FLOOD RISK ASSESSMENT

COCKENZIE BESS

On behalf of Cockenzie Storage Limited
Date: 16.01.2024 | Pegasus Ref: P23-0093 – Author: Lucy Ginn

Document Management

Version	Date	Author	Checked/ Approved by:	Reason for revision
Version 1	25.08.2023	Lucy Ginn	Luke Johnson	First Issue
Version 2	15.09.2023	Lucy Ginn	Luke Johnson	Updated Redline
Version 3	22.11.2023	Lucy Ginn	Luke Johnson	Updated Site Layout
Version 4	16.01.2024	Lucy Ginn	Luke Johnson	Updated Site Layout

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1. Introduction

Background

1.1. Pegasus Planning Group Ltd has been appointed by Cockenzie Storage Limited to undertake a Flood Risk Assessment (FRA) for a proposed Battery Energy Storage System (BESS) on land south-west of Cockenzie, East Lothian.

1.2. This assessment considers the risk of flooding from all sources including coastal, fluvial, surface water, groundwater, reservoirs, and drainage systems (sewers and culverts).

1.3. A proposed Surface Water Drainage Strategy to manage surface water runoff from the development and mitigate any potential negative water quality impacts has been prepared by David R Murray and Associates and is included as a separate submission to this report.

Relevant Policy and Guidance

1.4. This report considers the recommendations and requirements outlined in:

- National Planning Framework 4 (February 2023)
- Scottish Planning Policy (SPP) (June 2014)
- SEPA's Technical Flood Risk Guidance for Stakeholders (June 2022)
- SEPA's Development Guidance: Flood Risk (July 2018)
- SEPA's Climate Change Allowances for Flood Risk Assessment in Land Use Planning (April 2023)
- SEPA's Flood Risk and Land Use Vulnerability Guidance (July 2018)
- East Lothian Council Sustainable Drainage Systems (SuDS) Supplementary Planning Guidance (June 2019)
- East Lothian Council Local Development Plan Strategic Flood Risk Assessment (2018)

1.5. The Flood Risk Framework in Scottish Planning Policy and SEPA's Technical Flood Risk Guidance for Stakeholders details that an FRA is required for development in areas at risk of flooding or where the proposed development may increase flood risk elsewhere. SEPA's Surface Water Flood Map shows areas at risk at the site. The development proposals, if left unmitigated, also have the potential to increase flood risk elsewhere. An FRA is therefore required for the proposals.

1.6. Scottish Planning Policy (Paragraph 255) details that the planning system should promote "avoidance of increased surface water flooding through requirements for Sustainable Drainage Systems (SuDS)". In accordance with this, a Surface Water

Drainage Strategy to manage surface water runoff from the development has also been prepared and is included elsewhere in the planning submission.

2. Existing Site and Hydrology

Site Location & Existing Conditions

2.1. The site is located in Cockenzie, East Lothian and comprises approximately 17ha of greenfield land and associated access.

2.2. The site is bordered to the north by residential dwellings of Cockenzie, to the east by Avenue Road, to the south by open green space and to the west by Cockenzie Substation.

2.3. Approximate co-ordinates at the centre of the site are E: 340015, N: 675185. The nearest postcode is EH32 0JT.

2.4. The site location is shown in Figure 2.1.

Figure 2.1 – Site Location

2.5. A topographic survey of the site was complete in April 2023 by L&M Survey Services and is included in Appendix A. The topographic survey of the site shows that existing ground levels on site generally fall in a northerly direction from a high point of approximately 11.3mAOD in the south to the low point of approximately 8.0mAOD in the north.

Existing Drainage and Hydrology

2.6. The are no watercourses located on site. The nearest identified watercourse runs through the open green space to the south of the site.

2.7. Geological data from the British Geological Survey (BGS) shows the site is underlain by "Upper Limestone Formation - Sandstone with Subordinate Argillaceous Rocks and Limestone" bedrock in the west and "Passage Formation - Sandstone and Seatearth" bedrock in the east.

2.8. BGS also record superficial deposits at the site generally comprising "Till, Devensian – Diamicton", with a small area of "Raised Marine Deposits Of Holocene Age - Sand And Gravel" at the far western site access.

2.9. The National soil map of Scotland shows "Brown earths" extending across the entire site, with a parent material of "drifts derived from Carboniferous sandstones, shales and limestones".

3. Proposed Development

3.1. The proposals are for “Construction and operation of Battery Energy Storage System (BESS), transformer/sub-station an associated infrastructure”.

3.2. The proposed site layout in included in Appendix B.

4. Flood Risk and Land Use Vulnerability

Flood Risk Classification

4.1. Scottish Planning Policy (SPP) (2014) set out three categories of coastal and fluvial flood risk:

1) Little or No Risk – less than a 1 in 1000 year probability of coastal or fluvial flooding

2) Low to Medium Risk – between a 1 in 1000 year and 1 in 200 year probability of coastal or fluvial flooding

3) Medium to High Risk – greater than a 1 in 200 year probability of coastal and fluvial flooding

Land Use Vulnerability

4.2. SEPA's Flood Risk and Land Use Vulnerability Guidance classifies land uses according to how they are impacted by flooding.

