Flood Risk Assessment
And Drainage Strategy

Project:
IBA Plant, Ogee Business Park, Wellingborough

Client: Covanta and Day Aggregates

Report Reference: 6731-BCAL-XX-ZZ-RP-C-0001 P2

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Contents

1.0 Introduction

1.1 This report comprises a Flood Risk Assessment (FRA) in support of a planning application for a proposed IBA recycled aggregate plant. The site has the grid reference SP 897 706. The location of the site is shown on the plan enclosed in **Appendix A**. The development red line plan includes some areas of amenity land separate from the main development. These areas will be utilised to provide opportunities for habitat creation and improvement to assist the sustainability and biodiversity of the development but will not comprise engineering works. This report focuses on the main development area but will refer to the biodiversity areas where appropriate.

1.2 The objective of this report is to provide the Local Planning Authority (LPA), Lead Local Flood Authority (LLFA), and Environment Agency (EA) with sufficient information to consider flood risk. This report is written generally in accordance with the requirements set out in Paragraphs 30 and 68 of the Flood Risk and Coastal Change chapter of the Planning Practice Guidance (PPG) to the National Planning Policy Framework (NPPF), together with the Sustainable Drainage Systems 'Non-Statutory Technical Standards for Sustainable Drainage Systems' and Northamptonshire County Council's 'Local Standards and Guidance for Surface Water Drainage in Northamptonshire'.

1.3 All references made to the Planning Practice Guidance within this report relate to the Flood Risk and Coastal Change chapter and were correct at the time of drafting.

2.0 Site Description and Proposed Development

2.1 Site Location and Existing Use

2.1.1 The existing site is located off Don White Road on the Ogee Business Park within the Sanders Road industrial area of Wellingborough and has a central grid reference of SP 897 706. The site is bounded by agricultural land to the north, industry to the south and west and the midland mainline railway to the east. The location of the site is shown on the plan enclosed in **Appendix A**.

2.1.2 The existing site is plateaued, but undeveloped and zoned as part of the business park. (See topographical survey in **Appendix B**).

2.2 Site Background and History

2.2.1 The proposed development occupies plot 6/7/8 of the Ogee Business Park on which development began in 2006.

2.2.2 Historically the land in the area of Plot 6/7/8 was in agricultural usage before being brought into the wider extents of the Sanders Road Industrial Estate with the creation of the Ogee Business Park in conjunction with redevelopment of the adjacent Old Grammarians Sports Ground.

2.2.3 The infrastructure for the Ogee Business Park was granted planning approval in April 2006 ref WP/2006/0128F. Infrastructure provision comprised an adoptable road network proposed for adoption by the highway authority under a S38 agreement, together with separate systems of foul and surface water sewers proposed for adoption by the sewerage authority under a S104 agreement. Subsequently the foul sewer was adopted as a public foul sewer under the auspices of the Flood and Water Management Act 2010 whilst the surface water system and highways are still subject to the respective legal processes and require a certain proportion of the business park to be built out before the adoptions can proceed. Stub connections are provided from the adoptable drainage system into the proposed development site. The Ogee Business Park site wide drainage system is shown on the drawings contained within **Appendix C**.

2.2.4 The Ogee Business Park drainage system was designed in accordance with the flood risk management requirements current at the time and provides centralised attenuation of surface water drainage flows in a dry pond centrally within the estate discharging at a controlled rate to the River Ise to the East of the development. Individual plots are provided with unrestricted surface water discharge to the business park drainage system.

2.2.5 Following completion of the infrastructure a cut and fill operation was carried out to plateau the individual plots to take advantage of the economies of a wider earthmoving and reuse strategy over the business park as a whole. This plateauing operation was completed in 2008. Details of the plateauing operation for the Ogee Business Park and the specific development plot are shown on the drawings contained within **Appendix C**.

2.3 Site Constraints

2.3.1 Site constraints relating to drainage and flood risk mainly comprise land form, topographic and geological water features and drainage infrastructure.

2.3.2 Prior to plateauing the landform fell NW to SE with overland flows collected by the railway ditch to the east boundary and the field ditch to the south. These ditches remain. Both the road and drainage infrastructure also set constraints to site levels with the requirement to achieve connections.

2.3.3 The site has subsequently been plateaued and a topographical survey has established the existing predevelopment levels of the site. Levels of buildings and hardstandings will be set to suit the topography whilst meeting the connection constraints identified above. Overland flow routes will be considered in the detailed design. (See **Appendix B**).

2.4 Proposed Development

2.4.1 It is proposed to develop the site for the construction of an IBA aggregate processing and storage facility. This will comprise a reception and storage building, processing/sorting and grading machinery, external aggregate storage bays, office. maintenance and gatehouse/weighbridge buildings, HGV and staff/visitor parking, with associated access, and landscaped areas. To suit the proposed site use the majority of the site will be hard paved and impermeable. The proposed layout is shown on the plan enclosed in **Appendix D**.

2.4.2 The proposed impermeable area is approximately 23,320m² (2.33ha).

2.4.3 The planning application red line boundary includes some areas of amenity land separate from the main development. These areas will be utilised to provide opportunities for habitat creation and improvement to assist the sustainability and biodiversity of the development but will not comprise engineering works.

2.5 Design Basis

2.5.1 The drainage strategy has been prepared with due regard to North Northants Council's (previously Northamptonshire County Council) 'Local Standards and Guidance for Surface Water Drainage in Northamptonshire', together with national guidance and industry best practice. The drainage strategy is summarised below based on this.

2.5.2 The design uses the industry standard Causeway Flow computer software together with the FEH data for 60+min storms and FSR data for 15 & 30min storms and takes account of the latest published guidance for climate change allowance incorporating an allowance of 40%. Allowance for urban creep is not required as the site is for commercial uses and is fully developed leaving minimal scope for additional future drained areas.

3.0 Planning Policy

3.1 This section of the report will consider current National Planning Policy relating to flooding / flood risk and surface water drainage.

3.2 Flood Risk

3.2.1 This section of the report will consider current National Planning Policy relating to flooding and flood risk which can be found on the Planning Practice Guidance website. (http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/).

3.2.2 PPG, Paragraph 19 states that the aim of a Sequential Test is to steer development to areas with the lowest probability of flooding i.e., Flood Zone 1 (FZ1).

3.3 Vulnerability Classification

3.3.1 The proposed new development as 'non-hazardous waste treatment' is classified as 'Less Vulnerable' within Table 2: Flood Risk Vulnerability Classification set out in PPG, Paragraph 66.

3.4 Sequential Test

3.4.1 Flood Maps enclosed in **Appendix E** confirm the site to be situated in Flood Zone 1.

3.4.2 PPG, Paragraph 67 states that all types of development are considered an appropriate land use within Flood Zone 1 and therefore the proposed development type is appropriate.

3.5 Exception Test

3.5 There is no requirement in the current National Planning Policy to provide an exception test for a development site situated in Flood Zone 1.

3.6 Drainage

3.6.1 Planning Policy regarding drainage was updated by a written statement from the House of Commons HCWS161 dated 18/12/14 which stated that '…we expect local planning policies and decisions on planning applications relating to major development…to ensure that sustainable drainage systems for the management of run-off are put in place…'

3.6.2 Under the town and country planning order 2010 'major development' (in the context of this proposal) means development involving the provision of a building or buildings where the floor space to be created by the development is 1,000m^2 or more or the site area exceeds 1Ha.

3.6.3 As the total application comprises approx. 3.5Ha (2.4Ha main development and 1.1Ha additional biodiversity area), it is therefore classed as a major application and is therefore expected to comply with both the national guidance contained within the 'sustainable drainage systems: non-statutory technical standards' together with the local planning guidance provided by North Northants Council (previously Northamptonshire County Council) as LLFA and Drainage Authority.

4.0 Existing drainage and ground conditions

4.1 Watercourses

4.1.1 Existing land drainage ditches are present off the main site to the south and east, the first on the far side of the access road south of the site and the second at the toe of the low railway embankment immediately to the east of the site. The southern ditch is within the biodiversity area and will be maintained and improved as part of the environmental works. The nearest significant watercourse and main river is the River Ise located approximately 180 metres to the east on the far side of the main railway line.

4.2 Public Sewers

4.2.1 The closest sewers are located within the access road to the south of the site, foul water (FW) sewers are adopted by Anglin Water (AW) and the surface water (SW) sewers are subject to a S104 agreement.

