East Anglia ONE North and East Anglia TWO Offshore Windfarms

Clarification Note

SuDS Infiltration Note

Applicant: East Anglia TWO and East Anglia ONE North Limited
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Applicable to East Anglia ONE North and East Anglia TWO

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
001	17/11/2020	Paolo Pizzolla	Lesley Jamieson / Ian Mackay	Rich Morris
02	13/01/2021	Paolo Pizzolla	Lesley Jamieson / Ian Mackay	Rich Morris

Description of Revisions			
Rev	**Page**	**Section**	**Description**
001	n/a	n/a	Final for Deadline 2
02	n/a	n/a	Final for Deadline 4

Table of Contents

Glossary of Acronyms

CIRIA	Construction Industry Research and Information Association
DCO	Development Consent Order
FoS	Factor of Safety
SCC	Suffolk County Council
SuDS	Sustainable Drainage Systems

Glossary of Terminology

Applicants	East Anglia TWO Limited / East Anglia ONE North Limited
East Anglia ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
National Grid infrastructure	A National Grid substation, cable sealing end compounds, cable sealing end (with circuit breaker) compound, underground cabling and National Grid overhead line realignment works to facilitate connection to the national electricity grid, all of which will be consented as part of the proposed East Anglia TWO / East Anglia ONE North project Development Consent Order but will be National Grid owned assets.
National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO project / East Anglia ONE North project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO / East Anglia ONE North project Development Consent Order.
National Grid substation location	The proposed location of the National Grid substation.
Onshore substation	The East Anglia TWO / East Anglia ONE North substation and all of the electrical equipment within the onshore substation and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substations for the proposed East Anglia TWO project and the East Anglia ONE North project.
Order limits	The limits shown on the works plans within which the authorised project may be carried out.
Projects	The East Anglia TWO Offshore Windfarm and the East Anglia ONE North Offshore Windfarm.

1 Introduction

1.1 Overview

1. This technical note accompanies an illustrative infiltration Sustainable Drainage System (SuDS) design in support of the Development Consent Order (DCO) applications (the Applications) for the East Anglia TWO project and the East Anglia ONE North project (the Projects) submitted by East Anglia TWO and East Anglia ONE North Limited (the Applicants).

2. The illustrative design addresses Suffolk County Council's (SCC) request to consider infiltration as part of the drainage design, in accordance with the SuDS drainage hierarchy (SCC, 2018). The Applicants have been asked by SCC to demonstrate that there is sufficient space within the Order limits of the onshore substation location and the National Grid substation location to accommodate infiltration features with a worst case infiltration rate of 10mm/hr and an appropriate Factor of Safety (FoS) (LA-005 of the Water Resources and Flood Risk Statement of Common Ground). SCC also requested that the Applicants demonstrate compliance with the SCC guidance for SuDS design (2018).

3. Works to be undertaken within the onshore substation location include (amongst other things) the construction of two co-located onshore substations (a substation for East Anglia TWO and East Anglia ONE North respectively and hereafter referred to collectively as the 'onshore substation') and National Grid infrastructure, at Grove Wood, Friston, and associated landscaping and surface water management infrastructure. It should be noted that the ***draft DCO*** (APP-REP3-011) allows for flexibility for either project to use either onshore substation location.

4. It is noted that the basis of the design presented within the Applications is for SuDS attenuation ponds with a discharge connection to the Friston watercourse at a discharge rate that remains in line with the pre-development greenfield run-off rate. This represents a reasonable design for the Projects and ensures no increase to the existing discharge to the Friston Watercourse. Further information on the attenuation design is set out in the ***Outline Operational Drainage Management Plan*** (an updated version has been submitted at Deadline 4, document reference ExA.AS-1.D4.V2)..

5. This document demonstrates the viability of incorporating infiltration as part of the design during operation of the Projects to manage drainage. The ***Outline Code of Construction Practice*** (REP3-022) covers surface water and drainage requirements during construction, including sediment management and pollution prevention.

6. This document is applicable to both of the Projects and the Applications, and therefore is endorsed with the yellow and blue icon used to identify materially identical documentation in accordance with the Examining Authority's procedural decisions on document management of 23rd December 2019 (PD-004). Whilst this document has been submitted to both Examinations, if it is read for one project submission there is no need to read it for the other project submission.

2 Legislation and Relevant Guidance

2.1 Legislation

2.1.1 Flood and Water Management Act 2010

7. Under the Flood and Water Management Act 2010, Lead Local Flood Authorities (LLFAs) have responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses. SCC is the LLFA covering the onshore development area and is required to deliver a strategy for local flood risk management in its area, to investigate flooding and to maintain a register of flood risk assets.

2.2 Guidance

2.2.1 Suffolk County Council SuDS Guidance

8. SCC's SuDS design guidance (2018) has informed the illustrative infiltration design. Section 5 of the guidance (Suffolk Design Principles) indicates that "*soakage rates need to be above 5-10mm/hr for infiltration to be the sole means of drainage*" (i.e. the first option within the surface water drainage hierarchy).

9. SCC guidance also states that the aim of a SuDS design "*should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:*

   i) into the ground (infiltration);

   ii) to a surface water body (attenuation);

   iii) to a surface water sewer, highway drain or another drainage system; or

   iv) to a combined sewer".

10. As agreed in ***Table 13*** in the draft ***Statement of Common Ground with the Councils*** (REP1-072), the Applicants have therefore tested the SuDS design at an infiltration rate of 10mm/hr which is deemed to be a reasonable worst-case feasible infiltration rate.

11. The Applicants note that the application of the SuDS hierarchy is an iterative process dependent on site-specific conditions to identify an optimal drainage solution.

2.2.2 Construction Industry Research and Information Association

12. The Construction Industry Research and Information Association (CIRIA) SuDS Manual (2015) states that "*Where components are designed to manage the 1:10 year or 1:30 year event, it is usual to specify that half emptying occurs within 24 hours. If components are designed to infiltrate events greater than the 1:30 year*

event, designing to half empty in 24 hours can result in very large storage requirements and, with agreement from the drainage approving body, it may be appropriate to allow longer half emptying times".

13. On this basis, a 24hr and a 48hr half drain time has been included in the illustrative SuDS design for the 10mm/hr infiltration rate.

2.2.3 Sustainable Drainage Principles

14. 'Infiltration' refers to allowing or encouraging water to soak into the ground, through the natural hydrologic processes. This is normally the most desirable solution for the disposal of surface water from rainfall as it does not create additional runoff and contributes directly to the recharge of the underlying groundwater.

15. Ground investigations at the location of the onshore substations and National Grid infrastructure will be undertaken and will inform the final Operational Drainage Management Plan. Percolation tests will be undertaken as part of the detailed design process to determine the underlying permeability and the feasibility to dispose of surface water directly to ground or other engineered filtration systems, and to what degree.