4.3. The proposed BESS development is defined as 'Essential Infrastructure' under the description "essential utility infrastructure that has to be located in a flood risk area for operational reasons (this includes electricity generating power stations and grid and primary sub-stations, sewage treatment plants and water treatment works, wind turbines and other energy generating technologies)".

Suitability of Proposed Development

4.4. From a flood risk perspective (considering coastal and fluvial flooding only), SEPA's Flood Risk and Land Use Vulnerability Guidance details that Essential Infrastructure is generally:

- Suitable in areas of 'Little or No Risk'.
- Suitable in areas of 'Low to Medium Risk'.
- Suitable in areas of 'Medium to High Risk' subject to being designed and constructed to remain operational during a flood event (1 in 200 year) and not impede water flow.
- Suitable in areas of 'Medium to High Risk' within sparsely developed/undeveloped areas, where a flood risk location is required for operational reasons and an alternative lower-risk location is not available. Development should be designed and constructed to remain operational during a flood event (1 in 200 year) and not impede water flow.

4.5. The site is at Little to No Risk of coastal and fluvial flooding, as discussed in detail in Section 5. The proposed Essential Infrastructure development is therefore in accordance with SEPA's Flood Risk and Land Use Vulnerability Guidance (see above).

4.6. SPP (2014) also states that areas at Little or No Risk have "no constraints due to coastal or watercourse flooding". The development is therefore considered appropriate.

4.7. In addition to the above, this FRA assesses the risk of flooding to the site from all sources, including from surface water. SPP (2014) states that "Infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the annual probability of occurrence is greater than 0.5% (1:200 years)". Surface water flood risk, and the suitability of the development is considered below in Section 5.

5. Site Specific Flood Risk

5.1. In accordance with SPP (2014), this Flood Risk Assessment considers the risk of flooding from all sources including:

a) Coastal Flooding – from the sea

b) Fluvial Flooding – from rivers and streams

c) Surface Water Flooding – overland surface water flow and exceedance

d) Groundwater Flooding – from elevated groundwater levels or springs

e) Reservoir Flooding – from failure of reservoir dams

f) Drainage System Flooding – exceedance flows from an existing sewer system and culverts.

Flood Risk Classification

5.2. SEPA's flood maps define areas that are subject to a High, Medium or Low likelihood of flooding from coastal, fluvial and surface water sources. Table 5.1 below details the flood events associated with each of SEPA's likelihood categories.

Table 5.1 – SEPA Flood Map – Likelihood Classification

Likelihood of Flooding Event	Flood Event Impacting the Area
High	1 in 10 year
Medium	1 in 200 year
Low	1 in 1000 year

Coastal Flooding

5.3. SEPA's Coastal Flooding flood map defines the entire site to be at Little or No Risk of flooding, not predicted to be impacted by a 1 in 1000 year flood event (see Figure 5.1).

5.4. East Lothian Council's Strategic Flood Risk Assessment (2018) highlights that historically, coastal flooding has impacted the coastal areas of the region, referring to winter storms in 2010 and 2012. Although Cockenzie and the site are coastal, no historical flood events impacting the site or specific to Cockenzie are recorded in the SFRA.

5.5. Overall, the site is considered to be at **Little or No Risk** of coastal flooding.

Figure 5.1 – SEPA's Coastal Flooding Flood Map

Fluvial Flooding

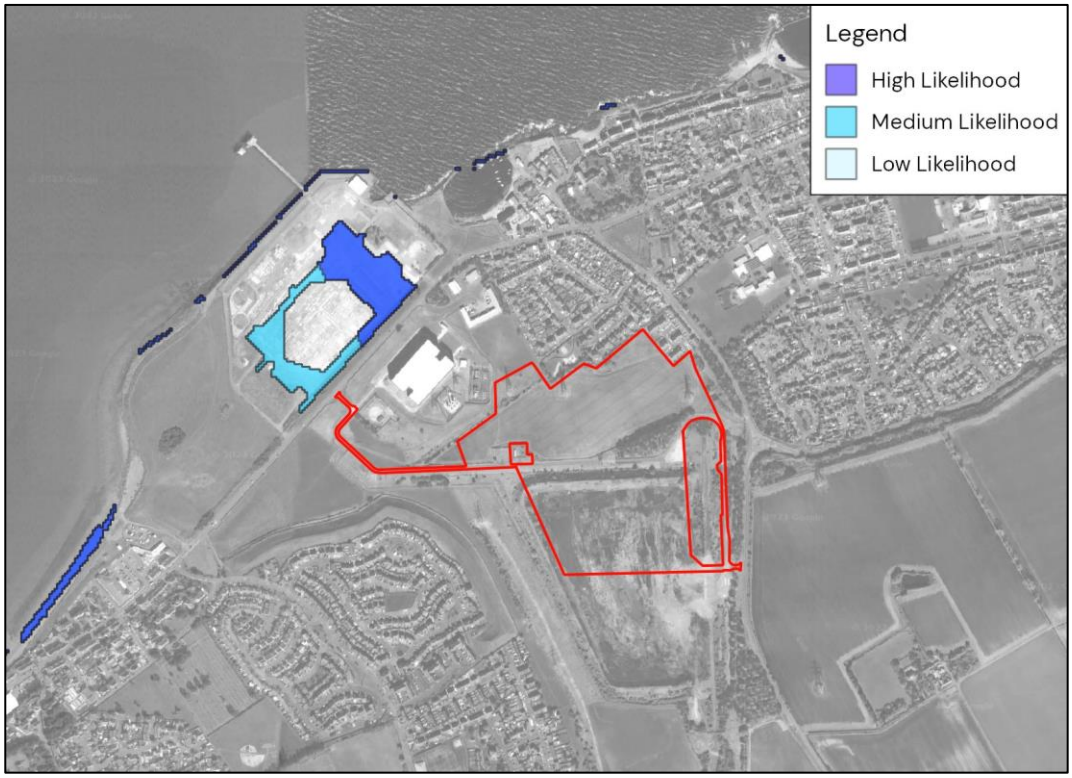
5.6. SEPA's River Flooding flood map defines the entire site to be at Little or No Risk of flooding, not predicted to be impacted by a 1 in 1000 year flood event (see Figure 5.2).

