McCloy Consulting

Drainage Impact Assessment

Land at Blackhillock, Keith

M03291-03_DG01| November 2024

WATER & ENVIRONMENTAL CONSULTANTS

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MAPPING

1 INTRODUCTION

1.1 Terms of Reference

This Drainage Assessment was commissioned by Blackhillock Flexpower Ltd to support a planning application for a battery storage site at lands at Blackhillock, Ketih.

The assessment will determine drainage characteristics and establish the means for safely disposing of surface water at the site.

1.2 Statement of Authority

McCloy Consulting is an independent environmental and water engineering consultancy specialising in drainage and SuDS design, drainage and hydrological assessments, river modelling and flood risk assessment. The practice has extensive experience in design and implementation of surface water management across the UK and Ireland.

This report and assessment have been prepared and reviewed by qualified professional civil engineers specialising in the fields of SuDS and drainage design and flood risk as required by Moray Council and SEPA. The key staff members involved in this project are as follows:

- Iain Black Msc BEng (Hons) – Project Engineer with experience in the fields of flood risk and drainage and surface water management design.
- Michael Rea *MEng (Hons*) – Senior Project Engineer specialising in the fields of drainage design, flood modelling and SuDS and surface water management design.
- Philip Duffy *BEng (Hons) CEng MIEI* – Associate and Senior Engineer with expertise in infrastructure engineering and drainage and wastewater design, green infrastructure, and environmental improvement schemes.

1.3 Objective

The objective of this report is to demonstrate that the surface water drainage design provided meets the requirements of Moray Council and includes:

- An overview of the site context including land uses and geology.
- Confirmation of hydraulic parameters including the outgoing flow rates and stormwater storage calculations.
- An overview of the proposed drainage system; and
- Confirmation of maintenance arrangements.

1.4 Site Location and Context

The site is located at Blackhillock,South of Ketih at British National Grid Reference (343847.5,848741.1) and is currently a greenfield site.

The proposals include the construction of Battery Energy Storage Systems (BESS) with HV compound to the north of the site and associated (unbound) hard standing forming tracks between the battery containers to the south.

The site topography survey indicates the site slopes from west to east, with low points located on the Eastern site border. Ground levels within the site observed from survey data vary between 153- 195m OD.

Figure 1-1 Existing Site

Figure 1-2 Proposed Site

1.5 Flood Risk and Existing Drainage Regime

Watercourses were identified from Scottish Environmental Protection Agency's (SEPA) online flood maps, OS mapping and using GIS routines on best available height data. An unnamed watercourse is located adjacent to the site which flows north easterly approximately 216m from the northern most point of the site to the Den Burn, as shown in Figure 1-3.

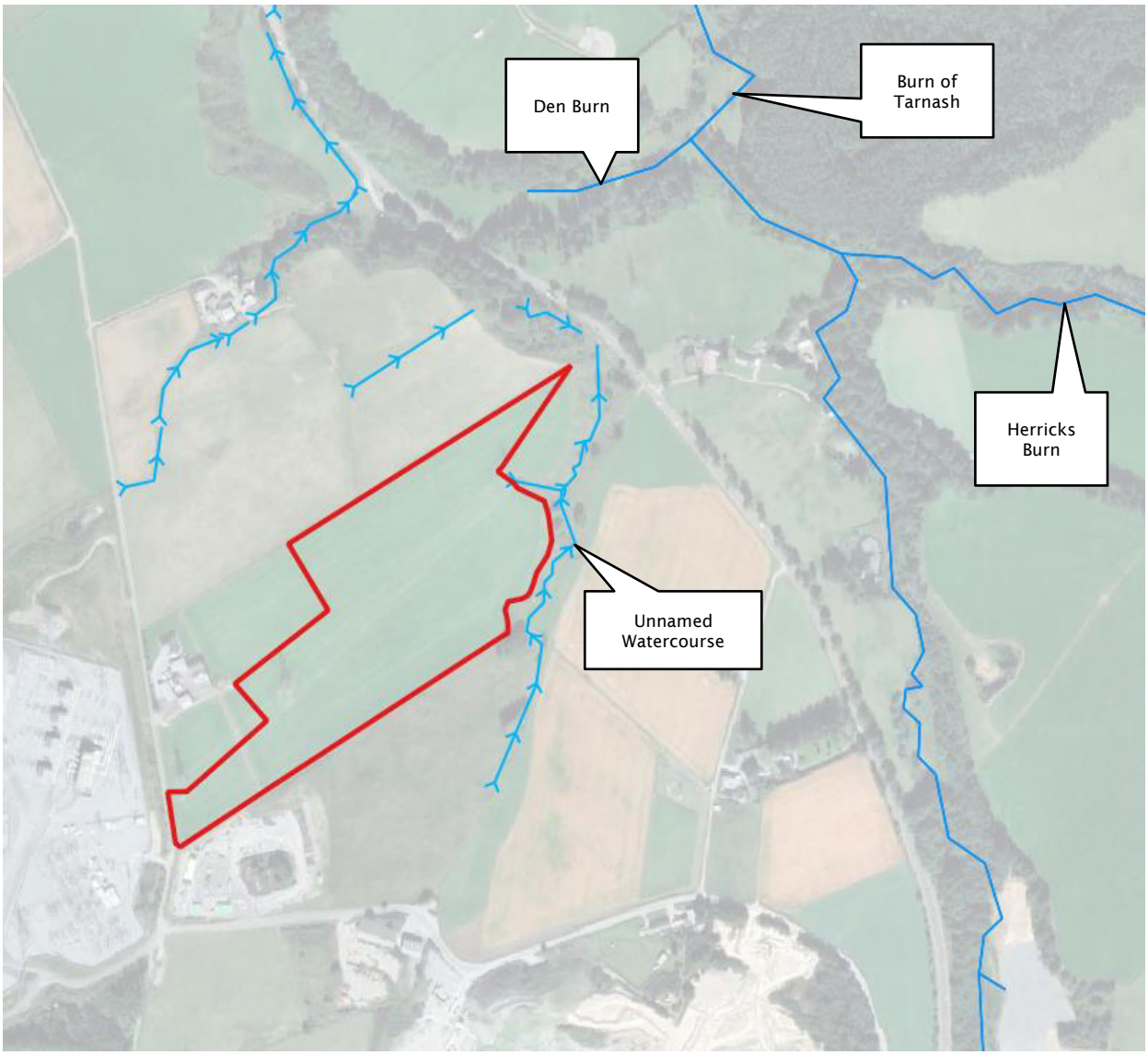


Figure 1-3 Site Hydrological Context

1.5.1 SEPA Flood Mapping

The site was reviewed against the Scottish Environmental Protection Agency's (SEPA) online flood maps[1], indicating:

- The site is unaffected by known fluvial floodplains.
- The site is unaffected by 0.5% AEP surface water flood extent. lies adjacent to the sites eastern site border.

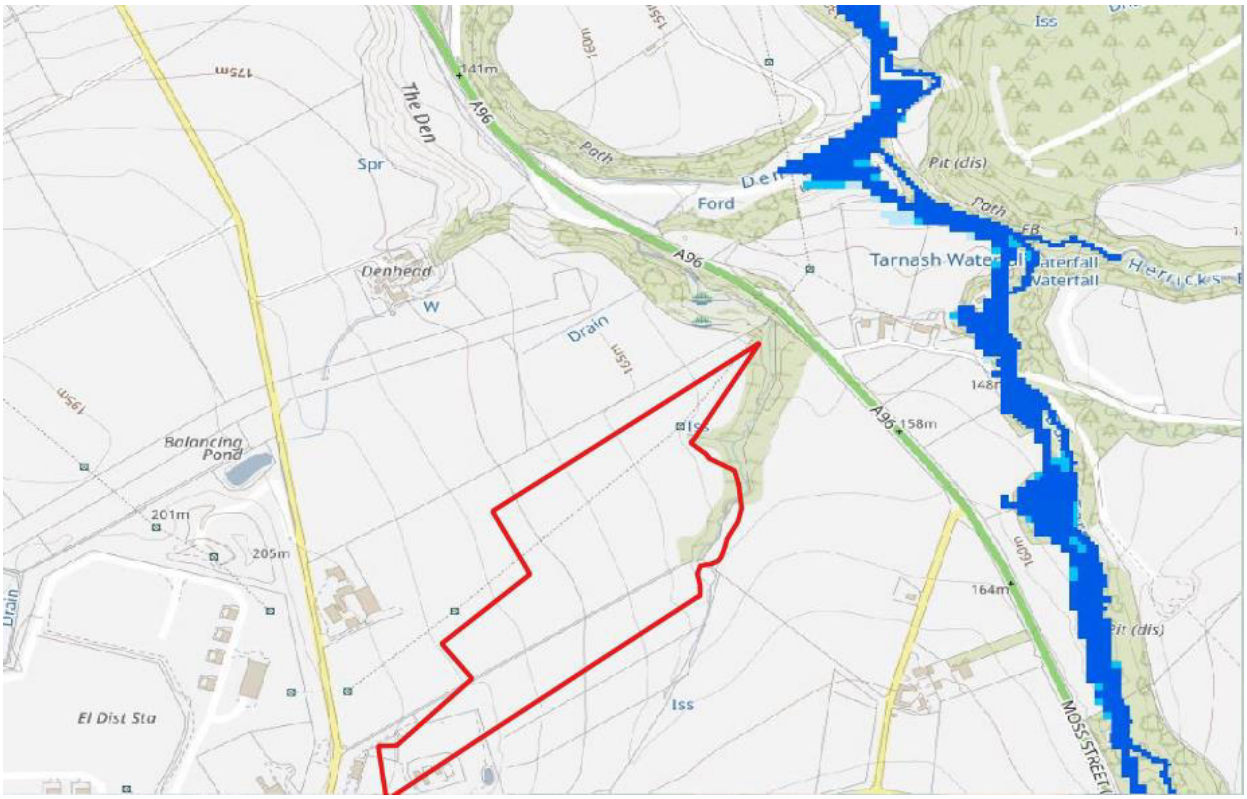


Figure 1-4 SEPA Fluvial Flood Map

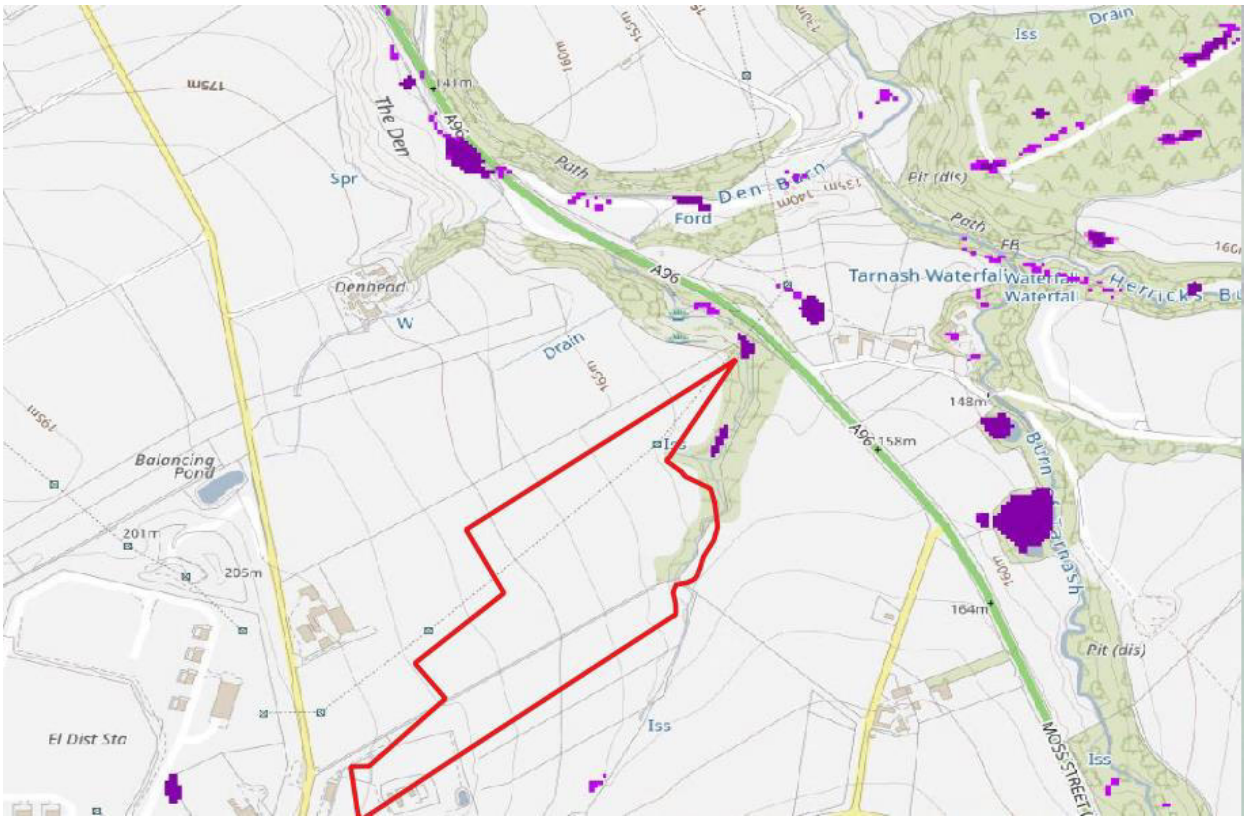


Figure 1-5 SEPA Surface Water Flood Mapping[1]

Flow routing analysis confirms that site runoff in its present state would tend to the southeast for the northern site, and northeast for the southern site. Both site flow paths tend towards the undesignated watercourse to the northeast of the site., uncontrolled runoff from the site and downstream of the site would drain as shown in the following figure. Development should allow for managed flow paths across the site per CIRIA document C635 – Designing for exceedance in urban drainage, to include ensuring that boundary conditions allow ingress and egress of surface water at identified flow routes.

