prof. 14.0 mm, cover 40.0 mm

Results

Value $\eta l = 11.57$ ---> Pile is long

Flexure bearing capacity	M_u	=	36.22	kNm
Value on horizontal axis		=	70.23	
Value taken from chart		=	79.43	
Pile resistance	Q_u	=	136.55	kN

Analysis of deflection :

Value taken from chart		=	0.00	
Deflection of the pile at ground level.	y	=	0.0	mm
Maximum horizontal force	Q_{max}	=	75.00	kN
Reduced resistance of pile	Q_u	=	45.52	kN

Horizontal pile resistance is NOT SATISFACTORY

[GEO5 - Pile (64 bit) | version 5.2022.60.0 | hardware key 12276 / 1 | Fugro Sial Yerbilimleri | Copyright © 2022 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

Appendix F

Geo-environmental Data

F.1 Soil Risk Assessment Analysis

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	AR-BH01	AR-BH02	BH104	BH106	BH106	MS-BH03	MS-BH05	MS-BH05	MS-BH05	MS-BH07	MS-BH08	MS-BH09
Depth	0.10-0.10	1.20-1.20	7.80-7.80	2.80-2.80	4.30-4.30	0.80-0.80	0.50-0.50	0.50-0.50	1.00-1.00	1.90-2.00	0.90-0.90	1.20-1.20
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	21/09/2022	22/12/10	06/10/2022	21/10/2022	21/10/2022	25/08/2022	06/09/2022	06/09/2022	06/09/2022	23/08/2022	09/09/2022	15/09/2022
Sample Received	27/09/2022	18/10/2022	18/10/2022	27/10/2022	27/10/2022	22/06/09	13/09/2022	13/09/2022	13/09/2022	09/06/2022	17/09/2022	24/09/2022
Sample No	ES2	ES11	ES 24	ES 13	ES 21	ES 8	ES 4	ES 4	ES 7	ES 12	ES 8	ES 9
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**												
			1% OGN													
Carbon																
Organic Matter (OGM)	%	<0.35		0	0.457	<0.35	0.798	0.74	0.791	<0.35	0.402	0.402	0.809	0.726	<0.35	<0.35
Inotganics																
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.0159	0.0144	0.132	0.0356	0.0362	<0.004	<0.004	<0.004	0.0079	0.0085	0.0965	0.0084
pH	pH Units	<1		0	9.19	8.03	10.5	8.67	8.26	8.47	8.44	8.44	8.07	8.6	7.74	8.35
Sulphate	mg/kg	<48		0	233	<48	568	291	128	<48	<48	<48	<48	<48	235	<48
Nitrite as NO2	mg/kg	<0.1		0	<0.1	0.17	0.23	0.33	<0.1	0.21	0.18	0.18	<0.1	<0.1	0.12	<0.1
Nitrate as NO3	mg/kg	<1		0	<1	<1	<1	<1	<1	3.14	2.18	2.18	<1	<1	4.99	1.03
Sulphide	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.00777	<0.0016	0.0189	0.00969	0.00426	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	0.00785	<0.0016
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<1.2
Arsenic	mg/kg	<0.6	640	0	0.626	2.29	18.5	7.19	1.65	1.44	2.19	2.19	2.14	1.31	1.56	0.873
Total Boron	mg/kg	<0.7		0	31.6	1.07	16.6	7.17	4.67	1.18	1.72	1.72	1.3	0.933	0.736	0.88
Cadmium	mg/kg	<0.02	190	0	0.177	<0.02	0.0996	0.0999	0.122	0.0459	0.0372	0.0372	0.165	0.0407	0.0248	0.0895
Chromium	mg/kg	<0.9		0	2.44	5.87	6.2	10.4	7.94	6.63	5.44	5.44	3.84	4.51	3.45	4.46
Copper	mg/kg	<1.4	68000	0	3.31	4.72	15.2	23.8	7.28	4.97	2.63	2.63	8.58	4.77	2.48	3.05
iron	mg/kg	<1000		0	4280	4420	7630	13100	6060	4960	3660	3660	5990	3670	3730	2630
Lead	mg/kg	<0.7	1100	0	8.03	4.79	11.1	7.85	7.19	6.59	8.05	8.05	5.05	5.15	3.84	5.41
Mercury	mg/kg	<0.1	1100	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	2.08	4.99	14.4	13.5	9.37	8.7	6.84	6.84	5.84	5.43	4.84	6.34
Selenium	mg/kg	<1	12000	0	1.38	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg	<1.9	7300000	0	20.4	9.58	20.6	22.5	34.5	16.8	11.2	11.2	9.11	11.1	11.2	11.9
Metals - (Liquids)																
Chromium, III	mg/kg	<0.9	8600	0	2.44	5.87	6.2	10.4	7.94	6.63	5.44	5.44	3.84	4.51	3.45	4.46
Phenols																
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	-	-	<50	<50	-	-	-	<50	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	-	-	<50	<50	-	-	-	<50	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	116	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																
EPH Surrogate % recovery**	%			0	91.5	96.2	106	109	99	98.7	105	105	100	103	98.8	103
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35
TPH Criteria Working Group (TPH CWG)																
GRO Surrogate % recovery**	%			0	-	-	-	-	98.3	96.1	-	-	-	99.3	-	-
Aliphatics >C5-C6	µg/kg	<10	3200	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aliphatics >C6-C8	µg/kg	<10	7800	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aliphatics >C8-C10	µg/kg	<10	2000	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aliphatics >C10-C12	µg/kg	<1000	9700	0	-	-	-	-	<1000	<1000	-	-	-	<1000	-	-
Aliphatics >C12-C16	µg/kg	<1000	59000	0	-	-	-	-	<1000	<1000	-	-	-	<1000	-	-
Aliphatics >C16-C21	µg/kg	<1000	1600000	0	-	-	-	-	<1000	<1000	-	-	-	1610	-	-
Aliphatics >C21-C35	µg/kg	<1000	1600000	0	-	-	-	-	2300	<1000	-	-	-	16500	-	-
Aliphatics >C35-C44	µg/kg	<1000	1600000	0	-	-	-	-	1980	<1000	-	-	-	1870	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	-	-	<5000	<5000	-	-	-	20000	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	-	-	<10000	<10000	-	-	-	50900	-	-
Aromatics >EC5-EC7	µg/kg	<10	26000	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aromatics >EC7-EC8	µg/kg	<10	56000	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aromatics >EC8-EC10	µg/kg	<10	3500	0	-	-	-	-	<10	<10	-	-	-	<10	-	-
Aromatics >EC10-EC12	µg/kg	<1000	16000	0	-	-	-	-	<1000	<1000	-	-	-	<1000	-	-
Aromatics >EC12-EC16	µg/kg	<1000	36000	0	-	-	-	-	<1000	<1000	-	-	-	<1000	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	-	-	<1000	<1000	-	-	-	1000	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	0	-	-	-	-	3150	<1000	-	-	-	17500	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	0	-	-	-	-	1640	<1000	-	-	-	11700	-	-
Aromatics > EC40-EC44	µg/kg	<1000	28000	0	-	-	-	-	<1000	<1000	-	-	-	1720	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	-	-	5110	<5000	-	-	-	30900	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	-	-	<10000	<10000	-	-	-	50900	-	-
EPH (C5-C40)	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35
Polyaromatic Hydrocarbons (PAHs)																
Naphthalene-d8 % recovery**	%			0	91.7	91.4	68	88	91.2	90.6	89.3	89.3	87	93.6	90.4	90.5
Acenaphthene-d10 % recovery**	%			0	93.4	91.5	63.9	89.1	90.1	90	90.2	90.2	89.5	94.5	88.9	92.7
Phenanthrene-d10 % recovery**	%			0	103	95.5	46.4	86.3	95.2	96.2	92.9	92.9	95	96.1	91.9	96.6
Chrysene-d12 % recovery**	%			0	97.4	84.8	30.1	77	111	104	90.2	90.2	86.4	87.8	84.4	89.1
Perylene-d12 % recovery**	%			0	84	77.8	21.4	74.2	111	89.2	86.9	86.9	82.5	90.4	80.8	83.5
Naphthalene	µg/kg	<9	190	0	<9	<9	<9	11.5	<9	<9	<9	<9	<9	<9	<9	<9
Acenaphthylene	µg/kg	<12	83000	0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	84000	0	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Fluorene	µg/kg	<10	63000	0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	220000	0	99.3	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Anthracene	µg/kg	<16	520000	0	17.6	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0	202	<17	<17	<17	<17	<17	<17	<17	<17	<17	<17	<17
Pyrene	µg/kg	<15	54000	0	174	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Benz(a)anthracene	µg/kg	<14	170	1	71.3	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Chrysene	µg/kg	<10	350	0	79.4	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	44	3	63.7	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0	29.6	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Benzo(a)pyrene	µg/kg	<15	35	3	52.5	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
indeno(123cd)pyrene	µg/kg	<18	500	0	42.5	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.5	0	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	3900	0	33.5	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24
PAH 16 Total	µg/kg	<118		0	866	<118	<118	<118	<118	<118	<118	<118	<118	<118	<118	<118
PCB's - (Solids)																
PCB 28	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 52	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 101	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 118	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 138	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 153	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 180	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	-	-	<21	-	-	-	-	-	-
PCB 81	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 77	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 123	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 114	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 105	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 126	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 167	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 156	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 157	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 169	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
PCB 189	µg/kg	<3		0	-	-	-	-	-	<3	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	-	-	<36	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																
Phenol	µg/kg	<100	1100000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	-	-	-	-	-	-	<100	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	<100	-	-
Nitrobenzene	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Isophorone	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Hexachloroethane	µg/kg	<100	22	0	-	-	-	-	-	-	-	-	-	<100	-	-
Hexachlorocyclopentadiene	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<200	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	<100	-	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	-	-	-	-	-	-	<100	-	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	<100	-	-
Dimethyl Phthalate	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	-	-	-	-	-	-	<100	-	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	<100	-	-
Dibenzofuran	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Carbazole	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	<100	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Bis(2-chloroethyl)ether	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Azobenzene	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Methylphenol	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Chlorophenylphenylether	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Chloroaniline	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Chloro-3-methylphenol	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
4-Bromophenylphenylether	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
3-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
2-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
2-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
2-Methylphenol	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	-	-	-	-	-	-	<100	-	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	<100	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	<100	-	-
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	-	-	<100	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	<100	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	-	-	<100	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	-	-	<100	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	AR-BH01	AR-BH02	BH104	BH106	BH106	MS-BH03	MS-BH05	MS-BH05	MS-BH05	MS-BH07	MS-BH08	MS-BH09
Depth	0.10-0.10	1.20-1.20	7.80-7.80	2.80-2.80	4.30-4.30	0.80-0.80	0.50-0.50	0.50-0.50	1.00-1.00	1.90-2.00	0.90-0.90	1.20-1.20
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	21/09/2022	22/12/10	06/10/2022	21/10/2022	21/10/2022	25/08/2022	06/09/2022	06/09/2022	06/09/2022	23/08/2022	09/09/2022	15/09/2022
Sample Received	27/09/2022	18/10/2022	18/10/2022	27/10/2022	27/10/2022	22/06/09	13/09/2022	13/09/2022	13/09/2022	09/06/2022	17/09/2022	24/09/2022
Sample No	ES2	ES11	ES 24	ES 13	ES 21	ES 8	ES 4	ES 4	ES 7	ES 12	ES 8	ES 9
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**												
2-Methylnaphthalene	µg/kg	<100	-	0	-	-	-	-	-	-	-	-	-	<100	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Benzo(a)anthracene	µg/kg	<100	90	0	-	-	-	-	-	-	-	-	-	<100	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	-	-	<100	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	-	<100	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	-	-	<100	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	-	-	<100	-	-
Chrysene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	-	<100	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	-	-	<100	-	-
indeno(123cd)pyrene	µg/kg	<100	60	0	-	-	-	-	-	-	-	-	-	<100	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	-	-	<100	-	-
Naphthalene	µg/kg	<100	200	0	-	-	-	-	-	-	-	-	-	<100	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	-	-	<100	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	<100	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	104	108	107	121	117	108	103	103	103	111	112	110
Toluene-d8**	%			0	99.3	102	102	102	98.9	97.1	96.4	96.4	95.2	97.4	98.8	98.6
4-Bromofluorobenzene**	%			0	88.3	101	89.1	75.3	71.5	92.4	89.1	89.1	87.1	91.9	93.6	96.2
Dichlorodifluoromethane	µg/kg	<6	-	0	-	-	-	-	-	-	-	-	-	<6	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	-	-	<7	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	-	-	<6	-	-
Bromomethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	-	-	<10	-	-
Trichlorofluorormethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	<6	-	-
1,1-Dichloroethene	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	-	-	<7	-	-
Dichloromethane	µg/kg	<10	270	0	-	-	-	-	-	-	-	-	-	<15	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<10	<10	<200	<10	<10	<10	<10	<10	<10	<10	<10	<10
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	<8	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	<6	-	-
2,2-Dichloropropane	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	<8	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	-	-	<7	-	-
1,1-Dichloropropene	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	-	-	<5	-	-
Benzene	µg/kg	<9	28	0	<9	<9	<180	<9	<9	<9	<9	<9	<9	<9	<9	<9
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	-	-	<9	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	-	-	<10	-	-
Dibromomethane	µg/kg	<9	-	0	-	-	-	-	-	-	-	-	-	<9	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	-	-	<7	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
Toluene	µg/kg	<7	869	0	<7	<7	<140	<7	<7	<7	<7	<7	<7	<7	<7	<7
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
1,1,2-Trichloroethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
1,3-Dichloropropane	µg/kg	<7	-	0	-	-	-	-	-	-	-	-	-	<7	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	-	-	<5	-	-
Dibromochloromethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
1,2-Dibromoethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	-	-	<5	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	-	-	<10	-	-
Ethylbenzene	µg/kg	<4	518	0	<4	<4	<80	<4	<4	<4	<4	<4	<4	<4	<4	<4
m & p Xylene	µg/kg	<10	576	0	<10	<10	<200	<10	<10	<10	<10	<10	<10	<10	<10	<10
o-Xylene	µg/kg	<10	576	0	<10	<10	<200	<10	<10	<10	<10	<10	<10	<10	<10	<10
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	-	-	<10	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	-	-	<10	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	-	-	<5	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	-	-	<10	-	-
1,2,3-Trichloropropane	µg/kg	<16	-	0	-	-	-	-	-	-	-	-	-	<16	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	-	-	<10	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	-	-	<10	-	-
2-Chlorotoluene	µg/kg	<9	-	0	-	-	-	-	-	-	-	-	-	<9	-	-
1,3,5-Trimethylbenzene	µg/kg	<8	-	0	-	-	-	-	-	-	-	-	-	<8	-	-
4-Chlorotoluene	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
Tert-Butylbenzene	µg/kg	<14	-	0	-	-	-	-	-	-	-	-	-	<14	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	-	-	<9	-	-
Sec-Butylbenzene	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
4-Isopropyltoluene	µg/kg	<10	-	0	-	-	-	-	-	-	-	-	-	<10	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	-	-	<8	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	-	-	<5	-	-
n-Butylbenzene	µg/kg	<11	-	0	-	-	-	-	-	-	-	-	-	<11	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	-	-	<10	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14	-	0	-	-	-	-	-	-	-	-	-	<14	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	<10	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	-	-	<20	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	-	-	<20	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	-	-	<13	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	-	-	<20	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	-	-	<20	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	-	<0.02	<0.02	-	-	-	<0.02	-	-
Sum of BTEX	µg/kg	<40		0	<40	<40	<800	<40	<40	<40	<40	<40	<40	<40	<40	<40
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Mevinphos	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Phorate	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Diazinon	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Disulfoton	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Heptachlor	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	<50	-	-	-	-	<100	<100	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Malathion	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
parathion	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Endrin	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Ethion	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	<50	-	-	-	-	<100	<100	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Ioxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**												
			1% OGN													
Sample ID					MS-BH12	MS-BH13	MS-BH13	MS-BH14	MS-BH15	MS-BH16	MS-BH17	MS-BH17	MS-BH17	MS-BH18	MS-BH19	MS-BH20
Depth					1.00-1.00	0.70-0.70	1.20-1.20	1.20-1.20	1.20-1.20	1.90-1.90	1.00-1.00	1.80-1.80	2.80-2.80	1.00-1.00	1.20-1.20	1.00-1.00
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					14/09/2022	10/04/2022	10/04/2022	23/08/2022	13/09/2022	26/08/2022	15/09/2022	15/09/2022	15/09/2022	10/06/2022	09/12/2022	09/08/2022
Sample Received					17/09/2022	18/10/2022	18/10/2022	09/06/2022	27/09/2022	09/06/2022	24/09/2022	24/09/2022	24/09/2022	18/10/2022	17/09/2022	13/09/2022
Sample No					ES 7	ES 5	ES 8	ES 12	ES 9	ES 16	ES 7	ES 10	ES 14	ES 8	ES 10	ES 7
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
Carbon																
Organic Matter (OGM)	%	<0.35		0	<0.35	<0.35	<0.35	0.386	<0.35	<0.35	0.36	<0.35	0.428	0.909	<0.35	<0.35
Inotganics																
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.0596	0.0128	0.0127	0.0422	0.0344	0.0422	0.142	0.0421	0.072	0.0746	<0.004	0.0088
pH	pH Units	<1		0	8.23	8.34	8.32	8.4	8.41	7.45	8.85	8.88	8.08	7.95	8.5	8.54
Sulphate	mg/kg	<48		0	141	<48	<48	70.5	<48	102	742	<48	2130	237	72.8	<48
Nitrite as NO2	mg/kg	<0.1		0	0.1	0.16	0.14	<0.1	0.13	<0.1	0.12	<0.1	1.48	0.32	0.14	<0.1
Nitrate as NO3	mg/kg	<1		0	1.77	3.29	2.2	4.14	1.47	<1	10.8	<1	<1	11.1	<1	<1
Sulphide	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	11.6
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.0047	<0.0016	<0.0016	0.00235	<0.0016	0.0034	0.0247	<0.0016	0.0711	0.0079	0.00243	<0.0016
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0	2.15	1.98	3.38	1.28	2.96	1.78	2.92	1.63	3.28	1.48	1.04	2.11
Total Boron	mg/kg	<0.7		0	2.09	<0.7	0.781	0.734	1.02	2.34	4.59	0.996	7.24	1.58	2.01	1.23
Cadmium	mg/kg	<0.02	190	0	0.0316	0.0353	0.0497	0.049	0.0434	0.0538	1.48	0.07	0.0741	<0.02	0.0509	0.0753
Chromium	mg/kg	<0.9		0	5.31	4.13	4.87	4.18	4.55	6.65	6.48	4.28	7.55	5.41	4.69	6.97
Copper	mg/kg	<1.4	68000	0	3.45	3.66	4.04	2.52	3.43	5.75	20.3	4.29	6.76	2.34	3.55	4
iron	mg/kg	<1000		0	4660	3490	4380	3150	3510	5040	5940	3300	7900	3060	3100	5170
Lead	mg/kg	<0.7	1100	0	6.76	4.89	6.43	4.6	5.21	4.72	69.7	4.11	5.8	6.26	6.66	8.79
Mercury	mg/kg	<0.1	1100	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	7.49	5.03	5.87	6.36	6.31	8.13	8.38	4.81	9.85	6.28	8.04	8.98
Selenium	mg/kg	<1	12000	0	<1	<1	<1	<1	<1	<1	<1	<1	1.01	<1	<1	<1
Zinc	mg/kg	<1.9	7300000	0	15.4	12.4	18.4	13	14.1	15	45.4	11.8	23.2	9.1	11.6	17.3
Metals - (Liquids)																
Chromium, III	mg/kg	<0.9	8600	0	5.31	4.13	4.87	4.18	4.55	6.65	6.48	4.28	7.55	5.41	4.69	6.97
Phenols																
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	-	-	-	<50	-	-	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	-	-	-	<50	-	-	-	-	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																
EPH Surrogate % recovery**	%			0	98.7	103	101	101	89.5	76	104	103	102	98.4	99.9	106
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35
TPH Criteria Working Group (TPH CWG)																
GRO Surrogate % recovery**	%			0	-	-	-	-	-	102	-	-	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	3200	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	7800	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	2000	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	9700	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	59000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1600000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1600000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1600000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	-	-	-	<5000	-	-	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	-	-	-	<10000	-	-	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	26000	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	56000	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	3500	0	-	-	-	-	-	<10	-	-	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	16000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	36000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	0	-	-	-	-	-	1170	-	-	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000	28000	0	-	-	-	-	-	<1000	-	-	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	-	-	-	<5000	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	-	-	-	<10000	-	-	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35
Polyaromatic Hydrocarbons (PAHs)																
Naphthalene-d8 % recovery**	%			0	86.1	90.9	89	92.2	91.6	83.7	89.2	87.3	88	90.5	84.5	85.8
Acenaphthene-d10 % recovery**	%			0	88.3	92.9	86.9	93.2	96.3	85.3	92.3	90.9	91.5	92.3	89.2	89.5
Phenanthrene-d10 % recovery**	%			0	91.2	95.1	83.1	93.7	107	84.2	96.1	93.4	93.9	94.5	91.7	95.9
Chrysene-d12 % recovery**	%			0	85.9	87.1	81.2	84	95.8	78.8	92.2	86.1	86.5	100	85.3	90.1
Perylene-d12 % recovery**	%			0	85.5	77.8	81.9	85.9	82.6	76	87.4	80.2	81.5	98.6	84.6	86.5
Naphthalene	µg/kg	<9	190	0	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9
Acenaphthylene	µg/kg	<12	83000	0	<12	<12	<12	<12	<12	<12	15.9	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	84000	0	<8	<8	<8	<8	<8	<8	<8	13.3	<8	<8	<8	<8
Fluorene	µg/kg	<10	63000	0	<10	<10	<10	<10	<10	<10	16.5	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	220000	0	<15	<15	<15	<15	<15	36.6	135	115	28.6	<15	<15	<15
Anthracene	µg/kg	<16	520000	0	<16	<16	<16	<16	<16	<16	44.6	21	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0	<17	<17	<17	<17	<17	70.7	213	97.5	36	<17	<17	<17
Pyrene	µg/kg	<15	54000	0	<15	<15	<15	<15	<15	63.2	180	79.1	34.1	<15	<15	<15
Benz(a)anthracene	µg/kg	<14	170	1	<14	<14	<14	<14	<14	34	97.2	36.4	17.5	<14	<14	<14
Chrysene	µg/kg	<10	350	0	<10	<10	<10	<10	<10	31.7	86	29.2	16.4	<10	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	44	3	<15	<15	<15	<15	<15	36.6	81.1	26.9	<15	<15	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0	<14	<14	<14	<14	<14	<14	39.6	<14	<14	<14	<14	<14
Benzo(a)pyrene	µg/kg	<15	35	3	<15	<15	<15	<15	<15	23.7	68.4	22.1	<15	<15	<15	<15
indeno(123cd)pyrene	µg/kg	<18	500	0	<18	<18	<18	<18	<18	<18	42.5	<18	<18	<18	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.5	0	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	3900	0	<24	<24	<24	<24	<24	<24	38.3	<24	<24	<24	<24	<24
PAH 16 Total	µg/kg	<118		0	<118	<118	<118	<118	<118	297	1060	441	133	<118	<118	<118
PCB's - (Solids)																
PCB 28	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	<21	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0	-	<3	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	<36	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																
Phenol	µg/kg	<100	1100000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	-	-	<100	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	-	-	<100	-	-	-	-	-	-
Nitrobenzene	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Isophorone	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0	-	-	-	-	-	<100	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100	-	0	-	-	-	-	-	<200	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	-	-	<100	-	-	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	-	-	<100	-	-	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	-	-	<100	-	-	-	-	-	-
Dimethyl Phthalate	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	-	-	<100	-	-	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	-	-	<100	-	-	-	-	-	-
Dibenzofuran	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Carbazole	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	-	-	<100	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Azobenzene	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Methylphenol	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Chloroaniline	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
3-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
2-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
2-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
2-Methylphenol	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	-	-	<100	-	-	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	<100	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	<100	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	<100	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	<100	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	<100	-	-	-	-	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	<100	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	MS-BH12	MS-BH13	MS-BH13	MS-BH14	MS-BH15	MS-BH16	MS-BH17	MS-BH17	MS-BH17	MS-BH18	MS-BH19	MS-BH20
Depth	1.00-1.00	0.70-0.70	1.20-1.20	1.20-1.20	1.20-1.20	1.90-1.90	1.00-1.00	1.80-1.80	2.80-2.80	1.00-1.00	1.20-1.20	1.00-1.00
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	14/09/2022	10/04/2022	10/04/2022	23/08/2022	13/09/2022	26/08/2022	15/09/2022	15/09/2022	15/09/2022	10/06/2022	09/12/2022	09/08/2022
Sample Received	17/09/2022	18/10/2022	18/10/2022	09/06/2022	27/09/2022	09/06/2022	24/09/2022	24/09/2022	24/09/2022	18/10/2022	17/09/2022	13/09/2022
Sample No	ES 7	ES 5	ES 8	ES 12	ES 9	ES 16	ES 7	ES 10	ES 14	ES 8	ES 10	ES 7
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**												
2-Methylnaphthalene	µg/kg	<100	-	0	-	-	-	-	-	<100	-	-	-	-	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Benzo(a)anthracene	µg/kg	<100	90	0	-	-	-	-	-	<100	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	<100	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	<100	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	<100	-	-	-	-	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	<100	-	-	-	-	-	-
Chrysene	µg/kg	<100	140	0	-	-	-	-	-	<100	-	-	-	-	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	<100	-	-	-	-	-	-
indeno(123cd)pyrene	µg/kg	<100	60	0	-	-	-	-	-	<100	-	-	-	-	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	<100	-	-	-	-	-	-
Naphthalene	µg/kg	<100	200	0	-	-	-	-	-	<100	-	-	-	-	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	<100	-	-	-	-	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	<100	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	112	113	111	105	101	105	110	110	107	104	111	104
Toluene-d8**	%			0	98.9	101	101	97.9	98.1	96.6	98.4	97.6	98.1	103	98.6	95.4
4-Bromofluorobenzene**	%			0	91.1	90.7	87.1	94.6	99.2	87.3	93.7	88.8	92.3	97.9	98.3	87.1
Dichlorodifluoromethane	µg/kg	<6	-	0	-	-	-	-	-	<6	-	-	-	-	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	<7	-	-	-	-	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	<6	-	-	-	-	-	-
Bromomethane	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	<10	-	-	-	-	-	-
Trichlorofluorormethane	µg/kg	<6		0	-	-	-	-	-	<6	-	-	-	-	-	-
1,1-Dichloroethene	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	<7	-	-	-	-	-	-
Dichloromethane	µg/kg	<10	270	0	-	-	-	-	-	<15	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<10	<10	<10	<10	<10	<10	<10	<10	<100	<200	<10	<10
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	<8	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	<6	-	-	-	-	-	-
2,2-Dichloropropane	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	<8	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	<7	-	-	-	-	-	-
1,1-Dichloropropene	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	<5	-	-	-	-	-	-
Benzene	µg/kg	<9	28	0	<9	<9	<9	<9	<9	<9	<9	<9	<90	<180	<9	<9
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	<9	-	-	-	-	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	<10	-	-	-	-	-	-
Dibromomethane	µg/kg	<9	-	0	-	-	-	-	-	<9	-	-	-	-	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	<7	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
Toluene	µg/kg	<7	869	0	<7	<7	<7	<7	<7	<7	<7	<7	<70	<140	<7	<7
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
1,3-Dichloropropane	µg/kg	<7	-	0	-	-	-	-	-	<7	-	-	-	-	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	<5	-	-	-	-	-	-
Dibromochloromethane	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
1,2-Dibromoethane	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	<5	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	<10	-	-	-	-	-	-
Ethylbenzene	µg/kg	<4	518	0	<4	<4	<4	<4	<4	<4	<4	<4	<40	<80	<4	<4
m & p Xylene	µg/kg	<10	576	0	<10	<10	<10	<10	<10	<10	<10	<10	<100	<200	<10	<10
o-Xylene	µg/kg	<10	576	0	<10	<10	<10	<10	<10	<10	<10	<10	<100	<200	<10	<10
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	<10	-	-	-	-	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	<10	-	-	-	-	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	<5	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	<10	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/kg	<16	-	0	-	-	-	-	-	<16	-	-	-	-	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	<10	-	-	-	-	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	<10	-	-	-	-	-	-
2-Chlorotoluene	µg/kg	<9	-	0	-	-	-	-	-	<9	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	<8	-	0	-	-	-	-	-	<8	-	-	-	-	-	-
4-Chlorotoluene	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
Tert-Butylbenzene	µg/kg	<14	-	0	-	-	-	-	-	<14	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	<9	-	-	-	-	-	-
Sec-Butylbenzene	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
4-Isopropyltoluene	µg/kg	<10	-	0	-	-	-	-	-	<10	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	<8	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	<5	-	-	-	-	-	-
n-Butylbenzene	µg/kg	<11	-	0	-	-	-	-	-	<11	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	<10	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14	-	0	-	-	-	-	-	<14	-	-	-	-	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	<10	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	<20	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	<20	-	-	-	-	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	<13	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	<20	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	<20	-	-	-	-	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	-	-	<0.02	-	-	-	-	-	-
Sum of BTEX	µg/kg	<40		0	<40	<40	<40	<40	<40	<40	<40	<40	<400	<800	<40	<40
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	<50	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	<50	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	<50	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	<0.01	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	MS-BH23	MS-BH24	MS-BH25	MS-BH25	MS-BH25	MS-BH25
Depth	1.20-1.20	1.20-1.20	0.40-0.40	1.50-1.50	3.50-3.50	4.50-4.50
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	30/09/2022	10/10/2022	26/09/2022	26/09/2022	27/09/2022	27/09/2022
Sample Received	13/10/2022	13/10/2022	10/05/2022	10/05/2022	18/10/2022	18/10/2022
Sample No	ES 10	ES 8	ES 5	ES 13	ES 21	ES 24
Batch Number	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**						
			1% OGN							
Carbon										
Organic Matter (OGM)	%	<0.35		0	<0.35	0.381	0.736	0.534	0.634	0.64
Inotganics										
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.216	0.0703	0.0159	0.343	0.231	0.229
pH	pH Units	<1		0	8.42	8.2	12.4	11.4	8.9	8.56
Sulphate	mg/kg	<48		0	448	199	17500	73500	2540	3080
Nitrite as NO2	mg/kg	<0.1		0	0.14	0.11	1.01	0.16	0.23	0.22
Nitrate as NO3	mg/kg	<1		0	<1	<1	2.12	<1	<1	<1
Sulphide	mg/kg	<15		0	<15	<15	308	787	40.7	104
Sulphur	mg/kg	<10		0	<10	<10	26.6	169	25	24
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.0149	0.00662	0.583	2.45	0.0848	0.103
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	<12
Metals - (Soilds)										
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0	2.88	2.75	9.11	8.41	4.08	4.25
Total Boron	mg/kg	<0.7		0	2.37	2.29	26.4	98.6	8.8	8.67
Cadmium	mg/kg	<0.02	190	0	0.0618	0.0588	27.4	0.0409	0.121	0.126
Chromium	mg/kg	<0.9		0	3.65	6.18	18.5	9.23	8.76	8.48
Copper	mg/kg	<1.4	68000	0	6.12	3.29	132	8.34	10.4	9.85
iron	mg/kg	<1000		0	9000	5380	8600	8420	13800	13200
Lead	mg/kg	<0.7	1100	0	6.8	7.89	265	14.9	9.92	9.58
Mercury	mg/kg	<0.1	1100	0	<0.1	<0.1	1.09	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	6.47	8.12	11.3	2.35	14.5	13.9
Selenium	mg/kg	<1	12000	0	<1	<1	2.92	6.45	<1	<1
Zinc	mg/kg	<1.9	7300000	0	19.4	20	1640	34.8	32.4	31
Metals - (Liquids)										
Chromium, III	mg/kg	<0.9	8600	0	3.65	6.18	18.5	9.23	8.76	8.48
Phenols										
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	0.0342	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)										
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	-	-	-	144
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	-	-	-	60.3
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	267	204
EPH (Extractable Petroleum Hydrocarbons)										
EPH Surrogate % recovery**	%			0	102	102	99.8	104	95.2	93.9
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	<35	228	<35	<35	<35
TPH Criteria Working Group (TPH CWG)										
GRO Surrogate % recovery**	%			0	-	-	-	-	-	104
Aliphatics >C5-C6	µg/kg	<10	3200	0	-	-	-	-	-	<10
Aliphatics >C6-C8	µg/kg	<10	7800	0	-	-	-	-	-	53.7
Aliphatics >C8-C10	µg/kg	<10	2000	0	-	-	-	-	-	90.4
Aliphatics >C10-C12	µg/kg	<1000	9700	0	-	-	-	-	-	<1000
Aliphatics >C12-C16	µg/kg	<1000	59000	0	-	-	-	-	-	<1000
Aliphatics >C16-C21	µg/kg	<1000	1600000	0	-	-	-	-	-	<1000
Aliphatics >C21-C35	µg/kg	<1000	1600000	0	-	-	-	-	-	2010
Aliphatics >C35-C44	µg/kg	<1000	1600000	0	-	-	-	-	-	<1000
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	-	-	-	<5000
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	-	-	-	<10000
Aromatics >EC5-EC7	µg/kg	<10	26000	0	-	-	-	-	-	<10
Aromatics >EC7-EC8	µg/kg	<10	56000	0	-	-	-	-	-	<10
Aromatics >EC8-EC10	µg/kg	<10	3500	0	-	-	-	-	-	60.3
Aromatics >EC10-EC12	µg/kg	<1000	16000	0	-	-	-	-	-	<1000
Aromatics >EC12-EC16	µg/kg	<1000	36000	0	-	-	-	-	-	<1000
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	-	-	-	<1000
Aromatics >EC21-EC35	µg/kg	<1000	28000	0	-	-	-	-	-	2440
Aromatics >EC35-EC44	µg/kg	<1000	28000	0	-	-	-	-	-	1490
Aromatics > EC40-EC44	µg/kg	<1000	28000	0	-	-	-	-	-	<1000
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	-	-	-	<5000
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	-	-	-	<10000
EPH (C5-C40)	mg/kg	<35		0	<35	<35	228	<35	<35	<35
Polyaromatic Hydrocarbons (PAHs)										
Naphthalene-d8 % recovery**	%			0	83	84	76.5	86	86.5	88.5
Acenaphthene-d10 % recovery**	%			0	87.7	87.9	77.7	83.4	91.2	92.8
Phenanthrene-d10 % recovery**	%			0	89.7	88.6	64.3	84.8	95.9	92.5
Chrysene-d12 % recovery**	%			0	85.6	73	38.6	94.7	94.7	90.3
Perylene-d12 % recovery**	%			0	79.6	70.2	28.6	88.2	97.6	91.4
Naphthalene	µg/kg	<9	190	0	<9	<9	<9	<9	<9	<9
Acenaphthylene	µg/kg	<12	83000	0	<12	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	84000	0	<8	<8	<8	<8	<8	<8
Fluorene	µg/kg	<10	63000	0	<10	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	220000	0	<15	<15	<15	140	<15	<15
Anthracene	µg/kg	<16	520000	0	<16	<16	<16	37	<16	<16
Fluoranthene	µg/kg	<17	23000	0	<17	<17	<17	438	<17	<17
Pyrene	µg/kg	<15	54000	0	<15	<15	<15	389	<15	<15
Benz(a)anthracene	µg/kg	<14	170	1	<14	<14	<14	183	<14	<14
Chrysene	µg/kg	<10	350	0	<10	<10	<10	183	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	44	3	<15	<15	<15	156	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0	<14	<14	<14	62.7	<14	<14
Benzo(a)pyrene	µg/kg	<15	35	3	<15	<15	<15	119	<15	<15
indeno(123cd)pyrene	µg/kg	<18	500	0	<18	<18	<18	77.8	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.5	0	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	3900	0	<24	<24	<24	64.3	<24	<24
PAH 16 Total	µg/kg	<118		0	<118	<118	<118	1850	<118	<118
PCB's - (Solids)										
PCB 28	µg/kg	<3		0	-	-	-	<3	-	-
PCB 52	µg/kg	<3		0	-	-	-	<3	-	-
PCB 101	µg/kg	<3		0	-	-	-	<3	-	-
PCB 118	µg/kg	<3		0	-	-	-	<3	-	-
PCB 138	µg/kg	<3		0	-	-	-	<3	-	-
PCB 153	µg/kg	<3		0	-	-	-	<3	-	-
PCB 180	µg/kg	<3		0	-	-	-	<3	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	<21	-	-
PCB 81	µg/kg	<3		0	-	-	-	<3	-	-
PCB 77	µg/kg	<3		0	-	-	-	<3	-	-
PCB 123	µg/kg	<3		0	-	-	-	<3	-	-
PCB 114	µg/kg	<3		0	-	-	-	<3	-	-
PCB 105	µg/kg	<3		0	-	-	-	<3	-	-
PCB 126	µg/kg	<3		0	-	-	-	<3	-	-
PCB 167	µg/kg	<3		0	-	-	-	<3	-	-
PCB 156	µg/kg	<3		0	-	-	-	<3	-	-
PCB 157	µg/kg	<3		0	-	-	-	<3	-	-
PCB 169	µg/kg	<3		0	-	-	-	<3	-	-
PCB 189	µg/kg	<3		0	-	-	-	<3	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	<36	-	-
Semi-Volatile Organic Compounds (SVOCs)										
Phenol	µg/kg	<100	1100000	0	-	-	-	-	<100	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	-	<100	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	-	<100	-
Nitrobenzene	µg/kg	<100	-	0	-	-	-	-	<100	-
Isophorone	µg/kg	<100	-	0	-	-	-	-	<100	-
Hexachloroethane	µg/kg	<100	22	0	-	-	-	-	<100	-
Hexachlorocyclopentadiene	µg/kg	<100	-	0	-	-	-	-	<100	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	-	<100	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	-	<100	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	-	<100	-
Dimethyl Phthalate	µg/kg	<100	-	0	-	-	-	-	<100	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	-	<100	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	-	<100	-
Dibenzofuran	µg/kg	<100	-	0	-	-	-	-	<100	-
Carbazole	µg/kg	<100	-	0	-	-	-	-	<100	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	-	<100	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	-	<100	-
Bis(2-chloroethoxy) methane	µg/kg	<100	-	0	-	-	-	-	<100	-
Bis(2-chloroethyl)ether	µg/kg	<100	-	0	-	-	-	-	<100	-
Azobenzene	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Methylphenol	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Chlorophenylphenylether	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Chloroaniline	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Chloro-3-methylphenol	µg/kg	<100	-	0	-	-	-	-	<100	-
4-Bromophenylphenylether	µg/kg	<100	-	0	-	-	-	-	<100	-
3-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	<100	-
2-Nitrophenol	µg/kg	<100	-	0	-	-	-	-	<100	-
2-Nitroaniline	µg/kg	<100	-	0	-	-	-	-	<100	-
2-Methylphenol	µg/kg	<100	-	0	-	-	-	-	<100	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	-	<100	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	-	<100	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	-	<100	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	-	<100	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	-	<100	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	-	<100	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	<100	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	<100	-
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	<100	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	<100	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	<100	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	<100	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	MS-BH23	MS-BH24	MS-BH25	MS-BH25	MS-BH25	MS-BH25
Depth	1.20-1.20	1.20-1.20	0.40-0.40	1.50-1.50	3.50-3.50	4.50-4.50
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	30/09/2022	10/10/2022	26/09/2022	26/09/2022	27/09/2022	27/09/2022
Sample Received	13/10/2022	13/10/2022	10/05/2022	10/05/2022	18/10/2022	18/10/2022
Sample No	ES 10	ES 8	ES 5	ES 13	ES 21	ES 24
Batch Number	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**						
2-Methylnaphthalene	µg/kg	<100	-	0	-	-	-	-	<100	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	<100	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	<100	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	<100	-
Benzo(a)anthracene	µg/kg	<100	90	0	-	-	-	-	<100	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	<100	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	<100	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	<100	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	<100	-
Chrysene	µg/kg	<100	140	0	-	-	-	-	<100	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	<100	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	<100	-
indeno(123cd)pyrene	µg/kg	<100	60	0	-	-	-	-	<100	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	<100	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	<100	-
Naphthalene	µg/kg	<100	200	0	-	-	-	-	<100	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	<100	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	<100	-
Volatile Organic Compounds (VOCs)										
Dibromofluoromethane**	%			0	118	127	53.8	81.1	113	121
Toluene-d8**	%			0	98.7	100	83.5	97.4	98.5	97.7
4-Bromofluorobenzene**	%			0	89.9	91.3	78.5	94.5	74.8	74.7
Dichlorodifluoromethane	µg/kg	<6	-	0	-	-	-	-	<6	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	<7	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	<6	-
Bromomethane	µg/kg	<10	-	0	-	-	-	-	<10	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	<10	-
Trichlorofluorormethane	µg/kg	<6		0	-	-	-	-	<6	-
1,1-Dichloroethene	µg/kg	<10	-	0	-	-	-	-	<10	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	<7	-
Dichloromethane	µg/kg	<10	270	0	-	-	-	-	<30	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<10	<10	<10	<10	<10	<10
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	<10	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	<8	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	<6	-
2,2-Dichloropropane	µg/kg	<10	-	0	-	-	-	-	<10	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	<10	-
Chloroform	µg/kg	<8		0	-	-	-	-	<8	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	<7	-
1,1-Dichloropropene	µg/kg	<10	-	0	-	-	-	-	<10	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	<10	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	<5	-
Benzene	µg/kg	<9	28	0	<9	<9	<9	<9	<9	<9
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	<9	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	<10	-
Dibromomethane	µg/kg	<9	-	0	-	-	-	-	<9	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	<7	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	<10	-
Toluene	µg/kg	<7	869	0	<7	<7	<7	<7	<7	<7
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	<10	-
1,1,2-Trichloroethane	µg/kg	<10	-	0	-	-	-	-	<10	-
1,3-Dichloropropane	µg/kg	<7	-	0	-	-	-	-	<7	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	<5	-
Dibromochloromethane	µg/kg	<10	-	0	-	-	-	-	<10	-
1,2-Dibromoethane	µg/kg	<10	-	0	-	-	-	-	<10	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	<5	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	<10	-
Ethylbenzene	µg/kg	<4	518	0	<4	<4	<4	<4	<4	<4
m & p Xylene	µg/kg	<10	576	0	<10	<10	<10	<10	<10	<10
o-Xylene	µg/kg	<10	576	0	<10	<10	<10	<10	<10	<10
Styrene	µg/kg	<10	3300	0	-	-	-	-	<10	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	<10	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	<5	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	<10	-
1,2,3-Trichloropropane	µg/kg	<16	-	0	-	-	-	-	<16	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	<10	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	<10	-
2-Chlorotoluene	µg/kg	<9	-	0	-	-	-	-	<9	-
1,3,5-Trimethylbenzene	µg/kg	<8	-	0	-	-	-	-	<8	-
4-Chlorotoluene	µg/kg	<10	-	0	-	-	-	-	<10	-
Tert-Butylbenzene	µg/kg	<14	-	0	-	-	-	-	<14	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	<9	-
Sec-Butylbenzene	µg/kg	<10	-	0	-	-	-	-	<10	-
4-Isopropyltoluene	µg/kg	<10	-	0	-	-	-	-	<10	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	<8	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	<5	-
n-Butylbenzene	µg/kg	<11	-	0	-	-	-	-	<11	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	<10	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14	-	0	-	-	-	-	<14	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	<10	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	<20	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	<20	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	<13	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	<20	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	<20	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	-	-	<0.02
Sum of BTEX	µg/kg	<40		0	<40	<40	<40	<40	<40	<40
Combined Pesticides / Herbicides										
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-
Subcontracted: Organics										
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**	**Sample ID**	**AR-BH01**	**AR-BH02**	**HR-BH01**	**HR-BH01**	**MS-BH25**	**MS-BH04**	**MS-BH04**	**MS-BH06**	**MS-BH10**	**MS-BH14**	**MS-BH16**	**MS-BH21**
			2.5 % (OGM)		**Depth**	0.80-0.80	0.30-0.30	0.70-0.70	1.20-1.20	0.75-0.75	0.50-0.50	1.20-1.20	0.90-0.90	1.10-1.10	0.45-0.45	0.80-0.80	0.80-0.80
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampled Date	21/09/2022	22/12/10	27/10/2022	27/10/2022	26/09/2022	14/09/2022	14/09/2022	01/09/2022	21/09/2022	23/08/2022	25/08/2022	31/08/2022
					Sample Received	27/09/2022	18/10/2022	22/03/11	22/03/11	10/05/2022	17/09/2022	17/09/2022	09/06/2022	27/09/2022	09/06/2022	09/06/2022	09/06/2022
					Sample No	ES5	ES5	ES 5	ES 7	ES 9	ES 4	ES 10	ES 7	ES 9	ES 6	ES 7	ES 7
					Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
					Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
Carbon																	
Organic Matter (OGM)	%	<0.35		0		1.98	2.14	1.31	1.02	1.14	1.98	1.88	1.09	1.83	2.41	2.03	2.14
Inotganics																	
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0		0.0535	0.0177	0.0329	0.0717	0.0417	0.0471	<0.004	<0.004	0.0063	0.075	0.332	<0.004
pH	pH Units	<1		0		9.22	8.23	8.28	8.3	10.9	8.39	7.39	8.24	8.27	8.26	8.87	8.38
Sulphate	mg/kg	<48		0		299	201	284	293	2120	301	130	70.6	<48	360	3040	206
Nitrite as NO2	mg/kg	<0.1		0		0.1	0.47	0.23	0.15	0.34	0.36	<0.1	0.15	0.14	0.42	1.04	0.2
Nitrate as NO3	mg/kg	<1		0		<1	4.59	39.6	16.1	<1	3.87	2.9	3.33	8.12	5.65	17.1	7.06
Sulphide	mg/kg	<15		0		<15	<15	<15	<15	106	<15	<15	<15	<15	<15	62.9	<15
Sulphur	mg/kg	<10		0		<10	<10	11.1	<10	51.7	<10	<10	<10	<10	10.7	97.8	<10
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0		0.00996	0.00671	0.00948	0.00978	0.0706	0.01	0.00434	0.00235	<0.0016	0.012	0.101	0.00687
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0		<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																	
Chromium, VI	mg/kg	<0.6	33	0		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0		0.979	12.2	6.87	7.4	9.44	15.4	0.975	1.54	3.13	14.1	10.3	4.89
Total Boron	mg/kg	<0.7		0		18.8	10.5	8.19	9.49	28.8	15.8	2.53	2.42	3.64	14.5	20	6.77
Cadmium	mg/kg	<0.02	190	0		0.225	0.27	0.137	0.177	0.637	0.184	0.0293	<0.02	0.0387	0.171	0.176	0.148
Chromium	mg/kg	<0.9		0		1.68	14.9	9.86	11.8	391	18.2	7.07	7.24	6.19	17	17.8	9.6
