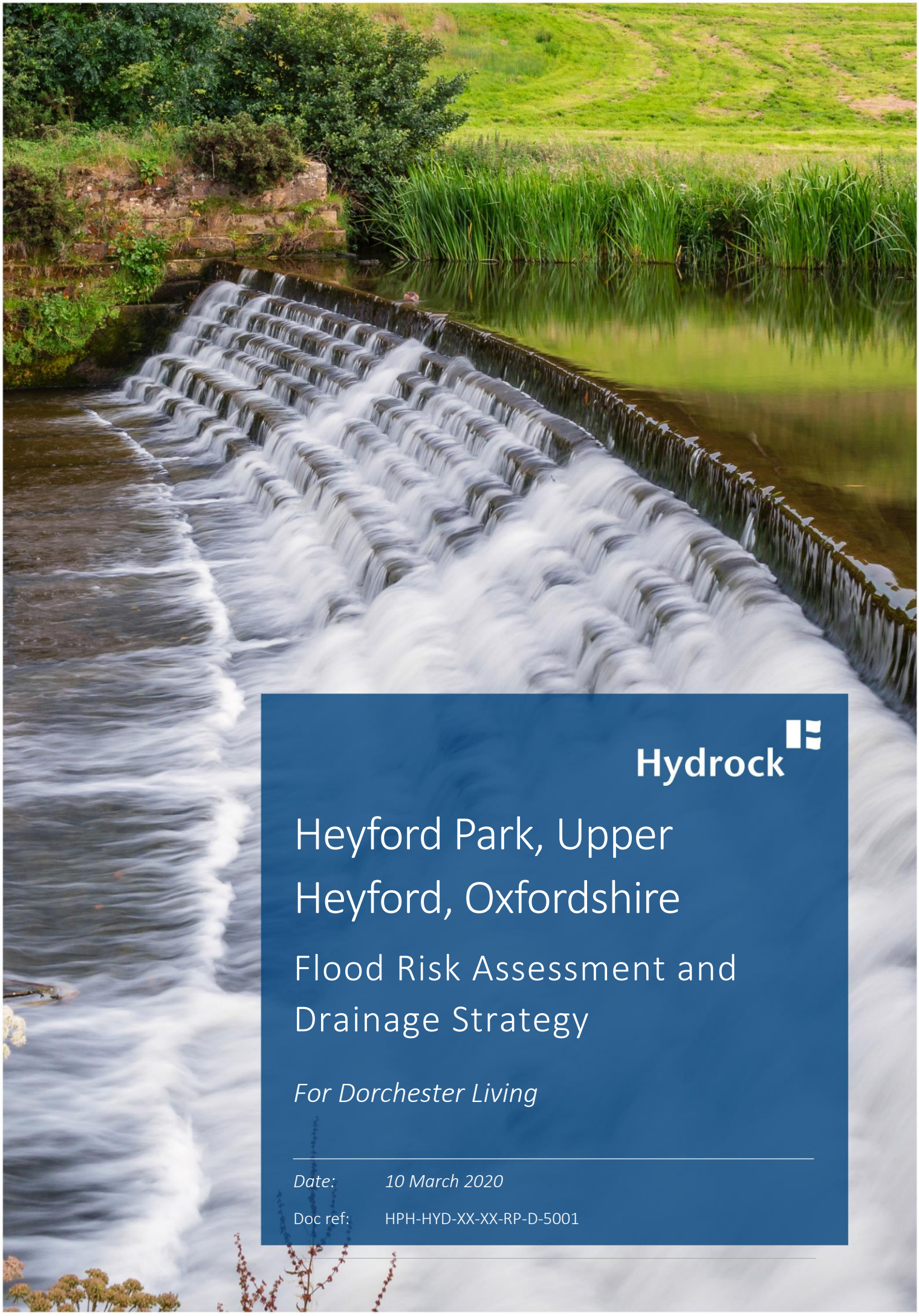

Hydrock

Heyford Park, Upper Heyford, Oxfordshire

Flood Risk Assessment and Drainage Strategy

For Dorchester Living

Date: *10 March 2020*

Doc ref: HPH-HYD-XX-XX-RP-D-5001

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1. INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client, Dorchester Living, in support of a Planning Application to be submitted to Cherwell District Council for a proposed mixed use development at Heyford Park, Upper Heyford, Oxfordshire.

This Flood Risk Assessment report has been prepared to address the requirements of the National Planning Policy Framework (NPPF), through:

- Assessing whether the site is likely to be affected by flooding.
- Assessing whether the proposed development is appropriate in the suggested location.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and occupants will be safe, whilst ensuring flood risk is not increased elsewhere.

The report considers the requirements for undertaking a Flood Risk Assessment as detailed in NPPF guidance.

2. SITE INFORMATION

2.1 Existing Situation

2.1.1 Location

Table 1 provides the summary site location details.

Table 1: Site Referencing Information

Address	Former RAF Upper Heyford, Oxfordshire, OX25 5HA
Grid Reference	451497, 226743 SP514267
Easting, Northing	451497, 226743

2.1.2 Existing Land Use

The Masterplan Area covers an area of around 449ha around the former RAF Upper Heyford. For the purpose of this report the Application Site to referred to as Heyford Park.

Heyford Park comprises an unused flying field (runway, taxi areas, control tower etc.) with a large portion of the remaining site area currently developed with former personnel living quarters, administrative office buildings, aircraft hangers, storage facilities, and areas of hardstanding working yards. Many of the former buildings are currently to commercial and industrial uses and these are currently accessed via internal site roads linked to main site entrance off Camp Road which runs through the middle of the site. There has already been some residential development on the site. The remainder of the site is undeveloped and is predominantly grassed.

Heyford Park has the B430 to the east and the B4030 to the south, with another B class road, Camp Road, running through the approximate centre of the site. The A43 is approximately 1.6km to the east of the site. Upper Heyford village is located to the west of the site and beyond Station Road. The next nearest urban centre is Bicester which is around 5.8km to the south east of the site.

2.1.3 Topography

A detailed topographical survey has been provided for the areas to the south of the flying field and existing runway areas. Where topographical information isn't available for the flying field and area to the north, Ordnance Survey contour mapping has been used to inform the general topography and falls. The flying field is shown as being the local high point within the wider area with ground the levels falling away in all directions.

The survey shows that there are a number of different falls through the site but, in general, there is a ridge that runs through the approximate centre of the site with site levels falling away from this. The level of the ridge varies but is generally around 125m AOD though levels do rise to around 130mAOD locally. Ground levels fall in a generally westerly direction with levels dropping along Camp Road to around 108m AOD at the junction with Somerton Road. The topographical survey also shows that site levels to the west of the ridge fall in a southerly direction with levels falling from Camp Road to a surveyed low of around 115.50m AOD, whilst levels rise to the northwest to a high within the site (within parcel 26) at around 138mAOD.

Levels to the east of the of the high point are shown to generally fall from a level of around 126m AOD on the south eastern apron of the runway to around 118.50m AOD at the southern limit of the survey.

2.1.4 Proposed Development

Planning permission is being sought for a hybrid planning application consisting of:

- demolition of buildings and structures as listed in Schedule 1;
- outline planning permission for up to:
  - 1,175 new dwellings (Class C3);
  - 60 close care dwellings (Class C2/C3);
  - 929 m^2 of retail (Class A1);
  - 670 m^2 comprising a new medical centre (Class D1);
  - 35,175 m^2 of new employment buildings, (comprising up to 6,330 m^2 Class B1a, 13,635 m^2 B1b/c, 9,250 m^2 Class B2, and 5,960 m^2 B8);
  - 2,415 m^2 of new school building on 2.4 ha site for a new school (Class D1);
  - 925 m^2 of community use buildings (Class D2); and 515 m^2 of indoor sports, if provided on-site (Class D2);
  - 30m in height observation tower with zip-wire with ancillary visitor facilities of up of 100 m^2 (Class D1/A1/A3);
  - 1,000 m^2 energy facility/infrastructure with a stack height of up to 24m (sui generis);
  - 2,520 m^2 additional education facilities (buildings and associated external infrastructure) at Buildings 73, 74 and 583 for education use (Class D1);
  - creation of areas of Open Space, Sports Facilities, Public Park and other green infrastructure.

- the change of use of the following buildings and areas:
  - Buildings 3036, 3037, 3038, 3039, 3040, 3041, and 3042 for employment use (Class B1b/c, B2, B8);

  - Buildings 217, 3052, 3053, 3054, 3055, 3102, and 3136 for employment use (Class B8);
  - Buildings 2010 and 3009 for filming and heritage activities (Sui Generis/Class D1);
  - Buildings 73 and 2004 (Class D1);
  - Buildings 391, 1368, 1443, 2005, 2006, 2007, 2008 and 2009 (Class D1/D2 with ancillary A1-A5 use);
  - Building 340 (Class D1, D2, A3);
  - 20.3ha of hardstanding for car processing (Sui Generis); and
  - 76.6ha for filming activities, including 2.1 ha for filming set construction and event parking (Sui Generis);
- the continuation of use of areas, buildings and structures already benefiting from previous planning permissions, as specified in Schedule 2.
- associated infrastructure works, including surface water attenuation provision and upgrading Chilgrove Drive and the junction with Camp Road.

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3. ASSESSMENT OF FLOOD RISK

3.1 Fluvial and Tidal Flooding

The Environment Agency's (EA's) Flood Zone Mapping shows that the site is entirely within Flood Zone 1 which comprises land assessed as having a less than 1 in 1,000 annual probability of fluvial or tidal flooding (<0.1%) in any year.

Being categorised as Flood Zone 1, it is therefore concluded that the site is suitably elevated above all surrounding watercourses to be above the extreme 1 in 1,000 year flood level. As such, the site is concluded as being at low risk from fluvial flooding. The closest watercourse to the site is the Gallos Brook which is a tributary of the larger River Cherwell.

Owing to the location and elevation of the site it is also concluded to be at negligible risk from tidal flooding.

3.2 Surface Water Flooding

The EA's flooding from surface water mapping shows that the site is predominantly classified as being at 'very low' risk from this source of flooding.

Whilst the site has been shown as being predominantly at low risk, some areas are classified as being at slightly higher risk with two potential surface flow routes within the site identified. One of these flows in an easterly direction along the northern site boundary and away from the site and poses little risk to the site.

The second flow route starts within the existing buildings at the south eastern corner of the site and drains across the site in a southerly direction with depths typically being below 300mm and only impacts a small area of the site. As such, the area immediately affected could be at an increased risk from this source.

In addition to the two identified surface flow routes there are a number of sections within the site shown to be at an increased risk. These areas are not shown to have connectivity (i.e. act as a flow route) with the wider area and are therefore only representative of locally lower sections within the site.

Apart from two localised areas where two flow routes have been identified the site is concluded as being at low risk from this source of flooding.

3.3 Groundwater Flooding

British Geological Survey mapping shows the site to be underlain by the White Limestone Formation.

Noting the potentially permeable nature of the underlying geology, and as detailed within the Oxfordshire County Council Strategic Flood Risk Assessment, groundwater has been known to result in localised issues but these are restricted to locally lower lying areas. For the purpose of this assessment, the Flood Zone 3 extent is considered representative of the 'worst case' groundwater flood risk.

As the site has been confirmed as being within Flood Zone 1, the site is concluded as being sufficiently elevated above the worst case groundwater risk and to therefore conducted to be at low risk from this source.

3.4 Infrastructure Failure Flooding

Owing to the generally developed nature of the site there is considered to be an existing sewer network (both surface and foul drainage systems). In the event of the surcharging of any of this network, overland flows will likely be conveyed by topography and contained within the existing road network and directed away from/around the site and not pose any significant risk to the site.

The site is therefore concluded to be at low risk from sewer flooding.

3.5 Flooding from Artificial Sources

A review of the EA's Flooding from Reservoirs map indicates that the site is not within the maximum extent of flooding in the event of a failure of any artificial source. There are also no raised large waterbodies identified in the near vicinity of the site (the closest being the Oxford Canal to the west which is at significantly lower elevation to the site).

