Technical Note:

Hamble Quarry: Updated Drainage Design

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Summary

The Drainage Design for Hamble Quarry has been updated following infiltration testing and an analysis of proposed groundwater levels. As part of the restoration phase for the quarry, it is proposed that inert fill material is used to restore ground levels to the existing levels. The calculations accompanying the amended drainage design, presented in this document, demonstrate that runoff associated with the design event, a 1 in 100-year storm with Climate Change, can infiltrate to ground via infiltration trenches (after temporary storage within detention basins in some locations) without increasing surface water discharges from the site. These calculations assume that the inert fill material does not provide any infiltration and uses a safety factor of 2 when applying the observed infiltration rates. Furthermore, in line with CIRIA guidance, the invert level of each infiltration feature has been set at least 1m above the maximum anticipated groundwater level.

Contents

1 Introduction

1.1 Background

Following submission of a planning application for sand and gravel extraction, followed by restoration with inert materials at Hamble Airfield (the Site), CEMEX UK Materials Ltd (CEMEX) has entered into correspondence with consultees. The Lead Local Flood Authority (LLFA) has requested further clarification of the proposed drainage design, following updates to infiltration rates and proposed groundwater levels, as outlined in the soakaway testing report (Stantec, 2022b) and the groundwater flow technical note (Stantec, 2023) respectively.

Correspondence with regard to surface water issues is summarised below.

Flood and Water management team, Economy, Transport & Environment Department, Hampshire County Council;

- Initial letter from Flood and Water management team SWM/2022/0033 dated 7 February 2022 to which Stantec UK Ltd (Stantec) responded by letter on 24 May 2022,
- Stantec letter response 331201108pbond001 dated 24 May 2022,
- Follow up letter from Flood and Water management team SWM/2022/0033 dated 30 January 2023.

The majority of the issues raised by the latest Flood and Water management team letter relate to surface water issues which are addressed within this Technical Note. However, the point "*A technical assessment on how the proposed material will impact groundwater flows and any mitigation proposed to manage the risk of groundwater flow obstruction*" relates to hydrogeological issues and this is dealt with in the groundwater flow technical note (Stantec, 2023).

1.2 Scope of work

In order to address concerns regarding the proposed drainage design raised by the Flood and Water management team, this Technical Note presents further calculations to demonstrate that the proposed drainage design can allow for the infiltration of all surface water runoff in a 1 in 100 year + Climate Change event, with all infiltration features having a base / invert level situated at least 1 m above the maximum groundwater level, in line with CIRIA guidance for SuDS design[1].

A plan showing the updated proposed restoration drainage design is included as Appendix A, which also shows details of invert levels, groundwater levels and discharge rates (where applicable). Full MicroDrainage calculations for each element of the drainage design are provided within Appendix B.

Furthermore, the exceedance flow routes have been shown, demonstrating that, in events that exceed the design capacity of the drainage system and surface water overtops the drainage features, surface water will follow the existing ground contours, and will not lead to an increase in surface water flood risk for properties downslope of the site.

[1] Section 25.2.2, CIRIA report C753 – The SuDS Manual. 2015.

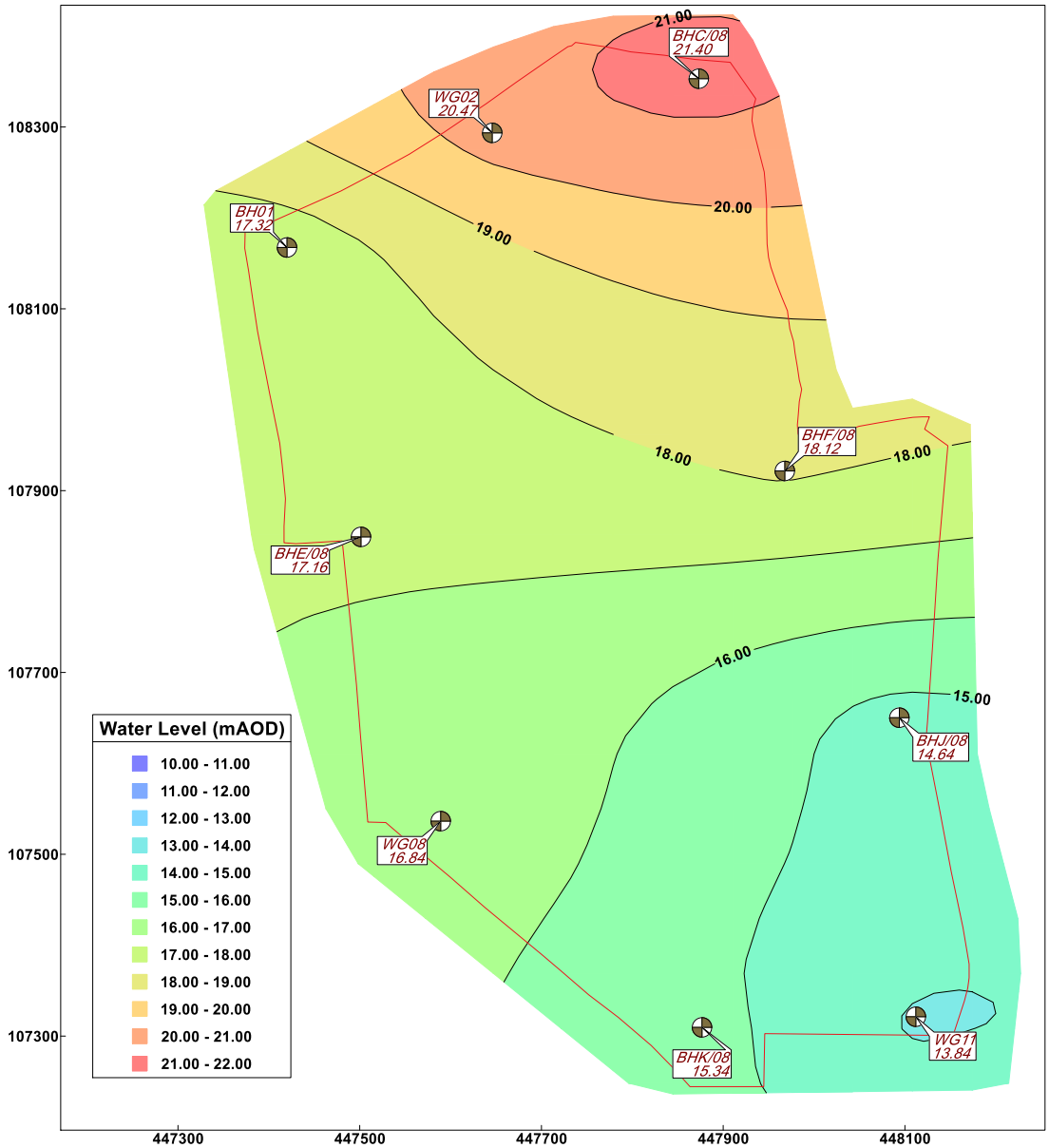
2 Groundwater levels

As the proposed restoration drainage design discharges all rainfall up to and including the design event via infiltration, features such as linear infiltration trenches and infiltration basins are necessary for the drainage design. The inert fill material is anticipated to have a lower permeability than the sand and gravel being extracted from the quarry. As a conservative measure, it has been assumed that the inert fill material provides no infiltration, and so infiltration features associated with the drainage design have been located outside the proposed extraction area. In these locations, infiltration rates have been taken from the results of Infiltration Testing carried out by Stantec (2022b).

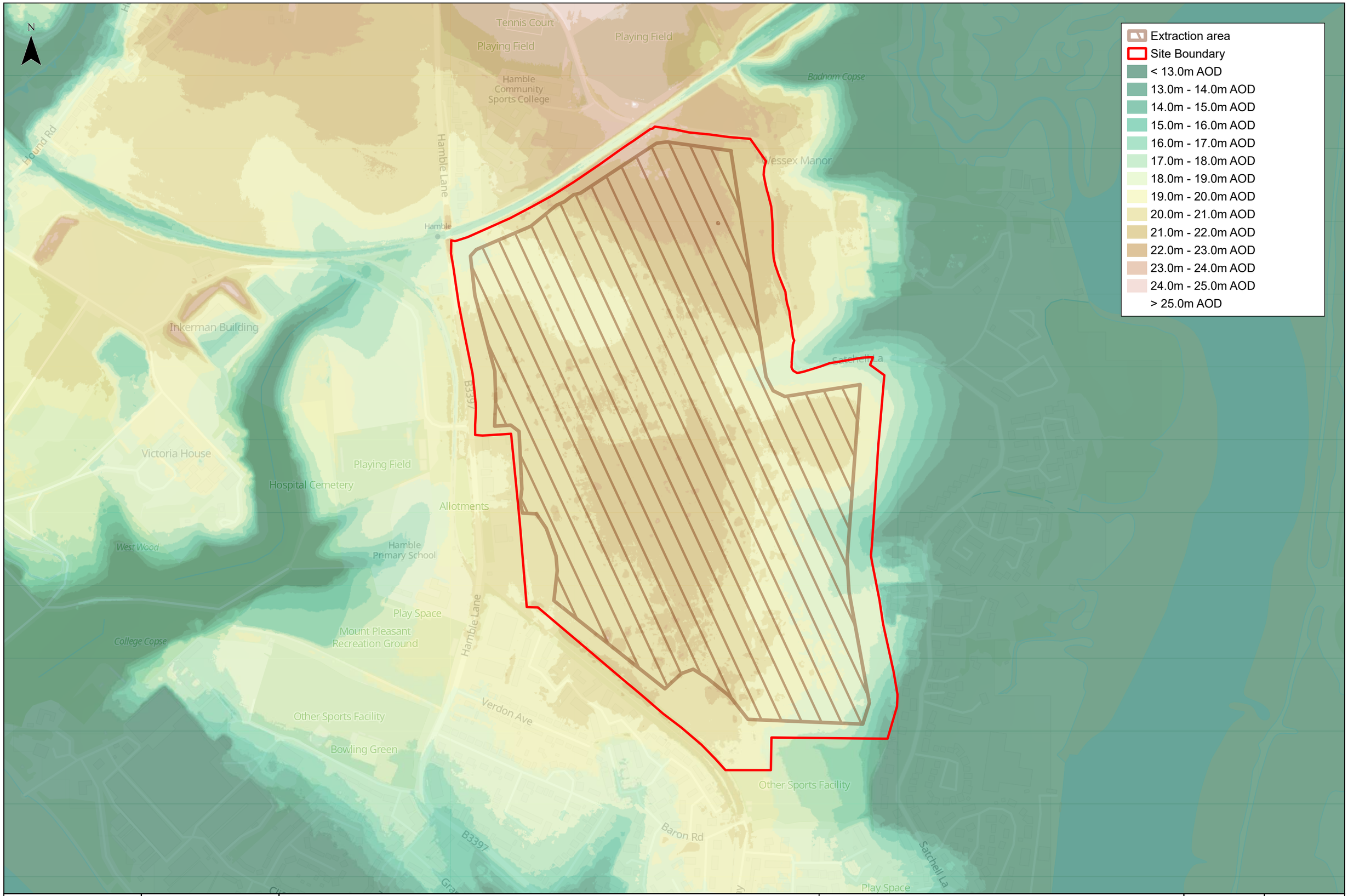
The CIRIA technical guidance for SuDS design recommends that, in designing infiltration systems, the base of any infiltration component is at least 1m above the maximum anticipated groundwater level. This is in order to ensure a depth of unsaturated soils to help ensure the infiltration performance of the component and protect underlying groundwater from contamination.

