TECHNICAL NOTE

RIDGE

PROJECT	DATE	BY	REFERENCE
5017396 – Bicester Motion- Hotel Pre-commencement conditions: Surface Water Drainage	09/06/2022	TC	5017396 - TN-0001

TITLE	REV
Update to Flood Risk Assessment and Drainage Strategy	A

1. INTRODUCTION

Ridge have been asked to prepare an update to the previous FRA & DS to provide additional information for the discharge of conditions. RAB Consultants prepared a flood risk assessment report and AKS Ward prepared a Surface Water Drainage Strategy, and water quality management report to accompany a planning application for a new hotel located within Bicester Motion. The development includes a new hotel building, car park and associated external areas. The site is bounded by hangar units to the east and south, by the A4421 road to the west and by the Bicester Airfield to the north.

2. SUMMARY OF FLOOD RISK ASSESMENT REPORT

The Flood Risk Assessment prepared by RAB Consultants highlights that the development site lies within Flood Zone 1. There is no recorded history of flooding within the site. The nearest brook, Langford brook is located over 1km east and the hotel ground elevation is roughly at 10m higher than the brook.

Flooding Types	Summary
Fluvial Flooding	Distance from the nearest river is over 1km and at a higher elevation. Hence, **low** risk of fluvial flooding.
Tidal Flooding	Due to its inland location, the risk of tidal or coastal flooding is **minimal.**
Surface Water Flooding	The surface water map identifies that there is a **very low** risk of flooding for the majority of the application boundary. However, there is a **low** risk of surface water flooding the southern part of the site.
Artificial Water Bodies	The site is quite far from any canal and the risk of reservoir flooding within the site area is **minimal** based on the information extracted from the Environmental Agency Reservoir Flood Map.
Ground Water	The risk of groundwater flooding is **very low** based on the information provided on the Environmental Agency Map. However, the north and south of the proposed sites are within a 'Minor aquifer high', increasing the possibility of flooding. It's been suggested that the development floor level be raised to 150mm above the ground level in order to provide protection against this type of flooding.

Refer to the appendices for the complete Flood Risk Assessment report prepared by RAB Consultants

3. DRAINAGE STRATEGY

The drainage strategy and water quality management report prepared by AKS Ward highlights the strategy to manage the surface water and foul water from the proposed development. The report prepared by AKS Ward is to be read in conjunction with the report prepared by RAB Consultants- Flood Risk Assessment. The site currently drains towards the watercourse located further southeast outside of Bicester Heritage. However, the surface water and foul water generated from the new development will be discharged in a suitable sustainable manner.

The drainage strategy is as follows:

3.1. Foul Water Drainage Strategy

In line with the AKS Ward report, the foul water from the proposed development will be discharged to the nearest public sewer located in the A4421 which is owned by Thames Water. A S106 application will be

submitted to connect the new sewer connection to the public sewer. Should the swimming pool not be provided free for visitors then a trade effluent license will need to be agreed with Thames Water.

The Swimming pool will be connected to the foul sewer. Prior to release of the water from the swimming pool in to the foul network, the water will be stored in a settling tank such that the chemicals can settle, and the flow released slowly over a prolonged period.

The foul drainage from the hotel will require a pumping station in order to connect to the public sewer. The pump station will require a to store a minimum of 24 hours' worth of foul flow from the hotel.

Capacity issues within the public sewer network is the responsibility of the sewerage undertaker. However, it is not considered that capacity concerns will be an issue for the development as, if necessary, the foul flows can be timed and restricted to accord with low flows within the public foul sewer network as a pump station is proposed.

3.2. Surface Water Drainage Strategy

Drainage hierarchy

- Current guidance states that a hierarchy of potential methods for discharging surface water from development must be followed:
  i. A soakaway or another adequate infiltration system; or where this is not practical
  ii. A watercourse or where this is not practicable
  iii. A sewer.

- The Environment Agency and relevant Government Legislation requires that the surface water strategies for new developments are in line with sustainable development through the use of Sustainable Drainage Systems (SuDS).

- Without mitigation and consideration, the proposed redevelopment of the site could lead to an unacceptable increase in the rate and volume of surface water generated from the site and a degradation in water quality.

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

SuDS Management Train

- In accordance with the discharge hierarchy, the surface water generated by the proposed development will be discharged utilising infiltration methods.
- Infiltration tests carried out in line with BRE 365 within the site shows that the surface water can be discharged via infiltration. Please refer to the appendices for the full results of the infiltration tests. The values used for the design are 1.18×10^{-4} m/s for the main car park area and 3.19×10^{-5} m/s for the other infiltration devices.

- Groundwater monitoring has also been undertaken for the site. See results table below. Based on the below results a conservative assumption has been made that all infiltration devices must have their base a maximum of 300mm below the existing ground level to allow for a minimum of 1m between the base of the infiltration feature and the groundwater level.

Date	time	Borehole location	Depth to water (M)
17/03/22	16:25	RO101	1.80
17/03/22	15:19	RO102	1.35
17/03/22	16:15	RO103	1.44
21/03/22	11:04	BHHRO101	1.72
21/03/22	11:13	BHHRO102	1.40
21/03/22	11:08	BHHRO103	1.46
28/03/22	11:37	BHHRO101	1.84
28/03/22	11:52	BHHRO102	1.51
28/03/22	11:31	BHHRO103	1.51

Figure 1- Ground Water monitoring Log (Hydrock 2022)

Contributing Areas

- There is significant increase in impermeable across the site compared to the existing site. The total site area is 4.55ha. out of which, the impermeable area is 1.59ha.

Table 1 – Catchment Area Summary

	PERMEABLE SURFACE	IMPERMEABLE SURFACE
Existing	4.55ha (100%)	0 (0%)
Proposed	2.96ha (65%)	1.59(35%)
Change	- 1.59 (-35%)	-1.59 (35%)

- As can be seen within the previous table, the permeable area has decreased by 35%. Therefore, the risk of surface water flooding is higher than when compared to the existing condition.

Allowance for Climate Change

- Table 2 (Peak Rainfall Intensity Allowance in Small and Urban Catchments) of Environment Agency (2019) Flood Risk Assessments: Climate Change Allowances confirms the climate change allowance of 40% should be adopted for the Application Site, assuming a lifespan of 100 years.

Proposed Drainage

As the proposal will increase the impermeable area on the site a drainage strategy as described below is required to mitigate the above issues. A drainage strategy inline with the above drainage hierarchy is proposed and detailed out below.

Main Building

- The proposed surface water strategy for the new development is to utilise infiltration through the use of geo-cellular tanks. The new attenuation will have an effective storage of 287m^3 will be designed for the 1 in 100-year event plus 40 % allowance for climate change.
- Rainwater collected through the roof using rainwater pipes will be stored in the storage tank.

- Levels have been increased at the location of geo-cellular crates to provide minimum cover whilst maintaining a 1m offset between the base of the crate and ground water level.
- Roof drainage will be conveyed above ground to the eastern side of the building where it will be connected via a very short network of shallow pipes.

Main Car Park

- The proposed surface water strategy for the new development is to utilise infiltration through the use of permeable paving. Throughout the car park, different permeable surfaces are proposed as indicated to tie in with the ecology proposals. The subbase will a depth of 300mm and provide an effective storage of 450m^3. During the 100year plus 40% CC storm event, the short duration intense rain fall is causing minor above ground flooding equating to 42m3 which is over the total area of the parking is only 6mm of depth. This will quickly dissipate after the storm has passed.
- Permeable paving will provide adequate treatment to the surface water flows leaving the parking areas.

Other Car Park areas

- The proposed surface water strategy for the new development is to utilise infiltration through the use of permeable paving. The subbase will at a depth of 300mm. During the extreme events up to and including the 1 in 100 yr. plus 40% CC storm event, the short duration intense rain falls is causing minor above ground flooding equating to less than 10mm of depth. This will quickly dissipate after the storm has passed.

Roads

- The proposed surface water strategy for the new development is to utilise infiltration through the use of swales. Flow from roads will flow through gaps in the kerb lines in to the Swales to remove the need for gulley's which would make the system too deep. The swales will be at a depth of 300mm with the side slopes of 1in 3. The swales have been sized to accommodate and treat the flows up to and including 1 in 100 yr. plus 40% CC storm event.

Summary

- The surface water drainage layout and detailed drainage calculations utilising Infodrainage (Innovyze updated product to Microdrainage) is provided in Appendices, at the rear of this report.
- It should be noted that the design of the drainage system is reliant on above ground conveyance to the infiltration features. As such, there is very limited piped network conveying the surface water.

Designing for Exceedance

- The proposed site levels are to provide a slope away from the proposed building. The proposed site levels are also to be designed in such a way that any exceedance flows across the site into the soft areas or to mimic existing flow paths. This will not cause an increase in risk to people or property.

3.3. SuDS Maintenance management & Maintenance plan

To ensure the long-term performance of the proposed DS, the on-site drainage system will be owned and maintained by the site operator or a maintenance company (MC) in accordance with the indicative schedule below:

ELEMENT / DRAINAGE COMPONENT	OWNERSHIP	MAINTENANCE REQUIREMENTS
Geocellular Infiltration Tank	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods, ensuring no solid material passes through outlet. Monitored for general condition of the tank and system generally, to suit manufacturer's guidance, check for leaks and displacement of cells. Inspection annually and before / after extreme storm events.
Catchpit Manholes	Site Operator / MC	To be monitored for silt build-up and cleaned as required using suction methods. Inspection annually and before / after extreme storm events.
Swales	Site Operator / MC	Clearance of litter and trash. Inlet and outlet clearing. Vegetation management as required to ensure weeds and invasive plants are controlled. Inspection annually and before / after extreme storm events.
Water Butts	Site Operator/MC	Clearance of leaves / debris from guttering and hopper inlets. Inspection annually and before / after extreme storm events.
Permeable paving	Site Operator / MC	Non-aggressive brushing of the whole surface (avoiding disruption of the jointing material, with suction rates adjusted, based on a trial), either manually or mechanically carried out annually. Top up of the gritstone may be required after cleaning. Weed control – excessive weed growth can be managed by localised spot-treatment with weed killers, in accordance with suppliers' recommendations. Inspection annually.
Rain Water Pipes	Site Operator / MC	Clearance of leaves / debris from guttering and hopper inlets. Rodding points provided to clear blockages via conventional rodding methods. Inspection annually and before / after extreme storm events.
Soil Vent Piles / "Stub Stacks"	Site Operator / MC	Rodding points to be provided to clear blockages via conventional rodding methods.

		Inspection annually.
Gullies (Internal & External)	Site Operator / MC	To be monitored for silt build-up and cleaned as required. Where provided, ensure air traps are primed and sealed to prevent smells. Inspection quarterly.
Surface Water Drainage Channels	Site Operator / MC	To be monitored and cleaned via jetting when any debris / silt reduces the cross-sectional area by 25% or more. Inspection to include both the channel and silt trap / gulley outlets. Inspection annually and before / after extreme storm events.
Below Ground Pipework Generally	Site Operator / MC	To be inspected for reduction in cross-sectional area (i.e. due to blockage, silt or debris build-up, root ingress etc) general condition of materials, pipe displacement and the like. Inspection annually and where appropriate before / after extreme storm events.
Manholes / Inspection Chambers Generally	Site Operator / MC	To be inspected for debris and integrity of chambers and covers generally. Inspection annually and where appropriate before / after extreme storm events.

APPENDIX A

Flood Risk Assessment

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Resilience and Flood Risk

Bicester Airfield, Bicester, OX26 5HA

FLOOD RISK ASSESSMENT

14/12/2016
Version 1.0
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Revision History

Version	Date	Amendments	Issued to
1.0	Dec 16		Oliver Bannister

Quality Control

Action	Signature	Date
Prepared	Alex Cartwright BSc (Hons) Msc Matt Tandy AMInsLM	09/12/2016
Checked	Matt Tandy AMInsLM	12/12/2016
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Contents

1.0 Introduction

RAB Consultants has prepared this Flood Risk Assessment (FRA) in support of the proposed hotel with associated corporate and leisure facilities at Bicester Airfield, Bicester, OX26 5HA.

