PROJECT:

BROCKHILL EAST, Phase 2

REDDITCH

DRAINAGE & FLOOD RISK STATEMENT

For

PERSIMMON HOMES SOUTH MIDLANDS AND GALLAGHER ESTATES

July 2013

Our Ref: AAC 4835

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

- This report considers the flood risk associated with the development of a parcel of greenfield land known as Brockhill East, Phase 2 on the northern outskirts of Redditch. The southern portion of the land falls within the Redditch Borough Council boundary with the northern portion being within Bromsgrove District Council's boundary.
- This report also sets out the proposed foul and surface water drainage strategy for the proposed development.

1.2 SITE DETAILS

- The site bounds the Birmingham to Redditch railway line to the east, Weights Lane to the north and an industrial development off Winsor Road to the south.
- Development by Persimmon Homes of a parcel of land known as Brockhill East Phase 1, located immediately to the south of Brockhill East Phase 2 is currently underway.
- An indicative masterplan for Brockhill East Phase 2 can be found in appendix A of this report. This also shows the phase 1 development.
- The phase 2 development parcel occupies approx 83 hectares, and the development proposals include residential parcels, a mixed use local centre and employment parcels. There are also extensive areas of public open space/amenity space including tree and woodland planting, as well as a network of surface water features which will provide a sustainable means of surface water run-off control.
- The approximate proposed impermeable area of the site is estimated to be 30% of the site area, this equates to 24.9 hectares (this includes highway infrastructure, roofs, hard standings, driveways and car parks etc).
- The Red Ditch flows through the site in a south easterly direction before turning to follow a north easterly route alongside but outside of the south eastern boundary of the site. It then turns again to flow in a south easterly direction adjacent to the railway boundary before passing beneath Windsor Road.
- The site is relatively steeply sloping and falls within the catchment of the Red Ditch.

2 FLOOD RISK

2.1 NATURE OF FLOOD RISK

- The Environment Agency is responsible for the provision of information pertaining to flood risk from tidal and main watercourses throughout England and Wales. The EA provides an online information service through its Flood Map data an extract of which is provided in Figure 1.1 below. The site is wholly in flood zone 1 and therefore not prone to flooding from main watercourses.

- The Red Ditch is not classified as a main watercourse therefore Clive Wilson, Redditch Borough Council's Operations Manager – Asset Maintenance has indicated that there may be a requirement to hydraulically model the Red Ditch in order to determine the extent of any flood zone associated with it. This modelling work would be undertaken and included within a Flood Risk Assessment for the site at the formal planning application stage. Suitable hydraulic modelling was undertaken and approved as part of the planning submission for phase 1, the hydraulic model used for this will be extended as required to fully assess any flood issues that may affect the phase 2 development. It is however thought that due to the steeply sloping nature of the phase 2 site any flooding would be contained within a very narrow corridor along the Red Ditch. Any proposed development would be kept well outside of any areas of potential flooding.

- Surface Water run-off from the impermeable areas of the proposed development will discharge at existing greenfield run off rates to the Red Ditch. Appropriate surface water detention facilities such as ponds and swales will be provided throughout the development to sufficiently accommodate flows arising from storms up to a 1 in 100 year event plus a 30% allowance for future climate change. As a consequence of the development flows within the development and downstream would be better regulated reducing the risk of flooding to properties to the south and east.

- The surface water drainage will fully comply with the requirements of the Land Drainage Act, the Flood Water Management Act, Severn Trent Water, Redditch Borough Council and Bromsgrove District Council.

Figure 1.1: Extract from EA Flood Map (downloaded on 30.07.2013)

Based upon the Ordnance Survey map with the Permission of the Controller of Her Majesty's Stationery Office. © Crown copyright Licence No. 100020449 RPS Design Group Ltd

3 SURFACE WATER DRAINAGE

3.1 SURFACE WATER DRAINAGE STRATEGY

- Surface water drainage within the development site will be designed to accommodate flows arising from storms up to a 1 in 100 year event plus a 30% allowance for future climate change without any surface flooding or risk to lower lying properties.

