LAND OFF LINDLEY MOOR ROAD, LINDLEY, HUDDERSFIELD, HD3 3SX

FLOOD RISK AND DRAINAGE ASSESSMENT

Final Report v1.3
April 2023

Weetwood Services Ltd
info@weetwood.net
www.weetwood.net

Report Title	**Land off Lindley Moor Road, Lindley, Huddersfield, HD3 3SX** Flood Risk Assessment Final Report v1.3
Client	2SH Developments
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Prepared by	Keely Bonser BSc (Hons) MSc PhD MCIWEM *Director* Tim Brook BSc (Hons) *Principal Engineer*
Checked and Approved by	Kevin Tilford BSc MSc PhD MBA CWEM FCIWEM CEnv *Managing Director*

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1 INTRODUCTION

1.1 Purpose of Report

Weetwood Services Ltd ('Weetwood') has been instructed by 2SH Developments to prepare a Flood Risk and Drainage Assessment (FRDA) report to accompany a hybrid planning application for the proposed development of land off Lindley Moor Road, Lindley ("the site") for mixed-uses.

The assessment has been undertaken in accordance with the requirements of the revised National Planning Policy Framework (NPPF) updated on 27 July 2021 and the Planning Practice Guidance (PPG) updated on 20 August 2021.

This report presents an assessment of flood risk from all identified sources and presents measures to mitigate the identified risk so that the development would be safe for its lifetime and would not increase flood risk elsewhere, in accordance with planning policy. The report includes a drainage strategy for foul and surface water.

1.2 Structure of the Report

The report is structured as follows:

Section 1 Introduction and report structure
Section 2 Provides background information relating to the development site
Section 3 Presents national and local flood risk and drainage planning policy
Section 4 Assesses the potential sources of flooding to the development site and presents flood risk mitigation measures based on the findings of the assessment
Section 5 Presents an illustrative foul water drainage scheme
Section 6 Presents an illustrative surface water drainage scheme
Section 7 Presents a summary of key findings and the recommendations

1.3 Relevant Documents

1.4 Relevant Documents

The assessment has been informed by the following documents:

- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume I, Kirklees Council, Calderdale Metropolitan Borough Council and Wakefield Council, April 2016
- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume II, Kirklees Council, July 2016
- Consultation Response from Kirklees Council Lead Local Flood Authority, ref: 2020/20447, 5 December 2020

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 Site Location

The approximately 6.26 hectare (ha) greenfield site is located to the south of Lindley Moor Road, Lindley, Huddersfield at Ordnance Survey National Grid Reference SE 109 190, as shown in **Figure 1**. The site is bounded by Crosland Road to the west, Weatherhill Road to the east and residential dwellings and open fields to the south.

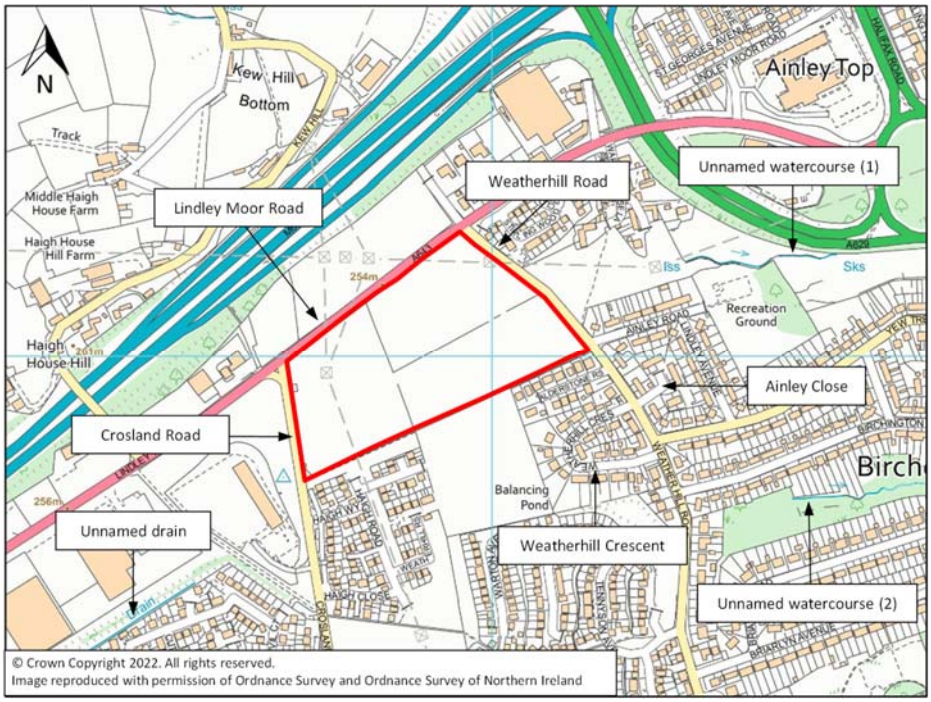


Figure 1: Site Location

2.2 Proposed Development

The development proposals entail the construction of 15 units accommodating a fast-food outlet, supermarket, restaurant, café/takeaways and a number of industrial and storage/distribution warehouses with associated access via Lindley Moor Road and areas of landscaping (**Appendix A**).

The detailed element of the planning application is for the proposed access road and Unit P, with the outline element being for Units A – N.

The PPG classifies food and general industry development as Less Vulnerable to flood risk.

2.3 Waterbodies in the Vicinity of the Site

An unnamed watercourse (referred to as Unnamed Watercourse (1) for the purposes of this report) emerges approximately 190 m to the east of the site and flows in an easterly direction.

An unnamed watercourse (Unnamed Watercourse (2)) emerges approximately 380 m to the south-east of the site and flows in an easterly direction.

An unnamed drain is located approximately 195 m to the south-west of the site.

An unnamed stone culvert (Unnamed Watercourse (3)) was reported by Haigh Huddleston & Associates (**Appendix B**) and was encountered at the eastern boundary of the site and appears to discharge to Unnamed Watercourse (1).

The above watercourses are classed as ordinary watercourses. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.

2.4 Ground Conditions

According to the Soilscapes soils dataset produced by the Cranfield Soil and AgriFood Institute[1], soil conditions at the site and within the surrounding area are freely draining loamy soils.

British Geological Survey mapping of surface geology[2] indicates the underlying bedrock formation comprises Sandstone (80 Yard Rock) within the northern portion and Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone) within the southern portion. No superficial deposits are recorded at the site.

According to the MAGIC website[3] the underlying Sandstone and Pennine Lower Coal Measures Formation bedrock are classified as Secondary A aquifers. The site is not shown to be located within a designated groundwater source protection zone.

2.5 Site Levels

A topographic survey of the site has been undertaken by Martin Walsh Architectural and is provided in **Appendix C**. LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in **Figure 2**.

Ground levels are highest towards the western boundary and lowest to the east of the site with site gradients falling away from the high point in a northerly/easterly/southerly direction. Ground levels across the site range between 236.0 metres Above Ordnance Datum (m AOD) to 265.5 m AOD.

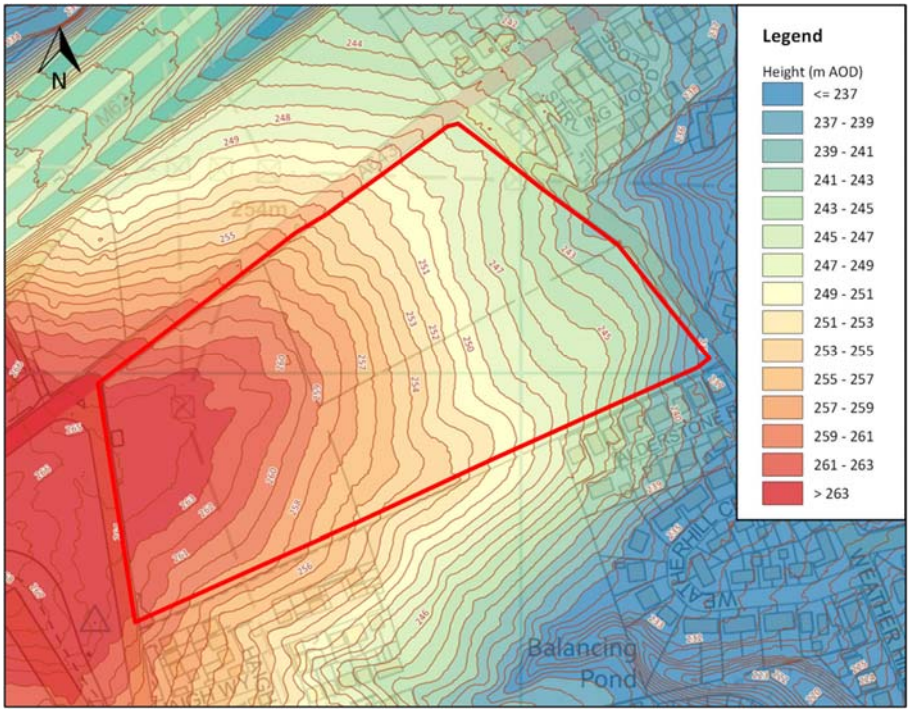


Figure 2: Digital Terrain Model from LiDAR Data

1 www.landis.org.uk/soilscapes/
2 http://mapapps.bgs.ac.uk/geologyofbritain/home.html
3 https://magic.defra.gov.uk/MagicMap.aspx

3 PLANNING POLICY AND GUIDANCE

3.1 National Planning Policy and Policy Guidance

The thrust of national planning policy, as articulated in the NPPF is that inappropriate development in areas at risk of flooding should be avoided where possible, as summarised below:

- Inappropriate development in areas at risk of flooding should be avoided and that development should be directed away from areas at highest risk (whether existing or future), but where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere (NPPF para. 159).
- The policy of seeking to steer development to areas with the lowest risk of flooding, from any source, is implemented through the application of the flood risk sequential test. Development should not be allocated or permitted if there are reasonably available sites, appropriate for the proposed development in areas with a lower risk of flooding. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding (NPPF para. 162).
- If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives) the exception test may have to be applied. The need for the test will depend on the potential vulnerability of the site and of the vulnerability of the development proposed (as set out in Annex 3 of NPPF; also PPG Table 2 and Table 3) (NPPF para. 163). For example, the exception test need not be applied for less vulnerable development in any flood zone, or for more vulnerable development in flood zones 1 or 2.
- Where the exception test must be applied, application of the test for development proposals at the application stage should be informed by a site-specific flood risk assessment. For the test to be passed it should be demonstrated that: (a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; (b) and the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall (NPPF para. 164). Both elements of the test should be satisfied for the development to be permitted (NPPF para. 165).
- Development should not increase flood risk elsewhere (NPPF para. 167).
- Where appropriate, planning applications should be supported by a site-specific flood risk assessment, and development should only be allowed in areas at risk of flooding where the flood risk assessment (and the sequential and exception tests, as required), demonstrate that: a) within the site, the most vulnerable development is located in areas of lowest flood risk (unless there are overriding reasons to prefer a different location); b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment; c) the development incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate; d) any residual (flood) risk can be safely managed; and e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan (NPPF para.167).
- NPPF para. 167 references Footnote 55. The footnote states that a site-specific flood risk assessment should be provided for all development in flood zones 2 and 3 [whilst] in flood zone 1, an assessment should accompany all proposals involving: sites of 1 ha or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use (NPPF para. 167).
- Applications for some minor development and changes of use should not be subject to the sequential or exception tests (NPPF para. 168). The exceptions are stated in Footnote 56.
- Major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems should: a) take account of advice from the lead local flood authority; b) have appropriate proposed minimum operational standards; c) have maintenance

arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and d) where possible, provide multifunctional benefits (NPPF para. 169).

Guidance on application of the sequential and exception test is provided in the PPG. For example:

- This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high flood risk areas (flood zones 2 and 3) and other areas affected by other sources of flooding where possible (PPG para. 18).
- Where there are no reasonably available sites in flood zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in flood zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in flood zones 1 or 2 should the suitability of sites in flood zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the exception test if required. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development (PPG para. 19).
- The sequential test does not need to be applied for individual developments on sites which have been allocated in development plans through the sequential test, or for applications for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site) (PPG para. 33)
- It should not normally be necessary to apply the sequential test to development proposals in flood zone 1, unless the Strategic Flood Risk Assessment for the area, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change) (PPG para. 33).
- For individual planning applications where there has been no sequential testing of the allocations in the development plan, or where the use of the site being proposed is not in accordance with the development plan, the area to apply the sequential test across will be defined by local circumstances relating to the catchment area for the type of development proposed. For some developments this may be clear, for example, the catchment area for a school. In other cases it may be identified from other Local Plan policies, such as the need for affordable housing within a town centre, or a specific area identified for regeneration. For example, where there are large areas in flood zones 2 and 3 (medium to high probability of flooding) and development is needed in those areas to sustain the existing community, sites outside them are unlikely to provide reasonable alternatives (PPG para. 33).
- When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local planning authority boundary.
- Any development proposal should take into account the likelihood of flooding from other sources, as well as from rivers and the sea. The sequential approach to locating development in areas at lower flood risk should be applied to all sources of flooding, including development in an area which has critical drainage problems, as notified to the local planning authority by the Environment Agency, and where the proposed location of the development would increase flood risk elsewhere (PPG para. 33).

3.2 Local Planning Policy and Guidance

The Kirklees Local Plan was adopted on 27 February 2019. The following policies are relevant in respect of flood risk and drainage:

- Policy LP5: Masterplanning Sites Part M states, in part, that masterplans will be expected to provide appropriate measures to mitigate flood risk and ensure that the development is resilient to the potential impacts of climate change.
- Policy LP24: Design Part D vii states, in part, that proposals should promote good design by ensuring high levels of sustainability through designing buildings that are resilient and resistant to flood risk.
- Policy LP27: Flood Risk is summarised as follows:
  - Proposals for development which require a Sequential Test will need to demonstrate that development has been directed to areas at the lowest probability of flooding, following a sequential risk-based approach
  - Proposals within flood zone 3ai will be assessed in accordance with national policies relating to flood zone 3a but with all of the following additional restrictions:
    - No new highly vulnerable or more vulnerable uses will be permitted;
    - Less vulnerable uses may only be permitted where the sequential test has been passed and
      - where extensions are linked operationally to an existing business or
      - where redevelopment of a site provides buildings with the same or a smaller footprint
  - All proposals will be expected to include flood mitigation measures which should be identified and considered through a site-specific flood risk assessment
  - Development will not be permitted within the functional floodplain
- Policy LP28: Drainage is summarised as follows:
  - SuDS will be used to assist in achieving the following:
    - Greenfield runoff rates should not be exceeded
    - Brownfield sites should have a minimum 30% reduction in runoff where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions
    - No negative impact on local water quality
    - Consider whether proposed open spaces and green infrastructure within sites can contribute to sustainable drainage of the site
  - Local conditions may require a lower runoff rate to be agreed to reflect volume control, local surface water risks, watercourse capacity and flood risk further downstream
  - There will be a general presumption against pumping surface water. Also demonstrate that the surface water management solution is designed for the lifetime of the development including maintenance arrangements
  - Accommodate flow paths by ensuring paths are designed to avoid buildings and curtilages
  - Development will only be permitted if water supply and waste water infrastructure is available or can be co-ordinated to meet the demand from the new development.

3.3 Legislation Originating from the European Union

The Water Framework Directive (WFD) provides a legal framework for the protection, improvement and sustainable use of inland surface waters, groundwater, transitional waters, and coastal waters across England, and seeks to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters
- Achieve at least 'good' status for all waterbodies by 2015
- Promote the sustainable use of water as a natural resource
- Conserve habitats and species that depend directly on water
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

The WFD applies to any proposed development which has the potential to impact on a waterbody. Where this is the case, the Environment Agency may require evidence demonstrating that the proposed development does not compromise the aims of the WFD.

3.4 Land Drainage Consent

Land drainage consent may be required from the lead local flood authority (LLFA) or drainage board for work to an ordinary watercourse.

Undertaking activities controlled by local byelaws also requires the relevant consent.

4 REVIEW OF FLOOD RISK

4.1 Historical Records of Flooding

The Environment Agency Recorded Flood Outlines map[4] (not shown) and the SFRA do not hold any records of historic flooding within the vicinity of the site.

However, Kirklees Council has advised by way of a pre-application consultation response letter (ref: 2020/20447; 5 December 2020) that it holds several records of surface water flooding incidents within the vicinity of the site including on Lindley Moor Road adjacent to the site due to blocked gullies, on Weatherhill Road to the east of the site, and to the rear gardens on Ainley Close and Weatherhill Crescent to the south/south-east of the site.

4.2 Flood Zone Designation

The Environment Agency Flood Map for Planning (Rivers and Sea) [5] (Error! Reference source not found.) indicates the site to be located in flood zone 1. Table 1 of the PPG defines flood zones in the vicinity of the site as follows[6]:

- Flood zone 1: Low Probability. Land having a less than 1 in 1,000 annual probability of river or sea flooding
- Flood zone 2: Medium Probability. Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding
- Flood zone 3a: High Probability. Land having a 1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater annual probability of sea flooding
- Flood zone 3b: Functional Floodplain. Land where water has to flow or be stored in times of flood.

Figure 3: Flood Map for Planning
Source: gov.uk website; Accessed: February 2022

[4] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/RecordedFloodOutlines&Mode=spatial
[5] https://flood-map-for-planning.service.gov.uk/
[6] https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables

The eastern portion of the site is located approximately 15 m and 33 m above Unnamed Watercourses (1) and (2) respectively, with the western portion of the site located approximately 5 m above the unnamed drain. On this basis, and given that the site is located within flood zone 1 on the Flood Map for Planning, the site is assessed not to be at risk of flooding from fluvial sources.

4.3 Flood Risk from Surface Water

The Flood Risk from Surface Water map (**Figure 4**) indicates that the site is at 'Very Low' risk of flooding from surface water.

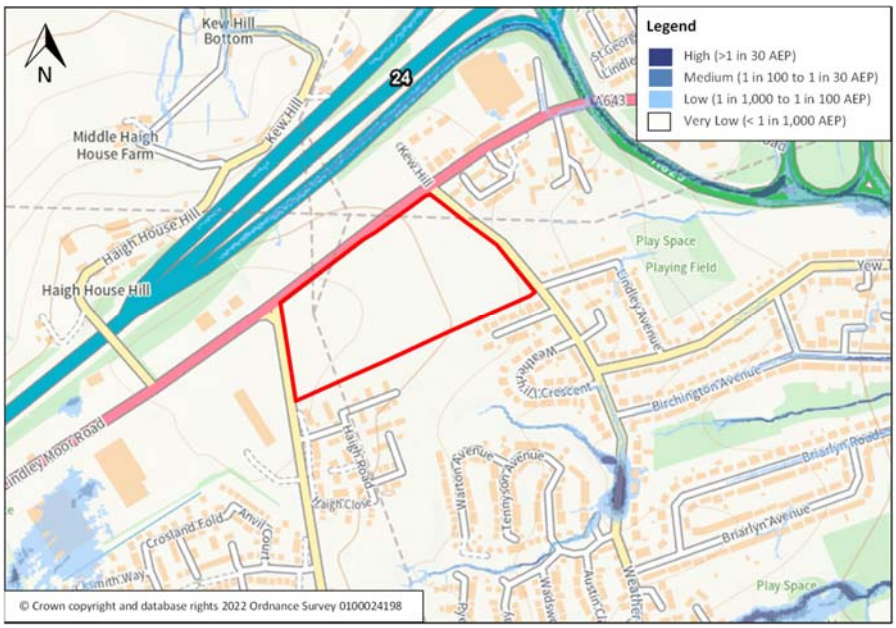


Figure 4: Flood Risk from Surface Water
Source: gov.uk website; Accessed: February 2022

Notwithstanding this, given the historic flooding issues reported by the lead local flood authority outlined in **Section 4.1**, 2D direct rainfall-runoff hydraulic modelling has been undertaken by Weetwood for the 1 in 100 AEP and 1 in 100 AEP event plus climate change events to determine the overland flow routes of surface water and to inform the drainage proposals so that the development proposals will not increase off-site flood risk.

The model outputs are presented in **Appendix D**. The outputs indicate the following:

- The majority of surface water runoff from the site flows in an easterly direction towards Unnamed Watercourse (1)
- Runoff adjacent to the south-eastern boundary of the site flows in a southerly direction along Weatherhill Road away from the site boundary.
- Runoff from the south-west corner of the site flows in a south-easterly direction, following the natural topography of the land to a localised valley that bisects Weatherhill Crescent and Warton Avenue.

No accumulation of surface water on the site is indicated. This is due to the sloping terrain and absence of localised depression.

4.4 Flood Risk from Reservoirs, Canals and Other Artificial Sources

There are no canals or other impounded waterbodies located within the immediate vicinity of the site. The Flood Risk from Reservoirs map indicates that the site is not at risk of flooding from such sources. The site is therefore assessed not to be at risk of flooding from reservoirs, canals or other artificial sources.

4.5 Flood Risk from Groundwater

The JBA Groundwater Flood Risk Indicator map (**Figure 5**) indicates that the site is at 'Negligible' and 'Very Low' risk of flooding from groundwater during a 1 in 100 AEP groundwater flooding event.

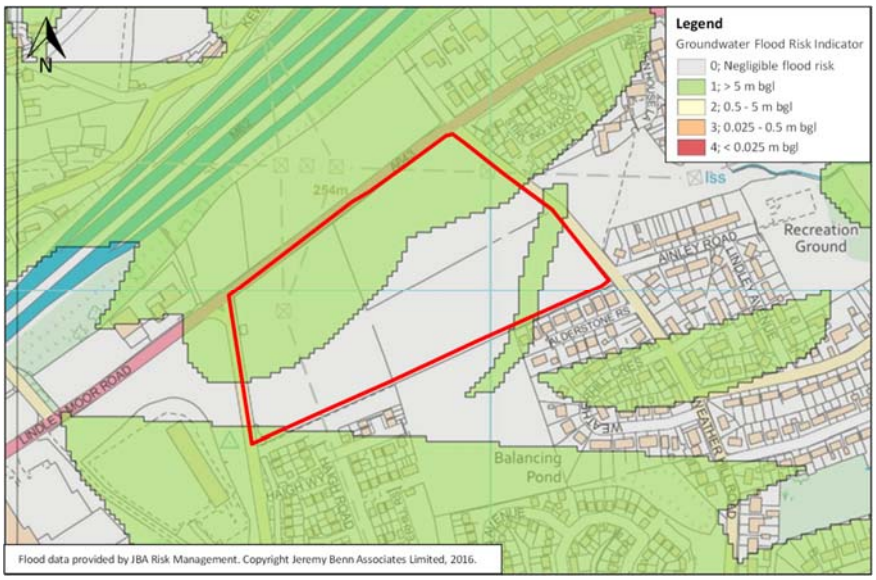


Figure 5: JBA Groundwater Flood Risk Indicator Map
Source: Blue Sky Maps; Accessed: February 2022

4.6 Sequential Test and Exception Test

The site is assessed as being at very low risk of flooding from all known sources. As such, the proposals satisfy the requirements of the sequential test and the exception test need not be applied. Nevertheless, the proposals are still required to meet the requirements for site specific flood risk assessments.