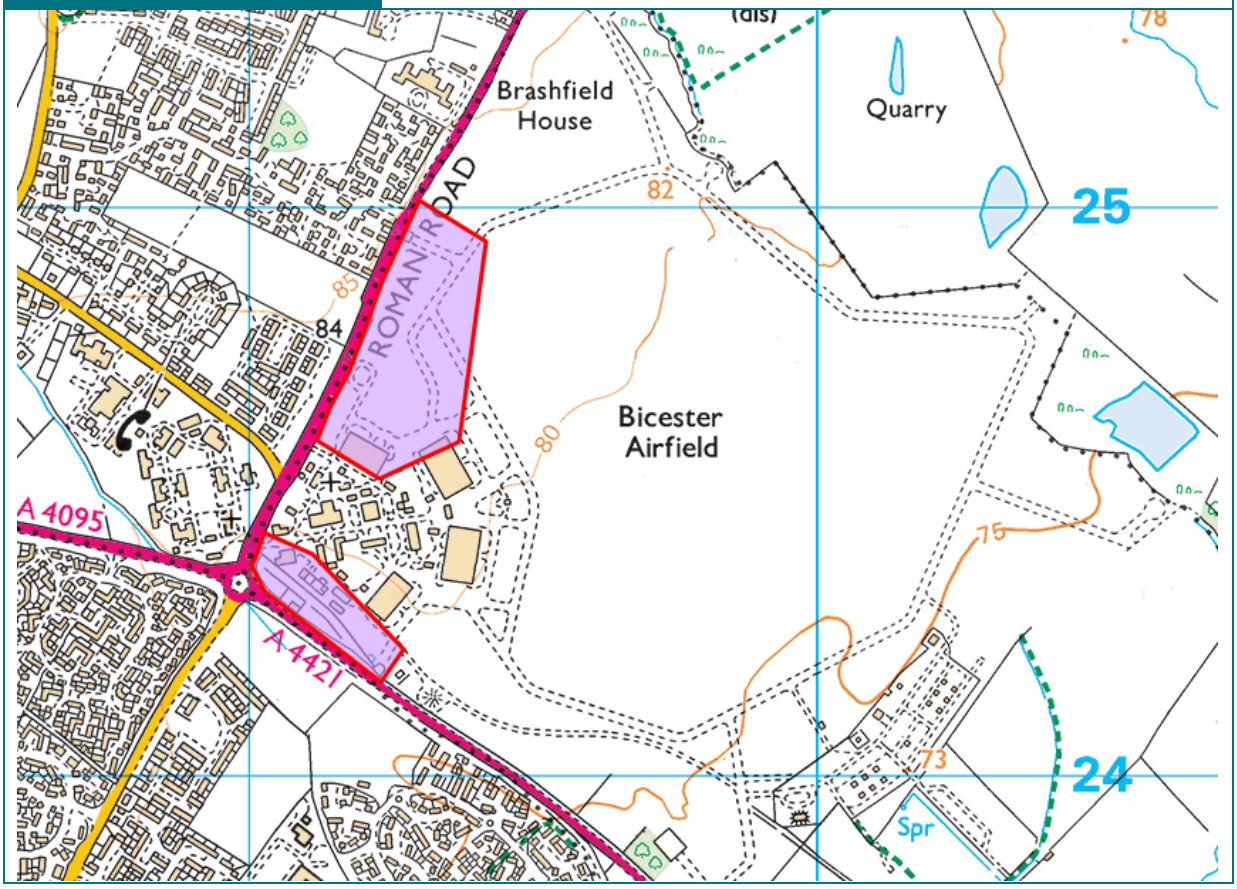
The development site is located in Flood Zone 1 according to the Environment Agency's Flood Map for Planning. The Planning Practice Guidance (PPG) for the National Planning Policy Framework (NPPF) requires a site specific FRA to be carried out for developments located in Flood Zones 2 & 3 and for those which are 1 hectare (ha) or greater in size. A site specific FRA is required to ensure that the development is safe from flooding and will not increase the risk of flooding elsewhere.

2.0 Site Details

2.1 Site Location

TABLE 1: SITE LOCATION

Site Address:	Bicester Airfield, Bicester, OX26 5HA
Existing land use:	Airfield
OS NGR:	459240, 224181
Local Planning Authority:	Cherwell District Council



2.2 Site Description

A site visit was undertaken by RAB Consultants on 12th August 2016, involving a photographic survey and visual assessment of the existing site and surrounding area, on a clear and sunny day. The site is located within Bicester Airfield which is an old RAF airbase situated in the north of Bicester. It shares its western and southern boundary with the A4421 (Figure 1, Figure 2) and the site benefits from three clear access points (Figure 3). The developable area to the west consists of a large grassed area along with sections of the taxiway, currently used as a recreational motorsport track (Figure 4), and an airfield hanger.

The smaller developable area to the south has some grassed areas (Figure 5) and a number of existing buildings (Figure 6). There is a historic carriageway running perpendicular to the A4421 for approximately 200m, which has become unused and overgrown (Figure 7).

The operations manager for Bicester Heritage explained the site benefits from good infiltration and the majority of the airfield is drained to ground. This is supported by the Elm Farm Quarry to the north which is thought to have mined limestone previously. The operations manager also explained that the Ministry of Defence included a combined sewer network within the site which is thought to be utilised by the existing buildings. An access lid for a Klargester was noted within the airfield although not within the proposed developable areas (Figure 10). A well-defined ditch was observed along the southern boundary of the airfield (Figure 9). This is thought to eventually discharge to Langford Brook approximately 1.35km downstream. The upstream channel was grassed and showing signs of having not received fluvial water for some time (Figure 8).

FIGURE 1: SOUTHERN BOUNDARY OF THE SITE

FIGURE 2: WESTERN BOUNDARY OF THE SITE

FIGURE 3: EXISTING ACCESS TO BICESTER AIRFIELD

FIGURE 4: VIEW OF THE DEVELOPABLE AREA TO THE WEST

FIGURE 5: VIEW OF THE DEVELOPABLE AREA TO THE SOUTH

FIGURE 6: AN EXAMPLE OF THE EXISTING BUILDINGS

FIGURE 7: VIEW OF THE HISTORIC CARRIAGEWAY ALONG THE SOUTHERN BOUNDARY

FIGURE 8: UPSTREAM CHANNEL AND CULVERT HEADWALL

FIGURE 9: VIEW OF THE WELL-DEFINED CHANNEL ALONG THE SOUTHERN BOUNDARY

FIGURE 10: EXISTING KLARGESTER UTILISED FOR FOUL WATER

2.3 Development Proposal

The proposed development comprises of a 300-room hotel with associated restaurant, kitchen, lounge, bar and reception areas. This will be complemented with a circa 2,800m^2 conference centre and circa 1,000m^2 leisure facilities. The external grounds will include car parking, utility plant rooms and outbuildings.

3.0 Flood Risk

3.1 Sequential Test

According to the Environment Agency's Flood Map for Planning the site lies in Flood Zone 1; which is land assessed as having less than 0.1% AEP (1 in 1,000 year) of fluvial or tidal flooding.

The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering all new development to the lowest flood risk areas. NPPF PPG Table 2 confirms the 'Flood risk vulnerability classification' of a site, depending upon the proposed usage. This classification is subsequently applied to Table 3 'Flood risk vulnerability and flood zone compatibility' to determine whether:

- The proposed development is suitable for the flood zone in which it is located; and
- Whether an Exception Test is required for the proposed development.

The proposed development is classed as a *'more vulnerable'* development in accordance with NPPF PPG; therefore, it is appropriate for the Flood Zone.

3.2 Flooding History

No historic flooding has been recorded within the Cherwell District Council Strategic Flood Risk Assessment (SFRA) for the site or surrounding area of northeast Bicester (SFRA, 2009: Appendix B-7). A robust internet search has revealed that flooding has been limited to the southern reaches of the Langford Brook floodplain within Bicester. The Langford Brook is located over 1km east of the site, and roughly 10m lower.

Sewer flooding is often caused by excess surface water entering the drainage network causing sewers to surcharge. Thames Water, who are responsible for the management of urban drainage and sewerage within the Borough, maintain a DG5 register of sites affected by sewer flood incidents on a post code basis. According to the Cherwell SFRA, the site has not been affected by sewer flooding due to failure or capacity issues. It is important to note that previous sewer flood incidents, or the lack thereof, do not indicate the current or future risk to the site. Upgrade work could have been carried out to alleviate any issues or conversely, in areas that have not experienced sewer flooding incidents, the local drainage infrastructure could deteriorate leading to future flooding.

3.3 Fluvial (Rivers)

The Environment Agency online Flood Map identifies the site outside the 0.1% AEP flood extent associated with the Langford Brook. Furthermore, according to the contours from the OS mapping, the site is approximately 10m above the Langford Brook. This natural topography provides protection to the airfield and the majority of Bicester and surrounding land would flood before the proposed development sites.

On the basis of these findings it can be determined the site is not at risk of fluvial flooding.

3.4 Coastal/Tidal

The site is a considerable distance from the sea and therefore is not currently identified at risk of coastal or tidal flooding.

3.5 Pluvial (Surface water)

When the infiltration capacity of land or the drainage capacity of a local sewer network is exceeded, excess rainwater flows overland. This water will collect in topographic depressions and at obstructions, which can inundate development in low lying areas. The severity of the rainfall event, the degree of saturation of the soil before the event, the permeability of soils and geology, and the gradient of the surrounding land and it's use; all contribute to and affect the severity of overland flow.

The Environment Agency Flood Map for Surface Water (Figure 11), can be used to see the approximate areas that would experience surface water flooding from a range of AEPs, which is used to categorise the risk (Table 2).

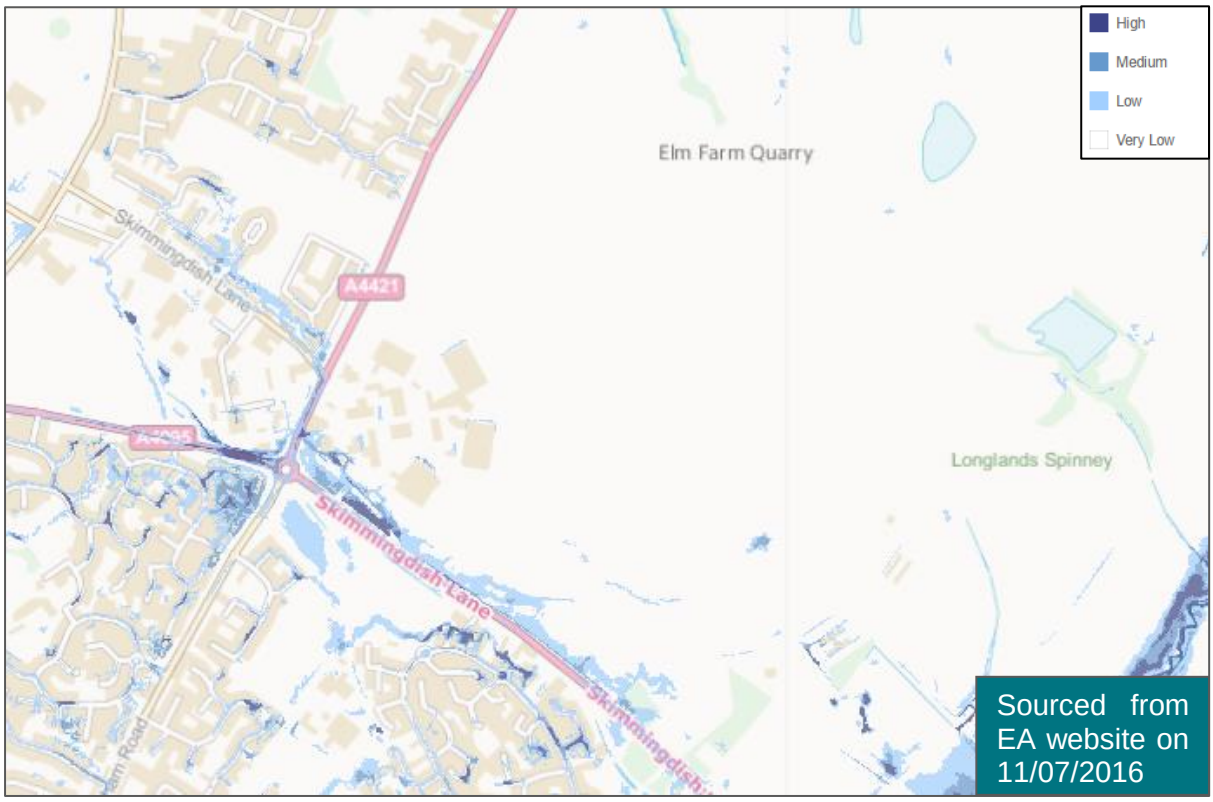


FIGURE 11: ENVIRONMENT AGENCY SURFACE WATER MAP

TABLE 2: ENVIRONMENT AGENCY SURFACE WATER RISK CATEGORIES

Surface Water Risk Category	Surface water flooding Annual Exceedance Probability
Very Low	< 0.1%
Low	Between 1% and 0.1% (1 in 100 years and 1 in 1000 years)
Medium	Between 1% and 3.3% (1 in 100 years and 1 in 30 years)
High	> 3.3% (1 in 30 years)

The surface water maps identify that there is a very low risk of surface water flooding for the majority of the airfield. The northern side of Skimmingdish Lane has been identified as medium to high risk, which is within the boundary of the proposed south site (Figure 12). Within this area is a well-defined ditch which probably provides conveyance for upstream catchments to the west. This water is likely to be making its way towards the Langford Brook. There is also a flowpath identified from the A4421 to the north west, through the site towards the ditch along the southern boundary. It appears to use the historic carriageway as the flow path. The south site is at medium to high risk of surface water flooding.

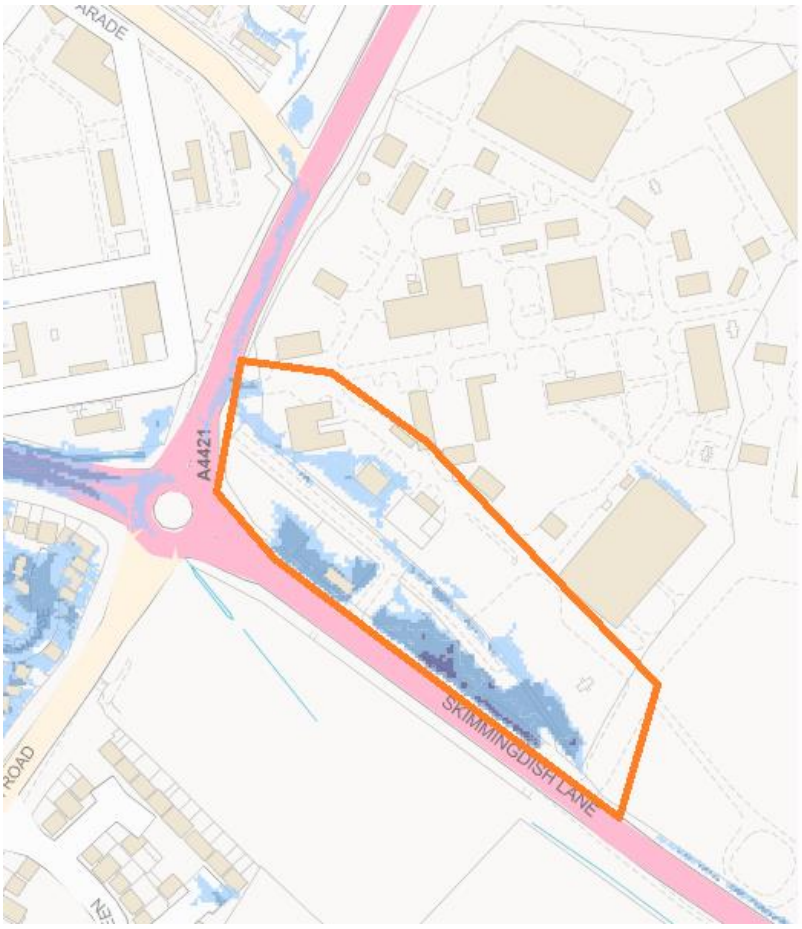


FIGURE 12: ENVIRONMENT AGENCY 1% AEP SURFACE WATER MAP FOR THE SOUTHERN AREA

3.6 Artificial Water Bodies

The site is not identified as being at risk of reservoir flooding from the Environment Agency Reservoir Flood Map. The site is located a considerable distance from any canal and therefore not currently at risk from flooding from this source.

