

APPENDIX 2.3 FLOOD RISK ASSESSMENT



Redrow

Land off Manchester Road, Rochdale

Flood Risk Assessment

680671-R1(00)-FRA

December 2022



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RSK GENERAL NOTES

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK LDE Ltd.

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1 INTRODUCTION

RSK Land and Development Engineering Ltd were commissioned by Redrow (the client) to provide a Flood Risk Assessment (FRA) to support the planning application at land off Manchester Road, Rochdale (the site). Development proposals include the development of residential units.

The purpose of the FRA is to establish the risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the flood risk to a more acceptable level. The FRA must demonstrate that the development will be safe from a flood risk perspective for its lifetime (in this case assumed to be 100 years) taking account of the vulnerability of its users, without increasing flood risk elsewhere.

This document has been produced to assess the flood risk from tidal, fluvial, surface water, groundwater, sewer and artificial sources in line with the National Planning Policy Framework (NPPF)¹ and its corresponding Planning Practice Guidance (PPG)². It includes a summary of the proposed surface water drainage strategy, showing how Sustainable Drainage Systems (SuDS) have been used to demonstrate surface water is appropriately managed on-site, with the aim that there is no increased risk of flooding on-site or elsewhere as a result of the development.

This assessment has been undertaken in consultation with the relevant authorities, and with reference to data, documents and guidance published by the Environment Agency (EA), the Lead Local Flood Authority (Rochdale Borough Council), the Local Planning Authority (LPA) (Rochdale Borough Council), and the Water Authority (United Utilities).

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

¹ Communities and Local Government, 'National Planning Policy Framework', published March 2012 and last updated July 2021.

² Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', published March 2014 and last updated August 2022.
<http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/>..

2 SITE DESCRIPTION & PROPOSALS

2.1 Existing site

2.1.1 Site description

Site Address: Land off Manchester Road,
 Rochdale
 M24 2SB (Nearest)

Site National Grid Reference: 389068 E, 409291 N

The site is located towards the south of Rochdale at land off Manchester Road and west of the A627(M). The site is comprised of several adjoining fields and the gardening centre with a total site area of 89.28Ha, this area excludes a parcel for Thornfield Farm and St John's Church.

Table 2.1, below, provides a description of the immediate surroundings of the site. **Figure 2.1** shows a Site Location Map.

Table 2.1: Site setting

Direction	Characteristic
North	The northern boundary of the site is defined by Thornham New Road and a vehicular track which extends eastwards from the road. The topography slopes steeply down towards the M62 north of the track. There is a treed area north west of the site.
East	The site generally has an upward sloping topography towards the eastern boundary. The A627(M) defines the eastern boundary and is within a cutting so is lower than the site. Thornham Fields Farm is encompassed by the site boundary towards the east of the site.
South	The site boundary is intersected by Thornham Lane towards the south of the site. The A664 to A627(M) highway defines the southern boundary of the wider site area.
West	Land to west of the site is generally the urban extents of Castleton and Slattocks. St John Thornham Church is encompassed by the site boundary towards the south-western extent of the site.



Figure 2.1: Site location map

2.1.2 Topography

The topography of the site has been assessed using the topographic survey available in **Appendix B**. Generally, the site has a topographical fall downwards in a westwards direction, though the site is characterised by an undulating topography. There are several high points through the site, predominately along the eastern border. Localised depressions direct surface water runoff to a watercourse which forms within the site boundary.

The gardening centre provides the main contribution to the existing impermeable area on the site. The remaining site is greenfield. The approximate land uses of the site is as follows:

Table 2.2: Existing site land uses

Land use	Area (Ha)	Percentage (%)
Impermeable	1.65	1.8
Permeable	87.63	98.2
Total	89.28	100

As the site is of mixed use as both undeveloped and previously developed land the site is considered as predominantly greenfield with some brownfield land.

2.1.3 Existing drainage

2.1.3.1 Public

The existing drainage on site and in the immediate surroundings has been assessed using the topographic survey (**Appendix B**) and the sewer records (**Appendix C**), the drainage details are as follows:

- 225mm diameter public combined sewer outside the north-western boundary of the site along Thornham New Road. The sewer flow westwards away from the site;
- A 225mm diameter public combined sewer outside the north-western boundary of the site along Croydon Avenue. The sewer flows to Chesham Avenue;
- A 225mm diameter public combined sewer outside the western boundary of the site along Carnforth Avenue. The sewer flows to Chesham Avenue;
- Where the 225mm diameter sewers from Croydon Avenue and Carnforth Avenue meet at Chesham Avenue, they join a 300mm combined sewer which flows westwards away from the site;
- Along Rochdale Road there are two public combined sewer systems, outside Sautridge Close a head of system for a 225mm diameter combined sewer flows northwards along Rochdale Road. Adjacent to this a head of system for a 225mm diameter combined sewer flows southwards along Rochdale Road;
- A 225mm diameter public combined sewer flows along Church Avenue, west of the site, and connections to the combined sewer on Rochdale Road;
- Towards the southern extents of the site a 300mm diameter public combined sewer flows westwards along Thornham Road and joins the combined sewer along Rochdale Road.

2.1.3.2 Private

The drainage details for private drainage within the site are as follows:

- There are land drains within the site boundary shown within **Appendix D**. The landowner confirmed they maintain the land drains to ensure good drainage of the fields which are agriculturally worked year round;
- The gardening centre within the site at the western boundary has a foul and surface water private drainage system. A summary of a drainage survey provided in **Appendix E** shows the flows from the site are ultimately drained to the public combined sewer on Rochdale Road;
- There are no other known private sewers within the site boundary.

2.2 Development proposals

The proposed development is for a residential end use across the site. The Phase 1 of the proposed development is generally located at the western extent of the site, a site layout for Phase 1 is included in **Appendix F** (this is also the engineering appraisal drawing for Phase 1).

The remaining site area is outlined as residential development for future Phases, a conceptual plan of the proposed development is included in **Appendix G** (this is also the whole site drainage strategy drawing).

Land south of Thornham Lane will be retained as greenfield and will provide ecological and amenity value to the proposed development.

3 ENVIRONMENTAL SETTING

3.1 Hydrology

3.1.1 Main River

The closest EA designated 'Main River' is an upstream tributary of Whit Brook approximately 0.3km south-west from the site. It is thought that the ordinary watercourse which starts within the site boundary is the upstream source of Whit Brook. The 'Main River' designation of Whit Brook starts at the culvert below the Rochdale Road/A627(M) roundabout and flows southwards in a culvert below Whitbrook Way and Rochdale Canal. The culvert issues west of Rochdale Canal.

Another EA designated 'Main River' is Trub Brook approximately 0.5km north-west from the site. The river appears to start as an outflow from Rochdale Canal and flows westwards towards a railway culvert.

The watercourses above have been described using mapping provided by the Environment Agency Statutory Main River Map (accessed November 2022).

3.1.2 Ordinary watercourses

There is a watercourse which starts within the site boundary which is referred to by the landowner as 'The Dell' (starting point at 388810 E, 409189 N). The Dell issues from a series of land drains, evidenced by the land drain plan drawn and provided by the land owner, in **Appendix D**. The land drains are connected by a series of manholes within the site and are noted on the topographic survey with 150mm diameter drains within the manholes. The landowner describes the land drains as being connected to the Dell by a '12 inch' culvert which passes under an area of high ground and issues from a steep bank into the watercourse. The high ground is comprised of a vehicular access road to the farm and underlain with a 300mm diameter watermain so is not considered to be part of the natural topography of the site.

