



# Northern Gateway

## Area GMA 1.1 – Flood Risk and Drainage High Level Constraints Review

A104444-5

June 2021

Prepared by WYG Environment Planning Transport Limited

On behalf of Northern Gateway Development Vehicle LLP



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- Appendix A - Report Conditions
- Appendix B - Site Boundary Plan
- Appendix C - United Utilities Sewer Records
- Appendix D - Greenfield Run-off Calculation
- Appendix E - Initial Estimated Attenuation Requirements
- Appendix F - Geology Plan
- Appendix G - Historic Mapping
- Appendix H - Watershed Analysis of GMA 1.1 Sub-Areas

## Drawings

- A104444-5-MAN-N-02 - Site Boundary Plan
- A104444-5-MAN-N-103 - Watershed Analysis of GMA 1.1 Sub-Areas



## 1.0 Introduction

WYG has been commissioned by Northern Gateway Development Vehicle LLP ('NGDV') to undertake a high level desk top and site reconnaissance constraints and opportunities review of a site referred to as Area GMA 1.1 within the proposed Greater Manchester Northern Gateway development area.

The site is identified as Allocation GM 1.1 in the draft Greater Manchester Strategic Framework (GMSF). It forms part of the strategic cross-boundary 'Northern Gateway' allocation positioned around the intersection of the M60, M62 and M66 Motorways.

## 1.1 Instruction

This desk top assessment and constraints review provides information to support the promotion of GMA 1.1 for allocation in the Greater Manchester Spatial Framework (GMSF). The findings from the assessment will be used to inform the site masterplan as it is updated and refined.

This report has assessed the land shown on A104444-5-MAN-N-01. It forms the majority part of proposed allocation GMA 1.1 'Heywood/Pilsworth (Northern Gateway)' in the draft GMSF. The north-eastern part of the proposed allocation already benefits from an outline planning permission for mixed use employment and residential development (the 'South Heywood' scheme, granted in March 2020). Since this part of the site already benefits from permission and is currently being delivered, it is not included within this assessment work commissioned by the NGDV.

## 1.2 Objectives

The overall objectives of the report are to:

1. Provide background desktop and site reconnaissance information
2. To assess the constraints and opportunities for development



3. To present next steps a) to assess constraints and opportunities and b) to address planning requirements (for allocation stage only).

The specialism specific objectives are:

1. Review the existing desk top assessments (Flood Risk and Drainage) for Areas 1 and 2, WYG reports A104444 High Level Constraints Volume 1 of August 2017.
2. Produce a new updated Flood Risk and Drainage report (based upon the 2017 reports noted above with any relevant additions as required). Report to include key constraints/opportunities relating to flood risk and drainage.

### **1.3 Proposed Development and Emerging Masterplan**

It is understood at this stage that Area GMA 1.1 will be developed primarily for commercial and industrial purposes (B1, B2 and B8 of the Town and Country Planning Use Classes Order 1987) with associated spine roads, and soft and hard landscaping, and around 200 residential dwellings in the west of the site, off Castle Road.

The 'South Heywood' scheme in the north-eastern part of the GMSF allocation already benefits from planning permission for a new link road, industrial development, 1000 new dwellings and a new local centre and primary school. This report does not consider this part of the allocation since it has already been subject to detailed assessment through the planning application.

### **1.4 Report Conditions**

Report conditions are enclosed as Appendix A.



## 1.5 Report Conclusions

The report concludes that flood risk to the development from existing fluvial (rivers and watercourses) sources is low and this is demonstrated on the Environment Agency Flood Map for Planning. The masterplan is being developed with consideration of the existing watercourses and where feasible the plans promote green/blue corridors adjacent to the existing watercourses.

The developing surface water drainage strategy promotes the widescale use of sustainable drainage features in accordance with the CIRIA SuDS Manual. Flood risk from the development will be mitigated through these features and water quality will be improved by following the recommendation for pollution prevention for large scale commercial/industrial schemes.

There will be negotiations with United Utilities (UU) to develop an acceptable foul water strategy for the scheme and this is likely to include upgrades of the existing public sewer network and nearby Bury Wastewater Treatment Works. UU have representation on the greater Manchester infrastructure board and will be fully engaged with the delivery of Northern Gateway.



## 2.0 Site Setting

### 2.1 Location and Size

Key details for Area GMA 1.1 are summarised in the table below.

Site Specifics	
<b>Address</b>	<b>Land to the north of the M62 and M66 junction (Simister Island), Rochdale</b>
<b>Grid Reference</b>	<b>383550 407966</b>
<b>Site Area</b>	<b>500 ha</b>

### 2.2 Site Description

The site currently comprises agricultural land with local roads crossing through the proposed development area. There are a number of farms and residential properties within the site boundary along with a golf course, Birch Industrial Estate, Birchwood Services and several other uses. The northern boundary is identified with a reservoir and watercourses.

Boundary	Description
<b>North</b>	<b>Pilsworth Landfill Site, agricultural land and the South Heywood Development</b>
<b>East</b>	<b>Agricultural land and residential properties</b>
<b>South</b>	<b>The M62 constrains the southern boundary beyond which Area GMA 1.2 is located</b>
<b>West</b>	<b>The M66 constrains the western boundary beyond which agricultural land, residential properties and GMSF Allocation GMA 1.3 are located</b>



### 2.3 Site Walkover

- The site is comprised predominantly of agricultural land with areas of woodland, farms and derelict barns.
- The topography is undulating with surface water features (typically ponds, streams and ditches) and livestock in numerous fields. The site is open to the public with some vehicle access routes and bridleways.
- Himalayan Balsam was identified notably within hedgerows and along field boundaries (during July 2017).
- The Birch Industrial park is located in a central north location and comprises of shed type constructed buildings with associated hard and soft landscaping. Access to the park is limited by the presence of a security lodge at the entrance. There are presently new sheds being constructed at the park. A former tank was noted adjacent to the south of the park. There is a stockpile of building materials located to the north of the park and adjacent to the site boundary containing mud, concrete, brick and asphalt. To the east of the park the landform is fairly undulating and includes mounding and a ridge rising to about four metres above the surrounding fields. Birch Services is located to the south east of the park, constrains the boundary with the M62 and comprises a number of buildings and mainly hardstanding. A petrol filling station is located within the complex.
- A golf course is located in the west of the site adjacent to the M66. The golf course mainly comprises soft landscaping with some water features.
- In the west of the site there are a small number of residential properties, a school playing field and a supplier of auxiliary construction equipment, there are bunds present to the south of the business and evidence of waste oil. There is evidence of the high-pressure gas main at the site, cadent gas equipment and a telecoms tower. There are localised areas of fly tipping.





### 3.0 Site Overview and Catchment Assessment

- The site currently comprises primarily of agricultural land and associated farms with local roads crossing parts of the proposed development areas. There is a golf course in the south west of the development area and various farm holdings throughout the development's extent. An office building is sited in the north western corner of the site currently occupied by the construction equipment supplier noted previously. The Birch Industrial Estate is located in the north eastern part of the site and consists of a number of commercial units.
- The site boundary encompasses a total area of circa 500ha. A drone survey was undertaken by WYG in May 2020 covering the northern portions of the development area. This survey was supplemented with publicly available LIDAR data in areas that were not covered. These identified that the overall site tends to generally fall towards the south west although at the smaller scale the land undulates and falls towards the various watercourses that flow through the site.
- For the purposes of this report, the GMA 1.1 area has been split into various catchments based upon proposed development areas as proposed at the time of writing, flow paths, and local topography. The sub-areas are detailed as follows and can be seen in Figure 2. A more detailed plan indicating the direction of existing overland flow paths within the site is included as Appendix H.

# Northern Gateway – High Level Constraints – Area GMA 1.1

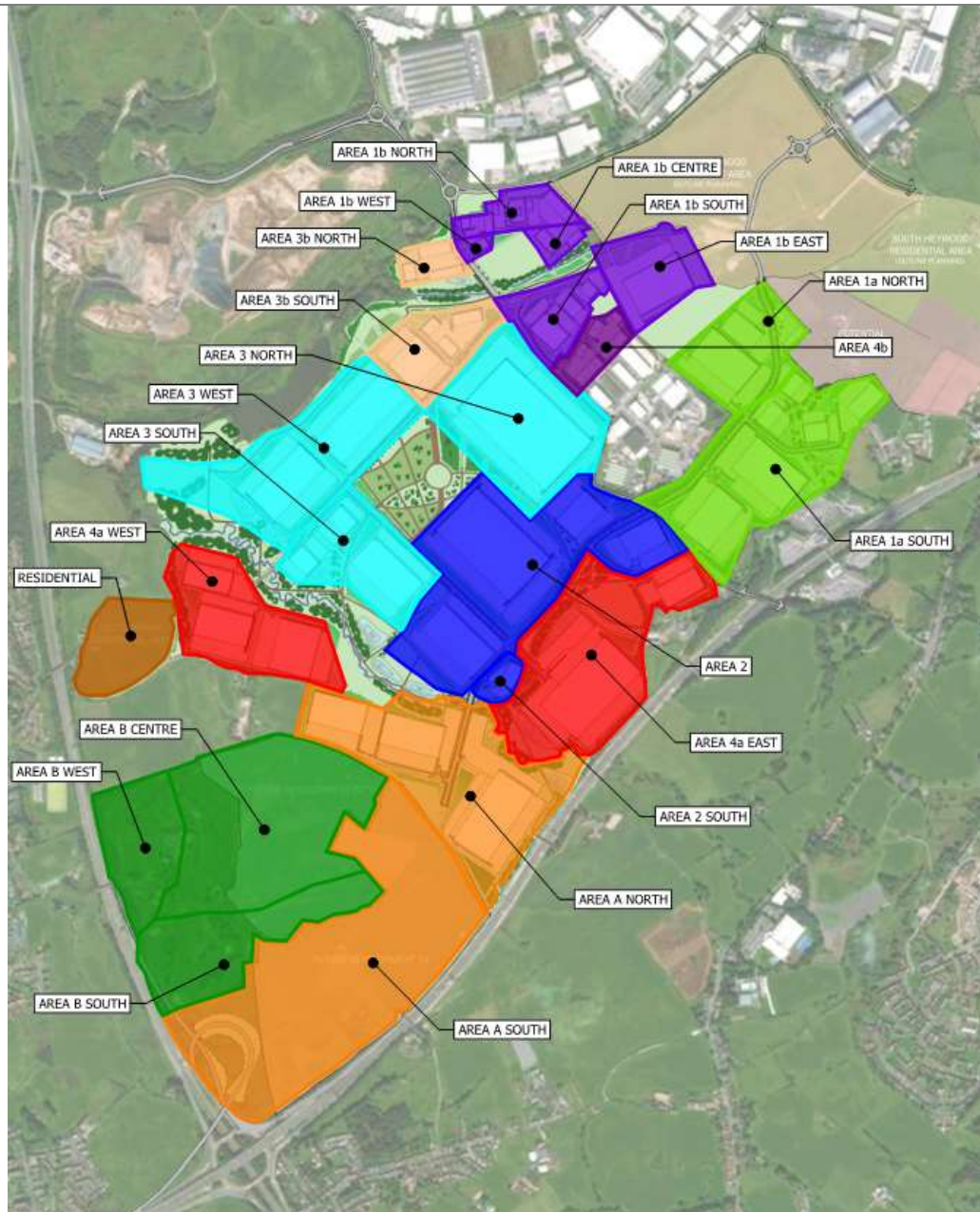


Figure 2 – Catchment Sub-Areas

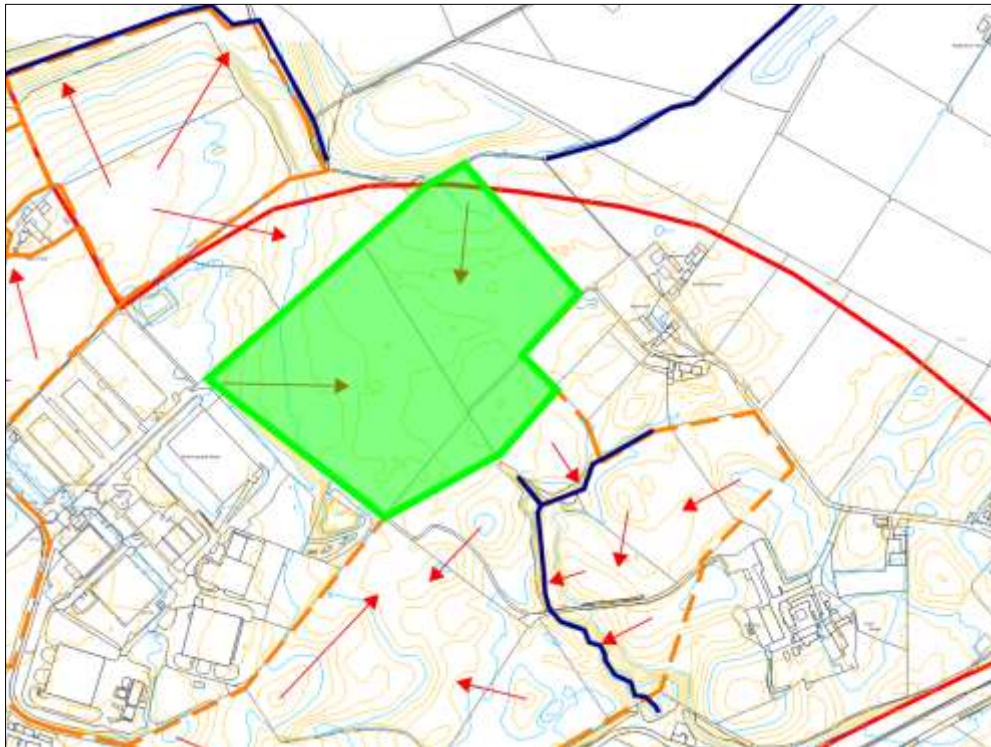
### 3.1 Sub-Area Assessments

#### 3.1.1 Area 1a North

Area 1a North currently consists of agricultural land with additional agricultural land to the north, east, and west. The southern boundary is shared with Birch Industrial Park whilst the South Heywood commercial development will be located to the north.

The sub-area falls from a high level of 124m AOD in the western corner and 120m AOD in the northern corner to a level of 117m AOD along the southern and eastern boundaries. Beyond this and into Phase 1a South the land stays relatively level. A watercourse is located approximately halfway along the southern boundary flowing southwards and is culverted under the M62 and Birch Services. A ditch and watercourse that feeds into Brightley Brook is located to the east and west respectively of the northern boundary.

Figure 3 following shows the lie of the land and the existing watercourses.





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Figure 3: Area 1a North – Existing Topography

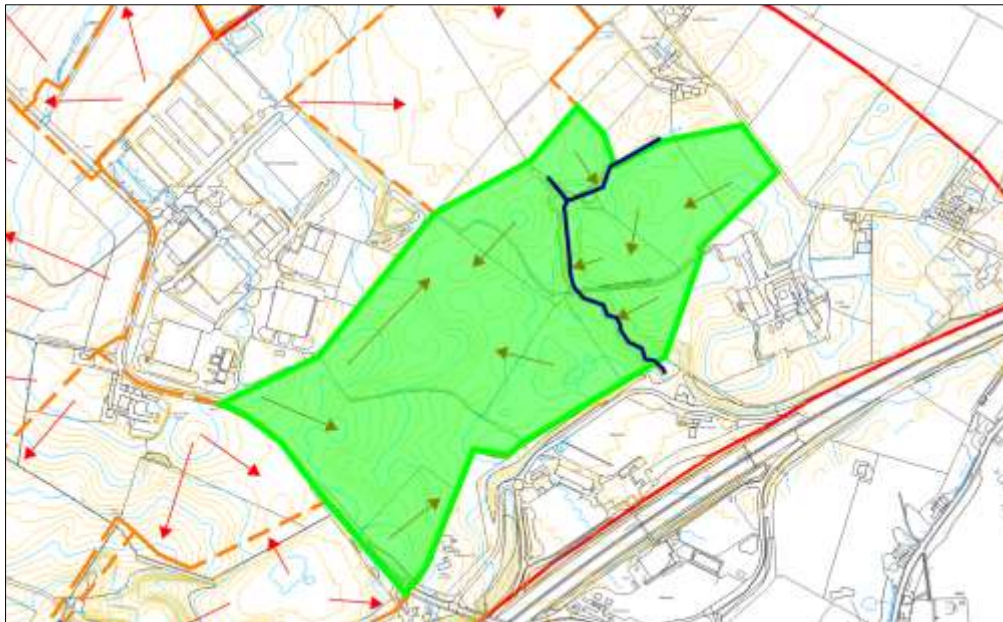
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### 3.1.2 Area 1a South

Area 1a South currently consists predominately of agricultural land. The western boundary is defined by Whittle Lane. Birch Industrial Park is located along the northern boundary and Birch Services to the south. There are small farm holdings to the east.