Copper	mg/kg	<1.4	68000	0		<1.4	15.3	11.3	12.8	13.1	19.2	3.56	4.96	3.08	15.8	17.1	5.25
iron	mg/kg	<1000		0		3830	23900	14400	19000	97400	33800	2630	5760	4830	30700	23800	11500
Lead	mg/kg	<0.7	1100	0		3.17	75.7	24.6	23.4	14.3	80.6	5.77	9.58	9.76	65.7	46.5	28.2
Mercury	mg/kg	<0.1	1100	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0		1.41	21.6	13.4	16	8.13	31.3	4.86	7.31	5.42	26.3	18.6	12.6
Selenium	mg/kg	<1	12000	0		1.3	<1	<1	<1	10.4	1.33	<1	<1	<1	<1	1.66	<1
Zinc	mg/kg	<1.9	7300000	0		19.1	92.8	45	55.8	56.3	111	7.93	17.6	16	94.1	84.3	35.3
Metals - (Liquids)																	
Chromium, III	mg/kg	<0.9	8600	0		1.68	14.9	9.86	11.8	391	18.2	7.07	7.24	6.19	17	17.8	9.6
Phenols																	
Phenol	mg/kg	<0.01	1100000	0		<0.01	<0.01	<0.01	<0.01	0.0325	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0		<0.01	0.012	<0.01	<0.01	0.0217	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0		<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0		<0.035	<0.035	<0.035	<0.035	0.0542	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																	
Total Aliphatic>C5-C10	µg/kg	<50		0		-	-	-	-	-	-	-	<50	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0		-	-	-	-	-	-	-	<50	-	-	-	-
GRO >C5-C10	µg/kg	<20		0		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																	
EPH Surrogate % recovery**	%			0		92.4	99.4	102	103	102	96.1	97.9	104	91.3	94.8	99.1	99.6
EPH Aliphatics >C10-C40	mg/kg	<35		0		<35	<35	<35	40	55.3	<35	62.6	<35	76.1	<35	76.3	86.8
TPH Criteria Working Group (TPH CWG)																	
GRO Surrogate % recovery**	%			0		-	-	-	-	-	-	-	95.8	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	5900	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	17000	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	4800	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	23000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	82000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1700000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1700000	0		-	-	-	-	-	-	-	6130	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1700000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0		-	-	-	-	-	-	-	6920	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0		-	-	-	-	-	-	-	17700	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	46000	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	110000	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	8100	0		-	-	-	-	-	-	-	<10	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	28000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	37000	0		-	-	-	-	-	-	-	<1000	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0		-	-	-	-	-	-	-	1220	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	0		-	-	-	-	-	-	-	4930	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	0		-	-	-	-	-	-	-	4530	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0		-	-	-	-	-	-	-	<1000	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0		-	-	-	-	-	-	-	10800	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0		-	-	-	-	-	-	-	17700	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0		<35	<35	<35	40	55.3	<35	62.6	<35	76.1	<35	76.3	86.8
Polyaromatic Hydrocarbons (PAHs)																	
Naphthalene-d8 % recovery**	%			0		90.4	87.4	87.4	81.6	79.7	82.8	84.7	91	84.1	94.4	84.5	88.8
Acenaphthene-d10 % recovery**	%			0		92.3	91.2	91.5	88.9	82.6	88.2	88	92.5	83.7	94.9	87.8	93
Phenanthrene-d10 % recovery**	%			0		101	95.4	94.2	87.8	83.9	90.4	91.1	94.8	84.2	94.1	88.4	95.4
Chrysene-d12 % recovery**	%			0		93.3	92.3	90.9	85.5	73.4	79.2	83.1	88.5	79.9	75.3	80.7	74.7
Perylene-d12 % recovery**	%			0		80.4	94.7	90.4	81.8	73.7	74.2	80.1	87.9	77	74.2	76.1	71.1
Naphthalene	µg/kg	<9	460	0		<9	<9	27.2	<9	90.5	<9	<9	<9	<9	14.1	68.8	<9
Acenaphthylene	µg/kg	<12	97000	0		<12	<12	<12	<12	23.2	<12	<12	<12	<12	<12	15.3	<12
Acenaphthene	µg/kg	<8	97000	0		<8	<8	25.4	<8	37.8	<8	<8	<8	<8	<8	54	<8
Fluorene	µg/kg	<10	68000	0		<10	<10	25.8	<10	53.9	<10	<10	<10	<10	<10	45.2	<10
Phenanthrene	µg/kg	<15	22000	0		48.6	59.2	272	28.1	559	24.2	<15	<15	<15	45.1	508	<15
Anthracene	µg/kg	<16	540000	0		26.3	<16	76.7	<16	181	<16	<16	<16	<16	<16	144	<16
Fluoranthene	µg/kg	<17	23000	0		168	76.6	303	51	835	<17	<17	<17	<17	22.3	991	<17
Pyrene	µg/kg	<15	54000	0		150	66.8	260	46	697	<15	<15	<15	<15	20.9	850	<15
Benz(a)anthracene	µg/kg	<14	170	**2**		61.5	33	127	26.8	326	<14	<14	<14	<14	<14	416	<14
Chrysene	µg/kg	<10	350	**1**		60.8	49	119	32.7	289	<10	<10	<10	<10	<10	393	<10
Benzo(b)fluoranthene	µg/kg	<15	44	**4**		46.5	80.2	131	40.3	277	<15	<15	<15	<15	18.8	475	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0		27.4	19	49.1	<14	133	<14	<14	<14	<14	<14	153	<14
Benzo(a)pyrene	µg/kg	<15	35	**4**		37.3	35.3	94.3	25.4	280	<15	<15	<15	<15	<15	307	<15
indeno(123cd)pyrene	µg/kg	<18	510	0		25	30.7	55.4	21.5	191	<18	<18	<18	<18	<18	222	<18
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**		<23	<23	<23	<23	35.1	<23	<23	<23	<23	<23	39.7	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0		<24	41.7	52.7	<24	180	<24	<24	<24	<24	<24	173	<24
PAH 16 Total	µg/kg	<118		0		651	492	1620	272	4190	<118	<118	<118	<118	121	4850	<118
PCB's - (Solids)																	
PCB 28	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0		-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																	
Phenol	µg/kg	<100	1100000	0		-	-	-	-	-	-	-	<100	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0		-	-	-	-	-	-	-	<100	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0		-	-	-	-	-	-	-	<100	-	-	-	-
Nitrobenzene	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Isophorone	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0		-	-	-	-	-	-	-	<100	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100	-	0		-	-	-	-	-	-	-	<200	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0		-	-	-	-	-	-	-	<100	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0		-	-	-	-	-	-	-	<100	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	<100	-	-	-	-
Dimethyl Phthalate	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0		-	-	-	-	-	-	-	<100	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	<100	-	-	-	-
Dibenzofuran	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Carbazole	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0		-	-	-	-	-	-	-	<100	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	<100	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
Azobenzene	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Nitrophenol	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Nitroaniline	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Methylphenol	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Chloroaniline	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
3-Nitroaniline	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
2-Nitrophenol	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
2-Nitroaniline	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
2-Methylphenol	µg/kg	<100	-	0		-	-	-	-	-	-	-	<100	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0		-	-	-	-	-	-	-	<100	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	<100	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	<100	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					AR-BH01	AR-BH02	HR-BH01	HR-BH01	MS-BH25	MS-BH04	MS-BH04	MS-BH06	MS-BH10	MS-BH14	MS-BH16	MS-BH21
Depth					0.80-0.80	0.30-0.30	0.70-0.70	1.20-1.20	0.75-0.75	0.50-0.50	1.20-1.20	0.90-0.90	1.10-1.10	0.45-0.45	0.80-0.80	0.80-0.80
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					21/09/2022	22/12/10	27/10/2022	27/10/2022	26/09/2022	14/09/2022	14/09/2022	01/09/2022	21/09/2022	23/08/2022	25/08/2022	31/08/2022
Sample Received					27/09/2022	18/10/2022	22/03/11	22/03/11	10/05/2022	17/09/2022	17/09/2022	09/06/2022	27/09/2022	09/06/2022	09/06/2022	09/06/2022
Sample No					ES5	ES5	ES 5	ES 7	ES 9	ES 4	ES 10	ES 7	ES 9	ES 6	ES 7	ES 7
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	<100	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	<100	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	<100	-	-	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	<100	-	-	-	-
2-Methylnaphthalene	µg/kg	<100	-	0	-	-	-	-	-	-	-	<100	-	-	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Benzo(a)anthracene	µg/kg	<100	90	0	-	-	-	-	-	-	-	<100	-	-	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	<100	-	-	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	<100	-	-	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	<100	-	-	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	<100	-	-	-	-
Chrysene	µg/kg	<100	140	0	-	-	-	-	-	-	-	<100	-	-	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	<100	-	-	-	-
indeno(123cd)pyrene	µg/kg	<100	60	0	-	-	-	-	-	-	-	<100	-	-	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	<100	-	-	-	-
Naphthalene	µg/kg	<100	200	0	-	-	-	-	-	-	-	<100	-	-	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	<100	-	-	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	<100	-	-	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	103	106	100	98	103	111	108	113	108	104	103	112
Toluene-d8**	%			0	98.7	98.2	92.4	93.7	92.7	92	92.6	93.8	96.7	95.8	93.8	97.6
4-Bromofluorobenzene**	%			0	94.2	90.9	78.9	81.4	74.8	70.1	70.8	78.8	86.6	90.4	92.3	97.9
Dichlorodifluoromethane	µg/kg	<6	-	0	-	-	-	-	-	-	-	<6	-	-	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	<7	-	-	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	<6	-	-	-	-
Bromomethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	<10	-	-	-	-
Trichlorofluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	<6	-	-	-	-
1,1-Dichloroethene	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	<7	-	-	-	-
Dichloromethane	µg/kg	<10	270	0	-	-	-	-	-	-	-	<40	-	-	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<10	<100	<10	<10	<10	<10	<10	<10	<100	<200	<200	<200
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	<8	-	-	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	<6	-	-	-	-
2,2-Dichloropropane	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	<8	-	-	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	<7	-	-	-	-
1,1-Dichloropropene	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	<5	-	-	-	-
Benzene	µg/kg	<9	28	0	<9	<90	<9	<9	<9	<9	<9	<9	<90	<180	<180	<180
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	<9	-	-	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	<10	-	-	-	-
Dibromomethane	µg/kg	<9	-	0	-	-	-	-	-	-	-	<9	-	-	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	<7	-	-	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
Toluene	µg/kg	<7	869	0	<7	<70	<7	<7	<7	<7	<7	<7	<70	<140	<140	<140
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
1,1,2-Trichloroethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
1,3-Dichloropropane	µg/kg	<7	-	0	-	-	-	-	-	-	-	<7	-	-	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	<5	-	-	-	-
Dibromochloromethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
1,2-Dibromoethane	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	<5	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	<10	-	-	-	-
Ethylbenzene	µg/kg	<4	518	0	<4	<40	<4	<4	<4	<4	<4	<4	<40	<80	<80	<80
m & p Xylene	µg/kg	<10	576	0	<10	<100	<10	<10	<10	<10	<10	<10	<100	<200	<200	<200
o-Xylene	µg/kg	<10	576	0	<10	<100	<10	<10	<10	<10	<10	<10	<100	<200	<200	<200
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	<10	-	-	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	<10	-	-	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	<5	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	<10	-	-	-	-
1,2,3-Trichloropropane	µg/kg	<16	-	0	-	-	-	-	-	-	-	<16	-	-	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	<10	-	-	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	<10	-	-	-	-
2-Chlorotoluene	µg/kg	<9	-	0	-	-	-	-	-	-	-	<9	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	<8	-	0	-	-	-	-	-	-	-	<8	-	-	-	-
4-Chlorotoluene	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
Tert-Butylbenzene	µg/kg	<14	-	0	-	-	-	-	-	-	-	<14	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	<9	-	-	-	-
Sec-Butylbenzene	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
4-Isopropyltoluene	µg/kg	<10	-	0	-	-	-	-	-	-	-	<10	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	<8	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	<5	-	-	-	-
n-Butylbenzene	µg/kg	<11	-	0	-	-	-	-	-	-	-	<11	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	<10	-	-	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14	-	0	-	-	-	-	-	-	-	<14	-	-	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	<10	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	<20	-	-	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	<20	-	-	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	<13	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	<20	-	-	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	<20	-	-	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	-	-	-	-	<0.02	-	-	-	-
Sum of BTEX	µg/kg	<40		0	<40	<400	<40	<40	<40	<40	<40	<40	<400	<800	<800	<800
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	<50	-	-	-	-	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	<50	-	-	-	-	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	<50	-	-	-	-	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	<0.01	-	-	-	-	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Ioxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**	**Sample ID**	BH101	BH101	BH101	BH101	BH102	BH102	BH102	BH103	BH103	BH103	BH103	BH104
			6 % OGM		**Depth**	0.20-0.20	2.80-2.80	4.80-4.80	8.80-8.80	1.00-1.00	14.80-14.80	9.80-9.80	1.20-1.20	18.80-18.80	5.80-5.80	7.80-7.80	2.80-2.80
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampled Date	21/09/2022	21/09/2022	21/09/2022	21/09/2022	27/09/2022	28/09/2022	28/09/2022	29/09/2022	30/09/2022	29/09/2022	29/09/2022	06/10/2022
					Sample Received	27/09/2022	27/09/2022	27/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022	44691	13/10/2022	44691	13/10/2022	18/10/2022
					Sample No	ES 1	ES 12	ES 18	ES 27	ES 6	ES 36	ES 28	ES 8	ES 48	ES 21	ES 25	ES 12
					Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
					Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
Carbon																	
Organic Matter (OGM)	%	<0.35		0		9.09	19.5	20.2	17.2	22.6	15.7	16.8	19.3	19.7	21.2	21.4	7.71
Inotganics																	
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0		<0.004	0.0271	0.0306	0.0433	0.0242	0.079	0.0461	0.0354	0.767	0.0543	0.0856	0.0321
pH	pH Units	<1		0		8.32	8.44	8.45	8.65	8.27	8.56	8.55	8.23	8.53	8.37	8.62	8.43
Sulphate	mg/kg	<48		0		129	162	162	675	202	535	454	245	1890	271	339	332
Nitrite as NO2	mg/kg	<0.1		0		0.91	0.13	0.13	<0.1	<0.1	0.12	<0.1	0.16	0.15	<0.1	0.12	0.17
Nitrate as NO3	mg/kg	<1		0		29.3	4.91	5.62	<1	7.49	<1	4.15	1.79	<1	3.52	7.41	<1
Sulphide	mg/kg	<15		0		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0		<10	<10	<10	<10	<10	18.1	<10	<10	15.8	92.2	<10	<10
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0		0.00431	0.00539	0.00541	0.0225	0.00674	0.0178	0.0151	0.00816	0.0629	0.00905	0.0113	0.0111
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0		<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																	
Chromium, VI	mg/kg	<0.6	33	0		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0		34.9	121	122	117	149	115	114	85	118	103	120	85.7
Total Boron	mg/kg	<0.7		0		14	29.4	29.4	37.1	23.8	58.6	33	16.8	72.4	21.4	29	23.8
Cadmium	mg/kg	<0.02	190	0		0.214	0.15	0.14	0.145	0.195	0.195	0.156	0.278	0.267	0.214	0.225	0.147
Chromium	mg/kg	<0.9		0		19.5	35	34.8	31.6	34.8	37.6	32.2	22	27.2	26.2	30.2	33.6
Copper	mg/kg	<1.4	68000	0		37.8	86.5	85.8	87.6	92.6	87.9	88.8	63.5	90	73.2	82.9	76.2
iron	mg/kg	<1000		0		25300	26500	26200	32600	46400	29800	32500	29300	33700	30700	32300	24100
Lead	mg/kg	<0.7	1100	0		67.2	50.6	49.2	49.1	51.5	53.7	48.3	49	42.3	44	44.1	49.3
Mercury	mg/kg	<0.1	1100	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0		30.3	44.8	43.5	44.7	61.5	47.6	47.3	45.3	50.6	48	50.7	41.4
Selenium	mg/kg	<1	12000	0		1.19	2.48	2.37	3.44	3.61	3.03	6.29	1.25	2.33	2.41	3.35	1.64
Zinc	mg/kg	<1.9	7300000	0		85.9	57.2	52.2	51.2	64.1	60.4	52.9	60.5	48.1	56.3	62.5	53.4
Metals - (Liquids)																	
Chromium, III	mg/kg	<0.9	8600	0		19.5	35	34.8	31.6	34.8	37.6	32.2	22	27.2	26.2	30.2	33.6
Phenols																	
Phenol	mg/kg	<0.01	1100000	0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0		<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0		<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																	
Total Aliphatic>C5-C10	µg/kg	<50		0		-	<50	-	-	-	-	-	-	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0		-	<50	-	-	-	-	-	-	-	-	-	-
GRO >C5-C10	µg/kg	<20		0		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																	
EPH Surrogate % recovery**	%			0		90.3	93.3	89.2	96.4	97.7	100	92.9	100	101	101	92.1	105
EPH Aliphatics >C10-C40	mg/kg	<35		0		59.7	136	151	166	81.6	131	<35	<35	262	<35	62.4	<35
TPH Criteria Working Group (TPH CWG)																	
GRO Surrogate % recovery**	%			0		-	18.6	-	-	-	-	-	-	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0		-	<1000	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0		-	1580	-	-	-	-	-	-	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0		-	21500	-	-	-	-	-	-	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0		-	92700	-	-	-	-	-	-	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0		-	17600	-	-	-	-	-	-	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0		-	133000	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0		-	158000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0		-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0		-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0		-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0		-	1520	-	-	-	-	-	-	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**		-	21900	-	-	-	-	-	-	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**		-	1310	-	-	-	-	-	-	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0		-	<1000	-	-	-	-	-	-	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0		-	25000	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0		-	158000	-	-	-	-	-	-	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0		59.7	136	151	166	81.6	131	<35	<35	262	<35	62.4	<35
Polyaromatic Hydrocarbons (PAHs)																	
Naphthalene-d8 % recovery**	%			0		81.8	64.4	55.4	52.8	70.2	47.6	62.7	75	34.5	62.1	51.1	78.4
Acenaphthene-d10 % recovery**	%			0		86.9	61.6	53.5	53.9	76.7	50	64.4	86.3	38.1	63.1	52.4	76
Phenanthrene-d10 % recovery**	%			0		87.5	23	16.7	8.23	41.4	13.4	27.9	60.3	7.09	26.8	17.5	51.5
Chrysene-d12 % recovery**	%			0		63.8	2.25	1.17	0.37	5.93	0.56	4	30.7	0.2	3.81	3.18	21.5
Perylene-d12 % recovery**	%			0		38.7	0.62	0.32	0.1	1.89	0.26	1.44	15	-	0.94	1.21	11.1
Naphthalene	µg/kg	<9	1100	0		<9	14.6	21.4	31.6	46.3	<9	<9	<45	13	15.2	15.6	<9
Acenaphthylene	µg/kg	<12	100000	0		<12	<12	<12	<12	<12	<12	<12	<60	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	100000	0		<8	<8	<8	<8	<8	<8	<8	<40	<8	<8	<8	<8
Fluorene	µg/kg	<10	71000	0		<10	<10	<10	<10	<10	<10	<10	<50	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	23000	0		37.4	<15	<15	<15	21.1	<15	<15	<75	<15	<15	<15	<15
Anthracene	µg/kg	<16	540000	0		<16	<16	<16	<16	<16	<16	<16	<80	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0		39.9	<17	<17	<17	<17	<17	<17	<85	<17	<17	<17	<17
Pyrene	µg/kg	<15	54000	0		36.4	<15	<15	<15	<15	<15	<15	<75	<15	<15	<15	20.2
Benz(a)anthracene	µg/kg	<14	180	**4**		<14	<14	<14	<14	<14	<14	<14	<70	<14	<14	<14	<14
Chrysene	µg/kg	<10	350	**3**		21.8	<10	<10	<10	<10	<10	<10	<50	<10	<10	<10	16.6
Benzo(b)fluoranthene	µg/kg	<15	45	**21**		22	<15	<15	<15	<15	<15	<15	<75	<15	<15	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0		<14	<14	<14	<14	<14	<14	<14	<70	<14	<14	<14	<14
Benzo(a)pyrene	µg/kg	<15	36	**15**		<15	<15	<15	<15	<15	<15	<15	<75	<15	<15	<15	<15
indeno(123cd)pyrene	µg/kg	<18	510	**1**		<18	<18	<18	<18	<18	<18	<18	<90	<18	<18	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**		<23	<23	<23	<23	<23	<23	<23	<115	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0		<24	<24	<24	<24	<24	<24	<24	<120	<24	<24	<24	<24
PAH 16 Total	µg/kg	<118		0		158	<118	<118	<118	<118	<118	<118	<590	<118	<118	<118	<118
PCB's - (Solids)																	
PCB 28	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0		-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																	
Phenol	µg/kg	<100	1100000	0		-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0		-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0		-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0		-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0		-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0		-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0		-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0		-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0		-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0		-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0		-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					BH101	BH101	BH101	BH101	BH102	BH102	BH102	BH103	BH103	BH103	BH103	BH104
Depth					0.20-0.20	2.80-2.80	4.80-4.80	8.80-8.80	1.00-1.00	14.80-14.80	9.80-9.80	1.20-1.20	18.80-18.80	5.80-5.80	7.80-7.80	2.80-2.80
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					21/09/2022	21/09/2022	21/09/2022	21/09/2022	27/09/2022	28/09/2022	28/09/2022	29/09/2022	30/09/2022	29/09/2022	29/09/2022	06/10/2022
Sample Received					27/09/2022	27/09/2022	27/09/2022	30/09/2022	30/09/2022	30/09/2022	30/09/2022	44691	13/10/2022	44691	13/10/2022	18/10/2022
Sample No					ES 1	ES 12	ES 18	ES 27	ES 6	ES 36	ES 28	ES 8	ES 48	ES 21	ES 25	ES 12
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	µg/kg	<100	140	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	-	-	-	-	-
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<100	200	**1**	-	-	-	-	-	-	-	-	-	-	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	112	109	108	127	119	105	120	112	118	129	116	106
Toluene-d8**	%			0	102	100	96.9	90.9	96.7	99	94.9	98.9	93.5	95.8	102	103
4-Bromofluorobenzene**	%			0	91.7	101	79.7	74.3	79	102	81.4	87.6	85.9	73.8	82.4	86.6
Dichlorodifluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	µg/kg	<10	270	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	<2000	<200	<200	<200	<2000	<200	<200	<200	<200	<200	<200
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/kg	<9	28	0	<180	<1800	<180	<180	<180	<1800	<180	<180	<180	<180	<180	<180
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	µg/kg	<7	869	0	<140	<1400	<140	<140	<140	<1400	<140	<140	<140	<140	<140	<140
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/kg	<7		0	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	µg/kg	<4	518	0	<80	<800	<80	<80	<80	<800	<80	<80	<80	<80	<80	<80
m & p Xylene	µg/kg	<10	576	0	<200	<2000	<200	<200	<200	<2000	<200	<200	<200	<200	<200	<200
o-Xylene	µg/kg	<10	576	0	<200	<2000	<200	<200	<200	<2000	<200	<200	<200	<200	<200	<200
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-Butylbenzene	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	-	-	-	-	-
Sec-Butylbenzene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/kg	<11		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	<4	-	-	-	-	-	-	-	-	-	-
Sum of BTEX	µg/kg	<40		0	<800	<8000	<800	<800	<800	<8000	<800	<800	<800	<800	<800	<800
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
loxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**												
			6 % OGM													
Sample ID					BH104	BH105	BH105	BH105	BH106	BH106	DS101	DS101	DS101	DS101	DS103	DS103
Depth					4.80-4.80	1.80-1.80	3.80-3.80	5.80-5.80	0.40-0.40	1.80-1.80	0.40-0.40	1.20-1.20	2.50-3.00	4.50-5.00	0.40-0.40	3.50-4.00
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					06/10/2022	05/10/2022	05/10/2022	05/10/2022	21/10/2022	21/10/2022	29/09/2022	29/09/2022	22/01/11	22/01/11	29/09/2022	29/09/2022
Sample Received					18/10/2022	13/10/2022	13/10/2022	13/10/2022	27/10/2022	27/10/2022	13/10/2022	13/10/2022	22/03/11	22/03/11	13/10/2022	18/10/2022
Sample No					ES 16	ES 8	ES 14	ES 18	ES 4	ES 9	ES 5	ES 8	ES 110	ES 112	ES 5	ES 12
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
Carbon																
Organic Matter (OGM)	%	<0.35		0	6.41	10.9	11.9	14.7	5.93	7.38	4.69	3.45	15.9	2.93	20.3	9.5
Inotganics																
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.0199	0.0561	0.0358	0.122	0.0206	0.0342	0.0601	0.0241	0.0484	0.367	0.163	0.0388
pH	pH Units	<1		0	8.44	8.66	8.6	8.52	8.51	8.42	8.61	8.48	8.77	10.7	8.28	8.19
Sulphate	mg/kg	<48		0	126	520	589	695	317	513	528	247	420	3980	440	98.8
Nitrite as NO2	mg/kg	<0.1		0	<0.1	<0.1	0.23	0.27	0.44	0.38	0.2	0.11	0.36	0.66	0.1	0.12
Nitrate as NO3	mg/kg	<1		0	1.43	<1	<1	36.3	1.51	<1	5.18	3.45	12	11.2	7.64	18.2
Sulphide	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	31.9	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.00419	0.0173	0.0196	0.0232	0.0106	0.0171	0.0176	0.00824	0.014	0.133	0.0147	0.00329
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0	86	72.2	73.2	97.5	56.4	41.6	63.6	46.3	63.2	80.3	140	121
Total Boron	mg/kg	<0.7		0	19.8	24.4	28.6	55.8	17.9	17.1	14.8	10.5	19.2	97.2	19	36
Cadmium	mg/kg	<0.02	190	0	0.639	0.167	0.204	0.219	<0.02	0.022	0.211	0.177	0.117	<0.02	0.209	0.642
Chromium	mg/kg	<0.9		0	46.7	24.5	27.3	37	25.4	20.9	15.4	11	17.3	16.7	28.2	43.9
Copper	mg/kg	<1.4	68000	0	83.1	70.8	74	78.4	78.3	82.3	122	70.9	37.2	63.6	89.2	103
iron	mg/kg	<1000		0	26600	30400	30700	29600	37400	29200	70100	45000	14100	64800	43100	32200
Lead	mg/kg	<0.7	1100	0	68.7	36.9	41.9	49.4	22.3	19.2	28.5	23	23.6	18.8	45.7	65.2
Mercury	mg/kg	<0.1	1100	0	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	46.4	38.8	40.9	43.4	36.6	30.3	59.4	42.1	20.2	46.7	51.9	59.7
Selenium	mg/kg	<1	12000	0	<10	2.03	2.38	4.45	<1	<1	1.77	1.08	1.59	3.69	1.57	1.85
Zinc	mg/kg	<1.9	7300000	0	64.3	45.1	50.5	59.2	41.3	31.7	47.5	31.1	28.2	33.8	55.9	69.7
Metals - (Liquids)																
Chromium, III	mg/kg	<0.9	8600	0	46.7	24.5	27.3	37	25.4	20.9	15.4	11	17.3	16.7	28.2	43.9
Phenols																
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	<0.01	<0.01	<0.01	<0.01	0.0246	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	<20	<20	53.7	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																
EPH Surrogate % recovery**	%			0	103	97.1	109	108	101	103	108	103	99.5	104	106	99.3
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	47.4	39.7	<35	<35	63	233
TPH Criteria Working Group (TPH CWG)																
GRO Surrogate % recovery**	%			0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0	-	-	-	-	-	-	-	-	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0	-	-	-	-	-	-	-	-	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	-	-	-	-	-	-	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0	<35	<35	<35	<35	<35	<35	47.5	39.7	<35	<35	63	233
Polyaromatic Hydrocarbons (PAHs)																
Naphthalene-d8 % recovery**	%			0	81.9	71.2	69.2	62.6	79	85.4	77.5	80.3	67.4	48.3	70.7	54.1
Acenaphthene-d10 % recovery**	%			0	82.1	74.1	72.7	65.2	80.5	85.6	83.9	91.4	66.7	44.9	78.4	57.9
Phenanthrene-d10 % recovery**	%			0	65.7	45.3	43.8	37.9	58	75.6	79.4	90.3	40.1	15	51.4	36.8
Chrysene-d12 % recovery**	%			0	34.3	15.9	15.1	12.6	30.7	65.8	58.5	62.3	18.2	1.04	16.6	17.5
Perylene-d12 % recovery**	%			0	17.6	7.51	6.61	5.47	15.2	47.9	31.7	32.7	9.16	0.26	6.36	9.22
Naphthalene	µg/kg	<9	1100	0	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	15.7	13.4
Acenaphthylene	µg/kg	<12	100000	0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	100000	0	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Fluorene	µg/kg	<10	71000	0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	23000	0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	20.2	<15
Anthracene	µg/kg	<16	540000	0	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0	24.6	<17	<17	<17	<17	<17	<17	<17	<17	<17	<17	<17
Pyrene	µg/kg	<15	54000	0	22.1	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Benz(a)anthracene	µg/kg	<14	180	**4**	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Chrysene	µg/kg	<10	350	**3**	18.7	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	45	**21**	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Benzo(a)pyrene	µg/kg	<15	36	**15**	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
indeno(123cd)pyrene	µg/kg	<18	510	**1**	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24
PAH 16 Total	µg/kg	<118		0	<118	<118	<118	<118	<118	<118	<118	<118	<118	<118	<118	<118
PCB's - (Solids)																
PCB 28	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																
Phenol	µg/kg	<100	1100000	0	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					BH104	BH105	BH105	BH105	BH106	BH106	DS101	DS101	DS101	DS101	DS103	DS103
Depth					4.80-4.80	1.80-1.80	3.80-3.80	5.80-5.80	0.40-0.40	1.80-1.80	0.40-0.40	1.20-1.20	2.50-3.00	4.50-5.00	0.40-0.40	3.50-4.00
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					06/10/2022	05/10/2022	05/10/2022	05/10/2022	21/10/2022	21/10/2022	29/09/2022	29/09/2022	22/01/11	22/01/11	29/09/2022	29/09/2022
Sample Received					18/10/2022	13/10/2022	13/10/2022	13/10/2022	27/10/2022	27/10/2022	13/10/2022	13/10/2022	22/03/11	22/03/11	13/10/2022	18/10/2022
Sample No					ES 16	ES 8	ES 14	ES 18	ES 4	ES 9	ES 5	ES 8	ES 110	ES 112	ES 5	ES 12
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	µg/kg	<100	140	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	-	-	-	-	-
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<100	200	**1**	-	-	-	-	-	-	-	-	-	-	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	111	133	114	123	110	112	118	121	107	119	132	109
Toluene-d8**	%			0	100	98.6	109	103	100	99.7	99.7	102	96.9	93.1	101	99.5
4-Bromofluorobenzene**	%			0	95.7	72.8	85.4	90.5	89.4	85.4	84	87.3	90.5	93.3	78.2	85.5
Dichlorodifluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	µg/kg	<10	270	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/kg	<9	28	0	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	µg/kg	<7	869	0	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/kg	<7		0	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	µg/kg	<4	518	0	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80
m & p Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
o-Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-Butylbenzene	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	-	-	-	-	-
Sec-Butylbenzene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/kg	<11		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of BTEX	µg/kg	<40		0	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	DS105	DS105	DS105	DS106	DS106	DS106	DS107	DS107	DS107	DS108	DS108	DS108
Depth	0.80-0.80	1.50-2.00	3.50-4.00	0.10-0.10	2.50-3.00	4.50-5.00	0.80-0.80	2.50-3.00	4.50-5.00	0.40-0.40	1.50-2.00	3.50-4.00
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	30/09/2022	28/09/2022	28/09/2022	30/09/2022	28/09/2022	28/09/2022	27/09/2022	27/09/2022	04/10/2022	29/09/2022	29/09/2022	29/09/2022
Sample Received	22/05/10	22/06/10	22/06/10	22/05/10	13/10/2022	13/10/2022	18/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022
Sample No	ES 7	ES 9	ES 11	ES 2	ES 10	ES 12	ES 8	ES 10	ES 12	ES 4	ES 10	ES 11
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC 6 % OGM**	**No. Above GAC**											
Carbon															
Organic Matter (OGM)	%	<0.35		0	15.1	20	16.6	6.67	22.8	22.1	12.2	16.5	15.3	19.7	15.6	16.6
Inotganics																
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.0156	0.0173	0.0245	<0.004	0.029	0.0416	0.0169	0.0262	0.024	0.0201	0.0304	0.0417
pH	pH Units	<1		0	8.53	8.44	8.6	8.23	8.51	8.7	8.5	8.57	9.05	8.26	8.29	8.36
Sulphate	mg/kg	<48		0	1080	314	360	384	298	342	129	311	328	214	251	280
Nitrite as NO2	mg/kg	<0.1		0	<0.1	<0.1	<0.1	1.02	0.1	0.21	0.16	<0.1	0.64	<0.1	<0.1	<0.1
Nitrate as NO3	mg/kg	<1		0	4.57	7.01	7.2	39.8	1.08	8.81	3.56	8.08	7.04	3.15	11.2	20.4
Sulphide	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0	<100	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.0359	0.0105	0.012	0.0128	0.00993	0.0114	0.0043	0.0104	0.0109	0.00715	0.00837	0.00934
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0	91	113	92.9	23	89.9	87	82.2	101	89.5	87.8	108	114
Total Boron	mg/kg	<0.7		0	22.3	30.1	33.9	13.2	33.9	33.6	23.1	35.4	36	22.6	29.7	34.4
Cadmium	mg/kg	<0.02	190	0	0.313	0.326	0.304	0.373	0.244	0.222	0.118	0.306	0.108	0.282	0.251	0.272
Chromium	mg/kg	<0.9		0	26.7	27.8	26.3	14.5	32.4	27.4	28.7	39.4	28.6	29.9	34.4	44.3
Copper	mg/kg	<1.4	68000	0	72.8	83.5	72.1	24.7	83.3	77.9	74.5	89	76.6	83.5	90.1	99.1
iron	mg/kg	<1000		0	22100	26200	25500	26100	34600	33200	26700	25900	28900	28900	31800	32700
Lead	mg/kg	<0.7	1100	0	42.4	43.3	39	68.1	47.7	38.7	38.4	50.1	39.4	47.4	52.9	61
Mercury	mg/kg	<0.1	1100	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	46.4	51.4	47.2	29.2	52.9	52.4	40	46.8	45.1	52.6	53.6	57
Selenium	mg/kg	<1	12000	0	1.83	2.3	2.85	1.46	2.84	2.42	1.36	3.06	2.37	1.7	2.16	3.06
Zinc	mg/kg	<1.9	7300000	0	52.3	49.4	46.1	88.7	55.7	51.1	45.5	59.2	49.3	52.4	57.8	63.9
Metals - (Liquids)																
Chromium, III	mg/kg	<0.9	8600	0	26.7	27.8	26.3	14.5	32.4	27.4	28.7	39.4	28.6	29.9	34.4	44.3
Phenols																
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																
Total Aliphatic>C5-C10	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	<50	-	-	-	-	-	-	-	-	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																
EPH Surrogate % recovery**	%			0	99.3	99	104	105	106	107	103	105	109	105	102	104
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	<35	<35	36.9	85.3	<35	<35	<35	<35	39	<35	<35
TPH Criteria Working Group (TPH CWG)																
GRO Surrogate % recovery**	%			0	-	25.2	-	-	-	-	-	-	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	<5000	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	<10000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0	-	<10	-	-	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**	-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**	-	<1000	-	-	-	-	-	-	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0	-	<1000	-	-	-	-	-	-	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	<5000	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	<10000	-	-	-	-	-	-	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0	<35	<35	<35	36.9	85.3	<35	<35	<35	<35	39	<35	<35
Polyaromatic Hydrocarbons (PAHs)																
Naphthalene-d8 % recovery**	%			0	73.2	72.1	43.9	77.8	54.8	45.5	52.1	65.5	56.6	70	65	72.4
Acenaphthene-d10 % recovery**	%			0	77.7	76.3	47.3	84.7	56.3	44	53.1	61.9	58.6	77.6	71.2	81.8
Phenanthrene-d10 % recovery**	%			0	61	52.8	16.2	79.5	11.1	6.7	32.1	32.9	16.2	51.3	40.8	52.3
Chrysene-d12 % recovery**	%			0	31.5	19.9	2.89	70	0.83	0.33	16.7	11.6	1.68	14.7	12	12.4
Perylene-d12 % recovery**	%			0	13.5	6.37	0.95	70.1	-	0.11	9.6	4.83	0.45	5.56	4.02	4
Naphthalene	µg/kg	<9	1100	0	<9	<9	<9	14.1	17	14.2	<9	<9	<9	11.2	19.4	17.4
Acenaphthylene	µg/kg	<12	100000	0	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	100000	0	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Fluorene	µg/kg	<10	71000	0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	23000	0	<15	<15	<15	42	<15	<15	<15	<15	<15	18.5	<15	<15
Anthracene	µg/kg	<16	540000	0	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0	<17	<17	<17	25.7	<17	<17	<17	<17	<17	<17	<17	<17
Pyrene	µg/kg	<15	54000	0	<15	<15	<15	22.4	<15	<15	<15	<15	<15	<15	<15	<15
Benz(a)anthracene	µg/kg	<14	180	**4**	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Chrysene	µg/kg	<10	350	**3**	<10	<10	<10	22.3	<10	<10	<10	12.8	<10	<10	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	45	**21**	<15	<15	<15	22.4	<15	<15	<15	<15	<15	<15	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
Benzo(a)pyrene	µg/kg	<15	36	**15**	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
indeno(123cd)pyrene	µg/kg	<18	510	**1**	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24	<24
PAH 16 Total	µg/kg	<118		0	<118	<118	<118	149	<118	<118	<118	<118	<118	<118	<118	<118
PCB's - (Solids)																
PCB 28	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																
Phenol	µg/kg	<100	1100000	0	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl Phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					DS105	DS105	DS105	DS106	DS106	DS106	DS107	DS107	DS107	DS108	DS108	DS108
Depth					0.80-0.80	1.50-2.00	3.50-4.00	0.10-0.10	2.50-3.00	4.50-5.00	0.80-0.80	2.50-3.00	4.50-5.00	0.40-0.40	1.50-2.00	3.50-4.00
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					30/09/2022	28/09/2022	28/09/2022	30/09/2022	28/09/2022	28/09/2022	27/09/2022	27/09/2022	04/10/2022	29/09/2022	29/09/2022	29/09/2022
Sample Received					22/05/10	22/06/10	22/06/10	22/05/10	13/10/2022	13/10/2022	18/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022
Sample No					ES 7	ES 9	ES 11	ES 2	ES 10	ES 12	ES 8	ES 10	ES 12	ES 4	ES 10	ES 11
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	µg/kg	<100	140	**2**	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	-	-	-	-	-
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<100	200	**1**	-	-	-	-	-	-	-	-	-	-	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	120	133	137	102	117	117	110	116	-	112	122	131
Toluene-d8**	%			0	98.2	95.1	94.1	97.4	96.7	97.1	101	97.7	-	102	101	99.4
4-Bromofluorobenzene**	%			0	87.8	77.7	70.6	92.7	74.4	78.2	83.8	78.6	-	84.6	82	72.7
Dichlorodifluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	µg/kg	<10	270	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/kg	<9	28	0	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	µg/kg	<7	869	0	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/kg	<7		0	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	µg/kg	<4	518	0	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80
m & p Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
o-Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/kg	<9		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-Butylbenzene	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	-	-	-	-	-
Sec-Butylbenzene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/kg	<11		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	-	-	-	-	-	-	-	-	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	-	-	-	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	<0.4	-	-	-	-	-	-	-	-	-	-
Sum of BTEX	µg/kg	<40		0	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
loxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**	**Sample ID**	DS109	DS110	DS110	DS110	DS111	DS111	DS111	MS-BH01	MS-BH01	MS-BH02	MS-BH02	MS-BH02
			6 % OGM		**Depth**	1.20-1.20	0.40-0.40	1.20-1.20	2.50-3.00	1.50-2.00	1.50-2.00	4.00-4.70	0.10-0.10	0.35-0.35	0.10-0.10	0.85-0.85	1.20-1.20
					Sample Type	SOLID	SOLID	SOLID	-	-	-	-	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampled Date	23/09/2022	28/09/2022	28/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	26/08/2022	26/08/2022	30/08/2022	30/08/2022	30/08/2022
					Sample Received	10/06/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	22/06/09	22/06/09	22/06/09	22/06/09	22/06/09
					Sample No	ES 8	ES 4	ES 7	ES 10	ES 9	ES 9	ES 12	ES 1	ES 4	ES 2	ES 9	ES 10
					Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
					Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
Carbon																	
Organic Matter (OGM)	%	<0.35		0		10	6.5	9.05	14	14.2	14.5	9.79	4.76	4.86	4.17	59.5	12.9
Inotganics																	
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0		0.0253	0.0407	0.0151	0.0269	0.0201	0.11	0.307	0.0148	<0.004	0.017	0.0957	0.0434
pH	pH Units	<1		0		8.48	8.72	8.4	9.01	8.62	8.71	11	8.23	8.33	8.17	7.63	6.94
Sulphate	mg/kg	<48		0		592	531	319	321	310	549	2270	370	303	422	1140	213
Nitrite as NO2	mg/kg	<0.1		0		0.1	0.14	0.1	0.18	0.14	0.17	0.16	0.93	1.22	3.38	0.49	<0.1
Nitrate as NO3	mg/kg	<1		0		3.84	3.72	3.21	7.52	6.73	3.96	1.45	3.94	6.65	6.35	33.9	10.3
Sulphide	mg/kg	<15		0		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Sulphur	mg/kg	<10		0		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Sulphur (ASB)	%	<0.0016		0		0.0197	0.0177	0.0106	0.0107	0.0103	0.0183	0.0756	0.0123	0.0101	0.0141	0.0378	0.00711
Total Cyanide	mg/kg	<1		0		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0		<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Metals - (Soilds)																	
Chromium, VI	mg/kg	<0.6	33	0		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	-
Arsenic	mg/kg	<0.6	640	0		77.4	59.8	74.7	76.3	86.5	90.8	53.3	17.3	15.3	16.8	13	1.29
Total Boron	mg/kg	<0.7		0		31.5	24.6	24.1	36	31	33.3	47.4	17.2	15.6	16.4	17.9	1.62
Cadmium	mg/kg	<0.02	190	0		0.276	0.175	0.223	0.179	0.25	0.13	0.132	0.304	0.184	0.272	0.181	0.0387
Chromium	mg/kg	<0.9		0		21.8	15.7	24.6	25.2	30.7	26.2	13.1	20.6	17.8	18.8	12.5	3.02
Copper	mg/kg	<1.4	68000	0		63.4	81.3	73.7	74.9	80	80.1	69.2	19.1	15.4	19.4	14.7	3.97
iron	mg/kg	<1000		0		21400	46700	34700	38000	37000	37500	43000	30600	28400	31100	30200	2120
Lead	mg/kg	<0.7	1100	0		40	30	35.8	36.9	46.8	42.6	22.8	82.4	72.7	82.2	54.2	5.14
Mercury	mg/kg	<0.1	1100	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0		42.2	41.3	40.8	42.5	45.8	46.5	35.3	28.8	25.8	29.4	23.5	2.42
Selenium	mg/kg	<1	12000	0		2	2.52	2.27	2.84	2.47	2.83	2.94	1.12	1	1.01	1.17	<1
Zinc	mg/kg	<1.9	7300000	0		47.5	86.8	48.5	50.6	65.7	63.6	36.5	109	93.3	113	75.4	4.19
Metals - (Liquids)																	
Chromium, III	mg/kg	<0.9	8600	0		21.8	15.7	24.6	25.2	30.7	26.2	13.1	20.6	17.8	18.8	12.5	-
Phenols																	
Phenol	mg/kg	<0.01	1100000	0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total cresols	mg/kg	<0.01		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenols	mg/kg	<0.015		0		<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols	mg/kg	<0.035		0		<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Gasoline Range Organics (GRO)																	
Total Aliphatic>C5-C10	µg/kg	<50		0		-	-	<50	-	-	-	-	-	<50	<50	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0		-	-	<50	-	-	-	-	-	<50	<50	-	-
GRO >C5-C10	µg/kg	<20		0		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EPH (Extractable Petroleum Hydrocarbons)																	
EPH Surrogate % recovery**	%			0		95.3	102	102	98.4	98.5	104	105	93.8	103	103	100	97.8
EPH Aliphatics >C10-C40	mg/kg	<35		0		<35	<35	<35	<35	<35	<35	<35	<35	96.9	<35	630	266
TPH Criteria Working Group (TPH CWG)																	
GRO Surrogate % recovery**	%			0		-	-	80.1	-	-	-	-	-	76.5	82.9	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0		-	-	1480	-	-	-	-	-	5160	6210	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0		-	-	<5000	-	-	-	-	-	6750	7050	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0		-	-	<10000	-	-	-	-	-	18700	12400	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0		-	-	<10	-	-	-	-	-	<10	<10	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**		-	-	<1000	-	-	-	-	-	8350	3230	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**		-	-	<1000	-	-	-	-	-	2800	<1000	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0		-	-	<1000	-	-	-	-	-	<1000	<1000	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0		-	-	<5000	-	-	-	-	-	12000	5400	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0		-	-	<10000	-	-	-	-	-	18700	12400	-	-
EPH (C5-C40)	mg/kg	<35		0		<35	<35	<35	<35	<35	<35	<35	<35	96.9	<35	630	266
Polyaromatic Hydrocarbons (PAHs)																	
Naphthalene-d8 % recovery**	%			0		55.7	75.8	72.2	71.2	75.2	71.7	52.9	85.3	84.7	92.3	81.8	83.4
Acenaphthene-d10 % recovery**	%			0		58.9	81.1	78.7	75.1	79.3	76.6	54.1	92.2	92.6	92.7	85.6	86.1
Phenanthrene-d10 % recovery**	%			0		33.8	69.3	62.3	42.9	57.6	54.1	22.7	97.4	97.4	92.6	85.1	85.5
Chrysene-d12 % recovery**	%			0		15.6	41.9	36.2	10.1	17.2	17.1	3.07	100	99.4	77.9	75.5	78.4
Perylene-d12 % recovery**	%			0		8.93	22.1	15.9	3.39	5.78	5.9	0.67	96.2	98.4	78	71.7	71.6
Naphthalene	µg/kg	<9	1100	0		<9	<9	<9	<9	<9	<9	18.1	14.7	<9	19.7	<9	<9
Acenaphthylene	µg/kg	<12	100000	0		<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
Acenaphthene	µg/kg	<8	100000	0		<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Fluorene	µg/kg	<10	71000	0		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenanthrene	µg/kg	<15	23000	0		<15	<15	<15	<15	<15	<15	<15	55.8	35.1	85.7	<15	<15
Anthracene	µg/kg	<16	540000	0		<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
Fluoranthene	µg/kg	<17	23000	0		<17	<17	<17	<17	<17	<17	<17	67.7	37.2	120	<17	<17
Pyrene	µg/kg	<15	54000	0		<15	<15	<15	<15	<15	<15	<15	58.6	32.5	99.1	<15	<15
Benz(a)anthracene	µg/kg	<14	180	**4**		<14	<14	<14	<14	<14	<14	<14	31.6	<14	43.4	<14	<14
Chrysene	µg/kg	<10	350	**3**		<10	<10	<10	<10	<10	<10	<10	39.1	24.2	52.9	<10	<10
Benzo(b)fluoranthene	µg/kg	<15	45	**21**		<15	<15	<15	<15	<15	<15	<15	47.7	28.1	78.4	<15	<15
Benzo(k)fluoranthene	µg/kg	<14	1200	0		<14	<14	<14	<14	<14	<14	<14	16.7	<14	22.6	<14	<14
Benzo(a)pyrene	µg/kg	<15	36	**15**		<15	<15	<15	<15	<15	<15	<15	26.7	<15	38	<15	<15
indeno(123cd)pyrene	µg/kg	<18	510	**1**		<18	<18	<18	<18	<18	<18	<18	25.7	<18	31.6	<18	<18
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**		<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0		<24	<24	<24	<24	<24	<24	<24	28.3	<24	34	<24	<24
PAH 16 Total	µg/kg	<118		0		<118	<118	<118	<118	<118	<118	<118	413	157	626	<118	<118
PCB's - (Solids)																	
PCB 28	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0		-	-	-	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0		-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																	
Phenol	µg/kg	<100	1100000	0		-	-	-	-	-	-	-	-	<100	<100	-	-
Pentachlorophenol	µg/kg	<100	1200	0		-	-	-	-	-	-	-	-	<100	<100	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Nitrobenzene	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Isophorone	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Hexachloroethane	µg/kg	<100	22	0		-	-	-	-	-	-	-	-	<100	<100	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0		-	-	-	-	-	-	-	-	<200	<200	-	-
Hexachlorobutadiene	µg/kg	<100	32	0		-	-	-	-	-	-	-	-	<100	<100	-	-
Hexachlorobenzene	µg/kg	<100	48	0		-	-	-	-	-	-	-	-	<100	<100	-	-
n-Dioctyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Dimethyl Phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Diethyl Phthalate	µg/kg	<100	150000	0		-	-	-	-	-	-	-	-	<100	<100	-	-
n-Dibutyl phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Dibenzofuran	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Carbazole	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0		-	-	-	-	-	-	-	-	<100	<100	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
Azobenzene	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Nitrophenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Chlorophenylphenylether	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Chloroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
4-Bromophenylphenylether	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
3-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
2-Nitrophenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
2-Nitroaniline	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
2-Methylphenol	µg/kg	<100		0		-	-	-	-	-	-	-	-	<100	<100	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2-Chlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	<100	<100	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0		-	-	-	-	-	-	-	-	<100	<100	-	-