The Dell flows south westwards and is culverted below Thornham Cricket Ground. The land owner described the culvert as twin '10 inch' drains with a manhole located within the cricket grounds. The topographic survey indicates the drains are a 300mm culvert, though not clear if this is singular or twin.

The outfall from the cricket pitch culverts is located within the site south of the cricket pitches. The outfall location is unclear from the topographic survey though it is clear where the watercourse channel is located. The watercourse flows south for a short 60m section and then enters a 525mm diameter concrete culvert for a 22m meter length and issues into the site again, flows southwards along the boundary and leaves the site over the boundary.

Off site the watercourse enters a culvert below Number 800 Rochdale Road, flows under Thornham Road and continues southwards as a culvert below Hopwood House (garage). The clearance works drawing sheet provided by Rochdale Council (**Appendix H**) best represents the assumed route of the culvert and identifies the known issues with the blocking of the culvert.

3.1.3 Other Waterbodies

There is a short length of ditch close to the north-western boundary of the site, this is shown on 'Sheet 6 of 9' of the topographic survey (**Appendix B**). The ditch starts at a manhole (cover level: 158.72mAOD) with a water level of 157.97mAOD recorded within the ditch. There is a 150mm diameter pipe at the downstream extent of the ditch with an invert level of 157.32mAOD. The landowner has stated this is a spring which supplies water to the adjacent farm south from the manhole.

There is a ditch on the north western boundary of the site shown on 'Sheet 6 of 9' and 'Sheet 8 of 9' of the topographic survey. The ditch has no apparent flow direction according to the bed levels and there are no pipes noted at either extent of the ditch. It is assumed the ditch is intended for use as an interception ditch to prevent overland runoff from the field east of the ditch from flowing over into the residential areas to the west of the site.

On 'Sheet 8 of 9' of the topographic survey there is a short section of ditch aligned east to west containing water with a depth of approximately 30mm. The levels in the ditch would suggest the water is flowing from east to west though there are no formal inflows or outflows to the ditch. It is possible the ditch represents where perched groundwater issues from the ground and sinks again. This would be evidenced by the fact the area of the ditch is within an area once used as a former sand quarry. Anecdotally the land owner stated that the quarry ceased once all sands had been excavated from the site.

On 'Sheet 8 of 9' of the topographic survey there is a ditch within a dense grouping of trees at the northern boundary of the site. The ditch appears to extend south from the trees and across the site aligned south to north. There is water recorded within the ditch with an approximate depth of 20mm, the water levels suggest a northwards flow into the grouping of trees. The ditch does not appear to correlate with any site boundaries and there are no formal vehicular or crossing points over the ditch. The ditch is assumed to be another overland flow interception feature.

Within the southern parcel of the site (south of Thornham Road) there is a large shallow pond shown on aerial photographic mapping to be surrounded by denser vegetation compared to the surrounding grassland. The pond appears to be fed from surface water runoff from the surrounding sloping topography. The outfall from the pond is formalised into a channel at the western extent of the parcel.

There is a large pond shown on 'Sheet 3 of 9' of the topographic survey (at coordinates: 388713 E, 409249 N). The pond is on the western boundary of the site and adjacent to 'The Dell' ordinary watercourse. The landowner confirmed that the pond is likely to have originated from a historical excavation of clay though it is unknown how the pond is fed water. At the time of the survey the water level in the pond was approximately 147.49mAOD.

There is a large pond shown on 'Sheet 4 of 9' of the topographic survey (at coordinates: 389028 E, 408999 N). The pond has a water level of 152.01mAODm, though has no apparent inflows or outflow.

There are further waterbodies and watercourses within the wider vicinity of the site.

3.2 Geology

3.2.1 Desk Study

Based on published geological records for the area (British Geological Survey online mapping), the site exhibits the following geology:

- Superficial Geology:
 - (north and eastern site areas) Glaciofluvial Sheet Deposits, Devensian - Sand and gravel. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.
 - (southern and western site areas) Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.
- Bedrock Geology: Pennine Lower Coal Measures Formation - Mudstone, siltstone and sandstone. Sedimentary bedrock formed between 319 and 318 million years ago during the Carboniferous period.

BGS Borehole data records were searched for nearby trial/borehole logs that may give relevant information regarding the on-site geology. The closest borehole log was located at Grange Road off Church Avenue, at the western boundary of the site. The borehole log from 1913, undertaken for Chamber Colliery Co Ltd, (BGS Reference: SD80NE3) describes the following strata:

- Soil to 0.45mbgl ("1 ft 6 inches");
- Boulder clay to 12.19mbgl ("40ft");
- Sand to 15.8mbgl ("52ft");
- The borehole log continues to a depth of 142m ("468ft") with varying strata of clays, shale, sandstone and coal.

Groundwater was not recorded in the borehole.

A second borehole was recorded outside of the western boundary of the site, at the service station on Rochdale Road, close to Thornham Road. The borehole log is from 1998 (SD80NE293) and describes the following strata:

- Made Ground to 1.25mbgl;
- Claybound silty sand with sandstone fragments and some fine gravel to borehole completed at 4.10mbgl.

Groundwater was struck within the borehole at 2.0mbgl and rose to 1.44mbgl within 40 minutes.

3.3 Hydrogeology

Hydrogeological information was obtained from the online Magic Maps service. These maps indicate that the site is underlain with bedrock is designated as a Secondary A Aquifer. The underlying superficial deposits are designated as Secondary A aquifers.

The site is not located within a Groundwater Source Protection Zone.

The site is not located within a Drinking Water Safeguard Zone (Surface Water), or
Drinking Water Safeguard Zone (Ground Water).

4 SOURCES OF FLOOD RISK

4.1 Criteria

In accordance with the NPPF and advice from the EA, an assessment of the risk associated with various flooding sources is required along with consideration of the effects of climate change over the design life of the development (in this case assumed to be 100 years).

The EA's most recent climate change guidance, published in May 2022³, should be referenced in order to identify the appropriate peak river flow and rainfall intensity allowances for the scheme. The appropriate allowance for peak river flow is based on the site's location in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

The flood risk elements that need to be considered for any site are defined in BS 8533 'Assessing and managing flood risk in development Code of practice'⁴ as the "Forms of Flooding" and are listed as:

- Flooding from rivers (fluvial flood risk);
- Flooding from the sea (tidal flood risk);
- Flooding from the land;
- Flooding from groundwater;
- Flooding from sewers (sewer and drain exceedance, pumping station failure etc); and
- Flooding from reservoirs, canals and other artificial structures.

The following section reviews each of these in respect of the subject site.

4.2 Definitions of Risk

Table 5.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year

³ Environment Agency, 'Guidance: Flood Risk Assessments: Climate Change Allowances'. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>, May 2022.

⁴ BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', December 2017.