3 Modelling Design Parameters

16. In order to demonstrate that sufficient space is available within the Order limits at the onshore substation location and the National Grid substation location to accommodate infiltration features, the following parameters have been modelled:

- Infiltration rate of 10mm/hr;
- 100% impermeable surface area for the onshore substations and National Grid infrastructure areas of hardstanding;
- FoS of 1 modelled for SuDS basin storage areas;
- FoS of 10 as a sensitivity check of the SuDS basin storage areas;
- 100% impermeable area for the permanent operational access road; and
- Attenuation of water during the 1 in 100 year plus 40% climate change scenario.

17. The modelling has considered both a 24hr and a 48hr half drain time and has used Flood Estimation Handbook (FEH) 2013 rainfall data as requested by SCC. This is produced by the UK Centre for Ecology and Hydrology[1].

18. A FoS of 10 has also been tested in the calculations for the indicative infiltration design. This approach is based on the guidance set out in Table 25.2 of the CIRIA SuDS Manual (2015).

19. The design parameters of the onshore substation and National Grid infrastructure are summarised in ***Table 3.1***.

Table 3.1 Onshore Substation Location Area Infiltration Design Footprints (assumed to be 100% impermeable

Equipment	East Anglia TWO (m^2)	East Anglia ONE North (m^2)	National Grid Infrastructure (m^2)
Overall substation operational footprint	32,300	32,300	44,950
Operational access road	13,600		N/A
Overal cable sealing end compounds and cable sealing end with circuit breaker compound operational footprint	N/A		10,000

[1] https://fehweb.ceh.ac.uk/

Equipment	East Anglia TWO (m^2)	East Anglia ONE North (m^2)	National Grid Infrastructure (m^2)
Permanent access road to sealing end compound	N/A		1,850
SuDS basin footprint	16,637 (9,603)*		12,712 (7,520)*
Total impermeable area	**94,837 (87,803)***		**69,512 (64,320)***
* Primary figures represent 24hr drainage specification. Figures in brackets represent the design sizing for 48hr drainage specification			

4 Results

20. Drawing ED11892-C-SK10 (***Appendix 1***: Figures) shows the indicative sizing of the infiltration basins based on a 10mm/hr infiltration rate, for both the 24hr and 48hr half drain times. The figure demonstrates that, based on the parameters modelled and described in ***section 3***, for both a 24hr half drain time and a 48hr half drain time, the infiltration basins can be accommodated within the Order limits whilst accommodating the mitigation planting presented within the Outline Landscape Mitigation Plan General Arrangement (an updated version has been submitted at Deadline 4, document reference ExA.AS-14.D4.V1).

21. Drawing ED11892-C-SK10 (***Appendix 1***) shows total depth of basin and respective maximum water level based on 1:100yr storms with 40% climate change. The Freeboard is the total depth of basin minus the total depth to maximum water level. For further information on depths and structure refer to page 4 (infiltration basin structure) of the modelling outputs for the 24hr and 48hr drain times for the onshore substation and National Grid infrastructure respectively (***Appendix 2***: Model Outputs).

22. The Applicants note SCC's comments at Deadline 3 regarding the need for an infiltration only design to achieve a half drain time of 24 hours under a 1 in 100 year plus 40% for climate change scenario. As shown in ***Appendix 2***: Model Outputs***,*** when applying a FoS of 10 to the parameters detailed in ***section 3***, the half drain time is in exceedance of 7 days and therefore does not meet SCC's specification for an infiltration only design, nor does it meet with the Applicant's basis of design for a combined infiltration/attenuation system which includes a discharge connection point at the Friston Watercourse. The Applicants consider that an infiltration only SuDS design as per the SCC (2018) SuDS hierarchy would not be reasonably practicable to implement. It is therefore the Applicants' view that a SuDS design combining infiltration with a discharge connection point at the Friston Watercourse is appropriate.

23. Pre-construction ground investigations including infiltration testing will be conducted in order to determine whether the baseline infiltration rate is greater than 10mm/hr. This will inform the extent to which infiltration measures can be promoted and incorporated into the final SuDS design as appropriate.

5 Conclusion

24. An infiltration only scheme has been demonstrated to be unviable (***section 4***) on the basis that when applying a FoS of 10, it would not achieve the required half drain time of 24 hours. In accordance with SCC's SuDS Guidance (***section 2.2.1***) it is therefore appropriate for attenuation to be considered. The Applicants also consider it wholly inappropriate for the proposed national infrastructure projects to be constrained to an infiltration only surface water manage solution, when commitments have been made by the Applicants for a combined infiltration/attenuation system where the discharge to the Friston Watercourse would not exceed the pre-development greenfield run-off rates.

25. Under the indicative attenuation design presented in ***section 6*** of the ***Outline Operational Drainage Management Plan*** (updated version submitted at Deadline 4, document reference ExA.AS-1.D4.V2) the SuDS basins can be accommodated within the order limits and the discharge rate can be controlled to remain within the pre-development greenfield run-off rates.

26. The development of the final drainage design will be in line with best practice and guidance applicable to the Projects, recognising their classification as Nationally Significant Infrastructure Projects. It will, where appropriate, include a combination of infiltration measures and a connection to the Friston watercourse in the vicinity of Church Road which does not exceed the pre-development greenfield run-off rate. Further information will be detailed in the final Operational Drainage Management Plan secured under the ***draft DCO*** (REP3-011).

27. Requirement 41 was included in the ***draft DCO*** (REP3-011) submitted at Deadline 3 requires the Operational Drainage Management Plan to be submitted to and approved by the relevant planning authority. This requirement will also provide that the Operational Drainage Management Plan must accord with the Outline Operational Drainage Management Plan and be implemented as approved. This is separate to the ***Outline Landscape and Ecological Management Strategy*** (APP-584).

28. The final design of the SuDS will be developed to reflect the final detailed design of the onshore substation and National Grid infrastructure and will be informed by pre-construction ground investigations (including infiltration testing). It will incorporate infiltration measures, where appropriate, but will retain a discharge connection to the Friston watercourse. The Applicants have committed to ensuring that the final design of the SuDS will not increase the rate of discharge to the Friston watercourse over that currently experienced during storm events. The connection to the Friston watercourse remains an integral part of the Projects.