- Flows should be limited to existing greenfield run off rates and discharge to the Red Ditch which runs through and outside the site.

- The greenfield run off rates have been calculated using Microdrainage software: ICP SUDS Mean Annual Flood, the results of which are as follows:

Impermeable area	24.9 hectares
Qbar run-off rate	109.4 litres/second
1 in 100 year run-off rate	281.1 litres/second

  The results are contained in appendix B.

- Surface Water detention volumes have been calculated again using Microdrainage software, the results of which are as follows:

Impermeable Area	24.9 hectares
Detention Volume, for Qbar Outflow	16882.7m^3
Detention Volume, for 1 in 100 year Outflow	13410.3m^3

  The results are contained in appendix C.

- The proposed surface water detention ponds shown on the masterplan contained in appendix A are of sufficient size to accommodate the flows arising from a 1 in 100 year storm plus a 30% allowance for future climate change, with an outflow no greater than the Qbar run off rate.

- The drainage proposals are subject to detailed design, following completion of a detailed development plan. At that time the actual impermeable areas will be utilised and the greenfield run-off rate re-calculated as necessary.

- The use of infiltration methods as means of surface water disposal will also be investigated following the undertaking of ground investigation works, however from the results obtained for phase 1 it is unlikely that such methods will be viable.

- The proposed detention ponds and other surface water features will be designed to provide sufficient treatment trains for surface water quality improvements, permanently wet ponds with reed beds and other natural features will be provided in the ponds which as well as improving water quality will also have amenity value and help to increase and enhance biodiversity etc.

4 FOUL WATER DRAINAGE

4.1 FOUL WATER DRAINAGE STRATEGY

- Severn Trent Water were commissioned by Persimmon Homes South Midlands to carry out various hydraulic modelling assessments of the foul water sewer network in the vicinity of the site to establish whether available capacity is available to accommodate foul water flows from the development.
- From the results of the modelling it was established that there was sufficient capacity to accommodate flows from phase 1 of the development within the foul water sewer infrastructure to the south of the site (Windsor Road), however it was identified that there would not be sufficient capacity within the immediate vicinity of the site to accommodate the foul flows arising from Phase 2 without the risk of flooding.
- Severn Trent Water have therefore advised that foul water from the Phase 2 development site would need to gravitate to a single new foul water pumping station, flows would then be pumped over the River Arrow and gravitate via a new trunk sewer through the Arrow Valley or around the outskirts of Redditch before outfalling to the existing public sewer system downstream of Ipsley Church Lane (where sufficient capacity exists) before finally discharging to the Spernall Sewage Treatment Works.
- This would provide a suitable and sustainable outfall.
- This solution would not exacerbate any existing flooding problems, and the new trunk sewer could be utilised to convey flows from other adjacent areas where flooding may be occurring thus improving capacities and alleviating occurrences of flooding.
- Severn Trent Water cannot refuse a sewer connection on capacity grounds, and as such they are obliged to upgrade the existing sewer system as necessary sufficient to accommodate new development flows (at their expense). They are required to carry out the improvement works within a reasonable time, which for major improvement works could be a number of years. Bearing this in mind the developer is continuing to discuss the development proposals with Severn Trent Water to ensure that the development will be deliverable and improvement works are completed at the necessary time.

5 CONCLUSIONS

5.1 FLOOD RISK

- As demonstrated in section 2 of this report, the site is not at risk of flooding from main watercourses and is located in flood zone 1
- Hydraulic modelling will be carried out to establish whether there is any potential flooding from the Red Ditch; no development would be carried out in any such areas.
- Surface water outflow from the site will be limited to existing greenfield run off rates, and suitable on site surface water detention facilities provided. As a consequence there will be no increase risk of flooding to the site or lower lying land outside the development site.
- In conclusion for the aforementioned reasons the proposed development would not increase flood risk.

5.2 SURFACE WATER DRAINAGE

- As demonstrated in section 3 of this report, a suitable surface water drainage solution can be provided with outflows at greenfield run-off rates to the Red Ditch.
- Sufficient space is provided on the current masterplan to accommodate the required surface water detention features.
- In conclusion for the aforementioned reasons a suitable and sustainable surface water drainage solution for proposed development is deliverable.