4.7 Flood Risk Mitigation Measures

The risk of flooding to the proposed development is assessed to be very low from all known sources. As such, no specific mitigation measures are required. However, finished floor levels of buildings should be set at a minimum of 0.15 m above adjacent ground levels following reprofiling of the site.

This will, subject to the implementation of an appropriately designed surface water drainage scheme (**Section 6**), enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy[7].

[7] Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

5 FOUL WATER MANAGEMENT

5.1 Existing Assets

Yorkshire Water public sewer records (**Appendix E**) indicate that there are no wastewater assets location on site. The following wastewater assets are present within the surrounding area:

- A 225 mm diameter public combined sewer is located adjacent to the south-eastern corner of the site in Weatherhill Road and flows in a southerly direction
- A 150 mm diameter public foul water sewer is located approximately 75 m to the east of the site and flows in an easterly direction
- A 150 mm diameter Section 104 foul water sewer is located in Stirling Wood Close and flows into the aforementioned sewer.

5.2 Foul Water Loadings

The anticipated domestic foul flows from the site have been calculated in accordance with British Flows and Loads. The expected total peak flow rate from the development would be 8.0 l/s.

Any commercial food preparation waste will need to pass through suitable traps to capture fats, grease and oils prior to discharge into the proposed foul water system.

5.3 New Connections

Yorkshire Water has advised, by way of a pre-planning sewerage enquiry response (**Appendix F**), that there is existing capacity in the local foul sewerage network to receive and treat domestic foul water from the proposed development and that foul water can discharge without restriction into the 225 mm diameter combined sewer in Weatherhill Road at a point to the south-east of the site.

6 SURFACE WATER MANAGEMENT

6.1 Existing Assets

Yorkshire Water public sewer records (**Appendix E**) indicate that a 150 mm diameter public surface water sewer is located approximately 75 m to the east of the site. The sewer flows from Stirling Wood Close and outfalls into the unnamed watercourse (1).

6.2 Surface Water Drainage at the Existing Site

The site is undeveloped greenfield. Given the sloping nature of the site and ground conditions, surface water runoff would be expected to slowly infiltrate where conditions allow and flow overland in a direction determined by topography, with the majority of the site flowing in an easterly direction.

The greenfield surface water runoff rates for the site, calculated using the ICP SUDS method within MicroDrainage are presented in **Table 1**. Details of the input parameters and the output results are provided in **Appendix G**.

Table 1: Greenfield Runoff Rate

AEP of Rainfall Event	Greenfield Runoff Rate (l/s/ha)	Greenfield Runoff Rate for 6.26 ha Site (l/s)
1 in 1	2.9	18.2
QBAR	3.4	21.3
1 in 30	6.0	37.6
1 in 100	7.1	44.4

6.3 Surface Water Drainage at the Developed Site

6.3.1 Disposal of Surface Water

In accordance with PPG para. 056, surface water runoff should be disposed of according to the following hierarchy: Into the ground (infiltration); To a surface water body; To a surface water sewer, highway drain, or another drainage system; To a combined sewer.

Kirklees Council has advised by way of a pre-application consultation response letter (ref: 2020/20447; 5 December 2020) that the disposal of surface water via infiltration is not viable due to the following reasons:

- Perched water tables within the immediate vicinity of the site
- Reports of flooding in the locality due to rapid runoff and a fast-responding catchment; and
- The site has a 1 in 10 gradient in the eastern portion.

It is subsequently proposed to direct all runoff from the developed site to the Unnamed Watercourse (3) to the eastern boundary of the site, ultimately discharging into Unnamed Watercourse (1). An alternative option is to discharge to Unnamed Watercourse (1) via a connection to the downstream manhole chamber MH2103 located in the field to the east, subject to Yorkshire Water approval.

6.3.2 Peak Flow Control

Kirklees Council LLFA has advised by way of a Planning Consultation Response (ref: 2022/91477, 30 September 2022) that the allowable discharge rate is set to 10.5 l/s.

6.3.3 Volume Control

Where reasonably practicable, for sites which have been previously developed, the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1 in 100 AEP, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

As outlined within the CIRIA SuDS Manual 2015 extra runoff volumes in extreme events may be managed by releasing all runoff (above the 1 in 1 AEP event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value.

It is proposed to restrict peak discharge rates to 10.5 l/s in up to the 1 in 100 AEP event, including an allowance for climate change, which is approximately 50% less than the QBAR rate for the whole site.

6.3.4 Attenuation Storage

Attenuation storage will be provided to store surface water runoff generated across roofs and hardstanding.

The attenuation storage facilities for the detailed planning extents (access road and Unit P) and the outline planning extents (Units A – N) have been modelled using the Network (**Appendix H**) and Source Control (**Appendix I**) modules of MicroDrainage respectively.

The required storage volumes have been sized to store the 1 in 100 AEP rainfall event including a 30% increase in rainfall intensity to allow for climate change in accordance with local guidance[8].

A preliminary surface water drainage layout is provided in **Appendix J** and a contributing areas plan is provided in **Appendix K**.

Access Road and Unit P (Detailed Planning Application)

Assuming a peak discharge rate of 10.5 l/s, a total storage volume of 2,971.2 m^3 would be required. It should be noted that the storage volume also allows for a nominal discharge rate of 2.5 l/s from specific units within the outline planning extent.

The storage volume serving the access road and Unit P could be accommodated within two pre-cast concrete tanks (1,200.0 m^2 x 2.0 m deep, 2,400.0 m^3 capacity and 350.0 m^2 x 1.5 m deep, 525.0 m^3 capacity) and the proposed pipe and manhole network.

Units A – N (Outline Planning Application)

Assuming a peak discharge rate of 2.5 l/s, the following storage volumes would be required:

- Unit A: 105.0 m^3, utilising a concrete storage tank (105.0 m^2 x 1.0 m deep, 105.0 m^3 capacity)
- Unit B: 115.0 m^3, utilising a concrete storage tank (115.0 m^2 x 1.0 m deep, 115.0 m^3 capacity)
- Unit C: 425.0 m^3, utilising a concrete storage tank (425.0 m^2 x 1.0 m deep, 425.0 m^3 capacity)
- Unit D-E: 375.0 m^3, utilising a concrete storage tank (375.0 m^2 x 1.0 m deep, 375.0 m^3 capacity)
- Unit F: 450.0 m^3, utilising a concrete storage tank (450.0 m^2 x 1.0 m deep, 450.0 m^3 capacity)
- Unit G: 500.0 m^3, utilising a concrete storage tank (500.0 m^2 x 1.0 m deep, 500.0 m^3 capacity)
- Unit H-N: 800.0 m^3, utilising a concrete storage tank (800.0 m^2 x 1.0 m deep, 800.0 m^3 capacity)

It should be noted that the calculations for the outline planning extents assume that all storage is provided within the formal attenuation storage facilities; with no storage being provided in the proposed pipe network. As such, the volumes of storage presented are likely to be an overestimate.

6.3.5 Exceedance Routes

Flows resulting from rainfall in excess of the 1 in 100 AEP rainfall event including an allowance for climate change will be managed in exceedance routes, as illustrated in **Appendix J**. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards carriageways, with the site being profiled to ensure that flood flows are directed away from built development.

[8] Kirklees Council (LLFA) consultation response, 22 February 2023

The introduction of a land drain along the southern boundary will ensure any overland flow is intercepted, preventing runoff from the site discharging towards the residential developments to the south. Any existing land drainage extending into the site from the south will need to be assessed at the detailed design stage.

6.3.6 Pollution Control

Table 26.2 of the CIRIA SuDS Manual and Table G3.1 of the Statutory Standards for SuDS identifies highly frequented lorry approaches to industrial estates, commercial yard and delivery areas, and commercial/industrial roofs as having a high to medium to low pollution hazard level.

Table 26.2 of the CIRIA SuDS Manual 2015 indicates that the pollution hazard indices for total suspended solids, hydrocarbons and metals are 0.80, 0.80 and 0.90, and 0.70, 0.60 and 0.70, and 0.3, 0.2 and 0.05 for highly frequented lorry approaches to industrial estates, commercial yard and delivery areas, and commercial/industrial roofs respectively.

Vegetated filter strips can remove coarse sediments and enables pollutants to be easily seen and trapped early in the treatment train. Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for filter strips for total suspended solids, hydrocarbons and metals are 0.40, 0.40 and 0.50 respectively.

Table 26.3 of the CIRIA SuDS Manual indicates that the SuDS mitigation indices for permeable paving for total suspended solids, hydrocarbons and metals are 0.70, 0.60 and 0.70 respectively. As such, the proposed surface water drainage system provides adequate water quality treatment.

The use of catchpit manholes, silt traps in gullies/channel drains and the use of Class 1 bypass separators within each unit will help prevent contaminants discharging into the downstream receptor.

The potential for additional SuDS features to be utilised at the site would be investigated further at the detailed design stage.

6.3.7 Adoption and Maintenance of SuDS

The pipe network, including the attenuation basin, designed in accordance with the Design and Construction Guidance[9], may be adopted by the sewerage undertaker.

Pipe networks and SuDS elements within the curtilage of individual units would be the responsibility of the owner of the property.

SuDS in open spaces may be maintained by a management company.

An indicative maintenance schedule is presented in **Table 2**.

Table 2: Maintenance Requirements

Schedule	Required action	Frequency
Permeable Paving		
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.
	Stabilise and mow contributing and adjacent areas	As required

[9] Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code"), Approved Version 2.0, 10 March 2020

Schedule	Required action	Frequency
Occasional maintenance	Removal of weeds or management using glyphosphate 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 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
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 accumulation rates and establish appropriate removal frequencies	Annually
	Monitor inspection chambers	
Concrete storage tank		
Regular maintenance	Inspect and identify any areas that are not operating correctly	Monthly for 3 months, then annually
	Remove debris from the catchment surface	Monthly
	Remove sediment from internal forebays	Annually, or as required
Remedial action	Repair inlets/outlets	As required
Monitoring	Inspect catchpit manholes and note rate of sediment accumulation	Monthly in the first year and then annually
	Inspect inlets/outlets to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years, or as required
Filter strip		
Regular maintenance	Remove sediments, litter, surface debris and weeds	Monthly or as required
	Mow amenity grass access paths and verges surrounding the filter strips at 35-60 mm minimum and 75 mm maximum	
	Mow filter strips at 100 mm with 150 mm maximum to filter and control runoff, removing first and last cut in season, and if grass is longer than 150 mm removing cuttings to wildlife piles on site	
Occasional maintenance	Where there is a build-up of silt on the filter strip, i.e. 50 mm or more above the design level, then remove and spread on site	As required
	Undertake when ground is damp in autumn or early spring and transplant turf and overseed to original design levels	
	Spread excavated material on site above SuDS design profile, e.g. top of banks	
Remedial actions	Remove and replace filter material and vegetation above	As required
Flow Control Unit		
Routine maintenance	Remove litter and debris and inspect for sediment accumulation	Six Monthly
	Remove sediment from sump	As necessary – Indicated by system inspections
Remedial actions	Replace malfunctioning parts or structures	As required

Schedule	Required action	Frequency
Monitoring	Inspect for evidence of poor operation	Six Monthly
	Inspect flow control unit and establish appropriate replacement frequencies	Six Monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first year of operation, then every six months

7 SUMMARY AND RECOMMENDATIONS

This report has been prepared on behalf of 2SH Developments and relates to the proposed development of land off Lindley Moor Road, Lindley for mixed-uses.

According to the Flood Map for Planning the proposed development is located outside the 1 in 1,000 AEP flood outline and is therefore defined by the NPPF as being situated within flood zone 1.

The site is assessed as not being at risk of flooding from fluvial sources, surface water, reservoirs, canals or other artificial sources and at a very low risk of flooding from groundwater. As such, the proposals satisfy the requirements of the sequential test and the exception test need not be applied.

This report has demonstrated that the proposed development may be completed in accordance with the requirements of planning policy subject to the following:

- Finished floor levels to be set 150 mm above adjacent ground levels
- The detailed drainage design to be submitted to and approved by the local planning authority prior to the commencement of development.

The proposals are not expected to impact flood risk elsewhere.

Yorkshire Water has advised that there is existing capacity in the local foul sewerage network to receive and treat the additional foul flows from the proposed development.

APPENDIX A

Proposed Layout (Partly Illustrative)

A1

A
B
C
D
E
F
G
H
I
J
K
L
M
N
P
sub

Outline Application Boundary
Detailed Application Boundary
Not within client ownership

0 5 10 25m

SCALE 1 : 500

Area Schedule

	Supermarket		Restaurant		Cafe / Take away		Warehouse		Office		Industrial			
Class Use	A1		A3		A3 / A5		B8		B1		B2			
2020 Class...	E (a)		E (b)		A3 / A5		B8		E (g)		B2			
	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	Total sq/m	Total sq/ft
A											525	5651	525	5651
B	377	4058											377	4058
C			908	9774									908	9774
D					391	4208							391	4208
E					525	5651							525	5651
F							2330	25079	242	2605			2572	27684
G							2615	28147	192	2066			2807	30213
H							314	3379			157	1689	471	5068
I							314	3379			157	1689	471	5068
J							314	3379			157	1689	471	5068
K							314	3379			157	1689	471	5068
L							314	3379			157	1689	471	5068
M							614	6609			232	2498	846	9107
N							307	3304			614	6609	921	9913
P							910	9795	1019	10968	2840	30569	4769	51332
Total	**377**	**4058**	**908**	**9774**	**916**	**9859**	**8346**	**89829**	**1453**	**15639**	**4996**	**53763**	**16996**	**182932**

Rev	Description	Drawn	Checked	Date
P2	Boundary Updated	JW	MJR	08-04-22
P1	ISSUED	CS	MR	06-12-21

Document Status : **S2**

Purpose of Issue: **FOR PLANNING**

MARTIN WALSH ARCHITECTURAL
Firth Buildings, 99 - 103 Leeds Rd, Dewsbury, WF12 7BU t: 01924 464342
e: info@martinwalsh.co.uk w: www.martinwalsh.co.uk

Project
Proposed Development at Lindley Moor Road, Lindley Huddersfield

Title
Proposed Site Application Plan

Client
2SH Developments

MWA Project Ref	Scale	Original Paper Size	Paper Orientation	Drawn
6194	1 : 500	@A1	Landscape	CS

File Identifier

Project	Originator	Volume	Level	Type	Role	Number	Revision
LMSH -	MWA -	ZZ -	XX -	DR -	A -	0004	P2

APPENDIX B

Site Investigation Extract

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 - 101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450862 e martin@haighhuddleston.co.uk

Phase 2
Geo-environmental Report

ON

PROPOSED BUSINESS PARK

AT

LINDLEY MOOR ROAD, HUDDERSFIELD

FOR

2SH Developments Ltd

APRIL 2022

E21/7768/R002

Haigh Huddleston Associates is the trading name of Haigh Huddleston Associates Limited
Registered Office: Firth Buildings, 99-101 Leeds Road, Dewsbury, WF12 7BU
Registered in England Number 6458196

INDEX

0.0 EXECUTIVE SUMMARY

SITE

The site consists of three grassed fields located to the south of Lindley Moor Road. The western and eastern boundaries are formed by Crosland Road and Weather Hill Road respectively. To the south there is an ongoing residential development.
The fields are delineated by intermittent mature hedges and trees.
There are two metal pylons located on the site. The first is located in the north west of the site and has overhead cables heading to the north and the south east. The second is located in the east of the site and has overhead cables heading to the west and east
At the time of the site investigation works, due to the adverse weather conditions, the ground conditions were noted to be very soft which proved difficult for the heavier plant to navigate.
The site generally falls from the north west to the south east.

HISTORY

There has been no significant development of the site since 1854. From 1854-1955 a Roman Road was indicated in the north west of the site and from 1854-1892 two wells were indicated in the north east of the site.
There has been residential development to the south east of the site from 1948, and to the south west from 2021.

GEOLOGY

The central and south eastern area of the site is shown to be underlain by the Pennine Lower Coal Measures consisting of Mudstone, Siltstone and Sandstone. The north eastern, north western and south eastern corners of the site are underlain by the Elland Flags, 80 Yard Rock and 48 Yard respectively, all consisting of Sandstone.
The trial pits generally proved topsoils overlying clays with a mudstone or sandstone bedrock encountered at 1.2-2.2m below existing ground levels.
The boreholes undertaken proved alternating bands of mudstone, siltstone and sandstone to a depth of 30m. Four of the rotary boreholes recorded a 0.1-0.8m thick unworked coal seam at the base of the black shale at depths of 9.4-27.7m below existing ground levels.

MINING/QUARRYING

The previous archaeological investigation identified a possible quarry adjacent the southern boundary of the site. This was not confirmed during the site investigation.
In TP07 in the south east of the site, a 0.1m thick coal seam was recorded in the clay strata at 0.8-0.9m below existing ground levels. In TP09 adjacent the eastern boundary, a 0.2m thick weathered coal seam and a 0.3m thick very

weak coal seam were encountered at 0.4-0.6 and 2.1-2.4m below existing ground levels. This is likely to be a single seam that split as it outcropped.
In only WS13 in the east of the site a 1.0m thick seam of coal was encountered at 1.0-2.0m below existing ground levels. This is potentially an exaggerated seam thickness from an upturn in the coal seam as it outcrops.
Four of the rotary boreholes recorded a 0.1-0.8m thick unworked coal seam at depths of 9.4-27.7m below existing ground levels. The coal was shallowest adjacent the recorded outcrops crossing the site.
None of the seams encountered showed evidence of being worked. However, due to the shallow nature of the coal adjacent the recorded outcrops, it is considered possible that the coal may have been worked and extracted from the surface through the use of bellpits. It is therefore recommended that a site scrape is undertaken during development to allow a visual inspection of the underlying natural strata to determine the presence of any features

HYDROLOGY

The nearest open surface water feature to the site is an un-named watercourse located 166m east of the site.
During the investigation works, a shallow sandstone culvert was encountered that exits the site through the eastern boundary and appears to discharge towards this open watercourse.

HYDROGEOLOGY

The bedrock underlying the site is classified as a Secondary (A) aquifer.
Groundwater seepage was noted in TP02, TP03, TP06, TP07, TP08 and TP09 at depths of 1.4-2.6m below existing ground levels. TP06 was left open for several hours and the groundwater level rose to within 1.3m of the surface level. Water strikes were recorded in eight of the fourteen boreholes at depths of 1.6-9.0m below ground level.
During the gas monitoring, water levels have been recorded between the surface and 2.70m below ground level.

HAZARDOUS GAS

The development is not in an area requiring radon protection measures.
A maximum carbon dioxide concentration of 4.8% was recorded in R15. No methane has been detected in any of the monitoring stations during the monitoring.
Based on the maximum concentrations and gas flow rates measured to date, the gas regime found on this site can be classified as CS1 by BS 8485:2015

CONTAMINATION

No elevated levels of contaminants were identified in the samples taken from site when compared to the tier 1 trigger levels for commercial land use.

REMEDIATION	Topsoil to be stripped and stockpiled behind protective fencing to prevent cross contamination during development. Watching brief to be undertaken during site strip for evidence of mining features, historical wells in north east of site and anecdotal quarry adjacent southern boundary. Exact location of fault line to be determined by further trial trenching following site strip prior to construction. Possible trace survey of existing land drainage to be undertaken to determine if any diversion works are required to accommodate the proposed development. Any features encountered to be surveyed and reported to all any necessary remediation strategies to be agreed.
FOUNDATIONS	that the commercial units should be constructed on strip/trench fill and pad footings founded entirely onto the mudstone/sandstone strata with ground bearing floor slabs. Due to the steep nature of the site, it is likely that re-levelling works will be required to accommodate the proposed commercial units and parking areas. Consideration may need to be given to piled foundations dependent on the depth to suitable founding material from final proposed finished floor levels.
.	Where shallow coal is encountered within the foundation excavations, the foundations should be extended beneath the coal strata to underlying mudstone/sandstone. The exposed coal face should be sealed off to prevent combustion.
DRAINAGE	Infiltration methods have proved unsuitable for use on site. A discharge rate has been previously agreed with the Local Water Authority and the LLFA through the planning application.

8.0 RESULTS OF THE INVESTIGATION

8.1 GEOTECHNICAL INVESTIGATION

8.1.1 A copy of the trial pit, window sample and borehole logs providing a complete record of strata encountered beneath the proposed development is presented in Appendix B.

8.1.2 The fieldwork generally proved a moderate depth of clays with a mudstone or sandstone bedrock.

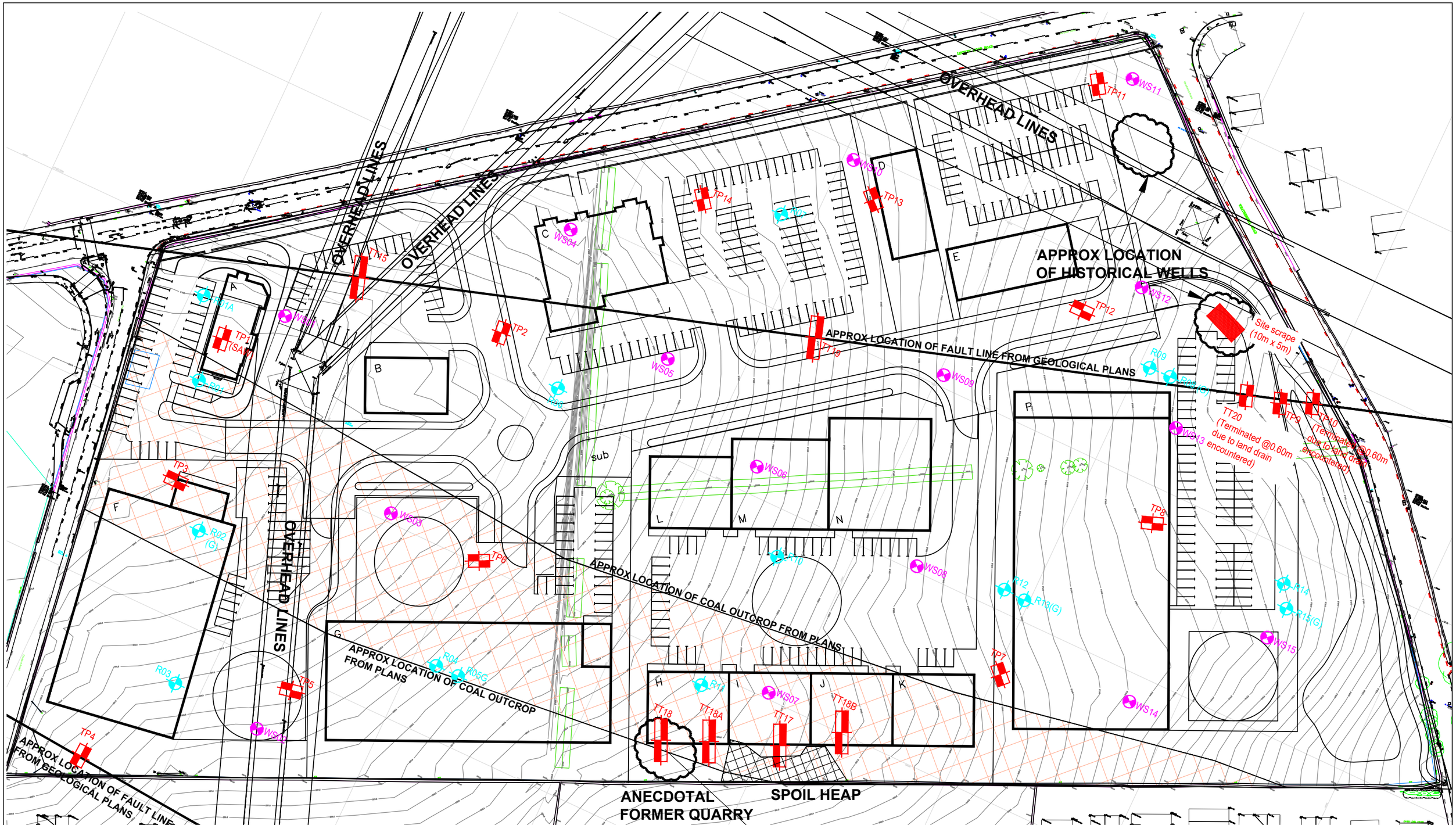
8.1.3 The surface of all the trial pits proved rough grass over 0.2-0.4m of dark brown/grey topsoil.

