

PROJECT 5018551 OHH SID	DATE 27/02/2024	BY BT	REFERENCE 5018551-TN-003
TITLE Response to LLFA Comment & Southern Water	REVISION P01		

1. INTRODUCTION

Ridge & Partners prepared Flood Risk Assessment, Drainage Strategy and SuDS Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site-reserved matters planning application).

This document involves a review of the Lead Local Flood Authorities (LLFA) and Southern Water comments in regard to the following documents:

- One Horton Heath- Internal Distributor Road- 5018551-RDG-XX-XX-DOC-C-9930
- Spine Road Drainage Strategy- 5018551- RDG-XX-XX-DOC-C-9950
- Spine Road SuDS Strategy- 5018551- RDG-XX-XX-DOC-C-9951

2. RESPONSE TO QUERIES RAISED BY LLFA

1. The maintenance schedule in 7.3 of the Flood Risk Assessment will require more detail to be in line with the SuDS Manual however this is considered suitable to be conditioned.

- A. The flood risk assessment) and suds strategy report are updated in line with suds manual. The maintenance schedule within flood risk and suds strategy reflects the ownership and maintenance responsibility for each drainage component. The permeable paving details and hydrobrake details are added within the suds layout section of the suds strategy report.

2. In the SuDS Strategy, the water quality chapter identifies porous paving as part of the treatment system however this is not referenced in the maintenance strategy. The maintenance strategy refers to regular, occasional, and remedial maintenance but this needs to be expanded on for the different drainage features.

- A. Maintenance schedules for drainage features such as permeable paving, flow restriction devices & chamber are added within the section 3 of the suds strategy report.

3. The drawings do not show porous paving, and this does not appear to be included in calculations so please clarify the proposed treatment systems and road construction.

- A. The layout for the proposed adjacent development is not confirmed yet. However, SuDs feature such as permeable paving and geo-cellular attenuation crates will be included within the adjacent development design. They have been included in the treatment train to show the routes water that is reaching the ponds will be treated via. The road construction being put forward as part of this application will be traditional tarmac to adoptable standards drained with gullies.

- 4. Please can the online controls and storage features be included within the calculation pack. This should include the hydrobrake head stage relationship outputs.**
- A. The flow controls have been included within the calculations. However, additional details for hydrobrake such as data sheet is provided within the appendices H of the drainage strategy report.
- 5. The road drainage has been designed to accept flows from the adjacent future plots, but it is not fully clear how these flows will be provided or what restrictions there are on discharge rates. The calculations are working on the basis of 65% impermeable area although there is also reference to 50% in some areas. This has potential to change going forwards and the allowable discharge rate should be clearly set out on the drawings. We would also request a table within the drainage strategy document listing each plot, percentage impermeable area, allowable discharge rate and connection point.**
- A. A table is provided within section 3.8 of drainage strategy report which provides the breakdown of each catchment and its impermeable area along with its restricted flow rate.
- 6. With the connection points, some are shown to be to the chambers within the road with others having a spur that appears to go beneath buildings. If no spur is provided, then future developments would need to excavate the newly constructed road / drainage to fit a connection so spurs would be advisable. However, the extent of this spur should be located such that it does not go beneath buildings and allows for suitable connection in future. Please note, levels of the connection have not been reviewed but should be at sufficient depth to allow for gradient connection for the future drained area.**
- A. The layout of the proposed adjacent development is not confirmed yet. The design of the drainage is completed based on the layout provided by the Architect. Spurs will terminate in chamber have been added to the drawings to allow for future connections where the location of the junctions are confirmed.
- 7. Catchment E is identified to discharge into Road 3 network. Please include the extracts from the previous application to demonstrate that there is sufficient capacity provided in the previous application and evidence how flows will be restricted to be within the allowable discharge rate.**
- A. The rate of discharge from catchment E, part of road 3 and part of SID road to suds Feature E is 32.3l/s. The total contributing catchment area for catchment E and road within the area of catchment E are as follows:

CONTRIBUTING AREA	IMPERMEABLE AREA	% OF IMPERMEABLE AREA	DISCHARGE RATE
Residential area within Catchment E	1.42ha	65%	
Sid Road within Catchment E	1.72ha	100%	32.3 l/s
Total	4.28ha		
			32.3l/s

An extract from previously approved planning application is shown in figure 1 of this technical note. The overall discharge rate from part of road 3 network and SID road which lies within the area of proposed development catchment E remains unchanged.

Strategic SuDS Features Schedule							
Strategic SuDS Feature	Contributing Catchment (ha)	% of impermeability	Q ₁₀₀ for Catchment (l/s)	1 in 1 Year Storage Volume (m ³)	1 in 1 Year Resulting Discharge (l/s)	1 in 100+40%CC Storage Volume(m ³)	1 in 100+40%CC Resulting Discharge(l/s)
A	2.037	65	18.4	165	17.8	802	18.3
	0.260	100					
B	3.750	65	30.0	260	28.1	1224	29.9
C	6.808	65	54.5	405	50.1	2172	54.4
D	3.381	65	27.1	244	23.7	1112	27
E	3.650	65	32.3	337	24.8	1706	32.3
	0.382	100					
F	3.360	65	26.9	241	23.9	1103	26.9
G	2.762	65	41.5	267	34.7	1450	40.3
	2.415	50					
H	1.603	30	70.8	683	44.1	2694	70.8
	0.409	100					
	6.831	65					
I	1.556	65	29.6	314	26.7	1339	28.7
J	2.139	65					
K	1.696	65	13.6	127	11.0	560	13.5
L	3.894	65	39.6	433	32.5	1860	39.5
	1.046	100					
M	2.213	65	17.7	156	16.2	728	17.7
N	5.759	65	46.1	477	31.1	1924	46.0
EM(Employment)	2.029	85	16.3	150	15.5	878	16.3

Figure 1: Extract from preliminary Management Plan strategy -G277/21

8. Exceedance flow plans are required for the pre and post development situation to demonstrate how overland flow routes will be maintained and managed and also to ensure flows are appropriately directed around the site in the event of drainage failure or extreme storm events.

A. An exceedance flow drawing for pre/post development is added within the appendix G of the drainage strategy report.

9. It is noted in the Flood Risk Assessment that there are areas of flood risk associated with the watercourses. Culverting is proposed whether roads cross these watercourses and further information is required to identify the extent of the flow routes in comparison to the proposals and impact of these crossing points on the existing flow routes. While culverting is acceptable at these locations to facilitate the road, additional information is required to justify the size of pipe and to provide replacement storage areas if surface water flood risk areas are being lost.

A. A detailed calculations and report which shows the surface water flow analysis is provided within Appendix D of this technote.

3. RESPONSE TO QUERIES RAISED BY SOUTHERN WATER

10. Specify the responsibilities of each party for the implementation of the SuDS scheme.

A. The maintenance plan is updated within flood risk assessment and suds strategy report and reflects Suds feature responsibilities for each party.

11. Provide a management and maintenance plan for the lifetime of the development.

A. The management and maintenance plan are provided within section 3 of suds strategy report.

12. Specify a timetable for implementation.

A. The current planning programme refers site works to start in June 2025. The duration of the site work is 52 weeks. The construction of SuDS feature will start from August 2025.

APPENDIX A

FLOOD RISK ASSESSMENT REPORT



RIDGE

**FLOOD RISK ASSESSMENT
ONE HORTON HEATH**

EASTLEIGH BOROUGH COUNCIL
February 2024

FLOOD RISK ASSESSMENT ONE HORTON HEATH

February 2024

Prepared for

Eastleigh Borough Council

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VERSION CONTROL

PROJECT NAME:

One Horton Heath – Eastleigh Borough Council – FRA - INTERNAL DISTRIBUTOR ROADS

PROJECT NUMBER:

5018551

DOCUMENT REFERENCE:

5018551 - RDG-XX-XX-DOC-C-9930

DOCUMENT STATUS:

S2 – Suitable for Information

REV	DATE	DESCRIPTION	AUTHOR	CSE	ICSE
-	16.06.2023		Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES	Paul Battersby B.Eng.	Tom Clark MEng GMICE
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2	31.07.23	Revised	Gary Beamish Eng.C, C.Eng, C.Env, CWEM, MICE, MCIWEM, FQSI, FCInstCES	Chris Levitt BEng (Hons) EngTech MICE	Tom Clark MEng GMICE
3	01.12.23	Updated to client’s comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE
4	22.02.24	Updated to LLFA’s comment	Binam Tiwari MSc GMICE	Tom Clark GMICE MEng	Chris Levitt BEng (Hons) EngTech MICE

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SECTION 01

INTRODUCTION

1. INTRODUCTION

1.1. Appointment and Brief

Ridge & Partners prepared this Flood Risk Assessment on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site- reserved matters planning application).

This assessment has been prepared for the benefit of the Hampshire County Council Lead Local Flood Authority and seeks to demonstrate that the proposed Internal Distributor Road is not at risk of flooding.

The purpose of this document is:

- To determine and outline potential sources of flooding along the Internal Distributor Road route, and;
- Establish how flood risk will be managed throughout the lifetime of the proposed Internal Distributor Road, taking into account the potential for climate change.
- Discuss the proposed outline surface water strategy for incorporation with the Internal Distributor Roads at the application site including SuDS for surface water quantity, surface water quality, amenity and biodiversity.

1.2. Aims and Objectives

It is intended to follow the procedures and guidance outlined within NPPF (2021), BS 8533 (2017), BS 8582 (2013), CIRIA C624 (2004) and SuDS Manual (C753) (2015) in the preparation of this document.

The governments flood mapping service shows that the site is largely within flood zone 1. It is therefore recommended that the proposal is split into steps. Step 1 and 2, outlined below, are required initially and will determine the risk of flooding. Subject to the findings, steps 3 and 4 may be required and even step 5 should the site be in the highest risk category.

Step 1 - Consultation with Lead Local Flood Authority (LLFA)

- Obtain and review the most up-to-date local flood risk information including the any previous Preliminary Flood Risk Assessments (PFRA), Strategic Flood Risk Assessments (SFRA) or Surface Water Management Plans (SWMP) undertaken for the area of interest;
- Review Environment Agency's online flood risk maps.
- Review Planning Policy applicable to the site.
- Liaise with Thames Water to obtain flooding history information etc.
- Consult with the Local Flood Authority.
- Advise you on our findings (email or tech note format).

Step 2 - Outline Flood Risk Assessment:

- Undertake a desktop assessment of pre- and post-development flood risk at the Site from all possible sources (fluvial, tidal, groundwater, sewers, overland and artificial sources);

- Outline the Sequential and Exception Test requirements.
- Advise on matters to be addressed with the Environment Agency.
- Produce an outline Flood Risk Assessment and circulate to the Client for comment.
- Incorporate comments from the Client and issue the final version.

If stages 1 and 2 determine that the site is either wholly or partly within an area of flood zone 2 or 3 then stages 3 and 4 are required.

Step 3 - Sequential Test:

- The process identifies the flood risks and development vulnerability in order to assess the suitability of each development location and where possible, steers more vulnerable developments to areas of lowest flood risk, matching vulnerability of land use to flood risk.

Step 4 - Exception Test:

- The Exception Test allows consideration of the wider sustainability benefits of a development to be considered to justify development in a higher risk flood zone.
- To ensure that the proposed development meets the requirements of the Exception test (NPPF):
 - It must be demonstrated that the development provides wider sustainability benefits for the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared.
 - The site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking into account the vulnerability of its users, without decreasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Should completed steps 1-4 still show that the development is at a high risk of flooding, hydraulic modelling would be required, as follows:

Step 5 - Hydraulic Modelling

- Obtain Environment Agency flood model for the development area.
- Review flood model variables to ensure data and variables are current.
- Update model to take account of findings of review and to include proposal.
- Validate model to assess updated risk of flood to the development area.
- All the above is to be undertaken in conjunction with Environment Agency to ensure their acceptance.

1.3. Limitations

The purpose of this report as outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

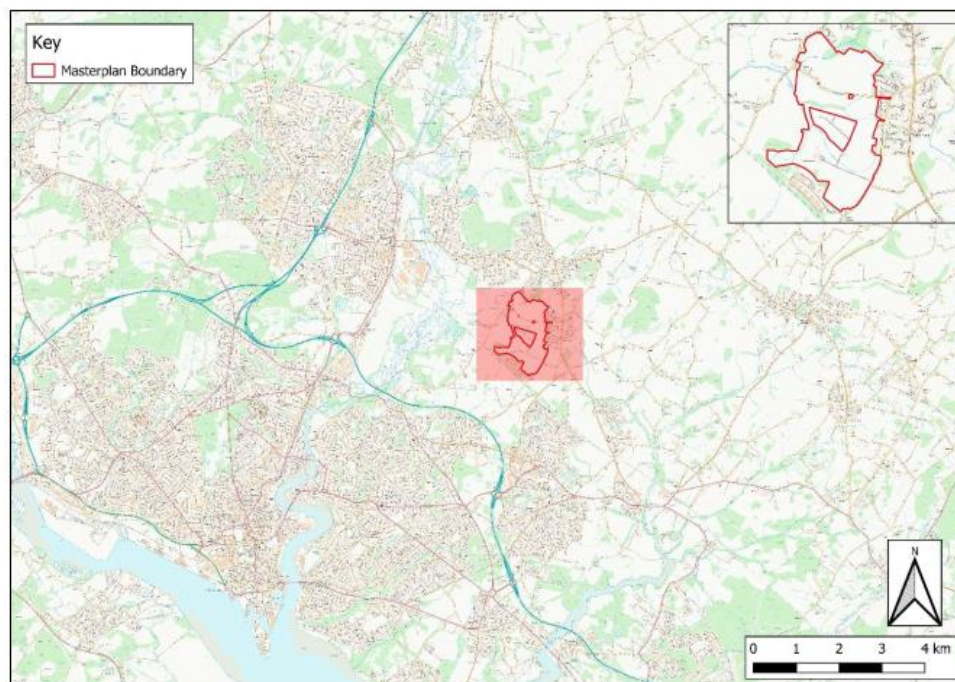
SECTION 02

PROJECT BACKGROUND

2. PROJECT BACKGROUND

2.1. Site Location and Existing Land Use

The site is located within the central two-thirds of One Horton Heath, Grid Reference SU 48931 17787, X (Easting) 448855 and Y (Northing) 117787. Latitude and Longitude (decimal), 50.949902, -1.3059010, Latitude and Longitude (degs, mins, secs), 50°57'00"N, 001°18'21"W. Postcode (nearest) is SO50 7BZ. The site is currently in agricultural use, mainly arable with some grassland. The overall road lengths for this assessment are captured within the central two-thirds of the One Horton Heath, red outline, as shown below:

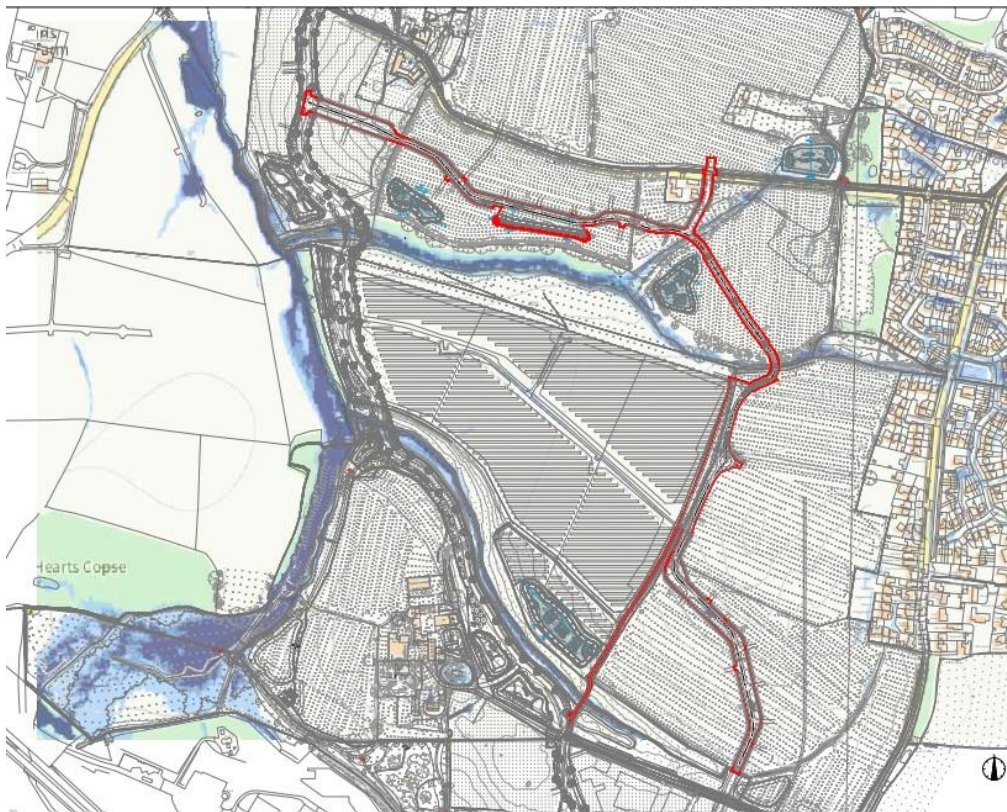


Site Location Area Plan (Google Earth Maps)



Area Of Flood Risk Assessment and Site Extents Area Plan (Google Earth Maps)

The Internal Distributor Road route focused upon by this Flood Risk Assessment is indicated below overlaid upon the Environment Agency (EA) surface water flood map:



EA Surface Water Flood Map With Internal Distributor Road Route Indicated In Red

2.2. Geology

The British Geological information is indicated below:

Bedrock geology: Wittering Formation - Bracklesham Group (BRB) are secondary or minor aquifers capable of supporting water supplies at a local rather than strategic level - Sand, silt and clay. Sedimentary bedrock formed between 56 and 41.2 million years ago during the Palaeogene period. Greyish brown laminated clay; wavy-to lenticular-bedded sand interbedded with clay in equal proportions; and fine-to medium-grained sparsely glauconitic sand. Bedrock Tertiary clays and sands which overlay Cretaceous Chalk at depth.

Definition of Lower Boundary: Rests on London Clay, a dark grey bioturbated clay below with marked lithological change to interbedded glauconitic fine-grained sand and very silty clay above.

Definition of Upper Boundary: Overlain by Earnley Sand Formation, well-marked by the transgressive basal surface of glauconitic silty sands with pebbles. Thickness: 40-53m.

Superficial deposits: Alluvium - Clay, silt, sand and gravel. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period. Alluvium is a general term for clay, silt, sand and gravel. It is the unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope. Synonym: alluvial deposits. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present. A number of drainage features and watercourses are present within the site. The watercourses within the site are tributaries of the River Itchen which is located approximately 1.5km to

the west of the site's boundary. The watercourse on the western boundary is classified as a 'Main River' and flows from south to north under Allington Lane and into the River Itchen to the south of Chickenhall Lane Wastewater Treatment Works (WwTW). All other onsite watercourses discharge into this unnamed 'Main River'. A number of ponds are also present within the site and in its immediate vicinity.

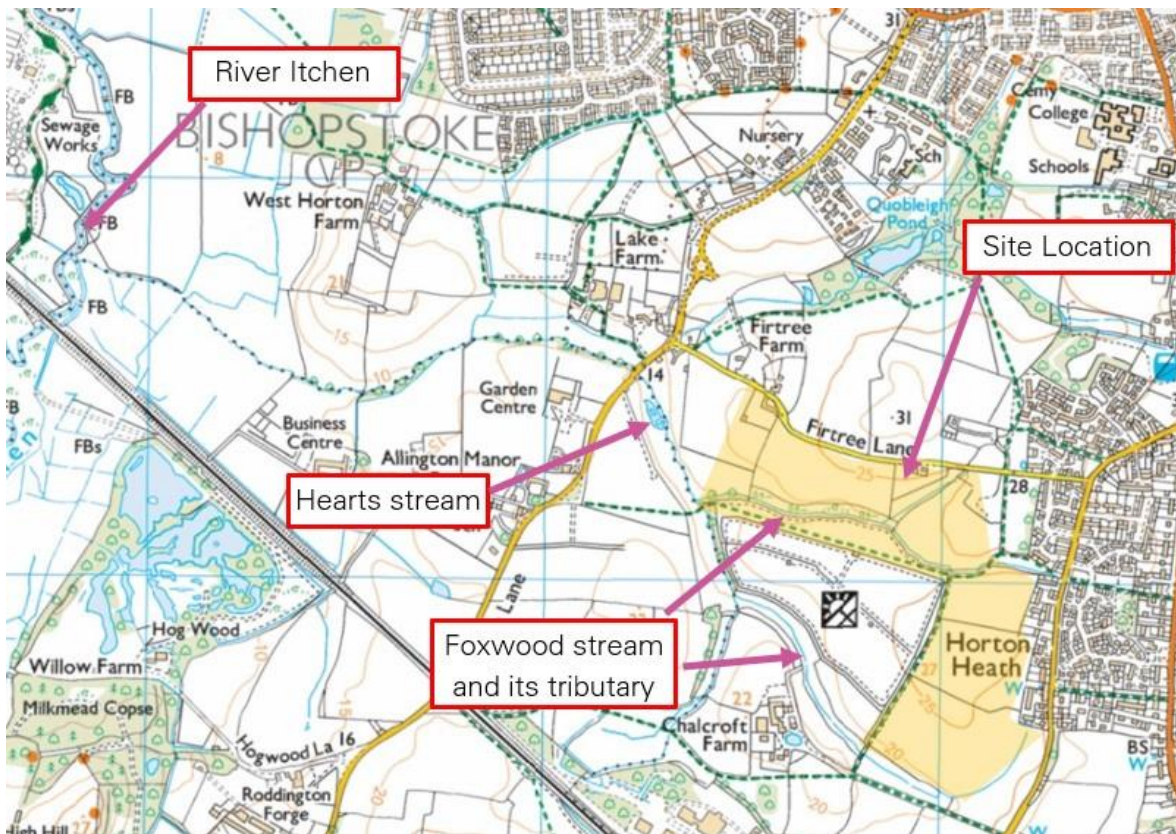


British Geological information map

The above British Geological information map indicates the Aquifer Classification is Secondary A. From an inspection of the Environment Agency's Source Protection Zones dataset the site does not fall into a Groundwater Source Protection Zone. With reference to the 'Environment Agency's approach to groundwater protection', the discharge of clean roof water to ground is acceptable both inside and outside SPZ1('inner zone') provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. If infiltration SuDS are to be used on any part of the site for surface run-off from roads, car parking and public or amenity areas, they would be suitably designed to ensure that the system does not pose an unacceptable risk to the source of supply.

In addition to the above information, Ridge has provided a report based on a visual site inspection and study of readily accessible referenced historical records, information supplied by those parties noted in the report and preliminary discussions with local and Statutory Authorities; reference Ridge *Geotechnical Investigation Report* (Ref: 5019962-RDG-XX-ST-DOC-C-00GIR01) dated 3 February 2023.

As part of the Geotechnical Investigation eleven boreholes were installed with 50mm diameter standpipes to circa 2.50mbgl to allow monitoring of groundwater levels across the site between 3 November 2022 and 30 March 2023. Following the completion of winter groundwater monitoring at land near Horton Heath, Hampshire, broadly centred on 448877 E 117310 N, the report provided commentary on groundwater gauging rounds conducted although it was unclear whether groundwater levels have peaked across the site, and therefore it recommends additional rounds to capture peak levels, and subsequent fall in groundwater level. Reference *One Horton Heath – Winter Groundwater Monitoring*, Letter Reference: 5019962-WGM/MS/T-815 dated 3 April 2023.



Location of River Itchen from the proposed site

The majority of the site geology is falling into HOST Class 25, which is defined as “Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity”.

On the basis of the available modelled flood levels provided by the Environment Agency, the areas of the site where built-development and the Internal Distributor Road are proposed are unaffected by the floodplain associated with the watercourses except for the watercourse crossing points where culverts have been designed to ensure the watercourse flows are maintained with no flooding of the roads.

2.3. Proposed Development

The proposed development is a part of One Horton Heath Site Wide Infrastructure Delivery which includes the construction of the Internal Distributor Road, residential homes, local centres and primary schools. However, this report primarily focuses on the Internal Distributor Road which runs between the Fir Tree Lane and the Foxwood stream connecting west to east and crosses the Foxwood Stream and runs adjacent to the solar farm before connecting to the north of the proposed lower acre site.

SECTION 03

FLOOD RISK STATEMENT

3. FLOOD RISK STATEMENT

3.1. Sources of Information

Information relating to the flood risk at the site at the time of writing has been obtained from, but not limited to:

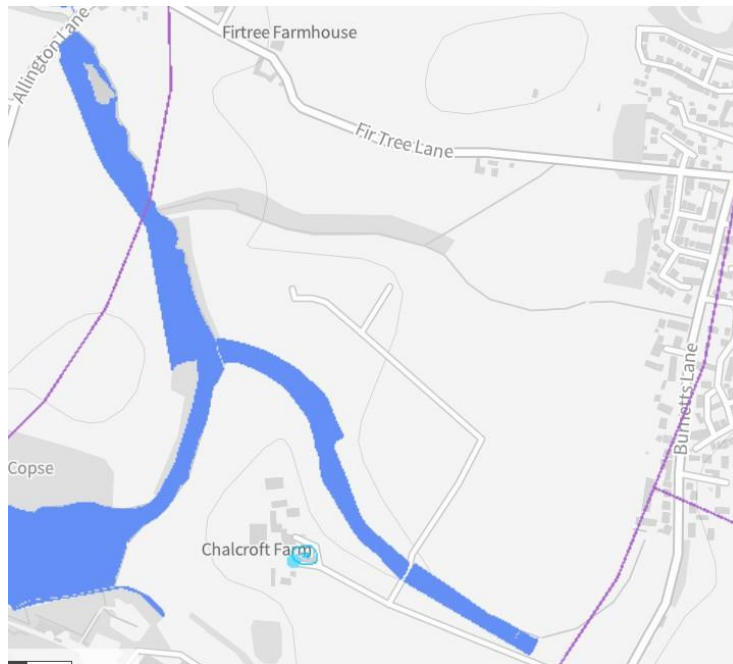
- The Environment Agency (EA) website;
- Water Environment (Water Framework Directive (WFD) England and Wales) Regulations 2017
- Flood and Water Management Act 2010
- Flood Risk Regulations 2009
- Flood Risk Assessments: Climate Change Allowances (2021)
- Eastleigh Borough Local Plan (2016-2036) April 2022
- Hampshire County Council Surface Water Management Plan – Eastleigh
- Eastleigh Flood Risk Assessment Guidance Document 2016
- CIRIA C753 SuDS Manual November 2015
- Internet research.

3.2. Hydrology / Hydrological Features

Hydrology is the study of the distribution and movement of water both on and below the Earth's surface, as well as the impact of human activity on water availability and conditions.

Hydrogeology is the study of groundwater – it is sometimes referred to as geohydrology or groundwater hydrology. Hydrogeology deals with how water gets into the ground (recharge), how it flows in the subsurface (through aquifers) and how groundwater interacts with the surrounding soil and rock (the geology).

The vadose zone is the variably saturated zone between the ground surface and the permanent water table of the groundwater. It is an important part of the water cycle and stores at least 8.5 times more water than is held by rivers. The vadose zone is the Earth's terrestrial subsurface that extends from the surface to the regional groundwater table. The vadose zone may be very shallow (less than 1 m) or very deep (extending hundreds of meters or more), depending on the depth to the water table. This zone is one of the underground soil strata that are of considerable interest in terms of pollution and becomes the focus for SuDS via infiltrating surface water and rainwater below ground to alleviate surface flooding.



Defra Magic Portal and the BGS GeoIndex

The above base map by Defra Magic Portal and the BGS GeoIndex (<https://www.bgs.ac.uk/datasets/aquifer-designation-data/>), states the aquifer designation dataset has been created by the Environment Agency (EA), Natural Resources Wales (NRW) and the BGS, and identifies the different aquifers of England and Wales. Groundwater protection policy in England and Wales uses aquifer designations that are consistent with the Water Framework Directive. The above blue shading (watercourses) relates to *“Priority Habitat Inventory - Coastal and Floodplain Grazing Marsh (England)”*. *Groundwater Vulnerability Map (England) – Medium*.

The map indicates the following:

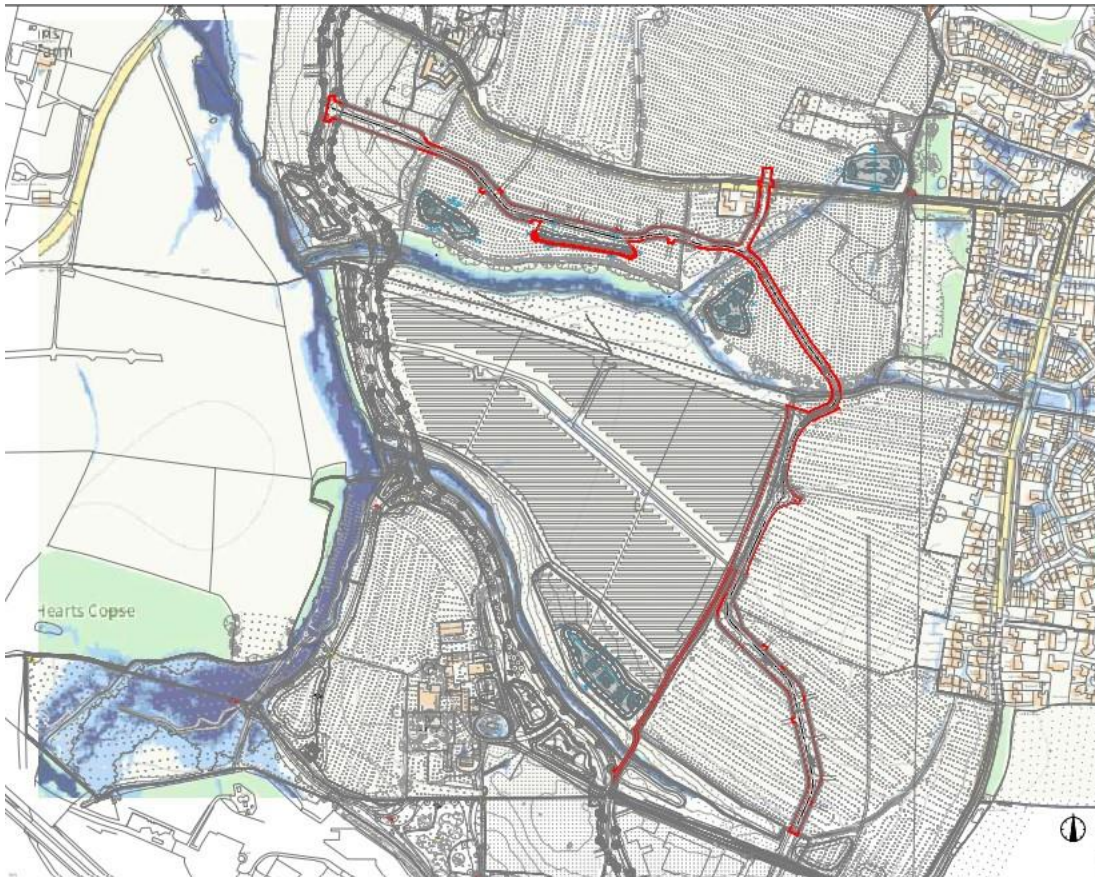
The borough of Eastleigh is dominated by two main river catchments; the River Itchen catchment covers the majority of the borough with the River Hamble catchment to the East.

- Geology and Soils: Groundwater Vulnerability Classification is Medium
- [Blue areas] Grassland: Priority Habitat Inventory - Coastal and Floodplain Grazing Marsh (England)
- [Green areas] Woodland: Ancient and Semi-Natural Woodland
- [Green areas] Woodland: Priority Habitat Inventory - Deciduous Woodland (England)

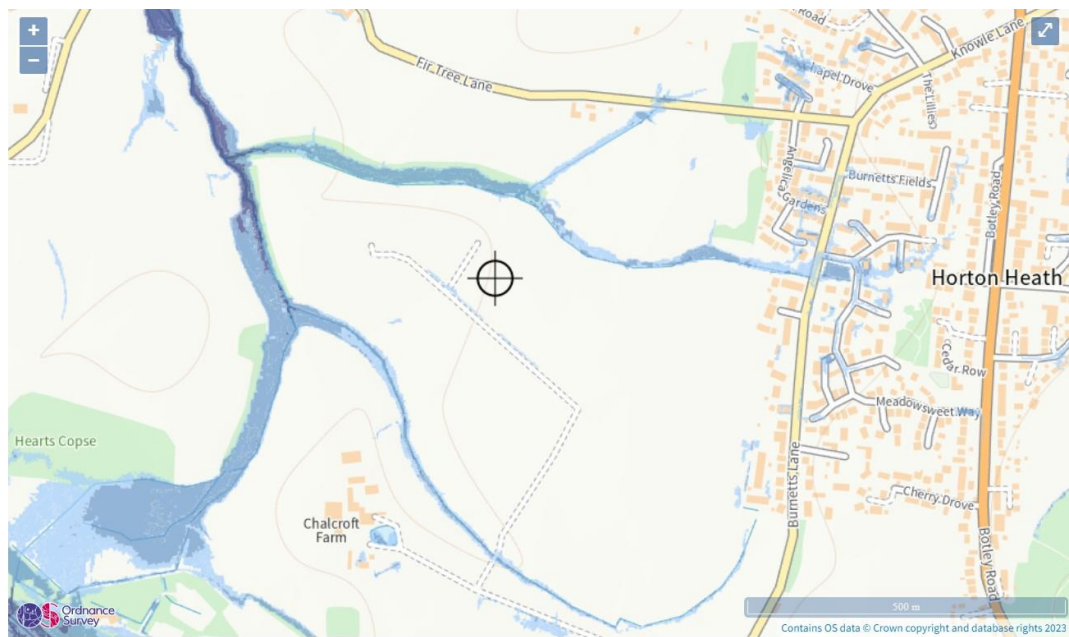
3.3. Historic Flooding

According to the Strategic Flood Risk Assessment produced by the Eastern Solent Coastal Partnership for the Partnership for Urban South Hampshire, and the Environment Agency Flood Maps for Planning, the site has a natural main river running through its western flank. The watercourse has tributaries running into it from the east and lower also from the east. Apart from the watercourse causing local bank-full and local overland flooding the remaining site area is in Flood Zone 1. However, apart from the watercourses there is no recorded flooding from any other sources, neither historical flooding nor specific event records, apart from the main river (outside the roads boundaries) and the watercourses.

The Environment Agency flood zoning map does shows surface water flooding from watercourse tributaries.



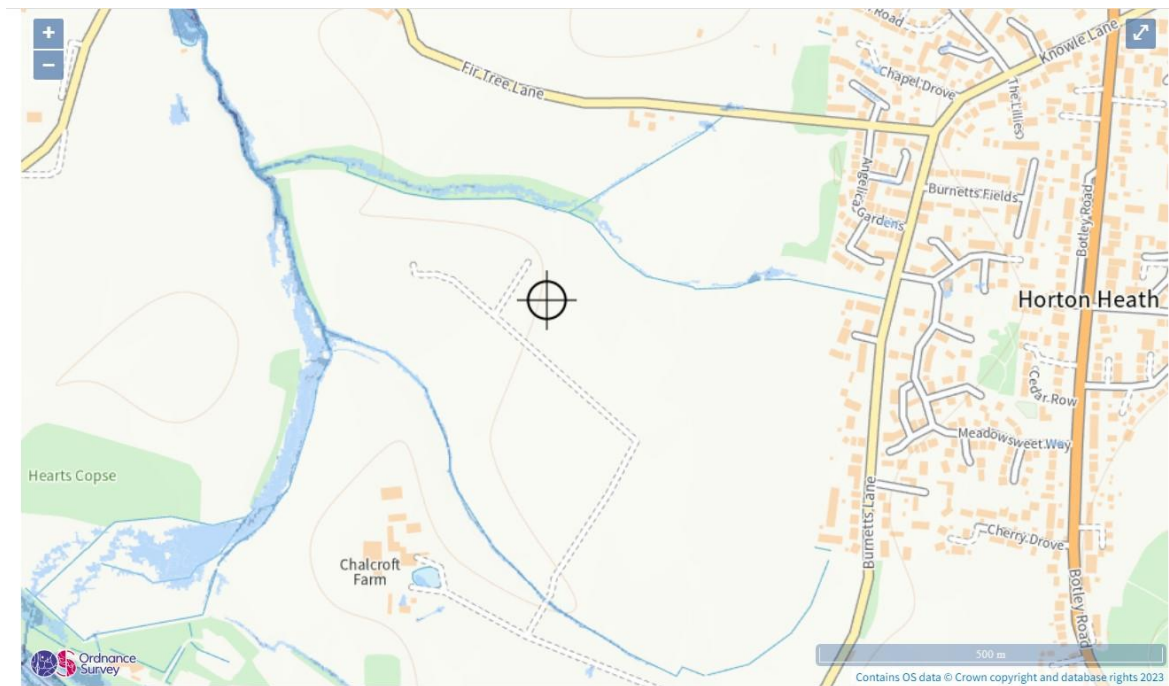
Environment Agency Extent of Flooding from surface water with proximity of the new roads in red



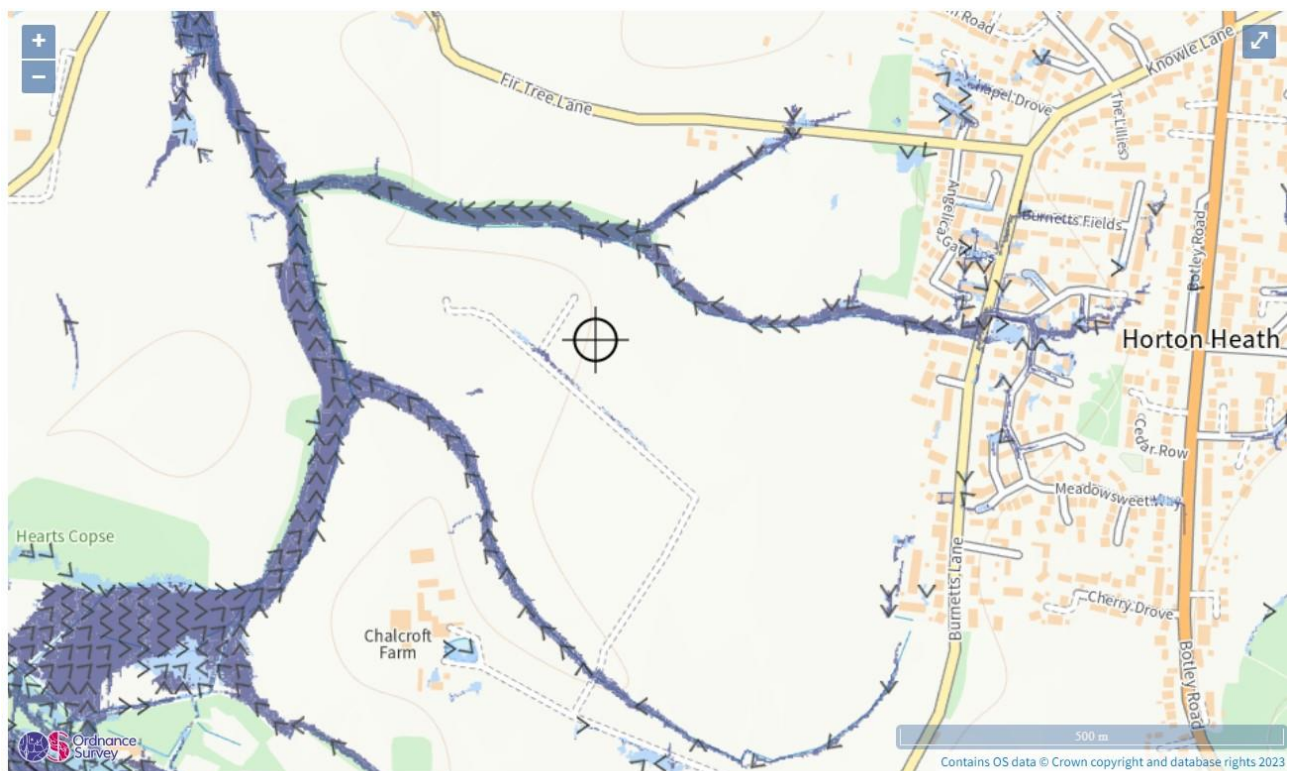
Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

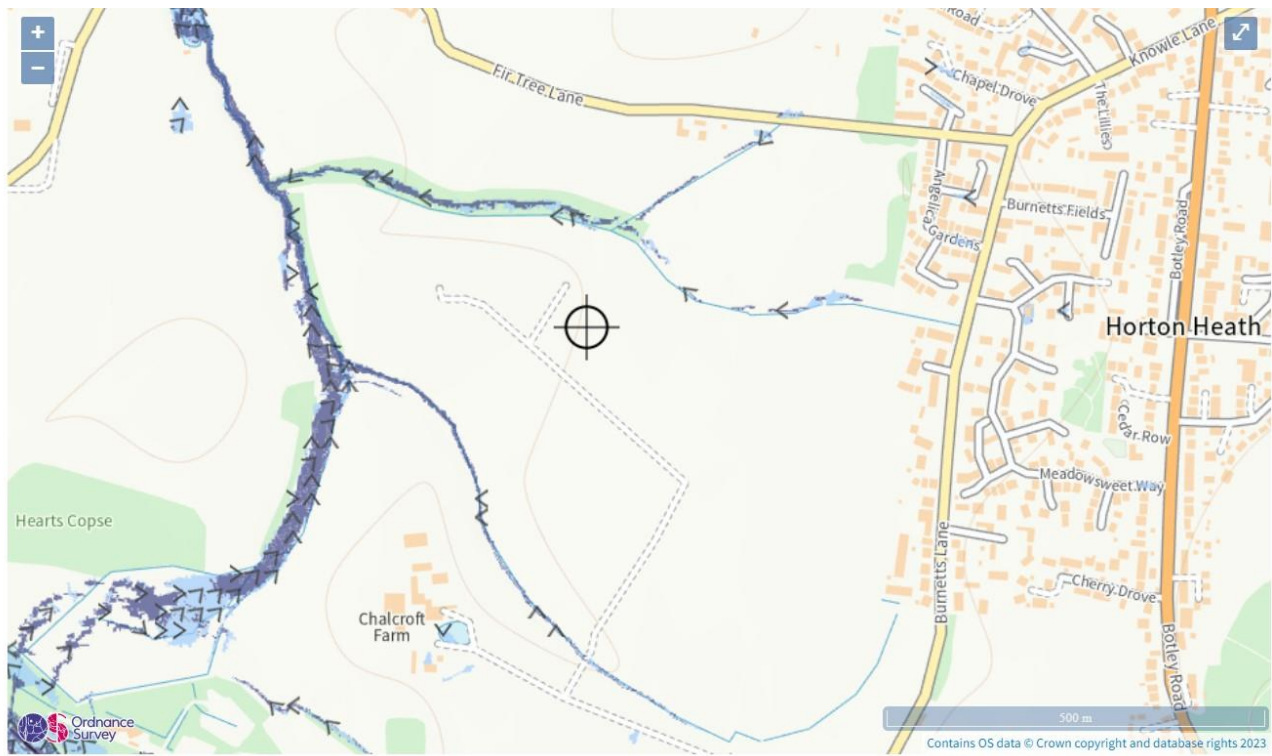
Environment Agency Surface Water Depth Low Risk Scenario



Environment Agency Surface Water Depth High Risk Scenario



Environment Agency Surface Water Velocity Low Risk Scenario



Surface water flood risk: water velocity in a high risk scenario
Flood velocity (metres/second)

Over 0.25 m/s Less than 0.25 m/s Direction of water flow Location you selected

Environment Agency Surface Water Velocity High Risk Scenario

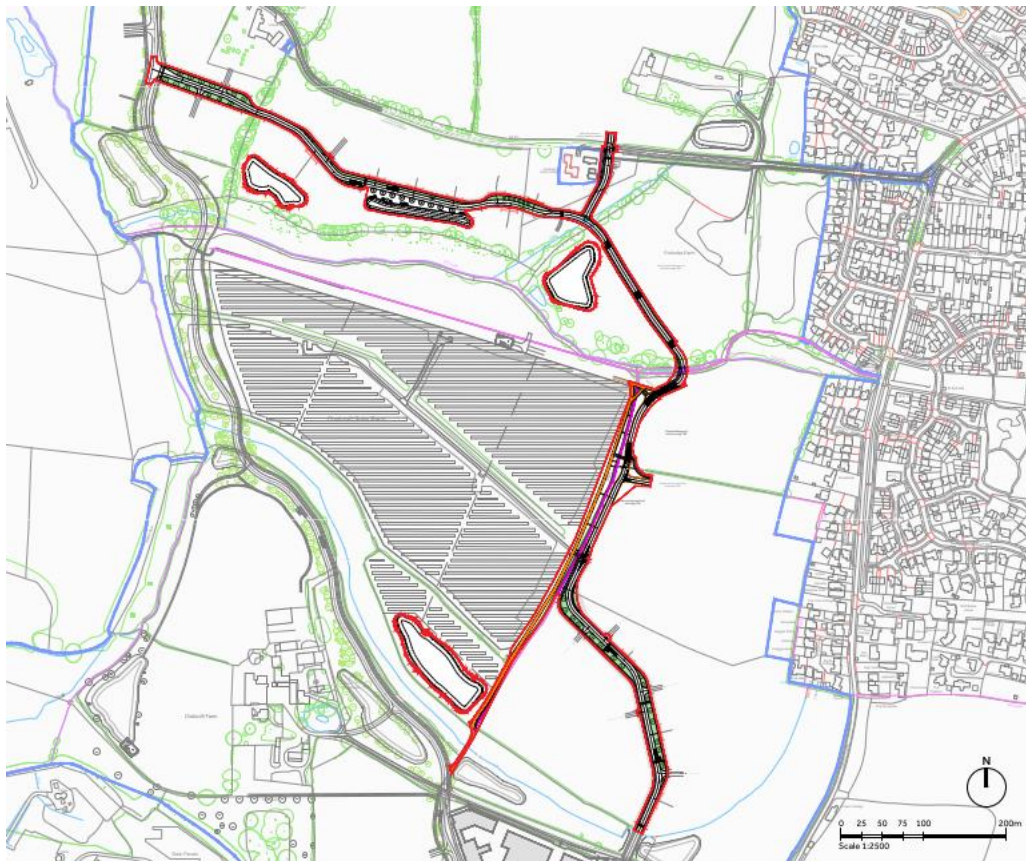
The definition of EA flood zones is provided within the National Planning Policy Framework (NPPF) and its associated Planning Practice Guidance (PPG) Table 1 (Flood Zones) and summarised below:

- **Flood Zone 1 (Low Probability)**
Land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1 % (1:1000 year) annual probability of occurrence and therefore considered to be at 'low probability' of flooding.
- **Flood Zone 2 (Medium Probability)**
Land which could be at risk of flooding with an annual probability of occurrence between 1% (1:100 year) and 0.1% (1:1000 year) from fluvial sources and between 0.5% (1:200 year) and 0.1% (1:1000 year) from tidal sources and therefore considered to be at 'medium probability' of flooding.
- **Flood Zone 3A (High Probability)**
Land which could be at risk of flooding with an annual probability of occurrence greater than 1% (1:100 year) from fluvial sources and greater than 0.5% (1:200 year) from tidal sources and therefore considered to be at 'high probability' of flooding.
- **Flood Zone 3B (Functional Floodplain)**
Land where water has to flow or be stored in times of flood. Local Planning Authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain in agreement with the Environment Agency. However, in general it is defined as land that would flood with an annual probability of 5 % (1:20 year) or greater.

Footnote 50 in the NPPF states that a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having

critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use. Furthermore, in assessing the flood zoning, the protection afforded by any flood defence structures or strategic flood management measures is not taken into account by the EA.

Paragraph 30 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.



Internal Distributor Road routes and watercourses crossings

With the foregoing in consideration, the northern section of the Internal Distributor Road runs parallel with the surface water flooding from the watercourse, before crossing the watercourse twice at its eastern extent and then running south to a further crossing point. The remaining site areas and Internal Distributor Road route are not shown to be at risk of flooding, as indicated by EA flood maps.

The majority of the developable site, and all proposed built development including the Internal Distributor Road, is to be located in Flood Zone 1 with the exception of the watercourse crossings that are design not to flood and not to exacerbate flooding elsewhere.

Failure (Breaching) of Flood Defences and Management Measures

Based upon EA mapping, the site does not benefit from, nor rely upon, the presence of formal raised flood defences and therefore corresponding flood risk to the site due to defence failure (breach) is negligible. With the foregoing in consideration, the site is deemed to be at **low risk of flooding due to failure of flood defences and management measures.**

Reservoirs

Based upon EA mapping, the site does not lie within an area denoted as being at risk of flooding in the event of a significant breach (failure) of raised reservoir embankments. With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Reservoirs**.

Canals and Artificial Water Bodies

There are no canals and other artificial water body in the site area apart from natural watercourses running across the site area and therefore this source poses no flood risk to the wider development area unaffected by flooding. With the foregoing in consideration, the site is deemed to be at **low risk of flooding from Canals and Artificial Water Bodies**.

Groundwater Flooding

Groundwater flooding is defined as flooding caused by the emergence of water originating from subsurface strata, with the most common forms being:

- A rise in groundwater from unconfined permeable soils (such as chalk), or shallow perched water tables after periods of heavy rainfall; or
-
- A rise in groundwater in unconsolidated permeable superficial deposits, which are in hydraulic continuity with local river levels and where the hydraulic gradient of the water table is low.

Based on the SFRA, the entire site is deemed to be at low risk of groundwater flooding except for the natural watercourses running along the western-south area, southern leg and north eastern area. It is considered that groundwater could be shallow on the site and shallowest in proximity to the onsite watercourses. With the foregoing in consideration, the site with the exception of the overland western-south area, southern leg and north eastern area watercourses flooding locally, the remaining site area is deemed to be at **low risk of groundwater flooding**, unless further intrusive site investigation identifies evidence to the contrary, such as perched water or similar.

Sewers and Artificial Drainage Systems

No public sewers are identified on the site and there are no known instances of flooding from overwhelmed sewers affecting the site. The risk of flooding from overwhelmed sewers is therefore assessed as Low. The SFRA does not find or mention any flooding in the area surrounding the application site. With the foregoing in consideration, the site is deemed to be at **low risk of sewers flooding**.

Failure of Utilities Infrastructure

It should be noted that burst water mains and failure of sewerage infrastructure could inherently pose a residual risk to any site. Assuming an adequate provision of buffer zones to allow overland flow paths along proposed infrastructure routes to be safeguarded, and accommodation of any sewer and utility easements within the future development layout, then utility and sewerage infrastructure are not deemed to pose a significant flood risk to the site. With the foregoing in consideration, the site is deemed to be at **low risk of flooding due to failure of utilities infrastructure**.

Tidal Flooding

Due to its inland location, the risk of tidal flooding to the site is considered negligible. With the foregoing in consideration, the site is deemed to be at **low risk of tidal flooding**.

Surface Water Flooding

The SFRA does not find or mention any surface water flooding at the application site with the exception of the watercourses flooding locally. With the foregoing in consideration, the remaining areas of the site are deemed to be at **low risk of surface water flooding**.

Overland Flow

Based upon the topography of the site and surrounding area, there is limited potential for surface water from **off-site** areas to progress overland toward the road or built development proposals, which is reinforced by interrogation of EA mapping. With the foregoing in consideration, the site, with the exception of the watercourses flooding locally, the remaining area of the site is deemed to be at **low risk of flooding** due to overland surface water flows.

Summary

FLOODING SOURCE	RISK
Fluvial Flooding (excluding existing natural watercourse)	Low
Failure (Breaching) of Flood Defences and Management Measures	Low
Reservoirs	Low
Canals and Artificial Water Bodies	Low
Groundwater Flooding	Low
Sewers and Artificial Drainage Systems	Low
Failure of Utility Infrastructure	Low
Tidal Flooding	Low
Surface Water Flooding (except for watercourse)	Low
Overland Flow from off-site areas (except for watercourse)	Low

Eastleigh Borough Council has a number of permissive powers under the Land Drainage Act 1991 for the prevention and mitigation of flood damage from ordinary watercourses and also responsibility for managing flood risk encompassed in planning legislation. Eastleigh falls within the Environment Agency's South East region. The Environment Agency has a supervisory role over all aspects relating to flood defence with a more specific role to the maintenance of main rivers. The borough is served by Southern Water supplying foul and surface water sewerage systems. Southern Water is also responsible for the maintenance of these networks.

SECTION 04

CLIMATE CHANGE

4. CLIMATE CHANGE

4.1. Anticipated Development Lifecycle

The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development. In accordance with the PPG, NPPF and best practice, a 100-year development lifecycle has been assumed for the proposed development of the site for predominantly residential end-use.

4.2. Climate Change Allowances

EA guidance “*Flood Risk Assessments: Climate Change Allowances*” (2022) outlines the required climate change allowances to be adopted when interrogating existing flood data and for use in the design of future surface water drainage systems.

Table 1 of ‘Flood risk assessments: climate change allowances’ gives the peak river flow allowances by river basin district for 3 categories: central, higher central and upper end, and 3-time frames. The appropriate allowance to use depends on the flood zone and the flood risk vulnerability classification of the development.

With reference to Table 1 of ‘Flood risk assessments: climate change allowances’ the appropriate allowances to use for the South East **river** basin district are the higher central and upper end allowances. The total potential change anticipated for 2070 to 2115 is given as 45% for the higher central category and 105% for the upper end category.

Table 2 of the same document also outlines that an extra 40% climate change allowance should be adopted for all peak **rainfall** intensities for the purposes of new surface water drainage design. This again assumes the ‘upper end’ value and a 100-year development lifecycle.

Department for Environment Food & Rural Affairs data services platform for the River Test and Itchen Management Catchment peak rainfall allowances, 3.3% annual exceedance rainfall event provides Central allowance 2050s epoch of 20% and 2070s epoch of 25%, Upper end allowances are given as 35% and 40% respectively. It also provides for a 1% annual exceedance rainfall event at the Central allowance for 2050s epoch of 20% and 2070s epoch of 25%, Upper end allowances are given as 40% and 45% respectively.

In addition, a building development creep allowance of 10% should be adopted in the calculations for new surface water drainage design within new housing conurbations.

4.3. Impacts on Flood Risk

Therefore, in terms of providing an acceptable standard of protection against flooding for new Internal Distributor Road and associated development, no flooding of the road or property should occur as a result of the ‘design flood’ corresponding to a 1 in 100-year fluvial flood event, or a 1 in 200-year tidal flood event, taking account of climate change and development creep. However, as this report primarily focuses on the construction of the road it is anticipated that this construction would not be considered appropriate to include 10% allowance for creep within separate modelling calculations.

SFRA and EA mapping confirms, apart from the existing natural watercourses, the site remains unaffected by fluvial or surface water flooding up to and including the 1% (1:100 year) AEP event, including an allowance for climate change and creep. Detailed EA mapping has also been interrogated with regard to the area of the site subject to Flood Zone 1 conditions, considering an appropriate climate change allowance.

The impact of climate change over the lifetime of the development must be taken into account within the assessment of post-development surface water runoff and subsequent design of surface water drainage systems for the proposed site.

4.4. Impacts on Proposed Surface Water Drainage Design

The impact of climate change over the lifetime of the development must be taken into account within the assessment of post-development surface water runoff and subsequent design of surface water drainage systems for the proposed site. SUDS systems will necessarily respect the Simple Index Approach for ensuring water quality is not impacted.

4.5. SuDS Management Train & Proposed SuDS Features

In accordance with the discharge hierarchy, the proposed development will discharge surface water to an existing ditch, Foxwood Stream and its tributary. The surface water discharged from the Internal Distributor Road and the nearby catchments will flow towards the SUDS feature which will be located within each catchment area.

SECTION 05

POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5. POLICY CONSTRAINTS AND IMPLICATIONS TO THE DEVELOPMENT

5.1. Sequential Test

The Sequential Test as outlined within the NPPF gives preference to locating new development in areas at lowest risk of flooding (i.e. Flood Zone 1) and requires developers to:

"... demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed"

Paragraph 157 of the NPPF states:

'All plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property.'

Paragraph 158 of the NPPF goes on to state:

'The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'

Paragraph 160 of the NPPF states:

'The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

- a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
- b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'

Paragraph 161 of the NPPF goes on to state:

'Both elements of the exception test should be satisfied for development to be allocated or permitted.'

Whilst it is ultimately the responsibility of the Local Planning Authority to undertake this test, the principle of siting residential development on this site has already been firmly established.

Similarly, redevelopment of a site which is wholly situated within Flood Zone 1 and where all future proposed built development can be sited within Flood Zone 1, will easily satisfy the requirements of the Sequential Test as no reasonably available alternative sites, at a lower risk of flooding, are expected to be identified.

With the foregoing in consideration, it is **likely** that the requirements of the sequential test would be satisfied.

5.2. Flood Risk Vulnerability

PPG Table 2: Flood Risk Vulnerability Classification (summarised below), identifies that transport infrastructure (including mass evacuation routes) which has to cross the area at risk are considered as a '**Essential Infrastructure**' use.