5.3 FOUL WATER DRAINAGE

- As demonstrated in section 4 of this report, a suitable foul water drainage solution can be provided in accordance with the requirements of Severn Trent Water.

- Some off site improvement works are required, all of which are deliverable and may have benefits to areas downstream where capacity problems exist and flooding occurs.
- In conclusion for the aforementioned reasons a suitable and sustainable foul water drainage solution for proposed development is deliverable.

5.4 ADDITIONAL REQUIREMENTS FOR FORMAL PLANNING APPLICATION IN RESPECT OD FLOOD RISK AND DRAINAGE

- Hydraulic Modelling of Red Ditch.
- Preparation of Flood Risk Assessment.
- Further dialogue and agreement with Redditch Borough Councils Land Drainage Officer.
- Further dialogue and agreement with Severn Trent Water with regard to the provision of foul water drainage outfall.
- Further preliminary but more detailed designs of surface water infrastructure and surface water detention facilities.
- Completion of detailed foul and surface water drainage strategy.

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APPENDICES

A. APPENDIX A

Drawing No. AAH4936-121-A Phase 2 Masterplan

The Contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts. The Contractor is to comply in all respects with current Building Legislation, British Standard Specifications, Building Regulations, Construction (Design & Management) Regulations, Party Wall Act etc, whether or not specifically stated on this drawing. This drawing must be read with and checked against any structural, geotechnical or other specialist documentation provided.

This drawing is not intended to show details of foundations, ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor. A suitable method of foundation should be provided allowing for existing ground conditions. Any suspect or fluid ground, contaminates on or within the ground, should be further investigated by a suitable expert. Any earthwork constructions shown indicate typical slopes for guidance only & should be further investigated by a suitable expert.

Where existing trees are to be retained they should be subject to a full Arboricultural inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services. A suitable method of foundation is to be provided to accommodate the proposed tree planting.

Sketch proposals are for illustrative purposes only & as such are subject to detailed site investigation including ground conditions/contaminants, drainage, design & planning/density negotiations. Sketch proposals may be based upon enlargements of Os sheets & visual estimations of existing site features, accuracy will therefore need to be verified by survey. Sketch proposals have not been considered in respect of CDM Regulations.

PERSIMMON

CHARLES CHURCH

Brockhill East, Redditch

Phase 2 Masterplan Redditch/Bromsgrove-1:2500@A1-17.05.13-AG

Rev A - Updated following LA Meeting. 02.07.13. PJB.

Key

- Proposed Residential Parcels
- Existing Trees & Hedgerows
- Proposed Woodland Planting
- Proposed Tree Planting
- Mixed Use Local Centre (with indicative gateway frontage)
- Employment (with indicative gateway frontage)
- Public Open Space / Amenity Space
- Indicative Drainage Basin / Existing Water Feature
- Main Street / Main Internal Loop Road
- Shared Surface Spaces / Local Streets
- Lowan's Hill Farm (proposed conversion)
- Vehicle Access Points
- Phase 1 Site Boundary

AAH4936-121-Rev A.

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B. APPENDIX B

Greenfield run-off calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 700 Urban 0.000
Area (ha) 24.900 Soil 0.450 Region Number Region 4

Results l/s

QBAR Rural 109.4
QBAR Urban 109.4

Q100 years 281.1

Q1 year 90.8
Q30 years 214.3
Q100 years 281.1

C. APPENDIX C

Surface Water Detention Volumes:

1. **Qbar outflow rate**
2. **I in 100 year outflow rate**

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.344	0.344	50.7	5779.5	O K
30 min Summer	98.450	0.450	65.7	7564.6	O K
60 min Summer	98.560	0.560	79.0	9401.7	O K
120 min Summer	98.668	0.668	89.4	11220.7	O K
180 min Summer	98.727	0.727	93.7	12217.5	O K
240 min Summer	98.765	0.765	96.1	12855.8	O K
360 min Summer	98.812	0.812	98.9	13648.1	O K
480 min Summer	98.842	0.842	100.6	14147.5	O K
600 min Summer	98.861	0.861	101.7	14459.4	O K
720 min Summer	98.872	0.872	102.3	14649.1	O K
960 min Summer	98.880	0.880	102.8	14791.9	O K
1440 min Summer	98.882	0.882	102.9	14816.7	O K
2160 min Summer	98.875	0.875	102.5	14705.0	O K
2880 min Summer	98.861	0.861	101.7	14463.1	O K
4320 min Summer	98.821	0.821	99.4	13788.4	O K
5760 min Summer	98.776	0.776	96.7	13035.3	O K
7200 min Summer	98.732	0.732	94.0	12296.6	O K
8640 min Summer	98.691	0.691	91.2	11611.5	O K
10080 min Summer	98.654	0.654	88.2	10989.8	O K
15 min Winter	98.385	0.385	56.7	6473.0	O K
30 min Winter	98.504	0.504	72.6	8474.5	O K
60 min Winter	98.627	0.627	85.8	10537.2	O K
120 min Winter	98.749	0.749	95.1	12588.9	O K
180 min Winter	98.817	0.817	99.2	13721.2	O K
240 min Winter	98.860	0.860	101.7	14452.0	O K
360 min Winter	98.915	0.915	104.7	15369.1	O K
480 min Winter	98.950	0.950	106.5	15958.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.774	0.0	3017.7	31
30 min Summer	81.962	0.0	3996.9	45
60 min Summer	51.304	0.0	7332.3	74
120 min Summer	31.039	0.0	8841.3	134
180 min Summer	22.830	0.0	9691.4	192
240 min Summer	18.253	0.0	10257.2	252
360 min Summer	13.251	0.0	11004.2	368
480 min Summer	10.562	0.0	11513.8	486
600 min Summer	8.851	0.0	11869.8	606
720 min Summer	7.658	0.0	12122.0	724
960 min Summer	6.089	0.0	12413.4	958
1440 min Summer	4.401	0.0	12453.9	1166
2160 min Summer	3.176	0.0	19124.9	1544
2880 min Summer	2.517	0.0	19731.7	1956
4320 min Summer	1.811	0.0	19821.9	2772
5760 min Summer	1.433	0.0	25140.7	3576
7200 min Summer	1.194	0.0	25985.1	4392
8640 min Summer	1.028	0.0	26515.4	5112
10080 min Summer	0.906	0.0	26654.5	5944
15 min Winter	124.774	0.0	3400.7	30
30 min Winter	81.962	0.0	4481.4	45
60 min Winter	51.304	0.0	8222.0	74
120 min Winter	31.039	0.0	9877.8	132
180 min Winter	22.830	0.0	10798.6	188
240 min Winter	18.253	0.0	11406.0	246
360 min Winter	13.251	0.0	12197.9	362
480 min Winter	10.562	0.0	12728.5	478

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	98.973	0.973	107.7	16339.2	O K
720 min Winter	98.987	0.987	108.4	16585.3	O K
960 min Winter	99.001	1.001	109.1	16822.7	O K
1440 min Winter	98.998	0.998	108.9	16759.1	O K
2160 min Winter	98.981	0.981	108.1	16489.0	O K
2880 min Winter	98.955	0.955	106.8	16047.4	O K
4320 min Winter	98.889	0.889	103.2	14928.9	O K
5760 min Winter	98.820	0.820	99.3	13767.7	O K
7200 min Winter	98.755	0.755	95.4	12683.7	O K
8640 min Winter	98.697	0.697	91.6	11716.2	O K
10080 min Winter	98.647	0.647	87.6	10872.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	8.851	0.0	13090.4	592
720 min Winter	7.658	0.0	13339.0	706
960 min Winter	6.089	0.0	13604.5	926
1440 min Winter	4.401	0.0	13554.3	1328
2160 min Winter	3.176	0.0	21323.7	1648
2880 min Winter	2.517	0.0	21955.1	2108
4320 min Winter	1.811	0.0	21941.6	2992
5760 min Winter	1.433	0.0	28162.6	3856
7200 min Winter	1.194	0.0	29110.9	4680
8640 min Winter	1.028	0.0	29709.8	5448
10080 min Winter	0.906	0.0	29873.4	6248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.500	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 24.900

