Scottish & Southern Electricity Networks

TRANSMISSION

Annex K - Drainage

September 2022

CRAIG MURRAIL SUBSTATION

ANNEX K
DRAINAGE IMPACT ASSESSMENT

JULY 2022

Prepared by
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1 INTRODUCTION

1.1 Background

This Drainage Impact Assessment (DIA) has been produced in support of a planning application for the construction of a 275 kV substation (the Proposed Development) on greenfield land north of Lochgilphead (the Site).

The Proposed Development is accompanied by Associated Development, a permanent overhead line (OHL) tie in comprising of 6 no. towers and access tracks. This is not included within this DIA given the absence of impermeable surfaces associated with it, therefore this DIA assesses only the Proposed Development.

This DIA has been prepared by Arcus Consultancy Services Ltd (Arcus), on behalf of SSEN Transmission (the Applicant) to satisfy the following requirements:

- Scottish Government, Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems[1];
- Scottish Government, Planning Advice Note 79: Water and Drainage[2];
- Scottish Environmental Protection Agency (SEPA), Technical Flood Risk Guidance for Stakeholders[3];
- Scottish Water, Sewers for Scotland 4th Edition[4];
- Construction Industry Research and Information Association (CIRIA), The Sustainable Urban Drainage Systems (SuDS) Manual (C753)[5]; and
- Argyll and Bute Council (ABC), Flood Risk Management Policy and Strategy[6].

The Proposed Development Layout Plan can be found in **Appendix A** of this DIA.

1.2 Site Context

The Site is located approximately 3.2 kilometres (km) north-east of Lochgilphead at National Grid Reference (NGR) E 187701, N 690911. The Site is approximately 850 metres (m) west of Dipping Burn.

The Proposed Development is in an area of commercial forestry with low conservation value as well as an area of semi-natural broadleaved woodland with higher ecological importance. Existing access tracks would be utilised to access the Proposed Development from the existing road to ensure operational access is maintained.

Ordnance Survey (OS) Terrain 5 data indicates Site elevations are in the approximate range of 120 to 105 m Above Ordnance Datum (AOD) with topography falling from a high point in the north to the lower elevations in the south of the Site, as shown by **Plate 1**.

[1] Scottish Government, Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems (2001). [Online]. Available at: https://www.gov.scot/publications/pan-61-sustainable-urban-drainage-systems/

[2] Scottish Government, Planning Advice note 79: Water and Drainage (2006). [Online]. Available at: https://www.gov.scot/publications/planning-advice-note-pan-79-water-drainage/

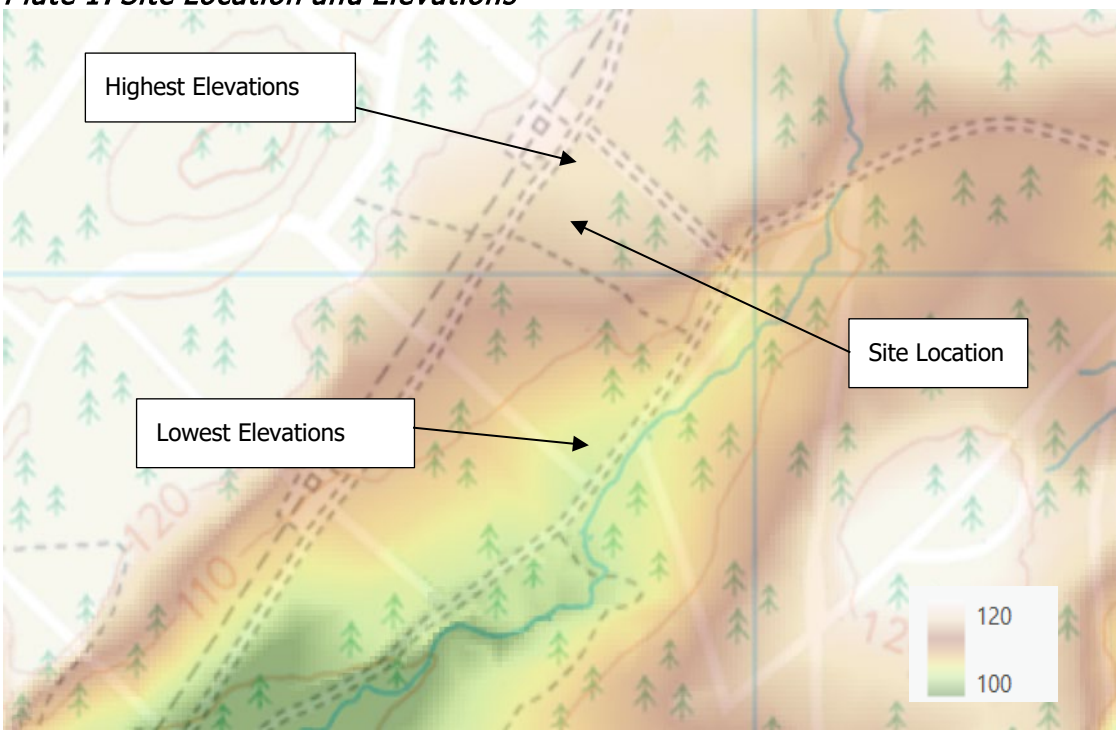
[3] SEPA, Technical Flood Risk Guidance for Stakeholders (2019). [Online]. Available at: https://www.sepa.org.uk/environment/land/planning/guidance-and-advice-notes/

