Intended for
Vantage Data Centers DUB11 Limited

Date
February 2022

Project Number
1620012232-003

KILCARBERY SUBSTATION AND TRANSMISSION LINES

VOLUME 3: TECHNICAL APPENDICIES

RAMBOLL

Volume 3: Technical Appendices
Table of Contents

Technical Appendix 1.1: IEMA Quality Mark Checklist

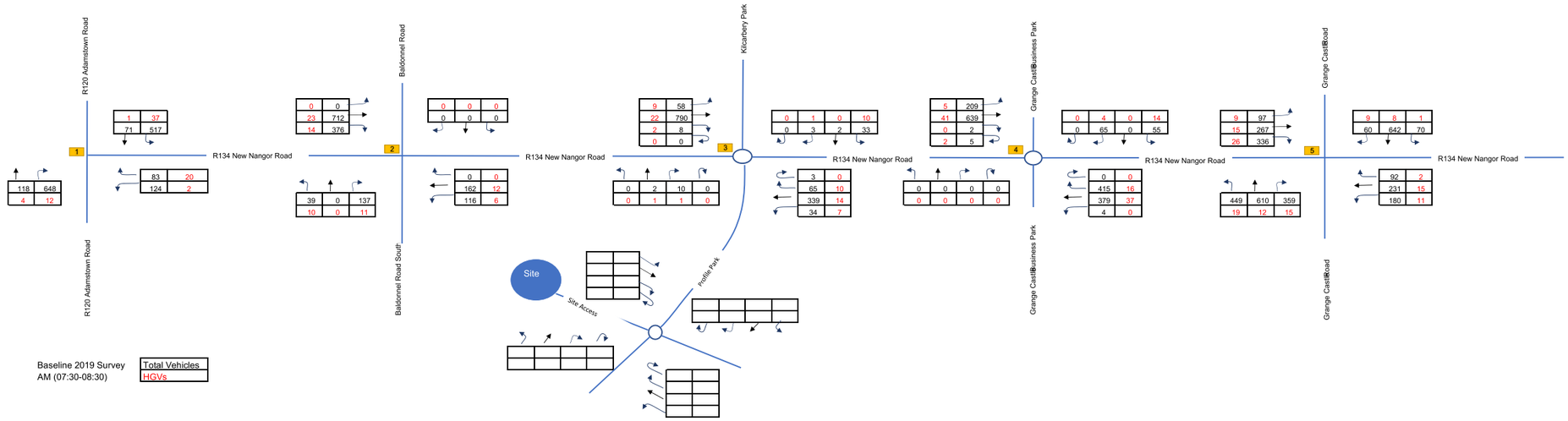
Table 1.1: IEMA Quality Mark Check	
EIA Commitment and ES Review Criteria	
EIA Commitment 1: Regulatory Compliance[1]	
a) Does the ES, in the light of the project being assessed, identify, describe and assess effects on:	√
- Human Beings	√
- Fauna & Flora	√
- Soil	√
- Water	√
- Air	√
- Climate	√
- Landscape	√
- Cultural Heritage	√
- Material Assets	√
b) Does the ES attempt to set out the interaction between the factors set out under criteria 1.a)?	√
c) Does the ES contain a clear section, or sections, providing a description of the project comprising information on the site, design and size of the project?	√
d) Does the ES contain a section, or sections, that describe the likely significant effects of the proposed project on the environment?	√
e) Does the ES contain a clear section, or sections, that provide a description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects?	√
f) Does the ES contain a clear section, or sections, that provides the data required to identify and assess the main effects which the project is likely to have on the environment?	√
g) Does the ES contain a section, or sections, that outline the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental effects?	√
h) Has a Non-Technical Summary been produced containing an outline of the information mentioned in 1c) to 1h)?	√
EIA Commitment 4: EIA Context	
A) Scoping	
i) Has the ES clearly stated what effects will be addressed and how this decision was reached?	√
ii) Are the main environmental concerns and their locations, where relevant, clearly identified with an explanation of the risks posed from the project? Including relevant environmental issues beyond the boundary of the proposal?	√
iii) Does the ES identify the environmental issues that will not be assessed and explain why they are not being considered further?	√

[1] A number of the criteria under this Commitment cover similar issues to criteria set out in the other three Commitments, below. Where this occurs IEMA recognise that there will inevitably be some overlap between the criteria. However, the assessment of the criteria under this Commitment is focussed on the presence or absence of the issue, whereas the assessment of similar criteria, within the other three Commitments, will focus on the quality of the consideration of the issue in question.

Table 1.1: IEMA Quality Mark Check	
EIA Commitment and ES Review Criteria	
iv) Is the sub-topic scope undertaken in relation to each of the topics included in the EIA appropriate and focussed	√
B) Alternatives, including iterative design	
i) Does the ES set out the main alternatives that were considered at different points during the development of the proposal?	√
ii) Are the main reasons for the selection of the proposal over distinct alternatives and design iterations easily identifiable?	√
iii) Does the ES clearly indicate how the EIA process, environmental issues and consultee responses influenced the iterative design process that led to the proposed project?	√
EIA Commitment 5: EIA Content	
A) Baseline	
i) Does the ES describe the current condition of those aspects of the environment that are likely to be significantly affected by the development?	√
ii) Is the sensitivity / importance of the baseline environment clearly evaluated?	√
iii) Are limitations in the baseline information identified and clearly set out?	√
B) Assessment	
i) Are the methods for establishing the magnitude of impacts on the receiving environment clearly defined?	√
ii) Does the ES set out a generic methodology for the assessment and evaluation of significance OR clearly explain and justify a specific method for each environmental issue?	√
iii) Does the assessment of significance consider the impact's deviation from the established baseline condition? (e.g. the sensitivity of the environment, the extent to which the impact is reversible, etc.).	√
iv) Does the ES identify the significance of impacts that would be anticipated to remain following the successful implementation of any mitigation set out in the ES?	√
vii) Does the ES give appropriate prominence to both positive and negative effects relative to their significance?	√
C) Environmental Management	
i) Does the ES describe the measures proposed to be implemented to avoid, reduce, and if possible, remedy significant adverse impacts of the proposed development?	√
ii) Is an indication of the effectiveness of the stated mitigation measures provided?	√
iii) Are details provided related to any management plans that the ES indicates should be implemented to deliver the mitigation measures and/or monitor the environmental impact of the project?	√
iv) Does the ES identify the general groups who will be responsible for the follow-up programme?	√

Table 1.1: IEMA Quality Mark Check	
EIA Commitment and ES Review Criteria	
EIA Commitment 6: EIA Communication	
A) Consultation	
i) Does the description of any consultation include details of those who were contacted, including statutory and non-statutory consultees, and the public?	√
ii) Does the main text of the ES provide a summary of the main issues raised by consultees?	√
iii) Does the ES set out if any of the issues raised by consultees will not be dealt with in the ES?	√
If so is clear justification set out as to why the issue has been scoped out?	√
B) ES Quality	
i) Does the ES provide appropriate illustrations through the use of maps and/or diagrams? In particular this should cover:	
- the location of the site, site layout and boundary,	√
- operational appearance,	√
- main environmental receptors and	√
- impacts displayed in a visual format where appropriate.	√
ii) Is the area of proposed land clearly described and indicated on an appropriate map or diagram?	√
iii) Are the anticipated timescales of construction, operation and (where appropriate) decommissioning of the proposal clearly set out in the main text?	√
iv) Is the information in the ES presented in a manner in which a non-specialist would be able to logically identify information they were seeking?	√
v) Are technical terms kept to a minimum, with a glossary provided?	√
C) Non-Technical Summary (NTS)	
i) Does the NTS provide sufficient information for the non-specialist reader to understand the main environmental impacts of the proposal without reference to the main ES?	√
ii) Are maps and diagrams included in the NTS that, at a minimum, illustrate the location of the application site, the footprint of the proposed development, and the location of relevant key features?	√
iii) Is it clear that the NTS was made available as a separate, stand-alone document to facilitate a wider readership?	√

Technical Appendix 7.1: Traffic Flow and Distribution Diagrams



KEY

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

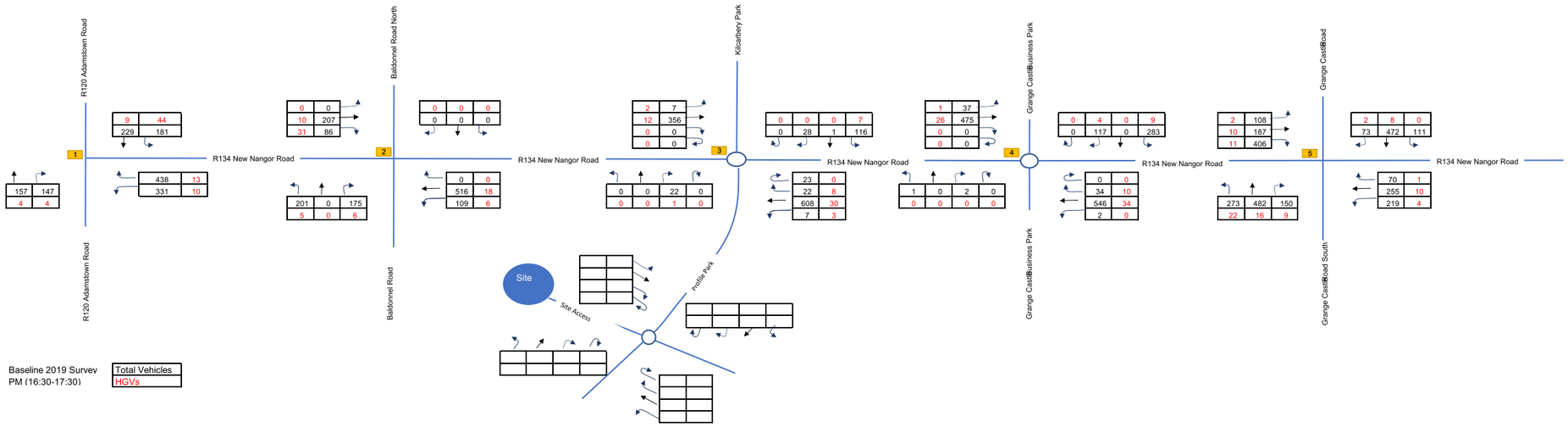
1620012232-001

Figure Title

Baseline 2019 Traffic Flows AM Peak

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.11	Revision 1



KEY

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

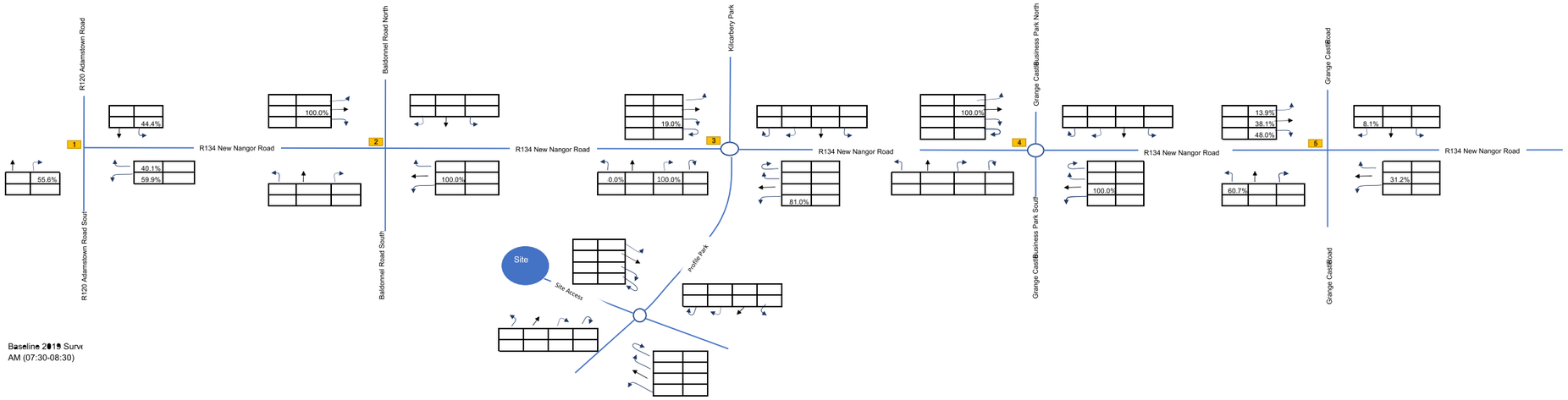
1620012232-001

Figure Title

Baseline 2019 Traffic Flows PM Peak

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.12	Revision 1



KEY

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

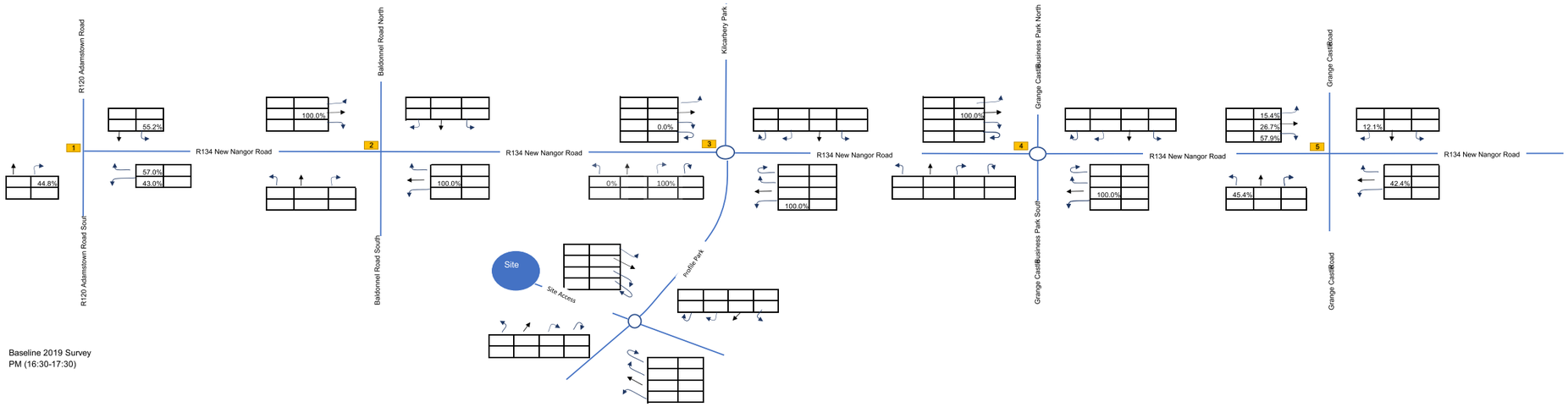
1620012232-001

Figure Title

Baseline 2019 Trip Distribution AM Peak

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.13	Revision 1



KEY

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

1620012232-001

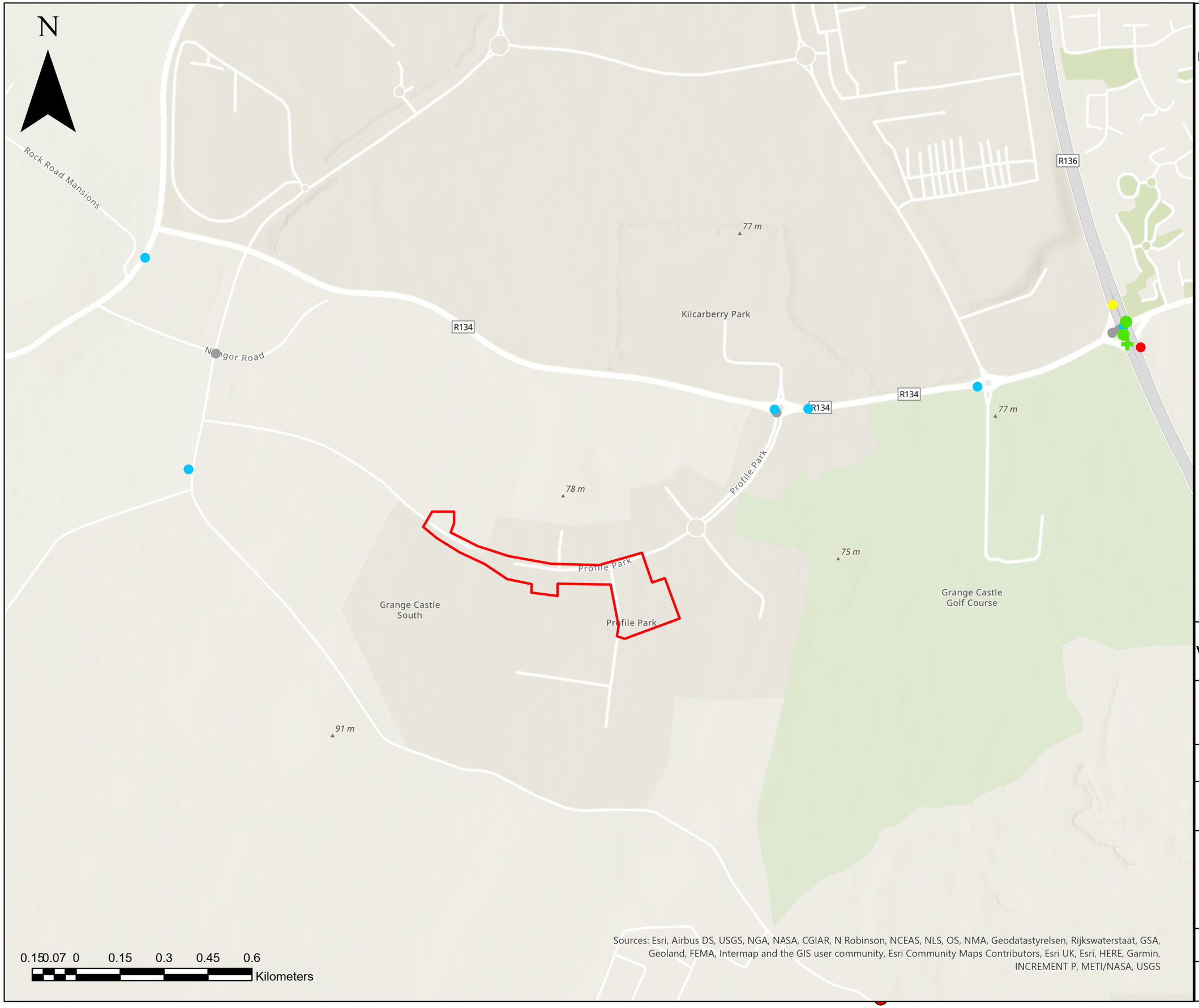
Figure Title

Baseline 2019 Trip Distribution PM Peak

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.14	Revision 1

Technical Appendix 7.2: Accident Data



KEY

KEY

- Site
- 'Slight' Accident
- 'Serious' Accident
- 'Fatal' Accident
- ACCIDENT DATA 2012
- ACCIDENT DATA 2013
- ACCIDENT DATA 2014
- ACCIDENT DATA 2015
- ACCIDENT DATA 2016

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

1620012232-001

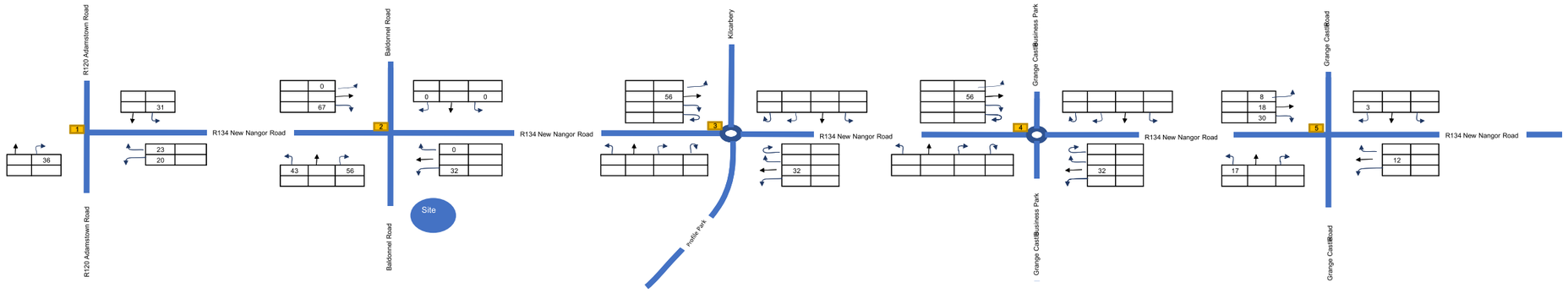
Figure Title

Accident Data

RAMBOLL

Date	Prepared By
05/07/2021	IS
Figure No.	Revision
1620012232-001/EIAR/002	1

Technical Appendix 7.3: Cumulative Schemes Daily Traffic Flow Diagrams



Cumulative Development: SD18A/0134
Operation Stage

Daily

Trip Generation

	Daily	
	Arriv	Dep
Total Vehicles	142	142

Trip Distribution:
As per the supporting EIAR, traffic accessing/egressing the site has been taken to have a 70/30 split with 70% of traffic heading north towards the Baldonnel Road/R134 junction and 30% heading south towards the Baldonnel Road / Aylmer Road junction. Trip distribution on the other junctions will be the same with the 2019 tra

KEY

Client
Vantage Data Centers Dub11 Limited

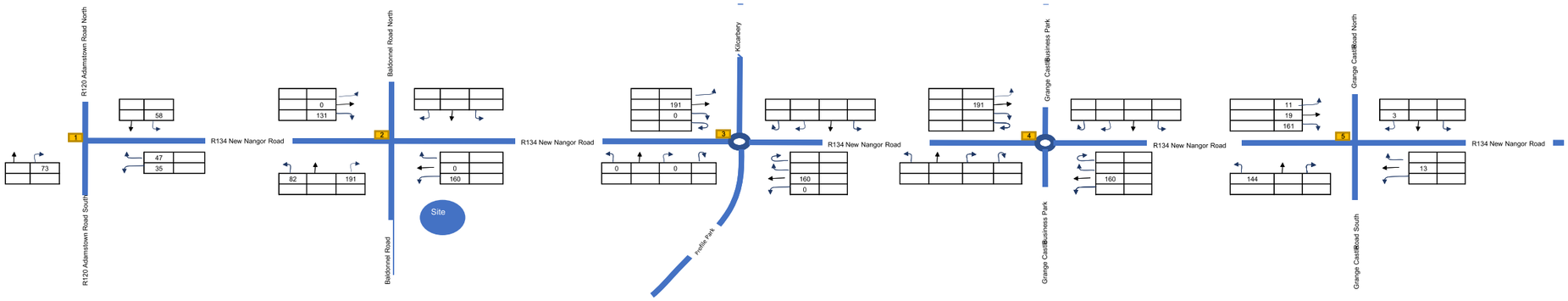
Project Title
VDC SID

Project Number
1620012232-001

Figure Title
Cumulative Scheme "SD18A/0134" Traffic Flows Daily

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.31	Revision 1



Cumulative Development: SD20A/0121
Demolition and Construction Stage

Daily

Trip Generation

	Daily	
	Arriv	Dep
Total Vehicles	420	420

SD20A/0121 (80,269sqm)
10 HGVs per hour
up to 300 vehicles per direction for commuting

Working hours: 07:00-19:00
12 hours

Trip Distribution:
Demolition and Construction traffic is distributed onto the network based upon the SD20A/0121 TIA
Light vehicle construction has been distributed across the surrounding road network in the same manner as the 2019 traffic surveys (57% of LGV arrivals to Grange Castle Busines Park are heading from Baldonnel Road South (North))
All heavy contruction traffic travels to the site from the N7 National Road and from the M50 arbital motorway via the R134 and R136 and departs along the same routes.

KEY

Client
Vantage Data Centers Dub11 Limited

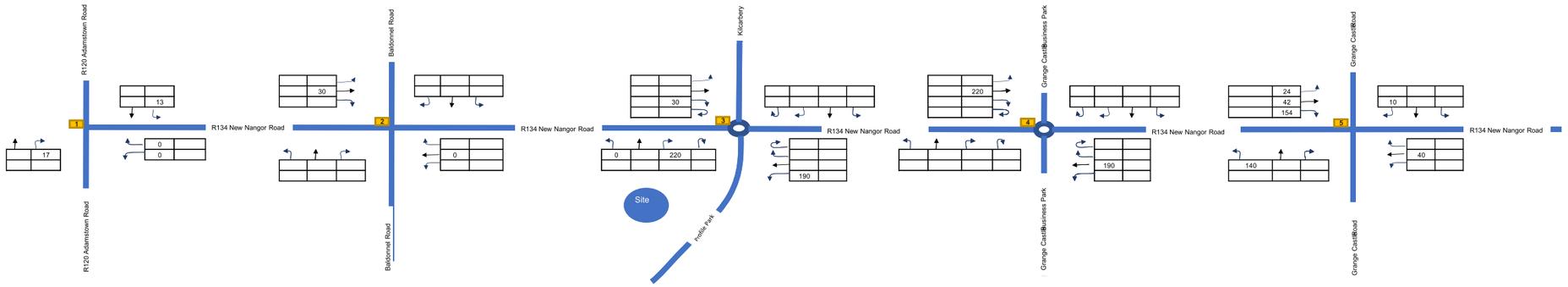
Project Title
VDC SID

Project Number
1620012232-001

Figure Title
Cumulative Scheme "SD20A/0121" Traffic Flows Daily

RAMBOLL

Date	Prepared By
28/07/2021	BVK
Figure No. 1620012232-001/EIAR/7.32	Revision 1



Cumulative Development: SA21A/0241
Demolition and Construction Stage

Daily

Trip Generation

	Daily	
	Arriv	Dep
Total Vehicles	220	220

SD20A/0121 (80,269sqm)
10 HGVs per hour
up to 300 vehicles per direction for commuting

Proposed Development (42,017sqm)
5 HGVs per hour
157 vehicles per direction for commuting

Working hours: 07:00-19:00
12 hours

Trip Distribution
Light vehicle construction has been distributed across the surrounding road network in the same manner as the 2019 traffic surveys
All heavy contruction traffic travels to the site from the N7 National Road and from the M50 arbital motorway via the R134 and R136 and departs along the same routes.

KEY

Client
Vantage Data Centers Dub11 Limited

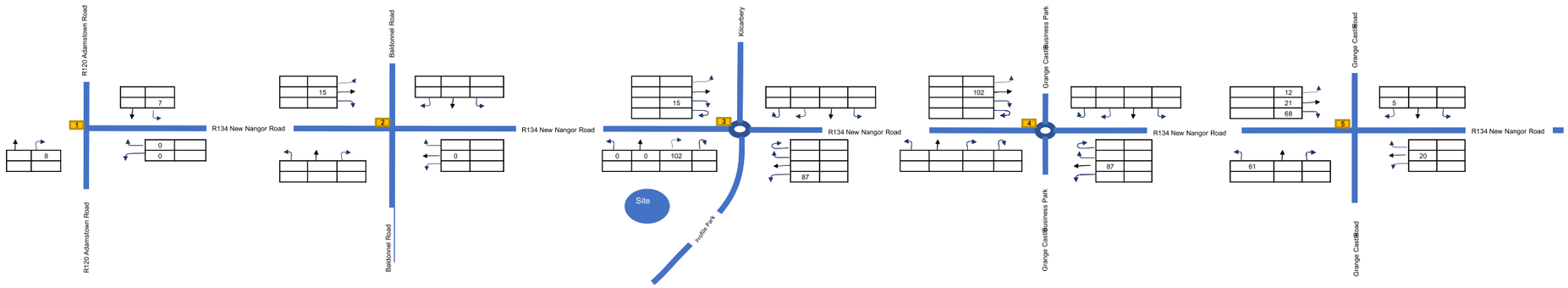
Project Title
VDC SID

Project Number
1620012232-001

Figure Title
Cumulative Scheme “SA21A/0241” Daily Traffic Flows

RAMBOLL

Date	Prepared By
22/11/2021	BVK
Figure No.	**Revision**
1620012232-001/SA21A/0241	1



Cumulative Development: SD21A/0186
Demolition and Construction Stage

Daily

Trip Generation

	Daily	
	Arriv	Dep
Total Vehicles	102	102

Trip Distribution
Light construction vehicles have been distributed across the surrounding road network in the same manner as the 2019 traffic surveys
All heavy contruction traffic travels to the site from the N7 National Road and from the M50 arbital motorway via the R134 and R136 and departs along the same routes.

KEY

Client
Vantage Data Centers Dub11 Limited

Project Title
VDC SID

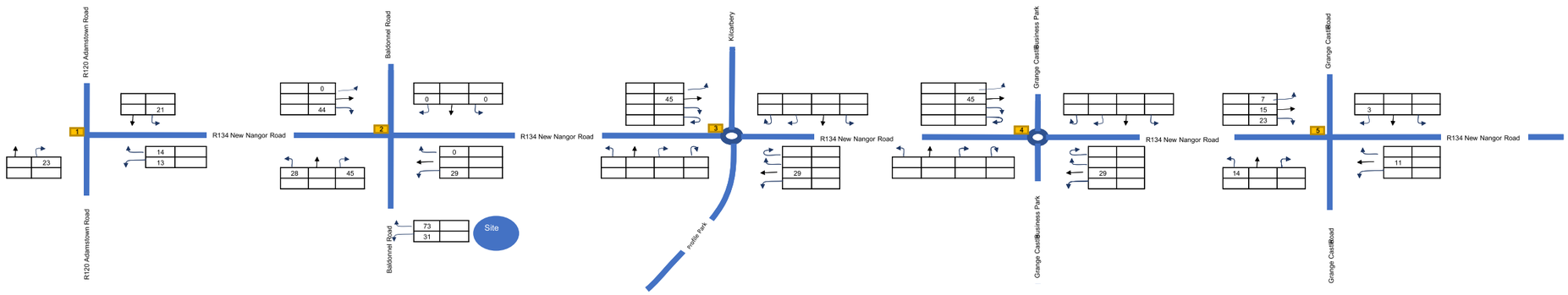
Project Number
1620012232-001

Figure Title
Cumulative Scheme "SD21A/0186" Daily Traffic Flows

RAMBOLL

Date	Prepared By
22/11/2021	BVK

Figure No.	Revision
1620012232-001/SD21A/0186	1



Cumulative Development: VA06S.309146
Demolition and Construction Stage

Daily

Trip Generation

		Daily	
		Arriv	Dep
Total Vehicles		104	104

Trip Distribution
Demolition and Construction traffic is distributed onto the network based upon theVA06S.309146 EIAR

KEY

Client

Vantage Data Centers Dub11 Limited

Project Title

VDC SID

Project Number

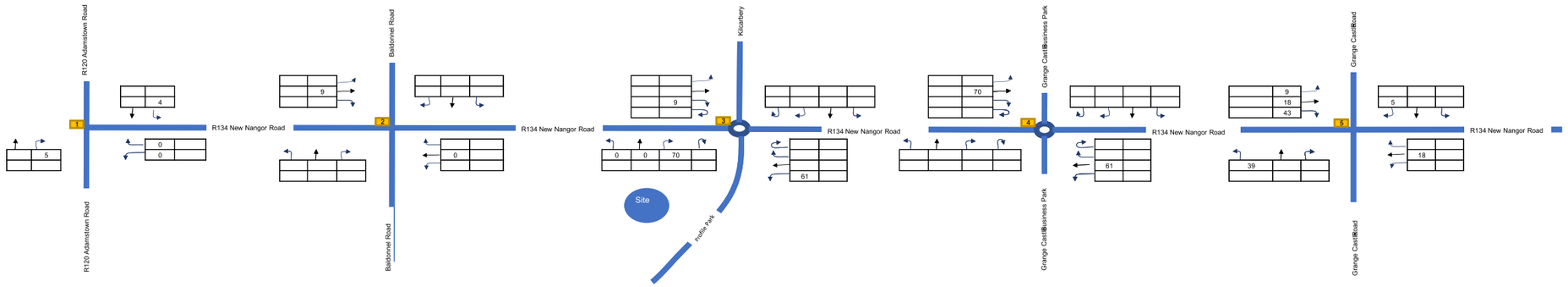
1620012232-001

Figure Title

Cumulative Scheme "VA06S.309146" Daily Traffic Flows

RAMBOLL

Date	Prepared By
22/11/2021	BVK
Figure No.	Revision
1620012232_001_VA06S_309146	1



Proposed Development
Demolition and Construction Stage

Daily

Trip Generation

	Daily	
	Arriv	Dep
Total Vehicles	70	70

Trip Distribution
Light vehicle construction has been distributed across the surrounding road network in the same manner as the 2019 traffic surveys
All heavy contruction traffic travels to the site from the N7 National Road and from the M50 arbital motorway via the R134 and R136 and departs along the same routes.

KEY

Client
Vantage Data Centers Dub11 Limited

Project Title
VDC SID

Project Number
1620012232-001

Figure Title
Proposed Development
Daily Traffic Flows

RAMBOLL

Date	Prepared By
22/11/2021	BVK
Figure No. 1620012232_001_PropDev	Revision 1

Technical Appendix 8.1: Air Quality Dust Risk Assessment Methodology

8. DUST RISK ASSESSMENT METHODOLOGY

Table 8.1: Determining Dust Emission Magnitude

Large	Medium	Small
Demolition		
• total building volume >50,000 m^3 • potentially dusty construction material (e.g. concrete) • on-site crushing and screening • demolition activities >20 m above ground level	• total building volume 20,000m^3 – 50,000 m^3 • potentially dusty construction • demolition activities 10-20 m above ground level	• total building volume <20,000 m^3 • construction material with low potential for dust release (e.g. metal cladding or timber) • demolition activities <10 m above ground • during wetter months
Earthworks		
• total site area >10,000 m^2 • potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • >10 heavy earth moving vehicles active at any one time • formation of bunds >8 m in height • total material moved >100,000 tonnes	• total site area 2,500 m^2 - 10,000 m^2 • moderately dusty soil type (e.g. silt) • 5-10 heavy earth moving vehicles active at any one time • formation of bunds 4 m – 8 m in height • total material moved 20,000 - 100,000 tonnes	• total site area <2,500 m^2 • soil type with large grain size (e.g. sand) • <5 heavy earth moving vehicles active at any one time • formation of bunds <4 m in height • total material moved <20,000 tonnes • earthworks during wetter months
Construction		
• total building volume >100,000 m^3 • piling • on-site concrete batching • sandblasting	• total building volume 25,000 m^3 - 100,000 m^3 • potentially dusty construction material (e.g. concrete) • piling • on-site concrete batching	• total building volume <25,000 m^3 • construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout		
• >50 HGV (>3.5t) movements in any one day • potentially dusty surface material (e.g. high clay content) • unpaved road length >100 m	• 10-50 HGV (>3.5t) movements in any one day • moderately dusty surface material (e.g. high clay content) • unpaved road length 50 m – 100 m	• <10 HGV (>3.5t) movements in any one day • surface material with low potential for dust release • unpaved road length <50 m

Table 8.2: Determining Receptor Sensitivity

High	Medium	Low
Sensitivities of People to Dust Soiling Effects		
• users can reasonably expect enjoyment of a high level of amenity; or • the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • the people or property would not reasonably be expected to be present continuously or regularly for extended periods as part of the normal pattern of use of the land. • indicative examples include parks and places of work.	• the enjoyment of amenity would not reasonably be expected; or • property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.
Sensitivities of People to the Health Effects of PM_{10}		
• locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	• Locations where human exposure is transient. • indicative examples include public footpaths, playing fields, parks and shopping streets.
Sensitivities of Receptors to Ecological Effects		

Table 8.2: Determining Receptor Sensitivity

• locations with an international or national designation *and* the designated features may be affected by dust soiling; or • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. • indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	• locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • locations with a national designation where the features may be affected by dust deposition. • indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	• locations with a local designation where the features may be affected by dust deposition. • indicative example is a local Nature Reserve with dust sensitive features.

Table 8.3: Determining Sensitivity of the Area - Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8.4: Determining Sensitivity of the Area – Human Health Impacts

	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	>28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	>24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium		>1	High	Medium	Low	Low	Low
Low		>1	Medium	Low	Low	Low	Low

Table 8.5: Determining Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 8.6: Determining Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8.7: Determining Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8.8: Determining Risk of Dust Impacts –Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Technical Appendix 9.1: Glossary of Noise and Vibration Terminology

9. TERMINOLOGY RELATING TO NOISE

Table 9.1: Noise Terminology

Term	Definition
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 ($_{s1}/_{s2}$). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the time period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index defined as the noise level exceeded for 90% of the time over the time period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
ree-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS5969.
BNL	The Basic Noise Level is the road traffic noise at a reference distance of 10 m from the road edge, expressed in terms of the L_{A10} statistical level (18-hour or one-hour), and calculated according by Calculation of Road Traffic Noise (CRTN) based on the traffic flow.
AAWT	Annual Average Weekday Traffic is the total number of vehicles annually (on Monday – Fridays) divided by the total number of weekdays in this period.
Rating Level ($L_{Ar,Tr}$)	To BS 4142:2014+A1:2019, the rating level is defined as the equivalent continuous A-weighted sound pressure level produced by the specific sound source over a given reference time interval, Tr plus any adjustment for the characteristic features of the sound (tonality, impulsivitys, etc).
NSR	A Noise Sensitive Receiver is any receiver that is classed as being sensitive to noise sources, (residential properties, churches, music studios etc).

Table 9.1: Noise Terminology

Term	Definition
$R_w + C_{tr}$	Weighted Sound Reduction index (R_w) with low frequency sound correction factor (C_{tr}). $R_w + C_{tr}$ is used when increased control of low frequency sound sources is required such as amplified music, and traffic or aircraft noise

TERMINOLOGY RELATING TO VIBRATION

Table 0.1: Noise Terminology

Term	Definition
VDV	Vibration Dose Value
Displacement, Acceleration and Velocity Root Mean Square (r.m.s.) and Peak Values Peak Particle Velocity (PPV)	Vibration is an oscillatory motion. The magnitude of vibration can be defined in terms of displacement (how far from the equilibrium position that something moves), velocity (how fast something moves), or acceleration (the rate of change of velocity). When describing vibration, one must specify whether peak values are used (i.e. the maximum displacement or maximum velocity) or r.m.s. / r.m.q. values (effectively an average value) are used. Standards for the assessment of building damage are usually given in terms of peak velocity (usually referred to as Peak Particle Velocity, or PPV), whilst human response to vibration is often described in terms of r.m.s. or r.m.q. acceleration.

Technical Appendix 9.2: Preliminary Construction Noise Assessment

9. PLANT ITEMS AND NOISE LEVELS USED IN THE ASSESSMENT

Table 9.1: Construction Noise Plant and Sound Power Levels Used in Assessment

Activity	Plant	Sound Power Level L_{wA} dB	No. of plant	Overall L_{wA} dB	On-time (% of hour)	Reference
Site enabling works	Wheeled excavator	94	2	97	50	BS 5228 Table C4.no.10
	Dumper	111	2	114	20	BS 5228 Table C.2 ave no.s 30-31
	Loading lorries	106	2	109	10	BS 5228 Table C1. no.7
	Scaffold erection	108	1	108	20	BS 5228 Table C.2 ave no.s 26-28
	Generator	102	1	102	100	BS 5228 Table D.7 no.1
	Electric drills	104	2	107	10	BS 5228 Table C.4 no. 32
	Metal cutter	107	2	110	5	BS 5228 Table D.6 no.54
	Electric bolter	104	2	107	10	BS 5228 Table C.1 no.18
	Road sweeper	104	1	104	10	BS 5228 Table D.6 no.54
	Telescopic handler	102	1	102	20	BS 5228 Table C.4 no.45
Demolition	Dozer	106	1	106	20	BS 5228 Table C.8 no. 6
	Pneumatic breaker	116	2	119	50	BS 5228 Table D.2 ave 7-10
	Excavator (tracked)	110	2	113	50	BS 5228 Table D.3 ave no.s 34-40
	Dumper	101	2	104	33	BS 5228 Table D.7 ave no.s 81-92
	Generator	102	1	102	10	BS 5228 Table C.4 no. 32
Substructure	Excavator (tracked)	110	2	113	50	BS 5228 Table D.3 ave no.s 34-40
	Lorry mounted concrete pump	107	2	110	80	BS 5228 Table D.6 ave no.s 34 & 36
	Dumper	101	2	104	50	BS 5228 Table D.7 ave no.s 81-92
	Road sweeper	104	2	107	30	BS 5228 Table C.4 no.90
	Generator	102	1	102	10	BS 5228 Table C.4 no. 32
	Crane	97	1	97	100	BS 5228 Table C.3 ave no.s 28-30
Superstructure	Lorry mounted concrete pump	107	2	110	50	BS 5228 Table D.6 ave no.s 34 & 36
	Crane	106	1	106	50	BS 5228 Table C.4 no. 38
	Generator	102	1	102	100	BS 5228 Table C.4 no. 32
	Electric drills	104	2	107	30	BS 5228 Table D.6 no.54
	Metal cutter	107	2	110	20	BS 5228 Table C.1 no.18
	Electric bolter	104	2	107	20	BS 5228 Table D.6 no.54
	Hydraulic access platforms	95	2	98	70	BS 5228 Table C.4 no. 57
	Road sweeper	104	2	107	10	BS 5228 Table C.4 no.90
Internal works / Fit-out	Generator	102	1	102	100	BS 5228 Table C.4 no. 32
	Welding plant	102	2	105	30	BS 5228 Table C.3 no. 31
	Electric drills	104	3	109	10	BS 5228 Table D.6 no. 54
External works	Generator	102	1	102	100	BS 5228 Table C.4 no. 32
	Excavator (tracked)	110	2	113	50	BS 5228 Table D.3 ave no.s 34-40
	Road sweeper	104	2	107	10	BS 5228 Table C.4 no.90
	Dumper	101	2	104	33	BS 5228 Table D.7 ave no.s 81-92
	Cement mixer truck	105	2	108	10	BS 5228 Table C.4 ave no.s 18 & 20

Technical Appendix 10.1: Engineering Planning Report

Clifton Scannell Emerson Associates

Engineering Planning Report - Drainage & Water Services

VDC DUB11 SUBSTATION – KILCARBERRY

Client: Vantage Data Centers

Date: 14th October 2021

Job Number: 21_115

CONSULTING ENGINEERS

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited,
Consulting Engineers, Seafort Lodge, Castledawson Avenue, Blackrock, Co. Dublin, Ireland.
T. +353 1 2885006 F. +353 1 2833466 E. info@csea.ie W. www.csea.ie

Document Control Sheet

Project Name:	VDC Dub11 Substation - Kilcarberry
Project Number:	21_115
Report Title:	Engineering Report - Drainage & Water Services
Filename:	RPT-21_115-002 Engineering Planning Report – Drainage & Water Services
CSEA Reference:	RPT-21_115-002

Issue No.	Issue Status	Date	Prepared by	Checked by
1.0	DRAFT	14/10/2021	DAB	PM
2.0	PLANNING	10/12/2021	DAB	PM
3.0	FINAL	10/02/2022	PM	PM

Table of Contents

List of Figures

List of Tables

1 Introduction

The following report is being submitted as part of the planning application for the Dub11 Substation in Profile Park, county Dublin. The report outlines the proposals for drainage services and water supply for the development.

1.1 Development Description

The proposed development primarily comprises the provision of two no. 110kV underground transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound along with associated and ancillary works and is described as follows:

The proposed 110kV GIS Substation Compound is to be located on lands to the south of those that are subject of an application for 2 no. data centres under South Dublin County Council Reg. Ref. SD21A/0241 and to the south of Falcon Avenue within Profile Park, and within an overall landholding bound to the north by Falcon Avenue, Profile Park; to the west by Casement Road, Profile Park; and to the east and south by undeveloped lands; and partly by the Digital Reality complex to the south-east within Profile Park, Clondalkin, Dublin 22. The site of the proposed development has an area of c. 3.19 hectares.

The proposed 110kV Gas Insulated Switchgear (GIS) Substation Compound includes the provision of a two storey GIS Substation building (with a gross floor area of 1,477sqm) (known as the Kilcarbery Substation), three transformers with associated ancillary equipment and enclosures, a single storey Client Control Building (with a gross floor area of 51.5sqm), lightning masts, car parking, associated underground services and roads within a 2.6m high fenced compound and all associated construction and ancillary works.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV Barnakyle Substation to the west. The proposed transmission line covers a distance of approximately 274m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass under the internal road network within Profile Park to where it will connect into the Barnakyle substation.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV underground Castlebaggot - Barnakyle circuit to the west within the Grange Castle South Business Park. The proposed transmission line covers a distance of approximately 492m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass both under, and to the north of the internal road network within Profile Park and Grange Castle Business Park South where it will connect into the Castlebaggot - Barnakyle circuit at a proposed new joint bay.

The development includes the connections to the two substations (existing and proposed) as well as to the Castlebaggot - Barnakyle circuit, associated underground services, and all associated construction and ancillary works.

Figure 1: Schematic Layout of Proposed Development

2 Surface Water

2.1 Overview

The proposed surface water is designed in accordance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS). All surface water works including connections will be carried out in accordance with the Code of Practice for Development Works – Drainage.

The catchment area of the Substation Compound subject to this planning application comprises different proposed surface finishes as shown in Table 1 below:

Table 1 Proposed Catchment Surface Finish

Ground Finish	Area m^2
Road Hardstand	2,810
Roofs	894
Stone Fill & Gravel	1,060
Concrete Footpath	494
Transformers Concrete Base	5,718

The proposed connection point for positive drainage serving the 110kV GIS substation will be to the permitted manholes which are located in the road to the north, as shown in drawing No. 21_115-CSE-00-XX-DR-C-2110. The catchment area of the transformers will be excluded from discharge to the proposed surface water network and will be connected to the proposed foul network (this will be discussed further in Section 3). Asphalt/Tarmac strips for earthing purposes under the proposed masts and along fence lines will discharge to ground via the adjacent stone fill and gravel areas. As part of the design the area of stone has been maximised with Asphalt/Tarmac strips required as part of the earthing and step & touch safety design.

2.2 Existing Surface Water Network

The existing surface water infrastructure is to the north of the site. There is a 600mm diameter concrete pipe to the north west running east-west, and a 750mm diameter concrete pipe to the north east running west to east. Given the geometry of the site, it will not be possible to tie into the pipe to the north west as its invert level of 73.59m AOD is not deep enough. The proposed surface water will tie into the manhole to the north east of the site, at an invert level of 72.40m AOD. This surface water pipe ultimately discharges into the Griffeen River to the north of the site.

2.3 Proposed Surface Water Network

Surface Water proposals for the development have been developed to mimic the natural drainage patterns of the side and in accordance with the Best Management Practices (BMPs) of Sustainable Drainage Systems (SuDS). The site drainage proposals are shown on drawing 21_115-CSE-00-XX-DR-C-2110 as part of this planning application. A full drawing list is included in Section 5 of this report. The pipe network is designed in accordance with the requirement of t Table 6.4 of the Greater Dublin Strategic Drainage Study (GDSDS) – See Figure 2 below.

Parameter	Surface Water Sewers
Minimum depth	1.2m cover under highways 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	225mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	1.0m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness – ks	0.6mm

Figure 2: Extract from GDSDS – Pipe Design Criteria

The surface water proposals include measures to attenuate and provide extensive treatment of surface water prior to discharge from the site. The measures include silt traps, land drains and oil separators to ensure the highest quality of surface water discharge in both the construction and operation phase of the proposed development.

Water is collected off the roofs through downpipes which connect into 225mm diameter uPVC pipes. Water from the roads is collected through gullies and is connected to the same 225mm diameter pipe network. The water then passes through an underground concrete attenuation tank, before passing through a hydrodynamic solid separator, a proposed hydrobrake and a NSBE010 (or equivalent) silt and oil separator with a silt capacity of 1000 litres and an oil capacity of 150 litres. The use of an underground concrete tank has been proposed based on the restriction of levels and space on site. The tank is placed beneath the proposed roadway serving HGVs (including abnormal delivery and replacement of the proposed transformers which can weigh up to 100 Tonnes), and due to the invert levels of the existing surface water network, there will not be enough cover to enable the use of a Stormtech or similar SUDS system. We also note the site will be heavily congested with underground services linking the proposed GIS Substation, Transformers, Control Building including LV, MV and HV Ducting which limits the location for surface water services.