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	6.225	4	8	6.225	8	12	6.225	12	16	6.225

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	16800.0	0.600	16800.0	1.200	16800.0	1.800	16800.0	2.400	16800.0
0.100	16800.0	0.700	16800.0	1.300	16800.0	1.900	16800.0	2.500	16800.0
0.200	16800.0	0.800	16800.0	1.400	16800.0	2.000	16800.0		
0.300	16800.0	0.900	16800.0	1.500	16800.0	2.100	16800.0		
0.400	16800.0	1.000	16800.0	1.600	16800.0	2.200	16800.0		
0.500	16800.0	1.100	16800.0	1.700	16800.0	2.300	16800.0		

Hydro-Brake® Outflow Control

Design Head (m) 1.000 Hydro-Brake® Type Md8 Invert Level (m) 98.000
Design Flow (l/s) 109.4 Diameter (mm) 412

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	12.6	0.800	98.2	2.000	148.5	4.000	207.9	7.000	275.0
0.200	28.2	1.000	109.0	2.200	155.3	4.500	220.5	7.500	284.6
0.300	44.0	1.200	118.2	2.400	161.9	5.000	232.4	8.000	294.0
0.400	58.8	1.400	126.5	2.600	168.2	5.500	243.7	8.500	303.0
0.500	72.1	1.600	134.2	3.000	180.4	6.000	254.6	9.000	311.8
0.600	83.2	1.800	141.5	3.500	194.6	6.500	265.0	9.500	320.3

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.426	0.426	126.7	5714.8	O K
30 min Summer	98.555	0.555	167.1	7435.5	O K
60 min Summer	98.682	0.682	204.5	9136.3	O K
120 min Summer	98.795	0.795	234.9	10657.6	O K
180 min Summer	98.846	0.846	247.5	11342.7	O K
240 min Summer	98.870	0.870	253.2	11664.3	O K
360 min Summer	98.884	0.884	256.5	11848.3	O K
480 min Summer	98.891	0.891	258.0	11936.9	O K
600 min Summer	98.893	0.893	258.5	11970.8	O K
720 min Summer	98.893	0.893	258.4	11965.6	O K
960 min Summer	98.885	0.885	256.7	11863.4	O K
1440 min Summer	98.856	0.856	249.8	11471.8	O K
2160 min Summer	98.802	0.802	236.6	10744.5	O K
2880 min Summer	98.749	0.749	222.8	10033.0	O K
4320 min Summer	98.659	0.659	197.9	8829.4	O K
5760 min Summer	98.590	0.590	177.7	7902.7	O K
7200 min Summer	98.535	0.535	161.1	7176.2	O K
8640 min Summer	98.491	0.491	147.4	6586.9	O K
10080 min Summer	98.456	0.456	136.2	6110.5	O K
15 min Winter	98.478	0.478	143.1	6400.5	O K
30 min Winter	98.622	0.622	187.2	8331.7	O K
60 min Winter	98.765	0.765	227.0	10246.4	O K
120 min Winter	98.894	0.894	258.6	11977.9	O K
180 min Winter	98.953	0.953	271.6	12773.8	O K
240 min Winter	98.982	0.982	277.5	13164.9	O K
360 min Winter	99.001	1.001	281.1	13414.8	O K
480 min Winter	99.001	1.001	281.1	13410.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.774	0.0	4728.7	30
30 min Summer	81.962	0.0	6292.3	44
60 min Summer	51.304	0.0	9152.8	72
120 min Summer	31.039	0.0	11099.2	130
180 min Summer	22.830	0.0	12250.9	186
240 min Summer	18.253	0.0	13056.9	244
360 min Summer	13.251	0.0	14201.3	330
480 min Summer	10.562	0.0	15066.1	386
600 min Summer	8.851	0.0	15748.8	448
720 min Summer	7.658	0.0	16310.1	514
960 min Summer	6.089	0.0	17188.0	650
1440 min Summer	4.401	0.0	18323.5	924
2160 min Summer	3.176	0.0	21162.7	1328
2880 min Summer	2.517	0.0	22297.2	1716
4320 min Summer	1.811	0.0	23740.0	2476
5760 min Summer	1.433	0.0	25651.2	3232
7200 min Summer	1.194	0.0	26691.1	3968
8640 min Summer	1.028	0.0	27521.0	4680
10080 min Summer	0.906	0.0	28113.3	5448
15 min Winter	124.774	0.0	5329.9	30
30 min Winter	81.962	0.0	7084.2	44
60 min Winter	51.304	0.0	10271.9	72
120 min Winter	31.039	0.0	12452.9	128
180 min Winter	22.830	0.0	13743.0	182
240 min Winter	18.253	0.0	14645.9	238
360 min Winter	13.251	0.0	15927.8	348
480 min Winter	10.562	0.0	16896.5	402