29. Influencing factors for the final SuDS design will include:

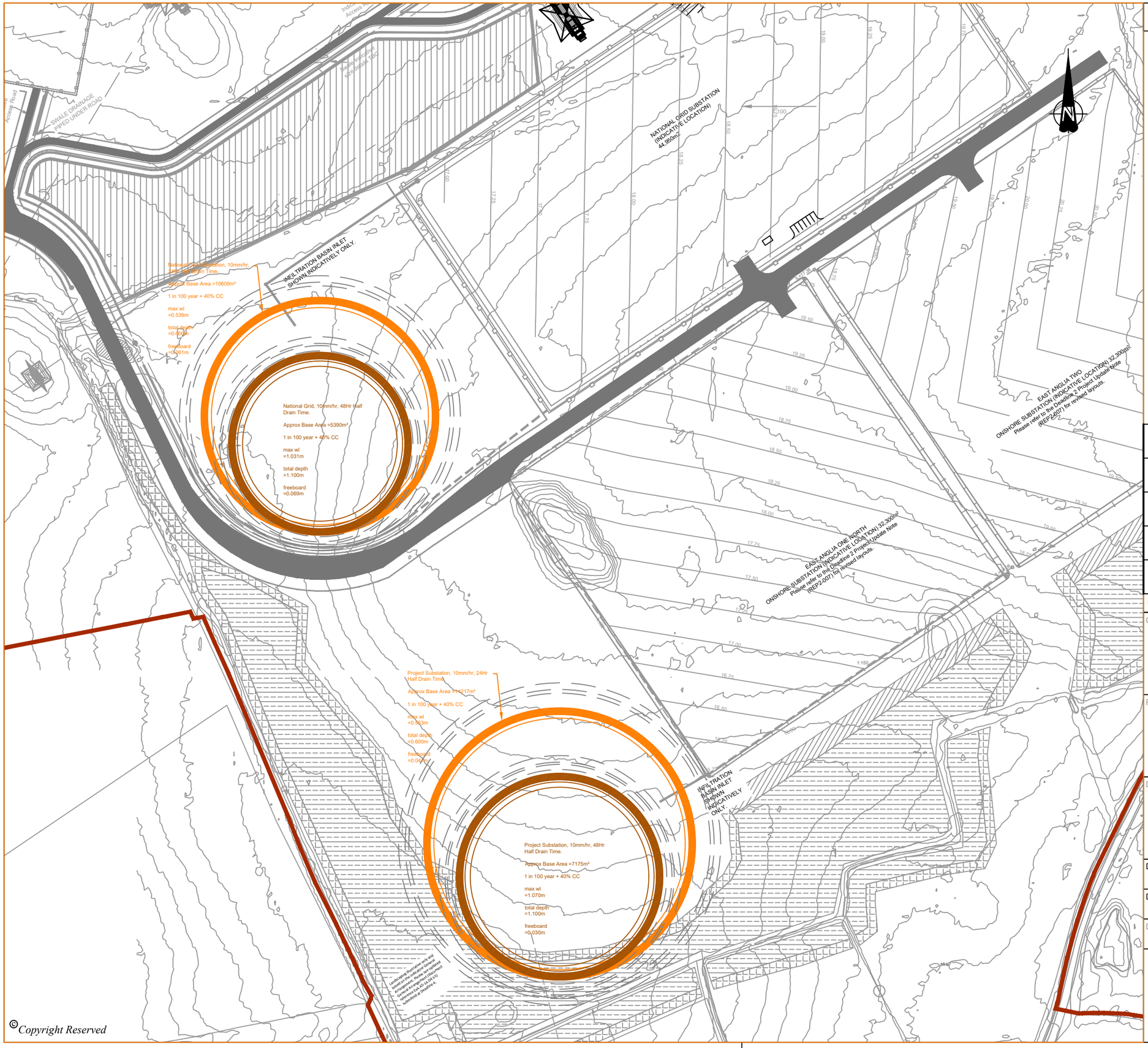
- Final sizing of onshore substation and National Grid infrastructure;
- Final percentage of impermeable areas within the onshore substations and National Grid infrastructure;
- Masterplanning considerations, including access road routing and landscaping;
- Pre-construction ground investigation results, including infiltration test results; and
- Discharge rate to the Friston watercourse which will not exceed the current discharge rate during storm events.

6 References

Construction Industry and Research Information Association (2015) The SuDS Manual (C753).

Suffolk County Council (2018) Sustainable Drainage Systems (SuDS): a Local Design Guide, Appendix A to the Suffolk Flood Risk Management Strategy.

Appendix 1: Figures



DO NOT SCALE FROM THIS DRAWING

NOTES:

INFILTRATION BASIN OPTIONS ARE SHOWN INDICATIVELY AS CIRCULAR FOR ILLUSTRATION PURPOSES ONLY. DETAILED DESIGN OF BASIN WOULD BE REQUIRED TO CONFIRM EXACT ELEVATIONS, SHAPES AND LOCATION OF EACH OPTION AS APPROPRIATE AND AS PART OF THE MASTERPLANNING PROCESS.

LEGEND

DENOTES PROPOSED EXTENT OF INFILTRATION BASIN OPTION FOR 24 HOUR HALF DRAIN TIME - 100% IMPERMEABLE HARDSTANDING.

DENOTES PROPOSED EXTENT OF INFILTRATION BASIN OPTION FOR 48 HOUR HALF DRAIN TIME - 100% IMPERMEABLE HARDSTANDING.

FOOTPRINT INCREASE USING SAFETY FACTOR OF 10 IN DESIGN.

DENOTES DCO ORDER LIMITS

REVISION	DETAILS	DATE	DR'N	CHK'D	APP'D
E	DRAWING UPDATED TO INCORPORATE REVISED HARDSTANDING AREAS AND 100% IMPERMEABILITY.	24.12.20	CS	CS	SH
D	DRAWING UPDATED TO ADDRESS SPR COMMENTS.	17.11.20	SH	SH	SH
C	DRAWING UPDATED FOR CLARITY	06.10.20	JN	JN	SH
B	INFILTRATION BASINS UPDATED.	17.09.20	JN	CS	SH
A	FIRST ISSUE	10.09.20	JN	CS	SH

CLIENT

HASKONING DHV UK LIMITED

PROJECT

EAST ANGLIA OFFSHORE WIND
EA1N & EA2

SKETCH

DRAWING TITLE

INFILTRATION BASIN
10mm PER HOUR
OPTIONS SKETCH

DRG No.		REV
ED11892-C-SK10		E
DRG SIZE	SCALE	DATE
A3		SEPT'20
DRAWN BY	CHECKED BY	APPROVED BY
JN	CS	SH

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BIRMINGHAM, BOLTON, CARDIFF, CARLISLE, GLASGOW, LEEDS, LONDON, MANCHESTER, NEWCASTLE UPON TYNE, STOKE ON TRENT