[4] Scottish Water, Sewers for Scotland (2018). [Online]. Available at: https://www.scottishwater.co.uk/-/media/ScottishWater/Document-Hub/Business-and-Developers/Connecting-to-our-network/All-connections-information/SewersForScotlandv4.pdf (Accessed 30/09/2021)

[5] CIRIA, The SuDS Manual (C753) (2015). [Online]. Available at: https://www.ciria.org/AsiCommon/Controls/BSA/Downloader.aspx

[6] Argyll and Bute Council Flood Risk Management Policy and Strategy (2015). [Online]. Available at: Flood_Risk_Management_Policy_and_Strategy%20-%20Final%20draft%20110315.pdf (argyll-bute.gov.uk)

Plate 1: Site Location and Elevations



There were no British Geological Survey (BGS) borehole scans available within close proximity to the Site. However, the BGS Geology of Britain Viewer[7] indicates that the site is underlain by bedrock geology consisting of Ardrishaig Phyllite Formation, with no superficial deposits recorded.

SLR conducted site investigations in 2016 and excavated 20 test pits. Of the 20 pits 11 comprised peats to depths of 0.6 to 3.9 m below ground level (bgl), underlain by gravelly silt.

A site visit indicated soils and ground conditions are extremely boggy with high water table, indicating infiltration would not be feasible.

Further details on peat depths associated are available in **Annex O: Peat Management Plan** of the Craig Murrail Substation Environmental Appraisal.

1.3 The Proposed Development Infrastructure

The Proposed Development will be constructed on top of the substation platform which will comprise a 1 m sub base which will comprise free draining fill material and is therefore assessed to be permeable.

The proposed temporary and permanent access tracks will comprise of permeable materials (e.g., Type 2 aggregate) and will be free draining and are therefore excluded from the total impermeable areas. The Associated Development is not considered to have any significant impermeable materials and therefore has not been considered within this appraisal. Impermeable areas associated with the Proposed Development are therefore limited to the buildings storing the diesel generator, feeder building, telecoms, mess and store room, LVAC room, battery room, switch room and the substation electrical infrastructure. The impermeable elements will create a total impermeable area of approximately 0.4 ha.

[7] British Geological Survey: Geology of Britain Viewer. [Online]. Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

2 SURFACE WATER DESIGN CONDITIONS

In accordance with the SuDS Manual, an evaluation has been undertaken to determine the most appropriate option to dispose of surface water from the Proposed Development.

2.1 Surface Water Discharge Options

The Proposed Development will not be permanently manned with infrequent maintenance visits. However, the Proposed Development will require welfare when manned and therefore there will be no demand for water re-use.

Consultations[8] with ABC have confirmed that infiltration testing is not required at the Planning Application submission stage and that the potential for infiltration drainage will be assessed through an estimated infiltration rate sought via the SuDS Manual.

2.2 Estimated Infiltration Rate

Table 25.1 of the SuDS Manual outlines estimated infiltration rates based on the Infiltration Drainage – Manual of Good Practice[9]. Table 25.1 indicates silt media has a typical maximum infiltration rate of an infiltration rate of 0.036 metres per hour (m/h).

