Flood Risk Assessment and Drainage Strategy

J. Murphy & Sons, Ollerton, NG22 9PZ

Presented to: J. Murphy & Sons Limited

Issued: December 2023

Delta-Simons Project No: 87854.548836

Protecting people and planet

Report Details

Client	J. Murphy & Sons Limited
Report Title	Flood Risk Assessment and Drainage Strategy
Site Address	J. Murphy & Sons, Ollerton, NG22 9PZ
Project No.	87854.548836
Delta-Simons Contact	Rachel Shepherd [redacted]

Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
2	Final	22nd December 2023	Updates following Site plan update.	[redacted]		
				Oliver Eglington Graduate	Rachel Shepherd Associate	Rachel Shepherd Associate

About us

Delta-Simons is a trusted, multidisciplinary environmental consultancy, focused on delivering the best possible project outcomes for customers. Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from across the UK we employ over 180 environmental professionals, bringing experience from across the private consultancy and public sector markets.

As part of Lucion Services, our combined team of 500 in the UK has a range of specialist skill sets in over 50 environmental consultancy specialisms including asbestos, hazardous materials, ecology, air and water services, geo-environmental and sustainability amongst others.

Delta-Simons is proud to be a founder member of the Inogen Environmental Alliance, enabling us to efficiently deliver customer projects worldwide by calling upon over 5000 resources in our global network of consultants, each committed to providing superior EH&S and sustainability consulting expertise to our customers. Through Inogen we can offer our Clients more consultants, with more expertise in more countries than traditional multinational consultancy.

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Reference of Terms

Canal Failure

Canal failure can include a breach or overtopping of a canal system due to the effects of a high intensity rainfall event or structural failure that is not associated with a rainfall event. Such failure can be very dangerous as it can involve the rapid release of large volumes of water at high velocity, however, it is typically limited to reaches of canal that are raised above the surrounding ground level on one or both side and where watercourses or other structures pass beneath the canal. The size and nature of canals themselves can also have a hydraulic control on the mechanisms of flooding associated with a failure, resulting in a rapid peak in flow followed by a gradual reduction as the flow becomes restricted by the capacity of the canal itself to rapidly pass flow to the breach or failure point.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the river banks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a back-up of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity. This can result in deep and widespread flooding, potentially resulting in significant damage. The likelihood of reservoir flooding occurring is generally extremely low given that all large reservoirs are managed in accordance with the Reservoirs Act 1975. Under the Reservoirs Act 1975, a large raised reservoir is defined as one that holds over 25,000 cubic metres of water above the level of the surrounding land. The EA's online reservoir inundation map illustrates the maximum flood extents that could potentially occur in the event of a reservoir failure.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs as a result of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

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Appendices

1.0 Introduction

1.1 Appointment

1.1.1 Delta-Simons Limited ("Delta-Simons") was instructed by J. Murphy & Sons Limited (the "Client") to carry out a Flood Risk Assessment (FRA) and Drainage Strategy (DS) of J. Murphy & Sons, Ollerton, NG22 9PZ (the "Site") to inform a planning application for additional development at the Site.

1.1.2 The assessment considers potential flood risks from all sources and provides options for managing any Site-specific flood risks identified, assuming the continued current commercial use of the Site.

1.2 Project Understanding

1.2.1 The Site is shown to be located within Flood Zone 1 (Low Probability) on the EA Flood Map for Planning, however, an Ordinary Watercourse is shown to flow through the southern extent of the Site. Therefore, the Client has requested an FRA to determine the level of risk from all sources, along with suitable mitigation measures to provide an informative report in line with the National Planning Policy Framework (NPPF) and associated planning guidance to support a planning application.

1.2.2 The aim of this report is to assess the potential flood risk to the Site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk. This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) revised in 2023, and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change.

1.2.3 Nottinghamshire County Council as Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

1.3 Scope of Works

1.3.1 The scope of works has been as follows for this FRA:

- Assess flood risk from all sources using best available information including review of EA data and mapping, topography and historical records;
- Assess previous relevant studies, local authority plans or strategies;
- Advise on flood mitigation measures and residual risks;
- Assess evacuation routes;
- Advise on availability of flood warnings;
- Identify the requirement for a Sequential Test;
- Incorporate results of hydraulic modelling study; and
- Prepare FRA report.

1.3.2 The scope of works has been as follows for this Drainage Strategy:

- Review existing conditions including sewer plans, British Geological Survey information and topographical information;
- Review Lead Local Flood Authority (LLFA) drainage policies;
- Analyse existing and proposed impermeable areas;

Calculate existing runoff rates (excluding existing drainage system modelling);

Assess method of surface water runoff disposal (soakaway/watercourse/sewer);

Establish surface water discharge rate in consultation with the LLFA/sewerage provider;

Estimate required attenuation volume using MicroDrainage or similar;

Assess and advise on suitable forms of SuDS;

Advise on drainage system maintenance measures;

Advise on surface water treatment methods;

Establish method of foul water drainage;

Prepare concept drainage sketch;

Prepare a plan of indicative exceedance flow routes; and

Prepare DS section.

1.3.3 This report takes into account the following national and local policies:

National Planning Policy Framework (NPPF) (2023)[1];

National Planning Practice Guidance (NPPG) (2014)[2];

CIRIA Guidance: The SuDS Manual (C753) (2017)[3]; and

Newark and Sherwood District Council Local Development and Planning Policies.

1.4 Sources of Information

1.4.1 The following sources of information have been reviewed and assessed for the purpose of this FRA:

EA online flood maps[4];

British Geological Society (BGS) Interactive Map[5];

MAGIC Interactive Map[6];

Envirocheck® Report (dated March 2023);

Newark and Sherwood District Council Level 1 Strategic Flood Risk Assessment (2009 SFRA);

Newark and Sherwood District Council Level 2 Phase 1 Strategic Flood Risk Assessment (2010 SFRA);

Nottinghamshire Preliminary Flood Risk Assessment (2011 PFRA);

Newark and Sherwood Level 2 Phase 2 Strategic Flood Risk Assessment (2012 SFRA); and

Nottingham County Council Local Flood Risk Management Strategy 2016-2021 (2016 LFRMS).

1 https://assets.publishing.service.gov.uk/media/65829e99fc07f3000d8d4529/NPPF_December_2023.pdf
2 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
3 https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx
4 https://flood-map-for-planning.service.gov.uk/
5 http://mapapps.bgs.ac.uk/geologyofbritain/home.html
6 http://www.magic.gov.uk/

1.5 Project Limitations

1.5.1 The wider Delta-Simons limitations are contained within Appendix A.

2.0 Site Description

2.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment.

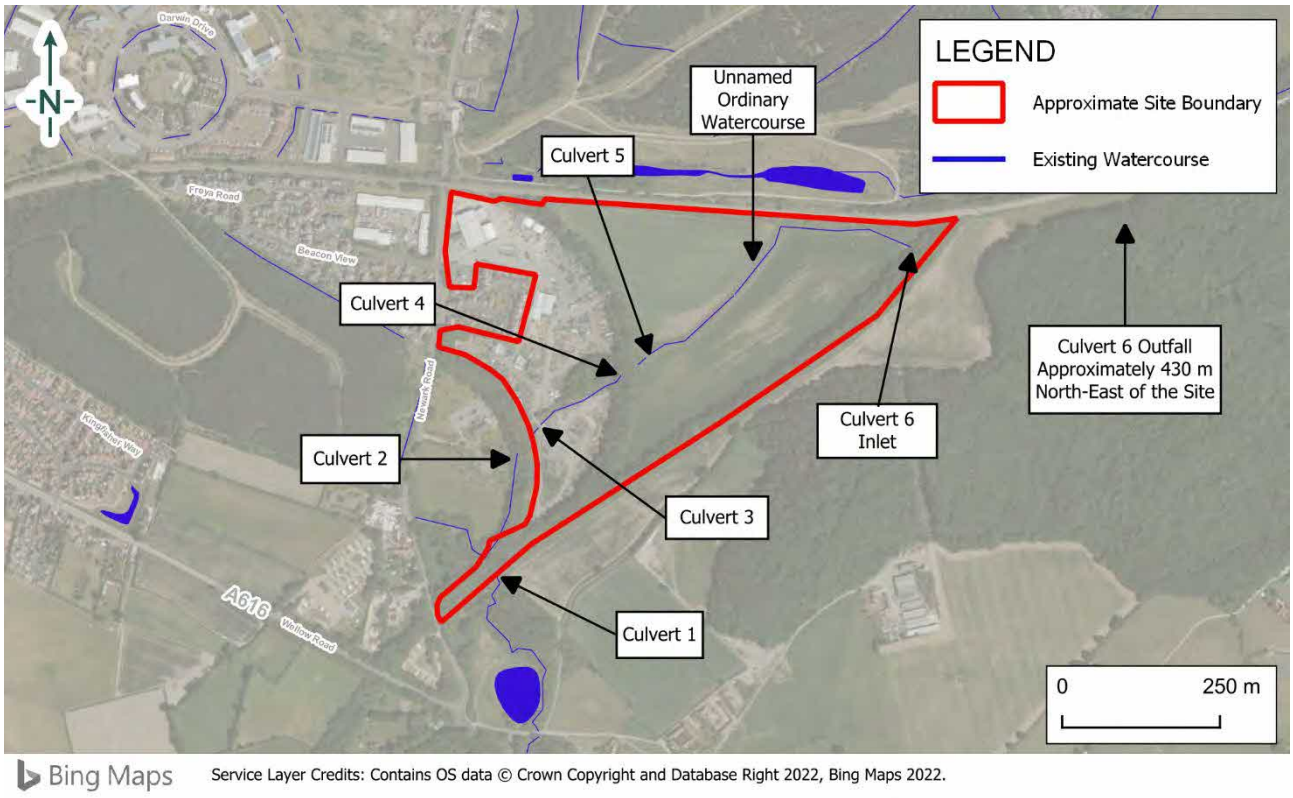

Figure 1: Site Location Plan

Co-ordinates	Centred approximately at National Grid Reference 467080, 367050.	**Area (approx.)**	24.33 Ha
Site Location	The Site is located in the south of New Ollerton village, approximately 4 km northeast of Sherwood Pines Forest Park.		
Existing Site Conditions	The Site is currently mixed use. The western area of the Site is currently occupied by Murphy Plant Ltd comprising multiple warehouse units with external yards and car parking. The eastern area of the Site is currently undeveloped greenfield land. The eastern/western extents of the Site are divided by a dense vegetation buffer. A constraints plan confirming the red line boundary, produced by Richard Hopkinson Architects is included as Appendix B. Access and egress to the Site is provided via Newark Road to the west. Current hardstanding on-Site occupies approximately 66,521 m^2, with remaining greenfield land occupying approximately 176,779 m^2. Existing hardstanding has been estimated using the topographical survey provided by the Client (see Appendix C).		
Topography	A topographical survey has been undertaken by JMS Survey in 2018 and is included in Appendix C. The topographical survey shows that within the east of the Site, the undeveloped greenfield land slopes from approximately 42.98 m AOD in the west		

	36.62 m AOD towards the east before sloping back up to 39.28 m AOD in the north-eastern corner. The west of the Site slopes from 45.48 m AOD in the north to 40.53 m AOD and then slopes back up to 43.91 m AOD in the south. Topographic levels to metres Above Ordnance Datum (m AOD) have also been derived from a 1 m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that the Site slopes from approximately 51 m AOD in the south-west to approximately 37 m AOD in the north-west. A LiDAR extract is included in Appendix D.
Hydrology	The nearest watercourse is the unnamed Ordinary Watercourse (unde jurisdiction of the LLFA) which runs through the Site in a generally south-west to north-easterly direction. The watercourse enters the Site through a culvert under an embankment. It runs through several culverts on-Site (labelled in Figure 1) to finally flow through another culvert in the north of the Site that flows into Broughtoun Dyke through an outfall approximately 430 m north-east of the Site. A CCTV Drainage Trace Survey was completed by Midland Survey Ltd in January 2023 (Appendix E) which confirmed the onwards connectivity of the Ordinary Waterc Broughton Dyke from the north-eastern corner of the Site. The nearest Main River (under the jurisdiction of the EA) is the River Maun which is located approximately 1.40 km east of the Site. The River Maun flows in a generally south-east to north-westerly direction.
Geology	Reference to the BGS online mapping (1:50,000 scale) indicates that the central area of the Site is underlain by superficial deposits of Alluvium described as comprising clay, silt, sand and gravel. No other superficial deposits were recorded elsewhere within the Site. The east of the Site is shown to be underlain by bedrock deposits from the Chester Formation which is described as comprising pebbly sandstone. The west of the Site is shown to be underlain by bedrock deposits from the Retford Member which is described as comprising mudstone. The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a Site-specific basis. The closest available historical BGS borehole record (SK66NE26, from 19 located approximately 170 m south of the Site. The geology encountered comprised the following generalised sequence: Coarse, sandstone laminae to a depth of 3.78 metres below ground level (m bgl); Sandstone, discontinuous silty laminae to 6.15 m bgl; Sandstone fine layers to 7.32 m bgl; Siltstone and sandstone interlaminated to 7.97 m bgl; Siltstone with fine sandstone laminae to 7.92 m bgl; Sandstone with layers of larger siltstone pebbles to 9.69 m bgl; Siltstone medium to coarse, fine sandstone laminae to 10.92 m bgl; Sandstone and siltstone interlaminated to 12.62 m bgl; Siltstone fine to mudstone silty to 13.03 m bgl; Coal Parkgate highly fragmented to 15.13 m bgl; over

	Seat Earth siltstone coarse, disturbed sandstone layers to 15.44 m bgl.
Hydrogeology	According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed 30/03/2023], the superficial deposits across the centre of the Site are classified as a Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'. The underlying bedrock deposits are described as a Principal Aquifer in the west and Secondary A Aquifer in the east. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. The EA's 'Source Protection Zones' data, obtained from MAGIC Map' mapping [accessed 30/03/2023], indicates that the Site is located within Zone III Total Catchment Groundwater Source Protection Zone. The BGS borehole did not indicate the presence of groundwater.
Proposed Site Conditions	The proposal is for the construction of a new commercial development in the eastern extent of the Site. Proposed development plans are included in Appendix F. The proposed development will result in an increase in hardstanding areas in the form of buildings and access by 28,997 m^2. Hardstanding will comprise 95,518 m^2 of the total Site area. The remaining permeable, soft landscaped areas will occupy 147,782 m^2 of the total Site area. Hardstanding areas have been measured from proposed development plans as provided by the Client, included in Appendix F.

3.0 Relevant Planning Policy and Guidance

3.1 Introduction

3.1.1 The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to any proposed development on the Site and relevant guidance and legislation.

3.2 Assessment of Flood Risk

3.2.1 The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the EA Flood Maps (Flood Map for Planning). This map defines three zones of different flood risk, the third of which is subdivided into two categories:

Zone 1 “Low probability of flooding” –This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);

Zone 2 “Medium probability of flooding” –This zone comprises 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;

Zone 3a “High probability of flooding” –This zone comprises 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; and

Zone 3b “Functional floodplain” –A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

3.3 National Planning Policy Framework

3.3.1 Flood risk in England is normally considered through the planning process in the NPPF (2023), produced by Ministry of Housing, Communities and Local Government.

3.3.2 The principal aim of the NPPF assessment of flood risk is that:

“Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

3.3.3 The NPPF requires an FRA to be produced where development Sites are:

Greater than one hectare in size;

All proposals for new development (including minor development and change of use) in Flood Zones 2 and 3;

Or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and

Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

3.3.4 The NPPF requires that developers consider not just the flood risk to the development but also the impact that the development might have on flood risk elsewhere. As well as Main Rivers and the sea, it is also necessary to consider flood risk from other sources, including surface water, groundwater, Ordinary Watercourses, artificial drainage systems, canals and reservoirs.

Sequential Test

3.3.5 A key part of the NPPF is that a proposed development must first pass a "Sequential Test" to demonstrate that the overall development proposal is appropriate in terms of flood risk. It ensures that a sequential approach is followed to guide new development to areas with the lowest probability of flooding.

Exception Test

3.3.6 The Exception Test determines whether the benefits of the proposed development will outweigh the potential flood risk.

Vulnerability Classification

3.3.7 In accordance with Table 2 of the NPPG: Flood Risk and Coastal Change, commercial/industrial developments are considered to be **'less vulnerable'**.

Table 1: Flood Risk Vulnerability Classification (from Table 3 of online Planning Practice Guidance)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water-Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

✓ development is permitted
✗ development is not permitted

3.3.8 Table 3 of the NPPG (reproduced above as Table 1), states that 'less vulnerable' development is considered appropriate within Flood Zones 1, 2 and 3.

3.3.9 With respect to the Sequential Test, the proposed development has followed a sequential approach and all new development will be located outside of the areas at fluvial and surface water flood risk. The proposed scheme needs to be located at this Site, in order to improve and expand the facilities associated with the existing operational Murphy hub. The development therefore passes the flood risk Sequential Test. The Exception Test does not need to be applied.

3.4 Local Policy

3.4.1 The Newark and Sherwood Local Development Framework 'Amended Core Strategy' (adopted March 2019) states:

"In terms of the potential impacts of climate change, the District is, due to there being a number of significant rivers within the area, particularly vulnerable to flood risk. In order to avoid locating inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk, national planning policy requires a sequential approach to flood risk. Thus the District Council has undertaken a Strategic Flood Risk Assessment (SFRA) to inform decisions over site allocations and in the determination of planning applications. The SFRA was reviewed and updated in 2016 to provide the necessary evidence base to inform 'Plan Review' The District Council will expect developers, as part of proposals, to take the study into account."

