

Pilsworth Lake Café

Flood Risk Assessment

16 April 2024



expedition

Rev	Date	Reason for Issue	Author	Checked	Approved
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1 Introduction

This Flood Risk Assessment (FRA) has been prepared to support the Minor Planning Application for the proposed development of the Pilsworth Lake Café, angling shop and rebuilt boathouse in Heywood, Greater Manchester.

This FRA includes a Sustainable Drainage Strategy (Section 7) which has been developed in line with best practice, local policy requirements and requirements from Bury Council, the Lead Local Flood Authority (LLFA).

The structure of this FRA follows the checklist included in the National Planning Policy Guidance (NPPG) on Flood Risk and Coastal Change [1].

2 Development Site and Location

2.1 Where is the development site located?

The application site, which covers an area of approximately 0.9Ha, is on Pilsworth Lake which is a large piece of land that incorporates two angling lakes, smaller ponds, and the site of a former cotton mill. Woodland and grassed banks surround the lakes. There is a small stream named the Brightley Brook, which is designated as a Main River by the Environment Agency (EA), which runs through the site from the northeast to the southwest and in places is confined within retaining walls (Figure 1).

The site is in the east of Bury District within Greater Manchester and connects to Moss Hall Road at the north end of the site. Access to the site is provided via a narrow track from Moss Hall Road in the northeast of the site. The approximate grid reference for the centre of the site is SD 83037 08521.

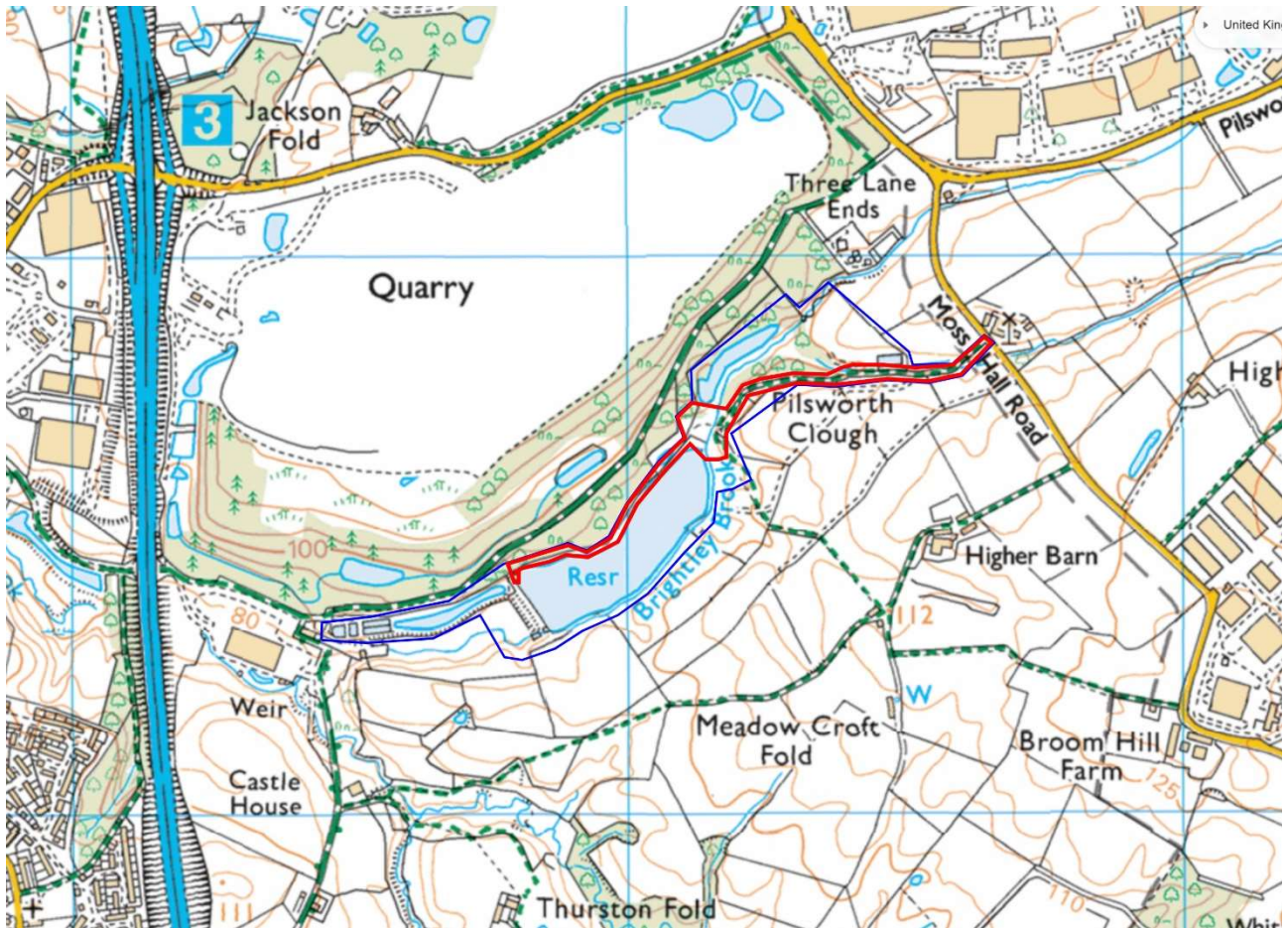


Figure 1 - Site Location Plan. Land in ownership (blue), application site (red)

2.2 What is the current use of the site?

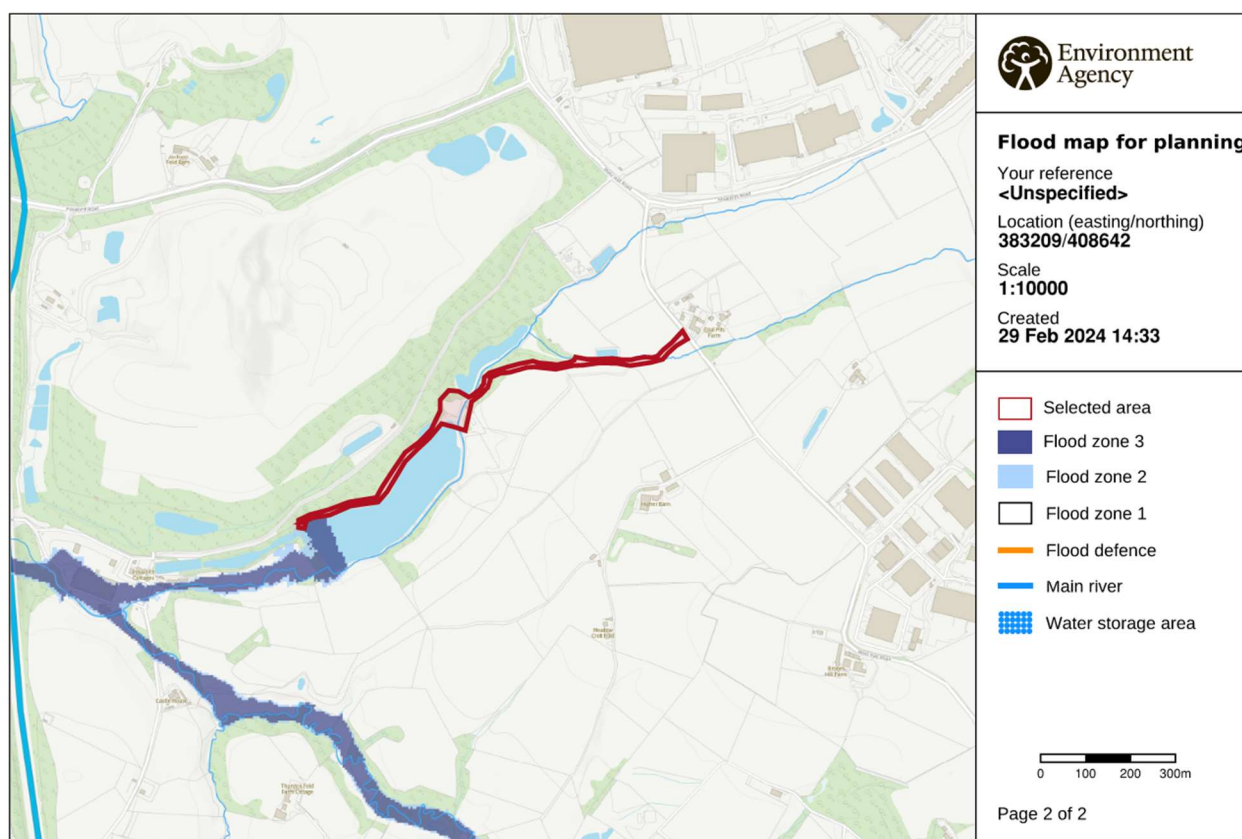
The Site is part of the Greater Manchester Green Belt and is designated a Special Landscape area and a wildlife corridor by Bury Council. It is currently used for recreational angling all year round including at night and there is a car park at the northeast end of the main lake and angling stations located around the lake. Various paths provide access to the stations from the car park.

Works were started on a café/bait shop structure which was given planning permission in November 2011 and the foundations remain. There are also various structures associated with angling around the perimeter of the lake, including a boathouse which has become degraded at the western corner of the main lake.

2.3 Which Flood Zone is the site within?

The Environment Agency (EA) flood map (Figure 2) shows the majority of the site is located within Flood Zone 1. The annual probability of this flooding from river or sea is less than 1 in 1,000 (<0.1%). There is an area in the south-west of the Site (in the location of the proposed rebuilt boathouse at the western end of the lake) which is shown to be in Flood Zone 3, with a 1 in 100 (1%) or greater chance of flooding each year from rivers. Note, it is believed that the Flood Zone 3 boundary shown on the mapping, which is relatively crude, is inaccurate in this location and extends further than it should. It spans across the location of the dam to the upstream side of the reservoir, which is approximately 3m higher than the downstream side. Due to this step in level, it is considered extremely unlikely that the flooding would reach this area. It is more likely that the area on the upstream side of the dam is actually in Flood Zone 1, as for the rest of the area around the lake, which is at a similar level. In this case, the boathouse would also be located within Flood Zone 1.

There is no reference in the SFRA to the site being in an area with future risk.



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Figure 2: EA Flood map

3 Development Proposals

3.1 What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?

The proposed development is to enhance the existing recreation and leisure use of the site through a new café and angling shop in the east of the site. Planning permission was granted in 2011 for the erection of a single-storey building with a pitched roof for a café, bait shop and accommodation. The new building will not be more than 25-30% greater than the consented building and its footprint will not exceed 160 to 170m². The works will include upgrading the access road into the site, the car park adjacent to the café/shop and related landscaping (Figure 3).



Figure 3: Proposed Masterplan – café and car park area

In addition, the existing boathouse will be rebuilt to create a storage area on a mezzanine level above open access for boats and pontoon storage (Figure 4).

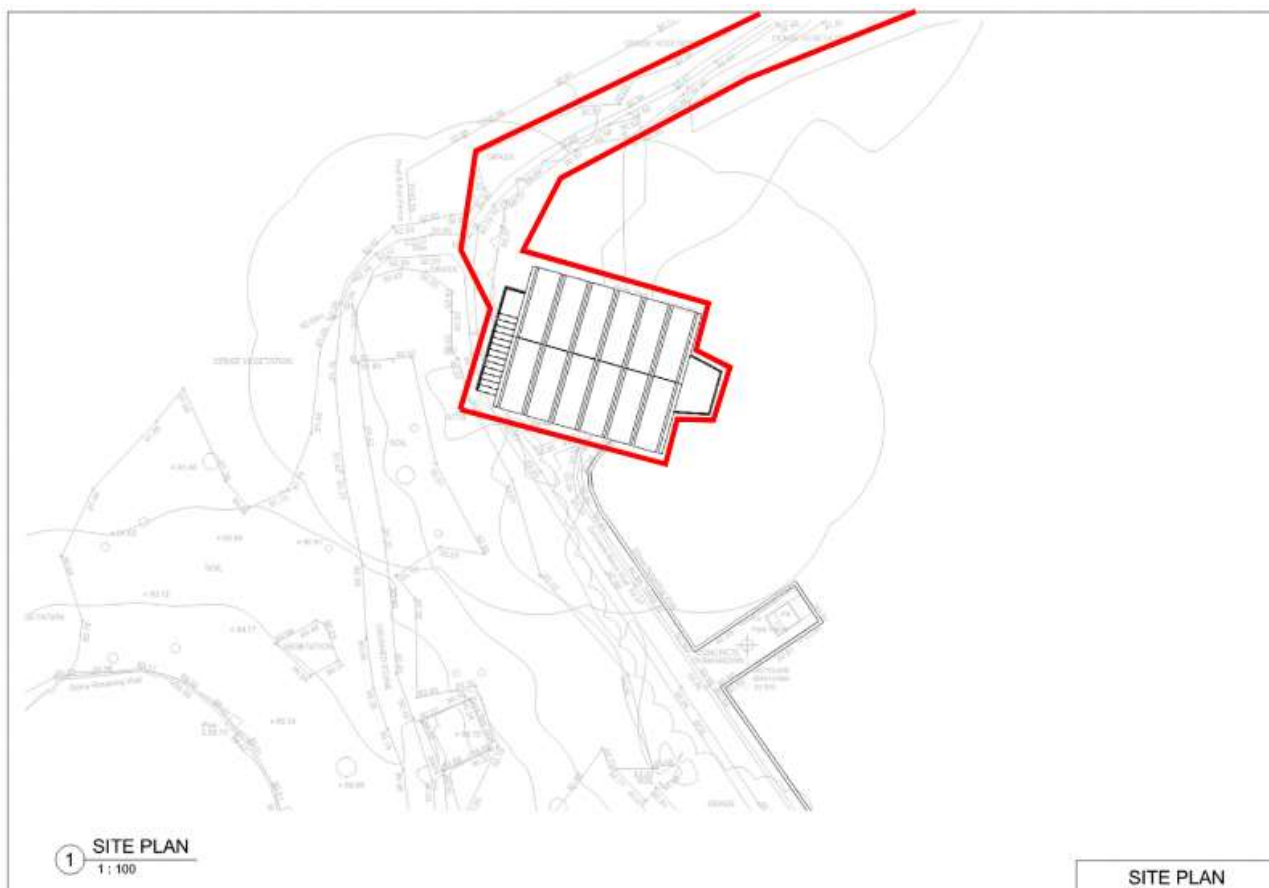


Figure 4 - Proposed boathouse plan

3.2 In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development?

The proposed building will be used as a café and shop which are classed as “Less Vulnerable” to flooding in Table 2 of the NPPF Technical Guidance. The rebuilt boathouse would be classed as “water-compatible development” as “water-based recreation” in Table 2 of the NPPF Technical Guidance. As such, the vulnerability classification of the proposed development as a whole is considered to be “Less Vulnerable”.