Exceeds GAC
Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					DS109	DS110	DS110	DS110	DS111	DS111	DS111	MS-BH01	MS-BH01	MS-BH02	MS-BH02	MS-BH02
Depth					1.20-1.20	0.40-0.40	1.20-1.20	2.50-3.00	1.50-2.00	1.50-2.00	4.00-4.70	0.10-0.10	0.35-0.35	0.10-0.10	0.85-0.85	1.20-1.20
Sample Type					SOLID	SOLID	SOLID	-	-	-	-	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					23/09/2022	28/09/2022	28/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	26/08/2022	26/08/2022	30/08/2022	30/08/2022	30/08/2022
Sample Received					10/06/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	22/06/09	22/06/09	22/06/09	22/06/09	22/06/09
Sample No					ES 8	ES 4	ES 7	ES 10	ES 9	ES 9	ES 12	ES 1	ES 4	ES 2	ES 9	ES 10
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	-	-	-	-	-	<100	<100	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	-	-	-	-	-	<100	<100	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	-	-	-	-	-	<100	<100	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	-	-	-	-	-	<100	<100	-	-
2-Methylnaphthalene	µg/kg	<100		0	-	-	-	-	-	-	-	-	<100	<100	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Chrysene	µg/kg	<100	140	**2**	-	-	-	-	-	-	-	-	<100	<100	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	-	-	-	-	-	-	<100	<100	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Naphthalene	µg/kg	<100	200	**1**	-	-	-	-	-	-	-	-	<100	<100	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	-	-	-	-	-	<100	<100	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	123	120	125	122	119	120	124	104	103	113	110	118
Toluene-d8**	%			0	98.6	101	100	96.8	105	100	98.2	97.1	96.5	97	93.6	89.6
4-Bromofluorobenzene**	%			0	88.1	86	78.9	85.3	87.8	83	81.9	90.3	90.8	93.8	83.6	78.9
Dichlorodifluoromethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	<120	<120	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	-	-	-	-	-	<140	<140	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	-	-	-	-	-	<120	<120	-	-
Bromomethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Trichlorofluorormethane	µg/kg	<6		0	-	-	-	-	-	-	-	-	<120	<120	-	-
1,1-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	-	-	-	-	-	<140	<140	-	-
Dichloromethane	µg/kg	<10	270	**1**	-	-	-	-	-	-	-	-	<315	<260	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	-	-	-	-	-	<160	<160	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	-	-	-	-	-	<120	<120	-	-
2,2-Dichloropropane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Chloroform	µg/kg	<8		0	-	-	-	-	-	-	-	-	<160	<160	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	-	-	-	-	-	<140	<140	-	-
1,1-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Benzene	µg/kg	<9	28	0	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180	<180
Trichloroethene	µg/kg	<9	12	0	-	-	-	-	-	-	-	-	<180	<180	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Dibromomethane	µg/kg	<9		0	-	-	-	-	-	-	-	-	<180	<180	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	-	-	-	-	-	<140	<140	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Toluene	µg/kg	<7	869	0	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140	<140
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,3-Dichloropropane	µg/kg	<7		0	-	-	-	-	-	-	-	-	<140	<140	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	-	-	-	-	-	<100	<100	-	-
Dibromochloromethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,2-Dibromoethane	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	-	-	-	-	-	<100	<100	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Ethylbenzene	µg/kg	<4	518	0	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80
m & p Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
o-Xylene	µg/kg	<10	576	0	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Styrene	µg/kg	<10	3300	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	-	-	-	-	-	<100	<100	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	-	-	-	-	-	-	<320	<320	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	-	-	-	-	-	<200	<200	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	-	-	-	-	-	<200	<200	-	-
2-Chlorotoluene	µg/kg	<9		0	-	-	-	-	-	-	-	-	<180	<180	-	-
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	-	-	-	-	-	-	<160	<160	-	-
4-Chlorotoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
Tert-Butylbenzene	µg/kg	<14		0	-	-	-	-	-	-	-	-	<280	<280	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	-	-	-	-	-	<180	<180	-	-
Sec-Butylbenzene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
4-Isopropyltoluene	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	-	-	-	-	-	<160	<160	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	-	-	-	-	-	<100	<100	-	-
n-Butylbenzene	µg/kg	<11		0	-	-	-	-	-	-	-	-	<220	<220	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	-	-	-	-	-	-	<280	<280	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	-	-	-	-	-	<200	<200	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	-	-	-	-	-	<400	<400	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	-	-	-	-	-	<400	<400	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	-	-	-	-	-	<260	<260	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	-	-	-	-	-	<400	<400	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	-	-	-	-	-	<400	<400	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	<0.4	-	-	-	-	-	<0.4	<0.4	-	-
Sum of BTEX	µg/kg	<40		0	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	-	-
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	-	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Test	**Units**	**LOD**	**Selected GAC**	**No. Above GAC**	**Sample ID**		**Depth**		**Sample Type**		**Sampled Date**		**Sample Received**		**Sample No**		**Batch Number**		**Strata / Zone**	
			6 % OGM		MS-BH03	MS-BH03	0.10-0.10	0.30-0.30	SOLID	SOLID	25/08/2022	25/08/2022	22/06/09	22/06/09	ES 1	ES 4	1	1	Made Ground	Made Ground
					MS-BH04	MS-BH04	0.10-0.10	0.80-0.80	SOLID	SOLID	13/09/2022	14/09/2022	17/09/2022	17/09/2022	ES 1	ES 7	1	1	Made Ground	Made Ground
					MS-BH05	MS-BH06	0.10-0.10	0.10-0.10	SOLID	SOLID	06/09/2022	01/09/2022	13/09/2022	09/06/2022	ES 1	ES 2	1	1	Made Ground	Made Ground
					MS-BH06	MS-BH07	0.50-0.50	0.20-0.30	SOLID	SOLID	01/09/2022	23/08/2022	09/06/2022	09/06/2022	ES 5	ES 1	1	1	Made Ground	Made Ground
					MS-BH08	MS-BH08	0.10-0.30	0.50-0.70	SOLID	SOLID	09/09/2022	09/09/2022	17/09/2022	17/09/2022	ES 2	ES 4	1	1	Made Ground	Made Ground
					MS-BH09	MS-BH09	0.10-0.10	0.50-0.50	SOLID	SOLID	15/09/2022	15/09/2022	24/09/2022	24/09/2022	ES 1	ES 4	1	1	Made Ground	Made Ground
Carbon																				
Organic Matter (OGM)	%	<0.35		0	3.91	-	3.36	76.2	4.03	5.22	15.9	4.95	4.19	4.52	3.33	3.69				
Inotganics																				
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.021	-	0.0265	0.0831	0.0223	0.0501	<0.004	0.077	0.053	0.177	0.0286	0.0212				
pH	pH Units	<1		0	8.15	-	8.32	7.5	8.22	8.19	7.98	8.39	8.26	8.33	6.97	8.26				
Sulphate	mg/kg	<48		0	347	-	293	797	260	554	647	427	521	674	324	211				
Nitrite as NO2	mg/kg	<0.1		0	2.02	-	0.6	0.35	1.43	5.04	4.63	1.86	0.52	1.16	1.46	0.37				
Nitrate as NO3	mg/kg	<1		0	3.74	-	8.43	25.4	12.6	9.41	17.7	6.21	4.22	7.24	6.33	5.73				
Sulphide	mg/kg	<15		0	<15	-	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15				
Sulphur	mg/kg	<10		0	<10	-	<10	<10	10.4	<10	<10	11	23.6	<10	<10	15				
Total Cyanide	mg/kg	<1		0	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1				
Total Sulphur (ASB)	%	<0.0016		0	0.0116	-	0.00978	0.0266	0.00866	0.0185	0.0216	0.0142	0.0174	0.0225	0.0108	0.00702				
Total Cyanide	mg/kg	<1		0	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1				
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	-	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15				
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	-	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12				
Metals - (Soilds)																				
Chromium, VI	mg/kg	<0.6	33	0	<0.6	-	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6				
Arsenic	mg/kg	<0.6	640	0	14.9	-	16.7	6.01	15.6	18	13.9	15.4	14.1	12.2	15.5	12.7				
Total Boron	mg/kg	<0.7		0	14.3	-	15.4	13.5	12.6	18.1	16.6	13.6	10.6	15.6	13.4	10.9				
Cadmium	mg/kg	<0.02	190	0	0.219	-	0.297	0.201	0.244	0.263	0.19	0.265	0.317	0.257	0.736	0.0768				
Chromium	mg/kg	<0.9		0	17.2	-	13.9	7.29	14.1	20.4	15.4	17	13.4	12.7	13.9	10.2				
Copper	mg/kg	<1.4	68000	0	17.4	-	23.7	11.4	17.7	21.2	15.7	20.2	15.9	16.6	18.1	11.9				
iron	mg/kg	<1000		0	28700	-	35300	14300	23400	33100	28100	27600	26900	22900	24600	24400				
Lead	mg/kg	<0.7	1100	0	74	-	79.9	29.8	70.2	86	61.4	74.5	65.2	55.1	70.3	61				
Mercury	mg/kg	<0.1	1100	0	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Nickel	mg/kg	<0.2	980	0	27.3	-	30.9	15.4	32	31.5	23.4	26.5	22.7	20	23.3	21.5				
Selenium	mg/kg	<1	12000	0	1.04	-	1.32	<1	<1	1.21	1.07	1.04	1.04	<1	<1	<1				
Zinc	mg/kg	<1.9	7300000	0	100	-	108	42.5	90.3	117	79.6	111	85.5	83	92.1	76.5				
Metals - (Liquids)																				
Chromium, III	mg/kg	<0.9	8600	0	17.2	-	13.9	7.29	14.1	20.4	15.4	17	13.4	12.7	13.9	10.2				
Phenols																				
Phenol	mg/kg	<0.01	1100000	0	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Total cresols	mg/kg	<0.01		0	<0.01	-	<0.01	<0.01	<0.01	<0.01	0.0145	<0.01	<0.01	<0.01	<0.01	<0.01				
Xylenols	mg/kg	<0.015		0	<0.015	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015				
Phenols	mg/kg	<0.035		0	<0.035	-	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035				
Gasoline Range Organics (GRO)																				
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	-	<50	<50	-	-	-	-	<50	-	-				
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	-	<50	<50	-	-	-	-	<50	-	-				
GRO >C5-C10	µg/kg	<20		0	<20	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20				
EPH (Extractable Petroleum Hydrocarbons)																				
EPH Surrogate % recovery**	%			0	105	-	96.9	82.3	104	94.1	101	99.4	93.1	81.9	96.2	107				
EPH Aliphatics >C10-C40	mg/kg	<35		0	<35	-	<35	216	41.3	<35	385	51.5	40.5	38.3	<35	93.3				
TPH Criteria Working Group (TPH CWG)																				
GRO Surrogate % recovery**	%			0	-	-	-	39.8	87.3	-	-	-	-	84.9	-	-				
Aliphatics >C5-C6	µg/kg	<10	12000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aliphatics >C6-C8	µg/kg	<10	40000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aliphatics >C8-C10	µg/kg	<10	11000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aliphatics >C10-C12	µg/kg	<1000	47000	0	-	-	-	<1000	<1000	-	-	-	-	<1000	-	-				
Aliphatics >C12-C16	µg/kg	<1000	90000	0	-	-	-	<1000	<1000	-	-	-	-	<1000	-	-				
Aliphatics >C16-C21	µg/kg	<1000	1800000	0	-	-	-	12200	<1000	-	-	-	-	1250	-	-				
Aliphatics >C21-C35	µg/kg	<1000	1800000	0	-	-	-	129000	9080	-	-	-	-	9660	-	-				
Aliphatics >C35-C44	µg/kg	<1000	1800000	0	-	-	-	70200	<1000	-	-	-	-	<1000	-	-				
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	-	211000	11000	-	-	-	-	11700	-	-				
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	-	422000	20300	-	-	-	-	31600	-	-				
Aromatics >EC5-EC7	µg/kg	<10	86000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aromatics >EC7-EC8	µg/kg	<10	180000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aromatics >EC8-EC10	µg/kg	<10	17000	0	-	-	-	<10	<10	-	-	-	-	<10	-	-				
Aromatics >EC10-EC12	µg/kg	<1000	36000	0	-	-	-	<1000	<1000	-	-	-	-	<1000	-	-				
Aromatics >EC12-EC16	µg/kg	<1000	38000	0	-	-	-	<1000	<1000	-	-	-	-	<1000	-	-				
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	-	11200	1310	-	-	-	-	1470	-	-				
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**	-	-	-	130000	6080	-	-	-	-	14800	-	-				
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**	-	-	-	68800	1960	-	-	-	-	3650	-	-				
Aromatics > EC40-EC44	µg/kg	<1000		0	-	-	-	9260	<1000	-	-	-	-	<1000	-	-				
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	-	211000	9340	-	-	-	-	19900	-	-				
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	-	422000	20300	-	-	-	-	31600	-	-				
EPH (C5-C40)	mg/kg	<35		0	<35	-	<35	216	41.3	<35	385	51.5	40.5	38.3	<35	93.3				
Polyaromatic Hydrocarbons (PAHs)																				
Naphthalene-d8 % recovery**	%			0	95.9	-	87.9	85.1	85.5	90.9	90.7	89.8	87.7	87.6	88.8	89				
Acenaphthene-d10 % recovery**	%			0	101	-	87.1	86.5	90	95	91.7	93.5	90.4	86.5	93	92.8				
Phenanthrene-d10 % recovery**	%			0	105	-	87.2	89.8	98.1	101	89.6	99	92.7	85.7	95.3	95.3				
Chrysene-d12 % recovery**	%			0	108	-	77.7	80.1	89.8	96.7	70.3	92.7	84.4	78.1	85.9	88.2				
Perylene-d12 % recovery**	%			0	88.7	-	78.9	71.3	87	94.4	71.7	88.3	77.6	77.6	78.5	82				
Naphthalene	µg/kg	<9	1100	0	22.4	-	<9	<9	22.5	17.4	<9	15.9	13.9	216	25	13.5				
Acenaphthylene	µg/kg	<12	100000	0	<12	-	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12				
Acenaphthene	µg/kg	<8	100000	0	<8	-	<8	<8	<8	30.3	<8	<8	<8	37.9	<8	<8				
Fluorene	µg/kg	<10	71000	0	<10	-	<10	<10	<10	21.2	<10	<10	<10	41.5	<10	<10				
Phenanthrene	µg/kg	<15	23000	0	87.2	-	59.4	<15	76.6	267	<15	74.6	53.5	291	192	66				
Anthracene	µg/kg	<16	540000	0	<16	-	<16	<16	<16	62.5	<16	<16	<16	77.6	<16	<16				
Fluoranthene	µg/kg	<17	23000	0	96.8	-	78.9	<17	70.6	412	<17	136	62.9	367	205	32.4				
Pyrene	µg/kg	<15	54000	0	85.8	-	69.2	<15	61.7	355	<15	117	52.4	320	178	32.2				
Benz(a)anthracene	µg/kg	<14	180	**4**	37.6	-	32.3	<14	31.7	152	<14	51.3	21.7	148	<14	16.8				
Chrysene	µg/kg	<10	350	**3**	54.9	-	44.1	<10	44.7	163	<10	56.8	28.9	157	70.7	24				
Benzo(b)fluoranthene	µg/kg	<15	45	**21**	70.9	-	55.1	<15	54.5	188	<15	81.3	37.7	183	109	24.1				
Benzo(k)fluoranthene	µg/kg	<14	1200	0	18.9	-	17.2	<14	16.7	64.6	<14	24	<14	72.2	<14	<14				
Benzo(a)pyrene	µg/kg	<15	36	**15**	31.6	-	33	<15	25.9	122	<15	47.4	18.3	143	73.1	<15				
indeno(123cd)pyrene	µg/kg	<18	510	**1**	24.1	-	27	<18	<18	86.4	<18	37.3	<18	99.4	58.1	<18				
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**	<23	-	<23	<23	<23	<23	<23	<23	<23	<23	<23	<23				
Benzo(ghi)perylene	µg/kg	<24	4000	0	33.5	-	32.6	<24	30.5	83.3	<24	37.4	<24	91.5	54.2	<24				
PAH 16 Total	µg/kg	<118		0	564	-	449	<118	435	2020	<118	679	289	2240	965	209				
PCB's - (Solids)																				
PCB 28	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 52	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 101	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 118	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 138	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 153	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 180	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 81	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 77	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 123	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 114	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 105	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 126	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 167	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 156	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 157	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 169	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
PCB 189	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	-	-	-				
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	-	-	-	-	-	-	-	-	-				
Semi-Volatile Organic Compounds (SVOCs)																				
Phenol	µg/kg	<100	1100000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Pentachlorophenol	µg/kg	<100	1200	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Nitrobenzene	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Isophorone	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Hexachloroethane	µg/kg	<100	22	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Hexachlorocyclopentadiene	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Hexachlorobenzene	µg/kg	<100	48	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
n-Dioctyl phthalate	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Dimethyl Phthalate	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
n-Dibutyl phthalate	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Dibenzofuran	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Carbazole	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Bis(2-chloroethoxy) methane	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Bis(2-chloroethyl)ether	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
Azobenzene	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Nitrophenol	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Nitroaniline	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Methylphenol	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Chlorophenylphenylether	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Chloroaniline	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Chloro-3-methylphenol	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
4-Bromophenylphenylether	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
3-Nitroaniline	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2-Nitrophenol	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2-Nitroaniline	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2-Methylphenol	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2-Chlorophenol	µg/kg	<100	3500	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	-	<200	<100	-	-	-	-	<100	-	-				