4.3 Ground Conditions

4.3.1 The development plot is situated generally on a bedrock of Whitby Mudstone (previously called Upper Lias Clay) with an area of superficial Ecton Member sand/gravel alluvial deposit (River Terrace Deposits) to the SE as identified in the BGS viewer and confirmed by the geotechnical investigations carried out for development of the whole business park site. The extracts from BGS and the ground investigation are contained in **Appendix F**. The ground investigation recorded varying ground water levels but rising to within less than 1 m of the ground surface at times.

4.3.2 The proposed development plot has subsequently been plateaued by earthworks operations cutting in to the NW and placing fill materials to the SE.

4.3.3 The natural ground strata are not suitable for infiltration drainage, the mudstone being impermeable and the river terrace deposits being water bearing to within less than 1m of ground surface. The made ground is not suitable for infiltration due to the risk of generating ground movements by erosion of fines or 'collapse inundation' of the engineered ground.

4.4 Existing discharge from the Site

4.4.1 The existing site would be considered to be hydrologically 'greenfield' with run off following the natural gradient of the ground. The plateauing operation carried out in 2008 retained a slight fall ensuring overland run-off would continue to drain east to the soak ditch alongside the railway.

5.0 Proposed Drainage Strategy

5.1 Drainage Constraints

5.1.1 The proposed site use as a waste processing facility for Incinerator Bottom Ash places some constraints on the drainage systems that can be used both for operational considerations and in order to protect the water and wider environment.

5.1.2 Operationally the site is to be used for the storage and processing of a granular aggregate and this requires robust impermeable hard surfaces for the operation of HGVs and heavy plant/machinery. In addition the processing of the material needs water for dust suppression and moisture content control etc, hence during operation run-off is proposed to be harvested and reused. Runoff from the IBAA storage area is potentially not suitable for direct discharge to the water environment and as part of the environmental permit must be discharged to the foul water system.

5.1.3 The wider Ogee Business Park has been designed to accommodate the development of the proposed plot and the surface water infrastructure provided is sized to receive the runoff from the development plot. Attenuation of the business park surface water flows is accommodated centrally in an open dry pond to the SE of the development plot before discharge to the watercourse, this water storage facility is within the biodiversity area and will be maintained and improved as part of the environmental works. The wider foul drainage system has not been designed for significant inflows of contaminated surface run-off and discharge rates to this system will need to be managed appropriately with on-plot storage.

5.2 SUDS Assessment

5.2.1 An assessment of suitable SuDs techniques has been carried out for the site and is enclosed within **Appendix G**.

5.2.2 As identified above the site is not suitable for direct infiltration as the majority of the site is underlain by the impermeable Whitby Mudstone (previously called the Upper Lias Clay). The areas of River Terrace Deposits (Sands and Gravels) that would be permeable are also unsuitable as they record groundwater levels of within 0.7m of the original ground surface. It is noted that the site has been plateaued by a cut and fill process – the areas of fill material are not suitable for direct infiltration due to the risk of mobilising fines or creating collapse settlement of the engineered materials. Finally the proposed IBAA storage area could generate run-off that presents a risk to the wider hydrogeological environment and is required to be discharged to the foul sewer. Taking account of all the above points the use of direct infiltration is not proposed within the site.

5.2.3 Despite the limitations imposed on the site by both geotechnical, operational and environmental protection constraints the SUDS Assessment identifies that filter trenches, attenuation storage and rainwater harvesting should be viable SUDS techniques for use on this site. In addition the client is actively pursuing the use of rainwater harvesting to meet the operational needs of the facility. Outside the main development the Client is pursuing biodiversity improvements within the wider area which will include improvements to the existing southern ditch and to the existing central water storage facility with the potential to achieve water quality and biodiversity gains to the water environment.

5.3 Ground Water / Land Drainage

5.3.1 There is the potential for small amounts of ground water to emanate from the retaining wall and batter slope in the NW corner of the plot.

5.3.2 It is proposed to collect this water in a filter drain system at the crest and toe of the bank and at the foot of the retaining wall. This water cannot be discharged via a sewer and will be directed back into the existing site land-drainage via the existing connection to the ditch on the south side of the access road (refer to drainage principles drawing in **Appendix H** and site wide drainage infrastructure drawing in **Appendix C**).

5.4 Surface Water Drainage

5.4.1 The SUDS drainage hierarchy has been considered and guided the drainage strategy, as follows:

- Infiltration to ground - considered unviable due to ground conditions (impermeable strata, high water table, unsuitable fill material and pollution risk see 5.2.2 above).
- Discharge to watercourse – The wider Ogee Business Park drainage utilised this option ultimately discharging attenuated surface water to the River Ise.
- Discharge to public sewer – Although ultimately clean surface water discharges to a watercourse the direct runoff from the plot is to a prospectively adoptable sw sewer to secure the future maintenance of the off site infrastructure. It is noted that contaminated run-off will discharge through the public foul sewer system.

5.4.2 The site wide infrastructure provides attenuation of flows to a standard of 1/100 years + 30% additional volume to allow for climate change. At the time of design this was based on an FSR calculation method. It is recognised that design standards and analysis methods have moved on and that a design prepared today would use the FEH calculation method and up to a 40% upper end climate change allowance.

5.4.3 In order to provide a robust assessment a comparison of storage volumes for the wider site was carried out using the Flow storage estimate tool for both assessment methods – it was found that the current preferred calculation method required 21% greater storage volumes to be provided.

5.4.4 As a result of the nature of operations on the proposed site a proportion of site area will generate potentially contaminated run-off that will be discharged to the foul system and will be required to be attenuated on site. There is therefore a reduction in area discharging to the Ogee Business Park central attenuation facility. The site wide design expects 95% of the plot area to be positively drained. This equates to 2.298Ha (based on a plot area of 2.419Ha). The total hard area proposed to be drained to the SW system is 1.816Ha, 79% of the expected drained area and a 21% reduction.

5.4.5 It can therefore be seen that the reduction in area draining to the central balancing facility compensates for the more onerous calculation methods expected to be used for current analysis and that utilisation of the existing attenuation facility for the proposed site should not present an unacceptable risk of flooding downstream.

5.4.6 The wider site surface water sewer system was designed to the adoptable standards current at the time and were designed to run pipe full in the 1 in 1 year event and simulated not to flood in the 30 year event. Based on this criteria whilst the central balancing facility can accommodate the site discharge at up to 100 years with climate change, the sewer system may not be able to convey the full flow without risk of flooding to downstream properties. To ensure the development does not increase this flood risk the maximum discharge the surface water sewer system can accommodate has been assessed from the original calcs and the onsite drainage restricted by provision of flow controls to not exceed this runoff rate.

5.4.7 From the historic surface water drainage calcs it can be seen that the maximum flow expected from the development in the 1/30yr event is 360l/s. This is distributed as 170l/s in catchment 1 the west part of the site and 190l/s in catchment 2 the east part. Yard surfaces in both areas are generally dished and can accommodate an element of surface ponding in more extreme events. The 2 catchments have been analysed with the hardstand modelled as shallow storage ponds and the excess volume can be shown to be accommodated on the yard surface in the critical events. Calculations are contained within **Appendix J**.

5.4.8 The site drainage follows the established methodology for the wider Ogee Business Park Site and utilises the central attenuation facility designed to accommodate the site runoff. A robust assessment has been carried out to assess the changed analysis requirements appropriate at the date of application. It can be seen that the available attenuation volume in the central balancing pond remains adequate for the site. Discharge flows are to be restricted to the capacity of the sewer system and it has been assessed that excess flow in events in excess of the sewer capacity can be accommodate on the hardstand surface without increasing flood risk either on the site or to downstream properties.

5.4.9 It is concluded that discharge of surface water to the wider site drainage system remains an appropriate solution for drainage of the proposed development. (See **Appendix H** for drainage strategy and **Appendix J** for calculations).

5.5 Foul Water Drainage

5.5.1 The wider Ogee Business Park foul drainage system was constructed to adoptable standards and was subsequently adopted by Anglian Water as a public foul sewer under the FWMA 2010. The pipe system was designed to Anglian Water standards of the time and at flow rates of 3.0l/s/Ha. The development plot at 2.4Ha gross area therefore has capacity for discharge of up to 7.2l/s. Connections are proposed to the public sewer at the points indicated on the drainage strategy enclosed in **Appendix H** and a pre development enquiry submitted to Anglian Water.

5.5.2 A normal SfA allowance for domestic quotient is 0.5l/s/HA equating to 1.2l/s and leaving 5.0l/s (7.2-5.0) for the trade discharge.

5.5.3 Based on the above the area of surfacing expected to generate contaminated run-off will be designed to discharge at a maximum of 5.0l/s for the FEH 1:100 year storm with 40% allowance for climate change. On site storage will be provided to attenuate flows above this rate. The drainage areas, connection points and storage volumes are shown on the drainage strategy (See **Appendix H**) and calculations included in **Appendix J**.

