



**WALKER INGRAM
ASSOCIATES**
CONSULTING ENGINEERS

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

SOUTH of LEE LANE, ROYSTON

On Behalf of

JOHNSON MOWAT

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QUALITY MANAGEMENT

ISSUE/REVISION	Revision v1.0	Revision v1.1	Revision v1.2	Revision v1.3
Prepared By	W Walker			
Date	6 th March 2020			
Signature				
Reviewed By	M Askew			
Date	6 th March 2020			
Signature				

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1.0 INTRODUCTION

- 1.1 Johnson Mowat is proposing to develop a parcel of land located south of Lee Lane, Royston with new residential dwellings. As part of the viability of the site and to supplement a planning application, it was decided that a Flood Risk Assessment and Drainage Strategy Report should be undertaken.
- 1.2 It is within the general development strategy of the country for development in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement for flood defence. Under the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Water Authority, Land Drainage Authority and Internal Drainage Board and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.
- 1.3 WIA has been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment and Drainage Strategy Report, in accordance with NPPF, to satisfy the requirements of the Planning Authority.
- 1.4 The walkover survey has been undertaken in March 2020.
- 1.5 This report is based on the interpretation and assessment of data provided by third parties. Whilst every effort has been taken to ensure this information is accurate and up-to-date, WIA cannot guarantee the accuracy of third party data and the findings of this report may change if the data is amended or updated after the date of consultation.



2.0 EXISTING SITE

General

- 2.1 The site is an irregular shaped piece of land equating to an area of approximately 3.6ha. The site is located on the western edge of Royston and is situated at Ordnance Survey Grid Reference SE 350 112.
- 2.2 A site location plan is presented in Appendix A.

Current Use

- 2.3 The site is greenfield, used as pasture land for the grazing of animals.

Boundaries

- 2.4 The site is bounded primarily by hedgerows and timber post and barbed wire fences with further farmland to the south and west. Following the full extent of the northern boundary is Lee Lane, with a residential development, currently under construction, located beyond. A small strip on farmland is situated to the east, separating the site from the residential area of Royston.

Topography and Vegetation

- 2.5 The site has a prominent fall in a northerly direction with levels ranging from approximately 75.0m A.O.D along the south eastern boundary, dropping to low point adjacent to a newly constructed roundabout, situated centrally along the site frontage, of approximately 70.20m A.O.D.
- 2.6 Vegetation on the site is minimal and is purely hedgerows, with the occasional sporadically located tree. However, extensive mature vegetation in the form of mature hedgerows, trees and bushes form the boundary edges.
- 2.7 A topographical survey was not available at the time of writing the report.



Existing Drainage

- 2.8 There is no obvious positive drainage system on the site, although, it has been confirmed by the landowner that a land drain exists on site that connects to a culvert watercourse located to the north east. Surface water run-off clearly discharges in a northerly direction.
- 2.9 The culverted watercourse noted above runs in a northerly direction following the eastern boundary of a residential development currently under construction. The culvert ultimately outfalls into an unnamed watercourse located approximately 275m in a northerly direction, from the site boundary at its nearest location. The watercourse flows in a north easterly direction.
- 2.10 The nearest river to the site is the River Dearne, located approximately 2.7km in a south westerly direction.

Geology and Hydrogeology

- 2.11 The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Oaks Rock - Sandstone Formation. The superficial deposits on site consist of Till, Mid Pleistocene – Diamicton.
- 2.12 The Environment Agency website designates the bedrock under the site as a Secondary A Aquifer. This is a permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.
- 2.13 The Environment Agency website shows that the site does not lie within a Groundwater Source Protection Zone.



3.0 ENVIRONMENT AGENCY CONSULTATION

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

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

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

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

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

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

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

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



- 3.3.3 Low - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year.
- 3.3.4 Very low - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year.
- 3.4 The majority of the proposed development is shown to be within a very low risk area for surface water flooding, however, the low-lying area adjacent to the roundabout is shown as having a high flood risk.



4.0 WATER AUTHORITY CONSULTATION

- 4.1 A consultation was requested from Yorkshire Water (YW), who are the Water Authority for this area, and a copy of their responses, dated 2nd and 11th January 2020, are presented in Appendix C for reference purposes. An overview of the comments and anticipated future responses are as follows.
- 4.2 No existing public sewers are recorded crossing the site, however, as of October 2011 and the private to public sewer transfer, there are many unchartered Yorkshire Water assets currently not shown on their records.
- 4.3 Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.
- 4.4 The site is remote from the public sewer network with the nearest public foul sewer being a 225mm diameter public foul water sewer recorded in Lee Lane, at a point approximately 285 metres from the site. This would be a suitable outfall location.
- 4.5 An alternative foul water outfall location would be the 225mm diameter public foul sewer recorded adjacent to Grange Road, 420m south east of the site. The outfall location is subject to formal planning approval.
- 4.6 In respect of surface water, reference should be made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy of surface water disposal. Consideration should firstly be given to discharge to soakaways, infiltration and watercourse, in that priority order, before connection to sewer will be considered.
- 4.7 Watercourses are located within the vicinity of the site. These appear to be the obvious place for surface water disposal (if SuDS are not viable).



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



5.0 LEAD LOCAL FLOOD AUTHORITY CONSULTATION

- 5.1 A formal consultation was not requested from Barnsley Metropolitan Borough Council (BMBC) who are the Lead Local Flood Authority (LLFA) for this area, however, the following responses are anticipated.
- 5.2 If the developer is to carry out works within or in close proximity of any watercourse, they must gain the relevant permissions from the Lead Local Flood Authority by contacting highwaydrainage@barnsley.gov.uk.
- 5.3 Surface water runoff rates should be calculated in accordance with 5l/s/ha for any contributing area of the site to watercourse.
- 5.4 There should be no increase in surface water runoff from the new development. NPPF recognises that the management of flood risk is not simply restricted to flood plains and that a catchment-wide approach should be employed.
- 5.5 Any balancing facility should be designed to accommodate a 1 in 30 year flow from the site below ground and a 1 in 100 year flow retained within the site (including an allowance of 30% for climate change), without causing any flooding to buildings.
- 5.6 There are alternatives to conventional storage for the control of surface water runoff that are favoured by the authority where ground conditions are suitable. Sustainable Urban Drainage Techniques (SuDS) tackle surface water run-off problems at source using features such as soakaways, permeable pavements, grassed swales, infiltration trenches, ponds and wetlands to attenuate flood peak flows, produce water quality improvements and environmental enhancements.
- 5.7 The authority seeks to promote the use of SuDS techniques to this site and the authority expects the developer of the site to submit detailed investigations such that the use of SuDS has been fully explored.