Acknowledging the underlying site conditions, infiltration as a means of drainage is assessed as unfeasible and surface water will be disposed of by controlled discharge to a nearby watercourse.

2.3 Greenfield Run-off rates

Greenfield run-off rates for the 0.4 ha of impermeable area, have been calculated using the ICP SuDS method[10] via Micro Drainage Software with rates shown in **Table 1** below and **Appendix B** of this DIA.

Q_{BAR} will be utilised as the outflow rate.

The application of this approach leads to the run-off from the Site to be attenuated and discharged to the greenfield run-off rate of 3.7 l/s in up to the 200-year return period, with appropriate climate change allowances.

Table 1: Site Run-off Flow Rates (taken from Micro Drainage)

Return Period	Q (l/s)
Q_{BAR}	3.7
1	3.2
30	7.1
100	9.3
200	10.5

2.4 Return Period and Climate Change Allowance

In accordance with Map 1 of SEPA's climate change (+CC) allowances[11] a 46% allowance has been incorporated into the drainage design (+46% CC).

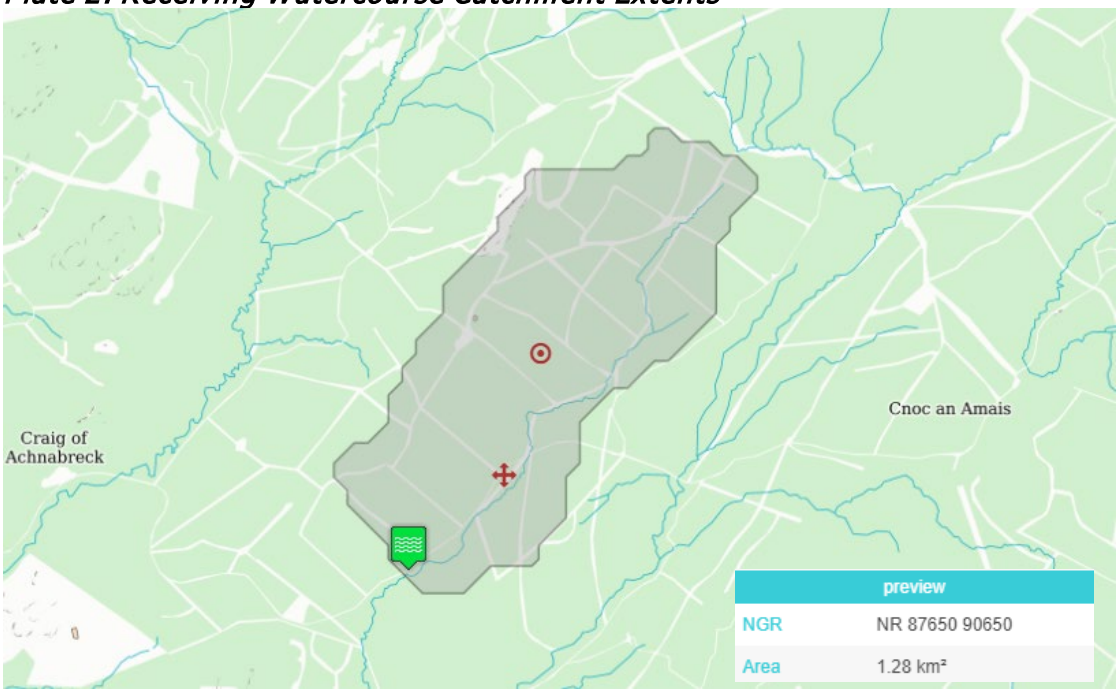
Attenuation is required in up to and including the 1:30-year (+CC) event with exceedance events up to the 1:200-year (+CC) event to be considered for offsite flooding.

[8] Email and telephone communications between D. Moore (ABC) and R. Duff (Arcus) January 2022.
[9] R, Bettess. Infiltration Drainage – Manual of Good Practice (1996). CIRIA R156.
[10] National SuDS Working Group, Interim Code of Practice for Sustainable Drainage Systems (2004). [Online]. Available at: https://www.susdrain.org/files/resources/other-guidance/nswg_icop_for_suds_0704.pdf
[11] SEPA, Climate Change Allowances for Flood Risk Assessment in Land Use Planning (2019). [Online]. Available at: https://www.sepa.org.uk/media/426913/lups_cc1.pdf

2.5 Discharge to Watercourse

The UK CEH (FEH) web map[12] indicates that an unnamed watercourse is served by a catchment of 1.28 km² as shown in **Plate 2**. This watercourse is located approximately 300 m south east of the Site. The watercourse flows in a southerly direction until it joins the Dipping Burn approximately 1.10 km south of the Site.