3.3 What is the expected or estimated lifetime of the proposed development likely to be?

The proposed development is assumed to have a design life of 100 years based on typical lifetimes of similar non-residential facilities in accordance with NPPF.

4 Sequential Test

4.1 What other locations with a lower risk of flooding have you considered for the proposed development?

The majority of the site falls within flood zone 1 which has a very low risk of flooding. Less vulnerable development is proposed within Flood Zone 1 and water compatible development is proposed within Flood Zone 3. Therefore, no alternative locations have been considered as part of the development.

4.2 If you have not considered any other locations, what are the reasons for this?

See Section 4.1

4.3 Explain why you consider the development cannot reasonably be located within an area with the lowest probability of flooding (Flood Zone 1); and, if your chosen site is within Flood Zone 3, explain why you consider the development cannot reasonably be located in the Flood Zone 2.

See Section 4.1.

4.4 As well as flood risk from rivers or the sea, have you taken account of the risk from any other sources of flooding in selecting the location for the development?

Other sources of flooding have been considered in Section 6 and do not affect any of the conclusions associated with the Sequential Test.

5 Climate Change

5.1 How is flood risk at the site likely to be affected by climate change?

Climate change is predicted to increase rainfall intensities, which will in turn increase the risk of surface water and fluvial flooding. This is discussed further in Section 6.

In developing the surface water drainage strategy, increases in rainfall intensities of +40% and +45% have been considered for the 1 in 30 and 1 in 100 year events respectively. This corresponds to the “Upper End Allowances” for the 2070’s horizon in the Irwell Management Catchment.

6 Site Specific Flood Risk

6.1 What is/are the main source(s) of flood risk on the site?

A review of the main potential sources of flooding that could affect the development has been carried out, considering the key sources of flooding defined in the National Planning Policy Framework (NPPF) [3].

6.1.1 Fluvial

The development is directly adjacent to the Brightley Brook which runs along the length of the site to the south side of the lakes in a stone retaining wall channel. The brook is designated as a Main River and falls under the jurisdiction of the EA. Downstream of the site it feeds into the River Irwell via the River Roch.

A stone retaining wall and concrete block wall dam the end of the larger lake. A valve and pipe control the outflow of water from the lake into a series of ponds below it, and a sluice acts as an overflow.

As discussed in Section 2.3, the Environment Agency (EA) Flood Map (Figure 2) shows that the site of the café and shop is in Flood Zone 1 and therefore not at risk of flooding from fluvial waters from any of the above waters. The site of the rebuilt boathouse is shown on the EA Flood Map as being located in Flood Zone 3 and therefore potentially at risk of flooding from the lake. However, as discussed in section 4.1, it is considered that this mapping is locally inaccurate and regardless, the development is ‘water compatible’.

6.1.2 Tidal

The site is not in proximity to any tidal water body. There is therefore no risk of tidal flooding.

6.1.3 Pluvial and Sewer Flooding

In a rural area such as that of the site and its surroundings, most surface water runoff infiltrates to the ground or joins local streams and water bodies. As can be seen from the United Utilities sewer map in Appendix D, there are no public sewers on or near the site. Therefore, the risk of sewer flooding is considered to be very low.

The EA surface water flood risk map shows localised high risk of flooding from surface water (Figure 5). This is generally located on the banks of the lakes, ponds and Brightley Brook. There is a small area with a high extent of flooding around the banks of the Brightley Brook in the location of the proposed café and shop. The main lake and surrounding banks are shown as high risk of surface water flooding due to the nature of the lake as a receiving waterbody.

Surface water in the developed locations will be managed using a drainage strategy which will protect the site to a 1 in 100 year +45% climate change flood event. The building Finished Floor Levels will provide a minimum of 150mm above external ground levels. This is described in more detail in Section 7.

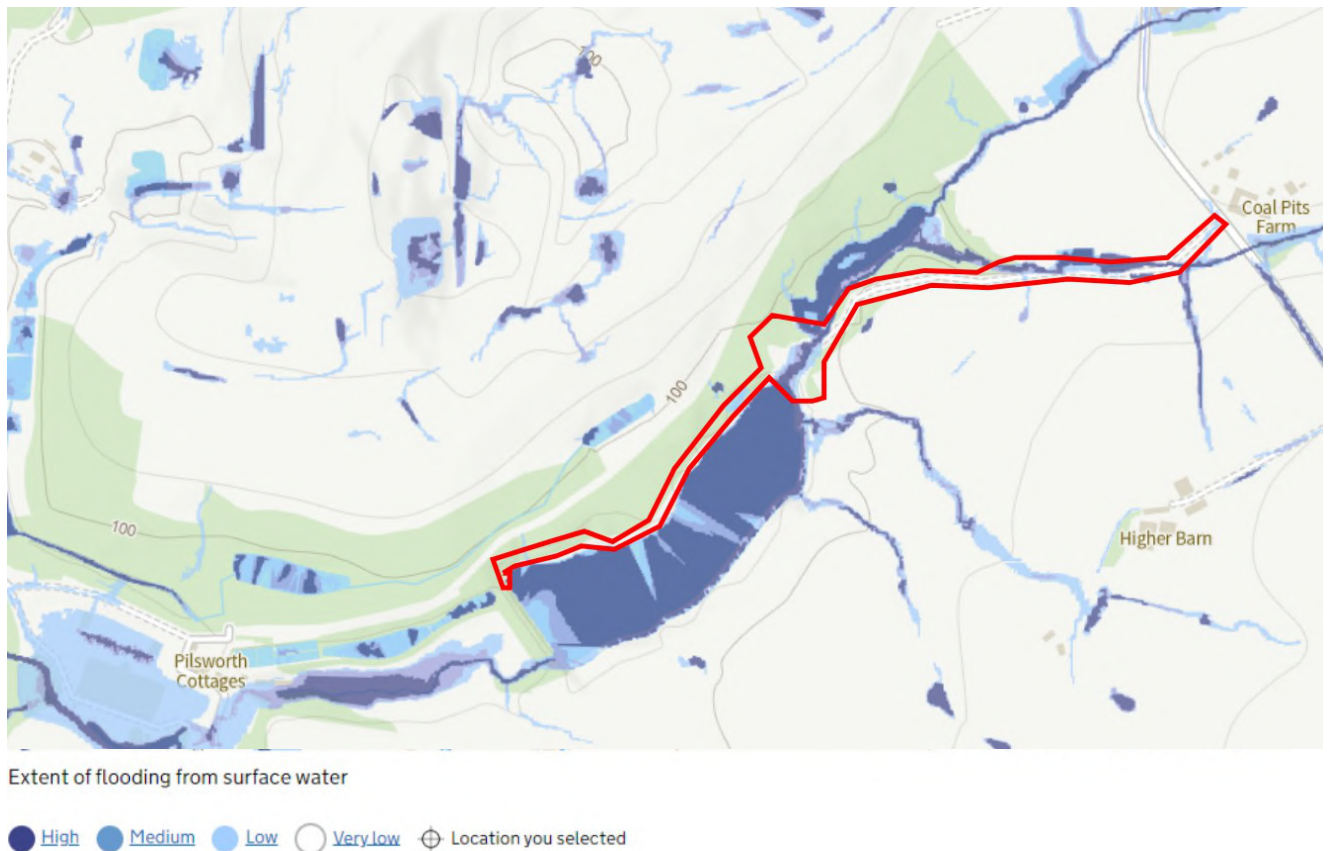


Figure 5: Surface Water Flood Map

6.1.4 Groundwater

The 2018 Bury Local Flood Risk Management Strategy [4] states that the council area reports relatively low incidents of groundwater flooding and the region has high permeability underlying geology. The site itself sits between areas identified as between 25% and 50% and less than 25% risk of groundwater flooding (Figure 6, site circled). Properties either side of the ownership boundary are in areas where flooding from groundwater is unlikely [5].

No comprehensive ground investigations have recently been undertaken at the site. Our understanding of the geology is therefore based on available records from the British Geological Survey (BGS) mapping service [6]. Superficial deposits in the area are a combination of clay, silt, sand and gravel sedimentary superficial deposits. The area lies over an aquifer and the bedrock mainly consists of sedimentary mudstone, siltstone and sandstone. The available BGS borehole information indicated groundwater approximately 1-3m below ground level. Based on these findings, a low risk of groundwater flooding is anticipated.

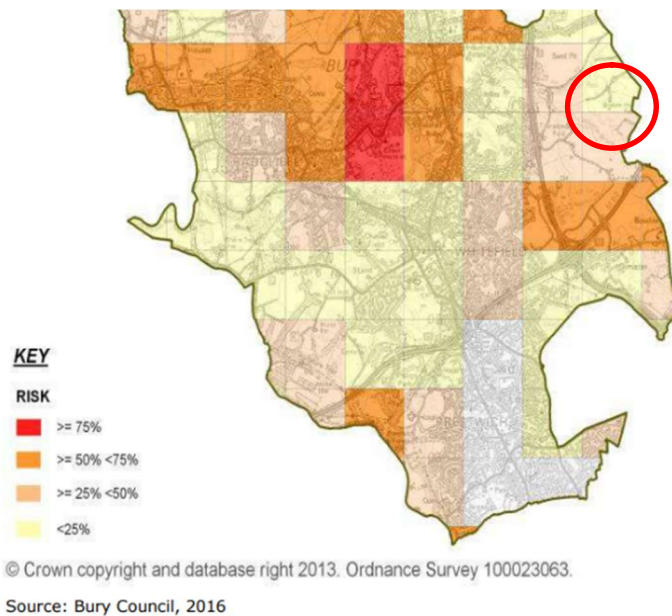


Figure 6 - Groundwater flooding map, Bury Council

6.1.5 Water Infrastructure

A review of EA flood risk maps for reservoir flooding shows that the site is not at risk from reservoir flooding. As can be seen in Figure 7 below, immediately downstream of the dam there is a risk of flooding. However the proposed development is located on the upstream side of the dam so is not at risk of flooding from reservoirs. Therefore, the risk of flooding to the site associated with Reservoir Breach is considered to be extremely low.

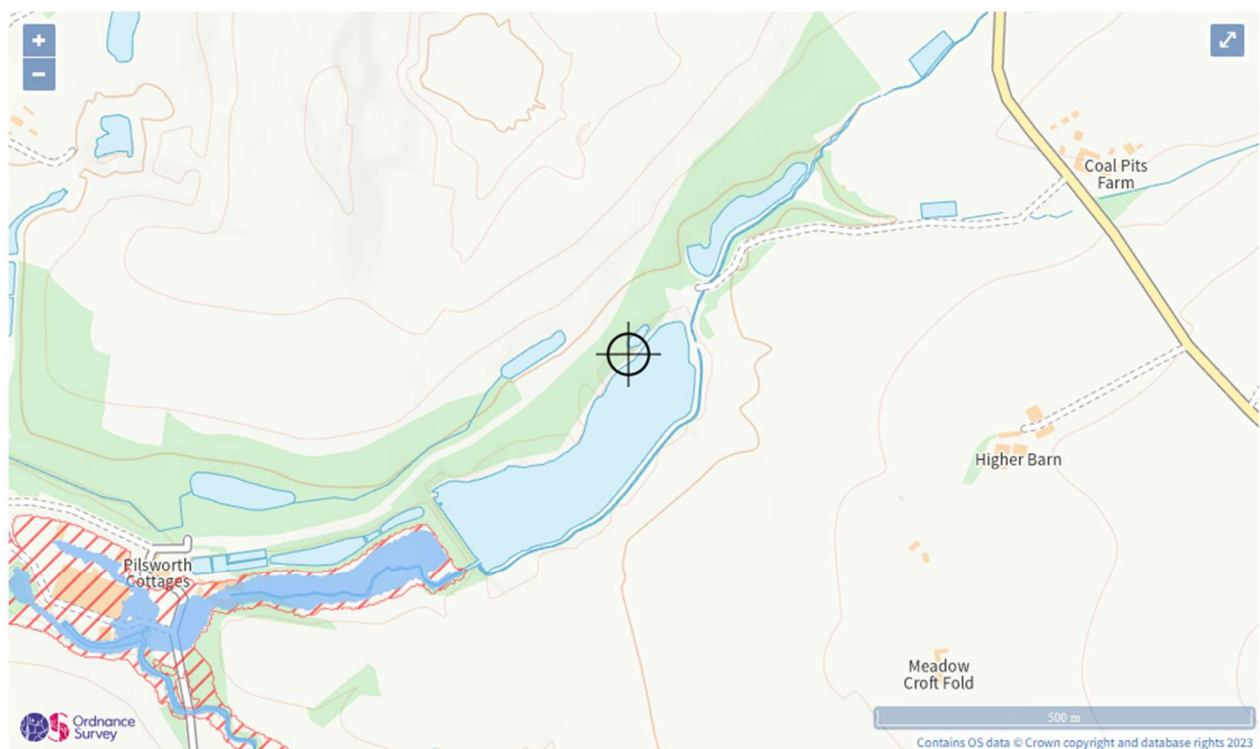


Figure 7 - Maximum extent of flooding from reservoirs, Environment Agency

6.1.6 Conclusions

The proposed site of the café and shop are located in Flood Zone 1. The boathouse is located in Flood Zone 3. However, as the boathouse is water compatible development, this is considered appropriate.