CLASSIFICATION	EXAMPLES OF USE
Essential Infrastructure	▪ Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. ▪ Essential utility infrastructure which has to be located within a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operation in times of flood. ▪ Wind turbines.
Highly Vulnerable	▪ Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. ▪ Emergency dispersal points. ▪ Basement dwellings. ▪ Caravans, mobile homes and park homes intended for permanent residential use. ▪ Installations requiring hazardous substances consent.
More Vulnerable	▪ Hospitals. ▪ Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. ▪ Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. ▪ Non-residential uses for health services, nurseries and educational establishments. ▪ Landfill and sites used for waste management facilities for hazardous waste. ▪ Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	▪ Police, ambulance and fire stations which are not required to be operational during flooding. ▪ Buildings used for shops, financial, professional and other services, restaurants, cafes and hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in the 'more vulnerable' class and assembly and leisure. ▪ Land and buildings used for agriculture and forestry. ▪ Waste treatment (excl. landfill and hazardous waste facilities). ▪ Minerals working and processing (except for sand and gravel working). ▪ Water treatment works which do not need to remain operation during times of flood. ▪ Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	▪ Flood control infrastructure. ▪ Water transmission infrastructure and pumping stations. ▪ Sewage transmission infrastructure and pumping stations. ▪ Sand and gravel working. ▪ Docks, marinas and wharves.

- Navigation facilities.
- Ministry of Defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

5.3. Flood Zone Compatibility

PPG Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (summarised below), confirms that the site is appropriate for 'Essential Infrastructure' and 'More Vulnerable' uses in Flood Zone 1 and Flood Zone 2 without the need for application of the Exception Test. In Flood Zone 3a the more vulnerable, which includes dwelling houses, and essential infrastructure, uses should only be permitted in this zone if the Exception Test is passed. In Flood Zone 3b new residential development should not be permitted but essential infrastructure is appropriate in this zone if the Exception Test is passed.

FLOOD ZONE	ESSENTIAL INFRASTRUCTURE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE	WATER COMPATIBLE
Zone 1	Permitted	Permitted	Permitted	Permitted	Permitted
Zone 2	Permitted	Exception Test Required	Permitted	Permitted	Permitted
Zone 3A	Exception Test Required	Not Permitted	Exception Test Required	Permitted	Permitted
Zone 3B	Exception Test Required	Not Permitted	Not Permitted	Not Permitted	Permitted

5.4. Functional Floodplain

The existing natural watercourses impose flood zones 2 and 3 to the immediate areas to the sides of the watercourse runs. However, the majority of the site and locations of the proposed Internal Distributor Road is not located within an area designated as functional floodplain Zone 2, 3A, 3B and therefore no constraints apply to the proposed development other than at watercourse crossing points where the design will cater for the flood risk and the watercourse.

5.5. Off-site Impact

If the site is redeveloped, roads or residential, there is the potential to exacerbate flood risk elsewhere (off-site).

This said, adequate site area is available within the application boundary to mitigate any loss of flood conveyance capacity that may result from the proposed development. SUDS and pond features are being designed to ensure adequate provisions.

Furthermore, provided that surface water run-off generated from the proposed development and Internal Distributor Road will be managed on-site in a sustainable manner, then no detrimental off-site impact is anticipated.

5.6. Safe Access and Egress

Safe (dry) access and egress via the proposed Internal Distributor Road is maintained at the site for well beyond the 1% (1:100 year) fluvial event + climate change + creep allowances, and therefore the associated requirements of the NPPF and PPG are satisfied.

5.7. Local Plan Requirements

In addition to the requirements set out within the NPPF (2021) and the PPGs, the Eastleigh Borough Council Local Plan review (2001 – 2011) contains saved policies relevant to this assessment:

- Policy 41.ES – Development affecting water courses.
Limits development as required by PPSs 25 and 9 and PPG20
- Policy 42.ES – Development in a catchment of a water course.
Limits development in areas at risk of flooding as required by PPS25
- Policy 43.ES – Areas at risk of flooding.
Limits development in areas at risk of flooding as required by PPS25
- Policy 44.ES – Development in areas at risk of flooding
Limits development in areas at risk of flooding as required by PPS25
- Policy 45.ES – Sustainable Drainage.
Controls development giving rise to risk of flooding as required by PPS25

The Eastleigh Borough Local Plan 2016 – 2036 was Adopted in April 2022. The following policies in the Adopted Local Plan are relevant to this assessment:

Eastleigh Borough Local Plan 2016-2036, Chapter 5: Development Management Policies, provides:

- Policy DM3 – Adaptation to climate change.
- Policy DM5 – Managing flood risk.
- Policy DM6 – Sustainable surface water management and watercourse management.
- Policy DM10 – Water and Waste Water.
- Policy DM11 – Nature conservation.

5.8. Compliance Summary

In order to comply with Eastleigh Borough Local Plan, the following steps will be taken:

- As the proposed new Internal Distributor Road routes are located within Flood Zone 1 except for crossing points within the overall red line area, roads and properties within flood zone 2 or 3 will not be proposed or built except for the crossing points and therefore a Sequential Test is not required.
- Incorporating thorough SuDS features as a method of alleviating and storing surface water run off
- Installing swales and ponds for surface water storage, if required

- Complying with Building Regulations and all relevant legislation
- Incorporating water butts for new residential developments, as required
- Maintaining the water quality through the use of swales, ponds, catchpits, sumps and gullies to intercept any contaminants before they reach infiltration systems or discharge into the watercourse.
- Ensuring the future proofing of the design by allowing for climate change and creep when calculating required storage volumes

SECTION 06

PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6. PROPOSED FLOOD MITIGATION AND MANAGEMENT MEASURES

6.1. Siting of the Built Development

As the proposed roads are to be located within Flood Zone 1 only, except for the watercourse crossing points, hence there is no need to consider alternative locations or designate areas for flood compensation.

6.2. Elevation of the Development Platform

In accordance with Highway and Building Regulations, it is recommended that the Internal Distributor Road will be 300mm above any predicted flood levels and finished ground floor levels be set a minimum of 150 mm above immediately adjacent ground levels for all proposed buildings, with the exception of level thresholds at access points.

6.3. External Ground Levels

It is considered that no significant criteria need be adopted for the setting of external ground levels, assuming these will not be significantly reduced or increased from existing, as above.

It is recommended that external levels are maintained below the proposed Internal Distributor Road levels and that residential property thresholds are not lower than the road levels without adequate flood resilience.

6.4. Fluvial Flood Storage Compensation

As the proposed site is categorised as being at low risk of Fluvial Flooding, there is no need to provide any compensation or mitigation for Fluvial Flooding

6.5. Overland Flow Routes

Pluvial Flooding (or surface runoff flooding) is caused by rainfall and is that flooding which occurs due to water ponding on or flowing over the surface before it reaches a drain or watercourse or SuDS system.

Any surface water run-off, including exceedance flows, can be appropriately conveyed to a new surface water SUDS drainage system whilst avoiding the road and proposed built development and key infrastructure (i.e., substations).

All proposed highways and associated drainage will be designed in accordance with current Highways Act and Building Regulations criteria, and SuDS adopting overland flow routes for the conveyance of excess floodwater toward areas of low vulnerability and water compatible end use (such as open space and soft landscaping), where water may be temporarily detained, if required.

SECTION 07

SURFACE WATER DRAINAGE

7. SURFACE WATER DRAINAGE

7.1. Context

Without mitigation and consideration, the proposed redevelopment of the site and the new Internal Distributor Road could lead to an unacceptable increase in the rate and volume of surface water generated from the site.

To comply with current guidance and best practice, sustainable drainage systems (SuDS) will be required, to be implemented in order to manage the volume, rate and quality of surface water discharged off-site.

In terms of volume control, where reasonably practicable, for greenfield development, the runoff volume in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event. Where reasonably practicable, for developments which have been previously developed this runoff volume must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume but should never exceed the runoff volume prior to redevelopment for that event. Where it is not reasonably practicable to constrain the volume of runoff as described it must be discharged at a rate that does not adversely affect flood risk. A separate modelling study demonstrates through evidenced based facts that the design will not be affected by flooding and flooding will not be exacerbated elsewhere.

Guidance on the design and construction of SuDS is provided in the 'Interim Code of Practice for Sustainable Drainage Systems', published by the National SUDS Working Group in July 2004 and in other CIRIA documents including The SuDS Manual 2015 (CIRIA C753), in the Environment Agency's document entitled 'Sustainable Drainage Systems (SUDS) An introduction', as well as in the Design and Construction Guidance (DCG) published by Water UK.

A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing surface water on the site wherever feasible. A full range of SuDS techniques has been considered for use on the site. Through early discussions with the Lead Local Flood Authority and other stakeholders it was agreed that the Strategic SuDS features on the site should include above ground storage features, ponds and swales, within the green corridors that follow the onsite watercourses.

Additional source control measures should be utilised within the upstream development parcels. This approach provides flexibility for the detailed design of individual development parcels whilst maximising the water quality, water quantity, amenity and biodiversity benefits of the overall SuDS strategy.

The SuDS Manual 2015, and CIRIA C687 'Planning for SuDs - making it happen', promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed Internal Distributor Road and associated development seeks to follow the concept of a SuDS management train.

A SuDS 'management train' approach is proposed to be implemented on the site. In terms of the SuDS 'management train', the surface water management strategy for the proposed Internal Distributor Road and development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design and housekeeping measures that should be considered include:

- Minimising the impermeable areas created on the site by providing permeable road surfaces and soft landscaping and planting wherever possible.
- Good site wide housekeeping and maintenance to minimise blockages and prevent pollution arising.
- Provision of water butts for rear gardens.
- The use of green roofs for public / commercial buildings where appropriate.
- The use of rainwater harvesting / reuse systems for public / commercial buildings and irrigation where appropriate.
- Installation of separators and other proprietary pollution control systems where land use requires or specific risks necessitate their use.
- Silt traps and trapped gullies to retain sediment.
- Planting within landscaped areas to encourage nutrient / pollutant uptake and evapotranspiration.
- The implementation of a SuDS Maintenance Strategy. Advice on what should be included within a maintenance strategy for the Strategic SuDS Features is included with this report. The SuDS Maintenance Strategy should become a living document that is continuously reviewed.

ii) Source Control

Source control is defined in The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source Control techniques that should be used within road and development parcels include the following:

- Pervious Paving: Pervious paving intercepts rainfall that lands on its surface before it can run overland into the downstream drainage system. This provides a degree of interception, particularly in the most polluted first-flush events, as well as filtration through the various layers of construction and through the stone sub-base. Pervious paving will be used for the road design and would typically be used for parking areas such as driveways, parking courts and car parks. Through the inclusion of a suitable flow control device, the stone sub-base in the pervious paving structure can be utilised to provide additional attenuation storage.
- Bioretention Areas / Rain Gardens / Swales / Ponds: Bioretention areas utilise planting and constructed soils to intercept rainfall from their contributing catchment areas and contribute to interception storage, evapotranspiration and pollution removal. They can also be incorporated into traffic calming infrastructure such as build outs and into roadside planting and tree pits. Bioretention Swales can be installed adjacent to larger areas of highway to provide water quality treatment and attenuation storage along their length. Ponds serve as attenuation and storage and provide a wide range of biodiversity benefits.
- Other filtration techniques: Filter Trenches and French Drains can be used to intercept runoff from larger parking areas and highway areas, if required. These will provide interception storage and filtration through the stone fill within the trenches.

iii) Site Control

Site control is the management of water from roads and sub-catchments within a development parcels. Through close consultation with the layout designers flow conveyance measures such as swales, ponds and filter trenches can be incorporated into the development parcels to provide additional attenuation, treatment, amenity and opportunities for habitat creation.

iv) Regional Control

Regional control is the strategic management of runoff across the wider site. The Strategic SuDS Features will provide the attenuation volume and flow control required to reduce post-development flow rates to below greenfield runoff rates.

The proper implementation of a SuDS management / treatment train using a combination of upstream source control and strategic SuDS features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance.

Detailed design of the road and individual development parcels should, where possible, create a diverse SuDS scheme that encourages sedimentation, filtration and biological uptake throughout the site; ensuring that effective maintenance and management procedures are followed and will be the key to ensuring the overall effectiveness of the SuDS scheme.

Detailed design of the road and individual development parcels should, where possible, create a diverse SuDS scheme that incorporates the principles of the SuDS 'management train'.

7.2. SuDS Constraints

Geology

A site investigation is reported to have been undertaken by Hydrock in April 2019. With regards to the use of soakaways / infiltration drainage on the site, the Ground Investigation Report concluded the following: -

"Soakaway drainage is considered unsuitable for this site, subject to further BRE365 compliant testing."

With regards to groundwater the Ground Investigation Report states the following: -

"Groundwater was not encountered during the investigation."

"Water levels recorded post-fieldwork range from 0.93m bgl to 2.77m bgl (15.86m OD to 29.66m OD)."

Based on the foregoing it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from the roads or the development on the majority of the site. However, in line with the recommendations of the Ground Investigation Report, it is recommended that localised infiltration testing is undertaken within the individual development parcels to identify any localised areas of the site where infiltration drainage may be feasible.

Groundwater monitoring is on-going in the locations of the proposed Strategic SuDS features to establish the highest annual groundwater levels to inform the detailed design of these features; it is noted that the winter Groundwater monitoring report is available.

Topography

The site predominantly slopes from East to West from an elevation of 28.14m to 20.59m with an approximately gradient of 1 in 12. However, the site falls from North to South from an elevation of 26.00m to 20.784m with an approximate gradient of 1 in 92m. The application site falls towards Foxwood Stream and its tributaries.

Trees

The siting and location of proposed SuDS features may be constrained by any proposal to retain established trees and to plant new trees, although requiring new drainage and SuDS features to be positioned outside of any root protection zones.

Public Safety and Maintenance

It is intended to fully utilise SUDS train management systems and the existing watercourses, it is unlikely that below ground geocellular drainage units for surface water will be required. It is intended to work with nature and enhance biodiversity opportunities.

Consideration must also be given to the access and future maintenance of these features, which lend themselves to significant landscaped areas remaining under private ownership.

Additional biodiversity and SuDS benefits could be achieved via the incorporation of 'above ground' systems such as swales, ponds, rainwater harvesting and water butts, within the development proposals.

7.3. Required Maintenance Schedule

To ensure the long-term performance of the proposed DS, the onsite drainage system will be owned and maintained by the site operator or a maintenance company (MC) in accordance with the indicative schedule below, in the alternative the local authority may wish to adopt such features. However, at the detailed drainage design stage a full management and maintenance plan detailing best practice system maintenance regimes and proprietary manufacturer requirements and lifecycle management, in accordance with the CIRIA SuDS Manual will need to be produced. In the absence of local authority adoptions, maintenance of the overall drainage network will be the responsibility of an appointed management company. Refer to section 3 (Suds Maintenance Plan), 5018551-RDG-XX-XX-DOC-C-9951 for detailed SuDS maintenance schedule.

ELEMENT / DRAINAGE COMPONENT	OWNERSHIP ADOPTION	/ MAINTENANCE REQUIREMENTS
Geocellular Attenuation Tank (if required)	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods, ensuring no solid material passes through outlet. Monitored for general condition of the tank and system generally, to suit manufacturer's guidance, check for leaks and displacement of 'cells'. Inspection annually and before / after extreme storm events.
Permeable Paving	Homeowners	Non-aggressive brushing of the whole surface (avoiding disruption of the jointing material, with suction rates adjusted, based on a trial), either manually or mechanically carried out annually. Top up of the gritstone may be required after cleaning. Weed control – excessive weed growth can be managed by localised spot-treatment with weed killers, in accordance with suppliers' recommendations. Inspection annually.
Flow Restriction Device & Chamber	Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. Check function of flow restriction componentry to suit manufacturer's guidance. Inspection annually and before / after extreme storm events.
Catchpit Manholes	Homeowners/Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. Inspection annually and before / after extreme storm events.
Rainwater Pipes	Homeowners	Clearance of leaves / debris from guttering and hopper inlets. Rodding points provided to clear blockages via conventional rodding methods. Inspection annually and before / after extreme storm events.

Soil Vent Piles / "Stub Stacks"	Homeowners	Rodding points to be provided to clear blockages via conventional rodding methods. Inspection annually.
Gullies (Internal & External)	HCC Highways	To be monitored for silt build-up and cleaned as required. Where provided, ensure air traps are primed and sealed to prevent smells. Inspection quarterly.
Swales	Site Operator / MC	To be monitored for litter and debris. Strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. Inspection quarterly and before / after extreme storm events.
Ponds	Eastleigh council management company	To be monitored for litter and debris. Careful strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. Inspection quarterly and before / after extreme storm events.

SECTION 08

FOUL WATER DRAINAGE

8. FOUL WATER DRAINAGE

The existing development site area is not crossed by any public foul sewers. Where appropriate it should be proposed to connect to an existing Public Foul Sewer network operated by Southern Water supplying foul and surface water sewerage systems.

The Foul sewers built as part of any new development must be constructed in accordance with Building Regulations Part H and where offered for adoption, to the local water company, in accordance with the latest technical guidance for the Design And Construction Guidance (DCG) April 2020.

SECTION 09

CONCLUSION

9. CONCLUSION

- Ridge & Partners prepared this Flood Risk Assessment on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR.
- Flood risk has been assessed in line with NPPF (2021), BS 8533 (2017), BS BS 8582 (2013), CIRIA C624 (2004) and SuDS Manual (C753) (2015), taking into account national and local planning policy and guidance to consider all potential sources of flooding to the site.
- Apart from the watercourse causing local bank-full and local overland flooding the remaining site area is in Flood Zone 1, although there are two additional tributary watercourses that will need to be crossed. However, apart from the watercourses there is no recorded flooding from any other sources, neither historical flooding nor specific event records, apart from the watercourses.
- Flood risk to the site from other potential sources such as surface water, ground water, sewers and infrastructure are also all considered low, with no significant flood risks identified. Soil Investigations and winter period borehole monitoring have been completed as referenced in Section 2.2.
- Based upon current information provided by the EA, the carefully selected site areas for the Internal Distributor Road and residential development within the site area are demonstrated to be at low probability of flooding (Flood Zone 1) from fluvial sources.
- Based upon our initial appraisal of flood risk, mitigation measures should be utilised to manage residual flood risks to the site. However, it is felt that the recommended measures are readily deliverable and would not unduly hinder or prevent the Internal Distributor Road construction or the redevelopment of the site.
- Development of the Internal Distributor Road and site within Flood Zone 1 areas only, with appropriate mitigation measures as outlined within this document, should readily satisfy the requirements of the Sequential Test as no reasonably available alternative sites, at a lower risk of flooding are expected to be identified. There is no requirement for the proposed development to be subject to the Exception Test. Adequately modelled and designed Internal Distributor Road crossing points over watercourses have been demonstrated.
- Surface water generated from the proposed Internal Distributor Road and development could be managed in a sustainable manner and at source by employing a wide variety of SuDS as far as possible with the support of enhanced biodiversity.
- Foul sewage from all new development should be connected to an existing public foul sewer system, subject to permission to connect or alternatively to new sewerage provisions with appropriate management and maintenance.

- The technical assessment of flood risk presented within this document demonstrates that the immediate and residual flood risks over the lifetime of the Internal Distributor Road and development are readily manageable and the redevelopment proposals are deemed acceptable in terms of flood risk throughout their lifetime, without increasing flood risk elsewhere.



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APPENDIX B

DRAINAGE STRATEGY REPORT



RIDGE

**SPINE ROAD DRAINAGE
STRATEGY**

ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL

February 2024



SPINE ROAD DRAINAGE STRATEGY ONE HORTON HEATH

Prepared for

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 Appendix H- Hydrobrake data sheet

1. INTRODUCTION

1.1. Appointment and Brief

Ridge & Partners prepared this Drainage Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site- reserved matters planning application).

The purpose of this document is to outline the development of the proposed DS, providing sufficient detail to enable both a thorough review of the design principles adopted and further refinement of the design as part of the ongoing development of the project.

The document aims to demonstrate the surface water management at the Application Site as follows:

- Provide an analysis of the impact of the proposed development on surrounding foul water infrastructure and identify the constraints present on the site in terms of suitability of conventional gravity drainage.
- Demonstrate the principles of surface water management in terms of limiting post development discharge rates and providing the necessary attenuation.

The proposed DS outlined herein is subject to further detailed analysis at the design stage. This report only focuses on the surface water strategy for the spine road.

1.2. Aims and Objectives

The DS has been prepared with reference to the following requirements:

- The DS must:
 - Ensure that flood risk to the Application Site and surrounding area is not increased over the lifetime of the Proposed Development;
 - Conform with all relevant National, Hampshire County Council and Local flood risk policies;
 - Adopt current design standards; and
 - Consider long-term maintenance with respect to practicality, ownership and funding.
- The DS should:
 - Mimic the existing drainage characteristics of the Application Site as far as is practical;
 - Look for opportunities to provide a reduction in flood risk to the Application Site and the surrounding area;
 - Adhere to current best practice guidance;
 - Contribute to the enhanced amenity and aesthetic value of the Application Site; and
 - Propose opportunities for biological enhancement and provide habitats for wildlife in urban areas.

Unnumbered heading styles can be applied rather than numbered if required with contents page adapted to suit.

1.3. Limitations

The purpose of this report is outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

1.4. Reference Information

The following documents have been consulted:

- Hampshire County Council (2011) Preliminary Flood Risk Assessment.
- Eastleigh Borough Council JBA Consulting (2018) Eastleigh Hydrological Sensitivity Study Conceptual Surface Water Drainage Strategy.
- Partnership for Urban South Hampshire (2016) – Strategic Flood Risk Assessment 2016 Update.
- Partnership for Urban South Hampshire (2019) – Green Infrastructure Implementation Plan.
- Environment Agency JBA Consulting (2019) Itchen Tributaries Modelling Study.
- Communities and Local Government Document. (2021). The National Planning Policy Framework.
- Environment Agency. (2022). Flood Risk Assessments: Climate Change Allowances.
- Environment Agency. (2013). Rainfall Runoff Management for Developments.
- CIRIA. (2015). C753 – The SuDS Manual.
- Secretary of State. (2015). Building Regulations Approved Document H.
- Butler & Davies. (2018). 4th Ed. Urban Drainage.
- British Geological Survey Online Mapping Tool.
- DEFRA / EA Interactive online mapping (magic.defra.gov.uk).
- Department for Environment, Food and Rural Affairs. (2015). Non-Statutory Technical Standards for Sustainable Drainage Systems.
- Department for Environment, Food and Rural Affairs & Environment Agency. (2017). Flood Risk Assessment for Planning Applications.
- Environment Agency (2019) Flood risk mapping information.
- Preliminary Water Management Strategy Plan (Sheet 1 of 2 and Sheet 2 of 2)

SECTION 2

PROJECT BACKGROUND

2. PROJECT BACKGROUND

2.1. Site Location

The application site is situated south of the Fir Tree Lane and north of the proposed Lower Acre development, adjacent to an existing solar farm.



Figure 1: Site Location Plan

The Ordnance Survey grid reference for the application site is SU 48807 17233, approximately 448807N, 117233E and the nearest postcode is SO50 7BZ. The total area of the proposed application site is 21.56ha.

2.2. Topography

The site predominantly slopes from east to west, with an elevation ranging from 28.14m to 20.59m with an approximate gradient of 1 in 12. However, it also has a north to south slope, descending from an elevation of 26.00m to 20.78m with an approximate gradient of 1 in 92. The application site falls towards Foxwood Stream and its tributaries.

2.3. Existing Drainage Infrastructure

Figure 2 shows that Catchment E will discharge surface water to SuDs feature E which will be constructed as part of Road 3 application prior to the development being built. The purpose of SuDs feature E is to manage and control surface water runoff. It is important to note that SuDs feature E will discharge the collected surface water into the Hearts Stream.



Figure 2: Location of catchment E and its discharge location, Suds Feature E

2.4. Geology and Hydrogeology

British Geological Survey (BGS) online mapping indicates that the Application Site is situated on a bedrock of Wittering Formation sand, silt and clay. This is overlain by superficial deposits of Alluvium around the watercourses that pass through the site.

The Environment Agency's online mapping suggests the underlying bedrock to be classified as a secondary A Aquifer and the site is located within a medium groundwater vulnerability zone.

2.5. Hydrological Settings

The nearest river is the River Itchen which is located 1.67km away from the proposed development. The tributary of Foxwood Stream runs between the solar farm and Fir Tree Lane and north of the proposed one Horton heath Lower Acre site as shown in figure 3.

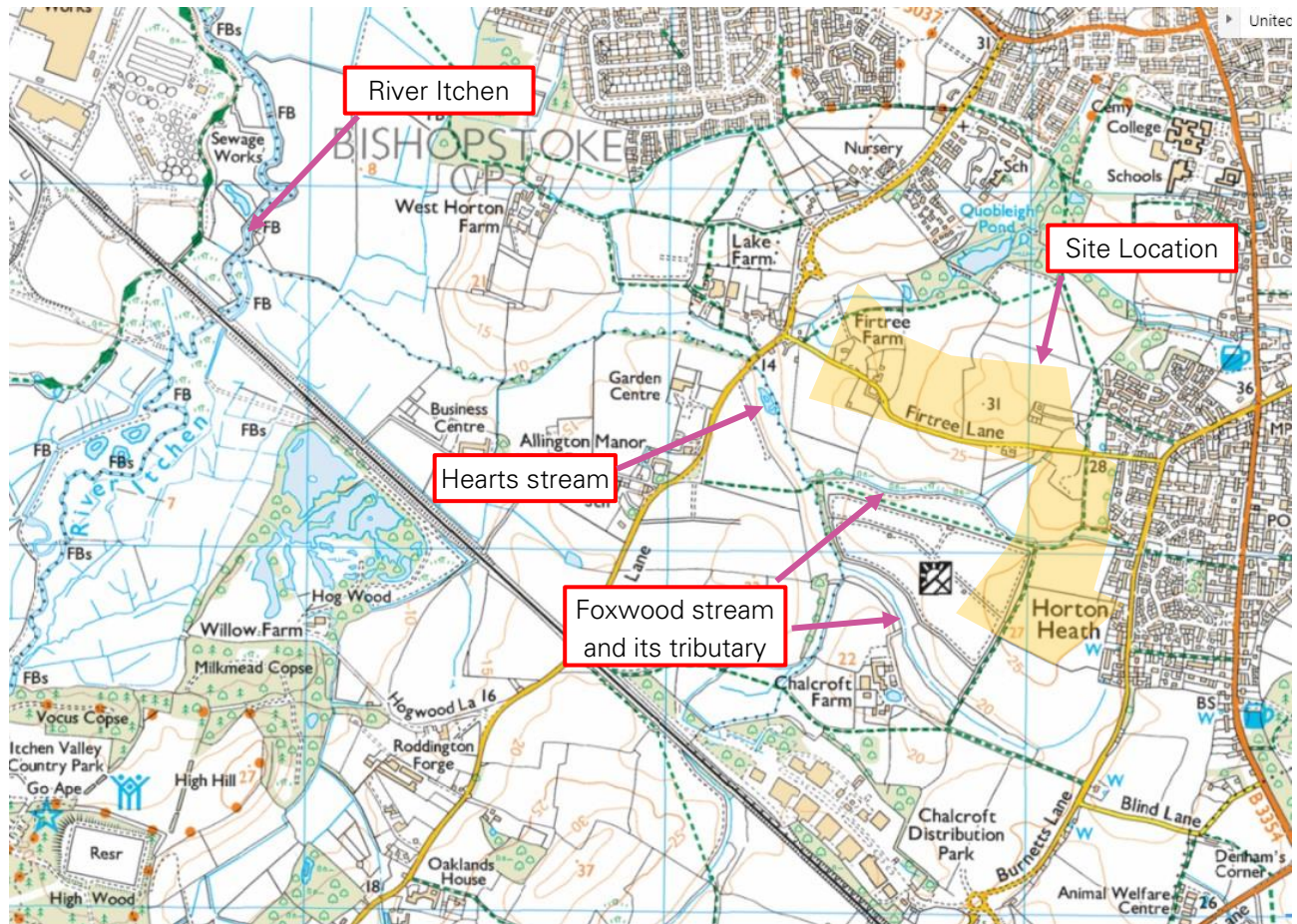


Figure 3: Location of River Itchen from the proposed site

2.6. Proposed Development

The proposed development is a part of the One Horton Heath Site Wide Infrastructure Delivery, which includes the construction of the roads, residential homes, local centres, school and its playground. However, this report primarily focuses on the spine road that spans between Fir Tree Lane and Foxwood stream, connecting the west and east portion of the development. This spine road crosses the Foxwood Stream and runs alongside the solar farm before linking to the northern section of the proposed Lower Acre site.

Refer to Appendix A for proposed site plan.

SECTION 3

PROPOSED SURFACE WATER DRAINAGE

3. PROPOSED SURFACE WATER DRAINAGE

3.1. Existing Site Location Data

The site location and hydrological data used within this assessment is summarised as follows:
is SU 48807 17233, approximately 448807N, 117233E.

- Grid Reference: SU488172_(448807N, 117233E)
- Return Period: 100 Years
- Average Annual Rainfall (SAAR): 800 mm/year
- Soil Index: 0.300
- UK Hydrological Region: Region 7

3.2. Existing Total Site Area

The existing site is currently an empty greenfield area. The total area of the existing site is as follows:

ITEM	AREA (SQ. M)	AREA (HECTARES)
	215600	21.56
Totals:		21.56

Therefore, an existing permeable and impermeable percentages are calculated as follows:

	IMPERMEABLE	PERMEABLE
Area (Ha)	0	21.56
Percentage (%)	0	100%

3.3. Calculation of Greenfield

Greenfield runoff rates have been estimated for the site using the methodology outlined in the Institute of Hydrology Report 124 method as set out within the Interim Code of Practice for SuDS (ICP) and Environment Agency guidance for catchment areas of 50 hectares or less.

This method of assessment is widely recognised as current best practice for estimation of catchment release rates for small catchments.

In line with outline planning application, as shown in Preliminary Water Management Strategy Plan drawing-G277/21 rev C (sheet 1 and sheet 2), the proposed development site has been divided into 3 catchments. The preliminary management strategy plan was carried out by PFA Consultant. The drawing highlights different catchment area within the proposed site. The drawing also provides information such as % of impermeability for each catchment area and their runoff rates and volume storages for the year 1 in 1, 1 in 100+40%cc and Qmed.

Each catchment area has been assigned a restricted flow rate before being discharged into the Foxwood Stream and its tributaries.

Catchment F:

RETURN PERIOD (1 IN X YEARS)	GREENFIELD RUN OFF RATE (L/S)
1 in 1	23.9
QMed	26.9
1 in 100+CC	26.9

The surface water from catchment area F, including the spine road that runs alongside it, is discharged into the strategic SuDS feature, Pond_F. The flow rate of surface water discharged from Pond_F to the Foxwood Stream is restricted to **26.9l/s**.

Catchment G:

RETURN PERIOD (1 IN X YEARS)	GREENFIELD RUN OFF RATE (L/S)
1 in 1	34.7
QMed	41.5
1 in 100+CC	41.5

The surface water from catchment area G, including the spine road that runs alongside it, is discharged into the strategic SuDS feature, Pond_G. The flow rate of surface water discharged from Pond_G to the Foxwood Stream is restricted to **41.5l/s**.

Catchment H:

RETURN PERIOD (1 IN X YEARS)	GREENFIELD RUN OFF RATE (L/S)
1 in 1	44.1
QMed	70.8
1 in 100+CC	70.8

The surface water from catchment area H, including the spine road that runs alongside it, is discharged into the strategic SuDS feature, Pond_H. The flow rate of surface water discharged from Pond_H to the Foxwood Stream is restricted to **70.8 l/s**.

3.4. Proposed Site Impermeable Area & Percentages

The total impermeable areas for the proposed site have been calculated as follows:

Catchment F:

The total area of catchment F is 4.28ha.

ITEM	AREA (SQ. M)	AREA (HECTARES)
Spine Road	7370	0.737
65% impermeable catchment	23040	2.304
Totals:	30410	3.041

Catchment G:

The total area of catchment G is 6.97ha.

ITEM	AREA (SQ. M)	AREA (HECTARES)
Spine Road	4930	0.493
65% impermeable catchment	22480	2.248
50% impermeable catchment	15070	1.507
Totals:	42480	4.248

CATCHMENT BREAKDOWN	% OF IMPERMEABILITY	RESTRICTED RATE	ATTENUATION LOCATION	DISCHARGE LOCATION
Catchment G development area 1	65%	No restriction	POND G	Discharges to Foxwood stream via proposed road drainage within Internal distributor Road and pond F
Catchment G development area 2	50%			
SID Road	100%			Discharges to Foxwood stream via Pond F
Overall Catchment Discharge Rate	-	26.9l/s		Discharges to Foxwood stream

Catchment H:

The total area of catchment G is 10.296ha.

ITEM	AREA (SQ. M)	AREA (HECTARES)
Spine Road	9230	0.923
30% impermeable catchment	4620	0.462
65% impermeable catchment	50910	5.091
Totals:	64764	6.476

Total area of impermeable throughout the site is as follows:

ITEM	AREA (SQ. M)	AREA (HECTARES)
Spine Road	21530	2.153
Total Impermeable Area	116120	11.61
Totals:	137650	13.765

Therefore, proposed permeable and impermeable percentages are calculated as follows:

	IMPERMEABLE	PERMEABLE
Area (Ha)	13.765	7.795
Percentage (%)	64	36
Change from Existing (%)	+64	-64

3.5. Allowance for Climate Change

Table 2 (Peak Rainfall Intensity Allowance in Small and Urban Catchments) of Environment Agency. (2019). Flood Risk Assessments: Climate Change Allowance confirms that the climate change allowance of **45%** should be adopted for the Application Site, assuming a lifespan of 100 years for development as recommended within the NPPF.

The storage volume has been designed based on the updated climate change allowance of 45%.

3.6. Allowance for Creep

As this report primarily focuses on the construction of the spine road running between catchment F, G & H. Therefore, it is anticipated that this construction would not be considered appropriate to include 10% allowance for creep within the calculations.

3.7. SuDS Management Train & Proposed SuDS Features

In accordance with the discharge hierarchy identified in Section 3, the surface water generated by the proposed development should be discharged to the ground via infiltration, where practicable to do so.

The presence of clay within the site makes it unsuitable for infiltration. Therefore, the discharge of surface via infiltration-based SuDS features (i.e., soakaways, infiltration basins) is not considered appropriate.

Resulting from this, the surface water discharged from the proposed development and its catchment will be discharged into an existing ditch, Foxwood Stream and its tributaries. The surface water will be stored within SuDS features like ponds and swale before being discharged into the ditch.

3.8. Proposed Design

The proposed development is mainly divided into 3 catchments (F, G & H) and each catchment has its own SuDs features from which the surface water will discharge into Foxwood stream as shown in figure 4.

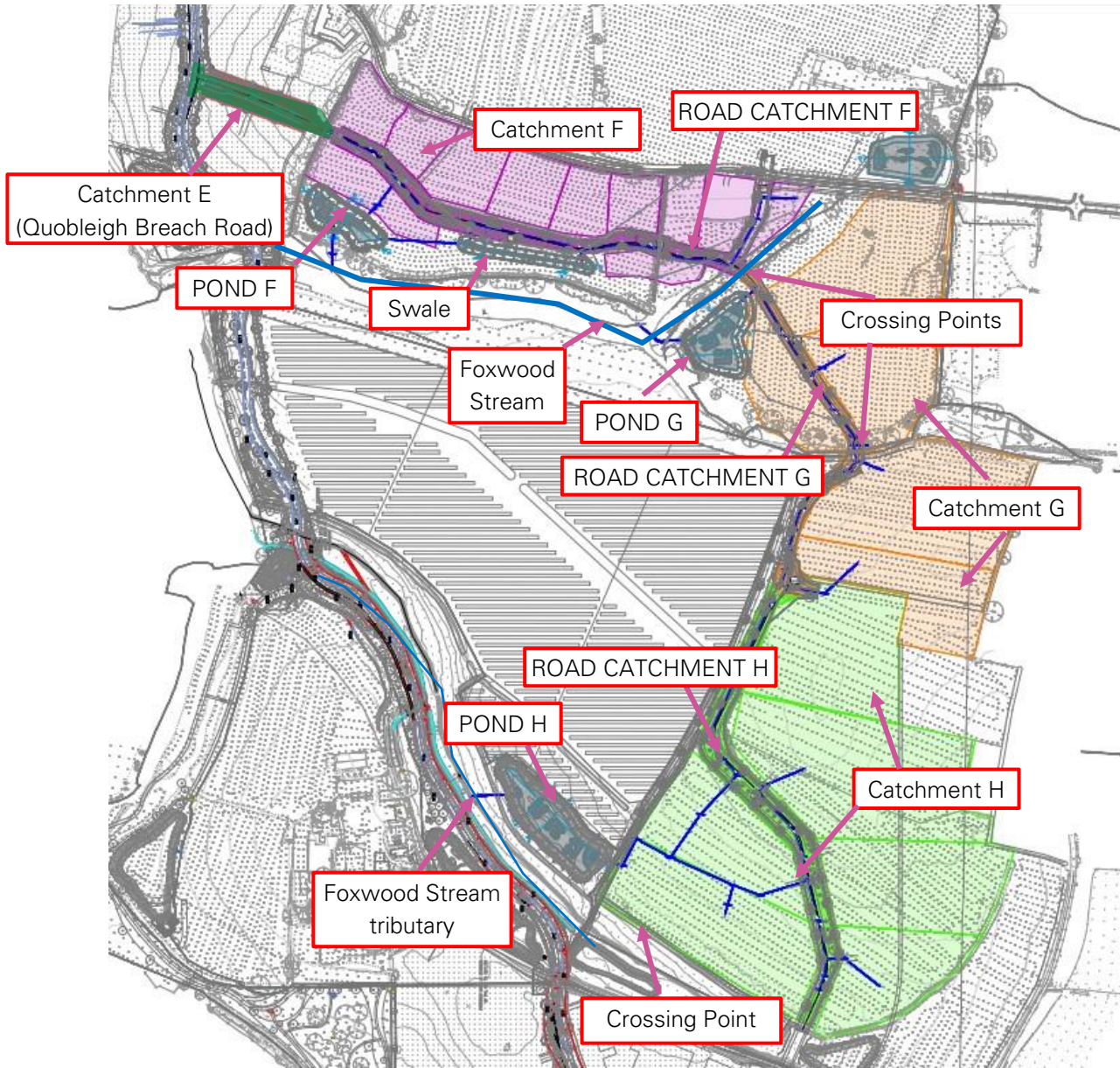


Figure 4: Location of catchments, ponds and swale

There are three watercourses crossing points within the extent of the spine road which have been taken into consideration during the hydraulic modelling.

Refer to Appendix C for overall plan with site plan.

Catchment F:

The catchment within F is divided into three catchments:

- Road catchments: 100% impermeable area- F_ROAD 1, 2, 3 & 4
- Assumed residential dwellings: 65% impermeable area- Catchment_F1, F2, F3, F4, F5, F6, F7, F8, F9, F10 & F11

Road catchments: 100% impermeable area:

The impermeable area for the road catchment F is 100%, 0.737ha. The surface water discharged from the road catchment, F_Road_1 is collected within the SuDs feature, Pond_F via manhole (MH_CF16). A petrol/oil inceptor is placed between the manhole (MH_CF18) and Pond_F to avoid any spillage and leakage into the pond and nearby watercourse.

The surface water collected from the road catchment, F_Road_2 is discharged into a swale via manhole (MH_CF12) whereas the surface water discharged from road catchment, F_Road_3 & F_Road_4 is also discharged into the swale via manhole (MH_CF9). A petrol/oil inceptor is placed between these manholes (MH_CF9 & MH_CF12) and swale to avoid any spillage and leakage into the pond and nearby watercourse.

Assumed residential dwellings: 65% impermeable area:

This catchment has an impermeable area of 65% of its total area (3.55ha). The surface water discharged from the catchment, catchment_F1, F2 & F10 is collected within the SuDs feature, Pond_F via manhole (MH_CF18). There are no hydro brakes placed within any of these catchments.

The surface water discharged from the catchment, Catchment_F3, F4 & F5 is discharged into the swale via manhole (MH_CF12). There is no hydrobrake within any of these catchments. Whereas the surface water discharged from catchment, Catchment_F6, F7, F8, F9 & F11 are discharged into swale via manhole (MH_CF9). However, the surface water discharged from the catchment, catchment_F9 is restricted to 1.0l/s at manhole (MH_CF1).

The surface water collected within the swale is discharged at the rate of 5.0l/s into the SuDs feature, POND_F which is then discharged into the nearby Foxwood Stream at the rate of 26.9l/s.

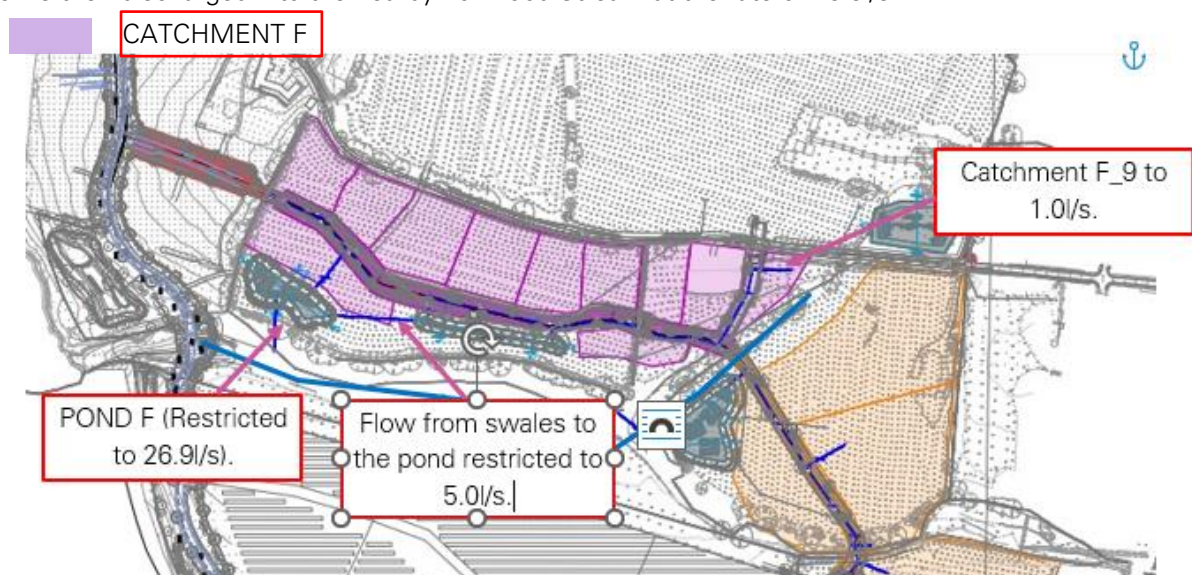


Figure 5: Location of Hydrobrake within Catchment F

CATCHMENT BREAKDOWN	% OF IMPERMEABILITY	RESTRICTED RATE	ATTENUATION LOCATION	DISCHARGE LOCATION	COMMENT
Catchment F_1 to F_2 development area	65%	No restriction	Pond F	Discharges to Pond F via proposed road drainage Internal distributor road.	There is no flow restriction from these catchments and discharges to Foxwood Stream via Pond F.
Catchment F_3 to F_8 development area	65%	No restriction	Swale and Pond F	Discharges to Pond F via proposed road drainage within Internal distributor Road and swale. The surface water collected within swale is discharged at a restricted rate of 5.0l/s,	There is no restriction from these catchments to the nearby swale. The final discharge location is Foxwood stream via swale and pond F.
Catchment F_9	65%	Restricted to 1.0l/s.	Swale and Pond F	The surface water discharges catchment F_9 is attenuated within geo-cellular crate. The required storage volume is 80.6m ³ . The flow from this catchment is discharged at a restricted rate of 1.0l/s.	The flow discharges into Pond F via Internal distributor road and swale
SID Road (F_ROAD_1)	100%	No restriction	Pond F	Discharges to Foxwood stream via Pond F.	There are no hydrobrake placed to restrict the flow from this catchment.
SID Road (F_ROAD_2 to F_ROAD_4)	100%	Swale restricted to 5.0l/s.	Swale and Pond F	Discharges to Foxwood stream via Pond F. The storage volume of swale is 2543m ³ .	The total flow from the development catchment F3 to F9 and the total flow from road catchment F_ROAD_2 to F_ROAD_4 is discharged into the swale which is then discharged into the pond F at a restricted rate of 5.0l/s.
Overall Catchment Discharge Rate	-	26.9l/s	Pond F	Discharges to Foxwood stream. The storage volume of Pond H is 998m ³ .	The surface water collected from proposed development catchment and road catchment is discharged into Foxwood stream via Pond F at a restricted rate of 26.9l/s.

Refer to appendix C- Drainage Layout for breakdown plan of catchment F- 5018551-RDG-XX-ST-DR-C-0501 & 502.

Catchment G:

The catchment within G is divided into three catchments:

- Road catchments: 100% impermeable area- G_ROAD 1 & 2
- Assumed local centres: 65% impermeable area- Catchment_G1, G2 & G3
- Assumed school building area: 50% impermeable area- Catchment_G4 & G5.

Road catchments: 100% impermeable area:

The impermeable area for the road catchment G is 100%, 0.493ha. The surface water discharged from the road catchment is collected within the Suds feature, Pond G via manhole (MH_CG35). A petrol/oil inceptor is placed between the manhole (MH_CG35) and pond G to avoid any spillage and leakage into the pond and nearby watercourse.

Assumed local centres: 65% impermeable area:

This catchment has an impermeable area of 65% of its total area (3.46ha). The surface water discharged from this catchment is collected within the Suds feature, Pond G via manholes (MH_CG35). A hydrobrake is placed within manhole (MH_CG33) and the flow from catchment Catchment_G2 is restricted to 7.70l/s.

Assumed school buildings 50% impermeable area:

This catchment has an impermeable area of 50% of its total area (3.01ha). The surface water discharged from the catchment_G4 is restricted to 25.37l/s at MH_CG29. Whereas the surface water discharged from the catchment_G5 is restricted to 15.01l/s at MH_CG19. The surface water collected from these catchments are discharged into the nearby suds feature, Pond_G via manhole (MH_CG35).

The surface water collected from nearby catchments within the Pond_G is discharged into the Foxwood Stream. The flow rate is restricted to 41.5l/s.

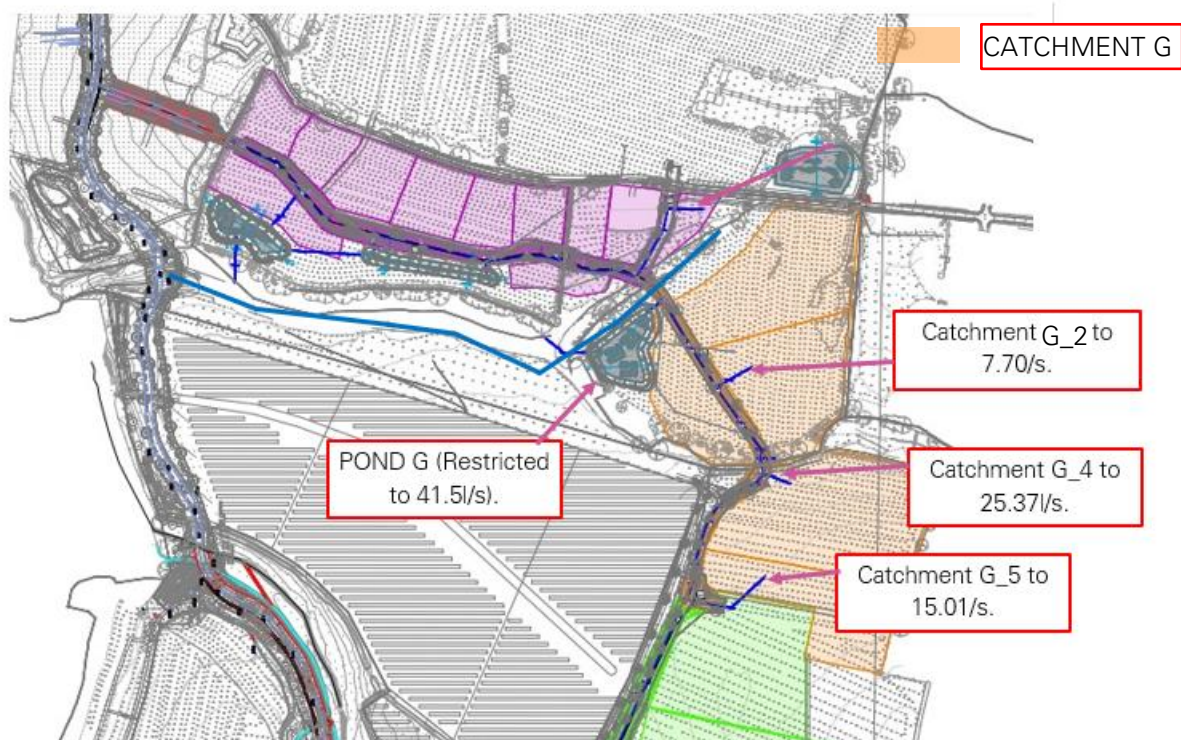


Figure 6: Location of Hydrobrake within Catchment G

CATCHMENT BREAKDOWN	% OF IMPERMEABILITY	RESTRICTED RATE	ATTENUATION LOCATION	DISCHARGE LOCATION	COMMENT
Catchment G_1 and G_3 development area	65%	No restriction	Pond G	Discharges to Pond G via proposed road drainage Internal distributor road.	There is no flow restriction from these catchments and discharges to Foxwood Stream via Pond G.
Catchment G_2 development area	65%	Restricted at 7.7l/s	Attenuated within geo-crates and Pond G	The surface water from catchment G_2 is attenuated within geo-cellular crate. The required storage volume is 628.3m3. The flow from this catchment is discharged at a restricted rate of 7.7l/s.	The flow discharges into Pond G via Internal distributor road drainage
Catchment G_4 development area	50%	Restricted at 25.37/s	Attenuated within geo-crates and Pond G	The surface water from catchment G_4 is attenuated within geo-cellular crate. The required storage volume is 481.5m3. The flow from this catchment is discharged at a restricted rate of 25.37l/s.	The flow discharges into Pond G via Internal distributor road drainage
Catchment G_5 development area	50%	Restricted at 15.01/s	Attenuated within geo-crates and Pond G	The surface water discharges catchment G_5 is attenuated within geo-cellular crate. The required storage volume is 252.3m3. The flow from this catchment is discharged at a restricted rate of 15.01l/s.	The flow discharges into Pond G via Internal distributor road drainage
SID Road G_ROAD_1	100%	No restriction	Pond G	Foxwood stream via Pond G.	The total flow from the development catchment G4 and G5 and road catchment G_Road_1 is diverted towards Pond F via Internal distributor road drainage
SID Road G_ROAD_2	100%	No restriction	Pond G	Foxwood stream via Pond G.	The total flow from G_ROAD_1 area and development catchment G_1 to G_3 and G_ROAD_2 is discharged into Pond G
Overall Catchment Discharge Rate	-	41.5l/s		Discharges to Foxwood stream via Pond G. The storage volume of Pond G is 2341m3.	The surface water from proposed development catchment and road catchment is discharged into Foxwood stream via Pond G at a restricted rate of 41.5l/s.

Refer to appendix C- Drainage Layout for breakdown plan of catchment G- 5018551-RDG-XX-ST-DR-C-0502 & 503.

Catchment H:

The catchment within H is divided into three catchments:

- Road catchments: 100% impermeable area- H_ROAD 1, 2 & 3
- Assumed sports ground: 30% impermeable area- Catchment_H1
- Assumed residential dwellings: 65% impermeable area- Catchment_H2, H3, H4, H5 & H6

Road catchments: 100% impermeable area:

The impermeable area for the road catchment H is 100%, 0.923ha. The surface water discharged from the road catchment is collected within the Suds feature, Pond H via manholes. A petrol/oil inceptor is placed between the manhole (MH_CH50) and pond H to avoid any spillage and leakage into the pond and nearby watercourse.

Assume sports ground: 30% impermeable area:

This catchment has an impermeable area of 30% of its total area (1.54ha). The surface water discharged from this catchment is collected within the Suds feature, Pond H via manholes (MH_CH50). There are no hydro brakes placed within the catchments associated with 30% impermeable area.

Assumed Residential dwellings: 65% impermeable area:

This catchment has an impermeable area of 65% of its total area (7.83ha). The surface water discharged from the catchment_H2 is restricted to 18.25l/s at MH_CH36. Whereas the surface water discharged from the catchment_H4 is restricted to 7.73l/s at MH_CH41 and catchment catchment_H5 is restricted to 13.13l/s at MH_CH31. The surface water collected from these catchments are discharged into the nearby suds feature, Pond_H via manhole (MH_CH50).

The surface water collected from nearby catchments within the Pond_H is discharged into the Foxwood Stream. The flow rate is restricted to 70.8l/s.

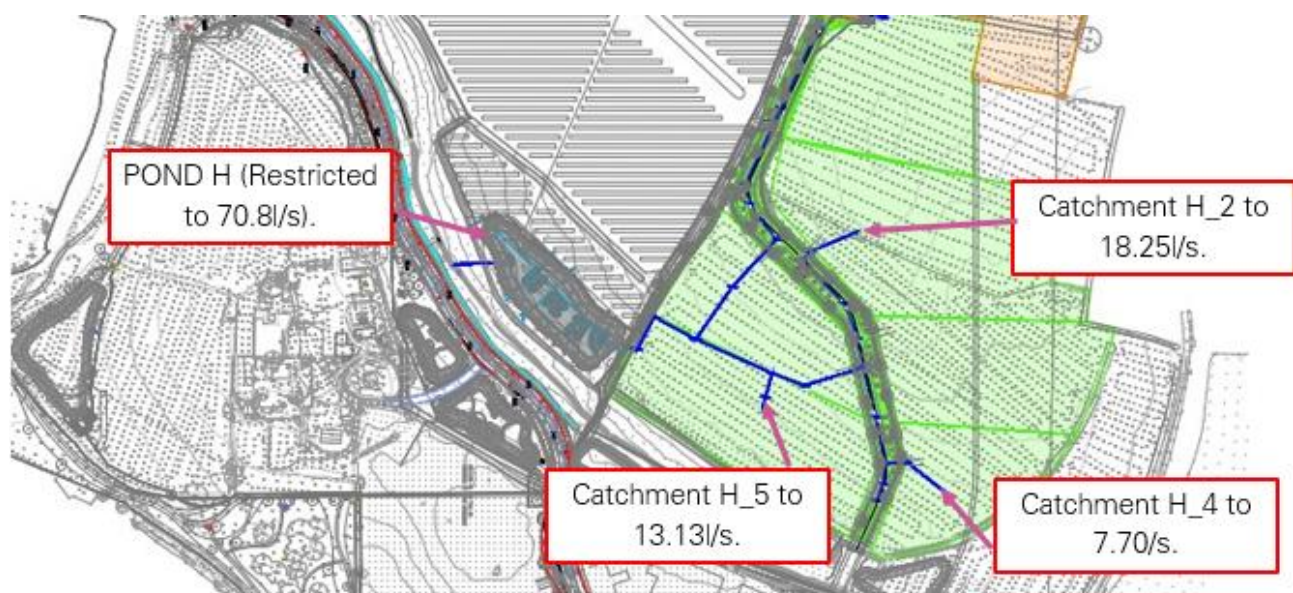


Figure 7: Figure 6: Location of Hydrobrake within Catchment H

CATCHMENT BREAKDOWN	% OF IMPERMEABILITY	RESTRICTED RATE	ATTENUATION LOCATION	DISCHARGE LOCATION	COMMENT
Catchment H_1 development area	30%	No restriction	Pond H	Discharges to Pond H via proposed road drainage Internal distributor road.	There is no flow restriction from these catchments and discharges to Foxwood Stream via Pond H.
Catchment H_2 development area	65%	Restricted at 18.25l/s	Attenuated within geo- crates and Pond H	The surface water from catchment- H_2 is attenuated within geo-cellular crate. The required storage volume is 1067.7m3. The flow from this catchment is discharged at a restricted rate of 18.25l/s.	The flow discharges into Pond H via Internal distributor road drainage
Catchment H_3 AND H_6 development area	65%	No restriction	Pond H	Discharges to Pond H via proposed road drainage Internal distributor road.	There is no flow restriction from these catchments and discharges to Foxwood Stream via Pond H.
Catchment H_4 development area	65%	Restricted at 7.7l/s	Attenuated within geo- crates and Pond G	The surface water from catchment H_4 is attenuated within geo-cellular crate. The required volume is 440.2m3. The flow from this catchment is discharged at a restricted rate of 7.70/s.	The flow discharges into Pond H via Internal distributor road drainage
Catchment H_5 development area	65%	Restricted at 13.13/s	Attenuated within geo- crates and Pond G	The surface water from catchment G_5 is attenuated within geo-cellular crate. The required volume is 753.3.3m3. The flow from this catchment is discharged at a restricted rate of 13.13/s.	The flow discharges into Pond H via Internal distributor road drainage
SID Road H_ROAD_1	100%	No restriction	Pond H	Foxwood stream via Pond H.	The flow from the development catchment H1 is diverted towards Pond H via Internal Road drainage
SID Road H_ROAD_2	100%	No restriction	Pond H	Foxwood stream via Pond H.	The flow from the development catchment H2 is diverted towards Pond H via Internal Road drainage
SID Road H_ROAD_3	100%	No restriction	Pond H	Foxwood stream via Pond H.	The flow from the development

				catchment H2 is diverted towards Pond H via Internal Road drainage
Overall Catchment Discharge Rate	-	70.8/s	Discharges to Foxwood stream via Pond H. The storage volume of Pond H is 4184m ³ .	The surface water from proposed development catchment and road catchment is discharged into Foxwood stream via Pond G at a restricted rate of 41.5l/s.