5.5.4 A S106 sewer connection application will need to be made to Anglian Water Services together with a trade effluent discharge application.

5.6 Rainwater Harvesting

5.6.1 It should be noted that the Client user proposes the use of rainwater harvesting to supply water used for dust suppression, this will further reduce the volume of run-off from the site but has not been taken into account in the calculations to provide a robust and conservative approach.

5.7 Exceedance Events

5.7.1 There is always the potential for the capacity of the proposed on-site drainage systems to be exceeded whether due to rainfall in excess of the design criteria, accidental blockage or failure of the drainage system, lack of or inadequate maintenance, overland flow from upstream sites, or other unexpected event.

5.6.2 In an exceedance event flooding could occur from manhole chambers, channel drains, roof gutters or even simply from overland flow onto the site. The site layout, levels and falls will be laid out to ensure that these exceedance flows can be routed safely across the site without risking inundation of buildings nor damage to plant and equipment.

5.6.3 Excess water would flow south-and east across the site discharging off the site into either the railway ditch or across the access road towards the existing drainage ditch on the south. See the drainage strategy in **Appendix H** for details of overland flow routes etc.

6.0 Drainage Maintenance

6.1 It is important that maintenance responsibility for all drainage elements and assets is clearly defined, and a maintenance plan is in place as inadequate maintenance will increase the risk of flooding due to failure.

6.2 It is proposed that long term all elements of the private on-site drainage system are to be maintained by the client/owner. Any public sewerage assets within the development boundary (eg adopted laterals) will be the responsibility of the sewerage authority. The off plot biodiversity areas will be maintained as part of the wider Ogee Business Park maintenance responsibility.

6.3 There will be a suitable maintenance regime in place for the site. As site operations can be expected to generate silt the maintenance regime relating to collection and clearance of this silt will be flexible and tailored to the site specific requirements. In particular within the operational and processing areas silt will be collected regularly from the settlement wedge pits by the on site plant and returned into the aggregate process stream in the main building. Similarly, silt collected during the regular 'road sweeping' of the yard surfaces will be returned into the process.

6.4 Outside of the operational area all remaining drainage assets will be subject to a more normal maintenance regime;

- The onsite gullies, drainage channels and settlement pits which are to be cleaned regularly for the lifetime of the development.
- Pipes, manholes, drainage channels and silt pits should be inspected at 6 monthly intervals and cleaned out at minimum 12 monthly intervals or such interval as determined.
- Maintenance checks and identified work should be carried out every six months and in accordance with the manufacturer's recommendations for the below ground storage structures, flow control chambers and any other specific drainage elements.
- A traditional manhole has been proposed at each end of the attenuation storage tank for CCTV inspection. CCTV inspection for the attenuation tank should be carried out in accordance with the manufacturer's recommendations.
- Refer also to specialist drainage channel manufacturer's information and maintenance requirements.
- In all instances, inspection and cleaning should be carried out only by a specialist contractor and in accordance with the guidelines given in "Safe Working in Sewers and at Sewage Works" published by National Joint Health and Safety Committee for the Water Services
- A full CCTV survey of the drainage system should also be carried out at 10 yearly intervals.

7.0 Assessment of Flood Hazard

7.1 Flooding from Rivers

7.1.1 The nearest significant natural watercourse and main river is the River Ise located approximately 180 metres to the east of the development on the far side of the main railway line.

7.1.2 Existing land drainage ditches are present off the main site to the south and east, the first on the far side of the access road south of the site and secondly at the toe of the low railway embankment immediately to the east of the site. These link to the river via the existing railway land drainage system and site outfall drainage.

7.1.3 Flood maps contained in **Appendix E** show the development site as being situated within Flood Zone 1. Development sites which are situated within Flood Zone 1 are defined within Table 1 of PPG, Paragraph 65 as having less than 1 in 1000 annual probability of river flooding. There are also no known records of historic river flooding affecting the proposed development site.

7.1.4 The maximum extent of flooding from the River Ise on the flood map shows water reaching the east side of the railway embankment bounding the site. In the interest of a robust assessment and due to the direct linkage of the railway ditch to the river the FRA prepared for the wider site was also reviewed whereby potential flood levels were considered to be 46.0mAOD. Proposed development levels are designed to be above 48.0mAOD and hence 2m above the potential flood level further confirming the developments flood zone definition as Flood Zone 1.

7.1.5 From consideration of the information shown on the flood maps, the potential for flooding from rivers within the vicinity of the site is considered to present low risk of flooding for the site.

7.2 Flooding from the Sea

7.2.1 The site is located inland, a significant distance from the coast and site levels are proposed to be above 48.0m AOD.

7.2.2 Flooding from the sea is unlikely and hence presents a very low risk of flooding of the site.

7.3 Flooding from Surface Water / Land

7.3.1 The long term flood risk information on the .Gov.uk website mapping has been reviewed, a copy of the flooding from surface water map is enclosed in **Appendix E**. The site is shown to have a variable risk of flooding from surface water, with the majority of the plot at very low risk, but with an area of low through to high risk ponding against the edge of the estate road. We are not however aware of any previous significant overland surface water flooding to have occurred on the site.

7.3.2 The topographic survey (in **Appendix B**) indicates the wider site falls generally from NW to SE and hence overland flows can be expected to follow this route. At the higher risk locations identified on the map the access road is noted to be slightly higher than the existing development plot and additionally anti-trespass mounds are placed along the edge of the undeveloped land hence combined these could be expected to cause ponding of overland flows as indicated on the flood map.

7.3.3 It should be noted that the wider site infrastructure includes land drainage provision to maintain connectivity of land drainage on the north of the access road into the existing ditch which on completion of the development will reduce the risk of the ponding shown. The land drainage provision is shown referenced S39 on the wider infrastructure plan contained in **Appendix C**.

7.3.4 The development site will be designed to ensure appropriate management of overland surface water and land drainage flows. In particular drainage will be provided to the retaining structures and cutting slopes at the NW corner and west boundary to intercept and collect low level flows into the existing land drainage provision to ensure water continues to be routed as existing. In more extreme rainfall events where capacity of the land drainage system may not be able to cope the design of the site will ensure overland flows are routed around and through the site on appropriate overland flow routes and not channelled into buildings, storage areas etc (refer to drainage principles drawing in **Appendix H**).

7.3.5 Whilst there is always a risk of potential flooding from overland surface water flows during exceptional rainfall or storm events, both the existing provisions in the wider infrastructure and the proposed site layout and drainage provisions should ensure that flooding from surface water and land would be considered to present a low risk to the developed site.

7.4 Flooding from Groundwater

7.4.1 The geotechnical information available for the site (refer to **Appendix F**) indicates that it is underlaid generally by the Whitby Mudstone Formation, a generally impermeable strata, but that there is an area of River Terrace Deposits to the SE which may have potential for ground water storage. Monitoring of the investigation boreholes recorded varying groundwater levels within this strata of up to within 0.7m of the original ground surface. It is noted that the original ground level in the SE of the development plot has been raised by in the order of 1-1.5m as part of the plateauing operations already completed since the geotechnical investigations were carried out and the existing ditch alongside the railway would be expected to collect and channel away any water from this area. We are not aware of any previous incidents of ground water flooding to have occurred on site.

7.4.2 There is always a risk of potential groundwater flows due to the emergence of groundwater at the surface after periods of extremely wet weather. Cutting in of levels at the NW corner could also expose seepages along the surface of and within the existing clay strata. However the provision of land drainage within the design and provision of appropriate overland flow paths as already considered in section 7.3 above will mitigate these risks.

7.4.3 From the above assessment and taking account of the proposed site layout and drainage provisions, groundwater flooding is considered to represent a low risk to the developed site.

7.5 Flooding from Sewers

7.5.1 The wider Ogee Business Park development includes drainage infrastructure provided to serve the proposed development plots. The drainage system was designed to adoptable standards and is subject to a S104 adoption process with the sewerage authority. The sewer system is located within the access road network and runs along the southern side of the development plot and at a lower level than the development at the SE corner. BCAL Consulting have not been made aware of any records of flooding in the vicinity that can be attributed to capacity limitations in the sewerage systems.

7.5.2 The wider surface water system was designed with attenuation for the 1 in 100 year event to be contained within a central open pond balancing facility. The pond has a design top water level of 47.35mAOD and minimum development plot levels are set at 47.7mAOD (refer to infrastructure plans contained in **Appendix C**). The proposed development has minimum levels of greater than 48.0mAOD and is not therefore considered at risk of sewer flooding in the design events.