The area generally falls from the boundaries towards a watercourse that flows southwards through the eastern portion of the site. The watercourse is at a level of approximately 114m AOD with a high point of 128m AOD at the corner of Whittle Lane and Birch Industrial Estate and 120m AOD in the eastern corner of the site.

Figure 4 following shows the lie of the land and the existing watercourses.



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Figure 4: Area 1a South – Existing Topography

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### 3.1.3 Area 1b North

Area 1b North consists primarily of agricultural land. Additional agricultural land lies to the south whilst the northern boundary is defined by a public house, Brightley Brook, and Pilsworth Road. The western boundary is defined by Moss Hall Road. The eastern boundary currently consists of agricultural land that forms part of the South Heywood Development. The southern boundary of the catchment is defined by the alignment of an underground water main.

The area generally falls from a high level of 117m AOD in the south eastern corner towards the northern boundary and Brightley Brook. The area's low point is 106m AOD in the north western corner of the area.

Figure 5 following shows the lie of the land and the existing watercourses.



Figure 5: Area 1b North – Existing Topography

### 3.1.4 Area 1b South

Area 1b South currently consists of agricultural land with additional agricultural land to the south, east, and west. The western boundary is defined by Moss Hall Road. Brightley Brook flows east to west off the northern boundary, the boundary itself is defined by the alignment of a buried gas main crossing the development. The residence of Moss Hall is located off the south eastern corner of the area with the access road running along the southern boundary with a pond along its northern side.

The area generally falls from south east to north west, towards Brightley Brook with a high point of 126m AOD in the centre of the south eastern boundary to a low of 110m AOD in the north western corner.

Figure 6 following shows the lie of the land and the existing watercourses.

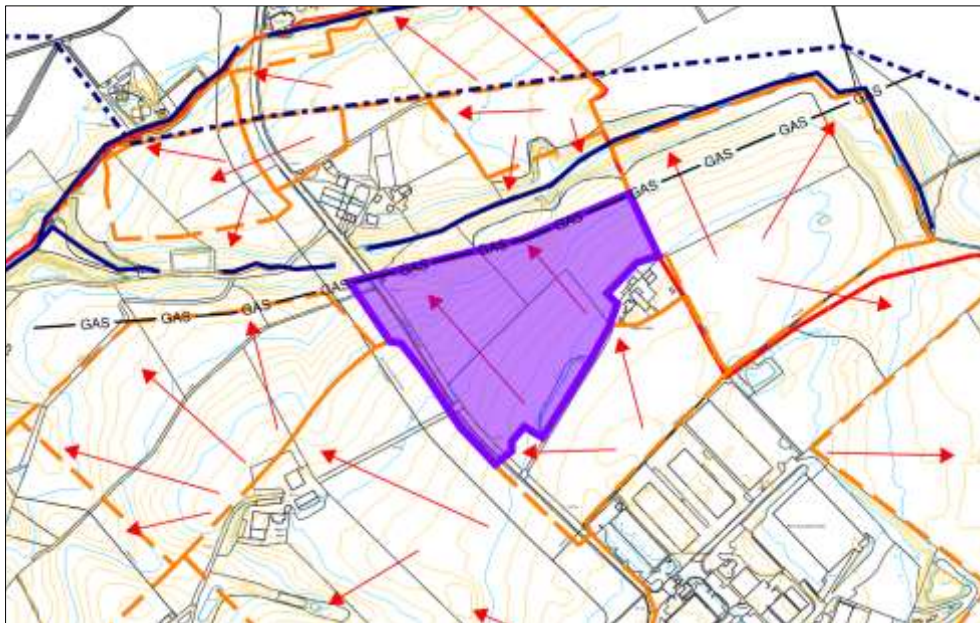


Figure 6: Area 1b South – Existing Topography



### 3.1.5 Area 1b East

Area 1b East currently consists of agricultural land with additional agricultural land to the west. The northern and eastern boundaries are defined by a tributary of Brightley Brook. The dwelling of Moss Hall is located at the approximate centre of the western boundary. The southern boundary is shared with unmade ground which is accessed via Birch Industrial Estate. A buried gas main is located within the northern boundary and cuts across the site from east to west.

The area generally falls towards Brightley Brook along the northern and eastern boundaries from a high point of 127m AOD in the south western corner of the area. A low level of 111m AOD was recorded in the north western corner of the area.

Figure 7 following shows the lie of the land and the existing watercourses.

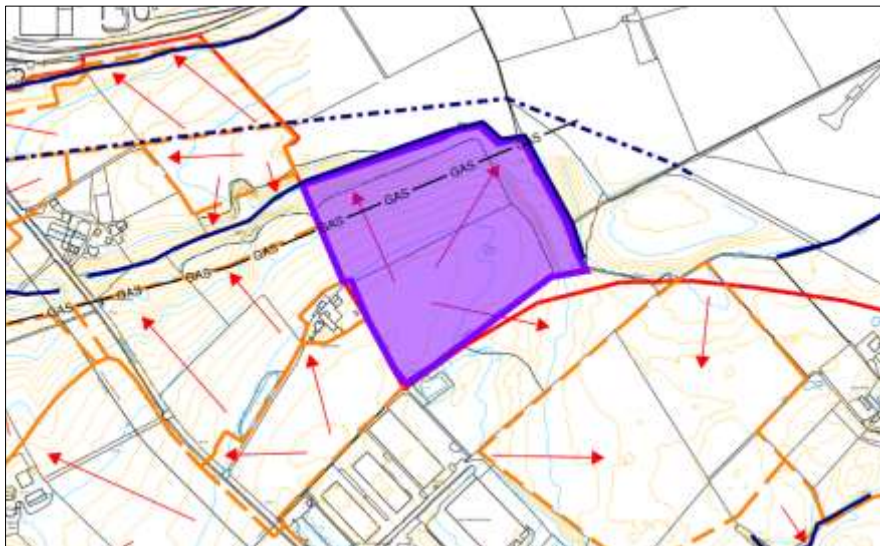


Figure 7: Area 1b South – Existing Topography

### 3.1.6 Area 1b West

Area 1b West currently consists of agricultural land with additional agricultural land to the north, east and west. The western boundary is defined by Moss Hall Lane whilst the southern boundary is defined by the residences of Coal Pits Farm. The northern boundary is defined by an underground water main.

The area generally falls from east to west across Moss Hall Lane and into area, Area 3b North. A high level of 111.6m AOD was recorded in the north eastern corner whilst a low level of 110m AOD was recorded in the north western corner.

Figure 8 following shows the lie of the land and the existing watercourses.

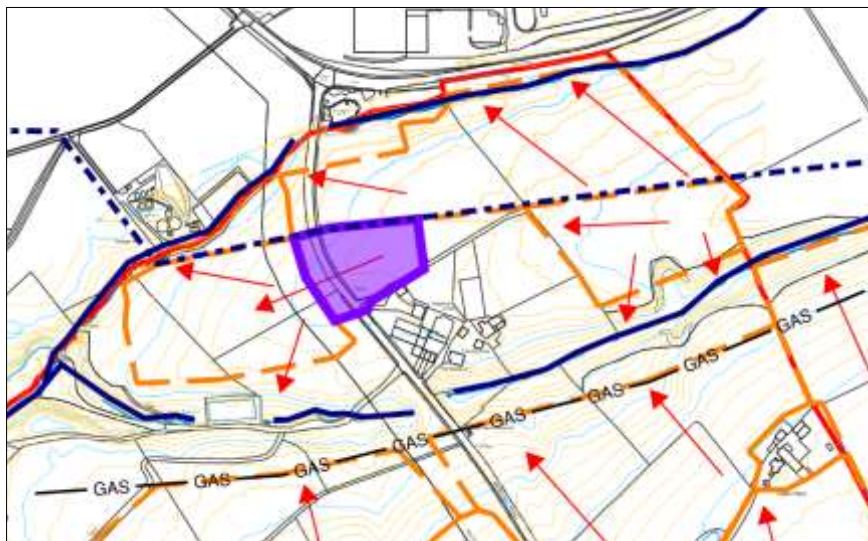


Figure 8: Area 1b West – Existing Topography



### 3.1.7 Area 1b Centre

Area 1b Centre currently consists of agricultural land with additional agricultural land to the north, east and west. The southern boundary is defined by the top bank of a cutting created by a tributary of Brightley Brook, this tributary flows from east to west. The northern boundary is defined by a buried water main.

The area generally falls from a level of 117m AOD in the north eastern corner to levels of 113m AOD in the western corners of the area.

Figure 9 following shows the lie of the land and the existing watercourses.

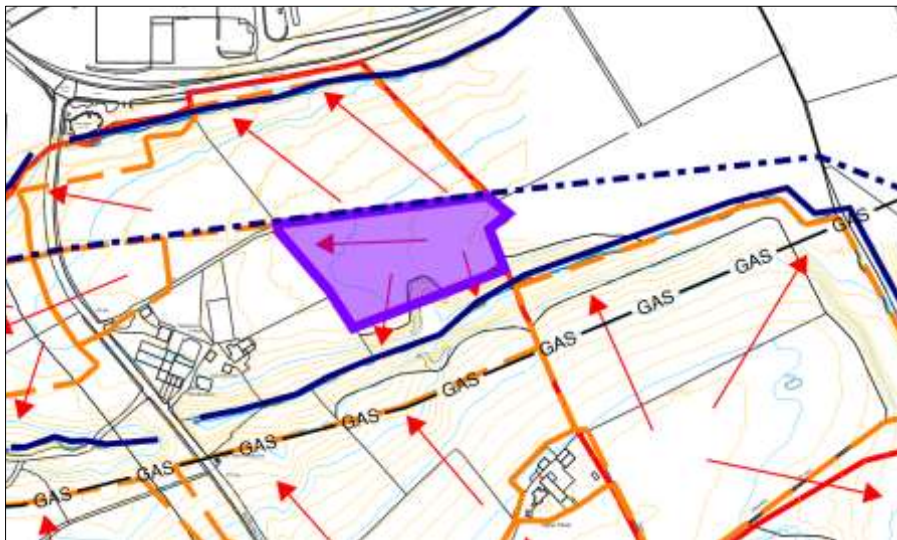


Figure 9: Area 1b Centre – Existing Topography

### 3.1.8 Area 2

Area 2 currently consists of agricultural land with access tracks to these holdings additional agricultural land to the north west and south east. The holding of Birch Hill Farm is located about the northern centre of the site and positioned opposite Birch Industrial Estate. The south western boundary is defined by the Whittle Brook cutting and the north eastern boundary by Whittle Lane and Birch Industrial Estate. A pair of small ponds are located within the lower third of the area.

The area generally falls from north east to south west with a high level of 132m AOD along the boundary and a low level of 86m AOD about the centre of the south western boundary,

Figure 10 following shows the lie of the land and the existing watercourses.



Figure 10: Area 2 – Existing Topography

### 3.1.9 Area 2 South

Area 2 South currently consists of agricultural land with additional agricultural land to the north. The southern boundary is defined by Whittle Brook flowing from east to west whilst a tributary flows along the northern and eastern boundaries

The area generally falls from north to south with a high level of 101m AOD in the northern corner whilst the south western boundary is generally at a level of around 88m AOD.

Figure 11 following shows the lie of the land and the existing watercourses.

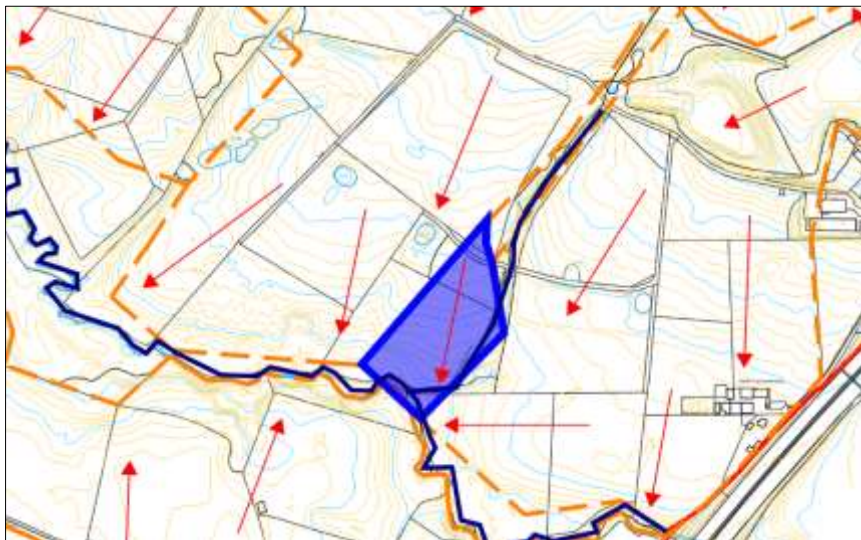


Figure 11: Area 2 South – Existing Topography

### 3.1.10 Area 3 North

Area 3 North currently consists of agricultural land with additional agricultural land to the south, and west. The northern and south eastern boundary is defined by Moss Hall Road beyond which is Birch Industrial Estate. The holding of Higher Barn is located along the western boundary and a dwelling believed associated with Broom Hill Farm straddles the southern boundary.

The area generally falls westwards towards Higher Farm although there is also a depression leading into the site from the western corner. There is a high level of 132m AOD along the eastern boundary with Birch Industrial Estate falling to 115m AOD along the western edge of the area. The depression is at a level of approximately 111m AOD and falls towards the west.

Figure 12 following shows the lie of the land and the existing watercourses.



Figure 12: Area 3 North – Existing Topography



### 3.1.11 Area 3 South

Phase 3 South currently consists of agricultural land and is surrounded by additional agricultural land to the north, east, and west. The south and south western boundaries are defined by the bank of Whittle Brook. The area is roughly bisected by a short distance of watercourse flowing south into Whittle Brook and an access track is present within the eastern portion of the area.

The area generally falls from the north eastern boundary towards Whittle Brook along the south western boundary. There is a high level of 109m AOD about the northern corner of the area and a low level of 91m AOD in the eastern corner.

Figure 13 following shows the lie of the land and the existing watercourses.

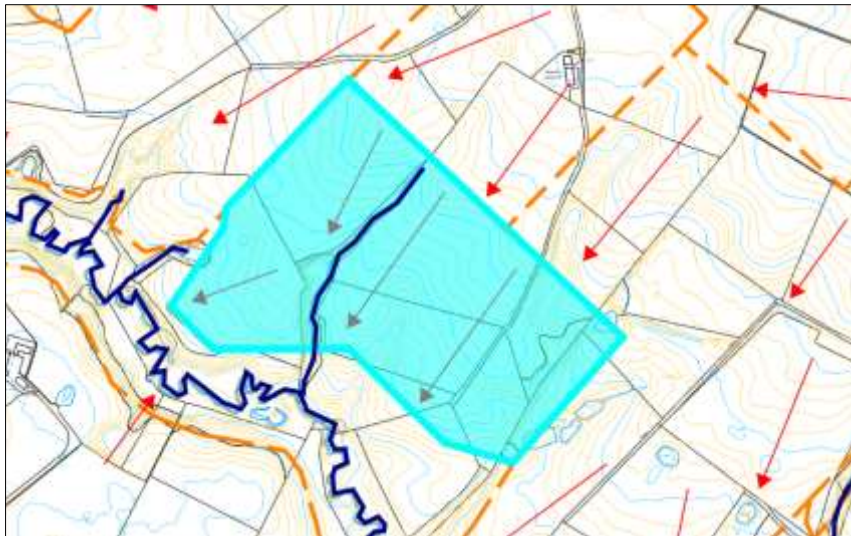


Figure 13: Area 3 South – Existing Topography

### 3.1.12 Area 3 West

Area 3 South currently consists of agricultural land and is surrounded by additional agricultural land to the north west and south east. The north western boundary is defined by Brightley Brook and a buried gas main; this gas main continues southwards through the area and separates the main area from a spur in the south western corner. The south eastern boundary is defined by Whittle Brook which converges with Castle Brook off the centre of the southern boundary and is renamed to Hollins Brook which then proceeds to flow towards the north west. Brightley Brook converges with Hollins Brook off the south western edge of the area.