Refer to appendix C- Drainage Layout for breakdown plan of catchment G- 5018551-RDG-XX-ST-DR-C-0502 & 504.

Refer to appendix C & D for detailed drainage layout drawings and surface water calculations.

Catchment E:

The surface water discharged from the road catchment E will be collected via standard gully's and discharged via the surface water network built as part of the Road 3 network. The rate of discharge from catchment E into SuDS feature E is 32.3l/s. The existing surface network from catchment E is shown within appendix C & D.

CONTRIBUTING AREA			IMPERMEABLE AREA	% OF IMPERMEABLE AREA	DISCHARGE RATE
Residential area	within		1.42ha	65%	
Catchment E					
Sid Road	within		1.72ha	100%	32.3 l/s
Catchment E					
Total			4.28ha		32.3/s

The surface water discharged from road catchment_E is discharged within manhole S33 (existing manhole) built as part of road 3 application.

Bridleway Catchment:

The surface water from the proposed bridleway will discharge into the adjacent ditch that runs along the bridleway. Bridleway will be designed in line with Hampshire bridleway services standards.

SECTION 4

CONCLUSIONS

4. CONCLUSIONS

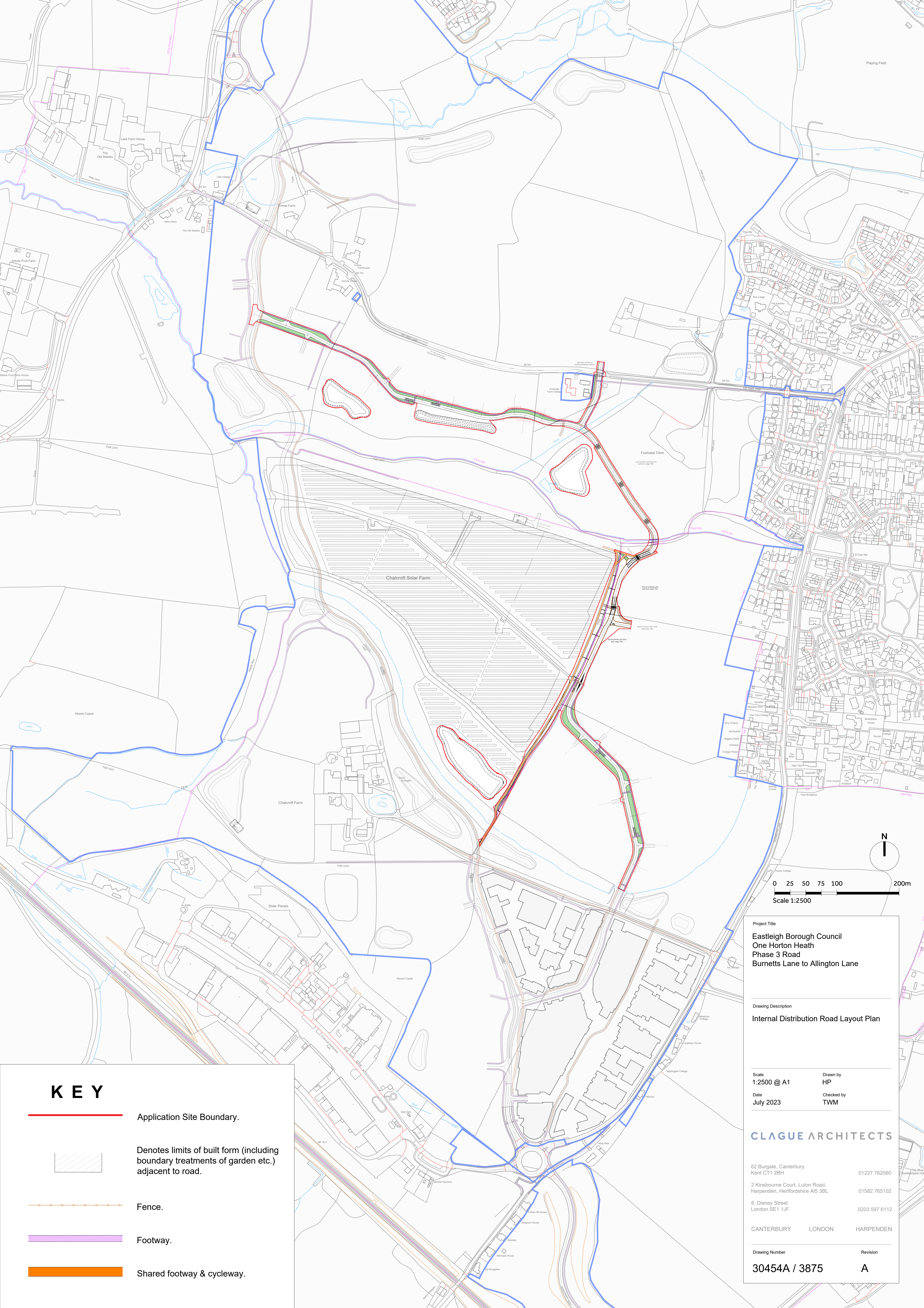
Ridge & Partners prepared this Drainage Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR.

- This report primarily focuses on the surface water strategy for the spine road.
- Surface Water generated from the proposed site will be managed in a sustainable manner in accordance with the guidance in the CIRIA SuDS Manual and at source as outlined within the accompanying drainage strategy drawings in Appendix C and Appendix D and in line with the strategy set out in the Outline planning application documents by PFA.
- There are three watercourse crossing points within the extent of the spine road which have been taken into consideration during the hydraulic modelling.
- The site is divided into three catchment areas, each catchment area has its own SuDs feature from which the surface water will be discharged into Foxwood Stream and its tributaries. Refer to appendix B for overall drainage layout.
- Catchment F, which consists of residential dwellings, has an impermeable area of 65% whereas the spine road that runs from east to west has an impermeable area of 100%. The surface water from this catchment is discharged into pond F via swale which is restricted to 5.0l/s.
- The surface water collected within pond F is discharged into Foxwood Stream at the rate of 26.9l/s.
- The catchment G, which consists of assumed local centre and school has an impermeable area of 65% and 50% respectively. Whereas the road catchment that runs north of catchment G towards south is 100% impermeable. The surface water from this catchment is discharged into pond G via manholes.
- The surface water collected within pond G is discharged into Foxwood Stream at the rate of 41.5l/s.
- The catchment H, which consists of assumed sports ground and residential dwellings has an impermeable area of 30% and 65% respectively. Whereas the spine road catchment which runs within catchment H is 100% impermeable. The surface water from this catchment is discharged into pond H via manholes.
- The surface water discharged from Road catchment_E is discharged into an existing manhole (S33), which was built as part of Road 3 application. The surface water collected from residential parcel and road catchment from this particular catchment is discharged into SuDS feature E, which then discharged into nearby stream at a restricted rate of 32.3l/s,
- The surface water collected within pond H is discharged into Foxwood Stream at the rate of 70.8l/s.

- Additional hydrobrakes are added within the catchment F, G & H to restrict the flow within the catchment area as shown in Appendix C.
- Petrol/Oil inceptor are placed between the final manholes and SuDs features to treat the surface water prior to discharge to the nearby watercourse.

APPENDIX A

PROPOSED SITE PLAN



KEY

Application Site Boundary.

Denotes limits of built form (including boundary treatments of garden etc.) adjacent to road.

Fence.

Footway.

Shared footway & cycleway.

Project Title
Eastleigh Borough Council
One Horton Heath
Phase 3 Road
Burnetts Lane to Allington Lane

Drawing Description
Internal Distribution Road Layout Plan

Scale
1:2500 @ A1
Date
July 2023
Drawn by
HP
Checked by
TWM

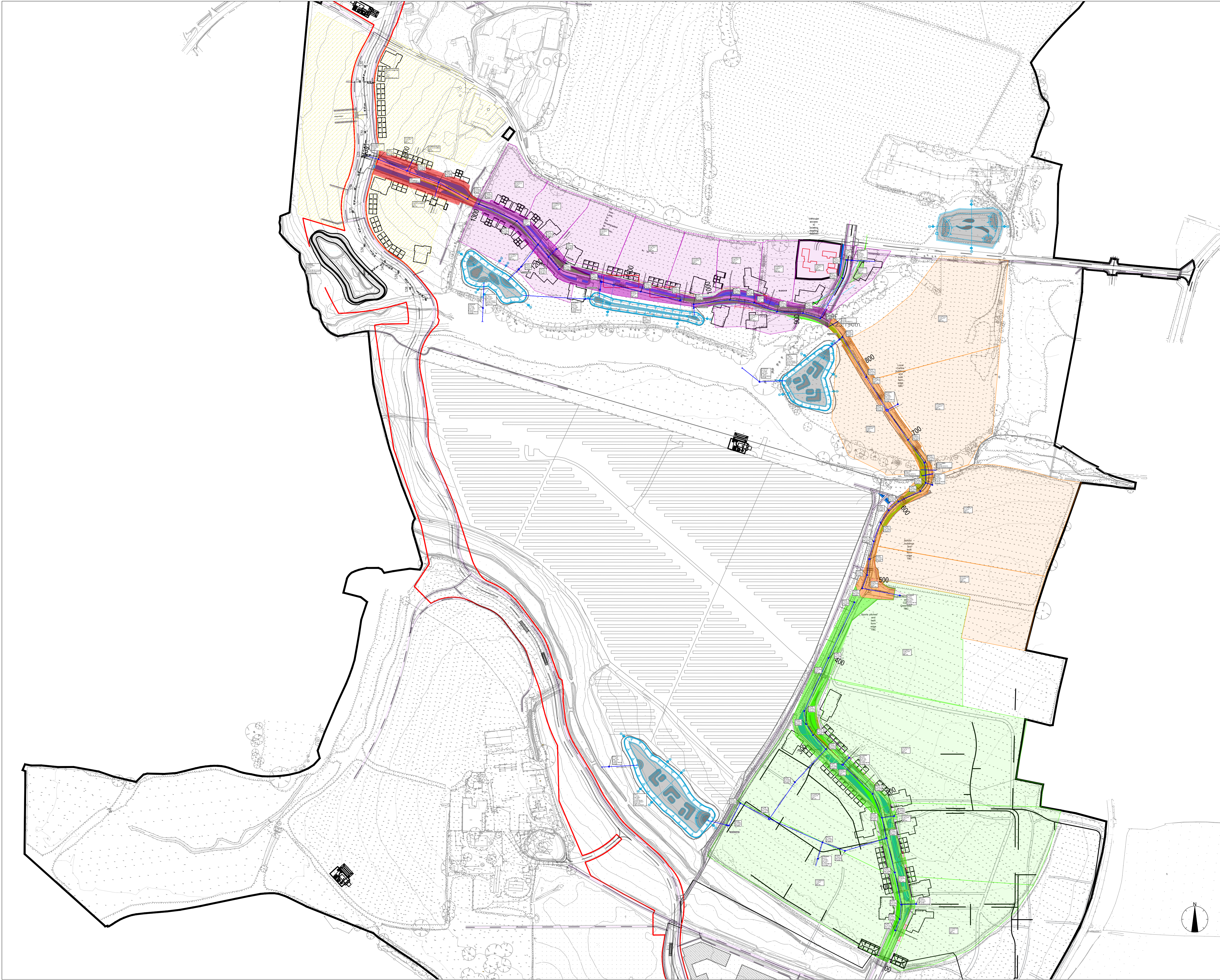
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Harpenden, Hertfordshire AL5 3BL
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8, Disney Street
London SE1 1JF
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CANTERBURY LONDON HARPENDEN

Drawing Number
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Revision
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APPENDIX B

OVERALL DRAINAGE LAYOUT



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INFRASTRUCTURE DELIVERY**

TITLE:
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LAYOUT**

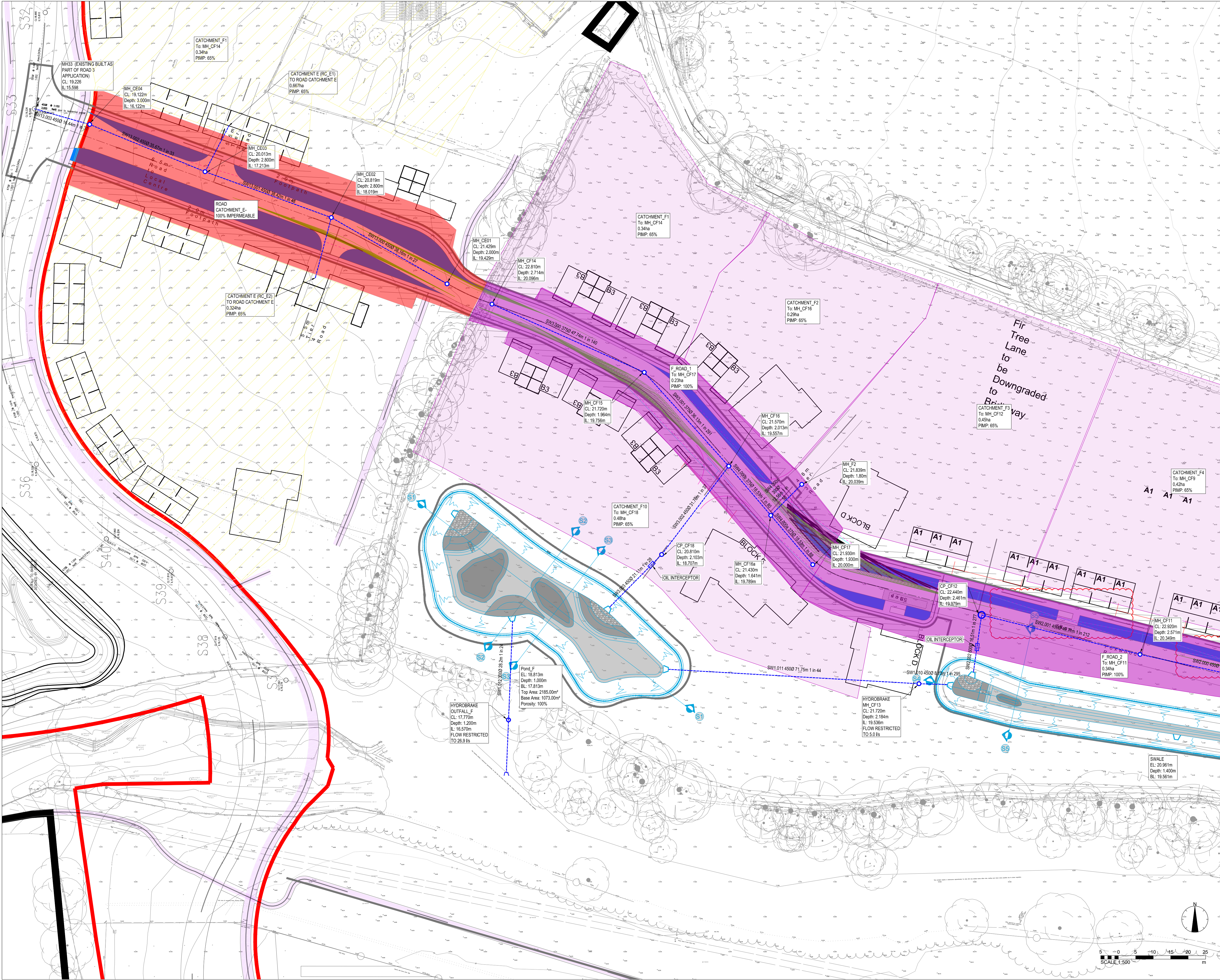
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APPENDIX C

DRAINAGE LAYOUT



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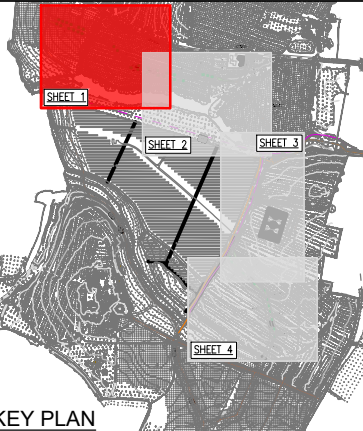
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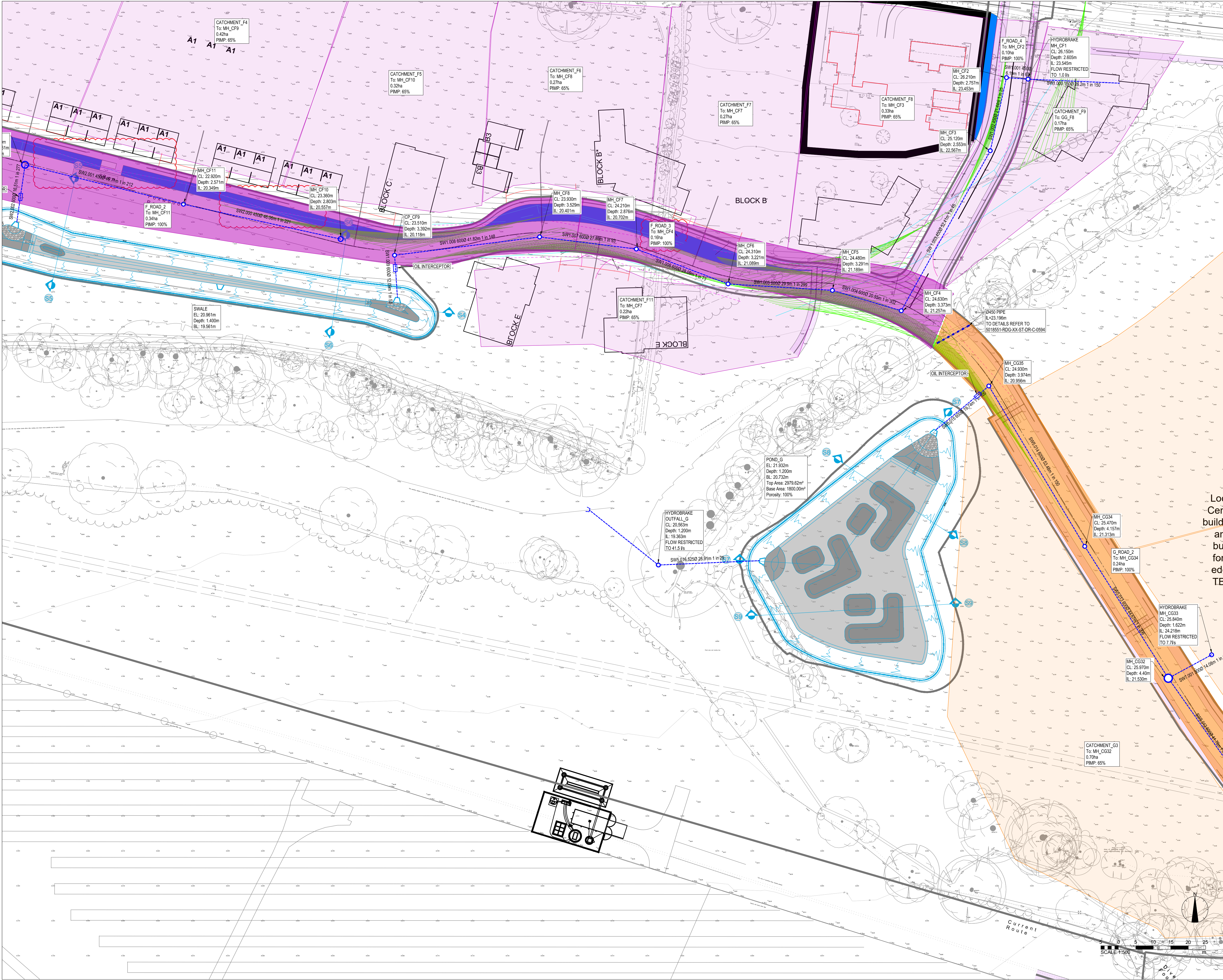
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INFRASTRUCTURE DELIVERY**

TITLE:
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SHEET 1**

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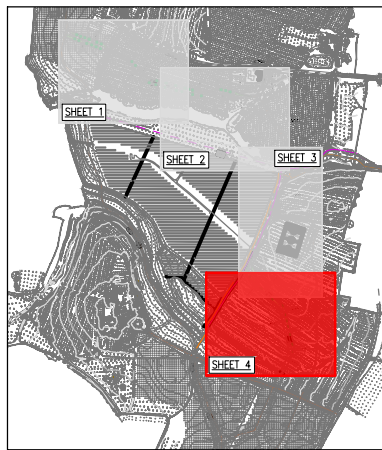
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P01	UPDATED DRAINAGE LAYOUT	27/07/2023	PO
REV	DESCRIPTION	DATE	DRAWN
INITIAL ISSUE		16/06/2023	JM

ORIGINATOR:



1 ROYAL COURT
KINGS WORTHY
WINCHESTER
SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:



IN ASSOCIATION WITH:

PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DRAINAGE STRATEGY
SHEET 4**

TECH:	PO	CSE:	ICSE:	SCALE:	1:500	@	A1
STATUS:				INITIAL ISSUE:	16/06/2023		

PRELIMINARY

DRAWING No:		ORG:	RDG	ZONE:	XX	LEVEL:	ST	TYPE:	DR	ROLE:	C	NUMBER:	0504	REV:	P03
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APPENDIX D

SURFACE WATER CALCULATIONS

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
	Designed by:	Checked by:	Approved By:	
	BT			
Report Details: Type: Inflow Summary Storm Phase: Phase		Ridge:		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
CATCHMEN T_F1	MH_CF14		Time of Concentration	0.338	65	0	65	0.220
CATCHMEN T_F2	MH_F2		Time of Concentration	0.289	65	0	65	0.188
CATCHMEN T_F3	MH_CF12		Time of Concentration	0.454	65	0	65	0.295
CATCHMEN T_F4	MH_CF11		Time of Concentration	0.417	65	0	65	0.271
CATCHMEN T_F5	MH_CF10		Time of Concentration	0.317	65	0	65	0.206
CATCHMEN T_F6	MH_CF8		Time of Concentration	0.270	65	0	65	0.176
CATCHMEN T_F7	MH_CF7		Time of Concentration	0.265	65	0	65	0.172
CATCHMEN T_F8	MH_CF3		Time of Concentration	0.330	65	0	65	0.215
CATCHMEN T_F9	GG_F8		Time of Concentration	0.168	65	0	65	0.109
CATCHMEN T_F10	MH_CF18		Time of Concentration	0.481	65	0	65	0.313
CATCHMEN T_F11	MH_CF7		Time of Concentration	0.216	65	0	65	0.140
CATCHMEN T_G1	MH_CG34		Time of Concentration	1.525	65	0	65	0.991
CATCHMEN T_G2	GG_G5 (1)		Time of Concentration	1.236	65	0	65	0.803
CATCHMEN T_G3	MH_CG32		Time of Concentration	0.698	65	0	65	0.454
CATCHMEN T_G4	GG_G5		Time of Concentration	1.923	50	0	50	0.961
CATCHMEN T_G5	GG_G6		Time of Concentration	1.090	50	0	50	0.545
CATCHMEN T_H1	MH_CG36		Time of Concentration	1.540	30	0	30	0.462
CATCHMEN T_H2	GG_H2		Time of Concentration	2.416	65	0	65	1.570
CATCHMEN T_H3	MH_C39a		Time of Concentration	1.463	65	0	65	0.951
CATCHMEN T_H4	GG_H4		Time of Concentration	1.024	65	0	65	0.666
CATCHMEN T_H5	GG_H5		Time of Concentration	1.739	65	0	65	1.130
CATCHMEN T_H6	MH_CH48		Time of Concentration	1.191	65	0	65	0.774
F_ROAD_1	MH_CF17		Time of Concentration	0.234	100	0	100	0.234
F_ROAD_2	MH_CF11		Time of Concentration	0.342	100	0	100	0.342
F_ROAD_3	MH_CF4		Time of Concentration	0.161	100	0	100	0.161
F_ROAD_4	MH_CF2		Time of Concentration	0.096	100	0	100	0.096
G_ROAD_1	MH_CG22		Time of Concentration	0.260	100	0	100	0.260
G_ROAD_2	MH_CG34		Time of Concentration	0.237	100	0	100	0.237
H_ROAD_1	MH_CG36		Time of Concentration	0.352	100	0	100	0.352
H_ROAD_2	MH_CH37		Time of Concentration	0.284	100	0	100	0.284
H_ROAD_3	MH_CH42		Time of Concentration	0.306	100	0	100	0.306
RC_E1	MH_CE03		Time of Concentration	0.667	65	0	65	0.433
RC_E2	MH_CE02		Time of Concentration	0.324	65	0	65	0.210

5018551 : Main Road SW Infodrainage Calcs P03			Date: 26/02/2024				RIDGE	
			Designed by: BT	Checked by:	Approved By:			
Report Details: Type: Inflow Summary Storm Phase: Phase			Ridge:					
ROAD CATCHMEN T_E	MH_CE01		Time of Concentration	0.301	100	0	100	0.301
TOTAL		0.0		22.954				14.830

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
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Report Details: Type: Network Design Criteria Storm Phase: Phase	Ridge:			

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

FSR

Type: FSR

Return Period (years)	100.0
Region	England And Wales
M5-60 (mm)	19.9
Ratio R	0.350

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:X)	500.00
Max. Slope (1:X)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Pipe Size Library

Default

Add. Increment (mm)	75
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Diameter (mm)	Min. Slope (1:X)	Max. Slope (1:X)
100	0.00	0.00
150	0.00	0.00

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Manhole Size Library

Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Additional Sizing

Connection (mm)	900
Diameter / Length (m)	0.900
Width (m)	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Access

Depth (m)	Ladder Protrusion (mm)
0.000	130
3.000	230

Benching Requirements

Landing Width (mm)	500
Benching Width (mm)	225

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Outfall Details Storm Phase: Phase	Ridge:			

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
OUTFALL_H	Free Discharge		
OUTFALL_F	Free Discharge		
OUTFALL_G	Free Discharge		
S33- (EXISTING)	Free Discharge		

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Ridge:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall	
FSR	Type: FSR
Region	England And Wales
M5-60 (mm)	19.9
Ratio R	0.350
Summer	☒
Winter	☒

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
100.0	0.000
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024		
	Designed by: BT	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:		

RIDGE



FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
F_ROAD_1	FSR: 1 years: +0 %: 15 mins: Winter	0.23	31.2	14.496
F_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.34	45.5	21.130
F_ROAD_3	FSR: 1 years: +0 %: 15 mins: Winter	0.16	21.4	9.948
F_ROAD_4	FSR: 1 years: +0 %: 15 mins: Winter	0.10	12.9	5.972
G_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.24	31.5	14.640
G_ROAD_1	FSR: 1 years: +0 %: 15 mins: Winter	0.26	34.7	16.084
H_ROAD_2	FSR: 1 years: +0 %: 15 mins: Winter	0.28	37.8	17.567
CATCHMENT_H4	FSR: 1 years: +0 %: 15 mins: Winter	1.02	88.7	41.189
CATCHMENT_H3	FSR: 1 years: +0 %: 15 mins: Winter	1.46	126.7	58.828
CATCHMENT_H2	FSR: 1 years: +0 %: 15 mins: Winter	2.42	209.3	97.148
CATCHMENT_H5	FSR: 1 years: +0 %: 15 mins: Winter	1.74	150.6	69.921
CATCHMENT_H6	FSR: 1 years: +0 %: 15 mins: Winter	1.19	103.1	47.871
CATCHMENT_H1	FSR: 1 years: +0 %: 15 mins: Winter	1.54	61.6	28.581
CATCHMENT_G5	FSR: 1 years: +0 %: 15 mins: Winter	1.09	72.6	33.714
CATCHMENT_G4	FSR: 1 years: +0 %: 15 mins: Winter	1.92	128.1	59.467
CATCHMENT_G2	FSR: 1 years: +0 %: 15 mins: Winter	1.24	107.0	49.684
CATCHMENT_G1	FSR: 1 years: +0 %: 15 mins: Winter	1.52	132.1	61.312
CATCHMENT_G3	FSR: 1 years: +0 %: 15 mins: Winter	0.70	60.5	28.069
CATCHMENT_F9	FSR: 1 years: +0 %: 15 mins: Winter	0.17	14.5	6.745
CATCHMENT_F8	FSR: 1 years: +0 %: 15 mins: Winter	0.33	28.6	13.282

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Report Details: Type: Inflows Summary Storm Phase: Phase		Ridge:			

CATCHME NT_F6	FSR: 1 years: +0 %: 15 mins: Winter	0.27	23.4	10.867
CATCHME NT_F3	FSR: 1 years: +0 %: 15 mins: Winter	0.45	39.4	18.268
CATCHME NT_F1	FSR: 1 years: +0 %: 15 mins: Winter	0.34	29.3	13.594
CATCHME NT_F10	FSR: 1 years: +0 %: 15 mins: Winter	0.48	41.7	19.347
CATCHME NT_F11	FSR: 1 years: +0 %: 15 mins: Winter	0.22	18.7	8.665
CATCHME NT_F2	FSR: 1 years: +0 %: 15 mins: Winter	0.29	25.0	11.610
CATCHME NT_F4	FSR: 1 years: +0 %: 15 mins: Winter	0.42	36.2	16.782
CATCHME NT_F5	FSR: 1 years: +0 %: 15 mins: Winter	0.32	27.5	12.743
CATCHME NT_F7	FSR: 1 years: +0 %: 15 mins: Winter	0.27	23.0	10.655
H_ROAD_ 1	FSR: 1 years: +0 %: 15 mins: Winter	0.35	47.0	21.801
H_ROAD_ 3	FSR: 1 years: +0 %: 15 mins: Winter	0.31	40.7	18.915
ROAD CATCHME NT E	FSR: 1 years: +0 %: 15 mins: Winter	0.30	40.1	18.631
RC_E1	FSR: 1 years: +0 %: 15 mins: Winter	0.67	57.8	26.813
RC_E2	FSR: 1 years: +0 %: 15 mins: Winter	0.32	28.0	13.013

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	Designed by: BT	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:		

RIDGE



FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
F_ROAD_1	FSR: 100 years: +45 %: 15 mins: Winter	0.23	144.1	66.778
F_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.34	210.0	97.344
F_ROAD_3	FSR: 100 years: +45 %: 15 mins: Winter	0.16	98.9	45.841
F_ROAD_4	FSR: 100 years: +45 %: 15 mins: Winter	0.10	59.3	27.497
G_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.24	145.5	67.446
G_ROAD_1	FSR: 100 years: +45 %: 15 mins: Winter	0.26	159.9	74.108
H_ROAD_2	FSR: 100 years: +45 %: 15 mins: Winter	0.28	174.6	80.931
CATCHMENT_H4	FSR: 100 years: +45 %: 15 mins: Winter	1.02	409.4	189.763
CATCHMENT_H3	FSR: 100 years: +45 %: 15 mins: Winter	1.46	584.7	271.030
CATCHMENT_H2	FSR: 100 years: +45 %: 15 mins: Winter	2.42	965.6	447.582
CATCHMENT_H5	FSR: 100 years: +45 %: 15 mins: Winter	1.74	695.0	322.135
CATCHMENT_H6	FSR: 100 years: +45 %: 15 mins: Winter	1.19	475.8	220.546
CATCHMENT_H1	FSR: 100 years: +45 %: 15 mins: Winter	1.54	284.1	131.688
CATCHMENT_G5	FSR: 100 years: +45 %: 15 mins: Winter	1.09	335.1	155.333
CATCHMENT_G4	FSR: 100 years: +45 %: 15 mins: Winter	1.92	591.1	273.977

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Report Details: Type: Inflows Summary Storm Phase: Phase	Ridge:			

CATCHME NT_G2	FSR: 100 years: +45 %: 15 mins: Winter	1.24	493.9	228.904
CATCHME NT_G1	FSR: 100 years: +45 %: 15 mins: Winter	1.52	609.5	282.488
CATCHME NT_G3	FSR: 100 years: +45 %: 15 mins: Winter	0.70	279.0	129.326
CATCHME NT_F9	FSR: 100 years: +45 %: 15 mins: Winter	0.17	67.0	31.064
CATCHME NT_F8	FSR: 100 years: +45 %: 15 mins: Winter	0.33	132.0	61.193
CATCHME NT_F6	FSR: 100 years: +45 %: 15 mins: Winter	0.27	108.0	50.059
CATCHME NT_F3	FSR: 100 years: +45 %: 15 mins: Winter	0.45	181.6	84.160
CATCHME NT_F1	FSR: 100 years: +45 %: 15 mins: Winter	0.34	135.1	62.632
CATCHME NT_F10	FSR: 100 years: +45 %: 15 mins: Winter	0.48	192.3	89.139
CATCHME NT_F11	FSR: 100 years: +45 %: 15 mins: Winter	0.22	86.2	39.935
CATCHME NT_F2	FSR: 100 years: +45 %: 15 mins: Winter	0.29	115.4	53.500
CATCHME NT_F4	FSR: 100 years: +45 %: 15 mins: Winter	0.42	166.8	77.331
CATCHME NT_F5	FSR: 100 years: +45 %: 15 mins: Winter	0.32	126.7	58.711
CATCHME NT_F7	FSR: 100 years: +45 %: 15 mins: Winter	0.27	105.9	49.099
H_ROAD_ 1	FSR: 100 years: +45 %: 15 mins: Winter	0.35	216.7	100.444
H_ROAD_ 3	FSR: 100 years: +45 %: 15 mins: Winter	0.31	188.0	87.143
ROAD CATCHME NT_E	FSR: 100 years: +45 %: 15 mins: Winter	0.30	185.2	85.848

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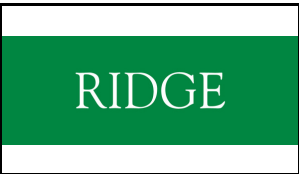
RC_E1	FSR: 100 years: +45 %: 15 mins: Winter	0.67	266.5	123.534
RC_E2	FSR: 100 years: +45 %: 15 mins: Winter	0.32	129.3	59.946

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Ridge:			



FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Outflow

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 1 years: +0 %: 15 mins: Winter	22.81 0	20.09 6	20.202	0.106	29.3	0.119	0.000	28.0	13.628	OK
MH_CF16	FSR: 1 years: +0 %: 15 mins: Winter	21.57 0	19.55 7	19.672	0.115	76.8	0.130	0.000	74.9	39.583	OK
MH_CF18	FSR: 1 years: +0 %: 15 mins: Winter	20.81 0	18.70 7	18.862	0.155	116.5	0.175	0.000	113.7	58.975	OK
MH_CF17	FSR: 1 years: +0 %: 15 mins: Winter	21.93 0	20.00 0	20.102	0.102	31.2	0.116	0.000	30.6	14.500	OK
MH_CF15	FSR: 1 years: +0 %: 15 mins: Winter	21.72 0	19.75 6	19.876	0.120	28.0	0.136	0.000	23.5	13.530	OK
MH_CF12	FSR: 1 years: +0 %: 15 mins: Winter	22.44 0	19.97 9	20.235	0.256	134.9	0.888	0.000	129.5	68.773	OK
MH_CF11	FSR: 1 years: +0 %: 15 mins: Winter	22.92 0	20.34 9	20.571	0.222	107.6	0.251	0.000	95.5	50.566	OK
MH_CF9	FSR: 1 years: +0 %: 15 mins: Winter	23.51 0	20.11 8	20.268	0.150	107.5	0.169	0.000	102.5	59.535	OK
MH_CF8	FSR: 1 years: +0 %: 15 mins: Winter	23.93 0	20.40 1	20.590	0.189	113.7	0.214	0.000	107.5	59.634	OK
MH_CF4	FSR: 1 years: +0 %: 15 mins: Winter	24.63 0	21.25 7	21.425	0.168	60.1	0.190	0.000	58.5	29.724	OK
MH_CF3	FSR: 1 years: +0 %: 15 mins: Winter	25.12 0	22.56 7	22.655	0.088	41.6	0.099	0.000	38.7	19.803	OK
MH_CF7	FSR: 1 years: +0 %: 15 mins: Winter	24.21 0	20.70 2	20.857	0.155	94.4	0.175	0.000	90.3	48.830	OK
MH_CF10	FSR: 1 years: +0 %: 15 mins: Winter	23.36 0	20.55 7	20.659	0.102	27.5	0.181	0.000	26.0	12.751	OK
MH_CG22	FSR: 1 years: +0 %: 15 mins: Winter	27.29 0	24.03 5	24.112	0.077	34.8	0.197	0.000	33.9	27.738	OK
MH_CG24	FSR: 1 years: +0 %: 30 mins: Winter	26.87 0	23.37 2	23.492	0.120	32.0	0.136	0.000	31.4	49.167	OK
MH_CG28	FSR: 1 years: +0 %: 30 mins: Winter	26.05 0	22.47 2	22.602	0.130	55.1	0.147	0.000	54.8	105.461	OK
MH_CG34	FSR: 1 years: +0 %: 15 mins: Winter	25.47 0	21.31 3	21.597	0.284	236.5	0.321	0.000	220.1	156.857	OK
MH_CG35	FSR: 1 years: +0 %: 15 mins: Winter	24.93 0	20.95 6	21.206	0.250	220.1	0.282	0.000	210.3	155.477	OK
MH_CG36	FSR: 1 years: +0 %: 15 mins: Winter	27.46 0	24.56 0	24.759	0.199	108.5	0.506	0.000	103.3	50.442	OK
MH_CG37	FSR: 1 years: +0 %: 15 mins: Winter	27.18 0	24.00 0	24.157	0.157	103.3	0.177	0.000	95.8	50.332	OK
MH_CG39	FSR: 1 years: +0 %: 15 mins: Winter	26.40 0	23.00 0	23.200	0.200	88.2	0.227	0.000	85.1	50.204	OK
MH_CG41	FSR: 1 years: +0 %: 15 mins: Winter	25.92 0	22.78 1	22.913	0.132	81.9	0.149	0.000	77.8	50.120	OK
MH_CH38	FSR: 1 years: +0 %: 15 mins: Winter	25.30 0	23.19 6	23.253	0.057	36.2	0.065	0.000	34.9	31.471	OK
MH_CH42	FSR: 1 years: +0 %: 15 mins: Winter	22.77 0	19.97 1	20.079	0.108	40.8	0.122	0.000	38.5	20.987	OK
MH_CH43	FSR: 1 years: +0 %: 15 mins: Summer	21.77 0	20.14 8	20.148	0.000	0.0	0.000	0.000	0.0	0.000	OK
MH_CH40	FSR: 1 years: +0 %: 15 mins: Winter	24.58 0	19.43 3	19.664	0.230	193.5	0.586	0.000	179.6	109.600	OK
MH_CH47	FSR: 1 years: +0 %: 15 mins: Winter	22.99 0	18.92 1	19.120	0.199	172.4	0.225	0.000	158.4	116.569	OK
OUTFALL_H	FSR: 1 years: +0 %: 960 mins: Winter	17.86 2	16.66 2	16.873	0.211	37.7	0.239	0.000	37.7	1494.411	OK
OUTFALL_F	FSR: 1 years: +0 %: 960 mins: Winter	17.77 0	16.57 0	16.688	0.118	10.0	0.133	0.000	10.0	567.985	OK
OUTFALL_G	FSR: 1 years: +0 %: 960 mins: Winter	20.56 3	19.36 3	19.564	0.201	28.1	0.228	0.000	28.1	1024.900	OK

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Report Details: Type: Junctions Summary Storm Phase: Phase				BT							
				Ridge:							

MH_CH50	FSR: 1 years: +0 %: 30 mins: Winter	20.83 0	18.03 6	18.287	0.251	290.9	0.284	0.000	290.6	318.126	OK
MH_CH36	FSR: 1 years: +0 %: 240 mins: Winter	25.71 0	23.75 0	24.213	0.463	19.5	0.524	0.000	16.0	243.456	OK
MH_CH37	FSR: 1 years: +0 %: 15 mins: Winter	25.77 0	23.68 1	23.781	0.100	38.2	0.255	0.000	36.2	31.878	OK
MH_CH41	FSR: 1 years: +0 %: 240 mins: Winter	22.61 0	20.18 8	20.417	0.229	7.1	0.259	0.000	6.6	90.239	OK
MH_CH31	FSR: 1 years: +0 %: 240 mins: Winter	22.43 0	19.47 0	19.727	0.257	9.2	0.290	0.000	9.1	176.079	OK
MH_CG19	FSR: 1 years: +0 %: 60 mins: Winter	27.58 0	25.05 4	25.466	0.411	16.8	0.465	0.000	11.8	50.007	OK
MH_CG20	FSR: 1 years: +0 %: 60 mins: Winter	27.43 0	24.60 0	24.660	0.060	11.8	0.068	0.000	11.8	49.804	OK
MH_CG29	FSR: 1 years: +0 %: 60 mins: Winter	25.61 9	23.11 9	24.438	1.319	23.8	1.492	0.000	25.3	90.767	Surcharged
MH_CF2	FSR: 1 years: +0 %: 15 mins: Winter	26.21 0	23.45 3	23.496	0.043	13.3	0.049	0.000	13.0	6.596	OK
MH_CF1	FSR: 1 years: +0 %: 360 mins: Winter	26.15 0	23.54 5	24.141	0.596	1.3	0.674	0.000	0.6	20.217	Surcharged
MH_CG32	FSR: 1 years: +0 %: 30 mins: Winter	25.97 0	21.53 0	21.711	0.181	94.9	0.888	0.000	92.4	154.110	OK
MH_CF13	FSR: 1 years: +0 %: 1440 mins: Winter	21.72 0	19.53 6	19.910	0.374	4.3	0.423	0.000	4.3	621.306	OK
MH_CH45	FSR: 1 years: +0 %: 15 mins: Winter	23.77 0	19.70 2	19.801	0.099	38.5	0.175	0.000	35.7	20.701	OK
MH_CG30	FSR: 1 years: +0 %: 30 mins: Winter	25.99 0	22.28 9	22.439	0.150	54.8	0.382	0.000	53.4	104.519	OK
MH_CG27	FSR: 1 years: +0 %: 30 mins: Winter	26.16 0	22.86 0	22.942	0.082	30.4	0.093	0.000	29.9	48.341	OK
MH_CG26	FSR: 1 years: +0 %: 30 mins: Winter	26.44 0	23.11 3	23.213	0.100	31.0	0.113	0.000	30.4	48.624	OK
MH_CH49	FSR: 1 years: +0 %: 30 mins: Winter	21.51 2	18.22 7	18.525	0.298	291.4	0.338	0.000	290.9	318.643	OK
MH_CH46	FSR: 1 years: +0 %: 15 mins: Winter	23.07 0	19.10 5	19.331	0.226	179.6	0.256	0.000	168.9	108.713	OK
MH_CH48	FSR: 1 years: +0 %: 15 mins: Winter	22.65 0	18.47 8	18.792	0.314	335.5	1.089	0.000	297.2	212.419	OK
MH_CG42	FSR: 1 years: +0 %: 15 mins: Winter	24.23 0	21.62 4	21.714	0.090	77.8	0.102	0.000	74.0	49.996	OK
MH_CG31	FSR: 1 years: +0 %: 15 mins: Winter	26.08 0	22.16 3	22.311	0.148	50.7	0.168	0.000	53.0	50.218	OK
MH_CG33	FSR: 1 years: +0 %: 240 mins: Winter	25.84 0	24.21 8	24.470	0.252	6.7	0.285	0.000	6.4	118.839	OK
MH_CF6	FSR: 1 years: +0 %: 15 mins: Winter	24.31 0	21.08 9	21.194	0.105	55.4	0.119	0.000	52.7	29.546	OK
MH_CF5	FSR: 1 years: +0 %: 15 mins: Winter	24.48 0	21.18 9	21.343	0.154	58.5	0.174	0.000	55.4	29.646	OK
MH_CG25	FSR: 1 years: +0 %: 30 mins: Winter	26.64 0	23.29 8	23.393	0.095	31.4	0.107	0.000	31.0	48.937	OK
MH_CG23	FSR: 1 years: +0 %: 15 mins: Winter	27.11 0	23.49 9	23.617	0.118	33.9	0.134	0.000	32.2	27.335	OK
MH_CG21	FSR: 1 years: +0 %: 60 mins: Winter	27.39 0	24.42 4	24.474	0.050	11.8	0.056	0.000	11.8	49.721	OK
MH_CG40	FSR: 1 years: +0 %: 15 mins: Winter	26.26 0	22.90 0	23.090	0.190	85.1	0.215	0.000	81.9	50.161	OK
MH_CG38	FSR: 1 years: +0 %: 15 mins: Winter	26.51 0	23.11 0	23.313	0.203	95.8	0.230	0.000	88.2	50.237	OK
MH_CH39	FSR: 1 years: +0 %: 15 mins: Winter	24.97 0	21.28 5	21.400	0.115	159.8	0.130	0.000	157.8	90.105	OK
MH_CH44	FSR: 1 years: +0 %: 15 mins: Summer	22.24 0	20.11 5	20.115	0.000	0.0	0.000	0.000	0.0	0.000	OK
MH_CF16a	FSR: 1 years: +0 %: 15 mins: Winter	21.43 0	19.78 9	19.924	0.135	55.2	0.153	0.000	53.4	26.106	OK
MH_F2	FSR: 1 years: +0 %: 15 mins: Winter	21.83 9	20.03 9	20.125	0.085	25.0	0.096	0.000	24.6	11.614	OK
MH_C39a	FSR: 1 years: +0 %: 15 mins: Winter	26.09 5	24.09 5	24.283	0.188	126.7	0.213	0.000	124.9	58.836	OK
S33-(EXISTING)	FSR: 1 years: +0 %: 15 mins: Winter	19.22 6	15.59 8	15.735	0.137	116.3	0.000	0.000	116.7	58.414	OK

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MH_CE01	FSR: 1 years: +0 %: 15 mins: Winter	21.42 9	19.42 9	19.505	0.076	40.1	0.086	0.000	39.4	18.644	OK		
MH_CE03	FSR: 1 years: +0 %: 15 mins: Winter	20.01 3	17.21 3	17.359	0.147	122.7	0.166	0.000	119.2	58.445	OK		
MH_CE04	FSR: 1 years: +0 %: 15 mins: Winter	19.12 2	16.12 2	16.274	0.152	119.2	0.172	0.000	116.3	58.414	OK		
MH_CE02	FSR: 1 years: +0 %: 15 mins: Winter	20.81 9	18.01 9	18.133	0.113	67.5	0.128	0.000	64.9	31.625	OK		

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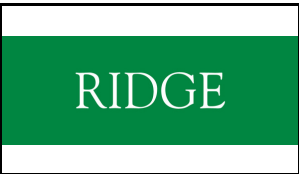


FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Outflow

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH_CF14	FSR: 100 years: +45 %: 15 mins: Winter	22.810	20.096	20.368	0.272	135.1	0.307	0.000	130.5	62.656	OK
MH_CF16	FSR: 100 years: +45 %: 15 mins: Winter	21.570	19.557	19.856	0.299	344.3	0.338	0.000	340.2	182.737	OK
MH_CF18	FSR: 100 years: +45 %: 15 mins: Winter	20.810	18.707	19.125	0.418	532.6	0.473	0.000	521.8	272.043	OK
MH_CF17	FSR: 100 years: +45 %: 15 mins: Summer	21.930	20.000	20.281	0.281	137.0	0.318	0.000	131.6	59.630	OK
MH_CF15	FSR: 100 years: +45 %: 15 mins: Winter	21.720	19.756	20.078	0.322	130.5	0.364	0.000	116.0	62.533	OK
MH_CF12	FSR: 100 years: +45 %: 15 mins: Winter	22.440	19.979	20.773	0.794	661.0	2.752	0.000	653.0	317.033	Surcharged
MH_CF11	FSR: 100 years: +45 %: 15 mins: Winter	22.920	20.349	22.016	1.667	489.4	1.885	0.000	479.5	233.217	Surcharged
MH_CF9	FSR: 100 years: +45 %: 15 mins: Winter	23.510	20.118	20.509	0.391	521.3	0.443	0.000	505.8	273.405	OK
MH_CF8	FSR: 100 years: +45 %: 15 mins: Winter	23.930	20.401	20.906	0.504	543.3	0.570	0.000	521.3	273.818	OK
MH_CF4	FSR: 100 years: +45 %: 15 mins: Winter	24.630	21.257	21.671	0.414	285.3	0.468	0.000	277.2	135.131	OK
MH_CF3	FSR: 100 years: +45 %: 15 mins: Winter	25.120	22.567	22.767	0.200	191.2	0.226	0.000	186.4	89.341	OK
MH_CF7	FSR: 100 years: +45 %: 15 mins: Winter	24.210	20.702	21.133	0.431	451.1	0.488	0.000	435.3	223.854	OK
MH_CF10	FSR: 100 years: +45 %: 15 mins: Winter	23.360	20.557	22.091	1.534	126.7	2.710	0.000	112.6	58.793	Surcharged
MH_CG22	FSR: 100 years: +45 %: 15 mins: Winter	27.290	24.035	24.234	0.199	172.0	0.507	0.000	168.4	90.155	OK
MH_CG24	FSR: 100 years: +45 %: 15 mins: Winter	26.870	23.372	23.674	0.302	162.5	0.341	0.000	157.6	89.273	OK
MH_CG28	FSR: 100 years: +45 %: 15 mins: Summer	26.050	22.472	22.707	0.235	156.0	0.265	0.000	160.1	109.556	OK
MH_CG34	FSR: 100 years: +45 %: 15 mins: Winter	25.470	21.313	22.856	1.543	920.2	1.745	0.000	918.6	601.471	Surcharged
MH_CG35	FSR: 100 years: +45 %: 15 mins: Winter	24.930	20.956	21.650	0.694	918.6	0.785	0.000	913.8	600.526	Surcharged
MH_CG36	FSR: 100 years: +45 %: 15 mins: Winter	27.460	24.560	27.202	2.642	500.8	6.724	0.000	440.4	231.136	Flood Risk
MH_CG37	FSR: 100 years: +45 %: 15 mins: Winter	27.180	24.000	25.781	1.781	440.4	2.014	0.000	418.6	231.788	Surcharged

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MH_CG39	FSR: 100 years: +45 %: 15 mins: Winter	26.40 0	23.00 0	24.104	1.104	407.8	1.248	0.000	400.9	232.113	Surcharged
MH_CG41	FSR: 100 years: +45 %: 15 mins: Winter	25.92 0	22.78 1	23.132	0.351	396.2	0.397	0.000	378.8	232.056	OK
MH_CH38	FSR: 100 years: +45 %: 15 mins: Winter	25.30 0	23.19 6	23.324	0.128	184.3	0.145	0.000	181.0	101.706	OK
MH_CH42	FSR: 100 years: +45 %: 15 mins: Winter	22.77 0	19.97 1	20.214	0.243	192.2	0.275	0.000	176.0	114.395	OK
MH_CH43	FSR: 100 years: +45 %: 15 mins: Winter	21.77 0	20.14 8	20.232	0.084	0.4	0.095	0.000	11.0	3.893	OK
MH_CH40	FSR: 100 years: +45 %: 15 mins: Summer	24.58 0	19.43 3	20.067	0.633	836.1	1.612	0.000	651.2	423.759	OK
MH_CH47	FSR: 100 years: +45 %: 15 mins: Summer	22.99 0	18.92 1	19.979	1.058	651.3	1.196	0.000	683.3	428.315	Surcharged
OUTFALL_H	FSR: 100 years: +45 %: 960 mins: Summer	17.86 2	16.66 2	17.145	0.483	70.7	0.546	0.000	70.7	5273.003	OK
OUTFALL_F	FSR: 100 years: +45 %: 360 mins: Winter	17.77 0	16.57 0	16.940	0.370	26.9	0.419	0.000	26.9	745.944	OK
OUTFALL_G	FSR: 100 years: +45 %: 120 mins: Summer	20.56 3	19.36 3	19.781	0.418	41.5	0.473	0.000	41.4	456.310	OK
MH_CH50	FSR: 100 years: +45 %: 15 mins: Winter	20.83 0	18.03 6	18.645	0.609	1333.7	0.689	0.000	1293.8	919.625	OK
MH_CH36	FSR: 100 years: +45 %: 60 mins: Summer	25.71 0	23.75 0	24.575	0.825	22.2	0.933	0.000	17.0	103.412	Surcharged
MH_CH37	FSR: 100 years: +45 %: 15 mins: Winter	25.77 0	23.68 1	23.912	0.231	189.7	0.589	0.000	184.3	102.352	OK
MH_CH41	FSR: 100 years: +45 %: 240 mins: Winter	22.61 0	20.18 8	20.717	0.529	8.5	0.598	0.000	7.7	190.289	Surcharged
MH_CH31	FSR: 100 years: +45 %: 960 mins: Winter	22.43 0	19.47 0	20.312	0.842	11.3	0.952	0.000	10.7	1080.915	Surcharged
MH_CG19	FSR: 100 years: +45 %: 15 mins: Summer	27.58 0	25.05 4	25.756	0.702	12.6	0.794	0.000	12.4	17.299	Surcharged
MH_CG20	FSR: 100 years: +45 %: 120 mins: Winter	27.43 0	24.60 0	24.661	0.061	12.4	0.070	0.000	12.5	156.114	OK
MH_CG29	FSR: 100 years: +45 %: 960 mins: Summer	25.61 9	23.11 9	24.756	1.637	27.0	1.851	0.000	25.3	860.745	Surcharged
MH_CF2	FSR: 100 years: +45 %: 15 mins: Winter	26.21 0	23.45 3	23.543	0.090	59.9	0.102	0.000	59.2	28.354	OK
MH_CF1	FSR: 100 years: +45 %: 480 mins: Winter	26.15 0	23.54 5	24.766	1.221	1.2	1.380	0.000	0.8	38.330	Surcharged
MH_CG32	FSR: 100 years: +45 %: 15 mins: Winter	25.97 0	21.53 0	22.882	1.352	326.3	6.635	0.000	429.8	258.280	Surcharged
MH_CF13	FSR: 100 years: +45 %: 15 mins: Summer	21.72 0	19.53 6	19.982	0.446	5.8	0.505	0.000	4.3	5.255	OK
MH_CH45	FSR: 100 years: +45 %: 15 mins: Winter	23.77 0	19.70 2	20.239	0.537	318.9	0.949	0.000	259.6	109.937	OK

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				Ridge:							

MH_CG30	FSR: 100 years: +45 %: 15 mins: Winter	25.99 0	22.28 9	22.934	0.644	114.6	1.639	0.000	162.5	120.001	Surcharged
MH_CG27	FSR: 100 years: +45 %: 15 mins: Winter	26.16 0	22.86 0	23.061	0.201	149.2	0.227	0.000	144.5	88.501	OK
MH_CG26	FSR: 100 years: +45 %: 15 mins: Winter	26.44 0	23.11 3	23.356	0.243	153.9	0.275	0.000	149.2	88.817	OK
MH_CH49	FSR: 100 years: +45 %: 15 mins: Winter	21.51 2	18.22 7	19.347	1.120	1337.6	1.267	0.000	1333.7	919.945	Surcharged
MH_CH46	FSR: 100 years: +45 %: 15 mins: Summer	23.07 0	19.10 5	20.120	1.016	651.2	1.149	0.000	638.2	416.966	Surcharged
MH_CH48	FSR: 100 years: +45 %: 15 mins: Winter	22.65 0	18.47 8	20.048	1.570	1356.4	5.439	0.000	1337.6	921.147	Surcharged
MH_CG42	FSR: 100 years: +45 %: 15 mins: Winter	24.23 0	21.62 4	21.836	0.213	378.8	0.241	0.000	366.2	231.733	OK
MH_CG31	FSR: 100 years: +45 %: 15 mins: Winter	26.08 0	22.16 3	22.969	0.806	162.5	0.912	0.000	242.3	124.551	Surcharged
MH_CG33	FSR: 100 years: +45 %: 30 mins: Winter	25.84 0	24.21 8	24.736	0.518	8.0	0.586	0.000	7.1	20.907	Surcharged
MH_CF6	FSR: 100 years: +45 %: 15 mins: Winter	24.31 0	21.08 9	21.359	0.270	267.7	0.306	0.000	259.0	134.866	OK
MH_CF5	FSR: 100 years: +45 %: 15 mins: Winter	24.48 0	21.18 9	21.550	0.361	277.2	0.408	0.000	267.7	135.021	OK
MH_CG25	FSR: 100 years: +45 %: 15 mins: Winter	26.64 0	23.29 8	23.544	0.246	157.6	0.278	0.000	153.9	89.013	OK
MH_CG23	FSR: 100 years: +45 %: 15 mins: Winter	27.11 0	23.49 9	23.815	0.316	168.4	0.358	0.000	162.5	89.720	OK
MH_CG21	FSR: 100 years: +45 %: 120 mins: Winter	27.39 0	24.42 4	24.475	0.051	12.5	0.058	0.000	12.5	155.873	OK
MH_CG40	FSR: 100 years: +45 %: 15 mins: Winter	26.26 0	22.90 0	23.711	0.811	400.9	0.917	0.000	396.2	232.076	Surcharged
MH_CG38	FSR: 100 years: +45 %: 15 mins: Winter	26.51 0	23.11 0	24.508	1.398	418.6	1.581	0.000	407.8	232.127	Surcharged
MH_CH39	FSR: 100 years: +45 %: 15 mins: Winter	24.97 0	21.28 5	21.544	0.259	756.5	0.293	0.000	754.8	372.116	OK
MH_CH44	FSR: 100 years: +45 %: 15 mins: Winter	22.24 0	20.11 5	20.229	0.113	11.0	0.128	0.000	36.3	14.010	OK
MH_CF16a	FSR: 100 years: +45 %: 15 mins: Winter	21.43 0	19.78 9	20.279	0.490	234.9	0.554	0.000	228.2	120.282	Surcharged
MH_F2	FSR: 100 years: +45 %: 15 mins: Winter	21.83 9	20.03 9	20.459	0.420	115.4	0.475	0.000	109.5	53.497	Surcharged
MH_C39a	FSR: 100 years: +45 %: 15 mins: Winter	26.09 5	24.09 5	25.870	1.775	584.7	2.008	0.000	575.4	271.051	Flood Risk
S33- (EXISTING)	FSR: 100 years: +45 %: 15 mins: Winter	19.22 6	15.59 8	15.926	0.328	511.6	0.000	0.000	511.6	269.421	OK
MH_CE01	FSR: 100 years: +45 %: 15 mins: Winter	21.42 9	19.42 9	19.595	0.167	185.2	0.189	0.000	183.1	85.870	OK