8.1.4 Underlying the topsoil in all but TP13, there was layer of orange/grey clay with occasional sandstone gravels and cobbles. This varied in thickness from 0.2-1.9m across the site, and was identified as weathered sandstone in TP2. TP10 was undertaken in a depression noted on the eastern boundary and stopped at the base of the topsoil as a shallow stone culvert with water flow was encountered in the clay strata. The culvert was noted to flow eastwards where it left the site.

8.1.5 In TP07 in the south east of the site, a 0.1m thick coal seam was recorded in the clay strata at 0.8-0.9m below existing ground levels. In TP09 adjacent the eastern boundary, a 0.2m thick weathered coal seam and a 0.3m thick very weak coal seam were encountered at 0.4-0.6 and 2.1-2.4m below existing ground levels. This is likely to be a single seam that split as it outcropped.

8.1.6 Beneath the topsoil in TP13, and beneath the clay in TP11, TP12 and TP14 there was a 0.2-1.0m thick layer of weak mudstone excavated as shaley gravels. All four of these trial pits were in the north east of the site.

8.1.7 Beneath the clay in TP02, TP03, TP05, TP07 and TP13 there was a 0.5-1.1m thick layer of weathered light brown sandstone excavated as gravels and cobbles. This was encountered at 0.4-1.3m below existing ground levels. TP05, TP07 and TP13 terminated in this strata at depths of 1.2-1.8m below existing ground levels where the sandstone became hard to excavate.



TRIAL TRENCH LOCATION

TRIAL PIT LOCATION

BOREHOLE LOCATION

WINDOW SAMPLE LOCATION

Rev B Updated to suit site investigation works	11.02.22 JF
Rev A Updated to suit revised planning layout	17.12.21 MD

Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Rd, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662

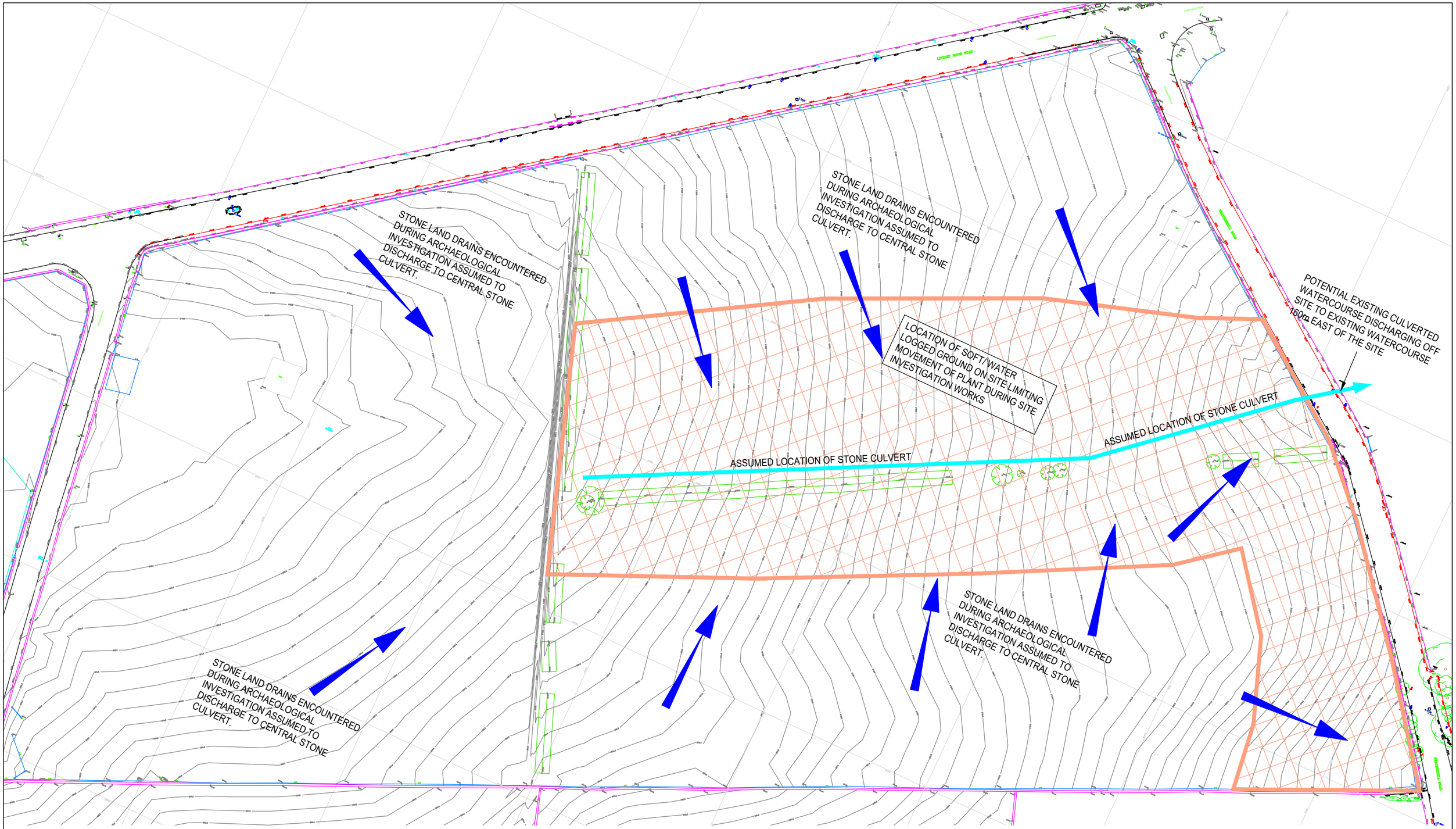
e martin@haighhuddleston.co.uk

Client: 2SH Developments Ltd

Project: Lindley Moor Road, Huddersfield

Detail: Site Investigation Plan

Scale	Dwn	Chkd	Date	Dwg No.
1:1000	MD		Sep'21	E20/7768/03B



KEY:

DIRECTION OF FLOW OF GROUND WATER

LOCATION OF SOFT/ WATER LOGGED GROUND ON SITE LIMITING MOVEMENT OF PLANT DURING SITE INVESTIGATION WORKS

Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Rd, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662

e martin@haighhuddleston.co.uk

Client	2SH Developments Ltd
Project	Lindley Moor Road, Huddersfield
Detail	GROUND WATER MOVEMENT PLAN

Scale	Dwn	Chkd	Date	Dwg No.
1:1000	JF		Apr'22	E20/7768/200

TRIAL HOLE NO. 10

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 -101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450662 e martin@haighhuddleston.co.uk

Client :	**MWA**	**Job No :**	**7768**
Site :	**LINDLEY**	**Date :**	**9 FEBRUARY 2022**

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	**0.5**	Strong light brown angular sandstone boulders. Land drain encountered.
1.0		Depth to base of land drain = 0.6m.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

……

……

APPENDIX C

Topographic Survey

Rev	Description	Drawn	Checked	Date
A	Survey Checks, Elec Pylon + Cable positions, adjacent propoerty hts and new junction layout.	HSL		08.04.20

Document Status : **S0**

Purpose of Issue: **FOR INFORMATION**

MARTIN WALSH ARCHITECTURAL

Firth Buildings, 99 - 103 Leeds Rd, Dewsbury, WF12 7BU t: 01924 464342
e: info@martinwalsh.co.uk w: www.martinwalsh.co.uk

Project
Feasibility Schemes at Lindley Moor Road, Lindley Huddersfield

Title
Existing Site Survey

Client
Michael Steel & Co. c/o Scott Hall

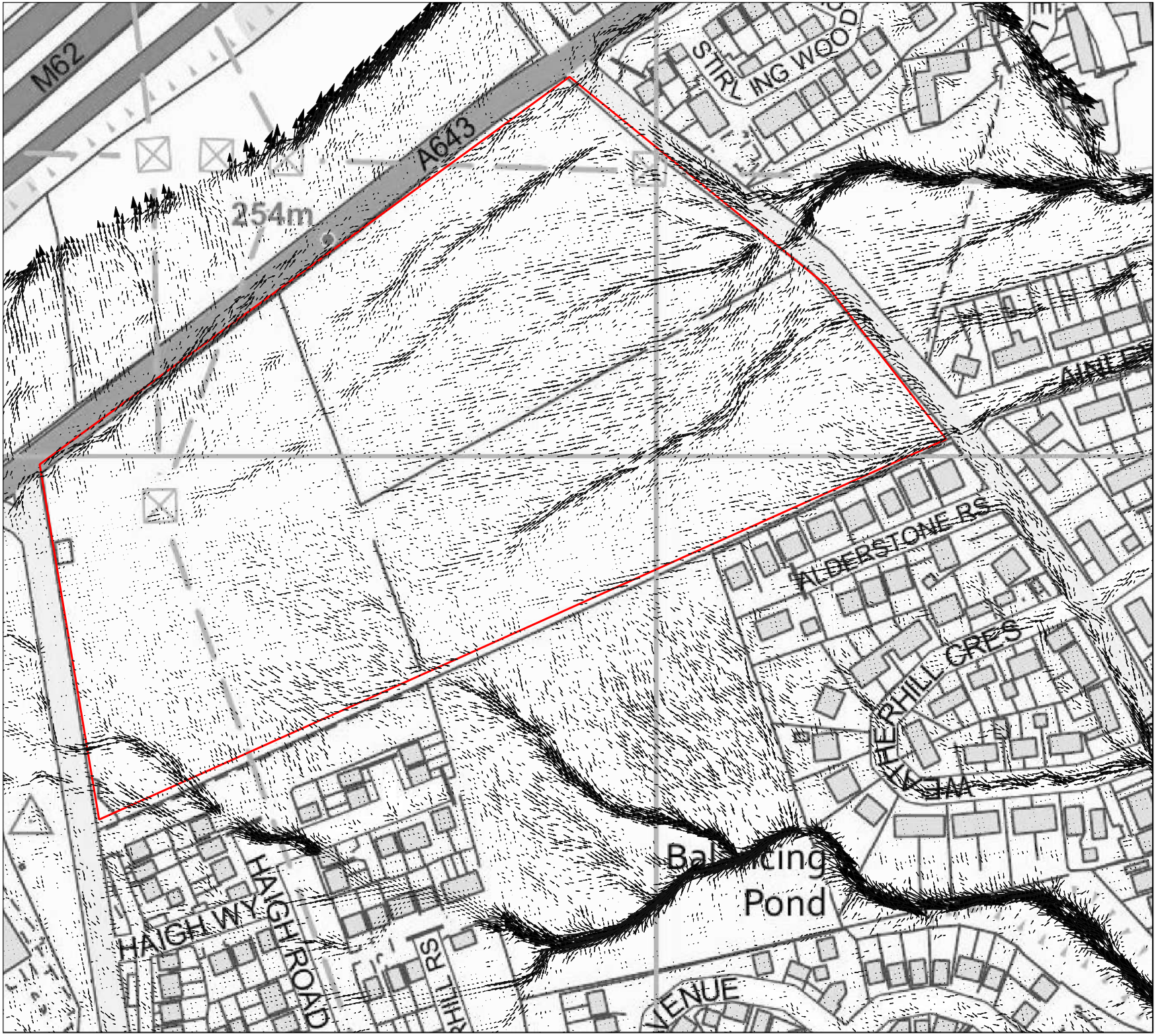
MWA Project Ref	Scale	Original Paper Size	Paper Orientation	Drawn	Checked
6194	1:500	@A1	Landscape	ABC	ABC

File Identifier

Project		Originator		Volume		Level		Type		Role		Number	Revision
SHLM	**-**	**MWA**	**-**	**01**	**-**	**GF**	**-**	**DR**	**-**	**A**	**-**	**0001**	**P1**

APPENDIX D

2D Direct Rainfall Modelling Outputs



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Legend

Flow Direction

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

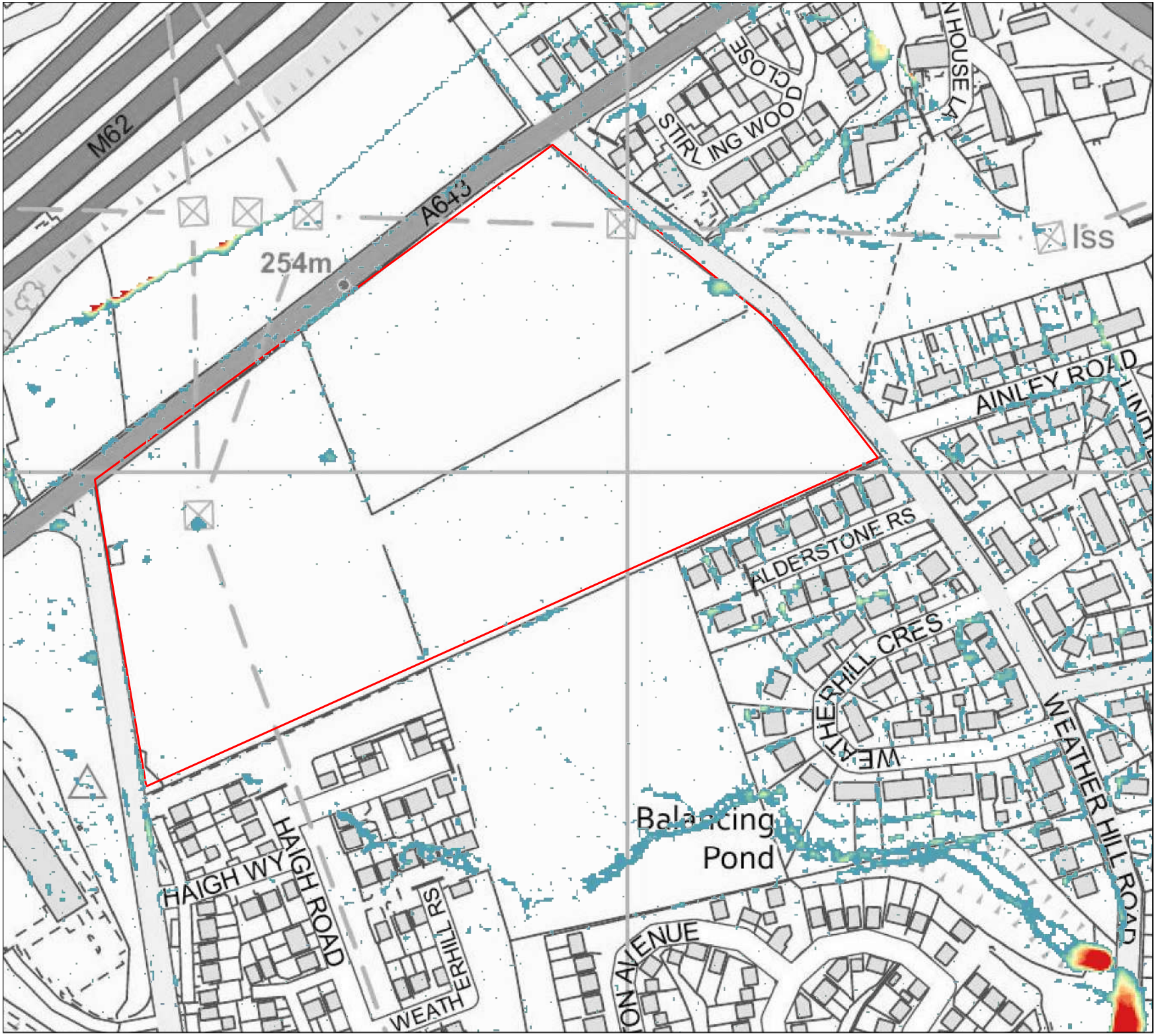
Drawing Title: **Baseline Scenario - Flow Pathways**
1 in 100 plus climate change (40%) AEP

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	28 February 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100CC40_vDir	A



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Depth (m)

- <= 0.04
- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths 1 in 30 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	7 March 2022

Project No:	Drawing No:	Rev:
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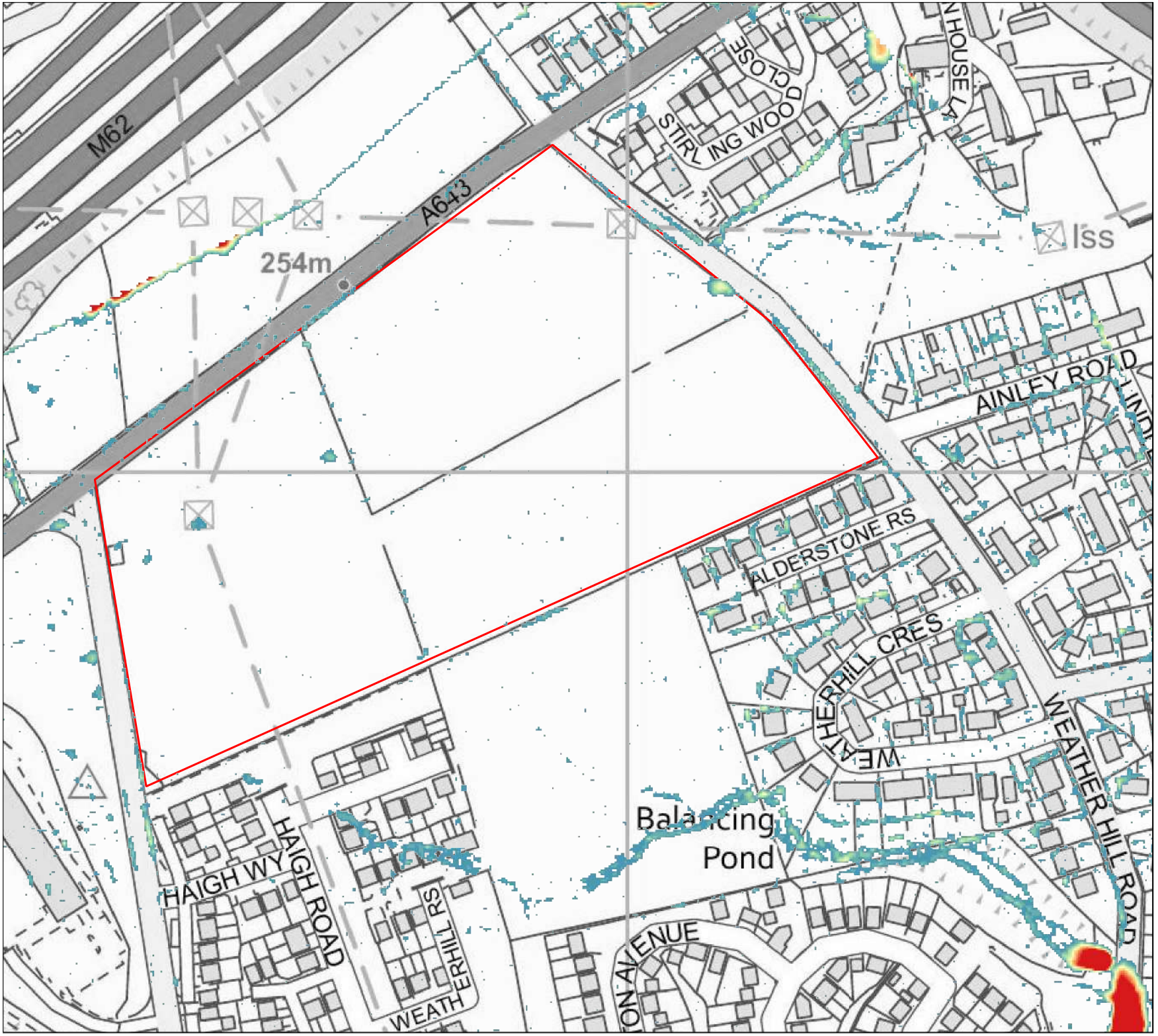

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Depth (m)

- <= 0.04
- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths 1 in 100 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	1 March 2022