The site is therefore concluded to be at negligible risk of flooding from artificial sources.

3.6 Summary

EA data for the area indicates that the entirety of the site is at low risk of flooding from fluvial and tidal sources and entirely within Flood Zone 1.

The site has also been concluded as being at low or negligible risk from all other assessed sources of potential flooding.

4. NPPF REQUIREMENTS

4.1 Planning Policy Requirements

The proposed development has been confirmed as being located within Flood Zone 1.

Residential development is considered 'more vulnerable' in terms of flood risk and all other forms of the proposed development are considered as 'less vulnerable' in terms of flood risk.

The NPPF Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table 3) indicates that 'more vulnerable' and 'less vulnerable' development is appropriate in Flood Zone 1 and accordingly the proposed development is concluded to meet the requirements of the Sequential Test.

4.2 Exception Test

Whilst the site is demonstrated to pass the Sequential Test, the following section details potential measures necessary to mitigate any residual flood risks, to ensure that the proposed development and occupants will be safe, and that flood risk will not be increased elsewhere within the design life of the proposed development, akin to the requirements of the second section of the Exception Test.

4.2.1 Resistance and Resilience of Site

No specific measures are considered necessary to protect the proposed development from flooding (as no significant sources of potential flood risk have been identified).

4.2.2 Safe Access and Egress

Safe / dry access is demonstrated to be possible via all directions onto Camp Road.

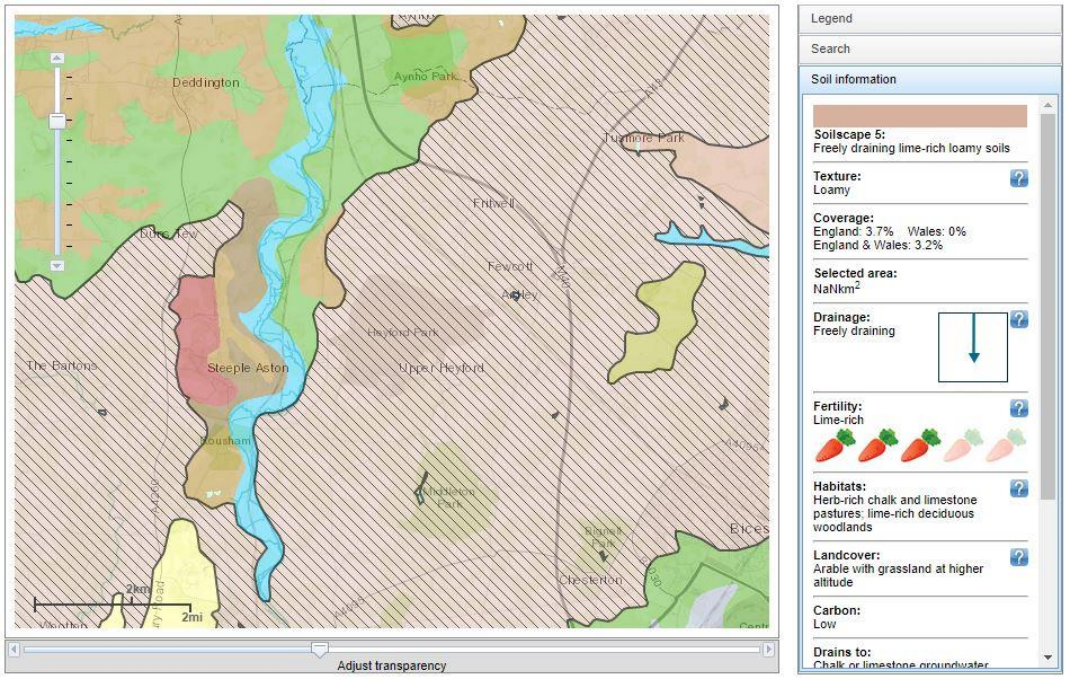
5. SURFACE WATER MANAGEMENT

5.1 Existing Surface Water Drainage

The existing site consists of approximately 455.5ha formed from the former RAF Upper Heyford airfield. The site comprises an unused flying field, personnel living quarters, administrative buildings, aircraft hangers and areas of hardstanding. The site is served by an extensive site wide private surface water drainage network with thirteen individual discharge locations to the surrounding water courses. The surrounding watercourses include the Gallos Brook and other unnamed brooks in the south, which are tributaries of the River Cherwell. In the north east there is the Padbury Brook. The current catchment for the site is roughly split in to five separate catchment zones due to the natural topography of the land. The majority of the area discharges in a southerly direction to the Gallos Brook and unnamed watercourses, with the north-eastern area draining in an easterly direction to the Padbury Brook.

An initial investigation in to the underlying bedrock shows predominantly White Limestone formation. This suggests that surface water discharge via infiltration may be a possibility though this will be subject to confirmation through site specific/plot specific infiltration testing at a later stage.

Figure 1: Cranfield University Soilscape Mapping



Infiltration solutions will therefore need to be confirmed via a full ground investigation and infiltration testing in accordance with BRE 365 to determine infiltration rates and groundwater levels but in the absence of such confirmation a solution that utilises attenuation is proposed to confirm a suitable strategy is deliverable for the site.

5.2 Proposed Surface Water Drainage

The existing site is served by a traditional gravity surface water network discharging to local watercourses. However, the underlying soils suggests that surface water may be able to discharge via infiltration, where ground water levels would allow. In the absence of infiltration information and confirmation of any possible contamination requiring the potential for remediation it is therefore proposed to demonstrate that surface water runoff can be reduced to the existing QBAR greenfield

rates. The surface water discharge from the individual parcels will be connected to a swale and attenuation basin network with a restricted flow to the adjacent water courses.

The surface water discharge rate will be restricted to the Mean Annual Flood (QBAR) rate. The greenfield run off rate for the site has been calculated to be 4.3l/s/ha. Greenfield run off calculations are provided in Appendix A. Attenuation for each parcel will be in the form of surface features including detention basins and swales or, where this is not practicable, underground tanks. Table 2 below summarises the required attenuation volumes and discharge rates for each of the proposed parcels. A 65% rate of development has been assumed for each parcel unless otherwise stated to calculate the allowable greenfield run off rate.

A 10% allowance for urban creep has also been applied to the residential parcel impermeable areas with the net storage volumes adjusted to suit.

A factor of 40% allowance for climate change has been included for the 1 in 100-year event to determine the maximum storage volumes required in each attenuation basin.

Table 2: Parcel Attenuation Requirements

Phase	Gross Area (Ha)	Impermeable Area & 65% (Ha)	Area Including Urban Creep (Ha)	Discharge Rate (l/s)	Attenuation Volume (m^3)
10	4.6	2.99	3.289	12.8	2616
11 & 12	6.90	4.48	4.92	19.2	3912
13	0.50	0.325	0.357	2.0	260
16	7.8	5.07	5.577	21.80	4432
17	2.6	1.69	1.86	7.2	1481
19	0.9	0.58	0.64	2.5	1017
20	0.5	0.5	0.5	2.15	386
21	4.4	2.86	3.146	12.30	2500
23	14.40	9.36	10.296	40.25	8180
39	0.4	0.26	0.286	2.0	197
40	0.50	0.325	0.357	2.0	260

There are two non residential parcels, 19 and parcel 20, which consists of 60 extra care units and a medical centre respectively. Due to limited space it is proposed that these are served by below ground attenuation tanks in the form of either a geocellular storage system or oversized plastic pipes. To deliver adequate treatment and mitigate pollution downstream, additional treatment trains will be proposed such as a tanked permeable paving system on any parking areas. The SuDS manual sets the requirements for acceptable pollution mitigation measures based on the land use classification.

It is recommended that a ground investigation is carried out and that this includes infiltration testing in accordance with BRE 365 to confirm that surface water discharge via infiltration is a possibility. If infiltration is viable, soakaway structures may compliment any attenuation.

Where areas of the site are to operate under their current use or remain undeveloped the existing drainage routes and discharge points will need to be maintained. It may be necessary for elements of exiting surface water drainage network passing through the proposed residential developments to be diverted to maintain a positive connection. Any surface water treatment elements such as petrol interceptors will also need to be maintained and/or relocated. Where proposed residential developments are to utilise existing networks the incoming discharge to this network will be significantly reduced as all redeveloped area will be restricted to greenfield run-off rate. The current surface water run-off from impermeable areas is discharged unrestricted to the existing system.

5.3 Water Quality

The proposed scheme will be designed to satisfy the guidance given in the CIRIA SuDS Manual 2015 and to comply with advice from the LLFA and to do so it is recommended that measures are put in place to improve water discharge quality. Such measures would include the provision of swales alongside proposed highway networks for carriageway run-off to convey water to attenuation storage features, rather than traditional gully systems. In addition to this permeable paving on private drives and tree-pits can be used. Forebay areas can also be included in to attenuation basins to contain accumulating sediments. Consideration will also need to be given to the future maintenance and adoption of any green SuDS features proposed.

5.4 Surface Water & SuDs Maintenance

The CIRIA SuDS Manual (CIRIA C753) highlights the various aspects of maintenance requirements for different sustainable drainage elements. The table below gives an overview of the potential maintenance processes for each individual form of surface water management system. The frequency to which these processes will need to be carried out is dependent on various factors, such as the size of the catchment area the system serves, the size of the feature itself, and the environment in which the feature is situated.

Table 3: Maintenance requirements for various SuDS features

	Pond	Wetland	Detention Basin	Infiltration Basin	Soakaway	Infiltration Trench
Regular maintenance:						

Inspection	● (M)	● (M)	● (M)	● (M)	● (A)	● (A)
Litter & debris removal	● (M)	● (M)	● (M)	● (M)	○ (AI)	● (AI)
Grass cutting	● (M)	● (M)	● (6M)	● (M)	○ (AI)	● (AI)
Weed & invasive plant control	○ (A)	○ (A)	○ (M)	○ (M)		○ (AI)
Shrub Management	○ (A)	○ (A)	○ (M)	○ (6M)		
Aquatic vegetation management	● (A)	● (A)	○ (A)			
Occasional maintenance:						
Sediment management	● (6M)	● (6M)	● (5YR)	● (AI)	● (A)	● (A)
Vegetation replacement	○ (5YR)	○ (5YR)	○ (5YR)	○ (A)		
Remedial maintenance:						
Structure repair **(As inspections require)**	○	○	○	○	○	○
Infiltration surface reconditioning **(As inspections require)**				○	○	○
(A) – Annually, **(M)** – Monthly, **(6M)** – Half Yearly, **(5YR)** – Every 5 years, **(AI)** – As inspections require						

● Will be required ○ May be required

It is proposed that any SuDS features be adopted and maintained by a private management company. The surface water drainage network could be offered to Thames Water under a Section 104 legal agreement.

6. FOUL WATER MANAGEMENT

6.1 Existing Foul Water

The site is currently served by an existing foul water system, which consists of pumping stations and a foul treatment plant in the south-east corner of the site. The existing foul network and sewerage treatment plant are all currently under private ownership. There is no record of any other foul sewers within the site boundary or adjacent to the site.

6.2 Proposed Foul Water

Currently all foul drainage from the site discharges to the existing sewerage treatment plant in the south-east corner of the site where the sewerage is treated and discharged to the Gallos Brook. Various elements of the sewerage treatment plant are to be refurbished to address issues of capacity, reliability and monitoring following the redevelopment of the site.

The table below shows the estimated foul discharge rates based on 4000litres/dwelling/day for each of the parcels.

Table 4: Parcel Foul Discharge Rates

Phase	Plots	Foul Discharge (l/s)
10	130	6.0
11	80	3.70
12	123	5.7
13	6	0.27
16	178	8.24
17	62	2.8
19	60	2.7
20	670m² Medical Centre	0.033
21	122	5.6
23	430	19.90
39	13	0.60

40	27	1.25

The site is currently served by various existing pumping stations. To achieve connections to the existing foul treatment plant from the proposed developments it will be necessary to use some pumped solutions due to the topography of the site. A new pumping station is proposed for parcel 23 which will be pumped to high ground within the creative city. A new gravity sewer will then serve parcels 11, 12 & 21 as well as 23 and connect to an existing pumping station located to the south of parcel 12 with a peak flow rate of 34.90l/s. It is likely that this pumping station will need to be upgraded to receive these proposed flows. A survey of the existing pump rate and overall condition of the pumping station will need to be carried out.

