Scottish & Southern Electricity Networks

TRANSMISSION

Annex J - Drainage Strategy and Drainage Plans

September 2022

ARCUS

AN SUIDHE SUBSTATION

ANNEX J
DRAINAGE IMPACT ASSESSMENT

JUNE 2022

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Registered in England & Wales No. 5644976

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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 south west of Inveraray (the Site) in the vicinity of the existing An Suidhe substation.

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: 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 comprises an area of approximately 8 hectares (ha) and is located approximately 500 metres (m) north of the existing An Suidhe Substation and approximately 4 kilometres (km) south west of Inveraray at National Grid Reference (NGR) 204861, 705524. The Site is approximately 300 m west of Douglas Water and upslope of the Douglas Water river valley and the existing substation.

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. The Proposed Development is accessed from the A83, utilising existing forestry tracks.

Ordnance Survey (OS) Terrain 5 data indicates Site elevations are in the approximate range of 165 to 190 m Above Ordnance Datum (AOD) with topography falling from a high point in the south to the lower elevations in the north 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/

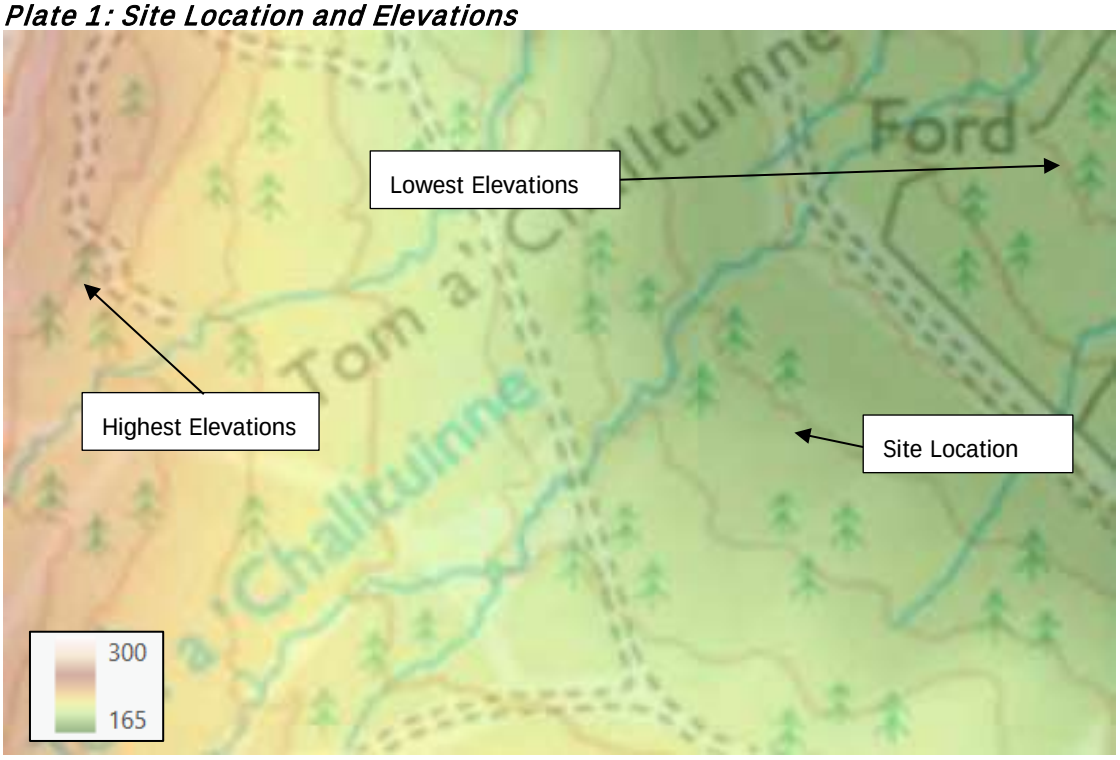
[3] SEPA, Technical Flood Risk Guidance for Stakeholders (2019). [Online]. Available at: https://www.sepa.org.uk/environment/land/planning/guidance-and-advice-notes/

[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



A British Geological Survey (BGS) borehole scan[7] located approximately 130 m north west of the Site indicates there is peat located at depths of 0.3 m before transitioning to sandy and gravelly clay strata to depths of 2.9 m below ground level (bgl). Further details on peat depths associated are available in **Annex N: Peat Management Plan** of the An Suidhe 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 covering an area of approximately 13,000 m² which will comprise free draining fill material and is therefore designed to be free draining.