Appendix 2: Model Outputs

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1505 minutes.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.799	0.149	40.9	2142.5	O K
30 min Summer	14.850	0.200	41.4	2876.6	O K
60 min Summer	14.900	0.250	41.9	3611.4	O K
120 min Summer	14.959	0.309	42.5	4479.7	Flood Risk
180 min Summer	14.999	0.349	42.9	5062.4	Flood Risk
240 min Summer	15.028	0.378	43.1	5500.1	Flood Risk
360 min Summer	15.070	0.420	43.6	6124.1	Flood Risk
480 min Summer	15.098	0.448	43.8	6539.3	Flood Risk
600 min Summer	15.116	0.466	44.0	6805.6	Flood Risk
720 min Summer	15.127	0.477	44.1	6970.5	Flood Risk
960 min Summer	15.134	0.484	44.2	7084.8	Flood Risk
1440 min Summer	15.122	0.472	44.1	6894.4	Flood Risk
2160 min Summer	15.088	0.438	43.7	6388.4	Flood Risk
2880 min Summer	15.054	0.404	43.4	5876.0	Flood Risk
4320 min Summer	14.990	0.340	42.8	4936.1	Flood Risk
5760 min Summer	14.938	0.288	42.3	4158.0	O K
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.817	0.167	41.1	2402.3	O K
30 min Winter	14.874	0.224	41.7	3227.7	O K
60 min Winter	14.931	0.281	42.2	4055.9	O K
120 min Winter	14.998	0.348	42.9	5044.6	Flood Risk
180 min Winter	15.043	0.393	43.3	5712.7	Flood Risk
240 min Winter	15.076	0.426	43.6	6217.6	Flood Risk
360 min Winter	15.125	0.475	44.1	6947.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	182
240 min Summer	21.109	0.0	242
360 min Summer	16.158	0.0	362
480 min Summer	13.321	0.0	482
600 min Summer	11.410	0.0	602
720 min Summer	10.016	0.0	722
960 min Summer	8.080	0.0	960
1440 min Summer	5.860	0.0	1258
2160 min Summer	4.154	0.0	1620
2880 min Summer	3.224	0.0	1992
4320 min Summer	2.228	0.0	2808
5760 min Summer	1.712	0.0	3584
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	33
60 min Winter	52.458	0.0	62
120 min Winter	33.215	0.0	122
180 min Winter	25.480	0.0	180
240 min Winter	21.109	0.0	240
360 min Winter	16.158	0.0	356

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.158	0.508	45.0	7443.8	Flood Risk
600 min Winter	15.179	0.529	46.8	7766.4	Flood Risk
720 min Winter	15.192	0.542	48.0	7970.9	Flood Risk
960 min Winter	15.203	0.553	48.9	8142.4	Flood Risk
1440 min Winter	15.195	0.545	48.2	8008.5	Flood Risk
2160 min Winter	15.156	0.506	44.9	7418.6	Flood Risk
2880 min Winter	15.114	0.464	44.0	6775.1	Flood Risk
4320 min Winter	15.028	0.378	43.1	5492.8	Flood Risk
5760 min Winter	14.953	0.303	42.4	4386.9	Flood Risk
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	474
600 min Winter	11.410	0.0	590
720 min Winter	10.016	0.0	702
960 min Winter	8.080	0.0	926
1440 min Winter	5.860	0.0	1356
2160 min Winter	4.154	0.0	1712
2880 min Winter	3.223	0.0	2164
4320 min Winter	2.228	0.0	3064
5760 min Winter	1.712	0.0	3872
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 9.483

Time From: (mins)	To: (mins)	Area (ha)
0	4	9.483

Note: This output relates to the Onshore Substations and is inclusive of the operational access road. Micro drainage area expressed in hectares. Area footprints and impermeability are summarised in the table below:

Equipment¤	East·Anglia·TWO·(m²)¤	East·Anglia·ONE·North·(m²)¤
Operational·access·road·¤	13,600¤	
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	N/A¤	
Permanent·access·road·to·sealing·end·compound¤	N/A¤	
SuDS·basin·footprint¤	16,637·(9,603)*¤	
Total·impermeable·area¤	**94,837·(87,803)*¤**	
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤		

Model Details

Storage is Online Cover Level (m) 15.250

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	14217.0	0.500	15075.0	0.600	16637.0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time exceeds 7 days.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.763	0.113	5.8	2323.5	O K
30 min Summer	14.802	0.152	5.9	3136.4	O K
60 min Summer	14.843	0.193	5.9	3979.2	O K
120 min Summer	14.893	0.243	6.0	5026.3	O K
180 min Summer	14.928	0.278	6.0	5771.0	O K
240 min Summer	14.956	0.306	6.0	6361.7	Flood Risk
360 min Summer	14.999	0.349	6.1	7278.0	Flood Risk
480 min Summer	15.032	0.382	6.1	7972.8	Flood Risk
600 min Summer	15.057	0.407	6.2	8508.5	Flood Risk
720 min Summer	15.077	0.427	6.2	8934.0	Flood Risk
960 min Summer	15.106	0.456	6.2	9549.4	Flood Risk
1440 min Summer	15.139	0.489	6.3	10260.2	Flood Risk
2160 min Summer	15.160	0.510	6.4	10709.9	Flood Risk
2880 min Summer	15.168	0.518	6.4	10872.6	Flood Risk
4320 min Summer	15.167	0.517	6.4	10849.6	Flood Risk
5760 min Summer	15.160	0.510	6.4	10699.0	Flood Risk
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.776	0.126	5.8	2602.6	O K
30 min Winter	14.820	0.170	5.9	3513.4	O K
60 min Winter	14.865	0.215	5.9	4458.1	O K
120 min Winter	14.921	0.271	6.0	5632.5	O K
180 min Winter	14.961	0.311	6.0	6468.4	Flood Risk
240 min Winter	14.993	0.343	6.1	7132.1	Flood Risk
360 min Winter	15.041	0.391	6.1	8162.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	364
480 min Summer	13.321	0.0	484
600 min Summer	11.410	0.0	604
720 min Summer	10.016	0.0	724
960 min Summer	8.080	0.0	964
1440 min Summer	5.860	0.0	1444
2160 min Summer	4.154	0.0	2164
2880 min Summer	3.224	0.0	2884
4320 min Summer	2.228	0.0	4324
5760 min Summer	1.712	0.0	5760
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	124
180 min Winter	25.480	0.0	184
240 min Winter	21.109	0.0	242
360 min Winter	16.158	0.0	362

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.078	0.428	6.2	8944.9	Flood Risk
600 min Winter	15.106	0.456	6.2	9549.0	Flood Risk
720 min Winter	15.128	0.478	6.2	10030.0	Flood Risk
960 min Winter	15.161	0.511	6.4	10727.5	Flood Risk
1440 min Winter	15.198	0.548	6.8	11536.9	Flood Risk
2160 min Winter	15.221	0.571	7.0	12058.3	Flood Risk
2880 min Winter	15.230	0.580	7.1	12259.8	Flood Risk
4320 min Winter	15.230	0.580	7.1	12274.5	Flood Risk
5760 min Winter	15.225	0.575	7.0	12151.0	Flood Risk
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	482
600 min Winter	11.410	0.0	602
720 min Winter	10.016	0.0	720
960 min Winter	8.080	0.0	956
1440 min Winter	5.860	0.0	1430
2160 min Winter	4.154	0.0	2140
2880 min Winter	3.223	0.0	2852
4320 min Winter	2.228	0.0	4240
5760 min Winter	1.712	0.0	5648
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 10.155

Time From:	(mins) To:	Area (ha)
0	4	10.155

Note: Under a FoS of 10, SuDS basin footprints increase by a factor of 1.2. This fully accommodates the storage requirements for the scenario but the drain down time (exceedance of 7 days) is not acceptable for an infiltration only design.

