CONSULTING ENGINEERS LTD

FLOOD RISK ASSESSMENT

PIT LANE, WOMBWELL

On Behalf of

CREST NICHOLSON YORKSHIRE

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QUALITY MANAGEMENT

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Prepared By	W Walker	W Walker		
Date	27 September 2023	15 April 2025		
Signature				
Reviewed By	A Bottomley	A Bottomley		
Date	27 September 2023	15 April 2025		
Signature				

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APPENDICIES

1.0 INTRODUCTION

1.1 Crest Nicholson Yorkshire is proposing to develop a large parcel of land located off Pit Lane, Wombwell with a new residential development. As part of the viability of the site and to supplement a planning application, it was decided that a Flood Risk Assessment Report should be undertaken.

1.2 It is within the general development strategy of the country for development in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement for flood defence. Under the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Water Authority, Land Drainage Authority and Internal Drainage Board and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.

1.3 OEC has been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with NPPF, to satisfy the requirements of the Planning Authority.

1.4 The consultations and walkover survey have been undertaken between July and August 2023, with the site location plan updated in April 2025.

1.5 This report is based on the interpretation and assessment of data provided by third parties. Whilst every effort has been taken to ensure this information is accurate and up-to-date, OEC cannot guarantee the accuracy of third party data and the findings of this report may change if the data is amended or updated after the date of consultation.

2.0 EXISTING SITE

General

2.1 The site is an irregular shaped piece of land equating to an area of approximately 7.4ha. The site is located on the western edge of Wombwell and is situated at Ordnance Survey Grid Reference SE 387 028.

2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is greenfield, used as agricultural farmland for the growing of crops.

Boundaries

2.4 The site is bounded primarily by a mix of fencing, with Pit Lane following the northern boundary and an un-named access track following the full extent of the western boundary, providing access to several yard/store areas. Residential properties line the eastern boundary, with sports pitches belonging to Wombwell Sports Club adjoining the site to the south.

Topography and Vegetation

2.5 The site has a prominent fall in a westerly direction with levels ranging between 89.7m A.O.D and 84.5m A.O.D along the eastern boundary, dropping to a low point of approximately 69.0m A.O.D in the western corner of the site.

2.6 Vegetation on the site is minimal and is purely crops, however, extensive mature vegetation in the form of mature hedgerows, trees and bushes, surround all boundaries of the site. The land is also divided into three parcels by hedgerows.

2.7 A topographical survey is presented in Appendix B, with site photographs in Appendix C.

Existing Drainage

2.8 There is no obvious positive drainage system on the site, although land drainage may be present. Surface water run-off clearly discharges in a westerly direction following the natural topography of the site.

2.9 An unnamed watercourse is located crossing the site that has a 150mm diameter public surface water sewer discharging into it towards the eastern boundary.

2.10 The nearest river to the site is the River Dove, located approximately 848m in a north-westerly direction, from the site boundary at its nearest location.

Geology and Hydrogeology

2.11 The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone.

2.12 The Environment Agency website designates the bedrock under the site as a Secondary A Aquifer. This is a permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

2.13 The Environment Agency website shows that the site does not lie within a Groundwater Source Protection Zone.

3.0 ENVIRONMENT AGENCY CONSULTATION

3.1 The Environment Agency Flood Map, which shows area of land that could flood from rivers or the sea and are shaded blue are presented in Appendix D. These areas do not take into account defences as water can overtop or can fail in extreme conditions. The EA flood zone classifications are defined as:-

3.1.1 Flood Zone 1 - 'Low Probability' is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%).

3.1.2 Flood Zone 2 - 'Medium Probability' is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of flooding from the sea (0.5% - 0.1%).

3.1.3 Flood Zone 3 - 'High Probability' is assessed as having a 1 in 100 or greater annual probability of river flooding in any year (greater than 1%) and a 1 in 200 chance or greater annual probability of flooding from the sea (less than 0.5%).

3.2 The EA flood map for planning shows the site is located within Flood Zone 1 and the site, therefore, has a low risk of fluvial flooding.

3.3 The flood map for surface water, which shows areas where surface water only would be expected to flow or pond in England & Wales, is also presented in Appendix D. All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:-

3.3.1 High - This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%).

3.3.2 Medium - This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year.

3.3.3 Low - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year.

3.3.4 Very low - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year.

3.4 The proposed development is shown to be within a very low risk area for surface water flooding, with a low risk area associated with the watercourse crossing the site.

4.0 WATER AUTHORITY CONSULTATION

4.1 A consultation was requested from Yorkshire Water (YW), who are the Water Authority for this area, and a copy of their response, reference Z003312, dated 30 June 2023, is presented in Appendix E for reference purposes.

4.2 As of October 2011, and the private to public sewer transfer, there are many unchartered Yorkshire Water assets currently not shown on their records.

4.3 There is a 150mm diameter public foul sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 4 (four) metres either side of the sewer centreline, or trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer.

4.4 There is a 150mm diameter public surface water sewer recorded on the site. In this instance, building-over may take place under the control of Part H4 Building Regulations 2010. No trees to be planted within 5 (five) metres of this public sewer.

4.5 Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

4.6 From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network.

4.7 The closest practicable point of discharge for foul will be the 150mm diameter foul public sewer close to the site, but a present it does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed site. Subject to the submission of a Formal Planning Application and robust build plan and start date, Yorkshire Water will carry out a feasibility study to determine suitable foul

connection points, any available capacity in the public sewer network, together with timescales for any potential upgrading works required.

4.8 The cost for any feasibility/modelling/upgrade works will be at Yorkshire Waters cost up-front and recouped via the site's eventual infrastructure charges.

4.9 In respect of surface water, reference is made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy of surface water disposal. Consideration should firstly be given to discharge to soakaways, infiltration and watercourse, in that priority order, before connection to sewer will be considered.

4.10 Sustainable Drainage Systems (SuDS), for example the sue of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal. It is advised to seek comments on the suitability of SuDS.

4.11 As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network.

4.12 As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/Lead Local Flood Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

4.13 It is understood that a culverted watercourse is located running through the site and open watercourses are located to the west of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

4.14 Restrictions on surface water disposal from the site may be imposed by other parties. It is strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority, with regards to surface water disposal from the site.