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					MS-BH03	MS-BH03	MS-BH04	MS-BH04	MS-BH05	MS-BH06	MS-BH06	MS-BH07	MS-BH08	MS-BH08	MS-BH09	MS-BH09
Depth					0.10-0.10	0.30-0.30	0.10-0.10	0.80-0.80	0.10-0.10	0.10-0.10	0.50-0.50	0.20-0.30	0.10-0.30	0.50-0.70	0.10-0.10	0.50-0.50
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					25/08/2022	25/08/2022	13/09/2022	14/09/2022	06/09/2022	01/09/2022	01/09/2022	23/08/2022	09/09/2022	09/09/2022	15/09/2022	15/09/2022
Sample Received					22/06/09	22/06/09	17/09/2022	17/09/2022	13/09/2022	09/06/2022	09/06/2022	09/06/2022	17/09/2022	17/09/2022	24/09/2022	24/09/2022
Sample No					ES 1	ES 4	ES 1	ES 7	ES 1	ES 2	ES 5	ES 1	ES 2	ES 4	ES 1	ES 4
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
2-Methylnaphthalene	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Acenaphthylene	µg/kg	<100	84000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Acenaphthene	µg/kg	<100	85000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Anthracene	µg/kg	<100	530000	0	-	-	-	<200	<100	-	-	-	-	130	-	-
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	-	<200	<100	-	-	-	-	141	-	-
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Chrysene	µg/kg	<100	140	**2**	-	-	-	<200	<100	-	-	-	-	184	-	-
Fluoranthene	µg/kg	<100	23000	0	-	-	-	<200	<100	-	-	-	-	304	-	-
Fluorene	µg/kg	<100	64000	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	-	<200	<100	-	-	-	-	<100	-	-
Phenanthrene	µg/kg	<100	22000	0	-	-	-	<200	<100	-	-	-	-	215	-	-
Pyrene	µg/kg	<100	54000	0	-	-	-	<200	<100	-	-	-	-	270	-	-
Naphthalene	µg/kg	<100	200	**1**	-	-	-	<200	<100	-	-	-	-	<100	-	-
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	-	<200	<100	-	-	-	-	<100	-	-
Volatile Organic Compounds (VOCs)																
Dibromofluoromethane**	%			0	103	-	126	131	118	111	115	120	115	115	104	110
Toluene-d8**	%			0	95.4	-	102	95.4	98.2	96.7	95.5	97.6	96	98.2	97	94.8
4-Bromofluorobenzene**	%			0	92.2	-	98.7	80.5	90.5	93.4	87.3	98.1	88.5	93.7	88.6	86.8
Dichlorodifluoromethane	µg/kg	<6		0	-	-	-	<120	<60	-	-	-	-	<120	-	-
Chloromethane	µg/kg	<7	1	0	-	-	-	<140	<70	-	-	-	-	<140	-	-
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	-	<120	<60	-	-	-	-	<120	-	-
Bromomethane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Chloroethane	µg/kg	<10	960	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Trichlorofluoromethane	µg/kg	<6		0	-	-	-	<120	<60	-	-	-	-	<120	-	-
1,1-Dichloroethene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Carbon Disulphide	µg/kg	<7	12	0	-	-	-	<140	<70	-	-	-	-	<140	-	-
Dichloromethane	µg/kg	<10	270	**1**	-	-	-	991	<135	-	-	-	-	<370	-	-
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	-	<100	<200	<100	<200	<200	<200	<100	<200	<100	<100
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,1-Dichloroethane	µg/kg	<8		0	-	-	-	<160	<80	-	-	-	-	<160	-	-
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	-	<120	<60	-	-	-	-	<120	-	-
2,2-Dichloropropane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Bromochloromethane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Chloroform	µg/kg	<8		0	-	-	-	<160	<80	-	-	-	-	<160	-	-
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	-	<140	<70	-	-	-	-	<140	-	-
1,1-Dichloropropene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Carbontetrachloride	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	-	<100	<50	-	-	-	-	<100	-	-
Benzene	µg/kg	<9	28	0	<180	-	<90	<180	<90	<180	<180	<180	<90	<180	<90	<90
Trichloroethene	µg/kg	<9	12	0	-	-	-	<180	<90	-	-	-	-	<180	-	-
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Dibromomethane	µg/kg	<9		0	-	-	-	<180	<90	-	-	-	-	<180	-	-
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	-	<140	<70	-	-	-	-	<140	-	-
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Toluene	µg/kg	<7	869	0	<140	-	<70	<140	<70	<140	<140	<140	<70	<140	<70	<70
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,3-Dichloropropane	µg/kg	<7		0	-	-	-	<140	<70	-	-	-	-	<140	-	-
Tetrachloroethene	µg/kg	<5	130	0	-	-	-	<100	<50	-	-	-	-	<100	-	-
Dibromochloromethane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,2-Dibromoethane	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Chlorobenzene	µg/kg	<5	59	0	-	-	-	<100	<50	-	-	-	-	<100	-	-
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Ethylbenzene	µg/kg	<4	518	0	<80	-	<40	<80	<40	<80	<80	<80	<40	<80	<40	<40
m & p Xylene	µg/kg	<10	576	0	<200	-	<100	<200	<100	<200	<200	<200	<100	<200	<100	<100
o-Xylene	µg/kg	<10	576	0	<200	-	<100	<200	<100	<200	<200	<200	<100	<200	<100	<100
Styrene	µg/kg	<10	3300	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Bromoform	µg/kg	<10	760	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Isopropylbenzene	µg/kg	<5	1400	0	-	-	-	<100	<50	-	-	-	-	<100	-	-
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	-	<320	<160	-	-	-	-	<320	-	-
Bromobenzene	µg/kg	<10	97	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Propylbenzene	µg/kg	<10	4100	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
2-Chlorotoluene	µg/kg	<9		0	-	-	-	<180	<90	-	-	-	-	<180	-	-
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	-	<160	<80	-	-	-	-	<160	-	-
4-Chlorotoluene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
Tert-Butylbenzene	µg/kg	<14		0	-	-	-	<280	<140	-	-	-	-	<280	-	-
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	-	<180	<90	-	-	-	-	<180	-	-
Sec-Butylbenzene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
4-Isopropyltoluene	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	-	<160	<80	-	-	-	-	<160	-	-
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	-	<100	<50	-	-	-	-	<100	-	-
n-Butylbenzene	µg/kg	<11		0	-	-	-	<220	<110	-	-	-	-	<220	-	-
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	-	<280	<140	-	-	-	-	<280	-	-
Tert-amyl methyl ether	µg/kg	<10		0	-	-	-	<200	<100	-	-	-	-	<200	-	-
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	-	<400	<200	-	-	-	-	<400	-	-
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	-	<400	<200	-	-	-	-	<400	-	-
Naphthalene	µg/kg	<13	200	0	-	-	-	<260	<130	-	-	-	-	<260	-	-
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	-	<400	<200	-	-	-	-	<400	-	-
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	-	<400	<200	-	-	-	-	<400	-	-
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	-	<0.4	<0.2	-	-	-	-	<0.4	-	-
Sum of BTEX	µg/kg	<40		0	<800	-	<400	<800	<400	<800	<800	<800	<400	<800	<400	<400
Combined Pesticides / Herbicides																
Dichlorvos	µg/kg	<50	842	0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Mevinphos	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Phorate	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Diazinon	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Disulfoton	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Heptachlor	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Aldrin	µg/kg	<50	54	0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Methyl Parathion	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Malathion	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Fenitrothion	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Heptachlor Epoxide	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
parathion	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Endosulphan I	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
p,p-DDE	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Dieldrin	µg/kg	<50	90	0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Endrin	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
p,p-TDE (DDD)	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Ethion	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Endosulphan II	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
p,p-DDT	µg/kg	<50		0	-	<150	-	-	-	-	-	<150	<50	-	<50	-
p,p-Methoxychlor	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Endosulphan sulphate	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
azinphos methyl	µg/kg	<50		0	-	<50	-	-	-	-	-	<50	<50	-	<50	-
Subcontracted: Organics																
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
2,4-DB	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Acifluorfen*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Bentazone	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Bromoxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Dicamba	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Diclofop	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Dinoseb*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
DNOC*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
fluroxypyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Ioxynil	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Triclopyr	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-
Triclosan*	mg/kg	<0.01		0	-	<0.01	-	-	-	-	-	<0.01	<0.01	-	<0.01	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	MS-BH09	MS-BH10	MS-BH10	MS-BH10	MS-BH11	MS-BH11	MS-BH12	MS-BH12	MS-BH14	MS-BH15	MS-BH16	MS-BH16
Depth	1.00-1.00	0.10-0.10	0.45-0.45	0.85-0.85	0.10-0.10	0.80-0.80	0.10-0.10	0.50-0.50	0.80-0.80	0.50-0.50	0.10-0.10	0.45-0.45
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	15/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	14/09/2022	14/09/2022	23/08/2022	13/09/2022	25/08/2022	25/08/2022
Sample Received	24/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	17/09/2022	17/09/2022	09/06/2022	27/09/2022	09/06/2022	09/06/2022
Sample No	ES 7	ES 2	ES 4	ES 7	ES 2	ES 6	ES 1	ES 4	ES 9	ES 4	ES 2	ES 4
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC 6 % OGM**	**No. Above GAC**												
Carbon																
Organic Matter (OGM)	%	<0.35		0	-	5.29	-	4.98	4.34	4	4.14	5.14	6	2.95	-	6.14
Inotganics																
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	-	<0.004	-	0.0232	0.0427	<0.004	0.0535	0.186	0.0802	0.198	-	0.35
pH	pH Units	<1		0	-	8.24	-	8.19	8.11	8.27	8.29	8.13	8.05	8.07	-	8.34
Sulphate	mg/kg	<48		0	-	191	-	209	294	84.5	578	661	336	475	-	3560
Nitrite as NO2	mg/kg	<0.1		0	-	2.58	-	0.4	2.37	0.36	1.72	0.57	0.45	0.28	-	0.58
Nitrate as NO3	mg/kg	<1		0	-	8.91	-	17.9	5.28	6.87	6.87	22.6	10.2	3.29	-	8.84
Sulphide	mg/kg	<15		0	-	<15	-	<15	<15	<15	<15	<15	<15	<15	-	<15
Sulphur	mg/kg	<10		0	-	10.5	-	12	<10	<10	<10	<10	<10	<10	-	25.4
Total Cyanide	mg/kg	<1		0	-	<1	-	<1	<1	<1	<1	<1	<1	<1	-	<1
Total Sulphur (ASB)	%	<0.0016		0	-	0.00638	-	0.00696	0.00979	0.00282	0.0193	0.022	0.0112	0.0158	-	0.119
Total Cyanide	mg/kg	<1		0	-	<1	-	<1	<1	<1	<1	<1	<1	<1	-	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	-	<15	-	<15	<15	<15	<15	<15	<15	<15	-	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	-	<12	-	<12	<12	<12	<12	<12	<12	<12	-	<12
Metals - (Soilds)																
Chromium, VI	mg/kg	<0.6	33	0	-	<0.6	-	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	-	<0.6
Arsenic	mg/kg	<0.6	640	0	-	16.3	-	12.6	17.5	2.76	16.1	4.82	2.09	4.7	-	12.5
Total Boron	mg/kg	<0.7		0	-	13.5	-	12.5	13.4	2.79	22.2	9.35	3.3	5.03	-	14.2
Cadmium	mg/kg	<0.02	190	0	-	0.266	-	0.141	0.283	0.0427	0.376	0.1	0.0555	0.055	-	0.233
Chromium	mg/kg	<0.9		0	-	15.3	-	13.9	15.9	3.06	16.4	3.97	3.9	7.67	-	33
Copper	mg/kg	<1.4	68000	0	-	19.4	-	16.1	19.7	3.7	19.2	8.66	19.8	3.61	-	23.7
iron	mg/kg	<1000		0	-	25200	-	22600	24100	4330	27500	8040	4110	6830	-	22300
Lead	mg/kg	<0.7	1100	0	-	71.3	-	56.7	72.5	8.95	77.5	33.3	7.26	17.2	-	38.9
Mercury	mg/kg	<0.1	1100	0	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Nickel	mg/kg	<0.2	980	0	-	24.1	-	23	24.2	3.84	26.3	7.29	3.55	6.99	-	18.5
Selenium	mg/kg	<1	12000	0	-	<1	-	<1	1.11	<1	1.31	<1	<1	<1	-	1.79
Zinc	mg/kg	<1.9	7300000	0	-	93.8	-	79.4	92.4	10.9	104	30.3	8.2	22.8	-	104
Metals - (Liquids)																
Chromium, III	mg/kg	<0.9	8600	0	-	15.3	-	13.9	15.9	3.06	16.4	3.97	3.9	7.67	-	33
Phenols																
Phenol	mg/kg	<0.01	1100000	0	-	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01
Total cresols	mg/kg	<0.01		0	-	<0.01	-	<0.01	0.0125	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.0114
Xylenols	mg/kg	<0.015		0	-	<0.015	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	-	<0.015
Phenols	mg/kg	<0.035		0	-	<0.035	-	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	-	<0.035
Gasoline Range Organics (GRO)																
Total Aliphatic>C5-C10	µg/kg	<50		0	<50	-	<50	-	-	<50	-	-	<50	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	<50	-	<50	-	-	<50	-	-	<50	-	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	<20
EPH (Extractable Petroleum Hydrocarbons)																
EPH Surrogate % recovery**	%			0	-	92.9	-	91.6	94.4	94.8	94	87.9	97.4	97	-	107
EPH Aliphatics >C10-C40	mg/kg	<35		0	-	<35	-	38.1	<35	87.1	<35	64.1	202	74.5	-	146
TPH Criteria Working Group (TPH CWG)																
GRO Surrogate % recovery**	%			0	90.2	-	81.1	-	-	119	-	-	73.1	-	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0	<1000	-	<1000	-	-	<1000	-	-	<1000	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0	<1000	-	<1000	-	-	<1000	-	-	<1000	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0	<1000	-	<1000	-	-	2520	-	-	2560	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0	<1000	-	4260	-	-	16600	-	-	20300	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0	1230	-	<1000	-	-	5720	-	-	3740	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	<5000	-	5160	-	-	24900	-	-	26600	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	<10000	-	14600	-	-	76400	-	-	106000	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0	<10	-	<10	-	-	<10	-	-	<10	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0	<1000	-	<1000	-	-	<1000	-	-	<1000	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0	<1000	-	<1000	-	-	<1000	-	-	1360	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	<1000	-	<1000	-	-	4270	-	-	15800	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**	<1000	-	8230	-	-	31500	-	-	42000	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**	<1000	-	1130	-	-	15600	-	-	20600	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0	<1000	-	<1000	-	-	<1000	-	-	2860	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	<5000	-	9440	-	-	51600	-	-	79800	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	<10000	-	14600	-	-	76400	-	-	106000	-	-	-
EPH (C5-C40)	mg/kg	<35		0	-	<35	-	38.1	<35	87.1	<35	64.1	202	74.5	-	146
Polyaromatic Hydrocarbons (PAHs)																
Naphthalene-d8 % recovery**	%			0	-	89.5	-	86	82.8	84.1	85.6	86.4	83.6	88.5	-	82.8
Acenaphthene-d10 % recovery**	%			0	-	96.5	-	86.9	81.4	84.8	89.5	89.9	86.4	91.4	-	85.5
Phenanthrene-d10 % recovery**	%			0	-	106	-	86.9	81.3	85.4	92.4	91.7	85.6	95.9	-	85.3
Chrysene-d12 % recovery**	%			0	-	97.2	-	83	77.4	82.4	83.6	80.8	79.7	95.9	-	80.6
Perylene-d12 % recovery**	%			0	-	82	-	78.6	73	79.4	78.3	81.2	73.9	93.5	-	75.1
Naphthalene	µg/kg	<9	1100	0	-	32	-	<9	12	<9	<9	<9	<9	<9	-	51.3
Acenaphthylene	µg/kg	<12	100000	0	-	<12	-	<12	<12	<12	<12	<12	<12	<12	-	30.9
Acenaphthene	µg/kg	<8	100000	0	-	<8	-	<8	<8	<8	<8	<8	<8	<8	-	<16
Fluorene	µg/kg	<10	71000	0	-	<10	-	<10	<10	<10	<10	<10	<10	<10	-	<20
Phenanthrene	µg/kg	<15	23000	0	-	107	-	85.4	64.3	<15	43.6	<15	<15	<15	-	288
Anthracene	µg/kg	<16	540000	0	-	19	-	<16	<16	<16	<16	<16	<16	<16	-	90.4
Fluoranthene	µg/kg	<17	23000	0	-	121	-	96.3	91.2	<17	53.4	<17	<17	<17	-	893
Pyrene	µg/kg	<15	54000	0	-	112	-	83	77.9	<15	44.9	<15	<15	<15	-	812
Benz(a)anthracene	µg/kg	<14	180	**4**	-	43.3	-	46.1	42.3	<14	20.5	<14	<14	<14	-	455
Chrysene	µg/kg	<10	350	**3**	-	63.7	-	46.7	48.8	<10	30.4	<10	<10	<10	-	464
Benzo(b)fluoranthene	µg/kg	<15	45	**21**	-	58.2	-	49.5	49.5	<15	30.8	<15	<15	<15	-	617
Benzo(k)fluoranthene	µg/kg	<14	1200	0	-	21.8	-	18.5	18.7	<14	<14	<14	<14	<14	-	232
Benzo(a)pyrene	µg/kg	<15	36	**15**	-	34	-	37.5	37.6	<15	<15	<15	<15	<15	-	451
indeno(123cd)pyrene	µg/kg	<18	510	**1**	-	31.1	-	24.7	26.5	<18	<18	<18	<18	<18	-	347
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**	-	<23	-	<23	<23	<23	<23	<23	<23	<23	-	55.5
Benzo(ghi)perylene	µg/kg	<24	4000	0	-	31.5	-	30	<24	<24	<24	<24	<24	<24	-	281
PAH 16 Total	µg/kg	<118		0	-	674	-	518	469	<118	224	<118	<118	<118	-	5070
PCB's - (Solids)																
PCB 28	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 52	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 101	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 118	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 138	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 153	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 180	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	<21	-	-	-	-	-	-	-	-	-
PCB 81	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 77	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 123	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 114	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 105	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 126	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 167	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 156	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 157	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 169	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
PCB 189	µg/kg	<3		0	-	-	<3	-	-	-	-	-	-	-	-	-
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	<36	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds (SVOCs)																
Phenol	µg/kg	<100	1100000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Nitrobenzene	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Isophorone	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Hexachloroethane	µg/kg	<100	22	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<200	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Dimethyl Phthalate	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Dibenzofuran	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Carbazole	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
Azobenzene	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Nitrophenol	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Nitroaniline	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Methylphenol	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Chlorophenylphenylether	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Chloroaniline	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
4-Bromophenylphenylether	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
3-Nitroaniline	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2-Nitrophenol	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2-Nitroaniline	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2-Methylphenol	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					MS-BH09	MS-BH10	MS-BH10	MS-BH10	MS-BH11	MS-BH11	MS-BH12	MS-BH12	MS-BH14	MS-BH15	MS-BH16	MS-BH16	
Depth					1.00-1.00	0.10-0.10	0.45-0.45	0.85-0.85	0.10-0.10	0.80-0.80	0.10-0.10	0.50-0.50	0.80-0.80	0.50-0.50	0.10-0.10	0.45-0.45	
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	
Sampled Date					15/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	14/09/2022	14/09/2022	23/08/2022	13/09/2022	25/08/2022	25/08/2022	
Sample Received					24/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	17/09/2022	17/09/2022	09/06/2022	27/09/2022	09/06/2022	09/06/2022	
Sample No					ES 7	ES 2	ES 4	ES 7	ES 2	ES 6	ES 1	ES 4	ES 9	ES 4	ES 2	ES 4	
Batch Number					1	1	1	1	1	1	1	1	1	1	1	1	
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	
1,4-Dichlorobenzene	µg/kg	<100	4500	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
1,3-Dichlorobenzene	µg/kg	<100	32	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
1,2-Dichlorobenzene	µg/kg	<100	2100	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
2-Chloronaphthalene	µg/kg	<100	390	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
2-Methylnaphthalene	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Acenaphthylene	µg/kg	<100	84000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Acenaphthene	µg/kg	<100	85000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Anthracene	µg/kg	<100	530000	0	<100	-	132	-	-	<100	-	-	<100	-	-	-	
Benzo(a)anthracene	µg/kg	<100	90	**2**	<100	-	167	-	-	<100	-	-	<100	-	-	-	
Benzo(b)fluoranthene	µg/kg	<100	100	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Benzo(k)fluoranthene	µg/kg	<100	140	0	<100	-	123	-	-	<100	-	-	<100	-	-	-	
Benzo(a)pyrene	µg/kg	<100	14	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Benzo(ghi)perylene	µg/kg	<100	650	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Chrysene	µg/kg	<100	140	**2**	<100	-	397	-	-	<100	-	-	<100	-	-	-	
Fluoranthene	µg/kg	<100	23000	0	<100	-	641	-	-	<100	-	-	<100	-	-	-	
Fluorene	µg/kg	<100	64000	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
indeno(123cd)pyrene	µg/kg	<100	60	**1**	<100	-	117	-	-	<100	-	-	<100	-	-	-	
Phenanthrene	µg/kg	<100	22000	0	<100	-	845	-	-	<100	-	-	<100	-	-	-	
Pyrene	µg/kg	<100	54000	0	<100	-	706	-	-	<100	-	-	<100	-	-	-	
Naphthalene	µg/kg	<100	200	**1**	<100	-	254	-	-	<100	-	-	<100	-	-	-	
dibenzo(ah)anthracene	µg/kg	<100	13	0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	<100	-	<100	-	-	<100	-	-	<100	-	-	-	
Volatile Organic Compounds (VOCs)																	
Dibromofluoromethane**	%			0	110	111	104	111	106	113	128	124	104	110	-	109	
Toluene-d8**	%			0	98.8	98	96.3	97.6	97.6	95.6	102	102	94.8	101	-	95.2	
4-Bromofluorobenzene**	%			0	95	87	96.5	91.7	90	83.7	95.6	95.6	86.9	87.3	-	84.2	
Dichlorodifluoromethane	µg/kg	<6		0	<6	-	<120	-	-	<60	-	-	<120	-	-	-	
Chloromethane	µg/kg	<7	1	0	<7	-	<140	-	-	<70	-	-	<140	-	-	-	
Vinyl Chloride	µg/kg	<6	0.063	0	<6	-	<120	-	-	<60	-	-	<120	-	-	-	
Bromomethane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Chloroethane	µg/kg	<10	960	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Trichlorofluoromethane	µg/kg	<6		0	<6	-	<120	-	-	<60	-	-	<120	-	-	-	
1,1-Dichloroethene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Carbon Disulphide	µg/kg	<7	12	0	<7	-	<140	-	-	<70	-	-	<140	-	-	-	
Dichloromethane	µg/kg	<10	270	**1**	<16	-	<200	-	-	<100	-	-	<345	-	-	-	
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<10	<100	<200	<100	<100	<100	<100	<200	<200	<100	-	<100	
trans-1,2-Dichloroethene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,1-Dichloroethane	µg/kg	<8		0	<8	-	<160	-	-	<80	-	-	<160	-	-	-	
cis-1,2-Dichloroethene	µg/kg	<6		0	<6	-	<120	-	-	<60	-	-	<120	-	-	-	
2,2-Dichloropropane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Bromochloromethane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Chloroform	µg/kg	<8		0	<8	-	<160	-	-	<80	-	-	<160	-	-	-	
1,1,1-Trichloroethane	µg/kg	<7	700	0	<7	-	<140	-	-	<70	-	-	<140	-	-	-	
1,1-Dichloropropene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Carbontetrachloride	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,2-Dichloroethane	µg/kg	<5	0.71	0	<5	-	<100	-	-	<50	-	-	<100	-	-	-	
Benzene	µg/kg	<9	28	0	<9	<90	<180	<90	<90	<90	<90	<180	<180	<90	-	<90	
Trichloroethene	µg/kg	<9	12	0	<9	-	<180	-	-	<90	-	-	<180	-	-	-	
1,2-Dichloropropane	µg/kg	<10	3.3	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Dibromomethane	µg/kg	<9		0	<9	-	<180	-	-	<90	-	-	<180	-	-	-	
Bromodichloromethane	µg/kg	<7	2.1	0	<7	-	<140	-	-	<70	-	-	<140	-	-	-	
cis-1,3-Dichloropropene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Toluene	µg/kg	<7	869	0	<7	<70	<140	<70	<70	<70	<70	<140	<140	<70	-	<70	
trans-1,3-Dichloropropene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,1,2-Trichloroethane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,3-Dichloropropane	µg/kg	<7		0	<7	-	<140	-	-	<70	-	-	<140	-	-	-	
Tetrachloroethene	µg/kg	<5	130	0	<5	-	<100	-	-	<50	-	-	<100	-	-	-	
Dibromochloromethane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,2-Dibromoethane	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Chlorobenzene	µg/kg	<5	59	0	<5	-	<100	-	-	<50	-	-	<100	-	-	-	
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Ethylbenzene	µg/kg	<4	518	0	<4	<40	<80	<40	<40	<40	<40	<80	<80	<40	-	<40	
m & p Xylene	µg/kg	<10	576	0	<10	<100	<200	<100	<100	<100	<100	<200	<200	<100	-	<100	
o-Xylene	µg/kg	<10	576	0	<10	<100	<200	<100	<100	<100	<100	<200	<200	<100	-	<100	
Styrene	µg/kg	<10	3300	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Bromoform	µg/kg	<10	760	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Isopropylbenzene	µg/kg	<5	1400	0	<5	-	<100	-	-	<50	-	-	<100	-	-	-	
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,2,3-Trichloropropane	µg/kg	<16		0	<16	-	<320	-	-	<160	-	-	<320	-	-	-	
Bromobenzene	µg/kg	<10	97	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Propylbenzene	µg/kg	<10	4100	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
2-Chlorotoluene	µg/kg	<9		0	<9	-	<180	-	-	<90	-	-	<180	-	-	-	
1,3,5-Trimethylbenzene	µg/kg	<8		0	<8	-	<160	-	-	<80	-	-	<160	-	-	-	
4-Chlorotoluene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
Tert-Butylbenzene	µg/kg	<14		0	<14	-	<280	-	-	<140	-	-	<280	-	-	-	
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	<9	-	<180	-	-	<90	-	-	<180	-	-	-	
Sec-Butylbenzene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
4-Isopropyltoluene	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,3-Dichlorobenzene	µg/kg	<8	32	0	<8	-	<160	-	-	<80	-	-	<160	-	-	-	
1,4-Dichlorobenzene	µg/kg	<5	4500	0	<5	-	<100	-	-	<50	-	-	<100	-	-	-	
n-Butylbenzene	µg/kg	<11		0	<11	-	<220	-	-	<110	-	-	<220	-	-	-	
1,2-Dichlorobenzene	µg/kg	<10	2100	0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	<14	-	<280	-	-	<140	-	-	<280	-	-	-	
Tert-amyl methyl ether	µg/kg	<10		0	<10	-	<200	-	-	<100	-	-	<200	-	-	-	
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	<20	-	<400	-	-	<200	-	-	<400	-	-	-	
Hexachlorobutadiene	µg/kg	<20	32	0	<20	-	<400	-	-	<200	-	-	<400	-	-	-	
Naphthalene	µg/kg	<13	200	0	<13	-	<260	-	-	<130	-	-	<260	-	-	-	
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	<20	-	<400	-	-	<200	-	-	<400	-	-	-	
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	<20	-	<400	-	-	<200	-	-	<400	-	-	-	
Sum of Detected Xylenes	mg/kg	<0.02		0	<0.02	-	<0.4	-	-	<0.2	-	-	<0.4	-	-	-	
Sum of BTEX	µg/kg	<40		0	<40	<400	<800	<400	<400	<400	<400	<800	<800	<400	-	<400	
Combined Pesticides / Herbicides																	
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	-	-	-	-	-	<50	-	
Mevinphos	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Phorate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Diazinon	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Disulfoton	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Heptachlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	-	-	-	-	-	<50	-	
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Malathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
parathion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	-	-	-	-	-	<50	-	
Endrin	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Ethion	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<150	-	
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	-	-	-	-	-	<50	-	
Subcontracted: Organics																	
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	-	-	-	-	-	<0.01	-	