Equipment¤	East·Anglia·TWO·(m²)¤	East·Anglia·ONE·North·(m²)¤
Operational·access·road·¤	13,600¤	
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	N/A¤	
Permanent·access·road·to·sealing·end·compound¤	N/A¤	
SuDS·basin·footprint¤	16,637·(9,603)*¤	
Total·impermeable·area¤	**94,837·(87,803)*¤**	
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤		

Model Details

Storage is Online Cover Level (m) 15.250

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	20472.0	0.500	21500.0	0.600	23357.0

Summary of Results for 100 year Return Period (+40%)

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Half Drain Time : 1461 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.797	0.147	30.7	1570.1	O K
30 min Summer	14.846	0.196	31.1	2107.7	O K
60 min Summer	14.895	0.245	31.5	2645.3	O K
120 min Summer	14.953	0.303	32.0	3279.8	Flood Risk
180 min Summer	14.991	0.341	32.3	3704.8	Flood Risk
240 min Summer	15.020	0.370	32.6	4023.3	Flood Risk
360 min Summer	15.060	0.410	32.9	4475.9	Flood Risk
480 min Summer	15.087	0.437	33.1	4775.3	Flood Risk
600 min Summer	15.104	0.454	33.3	4965.6	Flood Risk
720 min Summer	15.114	0.464	33.3	5081.0	Flood Risk
960 min Summer	15.121	0.471	33.4	5156.1	Flood Risk
1440 min Summer	15.108	0.458	33.3	5010.8	Flood Risk
2160 min Summer	15.075	0.425	33.0	4638.6	Flood Risk
2880 min Summer	15.041	0.391	32.7	4261.8	Flood Risk
4320 min Summer	14.979	0.329	32.2	3568.6	Flood Risk
5760 min Summer	14.927	0.277	31.8	2996.2	O K
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.814	0.164	30.8	1760.4	O K
30 min Winter	14.870	0.220	31.3	2365.0	O K
60 min Winter	14.925	0.275	31.8	2971.2	O K
120 min Winter	14.990	0.340	32.3	3693.7	Flood Risk
180 min Winter	15.034	0.384	32.7	4181.2	Flood Risk
240 min Winter	15.067	0.417	33.0	4548.7	Flood Risk
360 min Winter	15.114	0.464	33.3	5078.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	182
240 min Summer	21.109	0.0	242
360 min Summer	16.158	0.0	362
480 min Summer	13.321	0.0	482
600 min Summer	11.410	0.0	602
720 min Summer	10.016	0.0	722
960 min Summer	8.080	0.0	960
1440 min Summer	5.860	0.0	1242
2160 min Summer	4.154	0.0	1600
2880 min Summer	3.224	0.0	1988
4320 min Summer	2.228	0.0	2772
5760 min Summer	1.712	0.0	3576
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	33
60 min Winter	52.458	0.0	62
120 min Winter	33.215	0.0	122
180 min Winter	25.480	0.0	180
240 min Winter	21.109	0.0	240
360 min Winter	16.158	0.0	356

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.146	0.496	33.6	5438.0	Flood Risk
600 min Winter	15.166	0.516	34.9	5672.7	Flood Risk
720 min Winter	15.179	0.529	35.8	5819.7	Flood Risk
960 min Winter	15.189	0.539	36.6	5938.2	Flood Risk
1440 min Winter	15.179	0.529	35.8	5829.5	Flood Risk
2160 min Winter	15.141	0.491	33.6	5383.7	Flood Risk
2880 min Winter	15.098	0.448	33.2	4902.9	Flood Risk
4320 min Winter	15.014	0.364	32.5	3954.5	Flood Risk
5760 min Winter	14.940	0.290	31.9	3140.4	O K
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	474
600 min Winter	11.410	0.0	588
720 min Winter	10.016	0.0	702
960 min Winter	8.080	0.0	926
1440 min Winter	5.860	0.0	1356
2160 min Winter	4.154	0.0	1708
2880 min Winter	3.223	0.0	2160
4320 min Winter	2.228	0.0	3028
5760 min Winter	1.712	0.0	3864
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.951

Time From:	(mins) To:	Area (ha)
0	4	6.951

Note: This output relates to the National Grid infrastructure and is inclusive of the cable sealing end compounds and permanent access road. Micro drainage area expressed in hectares. Area footprints and impermeability are summarised in the table below:

Equipment¤	National·Grid·Infrastructure·(m²)¤
Overall·substation·operational·footprint¤	44,950¤
Operational·access·road·¤	N/A¤
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	10,000¤
Permanent·access·road·to·sealing·end·compound¤	1,850¶ ¤
SuDS·basin·footprint¤	12,712·(7,520)*¤
Total·impermeable·area¤	**69,512·(64,320)*¤**
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤	

Model Details

Storage is Online Cover Level (m) 15.250

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	10609.0	0.500	11351.0	0.600	12712.0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time exceeds 7 days.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.761	0.111	4.4	1706.3	O K
30 min Summer	14.799	0.149	4.4	2303.3	O K
60 min Summer	14.839	0.189	4.4	2922.2	O K
120 min Summer	14.888	0.238	4.5	3691.0	O K
180 min Summer	14.923	0.273	4.5	4237.6	O K
240 min Summer	14.951	0.301	4.5	4671.2	Flood Risk
360 min Summer	14.993	0.343	4.6	5343.6	Flood Risk
480 min Summer	15.025	0.375	4.6	5853.3	Flood Risk
600 min Summer	15.050	0.400	4.6	6246.1	Flood Risk
720 min Summer	15.069	0.419	4.7	6558.0	Flood Risk
960 min Summer	15.097	0.447	4.7	7008.7	Flood Risk
1440 min Summer	15.129	0.479	4.7	7528.2	Flood Risk
2160 min Summer	15.150	0.500	4.7	7854.9	Flood Risk
2880 min Summer	15.157	0.507	4.8	7971.4	Flood Risk
4320 min Summer	15.155	0.505	4.8	7947.9	Flood Risk
5760 min Summer	15.148	0.498	4.7	7829.7	Flood Risk
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.774	0.124	4.4	1911.4	O K
30 min Winter	14.817	0.167	4.4	2580.2	O K
60 min Winter	14.862	0.212	4.5	3273.9	O K
120 min Winter	14.917	0.267	4.5	4136.1	O K
180 min Winter	14.956	0.306	4.5	4749.8	Flood Risk
240 min Winter	14.986	0.336	4.6	5237.0	Flood Risk
360 min Winter	15.034	0.384	4.6	5993.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	364
480 min Summer	13.321	0.0	484
600 min Summer	11.410	0.0	604
720 min Summer	10.016	0.0	724
960 min Summer	8.080	0.0	964
1440 min Summer	5.860	0.0	1444
2160 min Summer	4.154	0.0	2164
2880 min Summer	3.224	0.0	2884
4320 min Summer	2.228	0.0	4324
5760 min Summer	1.712	0.0	5760
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	124
180 min Winter	25.480	0.0	184
240 min Winter	21.109	0.0	242
360 min Winter	16.158	0.0	362