3.7 Groundwater

British Geological Survey (BGS) records indicate that the majority of the proposed development site overlies bedrock composed of Cornbrash Formation – Limestone. The south eastern corner of the site is composed of Forest Marble Formation - Limestone and Mudstone. The BGS does not hold a record of superficial deposits in this area.

According to the Cherwell SFRA (2009), the northeast quadrant of Bicester, which includes the site and surrounding area, is not considered at risk from groundwater flooding. Owners of the site, along with other local members of the public did not mention issues associated with standing water during the winter months. Furthermore, from visiting the site there were no signs of water loving fauna indicative with land exposed to water for prolonged periods. The site is located within the wider slope of the valley, and as such any emerging groundwater would flow under gravity to the east, resulting in minimal flood levels if groundwater did emerge. Both the north and south proposed sites are within a ‘Minor aquifer high’ according to the Environment Agency’s groundwater vulnerability zone mapping.

Groundwater flooding usually occurs following a prolonged period of low intensity rainfall and although the risk is low, it is still a possibility. The future risk from this source is uncertain as climate change predictions indicate that although sea levels will rise, thus possibly raising groundwater levels, and overall summer rainfall will decrease, thus having a long-term effect of lowering the groundwater levels. Long periods of wet weather however are predicted to increase: these are the type of weather patterns that can cause groundwater flooding to occur. On the basis of these findings, the risk of groundwater flooding is understood to be low.

4.0 Mitigation Measures

4.1 Risk to Buildings

4.1.1. Finished Floor Levels

In accordance with BS8533:2011 *'Assessing and managing flood risk in development – code of practice'*, in order to afford a level of protection against flooding it is recommended that finished floor levels should be set at a nominal 300mm above either the 1% AEP of fluvial flooding or the 0.5% AEP of tidal flooding depending on which is greater (both including climate change).

The site is located outside of the 0.1% AEP of fluvial and tidal flooding, with a low risk associated with groundwater. As such surface water risk and infrastructure failure is considered most notable risk to mitigate from. The surface water risk is largely constrained to the topographic low area along the southern boundary where a well-defined, existing ditch is present. The remainder of the two proposed sites areas appear to be largely unaffected.

Industry best practice suggests setting floor levels 150mm above ground level to offer a level of protection against these sources of flooding.

4.2 Risk to Occupiers

4.2.1. Safe Access/Egress

According to PPG NPPF, safe access and egress should be contemplated at this stage in order to ensure that the occupants will be able to leave the property safely in the event of extreme flooding. The site is located outside the area at risk from fluvial flooding and has a low risk associated with groundwater and surface water flooding for the majority of the. During all flood events safe access and egress can be achieved from A4421, in accordance with BS 8533:2011. Access and egress routes would be restricted along the southern boundary due to the surface water risk identified.

4.3 Risk to Others

The proposed development is outside of the 0.1% AEP therefore does not reduce the available floodplain volume. Furthermore, any increase in impermeable area will be mitigated through the surface water drainage strategy.

4.3.1. Existing Flow Path

There is a surface water flow path identified within the site boundary, north of Skimmerdish Lane. The development proposals will need to include an opportunity for this flow path to pass through the site. An option could include its collection and the conveyance along the site's boundary before discharging to the existing ditch.

4.3.2. Surface Water Storage

The site currently provides storage for surface water between the southern boundary and the historic carriageway, as identified by the Environment Agency's Flood Map for Surface Water (Figure 12). Constructing buildings or raising land levels within this flood extent could reduce the available surface water storage and increase the risk of flooding off-site. Development should be steered away from this area unless a scheme to mitigate any impact is incorporated into the final design.

5.0 Surface Water Drainage Strategy

5.1 Existing Surface Water Drainage Arrangements

The operations manager for Bicester Heritage explained the site benefits from good infiltration and the majority of the airfield is drained to ground. The operations manager also explained that the Ministry of Defence included a combined sewer network within the site which is thought to be utilised by the existing buildings for surface and foul water discharge. An access lid for a Klargester was noted within the airfield although not within the proposed development areas.

The existing flow paths for the two proposed development sites generally fall from north west to south east (Figure 13, Figure 14

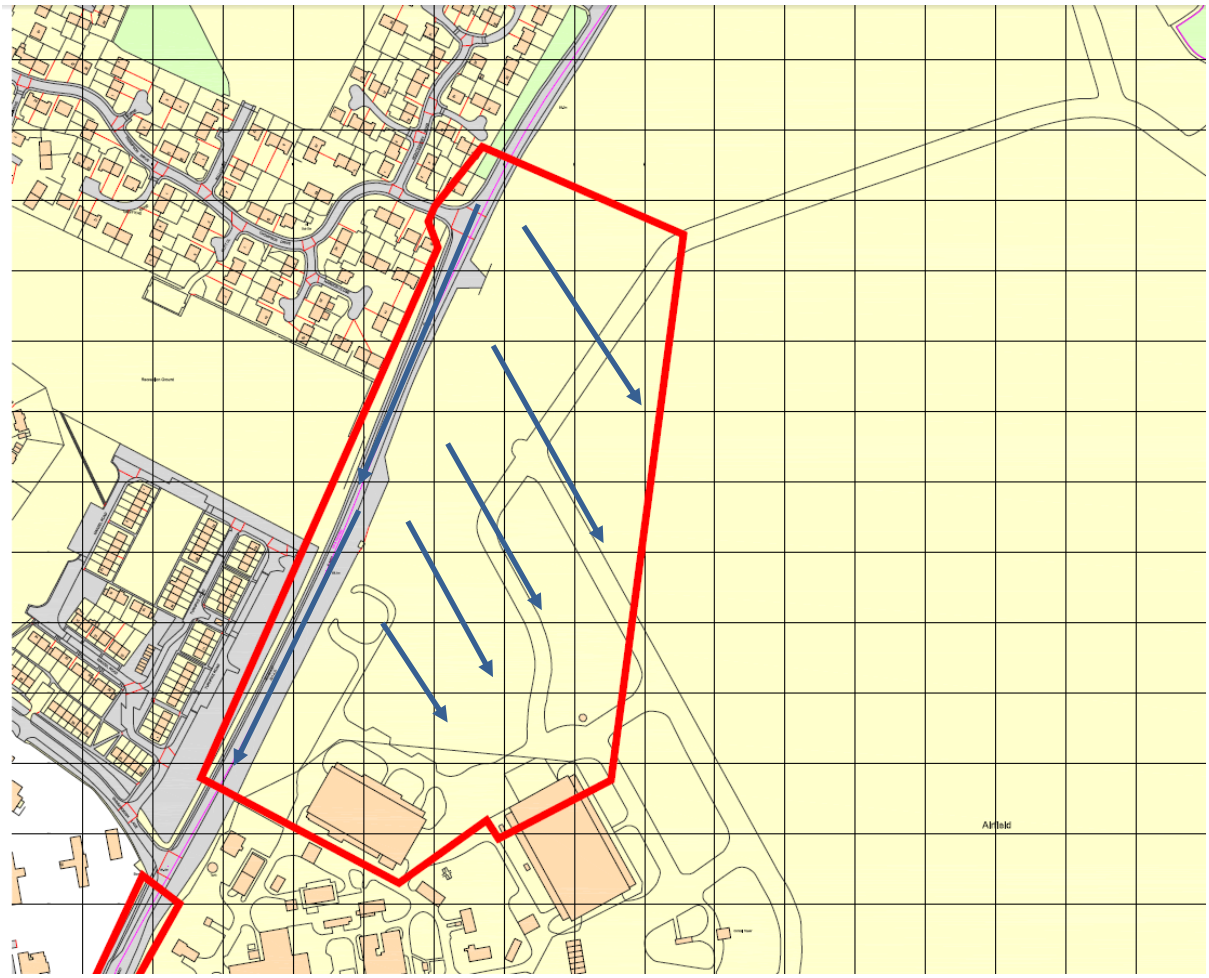


FIGURE 13: EXISTING FLOW PATHS OF WESTERN DEVELOPMENT SITE

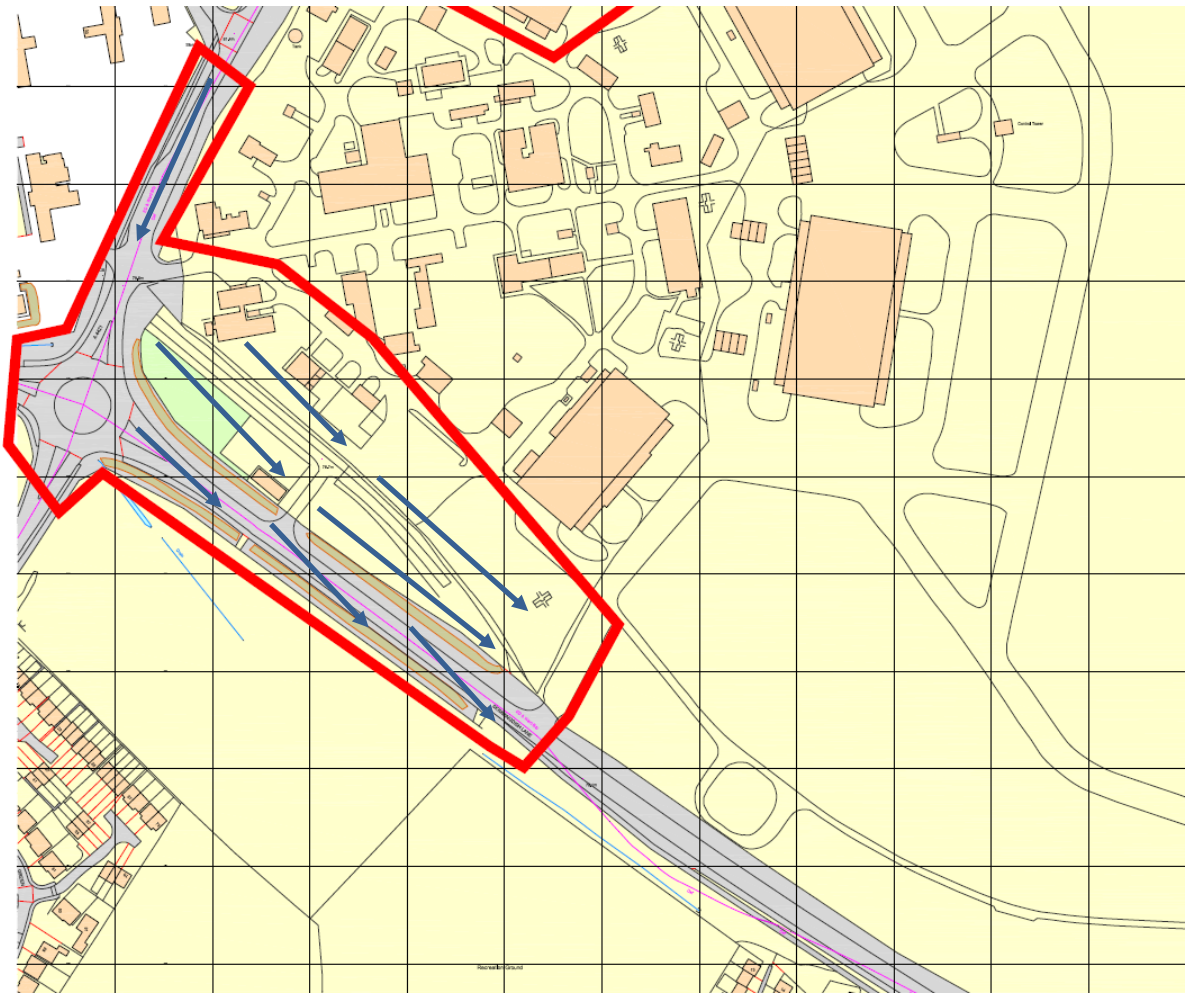


FIGURE 14: EXISTING FLOW PATHS FOR THE SOUTHERN DEVELOPMENT SITE

5.2 Local Policy

Cherwell District Council's local plan for 2011-2031 details their requirements in relations to Sustainable Drainage Systems (SuDS). Policy ESD 7 states;

"All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off. 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 groundwater quality must be taken into account, especially where infiltration techniques are proposed."

"SuDS seek to manage surface water as close to its source as possible, mimicking surface water flows arising from the site prior to the proposed development."

"In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed."

"Highways SuDS will be adopted by Oxfordshire County Council but must be located on the most appropriate land, requiring consideration of the need to provide access for maintenance purposes, and topographical factors."

5.3 SuDS Feasibility

The development provides an opportunity to incorporate Sustainable Drainage Systems (SuDS) to ensure there is no increased flood risk off-site to third parties as a result of the development.