5.7. 1m resolution LiDAR data downloaded from the 'Scottish Remote Sensing Portal' does not highlight any watercourses on site that may pose a risk to the site. There is a small watercourse evident in the LiDAR data to the south of the site. This watercourse is unnamed and does not have a clear outfall. It is presumed to been used to help manage drainage of the open green space to the south of the site and is considered unlikely to present a fluvial flood risk to the site.

5.8. The SFRA (2018) does not highlight any fluvial flood risk in Cockenzie.

5.9. Overall, the site is considered to be at **Little or No Risk** of fluvial flooding.

Figure 5.2 – SEPA's River Flooding Flood Map



Surface Water Flooding

5.10. SEPA's Surface Water flood map defines the majority of the site to have a Low Likelihood of flooding, not predicted to be impacted by a 1 in 1000 year rainfall event (see Figure 5.3).

5.11. There are some areas of the site predicted to be at risk, ranging from a High Likelihood (1 in 10 year probability) to Low Likelihood (1 in 1000 year probability).

5.12. There are 2 isolated areas of surface water flood risk predicted at the northern end of the site. As the surface water predicted to accumulate here is associated with surface water arising within the site boundary itself, it will be managed with the proposed Surface Water Drainage Strategy (prepared by David R Murray Associates) which will help mitigate the risk. In addition, development proposed within these 2 areas is limited (see below).

5.13. The SPP (2014) advises that infrastructure and buildings are generally designed to be free from surface water flooding during a 1 in 200 year rainfall event (outside the Medium Likelihood defined in the SEPA flood map).

5.14. The proposed site layout and SEPA Surface Water flood map is shown in Figure 5.4. Generally, the only proposed development in areas at risk of surface water flooding include a proposed bund and proposed SuDS features (see drainage strategy details elsewhere in the planning submission). There is a small area of BESS infrastructure proposed within the northwestern isolated area of Medium Likelihood (1 in 200 year).

It is considered that this risk with be managed and mitigated with the proposed Surface Water Drainage Strategy (prepared by David R Murray and Associates) and that the infrastructure would therefore be suitably protected from surface water flooding here.

5.15. In addition to the surface water predicted to arise on site which will be suitably managed, there is a surface water flow path along the eastern site access and flowing into the far northern edge of the site predicted by the SEPA flood map (Figure 5.3).

5.16. LiDAR data shows ground levels along the proposed eastern access to fall consistently to the north. It is therefore not expected the surface water would accumulate to significant depths here. Furthermore, the proposals are for a BESS which will be operated remotely and only visited occasionally for maintenance. The site will therefore not need to be accessed during an extreme surface water flood event.

5.17. No proposed BESS infrastructure is located at the end of the eastern flow path where surface water is predicted to accumulate.

5.18. Given the above, the site is considered to have a **Low Likelihood** of surface water flooding and with the proposed Surface Water Drainage Strategy in place, the development is considered to be safe from surface water flooding during its lifetime.