The site is also subject to surface water flooding, with a high risk identified on the EA flood maps. The risk of surface water flooding will be mitigated with the development of a sustainable drainage strategy as described in Section 7.

6.2 What is the probability of the site flooding?

As stated in Section 2.3, the majority of the site, including the café and shop, is located within Flood Zone 1, with an annual probability of fluvial flooding less than 0.1%. The boathouse is shown to be in Flood Zone 3, with an annual probability of fluvial flooding of greater than 1%. However, as discussed in section 2.3, the accuracy of the flood mapping, which is relatively crude, is questionable and it is considered likely that this will be in Flood Zone 1 too.

6.3 Are you aware of any other sources of flooding that may affect the site?

No other sources of flooding have been identified.

6.4 What is the expected depth and level for the design flood?

The EA Product 4 data (included in Appendix B) does not give values for expected depth and level for the design flood at the location of the proposed development within the site. The nearest level is provided downstream of the dam with a level of 89.35m for the undefended 1 in 100 year storm event. The water level of the reservoir is approximately 91.71m which is 2.36m higher than the flood level from the EA modelling.

6.5 Are properties expected to flood internally in the design flood and to what depth? Internal flood depths?

The café and shop are not expected to flood internally as it is in Flood Zone 1, there is no design flood level. Finished Floor Levels will be set a minimum of 150mm above external ground levels with slopes away from vulnerable areas such as doorways to minimise the risk of surface water flooding.

The boathouse is expected to flood internally where boats will be stored. This is below the storage area on the raised mezzanine floor. Flood levels would raise the water level in the boathouse to the spill level of the reservoir which is to be surveyed. The storage area on the mezzanine floor level will be at least 300mm above the spill level.

6.6 How will the development be made safe from flooding and the impacts of climate change, for its lifetime?

An increase in rainfall intensities as a consequence of climate change would increase river and surface water flows and hence fluvial flood levels and surface water flooding. However, this will not negatively affect the site as the drainage strategy will manage generated runoff for both the current and future latest predictions on climate increases. The drainage system will be maintained to continue optimum operation throughout the development's lifetime.

6.7 How will you ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere? Have you considered the impacts from climate change, over the expected lifetime of the development?

No significant risks of flooding have been identified for the café and shop development and upgrades to the access to the site. No measures are therefore required to protect these areas of the site from flooding that would increase flood risk off site and elsewhere.

Surface water from the developed areas along the western section of the access road will be attenuated in SuDS features before being discharged to the Brightley Brook at greenfield runoff rate. This is an improvement to the existing condition where the whole road catchment currently discharges unattenuated. Surface water from the café and boathouse will be discharged directly to the Lake which is considered to have a large storage capacity. The drainage system will be designed to ensure there is no surface water flooding for the 1 in 30 year event, with a 40% allowance for climate change and that surface water is contained on site for all events up to the 1 in 100 year + 45% climate change event.

No change of ground levels are proposed in areas shown as being in Flood Zone 3 on the EA Flood Maps. There will therefore be no impact on fluvial flooding off site.

6.8 Are there any opportunities offered by the development to reduce the causes and impacts of flooding?

As discussed in Section 7, surface water runoff from the access road will be attenuated in SUDs features prior to discharge at reduced rates to the Brightley Brook. This will be applied to existing access road and car park areas and therefore generate a reduction of flood risk associated with surface water discharge to the Brook.

7 Surface Water Management

7.1 What are the existing surface water drainage arrangements for the site?

The site is mainly rural permeable surface (soft landscaping) and currently predominantly drains through infiltration and overland flow to the ponds and lakes within the area. There is no known formal drainage anywhere on the site including the car park and access road. It is anticipated that where the road is adjacent to the Brightly Brook, water currently discharges to the brook via overland flow.

7.2 If known, what (approximately) are the existing rates of surface water run-off generated by the site?

The area of the site which discharges to the Brightley Brook is 0.281Ha and is considered to be brownfield land as an existing road. The existing surface water runoff rates and volumes from this site catchment have been calculated using FEH22 data for rainfall intensity (Appendix E and Table 1).

Table 1: Existing runoff rates.

Return Period (1 in X year)	Existing brownfield runoff rate (l/s)
1	18.9
30	48.1
100	60.4

7.3 What are the proposals for managing and discharging surface water from the site, including any measures for restricting discharge rates?

A surface water drainage strategy has been developed to support the planning application and is presented in this section. This strategy covers surface water drainage and foul drainage and is summarised below.

7.3.1 Strategic Principles

The following principles have been adopted in the development of a sustainable drainage strategy, in line with best practice, local policy requirements, and requirements from Bury Council (BC), the Lead Local Flood Authority (LLFA):

- **Maximising infiltration to ground**, in line with North West SuDS Pro-forma guidance referenced by BC [7] and established best practice from the SUDS Manual [8].
- **Discharge to privately owned lakes** utilising large storage volume of lake to control discharge to the wider catchment downstream, in line with BC guidance.
- **Controlling discharge to the Brightley Brook** where discharge to the lakes is not possible, in line with North West SuDS Pro-forma guidance [7], and DEFRA's Non-Technical Standards for sustainable drainage design [8]. This will be an improvement on the existing condition of the access road which currently drains unattenuated to the Brightley Brook.
- **Control run-off at source** in line with SUDS Manual [8] best practice and the SUDS Hierarchy defined within North West SuDS Pro-forma guidance [7].
- **Climate resilience** and consideration of extreme events, in line with the National Policy Guidance [1], and BS EN 752 [9]. The sustainable drainage system will be designed for no surface flooding for the 1:30 year +40% and no flooding of building and containment of surface water flows for the 1:100 year +45% rainfall event.
- **Control pollution and manage water quality** to minimise any impact on the receiving water environment in line with SUDS Manual [8] best practice.
- **Enhance biodiversity and amenity** in line with the SUDS Manual (CIRIA C753)

7.3.2 Disposal and Drainage Hierarchy

The drainage strategy (Appendix F and Figures 7 and 8 below) has been developed in line with the hierarchy for sustainable drainage which gives preference to infiltration over discharging to a watercourse, which in turn is preferable to discharge to surface water sewers. Based on ground conditions as described in Section 6.1.4, it is anticipated that 'concentrated' infiltration will not be feasible. 'Concentrated' infiltration is when precipitation occurs over an area, and the water is then conveyed to a soakaway feature for infiltration over a smaller area. It is not anticipated that infiltration rates will be high enough for this to be effective. It is proposed however to use 'diffuse' infiltration techniques for the permeable car parking areas and permeable footpaths. 'Diffuse' infiltration is where surface water infiltrates at the same location as the precipitation. This means infiltration occurs directly where it is received on the surface, mimicking natural ground surface behaviour and the existing condition. The feasibility of 'diffuse' infiltration will be confirmed with infiltration testing carried out in accordance with BRE 365.

For the remaining areas, where possible it is proposed to discharge flows directly to the privately owned lake, utilising the large storage volume of the lake to control discharge to the wider river catchment downstream. Where it is not possible to discharge to the privately owned lakes, it is proposed to control discharge to the Brightley Brook to as low as possible given the space and topographical constraints of the narrow, steep road, using SUDs features to provide attenuation. Due to the topography and constraints on

the site, a number of new outfalls are required. This strategy will require approval from the Environment Agency (EA). As the Brightley Brook is a Main River, any activities within 8m of Brook will require a Flood Risk Activity Permit.

A summary of the disposal strategies proposed for the developed areas is as follows:

- The **eastern section of the access road** will predominantly drain to filter drains via a crossfall in the road. Filter drains will be used for pollution control before discharge to the Brightley Brook. A number of outfall locations will be required due to the topography.
- The **western end of the access road** (where more space is available) will cross fall to a filter drain and be attenuated in a swale which will also provide pollution control and discharge to the Brightley Brook via an orifice to limit peak discharge to a greenfield runoff rate of Q_{bar} .
- The **car park bays and footpaths** will have permeable surfacing and will 'diffusely' infiltrate to ground.
- The **car park turning circle and overflow parking access road** will crossfall to filter drains which will discharge to the proposed wetland to provide top up as well as receiving pollution control before discharge to the lake.
- The **café/shop building and boathouse** will discharge to the privately owned lake utilising the large storage volume of the lake to provide attenuation. A green roof is provided on the lower section of part of the café building providing pollution control. Roof drainage from the pitched roof will be directed to raingardens to provide pollution control prior to discharge to the lake.

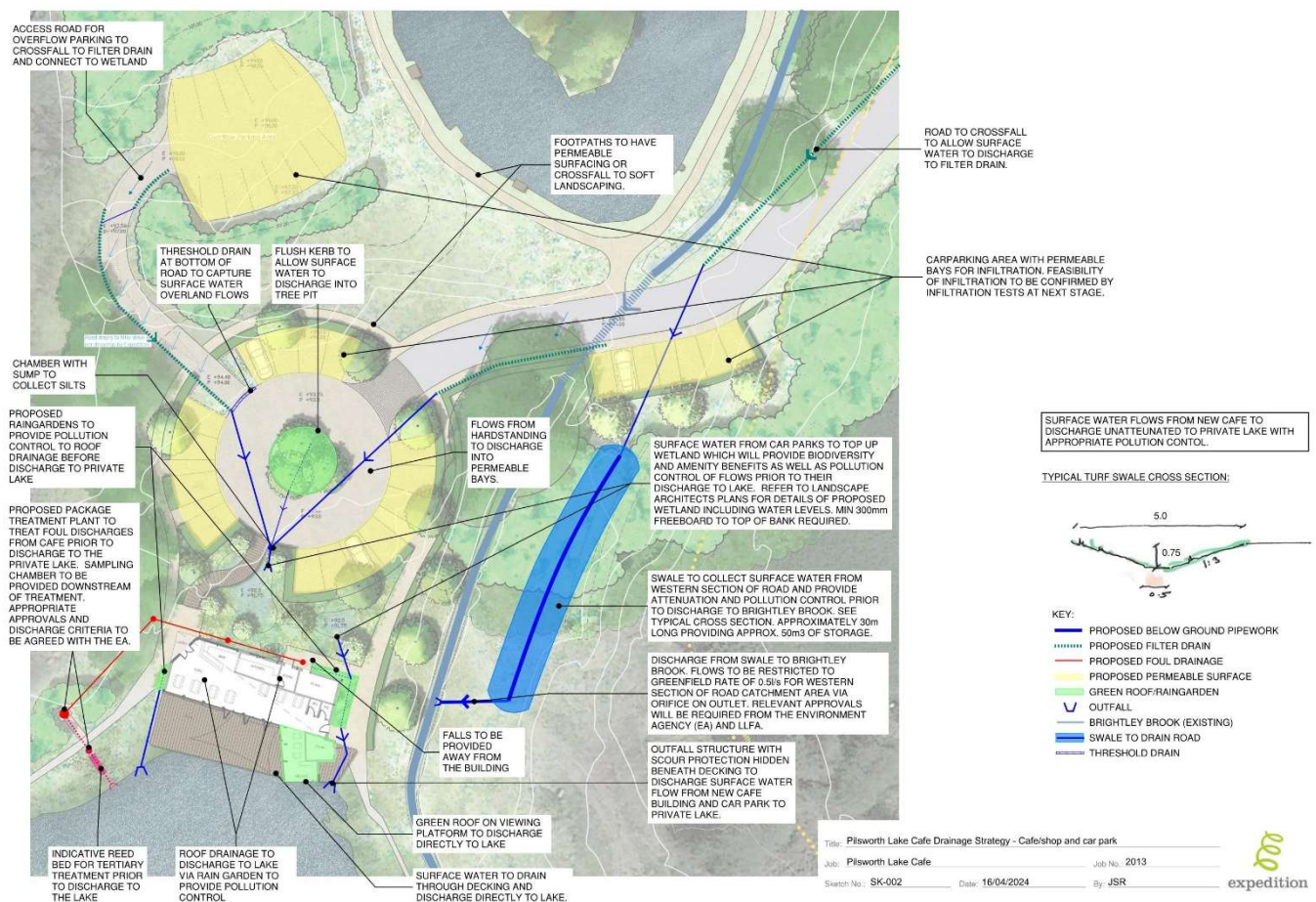


Figure 7 – Café/shop and car park drainage strategy (Appendix F)