The SuDS Manual (2015), discusses the SuDS approach to managing surface water runoff which is intended to mimic the natural catchment process as closely as is possible. The approach sets out the design objectives in respect of SuDS:

- Use of surface water runoff as a resource;
- Manage rainwater close to where it falls (at source);
- Manage runoff on the surface (above ground);
- Allow rainwater to soak into the ground (infiltration);
- Promote evapotranspiration;
- Slow and store runoff to mimic natural runoff rates and volumes;
- Reduce contamination of runoff through pollution prevention and by controlling the runoff at source; and
- Treat runoff to reduce the risk of urban contaminants causing environmental pollution

Depending on the characteristics of the site and local requirements, these may be used in conjunction and varying degrees. Table 3 present the functions of the SuDS components (management train) and their feasibility in respect of the site.

TABLE 3: FEASIBILITY OF SUDS TECHNIQUES AT THE DEVELOPMENT SITE

Technique	Description	Feasibility Y / N / M (Maybe)
Good building design and rainwater harvesting	Components that capture rainwater and facilitate its use within the building or local environment.	Yes.
Porous and pervious surface materials	Structural surfaces that allow water to penetrate, thus reducing the proportion of runoff that is conveyed to the drainage system (green roofs, pervious paving).	Yes, green/biodiversity roofs are dependent upon a non-pitched roof design. Pervious surfaces may suitable for the car parks and access roads where their use is low.
Infiltration Systems	Components that facilitate the infiltration of water into the ground. These often include temporary storage zones to accommodate runoff volumes before slow release to the soil.	Maybe. Local reports and BGS geology map suggests the site is underlay by limestone. Infiltration tests need to be undertaken to confirm the rate of infiltration.
Conveyance Systems	Components that convey flows to downstream storage systems (e.g. swales, watercourses).	Yes.
Storage Systems	Components that control the flows and, where possible, volumes of runoff being discharged from the site, by storing water and releasing it slowly (attenuation). These systems may also provide further treatment of the runoff (eg ponds, wetlands, and detention basins).	Yes, above ground storage should be promoted where possible.
Treatment Systems	Components that remove or facilitate the degradation of contaminants present in the runoff.	Yes, surface water should receive multiple treatments, in line with the SuDS Manual 2015, particularly where infiltration systems are to be used.

5.4 Conceptual Surface Water Drainage Strategy

It would appear that infiltration is likely to be feasible as the BGS geology map identifies the site being underlay by limestone, which typically provides good drainage properties. An infiltration test to BRE 365 should be undertaken to ensure the rate of infiltration is a minimum of 10^{-6}m/s. A storage system should be designed based on the infiltration rate identified. This could include infiltration ponds, wetlands or storage within a soakaway sub-base. Above ground storage will need to consider the wider use of the airfield. Permanent waterbodies can invite birds to the area which may present a risk to aviation vehicles and tier users.

Access roads and carpark areas could have an elevated surface towards a filter strip and then a filter drain before infiltrating to ground. The buildings roofs could incorporate a green/biodiversity roof to reduce annual average runoff or a rainwater harvesting system to use the collected water as a resource.

SuDS features designed for managing ground level surface runoff, will need to include appropriate mitigation of the pollution associated with the proposed land use, before infiltrating. This will present an opportunity to promote improved water quality.

Should infiltration be found unfeasible, the surface water could be discharged to the ditch along the southern boundary of the airfield. This should be at a controlled rate, as identified in Section 5.4.1, to ensure the risk from flooding off-site is not increased. This can be achieved by using a control structure such as an orifice plate or hydro-brake. Above ground conveyance systems, such as swales and ditches, should be considered before below ground (piped) systems.

5.4.1. Greenfield Runoff Rate and Volume

In accordance with the NPPF, the development must not increase the risk from flooding to others. The Greenfield runoff rate and volume is calculated to identify the existing discharge characteristics, which the development proposal must mimic to ensure this risk is adequately managed. The pre-development runoff rate was calculated (Appendix C) on a 1ha basis. Using the IH124 method for determining Greenfield runoff rate built into Microdrainage WinDes 2013.1 (including the modification given in the *Interim Code of Practice for SUDS, Chapter 6)*:

- AREA = 1ha
- SAAR = 678mm (obtained from WinDes 2013.1 built in FSR map)
- SPR = 30
- Soil = 0.15
- Pre-development QBAR = 0.4 l/s/ha
- Pre-development peak flow with 100% AEP (1 in 1 year) = 0.3 l/s/ha
- Pre-development Peak flow with 3.33% AEP (1 in 30 year) = 0.8 l/s/ha
- Pre-development Peak flow with 1% AEP (1 in 100 year) = 1 l/s/ha

- Pre-development Peak flow with 1% AEP (1 in 100 year) plus 40% climate change = 1.4 l/s/ha

Using the FSR method to determine rainfall and FSSR 16 fixed percentage runoff model for volume (Greenfield runoff volume analysis module built into Microdrainage WinDes 2013.1; Appendix B):

- M5_60 = 20.000mm
- Ratio R = 0.409
- CWI = 101
- Return period = 1% AEP (1 in 100 year)
- Storm duration = 360 minutes
- Area = 1ha
- PR% = 7.92%
- Pre-development Greenfield runoff volume = 49.09m^3/ha

The QBAR runoff rate for this site is low due to the soil characteristics and the potential for infiltration. Based on a controlled discharge rate of 0.4l/s/ha, between 753m^3 and 906m^3 of storage will be required per hectare of impermeable area. This has been estimated using the quick storage estimate function within Microdrainage (Appendix B).

Depending on the final site choice and developable area, 0.4l/s/ha may not be achievable due to feasibility of incorporating such a flow control device. Should this be the case and infiltration also proven unfeasible, the minimum recommended discharge rate for the whole site is 5l/s due to the risk of blockage to pipework associated with lower rates.

6.0 Conclusion

The proposed development at Bicester Airfield, Bicester, OX26 5HA; is located in Flood Zone 1 as defined in the NPPF. The proposal includes the development of a 300-room hotel with associated restaurant, kitchen, lounge, bar and reception areas. This will be complemented with a circa 2,800m^2 conference centre and circa 1,000m^2 leisure facilities.

On the basis of the available information from the Environment Agency and Cherwell District Council, the site is not identified at risk of flooding associated with fluvial, tidal or groundwater. There is a surface water risk within the south site and development should either be steered away from this area or use it as an opportunity to better manage the risk. Given the level of flood risk to the other areas, industry best practice suggests setting floor levels 150mm above the existing external level to offer a level of protection against these sources.

The proposed development can provide safe, dry access and egress during an extreme flood event. Access and egress along the southern boundary would be challenged due to the surface water risk.

There is a surface water flowpath within the south site which will need to be maintained. Incorporating a conveyance channel along the south west boundary before discharging to the existing ditch would provide this opportunity.

Surface water runoff from the proposed development should be managed using techniques outlined in the conceptual drainage strategy and feasible SuDS identified in Section 0. The local geology suggests there is a high potential for infiltration however this will need to be confirmed with an infiltration test to BRE 365. Should the results of this test be unfavourable, there is a ditch along the southern boundary which could be used to discharge the surface water from the proposed development. The mean greenfield annual runoff rate for the site is 0.4l/s/ha. Based on a controlled discharge rate of 0.4l/s, between 753m^3 and 906m^3 of storage will be required per hectare of impermeable area.

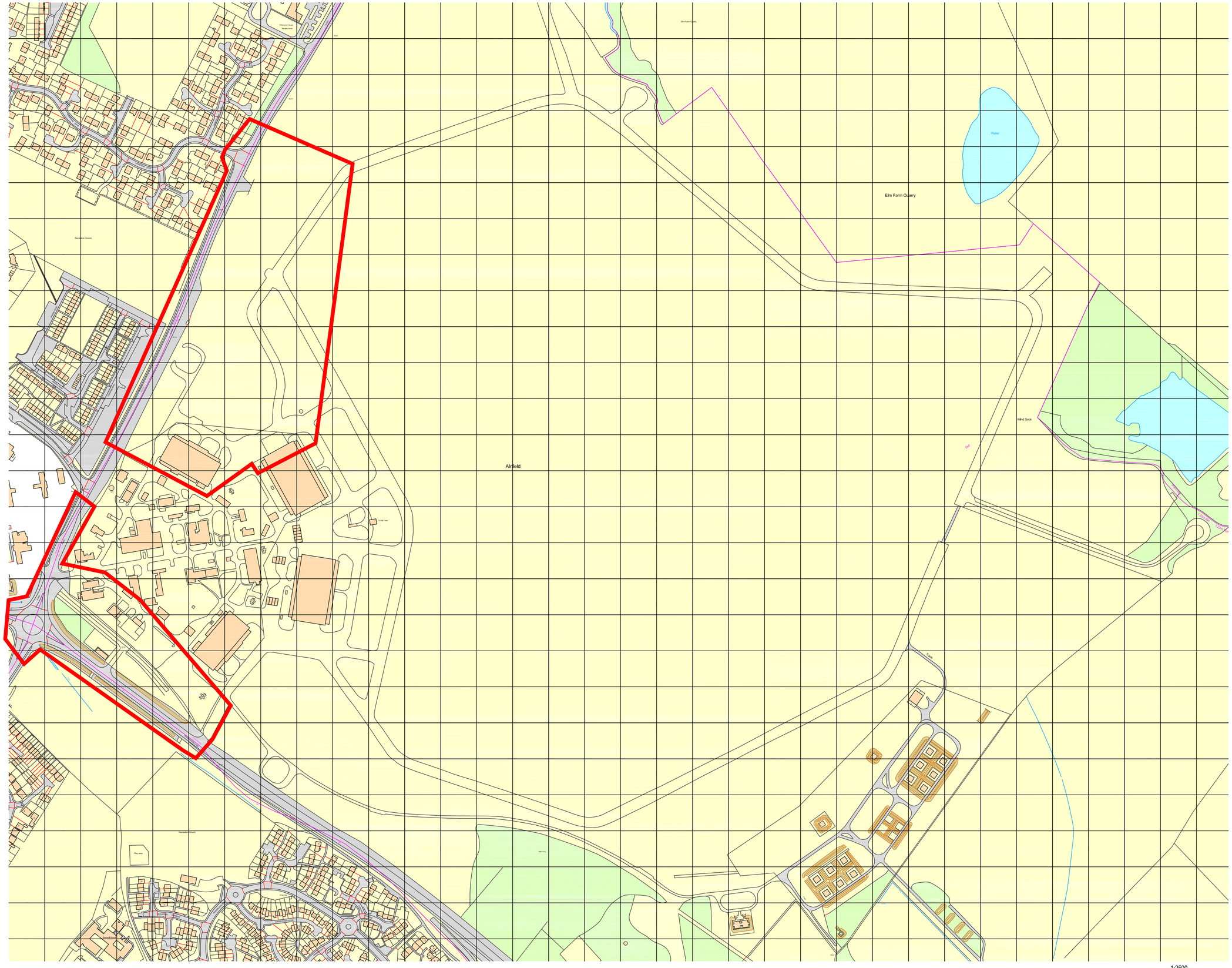
Depending on the final site choice and developable area, 0.4l/s/ha may not be achievable due to feasibility of incorporating such a flow control device. Should this be the case and infiltration also proven unfeasible, the minimum recommended discharge rate for the whole site is 5l/s due to the risk of blockage to pipework associated with lower rates.

It can be concluded that, providing the recommendations in this assessment are adhered to, the proposed residential property will be safe from flooding hazards, not impede the path of flood water, and it will remain safe for its lifetime while not increasing flood risk elsewhere.

7.0 Recommendations

- It is recommended that finished ground floor levels are set 150mm above the external ground level.
- The risk of surface water flooding to the south site will need to be addressed within the design of the scheme. Development should either be steered away from this area or use this as an opportunity to reduce the risk of surface water flooding by providing more efficient drainage features and ensuring that any new proposals do not increase the risk of flooding to others. It is therefore recommended that a detailed study to manage surface water is undertaken.
- A detailed drainage strategy should be developed alongside the proposals for the site. This should be informed by this conceptual strategy and incorporate SuDS identified in Section 5.0.
- Prior to detailed design and submission of a planning application, infiltration tests to BRE Digest 365 must be undertaken to ascertain the infiltration rate of the soil to determine the suitability of infiltration SuDS and inform the design of SuDS features.

Appendix A – Development Proposals



NOTES:

1. DO NOT SCALE
2. DRAWINGS TO BE READ IN CONJUNCTION WITH ALL SERVICES AND STRUCTURAL ENGINEERS DRAWINGS & SPECIFICATIONS.
3. © COPYRIGHT. DRAWINGS NOT TO BE REPRODUCED OR USED WITHOUT PRIOR WRITTEN CONSENT.