Figure 5.3 – SEPA's Surface Water Flooding Flood Map

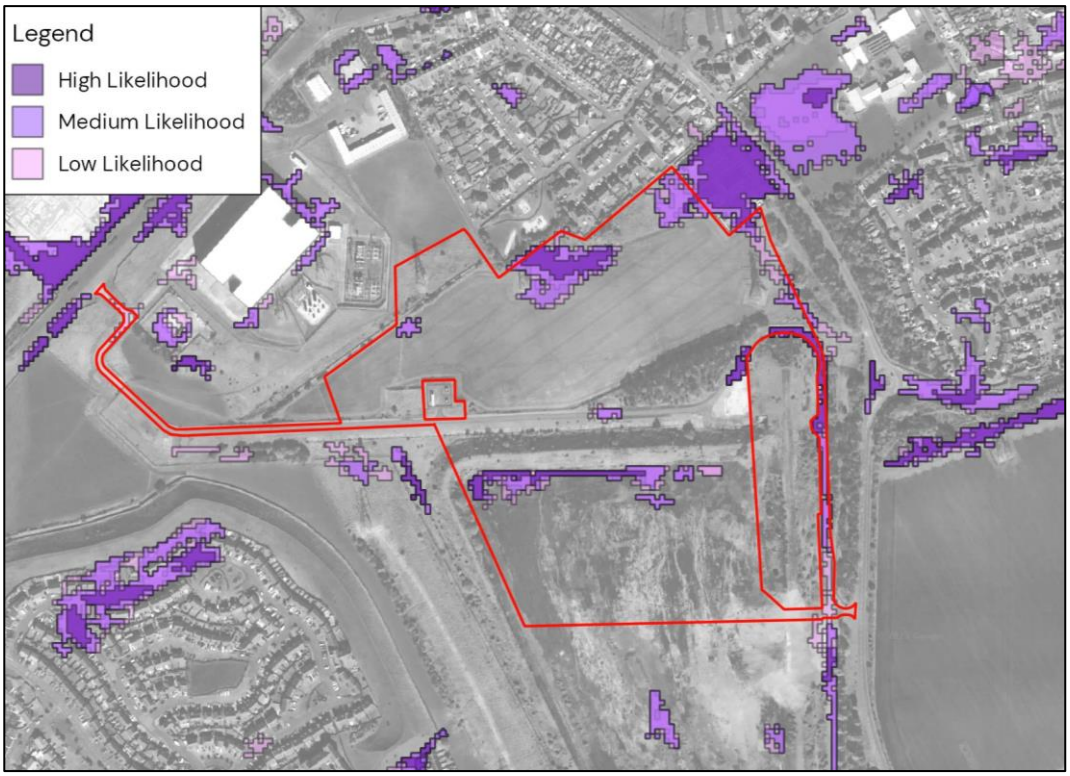
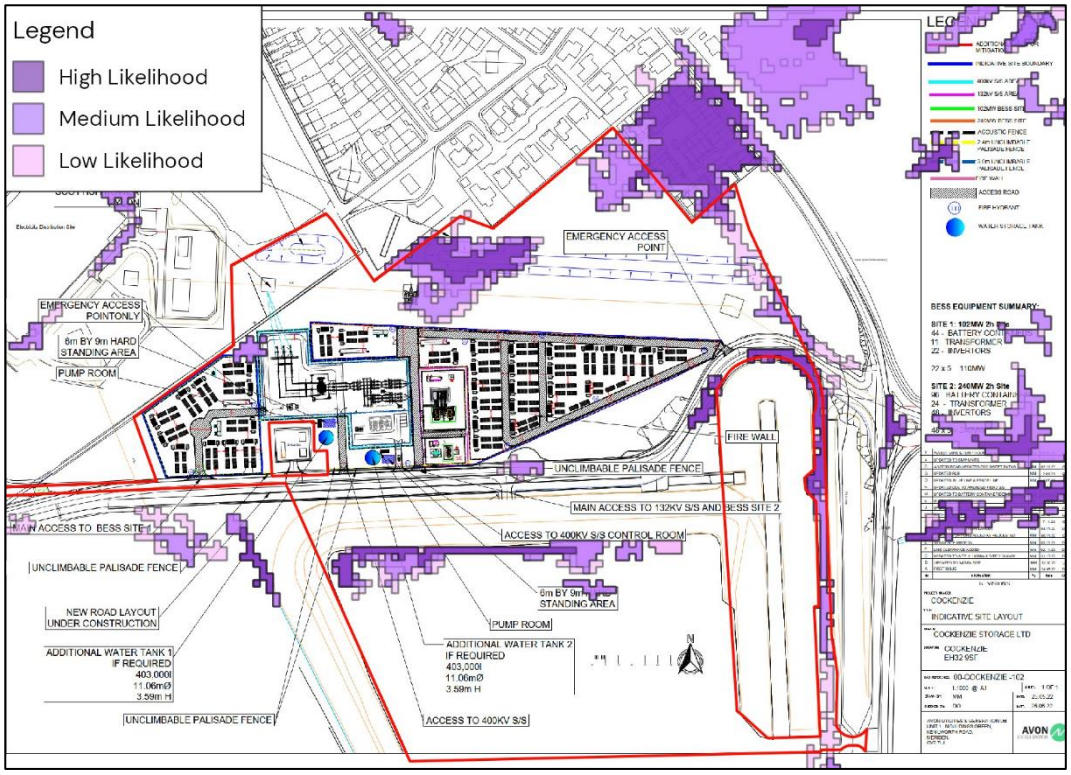


Figure 5.4 – SEPA's Surface Water Flooding Flood Map & Proposed Site Layout



Groundwater Flooding

5.19. BGS data show that the site is underlain by permeable limestone/sandstone bedrock in the west and mixed permeability sandstone/seatearth bedrock in the east. It is considered that there is potential for groundwater emergence through these bedrocks, given their expected permeable nature.