Plate 2: Receiving Watercourse Catchment Extents



3 SURFACE WATER DRAINAGE DESIGN

The measures outlined in the following Sections will be implemented by the Applicant's chosen Contractor to ensure that greenfield run-off rates are maintained during the construction and operational phases of the Proposed Development.

3.1 Should the drainage measures or final locations of infrastructure differ to what is outlined within this document, then the final detailed drainage design will be provided to ABC under an agreed pre-construction condition. Proposed Surface Water Drainage Scheme

The substation will be underlain by a permeable platform underlain by capping to depths of 1 m, with an area of 2.9 ha. The free draining nature of the platform enables the platform to be utilised for surface water attenuation at the location of the Proposed Development. A penstock will be incorporated into the system to prevent any pollutant run-off if required.

The area of the hardstanding equates to 0.4 ha, and therefore, the capping layer will have an area available for attenuation of 2.5 ha. These dimensions were inputted into Micro Drainage software as a cellular storage unit, in order to represent the porosity of the proposed platform.

The porosity of a capping layer is defined by the type of fill material applied, with typical porosity values extracted from Micro Drainage shown in **Plate 3**. The 6F2-type aggregate is assessed to have a porosity value of 0.2 (*i.e.*, the lowest range within the graded gravel category).

[12] UK Centre for Ecology and Hydrology, Flood Estimation Handbook. [Online]. Available at: https://fehweb.ceh.ac.uk/GB/map

Plate 3 – Typical Porosity Values (Taken from Micro Drainage)

Material	Porosity
Clean Stone	0.4 - 0.5
Uniform Gravel	0.3 - 0.4
Graded Sand or Gravel	0.2 - 0.3

The outfall to the open land drain is located within the extents of the Site and third-party access agreements that are required for the route to the discharge point will be sought prior to construction.

The outflow of the platform attenuation to the unnamed watercourse will be controlled by an orifice and discharge to the watercourse to the south at 1.6 l/s..

The critical storm event in up to a 1:200-year (+46% CC) event is shown in **Plate 4** with the designed feature able to attenuate surface water flows without overtopping.

Details of critical events for the 1:200-year (+46% CC) event can be found in **Appendix C**.

Plate 4: Network 1:200-Year (+CC) Critical Storm Event (Taken from Micro Drainage)

Storm Event	Rain (mm/hr)	Time to Vol Peak (mins)	Max Water Level (m)	Max Depth (m)	Flooded Volume (m³)	Max Control (l/s)	Discharge Volume (m³)	Max Filtration (l/s)	Σ Max Outflow (l/s)	Maximum Volume (m³)	Status
10080 min Winter	2.751	7568	109.210	0.210	0.0	1.6	710.8	0.0	1.6	1048.5	O K

3.2 Water Quality

The proposed Development will involve the construction and operation of a substation involving less than 300 traffic movements per day. Table 26.2 *Pollution hazard indices for different land use classifications* of the SuDS Manual identifies that the Proposed Development has a Pollution Hazard Level of Low, taken from the 'Low Traffic Roads e.g. residential roads and general access roads, < 300 traffic movements/day' scenario.

Table 2 outlines that the Proposed Development includes land uses which have the following Simple Index Approach (SIA) indices.

Table 2: Pollution Hazard Indices for Land Use Classifications

Land Use	Pollution Level Hazard	Total Suspended Soils	Metal	Hydrocarbons
Commercial/Industrial Roofing: Low Potential for Metal Leaching	Low	0.3	0.4	0.4

A SIA has been developed on behalf of the CIRIA to support the implementation of the water quality management design methods set out in the SuDS Manual, with appropriate cross referencing to the relevant 'Design Conditions' in the tool.

The Proposed Development has been categorised as 'Commercial/Industrial roofing: Low potential for metal leaching' within the SIA tool.