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.070	0.420	4.7	6567.0	Flood Risk
600 min Winter	15.097	0.447	4.7	7010.1	Flood Risk
720 min Winter	15.119	0.469	4.7	7362.7	Flood Risk
960 min Winter	15.151	0.501	4.8	7873.8	Flood Risk
1440 min Winter	15.187	0.537	5.1	8466.3	Flood Risk
2160 min Winter	15.209	0.559	5.3	8845.5	Flood Risk
2880 min Winter	15.218	0.568	5.4	8989.6	Flood Risk
4320 min Winter	15.218	0.568	5.4	8993.7	Flood Risk
5760 min Winter	15.212	0.562	5.3	8896.9	Flood Risk
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	482
600 min Winter	11.410	0.0	602
720 min Winter	10.016	0.0	720
960 min Winter	8.080	0.0	956
1440 min Winter	5.860	0.0	1430
2160 min Winter	4.154	0.0	2140
2880 min Winter	3.223	0.0	2852
4320 min Winter	2.228	0.0	4240
5760 min Winter	1.712	0.0	5648
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.458

Time From:	(mins) To:	Area (ha)
0	4	7.458

Note: Under a FoS of 10, SuDS basin footprints increase by a factor of 1.2. This fully accommodates the storage requirements for the scenario but the drain down time (exceedance of 7 days) is not acceptable for an infiltration only design.

Equipment¤	National·Grid·Infrastructure·(m²)¤
Overall·substation·operational·footprint¤	44,950¤
Operational·access·road·¤	N/A¤
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	10,000¤
Permanent·access·road·to·sealing·end·compound¤	1,850¶ ¤
SuDS·basin·footprint¤	12,712·(7,520)*¤
Total·impermeable·area¤	**69,512·(64,320)*¤**
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤	

Model Details

Storage is Online Cover Level (m) 15.250

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15277.0	0.500	16166.0	0.600	17782.0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2534 minutes.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.522	0.272	21.8	1994.6	O K
30 min Summer	14.613	0.363	22.4	2683.8	O K
60 min Summer	14.704	0.454	23.1	3384.3	O K
120 min Summer	14.813	0.563	23.8	4230.6	O K
180 min Summer	14.886	0.636	24.4	4813.6	O K
240 min Summer	14.943	0.693	24.8	5262.4	O K
360 min Summer	15.025	0.775	25.4	5928.4	O K
480 min Summer	15.083	0.833	25.8	6401.6	Flood Risk
600 min Summer	15.123	0.873	26.1	6736.0	Flood Risk
720 min Summer	15.152	0.902	26.3	6975.1	Flood Risk
960 min Summer	15.185	0.935	26.5	7249.9	Flood Risk
1440 min Summer	15.198	0.948	26.6	7358.5	Flood Risk
2160 min Summer	15.159	0.909	26.3	7027.2	Flood Risk
2880 min Summer	15.108	0.858	26.0	6609.1	Flood Risk
4320 min Summer	15.015	0.765	25.3	5846.5	O K
5760 min Summer	14.941	0.691	24.7	5253.2	O K
7200 min Summer	14.250	0.000	0.0	0.0	O K
8640 min Summer	14.250	0.000	0.0	0.0	O K
10080 min Summer	14.250	0.000	0.0	0.0	O K
15 min Winter	14.554	0.304	22.0	2235.6	O K
30 min Winter	14.656	0.406	22.7	3009.4	O K
60 min Winter	14.757	0.507	23.5	3797.6	O K
120 min Winter	14.879	0.629	24.3	4754.9	O K
180 min Winter	14.962	0.712	24.9	5417.0	O K
240 min Winter	15.025	0.775	25.4	5929.0	O K
360 min Winter	15.118	0.868	26.0	6693.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	362
480 min Summer	13.321	0.0	482
600 min Summer	11.410	0.0	602
720 min Summer	10.016	0.0	722
960 min Summer	8.080	0.0	962
1440 min Summer	5.860	0.0	1440
2160 min Summer	4.154	0.0	2052
2880 min Summer	3.224	0.0	2340
4320 min Summer	2.228	0.0	3072
5760 min Summer	1.712	0.0	3872
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	122
180 min Winter	25.480	0.0	182
240 min Winter	21.109	0.0	240
360 min Winter	16.158	0.0	358

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.184	0.934	26.5	7241.9	Flood Risk
600 min Winter	15.231	0.981	26.9	7635.3	Flood Risk
720 min Winter	15.265	1.015	28.0	7920.4	Flood Risk
960 min Winter	15.302	1.052	30.4	8249.2	Flood Risk
1440 min Winter	15.320	1.070	31.6	8413.1	Flood Risk
2160 min Winter	15.293	1.043	29.8	8164.2	Flood Risk
2880 min Winter	15.243	0.993	26.9	7731.5	Flood Risk
4320 min Winter	15.131	0.881	26.1	6794.9	Flood Risk
5760 min Winter	15.036	0.786	25.4	6022.4	O K
7200 min Winter	14.250	0.000	0.0	0.0	O K
8640 min Winter	14.250	0.000	0.0	0.0	O K
10080 min Winter	14.250	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	476
600 min Winter	11.410	0.0	594
720 min Winter	10.016	0.0	710
960 min Winter	8.080	0.0	942
1440 min Winter	5.860	0.0	1396
2160 min Winter	4.154	0.0	2052
2880 min Winter	3.223	0.0	2680
4320 min Winter	2.228	0.0	3288
5760 min Winter	1.712	0.0	4208
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 8.780

Time From: (mins)	To: (mins)	Area (ha)
0	4	8.780

Note: Under a FoS of 10, SuDS basin footprints increase by a factor of 1.2. This fully accommodates the storage requirements for the scenario but the drain down time (exceedance of 7 days) is not acceptable for an infiltration only design.