Flood Zone	Description
Flood Zone 3	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as 'functional floodplain'

Table 5.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Risk	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Table 5.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Medium
Very Low	Very Low		

4.3 Flooding from rivers (fluvial flood risk)

4.3.1 Main Rivers

The EA Flood Zone mapping study for England is available on their website at: <https://flood-map-for-planning.service.gov.uk>.

The latest EA published flood zone map (**Figure 5.1**) shows that the site lies within Flood Zone 1.

In December 2013, the EA released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 5.2**), which shows the EA's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, indicates that the site is entirely designated as 'very low' risk of flooding.

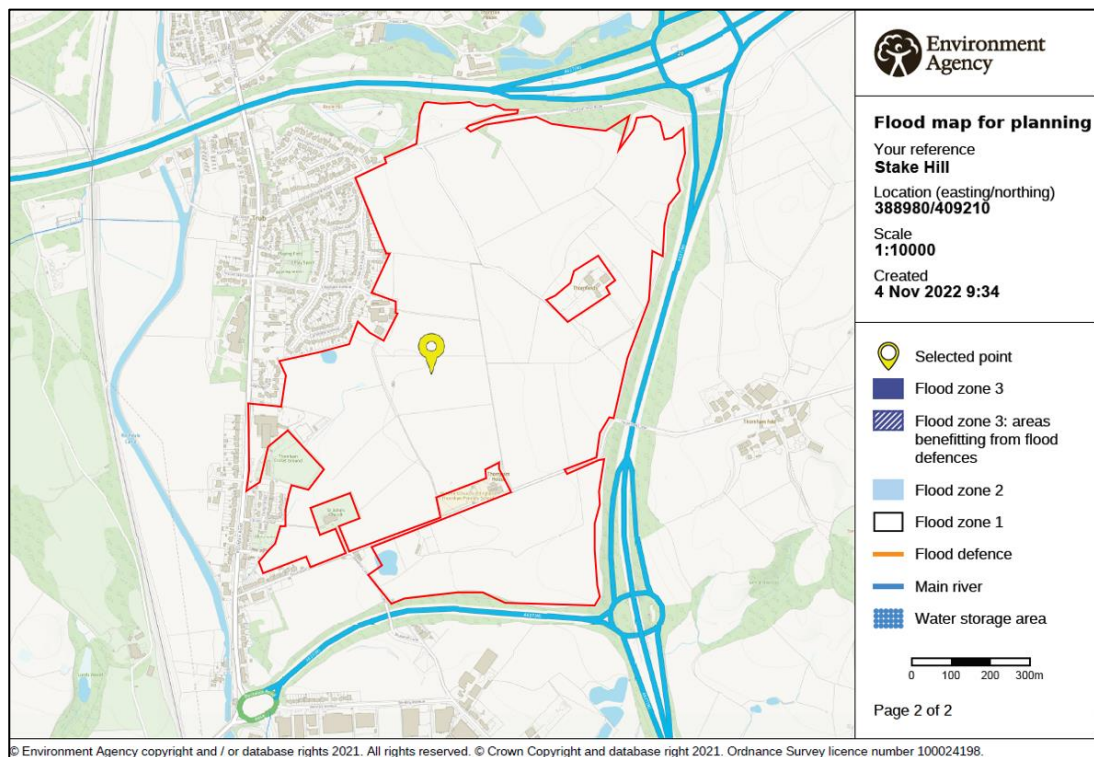


Figure 5.1: Environment Agency 'Flood map for planning'

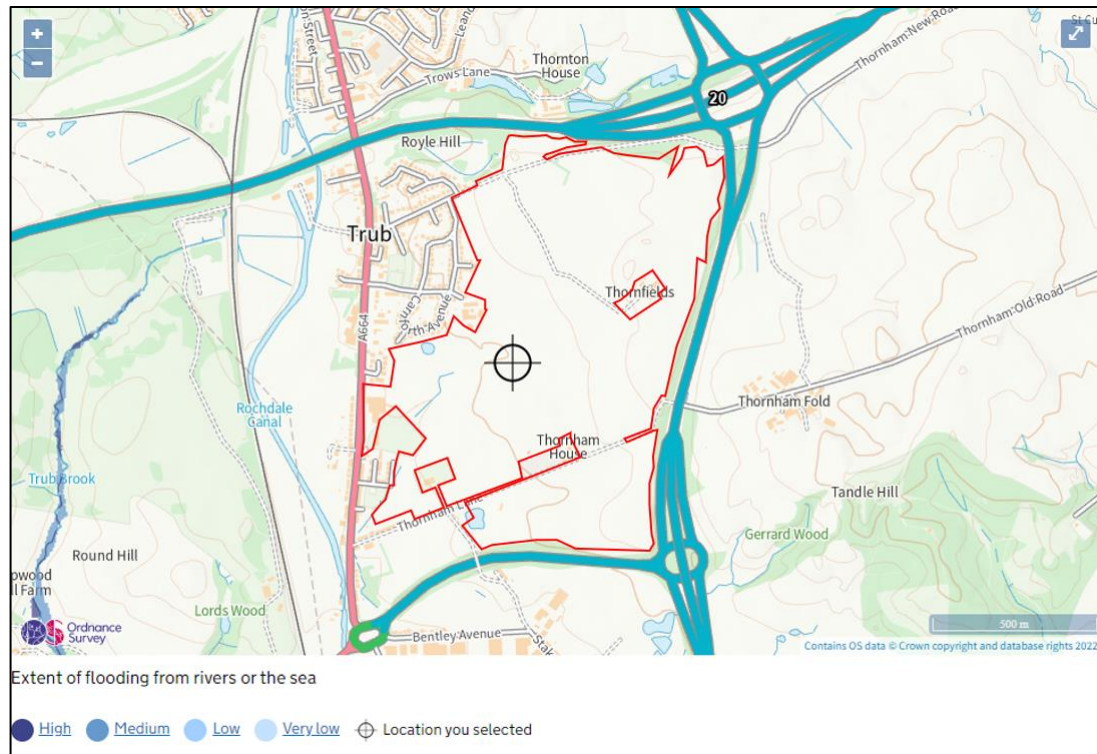


Figure 5.2: Environment Agency ‘Flood risk from rivers or the sea’ map (accessed November 2022)

4.3.2 Ordinary Watercourse

The ordinary watercourse referred to as ‘The Dell’ is within a steep sided channel at the lowest areas of the site and is unlikely to present any significant risk to the proposed development. The flood risk would likely seem greatest at the upstream extent of the culvert at the cricket pitches where The Dell channel becomes more shallow and the culverts may potentially act as a bottleneck for the flows in the watercourse. The topographic levels would suggest exceedance of the channel would result in flooding of the cricket pitch.

The Dell then flows on to a 525mm diameter concrete culvert below the access to the church from Church Avenue. The pre-development drainage enquiry response provided by Rochdale Council LLFA (**Appendix I**) notes that this culvert is prone to blockage and flooding due to the size and length.

The culvert under Thornham Road and Hopwood house is shown within **Appendix I** to frequently flood the highway. It is noted in the response that this is due to poor maintenance and an inadequate culvert as evidenced by the clearance works in **Appendix H**.

There is potential flood risk from the Dell , but likely to be of minimal impact to the proposed development, the flood risk from ordinary watercourse is considered **low**.