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID	MS-BH17	MS-BH19	MS-BH19	MS-BH20	MS-BH21	MS-BH21	MS-BH13	MS-BH18	MS-BH23	MS-BH23	MS-BH24
Depth	0.50-0.50	0.10-0.10	0.50-0.50	0.10-0.10	0.10-0.10	0.50-0.50	0.40-0.40	0.40-0.40	0.10-0.10	0.40-0.40	0.40-0.40
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	15/09/2022	09/12/2022	09/12/2022	09/08/2022	31/08/2022	31/08/2022	10/04/2022	10/06/2022	30/09/2022	30/09/2022	10/10/2022
Sample Received	27/09/2022	17/09/2022	17/09/2022	13/09/2022	09/06/2022	09/06/2022	18/10/2022	18/10/2022	13/10/2022	13/10/2022	13/10/2022
Sample No	ES 4	ES 1	ES 4	ES 1	ES 1	ES 4	ES 4	ES 4	ES 2	ES 4	ES 4
Batch Number	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**Selected GAC 6 % OGM**	**No. Above GAC**											
Carbon															
Organic Matter (OGM)	%	<0.35		0	4.83	3.47	19.5	3.34	4.33	-	7.38	4.6	-	4.03	4.67
Inotganics															
Sulphate as SO4 (2:1 Ext)	g/l	<0.004		0	0.276	0.0609	0.0554	0.0415	0.0089	-	0.234	0.0917	-	0.0051	0.0218
pH	pH Units	<1		0	9.22	8.17	8.02	7.94	8.24	-	8.3	8.01	-	8.15	8.14
Sulphate	mg/kg	<48		0	4120	403	563	321	386	-	1970	575	-	330	283
Nitrite as NO2	mg/kg	<0.1		0	0.39	0.39	1.03	0.58	1.99	-	0.38	1.68	-	0.38	0.94
Nitrate as NO3	mg/kg	<1		0	15.4	2.83	10.2	4.95	5.72	-	13.5	19.4	-	3.3	6.78
Sulphide	mg/kg	<15		0	72	<15	<15	<15	<15	-	22.4	<15	-	<15	<15
Sulphur	mg/kg	<10		0	67	<10	<10	<10	<10	-	119	15.8	-	<10	<10
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	-	<1	<1	-	<1	<1
Total Sulphur (ASB)	%	<0.0016		0	0.137	0.0134	0.0188	0.0107	0.0129	-	0.0656	0.0192	-	0.011	0.00945
Total Cyanide	mg/kg	<1		0	<1	<1	<1	<1	<1	-	<1	<1	-	<1	<1
Ammoniacal Nitrogen as NH4	mg/kg	<15		0	<15	<15	<15	<15	<15	-	<15	<15	-	<15	<15
Ammoniacal Nitrogen as N	mg/kg	<12		0	<12	<12	<12	<12	<12	-	<12	<12	-	<12	<12
Metals - (Soilds)															
Chromium, VI	mg/kg	<0.6	33	0	<0.6	<0.6	<0.6	<0.6	<0.6	-	<0.6	<0.6	-	<0.6	<0.6
Arsenic	mg/kg	<0.6	640	0	12.9	13.6	4.5	13	16.4	-	22.7	13.7	-	15.4	15.9
Total Boron	mg/kg	<0.7		0	19.1	13.7	7.86	10.3	15.9	-	12.3	12.8	-	12.5	10.7
Cadmium	mg/kg	<0.02	190	0	0.391	0.278	0.0911	0.221	0.248	-	0.558	0.229	-	0.293	0.28
Chromium	mg/kg	<0.9		0	36	12.5	6.56	11.7	18.4	-	39.2	12.8	-	16.3	13.6
Copper	mg/kg	<1.4	68000	0	29	14.9	5.44	15.5	18.7	-	57.4	16.4	-	19.3	21.6
iron	mg/kg	<1000		0	19600	19700	9080	20000	29300	-	36500	24400	-	26400	22500
Lead	mg/kg	<0.7	1100	0	36.2	48.3	20.9	52.4	86.2	-	69.1	72.9	-	71.9	65.2
Mercury	mg/kg	<0.1	1100	0	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	<0.1
Nickel	mg/kg	<0.2	980	0	15.4	18.7	8.92	19.2	28.9	-	24.3	22	-	23.1	20.6
Selenium	mg/kg	<1	12000	0	1.99	1.01	<1	<1	1.02	-	1.66	<1	-	<1	1.16
Zinc	mg/kg	<1.9	7300000	0	93.4	67.9	26.1	73.1	111	-	323	90.5	-	92.6	81.9
Metals - (Liquids)															
Chromium, III	mg/kg	<0.9	8600	0	36	12.5	6.56	11.7	18.4	-	39.2	12.8	-	16.3	13.6
Phenols															
Phenol	mg/kg	<0.01	1100000	0	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.01
Total cresols	mg/kg	<0.01		0	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.0113	<0.01	-	0.0116	<0.01
Xylenols	mg/kg	<0.015		0	<0.015	<0.015	<0.015	<0.015	<0.015	-	<0.015	<0.015	-	0.0348	0.0575
Phenols	mg/kg	<0.035		0	<0.035	<0.035	<0.035	<0.035	<0.035	-	<0.035	<0.035	-	0.0464	0.0575
Gasoline Range Organics (GRO)															
Total Aliphatic>C5-C10	µg/kg	<50		0	-	-	<50	-	-	-	-	-	-	-	-
Total Aromatic>EC5-EC10	µg/kg	<50		0	-	-	<50	-	-	-	-	-	-	-	-
GRO >C5-C10	µg/kg	<20		0	<20	<20	<20	<20	<20	-	<20	<20	-	<20	<20
EPH (Extractable Petroleum Hydrocarbons)															
EPH Surrogate % recovery**	%			0	97.5	112	83.2	98.5	101	-	94	103	-	101	105
EPH Aliphatics >C10-C40	mg/kg	<35		0	248	53	208	45.4	<35	-	132	57.8	-	<35	51.3
TPH Criteria Working Group (TPH CWG)															
GRO Surrogate % recovery**	%			0	-	-	87.1	-	-	-	-	-	-	-	-
Aliphatics >C5-C6	µg/kg	<10	12000	0	-	-	11.2	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	µg/kg	<10	40000	0	-	-	12.8	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	µg/kg	<10	11000	0	-	-	12.8	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	µg/kg	<1000	47000	0	-	-	<1000	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	µg/kg	<1000	90000	0	-	-	<1000	-	-	-	-	-	-	-	-
Aliphatics >C16-C21	µg/kg	<1000	1800000	0	-	-	2890	-	-	-	-	-	-	-	-
Aliphatics >C21-C35	µg/kg	<1000	1800000	0	-	-	21200	-	-	-	-	-	-	-	-
Aliphatics >C35-C44	µg/kg	<1000	1800000	0	-	-	7580	-	-	-	-	-	-	-	-
Total Aliphatic>C10-C44	µg/kg	<5000		0	-	-	31700	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics>C10-C44	µg/kg	<10000		0	-	-	132000	-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	µg/kg	<10	86000	0	-	-	<10	-	-	-	-	-	-	-	-
Aromatics >EC7-EC8	µg/kg	<10	180000	0	-	-	<10	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	µg/kg	<10	17000	0	-	-	<10	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	µg/kg	<1000	36000	0	-	-	<1000	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	µg/kg	<1000	38000	0	-	-	<1000	-	-	-	-	-	-	-	-
Aromatics >EC16-EC21	µg/kg	<1000	28000	0	-	-	11000	-	-	-	-	-	-	-	-
Aromatics >EC21-EC35	µg/kg	<1000	28000	**4**	-	-	58800	-	-	-	-	-	-	-	-
Aromatics >EC35-EC44	µg/kg	<1000	28000	**2**	-	-	28900	-	-	-	-	-	-	-	-
Aromatics > EC40-EC44	µg/kg	<1000		0	-	-	2550	-	-	-	-	-	-	-	-
Total Aromatics>EC10-EC44	µg/kg	<5000		0	-	-	100000	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	µg/kg	<10000		0	-	-	132000	-	-	-	-	-	-	-	-
EPH (C5-C40)	mg/kg	<35		0	248	53	208	45.4	<35	-	132	57.8	-	<35	51.3
Polyaromatic Hydrocarbons (PAHs)															
Naphthalene-d8 % recovery**	%			0	84.3	88.8	86.5	87.9	92.2	-	87.6	87.7	-	86	85.8
Acenaphthene-d10 % recovery**	%			0	94.7	86.9	88.2	91.2	95.2	-	94.4	93.2	-	88.6	91.4
Phenanthrene-d10 % recovery**	%			0	93.2	82.8	89.9	94.6	102	-	100	94.6	-	90.8	96.1
Chrysene-d12 % recovery**	%			0	91.8	74	77.3	93	97.8	-	90	84.1	-	85.2	89.6
Perylene-d12 % recovery**	%			0	71.4	74.5	74	87.4	95.4	-	95.6	81.4	-	82.4	79.4
Naphthalene	µg/kg	<9	1100	0	158	17	<9	30.5	23.6	-	107	12	-	28.6	57.9
Acenaphthylene	µg/kg	<12	100000	0	<120	<12	<12	<12	18.2	-	69	<12	-	<12	<12
Acenaphthene	µg/kg	<8	100000	0	<80	<8	<8	<8	<8	-	68.6	<8	-	<8	12.9
Fluorene	µg/kg	<10	71000	0	<100	<10	<10	<10	<10	-	75.9	<10	-	<10	11.5
Phenanthrene	µg/kg	<15	23000	0	924	52.8	<15	82.2	164	-	1240	107	-	73.6	202
Anthracene	µg/kg	<16	540000	0	442	<16	<16	<16	23.5	-	332	<16	-	<16	41.1
Fluoranthene	µg/kg	<17	23000	0	2330	76.6	<17	95.8	422	-	2790	244	-	89	295
Pyrene	µg/kg	<15	54000	0	2340	67.6	<15	85.8	370	-	2180	215	-	79.7	270
Benz(a)anthracene	µg/kg	<14	180	**4**	852	35.6	<14	48.7	181	-	1240	119	-	38.5	121
Chrysene	µg/kg	<10	350	**3**	829	47.4	<10	56.1	170	-	1140	137	-	53.9	147
Benzo(b)fluoranthene	µg/kg	<15	45	**21**	724	66.6	<15	80.3	250	-	1780	229	-	67.1	157
Benzo(k)fluoranthene	µg/kg	<14	1200	0	383	21.8	<14	21.5	85.8	-	706	76.9	-	17.2	48.9
Benzo(a)pyrene	µg/kg	<15	36	**15**	610	38.2	<15	40.5	162	-	1290	143	-	34.5	102
indeno(123cd)pyrene	µg/kg	<18	510	**1**	489	38.5	<18	27.1	120	-	834	112	-	33.8	83.4
dibenzo(ah)anthracene	µg/kg	<23	3.6	**2**	<230	<23	<23	<23	<23	-	205	<23	-	<23	<23
Benzo(ghi)perylene	µg/kg	<24	4000	0	377	41.7	<24	39.3	117	-	831	125	-	35.1	74.3
PAH 16 Total	µg/kg	<118		0	10500	504	<118	608	2110	-	14900	1520	-	551	1620
PCB's - (Solids)															
PCB 28	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 52	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 101	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 118	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 138	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 153	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 180	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
Sum of detected PCB 7 Congeners	µg/kg	<21		0	-	-	-	-	-	-	-	-	-	<21	<21
PCB 81	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 77	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 123	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 114	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 105	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 126	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 167	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 156	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 157	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 169	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
PCB 189	µg/kg	<3		0	-	-	-	-	-	-	-	-	-	<3	<3
Sum of detected WHO 12 PCBs	µg/kg	<36		0	-	-	-	-	-	-	-	-	-	<36	<36
Semi-Volatile Organic Compounds (SVOCs)															
Phenol	µg/kg	<100	1100000	0	-	-	<100	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/kg	<100	1200	0	-	-	<100	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Nitrobenzene	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Isophorone	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Hexachloroethane	µg/kg	<100	22	0	-	-	<100	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	<100	32	0	-	-	<100	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/kg	<100	48	0	-	-	<100	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Dimethyl Phthalate	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Diethyl Phthalate	µg/kg	<100	150000	0	-	-	<100	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Dibenzofuran	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Carbazole	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	<100	940000	0	-	-	<100	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
Azobenzene	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Methylphenol	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
2-Methylphenol	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	<100	230	0	-	-	<100	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/kg	<100	3500	0	-	-	<100	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/kg	<100	1900	0	-	-	<100	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/kg	<100	3700	0	-	-	<100	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/kg	<100	16000	0	-	-	<100	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/kg	<100	3500	0	-	-	<100	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/kg	<100	3500	0	-	-	<100	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/kg	<100	3500	0	-	-	<100	-	-	-	-	-	-	-	-