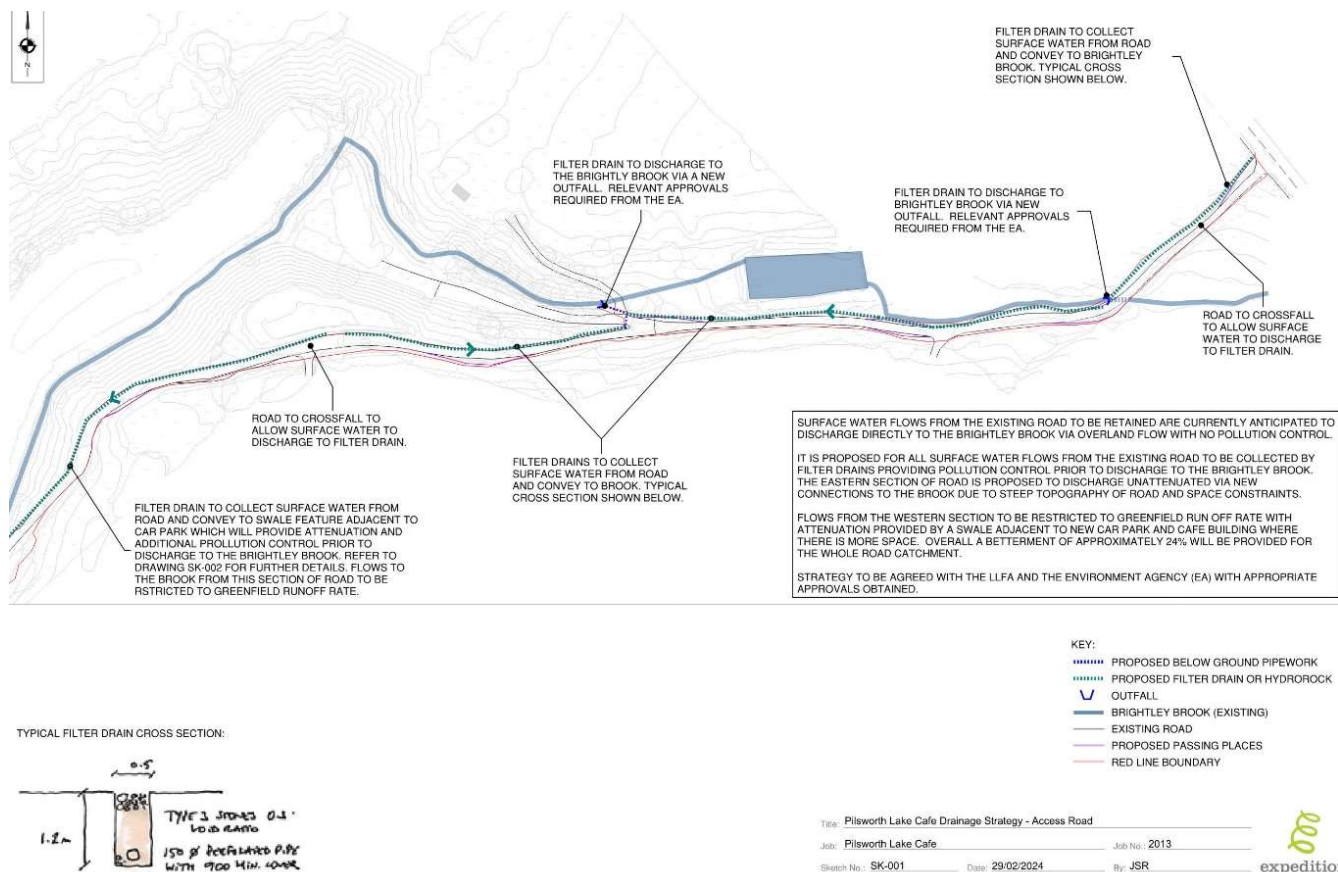


Figure 8 – Access road drainage strategy (Appendix F)

7.3.3. Runoff Rates and Attenuation requirements

Discharges to the Brightley Brook will be reduced from the current unrestricted runoff rates via three new outfalls.

Due to space and topographical constraints of the narrow, steep road, it is not possible to provide attenuation for the eastern section of the road. Filter drains are provided for pollution control.

Surface water for the last section of road (at its western end) will be attenuated in a swale prior to discharge at greenfield rate to the Brook. Modelling has been carried out for this catchment and an attenuation volume of approximately 49m³ is required to contain the 1 in 100 year + 45% climate change event.

The existing and proposed peak runoff rates for discharges to the Brightley Brook from the system have been calculated and are summarised in Table 2. Overall, a betterment of approximately 24% will be provided for the whole catchment area.

Table 2: Comparison of Existing and Proposed Peak Discharge Rates to the Brightley Brook

	Discharge rate (l/s) 1 in 1 year	Discharge rate (l/s) 1 in 30 year	Discharge rate (l/s) 1 in 100 year
Existing	18.90	48.15	60.35
Proposed	14.73	36.66	45.81
Betterment	4.17	11.49	14.54
Betterment (%)	22.1%	23.9%	24.1%

7.3.4 Source Control and Water Quality

Sustainable urban drainage features such as bioretention raingardens, a biodiverse wetland, turf swales, green roofs, filter drains and permeable paving has been integrated within the landscaping proposals for the development, and in particular along the access road and car parking areas. These features control runoff at source, remove diffused urban pollutants, and enhance biodiversity. The primary locations for these features are shown on the plans in Appendix F.

SuDS features such as swales, raingardens, wetland, and green roofs all improve local biodiversity which in turn increase amenity.

An assessment of the water quality of the surface water runoff has been carried out following the 'Simple Index Approach' defined within the SuDS Manual (CIRIA C753). This sets out the water treatment requirements in relation to land use. This assessment is summarised in Appendix G. The assessment demonstrates that the proposed strategy achieves a significant improvement from the existing untreated condition for discharge to groundwater, the Lake and the Brightley Brook.

7.3.5 Foul water strategy

United Utilities are the statutory sewage authority for the area and based on their asset map which has been obtained, there are no foul sewers in the vicinity of the site (see Appendix D).

The proposed café building will generate foul flows from the site. As there are no public sewers in the near vicinity, a package treatment plant with a reed bed providing tertiary treatment prior to discharge to the lake is proposed. The discharge criteria for the final effluent will need to be agreed with the EA and a permit may be required. Access for operation and maintenance of the plant will be provided from the main road.

The rebuilt boathouse will not generate foul flows.

7.4 How will you prevent run-off from the completed development causing an impact elsewhere?

The site's surface water drainage systems will be designed to restrict peak discharge to the Brightley Brook at the greenfield runoff rate. This will mitigate any potential increase of fluvial flood risk further downstream of the site.

The risk of pollution will be controlled following the approach set out in the SUDS Manual CIRIA (C573), ensuring the lakes and Brightley Brook are protected from pollution. This will be achieved using a combination of filter drains, swales, permeable paving and bioretention rain gardens. Refer to Section 7.3 for further details.

7.5 Where applicable, what are the plans for the ongoing operation and/or maintenance of the surface water drainage systems?

Maintenance of the drainage system will be carried out by the site owner or their delegated 'estate management team'. A maintenance and management schedule has been developed to ensure that the performance of the drainage systems is achieved over its entire design life. This has been based on guidance from the SuDS Manual (C753). It covers all elements of the system including: drainage pipework, green roofs, raingardens, swales, filter drains and porous pavements. The maintenance schedule is included in Appendix H.

8 Occupants and Users of the Development

8.1 Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with current use?

The proposed development will increase the number of people using the buildings and land. Currently the site is used by anglers and the purpose of the development is to increase access for angling and to other recreational users of the lake and its surroundings by providing a café, shop and rebuilt boathouse.

8.2 Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?

The site is currently used for angling throughout the day and night therefore access times to the site will not change.

8.3 Where appropriate, are you able to demonstrate how the occupants and users that may be more vulnerable to the impact of flooding will be located primarily in the parts of the building and site that are at lowest risk of flooding?

As discussed in Section 6 the café and shop are located in Flood Zone 1 and there are no significant direct flood risks. A robust drainage strategy will be implemented to address the management of surface water on the site for all events up to the 1:100 year event considering the long-term effects of climate change. Finished Floor Levels will be set a minimum of 150mm above external ground levels with slopes away from vulnerable areas such as doorways to minimise the risk of surface water flooding.

The boathouse (which is shown to be situated in Flood Zone 3) is classed as 'water-compatible' as described in section 3.2. The storage area will be situated on the raised mezzanine level and at least a minimum of 300mm above the reservoir spill level. Access routes will also be above this level meaning safe entry and exit during all flood events.

9 Exception Test

9.1 Would the proposed development provide wider sustainability benefits to the community? If so, could these benefits be considered to outweigh the flood risk to and from the proposed development?

The proposed café/shop is classified as 'Less Vulnerable' and is within Flood Zone 1. The boathouse is classified as 'water-compatible' and is within Flood Zone 3. In line with 'Table 2 – Flood Risk vulnerability and flood zone 'incompatibility' of the NPG, the Exception Test does not apply.

9.2 How can it be demonstrated that the proposed development will remain safe over its lifetime without increasing flood risk elsewhere?

See Section 9.1.

9.3 Will it be possible for the development to reduce flood risk overall?

See Section 9.1.

10 Residual Risk

10.1 What flood related risks will remain after the flood risk management and mitigation measures have been implemented?

The main residual risk of flooding will be associated with a failure or blockage of the drainage system. This could result in localised flooding to building and facilities. Flood depths would be relatively shallow, and although it may affect operations and could damage buildings and equipment, it is unlikely to be a risk to occupants. The risk associated with this will be mitigated through active maintenance of the drainage system. Finished Floor Levels will be set a minimum of 150mm above external ground levels with slopes away from vulnerable areas such as doorways to minimise the risk of surface water flooding.

10.2 How, and by whom, will these risks be managed over the lifetime of the development?

The residual risk of surface water flooding associated with a failure or exceedance of the surface water drainage system will be mitigated through active maintenance of the drainage system by the site owner or their delegated 'estate management team' as described in Section 7.5 and detailed in the maintenance schedule defined in Appendix H. This will be captured in the building and facilities Operation & Maintenance Manual.

11 FRA Credentials

11.1 Who has undertaken the flood risk assessment?

This Flood Risk Assessment has been produced by Jamie Skipper Reed, a Graduate Civil Engineer at Expedition Engineering. It has been reviewed by Fiona Wyatt, a Chartered Civil Engineer with the Institution of Civil Engineers (ICE) and Associate Director at Expedition Engineering and Fred Labbé, a chartered engineer and Director at Expedition Engineering.

11.2 When was the flood risk assessment completed?

This assessment was completed in April 2024.

12 References

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- [8] CIRIA, "The SuDS Manual, C753," CIRIA, 2015.
- [9] British Standards Institute, "BS EN 752 - Drains and sewer systems outside buildings," BSI, 2022.

Appendix A: Topographic Survey



Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.

ABBREVIATIONS

BT

CH

CL

EH

GU

LP

MH

RH

TF

TW

BT Cover

Cable Height

Cover Level

Eaves Height

Gully

Lamp Post

Man Hole

Ridge/Roof Height

Top of Fence

Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels (setting edge of carriageway) are observed at channel (bottom of kerb).

Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address
Pilsworth Fishery,
Heywood,
OL10 2RF
Project Description
Site Survey

Drawing Title
Existing Site Layout

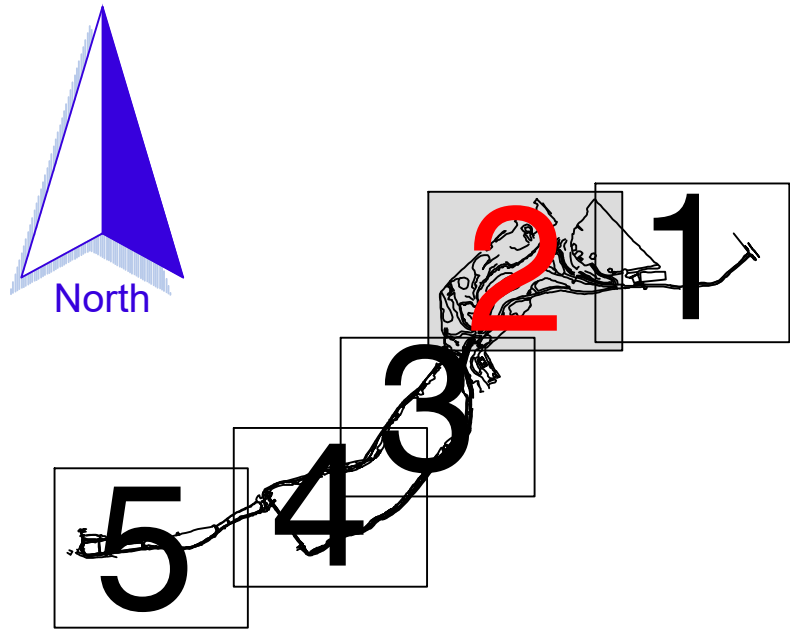
Scale	Date	Drawn By
1:500@A1	28/08/2020	SN/JF

Drawing Number

TRI-3105-01

Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.



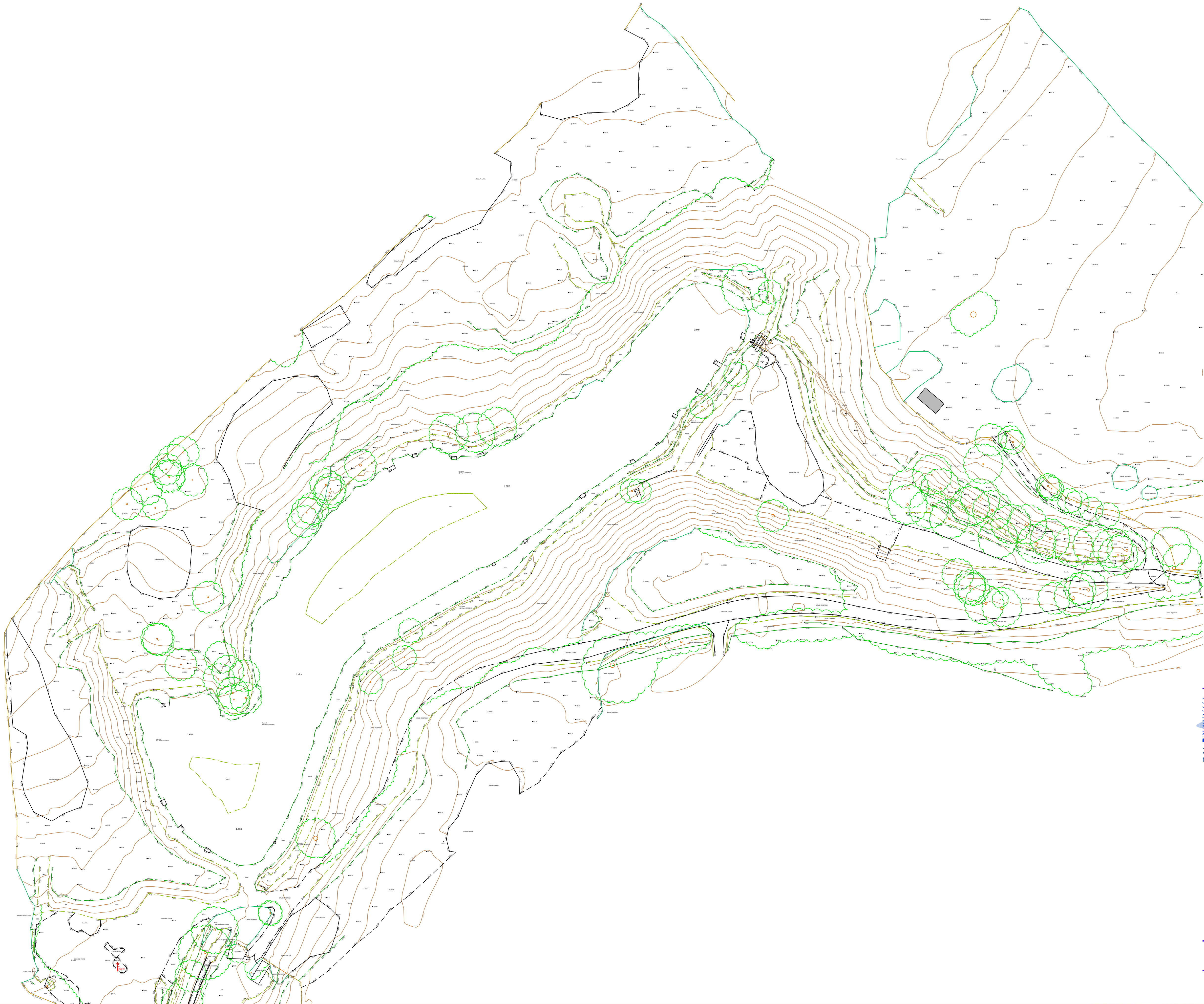
0 5 10 15 20 25 30 35 40 45 50
Metres

ABBREVIATIONS

BT BT Cover
CH Cable Height
CL Cover Level
EH Eaves Height
GU Gully
LP Lamp Post
MH Man Hole
RH Ridge/Roof Height
TF Top of Fence
TW Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.
Levels (setting edge of carriageway) are observed at channel (bottom of kerb).



Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address

Pilsworth Fishery,
Heywood,
OL10 2RF

Project Description

Site Survey

Drawing Title

Existing Site Layout

Scale	Date	Drawn By
1:500@A1	28/08/2020	SN/JF

Drawing Number

TRI-3105-02



Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.

North

1
2
3
4
5

0 5 10 15 20 25 30 35 40 45 50
Metres

ABBREVIATIONS

BT	BT Cover
CH	Cable Height
CL	Cover Level
EH	Eaves Height
GU	Gully
LP	Lamp Post
MH	Man Hole
RH	Ridge/Roof Height
TF	Top of Fence
TW	Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.
Levels (setting edge of carriageway) are observed at channel (bottom of kerb).

Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address
Pilsworth Fishery,
Heywood,
OL10 2RF
Project Description
Site Survey

Drawing Title
Existing Site Layout

Scale	Date	Drawn By
1:500@A1	28/08/2020	SN/JF
Drawing Number		
TRI-3105-03		



Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.

ABBREVIATIONS

BT	BT Cover
CH	Cable Height
CL	Cover Level
EH	Eaves Height
GU	Gully
LP	Lamp Post
MH	Man Hole
RH	Ridge/Roof Height
TF	Top of Fence
TW	Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels (setting edge of carriageway) are observed at channel (bottom of kerb).

Rev.A Description. Additional Survey Data



Site Address
Pilsworth Fishery,
Heywood,
OL10 2RF

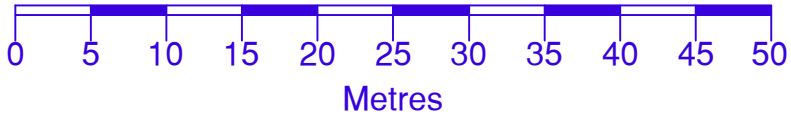
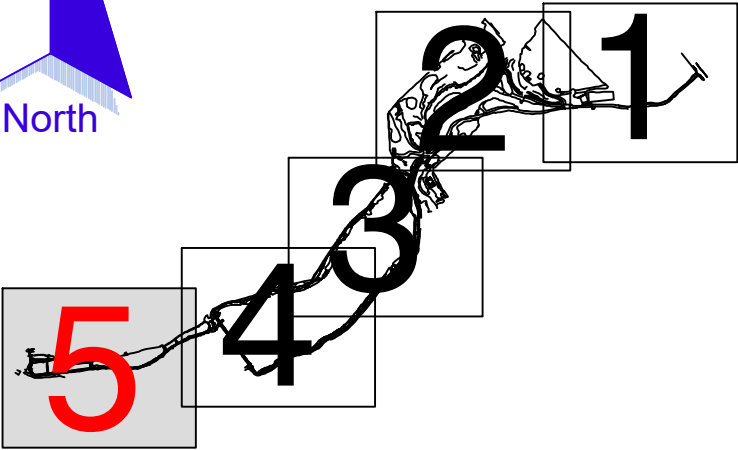
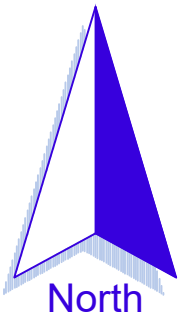
Project Description
Site Survey

Drawing Title
Existing Site Layout

Scale	Date	Drawn By
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Drawing Number		
TRI-3105-04		

Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.

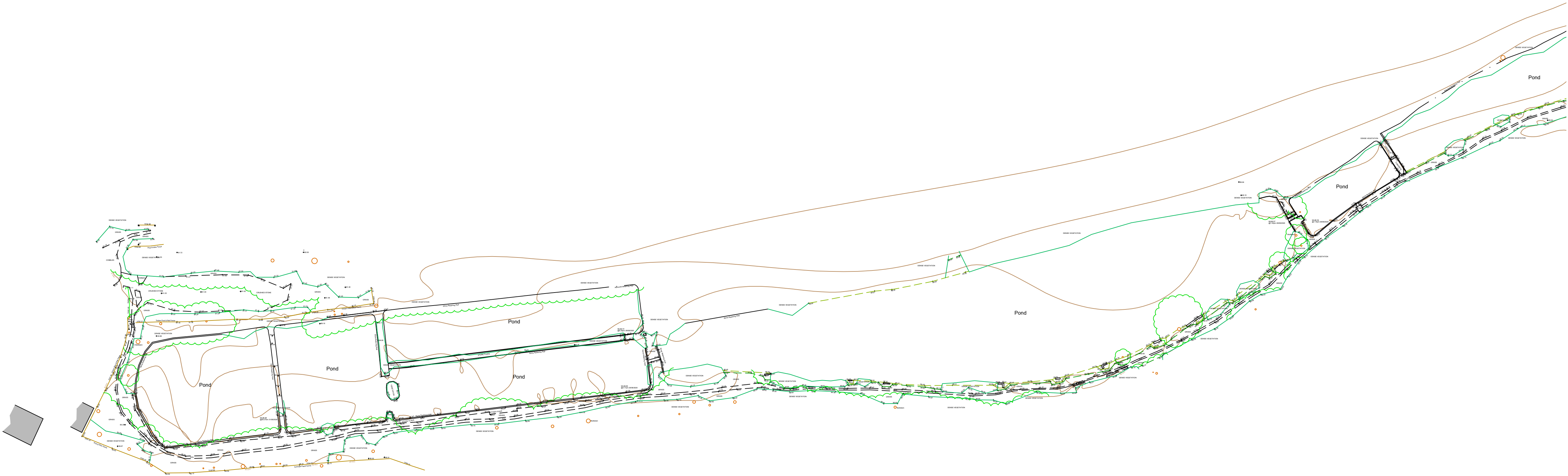


ABBREVIATIONS

- BT BT Cover
- CH Cable Height
- CL Cover Level
- EH Eaves Height
- GU Gully
- LP Lamp Post
- MH Man Hole
- RH Ridge/Roof Height
- TF Top of Fence
- TW Top of Wall

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.
Levels (setting edge of carriageway) are observed at channel (bottom of kerb).



Rev.A Description. Additional Survey Data



2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address

Pilsworth Fishery,
Heywood,
OL10 2RF

Project Description

Site Survey

Drawing Title

Existing Site Layout

Scale	Date	Drawn By
1:500@A1	28/08/2020	SN/JF

Drawing Number

TRI-3105-05

Appendix B: EA Flood Maps and Flood Data

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
383209/408642

Created
29 Feb 2024 14:33

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>

Flood map for planning

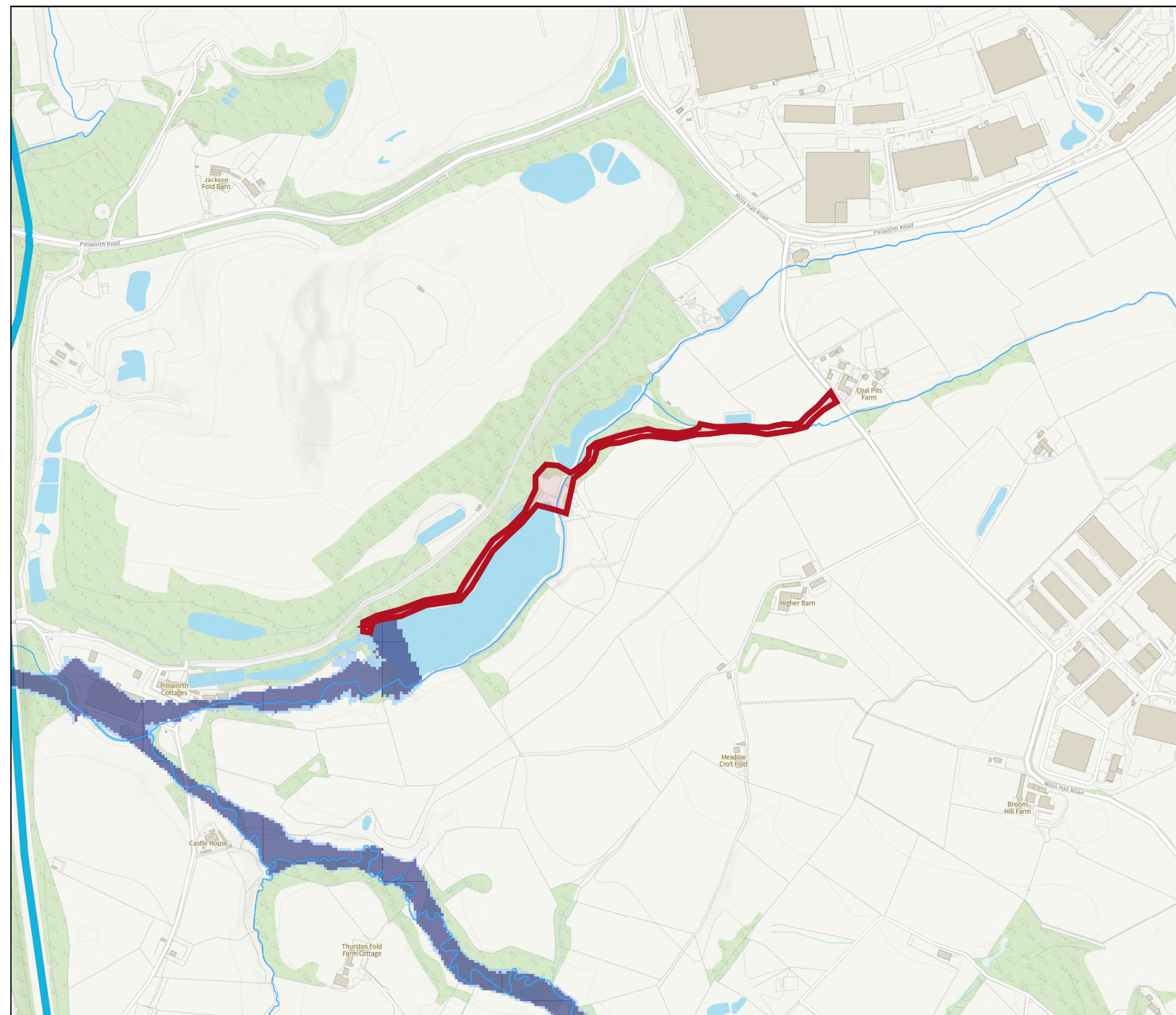
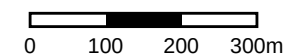
Your reference
<Unspecified>