3.4.2 The Amended Core Strategy includes the following policies related to flood risk and drainage:

Spatial Policy 9 Selecting Appropriate Sites for Allocation

Sites allocated for housing, employment and community facilities as part of the development plan will:

1. *Be in, or adjacent to, the existing settlement;*
2. *Be accessible and well related to existing facilities;*
3. *Be accessible by public transport, or demonstrate that the provision of such services could be viably provided;*
4. *Be the most sustainable in terms of impact on existing infrastructure, or demonstrate that infrastructure can be provided to address sustainability issues;*
5. *Appropriately address the historic environment, heritage assets and their setting in line with national policy and guidance and the findings of any Historic Impact Assessment for the site;*
6. *Appropriately address the findings of the Landscape Character Assessment and the conservation and enhancement actions of the particular landscape policy zone/zones affected;*
7. *Not impact on sites that are designated nationally or locally for their biodiversity and give preference to sites of lesser environmental value, avoid impact on biodiversity and provide net gains in biodiversity wherever possible;*
8. *Not lead to the loss of locally important open space and views or, in the case of housing and employment, other locally important community facilities (unless adequately replaced);*
9. *Be assessed by reference to a sequential risk based approach in order to be located in areas at the lowest risk of flooding and not increase flood risk on neighbouring sites; and*
10. *The allocation of sites for development will not lead to the sterilisation of known mineral resources as defined within the Minerals Local Plan.*

Core Policy 9 Sustainable Design

The District Council will expect new development proposals to demonstrate a high standard of sustainable design that both protects and enhances the natural environment and contributes to and sustains the rich local distinctiveness of the District. Therefore all new development should:

Achieve a high standard of sustainable design and layout that is capable of being accessible to all and of an appropriate form and scale to its context complementing the existing built and landscape environments;

Through its design, pro-actively manage surface water including, where feasible, the use of Sustainable Drainage Systems;

Minimise the production of waste and maximise its re-use and recycling;

Demonstrate an effective and efficient use of land that, where appropriate, promotes the re-use of previously developed land and that optimises site potential at a level suitable to local character;

Contribute to a compatible mix of uses, particularly in the town and village centres;

Provide for development that proves to be resilient in the long-term. Taking into account the potential impacts of climate change and the varying needs of the community; and

Take account of the need to reduce the opportunities for crime and the fear of crime, disorder and anti-social behaviour, and promote safe living environments.

The District Council will prepare an SPD which provides guidance to developers on the sustainable design of development and the consideration of making homes fit for purpose over their lifetime including ensuring adaptability and provision of broadband.

Core Policy 10 Climate Change

The District Council is committed to tackling the causes and impacts of climate change and to delivering a reduction in the Districts carbon footprint. The District Council will work with partners and developers to:

Promote energy generation from renewable and low-carbon sources, including community-led schemes, through supporting new development where it is able to demonstrate that its adverse impacts have been satisfactorily addressed. Policy DM4 'Renewable and Low Carbon Energy Generation' provides the framework against which the appropriateness of proposals will be assessed;

Ensure that development proposals maximise, where appropriate and viable, the use of available local opportunities for district heating and decentralised energy;

Mitigate the impacts of climate change through ensuring that new development proposals minimise their potential adverse environmental impacts during their 63 construction and eventual operation. New proposals for development should therefore:

Ensure that the impacts on natural resources are minimised and the use of renewable resources encouraged; and

Be efficient in the consumption of energy, water and other resources.

Steer new development away from those areas at highest risk of flooding, applying the sequential approach to its location detailed in Policy DM5 'Design'. Where appropriate the Authority will seek to secure strategic flood mitigation measures as part of new development;

Where appropriate having applied the Sequential Test move on to apply the Exceptions Test, in line with national guidance. In those circumstances where the wider Exceptions Test is not required proposals for new development in flood risk areas will still need to demonstrate that the safety of the development and future occupants from flood risk can be provided for, over the lifetime of the development; and

Ensure that new development positively manages its surface water run-off through the design and layout of development to ensure that there is no unacceptable impact in run-off into surrounding areas or the existing drainage regime.

3.5 Consultation

3.5.1 Pre-application advice was requested from Newark and Sherwood District Council, with a response received on 7th November 2023. A previous iteration of this FRA/DS was submitted to the Council as part of this and was reviewed by Nottinghamshire County Council as the LLFA. Their response was as follows:

'*Comments received 31.10.2023:*

3.5.2 We recognise that the applicant has now submitted further information for consideration. We note some concerns regarding the applicant's assessment of existing floor risk (para 4.3.7 of Flood Risk Assessment and Drainage Strategy) which could have a considerable impact on the viability of their proposals. We recommend the applicant ensure their interpretation of the information is correct and justifiable should they pursue any formal planning application. [Delta-Simons notes that the paragraph numbers have changed in this updated report.]

Comments received 02.10.2023:

3.5.3 No specific information has been submitted with regards to drainage for this pre-app enquiry, we have made some general comments on the information that we would expect see when the application is submitted for planning approval.

3.5.4 Please note there is an ordinary watercourse that crosses the site and this will be subject to a number of protective restrictions including the need for easements and limitations on alterations and it is recommended that these are discussed with us as part of any outline design considerations. Please also note it will not be acceptable to have the watercourse culverted.

3.5.5 Given the proposed scale of the development to satisfy the National Planning Policy Framework (NPPF) further details would need to be submitted to support this application. The NPPF requires that applications in Flood Zone 2, 3 and in Flood Zone 1 over 1 hectare should be accompanied by a site-specific flood risk assessment, reviewing the potential flood risks to the development from all sources. An FRA is vital if the local planning authority is to make an informed planning decision.

3.5.6 As LLFA we also require details of the proposed surface water drainage strategy for the development. Paragraph 165 of the NPPF states that major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The LLFA advise that any proposed drainage strategy should be in accordance with CIRIA C753 and current best practice guidance. Any FRA or drainage strategy should include following information:

An assessment of the nature of SuDS proposed to be used and demonstration that design is in accordance with CIRIA C753 and NPPF Paragraph 169.

Details of a proven outfall from site in accordance with the drainage hierarchy. The following options should be considered in order of preference:

Infiltration

Discharge to watercourse

Discharge to surface water sewer

Discharge to combined sewer

Justification for the use or not of infiltration, including the results of soakaway testing, in accordance with BRE 365.

Evidence the maximum discharge is set to the QBar Greenfield run-off rate for the positively drained area of development.

Demonstrate the site drainage system should cater for all rainfall events up to and including the 1 in 100-year event including a 40% allowance for climate change.

Provide details for exceedance flows; surface water should be contained within the site boundary without flooding any properties in a 1 in 100 year plus 40% climate change storm.

Evidence to demonstrate the viability (e.g Condition, Capacity and positive onward connection) of any receiving watercourse to accept and convey all surface water from the site.

Details of STW approval for connections to existing network and any adoption of site drainage infrastructure.

Evidence of approval for drainage infrastructure crossing third party land where applicable.

A surface water management plan demonstrating how surface water flows will be managed during construction to ensure no increase in flood risk off site.

Evidence of how the on-site surface water drainage systems shall be maintained and managed after completion and for the lifetime of the development to ensure long term effectiveness, and the party responsible for this.

3.5.7 *This is only a brief outline of the minimum information we would be expecting to see and not an exhaustive list. From looking at the site location plan there may also be existing surface water flow routes that need to be addressed, these should be identified in a site-specific flood risk assessment and adequately mitigated*.'

3.5.8 The above have been addressed throughout this updated report.

4.0 Assessment of Flood Risk

4.1 Tidal Flood Risk

4.1.1 The Site is situated inland and at a minimum of 36 m AOD and is significantly above sea level. Therefore, the risk from tidal flooding is considered **Negligible**.

4.2 Fluvial Flood Risk

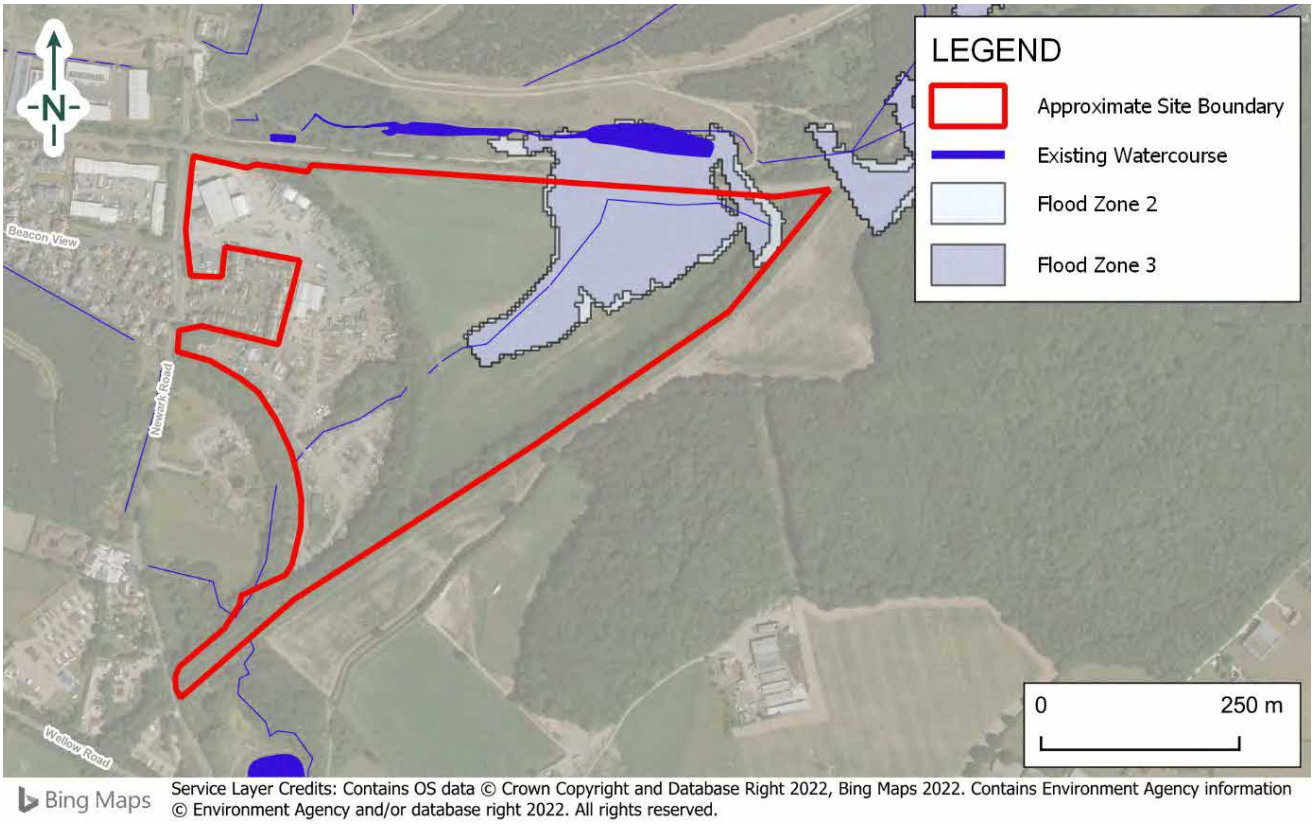

Figure 2: EA's Flood Map for Planning

4.2.1 According to the EA online Flood Map for Planning (Figure 2), the Site is largely situated within Flood Zone 1 (whereby the annual probability of fluvial flooding is less than 1 in 1000), whilst the north-eastern corner of the Site is shown to be located within Flood Zones 2 (whereby the annual probability is greater than 1 in 1000 but less than 1 in 100) & 3 (whereby the annual probability is greater than 1 in 100).

4.2.2 An unnamed Ordinary Watercourse runs through the middle of the Site in a generally south-east to north-west direction. The watercourse enters the Site in the south via a culvert under an embankment. It runs through several culverts on the Site to finally flow into another culvert in the north of the Site that flows into the Boughton Dyke. The culvert in the north of the Site has a length of approximately 540 m and its inlet is situated at the railway embankment, resulting in a potential flow restriction.

4.2.3 Given the identified flood extent mapping abruptly begins midway through the Site, it is likely that the unnamed watercourse that runs through the Site has not been subject to full and detailed hydraulic modelling. Therefore, the potential fluvial extent of the flooding is likely to be inaccurate. Site-specific surface water model has therefore been undertaken by Herrington Consulting Limited which is discussed in more detail below.

4.2.4 The EA 'Historical Flood Map' (Appendix G) indicates that there have been no historical incidents of fluvial flooding at the Site. The Site is not located within a Flood Warning and Alert Area.

4.2.5 A review of the relevant third-party reports does not indicate any evidence of Site-specific fluvial flood risk.

Hydraulic Modelling Report

4.2.6 Due to the elevated risk of fluvial flooding associated with the unnamed Ordinary Watercourse on-Site, a Site-specific surface water model has been constructed by Herrington Consulting Limited in December 2023 to represent the existing baseline conditions and the proposed development scenario. A Technical Note (doc ref: 3627) summarising the modelling methodology and results has been provided alongside this FRA & DS.

4.2.7 Visual outputs of the existing and proposed model scenarios for the 1 in 30 year, 1 in 100 year, 1 in 100 year plus 27% CC allowance, and 1 in 1000 year event are included as Appendix H. In line with EA climate change guidance, the design event is the 1 in 100 year plus 27% CC.

4.2.8 The results from the baseline modelling exercise show refined flood extents that depict a slightly reduced level of flood risk compared to the EA Online mapping.

4.2.9 Maximum flood depths during the 1 in 100 year +27% CC flood event are shown to exceed 1 m to the east of the watercourse. However, the proposed development will be located outside of the flood extent for this event. There will be very limited encroachment into the flood extent but this will not result in an alteration to flood risk off-Site, as water is backs up against the train line..

4.2.10 The model outputs indicate that during a residual risk scenario with a return period of 1 in 100 years +27% CC, where both the upstream and downstream culverts are 50% blocked, a portion of the proposed attenuation pond be located within the maximum modelled flood extents. However, the likelihood of this event occurring is low. The development areas themselves would remain outside of the flood extents.

4.2.11 Furthermore, the modelling report demonstrates that the proposed development will not result in any detrimental off-Site impacts.

4.2.12 Access and egress will remain available both within the Site towards Newark Road and off-Site in a northerly direction along Newark Road. It is recommended that Site users do not enter any area of floodwater when flooding occurs. It is considered that this can be achieved through a Flood Management Plan.

4.2.13 No further increase in ground levels or encroachment of building footprint should take place within the identified fluvial floodplain, without undertaking further iterations of hydraulic modelling to assess the impacts of any such changes.

4.2.14 The existing and proposed development on-Site is therefore considered to be at **Low** risk of fluvial flooding.

4.3 Surface Water Flood Risk

4.3.1 According to the EA's Long-Term Flood Risk Map for Surface Water (Figure 3), the Site is shown to be largely at a 'Very Low' risk from surface water flooding (flooding occurring as a result of rainfall with a less than 0.1% annual probability).

4.3.2 A flow path runs through the centre of the Site, flowing from south-west to north-east, which is associated with the course of the unnamed Ordinary Watercourse which is located within the Site. Surface water flooding with a 'Low' (<0.1% annual probability) to 'High' risk of occurring (>3.3% annual probability) is shown along the route of the watercourse, with the extent expanding in the north-east of the Site due to water backing up against the railway embankment. It is considered that the surface water flood risk is likely predominantly representative of the fluvial flood risk on-Site.

4.3.3 The areas of proposed development on-Site are shown to be wholly located outside of the areas of indicated Medium (between 1% and 0.1% annual probability) and High risk from surface water at the Site, however, according to the EA flood maps, the proposed workshop building will be partially situated within an area of Low risk from surface water flooding. Surface water depth mapping indicates that flood depths in this area of development in the west of the Site will exceed 300 mm. However, the workshop building in this area of indicated flood risk will be set at 41.7 m AOD, which is significantly higher than surrounding ground levels, therefore the risk of surface water flooding to the area of development on-Site is considered Low.

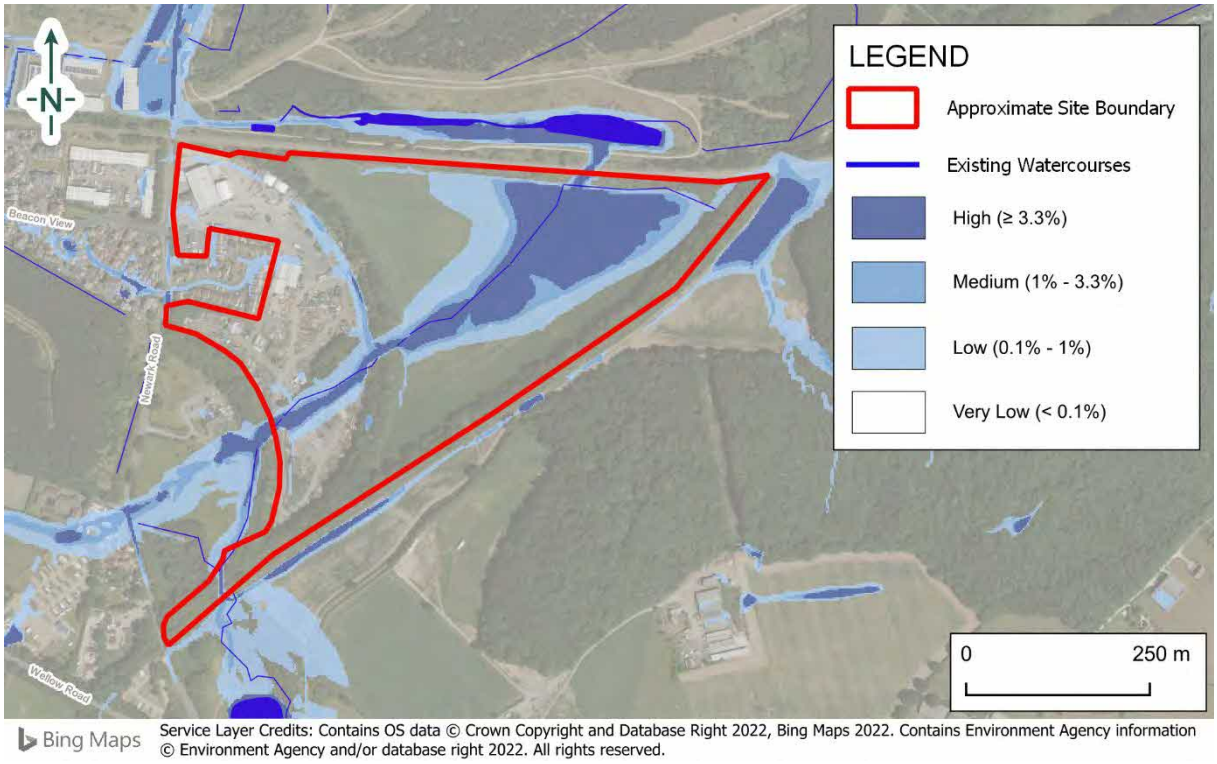

Figure 3: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)

4.3.4 Furthermore, the modelling report provided by Herrington Consulting Limited in December 2023 indicates that the proposed development on-Site will be located entirely outside of the modelled fluvial flood extents up to and including the 1 in 100 year +27% CC event. On this basis, it is considered likely that the development is outside of - or above - the 100 year plus 40% climate change pluvial flood extent.

4.3.5 The flood risk associated with the flow path/Ordinary Watercourse has been discussed further within the fluvial section above.