4.3.3 Climate Change

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the EA in May 2022. No model re-runs have been undertaken as part of this site-specific FRA. The impact upon the site should be negligible given its location within Flood Zone 1 and low risk of ordinary watercourse flooding.

The overall risk of fluvial flooding is considered to be **very low**.

4.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland and elevated location.

4.5 Flooding from the land (surface water flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the eastern boundary, either by overland flow or through infiltration.

The EA's surface water flood map (**Figure 5.3**) shows that the site is predominantly at very low risk from surface water flooding. However, given the undulating topography of the site there is a central surface water flow path that flows from Thornfields Farm through to the raised track/watermain aligned north to south through the site. The raised track interrupts the flow path and is shown within the surface water modelling to backlog and pond within a low point on the eastern side of the raised track.

The surface water path aligns with the land drainage network constructed by the landowner (or previous land owners) suggesting that surface water runoff within this flow path is actively drained to the Dell as currently existing despite the physical barrier caused by the raised track/watermain. The land drain sketch from **Appendix D** has been reproduced and overlain over the high-low surface water flood risk extent layers for context and is shown in **Figure 5.4**.

The eastern extent of the proposed Phase 1 development is within close proximity of the area of ponding associated with the surface water flow path. Ensuring that finished floor levels remain above the existing ground levels and ensuring the existing land drains are maintained or realigned to suit the proposed development will ensure that the risk of surface water ponding is reduced.

Once future phases of development to the east of Phase 1 are under construction, the contributing areas of runoff from greenfield to the surface water flow path will be reduced

and the risk from the flow path will lessen as surface water runoff from hardstanding is managed by a drainage system.

There are several isolated areas of surface water flood risk through the site which are associated with shallow depressions and the interception ditches discussed in Section 3.1.3. The shallow depressions are likely to be removed as part of earthworks for the development of the site and will not be a present risk to the proposed development.

There is a surface water flow path through the southern parcel, as it is not proposed to develop the land south of Thornham Road, besides potential landscaping works, the risk from the surface water flow path is considered to be low.

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance was updated by the EA in May 2022. Revised allowances for climate change have been included in the indicative drainage strategy below.

The overall risk of surface water flooding at the site is considered to be **low** provided it can be shown that the central surface water flow path can be managed until further phases of development beyond Phase 1 can reduce the contributing areas of runoff to the flow path.

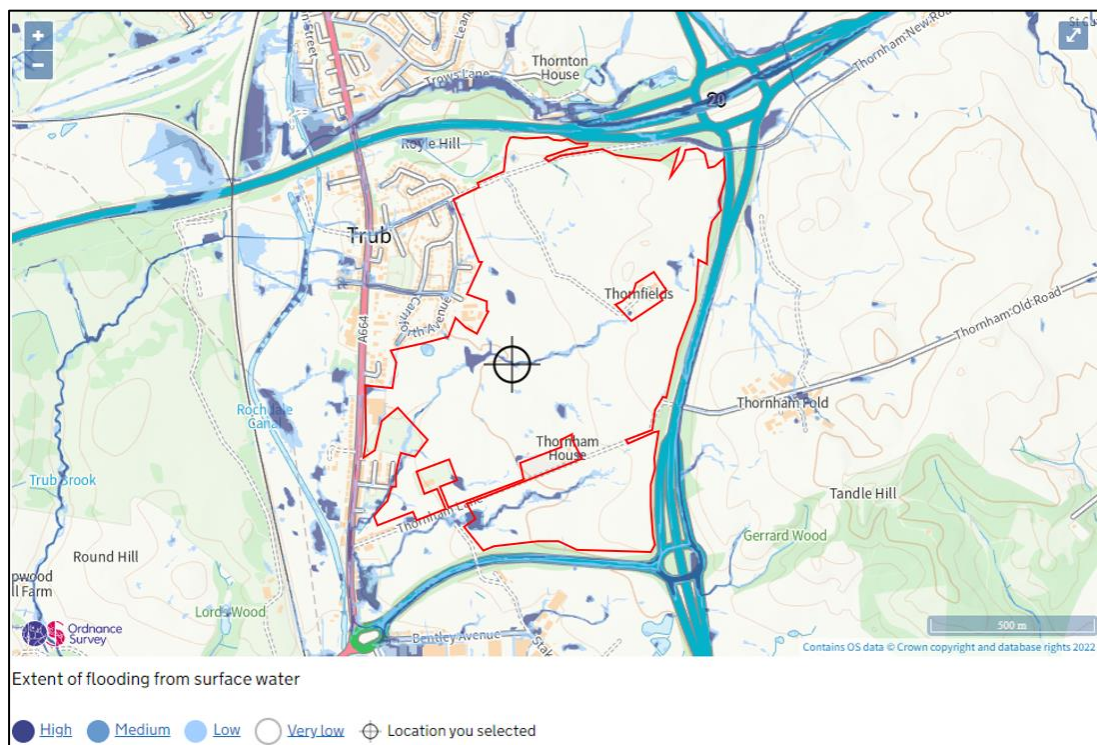


Figure 5.3: Environment Agency 'Flood risk from surface water' map (accessed November 2022)

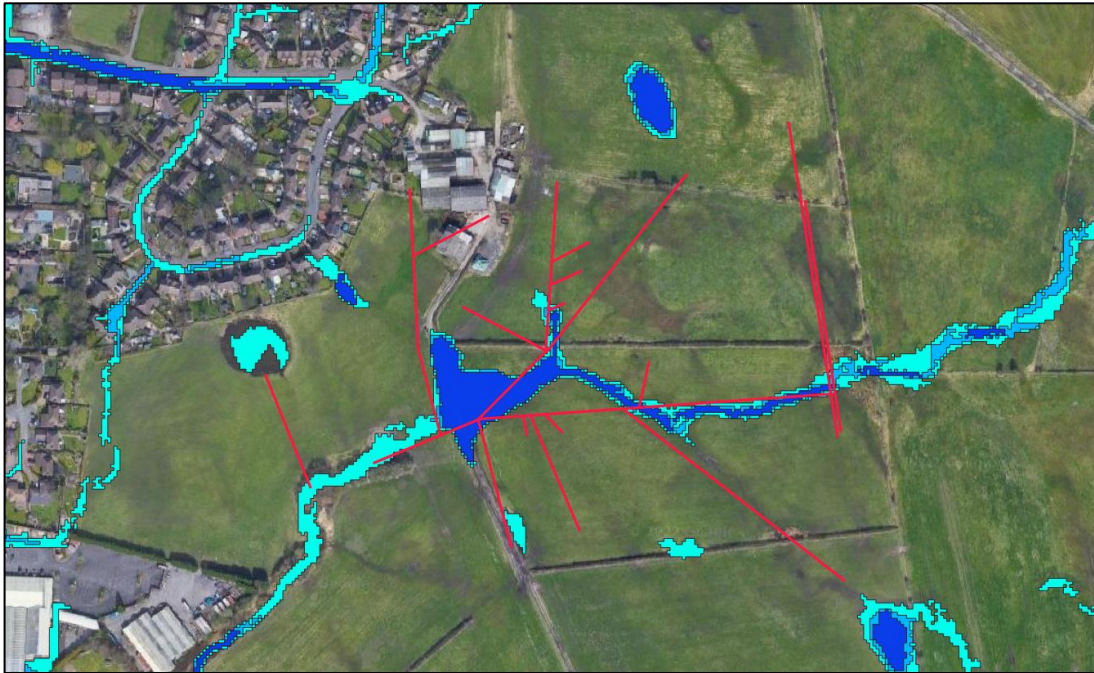


Figure 5.4: Environment Agency ‘Flood risk from surface water’ extents (blue shading) with potential land drain locations (red lines)

4.6 Flooding from groundwater

Groundwater flooding tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

The historical borehole log described in Section 3.2 notes that there is likely groundwater between 1.44mbgl – 2.0mbgl, however the borehole log was undertaken at an area lower than the site. Depths of the groundwater on site are unconfirmed without site specific testing.