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 0.2 ha.

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 be unmanned with infrequent maintenance visits and therefore there will be no demand for water re-use.

[7] British Geological Survey, Borehole Scans, BGS ID 694940. [Online]. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/694940/images/16697028.html

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

An assumed infiltration rate has been calculated based on the subsoils from the BGS borehole records located approximately 130 m south west of the Site. The borehole record shows sandy and gravelly clay strata to depths of 2.9 m bgl.

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 clay media has a typical maximum infiltration rate of an infiltration rate of 0.0000018 metres per hour (m/h).

The SuDS Manual outlines that where rates are less than 0.000001 m/h infiltration as a means of disposal of significant volumes of run-off may not be appropriate.

Acknowledging the limited infiltration capacity of the underlying soils 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 0.2 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 4.5 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}	4.5
1	2.8
30	8.5
100	11.2
200	12.7

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).

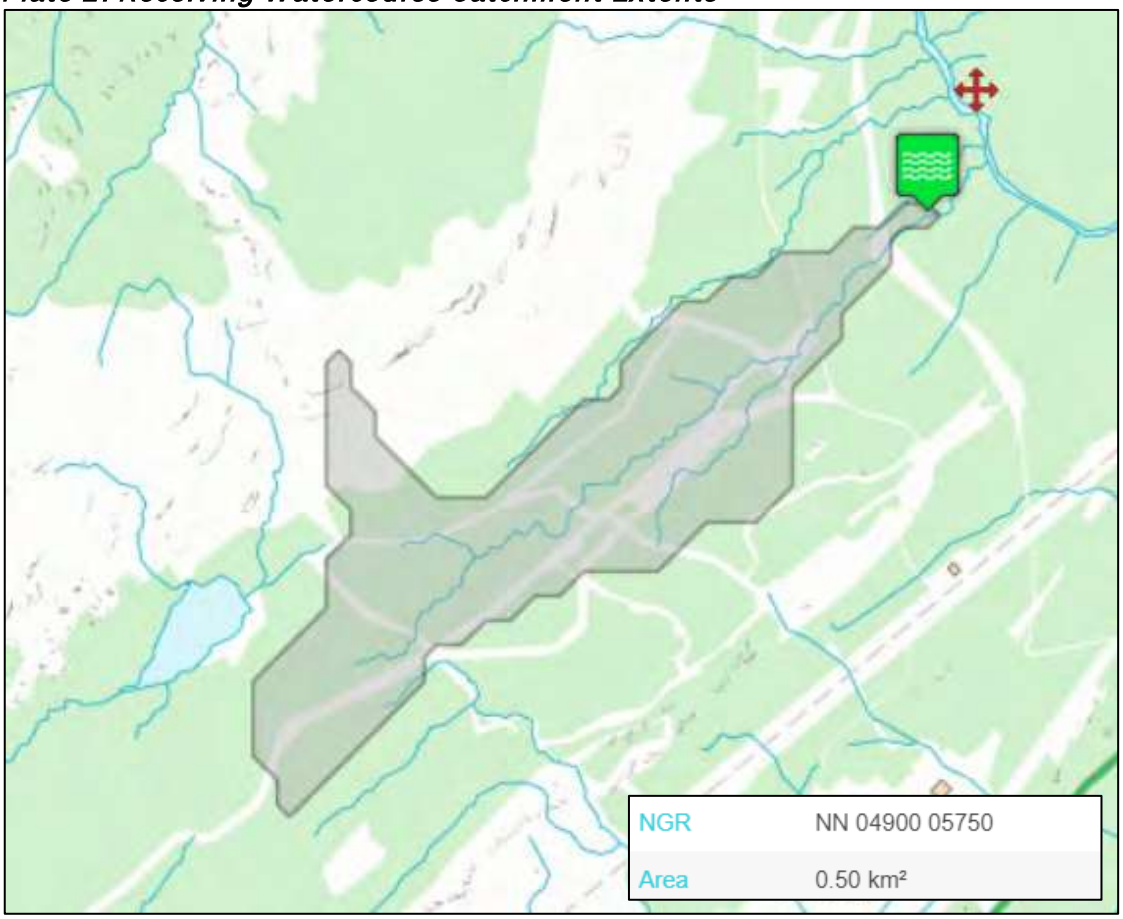
Attenuation is required in up to and including the 1:30-year (+CC) event with exceedance events up to the 1:200-year (+CC) event to be considered for offsite flooding.