4.3.6 Whilst the EA's surface water flood risk extent is greater than the modelled fluvial flood extent, it is considered that the hydraulic modelling presents a more accurate level of risk at the Site. In addition, the implementation of attenuation features as part of the development will reduce surface water ponding at the Site.

4.3.7 Surface water depth mapping indicates within the isolated pockets of surface water in the west of the Site, depths remain below 300 mm during the Low risk scenario which is deemed passable by pedestrians and vehicles.

4.3.8 Access and egress to the Site is recommended via Newark Road to the west. Safe access and egress to the Site along Newark Road to the south during all flood risk scenarios and is achievable in the north during the High and Medium risk scenarios. It is recommended that Site users do not enter any area of floodwater when flooding occurs and this would not be required for the operational use of the Site. It is considered that this can be achieved through a Flood Management Plan.

4.3.9 Mapping contained within the 2012 SFRA indicates depths greater than 0.3 m of surface water flooding in the northeast of the Site in relation to the Ordinary Watercourse. A review of relevant third party reports indicate no evidence of Site specific surface water flooding.

4.3.10 No further increase in ground levels or encroachment of building footprint should take place within the identified (fluvial) floodplain, without undertaking further iterations of hydraulic modelling to assess the impacts of any such changes.

4.3.11 Considering the above, the risk of surface water flooding to the proposed operational areas on-Site is deemed to be **Low.** The impact of the proposed development on surface water risk is covered in Section 5.0 to ensure that surface water risk is not exacerbated through appropriate SuDS measures.

4.4 Groundwater Flood Risk

4.4.1 A description of geology underlying the Site has been provided in Section 2.0, the closest BGS Borehole record did not indicate the presence of groundwater.

4.4.2 There are no basement levels associated within the developed area of the Site or within the proposed development, therefore the risk of groundwater seepage impacting the Site is considered Low. The existing western area of the Site and the area of proposed development is largely hardstanding, this will help inhibit the vertical migration of groundwater to the surface due to the presence of a permanent impermeable layer at the surface.

4.4.3 Based on the location of the on-Site Ordinary Watercourse, it is anticipated that local groundwater levels are likely to be in hydraulic continuity with the watercourse. However, as the proposed development is entirely located outside of –or above –the fluvial flood extents, it is not anticipated that it would be at elevated risk of groundwater flooding.

4.4.4 Mapping contained within the 2012 SFRA indicates the Site is located in an area with <25% susceptibility to groundwater flooding. A review of relevant third party reports did not identify further evidence of groundwater flooding within the Site.

4.4.5 Considering the above evidence, the risk of groundwater flooding is considered **Low**.

4.5 Artificial Sources Flood Risk

4.5.1 Sewer flood risk is typically hard to predict. Sewer flooding records contained within the 2012 SFRA indicate there have been no historic, recorded sewer flooding incidents within the Site. Based on available information to date, the Site-specific risk of sewer flooding is considered **Low**.

4.5.2 The Long-Term Flood Risk Map (Reservoirs) indicates that the Site is not within the flood extents of a reservoir overtopping or breach event. Flood risk from reservoirs is therefore considered **Negligible**.

4.5.3 There are no canals within the vicinity of the Site, and therefore canal flood risk is considered **Negligible**.

4.5.4 It can therefore be concluded that the risk of flooding from artificial sources is considered **Negligible to Low**.

4.6 Summary of Flood Risk

4.6.1 It can be concluded the risk of flooding to the proposed development areas is **Negligible to Low** from all sources. Notwithstanding this, given that external areas in the east of the Site - which are not proposed to be developed - could experience flooding to significant depths, flooded areas must be avoided by Site users. A Flood Management Plan should be produced to detail the actions for Site management to take in advance of flooding and when flooding occurs, to manage the risk to Site users.

4.6.2 It is also recommended, in line with Building Regulations, to elevate finished ground floor levels 150 mm above surrounding ground levels.

4.7 Residual Risks

4.7.1 A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop the unnamed Ordinary Watercourse and impact the Site. As the probability of a 1 in 1000 year flood event occurring is 0.1% in any given year, the probability is low and, therefore, no further mitigation beyond what is proposed is required.

4.7.2 In the event of an exceedance event occurring, the residual risk to people working within the Site can be managed through the implementation of an appropriate Flood Management Plan, which recognises the residual risks and details what action is to be taken by staff in the event of a flood to put occupants in a place of safety.

5.0 Drainage Strategy

5.1 Introduction

5.1.1 The existing Site currently comprises approximately 66,521 m^2 of hardstanding, with soft landscaping comprising approximately 176,779 m^2. The existing greenfield area in the east of the Site is not formally drained and therefore is considered to be 100% permeable. There is an Ordinary Watercourse which runs through the Site.

5.1.2 The proposed development will introduce approximately 28,997m^2 of additional hardstanding in the form of buildings and access, for a total proposed hardstanding area of 95,518 m^2.

5.1.3 The increase in hardstanding area will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the Site will be controlled.

5.2 Surface Water Discharge

5.2.1 The existing greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method, summarised in Table 2 below. The equivalent 1 in 2 year event greenfield rate for the 2.9 ha of additional hardstanding is 3.95 l/s, increasing to 13.72 l/s during the 1 in 100 year event.

Table 2: Greenfield Runoff Rates

Return Period	Runoff Rate (l/s)
1 in 2	3.95
1 in 10	7.31
1 in 30	9.94
1 in 100	13.72
1 in 1000	26.8

5.2.2 A flow rate of 3.9 l/s is proposed for the new development area at the Site to ensure the drainage system is self-cleansing.

5.3 Drainage Hierarchy

5.3.1 The recommended surface water drainage hierarchy (Paragraph 080 of the NPPG: Flood Risk and Coastal Change) is to utilise soakaway systems or infiltration as the preferred option, followed by discharging to an appropriate watercourse. If this is not feasible, the final option is to discharge to an existing public sewer.

Surface Water Discharge to Soakaway

5.3.2 The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). As described above the Site is partially underlain by superficial deposits of alluvium and wholly underlain by mudstone.

5.3.3 Due to the low permeability of the underlying mudstone, the light industrial use of parts of the Site and the likelihood that groundwater levels would be shallow in the vicinity of the watercourse, it can be concluded that soakaways are not be suitable for the discharge of surface water runoff.

Surface Water Discharge to Watercourse

5.3.4 Where soakaways are not suitable a connection to watercourse is the next consideration.

5.3.5 An Ordinary Watercourse flows through the Site in a south-west to north-easterly direction and in the east of the Site has a water level of 37-38 m AOD. Discharge to the Ordinary Watercourse at a rate of 3.9 l/s appears to be feasible.

5.3.6 A watercourse condition survey can be conditioned and undertaken prior to detailed design. The hydraulic modelling undertaken demonstrates the onward connectivity of the watercourse as well as the capacity it would have to receive additional flows –as the Site is not wholly located within the floodplain. Consideration would need to be given to the outfall level into the watercourse.

Surface Water Discharge to Sewer

5.3.7 As described above, a connection to the Ordinary Watercourse on-Site is considered to be feasible and therefore a connection to the public surface water sewer is not required.

5.4 Attenuation Storage

5.4.1 In order to achieve a discharge rate of 3.9 l/s, attenuation storage will be required. Quick Storage Estimates have been provided using MicroDrainage and are included in Appendix I and in Table 3 below.

Table 3: Attenuation Storage Volume Requirements

Storm Event	Attenuation Volume (m^3)
1 in 30 year plus 25% CC	1800 - 2705
1 in 100 year plus 40% CC	2854 - 3945

5.4.2 The attenuation volumes are provided for indicative purposes only and should be verified at the detailed design stage.

5.5 Sustainable Drainage Systems

5.5.1 Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. The following SuDS options have been considered:

Soakaways

5.5.2 As described above, the use of soakaways is not considered to be feasible.

Swales, Detention Basins and Ponds

5.5.3 Sufficient space is available on Site to utilise a pond, basin or swale as an above ground attenuation feature. In order to facilitate gravity drainage, attenuation features should be to the south of the proposed development.

5.5.4 MicroDrainage Source Control Calculations are included as Appendix J which demonstrate that an attenuation basin with a surface area of 3,522.8 m^2, a slope ratio of 1:3, a depth of 1.3 m with a 0.3 m freeboard will provide an attenuation volume of 3,009.3 m^3.

5.5.5 The fluvial modelling demonstrates that the attenuation pond would be located outside of the flood risk extent during the design 1 in 100 year plus 27% climate change event. Whilst some ingress is indicated to occur in the culvert blockage scenario, this is a residual risk and the freeboard in the pond would provide additional storage.

5.5.6 An open surface water attenuation feature such as a pond, basin or a swale can present a safety risk; the hazards and appropriate mitigation should be considered at the detailed design stage.

Rainwater Harvesting

5.5.7 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. However, rainwater harvesting techniques such as water butts could be incorporated within the final design if irrigation of on-Site landscaping is required.

Green Roofs

5.5.8 Green roofs are not proposed. Given the nature of the proposed development, the significant additional cost involved in installing and maintaining green roofs and the additional works required to allow for the additional loading on the building, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved.

Porous/Permeable Paving

5.5.9 Permeable surfacing could be incorporated within the proposed car parking area in the north-east of the Site. Storage would be provided within the sub-grade material prior to controlled release to the receiving watercourse. The amount of storage offered by permeable paving is subject to sub-grade depth and Site gradient. The use of permeable paving should be considered at the detailed design stage.

5.5.10 Based on an external paved area of approximately 2,580.48 m^2 in the car parking area, a sub-grade depth of 0.3 m and a void ratio of 30%, there is potential to accommodate approximately 226 m^3 of attenuation storage within the sub-grade of permeable paving (assuming the base of the sub-grade will be formed at a level gradient).

5.5.11 It is proposed to use a permeable surface, likely crushed aggregate within the proposed pylon training area in the south-east of the Site. The path which leads to this area could be permeably surfaced, either with a formal paving and subbase, or a crushed aggregate. This will be considered further at detailed design stage.

Underground Attenuation Tanks

5.5.12 As described above, an attenuation basin will be used and therefore underground attenuation will not be required.

5.6 Preferred Drainage Scheme

5.6.1 A conceptual drainage sketch (Appendix K) has been prepared to provide an indication of the proposed drainage strategy for the Site. It should be noted that detailed drainage design will be required at the detailed design stage.

5.6.2 It is proposed to provide an attenuation basin located to the south of the proposed workshop. The attenuation basin will have a surface area of at least 3,522 m^2, with a slope ratio of 1:3, a depth of 1.3 m (including a 0.3 m freeboard) and will provide an attenuation volume of at least 3,009 m^3. MicroDrainage Source Control Calculations are included as Appendix J. The size of the basin can be reduced at detailed design stage once the total area of porous surfacing is finalised.

5.6.3 Surface water runoff will be discharged to the Ordinary Watercourse on-Site at a rate of 3.9 l/s for all events up to and including the 1 in 100 year plus 40% CC event.

5.6.4 The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the proposed development.

5.7 Event Exceedance

5.7.1 Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within the landscaped areas. Finished floor levels will be set at a minimum of 150 mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.

5.7.2 Potential exceedance flow routes have been identified on the drainage sketch in Appendix K.

5.8 Surface Water Treatment

5.8.1 In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), other roofs (typically commercial/industrial roofs) have a 'low' pollution hazard level, with low traffic roads classified as having a 'low' pollution hazard level. Table 4 below shows the pollution hazard indices for each land use.

Table 4: Pollution Hazard Indices*

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other Roofs (typically commercial/industrial roofs)	Low	0.5	0.2**	0.4
Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' –Table 26.2

* Indices values range from 0-1.

** up to 0.8 where there is potential for metals to leach from the roof

5.8.2 Runoff in the west of the Site will be directed to permeable paving, with all runoff from proposed redevelopment areas ultimately directed to an on-Site attenuation basin. Table 5 below demonstrates that permeable paving and an attenuation pond both provide sufficient treatment.

Table 5: SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Attenuation Basin	0.7	0.7	0.5

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' –Table 26.3

5.8.3 An interceptor will be required in the car park in the west of the Site, at a ratio of one per 50 parking spaces.

5.9 Maintenance

5.9.1 Maintenance of drainage features such as permeable paving and an attenuation basin will be the responsibility of the Site owner and can be arranged through appointment of a Site management company.

5.9.2 Maintenance schedules for an attenuation basin and permeable paving are included in Appendix L. Maintenance of the separator will be as per the manufacturer's guidance.

5.10 Foul Water Discharge

5.10.1 There are no readily accessible public sewers within the vicinity of the Site therefore a private sewage treatment plant is likely to provide the best alternative for the Site. A biodisc treatment plant (or similar) would be a suitable option and would provide sufficient treatment for foul flows. Treated effluent should be discharged to the Ordinary Watercourse on-Site. The sewerage treatment plant should be placed a minimum of 7 m from habitable buildings and a minimum of 10m from watercourses. Therefore, the biodisc treatment plant (or similar) should be located in the landscaped areas in the eastern extent of the Site and outside the area considered to be at flood risk from both fluvial and surface water sources.

5.10.2 As neither foul sewerage nor surface water drainage is proposed to connect into the Severn Trent Water network, consultation with them has not been required.

5.11 Other Considerations

5.11.1 Maintenance access to the Ordinary Watercourse on-Site should be retained. Maintenance access can be ensured by providing an 8 m buffer free from building footprint either side of the watercourse. This has been achieved in the proposed development layout.

5.11.2 A Surface Water Management Plan to demonstrate how surface water flows will be managed during construction will be produced at detailed design stage. This Plan will help to ensure that there is no increase in flood risk off-Site. It would include a set of drawings showing the likely construction phasing and how storm water is dealt with throughout each phase, with flow/volume calculations annotated on the drawings.

6.0 Conclusions and Recommendations

6.1 Conclusions

6.1.1 All sources of flood risk have been assessed. Based on a review of all relevant data sources, the existing and proposed development areas on-Site are considered to be at **Low** risk from all sources of flooding.

6.1.2 Notwithstanding this, given that external areas in the east of the Site - which are not proposed to be developed - could experience flooding to significant depths, flooded areas must be avoided by Site users. A Flood Management Plan should be produced to detail the actions for Site management to take in advance of flooding and when flooding occurs, to manage the risk to Site users.

6.1.3 In line with Building Regulations, it is recommended to elevate finished ground floor levels 150 mm above surrounding ground levels.

6.1.4 The proposed development will introduce additional impermeable drainage area in the form of buildings and access. This will result in an increase in surface water runoff if unmitigated. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, flow control will be used, and attenuation provided on Site to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.

6.1.5 All methods of surface water discharge have been assessed. Discharge of surface water to the existing Ordinary Watercourse on-Site at a rate of 3.9 l/s appears to be the most practical option.

6.1.6 Attenuation storage will be required on Site in order to restrict surface water discharge to 3.9 l/s. Attenuation can be provided within an attenuation basin, supplemented by permeable paving.

6.1.7 There are no readily accessible public sewers within the vicinity of the Site therefore a private sewage treatment plant is likely to provide the best alternative for the Site. Treated effluent should be discharged to the unnamed Ordinary Watercourse on-Site. The biodisc treatment plant (or similar) should be located in the landscaped areas in the eastern extent of the Site and outside the area considered to be at flood risk from both fluvial and surface water sources.

6.2 Recommendations

Flood Risk

Set finished floor levels 150 mm above surrounding ground levels; and

Prepare a Flood Management Plan, to detail roles and responsibility of Site management and evacuation procedures to direct those on-Site to a place of safety.

Drainage Strategy

Verify the attenuation volumes included in this report when undertaking detailed drainage design; and

Make provision for sustainable drainage features in the eastern extent of the Site, as proposed.

Other

Maintenance access to the Ordinary Watercourse on-Site should be retained through providing an 8 m buffer free from building footprint either side of the watercourse, as proposed.

Appendix A –Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B –Constraints Plan

DRAWING STATUS

DRAFT

Drawing ref: 117-1001_Constraints plan - View 1

Title number: NT474969

Third party rights.
Refer to E7 under HM title NT524222

Unregistered title land

Third party rights.
Refer to E6 under title NT247302

Title number: NT352719

Watercourse

Drawing ref: 117-1002_Constraints plan - View 2

Title number: NT371683

Drawing ref: 117-1003_Constraints plan - View 3

SITE

- Site Boundary

  HM Land Registry:
  Refer to HM land registry title number NT247302, NT524222 & NT474761

- Surrounding titles (HM Land Registry)

CONSTRAINTS

DRAINAGE + WATER SERVICE (E15 + E19)

- Combined Public Sewer
  Drawing Ref: SK6667SE, SK6767NW, SK6767NE, SK6666NE, SK6766SW
  Severn Trent Water - 24/12/2018
- Distribution Main
  Drawing ref: SK6667SE, SK6767NW, SK6767SE, SK6666NE, SK6766NW, SK6666SE
  Severn Trent Water - 24/12/2018
- Public Foul Gravity Sewer
  Drawing Ref: SK6667SE, SK6767NW, SK6767NE, SK6666NE, SK6766SW
  Severn Trent Water - 24/12/2018
- Combined Use Pressurised Sewer
  Drawing Ref: SK6667SE, SK6767NW, SK6767NE, SK6666NE, SK6766SW
  Severn Trent Water - 24/12/2018
- Sewage Pumping Facility

GAS RECORDS (E14)

- LP Mains
  Drawing Ref: SP18857
  Cadent Gas Ltd - 12/12/2018
- MP Mains
  Drawing Ref: SP18857
  Cadent Gas Ltd - 12/12/2018

HIGHWAYS (E12)

- Adopted Highway
  Drawing ref: 183B9393:230213/341298
  Nottinghamshire County Council - 04/09/2018
- Right of Way
  Refer to HM land registry title number NT474761

ELECTRICITY RECORDS (E17)

- LV
  Drawing Ref: SP18857
  Western Power Distribution - 13/12/2018
- HV (11kV)
  Drawing Ref: SP18857
  Western Power Distribution - 13/12/2018
- HV (33kV)
  Drawing Ref: SP18857
  Western Power Distribution - 13/12/2018

TELECOM AND CABLE RECORDS (E21)

- Telecoms (Built)
  Drawing ref: UXN10222E, NBE10238H
  Open Reach BT - 03/01/2019

FLOOD SEARCH (E18)

- Flood risk area
  Drawing ref: 18753085
  Groundsure - 03/12/2018

01 (117_1000) **CONSTRAINTS PLAN**
1:2500@A0

NOTES:

Drawing based on Murphy survey drawings LBU0171_Ollerton Plan Depot_1_rev 1 dated 08/06/18

The information relating to each constraint/utility/service is for illustrative purposes only.