Location (easting/northing)
383209/408642

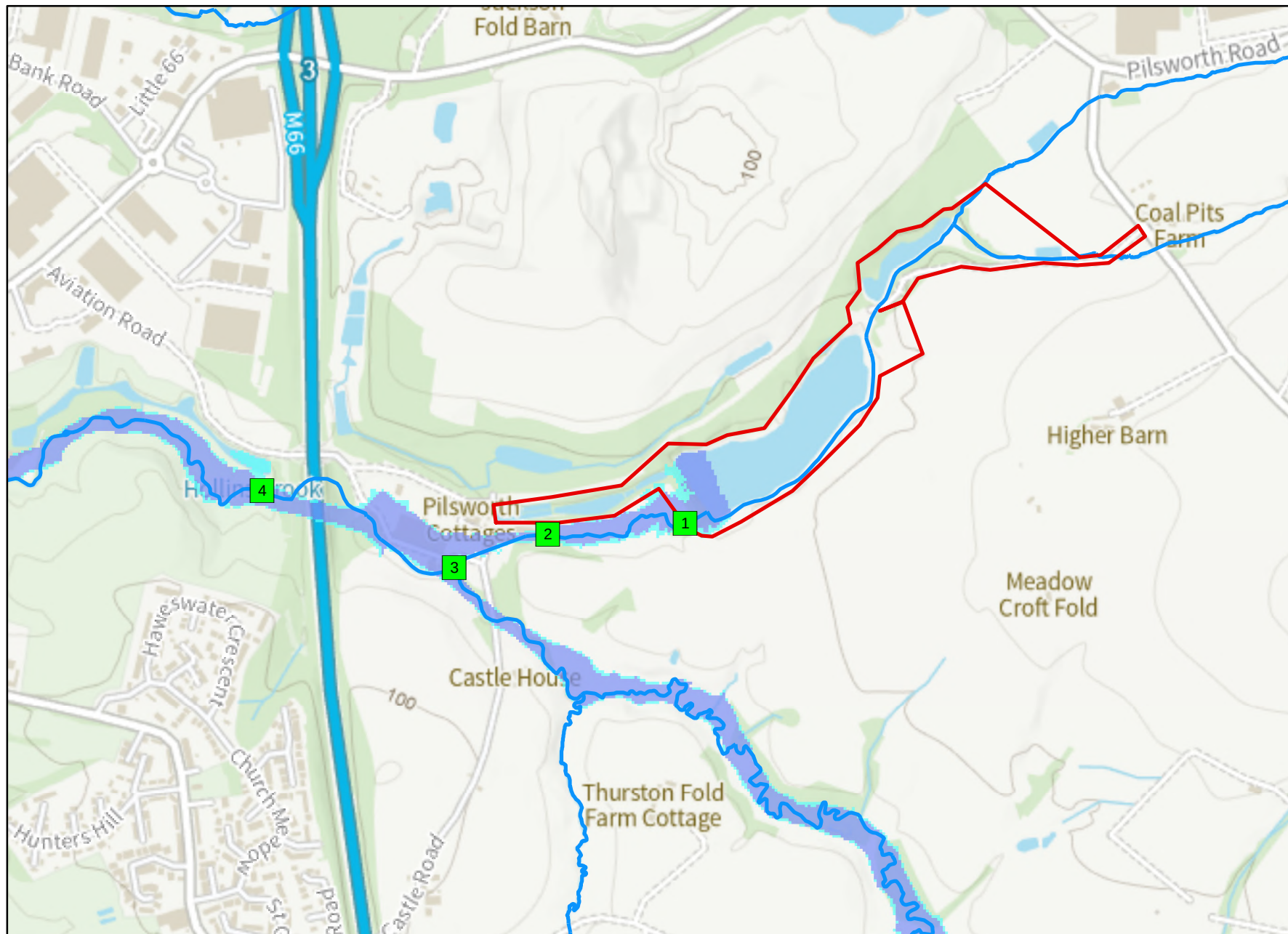
Scale
1:10000

Created
29 Feb 2024 14:33

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



Detailed Flood Map Centred on Moss Hall Road, Heywood, OL10 2RF. Created 02/10/2023 [GMMC328321JM]



1:10,001



Legend

-  Site Location
-  Model Measurements
-  Main River
-  Flood Zone 3
-  Flood Zone 2

					Undefended	
Map Reference	Model Node Reference	Easting	Northing	Data	1 % AEP (1 in 100 year)	0.1 % AEP (1 in 1000 year)
1	Jflow	382802	408317	Modelled Water Level (m aodN)	89.35	89.90
2		382553	408297	Modelled Water Level (m aodN)	85.99	86.44
3		382382	408237	Modelled Water Level (m aodN)	82.39	82.67
4		382033	408377	Modelled Water Level (m aodN)	78.84	79.78

Model data taken from National Generalised Modelling (JFLOW) 2004

AEP - Annual Exceedence Probability

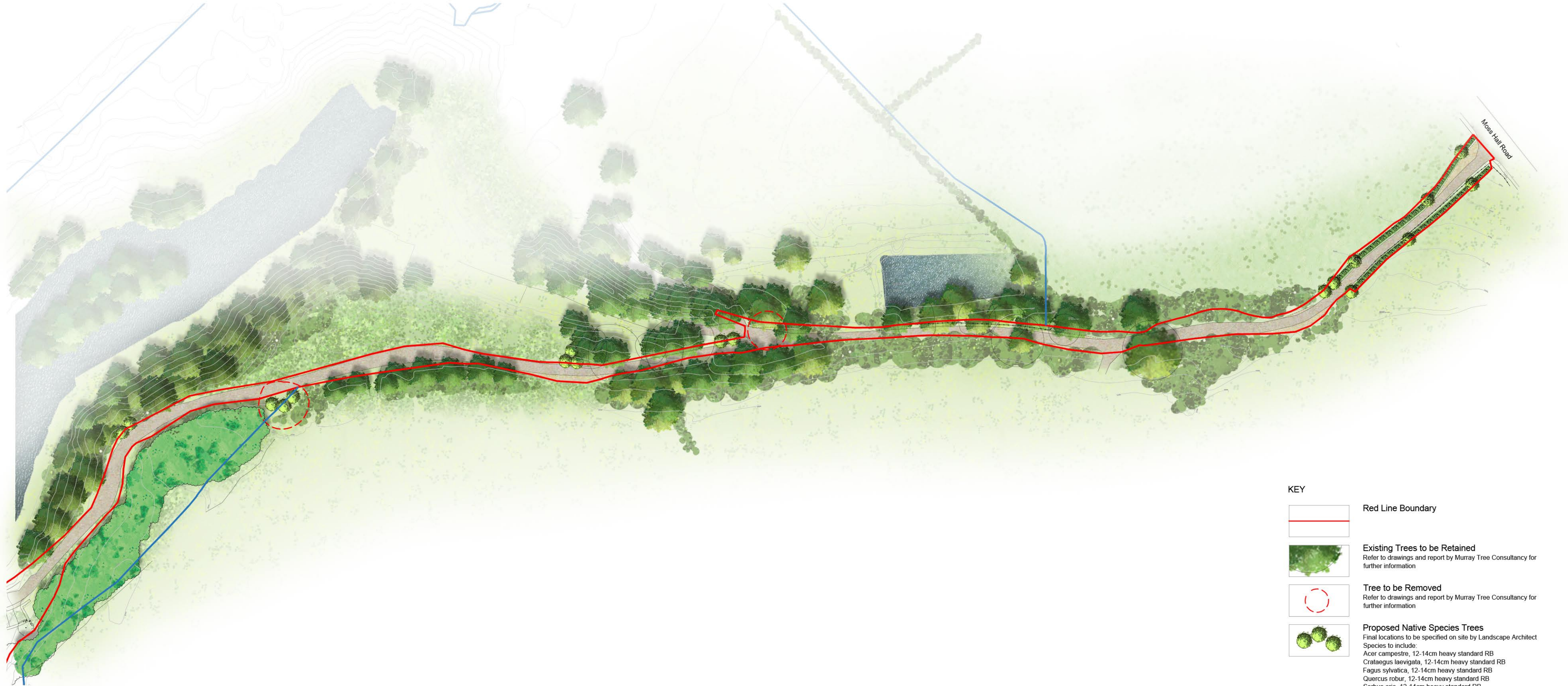
m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: Please note: J-Flow is broadscale National Generalised Modelling and as such is not sufficiently accurate for use in Flood Risk Assessments.

Climate Change Scenario - We do not hold climate change measurements at this location. For further guidance on climate change please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Appendix C: Proposed Development Plan



KEY



Red Line Boundary



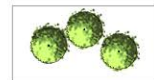
Existing Trees to be Retained

Refer to drawings and report by Murray Tree Consultancy for further information



Tree to be Removed

Refer to drawings and report by Murray Tree Consultancy for further information

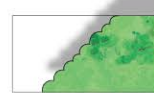


Proposed Native Species Trees

Final locations to be specified on site by Landscape Architect

Species to include:

Acer campestre, 12-14cm heavy standard RB
Crataegus laevigata, 12-14cm heavy standard RB
Fagus sylvatica, 12-14cm heavy standard RB
Quercus robur, 12-14cm heavy standard RB
Sorbus aria, 12-14cm heavy standard RB
Sorbus aucuparia, 12-14cm heavy standard RB



Proposed Native Woodland Planting

Alnus glutinosa 10% of mix (90% 60-90cm, BR transplants and 10% 8-10cm light standards)
Betula pendula 10% of mix (90% 60-90cm, BR transplants and 10% 8-10cm light standards)
Corylus avellana 30% of mix (100% 60-90cm BR transplants)
Crataegus monogyna 30% of mix (100% 60-90cm BR transplants)
Fagus sylvatica 10% of mix (90% 60-90cm, BR transplants and 10% 8-10cm light standards)
Quercus robur 10% of mix (90% 60-90cm, BR transplants and 10% 8-10cm light standards)



Proposed Native Species Hedge

Native species hedgerow planted to replace hedges H1 and H2 (see report by Murray Tree Consultancy for further information)

To be planted in a double staggered row @ 5 plants per lin m

Species mix:

Crataegus monogyna - 45% 60-90cm BR transplant
Corylus avellana - 20% 60-90cm BR transplant
Prunus spinosa - 20% 60-90cm BR transplant
Ilex aquifolium - 5% 3L CO
Viburnum opulus - 10% 60-90cm BR transplant



Access Track

Existing access track with areas widened to allow for passing places as per drawings by SCP

Unit 6, Longley Lane
Northenden, Manchester
M22 4WT

T: 0161 946 0808
E: design@barneswalker.co.uk
W: www.barneswalker.co.uk

DWG NO.
M3541-PA-02-V1

CLIENT:
Atelier Architects

WORK STAGE
PLANNING

SCALE
1:1000@A2

DWG TITLE:
Access Track Layout

PROJECT TITLE:
Pilsworth Lake, Bury

DATE
02.2024

DRAWN BY:
BWL

CHECKED BY:
BWL

Appendix D: United Utilities Asset Records

Jamie Skipper Reed

**Temple Chambers
3-7 Temple Avenue,
LONDON,
EC4Y 0HP**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: 001
Our Ref: UUPS-ORD-524766
Date: 17/10/2023**

Dear Sirs

Location: Pilsworth

I acknowledge with thanks your request dated 12/10/2023 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

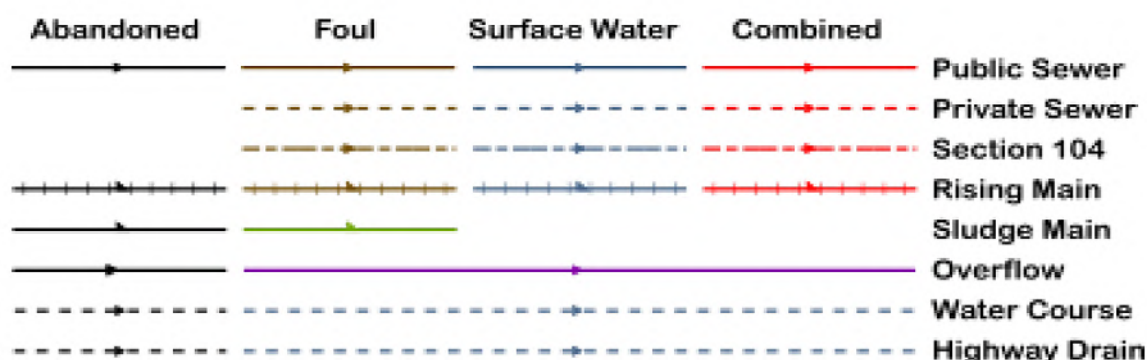
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	



SEWER RECORDS

Address or Site Reference

Pilsworth,

Scale: 1:5000
Date: 17/10/2023

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Ordnance Survey 100022432. Unauthorised
reproduction will infringe these copyrights.

Appendix E: Runoff Rates

Pilsworth Lake Café

Runoff Rate Calculations

By J Skipper Reed
Checked F Wyatt



Existing

Catchments	Area (m2)					Existing discharge rates (L/s)		
	Impermeable	Permeable (flat)	Permeable (sloped)	Total	Effective area	1 in 2	1 in 30	1 in 100
1	211.65	0	254.35	466	364.26			
2	996	0	624	1620	1370.4			
3	621.5	0	105.5	727	684.8			
Total	1829.15	0	983.85	2813	2419.46	18.90	48.15	60.35
Runoff coeffi	1	0.25	0.6					

Note - values taken from input into existing tab

Proposed - these rates are for the present. No climate change % used

Catchments	Area (m2)					Greenfield runoff				Unattenuated discharge rates (L/s)		
	Impermeable	Permeable (flat)	Permeable (sloped)	Total	Effective area	1 in 2	1 in 30	1 in 100	Qbar	1 in 2	1 in 30	1 in 100
1	260.25	0	205.75	466	383.7	0.31	0.61	0.74	0.36	2.997	7.636	9.571
2	1146	0	474	1620	1430.4	1.08	2.11	2.58	1.24	11.173	28.465	35.681
3	638.77	0	88.23	727	691.708	0.49	0.95	1.16	0.56	5.403	13.765	17.254
Total	2045.02	0	767.98	2813	2505.808	1.88	3.66	4.48	2.16			
Runoff coefficient		0.25	0.6									

Total rates from HR Wallingford greenfield rate calculator

Proposed rates (L/s)

1 in 2	1 in 30	1 in 100
14.73	36.66	45.81

Catchment 1 - Discharges unattenuated
Catchment 2 - Discharges unattenuated
Catchment 3 - Discharges at Qbar after attenuation in swale

Summary table

	Discharge rates (L/s)		
	1 in 2	1 in 30	1 in 100
Existing	18.90	48.15	60.35
Proposed	14.73	36.66	45.81
Improvement	4.17	11.49	14.54
%improvement	22.1	23.9	24.1

Improvement of proposed vs existing at present. % improvement increases with time due to CC factor.
Swale is designed to attenuate 1 in 100year plus 45% cc to Qbar

Calculated by:	Jamie Skipper Reed
Site name:	Pilsworth Lake Cafe
Site location:	Pilsworth

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.57526° N
Longitude:	2.25357° W
Reference:	1013600995
Date:	Feb 29 2024 18:07

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.281
-----------------------	-------

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{\text{BAR}} < 2.0 \text{ l/s/ha}$?

When Q_{BAR} is $< 2.0 \text{ l/s/ha}$ then limiting discharge rates are set at 2.0 l/s/ha .