2.3.1 Water Volumes

It is proposed to limit the discharge from the development to Greenfield runoff rates. The Greenfield runoff rate from the site has been estimated using equations in the Flood Studies Report for the estimation of the mean annual flood, more commonly known as the $Q_{BARrural}$ calculation. Discharge from the site compound will be limited to the Greenfield runoff rate using a vortex flow control unit and surface water will be attenuated within an underground tank in the north of the compound. The attenuated volume has been calculated assuming a 90% runoff rate from the roadways, 100% from roofs and using rainfall data from Met Eireann for Dublin Airport for the 1 in 100 year storm. The rainfall data has been factored up by 10% to allow for climate change.

The calculations for the Greenfield runoff rates and the attenuation volume can be found in **Appendix B**. The required attenuation volume is 285m^3 and the attenuation volume provided within the underground tank is 320m^3.

The finished floor level of the GIS building is 75.70m and the high water level in the attenuation tank will be 74.60m.

3 Proposed Foul Water Drainage

3.1 Overview

The proposed foul water drainage network collects domestic foul water from the GIS building within the Substation Compound. In addition, we note the proposed transformers are bunded and rainfall which passes through the transformer bunds is collected in the foul water network, which passes through a treatment unit (see Section 3.3) before connecting to the main foul water network in accordance with section 17.1.4 of the Greater Dublin Regional code of Practice for Drainage Works.

The proposed foul water network connects to the existing drainage network via the foul manhole (Ø300mm pipe) in road to the north of the site. Suitable oil sensors are fitted to each of the transformer bunds and in the event of an oil leak from the transformers the discharge from the bund will be automatically restricted. The proposed oil detectors will be monitored and maintained and will be connected to a monitored BMS system for immediate action.

Should the local authority require the bunds to be connected to the surface water system this can be accommodated and we request this be conditioned by agreement with the Local Authority.

The proposed foul pipe network has pipe sizes of Ø100mm and Ø225mm. The gradient of these pipes is in accordance with Section 3.6 of the Irish Water Code of Practice IW-CDS-5030-03 (Revision 2 – 2020).

3.2 Existing Foul Network

The existing foul water network is to the north of the site. There is a 300mm diameter uPVC pipe in the southern sidewalk in the road to the north. This pipe flows to the east and is approximately 6m below the existing ground level.

3.3 Proposed Foul Network

Foul water flows from the WC and mess room in the GIS building in a 100mm diameter uPVC pipe at a slope of 1:60. This is designed according to the minimum requirements as set out in Part H for drainage. Flows from the transformer bunds join the network at manhole FMH-02 from which a 225mm diameter uPVC pipe flows to the tie in manhole to the north of the site.

3.4 Pollution Control Measures on Foul Water Network

An additional foul sewer is to be provided from the transformers to capture rainwater. The drainage from transformers will pass through a Full Retention Interceptor (Type NSFA010, 100 litres oil storage capacity; or equivalent) located downstream of Manhole FMH-2.2. Details of the full retention separator are provided in **Appendix C**. The transformers' bunds will provide surface water storage during the 1 in 30 year storm event prior to discharging into the foul main. Reference to Drawing No. 21_115-CSE-00-XX-DR-C-2120. Oil Sensors and shut off valves are are proposed to be provided in the event of an oil leak from the transformers which will be monitored and maintained as discussed above.

4 Proposed Water Supply

4.1 Overview

As noted in Section 1.3 of this report, a connection application has been submitted to Irish Water and has received a connection offer. It is proposed to take a 100mm connection from the external watermain to the north of the site. This main is to feed the GIS building on the site. Water demand calculations can be found in **Appendix A**.

4.2 Existing Watermain

The existing watermain is a 250mm diameter pipe to the north of the site.

4.3 Proposed Watermain

It is proposed to take a 100mm connection from the external watermain to serve the GIS building and Transformer Compound as shown on the attached drawings. We note that water demand is minimal for the development with a single toilet and tea station in the GIS Building.

5 Accompanied Information

5.1 Planning Drawings:

This report should be read in conjunction with the following planning drawings issued in support of this application:

Table 2 Planning Drawings list

Drawing Number	Title
21_115-CSE-00-XX-DR-C-1000	OVERALL SITE LOCATION PLAN
21_115-CSE-00-XX-DR-C-1200	PROPOSED OVERALL SITE LAYOUT PLAN
21_115-CSE-00-XX-DR-C-1210	PROPOSED OVERALL ROUTE LAYOUT PLAN
21_115-CSE-00-XX-DR-C-1220	PROPOSED 110kV ROUTE LAYOUT PLAN & SECTIONS-SHEET 1
21_115-CSE-00-XX-DR-C-1221	PROPOSED 110kV ROUTE LAYOUT PLAN & SECTIONS-SHEET 2
21_115-CSE-00-XX-DR-C-1222	PROPOSED 110kV ROUTE LAYOUT PLAN & SECTIONS-SHEET 3
21_115-CSE-00-XX-DR-C-2100	SITE LOCATION MAP
21_115-CSE-00-XX-DR-C-2101	PROPOSED SITE LAYOUT & SITE LEVELS
21_115-CSE-00-XX-DR-C-2102	PROPOSED SURFACE LAYOUT
21_115-CSE-00-XX-DR-C-2105	PROPOSED FENCING LAYOUT PLAN
21_115-CSE-00-XX-DR-C-2106	PROPOSED 16.5m ARTIC HGV AUTOTRACKING
21_115-CSE-00-XX-DR-C-2107	PROPOSED 10m HGV AUTOTRACKING
21_115-CSE-00-XX-DR-C-2109	PROPOSED CLIENT & SUBSTATION ENTRANCE SIGHT LINES
21_115-CSE-00-XX-DR-C-2110	PROPOSED & EXISTING SURFACE WATER DRAINAGE LAYOUT
21_115-CSE-00-XX-DR-C-2120	PROPOSED & EXISTING FOUL WATER DRAINAGE LAYOUT
21_115-CSE-00-XX-DR-C-2130	PROPOSED & EXISTING WATERMAIN LAYOUT
21_115-CSE-00-XX-DR-C-2200	PROPOSED GRID CONNECTION CABLE ROUTE
21_115-CSE-00-XX-DR-C-2201	PROPOSED RURAL SUPPLY CABLE ROUTE

5.2 Report Appendices

The report appendices are as listed below:

Table 3 Report Appendices

Appendix	Description
Appendix A	Irish Water Pre-Connection
Appendix B	Surface Water Microdrainage Calculations
Appendix C	Proposed Full Retention Separator

Appendix A: Irish Water Pre-Connection

Appendix B: Surface Water Infodrainage Calculations

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)
SMH-11	Manhole	703705.998	730498.847	75.436	1.46
SMH-10	Manhole	703709.615	730489.146	75.42	1.518
SMH-09	Manhole	703657.28	730468.735	75.42	1.919
SMH-08	Manhole	703650.98	730466.051	75.49	2.038
SMH-07	Manhole	703643.038	730486.536	75.46	2.165
SMH-06	Manhole	703656.983	730492.036	75.42	2.232
SMH-05	Manhole	703643.588	730525.868	75.41	2.482
SMH-04	Manhole	703648.72	730530.428	75.40	2.51
SMH-01	Manhole	703673.196	730540.177	75.30	2.598
SMH-03	Manhole	703671.017	730545.18	75.58	2.917
SMH-02	Manhole	703670.204	730547.409	75.48	2.834
PI	Manhole	703668.868	730550.562	75.43	2.903
SMH=01	Manhole	703658.271	730575.573	74.99	2.59

Name	Invert Level (m)	Chamber Shape	Diameter (m)	Manhole Locked
SMH-11	73.976	Circular	1.20	☐
SMH-10	73.902	Circular	1.20	☐
SMH-09	73.501	Circular	1.20	☐
SMH-08	73.452	Circular	1.20	☐
SMH-07	73.295	Circular	1.20	☐
SMH-06	73.188	Circular	1.20	☐
SMH-05	72.928	Circular	1.20	☐
SMH-04	72.89	Circular	1.20	☐
SMH-01	72.702	Circular	1.20	☐
SMH-03	72.663	Circular	1.20	☐
SMH-02	72.646	Circular	1.20	☐
PI	72.522	Circular	1.20	☐
SMH=01	72.40	Circular	1.20	☐

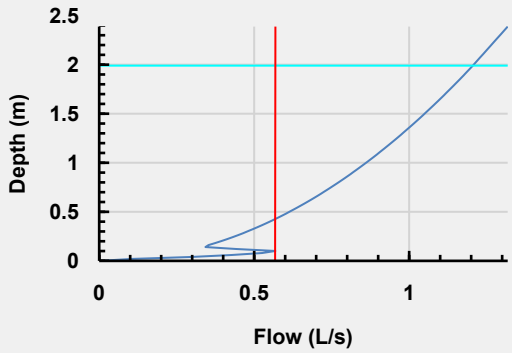
VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Inlets

Junction	Inlet Name	Incoming Item(s)	Bypass Destination	Capacity Type
SMH-11	Inlet (1)	Catchment Area	(None)	No Restriction
SMH-10	Inlet	P1.000 Catchment Area (1)	(None)	No Restriction
SMH-09	Inlet	P1.001 Catchment Area (3)	(None)	No Restriction
	Inlet (1)	Catchment Area (2)	(None)	No Restriction
SMH-08	Inlet	P1.002 P2.000	(None)	No Restriction
	Inlet (1)	Catchment Area (9)	(None)	No Restriction
SMH-07	Inlet	P1.003 Catchment Area (8)	(None)	No Restriction
	Inlet (1)	Catchment Area (7)	(None)	No Restriction
SMH-06	Inlet	P1.004	(None)	No Restriction
	Inlet (1)	P3.000	(None)	No Restriction
	Inlet (2)	Catchment Area (6)	(None)	No Restriction
SMH-05	Inlet	P1.005 Catchment Area (12) Catchment Area (15) Catchment Area (20)	(None)	No Restriction
	Inlet (1)	P4.000 Catchment Area (11) Catchment Area (14) Catchment Area (13)	(None)	No Restriction
	Inlet (2)	Catchment Area (17)	(None)	No Restriction
SMH-04	Inlet	P1.007 Catchment Area (21)	(None)	No Restriction
	Inlet (2)	Catchment Area (19)	(None)	No Restriction
SMH-01	Inlet	P1.008	(None)	No Restriction
	Inlet (1)	Catchment Area (18) Catchment Area (22)	(None)	No Restriction
SMH-03	Inlet	P1.009	(None)	No Restriction
SMH-02	Inlet	P1.010	(None)	No Restriction
PI	Inlet	P1.011	(None)	No Restriction
SMH=01	Inlet	P1.012	(None)	No Restriction

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Outlets

Junction	Outlet Name	Outgoing Connection	Outlet Type
SMH-11	Outlet	P1.000	Free Discharge
SMH-10	Outlet	P1.001	Free Discharge
SMH-09	Outlet	P1.002	Free Discharge
SMH-08	Outlet	P1.003	Free Discharge
SMH-07	Outlet	P1.004	Free Discharge
SMH-06	Outlet	P1.005	Free Discharge
SMH-05	Outlet	P1.006	Free Discharge
SMH-04	Outlet	P1.008	Free Discharge
SMH-01	Outlet	P1.009	Free Discharge
SMH-03	Outlet	P1.010	Free Discharge
SMH-02	Outlet	P1.011	Hydro-Brake®
	Invert Level (m)	72.65	
	Design Depth (m)	1.99	
	Design Flow (L/s)	1.2	
	Objective	Minimise Upstream Storage Requirements	
	Application	Surface Water Only	
	Sump Available	☐	
	Unit Reference	CHE-0042-1200-1990-1200	
			
PI	Outlet	P1.012	Free Discharge

Tank

Type : Tank

Dimensions

Exceedence Level (m)	75.40
Depth (m)	2.51
Base Level (m)	72.89
Freeboard (mm)	800
Initial Depth (m)	0.00
Porosity (%)	100
Average Slope (1:x)	0.00
Total Volume (m³)	326.039

Depth (m)	Area (m²)	Volume (m³)
0.000	190.666066	0.000
2.493	190.666066	475.331

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	P1.006
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	P1.007
Outlet Type	Free Discharge

Advanced

Perimeter	Square
Length (m)	19.01

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Connections Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Name	Length (m)	Connection Type	Slope (1:x)	Manning's n	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)	Downstream Cover Level (m)
P1.000	10.35	Pipe	140.000	0.013	225	75.436	73.976	75.42
P1.001	56.17	Pipe	140.000	0.013	225	75.420	73.902	75.42
P1.002	6.85	Pipe	140.000	0.013	225	75.420	73.501	75.49
Branch: P2.000								
P2.000	16.92	Pipe	75.865	0.013	225	75.590	73.710	75.49
P1.003	21.97	Pipe	140.000	0.013	225	75.490	73.452	75.46
P1.004	14.99	Pipe	140.000	0.013	225	75.460	73.295	75.42
Branch: P3.000								
P3.000	50.18	Pipe	110.277	0.013	225	75.385	73.660	75.42
P1.005	36.39	Pipe	140.000	0.013	225	75.420	73.188	75.41
Branch: P4.000								
P4.000	30.13	Pipe	95.635	0.013	225	75.770	73.243	75.41
P1.006	2.92	Pipe	140.000	0.013	225	75.410	72.928	75.40
P1.007	2.37	Pipe	140.000	0.013	225	75.400	72.907	75.40
P1.008	26.35	Pipe	140.000	0.013	225	75.400	72.890	75.30
P1.009	5.46	Pipe	140.000	0.013	225	75.300	72.702	75.58
P1.010	2.37	Pipe	140.000	0.013	225	75.580	72.663	75.48
P1.011	3.42	Pipe	140.000	0.013	225	75.480	72.646	75.43
P1.012	27.16	Pipe	222.649	0.013	225	75.425	72.522	74.99

Name	Downstream Invert Level (m)	Flow Restriction (L/s)
P1.000	73.902	
P1.001	73.501	
P1.002	73.452	
Branch: P2.000		
P2.000	73.487	
P1.003	73.295	
P1.004	73.188	
Branch: P3.000		
P3.000	73.205	
P1.005	72.928	
Branch: P4.000		
P4.000	72.928	
P1.006	72.907	
P1.007	72.890	
P1.008	72.702	
P1.009	72.663	
P1.010	72.646	
P1.011	72.622	1.3
P1.012	72.400	

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Manhole Schedule Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Name	Cover Level (m) Invert Level (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
SMH-11	75.436 73.976	Diameter / Length: 1.20					Manhole - Access not Required
E:703705.998 N:730498.847	1.46		{a} P1.000	Pipe	73.98	Diam/Width:225	Not Applicable
SMH-10	75.42 73.902	Diameter / Length: 1.20	{1} P1.000	Pipe	73.90	Diam/Width:225	Manhole - Access not Required
E:703709.615 N:730489.146	1.518		{a} P1.001	Pipe	73.90	Diam/Width:225	Not Applicable
SMH-09	75.42 73.501	Diameter / Length: 1.20	{1} P1.001	Pipe	73.50	Diam/Width:225	Manhole - Access not Required
E:703657.28 N:730468.735	1.919		{a} P1.002	Pipe	73.50	Diam/Width:225	Not Applicable
SMH-08	75.49 73.452	Diameter / Length: 1.20	{1} P1.002 {2} P2.000	Pipe Pipe	73.45 73.49	Diam/Width:225 Diam/Width:225	Manhole - Access not Required
E:703650.98 N:730466.051	2.038		{a} P1.003	Pipe	73.45	Diam/Width:225	Not Applicable
SMH-07	75.46 73.295	Diameter / Length: 1.20	{1} P1.003	Pipe	73.29	Diam/Width:225	Manhole - Access not Required
E:703643.038 N:730486.536	2.165		{a} P1.004	Pipe	73.29	Diam/Width:225	Not Applicable

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Manhole Schedule Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Name	Cover Level (m) Invert Level (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
SMH-06	75.42 73.188	Diameter / Length: 1.20	{1} P1.004	Pipe	73.19	Diam/Width:225	Manhole - Access not Required
E:703656.983 N:730492.036	2.232		{2} P3.000	Pipe	73.21	Diam/Width:225	
			{a} P1.005	Pipe	73.19	Diam/Width:225	Not Applicable
SMH-05	75.41 72.928	Diameter / Length: 1.20	{1} P1.005	Pipe	72.93	Diam/Width:225	Manhole - Access not Required
E:703643.588 N:730525.868	2.482		{2} P4.000	Pipe	72.93	Diam/Width:225	
			{a} P1.006	Pipe	72.93	Diam/Width:225	Not Applicable
SMH-04	75.40 72.89	Diameter / Length: 1.20	{1} P1.007	Pipe	72.89	Diam/Width:225	Manhole - Access not Required
E:703648.72 N:730530.428	2.51		{a} P1.008	Pipe	72.89	Diam/Width:225	Not Applicable
SMH-01	75.30 72.702	Diameter / Length: 1.20	{1} P1.008	Pipe	72.70	Diam/Width:225	Manhole - Access not Required
E:703673.196 N:730540.177	2.598		{a} P1.009	Pipe	72.70	Diam/Width:225	Not Applicable

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Manhole Schedule Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Name	Cover Level (m) Invert Level (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
SMH-03	75.58 72.663	Diameter / Length: 1.20	{1} P1.009	Pipe	72.66	Diam/Width:225	Manhole - Access not Required
E:703671.017 N:730545.18	2.917		{a} P1.010	Pipe	72.66	Diam/Width:225	Not Applicable
SMH-02	75.48 72.646	Diameter / Length: 1.20	{1} P1.010	Pipe	72.65	Diam/Width:225	Manhole - Access not Required
E:703670.204 N:730547.409	2.834		{a} P1.011	Pipe	72.65	Diam/Width:225	Not Applicable
PI	75.43 72.522	Diameter / Length: 1.20	{1} P1.011	Pipe	72.62	Diam/Width:225	Manhole - Access not Required
E:703668.868 N:730550.562	2.903		{a} P1.012	Pipe	72.52	Diam/Width:225	Not Applicable
SMH=01	74.99 72.40	Diameter / Length: 1.20	{1} P1.012	Pipe	72.40	Diam/Width:225	Manhole - Access not Required
E:703658.271 N:730575.573	2.59						Not Applicable

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Inflow Summary Storm Phase: SW drainage Flow Path: Flow Path	Company Address:		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (km²)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (km²)
Catchment Area	SMH-11		Time of Concentration	0.00027	100	0	100	0.00027
Catchment Area (1)	SMH-10		Time of Concentration	0.00014	90	0	90	0.00013
Catchment Area (3)	SMH-09		Time of Concentration	0.00027	100	0	100	0.00027
Catchment Area (2)	SMH-09		Time of Concentration	0.00049	90	0	90	0.00044
Branch: P2.000								
Catchment Area (10)	SMH-7.1		Time of Concentration	0.00004	90	0	90	0.00004
Catchment Area (9)	SMH-08		Time of Concentration	0.00041	90	0	90	0.00037
Catchment Area (8)	SMH-07		Time of Concentration	0.00031	100	0	100	0.00031
Catchment Area (7)	SMH-07		Time of Concentration	0.00024	90	0	90	0.00022
Branch: P3.000								
Catchment Area (5)	SMH-6.1		Time of Concentration	0.00038	90	0	90	0.00034
Catchment Area (4)	SMH-6.1		Time of Concentration	0.00028	100	0	100	0.00028
Catchment Area (6)	SMH-06		Time of Concentration	0.00024	90	0	90	0.00022
Branch: P4.000								
Catchment Area (16)	SMH-5.1		Time of Concentration	0.00011	90	0	90	0.00010
Catchment Area (12)	SMH-05		Time of Concentration	0.00059	50	0	50	0.00030
Catchment Area (15)	SMH-05		Time of Concentration	0.00046	100	0	100	0.00046
Catchment Area (20)	SMH-05		Time of Concentration	0.00019	50	0	50	0.00010
Catchment Area (11)	SMH-05		Time of Concentration	0.00018	90	0	90	0.00017
Catchment Area (14)	SMH-05		Time of Concentration	0.00016	100	0	100	0.00016
Catchment Area (13)	SMH-05		Time of Concentration	0.00004	50	0	50	0.00002
Catchment Area (17)	SMH-05		Time of Concentration	0.00034	90	0	90	0.00031
Catchment Area (21)	SMH-04		Time of Concentration	0.00012	50	0	50	0.00006
Catchment Area (19)	SMH-04		Time of Concentration	0.00005	90	0	90	0.00004
Catchment Area (18)	SMH-01		Time of Concentration	0.00019	90	0	90	0.00017
Catchment Area (22)	SMH-01		Time of Concentration	0.00012	50	0	50	0.00006
TOTAL		**0.0**		**0.00564**				**0.00482**

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Network Design Criteria Storm Phase: SW drainage	Company Address:		

Flow Options

Peak Flow Calculation	Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Level	Level Inverts
Min. Cover Depth (m)	1.20
Min. Slope (1:x)	1000.00
Max. Slope (1:x)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☑
Reduce Channel Depths	☑

Pipe Size Library

Default

Add. Increment (mm)	75

Diameter (mm)	Min. Slope (1:x)	Max. Slope (1:x)
100	0.00	0.00
150	0.00	0.00

Manhole Options

Apply Offset	☐
Synchronise Manhole Invert Levels	☑

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Outfall Details Storm Phase: SW drainage	Company Address:		

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
SMH=01	Free Discharge		

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

Runoff Type	Dynamic
Output Interval (mins)	1
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

Rainfall

FSR

Type: FSR

Region	Scotland and Ireland
M5-60 (mm)	17.0
Ratio R	0.300
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0
30.0	0
100.0	10

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880
2880	5760

ICP SUDS / IH 124

Details

Method	ICP SUDS
Area (km²)	0.006
SAAR (mm)	775.0
Soil	0.3
Region	Ireland Greater Dublin
Urban	0
Return Period (years)	0

Results

Region	QBAR Rural (L/s)	QBAR Urban (L/s)	Q 1 (years) (L/s)	Q 30 (years) (L/s)	Q 100 (years) (L/s)
Ireland Greater Dublin	1.2	1.2	1.0	2.6	3.2

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: SW drainage	Company Address:		

Critical Storm

Inflow	Storm Event	Inflow Area (km^2)	Max. Inflow (L/s)	Total Inflow (m^3)
Catchment Area	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	10.2	4.736
Catchment Area (1)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	4.9	2.282
Catchment Area (2)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	16.8	7.778
Catchment Area (3)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	10.3	4.777
Catchment Area (4)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	10.7	4.968
Catchment Area (5)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	13.1	6.074
Catchment Area (6)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	8.4	3.876
Catchment Area (7)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	8.3	3.846
Catchment Area (8)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	11.7	5.426
Catchment Area (9)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	14.2	6.574
Catchment Area (10)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	1.4	0.658
Catchment Area (11)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	6.3	2.924
Catchment Area (12)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	11.4	5.253
Catchment Area (13)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	0.8	0.360
Catchment Area (14)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	6.1	2.814
Catchment Area (15)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	17.8	8.241
Catchment Area (16)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	3.7	1.723
Catchment Area (17)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	11.9	5.493
Catchment Area (18)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	6.4	2.963
Catchment Area (19)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	1.7	0.775

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: SW drainage	Company Address:		

Catchment Area (20)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	3.7	1.690
Catchment Area (21)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	2.3	1.080
Catchment Area (22)	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	0.00	2.4	1.105

Critical Storm

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: SW drainage	Company Address:		

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
SMH-11	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.44	73.98	74.86	0.88	12.9	1.001	0.000	9.4	4.917	Surcharged
SMH-10	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.42	73.90	74.86	0.96	17.1	1.083	0.000	14.1	7.708	Surcharged
SMH-09	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.42	73.50	74.83	1.33	35.5	1.501	0.000	28.3	20.131	Surcharged
SMH-08	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.49	73.45	74.80	1.35	41.6	1.523	0.000	38.7	27.955	Surcharged
SMH-07	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.46	73.30	74.64	1.35	48.7	1.525	0.000	50.1	36.055	Surcharged
SMH-06	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.42	73.19	74.46	1.27	71.3	1.433	0.000	72.1	50.240	Surcharged
SMH-05	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.41	72.93	74.39	1.46	5.7	1.649	0.000	5.7	408.590	Surcharged
SMH-04	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.40	72.89	74.39	1.50	1.1	1.692	0.000	1.1	287.393	Surcharged
SMH-01	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.30	72.70	74.39	1.68	1.1	1.905	0.000	1.1	306.739	Surcharged
SMH-03	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.58	72.66	74.39	1.72	1.1	1.949	0.000	1.1	305.608	Surcharged
SMH-02	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.48	72.65	74.39	1.74	1.1	1.968	0.000	1.1	304.432	Surcharged
SMH=01	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	74.99	72.40	72.43	0.03	1.1	0.000	0.000	1.1	304.342	OK
SMH-5.1	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.77	73.24	74.39	1.14	0.1	1.293	0.000	0.1	8.137	Surcharged
SMH-6.1	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.39	73.66	74.53	0.87	23.9	0.987	0.000	19.1	10.861	Surcharged
SMH-7.1	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	75.59	73.71	74.80	1.09	15.3	1.233	0.000	5.1	1.824	Surcharged
PI	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	75.43	72.52	72.55	0.03	1.1	0.034	0.000	1.1	304.342	OK

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: SW drainage	Company Address:		

Critical Storm

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Tank	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	74.39	74.39	1.50	1.50	5.7	285.254	0.000	0.000	1.1	279.117	13	OK

VDC Dub11 Substation Kilcarberry:	Date: 08/12/2021		
	Designed by: DAB	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: SW drainage	Company Address:		

Critical Storm

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
P1.000	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-11	SMH-10	75.4	74.86	0.22	4.751	0.7	0.25	9.4	Surcharged
P1.001	FSR: 100 years: Increase Rainfall (%): +10: 30 mins: Summer	Pipe	SMH-10	SMH-09	75.4	74.68	0.22	8.509	0.4	0.39	14.7	Surcharged
P1.002	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-09	SMH-08	75.4	74.83	0.22	19.587	0.8	0.75	28.3	Surcharged
P1.003	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-08	SMH-07	75.5	74.80	0.22	26.820	1.0	1.02	38.7	Surcharged
P1.004	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-07	SMH-06	75.5	74.64	0.22	36.055	1.3	1.32	50.1	Surcharged
P1.005	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-06	SMH-05	75.4	74.46	0.22	50.031	1.8	1.9	72.1	Surcharged
P1.008	FSR: 30 years: Increase Rainfall (%): +0: 30 mins: Summer	Pipe	SMH-04	SMH-01	75.4	73.23	0.22	1.424	0.2	0.16	6.2	Surcharged
P1.009	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Summer	Pipe	SMH-01	SMH-03	75.3	73.25	0.22	2.504	0.4	0.16	5.9	Surcharged

P1.010	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Summer	Pipe	SMH-03	SMH-02	75.6	73.25	0.22	1.661	0.5	0.08	3.0	Surcharged
P4.000	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Summer	Pipe	SMH-5.1	SMH-05	75.8	73.53	0.22	1.526	0.1	0.11	4.9	Surcharged
P3.000	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Summer	Pipe	SMH-6.1	SMH-06	75.4	74.40	0.22	9.674	0.5	0.45	19.5	Surcharged
P2.000	FSR: 30 years: Increase Rainfall (%): +0: 15 mins: Winter	Pipe	SMH-7.1	SMH-08	75.6	74.05	0.22	0.474	0.2	0.11	5.5	Surcharged
P1.006	FSR: 100 years: Increase Rainfall (%): +10: 15 mins: Winter	Pipe	SMH-05	Tank	75.4	73.56	0.22	76.100	3.0	3.18	120.6	Surcharged
P1.007	FSR: 1 years: Increase Rainfall (%): +0: 15 mins: Winter	Pipe	Tank	SMH-04	75.4	73.01	0.11	1.420	0.6	0.16	6.1	OK
P1.011	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	Pipe	SMH-02	PI	75.5	74.39	0.03	304.405	0.4	0.03	1.1	Surcharged
P1.012	FSR: 100 years: Increase Rainfall (%): +10: 2880 mins: Winter	Pipe	PI	SMH=01	75.4	72.55	0.03	304.342	0.4	0.04	1.1	OK

Appendix C: Proposed Full Retention Separator

Full Retention NSF RANGE

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Kingspan Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Automatic closure device.
- Oil storage volume.
- Coalescer (Class I units only).

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.

- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size full retention separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m²) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction GRP chamber construction

Full Retention Separators

NSF RANGE

Kingspan NSF range achieved on average <1mg/l under EN 858-1 testing conditions

Performance

Kingspan were the first UK manufacturer to have the required range (3-30 l sec) certified to BS EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates. The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they meet the effluent quality requirements of BS EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity
- Oil storage volume
- Silt storage capacity
- Coalescer (Class I units only)
- Automatic closure device.

Kingspan full retention separators treat the whole of the specified flow.

Features

- Light and easy to install
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI
- Inclusive of silt storage volume
- Fitted inlet/outlet connectors
- Oil alarm system available
- Vent points within necks
- Extension access shafts for deep inverts
- Maintenance from ground level
- GRP or rotomoulded construction (subject to model)

To specify a nominal size full retention separator, the following information is needed:

- The calculated flow rate for the drainage area served. Our designs are based on the assumptions that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped
- The required discharge standard
- The drain invert inlet depth
- Pipework type, size and orientation.

Technical Specifications

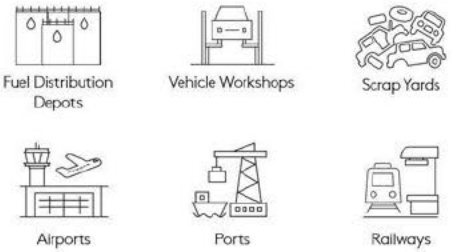
Unit Nominal Size	Flow (l/s)	Drainage Area (m²) PPG3 (0.018)	Storage Capacity (Ltrs)		Maximum Total Capacity (litres)	Length (mm)	Unit Dia. (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm	Min. Inlet Invert (mm)	Standard Pipework Dia. (mm)	No. of Coalescer Assemblies
			Silt	Oil								
NSFA210	210	11,667	21,000	2100	59,060	11,991	2820	2550	2450	1000	600	5
NSFA225	225	12,500	22,500	2250	63,000	12,760	2820	2550	2450	1000	600	5
NSFA240	240	13,333	24,000	2400	67,000	13,527	2820	2550	2450	1000	600	5
NSFA255	255	14,167	25,500	2550	71,000	14,295	2820	2550	2450	1000	600	6
NSFA270	270	15,000	27,000	2700	75,000	15,065	2820	2550	2450	1000	600	6
NSFA285	285	15,833	28,500	2850	79,000	15,833	2820	2550	2450	1000	600	6

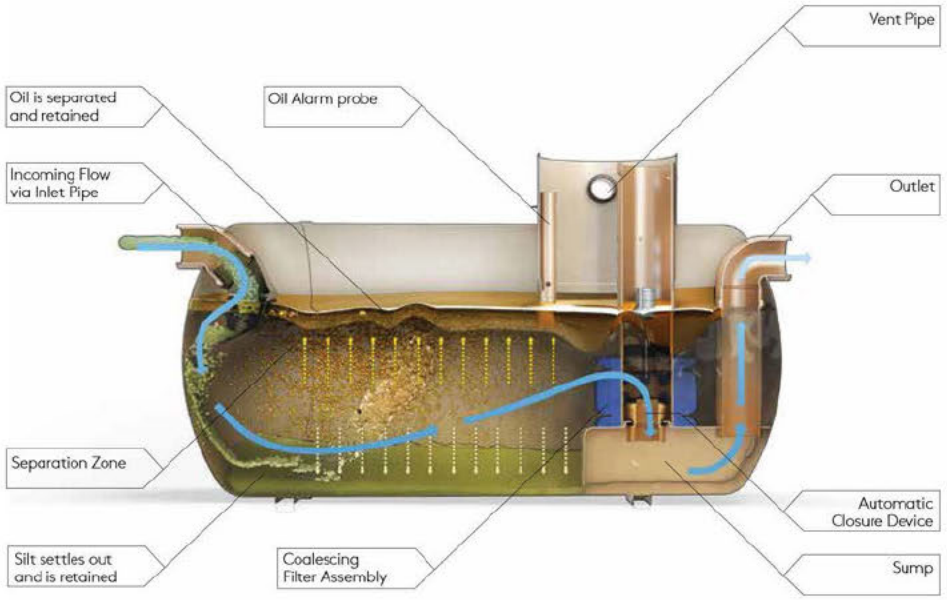
Model Reference	Flow (l/s)	Drainage Area (m2) PPG-3 (0.018)	Storage Capacity (Ltrs)		Length (mm)	Diameter (mm)	Manhole Cover Dimensions (mm)	Base Inlet Invert (mm)	Base to Outlet Invert (mm)	Min Inlet Invert (mm)	Standard Pipework Diameter (mm)
			Silt	Oil							
Polyethylene Chamber Construction											
NSFP003	3	170	300	30	1700	1350	600	1410	1335	550	160
NSFP006	6	335	600	60	1700	1350	600	1410	1335	550	160
GRP Chamber Construction											
NSFA010	10	555	1000	100	2610	1225	600	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	600	1050	1000	1000	200
NSFA020	20	1115	2000	200	3200	2010	600	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	600	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	600	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	600	1810	1760	1000	315
NSFA065	65	3160	6500	650	6850	2010	600	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	600	2500	2450	1000	315
NSFA100	100	5560	10000	1000	6200	2820	600	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	600	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	600	2500	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	600	2500	2450	1000	525
NSFA200	200	11110	20000	2000	11,280	2820	600	2500	2450	1000	600

** Systems to cater for larger flow rates are available on request. Email water-ME@kingspan.com for further information*
** Some units have more than one access shaft – diameter of largest shown.*

Applications

Full retention separators are used in high risk spillage areas such as:





Clifton Scannell Emerson Associates Limited, Civil & Structural Consulting Engineers
Seafort Lodge, Castledawson Avenue, Blackrock, Co. Dublin, Ireland.

T. +353 1 288 5006 F. +353 1 283 3466 E. info@csea.ie W. www.csea.ie

Technical Appendix 10.2: Flood Risk Assessment

Clifton Scannell Emerson Associates

Dub11 Substation - Kilcarberry

Flood Risk Assessment

Client: Vantage Data Centers

Date: 6th October 2021

Job Number: 21_115

CONSULTING ENGINEERS

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited,
Consulting Engineers, Seafort Lodge, Castlesdawson Avenue, Blackrock, Co. Dublin, Ireland.
T. +353 1 2885006 F. +353 1 2833466 E. info@csea.ie W. www.csea.ie

Document Control Sheet

Project Name:	VDC Dub11 Substation - Kilcarberry
Project Number:	21_115
Report Title:	Flood Risk Assessment
Filename:	RPT-21_115-001 Flood Risk Assessment
CSEA Reference:	RPT-21_115-001

Issue No.	Issue Status	Date	Prepared by	Checked by
1.0	DRAFT	2021-10-22	DAB	PM
2.0	PLANNING	2021-12-09	DAB	PM
3.0	FINAL	2022-02-10	PM	PM

Table of Contents

1. Introduction

Clifton Scannell Emerson Associates were requested to undertake a Flood Risk Assessment (FRA) to support the submission of a planning application by Vantage Data Centers for the proposed Substation development in Kilcarbery, Profile Park, County Dublin. The proposed development is of a brownfield site of approximately 0.6 Hectares. The site lies approximately 700m north of Casement Aerodrome and 12km west of Dublin City Centre, and is accessed from the R134 New Nangor Road.

The proposed development primarily comprises the provision of two no. 110kV underground transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound along with associated and ancillary works and is described as follows:

Figure 1: Aerial view of site

The proposed 110kV GIS Substation Compound is to be located on lands to the south of those that are subject of an application for 2 no. data centres under South Dublin County Council Reg. Ref. SD21A/0241 and to the south of Falcon Avenue within Profile Park, and within an overall landholding bound to the north by Falcon Avenue, Profile Park; to the west by Casement Road, Profile Park; and to the east and south by undeveloped lands; and partly by the Digital Reality complex to the south-east within Profile Park, Clondalkin, Dublin 22. The site of the proposed development has an area of c. 3.19 hectares.

The proposed 110kV Gas Insulated Switchgear (GIS) Substation Compound includes the provision of a two storey GIS Substation building (with a gross floor area of 1,477sqm) (known as the Kilcarbery Substation), three transformers with associated ancillary equipment and enclosures, a single storey Client Control Building (with a gross floor area of 51.5sqm), lightning masts, car parking, associated underground services and roads within a 2.6m high fenced compound and all associated construction and ancillary works.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV Barnakyle Substation to the west. The proposed transmission line covers a distance of approximately 274m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass under the internal road network within Profile Park to where it will connect into the Barnakyle substation.

One proposed underground single circuit 110kV transmission line will connect the proposed Kilcarbery 110kV GIS Substation to the existing 110kV underground Castlebaggot - Barnakyle circuit to the west within the Grange Castle South Business Park. The proposed transmission line covers a distance of approximately 492m within the townlands of Aungierstown and Ballybane, and Kilbride and will pass both under, and to the north of the internal road network within Profile Park and Grange Castle Business Park South where it will connect into the Castlebaggot - Barnakyle circuit at a proposed new joint bay.

The development includes the connections to the two substations (existing and proposed) as well as to the Castlebaggot - Barnakyle circuit, associated underground services, and all associated construction and ancillary works.

1.1 Scope of the Report

This Report is prepared in accordance with the requirements of the Department of the Environment Publication "The Planning system and Flood Risk Management guidelines for Planning Authorities (FRMG) published in November 2009. The scope of this assessment is a review of the flood risks which may affect the proposed development and/or the effect of increased flood risk to adjacent properties resulting from the proposed development.

1.2 Background Information

1.2.1 Catchment-based Flood Risk Assessment and Management

The Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessments and producing flood protection measures. The assessments addressed the potential impact of the proposed measures on waterbodies, hydromorphology and quality status.

1.2.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

1.2.3 Objectives of OPW Guidelines

Floods can have a broad range of impacts on people, property, infrastructure and the environment. Flood can cause damage to infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may cause long-term closures of businesses, leading to economic loss other than the damage caused during the event. The following are the core objectives of the OPW Guidelines:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

1.2.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using the Source-Path-Receptor concept model to identify where the flood originates from, the

floodwaters path, and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

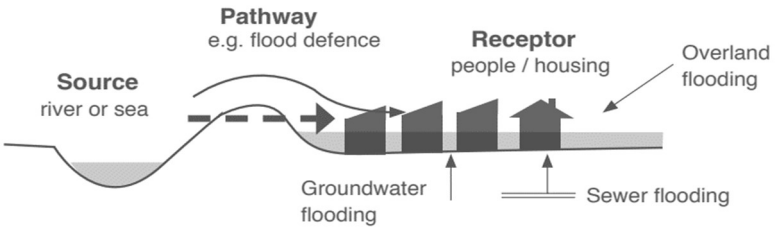


Figure 2: Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the "Flood Risk", which is "the combination of the likelihood of flooding and the potential consequences arising". Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding, expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

Flood Risk = Likelihood of flooding x Consequences of flooding.

1.2.5 Flood Zones

The Flood Zone is the spatial inundation area that falls within a range of likelihood of flooding. The OPW Guidelines specify three levels of flood zones:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) for river flooding and 0.5% AEP for coastal flooding);
Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% and 1% AEP for river flooding and between 0.1% and 0.5% AEP for coastal flooding;
Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding).

Flood Zone C covers all areas of the plan which are not in Zones A or B.

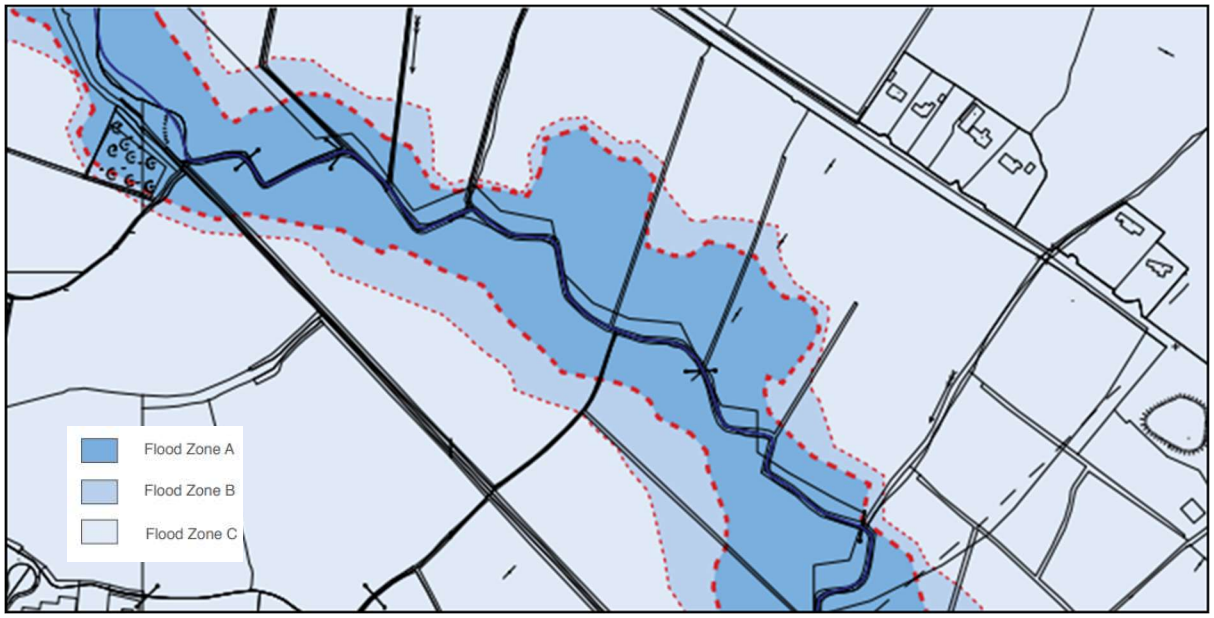


Figure 3: Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implications for each of the zones mentioned above are:

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone.

Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone.

Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to an assessment of flood hazards from sources other than rivers and the coast), but would need to meet the normal range of other planning and sustainable development considerations.

1.2.6 Sequential Approach

The Sequential Approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.

According to the sequential approach, if the development lies within a Flood Zone, it is required to consider measures for mitigating the flood impact to an acceptable level. It is also required to provide justification for proposing a development on a higher risk flood zone (see Figure 4 and 5 below).

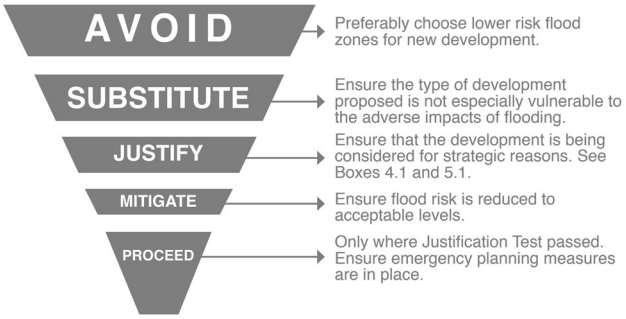


Figure 4: FRA Sequential Approach (extracted from OPW Guidelines, 2009)

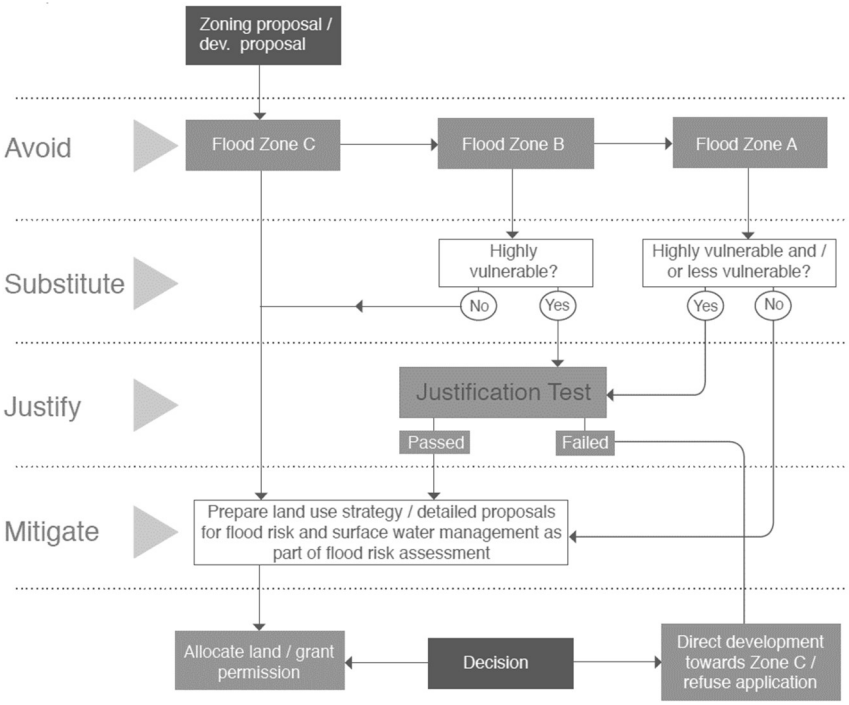


Figure 5: Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

1.2.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations
- **Less vulnerable:** This category includes land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenities, open space, outdoor sports and recreation facilities.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessments and classifies the vulnerability of flooding of different types of developments.

Table 3.2 of the OPW Guidelines illustrates those types of developments that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box 5.1 in the guidelines.

Table 1: Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

1.3 Impact of Climate Change on Flood Risk

The OPW states in the "Climate Change Sectoral Adaptation Plan 2015-2019" that climate change will significantly increase the flood risk by different mechanisms including:

- Sea level rise;
- Increase in Rainfall/Runoff;
- Increase in wind speed and hence extreme storm surge events.

The OPW specified two main Climate Change Scenarios for the Pilot CFRAMS Studies, which are: (1) Mid-Range Future Scenario MRFS and; (2) High-End Future Scenario HEFS. Table 2 below shows the parameters of each scenario.

Table 2: Flood Parameters for the Mid-Range Future and High-End Future Scenarios. Adopted From "Climate Change Sectoral Adaptation Plan 2015-2019"

Parameter	MRFS	HEFS
Rainfall	+20%	+30%
Flood Flows	+20%	+30%
Sea Level Rising	+500 mm	+1000 mm

2. Stage 1 - Flood Risk Identification

2.1 General

In this stage of the FRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

2.2 Source of Information

Information source reviewed for flood risk identification are listed in Table 3 below:

Table 3: Information Source Consulted

	Information Source	Remarks
1	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHive	An extract from EPA map viewer https://gis.epa.ie/EPAMaps/; with active *stream* and *flow direction* layers in Figure 6 shows the presence of a stream to the east of the site, running north toward the Griffeen River.
2	Predictive fluvial, coastal, pluvial and groundwater flood maps available on CFRAMS mapping obtained for the site from https://www.floodinfo.ie/map/floodmaps/	The site lies in Flood Zone C with 3% of the site having a 0.1% probability of flooding.
	SI ground water levels – See Appendix A.	Trial pits were free of water, with the only seepage occurring at 2.30m.

Figure 6: Extract from GeoHive Mapping indicating location of stream adjacent to site

2.3 OPW Flood Hazard Website

The OPW flood mapping website has been consulted. The proposed site location has no record of historical flooding. The nearest flood notes relate to flooding at the Peamount R134 R120 junction which was flooded in November 2000, see Figure 7. This junction lies approximately 1.2km from the proposed site.