The permeable / porous roads will be sufficient to effectively mitigate any suspended solids, metals and hydrocarbons held within surface water at the Proposed Development prior to discharging into the receiving watercourse under expected conditions i.e. in the absence of large hydrocarbon spill

The SIA outputs as shown in **Table 3**, demonstrate that the combined Pollution Mitigation Indices for the run-off area are met by the utilisation of the substation platform as a surface water attenuation structure.

Table 3: SIA outputs for Low Pollution Hazard Level scenario

	Total Suspended Solids	Metals	Hydrocarbons
Pollution Hazard Indices	0.3	0.4	0.5
Permeable Pavement	0.7	0.6	0.7

The outputs of the SIA tool indicate that the SuDS network has the required treatment potential in relation to the potential pollution hazard of the Proposed Development in the absence of significant spillages of hydrocarbons or other pollutants.

3.3 Construction Phase

The drainage measures implemented within the temporary works area (TWA) will be the responsibility of the appointed contractor. This area will comprise aggregate underlain by a permeable membrane. The contractor will implement temporary construction drainage measures in accordance with best practice guidance which will prevent any significant run-off in relation to the compaction of soils during construction (e.g., spill kits, drip trays, plant nappies, designated refuelling points, emergency response plans). Following the construction of the Development, the TWA will be decommissioned, with underlying ground reinstated to its original condition.

Therefore, the TWA not contribute to a significant increase in surface water run-off rates and need not be served by a formal drainage network.

The nature of hydrological incidents that could result from construction activities will be mitigated through the implementation of construction phase SuDS and the application of industry good practice as per CIRIA Guidance (C741)[13].

To prevent any sediment increase in associated run-off during the construction phase mitigation measures (e.g., spill kits, bunds, drip trays, plant nappies, designated refuelling points and emergency response plans) will effectively prevent sediment entering surrounding watercourses.

4 FOUL WATER DRAINAGE

During the construction phase a temporary a 'porta-loo' facility will be onsite, with waste being stored, managed and carried offsite by a licensed waste management courier. A septic tank will be installed to provide foul sewage management throughout the operational phase of the Proposed Development. The septic tank will be managed, inspected and drained by a licensed courier who will then dispose of the waste offsite. The septic tank will be registered with SEPA through the private sewage registration system.

5 LONG TERM MANAGEMENT AND TIMESCALES

5.1 Long Term Management

It will be the responsibility of SSEN Transmission to maintain effective drainage measures and rectify drainage measures that are not functioning adequately. A nominated person will also have responsibility for reporting on the functionality of drainage measures.

Where impermeable areas remain through the lifetime of the Proposed Development, the SuDS measures serving these areas will be checked on a regular basis. Should drainage measures require dredging or unblocking, this will be undertaken as soon as practicable by a local contractor engaged by SSEN Transmission.

[13] The Construction Industry Research and information Association (CIRIA), (2015), Environmental Good Practice on Site Guide (C741), CIRIA: London.

It is not anticipated that ABC or Scottish Water will adopt the new drainage network. Therefore, it will be the responsibility of SSEN Transmission to maintain effective drainage measures and rectify drainage measures that are not functioning adequately.

An outline management / maintenance plan is provided in **Table 4.** Pervious pavements would have similar maintenance characteristics to the platform due to the material filling used. Therefore, pervious pavements have been used to represent the maintenance of the platform.

Table 4: Long-term Maintenance schedule for the Pervious Paving[14]

Maintenance schedule	**Required action**	**Typical frequency**
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken material considered detrimental to the structural performance or a hazard to users	As required
	Rehabilitation of surface and upper substructure by remedial sweeping or appropriate method	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

5.2 Timescales

Drainage measures outlined within this DIA should be implemented as soon as practical by the Applicant's Contractor but as a minimum before the construction of any impermeable surfaces which are proposed to drain into the approved drainage system.

[14] Based on Table 20.15 - Operation and maintenance requirements for pervious pavements of the SuDS Manual.

6 CONCLUSION

This DIA provides details on the volume of storage required to attenuate surface water run-off from the construction of the Proposed Development. The Associated Development have not been assessed in this DIA.

The Proposed Development will involve the installation of approximately 0.4 ha of impermeable elements.

The Proposed Development will be underlain by a free draining platform which will be utilised for surface water attention.