[11] Flood Maps, 2021, Scottish Environmental Protection Agency, https://www.sepa.org.uk/environment/water/flooding/flood-maps/ [Accessed 07.09.22]

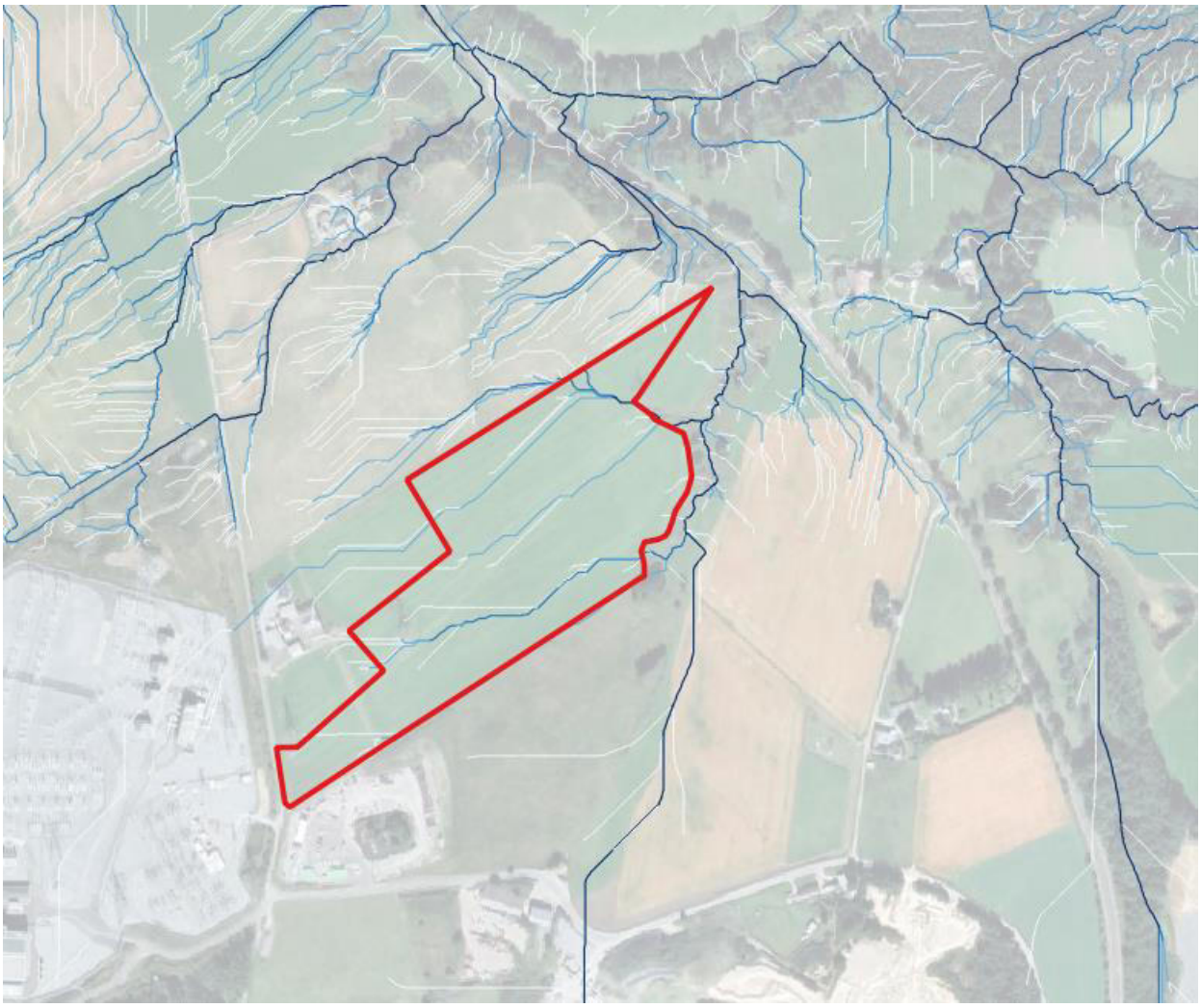


Figure 1-6 Overland Flow Paths

Due to the sites rural setting, no relevant Scottish Water sewerage / drainage infrastructure is anticipated in proximity to the site that would influence surface water flooding or cause flood risk from urban drainage failures.

1.6 Ground Conditions

A review of BGS geology data has been undertaken to inform this assessment. Underlying superficial geology based on BGS 1:50k mapping within site is indicated to be predominantly Devensian Till. An area of Alluvium comprising clay, silt, sand, and gravel is also noted to the east of the site as indicated in the following figure.

Figure 1-7 Superficial Geology

1.7 Private Water Supply

A review of the available online mapping for Private Water Supplies indicated the nearest downstream private water supply is approximately 2400m northeast of the site, at Seafield Avenue, Keith. Moray Development control confirms the location of a REG 2 spring located approximately 2367m. Category Reg 2 are supplies that are commercial (including private lets), or supply more than 50 people, while Category B are non-commercial that serve less than 50 people

[2]

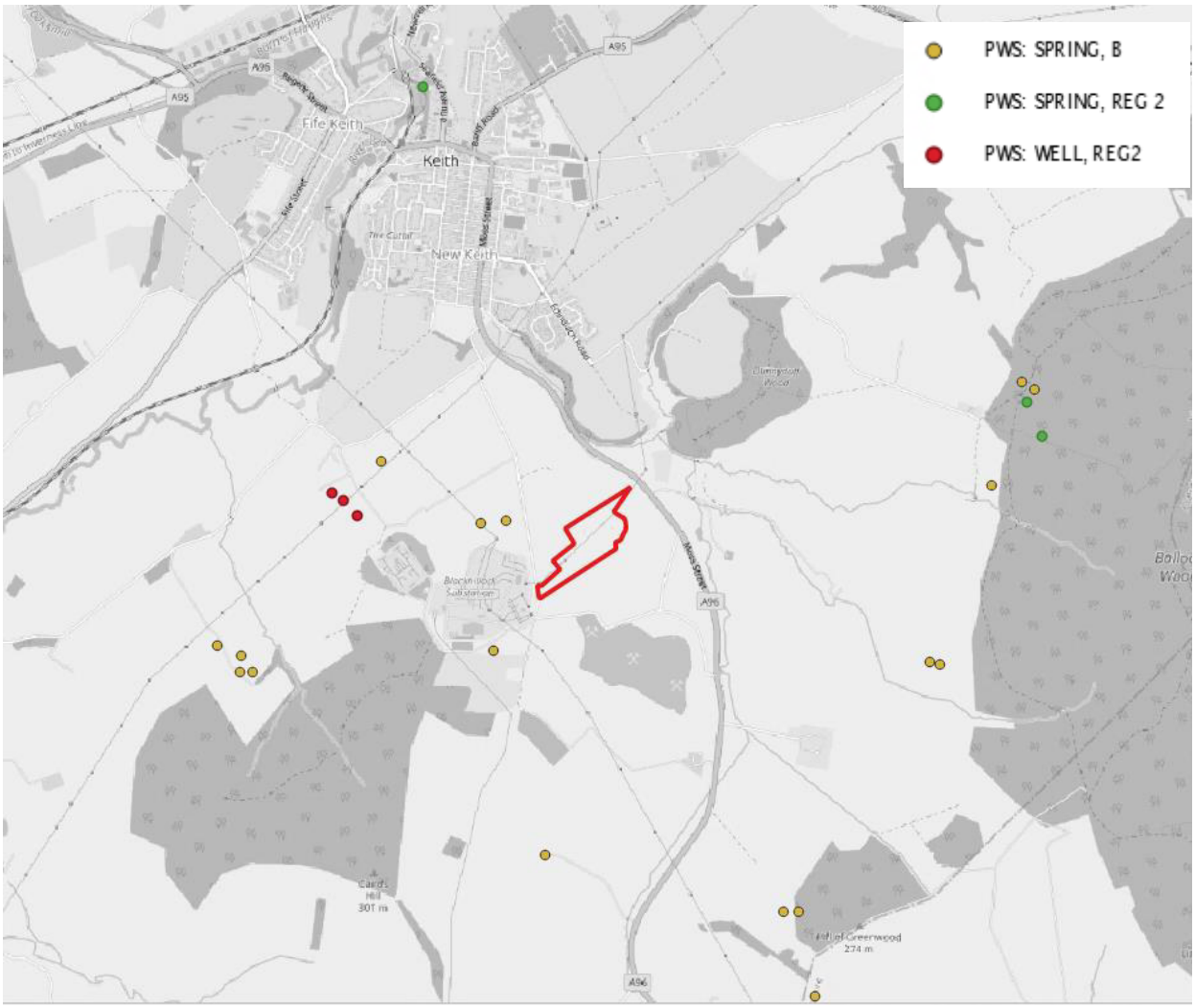


Figure 1-8 Private Water Supplies

[2] Private Water Supply - Scotland - Dataset - Spatial Hub Scotland
https://data.spatialhub.scot/dataset/private_water_supply-is

2 DESIGN STATEMENT

2.1 Design Criteria

2.1.1 Design Standard

The following criteria have been used to progress the design and are in line with Scottish Water requirements, Moray Council planning guidance[3], and SEPA.

- Design to demonstrate that a 1 in 200-year return period plus climate change event can be accommodated without presenting a flood risk to site.
- The 200 peak rainfall intensity allowance climate change of +37% has been adopted based on the SEPA Climate Change Allowances for Flood Risk Assessments indicated on the Land Use Planning web portal[4].
- Design to demonstrate that a 1 in 30-year return plus climate change can be accommodated without surcharging
- Design assumes that all unbound hardstanding areas are 60% impermeable, to offer conservative assessment of the attenuation requirements, infiltration has been assumed as zero.
- Ordinary storm water discharged is anticipated to be disposed to the watercourse southeast of the site at a flow limited to greenfield rate.
- Consideration of water quality management as part of the proposed drainage system.

In addition, it is assumed that:

- New hardstanding areas are to be attenuated to a greenfield rate, equated to 1in 2 year (QBAR) calculated as 6.366l/s/ha.
- Drainage will not be eligible for adoption and will be privately maintained; therefore, Scottish Water internal design standards are not applicable.

2.2 Proposed Layout

2.2.1 Discharge Strategy

It has been established that the proposals for the site shall increase the extent of impermeable surfaces at the site which would result in an increase in runoff from the site. The current site is greenfield; all runoff presently tends to the undesignated watercourses east of the site. Hardstanding will be attenuated to greenfield rate (equated to QBAR). It is proposed to discharge surface water from the site to the watercourse to the east. Attenuation ponds are proposed serving the northern and southern portions of the site as separate sub catchments.

A swale along hardstanding areas is proposed to collect runoff and convey flows to the attenuation pond. Flow controls on the outlet of the attenuation ponds will restrict flows to the greenfield rate of 9.6 Lps and 16 Lps the northern and southern sub-catchments respectively.

A sluice gate is proposed downstream of the attenuation ponds which will cut-off runoff from the site in the event of a pollution incident or to prevent firewater runoff entering the natural site in line with COMAH guidelines.

2.2.2 Effect of the Development

The site is currently undeveloped greenfield. The proposed development will cause an increase in the impermeable area of the site and is likely to result in an increase to the rate and volume of runoff from the site when compared to the existing scenario if not mitigated.

[3] Moray Council (April 2023) Moray Local Development Plan 2020. Available from http://www.moray.gov.uk/moray_standard/page_133431.html[Accessed: 2/8/2024]

[4] SEPA. (October 2024). Climate Change Allowances for Flood Risk Assessment in Land Use Planning. Available from: https://scottishepa.maps.arcgis.com/apps/webappviewer/index.html?id=2ddf84e295334f6b93bd0dbbb9ad7417. [Accessed: 3/10/2024].

An estimated of unmitigated post-development runoff for the site has been made as part of this assessment. Runoff estimates are based on plans submitted as part of the present applicating. A comparison of existing and proposed runoff rates in litres per second is given in the following table.

Table 2-1 Comparison of Unmitigated Surface Water Runoff Rates (Peak [1hr] Runoff Rates)

Return Period	Existing Site (lps)	Proposed Site (lps)	Increase (lps)
1 in 1 year (1hr)	55.2	125.8	70.6
1 in 30 year (1hr)	115	341.2	226.2
1 in 200 year (1hr)	159.3	457.7	298.4

2.2.3 Drainage Design

Innovyze Microdrainage software has been utilised in the design process to establish the storage requirements based on the above design criteria. Calculations are included in Appendix B.

The stormwater drainage of the hardstanding at the proposed site will comprise of sustainable drainage features (SuDS). Runoff will be directed into water catchment ponds located on the northeast for the northern site, and a series of ponds along the southern border, with volumes 712m^3 and a combined volume of 1583m^3 respectively This will be discharged at greenfield rate pro-rata based on impermeable sub-catchment area the drainage serves, equating to 9.6lps for the northern pond, and 16lps for the southern pond.

Runoff is restricted by a flow control, discharging downstream to an unnamed watercourse, eventually discharging to Den Burn.

The site presently slopes to the east, post development, uncontrolled runoff would similar drain easterly as indicated in Figure 1-6. Direct flood risk to adjacent lands will be mitigated by ensuring the control of runoff from the site up to a suitable flood protection measure as stipulated by SEPA (200yr rainfall including climate change).

The proposed drainage layout is included in Appendix C.

2.3 Water Treatment

To ensure best practice treatment of surface water within the drainage network the Simple Index Approach, as described in the CIRIA C753 SuDS Manual, has been used to provide an indication of the suitability of the system in mitigation of water quality risks to receiving waters.

The proposed development consists of battery energy storage systems and associated gravel access tracks is assessed as a low pollution hazard level per the CIRIA C753 SuDS Manual, Table 26.2. The SuDS manual indicates the following hazard indices attributed to this land use:

- Total Suspended Solids – 0.5
- Heavy Metals – 0.4
- Hydrocarbons – 0.4

The proposed drainage features include retention ponds. Per CIRIA C753, Table 26.3, the mitigation indices of a pond would exceed the respective pollution hazard indices shown above. Therefore, the proposed features are suitable for the nature of the development in terms of pollution risk mitigation.

2.4 Maintenance Requirements

Drainage assets shall be the responsibility of the site operator to maintain. The developer shall put in place drainage management procedures as part of the overall facility management.

