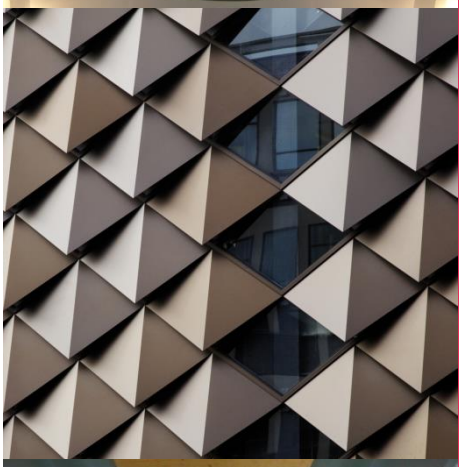

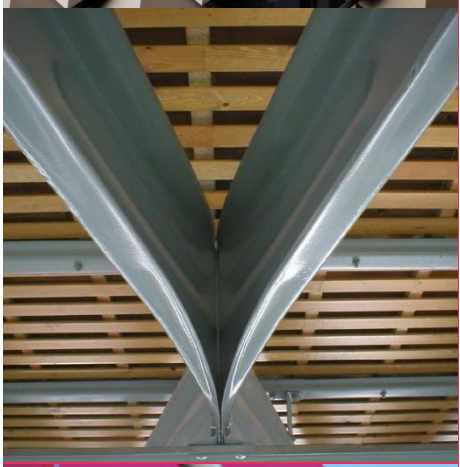

Proposed Great Wolf Lodge Chesterton, Bicester

Drainage & SuDS Strategy

Curtins Ref: 068535-CUR-00-XX-RP-C-00002

Revision: P01

Issue Date: 01 November 2019

Client Name: Great Lakes UK Limited

Site Address: Land to the east of M40 and south of A4095, Chesterton, Bicester

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Table 2: SuDS Opportunities

1.0 Introduction

1.1 Project Overview

Curtins Consulting Ltd have been appointed by Great Lakes UK Limited to prepare a drainage strategy for a proposed development to support a planning application. This report is intended to give an overview of the proposed strategy and suitable methods of discharge, it is to be read in conjunction with the site-specific flood risk assessment (FRA) 068535-CUR-00-XX-RP-C-00001 and the wider set of planning application documents.

This report is based on currently available information and discussions with the relevant authorities and bodies, namely Thames Water and Oxfordshire County Council (OCC) as the Lead Local Flood Authority (LLFA).

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

Where the proposed works, to which this report refers, are undertaken more than twelve months following the issue of this report Curtins Consulting shall reserve the right to revaluate the findings and conclusions by undertaking appropriate further investigations at no cost to Curtins.

1.2 Site Location

The Site is located on part of the existing golf course associated with the Bicester Hotel, Golf and Spa (BHGS). The Site is located to the west of Chesterton which is an outlier village to the west of Bicester. It is bound by the M40 to the west, A4095 to the north and the remainder of BHGS to the east and south. The project proposal intends to use holes 10-18 of the existing golf course to the north west of the hotel, which will remain in situ and operational. The remaining holes are to continue being used as a 9-hole golf course. The Site location can be seen in Figure 1-1 below.

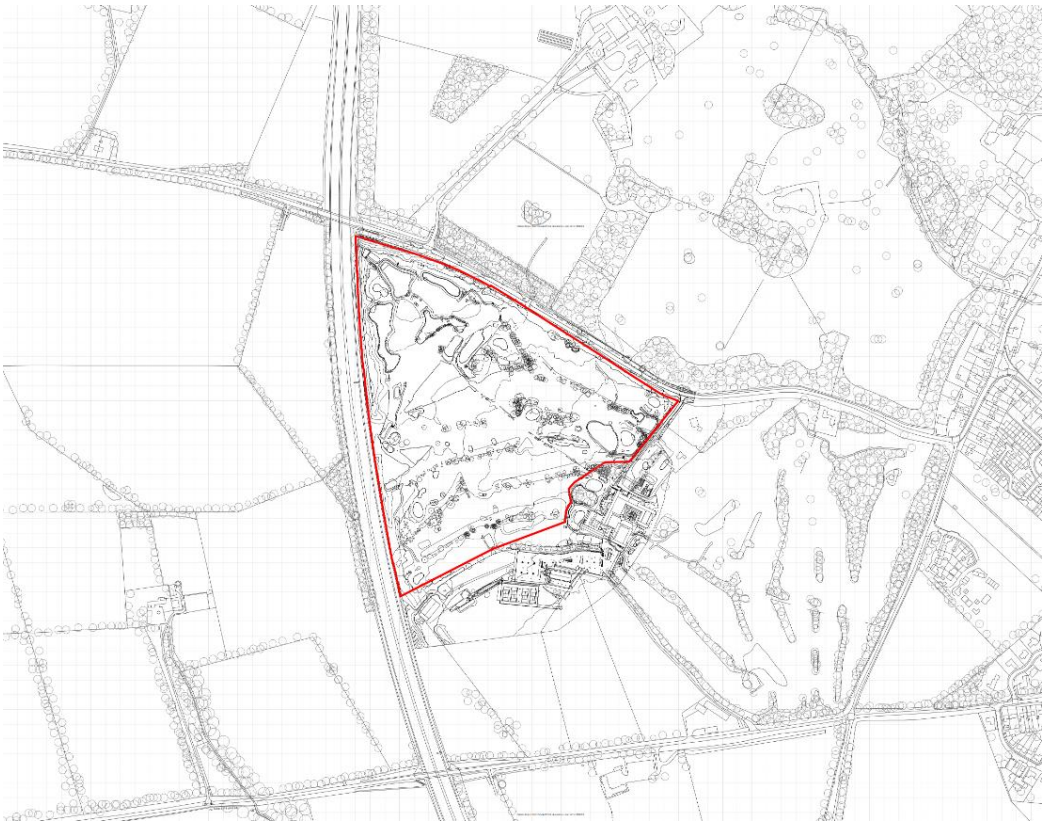

Figure 1-1: Site Location

The site has grid reference;

E:454923 N:221686

1.3 Site Description

The Site is currently used as part of an 18-hole golf course associated with BHGS. The project proposes to use the north western 9 holes as the Site for the development, turning the existing golf course from an 18 hole to a 9-hole golf course. The Site is currently accessed from the south, via a dedicated entrance of Green Lane. There is a secondary access to the service area from the West off the A4095. The Site planning boundary has a total area of 18.6ha.

The Site is located in Flood Zone 1, as shown on the Environment Agency's online mapping.

The site wide topographical survey is shown in **Appendix A**.

1.4 Project Proposal

It is proposed to construct a new part 3, part 4-storey 498 room hotel and waterpark with associated parking for approximately 900 vehicles. The Site will also offer indoor activities, conference facilities, food and beverage hall and public nature trails.

The proposed impermeable area of the development is approximately 7.2ha. This area is made up of the proposed structures and associated hardstanding, areas contributing to the drainage network, car park and access roads.

The Site layout is shown in **Appendix B.**

2.0 Planning and Policy Considerations

2.1 National Planning Policy Requirements

2.1.1 National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG)

In recent years, the Government and local Councils have placed increased priority on the need for developers to take full account for the risks of their development at all stages of the planning process. The National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) identifies how the issue of flooding is dealt with through the planning process and with the creation of a site-specific Flood Risk Assessment (FRA) for sites over 1ha in area or in Flood Zones 2 & 3. The Site is located in Flood Zone 1, however as the Site is larger than 1ha, a site-specific Flood Risk Assessment has also been undertaken for the Site.

2.1.2 DEFRA – Sustainable Drainage Systems

The Department for Environment, Food and Rural Affairs (DEFRA) national standards for sustainable drainage systems provides technical guidance on the design, construction and maintenance of Sustainable Drainage Systems (SuDS).

2.2 Local Planning Policy Requirements

2.2.1 The Cherwell Local Plan 2011-2031

This drainage strategy has been written in line with the current revision of the Cherwell Local Plan. The plan is aimed to support and guide developments in the area between 2011-2031.

This report has been specifically produced with the following policies in mind;

Policy ESD 6: Sustainable Flood Risk Management

This policy aims to reinforce the guidance set out in the NPPF and outlines Cherwell's requirements for new developments in respect to flooding. As with the requirements of the NPPF, ESD 6 outlines the requirements of the site-specific flood risk assessment. The policy states the need of the FRA to demonstrate that there will be no increase in surface water discharge or volume emanating from a site for any event up to and including the 1 in 100 year event (plus climate change), it also places the requirement for developments not to experience flooding for any events up to and including the 1 in 30 year storm event, ensuring any flood water is held safely on site.

Policy ESD 7: Sustainable Drainage Systems (SuDS)

This policy aims to promote the use of SuDS or all new developments in the management of surface water runoff. The policy states that;

"Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features"

2.2.2 Strategic Flood Risk Assessment

Cherwell District Council produced a SFRA in May 2017 which provides an update on a previous version with new legislative policy and summary of flood risk in Cherwell. The document provides guidelines on use of SuDS and guidance for FRAs. The document requires the consider of groundwater emergence as part of the decision-making process on the type of the SuDS techniques. The list of items to be provided with drainage strategy is set out below;

Site Drainage Strategy to include:

- SuDS proposals;
- Outfall locations and levels, including confirmation from relevant authorities that the proposed outfall location will be accepted;
- Rates of discharge including confirmation from relevant authorities that the proposed discharge rate will be accepted;
- On-site storage requirements including storage location indicated within the proposed development plan, confirmation that is it is to be located outside the existing 1% AEP+CC flood extent, and evidence that sufficient space is available; and
- Maintenance, funding and operation proposals for the SuDS.

2.2.3 Oxfordshire Flood Risk Management Plan

Oxfordshire County Council act as the Lead Local Flood Authority for the county. A Flood Risk Management Strategy has been produced as part of this role, with an aim to;

- Setting out a long-term programme for flood risk reduction.
- Setting out procedures for identifying relative priorities of measures for flood risk reduction.
- Establish how to find area where a holistic approach to flood risk reduction will achieve multiple benefits.
- Establish how to identify affordable measures for implementation to agreed time frames,
- Facilitate engagement and consultation with community and strategic partners.
- Encourage public awareness and self-help where appropriate.

3.0 Flood Risk Summary

A detailed site-specific Flood Risk Assessment (FRA) has been written for the Site (CUR-00-00-RP-C-00001). The FRA;

- Investigates all potential risks of current or future flooding to the Site
- Considers the impact the development may have elsewhere with regards to flooding
- Considers design proposals to mitigate any potential risk of flooding determined to be present

A summary of the assessments of flood risks posed to the Site is given below

3.1 Fluvial Flood Risk

With reference to the EA's indicative flood maps, it can be seen that the Site lies in Flood Zone 1 on the EA's flood risk maps. This means the Site has an annual flood probability of less than 0.1%.

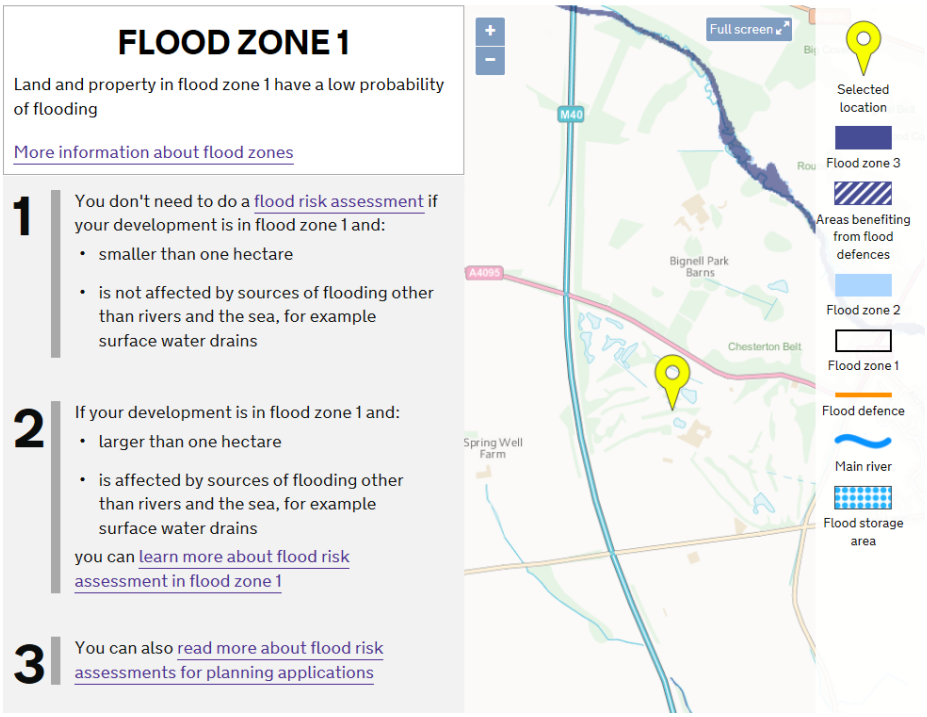

Figure 3-1: Environment Agency's Flood Zone Map

The risk of flooding from fluvial sources is therefore seen as very low.

3.1.1 Pluvial Flooding and Overland Flow

With reference to the EA's online mapping, data related to the risk of potential surface water inundation or flooding is also provided. This shows that the Site and the proposed outfall location (discussed later) is at very low risk of flooding.

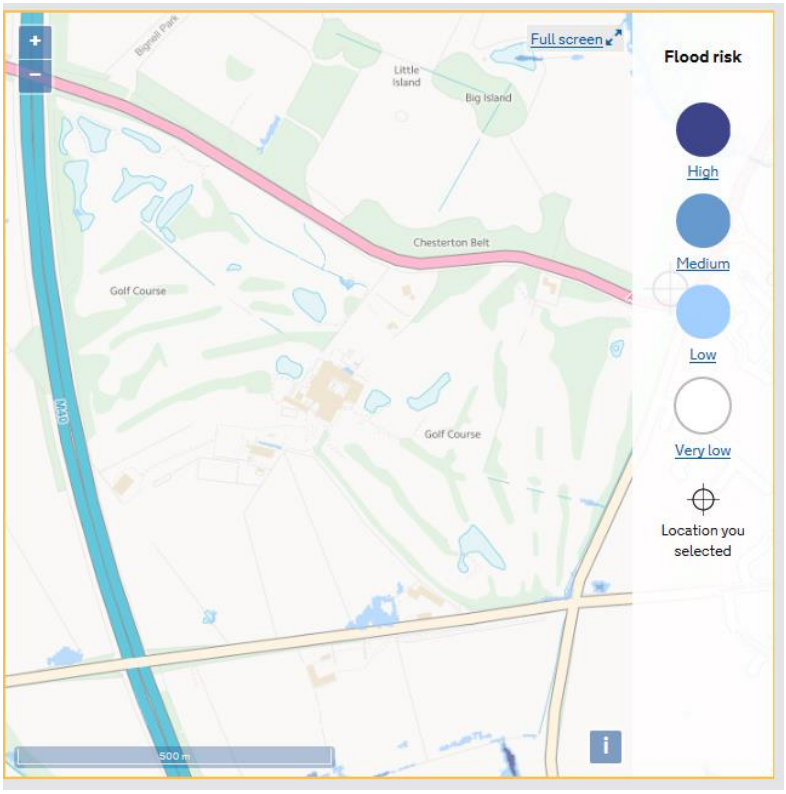

Figure 3-2: Surface Water Flood Risk Map

The risk of flooding to the Site from pluvial sources is therefore seen as very low.

3.1.2 Ground Water Flooding

An unmanned aerial vehicle survey was conducted across the Site to map the groundwater levels. An extract of this survey is shown in Figure 3-3.

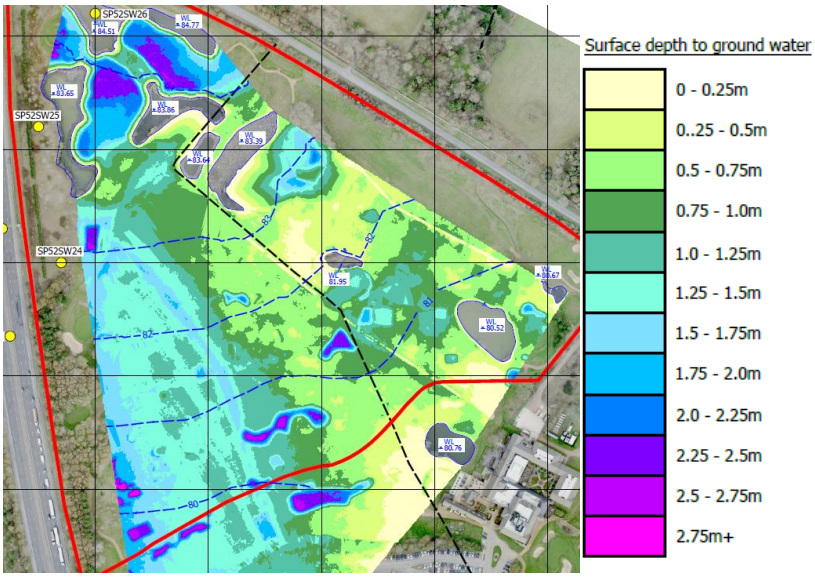

Figure 3-3: UAV Groundwater Survey

The survey shows that groundwater levels are shallow across the south and east of the Site. This is further discussed in the Flood Risk Assessment (068535-CUR-00-DR-RP-C-00001). Whilst initial indicators show that the groundwater levels are high, there are have been no report incidents of groundwater flooding in the Oxfordshire or Cherwell SFRA. Further site investigations is required to monitor the long term, seasonal level of the groundwater.

The Site currently benefits from land drainage across the east of the Site, corresponding to the highest level shown in Figure 3-3. There has been no formal survey conducted on this, however from site visits and aerial imagery, traces of the system can be identified. Figure 3-4 below shows evidence of land drainage in the south east of the Site. The approximate routes of the perforated land drains are shown using blue arrows, with the drainage ditches highlighted in dark blue. These have been confirmed during site visits.

Figure 3-4: Aerial Imagery Showing Land Drainage

It is proposed to reinstate the land drainage across the Site during construction, albeit at a lower level. The risk of groundwater flooding will therefore be managed following construction. This will be discussed later on in this report.

4.0 Existing Drainage

4.1 Public Sewerage

There are no public foul, surface or combined water sewers located on the Site or in the immediate vicinity of the Site. The closest public sewer is a Thames Water foul sewer located 400m to the east along the A4095, manhole reference 7601. This sewer serves the residential areas around Chesterton and also is the outfall for the rising main from the BHGS Golf Course. The location of the manhole can be seen in Figure 4-1. The Thames Water sewer records are contained in **Appendix C.**

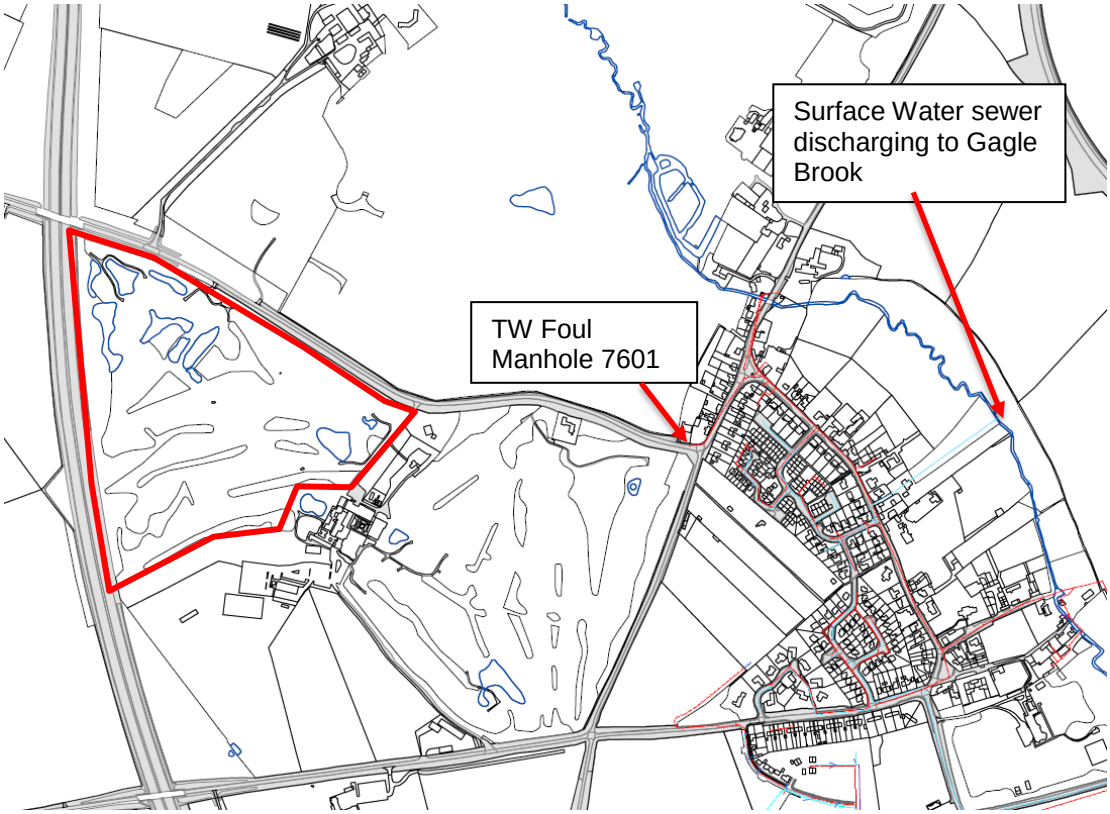

Figure 4-1: Thames Water Sewer Records Extract

There are public surface water sewers in Chesterton, however these are further away and not utilised currently by the Site as a method of discharge. All surface water sewers ultimately discharge to Gagle Brook.

4.2 Private Drainage

The Site is the back nine holes of the golf course associated with BHGS, however for the benefit of understanding, this section will refer to discharge from the southern nine holes and hotel/club house as well.

Following a site visit to the existing golf course and hotel and walk over with site maintenance staff, it has been seen that the existing buildings are served by a series of below ground foul water sewers. These sewers direct flows to the east and south of the building where foul flows are discharged into pump chambers. From here the sewerage is pumped across the southern 9 holes to the foul water manhole 7601 beneath the A4095. It is understood from maintenance staff that the macerator pumps used by the existing golf hotel and spa are currently at capacity.

Surface water across the existing site is collected via a range of above and below ground systems. There is a ditch network that manages land drainage and overland flow from the golf course and green spaces to the north and south of the existing hotel. The roof drainage is managed by guttering and rain water pipes guiding the surface water to a below ground sewer system. The surrounding hardstanding and car parking areas are drained using road and yard gullies. All of the surface water collection systems are then either discharged into an existing pond to the south of the hotel or downstream into the network of ditches guiding flows southward off the existing site. Figure 4-2 shows the arrangement of this network. The Site boundary is all drained via two ditches that outfall via a 300mm diameter pipe into a pond to the south of the existing hotel. The pond has a high-level outfall discharging to the ditch network shown in Figure 4-3. It is understood that the pond is used for irrigation of the existing site in summer.