An additional pumping station will be required in the south west corner of parcel 16 to serve both parcel 10 & 16. This will potentially be pumped to a proposed pumping station within the redeveloped site to the east of parcel 16. The peak flow rate from parcel 10 and 16 would be approximately 14.24l/s. Parcels 13, 17, 19, 20 and the changing facilities are proposed to discharge to the treatment plant via gravity. Where possible the existing foul network can be utilised, dependant on the condition and capacity of the existing pipework.

A full CCTV assessment of the existing network is recommended if not already carried out to confirm existing connectivity, condition, and capacities.

An overall strategy plan for the proposed foul drainage is provided in Appendix A.

It is proposed that it may be possible for the new foul network, pumping stations and existing treatment plant to be adopted an appropriate water authority further down the line via a Section 104 Legal Agreement.

7. CONCLUSIONS

This report has considered the flood risk posed to the site from a variety of sources of flooding, as defined by the NPPF.

EA data for the area indicates that the entirety of the site is at low risk of flooding from fluvial and tidal sources and entirely within Flood Zone 1.

The site has also been concluded as being at low or negligible risk from all other assessed sources of potential flooding and is therefore considered suitable for all forms of development.

The proposals are therefore concluded to meet the requirements of the Sequential Test.

Owing to the fact that no significant sources of flood risk were identified, no specific mitigation measures are considered necessary to address any flood risk to the development.

This report therefore demonstrates that - provided a suitable sustainable drainage system is employed – in line with the strategies outlined above, the proposed scheme:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Will not place additional persons at risk of flooding, and will offer a safe means of access and egress.
- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.
- Will put in place measures to ensure surface and foul water is appropriately managed.
- Will include suitable surface water treatment trains in the form of highway swales, permeable paving, tree pits and forebay areas to attenuation basins to be considered.
- Ensure confirmation that improvement works to the treatment plant has taken place and provides enough capacity for the development outlined above.

As such, the Application is concluded to meet the flood risk requirements of the NPPF.

Hydrock Consultants Limited

Appendix A – Drainage Strategy

Reference	Title
04583-HYD-INF-XX-C-CA-0001	Greenfield Run-Off Calculations
04583-HYD-INF-XX-C-CA-0002	Attenuation Volume Calculations
HPH-HYD-XX-XX-DR-C-2200	Surface Water Drainage Strategy
HPH-HYD-XX-XX-DR-C-2202	Foul Drainage Strategy

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	694	Region Number	Region 5

Results l/s

QBAR Rural	4.3
QBAR Urban	4.3
Q100 years	15.5
Q1 year	3.8
Q30 years	10.4
Q100 years	15.5

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	124.043	0.443	9.8	650.6	O K
30 min Summer	124.162	0.562	9.8	848.9	O K
60 min Summer	124.278	0.678	9.8	1050.4	O K
120 min Summer	124.385	0.785	9.8	1247.5	O K
180 min Summer	124.441	0.841	9.8	1353.3	O K
240 min Summer	124.475	0.875	9.8	1419.1	O K
360 min Summer	124.517	0.917	9.8	1501.4	Flood Risk
480 min Summer	124.542	0.942	9.8	1550.8	Flood Risk
600 min Summer	124.556	0.956	9.8	1580.0	Flood Risk
720 min Summer	124.564	0.964	9.8	1596.1	Flood Risk
960 min Summer	124.568	0.968	9.8	1603.5	Flood Risk
1440 min Summer	124.549	0.949	9.8	1565.8	Flood Risk
2160 min Summer	124.512	0.912	9.8	1491.5	Flood Risk
2880 min Summer	124.474	0.874	9.8	1417.7	O K
4320 min Summer	124.398	0.798	9.8	1272.2	O K
5760 min Summer	124.314	0.714	9.8	1116.2	O K
7200 min Summer	124.236	0.636	9.8	976.9	O K
8640 min Summer	124.165	0.565	9.8	853.6	O K
10080 min Summer	124.099	0.499	9.8	742.9	O K
15 min Winter	124.091	0.491	9.8	729.3	O K
30 min Winter	124.222	0.622	9.8	952.0	O K
60 min Winter	124.348	0.748	9.8	1179.3	O K
120 min Winter	124.467	0.867	9.8	1402.7	O K
180 min Winter	124.528	0.928	9.8	1522.7	Flood Risk
240 min Winter	124.566	0.966	9.8	1598.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	597.3	19
30 min Summer	90.866	0.0	755.5	34
60 min Summer	56.713	0.0	1044.6	64
120 min Summer	34.190	0.0	1251.6	124
180 min Summer	25.088	0.0	1365.1	184
240 min Summer	20.020	0.0	1435.9	242
360 min Summer	14.528	0.0	1507.9	362
480 min Summer	11.570	0.0	1511.7	482
600 min Summer	9.690	0.0	1496.0	602
720 min Summer	8.380	0.0	1478.2	722
960 min Summer	6.658	0.0	1442.6	960
1440 min Summer	4.807	0.0	1375.4	1370
2160 min Summer	3.465	0.0	2335.2	1708
2880 min Summer	2.744	0.0	2453.6	2080
4320 min Summer	1.973	0.0	2547.7	2936
5760 min Summer	1.559	0.0	2832.1	3688
7200 min Summer	1.298	0.0	2947.3	4464
8640 min Summer	1.118	0.0	3041.4	5192
10080 min Summer	0.985	0.0	3116.7	5944
15 min Winter	138.634	0.0	663.9	19
30 min Winter	90.866	0.0	805.8	33
60 min Winter	56.713	0.0	1167.1	64
120 min Winter	34.190	0.0	1386.9	122
180 min Winter	25.088	0.0	1491.7	180
240 min Winter	20.020	0.0	1531.8	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.613	1.013	9.8	1695.2	Flood Risk
480 min Winter	124.642	1.042	9.8	1755.4	Flood Risk
600 min Winter	124.660	1.060	9.8	1793.1	Flood Risk
720 min Winter	124.672	1.072	9.8	1816.3	Flood Risk
960 min Winter	124.680	1.080	9.8	1835.1	Flood Risk
1440 min Winter	124.670	1.070	9.8	1812.6	Flood Risk
2160 min Winter	124.624	1.024	9.8	1716.5	Flood Risk
2880 min Winter	124.579	0.979	9.8	1625.8	Flood Risk
4320 min Winter	124.481	0.881	9.8	1430.3	O K
5760 min Winter	124.368	0.768	9.8	1214.7	O K
7200 min Winter	124.243	0.643	9.8	989.2	O K
8640 min Winter	124.134	0.534	9.8	801.3	O K
10080 min Winter	124.038	0.438	9.8	641.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	1525.7	358
480 min Winter	11.570	0.0	1507.9	474
600 min Winter	9.690	0.0	1490.8	590
720 min Winter	8.380	0.0	1475.2	706
960 min Winter	6.658	0.0	1447.3	934
1440 min Winter	4.807	0.0	1399.2	1372
2160 min Winter	3.465	0.0	2605.1	1924
2880 min Winter	2.744	0.0	2719.9	2220
4320 min Winter	1.973	0.0	2628.0	3156
5760 min Winter	1.559	0.0	3172.1	4040
7200 min Winter	1.298	0.0	3301.5	4824
8640 min Winter	1.118	0.0	3408.2	5528
10080 min Winter	0.985	0.0	3494.6	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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.530

Time (mins) From:	To:	Area (ha)
0	4	2.530

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1320.0	1.200	2205.9	2.400	3317.9	3.600	4656.1	4.800	6220.6
0.200	1451.9	1.400	2375.5	2.600	3525.2	3.800	4901.2	5.000	6503.3
0.400	1590.2	1.600	2551.4	2.800	3738.9	4.000	5152.5		
0.600	1734.7	1.800	2733.6	3.000	3958.8	4.200	5410.1		
0.800	1885.4	2.000	2922.1	3.200	4184.9	4.400	5674.0		
1.000	2042.5	2.200	3116.9	3.400	4417.4	4.600	5944.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0142-9800-1200-9800
Design Head (m)	1.200
Design Flow (l/s)	9.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	142
Invert Level (m)	123.600
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.8	Kick-Flo®	0.777	8.0
Flush-Flo™	0.358	9.8	Mean Flow over Head Range	-	8.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	0.800	8.1	2.000	12.5	4.000	17.3	7.000	22.7
0.200	9.3	1.000	9.0	2.200	13.0	4.500	18.4	7.500	23.4
0.300	9.7	1.200	9.8	2.400	13.6	5.000	19.3	8.000	24.2
0.400	9.8	1.400	10.5	2.600	14.1	5.500	20.2	8.500	24.9
0.500	9.6	1.600	11.2	3.000	15.1	6.000	21.1	9.000	25.6
0.600	9.3	1.800	11.9	3.500	16.3	6.500	21.9	9.500	26.3

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	124.007	0.407	25.3	1504.1	O K
30 min Summer	124.122	0.522	25.3	1962.1	O K
60 min Summer	124.235	0.635	25.3	2426.9	O K
120 min Summer	124.341	0.741	25.3	2877.7	O K
180 min Summer	124.397	0.797	25.3	3119.1	O K
240 min Summer	124.431	0.831	25.3	3270.8	O K
360 min Summer	124.475	0.875	25.3	3462.6	O K
480 min Summer	124.500	0.900	25.3	3576.6	Flood Risk
600 min Summer	124.515	0.915	25.3	3642.5	Flood Risk
720 min Summer	124.522	0.922	25.3	3677.6	Flood Risk
960 min Summer	124.525	0.925	25.3	3689.3	Flood Risk
1440 min Summer	124.505	0.905	25.3	3600.8	Flood Risk
2160 min Summer	124.469	0.869	25.3	3437.2	O K
2880 min Summer	124.426	0.826	25.3	3249.4	O K
4320 min Summer	124.339	0.739	25.3	2869.2	O K
5760 min Summer	124.257	0.657	25.3	2520.4	O K
7200 min Summer	124.181	0.581	25.3	2205.1	O K
8640 min Summer	124.112	0.512	25.3	1923.2	O K
10080 min Summer	124.050	0.450	25.3	1676.7	O K
15 min Winter	124.053	0.453	25.3	1685.9	O K
30 min Winter	124.180	0.580	25.3	2200.2	O K
60 min Winter	124.305	0.705	25.3	2723.1	O K
120 min Winter	124.423	0.823	25.3	3236.4	O K
180 min Winter	124.486	0.886	25.3	3514.3	O K
240 min Winter	124.525	0.925	25.3	3688.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	1294.6	19
30 min Summer	90.866	0.0	1683.9	34
60 min Summer	56.713	0.0	2355.1	64
120 min Summer	34.190	0.0	2833.8	124
180 min Summer	25.088	0.0	3105.5	184
240 min Summer	20.020	0.0	3287.0	242
360 min Summer	14.528	0.0	3531.1	362
480 min Summer	11.570	0.0	3686.4	482
600 min Summer	9.690	0.0	3775.5	602
720 min Summer	8.380	0.0	3807.9	722
960 min Summer	6.658	0.0	3743.0	960
1440 min Summer	4.807	0.0	3527.3	1282
2160 min Summer	3.465	0.0	5350.9	1644
2880 min Summer	2.744	0.0	5628.8	2020
4320 min Summer	1.973	0.0	5980.0	2808
5760 min Summer	1.559	0.0	6527.0	3576
7200 min Summer	1.298	0.0	6787.8	4328
8640 min Summer	1.118	0.0	6996.3	5096
10080 min Summer	0.985	0.0	7152.7	5752
15 min Winter	138.634	0.0	1451.1	19
30 min Winter	90.866	0.0	1857.1	33
60 min Winter	56.713	0.0	2637.3	64
120 min Winter	34.190	0.0	3159.5	122
180 min Winter	25.088	0.0	3444.3	180
240 min Winter	20.020	0.0	3625.5	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.573	0.973	25.3	3908.7	Flood Risk
480 min Winter	124.603	1.003	25.3	4043.9	Flood Risk
600 min Winter	124.621	1.021	25.3	4126.9	Flood Risk
720 min Winter	124.631	1.031	25.3	4175.9	Flood Risk
960 min Winter	124.639	1.039	25.3	4210.6	Flood Risk
1440 min Winter	124.624	1.024	25.3	4141.3	Flood Risk
2160 min Winter	124.576	0.976	25.3	3920.3	Flood Risk
2880 min Winter	124.527	0.927	25.3	3697.0	Flood Risk
4320 min Winter	124.405	0.805	25.3	3157.5	O K
5760 min Winter	124.278	0.678	25.3	2610.7	O K
7200 min Winter	124.163	0.563	25.3	2129.9	O K
8640 min Winter	124.061	0.461	25.3	1717.3	O K
10080 min Winter	123.975	0.375	25.3	1380.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	3839.1	358
480 min Winter	11.570	0.0	3919.6	474
600 min Winter	9.690	0.0	3901.4	590
720 min Winter	8.380	0.0	3855.2	704
960 min Winter	6.658	0.0	3757.9	932
1440 min Winter	4.807	0.0	3570.5	1368
2160 min Winter	3.465	0.0	5979.3	1728
2880 min Winter	2.744	0.0	6270.8	2188
4320 min Winter	1.973	0.0	6582.3	3072
5760 min Winter	1.559	0.0	7312.8	3864
7200 min Winter	1.298	0.0	7607.8	4616
8640 min Winter	1.118	0.0	7844.7	5360
10080 min Winter	0.985	0.0	8027.2	5960