6.0 INTERNAL DRAINAGE BOARD CONSULTATION

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



7.0 MATERIAL CONSIDERATION IN RESPECT OF NPPF AND PPG

Flood Classification

- 7.1 The Environment Agency flood map has identified that the site falls within land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%). In accordance with Table 1 of the PPG, the site falls within Flood Zone 1 "low probability".
- 7.2 Therefore, all uses of the land are appropriate within this zone, but an assessment of the effect of surface water run-off will need to be incorporated in any Flood Risk Assessment.

End Use

- 7.3 The development proposal is for the construction of residential development on the site, and a copy of the masterplan layout is presented in Appendix D for reference purposes.
- 7.4 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "more vulnerable" classification.

Sequential & Exception Test

- 7.5 As set out in the NPPF, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding (Zone 1).
- 7.6 When the development site is evaluated in accordance with Table 3 of the PPG, the development shows that the Sequential Test is satisfied.
- 7.7 As the Sequential Test is satisfied it is not a requirement for an exception test to be provided.



Flood Sources

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

7.9 Flooding from Rivers (Fluvial)

The nearest river to the site is the River Dearne, which is located approximately 2.7km in a southerly direction, from the site boundary at its nearest location. Due to the distance from the site and the topography of the site being elevated substantially above the River, flooding from this source is considered to be low risk. This is evident from the Environment Agency Flood Maps.

7.10 Flooding from Local Watercourses (Fluvial)

A culverted watercourse is located approximately 53m in a north easterly direction, from the site boundary. Due to the low-lying nature of the site, being approximately 1-1.2m lower than the existing public highway, any flooding from a blockage scenario has the potential to inundate the site. This is evident from the surface water flood maps. Therefore, flooding from this source is considered to be medium risk and will need to be considered as part of the proposed development.

7.11 Flooding from the Sea (Tidal/Coastal)

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

7.12 Flooding from Land (Surface Water)

The majority of the proposed development is shown to be within a very low risk area for surface water flooding, however, the low-lying area adjacent to the roundabout is shown as having a high flood risk. Therefore, any surface water runoff has the potential to flood this area of the site and will need to be considered.



7.13 Flooding from Groundwater

The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Oaks Rock - Sandstone Formation. The superficial deposits on site consist of Till, Mid Pleistocene – Diamicton. Considering the geology

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

7.14 Flooding from Sewer

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

7.15 Flooding from Reservoirs, Canals or Artificial Sources

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

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

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



Table 1.0 – Degree of risk from each source of flooding

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

Climate Change

- 7.18 The NPPF and PPG has indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country.
- 7.19 United Kingdom climate change guidance was revised in February 2016 for peak river flows and peak rainfall intensities. With regards to peak river flows, a regionalised approach has now been adopted to climate change impacts based upon the river basin district of the proposed development site, the flood risk vulnerability of the proposed development and the present-day Flood Zone classification.
- 7.20 The proposed development site is situated within the River Humber river basin district, which, based on an “upper end” climate change scenario, could see peak river flows increase by 50% by 2115. As the site is situated entirely within Flood Zone 1, an increase of 50% in river flows is deemed unlikely to affect the proposed development site.
- 7.21 In accordance with the revised climate change data, the published figures show that, for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall could be up to 40%, subject to the location within the country and the drainage system should be designed in accordance with this



requirement. However, the Barnsley Metropolitan Borough Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 30% allowance for climate change for the 1 in 100 year event.

- 7.22 Due to the topography of the land and surrounding area, overland run-off from adjoining land may be an issue until the adjacent land is developed. Therefore, subject to timings of the developments in the area, it may be necessary to introduce cut off drains to prevent runoff entering the site and divert around the proposed dwellings. Therefore, any run-off from outside the site will be insignificant and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

Flood Mitigation

- 7.23 As the site falls within Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm, surface water runoff or blockage of the proposed drainage systems. The following precautionary flood mitigation measures are, therefore, recommended:-

- 7.23.1 The finished floor levels (FFL) to the properties shall be raised 300mm above the adjacent highway level or a minimum of 150mm above external levels, whichever is higher.
- 7.23.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.
- 7.23.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.
- 7.23.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.



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

Emergency Egress During Times of Flood

- 7.24 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.
- 7.25 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.



8.0 EXISTING AND PROPOSED DRAINAGE

Sustainable Drainage

- 8.1 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Oaks Rock - Sandstone Formation. The superficial deposits on site consist of Till, Mid Pleistocene – Diamicton. Considering the geology beneath the site, it is anticipated that the site is impermeable and, therefore, unsuitable for the disposal of surface water using infiltration techniques. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority. However, for the purpose of this report, a positive drainage system to watercourse or sewer will be required for surface water drainage.

Drainage

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

Existing Surface Water Run-Off

- 8.3 The site is greenfield and, therefore, in accordance with BMDC guidelines and regulations, surface water calculations have been undertaken using the 5l/s/ha method of calculating greenfield run-off rates.
- 8.4 For the proposed developed area of 3.2ha, the existing greenfield run-off rate has been calculated as 16l/s. (3.2ha x 5l/s). However, evidence that the existing land drain serving the site discharges directly into the existing culverted watercourse will need to be provided.



- 8.5 As no formal evidence of an existing positive land drainage connection from the site to watercourse is available at the time of writing this report, it is assumed that a nominal discharge rate of 5l/s will be required for surface water disposal. Connection will be made to the culverted watercourse located to the north east of the site.

Proposed Surface Water Drainage

- 8.6 Consideration of the proposed drainage should firstly be given to infiltration techniques (to ground). However, as the use of infiltration techniques are considered unviable, subject to infiltration testing being carried out, it will be necessary to provide a positive drainage system to watercourse or sewer. Watercourses are located within the vicinity of the site, therefore, these would be the most suitable outfall location for surface water drainage.
- 8.7 The masterplan layout, presented in Appendix D, has been assessed as having an impermeable area of approximately 1.6ha for semi-detached and detached properties. Indicative calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water sewer system should be designed to accommodate the 1 in 30 year storm event without flooding and a 1 in 100 year storm plus climate change event should be retained within the site in an area that does cause flooding to properties or third parties.
- 8.8 Restricting the discharge rate to no greater than 5l/s, on site storage of 666.1m³ will need to be provided for a 1 in 30 year storm. This can be achieved by several methods, including oversized pipes and underground tanks. The drainage system will also need to accommodate the 1 in 100 year plus 30% climate change event without causing flooding or property or third-party land. In the event that levels dictate that the 1 in 100 year plus climate change flood water will flow off site, an additional or larger storage facility will be required. Therefore, on site storage would increase to 1195.4m³. The indicative surface water calculations are presented in Appendix E. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.