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MH_CE03	FSR: 100 years: +45 %: 15 mins: Winter	20.01 3	17.21 3	17.855	0.642	604.9	0.727	0.000	527.2	268.999	Surcharged
MH_CE04	FSR: 100 years: +45 %: 15 mins: Winter	19.12 2	16.12 2	16.615	0.493	527.2	0.557	0.000	511.6	269.421	Surcharged
MH_CE02	FSR: 100 years: +45 %: 15 mins: Winter	20.81 9	18.01 9	18.308	0.288	312.4	0.326	0.000	338.4	145.562	OK

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		Designed by: BT	Checked by:		Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase		Ridge:			



**FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max.
Avg. Depth**

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 1 years: +0 %: 960 mins: Winter	17.973	17.973	0.160	0.160	15.2	183.363	0.000	10.0	568.307	244	81.626	OK
Swale	FSR: 1 years: +0 %: 1440 mins: Winter	19.910	19.910	0.081	0.349	18.8	390.253	0.000	4.3	621.526	791	84.655	OK
POND_G	FSR: 1 years: +0 %: 960 mins: Winter	20.992	20.992	0.260	0.260	45.7	503.269	0.000	28.1	1025.081	235	78.508	OK
POND H	FSR: 1 years: +0 %: 960 mins: Winter	17.936	17.936	0.280	0.280	65.5	831.391	0.000	37.7	1494.715	296	80.130	OK
GG_H2	FSR: 1 years: +0 %: 240 mins: Winter	24.216	24.216	0.116	0.116	47.1	154.047	0.000	19.5	243.870	82	85.572	OK
GG_H4	FSR: 1 years: +0 %: 240 mins: Winter	20.422	20.422	0.067	0.067	20.0	73.778	0.000	7.1	90.558	137	83.238	OK
GG_H5	FSR: 1 years: +0 %: 240 mins: Winter	19.728	19.728	0.128	0.128	33.9	120.414	0.000	9.2	176.220	124	84.015	OK
GG_G6	FSR: 1 years: +0 %: 60 mins: Winter	25.469	25.469	0.109	0.109	37.5	34.018	0.000	16.8	50.505	32	86.517	OK
GG_G5	FSR: 1 years: +0 %: 60 mins: Winter	24.457	24.457	0.097	0.097	66.1	58.327	0.000	23.8	90.975	36	87.885	OK
GG_F8	FSR: 1 years: +0 %: 360 mins: Winter	24.141	24.141	0.121	0.121	2.5	12.080	0.000	1.3	20.282	114	85.014	OK
GG_G5 (1)	FSR: 1 years: +0 %: 240 mins: Winter	24.473	24.473	0.113	0.113	24.1	88.441	0.000	6.7	119.019	111	85.924	OK

5018551 : Main Road SW Infodrainage Calcs P03		Date: 26/02/2024			
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Report Details: Type: Stormwater Controls Summary Storm Phase: Phase		Ridge:			



FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By:
Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Pond_F	FSR: 100 years: +45 %: 360 mins: Winter	18.228	18.228	0.415	0.415	93.1	529.038	0.000	26.9	746.491	208	46.989	OK
Swale	FSR: 100 years: +45 %: 1440 mins: Winter	20.784	20.784	0.955	1.223	66.6	1977.958	0.000	5.4	660.572	3519	22.223	OK
POND_G	FSR: 100 years: +45 %: 960 mins: Winter	21.656	21.656	0.924	0.924	126.8	2128.422	0.000	41.5	3790.386	437	9.105	OK
POND H	FSR: 100 years: +45 %: 960 mins: Winter	18.364	18.364	0.709	0.709	173.0	2270.180	0.000	70.7	5799.208	293	45.745	OK
GG_H2	FSR: 100 years: +45 %: 360 mins: Winter	24.814	24.814	0.714	0.714	146.3	951.143	0.000	18.1	671.607	476	10.915	OK
GG_H4	FSR: 100 years: +45 %: 360 mins: Winter	20.726	20.726	0.371	0.371	62.0	406.546	0.000	8.0	291.164	440	7.637	OK
GG_H5	FSR: 100 years: +45 %: 480 mins: Winter	20.365	20.365	0.765	0.765	84.9	719.104	0.000	10.8	556.687	575	4.536	OK
GG_G6	FSR: 100 years: +45 %: 120 mins: Winter	27.209	27.209	1.849	1.849	112.8	251.906	0.000	15.2	162.044	161	0.154	OK
GG_G5	FSR: 100 years: +45 %: 120 mins: Winter	25.098	25.098	0.738	0.738	199.0	443.439	0.000	27.4	292.522	168	7.894	OK
GG_F8	FSR: 100 years: +45 %: 480 mins: Winter	24.766	24.766	0.746	0.746	8.2	74.431	0.000	1.2	39.799	677	7.659	OK
GG_G5 (1)	FSR: 100 years: +45 %: 480 mins: Winter	25.026	25.026	0.666	0.666	60.3	522.218	0.000	7.2	368.461	627	16.886	OK

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	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Connections Summary Storm Phase: Phase	Ridge:			



FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF14	MH_CF15	22.810	20.202	0.113	13.628	1.0	0.17	28.0	OK
SW3.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF15	MH_CF16	21.720	19.876	0.114	13.530	0.8	0.2	23.5	OK
SW3.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF16	MH_CF18	21.570	19.672	0.135	39.583	1.9	0.14	74.9	OK
SW3.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF18	Pond_F	20.810	18.862	0.101	58.975	4.2	0.19	113.7	OK
SW2.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF12	Swale	22.440	20.235	0.243	68.773	1.2	0.31	129.5	OK
SW1.009	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF9	Swale	23.510	20.268	0.141	59.535	2.0	0.11	102.5	OK
SW2.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF11	MH_CF12	22.920	20.571	0.214	50.566	1.3	0.43	95.5	OK
SW1.008	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF8	MH_CF9	23.930	20.590	0.169	59.634	1.6	0.19	107.5	OK
SW1.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF3	MH_CF4	25.120	22.655	0.087	19.803	1.8	0.08	38.7	OK
SW1.007	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF7	MH_CF8	24.210	20.857	0.172	48.830	1.4	0.13	90.3	OK
SW2.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF10	MH_CF11	23.360	20.659	0.162	12.751	0.5	0.12	26.0	OK
SW5.014	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG34	MH_CG35	25.470	21.597	0.267	156.857	1.8	0.39	220.1	OK
SW5.015	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG35	POND_G	24.930	21.206	0.149	155.477	3.8	0.31	210.3	OK
SW8.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG36	MH_CG37	27.460	24.759	0.178	50.442	1.8	0.36	103.3	OK
SW 9.011	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	POND H	OUTFALL_H	19.472	17.936	0.140	1494.658	0.7	0.02	37.7	OK
SW1.012	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	Pond_F	OUTFALL_F	19.119	17.973	0.080	568.250	0.7	0.04	10.0	OK
SW5.016	FSR: 1 years: +0 %: 960 mins: Winter	Pipe	POND_G	OUTFALL_G	22.178	20.992	0.130	1025.049	0.7	0.03	28.1	OK
SW 9.010	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CH50	POND H	20.830	18.287	0.163	318.126	4.1	0.19	290.6	OK
SW9.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH37	MH_CH38	25.770	23.781	0.079	31.867	1.6	0.05	36.2	OK

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SW9.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.213	0.078	243.428	0.9	0.03	16.0	OK
SW9.000	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	GG_H2	MH_CH 36	27.826	24.183	0.256	42.694	0.4	0.04	26.4	OK
SW10.000	FSR: 1 years: +0 %: 120 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.417	0.143	54.864	0.2	0.04	7.8	OK
SW 12.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 31	MH_CH 47	22.430	19.727	0.087	176.044	0.8	0.02	9.1	OK
SW 12.000	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	19.728	0.192	176.220	0.3	0.02	9.2	OK
SW5.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	GG_G6	MH_CG 19	27.877	25.440	0.227	16.049	0.5	0.08	20.9	OK
SW5.001	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.466	0.059	49.936	1.0	0.04	11.8	OK
SW6.000	FSR: 1 years: +0 %: 60 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.448	0.300	80.792	0.6	0.13	36.7	OK
SW6.001	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 29	MH_CG 28	25.619	24.438	0.090	90.745	1.7	0.08	25.3	Surcharged
SW1.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.496	0.065	6.596	0.9	0.02	13.0	OK
SW1.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	GG_F8	MH_CF1	26.085	24.076	0.141	1.512	0.5	0.26	3.8	OK
SW1.001	FSR: 1 years: +0 %: 360 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.141	0.017	20.203	0.5	0	0.6	Surcharged
SW5.013	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	21.711	0.222	154.110	1.1	0.19	92.4	OK
SW1.010	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	Swale	MH_CF1 3	21.381	19.622	0.177	3.995	0.1	0.03	4.7	OK
SW1.011	FSR: 1 years: +0 %: 1440 mins: Winter	Pipe	MH_CF 13	Pond_F	21.720	19.910	0.093	621.206	0.7	0.01	4.3	OK
SW10.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.079	0.104	20.987	1.2	0.07	38.5	OK
SW5.010	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 28	MH_CG 30	26.050	22.602	0.140	105.461	1.1	0.09	54.8	OK
SW5.009	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	22.942	0.079	48.341	1.6	0.06	29.9	OK
SW5.008	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.213	0.091	48.624	1.3	0.1	30.4	OK
SW10.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	19.801	0.165	20.701	0.6	0.06	35.7	OK
SW 9.009	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	18.525	0.275	318.643	2.0	0.29	290.9	OK
SW9.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 40	MH_CH 46	24.580	19.664	0.228	109.600	1.6	0.18	179.6	OK
SW9.006	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 46	MH_CH 47	23.070	19.331	0.213	108.713	1.6	0.17	168.9	OK

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SW10.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.417	0.053	90.212	0.8	0.02	6.6	OK
SW 9.007	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 47	MH_CH 48	22.990	19.120	0.257	116.569	1.2	0.16	158.4	OK
SW 9.008	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	18.792	0.306	212.419	1.7	0.29	297.2	OK
SW8.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	22.913	0.111	50.120	2.5	0.16	77.8	OK
SW8.006	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.714	0.202	49.996	1.1	0.09	74.0	OK
SW5.011	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 30	MH_CG 31	25.990	22.439	0.148	104.519	1.0	0.12	53.4	OK
SW5.012	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.311	0.146	50.218	1.0	0.13	53.0	OK
SW7.000	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.452	0.161	34.404	0.3	0.09	8.1	OK
SW7.001	FSR: 1 years: +0 %: 240 mins: Winter	Pipe	MH_CG 33	MH_CG 32	25.840	24.470	0.087	118.824	1.2	0.01	6.4	OK
SW1.006	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.194	0.130	29.546	1.2	0.07	52.7	OK
SW1.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.425	0.161	29.724	1.0	0.15	58.5	OK
SW1.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.343	0.129	29.646	1.2	0.14	55.4	OK
SW5.006	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.492	0.107	49.167	1.1	0.15	31.4	OK
SW5.007	FSR: 1 years: +0 %: 30 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.393	0.097	48.937	1.2	0.09	31.0	OK
SW5.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.112	0.098	27.738	1.3	0.07	33.9	OK
SW5.005	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.617	0.119	27.335	1.0	0.13	32.2	OK
SW5.002	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.660	0.055	49.804	1.1	0.03	11.8	OK
SW5.003	FSR: 1 years: +0 %: 60 mins: Winter	Pipe	MH_CG 21	MH_CG 22	27.390	24.474	0.059	49.721	1.3	0.02	11.8	OK
SW8.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	23.200	0.195	50.204	1.3	0.32	85.1	OK
SW8.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.090	0.161	50.161	1.6	0.34	81.9	OK
SW8.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 37	MH_CG 38	27.180	24.157	0.180	50.332	1.6	0.26	95.8	OK
SW8.002	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	23.313	0.202	50.237	1.3	0.32	88.2	OK
SW9.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.253	0.086	31.471	2.0	0.02	34.9	OK

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SW9.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.400	0.173	90.105	2.3	0.08	157.8	OK
SW11.000	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	MH_CH 43	MH_CH 44	21.770	20.148	0.000	0.000	0.0	0	0.0	OK
SW11.001	FSR: 1 years: +0 %: 15 mins: Summer	Pipe	MH_CH 44	MH_CH 42	22.240	20.115	0.053	0.000	0.0	0	0.0	OK
SW4.000a	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 17	MH_CF1 6a	21.930	20.102	0.119	14.500	1.0	0.14	30.6	OK
SW4.000b	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CF 16a	MH_CF1 6	21.430	19.924	0.125	26.106	1.7	0.24	53.4	OK
SW4.000c	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_F2	MH_CF1 6a	21.839	20.125	0.110	11.614	1.0	0.16	24.6	OK
SW9.003a	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_C3 9a	MH_CH 39	26.095	24.283	0.176	58.836	2.5	0.39	124.9	OK
SW13.003	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CE 03	MH_CE0 4	20.013	17.359	0.149	58.445	2.6	0.21	119.2	OK
SW13.004	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CE 04	S33- (EXISTI NG)	19.122	16.274	0.144	58.414	2.6	0.2	116.3	OK
SW13.000	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CE 01	MH_CE0 2	21.429	19.505	0.095	18.644	1.6	0.06	39.4	OK
SW13.001	FSR: 1 years: +0 %: 15 mins: Winter	Pipe	MH_CE 02	MH_CE0 3	20.819	18.133	0.130	31.625	1.7	0.14	64.9	OK

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FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
SW3.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF14	MH_CF15	22.810	20.368	0.297	62.656	1.4	0.77	130.5	OK
SW3.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF15	MH_CF16	21.720	20.078	0.286	62.533	1.3	0.99	116.0	OK
SW3.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF16	MH_CF18	21.570	19.856	0.358	182.737	2.5	0.64	340.2	OK
SW3.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF18	Pond_F	20.810	19.125	0.269	272.043	5.3	0.85	521.8	OK
SW2.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF12	Swale	22.440	20.773	0.600	316.992	2.3	1.58	653.0	Surcharged
SW1.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF9	Swale	23.510	20.509	0.351	273.405	2.9	0.53	505.8	OK
SW2.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF11	MH_CF12	22.920	22.016	0.450	233.217	3.0	2.16	479.5	Surcharged
SW1.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF8	MH_CF9	23.930	20.906	0.448	273.818	2.3	0.92	521.3	OK
SW1.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF3	MH_CF4	25.120	22.767	0.232	89.341	2.3	0.39	186.4	OK
SW1.007	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF7	MH_CF8	24.210	21.133	0.468	223.854	1.8	0.61	435.3	OK
SW2.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF10	MH_CF11	23.360	22.091	0.450	58.793	0.7	0.52	112.6	Surcharged
SW5.014	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG34	MH_CG35	25.470	22.856	0.600	601.471	3.2	1.63	918.6	Surcharged
SW5.015	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG35	POND_G	24.930	21.650	0.406	600.526	4.5	1.33	913.8	Surcharged
SW8.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG36	MH_CG37	27.460	27.202	0.450	231.136	2.8	1.53	440.4	Flood Risk

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SW 9.011	FSR: 100 years: +45 %: 360 mins: Winter	Pipe	POND H	OUTFAL L_H	19.472	18.339	0.285	2429.209	0.7	0.04	70.7	Surch arged
SW1.012	FSR: 100 years: +45 %: 360 mins: Winter	Pipe	Pond_F	OUTFAL L_F	19.119	18.228	0.218	746.396	0.8	0.12	26.9	Surch arged
SW5.016	FSR: 100 years: +45 %: 240 mins: Summer	Pipe	POND_ G	OUTFAL L_G	22.178	21.369	0.226	947.366	0.7	0.04	41.5	Surch arged
SW 9.010	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 50	POND H	20.830	18.645	0.389	919.625	5.8	0.85	1293. 8	OK
SW9.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 37	MH_CH 38	25.770	23.912	0.180	102.175	2.6	0.27	184.3	OK
SW9.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 36	MH_CH 37	25.710	24.418	0.198	21.875	0.9	0.03	17.6	Surch arged
SW9.000	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	GG_H2	MH_CH 36	27.826	24.386	0.459	28.218	0.5	0.06	40.1	OK
SW10.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_H4	MH_CH 41	22.618	20.523	0.251	9.168	0.5	0.08	15.8	OK
SW 12.001	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 31	MH_CH 47	22.430	19.901	0.450	8.971	0.7	0.04	22.9	OK
SW 12.000	FSR: 100 years: +45 %: 960 mins: Winter	Pipe	GG_H5	MH_CH 31	22.085	20.312	0.450	1081.362	0.3	0.03	11.3	Surch arged
SW5.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_G6	MH_CG 19	27.877	25.807	0.450	22.373	0.6	0.15	41.8	OK
SW5.001	FSR: 100 years: +45 %: 30 mins: Winter	Pipe	MH_CG 19	MH_CG 20	27.580	25.949	0.061	36.870	1.0	0.04	12.5	Surch arged
SW6.000	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	GG_G5	MH_CG 29	26.056	24.943	0.300	140.867	0.7	0.12	33.7	Surch arged
SW6.001	FSR: 100 years: +45 %: 960 mins: Summer	Pipe	MH_CG 29	MH_CG 28	25.619	24.756	0.088	860.744	1.6	0.08	25.3	Surch arged
SW1.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 2	MH_CF3	26.210	23.543	0.145	28.354	1.3	0.09	59.2	OK
SW1.000	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	GG_F8	MH_CF1	26.085	24.465	0.150	5.514	0.5	0.24	3.5	Surch arged
SW1.001	FSR: 100 years: +45 %: 480 mins: Winter	Pipe	MH_CF 1	MH_CF2	26.150	24.766	0.024	38.313	0.6	0	0.8	Surch arged

5018551 : Main Road SW Infodrainage Calcs P03				Date: 26/02/2024			RIDGE					
				Designed by:	Checked by:	Approved By:						
Report Details: Type: Connections Summary Storm Phase: Phase				BT								
				Ridge:								

SW5.013	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 32	MH_CG 34	25.970	22.882	0.600	253.654	1.5	0.9	429.8	Surcharged
SW1.010	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	Swale	MH_CF1 3	21.381	19.883	0.450	6.537	0.1	0.04	7.1	OK
SW1.011	FSR: 100 years: +45 %: 60 mins: Summer	Pipe	MH_CF 13	Pond_F	21.720	20.186	0.169	25.472	0.5	0.01	4.3	Surcharged
SW10.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 42	MH_CH 45	22.770	20.214	0.388	94.555	1.3	0.3	176.0	OK
SW5.010	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CG 28	MH_CG 30	26.050	22.707	0.301	109.401	1.1	0.26	160.1	OK
SW5.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 27	MH_CG 28	26.160	23.061	0.185	88.501	2.3	0.31	144.5	OK
SW5.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 26	MH_CG 27	26.440	23.356	0.222	88.817	1.9	0.48	149.2	OK
SW10.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 45	MH_CH 40	23.770	20.239	0.600	94.111	1.0	0.46	259.6	OK
SW 9.009	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 49	MH_CH 50	21.512	19.347	0.750	919.945	3.0	1.32	1333.7	Surcharged
SW9.005	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 40	MH_CH 46	24.580	20.067	0.750	417.402	1.5	0.65	651.2	OK
SW9.006	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 46	MH_CH 47	23.070	20.120	0.750	416.966	1.6	0.63	638.2	Surcharged
SW10.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 41	MH_CH 42	22.610	20.521	0.145	6.189	0.9	0.03	10.1	OK
SW 9.007	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CH 47	MH_CH 48	22.990	19.979	0.750	424.670	1.5	0.68	683.3	Surcharged
SW 9.008	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 48	MH_CH 49	22.650	20.048	0.750	921.147	3.0	1.33	1337.6	Surcharged
SW8.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 41	MH_CG 42	25.920	23.132	0.282	232.056	3.6	0.78	378.8	OK
SW8.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 42	MH_CH 48	24.230	21.836	0.450	231.733	2.3	0.45	366.2	OK
SW5.011	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 30	MH_CG 31	25.990	22.934	0.600	118.158	1.1	0.38	162.5	Surcharged

5018551 : Main Road SW Infodrainage Calcs P03				Date: 26/02/2024			RIDGE					
				Designed by:	Checked by:	Approved By:						
Report Details: Type: Connections Summary Storm Phase: Phase				BT								
				Ridge:								

SW5.012	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 31	MH_CG 32	26.080	22.969	0.600	118.504	1.4	0.58	242.3	Surcharged
SW7.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	GG_G5 (1)	MH_CG 33	26.867	24.643	0.300	11.030	0.5	0.13	11.3	OK
SW7.001	FSR: 100 years: +45 %: 1440 mins: Summer	Pipe	MH_CG 33	MH_CG 32	25.840	24.858	0.094	781.933	1.3	0.01	7.1	Surcharged
SW1.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 6	MH_CF7	24.310	21.359	0.351	134.866	1.5	0.32	259.0	OK
SW1.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 4	MH_CF5	24.630	21.671	0.387	135.131	1.4	0.7	277.2	OK
SW1.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 5	MH_CF6	24.480	21.550	0.316	135.021	1.8	0.67	267.7	OK
SW5.006	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 24	MH_CG 25	26.870	23.674	0.274	89.273	1.6	0.74	157.6	OK
SW5.007	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 25	MH_CG 26	26.640	23.544	0.244	89.013	1.7	0.43	153.9	OK
SW5.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 22	MH_CG 23	27.290	24.234	0.258	90.155	1.8	0.33	168.4	OK
SW5.005	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 23	MH_CG 24	27.110	23.815	0.309	89.720	1.4	0.67	162.5	OK
SW5.002	FSR: 100 years: +45 %: 120 mins: Winter	Pipe	MH_CG 20	MH_CG 21	27.430	24.661	0.056	156.114	1.1	0.04	12.5	OK
SW5.003	FSR: 100 years: +45 %: 120 mins: Winter	Pipe	MH_CG 21	MH_CG 22	27.390	24.475	0.080	155.873	1.3	0.03	12.5	OK
SW8.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 39	MH_CG 40	26.400	24.104	0.450	232.113	2.5	1.51	400.9	Surcharged
SW8.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 40	MH_CG 41	26.260	23.711	0.450	232.076	2.5	1.66	396.2	Surcharged
SW8.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 37	MH_CG 38	27.180	25.781	0.450	231.788	2.6	1.12	418.6	Surcharged
SW8.002	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CG 38	MH_CG 39	26.510	24.508	0.450	232.127	2.6	1.48	407.8	Surcharged
SW9.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 38	MH_CH 39	25.300	23.324	0.194	101.706	2.3	0.1	181.0	OK

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				Ridge:								

SW9.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 39	MH_CH 40	24.970	21.544	0.600	372.116	2.7	0.39	754.8	OK
SW11.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 43	MH_CH 44	21.770	20.232	0.099	0.000	0.4	0.03	11.0	OK
SW11.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CH 44	MH_CH 42	22.240	20.229	0.178	0.567	0.5	0.06	36.3	OK
SW4.000a	FSR: 100 years: +45 %: 15 mins: Summer	Pipe	MH_CF 17	MH_CF1 6a	21.930	20.281	0.349	59.630	1.2	0.62	131.6	OK
SW4.000b	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CF 16a	MH_CF1 6	21.430	20.279	0.375	120.282	2.1	1.02	228.2	Surcharged
SW4.000c	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_F2	MH_CF1 6a	21.839	20.459	0.300	53.497	1.5	0.7	109.5	Surcharged
SW9.003a	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_C3 9a	MH_CH 39	26.095	25.870	0.375	271.051	5.2	1.81	575.4	Flood Risk
SW13.003	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CE 03	MH_CE0 4	20.013	17.855	0.450	268.999	3.3	0.93	527.2	Surcharged
SW13.004	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CE 04	S33- (EXISTING)	19.122	16.615	0.410	269.421	3.4	0.88	511.6	Surcharged
SW13.000	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CE 01	MH_CE0 2	21.429	19.595	0.228	85.870	2.3	0.29	183.1	OK
SW13.001	FSR: 100 years: +45 %: 15 mins: Winter	Pipe	MH_CE 02	MH_CE0 3	20.819	18.308	0.450	145.562	2.1	0.72	338.4	OK

5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			



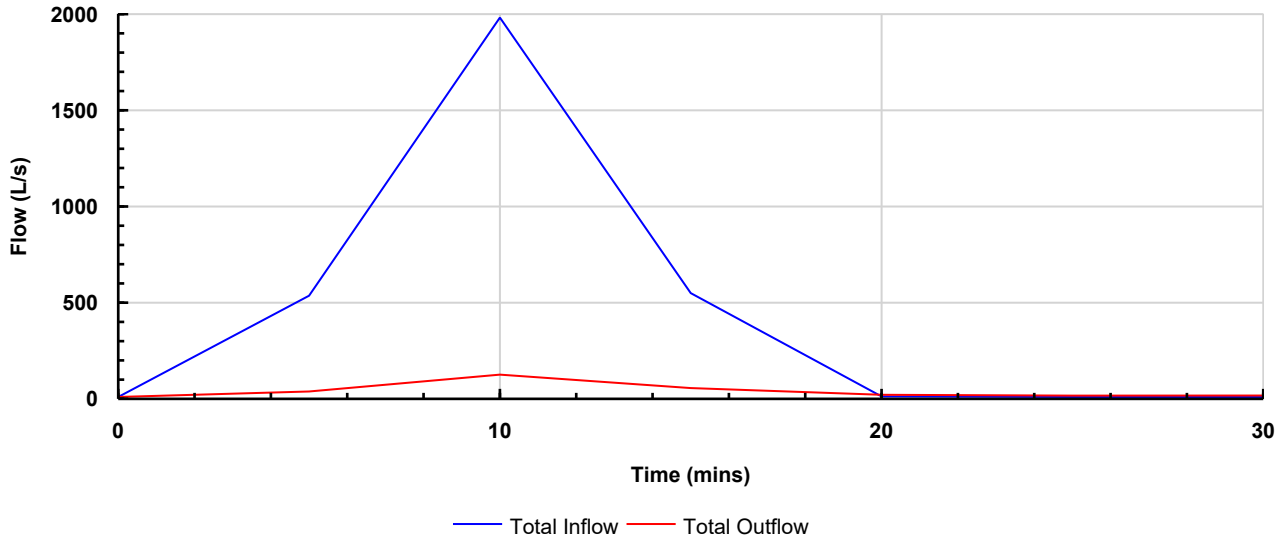
Phase
FSR: 1 years: Increase Rainfall (%): +0: 15 mins: Winter

Tables

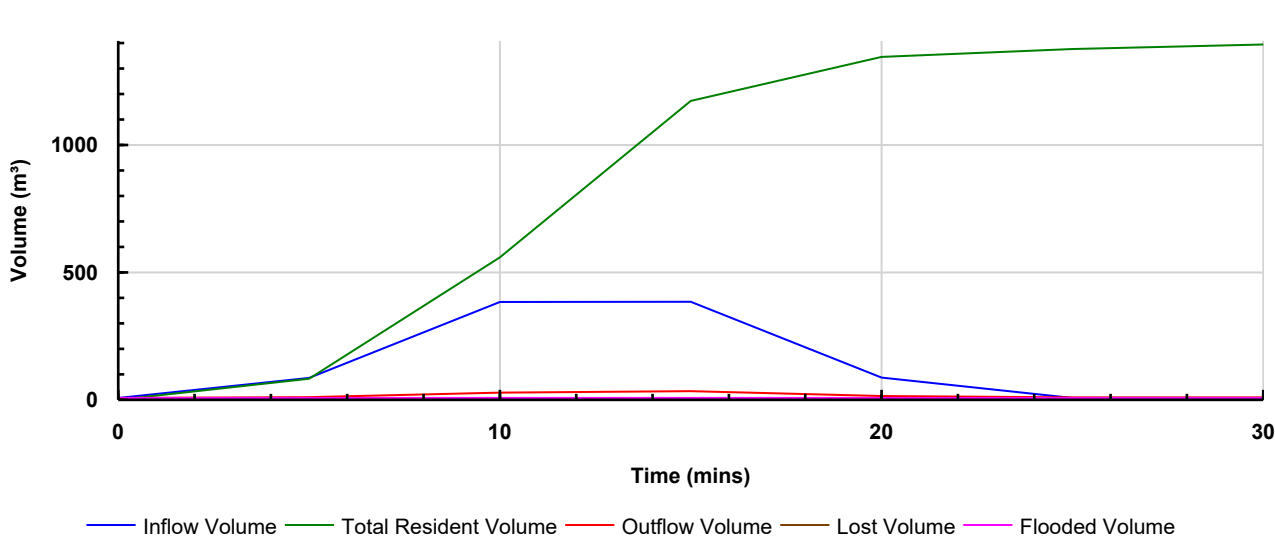
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			2.9	1.554
OUTFALL_F			1.3	1.013
OUTFALL_G			3.2	2.123
S33-(EXISTING)			116.7	58.414
TOTAL	1981.8	917.351	116.7	63.105

Graphs

Flow Graph



Volume Graph



5018551 : Main Road SW Infodrainage Calcs P03	Date: 26/02/2024			RIDGE
	Designed by: BT	Checked by:	Approved By:	
Report Details: Type: Phase Management Storm Phase: Phase	Ridge:			



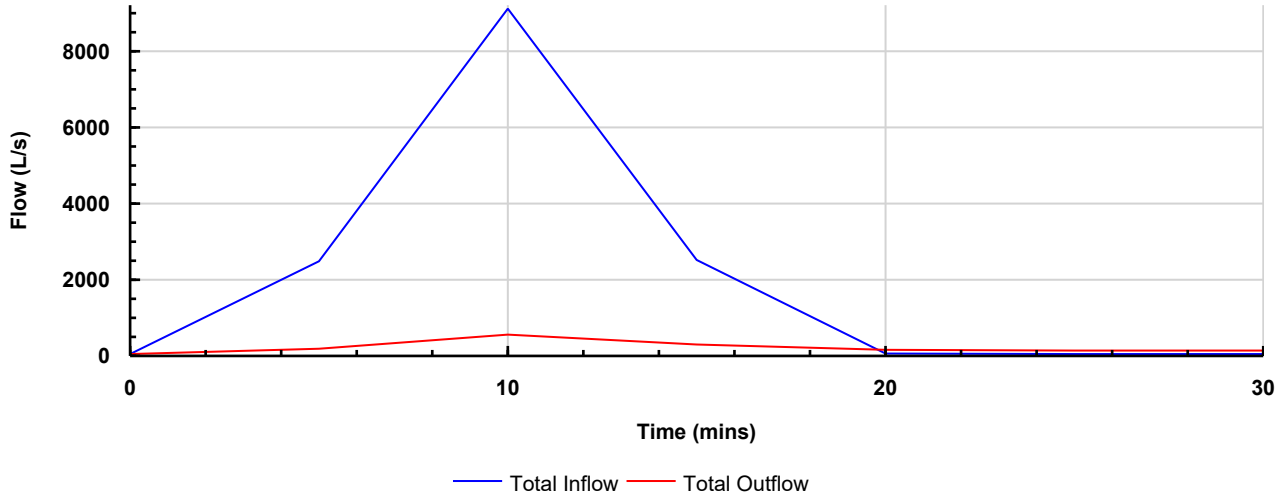
Phase
FSR: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Tables

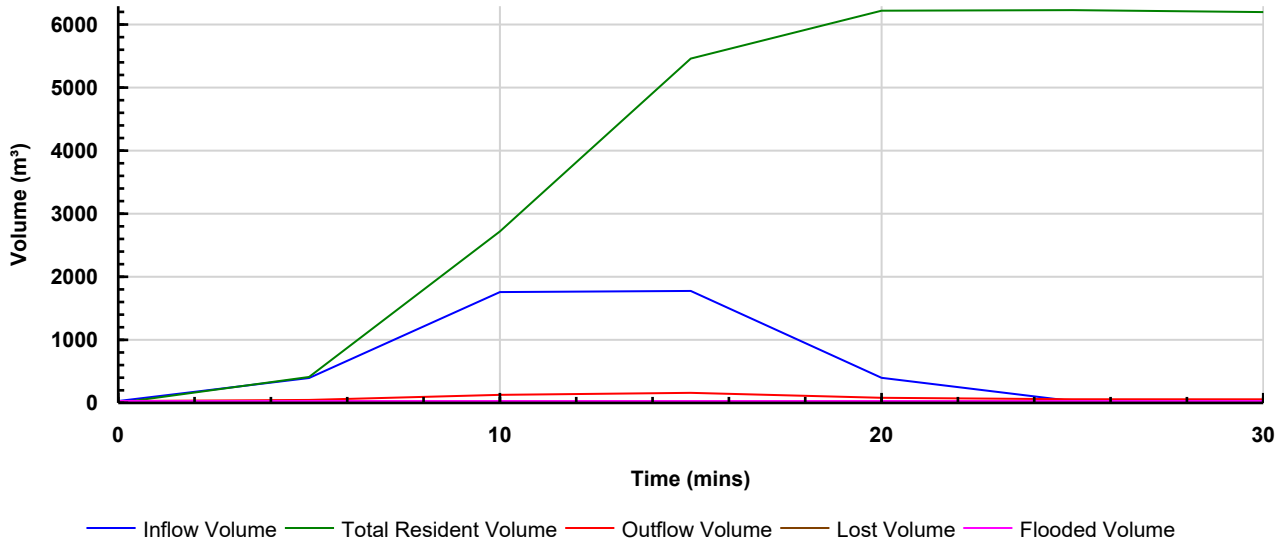
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
OUTFALL_H			41.8	35.576
OUTFALL_F			17.7	17.867
OUTFALL_G			33.1	31.313
S33-(EXISTING)			511.6	269.421
TOTAL	9118.7	4226.453	513.0	354.178

Graphs

Flow Graph

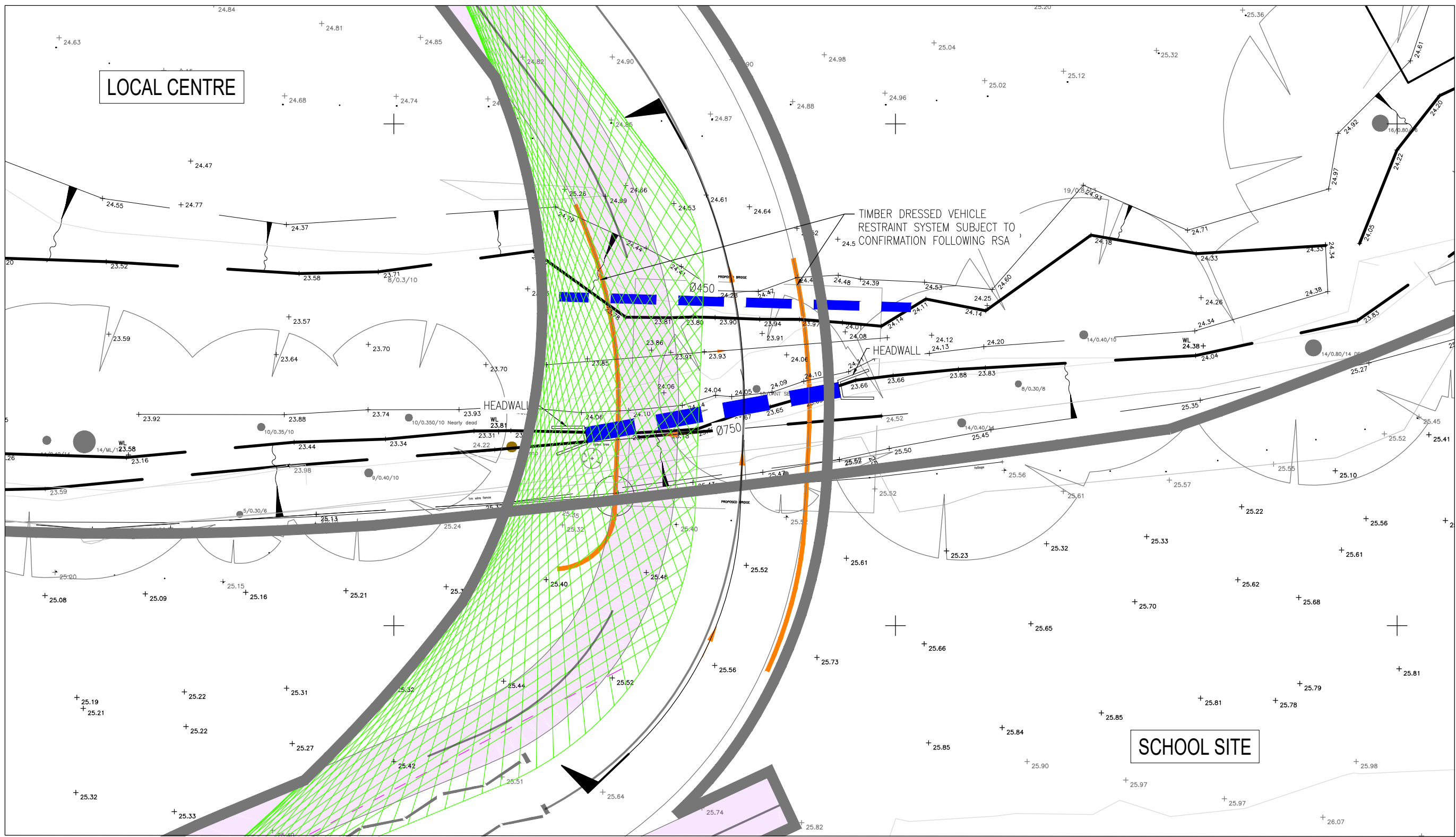


Volume Graph



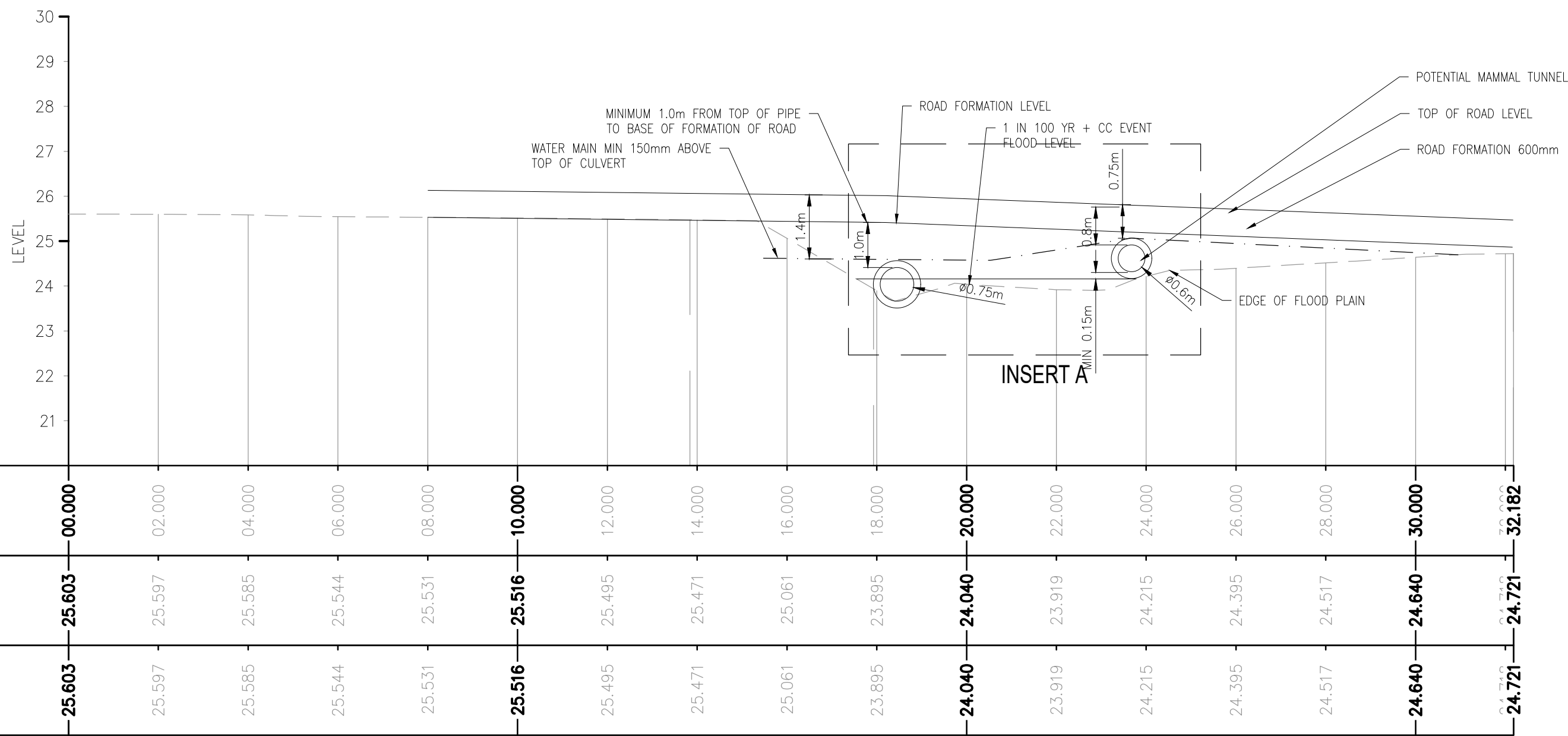
APPENDIX E

CROSSING POINT DRAWINGS

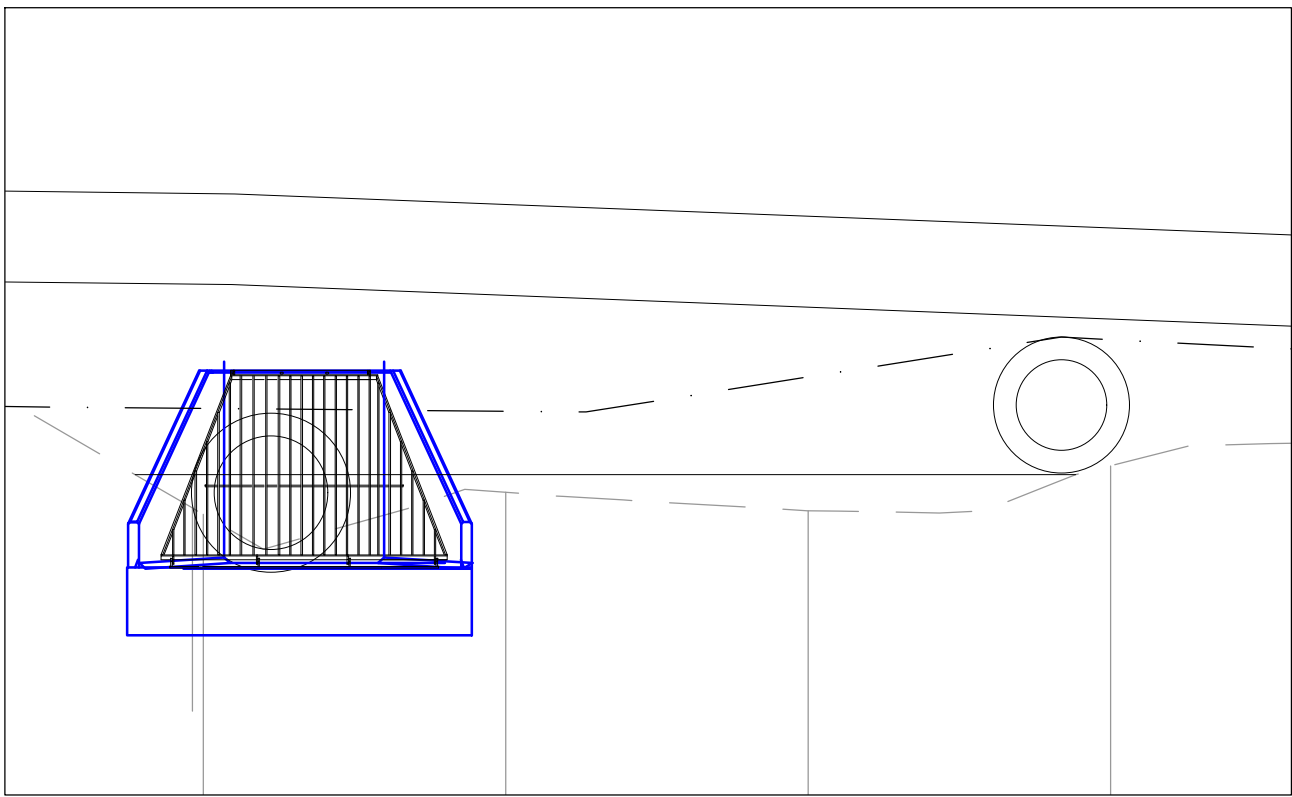


OVERALL PLAN
SCALE 1:200

South of Ditch Area – Longitudinal Section
SCALE: H 1:100, V 1:100. DATUM: 20.000



CHAINAGE	00.000	02.000	04.000	06.000	08.000	10.000	12.000	14.000	16.000	18.000	20.000	22.000	24.000	26.000	28.000	30.000	32.182
EXISTING LEVEL	25.603	25.597	25.585	25.544	25.531	25.516	25.495	25.471	25.061	23.895	24.040	23.919	24.215	24.395	24.517	24.640	24.721
PROPOSED LEVEL	25.603	25.597	25.585	25.544	25.531	25.516	25.495	25.471	25.061	23.895	24.040	23.919	24.215	24.395	24.517	24.640	24.721

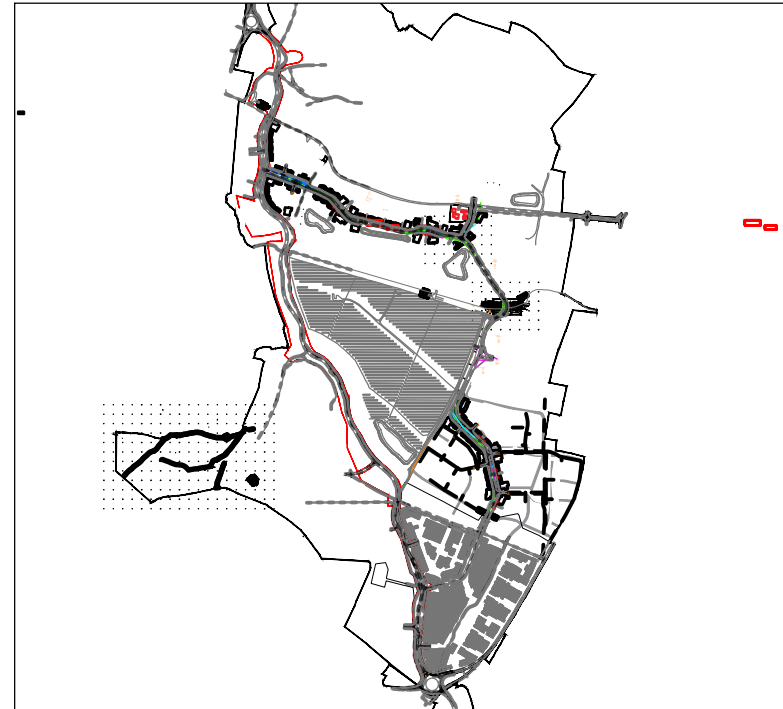


INSERT A
SCALE 1:50

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SITE PLAN
SCALE : 1:5000

P04	LEVELS ADJUST FOR MAMMAL TUNNELS AND TW REQUIREMENTS	01/12/23	PO
P03	UPDATED LENGTH PIPE AND MAMMAL	27/07/2023	PO
P02	MAMMAL TUNNEL REPOSITIONED	12/07/2023	JM
P01	UPDATE DRAWING WITH COMMENTS	05/07/2023	PO
-	INITIAL ISSUE	18/05/2023	RML

REV	DESCRIPTION	DATE	DRAWN
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ORIGINATOR:

RIDGE

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SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH
BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
PROPOSED ROAD RC05
CROSSING ROUTES
SECTIONS & PLAN

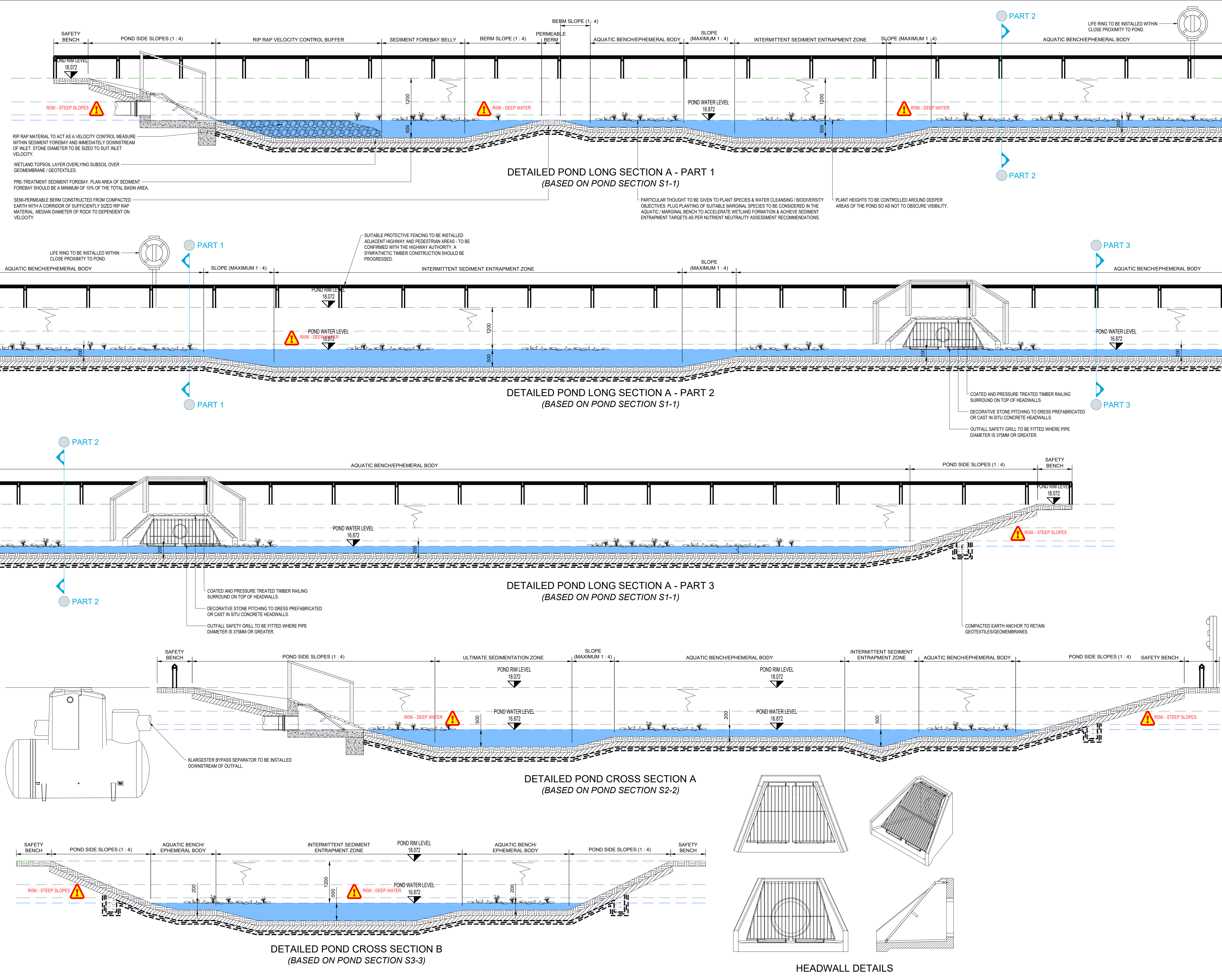
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RML			INITIAL ISSUE:	18/05/2023		

STATUS:
PRELIMINARY

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0595	P04

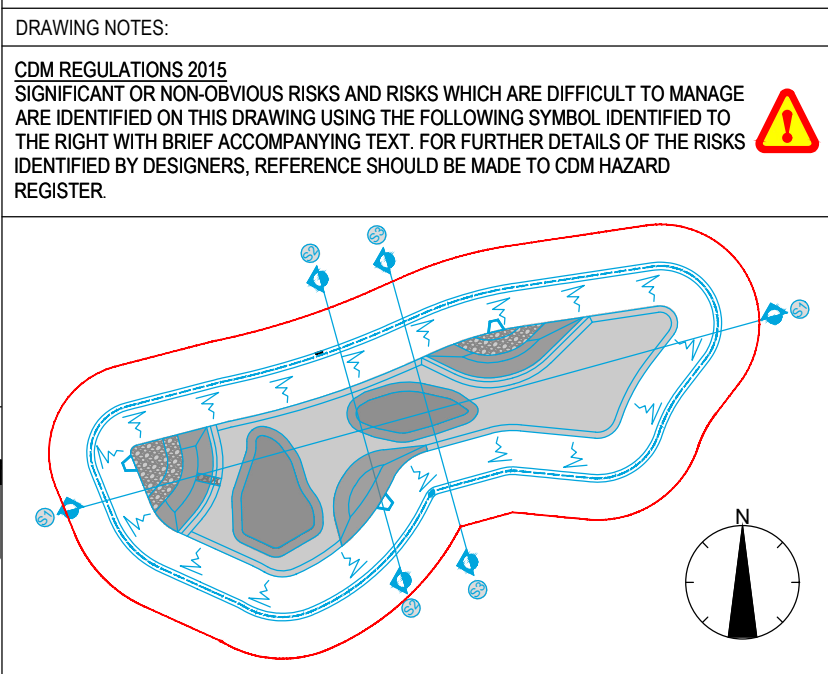
APPENDIX F

SUDS PLAN DRAWINGS



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WESTERN POND EXTRACT

P01	AMENDMENTS MADE IN SEDIMENTATION AREAS	17/02/2023	RML
INITIAL ISSUE		10/02/2023	ZS
REV	DESCRIPTION	DATE	DRAWN



1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW

TEL: 01962 834400

WWW.RIDGE.CO.UK



IN ASSOCIATION WITH:

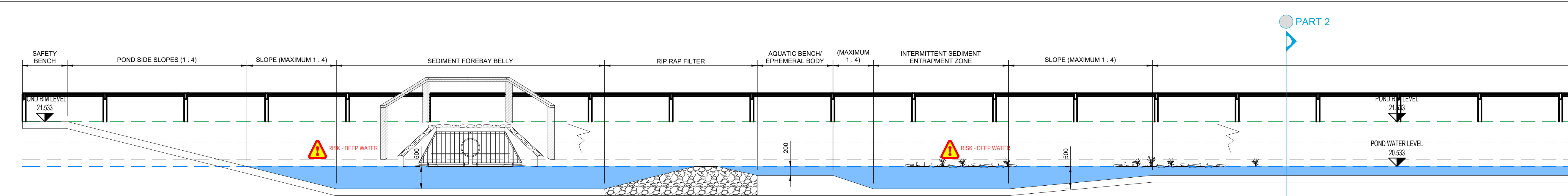
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**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DETAILED SuDS SECTIONS
WESTERN POND**

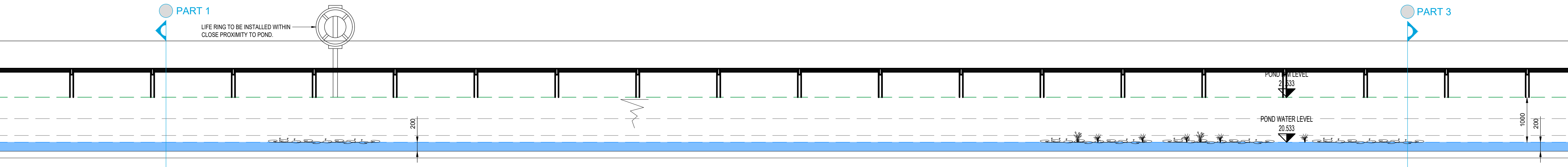
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INITIAL ISSUE:			10/02/2023	