The presence of springs onsite recorded by historical maps indicate perched or high groundwater. Given the geology of the site according to BGS mapping and the stratum described in the historical borehole log on Church Avenue, the presence of springs may be the result of superficial sand and gravel stratum over cohesive clay lenses preventing infiltration of groundwater.

The proposed development does not include any basement proposals. Therefore, aside from shallow foundations works, the proposals will have no material impact on the risk of

groundwater flooding both to and from the development. The resulting risk of groundwater flooding to the site is assessed as low.

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk is likely to be low.

The overall groundwater flood risk is considered to be **low**.

4.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in DCG Sewerage Sector Guidance⁵. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

Climate change is likely to result in an increase in flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but would not be significant in terms of the proposed development.

There are several sewers surrounding the site though these are limited to outside the western boundary. As the western boundary is generally the lowest area of the site then exceedance flow paths from sewer manholes are unlikely to flow any further into the site.

The resultant sewer flood risk is considered to be **very low**.

4.8 Flooding from reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

⁵ Design and Construction Guidance Sewerage Sector Guidance, Appendix C, May 2021.

The EA reservoir flood map (reproduced as **Figure 5.5**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large.

The EA mapping was updated in 2021 to demonstrate the potential maximum extent of flooding for two scenarios - a "dry day scenario" in which river levels are "normal", and a "wet day scenario" where the flooding from the reservoir coincides with flooding from rivers.

The EA mapping shows the site is outside of the area of flood risk from reservoirs.

Reservoir flooding is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site as a result of climate change.

The resultant flood risk is considered to be **very low**.

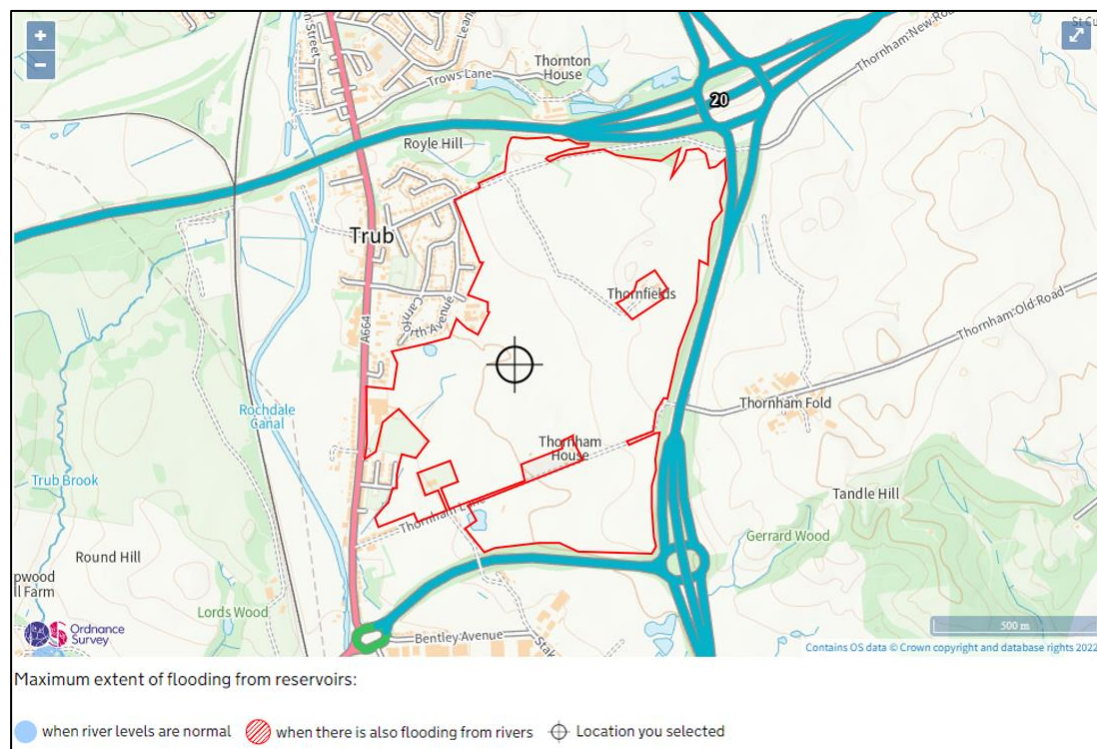


Figure 5.5: Environment Agency 'Flood risk from reservoirs' map

4.9 Other sources of flooding

4.9.1 Canals

The Rochdale Canal is outside of the western boundary of the site, and west of Rochdale Road. The canal flows north to south via a series of locks outside of the south-west of the site. A section of the canal is raised higher than Rochdale Road, though not higher than the site.

It is unlikely that flooding from the canal in the event of exceedance or a breach will be a flood risk to the site.

There are no other canals in the area therefore the flood risk from this source is considered **very low**.

4.9.2 Other artificial features

No other artificial features with the potential to result in a flood risk to the site have been identified.

5 FLOOD MITIGATION MEASURES

5.1 Overview

The developable area lies wholly within Flood Zone 1 and the risk of flooding from other sources is assessed as very low or low. To facilitate the development of the site a surface water drainage strategy has been designed, as discussed in Section 7.

5.2 Overland flow route

There is an overland surface water flow path through the centre of the site. The Phase 1 development encroaches onto the downstream extent of the flow path where the flows pond at the raised track. The development proposals should ensure that the ponding water does not result in flood risk to the development. It is recommended that the land drainage network which actively drains the surface water flow into the Dell is either maintained or realigned to suit the proposed development. Severing of the existing culvert could result in an increased frequency of flooding on the eastern side of the raised track until future phases of the development begin.

No further overland flow control measures are proposed as all surface water runoff up to the 1 in 100 year climate change storm will be stored on-site and discharged to the nearby watercourses. Surface flows may be generated due to drainage capacity exceedance, which can be conveyed into the SuDS features via surface flows along the new roads.

5.3 Finished floor levels

As the developable area will not be affected by fluvial flooding there is no need to incorporate any freeboard levels into the finished floor levels of the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels.

It is recommended that finished floors levels are set a minimum of 150mm above the local ground level in line with best practice to mitigate against the risk of surface water runoff.

5.4 Easements

Under the Water Resources Act 1991 and associated byelaws, works in, over, under or adjacent to main rivers require the consent of the EA and works in, over, under or adjacent to ordinary watercourses will require IDB, Local Authority or LLFA consent. This is to ensure that they neither interfere with the EA/LLFA's work nor adversely affect the environment, fisheries, wildlife and flood defence in the locality.