	Exceeds GAC
	Exceeds LOD

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground
Selected Screening Value (GAC) and Land Use	S4UL - Commercial

Sample ID					MS-BH17	MS-BH19	MS-BH19	MS-BH20	MS-BH21	MS-BH21	MS-BH13	MS-BH18	MS-BH23	MS-BH23	MS-BH24		
Depth					0.50-0.50	0.10-0.10	0.50-0.50	0.10-0.10	0.10-0.10	0.50-0.50	0.40-0.40	0.40-0.40	0.10-0.10	0.40-0.40	0.40-0.40		
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID		
Sampled Date					15/09/2022	09/12/2022	09/12/2022	09/08/2022	31/08/2022	31/08/2022	10/04/2022	10/06/2022	30/09/2022	30/09/2022	10/10/2022		
Sample Received					27/09/2022	17/09/2022	17/09/2022	13/09/2022	09/06/2022	09/06/2022	18/10/2022	18/10/2022	13/10/2022	13/10/2022	13/10/2022		
Sample No					ES 4	ES 1	ES 4	ES 1	ES 1	ES 4	ES 4	ES 4	ES 2	ES 4	ES 4		
Batch Number					1	1	1	1	1	1	1	1	1	1	1		
Strata / Zone					Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground		
1,4-Dichlorobenzene	µg/kg	<100	4500	0	-	-	<100	-	-	-	-	-	-	-	-		
1,3-Dichlorobenzene	µg/kg	<100	32	0	-	-	<100	-	-	-	-	-	-	-	-		
1,2-Dichlorobenzene	µg/kg	<100	2100	0	-	-	<100	-	-	-	-	-	-	-	-		
2-Chloronaphthalene	µg/kg	<100	390	0	-	-	<100	-	-	-	-	-	-	-	-		
2-Methylnaphthalene	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-		
Acenaphthylene	µg/kg	<100	84000	0	-	-	<100	-	-	-	-	-	-	-	-		
Acenaphthene	µg/kg	<100	85000	0	-	-	<100	-	-	-	-	-	-	-	-		
Anthracene	µg/kg	<100	530000	0	-	-	<100	-	-	-	-	-	-	-	-		
Benzo(a)anthracene	µg/kg	<100	90	**2**	-	-	<100	-	-	-	-	-	-	-	-		
Benzo(b)fluoranthene	µg/kg	<100	100	0	-	-	<100	-	-	-	-	-	-	-	-		
Benzo(k)fluoranthene	µg/kg	<100	140	0	-	-	<100	-	-	-	-	-	-	-	-		
Benzo(a)pyrene	µg/kg	<100	14	0	-	-	<100	-	-	-	-	-	-	-	-		
Benzo(ghi)perylene	µg/kg	<100	650	0	-	-	<100	-	-	-	-	-	-	-	-		
Chrysene	µg/kg	<100	140	**2**	-	-	<100	-	-	-	-	-	-	-	-		
Fluoranthene	µg/kg	<100	23000	0	-	-	<100	-	-	-	-	-	-	-	-		
Fluorene	µg/kg	<100	64000	0	-	-	<100	-	-	-	-	-	-	-	-		
indeno(123cd)pyrene	µg/kg	<100	60	**1**	-	-	<100	-	-	-	-	-	-	-	-		
Phenanthrene	µg/kg	<100	22000	0	-	-	<100	-	-	-	-	-	-	-	-		
Pyrene	µg/kg	<100	54000	0	-	-	<100	-	-	-	-	-	-	-	-		
Naphthalene	µg/kg	<100	200	**1**	-	-	<100	-	-	-	-	-	-	-	-		
dibenzo(ah)anthracene	µg/kg	<100	13	0	-	-	<100	-	-	-	-	-	-	-	-		
Bis(2-chloroisopropyl) ether	µg/kg	<100		0	-	-	<100	-	-	-	-	-	-	-	-		
Volatile Organic Compounds (VOCs)																	
Dibromofluoromethane**	%			0	103	114	117	115	113	-	107	112	-	108	120		
Toluene-d8**	%			0	96.6	97.8	96.4	96.8	98.9	-	103	101	-	103	98.3		
4-Bromofluorobenzene**	%			0	95.3	97.1	90.5	91.2	96.3	-	88.3	89.3	-	100	83.5		
Dichlorodifluoromethane	µg/kg	<6		0	-	-	<120	-	-	-	-	-	-	-	-		
Chloromethane	µg/kg	<7	1	0	-	-	<140	-	-	-	-	-	-	-	-		
Vinyl Chloride	µg/kg	<6	0.063	0	-	-	<120	-	-	-	-	-	-	-	-		
Bromomethane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Chloroethane	µg/kg	<10	960	0	-	-	<200	-	-	-	-	-	-	-	-		
Trichlorofluoromethane	µg/kg	<6		0	-	-	<120	-	-	-	-	-	-	-	-		
1,1-Dichloroethene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Carbon Disulphide	µg/kg	<7	12	0	-	-	<140	-	-	-	-	-	-	-	-		
Dichloromethane	µg/kg	<10	270	**1**	-	-	<480	-	-	-	-	-	-	-	-		
Methyl Tertiary Butyl Ether	µg/kg	<10	7900	0	<200	<200	<200	<100	<200	-	<100	<200	-	<200	<200		
trans-1,2-Dichloroethene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,1-Dichloroethane	µg/kg	<8		0	-	-	<160	-	-	-	-	-	-	-	-		
cis-1,2-Dichloroethene	µg/kg	<6		0	-	-	<120	-	-	-	-	-	-	-	-		
2,2-Dichloropropane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Bromochloromethane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Chloroform	µg/kg	<8		0	-	-	<160	-	-	-	-	-	-	-	-		
1,1,1-Trichloroethane	µg/kg	<7	700	0	-	-	<140	-	-	-	-	-	-	-	-		
1,1-Dichloropropene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Carbontetrachloride	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,2-Dichloroethane	µg/kg	<5	0.71	0	-	-	<100	-	-	-	-	-	-	-	-		
Benzene	µg/kg	<9	28	0	<180	<180	<180	<90	<180	-	<90	<180	-	<180	<180		
Trichloroethene	µg/kg	<9	12	0	-	-	<180	-	-	-	-	-	-	-	-		
1,2-Dichloropropane	µg/kg	<10	3.3	0	-	-	<200	-	-	-	-	-	-	-	-		
Dibromomethane	µg/kg	<9		0	-	-	<180	-	-	-	-	-	-	-	-		
Bromodichloromethane	µg/kg	<7	2.1	0	-	-	<140	-	-	-	-	-	-	-	-		
cis-1,3-Dichloropropene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Toluene	µg/kg	<7	869	0	<140	<140	<140	<70	<140	-	<70	<140	-	<140	<140		
trans-1,3-Dichloropropene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,1,2-Trichloroethane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,3-Dichloropropane	µg/kg	<7		0	-	-	<140	-	-	-	-	-	-	-	-		
Tetrachloroethene	µg/kg	<5	130	0	-	-	<100	-	-	-	-	-	-	-	-		
Dibromochloromethane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,2-Dibromoethane	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Chlorobenzene	µg/kg	<5	59	0	-	-	<100	-	-	-	-	-	-	-	-		
1,1,1,2-Tetrachloroethane	µg/kg	<10	4.8	0	-	-	<200	-	-	-	-	-	-	-	-		
Ethylbenzene	µg/kg	<4	518	0	<80	<80	<80	<40	<80	-	<40	<80	-	<80	<80		
m & p Xylene	µg/kg	<10	576	0	<200	<200	<200	<100	<200	-	<100	<200	-	<200	<200		
o-Xylene	µg/kg	<10	576	0	<200	<200	<200	<100	<200	-	<100	<200	-	<200	<200		
Styrene	µg/kg	<10	3300	0	-	-	<200	-	-	-	-	-	-	-	-		
Bromoform	µg/kg	<10	760	0	-	-	<200	-	-	-	-	-	-	-	-		
Isopropylbenzene	µg/kg	<5	1400	0	-	-	<100	-	-	-	-	-	-	-	-		
1,1,2,2-Tetrachloroethane	µg/kg	<10	290	0	-	-	<200	-	-	-	-	-	-	-	-		
1,2,3-Trichloropropane	µg/kg	<16		0	-	-	<320	-	-	-	-	-	-	-	-		
Bromobenzene	µg/kg	<10	97	0	-	-	<200	-	-	-	-	-	-	-	-		
Propylbenzene	µg/kg	<10	4100	0	-	-	<200	-	-	-	-	-	-	-	-		
2-Chlorotoluene	µg/kg	<9		0	-	-	<180	-	-	-	-	-	-	-	-		
1,3,5-Trimethylbenzene	µg/kg	<8		0	-	-	<160	-	-	-	-	-	-	-	-		
4-Chlorotoluene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
Tert-Butylbenzene	µg/kg	<14		0	-	-	<280	-	-	-	-	-	-	-	-		
1,2,4-Trimethylbenzene	µg/kg	<9	42	0	-	-	<180	-	-	-	-	-	-	-	-		
Sec-Butylbenzene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
4-Isopropyltoluene	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,3-Dichlorobenzene	µg/kg	<8	32	0	-	-	<160	-	-	-	-	-	-	-	-		
1,4-Dichlorobenzene	µg/kg	<5	4500	0	-	-	<100	-	-	-	-	-	-	-	-		
n-Butylbenzene	µg/kg	<11		0	-	-	<220	-	-	-	-	-	-	-	-		
1,2-Dichlorobenzene	µg/kg	<10	2100	0	-	-	<200	-	-	-	-	-	-	-	-		
1,2-Dibromo-3-Chloropropane	µg/kg	<14		0	-	-	<280	-	-	-	-	-	-	-	-		
Tert-amyl methyl ether	µg/kg	<10		0	-	-	<200	-	-	-	-	-	-	-	-		
1,2,4-Trichlorobenzene	µg/kg	<20	230	0	-	-	<400	-	-	-	-	-	-	-	-		
Hexachlorobutadiene	µg/kg	<20	32	0	-	-	<400	-	-	-	-	-	-	-	-		
Naphthalene	µg/kg	<13	200	0	-	-	<260	-	-	-	-	-	-	-	-		
1,2,3-Trichlorobenzene	µg/kg	<20	110	0	-	-	<400	-	-	-	-	-	-	-	-		
1,3,5-Trichlorobenzene	µg/kg	<20	24	0	-	-	<400	-	-	-	-	-	-	-	-		
Sum of Detected Xylenes	mg/kg	<0.02		0	-	-	<0.4	-	-	-	-	-	-	-	-		
Sum of BTEX	µg/kg	<40		0	<800	<800	<800	<400	<800	-	<400	<800	-	<800	<800		
Combined Pesticides / Herbicides																	
Dichlorvos	µg/kg	<50	842	0	-	-	-	-	-	<50	<50	-	<50	-	-		
Mevinphos	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Phorate	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
alpha-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Diazinon	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
gamma-Hexachlorocyclohexane (HCH / Lindane)	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Disulfoton	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Heptachlor	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Aldrin	µg/kg	<50	54	0	-	-	-	-	-	<50	<50	-	<50	-	-		
beta-Hexachlorocyclohexane (HCH)	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Methyl Parathion	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Malathion	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Fenitrothion	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Heptachlor Epoxide	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
parathion	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Endosulphan I	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
p,p-DDE	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Dieldrin	µg/kg	<50	90	0	-	-	-	-	-	<50	<50	-	<50	-	-		
Endrin	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
p,p-TDE (DDD)	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Ethion	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Endosulphan II	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
p,p-DDT	µg/kg	<50		0	-	-	-	-	-	<150	<50	-	<50	-	-		
p,p-Methoxychlor	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Endosulphan sulphate	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
azinphos methyl	µg/kg	<50		0	-	-	-	-	-	<50	<50	-	<50	-	-		
Subcontracted: Organics																	
2,4,5-Trichlorophenol	mg/kg	<0.01	3500	0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
2,4,5-TP (Fenoprop)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
2,4-DB	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
2,4-Dichloroprop (2,4 DP)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
4-Chlorophenoxyacetic acid (4-CPA)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Acifluorfen*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Bentazone	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Bromoxynil	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Dicamba	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Diclofop	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Dinoseb*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
DNOC*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
fluroxypyr	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Ioxynil	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
2-methyl-4-Chlorophenoxyacetic acid (MCPA)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
4-(4-Chloro-o-tolyloxy) butyric acid (MCPB)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Mecoprop (MCPP)*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Propoxycarbazone-sodium*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Triclopyr	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		
Triclosan*	mg/kg	<0.01		0	-	-	-	-	-	<0.01	<0.01	-	<0.01	-	-		