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

Watercourse Conditions

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

Proposed Foul Water Drainage

- 8.11 Foul water domestic waste shall discharge into either the 225mm diameter public foul water sewer recorded in Lee Lane, at a point approximately 285 metres from the site. Alternatively, the 225mm diameter public foul sewer recorded adjacent to Grange Road, 420m south east of the site. The outfall location will be subject to formal planning approval.
- 8.12 Subject to detailed design, if the site is not able to drain by gravity, it will be necessary to provide an adoptable foul water pumping station.



9.0 CONCLUSION

- 9.1 The site falls within Flood Zone 1 and the Sequential Test is satisfied. However, in order to accommodate the possibilities of flood from a catastrophic storm, surface water runoff or blockage of the proposed drainage systems, the following precautionary flood mitigation measures are recommended:-
- 9.1.1 The finished floor levels (FFL) to the properties shall be raised 300mm above the adjacent highway level or a minimum of 150mm above external levels, whichever is higher.
 - 9.1.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.
 - 9.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.
 - 9.1.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.
 - 9.1.5 If any water issues are found on the site or boundary levels result in flow of water into the site, these shall be accommodated by introducing "cut-off" drains to direct the flow around the development.
- 9.2 A 30% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.
- 9.3 Sustainable Drainage Systems of infiltration techniques have been assumed to be unsuitable on this particular site, for the purpose of the report. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority.

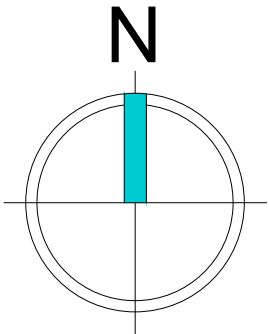
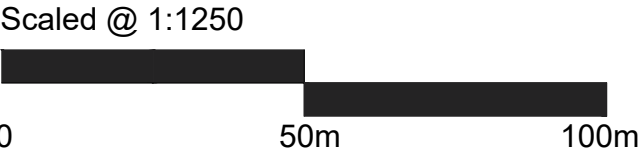


- 9.4 The proposed surface water drainage system shall be restricted to the agreed discharge rate with appropriate attenuation for a 1 in 100 year storm plus climate change incorporated into the design, prior to discharge into the watercourse. The detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on the development site.
- 9.5 The discharge of surface water to watercourse and/or the introduction of headwalls or works to the watercourse will require the consent of the LLFA by submitting an Application for Consent to Work Within a Watercourse.
- 9.6 Subject to detailed design, if the site is not able to drain by gravity, it will be necessary to provide an adoptable surface water pumping station.
- 9.7 Foul water domestic waste shall discharge into either the 225mm diameter public foul water sewer recorded in Lee Lane, at a point approximately 285 metres from the site. Alternatively, the 225mm diameter public foul sewer recorded adjacent to Grange Road, 420m south east of the site. The outfall location will be subject to formal planning approval.
- 9.8 Subject to detailed design, if the site is not able to drain by gravity, it will be necessary to provide an adoptable foul water pumping station.
- 9.9 No special mitigation measures are required for emergency egress during times of flood.
- 9.10 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.



A P P E N D I X A: SITE LOCATION PLAN





REV.	DESCRIPTION.	BY:	DATE:
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Suite 4, Unit 1,
Benton Office Park,
Bennett Avenue,
Horbury,
Wakefield,
WF4 8RA
Tel: 01924 669424

Web: www.sten-architecture.co.uk
Twitter: @STEN_arch
Facebook: [stenarchitecture](https://www.facebook.com/stenarchitecture)
LinkedIn: [Sten Architecture](https://www.linkedin.com/company/sten-architecture)

CLIENT:	Johnson Mowat			TITLE:		Location Plan	
SITE:	Lee Lane Royston			SCALE AT A3:	DATE:	DRAWN:	CHECKED:
				1:1250	10.02.20	BMS	
			PROJECT NO:	DRAWING NO:	REVISION:		
			2008	2008.01	-		



A P P E N D I X B: ENVIRONMENT AGENCY CONSULTATION

Flood map for planning

Your reference
137.001

Location (easting/northing)
435012/411295

Created
6 Mar 2020 12:01

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

This means:

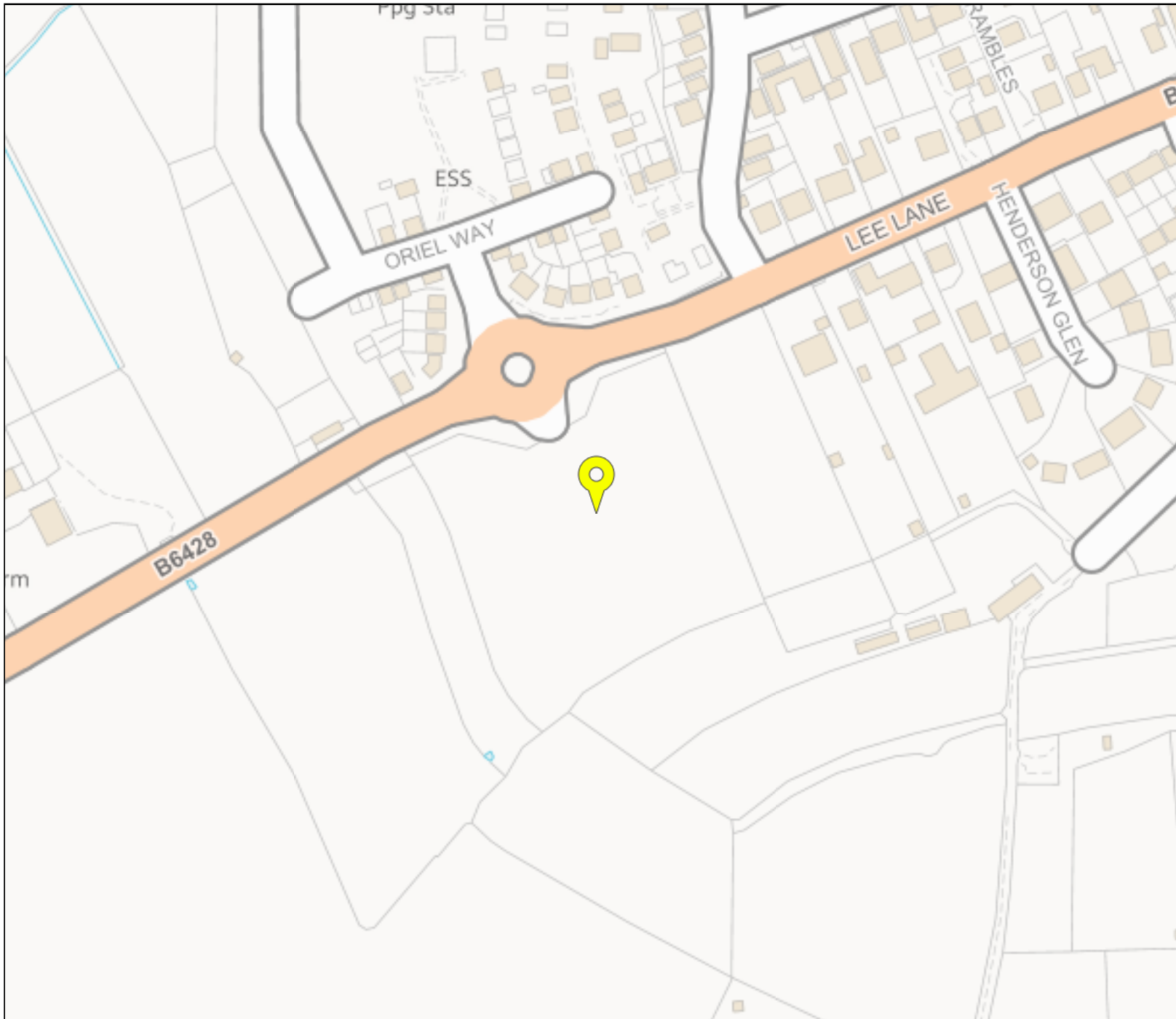
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