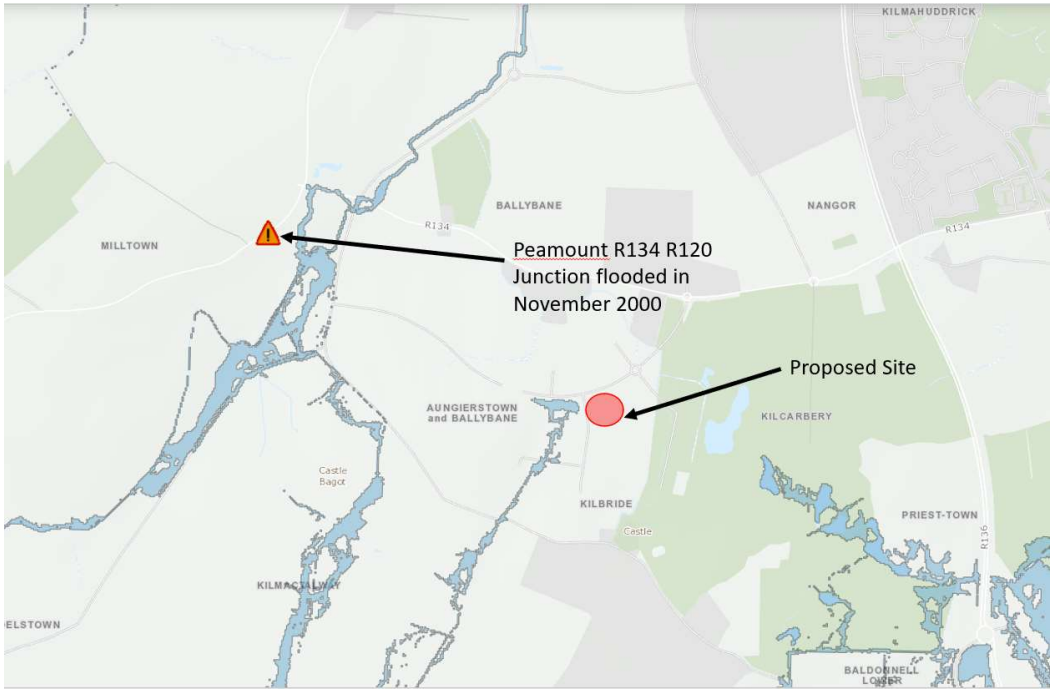


Figure 7: Historical Floods from OPW Website

2.4 PFRA Preliminary Flood Risk Assessment Map

The Catchment Flood Risk Assessment and Management (CFRAM) programme is designed to assess and map the country's river systems to identify areas at risk of significant flooding.

The PFRA Draft Map predicts flooding to the site under the following headings:

- Coastal Flood Extents (low, medium and high probability)
- River Flood Extents (low, medium and high probability)

As can be seen in Figure 8, approximately 3% of the site as a 0.1% probability of flooding. These are small, localised spots not connected to existing watercourses identified in the flood studies mapping and with the topography of the existing site falling form west to east, water is unlikely to actually pond at these locations. The site can therefore be classified as Zone C.

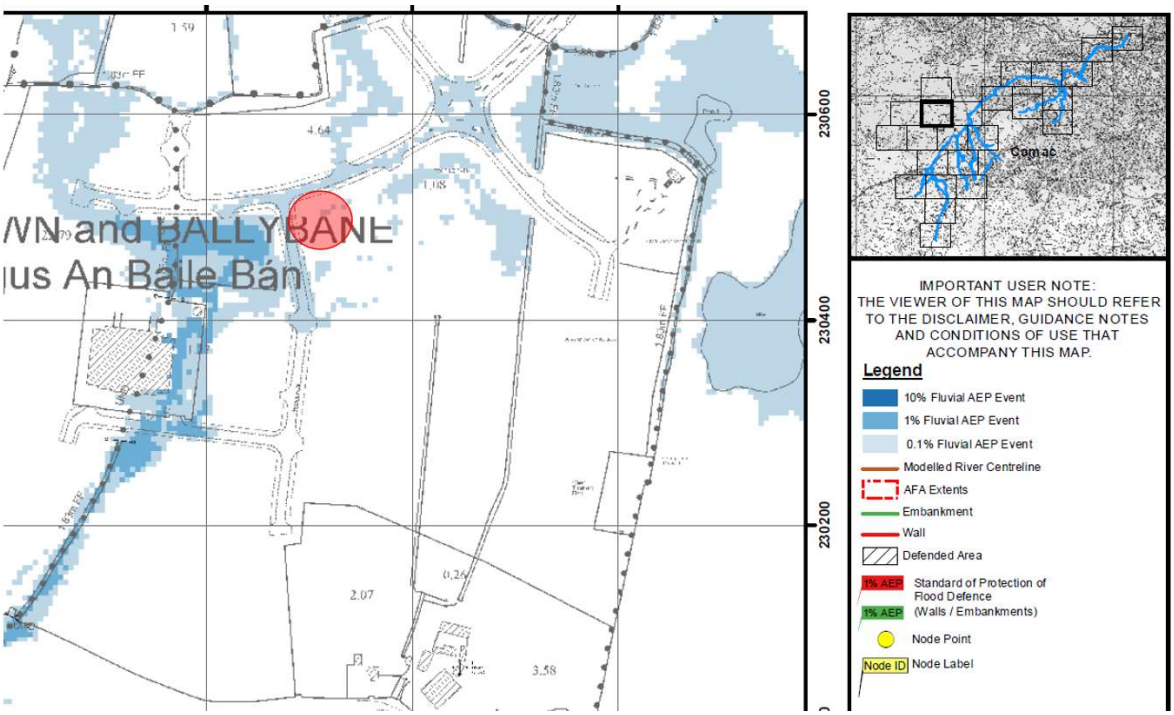


Figure 8: PFRA Maps – River Flood Extents – High-End Future Scenario

2.5 Historic O.S. Maps

Figure 9 shows the historic 6" OS mapping for the site and its immediate surroundings. There is no indication of flood risk at the site.

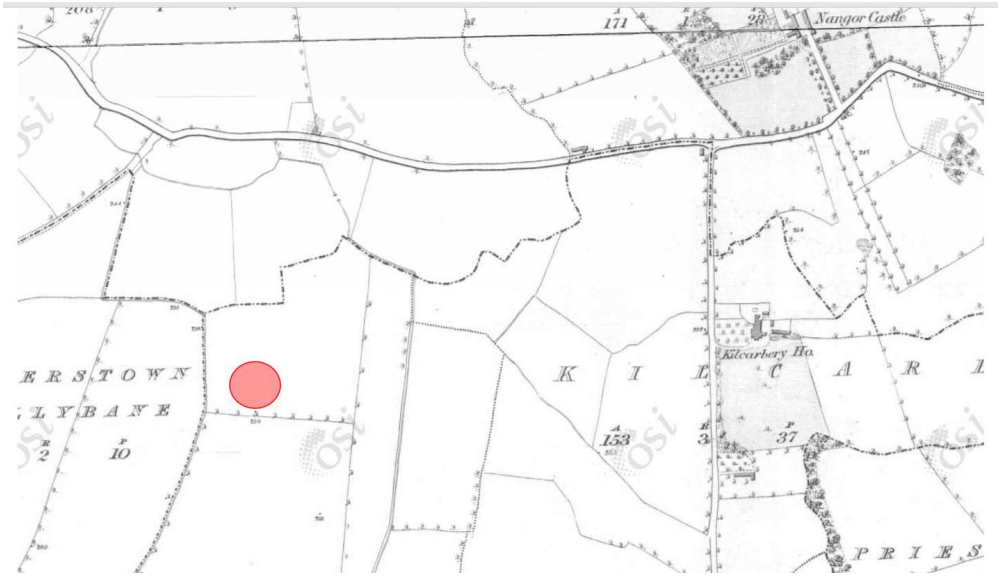


Figure 9: Historic 6" OSI Map

2.6 Pluvial Flooding

Pluvial flooding is usually caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads and through and around developments and ponding in low spots, which often coincide with fluvial floodplains in low lying areas. Any areas at risk from fluvial flooding will almost certainly be at risk from pluvial flooding.

Current CFRAM Final Pluvial Flood Maps for the catchment are not available. However, there have been no recorded historical flood events at the site and the site is located in Zone C. Furthermore, the proposed substation facility's surface water drainage system will be designed, constructed and tested in accordance with the Greater Dublin Drainage Strategic Study, Greater Dublin Regional Code of Practice for Drainage Works v6 and the CIRIA SuDS Manual V6, thereby mitigating any risk from pluvial flooding.

3. Stage 2: Initial Flood Risk Assessment

The indicators described in Section 4 suggest that the site is not at risk from Fluvial, Coastal, or Pluvial flooding. Accordingly, it is the conclusion of this flood risk assessment that a detailed assessment of flood risk is not appropriate.

4. Conclusion

We have assessed the available information and inspected the site and its environment. We have also taken into account the proposed building finished floor levels which will be approximately 1.2m higher than the existing ground level to facilitate tie-ins to the exiting road at the proposed entrances. The proposed development is not deemed to have any significant risk of flooding as discussed earlier in this report and is classified as Zone C. The proposed substation development falls under strategic infrastructure, for which the guidelines state that the development is appropriate within Flood Zone C as shown in Table 4 below. The site is therefore suitable for planning.

Table 4: Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

The assessment of each potential flood source is detailed in the table on the following page.

FLOOD SOURCE	PATHWAY	INFORMATION SOURCE CONSULTED	LIKELYHOOD	REASON
Storm surge from Irish Sea	Back-up of council drainage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	Lowest level of defence 75m O.D. Distance and Level difference from Irish Sea.
Surface water	Surcharging system blockage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	No record of surcharging or blockages on existing systems. Drainage Network maintained by Profile Park Management Company.
Foul sewer	Surcharging system blockage	Irish Water Drainage Records & OPW and Local Authority Reports	Low	No record of surcharging or blockages on existing systems. Drainage Network maintained by Profile Park Management Company.
Ground water source	Surcharging	OS Historic Maps PFRA Maps	Low	From mapping information there is no evidence of ground water flooding.
Overland flow	Run-off from roads	Site survey OS Maps PFRA Maps	Low	The nearest flood notes relate to flooding at the Peamount R134 R120 junction, 1.2km from the proposed site. Existing Drainage Network maintained by Profile Park Management Company. Proposed Finished Floor Levels higher than existing levels.

Appendix A: Site Investigation

IGSL Ltd

Project Appollo (Substation)

Ground Investigation Report

Project No. 23415

August 2021

M7 Business Park
Naas
Co. Kildare
Ireland

T: +353 (45) 846176
E: info@igsl.ie
W: www.igsl.ie

DOCUMENT ISSUE REGISTER

Distribution	Report Status	Revision	Date of Issue	Prepared By:	Approved By:
Ramboll	Factual Report, PDF by email	0	24 August 2021	John Lawler Professional Geologist BSc MSc PGeo EurGeol FGS	David Green BA BAI CEng FGS

TABLE OF CONTENTS

FIGURES

APPENDICES

FOREWORD
The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project (**Project Appollo (Substation)**) have been carried out by IGSL Limited in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (2015) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Principles for a classification
- EN ISO 14689-1:2017 Geotechnical Investigation and Testing – Identification, description & classification of rock

Reporting
No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Ramboll and the information should not be used without their prior written permission. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures
Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing
Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the

engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling
Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

IGSL has undertaken a programme of geotechnical site investigation works at a greenfield site located in Profile Park, Dublin 22. The site comprises a net area of approx. 1.6 acres (Figure 1). Profile Park comprises a 100 acre fully enclosed, private business park situated approximately 13 kilometres west of Dublin city centre.

Figure 1 – Site Location Plan (boxed area denotes extent of site investigation area)

Retrieved from Google Earth Pro (Image dated 04/04/2021)

The investigation comprised trial pits, dynamic probes, soakaway testing (to BRE 365) and in situ plate bearing testing. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL engineering geologist.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil and upper rockhead samples. The geotechnical testing included moisture contents, Atterberg Limits and particle size distribution [PSD]. Soil thermal conductivity was also measured using needle probe methods. Chemical analysis of soil samples to the BRE SD1 Concrete in Aggressive Ground suite was completed. Pyrite analysis to EN1744 was undertaken in order to quantify total sulphur and acid-soluble sulphate contents and to allow estimation of both oxidisable sulphides and equivalent pyrite content in the rock sample. Environmental tests were undertaken on soil samples (WAC *Rilta* suite) to assess suitability for off-site disposal to landfill. This report presents the factual geotechnical data acquired from the 2021 investigation. The exploratory hole locations are plotted on the site plan in Appendix 8.

2. FIELDWORK

2.1 General

The fieldworks were undertaken during June 2021. The works which form this report comprise the following:

- Trial Pits (6 No.)
- Dynamic Probing (22 No.[i])
- Soakaway Testing (to BRE365) (1 No.)
- Plate Bearing Testing (5 No.)
- Surveying of Exploratory Hole Locations

[i] Dynamic Probeholes DP12A and DP12B were undertaken following shallow refusals in both DP12 and DP12A

2.2 Trial Pits

Trial pitting was undertaken at six locations across the site using a JCB backhoe excavator. After first scanning the ground using a cable avoidance tool [CAT] and after consultation with available service drawings, the trial pits were each excavated, logged and sampled under the direction of an IGSL engineering geologist in accordance with BS 5930 (2015). Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing.

All trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs and photos are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions (where encountered) and stability of the pit sidewalls.

2.3 Dynamic Probing

In-situ "Heavy" dynamic probing (DPH) was performed at twenty-two locations using a compact crawler rig. The tracked Dando Terrier probing unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007. Due to shallow obstructions, additional probes were undertaken at locations DP12A and DP12B.

The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to avoid damage to equipment. The probe records are presented in Appendix 2 and include blow-counts in both numerical and graphical format.

2.4 Soakaway Testing (to BRE 365)

An infiltration test was performed to assess the suitability of the subsoil for dispersion of storm water through a soakaway system. The infiltration test was performed in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the subsoil, water was poured into the test pit, with records taken of the fall in water level against time. Following the first soak cycle, the procedure was repeated to ensure saturation of the subsoil. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final soak cycle. The soakaway design logs are presented in Appendix 3.

2.5 Plate Bearing Testing

Plate bearing tests were conducted at five locations each at a depth of 0.30m below ground level [bgl]. The tests were conducted on typically grey brown sandy very gravelly CLAY. Plate testing was undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used for the tests with kentledge provided by a mechanical excavator. Two load

cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 4.

2.6 Surveying of Exploratory Hole Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 8.

3. LABORATORY TESTING

Geotechnical laboratory testing was performed at IGSL's INAB-accredited laboratory in accordance with the methods set out in BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. Soils testing included moisture content and Atterberg Limit (Liquid / Plastic Limits) determination along with analysis of particle size distribution [PSD] and soil conductivity. The results from geotechnical testing on selected trial pit soils are presented in Appendix 5.

Chemical testing of soils to BRE SD1 test suite was also completed. The results feature in the Chemtest report in Appendix 6. Soil samples were selected from pits for specialist Waste Acceptance Criteria (WAC) analysis. The results can be used to classify the material with regard to its potential for disposal to landfill. These results are also presented in the Chemtest report in Appendix 6. The results of the testing to EN1744 on the upper rockhead sample from TP02 are presented in the Nicholls Colton report presented in Appendix 7.

BIBLIOGRAPHY

1.0 BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1

Trial Pit Logs and Photographs

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,641.45 E 730,516.65 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.47
ENGINEER	Ramboll	**EXCAVATION METHOD**	JCB

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	Firm brown sandy slightly gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159736 AA159737	B B	0.40-0.50 0.40-0.50		
			0.60	73.87						
1.0	Firm to stiff greyish brown sandy very gravelly CLAY with a medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159738 AA159739	B B	1.80-1.90 1.80-1.90		
			2.00	72.47						
2.0	Possible LIMESTONE Rockhead End of Trial Pit at 2.00m									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,674.85 E 730,523.58 N
		DATE STARTED	22/06/2021
		DATE COMPLETED	22/06/2021
CLIENT		**GROUND LEVEL (m)**	74.10
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159728 AA159729	B B	0.50-0.60 0.50-0.60		
1.0 Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.00	73.10		AA159730 AA159731	B B	1.90-2.00 1.90-2.00		
2.0 Possible LIMESTONE Rockhead End of Trial Pit at 2.10m		2.10	72.00						

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,702.61 E 730,534.87 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Brown mottled grey slightly silty sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.					AA159748	B	0.50-0.60		
					AA159749	B	0.50-0.60		
1.0									
Firm to stiff black sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.90	71.85						
2.0				1 (Seepage)	AA159750	B	2.30-2.40		
					AA159751	B	2.30-2.40		
Possible LIMESTONE Rockhead End of Trial Pit at 2.50m		2.50	71.25						

Groundwater Conditions
Seepage at 2.30m

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,705.37 E 730,508.75 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.94
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0									
Firm brown sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular.					AA159744 AA159745	B B	0.50-0.60 0.50-0.60		
1.0									
Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.10	72.84		AA159746	B	1.50-1.60		
Possible LIMESTONE Rockhead End of Trial Pit at 1.60m		1.60	72.34		AA159747	B	1.50-1.60		
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,680.66 E 730,500.79 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.30
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159740 AA159741	B B	0.40-0.50 0.40-0.50		
Stiff brown sandy very gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		0.60	73.70						
1.0					AA159742 AA159743	B B	1.60-1.70 1.60-1.70		
Possible LIMESTONE Rockhead End of Trial Pit at 1.70m		1.70	72.60						
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,643.57 E 730,495.61 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159732 AA159733	B B	0.50-0.60 0.50-0.60		
		0.90	73.85						
1.0 Dark brown sandy very gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159734 AA159735	B B	1.60-1.70 1.60-1.70		
		1.80	72.95						
Possible LIMESTONE Rockhead End of Trial Pit at 1.80m									
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

IGSL TP LOG 23415.GPJ IGSL.GDT 24/8/21

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 1 of 3

TP01 – 2 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 3 of 3

TP02 – 1 of 3

TP02 – 2 of 3

TP02 – 3 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP03 – 1 of 3

TP03 – 2 of 3

TP03 – 3 of 3

TP04 – 1 of 3

TP04 – 2 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP04 – 3 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP05 – 1 of 3

TP05 – 2 of 3

TP05 – 3 of 3

TP06 – 1 of 3

TP06 – 2 of 3

TP06 – 3 of 3

Appendix 2

Dynamic Probing

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP01
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.41 E
730,480.71 N
GROUND LEVEL (mOD) 74.93

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	6
						0.30	7
						0.40	8
						0.50	13
						0.60	15
						0.70	14
						0.80	15
						0.90	11
1.0						1.00	8
						1.10	5
						1.20	4
						1.30	4
						1.40	11
						1.50	17
						1.60	23
						1.70	19
						1.80	14
						1.90	8
2.0						2.00	12
						2.10	10
						2.20	10
						2.30	25
	End of Probe at 2.40 m			72.53			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP02
SHEET Sheet 1 of 1

CO-ORDINATES 703,658.47 E
730,483.35 N
GROUND LEVEL (mOD) 74.76

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

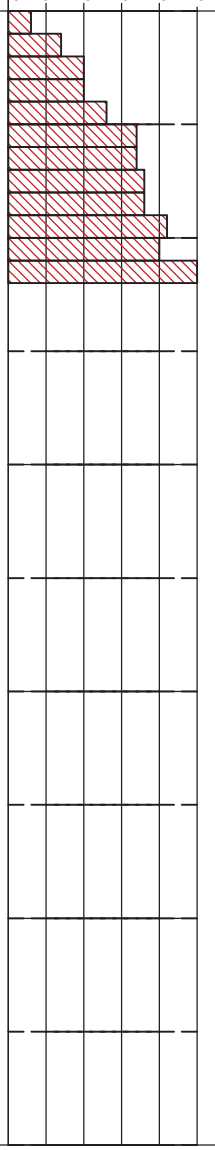
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	7
						0.20	10
						0.30	10
						0.40	13
						0.50	17
						0.60	17
						0.70	18
						0.80	18
						0.90	21
1.0						1.00	20
	End of Probe at 1.20 m			73.56		1.10	25
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP03
SHEET Sheet 1 of 1

CO-ORDINATES 703,678.30 E
730,485.98 N
GROUND LEVEL (mOD) 74.40

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

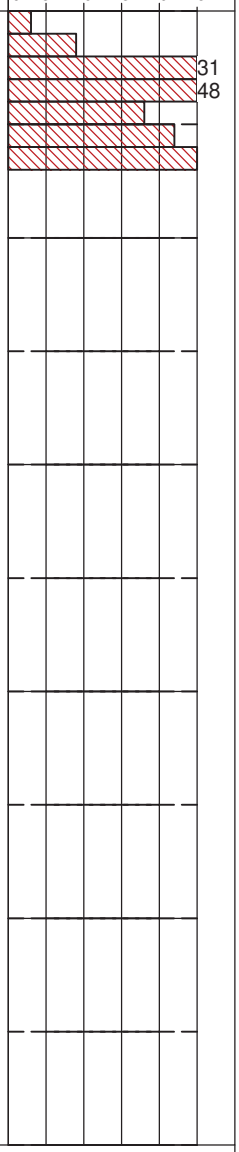
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	9
						0.20	31
						0.30	48
						0.40	18
						0.50	22
						0.60	25
	End of Probe at 0.70 m			73.70			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP04
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.97 E
730,490.03 N

GROUND LEVEL (mOD) 74.13

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

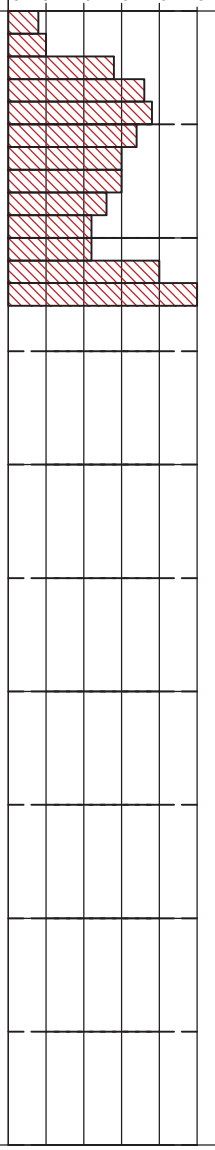
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	14
						0.30	18
						0.40	19
						0.50	17
						0.60	15
						0.70	15
						0.80	13
						0.90	11
1.0						1.00	11
						1.10	20
						1.20	25
	End of Probe at 1.30 m			72.83			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP05
SHEET Sheet 1 of 1

CO-ORDINATES 703,721.25 E
730,497.34 N

GROUND LEVEL (mOD) 74.00

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	9
						0.20	9
						0.30	15
						0.40	20
						0.50	17
						0.60	12
						0.70	11
						0.80	9
						0.90	7
1.0						1.00	8
						1.10	7
						1.20	5
						1.30	5
						1.40	4
						1.50	6
						1.60	8
						1.70	10
						1.80	10
						1.90	11
2.0						2.00	25
	End of Probe at 2.10 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP06
SHEET Sheet 1 of 1

CO-ORDINATES 703,718.48 E
730,512.36 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

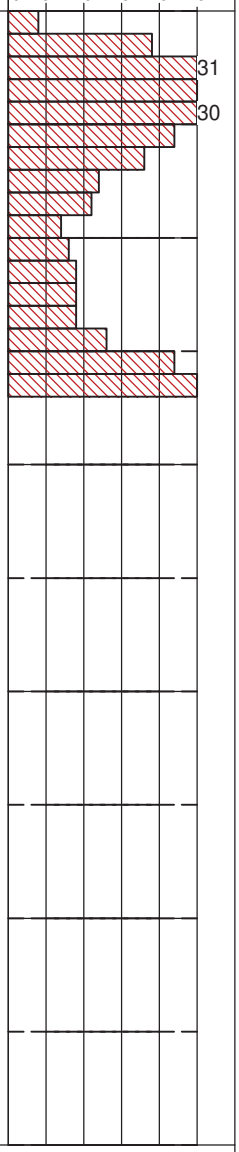
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	19
						0.20	31
						0.30	25
						0.40	30
						0.50	22
						0.60	18
						0.70	12
						0.80	11
						0.90	7
1.0						1.00	8
						1.10	9
						1.20	9
						1.30	9
						1.40	13
						1.50	22
						1.60	25
	End of Probe at 1.70 m			72.22			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP07
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.27 E
730,510.48 N

GROUND LEVEL (mOD) 74.03

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	8
						0.20	6
						0.30	5
						0.40	2
						0.50	4
						0.60	2
						0.70	3
						0.80	4
						0.90	13
1.0						1.00	16
						1.10	8
						1.20	11
						1.30	12
						1.40	14
						1.50	15
						1.60	16
						1.70	16
						1.80	23
						1.90	25
2.0	End of Probe at 2.00 m			72.03			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP08
SHEET Sheet 1 of 1

CO-ORDINATES 703,677.23 E
730,508.92 N
GROUND LEVEL (mOD) 74.28

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

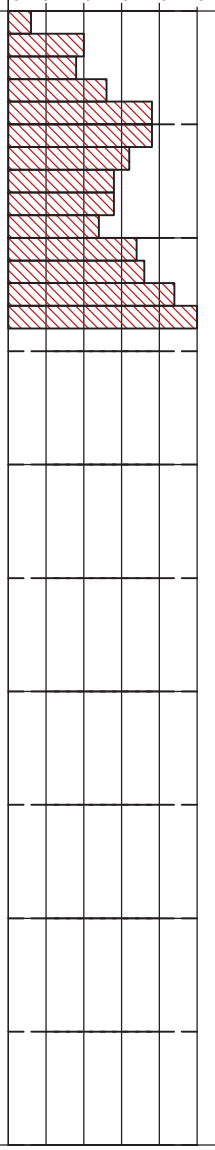
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	10
						0.20	9
						0.30	13
						0.40	19
						0.50	19
						0.60	16
						0.70	14
						0.80	14
						0.90	12
1.0						1.00	17
						1.10	18
						1.20	22
						1.30	25
	End of Probe at 1.40 m			72.88			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP09
SHEET Sheet 1 of 1

CO-ORDINATES 703,659.76 E
730,505.35 N
GROUND LEVEL (mOD) 74.67

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	6
						0.10	11
						0.20	16
						0.30	17
						0.40	13
						0.50	15
						0.60	17
						0.70	16
						0.80	10
						0.90	9
1.0						1.00	10
						1.10	12
						1.20	13
						1.30	25
	End of Probe at 1.40 m			73.27			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP10
SHEET Sheet 1 of 1

CO-ORDINATES 703,633.00 E
730,501.03 N
GROUND LEVEL (mOD) 74.77

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	6
						0.20	11
						0.30	17
						0.40	24
						0.50	23
						0.60	17
						0.70	14
						0.80	15
						0.90	10
1.0						1.00	7
						1.10	5
						1.20	5
						1.30	7
						1.40	7
						1.50	5
						1.60	5
						1.70	6
						1.80	7
						1.90	25
2.0	End of Probe at 2.00 m			72.77			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP11
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.25 E
730,512.03 N
GROUND LEVEL (mOD) 74.47

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

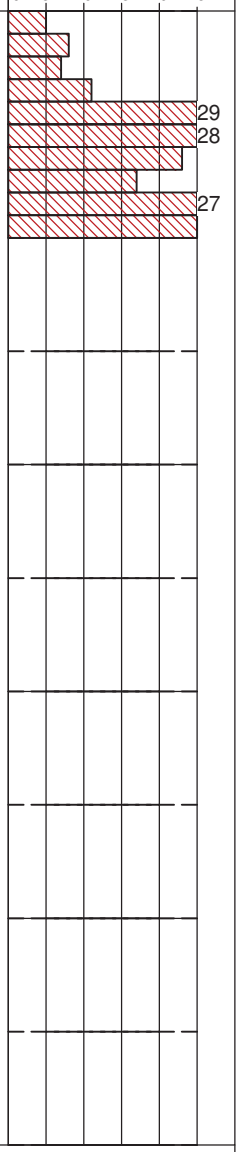
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	8
						0.20	7
						0.30	11
						0.40	29
						0.50	28
						0.60	23
						0.70	17
						0.80	27
						0.90	25
1.0	End of Probe at 1.00 m			73.47			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	9	
						0.10	14	
						0.20	35	35
	End of Probe at 0.30 m			74.24				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12A with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12A
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	10	
						0.10	31	31
	End of Probe at 0.20 m			74.34				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12B with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12B
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

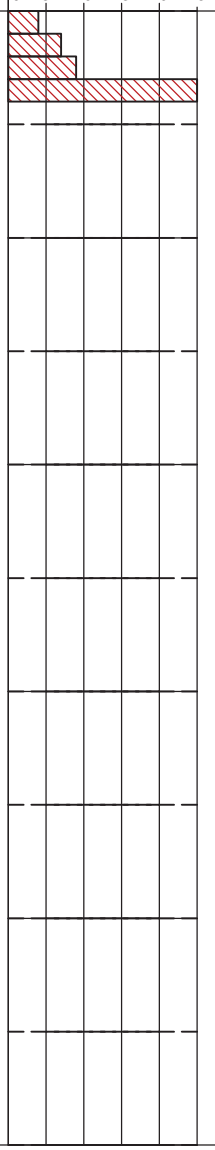
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	7
						0.20	9
						0.30	25
	End of Probe at 0.40 m			74.14			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP13
SHEET Sheet 1 of 1

CO-ORDINATES 703,676.23 E
730,520.95 N
GROUND LEVEL (mOD) 74.09

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	12
						0.20	8
						0.30	7
						0.40	9
						0.50	10
						0.60	12
						0.70	11
						0.80	10
						0.90	8
1.0						1.00	13
						1.10	13
						1.20	10
						1.30	9
						1.40	9
						1.50	7
						1.60	8
						1.70	4
						1.80	4
						1.90	5
2.0						2.00	8
						2.10	12
						2.20	25
	End of Probe at 2.30 m			71.79			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP14
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.07 E
730,526.54 N
GROUND LEVEL (mOD) 73.90

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	2
						0.10	4
						0.20	6
						0.30	6
						0.40	10
						0.50	9
						0.60	8
						0.70	6
						0.80	5
						0.90	6
1.0						1.00	4
						1.10	2
						1.20	2
						1.30	2
						1.40	2
						1.50	3
						1.60	7
						1.70	19
						1.80	24
						1.90	25
2.0	End of Probe at 2.00 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP15
SHEET Sheet 1 of 1

CO-ORDINATES 703,714.22 E
730,530.72 N
GROUND LEVEL (mOD) 73.82

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	5
						0.20	6
						0.30	5
						0.40	3
						0.50	3
						0.60	4
						0.70	3
						0.80	2
						0.90	0
1.0						1.00	1
						1.10	3
						1.20	6
						1.30	20
						1.40	22
						1.50	15
						1.60	14
						1.70	25
	End of Probe at 1.80 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP16
SHEET Sheet 1 of 1

CO-ORDINATES 703,709.00 E
730,551.32 N
GROUND LEVEL (mOD) 73.42

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	12
						0.20	18
						0.30	12
						0.40	8
						0.50	5
						0.60	3
						0.70	2
						0.80	2
						0.90	6
1.0						1.00	12
						1.10	9
						1.20	25
	End of Probe at 1.30 m			72.12			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP17
SHEET Sheet 1 of 1

CO-ORDINATES 703,696.59 E
730,547.68 N
GROUND LEVEL (mOD) 73.51

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

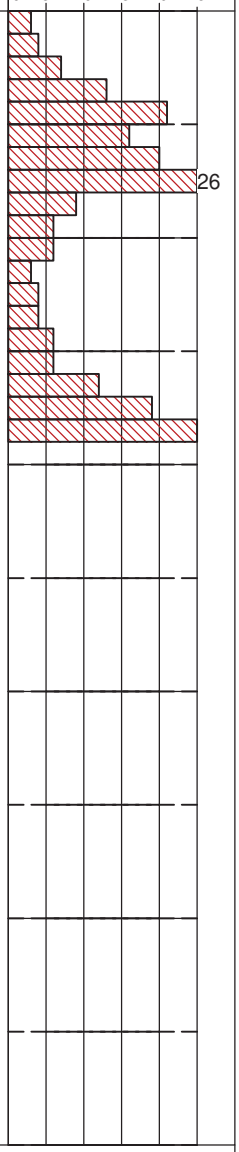
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	4
						0.20	7
						0.30	13
						0.40	21
						0.50	16
						0.60	20
						0.70	26
						0.80	9
						0.90	6
1.0						1.00	6
						1.10	3
						1.20	4
						1.30	4
						1.40	6
						1.50	6
						1.60	12
						1.70	19
						1.80	25
	End of Probe at 1.90 m			71.61			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP18
SHEET Sheet 1 of 1

CO-ORDINATES 703,673.63 E
730,539.03 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	12
						0.20	19
						0.30	24
						0.40	22
						0.50	16
						0.60	16
						0.70	12
						0.80	15
						0.90	8
1.0						1.00	9
						1.10	8
						1.20	9
						1.30	10
						1.40	15
						1.50	18
						1.60	14
						1.70	11
						1.80	25
	End of Probe at 1.90 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP19
SHEET Sheet 1 of 1

CO-ORDINATES 703,661.62 E
730,534.73 N
GROUND LEVEL (mOD) 74.16

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

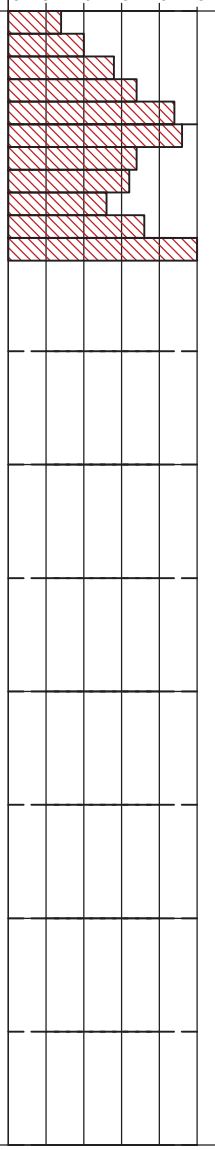
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	14
						0.30	17
						0.40	22
						0.50	23
						0.60	17
						0.70	16
						0.80	13
						0.90	18
1.0						1.00	25
	End of Probe at 1.10 m			73.06			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP20
SHEET Sheet 1 of 1

CO-ORDINATES 703,635.43 E
730,523.72 N
GROUND LEVEL (mOD) 74.46

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	7
						0.30	6
						0.40	5
						0.50	7
						0.60	6
						0.70	4
						0.80	3
						0.90	5
1.0						1.00	5
						1.10	3
						1.20	3
						1.30	3
						1.40	3
						1.50	5
						1.60	4
						1.70	6
						1.80	19
						1.90	25
2.0	End of Probe at 2.00 m			72.46			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

Appendix 3

Soakaway Test Records

Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 1)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	Dry

Notes:

Field Data

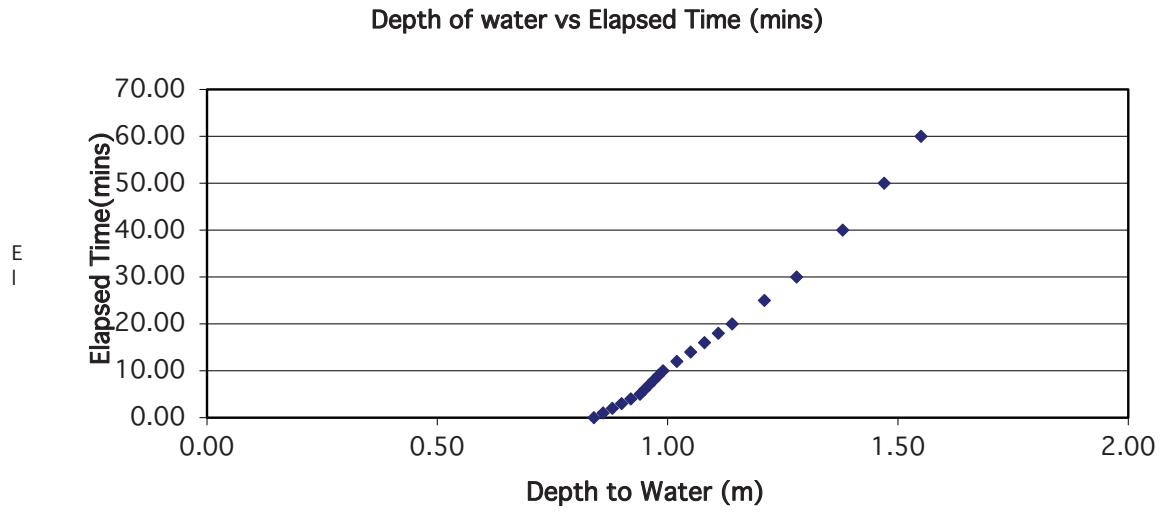
Depth to Water (m)	Elapsed Time (min)
0.84	0.00
0.86	1.00
0.88	2.00
0.90	3.00
0.92	4.00
0.94	5.00
0.95	6.00
0.96	7.00
0.97	8.00
0.98	9.00
0.99	10.00
1.02	12.00
1.05	14.00
1.08	16.00
1.11	18.00
1.14	20.00
1.21	25.00
1.28	30.00
1.38	40.00
1.47	50.00
1.55	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.84	m
Final depth to water =	1.55	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.982	m2
Total Exposed area =	4.942	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0023 m/min or 3.83111E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 2)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	Dry
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	

Notes:

Field Data

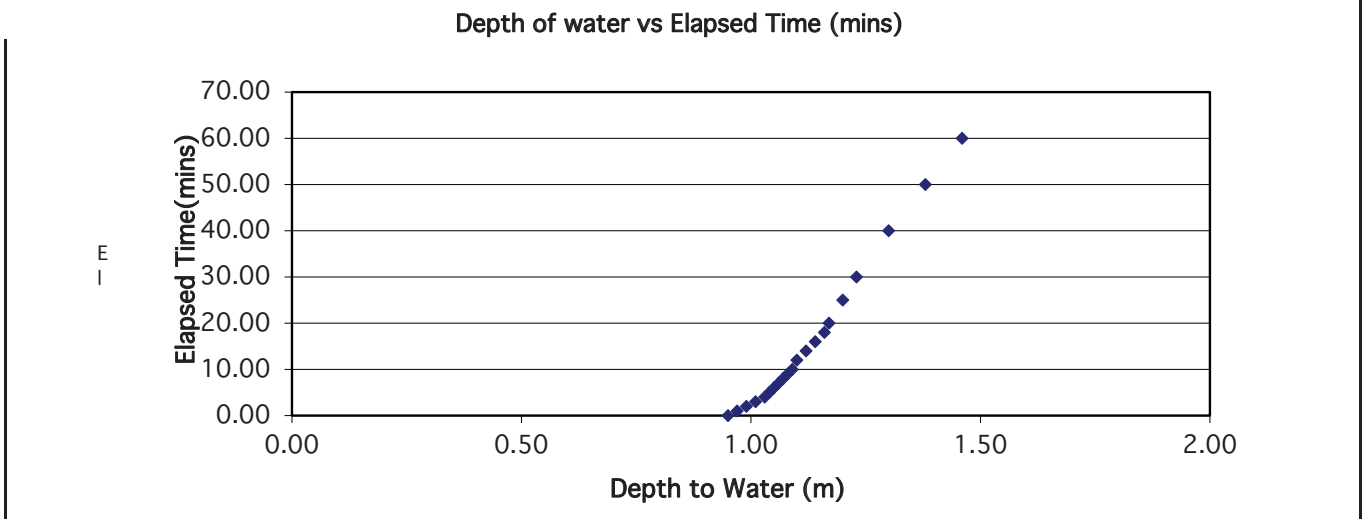
Depth to Water (m)	Elapsed Time (min)
0.95	0.00
0.97	1.00
0.99	2.00
1.01	3.00
1.03	4.00
1.04	5.00
1.05	6.00
1.06	7.00
1.07	8.00
1.08	9.00
1.09	10.00
1.10	12.00
1.12	14.00
1.14	16.00
1.16	18.00
1.17	20.00
1.20	25.00
1.23	30.00
1.30	40.00
1.38	50.00
1.46	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.95	m
Final depth to water =	1.46	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.938	m2
Total Exposed area =	4.898	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00167 m/min or 2.77664E-05 m/sec



Appendix 4

Plate Bearing Test Records

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

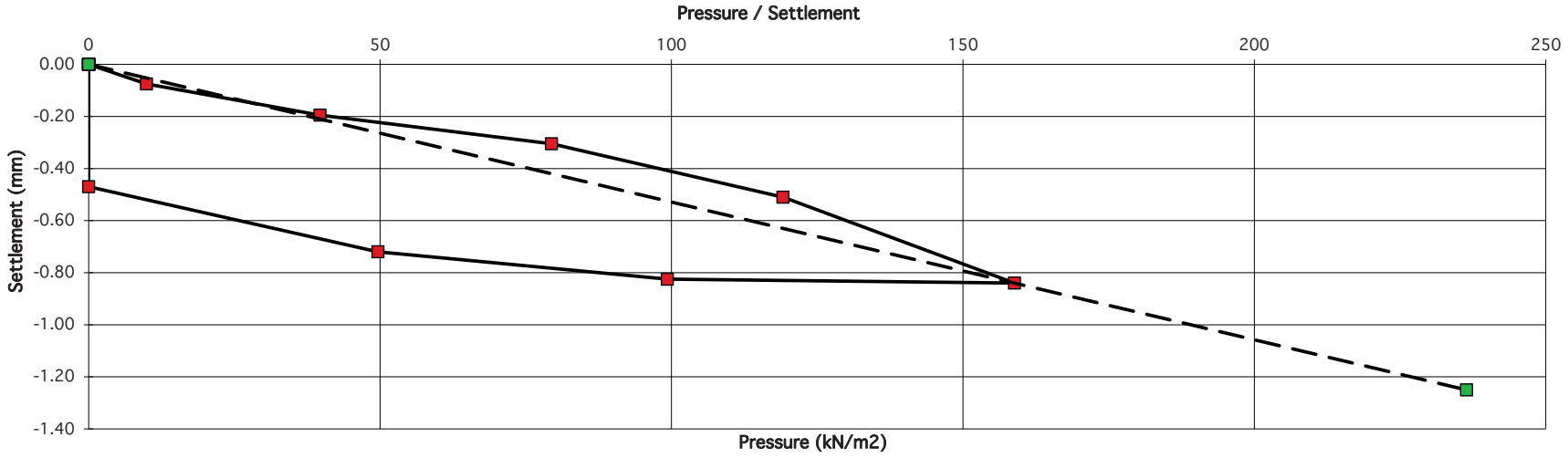
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Load
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 189
Modulus of subgrade reaction = 122 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 39.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

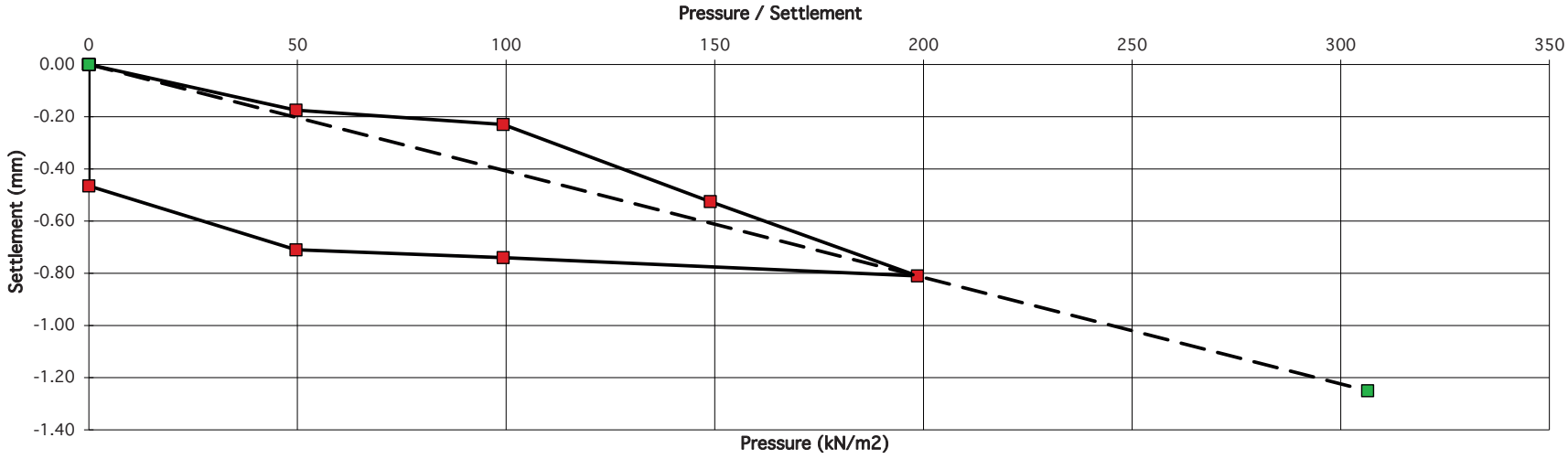
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Reload
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 245
Modulus of subgrade reaction = 158 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 62.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

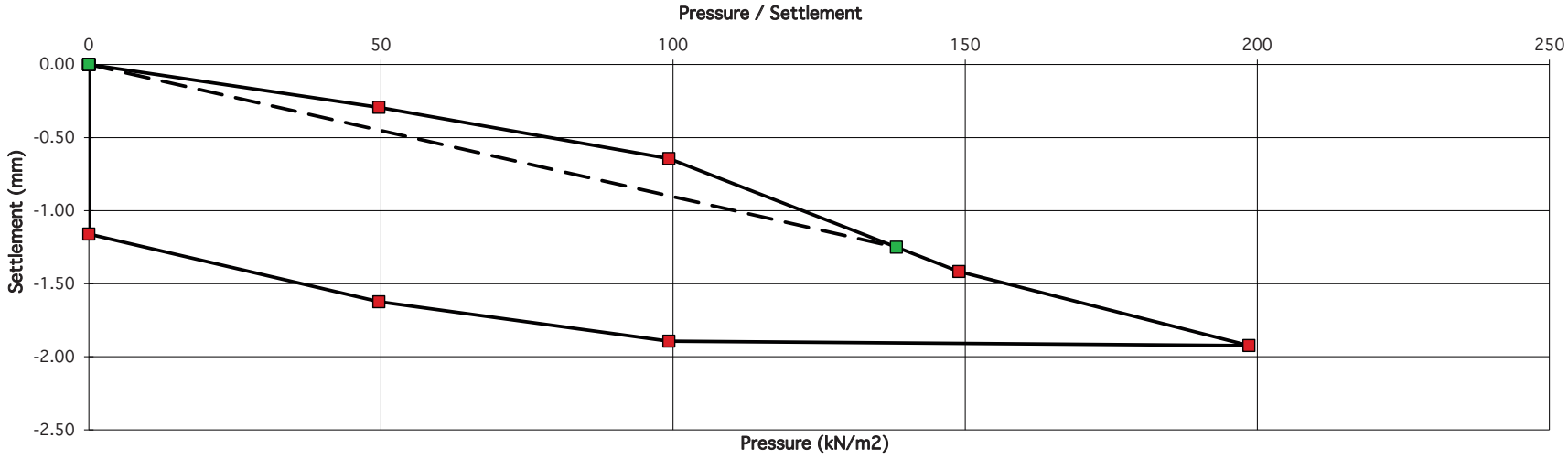
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Load
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 111
Modulus of subgrade reaction = 71 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