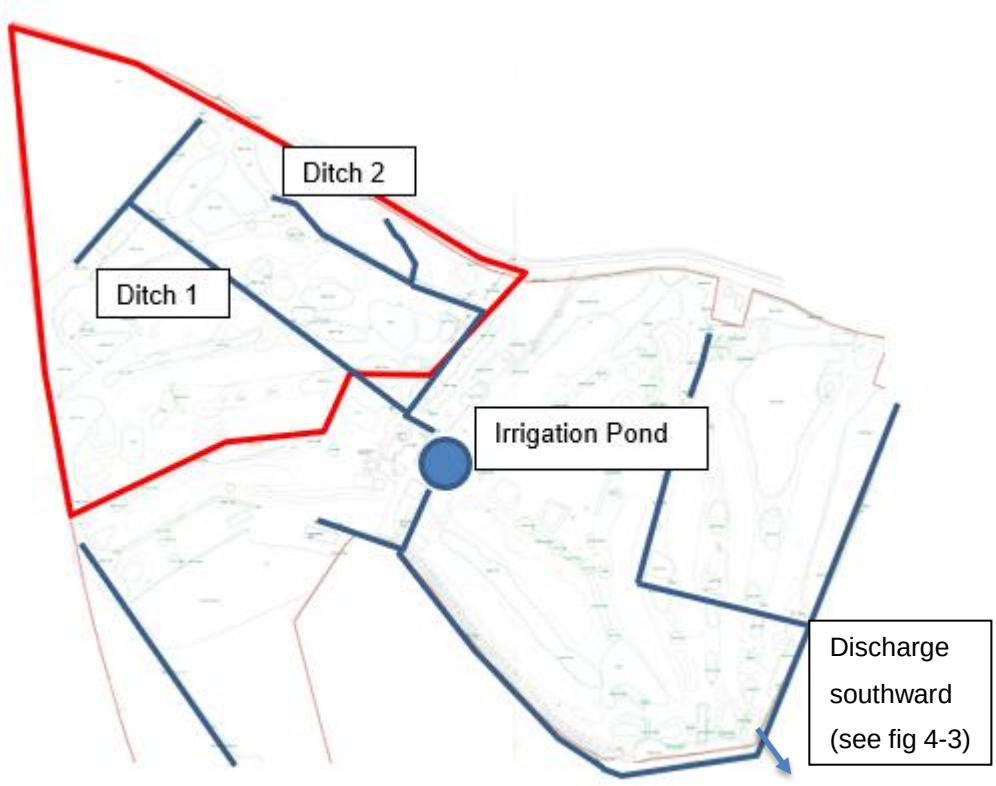

Figure 4-2: Site Wide Existing Drainage Network

It is assumed that all surface water is currently discharged from the existing site via a series of swales and culverts, leading flows southward to Gagle Brook. Figure 4-3 shows the approximate route, with swales shown in green and culverts in purple. This is the understanding taken from the flow direction of the ditched on the topographical survey, site walk overs and evidence given by the golf resorts maintenance staff.

Figure 4-3: Surface Water Discharge Route

5.0 Proposed Drainage Strategy

5.1 General

It is proposed to drain the surface water via the existing outfall network previously discussed. The discharge will be restricted to greenfield run-off rates, with excess flows being managed on the Site. The method of attenuation is proposed to follow the SuDS hierarchy, with green roofs, permeable pavements, detention basins and swales being used where possible.

A larger storage feature will be required to protect the Site during high intensity rainfall events, however due to spatial constraints this is required to be a below ground storage tank.

A separate foul water sewer is proposed to collect and convey foul water. As there are no existing foul sewers on, or near the Site that have available capacity, it is proposed to pump foul water to the nearest Thames Water manhole. The proposed pumping station is to be designed to the requirements of Sewers for Adoption 7th Edition, located to the east of the Site and offered to Thames Water for adoption. This is subject to agreement with Thames Water.

Two existing ditches that dissect the Site from north to south are proposed to be diverted as part of the scheme. These will be incorporated into the proposed car park and connect to the existing drainage ditch, running along the southern boundary.

5.2 Surface Water

5.2.1 Proposed Site Discharge

In line with the Drainage Hierarchy, surface water runoff from a site should endeavour to be controlled as close to the source as possible. Discharge from site should be via one of the methods detailed in Table 1, in descending priority;

Table 1: Discharge Opportunities

Sustainable Drainage Hierarchy	Site Specific Application
Store rainwater for later use	It is proposed to use a bespoke system that will allow for the below ground storage tank to be used for rainwater harvesting. The system will store water in the tank until the MET office forecasts rain, at which point it will begin discharge to provide storage capacity for excess run-off. The details of this system are to be provided separately by the MEP Engineer.
Use infiltration techniques, such as porous surfaces in non-clay areas	Due to high ground water levels across the Site, infiltration is not seen as a feasible outfall solution and therefore has been discounted. It is stated in Building Regulations that infiltration devices should not be used within 1m of the seasonal high groundwater level.
Attenuate rainwater in ponds or open water features for gradual release	Two above ground detention basins have been included on the Site, these are located either side of the main entrance to the hotel and can be seen on 068535-CUR-00-XX-DR-C-92000 – Below Ground Drainage General Arrangement in **Appendix E**.
Attenuate rainwater by storing in tanks or sealed water features for gradual release	It is proposed to store as much excess flows above ground in basins, where this is not possible, permeable pavements and swales are to be utilised. The remaining surface water run-off is to be attenuated in a below ground storage structure.
Discharge rainwater direct to a water course	It is proposed to mimic the existing outfall arrangement of the Site, where surface water is collected and discharged to the existing network of ditches and culverts, leading to Gagle Brook
Discharge rainwater to a surface water sewer/drain	There are no surface water sewers in the vicinity
Discharge rainwater to a combined sewer	There are no surface water sewers in the vicinity

The permitted discharge rate from the Site is proposed to be QBar. The Site has a total area of approximately 17ha, however it is estimated that only 7.2ha of this will be impermeable. Using the rural runoff calculator on MicroDrainage, the QBar rate has been estimated and can be seen in Figure 5-1.

Therefore, all surface water discharge from the Site is proposed to be limited to 31.3l/s for all storm events up to and including 1 in 100 year +40%. The flow restriction is proposed to be achieved using a vortex flow control device, located in the last manhole before meeting the existing below ground network. Further flow controls are proposed across the Site; however, these are aimed at managing surface water flows upstream and utilising attenuation volume held in the permeable pavements.

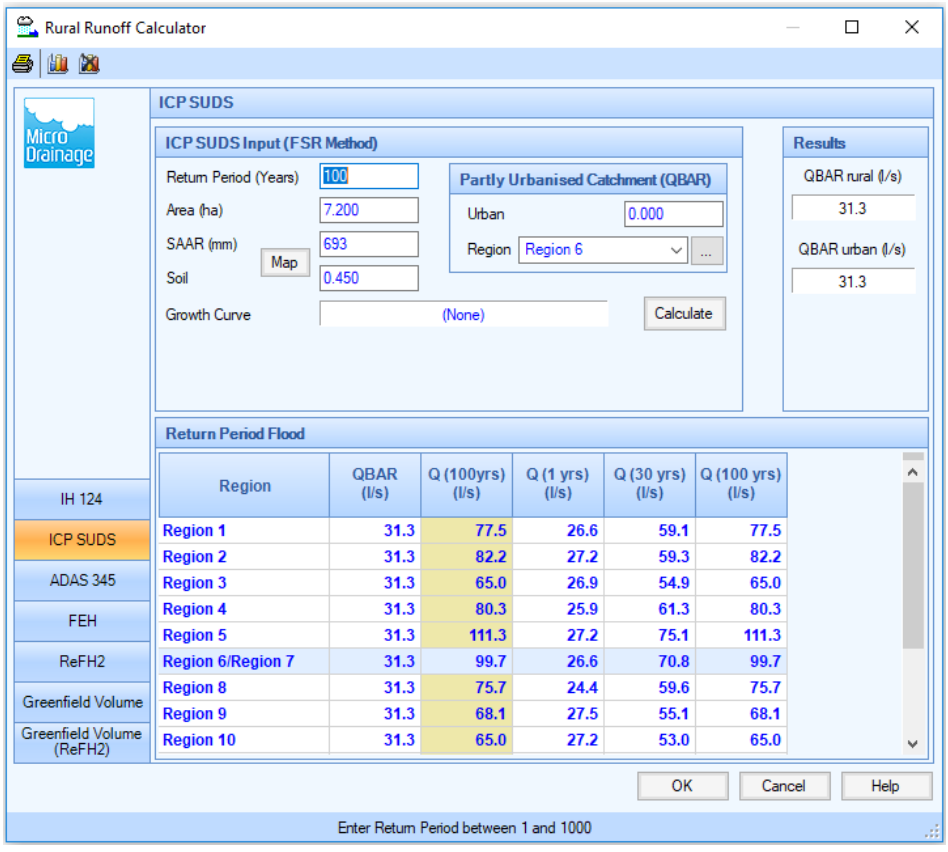

Figure 5-1: QBar Calculation

Following discussions with the LLFA, it has been agreed that the existing outfall and proposed discharge rate are adequate for this Site. As no surface water sewer is to be used for the Site outfall, discussions with Thames Water are not required. Similarly, as the Site does not discharge to a main river, the EA are not required to be consulted either.

The network has been modelled using MicroDrainage and the results can be seen in **Appendix D.**

5.2.2 Attenuation

As the Site discharge is proposed to be restricted to greenfield runoff rates, attenuation volume is required to hold excess flows. It is proposed to offer this volume through various SuDS features. The proposed below surface water network utilises detention basins, permeable pavements, swales and below ground attenuation tanks. The proposed General Arrangement is contained in **Appendix E**. The aim of the proposed strategy has been to push as much of the required storage volume up the drainage hierarchy as possible.

Permeable pavements are the most widely used SuDS feature across the Site. This is due to them being able to offer benefits to water quality and time of entry, as well as offering up the real estate for multi-use. The car park has been broken up into a number of systems each controlled using an orifice plate to ensure the storage volume is maximised over more frequent return periods. Table 2 shows the area and depth of each of the systems used in the MicroDrainage model. These will be subject to change following the development of the Site wide external levels strategy, however offer an insight into the storage volume required.

Further to the below, other storage volumes are required across the Site. These volumes are outlined in

Table 3 and shown in **Appendix E.**

Table 2: Permeable Pavement Dimensions

Permeable Paving Ref. (see 068535-CUR-00-00-DR-C-00001)	Area (m^2)	Sub-base Depth (mm)	Approximate Volume (m^3)
A	936	300	297
B	4775	300	430
C	2900	300	261
D	1480	300	133
E	520	300	47
F	630	300	57
G	3025	300	862
H	1700	300	153
I	685	300	62
J	690	300	62
K	945	300	85

Table 3: Storage Volumes

Storage Feature	Volume (m^3)
Pond (volume per pond)	342 – per pond
Tank (SW2)	100

Tank (SW44)	2000

5.2.3 Sustainable Drainage Systems

Developments should utilise sustainable drainage systems (SuDS) unless there are practical reasons for not doing so. As mentioned previously, the design should aim to reduce run-off rates and ensure that run-off is managed as close to its source as possible as per the drainage hierarchy (see Table 1).

The SuDS Hierarchy sets out the preferred method of discharging and managing water from a development site and aims to highlight why each item has been utilised or discounted.

Table 4 analyses the SuDS hierarchy and the appropriate techniques with specific focus on this project.

Where traditional collection systems are required, gully pots and channels are to be installed with gully pot ladders to allow for the escape of any Great Crested Newts. The gully and channels will also be constructed with a safe passageway between the kerb and gully pot/channel where required. In any case, gully pots and channels have only been included where absolutely necessary.

Table 4: SuDS Opportunities

SuDS Technique	Site Specific Analysis
Rainwater Harvesting	As discussed previously, the large below ground attenuation tank is to be installed with a specialist system, allowing for dual use as a rainwater harvesting tank. This is further detailed in the MEP report produced by Hoare Lea.
Living or Roofs/Areas	Green roofs are proposed on top of the food area of the proposed building. The permitted area for this is shown in **Appendix F**. The remainder of the area is to be used for plant or is not structurally suitable.
Basins and Ponds	Where possible surface water storage basins are encouraged. Two basins have been included either side of the main entrance. All other potential areas are either at risk of high groundwater, not hydraulically feasible or not within the ownership boundary.
Filter Strips and Swales	Swales are proposed along the service roads to the water park. These are only proposed to be conveyance swales and will be lined to prevent groundwater entering the surface water system. Two further swales are proposed through the car park, flowing from north to south. These swales have been designed as diversions for the existing drainage ditches crossing the site. This has been agreed with the LLFA.
Infiltration Devices	As previously mentioned, infiltration is not possible due to high ground water
Permeable Surfaces	The proposed car park is to be used as permeable pavement where possible. As there is likely to be a grade across the car park, the system will comprise of a number of small

	permeable pavement systems with orifice plates to retain flows during high intensity rainfall events. The proposed sub-base depths are approximately 300mm for all systems.
Tanked Systems	Tanks systems are to be used across the Site to protect property from flooding during high intensity rainfall events. These are to be used where no other form of storage is appropriate.

5.3 Foul Water

5.3.1 Outfall Location

The Site will be designed with a new separate below ground drainage foul sewer. The foul sewer will serve the hotel, waterpark and associated amenities. As previously discussed, there are no existing foul water sewers on the Site, with the closest being 400m away in Chesterton. The existing hotel and golf club discharge foul water to two on-site private pump stations, from here the effluent is pumped via rising main to the nearest Thames Water manhole (Ref. 7601). This is also the proposed outfall manhole for the Site. It is understood that this private system operates at above full capacity and often has operational issues as a result of this. It is therefore assumed that this is not a viable outfall for the Site and a new connection to TW manhole 7601 will be required.

5.3.2 Pumping Station

In order to provide a foul water drainage outfall to the Site, it is proposed to install an private pumping station as part of the drainage strategy. The details of this pumping station are yet to be confirmed, however it is anticipated to be located on the Site's eastern boundary, with access to the pumping station provided through the proposed car park. The pump station will be required to be designed in accordance with Sewers for Adoption 7th Edition. The pumping station will be installed with back up pumps and power supplies. If a 24-hour storage is also required, this will be agreed with Building Control.

5.3.3 Discharge Rates and Flows

The peak discharge rate for foul water has been estimated for the Site. As the project is currently at Stage 2, the estimation is based on required number of appliance and the proposed room layouts. The discharge rate from the waterpark has been provided by its designers.

An allowance has also been made for the backwash flows from the pools during maintenance. This will need to be confirmed at a later date and is not anticipated to be carried out at the peak flow time.

The total estimated site discharge, not including the pool backwash, has been calculated using BS EN 752:2018 using a frequency factor of 0.7. The peak discharge rate is estimated to be 50l/s. The calculations are shown in **Appendix G.**

The proposed foul network has been modelled using MicroDrainage to establish the required site outfall and pump requirements. As the internal SVP locations and flow rates have not been confirmed, the

model is solely used for estimating invert levels when the network is designed to Building Regulations and not BS EN 752.

5.4 Land Drainage

As previously discussed, the existing Site has a high groundwater table. In order to prevent the greens from waterlogging, a land drainage network has been installed. The small diameter perforated pipes at laid at a shallow depth and discharge to the existing drainage ditches on the Site. These ditches connect to the outfall described in Section 5.2. Images of these ditches, taken on a site walkover, are shown in Figure 5-2. Further information on the existing ditch network can be seen in the technical note in **Appendix H**.

Figure 5-2: Site Drainage Ditches

It is required to remove this land drainage as part of the proposal. This will include removing the existing drainage ditches. In order to ensure that the ground water is managed post-construction, a new land drainage network is proposed for the Site. An indicative layout has been illustrated In **Appendix I**. Further to this, a diversion of the two existing land drains have been proposed, as agreed with the LLFA in a pre-application meeting. The route of the diversion is shown on the Drainage General Arrangement drawings in **Appendix E**.

6.0 General Maintenance

All drainage within the Site will be maintained as a private network, not including the adoptable pumping station. A suitable maintenance strategy will be included within handover documentation by the contractor once final details and suppliers have been chosen for the individual drainage elements. This strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

An Operations and Maintenance Manual has been included in **Appendix J.**

7.0 Conclusions and Recommendations

This report is intended to provide further details on the design of the drainage systems for the proposed Great Wolf Lodge and to act as additional information in support of the planning application. The conclusions to be drawn from this report are as follows:

- The Site is located in Flood Zone 1 and therefore is at the lowest risk of fluvial flooding
- There is a low risk of surface water flooding across the Site
- The Site is subject to high ground water levels. There is an existing land drainage system on site that is proposed to be reinstated and upgraded as part of the works. As a result, it is anticipated that the flood risk will be suitably managed.
- Due to the above point, it is not anticipated that infiltration is a viable option for surface water discharge. This is demonstrated through a UAV survey of the Site.
- The proposed surface water outfall is via the existing network of drainage ditches, culverts and ponds on the Site..
- The surface water is proposed to discharge at the greenfield run-off rate. This has been calculated to be 31.3l/s
- Excess surface water flows are proposed to be attenuated using permeable pavements, detention basins, swales and a below ground attenuation tank.
- It is proposed to use green roofs, permeable pavements and swales as part of the on-site collection system
- Rainwater harvesting it to be proposed for the Site. The proposed attenuation tank it to be integrated with a specialist system that will allow for its use as a harvesting tank during no and low intensity rainfall events.
- There are two existing drainage ditches that flow from north to south across the Site and are used as part of the land drainage system. These are required to be diverted as part of the works.
- A separate foul water system is to be constructed as part of the project. As there is no viable outfall in the immediate vicinity, this will outfall to an adoptable pumping stations and be pumped via rising main to the nearest Thames Water manhole. The peak discharge rate is estimated to be 50l/s.

Appendices

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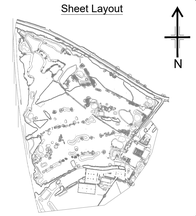
Appendix A – Topographical Survey

Sheet Layout



Topographic Abbreviations

AV	Air Vent	IL	Invert Level
BB	Belisha Beacon	JB	Junction Box
BD	Back Drop	KO	Kerb Outlet
BK	Brick	LB	Litter Bin
BL	Base/Bed Level	LP	Lamp Post
BOL	Bollard	MH	Man Hole
BP	Brick Pillar	MK	Service Marker
BPV	Brick Paviour	MT	Mercury Telephone Cover
BR	Bike Rack	OSBM	Ordnance Survey Benchmark
BS	Bus Stop	P	Post
BT	BT Inspection Cover	PB	Post Box
C	Combined (Sewer)	PCP	Pedestrian Control Point
C&W	Cable & Wireless	PLT	Planter
CA	Camera	PM	Parking Meter
CAJB	Cable Junction Box	PPL	Parapet Level
CATV	Cable Inspection Cover	PU	Pump
CB	Control Box	RE	Rodding Eye
CC	Comms Cabinet	RL	Ridge Level
CCTV	Close Circuit Television	RS	Road Sign
CD	Cable Duct	RW	Retaining Wall
CG	Cattle Grid	RWC	Rain Water Channel
CH	Coal Hole	RWP	Rain Water Pipe
CIP	Cable Inspection Point	S	Storm (Sewer)
CL	Cover Level	S/A	Soakaway
COL	Column	Sap	Sapling
Conc	Concrete	SB	Sliding Bollard
CP	Catch Pit	SC	Water Stop Cock
D	Depth	SD	Service Duct
DK	Drop Kerb	SEG	Side Entry Gully
DPC	Damp Proof Course	SL	Sill Level
EB	Electricity Control Box	SP	Sign Post
EJB	Electricity Junction Box	ST	Stay Cable
EL	Eave Level	SV	Stop Valve
ELEC	Electricity Inspection Cover	SW	Soil Vent Pipe
EM	Electric Meter	SWI	Swimming Pool
EP	Electricity Pylon/Pole	TB	Telephone Call Box
ER	Earth Rod	TBM	Temporary Bench Mark
F	Foul (Sewer)	TC	Traffic Control Inspection Cover
FB	Flower Bed	TH	Trial Hole
FC	Fuel Cover	THL	Threshold Level
FH	Fire Hydrant	TIC	Telephone Inspection Cover
FL	Floor Level	TJB	Telephone Junction Box
FLT	Floor Light	TL	Traffic Light
FO	Fibre Optic	TMC	Tarmac
FP	Footpath	TOW	Top of Wall
FRL	Flat Roof Level	TP	Telegraph Pole
G	Gully	TS	Tree Stump
GAS	Gas Inspection Cover	UTL	Unable To Lift
GJB	Gas Junction Box	VP	Vent Pipe
GM	Gas Meter	WL	Water Level
GP	Gate Post	WM	Water Meter
GV	Gas Vent	WO	Wash Out
HL	Head Level	WP	Waste Pipe
IC	Inspection Cover	WTR	Water Inspection Cover

Topographic Legend

- Gate
- Paving
- Bottom Of Batter
- Top Of Batter
- Building/Wall
- Drip/Vegetative Line
- Slab/concrete
- Slope of batter
- Kerb
- Pipes
- Fencelines
- Vegetative Border
- Railing
- Pin Kerb
- Overhead Power Line
- Building Canopy
- Grass Edge
- Contour With Level
- Edge of Hardstanding
- Bore Hole
- Tree
- Bush
- Survey Station
- Photograph Origin

Utility Abbreviations

AR	ASSUMED ROUTE	NVV	NO VISIBLE VALVE
D.O.C	DEPTH OF COVER	TPR	TAKEN FROM RECORDS
D.T.B	DEPTH TO BOTTOM	TLS	TRAFFIC LIGHT SENSOR
D.T.S	DEPTH TO SOLE	UNA	UNABLE TO GAIN ACCESS
D.T.W	DEPTH TO WATER	UTL	UNABLE TO LIFT
EOS	END OF SONDE	UTS	UNABLE TO SONDE
EOT	END OF TRACE	UTT	UNABLE TO TRACE
EUD	EMPTY UTILITY DUCT		
M.A.R	MAN ACCESS REQUIRED		
NVP	NO VISIBLE PIPE		

Utility Legend

- FUEL LINE - PETROL
- FUEL LINE - DIESEL, KERO OR PARAFFIN
- ELECTRICITY CABLE
- HIGH VOLTAGE ELECTRICITY CABLE
- WATER SUPPLY PIPE
- GAS
- TELECOM CABLE
- BT CABLE
- CABLE TELEVISION
- FIBRE OPTICS
- CATHODIC PROTECTION
- DUCTING
- HEATING PIPES
- SURFACE WATER DRAIN
- FOUL WATER DRAIN
- COMBINED DRAIN
- UNIDENTIFIED (LOCATED USING GPR) - SEE NOTES
- UNIDENTIFIED (LOCATED BY INDUCTION) - SEE NOTES
- UNIDENTIFIED (LOCATED BY RADIO) - SEE NOTES
- UNIDENTIFIED PIPELINE
- TANK GAUGE LINE OR COMMS CABLE
- OFF-SET FILL
- VENT PIPE
- OIL PIPE
- REMEDIATION PIPES
- VAPOR RECOVERY
- SURVEY EXTENTS BOUNDARY LINE
- END OF TRACE/SONDE

Chamber Extents

Report Photos

Notes

THE ACCURACY OF BOTH THE RADIO DETECTION EQUIPMENT AND THE GROUND PENETRATING RADAR, CAN ONLY BE ASSUMED TO BE +/-15% OF THE LOCATED DEPTH. FOR BOTH X,Y AND Z HEIGHT INFORMATION.