N

REF	DATE	REVISION	DRAWN	CHECKED
-	-	-	-	-

SCALE @A1	DATE	DRAWN BY	CHECKED BY
1:2500	FEB 14	TH	RT

DRAWING

LOCATION PLAN

PROJECT

CLIENT

RIDGE

THE COWYARDS
BLENHEIM PARK
OXFORD ROAD
WOODSTOCK
OX20 1QR

TEL: 01993 815000
FAX: 01993 815001
www.ridge.co.uk

DRG NO 122063-A-001

REV

FILE REFERENCE:

XREF FILE REFERENCE:

1:2500
0 20 40 60 80 100M

Design Brief
Project Heritage

50 x 4 star deluxe rooms

Parking immediately outside (of at least ½ of the rooms)
Parking to include electric supply for trickle charging and EV's
Covered canopies to bays – could be retractable

4 x Suites with en-suite, c60sqm in total
Remainder to be feature rooms i.e. airfield view, balcony/patio etc. all en-suite, c36sqm in total
Of which 10 to be twin (but can zip link Queen size double) and 36 to be Queen size double

Welcome/check in area
Public area toilets
Small bar, cellar, bar area c40 covers
Car feature – may be workshop, small museum etc. TBC
Linen room and storage
Connected to the main hotel if possible
3 story inc. ground.
Relevant % of accessible rooms from total bed stock

50 x 3star, lodge rooms

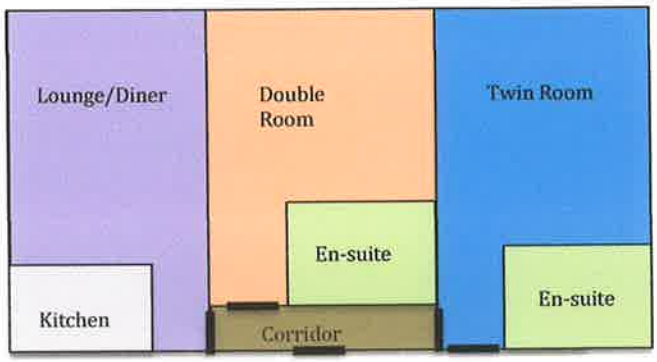
c26sqm in total
50 x King size double, plus single bed and en-suite
Parking close by if possible
Linen room and storage
No bars, food service or public toilets
No requirement to be connected to the hotel
3 story inc. ground
Relevant % of accessible rooms from total bed stock

50 x Self-catering apartment rooms

25 x 2 bedroomed apartments
Each apartment to be:

- 1 x lounge/kitchen/diner, c28sqm
- King size double room with en-suite c24sqm
- Twin room with en-suite c28sqm
- Corridor 4sqm
- Relevant % of accessible rooms from total
- All double and twin bedrooms accessible individually and as part of the apartment so they can be sold separately

Parking nearby
Linen room and storage
No requirement to be connected to the hotel
No bars, food service or public toilets
3 story inc. ground or as individual/cluster units of 4/6 apartments



150 x 4 star hotel rooms

Min 28sqm in total
30 x zip/link twin c30sqm
120 x King size double c28sqm
Relevant % of accessible rooms from total

Parking nearby
Linen room and storage
Connected to the core hotel
3 story inc. ground

Core hotel

Reception front desk, reception area, back office, concierge, toilets c150sqm
Lounge and Bar (could be connected to Reception) c150sqm
Restaurant c500sqm
Kitchen, cellar, staff areas c700sqm

Conference centre

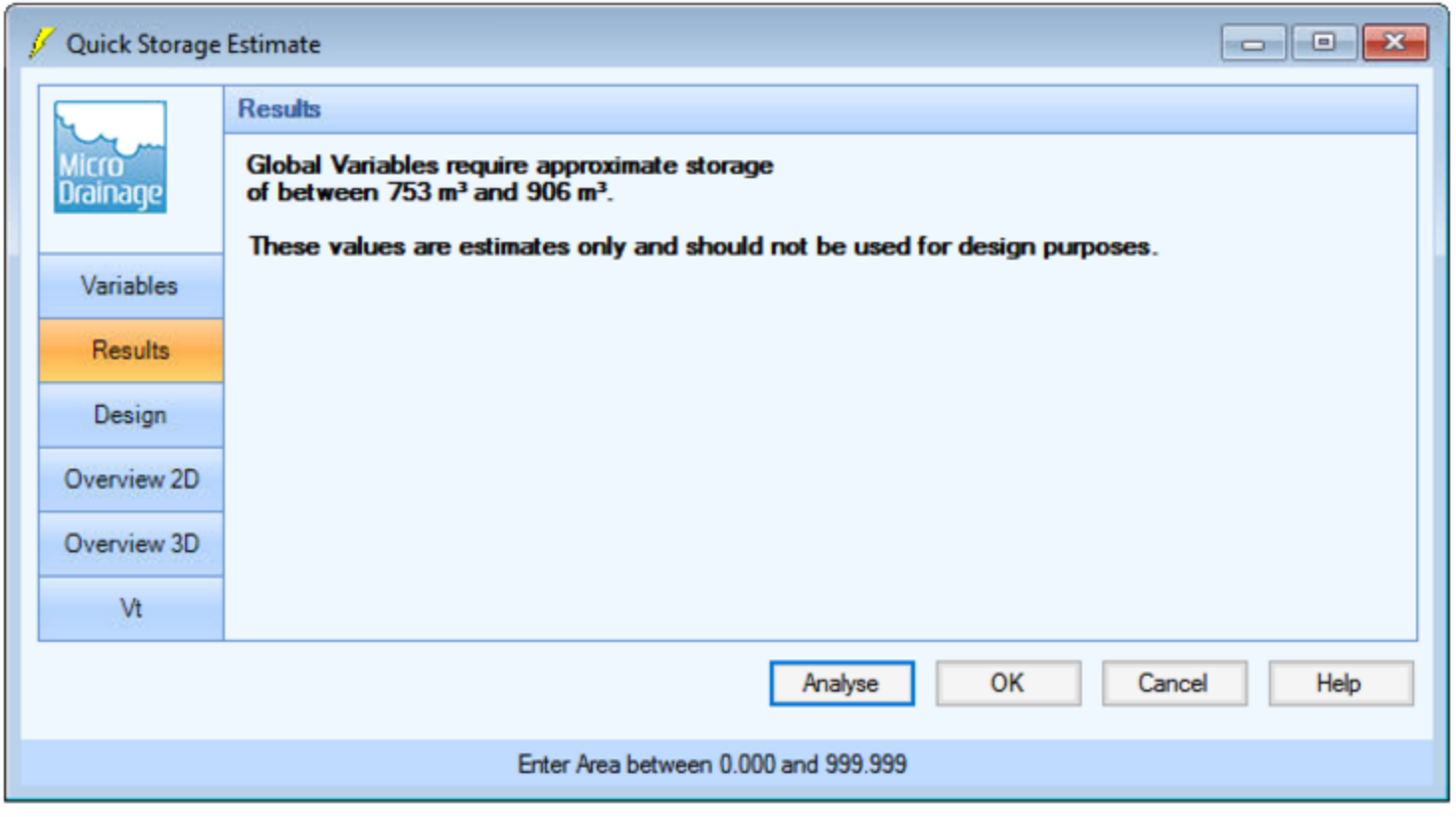
Main suite c500sqm. Sub dividable by 3 or 4
Bar, bar area, storage and welcome c300sqm
Second suite c300sqm. Sub dividable by 2 or 3
Bar, bar area, storage c200sqm
Further c1200sqm of meeting rooms ranging from 20sqm upwards
Corridors, public toilets c300sqm

Spa and leisure
Gym c200sqm

Changing areas, reception desk, storage c120sqm
Pool hall c200sqm (pool c120sqm)
Pool plant c30sqm
10 x treatment rooms, relax lounge, waiting area, nail bar c200sqm

External
Grounds, parking x 500 spaces, utility supplies, outbuildings

Appendix B – MicroDrainage Calculations


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 753 m³ and 906 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Area between 0.000 and 999.999

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.150
Area (ha)	1.000	Urban	0.000
SAAR (mm)	678	Region Number	Region 4

Results l/s

QBAR Rural	0.4
QBAR Urban	0.4
Q100 years	1.0
Q1 year	0.3
Q30 years	0.8
Q100 years	1.0

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.409
Areal Reduction Factor	1.00
Area (ha)	1.000
SAAR (mm)	678
CWI	101.040
Urban	0.000
SPR	10.000

APPENDIX B

Drainage Strategy

AKSWard®

CONSTRUCTION CONSULTANTS

Bicester Heritage Hotel

Drainage Strategy and Water Quality Management Report

BHH-AKSW-XX-XX-RP-C-0003

Prepared for

Bicester Heritage

July 2018

Job №: X162034

Seacourt Tower West Way Oxford OX2 0JJ
Tel: 01865 240071 Fax: 01865 248006
consult@aksward.com www.aksward.com

LONDON • HITCHIN • OXFORD • POOLE • SOUTHAMPTON

Contents

Appendices

Revision	Amendments	Prepared By	Checked	Date
P01	Preliminary Issue	NJ	GT	29.06.18
P02	Western car park removed. Entrance updated	NJ	GT	11.07.18

1.0 Introduction

1.1 AKS Ward have been commissioned to undertake a Drainage Strategy and Water Quality Management to support the planning application for a new hotel located within Bicester Heritage land.

1.2 The development includes a new hotel building, car parking and associated external areas.

1.3 The site is in Flood Zone 1 (low risk of fluvial flooding) and is 3.34 Hectares in area with approximately 1.80 Ha served by drainage. The site is located in Bicester and is currently a greenfield site.

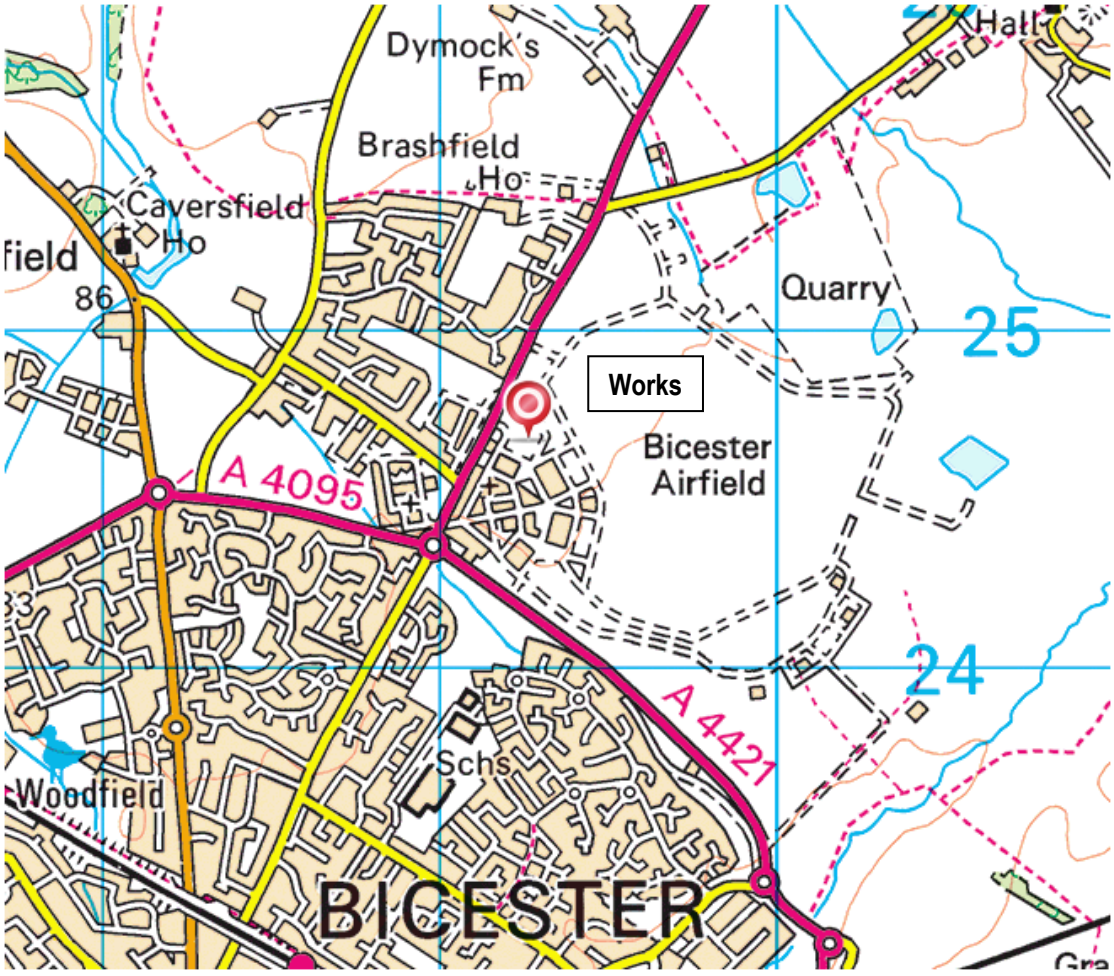
1.4 The site is bounded by hangar units to the east and south, by the A4421 road to the west and by the Bicester Airfield to the north.

1.5 This Drainage Strategy must be read in conjunction with the Flood Risk Assessment prepared for the site by RAB Consultants.

2.0 Development Site Details

2.1 Development Description & Location
The site is located at NGR SP 59258 24680.

The plans of the development are contained within Appendix C.



3.0 Site Drainage Strategy

3.1 Existing Surface Water

The site currently drains towards the southeast and infiltrates into the ground. During exceedance events when the ground is saturated, it is understood that the runoff volume would drain towards the watercourse located further southeast outside of Bicester Heritage

British Geological Survey indicates that the site is underlaid by Cornbrash Formation – Limestone. Infiltration tests were carried out within Bicester Heritage area and the results obtained were $1.43x10^{-6}$ m/s and $1.81x10^{-6}$ m/s.

Greenfield runoff rates and volumes have been calculated as follows:

Qbar:	0.7 l/s
Greenfield volume:	92.734 l/s

Existing drainage drawings are contained in Appendix A. Microdrainage calculations are contained in Appendix B

3.2 Proposed Surface Water

Surface system will be designed to agree with the National Standards for Sustainable Drainage.

Refer to drainage drawings and Microdrainage calculations in Appendix C and D. A Surface Water Pro-forma has been completed with a copy contained in Appendix E to ensure that the design is in accordance with the current SuDS requirements.

3.2.1 Runoff Destination

Due to ground conditions obtained, existing soil is considered permeable therefore infiltration as means of disposal is feasible.

Surface water drainage from the building and adjacent hard paving areas will be attenuated using a new cellular soakaway with a volume of 729.6 m^3. Soakaway has been designed using the lowest infiltration rate obtained ($1.43x10^{-6}$ m/s)

New parking areas will be drained using permeable paving. The new access road to the hotel will be drained via gullies into new swales located to both sides of the road.