Project No:	Drawing No:	Rev:
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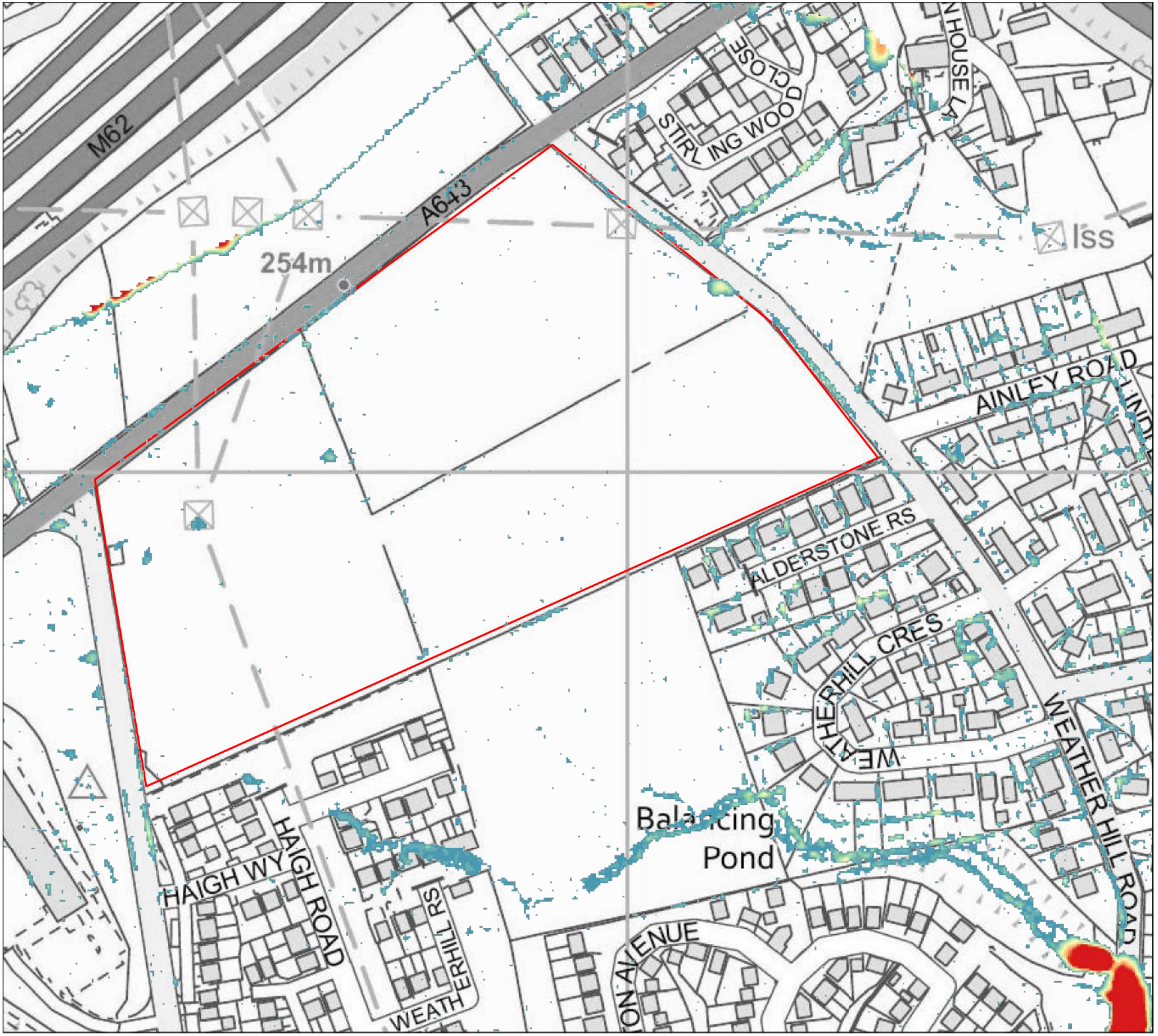

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Legend

Depth (m)

- <= 0.04
- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths**
1 in 100 plus climate change (40%) AEP

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	1 March 2022

Project No:	Drawing No:	Rev:
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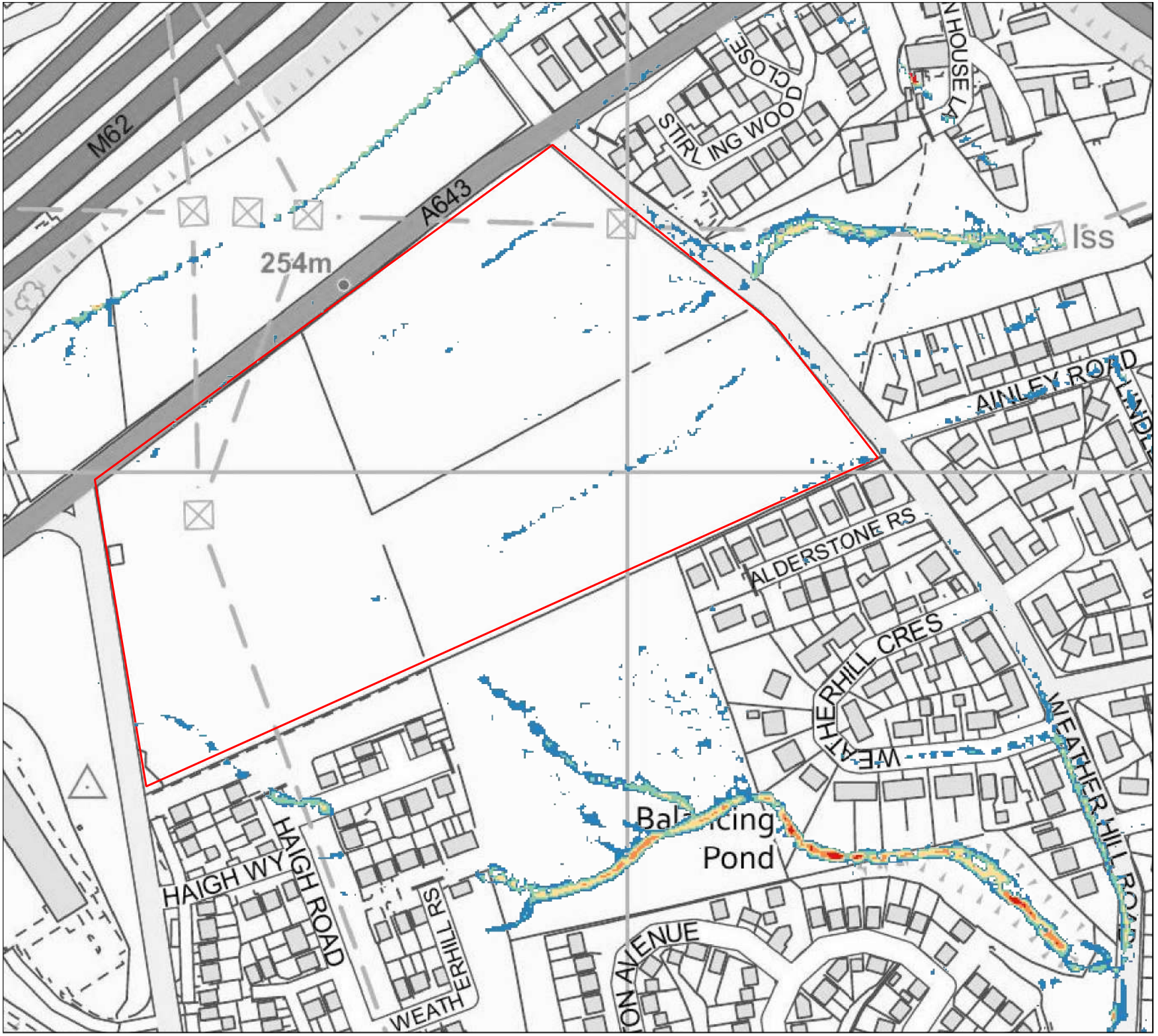

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Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Velocity 1 in 30 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
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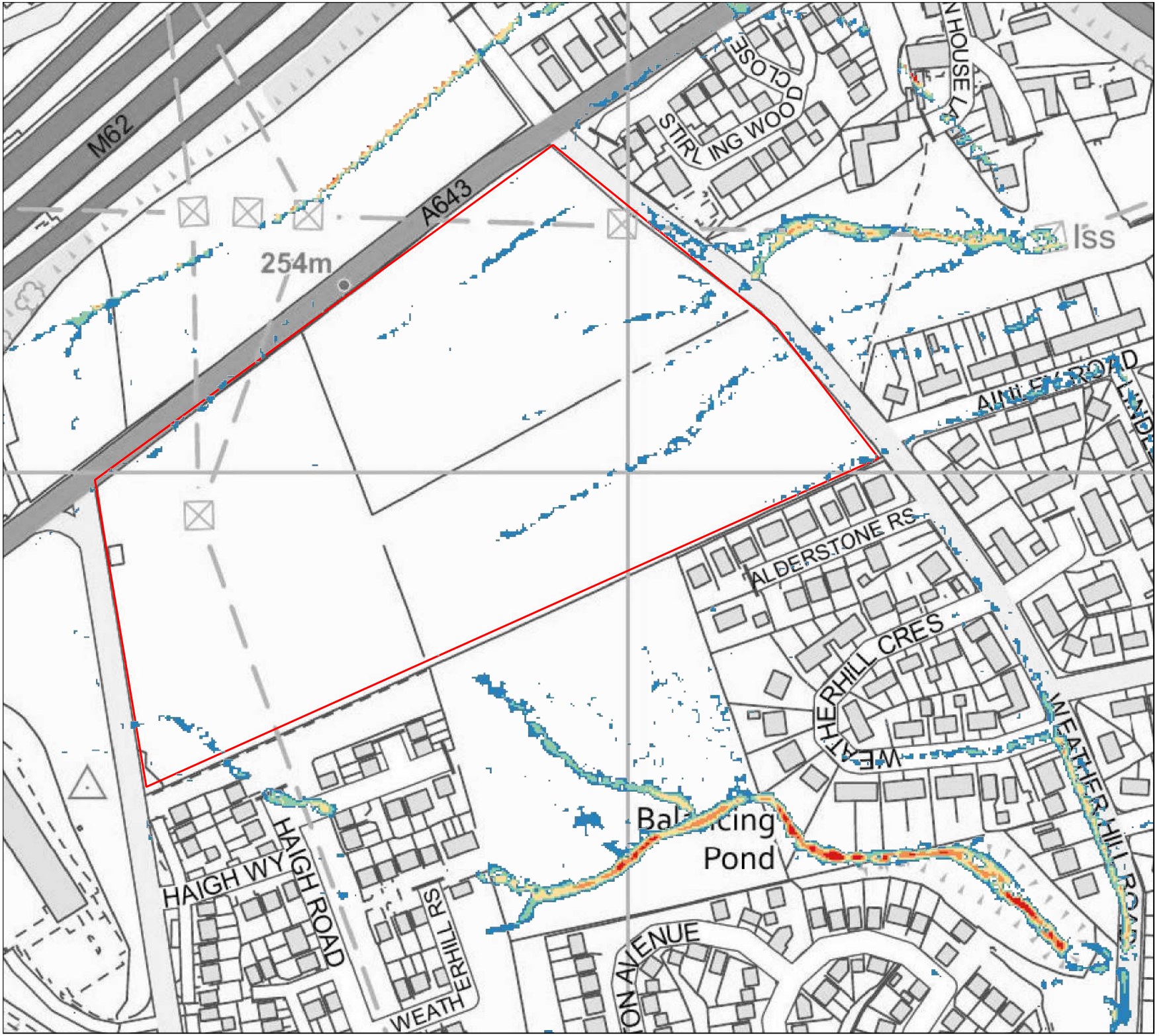

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Legend

Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

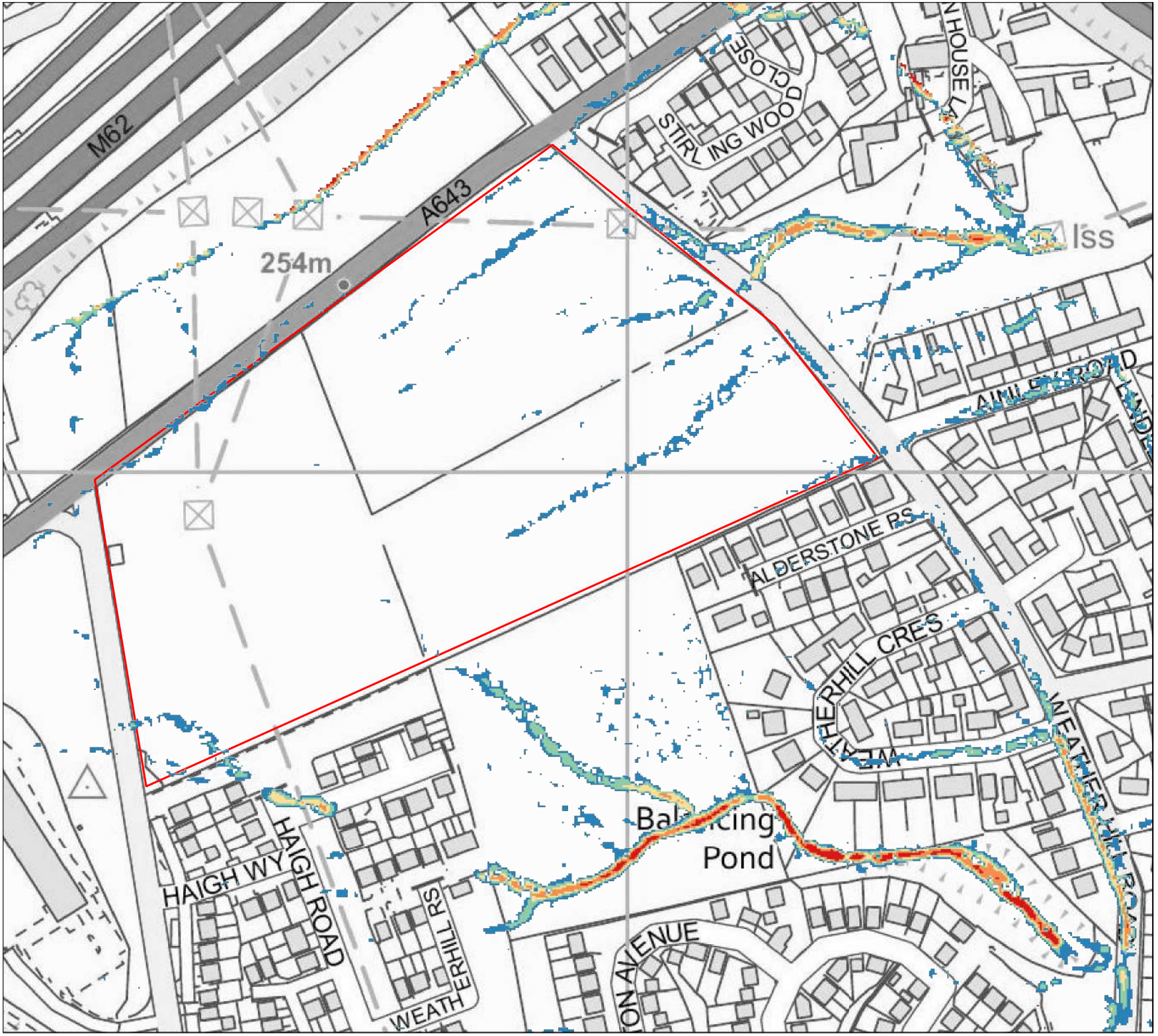
Drawing Title: **Baseline Scenario - Runoff Velocity 1 in 100 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100_v	A



Notes:

1. Do not scale from this drawing.

2. Map background reproduced from Ordnance Survey digital map data. Crown Copyright under licence.

Legend

Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

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W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Velocity**
1 in 100 plus climate change (40%) AEP

Map Orientation:

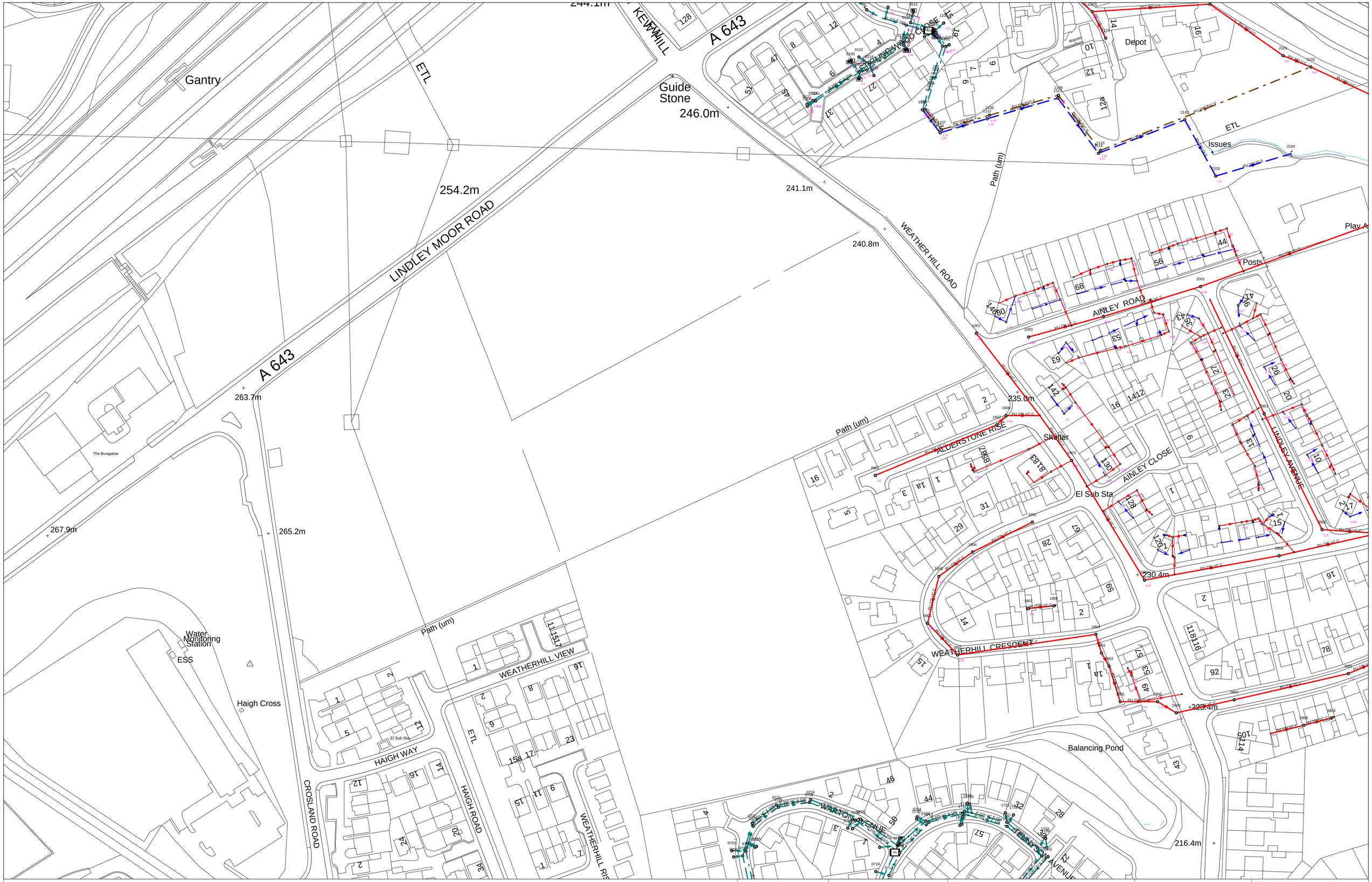
Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100CC40_v	A

APPENDIX E

Public Sewer Record



410799 : 418860	Map Name : SE1018NE	Title	Partial Key
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
		(Only) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	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 : 14/02/2022, 10:10:36
			Date Gen : 14/02/2022, 10:11:03
			Source : Sewer Network Enquiry

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

APPENDIX F

Correspondence with Yorkshire Water

YorkshireWater

Mr T Brook
Weetwood Services Ltd
22C Josephs Well
Hannover Walk
Leeds
LS3 1AB
tim.brook@weetwood.net

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

Your Ref:
Our Ref: Y001281

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

14th February 2022

Dear Mr Brook,

Lindley Moor Road, Lindley, Huddersfield, HD3 3TB – Pre-Planning Sewerage Enquiry U541537

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:

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.

Foul Water

Foul water domestic waste can discharge to the 225 mm diameter public combined sewer recorded in Weather Hill Road, at a point to the south-east of the site.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Surface Water

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 watercourse is located to the east of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

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.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network.

Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Surface water run-off from areas of vehicular parking and/or hardstanding etc. must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator.

It is imperative, however that surface water run-off from the forecourt of petrol stations, areas used for the delivery of fuel, areas used for and immediately adjacent to vehicle washing facilities and/or other similar areas where detergent is likely to be used is not discharged to any public surface water sewer network. Surface water from such areas must pass through an oil, petrol and grit interceptor/separator of adequate design before discharge to the public foul or combined sewer network. A trade effluent consent - that may be conditional and, amongst other things, place a restriction on the rate of discharge to public sewer - may be required for such discharges. The developer is advised to contact Yorkshire Water's Industrial Waste Section (telephone 0345 1242424) about any such proposal.

It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Other Observations

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

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.

YorkshireWater

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 constructed in accordance with the Code for Adoption 2021/22, 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 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.

Yorkshire Water's Trade Effluent team must be consulted in respect of any proposed trade effluent discharge to the public sewer.

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.