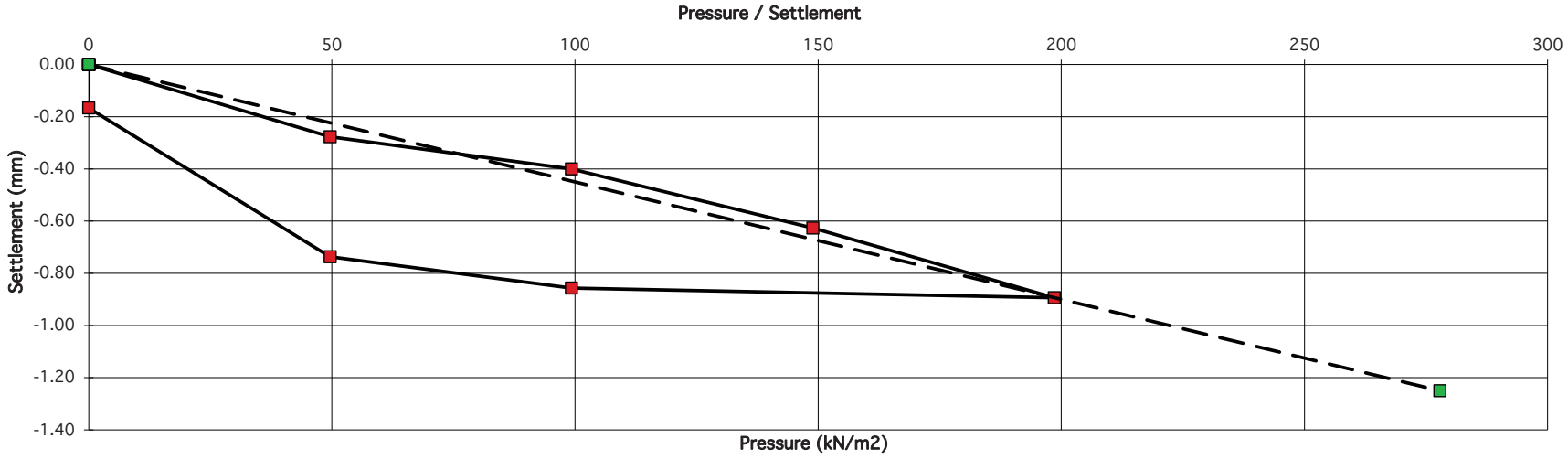
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Reload
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 222
Modulus of subgrade reaction = 143 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 52.4 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

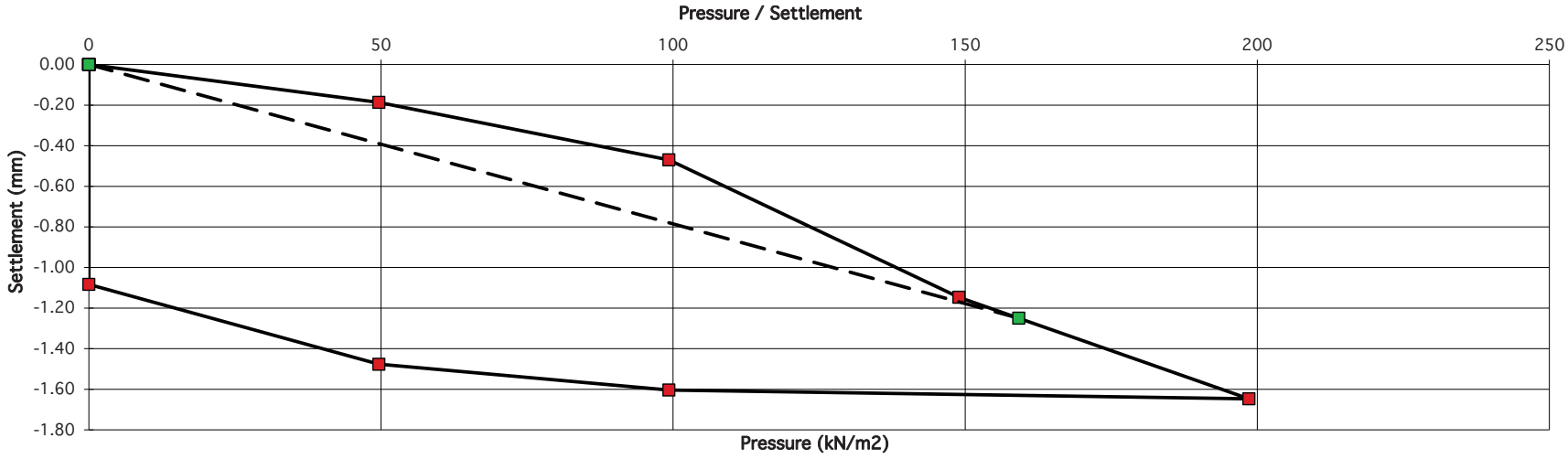
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Load
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 127
Modulus of subgrade reaction = 82 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 19.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

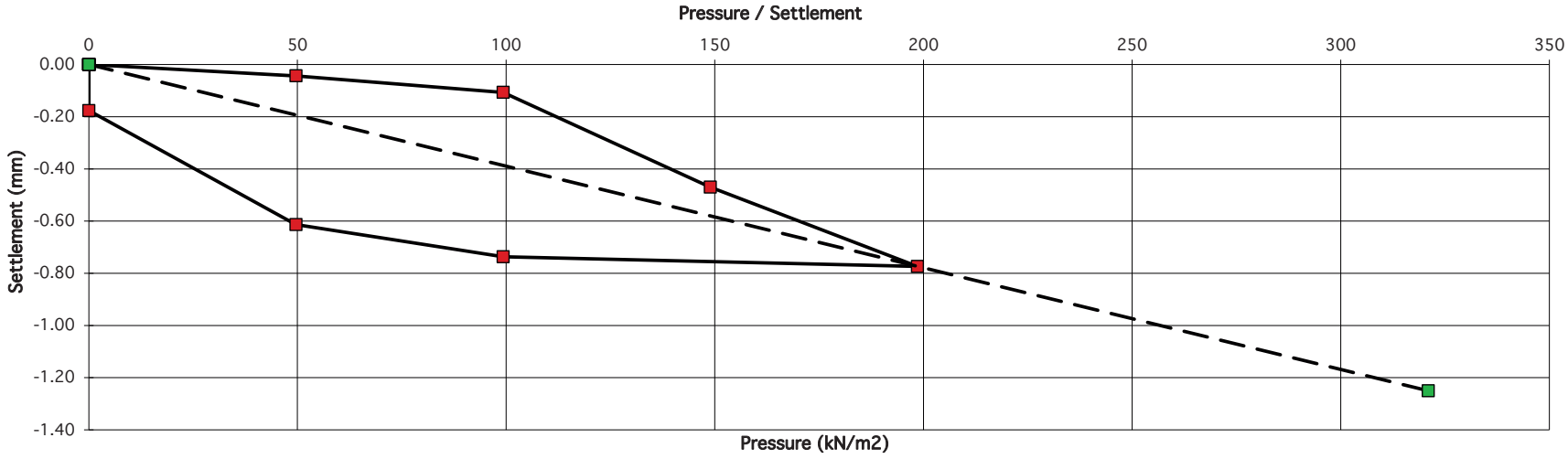
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Reload
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 257
Modulus of subgrade reaction = 165 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 67.2 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

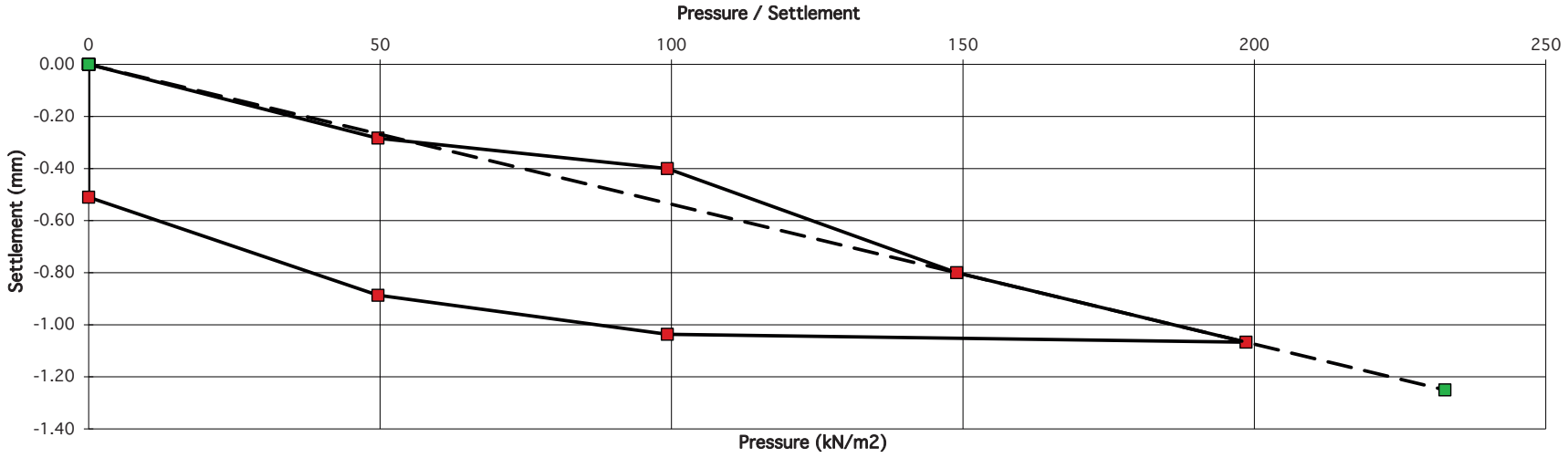
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Load
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 186
Modulus of subgrade reaction = 120 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 38.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

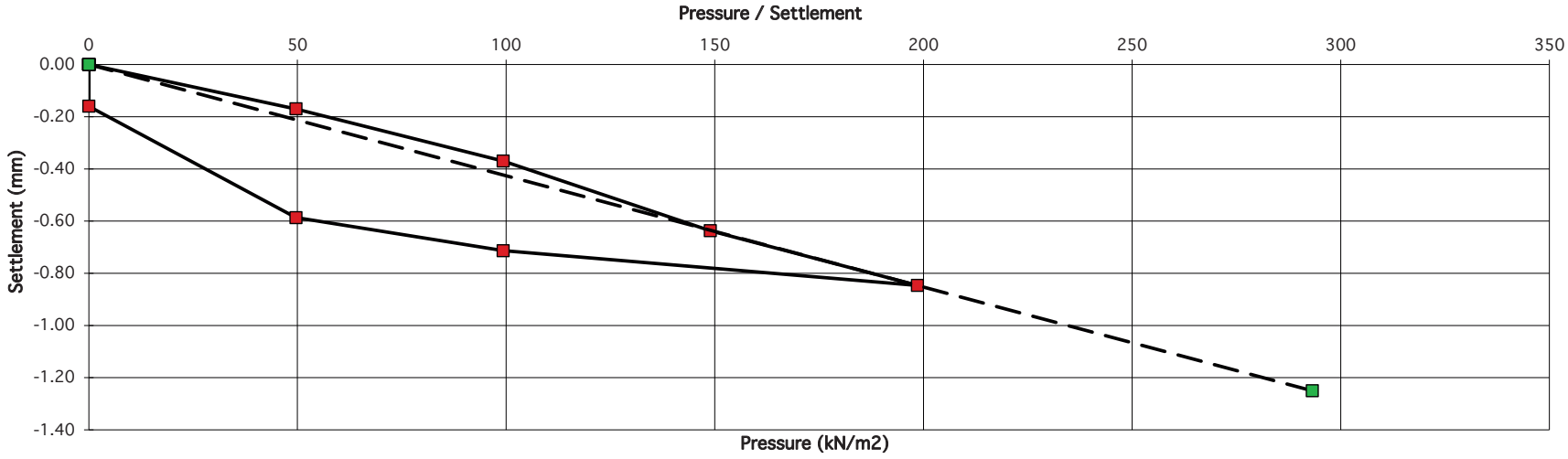
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Reload
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 235
Modulus of subgrade reaction = 151 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 57.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

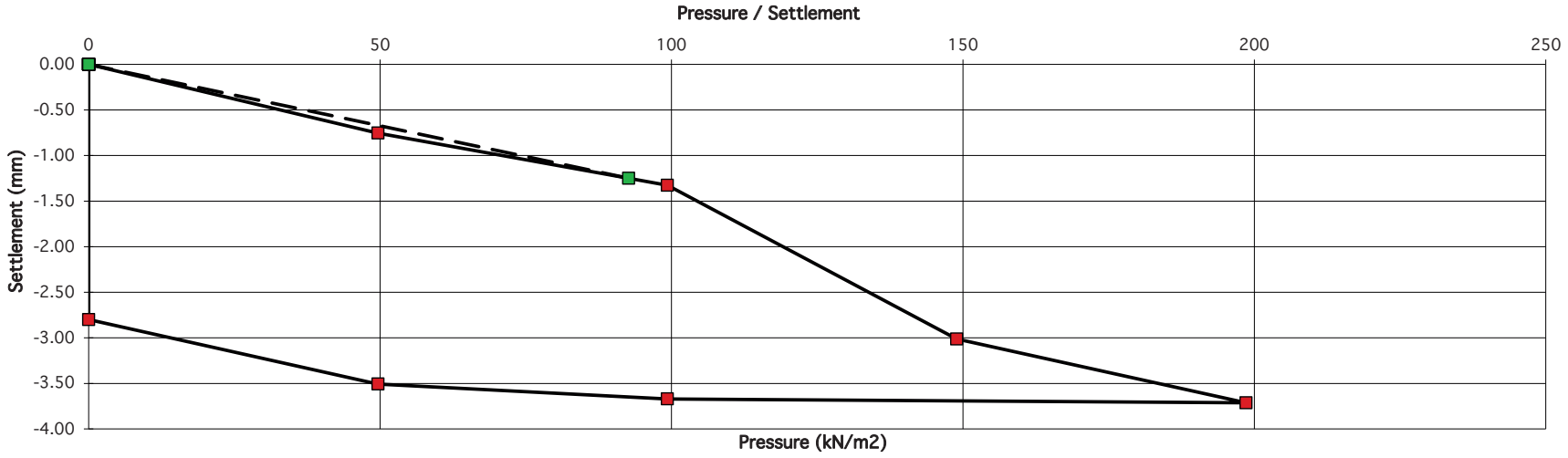
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Load
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 74
Modulus of subgrade reaction = 48 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

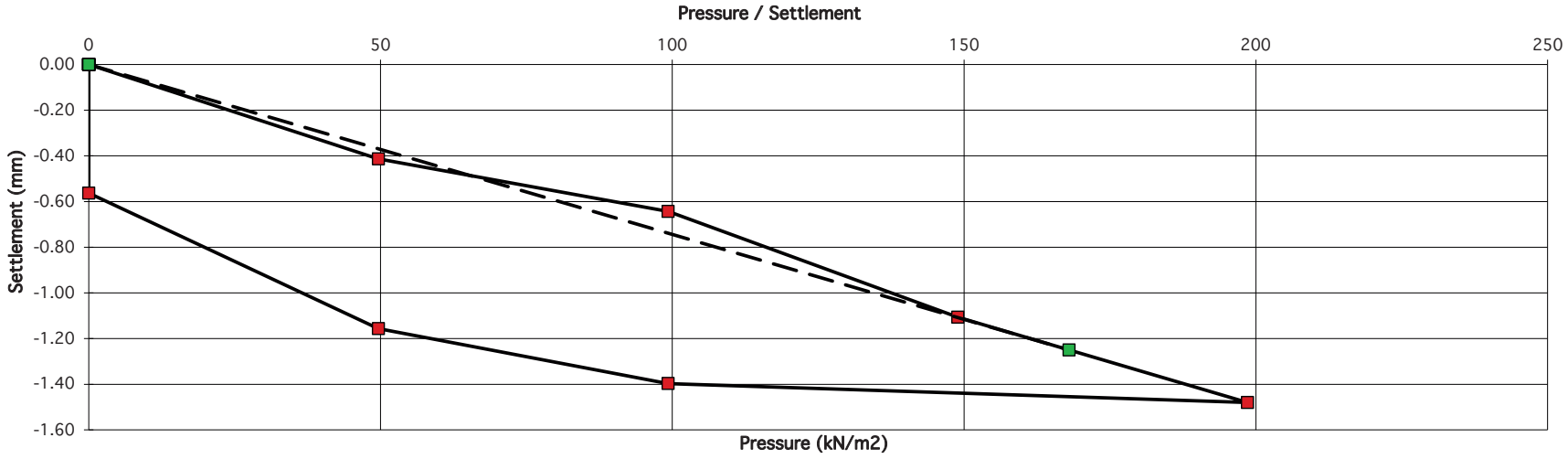
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Reload
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 134
Modulus of subgrade reaction = 86 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 21.9 %

Appendix 5

Geotechnical Laboratory Test Results - Soil

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R124908** Contract No. 23415 Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station Site

Customer Ramboll

Samples Received: 07/07/21 Date Tested: 07/07/21

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA159738	1.8	A21/3390	B	15	39	21	18	57	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP02	AA159729	0.5	A21/3392	B	13	35	20	15	71	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159749	0.5	A21/3393	B	17	35	19	16	74	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159751	2.3	A21/3394	B	20	35	23	12	49	WS	4.4	C L	Grey/brown slightly sandy, gravelly, CLAY
TP04	AA149746	1.5	A21/3395	B	15	35	19	16	58	WS	4.4	C L	Brown sandy gravelly CLAY
TP05	AA159742	1.6	A21/3396	B	12	39	22	17	71	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP06	AA159733	0.5	A21/3397	B	12	40	21	19	46	WS	4.4	C I	Brown sandy gravelly CLAY
TP06	AA159735	1.6	A21/3398	B	9.8	35	21	14	48	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY with many cobbles

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports
H Byrne (Laboratory Manager)

Approved by	Date	Page
H Byrne	13/08/21	1 of 1

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

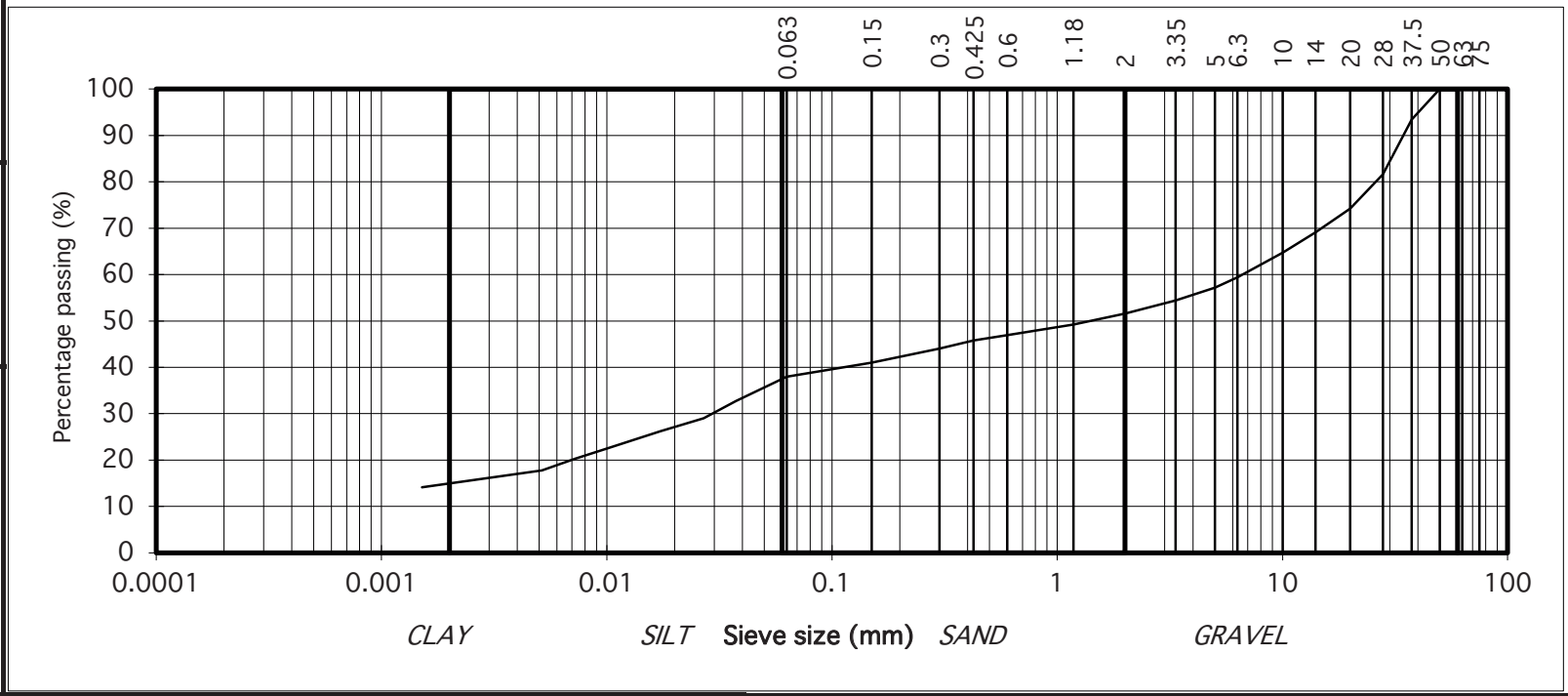
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	93	
28	82	
20	74	
14	69	
10	65	
6.3	59	
5	57	
3.35	54	
2	52	
1.18	49	SAND
0.6	47	
0.425	46	
0.3	44	
0.15	41	
0.063	38	SILT/CLAY
0.037	33	
0.027	29	
0.017	26	
0.010	23	
0.007	20	
0.005	18	
0.002	14	

Contract No. 23415 Report No. R124909
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP01
Sample No.* AA159738 Lab. Sample No. A21/3390
Sample Type: B
Depth* (m) 1.80 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

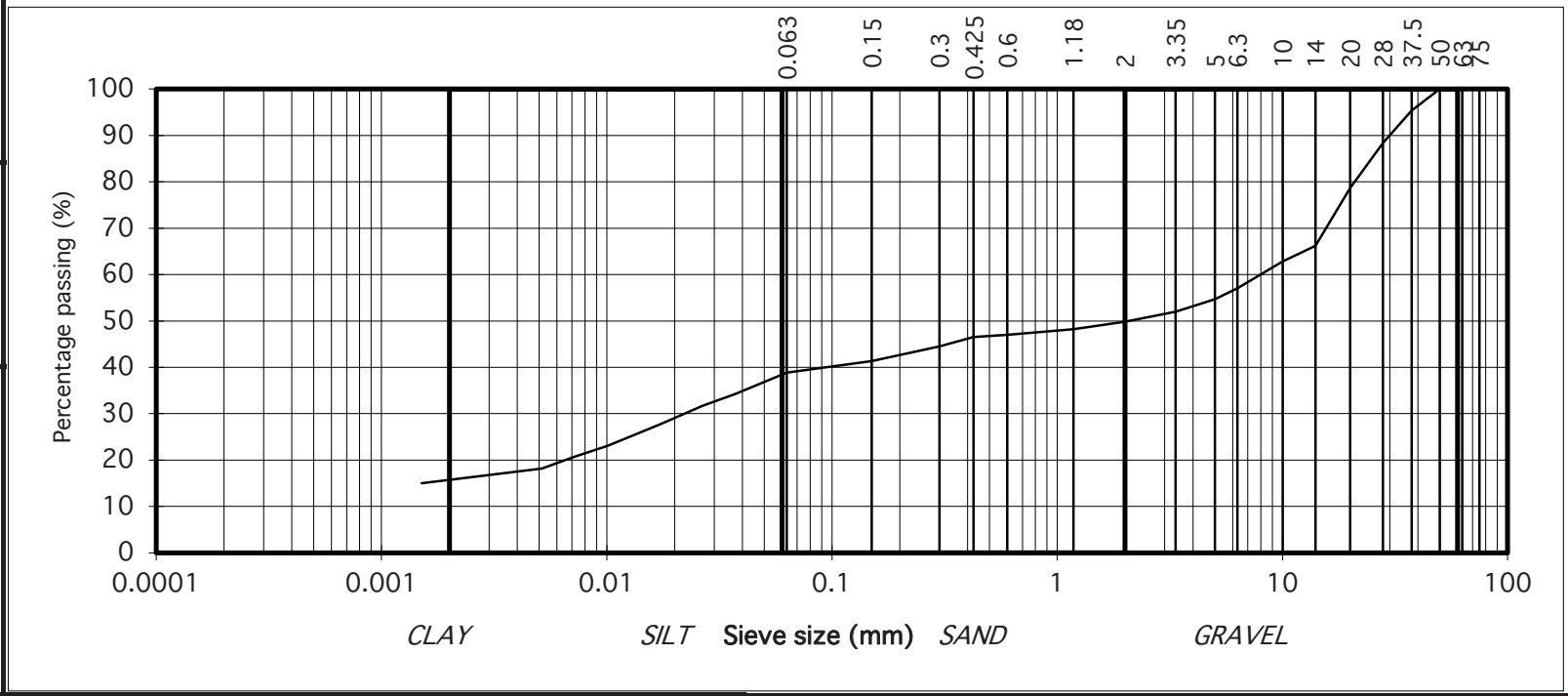
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	95	
28	88	
20	79	
14	66	
10	63	
6.3	57	
5	55	
3.35	52	
2	50	
1.18	48	SAND
0.6	47	
0.425	47	
0.3	45	
0.15	41	
0.063	39	SILT/CLAY
0.037	34	
0.027	32	
0.017	28	
0.010	23	
0.007	21	
0.005	18	
0.002	15	

Contract No. 23415 Report No. R124910
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP03
Sample No.* AA159750 Lab. Sample No. A21/3394
Sample Type: B
Depth* (m) 2.30 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Grey/brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

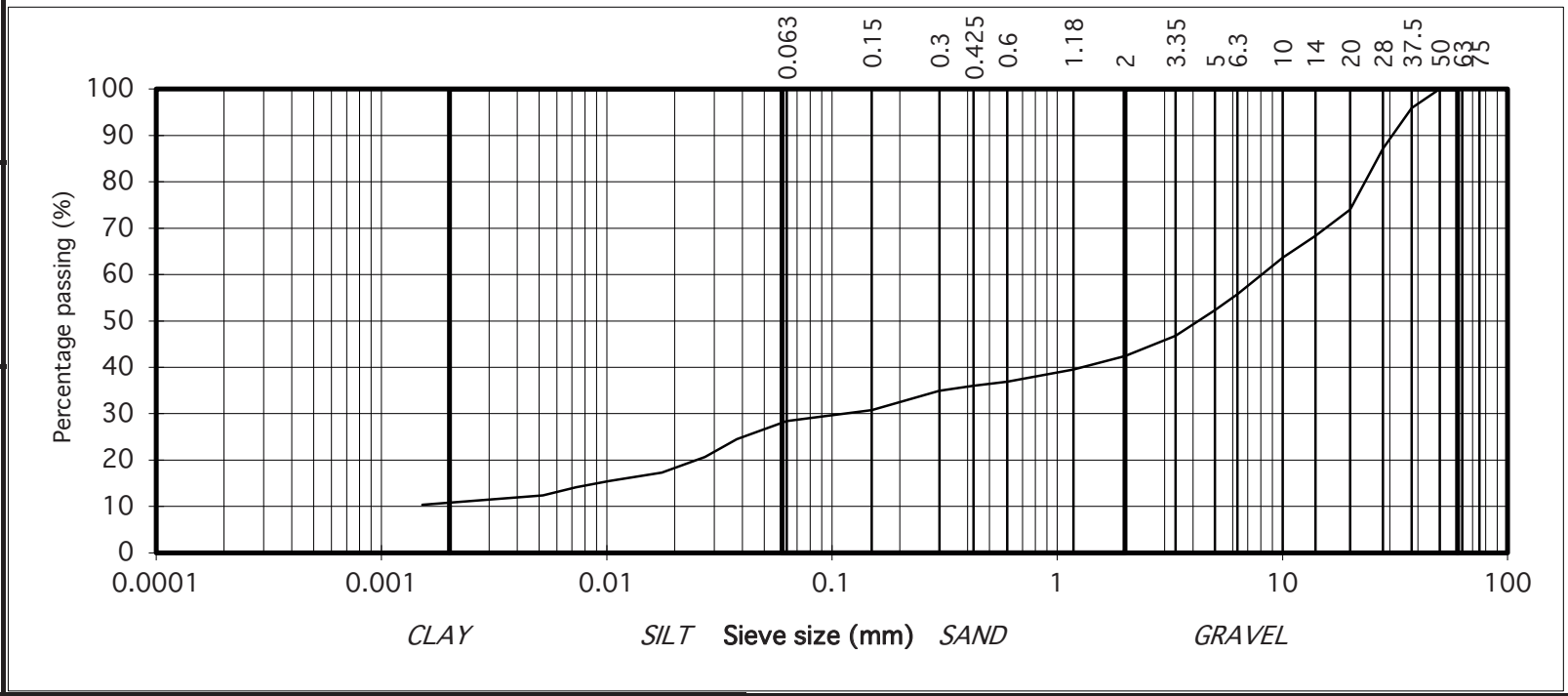
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	87	
20	74	
14	68	
10	64	
6.3	56	
5	52	
3.35	47	
2	42	
1.18	40	SAND
0.6	37	
0.425	36	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.038	24	
0.027	21	
0.018	17	
0.010	15	
0.007	14	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124911
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP05
Sample No.* AA159742 Lab. Sample No. A21/3396
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

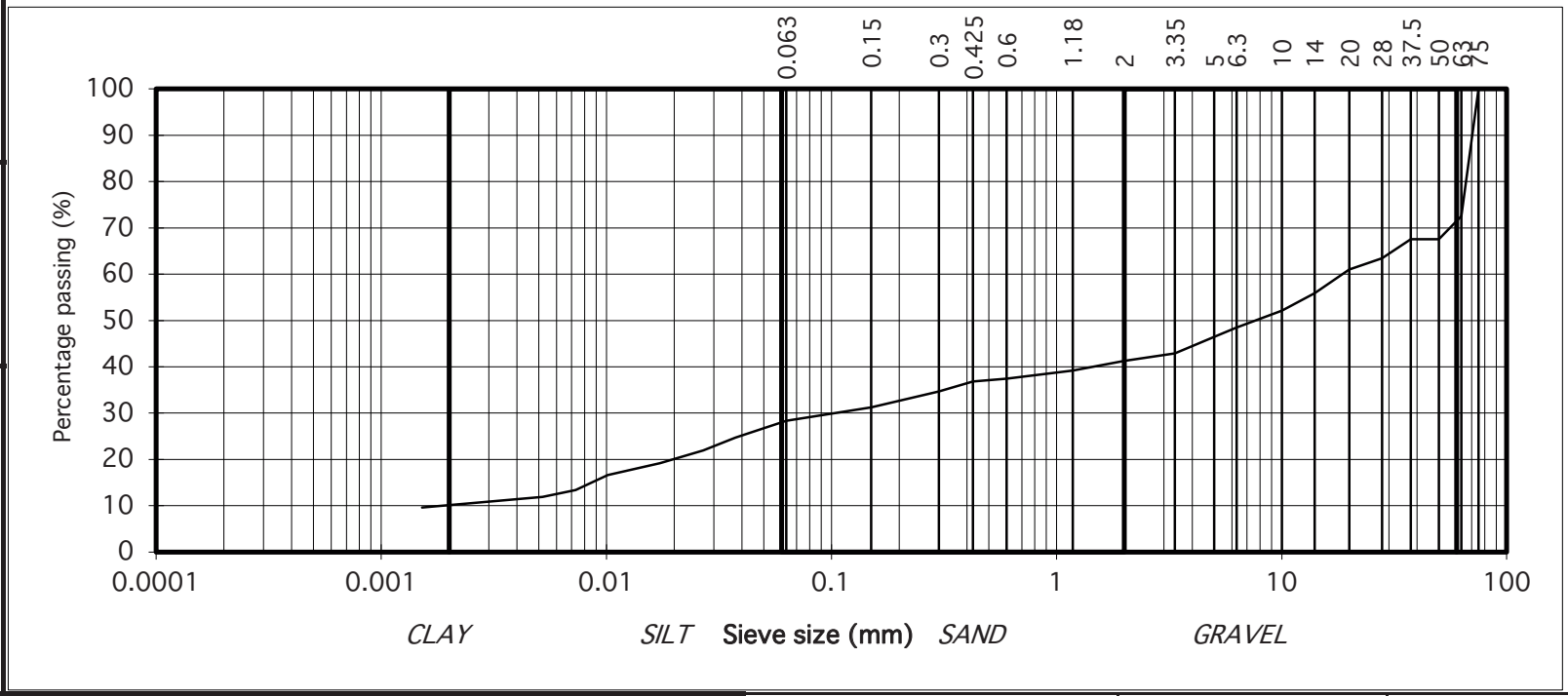
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	73	
50	68	GRAVEL
37.5	68	
28	63	
20	61	
14	56	
10	52	
6.3	48	
5	46	
3.35	43	
2	41	
1.18	39	SAND
0.6	37	
0.425	37	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.037	25	
0.027	22	
0.017	19	
0.010	17	
0.007	13	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124912
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP06
Sample No.* AA159735 Lab. Sample No. A21/3398
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY with many cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123623**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159729

Location TP02 0.5m

Soil description Brown sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.1812	0.8466
2	0.9028	1.1077
3	1.0554	0.9475
4	0.9860	1.0142
5	1.1528	0.8674
Average	1.0556	0.9567

Bulk density (Mg/m3)	1.66
Dry density (Mg/m3)	1.44
Water Content (%)	14.9
Porosity	0.46
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123624**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159751

Location TP03 2.3m

Soil description Brown and dark grey slightly sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4219	0.7033
2	1.6206	0.6171
3	1.4728	0.6790
4	1.4778	0.6767
5	1.5796	0.6331
Average	1.5145	0.6618

Bulk density (Mg/m3)	1.89
Dry density (Mg/m3)	1.48
Water Content (%)	27.3
Porosity	0.44
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123625**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159734

Location TP06 1.6m

Soil description Brown slightly sandy slightly gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4874	0.6723
2	1.4295	0.6996
3	1.4828	0.6744
4	1.4611	0.6844
5	1.2452	0.8031
Average	1.4212	0.7068

Bulk density (Mg/m3)	1.94
Dry density (Mg/m3)	1.7
Water Content (%)	14.4
Porosity	0.36
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

Appendix 6

Chemical / Environmental Test Records – Soil

2183

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-23005-1		
Initial Date of Issue:	13-Jul-2021		
Client	IGSL		
Client Address:	M7 Business Park Naas County Kildare Ireland		
Contact(s):	Darren Keogh		
Project	23415 Proposed Sub Station Site Grangecastle Dublin		
Quotation No.:	Q20-21693	**Date Received:**	05-Jul-2021
Order No.:		**Date Instructed:**	05-Jul-2021
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	13-Jul-2021
Date Approved:	13-Jul-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**		21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**		1234405	1234406	1234408
Order No.:				Client Sample Ref.:		AA159748	AA159746	AA159732
				Sample Location:		TP03	TP04	TP06
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.50	1.50	0.50
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH	U	1010	10:1		N/A	8.8	9.0	9.0
Ammonium	U	1220	10:1	mg/l	0.050	0.080	0.056	0.090
Ammonium	N	1220	10:1	mg/kg	0.10	1.1	0.86	1.4
Boron (Dissolved)	U	1455	10:1	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Benzo[j]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:				Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
				Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
				Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A		-	-		-	
Asbestos Identification	U	2192		N/A		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	
Moisture	N	2030	%	0.020	15	13	4.0	11	6.9	9.7
pH (2.5:1)	N	2010		4.0	[A] 8.8			[A] 9.0		[A] 9.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		[A] < 0.40	[A] < 0.40		[A] < 0.40	
Magnesium (Water Soluble)	N	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Total Sulphur	U	2175	%	0.010	[A] 0.023			[A] 0.026		[A] 0.046
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] 3.3		[A] 1.7	
Chloride (Water Soluble)	U	2220	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010			< 0.010		< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50		[A] < 0.50	
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		[A] 5.3	[A] 5.3		[A] 5.4	
Ammonium (Water Soluble)	U	2220	g/l	0.01	< 0.01			< 0.01		< 0.01
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.048	[A] 0.036	[A] 0.072	[A] 0.063	[A] 0.064	[A] 0.060
Arsenic	U	2450	mg/kg	1.0		14	18		16	
Barium	U	2450	mg/kg	10		33	15		28	
Cadmium	U	2450	mg/kg	0.10		0.97	0.71		0.81	
Chromium	U	2450	mg/kg	1.0		9.3	5.7		7.0	
Molybdenum	U	2450	mg/kg	2.0		3.4	< 2.0		< 2.0	
Antimony	N	2450	mg/kg	2.0		< 2.0	< 2.0		< 2.0	
Copper	U	2450	mg/kg	0.50		16	11		17	
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10		< 0.10	
Nickel	U	2450	mg/kg	0.50		28	25		22	
Lead	U	2450	mg/kg	0.50		10	4.0		7.0	
Selenium	U	2450	mg/kg	0.20		< 0.20	< 0.20		0.20	
Zinc	U	2450	mg/kg	0.50		29	28		21	
Chromium (Trivalent)	N	2490	mg/kg	1.0		9.3	5.7		7.0	
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50		< 0.50	
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10	< 10		< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL			**Chemtest Job No.:**		21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693			**Chemtest Sample ID.:**		1234404	1234405	1234406	1234407	1234408	1234409
Order No.:			Client Sample Ref.:		AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
			Sample Location:		TP01	TP03	TP04	TP05	TP06	TP06
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.40	0.50	1.50	0.50	0.50	1.60
			Asbestos Lab:			COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		[A] < 10	[A] < 10		[A] < 10	
Benzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Toluene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Ethylbenzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
m & p-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
o-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Naphthalene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluorene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Phenanthrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.082		[A] < 0.010	
Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.11		[A] < 0.010	
Benzo[a]anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Chrysene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[b]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[k]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[a]pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Coronene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Total Of 17 PAH's	N	2800	mg/kg	0.20		[A] < 0.20	[A] < 0.20		[A] < 0.20	
PCB 28	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 52	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL					**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693					**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:					Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
					Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
					Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
PCB 90+101	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 118	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 153	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 138	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 180	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total Phenols	U	2920	mg/kg	0.10		< 0.10	< 0.10		< 0.10	

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234405						
Sample Ref:	AA159748						
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.26	3	5	6
Loss On Ignition	2610	U	%	2.8	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.031	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0006	0.0060	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.010	0.10	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.43	4.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234406						
Sample Ref:	AA159746						
Sample ID:							
Sample Location:	TP04						
Top Depth(m):	1.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 1.8	3	5	6
Loss On Ignition	2610	U	%	3.0	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.027	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0002	0.0023	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0010	0.0098	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.011	0.11	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	53	530	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	4.0

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234408						
Sample Ref:	AA159732						
Sample ID:							
Sample Location:	TP06						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.69	3	5	6
Loss On Ignition	2610	U	%	2.7	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.014	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0009	0.0087	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0072	0.072	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.28	2.8	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.6	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1234404	AA159737		TP01		A	Amber Glass 250ml
1234404	AA159737		TP01		A	Plastic Tub 500g
1234405	AA159748		TP03		A	Amber Glass 250ml
1234405	AA159748		TP03		A	Plastic Tub 500g
1234406	AA159746		TP04		A	Amber Glass 250ml
1234406	AA159746		TP04		A	Plastic Tub 500g
1234407	AA159741		TP05		A	Amber Glass 250ml
1234407	AA159741		TP05		A	Plastic Tub 500g
1234408	AA159732		TP06		A	Amber Glass 250ml
1234408	AA159732		TP06		A	Plastic Tub 500g
1234409	AA159734		TP06		A	Amber Glass 250ml
1234409	AA159734		TP06		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurememrnt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.

Test Methods

SOP	Title	Parameters included	Method summary
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix 7

EN1744 Chemical Test Records – Upper Rockhead

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

IGSL
Unit F
M7 Business Park
Naas

Analytical Test Report: L21/02368/IGS/21-19643

Your Project Reference:	**23415 Grangecastle**	Samples Received on:	14/07/2021
Your Order Number:	19324	Testing Instruction Received:	14/07/2021
Report Issue Number:	1	Sample Tested:	14/07 to 26/07/2021
Samples Analysed:	1 aggregate sample	Report issued:	26/07/2021

Signed

Peter Swanston
Environmental Laboratory Manager
Nicholls Colton Group

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples were supplied by customer, results apply to the samples as received.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 10/12/2020
Owned by Emily Blissett - Customer Services Supervisor
Authorised by James Gane - Commercial Manager
J:\Public\Projects\2021\L21\IGS - IGSL\L21-2368-IGS\[L21-02368-IGS - 21-19643.XLSX]Cover Sheet

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analytical Test Results - Aggregate Testing

NC Reference	**178672**
Client Sample Reference	A21/3392
Material	Aggregate
Source/Client Ref	TP2 @ 1.9
Sample Description	Brown crushed rock

	Units	**Accreditation**	
EN 1744 Determinations			
Total Sulphur content (as S)	(%)	UKAS	0.03
Acid soluble sulphate content (as SO_3)	(%)	UKAS	0.05
Acid soluble sulphate content (as SO_4)	(%)	u	0.06
Water soluble sulphate content (as SO_3)	(%)	UKAS	0.03
Water soluble sulphate content (as SO_3)	(mg/l)	u	127
Water soluble sulphate content (as SO_4)	(%)	u	0.03
Water soluble sulphate content (as SO_4)	(mg/l)	u	152

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analysis Methodologies and Notes

Determinant	Test method and notes
EN 1744 Total Sulphur	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 11.
EN 1744 Acid Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 12.
EN 1744 Water Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 10.

Appendix 8

Exploratory Hole Location Plan

Project Appollo (Substation)

Exploratory Hole Location Plan

Legend

- Dynamic Probe
- Plate Bearing Test
- Soakaway Test (to BRE365)
- Trial Pit

DP16
DP17
DP18
DP19
PT02
TP03
DP15
DP20
DP14
TP02
PT01
DP13
DP12A
DP12
TP01
PT03
DP11
DP06
SA01
DP08
DP07
TP04
DP09
DP10
TP05
PT04
TP06
PT05
DP05
DP04
DP03
DP02
DP01

N

50 m

Google Earth

Clifton Scannell Emerson Associates Limited, Civil & Structural Consulting Engineers
Seafort Lodge, Castledawson Avenue, Blackrock, Co. Dublin, Ireland.

T. +353 1 288 5006 F. +353 1 283 3466 E. info@csea.ie W. www.csea.ie

Technical Appendix 11.1: Ecological Impact Assessment Report

Ecological Impact Assessment

Kilcarbery Substation and Transmission Lines

25/11/2021

Disclaimer

Neo Environmental Limited shall have no liability for any loss, damage, injury, claim, expense, cost or other consequence arising as a result of use or reliance upon any information contained in or omitted from this document.

Neo Environmental Ltd	
Head Office - Glasgow: Wright Business Centre, 1 Lonmay Road, Glasgow. G33 4EL **T** 0141 773 6262 **E:** info@neo-environmental.co.uk	
Warrington Office: Cinnamon House, Crab Lane, Warrington, WA2 0XP. **T:** 01925 661 716 **E:** info@neo-environmental.co.uk	**Rugby Office:** Valiant Suites, Lumonics House, Valley Drive, Swift Valley, Rugby, Warwickshire, CV21 1TQ. **T:** 01788 297012 **E:** info@neo-environmental.co.uk
Ireland Office: Johnstown Business Centre, Johnstown House, Naas, Co. Kildare. **T:** 00 353 (0)45 844250 **E:** info@neo-environmental.ie	**Northern Ireland Office:** 83-85 Bridge Street, Ballymena, Co. Antrim BT43 5EN **T**: 0282 565 04 13 **E:** info@neo-environmental.co.uk

Prepared For:

Ramboll

Prepared By:

Dara Dunlop BSc (Hons)

Louis Maloney BSc (Hons), MSc

	Name	Date
Edited By:	Dara Dunlop	25/11/2021
Checked By:	Louis Maloney	25/11/2021
	Name	**Signature**
Approved By	Paul Neary	

Contents

EXECUTIVE SUMMARY

2.1. An Ecological Impact Assessment (EcIA) has been undertaken on lands within Profile Park, Clondalkin, Dublin to assess the potential impacts from the Proposed Development on local ecology. Baseline information within the ecological assessment comprises of an initial desk-based assessment and a Fossitt habitat survey, which was extended to identify the presence or likely absence of protected species. These have been outlined within the relevant sections of this report.

2.2. The desk-based assessment identified four Special Areas of Conservation (SACs) and two Special Protection Areas (SPA) within 15km of the Application Site boundary. These designated sites have been outlined and fully assessed within the supporting Appropriate Assessment (AA) report. This report indicates that, there is no connectivity between the 6 Natura 2000 designated sites within 15km of the Application Site. This report also considered another 4 Natura 2000 sites outside of 15km as they are within the Zone of Influence (ZOI) due to hydrological connectivity. The pathway for interaction from the Application to the 4 Natura 2000 sites is too great and therefore hydrological connectivity is limited. Considering the limited hydrological connectivity, it was concluded that no potential significant effects will be incurred on any Natura 2000 site as a result of the proposed development.

2.3. Within 5km of the site boundary there are two Proposed Natural Heritage Areas (pNHAs). There is no connectivity between the Proposed Development and these two sites.

2.4. A total of four habitat types were noted during the Fossitt habitat survey undertaken in August 2021. The main habitat types recorded within the Application Site are Improved Agricultural Grassland (GA1) and Buildings and Artificial Surfaces (BL3). The lands directly under and adjacent to the Proposed Development are of low ecological value.

2.5. From the current survey findings and impact assessment conducted it is considered that the Proposed Development is unlikely to have significant impacts on local wildlife.

INTRODUCTION

Background

2.6. Neo Environmental Ltd has been appointed by Ramboll on behalf of Vantage Data Centers Dub 11 Limited (the "Applicant") to undertake an Ecological Impact Assessment for a 110kV GIS Substation, 3 no. transformer bays, and associated compound and site infrastructure (the "Proposed Development") on lands within Profile Park, Clondalkin, Dublin (the "Application Site").

Development Description

2.7. The project will support the power demand for the Data Center site to the north. The project includes the Kilcarbery 110kV GIS Substation, 3 no. transformer bays, and associated compound and site infrastructure.

Site Description

2.8. The site is located in Profile Park, centred around Irish grid reference E303647 N230493.

2.9. The site is an irregular parcel of land, extending to approximately 3.19 ha in area and is occupied by agricultural fields. Falcon Avenue runs along the northern boundary of the site.

2.10. The site's immediate boundaries are defined by the following:

- Falcon Avenue to the north, beyond which is undeveloped land, proposed to be developed into a Data Center;
- Agricultural fields to the east, beyond which is Grange Castle Golf Club;
- Barnakyle Substation to the southwest and Digital Reality Profile Park to the southeast, beyond which lies Casement Aerodrome; and
- A data center development on agricultural fields to the west and Castlebaggot Substation.

2.11. The wider context of the site is characterised by a mix of industrial and agricultural development with a fragmented mixture of commercial, industrial and residential uses.

Scope of the Assessment

2.12. An Ecological Impact Assessment was completed at the Application Site. The aims of this report are to:

- Determine the main habitat types within and immediately adjacent to the Application Site in relation to the Proposed Development footprint;
- Identify any actual or potential habitat or species constraints pertinent to the development of the Application Site and to identify how the Proposed Development can avoid, mitigate and, if necessary, compensate for impacts on these actual or potential constraints;
- Assess the potential impacts of the Proposed Development during the construction, operation and decommissioning phases;
- Provide mitigation to reduce the impacts of the activities undertaken during the various phases of the Proposed Development; and
- Identify potential opportunities for the Proposed Development to enhance and add to the biodiversity resource within the site.

2.13. This allows for the identification of potential ecological impacts and the compilation of appropriate mitigation measures where applicable.

Statement of Authority

2.14. The assessment has been conducted by ecologists registered with the Chartered Institute of Ecology and Environmental Management ("CIEEM"). All work has been carried out in line with the relevant professional guidance; CIEEM's Guidelines for Preliminary Ecological Appraisal[1] and the Environment, Heritage and Local Government's Guidance on Appropriate Assessments[2].