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.850

Time (mins) From:	To:	Area (ha)
0	4	5.850

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3482.0	1.200	4850.2	2.400	6444.5	3.600	8265.1	4.800	10311.9
0.200	3694.3	1.400	5100.2	2.600	6732.3	3.800	8590.5	5.000	10675.0
0.400	3912.9	1.600	5356.5	2.800	7026.3	4.000	8922.2		
0.600	4137.8	1.800	5619.1	3.000	7326.6	4.200	9260.2		
0.800	4369.0	2.000	5888.0	3.200	7633.1	4.400	9604.5		
1.000	4606.4	2.200	6163.1	3.400	7946.0	4.600	9955.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0217-2530-1200-2530
Design Head (m)	1.200
Design Flow (l/s)	25.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	217
Invert Level (m)	123.600
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	25.3	Kick-Flo®	0.845	21.4
Flush-Flo™	0.390	25.3	Mean Flow over Head Range	-	21.4

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)	Depth (m)	Flow (l/s)
0.100	7.3	0.800	22.5	2.000	32.3	4.000	45.1	7.000	59.2
0.200	21.3	1.000	23.2	2.200	33.8	4.500	47.7	7.500	61.2
0.300	25.0	1.200	25.3	2.400	35.3	5.000	50.2	8.000	63.1
0.400	25.3	1.400	27.2	2.600	36.6	5.500	52.6	8.500	65.0
0.500	25.1	1.600	29.0	3.000	39.3	6.000	54.9	9.000	66.8
0.600	24.6	1.800	30.7	3.500	42.3	6.500	57.1	9.500	68.6

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	124.223	0.623	1.8	97.4	O K
30 min Summer	124.342	0.742	1.8	126.7	O K
60 min Summer	124.447	0.847	1.8	156.0	O K
120 min Summer	124.536	0.936	1.8	183.5	Flood Risk
180 min Summer	124.578	0.978	1.8	197.2	Flood Risk
240 min Summer	124.601	1.001	1.8	205.1	Flood Risk
360 min Summer	124.626	1.026	1.9	213.5	Flood Risk
480 min Summer	124.636	1.036	1.9	217.1	Flood Risk
600 min Summer	124.638	1.038	1.9	217.8	Flood Risk
720 min Summer	124.635	1.035	1.9	216.7	Flood Risk
960 min Summer	124.619	1.019	1.9	211.4	Flood Risk
1440 min Summer	124.587	0.987	1.8	200.3	Flood Risk
2160 min Summer	124.544	0.944	1.8	185.9	Flood Risk
2880 min Summer	124.504	0.904	1.8	173.2	Flood Risk
4320 min Summer	124.427	0.827	1.8	150.2	O K
5760 min Summer	124.352	0.752	1.8	129.4	O K
7200 min Summer	124.276	0.676	1.8	110.0	O K
8640 min Summer	124.193	0.593	1.8	90.7	O K
10080 min Summer	124.085	0.485	1.8	68.3	O K
15 min Winter	124.273	0.673	1.8	109.2	O K
30 min Winter	124.399	0.799	1.8	142.2	O K
60 min Winter	124.511	0.911	1.8	175.4	Flood Risk
120 min Winter	124.607	1.007	1.8	206.9	Flood Risk
180 min Winter	124.653	1.053	1.9	223.1	Flood Risk
240 min Winter	124.679	1.079	1.9	232.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	98.1	19
30 min Summer	90.866	0.0	127.6	34
60 min Summer	56.713	0.0	161.4	64
120 min Summer	34.190	0.0	194.5	124
180 min Summer	25.088	0.0	214.1	182
240 min Summer	20.020	0.0	227.7	242
360 min Summer	14.528	0.0	247.7	362
480 min Summer	11.570	0.0	262.7	482
600 min Summer	9.690	0.0	274.3	600
720 min Summer	8.380	0.0	282.6	720
960 min Summer	6.658	0.0	284.4	896
1440 min Summer	4.807	0.0	276.0	1128
2160 min Summer	3.465	0.0	355.3	1516
2880 min Summer	2.744	0.0	375.2	1932
4320 min Summer	1.973	0.0	404.3	2764
5760 min Summer	1.559	0.0	426.5	3576
7200 min Summer	1.298	0.0	444.0	4392
8640 min Summer	1.118	0.0	458.6	5184
10080 min Summer	0.985	0.0	471.2	5752
15 min Winter	138.634	0.0	109.7	19
30 min Winter	90.866	0.0	138.5	33
60 min Winter	56.713	0.0	180.7	62
120 min Winter	34.190	0.0	217.8	122
180 min Winter	25.088	0.0	239.6	180
240 min Winter	20.020	0.0	254.8	238

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.708	1.108	1.9	243.6	Flood Risk
480 min Winter	124.722	1.122	1.9	249.1	Flood Risk
600 min Winter	124.728	1.128	1.9	251.4	Flood Risk
720 min Winter	124.729	1.129	1.9	251.6	Flood Risk
960 min Winter	124.720	1.120	1.9	248.2	Flood Risk
1440 min Winter	124.684	1.084	1.9	234.4	Flood Risk
2160 min Winter	124.632	1.032	1.9	215.9	Flood Risk
2880 min Winter	124.580	0.980	1.8	198.0	Flood Risk
4320 min Winter	124.474	0.874	1.8	164.1	O K
5760 min Winter	124.365	0.765	1.8	132.9	O K
7200 min Winter	124.247	0.647	1.8	103.1	O K
8640 min Winter	124.077	0.477	1.8	66.6	O K
10080 min Winter	123.937	0.337	1.8	42.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	276.5	356
480 min Winter	11.570	0.0	289.7	472
600 min Winter	9.690	0.0	291.6	584
720 min Winter	8.380	0.0	290.9	698
960 min Winter	6.658	0.0	288.7	916
1440 min Winter	4.807	0.0	284.5	1200
2160 min Winter	3.465	0.0	398.0	1624
2880 min Winter	2.744	0.0	420.2	2100
4320 min Winter	1.973	0.0	452.7	2984
5760 min Winter	1.559	0.0	477.7	3856
7200 min Winter	1.298	0.0	497.3	4688
8640 min Winter	1.118	0.0	513.7	5352
10080 min Winter	0.985	0.0	527.8	5856

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.380

Time (mins) From:	To:	Area (ha)
0	4	0.380

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	93.0	1.200	411.2	2.400	955.6	3.600	1726.2	4.800	2723.0
0.200	130.3	1.400	486.2	2.600	1068.3	3.800	1876.6	5.000	2911.1
0.400	173.9	1.600	567.5	2.800	1187.4	4.000	2033.4		
0.600	223.8	1.800	655.1	3.000	1312.6	4.200	2196.3		
0.800	280.0	2.000	749.0	3.200	1444.2	4.400	2365.6		
1.000	342.5	2.200	849.2	3.400	1582.1	4.600	2541.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	123.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

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)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	123.695	0.695	17.8	1169.6	O K
30 min Summer	123.872	0.872	17.8	1526.7	O K
60 min Summer	124.040	1.040	17.8	1887.0	O K
120 min Summer	124.191	1.191	17.8	2232.5	O K
180 min Summer	124.267	1.267	18.3	2413.1	O K
240 min Summer	124.312	1.312	18.6	2523.1	O K
360 min Summer	124.365	1.365	18.9	2654.5	O K
480 min Summer	124.394	1.394	19.1	2727.0	O K
600 min Summer	124.408	1.408	19.2	2763.5	O K
720 min Summer	124.414	1.414	19.2	2776.9	O K
960 min Summer	124.407	1.407	19.2	2760.5	O K
1440 min Summer	124.371	1.371	19.0	2669.0	O K
2160 min Summer	124.315	1.315	18.6	2530.0	O K
2880 min Summer	124.260	1.260	18.2	2397.5	O K
4320 min Summer	124.156	1.156	17.8	2151.4	O K
5760 min Summer	124.057	1.057	17.8	1926.2	O K
7200 min Summer	123.961	0.961	17.8	1714.0	O K
8640 min Summer	123.862	0.862	17.8	1505.1	O K
10080 min Summer	123.743	0.743	17.8	1263.9	O K
15 min Winter	123.767	0.767	17.8	1311.4	O K
30 min Winter	123.960	0.960	17.8	1711.8	O K
60 min Winter	124.142	1.142	17.8	2117.1	O K
120 min Winter	124.307	1.307	18.5	2510.0	O K
180 min Winter	124.391	1.391	19.1	2718.1	O K
240 min Winter	124.441	1.441	19.4	2846.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	1111.0	19
30 min Summer	90.866	0.0	1388.1	34
60 min Summer	56.713	0.0	1899.4	64
120 min Summer	34.190	0.0	2281.2	124
180 min Summer	25.088	0.0	2498.3	184
240 min Summer	20.020	0.0	2641.8	242
360 min Summer	14.528	0.0	2819.6	362
480 min Summer	11.570	0.0	2882.6	482
600 min Summer	9.690	0.0	2875.9	602
720 min Summer	8.380	0.0	2860.9	720
960 min Summer	6.658	0.0	2825.4	960
1440 min Summer	4.807	0.0	2747.4	1212
2160 min Summer	3.465	0.0	4228.2	1580
2880 min Summer	2.744	0.0	4455.5	1988
4320 min Summer	1.973	0.0	4719.8	2812
5760 min Summer	1.559	0.0	5099.4	3640
7200 min Summer	1.298	0.0	5307.4	4464
8640 min Summer	1.118	0.0	5479.1	5272
10080 min Summer	0.985	0.0	5620.4	5960
15 min Winter	138.634	0.0	1233.3	19
30 min Winter	90.866	0.0	1430.8	34
60 min Winter	56.713	0.0	2123.8	64
120 min Winter	34.190	0.0	2540.6	122
180 min Winter	25.088	0.0	2762.8	180
240 min Winter	20.020	0.0	2884.4	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.502	1.502	19.8	3005.1	Flood Risk
480 min Winter	124.537	1.537	20.0	3098.2	Flood Risk
600 min Winter	124.557	1.557	20.1	3151.2	Flood Risk
720 min Winter	124.567	1.567	20.2	3178.6	Flood Risk
960 min Winter	124.570	1.570	20.2	3185.3	Flood Risk
1440 min Winter	124.537	1.537	20.0	3097.9	Flood Risk
2160 min Winter	124.470	1.470	19.6	2920.4	O K
2880 min Winter	124.401	1.401	19.2	2745.1	O K
4320 min Winter	124.258	1.258	18.2	2392.4	O K
5760 min Winter	124.116	1.116	17.8	2059.2	O K
7200 min Winter	123.974	0.974	17.8	1743.0	O K
8640 min Winter	123.811	0.811	17.8	1401.2	O K
10080 min Winter	123.629	0.629	17.8	1043.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	2939.3	356
480 min Winter	11.570	0.0	2937.7	472
600 min Winter	9.690	0.0	2932.0	588
720 min Winter	8.380	0.0	2925.0	702
960 min Winter	6.658	0.0	2909.4	924
1440 min Winter	4.807	0.0	2884.8	1352
2160 min Winter	3.465	0.0	4730.4	1684
2880 min Winter	2.744	0.0	4977.1	2136
4320 min Winter	1.973	0.0	5071.9	3068
5760 min Winter	1.559	0.0	5711.7	3928
7200 min Winter	1.298	0.0	5944.7	4824
8640 min Winter	1.118	0.0	6138.7	5704
10080 min Winter	0.985	0.0	6299.4	6256