YorkshireWater

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

Chris Roberts
Development Services Technician

APPENDIX G

Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 SAAR (mm) 1200 Urban 0.000
Area (ha) 1.000 Soil 0.300 Region Number Region 3

Results l/s

QBAR Rural 3.4
QBAR Urban 3.4

Q1 year 2.9

Q1 year 2.9
Q30 years 6.0
Q100 years 7.1

APPENDIX H

Surface Water Attenuation – Detailed Planning Storage Volume Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.312	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.723	4-8	0.632

Total Area Contributing (ha) = 1.355

Total Pipe Volume (m³) = 91.771

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	36.926	0.400	92.3	0.053	5.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.59	257.650	0.053	0.0	0.0	0.0	1.05	18.5	7.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	16.000	1.600	10.0	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.001	19.209	0.100	192.1	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	13.312	0.750	17.7	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	30.000	1.950	15.4	0.025	5.00	2.5	0.600	o	150	Pipe/Conduit	
S4.000	25.000	0.250	100.0	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S3.001	55.060	3.900	14.1	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	31.350	0.350	89.6	0.019	5.00	2.5	0.600	o	150	Pipe/Conduit	
S3.002	9.869	0.150	65.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	86.871	5.750	15.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.000	10.000	0.350	28.6	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	50.00	5.08	258.850	0.000	2.5	0.0	0.0	3.20	56.6	2.5
S1.001	50.00	5.87	257.100	0.081	2.5	0.0	0.0	1.13	79.9	13.5
S1.002	50.00	5.93	257.000	0.105	2.5	0.0	0.0	3.75	265.0	16.7
S3.000	50.00	5.19	262.400	0.025	2.5	0.0	0.0	2.58	45.6	5.9
S4.000	50.00	5.41	260.700	0.000	2.5	0.0	0.0	1.00	17.8	2.5
S3.001	50.00	5.63	260.300	0.113	5.0	0.0	0.0	4.21	297.3	20.3
S5.000	50.00	5.49	256.900	0.019	2.5	0.0	0.0	1.06	18.8	5.1
S3.002	50.00	5.72	256.400	0.132	7.5	0.0	0.0	1.94	137.2	25.4
S1.003	50.00	6.29	256.250	0.237	10.0	0.0	0.0	4.07	287.4	42.1
S6.000	50.00	5.09	251.000	0.000	2.5	0.0	0.0	1.89	33.4	2.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.004	15.032	1.050	14.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	15.007	1.050	14.3	0.173	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	12.918	1.000	12.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.000	25.754	0.500	51.5	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.006	52.832	4.200	12.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	21.500	0.600	35.8	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.007	10.215	0.450	22.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.000	14.974	0.150	99.8	0.129	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	15.920	0.700	22.7	0.021	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.009	15.920	0.500	31.8	0.017	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	50.00	6.35	250.500	0.237	12.5	0.0	0.0	4.18	295.2	44.6
S7.000	50.00	5.06	250.500	0.173	0.0	0.0	0.0	4.18	295.5	23.4
S1.005	50.00	6.40	249.450	0.410	12.5	0.0	0.0	4.40	310.8	68.0
S8.000	50.00	5.31	249.100	0.000	2.5	0.0	0.0	1.40	24.8	2.5
S1.006	50.00	6.55	248.300	0.410	15.0	0.0	0.0	5.76	915.5	70.5
S9.000	50.00	5.21	245.000	0.000	2.5	0.0	0.0	1.69	29.8	2.5
S1.007	50.00	6.59	244.100	0.410	17.5	0.0	0.0	4.28	680.9	73.0
S10.000	50.00	5.16	243.950	0.129	0.0	0.0	0.0	1.57	111.2	17.5
S1.008	50.00	6.65	243.650	0.560	17.5	0.0	0.0	4.28	680.3	93.3
S1.009	50.00	6.72	242.950	0.577	17.5	0.0	0.0	3.61	574.6	95.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.010	42.136	1.300	32.4	0.032	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.011	35.195	0.550	64.0	0.027	0.00	0.0	0.600	o	600	Pipe/Conduit	
S11.000	37.500	0.300	125.0	0.065	5.00	0.0	0.600	o	300	Pipe/Conduit	
S11.001	10.308	0.100	103.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.002	36.250	1.800	20.1	0.115	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	31.000	1.750	17.7	0.111	5.00	0.0	0.600	o	300	Pipe/Conduit	
S11.003	4.000	0.050	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.004	4.000	0.050	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S13.000	94.934	0.450	211.0	0.220	5.00	0.0	0.600	o	300	Pipe/Conduit	
S14.000	95.000	0.550	172.7	0.208	5.00	0.0	0.600	o	300	Pipe/Conduit	
S14.001	49.810	0.300	166.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S13.001	18.000	1.200	15.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S13.002	34.573	1.000	34.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.010	50.00	6.89	242.300	0.609	17.5	0.0	0.0	4.29	1212.3	100.0
S1.011	50.00	7.08	241.000	0.636	17.5	0.0	0.0	3.05	861.7	103.6
S11.000	50.00	5.44	243.500	0.065	0.0	0.0	0.0	1.40	99.3	8.8
S11.001	50.00	5.56	243.200	0.065	0.0	0.0	0.0	1.55	109.5	8.8
S11.002	50.00	5.73	243.100	0.180	0.0	0.0	0.0	3.52	248.8	24.4
S12.000	50.00	5.14	243.050	0.111	0.0	0.0	0.0	3.75	265.3	15.0
S11.003	50.00	5.77	241.300	0.291	0.0	0.0	0.0	1.76	124.4	39.4
S11.004	50.00	5.80	241.150	0.291	0.0	0.0	0.0	1.76	124.4	39.4
S13.000	50.00	6.47	243.750	0.220	0.0	0.0	0.0	1.08	76.2	29.8
S14.000	50.00	6.33	244.150	0.208	0.0	0.0	0.0	1.19	84.4	28.2
S14.001	50.00	7.01	243.600	0.208	0.0	0.0	0.0	1.22	86.1	28.2
S13.001	50.00	7.08	243.300	0.428	0.0	0.0	0.0	4.08	288.4	58.0
S13.002	50.00	7.25	241.950	0.428	0.0	0.0	0.0	3.47	551.4	58.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.005	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.012	3.282	0.050	65.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.013	3.000#	0.050	60.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.014	17.503	0.200	87.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.005	50.00	7.33	240.950	0.719	0.0	0.0	0.0	1.00	17.8«	97.4
S1.012	49.98	7.35	240.450	1.355	17.5	0.0	0.0	3.01	850.8	200.9
S1.013	49.92	7.37	240.400	1.355	17.5	0.0	0.0	2.63	418.0	200.9
S1.014	49.11	7.64	240.350	1.355	17.5	0.0	0.0	1.07	19.0«	200.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Ba
S38	259.000	1.350	Open Manhole	1200	S1.000	257.650	150				
S37-FC (B)	261.250	2.400	Open Manhole	1200	S2.000	258.850	150				
S36	260.850	3.750	Open Manhole	1200	S1.001	257.100	300	S1.000	257.250	150	
								S2.000	257.250	150	
S35	260.500	3.500	Open Manhole	1200	S1.002	257.000	300	S1.001	257.000	300	
S34-FC (A)	264.000	1.600	Open Manhole	1200	S3.000	262.400	150				
S33-FC (F)	262.300	1.600	Open Manhole	1200	S4.000	260.700	150				
S32	263.750	3.450	Open Manhole	1200	S3.001	260.300	300	S3.000	260.450	150	
								S4.000	260.450	150	
S31-FC (G)	258.500	1.600	Open Manhole	1200	S5.000	256.900	150				
S30	260.150	3.750	Open Manhole	1200	S3.002	256.400	300	S3.001	256.400	300	
								S5.000	256.550	150	
S29	259.400	3.150	Open Manhole	1200	S1.003	256.250	300	S1.002	256.250	300	
								S3.002	256.250	300	
S28-FC (C)	253.000	2.000	Open Manhole	1200	S6.000	251.000	150				
S27	252.500	2.000	Open Manhole	1200	S1.004	250.500	300	S1.003	250.500	300	
								S6.000	250.650	150	
S-FS02	251.800	1.300	Open Manhole	600	S7.000	250.500	300				
S26	251.350	1.900	Open Manhole	1200	S1.005	249.450	300	S1.004	249.450	300	
								S7.000	249.450	300	
S25-FC (H-N)	250.600	1.500	Open Manhole	1200	S8.000	249.100	150				
S24	250.100	1.800	Open Manhole	1500	S1.006	248.300	450	S1.005	248.450	300	
								S8.000	248.600	150	
S23-FC (D-E)	247.000	2.000	Open Manhole	1200	S9.000	245.000	150				
S22	245.900	1.800	Open Manhole	1500	S1.007	244.100	450	S1.006	244.100	450	
								S9.000	244.400	150	
S-FS01	245.350	1.400	Open Manhole	600	S10.000	243.950	300				
S21	245.600	1.950	Open Manhole	1500	S1.008	243.650	450	S1.007	243.650	450	
								S10.000	243.800	300	
S20	244.800	1.850	Open Manhole	1500	S1.009	242.950	450	S1.008	242.950	450	
S19	244.400	2.100	Open Manhole	1500	S1.010	242.300	600	S1.009	242.450	450	
S18	244.000	3.000	Open Manhole	1500	S1.011	241.000	600	S1.010	241.000	600	
S17	245.000	1.500	Open Manhole	1200	S11.000	243.500	300				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Back (m
S16	245.000	1.800	Open Manhole	1200	S11.001	243.200	300	S11.000	243.200	300	
S15	244.750	1.650	Open Manhole	1200	S11.002	243.100	300	S11.001	243.100	300	
S14	244.550	1.500	Open Manhole	1200	S12.000	243.050	300				
S13-TANK	244.650	3.350	Open Manhole	1200	S11.003	241.300	300	S11.002	241.300	300	
								S12.000	241.300	300	
S12-BS	244.400	3.250	Open Manhole	1200	S11.004	241.150	300	S11.003	241.250	300	
S11	245.250	1.500	Open Manhole	1200	S13.000	243.750	300				
S10	245.350	1.200	Open Manhole	600	S14.000	244.150	300				
S9	245.350	1.750	Open Manhole	600	S14.001	243.600	300	S14.000	243.600	300	
S8	245.200	1.900	Open Manhole	1200	S13.001	243.300	300	S13.000	243.300	300	
								S14.001	243.300	300	
S7	244.500	2.550	Open Manhole	1500	S13.002	241.950	450	S13.001	242.100	300	
S6-FC (P)	243.580	2.630	Open Manhole	1500	S11.005	240.950	150	S11.004	241.100	300	
								S13.002	240.950	450	
S5-ORIFICE	244.000	3.550	Open Manhole	1500	S1.012	240.450	600	S1.011	240.450	600	
								S11.005	240.900	150	
S3-TANK	243.000	2.600	Open Manhole	1200	S1.013	240.400	450	S1.012	240.400	600	
S2-FC	243.000	2.650	Open Manhole	1800	S1.014	240.350	150	S1.013	240.350	450	
S1	241.350	1.200	Open Manhole	1200		OUTFALL		S1.014	240.150	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S38	410810.268	419041.808	410810.268	419041.808	Required	
S37-FC (B)	410817.963	419005.728	410817.963	419005.728	Required	
S36	410832.529	419012.348	410832.529	419012.348	Required	
S35	410844.110	418997.022	410844.110	418997.022	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S34-FC (A)	410774.120	418952.666	410774.120	418952.666	Required	
S33-FC (F)	410811.775	418942.318	410811.775	418942.318	Required	
S32	410801.432	418965.078	410801.432	418965.078	Required	
S31-FC (G)	410864.529	418959.317	410864.529	418959.317	Required	
S30	410851.558	418987.858	410851.558	418987.858	Required	
S29	410857.369	418995.835	410857.369	418995.835	Required	
S28-FC (C)	410920.649	419056.185	410920.649	419056.185	Required	
S27	410926.678	419048.207	410926.678	419048.207	Required	
S-FS02	410939.480	419042.284	410939.480	419042.284	Required	
S26	410938.671	419057.269	410938.671	419057.269	Required	
S25-FC (H-N)	410964.504	419044.509	410964.504	419044.509	Required	
S24	410948.978	419065.057	410948.978	419065.057	Required	
S23-FC (D-E)	410978.168	419114.061	410978.168	419114.061	Required	
S22	410991.130	419096.908	410991.130	419096.908	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S-FS01	411000.087	419088.114	411000.087	419088.114	Required	
S21	410999.280	419103.066	410999.280	419103.066	Required	
S20	411014.687	419107.072	411014.687	419107.072	Required	
S19	411028.414	419099.010	411028.414	419099.010	Required	
S18	411053.817	419065.392	411053.817	419065.392	Required	
S17	411015.739	419093.043	411015.739	419093.043	Required	
S16	411031.442	419058.989	411031.442	419058.989	Required	
S15	411041.570	419060.906	411041.570	419060.906	Required	
S14	411069.730	418999.836	411069.730	418999.836	Required	
S13-TANK	411056.749	419027.988	411056.749	419027.988	Required	
S12-BS	411060.382	419029.663	411060.382	419029.663	Required	
S11	411015.967	419076.388	411015.967	419076.388	Required	
S10	410970.734	419055.530	410970.734	419055.530	Required	
S9	411010.514	418969.260	411010.514	418969.260	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S8	411055.719	418990.177	411055.719	418990.177	Required	
S7	411072.065	418997.715	411072.065	418997.715	Required	
S6-FC (P)	411064.014	419031.338	411064.014	419031.338	Required	
S5-ORIFICE	411068.555	419033.431	411068.555	419033.431	Required	
S3-TANK	411071.535	419034.806	411071.535	419034.806	Required	
S2-FC	411058.266	419073.727	411058.266	419073.727	Required	
S1	411052.181	419090.138			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S38	259.000	257.650	1.200	Open Manhole	1200
S2.000	o	150	S37-FC (B)	261.250	258.850	2.250	Open Manhole	1200
S1.001	o	300	S36	260.850	257.100	3.450	Open Manhole	1200
S1.002	o	300	S35	260.500	257.000	3.200	Open Manhole	1200
S3.000	o	150	S34-FC (A)	264.000	262.400	1.450	Open Manhole	1200
S4.000	o	150	S33-FC (F)	262.300	260.700	1.450	Open Manhole	1200
S3.001	o	300	S32	263.750	260.300	3.150	Open Manhole	1200
S5.000	o	150	S31-FC (G)	258.500	256.900	1.450	Open Manhole	1200
S3.002	o	300	S30	260.150	256.400	3.450	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	36.926	92.3	S36	260.850	257.250	3.450	Open Manhole	1200
S2.000	16.000	10.0	S36	260.850	257.250	3.450	Open Manhole	1200
S1.001	19.209	192.1	S35	260.500	257.000	3.200	Open Manhole	1200
S1.002	13.312	17.7	S29	259.400	256.250	2.850	Open Manhole	1200
S3.000	30.000	15.4	S32	263.750	260.450	3.150	Open Manhole	1200
S4.000	25.000	100.0	S32	263.750	260.450	3.150	Open Manhole	1200
S3.001	55.060	14.1	S30	260.150	256.400	3.450	Open Manhole	1200
S5.000	31.350	89.6	S30	260.150	256.550	3.450	Open Manhole	1200
S3.002	9.869	65.8	S29	259.400	256.250	2.850	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.003	o	300	S29	259.400	256.250	2.850	Open Manhole	1200
S6.000	o	150	S28-FC (C)	253.000	251.000	1.850	Open Manhole	1200
S1.004	o	300	S27	252.500	250.500	1.700	Open Manhole	1200
S7.000	o	300	S-FS02	251.800	250.500	1.000	Open Manhole	600
S1.005	o	300	S26	251.350	249.450	1.600	Open Manhole	1200
S8.000	o	150	S25-FC (H-N)	250.600	249.100	1.350	Open Manhole	1200
S1.006	o	450	S24	250.100	248.300	1.350	Open Manhole	1500
S9.000	o	150	S23-FC (D-E)	247.000	245.000	1.850	Open Manhole	1200
S1.007	o	450	S22	245.900	244.100	1.350	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.003	86.871	15.1	S27	252.500	250.500	1.700	Open Manhole	1200
S6.000	10.000	28.6	S27	252.500	250.650	1.700	Open Manhole	1200
S1.004	15.032	14.3	S26	251.350	249.450	1.600	Open Manhole	1200
S7.000	15.007	14.3	S26	251.350	249.450	1.600	Open Manhole	1200
S1.005	12.918	12.9	S24	250.100	248.450	1.350	Open Manhole	1500
S8.000	25.754	51.5	S24	250.100	248.600	1.350	Open Manhole	1500
S1.006	52.832	12.6	S22	245.900	244.100	1.350	Open Manhole	1500
S9.000	21.500	35.8	S22	245.900	244.400	1.350	Open Manhole	1500
S1.007	10.215	22.7	S21	245.600	243.650	1.500	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.000	o	300	S-FS01	245.350	243.950	1.100	Open Manhole	600
S1.008	o	450	S21	245.600	243.650	1.500	Open Manhole	1500
S1.009	o	450	S20	244.800	242.950	1.400	Open Manhole	1500
S1.010	o	600	S19	244.400	242.300	1.500	Open Manhole	1500
S1.011	o	600	S18	244.000	241.000	2.400	Open Manhole	1500
S11.000	o	300	S17	245.000	243.500	1.200	Open Manhole	1200
S11.001	o	300	S16	245.000	243.200	1.500	Open Manhole	1200
S11.002	o	300	S15	244.750	243.100	1.350	Open Manhole	1200
S12.000	o	300	S14	244.550	243.050	1.200	Open Manhole	1200
S11.003	o	300	S13-TANK	244.650	241.300	3.050	Open Manhole	1200
S11.004	o	300	S12-BS	244.400	241.150	2.950	Open Manhole	1200
S13.000	o	300	S11	245.250	243.750	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.000	14.974	99.8	S21	245.600	243.800	1.500	Open Manhole	1500
S1.008	15.920	22.7	S20	244.800	242.950	1.400	Open Manhole	1500
S1.009	15.920	31.8	S19	244.400	242.450	1.500	Open Manhole	1500
S1.010	42.136	32.4	S18	244.000	241.000	2.400	Open Manhole	1500
S1.011	35.195	64.0	S5-ORIFICE	244.000	240.450	2.950	Open Manhole	1500
S11.000	37.500	125.0	S16	245.000	243.200	1.500	Open Manhole	1200
S11.001	10.308	103.1	S15	244.750	243.100	1.350	Open Manhole	1200
S11.002	36.250	20.1	S13-TANK	244.650	241.300	3.050	Open Manhole	1200
S12.000	31.000	17.7	S13-TANK	244.650	241.300	3.050	Open Manhole	1200
S11.003	4.000	80.0	S12-BS	244.400	241.250	2.850	Open Manhole	1200
S11.004	4.000	80.0	S6-FC (P)	243.580	241.100	2.180	Open Manhole	1500
S13.000	94.934	211.0	S8	245.200	243.300	1.600	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.000	o	300	S10	245.350	244.150	0.900	Open Manhole	600
S14.001	o	300	S9	245.350	243.600	1.450	Open Manhole	600
S13.001	o	300	S8	245.200	243.300	1.600	Open Manhole	1200
S13.002	o	450	S7	244.500	241.950	2.100	Open Manhole	1500
S11.005	o	150	S6-FC (P)	243.580	240.950	2.480	Open Manhole	1500
S1.012	o	600	S5-ORIFICE	244.000	240.450	2.950	Open Manhole	1500
S1.013	o	450	S3-TANK	243.000	240.400	2.150	Open Manhole	1200
S1.014	o	150	S2-FC	243.000	240.350	2.500	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.000	95.000	172.7	S9	245.350	243.600	1.450	Open Manhole	600
S14.001	49.810	166.0	S8	245.200	243.300	1.600	Open Manhole	1200
S13.001	18.000	15.0	S7	244.500	242.100	2.100	Open Manhole	1500
S13.002	34.573	34.6	S6-FC (P)	243.580	240.950	2.180	Open Manhole	1500
S11.005	5.000	100.0	S5-ORIFICE	244.000	240.900	2.950	Open Manhole	1500
S1.012	3.282	65.6	S3-TANK	243.000	240.400	2.000	Open Manhole	1200
S1.013	3.000#	60.0	S2-FC	243.000	240.350	2.200	Open Manhole	1800
S1.014	17.503	87.5	S1	241.350	240.150	1.050	Open Manhole	1200

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.053	0.053	0.053
2.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.028	0.028	0.028
1.002	-	-	100	0.024	0.024	0.024
3.000	-	-	100	0.025	0.025	0.025
4.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.088	0.088	0.088
5.000	-	-	100	0.019	0.019	0.019
3.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.173	0.173	0.173
1.005	-	-	100	0.000	0.000	0.000
8.000	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
10.000	-	-	100	0.129	0.129	0.129
1.008	-	-	100	0.021	0.021	0.021
1.009	-	-	100	0.017	0.017	0.017
1.010	-	-	100	0.032	0.032	0.032
1.011	-	-	100	0.027	0.027	0.027
11.000	-	-	100	0.065	0.065	0.065
11.001	-	-	100	0.000	0.000	0.000
11.002	-	-	100	0.115	0.115	0.115
12.000	-	-	100	0.111	0.111	0.111
11.003	-	-	100	0.000	0.000	0.000
11.004	-	-	100	0.000	0.000	0.000
13.000	-	-	100	0.220	0.220	0.220
14.000	-	-	100	0.208	0.208	0.208
14.001	-	-	100	0.000	0.000	0.000
13.001	-	-	100	0.000	0.000	0.000
13.002	-	-	100	0.000	0.000	0.000
11.005	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.355	1.355	1.355

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.014	S1	241.350	240.150	0.000	1200	0

Simulation Criteria for Storm

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

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 3	Number of Storage Structures 2	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.312		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6-FC (P), DS/PN: S11.005, Volume (m³): 10.1

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	240.950
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

Orifice Manhole: S5-ORIFICE, DS/PN: S1.012, Volume (m³): 15.9

Diameter (m) 0.250 Discharge Coefficient 0.600 Invert Level (m) 240.450

Hydro-Brake® Optimum Manhole: S2-FC, DS/PN: S1.014, Volume (m³): 7.0

Unit Reference	MD-SHE-0134-1050-2000-1050
Design Head (m)	2.000
Design Flow (l/s)	10.5
Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: S2-FC, DS/PN: S1.014, Volume (m³): 7.0

Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	240.350
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.5	Kick-Flo®	1.201	8.3
Flush-Flo™	0.589	10.4	Mean Flow over Head Range	-	9.2

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	4.8	1.200	8.3	3.000	12.7	7.000	19.0
0.200	8.7	1.400	8.9	3.500	13.7	7.500	19.7
0.300	9.7	1.600	9.4	4.000	14.6	8.000	20.3
0.400	10.2	1.800	10.0	4.500	15.4	8.500	20.9
0.500	10.4	2.000	10.5	5.000	16.2	9.000	21.5
0.600	10.4	2.200	11.0	5.500	17.0	9.500	22.1
0.800	10.2	2.400	11.4	6.000	17.7		
1.000	9.7	2.600	11.9	6.500	18.4		

Storage Structures for Storm

Tank or Pond Manhole: S13-TANK, DS/PN: S11.003

Invert Level (m) 241.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	1.500	350.0	1.501	0.0

Tank or Pond Manhole: S3-TANK, DS/PN: S1.013

Invert Level (m) 240.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	2.000	1200.0	2.001	0.0

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
S1.000	S38	1.527	0.631	0.000	2.158
S2.000	S37-FC (B)	2.714	0.262	0.000	2.976
S1.001	S36	4.241	1.273	0.000	5.514
S1.002	S35	3.958	0.856	0.000	4.815
S3.000	S34-FC (A)	1.810	0.509	0.000	2.318
S4.000	S33-FC (F)	1.810	0.421	0.000	2.230
S3.001	S32	3.902	3.807	0.000	7.709
S5.000	S31-FC (G)	1.810	0.533	0.000	2.342
S3.002	S30	4.241	0.613	0.000	4.854
S1.003	S29	3.563	6.056	0.000	9.618
S6.000	S28-FC (C)	2.262	0.156	0.000	2.417
S1.004	S27	2.262	0.978	0.000	3.240
S7.000	S-FS02	0.368	0.997	0.000	1.365
S1.005	S26	2.149	0.818	0.000	2.967
S8.000	S25-FC (H-N)	1.696	0.431	0.000	2.128
S1.006	S24	3.181	8.164	0.000	11.345
S9.000	S23-FC (D-E)	2.262	0.356	0.000	2.618
S1.007	S22	3.181	1.386	0.000	4.567
S10.000	S-FS01	0.396	0.984	0.000	1.380
S1.008	S21	3.446	2.293	0.000	5.739
S1.009	S20	3.269	2.293	0.000	5.563
S1.010	S19	3.711	11.490	0.000	15.201
S1.011	S18	5.301	9.527	0.000	14.828
S11.000	S17	1.696	2.566	0.000	4.262
S11.001	S16	2.036	0.644	0.000	2.680
S11.002	S15	1.866	2.478	0.000	4.344
S12.000	S14	1.696	2.106	0.000	3.803
S11.003	S13-TANK	3.789	0.198	525.117	529.103
S11.004	S12-BS	3.676	0.187	0.000	3.863
S13.000	S11	1.696	6.626	0.000	8.322
S14.000	S10	0.339	6.673	0.000	7.012
S14.001	S9	0.495	3.457	0.000	3.952
S13.001	S8	2.149	1.177	0.000	3.326
S13.002	S7	4.506	5.260	0.000	9.766
S11.005	S6-FC (P)	4.648	0.062	0.000	4.709
S1.012	S5-ORIFICE	6.273	0.546	0.000	6.820
S1.013	S3-TANK	2.941	0.239	2400.400	2403.579
S1.014	S2-FC	6.743	0.283	0.000	7.026
Total		107.609	87.334	2925.517	3120.459