2.15. Louis Maloney has four years of professional ecological experience. This includes terrestrial habitat and marine ecology surveys, and the management of Environmental Impact Assessment ("EIA") and Natura Impact Statement ("NIS") reports in Ireland. He holds a BSc in Marine Science from the National University of Ireland, and an MSc in Conservation Behaviour – Marine and Terrestrial Science.

2.16. Dara Dunlop is a Qualifying Member of CIEEM with circa 3 years' experience in the ecology sector, including working for an ecological consultancy, undertaking a range of protected species surveys and extended phase 1 habitat surveys for industrial schemes, and land

[1] CIEEM, 2017. Guidelines for Preliminary Ecological Appraisal. Available at www.cieem.net

[2] Environment, Heritage and Local Government, 2009. Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities. Available at www.npws.ie

management of designated sites. Dara has co-authored a number of reports including Ecological Impact Assessments and Protected Species Reports for various developments.

2.17. Dylan Donoghue is an Ecologist in the process of receiving membership with the Chartered Institute of Ecology and Environmental management (CIEEM). Dylan has 2 years' experience in the Ecology Sector, including working for an ecological consultancy, undertaking bird and bat surveys.

LEGISLATION AND PLANNING POLICY CONTEXT

European Legislation

2.18. European legislation relevant to the proposed development is outlined within Table 2-1 below.

Table 2-1: Relevant European Legislation

Directive	Main Provisions
EU Habitats Directive 92/43/EEC	The EU Habitats Directive sets out the framework for the designation and protection of sites for nature conservation for species and habitats listed in Annex II, IV and V. The directive was adopted in 1992 as a response to the Bern Convention. "*The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance*" The protection of species outlined in the Habitats Directive is transposed into national legislation principally by 'EC (Natural Habitats) Regulations 1997 (amended)'[3].
The Birds Directive 2009/147/EC	European Union members meet their obligations for bird species under the Bern Convention and Bonn Convention, and more generally by the means of the EU Birds Directive. The Birds Directive sets out the criteria for Special Protection Areas including; a list of species requiring protection in Annex 1 of the Directive and mechanisms for protecting wild birds naturally occurring in Europe. This Directive is transposed into national legislation principally by the 'EC (Birds and Natural Habitats) Regulations 2011'[4]. The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. It sets broad objectives for a wide range of activities, although the

[3] Office of the Attorney General (1997), European Communities (Natural Habitats) Regulations 1997 (amended 1998, 2005), available at www.irishstatutebook.ie

[4] Office of the Attorney General (2011), European Communities (Birds and Natural Habitats) Regulations 2011, available at www.irishstatutebook.ie

	precise legal mechanisms for their achievement are at the discretion of each Member State.
Environmental Liability Directive 2004/35/EC	The Environmental Liability Directive aims to make those causing damage to the environment (water, land and nature) legally and financially responsible for that damage. The directive covers environmental damage caused by or resulting from occupational activities to species and natural habitats protected under the 1992 Habitats Directive and the 1979 Wild Birds Directive. Damage to protected species and natural habitats is "*any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species*".
Bern Convention	The Bern Convention came into force in 1982, with the principal aims to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to regulate the exploitation of those species (including migratory species) listed in Appendix III.
Bonn Convention	The Bonn convention came into force in 1985. Contracting Parties work together to conserve migratory species and their habitats by providing strict protection for endangered migratory species (listed in Appendix I of the Convention), concluding multilateral Agreements for the conservation and management of migratory species which require or would benefit from international cooperation (listed in Appendix II), and by undertaking cooperative research activities.

National Legislation

2.19. The principal national legislation governing the protection of wildlife and natural resources in Ireland is:

- The Wildlife Act 1976 (amended 2000)[5] - this is the principal legislation for the protection of wildlife in Ireland and outlines strict protection for species that have significant conservation value. The Act also provides a mechanism to give statutory protection to Natural Heritage Areas ("NHAs"). The amendment in 2000 broadens the

[5] Office of the Attorney General (1976) Wildlife Act 1976 (amended 2000), available at www.irishstatutebook.ie

scope of the Wildlife Acts to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

- EC (Birds and Natural Habitats) Regulations 2011 (amended 2015)[6] - transposes the EU directives into law. It protects species and priority habitats considered to be of European interest.
- Flora Protection Order 2015[7] - this Order makes it illegal to cut, uproot or damage a listed species in any way. It is illegal to alter, damage or interfere in any way with their habitats. This protection applies wherever the plants are found.
- The EC (Water Policy) Regulations 2003[8] – transposes the Water Framework Directive into national law.

2.20. The regulations contained within the above referenced legislation have all been taken into account during the production of this ecological report.

Planning and Development Act, 2000 (as amended)[9]

2.21. Relevant sections regarding ecology within the Planning and Development Act 2000 (amended 2006) are as follows:

First Schedule, Part IV Environment and Amenities

"5. (a) Preserving and protecting flora, fauna and ecological diversity.

(b) Preserving and protecting trees, shrubs, plants and flowers.

6. Protecting and preserving (either in situ or by record) places, caves, sites, features and other objects of archaeological, geological, historical, scientific or ecological interest."

Fifth Schedule

"19. Any condition relating to the protection of features of the landscape which are of major importance for wild fauna and flora.

[6] Office of the Attorney General (2011) European Communities (Birds and Natural Habitats Regulations 2011 (amended 2015), available at www.irishstatutebook.ie

[7] Office of the Attorney General (2015) Flora Protection Order 2015, available at www.irishstatutebook.ie

[8] Office of the Attorney General (2003) European Communities (Water Policy) Regulations 2003, available at www.irishstatute book.ie

[9] Office of the Attorney General (2000) Planning and Development Act 2000, available at www.irishstatutebook.ie

20. Any condition relating to the preservation and protection of trees, shrubs, plants and flowers.

21. Any condition relating to the preservation (either in situ or by record) of places, caves, sites, features or other objects of archaeological, geological, historical, scientific or ecological interest.

22. Any condition relating to the conservation and preservation of—

(a) one or more specific—

(i) (I) natural habitat types in Annex I of the Habitats Directive, or

(II) species in Annex II of the Habitats Directive which the site hosts,

contained in a European site selected by the Minister for Arts, Heritage, Gaeltacht and the Islands in accordance with Annex III (Stage 1) of that Directive,

(ii) species of bird or their habitat or other habitat contained in a European site specified in Article 4 of the Birds Directive, which formed the basis of the classification of that site,

or

(b) any other area prescribed for the purpose of section 10(2)(c).”

Part XIV

“212. – (1) A planning authority may develop or secure or facilitate the development of land and, in particular and without prejudice to the generality of the foregoing, may do one or more of the following:

(f) secure the preservation of any view or prospect, any protected structure or other structure, any architectural conservation area or natural physical feature, any trees or woodlands or any site of archaeological, geological, historical;

(g) secure the creation, management, restoration or preservation of any site of scientific or ecological interest, including any Nature Conservation Site.”

Planning Policy Statement 2015[10]

2.22. The aim of Planning Policy Statement 2015 is as follows:

“Planning legislation in Ireland seeks to ensure, in the interests of the common good, the proper planning and sustainable development of urban and rural areas.”

[10]Environment, Community and Local Government (2015), Planning Policy Statement 2015, available at www.environ.ie

2.23. The Government outlined 10 key principles as a strategic guide in implementing the aim above. Relevant ecological principals outlined within this document include:

"4. Planning must support the transition to a low carbon future and adapt to a changing climate taking full account of flood risk and facilitating, as appropriate, the use of renewable resources, particularly the development of alternative indigenous energy resources.

8. Planning will conserve and enhance the rich qualities of natural and cultural heritage of Ireland in a manner appropriate to their significance, from statutorily designated sites to sites of local importance, and including the conservation and management of landscape quality to the maximum extent possible, so that these intrinsic qualities of our country can be enjoyed for their collective contribution to the quality of life of this and future generations.

9. Planning will support the protection and enhancement of environmental quality in a manner consistent with the requirements of relevant national and European standards by guiding development towards optimal locations from the perspective of ensuring high standards of water and air quality, biodiversity and the minimisation of pollution risk."

South Dublin Development Plan 2016–2022 [11]

2.24. The Plan sets out an overall strategy for the proper planning and sustainable development of the County and consists of a written statement and accompanying plans and maps

2.25. Chapter 9 of the Plan refers to the county's natural heritage and contains a number of key policies (outlined below), which aim to protect and enhance biodiversity and designated sites within the county:

HCL1: Objective 1: To protect, conserve and enhance natural, built and cultural heritage features and restrict development that would have a significant negative impact on these assets.

HCL1 Objective 2: To support the objectives and actions of the County Heritage Plan, including the preparation of a County Biodiversity Plan.

HCL12 Objective 1: To prevent development that would adversely affect the integrity of any Natura 2000 site located within and immediately adjacent to the County and promote favourable conservation status of habitats and protected species including those listed under the Birds Directive, the Wildlife Acts and the Habitats Directive.

HCL12 Objective 2 To ensure that projects that give rise to significant direct, indirect or secondary impacts on Natura 2000 sites, either individually or in combination with other plans or projects, will not be permitted unless the following is robustly demonstrated in accordance with Article 6(4) of the Habitats Directive and S.177AA of the Planning and Development Act (2000 – 2010) or any superseding legislation:

[11] Available from : https://sdcc.ie/en/services/planning/development-plan/plan-2016-2022/plan-2016-2022.html

1. There are no less damaging alternative solutions available; and

2. There are imperative reasons of overriding public interest (as defined in the Habitats Directive) requiring the project to proceed; and

3. Adequate compensatory measures have been identified that can be put in place.

HCL13 Objective 1 To ensure that any proposal for development within or adjacent to a proposed Natural Heritage Area (pNHA) is designed and sited to minimise its impact on the biodiversity, ecological, geological and landscape value of the pNHA particularly plant and animal species listed under the Wildlife Acts and the Habitats and Birds Directive including their habitats.

HCL13 Objective 2 To restrict development within a proposed Natural Heritage Area to development that is directly related to the area's amenity potential subject to the protection and enhancement of natural heritage and visual amenities including biodiversity and landscapes.

HCL15 Objective 1 To ensure that development does not have a significant adverse impact on rare and threatened species, including those protected under the Wildlife Acts 1976 and 2000, the Birds Directive 1979 and the Habitats Directive 1992.

HCL15 Objective 2 To ensure that, where evidence of species that are protected under the Wildlife Acts 1976 and 2000, the Birds Directive 1979 and the Habitats Directive 1992 exists, appropriate avoidance and mitigation measures are incorporated into development proposals as part of any ecological impact assessment

HCL15 Objective 3 To protect existing trees, hedgerows, and woodlands which are of amenity or biodiversity value and/ or contribute to landscape character and ensure that proper provision is made for their protection and management in accordance with Living with Trees: South Dublin County Council's Tree Management Policy 2015-2020.

2.26. The South Dublin County Council Development Plan for the period 2022 – 2028 is still under review.

South Dublin County Council Draft Biodiversity Action Plan 2015-2020[12]

2.27. The preparation of this Biodiversity Action Plan is an objective of the South Dublin County Heritage Plan and the South Dublin County Council Development Plan 2016-2022 The South Dublin County Biodiversity Plan was prepared in the context of a range of national and international plans for biodiversity protection and enhancement

2.28. The National Biodiversity Plan lists a range of actions for biodiversity that aim to achieve this vision, arranged under a series of 7 Strategic Objectives. These objectives are:

- the mainstreaming of biodiversity issues across the decision-making in all sectors;

[12]https://www.meath.ie/system/files/media/file-uploads/2019-06/County%20Meath%20Biodiversity%20Plan%202015-2020.pdf

- the strengthening of the knowledge base for conservation, management and sustainable use of biodiversity;
- increasing public awareness and appreciation of biodiversity and ecosystem services;
- the conservation and restoration of biodiversity and ecosystem services in the wider countryside;
- the conservation and restoration of biodiversity and ecosystem services in the marine environment;
- the expansion and improved management of protected areas and species; and
- the strengthening of international governance for biodiversity and ecosystem services.

Guidance Documents

BS 42020:2013 Biodiversity[13]

2.29. The British Standards Institute has published BS 42020:2013 Biodiversity. Code of practice for planning and development which offers a coherent methodology for biodiversity management. This document seeks to promote transparency and consistency in the quality and appropriateness of ecological information submitted with planning applications and applications for other regulatory approvals.

2.30. BS 42020:2013 cites CIEEM EcIA Guidelines as the acknowledged reference on ecological impact assessment. These guidelines provide recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring.

CIEEM Guidelines

2.31. The Chartered Institute of Ecology and Environmental Management (CIEEM) have produced guidance on Ecological Impact Assessment[14] (EcIA) and Ecological Report Writing[15].

2.32. EcIA is a process of identifying, quantifying and evaluating potential effects from activities such as those related to development on habitats, species and ecosystems. This EcIA process follows the tasks set out in Table 2-2.

[13] BS 42020:2013 Biodiversity. Code of practice for planning and development
[14] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine.
[15] CIEEM (2017) Guidelines for Ecological Report Writing

Table 2-2: EcIA Process

Task	Description
Scoping	Determining the matters to be addressed in the EcIA, including consultation to ensure the most effective input to defining the scope. Scoping is an ongoing process – the scope of the EcIA may be modified following further ecological survey/research and during impact assessment.
Establishing the baseline	Collecting information and describing the ecological conditions in the absence of the proposed project, to inform the assessment of impacts.
Important ecological features	Identifying important ecological features (habitats, species and ecosystems, including ecosystem function and processes) that may be affected, with reference to a geographical context in which they are considered important.
Impact assessment	An assessment of whether important ecological features will be subject to impacts and characterisation of these impacts and their effects3. Assessment of the significance of the residual ecological effects of the project (those remaining after mitigation), including cumulative effects.
Avoidance, mitigation, compensation and enhancement	Incorporating measures to avoid, reduce and compensate negative ecological impacts and their effects, and the provision of ecological enhancements. Monitoring impacts and their effects. Evaluation of the success of proposed mitigation, compensation and enhancement measures.

2.33. The aims of their EcIA guidelines are to:

- promote good practice;
- promote a scientifically rigorous and transparent approach to EcIA;
- provide a common framework to EcIA in order to promote better communication and closer cooperation between ecologists involved in EcIA; and
- provide decision-makers with relevant information about the likely ecological effects of a project.

METHODOLOGY

Zone of Influence

2.34. The Zone of Influence (ZOI) is the area encompassing all predicted negative ecological effects from a proposed scheme and is informed by the habitats present within the site and the nature of the proposals. Due to the scale and nature of the proposal, it is considered that the ZOI will fall within the distances from the proposed solar farm outlined in **Table 2-3** below. These were therefore considered appropriate for gathering information for the desk study.

Table 2-3: Study areas for ecological features

ECOLOGICAL FEATURE	STUDY AREA
International/European statutory designations	15km, or wherever hydrological influence extends
National statutory designations	5km
Protected and Priority Species	2km
Fossitt habitat survey	50m

Desk Study

2.35. A desk-based assessment was undertaken to collate available ecological information for the Application Site and the surrounding area. This included a search of statutory designated sites within a 5km radius of the Proposed Development, including: Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Nature Reserves (NRs), Wildfowl Sanctuaries, Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs). The descriptions of each of these sites was obtained utilising the National Parks and Wildlife Service (NPWS) website[16].

2.36. A data search was conducted though the National Biodiversity Data Centre (NBDC) to obtain information regarding protected/notable species within 2km of the Application Site boundary. The Application Site is located at Irish Grid Reference (IGR) E303647 N230493.

2.37. Additional information on the suitability of habitat in the surrounding area for bats was also obtained from the NBDC in the form of a habitat suitability map. The map provided enhanced information on the recorded distribution of bats and broad-scale geographic patterns of occurrence and local roosting habitat requirements for Irish bat species.

[16] NPWS website; available at: http://www.npws.ie/protected-sites.

Field Survey

Fossitt Habitat Survey

2.38. A Fossitt habitat survey was undertaken on the 17th of August by Dylan O'Donoghue. The Ecological Survey Area (ESA) covered all land within the Application Site and a 50m buffer around the entire site, where access was allowed.

2.39. Survey work was carried out in accordance with Fossitt habitat survey guidance[17]; habitats were mapped electronically in the field in order to produce a habitat map.

Species Scoping Survey

2.40. A species scoping survey was carried out to identify the presence of protected species, or the potential of the Application Site to support protected species. The aim of the survey was to provide an overview of the Application Site and to determine whether any further survey work was required.

2.41. No additional protected species surveys were undertaken at this time.

2.42. Table 2-4 below outlines the relevant habitat and field signs that indicate the potential presence of protected or notable species within the ESA.

Table 2-4: Indicative Habitats and Field Signs of Protected Species

TAXON	INDICATIVE HABITAT(S)	FIELD SIGNS (IN ADDITION TO SIGHTINGS)
Bats	Roosts – trees, buildings, bridges, caves, etc. Foraging areas – e.g. parkland, water bodies, streams, wetlands, woodland edges and hedgerow. Commuting routes – linear features (e.g.) hedgerows, water courses, tree lines). See Appendix C for preferred foraging and commuting habitat for individual species.	In or on potential roost sites: droppings stuck to walls, urine spotting in roof spaces, oil from fur staining round roost entrances, feeding remains (e.g. moth wings under a feeding perch).
Badger *Meles meles*	Found in most rural and many urban habitats.	Excavations and tracks: sett entrances, latrines, hairs, well-worn paths, prints, scratch marks on trees.

[17] Fossitt (2000) A Guide to Habitats in Ireland

Taxon	Indicative Habitat(s)	Field Signs (In Addition to Sightings)
Otter *Lutra lutra*	Watercourses.	Holts (or dens), prints, spraints (droppings), slide marks into watercourses, feeding signs (e.g. fish bones).
Birds	Trees, scrub, hedgerow, field margins, grassland, buildings.	Nests, droppings below nest sites (especially in buildings of trees), tree holes.
Common lizard *Zootoca vivipara*	Rough grassland, log and rubble piles.	Sloughed skins.

Additional Surveys

2.43. Following the Fossitt survey, a bat survey was carried out on the 17th August 2021 by Dylan O'Donogue. The results of 2021 bat survey is outlined in **Appendix B.**

2.44. The results of the transect and static surveys indicate that the site is used by very low numbers of commuting bats.

Weather Conditions

2.45. **Table 2-5** describes the weather conditions at the time of survey giving air temperature (°C), wind speed (Beaufort force), cloud cover (percentage) and precipitation.

Table 2-5: Weather conditions at time of survey

Survey Date	Temperature (°C)	Wind (km/h)	Cloud Cover (%)	Precipitation
17.08.2021	17	36	30	None

Limitations

2.46. Results of the assessment undertaken by Neo Environmental are representative of the time that surveying was undertaken.

2.47. The absence of specific species records returned during the data search does not necessarily indicate absence of a species or habitat from an area, but rather that these have not been recorded or are perhaps under-recorded within the search area.

2.48. A Fossitt habitat survey does not aim to produce a full botanical or faunal species list or provide a full protected species survey, but enables competent ecologists to ascertain an understanding of the ecology of the site in order to:

- Identify broadly the nature conservation value of a site and preliminary assess the significance of any potential impacts on habitat/species recorded, and/or
- Confirm the need and extent of any additional specific ecological surveys that are required to identify the true nature conservation value of a site.

2.49. At the time of the initial survey, access was only permitted within the landownership boundary. The areas of land which formed the ESA which were not within the landownership boundary were viewed from field boundaries, with the use of binoculars, where needed. It is considered that the limited access to areas of land directly adjacent to the Proposed Development boundary has not unduly impacted upon the findings of the habitat or species scoping surveys.

Evaluation Methods

2.50. The evaluation of ecological receptors is based upon the CIEEM guidelines[18] (2018) which suggests that the value or potential value of an ecological resource or feature (for example a habitat type, species or ecosystems) should be determined within a geographical context (e.g. rare at a local level). Attributing a value to a receptor, which is also a designated site, is generally precise, as the designations themselves provide an indication of value.

Impact Assessment

2.51. The impact assessment process involves:

- identifying and characterising impacts and their effects
- incorporating measures to avoid and mitigate negative impacts and effects
- assessing the significance of any residual effects after mitigation
- identifying appropriate compensation measures to offset significant residual effects; and
- identifying opportunities for ecological enhancement.

2.52. The terms ‘impact’ and ‘effect’ are used commonly throughout ecological reports. Impact is defined as a change experienced by an ecological feature, while effect is defined as the

[18] CIEEM (2018) Guidelines for the Ecological Impact Assessment in the UK and Ireland

outcome to an ecological feature from an impact. Impacts and effects can be positive, negative or neutral.

2.53. Assessment of potential impacts and effects needs to consider on-site, adjacent and more distant ecological features, including habitats, species and statutory and ecological designated sites.

2.54. This ecological impact assessment has been concluded by an experienced ecologist following CIEEM guidance[19].

BASELINE CONDITIONS

Designated Sites

2.55. The Proposed Development does not lie within or directly adjacent to any statutory or non-statutory designated environmental sites.

2.56. Within the ZOI there are six Special Areas of Conservation (SACs) and four Special Protection Areas (SPA). Within 5km of the Application Site boundary there are two Proposed Natural Heritage Areas (pNHAs).

2.57. Each of these sites are outlined in **Table 2-6** below, and detailed within **Figure 1 of Appendix A**.

2.58. The site descriptions are derived from the original site citations available from NPWS[20].

Table 2-6: Designated Sites.

SITE CODE	SITE NAME	QUALIFYING FEATURES	DISTANCE (KM), DIRECTION	POTENTIAL CONNECTIVITY WITH THE PROPOSED DEVELOPMENT SITE
SAC				
001398	Rye Water Valley/Carton SAC	Petrifying springs with tufa formation (*Cratoneurion*) [7220] *Vertigo angustior* (Narrow-mouthed Whorl Snail) [1014]	5.9km northwest	None

[19] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine.

[20] http://www.npws.ie/protected-sites

		Vertigo moulinsiana (Desmoulin's Whorl Snail) [1016]		
001209	Glenasmole Valley SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] Petrifying springs with tufa formation (*Cratoneurion*) [7220]	7.9km southeast	None
002122	Wicklow Mountains SAC	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] *Calaminarian* grasslands of the *Violetalia calaminariae* [6130] Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bogs (* if active bog) [7130] Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) [8110] Calcareous rocky slopes with chasmophytic vegetation [8210] Siliceous rocky slopes with chasmophytic vegetation [8220] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	9.6km southeast	None

		Lutra lutra (Otter) [1355]		
000397	Red Bog, Kildare SAC	Transition mires and quaking bogs [7140]	13.9km southwest	None
000210	South Dublin Bay SAC	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310] Embryonic shifting dunes [2110]	15.45km east	Hydrological connection
000206	North Dublin Bay SAC	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Humid dune slacks [2190] *Petalophyllum ralfsii* (Petalwort) [1395]	18.15km northeast	Hydrological connection
SPA				
004040	Wicklow Mountains SPA	Merlin (*Falco columbarius*) [A098] Peregrine (*Falco peregrinus*) [A103]	12.7km southeast	None
004063	Poulaphouca Reservoir SPA	Greylag Goose (*Anser anser*) [A043]	14.9km southwest	None

		Lesser Black-backed Gull (*Larus fuscus*) [A183]		
004024	South Dublin Bay and River Tolka SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit *(Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194] Wetland and Waterbirds [A999]	15.1km northeast	Hydrological connection
004006	North Bull Island SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140]	18.2km northeast	Hydrological connection

		Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (Calidris alpina) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Wetland and Waterbirds [A999]		
pNHA				
	Grand Canal pNHA	Canal system banked by hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland.	1.7km north	
	Liffey Valley pNHA	River system	4.5km north	

Habitats

2.59. A Fossitt habitat survey undertaken in August 2021 identified four habitat types within the survey boundary; each of these is outlined in **Table 2-7** below. In addition, habitat map is shown in **Figure 2 of Appendix A**.

Table 2-7: Habitat types on site

HABITAT TYPE	SPECIES PRESENT	OTHER OBSERVATIONS/ POTENTIAL FOR SPECIES
Buildings and Artificial Surfaces (BL3)	-	The Grange Castle Access road runs through the Application site. No ecological value.
Recolonising Bare Ground (ED3)	-	This habitat is found in the south of the site surrounding the road. Low ecological value.
Improved Agricultural Grassland (GA1)	Perennial rye grass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), creeping buttercup (*Ranunculus repens*), cock's-foot *(Dactylis glomerata*), vetch (*Vicia sp*.).	Some potential for foraging badger, birds and bats. Considered to be of low ecological value.
Treelines (WL2)	Ash (*Fraxinus excelsior*), hazel (*Corylus avellana*)	Providing bird nesting opportunities as well as foraging opportunities for many species. Not within the footprint if the Proposed Development Moderate ecological value at site level.

Protected and Notable Species

Desk Study

2.60. The potential presence of protected species within the study area was assessed through a data search conducted via the National Biodiversity Data Centre (NBDC). This identified records of invasive, rare, scarce and protected species within 2km of the Proposed Development location. The Application Site is located within the 1km grid squares O0330.

2.61. Additional information on the suitability of habitat in the surrounding area for bats was also obtained from the NBDC in the form of a habitat suitability map. The map provided enhanced information on the recorded distribution of bats, and broad-scale geographic patterns of occurrence and local roosting habitat requirements for Irish bat species.

2.62. In addition, the Fossitt habitat survey included a species scoping survey in order to assess the potential of the site to support protected species.

2.63. Table 2-8 summarises the protected/notable species recorded within the search area, and their potential to be present within the Application Site.

Table 2-8: Summary of Biological Records

Species	Grids with Recordings of Species	Suitable Habitat or Field Signs Observed within Survey Area	Potential for Species within Application Site
Mammals			
Irish hare (*Lepus timidus subsp. hibernicus*)	O0329 O0429	Grassland offers some limited potential for commuting, sub-optimal for foraging	No
West European hedgehog (*Erinaceus europaeus*)	O0330	Grassland offers some limited potential for commuting, unsuitable for breeding	No
Brown long-eared bat (*Plecotus auritus*)	O0331 O0231	Trees unsuitable for roosting, limited foraging potential	Yes
Daubenton's bat (*Myotis daubentonii*)	O0331 O0231	No, lacks suitable woodland and pond/river habitats	Yes
Leisler's bat (*Nyctalus leisleri*)	O0331 O0430 O0231 O0429	No roosting habitat, limited foraging potential, identified in flight	Yes
Pipistrelle (*Pipistrellus pipistrellus sensu lato*)	O0331 O0430 O0231 O0429	Trees unsuitable for roosting, limited foraging potential	Yes
Soprano pipistrelle (*Pipistrellus pygmaeus*)	O0331 O0430 O0231	No roosting habitat, limited foraging potential, identified in flight	Yes
European otter (*Lutra lutra*)	O0429	No, lacks watercourses	No
American mink* (*Mustela vison*)	O0429	No, lacks suitable wetland habitats	No
Eastern grey squirrel* (*Sciurus carolinensis*)	O0430	Yes, limited potential, small gappy treeline present on site	Yes

BIRDS			
House martin (*Delichon urbicum*)	O0329	No nesting potential, limited foraging potential	Yes
INVERTEBRATES			
Large red tailed bumblebee (*Bombus (Melanobombus) lapidarius*)	00229	Grassland offers some limited potential	Yes
Freshwater white-clawed crayfish (*Austropotamobius pallipes*)	O0429	No, lacks watercourses	No
FLORA			
Butterfly-bush (*Buddleja davidii*)	O0429	Yes	Yes

*indicates an invasive species

2.64. Table 2-9 below details the results of the NBDC Bat Suitability Index search undertaken for the Proposed Development. The index ranges from 0 to 100, with 0 being least favourable and 100 most favourable for bats.

Table 2-9: Bat Suitability Index

SPECIES	INDEX SCORE
Brown long-eared bat (*Plecotus auritus*)	35
Common pipistrelle (*Pipistrellus pipistrellus*)	40
Daubenton's bat (*Myotis daubentonii*)	41
Leisler's bat (Nyctalus leisleri)	0
Lesser horseshoe bat (*Rhinolophus hipposideros*)	41
Nathusius's pipistrelle (*Pipistrellus nathusii*)	19
Natterer's bat (*Myotis nattereri*)	19
Soprano pipistrelle (*Pipistrellus pygmaeus*)	19
Whiskered bat (*Myotis mystacinus*)	26

Baseline Results

Bats

2.65. The bat suitability index is presented in **Table 2-9**. Records of brown long eared bat, Daubenton's bat, Leisler's bat, soprano pipistrelle and pipistrelle species bat were identified in the desk study.

2.66. The Application Site is primarily comprised of a road, surrounded by recolonising bare ground and grassland. There are a small number of trees within the ESA, none of which provide suitable roosting opportunities.

2.67. A bat transect survey was carried out on the 17th August 2021. One soprano pipistrelle and two Leisler's bat were observed in flight across the site. Bat activity is considered to be **very low.**

Badger

2.68. No records of badger were returned from any grid squares relating to the site. No direct evidence of badger was identified on site and habitats present are not suitable for this species.

Otter

2.69. No records of otter were identified within 2km of the site, and the Application Site is not suitable for this species due to the lack of watercourses.

Hedgehog

2.70. One record of hedgehog was identified during the desk study; however, no direct evidence of hedgehog was identified on site and habitats present offer little potential for this species as it is unsheltered and offers limited foraging opportunities.

Other Mammals

2.71. Records of two invasive mammals; grey squirrel and American mink were identified during the desk study.

2.72. Both of these species are widespread across Ireland, however habitats recorded within the Application Site have low potential to support these species. American mink is often found near coastal areas and larger rivers, whereas grey squirrel prefer woodland and parkland habitats.

Birds

2.73. No formal bird surveys were undertaken in the Application Site. Only one species was observed during the site visit. A buzzard was noted commuting over the site.

2.74. Habitats on site are sub-optimal for most bird species, there are a small number of immature trees within the ESA which could offer potential nesting habitat for bird species.

Herptiles

2.75. No reptile or amphibian was identified during the 2km desk study, and no evidence or suitable habitat was noted during the site surveys.

Invertebrates

2.76. Only one species of notable or protected species were identified in the data search. No notable species were observed during the site surveys.

Flora

2.77. No protected species were returned as part of the data search. Only one record of an invasive species (Butterfly bush) was identified on the data search.

2.78. No rare or notable species were noted on site during the survey.

IMPACT ASSESSMENT

Best Practice Pollution Prevention Measures

2.79. Standard best practice pollution prevention measures will be adhered to, which will reduce the potential for impacts on ecology during the construction stage. As these are standard requirements, they are separate to mitigation measures (which are outlined later in this report). This is of particular importance with the proposed stream re-alignment.

2.80. Relevant measures include, but are not limited to:

Pollution Prevention

- Hydrocarbons, greases and hydraulic fluids will be stored in a secure compound area;
- All plant machinery will be properly serviced and maintained, thereby reducing risk of spillage or leakage;
- All waste produced from construction will be collected in skips, with the construction site kept tidy at all times;
- Excavated soil will be stored on site or removed by a licensed waste disposal unit;
- All materials and substances used for construction will be stored in a secure compound and all chemicals will be stored in secure containers to avoid potential contamination;
- Location of spill kit to be known by all construction workers and used in the event of spillage or leakage.

Waste Management

- Skips are to be used for site waste/debris at all times, and collected regularly or when full;
- All hydrocarbons and fluids are to be collected in leak-proof containers and removed from site for disposal or recycling;
- All waste from construction is to be stored within the site confines and then removed to a permitted waste facility.

Environmental Monitoring

- Contractor is to nominate member of staff as the environmental officer with the responsibility to ensure best practice measures are implemented and adhered to, with any incidents or non-compliance issues being reported to project team.

Designated Sites

2.81. Six Natura 2000 sites were identified within 15km of the Proposed Development Site. Another 4 Natura 2000 Sites are within the ZOI of the Application Site and were considered due to their hydrological connectivity. In total, these sites comprise of six SACs and four SPAs.

2.82. It is considered that the survey area is unlikely to support any of the Annex II species or assemblages of the designated sites.

2.83. The habitats of the Application Site are not suitable for supporting any mobile species associated with the SACs listed above. Narrow-mouthed Whorl Snail and Desmoulin's Whorl Snail (associated with Rye Water Valley/Carton SAC) are restricted to wetland habitats. There are no watercourses within the Application Site suitable for supporting otter.

2.84. The habitats are not suitable for supporting the qualifying bird species of the SPAs listed above. Merlin and Peregrine are associated with the upland habitats of the Wicklow Mountains SPA. Black-headed gulls (associated with Poulaphouca Reservoir SPA) nest in wetland habitats, but are not confined to wetlands, and will forage in domestic waste and fields of crop. As there is there is no food waste or crop associated within the Application Site it is considered there is no potential for gull species to scavenge within the site boundary. Greylag goose prefer coastal habitats or wetland habitats for foraging and/or breeding.

2.85. Given that no connectivity (potential pathway for impact) exists between the Application Site and any Natura 2000 designated sites within 15km of the Application Site, these sites have been scoped out of the impact assessment. No impacts upon these sites will result from the Proposed Development.

2.86. The existing surface water infrastructure comprises two pipes, ultimately discharging into the Griffen River north of the site, this discharges into the River Liffey, approximately 7km from the Application Site. The River Liffey stretches approximately 30km before entering into the Dublin Bay. Therefore, it is considered that there is a potential hydrological connection between the Application Site and the designated sites within the Dublin Bay (South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC) via the movement of surface waters.

2.87. Two proposed Natural Heritage Areas (pNHAs) were identified within 5km of the Proposed Development. There is a potential hydrological connection between the Application Ste and both sites. The existing surface water infrastructure of the development site comprises two pipes, which discharge into the River Griffen north of the site. The River Griffen crosses the Grand Canal and eventually discharges into the River Liffey.

In the Absence of Mitigation

Natura 2000 Sites (SPAs and SACs)

2.88. The Dublin Bay is located approximately 15km from the Application Site. Hydrological connectivity exists between these the Application Site and four sites within the Dublin Bay; South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC.

2.89. The South Dublin Bay and River Tolka SPA and North Bull Island SPA are designated due to supporting assemblages of wetland and waterbirds. Due to a lack of suitable habitat within the site, it is considered highly unlikely that these species would be present on site.

2.90. There are no watercourses on within the Application Site. Given the scale of the development and the large distance between the Application Site and the Dublin Bay, the dilution factor will result in a **negligible** impact upon the qualifying features of the SPAs and SACs. Therefore, **no significant effects** are predicted in the absence of mitigation.

Proposed Natural Heritage Areas (pNHAs)

2.1. The Grand Canal pNHA is located approximately 1.7km north of the Application Site. The Liffey Valley is located approximately 4.5km north. Both sites are hydrological connected via the surface water drainage on site.

2.2. As outlined above, there are no watercourses within the Application Site, and so the only pathway for contaminants would be through the contamination of surface waters. **No significant effects** are predicted in the absence of mitigation.

Recommended Mitigation Measures

2.3. There will be no significant contamination of water in the absence of mitigation. Notwithstanding this, during the construction phase, standard best practice measures will be adhered to.

2.4. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation.

2.5. Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations (up to 3m) during and after heavy rainfall events to ensure that the trenches are kept relatively dry.

Residual Effects

2.6. With best practice measures implemented during the construction of the Proposed Development there will be **no significant negative residual effects**.

Habitats

In the Absence of Mitigation

2.7. The construction of the Proposed Development will occur over land which has been identified as improved agricultural grassland, buildings and artificial surfaces and recolonising bare ground. These habitats are considered to be of **low ecological value** and currently offer limited potential to support wildlife.

2.8. Other potential impacts during the construction phase include indirect loss or damage of habitats as a result of dust and other air- or water-borne pollution. As the construction phase will adhere to all relevant legislation and best practice construction and pollution prevention methods, this is expected to cause only **negligible** loss in a local context where these habitats are frequent. Overall habitat loss is **not considered to be significant** in terms of the Application Site's intrinsic habitat interest.

2.9. It is therefore considered that the loss of habitat under the Proposed Development footprint **will not be significant**.

Recommended Mitigation Measures

2.10. It is considered that no significant impacts will occur in the absence of mitigation, and therefore no mitigation measures are proposed.

Residual Effects

2.11. With best practice measures implemented during the construction of the Proposed Development there will be **no significant negative residual effects**.

Protected and Notable Species

In the Absence of Mitigation

2.12. Each section below details the potential impacts in the absence of mitigation for protected and notable species during the construction phase and the operational phase (expected to be >20 years) of the Proposed Development.

Bats

2.13. The Proposed Development will not involve the removal of any buildings or trees. The Application Site is comprised of improved agricultural grassland, buildings and artificial surfaces and recolonising bare ground; these habitats offer sub-optimal foraging habitat for bat species due to the limited number of prey species present. The loss of these habitats under the Proposed Development footprint **will not lead to a significant reduction** in foraging habitat for local bats.

2.14. The site is currently subjected to high amounts of artificial light from neighbouring similar developments, and streetlighting. The increased amount of artificial light has the potential to reduce the suitability of this habitat to commuting and foraging bats.

Badger

2.15. Habitats on site are not suitable for supporting sett building badgers and are sub-optimal for foraging badger. Therefore, in the absence of mitigation the loss of this habitat will have a **negligible effect** on local badger populations.

2.16. Given that badgers are a highly mobile species there is the potential for the disturbance of badger during the construction phase of the Proposed Development. During the construction phase, the Proposed Development can cause undue stress in a number of ways. Installation of security fencing or hoarding can disrupt badger paths and cut off foraging areas within a clan's territory. Excavations can destroy badger setts, and any excavations lefts overnight can trap badgers.

2.17. The construction phase may have a minor temporary impact on commuting badger. This would result in an effect of **low** spatial and **short-term** temporal magnitude. Given the scale of the project it is considered likely that the Proposed Development will have a **negligible effect on the local badger population.**

Birds

2.18. The Proposed Development will occur on land that is currently of low ecological value and is subject to a level of disturbance from surrounding industrial developments. The Application Site offers limited habitat to support breeding and foraging birds as it is comprised entirely of buildings, artificial surfaces, improved agricultural grassland, and recolonising bare ground. There are a small number of immature trees within the ESA which could offer potential nesting habitat for bird species, however, no trees will be removed in the construction of the Proposed Development.

2.19. Main impacts on bird species from developments include:

- Direct loss or deterioration of habitats.
- Indirect habitat loss as a result of displacement by disturbance.

2.20. The construction phase may have a minor temporary impact on breeding birds, birds if construction works are undertaken between the months of March and August. This would result in an effect of **low spatial** and **short-term temporal** magnitude. Given the scale of the project it is considered likely that the Proposed Development will have a **negligible effect on the local bird populations**.

Mitigation Measures and Further Survey

Badger

2.21. All excavations are to be securely covered or closed off at the end of each working day to prevent the accidental trapping of badgers. Where this is not possible, a means of escape (for example a ramp) must be included to allow safe exit from the excavation. Checks of any open excavations should be performed by site staff prior to each day's works. The proposed security fencing will have mammal gates or a gap of at least 10cm at the bottom to allow free movement of badgers through the site.

2.22. With the implementation of these measures, **no significant effects** upon badger are predicted as a result of the Proposed Development.

Birds

2.23. It is considered unlikely that birds would be nesting within the Application Site, due to the lack of suitable habitat. However, should any bird roosting or nesting be observed within the Application Site during the development phase, works should stop immediately and a suitably qualified and experienced ecologist should be contacted for advice.

Residual Effects

2.24. With the implementation of mitigation measures and further survey prior to and during the construction phase of the Proposed Development, it is considered that there will be **a negligible effect** upon protected or notable species.

CUMULATIVE EFFECTS

2.25. As well as singular effects, cumulative effects also need to be considered. Article 6 of the EU Habitats Directive and Regulation 15 of the European Communities (Natural Habitats) Regulations state that any plan or project that may, either alone or in combination with other plans or projects, significantly affect a designated site, should be the subject of an Appropriate Assessment.

2.26. Cumulative impacts can be an issue when multiple proposals each have a small impact on designated sites. If several proposals also have a small impact, the combined result can have a significant impact on a Natura site.

2.27. A search of the South Dublin County Council online planning portal was undertaken to identify any Projects or developments within 3km which could impact any ecological features, either alone or in combination with the Proposed Development. These developments are outlined in Table 2-11 below.

Table 2-11: Key Developments within 3km of the Proposed Development

Planning Reference	Project Type	Distance and Direction	Planning Status	Date Granted
SD21A/0241	Demolition of the abandoned single storey dwelling and associated outbuilding (206sqm); construction of 2 two storey data centers with plant at roof level of each facility and associated ancillary development which will have a gross floor area of 40,589sq.m	50m north	Additional Information Request	26/10/2021
SD21A/0167	Construction of a gas fired power plant with an electrical output of up to 125MW with associated balance of plant, equipment and buildings.	50m east	Additional Information Request	19/08/2021
SD17A/0377	Revisions and alterations of the permitted development	50m southeast	Grant permission	15/12/2017

	of a data processing facility under planning Ref: SD12A/0002 on a 3.85 hectare site. The revised application consists of alterations to the DUB14 (previously DUB12) data centre/warehouse structure, granted in the previous application. The alterations to the DUB14 (Previously DUB12) include: (i) 2 data halls 2137 sq.m (increase of 180sq.m), (ii) offices/reception 478sq.m (decrease of 190 sq.m), (iii) support space/staff facilities and internal plant with a floor area of 953sq.m (increase of 84sq.m), (iv) external plant of 1,777sq.m (footprint increase of 35sq.m).			
SD21A/0186	Construction of a 3 storey (part 4 storey) data centre known as 'DB8' to include data halls, electrical/plant rooms including internal generators, offices, lobbies, ancillary staff areas including break rooms and toilets, stores, stair/lift cores throughout and photovoltaic panels at roof level	250m northeast	Additional Information Request	30/08/2021

SD20A/0121	Construction of 3 two storey data centres with mezzanine floors at each level of each facility and associated ancillary development that will have a gross floor area of 80,269sq.m on an overall site of 16.5hectares.	300m northwest	Granted	29/07/2020
VA06S.308585 (ABP ref)	Clutterland 110kV GIS Substation building and 2 underground single circuit transmission lines.	300m NW	Approve with Conditions	07/05/2021
SD20A/0295	Amendments and modifications to the permitted data centre development granted under Reg. Ref. SD18A/0134 - ABP Ref. ABP-302813-18 and the temporary substation permission granted under SD19A/0300 , Demolition of the existing single storey house of 'Erganagh' and the construction of a two storey data centre and delivery bays with associated three store office block and services that will have a gross floor area of 35,426sq.m on an overall site of 9.2 hectares.	500m west	Grant permission & grant retention	16/03/2021
SD18A/0134	Demolition of the existing single storey house of 'Erganagh' and the construction of a two storey data centre	>500m W	Grant Permission	24/09/2018

	and delivery bays with associated three storey office block and services that will have a gross floor area of 35,426sq.m on an overall site of 9.2 hectares.			
SD20A/0295 (amendment to SD18A/0134)	Amendments and modifications to the permitted data centre development granted under Reg. Ref. SD18A/0134 - ABP Ref. ABP-302813-18 and the temporary substation permission granted under SD19A/0300	>500m W	Grant Permission	16/03/2021

2.28. As the Proposed Development is situated within an industrial area, the majority of planning applications are for similar developments. Beyond 1km of the Application site, many sites to the north and east are residential in nature, with industrial and military areas also noted to the south.

2.29. It is considered that with the implementation of mitigation measures there will be no impact of the development of the Kilcarbery Substation and Transmission Lines upon any ecological feature. In conclusion, there is no potential for significant effects as a result of the Kilcarbery Substation and Transmission Lines upon any Natura 2000 site within the ZOI.

2.30. The substation will supply the power for the proposed data centre (planning application SD21A/0241) which is directly adjacent. The proposed data centre will result in a small cumulative loss in habitat. However, it is considered that the Proposed Development is comprised of land which is of low ecological significance. A biodiversity management plan has been produced with data centre planning application, it is considered that the enhancement measures proposed will result in net biodiversity gain. Therefore, the small cumulative loss in habitat will not be significant.

2.31. It has been concluded, that with measures included in Proposed Development and the implementation of best practice measures, that it is likely that there will be no significant cumulative effects to designated sites or any other ecological feature in combination with any other development.

CONCLUSION

2.32. To minimise potential impacts on local wildlife, ecological measures have been incorporated into the Proposed Development as part of the iterative design process (see Table 2-12 below). Standard best practice pollution prevention measures for the construction stage have also been outlined and considered as part of the impact assessment stage, prior to mitigation. These measures are also outlined within Table 2-12.

2.33. A total of four habitat types were noted during the habitat survey undertaken in August 2021. The main impacts during the construction phase include the direct loss of habitat under the Proposed Development footprint and indirect loss of habitat due to disturbance and pollution.

2.34. The desk-based assessment identified six Special Areas of Conservation (SACs) and four Special Protection Area (SPA) within the study zone. These designated sites have been outlined and fully assessed within the supporting Appropriate Assessment (AA) report. There is a hydrological connection between the Application Site and designated sites within the Dublin Bay (South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC). There are two Proposed Natural Heritage Areas (pNHAs) located within 5km of the Application Site.

2.35. There will be **no significant effect** on any designated sites as a result of the Proposed Development.

2.36. It is considered that the short-term disturbance from the Proposed Development **will not be significant on all ecological features** if the recommended mitigation is implemented.

Table 2-12: Integral design measures and standard best practice

Site/ Species	Potential Development Impacts	Phase of Development	Measures Implemented
Integral Design Measures			
Badger	Exclusion from foraging habitat	Operational	Security fencing to have 10cm gap at base to allow free movement of badger through the site.
Standard Best Practice Measures			
Aquatic environment	Pollution	Construction	Best practice pollution prevention measures implemented prior to and throughout the construction phase to prevent contaminants entering the aquatic environment.
Badger	Accidental trapping within excavations	Construction	All excavations should be securely covered, or a suitable means of escape provided at the end of each working day.