This drawing is based on information provided by Murphy Group within the Report on Title - E (updated 15.03.2019) and its accompanying appendices E1-E22 Please refer to the appropriate appendices within the Report on Title for the detailed information relating to the constraints identified.

The location of any services or constraints is also subject to a detailed site survey.

Please note, the list of constraints identified is not exhaustive. Additional surveys/consultation may be necessary prior to carry out any works or developing alternative uses for the site (e.g. arboricultural survey)

Site is within Sherwood Forest Regional Park

N

0 20M 40M 80M 125M

REVISIONS

Rev.	Description	Date	Checked
-	Draft Issue	12.04.19	

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PROJECT TITLE
OLLERTON, NEWARK

DRAWING TITLE
CONSTRAINTS PLAN - OVERALL VIEW

PROJECT NO.	DRAWING NO.	REVISION NO.	STATUS	
117	1000	-	DRAFT	1:2500@A0 1:10000@A3

ORIGINATED	CHECKED BY
04.19	DOD

Appendix C –Topographical Survey

NOTES

Rev	Description	Checked By	Date
2	Additional survey of farmer's fields added	A. MISTRY	08/06/18
3	Rail embankment survey added	A. MAZZEY	19/12/22

Project

OLLERTON PLANT DEPOT

Drawing Title

OLLERTON PLANT DEPOT

MURPHY
WORLD-CLASS INFRASTRUCTURE

Originating Office:
JMS Survey & Setting Out Department
Hiview House
Highgate Road
London
NW5 1TN
[redacted]

QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

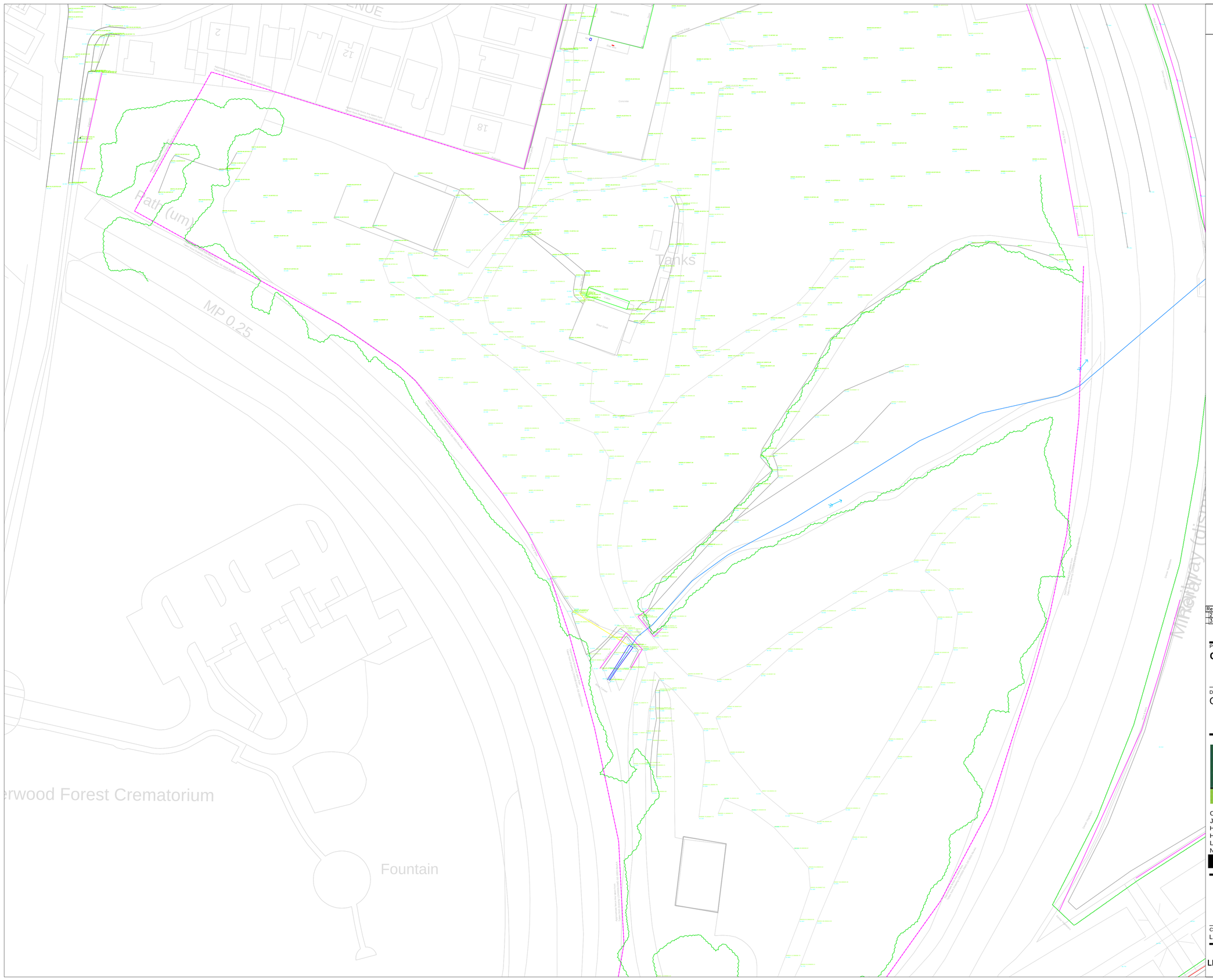
Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No

LBU0171_OLLERTON PLANT DEPOT_1

Revision

1



NOTES

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Project

OLLERTON PLANT DEPOT

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QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

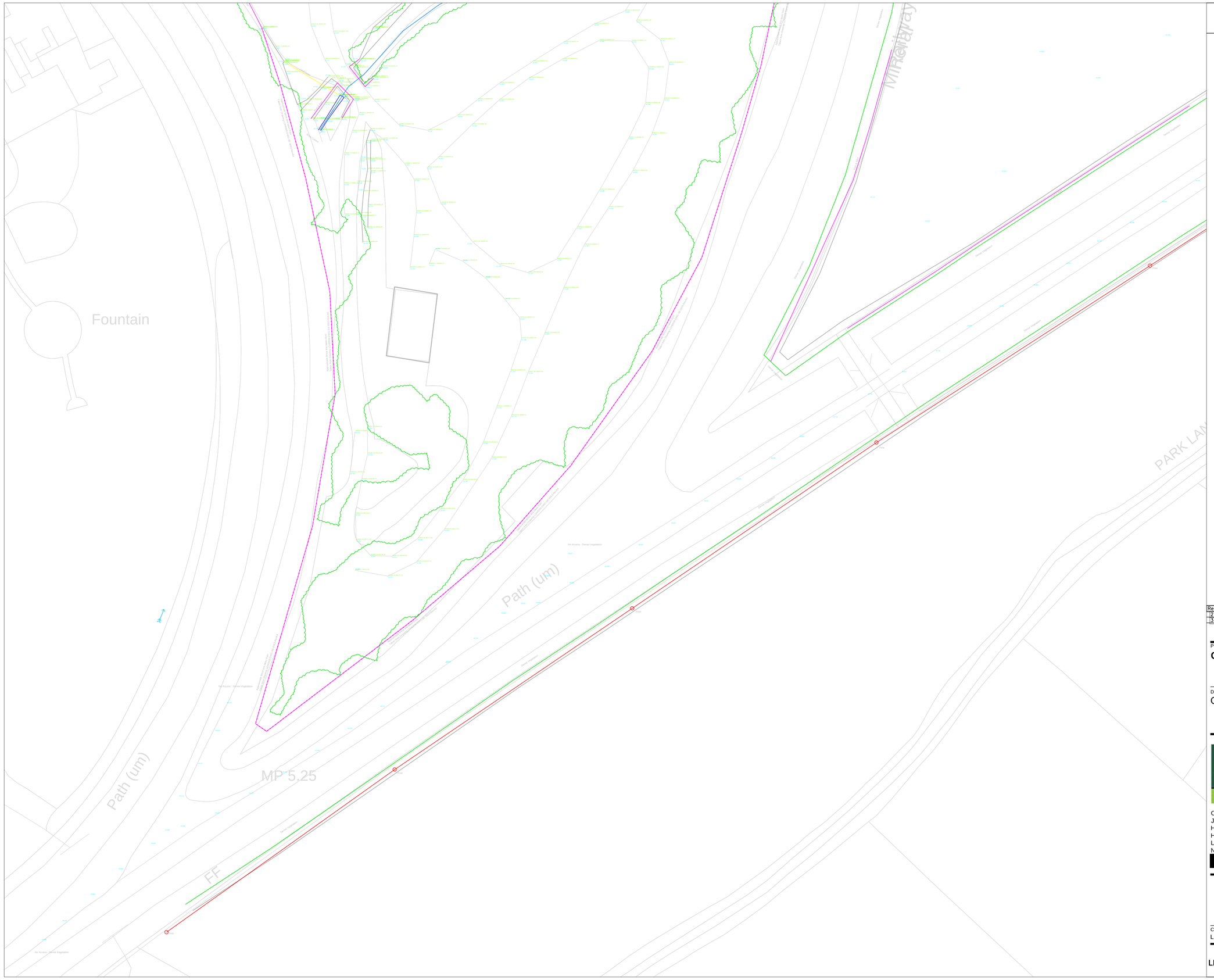
Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No

LBU0171_OLLERTON PLANT DEPOT_2

Revision

1



NOTES

Rev	Description	Checked By	Date
2	Additional survey of farmer's fields added	A. MISTRY	08/06/18
3	Rail embankment survey added	A. MAZZEY	19/12/22

Project

OLLERTON PLANT DEPOT

Drawing Title

OLLERTON PLANT DEPOT

MURPHY
WORLD-CLASS INFRASTRUCTURE

Originating Office:
JMS Survey & Setting Out Department
Hview House
Highgate Road
London
NW5 1TN
[redacted]

QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

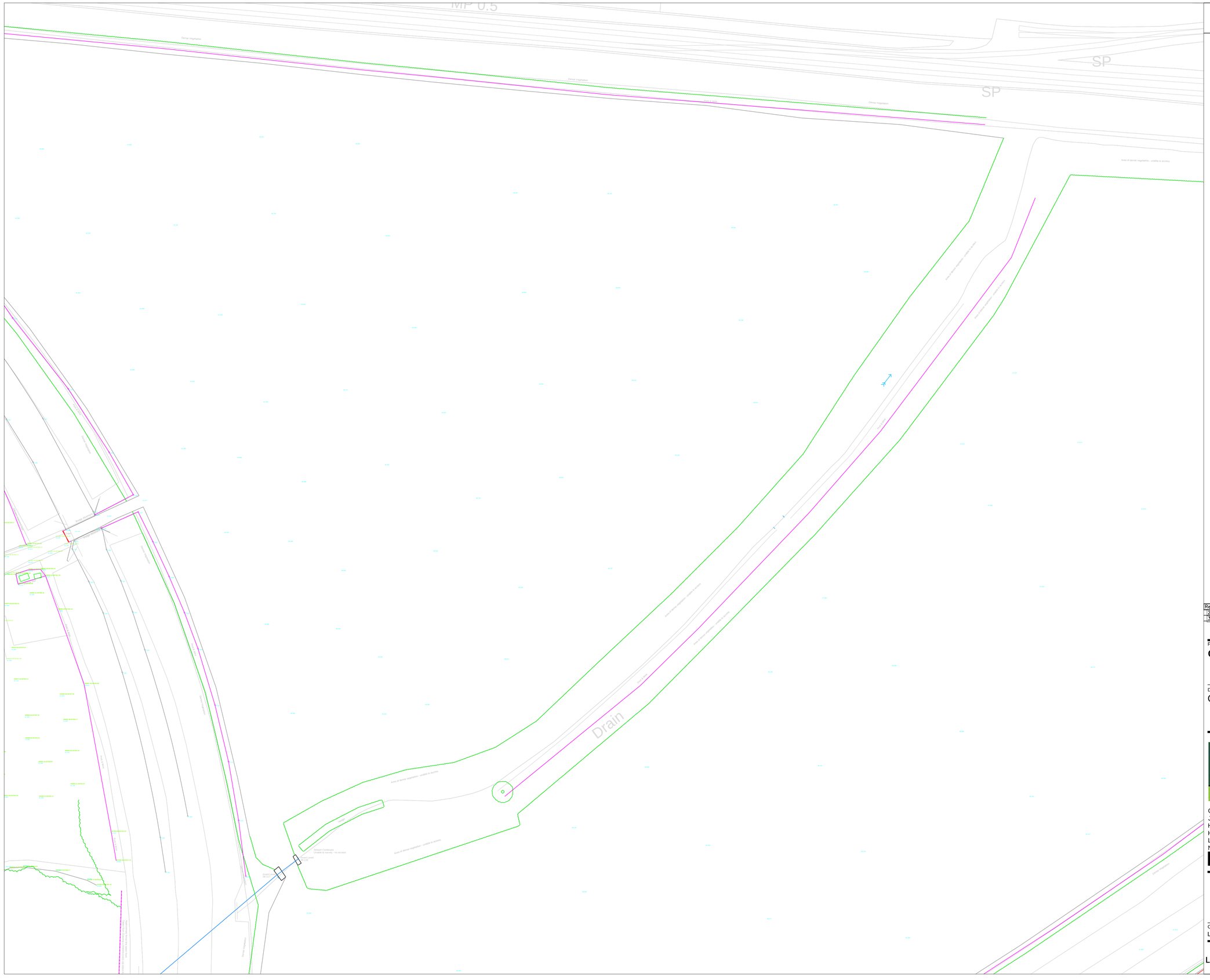
Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No

LBU0171_OLLERTON PLANT DEPOT_3

Revision

1



NOTES

Rev	Description	Checked By	Date
2	Additional survey of farmer's fields added	A. MISTRY	08/06/18
1	Rail embankment survey added	A. MAZZEY	19/12/22

Project

OLLERTON PLANT DEPOT

Drawing Title

OLLERTON PLANT DEPOT

MURPHY
WORLD-CLASS INFRASTRUCTURE

Originating Office:
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[redacted]

QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No

LBU0171_OLLERTON PLANT DEPOT_4

Revision

1

NOTES

Rev	Description	Checked By	Date
1	Additional survey of farmer's fields added	A. MISTRY	08/06/18

Project

OLLERTON PLANT DEPOT

Drawing Title

OLLERTON PLANT DEPOT

Originating Office:
JMS Survey & Setting Out Department
Hiview House
Highgate Road
London
NW5 1TN
[redacted]

QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

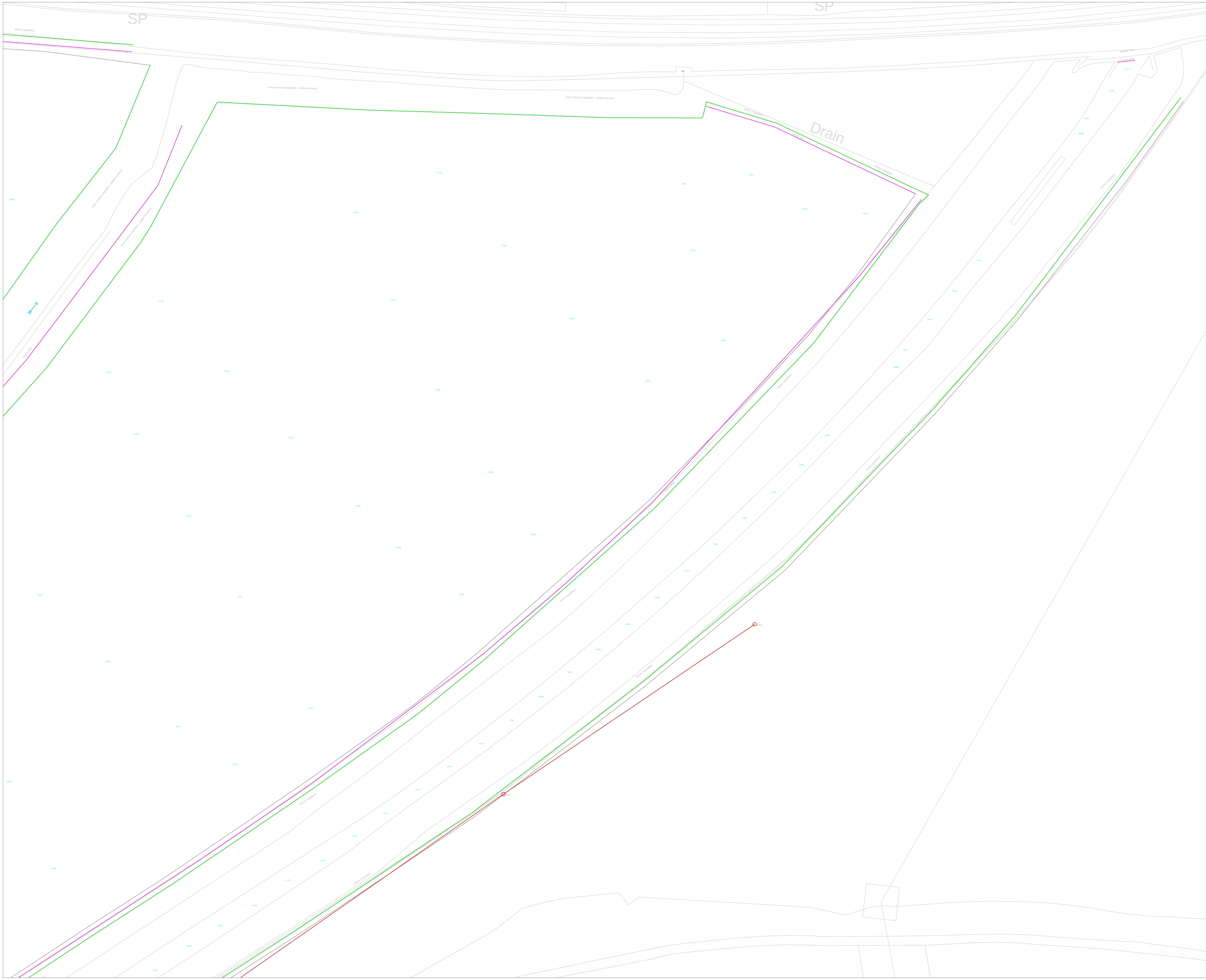
Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No

LBU0171_OLLERTON PLANT DEPOT_5

Revision

1



NOTES

Rev	Description	Checked By	Date
1	Additional survey of farmer's fields added	A. MISTRY	08/06/18