7.5.3 From the above assessment and taking account of the proposed site layout and drainage provisions, sewer flooding is considered to represent a low risk to the developed site.

7.6 Flooding from Artificial Sources

7.6.1 Based on Gov.uk interactive website mapping the site is not shown to be at potential risk of flooding from artificial sources such as reservoirs, a copy of the map is enclosed in **Appendix E**.

7.6.2 Gov.uk flood map data shows that flooding from artificial sources such as reservoirs is a very rare occurrence and hence an unlikely source of flooding for the site.

8.0 Conclusion

8.1 This report comprises a Drainage Strategy (DS) and Flood Risk Assessment (FRA) in support of a planning application for a proposed IBA recycled aggregate plant. Site proposals are shown on the plan enclosed in **Appendix D**.

8.2 Records have been obtained and there is no known historic flooding for the site. The site is located in Flood Zone 1 and is not at risk of flooding from rivers or seas. From the available information, land / surface water, groundwater and artificial sources are considered to present low risks of flooding to the site.

8.3 All types of development are considered appropriate land use within Flood Zone 1. The proposed use is therefore appropriate and in accordance with current National Planning Policy and the development proposals are considered appropriate for the site location in terms of flood risk.

8.4 The proposed development has been designed to ensure overland flow routes are provided away from the buildings.

8.5 The design of the proposed development and the proposed drainage should ensure that no flooding occurs, to any building on the site, for up to and including 1 in 100 year return period storm event with an additional 40% allowance for climate change.

8.6 There will always be a residual risk of flooding if the drains are not maintained sufficiently or during exceptional events when the drainage system is unable to cope with the rate or volume of rainfall. Appropriate bodies are responsible for maintenance of all parts of the drainage system. Regular maintenance will ensure this risk is minimised and allowance for overland exceedance routes ensure that if flooding occurs during an exceptional storm event it should not endanger human life.

8.7 An appropriate consideration of SuDS methods has taken place and appropriate use of drainage features including attenuation systems have been included within the development.

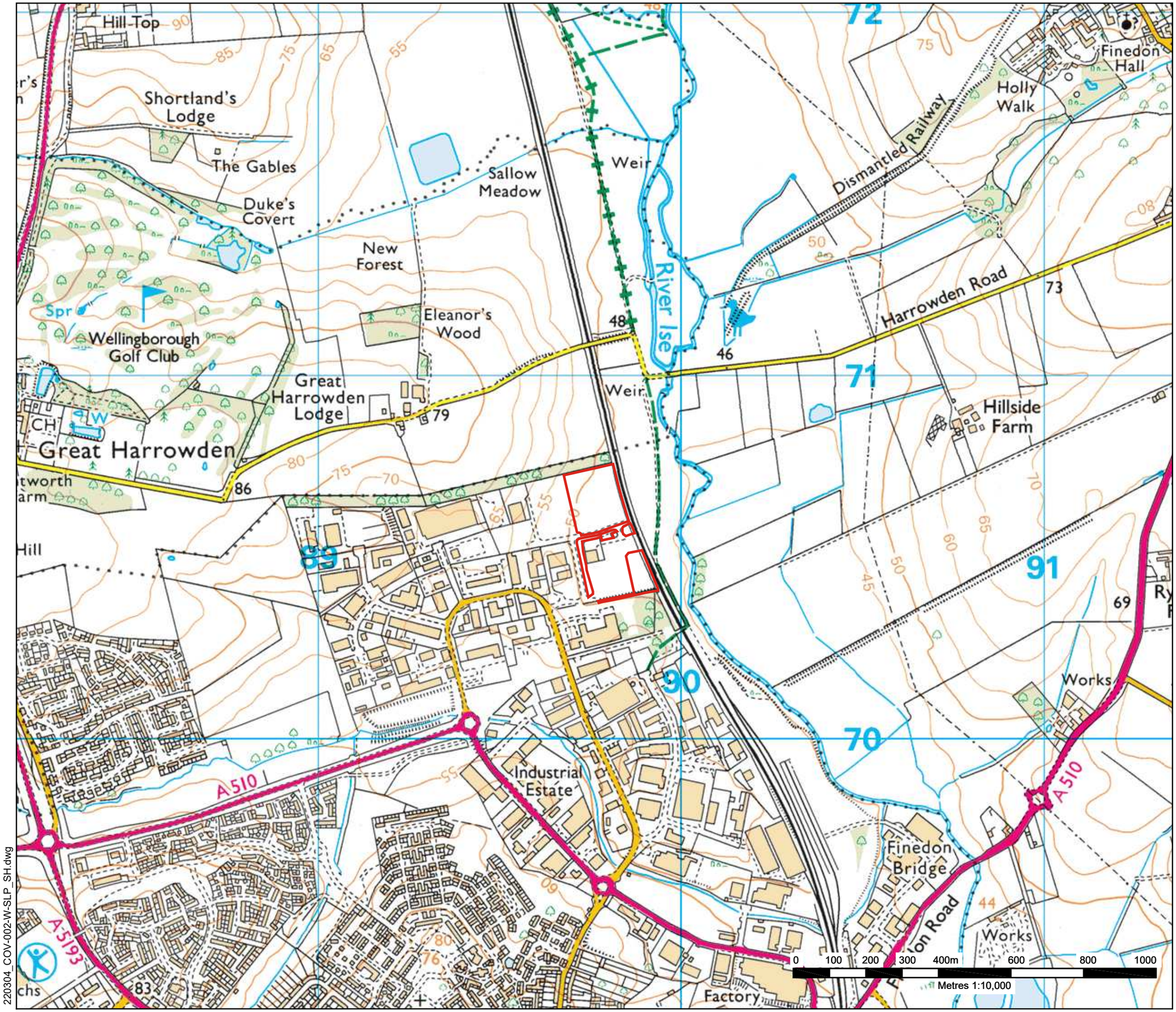
8.8 The site drainage follows the established methodology for the wider Ogee Business Park Site and utilises the central attenuation facility designed to accommodate the site runoff. A robust assessment has been carried out to assess the changed analysis requirements appropriate at the date of application. It can be seen that the available attenuation volume in the central balancing pond remains adequate for the site. Discharge flows are to be restricted to the capacity of the sewer system and it has been assessed that excess flow in events in excess of the sewer capacity can be accommodated on the hardstand surface without increasing flood risk either on the site or to downstream properties.

8.9 Part of the drained area at risk of generating contaminated run-off is required to drain to the foul drainage system for appropriate treatment. An attenuation storage volume is provided to limit the proposed runoff rate.to an acceptable level.

8.10 It is clear from the information provided above that the proposed development can be accomplished without presenting an unacceptable flood risk to occupiers, without increasing flood risk elsewhere and without detriment to the existing drainage infrastructure.

Appendix A – Site Location Plan


Ogee Business Park
Wellingborough,



LEGEND

Application Boundary

COVANTA

Powering Today. Protecting Tomorrow.