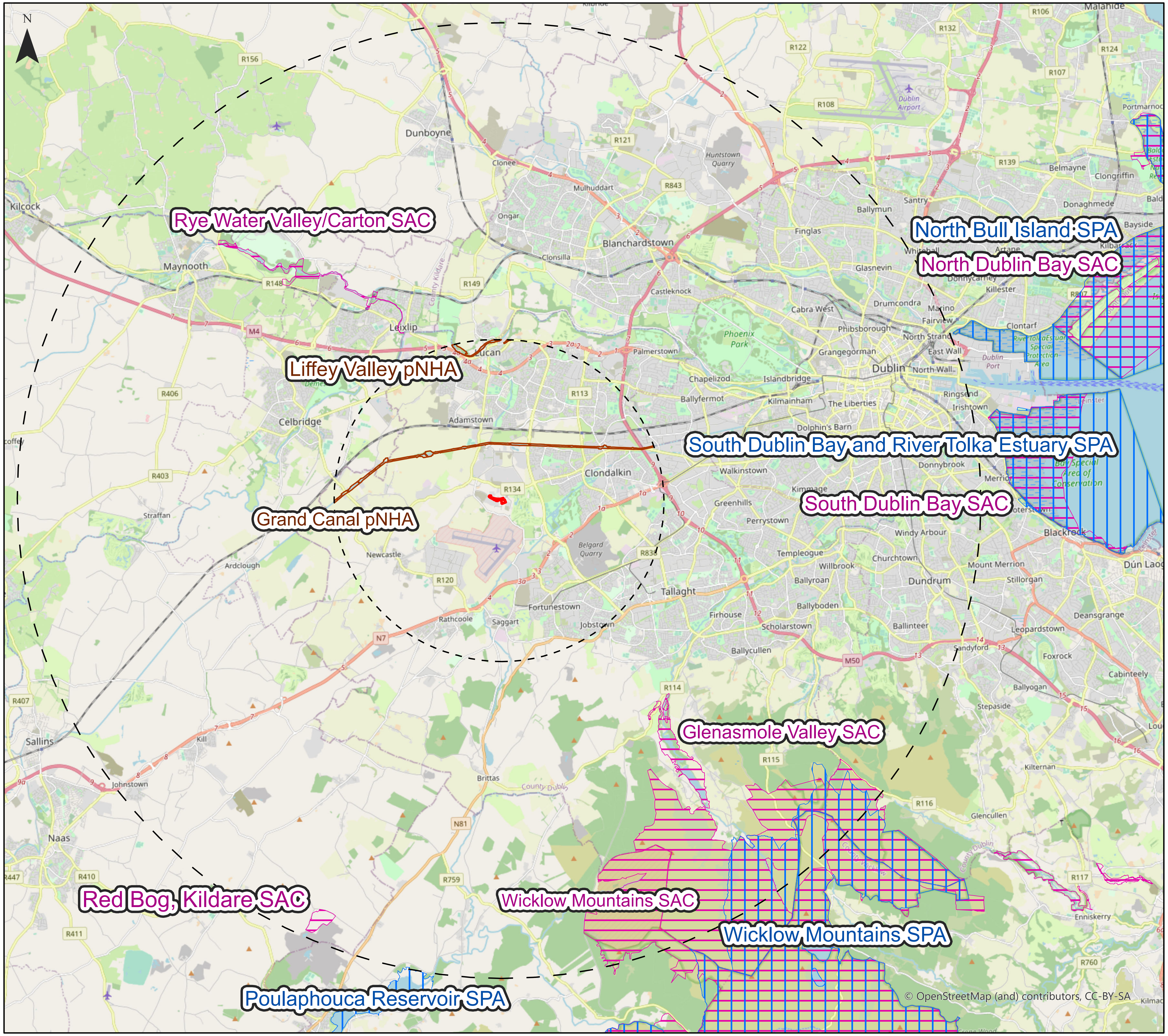
APPENDICES

Appendix A – Figures

- Figure 1 – Environmental Designations Map
- Figure 2 – Habitat Map

Appendix B – Bat Report

Appendix A – Figures



0 3.75 7.5 15 Kilometers

Kilcarbery Substation and Transmission Lines Environmental Designations Figure 1

Key

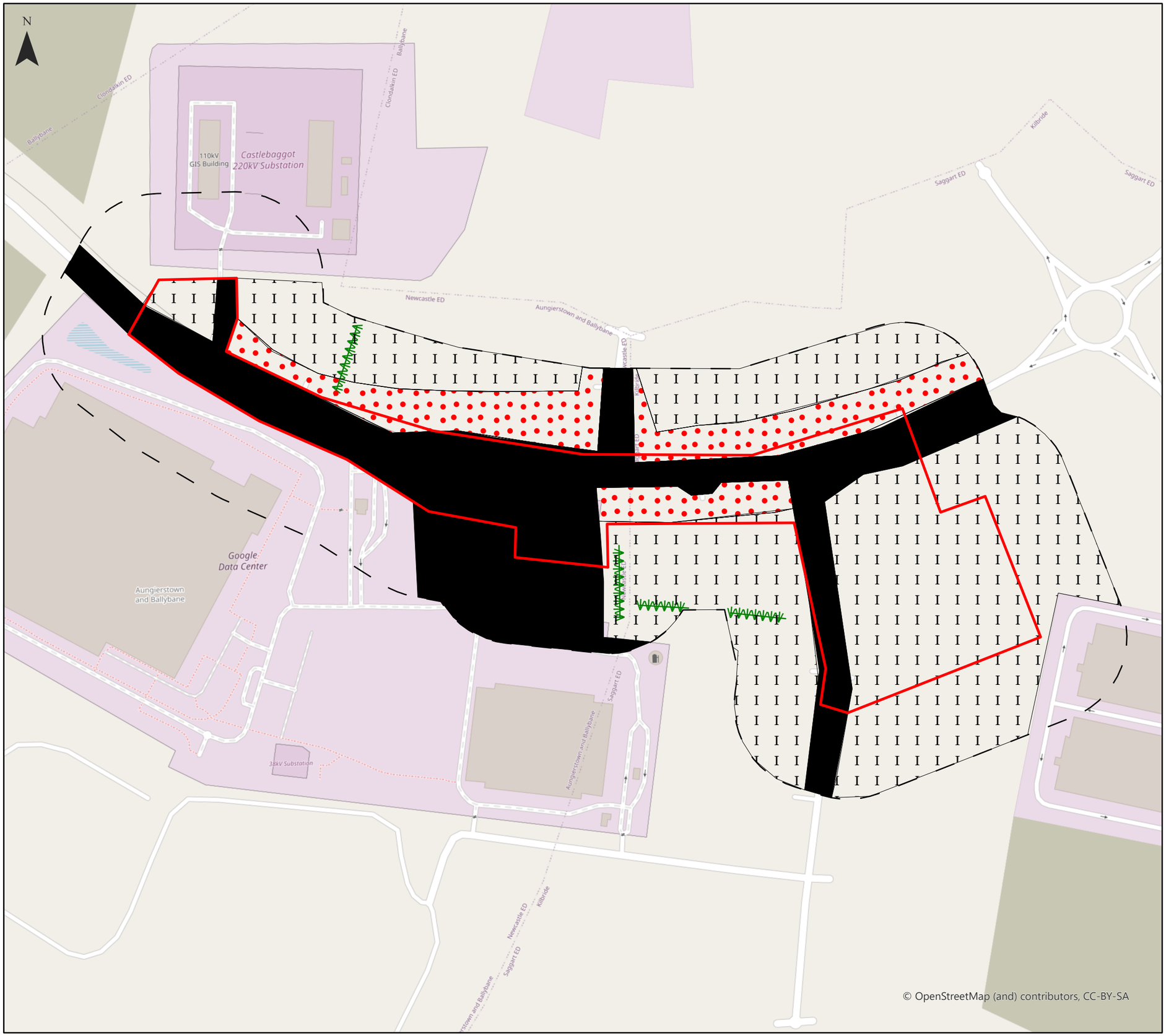
- Development Boundary
- 15km Study Area
- 5km Study Area
- Special Areas of Conservation (SACs)
- Special Protection Areas (SPAs)
- proposed Natural Heritage Areas (pNHAs)

Neo Office Address:
Johnstown Business Centre, Johnstown House, Naas, Co. Kildare

Date: 25/11/2021
Drawn By: Dara Dunlop
Scale (A3): 1:120,000
Drawing No: NEO00867/001IA

NEO ENVIRONMENTAL

Kilcarbery Substation and Transmission Lines Habitat Map Figure 2

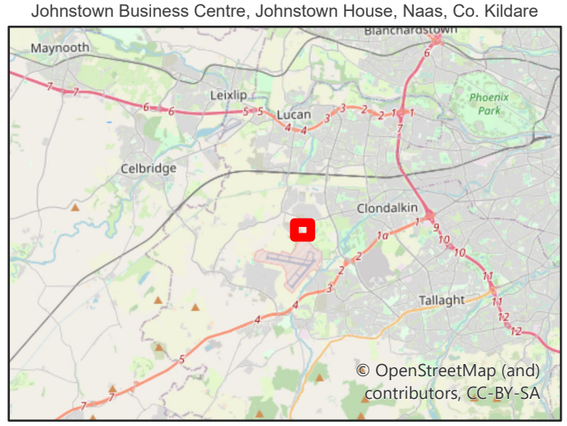


0 45 90 180 Meters

Key

- Development Boundary
- 50m Extended Survey Area (ESA)
- BL3 Buildings and Artifical Surfaces
- ED3 Recolonising Bare Ground
- GA1 Agricultural Grassland
- WL2 Treeline

Neo Office Address:
Johnstown Business Centre, Johnstown House, Naas, Co. Kildare



Date: 25/11/2021
Drawn By: Dara Dunlop
Scale (A3): 1:2,200
Drawing No: NEO00867/001IA

neo ENVIRONMENTAL

Appendix B: Bat Activity Report

25/11/2021

Disclaimer

Neo Environmental Limited shall have no liability for any loss, damage, injury, claim, expense, cost or other consequence arising as a result of use or reliance upon any information contained in or omitted from this document.

Neo Environmental Ltd	
Head Office - Glasgow: Wright Business Centre, 1 Lonmay Road, Glasgow. G33 4EL **T** 0141 773 6262 **E:** info@neo-environmental.co.uk	
Warrington Office: Cinnamon House, Crab Lane, Warrington, WA2 0XP. **T:** 01925 661 716 **E:** info@neo-environmental.co.uk	**Rugby Office:** Valiant Suites, Lumonics House, Valley Drive, Swift Valley, Rugby, Warwickshire, CV21 1TQ. **T:** 01788 297012 **E:** info@neo-environmental.co.uk
Ireland Office: Johnstown Business Centre, Johnstown House, Naas, Co. Kildare. **T:** 00 353 (0)45 844250 **E:** info@neo-environmental.ie	**Northern Ireland Office:** 83 – 85 Bridge Street, Ballymena, Northern Ireland, BT43 5EN. **T**: 0282 565 04 13 **E:** info@neo-environmental.co.uk

Prepared For:

Ramboll

Prepared By:

Dara Dunlop BSc (Hons)

Dylan Donoghue BSc (Hons)

Louis Maloney BSc (Hons), MSc

	Name	Date
Edited By:	Dara Dunlop & Dylan O'Donoghue	12/11/2021
Checked By:	Louis Maloney	12/11/2021
	Name	**Signature**
Approved By	Paul Neary	

Contents

INTRODUCTION

1.1. Neo Environmental Ltd has been appointed by Ramboll on behalf of Vantage Data Centers Dub 11 Limited (the "Applicant") to undertake a bat activity survey for a 110kV GIS Substation, 3 no. transformer bays, and associated compound and site infrastructure (the "Proposed Development") on lands within Profile Park, Clondalkin, Dublin (the "Application Site").

DEVELOPMENT DESCRIPTION

1.2. The project will support the power demand for the Data Center site to the north. The project includes the Kilcarbery 110kV GIS Substation, 3 no. transformer bays, and associated compound and site infrastructure.

SITE DESCRIPTION

1.3. The site is located in Profile Park, centred around Irish grid reference O 03647 30493.

1.4. The site is an irregular parcel of land, extending to approximately 3.19 ha in area and is occupied by agricultural fields. Falcon Avenue runs along the northern boundary of the site.

1.5. The site's immediate boundaries are defined by the following:

- Falcon Avenue to the north, beyond which is undeveloped land, proposed to be developed into a Data Center;
- Agricultural fields to the east, beyond which is Grange Castle Golf Club;
- Barnakyle Substation to the southwest and Digital Reality Profile Park to the southeast, beyond which lies Casement Aerodrome; and
- A data center development on agricultural fields to the west and Castlebaggot Substation.

1.6. The wider context of the site is characterised by a mix of industrial and agricultural development with a fragmented mixture of commercial, industrial and residential uses.

SCOPE OF THE ASSESSMENT

1.7. The objectives of the bat survey were as follows:

- To identify how bats are utilising the site;
- To identify the species of bats utilising the site; and
- To identify if there are any roosts present within the site boundary and, if relevant, to determine the type of roost and its size.

1.8. The aims of the survey are:

- To provide information on whether the proposed development site is utilised by bats;
- To identify if an application for a licence exclusion of bats for development purposes will be required;
- To assess the impacts (both positive and negative) on roosting, foraging and commuting bats; and
- To provide appropriate mitigation, recommendations and enhancement measures for bats (if required).

STATEMENT OF AUTHORITY

1.9. The assessment has been managed by an ecologist registered with the Chartered Institute of Ecology and Environmental Management ('CIEEM'). All work has been carried out in line with the relevant professional guidance; CIEEM's Guidelines for Preliminary Ecological Appraisal[1], Ecological Impact Assessment[2], and Report Writing[3].

1.10. Louis Maloney has four years of professional ecological experience. This includes terrestrial habitat and marine ecology surveys, and the management of Environmental Impact Assessment ("EIA") and Natura Impact Statement ("NIS") reports in Ireland. He holds a BSc

[1] CIEEM (2017) Guidelines for Preliminary Ecological Appraisal.
[2] CIEEM (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Costal and Marine.
[3] CIEEM (2017) Guidelines for Ecological Report Writing.

in Marine Science from the National University of Ireland, and an MSc in Conservation Behaviour – Marine and Terrestrial Science.

1.11. Dara Dunlop is a Qualifying Member of CIEEM with circa 3 years' experience in the ecology sector, including working for an ecological consultancy, undertaking a range of protected species surveys and extended phase 1 habitat surveys for industrial schemes, and land management of designated sites. Dara has co-authored a number of reports including Ecological Impact Assessments and Protected Species Reports for various developments.

1.12. Dylan Donoghue is an Ecologist in the process of receiving membership with the Chartered Institute of Ecology and Environmental management (CIEEM). Dylan has 2 years' experience in the Ecology Sector, including working for an ecological consultancy, undertaking bird and bat surveys.

LEGISLATION, POLICY AND GUIDANCE

PROTECTION OF BATS IN IRELAND

1.13. The EU Habitats Directive sets out the framework for the designation and protection of sites for nature conservation for species and habitats listed in Annex II, IV and V. The directive was adopted in 1992 as a response to the Bern Convention.

1.14. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

1.15. The protection of species outlined in the Habitats Directive is transposed into national legislation principally through the 'European Communities (Birds and Natural Habitats) Regulations 2011'.

1.16. In Ireland, all bat species, except one are classified as Annex IV species under the Habitats Directive. Annex IV species are species in need of strict protection. The exception is the Lesser Horseshoe bat (*Rhinolophus hipposideros*) which is an Annex II species (Priority Species). Annex II species are species requiring the designation of Special Areas of Conservation specifically for their protection. All species of bat in Ireland are strictly protected under the Habitats Directive to include deliberate disturbance of these species,

particularly during the periods of breeding, rearing and hibernation. It also specifies deterioration or destruction of breeding or resting places.

1.17. In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2012). Under this legislation, it is an offence:

- Intentionally to kill, injure or take a bat,
- To possess or control any live or dead specimen or anything derived from a bat,
- Wilfully to interfere with any structure or place used for breeding or resting by a bat,
- Wilfully to interfere with a bat while it is occupying a structure or place which it uses for that purpose.

GUIDANCE DOCUMENTS

1.18. The assessment was carried out in accordance with the following guidelines:

- Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London, and
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. NPWS, Department of Environment, Heritage and Local Government, Dublin.

METHODOLOGY

DESK STUDY

1.19. A desk-based assessment was undertaken to collate available information on bats, to provide an indication of species likely to be present within the surrounding area.

1.20. A data search was conducted through the National Biodiversity Data Centre (NBDC) to collate bat records within 2km of the proposed development in the past ten years. It should

be noted that a lack of desk study records does not infer species absence but is often the result of a lack of data.

1.21. Additional information on the suitability of habitat in the surrounding area for bats was also obtained from the NBDC in the form of a habitat suitability map. The map provided enhanced information on the recorded distribution of bats and broad-scale geographic patterns of occurrence and local roosting habitat requirements for Irish bat species.

DUSK TRANSECT SURVEY

1.22. A transect survey was undertaken on the 17th August 2021 during acceptable weather conditions (see **Table 1**, below).

1.23. An appropriate transect route of the survey area were determined by an ecologist prior to the first transect. The transect was walked at a constant speed, starting approximately 15 minutes before sunset and finishing approximately 90 minutes after.

1.24. A bat pass is defined by the Bat Conservation Trust (BCT) as a sequence of greater than two echolocation calls made as a single bat flies past the microphone. A bat pass is an index of bat activity rather than a measure of number of individuals in a population.

1.25. Bat passes were recorded using an Elekon Batscanner. Where possible, bats within the survey area were identified to their species level. As well as the audible recording of bats within the area, any visual records during the transect surveys were mapped and their activity (commuting, foraging, etc) noted.

1.26. Surveys were undertaken by Dylan Donoghue BSc (Hons), in suitable weather conditions (see Table 4-1)

Table 4-1: Timing and weather conditions for surveys

Survey	Date	Survey Start	Sunset	Survey End	Weather Conditions
Emergence Survey	17/08/2021	20.35	20.51	22.36	16°C, cloud cover 99%, dry, 2/10 wind

STATIC SURVEY

1.27. The survey area was assessed following the August transect survey. A static (Wildlife Acoustics Song Meter SM4 BAT FS) bat detector was deployed on site from the 17th August to record bat passes from 30 minutes before sunset to 15 mins before sunrise each night within the survey area. The bat detector was collected on the 17th September.

RESULTS

DESK STUDY

1.28. A desk-based assessment was undertaken to collate available information on bats, to provide an indication of species likely to be present within the surrounding area. The results of which are detailed within Table 2-8 and Table 2-9 of the EcIA report to which this report is appended.

1.29. A data search was conducted through the NBDC and found five species of bats recorded within 2km of the Application Site, as outlined in Table 5-1 below.

Table 5-1: Records of bats within 2km of the Application Site

Species	Grids with Recordings of Species
Brown Long-eared Bat (*Plecotus auritus*)	O0331 O0231
Daubenton's Bat (*Myotis daubentonii*)	O0331 O0231
Lesser Noctule (*Nyctalus leisleri*)	O0331 O0430 O0231 O0429
Pipistrelle (*Pipistrellus pipistrellus sensu lato*)	O0331 O0430 O0231 O0429
Soprano Pipistrelle (*Pipistrellus pygmaeus*)	O0331 O0430 O0231

DUSK TRANSECT AND STATIC SURVEY

1.30. Only 3 bat passes were recorded during the transect survey. One soprano pipistrelle was observed community over the Application Site. One Leisler's bat was recorded commuting, and towards the end of the survey one Leisler's bat was observed foraging over grassland along the eastern boundary of the Application Site. Static Survey Results

1.31. A one static activity survey was undertaken, from mid-August – September.

Table 5-4: Bat Passes Recorded During Static Survey

Date	Leisler's Bat	Common Pipistrelle
28/08	4	0
06/09	0	2
07/09	0	1
09/09	0	2
13/09	0	1
16/09	0	1
Total Passes	**4**	**8**

1.32. A total of 12 bat passes were recorded over the month. An average of 0.55 bat passes were recorded per night over 30 nights.

1.33. Only two species were recorded, the majority (66.67%) of calls were from Common pipistrelle.

CONCLUSION

1.34. The bat surveys revealed that bat activity is very low at the Application Site.

1.35. A static bat detector was deployed on site for one month, to determine the level of bat activity. Eight bat passes were recorded during this survey, this works out to an average of less than 1 bat passes (0.55) per night. Two species of bats were recorded: Leisler's bat and common pipistrelle.

1.36. Two species of bat were recorded during the transect survey: Leisler's bat and soprano pipistrelle. Of the bats recorded; two were commuting over the site and one was foraging over grassland.

1.37. It is considered that the Proposed Development **will not significantly impact** local bat populations.

GLASGOW - HEAD OFFICE

Wright Business Centre, 1 Lonmay Road, Glasgow G33 4EL
T: 0141 773 6262
www.neo-environmental.co.uk

N. IRELAND OFFICE

83-85 Bridge Street
Ballymena, Co. Antrim
Northern Ireland
BT43 5EN
T: 0282 565 04 13

IRELAND OFFICE

Johnstown Business Centre
Johnstown House, Naas
Co. Kildare
T: 00 353 (0)45 844250
E: info@neo-environmental.ie

RUGBY OFFICE

Valiant Office Suites
Lumonics House, Valley Drive,
Swift Valley, Rugby,
Warwickshire, CV21 1TQ
T: 01788 297012

WARRINGTON OFFICE

Cinnamon House, Cinnamon Park
Crab Lane, Fearnhead
Warrington
Cheshire
T: 01925 661 716

Technical Appendix 11.2: Appropriate Assessment Screening Report

Appropriate Assessment Screening

Kilcarbery Substation and Transmission Lines

24/11/2021

Disclaimer

Neo Environmental Limited shall have no liability for any loss, damage, injury, claim, expense, cost or other consequence arising as a result of use or reliance upon any information contained in or omitted from this document.

Neo Environmental Ltd	
Head Office - Glasgow: Wright Business Centre, 1 Lonmay Road, Glasgow. G33 4EL **T** 0141 773 6262 **E:** info@neo-environmental.co.uk	
Warrington Office: Cinnamon House, Crab Lane, Warrington, WA2 0XP. **T:** 01925 661 716 **E:** info@neo-environmental.co.uk	**Rugby Office:** Valiant Suites, Lumonics House, Valley Drive, Swift Valley, Rugby, Warwickshire, CV21 1TQ. **T:** 01788 297012 **E:** info@neo-environmental.co.uk
Ireland Office: Johnstown Business Centre, Johnstown House, Naas, Co. Kildare. **T:** 00 353 (0)45 844250 **E:** info@neo-environmental.ie	**Northern Ireland Office:** 83-85 Bridge Street, Ballymena, Co. Antrim BT43 5EN **T:** 0282 565 04 13 **E:** info@neo-environmental.co.uk

Prepared For:

Ramboll

Prepared By:

Dara Dunlop BSc (Hons)

Louis Maloney BSc (Hons), MSc

	Name	Date
Edited By:	Dara Dunlop	24/11/2021
Checked By:	Louis Maloney	24/11/2021
	Name	**Signature**
Approved By	Paul Neary	

Contents

1. EXECUTIVE SUMMARY

1.1. A Stage 1 Appropriate Assessment has been undertaken for a proposed substation and transmission lines on lands within Profile Park, Clondalkin, Dublin. The aim of the Appropriate Assessment Screening is to assess the potential for connectivity between the Proposed Development and any Natura 2000 site.

1.2. Within the Zone of Influence ("ZOI") surrounding the Site, there are ten Natura 2000 designated sites, comprising six Special Areas of Conservation ("SACs") and four Special Protection Areas ("SPAs").

1.3. The existing surface water infrastructure comprises two pipes, ultimately discharging into the Griffen River north of the site, this discharges into the River Liffey, approximately 7km from the Application Site. The River Liffey stretches approximately 30km before entering into the Dublin Bay. Therefore, it is considered that there is a very limited hydrological connection between the Application Site and the designated sites within the Dublin Bay (South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC) via surface water drainage.

1.4. To provide a current baseline for the Application Site, an ecological site visit was undertaken in August 2021 by Dylan Donoghue BSc (Hons). During this site visit habitats were assessed for their potential to support protected/notable species. No evidence of any qualifying species was observed within or adjacent to the Application Site during the site visit and habitats on site are considered to be sub-optimal.

1.5. It was found that no ecological or ornithological connectivity exists between the Proposed Development and any Natura 2000 Site within the ZOI.

1.6. There are no watercourses within the Application Site, and therefore the possibility of contamination reaching the river is very low. Additionally, the distance from the Natura 2000 Sites will result in the dissolution of contamination. It is considered that there will be no contamination of the designated sites within the Dublin Bay as a result of the Proposed Development.

1.7. This Appropriate Assessment Screening has concluded that the Proposed Development is **not likely to have a significant effect** on any Natura 2000 designated site. Therefore, the next stage of the Appropriate Assessment (Natura Impact Statement ("NIS")) is not required.

2. INTRODUCTION

Background

2.1. Neo Environmental Ltd has been appointed by Ramboll on behalf of Vantage Data Centers Dub 11 Limited (the "Applicant") to undertake an Appropriate Assessment (AA) Screening for a proposed 110kV GIS Substation and associated compound and site infrastructure (the "Proposed Development") located on lands within Profile Park, Clondalkin, Dublin (the "Application Site").

2.2. The aim of this screening document is to determine whether a Natura Impact Statement (NIS) is required for the Proposed Development.

Development Description

2.3. The project will support the power demand for the Data Center site to the north. The project includes the Kilcarbery 110kV GIS Substation, 3 no. transformer bays, and associated compound and site infrastructure.

Site Description

2.4. The site is located in Profile Park, centred around Irish grid reference O 03647 30493.

2.5. The site is an irregular parcel of land, extending to approximately 3.19 ha in area and is occupied by agricultural fields. Falcon Avenue runs along the northern boundary of the site.

2.6. The site's immediate boundaries are defined by the following:

- Falcon Avenue to the north, beyond which is undeveloped land, proposed to be developed into a Data Center;
- Agricultural fields to the east, beyond which is Grange Castle Golf Club;
- Barnakyle Substation to the southwest and Digital Reality Profile Park to the southeast, beyond which lies Casement Aerodrome; and
- A data center development on agricultural fields to the west and Castlebaggot Substation.

2.7. The wider context of the site is characterised by a mix of industrial and agricultural development with a fragmented mixture of commercial, industrial and residential uses.

Ecological Site Visit

2.1. A Fossit habitat survey was undertaken in August 2021 by Dylan Donoghue BSc (Hons) which identified the following habitats:

- Buildings and artificial surfaces (BL3)
- Recolonising bare ground (ED3)
- Improved Agricultural Grassland (GA1)
- Treelines (WL2)

2.2. No evidence of protected species was noted on site during this survey.

Statement of Authority

2.3. The assessment has been conducted by an ecologist registered with the Chartered Institute of Ecology and Environmental Management (CIEEM). All work has been carried out in line with the relevant professional guidance, namely CIEEM's Guidelines for Report Writing[1] and the Environment, Heritage and Local Government Guidance on Appropriate Assessments[2].

2.4. Louis Maloney has four years of professional ecological experience. This includes terrestrial habitat and marine ecology surveys, and the management of Environmental Impact Assessment ("EIA") and Natura Impact Statement ("NIS") reports in Ireland. He holds a BSc in Marine Science from the National University of Ireland, and an MSc in Conservation Behaviour – Marine and Terrestrial Science.

2.5. Dara Dunlop is a Qualifying Member of the Chartered Institute of Ecology and Environmental Management (CIEEM) with circa 3 years' experience in the ecology sector. This includes working for an ecological consultancy, undertaking a range of protected species surveys and extended phase 1 habitat surveys for residential schemes and land management of designated sites. Dara has co-authored a number of reports for various developments including Ecological Impact Assessments and Protected Species Reports.

2.6. Dylan Donoghue is an Ecologist in the process of receiving membership with the Chartered Institute of Ecology and Environmental management (CIEEM). Dylan has 2 years' experience in the Ecology Sector, including working for an ecological consultancy, undertaking bird and bat surveys.

[1] CIEEM (2017) Guidelines for Ecological Report Writing. Available at www.cieem.net

[2] Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities. Available at www.npws.ie

3. LEGISLATION & GUIDEANCE

REQUIREMENT FOR APPROPRIATE ASSESSMENT

3.1. The requirement for Appropriate Assessment of plans or projects originates from Article 6 (3) and (4) of European Union (EU) Habitats Directive. This is implemented in Ireland through the European Communities (Natural Habitats) Regulations of 1997, and the European Communities (Birds and Natural Habitats) Regulations 2011 – 2015 (as amended) and in particular, in relation to the planning consent process, in Part XAB of the Planning and Development Act 2000 – 2015 (as amended) where Section 177U sets out the requirements for Screening for AA.

3.2. This Appropriate Assessment Screening Report has been prepared in accordance with the above and the European Commission Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (European Commission 2002), the European Commission Guidance Managing Natura 2000 Sites (European Commission 2000) and with reference to the Department of the Environment and Heritage and Local Government guidance on Appropriate Assessment of plans and projects in Ireland (DEHLG 2009) and Natura 2000 (European Commission 2010).

3.3. The EU Habitats Directive (92/43/EEC) provides the framework for legal protection for habitats and species of European importance. The directive provides the legislative means to establish a network of sites (known as the Natura 2000 network) throughout the EU with the objective of conserving habitats and species deemed to be of International Importance. These sites include Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Birds Directive (formally known as the Conservation of Wild Birds Directive 79/409/EEC).

3.4. The wording of Article 6 (3) of the Directive is as follows:

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."

3.5. The relevant wording of Section 177U (4) of the Planning and Development Act is as follows:

"The competent authority shall determine that an appropriate assessment of a [...] proposed development [...] is required if it cannot be excluded, on the basis of objective information, that

the [...] proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site. As outlined in the European Commission document 'Assessment of plans and projects significantly affecting Natura 2000 sites', any project that is not directly connected with or necessary to the management of a Natura 2000 site, but likely to have a significant effect upon it, either individually or cumulatively will be subject to Appropriate Assessment.

Where significant effects are uncertain or unknown at the screening stage an AA will be required, due to the need to apply the precautionary principle. Conversely, if a project will have impacts on a site, but these impacts will clearly not affect or undermine those conservation objectives, it is not considered that it will have a significant effect on the site concerned.

As part of the assessment consideration is afforded to 'in combination' effects with other plans or projects on the integrity of Natura 2000 sites. Where adverse impacts are identified, mitigation measures can be proposed that would avoid reduce or remedy any such negative impacts and the plan or project should then be amended accordingly, thereby avoiding the need to proceed to Stage 3 'Alternative Solutions'.

3.6. If the assessment cannot exclude significant impacts either alone or in combination with other plans or projects, then the process must proceed to Stage 2.

3.7. The following legislation was used to inform the Article 6 assessments within this report:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, 1992[3];
- Council Directive 2009/147/EC on the Conservation of Wild Birds, 2009[4];
- The Planning and Development Acts 2000 (as amended)[5].
- NPWS, The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments, Unpublished Report, 2013[6].

GUIDANCE

3.8. The following guidance has been compiled and reviewed to inform the Article 6 assessments within this report:

[3] European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites, Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats directive 92/43/EEC. Available at: http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf
[4] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043
[5] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147
[6] Available at: http://www.irishstatutebook.ie/eli/2017/act/20/enacted/en/html

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities, 2009 (as amended)[7];
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10[8] & PSSP 2/10, 2008[9];
- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, 2001[10];
- CIEEM, Guidelines for Ecological Report Writing, 2017[11].

[7] Available at: https://www.npws.ie/sites/default/files/publications/pdf/Article_17_Print_Vol_3_report_species_v1_1_0.pdf
[8] Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf
[9] Available at: https://www.npws.ie/sites/default/files/general/Circular%20NPW1-10%20%26%20PSSP2-10%20Final.pdf
[10] Available at: https://www.npws.ie/sites/default/files/general/circular-npws-02-08.pdf
[11] CIEEM (2017) Guidelines for Ecological Report Writing. CIEEM, Winchester.

4. ASSESSMENT METHODOLOGY

STAGES OF APPROPRIATE ASSESSMENT

4.1. The Appropriate Assessment process comprises of four stages in order to identify whether proposals have the potential to impact significantly upon Natura 2000 designations. The stages are as follows:

- **Stage 1 Screening:** To determine the likelihood of significant impacts.
- **Stage 2 Natura Impact Statement:** To assess the impact of proposals on the integrity of the Natura 2000 site, considering the conservation objectives of the site and its ecological structure and function.
- **Stage 3 Assessment of alternatives:** Where significant impacts are anticipated despite mitigation measures, the proposal should progress to Stage 3 or no longer proceed.
- **Stage 4 Assessment where no alternative exists and where adverse impacts remain**: The final stage involves examining whether there are imperative reasons of overriding public interest for allowing the proposal to adversely impact upon a Natura 2000 site.

Source – Pathway - Receptor Model

4.2. The 'source-pathway-receptor' conceptual model is a tool used for environmental assessment. For an effect to occur, all elements of this model must be linked. The removal or absence of one of the elements of the model results in there being no likelihood for the effect in question to occur. For example:

- Source(s), e.g. blasting;
- Pathway(s) e.g. vibration and noise; and,
- Receptor(s) e.g. disturbance of nesting birds.

4.3. For an AA or NIS, this model is focused solely on the selection features of Natura 2000 sites as defined by National Parks and Wildlife Services (NPWS) and referenced within this report.

4.4. The Proposed Development may have the potential to result in a number of impacts, which could potentially affect the selection features of Natura 2000 sites. The analysis of these effects, using scientific knowledge and professional judgement, leads to the identification of a "zone of influence" for each effect (i.e., the distance at which the impact of the Proposed

Development could have potential effects, using professional judgement and published guidance).

STUDY ZONE IDENTIFICATION

4.5. The 'Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities'[12] states that the AA Screening should include the following:

"Any Natura 2000 sites within or adjacent to the plan or project area.

Any Natura 2000 sites within the likely zone of impact of the plan or project.

A distance of 15km is currently recommended in the case of plans and derives from UK guidance (Scott Wilson et. al., 2006). For projects, the distance could be much less than 15km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects.

Natura 2000 sites that are more than 15km from the plan or project area depending on the likely impacts of the plan or project, and the sensitivities of the ecological receptors, bearing in mind the precautionary principle. In the case of sites with water dependent habitats or species, and a plan or project that could affect water quality or quantity, for example, it may be necessary to consider the full extent of the upstream and/or downstream catchment."

4.6. It is considered that the Zone of Influence (ZOI) in connection with the Natura 2000 designated sites and their qualifying features will extend to a 15km radius. While this would be greater were the Proposed Development to have any hydrological influence beyond 15km, no such influence has been identified.

DESK STUDY

4.7. Sources of material that were consulted as part of the desk study for the purposes of the assessment are as follows:

- National Parks & Wildlife Service (NPWS) natural heritage database for Natura 2000 sites within the 15km ZOI of the Application Site[13];

[12] Department for Environment, Heritage and Local Government (2009) Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities.
Available at: http://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf

[13] Environment, Heritage and Local Government (2009) Appropriate Assessment of Plan and Projects in Ireland. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf

- NPWS site synopses, Natura 2000 Data Form and conservation objectives relating to each site and aerial images.

IMPACT ASSESSMENT PROCESS

4.8. The assessment process involves:

- Identifying and characterising Natura 2000 sites identified within the Zone of Influence surrounding the Application Site, and their qualifying features, and addressing whether any of these designated sites have any connectivity with the Proposed Development. If any site is found to have no connectivity, then these designated sites will be 'scoped out' or not considered further;
- Assessing whether there will be any significant impacts to any of the Natura 2000 site, in regard to changes that result from the construction, operation and decommissioning phases of a project. Qualifying features of a Natura 2000 site that lie outside of the ZOI and not subject to any impacts from the Proposed Development then these will be 'scoped out' or not considered further;
- Identifying any significant impacts on the integrity of the Natura 2000 site from the development and 'in combination' with any other development within 5km;
- Identifying the need for the Appropriate Assessment process to move to Stage 2: 'Natura Impact Statement or, if there are no impacts from the development, that the development may proceed.

5. BASELINE

5.1. In accordance with National Parks & Wildlife Service (NPWS) guidance, this stage of the AA has identified all Natura 2000 sites located within 15km of the development boundary.

5.2. Effects can depend more on the nature of impacts, sensitivity of receptors and causal linkage, rather than actual distances. The assessment below considers connectivity, either ecological, ornithological or hydrological, that may exist between the Proposed Development and the designated sites.

5.3. The potential effects associated with the Proposed Development have been identified. Those Natura 2000 sites which will not be significantly affected will be ruled out of any further assessment.

IDENTIFICATION OF NATURA 2000 SITES

5.4. There are ten Natura 2000 designated sites located within the Zone of Influence of the Application Site, comprising six Special Areas of Conservation (SACs), and four Special Protection Areas (SPAs). The qualifying features of each have been outlined within **Table 5-1** below.

5.5. **Figure 1**, **Appendix A** of this report details the location of these sites in relation to the Application Site.

Table 5-1: Natura 2000 sites within 15km, or with a hydrological connection

Site Code	Site Name	Qualifying Features	Distance (km), Direction	Potential Connectivity with the Proposed Development Site
SAC				
001398	Rye Water Valley/Carton SAC	Petrifying springs with tufa formation (*Cratoneurion*) [7220] *Vertigo angustior* (Narrow-mouthed Whorl Snail) [1014] *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016]	5.9km northwest	No connection

001209	Glenasmole Valley SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] Petrifying springs with tufa formation (*Cratoneurion*) [7220]	7.9km southeast	No connection
002122	Wicklow Mountains SAC	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] *Calaminarian* grasslands of the *Violetalia calaminariae* [6130] Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bogs (* if active bog) [7130] Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) [8110] Calcareous rocky slopes with chasmophytic vegetation [8210] Siliceous rocky slopes with chasmophytic vegetation [8220] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] *Lutra lutra* (Otter) [1355]	9.6km southeast	No connection
000397	Red Bog, Kildare SAC	Transition mires and quaking bogs [7140]	13.9km southwest	No connection

000210	South Dublin Bay SAC	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310] Embryonic shifting dunes [2110]	15.45km east	Hydrological connection
000206	North Dublin Bay SAC	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Humid dune slacks [2190] *Petalophyllum ralfsii* (Petalwort) [1395]	18.15km northeast	Hydrological connection
SPA				
004040	Wicklow Mountains SPA	Merlin (*Falco columbarius*) [A098] Peregrine (*Falco peregrinus*) [A103]	12.7km southeast	No connection
004063	Poulaphouca Reservoir SPA	Greylag Goose (*Anser anser*) [A043] Lesser Black-backed Gull (*Larus fuscus*) [A183]	14.9km southwest	No connection
004024	South Dublin Bay and River Tolka SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130]	15.13km northeast	Hydrological connection

		Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit *(Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194] Wetland and Waterbirds [A999]		
004006	North Bull Island SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (Calidris alpina) [A149] Black-tailed Godwit (*Limosa limosa*) [A156]	18.15km northeast	Hydrological connection

		Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Wetland and Waterbirds [A999]		

5.6. As shown in Table 5-1, the Application Site lacks ornithological connectivity with any of the detailed SPAs and lacks ecological connectivity with any of the SACs.

5.7. It is considered that the survey area is unlikely to support any of the Annex II species or assemblages listed above.

5.8. The habitats of the Application Site are not suitable for supporting any mobile species associated with the SACs listed above. Narrow-mouthed Whorl Snail and Desmoulin's Whorl Snail (associated with Rye Water Valley/Carton SAC) are restricted to wetland habitats. There are no watercourses within the Application Site suitable for supporting otter.

5.9. The habitats are not suitable for supporting the qualifying bird species of the SPAs listed above. Merlin and Peregrine are associated with the upland habitats of the Wicklow Mountains SPA. Black-headed gulls (associated with Poulaphouca Reservoir SPA and North Bull Island SPA) nest in wetland habitats, but are not confined to wetlands, and will forage in domestic waste and fields of crop. As there is there is no food waste or crop associated within the Application Site it is considered there is no potential for gull species to scavenge within the site boundary. Greylag goose prefer coastal habitats or wetland habitats for foraging and/or breeding.

5.10. The existing surface water infrastructure comprises two pipes, ultimately discharging into the Griffen River north of the site, this discharges into the River Liffey, approximately 7km from the Application Site. The River Liffey stretches approximately 30km before entering into the Dublin Bay. Therefore, it is considered that there is a very limited hydrological connection between the Application Site and the designated sites within the Dublin Bay (South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC) through the movement of surface waters. These Natura 2000 sites have not been scoped out and are discussed in detail in section 6.

5.11. Given that no connectivity (potential pathway for impact) exists between the Application Site and 6 of the above listed Natura 2000 designated sites (see Table 5-1) within 15km of the Application Site, these sites have been scoped out of the impact assessment. No impacts upon these sites will result from the Proposed Development.

6. ASSESSMENT OF LIKELY EFFECTS

IMPACT ASSESSMENT

6.1. This section discusses and evaluates the likely impacts of the Proposed Development affecting the Natura 2000 sites within the Zone of Influence (ZOI) of the Application Site (i.e. where there is some ecological, ornithological or hydrological connection between the Application Site and the Natura 2000 site).

6.2. As outlined within Table 5-1 above, the Application Site has hydrological connectivity (albeit limited) with the South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC, offering a pathway for impacts through the movement of contaminated waters.

6.3. Aquatic systems and the species/habitats which are dependent on these systems are sensitive to pollution and contamination of surface waters. Pollution can result from any of the following entering a body of surface or groundwater:

- Poisonous, noxious or polluting matter;
- Waste matter (including silt, cement, concrete, oil, petroleum spirit, chemicals, solvents, sewage and other polluting matter);
- Other harmful activities detrimentally affecting the status of a waterbody.

6.4. Table 6-1 below details common water pollutants and their effect on the aquatic environment and standard Best Practice Pollution Measures. (This table has been extracted from Ciria guidance[14]).

[14] Ciria (2015) Environmental Good Practice on Site guide, fourth edition

Table 6-1: Common water pollutants and their effects on the aquatic environment and standard prevention measures

Common Water Pollutants	Adverse **Effect on Aquatic Environment**	Standard Best Practice Pollution Prevention Measures
Silt	Reduces water quality, clogs fish gills, covers aquatic plants, impacts aquatic invertebrates, leads to a reduction in prey for species and leads to degradation of habitat	<u>Pollution Prevention</u> Hydrocarbons, greases and hydraulic fluids will be stored in a secure compound area; All plant machinery will be properly serviced and maintained thereby reducing risk of spillage or leakage; All waste produced from construction will be collected in skips with the construction site kept tidy at all times; Excavated soil will be stored on site or removed by a licensed waste disposal unit; All materials and substances used for construction will be stored in a secure compound and all chemicals to be stored in secure containers to avoid potential contamination; Location of spill kit to be known by all construction workers and implemented in the event of spillage or leakage. <u>Waste Management</u> Skips are to be used for site waste/debris at all times and collected regularly or when full; All hydrocarbons and fluids are to be collected in leak-proof containers and removed from site for disposal or recycling;
Bentonite (very fine silt)	Reduces water quality, clogs fish gills, covers aquatic plants, impacts aquatic invertebrates, leads to a reduction in prey for species and leads to degradation of habitat	
Cement or concrete wash water (highly alkaline)	Changes the chemical balance, is toxic to fish and other wildlife. This can lead to direct impacts for aquatic species (including otter), or indirect through loss of prey resources	
Detergent	Removes dissolved oxygen, can be toxic to fish and other wildlife present within the aquatic environment	

Hydrocarbons (e.g. oil, diesel)	Suffocates aquatic life, damaging to the wildlife (e.g. birds), and to water supplies including industrial abstractions	All waste from construction is to be stored within the site confines and removed to a permitted waste facility. <u>Environmental Monitoring</u> Contractor to nominate member of staff as the environmental officer with the responsibility to ensure best practice measures are implemented and adhered to, with any incidents or non-compliance issues being reported to project team.
Sewage	Reduces water quality, is toxic to aquatic wildlife, and damages water supplies	

South Dublin Bay and River Tolka Estuary SPA

6.5. As described within **Table 5-1**, The South Dublin Bay and River Tolka Estuary SPA is designated for its importance for the following Annex II species:

- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046];
- Oystercatcher (*Haematopus ostralegus)* [A130];
- Ringed Plover (*Charadrius hiaticula*) [A137];
- Grey Plover (*Pluvialis squatarola*) [A141];
- Knot (*Calidris canutus*) [A143];
- Sanderling (*Calidris alba*) [A144];
- Dunlin (*Calidris alpina*) [A149];
- Bar-tailed Godwit (*Limosa lapponica*) [A157];
- Redshank (*Tringa totanus*) [A162];
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179];
- Roseate Tern (*Sterna dougallii*) [A192];
- Common Tern (*Sterna hirundo)* [A193];

- Arctic Tern (*Sterna paradisaea*) [A194]; and
- Wetland and Waterbirds [A999].

Conservation Objectives for South Dublin Bay and River Tolka Estuary SPA

6.6. The main conservation objective[15] of the South Dublin Bay and River Tolka Estuary SPA is to restore the favourable conservation status of habitats and species of community interest. The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Character of the South Dublin Bay and River Tolka Estuary SPA

6.7. **Table 6-2** below, identifies the percentage of the extent of various habitat types within the South Dublin Bay and River Tolka Estuary SPA.

Table 6-2: Habitats within South Dublin Bay and River Tolka Estuary SPA

Code	Habitats River Boyne and Blackwater SAC	Extent (%)
N01	Marine areas and sea inlets	40
N02	Tidal rivers, estuaries, mud flats, sand flats, lagoons (including saltwork basins)	58
N04	Coastal sand dunes, Sand beaches, Machair	1
N05	Shingle, Sea cliffs, Islets	1

Assessment of Likely Impacts Affecting South Dublin Bay and River Tolka Estuary SPA

6.8. The South Dublin Bay and River Tolka Estuary SPA is located approximately 15km northeast but connectivity is over 30km downstream of the Application Site. The site has been designated for a number of important Annex II species of the E.U. Habitats Directive, as detailed within **Table 5-1** above. The SPA is comprised entirely of coastal, marine and estuarine habitats, and does not share any of the habitats as are found within the Application Site. It is considered highly unlikely that these species would be present on site.

[15] NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

6.9. There are no watercourses on within the Application Site. Given the drainage measures in place at the site, and the large distance between the Application site and the SPA, the dilution factor will result in a **negligible** impact upon the SPA and its qualifying species.

6.10. There will be no significant contamination of water in the absence of mitigation. Notwithstanding this, during the construction phase, standard best practice measures will be adhered to.

6.11. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation.

6.12. Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations (up to 3m) during and after heavy rainfall events to ensure that the trenches are kept relatively dry.

6.13. Therefore, **no significant effects** are predicted on qualifying species of South Dublin Bay and River Tolka Estuary SPA

SUMMARY OF POTENTIAL IMPACTS ON NATURA SITES WITHIN DUBLIN BAY

6.14. There is limited hydrological connectivity between the Proposed Development and Natura 2000 Sites within the Dublin Bay. Due to the drainage measures in place, and likely dispersion it is considered that potential effects are **negligible**. With best practice pollution measures in place it is considered that there is **no potential for significant effects**.

6.15. Potential impacts from the Proposed Development **will not be significant** or have a detrimental effect on the qualifying features of any Natura 2000 designated sites with a hydrological connection.

7. CUMULATIVE IMPACTS

7.1. As well as singular effects, cumulative effects need to be considered. Article 6 of the EU Habitats Directive and Regulation 15 of the European Communities (Natural Habitats) Regulations state that any plan or project that may (either alone or in combination with other plans or projects) significantly affect a Natura 2000 site should be the subject of an Appropriate Assessment.

7.2. Cumulative impacts can cause problems when proposals have a small impact on Natura 2000 sites. If other proposals have a small impact, the combined result can have a significant impact on the Natura site.

7.3. A search of the South Dublin County Council online planning portal was undertaken to identify any Projects or developments within 3km which could impact any ecological features, either alone or in combination with the Proposed Development. These developments are outlined in Table 2-11 below.

Table 2-11: Key Developments within 3km of the Proposed Development

Planning Reference	Project Type	Distance and Direction	Planning Status	Date Granted
SD21A/0241	Demolition of the abandoned single storey dwelling and associated outbuilding (206sqm); construction of 2 two storey data centers with plant at roof level of each facility and associated ancillary development which will have a gross floor area of 40,589sq.m	50m north	Additional Information Request	26/10/2021
SD21A/0167	Construction of a gas fired power plant with an electrical output of up to 125MW with associated balance of plant, equipment and buildings.	50m east	Additional Information Request	19/08/2021
SD17A/0377	Revisions and alterations of the permitted development of a data processing facility under	50m southeast	Grant permission	15/12/2017

	planning Ref: SD12A/0002 on a 3.85 hectare site. The revised application consists of alterations to the DUB14 (previously DUB12) data centre/warehouse structure, granted in the previous application. The alterations to the DUB14 (Previously DUB12) include: (i) 2 data halls 2137 sq.m (increase of 180sq.m), (ii) offices/reception 478sq.m (decrease of 190 sq.m), (iii) support space/staff facilities and internal plant with a floor area of 953sq.m (increase of 84sq.m), (iv) external plant of 1,777sq.m (footprint increase of 35sq.m).			
SD21A/0186	Construction of a 3 storey (part 4 storey) data centre known as 'DB8' to include data halls, electrical/plant rooms including internal generators, offices, lobbies, ancillary staff areas including break rooms and toilets, stores, stair/lift cores throughout and photovoltaic panels at roof level	250m northeast	Additional Information Request	30/08/2021
SD20A/0121	Construction of 3 two storey data centres with mezzanine floors at each level of each facility and associated ancillary development that will have a gross floor area of	300m northwest	Granted	29/07/2020

	80,269sq.m on an overall site of 16.5hectares.			
VA06S.308585 (ABP ref)	Clutterland 110kV GIS Substation building and 2 underground single circuit transmission lines.	300m NW	Approve with conditions	07/05/2021
SD20A/0295	Amendments and modifications to the permitted data centre development granted under Reg. Ref. SD18A/0134 - ABP Ref. ABP-302813-18 and the temporary substation permission granted under SD19A/0300 , Demolition of the existing single storey house of 'Erganagh' and the construction of a two storey data centre and delivery bays with associated three store office block and services that will have a gross floor area of 35,426sq.m on an overall site of 9.2 hectares.	500m west	Grant permission & grant retention	16/03/2021
SD18A/0134	Demolition of the existing single storey house of 'Erganagh' and the construction of a two storey data centre and delivery bays with associated three storey office block and services that will have a gross floor area of 35,426sq.m on an overall site of 9.2 hectares.	>500m W	Grant Permission	24/09/2018
SD20A/0295 (amendment to SD18A/0134)	Amendments and modifications to the permitted data centre development granted under Reg. Ref.	>500m W	Grant Permission	16/03/2021

	SD18A/0134 - ABP Ref. ABP-302813-18 and the temporary substation permission granted under SD19A/0300			

7.4. As the Proposed Development is situated within an industrial area, the majority of planning applications are for similar developments. Beyond 1km of the Application Site, many sites to the north and east are residential in nature, with industrial and military areas also noted to the south.