It is recommended development proposals retain the Dell and provided an easement from the watercourse.

5.5 Safe access/egress

The developable area lies outside of the 1 in 1000 year fluvial flood extent, with the access road also located outside this flood extent, therefore safe access and egress will be available up to this storm event.

6 PLANNING CONTEXT

6.1 Land use vulnerability

Table 2 of the PPG indicates the compatibility of various land uses in each flood zone, dependent on their vulnerability to flooding. Table 6.1 below is reproduced from Table 2 of PPG.

Table 6.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the PPG, the proposed development, based on its residential use, is classed as 'more vulnerable'. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

6.2 Sequential Test

The Sequential Test aims to direct new development to areas with the lowest probability of flooding. The developable area of the site has been identified as located within Flood Zone 1 with no other significant flooding issues from other. It is therefore considered the site would pass the Sequential Test.

6.3 Exception Test

In accordance with Table 6.1, there is no requirement to apply the Exception Test for a 'more vulnerable' development within Flood Zone 1.

7 SURFACE WATER DRAINAGE ASSESSMENT

7.1 Scope

In accordance with the Defra Non-Statutory Technical Standards⁶, the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to greenfield rates. Where a reduction to the greenfield rate is not practicable, the proposed surface water drainage strategy should not exceed the existing runoff rate.

In addition, Building Regulations Part H⁷ requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

This assessment includes an overview and comparison of the existing greenfield scenario and proposed development scenario.

7.2 Pre-development situation

The pro-rata IOH 124 method has been used to estimate the Greenfield surface water runoff for the site (89.28Ha), using the Windes Source Control Greenfield runoff rate estimation tool. Calculations are contained in **Appendix J**.

Table 7.1: IOH 124 surface water runoff (greenfield) (89.28Ha)

Return period	Peak flow (l/s)
QBar	609.9
1 in 1 year	530.6
1 in 30 year	1034.0
1 in 100 year	1268.5

⁶ DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015.

⁷ HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'.

Additionally the runoff rates have been calculated for 1ha which can be used pro-rata for the developable areas of proposed development and provide an estimate of greenfield runoff rates. Calculations are contained in **Appendix K**.

Table 7.2: IOH 124 surface water runoff (greenfield) (1Ha)

Return period	Peak flow (l/s/ha)
QBar	7.3
1 in 1 year	6.3
1 in 30 year	12.3
1 in 100 year	15.1

The rate of 7.3l/s per hectare of developable land has been agreed as an acceptable rate (for Phase 1) as per correspondence in the LLFA response in **Appendix I**.

7.3 Off-site discharge options and limits

The proposed development is for a residential end use. This will result in an increase in impermeable area and surface water runoff across the site. It will therefore be necessary to manage surface water on-site through conveyance towards the proposed point of discharge, whilst providing sufficient attenuation for all events up to the 1 in 100 year event inclusive of 45% climate change.

7.3.1 Point of discharge

Discharge options from the site have been considered in line with the SuDS hierarchy, as follows.

Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed study area. The effectiveness of infiltration is completely dependent on the physical conditions at the study area. Potential obstacles include:

- Local variations in permeability preventing infiltration - It is understood from the online geological mapping that the site is underlain with till. Anecdotally, the land owner has confirmed the sands at the northern section of the site have been removed as part of historic quarrying of the sand. The till geology is likely to be of a cohesive nature owing to clay lenses and likely to exhibit poor percolation rates;
- Shallow groundwater table - For infiltration drainage devices, Building Regulation approved document H states that these *"should not be built in ground where the water table reaches the bottom of the device at any time of the year"*. The nearby borehole log suggested groundwater close to the surface groundwater, albeit the borehole was recorded on land with a lower topographic elevation than the site;
- Source Protection Zones - The study area is not located within a Groundwater Source Protection Zone.

From the information available it would seem unlikely that infiltration can be considered a viable option as part of the drainage strategy.

Discharge to watercourse

There is a watercourse (the Dell) located within the site boundary which can be used to discharge surface water runoff to.

The existing development area of Phase 1 is shown to clearly drain to the Dell via topographic falls towards the western boundary.

The surface water flow path and land drainage evidenced in this report would suggest that contributing areas to the surface water flow path from future phases also discharge to the Dell.

It is recommended in the LLFA correspondence (**Appendix I**) that discharge to the Dell should be limited to the downstream extent of the cricket grounds culvert where possible due the unreliability of the culverts for flow conveyance.

The LLFA correspondence notes that careful consideration needs to be given to the discharge rates due to the frequent flooding of Rochdale Road and Thornham Road caused by the culvert below Hopwood farm house land.

Discharge to surface water sewer

There are no surface water sewers present which could be discharged to.

7.4 Post-development situation

The proposed development will increase the impermeable area (based on total site area), which, if unmitigated, will result in an increase in surface water runoff across the site. It will therefore be necessary to manage surface water on-site in order to limit the discharge of surface water off-site to an agreed rate, to provide sufficient on-site attenuation up to the 1 in 100 year climate change rainfall event.

It is proposed to provide a surface water drainage strategy which will closely mimic the pre-development surface water drainage of the site. Therefore, following the suitable options on the SuDS Hierarchy, surface water discharge from the site will be to on site watercourse (the Dell).

7.4.1 Discharge Rate

It is proposed to limit discharge from the site the Phase 1 development to 7.3l/s per developable hectare in line with an agreed rate with the LLFA which will restrict runoff to greenfield runoff rates. Surface water discharge will be to the Dell.

Future phases of development will discharge to the Dell at greenfield runoff rates. Rates are to be finalised following more detailed layout proposals.

7.4.2 Proposed drainage strategy

The proposed drainage strategy for Phase 1 outlined within **Appendix F**. The drainage strategy drawing includes notes on drainage proposals for attenuation.

The proposed drainage strategy for future phases of development is provided as a high level drainage strategy in **Appendix G**.

8 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The proposed development site lies in an area designated by the EA as Flood Zone 1, and is outlined to have a chance of flooding of less than 1 in 1,000 (<0.1%) in any year.

The NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1 and at the lowest risk of flooding from all sources. This FRA demonstrates that the requirements of the Sequential Test have been met. The proposed development is classified as 'more vulnerable' and therefore considered appropriate within Flood Zone 1 without application of the Exception Test.

This FRA has considered multiple sources of flooding and concluded the following:

Table 8.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial (Main River)	Very Low	Developable area is shown to be wholly within Flood Zone 1.
Fluvial (Ordinary)	Low	Areas of the site close to the lower level western boundary may be subject to flooding, this is thought to be exacerbated by culverting of the watercourse in several locations. The proposed development is unlikely to be at risk of flooding.
Tidal	Very Low	The site is inland and elevated.
Surface water	Very Low - Low	The central surface water flow path may impact on the eastern extents of the Phase 1 development until future phases of development reduce the contributing catchment to the surface water flow path. Consideration needs to be given to the floor levels and maintaining the land drainage at the raised track.
Groundwater	Low	Groundwater levels may be close to the surface but unlikely to be a risk to the proposed development.
Sewers	Very Low	Sewer records indicate sewer are located west of the site on lower ground.