3.2.2 Peak flow control

SuDS will be utilised on site in the form of permeable paving, swale and cellular soakaway. There will be no discharge flow rate from the site therefore peak runoff will not exceed the current flow rates for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event with an allowance for climate change.

3.2.3 Volume control

There is no additional discharged volume as the proposed hard paving areas and building will be drained into the permeable paving, cellular soakaway and swales therefore it will not exceed the current volume form each storm.

3.2.4 Flood risk within the development

The system has been designed in accordance with CIRIA SuDS manual with no flooding in the 30 year event and no flood water leaving the site for the 100 year + 40% climate change critical storm event.

3.2.5 Exceedance Events

In storm events exceeding the designed storm events above the 100 year + climate change the

flow of water would run towards the southeast of the site and ultimately discharge into the existing watercourse. This path is as per the existing situation

3.2.6 Structural integrity and construction
Surface system will be designed and constructed using approved materials in line with Building Regulation's and current British Standards appropriate for the location and proposed use.

3.2.7 Maintenance and operation
The drainage system will be CCTV surveyed on completion to ensure that the system is fully operational and maintenance schedules provided in the O&M manual for the owner to maintain the cellular tanks, permeable paving and swales.

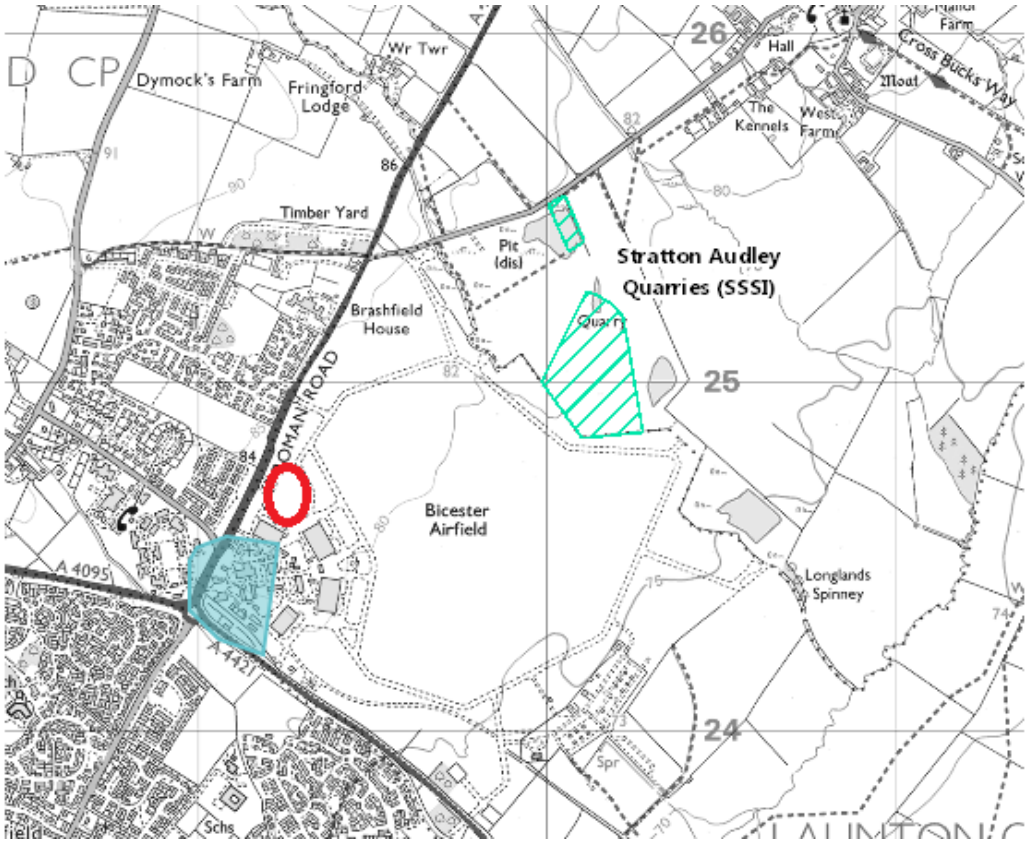
Maintenance schedules have been provided in Appendix F for the SuDS. The owner of the site will be responsible for maintaining the SuDS on site.

3.3 Existing and Proposed Foul Water.
Foul water will discharge via private pumping chamber into the existing public sewer located within the site. Connection will be on site and via direct connection to the existing public drainage system.

A Pre-development Enquiry will be submitted to Thames Water to agree the discharge flow rates from the new development.

Any new foul drainage will be connected to the public system and S106 connection applications made to Thames Water.

3.4 Stratton Audley Quarries Site of Special Scientific Interest
The proposed development is located approximately 800m from Stratton Audley Quarries, and area declared 'Site of Special Scientific Interest'.



The proposed site falls from northwest to southeast therefore it does not contribute to the hydrology of the SSSI.

4.0 Water Quality Management

The surface system will be designed in order to not affect the water quality of the receiving watercourse.

CIRIA SuDS Manual 2015 Chapter 26 assigns pollution hazard indices for different land use types and SuDS mitigation index for every SuDS component depending on where the discharge is, surface or ground water.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	0.8	0.8
Proprietary treatment systems[5, 6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

CIRIA SuDS Manual states that *'To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index that equals or exceeds the pollution hazard index'*

Total SuDS mitigation index ≥ pollution hazard index
(for each contaminant type) (for each contaminant type)

Pollution hazard indices for land use are as follows:

Roof:	TTS 0.2	Metals 0.2	Hydrocarbons 0.05
Access road & car park:	TTS 0.5	Metals 0.4	Hydrocarbons 0.4

SuDS mitigation indices are determined by the type of SuDS utilised on site. The proposal for this site a cellular tank and proprietary treatment system (vortex separator):

Permeable pavement:	TTS 0.7	Metals 0.6	Hydrocarbons 0.7
Swale:	TTS 0.5	Metals 0.6	Hydrocarbons 0.6

Catchpit manholes will be installed prior to connecting into the new cellular soakaway therefore providing additional treatment for the surface water drained from the roof which will improve the water quality further.

Appendix A

Surveys & Historic Information

Asset location search

Property Searches

AKS Ward
Seacourt Tower
West WaySeacourt Tower
OXFORD
OX2 0JJ

Search address supplied Royal Air Force
Buckingham Road
Bicester
OX26 5HA

Your reference X162034 - Bicester Heritage

Our reference ALS/ALS Standard/2018_3816510

Search date 19 June 2018

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.

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: Royal Air Force, Buckingham Road, Bicester, OX26 5HA

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

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:

SP5824SE
SP5824NE
SP5924SW
SP5924NW

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.

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:

SP5824SE
SP5824NE

Asset location search

Thames Water Property Searches

SP5924SW
SP5924NW

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.

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/2018_3816510

SP5824SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224250

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

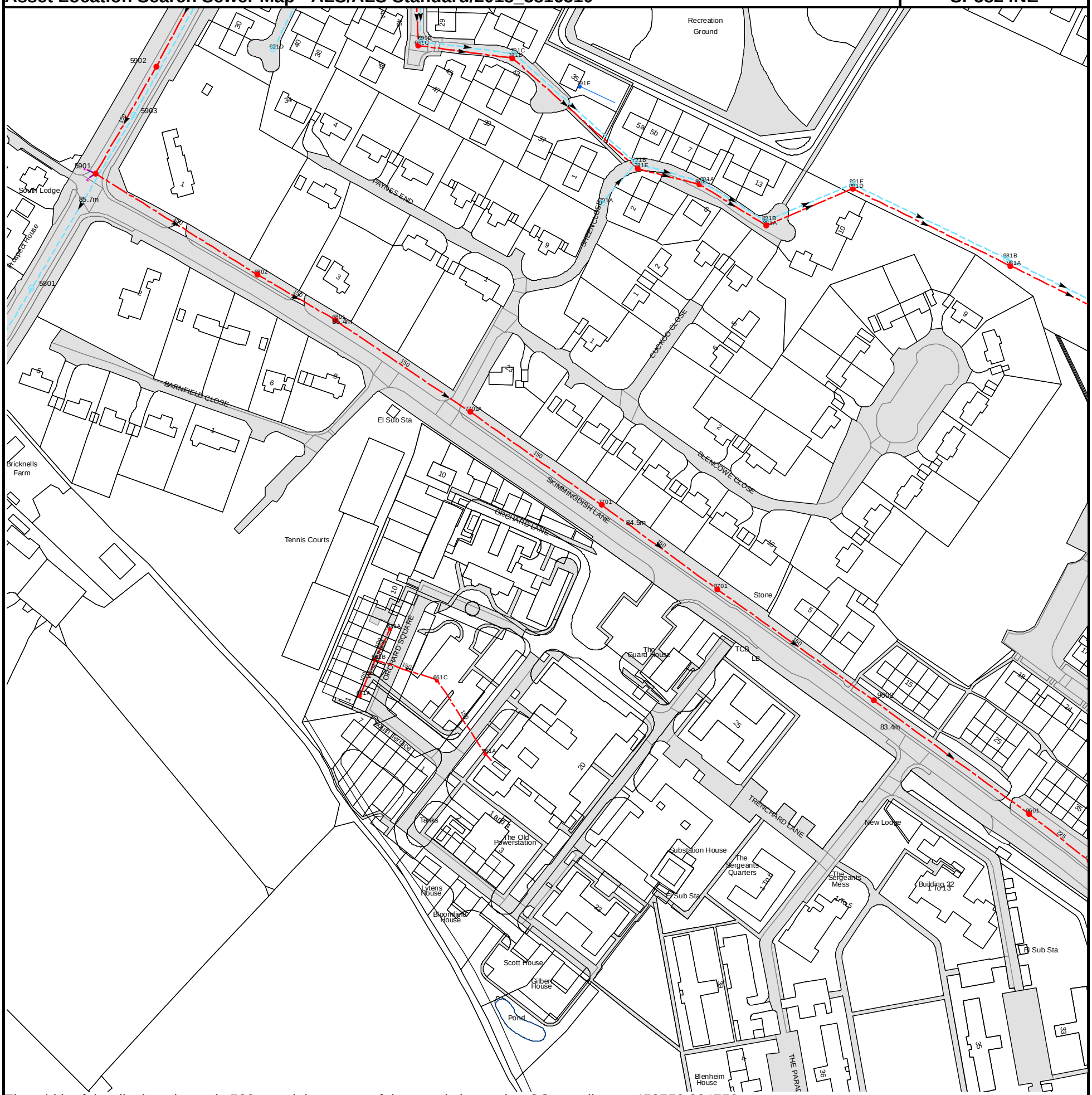
Manhole Reference	Manhole Cover Level	Manhole Invert Level
531K	n/a	n/a
521C	n/a	n/a
621A	n/a	n/a
711A	n/a	n/a
721C	n/a	n/a
721D	n/a	n/a
6101	n/a	80.4
601B	n/a	n/a
7003	n/a	79.8
7001	n/a	79.38
701B	n/a	n/a
701C	n/a	n/a
7102	n/a	78.6
7002	n/a	77.75
7005	n/a	n/a
7006	n/a	n/a
7004	n/a	79.1
701A	n/a	n/a
7110	n/a	77.94
7104	n/a	78.83
7111	n/a	77.48
8103	n/a	78.66
8051	81.08	80.26
8001	81.12	77.24
8050	81.22	80.29
8052	80.23	78.35
8055	n/a	n/a
8053	80.1	78.55
8054	n/a	n/a
5205	83.41	80.91
5305	83.43	81.48
521B	n/a	n/a
531A	n/a	n/a
5207	83.36	81.12
5206	83.4	80.6
531I	n/a	n/a
521A	n/a	n/a
531E	n/a	n/a
5201	83.06	81.38
531J	n/a	n/a
531B	n/a	n/a
531H	n/a	n/a
531C	n/a	n/a
5101	83.15	80.18
5310	82.8	80.51
5110	83.01	80.34
5309	82.8	81.18
5209	83.05	79.75
5208	83.01	80.41
5102	83.05	80.39
5109	83.04	80.94
5311	82.77	81.07
6201	82.47	80.18
6202	82.49	79.54
6206	82.57	80.88
6207	82.59	80.63
5202	83.66	81
5203	83.65	81.7
5302	83.8	81.15
5301	83.81	81.71
5304	83.57	81.57
5303	83.8	81.15
5204	83.41	81.55
5010	82.5	80.05
5004	82.52	79.75
5005	82.75	79.69
5009	82.76	80.15
5003	82.95	79.75
5008	83	80.4
501A	n/a	n/a
501B	n/a	n/a
501C	n/a	n/a
5001	82.97	81.31
5002	82.97	81.81
601A	n/a	n/a
5105	83.14	81
5106	83.11	81.53
611B	n/a	n/a
611A	n/a	n/a
611C	n/a	n/a
5107	83.31	81.36
5104	83.37	80.76
5108	83.11	81.12
5103	83.13	80.5
5306	83.42	80.74
5307	83.17	81.26
5308	83.21	81.65
6302	82.8	80.77
6301	82.83	80.09
631A	n/a	n/a
9401	79.54	78.59