5.0 LEAD LOCAL FLOOD AUTHORITY CONSULTATION

5.1 A consultation was requested from Barnsley Metropolitan Borough Council (BMBC) who are the Lead Local Flood Authority (LLFA) for this area, and a copy of their response, dated 26 June 2023 is presented in Appendix F.

5.2 The LLFA has provided a plan of watercourses within the vicinity of the site and the nearest flood incidents. It can be seen that the nearest incident is located downstream of the site.

5.3 The site is greenfield, therefore, run-off rates should be calculated using IH124, taking the Q_{BAR} run-off rate.

5.4 The surface water drainage design should demonstrate the following:-

- No surcharging above soffit level during a 1 year storm event
- No flooding of any part of the site during a 30 year storm event
- No flooding to property or third party land during a 100 year plus climate change storm event

5.5 It was confirmed that the LLFA are still using a 30% allowance for climate change and that no uplift for urban creep is required.

5.6 Further consultation took place with the LLFA to agree the surface water discharge rate, however, at the time of writing the report a response was still to be received.

6.0 INTERNAL DRAINAGE BOARD CONSULTATION

6.1 The proposed development site is not located within an Internal Drainage Board catchment.

7.0 MATERIAL CONSIDERATION IN RESPECT OF NPPF AND PPG

Flood Classification

7.1 The Environment Agency flood map has identified that the site falls within land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%). In accordance with Table 1 of the PPG, the site falls within Flood Zone 1 "low probability".

7.2 Therefore, all uses of the land are appropriate within this zone, but an assessment of the effect of surface water run-off will need to be incorporated in any Flood Risk Assessment.

End Use

7.3 The development proposal is for the construction of residential development on the site, and a copy of the planning layout is presented in Appendix G, for reference purposes.

7.4 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "more vulnerable" classification.

Sequential & Exception Test

7.5 As set out in the NPPF, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding (Zone 1).

7.6 When the development site is evaluated in accordance with Table 3 of the PPG, the development shows that the Sequential Test is not applicable.

7.7 As the Sequential Test is not applicable, it is not a requirement for an exception test to be provided.

Flood Sources

7.8 The risk of flooding to the site from all current and future potential sources of flooding has been assessed as follows:-

7.9 Flooding from Rivers (Fluvial)

The nearest river to the site is the River Dove, which is located approximately 848m in a north-westerly direction, from the site boundary at its nearest location. Due to the distance from the site and the topography of the site being elevated substantially above the River, flooding from this source is considered to be low risk. This is evident from the Environment Agency Flood Maps.

7.10 Flooding from Local Watercourses (Fluvial)

An un-named watercourse is recorded crossing the site that feeds into other watercourses to the west. Due to the topography of the site, flooding from this is considered to be low risk. However, it should still be considered as part of the proposed development.

7.11 Flooding from the Sea (Tidal/Coastal)

The site is not located near enough to the sea to cause a problem of flooding from this source.

7.12 Flooding from Land (Surface Water)

The EA surface water flood map shows the site to have a very low risk of surface water flooding, with only low risk areas associated with the watercourse crossing the site. Therefore, although flooding from this source is considered low risk, it should still be considered as part of the proposed development. It will also be necessary to ensure that run-off from Pit Lane does not flood the site.

7.13 Flooding from Groundwater

The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone. Considering the geology beneath the site, it is anticipated

that the site is impermeable and, therefore, in conjunction with the topography, flooding from this source is considered to be low risk.

7.14 Flooding from Sewer

There will be a new drainage system introduced for the proposed development. It is possible that any blockage of these sewers will result in flooding from the lowest cover level of manholes or gullies and this will need to be considered as part of any proposed development. Flooding from this source is considered to be low risk.

7.15 Flooding from Reservoirs, Canals or Artificial Sources

The Environment Agency produce maps which show the expected inundation area should a reservoir fail and release its capacity. It should be noted, however, that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The proposed development site is shown to be outside of the maximum extent of reservoir flooding.

7.16 There are no canals or other artificial sources within the immediate vicinity of the proposed development site that would pose a risk of flooding on site, therefore, the risk from this source is deemed to be negligible.

7.17 Table 1.0 below, summarises the findings of the detailed assessment and explanations of the flood risk issues on the site.

Table 1.0 – Degree of risk from each source of flooding

FLOOD SOURCE	RISK
River (Fluvial)	**Low**
Watercourse (Fluvial)	**Low**
Sea (Tidal/Coastal)	**Negligible**
Land (Surface Water)	**Low**
Groundwater	**Low**
Sewer	**Low**
Other – Reservoir	**Negligible**
Other - Canals	**Negligible**

Climate Change

7.18 The NPPF and PPG has indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country.

7.19 United Kingdom climate change guidance was revised in October 2021 for peak river flows and in May 2022 for peak rainfall intensities. A regionalised approach has now been adopted to climate change impacts, based upon management catchments of the river basin district of the proposed development site, the flood risk vulnerability of the proposed development and the present day Flood Zone Classification.

7.20 The proposed development site is situated within the Don and Rother Management Catchment, which, based on the "upper end" climate change scenario, could see peak river flows increase by 60% by the 2080's. As the site is situated entirely within Flood Zone 1, an increase of 60% in river flows is deemed unlikely to affect the proposed development site.

7.21 In accordance with the revised climate change data, the published figures show that, for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall could be up to 40%, subject to the location within the country and the drainage system should be designed in accordance with this requirement. However, the Barnsley Metropolitan Borough Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 30% allowance for climate change for the 1 in 100 year event.

7.22 Due to the topography of the land and surrounding area, overland run-off from adjoining land is unlikely to be an issue. Therefore, any run-off from outside the site will be insignificant and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

Flood Mitigation

7.23 As the site falls within Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm, overland run-off or blockage of the existing watercourse/sewer or proposed drainage system. The following precautionary flood mitigation measures are, therefore, recommended:-

7.23.1 The finished floor levels (FFL) to the properties shall be raised above external levels by a minimum of 150mm, wherever possible.