STATUS:
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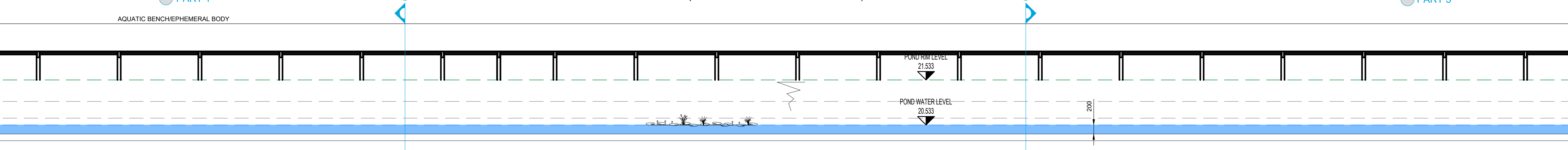
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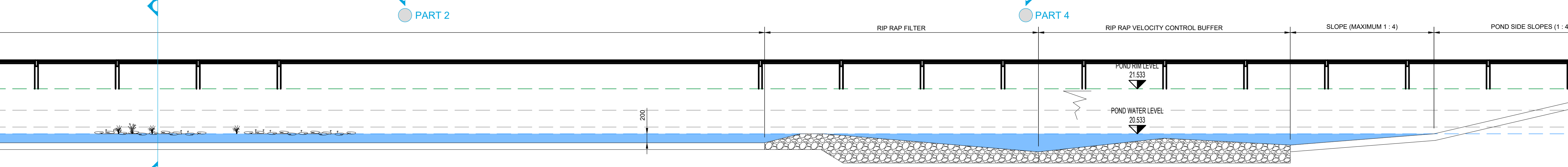
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(BASED ON POND SECTION S4-4)



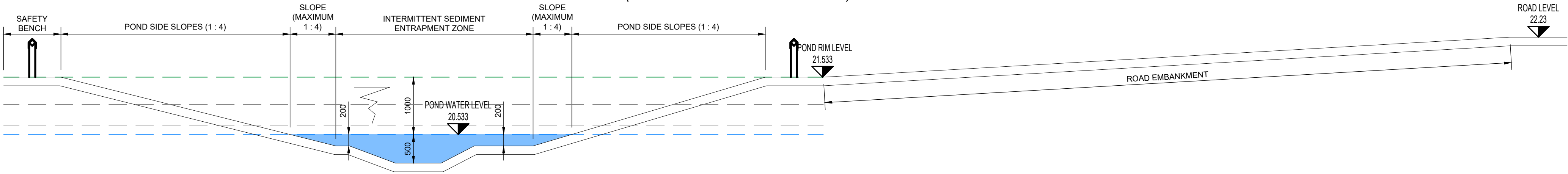
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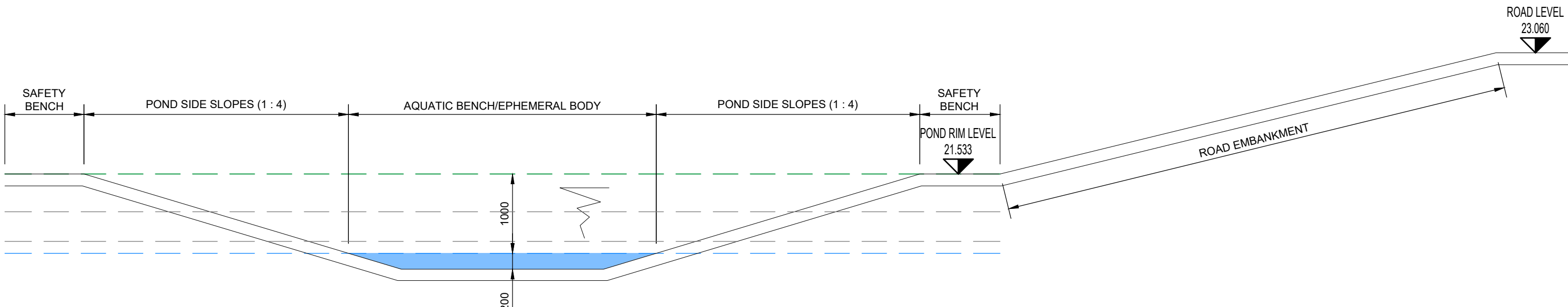
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(BASED ON POND SECTION S4-4)



DETAILED POND LONG SECTION B - PART 4
(BASED ON POND SECTION S4-4)



DETAILED POND CROSS SECTION B
(BASED ON POND SECTION S5-5)



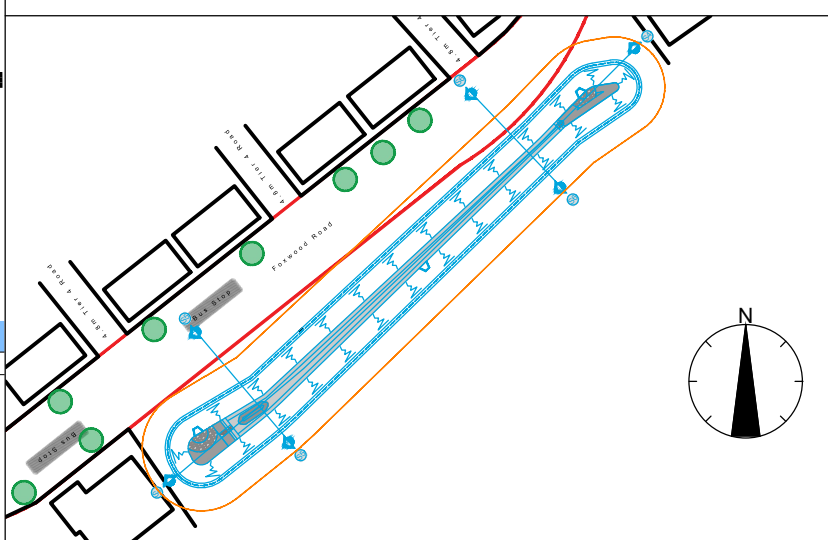
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DRAWING NOTES:

CDM REGULATIONS 2015
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CENTRAL POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML



1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK



IN ASSOCIATION WITH:

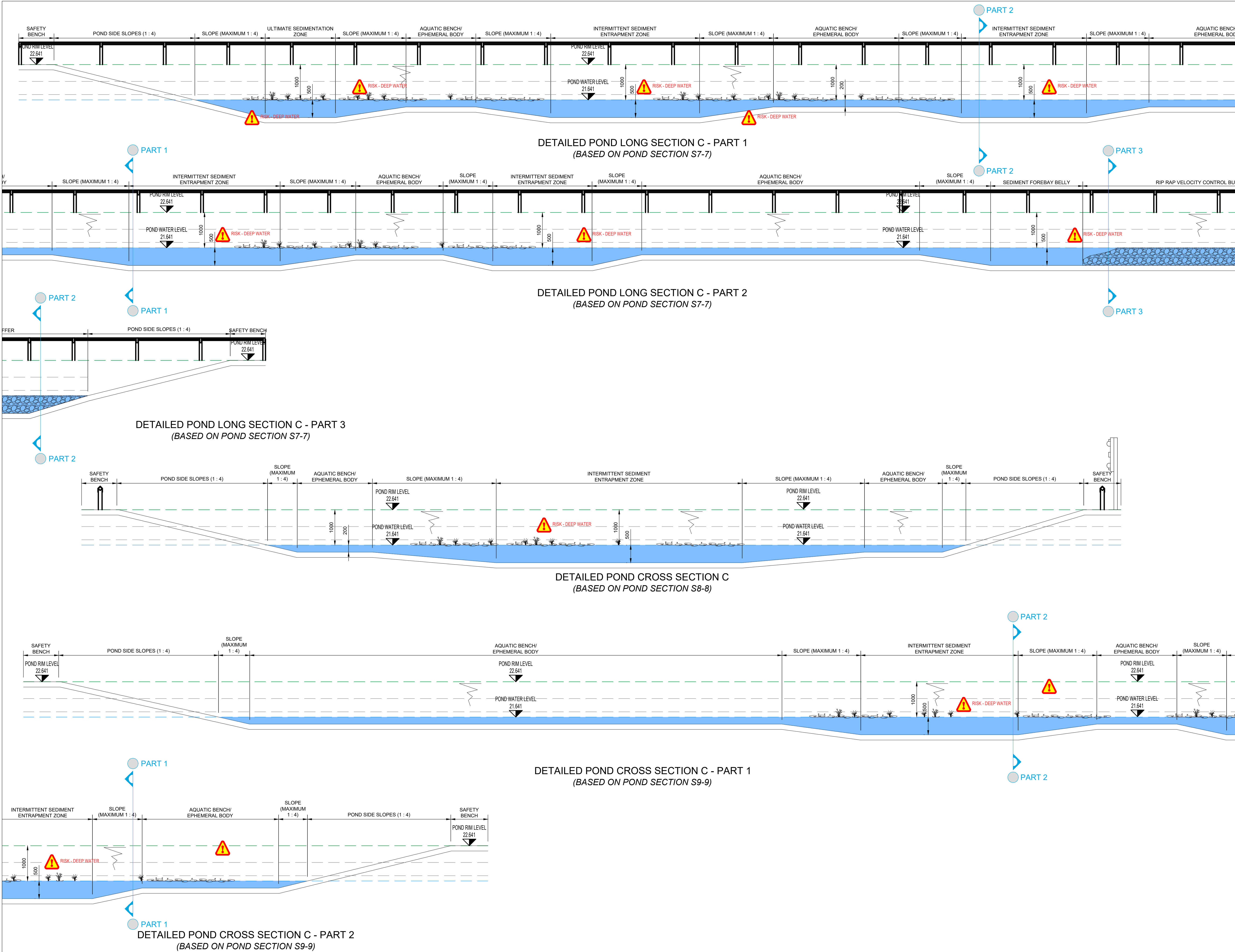
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DETAILED SuDS SECTIONS
CENTRAL POND**

TECH:	CSE:	ICSE:	SCALE:	@
RML	ZS	TC	1:50	A1

STATUS:
PRELIMINARY

DRAWING No:	PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0571	-	

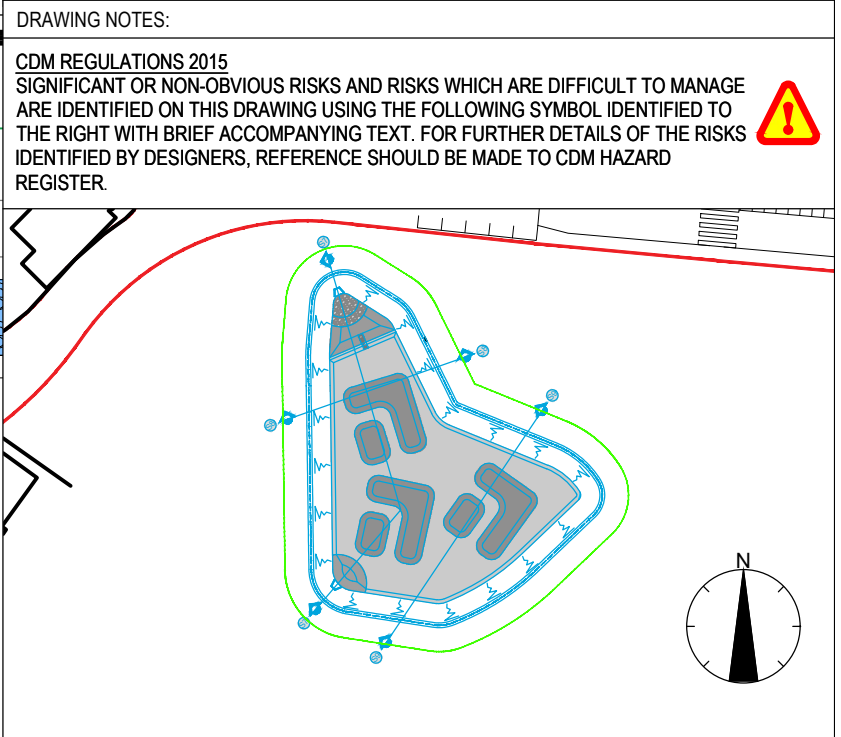


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DRAWING NOTES:

CDM REGULATIONS 2015
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EASTERN POND EXTRACT

REV	DESCRIPTION	DATE	DRAWN
-	INITIAL ISSUE	17/02/2023	RML



1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK



IN ASSOCIATION WITH:

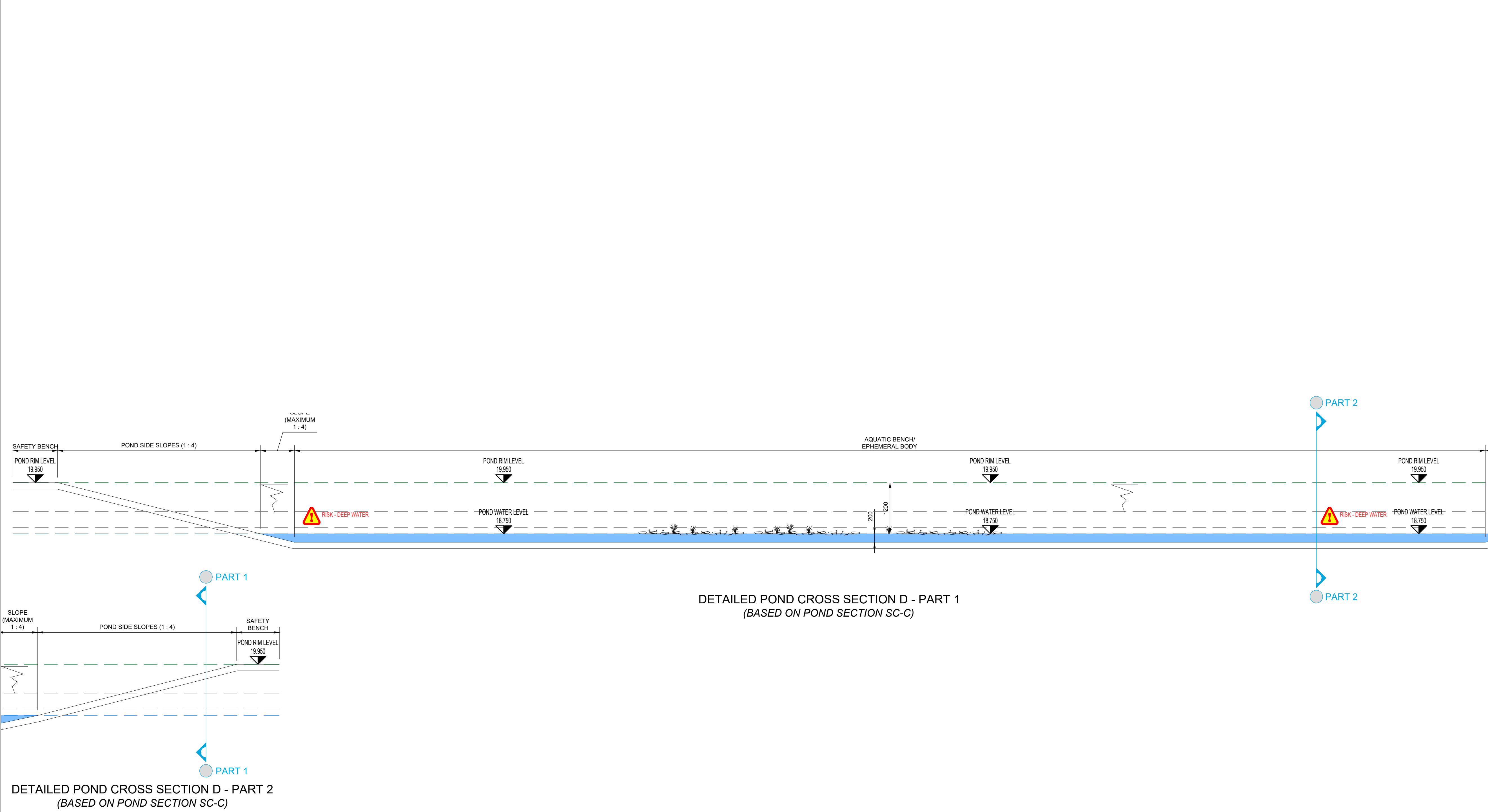
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DETAILED SuDS SECTIONS
EASTERN POND**

TECH:	CSE:	ICSE:	SCALE:	@
RML	ZS	TC	1:50	A1

STATUS:
PRELIMINARY

DRAWING No:	PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0572	-	



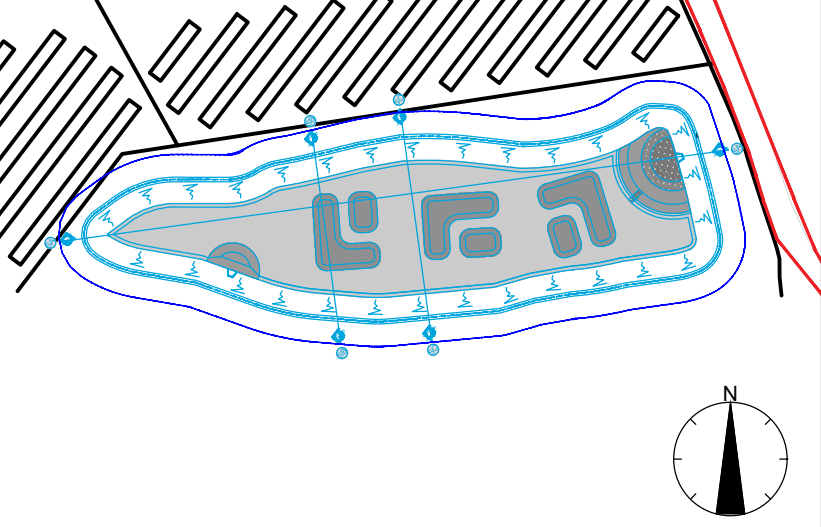
DETAILED POND CROSS SECTION D - PART 2
(BASED ON POND SECTION SC-C)

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DRAWING NOTES:

CDM REGULATIONS 2015
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SOUTHERN POND EXTRACT

-	INITIAL ISSUE	17/02/2023	RML
REV	DESCRIPTION	DATE	DRAWN

ORIGINATOR:

RIDGE

1 Royal Court,
Kings Worthy,
Winchester,
SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:

EASTLEIGH

BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
DETAILED SuDS SECTIONS
SOUTHERN POND

TECH:	CSE:	ICSE:	SCALE:	@
ZS	CL	TC	1:50	A1
STATUS:		PRELIMINARY		

DRAWING No:	PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0574	-	

APPENDIX G

EXCEEDANCE FLOW DRAINAGE PRE/POST DEVELOPMENT



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EXTERNAL REFERENCES:

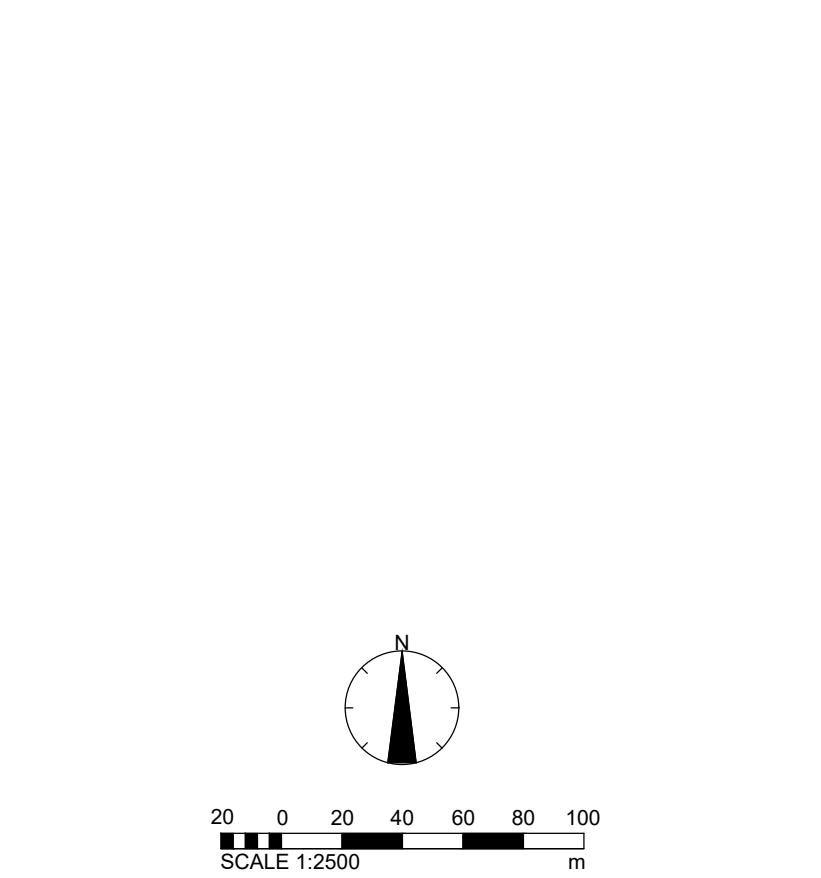
THIS INFORMATION & RIDGE & PARTNERS LLP CIVILS 3D MODEL & ASSOCIATED 3D OUTPUTS ARE BASED UPON THE FOLLOWING INFORMATION FROM THE DESIGN TEAM

- ARCHITECT REFERENCE:
- CLAGUE ARCHITECTS DWG No. 30454A/3875 (DATED JULY 2023)
- TOPO SURVEY REFERENCE:
- ENCOMPASS SURVEYS DWG No. ENCONE-HH-FEB21 (DATED FEBRUARY 2021)

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS INFORMATION IS CURRENT PRIOR TO CONSTRUCTION

LEGEND:

➤ OVERLAND FLOW ARROW



INITIAL ISSUE	22/02/2024	PO
REV / DESCRIPTION	DATE	DRAWN

ORIGINATOR:



1 ROYAL COURT
KINGS WORTHY
WINCHESTER
SO23 7TW

TEL: 01962 834400
WWW.RIDGE.CO.UK

CLIENT:



IN ASSOCIATION WITH:

PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**EXCEEDANCE FLOW DRAWING
(POST-DEVELOPMENT)**

TECH:	PO	CSE:	ICSE:	SCALE:	1:2500	@	A1
				INITIAL ISSUE:	23/02/2024		

STATUS:

INFORMATION

DRAWING No:	PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	0541	-	

APPENDIX H

HYDBROBRAKE DATA SHEET

POND G AND CATCHMENT G

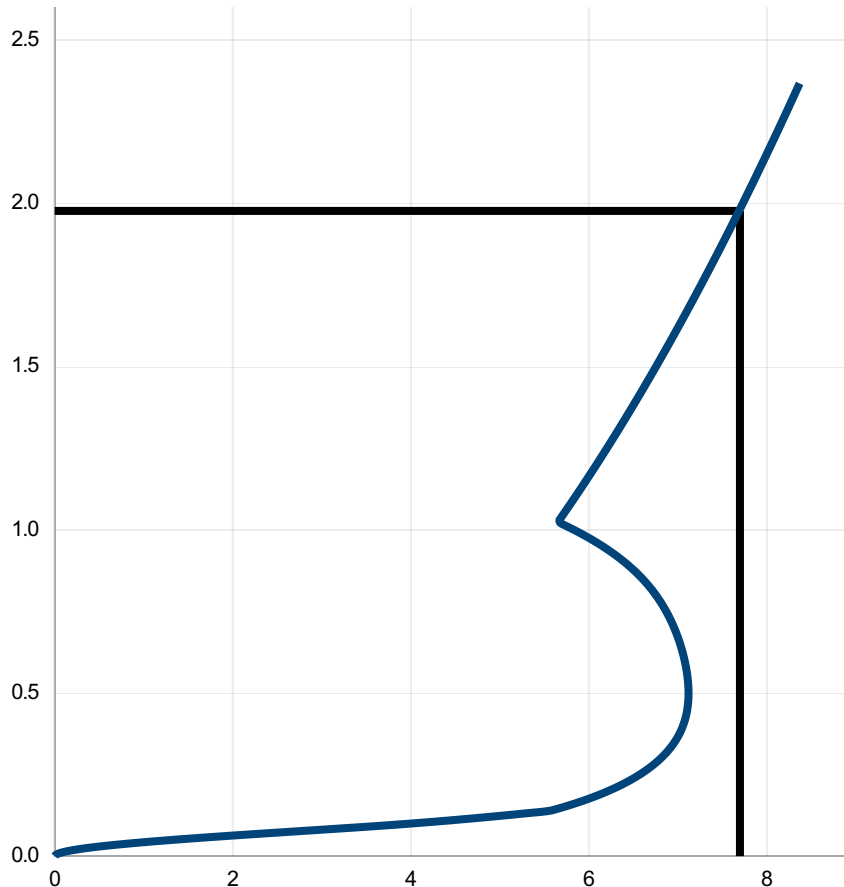
HYDROBRAKE DETAILS

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.976	7.700
Flush-Flo™	0.498	7.122
Kick-Flo®	1.022	5.652
Mean Flow		6.428



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.068	2.282
0.136	5.494
0.204	6.261
0.273	6.694
0.341	6.944
0.409	7.072
0.477	7.119
0.545	7.112
0.613	7.066
0.681	6.987
0.750	6.871
0.818	6.705
0.886	6.466
0.954	6.129
1.022	5.675
1.090	5.824
1.158	5.991
1.226	6.152
1.295	6.309
1.363	6.462
1.431	6.611
1.499	6.756
1.567	6.898
1.635	7.037
1.703	7.173
1.772	7.306
1.840	7.436
1.908	7.564
1.976	7.690

DESIGN ADVICE



The head/flow characteristics of this SHE-0115-7700-1976-7700 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:49
Site	OHH Sid_ Catchment G
DESIGNER	Binam Tiwari
Ref	Catchment_G2

SHE-0115-7700-1976-7700

Hydro-Brake® Optimum

Technical Specification

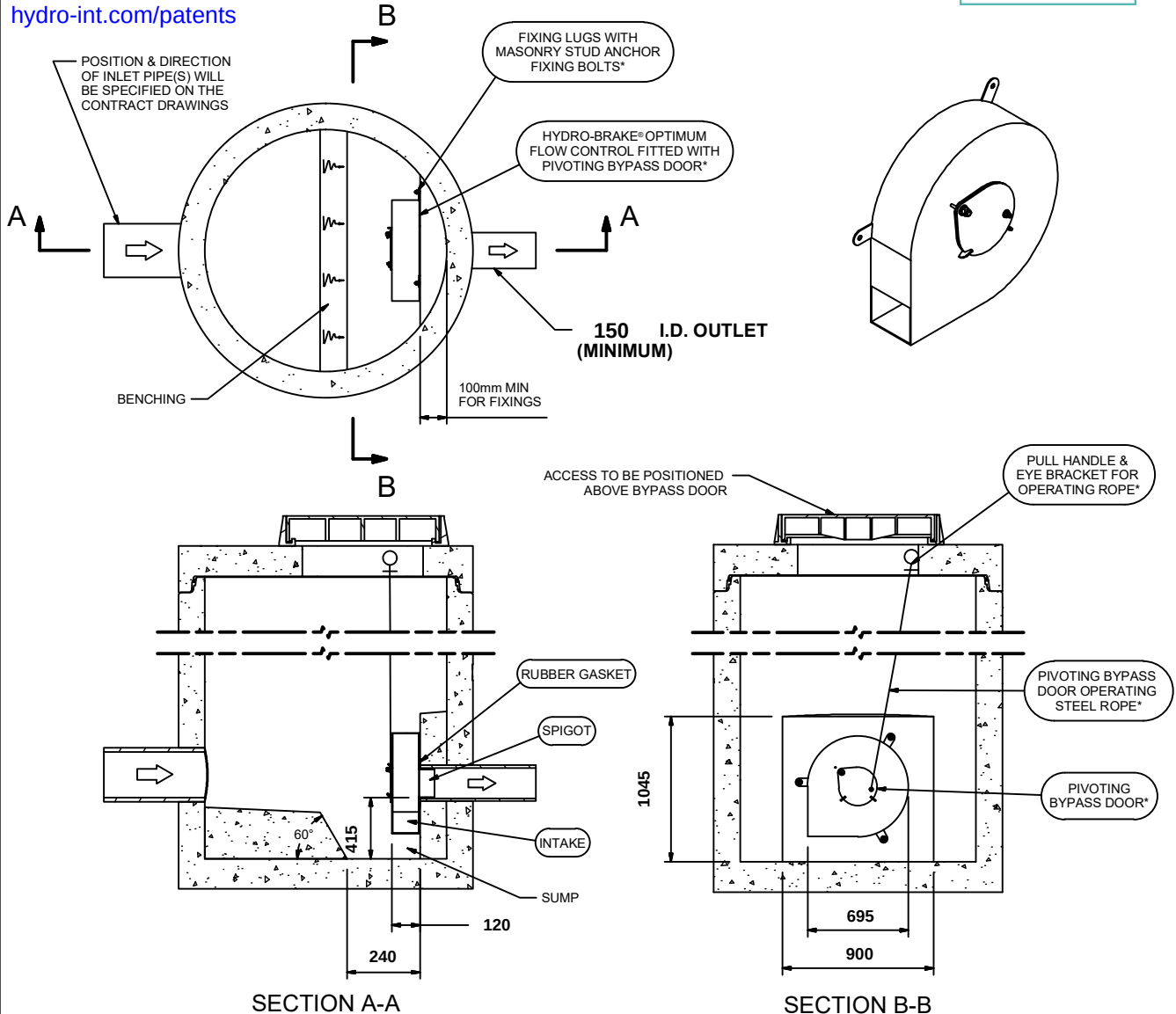
Control Point	Head (m)	Flow (l/s)
Primary Design	1.976	7.700
Flush-Flo™	0.498	7.122
Kick-Flo®	1.022	5.652
Mean Flow		6.428

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 20 kg



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IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

**DESIGN
ADVICE**



The head/flow characteristics of this SHE-0115-7700-1976-7700 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

**Hydro
International**

A CRH COMPANY

DATE	20/02/2024 12:49
SITE	OHH Sid Catchment G
DESIGNER	Binam Tiwari
REF	Catchment G2

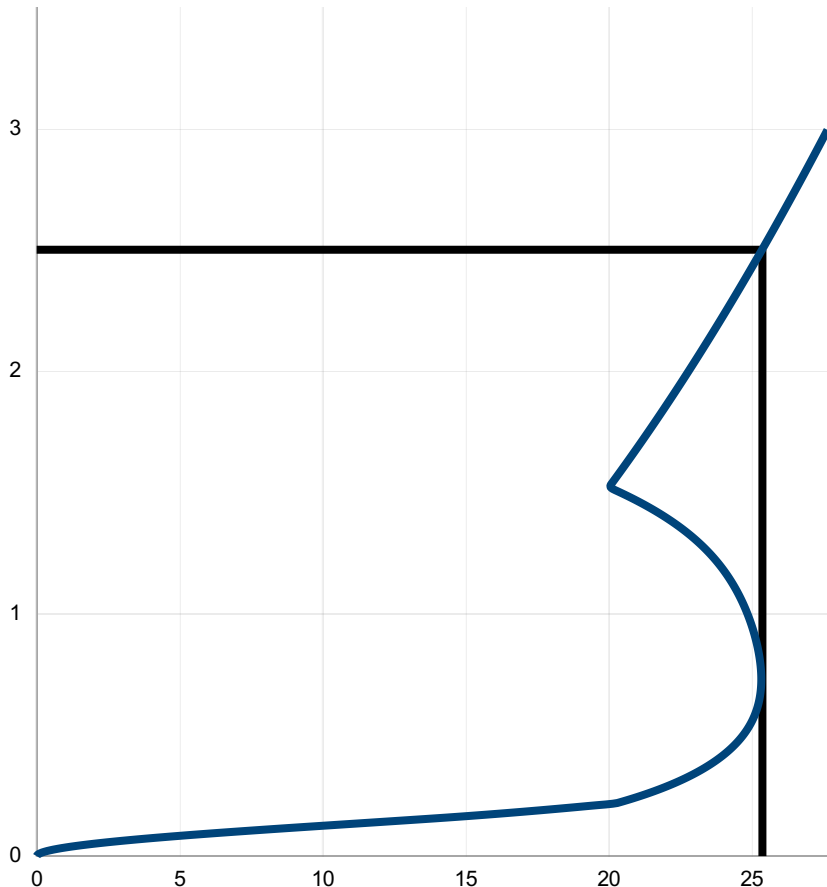
SHE-0115-7700-1976-7700
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.500	25.370
Flush-Flo™	0.729	25.331
Kick-Flo®	1.519	19.992
Mean Flow		22.150



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.086	5.272
0.172	15.883
0.259	21.372
0.345	23.069
0.431	24.151
0.517	24.810
0.603	25.170
0.690	25.317
0.776	25.313
0.862	25.200
0.948	25.001
1.034	24.720
1.121	24.340
1.207	23.830
1.293	23.140
1.379	22.210
1.466	20.977
1.552	20.196
1.638	20.723
1.724	21.235
1.810	21.734
1.897	22.222
1.983	22.698
2.069	23.164
2.155	23.620
2.241	24.067
2.328	24.505
2.414	24.934
2.500	25.357

DESIGN ADVICE



The head/flow characteristics of this SHE-0198-2537-2500-2537 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:48
Site	OHH Sid_ Catchment G
DESIGNER	Binam Tiwari
Ref	Catchment_G4

SHE-0198-2537-2500-2537
Hydro-Brake® Optimum

Technical Specification

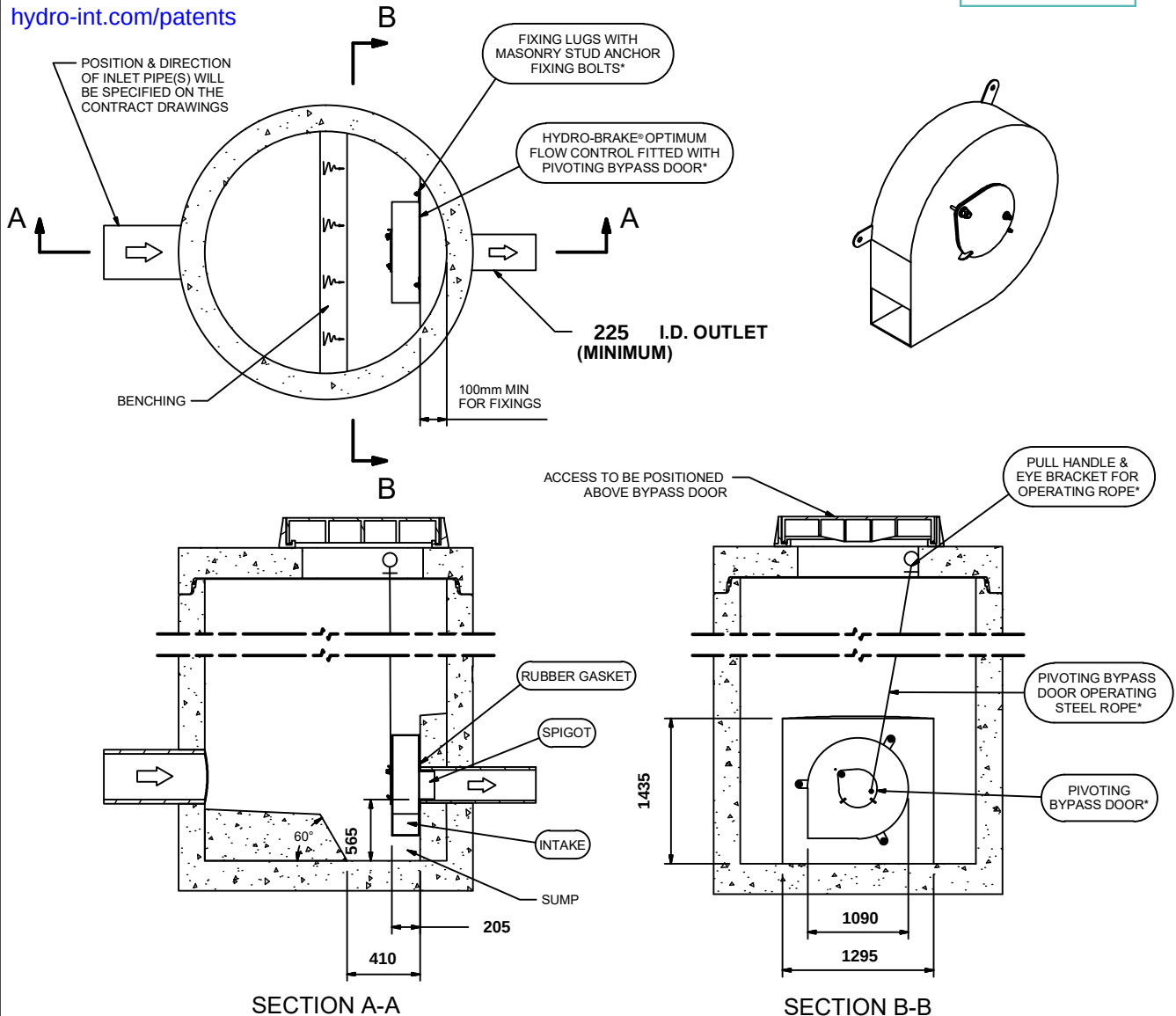
Control Point	Head (m)	Flow (l/s)
Primary Design	2.500	25.370
Flush-Flo™	0.729	25.331
Kick-Flo®	1.519	19.992
Mean Flow		22.150

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 100 kg



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IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

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ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

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**DESIGN
ADVICE**



The head/flow characteristics of this SHE-0198-2537-2500-2537 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

**Hydro
International**

A CRH COMPANY

DATE 20/02/2024 12:48

SITE OHH Sid Catchment G

DESIGNER Binam Tiwari

REF Catchment G4

SHE-0198-2537-2500-2537

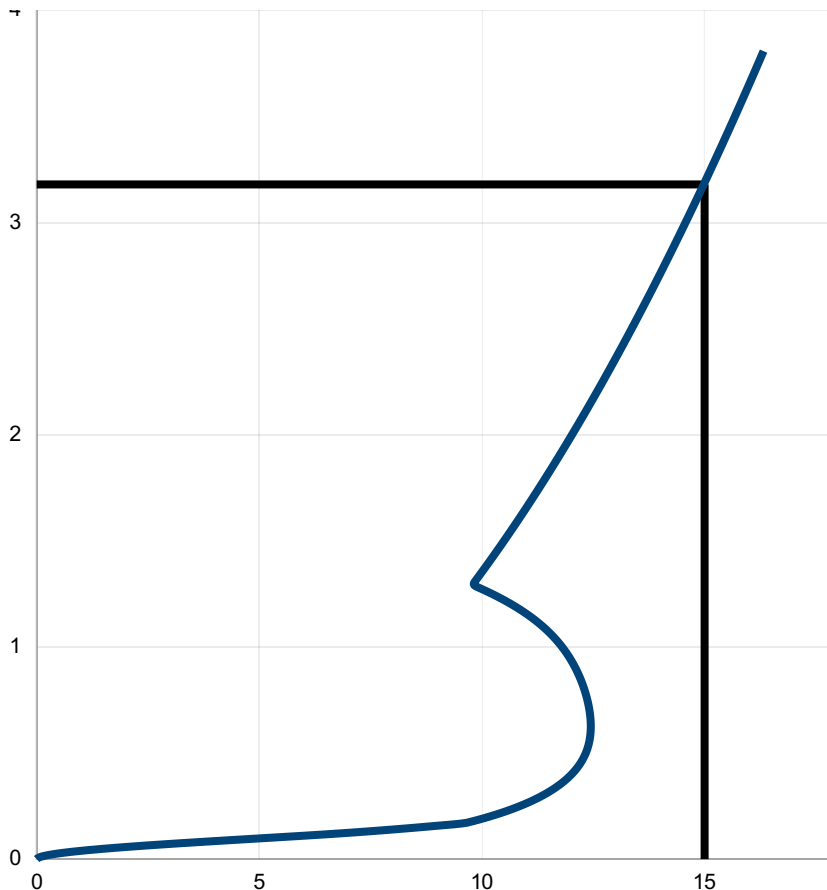
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	3.179	15.010
Flush-Flo™	0.626	12.452
Kick-Flo®	1.291	9.787
Mean Flow		11.842



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.110	5.954
0.219	10.460
0.329	11.603
0.438	12.176
0.548	12.413
0.658	12.447
0.767	12.353
0.877	12.162
0.987	11.854
1.096	11.373
1.206	10.628
1.315	9.875
1.425	10.253
1.535	10.617
1.644	10.968
1.754	11.307
1.864	11.636
1.973	11.954
2.083	12.264
2.192	12.566
2.302	12.859
2.412	13.146
2.521	13.426
2.631	13.700
2.741	13.968
2.850	14.231
2.960	14.489
3.069	14.742
3.179	14.990

DESIGN ADVICE



The head/flow characteristics of this SHE-0144-1501-3179-1501 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:46
Site	OHH Sid_ Catchment G
DESIGNER	Binam Tiwari
Ref	Catchment_G5

SHE-0144-1501-3179-1501
Hydro-Brake® Optimum

Technical Specification

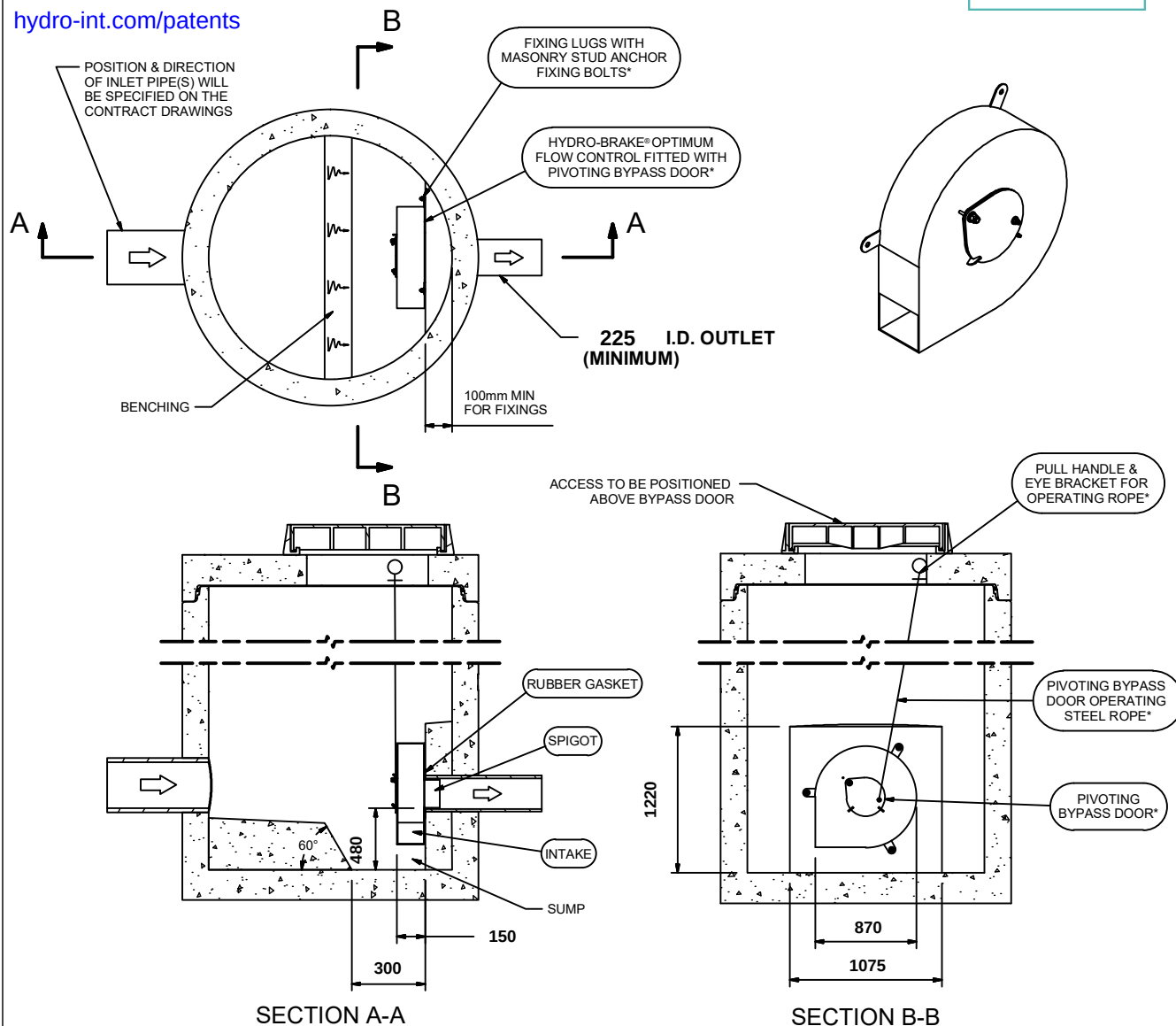
Control Point	Head (m)	Flow (l/s)
Primary Design	3.179	15.010
Flush-Flo™	0.626	12.452
Kick-Flo®	1.291	9.787
Mean Flow		11.842

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 70 kg



hydro-int.com/patents



IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0144-1501-3179-1501 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International
A CRH COMPANY

DATE	20/02/2024 12:46
SITE	OHH Sid Catchment G
DESIGNER	Binam Tiwari
REF	Catchment G5

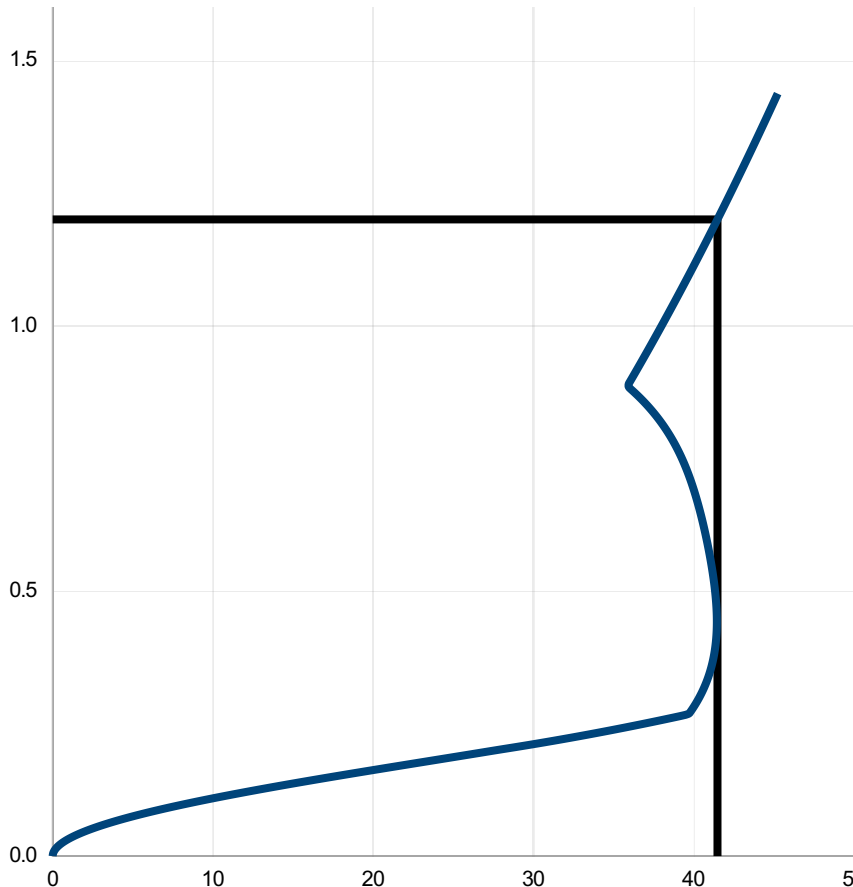
SHE-0144-1501-3179-1501
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.200	41.500
Flush-Flo™	0.442	41.460
Kick-Flo®	0.885	35.856
Mean Flow		34.511



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.041	1.595
0.083	6.020
0.124	12.641
0.166	20.684
0.207	29.190
0.248	36.701
0.290	40.190
0.331	40.848
0.372	41.242
0.414	41.428
0.455	41.453
0.497	41.359
0.538	41.180
0.579	40.938
0.621	40.646
0.662	40.299
0.703	39.879
0.745	39.349
0.786	38.655
0.828	37.728
0.869	36.488
0.910	36.346
0.952	37.128
0.993	37.894
1.034	38.643
1.076	39.377
1.117	40.097
1.159	40.804
1.200	41.498

DESIGN ADVICE



The head/flow characteristics of this SHE-0270-4150-1200-4150 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:50
Site	OHH Sid_ Catchment G
DESIGNER	Binam Tiwari
Ref	Pond_G

SHE-0270-4150-1200-4150
Hydro-Brake® Optimum

Technical Specification

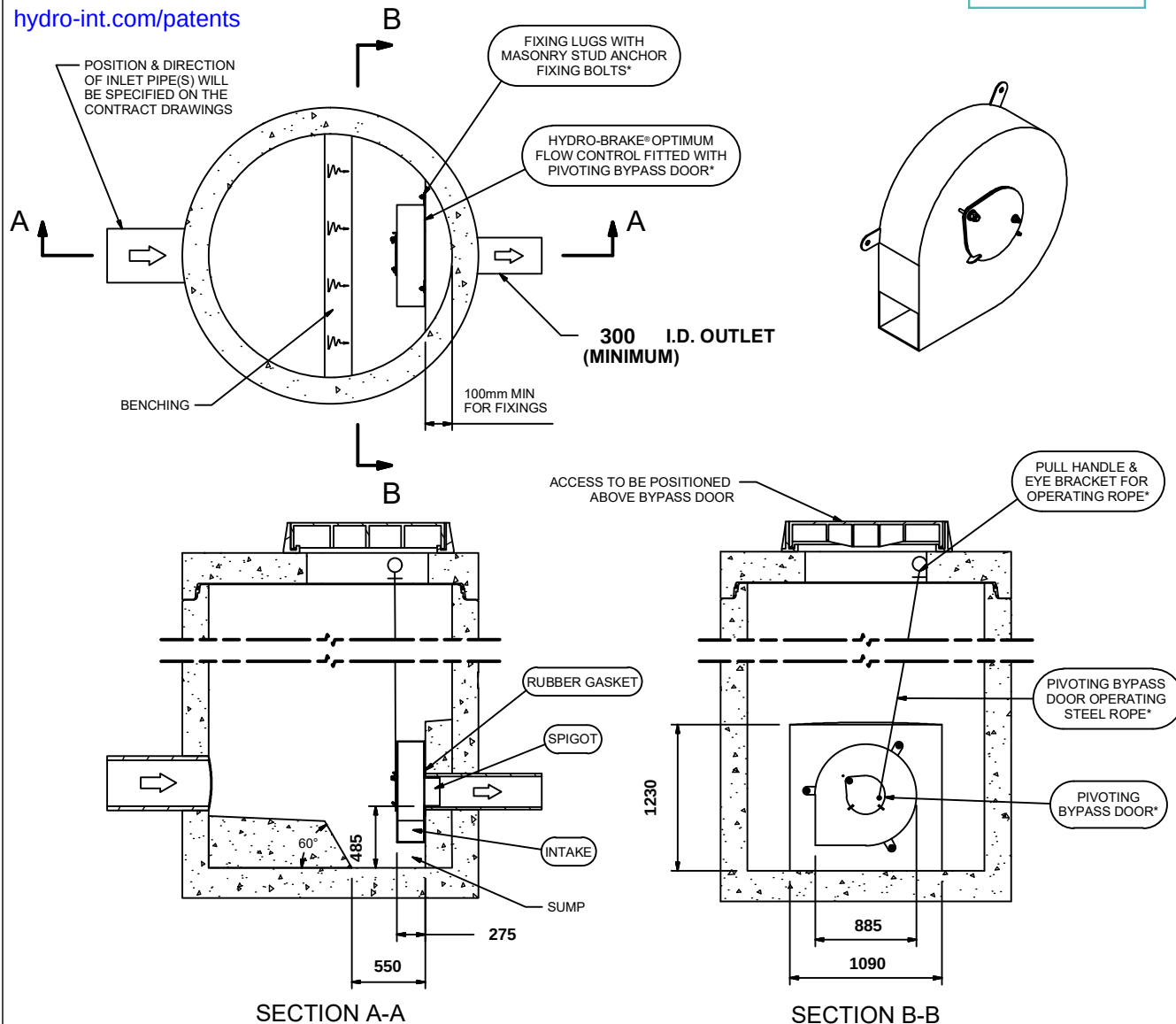
Control Point	Head (m)	Flow (l/s)
Primary Design	1.200	41.500
Flush-Flo™	0.442	41.460
Kick-Flo®	0.885	35.856
Mean Flow		34.511

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 80 kg



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IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0270-4150-1200-4150 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International
A CRH COMPANY

DATE	20/02/2024 12:50
SITE	OHH Sid Catchment G
DESIGNER	Binam Tiwari
REF	Pond_G

SHE-0270-4150-1200-4150
Hydro-Brake® Optimum

POND H AND CATCHMENT H

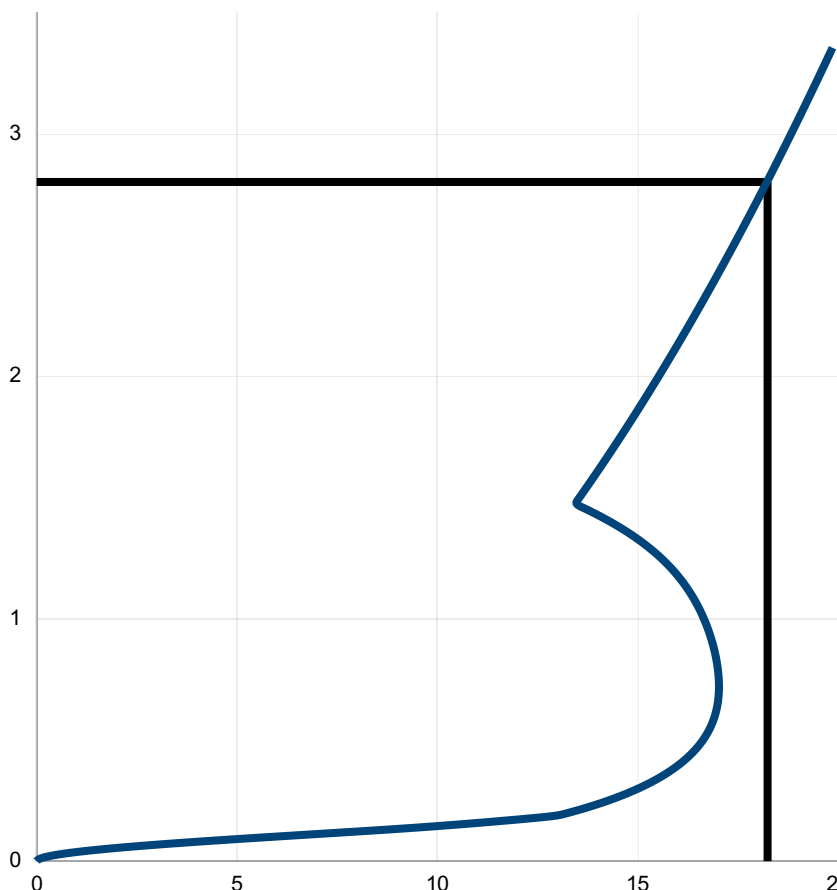
HYDROBRAKE DETAILS

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.800	18.250
Flush-Flo™	0.720	17.037
Kick-Flo®	1.471	13.432
Mean Flow		15.308



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.097	5.535
0.193	13.140
0.290	14.891
0.386	15.946
0.483	16.565
0.579	16.893
0.676	17.024
0.772	17.021
0.869	16.922
0.966	16.742
1.062	16.476
1.159	16.095
1.255	15.553
1.352	14.794
1.448	13.753
1.545	13.747
1.641	14.147
1.738	14.535
1.834	14.912
1.931	15.279
2.028	15.637
2.124	15.987
2.221	16.328
2.317	16.662
2.414	16.989
2.510	17.309
2.607	17.623
2.703	17.931
2.800	18.233

DESIGN ADVICE



The head/flow characteristics of this SHE-0164-1825-2800-1825 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE 22/02/2024 14:56