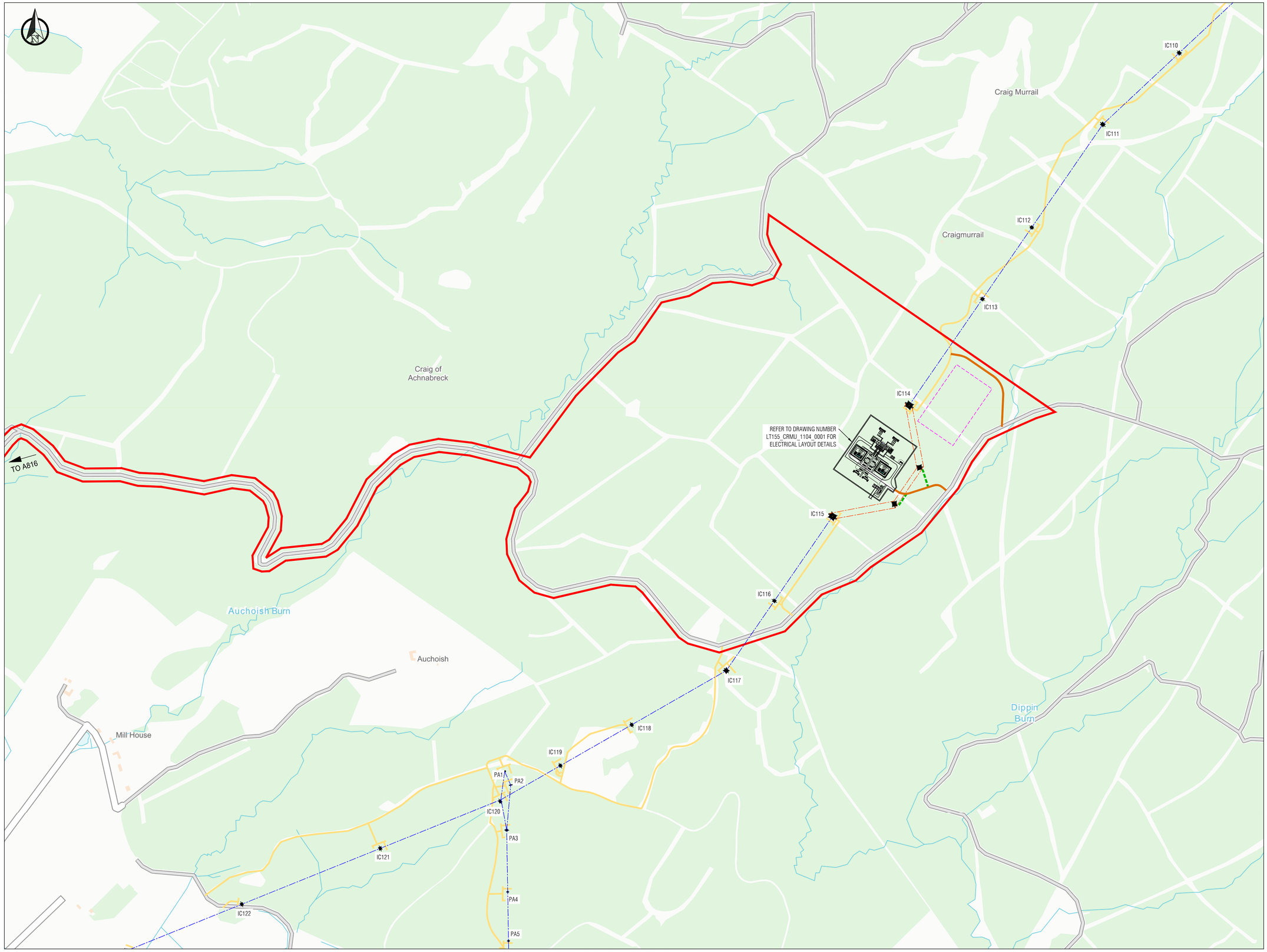
The proposed attenuation capacity of the platform detailed within this DIA is shown to store surface water without surcharge during a 1:200-year (+46 % CC) event and discharge to the nearest watercourse at a 3.7 l/s.