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

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

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



Flood map for planning

Your reference

137.001

Location (easting/northing)

435012/411295

Scale

1:2500

Created

6 Mar 2020 12:01

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m

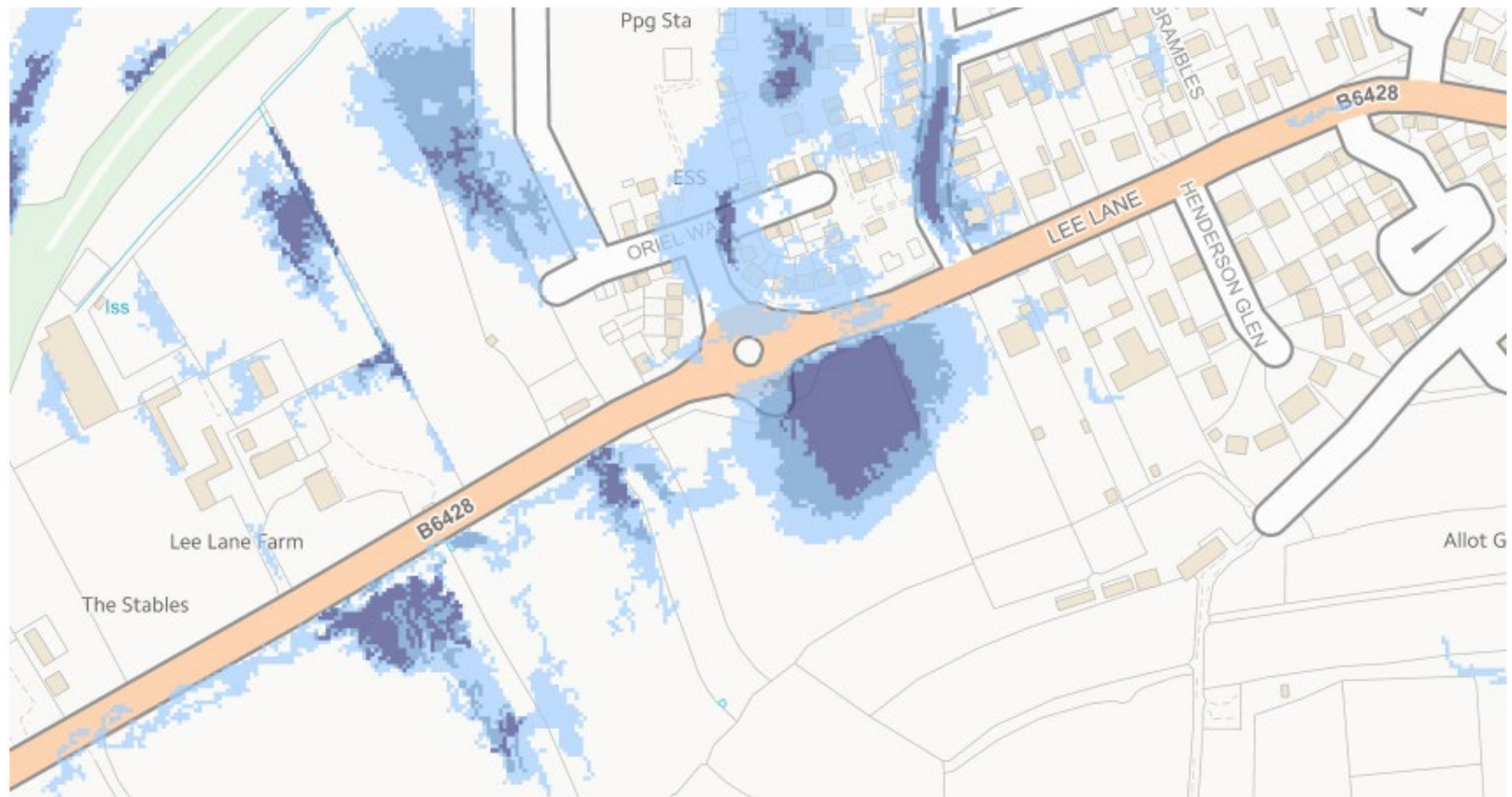


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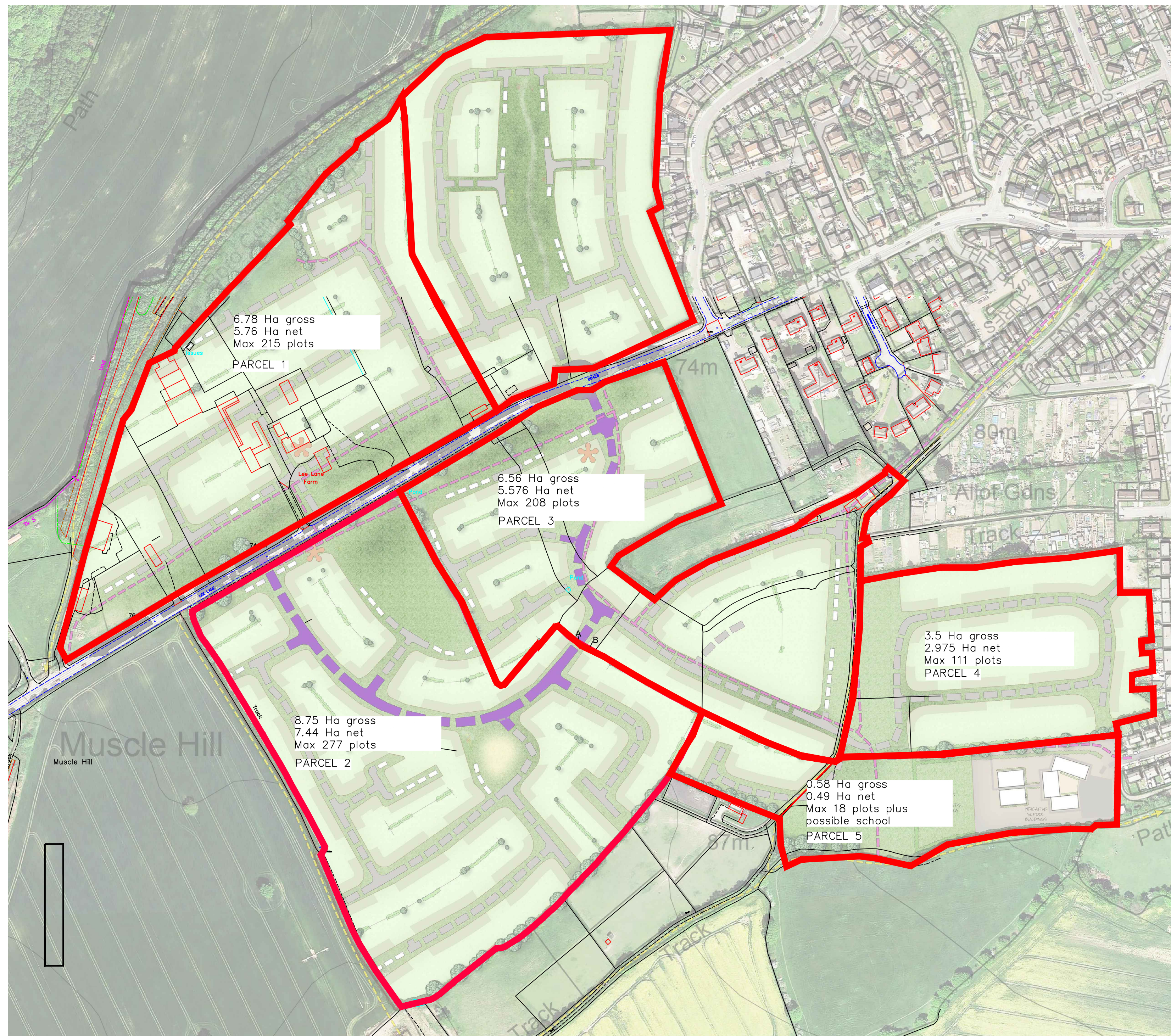
SOUTH of LEE LANE, ROYSTON

ENVIRONMENT AGENCY SURFACE WATER FLOOD MAP





A P P E N D I X C: WATER AUTHORITY CONSULTATION



Wayne Walker

From: Chris.Roberts@yorkshirewater.co.uk on behalf of technical.sewerage@yorkshirewater.co.uk
Sent: 02 January 2020 14:19
To: Wayne Walker
Subject: R928381 Lee Lane, Royston
Attachments: pic24389.gif; scanned-20200102152617.pdf; roberts4_rad21350.PDF; image001.png; Plot Areas & No.s.pdf

Hi Wayne,

The development as a whole will require YW to carry out a feasibility/modelling study.

Parcel 1 - Can discharge in 1B subject to S104 and developer agreement.

Parcel 1B - Already has a pumped connection into Park Head Close Parcel 2 - Has formal planning approval to discharge foul at 6 l/s into the

225 mm foul in Appleyard View or into Parcel 3 subject to agreement Parcel 3 - Can Discharge into 225 mm foul in Lee Lane at 4.75 l/s subject to formal planning approval.

Parcel 4 - Needs PPSE but Id send foul to the 225 mm foul to the south in parcel 5 Parcel 5 - Needs PPSE - As per 4

Kind Regards

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|-----+-----|
| (Embedded image moved |
|to file: pic24389.gif) |Chris Roberts
|
|We are open Monday to |Sewerage Technical Team
|Friday |Developer Services
|0800 – 1700
|We are closed Bank |Tel: 0345 1 20 84 82
|Holidays and Weekends |
|-----+-----|
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*** Please note, all correspondence must be sent to technical.sewerage@yorkshirewater.co.uk and will be responded to within 10 working days ***

Do you know you can now apply and pay your application fees on line ? We are working hard to continually develop and improve your customer experience, for more information and applications please follow this link <https://www.yorkshirewater.com/developers/apply-online/>

(See attached file: scanned-20200102152617.pdf)(See attached file: roberts4_rad21350.PDF)