Project
OLLERTON PLANT DEPOT

Drawing Title
OLLERTON PLANT DEPOT

Originating Office:
JMS Survey & Setting Out Department
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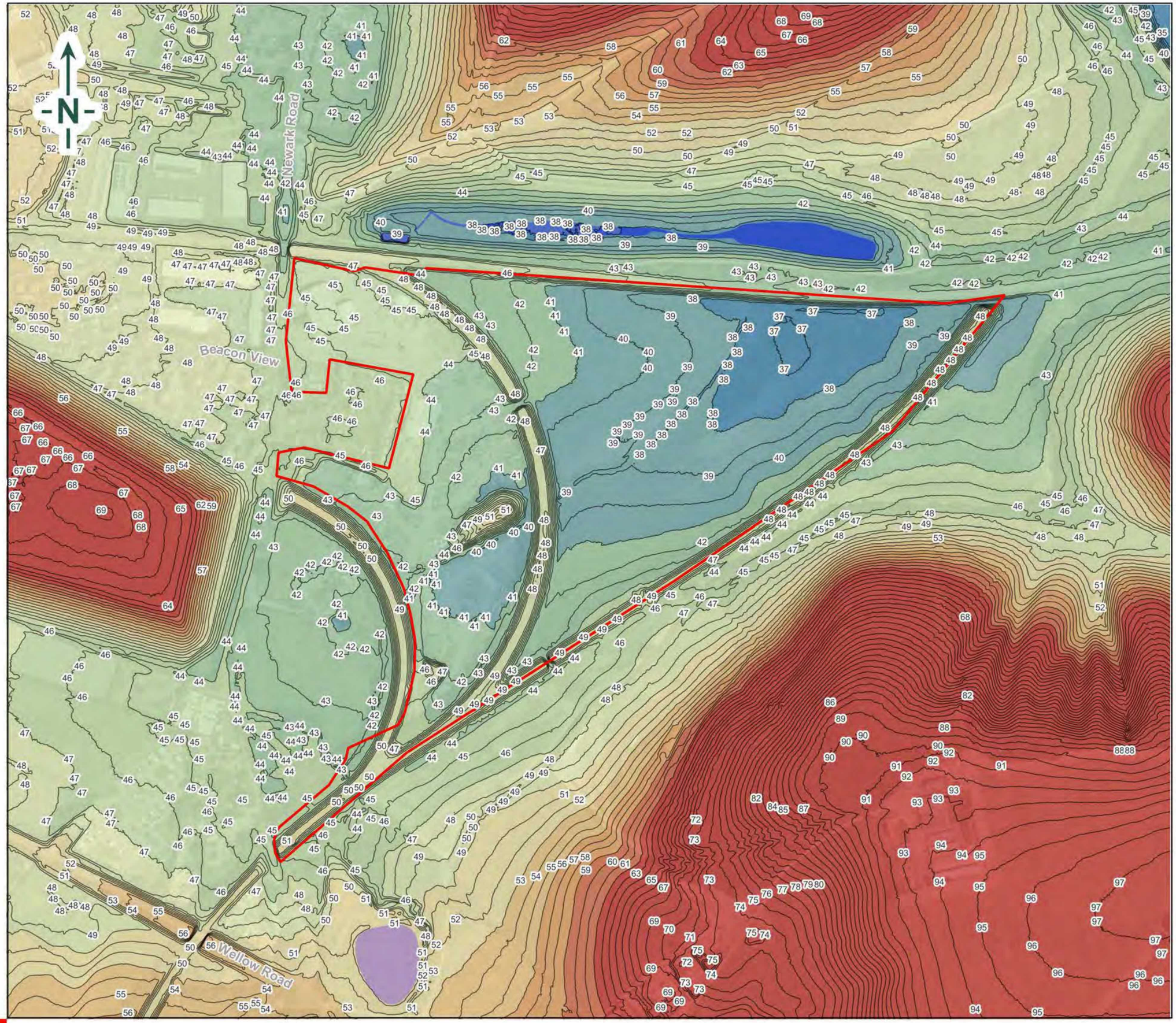
[redacted]

QA System - Checks		Date
Drawn By:	A. MISTRY	08/06/18
Checked:	R. SMITH	08/06/18

Contract No:	Drawing Status:	Scale:	Paper Size:
LBU0171	INFORMATION	1:500	A1

Drawing No	Revision
LBU0171_OLLERTON PLANT DEPOT_6	1

Appendix D –LiDAR Plan



Legend

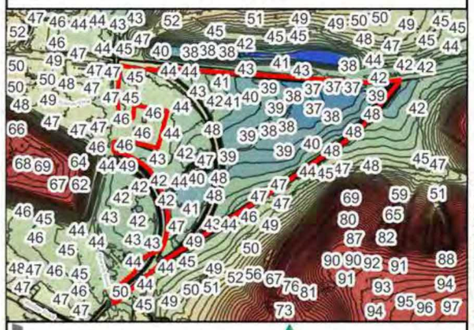
- Approximate Site Boundary
- Contours

Elevation (m AOD)

- <= 38
- 38 - 41
- 41 - 44
- 44 - 47
- 47 - 50
- 50 - 53
- 53 - 56
- 56 - 59
- 59 - 62
- > 62

0 50 100 150 200 250 m

Figure: LiDAR Plan		
Job: J. Murphy & Sons Limited		
Client: J. Murphy & Sons Limited, Ollerton, NG22 9PZ		
Appendix: E	Revision: A	Date: 06 April 2023
Drawn by: OE	Checked by: EB	Scale: 1:4,000
Job No.: 87854.5488		

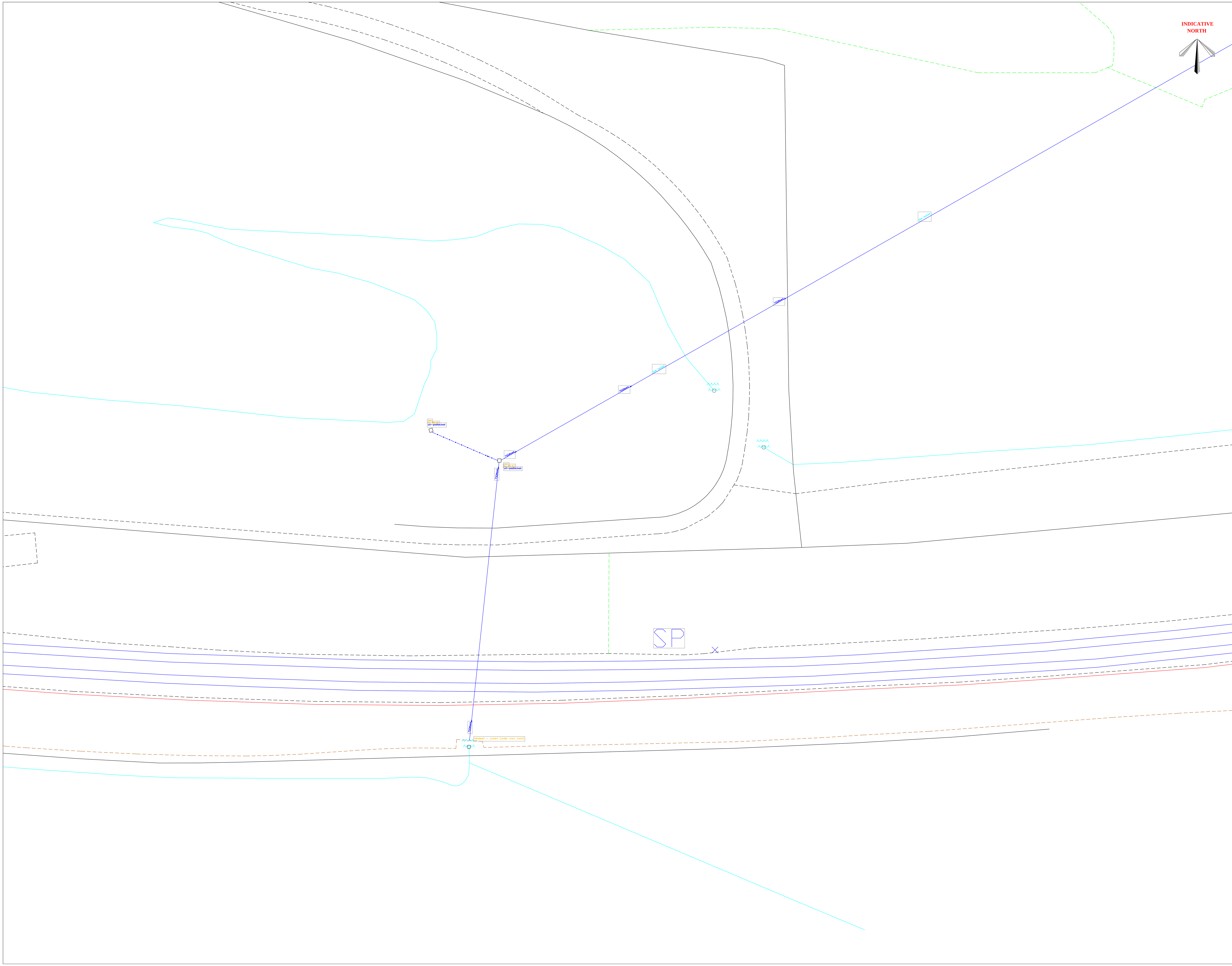


Bing Maps deltasimons Environment - Health & Safety - Sustainability

Site Plan Provided by Client.

C:\QGIS\87854.548836 Ollerton\qrs\87854.548836 Ollerton.qgz

Appendix E –CCTV Survey



NOTES

GENERAL NOTES :-

CCTV DRAINAGE SURVEY HAS BEEN PLOTTED ONTO AN OS BASE PLAN, THEREFORE MIDLAND SURVEY ACCEPTS NO RESPONSIBILTY FOR THE ACCURACY OF THIS DRAWING.

THIS DRAWING HAS BEEN PRODUCED WITH A PLOT SCALE ACCURACY OF 1:200

SERVICE COVERS INDICATED WHERE VISIBLE. PIPE INVERTS / DETAILS SURVEYED FROM SURFACE INSPECTION ONLY. GENERALLY DAMAGED COVERS AND COVERS WITHIN HIGHWAYS WILL NOT BE LIFTED

TREE SPECIES SHOULD BE CONFIRMED BY TREE SPECIALIST IF CRITICAL.

OVERHEAD CABLES ARE INDICATED USING REMOTE SURVEY METHODS AND ARE SUBJECT TO SEASONAL VARIATION, AND SHOULD BE TREATED AS APPROXIMATE.

THE SURVEYOR WILL NOT BE RESPONSIBLE FOR THE OMISSION OF DETAILS OBSCURED DURING SITE SURVEY

RICS PROFESSIONAL STANDARDS 3RD EDITION RULE 1.19 APPLIES TO THIS SURVEY.

TOPOGRAPHICAL SURVEY/UTILITY KEY :-

(ht) - height
ø - diameter
● - pea trap
a/g - above ground
a/r - assumed route
av - air valve
bb - belisha beacon
bd - back drop
bl - bed level
boll - bollard
bos - bottom of shaft
bt - telecom
c/b fence - closeboard fence
c/box - control box
catv - cable television
cl - cover level
con - conifer
cr - cable riser
cws - combined water sewer
d/chan - drainage channel
ejb - electric junction box
elec - electric
eot - end of trace
ep - electric pole
er - earth rod
f/bed - flower bed
fh - fire hydrant
fl - floor level
fs - fire switch
fws - foul water sewer
g - gully
g/run - gully run
gr - gas riser
h/chestnut - horse chestnut
h/thorn - hawthorn
ic - inspection cover
il - invert level
ill - illuminated
int - interceptor
lp - lamp post
mh - manhole cover
mkr - marker
o/h - over head

ol - off let
osa - off survey area
OSBM - ordnance survey bench mark
p & r fence - post & rail fence
pd - pit depth
pr - pipe riser
ptg - pipe to ground
pts - pipe to surface
re - rodding eye
ret wall - retaining wall
rs - road sign
rwp - rain water pipe
s/birch - silver birch
s/p - safety paving
sap - sapling
sec fence - security fence
sfc - soil filled chamber
sl - spot light
sp - soil pipe
st - stop tap
sv - stop valve
svp - soil vent pipe
sws - storm water sewer
TBM - temporary bench mark
tfr - taken from records
tl - threshold level
toc - top of cap
top - top of pipe
tot - top of tank
tp - telecom pole
ts - traffic signal
t/s - trench scar
u/s - underside
utl - unable to lift
utr - unable to rod
uts - unable to survey
utt - unable to trace
vp - vent pipe
wfc - water filled chamber
wl - water level
wm - water meter
wp - waste pipe
wr - water riser

UTILITY SURVEY KEY :-

HATCHED AREA
BOREHOLE
CPT
TRIAL PIT
HAND PIT
WINDOW SAMPLE

ELECTRIC CABLE
WATER PIPE
FOUL SEWER
STORM SEWER
COMBINED SEWER
DUCTS
CABLE TELEVISION
DATA CABLE
TELECOM CABLE
GAS PIPE
UNIDENTIFIED SERVICE
OTHER
CCTV
TRAFFIC LIGHT
OFFSET FILL
VENT
FUEL PIPE
GAUGE LINES
PIPE
ASSUMED ROUTE
TAKEN FROM RECORDS

DISCLAIMER :-

Electromagnetic techniques have been used in the location of underground services. The results are not infallible and trial excavations should be carried out to confirm service identification, positions and particularly depths, where these are critical. The completeness of the underground services information cannot be guaranteed.

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TSA Standards - "A utility mapping survey can be considered a 100% accurate depiction of the sub-surface environment, and the use of these drawings does not remove the requirement for the use of safe digging techniques at all times, in line with requirements of HSG47 and current CDM regulations".

UTILITY NOTES

THE ROUTE OF THE STORM SYSTEM HAS BEEN POSITIONED ON USING DYE TESTING AND SOUND CONNECTION.

0 2 4 8 12 16 20

MIDLAND SURVEY LTD

HEAD OFFICE
Cromwell House, Westfield Road, Southam, Warwickshire, CV47 0JH.
Tel: 01926 810811 Fax 01926 810812
E-Mail: mail@midlandsurvey.co.uk
www.midlandsurvey.co.uk

Client	DELTA SIMONS
Project	RUSHCLLIFFE HOUSE, NOTTINGHAM
Title	DRAIN MAPPING
Date	JAN 2023
Scale	1:200@A0
Dwg No	U09077 1
Surveyor	SD
Checked	N.C.

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING

NOTES

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ø – diameter
● – pea trap
a/g – above ground
a/r – assumed route
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bd – back drop
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boll – bollard
bos – bottom of shaft
bt – telecom
c/b fence – closeboard fence
c/box – control box
catv – cable television
cl – cover level
con – conifer
cr – cable riser
cws – combined water sewer
d/chan – drainage channel
ejb – electric junction box
elec – electric
eot – end of trace
ep – electric pole
er – earth rod
f/bed – flower bed
fh – fire hydrant
fl – floor level
fs – fire switch
fws – foul water sewer
g – gully
g/run – gully run
gr – gas riser
h/chestnut – horse chestnut
h/thorn – hawthorn
ic – inspection cover
il – invert level
ill – illuminated
int – interceptor
lp – lamp post
mh – manhole cover
mkr – marker
o/h – over head

ol – off let
osa – off survey area
OSBM – ordnance survey bench mark
p & r fence – post & rail fence
pd – pit depth
pr – pipe riser
ptg – pipe to ground
pts – pipe to surface
re – rodding eye
ret wall – retaining wall
rs – road sign
rwp – rain water pipe
s/birch – silver birch
s/p – safety paving
sap – sapling
sec fence – security fence
sfc – soil filled chamber
sl – spot light
sp – soil pipe
st – stop tap
sv – stop valve
svp – soil vent pipe
sws – storm water sewer
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tfr – taken from records
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tot – top of tank
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t/s – trench scar
u/s – underside
utl – unable to lift
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vp – vent pipe
wfc – water filled chamber
wl – water level
wm – water meter
wp – waste pipe
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HATCHED AREA
BOREHOLE
CPT
TRIAL PIT
HAND PIT
WINDOW SAMPLE

~ ELECTRIC CABLE
W WATER PIPE
FOUL SEWER
STORM SEWER
COMBINED SEWER
D DUCTS
TV CABLE TELEVISION
COM DATA CABLE
TELECOM CABLE
G GAS PIPE
U UNIDENTIFIED SERVICE
OTHER
CCTV CCTV
TL TRAFFIC LIGHT
O OFFSET FILL
V VENT
F FUEL PIPE
GL GAUGE LINES
P PIPE
AR ASSUMED ROUTE
TFR TAKEN FROM RECORDS

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0 2 4 8 12 16 20

MIDLAND SURVEY LTD

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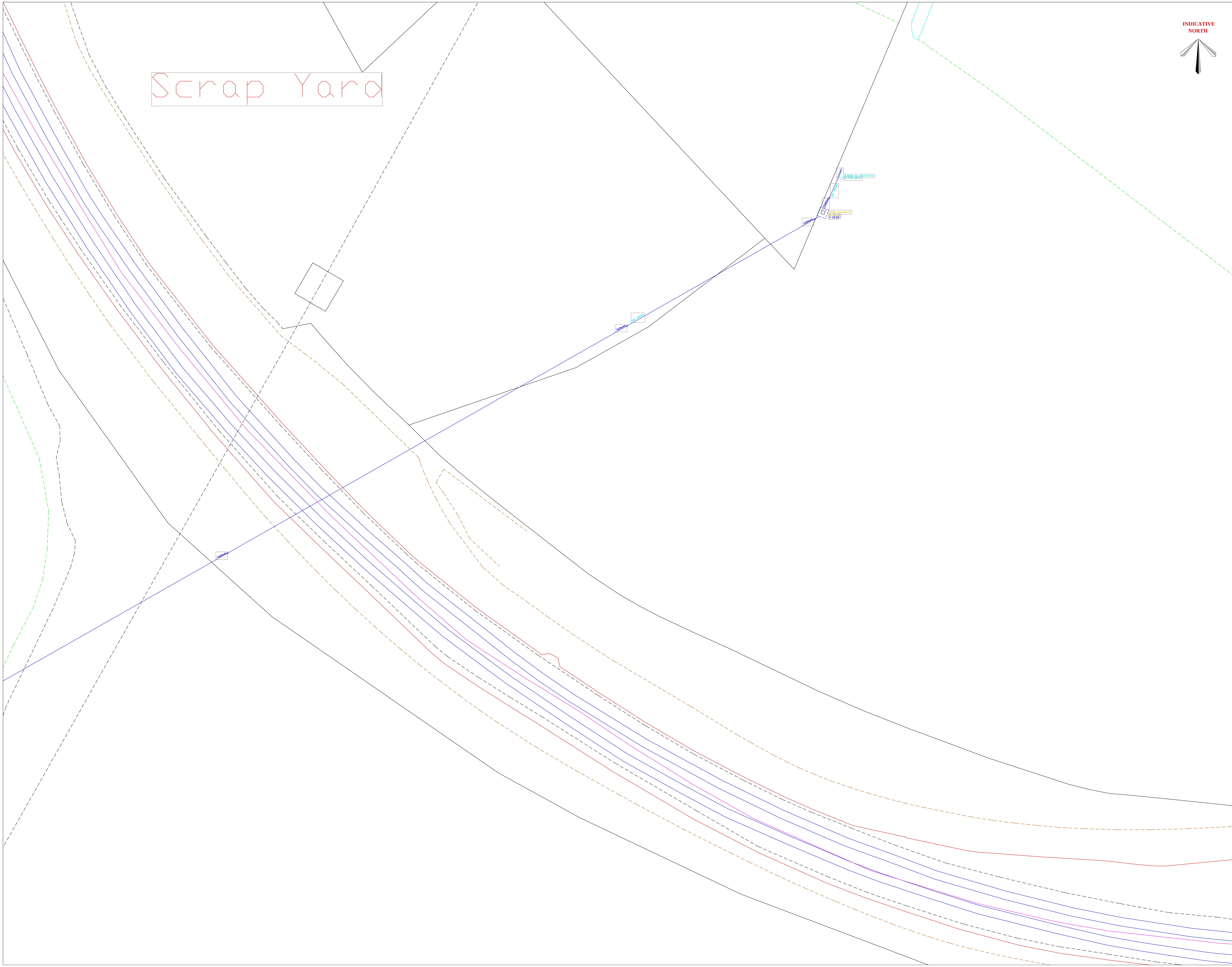
Tel: 01926 810811 Fax 01926 810812
E-Mail: mail@midlandsurvey.co.uk
www.midlandsurvey.co.uk

Client	DELTA SIMONS
Project	RUSHCLLIFFE HOUSE, NOTTINGHAM
Title	DRAIN MAPPING
Date	JAN 2023
Scale	1:200@A0
Dwg No	U09077 2
Surveyor	SD
Checked	N.C.