The following initial Maintenance Schedule indicates the required activities for the drainage system. Features requiring maintenance including the chambers are in accessible locations. A maintenance plan will be produced and should include:

Table 2-2 Site Drainage Maintenance Schedule

Inlets, Outlets, Pipework, Chambers and Cells		
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly
	Remove debris and sediment from chambers and cells	Monthly for first six months, then quarterly or after significant storm
Remedial actions	Repair/rehabilitate where required	As required
Monitoring	Check all structures to ensure all is in good condition and operating as designed.	Annually
	(Flow control) check for evidence of blockage	Monthly or after significant storm.
	(Flow control) check for damage to components	Annually or after significant storm.
Swale		
Regular Maintenance	Remove litter and debris	Monthly, as required
	Cut grass – to retain grass height within specific design range. Manage other vegetation and remove nuisance plants	Monthly, as required
	Inspect inlets, outlets, and overflows for blockages, and clear if required	Monthly
	Inspect filtration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, as required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or re-seeding	As required
	Relevel uneven surfaces and reinstate design level	As required

	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of soil surface	As required
Attenuation basin,		
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass for spillways and access routes. Cut grass: Meadow grass in and around basin.	Monthly (during growing season) or as required. Half yearly (spring / before nesting season and autumn)
Remedial Actions	Re-seed areas of poor vegetation cover.	As required
	Remove sediment from inlets, outlets and basin when required.	Every 5 years or as required
Monitoring	Check all structures to ensure all is in good conditions and operating as designed	Annually

Appendix A

Site Layout

Legend:

- Site Boundary
- Site Fence (2.4m)
- Acoustic Barrier (4m)
- OHL Exclusion Zone (35m from centre line)
- GS6 Safety Zone (22.5m from centre line)
- Tower Exclusion Zone (15m)
- Internal Road
- Emergency Access
- Embankments
- Inverter/ Transformer Skid
- Battery Container
- Back-up Generator
- Auxiliary Transfomer
- LV and Control Container
- Switchgear Container
- Storage Container
- Emergency Lighting
- Water Drainage Run
- Water Catchment Pond
- Water Reservoir/ Catchment Pond
- Attenuation Pond
- Water Pump Room / Valve Room
- Planting zones
- Wildflower Meadow
- Earth bunds (up to 5m)

Notes:

208 Battery Containers
52 Inverter/Transformer Skids

Transformers in purple have been included to accommodate for worst-case scenario

NORIKER POWER

Company: Noriker Power	Revision	Version	Change Description	Drafted By	Checked By	Date	Transmission type: E
	20	20.0	Design Freeze	IP	BW	22-08-24	
Project Title: Blackhillock							Intended Paper size: A2
Drawing Title:NPL-BLK-BLA-020-E							Scale: 1:1750

Appendix B

Calculations

Project	[Blackhilock, Ketih]
Ref	M03291-03
Date	14/10/2024

Purpose

To estimate the indicative (1-hr) change in runoff rate on a site caused by the proposed development. Note that proposed / indicative runoff rates are outline only and rely on the routing equation within the Modified Rational and Wallingford methods; actual runoff rates may differ significantly dependant on the nature of the surface water drainage network proposed and should be determined using hydraulic modelling.

Existing Site	A1	A2	A3	A4	**TOTAL**	
Roof	0				0	m^2
Bitmac / Paved / Hardstanding	0				0	m^2
					0	m^2

Proposed Site	A1	A2	A3	A4	**TOTAL**	
Roof	5676				5676	m^2
Bitmac / Paved / Hardstanding	17719				17719	m^2
					23395	m^2

Site Details

Total Site Area	9.12	**Ha**	
SAAR	887	**mm**	From FEH3
SAAR4170	1092	**mm**	From FEH3
UCWI	107	**mm**	
IOH124 region	2		from map ->
SOIL	4		From WRAP maps
SOIL	0.45		
DEEPSTOR	0.31		

Modified Rational Method (MRM):

	Existing		***Proposed***		
Length (m)	335	**m**	335	**m**	From Site Maps
Impermeable Area (ha)	0.000	**Ha**	2.339	**Ha**	
Max Height	118.0	**mAOD**	118.0	**mAOD**	From Survey
Min Height	98.9	**mAOD**	98.9	**mAOD**	From Survey
DeltaH	19.145		19.100		
Slope (%)	5.71		5.70		
Te (mins)	10.00		10.01		
ARF	0.000		0.980		

	Existing Site		Proposed Site	
PIMP	0.000	**%**	100.000	**%**
Percentage Runoff PR	0.45	**%**	81.79	**%**
Cv	0.00		0.82	
Cr	1.3		1.3	

Institute of Hydrology Report 124 (IoH 124) "Flood Estimation on Small Catchments" method

	Existing		***Proposed***	
Remaining Greenfield Area	9.12	**Ha**	6.78	**Ha**
% Greenfield	100.00	**%**	74.34	**%**

Existing Site - Peak (1-hr) Runoff Rates

Return Period	Permeable Runoff (IOH124) (lps)	Impermeable Runoff (MRM) (lps)	Total Runoff (lps)
1 in 2 year (1hr)	55.2	0.0	55.2
1 in 30 year (1hr)	115.0	0.0	115.0
1 in 100 year (1hr)	159.3	0.0	159.3

Proposed Site - Peak (1-hr) Runoff Rates

Return Period	Permeable Runoff (IOH124) (lps)	Impermeable Runoff (MRM) (lps)	Total Runoff (lps)
1 in 2 year (1hr)	35.7	90.1	125.8
1 in 30 year (1hr)	74.3	266.9	341.2
1 in 100 year (1hr)	102.9	354.7	457.7

Summary - Peak (1-hr) Runoff Rates

Return Period	Existing Site (lps)	Proposed Site (lps)	*Increase (lps)*	Increase (%)
1 in 2 year (1hr)	55.2	125.8	*70.6*	*128%*
1 in 30 year (1hr)	115.0	341.2	*226.2*	*197%*
1 in 100 year (1hr)	159.3	457.7	*298.4*	*187%*

By	Checked	Revision	Reason for Change	Date
IB	MR	1		04/05/2023
IB	MR	2	Revised Layout	28/06/2024
IB	MR	3	Revised Layout	14/10/2024

Summary of Results for 30 year Return Period (+37%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	156.695	0.195	9.3	0.0	9.3	120.7	O K
30 min Summer	156.765	0.265	9.6	0.0	9.6	166.3	O K
60 min Summer	156.838	0.338	9.6	0.0	9.6	214.9	O K
120 min Summer	156.909	0.409	9.6	0.0	9.6	263.1	O K
180 min Summer	156.945	0.445	9.6	0.0	9.6	287.9	O K
240 min Summer	156.966	0.466	9.6	0.0	9.6	302.2	O K
360 min Summer	156.989	0.489	9.6	0.0	9.6	318.5	O K
480 min Summer	157.001	0.501	9.6	0.0	9.6	327.1	O K
600 min Summer	157.007	0.507	9.6	0.0	9.6	331.3	O K
720 min Summer	157.009	0.509	9.6	0.0	9.6	332.6	O K
960 min Summer	157.005	0.505	9.6	0.0	9.6	329.7	O K
1440 min Summer	156.982	0.482	9.6	0.0	9.6	313.8	O K
2160 min Summer	156.936	0.436	9.6	0.0	9.6	281.3	O K
2880 min Summer	156.886	0.386	9.6	0.0	9.6	247.3	O K
4320 min Summer	156.798	0.298	9.6	0.0	9.6	188.0	O K
5760 min Summer	156.733	0.233	9.5	0.0	9.5	145.1	O K
7200 min Summer	156.688	0.188	9.2	0.0	9.2	116.4	O K
8640 min Summer	156.660	0.160	9.0	0.0	9.0	98.8	O K
10080 min Summer	156.647	0.147	8.4	0.0	8.4	90.5	O K
15 min Winter	156.718	0.218	9.4	0.0	9.4	135.7	O K
30 min Winter	156.797	0.297	9.6	0.0	9.6	187.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	69.532	0.0	121.6	0.0	25
30 min Summer	48.638	0.0	172.2	0.0	39
60 min Summer	32.389	0.0	235.2	0.0	66
120 min Summer	20.978	0.0	305.5	0.0	124
180 min Summer	16.152	0.0	353.2	0.0	182
240 min Summer	13.392	0.0	390.7	0.0	236
360 min Summer	10.259	0.0	449.2	0.0	298
480 min Summer	8.482	0.0	495.4	0.0	366
600 min Summer	7.314	0.0	534.1	0.0	434
720 min Summer	6.479	0.0	567.8	0.0	504
960 min Summer	5.350	0.0	625.1	0.0	644
1440 min Summer	4.083	0.0	715.1	0.0	918
2160 min Summer	3.113	0.0	823.2	0.0	1320
2880 min Summer	2.567	0.0	904.6	0.0	1704
4320 min Summer	1.954	0.0	1030.8	0.0	2424
5760 min Summer	1.609	0.0	1136.0	0.0	3120
7200 min Summer	1.383	0.0	1220.9	0.0	3816
8640 min Summer	1.223	0.0	1294.5	0.0	4424
10080 min Summer	1.102	0.0	1358.9	0.0	5152
15 min Winter	69.532	0.0	136.9	0.0	25
30 min Winter	48.638	0.0	193.5	0.0	39

Summary of Results for 30 year Return Period (+37%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	156.880	0.380	9.6	0.0	9.6	243.0	O K
120 min Winter	156.961	0.461	9.6	0.0	9.6	299.0	O K
180 min Winter	157.004	0.504	9.6	0.0	9.6	329.3	O K
240 min Winter	157.030	0.530	9.6	0.0	9.6	347.8	O K
360 min Winter	157.057	0.557	9.6	0.0	9.6	366.8	O K
480 min Winter	157.066	0.566	9.6	0.0	9.6	373.7	O K
600 min Winter	157.071	0.571	9.6	0.0	9.6	377.3	O K
720 min Winter	157.071	0.571	9.6	0.0	9.6	376.9	O K
960 min Winter	157.059	0.559	9.6	0.0	9.6	368.5	O K
1440 min Winter	157.015	0.515	9.6	0.0	9.6	337.0	O K
2160 min Winter	156.932	0.432	9.6	0.0	9.6	278.9	O K
2880 min Winter	156.850	0.350	9.6	0.0	9.6	222.9	O K
4320 min Winter	156.724	0.224	9.5	0.0	9.5	139.6	O K
5760 min Winter	156.659	0.159	9.0	0.0	9.0	97.7	O K
7200 min Winter	156.638	0.138	7.9	0.0	7.9	84.9	O K
8640 min Winter	156.625	0.125	7.0	0.0	7.0	76.3	O K
10080 min Winter	156.615	0.115	6.3	0.0	6.3	70.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	32.389	0.0	263.8	0.0	66
120 min Winter	20.978	0.0	342.4	0.0	122
180 min Winter	16.152	0.0	395.9	0.0	180
240 min Winter	13.392	0.0	437.9	0.0	236
360 min Winter	10.259	0.0	503.5	0.0	344
480 min Winter	8.482	0.0	555.2	0.0	396
600 min Winter	7.314	0.0	598.5	0.0	472
720 min Winter	6.479	0.0	636.3	0.0	550
960 min Winter	5.350	0.0	700.4	0.0	704
1440 min Winter	4.083	0.0	801.2	0.0	1002
2160 min Winter	3.113	0.0	922.2	0.0	1412
2880 min Winter	2.567	0.0	1013.5	0.0	1792
4320 min Winter	1.954	0.0	1155.3	0.0	2468
5760 min Winter	1.609	0.0	1272.5	0.0	3056
7200 min Winter	1.383	0.0	1367.7	0.0	3752
8640 min Winter	1.223	0.0	1450.2	0.0	4440
10080 min Winter	1.102	0.0	1522.9	0.0	5144

Model Details

Storage is Online Cover Level (m) 157.506

Tank or Pond Structure

Invert Level (m) 156.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	600.2	0.300	663.1	0.600	728.5	0.900	796.1
0.100	620.6	0.400	684.6	0.700	750.8	1.000	819.1
0.200	641.7	0.500	706.4	0.800	773.3	1.006	820.6

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0143-9600-1000-9600
Design Head (m)	1.000
Design Flow (l/s)	9.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	156.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	9.6
Flush-Flo™	0.302	9.6
Kick-Flo®	0.672	8.0
Mean Flow over Head Range	-	8.2

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	5.2	1.200	10.5	3.000	16.1	7.000	24.2
0.200	9.3	1.400	11.2	3.500	17.4	7.500	25.1
0.300	9.6	1.600	12.0	4.000	18.5	8.000	25.8
0.400	9.5	1.800	12.7	4.500	19.6	8.500	26.6
0.500	9.2	2.000	13.3	5.000	20.6	9.000	27.4
0.600	8.8	2.200	13.9	5.500	21.6	9.500	28.1
0.800	8.6	2.400	14.5	6.000	22.5		
1.000	9.6	2.600	15.1	6.500	23.4		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 157.506

Cascade Summary of Results for south pond 1.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	south pond 2.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	174.178	0.178	4.4	0.0	4.4	29.1	O K
30 min Summer	174.240	0.240	5.3	0.0	5.3	39.4	O K
60 min Summer	174.298	0.298	6.0	0.0	6.0	49.4	O K
120 min Summer	174.344	0.344	6.5	0.0	6.5	57.5	O K
180 min Summer	174.364	0.364	6.7	0.0	6.7	60.9	O K
240 min Summer	174.372	0.372	6.8	0.0	6.8	62.2	O K
360 min Summer	174.370	0.370	6.8	0.0	6.8	61.8	O K
480 min Summer	174.360	0.360	6.7	0.0	6.7	60.1	O K
600 min Summer	174.347	0.347	6.5	0.0	6.5	57.9	O K
720 min Summer	174.334	0.334	6.4	0.0	6.4	55.6	O K
960 min Summer	174.307	0.307	6.1	0.0	6.1	51.0	O K
1440 min Summer	174.262	0.262	5.6	0.0	5.6	43.3	O K
2160 min Summer	174.212	0.212	4.9	0.0	4.9	34.9	O K
2880 min Summer	174.178	0.178	4.4	0.0	4.4	29.1	O K
4320 min Summer	174.135	0.135	3.7	0.0	3.7	21.9	O K
5760 min Summer	174.112	0.112	3.2	0.0	3.2	18.1	O K
7200 min Summer	174.100	0.100	2.8	0.0	2.8	16.2	O K
8640 min Summer	174.092	0.092	2.5	0.0	2.5	14.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	67.999	0.0	31.6	0.0	23
30 min Summer	48.054	0.0	44.9	0.0	36
60 min Summer	32.637	0.0	61.6	0.0	60
120 min Summer	21.609	0.0	81.7	0.0	94
180 min Summer	16.790	0.0	95.2	0.0	128
240 min Summer	13.958	0.0	105.6	0.0	164
360 min Summer	10.671	0.0	121.1	0.0	232
480 min Summer	8.816	0.0	133.4	0.0	300
600 min Summer	7.597	0.0	143.7	0.0	366
720 min Summer	6.722	0.0	152.6	0.0	430
960 min Summer	5.538	0.0	167.7	0.0	558
1440 min Summer	4.205	0.0	190.9	0.0	804
2160 min Summer	3.186	0.0	217.4	0.0	1168
2880 min Summer	2.613	0.0	237.7	0.0	1532
4320 min Summer	1.973	0.0	269.0	0.0	2248
5760 min Summer	1.618	0.0	294.6	0.0	2944
7200 min Summer	1.387	0.0	315.7	0.0	3672
8640 min Summer	1.224	0.0	334.1	0.0	4408