WHILST 1ST HORIZON PROVIDE SUITABLY TRAINED STAFF ON ALL PROJECTS AND OUR INVESTMENT IN THE LATEST DETECTION EQUIPMENT, LOCATED DATA MUST NOT BE ASSUMED EXHAUSTIVE AND DOCUMENT HS(G)47 MUST ALWAYS BE ADHERED TO IN ALL AREAS DURING ANY EXCAVATION WORKS.

NO LIABILITY FOR ERRORS, OMISSIONS OR EXCEPTIONS WILL BE ACCEPTED BY 1ST HORIZON SURVEYING & ENGINEERING LTD.

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THIS DRAWING SHOULD ONLY BE USED FOR IT'S ORIGINAL PURPOSE. 1ST HORIZON SURVEYING & ENGINEERING LTD ACCEPTS NO RESPONSIBILITY FOR THIS DRAWING IF SUPPLIED TO ANY PARTY OTHER THAN THE ORIGINAL CLIENT.

DO NOT SCALE FROM THIS DRAWING.

ALL LEVELS ARE RELATED OSTN15 GRID PROJECTION.

Rev	Details	Name	Date

Client:
Curtins
17-19 Whitworth St West
Manchester
M1 5WG

Project:
Great Wolf Lodge,
Chesterton, Bicester,
OX26 1TH

Title:
Great Wolf Lodge
Topographic Survey
Overall Layout

Surveyed:	RD, RL, DF	CAD:	ABR, RD
Ch'k'd:	ABR	App'd:	JG
Date:	02.08.19	Scale:	1:100@A0

1ST HORIZON

1st Horizon Surveying and Engineering Ltd.

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88-90 High Street
Dodworth
Barnsley S75 3RQ

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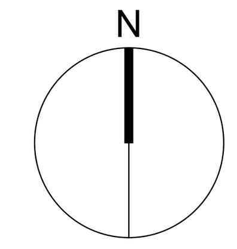
Fax: +44 (0)1226 766 317
www.1sth.co.uk
info@1sth.co.uk

No. CS-GW5389-01

Rev: -

Appendix B – Proposed Site Layout

Keyplan



Notes:
1. Do not scale
2. Contractor to Check all dimensions and report omissions and errors to the Architect
3. EPR Architects accepts no liability for use of this drawing by parties other than the party for whom it was prepared or for purposes other than those for which it was prepared.
4. This drawing is issued in dwg/dgn format as an uncontrolled version to enable the recipient to prepare their own documents/drawings/models for which they are solely responsible. This drawing is based on project information current at the time of issue. EPR Architects Limited accepts no liability for any alterations or additions to or discrepancies arising out of any change to such project information that occurs to the information after it is issued by EPR Architects Limited.
5. This drawing does not contain shared coordinates and is not issued for coordination purposes.

No.	Revision	Date	Initial	Chk'd
3	P03 - Planning Issue	08.11.19	LGO	AJ
2	P02 - Preliminary Planning Issue	30.10.19	LGO	AJ
1	P01 - Preliminary Planning Issue	25.10.19	LGO	CT

2019-11-08 11:39:12

Notes:
1. This drawing has been prepared for planning application purposes only.
2. EPR Architects accepts no liability for use of this drawing by parties other than the party for whom it was prepared or for purposes other than those for which it was prepared.
3. Landscape shown for illustrative purposes only; refer to Landscape Architect's for Landscape proposals for further details.
4. Tree locations & existing trees beyond site perimeter - indicative - for illustrative purposes only.

-10 0 10 20 30 40 50
SCALE 1:1250 m

EPR Architects
30 Millbank, London SW1P 4DU
+44(0)20 79327600
www.epr.co.uk

Proposed Great Wolf Lodge
Chesterton, Bicester, Oxfordshire

Proposed Site Plan

Scale @A1	Status	Revision
1:1250	Planning	3

Project Code - Originator - Zone - Level - Type - Role - Class. Number

10875 - EPR - 00 - ZZ - DR - A - TP-0102

Appendix C – Thames Water Sewer Records

Asset location search

Property Searches

Curtins
LONDON
EC1V 0BD

Search address supplied OX26 1TE

Your reference GWL 068535

Our reference ALS/ALS Standard/2019_3986151

Search date 15 April 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: OX26 1TE

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Thames Water Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SP5521NE
SP5521SE

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

The following quartiles have not been printed as they contain no assets:

SP5521NW
SP5421NE

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

The following quartiles have been printed as they fall within Thames' water area:

SP5521NE
SP5521SE

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

The following quartiles have not been printed as they contain no assets:

SP5521NW
SP5421NE

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

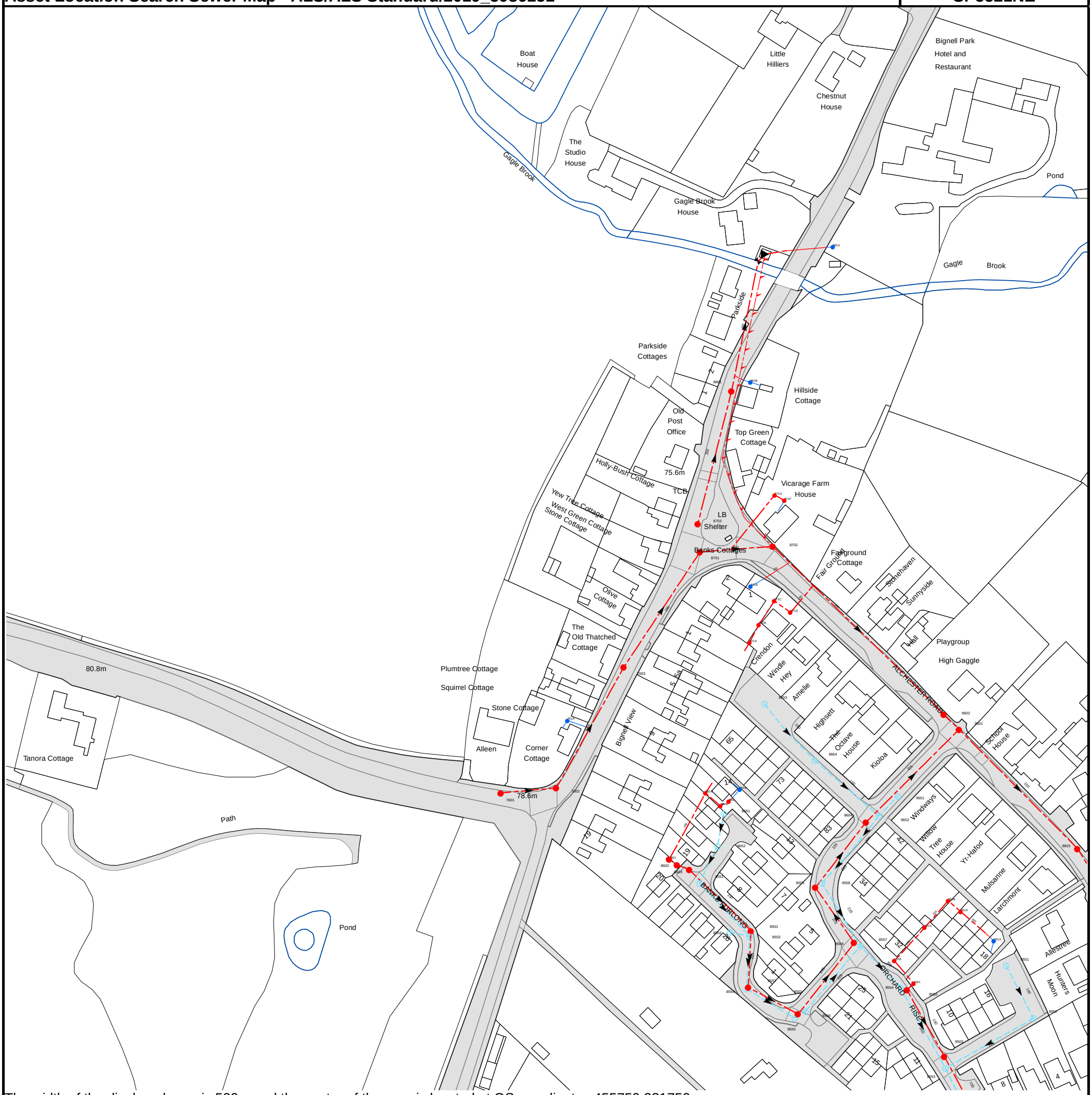
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3986151

SP5521NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 455750,221750

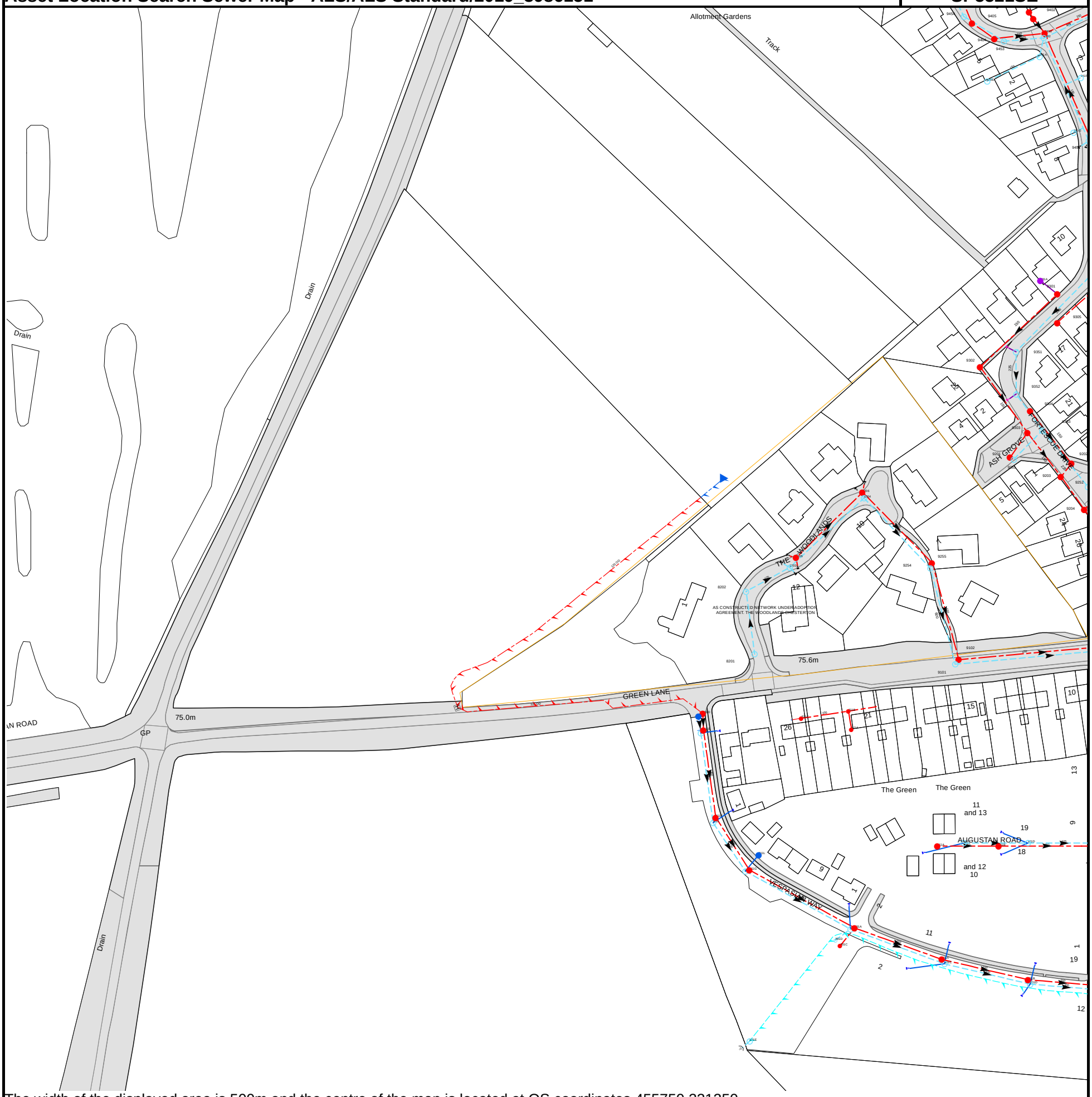
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9652	77.34	75.7
8651	77.99	76.64
861M	n/a	n/a
861L	n/a	n/a
9651	77.25	75.8
861N	n/a	n/a
7601	78.74	77.54
861K	n/a	n/a
7602	78.11	75.86
8654	77.49	76.06
9601	76.41	74.46
9602	76.44	74.56
8653	77.58	76.29
7603	77.63	75.56
871A	n/a	n/a
871B	n/a	n/a
871D	n/a	n/a
871C	n/a	n/a
871E	n/a	n/a
8701	76.71	75.26
8702	76.46	74.91
8703	76.56	75.09
871F	n/a	n/a
871G	n/a	n/a
8801	76.69	75.32
881B	n/a	n/a
881A	n/a	n/a
9552	76.3	75.23
9551	76.43	75.44
951A	n/a	n/a
9603	75.96	74.14
9553	76.54	75.13
9503	76.52	74.79
8555	77.65	75.69
8503	77.64	75.79
8556	77.63	75.64
9502	76.9	74.96
8554	77.86	75.92
8502	77.88	75.95
9554	76.93	75.26
9501	77.08	75.18
951E	n/a	n/a
8557	77.27	75.35
8504	77.24	75.44
8553	77.75	76.1
8552	77.97	76.35
8501	77.74	76.14
951C	n/a	n/a
951D	n/a	n/a
951B	n/a	n/a
8505	77.53	75.18
8558	77.49	75.57
8551	77.96	76.14
8603	77.93	76.49
8602	78.04	76.61
8601	78.06	76.65
8652	77.94	76.45
8604	77.29	74.92

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3986151

SP5521SE



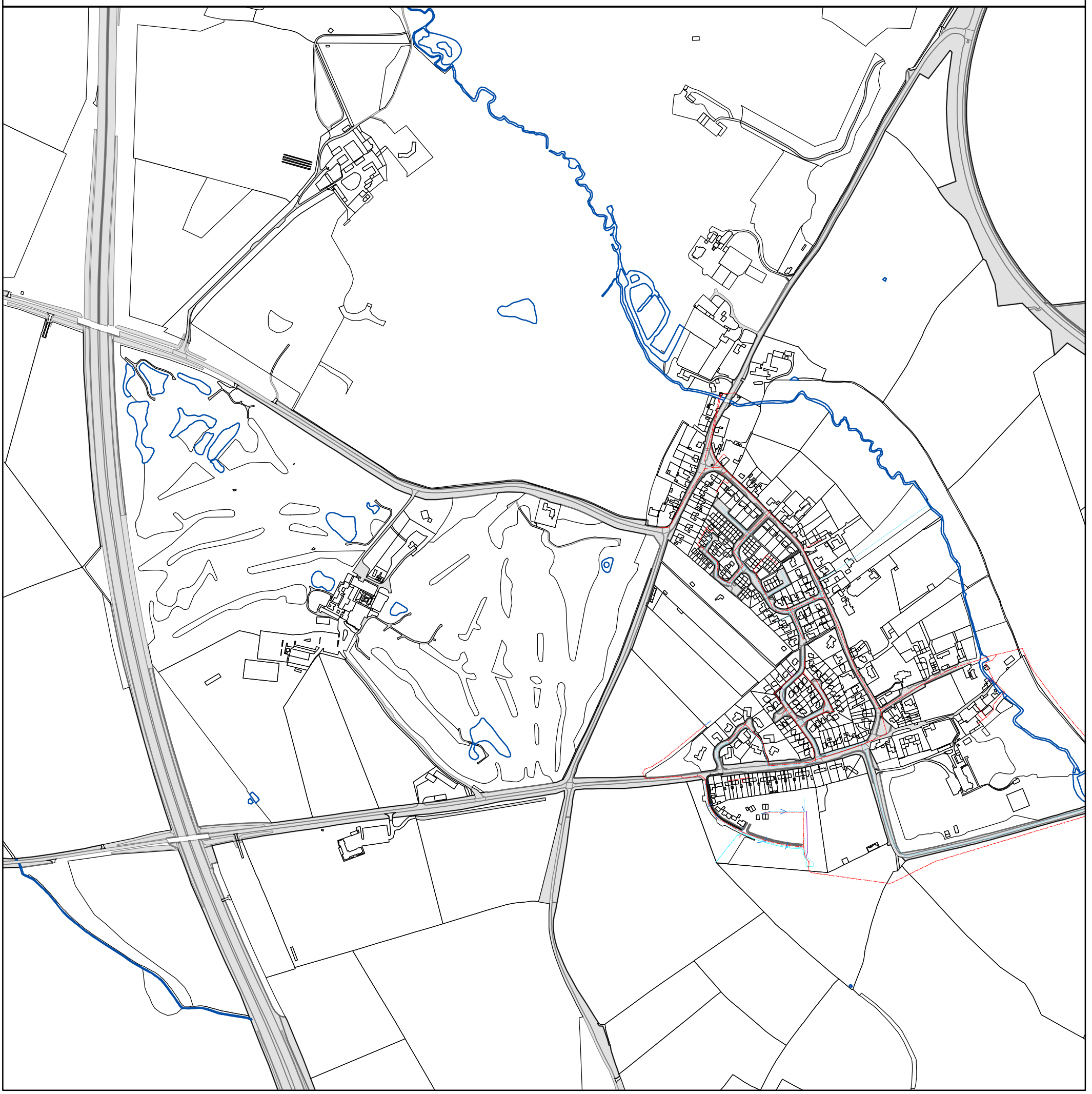
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 455750,221250

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9302	74.68	72.96
941E	n/a	n/a
9404	76.12	74.35
9453	76.1	74.54
9201	74.52	72.94
9251	74.49	73.18
9351	74.54	73.2
9352	74.52	73.09
9303	74.43	72.76
9304	74.5	73.05
941A	n/a	n/a
931A	n/a	n/a
9353	74.41	72.93
9305	74.69	73.52
9301	74.78	73.47
9202	74.28	72.7
941G	n/a	n/a
941F	n/a	n/a
9451	75.35	74.2
0451	75.15	73.59
9452	75.85	73.67
9403	75.85	74.08
9405	76.27	74.55
9402	76.05	74.78
9454	76.33	75
9401	76.13	75.33
9101	n/a	n/a
9102	n/a	n/a
8201	n/a	n/a
8202	75.24	73.81
9254	74.78	73
8203	75.07	73.7
9255	74.78	73.11
8205	75.09	74.1
9204	74.35	72.47
8204	74.78	73.2
8206	74.79	73.63
9252	74.27	72.77
9203	74.28	72.54
811C	n/a	n/a
811B	n/a	n/a
811A	n/a	n/a

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2019_3986151



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Printed By:	SAsirvat
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Map Centre:	455522,221600
Grid Reference:	SP5521NE

Comments:

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

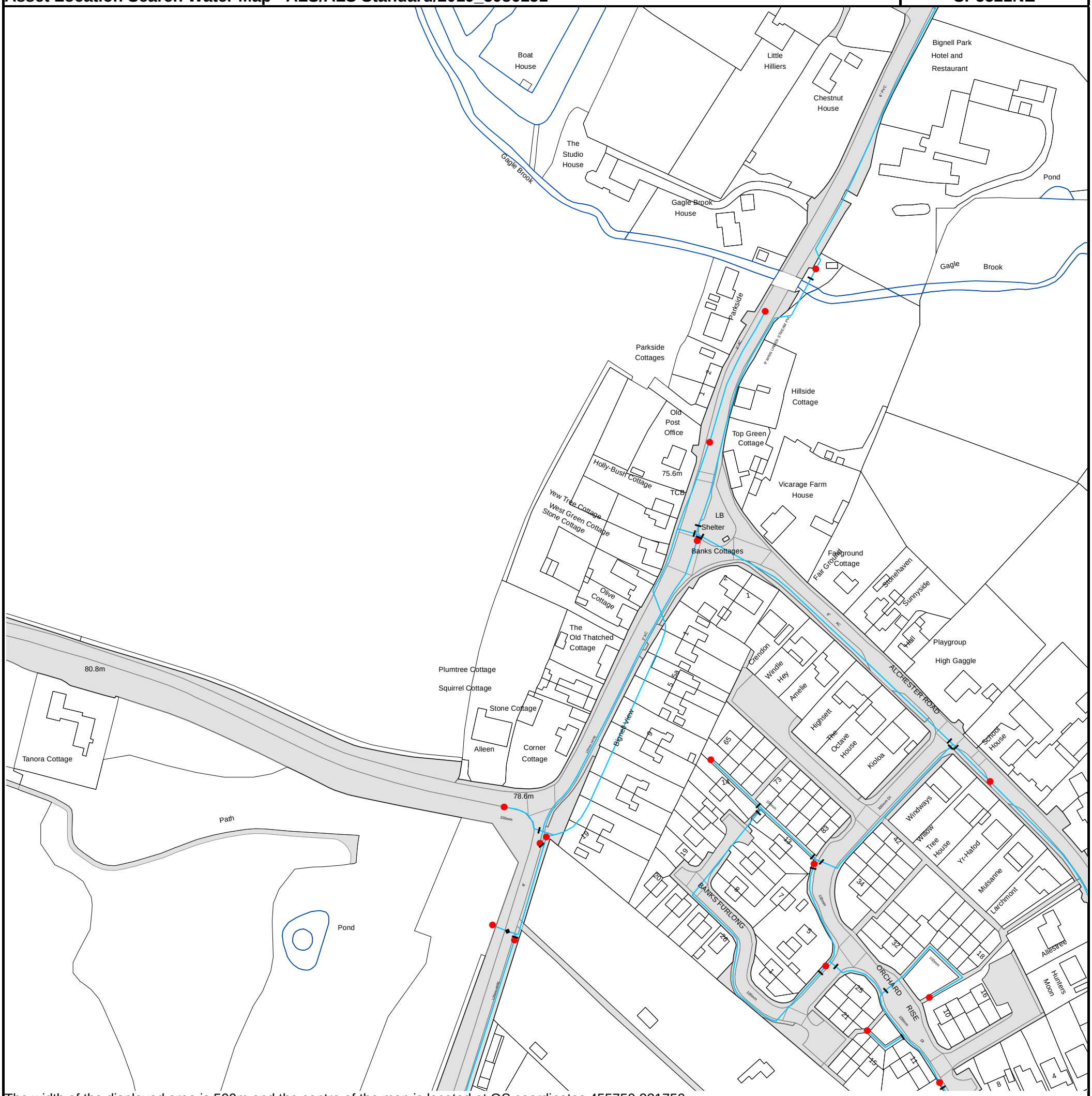
Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_3986151