5.20. Superficial deposits on site are also recorded by BGS generally comprising till, with a small area of marine deposits in the west. Till deposits are generally relatively impermeable are likely to restrict the potential emergence of groundwater on site.

5.21. Brown earths soils are recorded by the National soil map of Scotland to be present across the entire site. These soils are made up of equal parts silt, sand and clay and are freely draining. Groundwater emergence is possible though these presumed permeable soils.

5.22. The Hydrogeology Aquifer Classification defines bedrock at the site as a 'Moderately Productive Aquifer'.

5.23. The East Lothian SFRA (2018) does not report any issues with groundwater flooding in Cockenzie, highlighting risk in east Musselburgh, Port Seton and Dunbar only.

5.24. The site generally falls northerly without exhibiting any significant dips in local topography. As a result, site topography is not considered to be conducive to

groundwater flooding, with any groundwater to emerge expected to flow northerly, away from the site and in accordance with site topography.

5.25. Overall, the site is considered to be at Low risk of flooding from groundwater.

Drainage System Flooding

5.26. The East Lothian SFRA (2018) does not highlight any risk of flooding from sewers in Cockenzie, with Humbie being the only area mentioned.

5.27. The site generally falls northerly without exhibiting any significant dips in local topography. As a result, site topography is not considered to be conducive to sewer flooding, with any flood waters from the local sewer network expected to flow northerly, away from the site and in accordance with site topography.

5.28. The site is therefore considered to be at **Low** risk of sewer flooding.

Reservoir Flooding

5.29. There are no Reservoirs identified in the vicinity of the site that are expected to pose a risk to the proposed development should they fail.

5.30. SEPA's Reservoir Inundation maps do not highlight the site or any land in the immediate vicinity to be at risk of reservoir flooding.

5.31. Reservoirs in Scotland are regulated under the Reservoirs (Scotland) Act 2011. The Act implements a proportionate and risk-based set of regulations to manage the consequence of uncontrolled water release from reservoirs. The strict regulations involved with reservoir operations ensures that the likelihood of a significant breach event occurring is very low, and that the associated risk is also low.

5.32. Overall, the site is considered to be at **Very Low** risk of flooding from reservoirs.

Access & Egress

5.33. The site is proposed to be accessed via Edinburgh Road to the west and the B6371 to the east.

5.34. Edinburgh Road is not considered to be a significant flood risk from any source.

5.35. SEPA data shows surface water flood risk along the B6371. As discussed above however, given the northerly fall of the road, surface water is not predicted to accumulate to significant depths here. Furthermore, the proposed BESS will be controlled remotely and only visited occasionally for maintenance operations. Consequently, there will be no requirement for site access or egress during times of extreme flood.

Flood Risk Summary

5.36. The risk of flooding from all sources is summarised in Table 5.2:

Table 5.2 – Flood Risk to the Site from All Sources

Flood Source	Flood Risk	Mitigation/Comments
Coastal	Little or No Risk	• SEPA does not predict the site to be impacted by a 1 in 1000 year coastal flood event
Fluvial	Little or No Risk	• SEPA does not predict the site to be impacted by a 1 in 1000 year fluvial flood event
Surface Water	Low	• Across the majority of the site, SEPA does not predict the site to be impacted by a 1 in 1000 year surface water flood event. • Areas identified to be at risk that are associated with surface water arising on site will be manage with the Proposed Surface Water Drainage Strategy prepared by David R Murray and Associates
Groundwater	Low	• Ground conditions on site are potentially suitable for groundwater emergence • Site topography is not considered conducive to groundwater flooding
Drainage Systems	Low	• The East Lothian SFRA does not highlight any risk of flooding from sewers in Cockenzie • Site topography is not considered conducive to groundwater flooding
Reservoirs	Very Low	• SEPA's Reservoir Inundation maps do not highlight the site or any land in the immediate vicinity to be at risk of reservoir flooding. • The likelihood of a reservoir breach is considered to be very low

6. Summary

6.1. The site comprises approximately 17ha of greenfield land and associated access. The site is proposed for the "construction and operation of Battery Energy Storage System (BESS), transformer/sub-station an associated infrastructure".