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S38	15 minute 1 year Winter I+0%	259.000	257.713	-0.087	0.000	0.36
S2.000	S37-FC (B)	15 minute 1 year Summer I+0%	261.250	258.871	-0.129	0.000	0.05
S1.001	S36	15 minute 1 year Winter I+0%	260.850	257.183	-0.217	0.000	0.17
S1.002	S35	15 minute 1 year Winter I+0%	260.500	257.050	-0.250	0.000	0.07
S3.000	S34-FC (A)	15 minute 1 year Winter I+0%	264.000	262.435	-0.115	0.000	0.13
S4.000	S33-FC (F)	15 minute 1 year Summer I+0%	262.300	260.738	-0.112	0.000	0.15
S3.001	S32	15 minute 1 year Winter I+0%	263.750	260.348	-0.252	0.000	0.06
S5.000	S31-FC (G)	15 minute 1 year Winter I+0%	258.500	256.953	-0.097	0.000	0.27
S3.002	S30	15 minute 1 year Winter I+0%	260.150	256.497	-0.203	0.000	0.22
S1.003	S29	15 minute 1 year Winter I+0%	259.400	256.322	-0.228	0.000	0.13
S6.000	S28-FC (C)	15 minute 1 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.004	S27	15 minute 1 year Winter I+0%	252.500	250.578	-0.222	0.000	0.16
S7.000	S-FS02	15 minute 1 year Winter I+0%	251.800	250.559	-0.241	0.000	0.09

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

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S38		0.065	6.4	OK
S2.000	S37-FC (B)		0.018	2.5	OK
S1.001	S36		0.088	11.8	OK
S1.002	S35		0.119	14.2	OK
S3.000	S34-FC (A)		0.034	5.5	OK
S4.000	S33-FC (F)		0.038	2.5	OK
S3.001	S32		0.049	17.1	OK
S5.000	S31-FC (G)		0.054	4.8	OK
S3.002	S30		0.115	21.8	OK
S1.003	S29		0.117	36.0	OK
S6.000	S28-FC (C)		0.027	2.5	OK
S1.004	S27		0.092	38.4	OK
S7.000	S-FS02		0.015	21.1	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.005	S26	15 minute 1 year Winter I+0%	251.350	249.548	-0.202	0.000
S8.000	S25-FC (H-N)	15 minute 1 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.006	S24	15 minute 1 year Winter I+0%	250.100	248.380	-0.370	0.000
S9.000	S23-FC (D-E)	15 minute 1 year Summer I+0%	247.000	245.030	-0.120	0.000
S1.007	S22	15 minute 1 year Winter I+0%	245.900	244.223	-0.327	0.000
S10.000	S-FS01	15 minute 1 year Winter I+0%	245.350	244.033	-0.217	0.000
S1.008	S21	15 minute 1 year Winter I+0%	245.600	243.775	-0.325	0.000
S1.009	S20	15 minute 1 year Winter I+0%	244.800	243.088	-0.312	0.000
S1.010	S19	15 minute 1 year Winter I+0%	244.400	242.415	-0.485	0.000
S1.011	S18	1440 minute 1 year Winter I+0%	244.000	241.860	0.260	0.000
S11.000	S17	15 minute 1 year Winter I+0%	245.000	243.559	-0.241	0.000
S11.001	S16	15 minute 1 year Winter I+0%	245.000	243.263	-0.237	0.000
S11.002	S15	15 minute 1 year Winter I+0%	244.750	243.159	-0.241	0.000
S12.000	S14	15 minute 1 year Winter I+0%	244.550	243.096	-0.254	0.000
S11.003	S13-TANK	1440 minute 1 year Winter I+0%	244.650	241.754	0.154	0.000
S11.004	S12-BS	1440 minute 1 year Winter I+0%	244.400	241.756	0.306	0.000
S13.000	S11	15 minute 1 year Winter I+0%	245.250	243.875	-0.175	0.000
S14.000	S10	15 minute 1 year Winter I+0%	245.350	244.265	-0.185	0.000
S14.001	S9	15 minute 1 year Winter I+0%	245.350	243.710	-0.190	0.000
S13.001	S8	15 minute 1 year Winter I+0%	245.200	243.388	-0.212	0.000
S13.002	S7	15 minute 1 year Winter I+0%	244.500	242.044	-0.356	0.000
S11.005	S6-FC (P)	1440 minute 1 year Winter I+0%	243.580	241.758	0.658	0.000
S1.012	S5-ORIFICE	1440 minute 1 year Winter I+0%	244.000	241.856	0.806	0.000
S1.013	S3-TANK	1440 minute 1 year Winter I+0%	243.000	241.818	0.968	0.000
S1.014	S2-FC	1440 minute 1 year Winter I+0%	243.000	241.824	1.324	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.005	S26	0.23		0.127	58.8	OK
S8.000	S25-FC (H-N)	0.11		0.031	2.5	OK
S1.006	S24	0.07		0.133	61.2	OK
S9.000	S23-FC (D-E)	0.09		0.028	2.5	OK
S1.007	S22	0.17		0.232	63.6	OK
S10.000	S-FS01	0.17		0.022	15.7	OK
S1.008	S21	0.17		0.253	80.7	OK
S1.009	S20	0.21		0.290	82.1	OK
S1.010	S19	0.08		0.195	84.9	OK
S1.011	S18	0.03		6.418	23.4	SURCHARGED
S11.000	S17	0.08		0.062	7.7	OK

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S11.001	S16	0.10		0.126	7.8	OK
S11.002	S15	0.09		0.103	19.5	OK
S12.000	S14	0.06		0.046	13.5	OK
S11.003	S13-TANK	0.04		160.082	2.4	SURCHARGED
S11.004	S12-BS	0.04		0.878	2.2	SURCHARGED
S13.000	S11	0.33		0.136	24.3	OK
S14.000	S10	0.29		0.031	23.4	OK
S14.001	S9	0.28		0.205	23.0	OK
S13.001	S8	0.19		0.359	47.1	OK
S13.002	S7	0.10		0.157	47.1	OK
S11.005	S6-FC (P)	0.18		4.647	2.5	SURCHARGED
S1.012	S5-ORIFICE	0.07		12.065	25.8	SURCHARGED
S1.013	S3-TANK	0.07		1703.952	11.6	SURCHARGED
S1.014	S2-FC	0.59		3.978	10.4	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S38	15 minute 2 year Winter I+0%	259.000	257.722	-0.078	0.000	0.46
S2.000	S37-FC (B)	15 minute 2 year Summer I+0%	261.250	258.871	-0.129	0.000	0.05
S1.001	S36	15 minute 2 year Winter I+0%	260.850	257.193	-0.207	0.000	0.21
S1.002	S35	15 minute 2 year Winter I+0%	260.500	257.057	-0.243	0.000	0.08
S3.000	S34-FC (A)	15 minute 2 year Winter I+0%	264.000	262.438	-0.112	0.000	0.15
S4.000	S33-FC (F)	15 minute 2 year Summer I+0%	262.300	260.738	-0.112	0.000	0.15
S3.001	S32	15 minute 2 year Winter I+0%	263.750	260.354	-0.246	0.000	0.07
S5.000	S31-FC (G)	15 minute 2 year Winter I+0%	258.500	256.957	-0.093	0.000	0.30
S3.002	S30	15 minute 2 year Winter I+0%	260.150	256.506	-0.194	0.000	0.27
S1.003	S29	15 minute 2 year Winter I+0%	259.400	256.329	-0.221	0.000	0.16
S6.000	S28-FC (C)	15 minute 2 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.004	S27	15 minute 2 year Winter I+0%	252.500	250.587	-0.213	0.000	0.19
S7.000	S-FS02	15 minute 2 year Winter I+0%	251.800	250.566	-0.234	0.000	0.11

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

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S38		0.076	8.3	OK
S2.000	S37-FC (B)		0.018	2.5	OK
S1.001	S36		0.100	14.6	OK
S1.002	S35		0.138	17.7	OK
S3.000	S34-FC (A)		0.038	6.4	OK
S4.000	S33-FC (F)		0.038	2.5	OK
S3.001	S32		0.055	20.7	OK
S5.000	S31-FC (G)		0.058	5.5	OK
S3.002	S30		0.127	26.0	OK
S1.003	S29		0.131	43.7	OK
S6.000	S28-FC (C)		0.027	2.5	OK
S1.004	S27		0.103	46.1	OK
S7.000	S-FS02		0.017	27.3	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.005	S26	15 minute 2 year Winter I+0%	251.350	249.560	-0.190	0.000
S8.000	S25-FC (H-N)	15 minute 2 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.006	S24	15 minute 2 year Winter I+0%	250.100	248.391	-0.359	0.000
S9.000	S23-FC (D-E)	15 minute 2 year Summer I+0%	247.000	245.030	-0.120	0.000
S1.007	S22	15 minute 2 year Winter I+0%	245.900	244.237	-0.313	0.000
S10.000	S-FS01	15 minute 2 year Winter I+0%	245.350	244.045	-0.205	0.000
S1.008	S21	15 minute 2 year Winter I+0%	245.600	243.790	-0.310	0.000
S1.009	S20	15 minute 2 year Winter I+0%	244.800	243.104	-0.296	0.000
S1.010	S19	15 minute 2 year Winter I+0%	244.400	242.427	-0.473	0.000
S1.011	S18	1440 minute 2 year Winter I+0%	244.000	241.909	0.309	0.000
S11.000	S17	15 minute 2 year Winter I+0%	245.000	243.567	-0.233	0.000
S11.001	S16	15 minute 2 year Winter I+0%	245.000	243.271	-0.229	0.000
S11.002	S15	15 minute 2 year Winter I+0%	244.750	243.167	-0.233	0.000
S12.000	S14	15 minute 2 year Winter I+0%	244.550	243.103	-0.247	0.000
S11.003	S13-TANK	1440 minute 2 year Winter I+0%	244.650	241.804	0.204	0.000
S11.004	S12-BS	1440 minute 2 year Winter I+0%	244.400	241.806	0.356	0.000
S13.000	S11	15 minute 2 year Winter I+0%	245.250	243.895	-0.155	0.000
S14.000	S10	15 minute 2 year Winter I+0%	245.350	244.283	-0.167	0.000
S14.001	S9	15 minute 2 year Winter I+0%	245.350	243.727	-0.173	0.000
S13.001	S8	15 minute 2 year Winter I+0%	245.200	243.401	-0.199	0.000
S13.002	S7	15 minute 2 year Winter I+0%	244.500	242.055	-0.345	0.000
S11.005	S6-FC (P)	1440 minute 2 year Winter I+0%	243.580	241.808	0.708	0.000
S1.012	S5-ORIFICE	1440 minute 2 year Winter I+0%	244.000	241.905	0.855	0.000
S1.013	S3-TANK	1440 minute 2 year Winter I+0%	243.000	241.867	1.017	0.000
S1.014	S2-FC	1440 minute 2 year Winter I+0%	243.000	241.875	1.375	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.005	S26	0.29		0.147	72.4	OK
S8.000	S25-FC (H-N)	0.11		0.031	2.5	OK
S1.006	S24	0.09		0.151	74.8	OK
S9.000	S23-FC (D-E)	0.09		0.028	2.5	OK
S1.007	S22	0.20		0.265	77.1	OK
S10.000	S-FS01	0.22		0.025	20.3	OK
S1.008	S21	0.21		0.296	99.4	OK
S1.009	S20	0.25		0.331	101.2	OK
S1.010	S19	0.10		0.218	104.8	OK
S1.011	S18	0.03		6.933	24.5	SURCHARGED
S11.000	S17	0.11		0.070	10.0	OK

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S11.001	S16	0.13		0.144	10.1	OK
S11.002	S15	0.11		0.118	25.3	OK
S12.000	S14	0.07		0.055	17.5	OK
S11.003	S13-TANK	0.05		177.963	2.8	SURCHARGED
S11.004	S12-BS	0.04		0.935	2.6	SURCHARGED
S13.000	S11	0.43		0.159	31.5	OK
S14.000	S10	0.37		0.036	30.3	OK
S14.001	S9	0.37		0.314	29.6	OK
S13.001	S8	0.25		0.411	60.9	OK
S13.002	S7	0.13		0.178	60.8	OK
S11.005	S6-FC (P)	0.18		5.005	2.5	SURCHARGED
S1.012	S5-ORIFICE	0.08		12.151	26.9	SURCHARGED
S1.013	S3-TANK	0.07		1762.283	11.6	SURCHARGED
S1.014	S2-FC	0.59		4.106	10.4	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S38	15 minute 30 year Winter I+0%	259.000	257.760	-0.040	0.000	0.88
S2.000	S37-FC (B)	15 minute 30 year Summer I+0%	261.250	258.871	-0.129	0.000	0.05
S1.001	S36	15 minute 30 year Winter I+0%	260.850	257.231	-0.169	0.000	0.38
S1.002	S35	15 minute 30 year Winter I+0%	260.500	257.080	-0.220	0.000	0.15
S3.000	S34-FC (A)	15 minute 30 year Winter I+0%	264.000	262.448	-0.102	0.000	0.23
S4.000	S33-FC (F)	15 minute 30 year Summer I+0%	262.300	260.738	-0.112	0.000	0.15
S3.001	S32	15 minute 30 year Winter I+0%	263.750	260.375	-0.225	0.000	0.14
S5.000	S31-FC (G)	15 minute 30 year Winter I+0%	258.500	256.971	-0.079	0.000	0.45
S3.002	S30	15 minute 30 year Winter I+0%	260.150	256.551	-0.149	0.000	0.50
S1.003	S29	15 minute 30 year Winter I+0%	259.400	256.362	-0.188	0.000	0.29
S6.000	S28-FC (C)	15 minute 30 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.004	S27	15 minute 30 year Winter I+0%	252.500	250.621	-0.179	0.000	0.34
S7.000	S-FS02	15 minute 30 year Winter I+0%	251.800	250.593	-0.207	0.000	0.21

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

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S38		0.119	15.7	OK
S2.000	S37-FC (B)		0.018	2.5	OK
S1.001	S36		0.145	26.3	OK
S1.002	S35		0.199	33.4	OK
S3.000	S34-FC (A)		0.049	9.9	OK
S4.000	S33-FC (F)		0.038	2.5	OK
S3.001	S32		0.080	40.4	OK
S5.000	S31-FC (G)		0.075	8.1	OK
S3.002	S30		0.203	48.3	OK
S1.003	S29		0.201	80.9	OK
S6.000	S28-FC (C)		0.027	2.5	OK
S1.004	S27		0.153	84.0	OK
S7.000	S-FS02		0.025	51.6	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.005	S26	15 minute 30 year Winter I+0%	251.350	249.608	-0.142	0.000
S8.000	S25-FC (H-N)	15 minute 30 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.006	S24	15 minute 30 year Winter I+0%	250.100	248.422	-0.328	0.000
S9.000	S23-FC (D-E)	15 minute 30 year Summer I+0%	247.000	245.030	-0.120	0.000
S1.007	S22	15 minute 30 year Winter I+0%	245.900	244.289	-0.261	0.000
S10.000	S-FS01	15 minute 30 year Winter I+0%	245.350	244.085	-0.165	0.000
S1.008	S21	15 minute 30 year Winter I+0%	245.600	243.845	-0.255	0.000
S1.009	S20	15 minute 30 year Winter I+0%	244.800	243.168	-0.232	0.000
S1.010	S19	15 minute 30 year Winter I+0%	244.400	242.476	-0.424	0.000
S1.011	S18	15 minute 30 year Winter I+0%	244.000	242.249	0.649	0.000
S11.000	S17	15 minute 30 year Winter I+0%	245.000	243.593	-0.207	0.000
S11.001	S16	15 minute 30 year Winter I+0%	245.000	243.300	-0.200	0.000
S11.002	S15	15 minute 30 year Winter I+0%	244.750	243.200	-0.200	0.000
S12.000	S14	15 minute 30 year Winter I+0%	244.550	243.124	-0.226	0.000
S11.003	S13-TANK	720 minute 30 year Winter I+0%	244.650	242.057	0.457	0.000
S11.004	S12-BS	720 minute 30 year Winter I+0%	244.400	242.057	0.607	0.000
S13.000	S11	15 minute 30 year Winter I+0%	245.250	243.972	-0.078	0.000
S14.000	S10	15 minute 30 year Winter I+0%	245.350	244.348	-0.102	0.000
S14.001	S9	15 minute 30 year Winter I+0%	245.350	243.787	-0.113	0.000
S13.001	S8	15 minute 30 year Winter I+0%	245.200	243.444	-0.156	0.000
S13.002	S7	15 minute 30 year Winter I+0%	244.500	242.098	-0.302	0.000
S11.005	S6-FC (P)	720 minute 30 year Winter I+0%	243.580	242.056	0.956	0.000
S1.012	S5-ORIFICE	1440 minute 30 year Winter I+0%	244.000	242.112	1.062	0.000
S1.013	S3-TANK	1440 minute 30 year Winter I+0%	243.000	242.073	1.223	0.000
S1.014	S2-FC	1440 minute 30 year Winter I+0%	243.000	242.080	1.580	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.005	S26	0.54		0.246	134.3	OK
S8.000	S25-FC (H-N)	0.11		0.031	2.5	OK
S1.006	S24	0.16		0.207	137.3	OK
S9.000	S23-FC (D-E)	0.09		0.028	2.5	OK
S1.007	S22	0.37		0.387	139.9	OK
S10.000	S-FS01	0.41		0.037	38.5	OK
S1.008	S21	0.39		0.452	182.9	OK
S1.009	S20	0.47		0.518	187.5	OK
S1.010	S19	0.19		0.306	195.9	OK
S1.011	S18	0.22		10.546	156.4	SURCHARGED
S11.000	S17	0.21		0.100	18.9	OK

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S11.001	S16	0.24		0.206	19.1	OK
S11.002	S15	0.24		0.181	54.7	OK
S12.000	S14	0.14		0.078	33.1	OK
S11.003	S13-TANK	0.04		267.330	2.5	SURCHARGED
S11.004	S12-BS	0.04		1.218	2.5	SURCHARGED
S13.000	S11	0.81		0.245	59.6	OK
S14.000	S10	0.70		0.055	57.2	OK
S14.001	S9	0.69		0.697	56.1	OK
S13.001	S8	0.46		0.981	115.2	OK
S13.002	S7	0.24		0.253	114.9	OK
S11.005	S6-FC (P)	0.18		6.643	2.5	SURCHARGED
S1.012	S5-ORIFICE	0.09		12.517	31.4	SURCHARGED
S1.013	S3-TANK	0.07		2010.612	11.6	SURCHARGED
S1.014	S2-FC	0.59		4.629	10.4	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S38	15 minute 100 year Winter I+30%	259.000	258.182	0.382	0.000	1.39
S2.000	S37-FC (B)	15 minute 100 year Summer I+30%	261.250	258.871	-0.129	0.000	0.05
S1.001	S36	15 minute 100 year Winter I+30%	260.850	257.268	-0.132	0.000	0.58
S1.002	S35	15 minute 100 year Winter I+30%	260.500	257.101	-0.199	0.000	0.24
S3.000	S34-FC (A)	15 minute 100 year Winter I+30%	264.000	262.461	-0.089	0.000	0.34
S4.000	S33-FC (F)	15 minute 100 year Summer I+30%	262.300	260.738	-0.112	0.000	0.15
S3.001	S32	15 minute 100 year Winter I+30%	263.750	260.397	-0.203	0.000	0.23
S5.000	S31-FC (G)	15 minute 100 year Winter I+30%	258.500	256.990	-0.060	0.000	0.65
S3.002	S30	15 minute 100 year Winter I+30%	260.150	256.602	-0.098	0.000	0.78
S1.003	S29	15 minute 100 year Winter I+30%	259.400	256.394	-0.156	0.000	0.45
S6.000	S28-FC (C)	15 minute 100 year Summer I+30%	253.000	251.029	-0.121	0.000	0.08
S1.004	S27	15 minute 100 year Winter I+30%	252.500	250.655	-0.145	0.000	0.52
S7.000	S-FS02	15 minute 100 year Winter I+30%	251.800	250.623	-0.177	0.000	0.35

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

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S38		0.596	24.9	SURCHARGED
S2.000	S37-FC (B)		0.018	2.5	OK
S1.001	S36		0.191	40.1	OK
S1.002	S35		0.255	51.5	OK
S3.000	S34-FC (A)		0.063	15.0	OK
S4.000	S33-FC (F)		0.038	2.5	OK
S3.001	S32		0.104	64.5	OK
S5.000	S31-FC (G)		0.096	11.8	OK
S3.002	S30		0.291	75.9	OK
S1.003	S29		0.318	126.2	OK
S6.000	S28-FC (C)		0.027	2.5	OK
S1.004	S27		0.210	129.5	OK
S7.000	S-FS02		0.033	86.7	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.005	S26	15 minute 100 year Winter I+30%	251.350	249.666	-0.084	0.000
S8.000	S25-FC (H-N)	15 minute 100 year Summer I+30%	250.600	249.132	-0.118	0.000
S1.006	S24	15 minute 100 year Winter I+30%	250.100	248.456	-0.294	0.000
S9.000	S23-FC (D-E)	15 minute 100 year Summer I+30%	247.000	245.030	-0.120	0.000
S1.007	S22	15 minute 100 year Winter I+30%	245.900	244.781	0.231	0.000
S10.000	S-FS01	15 minute 100 year Winter I+30%	245.350	244.718	0.468	0.000
S1.008	S21	15 minute 100 year Winter I+30%	245.600	244.583	0.483	0.000
S1.009	S20	15 minute 100 year Winter I+30%	244.800	244.318	0.918	0.000
S1.010	S19	15 minute 100 year Winter I+30%	244.400	244.085	1.185	0.000
S1.011	S18	15 minute 100 year Winter I+30%	244.000	243.730	2.130	0.000
S11.000	S17	15 minute 100 year Winter I+30%	245.000	243.624	-0.176	0.000
S11.001	S16	15 minute 100 year Winter I+30%	245.000	243.333	-0.167	0.000
S11.002	S15	15 minute 100 year Winter I+30%	244.750	243.233	-0.167	0.000
S12.000	S14	15 minute 100 year Winter I+30%	244.550	243.148	-0.202	0.000
S11.003	S13-TANK	1440 minute 100 year Winter I+30%	244.650	242.763	1.163	0.000
S11.004	S12-BS	1440 minute 100 year Winter I+30%	244.400	242.763	1.313	0.000
S13.000	S11	15 minute 100 year Winter I+30%	245.250	244.584	0.534	0.000
S14.000	S10	15 minute 100 year Winter I+30%	245.350	244.794	0.344	0.000
S14.001	S9	15 minute 100 year Winter I+30%	245.350	243.957	0.057	0.000
S13.001	S8	15 minute 100 year Winter I+30%	245.200	243.521	-0.079	0.000
S13.002	S7	15 minute 100 year Winter I+30%	244.500	242.916	0.516	0.000
S11.005	S6-FC (P)	1440 minute 100 year Winter I+30%	243.580	242.763	1.663	0.000
S1.012	S5-ORIFICE	15 minute 100 year Winter I+30%	244.000	243.482	2.432	0.000
S1.013	S3-TANK	1440 minute 100 year Winter I+30%	243.000	242.380	1.530	0.000
S1.014	S2-FC	1440 minute 100 year Winter I+30%	243.000	242.384	1.884	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.005	S26	0.85		0.374	214.0	OK
S8.000	S25-FC (H-N)	0.11		0.031	2.5	OK
S1.006	S24	0.26		0.267	217.1	OK
S9.000	S23-FC (D-E)	0.09		0.028	2.5	OK
S1.007	S22	0.58		2.251	219.9	SURCHARGED
S10.000	S-FS01	0.69		0.216	64.6	SURCHARGED
S1.008	S21	0.61		4.010	286.2	SURCHARGED
S1.009	S20	0.71		4.703	281.3	SURCHARGED
S1.010	S19	0.26		5.439	273.0	SURCHARGED
S1.011	S18	0.31		16.305	222.5	FLOOD RISK
S11.000	S17	0.35		0.134	31.7	OK