As part of the restoration plan, the quarry void will be filled with lower permeability inert fill material. However, as demonstrated in the groundwater flow technical note (Stantec, 2023), it is not anticipated that groundwater levels in the surrounding superficial strata will be significantly impacted by this and the drainage design can be based on the January 2023 groundwater contours for the River Terrace Deposits as shown in Figure 2.1, which represents the seasonal maximum groundwater levels.

Figure 2.1 River Terrace Deposit Anticipated Ground Water Levels January 2023.



By examining the LiDAR Digital Terrain Model (DTM) for the site (Figure 2.2), the ground levels towards the north-east corner of the site are shown to be approximately 22 mAOD. As the maximum groundwater level in the RTD is less than 1m below the ground surface, infiltration features are not suitable in this location. However, all other areas of the site are underlain by an unsaturated zone of at least 1m depth below ground level.



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HAMBLE QUARRY

LiDAR 1m Topography

0 300 600 m

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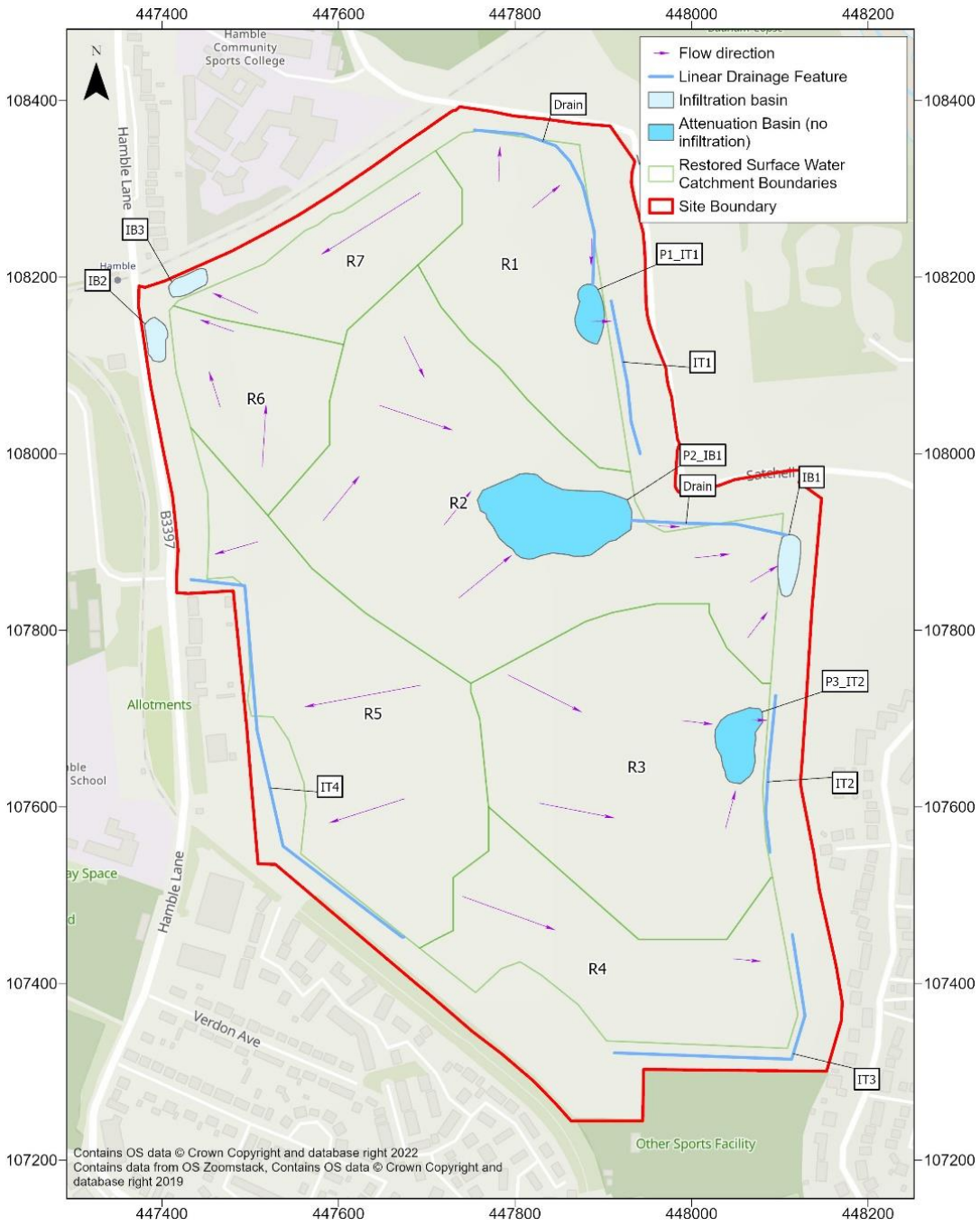
3 Drainage Design

The restored site has been separated into subcatchments, as shown in Figure 3.1. Full details of each restoration phase drainage element are provided in Appendix A.

Figure 3.1 Updated Restoration Subcatchments



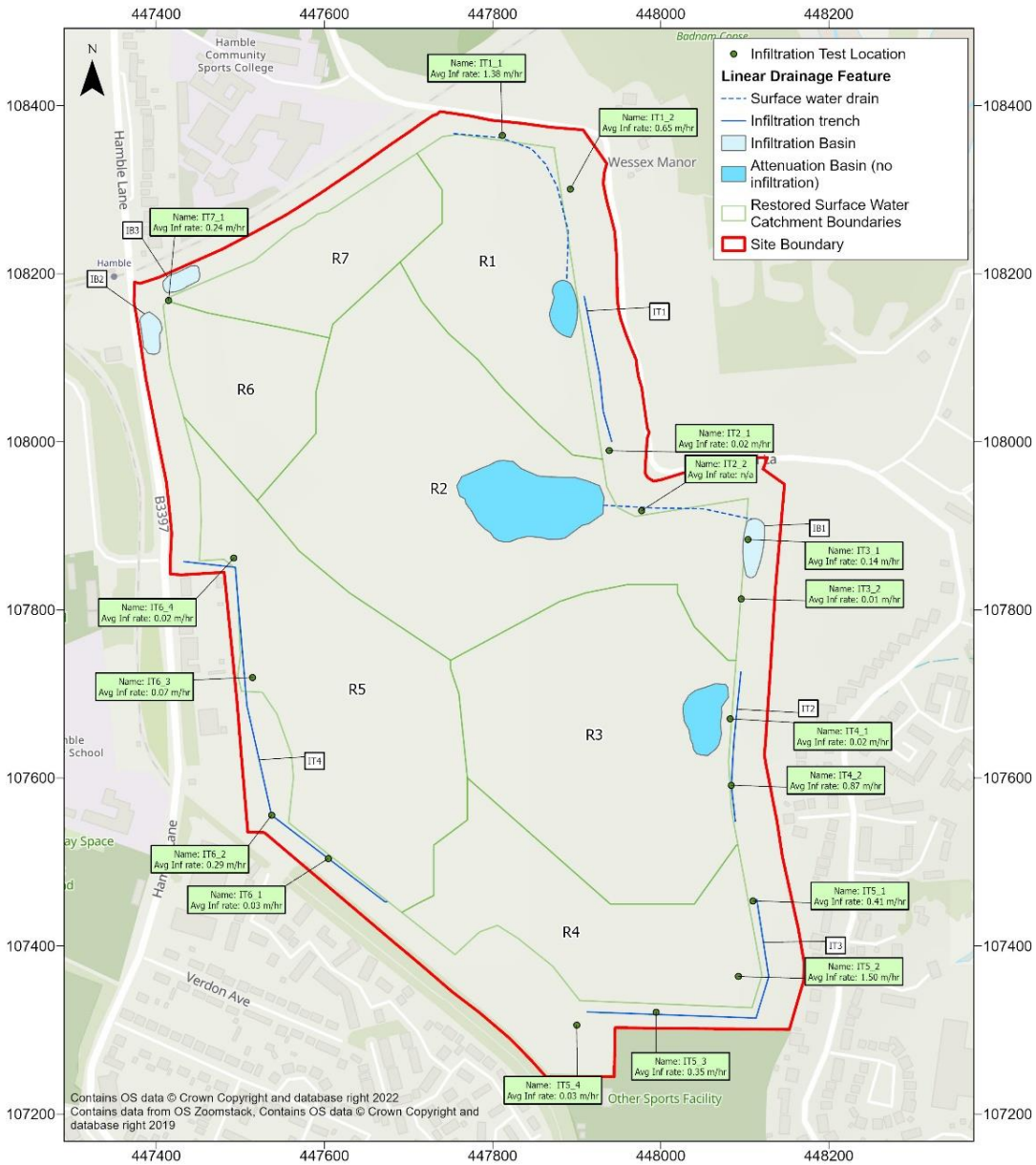
For each subcatchment, the rainfall has been calculated using the Revitalised Flood Hydrograph method (ReFH2) to derive 1 in 100 year rainfall rates and hydrographs for the site, in line with the original FRA drainage calculations (Stantec, 2021). It is assumed that the restoration phase of the development has a lifetime of over 100 years, so a 45% climate change factor was then applied to this rainfall, in line with the recommended Upper End 2070s rainfall allowance for the Test and Itchen Management Catchment. The Upper End allowance has been used following the guidance for peak rainfall as part of the Climate Change (UK

Government, 2022). The original drainage design used a 40% climate change uplift, in line with the guidance in place at the time of the FRA.

The 1 in 100 year + Climate Change hydrograph has then been pro-rated based on subcatchment area. MicroDrainage software was then used to test each subcatchment to ensure that the proposed dimensions of each feature is sufficient to allow for infiltration in the design event.

Average infiltration rates used in the calculations were taken from the results of the infiltration testing (Stantec, 2022) (Figure 3.2). Note: infiltration testing was inconclusive at test location "IT2_2" and therefore no infiltration is assumed for the surface water drain located here. In the MicroDrainage calculations, a Factor of Safety of 2 has been used, which means that the infiltration rates used in the calculations are halved as a conservative measure. Results of the MicroDrainage calculations are provided in Appendix B.

Figure 3.2 Infiltration testing results(Source: Stantec, 2022b)



As with the original drainage design, surface water is managed through a combination of attenuation basins (which assume zero infiltration to ground), discharge control structures, infiltration basins and infiltration trenches. As mentioned in Section 2, groundwater levels in the north east of the site are too close to the ground

surface to allow for an infiltration feature, despite the high infiltration rate in this location. Therefore, a shallow surface water drain is proposed at the edge of the extraction area in this location in order to divert surface water to the south, into an attenuation basin. This will then release surface water via a controlled discharge (such as an orifice plate or Hydrobrake™ system) into infiltration trench IT1 at a maximum rate of 36 l/s. The typical flows encountered in the shallow surface water drain are considered to be small, and a surface water "grip" is anticipated to be sufficient; a 0.5 m wide, shallow trench, approximately 250 mm deep. Further details will be provided as part of the detailed drainage design. Similarly, a surface water channel is required to convey discharge from attenuation basin P2_IB1, which has a discharge restricted to a maximum of 55 l/s. Again, a 250 mm deep channel would be sufficient to convey this small flow, but further dimensions are to be provided as part of the detailed design.