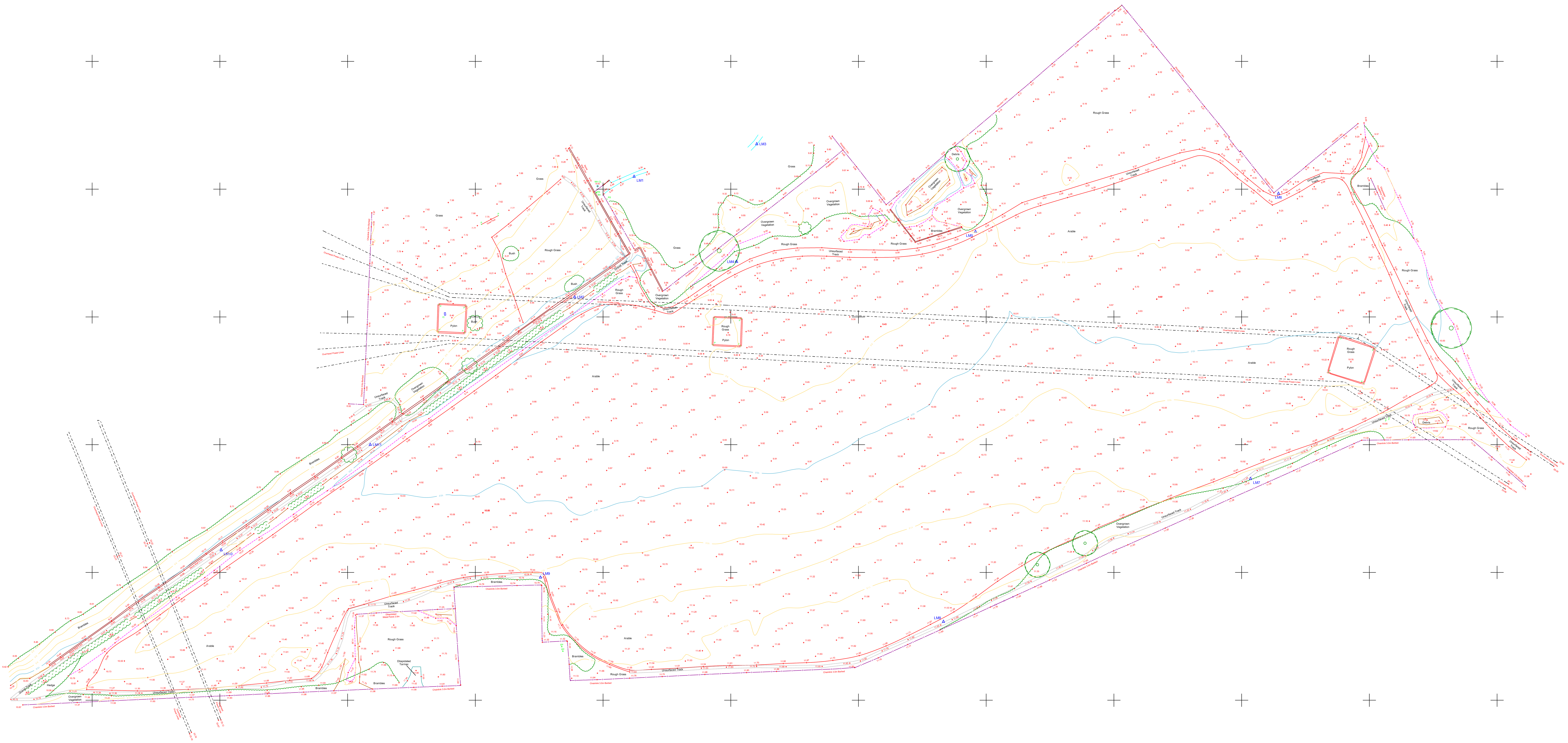
6.2. The proposed development (Essential Infrastructure) is in accordance with SEPA's Flood Risk and Land Use Vulnerability Guidance.

6.3. The site is not considered to be a significant risk of flooding from any source. SEPA mapping predicts areas of the site to be at risk of surface water flooding. These at risk areas have generally been kept clear of vulnerable infrastructure.

6.4. A Surface Water Drainage Strategy has been prepared by David R Murray and Associates to manage surface water runoff from the proposed development and is included elsewhere in the planning documents.

6.5. Overall, the development is not considered to be at significant risk of flooding and a Surface Water Drainage Strategy will be implemented to ensure flood risk elsewhere is not impacted.

Appendix A – Topographic Survey



LEGEND

Contour
Prominent Contour
Kerb
Low Kerb
Road Verge
Back of Footpath
Crash Barrier
Wall
Wall (To scale)
Wall Overhang
Concrete Base
Steps
Fence
Gate
Building
Building Minor
Building Overhang
Soffit Line
Top of bank
Bottom of bank
Change of Surface
Tactile Paving
Track (To scale)
Ditch
Water Line
Rock Outcrop
Hedge (To scale)
Foliage
Tree Area
Tree
Bush
Pipeline
Channel (To scale)
Overhead Line
Seat
Junction / Location Box
Road Sign
Railway
Bearer
Buffer
Cable Housing
Check Rail
Coping Edge
Ground Cable
Ground Signal
Hollow Sleeper
Magnet
Mast
Orange Pipe Crossing
Red Bond
Signal
Signal Wire
Sleeper Edge
Switch
Switch Equipment
Track Warning System
Twist — Twist Location
Clip
Missing Clip