The area generally falls from east to west with a high point of 114m AOD in the eastern corner and a low point of 88m AOD in the southern corner. The spur in the south western corner falls towards the rivers from a high level of 98m AOD to 90m AOD about the base.

Figure 14 following shows the lie of the land and the existing watercourses.

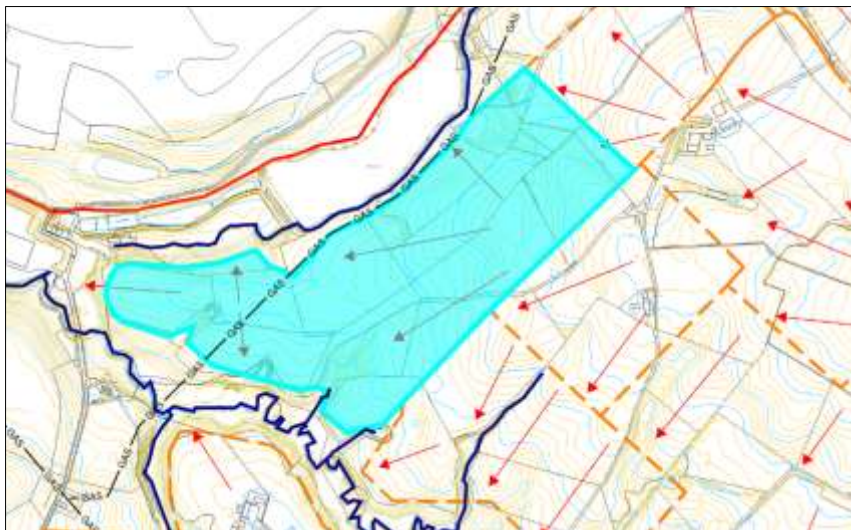


Figure 14: Area 3 West – Existing Topography

### 3.1.13 Area 3b North

Area 3b North currently consists of agricultural land with additional agricultural land to the east. The north western boundary is defined by Brightley Brook and the southern boundary by a tributary of the brook, the pair converge to the west of the area. An underground water main flows along the northern boundary.

The area generally falls from a high level of 110.5m AOD about the centre of the eastern boundary down to the watercourses and a level of 103m AOD in the north, 104m AOD in the west, and 107m AOD in the south.

Figure 15 following shows the lie of the land and the existing watercourses.

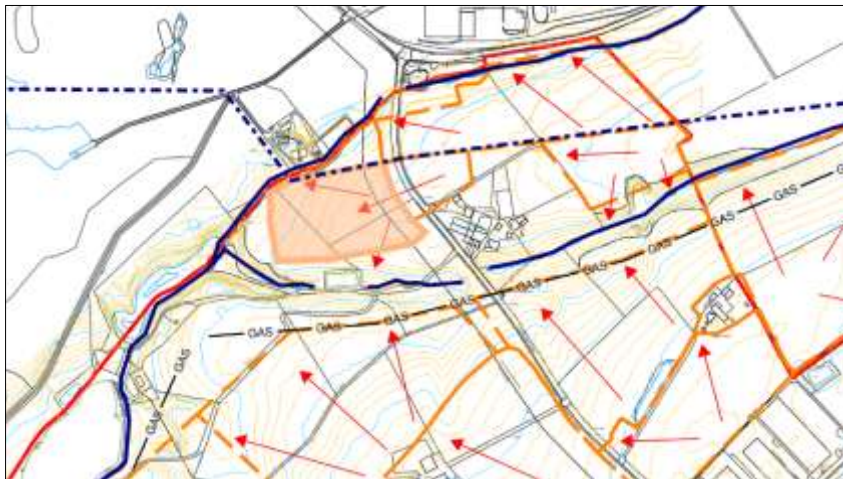


Figure 15: Area 3b North – Existing Topography

### 3.1.14 Area 3b South

Area 3b South currently consists of agricultural land with additional agricultural land to the north east, south west, and south east. Brightley Book and a tributary flow to the north east. The northern boundary is defined by the alignment of an underground gas main. The area is roughly bisected north to south by an access track and the holding on Higher Barn is off the south eastern boundary.

The area generally falls from a high level of 117.5m AOD about the centre of the south eastern boundary, around the area of Higher Barn, and falls away towards the north east. There is a low level of 103m AOD in the western corner of the area which rises along the boundary to 106m AOD where the boundary moves to follow the alignment of the gas main.

Figure 16 following shows the lie of the land and the existing watercourses.

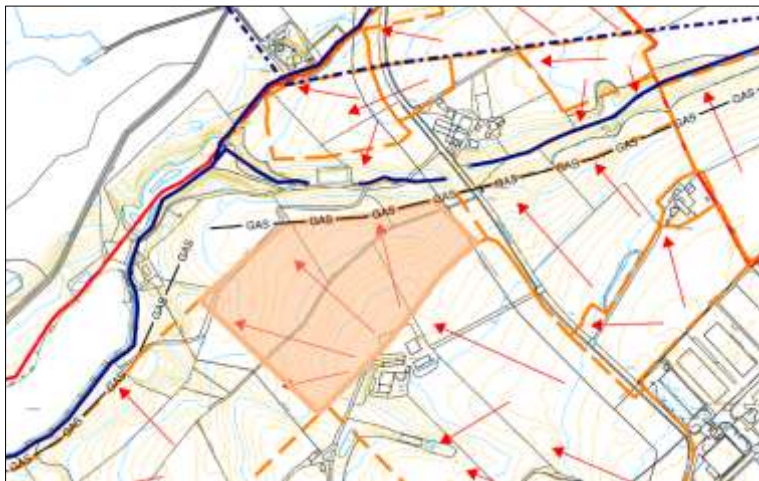


Figure 16: Area 3b South – Existing Topography



### 3.1.15 Area 4a East

Area 4a East currently consists of agricultural land with additional agricultural land to the north east and north west. The majority of the western boundary is defined by an ordinary watercourse which outfalls into Whittle Brook which flows east to west and defines the southern boundary. The southern portion of the eastern boundary is defined by the M62 and the northern portion by the holding of Whittlefold Farm from which access tracks extend into the area. The north eastern boundary is defined by Whittle Lane. Whittle Fold Smallholding is located within the south eastern portion of the area

The northern part of the area has a high point of 130m AOD from which it falls in all directions to a level of around 125m AOD. The southern area falls from the main access track leading out of Whittlefold towards Whittle Brook in the south. The access track is generally at a level of 115m AOD with a longfall towards the west. The area has a low level of 88m AOD in the south western corner rising to 92m AOD in the south eastern.

Figure 17 following shows the lie of the land and the existing watercourses.

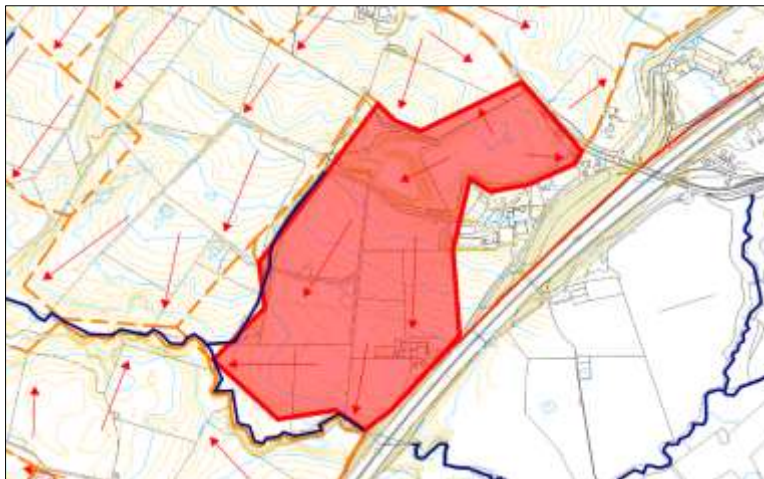


Figure 17: Area 4a East – Existing Topography

### 3.1.16 Area 4a West

Area 4a West currently consists primarily of agricultural land with additional agricultural land to the south. The holding of Thurston Fold is located within the northern section of the area with the access road cutting through the site. The western portion of the southern boundary is defined by Griffie Lane which provides access to a number of individual dwellings. The northern and eastern boundaries are defined by Whittle Brook whilst the western boundary is defined by Castle Brook.

The area generally falls towards the north, east, and west from a high point of 97m AOD positioned approximately at the junction with Griffie Lane and the access road to Thurston Fold. The area falls to around 90m AOD along all three sides.

Figure 18 following shows the lie of the land and the existing watercourses.

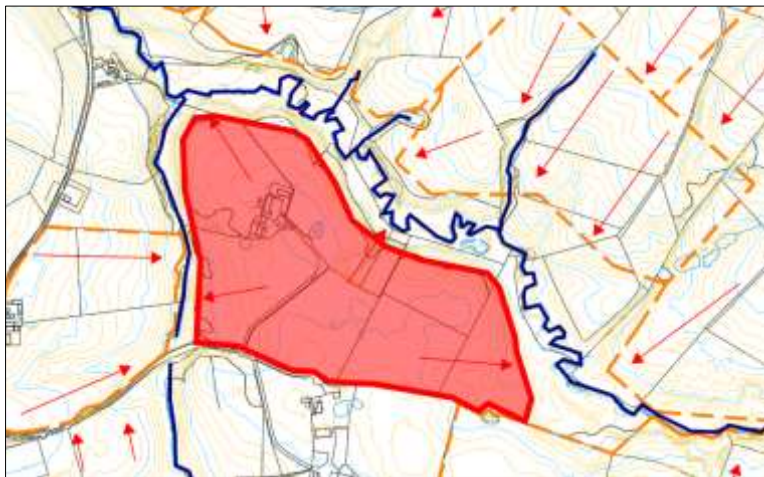


Figure 18: Area 4a West – Existing Topography

### 3.1.17 Area 4b

- Area 4b currently consists primarily of agricultural land with additional agricultural land to the north, south, and west. Birch Industrial Estate defines the south eastern boundary, the south western boundary is defined by Moss Hall Road, and the north western boundary is defined by the access road to the holding of Moss Hall which is located off the northern corner of the area.
- The area generally falls from a high point of 128m AOD about the centre of the south eastern boundary towards the south west and north west to low point of around 124m AOD and 126m AOD respectively.

Figure 19 following shows the lie of the land and the existing watercourses.



Figure 19: Area 4b – Existing Topography



### 3.1.18 Area A North

Area A North currently consists primarily of agricultural land with additional agricultural land to the south and west. The western portion of the southern boundary is shared with Pike Fold Golf Club, the eastern boundary is defined by the M62, and the northern boundary is defined by Whittle Brook. The southern boundary is defined by an underground gas main. The holding of Unsworth Moss Farm is located within the eastern portion of the southern boundary and an access road enters the area along the eastern boundary. A small pond is located within the north eastern portion of the area.

The eastern portion of the area falls back towards the centreline with a high level of 102m AOD about the centre of the western boundary falling to a valley line of around 90m AOD which is demarcated by a fence line approximately one third of the way into the area. The western portion of the area falls from a plateau of around 98m located in the centre of the area and falls away to all side with the most pronounced falls being eastwards into the previously mentioned valley line and northwards towards Whittle Brook. Low levels along the northern boundary range from 94m AOD in the far western corner to 86m AOD where the boundary meets Whittle Brook.

Figure 20 following shows the lie of the land and the existing watercourses.



Figure 20: Area A North – Existing Topography



### 3.1.19 Area A South

Area A South currently consists primarily of agricultural land with additional agricultural land to the north east. The northern boundary is shared with Pike Fold Golf Club and demarcated by a watercourse. The southern boundary is defined by the M62 and the western boundary by the M66. The holding of Unsworth Moss Farm is located along the north eastern boundary whilst the holding of Egypt Farm is located along the southern boundary adjacent to an additional tributary of Castle Brook. The north eastern boundary is defined by a buried gas main. These tributaries are classed as ordinary watercourses. The site is bisected from north east to south west by Egypt Lane which enters the area around the centre of the southern boundary and provides access to Egypt Farm and Unsworth Moss Farm.

The area generally falls towards the northern boundary shared with Pike Fold Golf Club. A significant mound in the southern portion of the area crests at 103m AOD. The site is otherwise relatively flat with a level of 91m AOD along the boundary with Pike Fold Golf Club and 94-97m AOD along the southern boundary with the M62 falling from south to north. The extension in the north of the area falls from a high point of 97m AOD in the northern corner to 91m AOD to meet the unnamed watercourse extending into the area.



Figure 21 following shows the lie of the land and the existing watercourses.

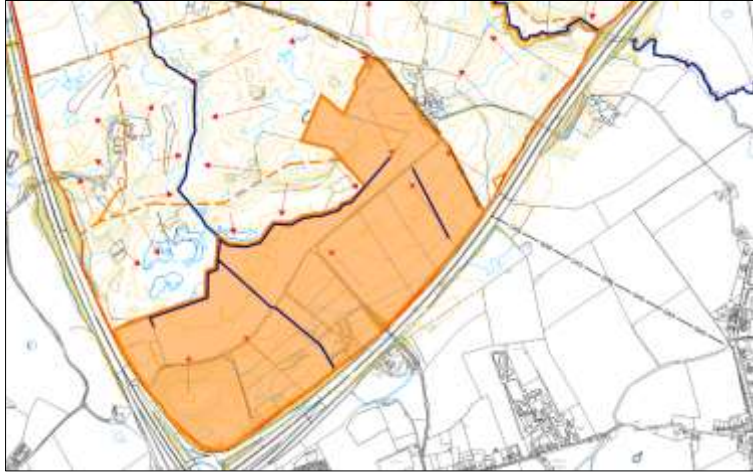


Figure 21: Area A South – Existing Topography

### 3.1.20 Area B South

Area B South currently consists of a portion of Pike Fold Golf Club. The remainder of the course lies to the north. The western boundary is defined by the M66. The southern boundary is defined by the unnamed watercourses that act as tributaries to Castle Brook which bisects the area and is classed as a main river flowing south to north. The eastern boundary is shared with agricultural land. Within the area are a number of ponds which have been constructed as water features of the golf course.

The area generally falls north to south with a high level of 100m AOD with mounds straddling the western and eastern edges of the northern boundary. The level along the southern boundary is generally 91m AOD whilst the bank levels of Castle Brook are around 90m AOD.

Figure 22 following shows the lie of the land and the existing watercourses.



Figure 22: Area B South – Existing Topography



### 3.1.21 Area B West

Area B West currently consists of a portion of Pike Fold Golf Club. The remainder of the course lies to the east and south. The western boundary is defined by the M66 and the northern boundary is shared with areas of agricultural land. The golf club house bisects the eastern boundary and a private residence is located in the southern portion of the area. The access road to both of these structures enters the site from the west via a bridge over the M66. A number of water features constructed as part of the golf course are located in the open space to the west of the club house.

The area generally falls from the southern boundary towards the north western corner of the area. The club house is sited on a plateau of 97m AOD and a mound straddling the far southern boundary has a crest level of 104m AOD. These fall to a low level of 90m AOD along the northern boundary.

Figure 23 following shows the lie of the land and the existing watercourses.



Figure 23: Area B South – Existing Topography

### 3.1.22 Area B Central

Area B Central currently consists of the remainder of Pike Fold Golf Club not contained within the southern and western portions of Area 3. The northern and eastern boundaries are shared with areas of agricultural land. The north eastern boundary is defined by the line of an underground gas main. The golf club house bisects the western boundary and the area is bisected by the Castle Brook main river which flows through the site south to north. A number of water features constructed as part of the golf course are located throughout the area.

The area generally falls towards Castle Brook, which bisects the site. The club house sits on a plateau of 97m AOD and is at the same level as the far eastern corner of the area. A mound straddling the south eastern corner of the area has a crest level of 100m AOD. Castle Brook represents the low points of the area falling from 89m AOD along the southern boundary falling to 87m AOD at the northern boundary.