Heatons

Planning Environment Design

SITE
Wellingborough

PROJECT
Proposed IBA Plant

DRAWING TITLE
Site Location Plan

DATE
March 2022

REFERENCE
COV-002-W-SLP

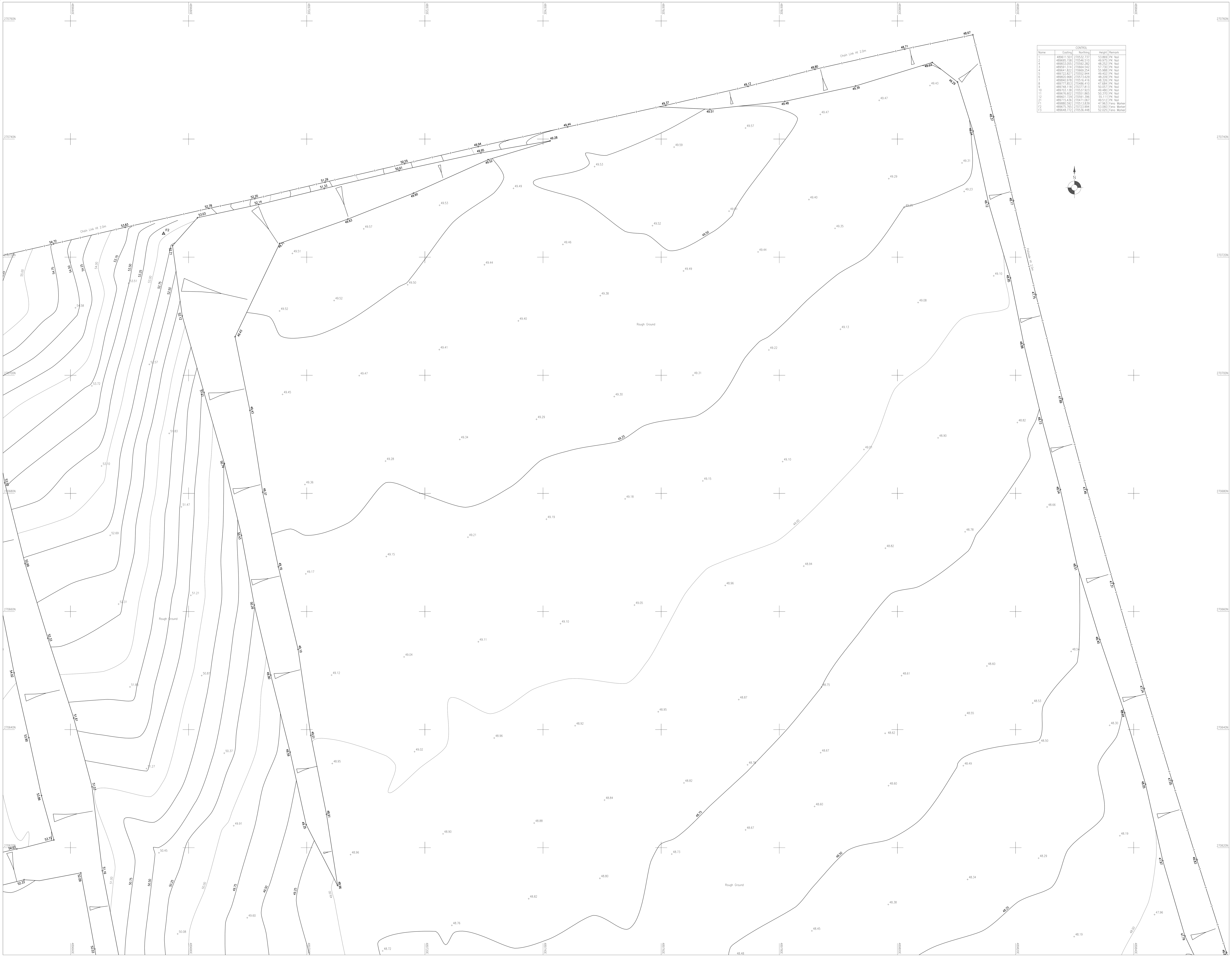
SCALE
1:10,000 @ A3

STATUS
FINAL

Heatons The Arc, 6 Mallard Way, Pride Park, Derby. DE24 8GX
www.heatonplanning.co.uk

220304_COV-002-W-SLP_SH.dwg

Appendix B – Topographical Survey



CONTROL				
Name	Easting	Northing	Height	Remark
1	489611.501	270532.737	53.869	PK Nail
2	489695.158	270546.510	49.975	PK Nail
4	489833.055	270592.282	48.252	PK Nail
3	489591.314	270664.542	57.730	PK Nail
4	489641.822	270669.254	55.988	PK Nail
5	489722.827	270552.944	49.402	PK Nail
6	489820.968	270573.629	48.209	PK Nail
7	489840.978	270516.416	48.326	PK Nail
8	489777.853	270486.410	47.684	PK Nail
9	489748.118	270377.813	50.057	PK Nail
10	489703.138	270537.923	49.480	PK Nail
11	489676.602	270551.865	50.370	PK Nail
12	489601.729	270591.396	55.111	PK Nail
21	489715.436	270471.067	49.512	PK Nail
F1	489880.592	270513.839	47.963	Feno Marker
F2	489675.765	270723.994	53.060	Feno Marker
F3	489648.772	270536.448	52.025	Feno Marker

Legend:

Abbreviated Features:

AV	Air Valve
Av.	Average
B	Bollard
BB	Belisha Beacon
BH	Borehole
BL	Bed Level
BS	Bus Stop
BT	British Telecom Cover
B/RW	Brick Retaining Wall
Br/W	Brick Wall
CATV	Cable TV Cover
CCTV	Close Circuit TV
CL	Cover Level
Col.	Column
C/RW	Concrete Retaining Wall
C/Pit	Catch Pit
DPC	Damp Proof Course
DK	Drop Kerb
Dr	Drain
EL	Eaves Level
ER	Earth Rod
EP	Electricity Pole
FH	Fire Hydrant
FL	Floor Level
F/Light	Flood Light
FW	Foul Water
FP	Foot Path
G	Gully
GV	Gas Valve
GP	Gate Post
Ht.	Height
IC	Inspection Chamber
IL	Invert Level
KO	Kerb Outlet
LB	Letter Box
LP	Lamp Post
MH	Manhole
Mkr	Marker Post
MS	Mile Stone
OSBM	Ordnance Survey Bench Mark
OH	Overhead
P	Post
PB	Post Box
PE	Pipe
PM	Parking Meter
RE	Rodding Eye
RL	Ridge Level
RP	Reflector Post
RS	Road Sign
RW	Retaining Wall
RWP	Rain Water Pipe
S	Stump
SL	Soffit Level
SN	Sign
SNP	Street Name Plate
SV	Stop Valve
SVP	Soil & Vent Pipe
SW	Surface Water
S/RW	Stone Retaining Wall
St/W	Stone Wall
TCB	Telephone Call Box
TL	Traffic Light
TP	Telegraph Pole
UG	Underground
US	Underside
UTL	Unable To Lift
DUTL	Damaged UTL
OUTL	Obstructed UTL
SUTL	Sealed UTL
VP	Vent Pipe
WL	Water Level
WM	Water Meter
WO	Wash Out
WT	Water Tap
Ø	Diameter

Fence Abbreviations:

B/W	Barbed Wire
C/B	Close Boarded
C/I	Corrugated Iron
C/L	Chain Link
C/P	Chestnut Paling
I/R	Iron Railing
P/R	Post & Rail
P/W	Post & Wire

Symbols:

Control Station :

Manhole/Inspection Chamber :

Inlet Pipe

Out Flow

Inlet Pipe

Pipe

Bush :

Tree : Spread & Girth Shown to Scale

Gate :

Spot Level : 52.65

Bore Hole :

Trial Hole :

Lines:

Wall :

Verge :

Fence :

Boundary :

Edge of Spread :

Hedge :

Embankment : Top of Bank / Bottom of Bank

OH Telecom :

OH Electric :

Drainage Flow :

Contours :

Hatching:

Building :

Open Sided Building :

General Notes:

1. Man entry to sewers has not been undertaken. Depths, pipe sizes and quantity of pipes are measured from the surface. We therefore cannot guarantee the completeness or accuracy of the sewer data which should be checked with the local authority and/or on site.

2. All tree heights and spreads are approximate. The plan position of trunks are taken at ground level. Girth measurements are taken at a 1.5m height. We have attempted to identify tree species, however if tree species are critical specialist advice should be sought.

3. Survey information is as result of measurement to existing features and does not imply legal ownership of boundaries or land divisions. Where boundary alignment lines are added to the survey drawing and are taken from legal documents or other information supplied they are done so within the constraints of drawing quality and scale. They are provided on the basis of opinion and do not imply legal contract.

Plan Coordinate Control:-
Plan Coordinates relate to National Grid OSGB36(02) using GPS. LSF
LSF = 1.000 at Stn 2

Level Datum:-
All Levels relate to OSGB36(02) using GPS

Sheet Location Diagram:

1 2 3 4 5 6

Notes:

REV NO	REV NOTE	DATE	SIGNED

THE SURVEY ASSOCIATION

GLOBAL SURVEYS

6 Franklin's Close, Ecton, Northants, NN6 0QG
Tel: 01604 491543 Fax: 01604 790361
Email: info@globalsurveys.co.uk

Site: Ogee Business Park
Wellingborough

Client: Stepnell Ltd

Survey Description: Topographical Survey

Date	May 2016	Scale	1/200 @ A0
Dwg No.	15949-Topo	Surveyor	DT
Sheet	2 of 6	Checked	MSW

CONTROL				
Name	Easting	Northing	Height	Remark
1	489611.501	270532.737	53.869	PK Nail
2	489695.158	270546.510	49.975	PK Nail
4	489833.055	270592.282	48.252	PK Nail
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F2	489675.765	270723.994	53.060	Feno Marker
F3	489648.772	270536.448	52.025	Feno Marker

Legend:

Abbreviated Features:

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Av.	Average
B	Bollard
BB	Belisha Beacon
BH	Borehole
BL	Bed Level
BS	Bus Stop
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Br/W	Brick Wall
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Col.	Column
C/RW	Concrete Retaining Wall
C/Pit	Catch Pit
DPC	Damp Proof Course
DK	Drop Kerb
Dr	Drain
EL	Eaves Level
ER	Earth Rod
EP	Electricity Pole
FH	Fire Hydrant
FL	Floor Level
F/Light	Flood Light
FW	Foul Water
FP	Foot Path
G	Gully
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Symbols:

Control Station :
Manhole/Inspection Chamber :
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Inlet Pipe
Pipe
Bush :
Tree : Spread & Girth Shown to Scale
Gate :
Spot Level : 52.65
Bore Hole :
Trial Hole :

Lines:

Wall :
Verge :
Fence :
Boundary :
Edge of Spread :
Hedge :
Embankment : Top of Bank / Bottom of Bank
OH Telecom :
OH Electric :
Drainage Flow :
Contours : 85.00 / 84.75

Hatching:

Building :
Open Sided Building :

General Notes:

1. Man entry to sewers has not been undertaken. Depths, pipe sizes and quantity of pipes are measured from the surface. We therefore cannot guarantee the completeness or accuracy of the sewer data which should be checked with the local authority and/or on site.