A summary of the drainage mechanisms for each restoration subcatchment is provided in Table 3.1, with a summary of dimensions of infiltration trenches and basins (both for attenuation and for infiltration) shown in Table 3.2 and Table 3.3 respectively.

Table 3.1 Subcatchment summary

Sub-catchment	Area (ha)	Drainage Element(s)	Destination
R1	5.334	Attenuation Basin – P1_IT1, discharging to: Infiltration Trench – IT1	East
R2	13.115	Attenuation Basin – P2_IB1, discharging to: Infiltration Basin – IB1	East
R3	9.489	Attenuation Basin – P3_IT2, discharging to: Infiltration Trench – IT2	East
R4	5.483	Infiltration Trench – IT3	East
R5	8.353	Infiltration Trench – IT4	West
R6	2.978	Infiltration Basin – IB2	West
R7	2.942	Infiltration Basin – IB3	West

Table 3.2 Infiltration Trench Dimensions

Reference	Invert level (mAOD)	Maximum Groundwater level (mAOD)	Ground level (mAOD)	Depth (m)	Width (m)	Length (m)	Infiltration rate (m/hr)
IT1	21.0	~20	21.7	0.7	3.5	176	0.33
IT2	15.7	14.6	16.8	1.1	4	177	0.45
IT3	15.4	13.8	16.5	1.1	2.5	270	0.57
IT4	17.9	16.8	20.3	2.4	5	560	0.10

Note: all infiltration trenches assumed to be gravel-filled with porosity of 30%

Table 3.3 Basin Dimensions

Reference	Type	Base level (mAOD)	Max ground-water level (mAOD)	Ground level (mAOD)	Depth (m)	Footprint (m^2)	Volume (m^3)	Infiltration rate (m/hr)	Discharge rate (l/s)
P1_IT1	Attenuation	21.0	n/a	22.0	1	1654	1447	n/a	36
P2_IB1	Attenuation	19.1	n/a	20.6	1.5	11442	15916	n/a	55
IB1	Infiltration	19	~18	19.5	0.5	1445	673	0.14	n/a
P3_IT2	Attenuation	15.7	n/a	17.1	1.4	3300	4047	n/a	62
IB2	Infiltration	18.32	17.32	19	0.68	967	600	0.24	n/a
IB3	Infiltration	18.32	17.32	19	0.68	910	548	0.24	n/a

Note: all basins assumed to have side slopes of 1:3 gradient

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4 Updated Restoration Flow Exceedance Routes

As can be demonstrated by the MicroDrainage calculations (Appendix B), conservative assumptions have been made throughout the design process, such as assuming that the inert fill material does not have any infiltration potential, and the use of a factor of safety of 2 when applying infiltration rates. In the event that the capacity of the SuDS features described here are exceeded, exceedance flows would be eastwards and westward, radially from the Site, in line with the current surface water flood risk mapping for the site. As outlined in the FRA (Stantec, 2021), due to the existing site contours, 53% of the land cover drains to the River Hamble to the east, while 47% of the land drains to the west, to Southampton Water. Under the restoration topography, sub-catchments R1 to R4 drain to the east, which have a 66% proportion of the site land cover, whereas sub-catchments R5 to R7 drain to the west, which have a 34% proportion of the site land cover.

The proposed updated restoration flow exceedance routes are illustrated in Appendix C. While these flow routes are the same as in the baseline scenario, changes in topography mean that a larger area will drain to the eastern catchment compared to the western catchment. As surface water drainage will be along known surface water drainage routes, avoiding properties downslope of the site, and there is no surface water discharge contribution from the site in events up to the design 1 in 100 year + Climate Change event due to the infiltration features, it is anticipated that the change in topography in the restoration phase does not represent an increase in surface water flood risk when compared to baseline surface water flood risk.

5 Conclusions

CEMEX is proposing to extract sand and gravel from the former Hamble Airfield Site near Southampton, Hampshire. The Site would be progressively worked and restored back to levels comparable with the current topography.

Following further work to demonstrate the restoration phase groundwater levels and to measure the infiltration rate at several locations on the perimeter of the site, the restoration plan for surface water has been updated to account for groundwater levels, observed infiltration rates and a slightly increased Climate Change allowance.

Dimensions of the proposed restoration phase SUDS features have been provided and calculations have been provided to demonstrate the surface water features' effectiveness for a 1 in 100 year + 45% Climate Change design storm event. An exceedance flow diagram has also been updated to demonstrate the flow pathways for storm events that exceed the design storm event, demonstrating that it is anticipated that exceedance flow continues to follow the route of existing surface water, by comparing the exceedance flow routes with the Environment Agency surface water flood maps.

6 References

CIRIA, 2015. The SuDS Manual. Reference: Report C753

Stantec, 2021. Hamble Airfield Quarry – Flood Risk Assessment. November 2021

Stantec, 2022a. Proposed extraction of sand and gravel at Hamble Airfield: further response to consultee queries. Our ref: 331201108pbond002. 23 June 2022.

Stantec, 2022b. Hamble Quarry: Infiltration Testing. Reference: 331201108R6. October 2022.

UK Government, 2022. Flood risk assessments: climate change allowances. Accessed at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

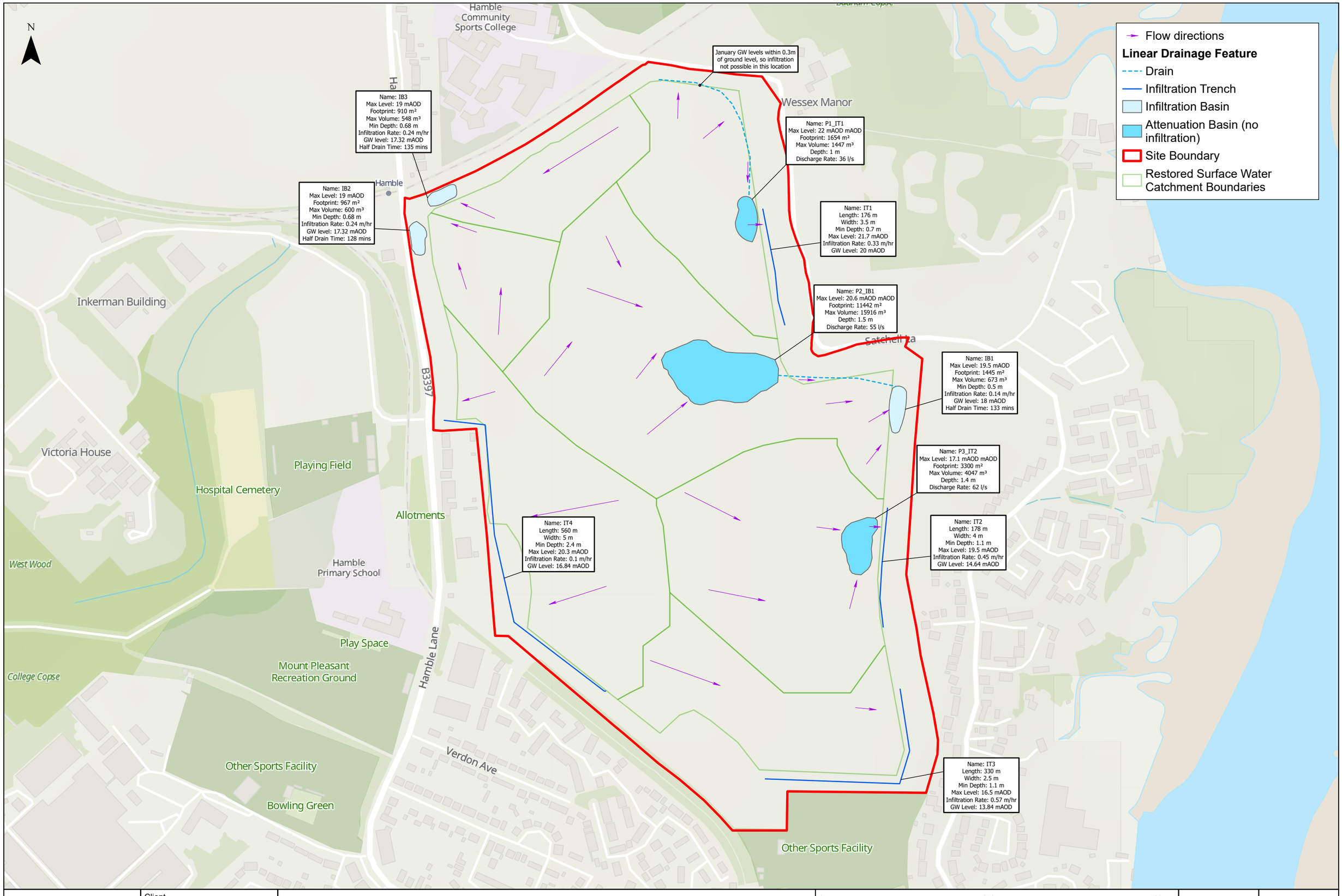
Stantec, 2023. Hamble Quarry: Groundwater Flow. Reference: 331201108TN2. May 2023.