Figure 24 following shows the lie of the land and the existing watercourses.



Figure 24: Area B Centre – Existing Topography

### 3.1.23 Residential

The Residential area currently consists primarily of agricultural land with pair of private residences located about the centre of the western boundary. Additional agricultural lies to the north and south. The eastern boundary is defined by Castle Brook and the western boundary by Castle Road and Griffie Lane the latter of which also defines the southern boundary.

The area generally falls from west to east with a high level of 100m AOD to 101m AOD along the western boundary falling to 83m AOD in the north eastern corner of the area.

Figure 25 following shows the lie of the land and the existing watercourses.



Figure 25: Area 3 Centre – Existing Topography



### 4.0 Flood Risk

A review has been undertaken of the Environment Agency (EA) Flood Maps for Planning; the Bury, Rochdale, and Oldham joint Strategic Flood Risk Assessment and associated mapping to identify potential sources of flood risk to the development alongside other relevant reports and documentation.

#### 4.1 Fluvial Flood Risk

The EA Main River Map identifies that there are 4 no. watercourses within the GMA 1.1 boundary that are classified as Main Rivers, namely Hollins Brook, Whittle Brook, Castle Brook, and Brightley Brook. A further main river, Gigg Brook, flows east to west to the north of the site but is not considered to directly affect or be affected by the development.

Whittle Brook drains through the site flowing from south east to north west. It drains areas to the east of Birch Industrial Estate (where it is classed as an ordinary watercourse) and areas to the south of Birch Services; from this point onwards, it is classified as a main river. Site topography identifies that land falls into the brook as it proceeds through the development and therefore it is considered to provide land drainage to the existing site on both sides of the M62. Mapping would indicate that Whittle Brook has a confluence with Brightley Brook around the location of the existing Garic Ltd offices in the north western area of the development.

Castle Brook drains through the site south to north and has a confluence with Whittle Brook approximately 400m upstream of the latter's confluence with Brightley Brook. For its length the brook is offset from the M66 by approximately the same distance of 400m with its source being about the slip road for Junction 18 of the M62 where it is classified as an ordinary watercourse; it is classified as a main river from the point it enters Pike Fold Golf Club.

Brightley Brook has 2 sources from Pilsworth Road and the far side of Birch Industrial Park, the former flows along the southern edge of Pilsworth Rd

whilst the latter defines the northern interface between the Northern Gateway and South Heywood schemes. The brook flows from east to west through the site with a public footpath along the right-hand bank. Furthermore, there is a series of ponds and an engineered reservoir upstream of the Garic Ltd offices. Brightley brook is then culverted, and the alignment is assumed to be under the Garic Ltd service yard and converges with Hollins Brook on the eastern side of the M66 and returns to open channel to the west of the M66. Hollins Brook is a tributary of the River Roch which in turn outfalls into the River Irwell.

The Main Rivers as classified by the EA are indicated in Figure 26 following.

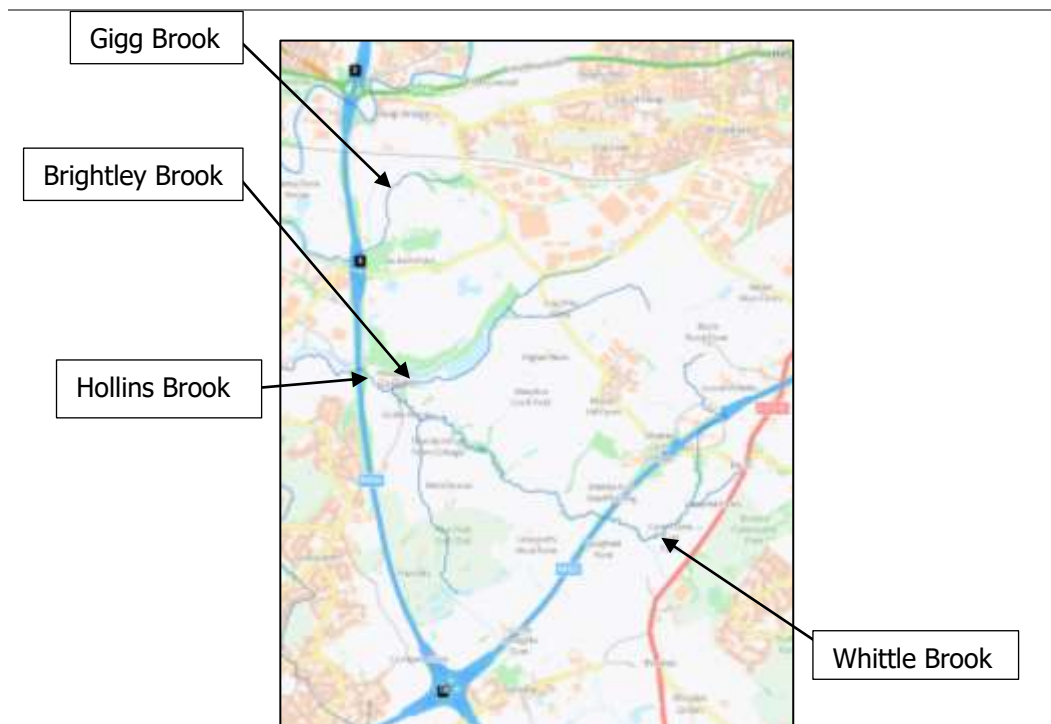


Figure 26: Extract from EA Main River Map (Nov. 2019)

The EA updated flood map for planning identifies that the majority of the site is located within Flood Zone 1 (i.e. land assessed as having a lower than 1 in 1000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP)) in any one year). However, there are areas along the banks of both Whittle Brook and Brightley Brook that have been identified as being located within areas of Flood Zone 3 (i.e. land with a  $\geq 1.0\%$  AEP of



river flooding occurring). However, as there will be a requirement to provide an 8m easement either side of watercourses within the site, the presence of these areas of Flood Zone 3 do not present any additional restrictions to the development.

The development is predominantly for industrial/commercial use but there is an area of residential dev for circa 200 dwellings in west part of site at Castle Brook. In terms of climate change allowances for the scheme the industrial/commercial and residential elements must be assessed separately. The industrial/commercial use should be assessed with a lifespan through to 2069 and the residential should be assessed with a lifespan through to 2119. In accordance with the EA peak river flow allowance for the North West River Basin, the industrial/commercial areas should be assessed with a 25% to 30% allowance and the residential should be assessed with a 35% to 70% allowance. This has not been considered as part of this initial investigation and correspondence with the Environment Agency has confirmed that they have no modelling within the site. Therefore, additional modelling will be required during detailed design and plot specific flood risk assessments. There is a risk that any future modelling of these watercourses could alter the extent of the EA Flood Zones and this will be considered at the time.

Figure 27 following shows the extent of flooding as indicated on the EA Updated Flood Map for Planning.





**Figure 27: Extract from Updated Flood Map for Planning (Nov. 2019)**

## 4.2 Surface Water and Overland Flows

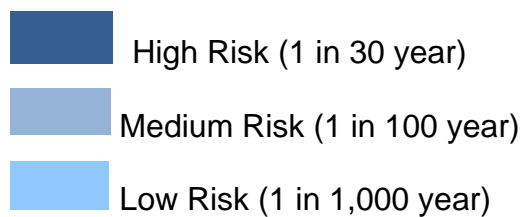
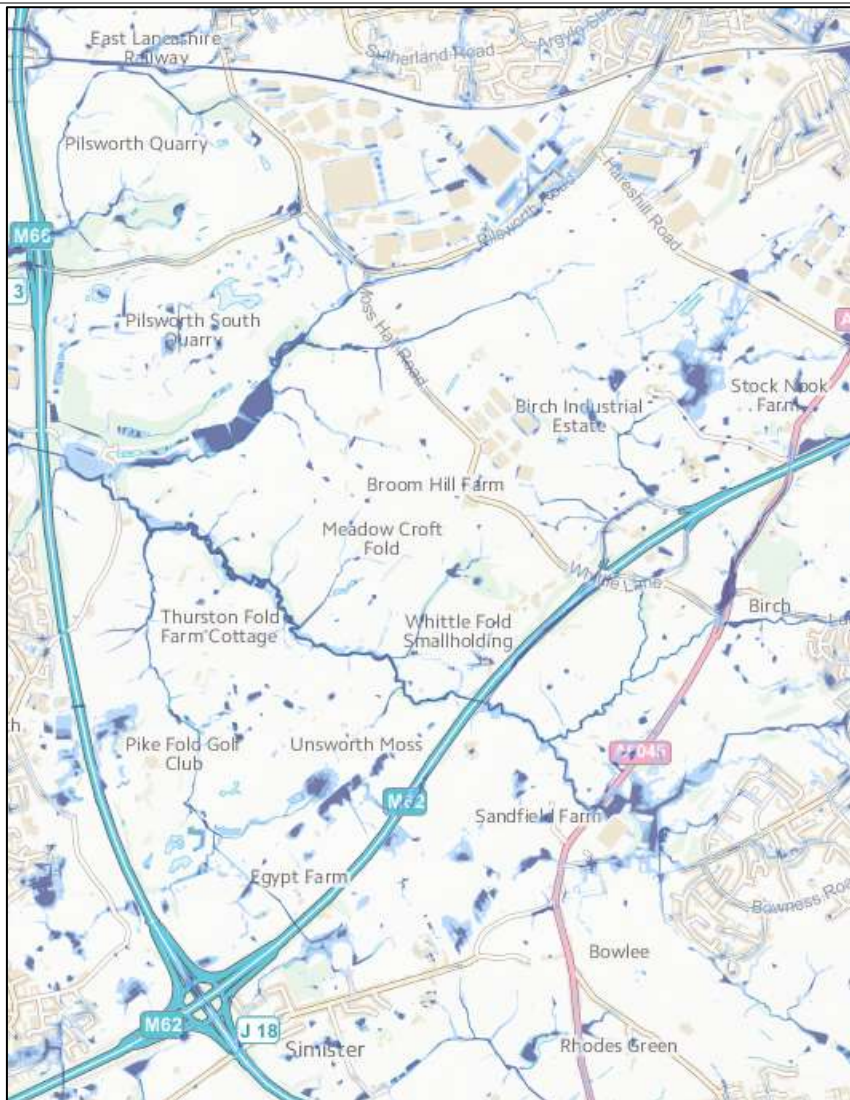


Surface water flooding occurs where high rainfall events exceed the drainage capacity in an area (i.e. sewer system and/or watercourse), leading to flooding.

The majority of the sub-areas drain overland to existing watercourses, as identified in Section 3.1 of this report.

An extract of the Environment Agency's Updated Flood Map for Surface Water is shown in Figure 28 below, where it can be seen that there is an intricate network of overland flows and ponding throughout the site at various levels of risk. In general, these flows are of low risk and can be considered as runoff from agrarian land into the watercourses described above. There is an area at high risk of localised ponding to the west of Stock Nook Farm. It is essential that the future developments maintain the natural overland flow routes and design out the areas of ponding which would present a flood risk to structures in that area.





**Figure 28: Development Wide Extract from Updated Surface Water Flood Map for Planning (Nov. 2019)**

### 4.3 Groundwater Flooding



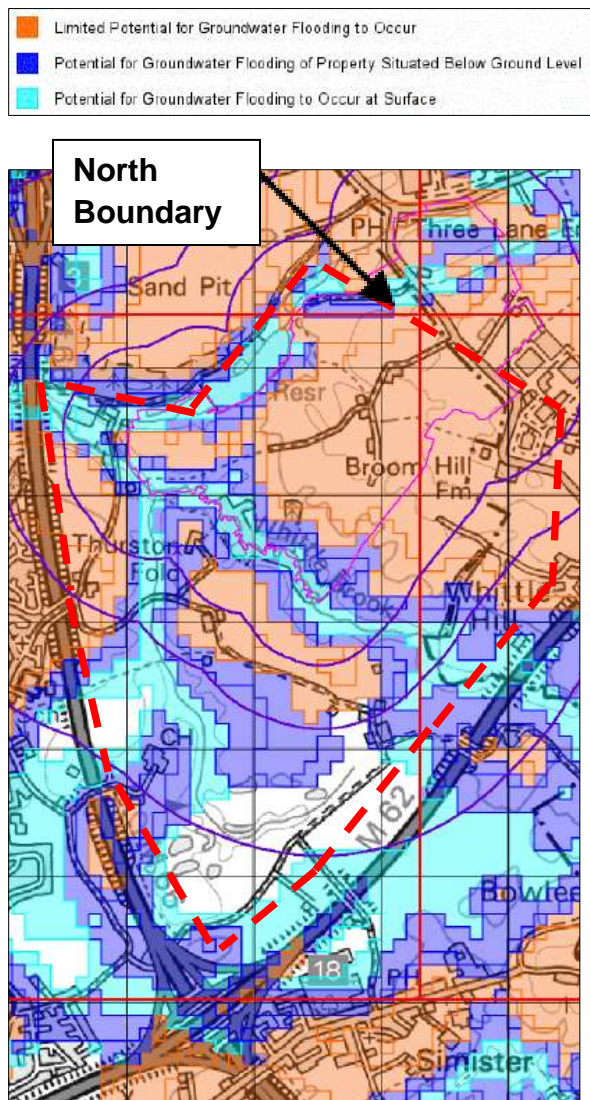
The Bury, Rochdale and Oldham Strategic Flood Risk Assessment dated November 2009 details that there have been relatively few reported incidents of groundwater flooding in the areas and did not identify any substantial evidence of groundwater flooding occurring in the region.

Geological maps for the area indicate that Glacial Till drift underlies the majority of the GMA 1.1 site, however, is not present in the north-east. There are localised areas of glacial fluvial deposits, moraine, head, peat and ice contact deposits above the Glacial Till and Bedrock.

The soils at the site are classified as having low to high leaching potential. The Peat and Glaciofluvial Deposits typically have high leaching potential, whereas the leaching potential of the Glacial Till is low.

The British Geological Survey Groundwater Flood Map (shown in Figure 13 following) shows that there is potential for groundwater flooding.

It is therefore considered that there is a localised risk of groundwater flooding at and below ground level across parts of the GMA 1.1 site. Notwithstanding this, Finished Floor Levels will be set appropriately to mitigate against any groundwater flood risk issue and to facilitate the required use of the building. Where necessary local land drainage systems will be designed and installed to lower the risk of groundwater flooding in proximity to the development plateaus. Where appropriate waterproofing and anti-flotation measures can be made to any below ground structures, to reduce the impact of high ground water. The exact measures to be implemented will need to be considered further at detailed design. Figure 29 following indicates areas where there may be potential for groundwater flooding to occur.



**Figure 29: BGS Groundwater Flood Map (2017)**

#### 4.4 Reservoir Flooding

Although the probability of a catastrophic dam failure is considered to be extremely rare, the consequences of such an event would be severe. A review of the EA online map of ‘Risk of Flooding from Reservoirs’ identified that parts of the site would be at risk of flooding during a reservoir failure to depths of up to 2m.

Although the potential for a reservoir failure cannot be discounted it must also be noted that such an event would require a highly exceptional convergence

of circumstances and so the actual risk posed to the development from the failure of a reservoir and any subsequent flooding is considered to be low. All reservoirs greater than 25,000m<sup>3</sup> are regularly monitored and inspected by a certified Panel Engineer, in-line with the Reservoirs Act 1975. Responsibility lies with reservoir owners, and failure to carry out adequate inspections is a criminal offence.

Figure 30 following shows the EA reservoir flood map for the area.



**Figure 30: EA Reservoir Flood Map for Planning (Nov. 2019)**

#### 4.5 Sewer Flooding

As the land being used for the development consists almost exclusively of agrarian land and there is no formal sewerage network over the vast majority of the area.



## Northern Gateway – High Level Constraints – Area GMA 1.1

United Utilities sewer records from areas around the development suggest that there is no publicly adopted sewerage network within or in the immediate surrounds of the site boundary. This has been supported by observations on Google Street view where the only sewerage that could be identified in surrounding roads was highway drainage, which falls under the remit of the local highway authority.

It is understood that existing farms within the development area are drained to private septic tanks or similar non-mains sewage systems whilst the Birch Industrial Park within the development area and Heywood Distribution Park to the north east of the development drain to private sewage treatment plants as identified in Figure 31 following.