SP5521NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 455750,221750

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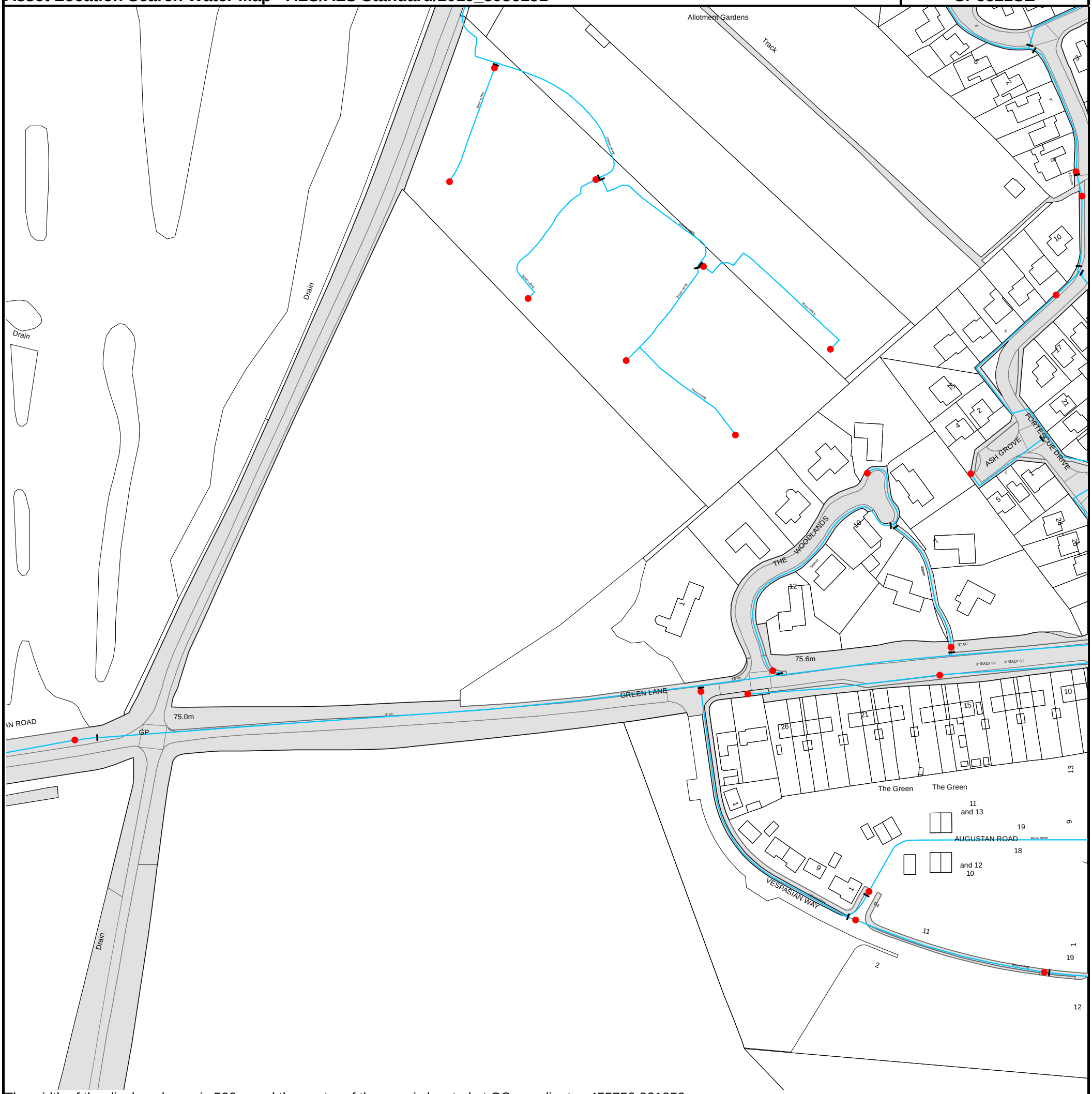
Asset Location Search Water Map - ALS/ALS Standard/2019_3986151

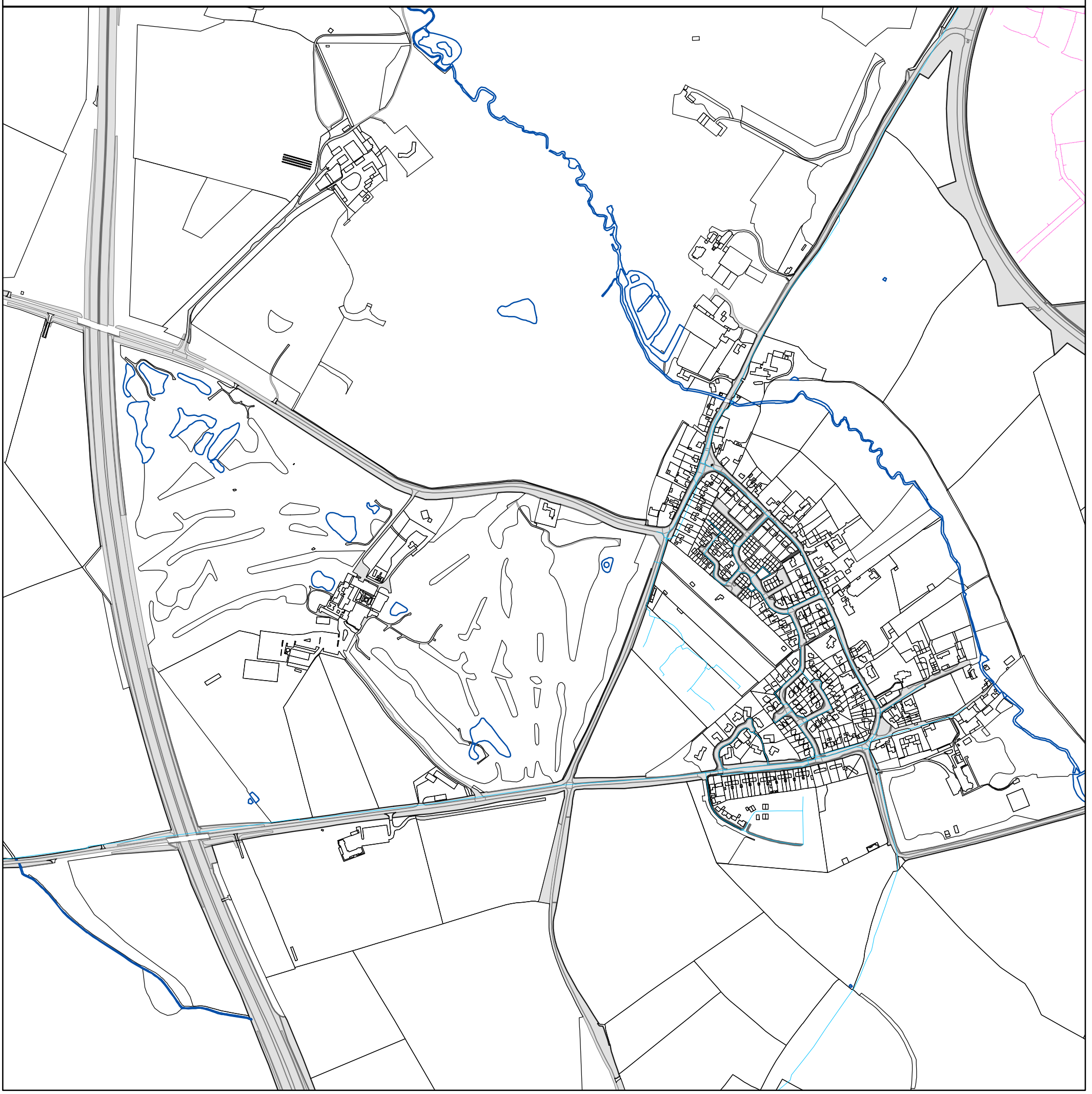
SP5521SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 455750,221250

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2019_3986151



0 45 90 180 270 360
Meters

Scale:	1:7158
Width:	2000m
Printed By:	SAsirvat
Print Date:	15/04/2019
Map Centre:	455522,221600
Grid Reference:	SP5521NE

Comments:

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix D – Surface Water MicroDrainage Results

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)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.70
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

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
S1.000	51.850	0.346	149.9	0.182	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	18.713	0.125	150.0	0.262	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	37.389	0.249	150.0	0.139	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	27.734	0.185	150.0	0.183	4.00	0.0	0.600	o	450	Pipe/Conduit	
S2.001	16.489	0.110	150.0	0.021	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.003	29.486	0.197	150.0	0.029	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	85.930	0.158	543.9	0.172	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	10.784	0.025	431.4	0.102	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.006	40.931	0.084	487.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.007	40.728	0.327	124.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S3.000	18.510	0.093	199.0	0.091	4.00	0.0	0.600	o	300	Pipe/Conduit	
S3.001	25.698	0.128	200.8	0.371	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	90.845	0.214	424.5	0.000	0.00	0.0	0.600	o	525	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)
S1.000	50.00	4.67	81.800	0.182	0.0	0.0	0.0	1.28	90.6	24.7
S1.001	50.00	4.86	81.304	0.445	0.0	0.0	0.0	1.66	263.6	60.2
S1.002	50.00	5.24	81.179	0.584	0.0	0.0	0.0	1.66	263.6	79.0
S2.000	50.00	4.28	81.500	0.183	0.0	0.0	0.0	1.66	263.6	24.8
S2.001	50.00	4.44	81.315	0.204	0.0	0.0	0.0	1.66	263.6	27.7
S1.003	50.00	5.53	80.930	0.817	0.0	0.0	0.0	1.66	263.6	110.6
S1.004	50.00	7.19	80.733	0.989	0.0	0.0	0.0	0.86	137.5	133.9
S1.005	50.00	7.38	80.575	1.092	0.0	0.0	0.0	0.97	154.7	147.8
S1.006	50.00	8.05	80.475	1.092	0.0	0.0	0.0	1.01	218.2	147.8
S1.007	50.00	8.39	80.391	1.092	0.0	0.0	0.0	2.01	434.5	147.8
S3.000	50.00	4.28	81.400	0.091	0.0	0.0	0.0	1.11	78.5	12.4
S3.001	50.00	4.55	81.082	0.463	0.0	0.0	0.0	1.58	341.4	62.7
S1.008	50.00	9.79	80.064	1.554	0.0	0.0	0.0	1.08	234.0	210.5

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
S1.009	18.244	0.212	86.1	0.074	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	17.546	0.088	199.4	0.094	4.00	0.0	0.600	o	300	Pipe/Conduit	
S4.001	29.597	0.148	200.0	0.334	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.010	40.263	0.071	567.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.011	43.225	0.086	502.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.012	11.877	0.021	565.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.013	88.680	0.222	399.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S5.000	43.138	0.069	625.2	0.108	4.00	0.0	0.600	o	500	Pipe/Conduit	
S6.000	11.170	0.094	118.8	0.000	4.00	0.0	0.600	o	450	Pipe/Conduit	
S5.001	17.050	0.067	254.5	0.286	0.00	0.0	0.600	o	500	Pipe/Conduit	
S5.002	56.548	0.268	211.0	0.347	0.00	0.0	0.600	o	500	Pipe/Conduit	
S5.003	119.208	0.478	249.4	0.190	0.00	0.0	0.600	o	500	Pipe/Conduit	
S7.000	41.099	0.113	363.7	0.131	4.00	0.0	0.600	o	750	Pipe/Conduit	
S8.000	13.815	0.152	90.9	0.171	4.00	0.0	0.600	o	350	Pipe/Conduit	
S8.001	53.708	0.134	400.8	0.230	0.00	0.0	0.600	o	350	Pipe/Conduit	
S1.014	28.594	0.191	150.0	0.524	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.015	76.982	0.192	400.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S9.000	15.276	0.034	449.3	0.000	4.00	0.0	0.600	o	375	Pipe/Conduit	
S9.001	57.051	0.905	63.0	0.650	0.00	0.0	0.600	o	375	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)
S1.009	50.00	9.92	79.850	1.629	0.0	0.0	0.0	2.42	522.9	220.6
S4.000	50.00	4.26	81.400	0.094	0.0	0.0	0.0	1.11	78.4	12.8
S4.001	50.00	4.61	81.162	0.428	0.0	0.0	0.0	1.43	228.1	58.0
S1.010	50.00	10.58	79.563	2.057	0.0	0.0	0.0	1.02	287.1	278.5
S1.011	50.00	11.25	79.492	2.057	0.0	0.0	0.0	1.08	305.2	278.5
S1.012	50.00	11.44	79.406	2.057	0.0	0.0	0.0	1.02	287.5	278.5
S1.013	50.00	12.66	79.385	2.057	0.0	0.0	0.0	1.21	342.7	278.5
S5.000	50.00	4.83	80.771	0.108	0.0	0.0	0.0	0.86	169.1	14.7
S6.000	50.00	4.10	81.500	0.000	0.0	0.0	0.0	1.86	296.5	0.0
S5.001	50.00	5.04	80.702	0.395	0.0	0.0	0.0	1.36	266.5	53.4
S5.002	50.00	5.68	80.635	0.742	0.0	0.0	0.0	1.49	292.9	100.4
S5.003	50.00	7.12	80.317	0.932	0.0	0.0	0.0	1.37	269.2	126.2
S7.000	50.00	4.47	80.300	0.131	0.0	0.0	0.0	1.46	645.7	17.7
S8.000	50.00	4.13	80.600	0.171	0.0	0.0	0.0	1.82	175.1	23.2
S8.001	50.00	5.17	80.448	0.402	0.0	0.0	0.0	0.86	82.8	54.4
S1.014	50.00	12.87	79.013	4.045	0.0	0.0	0.0	2.28	1008.5	547.8
S1.015	50.00	13.79	78.822	4.045	0.0	0.0	0.0	1.39	615.4	547.8
S9.000	50.00	4.30	81.149	0.000	0.0	0.0	0.0	0.85	93.7	0.0
S9.001	50.00	4.72	81.115	0.650	0.0	0.0	0.0	2.29	252.4	88.0

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
S10.000	12.952	0.022	588.7	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S10.001	9.455	0.232	40.8	0.322	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	16.772	0.496	33.8	0.123	0.00	0.0	0.600	o	375	Pipe/Conduit	
S11.000	11.319	0.039	290.2	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S11.001	15.510	0.039	397.7	0.435	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.003	50.328	0.149	337.8	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S12.000	27.093	0.119	227.7	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S12.001	25.584	0.078	328.0	0.155	0.00	0.0	0.600	o	350	Pipe/Conduit	
S9.004	55.057	0.110	500.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S13.000	18.331	0.167	109.8	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S13.001	15.785	0.029	544.3	0.556	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.005	44.176	0.457	96.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S14.000	19.864	0.265	75.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S14.001	18.644	0.162	115.1	0.507	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.006	18.723	0.056	334.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S15.000	59.093	0.405	145.9	0.000	4.00	0.0	0.600	o	675	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)
S10.000	50.00	4.70	80.739	0.000	0.0	0.0	0.0	0.31	2.4	0.0
S10.001	50.00	4.77	80.592	0.322	0.0	0.0	0.0	2.06	81.7	43.7
S9.002	50.00	4.86	80.210	1.095	0.0	0.0	0.0	3.13	345.2	148.3
S11.000	50.00	4.42	80.067	0.000	0.0	0.0	0.0	0.45	3.5	0.0
S11.001	50.00	4.68	79.678	0.435	0.0	0.0	0.0	1.01	161.2	58.8
S9.003	50.00	5.55	79.564	1.530	0.0	0.0	0.0	1.21	262.6	207.1
S12.000	50.00	4.89	80.112	0.000	0.0	0.0	0.0	0.51	4.0	0.0
S12.001	50.00	5.34	79.743	0.155	0.0	0.0	0.0	0.95	91.6	20.9
S9.004	50.00	6.40	79.340	1.684	0.0	0.0	0.0	1.08	305.8	228.1
S13.000	50.00	4.42	80.239	0.000	0.0	0.0	0.0	0.73	5.8	0.0
S13.001	50.00	4.76	79.797	0.556	0.0	0.0	0.0	0.77	85.0	75.2
S9.005	50.00	6.70	79.230	2.240	0.0	0.0	0.0	2.48	700.4	303.3
S14.000	50.00	4.37	79.700	0.000	0.0	0.0	0.0	0.89	7.0	0.0
S14.001	50.00	4.58	79.235	0.507	0.0	0.0	0.0	1.46	103.5	68.7
S9.006	50.00	6.93	78.773	2.747	0.0	0.0	0.0	1.33	375.0	372.0
S15.000	50.00	4.45	79.000	0.000	0.0	0.0	0.0	2.17	775.7	0.0

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
S1.016	91.803	0.141	651.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.017	24.873	0.050	497.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.018	93.931	0.188	499.6	0.000	0.00	0.0	0.600	o	300	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)
S1.016	50.00	16.30	78.595	6.792	0.0	0.0	0.0	0.61	43.0«	919.8
S1.017	50.00	16.90	78.454	6.792	0.0	0.0	0.0	0.70	49.4«	919.8
S1.018	50.00	19.14	78.450	6.792	0.0	0.0	0.0	0.70	49.2«	919.8

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	82.700	0.900	Open Manhole	1200	S1.000	81.800	300				
S2	82.700	1.396	Open Manhole	1350	S1.001	81.304	450	S1.000	81.454	300	
S3	82.700	1.521	Open Manhole	1350	S1.002	81.179	450	S1.001	81.179	450	
S4	82.700	1.200	Open Manhole	1350	S2.000	81.500	450				
S5	82.700	1.385	Open Manhole	1350	S2.001	81.315	450	S2.000	81.315	450	
S6	82.700	1.770	Open Manhole	1350	S1.003	80.930	450	S1.002	80.930	450	
								S2.001	81.205	450	275
S7	83.000	2.267	Open Manhole	1350	S1.004	80.733	450	S1.003	80.733	450	
S8	83.000	2.425	Open Manhole	1350	S1.005	80.575	450	S1.004	80.575	450	
S9	82.700	2.225	Open Manhole	1500	S1.006	80.475	525	S1.005	80.550	450	
S10	82.700	2.309	Open Manhole	1500	S1.007	80.391	525	S1.006	80.391	525	
S11	82.600	1.200	Open Manhole	1200	S3.000	81.400	300				
S12	82.600	1.518	Open Manhole	1500	S3.001	81.082	525	S3.000	81.307	300	
S13	82.700	2.636	Open Manhole	1500	S1.008	80.064	525	S1.007	80.064	525	
								S3.001	80.954	525	890
S14	82.600	2.750	Open Manhole	1500	S1.009	79.850	525	S1.008	79.850	525	
S15	82.600	1.200	Open Manhole	1200	S4.000	81.400	300				
S16	82.600	1.438	Open Manhole	1350	S4.001	81.162	450	S4.000	81.312	300	
S17	82.250	2.687	Open Manhole	1500	S1.010	79.563	600	S1.009	79.638	525	
								S4.001	81.014	450	1301
S18	81.550	2.058	Open Manhole	1500	S1.011	79.492	600	S1.010	79.492	600	
S19	81.700	2.294	Open Manhole	1500	S1.012	79.406	600	S1.011	79.406	600	
S20	81.600	2.215	Open Manhole	1500	S1.013	79.385	600	S1.012	79.385	600	
S21	82.700	1.929	Open Manhole	1500	S5.000	80.771	500				
S22	82.700	1.200	Open Manhole	1350	S6.000	81.500	450				
S23	82.700	1.998	Open Manhole	1500	S5.001	80.702	500	S5.000	80.702	500	
								S6.000	81.406	450	654
S24	82.700	2.065	Open Manhole	1500	S5.002	80.635	500	S5.001	80.635	500	
S25	82.300	1.983	Open Manhole	1500	S5.003	80.317	500	S5.002	80.367	500	50
S26	82.700	2.400	Open Manhole	1800	S7.000	80.300	750				
S27	82.700	2.100	Open Manhole	1200	S8.000	80.600	350				
S28	82.700	2.252	Open Manhole	1200	S8.001	80.448	350	S8.000	80.448	350	
S29	82.100	3.087	Open Manhole	1800	S1.014	79.013	750	S1.013	79.163	600	
								S5.003	79.839	500	576
								S7.000	80.187	750	1174
								S8.001	80.314	350	901
S30	82.000	3.178	Open Manhole	1800	S1.015	78.822	750	S1.014	78.822	750	
S31	83.000	1.851	Open Manhole	1350	S9.000	81.149	375				
S31a	83.000	1.885	Open Manhole	1350	S9.001	81.115	375	S9.000	81.115	375	
S32	82.500	1.761	Open Manhole	1200	S10.000	80.739	100				
S32a	82.500	1.908	Open Manhole	1200	S10.001	80.592	225	S10.000	80.717	100	
S33	82.500	2.290	Open Manhole	1350	S9.002	80.210	375	S9.001	80.210	375	
								S10.001	80.360	225	
S34	81.500	1.433	Open Manhole	1200	S11.000	80.067	100				
S34a	81.500	1.822	Open Manhole	1350	S11.001	79.678	450	S11.000	80.028	100	
S35	81.500	1.936	Open Manhole	1500	S9.003	79.564	525	S9.002	79.714	375	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
								S11.001	79.639	450	
S36	81.500	1.388	Open Manhole	1200	S12.000	80.112	100				
S36a	81.500	1.757	Open Manhole	1200	S12.001	79.743	350	S12.000	79.993	100	
S37	81.500	2.160	Open Manhole	1500	S9.004	79.340	600	S9.003	79.415	525	
								S12.001	79.665	350	75
S38	81.500	1.261	Open Manhole	1200	S13.000	80.239	100				
S39	81.500	1.703	Open Manhole	1350	S13.001	79.797	375	S13.000	80.072	100	
S40	81.500	2.270	Open Manhole	1500	S9.005	79.230	600	S9.004	79.230	600	
								S13.001	79.768	375	313
S41	81.500	1.800	Open Manhole	1200	S14.000	79.700	100				
S41a	81.500	2.265	Open Manhole	1200	S14.001	79.235	300	S14.000	79.435	100	
S42	81.500	2.727	Open Manhole	1500	S9.006	78.773	600	S9.005	78.773	600	
								S14.001	79.073	300	
S43	81.500	2.500	Open Manhole	1500	S15.000	79.000	675				
S44	81.500	2.905	Open Manhole	1800	S1.016	78.595	300	S1.015	78.630	750	485
								S9.006	78.717	600	422
								S15.000	78.595	675	
S45	80.789	2.335	Open Manhole	1200	S1.017	78.454	300	S1.016	78.454	300	
S46	80.984	2.580	Open Manhole	1200	S1.018	78.450	300	S1.017	78.404	300	
S	80.000	1.738	Open Manhole	300		OUTFALL		S1.018	78.262	300	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.018	S	80.000	78.262	78.550	300	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 Time/Area Diagrams 0
Number of Online Controls 10 Number of Storage Structures 11 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)	20.000	Storm Duration (mins)	30
Ratio R	0.413		

Online Controls for Storm

Orifice Manhole: S12, DS/PN: S3.001, Volume (m³): 3.9

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 81.082

Orifice Manhole: S16, DS/PN: S4.001, Volume (m³): 3.2

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 81.162

Orifice Manhole: S23, DS/PN: S5.001, Volume (m³): 13.3

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 80.702

Orifice Manhole: S31a, DS/PN: S9.001, Volume (m³): 4.2

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 81.115

Orifice Manhole: S32a, DS/PN: S10.001, Volume (m³): 2.3

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 80.717

Orifice Manhole: S34a, DS/PN: S11.001, Volume (m³): 2.7

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 79.928

Orifice Manhole: S36a, DS/PN: S12.001, Volume (m³): 2.2

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 79.992

Orifice Manhole: S39, DS/PN: S13.001, Volume (m³): 2.6

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 79.997

Orifice Manhole: S41a, DS/PN: S14.001, Volume (m³): 2.7

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 79.435

Hydro-Brake® Optimum Manhole: S44, DS/PN: S1.016, Volume (m³): 66.0

Unit Reference	MD-SHE-0215-3130-2800-3130
Design Head (m)	2.800
Design Flow (l/s)	31.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	78.595
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.800	31.3	Kick-Flo®	1.678	24.5
Flush-Flo™	0.801	31.3	Mean Flow over Head Range	-	27.3