Appendices

Appendix A

Updated Drainage Layout

Report Reference: 666789
Report Status: Final



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Client: CEMEX

HAMBLE QUARRY

Updated Restored Drainage Layout

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Appendix A | Rev: A

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Appendix B

MicroDrainage Calculations

01 – Attenuation Basin 1 (P1_IT1)

02 – Infiltration Trench IT1

03 – Attenuation Basin 2 (P2_IB1)

04 – Infiltration Basin IB1

05 – Attenuation Basin 3 (P3_IT2)

06 – Infiltration Trench IT2

07 – Infiltration Trench IT3

08 – Infiltration Trench IT4

09 – Infiltration Basin IB2

10 – Infiltration Basin IB3

Cascade Summary of Results for Restored - Pond1_to_IT1.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Restored - IT1_v5.SRCX	Restored - IT1_v5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	21.209	0.209	27.8	269.3	O K
30 min Summer	21.249	0.249	34.1	323.3	O K
60 min Summer	21.296	0.296	35.4	387.3	O K
120 min Summer	21.404	0.404	36.0	537.0	O K
180 min Summer	21.495	0.495	36.0	666.6	O K
240 min Summer	21.574	0.574	36.0	781.1	O K
360 min Summer	21.705	0.705	36.0	977.8	Flood Risk
480 min Summer	21.803	0.803	36.0	1129.6	Flood Risk
600 min Summer	21.872	0.872	36.0	1239.4	Flood Risk
720 min Summer	21.926	0.926	36.0	1325.8	Flood Risk
960 min Summer	21.934	0.934	36.0	1339.7	Flood Risk
1440 min Summer	21.912	0.912	36.0	1303.7	Flood Risk
2160 min Summer	21.893	0.893	36.0	1272.4	Flood Risk
2880 min Summer	21.854	0.854	36.0	1210.9	Flood Risk
4320 min Summer	21.861	0.861	36.0	1221.9	Flood Risk
5760 min Summer	21.804	0.804	36.0	1131.2	Flood Risk
7200 min Summer	21.770	0.770	36.0	1078.8	Flood Risk
8640 min Summer	21.706	0.706	36.0	980.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	780.5	207
30 min Summer	92.702	0.0	958.9	217
60 min Summer	57.398	0.0	1400.0	250
120 min Summer	35.539	0.0	1762.5	324
180 min Summer	26.848	0.0	2041.3	384
240 min Summer	22.004	0.0	2280.2	436
360 min Summer	16.624	0.0	2687.9	536
480 min Summer	13.624	0.0	3019.2	632
600 min Summer	11.676	0.0	3307.1	726
720 min Summer	10.293	0.0	3562.4	832
960 min Summer	8.164	0.0	3787.4	1044
1440 min Summer	5.889	0.0	4075.8	1426
2160 min Summer	4.248	0.0	5499.5	1824
2880 min Summer	3.369	0.0	5905.9	2248
4320 min Summer	2.508	0.0	6742.4	3128
5760 min Summer	2.035	0.0	8338.0	4024
7200 min Summer	1.730	0.0	9173.6	4920
8640 min Summer	1.515	0.0	9869.6	5680

Cascade Summary of Results for Restored - Pond1_to_IT1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	21.196	0.196	25.6	252.7	O K
30 min Winter	21.230	0.230	31.3	298.2	O K
60 min Winter	21.275	0.275	35.1	357.6	O K
120 min Winter	21.415	0.415	36.0	551.1	O K
180 min Winter	21.526	0.526	36.0	710.9	O K
240 min Winter	21.628	0.628	36.0	860.9	O K
360 min Winter	21.809	0.809	36.0	1139.4	Flood Risk
480 min Winter	21.889	0.889	36.0	1266.4	Flood Risk
600 min Winter	21.947	0.947	36.0	1361.0	Flood Risk
720 min Winter	21.992	0.992	36.0	1434.3	Flood Risk
960 min Winter	21.997	0.997	36.0	1441.9	Flood Risk
1440 min Winter	21.972	0.972	36.0	1400.7	Flood Risk
2160 min Winter	21.898	0.898	36.0	1280.8	Flood Risk
2880 min Winter	21.804	0.804	36.0	1131.4	Flood Risk
4320 min Winter	21.647	0.647	36.0	890.4	O K
5760 min Winter	21.459	0.459	36.0	614.0	O K
7200 min Winter	21.353	0.353	35.9	464.6	O K
8640 min Winter	21.282	0.282	35.2	367.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	149.721	0.0	771.3	209
30 min Winter	92.702	0.0	926.0	217
60 min Winter	57.398	0.0	1399.0	244
120 min Winter	35.539	0.0	1874.6	328
180 min Winter	26.848	0.0	2209.8	388
240 min Winter	22.004	0.0	2511.0	442
360 min Winter	16.624	0.0	3053.8	546
480 min Winter	13.624	0.0	3378.4	634
600 min Winter	11.676	0.0	3658.4	726
720 min Winter	10.293	0.0	3906.4	826
960 min Winter	8.164	0.0	4148.5	1032
1440 min Winter	5.889	0.0	4483.2	1440
2160 min Winter	4.248	0.0	5899.9	1872
2880 min Winter	3.369	0.0	6248.2	2352
4320 min Winter	2.508	0.0	6937.8	3204
5760 min Winter	2.035	0.0	8339.0	3936
7200 min Winter	1.730	0.0	9017.3	4656
8640 min Winter	1.515	0.0	9573.0	5352

Cascade Rainfall Details for Restored - Pond1_to_IT1.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - Pond1_to_IT1.SRCX

Storage is Online Cover Level (m) 22.000

Tank or Pond Structure

Invert Level (m) 21.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1250.0	1.000	1654.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0256-3600-1000-3600
Design Head (m)	1.000
Design Flow (l/s)	36.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	256
Invert Level (m)	21.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	36.0
Flush-Flo™	0.401	36.0
Kick-Flo®	0.758	31.5
Mean Flow over Head Range	-	29.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.2	1.200	39.3	3.000	61.1	7.000	92.3
0.200	26.3	1.400	42.3	3.500	65.9	7.500	95.5
0.300	35.4	1.600	45.1	4.000	70.3	8.000	98.5
0.400	36.0	1.800	47.8	4.500	74.5	8.500	101.5
0.500	35.7	2.000	50.3	5.000	78.4	9.000	104.4
0.600	34.8	2.200	52.6	5.500	82.1	9.500	107.2
0.800	32.4	2.400	54.9	6.000	85.6		
1.000	36.0	2.600	57.1	6.500	89.1		

Cascade Summary of Results for Restored - IT1_v5.SRCX

Upstream Structures	Outflow To	Overflow To
Restored - Pond1_to_IT1.SRCX	(None)	(None)

Half Drain Time : 22 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	21.164	0.164	27.6	14.1	O K
30 min Summer	21.274	0.274	31.3	34.3	O K
60 min Summer	21.391	0.391	33.2	55.9	O K
120 min Summer	21.480	0.480	34.7	72.4	Flood Risk
180 min Summer	21.508	0.508	35.1	77.6	Flood Risk
240 min Summer	21.518	0.518	35.3	79.5	Flood Risk
360 min Summer	21.519	0.519	35.3	79.6	Flood Risk
480 min Summer	21.514	0.514	35.2	78.7	Flood Risk
600 min Summer	21.516	0.516	35.3	79.1	Flood Risk
720 min Summer	21.517	0.517	35.3	79.3	Flood Risk
960 min Summer	21.518	0.518	35.3	79.4	Flood Risk
1440 min Summer	21.518	0.518	35.3	79.5	Flood Risk
2160 min Summer	21.518	0.518	35.3	79.4	Flood Risk
2880 min Summer	21.517	0.517	35.3	79.3	Flood Risk
4320 min Summer	21.530	0.530	35.5	81.6	Flood Risk
5760 min Summer	21.538	0.538	35.6	83.2	Flood Risk
7200 min Summer	21.539	0.539	35.7	83.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	149.721	0.0	223
30 min Summer	92.702	0.0	292
60 min Summer	57.398	0.0	374
120 min Summer	35.539	0.0	522
180 min Summer	26.848	0.0	638
240 min Summer	22.004	0.0	762
360 min Summer	16.624	0.0	1024
480 min Summer	13.624	0.0	1284
600 min Summer	11.676	0.0	1498
720 min Summer	10.293	0.0	1692
960 min Summer	8.164	0.0	1936
1440 min Summer	5.889	0.0	2362
2160 min Summer	4.248	0.0	2980
2880 min Summer	3.369	0.0	3528
4320 min Summer	2.508	0.0	4648
5760 min Summer	2.035	0.0	5416
7200 min Summer	1.730	0.0	6192

Cascade Summary of Results for Restored - IT1_v5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	21.544	0.544	35.7	84.2	Flood Risk
15 min Winter	21.151	0.151	25.3	12.0	O K
30 min Winter	21.199	0.199	30.1	20.6	O K
60 min Winter	21.354	0.354	32.6	49.2	O K
120 min Winter	21.486	0.486	34.8	73.5	Flood Risk
180 min Winter	21.515	0.515	35.3	78.8	Flood Risk
240 min Winter	21.521	0.521	35.4	80.1	Flood Risk
360 min Winter	21.515	0.515	35.3	78.9	Flood Risk
480 min Winter	21.517	0.517	35.3	79.3	Flood Risk
600 min Winter	21.518	0.518	35.3	79.5	Flood Risk
720 min Winter	21.519	0.519	35.3	79.6	Flood Risk
960 min Winter	21.519	0.519	35.3	79.7	Flood Risk
1440 min Winter	21.519	0.519	35.3	79.7	Flood Risk
2160 min Winter	21.519	0.519	35.3	79.6	Flood Risk
2880 min Winter	21.519	0.519	35.3	79.6	Flood Risk
4320 min Winter	21.547	0.547	35.8	84.8	Flood Risk
5760 min Winter	21.557	0.557	36.0	86.7	Flood Risk
7200 min Winter	21.549	0.549	35.8	85.2	Flood Risk
8640 min Winter	21.504	0.504	35.1	76.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
8640 min Summer	1.515	0.0	6808
15 min Winter	149.721	0.0	227
30 min Winter	92.702	0.0	265
60 min Winter	57.398	0.0	346
120 min Winter	35.539	0.0	532
180 min Winter	26.848	0.0	674
240 min Winter	22.004	0.0	836
360 min Winter	16.624	0.0	1210
480 min Winter	13.624	0.0	1434
600 min Winter	11.676	0.0	1632
720 min Winter	10.293	0.0	1810
960 min Winter	8.164	0.0	2040
1440 min Winter	5.889	0.0	2454
2160 min Winter	4.248	0.0	2992
2880 min Winter	3.369	0.0	3460
4320 min Winter	2.508	0.0	4108
5760 min Winter	2.035	0.0	4400
7200 min Winter	1.730	0.0	4864
8640 min Winter	1.515	0.0	5536

Cascade Rainfall Details for Restored - IT1_v5.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - IT1_v5.SRCX

Storage is Online Cover Level (m) 21.700

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.33000	Trench Width (m)	3.5
Infiltration Coefficient Side (m/hr)	0.33000	Trench Length (m)	176.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	21.000	Cap Infiltration Depth (m)	0.000

Cascade Summary of Results for Restored - Pond2_to_IB1.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Restored - IB1_v5.SRCX	Restored - IB1_v5.SRCX

Critical storm may not be identified, please run longer storm durations.