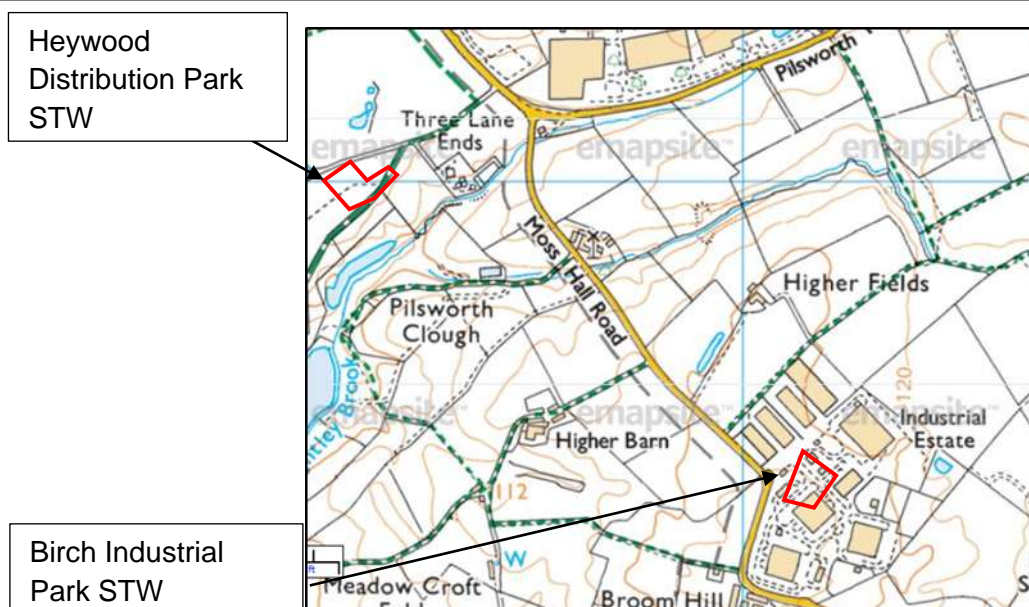


Figure 31: Location of Private Sewage Treatment Works

Additionally, there remains the potential for additional private drainage networks to be within the development that have not been identified at this stage and this will need to be confirmed through future topographic surveys.

At this stage, considering all of the above, it is assumed that the site is at low risk of sewer flooding.



A copy of the public sewer records provided by United Utilities has been included within Appendix C.

#### **4.6 Greater Manchester Strategic Flood Risk Management Framework**

The Strategic Management Framework published September 2018 did not identify any additional potential sources of flood risk to the site.

#### **4.7 Bury, Rochdale, and Oldham Joint Strategic Flood Risk Assessment**

The Strategic Flood Risk Assessment (SFRA) jointly published in November 2009 included a review of DG5 records provided by United Utilities detailing internal and external flooding of properties caused by sewers.

No other additional information was noted during the review of the SFRA.



## 5.0 Preliminary Design Considerations

### 5.1 Flood Risk

As described in Section 4.0 of this report, other than the risk of fluvial flooding (which is retained within the 8m easement on the banks of the main rivers passing through the development), the main flood risk to the GMA 1.1 area is groundwater flooding. There is also a risk of flooding from surface water and overland flow routes that will need to be mitigated as each phase of the development is brought forwards.

The main design considerations to mitigate the flood risk are:

- Maintain an 8m clear zone either side of any Main River;
- Existing main rivers and subsidiary watercourses should be maintained in open channel with culverting and or major diversions avoided where possible;
- Existing rivers and watercourses should form an integral element to any future development. Consideration should be given to green / blue corridors centred around the natural channels of the watercourses. This would provide a cost effective and efficient method of delivering flood risk mitigation, SuDS features, habitats and biodiversity throughout the development area;
- It is likely that ground levels will be adjusted during development, altering overland flow routes and areas at risk of flooding. It is essential that futures plans for the development phases take into account the overland flow routes, groundwater flood risk and potential areas of ponding. Surveys of watercourses and areas of standing water may be required during the design stages to fully understand flow paths across the area, noting that a topographic survey will offer a more accurate picture of the terrain rather than the LIDAR data used in producing the Surface Water Flood Map;



- Developers take into account the risk of reservoir flooding.

## 5.2 Local Planning Policies

The Northern Gateway development area falls within the boundaries of both Bury and Rochdale councils. Therefore, the policies of these councils were reviewed along with the Greater Manchester Combined Authority Policy of which both councils are a member.





### 5.2.1 Greater Manchester Spatial Framework

The Greater Manchester Spatial Framework (GMSF) details Manchester's future plan for homes, jobs and the environment. The draft GMSF published January 2019 notes that there are areas of flood risk within Manchester and presents policy GM-S 5 'Flood Risk and the Water Environment'. The policy states that efforts should be made to adopt natural flood management including the use of Sustainable Drainage System to minimise the impact of present and future flooding. Furthermore, discharge of surface water should be restricted to greenfield run-off rates or alternative rates specified in district local plans.

Area GMA 1.1 plus the area of the South Heywood Scheme are allocated within the draft Greater Manchester Spatial Framework published in January 2019 as GM Allocation 1.1 'Heywood/Pilsworth (Northern Gateway)'. This allocation and two others, GM 1.2 and GM 1.3, together form the wider 'Northern Gateway' cross-boundary strategic allocation (Policy GM Allocation 1).

The GMSF sets high level principles for the flood risk and drainage in the Greater Manchester area, these will need to be incorporated within the GMA 1.1 development. Policy GM Allocation 1.1 and the supporting text specifies that:

- A drainage strategy will be required to control surface water run-off from the site.
- Designed features should look to mimic the natural drainage features on the Development Site.
- Sustainable drainage features should be incorporated and include 'green and blue' infrastructure. These shall address both flooding and water quality issues.



- Whittle and Brightley Brooks should be enhanced as part of the development.
- Recreational areas should be incorporated into SuDS features.

### **5.2.2 Bury Unitary Development Plan**

Section 2 of the Bury Unitary Development Plan adopted August 1997 includes policy EN5/1 – New Development and Flood Risk. As part of this clause the council will not permit development where *such development would be at risk of flooding, would be likely to increase the risk of flooding elsewhere, or would adversely affect river flood defences.*



### **5.2.3 Rochdale Core Strategy 2016**

Policy G8 'Managing Water Resources and Flood Risk' seeks to ensure new development does not lead to any form of increased flooding locally or further downstream, does not impede natural water and flood risk management, is not detrimental to existing or potential flood storage areas, contributes where possible to alleviating existing flood risk, is itself well protected from flood risk and ensures prudent use of water resources.

## **5.3 Surface Water Drainage**

### **5.3.1 Surface Water Drainage Strategy**

In order to ensure that surface water runoff from the site does not cause an increase in flood risk, the management of runoff has been considered via a sequential approach, in line with Building Regulations and national planning policy.

The following options for the disposal of surface water runoff were considered, in order of preference:

- i) A soakaway or some other infiltration system – Based on the ground conditions details within Section 4.3, it is considered that the use of infiltration techniques may be viable across the GMA 1.1 Development Site. This is the preferential option to discharge surface water from the site. Localised ground investigations will be required to confirm infiltration potential.
- ii) A watercourse or tidal outfall – The majority of sub-areas drain overland to existing watercourses. It is therefore assumed that these will provide suitable points of surface water discharge for future developments.
- iii) A sewer – There are no public sewers within or adjacent to the Development Site although the new development is likely to be



provided with adoptable public sewers during the detailed development phases.

It is likely that infiltration will be widely used across the scheme, however, if infiltration is deemed unsuitable within an area connection can be made to regional surface water drainage systems that will outfall to the various watercourses flowing through the site.

Suitable points of discharge for future surface water run-off will be required for all development sub-areas. The allowable discharge rate will be restricted to the equivalent greenfield discharge rate. The greenfield Qbar discharge rate has been calculated as 7.73 l/s/ha taken about the centre of GMA 1.1 and whilst this may vary slightly across the site it is considered of sufficient accuracy at this stage.

In draining each plot within the new development, it will be necessary to design the drainage system such that there is not increase in flood risk to the plot, the surrounding plots, and the wider area for all events up to and including the 1 in 100 year storm event plus an allowance for climate change. In addition, the design should seek to maximise the use of Sustainable Drainage Techniques as required by national and local planning policies.

The greenfield runoff calculation is included as Appendix D.

### **5.3.2 Required Attenuation**

As the development will result in a significant increase in the impermeable area, on-site attenuation is likely to be required which may be provided in plot, phase, or development wide attenuation features.

The preferred and most economical solution is generally to provide a suitable sized attenuation basin, whilst maximising infiltration where feasible, within each phase of the development serving a number of plots and these would ideally be located adjacent to, and at a higher elevation than, their receiving watercourse.



The attenuation basins, which can be singular per individual development plot or a site wide attenuation feature can be designed as a dry basin or a pond which retains a shallow level of permanent water.

A preliminary set of estimates has been carried out based on the following parameters:

- Greenfield Run-off  $Q_{Bar}$  Rate – 7.73 l/s/ha (calculations within Appendix D)
- Assumed 85% impermeable land for industrial and commercial purposes
- Assumed 65% impermeable land for residential purposes

Therefore, the total permissible greenfield run-off rate for the total GMA 1.1 area is 3,411 l/s. Based off this Table 5.1 following indicates the initial estimate of the required attenuation with the supporting calculations included as Appendix E. In areas of the development proposed as industrial and commercial it is considered that a lifespan through to 2069 is suitable; Environment Agency guidance for peak rainfall intensity increase due to climate change over this period is +20%. In the residential area in the west of the development it is considered that the lifespan of the dwellings will extend to 2119, in this instance the Environment Agency guidance for peak rainfall intensity increase due to climate change is +40%. These allowances will be used in the hydraulic modelling developed to support the design of the urban drainage system.

**Table 5.1: Estimated Required Attenuation (Site-wide)**

Storm Event (AEP)	Discharge Rate (l/s/ha)	Estimated Required Attenuation (Assuming no infiltration) (m <sup>3</sup> per hectare)
1 in 30 (Commercial)	6.6	287
1 in 100 + Climate Change (Commercial)	6.6	510
1 in 30 (Residential)	5.1	224
1 in 100 + Climate Change (Residential)	5.1	488

For the 1 in 30-year storm event, approximately 287m<sup>3</sup> per hectare of attenuation is required in the commercial the GMA 1.1 site, and around 340m<sup>3</sup> per hectare in residential areas. These are initial estimates to inform high level design and accurate requirements will be specified during detailed design.

Additional storage will be required to cater for all additional storm events up to and including the 1 in 100 AEP plus climate change and this can either be provided by allowing temporary above ground flooding to hardstanding areas such as roads and car parks, or alternatively by increasing the size of the attenuation features..

The actual required attenuation will depend on the extent of the impermeable area in each phase and the infiltration properties of the soils throughout the site. If there is infiltration potential within the soil, this will reduce the volume





of attenuation required. This infiltration potential shall be determined through ground investigation in latter stages of the planning process.



## **5.4 Sustainable Drainage Systems (SuDS)**

The new development of the GMA 1.1 site offers opportunities to deliver a fully compliant SuDS design in relation to the surface water drainage of each site.

In order to comply with the national guidelines and policies set by the local authorities and the Non-Statutory Technical Standards for Sustainable Drainage, the design of the surface water drainage system should seek to maximise the use of SuDS techniques.

This section reviews the suitability of the different SuDS elements available across the development.

### **5.4.1 Potential for Infiltration**

As detailed in Section 4.3, Glacial Till underlies the majority of the GMA 1.1 site, with localised areas of moraine, head, Glacial Fluvial deposits, peat and ice contact deposits above it.

The Glaciofluvial Deposits, moraine and head deposits present may provide a level of permeability.

It is therefore considered that infiltration techniques may be viable on parts of the GMA 1.1 Development Site. As described previously, this is the preferential option to discharge surface water from the site and has the potential to reduce the attenuation requirements across the site.

Ground conditions will need to be confirmed by ground investigation on a more localised basis as the GMA 1.1 development plans progress, to determine where infiltration of surface water may be utilised.

A Geology Plan displaying the local ground conditions is included within Appendix F and historic mapping identifying the bleach factory as Appendix G.

### **5.4.2 The SuDS Management Train**

The overarching principle of a SuDS system is to minimise the impacts arising from the development on the quantity and quality of the development surface water run-off, whilst at the same time replicating the natural drainage from the site before development.

The key objectives of SuDS are to minimise the impacts from the development on the quantity and quality of run-off and to maximise amenity and biodiversity opportunities.

The accepted SuDS management train consists of three elements:

- Source Control: Water butts, green roofs, filter drains, pervious surfaces, swales.
- Site Control: Swales, ponds, wetlands, infiltration devices
- Regional Control: Basins, ponds, wetlands, and reservoirs

The following is an illustration of the SuDS principles and how they may be applied to a development via a SuDS Management Train.

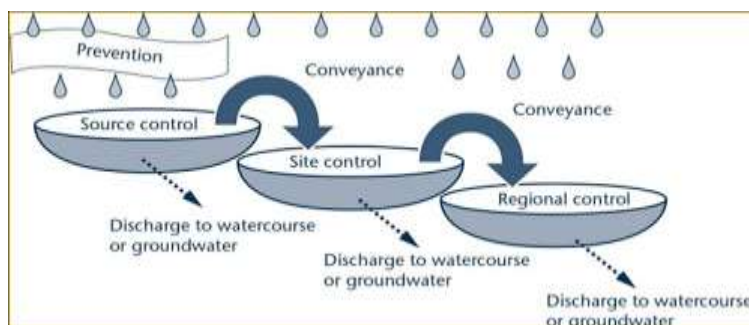


Table 5.2 following reviews the suitability of different SuDS elements within the site. Note development plans, and therefore applicable SuDS elements, are indicative at this stage.



Table 5.2 – Review of SUDS Options

Type of SuDS	Description	Description	Applicability to the Site
<b>Source Control</b>	Water butts	Small storage tanks on each individual housing unit.	This may be appropriate for the residential areas of the site.
<b>Source Control</b>	Rainwater harvesting	Recycling of water from roofs and impermeable areas.	May be appropriate for the site.
<b>Source Control</b>	Green roofs	Vegetated roofs that reduce runoff and remove pollutants.	May be appropriate for the commercial areas the site.
<b>Source Control</b>	Pervious surfaces	Permeable surfaces that allow surface water inflow into underlying basal stone drainage systems.	May be appropriate for the site.
<b>Site &amp; Regional Control</b>	Filter drains	Linear drains or trenches filled with granular material.	May be appropriate for the site dependent on local ground conditions.
<b>Site &amp; Regional Control</b>	Swales	Vegetated channels to convey store and treat runoff.	May be appropriate for the site.



<b>Site &amp; Regional Control</b>	Basins/ponds	Shallow areas of open space that temporarily hold water and collect silt.	May be appropriate for the site.
<b>Site &amp; Regional Control</b>	Infiltration basin	Shallow depression that stores runoff before it infiltrates into the subsoil.	May be appropriate for the site dependent on local ground conditions.
<b>Site &amp; Regional Control</b>	Infiltration devices	Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground.	May be appropriate for the site dependent on local ground conditions.





### 5.4.3 Water Quality

The SuDS design should seek to provide an appropriate management train of SuDS components to effectively mitigate the pollution risks associated with the different site users.

Within the GMA 1.1 development area, there are two key drivers with respect to pollutant risks from surface water runoff:

- Pollution from building roofs;
- Pollution from areas of hardstanding such as yards, parking areas, and highways;

In accordance with Table 26.2 of The SuDS Manual, as summarised in Table 5.3 following, the pollution hazard level will vary with each plot due to the variety of potential uses. With the potential for land uses with a 'High' hazard level a specific, detailed risk assessment will be required which is beyond the scope of this report and should be considered at an individual plot level when relevant. Therefore, the maximum hazard level to be considered is 'Medium' and the requirements for discharge to surface waters state that the 'Simple index approach' should be used.

Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use, as set out in Table 5.3 following.