2. All tree heights and spreads are approximate. The plan position of trunks are taken at ground level. Girth measurements are taken at a 1.5m height. We have attempted to identify tree species, however if tree species are critical specialist advice should be sought.

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Plan Coordinate Control:–
Plan Coordinates relate to National Grid OSGB36(02) using GPS. LSF
LSF = 1.000 at Stn 2

Level Datum:–
All Levels relate to OSGB36(02) using GPS

Sheet Location Diagram:

1 2 3 4 5 6

Notes:

REV NO	REV NOTE	DATE	SIGNED

THE SURVEY ASSOCIATION

GLOBAL SURVEYS
6 Franklin's Close, Ecton, Northants, NN6 0QG
Tel: 01604 491543 Fax: 01604 790361
Email: info@globalsurveys.co.uk

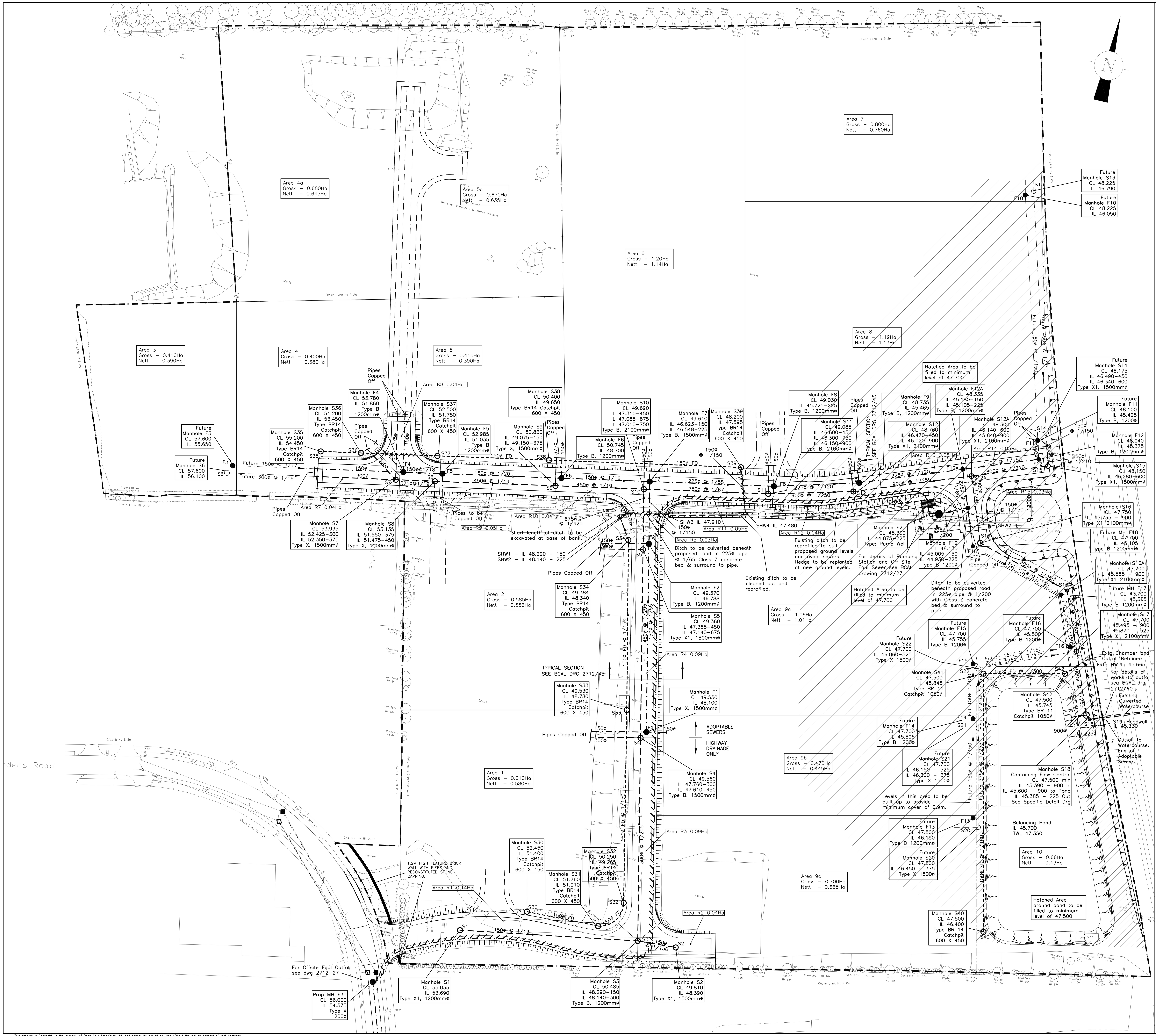
Site: Ogee Business Park Wellingborough

Client: Stepnell Ltd

Survey Description: Topographical Survey

Date	May 2016	Scale	1/200 @ A0
Dwg No.	15949–Topo	Surveyor	DT
Sheet	4 of 6	Checked	MSW

Appendix C – Business Park Infrastructure Plans



KEY

- 600ø @ 1/250 — Pipe Diameter and Gradient
- F1 — Proposed Foul Water MH and Reference N°
- S1 — Proposed Surface Water MH and Reference N°
- EF1 — Existing Foul Water MH and Reference N°
- ES1 — Existing Surface Water MH and Reference N°
- Proposed Foul Water Sewer (Direction of Flow)
- Proposed Surface Water Sewer (Direction of Flow)
- Proposed Foul Water Rising Main
- Existing Foul Water Sewer
- Existing Surface Water Sewer
- FD — Fin Drain or Narrow Filter Drain
- Pipe with Class Z concrete bed & surround.
- Drained areas
- Anglian Water proposed easement, minimum 3m from outside of pipe.
- HW — Headwall
- SHW — Sandbag Headwall – Refer to dwg 2712-51

Notes

1, All works to be carried out in accordance with the requirements of Sewers for Adoption 5th Edition and the adopting authorities requirements.

2, Foul Water Rising Mains shall be constructed in strict accordance with the requirements of Sewers for Adoption 5th Edition.

3, Drawing is based upon layout submitted for planning permission, Stepnell drawing ref 13–101–01 together with plot layout drg ref 13–OG–Plots Plus.

4, Base survey produced from a composite of existing survey information, additional survey provided by Stepnell Ltd and Ordnace Survey data, crown copyright.

5, When connecting to existing drains/sewers the contractor must ensure the final run is roddable.

6. New connections to and chambers on existing adopted sewers to be constructed in accordance with the requirements of Sewers for Adoption 5th Edition.

7. All proposed sewers to have Class S granular bed and surround, except where
   a, cover beneath roads or hardstanding is less than 1.2m
   b, cover beneath fields is less than 0.9m
in which case a concrete protection slab is required.

8. All private pipes and highway drains to have Class S granular bed and surround, except where
   a, cover beneath roads or hardstanding is less than 1.2m
   b, cover beneath fields is less than 0.9m
in which case class Z concrete bed and surround is required.

9. Side connections to be 1:100 gradient, unless stated otherwise.

10. Land drains. Where contractor severs existing land drains he shall reconnect them into new pipes. Land drains must NOT be connected either directly or indirectly into adoptable sewers.

11. CCTV Survey: To be carried out on completion of construction.

NOTES
DO NOT SCALE

This drawing to be read in conjunction with all relevant Architects, Engineers and Specialists drawings particularly for holes, inserts etc., also all relevant specifications and Bill of quantities.

All dimensions are in millimetres.
All levels are in metres.