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	19.262	0.162	17.3	1602.5	O K
30 min Summer	19.296	0.196	22.5	1944.1	O K
60 min Summer	19.328	0.228	26.7	2262.0	O K
120 min Summer	19.390	0.290	28.9	2884.5	O K
180 min Summer	19.440	0.340	29.5	3397.7	O K
240 min Summer	19.485	0.385	29.8	3856.0	O K
360 min Summer	19.567	0.467	30.0	4691.3	O K
480 min Summer	19.639	0.539	30.0	5434.7	O K
600 min Summer	19.705	0.605	30.0	6127.3	O K
720 min Summer	19.767	0.667	30.0	6778.1	O K
960 min Summer	19.829	0.729	30.0	7427.7	O K
1440 min Summer	19.924	0.824	30.0	8436.8	O K
2160 min Summer	20.054	0.954	30.0	9840.2	O K
2880 min Summer	20.145	1.045	30.0	10826.0	O K
4320 min Summer	20.342	1.242	30.0	12997.5	Flood Risk
5760 min Summer	20.447	1.347	30.0	14183.3	Flood Risk
7200 min Summer	20.547	1.447	30.0	15309.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	1154.6	384
30 min Summer	92.702	0.0	1491.1	390
60 min Summer	57.398	0.0	2942.3	406
120 min Summer	35.539	0.0	3768.0	454
180 min Summer	26.848	0.0	4287.3	518
240 min Summer	22.004	0.0	4570.5	600
360 min Summer	16.624	0.0	4639.4	872
480 min Summer	13.624	0.0	4561.7	1128
600 min Summer	11.676	0.0	4449.6	1354
720 min Summer	10.293	0.0	4329.1	1558
960 min Summer	8.164	0.0	4114.7	1828
1440 min Summer	5.889	0.0	3717.7	2308
2160 min Summer	4.248	0.0	7950.2	3044
2880 min Summer	3.369	0.0	7168.5	3696
4320 min Summer	2.508	0.0	6587.8	4776
5760 min Summer	2.035	0.0	15232.7	6016
7200 min Summer	1.730	0.0	14672.9	7368

Cascade Summary of Results for Restored - Pond2_to_IB1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
8640 min Summer	20.616	1.516	30.2	16103.0	FLOOD
15 min Winter	19.252	0.152	15.7	1506.2	O K
30 min Winter	19.282	0.182	20.5	1804.2	O K
60 min Winter	19.317	0.217	25.3	2147.6	O K
120 min Winter	19.398	0.298	29.0	2968.0	O K
180 min Winter	19.460	0.360	29.7	3600.8	O K
240 min Winter	19.520	0.420	29.9	4206.0	O K
360 min Winter	19.636	0.536	30.0	5401.1	O K
480 min Winter	19.711	0.611	30.0	6183.7	O K
600 min Winter	19.778	0.678	30.0	6894.3	O K
720 min Winter	19.841	0.741	30.0	7552.8	O K
960 min Winter	19.908	0.808	30.0	8263.1	O K
1440 min Winter	20.016	0.916	30.0	9428.2	O K
2160 min Winter	20.131	1.031	30.0	10672.1	O K
2880 min Winter	20.193	1.093	30.0	11348.6	O K
4320 min Winter	20.334	1.234	30.0	12917.3	Flood Risk
5760 min Winter	20.393	1.293	30.0	13566.5	Flood Risk
7200 min Winter	20.447	1.347	30.0	14180.8	Flood Risk
8640 min Winter	20.477	1.377	30.0	14517.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.515	186.8	14259.5	8760
15 min Winter	149.721	0.0	1097.4	392
30 min Winter	92.702	0.0	1392.4	396
60 min Winter	57.398	0.0	2886.1	412
120 min Winter	35.539	0.0	3968.6	464
180 min Winter	26.848	0.0	4517.3	552
240 min Winter	22.004	0.0	4705.2	746
360 min Winter	16.624	0.0	4688.6	1100
480 min Winter	13.624	0.0	4582.9	1330
600 min Winter	11.676	0.0	4469.3	1534
720 min Winter	10.293	0.0	4356.8	1722
960 min Winter	8.164	0.0	4165.0	1984
1440 min Winter	5.889	0.0	3808.0	2482
2160 min Winter	4.248	0.0	7905.8	3176
2880 min Winter	3.369	0.0	7538.5	3668
4320 min Winter	2.508	0.0	7212.2	4700
5760 min Winter	2.035	0.0	16045.9	5904
7200 min Winter	1.730	0.0	15447.6	7224
8640 min Winter	1.515	0.0	15054.9	8536

Cascade Rainfall Details for Restored - Pond2_to_IB1.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - Pond2_to_IB1.SRCX

Storage is Online Cover Level (m) 20.600

Tank or Pond Structure

Invert Level (m) 19.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	9800.0	1.500	11442.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0230-3000-1500-3000
Design Head (m)	1.500
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	230
Invert Level (m)	19.100
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	30.0
Flush-Flo™	0.462	30.0
Kick-Flo®	1.016	24.9
Mean Flow over Head Range	-	25.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	27.0	3.000	41.9	7.000	63.1
0.200	23.1	1.400	29.0	3.500	45.1	7.500	65.2
0.300	29.0	1.600	30.9	4.000	48.1	8.000	67.3
0.400	29.9	1.800	32.7	4.500	50.9	8.500	69.3
0.500	29.9	2.000	34.4	5.000	53.6	9.000	71.3
0.600	29.6	2.200	36.0	5.500	56.1	9.500	73.2
0.800	28.5	2.400	37.6	6.000	58.5		
1.000	25.4	2.600	39.1	6.500	60.8		

Cascade Summary of Results for Restored - IB1_v5.SRCX

Upstream Structures	Outflow To	Overflow To
Restored - Pond2_to_IB1.SRCX	(None)	(None)

Half Drain Time : 129 minutes.

Critical storm may not be identified, please run longer storm durations.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	19.034	0.034	17.1	42.7	O K
30 min Summer	19.045	0.045	22.4	56.0	O K
60 min Summer	19.062	0.062	25.3	77.6	O K
120 min Summer	19.165	0.165	26.8	211.9	O K
180 min Summer	19.221	0.221	27.7	285.9	Flood Risk
240 min Summer	19.257	0.257	28.3	333.6	Flood Risk
360 min Summer	19.300	0.300	28.9	391.7	Flood Risk
480 min Summer	19.306	0.306	29.0	401.0	Flood Risk
600 min Summer	19.296	0.296	28.9	387.0	Flood Risk
720 min Summer	19.281	0.281	28.6	365.9	Flood Risk
960 min Summer	19.260	0.260	28.3	338.4	Flood Risk
1440 min Summer	19.223	0.223	27.7	288.8	Flood Risk
2160 min Summer	19.235	0.235	27.9	304.6	Flood Risk
2880 min Summer	19.178	0.178	27.0	229.0	O K
4320 min Summer	19.175	0.175	27.0	225.0	O K
5760 min Summer	19.229	0.229	27.8	296.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	149.721	0.0	439
30 min Summer	92.702	0.0	444
60 min Summer	57.398	0.0	652
120 min Summer	35.539	0.0	1406
180 min Summer	26.848	0.0	2010
240 min Summer	22.004	0.0	2402
360 min Summer	16.624	0.0	2880
480 min Summer	13.624	0.0	2880
600 min Summer	11.676	0.0	2880
720 min Summer	10.293	0.0	2880
960 min Summer	8.164	0.0	2880
1440 min Summer	5.889	0.0	2880
2160 min Summer	4.248	0.0	5760
2880 min Summer	3.369	0.0	2644
4320 min Summer	2.508	0.0	5760
5760 min Summer	2.035	0.0	7200

Cascade Summary of Results for Restored - IB1_v5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Summer	19.287	0.287	28.7	374.5	Flood Risk
8640 min Summer	19.333	0.333	29.5	436.9	Flood Risk
15 min Winter	19.031	0.031	15.6	39.2	O K
30 min Winter	19.041	0.041	20.4	50.9	O K
60 min Winter	19.050	0.050	24.9	62.9	O K
120 min Winter	19.183	0.183	27.1	234.9	O K
180 min Winter	19.243	0.243	28.1	315.5	Flood Risk
240 min Winter	19.282	0.282	28.7	367.3	Flood Risk
360 min Winter	19.309	0.309	29.1	404.8	Flood Risk
480 min Winter	19.298	0.298	28.9	389.8	Flood Risk
600 min Winter	19.281	0.281	28.7	366.7	Flood Risk
720 min Winter	19.263	0.263	28.4	341.5	Flood Risk
960 min Winter	19.237	0.237	28.0	307.1	Flood Risk
1440 min Winter	19.182	0.182	27.1	233.3	O K
2160 min Winter	19.171	0.171	26.9	219.3	O K
2880 min Winter	19.181	0.181	27.1	232.5	O K
4320 min Winter	19.197	0.197	27.3	254.1	O K
5760 min Winter	19.236	0.236	27.9	305.5	Flood Risk
7200 min Winter	19.236	0.236	27.9	305.0	Flood Risk
8640 min Winter	19.257	0.257	28.3	333.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Summer	1.730	0.0	8512
8640 min Summer	1.515	0.0	9744
15 min Winter	149.721	0.0	539
30 min Winter	92.702	0.0	445
60 min Winter	57.398	0.0	490
120 min Winter	35.539	0.0	1590
180 min Winter	26.848	0.0	2262
240 min Winter	22.004	0.0	2684
360 min Winter	16.624	0.0	2880
480 min Winter	13.624	0.0	2880
600 min Winter	11.676	0.0	2880
720 min Winter	10.293	0.0	2880
960 min Winter	8.164	0.0	2880
1440 min Winter	5.889	0.0	2880
2160 min Winter	4.248	0.0	2088
2880 min Winter	3.369	0.0	2440
4320 min Winter	2.508	0.0	3088
5760 min Winter	2.035	0.0	11520
7200 min Winter	1.730	0.0	8152
8640 min Winter	1.515	0.0	9384

Cascade Rainfall Details for Restored - IB1_v5.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - IB1_v5.SRCX

Storage is Online Cover Level (m) 19.500

Infiltration Basin Structure

Invert Level (m) 19.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.14000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.14000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1250.0	0.500	1445.1

Cascade Summary of Results for Restored - Pond3_to_IT2.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Restored - IT2_v5.SRCX	Restored - IT2_v5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.964	0.264	49.1	679.1	O K
30 min Summer	16.018	0.318	59.5	820.9	O K
60 min Summer	16.081	0.381	61.0	992.5	O K
120 min Summer	16.217	0.517	62.0	1365.2	O K
180 min Summer	16.327	0.627	62.0	1674.5	O K
240 min Summer	16.421	0.721	62.0	1943.7	O K
360 min Summer	16.576	0.876	62.0	2399.6	O K
480 min Summer	16.696	0.996	62.0	2763.3	O K
600 min Summer	16.795	1.095	62.0	3069.5	O K
720 min Summer	16.874	1.174	62.0	3317.0	Flood Risk
960 min Summer	16.913	1.213	62.0	3441.4	Flood Risk
1440 min Summer	16.935	1.235	62.0	3512.0	Flood Risk
2160 min Summer	16.940	1.240	62.0	3526.9	Flood Risk
2880 min Summer	16.906	1.206	62.0	3418.2	Flood Risk
4320 min Summer	16.945	1.245	62.0	3543.5	Flood Risk
5760 min Summer	16.912	1.212	62.0	3435.9	Flood Risk
7200 min Summer	16.910	1.210	62.0	3430.8	Flood Risk
8640 min Summer	16.897	1.197	62.0	3391.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	1544.0	234
30 min Summer	92.702	0.0	1909.1	247
60 min Summer	57.398	0.0	2734.9	290
120 min Summer	35.539	0.0	3460.2	356
180 min Summer	26.848	0.0	4019.9	410
240 min Summer	22.004	0.0	4501.0	458
360 min Summer	16.624	0.0	5325.0	552
480 min Summer	13.624	0.0	5997.3	656
600 min Summer	11.676	0.0	6582.9	762
720 min Summer	10.293	0.0	7101.0	870
960 min Summer	8.164	0.0	7550.1	1084
1440 min Summer	5.889	0.0	7808.1	1532
2160 min Summer	4.248	0.0	10785.9	2144
2880 min Summer	3.369	0.0	11626.9	2516
4320 min Summer	2.508	0.0	13351.8	3356
5760 min Summer	2.035	0.0	16225.5	4208
7200 min Summer	1.730	0.0	17893.3	5072
8640 min Summer	1.515	0.0	19309.7	5928