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

Hydro-Brake® Optimum Manhole: S44, DS/PN: S1.016, Volume (m³): 66.0

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.800	31.3	2.000	26.6	4.000	37.1	7.000	48.6
0.200	21.0	1.000	31.0	2.200	27.9	4.500	39.3	7.500	50.3
0.300	26.8	1.200	30.2	2.400	29.0	5.000	41.3	8.000	51.9
0.400	28.8	1.400	28.7	2.600	30.2	5.500	43.3	8.500	53.4
0.500	30.1	1.600	26.1	3.000	32.3	6.000	45.1	9.000	54.9
0.600	30.8	1.800	25.3	3.500	34.8	6.500	46.9	9.500	56.4

Storage Structures for Storm

Tank or Pond Manhole: S2, DS/PN: S1.001

Invert Level (m) 81.304

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	1.000	100.0	1.001	0.0

Tank or Pond Manhole: S12, DS/PN: S3.001

Invert Level (m) 82.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	183.0	0.500	1184.0

Tank or Pond Manhole: S16, DS/PN: S4.001

Invert Level (m) 82.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	183.0	0.500	1184.0

Porous Car Park Manhole: S23, DS/PN: S5.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.0
Membrane Percolation (mm/hr)	1000	Length (m)	30.0
Max Percolation (l/s)	250.0	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.95	Evaporation (mm/day)	3
Invert Level (m)	82.400	Membrane Depth (mm)	0

Porous Car Park Manhole: S31a, DS/PN: S9.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	70.0
Membrane Percolation (mm/hr)	1000	Length (m)	70.0
Max Percolation (l/s)	1361.1	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	82.600	Membrane Depth (mm)	0

Porous Car Park Manhole: S32a, DS/PN: S10.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	54.0
Membrane Percolation (mm/hr)	1000	Length (m)	54.0
Max Percolation (l/s)	810.0	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	82.100	Membrane Depth (mm)	0

Porous Car Park Manhole: S34a, DS/PN: S11.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	50.0
Membrane Percolation (mm/hr)	1000	Length (m)	40.0
Max Percolation (l/s)	555.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.100	Membrane Depth (mm)	0

Porous Car Park Manhole: S36a, DS/PN: S12.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.0
Membrane Percolation (mm/hr)	1000	Length (m)	21.0
Max Percolation (l/s)	175.0	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.100	Membrane Depth (mm)	0

Porous Car Park Manhole: S39, DS/PN: S13.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	65.0
Membrane Percolation (mm/hr)	1000	Length (m)	64.0
Max Percolation (l/s)	1155.6	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.100	Membrane Depth (mm)	0

Porous Car Park Manhole: S41a, DS/PN: S14.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	55.0
Membrane Percolation (mm/hr)	1000	Length (m)	55.0
Max Percolation (l/s)	840.3	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.95	Evaporation (mm/day)	3
Invert Level (m)	81.100	Membrane Depth (mm)	0

Tank or Pond Manhole: S44, DS/PN: S1.016

Invert Level (m) 79.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2000.0	1.000	2000.0	1.001	0.0

2 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 10 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 455172 221569 Cv (Summer) 0.750
FEH Rainfall Version 2013 Data Type Point 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, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	2	+20%	100/15 Summer				81.939	-0.161	0.000
S1.001	S2	15 Winter	2	+20%	30/15 Summer				81.470	-0.284	0.000
S1.002	S3	15 Winter	2	+20%	30/15 Summer				81.357	-0.272	0.000
S2.000	S4	15 Winter	2	+20%	100/15 Summer				81.624	-0.326	0.000
S2.001	S5	15 Winter	2	+20%	30/15 Winter				81.458	-0.307	0.000
S1.003	S6	15 Winter	2	+20%	30/15 Summer				81.197	-0.183	0.000
S1.004	S7	15 Winter	2	+20%	30/15 Summer				81.142	-0.042	0.000
S1.005	S8	30 Winter	2	+20%	2/30 Winter				81.026	0.000	0.000
S1.006	S9	15 Winter	2	+20%	30/15 Winter				80.794	-0.207	0.000
S1.007	S10	15 Winter	2	+20%	100/15 Winter				80.591	-0.326	0.000
S3.000	S11	240 Winter	2	+20%	2/15 Summer				82.293	0.593	0.000
S3.001	S12	240 Winter	2	+20%	2/15 Summer				82.292	0.685	0.000
S1.008	S13	15 Winter	2	+20%	100/15 Summer				80.341	-0.248	0.000
S1.009	S14	15 Winter	2	+20%	100/15 Winter				80.054	-0.321	0.000
S4.000	S15	240 Winter	2	+20%	2/15 Summer				82.281	0.581	0.000
S4.001	S16	240 Winter	2	+20%	2/15 Summer				82.281	0.669	0.000
S1.010	S17	30 Winter	2	+20%	100/15 Summer				79.915	-0.248	0.000
S1.011	S18	30 Winter	2	+20%	100/15 Summer				79.856	-0.236	0.000
S1.012	S19	30 Winter	2	+20%	100/15 Summer				79.809	-0.197	0.000
S1.013	S20	30 Winter	2	+20%	100/15 Summer				79.627	-0.358	0.000
S5.000	S21	240 Winter	2	+20%	2/15 Summer				82.474	1.203	0.000
S6.000	S22	240 Winter	2	+20%	2/15 Summer				82.474	0.524	0.000
S5.001	S23	240 Winter	2	+20%	2/15 Summer				82.474	1.272	0.000
S5.002	S24	15 Winter	2	+20%	100/15 Summer				80.794	-0.341	0.000
S5.003	S25	15 Winter	2	+20%	100/15 Summer				80.519	-0.298	0.000
S7.000	S26	15 Winter	2	+20%	100/360 Winter				80.408	-0.642	0.000
S8.000	S27	15 Winter	2	+20%	30/15 Summer				80.743	-0.207	0.000
S8.001	S28	15 Winter	2	+20%	30/15 Summer				80.717	-0.081	0.000
S1.014	S29	480 Winter	2	+20%	30/240 Winter				79.442	-0.321	0.000
S1.015	S30	480 Winter	2	+20%	30/15 Winter				79.429	-0.144	0.000
S9.000	S31	360 Winter	2	+20%	2/15 Summer				82.739	1.215	0.000
S9.001	S31a	360 Winter	2	+20%	2/15 Summer				82.739	1.249	0.000
S10.000	S32	240 Winter	2	+20%	2/15 Summer				82.189	1.350	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.44		37.6	OK	
S1.001	S2	0.29		58.3	OK	
S1.002	S3	0.33		75.7	OK	
S2.000	S4	0.17		37.9	OK	
S2.001	S5	0.22		41.0	OK	
S1.003	S6	0.47		105.4	OK	
S1.004	S7	0.87		112.6	OK	
S1.005	S8	1.24		114.0	SURCHARGED	
S1.006	S9	0.62		117.8	OK	
S1.007	S10	0.31		116.2	OK	
S3.000	S11	0.06		3.8	SURCHARGED	
S3.001	S12	0.01		3.6	SURCHARGED	
S1.008	S13	0.51		112.3	OK	
S1.009	S14	0.32		113.7	OK	
S4.000	S15	0.06		4.0	SURCHARGED	
S4.001	S16	0.02		3.5	SURCHARGED	
S1.010	S17	0.47		114.7	OK	
S1.011	S18	0.42		110.0	OK	
S1.012	S19	0.79		109.1	OK	
S1.013	S20	0.34		107.6	OK	
S5.000	S21	0.03		4.6	FLOOD RISK	
S6.000	S22	0.00		0.6	FLOOD RISK	
S5.001	S23	0.02		4.4	FLOOD RISK	
S5.002	S24	0.22		57.7	OK	
S5.003	S25	0.34		87.5	OK	
S7.000	S26	0.05		27.1	OK	
S8.000	S27	0.26		35.2	OK	
S8.001	S28	0.93		72.2	OK	
S1.014	S29	0.12		81.2	OK	
S1.015	S30	0.15		80.3	OK	
S9.000	S31	0.01		0.5	FLOOD RISK	
S9.001	S31a	0.02		4.2	FLOOD RISK	
S10.000	S32	0.29		0.7	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)
S10.001	S32a	240 Winter	2	+20%	2/15 Summer				82.189	1.372	0.000
S9.002	S33	30 Winter	2	+20%	100/240 Winter				80.283	-0.302	0.000
S11.000	S34	120 Winter	2	+20%	2/15 Summer				81.150	0.983	0.000
S11.001	S34a	120 Winter	2	+20%	2/15 Summer				81.150	1.022	0.000
S9.003	S35	30 Winter	2	+20%	100/240 Winter				79.689	-0.400	0.000
S12.000	S36	120 Winter	2	+20%	2/15 Summer				81.167	0.955	0.000
S12.001	S36a	120 Winter	2	+20%	2/15 Summer				81.167	1.074	0.000
S9.004	S37	30 Winter	2	+20%	100/240 Summer				79.480	-0.460	0.000
S13.000	S38	360 Winter	2	+20%	2/15 Summer				81.255	0.916	0.000
S13.001	S39	360 Winter	2	+20%	2/15 Summer				81.255	1.083	0.000
S9.005	S40	480 Winter	2	+20%	30/960 Winter				79.388	-0.442	0.000
S14.000	S41	240 Winter	2	+20%	2/15 Summer				81.185	1.385	0.000
S14.001	S41a	240 Winter	2	+20%	2/15 Summer				81.185	1.650	0.000
S9.006	S42	480 Winter	2	+20%	2/240 Winter				79.385	0.012	0.000
S15.000	S43	480 Winter	2	+20%	30/240 Winter				79.382	-0.293	0.000
S1.016	S44	480 Winter	2	+20%	2/15 Summer				79.382	0.487	0.000
S1.017	S45	480 Winter	2	+20%					78.668	-0.086	0.000
S1.018	S46	480 Winter	2	+20%					78.626	-0.124	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32a	0.06		4.0	SURCHARGED	
S9.002	S33	0.08		22.6	OK	
S11.000	S34	0.35		1.2	SURCHARGED	
S11.001	S34a	0.07		8.2	SURCHARGED	
S9.003	S35	0.13		30.1	OK	
S12.000	S36	0.22		0.9	SURCHARGED	
S12.001	S36a	0.04		3.6	SURCHARGED	
S9.004	S37	0.12		33.1	OK	
S13.000	S38	0.07		0.4	FLOOD RISK	
S13.001	S39	0.07		3.7	FLOOD RISK	
S9.005	S40	0.04		26.4	OK	
S14.000	S41	0.09		0.6	SURCHARGED	
S14.001	S41a	0.05		4.4	SURCHARGED	
S9.006	S42	0.11		29.9	SURCHARGED	
S15.000	S43	0.00		0.0	OK	
S1.016	S44	0.74		30.9	SURCHARGED	
S1.017	S45	0.70		30.9	OK	
S1.018	S46	0.65		30.9	OK	

30 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 10 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 455172 221569 Cv (Summer) 0.750
FEH Rainfall Version 2013 Data Type Point 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, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	30	+20%	100/15 Summer				82.074	-0.026	0.000
S1.001	S2	15 Winter	30	+20%	30/15 Summer				81.883	0.129	0.000
S1.002	S3	15 Winter	30	+20%	30/15 Summer				81.807	0.177	0.000
S2.000	S4	15 Winter	30	+20%	100/15 Summer				81.848	-0.102	0.000
S2.001	S5	15 Winter	30	+20%	30/15 Winter				81.776	0.011	0.000
S1.003	S6	15 Summer	30	+20%	30/15 Summer				81.673	0.293	0.000
S1.004	S7	15 Summer	30	+20%	30/15 Summer				81.533	0.350	0.000
S1.005	S8	15 Winter	30	+20%	2/30 Winter				81.163	0.137	0.000
S1.006	S9	15 Winter	30	+20%	30/15 Winter				81.004	0.004	0.000
S1.007	S10	15 Winter	30	+20%	100/15 Winter				80.673	-0.243	0.000
S3.000	S11	240 Winter	30	+20%	2/15 Summer				82.457	0.757	0.000
S3.001	S12	240 Winter	30	+20%	2/15 Summer				82.457	0.850	0.000
S1.008	S13	15 Winter	30	+20%	100/15 Summer				80.479	-0.110	0.000
S1.009	S14	30 Winter	30	+20%	100/15 Winter				80.236	-0.139	0.000
S4.000	S15	240 Winter	30	+20%	2/15 Summer				82.440	0.740	0.000
S4.001	S16	240 Winter	30	+20%	2/15 Summer				82.440	0.828	0.000
S1.010	S17	60 Summer	30	+20%	100/15 Summer				80.163	0.000	0.000
S1.011	S18	30 Summer	30	+20%	100/15 Summer				80.092	0.000	0.000
S1.012	S19	30 Winter	30	+20%	100/15 Summer				80.006	0.000	0.000
S1.013	S20	960 Winter	30	+20%	100/15 Summer				79.851	-0.134	0.000
S5.000	S21	240 Winter	30	+20%	2/15 Summer				82.573	1.302	0.000
S6.000	S22	240 Winter	30	+20%	2/15 Summer				82.573	0.623	0.000
S5.001	S23	240 Winter	30	+20%	2/15 Summer				82.573	1.371	0.000
S5.002	S24	15 Winter	30	+20%	100/15 Summer				80.927	-0.208	0.000
S5.003	S25	15 Winter	30	+20%	100/15 Summer				80.713	-0.104	0.000
S7.000	S26	15 Winter	30	+20%	100/360 Winter				80.471	-0.579	0.000
S8.000	S27	15 Winter	30	+20%	30/15 Summer				81.565	0.615	0.000
S8.001	S28	15 Winter	30	+20%	30/15 Summer				81.435	0.637	0.000
S1.014	S29	960 Winter	30	+20%	30/240 Winter				79.836	0.073	0.000
S1.015	S30	960 Winter	30	+20%	30/15 Winter				79.834	0.261	0.000
S9.000	S31	360 Winter	30	+20%	2/15 Summer				82.845	1.321	0.000
S9.001	S31a	360 Winter	30	+20%	2/15 Summer				82.845	1.355	0.000
S10.000	S32	240 Winter	30	+20%	2/15 Summer				82.272	1.433	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.97		83.3	OK	
S1.001	S2	0.48		96.0	SURCHARGED	
S1.002	S3	0.46		106.0	SURCHARGED	
S2.000	S4	0.37		82.4	OK	
S2.001	S5	0.42		78.9	SURCHARGED	
S1.003	S6	0.68		153.8	SURCHARGED	
S1.004	S7	1.38		179.5	SURCHARGED	
S1.005	S8	2.39		219.2	SURCHARGED	
S1.006	S9	1.13		214.3	SURCHARGED	
S1.007	S10	0.56		212.5	OK	
S3.000	S11	0.11		7.6	FLOOD RISK	
S3.001	S12	0.01		3.9	FLOOD RISK	
S1.008	S13	0.94		206.4	OK	
S1.009	S14	0.64		226.9	OK	
S4.000	S15	0.12		7.9	FLOOD RISK	
S4.001	S16	0.02		3.7	FLOOD RISK	
S1.010	S17	0.83		202.5	OK	
S1.011	S18	0.75		196.3	OK	
S1.012	S19	1.57		218.2	OK	
S1.013	S20	0.12		38.7	OK	
S5.000	S21	0.06		9.2	FLOOD RISK	
S6.000	S22	0.00		0.0	FLOOD RISK	
S5.001	S23	0.02		4.5	FLOOD RISK	
S5.002	S24	0.62		164.2	OK	
S5.003	S25	0.97		250.0	OK	
S7.000	S26	0.12		62.8	OK	
S8.000	S27	0.58		77.5	SURCHARGED	
S8.001	S28	2.37		183.1	SURCHARGED	
S1.014	S29	0.12		82.4	SURCHARGED	
S1.015	S30	0.15		81.3	SURCHARGED	
S9.000	S31	0.00		0.0	FLOOD RISK	
S9.001	S31a	0.02		4.4	FLOOD RISK	
S10.000	S32	0.00		0.0	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)
S10.001	S32a	240 Winter	30	+20%	2/15 Summer				82.272	1.455	0.000
S9.002	S33	15 Winter	30	+20%	100/240 Winter				80.335	-0.250	0.000
S11.000	S34	120 Winter	30	+20%	2/15 Summer				81.284	1.117	0.000
S11.001	S34a	120 Winter	30	+20%	2/15 Summer				81.284	1.156	0.000
S9.003	S35	480 Winter	30	+20%	100/240 Winter				79.926	-0.163	0.000
S12.000	S36	120 Winter	30	+20%	2/15 Summer				81.308	1.096	0.000
S12.001	S36a	120 Winter	30	+20%	2/15 Summer				81.308	1.215	0.000
S9.004	S37	480 Winter	30	+20%	100/240 Summer				79.903	-0.037	0.000
S13.000	S38	360 Winter	30	+20%	2/15 Summer				81.365	1.026	0.000
S13.001	S39	360 Winter	30	+20%	2/15 Summer				81.365	1.193	0.000
S9.005	S40	960 Winter	30	+20%	30/960 Winter				79.837	0.007	0.000
S14.000	S41	240 Winter	30	+20%	2/15 Summer				81.247	1.447	0.000
S14.001	S41a	240 Winter	30	+20%	2/15 Summer				81.247	1.712	0.000
S9.006	S42	960 Winter	30	+20%	2/240 Winter				79.834	0.461	0.000
S15.000	S43	960 Winter	30	+20%	30/240 Winter				79.831	0.156	0.000
S1.016	S44	960 Winter	30	+20%	2/15 Summer				79.831	0.936	0.000
S1.017	S45	480 Summer	30	+20%					78.670	-0.084	0.000
S1.018	S46	480 Summer	30	+20%					78.627	-0.123	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32a	0.06		4.1	FLOOD RISK	
S9.002	S33	0.24		67.0	OK	
S11.000	S34	0.00		0.0	FLOOD RISK	
S11.001	S34a	0.08		8.7	FLOOD RISK	
S9.003	S35	0.10		22.6	OK	
S12.000	S36	0.01		0.0	FLOOD RISK	
S12.001	S36a	0.05		3.8	FLOOD RISK	
S9.004	S37	0.10		26.2	OK	
S13.000	S38	0.00		0.0	FLOOD RISK	
S13.001	S39	0.07		3.9	FLOOD RISK	
S9.005	S40	0.04		27.0	SURCHARGED	
S14.000	S41	0.00		0.0	FLOOD RISK	
S14.001	S41a	0.05		4.5	FLOOD RISK	
S9.006	S42	0.11		31.4	SURCHARGED	
S15.000	S43	0.00		0.0	SURCHARGED	
S1.016	S44	0.75		31.2	SURCHARGED	
S1.017	S45	0.71		31.2	OK	
S1.018	S46	0.66		31.2	OK	

100 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 10 Number of Storage Structures 11 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 455172 221569 Cv (Summer) 0.750
FEH Rainfall Version 2013 Data Type Point 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, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	100	+40%	100/15 Summer				82.683	0.583	0.000
S1.001	S2	30 Winter	100	+40%	30/15 Summer				82.480	0.726	0.000
S1.002	S3	15 Winter	100	+40%	30/15 Summer				82.376	0.747	0.000
S2.000	S4	30 Winter	100	+40%	100/15 Summer				82.425	0.475	0.000
S2.001	S5	30 Winter	100	+40%	30/15 Winter				82.299	0.534	0.000
S1.003	S6	15 Winter	100	+40%	30/15 Summer				82.237	0.857	0.000
S1.004	S7	30 Winter	100	+40%	30/15 Summer				82.053	0.869	0.000
S1.005	S8	960 Winter	100	+40%	2/30 Winter				81.525	0.499	0.000
S1.006	S9	960 Winter	100	+40%	30/15 Winter				81.523	0.522	0.000
S1.007	S10	960 Winter	100	+40%	100/15 Winter				81.520	0.604	0.000
S3.000	S11	360 Winter	100	+40%	2/15 Summer				82.571	0.871	0.000
S3.001	S12	360 Winter	100	+40%	2/15 Summer				82.570	0.963	0.000
S1.008	S13	960 Winter	100	+40%	100/15 Summer				81.518	0.929	0.000
S1.009	S14	960 Winter	100	+40%	100/15 Winter				81.513	1.138	0.000
S4.000	S15	360 Winter	100	+40%	2/15 Summer				82.550	0.850	0.000
S4.001	S16	360 Winter	100	+40%	2/15 Summer				82.549	0.937	0.000
S1.010	S17	960 Winter	100	+40%	100/15 Summer				81.510	1.347	0.000
S1.011	S18	960 Winter	100	+40%	100/15 Summer				81.507	1.415	0.000
S1.012	S19	960 Winter	100	+40%	100/15 Summer				81.503	1.497	0.000
S1.013	S20	960 Winter	100	+40%	100/15 Summer				81.501	1.516	0.000
S5.000	S21	240 Winter	100	+40%	2/15 Summer				82.677	1.406	0.000
S6.000	S22	240 Winter	100	+40%	2/15 Summer				82.677	0.727	0.000
S5.001	S23	240 Winter	100	+40%	2/15 Summer				82.677	1.475	0.000
S5.002	S24	960 Winter	100	+40%	100/15 Summer				81.503	0.368	0.000
S5.003	S25	960 Winter	100	+40%	100/15 Summer				81.501	0.684	0.000
S7.000	S26	960 Winter	100	+40%	100/360 Winter				81.497	0.447	0.000
S8.000	S27	15 Winter	100	+40%	30/15 Summer				82.428	1.478	0.000
S8.001	S28	15 Winter	100	+40%	30/15 Summer				82.302	1.504	0.000
S1.014	S29	960 Winter	100	+40%	30/240 Winter				81.497	1.734	0.000
S1.015	S30	960 Winter	100	+40%	30/15 Winter				81.493	1.921	0.000
S9.000	S31	480 Winter	100	+40%	2/15 Summer				82.952	1.428	0.000
S9.001	S31a	480 Winter	100	+40%	2/15 Summer				82.952	1.462	0.000
S10.000	S32	240 Winter	100	+40%	2/15 Summer				82.352	1.513	0.000