Equipment¤	East·Anglia·TWO·(m²)¤	East·Anglia·ONE·North·(m²)¤
Operational·access·road·¤	13,600¤	
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	N/A¤	
Permanent·access·road·to·sealing·end·compound¤	N/A¤	
SuDS·basin·footprint¤	16,637·(9,603)*¤	
Total·impermeable·area¤	**94,837·(87,803)*¤**	
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤		

Model Details

Storage is Online Cover Level (m) 15.350

Infiltration Basin Structure

Invert Level (m) 14.250 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	7175.0	0.700	8040.0	1.000	8426.0	1.100	9603.0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time exceeds 7 days.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.450	0.200	3.0	2092.9	O K
30 min Summer	14.518	0.268	3.1	2825.8	O K
60 min Summer	14.589	0.339	3.2	3587.0	O K
120 min Summer	14.676	0.426	3.2	4535.1	O K
180 min Summer	14.738	0.488	3.3	5211.1	O K
240 min Summer	14.786	0.536	3.3	5748.7	O K
360 min Summer	14.861	0.611	3.4	6585.5	O K
480 min Summer	14.918	0.668	3.4	7223.3	O K
600 min Summer	14.961	0.711	3.5	7717.8	O K
720 min Summer	14.996	0.746	3.5	8113.3	O K
960 min Summer	15.046	0.796	3.5	8691.9	O K
1440 min Summer	15.106	0.856	3.6	9381.3	Flood Risk
2160 min Summer	15.147	0.897	3.6	9860.1	Flood Risk
2880 min Summer	15.166	0.916	3.6	10080.9	Flood Risk
4320 min Summer	15.177	0.927	3.6	10205.2	Flood Risk
5760 min Summer	15.177	0.927	3.6	10209.9	Flood Risk
7200 min Summer	14.250	0.000	0.0	0.0	O K
8640 min Summer	14.250	0.000	0.0	0.0	O K
10080 min Summer	14.250	0.000	0.0	0.0	O K
15 min Winter	14.473	0.223	3.1	2344.2	O K
30 min Winter	14.550	0.300	3.1	3165.4	O K
60 min Winter	14.629	0.379	3.2	4018.4	O K
120 min Winter	14.726	0.476	3.3	5081.3	O K
180 min Winter	14.794	0.544	3.3	5839.6	O K
240 min Winter	14.848	0.598	3.4	6442.9	O K
360 min Winter	14.932	0.682	3.4	7382.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	364
480 min Summer	13.321	0.0	484
600 min Summer	11.410	0.0	604
720 min Summer	10.016	0.0	724
960 min Summer	8.080	0.0	964
1440 min Summer	5.860	0.0	1444
2160 min Summer	4.154	0.0	2164
2880 min Summer	3.224	0.0	2884
4320 min Summer	2.228	0.0	4324
5760 min Summer	1.712	0.0	5768
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	124
180 min Winter	25.480	0.0	184
240 min Winter	21.109	0.0	244
360 min Winter	16.158	0.0	362

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	14.995	0.745	3.5	8099.3	O K
600 min Winter	15.043	0.793	3.5	8655.6	O K
720 min Winter	15.082	0.832	3.6	9101.0	Flood Risk
960 min Winter	15.138	0.888	3.6	9754.1	Flood Risk
1440 min Winter	15.205	0.955	3.7	10536.2	Flood Risk
2160 min Winter	15.252	1.002	3.7	11088.1	Flood Risk
2880 min Winter	15.273	1.023	3.9	11350.0	Flood Risk
4320 min Winter	15.287	1.037	4.0	11517.6	Flood Risk
5760 min Winter	15.290	1.040	4.0	11551.8	Flood Risk
7200 min Winter	14.250	0.000	0.0	0.0	O K
8640 min Winter	14.250	0.000	0.0	0.0	O K
10080 min Winter	14.250	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	482
600 min Winter	11.410	0.0	602
720 min Winter	10.016	0.0	722
960 min Winter	8.080	0.0	962
1440 min Winter	5.860	0.0	1440
2160 min Winter	4.154	0.0	2144
2880 min Winter	3.223	0.0	2856
4320 min Winter	2.228	0.0	4280
5760 min Winter	1.712	0.0	5704
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 9.141

Time From:	(mins) To:	Area (ha)
0	4	9.141

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Note: Under a FoS of 10, SuDS basin footprints increase by a factor of 1.2. This fully accommodates the storage requirements for the scenario but the drain down time (exceedance of 7 days) is not acceptable for an infiltration only design.

Equipment¤	East·Anglia·TWO·(m²)¤	East·Anglia·ONE·North·(m²)¤
Operational·access·road·¤	13,600¤	
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	N/A¤	
Permanent·access·road·to·sealing·end·compound¤	N/A¤	
SuDS·basin·footprint¤	16,637·(9,603)*¤	
Total·impermeable·area¤	**94,837·(87,803)*¤**	
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤		

Model Details

Storage is Online Cover Level (m) 15.350

Infiltration Basin Structure

Invert Level (m) 14.250 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	10331.0	0.700	11365.0	1.000	11823.0	1.100	13210.0

Summary of Results for 100 year Return Period (+40%)

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Half Drain Time : 2488 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.914	0.264	16.6	1460.8	O K
30 min Summer	15.002	0.352	17.1	1965.3	O K
60 min Summer	15.091	0.441	17.6	2477.5	O K
120 min Summer	15.195	0.545	18.3	3095.5	O K
180 min Summer	15.266	0.616	18.7	3520.4	O K
240 min Summer	15.319	0.669	19.0	3846.8	O K
360 min Summer	15.398	0.748	19.5	4329.9	O K
480 min Summer	15.453	0.803	19.9	4671.4	Flood Risk
600 min Summer	15.491	0.841	20.1	4911.3	Flood Risk
720 min Summer	15.518	0.868	20.3	5081.2	Flood Risk
960 min Summer	15.548	0.898	20.5	5272.3	Flood Risk
1440 min Summer	15.558	0.908	20.5	5332.6	Flood Risk
2160 min Summer	15.517	0.867	20.3	5073.4	Flood Risk
2880 min Summer	15.468	0.818	20.0	4768.7	Flood Risk
4320 min Summer	15.379	0.729	19.4	4211.4	O K
5760 min Summer	15.308	0.658	19.0	3774.6	O K
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.945	0.295	16.7	1637.4	O K
30 min Winter	15.044	0.394	17.3	2203.7	O K
60 min Winter	15.142	0.492	17.9	2780.2	O K
120 min Winter	15.259	0.609	18.7	3479.4	O K
180 min Winter	15.338	0.688	19.1	3962.1	O K
240 min Winter	15.399	0.749	19.5	4334.8	O K
360 min Winter	15.488	0.838	20.1	4889.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	362
480 min Summer	13.321	0.0	482
600 min Summer	11.410	0.0	602
720 min Summer	10.016	0.0	722
960 min Summer	8.080	0.0	962
1440 min Summer	5.860	0.0	1440
2160 min Summer	4.154	0.0	1968
2880 min Summer	3.224	0.0	2280
4320 min Summer	2.228	0.0	3028
5760 min Summer	1.712	0.0	3856
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	122
180 min Winter	25.480	0.0	182
240 min Winter	21.109	0.0	240
360 min Winter	16.158	0.0	358

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.550	0.900	20.5	5286.0	Flood Risk
600 min Winter	15.594	0.944	20.8	5568.9	Flood Risk
720 min Winter	15.626	0.976	21.0	5773.6	Flood Risk
960 min Winter	15.663	1.013	21.9	6015.5	Flood Risk
1440 min Winter	15.681	1.031	22.9	6132.0	Flood Risk
2160 min Winter	15.651	1.001	21.2	5930.8	Flood Risk
2880 min Winter	15.593	0.943	20.8	5560.7	Flood Risk
4320 min Winter	15.486	0.836	20.1	4881.9	Flood Risk
5760 min Winter	15.395	0.745	19.5	4308.1	O K
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	476
600 min Winter	11.410	0.0	594
720 min Winter	10.016	0.0	710
960 min Winter	8.080	0.0	942
1440 min Winter	5.860	0.0	1398
2160 min Winter	4.154	0.0	2056
2880 min Winter	3.223	0.0	2628
4320 min Winter	2.228	0.0	3284
5760 min Winter	1.712	0.0	4160
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.432