APPENDIX A – SITE LAYOUT

APPENDIX B – ICP SUDS OUTPUTS

APPENDIX C – MICRODRAINAGE OUTPUTS

A1



INDICATIVE CRAIG MURRAIL SITE LOCATION PLAN
SCALE @A1 1:5000

SCALE AT 1:5000
0m 125m 250m 375m 500m

DOCUMENT REFERENCE:

NOTES:-

1. ALL DIMENSIONS ARE IN METRES (m) UNLESS NOTED OTHERWISE.
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LEGEND:-

- PROPOSAL OF APPLICATION NOTICE BOUNDARY
- NEW LOCHGILPHEAD TO CROSSAIG OHL ACCESS TRACKS (FROM BALFOUR BEATTY)
- NEW LOCHGILPHEAD TO CROSSAIG OVERHEAD LINE
- PROPOSED OHL ALIGNMENT
- EXISTING OVERHEAD LINE
- PROPOSED TEMPORARY WORKS AREA
- PROPOSED PERMANENT ACCESS TRACK
- PROPOSED TEMPORARY ACCESS TRACK

CRAIG MURRAIL KEY LOCATION PLAN
N.T.S.

DRAFT

0C	SP		01.04.2022	INDICATIVE CRAIG MURRAIL SITE LOCATION PLAN UPDATED SUBSTATION LAYOUT
0B	SP		25.02.2022	INDICATIVE CRAIG MURRAIL SITE LOCATION PLAN
0A	SP		20.01.2022	INDICATIVE CRAIG MURRAIL SITE LOCATION PLAN

Scottish & Southern Electricity Networks

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Project: ARGYLL AND KINTYRE 275 kV SUBSTATIONS

Project Number: LT000155 **Location:** ARGYLL

Title: ARGYLL AND KINTYRE 275 kV SUBSTATIONS
INDICATIVE CRAIG MURRAIL SITE LOCATION PLAN
OPTION 2

Drawing Status: FOR INFORMATION	**Drawn:** SP
Scale: 1:5000	**Checked:**
Date: 01.04.2022	**Approved:**

Drawing Number:	**Sheet No:**	**Revision No:**
LT155_CRMU_0802_0006	1	C

File Name: LT155_CRMU_0802_0006_00_0A.dwg

Summary of Results for 200 year Return Period (+46%)

Half Drain Time : 6589 minutes.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	109.024	0.024	0.0	0.2	0.2	119.7	O K
30 min Summer	109.032	0.032	0.0	0.3	0.3	158.1	O K
60 min Summer	109.042	0.042	0.0	0.4	0.4	208.5	O K
120 min Summer	109.055	0.055	0.0	0.6	0.6	274.3	O K
180 min Summer	109.064	0.064	0.0	0.8	0.8	321.4	O K
240 min Summer	109.072	0.072	0.0	0.8	0.8	359.4	O K
360 min Summer	109.084	0.084	0.0	0.9	0.9	420.0	O K
480 min Summer	109.094	0.094	0.0	1.0	1.0	468.2	O K
600 min Summer	109.102	0.102	0.0	1.0	1.0	508.8	O K
720 min Summer	109.109	0.109	0.0	1.1	1.1	543.9	O K
960 min Summer	109.117	0.117	0.0	1.1	1.1	586.8	O K
1440 min Summer	109.130	0.130	0.0	1.2	1.2	648.7	O K
2160 min Summer	109.142	0.142	0.0	1.3	1.3	708.8	O K
2880 min Summer	109.149	0.149	0.0	1.3	1.3	747.5	O K
4320 min Summer	109.162	0.162	0.0	1.4	1.4	811.6	O K
5760 min Summer	109.171	0.171	0.0	1.4	1.4	856.3	O K
7200 min Summer	109.178	0.178	0.0	1.5	1.5	890.6	O K
8640 min Summer	109.184	0.184	0.0	1.5	1.5	917.6	O K
10080 min Summer	109.188	0.188	0.0	1.5	1.5	938.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	159.816	0.0	13.4	27
30 min Summer	105.584	0.0	20.9	42
60 min Summer	69.754	0.0	56.2	72
120 min Summer	46.084	0.0	83.7	132
180 min Summer	36.161	0.0	103.4	192
240 min Summer	30.445	0.0	117.2	250
360 min Summer	23.890	0.0	133.8	370
480 min Summer	20.114	0.0	142.9	490
600 min Summer	17.601	0.0	149.2	610
720 min Summer	15.783	0.0	153.8	728
960 min Summer	12.941	0.0	156.5	968
1440 min Summer	9.783	0.0	155.0	1446
2160 min Summer	7.395	0.0	334.3	2164
2880 min Summer	6.064	0.0	333.2	2884
4320 min Summer	4.695	0.0	317.9	4024
5760 min Summer	3.916	0.0	692.7	4728
7200 min Summer	3.401	0.0	692.3	5480
8640 min Summer	3.032	0.0	678.2	6232
10080 min Summer	2.751	0.0	653.1	7064