7.23.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

7.23.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.

7.23.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.

7.23.5 If any water issues are found on the site or boundary levels result in flow of water into the site, these shall be accommodated by introducing "cut-off" drains to direct the flow around the development and back into the watercourse to mimic the existing surface water regime.

Emergency Egress During Times of Flood

7.24 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.

7.25 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.

8.0 EXISTING AND PROPOSED DRAINAGE

Sustainable Drainage

8.1 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone. Considering the anticipated geology beneath the site, it is anticipated that the site is unsuitable for the disposal of surface water using infiltration techniques, and a positive drainage system to watercourse or sewer will be required for surface water drainage. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority.

Drainage

8.2 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

Existing Surface Water Run-Off

8.3 The site is greenfield and, therefore, in accordance with current Guidelines and Regulations, indicative surface water calculations have been undertaken using the IH124 method of calculating greenfield run-off rates. The calculations are presented in Appendix H.

8.4 It is unusual to use the IH124 method for calculating greenfield runoff rates with an area less than 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required.

8.5 For an approximate developed area of 5.78ha, the existing greenfield run-off rates have been linearly interpolated with the results presented in Table 2.0 below.

Table 2.0 – Existing greenfield runoff rates

Storm Event	Discharge Rate
1 year	**16.8 l/s**
Q_{BAR}	**19.5 l/s**
30 year	**34.3 l/s**
100 year	**40.6 l/s**

8.6 Based on the above, a restricted discharge rate using the Q_{BAR} rate of 19.5 l/s should be acceptable to the LLFA. This would result in a reduction on the 100 year storm run-off rate of 52%.

Proposed Surface Water Drainage

8.7 Consideration of the proposed drainage should firstly be given to infiltration techniques (to ground). Therefore, it will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority. However, as the use of infiltration techniques may be unviable, it will be necessary to provide a positive drainage system to watercourse or sewer.

8.8 The site currently discharges into the watercourse crossing the site, therefore, subject to infiltration techniques being discounted, this would be the obvious outfall location.

8.9 It is anticipated that the planning layout, presented in Appendix G, will have an impermeable area of approximately 60% of the development area (3.47ha) for semi-detached and detached properties. Indicative calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water sewer system should be designed to accommodate the 1 in 30 year storm event without flooding and a 1 in 100 year storm plus climate change event should be retained within the site in an area that does not cause flooding to properties or third parties.

8.10 Restricting the discharge rate to no greater than 19.5 l/s, on site storage of 1393m³ will need to be provided for a 1 in 30 year storm. This can be achieved by several

methods, including oversized pipes and underground tanks. The drainage system will also need to accommodate the 1 in 100 year plus 30% climate change event without causing flooding or property or third-party land. In the event that levels dictate that the 1 in 100 year plus climate change flood water will flow off site, an additional or larger storage facility will be required. Therefore, on site storage would increase to 2629m³. The indicative surface water calculations are presented in Appendix I. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.

8.11 Subject to detailed design, if the site is not able to drain by gravity, it will be necessary to provide an adoptable surface water pumping station.

Consents

8.12 The discharge of surface water to watercourse and/or the introduction of headwalls or works to the watercourse will require the consent of the LLFA by submitting an Application for Consent to Work Within a Watercourse.

8.13 The discharge of foul or surface water to sewer and/or the introduction of manholes or works to a public sewer will require the consent of the Water Authority.

8.14 Access arrangements will need to be agreed with the LLFA for future improvements or maintenance of the existing watercourse.

Proposed Foul Water Drainage

8.15 The closest practicable point of discharge for foul will be the 150mm diameter foul public sewer close to the site, but a present it does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed site. Subject to the submission of a Formal Planning Application and robust build plan and start date, Yorkshire Water will carry out a feasibility study to determine suitable foul connection points, any available capacity in the public sewer network, together with timescales for any potential upgrading works required.

8.16 From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network.

9.0 CONCLUSION

9.1 The site falls within Flood Zone 1 and the Sequential Test is satisfied. However, in order to accommodate the possibilities of flood from a catastrophic storm or blockage of the existing watercourse/sewer or proposed drainage system, the following precautionary flood mitigation measures are recommended:-

9.1.1 The finished floor levels (FFL) to the properties shall be raised above external levels by a minimum of 150mm, wherever possible.

9.1.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

9.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.

9.1.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.

9.1.5 If any water issues are found on the site or boundary levels result in flow of water into the site, these shall be accommodated by introducing "cut-off" drains to direct the flow around the development and back into the watercourse to mimic the existing surface water regime.

9.2 A 30% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.

9.3 Sustainable Drainage Systems of infiltration techniques are considered to be unsuitable on this particular site due to the geological parameters of the natural soils. However, it will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority.

9.4 The proposed surface water drainage system shall be restricted to the agreed discharge rate with appropriate attenuation for a 1 in 100 year storm plus climate change event incorporated into the design, prior to discharge to watercourse. The detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on the development site

9.5 The discharge of surface water to watercourse and/or the introduction of headwalls or works to the watercourse will require the consent of the LLFA by submitting an Application for Consent to Work Within a Watercourse.

9.6 The discharge of foul or surface water to sewer and/or the introduction of manholes or works to a public sewer will require the consent of the Water Authority.

9.7 Access arrangements will need to be agreed with the LLFA for future improvements or maintenance of the existing watercourse.

9.8 The closest practicable point of discharge for foul will be the 150mm diameter foul public sewer close to the site, but a present it does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed site. Subject to the submission of a Formal Planning Application and robust build plan and start date, Yorkshire Water will carry out a feasibility study to determine suitable foul connection points, any available capacity in the public sewer network, together with timescales for any potential upgrading works required.

9.9 From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network.

9.10 No special mitigation measures are required for emergency egress during times of flood.

9.11 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.