Cascade Summary of Results for south pond 1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	174.086	0.086	2.3	0.0	2.3	13.9	O K
15 min Winter	174.199	0.199	4.7	0.0	4.7	32.6	O K
30 min Winter	174.269	0.269	5.6	0.0	5.6	44.4	O K
60 min Winter	174.335	0.335	6.4	0.0	6.4	55.9	O K
120 min Winter	174.385	0.385	6.9	0.0	6.9	64.5	O K
180 min Winter	174.403	0.403	7.1	0.0	7.1	67.6	O K
240 min Winter	174.406	0.406	7.1	0.0	7.1	68.2	O K
360 min Winter	174.394	0.394	7.0	0.0	7.0	66.0	O K
480 min Winter	174.374	0.374	6.8	0.0	6.8	62.5	O K
600 min Winter	174.352	0.352	6.6	0.0	6.6	58.7	O K
720 min Winter	174.330	0.330	6.4	0.0	6.4	55.0	O K
960 min Winter	174.291	0.291	5.9	0.0	5.9	48.2	O K
1440 min Winter	174.230	0.230	5.2	0.0	5.2	37.8	O K
2160 min Winter	174.171	0.171	4.3	0.0	4.3	28.0	O K
2880 min Winter	174.136	0.136	3.7	0.0	3.7	22.1	O K
4320 min Winter	174.102	0.102	2.9	0.0	2.9	16.6	O K
5760 min Winter	174.090	0.090	2.4	0.0	2.4	14.5	O K
7200 min Winter	174.081	0.081	2.1	0.0	2.1	13.1	O K
8640 min Winter	174.075	0.075	1.8	0.0	1.8	12.1	O K
10080 min Winter	174.070	0.070	1.6	0.0	1.6	11.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.101	0.0	350.5	0.0	5136
15 min Winter	67.999	0.0	35.4	0.0	24
30 min Winter	48.054	0.0	50.4	0.0	36
60 min Winter	32.637	0.0	69.0	0.0	62
120 min Winter	21.609	0.0	91.5	0.0	100
180 min Winter	16.790	0.0	106.7	0.0	138
240 min Winter	13.958	0.0	118.3	0.0	176
360 min Winter	10.671	0.0	135.7	0.0	250
480 min Winter	8.816	0.0	149.5	0.0	320
600 min Winter	7.597	0.0	161.0	0.0	388
720 min Winter	6.722	0.0	171.0	0.0	454
960 min Winter	5.538	0.0	187.8	0.0	584
1440 min Winter	4.205	0.0	213.9	0.0	832
2160 min Winter	3.186	0.0	243.5	0.0	1192
2880 min Winter	2.613	0.0	266.2	0.0	1540
4320 min Winter	1.973	0.0	301.3	0.0	2244
5760 min Winter	1.618	0.0	330.0	0.0	2944
7200 min Winter	1.387	0.0	353.6	0.0	3672
8640 min Winter	1.224	0.0	374.3	0.0	4408
10080 min Winter	1.101	0.0	392.7	0.0	5136

Cascade Rainfall Details for south pond 1.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.000

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

Time Area Diagram

Total Area (ha) 0.253

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.084	4	8	0.084	8	12	0.085

Cascade Model Details for south pond 1.SRCX

Storage is Online Cover Level (m) 175.500

Tank or Pond Structure

Invert Level (m) 174.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	160.0	0.500	180.0	1.000	200.0	1.500	220.0

Orifice Outflow Control

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 174.000

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 175.500

Cascade Summary of Results for south pond 2.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 1.SRCX	south pond 3.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	174.206	0.206	8.2	0.0	8.2	29.6	O K
30 min Summer	174.277	0.277	10.0	0.0	10.0	40.3	O K
60 min Summer	174.347	0.347	11.4	0.0	11.4	50.9	O K
120 min Summer	174.403	0.403	12.4	0.0	12.4	59.7	O K
180 min Summer	174.429	0.429	12.8	0.0	12.8	63.6	O K
240 min Summer	174.440	0.440	13.0	0.0	13.0	65.4	O K
360 min Summer	174.441	0.441	13.1	0.0	13.1	65.6	O K
480 min Summer	174.433	0.433	12.9	0.0	12.9	64.2	O K
600 min Summer	174.420	0.420	12.7	0.0	12.7	62.2	O K
720 min Summer	174.405	0.405	12.4	0.0	12.4	60.0	O K
960 min Summer	174.376	0.376	11.9	0.0	11.9	55.4	O K
1440 min Summer	174.324	0.324	10.9	0.0	10.9	47.5	O K
2160 min Summer	174.266	0.266	9.7	0.0	9.7	38.6	O K
2880 min Summer	174.225	0.225	8.7	0.0	8.7	32.4	O K
4320 min Summer	174.172	0.172	7.3	0.0	7.3	24.7	O K
5760 min Summer	174.144	0.144	6.4	0.0	6.4	20.6	O K
7200 min Summer	174.131	0.131	5.6	0.0	5.6	18.6	O K
8640 min Summer	174.121	0.121	5.0	0.0	5.0	17.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	67.999	0.0	63.0	0.0	24
30 min Summer	48.054	0.0	89.6	0.0	36
60 min Summer	32.637	0.0	123.1	0.0	62
120 min Summer	21.609	0.0	163.2	0.0	98
180 min Summer	16.790	0.0	190.4	0.0	132
240 min Summer	13.958	0.0	211.1	0.0	166
360 min Summer	10.671	0.0	242.1	0.0	234
480 min Summer	8.816	0.0	266.8	0.0	302
600 min Summer	7.597	0.0	287.4	0.0	368
720 min Summer	6.722	0.0	305.2	0.0	434
960 min Summer	5.538	0.0	335.2	0.0	562
1440 min Summer	4.205	0.0	381.7	0.0	810
2160 min Summer	3.186	0.0	434.8	0.0	1172
2880 min Summer	2.613	0.0	475.3	0.0	1532
4320 min Summer	1.973	0.0	537.8	0.0	2248
5760 min Summer	1.618	0.0	589.2	0.0	2944
7200 min Summer	1.387	0.0	631.4	0.0	3672
8640 min Summer	1.224	0.0	668.2	0.0	4408

Cascade Summary of Results for south pond 2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	174.113	0.113	4.5	0.0	4.5	16.0	O K
15 min Winter	174.230	0.230	8.8	0.0	8.8	33.2	O K
30 min Winter	174.310	0.310	10.6	0.0	10.6	45.3	O K
60 min Winter	174.390	0.390	12.2	0.0	12.2	57.6	O K
120 min Winter	174.450	0.450	13.2	0.0	13.2	67.1	O K
180 min Winter	174.475	0.475	13.6	0.0	13.6	70.9	O K
240 min Winter	174.482	0.482	13.7	0.0	13.7	72.0	O K
360 min Winter	174.472	0.472	13.6	0.0	13.6	70.5	O K
480 min Winter	174.452	0.452	13.2	0.0	13.2	67.4	O K
600 min Winter	174.429	0.429	12.9	0.0	12.9	63.7	O K
720 min Winter	174.405	0.405	12.4	0.0	12.4	60.0	O K
960 min Winter	174.361	0.361	11.6	0.0	11.6	53.0	O K
1440 min Winter	174.289	0.289	10.2	0.0	10.2	42.1	O K
2160 min Winter	174.218	0.218	8.5	0.0	8.5	31.4	O K
2880 min Winter	174.174	0.174	7.4	0.0	7.4	25.0	O K
4320 min Winter	174.134	0.134	5.8	0.0	5.8	19.1	O K
5760 min Winter	174.117	0.117	4.8	0.0	4.8	16.7	O K
7200 min Winter	174.106	0.106	4.1	0.0	4.1	15.1	O K
8640 min Winter	174.098	0.098	3.6	0.0	3.6	13.9	O K
10080 min Winter	174.092	0.092	3.3	0.0	3.3	13.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.101	0.0	700.9	0.0	5136
15 min Winter	67.999	0.0	70.7	0.0	24
30 min Winter	48.054	0.0	100.6	0.0	36
60 min Winter	32.637	0.0	138.0	0.0	62
120 min Winter	21.609	0.0	182.9	0.0	102
180 min Winter	16.790	0.0	213.3	0.0	140
240 min Winter	13.958	0.0	236.5	0.0	178
360 min Winter	10.671	0.0	271.3	0.0	252
480 min Winter	8.816	0.0	298.9	0.0	324
600 min Winter	7.597	0.0	322.0	0.0	392
720 min Winter	6.722	0.0	341.9	0.0	460
960 min Winter	5.538	0.0	375.6	0.0	588
1440 min Winter	4.205	0.0	427.7	0.0	840
2160 min Winter	3.186	0.0	487.0	0.0	1196
2880 min Winter	2.613	0.0	532.4	0.0	1556
4320 min Winter	1.973	0.0	602.5	0.0	2248
5760 min Winter	1.618	0.0	659.9	0.0	2952
7200 min Winter	1.387	0.0	707.3	0.0	3680
8640 min Winter	1.224	0.0	748.5	0.0	4416
10080 min Winter	1.101	0.0	785.2	0.0	5120

Cascade Rainfall Details for south pond 2.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.000

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

Time Area Diagram

Total Area (ha) 0.253

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.084	4	8	0.084	8	12	0.085

Cascade Model Details for south pond 2.SRCX

Storage is Online Cover Level (m) 175.500

Tank or Pond Structure

Invert Level (m) 174.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	0.500	160.0	1.000	170.0	1.500	180.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 174.000

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 175.500

Cascade Summary of Results for south pond 3.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 2.SRCX south pond 1.SRCX	south pond 4.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	170.816	0.316	10.8	0.0	10.8	61.0	O K
30 min Summer	170.939	0.439	13.0	0.0	13.0	85.3	O K
60 min Summer	171.076	0.576	15.1	0.0	15.1	112.9	O K
120 min Summer	171.214	0.714	17.0	0.0	17.0	141.2	O K
180 min Summer	171.279	0.779	17.8	0.0	17.8	154.8	O K
240 min Summer	171.312	0.812	18.2	0.0	18.2	161.8	O K
360 min Summer	171.346	0.846	18.6	0.0	18.6	169.1	O K
480 min Summer	171.361	0.861	18.8	0.0	18.8	172.4	O K
600 min Summer	171.364	0.864	18.8	0.0	18.8	172.9	O K
720 min Summer	171.359	0.859	18.8	0.0	18.8	171.7	O K
960 min Summer	171.335	0.835	18.5	0.0	18.5	166.8	O K
1440 min Summer	171.270	0.770	17.7	0.0	17.7	153.0	O K
2160 min Summer	171.169	0.669	16.4	0.0	16.4	131.8	O K
2880 min Summer	171.080	0.580	15.2	0.0	15.2	113.7	O K
4320 min Summer	170.949	0.449	13.2	0.0	13.2	87.4	O K
5760 min Summer	170.863	0.363	11.7	0.0	11.7	70.2	O K
7200 min Summer	170.800	0.300	10.4	0.0	10.4	57.8	O K
8640 min Summer	170.754	0.254	9.4	0.0	9.4	48.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	67.999	0.0	124.8	0.0	26
30 min Summer	48.054	0.0	177.5	0.0	40
60 min Summer	32.637	0.0	243.9	0.0	68
120 min Summer	21.609	0.0	323.5	0.0	124
180 min Summer	16.790	0.0	377.3	0.0	180
240 min Summer	13.958	0.0	418.3	0.0	210
360 min Summer	10.671	0.0	479.9	0.0	272
480 min Summer	8.816	0.0	528.8	0.0	338
600 min Summer	7.597	0.0	569.6	0.0	406
720 min Summer	6.722	0.0	604.9	0.0	472
960 min Summer	5.538	0.0	664.4	0.0	606
1440 min Summer	4.205	0.0	756.5	0.0	868
2160 min Summer	3.186	0.0	861.7	0.0	1240
2880 min Summer	2.613	0.0	942.1	0.0	1600
4320 min Summer	1.973	0.0	1066.0	0.0	2320
5760 min Summer	1.618	0.0	1167.8	0.0	3016
7200 min Summer	1.387	0.0	1251.5	0.0	3744
8640 min Summer	1.224	0.0	1324.5	0.0	4440