Source	Level of risk	Mitigation
Reservoir	Very Low	The site is not within an area of reservoir flooding.
Other sources	Very Low	There are no confirmed sources of artificial flood risk.

The proposals will follow best practice regarding site drainage to ensure that any surface water runoff from the development is managed, ensuring flood risk is not increased elsewhere.

In order to prevent flooding on site attenuation and controlled discharge will be utilised to control surface water flows to greenfield rates. These features will be designed to store the volume of water associated with a 1 in 100-year rainfall event, plus an additional allowance to account for increased rainfall due to climate change.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

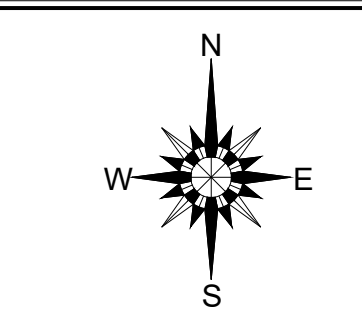
APPENDIX A

RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Redrow (the "client") in accordance with the terms of a contract between RSK and the "client" dated August 2022. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B

TOPOGRAPHIC SURVEY



SURVEY LEGEND

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DISCLAIMER:

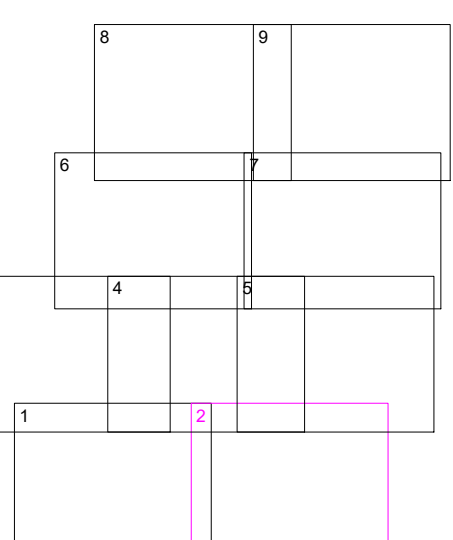
ONLY MANHOLES AND SERVICES SHOWN WERE VISIBLE AT THE TIME OF SURVEY.
MAN ENTRY TO SEWERS HAS NOT BEEN UNDERTAKEN, DEPTHS, PIPESIZES ETC
ARE MEASURED FROM GROUND LEVEL.
DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED PRIOR TO ANY WORK
COMMENCING.
BOUNDARIES SHOWN ARE PHYSICAL AND MAY NOT REPRESENT LEGALLY CONVEYED
OWNERSHIP.
TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE
AVERAGE SPREAD. THE TREE CANOPY LENGTH DENOTES THE TREES EXTREMITY.

SURVEY NOTES

ALL LEVELS ARE RELATED TO 0.8 DATUM (08GB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

Name	SURVEY STATIONS		Height
	East	North	
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21100	389004.081	400710.360	157.740
21100	389000.425	400114.292	158.172
21100A	389035.318	400117.594	157.290
21100	389015.107	400117.672	158.622
21102	389055.381	400091.445	154.149
21103	389022.474	400174.464	161.171
21104	389066.748	400066.888	159.082
21105	389017.829	400014.163	158.661
21106	389076.724	400049.396	158.447
21107	389052.802	400049.557	157.893
21108	389018.736	400049.787	157.893
21108	389134.439	400060.697	157.397
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	Esting	Nothing	Height
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CT2A	390922.145		144.448
CT3A	390888.02	403770.621	152.266
CT4A	390881.071	403681.623	163.171
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CT22B2	390882.040	403117.721	142.037
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CT22B100	390792.200	400971.408	144.505



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TOPO SURVEY UPDATED	A	21.01.22	DHMP	-
DESCRIPTION	REV	DATE	DRWN	APPR



SurveyEng Ltd
and Surveyors & Engineers

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WESTHOUGHTON
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BL5 3GE

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info@surveyeng.co.uk

CLIENT
REDROW

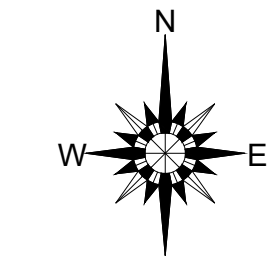
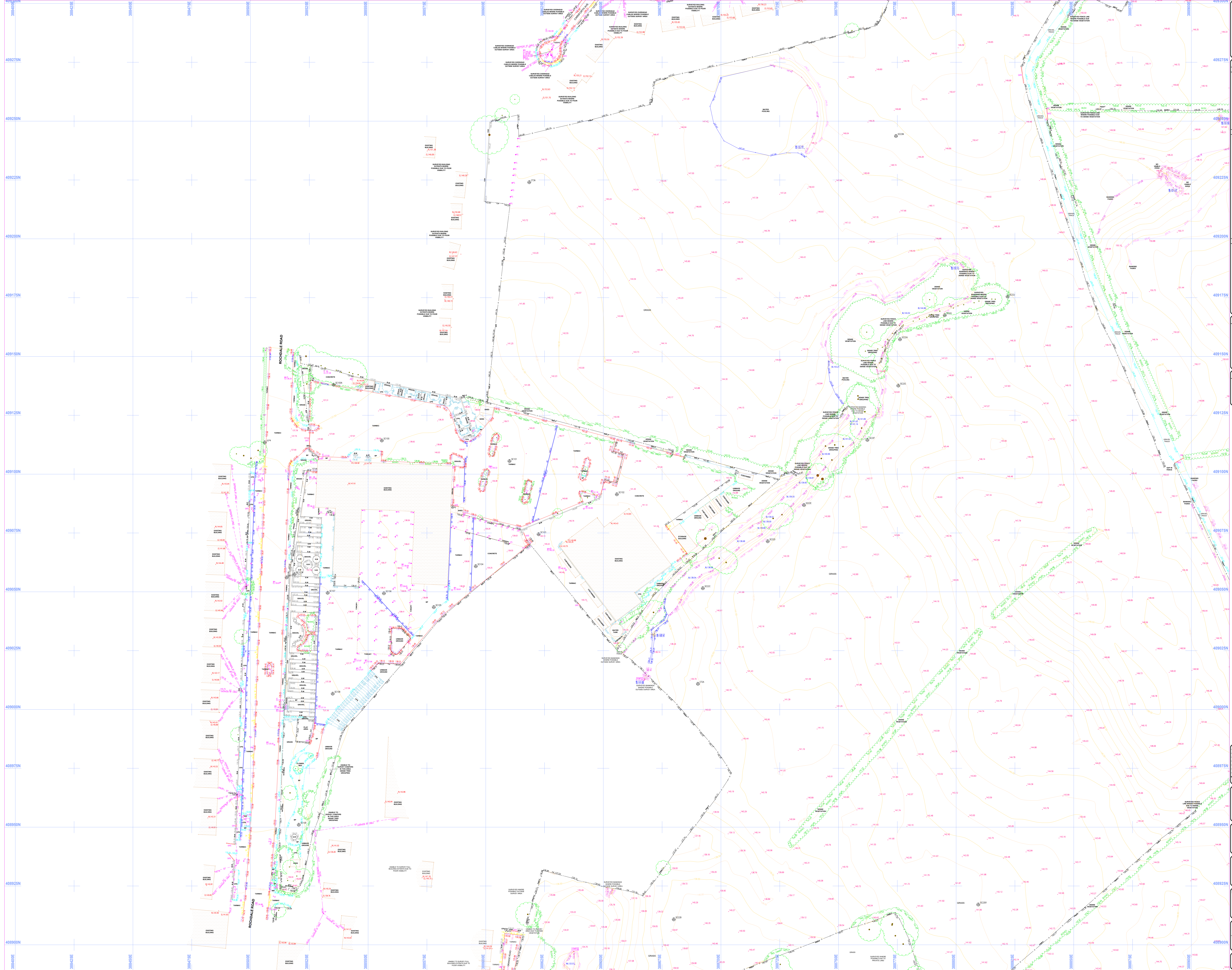
REDROW