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

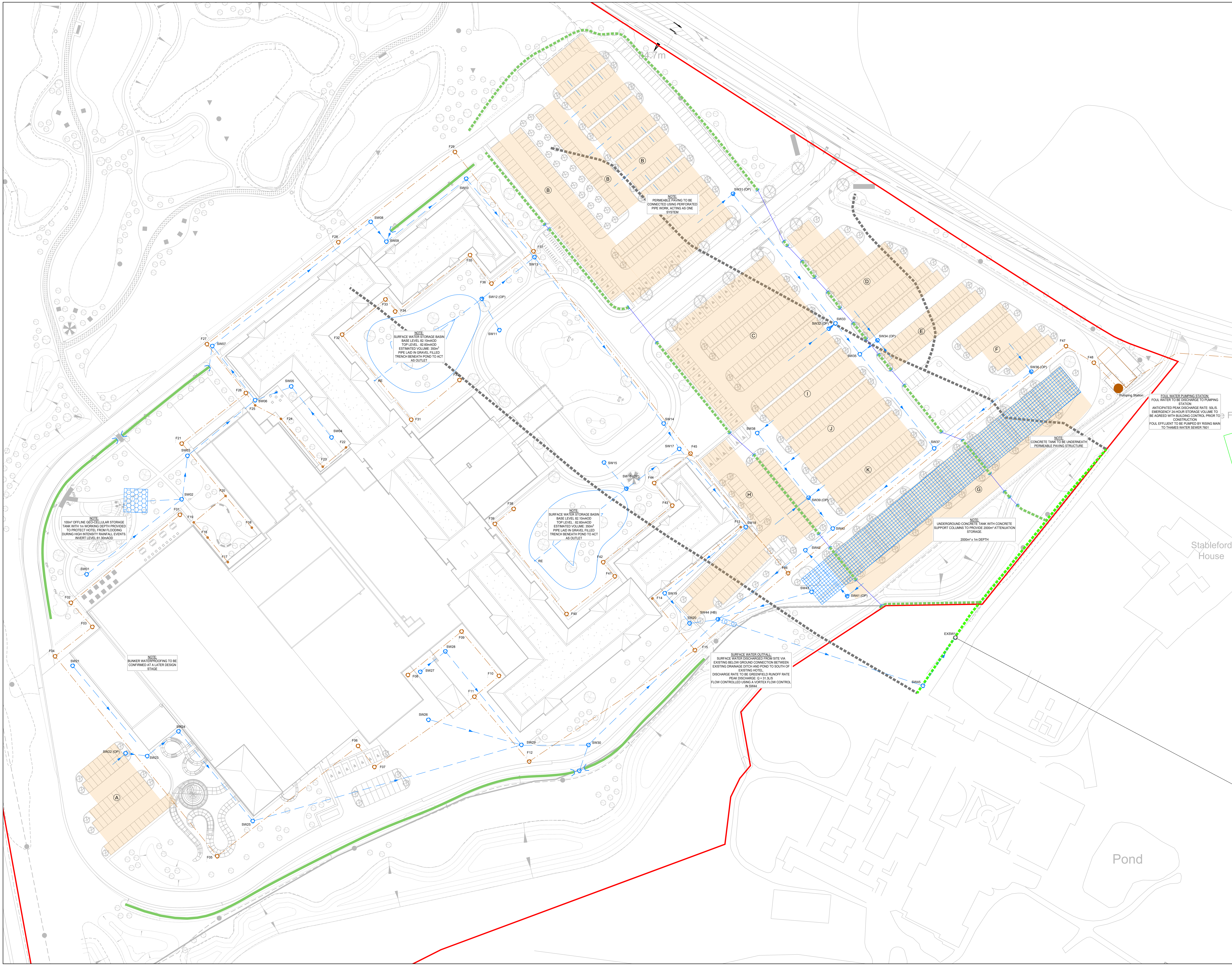
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.27		109.1	FLOOD RISK	
S1.001	S2	0.68		134.8	FLOOD RISK	
S1.002	S3	0.74		171.1	SURCHARGED	
S2.000	S4	0.38		85.1	FLOOD RISK	
S2.001	S5	0.50		93.7	SURCHARGED	
S1.003	S6	1.03		231.8	SURCHARGED	
S1.004	S7	1.98		256.5	SURCHARGED	
S1.005	S8	0.48		43.7	SURCHARGED	
S1.006	S9	0.23		43.7	SURCHARGED	
S1.007	S10	0.12		43.7	SURCHARGED	
S3.000	S11	0.12		8.2	FLOOD RISK	
S3.001	S12	0.01		4.0	FLOOD RISK	
S1.008	S13	0.22		47.5	SURCHARGED	
S1.009	S14	0.14		50.4	SURCHARGED	
S4.000	S15	0.13		8.5	FLOOD RISK	
S4.001	S16	0.02		3.9	FLOOD RISK	
S1.010	S17	0.22		53.7	SURCHARGED	
S1.011	S18	0.20		53.8	FLOOD RISK	
S1.012	S19	0.39		53.9	FLOOD RISK	
S1.013	S20	0.17		53.6	FLOOD RISK	
S5.000	S21	0.09		13.6	FLOOD RISK	
S6.000	S22	0.00		0.0	FLOOD RISK	
S5.001	S23	0.02		4.7	FLOOD RISK	
S5.002	S24	0.07		17.9	SURCHARGED	
S5.003	S25	0.10		25.5	SURCHARGED	
S7.000	S26	0.01		5.2	SURCHARGED	
S8.000	S27	0.85		113.2	FLOOD RISK	
S8.001	S28	3.43		265.4	SURCHARGED	
S1.014	S29	0.18		121.0	SURCHARGED	
S1.015	S30	0.22		120.9	SURCHARGED	
S9.000	S31	0.00		0.0	FLOOD RISK	
S9.001	S31a	0.02		4.5	FLOOD RISK	
S10.000	S32	0.00		0.0	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S10.001	S32a	240 Winter	100	+40%	2/15 Summer				82.352	1.535	0.000
S9.002	S33	960 Winter	100	+40%	100/240 Winter				81.497	0.912	0.000
S11.000	S34	120 Winter	100	+40%	2/15 Summer				81.422	1.255	0.000
S11.001	S34a	120 Winter	100	+40%	2/15 Summer				81.422	1.294	0.000
S9.003	S35	960 Winter	100	+40%	100/240 Winter				81.493	1.404	0.000
S12.000	S36	120 Winter	100	+40%	2/15 Summer				81.457	1.245	0.000
S12.001	S36a	120 Winter	100	+40%	2/15 Summer				81.457	1.364	0.000
S9.004	S37	960 Winter	100	+40%	100/240 Summer				81.491	1.551	0.000
S13.000	S38	960 Winter	100	+40%	2/15 Summer				81.487	1.148	0.000
S13.001	S39	960 Winter	100	+40%	2/15 Summer				81.487	1.315	0.000
S9.005	S40	960 Winter	100	+40%	30/960 Winter				81.490	1.660	0.000
S14.000	S41	960 Winter	100	+40%	2/15 Summer				81.303	1.503	0.000
S14.001	S41a	960 Winter	100	+40%	2/15 Summer				81.303	1.768	0.000
S9.006	S42	960 Winter	100	+40%	2/240 Winter				81.489	2.116	0.000
S15.000	S43	960 Winter	100	+40%	30/240 Winter				81.488	1.813	0.000
S1.016	S44	960 Winter	100	+40%	2/15 Summer				81.488	2.593	0.000
S1.017	S45	960 Winter	100	+40%					78.670	-0.084	0.000
S1.018	S46	960 Winter	100	+40%					78.627	-0.123	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32a	0.06		4.2	FLOOD RISK	
S9.002	S33	0.05		13.3	SURCHARGED	
S11.000	S34	0.00		0.0	FLOOD RISK	
S11.001	S34a	0.08		8.8	FLOOD RISK	
S9.003	S35	0.09		21.6	FLOOD RISK	
S12.000	S36	0.01		0.0	FLOOD RISK	
S12.001	S36a	0.05		4.0	FLOOD RISK	
S9.004	S37	0.09		24.6	FLOOD RISK	
S13.000	S38	0.00		0.0	FLOOD RISK	
S13.001	S39	0.07		3.9	FLOOD RISK	
S9.005	S40	0.05		28.0	FLOOD RISK	
S14.000	S41	0.00		0.0	FLOOD RISK	
S14.001	S41a	0.05		4.4	FLOOD RISK	
S9.006	S42	0.12		32.2	FLOOD RISK	
S15.000	S43	0.00		0.2	FLOOD RISK	
S1.016	S44	0.75		31.3	FLOOD RISK	
S1.017	S45	0.71		31.3	OK	
S1.018	S46	0.66		31.3	OK	

Appendix E – Drainage General Arrangement



GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE FROM THIS DRAWING. ALL DETAILS AND DIMENSIONS AND LEVELS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
3. ALL LEVELS ARE IN METERS & DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
4. DESIGN BASED ON TOPOGRAPHICAL & CCTV SURVEY AVAILABLE AT THE TIME OF DESIGN. ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
5. ALL PIPEWORK TO BE VITRIFIED CLAY.
6. WHERE EXISTING DRAINAGE IS BEING USED, ALLOWANCES SHOULD BE MADE TO REMEDIATE THIS DRAINAGE IN LINE WITH AVAILABLE CCTV SURVEY INFORMATION.
7. WHERE THERE IS NO REQUIREMENT TO KEEP EXISTING DRAINAGE, ALLOWANCES SHOULD BE MADE TO ABANDON THIS IN LINE WITH CURTINS DRAINAGE SPECIFICATION.
8. ALL INTERNAL DRAINAGE POINTS ARE SHOWN INDICATIVELY AND ARE TO BE DESIGNED AND SET OUT BY THE M&E ENGINEER.
9. ANY DRAINAGE RUNS AND THEIR CONNECTIONS DAMAGED THROUGH CONSTRUCTION WORKS SHOULD BE REPLACED TO SUFFICIENT STANDARD.
10. CURTINS ACCEPT NO RESPONSIBILITY FOR DEFECTS OR INADEQUACIES OF EXISTING DRAINAGE SYSTEMS. FAILURE OF SITE DRAINAGE DUE TO AN ISSUE WITH THESE NETWORKS ARE OUTSIDE OF OUR REMIT UNLESS SPECIFICALLY INSTRUCTED OTHERWISE.
11. THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
12. EXISTING DITCH DIVERSIONS TO BE 1M WIDE AND 300-500mm IN DEPTH, AS AGREED WITH THE LLFA
13. SITE SURFACE WATER DISCHARGE LIMITED TO QBAR (31.3l/s) AS AGREED WITH OCC
14. FOUL PUMPING STATION TO BE DESIGNED BY OTHERS AT LATER DESIGN STAGE. PROVISION OF 24-HOUR EMERGENCY STORAGE TO BE AGREED WITH BUILDING CONTROL AT LATER DESIGN STAGE. SECONDARY POWER SUPPLY AND SECONDARY PUMP TO BE PROVIDED.

KEY:

-SURFACE WATER DRAIN.

SW00 -SURFACE WATER CHAMBER.

-FOUL WATER DRAIN.

FW00 -FOUL WATER CHAMBER.

-EXISTING SURFACE WATER SEWER

-SURFACE WATER CULVERT

-BYPASS SEPARATOR

ORIFICE PLATES:

SW12 (OP) -ORIFICE PLATE: Ø(mm): 50 INVERT LEVEL: 81.08m AOD

SW16 (OP) -ORIFICE PLATE: Ø(mm): 50 INVERT LEVEL: 81.16m AOD

SW22 (OP) -ORIFICE PLATE: Ø(mm): 40 INVERT LEVEL: 80.70m AOD

SW31 (OP) -ORIFICE PLATE: Ø(mm): 40 INVERT LEVEL: 81.12m AOD

SW32 (OP) -ORIFICE PLATE: Ø(mm): 40 INVERT LEVEL: 80.72m AOD

SW34 (OP) -ORIFICE PLATE: Ø(mm): 60 INVERT LEVEL: 79.93m AOD

SW36 (OP) -ORIFICE PLATE: Ø(mm): 40 INVERT LEVEL: 79.99m AOD

SW39 (OP) -ORIFICE PLATE: Ø(mm): 50 INVERT LEVEL: 80.00m AOD

SW41 (OP) -ORIFICE PLATE: Ø(mm): 50 INVERT LEVEL: 79.44m AOD

HYDROBRAKES:

SW42 (HB) -HYDROBRAKE: Q (l/s): 31.3 H (m): 2 Ø(mm): 227 INVERT LEVEL: 78.60m AOD

-BELOW GROUND SURFACE WATER GEO-CELLULAR STORAGE.

-BELOW GROUND SURFACE WATER ATTENUATION CONCRETE TANK WITH SUPPORT COLUMNS

-ABOVE GROUND SURFACE WATER STORAGE BASIN DEPTH: 500mm SLOPE: 1h:20v

-PERMEABLE SUB-BASE. SUB-BASE TO COLLECT AND ATTENUATE FLOWS. SURFACING TO BE CONFIRMED AT DETAILED DESIGN PHASE.

(A) -PERMEABLE SUB-BASE. AREA: 936m^2 DEPTH: 300mm @ 95% VOID RATIO

(B) -PERMEABLE SUB-BASE. AREA: 4775m^2 DEPTH: 300mm @ 30% VOID RATIO

(C) -PERMEABLE SUB-BASE. AREA: 2900m^2 DEPTH: 300mm @ 30% VOID RATIO

(D) -PERMEABLE SUB-BASE. AREA: 1480m^2 DEPTH: 300mm @ 30% VOID RATIO

(E) -PERMEABLE SUB-BASE. AREA: 520m^2 DEPTH: 300mm @ 30% VOID RATIO

(F) -PERMEABLE SUB-BASE. AREA: 630m^2 DEPTH: 300mm @ 30% VOID RATIO

(G) -PERMEABLE SUB-BASE. AREA: 3025m^2 DEPTH: 300mm @ 95% VOID RATIO

(H) -PERMEABLE SUB-BASE. AREA: 1700m^2 DEPTH: 300mm @ 30% VOID RATIO

(I) -PERMEABLE SUB-BASE. AREA: 685m^2 DEPTH: 300mm @ 30% VOID RATIO

(J) -PERMEABLE SUB-BASE. AREA: 690m^2 DEPTH: 300mm @ 30% VOID RATIO

(K) -PERMEABLE SUB-BASE. AREA: 945m^2 DEPTH: 300mm @ 30% VOID RATIO

-PROPOSED SWALE. LOCATIONS AND DEPTHS TO BE CONFIRMED. ANTICIPATED DEPTH 300-500mm.

-PLANNING BOUNDARY.

-EXISTING SURFACE WATER SEWER

-EXISTING LAND DRAINS TO BE RETAINED

-EXISTING LAND DRAINS TO BE DIVERTED.

-PROPOSED DIVERTED LAND DRAIN.

Rev:	Description:	Date:	By:	Chkd:
P05	UPDATED FOLLOWING COMMENT	11.11.19	LB	MS
P04	FOUL NETWORK ADDED	18.09.19	LB	MS
P03	UPDATED FOLLOWING COMMENTS	04.09.19	LB	MS
P02	FOR INFORMATION	28.08.19	LB	MS
P01	PRELIMINARY ISSUE	02.08.19	NMH	MS

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Status: PRELIMINARY

Project: GREAT WOLF LODGE

Drg Title: PROPOSED DRAINAGE STRATEGY

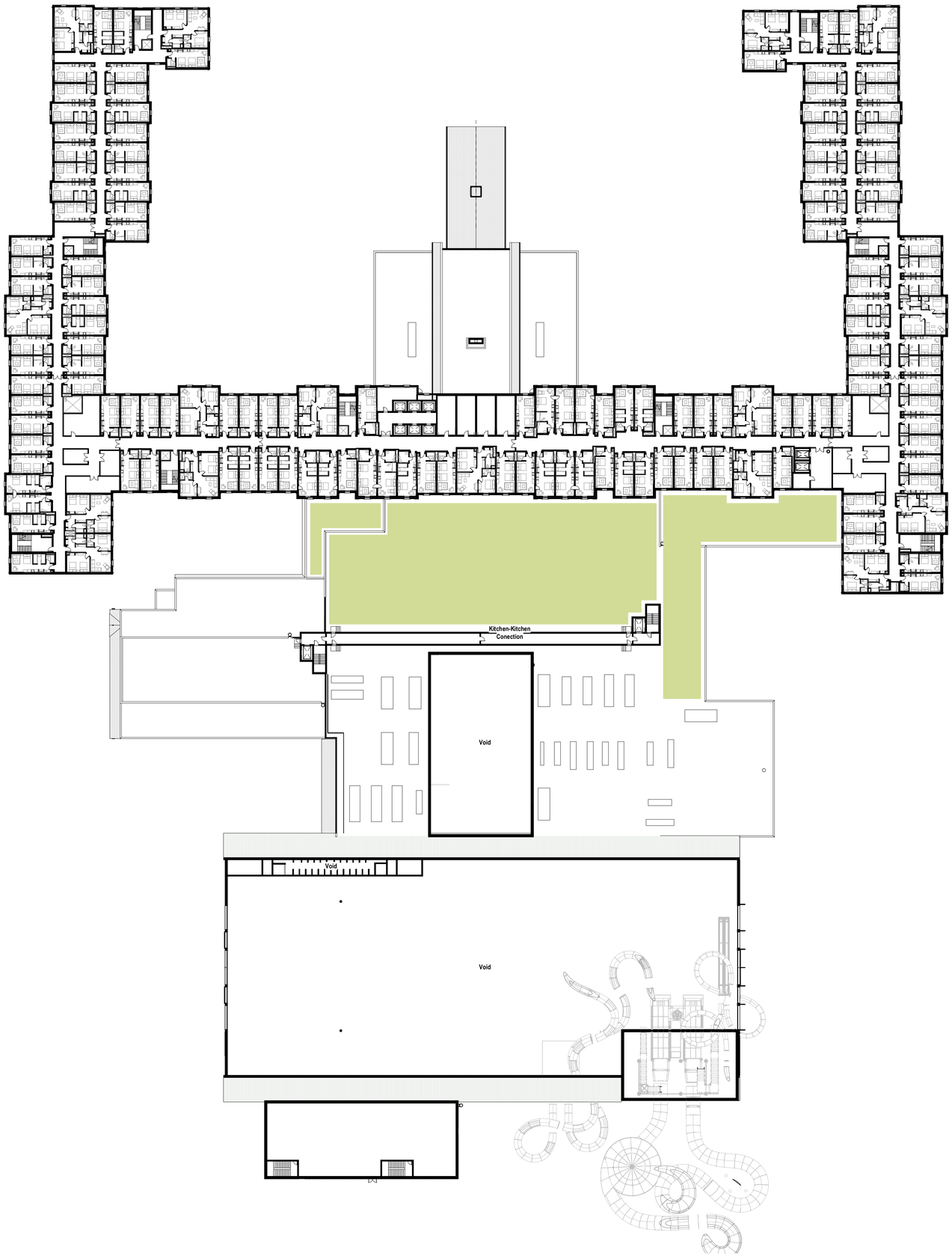
Size:	Date:	Drawn By:	Designed By:	Checked By:
A0	02.08.19	NMH	MS	MS
Scale: 1:500				

Project No: - Originator: - Zone: - Level: - Type: - Discipline: - Category / Number: - Rev:

06535 - CUR - 00 - XX - DR - C - 92000 -P05

FILE PATH: Projects\068000.000 - 068999.000\068535 - Great Wolfe Lodge\QMS 4 Production\4B Drawings\CS\AutoCAD\92\

Appendix F – Green Roof Proposed Locations



Keyplan

North

Notes:
1. Do not scale
2. Contractor to Check all dimensions and report omissions and errors to the Architect.
3. EPR Architects accepts no liability for use of this drawing by parties other than the party for whom it was prepared or for purposes other than those for which it was prepared.
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5. This drawing does not contain shared coordinates and is not issued for coordination purposes.

No.	Revision	Date	Initial	Chk'd
1	P01 - Preliminary Planning Issue	25.10.19	LGO	CT

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Proposed Second Floor Plan

Scale @A1	Status	Suitability	Revision
As indicated	Planning	S4	1

Project Code	Originator	Zone	Level	Type	Role	Class.	Number
10875	EPR	00	02	DR	A	TP	0202

Appendix G – Foul Water Flow Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	3.000
Frequency Factor	0.70	Min Design Depth for Optimisation (m)	0.900
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.70
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	59.816	0.399	149.9	0.000	500.0	0.0	1.500	o	225	Pipe/Conduit	
1.001	13.775	0.092	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.002	20.283	0.135	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.003	109.867	0.732	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.004	76.373	0.509	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.005	11.385	0.076	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.006	52.188	0.348	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
2.000	29.500	0.197	150.0	0.000	32.4	0.0	1.500	o	150	Pipe/Conduit	
2.001	24.763	0.165	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
2.002	13.729	0.092	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.007	36.245	0.242	150.0	0.000	47.4	0.0	1.500	o	225	Pipe/Conduit	
1.008	85.233	0.568	150.0	0.000	310.7	0.0	1.500	o	225	Pipe/Conduit	
3.000	48.558	0.324	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
3.001	28.551	0.190	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.009	51.591	0.344	150.0	0.000	310.7	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	81.950	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.001	81.551	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.002	81.459	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.003	81.324	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.004	80.592	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.005	80.082	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
1.006	80.006	0.000	0.0	500.0	0.0	102	0.90	0.94	37.2	15.7
2.000	81.650	0.000	0.0	32.4	0.0	58	0.63	0.71	12.6	4.0
2.001	81.453	0.000	0.0	32.4	0.0	58	0.63	0.71	12.6	4.0
2.002	81.288	0.000	0.0	32.4	0.0	58	0.63	0.71	12.6	4.0
1.007	79.659	0.000	0.0	579.8	0.0	106	0.91	0.94	37.2	16.9
1.008	79.417	0.000	0.0	890.5	0.0	120	0.96	0.94	37.2	20.9
3.000	81.950	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
3.001	81.626	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
1.009	78.849	0.000	0.0	1201.2	0.0	132	1.00	0.94	37.2	24.3

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	17.590	0.117	150.0	0.000	110.0	0.0	1.500	o	150	Pipe/Conduit	
5.000	13.604	0.091	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
5.001	8.771	0.058	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
5.002	17.663	0.118	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
4.001	29.164	0.194	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
4.002	35.000	0.233	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.000	12.912	0.086	150.1	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.001	27.128	0.181	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.002	12.422	0.083	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.003	6.605	0.044	150.0	0.000	24.7	0.0	1.500	o	150	Pipe/Conduit	
4.003	26.658	0.178	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
4.004	71.000	0.473	150.0	0.000	310.7	0.0	1.500	o	225	Pipe/Conduit	
4.005	62.938	0.420	150.0	0.000	310.7	0.0	1.500	o	225	Pipe/Conduit	
4.006	54.049	0.360	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
7.000	26.663	0.178	150.0	0.000	311.0	0.0	1.500	o	150	Pipe/Conduit	
7.001	46.809	0.312	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.002	23.820	0.159	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.003	6.986	0.047	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.004	39.449	0.263	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.005	15.212	0.101	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.006	22.608	0.151	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.000	81.950	0.000	0.0	110.0	0.0	82	0.74	0.71	12.6	7.3
5.000	81.950	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
5.001	81.859	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
5.002	81.801	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
4.001	81.683	0.000	0.0	110.0	0.0	82	0.74	0.71	12.6	7.3
4.002	81.489	0.000	0.0	110.0	0.0	82	0.74	0.71	12.6	7.3
6.000	81.950	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
6.001	81.864	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
6.002	81.683	0.000	0.0	0.0	0.0	0	0.00	0.71	12.6	0.0
6.003	81.600	0.000	0.0	24.7	0.0	54	0.61	0.71	12.6	3.5
4.003	81.255	0.000	0.0	134.7	0.0	87	0.76	0.71	12.6	8.1
4.004	81.003	0.000	0.0	445.4	0.0	98	0.88	0.94	37.2	14.8
4.005	80.529	0.000	0.0	756.1	0.0	115	0.94	0.94	37.2	19.2
4.006	80.110	0.000	0.0	756.1	0.0	115	0.94	0.94	37.2	19.2
7.000	81.850	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.001	81.672	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.002	81.360	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.003	81.201	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.004	81.155	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.005	80.892	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
7.006	80.790	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.007	109.313	0.729	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
8.000	10.271	0.068	150.0	0.000	311.0	0.0	1.500	o	150	Pipe/Conduit	
8.001	49.399	0.329	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
8.002	26.133	0.174	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
8.003	7.804	0.052	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
8.004	38.296	0.255	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
8.005	12.339	0.082	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
8.006	19.969	0.133	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
4.008	65.883	0.439	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.010	156.471	1.043	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.011	17.268	0.115	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.012	11.978	0.080	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.007	79.749	0.000	0.0	1067.1	0.0	128	0.98	0.94	37.2	22.9
8.000	81.850	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.001	81.782	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.002	81.452	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.003	81.278	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.004	81.226	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.005	80.971	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
8.006	80.888	0.000	0.0	311.0	0.0	120	0.81	0.71	12.6	12.3
4.008	79.021	0.000	0.0	1378.1	0.0	138	1.01	0.94	37.2	26.0
1.010	78.505	0.000	0.0	2579.3	0.0	176	1.06	0.94	37.2	35.6
1.011	77.462	0.000	0.0	2579.3	0.0	176	1.06	0.94	37.2	35.6
1.012	77.346	0.000	0.0	2579.3	0.0	176	1.06	0.94	37.2	35.6