Cascade Summary of Results for Restored - Pond3_to_IT2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	15.948	0.248	45.2	637.0	O K
30 min Winter	15.993	0.293	55.5	756.8	O K
60 min Winter	16.055	0.355	60.4	921.3	O K
120 min Winter	16.233	0.533	62.0	1410.0	O K
180 min Winter	16.368	0.668	62.0	1791.2	O K
240 min Winter	16.488	0.788	62.0	2141.1	O K
360 min Winter	16.704	1.004	62.0	2788.2	O K
480 min Winter	16.816	1.116	62.0	3134.7	Flood Risk
600 min Winter	16.900	1.200	62.0	3399.1	Flood Risk
720 min Winter	16.968	1.268	62.0	3617.1	Flood Risk
960 min Winter	17.003	1.303	62.0	3728.8	Flood Risk
1440 min Winter	17.023	1.323	62.0	3795.7	Flood Risk
2160 min Winter	16.977	1.277	62.0	3644.7	Flood Risk
2880 min Winter	16.887	1.187	62.0	3357.0	Flood Risk
4320 min Winter	16.809	1.109	62.0	3111.6	Flood Risk
5760 min Winter	16.594	0.894	62.0	2454.1	O K
7200 min Winter	16.448	0.748	62.0	2024.1	O K
8640 min Winter	16.317	0.617	62.0	1645.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	149.721	0.0	1504.2	239
30 min Winter	92.702	0.0	1823.7	245
60 min Winter	57.398	0.0	2710.6	282
120 min Winter	35.539	0.0	3669.3	358
180 min Winter	26.848	0.0	4346.8	412
240 min Winter	22.004	0.0	4956.5	464
360 min Winter	16.624	0.0	6057.7	570
480 min Winter	13.624	0.0	6718.8	664
600 min Winter	11.676	0.0	7288.2	762
720 min Winter	10.293	0.0	7787.0	864
960 min Winter	8.164	0.0	8245.7	1072
1440 min Winter	5.889	0.0	8281.8	1506
2160 min Winter	4.248	0.0	11582.0	2136
2880 min Winter	3.369	0.0	12308.5	2528
4320 min Winter	2.508	0.0	13770.8	3460
5760 min Winter	2.035	0.0	16239.9	4264
7200 min Winter	1.730	0.0	17597.7	5056
8640 min Winter	1.515	0.0	18733.2	5816

Cascade Rainfall Details for Restored - Pond3_to_IT2.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - Pond3_to_IT2.SRCX

Storage is Online Cover Level (m) 17.100

Tank or Pond Structure

Invert Level (m) 15.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2500.0	1.400	3299.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0318-6200-1400-6200
Design Head (m)	1.400
Design Flow (l/s)	62.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	318
Invert Level (m)	15.700
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	62.0
Flush-Flo™	0.515	62.0
Kick-Flo®	1.030	53.4
Mean Flow over Head Range	-	51.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.5	1.200	57.5	3.000	89.7	7.000	135.5
0.200	32.5	1.400	62.0	3.500	96.6	7.500	140.2
0.300	56.9	1.600	66.1	4.000	103.1	8.000	144.7
0.400	61.2	1.800	70.0	4.500	109.2	8.500	149.0
0.500	62.0	2.000	73.6	5.000	115.0	9.000	153.2
0.600	61.7	2.200	77.1	5.500	120.5	9.500	157.4
0.800	59.8	2.400	80.5	6.000	125.7		
1.000	54.9	2.600	83.6	6.500	130.7		

Cascade Summary of Results for Restored - IT2_v5.SRCX

Upstream Structures	Outflow To	Overflow To
Restored - Pond3_to_IT2.SRCX	(None)	(None)

Half Drain Time : 25 minutes.

Critical storm may not be identified, please run longer storm durations.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	15.922	0.222	47.3	28.3	O K
30 min Summer	16.229	0.529	54.2	93.7	O K
60 min Summer	16.382	0.682	57.7	126.1	O K
120 min Summer	16.495	0.795	60.2	150.1	O K
180 min Summer	16.532	0.832	61.1	157.9	Flood Risk
240 min Summer	16.545	0.845	61.4	160.6	Flood Risk
360 min Summer	16.549	0.849	61.5	161.6	Flood Risk
480 min Summer	16.548	0.848	61.4	161.3	Flood Risk
600 min Summer	16.546	0.846	61.4	160.9	Flood Risk
720 min Summer	16.546	0.846	61.4	160.8	Flood Risk
960 min Summer	16.545	0.845	61.4	160.8	Flood Risk
1440 min Summer	16.545	0.845	61.4	160.7	Flood Risk
2160 min Summer	16.545	0.845	61.4	160.6	Flood Risk
2880 min Summer	16.545	0.845	61.4	160.6	Flood Risk
4320 min Summer	16.544	0.844	61.3	160.4	Flood Risk
5760 min Summer	16.548	0.848	61.4	161.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	149.721	0.0	291
30 min Summer	92.702	0.0	347
60 min Summer	57.398	0.0	432
120 min Summer	35.539	0.0	582
180 min Summer	26.848	0.0	712
240 min Summer	22.004	0.0	854
360 min Summer	16.624	0.0	1158
480 min Summer	13.624	0.0	1462
600 min Summer	11.676	0.0	1752
720 min Summer	10.293	0.0	2000
960 min Summer	8.164	0.0	2284
1440 min Summer	5.889	0.0	2760
2160 min Summer	4.248	0.0	3432
2880 min Summer	3.369	0.0	4012
4320 min Summer	2.508	0.0	5260
5760 min Summer	2.035	0.0	6296

Cascade Summary of Results for Restored - IT2_v5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Summer	16.558	0.858	61.7	163.4	Flood Risk
8640 min Summer	16.558	0.858	61.7	163.4	Flood Risk
15 min Winter	15.873	0.173	45.1	17.9	O K
30 min Winter	16.092	0.392	51.1	64.5	O K
60 min Winter	16.340	0.640	56.7	117.2	O K
120 min Winter	16.505	0.805	60.5	152.1	Flood Risk
180 min Winter	16.540	0.840	61.3	159.6	Flood Risk
240 min Winter	16.549	0.849	61.5	161.6	Flood Risk
360 min Winter	16.548	0.848	61.4	161.4	Flood Risk
480 min Winter	16.547	0.847	61.4	161.0	Flood Risk
600 min Winter	16.546	0.846	61.4	160.9	Flood Risk
720 min Winter	16.545	0.845	61.4	160.8	Flood Risk
960 min Winter	16.545	0.845	61.4	160.7	Flood Risk
1440 min Winter	16.544	0.844	61.3	160.5	Flood Risk
2160 min Winter	16.545	0.845	61.4	160.6	Flood Risk
2880 min Winter	16.545	0.845	61.4	160.7	Flood Risk
4320 min Winter	16.546	0.846	61.4	160.9	Flood Risk
5760 min Winter	16.563	0.863	61.8	164.5	Flood Risk
7200 min Winter	16.565	0.865	61.8	164.9	Flood Risk
8640 min Winter	16.569	0.869	61.9	165.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Summer	1.730	0.0	7280
8640 min Summer	1.515	0.0	8096
15 min Winter	149.721	0.0	249
30 min Winter	92.702	0.0	334
60 min Winter	57.398	0.0	406
120 min Winter	35.539	0.0	596
180 min Winter	26.848	0.0	758
240 min Winter	22.004	0.0	950
360 min Winter	16.624	0.0	1394
480 min Winter	13.624	0.0	1702
600 min Winter	11.676	0.0	1954
720 min Winter	10.293	0.0	2174
960 min Winter	8.164	0.0	2440
1440 min Winter	5.889	0.0	2880
2160 min Winter	4.248	0.0	3472
2880 min Winter	3.369	0.0	3964
4320 min Winter	2.508	0.0	5032
5760 min Winter	2.035	0.0	5536
7200 min Winter	1.730	0.0	6024
8640 min Winter	1.515	0.0	6512

Cascade Rainfall Details for Restored - IT2_v5.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Cascade Model Details for Restored - IT2_v5.SRCX

Storage is Online Cover Level (m) 16.800

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.45000	Trench Width (m)	4.0
Infiltration Coefficient Side (m/hr)	0.45000	Trench Length (m)	177.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	15.700	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 15 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	15.697	0.297	65.8	33.0	O K
30 min Summer	15.749	0.349	73.0	45.4	O K
60 min Summer	15.783	0.383	74.7	53.4	O K
120 min Summer	15.900	0.500	80.7	81.7	O K
180 min Summer	15.996	0.596	85.6	104.6	O K
240 min Summer	16.066	0.666	89.2	121.4	O K
360 min Summer	16.152	0.752	93.5	142.1	O K
480 min Summer	16.193	0.793	95.7	152.0	O K
600 min Summer	16.218	0.818	96.9	157.9	Flood Risk
720 min Summer	16.231	0.831	97.6	161.1	Flood Risk
960 min Summer	16.146	0.746	93.2	140.6	O K
1440 min Summer	15.987	0.587	85.1	102.4	O K
2160 min Summer	15.825	0.425	76.9	63.5	O K
2880 min Summer	15.715	0.315	70.2	37.2	O K
4320 min Summer	15.682	0.282	62.1	29.7	O K
5760 min Summer	15.653	0.253	55.2	24.0	O K
7200 min Summer	15.637	0.237	51.3	21.1	O K
8640 min Summer	15.624	0.224	48.4	18.8	O K
15 min Winter	15.673	0.273	59.9	27.9	O K
30 min Winter	15.710	0.310	69.1	36.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	123
30 min Summer	92.702	0.0	135
60 min Summer	57.398	0.0	156
120 min Summer	35.539	0.0	204
180 min Summer	26.848	0.0	248
240 min Summer	22.004	0.0	288
360 min Summer	16.624	0.0	362
480 min Summer	13.624	0.0	428
600 min Summer	11.676	0.0	496
720 min Summer	10.293	0.0	562
960 min Summer	8.164	0.0	692
1440 min Summer	5.889	0.0	950
2160 min Summer	4.248	0.0	1324
2880 min Summer	3.369	0.0	1664
4320 min Summer	2.508	0.0	2408
5760 min Summer	2.035	0.0	3160
7200 min Summer	1.730	0.0	3920
8640 min Summer	1.515	0.0	4664
15 min Winter	149.721	0.0	123
30 min Winter	92.702	0.0	134