PROJECT TITLE
ROCHDALE ROAD, MIDDLETON

DRAWING DETAIL

TOPOGRAPHICAL LAND SURVEY
SHEET 2 OF 2

PROJECT ENGINEER	MM/DS	DATE	19.03.2021
DRAWN	DH/DS	SCALE	1:500@A0
DRAWING NUMBER			REVISION
RH.TS.21			A



SURVEY ORIENTATED TO OS GRID (OSGB36-15)

SURVEY LEGEND

[illegible]

DISCLAIMER

ONLY MANHOLES AND SERVICES SHOWN WERE VISIBLE AT THE TIME OF SURVEY.
MAN ENTRY TO SEWERS HAS NOT BEEN UNDERTAKEN. DEPTHS, PIPES/ZECS ETC
ARE MEASURED FROM GROUND LEVEL.
DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED PRIOR TO ANY WORK
COMMENCING.

OWN ARE PHYSICAL AND MAY NOT REPRESENT

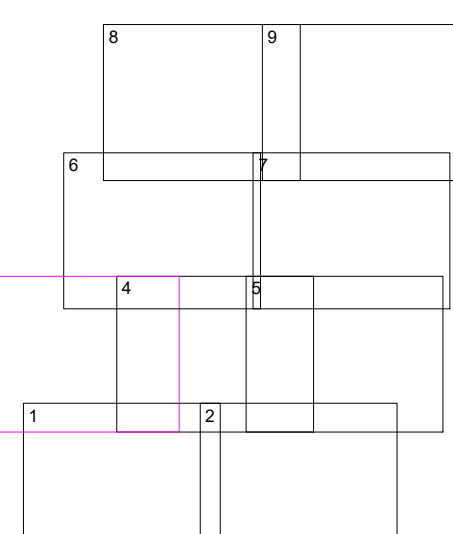
TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE AVERAGE SPREAD, THE TREE CANOPY LAYER DENOTES THE TREES EXTREMITY.

SURVEY NOTES

ALL LEVELS ARE RELATED TO 0.8 DATUM (08GB98-15)
 ESTABLISHED BY C&A, LINDSEY RD NE, L-100, OMAHA, NE 68131

SURVEY STATIONS			
Name	Easting	Northing	Height
aP3	39001.561	40066.002	156.006
aP4	39000.661	40011.883	157.000
aP5	39000.825	40011.936	158.012
aT00A	39001.101	40011.590	157.000
aT01	39001.101	40011.592	158.000
aT02	38995.748	40001.495	141.149
aT03	38982.476	40017.484	141.149
aT04	38986.781	40003.600	150.000
aT06	38987.929	40044.503	158.661
aT07	39000.724	40004.096	157.000
aT08	39000.820	40004.507	157.003
aT09A	39001.736	40007.647	167.000
aT09B	39003.459	40007.607	157.000
aT09	39001.522	40086.012	156.135

SURVEY STATISTICS				
Name	East	North	High	
CTA	390482.323	400798.138	172.44	
CT7A	390099.254	400798.138	172.44	
CT8	390180.000	400828.045	174.44	
CT9	390328.072	400787.621	172.44	
CT10	390379.871	400861.823	174.44	
CT21B	390809.400	400917.171	172.44	
CT21C	390809.400	400917.171	172.44	
CT22	390719.867	400971.468	181.44	
CT22B	390719.867	400966.867	181.44	
CT22C	390719.867	400914.514	181.44	
CT22D	390719.867	400913.625	181.44	
CT22E	390719.867	400915.310	181.44	
CT22F	390719.867	400916.509	181.44	
CT22G	390719.867	400917.708	181.44	
CT21L	390326.848	400248.459	157.94	
CT21M	390326.848	400314.648	157.94	
CT21N	390326.848	400504.185	157.94	
CT21O	390326.848	400694.231	157.94	
CT21P	390326.848	400884.277	157.94	
CT21Q	390326.848	401074.323	157.94	
CT21R	390326.848	401264.369	157.94	
CT21S	390326.848	401454.415	157.94	
CT21T	390326.848	401644.461	157.94	
CT21U	390326.848	401834.507	157.94	
CT21V	390326.848	402024.553	157.94	
CT21W	390326.848	402214.599	157.94	
CT21X	390326.848	402404.645	157.94	
CT21Y	390326.848	402594.691	157.94	
CT21Z	390326.848	402784.737	157.94	
CT21AA	390326.848	402974.783	157.94	
CT21AB	390326.848	403164.829	157.94	
CT21AC	390326.848	403354.875	157.94	
CT21AD	390326.848	403544.921	157.94	
CT21AE	390326.848	403734.967	157.94	
CT21AF	390326.848	403925.013	157.94	
CT21AG	390326.848	404115.059	157.94	
CT21AH	390326.848	404305.105	157.94	
CT21AI	390326.848	404495.151	157.94	
CT21AJ	390326.848	404685.197	157.94	
CT21AK	390326.848	404875.243	157.94	
CT21AL	390326.848	405065.289	157.94	
CT21AM	390326.848	405255.335	157.94	
CT21AN	390326.848	405445.381	157.94	
CT21AO	390326.848	405635.427	157.94	
CT21AP	390326.848	405825.473	157.94	
CT21AQ	390326.848	406015.519	157.94	
CT21AR	390326.848	406205.565	157.94	
CT21AS	390326.848	406395.611	157.94	
CT21AT	390326.848	406585.657	157.94	
CT21AU	390326.848	406775.703	157.94	
CT21AV	390326.848	406965.749	157.94	
CT21AW	390326.848	407155.795	157.94	
CT21AX	390326.848	407345.841	157.94	
CT21AY	390326.848	407535.887	157.94	
CT21AZ	390326.848	407725.933	157.94	
CT21BA	390326.848	407915.979	157.94	
CT21BB	390326.848	408106.025	157.94	
CT21BC	390326.848	408296.071	157.94	
CT21BD	390326.848	408486.117	157.94	
CT21BE	390326.848	408676.163	157.94	



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TOPO SURVEY UPDATED	A	21.01.22	DHMP	-
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SurveyEng Ltd
Land Surveyors & Engineers

CLIENT
REDROW

PROJECT TITLE
ROCHDALE ROAD, MIDDLETON

DRAWING DETAIL

TOPOGRAPHI
SHEET 3 OF 9

PROJECT ENGINEER	MM/DS	DATE	19.03.2021
DRAWN	DH/DS	SCALE	1:500@A0

DRAWING NUMBER RH.TS.21	REVISION A
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