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7204	n/a	79.25
7208	81.4	80.02
7207	n/a	n/a
6210	81.97	79.7
6203	81.93	80.21
6209	81.88	79.94
6204	81.9	80.42
7209	n/a	n/a
721B	n/a	n/a
721A	n/a	n/a
6208	82.24	80.17
6205	82.22	80.55
7310	n/a	n/a
6305	82.01	80.57
7309	81.47	79.41
7308	81.45	79.79
7311	81.44	79.15
7306	80.99	79.37
7301	81.03	78.32
6304	82.16	80.36
7305	81.33	79.65
7302	81.38	78.78
6303	82.15	79.68
7304	81.77	79.97
7303	81.77	79.19
6306	82.41	80.53
6307	82.46	79.8
8101	80.65	77.43
8104	n/a	78.05
8110	80.56	77.53
8108	n/a	77.03
8105	n/a	78.26
8107	n/a	77.85
8106	n/a	78.41
7201	n/a	78.13
8212	n/a	n/a
8210	n/a	78.67
8213	n/a	n/a
8211	80.56	78.76
8214	80.27	77.56
8204	n/a	79.18
8202	n/a	78.88
8206	n/a	77.63
8203	n/a	78.98
8205	n/a	77.7
8216	80.57	78.89
8215	80.55	77.85
8303	80.4	79.05
8301	80.36	78.04
7307	80.66	79.17
8302	80.67	78.14
8306	80.47	79.04
8304	80.43	79.2
8305	80.48	78.81
831A	n/a	n/a
831B	n/a	n/a
831C	n/a	n/a
8102	80.5	78.02
8207	n/a	76.54
8201	n/a	78.72
8109	n/a	n/a
9204	n/a	78.47
9203	n/a	78.92
9303	n/a	78.75
9302	n/a	79.19
9104	n/a	n/a
9205	n/a	n/a
9201	79.59	77.75
9101	n/a	n/a
9207	n/a	n/a
9102	n/a	n/a
9208	n/a	n/a
9202	79.54	77.72
9103	n/a	n/a
9301	79.62	77.9
9106	n/a	n/a
6103	n/a	79.98
611D	n/a	n/a
7109	n/a	78.07
7105	n/a	78.96
7101	n/a	78.38
7108	n/a	78.16
7106	n/a	79.05
7103	n/a	79.28
6104	n/a	78.72
6102	n/a	79.56
6107	n/a	79.73
6110	n/a	78.89
7121	n/a	79.23
7118	n/a	79.65
6108	n/a	80.01
6111	n/a	79.56
7120	n/a	79.43

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7117	n/a	79.85
6109	n/a	79.93
6112	82.48	79.32
7112	n/a	78
7107	n/a	78.54
7119	n/a	80.15
7206	n/a	79.73
7202	n/a	78.68
7205	n/a	79.09
7203	n/a	78.83
9006	n/a	n/a
9001	79.47	77.16
9002	n/a	n/a
9007	n/a	n/a
9008	n/a	n/a
9004	n/a	n/a
9009	n/a	n/a
9005	n/a	n/a
9105	n/a	n/a

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510

SP5824NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224750

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
661A	n/a	n/a
661B	n/a	n/a
671A	n/a	n/a
661C	n/a	n/a
761A	n/a	n/a
791F	n/a	n/a
5801	n/a	n/a
6802	85.62	83.47
5901	85.75	83.93
5903	n/a	n/a
5902	86.19	84.32
691D	n/a	n/a
691C	n/a	n/a
691B	n/a	n/a
791C	n/a	n/a
6801	85.368	83.078
7701A	85.025	82.595
791D	n/a	n/a
7701	84.35	82.18
791A	n/a	n/a
791B	n/a	n/a
791E	n/a	n/a
891C	n/a	n/a
891A	n/a	n/a
8701	84.05	81.75
891B	n/a	n/a
881A	n/a	n/a
891D	n/a	n/a
891E	n/a	n/a
9602	n/a	n/a
981B	n/a	n/a
981A	n/a	n/a
9601	82.4	80.59
0601	82.161	80.421

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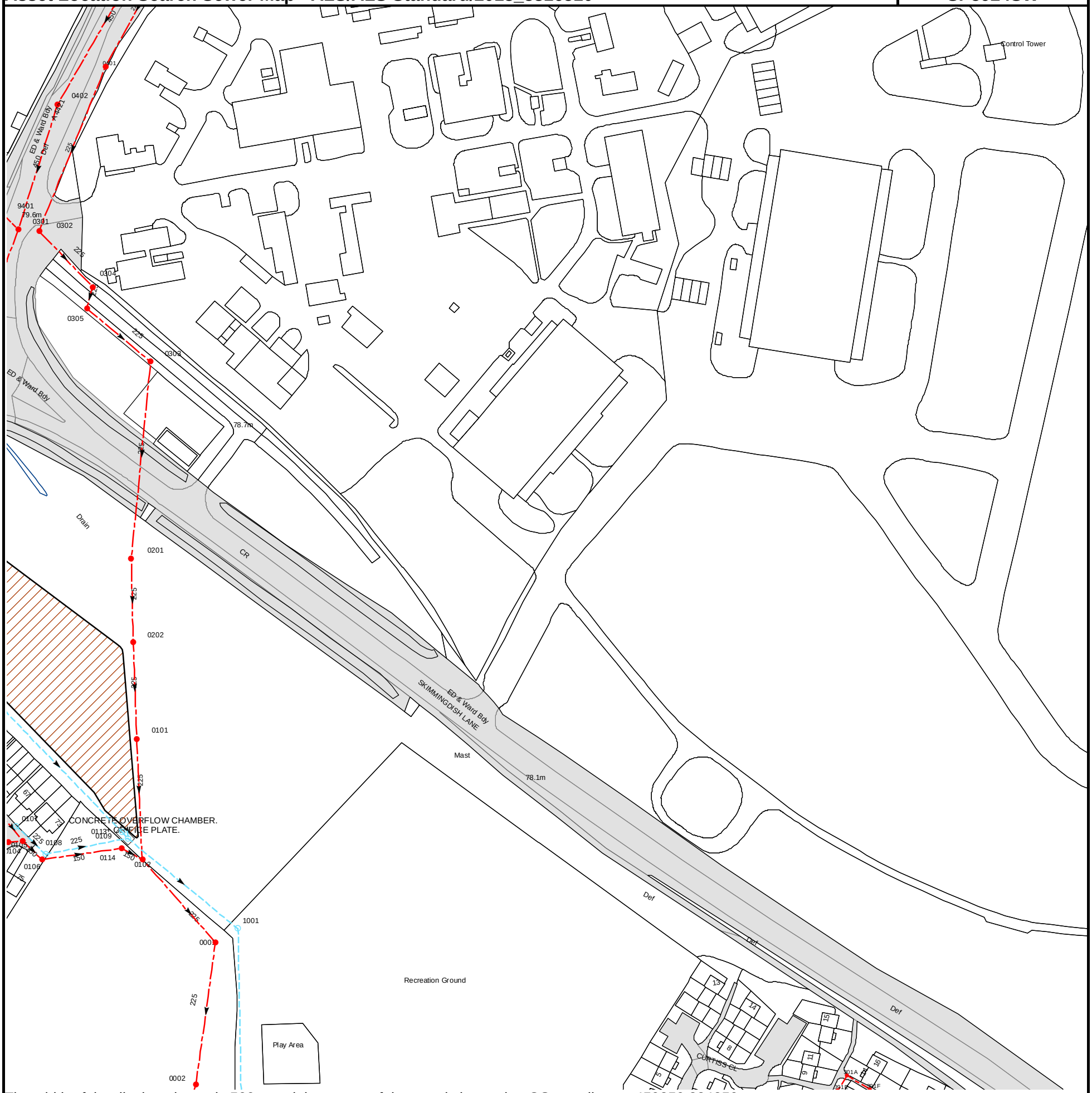
Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510

SP5924SW



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Manhole Reference	Manhole Cover Level	Manhole Invert Level
0301	79.67	78.03
0302	79.52	78.48
0402	80.37	78.27
0401	80.61	79.04
0107	n/a	n/a
0305	n/a	n/a
0304	79.42	78.28
0113	n/a	n/a
0201	n/a	n/a
0202	n/a	n/a
0101	n/a	n/a
0303	n/a	n/a
0002	n/a	n/a
0001	77.72	76.44
1001	n/a	n/a
0106	n/a	n/a
0102	77.87	76.65
0108	n/a	n/a
0114	n/a	n/a
0104	n/a	n/a
0105	n/a	n/a
0109	n/a	n/a
301A	n/a	n/a

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Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510

SP5924NW

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
191S	n/a	n/a
091C	n/a	n/a
091B	n/a	n/a
091A	n/a	n/a
091G	n/a	n/a
091D	n/a	n/a
191J	n/a	n/a
191B	n/a	n/a
191A	n/a	n/a
191G	n/a	n/a
291D	n/a	n/a
291B	n/a	n/a
291C	n/a	n/a
0502	81.079	79.379
0501	81.22	79.22
1601	82.73	79.52
1701	83.87	79.67
1702	84.44	79.84
1703	84.17	80.85
1704	84.41	80.21
171A	n/a	n/a
2801	n/a	n/a
081A	n/a	n/a
191N	n/a	n/a
181C	n/a	n/a
181A	n/a	n/a
191Q	n/a	n/a
191R	n/a	n/a
181B	n/a	n/a
191L	n/a	n/a
191M	n/a	n/a
191K	n/a	n/a
191F	n/a	n/a
191P	n/a	n/a
091H	n/a	n/a
191I	n/a	n/a
091E	n/a	n/a
191C	n/a	n/a
091F	n/a	n/a
191O	n/a	n/a
191H	n/a	n/a
0504	82.09	80.06
0503	81.4	79.78
291A	n/a	n/a
2802	n/a	n/a
2901	n/a	n/a

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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/2018_3816510

SP5824SE

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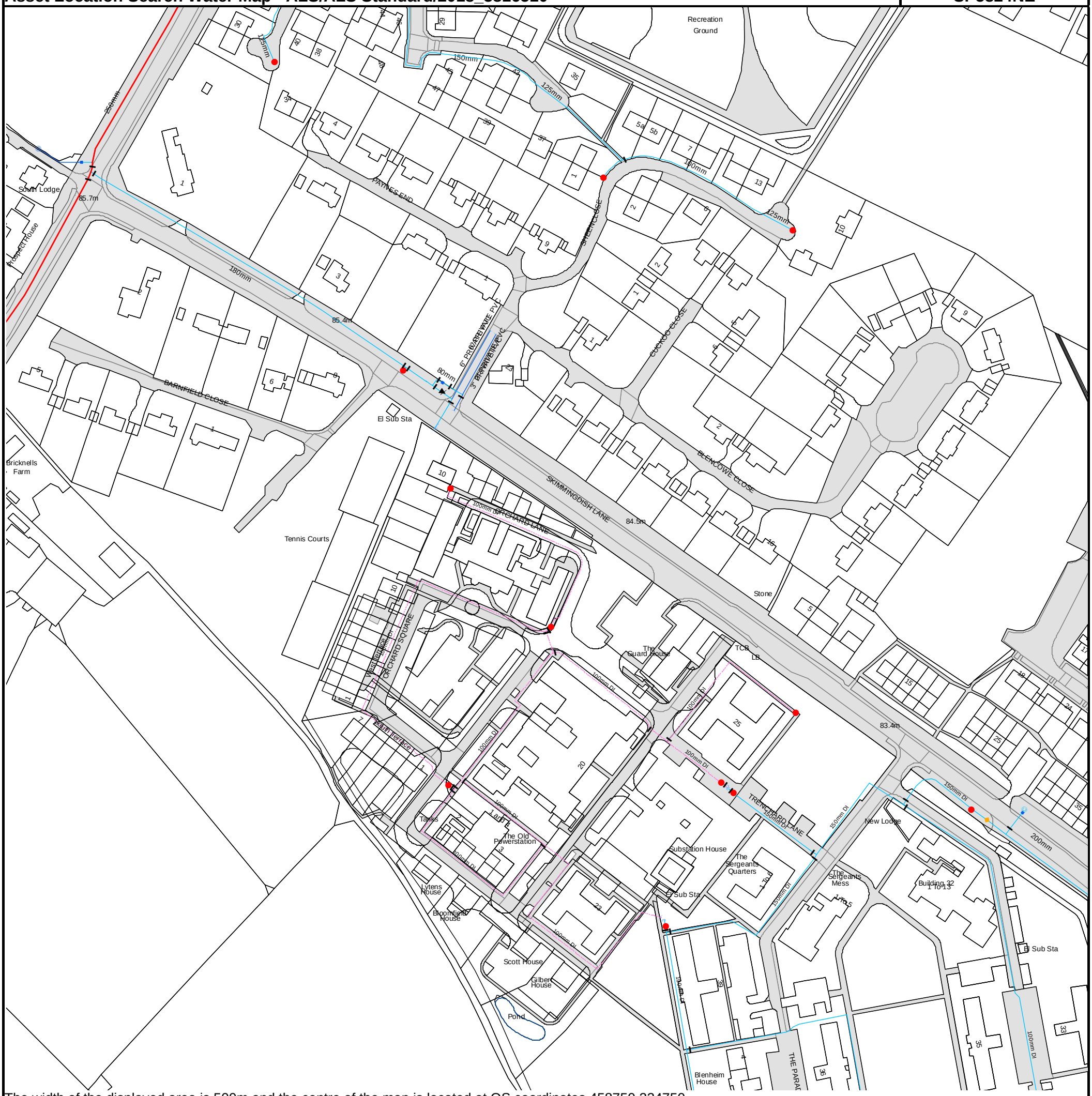
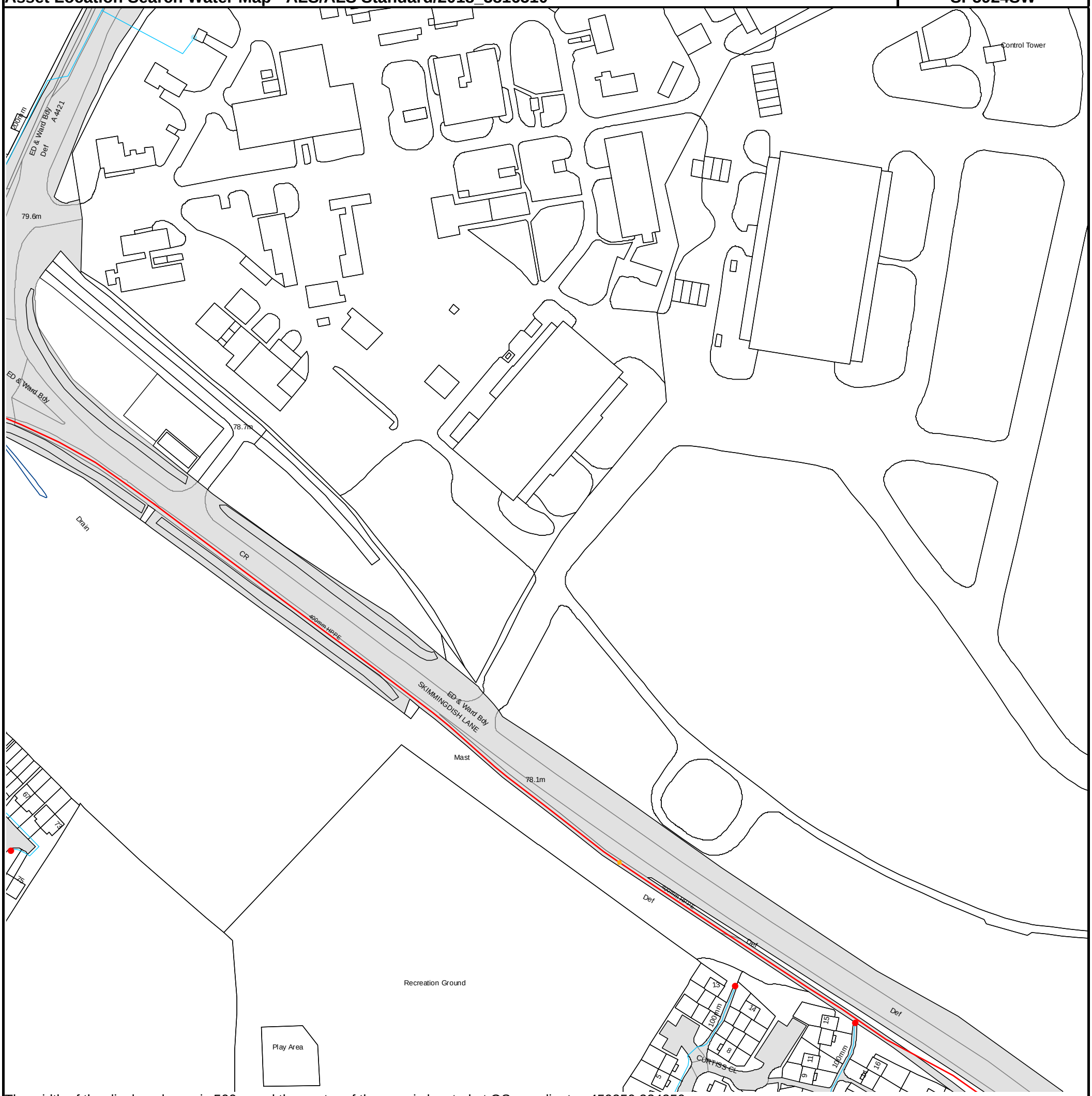
Asset Location Search Water Map - ALS/ALS Standard/2018_3816510