Cascade Summary of Results for south pond 3.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	170.722	0.222	8.7	0.0	8.7	42.6	O K
15 min Winter	170.854	0.354	11.5	0.0	11.5	68.5	O K
30 min Winter	170.992	0.492	13.9	0.0	13.9	95.9	O K
60 min Winter	171.146	0.646	16.1	0.0	16.1	127.1	O K
120 min Winter	171.303	0.803	18.1	0.0	18.1	159.9	O K
180 min Winter	171.380	0.880	19.0	0.0	19.0	176.3	O K
240 min Winter	171.417	0.917	19.4	0.0	19.4	184.3	O K
360 min Winter	171.448	0.948	19.8	0.0	19.8	191.0	O K
480 min Winter	171.456	0.956	19.9	0.0	19.9	192.9	O K
600 min Winter	171.448	0.948	19.8	0.0	19.8	191.0	O K
720 min Winter	171.429	0.929	19.6	0.0	19.6	187.0	O K
960 min Winter	171.377	0.877	19.0	0.0	19.0	175.6	O K
1440 min Winter	171.257	0.757	17.6	0.0	17.6	150.3	O K
2160 min Winter	171.100	0.600	15.5	0.0	15.5	117.7	O K
2880 min Winter	170.982	0.482	13.7	0.0	13.7	94.0	O K
4320 min Winter	170.834	0.334	11.1	0.0	11.1	64.5	O K
5760 min Winter	170.750	0.250	9.3	0.0	9.3	48.1	O K
7200 min Winter	170.700	0.200	8.1	0.0	8.1	38.4	O K
8640 min Winter	170.668	0.168	7.2	0.0	7.2	32.2	O K
10080 min Winter	170.647	0.147	6.5	0.0	6.5	28.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.101	0.0	1389.3	0.0	5152
15 min Winter	67.999	0.0	140.1	0.0	26
30 min Winter	48.054	0.0	199.2	0.0	39
60 min Winter	32.637	0.0	273.4	0.0	68
120 min Winter	21.609	0.0	362.5	0.0	122
180 min Winter	16.790	0.0	422.7	0.0	178
240 min Winter	13.958	0.0	468.7	0.0	228
360 min Winter	10.671	0.0	537.7	0.0	286
480 min Winter	8.816	0.0	592.4	0.0	360
600 min Winter	7.597	0.0	638.1	0.0	434
720 min Winter	6.722	0.0	677.7	0.0	506
960 min Winter	5.538	0.0	744.4	0.0	644
1440 min Winter	4.205	0.0	847.7	0.0	908
2160 min Winter	3.186	0.0	965.3	0.0	1280
2880 min Winter	2.613	0.0	1055.3	0.0	1640
4320 min Winter	1.973	0.0	1194.3	0.0	2336
5760 min Winter	1.618	0.0	1308.0	0.0	3040
7200 min Winter	1.387	0.0	1401.8	0.0	3744
8640 min Winter	1.224	0.0	1483.6	0.0	4448
10080 min Winter	1.101	0.0	1556.5	0.0	5152

Cascade Rainfall Details for south pond 3.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.497

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.165	4	8	0.166	8	12	0.166

Cascade Model Details for south pond 3.SRCX

Storage is Online Cover Level (m) 172.000

Tank or Pond Structure

Invert Level (m) 170.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	190.0	0.500	200.0	1.000	220.0	1.500	240.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 170.500

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 172.000

Cascade Summary of Results for south pond 4.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 3.SRCX south pond 2.SRCX south pond 1.SRCX	south pond 5.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	163.245	0.245	9.2	0.0	9.2	35.5	O K
30 min Summer	163.343	0.343	11.3	0.0	11.3	50.3	O K
60 min Summer	163.459	0.459	13.3	0.0	13.3	68.4	O K
120 min Summer	163.595	0.595	15.4	0.0	15.4	90.2	O K
180 min Summer	163.680	0.680	16.6	0.0	16.6	104.3	O K
240 min Summer	163.740	0.740	17.3	0.0	17.3	114.4	O K
360 min Summer	163.815	0.815	18.3	0.0	18.3	127.2	O K
480 min Summer	163.846	0.846	18.6	0.0	18.6	132.7	O K
600 min Summer	163.858	0.858	18.8	0.0	18.8	134.7	O K
720 min Summer	163.863	0.863	18.8	0.0	18.8	135.7	O K
960 min Summer	163.863	0.863	18.8	0.0	18.8	135.6	O K
1440 min Summer	163.838	0.838	18.5	0.0	18.5	131.3	O K
2160 min Summer	163.774	0.774	17.8	0.0	17.8	120.3	O K
2880 min Summer	163.701	0.701	16.8	0.0	16.8	107.9	O K
4320 min Summer	163.570	0.570	15.0	0.0	15.0	86.2	O K
5760 min Summer	163.470	0.470	13.5	0.0	13.5	70.2	O K
7200 min Summer	163.394	0.394	12.2	0.0	12.2	58.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	67.999	0.0	152.0	0.0	93
30 min Summer	48.054	0.0	216.5	0.0	120
60 min Summer	32.637	0.0	298.3	0.0	152
120 min Summer	21.609	0.0	395.7	0.0	200
180 min Summer	16.790	0.0	461.5	0.0	240
240 min Summer	13.958	0.0	511.7	0.0	278
360 min Summer	10.671	0.0	587.1	0.0	368
480 min Summer	8.816	0.0	647.0	0.0	474
600 min Summer	7.597	0.0	696.9	0.0	530
720 min Summer	6.722	0.0	740.1	0.0	590
960 min Summer	5.538	0.0	813.0	0.0	712
1440 min Summer	4.205	0.0	925.6	0.0	960
2160 min Summer	3.186	0.0	1054.7	0.0	1336
2880 min Summer	2.613	0.0	1153.1	0.0	1704
4320 min Summer	1.973	0.0	1304.5	0.0	2420
5760 min Summer	1.618	0.0	1429.5	0.0	3120
7200 min Summer	1.387	0.0	1532.0	0.0	3824

Cascade Summary of Results for south pond 4.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	163.337	0.337	11.2	0.0	11.2	49.3	O K
10080 min Summer	163.294	0.294	10.3	0.0	10.3	42.9	O K
15 min Winter	163.274	0.274	9.9	0.0	9.9	39.8	O K
30 min Winter	163.382	0.382	12.0	0.0	12.0	56.3	O K
60 min Winter	163.510	0.510	14.2	0.0	14.2	76.6	O K
120 min Winter	163.661	0.661	16.3	0.0	16.3	101.1	O K
180 min Winter	163.755	0.755	17.5	0.0	17.5	117.0	O K
240 min Winter	163.821	0.821	18.3	0.0	18.3	128.4	O K
360 min Winter	163.907	0.907	19.3	0.0	19.3	143.3	O K
480 min Winter	163.951	0.951	19.8	0.0	19.8	151.1	O K
600 min Winter	163.963	0.963	19.9	0.0	19.9	153.2	O K
720 min Winter	163.962	0.962	19.9	0.0	19.9	153.2	O K
960 min Winter	163.951	0.951	19.8	0.0	19.8	151.1	O K
1440 min Winter	163.885	0.885	19.1	0.0	19.1	139.4	O K
2160 min Winter	163.753	0.753	17.5	0.0	17.5	116.7	O K
2880 min Winter	163.632	0.632	15.9	0.0	15.9	96.3	O K
4320 min Winter	163.452	0.452	13.2	0.0	13.2	67.2	O K
5760 min Winter	163.340	0.340	11.2	0.0	11.2	49.9	O K
7200 min Winter	163.271	0.271	9.8	0.0	9.8	39.4	O K
8640 min Winter	163.225	0.225	8.7	0.0	8.7	32.5	O K
10080 min Winter	163.194	0.194	7.9	0.0	7.9	27.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.224	0.0	1621.3	0.0	4528
10080 min Summer	1.101	0.0	1700.4	0.0	5248
15 min Winter	67.999	0.0	170.7	0.0	100
30 min Winter	48.054	0.0	242.9	0.0	126
60 min Winter	32.637	0.0	334.3	0.0	160
120 min Winter	21.609	0.0	443.4	0.0	210
180 min Winter	16.790	0.0	517.1	0.0	250
240 min Winter	13.958	0.0	573.4	0.0	288
360 min Winter	10.671	0.0	657.8	0.0	366
480 min Winter	8.816	0.0	724.9	0.0	472
600 min Winter	7.597	0.0	780.9	0.0	560
720 min Winter	6.722	0.0	829.3	0.0	614
960 min Winter	5.538	0.0	910.9	0.0	738
1440 min Winter	4.205	0.0	1037.1	0.0	1002
2160 min Winter	3.186	0.0	1181.5	0.0	1380
2880 min Winter	2.613	0.0	1291.7	0.0	1736
4320 min Winter	1.973	0.0	1461.6	0.0	2428
5760 min Winter	1.618	0.0	1601.2	0.0	3120
7200 min Winter	1.387	0.0	1716.0	0.0	3824
8640 min Winter	1.224	0.0	1816.1	0.0	4504
10080 min Winter	1.101	0.0	1905.1	0.0	5208

Cascade Rainfall Details for south pond 4.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.225

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.075	4	8	0.075	8	12	0.075

Cascade Model Details for south pond 4.SRCX

Storage is Online Cover Level (m) 164.500

Tank or Pond Structure

Invert Level (m) 163.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	0.500	160.0	1.000	180.0	1.500	200.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 163.000

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 164.500

Cascade Summary of Results for south pond 5.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 4.SRCX south pond 3.SRCX south pond 2.SRCX south pond 1.SRCX	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	156.929	0.129	8.7	0.0	8.7	33.6	O K
30 min Summer	156.954	0.154	10.9	0.0	10.9	40.3	O K
60 min Summer	156.984	0.184	13.0	0.0	13.0	48.2	O K
120 min Summer	157.055	0.255	14.3	0.0	14.3	67.0	O K
180 min Summer	157.119	0.319	15.0	0.0	15.0	84.0	O K
240 min Summer	157.172	0.372	15.4	0.0	15.4	98.1	O K
360 min Summer	157.251	0.451	15.8	0.0	15.8	119.2	O K
480 min Summer	157.308	0.508	15.9	0.0	15.9	134.6	O K
600 min Summer	157.347	0.547	16.0	0.0	16.0	145.3	O K
720 min Summer	157.374	0.574	16.0	0.0	16.0	152.4	O K
960 min Summer	157.395	0.595	16.0	0.0	16.0	158.3	O K
1440 min Summer	157.373	0.573	16.0	0.0	16.0	152.4	O K
2160 min Summer	157.316	0.516	15.9	0.0	15.9	136.7	O K
2880 min Summer	157.249	0.449	15.8	0.0	15.8	118.8	O K
4320 min Summer	157.128	0.328	15.1	0.0	15.1	86.3	O K
5760 min Summer	157.044	0.244	14.2	0.0	14.2	64.1	O K
7200 min Summer	156.992	0.192	13.2	0.0	13.2	50.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	67.999	0.0	165.3	0.0	152
30 min Summer	48.054	0.0	236.5	0.0	181
60 min Summer	32.637	0.0	328.4	0.0	218
120 min Summer	21.609	0.0	436.0	0.0	322
180 min Summer	16.790	0.0	508.7	0.0	390
240 min Summer	13.958	0.0	564.2	0.0	450
360 min Summer	10.671	0.0	647.5	0.0	552
480 min Summer	8.816	0.0	713.6	0.0	646
600 min Summer	7.597	0.0	768.7	0.0	730
720 min Summer	6.722	0.0	816.4	0.0	810
960 min Summer	5.538	0.0	896.7	0.0	964
1440 min Summer	4.205	0.0	1020.5	0.0	1204
2160 min Summer	3.186	0.0	1164.7	0.0	1548
2880 min Summer	2.613	0.0	1273.1	0.0	1892
4320 min Summer	1.973	0.0	1439.4	0.0	2572
5760 min Summer	1.618	0.0	1579.1	0.0	3232
7200 min Summer	1.387	0.0	1692.2	0.0	3896

Cascade Summary of Results for south pond 5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	156.973	0.173	12.2	0.0	12.2	45.2	O K
10080 min Summer	156.960	0.160	11.3	0.0	11.3	41.8	O K
15 min Winter	156.936	0.136	9.4	0.0	9.4	35.6	O K
30 min Winter	156.964	0.164	11.6	0.0	11.6	42.9	O K
60 min Winter	157.004	0.204	13.5	0.0	13.5	53.5	O K
120 min Winter	157.102	0.302	14.9	0.0	14.9	79.4	O K
180 min Winter	157.183	0.383	15.5	0.0	15.5	101.0	O K
240 min Winter	157.250	0.450	15.8	0.0	15.8	119.0	O K
360 min Winter	157.352	0.552	16.0	0.0	16.0	146.7	O K
480 min Winter	157.429	0.629	16.0	0.0	16.0	167.4	O K
600 min Winter	157.482	0.682	16.0	0.0	16.0	182.1	O K
720 min Winter	157.518	0.718	16.0	0.0	16.0	191.9	O K
960 min Winter	157.548	0.748	16.0	0.0	16.0	200.0	O K
1440 min Winter	157.494	0.694	16.0	0.0	16.0	185.3	O K
2160 min Winter	157.354	0.554	16.0	0.0	16.0	147.1	O K
2880 min Winter	157.217	0.417	15.7	0.0	15.7	110.3	O K
4320 min Winter	157.040	0.240	14.1	0.0	14.1	63.0	O K
5760 min Winter	156.975	0.175	12.4	0.0	12.4	45.8	O K
7200 min Winter	156.953	0.153	10.8	0.0	10.8	40.1	O K
8640 min Winter	156.939	0.139	9.7	0.0	9.7	36.3	O K
10080 min Winter	156.929	0.129	8.7	0.0	8.7	33.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.224	0.0	1790.6	0.0	4576
10080 min Summer	1.101	0.0	1876.9	0.0	5256
15 min Winter	67.999	0.0	186.0	0.0	158
30 min Winter	48.054	0.0	265.8	0.0	190
60 min Winter	32.637	0.0	368.3	0.0	252
120 min Winter	21.609	0.0	488.8	0.0	352
180 min Winter	16.790	0.0	570.2	0.0	428
240 min Winter	13.958	0.0	632.4	0.0	492
360 min Winter	10.671	0.0	725.6	0.0	600
480 min Winter	8.816	0.0	799.7	0.0	696
600 min Winter	7.597	0.0	861.4	0.0	784
720 min Winter	6.722	0.0	914.9	0.0	868
960 min Winter	5.538	0.0	1004.9	0.0	1018
1440 min Winter	4.205	0.0	1143.8	0.0	1278
2160 min Winter	3.186	0.0	1304.8	0.0	1608
2880 min Winter	2.613	0.0	1426.4	0.0	1932
4320 min Winter	1.973	0.0	1613.1	0.0	2556
5760 min Winter	1.618	0.0	1768.8	0.0	3168
7200 min Winter	1.387	0.0	1895.6	0.0	3872
8640 min Winter	1.224	0.0	2005.9	0.0	4520
10080 min Winter	1.101	0.0	2103.4	0.0	5208

Cascade Rainfall Details for south pond 5.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.129