[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 the Tom an Buachaillean watercourse is served by a catchment of 0.5 km² as shown in **Plate 2**. This watercourse is located approximately 120 m north west of the Site. The watercourse flows in a northerly direction until it joins the Douglas Water approximately 300 m north east 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.

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.

3.1 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 1.3 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.

The area of the hardstanding equates to 0.2 ha, and therefore, the capping layer will have an area available for attenuation of 1.1 ha. These dimensions were inputted into Micro Drainage software as a cellular storage unit, in order to represent the porosity of the proposed platform.

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

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).

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 Tom an Buachaillean will be controlled by a orifice and discharge to the watercourse to the west at 4.5 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
960 min Winter	12.941	710	175.967	0.967	0.0	4.3	345.0	0.0	4.3	212.7	Flood Risk

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 substation platform has been represented using a permeable pavement which does not utilise infiltration. The outputs of the SIA outline that the permeable paving unit representing the platform 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 spills.

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 will 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 on-site, with waste being stored, managed and carried off-site 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 off-site. The septic tank will be registered with SEPA through the private sewage registration system.

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

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

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

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
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 blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging

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

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.

Measures such as drainage pipes should be installed at the same time as the excavations, or as soon as practicable thereafter.

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 proposed OHL works have not been assessed in this DIA.

The Proposed Development will involve the installation of approximately 0.2 ha of impermeable elements.

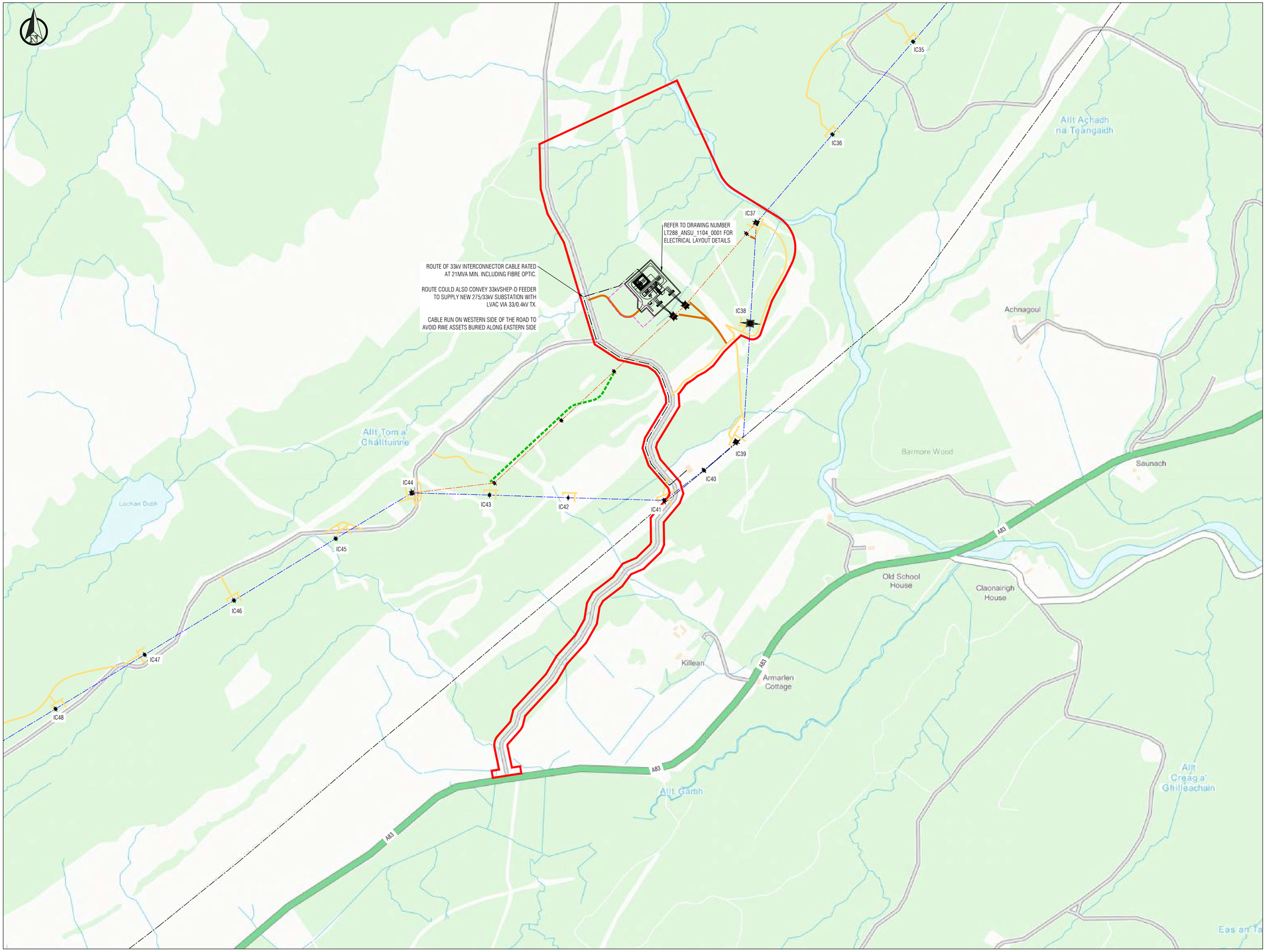
The Proposed Development will be underlain by a free draining platform which will be utilised for surface water attention.