7.5. It is considered that there is no potential for significant effects as a result of the Kilcarbery Substation and Transmission Lines upon any Natura 2000 site.

7.6. The substation will supply the power for the proposed data center (planning application SD21A/0241) directly adjacent to the Proposed Development. It is considered that the both the substation and proposed data center is comprised of land which is of low ecological significance. A biodiversity management plan has been produced with data center planning application, it is considered that the enhancement measures proposed will result in net biodiversity gain. Given the distance (approximately 30km downstream) and dilution factors, it is not anticipated that the proposed data center would cause any impact to any designated site or its qualifying features.

7.7. It has therefore been concluded that the Proposed Development will give rise to no likely significant cumulative effects upon Natura 2000 designated sites in combination with any other development.

8. CONCLUSION

8.1. According to NPWS (2009), the Appropriate Assessment Stage 1: Screening exercise can result in one of three conditions:

- An Appropriate Assessment is not required i.e., where the plan/proposal is associated with the management of the site;
- There is no potential for significant effects i.e., Appropriate Assessment is not required;
- Significant effects are certain, likely or uncertain i.e., the project must either proceed to Stage 2: Appropriate Assessment or be rejected.

8.2. The Proposed Development was screened for likely significant adverse effects upon any designated sites within its Zone of Influence. There are ten designated sites, comprising six Special Areas of Conservation (SACs) and four Special Protection Areas (SPAs).

8.3. It was found that no ecological or ornithological connectivity exists between the Proposed Development and any Natura 2000 Site. It was found that there is limited hydrological connectivity between the Application Site and the designated sites within the Dublin Bay (South Dublin Bay and River Tolka SPA, North Bull Island SPA, South Dublin Bay SAC and North Dublin Bay SAC).

8.4. It has been concluded that the Proposed Development **will not lead to significant adverse impacts** upon any Natura 2000 sites. **No likely significant effect** is foreseen upon these Natura 2000 sites as a result of the proposals, either alone or in combination with any other development.

8.5. This screening report, based on the best available scientific information, finds that there is no reasonable scientific doubt that the development does not pose any risk of significant adverse effects on Natura 2000 sites, and that the development does not require progression to a Stage 2 AA.

9. APPENDICES

Appendix A

- Figure 1: Natura 2000 Designated Sites

Kilcarbery Substation and Transmission Lines
Natura 2000 Sites
Figure 1

Key

- Development Boundary
- 15km Study Area
- Special Areas of Conservation (SACs)
- Special Protection Areas (SPAs)

Rye Water Valley/Carton SAC

North Bull Island SPA

North Dublin Bay SAC

South Dublin Bay and River Tolka Estuary SPA

South Dublin Bay SAC

Glenasmole Valley SAC

Red Bog, Kildare SAC

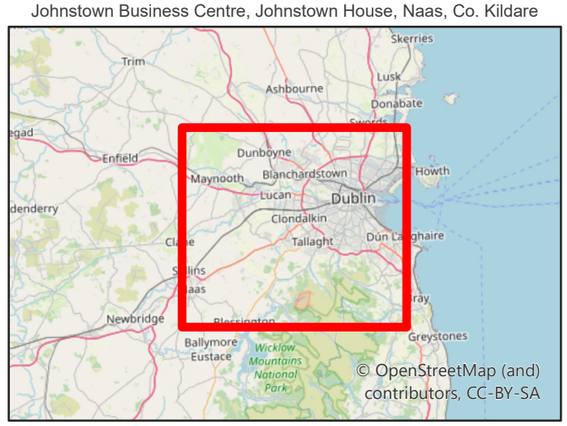
Wicklow Mountains SAC

Wicklow Mountains SPA

Poulaphouca Reservoir SPA

0 3.75 7.5 15 Kilometers

Neo Office Address:
Johnstown Business Centre, Johnstown House, Naas, Co. Kildare



Date: 25/11/2021
Drawn By: Dara Dunlop
Scale (A3): 1:120,000
Drawing No: NEO00867/001IA

neo ENVIRONMENTAL

GLASGOW - HEAD OFFICE

Wright Business Centre, 1 Lonmay Road, Glasgow G33 4EL
T: 0141 773 6262
www.neo-environmental.co.uk

N. IRELAND OFFICE

83-85 Bridge Street
Ballymena, Co. Antrim
Northern Ireland
BT43 5EN
T: 0282 565 04 13

IRELAND OFFICE

Johnstown Business Centre
Johnstown House, Naas
Co. Kildare
T: 00 353 (0)45 844250
E: info@neo-environmental.ie

RUGBY OFFICE

Valiant Office Suites
Lumonics House, Valley Drive,
Swift Valley, Rugby,
Warwickshire, CV21 1TQ
T: 01788 297012

WARRINGTON OFFICE

Cinnamon House, Cinnamon Park
Crab Lane, Fearnhead
Warrington
Cheshire
T: 01925 661 716

Technical Appendix 12.1: Ground Investigation Report

IGSL Ltd

Project Appollo (Substation)

Ground Investigation Report

Project No. 23415

August 2021

M7 Business Park
Naas
Co. Kildare
Ireland

T: +353 (45) 846176
E: info@igsl.ie
W: www.igsl.ie

DOCUMENT ISSUE REGISTER

Distribution	Report Status	Revision	Date of Issue	Prepared By:	Approved By:
Ramboll	Factual Report, PDF by email	0	24 August 2021	John Lawler Professional Geologist BSc MSc PGeo EurGeol FGS	David Green BA BAI CEng FGS

TABLE OF CONTENTS

FIGURES

APPENDICES

FOREWORD
The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards
The ground investigation works for this project (**Project Appollo (Substation)**) have been carried out by IGSL Limited in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (2015) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Principles for a classification
- EN ISO 14689-1:2017 Geotechnical Investigation and Testing – Identification, description & classification of rock

Reporting
No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Ramboll and the information should not be used without their prior written permission. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures
Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing
Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the

engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling
Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

IGSL has undertaken a programme of geotechnical site investigation works at a greenfield site located in Profile Park, Dublin 22. The site comprises a net area of approx. 1.6 acres (Figure 1). Profile Park comprises a 100 acre fully enclosed, private business park situated approximately 13 kilometres west of Dublin city centre.

Figure 1 – Site Location Plan (boxed area denotes extent of site investigation area)

Retrieved from Google Earth Pro (Image dated 04/04/2021)

The investigation comprised trial pits, dynamic probes, soakaway testing (to BRE 365) and in situ plate bearing testing. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL engineering geologist.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil and upper rockhead samples. The geotechnical testing included moisture contents, Atterberg Limits and particle size distribution [PSD]. Soil thermal conductivity was also measured using needle probe methods. Chemical analysis of soil samples to the BRE SD1 Concrete in Aggressive Ground suite was completed. Pyrite analysis to EN1744 was undertaken in order to quantify total sulphur and acid-soluble sulphate contents and to allow estimation of both oxidisable sulphides and equivalent pyrite content in the rock sample. Environmental tests were undertaken on soil samples (WAC *Rilta* suite) to assess suitability for off-site disposal to landfill. This report presents the factual geotechnical data acquired from the 2021 investigation. The exploratory hole locations are plotted on the site plan in Appendix 8.

2. FIELDWORK

2.1 General

The fieldworks were undertaken during June 2021. The works which form this report comprise the following:

- Trial Pits (6 No.)
- Dynamic Probing (22 No.[i])
- Soakaway Testing (to BRE365) (1 No.)
- Plate Bearing Testing (5 No.)
- Surveying of Exploratory Hole Locations

[i] Dynamic Probeholes DP12A and DP12B were undertaken following shallow refusals in both DP12 and DP12A

2.2 Trial Pits

Trial pitting was undertaken at six locations across the site using a JCB backhoe excavator. After first scanning the ground using a cable avoidance tool [CAT] and after consultation with available service drawings, the trial pits were each excavated, logged and sampled under the direction of an IGSL engineering geologist in accordance with BS 5930 (2015). Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing.

All trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs and photos are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions (where encountered) and stability of the pit sidewalls.

2.3 Dynamic Probing

In-situ "Heavy" dynamic probing (DPH) was performed at twenty-two locations using a compact crawler rig. The tracked Dando Terrier probing unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007. Due to shallow obstructions, additional probes were undertaken at locations DP12A and DP12B.

The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to avoid damage to equipment. The probe records are presented in Appendix 2 and include blow-counts in both numerical and graphical format.

2.4 Soakaway Testing (to BRE 365)

An infiltration test was performed to assess the suitability of the subsoil for dispersion of storm water through a soakaway system. The infiltration test was performed in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the subsoil, water was poured into the test pit, with records taken of the fall in water level against time. Following the first soak cycle, the procedure was repeated to ensure saturation of the subsoil. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final soak cycle. The soakaway design logs are presented in Appendix 3.

2.5 Plate Bearing Testing

Plate bearing tests were conducted at five locations each at a depth of 0.30m below ground level [bgl]. The tests were conducted on typically grey brown sandy very gravelly CLAY. Plate testing was undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used for the tests with kentledge provided by a mechanical excavator. Two load

cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 4.

2.6 Surveying of Exploratory Hole Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 8.

3. LABORATORY TESTING

Geotechnical laboratory testing was performed at IGSL's INAB-accredited laboratory in accordance with the methods set out in BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. Soils testing included moisture content and Atterberg Limit (Liquid / Plastic Limits) determination along with analysis of particle size distribution [PSD] and soil conductivity. The results from geotechnical testing on selected trial pit soils are presented in Appendix 5.

Chemical testing of soils to BRE SD1 test suite was also completed. The results feature in the Chemtest report in Appendix 6. Soil samples were selected from pits for specialist Waste Acceptance Criteria (WAC) analysis. The results can be used to classify the material with regard to its potential for disposal to landfill. These results are also presented in the Chemtest report in Appendix 6. The results of the testing to EN1744 on the upper rockhead sample from TP02 are presented in the Nicholls Colton report presented in Appendix 7.

BIBLIOGRAPHY

1.0 BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1

Trial Pit Logs and Photographs

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,641.45 E 730,516.65 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.47
ENGINEER	Ramboll	**EXCAVATION METHOD**	JCB

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	Firm brown sandy slightly gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159736 AA159737	B B	0.40-0.50 0.40-0.50		
			0.60	73.87						
1.0	Firm to stiff greyish brown sandy very gravelly CLAY with a medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159738 AA159739	B B	1.80-1.90 1.80-1.90		
			2.00	72.47						
2.0	Possible LIMESTONE Rockhead End of Trial Pit at 2.00m									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,674.85 E 730,523.58 N
		DATE STARTED	22/06/2021
		DATE COMPLETED	22/06/2021
CLIENT		**GROUND LEVEL (m)**	74.10
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159728 AA159729	B B	0.50-0.60 0.50-0.60		
1.0 Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.00	73.10		AA159730 AA159731	B B	1.90-2.00 1.90-2.00		
2.0 Possible LIMESTONE Rockhead End of Trial Pit at 2.10m		2.10	72.00						

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,702.61 E 730,534.87 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Brown mottled grey slightly silty sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular.					AA159748	B	0.50-0.60		
					AA159749	B	0.50-0.60		
1.0									
Firm to stiff black sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.90	71.85						
2.0				1 (Seepage)	AA159750	B	2.30-2.40		
					AA159751	B	2.30-2.40		
Possible LIMESTONE Rockhead End of Trial Pit at 2.50m		2.50	71.25						

Groundwater Conditions
Seepage at 2.30m

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,705.37 E 730,508.75 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	73.94
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0									
Firm brown sandy gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular.					AA159744 AA159745	B B	0.50-0.60 0.50-0.60		
1.0									
Possible Weathered Rockhead comprising muddy limestone recovered as (dense) brown slightly clayey slightly sandy GRAVEL with a high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.		1.10	72.84		AA159746	B	1.50-1.60		
Possible LIMESTONE Rockhead End of Trial Pit at 1.60m		1.60	72.34		AA159747	B	1.50-1.60		
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,680.66 E 730,500.79 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.30
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to medium, subangular to angular.					AA159740 AA159741	B B	0.40-0.50 0.40-0.50		
Stiff brown sandy very gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.		0.60	73.70						
1.0					AA159742 AA159743	B B	1.60-1.70 1.60-1.70		
Possible LIMESTONE Rockhead End of Trial Pit at 1.70m		1.70	72.60						
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

TRIAL PIT RECORD

REPORT NUMBER 23415

CONTRACT	Project Appollo (Substation)	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	J. Condon	**CO-ORDINATES**	703,643.57 E 730,495.61 N
		DATE STARTED	23/06/2021
		DATE COMPLETED	23/06/2021
CLIENT		**GROUND LEVEL (m)**	74.75
		EXCAVATION METHOD	JCB
ENGINEER	Ramboll		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Firm brown sandy very gravelly CLAY with a medium to high cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159732 AA159733	B B	0.50-0.60 0.50-0.60		
		0.90	73.85						
1.0 Dark brown sandy very gravelly CLAY with a low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular.					AA159734 AA159735	B B	1.60-1.70 1.60-1.70		
		1.80	72.95						
Possible LIMESTONE Rockhead End of Trial Pit at 1.80m									
2.0									

Groundwater Conditions

Stability
Good

General Remarks
CAT [cable avoidance tool] used ahead of breaking ground

IGSL TP LOG 23415.GPJ IGSL.GDT 24/8/21

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 1 of 3

TP01 – 2 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP01 – 3 of 3

TP02 – 1 of 3

TP02 – 2 of 3

TP02 – 3 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP03 – 1 of 3

TP03 – 2 of 3

TP03 – 3 of 3

TP04 – 1 of 3

TP04 – 2 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP04 – 3 of 3

Project Appollo (Substation)
Project No: 23415
Trial Pit Photographs

TP05 – 1 of 3

TP05 – 2 of 3

TP05 – 3 of 3

TP06 – 1 of 3

TP06 – 2 of 3

TP06 – 3 of 3

Appendix 2

Dynamic Probing

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP01
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.41 E
730,480.71 N
GROUND LEVEL (mOD) 74.93

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	6
						0.30	7
						0.40	8
						0.50	13
						0.60	15
						0.70	14
						0.80	15
						0.90	11
1.0						1.00	8
						1.10	5
						1.20	4
						1.30	4
						1.40	11
						1.50	17
						1.60	23
						1.70	19
						1.80	14
						1.90	8
2.0						2.00	12
						2.10	10
						2.20	10
						2.30	25
	End of Probe at 2.40 m			72.53			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP02
SHEET Sheet 1 of 1

CO-ORDINATES 703,658.47 E
730,483.35 N
GROUND LEVEL (mOD) 74.76

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

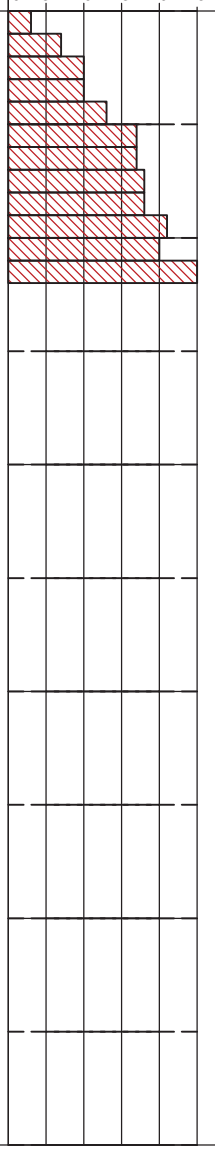
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	7
						0.20	10
						0.30	10
						0.40	13
						0.50	17
						0.60	17
						0.70	18
						0.80	18
						0.90	21
1.0						1.00	20
	End of Probe at 1.20 m			73.56		1.10	25
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP03
SHEET Sheet 1 of 1

CO-ORDINATES 703,678.30 E
730,485.98 N
GROUND LEVEL (mOD) 74.40

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

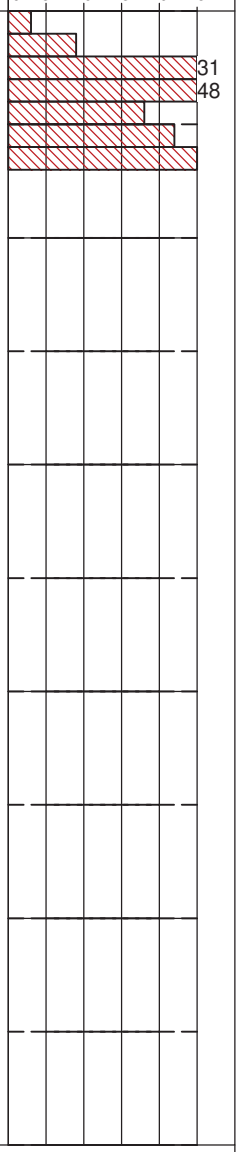
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	9
						0.20	31
						0.30	48
						0.40	18
						0.50	22
						0.60	25
	End of Probe at 0.70 m			73.70			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP04
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.97 E
730,490.03 N

GROUND LEVEL (mOD) 74.13

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

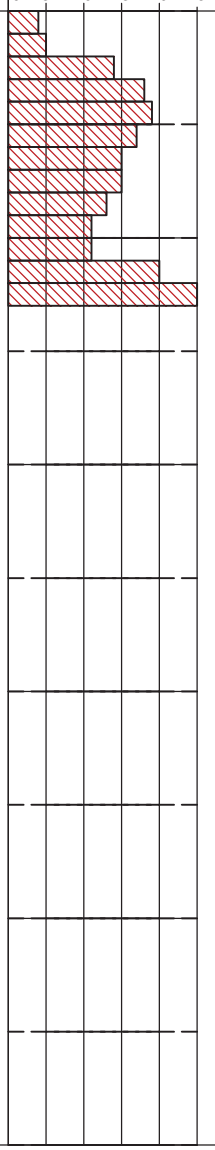
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	5
						0.20	14
						0.30	18
						0.40	19
						0.50	17
						0.60	15
						0.70	15
						0.80	13
						0.90	11
1.0						1.00	11
						1.10	20
						1.20	25
	End of Probe at 1.30 m			72.83			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP05
SHEET Sheet 1 of 1

CO-ORDINATES 703,721.25 E
730,497.34 N

GROUND LEVEL (mOD) 74.00

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	9
						0.20	9
						0.30	15
						0.40	20
						0.50	17
						0.60	12
						0.70	11
						0.80	9
						0.90	7
1.0						1.00	8
						1.10	7
						1.20	5
						1.30	5
						1.40	4
						1.50	6
						1.60	8
						1.70	10
						1.80	10
						1.90	11
2.0						2.00	25
	End of Probe at 2.10 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP06
SHEET Sheet 1 of 1

CO-ORDINATES 703,718.48 E
730,512.36 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

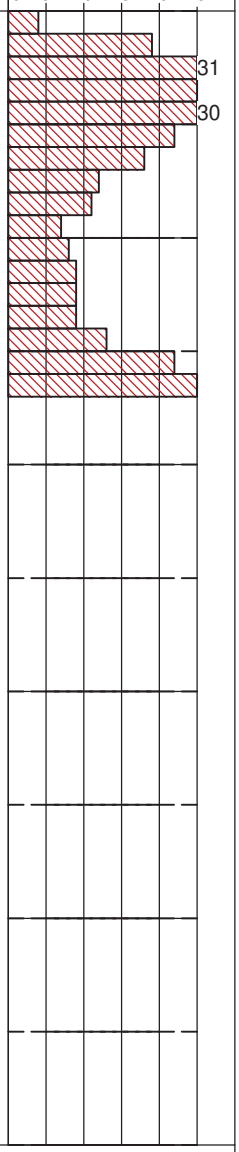
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	19
						0.20	31
						0.30	25
						0.40	30
						0.50	22
						0.60	18
						0.70	12
						0.80	11
						0.90	7
1.0						1.00	8
						1.10	9
						1.20	9
						1.30	9
						1.40	13
						1.50	22
						1.60	25
	End of Probe at 1.70 m			72.22			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP07
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.27 E
730,510.48 N

GROUND LEVEL (mOD) 74.03

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	8
						0.20	6
						0.30	5
						0.40	2
						0.50	4
						0.60	2
						0.70	3
						0.80	4
						0.90	13
1.0						1.00	16
						1.10	8
						1.20	11
						1.30	12
						1.40	14
						1.50	15
						1.60	16
						1.70	16
						1.80	23
						1.90	25
2.0	End of Probe at 2.00 m			72.03			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP08
SHEET Sheet 1 of 1

CO-ORDINATES 703,677.23 E
730,508.92 N
GROUND LEVEL (mOD) 74.28

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

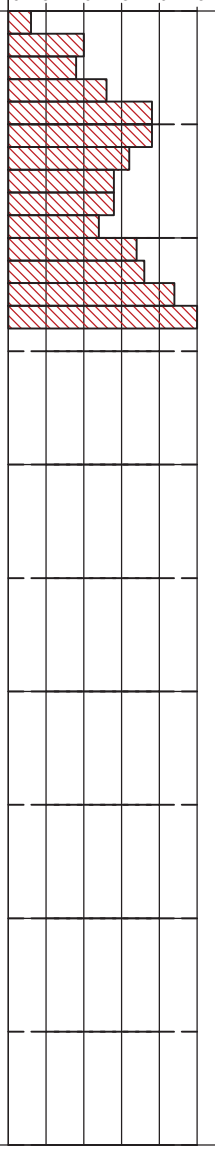
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	10
						0.20	9
						0.30	13
						0.40	19
						0.50	19
						0.60	16
						0.70	14
						0.80	14
						0.90	12
1.0						1.00	17
						1.10	18
						1.20	22
						1.30	25
	End of Probe at 1.40 m			72.88			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP09
SHEET Sheet 1 of 1

CO-ORDINATES 703,659.76 E
730,505.35 N
GROUND LEVEL (mOD) 74.67

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	6
						0.10	11
						0.20	16
						0.30	17
						0.40	13
						0.50	15
						0.60	17
						0.70	16
						0.80	10
						0.90	9
1.0						1.00	10
						1.10	12
						1.20	13
						1.30	25
	End of Probe at 1.40 m			73.27			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP10
SHEET Sheet 1 of 1

CO-ORDINATES 703,633.00 E
730,501.03 N
GROUND LEVEL (mOD) 74.77

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	6
						0.20	11
						0.30	17
						0.40	24
						0.50	23
						0.60	17
						0.70	14
						0.80	15
						0.90	10
1.0						1.00	7
						1.10	5
						1.20	5
						1.30	7
						1.40	7
						1.50	5
						1.60	5
						1.70	6
						1.80	7
						1.90	25
2.0	End of Probe at 2.00 m			72.77			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP11
SHEET Sheet 1 of 1

CO-ORDINATES 703,634.25 E
730,512.03 N
GROUND LEVEL (mOD) 74.47

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

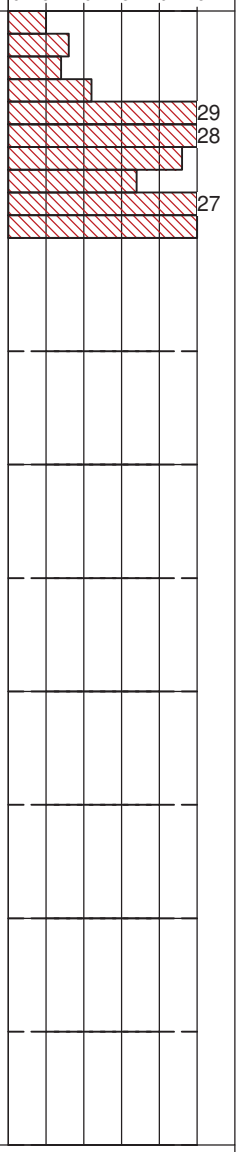
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	5
						0.10	8
						0.20	7
						0.30	11
						0.40	29
						0.50	28
						0.60	23
						0.70	17
						0.80	27
						0.90	25
1.0	End of Probe at 1.00 m			73.47			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	9	
						0.10	14	
						0.20	35	35
	End of Probe at 0.30 m			74.24				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12A with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12A
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record (0 5 10 15 20 25)
0.0	.					0.00	10	
						0.10	31	31
	End of Probe at 0.20 m			74.34				
1.0								
2.0								
3.0								
4.0								

GROUNDWATER OBSERVATIONS

REMARKS
Obstruction encountered. Moved to DP12B with probe re-attempted.

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP12B
SHEET Sheet 1 of 1

CO-ORDINATES 703,660.86 E
730,517.73 N

GROUND LEVEL (mOD) 74.54

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

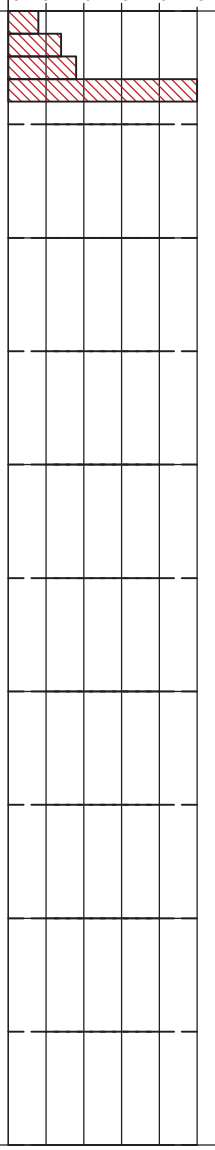
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	7
						0.20	9
						0.30	25
	End of Probe at 0.40 m			74.14			
1.0							
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP13
SHEET Sheet 1 of 1

CO-ORDINATES 703,676.23 E
730,520.95 N
GROUND LEVEL (mOD) 74.09

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	12
						0.20	8
						0.30	7
						0.40	9
						0.50	10
						0.60	12
						0.70	11
						0.80	10
						0.90	8
1.0						1.00	13
						1.10	13
						1.20	10
						1.30	9
						1.40	9
						1.50	7
						1.60	8
						1.70	4
						1.80	4
						1.90	5
2.0						2.00	8
						2.10	12
						2.20	25
	End of Probe at 2.30 m			71.79			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP14
SHEET Sheet 1 of 1

CO-ORDINATES 703,697.07 E
730,526.54 N
GROUND LEVEL (mOD) 73.90

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	2
						0.10	4
						0.20	6
						0.30	6
						0.40	10
						0.50	9
						0.60	8
						0.70	6
						0.80	5
						0.90	6
1.0						1.00	4
						1.10	2
						1.20	2
						1.30	2
						1.40	2
						1.50	3
						1.60	7
						1.70	19
						1.80	24
						1.90	25
2.0	End of Probe at 2.00 m			71.90			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP15
SHEET Sheet 1 of 1

CO-ORDINATES 703,714.22 E
730,530.72 N
GROUND LEVEL (mOD) 73.82

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	5
						0.20	6
						0.30	5
						0.40	3
						0.50	3
						0.60	4
						0.70	3
						0.80	2
						0.90	0
1.0						1.00	1
						1.10	3
						1.20	6
						1.30	20
						1.40	22
						1.50	15
						1.60	14
						1.70	25
	End of Probe at 1.80 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP16
SHEET Sheet 1 of 1

CO-ORDINATES 703,709.00 E
730,551.32 N
GROUND LEVEL (mOD) 73.42

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	12
						0.20	18
						0.30	12
						0.40	8
						0.50	5
						0.60	3
						0.70	2
						0.80	2
						0.90	6
1.0						1.00	12
						1.10	9
						1.20	25
	End of Probe at 1.30 m			72.12			
2.0							
3.0							
4.0							

Graphic Probe Record
0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP17
SHEET Sheet 1 of 1

CO-ORDINATES 703,696.59 E
730,547.68 N
GROUND LEVEL (mOD) 73.51

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

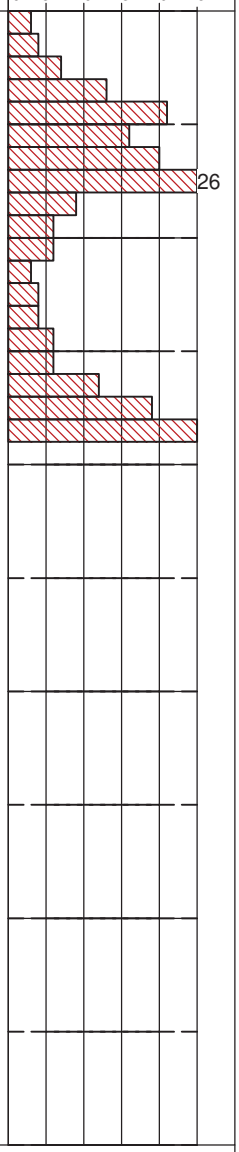
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	4
						0.20	7
						0.30	13
						0.40	21
						0.50	16
						0.60	20
						0.70	26
						0.80	9
						0.90	6
1.0						1.00	6
						1.10	3
						1.20	4
						1.30	4
						1.40	6
						1.50	6
						1.60	12
						1.70	19
						1.80	25
	End of Probe at 1.90 m			71.61			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP18
SHEET Sheet 1 of 1

CO-ORDINATES 703,673.63 E
730,539.03 N
GROUND LEVEL (mOD) 73.92

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	4
						0.10	12
						0.20	19
						0.30	24
						0.40	22
						0.50	16
						0.60	16
						0.70	12
						0.80	15
						0.90	8
1.0						1.00	9
						1.10	8
						1.20	9
						1.30	10
						1.40	15
						1.50	18
						1.60	14
						1.70	11
						1.80	25
	End of Probe at 1.90 m			72.02			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP19
SHEET Sheet 1 of 1

CO-ORDINATES 703,661.62 E
730,534.73 N
GROUND LEVEL (mOD) 74.16

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

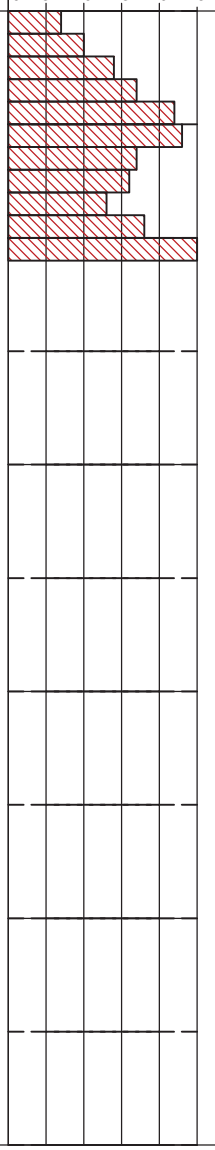
DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	14
						0.30	17
						0.40	22
						0.50	23
						0.60	17
						0.70	16
						0.80	13
						0.90	18
1.0						1.00	25
	End of Probe at 1.10 m			73.06			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

DYNAMIC PROBE RECORD

REPORT NUMBER 23415

CONTRACT Project Appollo (Substation)

PROBE NO. DP20
SHEET Sheet 1 of 1

CO-ORDINATES 703,635.43 E
730,523.72 N
GROUND LEVEL (mOD) 74.46

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 25/06/2021
DATE LOGGED 25/06/2021

CLIENT
ENGINEER Ramboll

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	7
						0.10	10
						0.20	7
						0.30	6
						0.40	5
						0.50	7
						0.60	6
						0.70	4
						0.80	3
						0.90	5
1.0						1.00	5
						1.10	3
						1.20	3
						1.30	3
						1.40	3
						1.50	5
						1.60	4
						1.70	6
						1.80	19
						1.90	25
2.0	End of Probe at 2.00 m			72.46			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 23415.GPJ IGSL.GDT 24/8/21

Appendix 3

Soakaway Test Records

Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 1)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	Dry

Notes:

Field Data

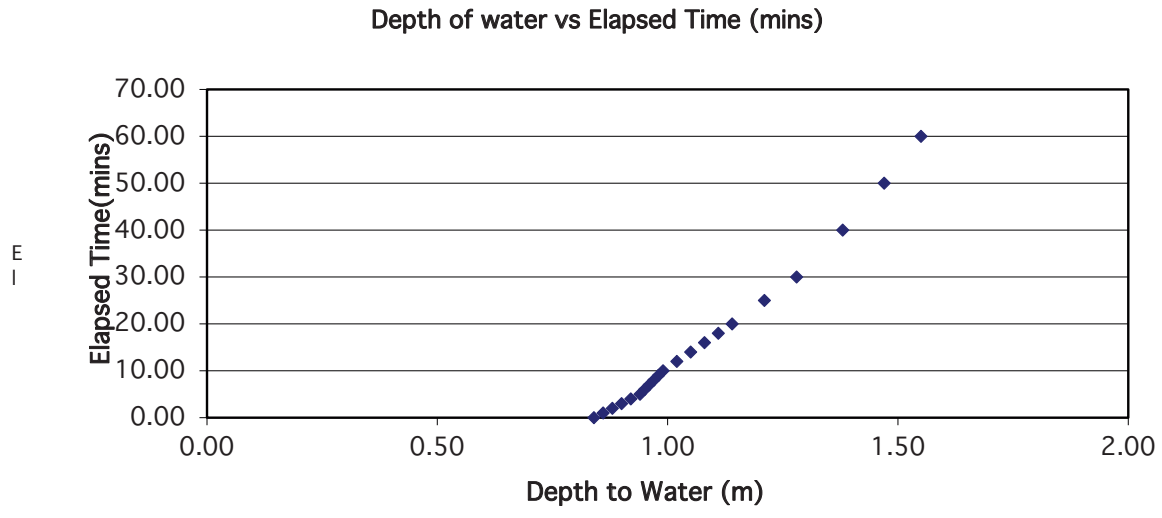
Depth to Water (m)	Elapsed Time (min)
0.84	0.00
0.86	1.00
0.88	2.00
0.90	3.00
0.92	4.00
0.94	5.00
0.95	6.00
0.96	7.00
0.97	8.00
0.98	9.00
0.99	10.00
1.02	12.00
1.05	14.00
1.08	16.00
1.11	18.00
1.14	20.00
1.21	25.00
1.28	30.00
1.38	40.00
1.47	50.00
1.55	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.84	m
Final depth to water =	1.55	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.982	m2
Total Exposed area =	4.942	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.0023 m/min or 3.83111E-05 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract:	Project Appollo	Contract No.	23415
Test No.	SA01 (Cycle 2)	Easting	703665.051
Engineer:	Ramboll	Northing	730509.392
Date:	22/06/2021	Elevation (m OD)	74.466

Summary of ground conditions

from	to	Description	Ground water
0.00	1.00	Firm brown sandy very gravelly CLAY with a medium cobble content	Dry
1.00	2.10	Brown slightly clayey slightly sandy GRAVEL with a medium cobble content	

Notes:

Field Data

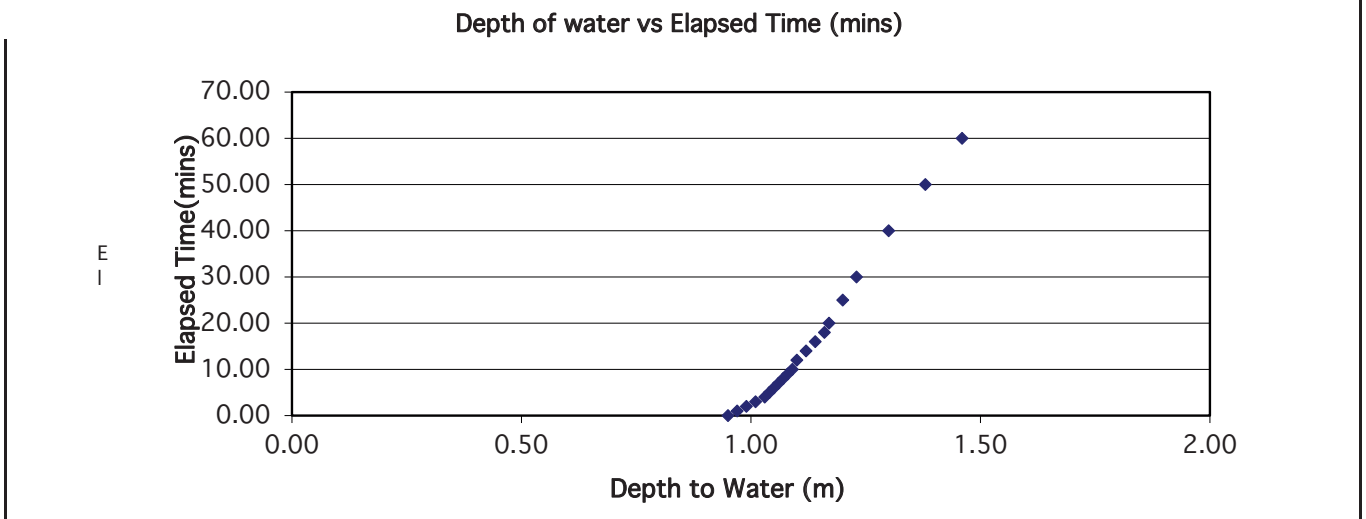
Depth to Water (m)	Elapsed Time (min)
0.95	0.00
0.97	1.00
0.99	2.00
1.01	3.00
1.03	4.00
1.04	5.00
1.05	6.00
1.06	7.00
1.07	8.00
1.08	9.00
1.09	10.00
1.10	12.00
1.12	14.00
1.14	16.00
1.16	18.00
1.17	20.00
1.20	25.00
1.23	30.00
1.30	40.00
1.38	50.00
1.46	60.00

Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.60	
Length of Pit (L)	1.60	m
Initial depth to Water =	0.95	m
Final depth to water =	1.46	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test perio	3.938	m2
Total Exposed area =	4.898	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00167 m/min or 2.77664E-05 m/sec



Appendix 4

Plate Bearing Test Records

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

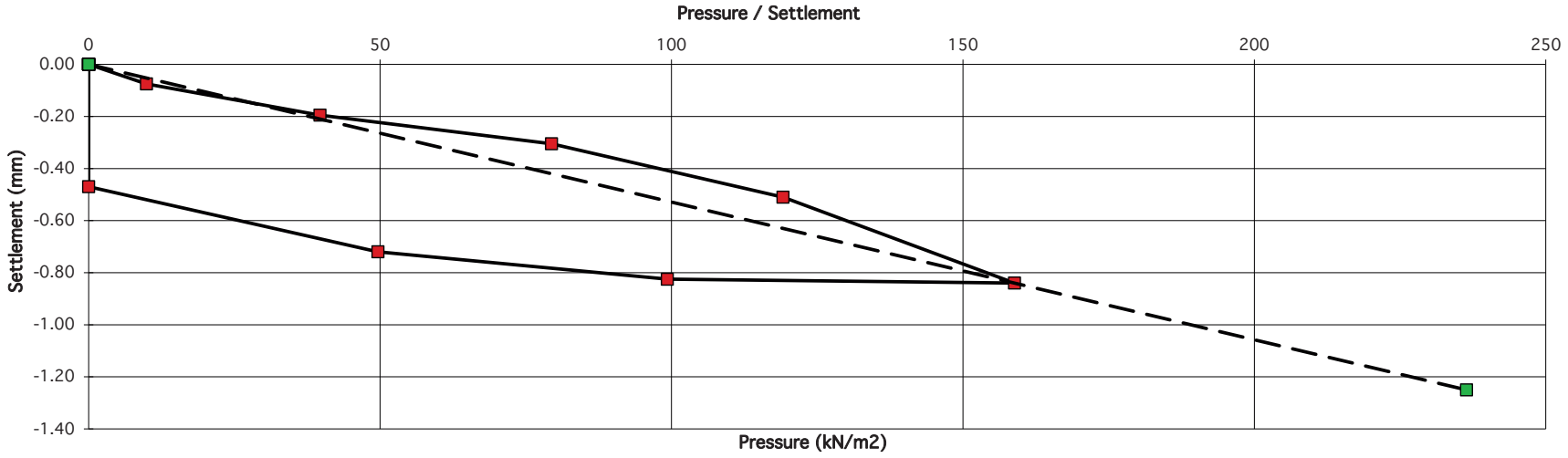
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Load
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 189
Modulus of subgrade reaction = 122 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 39.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

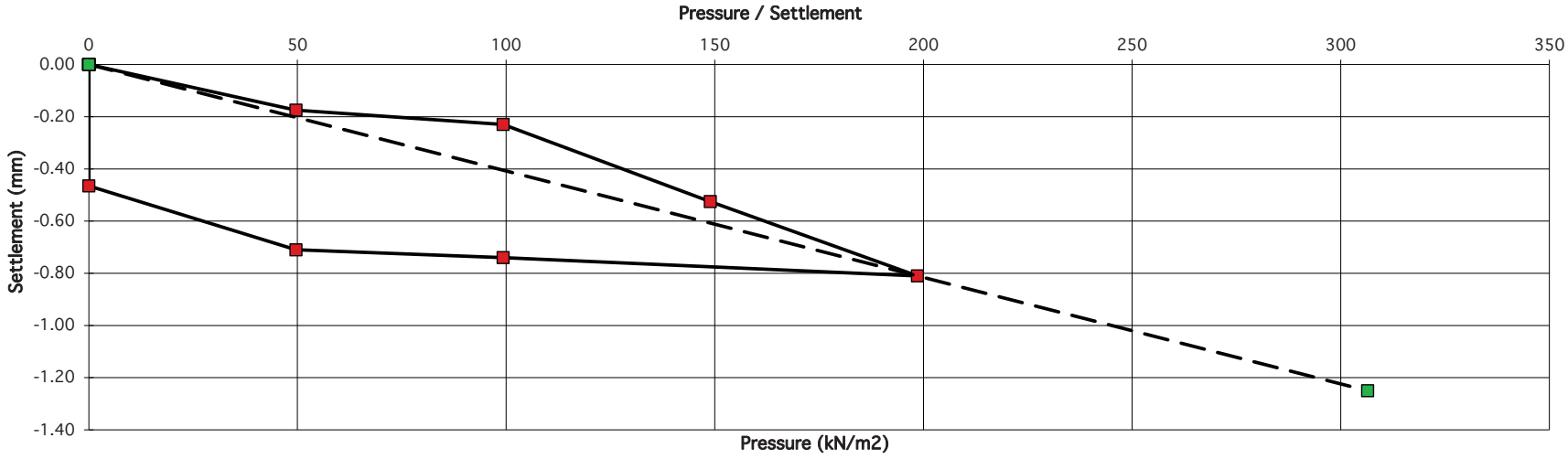
Reference No.	R122967
Contract	Project Appollo (Substation)
Test No.	PT01 - Reload
Location	E - 703650.516, N - 730520.551, Elev - 74.399
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 245
Modulus of subgrade reaction = 158 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 62.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

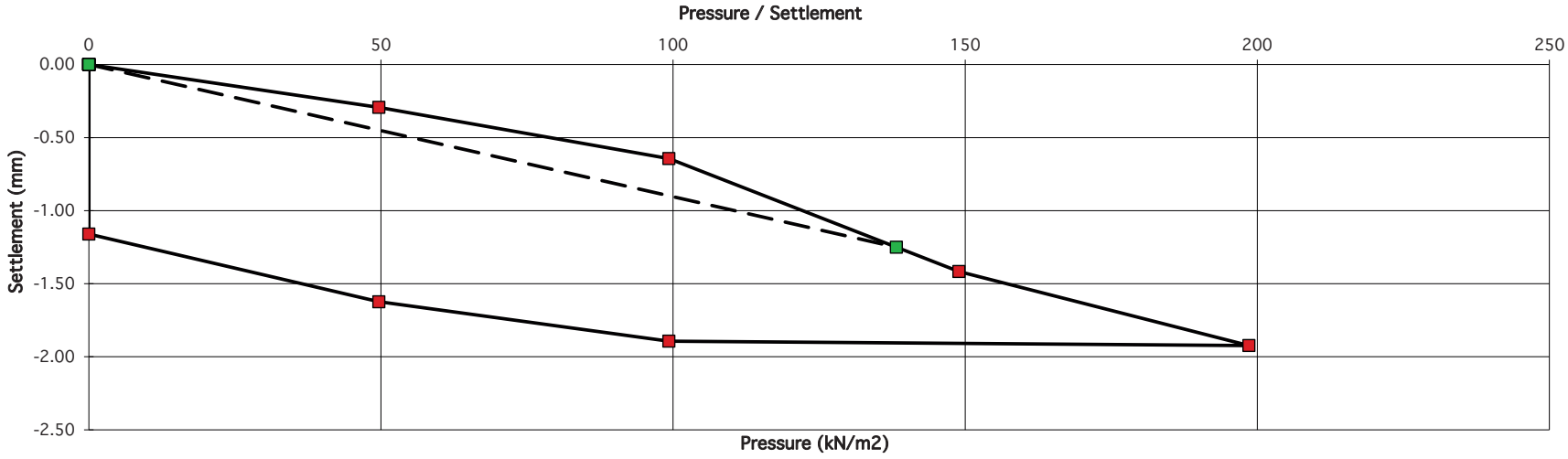
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Load
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 111
Modulus of subgrade reaction = 71 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

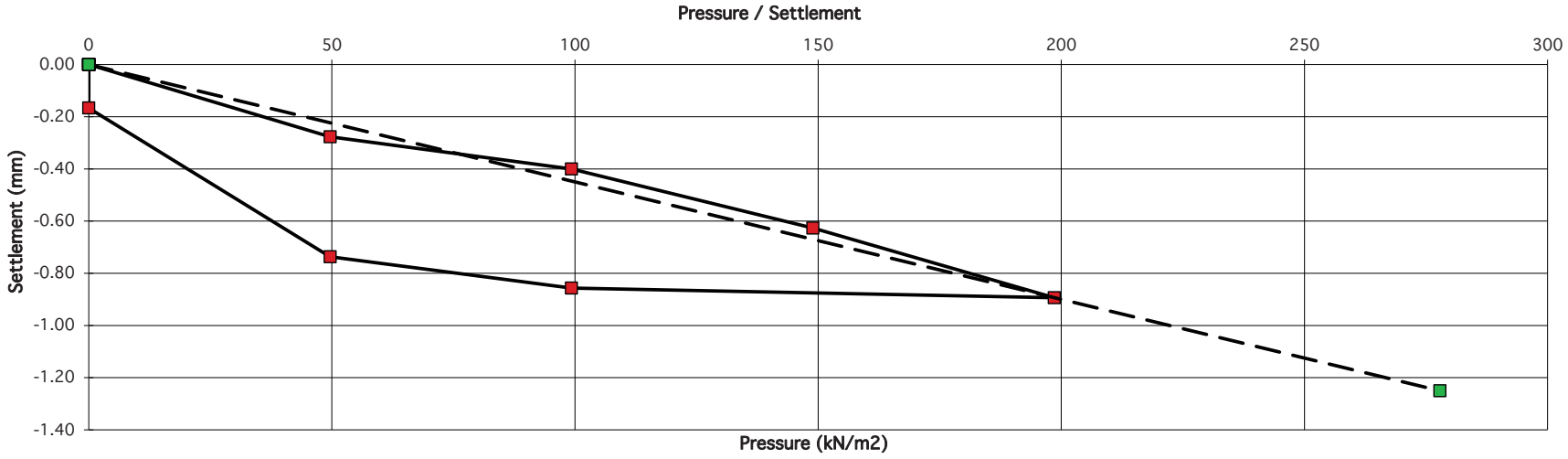
Reference No.	R122968
Contract	Project Appollo (Substation)
Test No.	PT02 - Reload
Location	E - 703696.213, N - 730534.222, Elev - 73.759
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 222
Modulus of subgrade reaction = 143 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 52.4 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

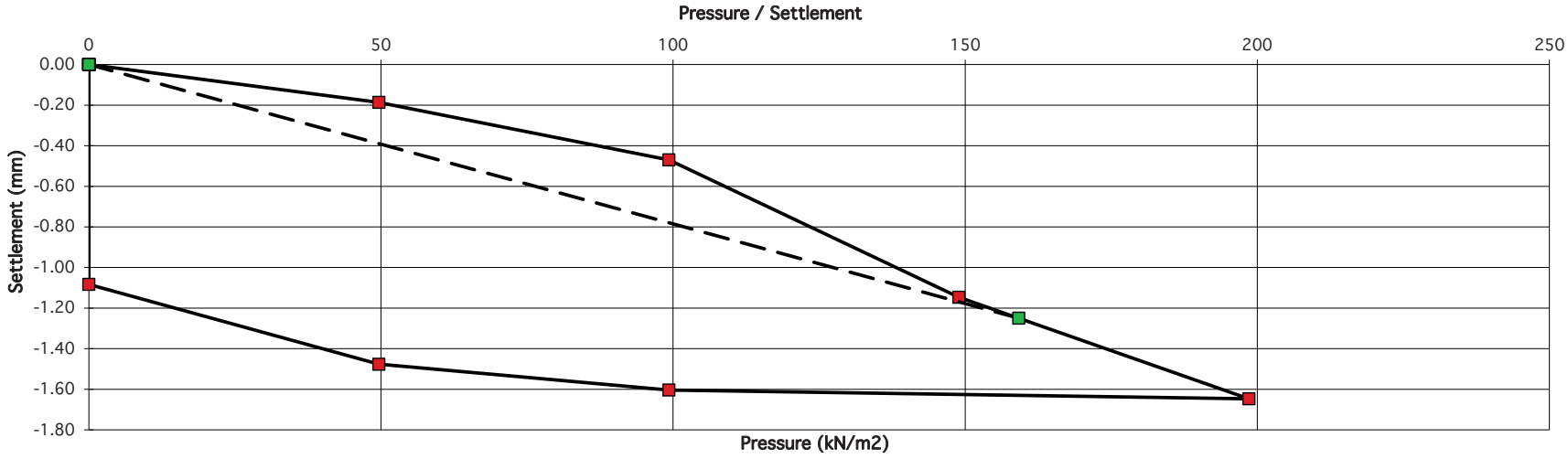
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Load
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No. .....