		Sample ID	BH102	BH102	BH105	DS101	DS105	DS108	DS111	DS111	MS-BH05	MS-BH05	MS-BH06	MS-BH08	MS-BH09
		Depth	1.00-1.00	9.80-9.80	5.80-5.80	1.20-1.20	3.50-4.00	1.50-2.00	1.50-2.00	1.50-2.00	0.50-0.50	1.00-1.00	0.50-0.50	0.50-0.70	1.20-1.20
		Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Client Name	SSE	Sampled Date	27/09/2022	28/09/2022	05/10/2022	29/09/2022	28/09/2022	29/09/2022	29/09/2022	29/09/2022	06/09/2022	06/09/2022	01/09/2022	09/09/2022	15/09/2022
Site Name	Keadby	Sample Received	30/09/2022	30/09/2022	13/10/2022	13/10/2022	06/10/2022	13/10/2022	13/10/2022	13/10/2022	13/09/2022	13/09/2022	06/09/2022	17/09/2022	24/09/2022
Job Number	F212561	Sample No	ES 6	ES 28	ES 18	ES 8	ES 11	ES 10	ES 9	ES 9	ES 4	ES 7	ES 5	ES 4	ES 9
Date	12/01/2023	Batch Number	1	1	1	1	1	1	1	1	1	1	1	1	1
Description of Data Assessment / Zoning	Made Ground														
		Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	Units	LOD													
CEN 2:1 - Carbon, Organic (diss.filt)	mg/kg	<3	6.7	<6	<6	<6	<6	<6	7.86	<6	23.8	28.8	-	15.5	57
CEN 2:1 - Carbon, Organic (diss.filt)	mg/l	<3	3.35	<3	<3	<3	<3	<3	3.93	<3	11.9	14.4	-	7.75	28.5
CEN 2:1 - pH	pH Units		8.15	8.42	8.47	8.47	8.17	8.4	8.5	8.69	8.15	7.87	-	8.42	7.87
CEN 2:1 - Temperature	°C		20.8	18.3	16.1	17.1	20.8	17.9	15.1	10.7	18.6	18.9	-	18.1	14.2
CEN 2:1 - Conductivity @ 20 deg.C	µS/cm		100	266	422	88.4	112	195	199	98.3	125	63.2	-	448	81
CEN 2:1 - Nitrite as NO2	mg/kg	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1
CEN 2:1 - Nitrite as NO2	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05
CEN 2:1 - pH (diss.filt)	pH Units	<1	8.03	8.3	8.47	8.26	8.31	8.23	8.48	8.51	8	7.54	-	8.33	7.58
CEN 2:1 - Sulphate	mg/kg	<2	35.6	91.8	200	27	51.2	53	40.4	33.6	<4	<4	-	540	5
CEN 2:1 - Sulphate	mg/l	<2	17.8	45.9	99.8	13.5	25.6	26.5	20.2	16.8	<2	<2	-	270	2.5
CEN 2:1 - Ammoniacal Nitrogen as N (low level)	mg/kg	<0.01	0.0288	0.0318	0.0426	0.0236	1.42	0.0442	0.0588	0.0284	0.106	0.056	-	0.101	0.224
CEN 2:1 - Ammoniacal Nitrogen as N (low level)	mg/l	<0.01	0.0144	0.0159	0.0213	0.0118	0.711	0.0221	0.0294	0.0142	0.053	0.028	-	0.0505	0.112
CEN 2:1 - Conductivity @ 20 deg.C (diss.filt)	mg/kg	<20	-	-	-	-	-	-	-	-					
CEN 2:1 - Conductivity @ 20 deg.C (diss.filt)	mg/l	<20	-	-	-	-	-	-	-	-					
CEN 2:1 - Ammoniacal Nitrogen Low as NH4	mg/kg	<0.01	0.372	0.41	0.546	0.0302	1.83	0.568	0.756	0.366	1.36	0.072	-	1.3	0.288
CEN 2:1 - Ammoniacal Nitrogen Low as NH4	mg/l	<0.01	0.186	0.205	0.273	0.0151	0.914	0.284	0.378	0.183	0.681	0.036	-	0.65	0.144
CEN 2:1 - Nitrate as NO3	mg/kg	<0.3	5.22	4.76	40.4	4.16	7.54	7.66	5	5.78	2.28	1.45	-	6.02	3.86
CEN 2:1 - Nitrate as NO3	mg/l	<0.3	2.61	2.38	20.2	2.08	3.77	3.83	2.5	2.89	1.14	0.726	-	3.01	1.93
CEN 2:1 - Cyanide, Total (low level)	mg/kg	<5.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
CEN 2:1 - Cyanide, Total (low level)	mg/l	<5.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005
CEN 2:1 - Cyanide, Free (low level)	mg/kg	<2.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005
CEN 2:1 - Cyanide, Free (low level)	mg/l	<2.5	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	-	<0.0025	<0.0025
CEN 2:1 - Low Level Hexavalent Chromium	mg/kg	<0.003	0.026	0.032	0.202	0.0169	0.101	0.0414	0.0796	0.0666	<0.006	<0.006	-	<0.006	<0.006
CEN 2:1 - Low Level Hexavalent Chromium	mg/l	<0.003	0.013	0.016	0.101	0.00846	0.0507	0.0207	0.0398	0.0333	<0.003	<0.003	-	<0.003	<0.003
CEN 2:1 - Chromium, Trivalent (Low)	mg/kg	<0.003	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	-	<0.006	<0.006
CEN 2:1 - Chromium, Trivalent (Low)	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-	<0.003	<0.003
CEN 2:1 - Mercury (diss.filt)	mg/kg	<0.01	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	-	<0.00002	<0.00002
CEN 2:1 - Mercury (diss.filt)	mg/l	<0.01	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00001	<0.00001
CEN 2:1 - Arsenic (diss.filt)	mg/kg	<0.5	0.47	0.466	0.0732	0.193	0.284	0.224	0.197	0.179	<0.001	0.00159	-	0.00168	0.00232
CEN 2:1 - Arsenic (diss.filt)	mg/l	<0.5	0.235	0.233	0.0366	0.0966	0.142	0.112	0.0985	0.0896	<0.0005	0.000794	-	0.000838	0.00116
CEN 2:1 - Boron (diss.filt)	mg/kg	<10	0.185	2.12	8.06	0.158	1.37	0.372	0.716	0.65	0.0632	0.0216	-	0.124	0.0348
CEN 2:1 - Boron (diss.filt)	mg/l	<10	0.0927	1.06	4.03	0.0788	0.686	0.186	0.358	0.325	0.0316	0.0108	-	0.0619	0.0174
CEN 2:1 - Cadmium (diss.filt)	mg/kg	<0.08	<0.00016	<0.00016	0.000548	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	-	<0.00016	<0.00016
CEN 2:1 - Cadmium (diss.filt)	mg/l	<0.08	<0.00008	<0.00008	0.000274	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	-	<0.00008	<0.00008
CEN 2:1 - Chromium (diss.filt)	mg/kg	<1	0.0216	0.0268	0.162	0.0148	0.0832	0.0358	0.068	0.0548	<0.002	0.00212	-	<0.002	0.0058
CEN 2:1 - Chromium (diss.filt)	mg/l	<1	0.0108	0.0134	0.0809	0.00738	0.0416	0.0179	0.034	0.0274	<0.001	0.00106	-	<0.001	0.0029
CEN 2:1 - Copper (diss.filt)	mg/kg	<0.3	0.00174	0.00157	<0.0006	<0.0006	0.00105	<0.0006	<0.0006	<0.0006	0.00366	0.00554	-	0.0139	0.0167
CEN 2:1 - Copper (diss.filt)	mg/l	<0.3	0.000869	0.000787	<0.0003	<0.0003	0.000523	<0.0003	<0.0003	<0.0003	0.00183	0.00277	-	0.00695	0.00837
CEN 2:1 - Lead (diss.filt)	mg/kg	<0.2	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.00139	-	<0.0004	0.00806
CEN 2:1 - Lead (diss.filt)	mg/l	<0.2	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.000697	-	<0.0002	0.00403
CEN 2:1 - Nickel (diss.filt)	mg/kg	<0.4	0.000822	0.00159	<0.0008	<0.0008	<0.0008	0.000916	<0.0008	<0.0008	0.00127	0.0032	-	0.00434	0.00284
CEN 2:1 - Nickel (diss.filt)	mg/l	<0.4	0.000411	0.000795	<0.0004	<0.0004	<0.0004	0.000458	<0.0004	<0.0004	0.000634	0.0016	-	0.00217	0.00142
CEN 2:1 - Selenium (diss.filt)	mg/kg	<1.0	0.0496	0.0626	0.2	0.00456	0.112	0.0476	0.0338	0.0306	<0.002	<0.002	-	<0.002	<0.002
CEN 2:1 - Selenium (diss.filt)	mg/l	<1.0	0.0248	0.0313	0.1	0.00228	0.0561	0.0238	0.0169	0.0153	<0.001	<0.001	-	<0.001	<0.001
CEN 2:1 - Zinc (diss.filt)	mg/kg	<1.0	0.0039	0.00566	0.00302	0.00324	<0.002	<0.002	0.024	0.003	0.00208	0.0059	-	0.0134	0.0112
CEN 2:1 - Zinc (diss.filt)	mg/l	<1.0	0.00195	0.00283	0.00151	0.00162	<0.001	<0.001	0.012	0.0015	0.00104	0.00295	-	0.0067	0.0056
CEN 2:1 - Calcium (Dis.Filt)	mg/kg	<0.2	63.4	47.2	71.2	58.2	54	72.8	65.6	64.8	60.8	20.4	-	260	25.4
CEN 2:1 - Calcium (Dis.Filt)	mg/l	<0.2	31.7	23.6	35.6	29.1	27	36.4	32.8	32.4	30.4	10.2	-	130	12.7
CEN 2:1 - Iron (Dis.Filt)	mg/kg	<0.019	<0.038	<0.038	<0.038	<0.038	<0.038	<0.038	<0.038	<0.038	0.782	1.14	-	<0.038	1.34
CEN 2:1 - Iron (Dis.Filt)	mg/l	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019	0.391	0.571	-	<0.019	0.668
CEN 2:1 - Hardness, Total as CaCO3	mg/kg	<0.65	179	250	440	164	208	212	250	244	160	54.8	-	704	85.6
CEN 2:1 - Hardness, Total as CaCO3	mg/l	<0.65	89.5	125	220	82	104	106	125	122	80.1	27.4	-	352	42.8
CEN 2:1 - Naphthalene (aq)	mg/kg	<0.01	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	-	<0.00004	<0.00002
CEN 2:1 - Naphthalene (aq)	mg/l	<0.01	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Acenaphthene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.0000294	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Acenaphthene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.0000147	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Acenaphthylene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Acenaphthylene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Fluoranthene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.0000248	-	<0.00002	<0.00001
CEN 2:1 - Fluoranthene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.0000124	-	<0.00001	<0.000005
CEN 2:1 - Anthracene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Anthracene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Phenanthrene (aq)	mg/kg	<0.005	<0.00001	0.0000199	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.0000202	-	<0.00002	<0.00001
CEN 2:1 - Phenanthrene (aq)	mg/l	<0.005	<0.000005	0.00000995	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.0000101	-	<0.00001	<0.000005
CEN 2:1 - Fluorene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Fluorene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Chrysene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Chrysene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Pyrene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.0000186	-	<0.00002	<0.00001
CEN 2:1 - Pyrene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.00000928	-	<0.00001	<0.000005
CEN 2:1 - Benzo(a)anthracene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Benzo(a)anthracene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Benzo(b)fluoranthene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Benzo(b)fluoranthene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Benzo(a)pyrene (aq)	mg/kg	<0.002	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	<0.000004	-	<0.000008	<0.000004
CEN 2:1 - Benzo(a)pyrene (aq)	mg/l	<0.002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	<0.000002	-	<0.000004	<0.000002
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/kg	<0.005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00002	<0.00001
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/l	<0.005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	-	<0.00001	<0.000005
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/kg	<0.082	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	<0.000164	-	<0.000328	<0.000164
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/l	<0.082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	<0.000082	-	<0.000164	<0.000082

		Sample ID	MS-BH10	MS-BH14	MS-BH14	MS-BH16	MS-BH21	MS-BH06
		Depth	0.85-0.85	0.45-0.45	1.20-1.20	0.45-0.45	0.80-0.80	0.50-0.50
		Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Client Name	SSE	Sampled Date	21/09/2022	23/08/2022	23/08/2022	25/08/2022	31/08/2022	01/09/2022
Site Name	Keadby	Sample Received	27/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022
Job Number	F212561	Sample No	ES 7	ES 6	ES 12	ES 4	ES 7	ES 5
Date	12/01/2023	Batch Number	1	1	1	1	1	1
Description of Data Assessment / Zoning	Made Ground							
		Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	Units	LOD						
CEN 2:1 - Carbon, Organic (diss.filt)	mg/kg	<3	16.9	10.7	57.6	20.4	33.4	209
CEN 2:1 - Carbon, Organic (diss.filt)	mg/l	<3	8.47	5.34	28.8	10.2	16.7	20.9
CEN 2:1 - pH	pH Units		8.42	8.27	8.02	8.36	8.16	8.41
CEN 2:1 - Temperature	°C		20.7	20.3	20.5	20.4	20.8	17.2
CEN 2:1 - Conductivity @ 20 deg.C	µS/cm		247	312	181	892	162	165
CEN 2:1 - Nitrite as NO2	mg/kg	<0.05	0.134	<0.1	<0.1	<0.1	0.118	<0.5
CEN 2:1 - Nitrite as NO2	mg/l	<0.05	0.067	<0.05	<0.05	<0.05	0.059	<0.05
CEN 2:1 - pH (diss.filt)	pH Units	<1	8.18	8.28	7.92	8.35	8.22	8.26
CEN 2:1 - Sulphate	mg/kg	<2	20.8	151	74.6	570	<4	<2
CEN 2:1 - Sulphate	mg/l	<2	10.4	75.3	37.3	285	<2	<20
CEN 2:1 - Ammoniacal Nitrogen as N (low level)	mg/kg	<0.01	0.31	0.14	<0.02	0.072	0.048	0.23
CEN 2:1 - Ammoniacal Nitrogen as N (low level)	mg/l	<0.01	0.155	0.07	<0.01	0.036	0.024	0.023
CEN 2:1 - Conductivity @ 20 deg.C (diss.filt)	mg/kg	<20						
CEN 2:1 - Conductivity @ 20 deg.C (diss.filt)	mg/l	<20						
CEN 2:1 - Ammoniacal Nitrogen Low as NH4	mg/kg	<0.01	0.398	0.18	<0.02	0.926	0.618	2.96
CEN 2:1 - Ammoniacal Nitrogen Low as NH4	mg/l	<0.01	0.199	0.09	<0.01	0.463	0.309	0.296
CEN 2:1 - Nitrate as NO3	mg/kg	<0.3	11.3	4.52	5.64	11.6	4.38	45.2
CEN 2:1 - Nitrate as NO3	mg/l	<0.3	5.63	2.26	2.82	5.78	2.19	4.52
CEN 2:1 - Cyanide, Total (low level)	mg/kg	<5.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
CEN 2:1 - Cyanide, Total (low level)	mg/l	<5.0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
CEN 2:1 - Cyanide, Free (low level)	mg/kg	<2.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025
CEN 2:1 - Cyanide, Free (low level)	mg/l	<2.5	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
CEN 2:1 - Low Level Hexavalent Chromium	mg/kg	<0.003	<0.006	<0.006	<0.006	<0.006	<0.006	<0.03
CEN 2:1 - Low Level Hexavalent Chromium	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CEN 2:1 - Chromium, Trivalent (Low)	mg/kg	<0.003	<0.006	<0.006	<0.006	<0.006	<0.006	<0.03
CEN 2:1 - Chromium, Trivalent (Low)	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
CEN 2:1 - Mercury (diss.filt)	mg/kg	<0.01	<0.00002	<0.00002	0.0000312	<0.00002	0.0000232	<0.0001
CEN 2:1 - Mercury (diss.filt)	mg/l	<0.01	<0.00001	<0.00001	0.0000156	<0.00001	0.0000116	<0.00001
CEN 2:1 - Arsenic (diss.filt)	mg/kg	<0.5	0.00109	<0.001	0.0072	0.0057	<0.001	0.00545
CEN 2:1 - Arsenic (diss.filt)	mg/l	<0.5	0.000547	<0.0005	0.0036	0.00285	<0.0005	0.000545
CEN 2:1 - Boron (diss.filt)	mg/kg	<10	0.114	0.122	0.0712	0.336	0.103	0.633
CEN 2:1 - Boron (diss.filt)	mg/l	<10	0.0572	0.061	0.0356	0.168	0.0515	0.0633
CEN 2:1 - Cadmium (diss.filt)	mg/kg	<0.08	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.0008
CEN 2:1 - Cadmium (diss.filt)	mg/l	<0.08	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
CEN 2:1 - Chromium (diss.filt)	mg/kg	<1	<0.002	0.00244	0.00434	0.0024	<0.002	<0.01
CEN 2:1 - Chromium (diss.filt)	mg/l	<1	<0.001	0.00122	0.00217	0.0012	<0.001	<0.001
CEN 2:1 - Copper (diss.filt)	mg/kg	<0.3	0.01	0.00838	0.011	0.0162	0.00556	0.0587
CEN 2:1 - Copper (diss.filt)	mg/l	<0.3	0.00501	0.00419	0.00549	0.0081	0.00278	0.00587
CEN 2:1 - Lead (diss.filt)	mg/kg	<0.2	0.00208	<0.0004	0.00252	<0.0004	0.000674	0.00619
CEN 2:1 - Lead (diss.filt)	mg/l	<0.2	0.00104	<0.0002	0.00126	<0.0002	0.000337	0.000619
CEN 2:1 - Nickel (diss.filt)	mg/kg	<0.4	0.006	<0.0008	<0.0008	0.00384	<0.0008	0.0262
CEN 2:1 - Nickel (diss.filt)	mg/l	<0.4	0.003	<0.0004	<0.0004	0.00192	<0.0004	0.00262
CEN 2:1 - Selenium (diss.filt)	mg/kg	<1.0	<0.002	<0.002	<0.002	0.00204	<0.002	<0.01
CEN 2:1 - Selenium (diss.filt)	mg/l	<1.0	<0.001	<0.001	<0.001	0.00102	<0.001	<0.001
CEN 2:1 - Zinc (diss.filt)	mg/kg	<1.0	0.00832	0.0204	0.00324	0.0163	0.00268	0.0691
CEN 2:1 - Zinc (diss.filt)	mg/l	<1.0	0.00416	0.0102	0.00162	0.00813	0.00134	0.00691
CEN 2:1 - Calcium (Dis.Filt)	mg/kg	<0.2	77.6	132	69.4	286	71.6	328
CEN 2:1 - Calcium (Dis.Filt)	mg/l	<0.2	38.8	66.2	34.7	143	35.8	32.8
CEN 2:1 - Iron (Dis.Filt)	mg/kg	<0.019	0.342	0.488	0.562	<0.038	1.73	2.53
CEN 2:1 - Iron (Dis.Filt)	mg/l	<0.019	0.171	0.244	0.281	<0.019	0.866	0.253
CEN 2:1 - Hardness, Total as CaCO3	mg/kg	<0.65	210	358	185	860	193	908
CEN 2:1 - Hardness, Total as CaCO3	mg/l	<0.65	105	179	92.3	430	96.3	90.8
CEN 2:1 - Naphthalene (aq)	mg/kg	<0.01	<0.00004	<0.00008	<0.00002	<0.00004	<0.00002	<0.0001
CEN 2:1 - Naphthalene (aq)	mg/l	<0.01	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00001
CEN 2:1 - Acenaphthene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Acenaphthene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Acenaphthylene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Acenaphthylene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Fluoranthene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	0.0000204	0.0000599
CEN 2:1 - Fluoranthene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	0.0000102	0.00000599
CEN 2:1 - Anthracene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Anthracene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Phenanthrene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	0.000058
CEN 2:1 - Phenanthrene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	0.0000058
CEN 2:1 - Fluorene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Fluorene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Chrysene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Chrysene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Pyrene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	0.0000183	0.0000521
CEN 2:1 - Pyrene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	0.00000914	0.00000521
CEN 2:1 - Benzo(a)anthracene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Benzo(a)anthracene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Benzo(b)fluoranthene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Benzo(b)fluoranthene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Benzo(a)pyrene (aq)	mg/kg	<0.002	<0.000008	<0.000016	<0.000004	<0.000008	<0.000004	<0.00002
CEN 2:1 - Benzo(a)pyrene (aq)	mg/l	<0.002	<0.000004	<0.000008	<0.000002	<0.000004	<0.000002	<0.000002
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/kg	<0.005	<0.00002	<0.00004	<0.00001	<0.00002	<0.00001	<0.00005
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/l	<0.005	<0.00001	<0.00002	<0.000005	<0.00001	<0.000005	<0.000005
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/kg	<0.082	<0.000328	<0.000656	<0.000164	<0.000328	<0.000164	<0.00082
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/l	<0.082	<0.000164	<0.000328	<0.000082	<0.000164	<0.000082	<0.000082

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground

Sample ID	BH102	BH102	BH102	BH103	BH103	BH103	BH104	BH104	BH105	BH105	BH106	BH106
Depth	1.00-1.00	14.80-14.80	9.80-9.80	1.20-1.20	5.80-5.80	7.80-7.80	2.80-2.80	7.80-7.80	1.80-1.80	5.80-5.80	0.40-0.40	1.80-1.80
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	27/09/2022	28/09/2022	28/09/2022	29/09/2022	29/09/2022	29/09/2022	06/10/2022	06/10/2022	05/10/2022	05/10/2022	21/10/2022	21/10/2022
Sample Received	30/09/2022	30/09/2022	30/09/2022	05/10/2022	05/10/2022	13/10/2022	18/10/2022	18/10/2022	13/10/2022	13/10/2022	27/10/2022	27/10/2022
Sample No	ES 6	ES 36	ES 28	ES 8	ES 21	ES 25	ES 12	ES 24	ES 8	ES 18	ES 4	ES 9
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	**<0.001**	-	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	**<0.001**	-	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	None	-	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	N/A	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	**<0.001**	-	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	**Detected**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	**Fibre bundle in soil**	-	-	-	-	-	-	-

BH106	BH106	DS101	DS101	DS101	DS101	DS103	DS103	DS105	DS105	DS105	DS106
2.80-2.80	4.30-4.30	0.40-0.40	1.20-1.20	2.50-3.00	4.50-5.00	0.40-0.40	3.50-4.00	0.80-0.80	1.50-2.00	3.50-4.00	0.10-0.10
SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
21/10/2022	21/10/2022	29/09/2022	29/09/2022	01/11/2022	01/11/2022	29/09/2022	29/09/2022	30/09/2022	28/09/2022	28/09/2022	30/09/2022
27/10/2022	27/10/2022	13/10/2022	13/10/2022	03/11/2022	03/11/2022	13/10/2022	18/10/2022	05/10/2022	06/10/2022	06/10/2022	05/10/2022
ES 13	ES 21	ES 5	ES 8	ES 110	ES 112	ES 5	ES 12	ES 7	ES 9	ES 11	ES 2
1	1	1	1	1	1	1	1	1	1	1	1
Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground

Sample ID	DS106	DS107	DS108	DS108	DS109	DS110	DS110	DS111	DS111	DS111	HR-BH01	HR-BH01
Depth	4.50-5.00	4.50-5.00	1.50-2.00	3.50-4.00	1.20-1.20	0.40-0.40	2.50-3.00	1.50-2.00	1.50-2.00	4.00-4.70	0.70-0.70	1.20-1.20
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	28/09/2022	04/10/2022	29/09/2022	29/09/2022	23/09/2022	28/09/2022	29/09/2022	29/09/2022	29/09/2022	29/09/2022	27/10/2022	27/10/2022
Sample Received	13/10/2022	13/10/2022	13/10/2022	13/10/2022	06/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	13/10/2022	03/11/2022	03/11/2022
Sample No	ES 12	ES 12	ES 10	ES 11	ES 8	ES 4	ES 10	ES 9	ES 9	ES 12	ES 5	ES 7
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MS-BH18	MS-BH18	MS-BH23	MS-BH24	MS-BH25	MS-BH25	MS-BH25	AR-BH01	AR-BH01	BH101	BH101	BH101
0.40-0.40	1.00-1.00	1.20-1.20	0.40-0.40	0.40-0.40	0.75-0.75	1.50-1.50	0.10-0.10	0.45-0.45	2.80-2.80	4.80-4.80	8.80-8.80
SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
06/10/2022	06/10/2022	30/09/2022	10/10/2022	26/09/2022	26/09/2022	26/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022
18/10/2022	18/10/2022	13/10/2022	13/10/2022	05/10/2022	05/10/2022	05/10/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	30/09/2022
ES 4	ES 8	ES 10	ES 4	ES 5	ES 9	ES 13	ES 2	ES 4	ES 12	ES 18	ES 27
1	1	1	1	1	1	1	1	1	1	1	1
Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	**<0.001**	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	**<0.001**	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	None	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	**<0.001**	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	**Detected**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	**Fibre bundle in soil**	-	-	-	-	-	-