**Table 5.3 – Pollution Hazard Indices**

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
<b>Residential roofs</b>	Very Low	0.2	0.2	0.05
<b>Other roofs (typically commercial/industrial roofs)</b>	Low	0.3	0.2 – 0.8	0.05
<b>Individual property driveways; residential car parks; low traffic roads; non-residential car parking with infrequent change</b>	Low	0.5	0.4	0.4
<b>Commercial yard and delivery areas; non-residential car parking with frequent change; all roads except low traffic roads and trunk roads/motorways</b>	Medium	0.7	0.6	0.7
<b>Sites with heavy pollution (e.g. haulage yards, lorry parks, approaches to industrial estates); sites where chemicals and fuels are to be delivered, handled, stored, used, or manufactured; industrial sites; trunk roads and motorways</b>	High	0.8	0.8	0.9



Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the required pollution hazard index identified within Table 4.2.

Table 26.3 of The SuDS Manual states the various mitigation indices for discharges to surface waters. Table 26.4 provides mitigation indices when considering discharge via infiltration but, due to current uncertainty regarding the effectiveness of this method throughout the site, has not been included here. As plans for the GMA 1.1 development are indicative at this stage, it is not possible to determine the exact SuDS management strategy and treatment processes that will be implemented on the site. For reference, the treatment properties for the SuDS elements detailed in Table 5.2 previously can be seen in Table 5.4 following. It is clear that a SuDS network consisting of multiple features and incorporating all three elements of the management train will be required in order to effectively treat surface water runoff from the GMA 1.1 development to a level safe to discharge.

**Table 5.4 – SuDS Mitigation Indices for Discharge to Surface Water**

Types of SuDS component	TSS	Metals	Hydrocarbons
<b>Filter Strip</b>	0.4	0.4	0.5
<b>Filter Drain</b>	0.4	0.4	0.4
<b>Swale</b>	0.5	0.6	0.6
<b>Bioretention System</b>	0.8	0.8	0.8
<b>Permeable Pavement</b>	0.7	0.6	0.7
<b>Detention Basin</b>	0.5	0.5	0.6



<b>Pond</b>	0.7	0.7	0.5
<b>Wetland</b>	0.8	0.8	0.8

Provided that when the sum of the mitigation indices of the treatment techniques being provided are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving system. It must be noted that the mitigation index of each SuDS component downstream of the initial component will be reduced by 50%.

#### 5.4.4 Maintenance of the Drainage System

In order for the SuDS elements to work effectively, ongoing maintenance of the drainage system will be required. Depending on the drainage adoption strategy, the maintenance will be undertaken by either the local water authority (United Utilities), the local authority, or an approved management company.

United Utilities adopted the Sewerage Sector's Design and Construction Guidance in April 2020 that has been produced as a requirement of OFWAT's Adoption code. A major change in the guidance is that, for the first time, guidance is provided that on the type of SuDS that will be made adoptable (by meeting the definition of a sewer) through the DCG's implementation by water companies in England.

It will be the responsibility of the drainage engineer to produce a maintenance schedule for the SuDS features on each plot or phase as the respective plans are developed.

## 5.5 Foul Drainage



### 5.5.1 Existing Foul Drainage

Copies of the United Utilities public sewer records have been obtained for areas around the development and from these and the agrarian use of the site, it has been concluded that there are no public foul water sewers within the development area.

The nearest United Utilities Sewage works is the Bury Wastewater Treatment Works located approximately 2 km to the west of the development.

As discussed in Section 4.5, the existing farms within the development are understood to drain to private septic tanks or similar non-mains sewerage systems whilst the Birch Industrial Estate and Heywood Distribution Park drain to privately maintained sewage treatment plants within the development site.

Copies of the United Utilities Sewer Records are contained within Appendix C.

### 5.5.2 Foul Water Drainage Strategy

#### Connection to Existing Public Network

The preferable foul water strategy is to discharge foul flows to the existing public sewer network.

UU have a responsibility to permit the connection of consented development to their network at development boundaries, even if new downstream infrastructure / upgrades are required. UU recover the reasonable costs of new connections via infrastructure charges that will be applied by UU when new properties connect to their network. These charges help fund downstream reinforcement to water and wastewater networks to provide the capacity needed for the development.

It is anticipated that Developers will need to construct foul water drainage infrastructure within the site up to the boundary / point of discharge specified



by UU. UU have been engaged through the Greater Manchester Infrastructure Board forum and consultation is continuing to determine appropriate points of discharge to coordinate with the wider upgrade works of the public sewer network in the region.

Where it is necessary or economic to connect the site infrastructure to the public sewer network by means of a pipeline through third party land, and third party agreement to such a pipeline is not forthcoming, a connection across the third party land can be requisitioned from UU who will then use their statutory right to lay public sewers through the third party land.

It is recommended that the foul water drainage infrastructure within the development boundary should be designed and constructed in-line with Sewers for Adoption guidelines and put up for adoption under S104 applications to UU.

All points of connection to the public sewer system will be under S106 applications to UU. An S106 application to connect a new larger sewer into an existing smaller sewer will not be permitted.





## 6.0 Constraints and Opportunities

### 6.1 Constraints

#### 6.1.1 Surface Water

- Discharge is to be restricted to the greenfield run-off rate of 7.73 l/s/ha. (assuming no infiltration)
- At the restricted discharge rate it is estimated that 287m<sup>3</sup> per hectare and 224 m<sup>3</sup> per hectare of attenuation storage will be required in commercial and residential areas during 1 in 30 AEP storm event and 510m<sup>3</sup> per hectare and 488m<sup>3</sup> per hectare for commercial and residential areas for the 1 in 100 AEP storm event plus allowance for climate change. Attention is drawn to the fact that any body of water with an excess of 25,000m<sup>3</sup> of storage above ground level is classed as a reservoir and as such must meet the requirements of the Reservoirs Act 1975.
- No public surface water sewers have been identified within the site, therefore surface water run-off will be discharged into the ground through multiple infiltration structures or to the watercourses within the site at the limiting discharge rates. As these watercourses are classified as either main rivers or ordinary watercourses, consultations must be made with the Environment Agency and bespoke environmental permits applied for in the former and the Lead Local Flood Authority and land drainage consent applied for in the latter.
- Various parts of the site have been identified as a former bleach works, mill, various backfilled quarries and coal pit; it is considered highly unlikely that infiltration of surface water will be an environmentally safe option in these areas.



### 6.1.2 Foul Water

- No public foul sewers were identified within the development boundary, therefore foul water will be pumped to a new or existing point of discharge specified by United Utilities, outside of the development boundary.
- Consultations must be made with United Utilities to develop a cost-effective strategy for managing the discharge of foul flows from the development.

### 6.2 Opportunities

- The drainage strategy provides an opportunity to bring the GMA 1.1 Development in-line with the Greater Manchester Spatial Framework Policy. The drainage system should include a variety of SuDS features providing green/blue spaces (such as detention basins and swales). These shall address both flooding and water quality issues and be designed to mimic natural drainage features of the Development Site and provide recreational areas for the public.
- It is recommended that, due to the scale of the attenuation required, that this is provided in phase specific detention basins.
- Alternate SuDS options, such as wetlands, provide an opportunity to maximise biodiversity and maximise public open space.
- Infiltration may be possible across much of the GMA 1.1 Development Site subject to BRE365 compliant infiltration testing.



## 7.0 Conclusions

The Flood Risk and Drainage Constraints Assessment has determined that the GMA 1.1 development area is generally at low risk of flooding from fluvial sources. This is supported by the EA Flood Maps for Planning which indicate Flood Zones 2 and 3 are generally confined within the channels of the watercourses crossing the development and the remaining development is entirely in Flood Zone 1. The masterplan is being developed with due consideration for the existing topography, watercourses and rivers, and development plots are likely to be located with substantial offsets from these features. This provides the opportunity to create green/blue corridors adjacent to the alignments of these existing watercourses. Furthermore, this approach does not require the diversion of any of these existing watercourses and culverting works will be kept to a minimum and required only where there are highway crossings.

The report sets out the principles for how the scheme can be served for surface water drainage and it is proposed to comprehensively promote the use of sustainable drainage systems across the scheme to mitigate flood risk occurring from the development and to minimise pollution runoff into the receiving waterbodies. It is proposed that all SuDS features will comply with CIRIA C753, The SuDS Manual, and any requirements of the Lead Local Flood Authorities which will be either Rochdale Borough Council or Bury Council. It is proposed that the post-development discharge rates will be limited to existing greenfield and where possible the increase in volumetric run-off will be limited by the potential use of infiltration structures such as basins, soakaways, filter drains, etc. Where it is not possible to infiltrate to the ground the additional volume of run-off will be attenuated and discharged at existing greenfield rates. All surface water discharge points are proposed to connect to the existing watercourses in and around the development site as there are no surface water public sewers. This strategy is in accordance with



the hierarchy established in planning guidance, the SuDS Manual, and Building Regulations Part H.

Engagement with UU is proposed to establish a feasible regional foul drainage strategy which will rely upon upgrade works of the UU public sewer network and potentially to Bury Wastewater Treatment Works. It has been identified that the majority of the development site is likely to discharge to the Bury Wastewater Treatment Works to the west of the M66. Provision should be allowed for in the masterplan for a primary foul pump station to facilitate this strategy.

This Assessment demonstrates there are no flood risk or drainage constraints that would preclude the proposed development of Area GMA 1.1 and the site is suitable for allocation in the GMSF. The findings from the assessment should be used to inform the site masterplan as it is updated and refined.

Further detailed investigations and consultation with UU, the EA and the Lead Local Flood Authorities will be undertaken as part of the detailed design stage for any future planning application.



## 8.0 Appendices



## Appendix A - Report Conditions

- This Report has been prepared using reasonable skill and care for the sole benefit of Northern Gateway Development Vehicle LLP (“the Client”) for the proposed uses stated in the report by WYG Environment Planning Transport Limited (“WYG”). WYG exclude all liability for any other uses and to any other party. The report must not be relied on or reproduced in whole or in part by any other party without the copyright holder’s permission.
- No liability is accepted or warranty given for; unconfirmed data, third party documents and information supplied to WYG or for the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report. WYG does not purport to provide specialist legal, tax or accounting advice.
- The report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections'.
- Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times. No investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions. The “shelf life” of the Report will be determined by a number of factors including; its original purpose, the Client’s instructions, passage of time, advances in technology and techniques, changes in legislation etc. and therefore may require future re-assessment.

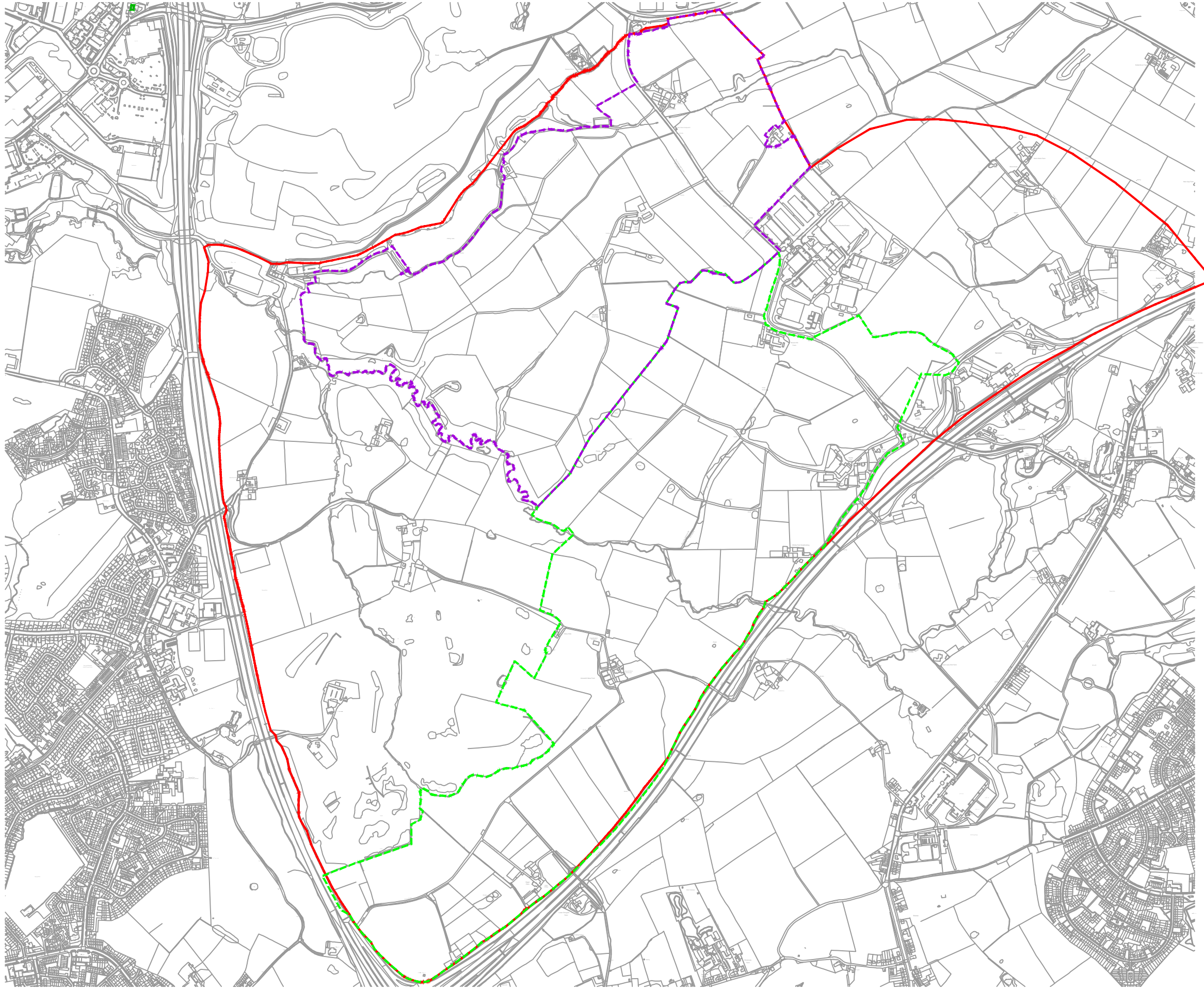




- The whole of the report must be read as other sections of the report may contain information which puts into context the findings in any executive summary.
- The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYG accept no liability for issues with performance arising from such factors.