AV — Air Valve
Bed Level — Bed Level
BH — Borehole
Bin — Rubbish Bin
Bol — Bollard
BS — Bus Stop
BT — British Telecom
CTV — Cable T.V.
CR — Cable Riser
CCTV — Camera
CULV IL — Culvert
Dp — Down Pipe
Dr — Drain
EP — Electricity Pole
ER — Earth Rod
FH — Fire Hydrant
FL — Floor Level
G — Gully
Gas — Gas Pipe
GR — Gas Riser
GV — Gas Valve
IC — Inspection Cover Small
IC — Inspection Cover Large
IL — Invert Level
IRS — Illuminated Road Sign
KO — Kerb Outlet
LP — Lamp Post
L/B — Lifebelt
Met — Meter
MH — Circular Manhole
MH — Manhole
MH — Triangular Manhole
Mon — Monitor
Moor — Mooring Post
MP — Marker Post
P — Post
PB — Post Box
Pipe — Pipe
PIT — Trial Pit
RE — Rodding Eye
RS — Road Sign
Spot Level
SC — Stop Cock
Stay — Stay
Phone — Telephone
Stp — Tree Stump
TL — Threshold Level
TP — Telegraph Pole
TS — Traffic Signal
WLev — Water Level
Axle Counter — Axle Counter
Cant — Cant Marker
CN — Crossing Nose
Exp — Expansion Joint
FB — Flash Butt Weld
IJ/4 — Insulated Joint
MM — Mileage Marker
EJ/4 — Non Insulated Joint
TW — Thermic Weld
E/L — Eaves Level
R/L — Ridge Level

CONTROL STATION COORDINATES

STN	EASTING	NORTHING	LEVEL
LM1	339912.154	675304.907	8.320
LM2	339888.904	675257.739	10.353
LM3	339960.181	675317.648	9.153
LM4	339952.318	675271.594	9.264
LM5	340045.822	675283.344	9.574
LM6	340164.407	675298.299	9.271
LM7	340153.501	675186.663	11.197
LM8	340033.273	675130.739	11.889
LM9	339875.509	675148.070	10.678
LM10	339750.505	675158.755	10.575
LM11	339808.857	675199.990	10.116

N

INDICATIVE OF NORTH

Notes:

All levels shown are relative to the O.S. active GPS network (OSGM15).

The co-ordinates shown on this plan are relative to the O.S. active GPS network (OSTN15).
The survey is orientated approximately to grid north.

L&M Survey Services
LAND • RAIL • UTILITY

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Client :

GRESHAM HOUSE DEVCO PIPELINE LTD
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LONDON
EC4A 3TW

Project Title :