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(2) Are flow rates $< 5.0 \text{ l/s}$?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	1040	1040
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	2.16	2.16
1 in 1 year (l/s):	1.88	1.88
1 in 30 years (l/s):	3.66	3.66
1 in 100 year (l/s):	4.48	4.48
1 in 200 years (l/s):	5.11	5.11

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Expedition Engineering

4 Maguire Street
London
SE1 2NQ

Pilsworth Lake Cafe
Access road swale sizing

Date 26/03/2024
File SWALE SIZING.SRCX

Designed by JSR
Checked by FW

Innovyze

Source Control 2020.1.3

Page 1



Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 796 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	93.134	0.384	0.0	0.4	0.4	17.1	O K
30 min Summer	93.211	0.461	0.0	0.5	0.5	23.4	Flood Risk
60 min Summer	93.283	0.533	0.0	0.5	0.5	30.2	Flood Risk
120 min Summer	93.329	0.579	0.0	0.5	0.5	35.0	Flood Risk
180 min Summer	93.353	0.603	0.0	0.5	0.5	37.6	Flood Risk
240 min Summer	93.368	0.618	0.0	0.5	0.5	39.3	Flood Risk
360 min Summer	93.384	0.634	0.0	0.5	0.5	41.1	Flood Risk
480 min Summer	93.390	0.640	0.0	0.5	0.5	41.8	Flood Risk
600 min Summer	93.391	0.641	0.0	0.5	0.5	41.9	Flood Risk
720 min Summer	93.390	0.640	0.0	0.5	0.5	41.8	Flood Risk
960 min Summer	93.387	0.637	0.0	0.5	0.5	41.4	Flood Risk
1440 min Summer	93.376	0.626	0.0	0.5	0.5	40.2	Flood Risk
2160 min Summer	93.359	0.609	0.0	0.5	0.5	38.3	Flood Risk
2880 min Summer	93.342	0.592	0.0	0.5	0.5	36.4	Flood Risk
4320 min Summer	93.312	0.562	0.0	0.5	0.5	33.2	Flood Risk
5760 min Summer	93.285	0.535	0.0	0.5	0.5	30.4	Flood Risk
7200 min Summer	93.260	0.510	0.0	0.5	0.5	28.0	Flood Risk
8640 min Summer	93.238	0.488	0.0	0.5	0.5	25.9	Flood Risk
10080 min Summer	93.218	0.468	0.0	0.5	0.5	24.1	Flood Risk
15 min Winter	93.161	0.411	0.0	0.4	0.4	19.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.418	0.0	17.6	30
30 min Summer	94.978	0.0	24.1	44
60 min Summer	62.183	0.0	31.7	74
120 min Summer	37.047	0.0	37.8	132
180 min Summer	27.313	0.0	41.8	190
240 min Summer	21.991	0.0	44.8	248
360 min Summer	16.198	0.0	49.5	364
480 min Summer	13.017	0.0	53.1	482
600 min Summer	10.978	0.0	56.0	576
720 min Summer	9.547	0.0	58.4	626
960 min Summer	7.652	0.0	62.3	750
1440 min Summer	5.605	0.0	66.6	1012
2160 min Summer	4.132	0.0	75.9	1428
2880 min Summer	3.346	0.0	81.9	1844
4320 min Summer	2.510	0.0	92.2	2644
5760 min Summer	2.062	0.0	101.0	3456
7200 min Summer	1.777	0.0	108.7	4192
8640 min Summer	1.579	0.0	116.0	4944
10080 min Summer	1.434	0.0	122.9	5744
15 min Winter	138.418	0.0	19.7	30

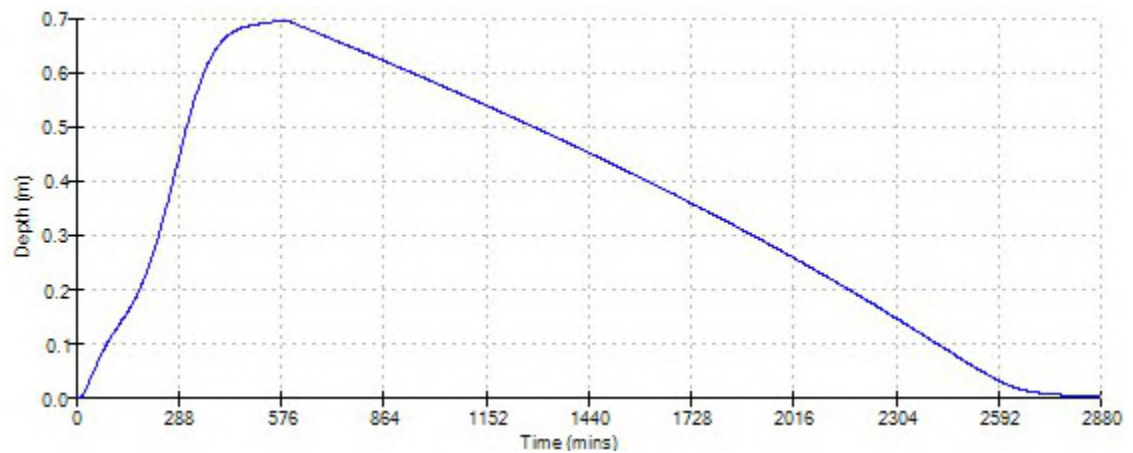
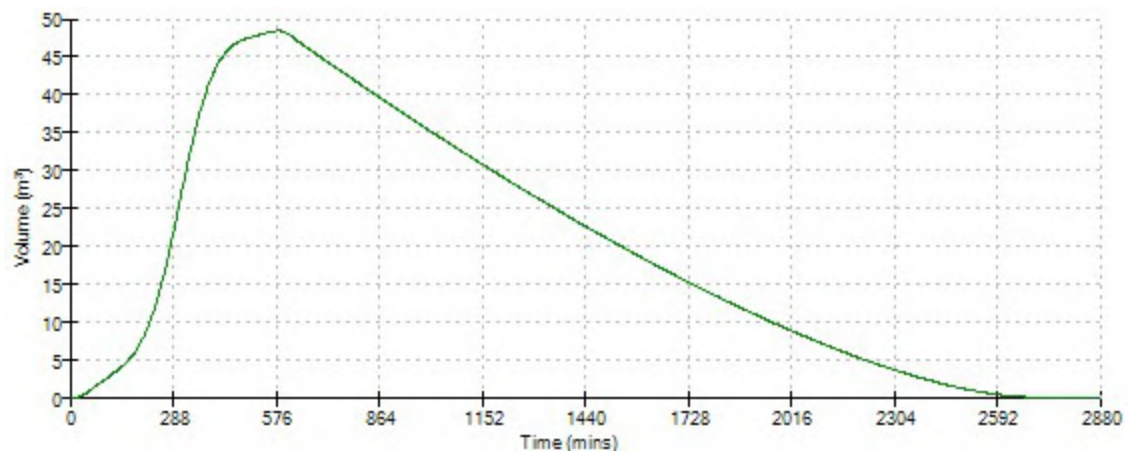
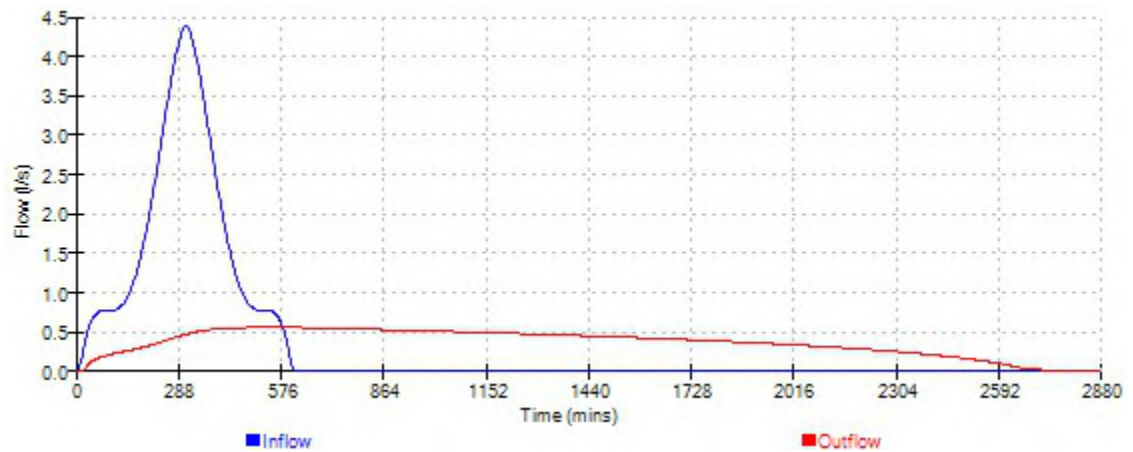
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Expedition Engineering							Page 2
4 Maguire Street London SE1 2NQ				Pilsworth Lake Cafe Access road swale sizing			
Date 26/03/2024 File SWALE SIZING.SRCX				Designed by JSR Checked by FW			
Innovyze				Source Control 2020.1.3			
Summary of Results for 100 year Return Period (+45%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	93.242	0.492	0.0	0.5	0.5	26.3	Flood Risk
60 min Winter	93.320	0.570	0.0	0.5	0.5	34.0	Flood Risk
120 min Winter	93.370	0.620	0.0	0.5	0.5	39.5	Flood Risk
180 min Winter	93.396	0.646	0.0	0.5	0.5	42.5	Flood Risk
240 min Winter	93.413	0.663	0.0	0.5	0.5	44.6	Flood Risk
360 min Winter	93.433	0.683	0.0	0.6	0.6	47.0	Flood Risk
480 min Winter	93.441	0.691	0.0	0.6	0.6	48.1	Flood Risk
600 min Winter	93.444	0.694	0.0	0.6	0.6	48.4	Flood Risk
720 min Winter	93.444	0.694	0.0	0.6	0.6	48.4	Flood Risk
960 min Winter	93.438	0.688	0.0	0.6	0.6	47.6	Flood Risk
1440 min Winter	93.425	0.675	0.0	0.6	0.6	46.0	Flood Risk
2160 min Winter	93.401	0.651	0.0	0.5	0.5	43.1	Flood Risk
2880 min Winter	93.375	0.625	0.0	0.5	0.5	40.1	Flood Risk
4320 min Winter	93.327	0.577	0.0	0.5	0.5	34.8	Flood Risk
5760 min Winter	93.284	0.534	0.0	0.5	0.5	30.3	Flood Risk
7200 min Winter	93.245	0.495	0.0	0.5	0.5	26.5	Flood Risk
8640 min Winter	93.210	0.460	0.0	0.5	0.5	23.4	Flood Risk
10080 min Winter	93.179	0.429	0.0	0.4	0.4	20.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	94.978	0.0	27.0	44			
60 min Winter	62.183	0.0	35.5	72			
120 min Winter	37.047	0.0	42.3	130			
180 min Winter	27.313	0.0	46.8	186			
240 min Winter	21.991	0.0	50.2	244			
360 min Winter	16.198	0.0	55.5	358			
480 min Winter	13.017	0.0	59.4	470			
600 min Winter	10.978	0.0	62.7	580			
720 min Winter	9.547	0.0	65.3	686			
960 min Winter	7.652	0.0	69.2	792			
1440 min Winter	5.605	0.0	71.8	1090			
2160 min Winter	4.132	0.0	85.0	1548			
2880 min Winter	3.346	0.0	91.7	1992			
4320 min Winter	2.510	0.0	103.2	2852			
5760 min Winter	2.062	0.0	113.1	3640			
7200 min Winter	1.777	0.0	121.8	4464			
8640 min Winter	1.579	0.0	129.9	5192			
10080 min Winter	1.434	0.0	137.6	5952			
©1982-2020 Innovyze							