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.550

Time (mins) From:	To:	Area (ha)
0	4	4.550

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1437.0	1.200	2356.4	2.400	3501.9	3.600	4873.7	4.800	6471.7
0.200	1574.5	1.400	2531.6	2.600	3714.9	3.800	5124.3	5.000	6760.0
0.400	1718.3	1.600	2713.1	2.800	3934.1	4.000	5381.2		
0.600	1868.4	1.800	2900.9	3.000	4159.6	4.200	5644.4		
0.800	2024.8	2.000	3095.0	3.200	4391.3	4.400	5913.9		
1.000	2187.4	2.200	3295.3	3.400	4629.4	4.600	6189.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0186-1780-1200-1780
Design Head (m)	1.200
Design Flow (l/s)	17.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	186
Invert Level (m)	123.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	17.8	Kick-Flo®	0.819	14.8
Flush-Flo™	0.371	17.8	Mean Flow over Head Range	-	15.2

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)	Depth (m)	Flow (l/s)
0.100	6.5	0.800	15.3	2.000	22.7	4.000	31.7	7.000	41.5
0.200	16.7	1.000	16.3	2.200	23.8	4.500	33.5	7.500	42.9
0.300	17.6	1.200	17.8	2.400	24.8	5.000	35.2	8.000	44.2
0.400	17.8	1.400	19.1	2.600	25.7	5.500	36.9	8.500	45.6
0.500	17.5	1.600	20.4	3.000	27.6	6.000	38.5	9.000	46.8
0.600	17.2	1.800	21.6	3.500	29.7	6.500	40.0	9.500	48.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	123.688	0.388	6.7	442.3	O K
30 min Summer	123.792	0.492	6.7	577.0	O K
60 min Summer	123.893	0.593	6.7	713.8	O K
120 min Summer	123.986	0.686	6.7	846.9	O K
180 min Summer	124.035	0.735	6.7	918.6	O K
240 min Summer	124.065	0.765	6.7	964.0	O K
360 min Summer	124.103	0.803	6.7	1021.4	O K
480 min Summer	124.126	0.826	6.7	1056.3	O K
600 min Summer	124.139	0.839	6.7	1077.2	O K
720 min Summer	124.147	0.847	6.7	1089.1	O K
960 min Summer	124.151	0.851	6.7	1095.9	O K
1440 min Summer	124.136	0.836	6.7	1072.6	O K
2160 min Summer	124.101	0.801	6.7	1018.8	O K
2880 min Summer	124.065	0.765	6.7	964.1	O K
4320 min Summer	123.989	0.689	6.7	850.8	O K
5760 min Summer	123.919	0.619	6.7	750.5	O K
7200 min Summer	123.854	0.554	6.7	660.0	O K
8640 min Summer	123.793	0.493	6.7	578.5	O K
10080 min Summer	123.737	0.437	6.7	505.2	O K
15 min Winter	123.730	0.430	6.7	495.8	O K
30 min Winter	123.844	0.544	6.7	647.1	O K
60 min Winter	123.955	0.655	6.7	801.2	O K
120 min Winter	124.058	0.758	6.7	953.1	O K
180 min Winter	124.112	0.812	6.7	1035.5	O K
240 min Winter	124.146	0.846	6.7	1087.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	406.0	19
30 min Summer	90.866	0.0	513.6	34
60 min Summer	56.713	0.0	710.6	64
120 min Summer	34.190	0.0	852.4	124
180 min Summer	25.088	0.0	931.0	184
240 min Summer	20.020	0.0	980.3	244
360 min Summer	14.528	0.0	1031.8	362
480 min Summer	11.570	0.0	1036.7	482
600 min Summer	9.690	0.0	1025.5	602
720 min Summer	8.380	0.0	1012.3	722
960 min Summer	6.658	0.0	985.5	962
1440 min Summer	4.807	0.0	935.2	1426
2160 min Summer	3.465	0.0	1587.9	1748
2880 min Summer	2.744	0.0	1669.1	2132
4320 min Summer	1.973	0.0	1759.2	2856
5760 min Summer	1.559	0.0	1925.6	3640
7200 min Summer	1.298	0.0	2003.8	4400
8640 min Summer	1.118	0.0	2067.8	5184
10080 min Summer	0.985	0.0	2119.1	5856
15 min Winter	138.634	0.0	451.3	19
30 min Winter	90.866	0.0	549.0	33
60 min Winter	56.713	0.0	794.3	64
120 min Winter	34.190	0.0	945.8	122
180 min Winter	25.088	0.0	1018.2	182
240 min Winter	20.020	0.0	1046.8	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.188	0.888	6.7	1154.2	O K
480 min Winter	124.214	0.914	6.7	1196.0	O K
600 min Winter	124.230	0.930	6.7	1222.5	O K
720 min Winter	124.241	0.941	6.7	1239.2	O K
960 min Winter	124.249	0.949	6.7	1253.6	O K
1440 min Winter	124.242	0.942	6.7	1241.1	O K
2160 min Winter	124.203	0.903	6.7	1177.6	O K
2880 min Winter	124.161	0.861	6.7	1110.7	O K
4320 min Winter	124.068	0.768	6.7	968.8	O K
5760 min Winter	123.959	0.659	6.7	807.0	O K
7200 min Winter	123.858	0.558	6.7	666.1	O K
8640 min Winter	123.766	0.466	6.7	543.3	O K
10080 min Winter	123.685	0.385	6.7	439.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	1042.3	358
480 min Winter	11.570	0.0	1027.6	474
600 min Winter	9.690	0.0	1013.1	590
720 min Winter	8.380	0.0	999.9	708
960 min Winter	6.658	0.0	976.5	934
1440 min Winter	4.807	0.0	936.9	1384
2160 min Winter	3.465	0.0	1770.4	1988
2880 min Winter	2.744	0.0	1847.4	2248
4320 min Winter	1.973	0.0	1807.3	3196
5760 min Winter	1.559	0.0	2156.8	3984
7200 min Winter	1.298	0.0	2244.7	4760
8640 min Winter	1.118	0.0	2317.2	5528
10080 min Winter	0.985	0.0	2376.0	6160

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.720

Time (mins) From:	To:	Area (ha)
0	4	1.720

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1027.0	1.200	1821.7	2.400	2842.6	3.600	4089.7	4.800	5563.0
0.200	1143.7	1.400	1976.2	2.600	3034.8	3.800	4319.6	5.000	5830.6
0.400	1266.8	1.600	2136.9	2.800	3233.2	4.000	4555.7		
0.600	1396.1	1.800	2303.9	3.000	3437.9	4.200	4798.1		
0.800	1531.7	2.000	2477.2	3.200	3648.9	4.400	5046.8		
1.000	1673.6	2.200	2656.8	3.400	3866.2	4.600	5301.8		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0118-6700-1200-6700
Design Head (m)	1.200
Design Flow (l/s)	6.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	118
Invert Level (m)	123.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.7	Kick-Flo®	0.759	5.4
Flush-Flo™	0.356	6.7	Mean Flow over Head Range	-	5.8

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)	Depth (m)	Flow (l/s)
0.100	4.2	0.800	5.5	2.000	8.5	4.000	11.8	7.000	15.4
0.200	6.3	1.000	6.2	2.200	8.9	4.500	12.5	7.500	16.0
0.300	6.7	1.200	6.7	2.400	9.3	5.000	13.1	8.000	16.5
0.400	6.7	1.400	7.2	2.600	9.6	5.500	13.8	8.500	16.9
0.500	6.6	1.600	7.7	3.000	10.3	6.000	14.3	9.000	17.4
0.600	6.3	1.800	8.1	3.500	11.1	6.500	14.9	9.500	17.9

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	123.661	0.361	2.3	164.6	O K
30 min Summer	123.759	0.459	2.3	214.8	O K
60 min Summer	123.855	0.555	2.3	265.8	O K
120 min Summer	123.945	0.645	2.3	315.8	O K
180 min Summer	123.992	0.692	2.3	342.8	O K
240 min Summer	124.021	0.721	2.3	359.7	O K
360 min Summer	124.057	0.757	2.3	381.0	O K
480 min Summer	124.078	0.778	2.3	394.0	O K
600 min Summer	124.092	0.792	2.3	401.9	O K
720 min Summer	124.099	0.799	2.3	406.5	O K
960 min Summer	124.104	0.804	2.3	409.5	O K
1440 min Summer	124.091	0.791	2.3	401.7	O K
2160 min Summer	124.059	0.759	2.3	382.4	O K
2880 min Summer	124.028	0.728	2.3	363.8	O K
4320 min Summer	123.967	0.667	2.3	328.2	O K
5760 min Summer	123.899	0.599	2.3	290.4	O K
7200 min Summer	123.837	0.537	2.3	256.2	O K
8640 min Summer	123.780	0.480	2.3	225.7	O K
10080 min Summer	123.728	0.428	2.3	198.6	O K
15 min Winter	123.700	0.400	2.3	184.5	O K
30 min Winter	123.809	0.509	2.3	240.9	O K
60 min Winter	123.914	0.614	2.3	298.5	O K
120 min Winter	124.013	0.713	2.3	355.2	O K
180 min Winter	124.065	0.765	2.3	385.8	O K
240 min Winter	124.097	0.797	2.3	405.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	154.2	19
30 min Summer	90.866	0.0	188.3	34
60 min Summer	56.713	0.0	266.7	64
120 min Summer	34.190	0.0	319.0	124
180 min Summer	25.088	0.0	345.8	184
240 min Summer	20.020	0.0	358.8	244
360 min Summer	14.528	0.0	362.2	362
480 min Summer	11.570	0.0	358.8	482
600 min Summer	9.690	0.0	354.6	602
720 min Summer	8.380	0.0	350.3	722
960 min Summer	6.658	0.0	342.3	962
1440 min Summer	4.807	0.0	327.6	1428
2160 min Summer	3.465	0.0	592.5	1772
2880 min Summer	2.744	0.0	621.4	2136
4320 min Summer	1.973	0.0	615.5	2944
5760 min Summer	1.559	0.0	717.2	3744
7200 min Summer	1.298	0.0	746.5	4472
8640 min Summer	1.118	0.0	770.7	5264
10080 min Summer	0.985	0.0	790.6	5952
15 min Winter	138.634	0.0	170.1	19
30 min Winter	90.866	0.0	193.9	34
60 min Winter	56.713	0.0	297.8	64
120 min Winter	34.190	0.0	350.6	122
180 min Winter	25.088	0.0	365.0	182
240 min Winter	20.020	0.0	364.8	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.138	0.838	2.3	430.3	O K
480 min Winter	124.163	0.863	2.3	446.1	O K
600 min Winter	124.180	0.880	2.3	456.3	O K
720 min Winter	124.190	0.890	2.3	462.8	O K
960 min Winter	124.199	0.899	2.3	468.7	O K
1440 min Winter	124.194	0.894	2.3	465.2	O K
2160 min Winter	124.159	0.859	2.3	443.3	O K
2880 min Winter	124.121	0.821	2.3	419.6	O K
4320 min Winter	124.043	0.743	2.3	372.9	O K
5760 min Winter	123.958	0.658	2.3	323.3	O K
7200 min Winter	123.857	0.557	2.3	267.2	O K
8640 min Winter	123.769	0.469	2.3	220.1	O K
10080 min Winter	123.692	0.392	2.3	180.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	360.4	358
480 min Winter	11.570	0.0	355.8	474
600 min Winter	9.690	0.0	351.7	590
720 min Winter	8.380	0.0	348.2	708
960 min Winter	6.658	0.0	342.2	934
1440 min Winter	4.807	0.0	333.0	1384
2160 min Winter	3.465	0.0	658.9	2008
2880 min Winter	2.744	0.0	674.8	2252
4320 min Winter	1.973	0.0	628.4	3196
5760 min Winter	1.559	0.0	803.3	4104
7200 min Winter	1.298	0.0	836.1	4896
8640 min Winter	1.118	0.0	863.4	5616
10080 min Winter	0.985	0.0	886.1	6352