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| From: |
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|-----|
|Wayne Walker <wayne@walkeringram.co.uk>
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|>-----|
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|----->
| To: |
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Wayne Walker

From: Chris.Roberts@yorkshirewater.co.uk on behalf of technical.sewerage@yorkshirewater.co.uk
Sent: 11 January 2020 11:08
To: Wayne Walker
Subject: R928381 Lee Lane, Royston
Attachments: pic14688.gif

Hi Wayne,

Parcel 1 Proposal

Connection into parcel 3 then into the south east system would be preferable. A modelling request would be required at the developers cost at pre planning.

Parcel 3 Proposal

This would be preferable.

Kind Regards

|-----+-----|
| (Embedded image moved |
|to file: pic14688.gif) |Chris Roberts
|
|We are open Monday to |Sewerage Technical Team
|Friday |Developer Services
|0800 – 1700 |
|We are closed Bank |Tel: 0345 1 20 84 82
|Holidays and Weekends |
|-----+-----|

*** Please note, all correspondence must be sent to technical.sewerage@yorkshirewater.co.uk and will be responded to within 10 working days ***

Do you know you can now apply and pay your application fees on line ? We are working hard to continually develop and improve your customer experience, for more information and applications please follow this link <https://www.yorkshirewater.com/developers/apply-online/>

|----->
| From: |
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|Wayne Walker <wayne@walkeringram.co.uk>
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| To: |
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|Technical Sewerage@NotesMail

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| Cc: |
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|Chris Roberts/Water Business Unit/YWS/Yorkshire Water@O365
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>-----
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| Date: |
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|02/01/2020 14:42 |
>-----
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|----->
| Subject: |
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|RE: R928381 Lee Lane, Royston |
>-----
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Hi Chris,

Happy New Year.