Depth ..... m bgl



Gradient at 1.25 mm settlement intersection = 127
Modulus of subgrade reaction = 82 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 19.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

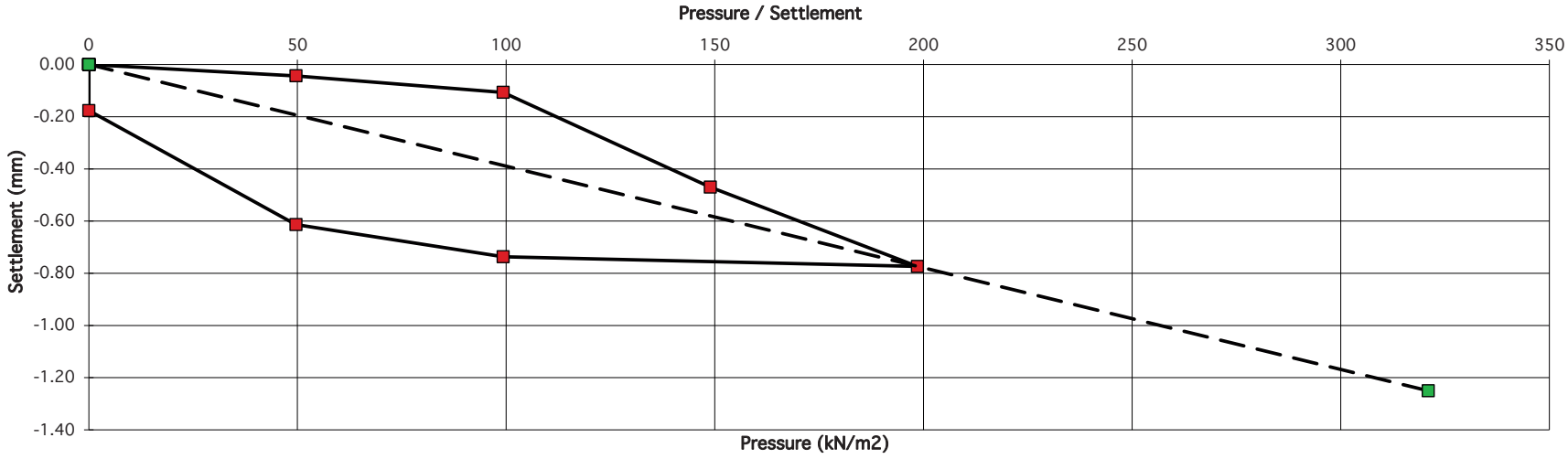
Reference No.	R122969
Contract	Project Appollo (Substation)
Test No.	PT03 - Reload
Location	E - 703679.275, N - 730514.143, Elev - 74.203
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 257
Modulus of subgrade reaction = 165 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 67.2 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

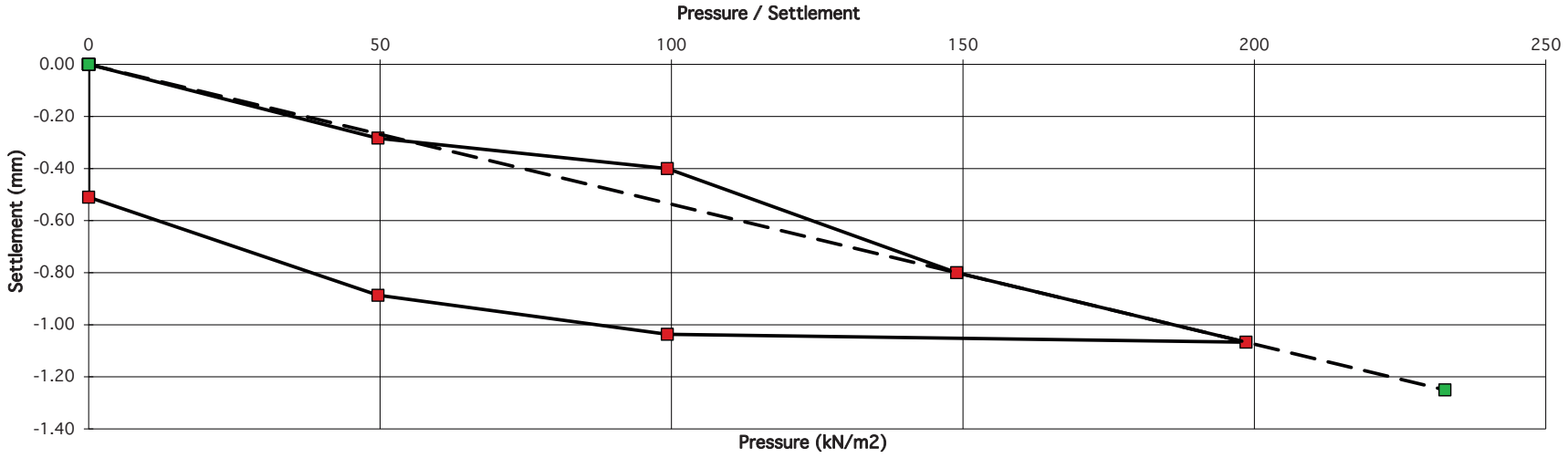
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Load
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 186
Modulus of subgrade reaction = 120 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 38.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

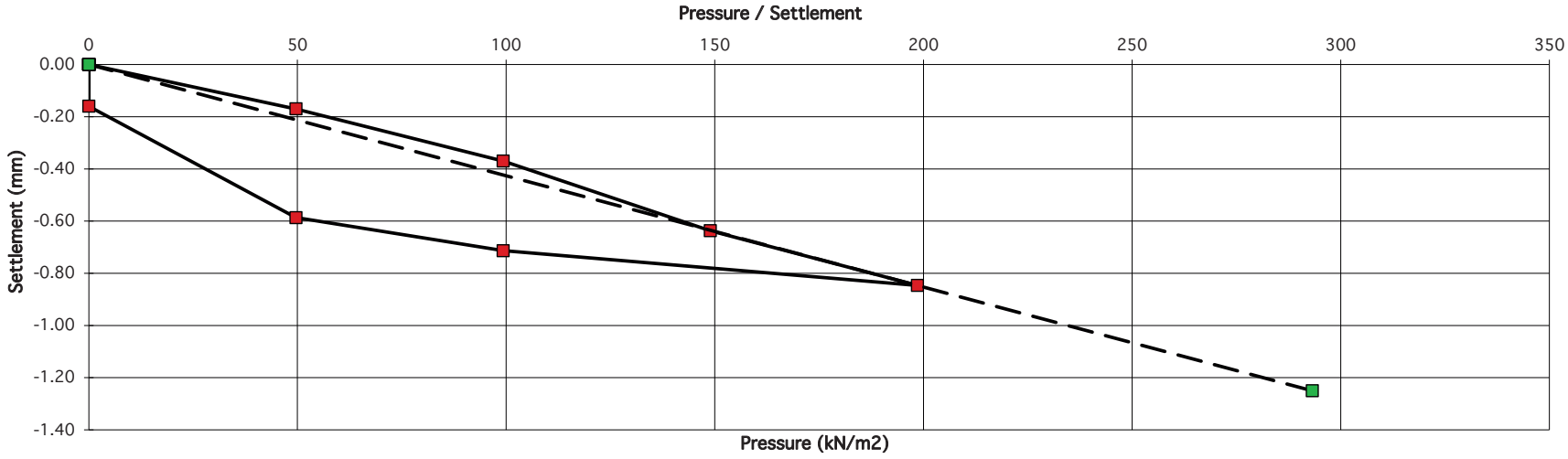
Reference No.	R122970
Contract	Project Appollo (Substation)
Test No.	PT04 - Reload
Location	E - 703700.577, N - 730501.087, Elev - 74.05
Depth	300mm bgl
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Stiff sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 235
Modulus of subgrade reaction = 151 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 57.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

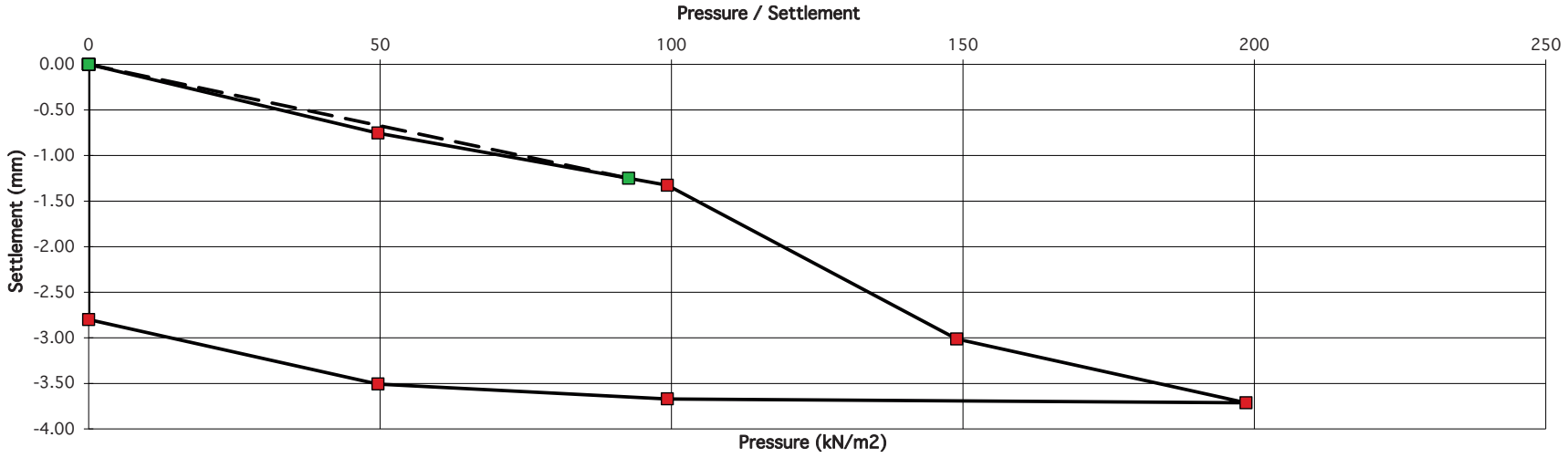
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Load
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 74
Modulus of subgrade reaction = 48 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

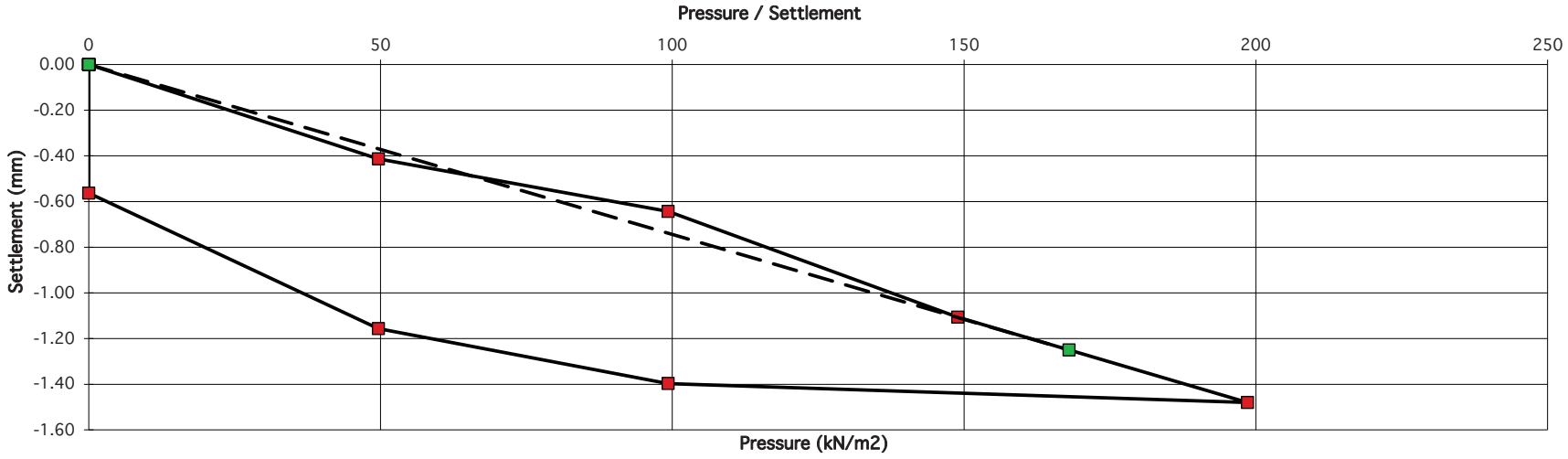
Reference No.	R122971
Contract	Project Appollo (Substation)
Test No.	PT05 - Reload
Location	E - 703651.343, N - 730496.431, Elev - 74.793
Depth	300mm
Client	Ramboll
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	J. Condon
Authorised by	
Date	23/06/2021

Description of soil under test
(natural soil, placed fill, sub-base)

Grey brown sandy very gravelly CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 134
Modulus of subgrade reaction = 86 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 21.9 %

Appendix 5

Geotechnical Laboratory Test Results - Soil

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R124908** Contract No. 23415 Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station Site

Customer Ramboll

Samples Received: 07/07/21 Date Tested: 07/07/21

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA159738	1.8	A21/3390	B	15	39	21	18	57	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP02	AA159729	0.5	A21/3392	B	13	35	20	15	71	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159749	0.5	A21/3393	B	17	35	19	16	74	WS	4.4	C L	Brown sandy gravelly CLAY
TP03	AA159751	2.3	A21/3394	B	20	35	23	12	49	WS	4.4	C L	Grey/brown slightly sandy, gravelly, CLAY
TP04	AA149746	1.5	A21/3395	B	15	35	19	16	58	WS	4.4	C L	Brown sandy gravelly CLAY
TP05	AA159742	1.6	A21/3396	B	12	39	22	17	71	WS	4.4	C I	Brown slightly sandy, gravelly, CLAY
TP06	AA159733	0.5	A21/3397	B	12	40	21	19	46	WS	4.4	C I	Brown sandy gravelly CLAY
TP06	AA159735	1.6	A21/3398	B	9.8	35	21	14	48	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY with many cobbles

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports
H Byrne (Laboratory Manager)

Approved by	Date	Page
H Byrne	13/08/21	1 of 1

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

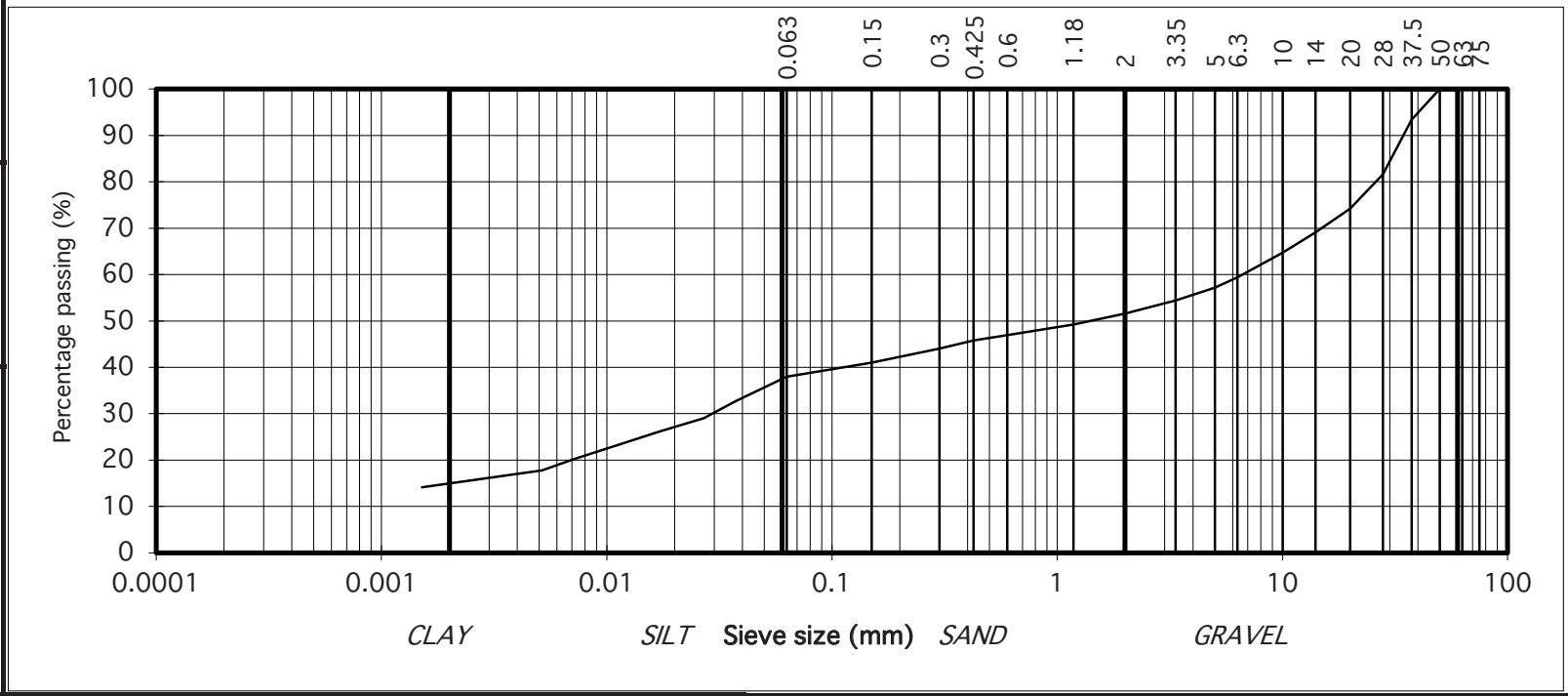
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	93	
28	82	
20	74	
14	69	
10	65	
6.3	59	
5	57	
3.35	54	
2	52	
1.18	49	SAND
0.6	47	
0.425	46	
0.3	44	
0.15	41	
0.063	38	SILT/CLAY
0.037	33	
0.027	29	
0.017	26	
0.010	23	
0.007	20	
0.005	18	
0.002	14	

Contract No. 23415 Report No. R124909
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP01
Sample No.* AA159738 Lab. Sample No. A21/3390
Sample Type: B
Depth* (m) 1.80 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

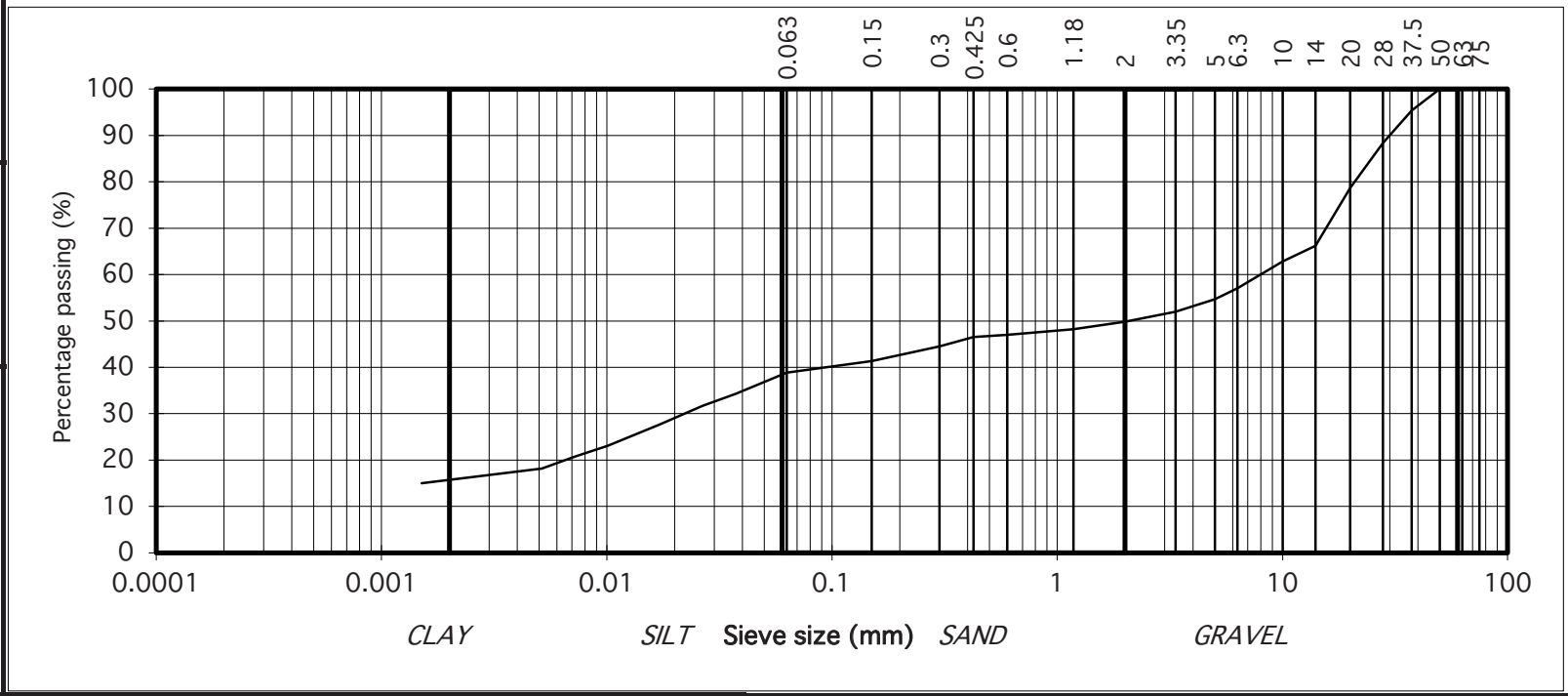
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	95	
28	88	
20	79	
14	66	
10	63	
6.3	57	
5	55	
3.35	52	
2	50	
1.18	48	SAND
0.6	47	
0.425	47	
0.3	45	
0.15	41	
0.063	39	SILT/CLAY
0.037	34	
0.027	32	
0.017	28	
0.010	23	
0.007	21	
0.005	18	
0.002	15	

Contract No. 23415 Report No. R124910
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP03
Sample No.* AA159750 Lab. Sample No. A21/3394
Sample Type: B
Depth* (m) 2.30 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Grey/brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

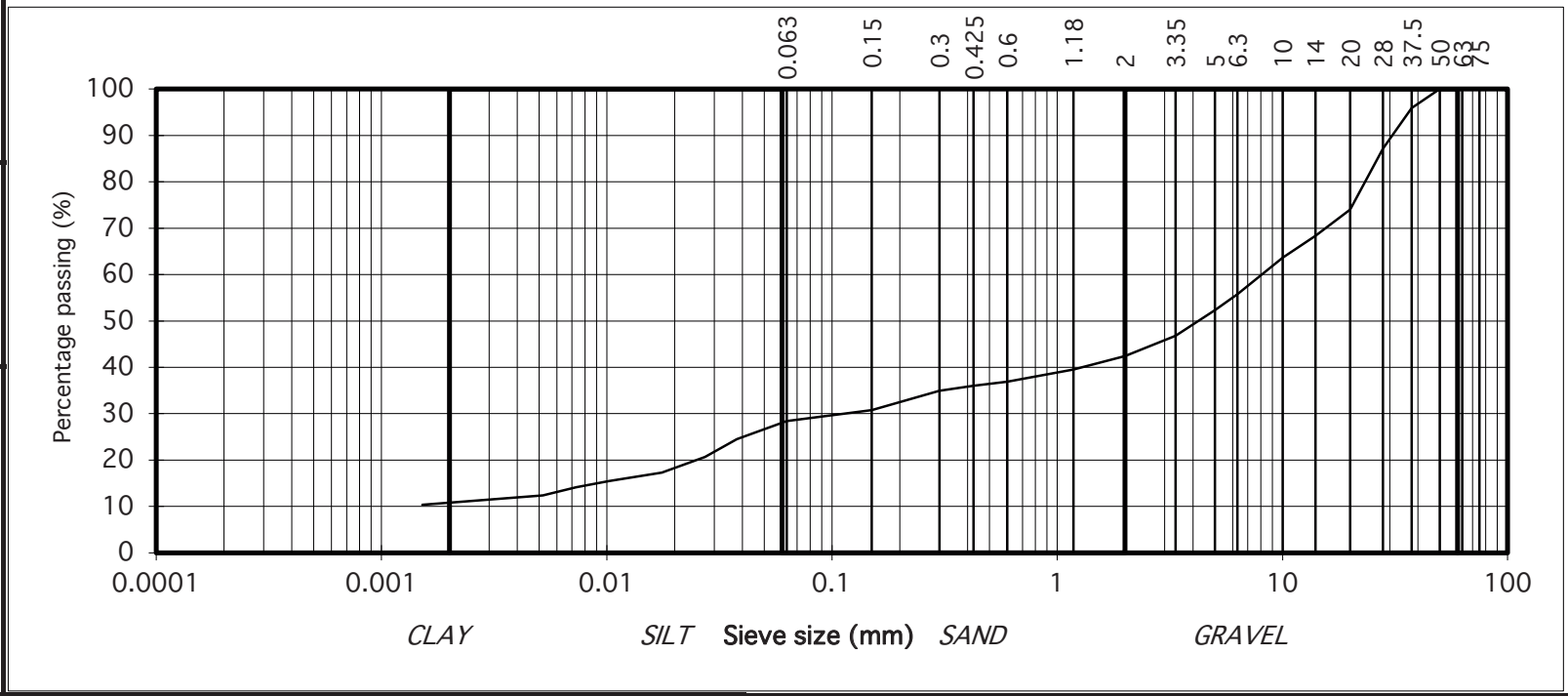
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	87	
20	74	
14	68	
10	64	
6.3	56	
5	52	
3.35	47	
2	42	
1.18	40	SAND
0.6	37	
0.425	36	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.038	24	
0.027	21	
0.018	17	
0.010	15	
0.007	14	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124911
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP05
Sample No.* AA159742 Lab. Sample No. A21/3396
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

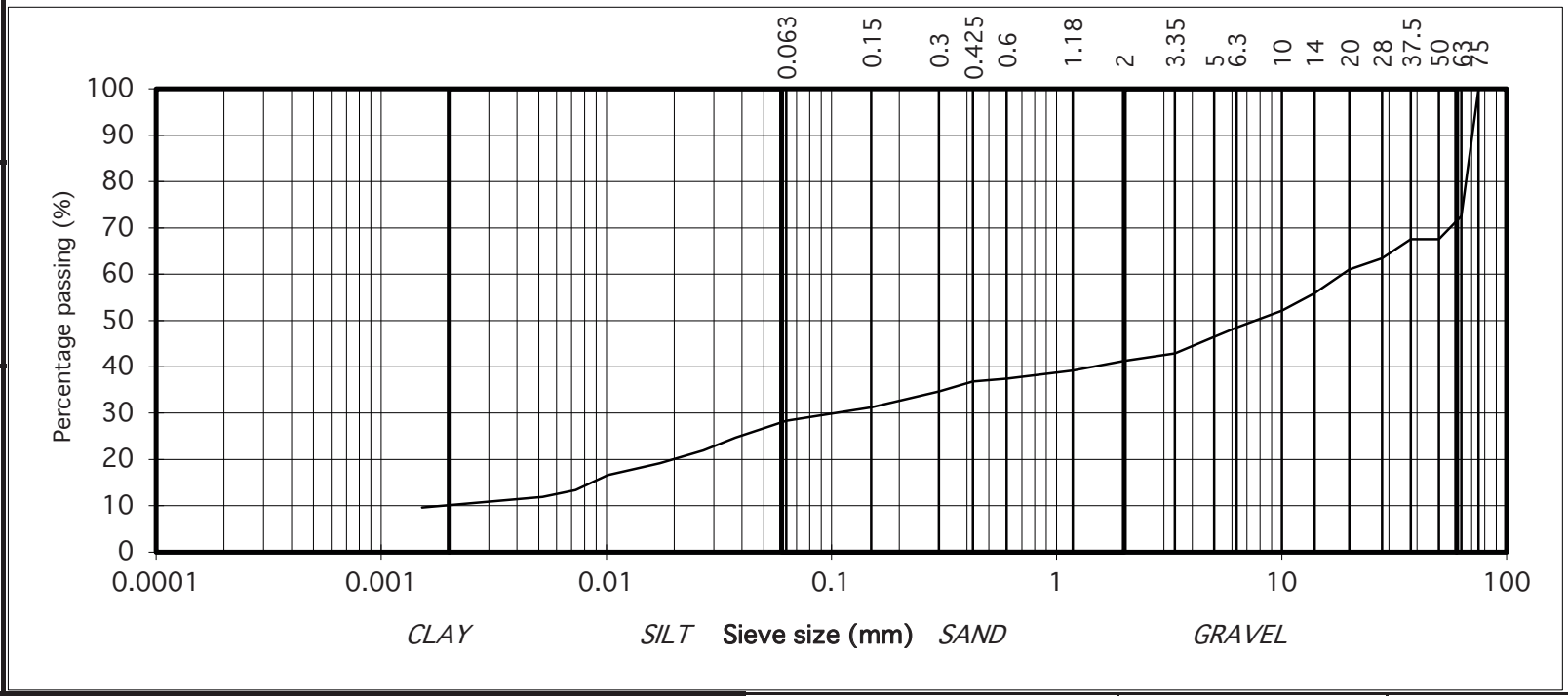
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

particle size	% passing	
75	100	COBBLES
63	73	
50	68	GRAVEL
37.5	68	
28	63	
20	61	
14	56	
10	52	
6.3	48	
5	46	
3.35	43	
2	41	
1.18	39	SAND
0.6	37	
0.425	37	
0.3	35	
0.15	31	
0.063	28	SILT/CLAY
0.037	25	
0.027	22	
0.017	19	
0.010	17	
0.007	13	
0.005	12	
0.002	10	

Contract No. 23415 Report No. R124912
Contract Name: Grangecastle , Dublin 24 - Proposed Sub Station
BH/TP* : TP06
Sample No.* AA159735 Lab. Sample No. A21/3398
Sample Type: B
Depth* (m) 1.60 Customer: Ramboll
Date Received 07/07/2021 Date Testing started 07/07/2021
Description: Brown slightly sandy, gravelly, CLAY with many cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
This report shall not be reproduced except in full without the written approval of the Laboratory.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	13/08/21	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123623**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159729

Location TP02 0.5m

Soil description Brown sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.1812	0.8466
2	0.9028	1.1077
3	1.0554	0.9475
4	0.9860	1.0142
5	1.1528	0.8674
Average	1.0556	0.9567

Bulk density (Mg/m3)	1.66
Dry density (Mg/m3)	1.44
Water Content (%)	14.9
Porosity	0.46
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123624**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159751

Location TP03 2.3m

Soil description Brown and dark grey slightly sandy gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4219	0.7033
2	1.6206	0.6171
3	1.4728	0.6790
4	1.4778	0.6767
5	1.5796	0.6331
Average	1.5145	0.6618

Bulk density (Mg/m3)	1.89
Dry density (Mg/m3)	1.48
Water Content (%)	27.3
Porosity	0.44
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Determination of Thermal Conductivity of Soil by Thermal Needle Probe

Report No. **R123625**

Contract No. 23415

Contract Name: Sub Station Site Grangecastle

Client: Ramboll

Sample No. 159734

Location TP06 1.6m

Soil description Brown slightly sandy slightly gravelly SILT/CLAY

Preparation <8mm material remoulded at as received water content

Date Tested: 08/07/2021

Test No.	Thermal Conductivity K (W/m.k)	Thermal Resistivity R (m K/W)
1	1.4874	0.6723
2	1.4295	0.6996
3	1.4828	0.6744
4	1.4611	0.6844
5	1.2452	0.8031
Average	1.4212	0.7068

Bulk density (Mg/m3)	1.94
Dry density (Mg/m3)	1.7
Water Content (%)	14.4
Porosity	0.36
Particle density (assumed)	2.65

Notes: Water content measured in accordance with ISO 17892-1:2014. Bulk density measured by linear measurement. Porosity calculated (voids ratio/1+voids ratio). Thermal measurements undertake using a TEMPOS and TR-3 probe (manufactured by METER Group).

The result relates to the specimen tested as received
Opinions and interpretations are outside the scope of accreditation.

Persons authorised to approve report
J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Materials Laboratory	Approved by	Date	Page
		12/07/21	1 of 1

Appendix 6

Chemical / Environmental Test Records – Soil

2183

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-23005-1		
Initial Date of Issue:	13-Jul-2021		
Client	IGSL		
Client Address:	M7 Business Park Naas County Kildare Ireland		
Contact(s):	Darren Keogh		
Project	23415 Proposed Sub Station Site Grangecastle Dublin		
Quotation No.:	Q20-21693	**Date Received:**	05-Jul-2021
Order No.:		**Date Instructed:**	05-Jul-2021
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	13-Jul-2021
Date Approved:	13-Jul-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**		21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**		1234405	1234406	1234408
Order No.:				Client Sample Ref.:		AA159748	AA159746	AA159732
				Sample Location:		TP03	TP04	TP06
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.50	1.50	0.50
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH	U	1010	10:1		N/A	8.8	9.0	9.0
Ammonium	U	1220	10:1	mg/l	0.050	0.080	0.056	0.090
Ammonium	N	1220	10:1	mg/kg	0.10	1.1	0.86	1.4
Boron (Dissolved)	U	1455	10:1	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Benzo[j]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693				**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:				Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
				Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
				Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A		-	-		-	
Asbestos Identification	U	2192		N/A		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	
Moisture	N	2030	%	0.020	15	13	4.0	11	6.9	9.7
pH (2.5:1)	N	2010		4.0	[A] 8.8			[A] 9.0		[A] 9.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		[A] < 0.40	[A] < 0.40		[A] < 0.40	
Magnesium (Water Soluble)	N	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Total Sulphur	U	2175	%	0.010	[A] 0.023			[A] 0.026		[A] 0.046
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] 3.3		[A] 1.7	
Chloride (Water Soluble)	U	2220	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010			< 0.010		< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50		[A] < 0.50	
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		[A] 5.3	[A] 5.3		[A] 5.4	
Ammonium (Water Soluble)	U	2220	g/l	0.01	< 0.01			< 0.01		< 0.01
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.048	[A] 0.036	[A] 0.072	[A] 0.063	[A] 0.064	[A] 0.060
Arsenic	U	2450	mg/kg	1.0		14	18		16	
Barium	U	2450	mg/kg	10		33	15		28	
Cadmium	U	2450	mg/kg	0.10		0.97	0.71		0.81	
Chromium	U	2450	mg/kg	1.0		9.3	5.7		7.0	
Molybdenum	U	2450	mg/kg	2.0		3.4	< 2.0		< 2.0	
Antimony	N	2450	mg/kg	2.0		< 2.0	< 2.0		< 2.0	
Copper	U	2450	mg/kg	0.50		16	11		17	
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10		< 0.10	
Nickel	U	2450	mg/kg	0.50		28	25		22	
Lead	U	2450	mg/kg	0.50		10	4.0		7.0	
Selenium	U	2450	mg/kg	0.20		< 0.20	< 0.20		0.20	
Zinc	U	2450	mg/kg	0.50		29	28		21	
Chromium (Trivalent)	N	2490	mg/kg	1.0		9.3	5.7		7.0	
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50		< 0.50	
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10	< 10		< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL			**Chemtest Job No.:**		21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693			**Chemtest Sample ID.:**		1234404	1234405	1234406	1234407	1234408	1234409
Order No.:			Client Sample Ref.:		AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
			Sample Location:		TP01	TP03	TP04	TP05	TP06	TP06
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.40	0.50	1.50	0.50	0.50	1.60
			Asbestos Lab:			COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0		[A] < 5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		[A] < 10	[A] < 10		[A] < 10	
Benzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Toluene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Ethylbenzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
m & p-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
o-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Naphthalene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Acenaphthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluorene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Phenanthrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.082		[A] < 0.010	
Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] 0.11		[A] < 0.010	
Benzo[a]anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Chrysene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[b]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[k]fluoranthene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[a]pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Indeno(1,2,3-c,d)Pyrene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Benzo[g,h,i]perylene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Coronene	N	2800	mg/kg	0.010		[A] < 0.010	[A] < 0.010		[A] < 0.010	
Total Of 17 PAH's	N	2800	mg/kg	0.20		[A] < 0.20	[A] < 0.20		[A] < 0.20	
PCB 28	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 52	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	

Results - Soil

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL					**Chemtest Job No.:**	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693					**Chemtest Sample ID.:**	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:					Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
					Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
					Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
PCB 90+101	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 118	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 153	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 138	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
PCB 180	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total PCBs (7 congeners)	N	2815	mg/kg	0.0010		[A] < 0.0010	[A] < 0.0010		[A] < 0.0010	
Total Phenols	U	2920	mg/kg	0.10		< 0.10	< 0.10		< 0.10	

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234405						
Sample Ref:	AA159748						
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.26	3	5	6
Loss On Ignition	2610	U	%	2.8	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.031	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0006	0.0060	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.010	0.10	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.43	4.3	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234406						
Sample Ref:	AA159746						
Sample ID:							
Sample Location:	TP04						
Top Depth(m):	1.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 1.8	3	5	6
Loss On Ignition	2610	U	%	3.0	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.027	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0002	0.0023	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0010	0.0098	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.011	0.11	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.35	3.5	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	53	530	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	4.0

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	21-23005						
Chemtest Sample ID:	1234408						
Sample Ref:	AA159732						
Sample ID:							
Sample Location:	TP06						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.69	3	5	6
Loss On Ignition	2610	U	%	2.7	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 congeners)	2815	N	mg/kg	[A] < 0.0010	1	--	--
TPH Total WAC	2670	U	mg/kg	[A] < 10	500	--	--
Total Of 17 PAH's	2800	N	mg/kg	[A] < 0.20	100	--	--
pH	2010	U		9.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.014	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	< 0.0002	< 0.0002	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0009	0.0087	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0072	0.072	0.5	10	30
Nickel	1455	U	< 0.0005	< 0.0005	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	< 0.003	< 0.003	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.28	2.8	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.6	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1234404	AA159737		TP01		A	Amber Glass 250ml
1234404	AA159737		TP01		A	Plastic Tub 500g
1234405	AA159748		TP03		A	Amber Glass 250ml
1234405	AA159748		TP03		A	Plastic Tub 500g
1234406	AA159746		TP04		A	Amber Glass 250ml
1234406	AA159746		TP04		A	Plastic Tub 500g
1234407	AA159741		TP05		A	Amber Glass 250ml
1234407	AA159741		TP05		A	Plastic Tub 500g
1234408	AA159732		TP06		A	Amber Glass 250ml
1234408	AA159732		TP06		A	Plastic Tub 500g
1234409	AA159734		TP06		A	Amber Glass 250ml
1234409	AA159734		TP06		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurememrnt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.

Test Methods

SOP	Title	Parameters included	Method summary
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix 7

EN1744 Chemical Test Records – Upper Rockhead

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

IGSL
Unit F
M7 Business Park
Naas

Analytical Test Report: L21/02368/IGS/21-19643

Your Project Reference:	**23415 Grangecastle**	Samples Received on:	14/07/2021
Your Order Number:	19324	Testing Instruction Received:	14/07/2021
Report Issue Number:	1	Sample Tested:	14/07 to 26/07/2021
Samples Analysed:	1 aggregate sample	Report issued:	26/07/2021

Signed

Peter Swanston
Environmental Laboratory Manager
Nicholls Colton Group

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples were supplied by customer, results apply to the samples as received.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 10/12/2020
Owned by Emily Blissett - Customer Services Supervisor
Authorised by James Gane - Commercial Manager
J:\Public\Projects\2021\L21\IGS - IGSL\L21-2368-IGS\[L21-02368-IGS - 21-19643.XLSX]Cover Sheet

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analytical Test Results - Aggregate Testing

NC Reference	**178672**
Client Sample Reference	A21/3392
Material	Aggregate
Source/Client Ref	TP2 @ 1.9
Sample Description	Brown crushed rock

	Units	**Accreditation**	
EN 1744 Determinations			
Total Sulphur content (as S)	(%)	UKAS	0.03
Acid soluble sulphate content (as SO_3)	(%)	UKAS	0.05
Acid soluble sulphate content (as SO_4)	(%)	u	0.06
Water soluble sulphate content (as SO_3)	(%)	UKAS	0.03
Water soluble sulphate content (as SO_3)	(mg/l)	u	127
Water soluble sulphate content (as SO_4)	(%)	u	0.03
Water soluble sulphate content (as SO_4)	(mg/l)	u	152

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L21/02368/IGS/21-19643

Project Reference - 23415 Grangecastle

Analysis Methodologies and Notes

Determinant	Test method and notes
EN 1744 Total Sulphur	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 11.
EN 1744 Acid Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 12.
EN 1744 Water Soluble Sulphate	Testing was in accordance with BS EN 1744-1:2009 + A1:2012 clause 10.

Appendix 8

Exploratory Hole Location Plan

Project Appollo (Substation)

Exploratory Hole Location Plan

Legend

- Dynamic Probe
- Plate Bearing Test
- Soakaway Test (to BRE365)
- Trial Pit

DP16
DP17
DP18
DP19
PT02
TP03
DP15
DP20
DP14
TP02
PT01
DP13
DP12A
DP12
TP01
PT03
DP11
DP06
SA01
DP08
DP07
TP04
DP09
DP10
TP05
PT04
TP06
PT05
DP05
DP04
DP03
DP02
DP01

N

50 m

Google Earth

Technical Appendix 12.2: Contamination Land Interpretative Screening Sheet

Results - Soil

SOIL RESULTS

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				Chemtest Job No.:	21-23005	21-23005	21-23005	21-23005	21-23005	21-23005
Quotation No.: Q20-21693				Chemtest Sample ID.:	1234404	1234405	1234406	1234407	1234408	1234409
Order No.:				Client Sample Ref.:	AA159737	AA159748	AA159746	AA159741	AA159732	AA159734
				Sample Location:	TP01	TP03	TP04	TP05	TP06	TP06
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.40	0.50	1.50	0.50	0.50	1.60
				Asbestos Lab:		COVENTRY	COVENTRY		COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A		-	-		-	
Asbestos Identification	U	2192		N/A		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	
Moisture	N	2030	%	0.020	15	13	4.0	11	6.9	9.7
pH (2.5:1)	N	2010		4.0	[A] 8.8			[A] 9.0		[A] 9.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		[A] < 0.40	[A] < 0.40		[A] < 0.40	
Magnesium (Water Soluble)	N	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Total Sulphur	U	2175	%	0.010	[A] 0.023			[A] 0.026		[A] 0.046
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] 3.3		[A] 1.7	
Chloride (Water Soluble)	U	2220	g/l	0.010	[A] < 0.010			[A] < 0.010		[A] < 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010			< 0.010		< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50		[A] < 0.50	
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		[A] 5.3	[A] 5.3		[A] 5.4	
Ammonium (Water Soluble)	U	2220	g/l	0.01	< 0.01			< 0.01		< 0.01
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.048	[A] 0.036	[A] 0.072	[A] 0.063	[A] 0.064	[A] 0.060
Arsenic	U	2450	mg/kg	1.0		14	18		16	
Barium	U	2450	mg/kg	10		33	15		28	
Cadmium	U	2450	mg/kg	0.10		0.97	0.71		0.81	
Chromium	U	2450	mg/kg	1.0		9.3	5.7		7.0	
Molybdenum	U	2450	mg/kg	2.0		3.4	< 2.0		< 2.0	
Antimony	N	2450	mg/kg	2.0		< 2.0	< 2.0		< 2.0	
Copper	U	2450	mg/kg	0.50		16	11		17	
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10		< 0.10	
Nickel	U	2450	mg/kg	0.50		28	25		22	
Lead	U	2450	mg/kg	0.50		10	4.0		7.0	
Selenium	U	2450	mg/kg	0.20		< 0.20	< 0.20		0.20	
Zinc	U	2450	mg/kg	0.50		29	28		21	
Chromium (Trivalent)	N	2490	mg/kg	1.0		9.3	5.7		7.0	
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50		< 0.50	
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10		< 10	< 10		< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0		[A] < 1.0	

Commercial	Residential
640	37
	1300
210	22
	2400
	180
2300	200
	3700
49	26

Results - Soil

LEACHATE TESTING

Project: 23415 Proposed Sub Station Site Grangecastle Dublin

Client: IGSL				Chemtest Job No.:		21-23005	21-23005	21-23005
Quotation No.: Q20-21693				Chemtest Sample ID.:		1234405	1234406	1234408
Order No.:				Client Sample Ref.:		AA159748	AA159746	AA159732
				Sample Location:		TP03	TP04	TP06
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.50	1.50	0.50
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH	U	1010	10:1		N/A	8.8	9.0	9.0
Ammonium	U	1220	10:1	mg/l	0.050	0.080	0.056	0.090
Ammonium	N	1220	10:1	mg/kg	0.10	1.1	0.86	1.4
Boron (Dissolved)	U	1455	10:1	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Benzo[j]fluoranthene	N	1800	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010