Site Catchment H5

DESIGNER Binam Tiwari

Ref Catchment_H2

SHE-0164-1825-2800-1825

Hydro-Brake® Optimum

Technical Specification

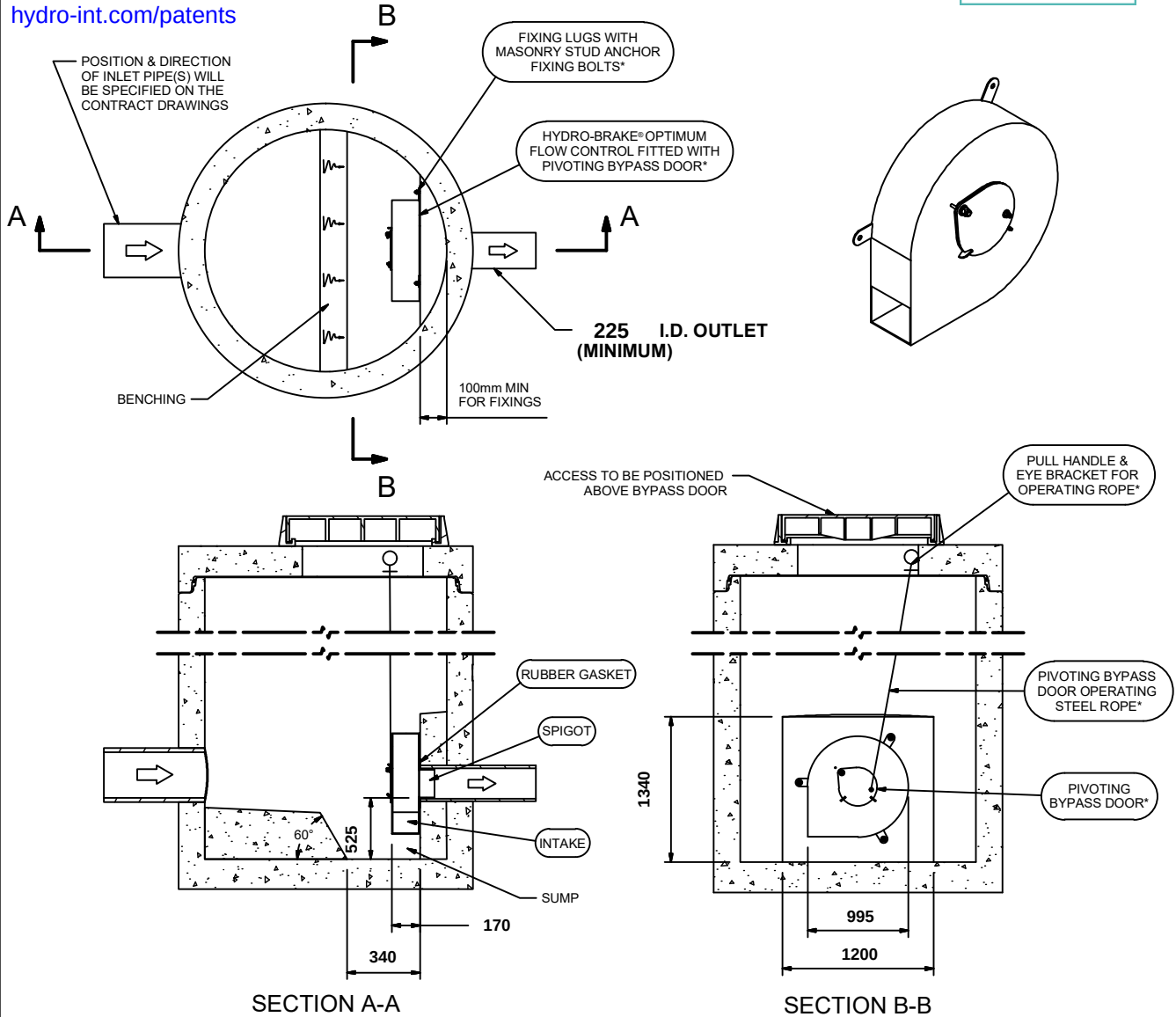
Control Point	Head (m)	Flow (l/s)
Primary Design	2.800	18.250
Flush-Flo™	0.720	17.037
Kick-Flo®	1.471	13.432
Mean Flow		15.308

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 90 kg



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IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0164-1825-2800-1825 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE 22/02/2024 14:56

SITE Catchment H5

DESIGNER Binam Tiwari

REF Catchment H2

SHE-0164-1825-2800-1825

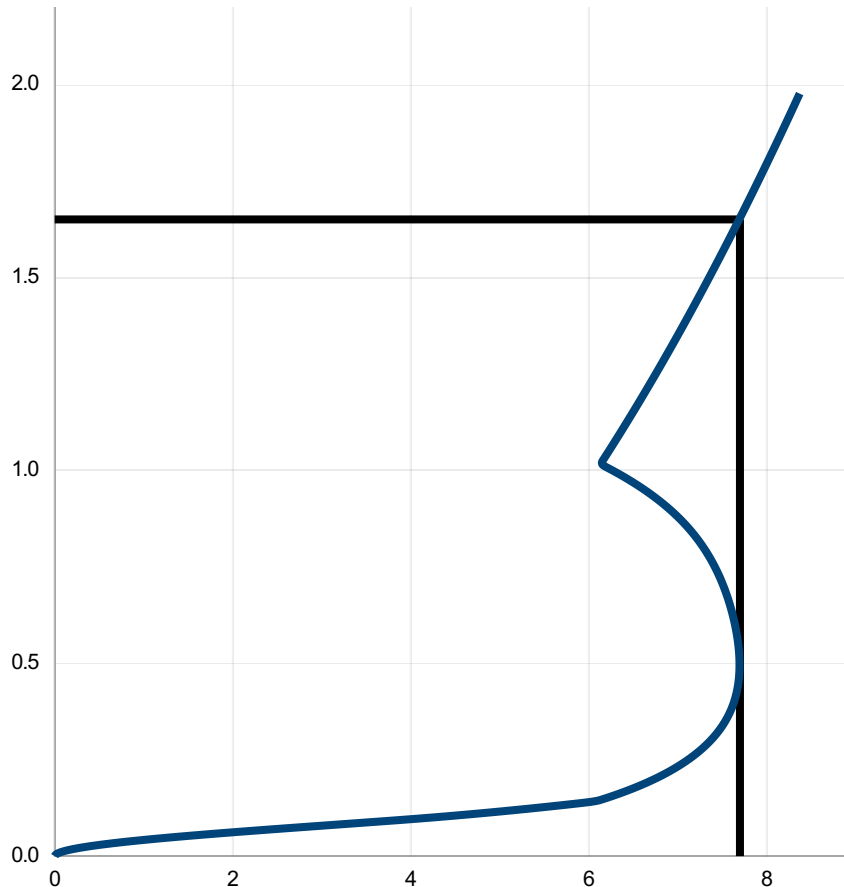
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.650	7.700
Flush-Flo™	0.495	7.695
Kick-Flo®	1.015	6.129
Mean Flow		6.751



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Head (m)	Flow (l/s)
0.000	0.000
0.057	1.733
0.114	4.921
0.171	6.446
0.228	6.967
0.284	7.304
0.341	7.513
0.398	7.631
0.455	7.685
0.512	7.694
0.569	7.669
0.626	7.618
0.683	7.542
0.740	7.439
0.797	7.299
0.853	7.109
0.910	6.851
0.967	6.508
1.024	6.156
1.081	6.313
1.138	6.465
1.195	6.614
1.252	6.759
1.309	6.901
1.366	7.039
1.422	7.175
1.479	7.308
1.536	7.438
1.593	7.566
1.650	7.691

DESIGN ADVICE



The head/flow characteristics of this SHE-0120-7700-1650-7700 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE 22/02/2024 14:58

Site Catchment H

DESIGNER Binam Tiwari

Ref Catchment_H4

SHE-0120-7700-1650-7700

Hydro-Brake® Optimum

Technical Specification

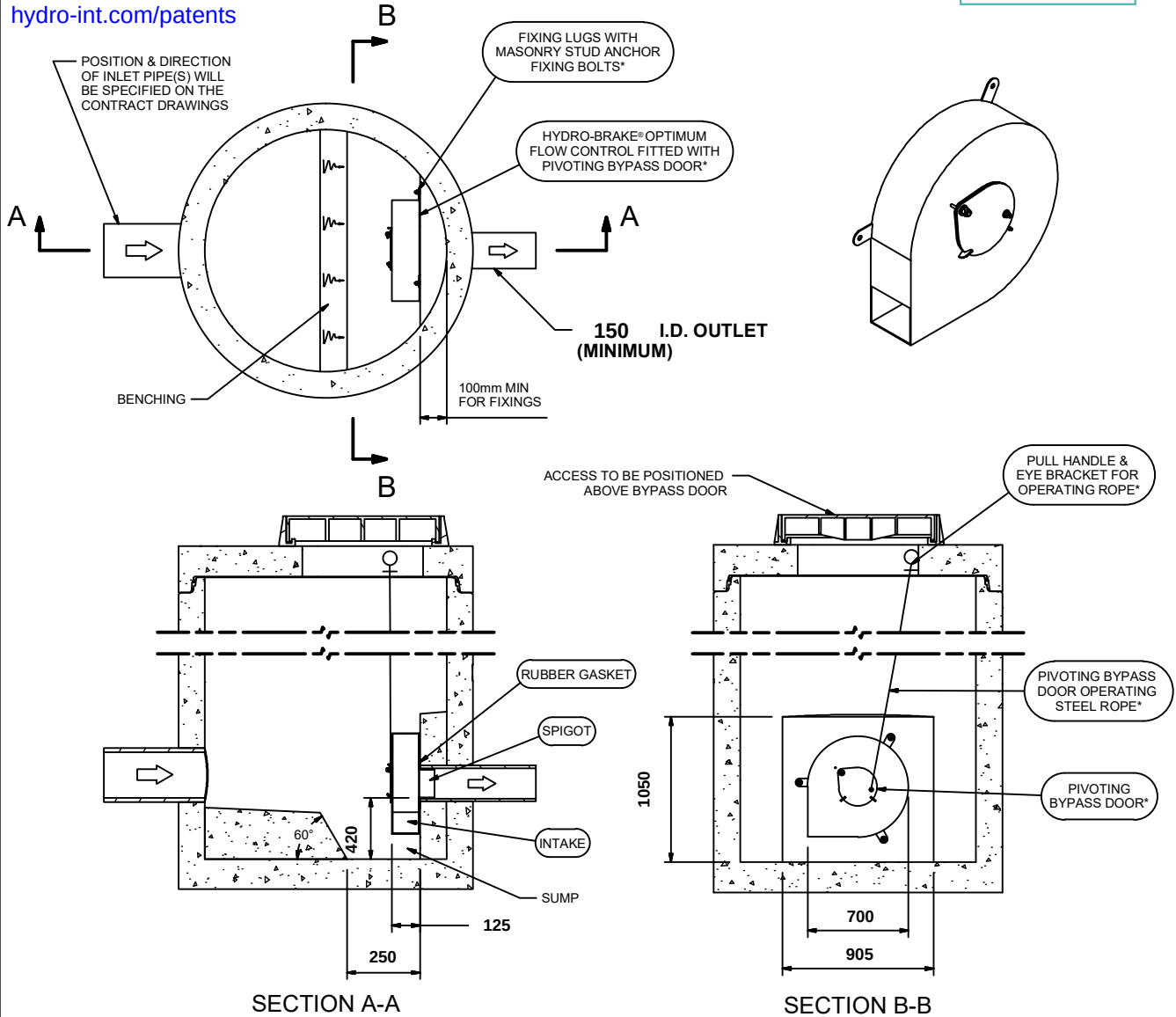
Control Point	Head (m)	Flow (l/s)
Primary Design	1.650	7.700
Flush-Flo™	0.495	7.695
Kick-Flo®	1.015	6.129
Mean Flow		6.751

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 30 kg



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IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0120-7700-1650-7700 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International
A CRH COMPANY

DATE 22/02/2024 14:58

SITE Catchment H

DESIGNER Binam Tiwari

REF Catchment H4

SHE-0120-7700-1650-7700

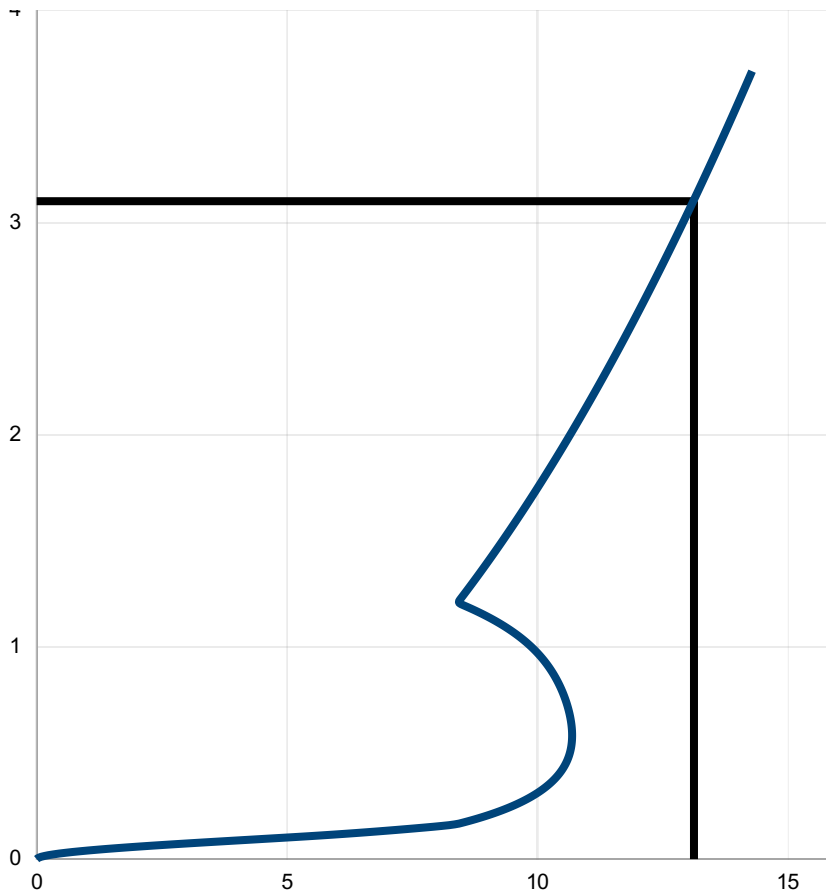
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	3.100	13.130
Flush-Flo™	0.583	10.696
Kick-Flo®	1.206	8.403
Mean Flow		10.280



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Head (m)	Flow (l/s)
0.000	0.000
0.107	5.366
0.214	9.106
0.321	10.059
0.428	10.514
0.534	10.681
0.641	10.678
0.748	10.567
0.855	10.364
0.962	10.039
1.069	9.522
1.176	8.718
1.283	8.648
1.390	8.979
1.497	9.297
1.603	9.604
1.710	9.900
1.817	10.187
1.924	10.465
2.031	10.735
2.138	10.999
2.245	11.255
2.352	11.506
2.459	11.750
2.566	11.990
2.672	12.224
2.779	12.453
2.886	12.678
2.993	12.899
3.100	13.116

DESIGN ADVICE



The head/flow characteristics of this SHE-0135-1313-3100-1313 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
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DATE 22/02/2024 14:59

Site Catchment H

DESIGNER Binam Tiwari

Ref Catchment_H5

SHE-0135-1313-3100-1313

Hydro-Brake® Optimum

Technical Specification

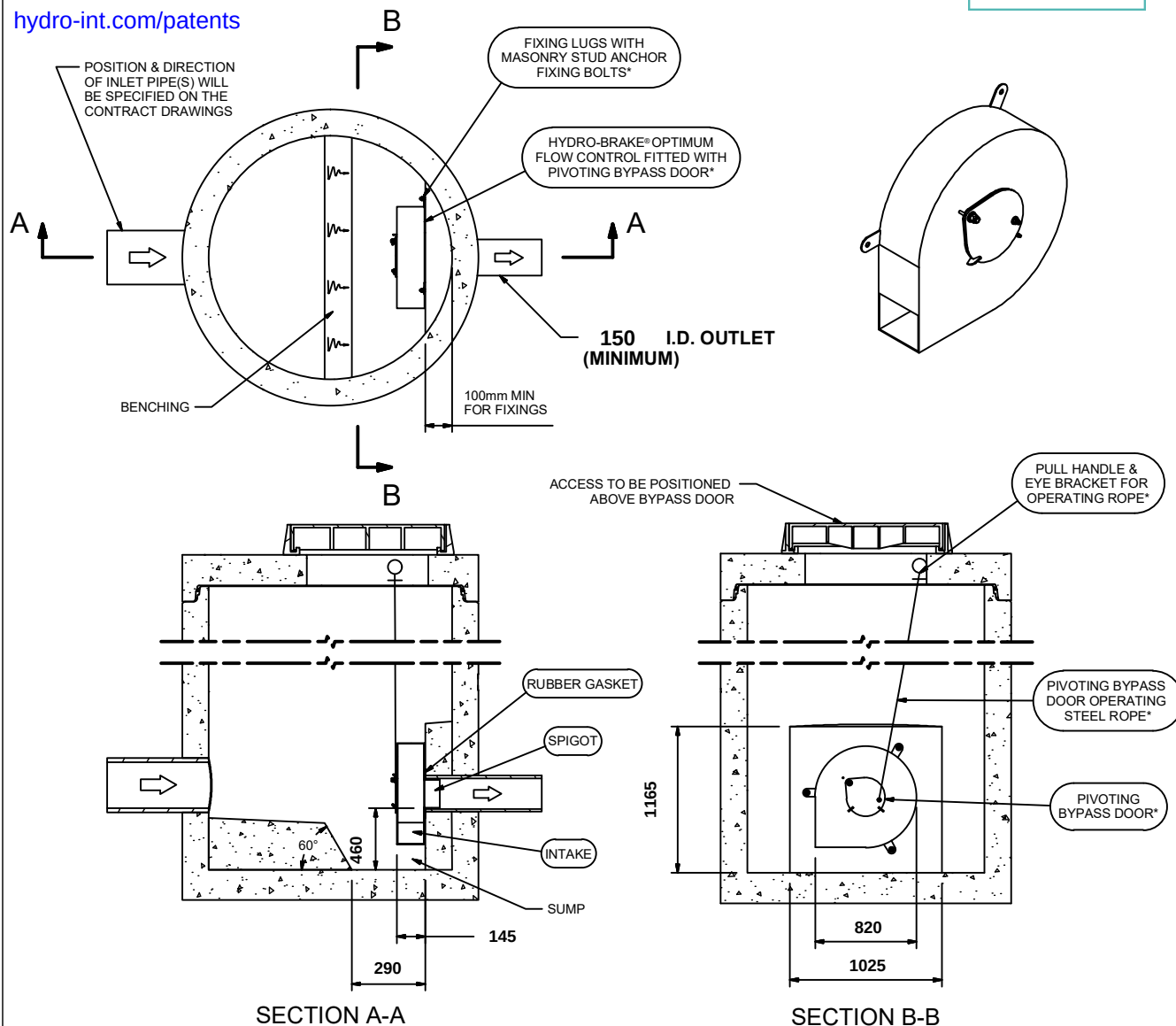
Control Point	Head (m)	Flow (l/s)
Primary Design	3.100	13.130
Flush-Flo™	0.583	10.696
Kick-Flo®	1.206	8.403
Mean Flow		10.280

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 60 kg



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IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0135-1313-3100-1313 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

**Hydro
International**
 A CRH COMPANY

DATE 22/02/2024 14:59

SITE Catchment H

DESIGNER Binam Tiwari

REF Catchment H5

SHE-0135-1313-3100-1313

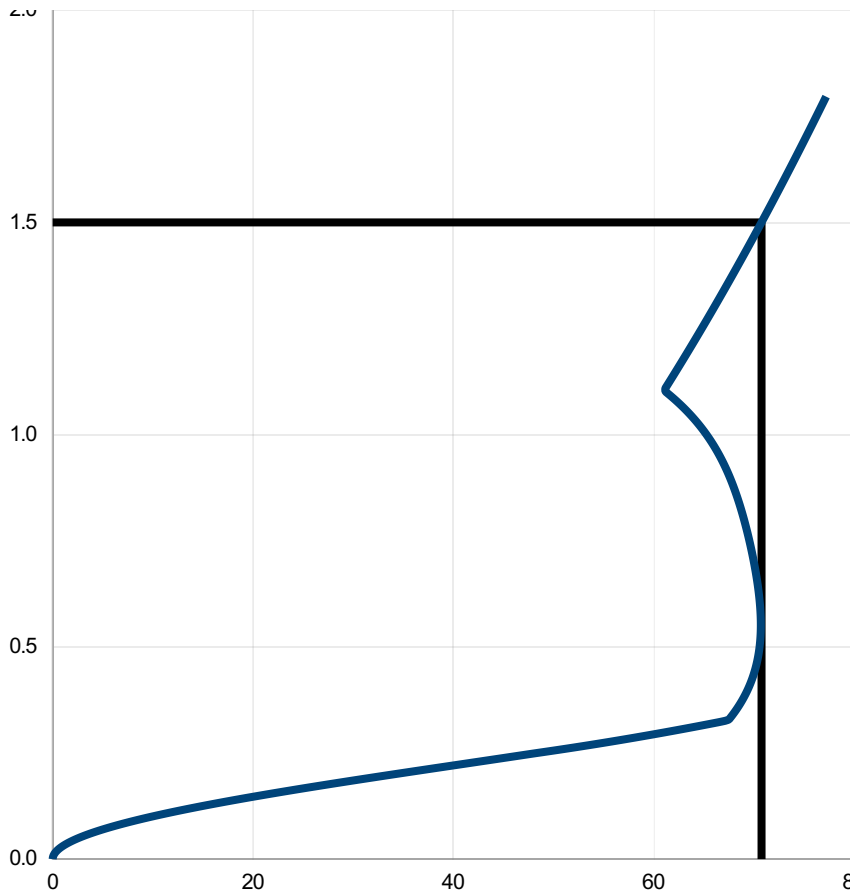
Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.500	70.800
Flush-Flo™	0.551	70.729
Kick-Flo®	1.103	61.030
Mean Flow		58.967



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Head (m)	Flow (l/s)
0.000	0.000
0.052	2.787
0.103	10.513
0.155	22.063
0.207	36.072
0.259	50.855
0.310	63.819
0.362	68.559
0.414	69.686
0.466	70.359
0.517	70.675
0.569	70.717
0.621	70.555
0.672	70.245
0.724	69.827
0.776	69.319
0.828	68.711
0.879	67.970
0.931	67.030
0.983	65.799
1.034	64.160
1.086	61.974
1.138	61.952
1.190	63.295
1.241	64.608
1.293	65.895
1.345	67.155
1.397	68.391
1.448	69.604
1.500	70.795

DESIGN ADVICE



The head/flow characteristics of this SHE-0335-7080-1500-7080 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
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A CRH COMPANY

DATE 22/02/2024 15:00

Site Pond H

DESIGNER Binam Tiwari

Ref Pond H

SHE-0335-7080-1500-7080

Hydro-Brake® Optimum

Technical Specification

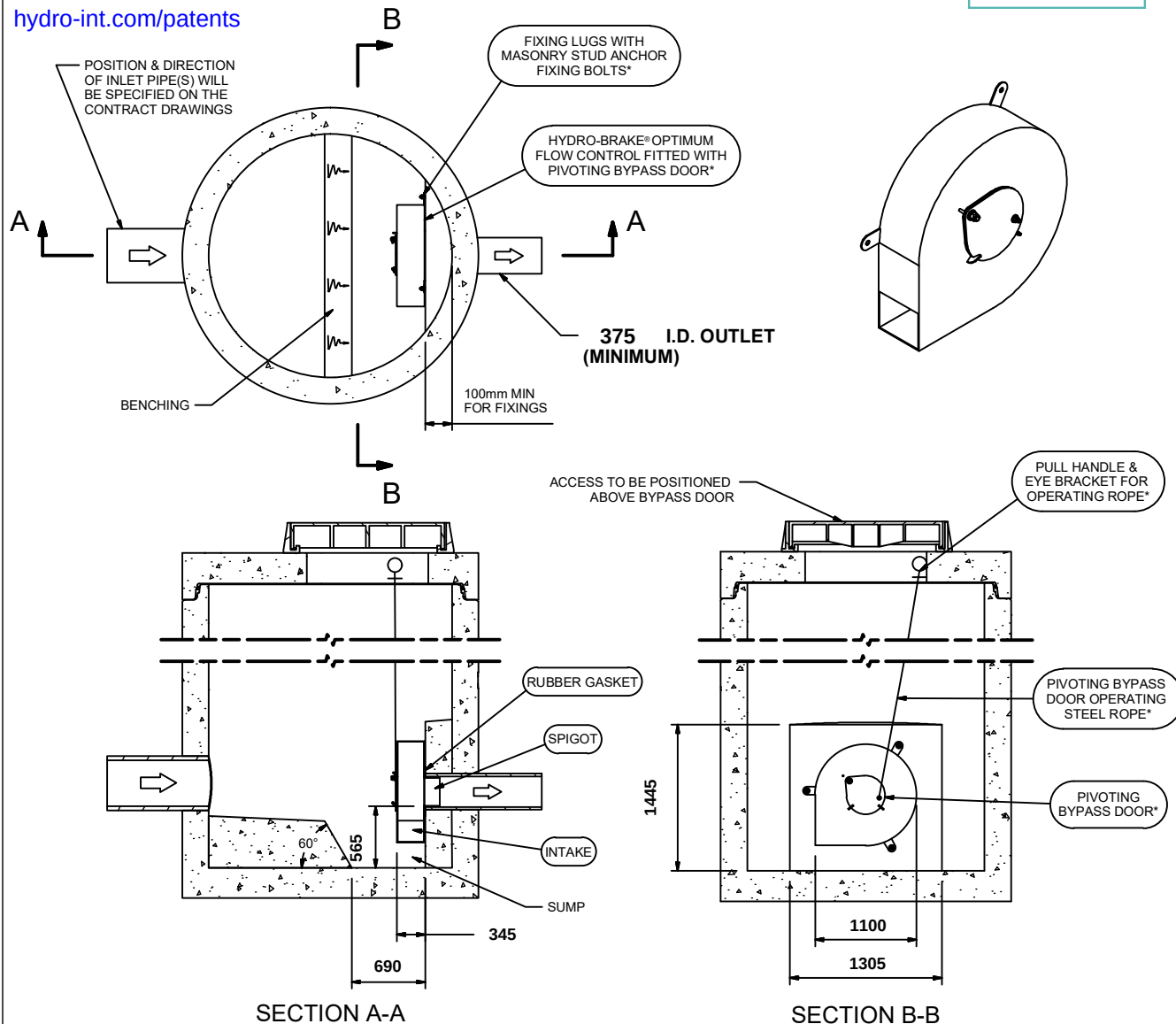
Control Point	Head (m)	Flow (l/s)
Primary Design	1.500	70.800
Flush-Flo™	0.551	70.729
Kick-Flo®	1.103	61.030
Mean Flow		58.967

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 120 kg



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IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0335-7080-1500-7080

Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International
A CRH COMPANY

DATE 22/02/2024 15:00

SITE Pond H

DESIGNER Binam Tiwari

REF Pond H

SHE-0335-7080-1500-7080

Hydro-Brake® Optimum

POND F AND CATCHMENT F

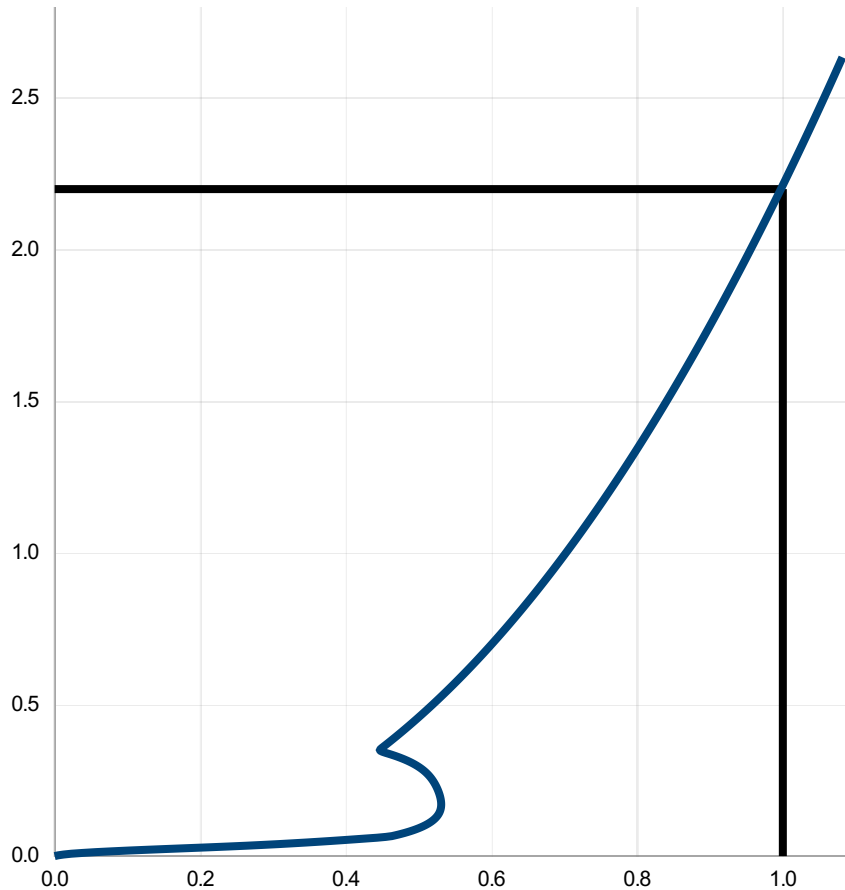
HYDROBRAKE DETAILS

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.200	1.000
Flush-Flo™	0.171	0.531
Kick-Flo®	0.347	0.444
Mean Flow		0.716



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Head (m)	Flow (l/s)
0.000	0.000
0.076	0.480
0.152	0.530
0.228	0.524
0.303	0.494
0.379	0.461
0.455	0.499
0.531	0.533
0.607	0.564
0.683	0.594
0.759	0.622
0.834	0.648
0.910	0.674
0.986	0.698
1.062	0.721
1.138	0.743
1.214	0.765
1.290	0.786
1.366	0.806
1.441	0.825
1.517	0.844
1.593	0.863
1.669	0.881
1.745	0.899
1.821	0.916
1.897	0.933
1.972	0.950
2.048	0.966
2.124	0.982
2.200	0.997

DESIGN ADVICE



The head/flow characteristics of this SHE-0039-1000-2200-1000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
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A CRH COMPANY

DATE	20/02/2024 12:42
Site	OHH Sid_ Catchment F
DESIGNER	Binam Tiwari
Ref	Catchment_F9

SHE-0039-1000-2200-1000

Hydro-Brake® Optimum

Technical Specification

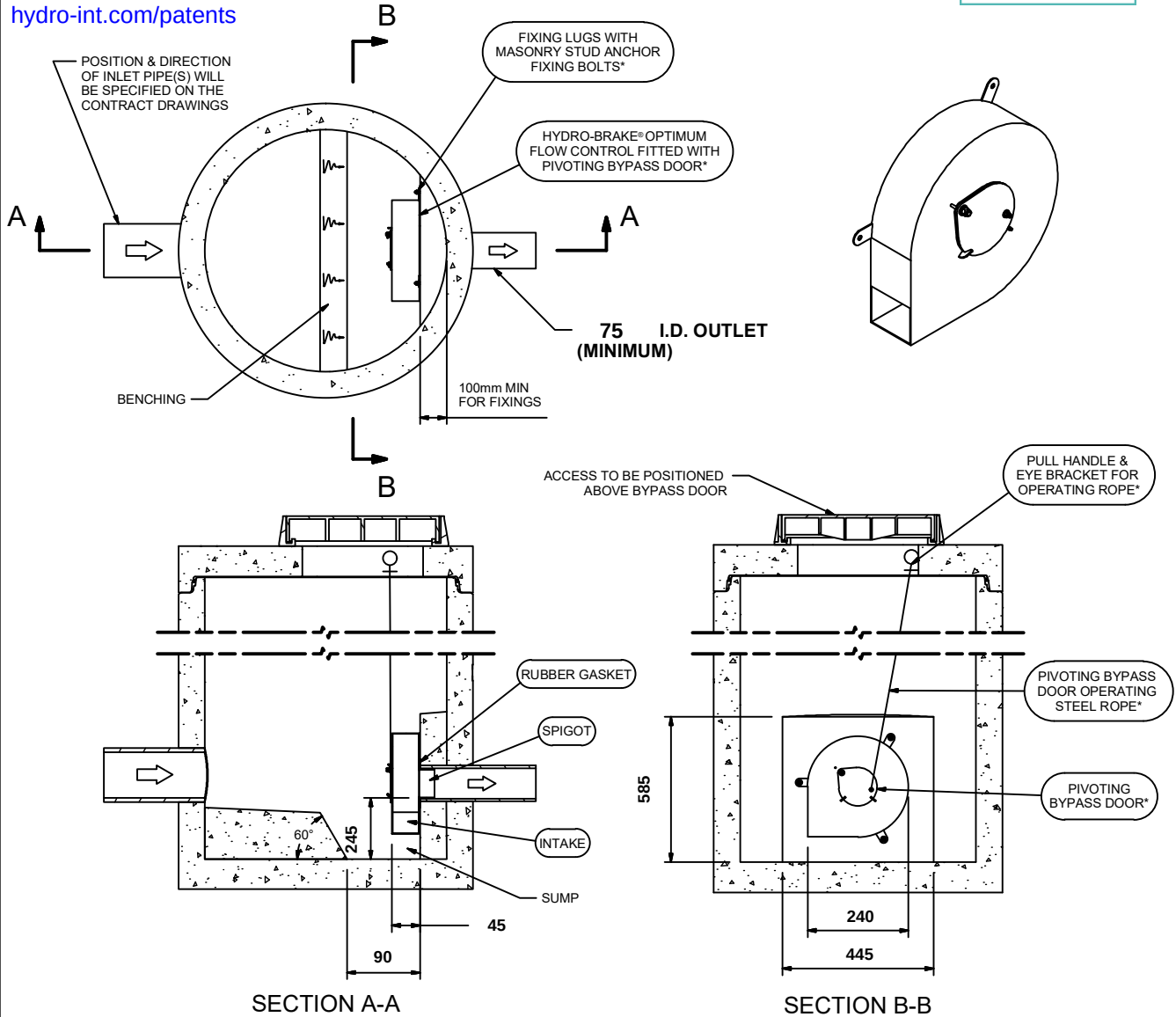
Control Point	Head (m)	Flow (l/s)
Primary Design	2.200	1.000
Flush-Flo™	0.171	0.531
Kick-Flo®	0.347	0.444
Mean Flow		0.716

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 0 kg



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IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0039-1000-2200-1000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

**Hydro
International**
 A CRH COMPANY

DATE	20/02/2024 12:42
SITE	OHH Sid Catchment F
DESIGNER	Binam Tiwari
REF	Catchment F9

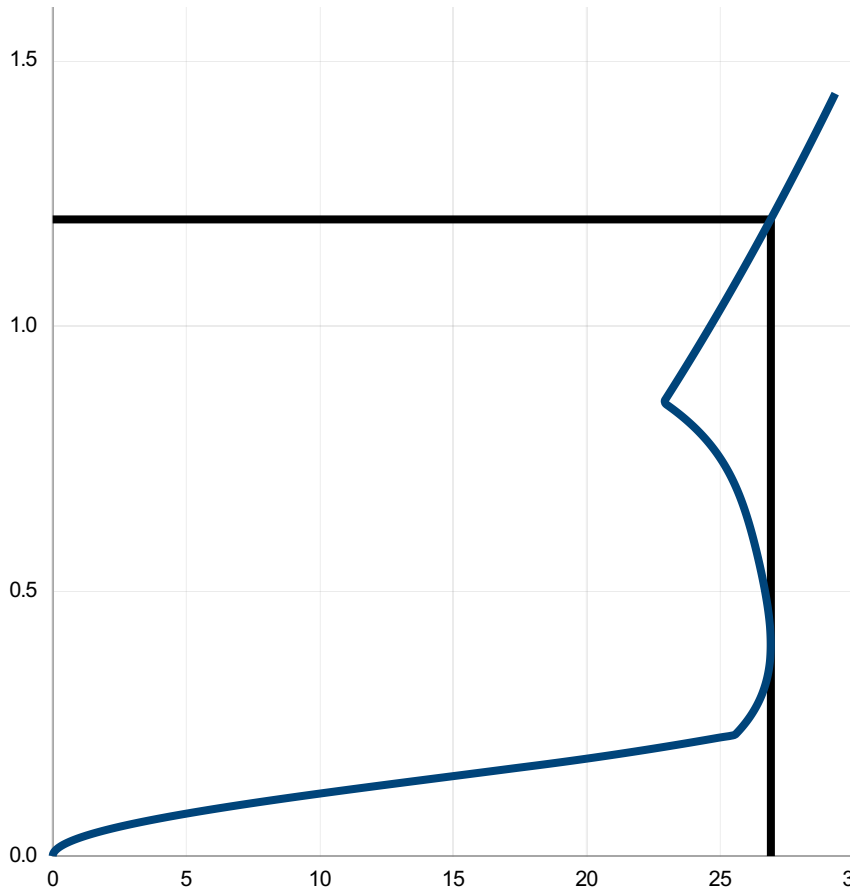
SHE-0039-1000-2200-1000
 Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.200	26.900
Flush-Flo™	0.399	26.897
Kick-Flo®	0.854	22.865
Mean Flow		22.773



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Head (m)	Flow (l/s)
0.000	0.000
0.041	1.432
0.083	5.320
0.124	10.925
0.166	17.275
0.207	23.033
0.248	25.906
0.290	26.432
0.331	26.737
0.372	26.875
0.414	26.890
0.455	26.819
0.497	26.691
0.538	26.527
0.579	26.336
0.621	26.117
0.662	25.854
0.703	25.519
0.745	25.070
0.786	24.452
0.828	23.602
0.869	23.054
0.910	23.571
0.952	24.075
0.993	24.568
1.034	25.051
1.076	25.524
1.117	25.988
1.159	26.443
1.200	26.890

DESIGN ADVICE



The head/flow characteristics of this SHE-0224-2690-1200-2690 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:45
Site	OHH Sid_ Catchment F
DESIGNER	Binam Tiwari
Ref	Pond F

SHE-0224-2690-1200-2690

Hydro-Brake® Optimum

Technical Specification

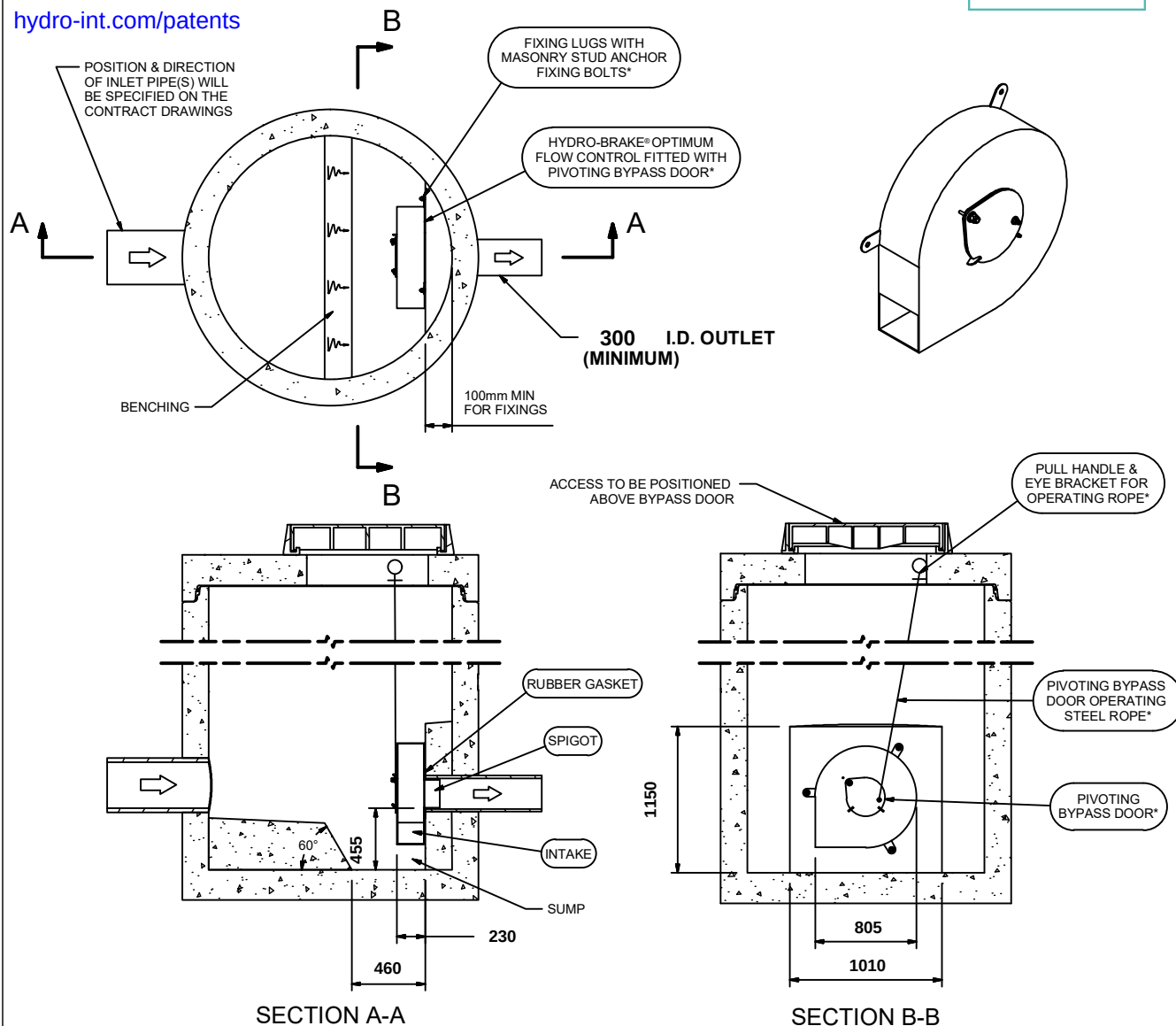
Control Point	Head (m)	Flow (l/s)
Primary Design	1.200	26.900
Flush-Flo™	0.399	26.897
Kick-Flo®	0.854	22.865
Mean Flow		22.773

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 40 kg



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IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0224-2690-1200-2690 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:45
SITE	OHH Sid Catchment F
DESIGNER	Binam Tiwari
REF	Pond F

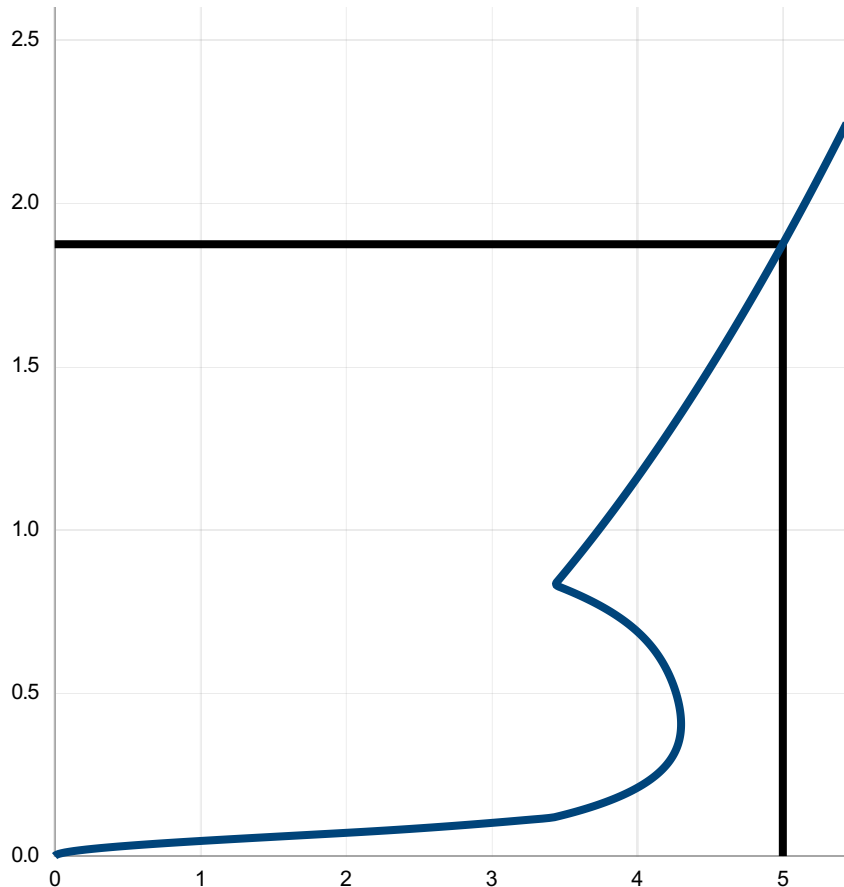
SHE-0224-2690-1200-2690
 Hydro-Brake® Optimum

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.874	5.000
Flush-Flo™	0.405	4.301
Kick-Flo®	0.830	3.430
Mean Flow		4.023



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Head (m)	Flow (l/s)
0.000	0.000
0.065	1.729
0.129	3.522
0.194	3.934
0.258	4.156
0.323	4.264
0.388	4.300
0.452	4.292
0.517	4.254
0.582	4.189
0.646	4.091
0.711	3.939
0.775	3.710
0.840	3.450
0.905	3.569
0.969	3.684
1.034	3.795
1.099	3.903
1.163	4.007
1.228	4.108
1.292	4.207
1.357	4.303
1.422	4.397
1.486	4.488
1.551	4.578
1.616	4.665
1.680	4.751
1.745	4.835
1.809	4.918
1.874	4.999

DESIGN ADVICE



The head/flow characteristics of this SHE-0093-5000-1874-5000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:44
Site	OHH Sid_ Catchment F
DESIGNER	Binam Tiwari
Ref	Swale

SHE-0093-5000-1874-5000

Hydro-Brake® Optimum

Technical Specification

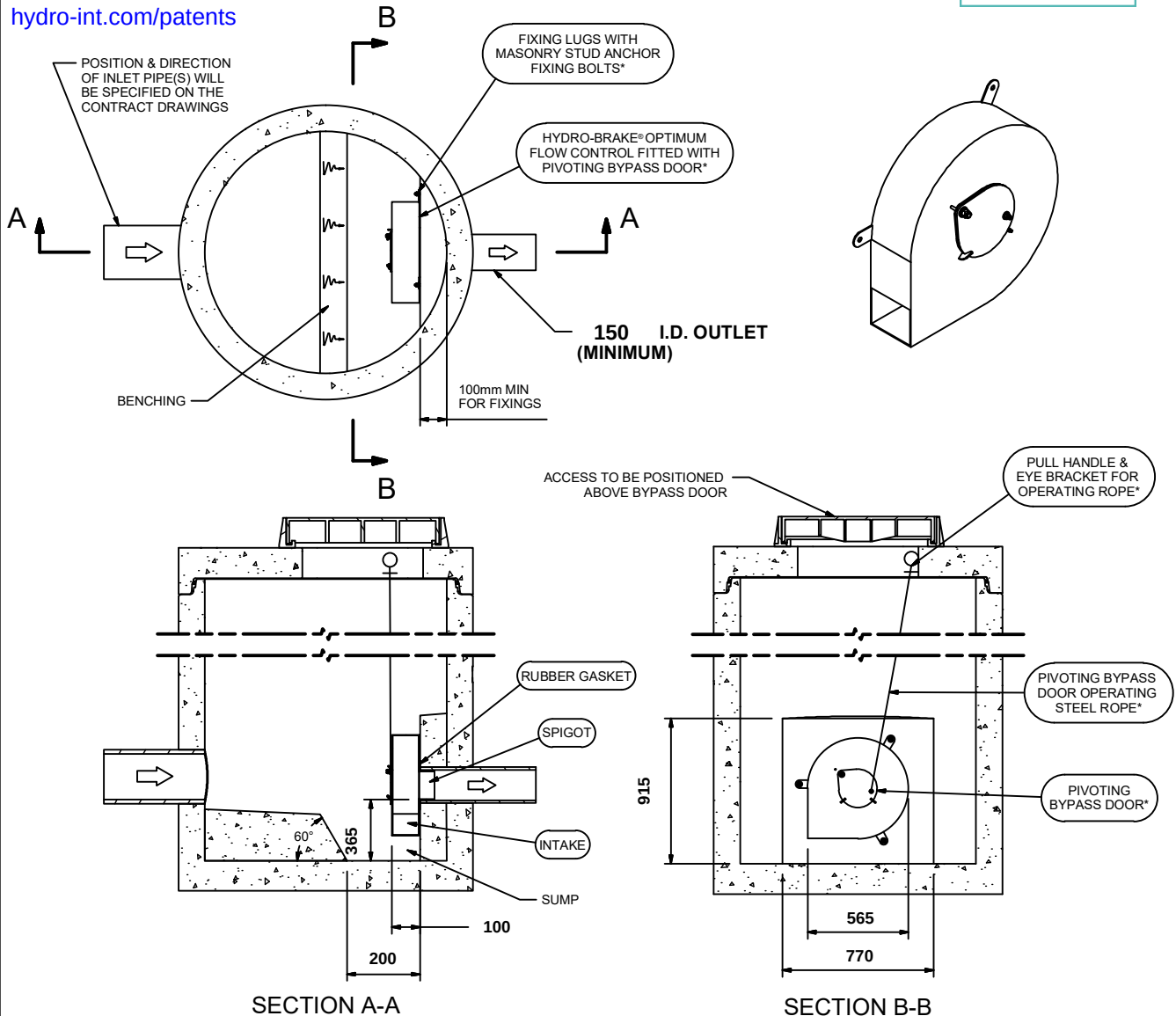
Control Point	Head (m)	Flow (l/s)
Primary Design	1.874	5.000
Flush-Flo™	0.405	4.301
Kick-Flo®	0.830	3.430
Mean Flow		4.023

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 20 kg



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IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0093-5000-1874-5000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	20/02/2024 12:44
SITE	OHH Sid Catchment F
DESIGNER	Binam Tiwari
REF	Swale

SHE-0093-5000-1874-5000
 Hydro-Brake® Optimum



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APPENDIX C

SUDS STRATEGY REPORT



RIDGE

**SPINE ROAD
SUDS STRATEGY**

ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL

December 2023



SPINE ROAD SUDS STRATEGY ONE HORTON HEATH

Prepared for

Eastleigh Borough Council
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PROJECT NAME: Spine Road SuDS Strategy
PROJECT NUMBER: 5018551
DOCUMENT REFERENCE: 5018551-RDG-XX-XX-DOC-C-9951
DOCUMENT STATUS: S2 – Suitable for Information

[illegible]

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Appendices:

Appendix A- Overall Drainage Layout
Appendix B- Proposed Site Plan
Appendix C- SuDs Plan drawings

SECTION 1

INTRODUCTION

1. PROJECT BACKGROUND

1.1. Overview

Ridge & Partners prepared this SuDS Strategy on behalf of Eastleigh Borough Council. The proposed development has been designed in full accordance with the Development Plan and Outline Planning Application (OPA) O/20/89498, which has a resolution to grant consent subject to S106 negotiations relating to education. This application is for full planning consent due to the time for these negotiations to complete. Submitting details of the Secondary Infrastructure Road (SIR) as a full planning application will deliver the SIR in accordance with, and as part of the OPA, but enable commencement more quickly than waiting for the resolution of the OPA S106 and the determination of an application for Reserved Matters Approval of details of the SIR. The site is located at One Horton Heath at approximately SO50 7BZ, Grid reference SU 48905 16935 (hereby referred to as the 'Application Site- reserved matters planning application).

1.2. Site Location

The application site is situated south of the Fir Tree Lane and north of the proposed Lower Acre development, adjacent to an existing solar farm. The existing site is currently an empty greenfield area.



Figure 1: Site Location Plan

The Ordnance Survey grid reference for the application site is SU 48807 17233, approximately 448807N, 117233E and the nearest postcode is SO50 7BZ. The total area of the proposed application site is 21.56ha.

1.3. Hydrological Settings

The nearest river is the River Itchen which is located 1.67km away from the proposed development. The tributary of Foxwood Stream runs between the solar farm and the Fir Tree Lane and north of the proposed one Horton Heath Lower Acre site as shown in figure 3.

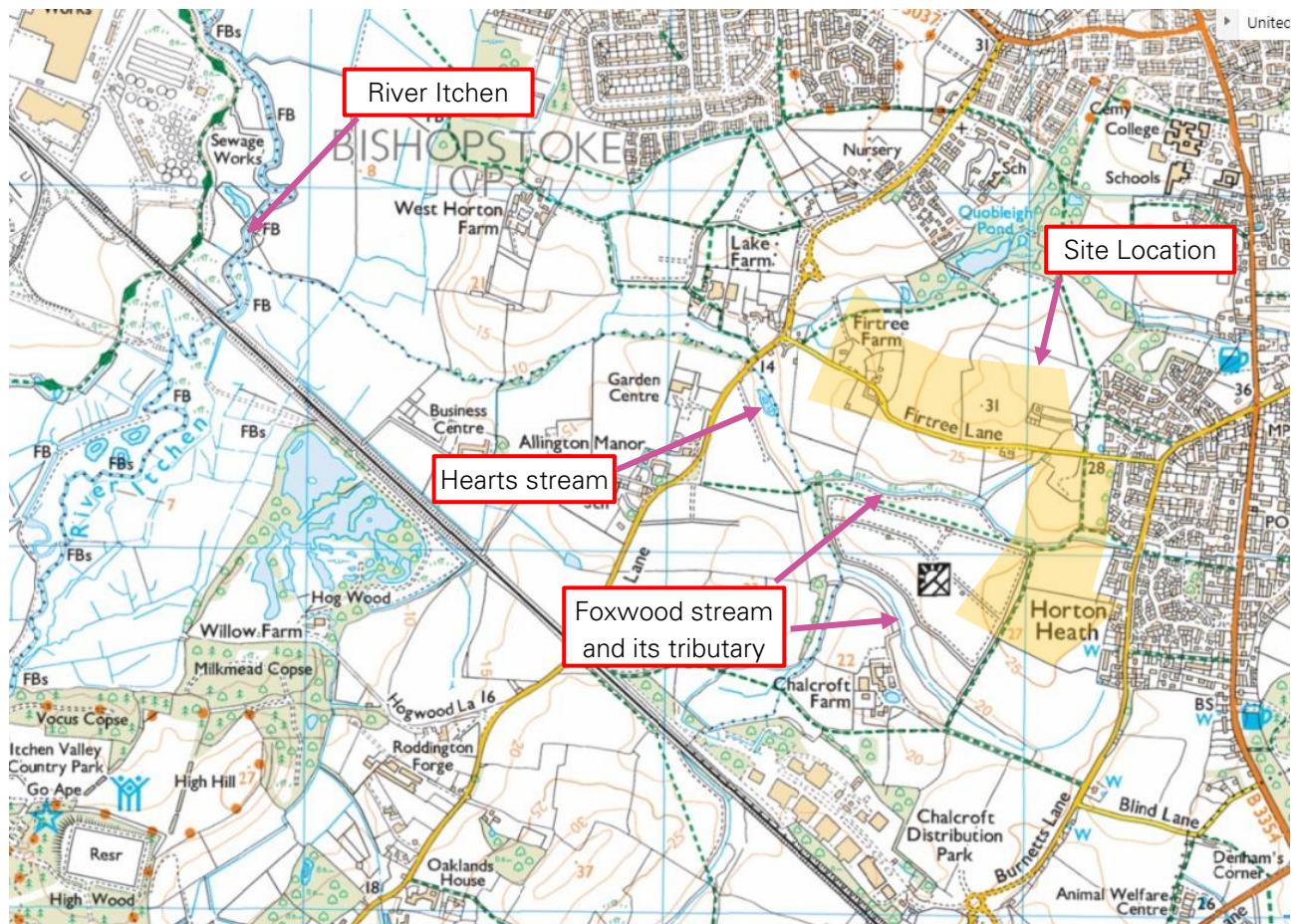


Figure 2: Location of River Itchen from the proposed site

1.4. Proposed Development

The proposed development is a part of the One Horton Heath Site Wide Infrastructure Delivery, which includes the construction of the roads, residential homes, local centres, school and its playground. However, this report primarily focuses on the spine road that spans between Fir Tree Lane and Foxwood stream, connecting the west and east portion of the development. This spine road crosses the Foxwood Stream and runs alongside the solar farm before linking to the northern section of the proposed Lower Acre site.

SECTION 2

WATER QUALITY

2. WATER QUALITY

2.1. Introduction

The proposed development utilises flow paths through swales and pond before making its final destination to the nearest watercourse, Foxwood Stream and its tributaries.

Petrol/Oil inceptor is placed between the manholes and SuDs feature such as ponds and swales to avoid any leakage or spillage to the nearby watercourse. Refer to drawing 5018551-RDG-XX-XX-DR-501 to 504.

Refer to Appendix A for overall drainage layout.

2.2. Simple Index Tool

The Simple Index Approach has been utilised to assess the water quality management set out in the SuDS Manual, with appropriate cross referencing to the relevant 'Design Conditions'.

The results of these assessments are in the following tables for each catchment area and confirm that the proposed spine roads and access roads are suitable designed into maintain water quality.