Thank you for the response, very useful at this stage. Just a few questions please:-

Parcel 1

If a connection into Parcel 1B isn't possible, would it be acceptable to connect into Parcel 3 and either discharge to Lee Lane, or as suggested above, to the south east? Or, have its own connection into Lee Lane?

Parcel 3

As an alternative, would it be acceptable to discharge into the foul to the south east? This will avoid a substantial length of sewer/rising main down Lee Lane. Looking at the topography this outfall location may also be more suitable.

Thanks,

Regards

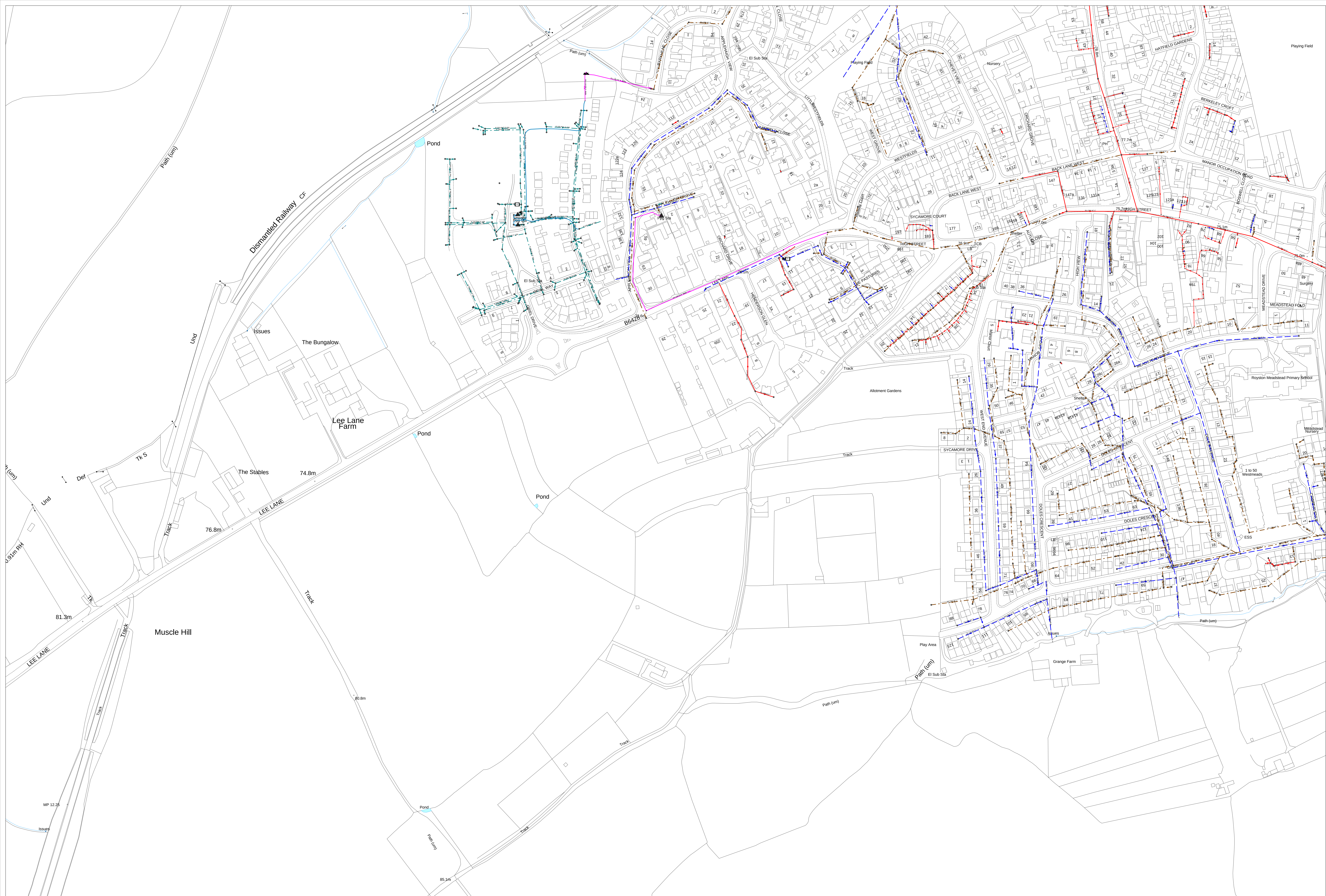
Wayne Walker

T: 01924 792312

M: 07901 680224

E: wayne@walkeringram.co.uk

Walker Ingram Associates Ltd





A P P E N D I X D: MASTERPLAN LAYOUT





A P P E N D I X E: INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS



Walker Ingram Associates					Page 1
Office G4, Flexspace Monckton Road Wakefield, WF2 7AS		South of Lee Lane, Royston Johnson Mowat 30yr calcs			
Date 06/03/2020 11:50 File 137.001 30yr calcs.SRCX		Designed by W.Walker Checked by			
Innovyze		Source Control 2019.1			
<p style="text-align: center;"><u>Summary of Results for 30 year Return Period</u></p>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.338	0.338	3.6	206.3	O K
30 min Summer	100.445	0.445	3.6	271.7	O K
60 min Summer	100.559	0.559	3.6	341.2	O K
120 min Summer	100.677	0.677	3.6	413.0	O K
180 min Summer	100.745	0.745	3.6	454.6	O K
240 min Summer	100.791	0.791	3.6	482.8	O K
360 min Summer	100.852	0.852	3.6	519.7	O K
480 min Summer	100.890	0.890	3.6	543.1	O K
600 min Summer	100.915	0.915	3.6	558.4	O K
720 min Summer	100.932	0.932	3.6	568.5	O K
960 min Summer	100.948	0.948	3.6	578.4	O K
1440 min Summer	100.944	0.944	3.6	575.9	O K
2160 min Summer	100.918	0.918	3.6	559.9	O K
2880 min Summer	100.887	0.887	3.6	541.0	O K
4320 min Summer	100.820	0.820	3.6	500.0	O K
5760 min Summer	100.741	0.741	3.6	452.2	O K
7200 min Summer	100.664	0.664	3.6	405.1	O K
8640 min Summer	100.595	0.595	3.6	362.9	O K
10080 min Summer	100.532	0.532	3.6	324.8	O K
15 min Winter	100.379	0.379	3.6	231.3	O K
30 min Winter	100.500	0.500	3.6	304.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	69.625	0.0	193.3	19	
30 min Summer	46.099	0.0	251.6	34	
60 min Summer	29.238	0.0	343.0	64	
120 min Summer	18.009	0.0	421.5	124	
180 min Summer	13.416	0.0	468.9	184	
240 min Summer	10.836	0.0	501.5	242	
360 min Summer	7.992	0.0	542.0	362	
480 min Summer	6.438	0.0	555.8	482	
600 min Summer	5.441	0.0	553.9	602	
720 min Summer	4.740	0.0	548.8	722	
960 min Summer	3.810	0.0	535.6	960	
1440 min Summer	2.797	0.0	508.8	1372	
2160 min Summer	2.051	0.0	876.4	1728	
2880 min Summer	1.644	0.0	931.5	2108	
4320 min Summer	1.203	0.0	949.4	2940	
5760 min Summer	0.963	0.0	1107.1	3744	
7200 min Summer	0.810	0.0	1163.7	4472	
8640 min Summer	0.703	0.0	1211.3	5272	
10080 min Summer	0.624	0.0	1251.8	5960	
15 min Winter	69.625	0.0	215.8	19	
30 min Winter	46.099	0.0	275.7	33	
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Walker Ingram Associates				Page 2	
Office G4, Flexspace Monckton Road Wakefield, WF2 7AS		South of Lee Lane, Royston Johnson Mowat 30yr calcs			