Summary of Results for 200 year Return Period (+46%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	109.027	0.027	0.0	0.2	0.2	134.1	O K
30 min Winter	109.035	0.035	0.0	0.3	0.3	177.0	O K
60 min Winter	109.047	0.047	0.0	0.5	0.5	233.4	O K
120 min Winter	109.061	0.061	0.0	0.7	0.7	307.2	O K
180 min Winter	109.072	0.072	0.0	0.8	0.8	360.1	O K
240 min Winter	109.081	0.081	0.0	0.9	0.9	402.8	O K
360 min Winter	109.094	0.094	0.0	1.0	1.0	470.8	O K
480 min Winter	109.105	0.105	0.0	1.1	1.1	525.0	O K
600 min Winter	109.114	0.114	0.0	1.1	1.1	570.6	O K
720 min Winter	109.122	0.122	0.0	1.2	1.2	610.1	O K
960 min Winter	109.132	0.132	0.0	1.2	1.2	658.7	O K
1440 min Winter	109.146	0.146	0.0	1.3	1.3	729.0	O K
2160 min Winter	109.160	0.160	0.0	1.4	1.4	798.4	O K
2880 min Winter	109.169	0.169	0.0	1.4	1.4	844.2	O K
4320 min Winter	109.184	0.184	0.0	1.5	1.5	921.6	O K
5760 min Winter	109.193	0.193	0.0	1.5	1.5	967.1	O K
7200 min Winter	109.200	0.200	0.0	1.6	1.6	1001.2	O K
8640 min Winter	109.206	0.206	0.0	1.6	1.6	1028.6	O K
10080 min Winter	109.210	0.210	0.0	1.6	1.6	1048.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	159.816	0.0	16.6	27
30 min Winter	105.584	0.0	24.4	42
60 min Winter	69.754	0.0	66.5	72
120 min Winter	46.084	0.0	97.9	130
180 min Winter	36.161	0.0	118.0	188
240 min Winter	30.445	0.0	130.9	248
360 min Winter	23.890	0.0	145.6	366
480 min Winter	20.114	0.0	155.0	484
600 min Winter	17.601	0.0	161.6	602
720 min Winter	15.783	0.0	166.4	718
960 min Winter	12.941	0.0	169.2	954
1440 min Winter	9.783	0.0	167.7	1422
2160 min Winter	7.395	0.0	362.1	2116
2880 min Winter	6.064	0.0	361.0	2796
4320 min Winter	4.695	0.0	345.1	4112
5760 min Winter	3.916	0.0	753.7	5312
7200 min Winter	3.401	0.0	752.7	5704
8640 min Winter	3.032	0.0	737.4	6656
10080 min Winter	2.751	0.0	710.8	7568

Rainfall Details

Rainfall Model	FEH
Return Period (years)	200
FEH Rainfall Version	1999
Site Location	GB 204900 705750 NN 04900 05750
C (1km)	-0.017
D1 (1km)	0.492
D2 (1km)	0.400
D3 (1km)	0.459
E (1km)	0.252
F (1km)	2.532
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+46

Time Area Diagram

Total Area (ha) 0.400

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.133	4	8	0.133	8	12	0.133

Model Details

Storage is Online Cover Level (m) 110.000

Cellular Storage Structure

Invert Level (m) 109.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25000.0	0.0	1.000	25000.0	0.0

Orifice Outflow Control

Diameter (m) 0.042 Invert Level (m) 109.000
Discharge Coefficient 0.600

ICP SUDS Mean Annual Flood

Input

Return Period (years)	200	Soil	0.400
Area (ha)	0.400	Urban	0.000
SAAR (mm)	1660	Region Number	Region 1

Results l/s

QBAR Rural	3.7
QBAR Urban	3.7
Q200 years	10.5
Q1 year	3.2
Q30 years	7.1
Q100 years	9.3