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 4.5 l/s.

APPENDIX A – SITE LAYOUT

APPENDIX B – MICRODRAINAGE OUTPUTS

APPENDIX C – ICP SUDS OUTPUTS



INDICATIVE AN SUIDHE 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
- 33kV INTERCONNECTOR CABLE ROUTE

AN SUIDHE KEY LOCATION PLAN
N.T.S.

DRAFT

0G	SP	08.04.2022	INDICATIVE AN SUIDHE ACCESS TRACKS UPDATED SUBSTATION LAYOUT
0F	SP	31.03.2022	INDICATIVE AN SUIDHE ACCESS TRACKS 33kV CABLE ROUTE ADDED
0E	SP	25.02.2022	INDICATIVE AN SUIDHE SITE LOCATION PLAN
0D	SP	20.01.2022	INDICATIVE AN SUIDHE SITE LOCATION PLAN
0C	SP	07.01.2022	INDICATIVE AN SUIDHE SITE LOCATION PLAN
0B	SP	06.01.2022	INDICATIVE AN SUIDHE SITE LOCATION PLAN
0A	SP	15.12.2021	INDICATIVE AN SUIDHE SITE LOCATION PLAN

Scottish & Southern Electricity Networks

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Project: ARGYLL AND KINTYRE 275 kV SUBSTATIONS

Project Number: LT000288 **Location:** ARGYLL

Title: ARGYLL AND KINTYRE 275 kV SUBSTATIONS
INDICATIVE AN-SUIDHE SITE LOCATION PLAN

Drawing Status: FOR INFORMATION **Drawn:** SP
Scale: 1:5000 **Checked:**
Date: 08.04.2022 **Approved:**
Drawing Number: LT288_ANSU_0802_0005 **Sheet No:** 1 **Revision No:** G

File Name: LT288_ANSU_0802_0005_00_0G.dwg

ICP SUDS Mean Annual Flood

Input

Return Period (years) 200 SAAR (mm) 2333 Urban 0.000
Area (ha) 0.200 Soil 0.500 Region Number Region 1

Results l/s

QBAR Rural 4.5
QBAR Urban 4.5

Q200 years 12.7

Q1 year 3.8
Q30 years 8.5
Q100 years 11.2

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

Half Drain Time : 2226 minutes.

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	175.027	0.027	0.0	0.2	0.2	59.8	O K
30 min Summer	175.036	0.036	0.0	0.4	0.4	78.8	O K
60 min Summer	175.047	0.047	0.0	0.6	0.6	103.6	O K
120 min Summer	175.062	0.062	0.0	0.8	0.8	135.4	O K
180 min Summer	175.072	0.072	0.0	1.0	1.0	157.6	O K
240 min Summer	175.080	0.080	0.0	1.1	1.1	175.1	O K
360 min Summer	175.092	0.092	0.0	1.2	1.2	202.3	O K
480 min Summer	175.101	0.101	0.0	1.2	1.2	223.1	O K
600 min Summer	175.109	0.109	0.0	1.3	1.3	239.8	O K
720 min Summer	175.115	0.115	0.0	1.3	1.3	253.7	O K
960 min Summer	175.122	0.122	0.0	1.4	1.4	268.0	O K
1440 min Summer	175.129	0.129	0.0	1.4	1.4	284.4	O K
2160 min Summer	175.136	0.136	0.0	1.5	1.5	299.6	O K
2880 min Summer	175.141	0.141	0.0	1.5	1.5	309.5	O K
4320 min Summer	175.149	0.149	0.0	1.6	1.6	327.9	O K
5760 min Summer	175.153	0.153	0.0	1.6	1.6	336.7	O K
7200 min Summer	175.155	0.155	0.0	1.6	1.6	340.2	O K
8640 min Summer	175.155	0.155	0.0	1.6	1.6	340.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	159.816	0.0	15.0	27
30 min Summer	105.584	0.0	23.7	42
60 min Summer	69.754	0.0	54.5	72
120 min Summer	46.084	0.0	78.1	130
180 min Summer	36.161	0.0	95.2	190
240 min Summer	30.445	0.0	108.7	248
360 min Summer	23.890	0.0	129.6	368
480 min Summer	20.114	0.0	144.9	486
600 min Summer	17.601	0.0	156.5	606
720 min Summer	15.783	0.0	165.3	724
960 min Summer	12.941	0.0	172.7	962
1440 min Summer	9.783	0.0	175.6	1348
2160 min Summer	7.395	0.0	312.8	1692
2880 min Summer	6.064	0.0	329.6	2076
4320 min Summer	4.695	0.0	336.6	2900
5760 min Summer	3.916	0.0	517.3	3744
7200 min Summer	3.401	0.0	554.2	4544
8640 min Summer	3.032	0.0	579.4	5368