Date 06/03/2020 11:50 File 137.001 30yr calcs.SRCX		Designed by W.Walker Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.628	0.628	3.6	383.1	O K
120 min Winter	100.763	0.763	3.6	465.1	O K
180 min Winter	100.841	0.841	3.6	512.9	O K
240 min Winter	100.893	0.893	3.6	544.9	O K
360 min Winter	100.963	0.963	3.6	587.2	O K
480 min Winter	101.008	1.008	3.6	615.0	O K
600 min Winter	101.039	1.039	3.6	633.8	O K
720 min Winter	101.060	1.060	3.6	646.9	O K
960 min Winter	101.085	1.085	3.6	661.7	O K
1440 min Winter	101.092	1.092	3.6	666.1	O K
2160 min Winter	101.057	1.057	3.6	645.0	O K
2880 min Winter	101.019	1.019	3.6	621.3	O K
4320 min Winter	100.926	0.926	3.6	565.1	O K
5760 min Winter	100.822	0.822	3.6	501.6	O K
7200 min Winter	100.695	0.695	3.6	423.8	O K
8640 min Winter	100.583	0.583	3.6	355.4	O K
10080 min Winter	100.488	0.488	3.6	297.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	29.238	0.0	383.9	64	
120 min Winter	18.009	0.0	470.0	122	
180 min Winter	13.416	0.0	519.0	180	
240 min Winter	10.836	0.0	547.9	240	
360 min Winter	7.992	0.0	562.9	358	
480 min Winter	6.438	0.0	559.3	474	
600 min Winter	5.441	0.0	553.2	590	
720 min Winter	4.740	0.0	546.7	706	
960 min Winter	3.810	0.0	534.7	934	
1440 min Winter	2.797	0.0	515.0	1372	
2160 min Winter	2.051	0.0	977.5	1964	
2880 min Winter	1.644	0.0	1027.5	2224	
4320 min Winter	1.203	0.0	975.4	3160	
5760 min Winter	0.963	0.0	1239.9	4096	
7200 min Winter	0.810	0.0	1303.4	4896	
8640 min Winter	0.703	0.0	1357.0	5624	
10080 min Winter	0.624	0.0	1403.2	6352	
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Walker Ingram Associates		Page 3
Office G4, Flexspace Monckton Road Wakefield, WF2 7AS	South of Lee Lane, Royston Johnson Mowat 30yr calcs	
Date 06/03/2020 11:50 File 137.001 30yr calcs.SRCX	Designed by W.Walker Checked by	
Innovyze Source Control 2019.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.362	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.600

Time (mins)	Area
From:	To: (ha)
0	4 1.600

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Office G4, Flexspace Monckton Road Wakefield, WF2 7AS	South of Lee Lane, Royston Johnson Mowat 30yr calcs	
Date 06/03/2020 11:50 File 137.001 30yr calcs.SRCX	Designed by W.Walker Checked by	
Innovyze Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	610.0	1.400	610.0	2.800	610.0	4.200	610.0
0.200	610.0	1.600	610.0	3.000	610.0	4.400	610.0
0.400	610.0	1.800	610.0	3.200	610.0	4.600	610.0
0.600	610.0	2.000	610.0	3.400	610.0	4.800	610.0
0.800	610.0	2.001	610.0	3.600	610.0	5.000	610.0
1.000	610.0	2.400	610.0	3.800	610.0		
1.200	610.0	2.600	610.0	4.000	610.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0087-4500-2000-4500
Design Head (m)	2.000
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	4.5
Flush-Flo™	0.379	3.6
Kick-Flo®	0.775	2.9
Mean Flow over Head Range	-	3.5

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	2.6	1.200	3.6	3.000	5.4	7.000	8.1
0.200	3.4	1.400	3.8	3.500	5.8	7.500	8.4
0.300	3.6	1.600	4.1	4.000	6.2	8.000	8.6
0.400	3.6	1.800	4.3	4.500	6.6	8.500	8.9
0.500	3.6	2.000	4.5	5.000	6.9	9.000	9.1
0.600	3.5	2.200	4.7	5.500	7.2	9.500	9.4
0.800	2.9	2.400	4.9	6.000	7.5		
1.000	3.3	2.600	5.1	6.500	7.8		