SP5824NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224750

Asset Location Search Water Map - ALS/ALS Standard/2018_3816510	SP5924SW



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Asset Location Search Water Map - ALS/ALS Standard/2018_3816510

SP5924NW

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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**

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 he finds that you have suffered actual loss 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
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

SOAKAWAY TEST - BRE DIGEST 365

PROJECT: Bicester Heritage
JOB REF: N16218
DATE: 01/02/2018
TEST REF: ST1 - SW Corner

Length of trial pit	=	L_{TP}	=	0.90	m
Width of trial pit	=	W_{TP}	=	0.90	m
Depth of trial pit	=	D	=	1.00	m
Pit Voids	=	PV	=	100	%

(Note - for open pits, PV = 100%. For stone filled pits, PV = 30%)

Water Depth at Start of Test, D_{TP}	=	0.850	m
75% Effective Depth, D_{75}	=	0.888	m
50% Effective Depth, D_{50}	=	0.926	m
25% Effective Depth, D_{25}	=	0.963	m

Time from 75% to 25% effective depth, T_L = 655 mins

Volume of water escaping during this test between D_{75} and D_{25}

= $V_{tp\mathbf{75\text{-}25}}$

= (L_{TP} x W_{TP} x (D_{25} - D_{75}) x PV) = 0.061 m^3

Mean surface area through which the above volume escapes, is the wetted area.
Only 50% of the effective depth is allowed in the calculation:

Hence: A_{P50} = Wet Base Area + Wet Sides Area (from D_{50} to base of pit)

A_{P50} = (L_{TP} x W_{TP}) + ($2L_{TP}$+$2W_{TP}$) x (D-D_{50})

A_{P50} = 0.81 + 0.268

A_{P50} = 1.08 m^2

Soil Infiltration Rate = f = $\frac{V_{TP75\text{-}25}}{A_{P50} \times 60 \times T_L}$ m/s

f = $\frac{0.06}{1.08 \times 60 \times 655}$ m/s

Soil Infiltration Rate f = 1.43E-06 m/s

SOAKAWAY TEST - BRE DIGEST 365

PROJECT: Bicester Heritage
JOB REF: N16218
DATE: 01/02/2018
TEST REF: ST2 - Mid way along S elevation

Length of trial pit	=	L_{TP}	=	1.10	m
Width of trial pit	=	W_{TP}	=	0.90	m
Depth of trial pit	=	D	=	1.00	m
Pit Voids	=	PV	=	100	%

(Note - for open pits, PV = 100%. For stone filled pits, PV = 30%)

Water Depth at Start of Test, D_{TP}	=	0.800	m
75% Effective Depth, D_{75}	=	0.850	m
50% Effective Depth, D_{50}	=	0.900	m
25% Effective Depth, D_{25}	=	0.950	m

Time from 75% to 25% effective depth, T_L = 655 mins

Volume of water escaping during this test between D_{75} and D_{25}

= V_{tp}**75-25**

= (L_{TP} x W_{TP} x (D_{25} - D_{75}) x PV) = 0.099 m^3

Mean surface area through which the above volume escapes, is the wetted area.
Only 50% of the effective depth is allowed in the calculation:

Hence:
A_{P50} = Wet Base Area + Wet Sides Area (from D_{50} to base of pit)
A_{P50} = (L_{TP} x W_{TP}) + ($2L_{TP}$+$2W_{TP}$) x (D-D_{50})
A_{P50} = 0.99 + 0.400
A_{P50} = 1.39 m^2

Soil Infiltration Rate = f = $\frac{V_{TP75-25}}{A_{P50} \times 60 \times T_L}$ m/s

f = $\frac{0.10}{1.39 \times 60 \times 655}$ m/s

Soil Infiltration Rate f = 1.81E-06 m/s

Appendix B

Existing Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	30	Soil	0.150
Area (ha)	1.800	Urban	0.000
SAAR (mm)	682	Region Number	Region 6

Results l/s

QBAR Rural	0.7
QBAR Urban	0.7
Q30 years	1.6
Q1 year	0.6
Q30 years	1.6
Q100 years	2.3

Greenfield Runoff Volume

FSR Data

Return Period (years)	1
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.800
SAAR (mm)	685
CWI	102.300
Urban	0.000
SPR	10.000

Results

Percentage Runoff (%)	4.33
Greenfield Runoff Volume (m^3)	16.946

Greenfield Runoff Volume

FSR Data

Return Period (years)	30
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.800
SAAR (mm)	685
CWI	102.300
Urban	0.000
SPR	10.000

Results

Percentage Runoff (%)	6.26
Greenfield Runoff Volume (m^3)	54.053

Greenfield Runoff Volume

FSR Data

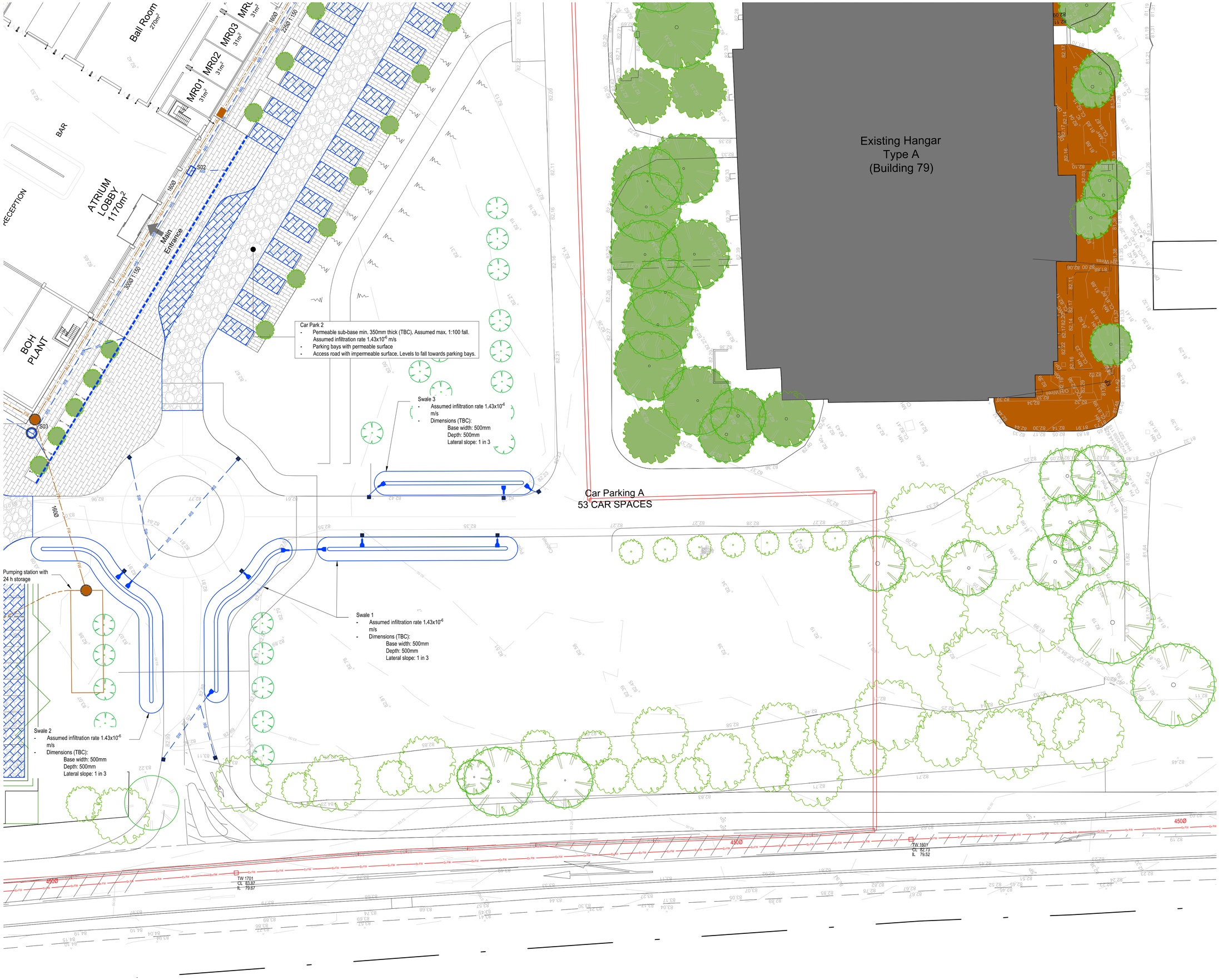
Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.800
SAAR (mm)	685
CWI	102.300
Urban	0.000
SPR	10.000

Results

Percentage Runoff (%)	8.27
Greenfield Runoff Volume (m^3)	92.734

Appendix C

Proposed Site Plans



GENERAL NOTES

1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2. All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.
3. Connections to Public sewers to be agreed and inspected by Water Authority.
4. Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
5. Invert to base of soil stack bends to be 450mm below lowest branch connection for up to 3 storeys buildings. For buildings up to 5 storeys the invert to base of soil stack bends should be not less than 750mm.
6. All RWP and Foul Water drain point setting out is to be confirmed by Architect.
7. All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
8. Foul drains to project 100mm above finished floor level.
9. All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
10. All external covers in footpaths and roads in non tarmac areas to have recessed trays to suit the paving material.
11. Refer to drainage specification for pipe materials.
12. All pipework to be 100/110Ø UNO. Refer to note 7 connection sizes.
13. All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
14. This drawing has been produced in colour and should be reproduced in colour for clarity.
15. A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Key

- Road Gully
- Storm Polypropylene Inspection Chamber
- Storm Concrete Inspection Chamber
- Storm Concrete Manhole
- Permeable Sub-base
- Permeable Paving
- Grasscrete Paving
- Foul Polypropylene Inspection Chamber
- Foul Concrete Inspection Chamber
- Foul Concrete Manhole
- FW New Foul Sewer
- New Foul Rising Main
- SW New Surface Water Sewer
- New Linear Drainage System

Existing Drainage

- Existing Manholes
- Ex FW Existing Foul Sewer
- Ex SW Existing Surface Water Sewer
- Existing Sewers to be abandoned and grouted up either end

Rev.	Amendment	Drn	Chkd	Date
P03	Drainage updated to suit revised entrance	NJ	GT	11.07.18
P02	Preliminary Issue	NJ	GT	29.06.18
P01	Preliminary Issue	NJ	GT	21.06.18

Drg. Status: Preliminary
Suitability

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☐ Hitchin
■ Oxford
☐ Southampton
☐ Birmingham

Client: Bicester Heritage Ltd.

Project: Bicester Heritage Hotel

Title: Drainage Layout
Sheet 1 of 3

Reviewed Scheme	GT	Date	21.06.18
Reviewed Final		Date	
Scales at A1	1:250	Project No.	X162034

Project Ref.	Originator	Zone	Level	Type	Role	Drg No.	Rev.
BHH	AKSW	XX	GF	DR	C	9201	P03