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.640

Time (mins) From:	To:	Area (ha)
0	4	0.640

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	416.0	1.200	717.0	2.400	1099.4	3.600	1563.3	4.800	2108.6
0.200	460.5	1.400	775.1	2.600	1171.1	3.800	1648.5	5.000	2207.4
0.400	507.3	1.600	835.4	2.800	1245.0	4.000	1736.0		
0.600	556.3	1.800	898.0	3.000	1321.2	4.200	1825.8		
0.800	607.6	2.000	962.9	3.200	1399.6	4.400	1917.8		
1.000	661.2	2.200	1030.0	3.400	1480.3	4.600	2012.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	123.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5	Kick-Flo®	0.644	1.9
Flush-Flo™	0.318	2.3	Mean Flow over Head Range	-	2.1

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)	Depth (m)	Flow (l/s)
0.100	1.9	0.800	2.1	2.000	3.2	4.000	4.4	7.000	5.7
0.200	2.2	1.000	2.3	2.200	3.3	4.500	4.6	7.500	5.9
0.300	2.3	1.200	2.5	2.400	3.4	5.000	4.8	8.000	6.0
0.400	2.3	1.400	2.7	2.600	3.6	5.500	5.1	8.500	6.2
0.500	2.2	1.600	2.8	3.000	3.8	6.000	5.3	9.000	6.4
0.600	2.0	1.800	3.0	3.500	4.1	6.500	5.5	9.500	6.5

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	123.727	0.427	2.9	197.9	O K
30 min Summer	123.841	0.541	2.9	258.2	O K
60 min Summer	123.951	0.651	2.9	319.4	O K
120 min Summer	124.054	0.754	2.9	379.3	O K
180 min Summer	124.107	0.807	2.9	411.1	O K
240 min Summer	124.139	0.839	2.9	430.8	O K
360 min Summer	124.178	0.878	2.9	455.4	O K
480 min Summer	124.202	0.902	2.9	470.1	O K
600 min Summer	124.215	0.915	2.9	478.6	O K
720 min Summer	124.222	0.922	2.9	483.2	O K
960 min Summer	124.225	0.925	2.9	484.9	O K
1440 min Summer	124.205	0.905	2.9	472.4	O K
2160 min Summer	124.167	0.867	2.9	448.2	O K
2880 min Summer	124.130	0.830	2.9	425.2	O K
4320 min Summer	124.059	0.759	2.9	382.1	O K
5760 min Summer	123.981	0.681	2.9	336.8	O K
7200 min Summer	123.905	0.605	2.9	293.3	O K
8640 min Summer	123.836	0.536	2.9	255.4	O K
10080 min Summer	123.773	0.473	2.9	221.9	O K
15 min Winter	123.773	0.473	2.9	221.9	O K
30 min Winter	123.898	0.598	2.9	289.6	O K
60 min Winter	124.019	0.719	2.9	358.8	O K
120 min Winter	124.132	0.832	2.9	426.5	O K
180 min Winter	124.190	0.890	2.9	462.8	O K
240 min Winter	124.226	0.926	2.9	485.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	188.7	19
30 min Summer	90.866	0.0	234.3	34
60 min Summer	56.713	0.0	322.5	64
120 min Summer	34.190	0.0	386.5	124
180 min Summer	25.088	0.0	421.4	184
240 min Summer	20.020	0.0	441.5	244
360 min Summer	14.528	0.0	452.9	362
480 min Summer	11.570	0.0	450.6	482
600 min Summer	9.690	0.0	446.3	602
720 min Summer	8.380	0.0	441.6	722
960 min Summer	6.658	0.0	432.2	960
1440 min Summer	4.807	0.0	414.5	1372
2160 min Summer	3.465	0.0	715.3	1712
2880 min Summer	2.744	0.0	752.6	2104
4320 min Summer	1.973	0.0	768.4	2936
5760 min Summer	1.559	0.0	863.3	3744
7200 min Summer	1.298	0.0	898.5	4472
8640 min Summer	1.118	0.0	927.7	5192
10080 min Summer	0.985	0.0	952.0	5952
15 min Winter	138.634	0.0	209.1	19
30 min Winter	90.866	0.0	242.4	34
60 min Winter	56.713	0.0	360.3	64
120 min Winter	34.190	0.0	427.8	122
180 min Winter	25.088	0.0	453.8	180
240 min Winter	20.020	0.0	456.9	240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.271	0.971	2.9	514.8	O K
480 min Winter	124.298	0.998	2.9	532.9	O K
600 min Winter	124.315	1.015	2.9	544.1	O K
720 min Winter	124.326	1.026	2.9	551.0	O K
960 min Winter	124.334	1.034	2.9	556.3	O K
1440 min Winter	124.322	1.022	2.9	548.8	O K
2160 min Winter	124.277	0.977	2.9	518.8	O K
2880 min Winter	124.233	0.933	2.9	490.3	O K
4320 min Winter	124.140	0.840	2.9	431.8	O K
5760 min Winter	124.040	0.740	2.9	371.3	O K
7200 min Winter	123.919	0.619	2.9	301.2	O K
8640 min Winter	123.812	0.512	2.9	242.8	O K
10080 min Winter	123.720	0.420	2.9	194.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	453.5	358
480 min Winter	11.570	0.0	448.7	474
600 min Winter	9.690	0.0	444.2	590
720 min Winter	8.380	0.0	440.2	706
960 min Winter	6.658	0.0	433.3	934
1440 min Winter	4.807	0.0	422.6	1382
2160 min Winter	3.465	0.0	798.5	1964
2880 min Winter	2.744	0.0	833.2	2224
4320 min Winter	1.973	0.0	791.5	3156
5760 min Winter	1.559	0.0	966.9	4088
7200 min Winter	1.298	0.0	1006.4	4832
8640 min Winter	1.118	0.0	1039.3	5536
10080 min Winter	0.985	0.0	1066.8	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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.770

Time (mins) From:	To:	Area (ha)
0	4	0.770

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	416.0	1.200	717.0	2.400	1099.4	3.600	1563.3	4.800	2108.6
0.200	460.5	1.400	775.1	2.600	1171.1	3.800	1648.5	5.000	2207.4
0.400	507.3	1.600	835.4	2.800	1245.0	4.000	1736.0		
0.600	556.3	1.800	898.0	3.000	1321.2	4.200	1825.8		
0.800	607.6	2.000	962.9	3.200	1399.6	4.400	1917.8		
1.000	661.2	2.200	1030.0	3.400	1480.3	4.600	2012.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0079-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	79
Invert Level (m)	123.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.0	Kick-Flo®	0.707	2.4
Flush-Flo™	0.348	2.9	Mean Flow over Head Range	-	2.6

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)	Depth (m)	Flow (l/s)
0.100	2.3	0.800	2.5	2.000	3.8	4.000	5.2	7.000	6.8
0.200	2.8	1.000	2.8	2.200	4.0	4.500	5.5	7.500	7.0
0.300	2.9	1.200	3.0	2.400	4.1	5.000	5.8	8.000	7.3
0.400	2.9	1.400	3.2	2.600	4.3	5.500	6.1	8.500	7.5
0.500	2.8	1.600	3.4	3.000	4.6	6.000	6.3	9.000	7.7
0.600	2.7	1.800	3.6	3.500	4.9	6.500	6.6	9.500	7.9

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	123.775	0.775	29.8	1967.6	O K
30 min Summer	123.977	0.977	29.8	2569.9	O K
60 min Summer	124.167	1.167	29.8	3176.5	O K
120 min Summer	124.340	1.340	31.6	3758.1	O K
180 min Summer	124.427	1.427	32.6	4061.5	O K
240 min Summer	124.478	1.478	33.1	4244.5	O K
360 min Summer	124.538	1.538	33.8	4461.9	Flood Risk
480 min Summer	124.570	1.570	34.1	4580.0	Flood Risk
600 min Summer	124.586	1.586	34.3	4637.6	Flood Risk
720 min Summer	124.591	1.591	34.3	4656.1	Flood Risk
960 min Summer	124.581	1.581	34.2	4619.8	Flood Risk
1440 min Summer	124.541	1.541	33.8	4474.1	Flood Risk
2160 min Summer	124.479	1.479	33.1	4247.6	O K
2880 min Summer	124.417	1.417	32.5	4025.7	O K
4320 min Summer	124.297	1.297	31.1	3610.1	O K
5760 min Summer	124.185	1.185	29.8	3233.8	O K
7200 min Summer	124.077	1.077	29.8	2885.7	O K
8640 min Summer	123.973	0.973	29.8	2557.1	O K
10080 min Summer	123.862	0.862	29.8	2221.7	O K
15 min Winter	123.857	0.857	29.8	2206.9	O K
30 min Winter	124.076	1.076	29.8	2882.2	O K
60 min Winter	124.284	1.284	31.0	3565.3	O K
120 min Winter	124.473	1.473	33.1	4225.4	O K
180 min Winter	124.569	1.569	34.1	4574.5	Flood Risk
240 min Winter	124.626	1.626	34.7	4789.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	1853.0	23
30 min Summer	90.866	0.0	2316.8	38
60 min Summer	56.713	0.0	3190.9	68
120 min Summer	34.190	0.0	3833.6	126
180 min Summer	25.088	0.0	4201.0	186
240 min Summer	20.020	0.0	4446.6	246
360 min Summer	14.528	0.0	4769.5	364
480 min Summer	11.570	0.0	4938.3	484
600 min Summer	9.690	0.0	4967.9	602
720 min Summer	8.380	0.0	4951.2	722
960 min Summer	6.658	0.0	4898.8	958
1440 min Summer	4.807	0.0	4771.2	1176
2160 min Summer	3.465	0.0	7120.6	1560
2880 min Summer	2.744	0.0	7503.0	1964
4320 min Summer	1.973	0.0	7967.4	2808
5760 min Summer	1.559	0.0	8593.1	3632
7200 min Summer	1.298	0.0	8943.1	4400
8640 min Summer	1.118	0.0	9231.2	5264
10080 min Summer	0.985	0.0	9466.2	6048
15 min Winter	138.634	0.0	2055.1	23
30 min Winter	90.866	0.0	2418.2	37
60 min Winter	56.713	0.0	3568.6	66
120 min Winter	34.190	0.0	4273.2	124
180 min Winter	25.088	0.0	4658.9	182
240 min Winter	20.020	0.0	4893.0	242