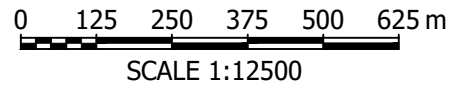
**Appendix B - Site Boundary Plan**



DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

KEY

- 2019 - SITE BOUNDARY PLAN GMA 1.1 (NORTH OF THE M62)
- 2017 AREA 1 BOUNDARY
- 2017 AREA 2 BOUNDARY



A	GMA 1.1 BOUNDARY UPDATED	CM	CM	PG	19.11.19
REV	DESCRIPTION	BY	CHK	APP	DATE

QUAY WEST at MediaCity UK  
 TRAFFORD WHARF ROAD  
 TRAFFORD PARK  
 MANCHESTER  
 M17 1HH  
 TEL: +44 (0)161 872 3223  
 FAX: +44 (0)161 872 3193  
 e-mail: manchester@wyg.com



Client:  
**NORTHERN GATEWAY DEVELOPMENT VEHICLE LLP**

Project: A104444-5  
**NORTHERN GATEWAY GMA 1.1**

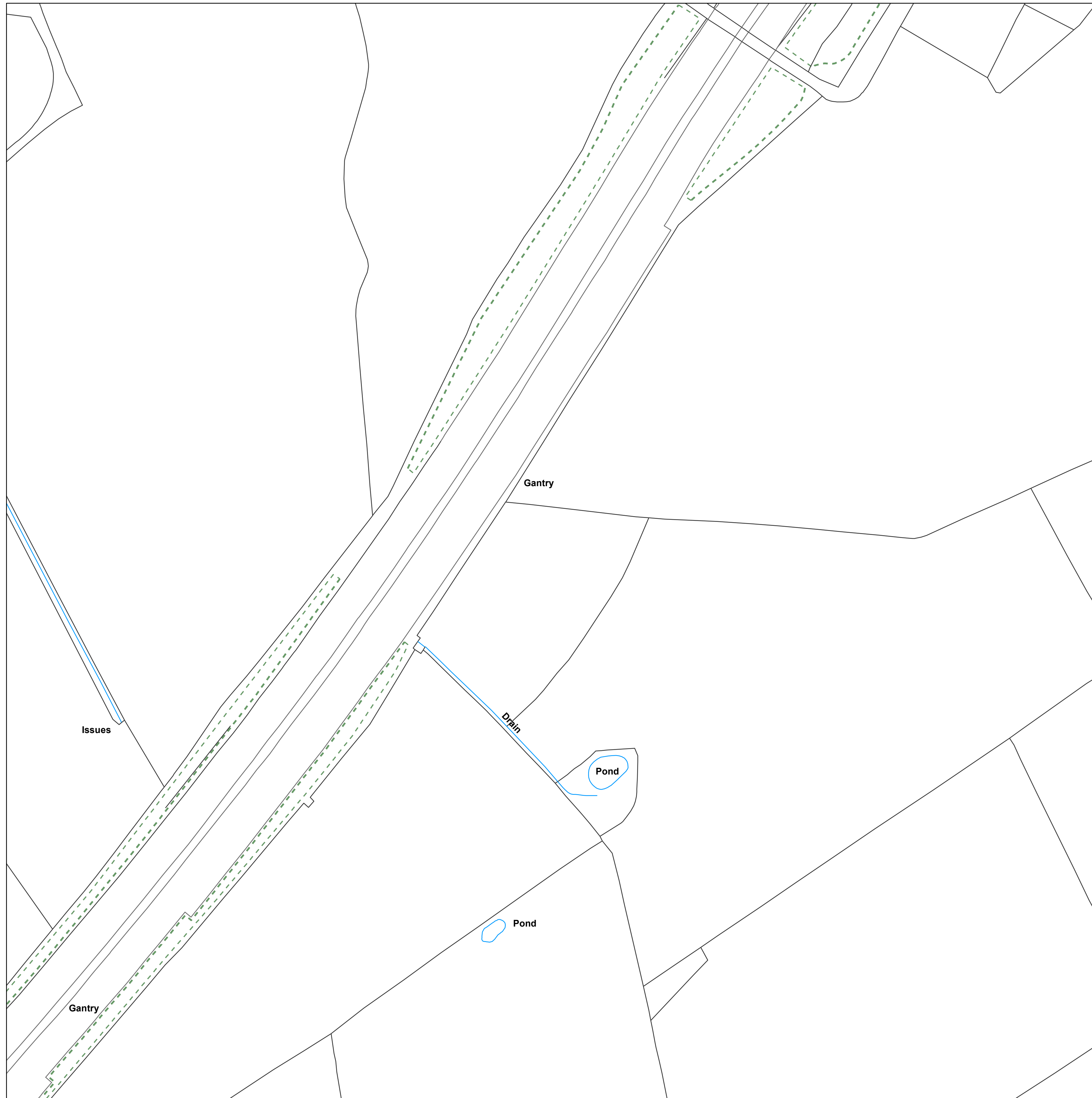
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**GMA 1.1 (NORTH OF M62) SITE BOUNDARY PLAN**

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Project No.	Office	Type	Drawing No.	Revision			
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**Appendix C - United Utilities Sewer Records**





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### WASTE WATER SYMBOLOGY

Foul	Surface	Combined	Overflow	Manhole
				Manhole, Side Entry
				Main Sewer, Public
				Main Sewer, Private
				Main Sewer, S104
				Rising Main, Public
				Rising Main, Private
				Rising Main, S104
				Highway Drain, Private

Foul	Surface	Combined	WW Site Termination	Sludge Main, Public
			Air Valve	Sludge Main, Private
			Cascade	Sludge Main, S104
			Non Return Valve	
			Extent of Survey	
			Flow Meter	
			Gully	
			Hatch Box	
			Head of System	
			Hydrobrake / Vortex	
			Inlet	
			Inspection Chamber	
			Bifurcation	
			Catchpit	
			Contaminated Surface Water	
			WW Pumping Station	
			Sludge Pumping Station	
			Sewer Overflow	
			T Junction/Saddle	
			LampHole	
			Oil Interceptor	
			PenStock	
			Pump	
			RoddingEye	
			Soakaway	
			Summit	
			Valve	
			Valve Chamber	
			Washout Chamber	
			DropShaft	
			WW Treatment Works	
			Septic Tank	
			Vent Column	
			Network Storage Tank	
			Orifice Plate	
			Vortex Chamber	
			Penstock Chamber	
			Blind Manhole	
			Screen Chamber	Control Kiosk
			Discharge Point	Unspecified
			Outfall	

### LEGEND

MANHOLE FUNCTION	
FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE	
CI	Circular
EG	Egg
OV	Oval
FT	Flat Top
RE	Rectangular
SQ	Square
TR	Trapezoidal
AR	Arch
BA	Barrel
HO	HorseShoe
UN	Unspecified

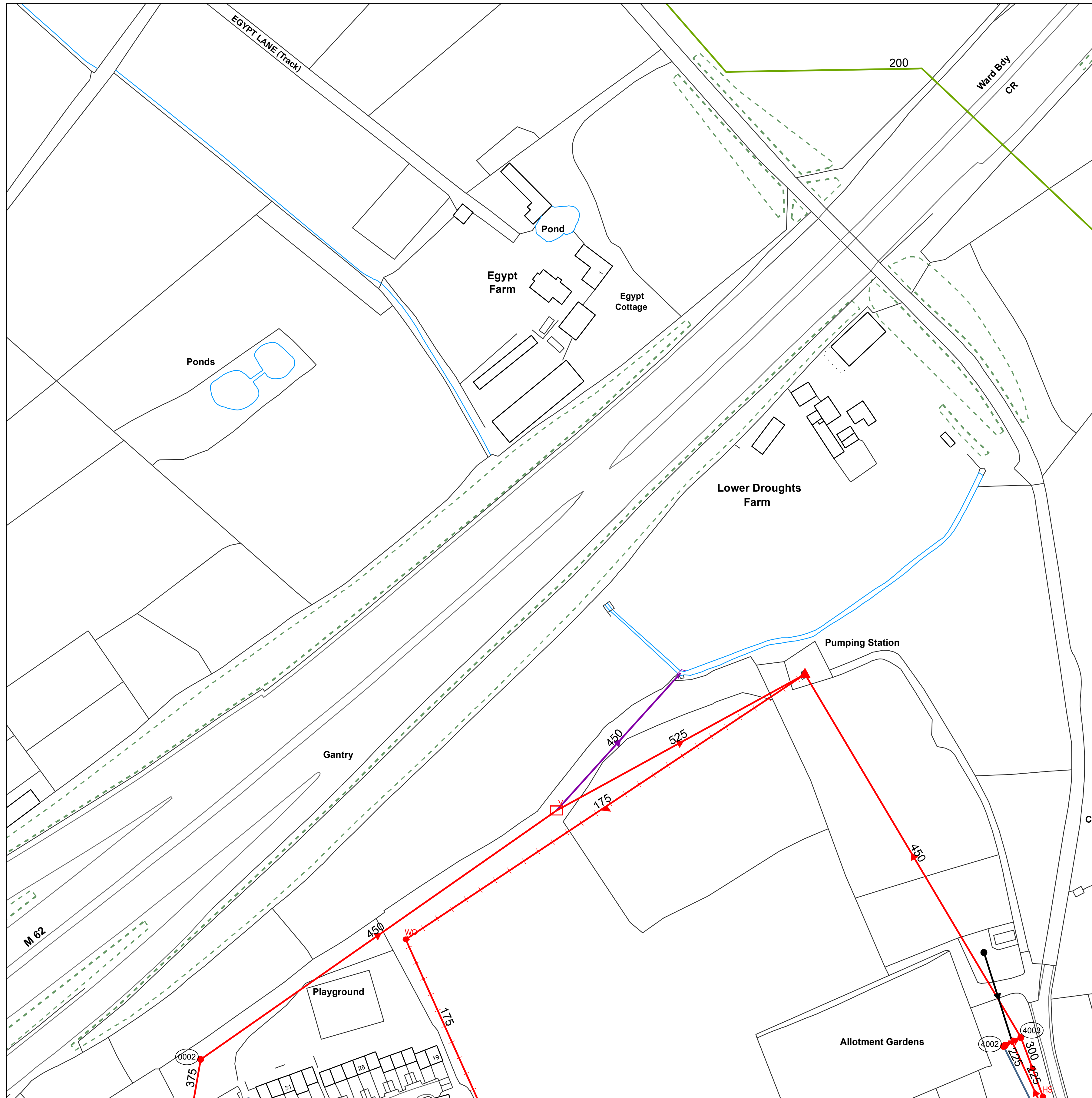
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown. Crown copyright and database rights [2016] Ordnance Survey 100022432.

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 Sheet 1 of 1







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4003		CO	0	450		CI	CO	193.73	
4004		CO	0	450		CI	CO	193.73	
4001		CO	0	450		CI	CO	193.73	
2101		CO	0	175		CI	PVC	219.71	
3102		CO	0	175		CI	PVC	219.71	

**WASTE WATER SYMBOLOGY**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**ABANDONED PIPE**

**MANHOLE FUNCTION**

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

**SEWER SHAPE**

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

**SEWER MATERIAL**

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
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 Sheet 1 of 1

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 Scale: 1:1250 Date: 18/07/2017







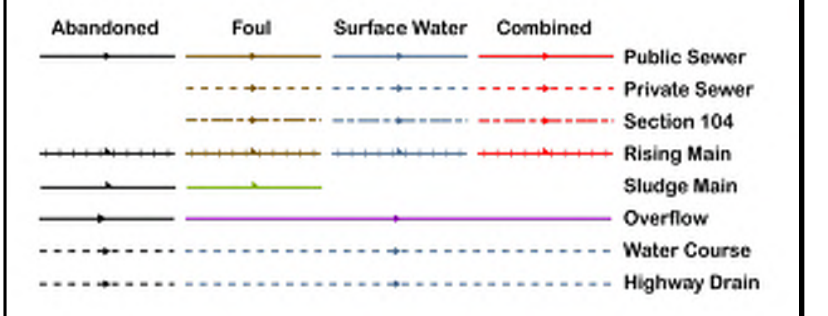
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Reho Cover Func Invert Size x Size y Shape Mat Length Grad

Reho Cover Func Invert Size x Size y Shape Mat Length Grad

**LEGEND**



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

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

**MANHOLE FUNCTION**  
 FO Foul  
 SW Surface Water  
 CO Combined  
 OV Overflow

**SEWER SHAPE**  
 CI Circular TR Trapezoidal  
 EG Egg AR Arch  
 OV Oval BA Barrel  
 FT Flat Top HO HorseShoe  
 RE Rectangular UN Unspecified  
 SQ Square

**SEWER MATERIAL**  
 AC Asbestos Cement  
 BR Brick  
 PE Polyethylene  
 RP Reinforced Plastic Matrix  
 CO Concrete  
 CSB Concrete Segment Bolted  
 CSU Concrete Segment Unbolted  
 CC Concrete Box Culverted  
 PSC Plastic / Steel Composite  
 GRC Glass Reinforced Plastic  
 DI Ductile Iron  
 PVC Polyvinyl Chloride  
 CI Cast Iron  
 SI Spun Iron  
 ST Steel  
 VC Vitrified Clay  
 PP Polypropylene  
 PF Pitch Fibre  
 MAC Masonry, Coursed  
 MAR Masonry, Random  
 U Unspecified

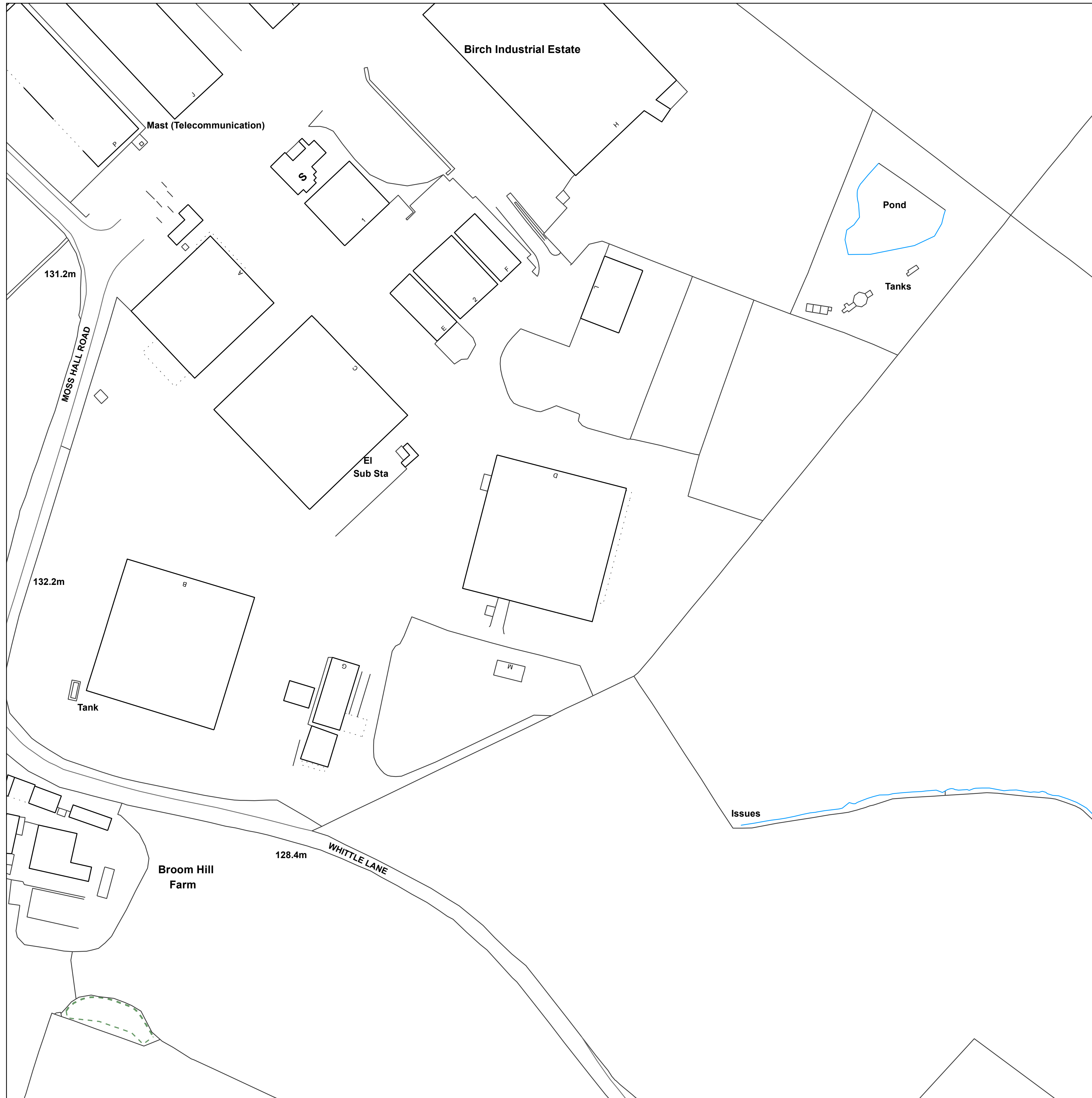
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**WASTE WATER SYMBOLGY**

Foul	Surface	Combined	Overflow	Manhole

Foul	Surface	Combined	WW Site Termination	Sludge Main, Public

**ABANDONED PIPE**

	MainSewer
	Rising Main
	Highway Drain
	Sludge Main

**LEGEND**

MANHOLE FUNCTION	
FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow
SEWER SHAPE	
CI	Circular
EG	Egg
OV	Oval
FT	Flat Top
RE	Rectangular
SQ	Square
TR	Trapezoidal
AR	Arch
BA	Barrel
HO	HorseShoe
UN	Unspecified
SEWER MATERIAL	
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PE	Polyethylene
RP	Reinforced Plastic Matrix
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CSU	Concrete Segment Unbolted
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PSC	Plastic/Steel Composite
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ST	Steel
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PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

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 Scale: 1:1250 Date: 18/07/2017



**Appendix D - Greenfield Run-off Calculation**

Calculated by:

Site name:

Site location:

**Site Details**

Latitude:

Longitude:

Reference:

Date:

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

**Runoff estimation approach**

**Site characteristics**

Total site area (ha):

**Methodology**

Q<sub>BAR</sub> estimation method:

SPR estimation method:

**Soil characteristics**

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

**Hydrological characteristics**

	Default	Edited
SAAR (mm):	1029	1029
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