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1	82.700	0.750	Open Manhole	1200	1.000	81.950	225				
F2	82.700	1.149	Open Manhole	1200	1.001	81.551	225	1.000	81.551	225	
F3	82.700	1.241	Open Manhole	1200	1.002	81.459	225	1.001	81.459	225	
F4	82.700	1.376	Open Manhole	1200	1.003	81.324	225	1.002	81.324	225	
F5	82.700	2.108	Open Manhole	1200	1.004	80.592	225	1.003	80.592	225	
F6	82.700	2.618	Open Manhole	1200	1.005	80.082	225	1.004	80.082	225	
F7	82.700	2.694	Open Manhole	1200	1.006	80.006	225	1.005	80.006	225	
F8	82.700	1.050	Open Manhole	1200	2.000	81.650	150				
F9	82.700	1.247	Open Manhole	1200	2.001	81.453	150	2.000	81.453	150	
F10	82.700	1.412	Open Manhole	1200	2.002	81.288	150	2.001	81.288	150	
F11	82.700	3.041	Open Manhole	1200	1.007	79.659	225	1.006	79.659	225	
								2.002	81.197	150	1463
F12	82.200	2.783	Open Manhole	1200	1.008	79.417	225	1.007	79.417	225	
F13	82.700	0.750	Open Manhole	1200	3.000	81.950	150				
F14	82.700	1.074	Open Manhole	1200	3.001	81.626	150	3.000	81.626	150	
F15	82.100	3.251	Open Manhole	1200	1.009	78.849	225	1.008	78.849	225	
								3.001	81.436	150	2512
F16	82.700	0.750	Open Manhole	1200	4.000	81.950	150				
F17	82.700	0.750	Open Manhole	1200	5.000	81.950	150				
F18	82.700	0.841	Open Manhole	1200	5.001	81.859	150	5.000	81.859	150	
F19	82.700	0.899	Open Manhole	1200	5.002	81.801	150	5.001	81.801	150	
F20	82.700	1.017	Open Manhole	1200	4.001	81.683	150	4.000	81.833	150	150
								5.002	81.683	150	
F21	82.700	1.211	Open Manhole	1200	4.002	81.489	150	4.001	81.489	150	
F22	82.700	0.750	Open Manhole	1200	6.000	81.950	150				
F23	82.700	0.836	Open Manhole	1200	6.001	81.864	150	6.000	81.864	150	
F24	82.700	1.017	Open Manhole	1200	6.002	81.683	150	6.001	81.683	150	
F25	82.700	1.100	Open Manhole	1200	6.003	81.600	150	6.002	81.600	150	
F26	82.700	1.445	Open Manhole	1200	4.003	81.255	150	4.002	81.255	150	
								6.003	81.556	150	301
F27	83.000	1.997	Open Manhole	1200	4.004	81.003	225	4.003	81.078	150	
F28	83.000	2.471	Open Manhole	1200	4.005	80.529	225	4.004	80.529	225	
F29	83.000	2.890	Open Manhole	1200	4.006	80.110	225	4.005	80.110	225	
F30	82.600	0.750	Open Manhole	1200	7.000	81.850	150				
F31	82.600	0.928	Open Manhole	1200	7.001	81.672	150	7.000	81.672	150	
F32	82.600	1.240	Open Manhole	1200	7.002	81.360	150	7.001	81.360	150	
F33	82.600	1.399	Open Manhole	1200	7.003	81.201	150	7.002	81.201	150	
F34	82.600	1.445	Open Manhole	1200	7.004	81.155	150	7.003	81.155	150	
F35	82.600	1.708	Open Manhole	1200	7.005	80.892	150	7.004	80.892	150	
F36	82.600	1.810	Open Manhole	1200	7.006	80.790	150	7.005	80.790	150	
F37	82.600	2.851	Open Manhole	1200	4.007	79.749	225	4.006	79.749	225	
								7.006	80.640	150	815
F38	82.600	0.750	Open Manhole	1200	8.000	81.850	150				
F39	82.600	0.818	Open Manhole	1200	8.001	81.782	150	8.000	81.782	150	
F40	82.600	1.148	Open Manhole	1200	8.002	81.452	150	8.001	81.452	150	
F41	82.600	1.322	Open Manhole	1200	8.003	81.278	150	8.002	81.278	150	

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F42	82.600	1.374	Open Manhole	1200	8.004	81.226	150	8.003	81.226	150	
F43	82.600	1.629	Open Manhole	1200	8.005	80.971	150	8.004	80.971	150	
F44	82.600	1.712	Open Manhole	1200	8.006	80.888	150	8.005	80.888	150	
F45	82.700	3.679	Open Manhole	1200	4.008	79.021	225	4.007	79.021	225	
								8.006	80.755	150	1660
F46	81.100	2.595	Open Manhole	1200	1.010	78.505	225	1.009	78.505	225	
								4.008	78.581	225	77
F47	82.000	4.538	Open Manhole	1200	1.011	77.462	225	1.010	77.462	225	
F48	82.000	4.654	Open Manhole	1200	1.012	77.346	225	1.011	77.346	225	
FPumping Station	83.875	6.608	Open Manhole	225		OUTFALL		1.012	77.267	225	

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012	FPumping Station	83.875	77.267	77.900	225	0

Hotel

Room Name	Room Count	Toilet Count	Sink Count	Shower Count	Bath Count	DU Toilets	DU Sinks	DU Shower	DU Bath	Total
Family Suite	239	1	1	1	1	478	71.7	119.5	143.4	812.6
Grizzly Suite	55	2	3	2	1	220	49.5	55	33	357.5
Kids Cabin	95	1	1	1	1	190	28.5	47.5	57	323
Wolf Den	109	1	1	1	1	218	32.7	54.5	65.4	370.6
									Total Hotel DU:	1863.7
									Frequency Fact:	0.7
									Flow (l/s)	30.22

Water park

Room Name	Room Count	Toilet Count	Sink Count	Shower Count	Urinal Count	DU Toilets	DU Sinks	DU Urinal	DU Bath	Total
Mens Guest Toilet	1	9	10	12	8	18	3	6	4.8	31.8
Womens Guest Toilet	1	13	9	12	0	26	2.7	6	0	34.7
Disabled Guest Toilet	4	1	1	1	0	8	1.2	2	0	11.2
Staff Toilet	1	11	14	6	3	22	4.2	3	1.8	31
									Total Hotel DU:	108.7
									Frequency Fact:	0.7
									Flow (l/s)	7.30

Back of House Estimate

Appliance	DU	Count	Total DU
Wash Basin	0.3	8	2.4
Shower with plug	0.5	2	1
Single urinal with cistern	0.5	2	1
kitchen sink	0.6	5	3
dishwasher	0.6	4	2.4
washing machine up to 12kg	1.2	20	24
WC 9l	2	5	10
Floor gully DN70	0.9	4	3.6
		Total DU	47.4
		Freqency Fact:	0.7
		Flow (l/s):	4.82

Conference Area Estimate

Appliance	DU	Count	Total DU
Wash Basin	0.3	8	2.4
Single urinal with cistern	0.5	6	3
kitchen sink	0.6	2	1.2
dishwasher	0.6	2	1.2
WC 9l	2	8	16
Floor gully DN70	0.9	1	0.9
		Total DU	24.7
		Freqency Fact:	0.7
		Flow (l/s):	3.48

Food Hall Estimate

Appliance	DU	Count	Total DU
Wash Basin	0.3	16	4.8
Single urinal with cistern	0.5	4	2
kitchen sink	0.6	8	4.8
dishwasher	0.6	8	4.8
WC 9l	2	8	16
		Total DU	32.4
		Freqency Fact:	0.7
		Flow (l/s):	3.98

Total Discharge

Area	Total DU	Total Flow (l/s)
Hotel	1863.7	30.22
Water Park Toilets	108.7	7.30
Back of House	47.4	4.82
Conference	24.7	3.48
Food Hall	32.4	3.98
Condensation		1.05
Back Wash Pool		TBC
All		50.85

Appendix H – Existing Land Drainage Note

Proposed Great Wolf Lodge Chesterton, Bicester

Technical Note – Existing Site Ditches

Curtins Ref: 068535-CUR-00-XX-DS-C-0003

Revision: P01

Issue Date: November 2019

Client Name: Great Lakes UK Limited

Site Address: Land to the east of M40 and south of A4095, Chesterton, Bicester

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1.0 Introduction

The proposed drainage strategy for the Great Wolf Lodge development, proposes to divert two existing drainage ditches that cross the Site. The strategy has been outlined in detail in the Below Ground Drainage Strategy (068535-CUR-00-XX-RP-C-00002-P01).

This document has been written to provide further information on the ditches running across the Site.

The approximate location of the ditches is shown in Figure 1-1 below. The ditches are also shown in detail on the topographical survey produced by 1st Horizon (Drawing CS-GW5389-01).

Figure 1-1: Approximate Ditch Location

2.0 Description

As shown above, there are two existing ditches running across the Site from north to south. It is understood that these ditches were constructed by site maintenance staff to manage ground water. This was confirmed by the site staff during a walkover. The two ditches join in an inspection chamber to the north of the existing hotel. From here, any flows are directed to an irrigation pond to the south east of the hotel. The full discharge route is outlined in the Below Ground Drainage Strategy (068535-CUR-00-XX-RP-C-00002-P01).

This section will give an overview of the two ditches. For clarity the ditch closest to the A4095 has been referred to as the northern ditch, with the ditch running closest to the M40 referred to as the southern ditch.

2.1 Southern Ditch

The topographical survey shows the southern ditch to begin in the dense vegetation to the north of the Site. There is no indication from the topographical survey, aerial mapping or site walkovers, that the ditch has any inlets at its origin.

The level at the base of the ditch is 83.332mAOD at its origin, the ditch depth is approximately 500mm. The topographical survey indicates only one piped inlet into the ditch along its length, this is a 300mm diameter pipe adjacent to the inlet to the culvert described below. It is believed this 300mm inlet is a high-level overflow from the lined pond to the south, this is shown in Figure 2-2. The site walkover only encountered small diameter shallow perforated land drains and no other inlets not shown on the topographical survey.

Prior to discharge into the inspection chamber with the northern ditch, the southern ditch is culverted for approximately 50m. The invert level before the ditch enters the culvert is 80.863m with a depth of approximately 1m. The inlet to the culvert was not been highlighted on the topographical survey but observed during a site walkover. This can be seen in Figure 2-1 below.

Figure 2-1: Southern Ditch Culvert Inlet

The area to the south of the southern culvert has been highlighted in Figure 2-2 for clarity. The culvert has been viewed on the Site and the connection between the two ditches confirmed by site maintenance staff.

The ditch was completely dry for its entire length during the walkover and there was no evidence of water retention or regular flow through the ditches for the majority of their length.

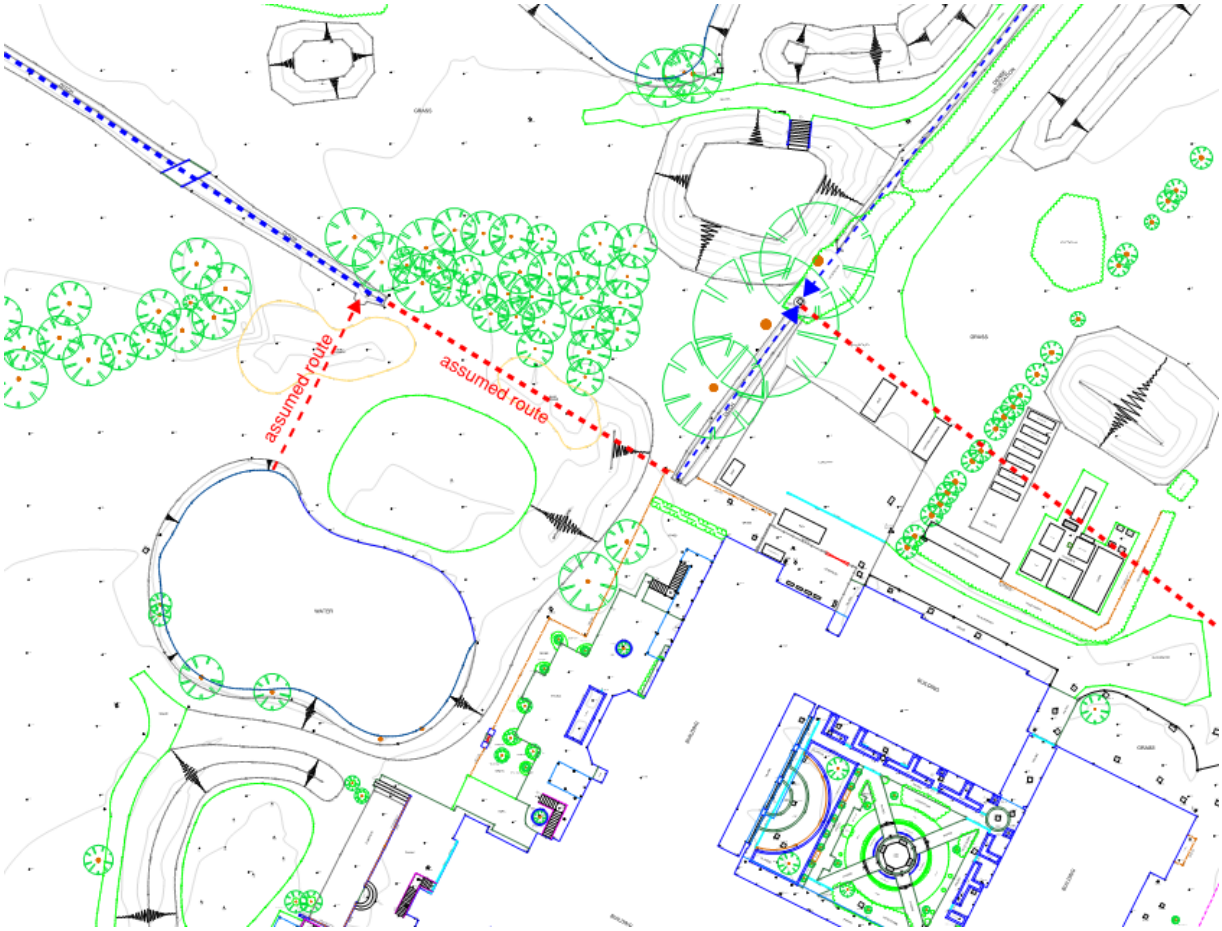

Figure 2-2: Southern Ditch Outfall (Ditch – Blue, Culvert – Red)

2.2 Northern Ditch

The topographical survey indicates that the northern ditch begins at the foot of an earth mound. There is no indication from the topographical survey, aerial mapping or site walkover, that the ditch has any inlets at its origin. This can be seen on the topographical survey produced by 1st Horizon (Drawing CS-GW5389-01).

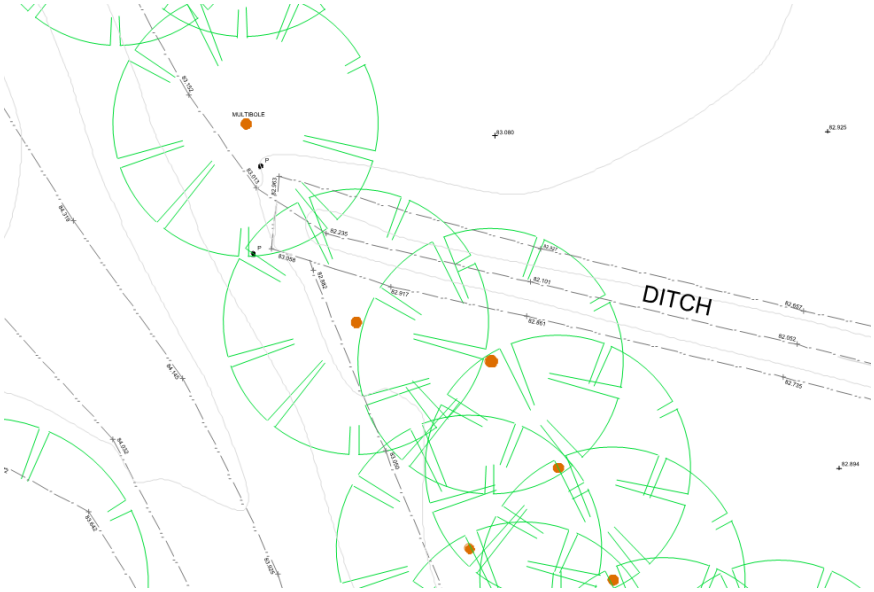

Figure 2-3: Northern Ditch Origin

The level at the base of the ditch at its origin is 82.235mAOD, the depth is approximately 700mm. The topographical survey indicates no piped inlet into the ditch along its entire length, however a secondary ditch connects from the north, mid-way along its length. There are no inlets into secondary ditch. The site walkover only encountered small diameter shallow perforated land drains, that were installed by the land owner and no other inlets.

Prior to discharge into the inspection chamber, where it meets the southern ditch, a small pond is encountered along its length. From visual inspection, this pond appears to not be lined and at the time of the visit was not actively discharging via the downstream ditch. Site staff confirmed this pond to be groundwater fed.

Except for the section where the pond was encountered, the ditch was completely dry for its entire length.

The ditch outlet from the pond has an invert level of 80.574mAOD and a depth of approximately 500mm. The route is shown in Figure 2-4.

Figure 2-4: Northern Ditch Outlet

3.0 Existing Site Wide Drainage Interpretation

3.1 Historic Mapping

It is understood that the formation of the two ditches was by the golf course maintenance staff as a land drainage network to prevent the putting greens and fairways from flooding. It is unclear when these were constructed, however these do not appear on maps from the 80's that were received as part of the Envirocheck report – see Figure 3-1. The golf course can be seen to occupy the Site at this time and other drains have been recorded on the map.

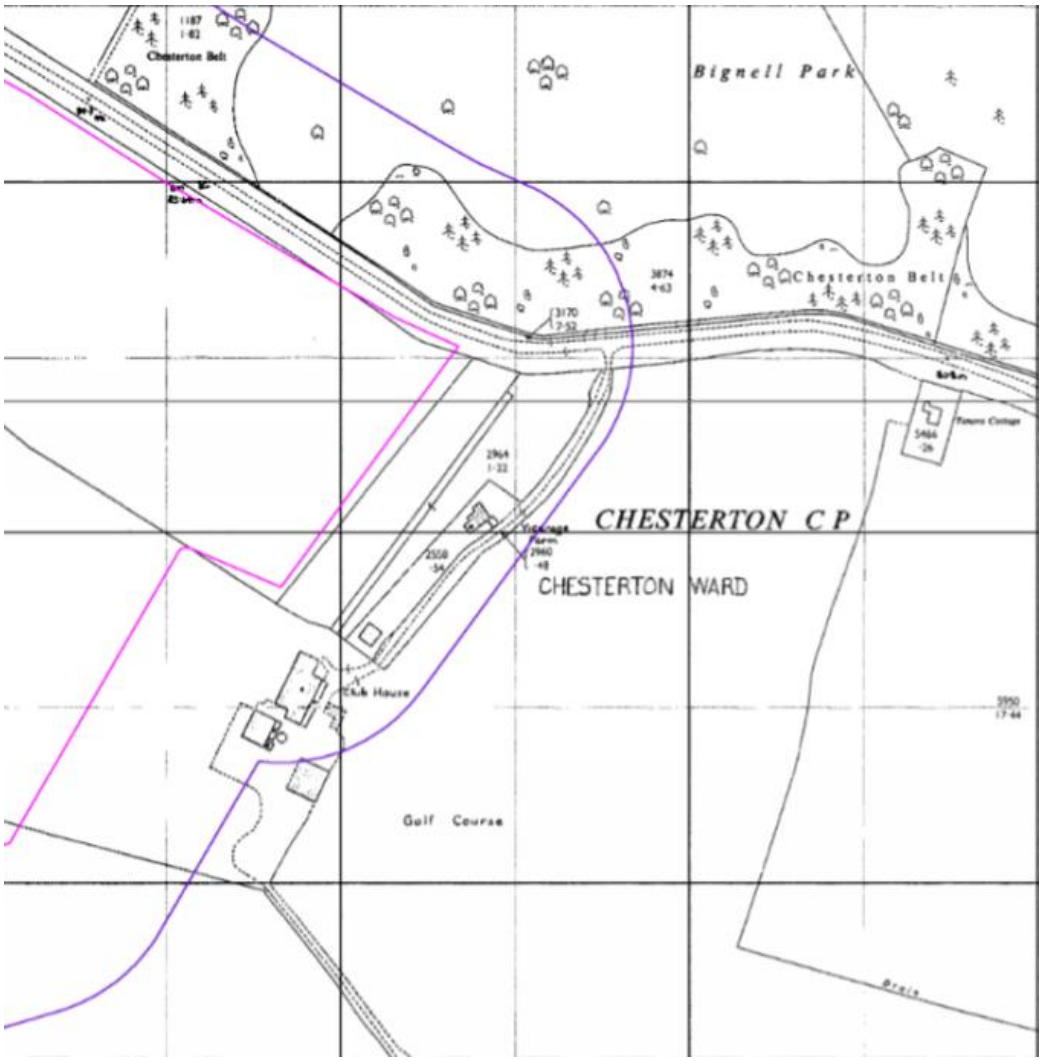

Figure 3-1: Historic Mapping - OS Maps 1980's

3.2 Groundwater

As stated above and confirmed by the site maintenance manager during our visit, it is understood that the usage and original creation of these ditches were to drain the land to the south east of the Site.

The geology of the Site consists of Cornbrash limestone overlying Forest Marble which acts as a partial aquiclude.

A number of ponds have been constructed on the Site which are directly filled by groundwater from the Cornbrash. A UAV survey combined with examination of borehole records around the Site confirms that the groundwater is very high as shown by the UAV plot of pond levels and that soakaways will not work. This has been discussed in the Below Ground Drainage Strategy (068535-CUR-00-XX-RP-C-00002-V02). The results of the UAV survey can be seen in Figure 3-2.