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.043	4	8	0.043	8	12	0.043

Cascade Model Details for south pond 5.SRCX

Storage is Online Cover Level (m) 158.800

Tank or Pond Structure

Invert Level (m) 156.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	260.0	1.000	280.0	2.000	300.0
0.500	270.0	1.500	290.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0165-1600-2000-1600
Design Head (m)	2.000
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	165
Invert Level (m)	156.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	16.0
Flush-Flo™	0.579	16.0
Kick-Flo®	1.216	12.6
Mean Flow over Head Range	-	14.0

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	5.9	1.200	12.9	3.000	19.4	7.000	29.1
0.200	13.4	1.400	13.5	3.500	20.9	7.500	30.1
0.300	14.9	1.600	14.4	4.000	22.3	8.000	31.1
0.400	15.6	1.800	15.2	4.500	23.6	8.500	32.0
0.500	15.9	2.000	16.0	5.000	24.8	9.000	32.9
0.600	16.0	2.200	16.7	5.500	25.9	9.500	33.8
0.800	15.7	2.400	17.4	6.000	27.0		
1.000	14.8	2.600	18.1	6.500	28.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 158.800

Cascade Summary of Results for south pond 1 - 200.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	south pond 2 - 200.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow Σ (l/s)	Max Volume (m³)	Status
15 min Summer	178.012	0.512	3.6	0.0	3.6	57.7	O K
30 min Summer	178.200	0.700	4.3	0.0	4.3	82.1	O K
60 min Summer	178.396	0.896	4.9	0.0	4.9	109.5	O K
120 min Summer	178.581	1.081	5.4	0.0	5.4	137.1	O K
180 min Summer	178.663	1.163	5.6	0.0	5.6	149.9	O K
240 min Summer	178.701	1.201	5.7	0.0	5.7	156.0	Flood Risk
360 min Summer	178.733	1.233	5.7	0.0	5.7	161.0	Flood Risk
480 min Summer	178.746	1.246	5.8	0.0	5.8	163.2	Flood Risk
600 min Summer	178.748	1.248	5.8	0.0	5.8	163.4	Flood Risk
720 min Summer	178.741	1.241	5.8	0.0	5.8	162.4	Flood Risk
960 min Summer	178.716	1.216	5.7	0.0	5.7	158.3	Flood Risk
1440 min Summer	178.645	1.145	5.5	0.0	5.5	147.1	O K
2160 min Summer	178.534	1.034	5.2	0.0	5.2	129.9	O K
2880 min Summer	178.431	0.931	5.0	0.0	5.0	114.6	O K
4320 min Summer	178.263	0.763	4.5	0.0	4.5	90.7	O K
5760 min Summer	178.138	0.638	4.1	0.0	4.1	73.9	O K
7200 min Summer	178.042	0.542	3.8	0.0	3.8	61.4	O K
8640 min Summer	177.968	0.468	3.5	0.0	3.5	52.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	99.703	0.0	60.5	0.0	25
30 min Summer	72.140	0.0	87.7	0.0	39
60 min Summer	49.794	0.0	121.6	0.0	66
120 min Summer	33.271	0.0	162.5	0.0	124
180 min Summer	25.831	0.0	189.2	0.0	180
240 min Summer	21.369	0.0	208.8	0.0	214
360 min Summer	16.115	0.0	236.2	0.0	278
480 min Summer	13.191	0.0	257.8	0.0	344
600 min Summer	11.278	0.0	275.5	0.0	414
720 min Summer	9.913	0.0	290.6	0.0	484
960 min Summer	8.074	0.0	315.5	0.0	622
1440 min Summer	6.024	0.0	353.1	0.0	894
2160 min Summer	4.475	0.0	393.7	0.0	1284
2880 min Summer	3.614	0.0	424.0	0.0	1672
4320 min Summer	2.667	0.0	469.2	0.0	2420
5760 min Summer	2.154	0.0	505.6	0.0	3120
7200 min Summer	1.826	0.0	535.7	0.0	3832
8640 min Summer	1.596	0.0	561.9	0.0	4584

Cascade Summary of Results for south pond 1 - 200.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	177.909	0.409	3.2	0.0	3.2	44.9	O K
15 min Winter	178.068	0.568	3.8	0.0	3.8	64.8	O K
30 min Winter	178.276	0.776	4.5	0.0	4.5	92.4	O K
60 min Winter	178.493	0.993	5.1	0.0	5.1	123.7	O K
120 min Winter	178.700	1.200	5.7	0.0	5.7	155.7	O K
180 min Winter	178.796	1.296	5.9	0.0	5.9	171.3	Flood Risk
240 min Winter	178.841	1.341	6.0	0.0	6.0	178.8	Flood Risk
360 min Winter	178.867	1.367	6.0	0.0	6.0	183.2	Flood Risk
480 min Winter	178.878	1.378	6.1	0.0	6.1	185.0	Flood Risk
600 min Winter	178.873	1.373	6.1	0.0	6.1	184.1	Flood Risk
720 min Winter	178.858	1.358	6.0	0.0	6.0	181.6	Flood Risk
960 min Winter	178.813	1.313	5.9	0.0	5.9	174.1	Flood Risk
1440 min Winter	178.701	1.201	5.7	0.0	5.7	155.9	Flood Risk
2160 min Winter	178.534	1.034	5.2	0.0	5.2	129.9	O K
2880 min Winter	178.389	0.889	4.8	0.0	4.8	108.4	O K
4320 min Winter	178.166	0.666	4.2	0.0	4.2	77.5	O K
5760 min Winter	178.015	0.515	3.7	0.0	3.7	58.0	O K
7200 min Winter	177.910	0.410	3.2	0.0	3.2	45.1	O K
8640 min Winter	177.835	0.335	2.9	0.0	2.9	36.2	O K
10080 min Winter	177.781	0.281	2.6	0.0	2.6	30.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.426	0.0	585.3	0.0	5256
15 min Winter	99.703	0.0	67.8	0.0	25
30 min Winter	72.140	0.0	98.3	0.0	39
60 min Winter	49.794	0.0	136.2	0.0	66
120 min Winter	33.271	0.0	182.0	0.0	122
180 min Winter	25.831	0.0	212.0	0.0	178
240 min Winter	21.369	0.0	233.8	0.0	232
360 min Winter	16.115	0.0	264.5	0.0	292
480 min Winter	13.191	0.0	288.7	0.0	368
600 min Winter	11.278	0.0	308.6	0.0	446
720 min Winter	9.913	0.0	325.5	0.0	522
960 min Winter	8.074	0.0	353.4	0.0	672
1440 min Winter	6.024	0.0	395.4	0.0	958
2160 min Winter	4.475	0.0	441.0	0.0	1364
2880 min Winter	3.614	0.0	474.9	0.0	1760
4320 min Winter	2.667	0.0	525.6	0.0	2508
5760 min Winter	2.154	0.0	566.3	0.0	3224
7200 min Winter	1.826	0.0	600.0	0.0	3904
8640 min Winter	1.596	0.0	629.3	0.0	4592
10080 min Winter	1.426	0.0	655.6	0.0	5344

Cascade Rainfall Details for south pond 1 - 200.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.326

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.108	4	8	0.109	8	12	0.109

Cascade Model Details for south pond 1 - 200.SRCX

Storage is Online Cover Level (m) 179.000

Tank or Pond Structure

Invert Level (m) 177.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	125.0	1.000	150.0	1.500	175.0

Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 177.500

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 179.000

Cascade Summary of Results for south pond 2 - 200.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 1 - 200.SRCX	south pond 3 - 200.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	174.292	0.292	10.3	0.0	10.3	42.6	O K
30 min Summer	174.400	0.400	12.4	0.0	12.4	59.2	O K
60 min Summer	174.503	0.503	14.0	0.0	14.0	75.4	O K
120 min Summer	174.584	0.584	15.2	0.0	15.2	88.4	O K
180 min Summer	174.616	0.616	15.7	0.0	15.7	93.6	O K
240 min Summer	174.625	0.625	15.8	0.0	15.8	95.2	O K
360 min Summer	174.615	0.615	15.7	0.0	15.7	93.4	O K
480 min Summer	174.596	0.596	15.4	0.0	15.4	90.3	O K
600 min Summer	174.573	0.573	15.1	0.0	15.1	86.7	O K
720 min Summer	174.551	0.551	14.8	0.0	14.8	83.1	O K
960 min Summer	174.507	0.507	14.1	0.0	14.1	76.1	O K
1440 min Summer	174.436	0.436	13.0	0.0	13.0	64.7	O K
2160 min Summer	174.358	0.358	11.6	0.0	11.6	52.6	O K
2880 min Summer	174.304	0.304	10.5	0.0	10.5	44.4	O K
4320 min Summer	174.235	0.235	9.0	0.0	9.0	34.0	O K
5760 min Summer	174.194	0.194	7.9	0.0	7.9	27.9	O K
7200 min Summer	174.166	0.166	7.1	0.0	7.1	23.8	O K
8640 min Summer	174.148	0.148	6.5	0.0	6.5	21.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	99.703	0.0	107.0	0.0	23
30 min Summer	72.140	0.0	155.2	0.0	35
60 min Summer	49.794	0.0	215.6	0.0	60
120 min Summer	33.271	0.0	288.3	0.0	94
180 min Summer	25.831	0.0	335.8	0.0	128
240 min Summer	21.369	0.0	370.5	0.0	164
360 min Summer	16.115	0.0	419.1	0.0	232
480 min Summer	13.191	0.0	457.5	0.0	300
600 min Summer	11.278	0.0	488.9	0.0	366
720 min Summer	9.913	0.0	515.7	0.0	432
960 min Summer	8.074	0.0	560.0	0.0	562
1440 min Summer	6.024	0.0	626.5	0.0	812
2160 min Summer	4.475	0.0	699.2	0.0	1176
2880 min Summer	3.614	0.0	752.8	0.0	1540
4320 min Summer	2.667	0.0	833.0	0.0	2256
5760 min Summer	2.154	0.0	897.9	0.0	3000
7200 min Summer	1.826	0.0	951.3	0.0	3688
8640 min Summer	1.596	0.0	997.7	0.0	4416

Cascade Summary of Results for south pond 2 - 200.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	174.138	0.138	6.1	0.0	6.1	19.7	O K
15 min Winter	174.326	0.326	11.0	0.0	11.0	47.8	O K
30 min Winter	174.448	0.448	13.2	0.0	13.2	66.6	O K
60 min Winter	174.564	0.564	15.0	0.0	15.0	85.2	O K
120 min Winter	174.651	0.651	16.2	0.0	16.2	99.3	O K
180 min Winter	174.680	0.680	16.6	0.0	16.6	104.1	O K
240 min Winter	174.684	0.684	16.6	0.0	16.6	104.7	O K
360 min Winter	174.657	0.657	16.3	0.0	16.3	100.3	O K
480 min Winter	174.624	0.624	15.8	0.0	15.8	94.9	O K
600 min Winter	174.589	0.589	15.3	0.0	15.3	89.2	O K
720 min Winter	174.555	0.555	14.8	0.0	14.8	83.8	O K
960 min Winter	174.496	0.496	13.9	0.0	13.9	74.2	O K
1440 min Winter	174.404	0.404	12.4	0.0	12.4	59.8	O K
2160 min Winter	174.314	0.314	10.7	0.0	10.7	46.0	O K
2880 min Winter	174.257	0.257	9.5	0.0	9.5	37.3	O K
4320 min Winter	174.190	0.190	7.8	0.0	7.8	27.3	O K
5760 min Winter	174.152	0.152	6.7	0.0	6.7	21.8	O K
7200 min Winter	174.135	0.135	5.9	0.0	5.9	19.2	O K
8640 min Winter	174.124	0.124	5.2	0.0	5.2	17.7	O K
10080 min Winter	174.116	0.116	4.7	0.0	4.7	16.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.426	0.0	1039.1	0.0	5144
15 min Winter	99.703	0.0	119.9	0.0	23
30 min Winter	72.140	0.0	174.0	0.0	36
60 min Winter	49.794	0.0	241.6	0.0	62
120 min Winter	33.271	0.0	323.0	0.0	100
180 min Winter	25.831	0.0	376.2	0.0	138
240 min Winter	21.369	0.0	415.0	0.0	176
360 min Winter	16.115	0.0	469.5	0.0	250
480 min Winter	13.191	0.0	512.4	0.0	322
600 min Winter	11.278	0.0	547.6	0.0	392
720 min Winter	9.913	0.0	577.6	0.0	460
960 min Winter	8.074	0.0	627.2	0.0	594
1440 min Winter	6.024	0.0	701.8	0.0	852
2160 min Winter	4.475	0.0	783.1	0.0	1236
2880 min Winter	3.614	0.0	843.2	0.0	1612
4320 min Winter	2.667	0.0	933.1	0.0	2340
5760 min Winter	2.154	0.0	1005.7	0.0	3064
7200 min Winter	1.826	0.0	1065.5	0.0	3752
8640 min Winter	1.596	0.0	1117.5	0.0	4496
10080 min Winter	1.426	0.0	1164.0	0.0	5144

Cascade Rainfall Details for south pond 2 - 200.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.000

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

Time Area Diagram

Total Area (ha) 0.253

Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)
0	4	0.084	4	8	0.084	8	12	0.085

Cascade Model Details for south pond 2 - 200.SRCX

Storage is Online Cover Level (m) 175.500

Tank or Pond Structure

Invert Level (m) 174.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	0.500	160.0	1.000	170.0	1.500	180.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 174.000