APPENDIX A: SITE LOCATION PLAN

CONSULTING ENGINEERS LTD

CREST NICHOLSON YORKSHIRE

PIT LANE, WOMBWELL

SITE LOCATION PLAN

GRID REFERENCE: SE 387 028

APPENDIX B: TOPOGRAPHICAL SURVEY


Pit Lane
Summer Lane
Windmill Road
Windmill Court
Burrows Grove
Crop field
CONTAINER

APPENDIX C: SITE PHOTOGRAPHS

CREST NICHOLSON YORKSHIRE

PIT LANE, WOMBWELL

PHOTOGRAPH KEY PLAN

	
Photograph 1	Photograph 2
	
Photograph 3	Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

	
Photograph 9	Photograph 10
	
Photograph 11	Photograph 12

	
Photograph 13	Photograph 14

APPENDIX D: ENVIRONMENT AGENCY CONSULTATION

Flood map for planning

Your reference	Location (easting/northing)	Created
160.007	**438715/402793**	**26 Jun 2023 10:22**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

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.

Environment Agency

Flood map for planning

Your reference
160.007

Location (easting/northing)
438715/402793

Scale
1:2500

Created
26 Jun 2023 10:22

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

0 20 40 60m

CREST NICHOLSON YHORKSHIRE

PIT LANE, WOMBWELL

ENVIRONMENT AGENCY SURFACE WATER FLOOD MAP

Extent of flooding from surface water

High Medium Low Very low Location you selected

APPENDIX E: WATER AUTHORITY CONSULTATION

YorkshireWater

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
George Mullaney on 0345 120 8482

30th June 2023

OEC Consulting Engineers
Unit 8 Clarke Hall Farm
Aberford Road
Wakefield
West Yorkshire
WF1 4AL
WAYNE@OECCONSULT.CO.UK

Your Ref:
Our Ref: Z003312

Dear Mr Walker,

Pit Lane, Wombwell, Barnsley, S73 8PN - Pre-Planning Enquiry V166515

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Existing Infrastructure

There is a 150mm diameter public foul sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 4 (four) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

There is a 150mm diameter public surface water sewer recorded on the site. In this instance, building-over may take place under the control of Part H4 Building Regulations 2010. No trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter,

please telephone 0345 120 84 82.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network.

The closest practicable point of discharge for foul will be the 150mm foul public sewer close to the site, but at present it does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed site. Subject to the submission of a Formal Planning Application and robust build plan and start date, Yorkshire Water will carry out a feasibility study to determine suitable foul connection points, any available capacity in the public sewer network, together with timescales for any potential upgrading works required.

The cost for any feasibility/modelling/upgrade works will be at Yorkshire Waters cost up-front and recouped via the sites eventual infrastructure charges.

What are infrastructure charges?

We levy infrastructure charges for all newly connected properties that have not been connected to our water or sewer network before. The charges are calculated to recover the cost of reinforcing our existing water and sewer networks needed to serve new developments. The charges are set to recover the costs over the whole of the Yorkshire Water area to increase capacity.

For more information

https://www.yorkshirewater.com/developers/developer-services-charges

Please review section 4 (page 68) of our New Connection Charging Arrangements 2023/2024 for an explanation of our infrastructure charges

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network.

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that a culverted watercourse is located running through the site and open watercourses are located to the west of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply online or obtain an application form from our website (www.yorkshirewater.com/developers/sewerage/sewerage-connections/) or by telephoning 0345 120 84 82.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network or interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for Code for Adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and

YorkshireWater

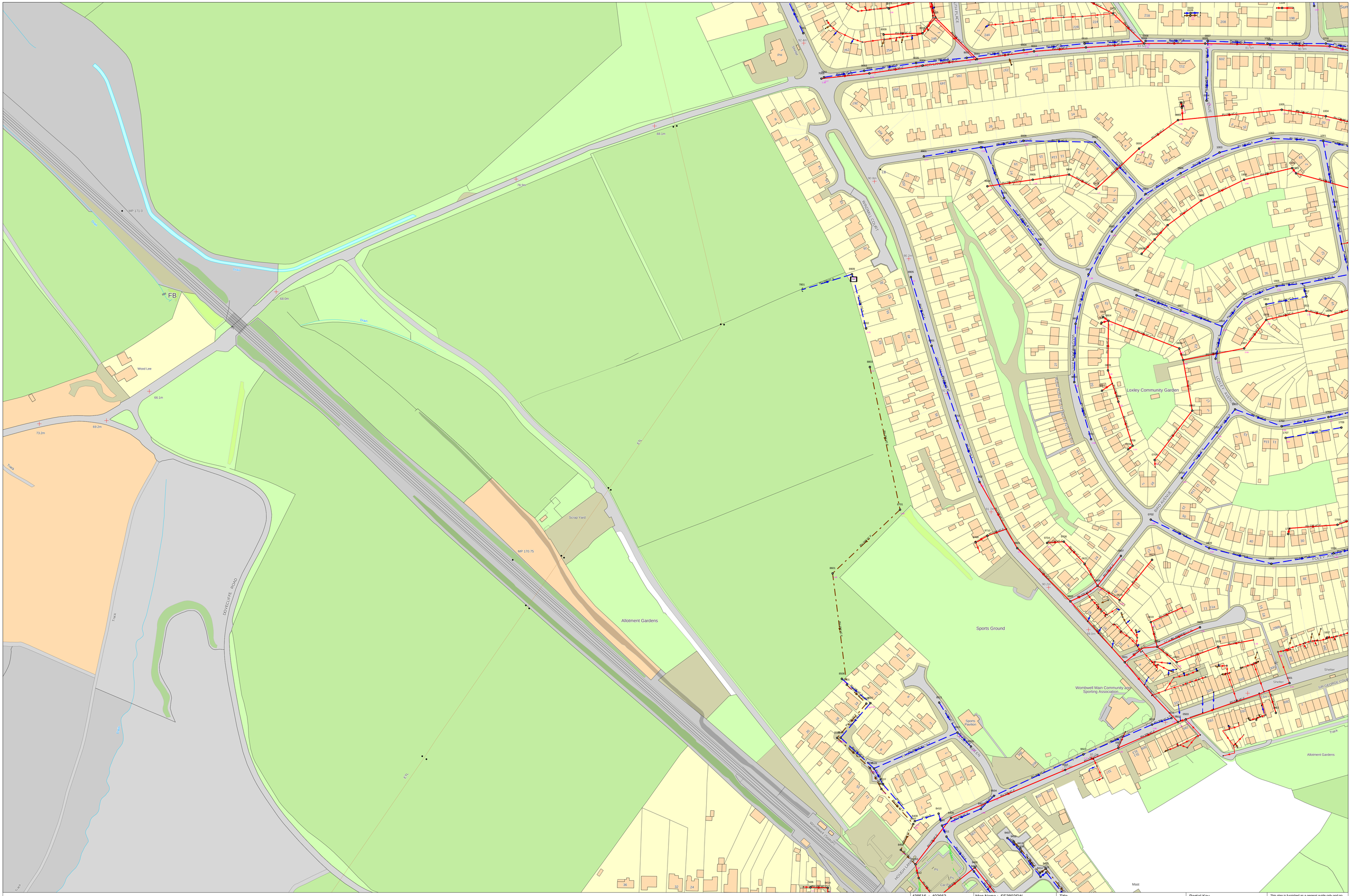
constructed in accordance with the Code for Adoption, pursuant to an agreement under Section 104 of the Water Industry Act 1991. We are happy to offer pre-development technical advice on any prospective sites that you would like to put forward for adoption, prior to submission of your adoption application.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Sewer Adoption, Diversion and Requisition (telephone 0345 120 84 82) or email technical.sewerage@yorkshirewater.co.uk or visit - https://www.yorkshirewater.com/developers/sewerage/sewer-adoptions/ for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