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Office G4, Flexspace Monckton Road Wakefield, WF2 7AS		South of Lee Lane, Royston Johnson Mowat 100yr + 30% calcs			
Date 06/03/2020 11:49 File 137.001 100yr + 30% cal...		Designed by W.Walker Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.571	0.571	3.6	348.5	O K
30 min Summer	100.762	0.762	3.6	464.6	O K
60 min Summer	100.966	0.966	3.6	589.3	O K
120 min Summer	101.177	1.177	3.6	717.9	O K
180 min Summer	101.297	1.297	3.7	790.9	O K
240 min Summer	101.376	1.376	3.8	839.1	O K
360 min Summer	101.480	1.480	3.9	902.9	O K
480 min Summer	101.551	1.551	4.0	946.1	O K
600 min Summer	101.601	1.601	4.1	976.4	O K
720 min Summer	101.636	1.636	4.1	998.0	O K
960 min Summer	101.680	1.680	4.1	1024.6	O K
1440 min Summer	101.705	1.705	4.2	1040.0	O K
2160 min Summer	101.675	1.675	4.1	1021.6	O K
2880 min Summer	101.634	1.634	4.1	997.0	O K
4320 min Summer	101.549	1.549	4.0	945.0	O K
5760 min Summer	101.468	1.468	3.9	895.5	O K
7200 min Summer	101.391	1.391	3.8	848.6	O K
8640 min Summer	101.318	1.318	3.7	804.1	O K
10080 min Summer	101.251	1.251	3.6	762.8	O K
15 min Winter	100.640	0.640	3.6	390.6	O K
30 min Winter	100.854	0.854	3.6	521.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	117.105	0.0	296.4	19	
30 min Summer	78.278	0.0	297.9	34	
60 min Summer	49.937	0.0	559.6	64	
120 min Summer	30.781	0.0	574.2	124	
180 min Summer	22.866	0.0	572.3	184	
240 min Summer	18.394	0.0	572.5	244	
360 min Summer	13.477	0.0	577.0	362	
480 min Summer	10.808	0.0	585.5	482	
600 min Summer	9.101	0.0	596.4	602	
720 min Summer	7.904	0.0	604.7	722	
960 min Summer	6.321	0.0	614.5	962	
1440 min Summer	4.605	0.0	617.8	1440	
2160 min Summer	3.349	0.0	1181.7	1928	
2880 min Summer	2.668	0.0	1158.6	2280	
4320 min Summer	1.933	0.0	1115.4	3072	
5760 min Summer	1.536	0.0	1765.0	3920	
7200 min Summer	1.285	0.0	1842.5	4752	
8640 min Summer	1.110	0.0	1901.0	5536	
10080 min Summer	0.981	0.0	1883.4	6360	
15 min Winter	117.105	0.0	303.4	19	
30 min Winter	78.278	0.0	285.6	34	
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Office G4, Flexspace Monckton Road Wakefield, WF2 7AS		South of Lee Lane, Royston Johnson Mowat 100yr + 30% calcs			
Date 06/03/2020 11:49 File 137.001 100yr + 30% cal...		Designed by W.Walker Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	101.083	1.083	3.6	660.8	O K
120 min Winter	101.321	1.321	3.7	806.0	O K
180 min Winter	101.457	1.457	3.9	889.0	O K
240 min Winter	101.548	1.548	4.0	944.1	O K
360 min Winter	101.669	1.669	4.1	1018.0	O K
480 min Winter	101.752	1.752	4.2	1068.9	O K
600 min Winter	101.812	1.812	4.3	1105.3	O K
720 min Winter	101.856	1.856	4.3	1132.1	O K
960 min Winter	101.914	1.914	4.4	1167.3	O K
1440 min Winter	101.960	1.960	4.5	1195.4	O K
2160 min Winter	101.947	1.947	4.4	1187.6	O K
2880 min Winter	101.892	1.892	4.4	1154.3	O K
4320 min Winter	101.789	1.789	4.3	1091.4	O K
5760 min Winter	101.677	1.677	4.1	1023.1	O K
7200 min Winter	101.566	1.566	4.0	955.4	O K
8640 min Winter	101.459	1.459	3.9	889.9	O K
10080 min Winter	101.358	1.358	3.8	828.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	49.937	0.0	575.3	64	
120 min Winter	30.781	0.0	575.0	122	
180 min Winter	22.866	0.0	578.5	182	
240 min Winter	18.394	0.0	585.1	240	
360 min Winter	13.477	0.0	604.1	358	
480 min Winter	10.808	0.0	621.4	476	
600 min Winter	9.101	0.0	633.1	594	
720 min Winter	7.904	0.0	641.1	708	
960 min Winter	6.321	0.0	650.1	942	
1440 min Winter	4.605	0.0	651.1	1398	
2160 min Winter	3.349	0.0	1226.2	2052	
2880 min Winter	2.668	0.0	1223.8	2596	
4320 min Winter	1.933	0.0	1188.8	3284	
5760 min Winter	1.536	0.0	1975.7	4208	
7200 min Winter	1.285	0.0	2059.6	5120	
8640 min Winter	1.110	0.0	2095.1	6048	
10080 min Winter	0.981	0.0	1993.6	6952	
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Walker Ingram Associates		Page 3
Office G4, Flexspace Monckton Road Wakefield, WF2 7AS	South of Lee Lane, Royston Johnson Mowat 100yr + 30% calcs	
Date 06/03/2020 11:49 File 137.001 100yr + 30% cal...	Designed by W.Walker Checked by	
Innovyze Source Control 2019.1		

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	0.362	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.600

Time (mins)	Area
From:	To: (ha)
0	4 1.600

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Walker Ingram Associates		Page 4
Office G4, Flexspace Monckton Road Wakefield, WF2 7AS	South of Lee Lane, Royston Johnson Mowat 100yr + 30% calcs	
Date 06/03/2020 11:49 File 137.001 100yr + 30% cal...	Designed by W.Walker Checked by	
Innovyze Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	610.0	1.400	610.0	2.800	610.0	4.200	610.0
0.200	610.0	1.600	610.0	3.000	610.0	4.400	610.0
0.400	610.0	1.800	610.0	3.200	610.0	4.600	610.0
0.600	610.0	2.000	610.0	3.400	610.0	4.800	610.0
0.800	610.0	2.001	610.0	3.600	610.0	5.000	610.0
1.000	610.0	2.400	610.0	3.800	610.0		
1.200	610.0	2.600	610.0	4.000	610.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0087-4500-2000-4500
Design Head (m)	2.000
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	4.5
Flush-Flo™	0.379	3.6
Kick-Flo®	0.775	2.9
Mean Flow over Head Range	-	3.5

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	2.6	1.200	3.6	3.000	5.4	7.000	8.1
0.200	3.4	1.400	3.8	3.500	5.8	7.500	8.4
0.300	3.6	1.600	4.1	4.000	6.2	8.000	8.6
0.400	3.6	1.800	4.3	4.500	6.6	8.500	8.9
0.500	3.6	2.000	4.5	5.000	6.9	9.000	9.1
0.600	3.5	2.200	4.7	5.500	7.2	9.500	9.4
0.800	2.9	2.400	4.9	6.000	7.5		
1.000	3.3	2.600	5.1	6.500	7.8		

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