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 175.500

Cascade Summary of Results for south pond 3 - 200.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 2 - 200.SRCX south pond 1 - 200.SRCX	south pond 4 - 200.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	170.963	0.463	13.4	0.0	13.4	90.1	O K
30 min Summer	171.156	0.656	16.2	0.0	16.2	129.1	O K
60 min Summer	171.370	0.870	18.9	0.0	18.9	174.3	O K
120 min Summer	171.587	1.087	21.3	0.0	21.3	221.8	O K
180 min Summer	171.690	1.190	22.3	0.0	22.3	245.0	O K
240 min Summer	171.736	1.236	22.7	0.0	22.7	255.5	Flood Risk
360 min Summer	171.772	1.272	23.1	0.0	23.1	263.7	Flood Risk
480 min Summer	171.786	1.286	23.2	0.0	23.2	267.0	Flood Risk
600 min Summer	171.784	1.284	23.2	0.0	23.2	266.6	Flood Risk
720 min Summer	171.773	1.273	23.1	0.0	23.1	264.0	Flood Risk
960 min Summer	171.735	1.235	22.7	0.0	22.7	255.3	Flood Risk
1440 min Summer	171.637	1.137	21.8	0.0	21.8	233.0	O K
2160 min Summer	171.490	0.990	20.2	0.0	20.2	200.3	O K
2880 min Summer	171.364	0.864	18.8	0.0	18.8	172.8	O K
4320 min Summer	171.173	0.673	16.5	0.0	16.5	132.8	O K
5760 min Summer	171.046	0.546	14.7	0.0	14.7	106.7	O K
7200 min Summer	170.954	0.454	13.3	0.0	13.3	88.4	O K
8640 min Summer	170.889	0.389	12.2	0.0	12.2	75.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	99.703	0.0	198.1	0.0	26
30 min Summer	72.140	0.0	287.6	0.0	40
60 min Summer	49.794	0.0	400.4	0.0	68
120 min Summer	33.271	0.0	535.4	0.0	126
180 min Summer	25.831	0.0	623.7	0.0	182
240 min Summer	21.369	0.0	688.1	0.0	224
360 min Summer	16.115	0.0	778.5	0.0	284
480 min Summer	13.191	0.0	849.7	0.0	346
600 min Summer	11.278	0.0	908.1	0.0	414
720 min Summer	9.913	0.0	957.9	0.0	482
960 min Summer	8.074	0.0	1040.2	0.0	616
1440 min Summer	6.024	0.0	1163.6	0.0	880
2160 min Summer	4.475	0.0	1299.0	0.0	1260
2880 min Summer	3.614	0.0	1398.8	0.0	1624
4320 min Summer	2.667	0.0	1547.5	0.0	2344
5760 min Summer	2.154	0.0	1668.5	0.0	3064
7200 min Summer	1.826	0.0	1767.7	0.0	3768
8640 min Summer	1.596	0.0	1853.9	0.0	4496

Cascade Summary of Results for south pond 3 - 200.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	170.837	0.337	11.2	0.0	11.2	65.2	O K
15 min Winter	171.018	0.518	14.3	0.0	14.3	101.1	O K
30 min Winter	171.232	0.732	17.2	0.0	17.2	145.0	O K
60 min Winter	171.471	0.971	20.0	0.0	20.0	196.2	O K
120 min Winter	171.716	1.216	22.5	0.0	22.5	250.9	Flood Risk
180 min Winter	171.836	1.336	23.7	0.0	23.7	278.6	Flood Risk
240 min Winter	171.893	1.393	24.2	0.0	24.2	291.9	Flood Risk
360 min Winter	171.922	1.422	24.4	0.0	24.4	298.8	Flood Risk
480 min Winter	171.930	1.430	24.5	0.0	24.5	300.7	Flood Risk
600 min Winter	171.916	1.416	24.4	0.0	24.4	297.5	Flood Risk
720 min Winter	171.890	1.390	24.2	0.0	24.2	291.2	Flood Risk
960 min Winter	171.818	1.318	23.5	0.0	23.5	274.4	Flood Risk
1440 min Winter	171.655	1.155	21.9	0.0	21.9	237.1	O K
2160 min Winter	171.438	0.938	19.7	0.0	19.7	188.9	O K
2880 min Winter	171.269	0.769	17.7	0.0	17.7	152.8	O K
4320 min Winter	171.044	0.544	14.7	0.0	14.7	106.2	O K
5760 min Winter	170.911	0.411	12.5	0.0	12.5	79.8	O K
7200 min Winter	170.826	0.326	11.0	0.0	11.0	63.1	O K
8640 min Winter	170.769	0.269	9.8	0.0	9.8	51.8	O K
10080 min Winter	170.729	0.229	8.8	0.0	8.8	44.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.426	0.0	1930.6	0.0	5240
15 min Winter	99.703	0.0	222.1	0.0	26
30 min Winter	72.140	0.0	322.4	0.0	40
60 min Winter	49.794	0.0	448.6	0.0	68
120 min Winter	33.271	0.0	599.8	0.0	124
180 min Winter	25.831	0.0	698.7	0.0	180
240 min Winter	21.369	0.0	770.8	0.0	232
360 min Winter	16.115	0.0	872.1	0.0	296
480 min Winter	13.191	0.0	951.9	0.0	368
600 min Winter	11.278	0.0	1017.3	0.0	442
720 min Winter	9.913	0.0	1073.0	0.0	516
960 min Winter	8.074	0.0	1165.1	0.0	658
1440 min Winter	6.024	0.0	1303.4	0.0	930
2160 min Winter	4.475	0.0	1455.0	0.0	1320
2880 min Winter	3.614	0.0	1566.8	0.0	1684
4320 min Winter	2.667	0.0	1733.5	0.0	2420
5760 min Winter	2.154	0.0	1868.8	0.0	3120
7200 min Winter	1.826	0.0	1979.9	0.0	3824
8640 min Winter	1.596	0.0	2076.5	0.0	4504
10080 min Winter	1.426	0.0	2162.7	0.0	5240

Cascade Rainfall Details for south pond 3 - 200.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.497

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.165	4	8	0.166	8	12	0.166

Cascade Model Details for south pond 3 - 200.SRCX

Storage is Online Cover Level (m) 172.000

Tank or Pond Structure

Invert Level (m) 170.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	190.0	0.500	200.0	1.000	220.0	1.500	240.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 170.500

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 172.000

Cascade Summary of Results for south pond 4 - 200.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 3 - 200.SRCX south pond 2 - 200.SRCX south pond 1 - 200.SRCX	south pond 5 - 200.SRCX	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow Σ (l/s)	Max Volume (m³)	Status
15 min Summer	163.352	0.352	11.5	0.0	11.5	51.7	O K
30 min Summer	163.500	0.500	14.0	0.0	14.0	74.9	O K
60 min Summer	163.675	0.675	16.5	0.0	16.5	103.5	O K
120 min Summer	163.877	0.877	19.0	0.0	19.0	138.0	O K
180 min Summer	163.999	0.999	20.3	0.0	20.3	159.8	O K
240 min Summer	164.082	1.082	21.2	0.0	21.2	174.8	O K
360 min Summer	164.183	1.183	22.2	0.0	22.2	193.5	O K
480 min Summer	164.240	1.240	22.8	0.0	22.8	204.3	Flood Risk
600 min Summer	164.257	1.257	22.9	0.0	22.9	207.5	Flood Risk
720 min Summer	164.260	1.260	23.0	0.0	23.0	208.0	Flood Risk
960 min Summer	164.253	1.253	22.9	0.0	22.9	206.7	Flood Risk
1440 min Summer	164.213	1.213	22.5	0.0	22.5	199.1	Flood Risk
2160 min Summer	164.126	1.126	21.7	0.0	21.7	182.9	O K
2880 min Summer	164.029	1.029	20.7	0.0	20.7	165.1	O K
4320 min Summer	163.848	0.848	18.6	0.0	18.6	133.1	O K
5760 min Summer	163.708	0.708	16.9	0.0	16.9	109.1	O K
7200 min Summer	163.601	0.601	15.5	0.0	15.5	91.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	99.703	0.0	238.4	0.0	108
30 min Summer	72.140	0.0	346.5	0.0	137
60 min Summer	49.794	0.0	483.6	0.0	174
120 min Summer	33.271	0.0	646.9	0.0	226
180 min Summer	25.831	0.0	753.7	0.0	268
240 min Summer	21.369	0.0	831.5	0.0	306
360 min Summer	16.115	0.0	940.7	0.0	376
480 min Summer	13.191	0.0	1026.9	0.0	486
600 min Summer	11.278	0.0	1097.4	0.0	580
720 min Summer	9.913	0.0	1157.6	0.0	636
960 min Summer	8.074	0.0	1256.9	0.0	756
1440 min Summer	6.024	0.0	1405.9	0.0	1000
2160 min Summer	4.475	0.0	1570.4	0.0	1376
2880 min Summer	3.614	0.0	1690.9	0.0	1752
4320 min Summer	2.667	0.0	1870.4	0.0	2472
5760 min Summer	2.154	0.0	2017.2	0.0	3184
7200 min Summer	1.826	0.0	2137.0	0.0	3896

Cascade Summary of Results for south pond 4 - 200.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	163.518	0.518	14.3	0.0	14.3	77.8	O K
10080 min Summer	163.451	0.451	13.2	0.0	13.2	67.2	O K
15 min Winter	163.392	0.392	12.2	0.0	12.2	57.9	O K
30 min Winter	163.556	0.556	14.8	0.0	14.8	83.9	O K
60 min Winter	163.749	0.749	17.4	0.0	17.4	116.0	O K
120 min Winter	163.971	0.971	20.0	0.0	20.0	154.6	O K
180 min Winter	164.106	1.106	21.4	0.0	21.4	179.1	O K
240 min Winter	164.197	1.197	22.4	0.0	22.4	196.1	O K
360 min Winter	164.310	1.310	23.4	0.0	23.4	217.5	Flood Risk
480 min Winter	164.380	1.380	24.1	0.0	24.1	231.1	Flood Risk
600 min Winter	164.409	1.409	24.3	0.0	24.3	236.9	Flood Risk
720 min Winter	164.411	1.411	24.4	0.0	24.4	237.2	Flood Risk
960 min Winter	164.390	1.390	24.2	0.0	24.2	233.2	Flood Risk
1440 min Winter	164.314	1.314	23.5	0.0	23.5	218.3	Flood Risk
2160 min Winter	164.151	1.151	21.9	0.0	21.9	187.5	O K
2880 min Winter	163.990	0.990	20.2	0.0	20.2	158.0	O K
4320 min Winter	163.732	0.732	17.2	0.0	17.2	113.2	O K
5760 min Winter	163.562	0.562	14.9	0.0	14.9	84.9	O K
7200 min Winter	163.446	0.446	13.1	0.0	13.1	66.4	O K
8640 min Winter	163.366	0.366	11.7	0.0	11.7	53.9	O K
10080 min Winter	163.309	0.309	10.6	0.0	10.6	45.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.596	0.0	2241.2	0.0	4592
10080 min Summer	1.426	0.0	2333.7	0.0	5312
15 min Winter	99.703	0.0	267.4	0.0	114
30 min Winter	72.140	0.0	388.5	0.0	144
60 min Winter	49.794	0.0	541.9	0.0	182
120 min Winter	33.271	0.0	724.8	0.0	236
180 min Winter	25.831	0.0	844.3	0.0	280
240 min Winter	21.369	0.0	931.5	0.0	318
360 min Winter	16.115	0.0	1053.8	0.0	388
480 min Winter	13.191	0.0	1150.3	0.0	482
600 min Winter	11.278	0.0	1229.4	0.0	586
720 min Winter	9.913	0.0	1296.7	0.0	674
960 min Winter	8.074	0.0	1407.9	0.0	782
1440 min Winter	6.024	0.0	1574.8	0.0	1046
2160 min Winter	4.475	0.0	1758.9	0.0	1436
2880 min Winter	3.614	0.0	1894.0	0.0	1812
4320 min Winter	2.667	0.0	2095.4	0.0	2520
5760 min Winter	2.154	0.0	2259.3	0.0	3232
7200 min Winter	1.826	0.0	2393.6	0.0	3920
8640 min Winter	1.596	0.0	2510.4	0.0	4600
10080 min Winter	1.426	0.0	2614.3	0.0	5336

Cascade Rainfall Details for south pond 4 - 200.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.225

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.075	4	8	0.075	8	12	0.075

Cascade Model Details for south pond 4 - 200.SRCX

Storage is Online Cover Level (m) 164.500

Tank or Pond Structure

Invert Level (m) 163.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	140.0	0.500	160.0	1.000	180.0	1.500	200.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 163.000

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 164.500

Cascade Summary of Results for south pond 5 - 200.SRCX

Upstream Structures	Outflow To	Overflow To
south pond 4 - 200.SRCX south pond 3 - 200.SRCX south pond 2 - 200.SRCX south pond 1 - 200.SRCX	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	156.956	0.156	11.0	0.0	11.0	40.8	O K
30 min Summer	156.997	0.197	13.3	0.0	13.3	51.6	O K
60 min Summer	157.106	0.306	14.9	0.0	14.9	80.4	O K
120 min Summer	157.298	0.498	15.9	0.0	15.9	132.0	O K
180 min Summer	157.462	0.662	16.0	0.0	16.0	176.4	O K
240 min Summer	157.597	0.797	16.0	0.0	16.0	213.4	O K
360 min Summer	157.799	0.999	16.0	0.0	16.0	269.8	O K
480 min Summer	157.984	1.184	16.0	0.0	16.0	321.9	O K
600 min Summer	158.118	1.318	16.0	0.0	16.0	360.1	O K
720 min Summer	158.191	1.391	16.0	0.0	16.0	381.0	O K
960 min Summer	158.267	1.467	16.0	0.0	16.0	403.0	O K
1440 min Summer	158.292	1.492	16.0	0.0	16.0	410.0	O K
2160 min Summer	158.170	1.370	16.0	0.0	16.0	374.9	O K
2880 min Summer	157.958	1.158	16.0	0.0	16.0	314.3	O K
4320 min Summer	157.589	0.789	16.0	0.0	16.0	211.5	O K
5760 min Summer	157.351	0.551	16.0	0.0	16.0	146.2	O K
7200 min Summer	157.196	0.396	15.6	0.0	15.6	104.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	99.703	0.0	259.1	0.0	171
30 min Summer	72.140	0.0	377.6	0.0	222
60 min Summer	49.794	0.0	530.3	0.0	322
120 min Summer	33.271	0.0	709.6	0.0	452
180 min Summer	25.831	0.0	826.9	0.0	552
240 min Summer	21.369	0.0	912.3	0.0	634
360 min Summer	16.115	0.0	1032.3	0.0	768
480 min Summer	13.191	0.0	1126.8	0.0	904
600 min Summer	11.278	0.0	1204.3	0.0	992
720 min Summer	9.913	0.0	1270.2	0.0	1068
960 min Summer	8.074	0.0	1379.2	0.0	1218
1440 min Summer	6.024	0.0	1542.2	0.0	1514
2160 min Summer	4.475	0.0	1725.2	0.0	1908
2880 min Summer	3.614	0.0	1857.5	0.0	2252
4320 min Summer	2.667	0.0	2053.7	0.0	2848
5760 min Summer	2.154	0.0	2216.6	0.0	3488
7200 min Summer	1.826	0.0	2348.2	0.0	4128