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S11.001	S16	0.41		0.370	32.1	OK
S11.002	S15	0.40		0.291	91.5	OK
S12.000	S14	0.23		0.105	55.6	OK
S11.003	S13-TANK	0.04		516.981	2.5	SURCHARGED
S11.004	S12-BS	0.04		2.016	2.5	SURCHARGED
S13.000	S11	1.35		0.937	99.9	SURCHARGED
S14.000	S10	1.17		0.181	95.3	SURCHARGED
S14.001	S9	1.10		2.551	88.8	SURCHARGED
S13.001	S8	0.73		2.243	180.1	OK
S13.002	S7	0.37		2.347	176.5	SURCHARGED
S11.005	S6-FC (P)	0.19		8.642	2.7	SURCHARGED
S1.012	S5-ORIFICE	0.61		14.938	212.3	SURCHARGED
S1.013	S3-TANK	0.07		2378.210	11.7	SURCHARGED
S1.014	S2-FC	0.60		5.403	10.5	SURCHARGED

APPENDIX I

Surface Water Attenuation – Outline Planning Storage Volume Calculations

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	262.978	0.378	2.5	39.7	O K
30 min Summer	263.109	0.509	2.5	53.4	O K
60 min Summer	263.248	0.648	2.5	68.0	O K
120 min Summer	263.371	0.771	2.5	81.0	O K
180 min Summer	263.419	0.819	2.5	86.0	O K
240 min Summer	263.433	0.833	2.5	87.5	O K
360 min Summer	263.435	0.835	2.5	87.7	O K
480 min Summer	263.426	0.826	2.5	86.7	O K
600 min Summer	263.412	0.812	2.5	85.3	O K
720 min Summer	263.396	0.796	2.5	83.6	O K
960 min Summer	263.360	0.760	2.5	79.8	O K
1440 min Summer	263.281	0.681	2.5	71.5	O K
2160 min Summer	263.139	0.539	2.5	56.6	O K
2880 min Summer	263.020	0.420	2.5	44.1	O K
4320 min Summer	262.857	0.257	2.5	27.0	O K
5760 min Summer	262.769	0.169	2.4	17.8	O K
7200 min Summer	262.722	0.122	2.2	12.8	O K
8640 min Summer	262.697	0.097	2.0	10.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	41.2	18
30 min Summer	76.210	0.0	56.5	33
60 min Summer	49.937	0.0	74.4	62
120 min Summer	31.554	0.0	94.0	122
180 min Summer	23.716	0.0	106.0	182
240 min Summer	19.196	0.0	114.4	240
360 min Summer	14.282	0.0	127.7	314
480 min Summer	11.554	0.0	137.8	380
600 min Summer	9.792	0.0	145.9	444
720 min Summer	8.549	0.0	152.9	512
960 min Summer	6.892	0.0	164.3	652
1440 min Summer	5.076	0.0	181.5	926
2160 min Summer	3.728	0.0	200.2	1316
2880 min Summer	2.991	0.0	214.1	1672
4320 min Summer	2.187	0.0	234.8	2376
5760 min Summer	1.753	0.0	251.1	3048
7200 min Summer	1.477	0.0	264.4	3744
8640 min Summer	1.284	0.0	275.9	4408

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
10080 min Summer	262.686	0.086	1.8	9.0	O K
15 min Winter	263.025	0.425	2.5	44.6	O K
30 min Winter	263.174	0.574	2.5	60.3	O K
60 min Winter	263.332	0.732	2.5	76.9	O K
120 min Winter	263.475	0.875	2.5	91.9	O K
180 min Winter	263.535	0.935	2.5	98.2	O K
240 min Winter	263.557	0.957	2.5	100.5	O K
360 min Winter	263.567	0.967	2.5	101.5	O K
480 min Winter	263.551	0.951	2.5	99.9	O K
600 min Winter	263.534	0.934	2.5	98.1	O K
720 min Winter	263.512	0.912	2.5	95.7	O K
960 min Winter	263.458	0.858	2.5	90.1	O K
1440 min Winter	263.338	0.738	2.5	77.5	O K
2160 min Winter	263.115	0.515	2.5	54.1	O K
2880 min Winter	262.943	0.343	2.5	36.0	O K
4320 min Winter	262.761	0.161	2.3	16.9	O K
5760 min Winter	262.697	0.097	2.0	10.2	O K
7200 min Winter	262.681	0.081	1.7	8.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	285.9	5136
15 min Winter	111.165	0.0	46.1	18
30 min Winter	76.210	0.0	63.3	33
60 min Winter	49.937	0.0	83.3	62
120 min Winter	31.554	0.0	105.3	120
180 min Winter	23.716	0.0	118.8	178
240 min Winter	19.196	0.0	128.2	234
360 min Winter	14.282	0.0	143.0	342
480 min Winter	11.554	0.0	154.3	396
600 min Winter	9.792	0.0	163.5	468
720 min Winter	8.549	0.0	171.3	546
960 min Winter	6.892	0.0	184.1	702
1440 min Winter	5.076	0.0	203.3	1010
2160 min Winter	3.728	0.0	224.3	1404
2880 min Winter	2.991	0.0	239.8	1732
4320 min Winter	2.187	0.0	263.0	2376
5760 min Winter	1.753	0.0	281.2	2944
7200 min Winter	1.477	0.0	296.2	3672

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
8640 min Winter	262.671	0.071	1.5	7.4	O K
10080 min Winter	262.664	0.064	1.3	6.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	309.0	4400
10080 min Winter	1.141	0.0	320.3	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.199

Time (mins) From:	To:	Area (ha)
0	4	0.199

Model Details

Storage is Online Cover Level (m) 264.600

Tank or Pond Structure

Invert Level (m) 262.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	105.0	1.000	105.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	262.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	259.717	0.367	2.5	42.2	O K
30 min Summer	259.845	0.495	2.5	56.9	O K
60 min Summer	259.980	0.630	2.5	72.5	O K
120 min Summer	260.104	0.754	2.5	86.7	O K
180 min Summer	260.155	0.805	2.5	92.5	O K
240 min Summer	260.172	0.822	2.5	94.5	O K
360 min Summer	260.178	0.828	2.5	95.2	O K
480 min Summer	260.171	0.821	2.5	94.4	O K
600 min Summer	260.159	0.809	2.5	93.1	O K
720 min Summer	260.145	0.795	2.5	91.4	O K
960 min Summer	260.113	0.763	2.5	87.7	O K
1440 min Summer	260.041	0.691	2.5	79.5	O K
2160 min Summer	259.912	0.562	2.5	64.6	O K
2880 min Summer	259.797	0.447	2.5	51.4	O K
4320 min Summer	259.633	0.283	2.5	32.5	O K
5760 min Summer	259.539	0.189	2.4	21.7	O K
7200 min Summer	259.486	0.136	2.2	15.6	O K
8640 min Summer	259.456	0.106	2.1	12.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	43.6	18
30 min Summer	76.210	0.0	59.9	33
60 min Summer	49.937	0.0	78.8	62
120 min Summer	31.554	0.0	99.7	122
180 min Summer	23.716	0.0	112.4	182
240 min Summer	19.196	0.0	121.3	240
360 min Summer	14.282	0.0	135.4	330
480 min Summer	11.554	0.0	146.0	388
600 min Summer	9.792	0.0	154.7	452
720 min Summer	8.549	0.0	162.1	520
960 min Summer	6.892	0.0	174.2	656
1440 min Summer	5.076	0.0	192.4	938
2160 min Summer	3.728	0.0	212.3	1324
2880 min Summer	2.991	0.0	227.0	1700
4320 min Summer	2.187	0.0	248.9	2380
5760 min Summer	1.753	0.0	266.2	3056
7200 min Summer	1.477	0.0	280.3	3744
8640 min Summer	1.284	0.0	292.5	4416

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
10080 min Summer	259.441	0.091	1.9	10.5	O K
15 min Winter	259.762	0.412	2.5	47.4	O K
30 min Winter	259.907	0.557	2.5	64.1	O K
60 min Winter	260.063	0.713	2.5	81.9	O K
120 min Winter	260.205	0.855	2.5	98.3	O K
180 min Winter	260.267	0.917	2.5	105.5	O K
240 min Winter	260.293	0.943	2.5	108.4	O K
360 min Winter	260.309	0.959	2.5	110.3	O K
480 min Winter	260.297	0.947	2.5	108.9	O K
600 min Winter	260.281	0.931	2.5	107.1	O K
720 min Winter	260.262	0.912	2.5	104.9	O K
960 min Winter	260.215	0.865	2.5	99.5	O K
1440 min Winter	260.107	0.757	2.5	87.1	O K
2160 min Winter	259.906	0.556	2.5	63.9	O K
2880 min Winter	259.733	0.383	2.5	44.0	O K
4320 min Winter	259.535	0.185	2.4	21.3	O K
5760 min Winter	259.458	0.108	2.1	12.4	O K
7200 min Winter	259.436	0.086	1.8	9.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	303.1	5144
15 min Winter	111.165	0.0	48.9	18
30 min Winter	76.210	0.0	67.1	33
60 min Winter	49.937	0.0	88.3	62
120 min Winter	31.554	0.0	111.6	120
180 min Winter	23.716	0.0	125.9	178
240 min Winter	19.196	0.0	135.9	234
360 min Winter	14.282	0.0	151.6	344
480 min Winter	11.554	0.0	163.6	442
600 min Winter	9.792	0.0	173.3	476
720 min Winter	8.549	0.0	181.5	552
960 min Winter	6.892	0.0	195.1	710
1440 min Winter	5.076	0.0	215.5	1022
2160 min Winter	3.728	0.0	237.8	1428
2880 min Winter	2.991	0.0	254.3	1784
4320 min Winter	2.187	0.0	278.8	2420
5760 min Winter	1.753	0.0	298.1	3048
7200 min Winter	1.477	0.0	314.0	3680

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
8640 min Winter	259.424	0.074	1.6	8.6	O K
10080 min Winter	259.417	0.067	1.4	7.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	327.6	4408
10080 min Winter	1.141	0.0	339.6	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.211

Time (mins) From:	To:	Area (ha)
0	4	0.211

Model Details

Storage is Online Cover Level (m) 262.250

Tank or Pond Structure

Invert Level (m) 259.350

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	115.0	1.000	115.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	259.350
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	251.222	0.272	2.5	115.4	O K
30 min Summer	251.320	0.370	2.5	157.3	O K
60 min Summer	251.430	0.480	2.5	203.9	O K
120 min Summer	251.545	0.595	2.5	253.0	O K
180 min Summer	251.611	0.661	2.5	280.7	O K
240 min Summer	251.651	0.701	2.5	298.0	O K
360 min Summer	251.708	0.758	2.5	322.1	O K
480 min Summer	251.742	0.792	2.5	336.7	O K
600 min Summer	251.764	0.814	2.5	345.9	O K
720 min Summer	251.777	0.827	2.5	351.6	O K
960 min Summer	251.788	0.838	2.5	356.2	O K
1440 min Summer	251.780	0.830	2.5	352.8	O K
2160 min Summer	251.755	0.805	2.5	342.3	O K
2880 min Summer	251.726	0.776	2.5	329.6	O K
4320 min Summer	251.661	0.711	2.5	302.2	O K
5760 min Summer	251.595	0.645	2.5	274.1	O K
7200 min Summer	251.519	0.569	2.5	241.7	O K
8640 min Summer	251.452	0.502	2.5	213.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	110.2	19
30 min Summer	76.210	0.0	150.6	34
60 min Summer	49.937	0.0	206.8	64
120 min Summer	31.554	0.0	261.1	124
180 min Summer	23.716	0.0	293.6	184
240 min Summer	19.196	0.0	315.9	242
360 min Summer	14.282	0.0	349.2	362
480 min Summer	11.554	0.0	370.0	482
600 min Summer	9.792	0.0	379.3	602
720 min Summer	8.549	0.0	379.5	722
960 min Summer	6.892	0.0	373.5	960
1440 min Summer	5.076	0.0	356.9	1254
2160 min Summer	3.728	0.0	561.7	1640
2880 min Summer	2.991	0.0	599.2	2044
4320 min Summer	2.187	0.0	641.0	2892
5760 min Summer	1.753	0.0	708.0	3696
7200 min Summer	1.477	0.0	745.6	4472
8640 min Summer	1.284	0.0	777.5	5192

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
10080 min Summer	251.393	0.443	2.5	188.2	O K
15 min Winter	251.254	0.304	2.5	129.4	O K
30 min Winter	251.365	0.415	2.5	176.5	O K
60 min Winter	251.489	0.539	2.5	229.0	O K
120 min Winter	251.621	0.671	2.5	285.1	O K
180 min Winter	251.694	0.744	2.5	316.4	O K
240 min Winter	251.741	0.791	2.5	336.2	O K
360 min Winter	251.807	0.857	2.5	364.2	O K
480 min Winter	251.848	0.898	2.5	381.7	O K
600 min Winter	251.876	0.926	2.5	393.4	O K
720 min Winter	251.894	0.944	2.5	401.1	O K
960 min Winter	251.913	0.963	2.5	409.1	O K
1440 min Winter	251.911	0.961	2.5	408.6	O K
2160 min Winter	251.877	0.927	2.5	393.9	O K
2880 min Winter	251.837	0.887	2.5	377.1	O K
4320 min Winter	251.744	0.794	2.5	337.6	O K
5760 min Winter	251.647	0.697	2.5	296.1	O K
7200 min Winter	251.529	0.579	2.5	246.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	804.8	5952
15 min Winter	111.165	0.0	123.5	19
30 min Winter	76.210	0.0	167.4	33
60 min Winter	49.937	0.0	231.6	62
120 min Winter	31.554	0.0	291.8	122
180 min Winter	23.716	0.0	327.3	180
240 min Winter	19.196	0.0	350.8	240
360 min Winter	14.282	0.0	380.5	356
480 min Winter	11.554	0.0	387.3	472
600 min Winter	9.792	0.0	386.1	588
720 min Winter	8.549	0.0	383.2	702
960 min Winter	6.892	0.0	376.6	930
1440 min Winter	5.076	0.0	364.0	1358
2160 min Winter	3.728	0.0	628.3	1712
2880 min Winter	2.991	0.0	668.7	2188
4320 min Winter	2.187	0.0	676.3	3112
5760 min Winter	1.753	0.0	793.0	4032
7200 min Winter	1.477	0.0	835.1	4832

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
8640 min Winter	251.422	0.472	2.5	200.6	O K
10080 min Winter	251.335	0.385	2.5	163.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	871.1	5536
10080 min Winter	1.141	0.0	902.0	6248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.562

Time (mins) From:	To:	Area (ha)
0	4	0.562

Model Details

Storage is Online Cover Level (m) 253.000

Tank or Pond Structure

Invert Level (m) 250.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	425.0	1.000	425.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	250.950
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	245.273	0.273	2.5	102.5	O K
30 min Summer	245.372	0.372	2.5	139.6	O K
60 min Summer	245.482	0.482	2.5	180.6	O K
120 min Summer	245.596	0.596	2.5	223.6	O K
180 min Summer	245.660	0.660	2.5	247.7	O K
240 min Summer	245.700	0.700	2.5	262.4	O K
360 min Summer	245.753	0.753	2.5	282.3	O K
480 min Summer	245.784	0.784	2.5	293.8	O K
600 min Summer	245.802	0.802	2.5	300.6	O K
720 min Summer	245.812	0.812	2.5	304.3	O K
960 min Summer	245.816	0.816	2.5	305.9	O K
1440 min Summer	245.803	0.803	2.5	300.9	O K
2160 min Summer	245.772	0.772	2.5	289.6	O K
2880 min Summer	245.738	0.738	2.5	276.6	O K
4320 min Summer	245.663	0.663	2.5	248.5	O K
5760 min Summer	245.577	0.577	2.5	216.5	O K
7200 min Summer	245.500	0.500	2.5	187.6	O K
8640 min Summer	245.433	0.433	2.5	162.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	99.1	19
30 min Summer	76.210	0.0	136.0	34
60 min Summer	49.937	0.0	184.6	64
120 min Summer	31.554	0.0	233.3	124
180 min Summer	23.716	0.0	262.7	182
240 min Summer	19.196	0.0	283.2	242
360 min Summer	14.282	0.0	314.9	362
480 min Summer	11.554	0.0	337.8	482
600 min Summer	9.792	0.0	355.0	602
720 min Summer	8.549	0.0	366.9	720
960 min Summer	6.892	0.0	372.8	960
1440 min Summer	5.076	0.0	358.4	1196
2160 min Summer	3.728	0.0	500.8	1580
2880 min Summer	2.991	0.0	535.0	1988
4320 min Summer	2.187	0.0	583.4	2848
5760 min Summer	1.753	0.0	630.1	3624
7200 min Summer	1.477	0.0	663.5	4328
8640 min Summer	1.284	0.0	692.0	5096

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
10080 min Summer	245.375	0.375	2.5	140.5	O K
15 min Winter	245.306	0.306	2.5	114.9	O K
30 min Winter	245.418	0.418	2.5	156.6	O K
60 min Winter	245.541	0.541	2.5	203.0	O K
120 min Winter	245.673	0.673	2.5	252.2	O K
180 min Winter	245.745	0.745	2.5	279.3	O K
240 min Winter	245.790	0.790	2.5	296.2	O K
360 min Winter	245.852	0.852	2.5	319.6	O K
480 min Winter	245.890	0.890	2.5	333.8	O K
600 min Winter	245.914	0.914	2.5	342.7	O K
720 min Winter	245.929	0.929	2.5	348.2	O K
960 min Winter	245.940	0.940	2.5	352.7	O K
1440 min Winter	245.927	0.927	2.5	347.7	O K
2160 min Winter	245.887	0.887	2.5	332.6	O K
2880 min Winter	245.839	0.839	2.5	314.5	O K
4320 min Winter	245.730	0.730	2.5	273.7	O K
5760 min Winter	245.603	0.603	2.5	226.3	O K
7200 min Winter	245.477	0.477	2.5	179.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	716.3	5760
15 min Winter	111.165	0.0	111.2	19
30 min Winter	76.210	0.0	151.8	33
60 min Winter	49.937	0.0	206.8	62
120 min Winter	31.554	0.0	261.1	122
180 min Winter	23.716	0.0	293.7	180
240 min Winter	19.196	0.0	316.2	240
360 min Winter	14.282	0.0	350.1	356
480 min Winter	11.554	0.0	372.0	472
600 min Winter	9.792	0.0	382.6	586
720 min Winter	8.549	0.0	383.6	700
960 min Winter	6.892	0.0	378.8	924
1440 min Winter	5.076	0.0	364.2	1340
2160 min Winter	3.728	0.0	560.7	1668
2880 min Winter	2.991	0.0	598.6	2136
4320 min Winter	2.187	0.0	647.0	3068
5760 min Winter	1.753	0.0	705.8	3928
7200 min Winter	1.477	0.0	743.3	4616

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
8640 min Winter	245.378	0.378	2.5	141.8	O K
10080 min Winter	245.298	0.298	2.5	111.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	775.2	5360
10080 min Winter	1.141	0.0	802.8	6048

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.500

Time (mins) From:	To:	Area (ha)
0	4	0.500

Model Details

Storage is Online Cover Level (m) 247.000

Tank or Pond Structure

Invert Level (m) 245.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	375.0	1.000	375.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	245.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	261.026	0.276	2.5	124.2	O K
30 min Summer	261.126	0.376	2.5	169.3	O K
60 min Summer	261.238	0.488	2.5	219.6	O K
120 min Summer	261.356	0.606	2.5	272.9	O K
180 min Summer	261.424	0.674	2.5	303.1	O K
240 min Summer	261.466	0.716	2.5	322.1	O K
360 min Summer	261.525	0.775	2.5	348.8	O K
480 min Summer	261.562	0.812	2.5	365.3	O K
600 min Summer	261.586	0.836	2.5	376.1	O K
720 min Summer	261.601	0.851	2.5	383.1	O K
960 min Summer	261.616	0.866	2.5	389.7	O K
1440 min Summer	261.612	0.862	2.5	387.8	O K
2160 min Summer	261.590	0.840	2.5	377.8	O K
2880 min Summer	261.562	0.812	2.5	365.3	O K
4320 min Summer	261.502	0.752	2.5	338.3	O K
5760 min Summer	261.442	0.692	2.5	311.3	O K
7200 min Summer	261.378	0.628	2.5	282.5	O K
8640 min Summer	261.306	0.556	2.5	250.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	117.8	19
30 min Summer	76.210	0.0	160.2	34
60 min Summer	49.937	0.0	221.9	64
120 min Summer	31.554	0.0	279.8	124
180 min Summer	23.716	0.0	314.1	184
240 min Summer	19.196	0.0	337.2	242
360 min Summer	14.282	0.0	369.1	362
480 min Summer	11.554	0.0	382.5	482
600 min Summer	9.792	0.0	382.9	602
720 min Summer	8.549	0.0	380.3	722
960 min Summer	6.892	0.0	372.8	960
1440 min Summer	5.076	0.0	357.1	1312
2160 min Summer	3.728	0.0	602.6	1668
2880 min Summer	2.991	0.0	641.6	2072
4320 min Summer	2.187	0.0	655.9	2900
5760 min Summer	1.753	0.0	760.7	3744
7200 min Summer	1.477	0.0	801.1	4608
8640 min Summer	1.284	0.0	835.5	5280