George Mullaney
Development Services Technician



438516 : 402662

Map Name : SE3802SW

Yorkshire Water,
PO Box 500,
Halifax Road,
Bradford BD6 2LZ
Contact Name :
G Mullaney
Contact Tel :

Title

Notes

Partial Key

Foul Sewer = F
Combined Sewer = C
Surface Water Sewer = SW
Trade Sewer = TD
Partially Separate = PS

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

Date Req : 30/06/2023, 14:16:33

Date Gen : 30/06/2023, 14:17:13

Source : Sewer Network Enquiry

UPN: Undefined

Originator: G Mullaney, ,

APPENDIX F: LEAD LOCAL FLOOD AUTHORITY CONSULTATION

Wayne Walker

From: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>
Sent: 26 June 2023 12:28
To: Wayne Walker
Subject: RE: 160.007 Pit Lane, Wombwell - Consultation
Attachments: Pit Lane Flooding.BMP; Pit Lane .png

Hello Wayne

See information below and attached plans of a watercourse and the nearest flooding location

Thanks

From: Wayne Walker <wayne@oecconsult.co.uk>
Sent: 26 June 2023 10:31
To: Grayson , Ian (SENIOR ENGINEER - ASSETS) <iangrayson@barnsley.gov.uk>
Subject: 160.007 Pit Lane, Wombwell - Consultation

Good Morning Ian,

Hope you're well.

Our client is proposing to redevelop the above site for new residential dwellings and we are pleased to provide a site location plan showing the site boundary for your information. The Ordnance Survey Grid Reference is SE 387 027 (438729, 402799) with the nearest post code of S73 8PN The site area is approximately 7.40ha.

We have been appointed to prepare a Flood Risk Assessment and Drainage Strategy for the site and would thank you for information relating to the following: -

- Known flooding incidents
- Restrictions relating to surface water discharge - greenfield IH124, Qbar rate Greenfield rate would be required calculated using IH124 or Qbar method, either is acceptable
- Known watercourse locations (open or culverted)
- Specific surface water design requirements e.g.: -
  i) No surcharging in 1-year storm events YES
  ii) No flooding in 30-year storm events YES
  iii) No flooding to property or third party in 100-year + 30% climate change event (do Barnsley now require a increased climate change allowance or still 30%?)
  YES Barnsley still use 30%
  iv) Do you require a 10% uplift on impermeable areas for urban creep? No uplift for Urban Creep
  v) CV value set to 1? YES
- Are Barnsley adopting any SuDS features? Eg. Highway swales NO in general, Highway Drainage features would need to be discussed in detail with Highways Development Control
-
- Any other information relating to flood risk or drainage to assist with the proposals.

We trust that the above and enclosed is satisfactory, however, should you require any additional information please do not hesitate to contact us.