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.695	1.695	35.4	5052.5	Flood Risk
480 min Winter	124.735	1.735	35.8	5204.6	Flood Risk
600 min Winter	124.757	1.757	36.0	5289.2	Flood Risk
720 min Winter	124.767	1.767	36.1	5330.6	Flood Risk
960 min Winter	124.768	1.768	36.1	5332.9	Flood Risk
1440 min Winter	124.726	1.726	35.7	5172.0	Flood Risk
2160 min Winter	124.652	1.652	35.0	4887.3	Flood Risk
2880 min Winter	124.572	1.572	34.1	4589.1	Flood Risk
4320 min Winter	124.408	1.408	32.4	3993.2	O K
5760 min Winter	124.246	1.246	30.5	3438.8	O K
7200 min Winter	124.090	1.090	29.8	2926.4	O K
8640 min Winter	123.930	0.930	29.8	2425.9	O K
10080 min Winter	123.725	0.725	29.8	1824.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	5087.0	358
480 min Winter	11.570	0.0	5103.0	474
600 min Winter	9.690	0.0	5102.5	588
720 min Winter	8.380	0.0	5096.7	702
960 min Winter	6.658	0.0	5077.0	924
1440 min Winter	4.807	0.0	5033.8	1334
2160 min Winter	3.465	0.0	7967.7	1664
2880 min Winter	2.744	0.0	8385.6	2132
4320 min Winter	1.973	0.0	8698.8	3028
5760 min Winter	1.559	0.0	9625.2	3920
7200 min Winter	1.298	0.0	10017.4	4760
8640 min Winter	1.118	0.0	10343.0	5624
10080 min Winter	0.985	0.0	10611.2	6256

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.670

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	3.835	4	8	3.835

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2200.0	1.200	3310.7	2.400	4647.6	3.600	6210.8	4.800	8000.1
0.200	2369.4	1.400	3517.8	2.600	4892.5	3.800	6493.3	5.000	8320.3
0.400	2545.1	1.600	3731.2	2.800	5143.5	4.000	6782.1		
0.600	2727.1	1.800	3950.9	3.000	5400.9	4.200	7077.1		
0.800	2915.3	2.000	4176.9	3.200	5664.6	4.400	7378.5		
1.000	3109.9	2.200	4409.1	3.400	5934.5	4.600	7686.1		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0234-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	123.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	30.0	Kick-Flo®	0.855	25.5
Flush-Flo™	0.406	29.8	Mean Flow over Head Range	-	25.2

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)	Depth (m)	Flow (l/s)
0.100	7.8	0.800	26.9	2.000	38.3	4.000	53.5	7.000	70.3
0.200	23.6	1.000	27.5	2.200	40.1	4.500	56.7	7.500	72.7
0.300	29.4	1.200	30.0	2.400	41.8	5.000	59.7	8.000	75.0
0.400	29.8	1.400	32.3	2.600	43.5	5.500	62.5	8.500	77.2
0.500	29.6	1.600	34.4	3.000	46.6	6.000	65.2	9.000	79.4
0.600	29.1	1.800	36.4	3.500	50.2	6.500	67.8	9.500	81.5

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	122.065	0.535	1.8	63.6	O K
30 min Summer	122.176	0.646	1.8	82.6	O K
60 min Summer	122.272	0.742	1.8	101.1	O K
120 min Summer	122.350	0.820	1.8	117.5	O K
180 min Summer	122.384	0.854	1.8	124.9	O K
240 min Summer	122.399	0.869	1.8	128.4	O K
360 min Summer	122.409	0.879	1.8	130.8	O K
480 min Summer	122.407	0.877	1.8	130.1	O K
600 min Summer	122.396	0.866	1.8	127.8	O K
720 min Summer	122.385	0.855	1.8	125.3	O K
960 min Summer	122.363	0.833	1.8	120.4	O K
1440 min Summer	122.323	0.793	1.8	111.6	O K
2160 min Summer	122.266	0.736	1.8	99.8	O K
2880 min Summer	122.209	0.679	1.8	88.8	O K
4320 min Summer	122.082	0.552	1.8	66.2	O K
5760 min Summer	121.947	0.417	1.8	45.6	O K
7200 min Summer	121.842	0.312	1.8	31.6	O K
8640 min Summer	121.761	0.231	1.8	22.1	O K
10080 min Summer	121.705	0.175	1.7	16.0	O K
15 min Winter	122.112	0.582	1.8	71.4	O K
30 min Winter	122.230	0.700	1.8	92.8	O K
60 min Winter	122.333	0.803	1.8	113.8	O K
120 min Winter	122.418	0.888	1.8	132.8	O K
180 min Winter	122.456	0.926	1.8	141.8	Flood Risk
240 min Winter	122.475	0.945	1.8	146.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	64.7	19
30 min Summer	90.866	0.0	84.8	34
60 min Summer	56.713	0.0	106.2	64
120 min Summer	34.190	0.0	128.1	122
180 min Summer	25.088	0.0	141.0	182
240 min Summer	20.020	0.0	150.0	242
360 min Summer	14.528	0.0	163.3	362
480 min Summer	11.570	0.0	173.3	480
600 min Summer	9.690	0.0	181.5	574
720 min Summer	8.380	0.0	188.3	622
960 min Summer	6.658	0.0	199.4	748
1440 min Summer	4.807	0.0	215.8	1010
2160 min Summer	3.465	0.0	233.8	1428
2880 min Summer	2.744	0.0	246.9	1844
4320 min Summer	1.973	0.0	266.1	2636
5760 min Summer	1.559	0.0	280.6	3296
7200 min Summer	1.298	0.0	292.1	3968
8640 min Summer	1.118	0.0	301.7	4592
10080 min Summer	0.985	0.0	310.0	5248
15 min Winter	138.634	0.0	72.5	19
30 min Winter	90.866	0.0	94.9	33
60 min Winter	56.713	0.0	119.0	62
120 min Winter	34.190	0.0	143.4	120
180 min Winter	25.088	0.0	157.9	180
240 min Winter	20.020	0.0	168.0	238

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	122.491	0.961	1.8	150.4	Flood Risk
480 min Winter	122.493	0.963	1.8	150.9	Flood Risk
600 min Winter	122.488	0.958	1.8	149.5	Flood Risk
720 min Winter	122.477	0.947	1.8	146.9	Flood Risk
960 min Winter	122.450	0.920	1.8	140.4	Flood Risk
1440 min Winter	122.402	0.872	1.8	129.0	O K
2160 min Winter	122.324	0.794	1.8	112.0	O K
2880 min Winter	122.244	0.714	1.8	95.5	O K
4320 min Winter	122.041	0.511	1.8	59.7	O K
5760 min Winter	121.847	0.317	1.8	32.2	O K
7200 min Winter	121.720	0.190	1.7	17.6	O K
8640 min Winter	121.653	0.123	1.6	10.8	O K
10080 min Winter	121.619	0.089	1.4	7.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	182.8	352
480 min Winter	11.570	0.0	194.1	466
600 min Winter	9.690	0.0	203.2	576
720 min Winter	8.380	0.0	210.8	680
960 min Winter	6.658	0.0	223.3	790
1440 min Winter	4.807	0.0	241.5	1082
2160 min Winter	3.465	0.0	261.9	1540
2880 min Winter	2.744	0.0	276.5	1988
4320 min Winter	1.973	0.0	298.1	2772
5760 min Winter	1.559	0.0	314.3	3400
7200 min Winter	1.298	0.0	327.2	3968
8640 min Winter	1.118	0.0	337.9	4584
10080 min Winter	0.985	0.0	347.2	5144

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.250

Time (mins) From:	To:	Area (ha)
0	4	0.250

Model Details

Storage is Online Cover Level (m) 122.730

Tank or Pond Structure

Invert Level (m) 121.530

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	80.0	1.200	304.6	2.400	673.9	3.600	1188.0	4.800	1846.9
0.200	107.4	1.400	356.1	2.600	749.5	3.800	1287.8	5.000	1970.8
0.400	138.8	1.600	411.6	2.800	829.2	4.000	1391.6		
0.600	174.2	1.800	471.1	3.000	912.9	4.200	1499.4		
0.800	213.6	2.000	534.7	3.200	1000.6	4.400	1611.2		
1.000	257.1	2.200	602.3	3.400	1092.3	4.600	1727.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	121.530
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

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)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	124.202	0.602	1.8	96.9	O K
30 min Summer	124.329	0.729	1.8	126.1	O K
60 min Summer	124.442	0.842	1.8	155.3	O K
120 min Summer	124.539	0.939	1.8	182.6	Flood Risk
180 min Summer	124.584	0.984	1.8	196.3	Flood Risk
240 min Summer	124.610	1.010	1.8	204.2	Flood Risk
360 min Summer	124.637	1.037	1.9	212.6	Flood Risk
480 min Summer	124.648	1.048	1.9	216.2	Flood Risk
600 min Summer	124.650	1.050	1.9	216.9	Flood Risk
720 min Summer	124.647	1.047	1.9	215.8	Flood Risk
960 min Summer	124.631	1.031	1.9	210.7	Flood Risk
1440 min Summer	124.596	0.996	1.8	200.0	Flood Risk
2160 min Summer	124.549	0.949	1.8	185.7	Flood Risk
2880 min Summer	124.506	0.906	1.8	173.1	Flood Risk
4320 min Summer	124.423	0.823	1.8	150.3	O K
5760 min Summer	124.343	0.743	1.8	129.5	O K
7200 min Summer	124.261	0.661	1.8	110.1	O K
8640 min Summer	124.167	0.567	1.8	89.4	O K
10080 min Summer	124.061	0.461	1.8	68.1	O K
15 min Winter	124.255	0.655	1.8	108.6	O K
30 min Winter	124.390	0.790	1.8	141.5	O K
60 min Winter	124.511	0.911	1.8	174.5	Flood Risk
120 min Winter	124.615	1.015	1.9	205.9	Flood Risk
180 min Winter	124.666	1.066	1.9	222.0	Flood Risk
240 min Winter	124.695	1.095	1.9	231.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	97.4	19
30 min Summer	90.866	0.0	126.5	34
60 min Summer	56.713	0.0	160.4	64
120 min Summer	34.190	0.0	193.4	124
180 min Summer	25.088	0.0	212.8	182
240 min Summer	20.020	0.0	226.3	242
360 min Summer	14.528	0.0	246.2	362
480 min Summer	11.570	0.0	261.0	482
600 min Summer	9.690	0.0	272.5	600
720 min Summer	8.380	0.0	280.9	720
960 min Summer	6.658	0.0	283.9	894
1440 min Summer	4.807	0.0	275.3	1126
2160 min Summer	3.465	0.0	353.4	1516
2880 min Summer	2.744	0.0	373.1	1932
4320 min Summer	1.973	0.0	402.0	2764
5760 min Summer	1.559	0.0	424.3	3576
7200 min Summer	1.298	0.0	441.6	4392
8640 min Summer	1.118	0.0	456.2	5184
10080 min Summer	0.985	0.0	468.6	5752
15 min Winter	138.634	0.0	108.9	19
30 min Winter	90.866	0.0	137.8	33
60 min Winter	56.713	0.0	179.7	62
120 min Winter	34.190	0.0	216.5	122
180 min Winter	25.088	0.0	238.2	180
240 min Winter	20.020	0.0	253.2	238

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	124.727	1.127	1.9	242.3	Flood Risk
480 min Winter	124.743	1.143	2.0	247.8	Flood Risk
600 min Winter	124.749	1.149	2.0	250.1	Flood Risk
720 min Winter	124.750	1.150	2.0	250.3	Flood Risk
960 min Winter	124.740	1.140	2.0	246.9	Flood Risk
1440 min Winter	124.701	1.101	1.9	233.5	Flood Risk
2160 min Winter	124.645	1.045	1.9	215.3	Flood Risk
2880 min Winter	124.588	0.988	1.8	197.5	Flood Risk
4320 min Winter	124.473	0.873	1.8	163.8	O K
5760 min Winter	124.355	0.755	1.8	132.8	O K
7200 min Winter	124.228	0.628	1.8	102.6	O K
8640 min Winter	124.050	0.450	1.8	66.1	O K
10080 min Winter	123.917	0.317	1.8	42.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.528	0.0	274.7	356
480 min Winter	11.570	0.0	288.5	472
600 min Winter	9.690	0.0	291.6	584
720 min Winter	8.380	0.0	291.2	698
960 min Winter	6.658	0.0	288.8	916
1440 min Winter	4.807	0.0	283.4	1184
2160 min Winter	3.465	0.0	395.8	1624
2880 min Winter	2.744	0.0	417.9	2080
4320 min Winter	1.973	0.0	450.0	2984
5760 min Winter	1.559	0.0	475.2	3856
7200 min Winter	1.298	0.0	494.7	4688
8640 min Winter	1.118	0.0	510.9	5280
10080 min Winter	0.985	0.0	524.9	5848