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
10080 min Summer	261.245	0.495	2.5	222.8	O K
15 min Winter	261.059	0.309	2.5	139.2	O K
30 min Winter	261.172	0.422	2.5	189.9	O K
60 min Winter	261.298	0.548	2.5	246.6	O K
120 min Winter	261.433	0.683	2.5	307.3	O K
180 min Winter	261.509	0.759	2.5	341.4	O K
240 min Winter	261.557	0.807	2.5	363.1	O K
360 min Winter	261.626	0.876	2.5	394.1	O K
480 min Winter	261.670	0.920	2.5	413.9	O K
600 min Winter	261.700	0.950	2.5	427.3	O K
720 min Winter	261.720	0.970	2.5	436.5	O K
960 min Winter	261.743	0.993	2.5	446.8	O K
1440 min Winter	261.748	0.998	2.5	449.3	O K
2160 min Winter	261.717	0.967	2.5	435.1	O K
2880 min Winter	261.682	0.932	2.5	419.2	O K
4320 min Winter	261.595	0.845	2.5	380.5	O K
5760 min Winter	261.506	0.756	2.5	340.2	O K
7200 min Winter	261.412	0.662	2.5	297.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	864.8	6048
15 min Winter	111.165	0.0	131.9	19
30 min Winter	76.210	0.0	177.4	33
60 min Winter	49.937	0.0	248.4	64
120 min Winter	31.554	0.0	312.3	122
180 min Winter	23.716	0.0	348.8	180
240 min Winter	19.196	0.0	371.2	240
360 min Winter	14.282	0.0	388.9	358
480 min Winter	11.554	0.0	388.4	474
600 min Winter	9.792	0.0	385.6	590
720 min Winter	8.549	0.0	382.4	704
960 min Winter	6.892	0.0	376.4	932
1440 min Winter	5.076	0.0	366.6	1370
2160 min Winter	3.728	0.0	673.0	1752
2880 min Winter	2.991	0.0	711.6	2192
4320 min Winter	2.187	0.0	682.9	3152
5760 min Winter	1.753	0.0	852.0	4040
7200 min Winter	1.477	0.0	897.2	4968

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
8640 min Winter	261.296	0.546	2.5	245.6	O K
10080 min Winter	261.202	0.452	2.5	203.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	936.0	5704
10080 min Winter	1.141	0.0	969.2	6360

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.604

Time (mins) From:	To:	Area (ha)
0	4	0.604

Model Details

Storage is Online Cover Level (m) 262.750

Tank or Pond Structure

Invert Level (m) 260.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	450.0	1.000	450.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	260.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	257.757	0.257	2.5	128.4	O K
30 min Summer	257.850	0.350	2.5	175.0	O K
60 min Summer	257.954	0.454	2.5	227.1	O K
120 min Summer	258.065	0.565	2.5	282.3	O K
180 min Summer	258.127	0.627	2.5	313.7	O K
240 min Summer	258.168	0.668	2.5	333.9	O K
360 min Summer	258.225	0.725	2.5	362.4	O K
480 min Summer	258.261	0.761	2.5	380.4	O K
600 min Summer	258.285	0.785	2.5	392.3	O K
720 min Summer	258.301	0.801	2.5	400.3	O K
960 min Summer	258.317	0.817	2.5	408.7	O K
1440 min Summer	258.317	0.817	2.5	408.7	O K
2160 min Summer	258.298	0.798	2.5	399.1	O K
2880 min Summer	258.273	0.773	2.5	386.7	O K
4320 min Summer	258.219	0.719	2.5	359.4	O K
5760 min Summer	258.163	0.663	2.5	331.4	O K
7200 min Summer	258.100	0.600	2.5	299.9	O K
8640 min Summer	258.038	0.538	2.5	269.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	120.1	19
30 min Summer	76.210	0.0	163.0	34
60 min Summer	49.937	0.0	228.3	64
120 min Summer	31.554	0.0	287.8	124
180 min Summer	23.716	0.0	322.7	184
240 min Summer	19.196	0.0	345.7	242
360 min Summer	14.282	0.0	375.4	362
480 min Summer	11.554	0.0	383.7	482
600 min Summer	9.792	0.0	381.9	602
720 min Summer	8.549	0.0	378.3	722
960 min Summer	6.892	0.0	369.7	960
1440 min Summer	5.076	0.0	352.9	1370
2160 min Summer	3.728	0.0	620.7	1712
2880 min Summer	2.991	0.0	659.0	2104
4320 min Summer	2.187	0.0	654.9	2940
5760 min Summer	1.753	0.0	785.6	3800
7200 min Summer	1.477	0.0	827.3	4544
8640 min Summer	1.284	0.0	862.7	5280

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
10080 min Summer	257.984	0.484	2.5	242.0	O K
15 min Winter	257.788	0.288	2.5	143.9	O K
30 min Winter	257.893	0.393	2.5	196.3	O K
60 min Winter	258.010	0.510	2.5	255.0	O K
120 min Winter	258.136	0.636	2.5	317.9	O K
180 min Winter	258.207	0.707	2.5	353.6	O K
240 min Winter	258.253	0.753	2.5	376.5	O K
360 min Winter	258.319	0.819	2.5	409.3	O K
480 min Winter	258.361	0.861	2.5	430.6	O K
600 min Winter	258.390	0.890	2.5	445.2	O K
720 min Winter	258.411	0.911	2.5	455.5	O K
960 min Winter	258.435	0.935	2.5	467.6	O K
1440 min Winter	258.445	0.945	2.5	472.7	O K
2160 min Winter	258.419	0.919	2.5	459.4	O K
2880 min Winter	258.388	0.888	2.5	444.0	O K
4320 min Winter	258.312	0.812	2.5	405.8	O K
5760 min Winter	258.230	0.730	2.5	365.0	O K
7200 min Winter	258.142	0.642	2.5	320.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	892.7	6056
15 min Winter	111.165	0.0	134.5	19
30 min Winter	76.210	0.0	180.0	33
60 min Winter	49.937	0.0	255.5	64
120 min Winter	31.554	0.0	320.8	122
180 min Winter	23.716	0.0	357.2	180
240 min Winter	19.196	0.0	377.6	240
360 min Winter	14.282	0.0	388.6	358
480 min Winter	11.554	0.0	386.3	474
600 min Winter	9.792	0.0	382.4	590
720 min Winter	8.549	0.0	378.5	706
960 min Winter	6.892	0.0	371.6	934
1440 min Winter	5.076	0.0	361.0	1372
2160 min Winter	3.728	0.0	691.6	1944
2880 min Winter	2.991	0.0	722.9	2220
4320 min Winter	2.187	0.0	678.1	3156
5760 min Winter	1.753	0.0	879.9	4096
7200 min Winter	1.477	0.0	926.5	5040

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
8640 min Winter	258.037	0.537	2.5	268.7	O K
10080 min Winter	257.952	0.452	2.5	226.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	966.4	5712
10080 min Winter	1.141	0.0	1000.6	6448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.624

Time (mins) From:	To:	Area (ha)
0	4	0.624

Model Details

Storage is Online Cover Level (m) 259.500

Tank or Pond Structure

Invert Level (m) 257.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	1.000	500.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	257.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	247.740	0.240	2.5	192.0	O K
30 min Summer	247.828	0.328	2.5	262.4	O K
60 min Summer	247.927	0.427	2.5	341.8	O K
120 min Summer	248.034	0.534	2.5	427.3	O K
180 min Summer	248.096	0.596	2.5	477.2	O K
240 min Summer	248.138	0.638	2.5	510.5	O K
360 min Summer	248.200	0.700	2.5	559.9	O K
480 min Summer	248.242	0.742	2.5	593.5	O K
600 min Summer	248.273	0.773	2.5	618.1	O K
720 min Summer	248.296	0.796	2.5	636.8	O K
960 min Summer	248.328	0.828	2.5	662.5	O K
1440 min Summer	248.358	0.858	2.5	686.8	O K
2160 min Summer	248.362	0.862	2.5	689.8	O K
2880 min Summer	248.350	0.850	2.5	679.9	O K
4320 min Summer	248.318	0.818	2.5	654.6	O K
5760 min Summer	248.286	0.786	2.5	628.4	O K
7200 min Summer	248.253	0.753	2.5	602.2	O K
8640 min Summer	248.220	0.720	2.5	575.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	162.0	23
30 min Summer	76.210	0.0	200.4	38
60 min Summer	49.937	0.0	327.3	68
120 min Summer	31.554	0.0	394.2	126
180 min Summer	23.716	0.0	405.6	186
240 min Summer	19.196	0.0	400.5	246
360 min Summer	14.282	0.0	387.4	366
480 min Summer	11.554	0.0	377.7	486
600 min Summer	9.792	0.0	370.5	604
720 min Summer	8.549	0.0	365.0	724
960 min Summer	6.892	0.0	357.2	964
1440 min Summer	5.076	0.0	351.2	1442
2160 min Summer	3.728	0.0	743.0	2144
2880 min Summer	2.991	0.0	717.9	2476
4320 min Summer	2.187	0.0	665.9	3240
5760 min Summer	1.753	0.0	1165.4	4040
7200 min Summer	1.477	0.0	1222.4	4896
8640 min Summer	1.284	0.0	1260.3	5712

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
10080 min Summer	248.186	0.686	2.5	549.0	O K
15 min Winter	247.769	0.269	2.5	215.2	O K
30 min Winter	247.868	0.368	2.5	294.3	O K
60 min Winter	247.979	0.479	2.5	383.6	O K
120 min Winter	248.100	0.600	2.5	480.3	O K
180 min Winter	248.171	0.671	2.5	537.1	O K
240 min Winter	248.218	0.718	2.5	574.6	O K
360 min Winter	248.288	0.788	2.5	630.6	O K
480 min Winter	248.337	0.837	2.5	669.3	O K
600 min Winter	248.373	0.873	2.5	698.1	O K
720 min Winter	248.400	0.900	2.5	720.3	O K
960 min Winter	248.440	0.940	2.5	751.6	O K
1440 min Winter	248.480	0.980	2.5	784.3	O K
2160 min Winter	248.495	0.995	2.5	796.3	O K
2880 min Winter	248.484	0.984	2.5	787.3	O K
4320 min Winter	248.441	0.941	2.5	753.1	O K
5760 min Winter	248.397	0.897	2.5	718.0	O K
7200 min Winter	248.350	0.850	2.5	679.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	1243.6	6552
15 min Winter	111.165	0.0	178.0	23
30 min Winter	76.210	0.0	206.9	37
60 min Winter	49.937	0.0	362.1	66
120 min Winter	31.554	0.0	407.0	126
180 min Winter	23.716	0.0	398.8	184
240 min Winter	19.196	0.0	390.7	244
360 min Winter	14.282	0.0	379.1	360
480 min Winter	11.554	0.0	372.4	478
600 min Winter	9.792	0.0	368.5	596
720 min Winter	8.549	0.0	366.5	712
960 min Winter	6.892	0.0	367.4	946
1440 min Winter	5.076	0.0	371.0	1402
2160 min Winter	3.728	0.0	751.9	2076
2880 min Winter	2.991	0.0	733.0	2708
4320 min Winter	2.187	0.0	703.3	3380
5760 min Winter	1.753	0.0	1302.2	4328
7200 min Winter	1.477	0.0	1358.3	5264

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
8640 min Winter	248.301	0.801	2.5	640.5	O K
10080 min Winter	248.251	0.751	2.5	600.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	1351.1	6216
10080 min Winter	1.141	0.0	1287.7	7064

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.931

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.431

Model Details

Storage is Online Cover Level (m) 249.500

Tank or Pond Structure

Invert Level (m) 247.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	1.000	800.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	247.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

APPENDIX J

Preliminary Drainage Layout

N

KEY

- EXISTING WATERCOURSE
- EXISTING COMBINED WATER SEWER
- EXISTING FOUL WATER SEWER
- EXISTING SURFACE WATER SEWER
- EXISTING COMBINED/FOUL WATER MANHOLE
- EXISTING SURFACE WATER MANHOLE
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER MANHOLE
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FILTER STRIP
- PROPOSED PRE-CAST CONCRETE STORAGE TANK
- PROPOSED PERMEABLE PAVING (FOR WATER QUALITY PURPOSES ONLY)
- PROPOSED BY-PASS SEPARATOR
- EXISTING GROUND LEVEL
- DETAILED PLANNING SITE BOUNDARY
- OUTLINE PLANNING SITE BOUNDARY
- PROPOSED RETAINING WALL
- EXCEEDANCE FLOW ROUTE
- PROPOSED LAND DRAIN

CONCRETE STORAGE TANK (D-E)
375.0 m³ x 1.0 m = 375.0 m³

CONCRETE STORAGE TANK (C)
425.0 m³ x 1.0 m = 425.0 m³

CONCRETE STORAGE TANK (B)
115.0 m³ x 1.0 m = 115.0 m³

CONCRETE STORAGE TANK (A)
105.0 m³ x 1.0 m = 105.0 m³

CONCRETE STORAGE TANK (F)
450.0 m³ x 1.0 m = 450.0 m³

CONCRETE STORAGE TANK (G)
500.0 m³ x 1.0 m = 500.0 m³

CONCRETE STORAGE TANK (H)
800.0 m³ x 1.0 m = 800.0 m³

EXISTING ON SITE LAND DRAINAGE NOTED DURING SURVEY BY HUDDLESTON & ASSOCIATES (REF: PHASE 2 GEO-ENVIRONMENTAL REPORT, E2/17769/R002, FEB 2022) TO BE GRUBBED UP

APPROXIMATE LOCATION OF AN EXISTING STONE CULVERT AS REPORTED BY HAIGH HUDDLESTON & ASSOCIATES (REF: TP10, PHASE 2 GEO-ENVIRONMENTAL REPORT, E2/17769/R002, FEB 2022) GL=240.80 IL=240.20 (0.6 m DEEP)

ASSUMED ROUTE OF CULVERTED WATERCOURSE

EXISTING STONE CULVERT UNDERSTOOD TO CONNECT TO WATERCOURSE TO THE EAST

OFF-LINE CONCRETE STORAGE TANK
1,200.0 m³ x 2.0 m = 2,400.0 m³
CL = 243.50-243.00
SL = 242.40 (MIN. 0.6 m COVER)
IL = 240.40
1:1 AEP WATER LEVEL = 241.818 m AOD
1:2 AEP WATER LEVEL = 241.867 m AOD
1:30 AEP WATER LEVEL = 242.073 m AOD
1:100 +30%CC AEP WATER LEVEL = 242.380 m AOD

OFF-LINE CONCRETE STORAGE TANK
350.0 m³ x 1.5 m = 525.0 m³
CL = 245.00-244.65
SL = 242.80 (2.20-1.85 m COVER)
IL = 241.30
1:1 AEP WATER LEVEL = 241.754 m AOD
1:2 AEP WATER LEVEL = 241.804 m AOD
1:30 AEP WATER LEVEL = 242.057 m AOD
1:100 +30%CC AEP WATER LEVEL = 242.763 m AOD

OVERLAND FLOWS TO THE NORTH OF THE PERSIMMON RESIDENTIAL DEVELOPMENT TO FOLLOW EXISTING TOPOGRAPHY

POST-DEVELOPMENT RUNOFF FROM AREAS FALLING IN A SOUTHERLY DIRECTION WILL BE LESS THAN PRE-DEVELOPMENT RUNOFF

PROPOSED LAND DRAIN TO ENSURE OVERLAND FLOWS ARE DIRECTED AWAY FROM BUILT DEVELOPMENT TO THE SOUTH

Ex.MH 1101 CL=TBC IL=2.74m DEEP
Ex.MH 1116 CL=TBC IL=1.00m DEEP
Ex.MH CL=TBC IL=1.37m DEEP
Ex.MH 2101 CL=TBC IL=1.37m DEEP
Ex.MH 3102 CL=TBC IL=1.87m DEEP
Ex.MH 0119 CL=TBC IL=1.83m DEEP
Ex.MH 0107 CL=TBC IL=2.05m DEEP
Ex.MH 1107 CL=TBC IL=1.53m DEEP
Ex.MH 1111 CL=TBC IL=1.54m DEEP
Ex.MH 1108 CL=TBC IL=1.99m DEEP
Ex.MH 1112 CL=TBC IL=1.79m DEEP
Ex.MH 1109 CL=TBC IL=12.43m DEEP
Ex.MH 1113 CL=TBC IL=2.14m DEEP
Ex.MH 1110 CL=TBC IL=1.76m DEEP
Ex.MH 1114 CL=TBC IL=1.97m DEEP
Ex.MH 2102 CL=TBC IL=2.30m DEEP
Ex.MH 2103 CL=230.00 (TBC) IL=227.80 (TBC) (2.20m DEEP)
Ex.OUTFALL 2104 IL=TBC
Ex.MH 2001 CL=TBC IL=2.16m DEEP
Ex.MH 1002 CL=TBC IL=2.13m DEEP
Ex.MH 1001 CL=236.41 IL=234.58
Ex.MH 1003 CL=TBC IL=1.98m DEEP
Ex.MH 1906 CL=TBC IL=2.33m DEEP
Ex.MH 1907 CL=TBC IL=1.65m DEEP
Ex.MH 0901 CL=TBC IL=1.50m DEEP
Ex.MH 1903 CL=TBC IL=1.85m DEEP
Ex.MH 2803 CL=TBC IL=1.87m DEEP

PUBLIC 300Ø
PUBLIC 1500
PUBLIC 2250

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM MARTIN WALSH ARCHITECTURAL'S 'PROPOSED SITE APPLICATION PLAN' (REF: 6194 LMSH - MWA - ZZ - XX - DR - A - 004 P1, DEC 2021).
3. EXISTING LEVEL INFORMATION TAKEN FROM MARTIN WALSH ARCHITECTURAL'S 'EXISTING SITE SURVEY' DRAWING (REF: 6194 SHLM - MWA - 01 - GF - DR - A - 001 P1, APR 2020).
4. EXISTING DRAINAGE INFORMATION TAKEN FROM YORKSHIRE WATER SEWER RECORDS (FEB 2022).
5. PROPOSED DRAINAGE LEVELS BASED ON MELIA SMITH & JONES 'RETAINING WALL LAYOUT' (REF: 222043-MSJ-ZZ-XX-DR-C-3000 P2, APRIL 2022).

REV	DATE	DESCRIPTION	DRAWN	CHECK
P4	04.04.23	SURFACE WATER DRAINAGE UPDATED TO SUIT LLFA COMMENTS	TB	DH
P3	12.01.23	SURFACE WATER DRAINAGE UPDATED TO SUIT LLFA COMMENTS	TB	DH
P2	25.04.22	DRAINAGE LEVELS UPDATED TO SUIT PROPOSED LEVEL INFORMATION	TB	JR
P1	03.03.22	INITIAL ISSUE	TB	JR

Weetwood
Development • Planning • Environment
Suite C22 Josephs Wells
Hanover Walk, Leeds
LS3 1AB
Tel 0113 244 1377
info@weetwood.net
www.weetwood.net

Client
2SH DEVELOPMENTS

Drawing Status: PRELIMINARY	Date: MAR 2022
	Scale (A0): 1:500
Project: LINDLEY MOOR ROAD, LINDLEY, HUDDERSFIELD	Drawn: TB
	Checked: JR
	Project No: 5474
Title: PROPOSED DRAINAGE LAYOUT	Drawing No: 104
	Revision: P4

APPENDIX K

Contributing Areas Plan

N

CONTRIBUTING AREA KEY

- S1.000 (0.053 ha)
- S2.000 (0.000 ha + 2.5 l/s)
- S1.001 (0.028 ha)
- S1.002 (0.024 ha)
- S3.000 (0.025 ha + 2.5 l/s)
- S4.000 (0.000 ha + 2.5 l/s)
- S3.001 (0.088 ha)
- S5.000 (0.019 ha + 2.5 l/s)
- S6.000 (0.000 ha + 2.5 l/s)
- S7.000 (0.173 ha)
- S8.000 (0.000 ha + 2.5 l/s)
- S9.000 (0.000 ha + 2.5 l/s)
- S10.000 (0.129 ha)
- S1.008 (0.021 ha)
- S1.009 (0.017 ha)
- S1.010 (0.032 ha)
- S1.011 (0.027 ha)
- S11.000 (0.065 ha)
- S11.002 (0.115 ha)
- S12.000 (0.111 ha)
- S13.000 (0.220 ha)
- S14.000 (0.208 ha)
- OUTLINE PLANNING
- DETAILED PLANNING SITE BOUNDARY
- OUTLINE PLANNING SITE BOUNDARY

PROPOSED IMPERMEABLE AREA
A = 0.221 ha
A = 0.221 x 0.9 (90%) = 0.199 ha

PROPOSED IMPERMEABLE AREA
B = 0.234 ha
B = 0.234 x 0.9 (90%) = 0.211 ha

PROPOSED IMPERMEABLE AREA
C = 0.624 ha
C = 0.624 x 0.9 (90%) = 0.562 ha

PROPOSED IMPERMEABLE AREA
D-E = 0.556 ha
D-E = 0.556 x 0.9 (90%) = 0.500 ha

PROPOSED IMPERMEABLE AREA
F = 0.671 ha
F = 0.671 x 0.9 (90%) = 0.604 ha

PROPOSED IMPERMEABLE AREA
G = 0.693 ha
G = 0.693 x 0.9 (90%) = 0.624 ha

PROPOSED IMPERMEABLE AREA
H-N = 1.034 ha
H-N = 1.034 x 0.9 (90%) = 0.931 ha

LINDLEY MOOR ROAD

WEATHERILL ROAD

Crossley Wood

New Development Under Construction

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM MARTIN WALSH ARCHITECTURAL'S 'PROPOSED SITE APPLICATION PLAN' (REF: 6194 LMSH - MWA - ZZ - XX - DR - A - 004 P1, DEC 2021).

REV	DATE	DESCRIPTION	DRAWN	CHECK
P1	04.04.23	INITIAL ISSUE	TB	DH

Weetwood
Development • Planning • Environment

Suite C22 Josephs Wells
Hanover Walk, Leeds
LS3 1AB
Tel 0113 244 1377
info@weetwood.net
www.weetwood.net

Client
2SH DEVELOPMENTS

Drawing Status
PRELIMINARY

Project
LINDLEY MOOR ROAD
LINDLEY
HUDDERSFIELD

Title
CONTRIBUTING AREAS PLAN

Date: APR 2023
Scale (A0): 1:500
Drawn: TB
Checked: DH
Project No: 5474
Drawing No: 110
Revision: P1

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