Regards

CREST NICHOLSON YHORKSHIRE

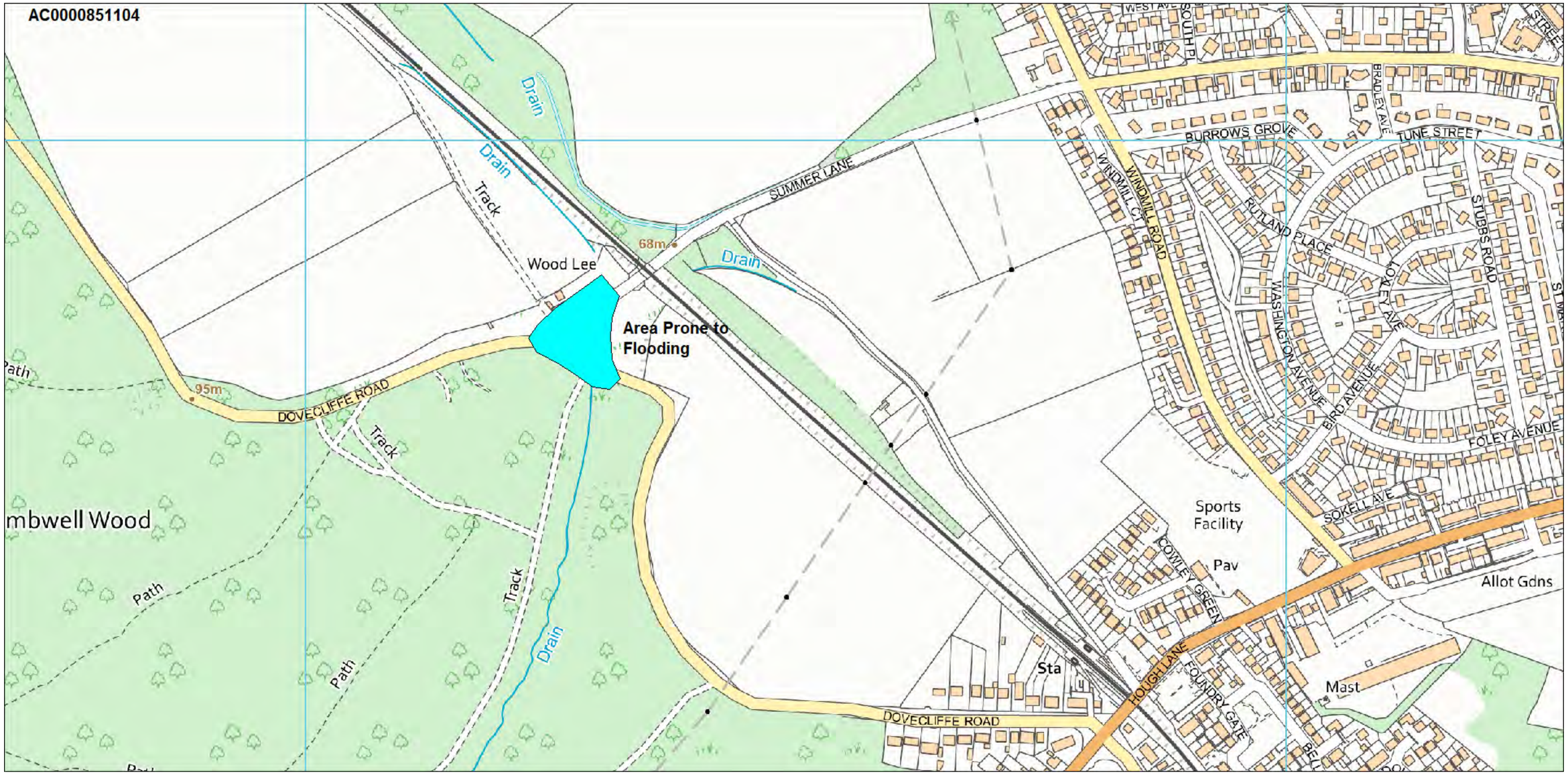
PIT LANE, WOMBWELL

LLFA CONSULTATION

PIT LANE

CONSULTING ENGINEERS LTD

PIT LANE FLOODING



APPENDIX G: PLANNING LAYOUT

Crest NICHOLSON

PH
Shelter
R12.0
2.5
1.5
5.5
PIT LANE
R17.0
2.00
R30
5.5
5.5
PIT LANE
88.1m
SITE ACCESS
SUMMER LANE
WINDMILL ROAD
WINDMILL COURT
BURROWS GROVE
WINDMILL COURT
WINDMILL RUISE
Track
Scrap Yard
MP 170.75
Allotment Gardens
PASHLEY CROFT

CREST NICHOLSON	Pit Lane, Wombwell	SK01	STEN ARCHITECTURE

Reference	Floor Area (Sqft)		Storeys	Total	Total Sqft	% of Mix
Private						
2 BEDS						
Ashtead End	685	Parking 1 space	2	8	5480	3.5%
Ashtead Mid	685	Parking 1 space	2	5	3425	2.4%
Cromer End	785	Parking 1 space	2	10	7650	4.9%
Cromer Mid	765	Parking 1 space	2	4	3060	1.9%
3 BEDS						
Leigh End	880	Parking	2.5	24	21120	11.7%
Leigh Mid	880	Parking	2.5	1	880	0.5%
Evesham End	933	Parking	2	32	29856	15.5%
Chesham End	997	Parking	2	2	1994	1.0%
Chesham Detached	997	Parking	2	3	2991	1.5%
Seaton End	1043	Parking	2	6	6258	2.9%
Seaton Detached	1043	Parking	2	8	8344	3.9%
4 BEDS						
Filey	1127	parking	2.5	16	18032	7.8%
Romsey	1176	SDG	2	7	8232	3.4%
Jason Integ 1215	1216	Integ Garage	2	19	23104	9.2%
Jason Integ 1276	1276	Integ Garage	2	14	17864	6.8%
Winkfield	1371	SDG	2	8	10968	3.5%
Forester	1528	Integ Garage	2	11	16808	5.3%
5 BEDS						
Whiskey	1371	SDG	2	7	9597	3.4%
Buckingham	1517	SDG	2	11	16687	5.3%
Windsor	1751	SDG	2	10	17510	4.5%
Sub-Total				**206**	**229860**	**100.0%**
Affordable						
Maisonette GF (1B)	683	Parking	2	3	1749	1.3%
Maisonette FF (1B)	879	Parking	2	3	2037	1.3%
AFR2B3P	767	Parking	2	6	4602	2.6%
AFR3B4P	914	Parking	2	7	6398	3.1%
AFR4B5P	1058	Parking	2	4	4232	1.7%
Sub-Total				**23**	**19018**	**10.0%**
Total				**229**	**248878**	

	Acres	Hectares
Approx gross area	18.29	7.4
Approx POS	2.61	1.055
Approx nett area	14.28	5.78
coverage	17426	40

SALES AREA
TO BE CONFIRMED

DRAFT LAYOUT SK01 | MARCH 2023 | 1:500 @ A0
PIT LANE, WOMBWELL
0 10 20 30 40 50
NORTH

The Studio
Harrison Street
Wakefield
WF1 1PS
Tel: 01924 950995
www.sten-architecture.co.uk

STEN ARCHITECTURE

APPENDIX H: INDICATIVE GREENFIELD RUN-OFF RATE CALCULATIONS

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	50.000	Urban	0.000
SAAR (mm)	696	Region Number	Region 3

Results l/s

QBAR Rural	169.0
QBAR Urban	169.0
Q1 year	145.3
Q1 year	145.3
Q2 years	159.4
Q5 years	211.2
Q10 years	245.0
Q20 years	277.5
Q25 years	288.3
Q30 years	297.0
Q50 years	320.0
Q100 years	351.5
Q200 years	398.8
Q250 years	414.0
Q1000 years	513.7