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	15.737	0.337	72.4	42.6	O K
120 min Winter	15.894	0.494	80.4	80.2	O K
180 min Winter	16.018	0.618	86.7	109.8	O K
240 min Winter	16.117	0.717	91.8	133.7	O K
360 min Winter	16.257	0.857	98.9	167.4	Flood Risk
480 min Winter	16.257	0.857	98.9	167.2	Flood Risk
600 min Winter	16.238	0.838	97.9	162.7	Flood Risk
720 min Winter	16.211	0.811	96.6	156.2	Flood Risk
960 min Winter	16.071	0.671	89.4	122.5	O K
1440 min Winter	15.849	0.449	78.1	69.4	O K
2160 min Winter	15.699	0.299	66.4	33.6	O K
2880 min Winter	15.662	0.262	57.3	25.6	O K
4320 min Winter	15.625	0.225	48.5	18.9	O K
5760 min Winter	15.598	0.198	42.4	14.7	O K
7200 min Winter	15.583	0.183	38.8	12.5	O K
8640 min Winter	15.571	0.171	36.2	11.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	57.398	0.0	154
120 min Winter	35.539	0.0	204
180 min Winter	26.848	0.0	248
240 min Winter	22.004	0.0	290
360 min Winter	16.624	0.0	368
480 min Winter	13.624	0.0	438
600 min Winter	11.676	0.0	508
720 min Winter	10.293	0.0	578
960 min Winter	8.164	0.0	712
1440 min Winter	5.889	0.0	976
2160 min Winter	4.248	0.0	1332
2880 min Winter	3.369	0.0	1728
4320 min Winter	2.508	0.0	2500
5760 min Winter	2.035	0.0	3360
7200 min Winter	1.730	0.0	4176
8640 min Winter	1.515	0.0	5000

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Model Details

Storage is Online Cover Level (m) 16.500

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.57000	Trench Width (m)	2.5
Infiltration Coefficient Side (m/hr)	0.57000	Trench Length (m)	320.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	15.400	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 228 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	18.519	0.619	45.1	285.1	O K
30 min Summer	18.662	0.762	47.4	405.0	O K
60 min Summer	18.801	0.901	49.6	522.0	O K
120 min Summer	19.072	1.172	54.0	749.4	O K
180 min Summer	19.280	1.380	57.3	924.1	O K
240 min Summer	19.452	1.552	60.0	1068.3	O K
360 min Summer	19.722	1.822	64.4	1295.7	O K
480 min Summer	19.909	2.009	67.3	1452.7	O K
600 min Summer	20.038	2.138	69.4	1560.3	Flood Risk
720 min Summer	20.127	2.227	70.8	1635.5	Flood Risk
960 min Summer	20.086	2.186	70.2	1600.9	Flood Risk
1440 min Summer	19.999	2.099	68.8	1528.2	O K
2160 min Summer	19.936	2.036	67.8	1475.0	O K
2880 min Summer	19.834	1.934	66.1	1389.5	O K
4320 min Summer	19.802	1.902	65.6	1362.3	O K
5760 min Summer	19.673	1.773	63.6	1253.9	O K
7200 min Summer	19.607	1.707	62.5	1199.0	O K
8640 min Summer	19.540	1.640	61.4	1142.1	O K
15 min Winter	18.475	0.575	44.4	247.6	O K
30 min Winter	18.591	0.691	46.2	344.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	200
30 min Summer	92.702	0.0	229
60 min Summer	57.398	0.0	268
120 min Summer	35.539	0.0	328
180 min Summer	26.848	0.0	378
240 min Summer	22.004	0.0	422
360 min Summer	16.624	0.0	508
480 min Summer	13.624	0.0	596
600 min Summer	11.676	0.0	686
720 min Summer	10.293	0.0	774
960 min Summer	8.164	0.0	918
1440 min Summer	5.889	0.0	1184
2160 min Summer	4.248	0.0	1596
2880 min Summer	3.369	0.0	2012
4320 min Summer	2.508	0.0	2856
5760 min Summer	2.035	0.0	3688
7200 min Summer	1.730	0.0	4512
8640 min Summer	1.515	0.0	5320
15 min Winter	149.721	0.0	193
30 min Winter	92.702	0.0	221

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	18.735	0.835	48.5	465.9	O K
120 min Winter	19.088	1.188	54.2	763.1	O K
180 min Winter	19.340	1.440	58.2	974.6	O K
240 min Winter	19.560	1.660	61.8	1158.9	O K
360 min Winter	19.931	2.031	67.7	1470.7	O K
480 min Winter	20.098	2.198	70.4	1611.4	Flood Risk
600 min Winter	20.210	2.310	72.2	1705.4	Flood Risk
720 min Winter	20.285	2.385	73.4	1767.9	Flood Risk
960 min Winter	20.231	2.331	72.5	1722.8	Flood Risk
1440 min Winter	20.118	2.218	70.7	1628.0	Flood Risk
2160 min Winter	19.929	2.029	67.7	1469.4	O K
2880 min Winter	19.724	1.824	64.4	1296.7	O K
4320 min Winter	19.507	1.607	60.9	1114.5	O K
5760 min Winter	19.249	1.349	56.8	897.9	O K
7200 min Winter	19.080	1.180	54.1	756.3	O K
8640 min Winter	18.933	1.033	51.7	632.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	57.398	0.0	260
120 min Winter	35.539	0.0	330
180 min Winter	26.848	0.0	378
240 min Winter	22.004	0.0	422
360 min Winter	16.624	0.0	508
480 min Winter	13.624	0.0	594
600 min Winter	11.676	0.0	684
720 min Winter	10.293	0.0	776
960 min Winter	8.164	0.0	940
1440 min Winter	5.889	0.0	1224
2160 min Winter	4.248	0.0	1680
2880 min Winter	3.369	0.0	2128
4320 min Winter	2.508	0.0	3016
5760 min Winter	2.035	0.0	3880
7200 min Winter	1.730	0.0	4728
8640 min Winter	1.515	0.0	5560

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Model Details

Storage is Online Cover Level (m) 20.300

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.10200	Trench Width (m)	5.0
Infiltration Coefficient Side (m/hr)	0.10200	Trench Length (m)	560.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	17.900	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 128 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	18.386	0.086	26.8	65.4	O K
30 min Summer	18.431	0.131	27.7	100.7	O K
60 min Summer	18.479	0.179	28.7	138.9	O K
120 min Summer	18.574	0.274	30.7	216.3	O K
180 min Summer	18.644	0.344	32.2	275.8	O K
240 min Summer	18.701	0.401	33.4	325.0	Flood Risk
360 min Summer	18.787	0.487	35.3	400.5	Flood Risk
480 min Summer	18.837	0.537	36.4	446.5	Flood Risk
600 min Summer	18.869	0.569	37.0	475.4	Flood Risk
720 min Summer	18.889	0.589	37.5	494.0	Flood Risk
960 min Summer	18.863	0.563	36.9	470.5	Flood Risk
1440 min Summer	18.814	0.514	35.8	425.0	Flood Risk
2160 min Summer	18.761	0.461	34.7	377.5	Flood Risk
2880 min Summer	18.698	0.398	33.4	322.1	O K
4320 min Summer	18.639	0.339	32.1	271.4	O K
5760 min Summer	18.561	0.261	30.4	206.1	O K
7200 min Summer	18.512	0.212	29.4	166.0	O K
8640 min Summer	18.469	0.169	28.5	131.2	O K
15 min Winter	18.374	0.074	26.5	55.9	O K
30 min Winter	18.408	0.108	27.2	82.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	152
30 min Summer	92.702	0.0	188
60 min Summer	57.398	0.0	222
120 min Summer	35.539	0.0	278
180 min Summer	26.848	0.0	330
240 min Summer	22.004	0.0	380
360 min Summer	16.624	0.0	472
480 min Summer	13.624	0.0	562
600 min Summer	11.676	0.0	642
720 min Summer	10.293	0.0	714
960 min Summer	8.164	0.0	840
1440 min Summer	5.889	0.0	1100
2160 min Summer	4.248	0.0	1500
2880 min Summer	3.369	0.0	1896
4320 min Summer	2.508	0.0	2696
5760 min Summer	2.035	0.0	3480
7200 min Summer	1.730	0.0	4248
8640 min Summer	1.515	0.0	5000
15 min Winter	149.721	0.0	139
30 min Winter	92.702	0.0	177

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	18.456	0.156	28.2	120.9	O K
120 min Winter	18.582	0.282	30.9	223.6	O K
180 min Winter	18.670	0.370	32.8	297.5	O K
240 min Winter	18.744	0.444	34.3	362.1	Flood Risk
360 min Winter	18.862	0.562	36.9	469.1	Flood Risk
480 min Winter	18.902	0.602	37.8	506.7	Flood Risk
600 min Winter	18.922	0.622	38.2	525.6	Flood Risk
720 min Winter	18.932	0.632	38.4	534.2	Flood Risk
960 min Winter	18.892	0.592	37.5	496.7	Flood Risk
1440 min Winter	18.817	0.517	35.9	428.2	Flood Risk
2160 min Winter	18.705	0.405	33.5	327.9	Flood Risk
2880 min Winter	18.599	0.299	31.2	237.2	O K
4320 min Winter	18.477	0.177	28.7	137.0	O K
5760 min Winter	18.371	0.071	26.5	53.8	O K
7200 min Winter	18.348	0.048	24.8	36.0	O K
8640 min Winter	18.344	0.044	23.0	33.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	57.398	0.0	216
120 min Winter	35.539	0.0	278
180 min Winter	26.848	0.0	332
240 min Winter	22.004	0.0	380
360 min Winter	16.624	0.0	472
480 min Winter	13.624	0.0	562
600 min Winter	11.676	0.0	644
720 min Winter	10.293	0.0	720
960 min Winter	8.164	0.0	856
1440 min Winter	5.889	0.0	1142
2160 min Winter	4.248	0.0	1572
2880 min Winter	3.369	0.0	1988
4320 min Winter	2.508	0.0	2800
5760 min Winter	2.035	0.0	3520
7200 min Winter	1.730	0.0	4176
8640 min Winter	1.515	0.0	4952

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Model Details

Storage is Online Cover Level (m) 19.000

Infiltration Basin Structure

Invert Level (m) 18.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.24000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.24000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	750.0	0.700	967.7

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 135 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	18.414	0.094	25.4	67.7	O K
30 min Summer	18.465	0.145	26.4	105.0	O K
60 min Summer	18.517	0.197	27.5	144.2	O K
120 min Summer	18.617	0.297	29.5	222.4	O K
180 min Summer	18.692	0.372	31.1	282.5	O K
240 min Summer	18.752	0.432	32.3	332.0	Flood Risk
360 min Summer	18.842	0.522	34.2	408.0	Flood Risk
480 min Summer	18.896	0.576	35.3	454.7	Flood Risk
600 min Summer	18.929	0.609	36.0	484.1	Flood Risk
720 min Summer	18.951	0.631	36.5	503.1	Flood Risk
960 min Summer	18.925	0.605	36.0	480.5	Flood Risk
1440 min Summer	18.875	0.555	34.9	436.7	Flood Risk
2160 min Summer	18.823	0.503	33.8	391.8	Flood Risk
2880 min Summer	18.761	0.441	32.5	338.8	Flood Risk
4320 min Summer	18.703	0.383	31.3	291.6	Flood Risk
5760 min Summer	18.625	0.305	29.7	228.7	O K
7200 min Summer	18.577	0.257	28.7	190.4	O K
8640 min Summer	18.533	0.213	27.8	156.7	O K
15 min Winter	18.400	0.080	25.1	57.3	O K
30 min Winter	18.439	0.119	25.9	85.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	149.721	0.0	158
30 min Summer	92.702	0.0	193
60 min Summer	57.398	0.0	226
120 min Summer	35.539	0.0	282
180 min Summer	26.848	0.0	334
240 min Summer	22.004	0.0	382
360 min Summer	16.624	0.0	474
480 min Summer	13.624	0.0	566
600 min Summer	11.676	0.0	646
720 min Summer	10.293	0.0	718
960 min Summer	8.164	0.0	844
1440 min Summer	5.889	0.0	1104
2160 min Summer	4.248	0.0	1504
2880 min Summer	3.369	0.0	1904
4320 min Summer	2.508	0.0	2708
5760 min Summer	2.035	0.0	3496
7200 min Summer	1.730	0.0	4272
8640 min Summer	1.515	0.0	5040
15 min Winter	149.721	0.0	147
30 min Winter	92.702	0.0	183