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING



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osa – off survey area
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WINDOW SAMPLE

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WATER PIPE
FOUL SEWER
STORM SEWER
COMBINED SEWER
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TRAFFIC LIGHT
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Title	DRAIN MAPPING
Date	JAN 2023
Scale	1:200@A0
Dwg No	U09077 2
Surveyor	SD
Checked	N.C.

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING

Appendix F –Proposed Development Plan

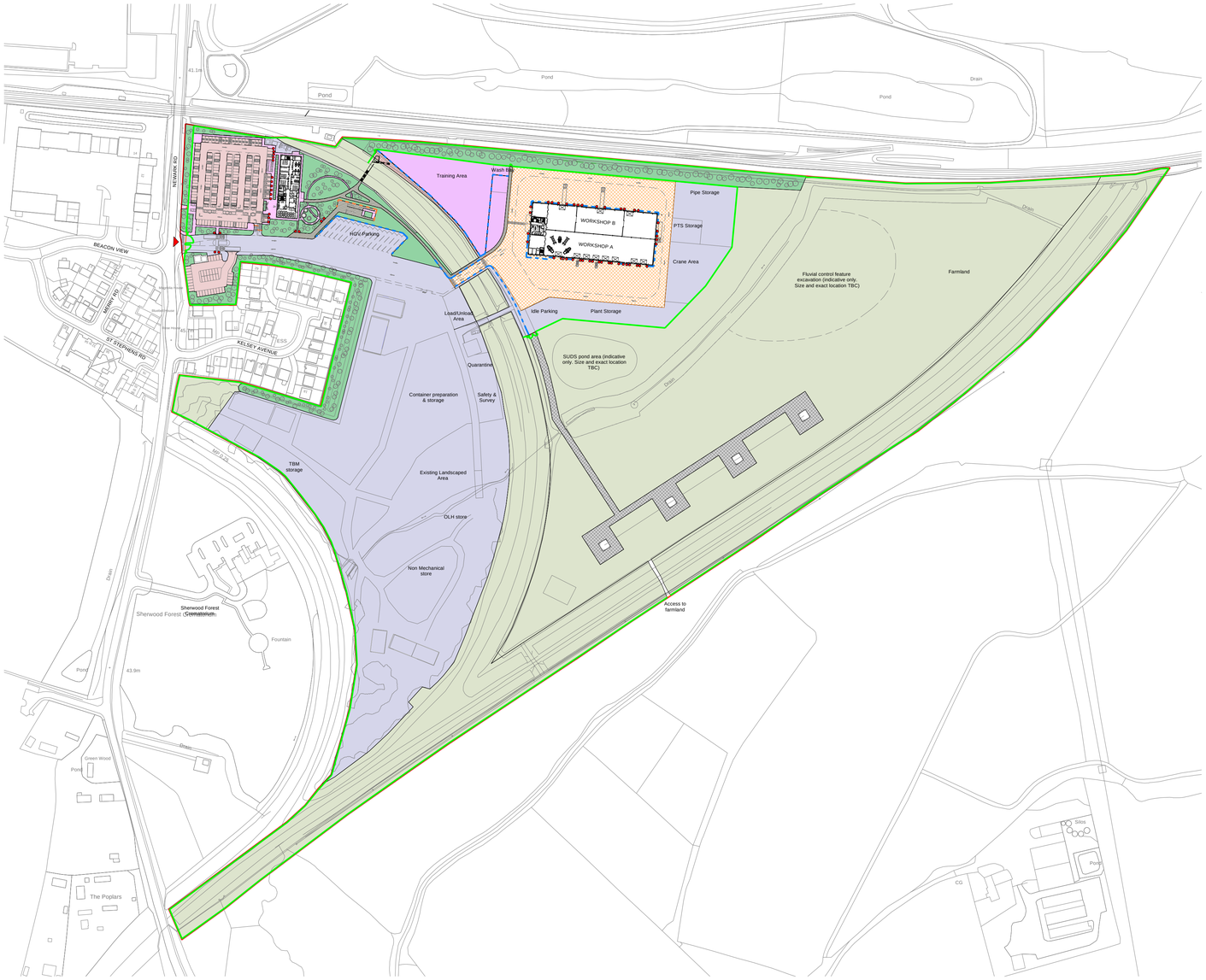
N

0 25.0 m 50.0 m 100.0 m

SCALE: 1:2000

Zone: 01

Status: PL



Permeable Pavers

ArmCo safety barriers

Railing - 1100mm high galvanised steel with flat bar balustrades

Asphalt

Block Paving [Colour: Grey]

Proposed soft landscaping - Refer to Fabrik drawings and specifications for details

Bollards - 1100mm high bolt-down PPC galvanised steel bollards [Colour: Yellow]

Fence - 2.7m high Securimesh 358 weldmesh fencing

Reinforced gravel to pylon training area and access path

Concrete - Brushed concrete to engineer's specification

Existing landscaping to be retained and enhanced in line with Fabrik drawings and specifications

Existing surface to be retained and made good where necessary

Timber boardwalk with non-slip surface

Ground works simulation area - Loose soil and rubble

External Materials Legend
1 : 100

1 Site Plan - External Finishes Plan
1 : 2000

The contractor must check dimensions on site. Only figured dimensions to be worked from.

Any discrepancies must be reported to the architect before proceeding

DRAWING CONVENTIONS:

For ease of reading,View Tags (Elevation, Section markers etc.) indicate last 4 digits of Document no. only

NOTES:

DRAFT

REVISIONS

Rev.	Description	Date	Checked
-	Issued for Coordination	08/12/2023	SN

GTH / architects
www.gth-architects.com

The Print Rooms, 164/180 Union Street, London, SE1 0GE

design@gth-architects.com
www.gth-architects.com

PROJECT TITLE: Ollerton Project

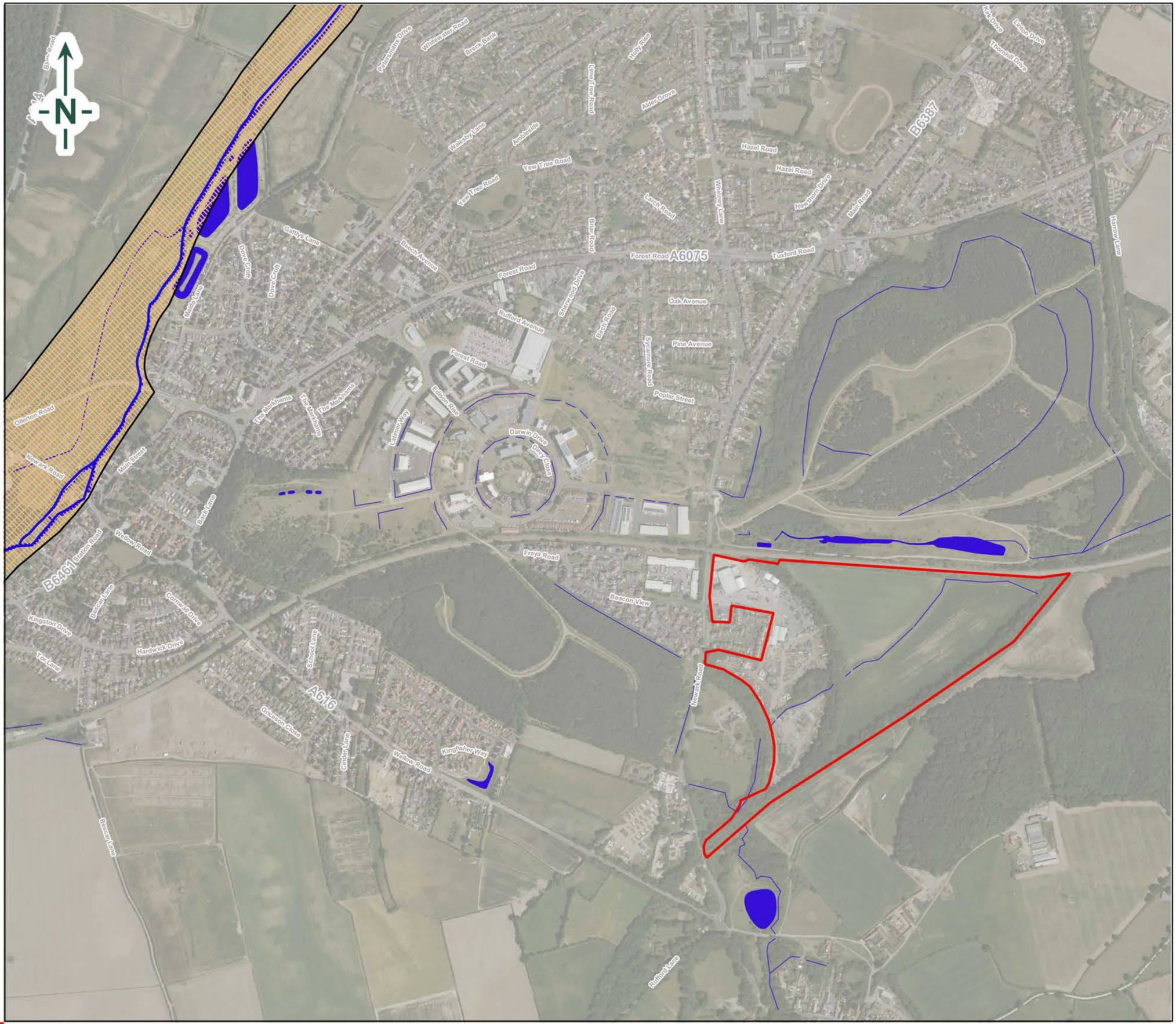
Newark Rd, New Ollerton, Newark NG22 9QG

DOCUMENT TITLE: Site Plan- External Finishes Plan

DOCUMENT NO:	STATUS:	REVISION:	SCALE @ A1:	SCALE @ A3:
117-GTH-01-ZZ-DR-A-1104	PL	-	1:2000	

CURRENT ISSUE DATE: 08/12/2023

Appendix G –EA Historic Flood Map



Legend

- Approximate Site Boundary
- Existing Watercourses
- Historic Flooding

0 100 200 300 400 500 m

Figure	Historic Flooding
Job	J. Murphy & Sons Limited
Client	J. Murphy & Sons Limited, Ollerton, NG22 9PZ

Appendix	Revision	Date
H	A	06 April 2023
Drawn by	**Checked by**	**Scale**
OE	EB	1:8,000

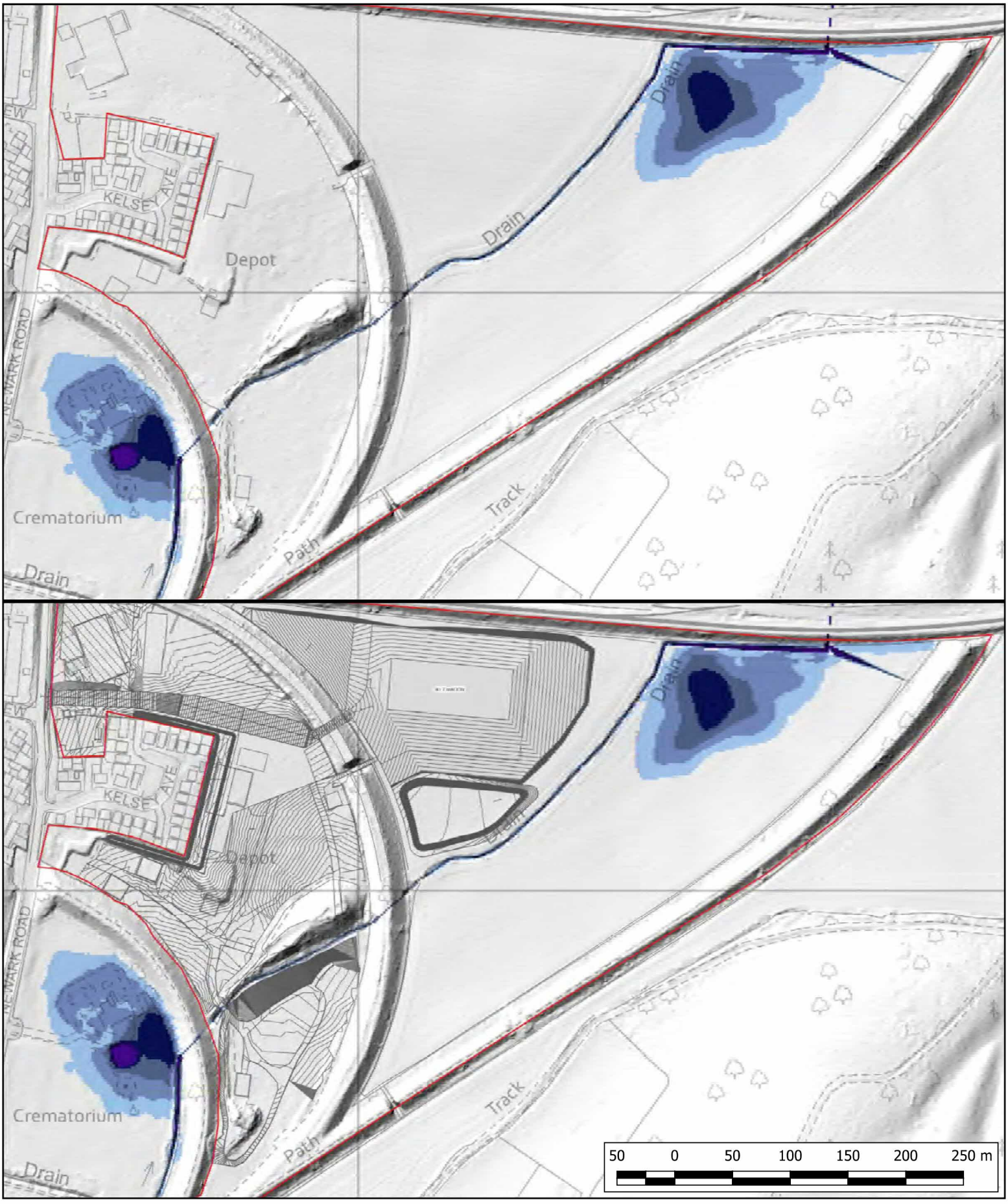
Job No. 87854.5488

Bing Maps deltasimons Environment - Health & Safety - Sustainability

Site Plan Provided by Client.