**Notes**

**(1) Is Q<sub>BAR</sub> < 2.0 l/s/ha?**

When Q<sub>BAR</sub> is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

**(2) Are flow rates < 5.0 l/s?**

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

**(3) Is SPR/SPRHOST ≤ 0.3?**

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

**Greenfield runoff rates**

	Default	Edited
Q <sub>BAR</sub> (l/s):	7.58	7.58
1 in 1 year (l/s):	6.59	6.59
1 in 30 years (l/s):	12.88	12.88
1 in 100 year (l/s):	15.76	15.76
1 in 200 years (l/s):	17.96	17.96

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



**Appendix E - Initial Estimated Attenuation Requirements**

# Northern Gateway G1.1 Quick Storage Estimate



Discharge Rate - 3,411 l/s  
Impermeable Area - 450 ha

**Variables**

FSR Rainfall	Cv (Summer)	0.750
Return Period (years)	Cv (Winter)	0.840
30	Impermeable Area (ha)	450.000
Region	Maximum Allowable Discharge (l/s)	3411.0
England and Wales	Infiltration Coefficient (m/hr)	0.00000
Map	Safety Factor	2.0
M5-60 (mm)	Ratio R	0.319
18.600	Climate Change (%)	0
Ratio R		
0.319		

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Q30 – Parameters

**Results**

**Global Variables require approximate storage of between 116434 m<sup>3</sup> and 187211 m<sup>3</sup>.**

**These values are estimates only and should not be used for design purposes.**

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Q30 – Results



# Northern Gateway G1.1 Quick Storage Estimate



**Quick Storage Estimate**

**Variables**

FSR Rainfall	Cv (Summer)	0.750
Return Period (years): 100	Cv (Winter)	0.840
Region: England and Wales	Impervious Area (ha)	450.000
Map	Maximum Allowable Discharge (l/s)	3411.0
M5-60 (mm): 18.600	Infiltration Coefficient (m/hr)	0.00000
Ratio R: 0.319	Safety Factor	2.0
	Climate Change (%)	20

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Q100 + 20% Climate Change – Parameters

**Quick Storage Estimate**

**Results**

**Global Variables require approximate storage of between 216544 m<sup>3</sup> and 324791 m<sup>3</sup>.**

**These values are estimates only and should not be used for design purposes.**

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Q100 + 20% Climate Change– Results

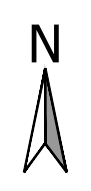
## Estimated Storage Requirements

Q30	-	151,823 m <sup>3</sup>
Q100 + 20% Climate Change	-	270,668 m <sup>3</sup>

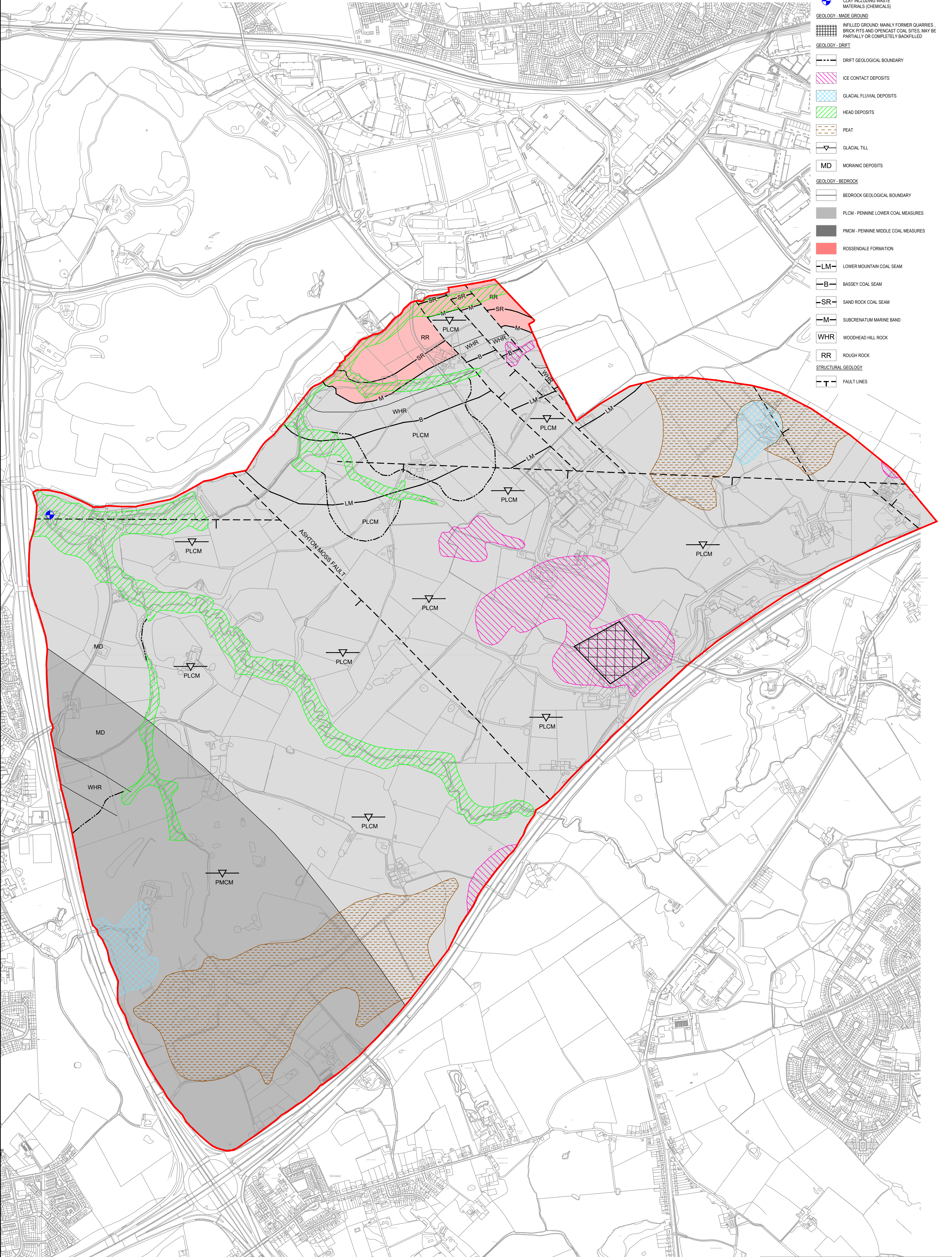


**Appendix F - Geology Plan**





- KEY**
- GMA 1.1 - SITE BOUNDARY
  - BOREHOLE CONTAINING SOFT CLAY INCLUDING WASTE MATERIALS (CHEMICALS)
- GEOLOGY - MADE GROUND**
- INFILLED GROUND; MAINLY FORMER QUARRIES, BRICK PITS AND OPENCAST COAL SITES. MAY BE PARTIALLY OR COMPLETELY BACKFILLED
- GEOLOGY - DRIFT**
- DRIFT GEOLOGICAL BOUNDARY
  - ICE CONTACT DEPOSITS
  - GLACIAL FLUVIAL DEPOSITS
  - HEAD DEPOSITS
  - PEAT
  - GLACIAL TILL
  - MD MORAINIC DEPOSITS
- GEOLOGY - BEDROCK**
- BEDROCK GEOLOGICAL BOUNDARY
  - PLCM - PENNINE LOWER COAL MEASURES
  - PMCM - PENNINE MIDDLE COAL MEASURES
  - ROSSENDALE FORMATION
  - LM LOWER MOUNTAIN COAL SEAM
  - B BASSEY COAL SEAM
  - SR SAND ROCK COAL SEAM
  - M SUBRENATUM MARINE BAND
  - WHR WOODHEAD HILL ROCK
  - RR ROUGH ROCK
- STRUCTURAL GEOLOGY**
- FAULT LINES



REV	DESCRIPTION	By	CHK	APP	DATE

Scale @	A1	Drawn	Date	Checked	Date	Approved	Date
1:6,000		CM	02.12.19	CEM	05.12.19		

Project No.	Office	Type	Drawing No.	Revision
A104444-5	MAN	N	05	

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Client:  
**NORTHERN GATEWAY  
 DEVELOPMENT VEHICLE LLP**

Project: A104444-5  
**NORTHERN GATEWAY GMA 1.1**

Drawing Title:  
**GMA 1.1: GEOLOGY PLAN**





**Appendix G - Historic Mapping**

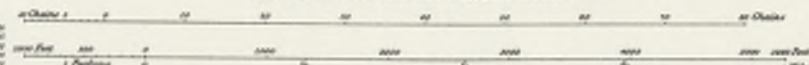


HEYWOOD AND RADCLIFFE DIVISION  
RADCLIFFE C.D. RADCLIFFE P.N.

HEYWOOD AND RADCLIFFE DIVISION

Surveyed in 1886. Re-levell'd in 1907-08. Revisions limited to 1935.

Scale - Six Inches to One Statute Mile or 600 Feet to One Inch=600



N.B.—The representation on this map of a Road, Track, or Footpath, is no evidence of the existence of a right of way.  
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- CHARACTERISTICS AND SYMBOLS**
- County Boundary ————
  - Parliamentary Division Boundary ————
  - Rural District Boundary ————
  - Parish Boundary ————
  - Boundary of Township and the
  - Anticipation, Site of ————
  - Arrow showing direction of flow of water ————
  - Footpath ————
  - Station ————
  - Transmittorial Station ————

The altitudes of Bench Marks and surface heights are given in Feet above the mean level of the sea at NEWCASTLE. The contours, however, are referred to the *Old Liverpool Datum* and not based on the *New Ordnance Datum*. This may produce discrepancies between the contours and the bench marks and care should be taken to check any possible confusion between data of measuring and reducing.

It refers heights to the *absolute Liverpool Datum*, and to the figures shown 2-2 feet. This datum applies to this plan only and is only approximately to O.T. feet. Further information on application.

Altitudes indicated above 1 1/4 ft. are O.T. refer to bench marks on buildings, walls, etc. These marks are printed or delivered by the height, refer to surface levels.

The roads and buildings added in 1935 were surveyed by hand methods as an emergency measure and do not measure to the accuracy of the rest of the map, consequently the boundaries in these areas do not refer to their original positions relative to the land datum. They have therefore been centred between the marks.

**THE NATIONAL GRID**

To refer to a particular point—(1) Read for each half of the reference the double figures printed on large type in the margins, which denote line of Eastings and Northings. (2) Then, to obtain reading to nearest 100 yards, note the position of some 10 marks from the grid lines which are lines *not* shown. (3) Then, to obtain reading to nearest 10 yards, note the position of some 10 marks from the grid lines which are lines *not* shown.

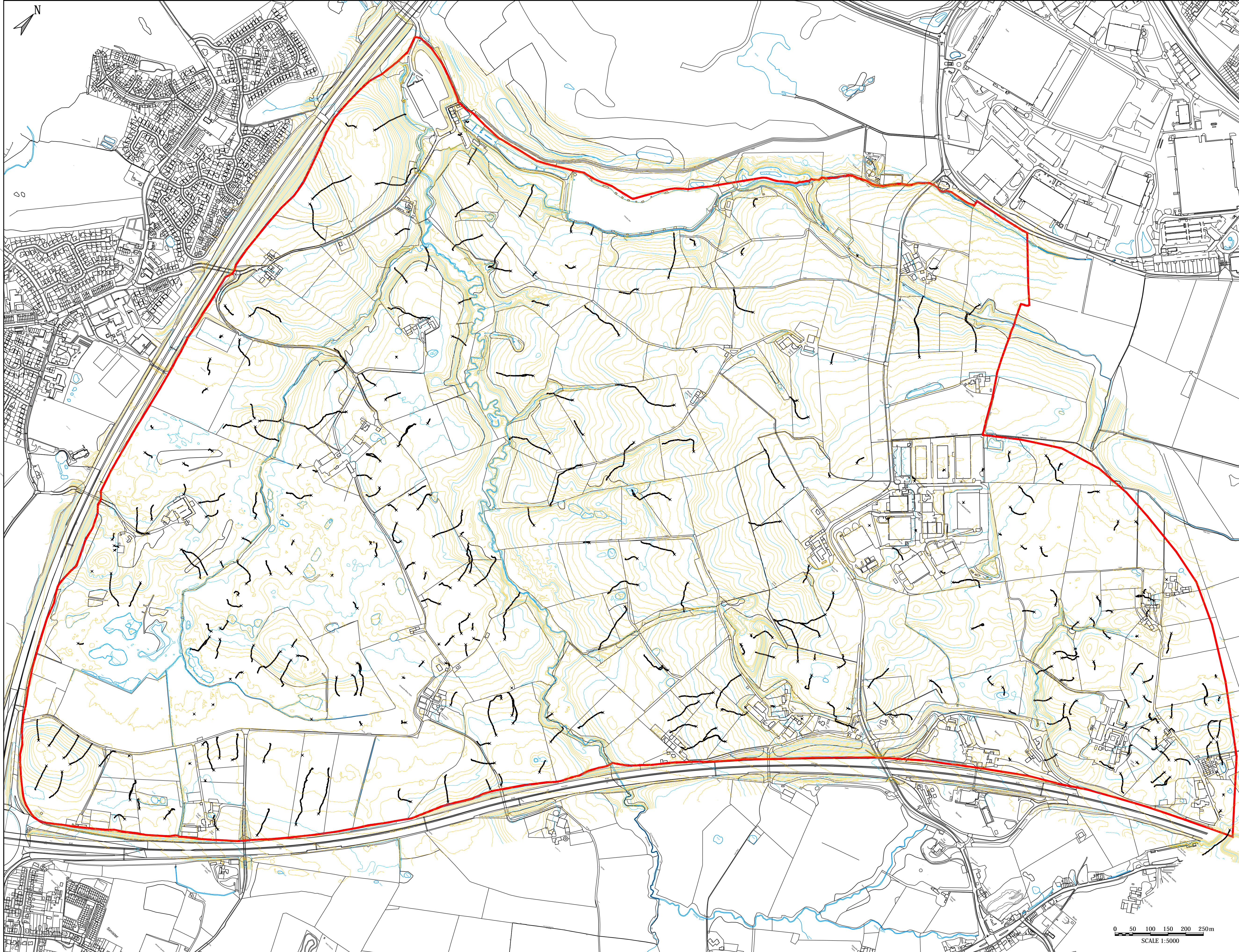


1000	00	01	02	03	04	05	06	07	08	09	10
900	10	11	12	13	14	15	16	17	18	19	20
800	20	21	22	23	24	25	26	27	28	29	30
700	30	31	32	33	34	35	36	37	38	39	40
600	40	41	42	43	44	45	46	47	48	49	50
500	50	51	52	53	54	55	56	57	58	59	60
400	60	61	62	63	64	65	66	67	68	69	70
300	70	71	72	73	74	75	76	77	78	79	80
200	80	81	82	83	84	85	86	87	88	89	90
100	90	91	92	93	94	95	96	97	98	99	00
0	00	01	02	03	04	05	06	07	08	09	10



**Appendix H - Existing Overland Flow Paths**





DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

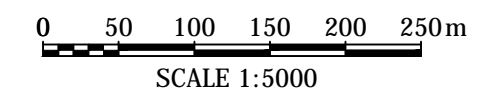
**NOTES**

1. ALL LEVELS IN METRES AOD
2. CONTAINS LIDAR AND OS BACKGROUND DATA PUBLIC AVAILABLE UNDER OPEN GOVERNMENT LICENCE V3.0. CROWN COPYRIGHT
3. SITE BOUNDARY FROM WYG DRAWING A104444-5-MAN-N-01-REV-A, NOV 2019

**KEY**


- DEVELOPMENT BOUNDARY
- SURFACE WATER FLOW PATH

**PRELIMINARY ISSUE**



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Project: A104444-5  
**NORTHERN GATEWAY GMA 1.1**

Drawing Title:  
**GMA 1.1 (NORTH OF M62)  
EXISTING OVERLAND FLOW PATHS**

REV	DESCRIPTION	BY	CHK	APP	DATE		
-	INITIAL ISSUE	OC	JP	MSE			
Scale @	A1	Drawn	Date	Checked	Date	Approved	Date
1:5000	OC	NOV 19	JP	NOV 19	MSE	NOV 19	
Project No.	Office	Type	Drawing No.	Revision			
A104444-5	MAN	N	103	-			