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground

Sample ID	MS-BH01	MS-BH02	MS-BH02	MS-BH03	MS-BH03	MS-BH04	MS-BH04	MS-BH04	MS-BH04	MS-BH05	MS-BH05	MS-BH07
Depth	0.10-0.10	0.85-0.85	1.20-1.20	0.10-0.10	0.80-0.80	0.10-0.10	0.50-0.50	0.80-0.80	1.20-1.20	0.10-0.10	0.50-0.50	0.20-0.30
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	26/08/2022	30/08/2022	30/08/2022	25/08/2022	25/08/2022	13/09/2022	14/09/2022	14/09/2022	14/09/2022	06/09/2022	06/09/2022	23/08/2022
Sample Received	06/09/2022	06/09/2022	06/09/2022	06/09/2022	06/09/2022	17/09/2022	17/09/2022	17/09/2022	17/09/2022	13/09/2022	13/09/2022	06/09/2022
Sample No	ES 1	ES 9	ES 10	ES 1	ES 8	ES 1	ES 4	ES 7	ES 10	ES 1	ES 4	ES 1
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MS-BH08	MS-BH08	MS-BH09	MS-BH09	MS-BH09	MS-BH10	MS-BH10	MS-BH10	MS-BH11	MS-BH11	MS-BH12	MS-BH12
0.10-0.30	0.50-0.70	0.10-0.10	0.50-0.50	1.20-1.20	0.10-0.10	0.45-0.45	0.85-0.85	0.10-0.10	0.80-0.80	0.10-0.10	0.50-0.50
SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
09/09/2022	09/09/2022	15/09/2022	15/09/2022	15/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	21/09/2022	14/09/2022	14/09/2022
17/09/2022	17/09/2022	24/09/2022	24/09/2022	24/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	27/09/2022	17/09/2022	17/09/2022
ES 2	ES 4	ES 1	ES 4	ES 9	ES 2	ES 4	ES 7	ES 2	ES 6	ES 1	ES 4
1	1	1	1	1	1	1	1	1	1	1	1
Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	-	-	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Client Name	SSE
Site Name	Keadby
Job Number	F212561
Date	12/01/2023
Description of Data Assessment / Zoning	Made Ground

Sample ID	MS-BH14	MS-BH14	MS-BH14	MS-BH15	MS-BH15	MS-BH16	MS-BH16	MS-BH17	MS-BH17	MS-BH17	MS-BH19	MS-BH20
Depth	0.45-0.45	0.80-0.80	1.20-1.20	0.50-0.50	1.20-1.20	0.10-0.10	0.45-0.45	0.50-0.50	1.00-1.00	1.80-1.80	0.10-0.10	0.10-0.10
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date	23/08/2022	23/08/2022	23/08/2022	13/09/2022	13/09/2022	25/08/2022	25/08/2022	15/09/2022	15/09/2022	15/09/2022	12/09/2022	08/09/2022
Sample Received	06/09/2022	06/09/2022	06/09/2022	27/09/2022	27/09/2022	06/09/2022	06/09/2022	27/09/2022	24/09/2022	24/09/2022	17/09/2022	13/09/2022
Sample No	ES 6	ES 9	ES 12	ES 4	ES 9	ES 2	ES 4	ES 4	ES 7	ES 10	ES 1	ES 1
Batch Number	1	1	1	1	1	1	1	1	1	1	1	1
Strata / Zone	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**											
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-	-	-	-	-	-	**<0.001**	-	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-	-	-	-	-	-	**<0.001**	-	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	**None**	-	-	-	-
Analysts Comments	-	-	-	-	-	-	-	-	-	-	**N/A**	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-	-	-	-	-	-	**<0.001**	-	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	**Detected**	Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	-	-	-	-	-	-	-	-	-	-	**Loose fibres in soil**	-	-	-	-

MS-BH20	MS-BH21
1.00-1.00	0.10-0.10
SOLID	SOLID
08/09/2022	31/08/2022
13/09/2022	06/09/2022
ES 7	ES 1
1	1
Made Ground	Made Ground

Test	**Units**	**LOD**	**No. Detected**		
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	-
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	-
Additional Asbestos Components (Using TM048)	-	-	-	-	-
Analysts Comments	-	-	-	-	-
Asbestos Quantification - Total - %	%	<0.001	-	-	-
Chrysotile (White) Asbestos	-	-	**2**	Not Detected	Not Detected
Amosite (Brown) Asbestos	-	-	**1**	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	-	-	-	Not Detected	Not Detected
Asbestos Anthophyllite	-	-	-	Not Detected	Not Detected
Asbestos Tremolite	-	-	-	Not Detected	Not Detected
Asbestos Actinolite	-	-	-	Not Detected	Not Detected
Non-Asbestos Fibre	-	-	-	Not Detected	Not Detected
Comments	-	-	-	-	-

F.2 Groundwater Risk assessment Analysis

Borehole Number			AR-BH01			AR-BH02			BH101			BH102			BH103		
Well Screen Zone (m)			2.00-5.00			7.00-10.00			18.00-21.00			18.00-30.00			17.20-29.20		
Sample Depth (m)			5.00	5.00	5.00	10.00	10.00	10.00	19.00	19.00	19.00	28.00	28.00	28.00	25.00	26.00	27.00
Round Number			1	3	5	1	3	5	1	3	5	1	3	5	5	3	1
Well Screen Stratum	Units	WQS	Alluvium			Alluvium			Alluvium			Alluvium			Alluvium		
pH	pH units	-	7.17	7.15	7.39	7.39	7.2	7.62	9.09	9.25	9.23	8.13	8.66	8.24	7.89	7.97	7.28
Arsenic	ug/l	10	16.5	10.2	13.6	6.4	7.29	8.2	28.8	34.4	24.2	17.3	24.3	18.2	16.7	13.3	32.3
Boron	ug/l	-	151	119	93.4	187	136	121	14400	21600	18000	13400	19200	17800	26100	26500	24200
Cadmium	ug/l	5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.845	1.02	1.17	1.49	1.84	2.07	1.39	1.22	0.92
Chromium	ug/l	50	1.43	1.96	<1	<1	1.41	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/l	2000	<0.3	<0.3	<0.3	0.615	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead	ug/l	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-															
Mercury	ug/l	1	0.0105	<0.01	<0.01	0.012	<0.01	<0.01	0.0121	<0.01	<0.01	0.0106	<0.01	<0.01	<0.01	<0.01	0.0108
Nickel	ug/l	4	2.35	2.76	1.95	3.34	3.88	3.87	2.47	3.27	2.45	3.98	4.13	3.88	5.27	4.76	5.5
Zinc	ug/l	500	3.93	3.13	2.65	2.89	4.06	1.09	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Organic Carbon	mg/l	-	22	21.8	21.5	17.1	16.8	16.8	12.5	5.09	9.68	102	65.5	23.8	23.9	93.6	40.8
BOD (total, 5 day)	mg/l	-															
Chemical oxygen dema	mg/l	-															
Nitrate	mg/l	50	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	4.52	7.61	8.14	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	mg/l	250															
Phenol (Monohydric)	mg/l	0.0077	<0.5	<0.5	<0.5	1.09	2.26	1.54	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0053	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Acenaphthylene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00721	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Benzo (g,h,i) perylene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0795	0.0433	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Benzo(a)anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.074	0.0436	0.0194	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Benzo(a)pyrene	ug/l	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0881	0.0537	0.0158	<0.04	<0.002	<0.002	<0.04	<0.002	<0.04
Benzo(b)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.131	0.0781	0.0238	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Benzo(k)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0403	0.0284	0.0107	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Chrysene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.101	0.0519	0.0257	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Dibenz-a-h-anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Fluoranthene	ug/l	-	0.00623	<0.005	<0.005	0.00624	<0.005	<0.005	0.144	0.1	0.0385	<0.1	0.0089	0.0114	<0.1	0.0162	<0.1
Fluorene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Indeno(1,2,3-cd)pyrene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0429	0.0347	0.0128	<0.1	<0.005	<0.005	<0.1	<0.005	<0.1
Napthalene	ug/l	2	0.0146	<0.01	<0.01	<0.01	<0.01	<0.01	0.0995	0.0683	0.0227	<0.2	<0.01	<0.01	<0.2	0.0114	<0.2
Phenanthrene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0518	0.0388	0.0179	<0.1	<0.005	0.00728	<0.1	0.007	<0.1
Pyrene	ug/l	-	0.00639	<0.005	<0.005	0.00763	<0.005	<0.005	0.143	0.101	0.0337	<0.1	0.008	0.012	<0.1	0.0155	<0.1
Pah,Total	ug/l	-	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	1	0.647	0.221	<1.64	<0.082	<0.082	<1.64	<0.082	<1.64
EPH >C10-40**	ug/l	-	113	114	<100	136	<100	<100	638	879	207	128	151	139	434	236	429

Key

All results reported in mg/l.

–	Not sampled/analysed or no WQS available
WQS	Water Quality Standard
888	Exceeds Water Quality Standards
888	Exceeds Detection Limit
0	Below Detection Limit
**	No WQS for EPH/TPH

Borehole Number			BH104			DS111			HR-BH01			MS-BH01			MS-BH02		
Well Screen Zone (m)			4.50-9.00			0.50-4.70			2.00-5.00			7.00-10.00			9.00-12.00		
Sample Depth (m)			8.00	8.00	8.50	4.00	4.00	4.50	4.00	5.00	5.00	7.00	7.00	7.00	8.00	8.50	9.00
Round Number			3	5	1	3	5	1	3	1	5	1	3	5	5	1	3
Well Screen Stratum	Units	WQS	Made Ground			Made Ground			Alluvium			Alluvium			Alluvium		
pH	pH units	-	9.27	9.27	9.31	11.2	11.2	10.9	6.72	7.03	7.64	7.5	7.21	7.42	7.15	6.73	7.3
Arsenic	ug/l	10	82.5	102	79.2	36.5	34.3	28.9	21.6	22.4	22	189	53.9	123	48.7	169	33.1
Boron	ug/l	-	7250	7140	7940	1490	1370	774	176	169	229	66.1	61.7	53.3	107	83.9	120
Cadmium	ug/l	5	0.304	0.313	0.263	0.122	0.143	0.179	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	ug/l	50	1.74	<1	8.25	13.6	8.75	<1	1.06	<1	<1	<1	<1	<1	<1	<1	1.06
Copper	ug/l	2000	<0.3	<0.3	1.86	1.67	1.13	1.06	<0.3	0.44	<0.3	0.592	<0.3	<0.3	<0.3	<0.3	<0.3
Lead	ug/l	10	0.223	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-															
Mercury	ug/l	1	<0.01	<0.01	0.0104	<0.01	<0.01	0.0128	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	ug/l	4	1.88	1.67	1.96	1.04	0.403	0.924	1.13	1.93	1.09	0.844	3.19	1.72	9.41	1.19	9.18
Zinc	ug/l	500	7.46	<1	<1	<1	<1	5.95	3.85	5.86	3.98	2.2	4.66	2.16	6.12	3.23	7.19
Total Organic Carbon	mg/l	-	5.38	3.64	3.18	3.02	<3	3.66	14.6	15.7	9.33	10.1	19.3	18.1	26.1	15.9	24.2
BOD (total, 5 day)	mg/l	-															
Chemical oxygen dema	mg/l	-															
Nitrate	mg/l	50	<0.3	<0.3	<0.3	1.05	<0.3	<0.3	0.464	<0.3	<0.3	<0.3	0.312	0.997	<0.3	<0.3	<0.3
Chloride	mg/l	250															
Phenol (Monohydric)	mg/l	0.0077	<0.5	<0.5	<0.5	<0.5	0.67	2.64	4.8	6.88	2.74	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/l	-	0.0122	0.0665	0.0051	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthylene	ug/l	-	0.0097	0.0403	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Anthracene	ug/l	-	0.0374	0.15	0.015	0.0073	<0.005	0.00729	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo (g,h,i) perylene	ug/l	0.10	0.209	0.688	0.0981	0.0326	<0.005	0.0502	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)anthracene	ug/l	-	0.261	0.929	0.136	0.0539	0.0103	0.0692	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)pyrene	ug/l	0.01	0.304	0.993	0.144	0.0572	0.0119	0.0779	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Benzo(b)fluoranthene	ug/l	0.10	0.392	1.46	0.214	0.0756	0.0194	0.101	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene	ug/l	0.10	0.166	0.486	0.064	0.0303	0.00782	0.0328	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chrysene	ug/l	-	0.309	1.14	0.204	0.0628	<0.005	0.0935	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dibenz-a-h-anthracene	ug/l	-	0.0327	<0.005	0.0173	0.0067	<0.005	0.00913	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoranthene	ug/l	-	0.552	1.95	0.223	0.108	0.0192	0.112	0.0054	<0.005	<0.005	0.0132	0.00986	<0.005	<0.005	<0.005	<0.005
Fluorene	ug/l	-	0.0084	0.0424	0.00501	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0066
Indeno(1,2,3-cd)pyrene	ug/l	0.10	0.176	0.465	0.0772	0.0354	0.0107	0.0497	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Napthalene	ug/l	2	0.0705	0.263	0.0384	0.0265	0.0127	0.0337	0.0149	<0.01	<0.01	<0.01	0.0114	<0.01	<0.01	0.018	0.0537
Phenanthrene	ug/l	-	0.145	0.586	0.0833	0.0325	0.00661	0.0304	<0.005	<0.005	<0.005	0.00888	0.0103	<0.005	<0.005	0.00707	0.0108
Pyrene	ug/l	-	0.557	1.82	0.229	0.0984	0.0183	0.112	<0.005	<0.005	<0.005	0.0248	0.0156	0.0071	<0.005	0.00532	<0.005
Pah,Total	ug/l	-	3.24	11.1	1.55	0.627	0.117	0.779	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082
EPH >C10-40**	ug/l	-	1130	1730	573	152	144	148	<100	<100	<100	340	184	103	<100	<100	<100

Key

All results reported in mg/l.

–	Not sampled/analys
WQS	Water Quality Stanc
888	Exceeds Water Qua
888	Exceeds Detection I
0	Below Detection Lin
**	No WQS for EPH/T

Borehole Number			MS-BH03			MS-BH05			MS-BH07			MS-BH09			MS-BH10		
Well Screen Zone (m)			3.00-6.00			3.00-6.00			9.50-12.50			3.00-9.00			7.00-10.00		
Sample Depth (m)			4.00	4.50	4.50	6.00	6.00	6.00	11.00	11.00	11.00	9.00	9.00	9.00	10.00	10.00	10.00
Round Number			5	1	3	1	3	5	1	3	5	1	3	5	1	3	5
Well Screen Stratum	Units	WQS	Alluvium			Alluvium			Alluvium			Alluvium			Alluvium		
pH	pH units	-	7.45	7.24	7.41	7.54	6.53	6.71	7.35	7.36	7.5	7.5	6.92	6.73	7.56	7.8	7.7
Arsenic	ug/l	10	91.2	90.7	77.5	277	227	214	17.9	3.51	3.15	67.8	42.9	44.4	24.1	27.5	45
Boron	ug/l	-	39.5	38.4	48.8	50.7	59.1	53.2	521	187	172	80.6	68.5	63	98	82.3	62.3
Cadmium	ug/l	5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.313	<0.08	<0.08	<0.08	<0.08	<0.08	0.119	0.201	0.219
Chromium	ug/l	50	<1	<1	<1	<1	<1	<1	1.77	6.11	5.74	<1	1.05	<1	1.88	5.35	<1
Copper	ug/l	2000	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.649	1.95	1.59	0.373	<0.3	<0.3	<0.3	<0.3	<0.3
Lead	ug/l	10	<0.2	<0.2	<0.2	<0.2	0.22	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-															
Mercury	ug/l	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	ug/l	4	2.05	2.61	4.07	0.966	4.14	3.5	2.85	6.93	6.61	7.02	15.5	11.8	2.23	1.75	1.19
Zinc	ug/l	500	2.74	4.37	3.09	3.56	3.8	2.62	2.53	4.1	3.42	5.02	6.29	5.42	2.03	2.86	1.17
Total Organic Carbon	mg/l	-	14.8	16	14.8	14.9	12.4	14.6	14.7	15.1	15.7	14.2	12.8	13.7	12.4	12.2	11.3
BOD (total, 5 day)	mg/l	-															
Chemical oxygen dema	mg/l	-															
Nitrate	mg/l	50	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	7.1	0.738	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	mg/l	250															
Phenol (Monohydric)	mg/l	0.0077	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/l	-	<0.005	<0.005	0.0137	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthylene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo (g,h,i) perylene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)pyrene	ug/l	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Benzo(b)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chrysene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dibenz-a-h-anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoranthene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0089	<0.005	<0.005	<0.005	<0.005
Fluorene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Napthalene	ug/l	2	<0.01	<0.01	<0.01	0.0115	0.0142	0.0177	<0.01	<0.01	<0.01	0.0127	0.0317	0.0314	<0.01	<0.01	<0.01
Phenanthrene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0054	<0.005	<0.005
Pyrene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0072	<0.005	0.0065	<0.005	<0.005
Pah,Total	ug/l	-	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082
EPH >C10-40**	ug/l	-	<100	<100	<100	110	<100	<100	<100	<100	<100	<100	107	<100	<100	<100	<100

Key

All results reported in mg/l.

–	Not sampled/analys
WQS	Water Quality Stanc
888	Exceeds Water Qua
888	Exceeds Detection I
0	Below Detection Lin
**	No WQS for EPH/T

Borehole Number			MS-BH12			MS-BH13			MS-BH17			MS-BH19			MS-BH20		
Well Screen Zone (m)			5.00-8.00			7.00-10.00			3.00-6.00			3.00-6.00			9.00-12.00		
Sample Depth (m)			8.00	8.00	8.00	9.00	9.00	9.00	6.00	6.00	6.00	5.00	5.00	5.50	8.00	8.00	8.00
Round Number			1	3	5	1	3	5	1	3	5	3	5	1	1	3	5
Well Screen Stratum	Units	WQS	Alluvium			Alluvium			Alluvium			Alluvium			Alluvium		
pH	pH units	-	7.28	7.28	7.19	7.43	7.78	7.57	7.08	6.92	7.01	6.96	6.81	6.98	7.7	7.56	7.92
Arsenic	ug/l	10	42.6	44.3	37	54.3	81.6	53.1	146	74.2	53.6	101	2.35	120	35.8	2.44	3.27
Boron	ug/l	-	83.8	188	181	93.8	84.2	69.9	39.4	77.3	82.5	48.7	64.3	63.1	206	157	83.3
Cadmium	ug/l	5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	ug/l	50	<1	<1	<1	<1	2.01	<1	<1	1.16	<1	<1	5.21	<1	2.56	<1	5.44
Copper	ug/l	2000	0.358	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.15	<0.3	<0.3	0.525	1.01
Lead	ug/l	10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-															
Mercury	ug/l	1	0.0103	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	ug/l	4	2.68	1.01	0.947	1.48	1.43	0.867	1.63	4.19	3.91	5.8	12.7	5.49	5.68	5.56	4.77
Zinc	ug/l	500	2.42	4.96	1.57	1.88	1.25	1.31	3.09	5.31	2.17	3.02	24.6	2.24	3.3	5.44	5.03
Total Organic Carbon	mg/l	-	12.3	11.4	12.5	14.4	12.8	11.3	21	18.6	20.3	10.4	8.94	18	12.7	12	14.3
BOD (total, 5 day)	mg/l	-															
Chemical oxygen dema	mg/l	-															
Nitrate	mg/l	50	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chloride	mg/l	250															
Phenol (Monohydric)	mg/l	0.0077	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.33	1.79	0.5
Acenaphthene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0076	<0.005	<0.01	<0.005	<0.1	<0.005	<0.005	<0.005
Acenaphthylene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	<0.005	<0.005
Anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	<0.005	<0.005
Benzo (g,h,i) perylene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0319	<0.005
Benzo(a)anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0117	<0.005
Benzo(a)pyrene	ug/l	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	<0.04	<0.002	0.0311	<0.002
Benzo(b)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0438	<0.005
Benzo(k)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0161	<0.005
Chrysene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0234	<0.005
Dibenz-a-h-anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	<0.005	<0.005
Fluoranthene	ug/l	-	<0.005	0.0091	<0.005	<0.005	0.0122	<0.005	0.0095	0.0084	<0.005	0.0294	<0.005	<0.1	<0.005	0.0302	<0.005
Fluorene	ug/l	-	<0.005	<0.005	<0.005	0.0074	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.1	<0.005	0.0245	<0.005
Napthalene	ug/l	2	0.0652	0.037	<0.01	0.0561	0.0542	<0.01	0.0119	0.0242	<0.01	0.028	<0.01	<0.2	<0.01	<0.01	<0.01
Phenanthrene	ug/l	-	<0.005	<0.005	<0.005	0.0102	<0.005	<0.005	0.0113	0.0193	0.0075	0.0243	<0.005	0.135	<0.005	0.0218	<0.005
Pyrene	ug/l	-	<0.005	0.0093	<0.005	<0.005	0.0113	0.0053	0.0096	<0.005	<0.005	0.0355	<0.005	<0.1	<0.005	0.0517	<0.005
Pah,Total	ug/l	-	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.164	<0.082	<1.64	<0.082	0.286	<0.082
EPH >C10-40**	ug/l	-	<100	190	139	218	120	<100	<100	<100	<100	152	<100	226	<100	2100	<100

Key

All results reported in mg/l.

–	Not sampled/analys
WQS	Water Quality Stanc
888	Exceeds Water Qua
888	Exceeds Detection I
0	Below Detection Lin
**	No WQS for EPH/T

Borehole Number			MS-BH21			MS-BH23			MS-BH25			SWD102		SWD104		SWD105	
Well Screen Zone (m)			14.50-17.50			1.00-6.00			3.00-5.00			0.00		0.00		0.00	
Sample Depth (m)			16.00	17.00	17.00	3.00	3.00	3.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00
Round Number			1	3	5	1	3	5	1	3	5	1	3	1	3	1	3
Well Screen Stratum	Units	WQS	Mercia Mudstone Group			Alluvium			Made Ground			-		-		-	
pH	pH units	-	8.12	7.44	7.33	7.49	7.36	7.46	9.79	8.26	7.36	7.57	7.79	8.26	7.96	8.32	7.64
Arsenic	ug/l	10	13.4	13.7	24.6	9.11	13.8	10.5	11.2	10.3	7.06	1.16	1.03	1.31	1.2	1.13	1.34
Boron	ug/l	-	181	109	85.2	123	142	127	37.8	113	201	658	472	267	349	306	392
Cadmium	ug/l	5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.125	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	ug/l	50	1.3	1.3	<1	2.36	<1	<1	1.1	1.28	4.75	<1	<1	2.05	<1	<1	<1
Copper	ug/l	2000	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	8.58	2.18	<0.3	1.18	1.02	1.3	1.2	1.6	1.49
Lead	ug/l	10	<0.2	<0.2	<0.2	0.524	0.492	0.479	<0.2	0.546	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-															
Mercury	ug/l	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0152	<0.01	<0.01	0.0114	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	ug/l	4	0.883	2.62	2.09	4.33	8.74	9.86	5.74	3.29	1.4	3.59	2.3	1.69	2.32	1.46	2.37
Zinc	ug/l	500	1.58	11	7.4	3.3	1.88	2.22	1.09	34	<1	1.1	1.43	2.14	3.42	2.54	3.25
Total Organic Carbon	mg/l	-	9.84	12.6	14.2	10.8	8.45	7.45	15.7	29.3	38.6	10.2	9.31	10.1	12.9	9.24	12.4
BOD (total, 5 day)	mg/l	-															
Chemical oxygen dema	mg/l	-															
Nitrate	mg/l	50	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.375	2.47	5.48	8.03	5.83	8.79
Chloride	mg/l	250															
Phenol (Monohydric)	mg/l	0.0077	1.72	0.81	2.11	<0.5	<0.5	<0.5	7.04	26.9	10.1	<0.5	<0.5	0.64	<0.5	0.76	<0.5
Acenaphthene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthylene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo (g,h,i) perylene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(a)pyrene	ug/l	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Benzo(b)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chrysene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dibenz-a-h-anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoranthene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0109	0.0059	<0.005	<0.005	<0.005	0.014	0.01	0.0163	0.011
Fluorene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0062	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Napthalene	ug/l	2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0481	0.0308	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0184	0.0087	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Pyrene	ug/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0155	<0.005	<0.005	<0.005	<0.005	0.0177	0.0104	0.0193	0.0115
Pah,Total	ug/l	-	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	0.0991	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082	<0.082
EPH >C10-40**	ug/l	-	<100	<100	<100	<100	<100	<100	143	113	<100	<100	<100	<100	<100	<100	<100

Key

All results reported in mg/l.

–	Not sampled/analys
WQS	Water Quality Stanc
888	Exceeds Water Qua
888	Exceeds Detection I
0	Below Detection Lin
**	No WQS for EPH/T

Borehole Number			SWD106		SWD107	
Well Screen Zone (m)			0.00		0.00	
Sample Depth (m)			0.00	0.00	0.00	0.00
Round Number			1	3	1	3
Well Screen Stratum	Units	WQS	-		-	
pH	pH units	-	8.29	7.7	7.65	7.71
Arsenic	ug/l	10	1.82	1.9	1.35	1.62
Boron	ug/l	-	370	437	390	658
Cadmium	ug/l	5	<0.08	<0.08	<0.08	<0.08
Chromium	ug/l	50	6.23	<1	<1	<1
Copper	ug/l	2000	1.38	0.97	2.4	0.648
Lead	ug/l	10	<0.2	<0.2	<0.2	<0.2
Magnesium	mg/l	-				
Mercury	ug/l	1	0.0111	<0.01	<0.01	<0.01
Nickel	ug/l	4	1.51	2.4	5.58	1.31
Zinc	ug/l	500	2.1	3.49	1.78	<1
Total Organic Carbon	mg/l	-	10.4	13.1	15.4	11.9
BOD (total, 5 day)	mg/l	-				
Chemical oxygen dema	mg/l	-				
Nitrate	mg/l	50	5.98	7.99	24.2	15.9
Chloride	mg/l	250				
Phenol (Monohydric)	mg/l	0.0077	<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Acenaphthylene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Benzo (g,h,i) perylene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005
Benzo(a)anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Benzo(a)pyrene	ug/l	0.01	<0.002	<0.002	<0.002	<0.002
Benzo(b)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005
Benzo(k)fluoranthene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005
Chrysene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Dibenz-a-h-anthracene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Fluoranthene	ug/l	-	0.0124	0.0082	<0.005	<0.005
Fluorene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Indeno(1,2,3-cd)pyrene	ug/l	0.10	<0.005	<0.005	<0.005	<0.005
Napthalene	ug/l	2	<0.01	<0.01	<0.01	<0.01
Phenanthrene	ug/l	-	<0.005	<0.005	<0.005	<0.005
Pyrene	ug/l	-	0.0146	0.0086	<0.005	<0.005
Pah,Total	ug/l	-	<0.082	<0.082	<0.082	<0.082
EPH >C10-40**	ug/l	-	110	<100	<100	<100

Key

All results reported in mg/l.

–	Not sampled/analys
WQS	Water Quality Stanc
888	Exceeds Water Qua
888	Exceeds Detection I
0	Below Detection Lin
**	No WQS for EPH/T