C:\QGIS\87854.548836 Ollerton\qgs\87854.548836 Ollerton.qgz

Appendix H –Hydraulic Modelling Outputs



TITLE

MAXIMUM DEPTH OF FLOODING 1 IN 30 YEAR RETURN PERIOD EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary

DETAILS

EXISTING

PROPOSED

NOTES

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3. All heights are in metres Above Ordnance Datum Newlyn (mAODN) unless otherwise stated

REV	DESCRIPTION	DATE
1	1st issue	27-02-2023
2	2nd issue	15-03-2023
3	3rd issue	18-12-2023

herrington CONSULTING Part of eps

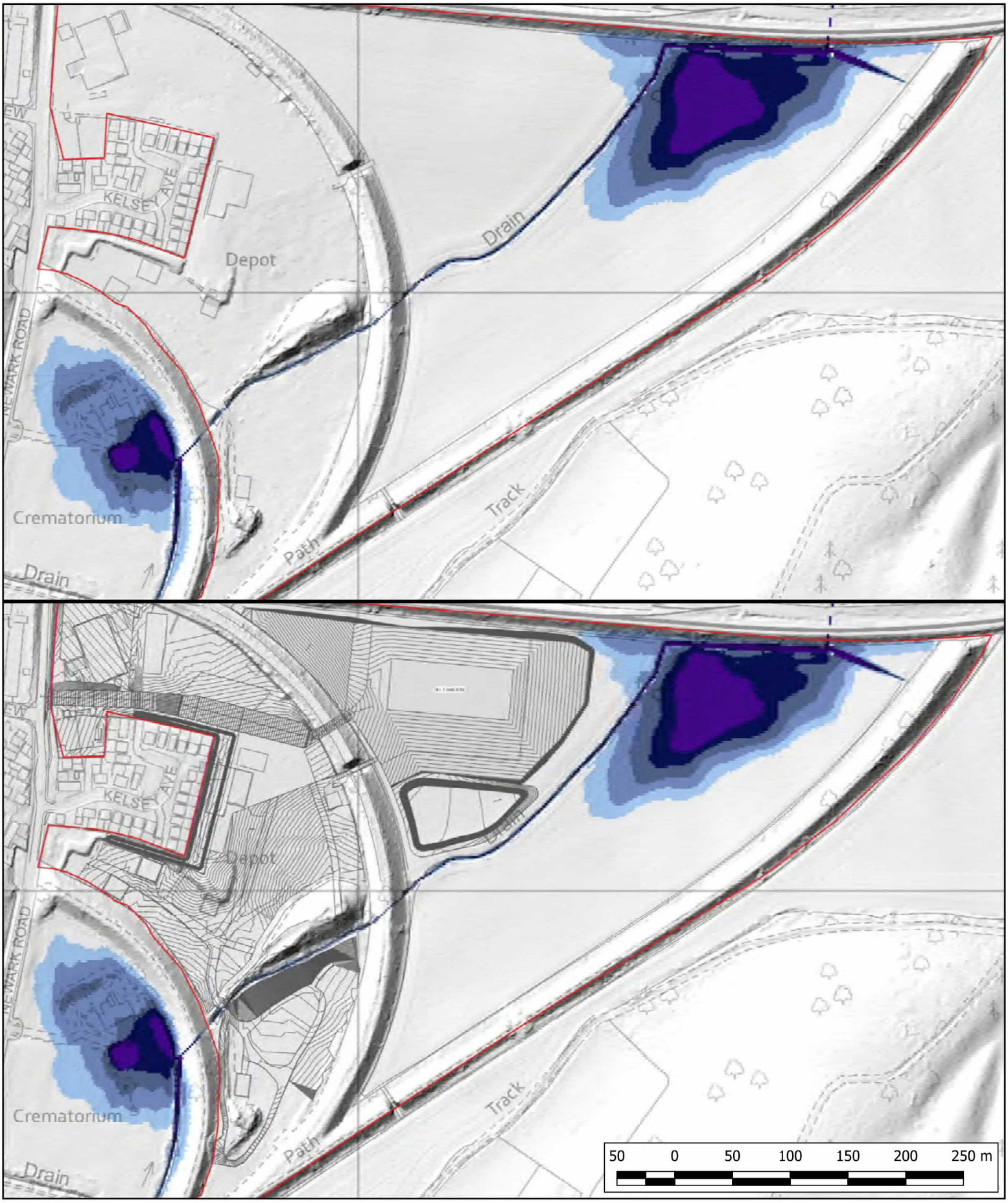
Canterbury (HQ): Unit 6-7 Barham Business Park, Elham Valley Road, Canterbury, Kent CT4 6DQ
London: Unit 50.11, Mezzanine, 52 Bermondsey Street, London, SE1 3UD

CLIENT DELTA-SIMONS LTD

PROJECT NEWARK ROAD, NEW OLLERTON

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:3000 @ A3	3627	DW	NW

DRAWING No. A.1



TITLE

MAXIMUM DEPTH OF FLOODING 1 IN 100 YEAR RETURN PERIOD EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary

DETAILS

EXISTING

PROPOSED

NOTES

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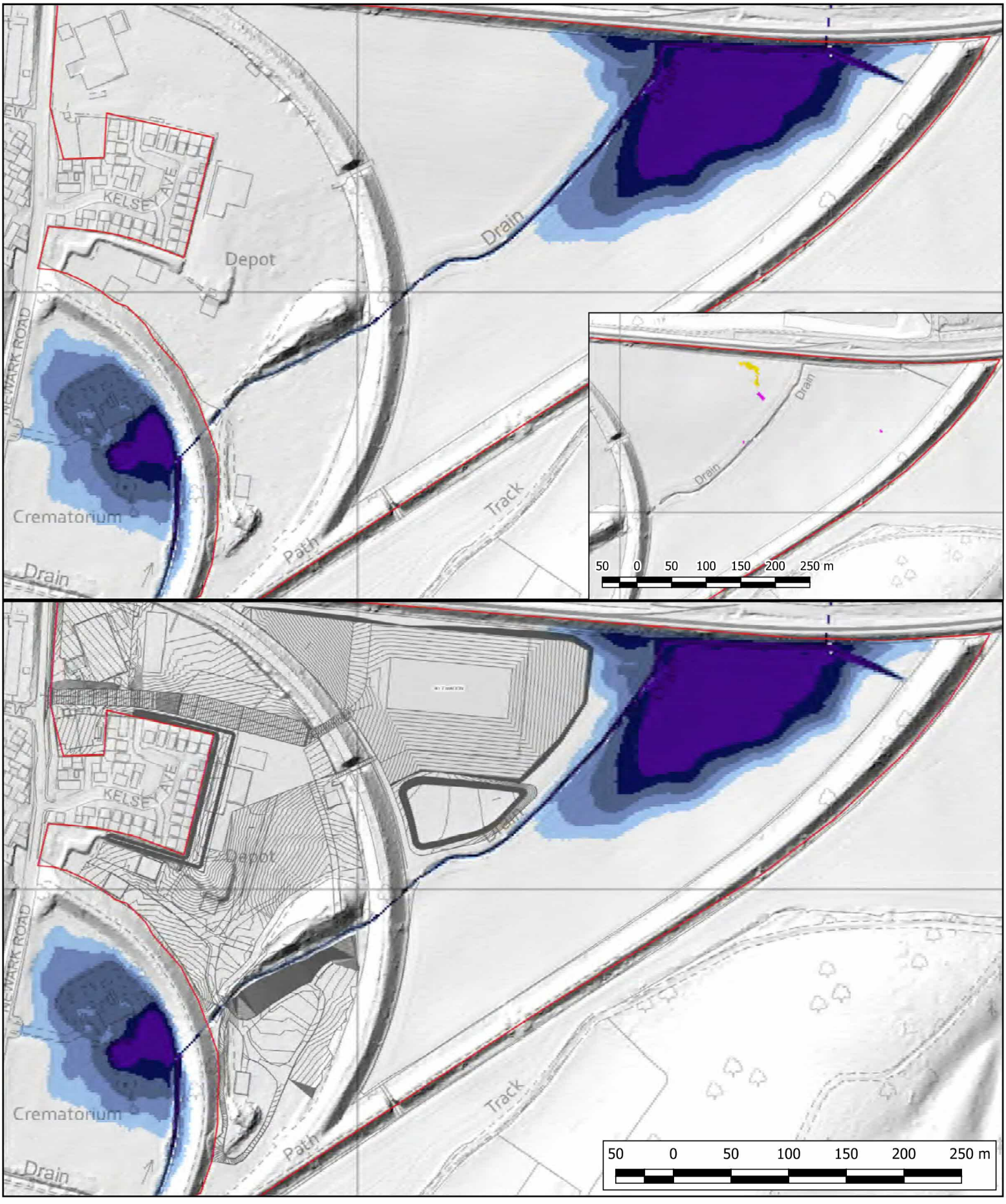
PROJECT NEWARK ROAD, NEW OLLERTON

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:3000 @ A3	3627	DW	NW

DRAWING No. A.2



TITLE

MAXIMUM DEPTH OF FLOODING 1 IN 100 YEAR RETURN PERIOD EVENT + 27% CLIMATE CHANGE

LEGEND

Maximum Depth (m)
- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary

Proposed water levels minus existing water levels
- Now dry
- < -1.00
- -1.00 - -0.10
- -0.10 - -0.05
- -0.05 - -0.03
- -0.03 - -0.01
- -0.01 - 0.01
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- 0.10 - 1.00
- > 1.00
- Now wet

DETAILS

EXISTING

Proposed - Existing levels

PROPOSED

NOTES

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3	3rd issue	18-12-2023

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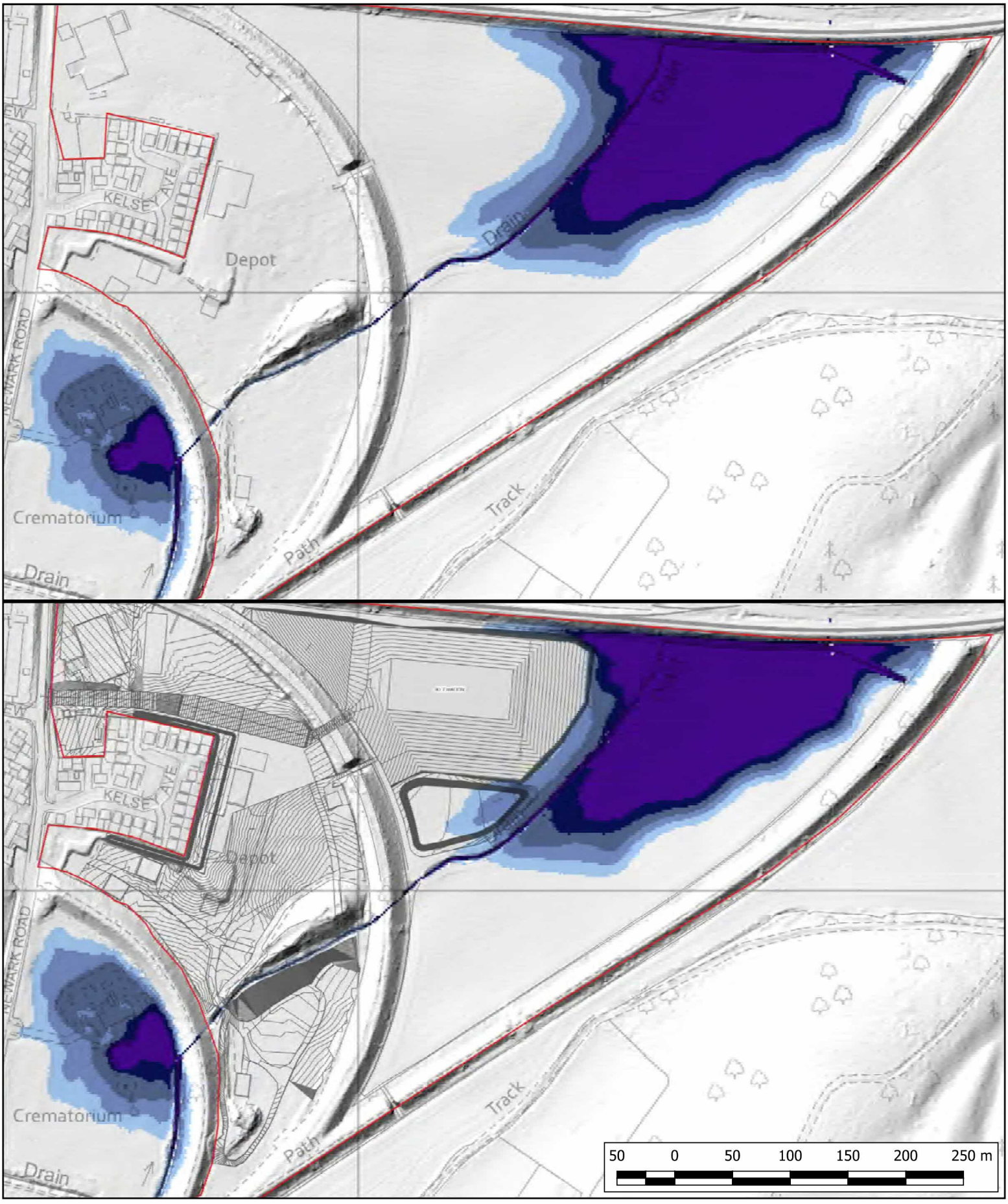
CLIENT: DELTA-SIMONS LTD

PROJECT: NEWARK ROAD, NEW OLLERTON

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:3000 @ A3	3627	DW	NW

DRAWING No.: **A.3**



TITLE

RESIDUAL RISK SCENARIO
MAXIMUM DEPTH OF FLOODING 1 IN 100 YEAR RETURN PERIOD EVENT
+ 27% CLIMATE CHANGE

LEGEND

Maximum Depth (m)
- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary

DETAILS

EXISTING, DOWNSTREAM CULVERT 50% BLOCKED

PROPOSED, DOWNSTREAM CULVERT 50% BLOCKED

NOTES

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REV	DESCRIPTION	DATE
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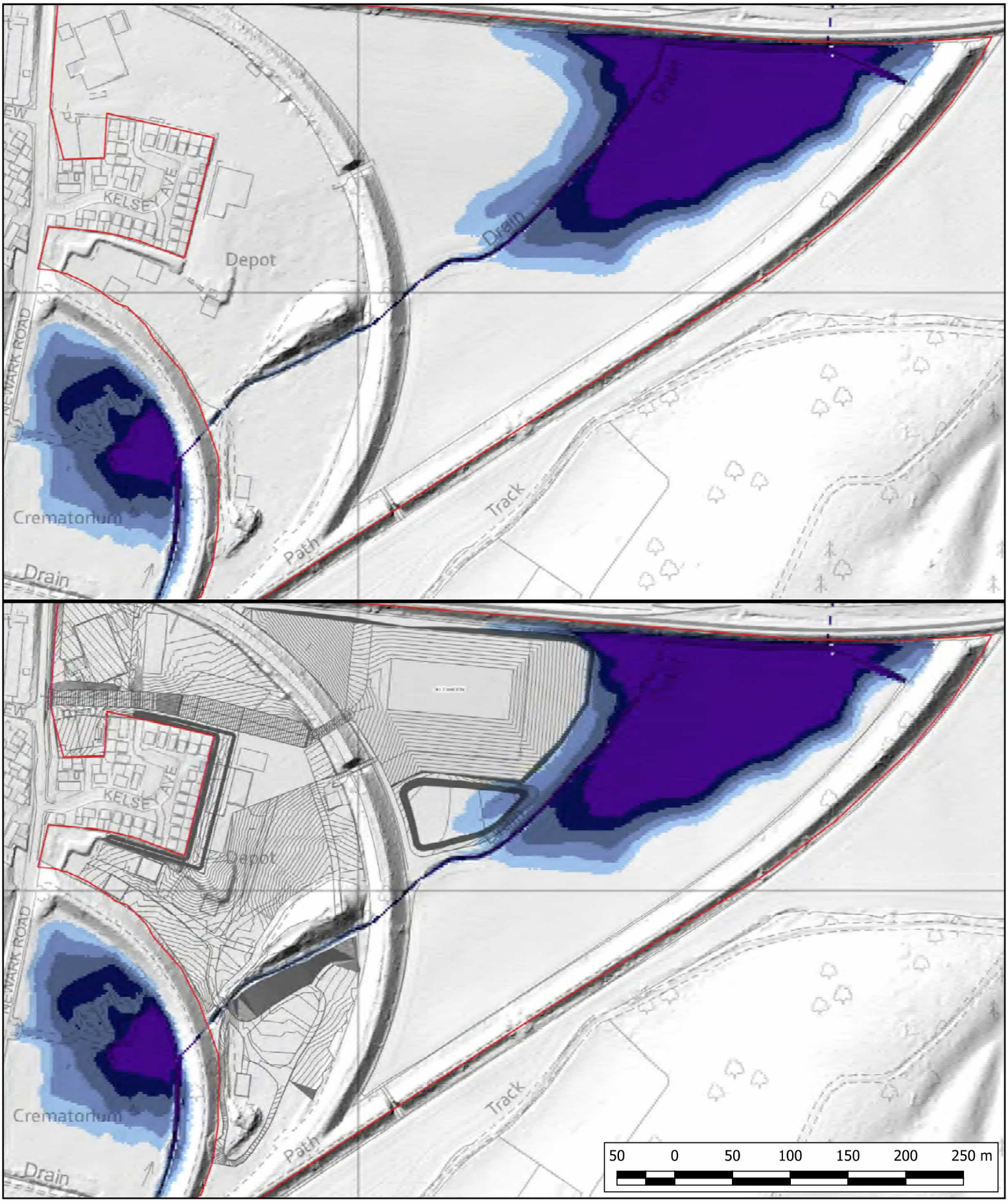
PROJECT NEWARK ROAD, NEW OLLERTON

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:3000 @ A3	3627	DW	NW

DRAWING No. A.4



TITLE

MAXIMUM DEPTH OF FLOODING 1 IN 1000 YEAR RETURN PERIOD EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary