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
10080 min Summer	175.154	0.154	0.0	1.6	1.6	338.5	O K
15 min Winter	175.030	0.030	0.0	0.3	0.3	66.9	O K
30 min Winter	175.040	0.040	0.0	0.4	0.4	88.2	O K
60 min Winter	175.053	0.053	0.0	0.7	0.7	116.0	O K
120 min Winter	175.069	0.069	0.0	0.9	0.9	151.6	O K
180 min Winter	175.080	0.080	0.0	1.1	1.1	176.7	O K
240 min Winter	175.089	0.089	0.0	1.1	1.1	196.5	O K
360 min Winter	175.103	0.103	0.0	1.3	1.3	227.2	O K
480 min Winter	175.114	0.114	0.0	1.3	1.3	250.8	O K
600 min Winter	175.123	0.123	0.0	1.4	1.4	269.8	O K
720 min Winter	175.130	0.130	0.0	1.4	1.4	285.7	O K
960 min Winter	175.137	0.137	0.0	1.5	1.5	302.4	O K
1440 min Winter	175.147	0.147	0.0	1.6	1.6	322.5	O K
2160 min Winter	175.153	0.153	0.0	1.6	1.6	336.5	O K
2880 min Winter	175.157	0.157	0.0	1.6	1.6	345.9	O K
4320 min Winter	175.164	0.164	0.0	1.7	1.7	361.4	O K
5760 min Winter	175.166	0.166	0.0	1.7	1.7	365.7	O K
7200 min Winter	175.166	0.166	0.0	1.7	1.7	364.1	O K
8640 min Winter	175.163	0.163	0.0	1.7	1.7	359.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	2.751	0.0	591.6	6160
15 min Winter	159.816	0.0	18.4	27
30 min Winter	105.584	0.0	27.7	41
60 min Winter	69.754	0.0	63.4	70
120 min Winter	46.084	0.0	90.1	128
180 min Winter	36.161	0.0	109.0	186
240 min Winter	30.445	0.0	124.0	244
360 min Winter	23.890	0.0	146.4	362
480 min Winter	20.114	0.0	162.4	478
600 min Winter	17.601	0.0	174.0	594
720 min Winter	15.783	0.0	182.4	708
960 min Winter	12.941	0.0	188.7	936
1440 min Winter	9.783	0.0	191.4	1374
2160 min Winter	7.395	0.0	349.3	1760
2880 min Winter	6.064	0.0	365.4	2200
4320 min Winter	4.695	0.0	368.8	3124
5760 min Winter	3.916	0.0	580.9	4040
7200 min Winter	3.401	0.0	620.9	4904
8640 min Winter	3.032	0.0	647.9	5792

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	175.160	0.160	0.0	1.6	1.6	352.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	2.751	0.0	658.0	6656

Rainfall Details

Rainfall Model	FEH
Return Period (years)	200
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) 0.200

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.067	4	8	0.067	8	12	0.067

Model Details

Storage is Online Cover Level (m) 176.000

Cellular Storage Structure

Invert Level (m) 175.000 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	11000.0	0.0	1.000	11000.0	0.0

Orifice Outflow Control

Diameter (m) 0.046 Discharge Coefficient 0.600 Invert Level (m) 175.000