APPENDIX I: INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.450	0.450	19.3	591.8	O K
30 min Summer	100.590	0.590	19.5	775.7	O K
60 min Summer	100.734	0.734	19.5	965.5	O K
120 min Summer	100.875	0.875	19.5	1151.0	O K
180 min Summer	100.949	0.949	19.5	1247.7	O K
240 min Summer	100.992	0.992	19.5	1304.9	O K
360 min Summer	101.038	1.038	19.5	1364.6	O K
480 min Summer	101.056	1.056	19.5	1388.1	O K
600 min Summer	101.057	1.057	19.5	1389.5	O K
720 min Summer	101.052	1.052	19.5	1383.9	O K
960 min Summer	101.037	1.037	19.5	1364.0	O K
1440 min Summer	100.992	0.992	19.5	1304.2	O K
2160 min Summer	100.910	0.910	19.5	1196.0	O K
2880 min Summer	100.826	0.826	19.5	1085.8	O K
4320 min Summer	100.671	0.671	19.5	882.3	O K
5760 min Summer	100.542	0.542	19.5	712.8	O K
7200 min Summer	100.441	0.441	19.2	580.1	O K
8640 min Summer	100.364	0.364	18.8	478.7	O K
10080 min Summer	100.306	0.306	18.2	402.5	O K
15 min Winter	100.450	0.450	19.3	591.6	O K
30 min Winter	100.590	0.590	19.5	775.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	69.690	0.0	572.2	19
30 min Summer	46.121	0.0	762.2	33
60 min Summer	29.238	0.0	997.8	64
120 min Summer	18.000	0.0	1230.6	122
180 min Summer	13.406	0.0	1375.6	182
240 min Summer	10.826	0.0	1481.3	242
360 min Summer	7.983	0.0	1638.4	362
480 min Summer	6.430	0.0	1758.8	480
600 min Summer	5.433	0.0	1856.6	582
720 min Summer	4.732	0.0	1939.5	624
960 min Summer	3.803	0.0	2075.1	748
1440 min Summer	2.792	0.0	2273.3	1008
2160 min Summer	2.046	0.0	2544.8	1408
2880 min Summer	1.640	0.0	2719.1	1812
4320 min Summer	1.200	0.0	2976.5	2592
5760 min Summer	0.960	0.0	3193.2	3296
7200 min Summer	0.808	0.0	3355.5	4032
8640 min Summer	0.701	0.0	3491.5	4672
10080 min Summer	0.622	0.0	3607.6	5352
15 min Winter	69.690	0.0	572.2	19
30 min Winter	46.121	0.0	762.2	33

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.734	0.734	19.5	965.7	O K
120 min Winter	100.875	0.875	19.5	1151.0	O K
180 min Winter	100.949	0.949	19.5	1247.6	O K
240 min Winter	100.992	0.992	19.5	1305.0	O K
360 min Winter	101.039	1.039	19.5	1365.7	O K
480 min Winter	101.057	1.057	19.5	1390.5	O K
600 min Winter	101.060	1.060	19.5	1393.4	O K
720 min Winter	101.051	1.051	19.5	1382.4	O K
960 min Winter	101.024	1.024	19.5	1346.4	O K
1440 min Winter	100.957	0.957	19.5	1258.1	O K
2160 min Winter	100.832	0.832	19.5	1094.1	O K
2880 min Winter	100.707	0.707	19.5	930.3	O K
4320 min Winter	100.497	0.497	19.4	653.8	O K
5760 min Winter	100.351	0.351	18.7	462.1	O K
7200 min Winter	100.258	0.258	17.5	339.0	O K
8640 min Winter	100.203	0.203	16.4	267.4	O K
10080 min Winter	100.181	0.181	14.8	238.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	29.238	0.0	997.8	62
120 min Winter	18.000	0.0	1230.6	120
180 min Winter	13.406	0.0	1375.6	178
240 min Winter	10.826	0.0	1481.4	236
360 min Winter	7.983	0.0	1638.5	352
480 min Winter	6.430	0.0	1758.9	464
600 min Winter	5.433	0.0	1856.8	572
720 min Winter	4.732	0.0	1939.8	676
960 min Winter	3.803	0.0	2075.7	762
1440 min Winter	2.792	0.0	2275.2	1066
2160 min Winter	2.046	0.0	2545.0	1496
2880 min Winter	1.640	0.0	2719.4	1904
4320 min Winter	1.200	0.0	2977.3	2676
5760 min Winter	0.960	0.0	3193.3	3344
7200 min Winter	0.808	0.0	3355.7	3968
8640 min Winter	0.701	0.0	3492.0	4584
10080 min Winter	0.622	0.0	3609.1	5248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.363	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.470