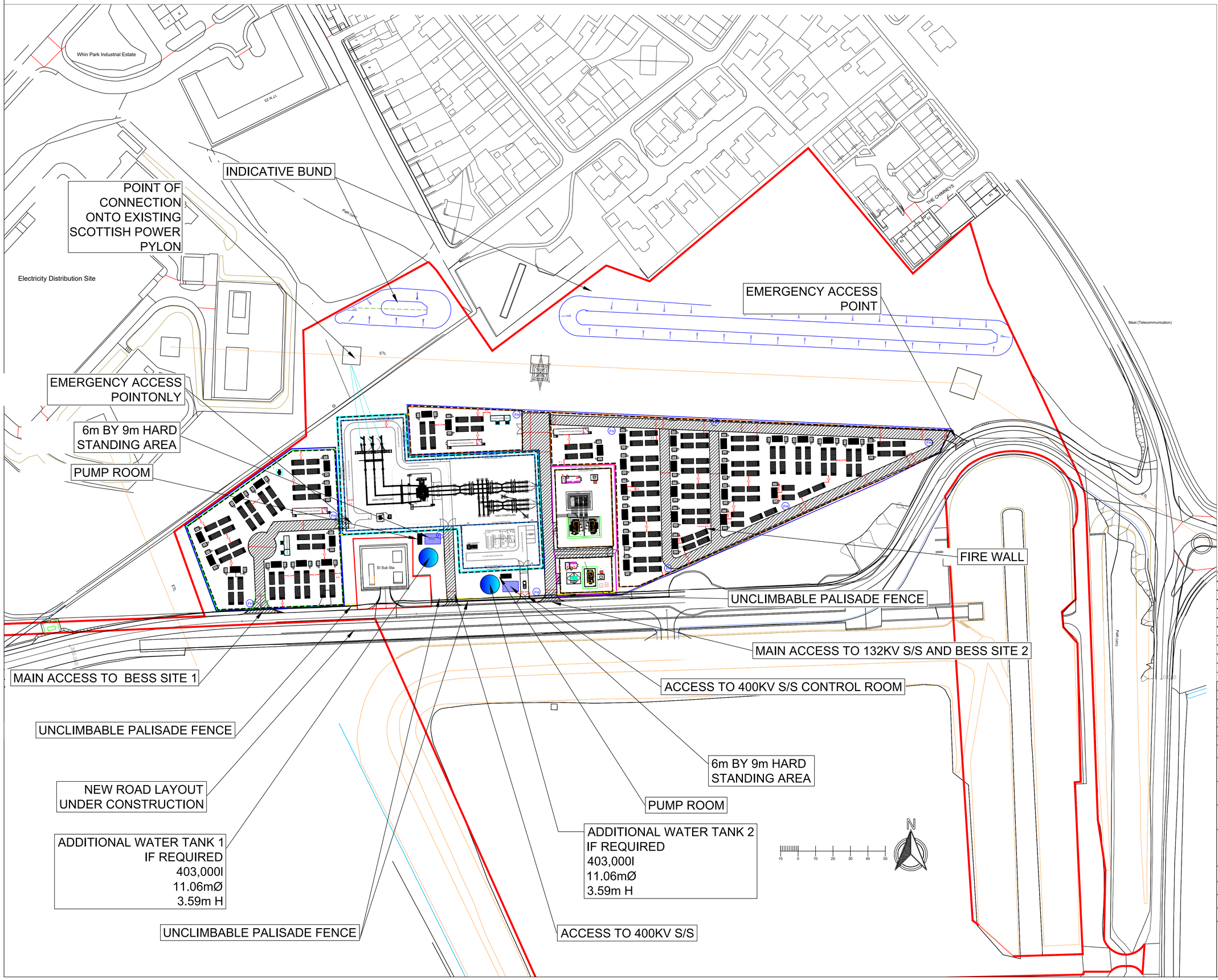
TOPOGRAPHICAL SURVEY

COCKENZIE
PRESTON
EH32 9SF

Sheet Title :		Scale :	
SHEET 1 OF 2		1:500	
Surveyed date : 19/04/23	Issued date : 21/04/23	Enquiry No : 27650	Project No : 15763
Surveyed by : MJ	Processed by : MJ	Checked by : SMcM	Approved by : KRJA

A0 Sheet

Appendix B – Proposed Site Layout



LEGEND

- ADDITIONAL LAND FOR MITIGATION.
- INDICATIVE SITE BOUNDARY
- 400kV S/S AREA
- 132kV S/S AREA
- 102MW BESS SITE
- 240MW BESS SITE
- ACOUSTIC FENCE
- 2.4m UNCLIMBABLE PALISADE FENCE
- 3.0m UNCLIMBABLE PALISADE FENCE
- FIRE WALL
- ACCESS ROAD
- FH FIRE HYDRANT
- WATER STORAGE TANK

BESS EQUIPMENT SUMMARY:

SITE 1: 102MW 2h Site
44 - BATTERY CONTAINERS
11 - TRANSFORMER
22 - INVERTORS

22 x 5 = 110MW

SITE 2: 240MW 2h Site
96 - BATTERY CONTAINERS
24 - TRANSFORMER
48 - INVERTORS

48 x 5 = 240MW

No	INFORMATION	By	Date	Chkd
T	WATER TANK & PUMP ROOM ADDED	MM	05.01.24	GJ
S	UPDATED TO 5MW UNITS	MM	15.11.23	GJ
R	ACCESS ROAD UPDATED FOR SWEPT PATHS	MM	02.11.23	GJ
Q	UPDATED RLB	MM	12.09.23	GJ
O	UPDATED BLUE LINE & FENCE LINE	MM	13.07.23	GJ
N	UPDATED DUE TO AMENDED 400KV S/S	MM	05.07.23	GJ
M	UPDATED TO BATTERY CONTAINERISED SYSTEM	MM	26.06.23	GJ
k	UPDATED 132 S/S	MM	19.05.23	GJ
J	UPDATED 400KV S/S	MM	16.05.23	GJ
I	BOTH 2H SITES - ALL EQUIPMENT IN NORTH	MM	06.04.23	GJ
H	UPDATED 132/33KV SUBSTATIONS	MM	17.11.22	GJ
G	ALTERNATIVE BATTERY LAYOUT	MM	04.11.22	DO
F	400KV SUB OPTIONS ADDED AS REQUESTED	MM	09.11.22	GC
E	100MW SITE MADE 2h	MM	03.11.22	DO
D	LINE CLEARANCE ADDED	MM	02.11.22	DO
C	UPDATED TO SITE 1: 100MW & SITE 2: 240MW	MM	31.10.22	DO
B	UPDATED TO 340MW SITE	MM	31.10.22	DO
A	FIRST ISSUE	MM	24.05.22	DO

REVISIONS

PROJECT NUMBER
COCKENZIE

TITLE:
INDICATIVE SITE LAYOUT

CLIENT:
COCKENZIE STORAGE LTD

LOCATION:
COCKENZIE
EH32 9SF

CAD REFERENCE: 00-COCKENZIE -102

SCALE:	1:1000 @ A1	SHEET:	1 OF 1
DRAWN BY:	MM	DATE:	25.05.22
CHECKED BY:	DO	DATE:	25.05.22

AVON UTILITIES & GENERATION Ltd
UNIT 1 , MOULDINGS GREEN,
KENILWORTH ROAD,
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AVON UTILITIES & GENERATION

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