Catchment F

Access Road to Pond F

SUMMARY TABLE	
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7

SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient
Spine road to pond F	
SUMMARY TABLE	
Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	

Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Spine road to Pond F via swale

SUMMARY TABLE

Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
SuDS components proposed	
Component 3	Swale
SuDS Pollution Mitigation Indices	

SuDS Pollution Mitigation Indices

TSS	0.5
-----	-----

Metals	0.6
--------	-----

Hydrocarbons	0.7
--------------	-----

Combined Pollution Mitigation Indices

TSS	>0.95
-----	-------

Metals	>0.95
--------	-------

Hydrocarbons	>0.95
--------------	-------

Acceptability of Pollution Mitigation

TSS	Sufficient
-----	------------

Metals	Sufficient
--------	------------

Hydrocarbons	Sufficient
--------------	------------

Access road to Pond F via swale

SUMMARY TABLE

Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
Pollution Hazard Level	Low
Pollution Hazard Indices	
TSS	0.5
Metals	0.4
Hydrocarbons	0.4
SuDS components proposed	
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
SuDS components proposed	
Component 3	Swale
SuDS Pollution Mitigation Indices	

SuDS Pollution Mitigation Indices

TSS 0.5

Metals 0.6

Hydrocarbons 0.7

Combined Pollution Mitigation Indices

TSS >0.95

Metals >0.95

Hydrocarbons >0.95

Acceptability of Pollution Mitigation

TSS Sufficient

Metals Sufficient

Hydrocarbons Sufficient

Catchment G

Access Road to Pond G

SUMMARY TABLE

Land Use Type Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)

Pollution Hazard Level Low

Pollution Hazard Indices

TSS 0.5

Metals 0.4

Hydrocarbons 0.4

SuDS components proposed

Component 1 Pervious pavement (where the pavement is not designed as an infiltration component)

SuDS Pollution Mitigation Indices

TSS	0.7
-----	-----

Metals	0.6
--------	-----

Hydrocarbons	0.7
--------------	-----

SuDS components proposed

Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
-------------	--

SuDS Pollution Mitigation Indices

TSS	0.7
-----	-----

Metals	0.7
--------	-----

Hydrocarbons	0.7
--------------	-----

Combined Pollution Mitigation Indices

TSS	>0.95
-----	-------

Metals	>0.95
--------	-------

Hydrocarbons	>0.95
--------------	-------

Acceptability of Pollution Mitigation

TSS	Sufficient
-----	------------

Metals	Sufficient
--------	------------

Hydrocarbons	Sufficient
--------------	------------

Spine road to pond G

SUMMARY TABLE

Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
Pollution Hazard Level	Medium
Pollution Hazard Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.6
Hydrocarbons	0.7
SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95

Hydrocarbons >0.95

Acceptability of Pollution Mitigation

TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

Catchment H

Access Road to Pond H

SUMMARY TABLE

Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)
---------------	--

Pollution Hazard Level	Low
------------------------	-----

Pollution Hazard Indices

TSS	0.5
Metals	0.4
Hydrocarbons	0.4

SuDS components proposed

Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
-------------	---

SuDS Pollution Mitigation Indices

TSS	0.7
Metals	0.6
Hydrocarbons	0.7

SuDS components proposed

Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
-------------	--

SuDS Pollution Mitigation Indices

TSS	0.7
-----	-----

Metals	0.7
--------	-----

Hydrocarbons	0.7
--------------	-----

Combined Pollution Mitigation Indices

TSS	>0.95
-----	-------

Metals	>0.95
--------	-------

Hydrocarbons	>0.95
--------------	-------

Acceptability of Pollution Mitigation

TSS	Sufficient
-----	------------

Metals	Sufficient
--------	------------

Hydrocarbons	Sufficient
--------------	------------

Spine road to pond G

SUMMARY TABLE

Land Use Type	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)
---------------	--

Pollution Hazard Level	Medium
------------------------	--------

Pollution Hazard Indices

TSS	0.7
-----	-----

Metals	0.6
--------	-----

Hydrocarbons	0.7
--------------	-----

SuDS components proposed

Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)
-------------	---

SuDS Pollution Mitigation Indices

TSS	0.7
-----	-----

Metals	0.6
--------	-----

Hydrocarbons	0.7
SuDS components proposed	
Component 2	Proprietary treatment system (Petrol/Oil Inceptor)
SuDS Pollution Mitigation Indices	
TSS	0.7
Metals	0.7
Hydrocarbons	0.7
Combined Pollution Mitigation Indices	
TSS	>0.95
Metals	>0.95
Hydrocarbons	>0.95
Acceptability of Pollution Mitigation	
TSS	Sufficient
Metals	Sufficient
Hydrocarbons	Sufficient

2.3. Removal of Nutrient (Nitrates and Phosphorous)

Ponds

Retention ponds are structures that provide both retention and treatment of contaminated storm water runoff. Retention ponds include a permanent pool of water into which storm water runoff is directed and outflows are controlled to reduced flow rate. A well-designed pond provides a community asset and opportunities for new habitats. The pond's physical, biological and chemical processes work to remove storm water pollutants. Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake. In general, a higher-level storm water quantity control can be achieved as well as providing amenity benefits.

Landscaped depressions containing permanent pools of water, retention ponds are similar in many respects to detention basins, in that they can collect and temporarily store / attenuate surface water runoff and release it more slowly to the discharge point. However, they can provide an enhanced level of water quality treatment and also provide biodiversity and amenity benefits by supporting emergent and submerged vegetation along the waterline and within shallow marshy areas. Retention ponds need to be designed with suitable upstream

pre-treatment systems to prevent open water areas becoming blocked with silt, odorous due to pollution or stagnant.

The phosphorous within the pond will be alleviated using the following mechanism:

- Sediment removal device has been included upstream to prevent gross pollution and the volume of the pond being compromised by the build up of sediments.
- The pond has been designed so that the deposited fine sediment on the bottom is not washed out in high flows.
- Uptake by plants and aquatic flora to reduce the phosphorous within the pond.

The nitrate within the pond will be alleviated using the following mechanism:

- Removal of coarse sediments within the sediment forebay.
- The permanent pool of water provides further settlement of fine sediments and removal of nutrients
- Nitrogen reducing native marginal and aquatic species (including evergreen plants).
- The incorporation of distinct zones in the large basin providing the water quality and quantity volume storage in a number of independent cells. These features create increased attenuation, longer pollutant removal pathways (and therefore enhanced pollution removal) an easier maintenance regime and more varied ecology.
- Basins include a sediment forebay, permanent micro pools, attenuation storage volume above permanent pool water level and aquatic benches surrounding the permanent micro pools, which support wetland planting, acting as a biological filter and providing ecology amenity and safety benefits. Around the micro pools shallow wet/marshy grassland areas provide further filtration.

Swale

Swales are a linear SuDS device often used along roads or paths. Dry swale is a good pollutant removal which provides significantly better performance for metals and nitrate. Dry swales typically remove 65 percent of total phosphorus (TP), 50 percent of total nitrogen (TN), and between 80 and 90 percent of metals.

The phosphorous within the swale will be alleviated using the following mechanism:

- By use of hydrobrake, the flow entering the swale can be slowed down which helps to reduce the phosphorous count within the swale.
- Uptake by plants and aquatic flora to reduce the phosphorous within the swale.
- Sediment bound phosphorous is removed through sedimentation.

SECTION 03

SUDS MAINTENANCE PLAN

3. SUDS MAINTENANCE PLAN

3.1. Introduction

This section sets out the principles for the long-term management and maintenance of the proposed surface water Sustainable Drainage Systems (SuDS) to be constructed to discharge surface water discharged from the spine road and the access road nearby within the area of One Horton Heath (See Appendix B for proposed site plan). The purpose of this section is to set out the basis of the SuDS Maintenance Plan for the development and to ensure that the management company is entrusted with a robust inspection and maintenance programme. It ensures that the optimum operation of the drainage network is continually maintained for the lifetime of the development and to prevent the increased risk of flooding both on and off site in accordance with the National Planning Policy Framework (NPPF).

All those responsible for maintenance should follow relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) for all activities listed within this section including lone working, if relevant) and risk assessments should always be undertaken. Any contractor employed by the Site Operator/Management Company shall carry out periodic maintenance of all such SuDS in accordance with the schedules listed in this section. Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.

3.2. SuDs Layout

The storm water drainage strategy for the proposed development is to utilise a range of SuDS features to discharge the surface water to the nearest water course, Foxwood Stream via ponds. The layout for the proposed development is not confirmed yet. However, SuDs feature like permeable paving will be include within development design. The treatment train

The proposed storm water system contains the following SuDS Components:

- Ponds
- Swales
- Permeable Paving
- Hydro brake Flow Controls
- Petrol/oil Inceptors

There are three categories of maintenance activities referred to in this Section:

- Regular maintenance (including inspections and monitoring).

Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

- Occasional maintenance

Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).

- Remedial maintenance

Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

Ponds

There are 3 ponds present within the vicinity of the spine road which will be utilised to discharge the surface water from the spine road and the nearby catchments. The depth of the pond are as follows:

POND	DEPTH
Pond_F	1.0m
Pond_G	1.2m
Pond_H	1.5m

To ensure that the people who are in the vicinity of the pond are aware of the potential danger and also to minimize the risk of drowning, a lifesaving ring should be provided within the area of the pond.

Ponds will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities, along with likely machinery requirements and typical annual costs- within the Maintenance Plan. The treatment performance of ponds is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Maintenance of ponds is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work required for a SuDS Pond is necessary for standard public open space.

Regular inspection and maintenance are important for the effective operation of ponds as designed. Maintenance responsibility for a pond and its surrounding area should always be placed with a responsible organisation. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

Any invasive maintenance work such as silt or vegetation removal is only required intermittently, but it should be planned to be sympathetic to the requirements of wildlife in a pond. Care should be taken to avoid disturbance to nesting birds during the breeding season and habitats of target species (e.g., great crested newt and water voles) at critical times. The window for carrying out maintenance to achieve this is usually towards the end of the growing season (typically September/October), although this will vary with species).

Invasive silt and vegetation removal should only be carried out to limited areas at any one time 25-30% of the pond area on one occasion each year to minimise the impact on biodiversity. Plant management, to achieve particular desired habitat effects, should be clearly specified in a maintenance schedule.

Site vegetation should be trimmed as necessary to keep the pond free of leaves and to maintain the aesthetic appearance of the site. Slope areas that have become bare should be re-vegetated and any eroded areas should be regraded before replanting.

Maintenance access (or "easement") should be provided to the pond from a public or private road. An assessment should be made at the planning stage regarding the maintenance and associated access requirements. Ideally, access should be at least 3.5 m wide, have a maximum cross fall of 1 in 7, and be sufficiently robust to withstand maintenance equipment and vehicles. However, temporary access routes for infrequent operations could be considered where permanent routes are not appropriate. The access should extend to any forebay, safety and aquatic benches, inlet and outlet infrastructure. Consideration should be given as to whether maintenance vehicles will need to turn around. Wherever possible.

SuDS ponds and wetlands should be designed so that special machinery is not required to undertake maintenance. The list of actions is not exhaustive, and some actions may not always be required. Consideration should be given to the need to control risks to biosecurity during maintenance operations.

Sediments excavated from ponds or forebays that receive runoff from residential or standard road and roof areas should be safely disposed of in accordance with current waste management legislation. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Chemical testing of the sediment may be required, before sediment excavation, to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases on low-risk sites with source control and a Management Train, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. If ponds are to be drawn down, care should be taken to prevent downstream discharge of sediments and anoxic water. The environmental regulator should be notified before such activities.

New ponds may become rapidly dominated by invasive native plants, particularly common bulrush (*Typha latifolia*). As it is not desirable for all new ponds to be bulrush dominated, it should be ensured that in the first five years, while vegetation is establishing, certain plant growth is controlled. After this time, ponds can usually be allowed to develop naturally recognising that, unless the margins are occasionally managed, they are likely to become dominated by trees and shrubs.

Eutrophication of SuDS ponds can occur during the summer months. This is best alleviated by controlling the nutrient source or providing a continuous baseflow to the pond. Unless eutrophication is severe, aeration can be used as a stop-gap measure to save aquatic animal species and reduce risks to receiving waters. However, the addition of barley straw bales, dredging or rendering the nutrients inactive by chemical means can also be successful.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the pond should be monitored, and maintenance schedules adjusted to suit requirements.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate.

This information will be required as part of the health and safety file.

Regular Maintenance

Monthly

Remove any debris and litter. Cut grass and manage other vegetation, inspect outlet and inlet and for blockage.

Yearly

Hand cut submerged and emergent aquatic plants. Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level. Tidy all dead growth before the start of growing season.

Occasional Maintenance

Remove sediment from the main body of big ponds when pool volume is reduced by 20%.

Remedial Actions

Repair erosion or other damages, replant, aerate pond when signs of eutrophication are detected, realign riprap or repair other damage, repair/rehabilitate inlets, outlets and overflows.

Swale

There is only one swale within the proposed development. The depth of the swale is 1.4m. To ensure that the people who are in the vicinity of the swale are aware of the potential danger and also to minimize the risk of drowning, a lifesaving ring should be provided within the area of the swale.

Swales will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs - within the Maintenance Plan. The treatment performance of swales is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Maintenance of swales is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a swale over and above what is necessary for standard public open space. Provided that landscape management is already required at site, swale maintenance should have marginal cost implications. However, regular inspection and maintenance are important for the effective operation of swales as designed. Maintenance responsibility for a swale should always be placed with an appropriate organisation. If swales are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

Adequate access should be provided to all swale areas for inspection and maintenance, including for appropriate equipment and vehicles. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

The major maintenance requirement for dry swales is mowing. Mowing should ideally retain grass lengths of 75-150 mm across the main "treatment" surface, to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. However, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality.

Grass clippings should be disposed of either off site or outside the area of the swale, to remove nutrients and pollutants. For wet swales, mowing of wetland vegetation is not required. However, harvesting of very dense vegetation may be desirable in the autumn after plant die-back, to prevent the discharge of excess organic material into receiving waters. All vegetation management activities should take account of the need to maximise biosecurity and prevent the spread of invasive species.

Occasionally sediment will need to be removed (e.g., once deposits exceed 25 mm in depth), although this can be minimised by ensuring that upstream areas are stabilised and by incorporating effective pre-treatment devices. Available evidence from monitoring studies indicates that small, distributed infiltration practices such as swales do not contaminate underlying soils, even after more than 10 years of operation (TRCA, 2008). Sediments excavated from a swale that receives runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff from busy streets with high vehicle traffic, sediment testing will be essential. Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the swales should be monitored, and maintenance schedules adjusted to suit requirements.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

Regular Maintenance

Monthly

Remove any debris from the catchment surface (If it poses any risk on its operation work). Cut grass and manage other vegetation, inspect outlet and inlet and overflows for blockage.

Half yearly

Inspect inlet and facility surface for silt accumulation, establish silt removal frequencies.

Occasional Maintenance

Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required.

Remedial Actions

Remove erosion or other damage by re-turfing or re-seeding. Relevel uneven surface and reinstate design level. Remove build-up of sediment. Remove and dispose of oil or petrol residues using safe standard practices.

Permeable Paving

The exact location of the permeable paving for the proposed development is not confirmed yet. However, permeable paving will be included within the development design.

Regular inspection and maintenance are important for the effective operation of pervious pavements. Maintenance responsibility for a permeable pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the pavement to the client, it should be inspected for clogging, litter, weeds and water ponding, and all failures should be rectified. After handover, the pavement should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Extensive experience suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most sites. However, in some instances, more or less sweeping may be required and the frequency should be adjusted to suit site-specific circumstances and should be informed by inspection reports.

A brush and suction cleaner (which can be a lorry-mounted device or a smaller precinct sweeper) should be used for regular sweeping. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced. It is also possible to clean the surface using lightweight rotating brush cleaners combined with power spraying using hot water and is done every two years at the site.

If the surface has clogged then a more specialist sweeper with water jetting and oscillating and rotating brushes may be required, especially for porous asphalt surfaces, to restore the surface infiltration rate to an

acceptable level. The specialist equipment should be adjusted so that it does not strip binder from the aggregate in the asphalt.

The likely design life of grass reinforcement will be dictated by trafficking and is likely to be about 20 years if designed correctly. For concrete block permeable paving the design life should be no different from standard paving, assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging. Porous asphalt will lose strength and begin to fatigue due to oxidation of the binder. This is likely to occur slightly faster in porous asphalt than normal asphalt, so the design life will be reduced slightly. Porous concrete should have a similar design life to a normal concrete slab.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Maintenance Plans and schedules should be prepared during the design phase. Specific maintenance needs of the pervious pavement should be monitored, and maintenance schedules adjusted to suit requirements.

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

Refer to Maintenance schedule plan on section 3.3 to identify the maintenance frequency of permeable paving.

Petrol/Oil Inceptor

There are 5 petrol/oil inceptors installed within the spine of the main road and the pond. One of the primary regular tasks to be undertaken is cleaning the channel drain, removing any oil and petrol that has accumulated on the surface. Dirt, grime, debris and standing or clinging oil, petrol and tank of the inceptor to be cleaned. It is advised to be cleaned every 3 to 6 months.

Quarterly Maintenance

- Check the integrity of the inceptor and its mechanical parts and service all the electrical system.
- Inspect the filters and repair or replace as necessary
- Remove all silt and contaminants removed and disposed in accordance with regulation.

Hydro brake Flow Control

There are 11 hydro brakes placed within the manholes of surface water network. They tend to have an S-shaped discharge curve. These should be maintained in accordance with maintenance plan. The manhole with hydro brake should be checked for silt before and after each storm. It is also required to check the functionality of flow restriction as per manufacturer's specification.

3.3. Required Maintenance Schedule

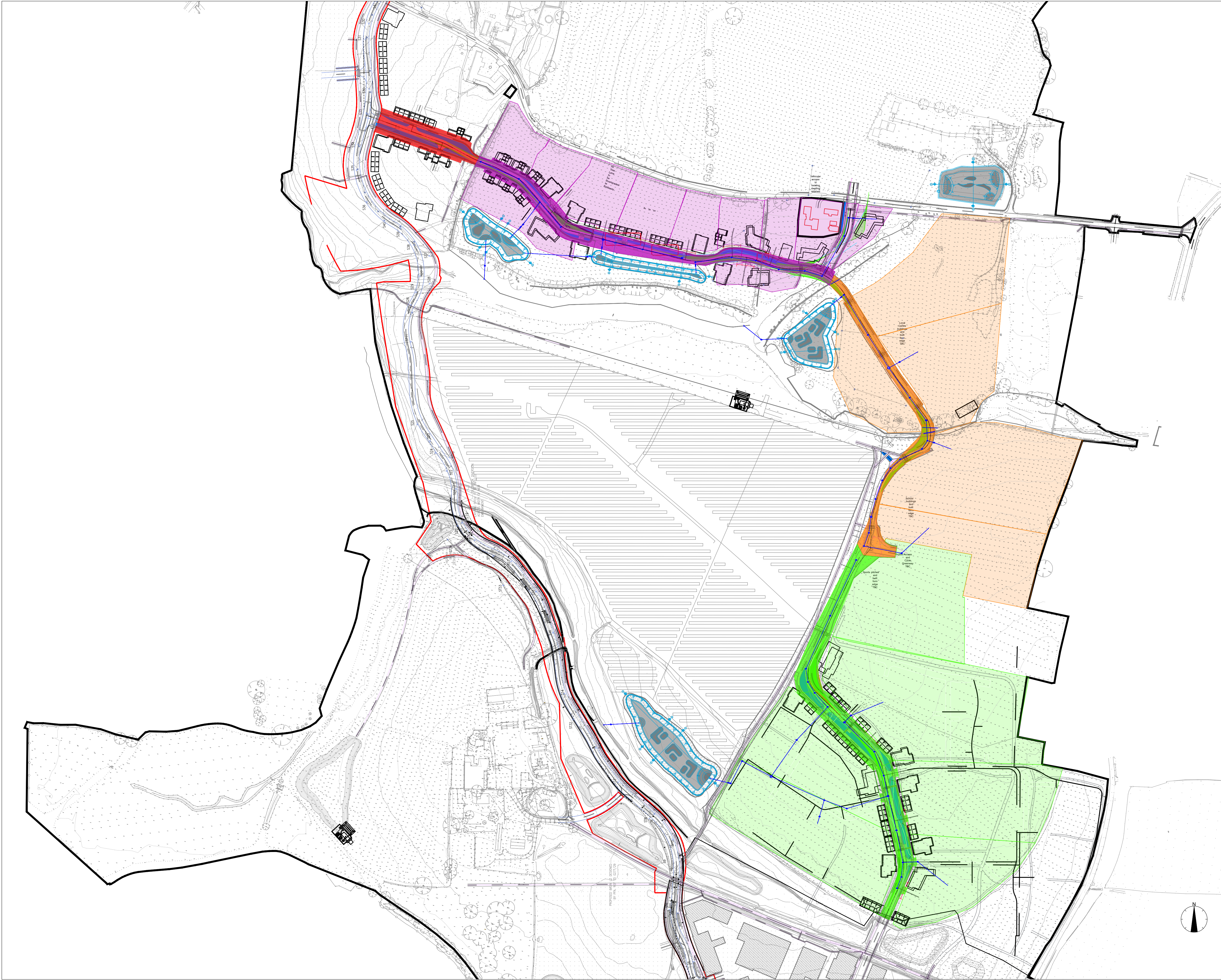
To ensure the long-term performance of the proposed DS, the onsite drainage system will be owned and maintained by the site operator or a maintenance company (MC) in accordance with the indicative schedule below, in the alternative the local authority may wish to adopt such features. However, at the detailed drainage design stage a full management and maintenance plan detailing best practice system maintenance regimes and proprietary manufacturer requirements and lifecycle management, in accordance with the CIRIA SuDS Manual will need to be produced. In the absence of local authority adoptions, maintenance of the overall drainage network will be the responsibility of an appointed management company.

ELEMENT / DRAINAGE COMPONENT	OWNERSHIP ADOPTION	/ MAINTENANCE REQUIREMENTS
Geocellular Attenuation Tank (if required)	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods, ensuring no solid material passes through outlet. Monitored for general condition of the tank and system generally, to suit manufacturer's guidance, check for leaks and displacement of 'cells'. Inspection annually and before / after extreme storm events.
Permeable Paving	Homeowners	Non-aggressive brushing of the whole surface (avoiding disruption of the jointing material, with suction rates adjusted, based on a trial), either manually or mechanically carried out annually. Top up of the gritstone may be required after cleaning. Weed control – excessive weed growth can be managed by localised spot-treatment with weed killers, in accordance with suppliers' recommendations. Inspection annually.
Flow Restriction Device & Chamber	Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. Check function of flow restriction componentry to suit manufacturer's guidance. Inspection annually and before / after extreme storm events.
Catchpit Manholes	Homeowners/Southern Water	To be monitored for silt build-up and cleaned as required using suction methods. Inspection annually and before / after extreme storm events.
Rainwater Pipes	Homeowners	Clearance of leaves / debris from guttering and hopper inlets. Rodding points provided to clear blockages via conventional rodding methods. Inspection annually and before / after extreme storm events.
Soil Vent Piles / "Stub Stacks"	Homeowners	Rodding points to be provided to clear blockages via conventional rodding methods. Inspection annually.

Gullies (Internal & External)	HCC Highways	To be monitored for silt build-up and cleaned as required. Where provided, ensure air traps are primed and sealed to prevent smells. Inspection quarterly.
Swales	Site Operator / MC	To be monitored for litter and debris. Strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. Inspection quarterly and before / after extreme storm events.
Ponds	Eastleigh council management company	To be monitored for litter and debris. Careful strimming to remove overgrown vegetation twice yearly. Removal of self-seeded saplings to prevent new tree growth. Monitor for silt build up and remove and spread locally outside design profile as required. Inspection quarterly and before / after extreme storm events.

APPENDIX A

OVERALL DRAINAGE LAYOUT



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EXTERNAL REFERENCES:

THIS INFORMATION & RIDGE & PARTNERS LLP CIVILS 3D MODEL & ASSOCIATED 3D OUTPUTS ARE BASED UPON THE FOLLOWING INFORMATION FROM THE DESIGN TEAM

- ARCHITECT REFERENCE:
- ARCH DWG No. 30454A / XX (DATED DEC 22)
- SURVEY REFERENCE:
- SURVEY DWG No. ENCIONE-HH-FEB21 (DATED FEB 21)

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS INFORMATION IS CURRENT PRIOR TO CONSTRUCTION

LEGEND	
	PROPOSED PRIVATE S.W. DRAIN
	PROPOSED 1200mm Ø MANHOLE
	PROPOSED HEADWALL
	PROPOSED OIL INTERCEPTOR
	PROPOSED PIPE/MAMMAL
	CATCHMENT AREA F
	CATCHMENT AREA G
	CATCHMENT ROAD AREA F
	CATCHMENT ROAD AREA G
	CATCHMENT ROAD AREA H
	CATCHMENT ROAD AREA I
	CATCHMENT ROAD AREA E

P02	UPDATED DRAINAGE LAYOUT	01/12/2023	BT
P01	UPDATED DRAINAGE LAYOUT	27/07/2023	PO
	INITIAL ISSUE	16/06/2023	JM
REV	DESCRIPTION	DATE	DRAWN

ORIGINATOR:

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KINGS WORTHY
WINCHESTER
SO23 7TW

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WWW.RIDGE.CO.UK

CLIENT:

IN ASSOCIATION WITH:

PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**OVERALL DRAINAGE
LAYOUT**

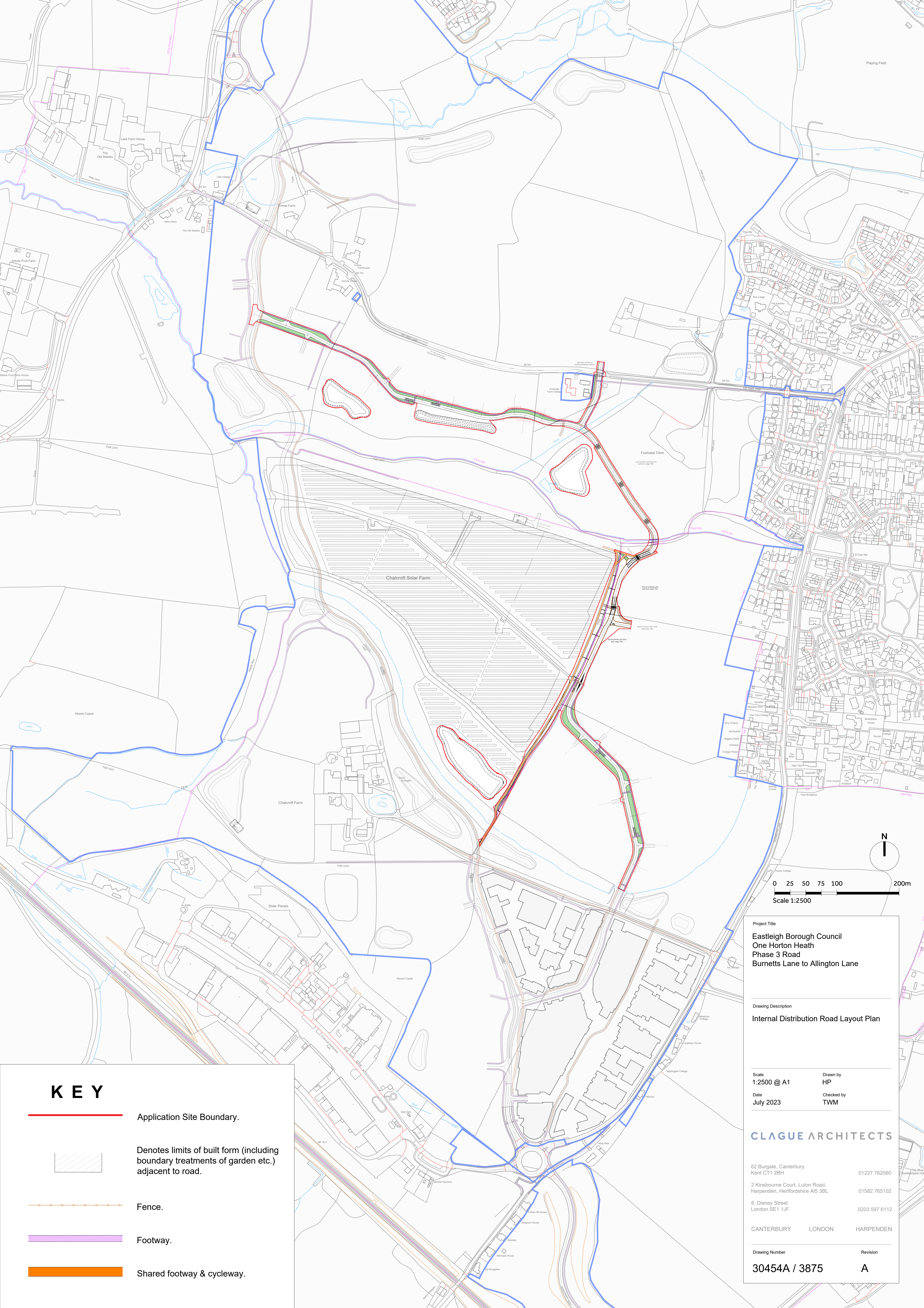
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5018551	RDG	XX	ST	DR	C	0500	P02

APPENDIX B

PROPOSED SITE PLAN



KEY

Application Site Boundary.



Denotes limits of built form (including boundary treatments of garden etc.) adjacent to road.



Fence.

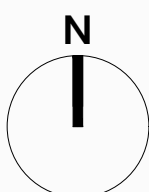


Footway.



Shared footway & cycleway.

0 25 50 75 100 200m
Scale 1:2500



Project Title
Eastleigh Borough Council
One Horton Heath
Phase 3 Road
Burnetts Lane to Allington Lane

Drawing Description
Internal Distribution Road Layout Plan

Scale
1:2500 @ A1
Date
July 2023

Drawn by
HP
Checked by
TWM

CLAGUE ARCHITECTS

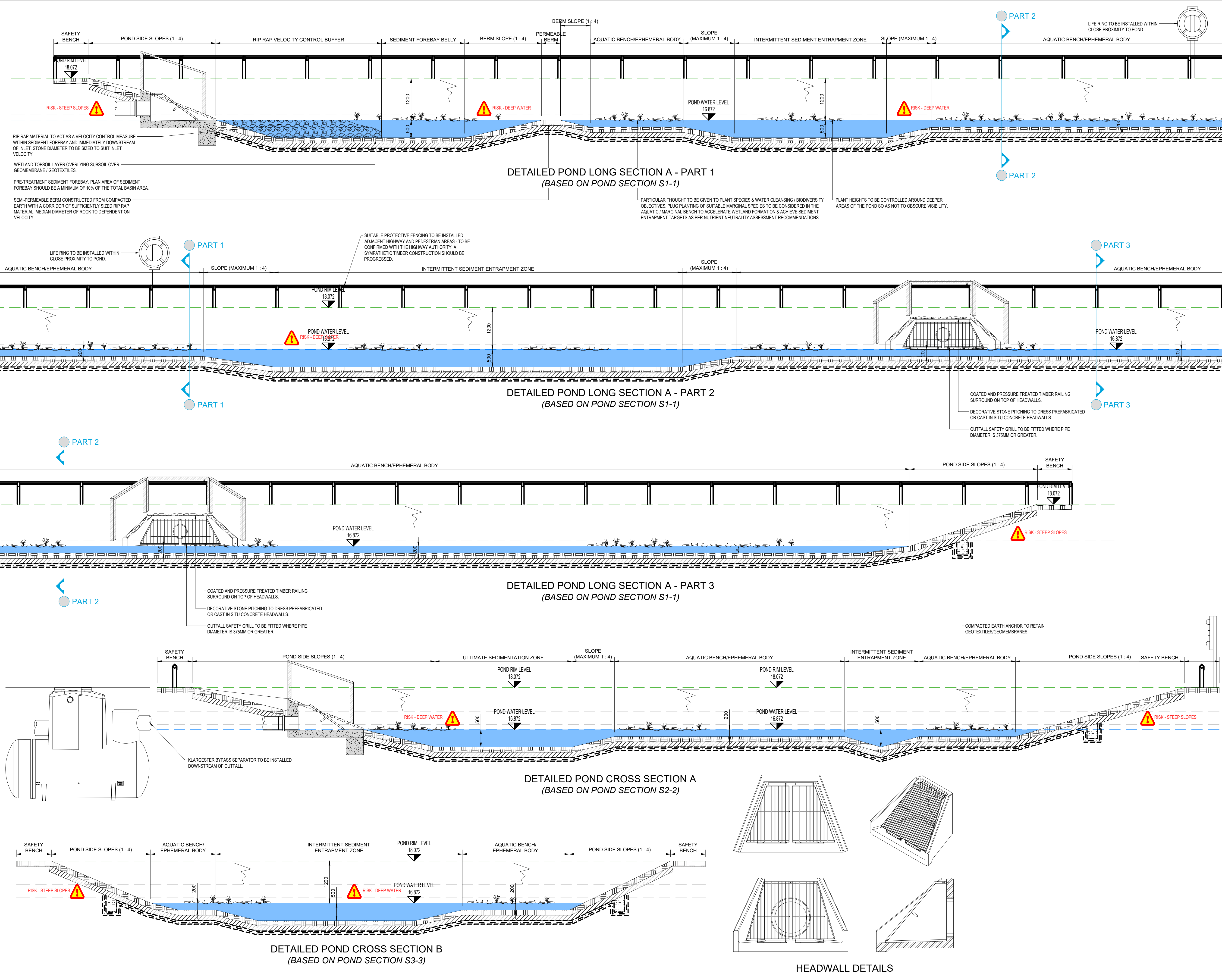
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8, Disney Street
London SE1 1JF 0203 597 6112
CANTERBURY LONDON HARPENDEN

Drawing Number
30454A / 3875

Revision
A

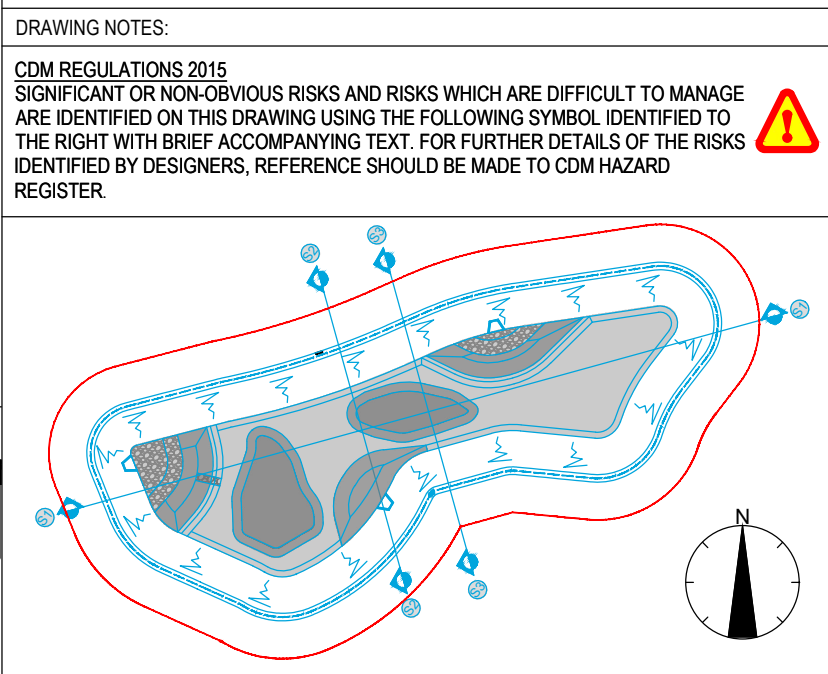
APPENDIX C

SUDS PLAN DRAWINGS



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WESTERN POND EXTRACT

P01	AMENDMENTS MADE IN SEDIMENTATION AREAS	17/02/2023	RML
INITIAL ISSUE		10/02/2023	ZS
REV	DESCRIPTION	DATE	DRAWN



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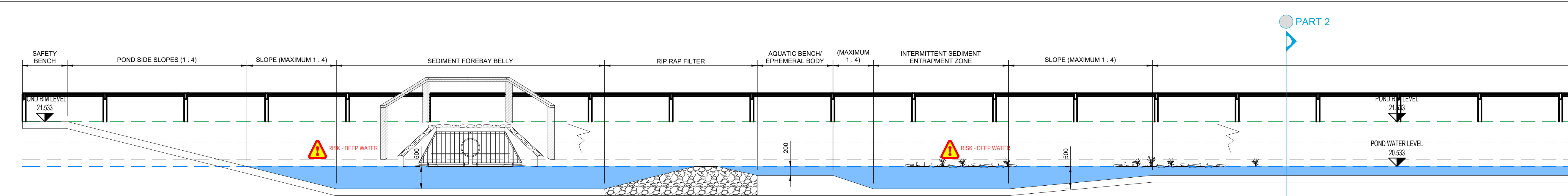
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DETAILED SuDS SECTIONS
WESTERN POND**

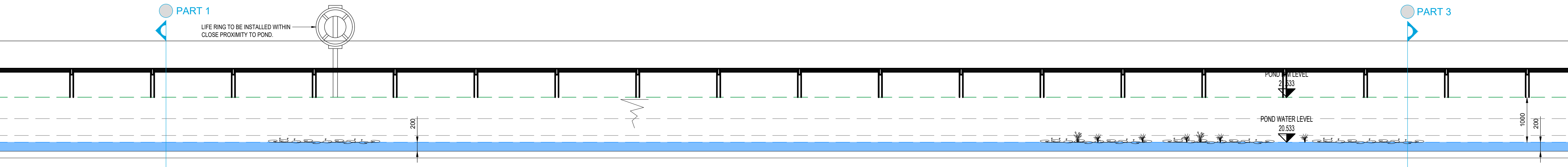
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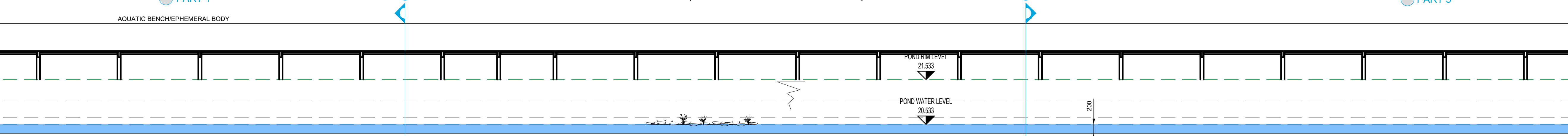
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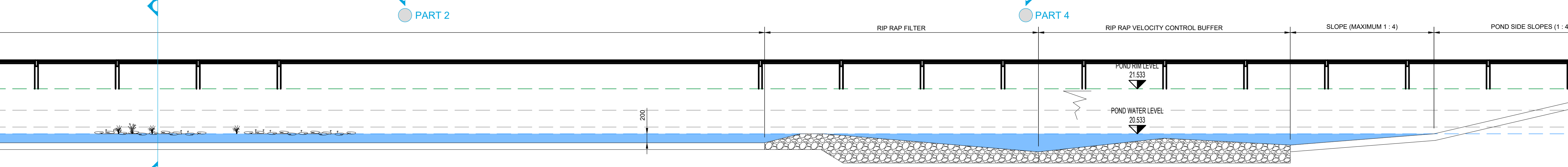
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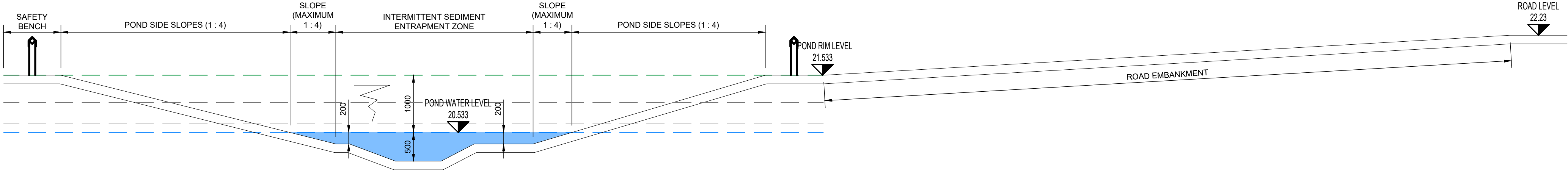
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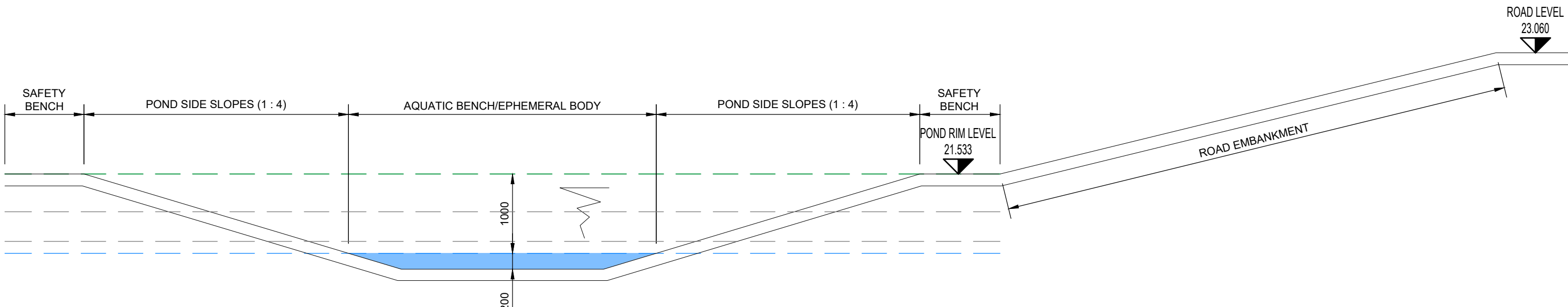
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DETAILED POND LONG SECTION B - PART 4
(BASED ON POND SECTION S4-4)



DETAILED POND CROSS SECTION B
(BASED ON POND SECTION S5-5)



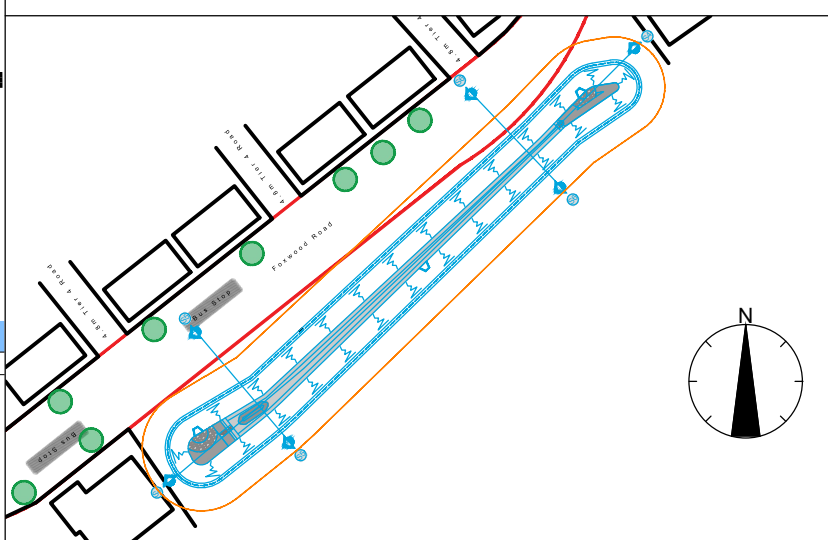
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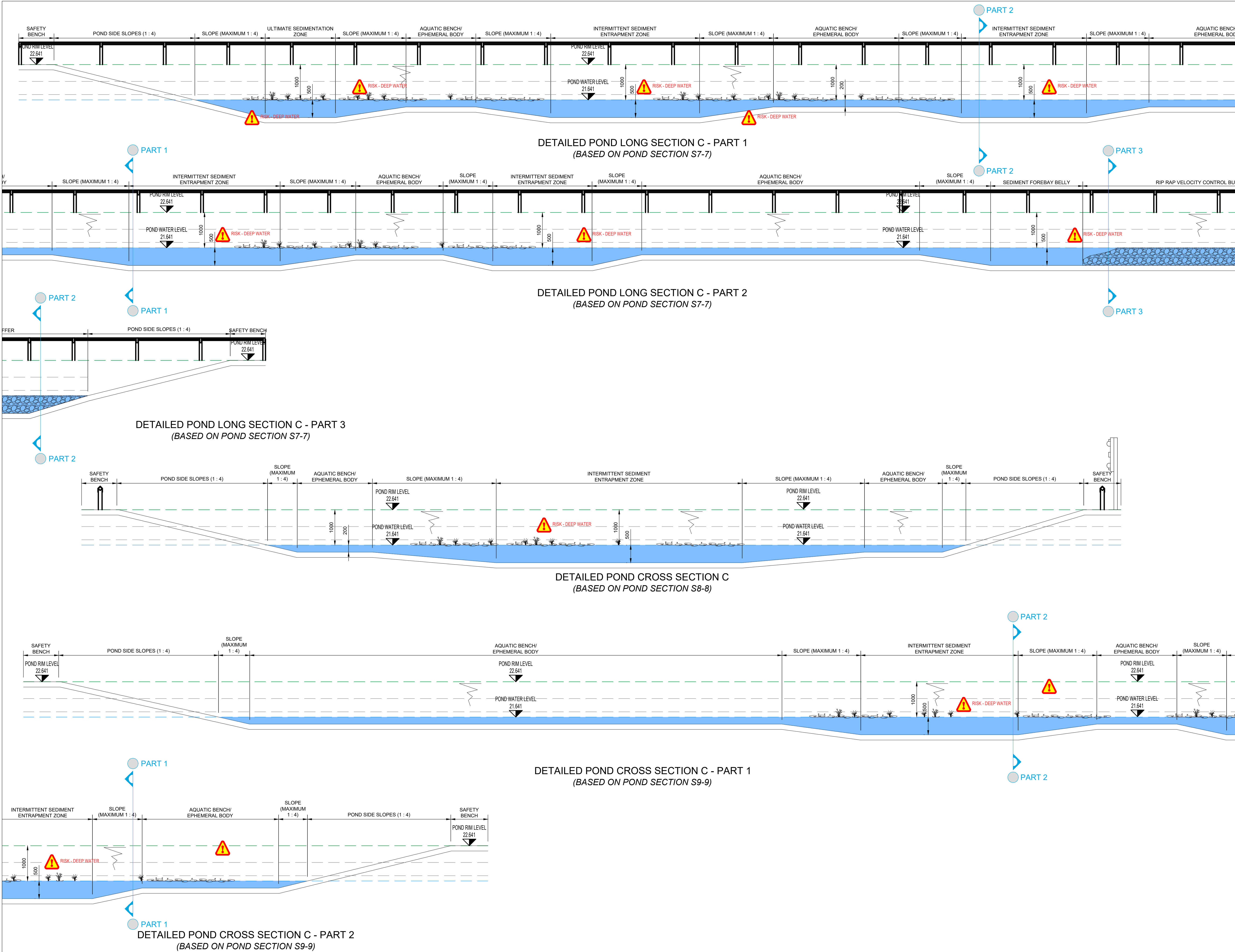
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
**DETAILED SuDS SECTIONS
CENTRAL POND**

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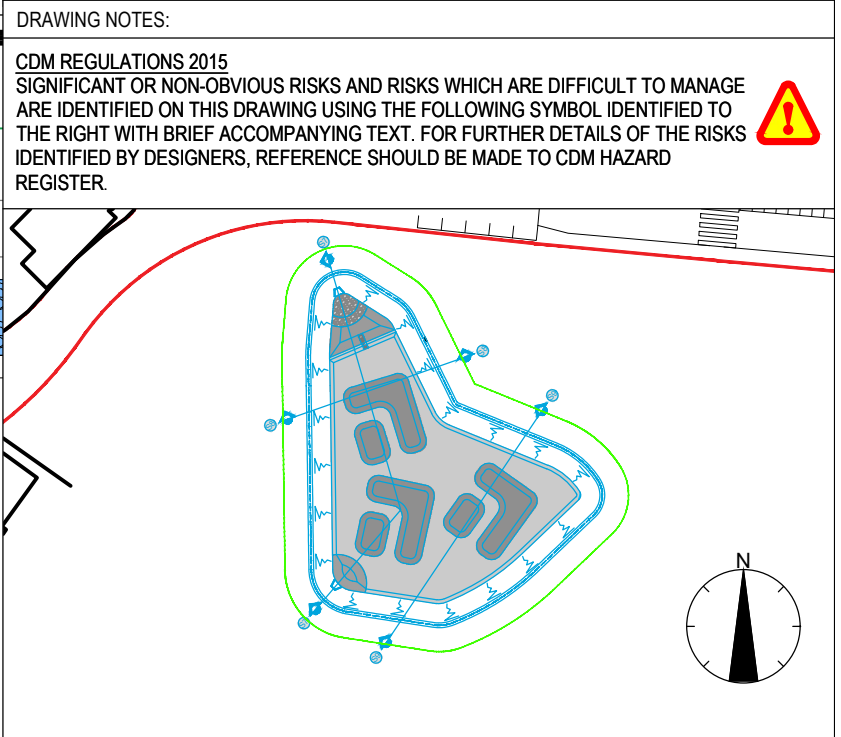


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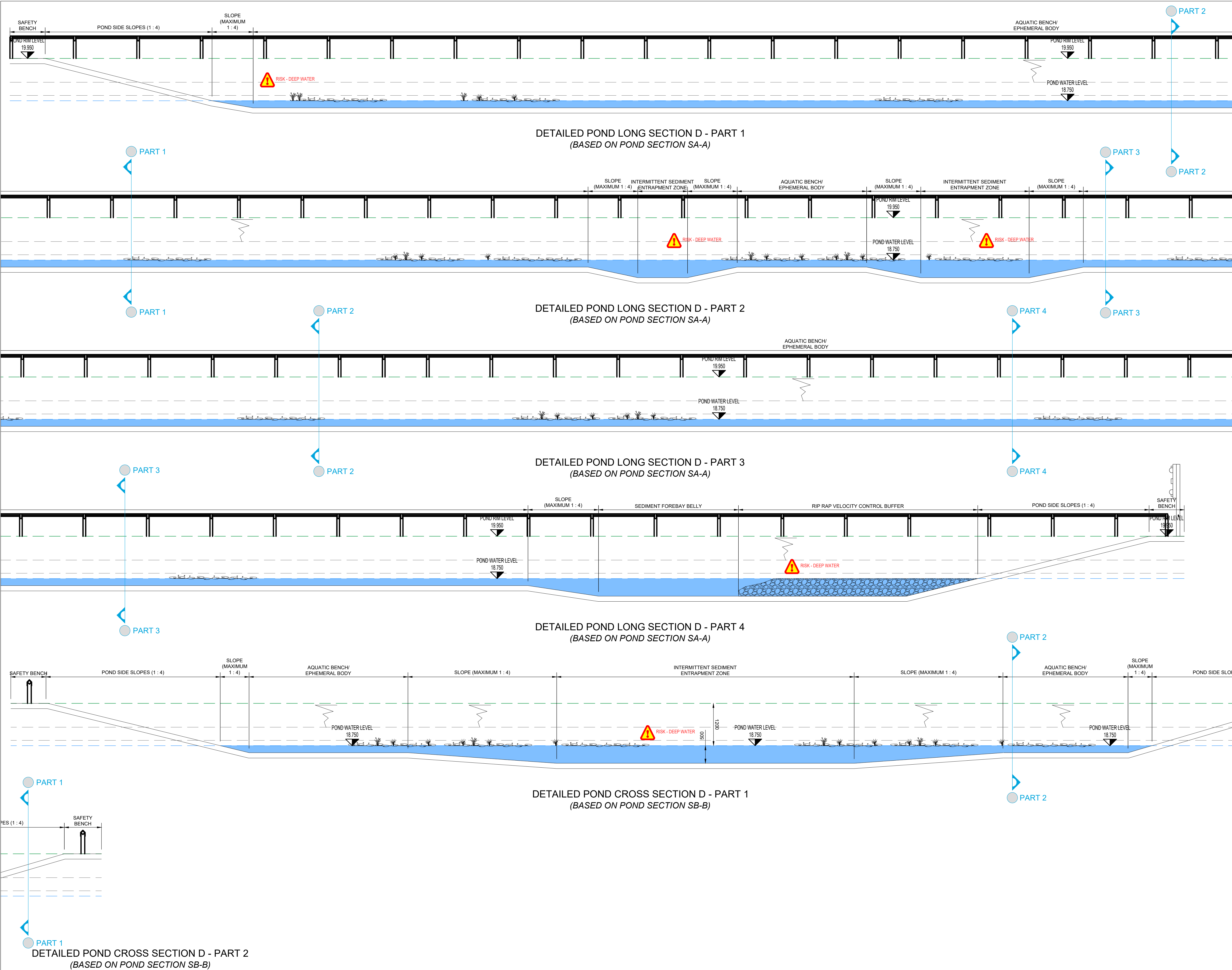
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
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EASTERN POND**

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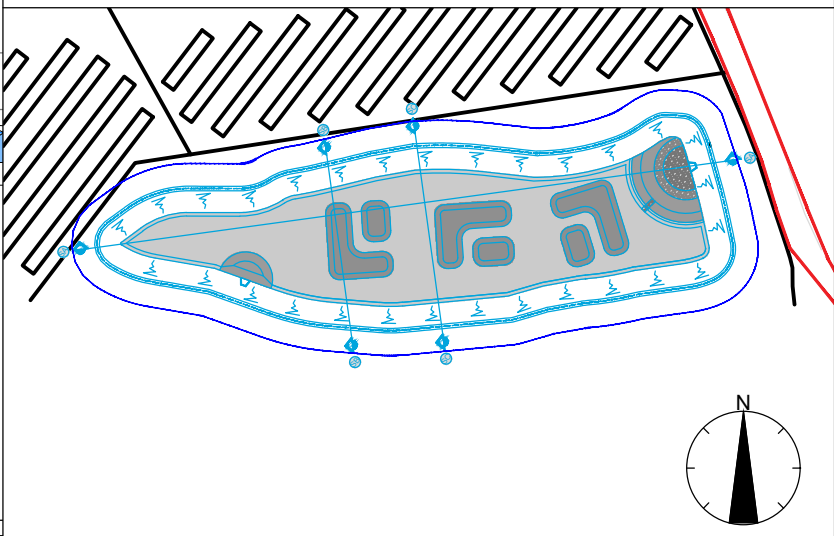


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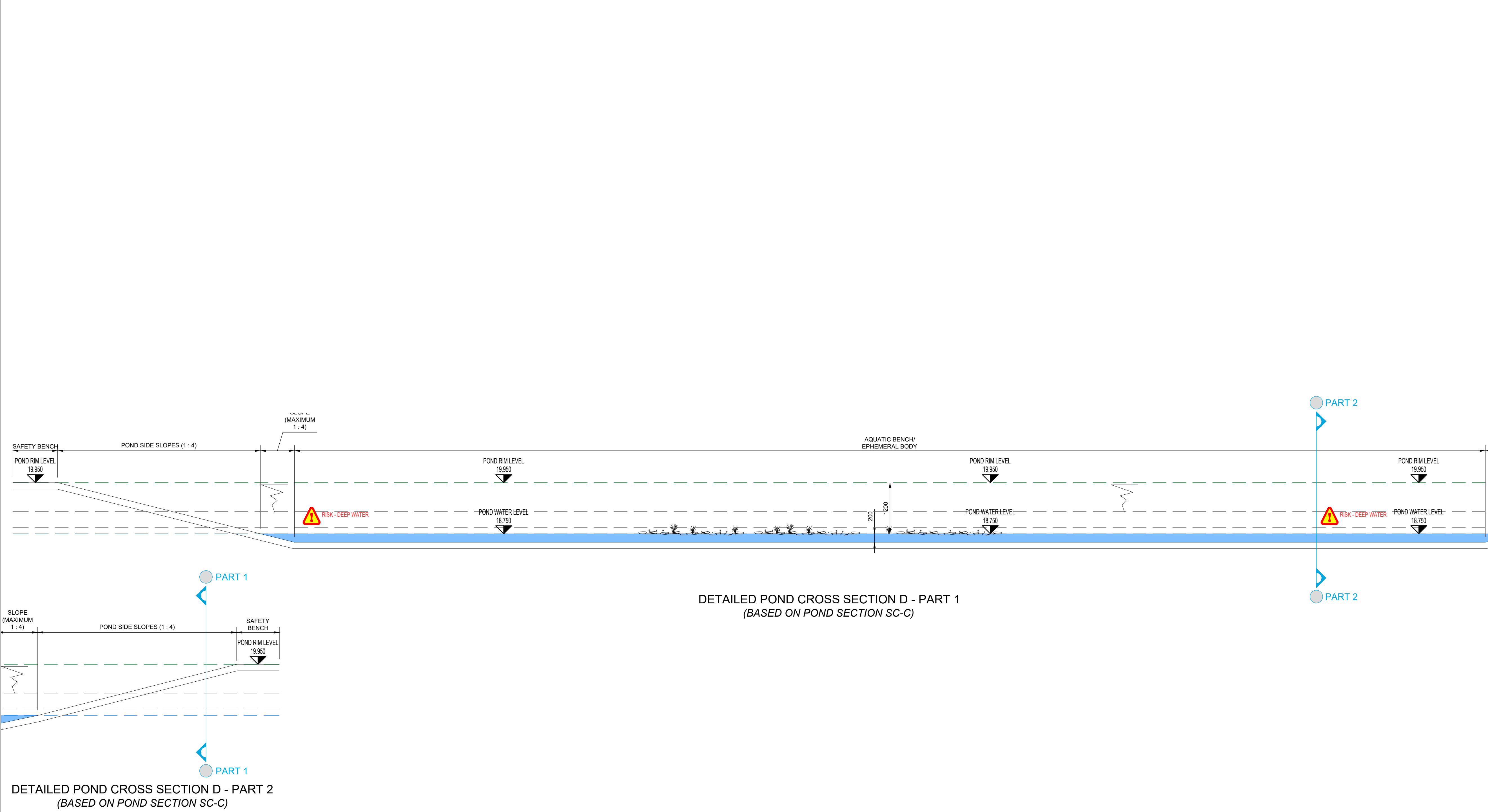
PROJECT:
**ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY**

TITLE:
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SOUTHERN POND**

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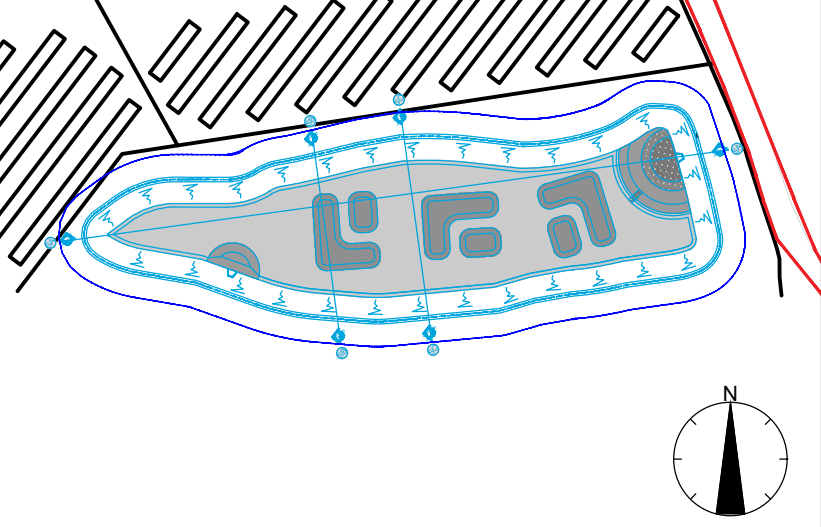
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BOROUGH COUNCIL

IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

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APPENDIX D

SURFACE WATER FLOW ANALYSIS



RIDGE

**SURFACE WATER FLOW
ANALYSIS
FOXWOOD WATERCOURSE**

ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL
February 2023

SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE



SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE ONE HORTON HEATH

EASTLEIGH BOROUGH COUNCIL

February 2023

Prepared for

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SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE

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SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE

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SECTION 1

INTRODUCTION

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1. INTRODUCTION

1.1. Appointment and Brief

This surface water flow analysis has been prepared on behalf of Eastleigh Borough Council for the proposed development at One Horton Heath, approx. postcode SO50 7BZ (hereby referred to as the 'Application Site'). This report has been prepared for the benefit of the Hampshire County Council Lead Local Flood Authority and seeks to quantify existing flows within the Foxwood Watercourse and prove that the proposed bridge/crossing at the proposed local centre shall not impinge on the capacity of the watercourse.