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	18.493	0.173	27.0	126.0	O K
120 min Winter	18.627	0.307	29.7	229.8	O K
180 min Winter	18.719	0.399	31.6	304.3	Flood Risk
240 min Winter	18.797	0.477	33.2	369.2	Flood Risk
360 min Winter	18.921	0.601	35.9	476.5	Flood Risk
480 min Winter	18.964	0.644	36.8	515.0	Flood Risk
600 min Winter	18.986	0.666	37.2	534.9	Flood Risk
720 min Winter	18.996	0.676	37.5	544.4	Flood Risk
960 min Winter	18.957	0.637	36.6	508.6	Flood Risk
1440 min Winter	18.883	0.563	35.1	443.5	Flood Risk
2160 min Winter	18.771	0.451	32.7	347.3	Flood Risk
2880 min Winter	18.664	0.344	30.5	259.5	O K
4320 min Winter	18.540	0.220	27.9	162.3	O K
5760 min Winter	18.427	0.107	25.6	77.0	O K
7200 min Winter	18.370	0.050	24.4	35.4	O K
8640 min Winter	18.366	0.046	22.6	32.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	57.398	0.0	220
120 min Winter	35.539	0.0	282
180 min Winter	26.848	0.0	336
240 min Winter	22.004	0.0	384
360 min Winter	16.624	0.0	474
480 min Winter	13.624	0.0	564
600 min Winter	11.676	0.0	646
720 min Winter	10.293	0.0	724
960 min Winter	8.164	0.0	860
1440 min Winter	5.889	0.0	1148
2160 min Winter	4.248	0.0	1580
2880 min Winter	3.369	0.0	1996
4320 min Winter	2.508	0.0	2820
5760 min Winter	2.035	0.0	3592
7200 min Winter	1.730	0.0	4192
8640 min Winter	1.515	0.0	4960

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 447250 107950 SU 47250 07950
C (1km)	-0.026
D1 (1km)	0.428
D2 (1km)	0.314
D3 (1km)	0.392
E (1km)	0.299
F (1km)	2.303
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	8640
Climate Change %	+45

Model Details

Storage is Online Cover Level (m) 19.000

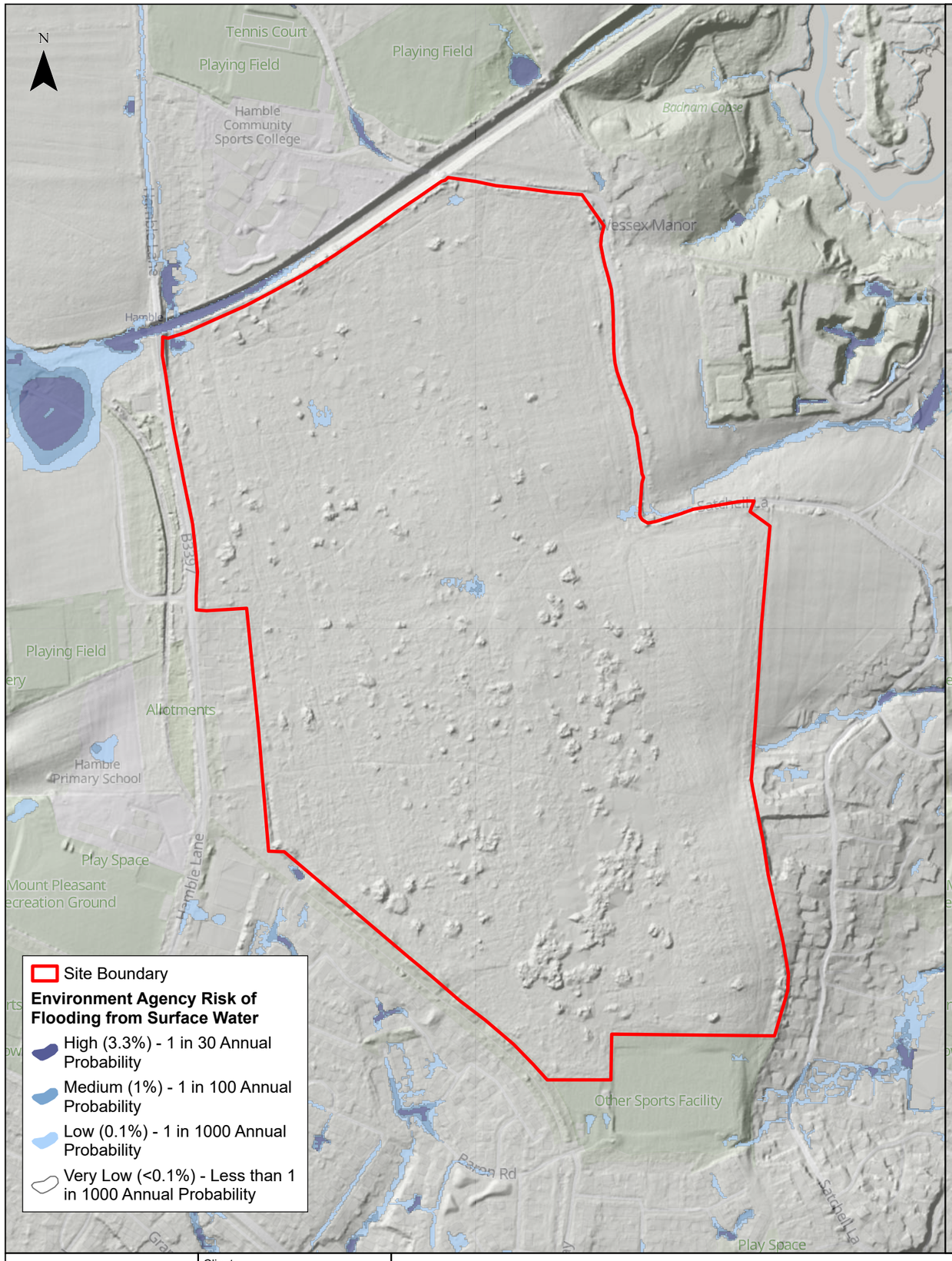
Infiltration Basin Structure

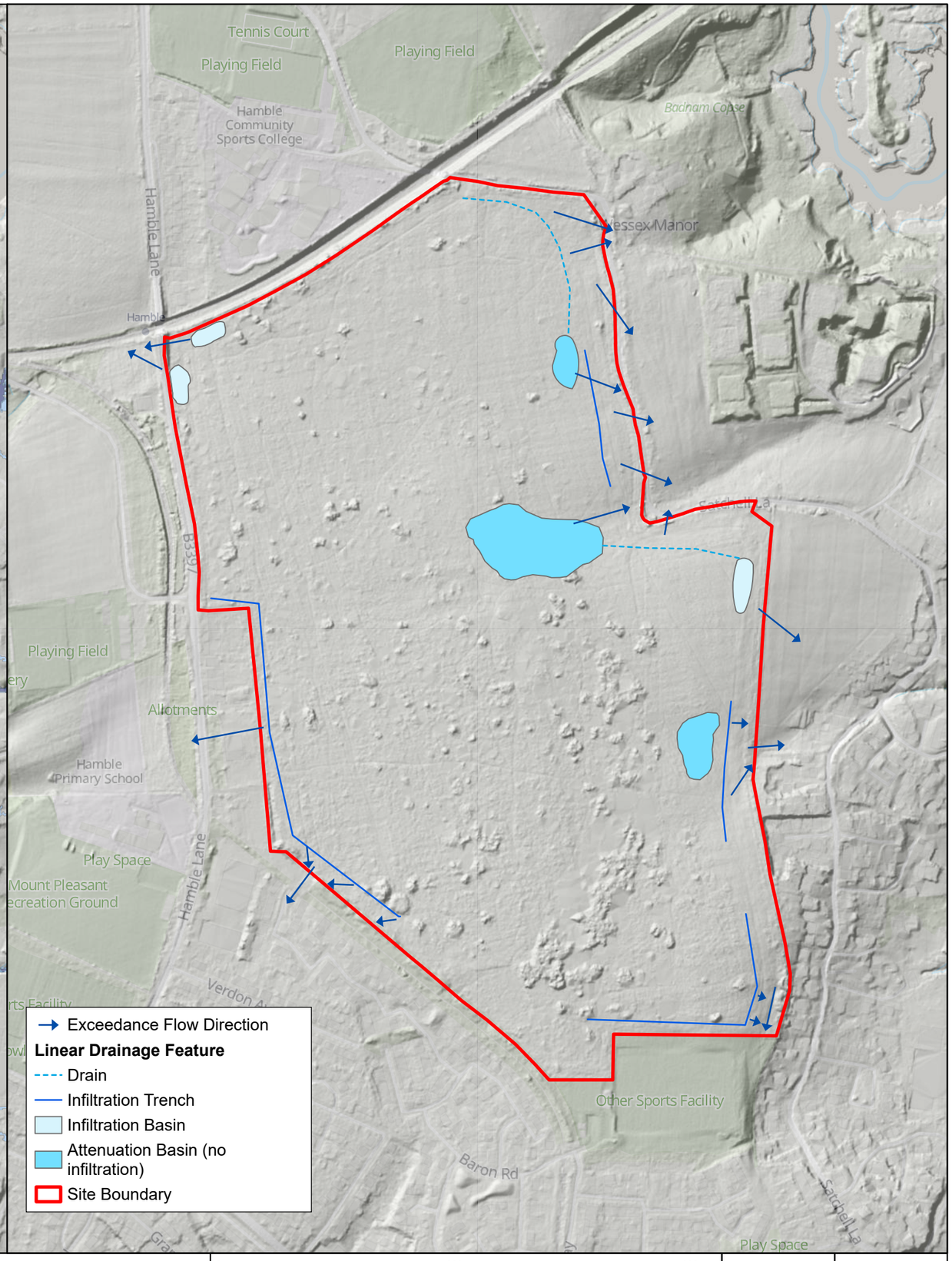
Invert Level (m) 18.320 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.24000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.24000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	705.0	0.680	910.1

Appendix C

Exceedance Flow Routes





Stantec

Client: CEMEX

HAMBLE QUARRY

Exceedance Flow Routes

0 300 600 m

1:6,000 @ A3	Date: 12/05/2023
Drawn: RP	Checked: RS
Appendix C	Rev: A

Document Path: C:\Users\rpickersgill\Documents\ArcGIS\Projects\Hamble_2\Hamble_2.aprx