Concrete

Grades to be:–

Cover to be:–

For bending schedules see sheets:–

Bar notation is shown as follows:–
No. Type Size – Mark – Spacing – Layer

Types are:– R Mild Steel
T High Tensile

Structural Steel

Unless Noted Otherwise:–

Materials and Dimensional Standards to comply with the requirements of Table A, National Structural Steelwork Specification Grade S275 and for Structural Hollow Sections BS EN 10 210 Grade S275J2H

Open holes shown dia.

Bolts shown dia.

Bolt grades generally 8.8 unless noted

Refer also to Drawings

No	Revision	Date	Drn	Chkd
H	Road layout redrawn to avoid tree. Sewer layout and levels revised to suit.	02/03/2006	BPK	
G	Redrawn onto Nov 2005 survey. Sewer levels revised to suit new survey benchmark (All levels raised by 200mm). Area around tree marked as 'In Abeyance'. CONSTRUCTION ISSUE	10/02/2006	BPK	
F	F4, F5, F8 & F9 revised to avoid potential clash of laterals.	02/11/2005	BPK	
E	Road layout revised, road 3 realigned, extended to railway boundary and turning head added, western turning head repositioned to north of road. Pumping Station moved to suit. Additional 3 acres of site added. Pond redesigned to include additional site with base at 45.500 and top water level at 47.150. Foul and surface water drainage re-designed. Manhole positions adjusted to suit road layout and plot arrangement as indicated on latest Architect's drawing.	26/10/2005	BPK	
D	Pumping staion and access relocated. Drainage revised to suit.	11/07/2005	MB	
C	Note numbering corrected, note 9 amended, chambers S1,S2,S7,S8,S9&F1 resized due to unavailability of 1350ø rings, Pumping station revised to indicate both outfall options.	20/04/2005	BPK	
B	Minor revisions to AW requirements, Type E manholes revised to type X, F6 resized, easements shown.	09/03/2005	BPK	
A	Minor revisions to layout and notes.	15/03/2004	MB	BPK
File: T:\Projects\2700-\2712\2712-20+.DWG	Original	25/02/2004	BPK	PK

BCAL
CONSULTING ENGINEERS
PROJECT MANAGERS
BRIAN COLE ASSOCIATES LTD.
Lloyds Bank Chambers. 48A Market Street,
Wellingborough, Northamptonshire.NN8 1AA
Telephone:(01933)440024 Fax:(01933)440041

Client

Stepnell Ltd

Project

Ogee Business Park
Sanders Road
Wellingborough

Drg. Title

Overall Site Drainage Scheme

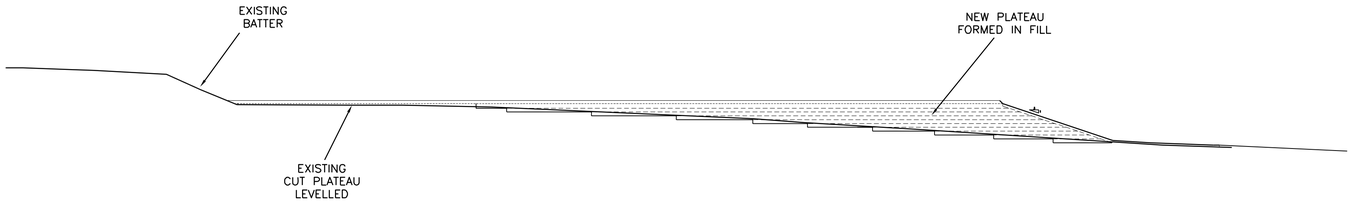
Scale 1:500

Drg. No. 2712-25 H

FOR CONSTRUCTION

PLAN

(Scale 1:1000)



TYPICAL SECTION A–A

(Scale 1:200)

Summary of Works

North Western High Level Plots.
The area referred as to the high level plots, consists of the three plots which step down the hill immediately east of the access road to the Robinson building. It is intended that these are constructed as flat plateaus at 56.000, 54.000 and 52.000 metres AOD respectively.

Topsoil was stripped and the plateaus were cut to formation in Phase 1. The existing formation is to be prepared, removing any soft spots as necessary and making up levels to the plateau in acceptable material excavated from the stockpiles compacted appropriately in accordance with the specification.

On completion of those plots the batters to the East are to be topsoiled and the area left in a tidy condition. The finished plateaus are to be protected from weather deterioration by a 200 mm thickness of material.

North Eastern Main Plot.
The North Eastern main plot is located adjacent to the railway line. Works to this area will consist of the removal of the remaining topsoil, excavation to approximately formation, preparing and proof rolling the formation, dealing with soft spots accordingly and then placing fill to make up levels to the plateau in acceptable material compacted appropriately in accordance with the specification.

On completion of the area, it is to be protected similarly to the high level plot with a 200mm layer of material to prevent the surface deteriorating. A small area of fill that falls outside the plot boundary is similarly to be prepared with topsoil and all rubbish etc removed.

South Eastern Plot.
The third plot to the South East surrounding the balancing pond is currently occupied by various stock piles of materials, these are to be used where appropriate as either acceptable material in the fill to the adjacent plots or as unacceptable material in the 200mm thickness to protect the surfaces. Contractor to seek approval from the geotechnical enginner to the appropriate classification. Any surplus material is to be retained in tidy stockpiles.

It is intended in the future that this area will be made up to appropriate levels as Phase 3 of the earthworks operation. Any stockpiles should therefore be kept in a controlled manner and if at all possible, kept to the southern half of the plot in order to leave sufficient working space for future operations.

It is not acceptable to excavate borrow pits or similar areas of over–excavation on this plot if there is a shortfall of acceptable material for the Northern plots. Further if additional material storage mounds are required then any remaining topsoil must be removed before forming of mounds. Material is also not to be simply spread around on this plot, any material not placed in mounds must be appropriately engineered.

Notes

1, Drawing based on survey carried out by Global Surveys ref 9998 dated 6 Aug 2007.

2, All earthworks operations to be carried out entirely in accordance with the Geotechnical Consultants Specification produced by Ground Engineering ref C10346B and the associated Specification for Highway Works (SHW).

3, Contractor to liaise with Stepnell Ltd, BCAL and Ground Engineering to ensure works are inspected and tested. Compliance testing is required on this contract.

4, Volumes given are approximate and provided for information only. Contractor to satisfy himself of actual volumes etc.

5, Contractor may wish to consider the use of methods to modify the moisture content of the fill materials stockpiled on site to enhance their structural properties. Any such proposal should be carried out with full consultation and approval of both the Geotechnical Engineer and BCAL.

6, Services are present on this site, and the contractor should satisfy himself as to their location prior to commencing any excavations. Any services indicated on the drawings are based on information given on the survey. No warranty is given as to the accuracy of this information and no liability accepted for incorrectly located plant. The contractor is to obtain all necessary utility company information prior to commencing any excavations on site. Contractor is recommended to accurately locate services by hand dug trial holes prior to carrying out mechanical excavation. For details of all new mains and services installed on site contact Stepnell Ltd.

7, Parts of the site are in close proximity to a live main line railway, Contractor to liaise with Network Rail engineers to ensure all works are carried out in accordance with Network Rail's guidelines/requirements for working adjacent to live railways.

Volumes Summary – Earthworks Phase 2

Volumes given are approximate and provided for information only. Contractor to satisfy himself of actual volumes etc.

Totals

Excavation	Total Excavation Plot A		100 m3
	Total Excavation Plot B		100 m3
	Total Excavation Plot C		100 m3
	Total Excavation Plot D		3345 m3
	Excavation Mound A		7800 m3
	Excavation Mound B		1014 m3
	Excavation Mound C		7096 m3
	Excavation Mound D		7687 m3
	Excavation Mound F		5743 m3
	Excavation Mound I		2206 m3
		Total	35191 m3
Fill	Total Fill Plot A		1920 m3
	Total Fill Plot B		2900 m3
	Total Fill Plot C		2020 m3
	Total Fill Plot D		19261 m3
		Total	26101 m3
Protection	Plot A		375 m3
	Plot B		450 m3
	Plot C		520 m3
	Plot D		4075 m3
		Total	5420 m3
Topsoil	Excavate Topsoil Plot D		3341 m3
	Excavation Mound E		5994 m3
		Total	9335 m3
	Place Topsoil Plot A		50 m3
	Place Topsoil Plot B		60 m3
	Place Topsoil Plot C		50 m3
	Place Topsoil Plot D		50 m3
	Place Topsoil Haul Route		2400 m3
		Total	2610 m3
Remaining Spoil on South East Plot			
	Topsoil (9335–2610)		6725 m3
	Fill (All 35191–26101–5420)		3670 m3

NOTES
DO NOT SCALE

This drawing to be read in conjunction with all relevant BCAL, Architects, Consultants, Specialist project drawings and Specifications.