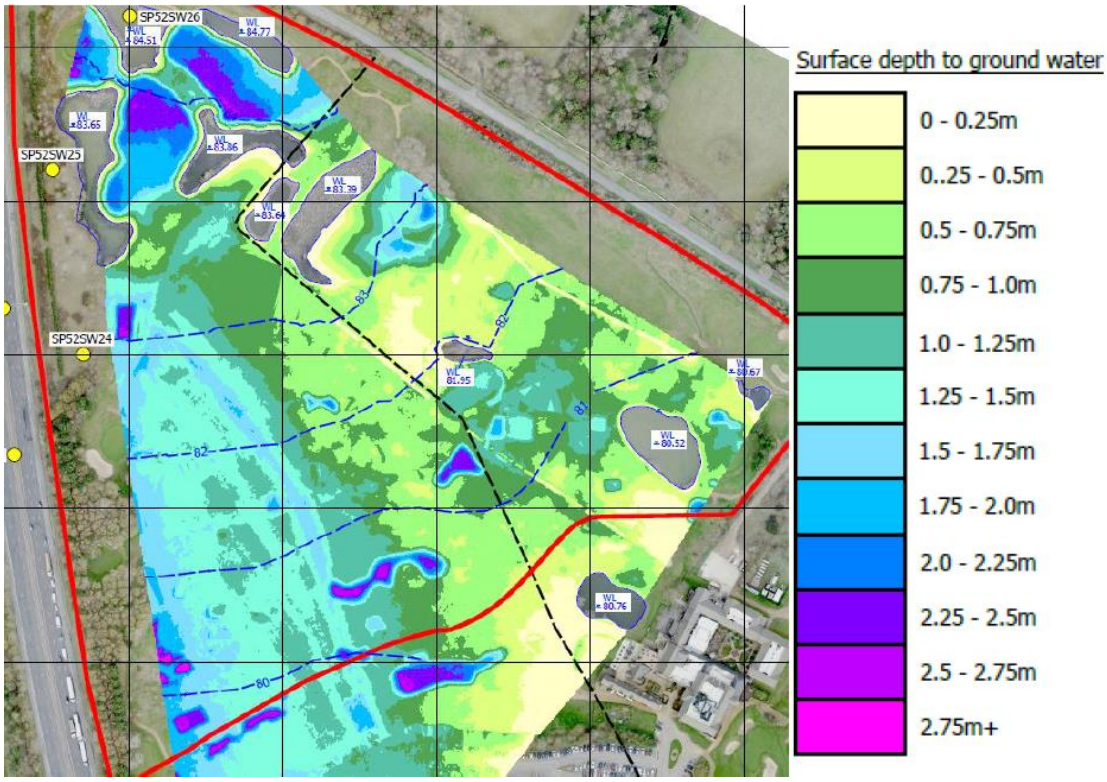

Figure 3-2: UAV Groundwater Survey

It can therefore be seen that the ditches are located in the area where groundwater levels are shallowest. This is further confirmed by the presence of perforated pipework laid across this area of the Site, that outfall into these ditches. These shallow small diameter land drains have been observed during site walk overs and can be seen on aerial imagery. Extracts from the aerial imagery showing the surface marks from the land drains can be seen in Figure 3-3 .

It should also be noted, that due to the expanse of shallow perforated pipework across the Site that outfall to these ditches, large areas of the Site could be considered as positively drained and therefore not behave truly like a greenfield. The proposed strategy is therefore considered to be reducing flood risk across the Site and down stream by removing these ditches and incorporating formal controlled network.

Figure 3-3: Aerial Imagery Evidence of Land Drainage

3.3 Existing Pond Catchment

As previously discussed, these ditches have no formal inlets at their origins and only internal connection within the Site, which have been formed by the site's maintenance team. They are not positively connected to the ponds in the northern region of the Site and do not act as a high-level outfall from the ponds. This is proven by the fact that the northern ditch is separated from the ponds by an earth mound, which would prevent any overland run-off reaching the ditch.

It is also understood that the ponds are not connected above ground in any way to each other or any off-site water feature. This can be seen on the topographical survey. None of the ponds in the northern region of the Site were lined and it is understood they are groundwater fed. It is accepted that the ponds were dug by the existing site owner to form features for the golf course, and subsequently filled with groundwater.

3.4 Oxfordshire Flood Toolkit

The Oxfordshire Flood Toolkit shows all surface water drains, ditches and watercourses in the county and has been used in the production of the site wide drainage strategy. An extract covering the Site and the area around it can be seen in Figure 3-4.

The mapping shows that the Site has a river (Gagle brook) to the east and a number of drains around the Site. However, it shows that there are no drains or watercourses on the Site. The nearest drain is on the Site of the existing gold course, to the south.

Figure 3-4: Oxfordshire Flood Toolkit Extract

4.0 Mitigation

The diverted ditches have been shown on the proposed Drainage Strategy Drawing (06535-CUR-00-XX-DR-C-92000). It is understood that any significant change to land drainage across the Site, may have an effect on the ponds water levels. However, until a detailed site investigation is undertaken, this cannot be known for certain.

In the interim period before a site investigation is completed, it is proposed to divert the land drainage. Following site surveys, if this is proven to not be effective, the strategy will be adjusted accordingly. The proposed diversion can be seen on Drainage Strategy Drawing (06535-CUR-00-XX-DR-C-92000).

The area currently served by the existing perforated pipework, feeding into the ditches to the east is proposed to be drained using a new below ground network of perforated pipework, discharging to the downstream end of the northern drainage ditch. To maintain groundwater levels to the north of the hotel and car park, a swale has been included in the proposed surface water drainage strategy.

This strategy has been developed to maintain groundwater levels in the north, whilst mitigating flood risk in the south. Monitoring of groundwater levels, post planning, will ensure that accurate groundwater levels are known to inform the design of the proposed drainage features.

5.0 Conclusion

From the evidence presented in this technical note, it is concluded that the two ditches running across the Site are not watercourses and were constructed for use as land drains by the golf course and continue to act in this way. Their use is highlighted by the lack of inlets into them and UAV survey indicating high groundwater in their vicinity.

The proposed development requires their removal, as they are located in the building and car park footprint. It has been proposed to maintain the existing drainage regime with the use of land drains and swales as discussed with OCC as the LLFA and outlined in the drainage strategy.

Following receipt of site investigations, the results are to be analysed to ensure that the sites below ground hydrology will not be affected by their removal or the inclusion of the proposed mitigating measures. If this is proven to not be the case, the drainage strategy will be amended to ensure the pond water levels are maintained.

The proposed outfalls of all areas of the Site remains to be the ditch where the existing northern and southern ditch outfall, prior to entering the inspection chamber.

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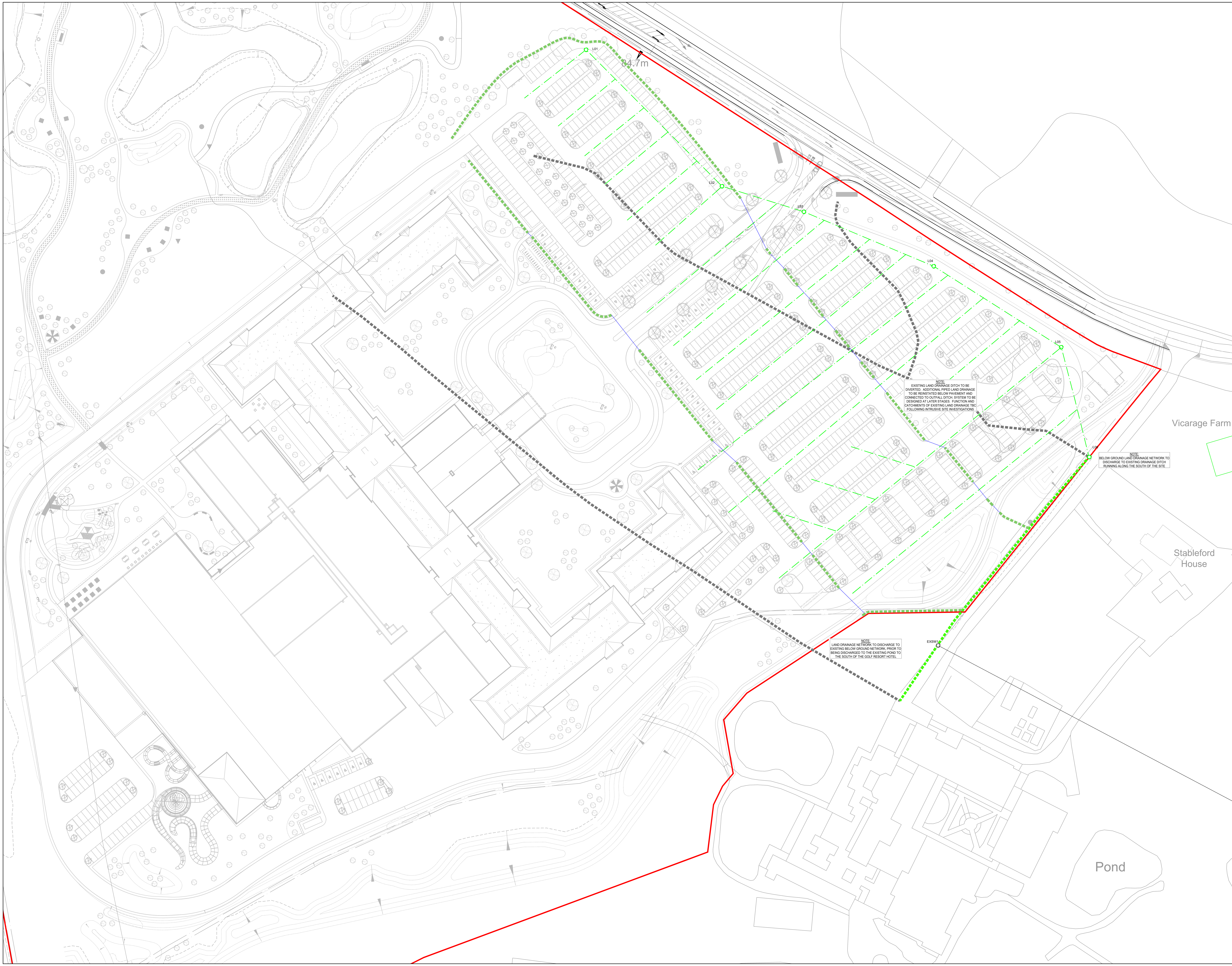
Appendix I – Proposed Land Drainage General Arrangement



GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE FROM THIS DRAWING. ALL DETAILS AND DIMENSIONS AND LEVELS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
3. ALL LEVELS ARE IN METERS & DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
4. DESIGN BASED ON TOPOGRAPHICAL & CCTV SURVEY AVAILABLE AT THE TIME OF DESIGN. ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
5. ALL PIPEWORK TO PERFORATED HDPE.
6. WHERE EXISTING DRAINAGE IS BEING USED, ALLOWANCES SHOULD BE MADE TO REMEDIATE THIS DRAINAGE IN LINE WITH AVAILABLE CCTV SURVEY INFORMATION.
7. WHERE THERE IS NO REQUIREMENT TO KEEP EXISTING DRAINAGE, ALLOWANCES SHOULD BE MADE TO ABANDON THIS IN LINE WITH CURTINS DRAINAGE SPECIFICATION.
8. ALL INTERNAL DRAINAGE POINTS ARE SHOWN INDICATIVELY AND ARE TO BE DESIGNED AND SET OUT BY THE M&E ENGINEER.
9. ANY DRAINAGE RUNS AND THEIR CONNECTIONS DAMAGED THROUGH CONSTRUCTION WORKS SHOULD BE REPLACED TO SUFFICIENT STANDARD.
10. CURTINS ACCEPT NO RESPONSIBILITY FOR DEFECTS OR INADEQUACIES OF EXISTING DRAINAGE SYSTEMS. FAILURE OF SITE DRAINAGE DUE TO AN ISSUE WITH THESE NETWORKS ARE OUTSIDE OF OUR REMIT UNLESS SPECIFICALLY INSTRUCTED OTHERWISE.
11. THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
12. LATERAL BRANCHES TO MAIN BELOW GROUND LAND DRAINAGE RUNS NOT SHOWN FOR CLARITY. LAND DRAINAGE TO BE INSTALLED IN A HERRINGBONE PATTERN, WITH DRAIN SPACING TO CONFIRMED FOLLOWING COMPLETION OF DETAILED GEOLOGICAL INVESTIGATIONS.

-EXISTING SURFACE WATER SEWER
-EXISTING LAND DRAINS TO BE RETAINED
-EXISTING LAND DRAINS TO BE DIVERTED.
-PROPOSED DIVERTED LAND DRAIN
-PROPOSED PERFORATED LAND DRAINAGE.
L01 -PROPOSED LAND DRAINAGE CHAMBER.

Rev:	Description:	Date:	By:	Chkd:
P02	UPDATED FOLLOWING COMMENTS	11.11.19	MS	TL
P01	PRELIMINARY ISSUE	17.09.19	MS	TL

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Status: PRELIMINARY

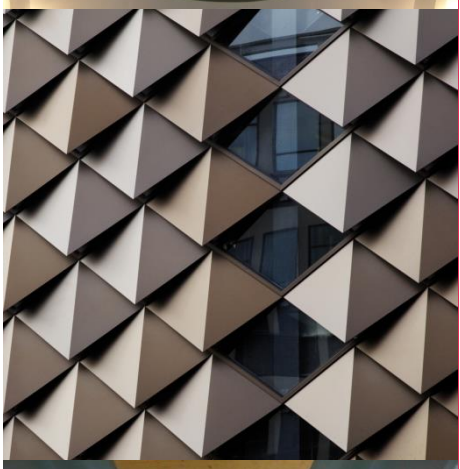
Project: GREAT WOLF LODGE

Drg Title: PROPOSED LAND DRAINAGE GENERAL ARRANGEMENT

Size:	Date:	Drawn By:	Designed By:	Checked By:
A0	17.09.19	MCS	MCS	TL
Scale: 1:500				

Project No:	Originator:	Zone:	Level:	Type:	Discipline:	Category / Number:	Rev:
06535	CUR	00	XX	DR	C	92003	P02

Appendix J – Operations and Maintenance Manual



Proposed Great Wolf Lodge Chesterton, Bicester

Drainage Operations and Maintenance Manual

Curtins Ref: 068535-CUR-00-XX-RP-C-00003

Revision: P01

Issue Date: November 2019

Client Name: Great Lakes UK Limited

Site Address: Land to the east of M40 and South of A4095, Chesterton, Bicester

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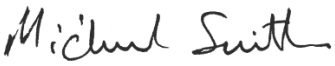
Michael Smith **MEng (Hons)** Senior Infrastructure Engineer		11/11/2019

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1.0 Introduction

1.1 Project Background

Curtins Consulting Limited has been appointed by Great Lakes UK Limited to prepare a Surface Water Drainage Operations and Maintenance Manual as part of the Drainage Strategy, 068535-CUR-00-DR-RP-C-00002, for the proposed Great Wolf Lodge development. This should also be rea din conjunction with the Flood Risk Assessment (FRA).

This report is based on currently best practice guidance.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

In accordance with the FRA the surface water network has been designed to accommodate the 1 in 100-year event plus an allowance of 40% for climate change.

1.2 Scope of O&M Manual

This manual is intended to give an overview of the operation and maintenance for the range of SuDS features included with the drainage strategy and in relation to typical details only. Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the Site requirements.

2.0 Pipes (Including Oversized)

2.1 Location and Description

Pipes are the main conveyance across the Site with the network.

Pipes are proprietary products and the materials can vary across the Site and as such where used the manufacture's recommendations should be followed. Regardless of the product used, the pipes will be fully compliant with the Curtins drainage specification once the design has been progressed.

2.2 Operation

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleansing where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

2.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with the individual owners of the property for laterals and Thames Water for adopted sewers.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection should be provided as post construction CCTV survey.	N/A
	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
Occasional maintenance	Check and remove large vegetation growth near pipe runs.	Every 6 months
Remedial actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If above does not improve performance.

3.0 Green Roofs

3.1 Location and Description

Green roofs are proposed on top of the Family Entertainment Centre (FEC) section of the proposed development. Further detail of the green roofs system is shown in EPR's Design & Access Statement and plans and drawings submitted with the planning application.

Green roofs are areas of vegetation that provide visual benefit, ecological value and reduce surface water runoff. A green roof consists of a system in which several materials are layered to achieve the desired vegetative cover and drainage characteristics.

3.2 Operation

Green roofs can provide benefits in terms of reducing peak flow rates to the Site drainage system. The depth of rainfall that will be stored in any rainfall event is a function of the antecedent soil moisture, the soil depth, the roof gradient and any specific storage provision designed within the drainage layer.

3.3 Inspection and Maintenance Regime

Green roofs are likely to required regular inspection and maintenance. Access routes to the roof should be designed and maintained to be safe and efficient, and walkways should always be kept clear of obstructions.

All maintenance actions carried out at roof level must be in full compliance with the appropriate health and safety regulations, and particularly those specifically dealing with working at height.

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes ad roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediments sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plant as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate0 as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

4.0 Filter Strips, French Drains and Underdrained Swales

4.1 Location and Description

The features are located as shown on the Proposed surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000.

The features will be designed in accordance with CIRIA C753.

4.2 Operation

The filter strips, French drains and underdrained swales are intended to be the surface water conveyance, water quality and attenuation storage features. These features are intended to be dry except during rainfall events.

The surface water should permeate through the upper layer of the feature in to the permeable stone below. The water is then collected and conveyed in the perforate pipe within the aggregate trench.

Access for maintenance has been provided through access chambers and rodding points.

4.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the features. Maintenance responsibility for the features and their surrounding area should be placed with Great Lakes UK Limited.

Plant management, to achieve the required habitat/appearance, should be specified clearly in a maintenance schedule by the landscape architect planned to coincide with other site wide maintenance operations.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect feature surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination	Half yearly and after large storms.
	Check feature surface for even gradients	Half yearly
	Inspect gravel diaphragm trench upstream of filter strip for clogging	Half yearly.
	Inspect silt accumulation rates and establish appropriate removal frequencies.	Half yearly.
Regular maintenance\inspection	Litter and debris removal	Monthly or as required
	Grass cutting (to maintain grass height within landscape architect's specified design range)	To be confirmed by Landscape Architect [Monthly (during growing season) or as required]
	Manage other vegetation and remove nuisance plants/dead growth.	Monthly (at start, then as required).
	Remove sediment from main channel.	Annually (or as required after heavy rainfall events)
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter and cut back adjacent vegetation where possible.	Annually, or as required. As per landscape architect's specification.
	Re-seed areas of poor vegetation growth (seed mix to landscape architect's specification).	Annually, or as required. As per landscape architect's specification
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing. Soil reinforcement such as coir matting should be used and staked in accordance with manufacturer's instructions.	As required.
	Realignment of flow channel/dished surface.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Re-level uneven surfaces and reinstate design levels. This may be required as part of sediment removal.	As required.
	Replace geotextiles and clean and replace filter media, if clogging occurs. Terram 1000 typical design life is 25 years.	As required.
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels	As required.

5.0 Permeable Pavements

5.1 Location and Description

Permeable paving is proposed across the site, forming the majority collection system for all ground level hardstanding and car parking. The extents of the permeable paving can be seen on the Drainage General Arrangement drawing 068535-CUR-00-XX-DR-C-92000.

The permeable pavement has been designed in accordance with CIRIA C753.

Permeable pavements contain proprietary products and as such, the manufacture's recommendations should be followed where used.

5.2 Operation

Permeable pavements are an efficient mean of managing surfaces water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. The permeable pavements may also be utilised as an infiltration area or soakaway for other areas of the development.

The surface has been designed to be porous or to contain gaps where rain can flow through the upper construction layers in to the voided stone which makes up the sub-base.

5.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the pervious pavement. Maintenance responsibility for the pavement and its surrounding area should be placed with Great Lakes UK Ltd.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 hours after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.
Regular maintenance/inspection	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Removal of weed or management using glyphosate applied directly into the weeds by an applicator rather than spraying.	As required – one per year on less frequently used pavements.
	Stabilise and mow contributing and adjacent areas.	As required.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials.	As required.
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).

6.0 Swales

6.1 Location and Description

The swales are located to the boundary of the Site, as shown on the Proposed Surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000

The swales have been designed in accordance with CIRIA C753.

6.2 Operation

The swales are intended to be the surface water conveyance, water quality and potentially attenuation storage features. These features are intended to be dry except during rainfall events.

The surface water should flow contained within the swale as a form of conveyance until connected to another feature.

6.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the swales. Maintenance responsibility for the swales and its surrounding area should be placed with Great Lakes UK Limited.

Plant management, to achieve the required habitat/appearance, should be specified clearly in a maintenance schedule by the landscape architect planned to coincide with other site wide maintenance operations.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect feature surface to identify evidence of erosion, compaction, ponding, and contamination. Record areas where water is ponding for >48 hours.	Every three months and after large storms.
	Check feature surface for even gradients	Half yearly
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly.
	Inspect silt accumulation rates and establish appropriate removal frequencies.	Half yearly.
Regular maintenance\inspection	Litter and debris removal	Monthly or as required
	Grass cutting (to maintain grass height within landscape architect's specified design range)	To be confirmed by Landscape Architect [Monthly (during growing season) or as required]
	Manage other vegetation and remove nuisance plants/dead growth.	Monthly (at start, then as required).
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter and cut back adjacent vegetation where possible.	Annually, or as required. As per landscape architect's specification.
	Re-seed areas of poor vegetation growth (seed mix to landscape architect's specification).	Annually, or as required. As per landscape architect's specification
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing. Soil reinforcement such as coir matting should be used and staked in accordance with manufacturer's instructions.	As required.
	Realignment of flow channel/dished surface.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Re-level uneven surfaces and reinstate design levels. This may be required as part of sediment removal.	As required.
	Replace geotextiles\geomembranes (if present) if damaged. Terram 1000 typical design life is 25 years.	As required.

7.0 Attenuation Tank (Concrete Tanks)

7.1 Location and Description

The concrete attenuation tank is located in the car parking area to the west of the Site, as shown on the Proposed Surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000.

The tank will be designed in accordance with CIRIA C753.

The concrete units are yet to be confirmed if proprietary products or cast in situ, therefore manufacturer's recommendations should also be taken in to consideration. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken in to consideration.

7.2 Operation

The attenuation tank is intended to be the surface water storage feature to attenuate the discharge from the Site up to and including the 1 in 100 year plus 40% climate change event. The tank is intended to be empty between rainfall events.

Access for maintenance is yet to be confirmed, awaiting final design.

7.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried a regularly inspection regime is very important to ensure the correction functionality of the surface water drainage network. Maintenance responsibility for an attenuation tank and its surrounding area should be placed with Great Lake UK limited.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
	Check penstocks and other mechanical devices (if present).	Half yearly.
	Inspect ventilation cowl (if present)	Monthly and after large storms.
Regular maintenance\inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then every six months
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually (or as required after heavy rainfall events)
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.

8.0 Attenuation Tank (Geocellular Units)

8.1 Location and Description

The attenuation tank is located to the north west of the Site, as shown on the Proposed Surface Water Drainage Strategy 068535-CUR-00-XX-DR-C-92000. The geocellular tank is to the north, accounting for 100m^3 of attenuation.

The tank will be designed in accordance with CIRIA C753.

Geocellular units are proprietary products and therefore manufacturer's recommendations should also be taken in to consideration. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken in to consideration.

8.2 Operation

The attenuation tank is intended to be the surface water storage feature to attenuate the discharge from the Site up to and including the 1 in 100 year plus 40% climate change event. The tank is intended to be empty between rainfall events.

8.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried a regularly inspection regime is very important to ensure the correction functionality of the surface water drainage network. Maintenance responsibility for an attenuation tank and its surrounding area should be placed with Great Lakes UK Limited.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
	Check penstocks and other mechanical devices (if present).	Half yearly.
	Inspect ventilation cowl (if present)	Monthly and after large storms.
Regular maintenance\inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then every six months
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually (or as required after heavy rainfall events)
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.

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