The purpose of this document is to analyse existing flows within the Foxwood Watercourse. Catchment areas shall be defined, as well as existing, contributing land uses. An appropriate allowance for baseflow from groundwater shall be included in the calculations as will a determined allowance for climate change. This report shall demonstrate that the proposed bridge/crossing shall not affect the existing watercourse capacity.

This report aims to demonstrate that existing flows shall not be detrimentally affected and that flood risk shall not increase onsite, this shall be demonstrated as follows:

- Provide calculations to quantify the likely flow rate through the watercourse for the design peak return period storm of the development, with a suitable allowance for climate change.
- Analyse background mapping for the area to determine the nature of surface water flows and to determine the level within the existing watercourse.
- Model the flow capacity of the existing watercourse and compare this against the proposed cross sectional area of the bridge/crossing as required.

The proposed flow analysis outlined herein is subject to further detailed analysis at detailed design stage and once further topographical information is received.

1.2. Aims and Objectives

This flow analysis has been prepared with reference to the following requirements:

- The flow analysis must:
 - Ensure that flood risk to the Application Site and surrounding area is not increased over the lifetime of the Proposed Development.
 - Conform with all relevant National and Local flood risk policies.
 - Ensure that existing flows and flood risk are properly defined, quantified and mitigated to ensure that the development is kept safe for the entirety of its design life with respect to flood risk with a suitable allowance for climate change. As well as this the analysis should ensure that the capacity of the existing watercourse isn't affected through the proposals.
- The flow analysis should:
 - Quantify the existing drainage characteristics of the watercourse as far as is practical.
 - Look for opportunities to provide a reduction in flood risk to the Application Site and the surrounding area.
 - Adhere to current best practice guidance.
 - Contribute to the enhanced amenity and aesthetic value of the Application Site; and
 - Propose opportunities for biological enhancement and provide habitats for wildlife in urban areas.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1.3. Limitations

The purpose of this report is outlined in Section 1.2, together with those related matters specifically referred to therein and it is not intended to be used for any other purposes. The report is for the sole benefit and may only be relied upon by the addressee, to whom we will owe a duty of care. The report and any part of it is confidential to the addressee and should not be disclosed to any third party for any purpose, without the prior written consent of Ridge and Partners LLP as to the form and context of such disclosure. The granting of such consent shall not entitle the third party to place reliance on the report, nor shall it confer any third-party rights pursuant to the Contracts (Rights of Third Parties) Act. The report may not be assigned to any third party.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

1.4. Reference Information

The following documents have been consulted:

- Hampshire County Council (2011) Preliminary Flood Risk Assessment.
- Eastleigh Borough Council JBA Consulting (2018) Eastleigh Hydrological Sensitivity Study Conceptual Surface Water Drainage Strategy.
- Partnership for Urban South Hampshire (2016) – Strategic Flood Risk Assessment 2016 Update.
- Partnership for Urban South Hampshire (2019) – Green Infrastructure Implementation Plan.
- Environment Agency JBA Consulting (2019) Itchen Tributaries Modelling Study.
- Communities and Local Government Document. (2021). The National Planning Policy Framework.
- Environment Agency. (2022). Flood Risk Assessments: Climate Change Allowances.
- Environment Agency. (2013). Rainfall Runoff Management for Developments.
- CIRIA. (2015). C753 – The SuDS Manual.
- Secretary of State. (2015). Building Regulations Approved Document H.
- Butler & Davies. (2018). 4th Ed. Urban Drainage.
- British Geological Survey Online Mapping Tool.
- DEFRA / EA Interactive online mapping (magic.defra.gov.uk).
- Department for Environment, Food and Rural Affairs. (2015). Non-Statutory Technical Standards for Sustainable Drainage Systems.
- Department for Environment, Food and Rural Affairs & Environment Agency. (2017). Flood Risk Assessment for Planning Applications.
- Environment Agency (2019) Flood risk mapping information.

This report should be read in conjunction with:

- PFA Consulting G277-DOC01 FRA – Flood Risk Assessment
- Odyssey Consulting Engineers 19-367 – Flood Risk Addendum
- Geomap EBC-OHH-08-09-19 – Topographical Survey

SECTION 2

PROJECT BACKGROUND & EXISTING FLOWS

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

2. PROJECT BACKGROUND & EXISTING FLOWS

2.1. Site Location and Existing Land Use

The site is located to the west of Horton Heath, Grid Reference SU 48916 17082, X (Easting) 448916, and Y (Northing) 117082. Latitude and Longitude (decimal), 50.951101, -1.3050041, Latitude and Longitude (degs, mins, secs), 50°57'04"N , 001°18'18"W. Postcode (nearest) is SO50 7BZ. The site is currently in agricultural use, mainly arable with some grassland. The overall site area location is shown below:

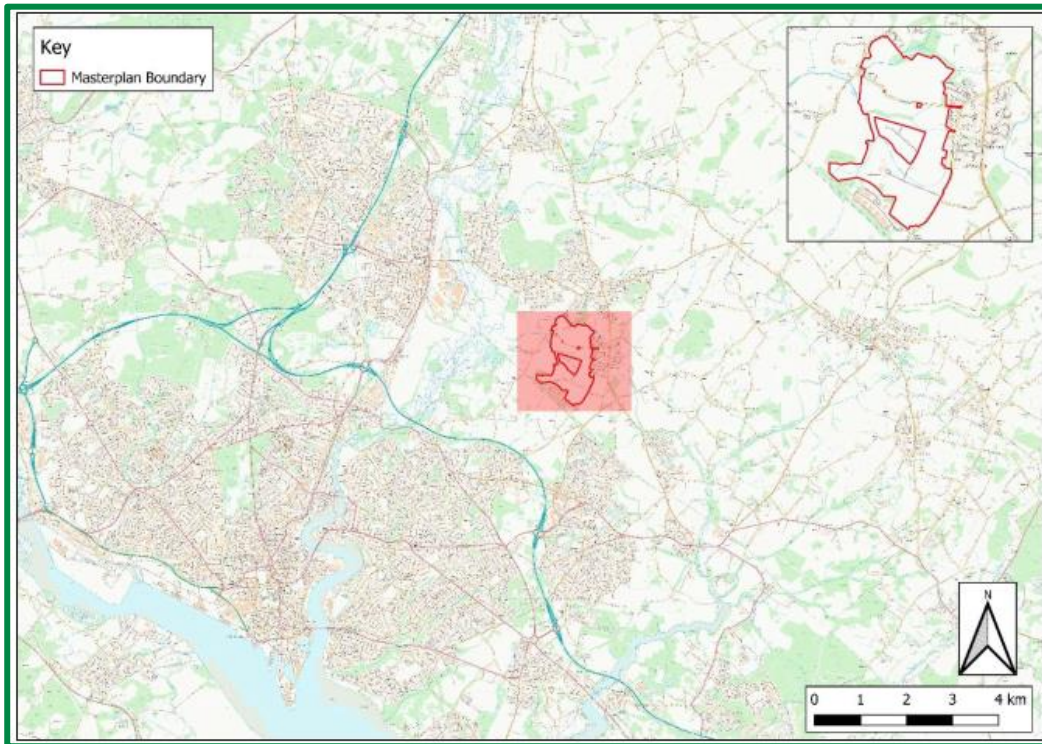


Figure 1: Site Location Area Plan (Google Earth Maps)

2.2. Topography

The site predominantly slopes from East to West from an elevation of circa 30 m Above Ordinance Datum (AOD) to the rear of Bramley Gardens down to circa 17m AOD at the Quobleigh Stream to the East. Local topography around the Foxwood Watercourse suggests that the approximate elevation of the ditch at the location of the proposed bridge/crossing is circa 24m AOD. The ditch is between 1.00-1.15m deep on the south side and circa 0.79m deep on the north side. The bed of the watercourse spans approximately 1.10m. In plan the southern side slopes are 1.98m wide, with the northern side slopes being approximately 5.51m wide as the watercourse passes under the proposed bridge. Further topographical information has been instructed to provide detailed levels and dimensions of the bank and channel bed; however, there is sufficient extant information to perform an appropriately detailed analysis.

2.3. Geology and Hydrogeology

British Geological Survey (BGS) online mapping indicates that the Application Site is situated on a bedrock of Wittering Formation sand, silt and clay. This is overlain by superficial deposits of Alluvium around the watercourses that pass through the site.

The Environment Agency's online mapping suggests the underlying bedrock to be classified as a secondary A Aquifer and the site is located within a medium groundwater vulnerability zone.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

2.4. Hydrology

An arm of the Moorgreen Brook, a Main River, is present to the North of the site. This confluences with the Quobleigh Watercourse, also a Main River, this being the Southern arm of the Moorgreen Brook, to the West of the site. The Quobleigh Watercourse accepts flows from the Foxwood Watercourse, which flows through the Application Site. The Foxwood Watercourse is the watercourse that is the subject of this review.

The Foxwood Watercourse arises from the ridge on which the settlement of Horton Heath sits and owing to its small catchment and constant baseflow it is likely that the stream is spring fed from the Eastern Knowle Hill. The Foxwood Watercourse accepts additional flow from other minor watercourses before communicating with the Quobleigh Watercourse, notably a spur connecting from the North located to the South of Fir Tree Lane which connects to the Foxwood Watercourse to the West of the proposed Bridge.

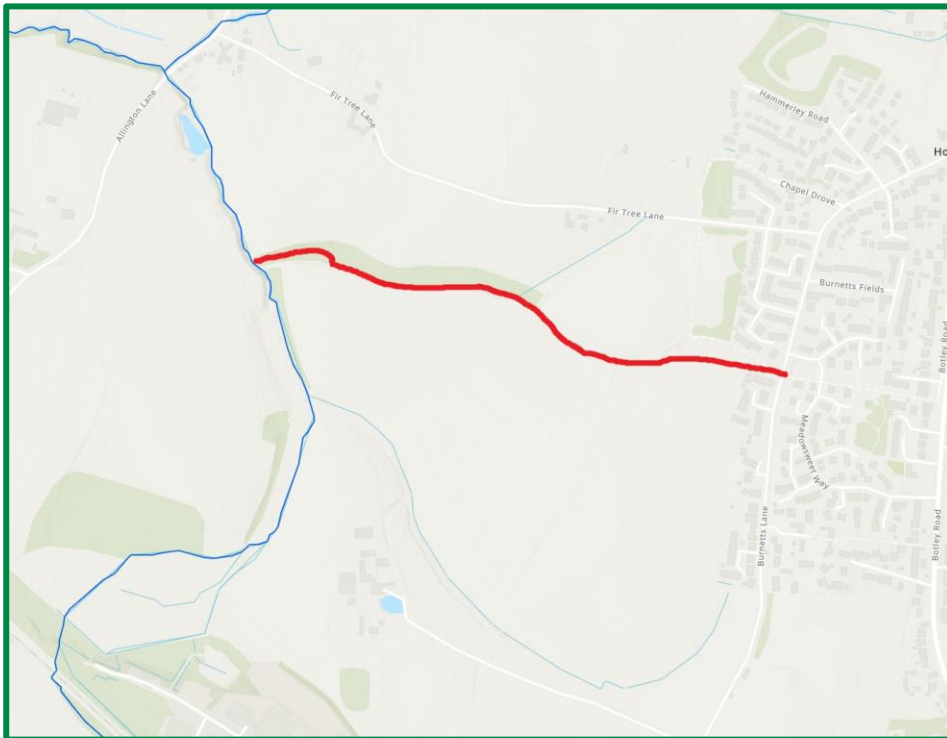


Figure 2 - Map showing Foxwood Watercourse route from the site to confluence with the Quobleigh Watercourse

An indication of the likely flows and flood extents of the Foxwood and Quobleigh Watercourses can be found on Environment Agency Long-term Flood Risk mapping, it should be noted that the mapping is not an accurate reflection of real world flows. This is as published in the Environment Agency's "What is the Risk of Flooding from Surface Water map?" methodology which states:

*"Although the maps appear to show flooding from ordinary watercourses, **they should not be taken as definitive mapping of flood risk from these as the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled.** Also, structures (such as bridges, culverts and weirs) and flood risk management infrastructure (such as defences) are not represented."*

SURFACE WATER FLOW ANALYSIS
FOXWOOD WATERCOURSE

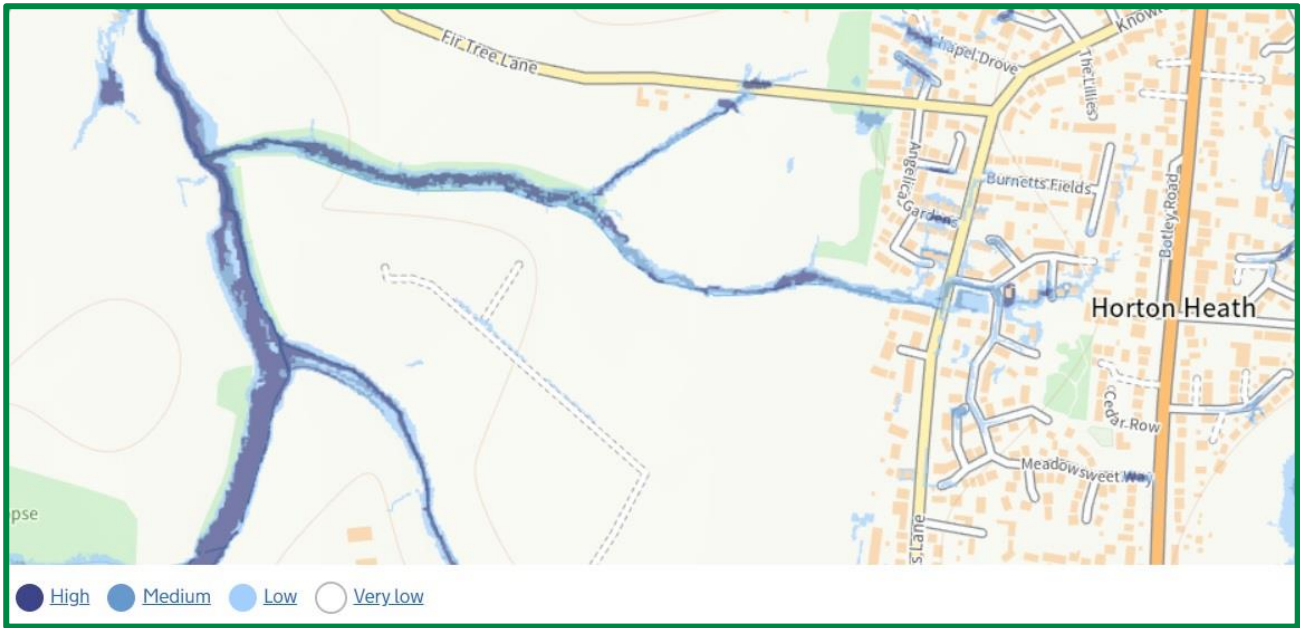


Figure 3 – EA surface water flood mapping – Risk

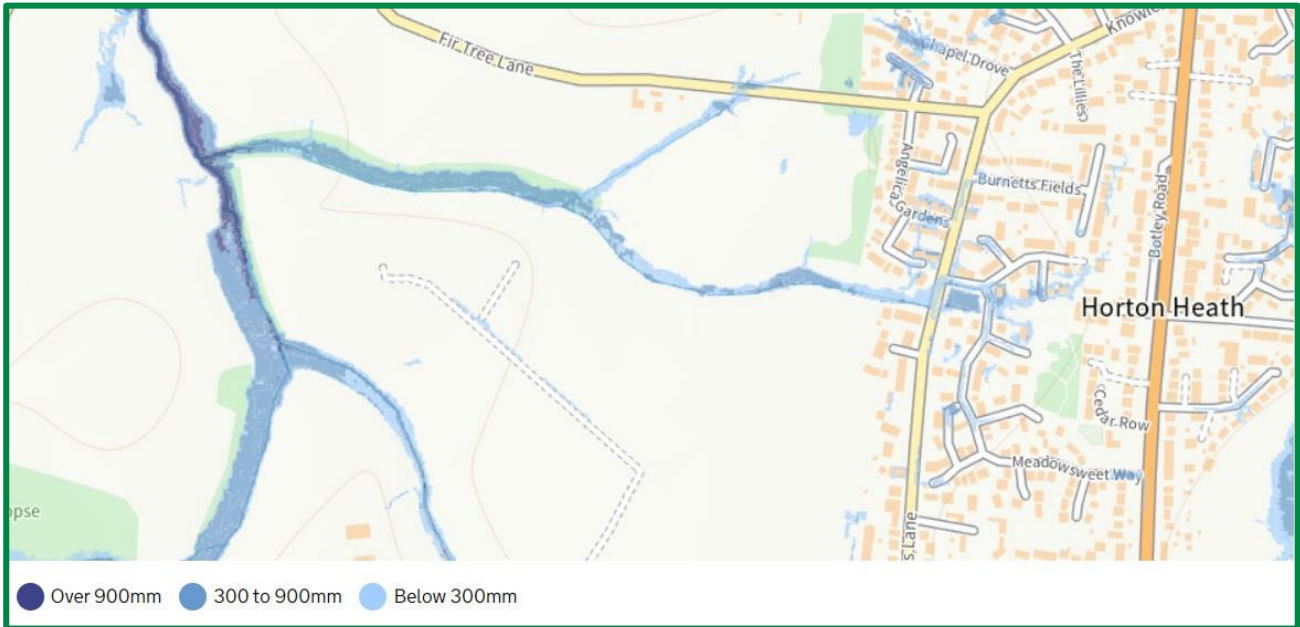


Figure 4 – EA surface water flood mapping – Depth

SURFACE WATER FLOW ANALYSIS FOXWOOD WATERCOURSE



Figure 5 – EA surface water flood mapping – Velocity

The EA's surface water flood map should not be taken as definitive as the map has been based on national LiDAR datasets which pick out depressions in the topographic ground profile and therefore would not be able to comprehensively survey the Foxwood Watercourse.

2.5. Proposed Crossing Design

The development in its current form proposes a bridge crossing constituting a reinforced concrete shell with stone and bituminous layers placed on top. The structure shall be clad in facing material such as brick and stone. The bridge spans approximately 9.50m and has a soffit height 1.80m above the banks of the Foxwood Watercourse. When considering pavement layers and the thickness of the reinforced concrete structure, which has been based on the Ridge and Partners LLP Tollbrook Bridge Structural Drawing (5015560-RDG-ST-XX-DR-S-1000-P02). The 1.80m requirement originates from the Hampshire County Council TG7 Technical Guidance Note (Adoption of Structures). As part of this report a review will be undertaken of the capacity of this structure and a comparison will be undertaken against existing flows to determine the appropriateness of such a structure. A review of a piped solution shall also be undertaken to see whether a precast concrete bridge can be avoided.

2.6. Quantifying Existing Flows

To appropriately determine the extent and quantity of overland flow passing along the Foxwood Watercourse; attention has been paid to the UK Centre for Ecology & Hydrology Flood Estimation Handbook web service which provides data on the quantity of land which contributes to a catchment:

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

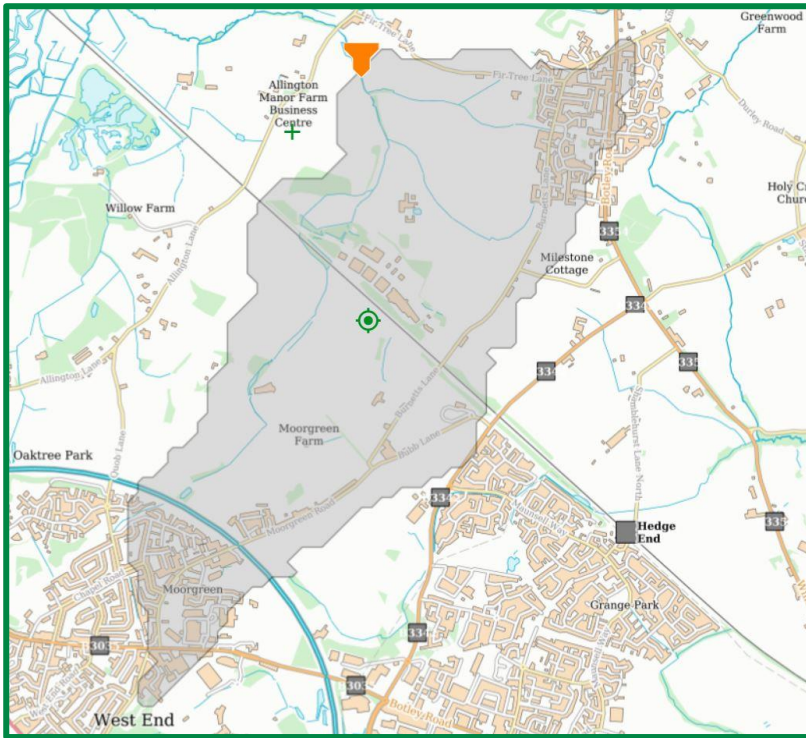


Figure 6 – FEH Catchment Mapping

The size of the catchment contributing to the western Moorgreen Brook is 3.825km². Breaking this area down one can determine the area for each of the contributing minor watercourses. To determine the catchment of the Foxwood Watercourse a review has been undertaken of TessaDEM data and Ordnance Survey data, the Foxwood Watercourse catchment extends to the majority of the settlement of Horton Heath as well as areas of open space within and to the North of the Application Site.

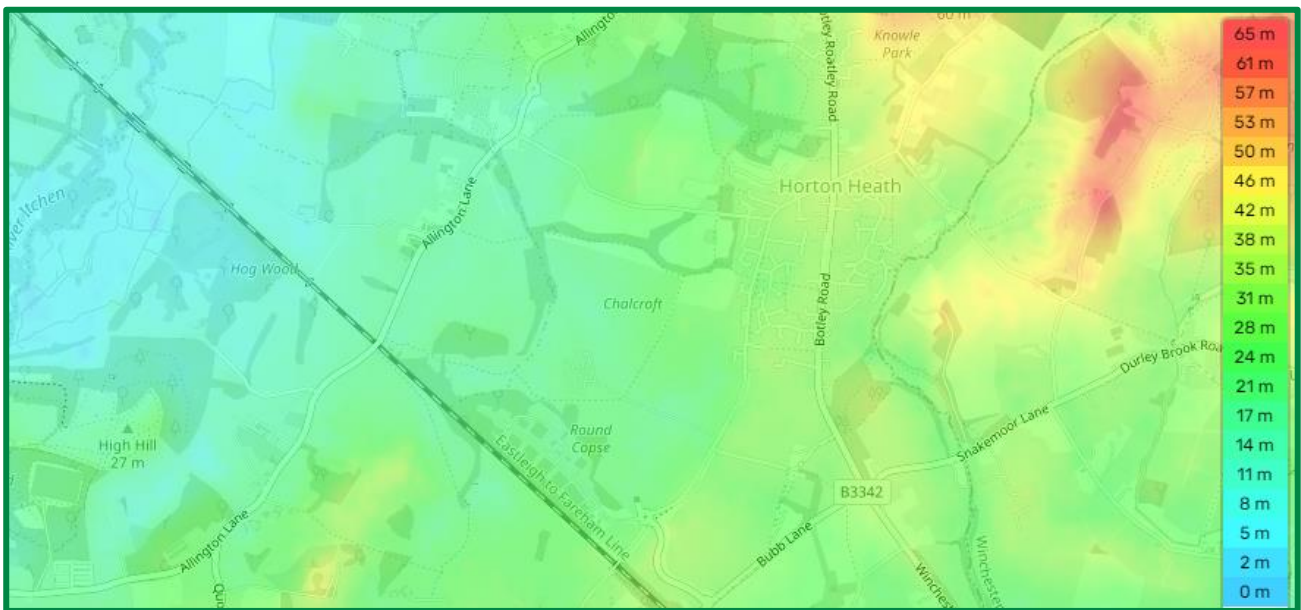


Figure 7 – Wider Topographical Mapping of the course of the Foxwood Watercourse (Contains information from TessaDEM [Open-Database-Licence], which is made available here under the Open Database License (ODbL). Also contains OS data © Crown copyright and database right 2022.

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

The area downstream of the bridge has been discounted and therefore only the areas shaded green and red on the below extract have been considered, where the green areas are greenfield areas and the red areas are impermeable areas of the settlement of Horton Heath. In the calculations it has conservatively been assumed that the entirety of the red area is impermeable, making no account for gardens, areas of public open space and verges, which are likely to be significant.

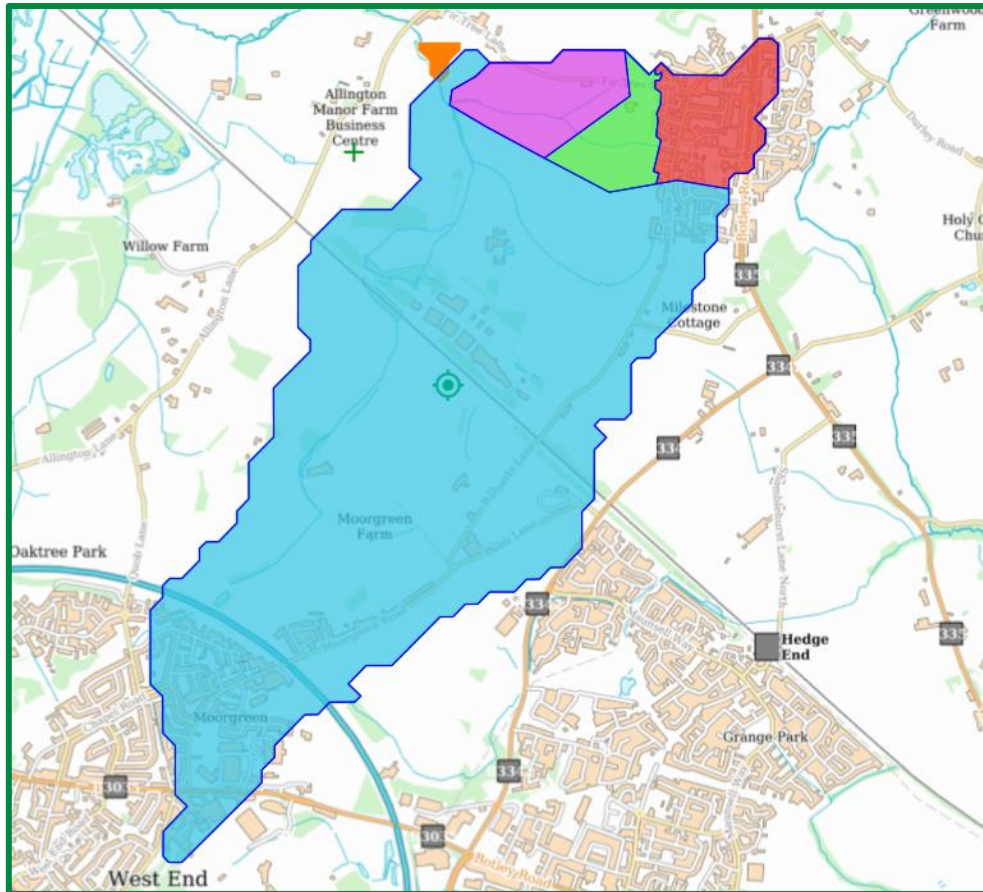


Figure 8 – Factored catchment extents

To determine how much flow this catchment will generate, greenfield runoff rate calculations have been undertaken utilising the Source Control module of the Innovyze MicroDrainage design package. The analysis relies on the IH124 method, which is appropriate for catchments above 50 hectares, and uses linear interpolation to generate a flow rate through the ICP SUDS method (Interim Code of Practice for Sustainable Drainage Systems). The calculations are based on the development being in region 7 and SAAR and Soil Index values for the catchment, being 800mm and 0.400 respectively. Owing to the largely impermeable nature of the underlying soils the Soil Index has been manually adjusted from 0.300 to 0.400, to conservatively estimate flow rates. The Partly Urbanised Catchment has been specified as 0.620, this being the percentage of the red area of the contributing catchment.

An appropriate climate change allowance will need to be added to this flow to accommodate future rainfall events. This could either be accommodated as a peak river flow allowance as per values published for the Test and Itchen Management Catchment (35% for the central allowance) or a peak rainfall allowance for this catchment (45% for the upper end allowance). To be conservative the 45% allowance has been applied. The results are presented in *Appendix A* and are tabulated overleaf:

SURFACE WATER FLOW ANALYSIS
FOXWOOD WATERCOURSE

AREA	QBAR (L/S)	Q1 (L/S)	Q30 (L/S)	Q100 (L/S)	Q100+CC (L/S)
33.892	312.8	265.9	567.1	676.5	980.9

Runoff is not the only contributor to watercourse flows and often a significant proportion of watercourse flow arises from influent groundwater, which is evident from the baseflow visible in the stream. The magnitude of groundwater input is dependent on the prevalent underlying strata with UK Centre for Ecology and Hydrology National River Flow Archive (NRFH) data suggesting that the contributing Base Flow Index (BFI) from groundwater can range from 0.150-0.350 within impervious clay catchments to greater than 0.9 in pervious chalk catchments. As the underlying ground at the site is typically a silty, sandy clay the higher BFI of 0.350 has been progressed. This has conservatively been applied to the calculations as an additional 35% of the maximum flow discussed previously. This results in a total flow of 1324.2l/s.

SECTION 3

QUANTIFYING CAPACITY OF EXISTING AND PROPOSED CONVEYANCE FEATURES

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

3. QUANTIFYING CAPACITY OF EXISTING AND PROPOSED CONVEYANCE FEATURES

3.1. Existing Watercourse

As discussed in Section 2 the local topography around the Foxwood Watercourse suggests that the approximate elevation of the ditch at the location of the proposed bridge is circa 24m AOD. The ditch is between 1.00-1.15m deep on the south side and circa 0.79m deep on the north side. The bed of the watercourse spans approximately 1.10m and in plan the southern side slopes are 1.98m wide, with the northern side slopes being approximately 5.51m wide as the watercourse passes under the proposed bridge. Aggregate cross sections have been deduced (see *Appendix B*), these have been based on a height of 0.79m and the equalised side slopes, which still produce the same cross sectional area, which is on average 3.623m². Average side slopes are approximately 1 in 4.52 (22.10%), an angle of 12.767 degrees from the horizontal.

This cross sectional area has been modelled in the Network module of the Innovyze MicroDrainage design package, utilising a user specified conduit. The gradient has been obtained from local topographical information, available on the Geomap survey, resulting in a gradient of 1 in 64.5 (1.55%). A Manning's n value of 0.060 has been applied to the channel, this being appropriate for a narrow channel in very poor condition. The capacity of the existing channel under such conditions is equal to 7573.5l/s (see *Appendix C*). As can be seen, the existing ditch is more than adequate to convey all anticipated flows from a design return period for residential development, with a suitable allowance for climate change.

ELEMENT	DESIGN FLOW RATE (L/S)
MAXIMUM FLOW	1324.2
DITCH CAPACITY	7573.5

By applying the base flow to the watercourse model one can determine the water level during the design return period event + climate change. In the upstream node the depth of water would be approximately 369mm. As can be seen in *Appendix B* this results in a cross sectional area of 1.01m².

3.2. Proposed Structure

The proposed bridge would not affect the flow characteristics of the main channel of the Foxwood Watercourse as it would span from bank to bank without effecting the channel itself and therefore would not impede flows.

An analysis has been undertaken of the capacity of a number of pipes to determine whether these conduits have adequate capacity to convey the expected surface water flows. The gradient of the pipes has been modelled at the same gradient of the existing channel. The capacity of a number of scenarios have been presented in *Appendix D* and tabulated overleaf:

SURFACE WATER FLOW ANALYSIS

FOXWOOD WATERCOURSE

PIPE DIAMETER/ DIMENSIONS (MM)	CAPACITY (L/S)	CROSS SECTIONAL AREA (M ²)
600	858.4	0.283
750	1541.1	0.442
900	2484.6*	0.636*
1050	3719.2*	0.866*
1200	5273.4*	1.131*
1350 X 800 (BOX CULVERT)	4514.3	1.080

**Soffit heights exceed existing bank height (790mm)*

As can be seen: 750, 900 and 1050mm pipes have more than adequate capacity to contain the maximum anticipated flows; however, they shall reduce the cross sectional area of the wetted extents. A 1200mm diameter pipe would have adequate cross sectional area but would exceed the height of the existing bank, thereby nullifying a significant portion of the pipe. A 1350x800mm box culvert is capable of containing the maximum anticipated flow whilst not reducing the cross sectional area of the wetted extents, such a system would not drastically exceed the adjacent bank level (0.79m high) and would still have adequate capacity and cross sectional area at existing bank height.

3.3. Structure Discussion

The incorporation of a bridge would result in a significantly increased build up owing to the requirement to have a 1.80m clearance under the bridge as well as the associated build up requirements, which can largely be avoided through the incorporation of a box culvert. With the increased build up there is an associated carbon impact, owing to the quantity of imported stone and precast concrete. There is also a logistical and earthworks impact as significant grading would be required to ensure that ground is graded to accommodate the increased height, this will have wider implications on the watercourse and the surrounding open space. For amenity, climate and design purposes, a box culvert would be preferable to a bridge.

SECTION 4

CONCLUSIONS

4. CONCLUSIONS

- The flows of the Foxwood Watercourse have been quantified in detail, with appropriate consideration to catchment mapping, climate change allowance, the permeability of the contributing catchment and the impact of groundwater to base flows.
- A selection of conveyance features has been presented which are capable of conveying the existing overland flows associated with the Foxwood Watercourse passing through the Application Site.
- Pipes and culverts can be selected which will have adequate capacity to contain maximum flows; however, only a box culvert with a minimum width of 1350mm and a minimum height of 800mm will be equivalent in cross sectional area to the former wetted area during the peak design return period storm.
- As a result of the implementation of such conveyance features proposed safe access and egress can be maintained over the Foxwood Watercourse and flows through the existing watercourse shall not be exceeded.
- It should be noted that this strategy presents a number of possible solutions to demonstrate that the flows from the Foxwood Watercourse can be successfully and sustainably conveyed and should not be interpreted as the definitive solution.

APPENDIX A

GREENFIELD RUNOFF CALCULATIONS FOR EXISTING CATCHMENT

Ridge and Partners LLP		Page 1
The Cowyards Blenheim Park, Oxford Road Woodstock OX20 1QR	One Horton Heath Site Wide Infastructure Eastleigh Borough Council	
Date 23/02/2023	Designed by Zak Simmonds	
File CATCHMENT CALCULATIONS.SRCX	Checked by Chris Levitt	
Innovyze	Source Control 2020.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 800 Urban 0.620
Area (ha) 33.892 Soil 0.400 Region Number Region 7

Results 1/s

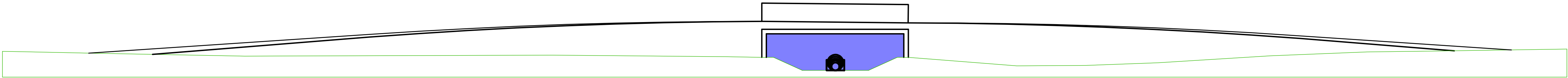
QBAR Rural 134.8
QBAR Urban 312.8

Q100 years 676.5

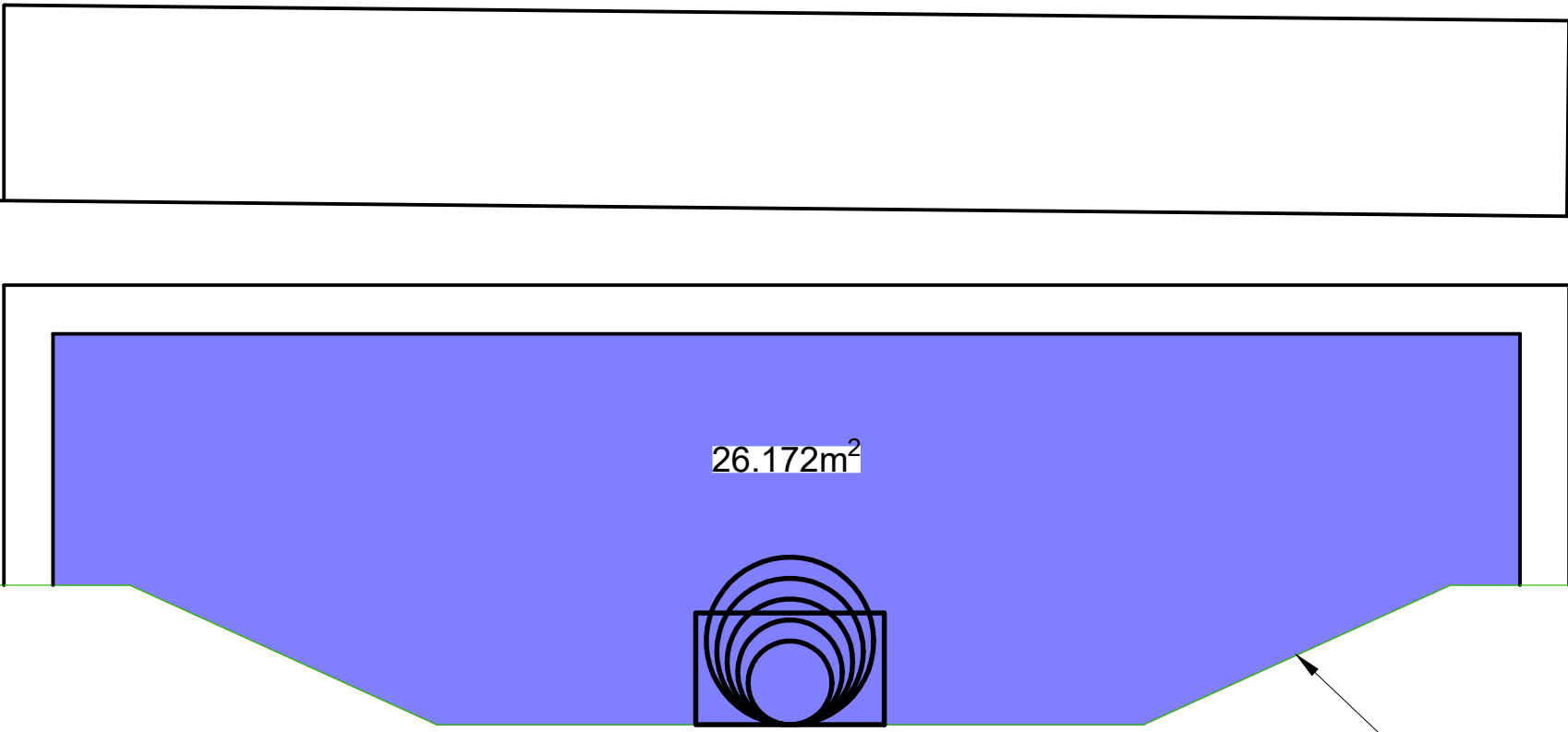
Q1 year 265.9
Q30 years 567.1
Q100 years 676.5

APPENDIX B

EXISTING DITCH AND PROPOSED CONVEYANCE FEATURE DETAILS

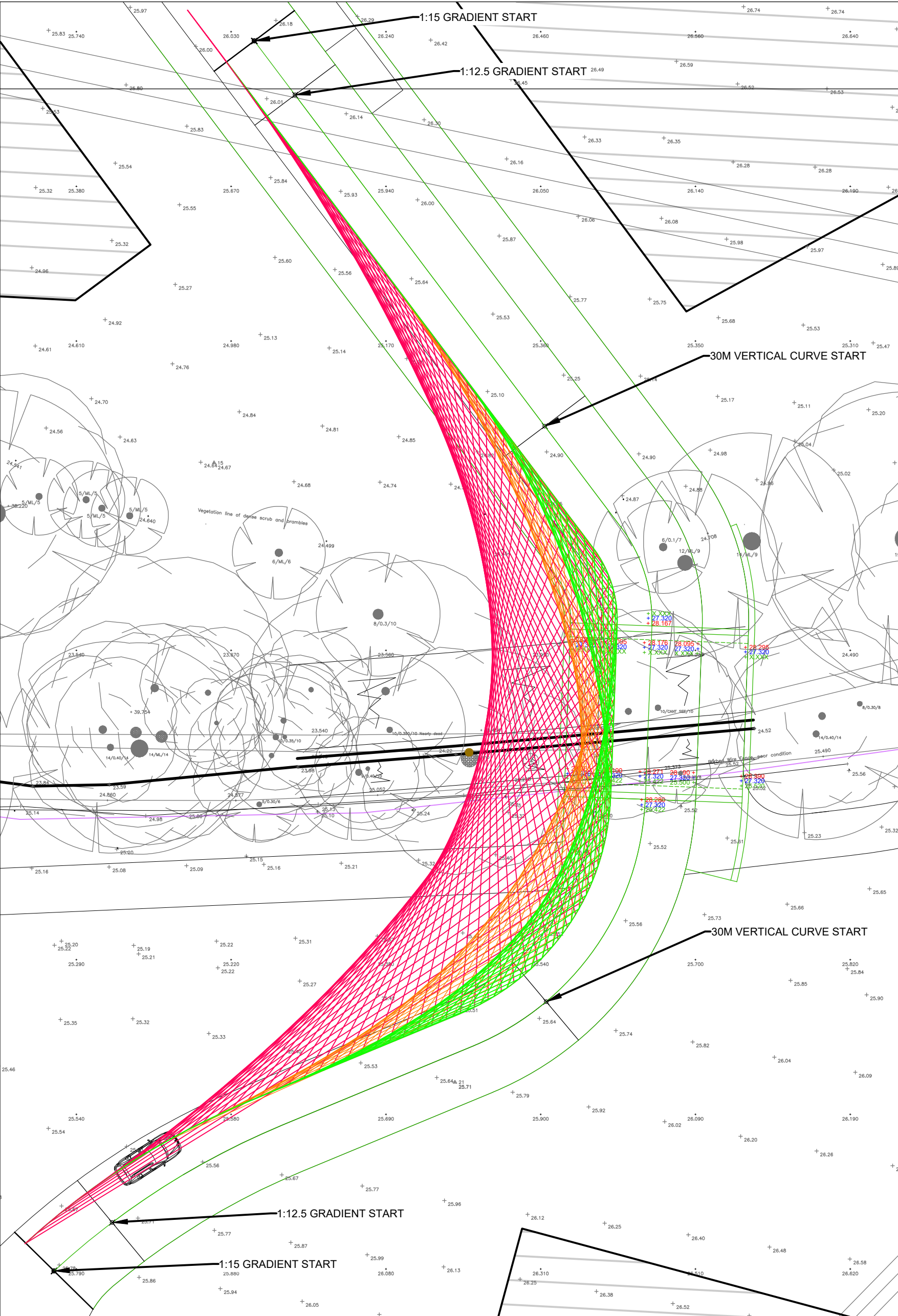


Bridge Sectional Elevation
SCALE 1:200

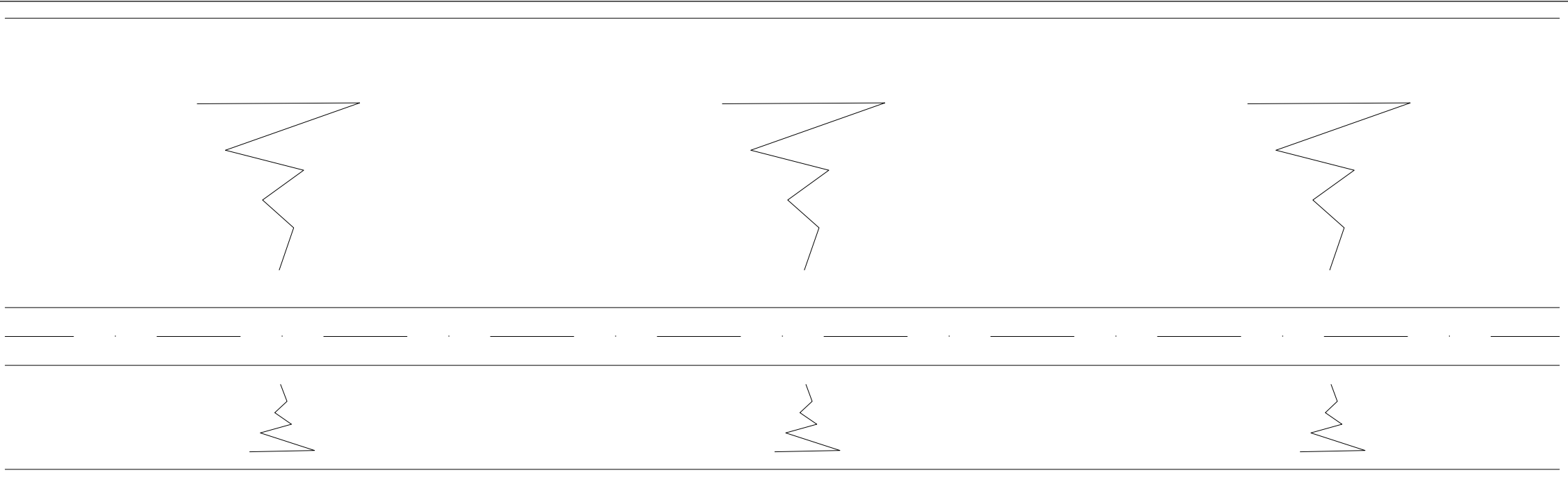


Bridge Capacity Comparison
SCALE 1:50

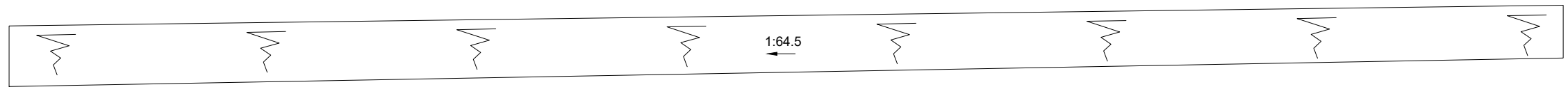
Indicative and conservative
side slope extents considered.



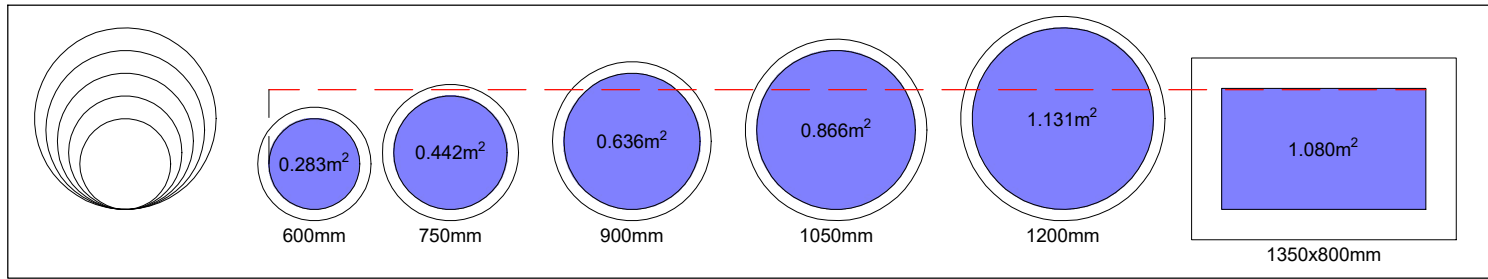
Bridge/Crossing Extract
SCALE 1:250



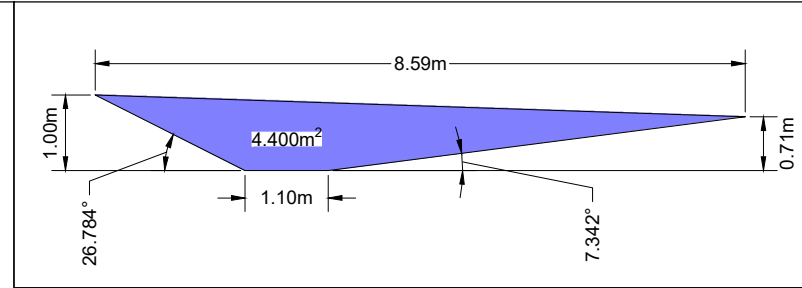
Watercourse Plan
SCALE 1:50



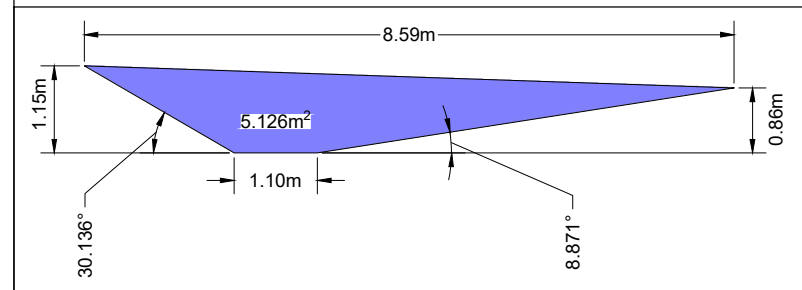
Watercourse Long Section
SCALE 1:50



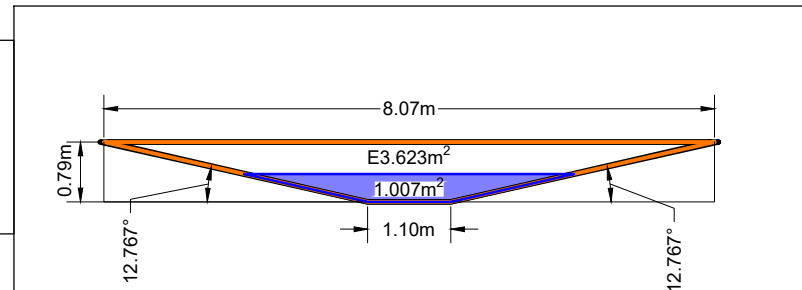
Pipe/Culvert Cross Sectional Area
SCALE 1:50



Upstream Cross Section
SCALE 1:100



Downstream Cross Section
SCALE 1:100



Aggregate Cross Section
SCALE 1:100

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EXTERNAL REFERENCES:

THIS INFORMATION & RIDGE & PARTNERS LLP CIVILS 3D MODEL & ASSOCIATED 3D OUTPUTS ARE BASED UPON THE FOLLOWING INFORMATION FROM THE DESIGN TEAM

ARCHITECT REFERENCE:

- ARCH DWG No. (DATED XX/XX/20XX)

SURVEY REFERENCE:

- SURVEY DWG No. EBC-OHH-31-10-22 (DATED 31/10/2022)

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS INFORMATION IS CURRENT PRIOR TO CONSTRUCTION

INITIAL ISSUE	23/02/2023	ZS
REV DESCRIPTION	DATE	DRAWN
ORIGINATOR:		



1 ROYAL COURT
KING'S WORTHY
WINCHESTER
SO23 7TW

TEL: 01962 634400

WWW.RIDGE.CO.UK



IN ASSOCIATION WITH:

PROJECT:
ONE HORTON HEATH
SITE WIDE
INFRASTRUCTURE DELIVERY

TITLE:
FOXWOOD WATERCOURSE
CAPACITY ANALYSIS

TECH: ZS	CSE: CL	ICSE: TC	SCALE: AS SHOWN	@ A1
STATUS:			INITIAL ISSUE:	23/02/2023

INFORMATION

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018551	RDG	XX	ST	DR	C	2206	-

APPENDIX C

EXISTING DITCH CAPACITY CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.345	0.300	64.5	0.000	5.00	1324.2	0.060	\/	-7	Pipe/Conduit	
1.001	5.000	0.080	62.5	0.000	0.00	0.0	0.060	\/	-7	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.22	24.520	0.000	1324.2	0.0	0.0	1.45	7573.5	1324.2
1.001	50.00	5.28	24.220	0.000	1324.2	0.0	0.0	1.48	7692.7	1324.2

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-7	\/	1100	790	12.8		2.343	5.213

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	\/	-7	FOXWOOD 1	25.520	24.520	0.210	Open Manhole	3000
1.001	\/	-7	FOXWOOD 2	25.320	24.220	0.310	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.345	64.5	FOXWOOD 2	25.320	24.220	0.310	Junction	
1.001	5.000	62.5		0.000	24.140		Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	0	Number of Storage Structures	0
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.350		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.900 Cv (Summer) 0.750
Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15
Return Period(s) (years) 1
Climate Change (%) 0

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Cap.	Pipe Flow (l/s)	Status
1.000	FOXWOOD 1	15 minute 1 year Summer I+0%	25.520	24.889	-0.421	0.000	0.19	1324.2	OK
1.001	FOXWOOD 2	15 minute 1 year Summer I+0%	25.320	24.591	-0.419	0.000	0.17	1343.5	OK

APPENDIX D

PROPOSED CONVEYANCE FEATURE CAPACITY CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.345	0.300	64.5	0.000	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	19.345	0.300	64.5	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.002	19.345	0.300	64.5	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.003	19.345	0.300	64.5	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.004	19.345	0.300	64.5	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit	
1.005	19.345	0.300	64.5	0.000	0.00	0.0	0.600	[]	-8	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	24.520	0.000	0.0	0.0	0.0	3.04	858.4	0.0
1.001	50.00	5.20	24.520	0.000	0.0	0.0	0.0	3.49	1541.1	0.0
1.002	50.00	5.28	24.520	0.000	0.0	0.0	0.0	3.91	2484.6	0.0
1.003	50.00	5.36	24.520	0.000	0.0	0.0	0.0	4.30	3719.2	0.0
1.004	50.00	5.43	24.520	0.000	0.0	0.0	0.0	4.66	5273.4	0.0
1.005	50.00	5.50	24.520	0.000	0.0	0.0	0.0	4.18	4514.3	0.0

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-8	[]	1350	800	90.0		1.005	1.080

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	600	600MM PIPE	25.520	24.520	0.400	Junction	
1.001	o	750	750MM PIPE	25.520	24.520	0.250	Junction	
1.002	o	900	900MM PIPE	25.520	24.520	0.100	Open Manhole	1800
1.003	o	1050	1050MM PIPE	25.520	24.520	-0.050	Open Manhole	1950
1.004	o	1200	1200MM PIPE	25.520	24.520	-0.200	Open Manhole	2100
1.005	[]	-8	BOX CULVERT	25.520	24.520	0.200	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.345	64.5	750MM PIPE	25.520	24.220	0.700	Junction	
1.001	19.345	64.5	900MM PIPE	25.520	24.220	0.550	Open Manhole	1800
1.002	19.345	64.5	1050MM PIPE	25.520	24.220	0.400	Open Manhole	1950
1.003	19.345	64.5	1200MM PIPE	25.520	24.220	0.250	Open Manhole	2100
1.004	19.345	64.5	BOX CULVERT	25.520	24.220	0.100	Open Manhole	3000
1.005	19.345	64.5		0.000	24.220		Open Manhole	0



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