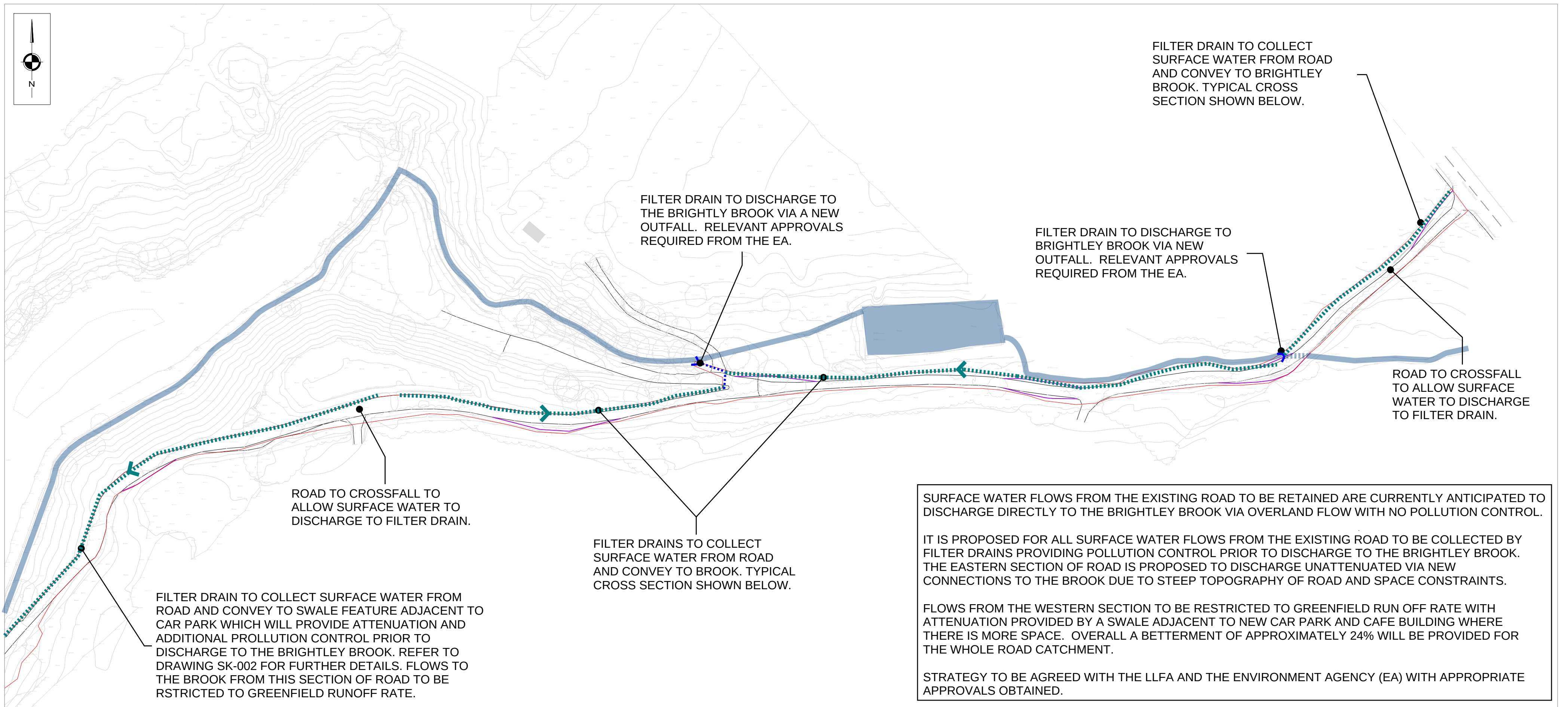
Expedition Engineering		Page 3																								
4 Maguire Street London SE1 2NQ	Pilsworth Lake Cafe Access road swale sizing																									
Date 26/03/2024 File SWALE SIZING.SRCX	Designed by JSR Checked by FW																									
Innovyze																										
Source Control 2020.1.3																										
Rainfall Details Rainfall ModelFEH Return Period (years)100 FEH Rainfall Version2013 Site Location GB 383230 408776 SD 83230 08776 Data TypePoint Summer StormsYes Winter StormsYes Cv (Summer)0.750 Cv (Winter)0.840 Shortest Storm (mins)15 Longest Storm (mins)10080 Climate Change %+45 Time Area Diagram Total Area (ha) 0.068 <table><tr><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th><th>Time (mins)</th><th>Area</th></tr><tr><th>From: To:</th><th>(ha)</th><th>From: To:</th><th>(ha)</th><th>From: To:</th><th>(ha)</th><th>From: To:</th><th>(ha)</th></tr><tr><td>0 4</td><td>0.017</td><td>4 8</td><td>0.017</td><td>8 12</td><td>0.017</td><td>12 16</td><td>0.017</td></tr></table> ©1982-2020 Innovyze			Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.017	4 8	0.017	8 12	0.017	12 16	0.017
Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area																			
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)																			
0 4	0.017	4 8	0.017	8 12	0.017	12 16	0.017																			

Expedition Engineering		Page 4																								
4 Maguire Street London SE1 2NQ	Pilsworth Lake Cafe Access road swale sizing																									
Date 26/03/2024 File SWALE SIZING.SRCX	Designed by JSR Checked by FW																									
Innovyze Source Control 2020.1.3																										
Model Details Storage is Online Cover Level (m) 93.500 Swale Structure <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Length (m)</td><td>30.0</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td>Side Slope (1:X)</td><td>3.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Porosity</td><td>0.90</td><td>Cap Volume Depth (m)</td><td>0.000</td></tr><tr><td>Invert Level (m)</td><td>92.750</td><td>Cap Infiltration Depth (m)</td><td>0.000</td></tr><tr><td>Base Width (m)</td><td>0.5</td><td></td><td></td></tr></table> Orifice Outflow Control Diameter (m) 0.018 Discharge Coefficient 0.600 Invert Level (m) 92.750			Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	30.0	Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0	Safety Factor	2.0	Slope (1:X)	0.0	Porosity	0.90	Cap Volume Depth (m)	0.000	Invert Level (m)	92.750	Cap Infiltration Depth (m)	0.000	Base Width (m)	0.5		
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	30.0																							
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Safety Factor	2.0	Slope (1:X)	0.0																							
Porosity	0.90	Cap Volume Depth (m)	0.000																							
Invert Level (m)	92.750	Cap Infiltration Depth (m)	0.000																							
Base Width (m)	0.5																									
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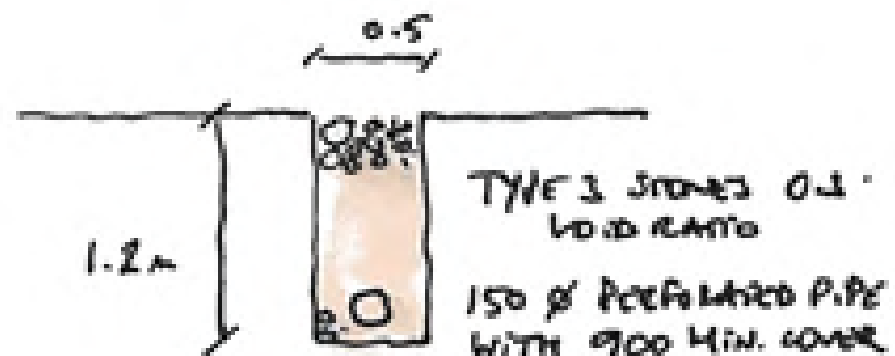
Event: 600 min Winter



Appendix F: Drainage Strategy



TYPICAL FILTER DRAIN CROSS SECTION:



KEY:

- PROPOSED BELOW GROUND PIPEWORK
- PROPOSED FILTER DRAIN OR HYDROROCK
- OUTFALL
- BRIGHTLEY BROOK (EXISTING)
- EXISTING ROAD
- PROPOSED PASSING PLACES
- RED LINE BOUNDARY

Title: Pilsworth Lake Cafe Drainage Strategy - Access Road

Job: Pilsworth Lake Cafe

Job No.: 2013

Sketch No.: SK-001

Date: 01/03/2024

By: JSR

ACCESS ROAD FOR
OVERFLOW PARKING TO
CROSSFALL TO FILTER DRAIN
AND CONNECT TO WETLAND

FOOTPATHS TO HAVE
PERMEABLE
SURFACING OR
CROSSFALL TO SOFT
LANDSCAPING.

ROAD TO CROSSFALL
TO ALLOW SURFACE
WATER TO DISCHARGE
TO FILTER DRAIN.

THRESHOLD DRAIN
AT BOTTOM OF
ROAD TO CAPTURE
SURFACE WATER
OVERLAND FLOWS

FLUSH KERB TO
ALLOW SURFACE
WATER TO
DISCHARGE INTO
TREE PIT

CARPARKING AREA WITH PERMEABLE
BAYS FOR INFILTRATION. FEASIBILITY
OF INFILTRATION TO BE CONFIRMED BY
INFILTRATION TESTS AT NEXT STAGE.

CHAMBER WITH
SUMP TO
COLLECT SILTS

PROPOSED
RAINGARDENS TO
PROVIDE POLLUTION
CONTROL TO ROOF
DRAINAGE BEFORE
DISCHARGE TO PRIVATE
LAKE

PROPOSED PACKAGE
TREATMENT PLANT TO
TREAT FOUL DISCHARGES
FROM CAFE PRIOR TO
DISCHARGE TO THE
PRIVATE LAKE. SAMPLING
CHAMBER TO BE
PROVIDED DOWNSTREAM
OF TREATMENT.
APPROPRIATE
APPROVALS AND
DISCHARGE CRITERIA TO
BE AGREED WITH THE EA.

FLOWES FROM
HARDSTANDING
TO DISCHARGE
INTO
PERMEABLE
BAYS.

SURFACE WATER FROM CAR PARKS TO TOP UP
WETLAND WHICH WILL PROVIDE BIODIVERSITY
AND AMENITY BENEFITS AS WELL AS POLLUTION
CONTROL OF FLOWS PRIOR TO THEIR
DISCHARGE TO LAKE. REFER TO LANDSCAPE
ARCHITECTS PLANS FOR DETAILS OF PROPOSED
WETLAND INCLUDING WATER LEVELS. MIN 300mm
FREEBOARD TO TOP OF BANK REQUIRED.

SWALE TO COLLECT SURFACE WATER FROM
WESTERN SECTION OF ROAD AND PROVIDE
ATTENUATION AND POLLUTION CONTROL PRIOR
TO DISCHARGE TO BRIGHTLEY BROOK. SEE
TYPICAL CROSS SECTION. APPROXIMATELY 30m
LONG PROVIDING APPROX. 50m3 OF STORAGE.

DISCHARGE FROM SWALE TO BRIGHTLEY
BROOK. FLOWS TO BE RESTRICTED TO
GREENFIELD RATE OF 0.5l/s FOR WESTERN
SECTION OF ROAD CATCHMENT AREA VIA
ORIFICE ON OUTLET. RELEVANT APPROVALS
WILL BE REQUIRED FROM THE ENVIRONMENT
AGENCY (EA) AND LLFA.

FALLS TO BE
PROVIDED
AWAY FROM
THE BUILDING

OUTFALL STRUCTURE WITH
SCOUR PROTECTION HIDDEN
BENEATH DECKING TO
DISCHARGE SURFACE WATER
FLOW FROM NEW CAFE
BUILDING AND CAR PARK TO
PRIVATE LAKE.

GREEN ROOF ON VIEWING
PLATFORM TO DISCHARGE
DIRECTLY TO LAKE

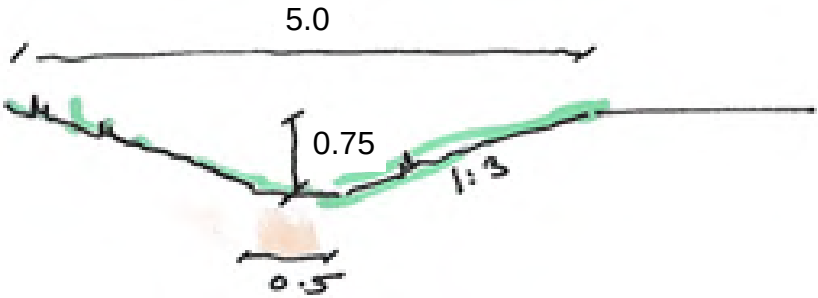
ROOF DRAINAGE TO
DISCHARGE TO LAKE
VIA RAIN GARDEN TO
PROVIDE POLLUTION
CONTROL

INDICATIVE REED
BED FOR TERTIARY
TREATMENT PRIOR
TO DISCHARGE TO
THE LAKE

SURFACE WATER TO DRAIN
THROUGH DECKING AND
DISCHARGE DIRECTLY TO LAKE.

SURFACE WATER FLOWS FROM NEW CAFE TO
DISCHARGE UNATTEUNATED TO PRIVATE LAKE WITH
APPROPRIATE POLLUTION CONTROL.

TYPICAL TURF SWALE CROSS SECTION:



- KEY:
- PROPOSED BELOW GROUND PIPEWORK
 - PROPOSED FILTER DRAIN
 - PROPOSED FOUL DRAINAGE
 - PROPOSED PERMEABLE SURFACE
 - GREEN ROOF/RAINGARDEN
 - OUTFALL
 - BRIGHTLEY BROOK (EXISTING)
 - SWALE TO DRAIN ROAD
 - THRESHOLD DRAIN

Title: Pilsworth Lake Cafe Drainage Strategy - Cafe/shop and car park

Job: Pilsworth Lake Cafe

Job No.: 2013

Sketch No.: SK-002

Date: 16/04/2024

By: JSR

Appendix G: SuDS Treatment Assessment

Pollution hazard indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
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

SuDS component	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Filtration Drain	0.4	0.4	0.4
Permeable pavement	0.7	0.6	0.7

Route 1:	Road to Brook via filter drain		
SuDS component	TSS	Metals	Hydrocarbons
Filtration Drain	0.4	0.4	0.4
Source - low risk	-0.5	-0.4	-0.4
net treatment	-0.1	0	0
Meet SuDs Criteria?			

Route 2:	Roof to lake via green roof or raingarden		
SuDS component	TSS	Metals	Hydrocarbons
Bioretention system	0.8	0.8	0.8
Source - low risk	-0.3	-0.2	-0.05
net treatment	0.5	0.6 to 0	0.75
Meet SuDs Criteria?			

Route 3:	Car park to lake via permeable pavement		
SuDS component	TSS	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Source - low risk	-0.5	-0.4	-0.4
net treatment	0.2	0.2	0.3
Meet SuDs Criteria?			

Route 4:	Car park to lake via wetland		
SuDS component	TSS	Metals	Hydrocarbons
Bioretention System	0.8	0.8	0.8
Source - low risk	-0.5	-0.4	-0.4
net treatment	0.3	0.4	0.4
Meet SuDs Criteria?			

Route 5:	Road to Brook via swale		
SuDS component	TSS	Metals	Hydrocarbons
Filtration drain	0.5	0.6	0.6
Source - low risk	-0.5	-0.4	-0.4
net treatment	0	0.2	0.2
Meet SuDs Criteria?			

Appendix H: SuDS Maintenance and Management Plan

Maintenance and Management

Maintenance of the drainage system will be carried out by the owners of the relevant assets as set out below:

- SuDS and on-site drainage will be owned and maintained by Patel & Patel

The indicative maintenance requirements for each proposed SuDS component is given below, taken from CIRIA report C753 "The SuDS Manual".

Drainage Pipes

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	Annually
	Cleaning of gutters and any filters on downpipes	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals

Green roofs

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and 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 sediment 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, replace dead plants as required	Monthly
	Post establishment, replace dead plants as required	Annually
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required

SuDS Maintenance & Management Plan

	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting as required	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

Swales

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular Maintenance	Litter and debris removal	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season, or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly (or when required)
	Inspect inlets, outlets and overflows for evidence of blockage and clear if required	Monthly
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility structure for all silt accumulation. Establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Re-seed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseedling	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As Required
	Scarify and spike topsoil layer to improve infiltration performances, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required

Bioretention systems (Rain gardens)

SuDS Maintenance & Management Plan

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be >20 years

Porous Pavements

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
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

SuDS Maintenance & Management Plan

	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 material	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)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually



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