DETAILS

EXISTING

PROPOSED

NOTES

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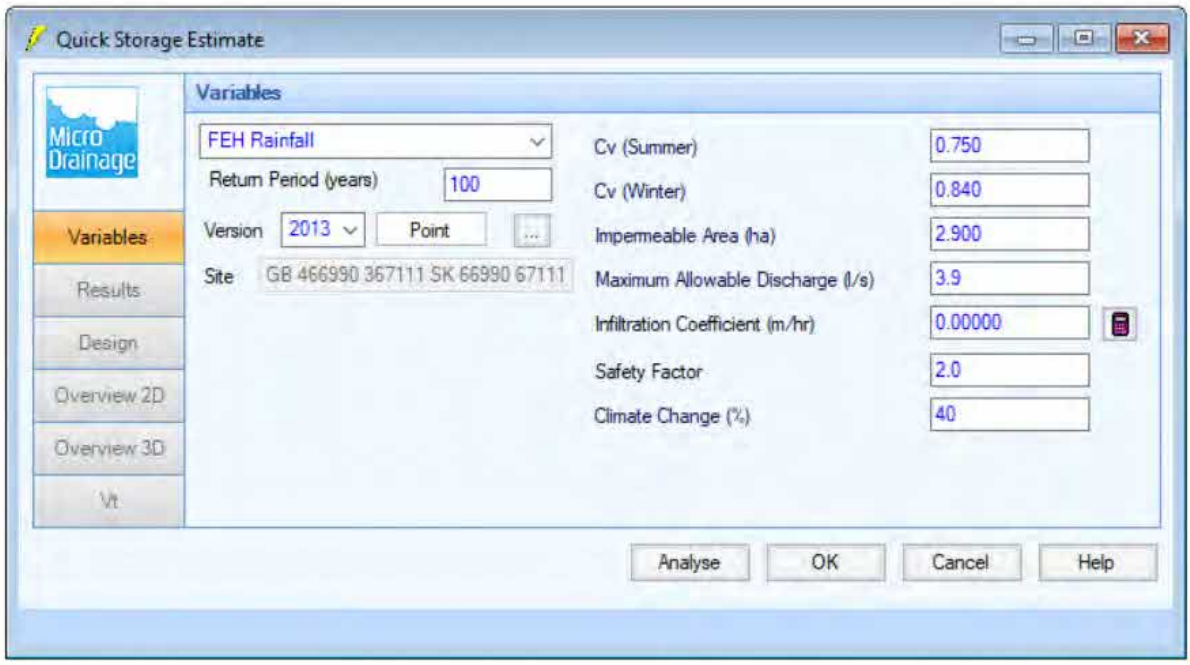
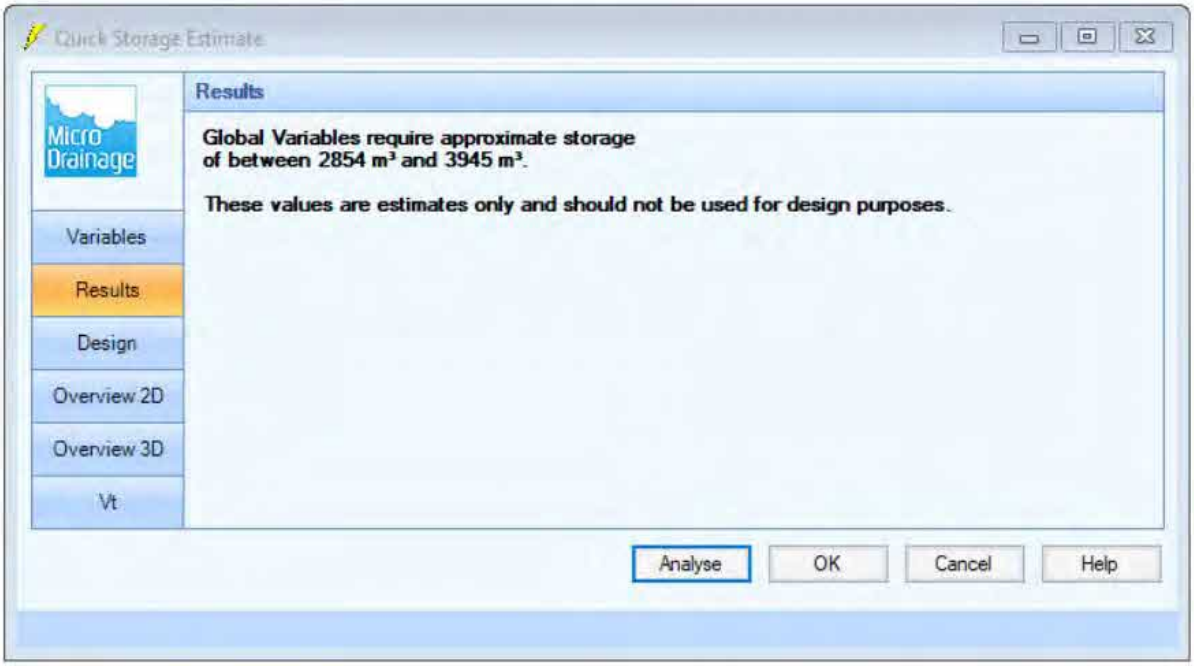
PROJECT NEWARK ROAD, NEW OLLERTON

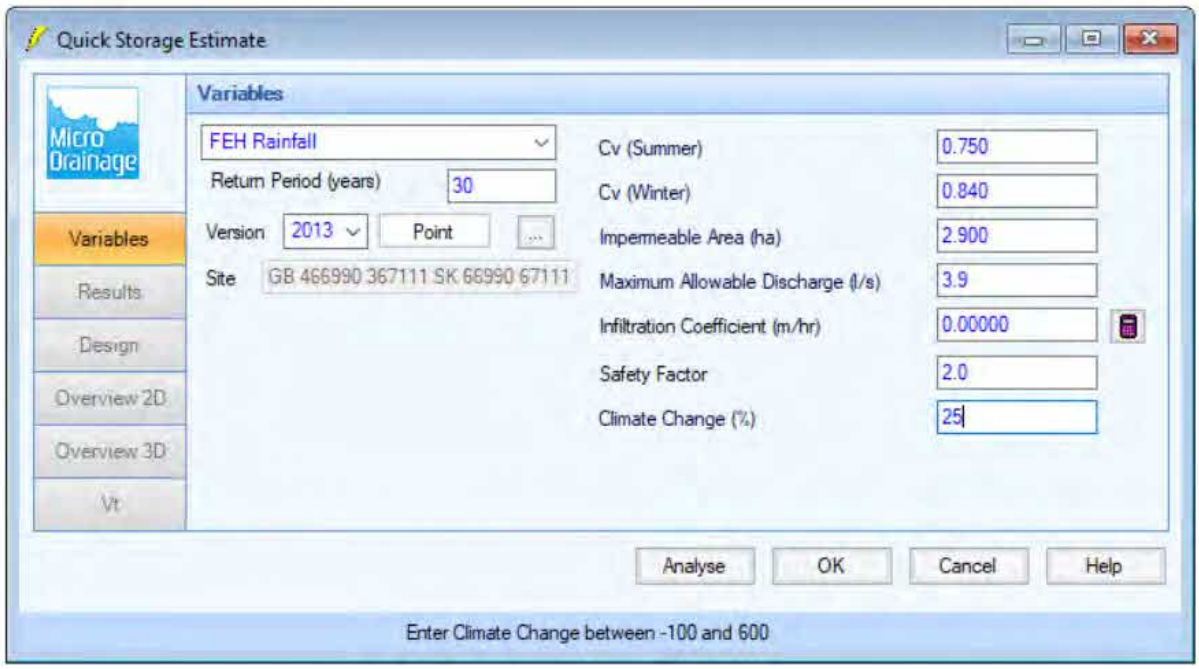
SCALE	PROJECT No.	INITIALS	CHECKED BY
1:3000 @ A3	3627	DW	NW

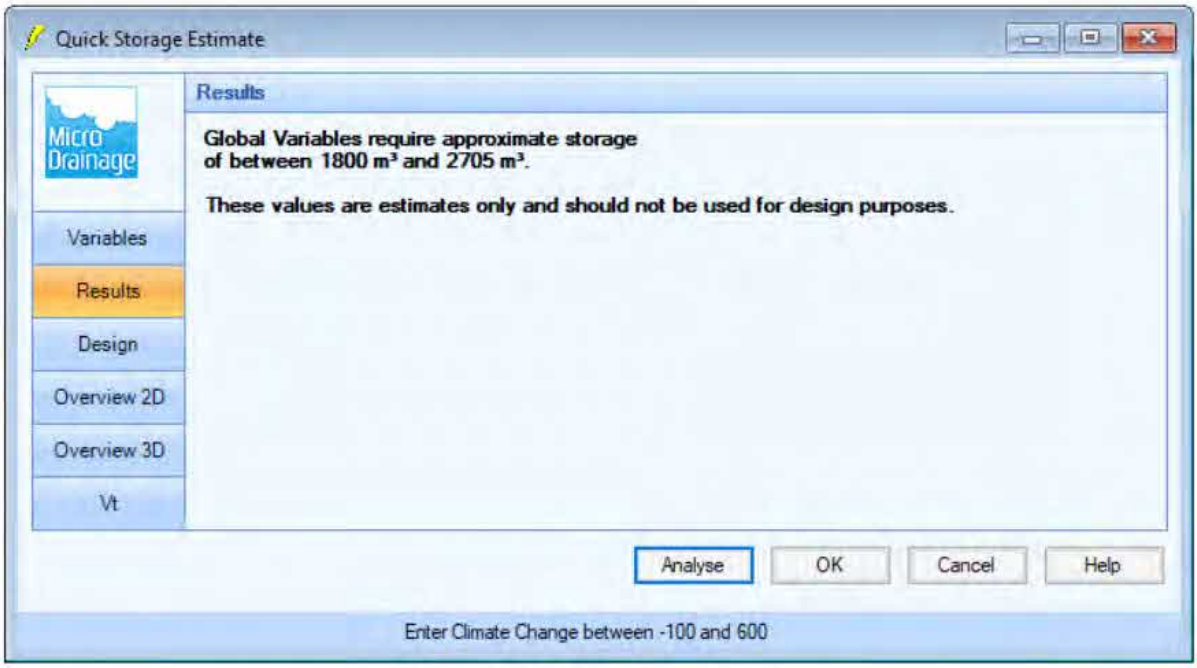
DRAWING No. A.5

Appendix I –MicroDrainage Quick Storage Estimates


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years) 100
Version 2013
Point
Site GB 466990 367111 SK 66990 67111
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 2.900
Maximum Allowable Discharge (l/s) 3.9
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 40
Analyse
OK
Cancel
Help


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 2854 m³ and 3945 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years) 30
Version 2013
Point
Site GB 466990 367111 SK 66990 67111
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 2.900
Maximum Allowable Discharge (l/s) 3.9
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 25
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 1800 m³ and 2705 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600

Appendix J –MicroDrainage Source Control Output

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.998	0.298	3.9	845.4	O K
30 min Summer	9.087	0.387	3.9	1105.4	O K
60 min Summer	9.175	0.475	3.9	1371.1	O K
120 min Summer	9.252	0.552	3.9	1604.1	O K
180 min Summer	9.300	0.600	3.9	1753.2	O K
240 min Summer	9.336	0.636	3.9	1864.8	O K
360 min Summer	9.388	0.688	3.9	2028.2	O K
480 min Summer	9.425	0.725	3.9	2144.2	O K
600 min Summer	9.453	0.753	3.9	2232.0	O K
720 min Summer	9.474	0.774	3.9	2301.2	O K
960 min Summer	9.506	0.806	3.9	2402.6	O K
1440 min Summer	9.543	0.843	3.9	2522.1	O K
2160 min Summer	9.568	0.868	3.9	2601.8	O K
2880 min Summer	9.577	0.877	3.9	2631.4	O K
4320 min Summer	9.573	0.873	3.9	2621.1	O K
5760 min Summer	9.560	0.860	3.9	2576.3	O K
7200 min Summer	9.549	0.849	3.9	2543.0	O K
8640 min Summer	9.543	0.843	3.9	2521.1	O K
10080 min Summer	9.539	0.839	3.9	2508.4	O K
15 min Winter	9.033	0.333	3.9	947.2	O K
30 min Winter	9.131	0.431	3.9	1238.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	156.210	0.0	331.1	27
30 min Summer	102.227	0.0	332.4	42
60 min Summer	63.553	0.0	660.7	72
120 min Summer	37.359	0.0	641.6	132
180 min Summer	27.341	0.0	620.1	192
240 min Summer	21.896	0.0	596.7	252
360 min Summer	16.000	0.0	564.9	370
480 min Summer	12.783	0.0	551.5	490
600 min Summer	10.726	0.0	548.1	610
720 min Summer	9.285	0.0	550.7	730
960 min Summer	7.378	0.0	555.2	970
1440 min Summer	5.314	0.0	553.2	1448
2160 min Summer	3.812	0.0	1118.5	2168
2880 min Summer	3.012	0.0	1113.4	2884
4320 min Summer	2.167	0.0	1079.9	4320
5760 min Summer	1.725	0.0	2216.1	5472
7200 min Summer	1.453	0.0	2153.0	6056
8640 min Summer	1.269	0.0	2107.0	6832
10080 min Summer	1.136	0.0	2064.2	7568
15 min Winter	156.210	0.0	333.7	27
30 min Winter	102.227	0.0	330.3	42

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.230	0.530	3.9	1536.7	O K
120 min Winter	9.315	0.615	3.9	1799.3	O K
180 min Winter	9.369	0.669	3.9	1967.6	O K
240 min Winter	9.409	0.709	3.9	2093.1	O K
360 min Winter	9.467	0.767	3.9	2277.2	O K
480 min Winter	9.508	0.808	3.9	2408.6	O K
600 min Winter	9.539	0.839	3.9	2508.6	O K
720 min Winter	9.563	0.863	3.9	2587.9	O K
960 min Winter	9.599	0.899	3.9	2705.4	O K
1440 min Winter	9.642	0.942	3.9	2847.1	O K
2160 min Winter	9.673	0.973	3.9	2948.9	O K
2880 min Winter	9.687	0.987	3.9	2994.6	O K
4320 min Winter	9.691	0.991	3.9	3009.3	O K
5760 min Winter	9.683	0.983	3.9	2983.0	O K
7200 min Winter	9.672	0.972	3.9	2943.8	O K
8640 min Winter	9.660	0.960	3.9	2903.9	O K
10080 min Winter	9.655	0.955	3.9	2888.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	63.553	0.0	651.6	72
120 min Winter	37.359	0.0	617.1	130
180 min Winter	27.341	0.0	583.4	190
240 min Winter	21.896	0.0	566.1	248
360 min Winter	16.000	0.0	558.3	366
480 min Winter	12.783	0.0	567.4	484
600 min Winter	10.726	0.0	574.6	602
720 min Winter	9.285	0.0	579.3	722
960 min Winter	7.378	0.0	583.4	958
1440 min Winter	5.314	0.0	580.2	1428
2160 min Winter	3.812	0.0	1178.3	2124
2880 min Winter	3.012	0.0	1171.2	2824
4320 min Winter	2.167	0.0	1133.7	4192
5760 min Winter	1.725	0.0	2283.6	5480
7200 min Winter	1.453	0.0	2263.5	6768
8640 min Winter	1.269	0.0	2232.9	7264
10080 min Winter	1.136	0.0	2189.4	7968

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 466990 367111 SK 66990 67111
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.900

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.967	4	8	0.967	8	12	0.967

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2750.0	1.300	3522.8

Hydro-Brake® Optimum Outflow Control

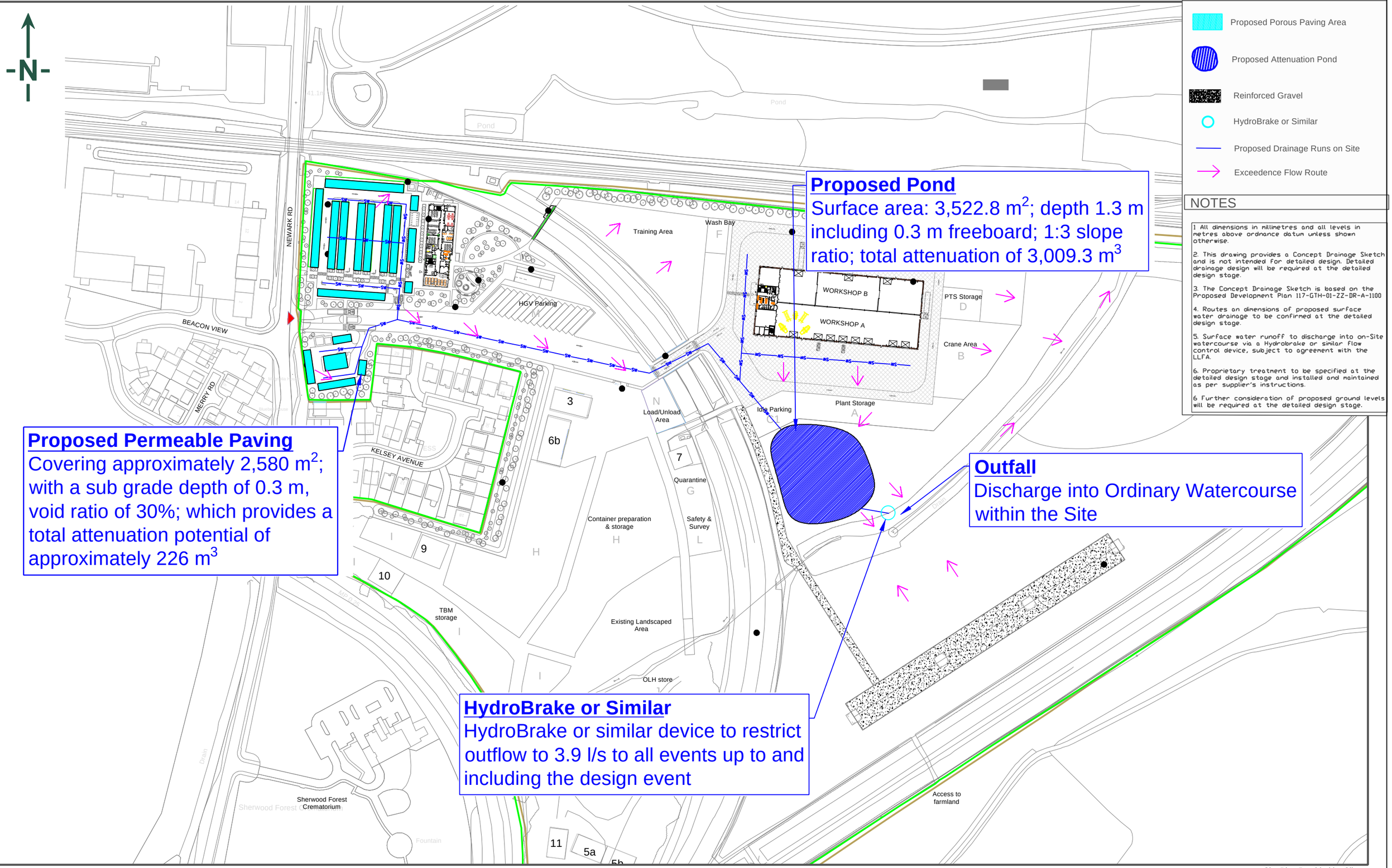
Unit Reference	MD-SHE-0094-3900-1000-3900
Design Head (m)	1.000
Design Flow (l/s)	3.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	8.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.9
Flush-Flo™	0.297	3.9
Kick-Flo®	0.632	3.2
Mean Flow over Head Range	-	3.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.2	3.000	6.5	7.000	9.7
0.200	3.8	1.400	4.6	3.500	7.0	7.500	10.0
0.300	3.9	1.600	4.8	4.000	7.4	8.000	10.4
0.400	3.8	1.800	5.1	4.500	7.9	8.500	10.7
0.500	3.7	2.000	5.4	5.000	8.3	9.000	10.9
0.600	3.4	2.200	5.6	5.500	8.7	9.500	11.2
0.800	3.5	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

Appendix K –Concept Drainage Sketch



Site Plan Provided by Client

DeltaSimons

TITLE:
Concept Drainage Sketch
J. Murphy & Sons, Ollerton, NG22 9PZ

DRAWN BY: AR	SCALE: Not to Scale	PROEJCT NO: 87854.548836
CHECKED BY: OE	REVISION: 1	APPENDIX: K
DATE: 22-12-2023		

Appendix L –Maintenance Schedules

Permeable Paving Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on Site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual'

Detention Basin Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass-for spillways and access routes	Monthly (during growing season), or as required
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides. structures. pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebays	Annually (or as required)
	Manage wetland plants in outlet pool –where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed - areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years. or as required
	Remove sediment from inlets, outlets. forebays and main basin when required	Every 5 years. or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Ref. Table 22.1 CIRIA C753 'The SuDS Manual'