Time (mins) From:	To:	Area (ha)
0	4	3.470

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1315.0	0.700	1315.0	1.400	1315.0	2.100	1315.0
0.100	1315.0	0.800	1315.0	1.500	1315.0	2.200	1315.0
0.200	1315.0	0.900	1315.0	1.600	1315.0	2.300	1315.0
0.300	1315.0	1.000	1315.0	1.700	1315.0	2.400	1315.0
0.400	1315.0	1.100	1315.0	1.800	1315.0	2.500	1315.0
0.500	1315.0	1.200	1315.0	1.900	1315.0		
0.600	1315.0	1.300	1315.0	2.000	1315.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0182-1950-2000-1950
Design Head (m)	2.000
Design Flow (l/s)	19.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	19.5
Flush-Flo™	0.582	19.5
Kick-Flo®	1.233	15.5
Mean Flow over Head Range	-	17.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	16.1	3.000	23.6	7.000	35.5
0.200	16.3	1.400	16.4	3.500	25.5	7.500	36.7
0.300	18.1	1.600	17.5	4.000	27.1	8.000	37.9
0.400	19.0	1.800	18.5	4.500	28.7	8.500	39.0
0.500	19.4	2.000	19.5	5.000	30.2	9.000	40.1
0.600	19.5	2.200	20.4	5.500	31.6	9.500	41.2
0.800	19.1	2.400	21.2	6.000	33.0		
1.000	18.2	2.600	22.1	6.500	34.3		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.762	0.762	19.5	1002.5	O K
30 min Summer	101.013	1.013	19.5	1332.0	O K
60 min Summer	101.280	1.280	19.5	1682.6	O K
120 min Summer	101.546	1.546	19.5	2032.9	O K
180 min Summer	101.689	1.689	19.5	2221.0	O K
240 min Summer	101.778	1.778	19.5	2337.5	O K
360 min Summer	101.882	1.882	19.5	2475.5	O K
480 min Summer	101.942	1.942	19.5	2554.1	O K
600 min Summer	101.974	1.974	19.5	2595.6	O K
720 min Summer	101.987	1.987	19.5	2613.4	O K
960 min Summer	101.980	1.980	19.5	2604.2	O K
1440 min Summer	101.927	1.927	19.5	2533.7	O K
2160 min Summer	101.836	1.836	19.5	2414.7	O K
2880 min Summer	101.745	1.745	19.5	2294.8	O K
4320 min Summer	101.568	1.568	19.5	2061.5	O K
5760 min Summer	101.394	1.394	19.5	1833.4	O K
7200 min Summer	101.200	1.200	19.5	1577.4	O K
8640 min Summer	101.002	1.002	19.5	1318.2	O K
10080 min Summer	100.848	0.848	19.5	1115.2	O K
15 min Winter	100.762	0.762	19.5	1002.3	O K
30 min Winter	101.013	1.013	19.5	1332.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.218	0.0	970.6	19
30 min Summer	78.317	0.0	1286.1	34
60 min Summer	49.937	0.0	1708.8	64
120 min Summer	30.767	0.0	2102.5	124
180 min Summer	22.850	0.0	2337.5	182
240 min Summer	18.379	0.0	2500.8	242
360 min Summer	13.462	0.0	2730.2	362
480 min Summer	10.795	0.0	2888.0	482
600 min Summer	9.088	0.0	2981.0	602
720 min Summer	7.892	0.0	3003.8	720
960 min Summer	6.311	0.0	2970.2	960
1440 min Summer	4.597	0.0	2851.1	1184
2160 min Summer	3.342	0.0	4153.9	1560
2880 min Summer	2.662	0.0	4406.0	1988
4320 min Summer	1.929	0.0	4746.6	2812
5760 min Summer	1.533	0.0	5098.8	3640
7200 min Summer	1.281	0.0	5328.1	4464
8640 min Summer	1.107	0.0	5518.4	5112
10080 min Summer	0.978	0.0	5683.5	5848
15 min Winter	117.218	0.0	970.6	19
30 min Winter	78.317	0.0	1286.1	33

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	101.279	1.279	19.5	1682.0	O K
120 min Winter	101.546	1.546	19.5	2033.5	O K
180 min Winter	101.690	1.690	19.5	2222.9	O K
240 min Winter	101.780	1.780	19.5	2340.1	O K
360 min Winter	101.886	1.886	19.5	2480.7	O K
480 min Winter	101.949	1.949	19.5	2562.4	O K
600 min Winter	101.983	1.983	19.5	2607.5	O K
720 min Winter	101.999	1.999	19.5	2629.2	O K
960 min Winter	101.999	1.999	19.5	2629.1	O K
1440 min Winter	101.933	1.933	19.5	2541.5	O K
2160 min Winter	101.819	1.819	19.5	2392.6	O K
2880 min Winter	101.693	1.693	19.5	2226.7	O K
4320 min Winter	101.428	1.428	19.5	1877.4	O K
5760 min Winter	101.107	1.107	19.5	1455.9	O K
7200 min Winter	100.830	0.830	19.5	1091.0	O K
8640 min Winter	100.620	0.620	19.5	814.8	O K
10080 min Winter	100.467	0.467	19.3	614.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	1708.8	64
120 min Winter	30.767	0.0	2102.5	122
180 min Winter	22.850	0.0	2337.5	180
240 min Winter	18.379	0.0	2500.8	240
360 min Winter	13.462	0.0	2730.1	356
480 min Winter	10.795	0.0	2887.6	472
600 min Winter	9.088	0.0	2980.1	586
720 min Winter	7.892	0.0	3001.8	700
960 min Winter	6.311	0.0	2967.7	922
1440 min Winter	4.597	0.0	2851.0	1312
2160 min Winter	3.342	0.0	4154.0	1644
2880 min Winter	2.662	0.0	4406.6	2108
4320 min Winter	1.929	0.0	4756.2	3028
5760 min Winter	1.533	0.0	5099.1	3864
7200 min Winter	1.281	0.0	5328.3	4536
8640 min Winter	1.107	0.0	5518.9	5192
10080 min Winter	0.978	0.0	5685.2	5848

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.363	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 3.470

Time (mins) From:	To:	Area (ha)
0	4	3.470

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1315.0	0.700	1315.0	1.400	1315.0	2.100	1315.0
0.100	1315.0	0.800	1315.0	1.500	1315.0	2.200	1315.0
0.200	1315.0	0.900	1315.0	1.600	1315.0	2.300	1315.0
0.300	1315.0	1.000	1315.0	1.700	1315.0	2.400	1315.0
0.400	1315.0	1.100	1315.0	1.800	1315.0	2.500	1315.0
0.500	1315.0	1.200	1315.0	1.900	1315.0		
0.600	1315.0	1.300	1315.0	2.000	1315.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0182-1950-2000-1950
Design Head (m)	2.000
Design Flow (l/s)	19.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	19.5
Flush-Flo™	0.582	19.5
Kick-Flo®	1.233	15.5
Mean Flow over Head Range	-	17.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	16.1	3.000	23.6	7.000	35.5
0.200	16.3	1.400	16.4	3.500	25.5	7.500	36.7
0.300	18.1	1.600	17.5	4.000	27.1	8.000	37.9
0.400	19.0	1.800	18.5	4.500	28.7	8.500	39.0
0.500	19.4	2.000	19.5	5.000	30.2	9.000	40.1
0.600	19.5	2.200	20.4	5.500	31.6	9.500	41.2
0.800	19.1	2.400	21.2	6.000	33.0		
1.000	18.2	2.600	22.1	6.500	34.3		