Cascade Summary of Results for south pond 5 - 200.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	157.100	0.300	14.9	0.0	14.9	79.0	O K
10080 min Summer	157.038	0.238	14.1	0.0	14.1	62.5	O K
15 min Winter	156.966	0.166	11.7	0.0	11.7	43.5	O K
30 min Winter	157.025	0.225	13.9	0.0	13.9	59.0	O K
60 min Winter	157.166	0.366	15.4	0.0	15.4	96.5	O K
120 min Winter	157.416	0.616	16.0	0.0	16.0	163.8	O K
180 min Winter	157.631	0.831	16.0	0.0	16.0	223.1	O K
240 min Winter	157.818	1.018	16.0	0.0	16.0	275.0	O K
360 min Winter	158.135	1.335	16.0	0.0	16.0	365.0	O K
480 min Winter	158.300	1.500	16.0	0.0	16.0	412.6	O K
600 min Winter	158.404	1.604	16.0	0.0	16.0	442.6	O K
720 min Winter	158.473	1.673	16.0	0.0	16.0	462.8	O K
960 min Winter	158.550	1.750	16.0	0.0	16.0	485.7	Flood Risk
1440 min Winter	158.576	1.776	16.0	0.0	16.0	493.3	Flood Risk
2160 min Winter	158.424	1.624	16.0	0.0	16.0	448.6	O K
2880 min Winter	158.180	1.380	16.0	0.0	16.0	377.7	O K
4320 min Winter	157.491	0.691	16.0	0.0	16.0	184.5	O K
5760 min Winter	157.181	0.381	15.5	0.0	15.5	100.5	O K
7200 min Winter	157.044	0.244	14.1	0.0	14.1	64.0	O K
8640 min Winter	156.983	0.183	12.9	0.0	12.9	47.8	O K
10080 min Winter	156.965	0.165	11.6	0.0	11.6	43.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.596	0.0	2462.4	0.0	4776
10080 min Summer	1.426	0.0	2563.0	0.0	5448
15 min Winter	99.703	0.0	290.9	0.0	178
30 min Winter	72.140	0.0	423.7	0.0	253
60 min Winter	49.794	0.0	594.3	0.0	356
120 min Winter	33.271	0.0	795.1	0.0	506
180 min Winter	25.831	0.0	926.5	0.0	618
240 min Winter	21.369	0.0	1022.2	0.0	714
360 min Winter	16.115	0.0	1156.5	0.0	864
480 min Winter	13.191	0.0	1262.4	0.0	944
600 min Winter	11.278	0.0	1349.2	0.0	1024
720 min Winter	9.913	0.0	1423.0	0.0	1100
960 min Winter	8.074	0.0	1545.0	0.0	1252
1440 min Winter	6.024	0.0	1727.6	0.0	1550
2160 min Winter	4.475	0.0	1932.4	0.0	1976
2880 min Winter	3.614	0.0	2080.7	0.0	2364
4320 min Winter	2.667	0.0	2301.0	0.0	2916
5760 min Winter	2.154	0.0	2482.8	0.0	3472
7200 min Winter	1.826	0.0	2630.3	0.0	4088
8640 min Winter	1.596	0.0	2758.3	0.0	4624
10080 min Winter	1.426	0.0	2871.7	0.0	5360

Cascade Rainfall Details for south pond 5 - 200.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	15.600	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+37

Time Area Diagram

Total Area (ha) 0.129

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.043	4	8	0.043	8	12	0.043

Cascade Model Details for south pond 5 - 200.SRCX

Storage is Online Cover Level (m) 158.800

Tank or Pond Structure

Invert Level (m) 156.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	260.0	1.000	280.0	2.000	300.0
0.500	270.0	1.500	290.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0165-1600-2000-1600
Design Head (m)	2.000
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	165
Invert Level (m)	156.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	16.0
Flush-Flo™	0.579	16.0
Kick-Flo®	1.216	12.6
Mean Flow over Head Range	-	14.0

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

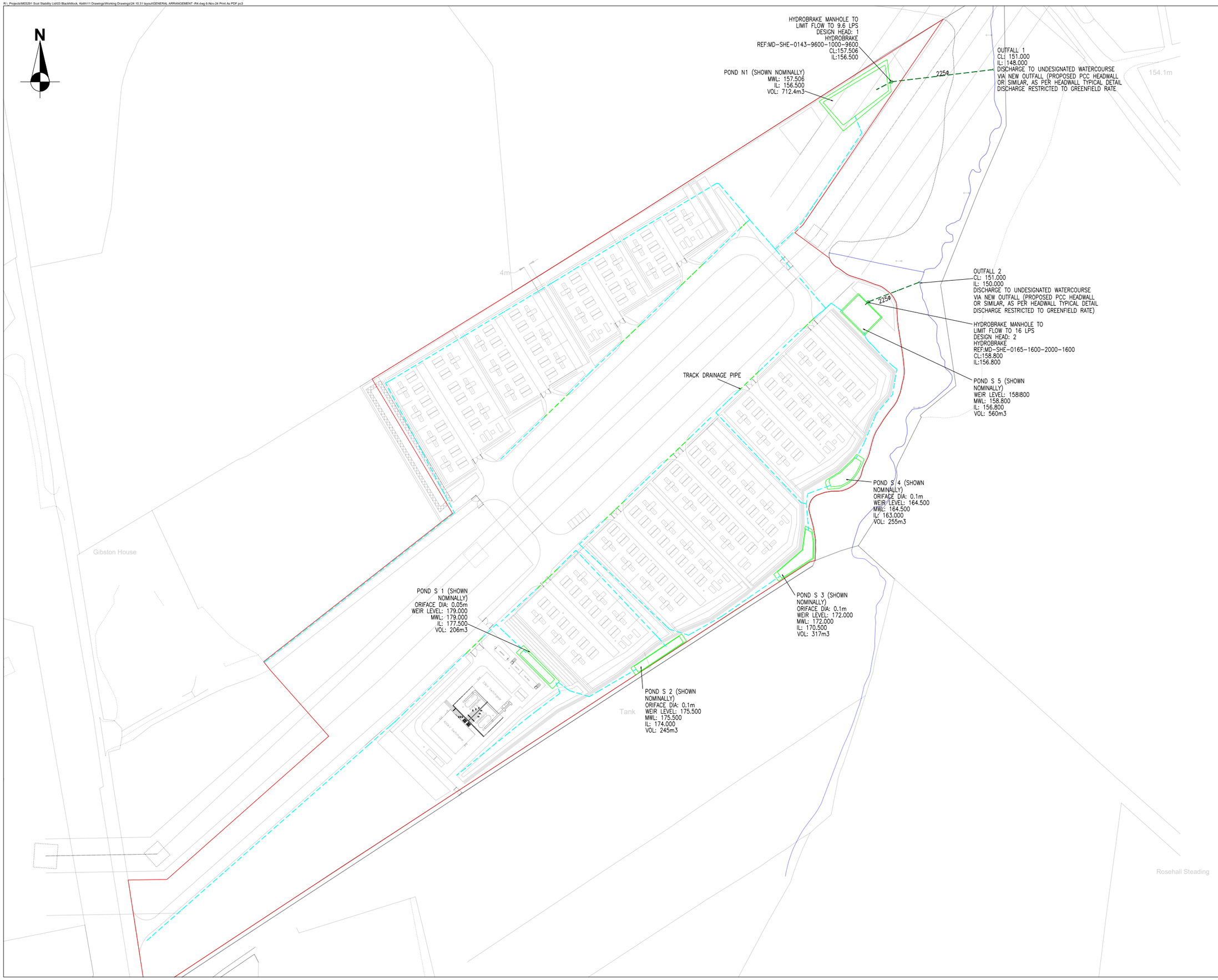
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	12.9	3.000	19.4	7.000	29.1
0.200	13.4	1.400	13.5	3.500	20.9	7.500	30.1
0.300	14.9	1.600	14.4	4.000	22.3	8.000	31.1
0.400	15.6	1.800	15.2	4.500	23.6	8.500	32.0
0.500	15.9	2.000	16.0	5.000	24.8	9.000	32.9
0.600	16.0	2.200	16.7	5.500	25.9	9.500	33.8
0.800	15.7	2.400	17.4	6.000	27.0		
1.000	14.8	2.600	18.1	6.500	28.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 158.800

Appendix C

Drainage Layout Drawings



NOTES

GENERAL

1. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

2. THIS DRAWING SHALL BE REVIEWED IN CONJUNCTION WITH ALL RELEVANT ENGINEERING DESIGN DRAWINGS.

3. THIS DRAWING IS NOT TO BE SCALED FROM.

4. THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY UNDERTAKERS IN REGARD TO LOCATING ALL EXISTING SERVICES WITHIN AND ADJACENT TO THE SITE OF THE WORK

LEGEND

SITE BOUNDARY

PROPOSED ATTENUATION POND

PROPOSED DRAINAGE PIPE

PROPOSED SWALES

UNDESIGNATED WATERCOURSE

PROPOSED TRACK DRAINAGE PIPE

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
4	IB	PD	01/11/24	REVISED LAYOUT
3	IB	PD	03/10/24	REVISED LAYOUT
2	IB	MR	22/05/24	FOR PLANNING
1	IB	PD	12/05/23	FOR REVIEW

STATUS

FOR REVIEW

McCloy Consulting

T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

Mossley Mill, Lower Ground (West)
Carnmoney Road North
Newtownabbey
Co. Antrim, BT36 5QA

PROJECT

BESS
BLACKHILLOCK, KEITH

CLIENT

BLACKHILLOCK FLEXPOWER LTD

DRAWING TITLE

PROPOSED DRAINAGE LAYOUT
GENERAL ARRANGEMENT

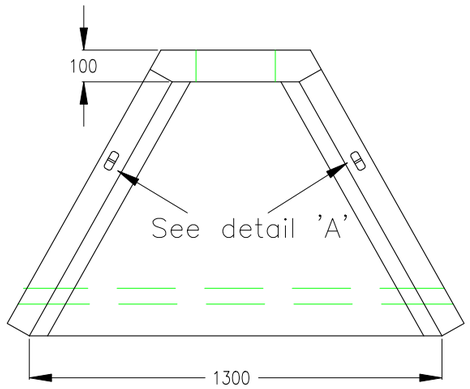
SCALE	ORIGINAL SIZE
1:1000	A1

DRAWN	CHECKED	DATE
IB	PD	06/11/2024

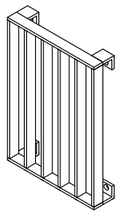
PROJECT No.	DRAWING No.	ISSUE NO.
M03291-03	DWG_100	4

INDICATIVE DESIGN

INDICATIVE HEADWALL DETAIL

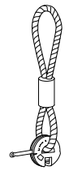


Opening in back wall cast to suit the outside diameter pipe at invert height to opening as required.

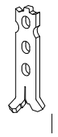


Detail 'B'

SPILLWAY HEADWALL
H3C (DRAINAGE OUTFALL)

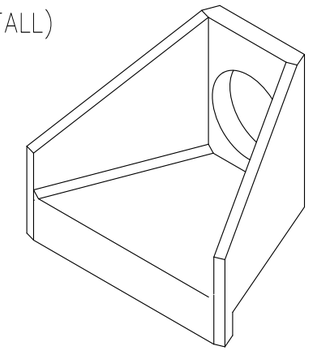


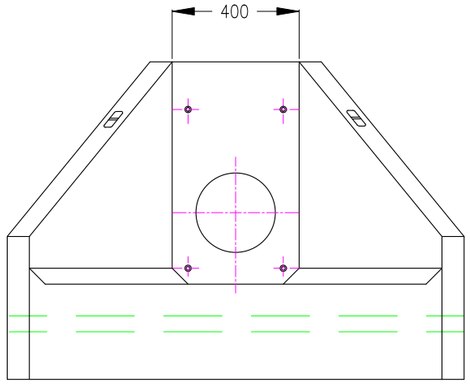
Lifting ring clutch

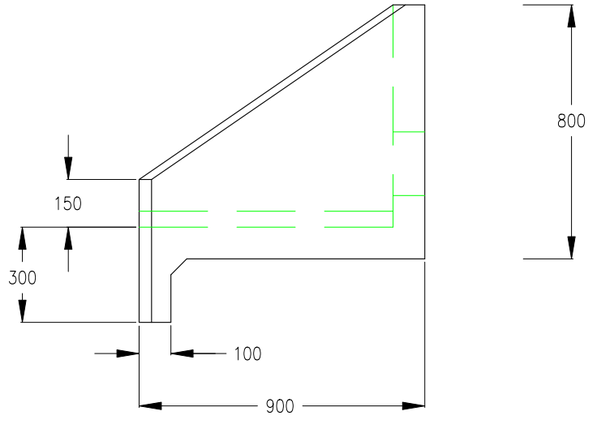


Detail 'A'
'Cast in' Universal anchor point

Installation







Units should be bedded on minimum 100mm of semi-dry concrete. Sit the headwall level or with a slight fall 1:50 from pipe to spill mouth.
For full detailed installation instructions contact ALTHON Ltd, 01603 488700

Material: Reinforced concrete
Weight approximately 540kg

All dimensions in mm

Althon

ALTHON LIMITED. VULCAN ROAD SOUTH, NORWICH, NR6 6AF
TEL 01603 488700 FAX 01603488598
www.althon.co.uk

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	IB	PD	14/11/2024	FOR INFORMATION
1	IB	PD	25/04/2024	FOR INFORMATION

STATUS
FOR INFORMATION

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W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West),
Carnmoney Road North,
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BT36 5QA

PROJECT
BESS
BLACKHILLOCK, KEITH

CLIENT
BLACKHILLOCK FLEXPOWER LTD

DRAWING TITLE
INDICATIVE HEADWALL DETAILS

SCALE	ORIGINAL SIZE
N/A	A1

DRAWN	CHECKED	DATE
IB	PD	14/11/2024

PROJECT No.	DRAWING No.	ISSUE NO.
M03291-03	DWG200	2