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
600 min Winter	99.000	1.000	281.0	13408.3	O K
720 min Winter	98.995	0.995	280.0	13340.3	O K
960 min Winter	98.976	0.976	276.2	13078.3	O K
1440 min Winter	98.921	0.921	264.8	12347.9	O K
2160 min Winter	98.835	0.835	244.9	11197.3	O K
2880 min Winter	98.759	0.759	225.6	10175.5	O K
4320 min Winter	98.640	0.640	192.6	8577.4	O K
5760 min Winter	98.554	0.554	166.9	7426.2	O K
7200 min Winter	98.490	0.490	147.1	6571.1	O K
8640 min Winter	98.441	0.441	131.5	5911.1	O K
10080 min Winter	98.402	0.402	118.8	5385.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	8.851	0.0	17661.3	472
720 min Winter	7.658	0.0	18290.3	548
960 min Winter	6.089	0.0	19274.2	700
1440 min Winter	4.401	0.0	20546.7	994
2160 min Winter	3.176	0.0	23713.5	1412
2880 min Winter	2.517	0.0	24987.9	1820
4320 min Winter	1.811	0.0	26619.5	2600
5760 min Winter	1.433	0.0	28732.7	3352
7200 min Winter	1.194	0.0	29900.6	4112
8640 min Winter	1.028	0.0	30838.0	4848
10080 min Winter	0.906	0.0	31527.0	5560

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.500	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 24.900

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	6.225	4	8	6.225	8	12	6.225	12	16	6.225

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	13402.0	0.600	13402.0	1.200	13402.0	1.800	13402.0	2.400	13402.0
0.100	13402.0	0.700	13402.0	1.300	13402.0	1.900	13402.0	2.500	13402.0
0.200	13402.0	0.800	13402.0	1.400	13402.0	2.000	13402.0		
0.300	13402.0	0.900	13402.0	1.500	13402.0	2.100	13402.0		
0.400	13402.0	1.000	13402.0	1.600	13402.0	2.200	13402.0		
0.500	13402.0	1.100	13402.0	1.700	13402.0	2.300	13402.0		

Hydro-Brake® Outflow Control

Design Head (m) 1.000 Hydro-Brake® Type Md8 Invert Level (m) 98.000
Design Flow (l/s) 281.1 Diameter (mm) 664

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	23.4	0.800	236.1	2.000	395.6	4.000	542.4	7.000	714.4
0.200	53.6	1.000	281.0	2.200	412.4	4.500	574.2	7.500	739.4
0.300	85.8	1.200	312.5	2.400	428.5	5.000	604.6	8.000	763.6
0.400	118.3	1.400	336.8	2.600	444.0	5.500	633.7	8.500	787.1
0.500	150.1	1.600	358.3	3.000	473.7	6.000	661.6	9.000	809.9
0.600	180.7	1.800	377.7	3.500	509.0	6.500	688.5	9.500	832.1