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.378

Time (mins) From:	To:	Area (ha)
0	4	0.378

Model Details

Storage is Online Cover Level (m) 124.800

Tank or Pond Structure

Invert Level (m) 123.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	110.0	1.200	360.8	2.400	756.5	3.600	1296.8	4.800	1982.0
0.200	141.8	1.400	416.7	2.600	836.5	3.800	1401.0	5.000	2110.2
0.400	177.5	1.600	476.6	2.800	920.5	4.000	1509.1		
0.600	217.3	1.800	540.6	3.000	1008.5	4.200	1621.3		
0.800	261.1	2.000	608.5	3.200	1100.6	4.400	1737.5		
1.000	309.0	2.200	680.5	3.400	1196.7	4.600	1857.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	123.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

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)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

OS NORTH

FILMING AREA
27 WEST

FILMING AREA
27 EAST

WALK/CYCLE ROUTE THROUGH PARK (APPROX. 1KM)

SECURITY ENTRANCE TO FLYING FIELD COMMERCIAL

TEMPORARY SET CONSTRUCTION/EVENT PARKING ALONG TAXIWAY
24

PROPOSED ROUTE FOR THE AVES DITCH FOOTPATH/BRIDLEWAY ROUTE

APPROVED ROUTE FOR THE PORTWAY FOOTPATH/BRIDLEWAY ROUTE

PROPOSED HEDGEROW WITH TREES ON WESTERN SIDE OF PORTWAY

FLYING FIELD PARK
20.5HA
28

30
CONTROL TOWER PARK
3.9HA

CORE VISITOR DESTINATION AREA
3.6HA
29

EDUCATIONAL SITE WITH POTENTIAL EARLY YEARS PROVISION
(AGE TBC)
2.4HA
31

CREATIVE CITY
11.1HA
22

23

PROPOSED SCREENING

CAR PROCESSING ACCESS

25
CAR PROCESSING HARDSTANDING AREA
20.3HA

12 WEST

12 EAST

21

LEGIONEERS FARM

FENCE DIVIDING CREATIVE CITY & COMMERCIAL

COMMERCIAL
2.3HA

33

UPPER HEYFORD

DAY CARE NURSERY
17/01680/F
TEMPORARY APPLICATION PERMITTED FOR 10 YEARS

10

19

11

15
AREA OF FUTURE RESIDENTIAL DEVELOPMENT WITHIN POLICY VILLAGES 5

40

20

PYE HOMES
15/05037/F
NOT YET DETERMINED

13

HEYFORD PARK FREE SCHOOL

32 EAST

LAND SOUTH OF CAMP ROAD
16/02446/F
NOT YET DETERMINED

39

38

32 WEST

17

34

SPORTS PARK
4.2HA
18

16

SEWAGE TREATMENT WORKS

SEWAGE TREATMENT WORKS IMPROVEMENTS

36

ATTENUATION BASIN SERVING PARCEL 10.
MAX VOLUME 1929m^3

HYDROBRAKE FLOW CONTROL SERVING PARCEL 10 TO DISCHARGE TO EXISTING EXISTING NETWORK
IMPERMEABLE AREA 2.50 HA.
DISCHARGE RATE 9.8 L/S

HYDROBRAKE FLOW CONTROL SERVING PARCEL 16 AND INDOOR
IMPERMEABLE AREA 4.77 HA.
DISCHARGE RATE 17.8L/S

ATTENUATION BASIN SERVING PARCEL 16
MAX VOLUME 3728m^3

ATTENUATION BASIN SERVING RESIDENTIAL PARCEL 39.
CAPACITY 150 m^3

HYDROBRAKE FLOW CONTROL SERVING RESIDENTIAL PARCEL 39 IMPERMEABLE AREA 0.25HA.
DISCHARGE RATE 2.0L/S

ATTENUATION BASIN SERVING PARCEL 17.
CAPACITY 1529.4 m^3

HYDROBRAKE FLOW CONTROL SERVING PARCEL 17 TO DISCHARGE TO EXISTING BROOK
IMPERMEABLE AREA 1.72 HA.
DISCHARGE RATE 6.7 L/S

ATTENUATION BASIN SERVING PARCEL 13.
CAPACITY 310.3 m^3

HYDROBRAKE FLOW CONTROL SERVING PARCEL 13 TO DISCHARGE TO EXISTING NETWORK
IMPERMEABLE AREA 0.34HA.
DISCHARGE RATE 2L/S

ATTENUATION BASIN SERVING PARCEL 11, 12 & 21.
MAX VOLUME 4819m^3

HYDROBRAKE FLOW CONTROL SERVING PARCEL 11,12 AND 21 IMPERMEABLE AREA 6.31HA.
DISCHARGE RATE 25.2 L/S

PROPOSED SWALE SERVING PARCEL 23.
CAPACITY 247m^3.

ATTENUATION BASIN SERVING PARCEL 23.
STORAGE VOLUME 833m^3

HYDROBRAKE FLOW CONTROL SERVING PARCEL 23 TO DISCHARGE TO EXISTING BROOK
IMPERMEABLE AREA 7.67 HA.
DISCHARGE RATE 32.7L/S

ATTENUATION BASIN SERVING RESIDENTIAL PHASE 23.
CAPACITY 238m^3

RESIDENTIAL PROVISION

DORCHESTER LAND PART OF THIS APPLICATION

SURFACE WATER SEWER LEGEND

- 23 — Proposed Phase number
- Proposed Surface Water Sewer
- Existing Surface Water Sewer
- Existing Surface Water Sewer to be diverted
- Existing Surface Water Sewer to be removed
- Existing Watercourse
- Proposed Cellular Storage Tank
- Proposed Attenuation Basin

NOTES
1.- Discharge rate based on QBAR greenfield discharge rate of 4.3 l/s/ha.
2.- Discharge rate based on assumption that gross area is 65% impermeable for residential and and 90% for Mixed Use, Village Centre and Indoor Sport.
3.- Impermeable areas for residential use quoted include additional 10% impermeable area for urban creep.

REV	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P03	RFS	04/03/20 20	SM	04/03/20 20	SM	04/03/20 20
P02	RFS	02.10.17	SM	02.10.17	SM	02.10.17
OS map added. Attenuation basin note from phase 11 and 12 amended. Phase 23 attenuation basin resized.						
P01	RFS	28.09.17	SM	28.09.17	SM	29.09.17
First issue						

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CLIENT
DORCHESTER LIVING

PROJECT
HEYFORD PARK

TITLE
SURFACE WATER DRAINAGE STRATEGY PLAN

HYDROCK PROJECT NO.
C-04583-C

SCALE @ A1
1:5000

PURPOSE OF ISSUE
SUITABLE FOR INFORMATION

STATUS
S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
HPH-HYD-XX-XX-DR-C-2200

REVISION
P3

OS NORTH

PROPOSED FOUL GRAVITY SEWER SERVING 115 PLOTS FROM PHASE 21 AT FLOW OF 5.3 L/S

PROPOSED FOUL GRAVITY SEWER SERVING 163 PLOTS FROM PHASE 21 AT FLOW OF 7.5 L/S

PROPOSED FOUL GRAVITY SEWER SERVING 60 EXTRA CARE DWELLINGS FROM PHASE 19 AT 2.78 L/S

EXISTING FOUL SEWER SERVING PHASE 20 AT FLOW OF 0.158 L/S. MEDICAL CENTRE - 670 m^2 - 0.066 L/S. RETAIL SPACE - 929 m^2 - 0.092 L/S. SUBJECT TO CAPACITY AND CONDITIONS

PROPOSED FOUL SEWER SERVING 118 DWELLINGS FROM PHASE 10 AT FLOW OF 5.4 L/S.

PROPOSED FOUL SEWER SERVING 13 DWELLINGS FROM PARCEL 39 AT FLOW OF 0.6L/S.

PROPOSED FOUL SEWER SERVING 178 DWELLINGS FROM PHASE 16 AT FLOW OF 8.5 L/S.

PROPOSED PUMPING STATION SERVING PARCEL 10,& 16. ACCUMULATIVE PEAK FLOW OF 14.25 L/S.

PROPOSED RISING MAIN SERVING TO DISCHARGE TO PROPOSED PUMPING STATION.

PROPOSED PUMPING STATION OBTAINED FROM WOODS HARDWICK DRAWING REFERENCE 'HEYF/5/149A'

PROPOSED RISING MAIN OBTAINED FROM WOODS HARDWICK DRAWING REFERENCE 'HEYF/5/149A'

PROPOSED FOUL GRAVITY SEWER SERVING VILLAGE CENTRE OBTAINED FROM WOODS HARDWICK DRAWING REFERENCE 'HEYF/5/149A' TO BE DIVERTED. FLOW TO BE DETERMINED. SUBJECT TO CAPACITY AND CONDITIONS

PROPOSED FOUL SEWER OBTAINED FROM WOODS HARDWICK DRAWING REFERENCE 'HEYF/5/149A' TO BE RETAINED.

PROPOSED FOUL SEWER SERVING 27 DWELLINGS FROM PARCEL 40 AT FLOW OF 1.2L/S.

EXISTING FOUL SEWER TO BE RETAINED. SUBJECT TO CAPACITY AND CONDITIONS.

PROPOSED FOUL SEWER OBTAINED FROM WOODS HARDWICK DRAWING REFERENCE 'HEYF/5/149A' TO BE DIVERTED.

PROPOSED FOUL SEWER SERVING 62 DWELLINGS FROM PHASE 17 AT FLOW OF 2.9 L/S.

EXISTING TREATMEN PLANT.

PROPOSED PUMPING STATION SERVING PHASE 23. 400 PLOTS DISCHARGING AT 18.52 L/S TO PUMPING STATION.

PROPOSED RISING SERVING PHASE 23

EXISTING FOUL GRAVITY SEWER TO BE UPGRADED TO SERVE PHASES 11, 12, 21 AND 23. SUBJECT TO CAPACITY AND CONDITIONS. ACCUMULATIVE PEAK FLOW OF 34.56 L/S.

EXISTING PUMPING STATION TO BE UPGRADED TO SERVE PHASES 11, 12, 21 AND 23. SUBJECT TO CAPACITY AND CONDITIONS.

PROPOSED FOUL GRAVITY SEWER SERVING 70 DWELLINGS FROM PHASE 11 AT FLOW OF 2.78 L/S

PROPOSED FOUL GRAVITY SEWER SERVING 5 DWELLINGS FROM PHASE 13 AT FLOW OF 0.23 L/S

FOUL WATER SEWER LEGEND

- 23 — Proposed Phase number
- Proposed Foul Water Sewer
- Existing Foul Water Sewer (Subject to condition and capacity)
- Existing Foul Water Sewer to be diverted
- Proposed Rising Main
- Existing Rising Main
- Proposed Pumping Station
- Existing Pumping Station
- CL118.71 IL117.835 — Proposed Cover level and Invert level obtained from Woods Hardwick drawing
- CL117.90 — Cover level based on survey information

NOTES
1.- Confirmation of capacity at existing foul treatment plant required for parcels 11 to 23.
2.- Condition and route of existing sewers to be confirmed.
3.- Residential flows based on 4000l/s/dwelling as specified in SFA 7th Edition.
4.- Medical centre, retail space and changing facilities flows based on Plumbing Engineering Services Design Guide.

REV	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P03	RFS	04/03/20 20	SM	04/03/20 20	SM	04/03/20 20
P02	RFS	16:04:18	SM	16:04:18	SM	16:04:18
Updated Masterplan to layout Rev Y						
P01	RFS	02.10.17	SM	02.10.17	SM	02.10.17
First issue						

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CLIENT: DORCHESTER LIVING

PROJECT: HEYFORD PARK

TITLE: FOUL WATER DRAINAGE STRATEGY PLAN

HYDROCK PROJECT NO.: C-04583-C

SCALE @ A1: 1:5000

PURPOSE OF ISSUE: SUITABLE FOR INFORMATION

STATUS: S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): HPH-HYD-XX-XX-DR-C-2202

REVISION: P3