Time From:	(mins) To:	Area (ha)
0	4	6.432

Note: This output relates to the National Grid infrastructure and is inclusive of the cable sealing end compounds and permanent access road. Micro drainage area expressed in hectares. Area footprints and impermeability are summarised in the table below:

Equipment¤	National·Grid·Infrastructure·(m²)¤
Overall·substation·operational·footprint¤	44,950¤
Operational·access·road·¤	N/A¤
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	10,000¤
Permanent·access·road·to·sealing·end·compound¤	1,850¶ ¤
SuDS·basin·footprint¤	12,712·(7,520)*¤
Total·impermeable·area¤	**69,512·(64,320)*¤**
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤	

Model Details

Storage is Online Cover Level (m) 15.750

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5390.0	0.700	6143.0	1.000	6481.0	1.100	7518.0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time exceeds 7 days.

Note the status column provides an indication of the worst case scenario and should be reviewed alongside the maximum volumes. This is then used to identify the critical storm duration and volume of storage required.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	14.845	0.195	2.3	1535.8	O K
30 min Summer	14.912	0.262	2.3	2073.6	O K
60 min Summer	14.980	0.330	2.4	2632.1	O K
120 min Summer	15.065	0.415	2.5	3327.6	O K
180 min Summer	15.124	0.474	2.5	3823.5	O K
240 min Summer	15.171	0.521	2.5	4217.7	O K
360 min Summer	15.244	0.594	2.6	4831.2	O K
480 min Summer	15.298	0.648	2.6	5298.7	O K
600 min Summer	15.340	0.690	2.7	5660.9	O K
720 min Summer	15.374	0.724	2.7	5950.5	O K
960 min Summer	15.422	0.772	2.7	6373.9	O K
1440 min Summer	15.480	0.830	2.8	6877.3	Flood Risk
2160 min Summer	15.519	0.869	2.8	7224.8	Flood Risk
2880 min Summer	15.537	0.887	2.8	7383.1	Flood Risk
4320 min Summer	15.546	0.896	2.8	7466.8	Flood Risk
5760 min Summer	15.546	0.896	2.8	7463.0	Flood Risk
7200 min Summer	14.650	0.000	0.0	0.0	O K
8640 min Summer	14.650	0.000	0.0	0.0	O K
10080 min Summer	14.650	0.000	0.0	0.0	O K
15 min Winter	14.868	0.218	2.3	1720.2	O K
30 min Winter	14.942	0.292	2.4	2322.8	O K
60 min Winter	15.019	0.369	2.4	2948.7	O K
120 min Winter	15.113	0.463	2.5	3728.4	O K
180 min Winter	15.179	0.529	2.5	4284.6	O K
240 min Winter	15.231	0.581	2.6	4727.0	O K
360 min Winter	15.312	0.662	2.6	5416.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	122.248	0.0	19
30 min Summer	82.572	0.0	34
60 min Summer	52.458	0.0	64
120 min Summer	33.215	0.0	124
180 min Summer	25.480	0.0	184
240 min Summer	21.109	0.0	244
360 min Summer	16.158	0.0	364
480 min Summer	13.321	0.0	484
600 min Summer	11.410	0.0	604
720 min Summer	10.016	0.0	724
960 min Summer	8.080	0.0	964
1440 min Summer	5.860	0.0	1444
2160 min Summer	4.154	0.0	2164
2880 min Summer	3.224	0.0	2884
4320 min Summer	2.228	0.0	4324
5760 min Summer	1.712	0.0	5768
7200 min Summer	-0.012	0.0	0
8640 min Summer	-0.010	0.0	0
10080 min Summer	-0.008	0.0	0
15 min Winter	122.248	0.0	19
30 min Winter	82.572	0.0	34
60 min Winter	52.458	0.0	64
120 min Winter	33.215	0.0	124
180 min Winter	25.480	0.0	184
240 min Winter	21.109	0.0	244
360 min Winter	16.158	0.0	362

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
480 min Winter	15.373	0.723	2.7	5941.4	O K
600 min Winter	15.419	0.769	2.7	6349.0	O K
720 min Winter	15.457	0.807	2.7	6675.2	Flood Risk
960 min Winter	15.511	0.861	2.8	7153.1	Flood Risk
1440 min Winter	15.575	0.925	2.8	7724.3	Flood Risk
2160 min Winter	15.619	0.969	2.9	8125.4	Flood Risk
2880 min Winter	15.640	0.990	2.9	8314.7	Flood Risk
4320 min Winter	15.653	1.003	2.9	8432.3	Flood Risk
5760 min Winter	15.655	1.005	2.9	8451.7	Flood Risk
7200 min Winter	14.650	0.000	0.0	0.0	O K
8640 min Winter	14.650	0.000	0.0	0.0	O K
10080 min Winter	14.650	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
480 min Winter	13.321	0.0	482
600 min Winter	11.410	0.0	602
720 min Winter	10.016	0.0	722
960 min Winter	8.080	0.0	962
1440 min Winter	5.860	0.0	1440
2160 min Winter	4.154	0.0	2144
2880 min Winter	3.223	0.0	2856
4320 min Winter	2.228	0.0	4280
5760 min Winter	1.712	0.0	5704
7200 min Winter	-0.012	0.0	0
8640 min Winter	-0.010	0.0	0
10080 min Winter	-0.008	0.0	0

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 641300 260300 TM 41300 60300	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.708

Time (mins) From:	To:	Area (ha)
0	4	6.708

Note: Under a FoS of 10, SuDS basin footprints increase by a factor of 1.2. This fully accommodates the storage requirements for the scenario but the drain down time (exceedance of 7 days) is not acceptable for an infiltration only design.

Equipment¤	National·Grid·Infrastructure·(m²)¤
Overall·substation·operational·footprint¤	44,950¤
Operational·access·road·¤	N/A¤
Overal·cable·sealing·end·compounds·and·cable·sealing·end·with·circuit·breaker·compound·operational·footprint¤	10,000¤
Permanent·access·road·to·sealing·end·compound¤	1,850¶ ¤
SuDS·basin·footprint¤	12,712·(7,520)*¤
Total·impermeable·area¤	**69,512·(64,320)*¤**
*·Primary·figures·represent·24hr·drainage·specification.·Figures·in·brackets·represent·the·design·sizing·for·48hr·drainage·specification¤	

Model Details

Storage is Online Cover Level (m) 15.750

Infiltration Basin Structure

Invert Level (m) 14.650 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.01000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.01000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	7761.0	0.700	8660.0	1.000	9061.0	1.100	10280.0