Current British Standards apply.

All dimensions are in millimetres.
All levels are in metres.

CONCRETE

Grades to be:–

Cover to be:–

For bending schedules see sheets:–

Bar notation is shown as follows:–
No. Type Size – Mark – Spacing – Layer

Reinforcement Notation Type H unless noted Grade B500A, B500B or B500C conforming to BS 4449:2005

All Scheduling to BS 8666:2005

STRUCTURAL STEEL
Unless Noted Otherwise:–

Materials and Dimensional Standards to comply with the requirements of Table 2.1, National Structural Steelwork Specification. Grade S275. Structural Hollow Sections to be Hot Finished to BS EN 10210–1

All Works to be carried out to the requirements of the the current version of the National Structural Steelwork Specification on day of manufacture..

Refer also to Drawings

No	Revision	Date	Drn	Chkd
File:	Original			

BCAL
CONSULTING ENGINEERS
PROJECT MANAGERS
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Lloyds Bank Chambers. 48A Market Street,
Wellingborough, Northamptonshire.NN81AA
Telephone:(01933)440024 Fax:(01933)440041

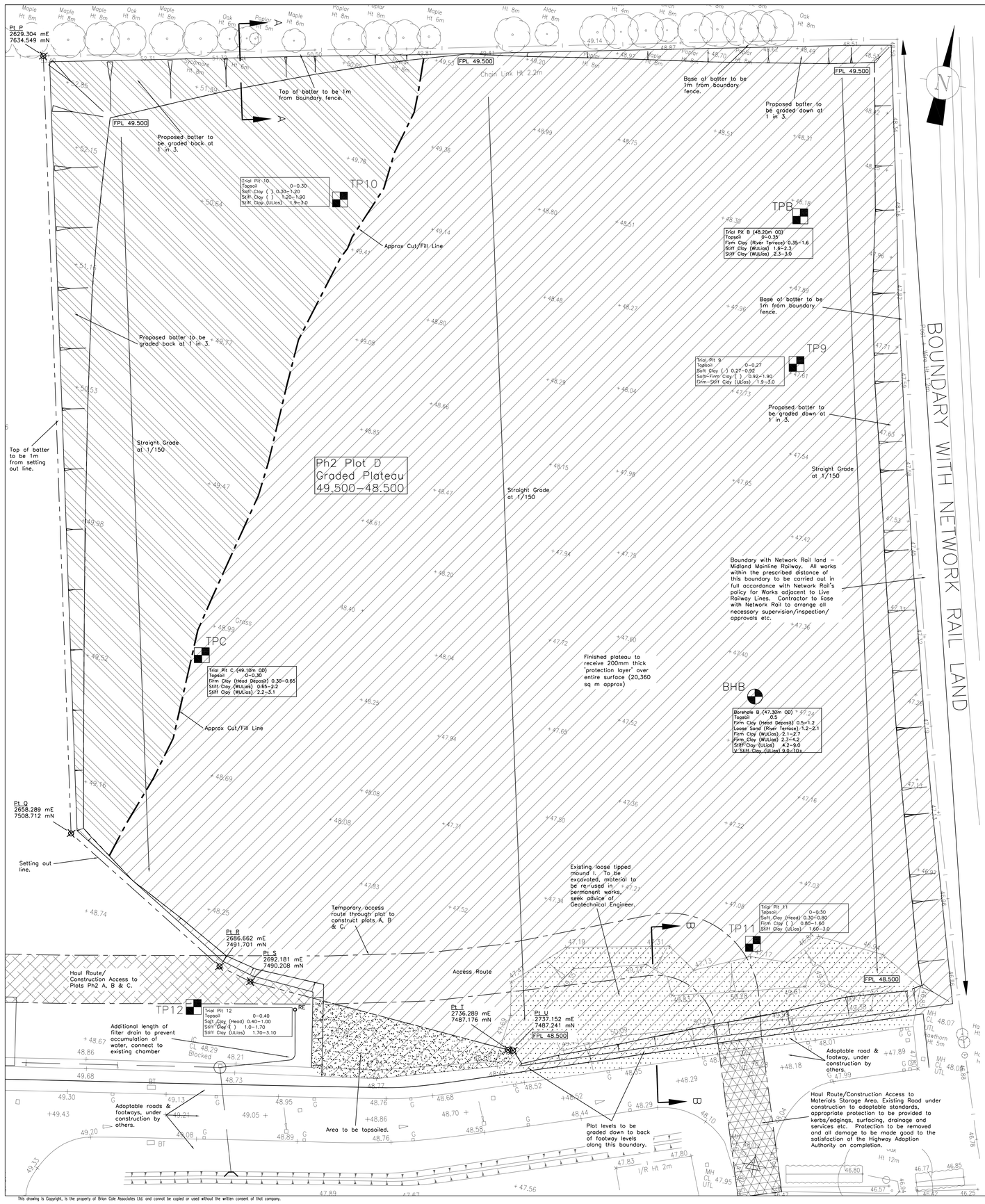
Client
Stepnell Ltd

Project
Ogee Business Park

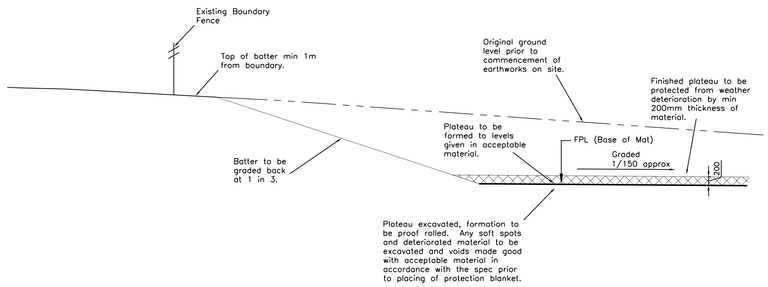
Drg. Title
Earthworks Phase 2
Overall Scheme

Scale
As Noted

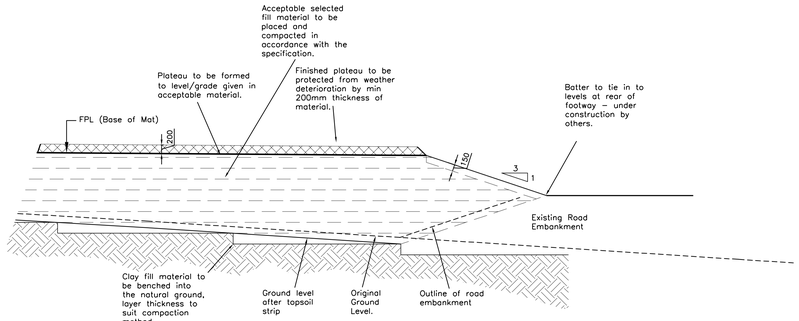
Drg. No.
2712/92



Typical Section A–A
Scale 1:50



Typical Section B–B
Scale 1:50



Key

1. Excavation
Area to be proof rolled, soft spots/deteriorated areas removed and levels trimmed or made up to suit plateau in acceptable material.

2. General Fill
Area to be proof rolled, soft spots/deteriorated areas removed and levels made up to suit plateau in acceptable material.

3. Future Construction Access Position/Ramp
Access ramp formed in acceptable material.

4. Topsoil to Filled Area
Topsoil placed to filled areas 150mm thick.

5. Haul Road/Trafficked Areas
Haul Route /Trafficked area to be re-instated on completion of the Works, all deteriorated material to be removed, surface to be ripped and reinstated with 150mm thickness of topsoil.

Existing Drainage to be Protected/Modified/Adjusted to suit new levels

Approximate Cut/Fill Boundary.

Extent of 200mm thick protection mat to finished plateau.

FPL 50.000 — Finished Plateau Level (Before placement of protection layer).

Setting Out co-ordinate relative to survey grid.

Ground Investigation Trial Hole/Borehole Location

Notes

1. Drawing based on survey carried out by Global Surveys ref 9998 dated 6 Aug 2007.

2. All earthworks operations to be carried out entirely in accordance with the Geotechnical Consultants Specification produced by Ground Engineering ref C103468 and the associated Specification for Highway Works (SHW).

3. Contractor to liaise with Stepnell Ltd, BCAL and Ground Engineering to ensure works are inspected and tested. Compliance testing is required on this contract.

4. Trial hole positions and descriptions are given for background information only, for details of trial hole record and full descriptions of ground conditions found refer to ground investigation reports.

5. Volumes given are approximate and provided for information only. Contractor to satisfy himself of actual volumes etc.

6. Contractor may wish to consider the use of methods to modify the moisture content of the fill materials stockpiled on site to enhance their structural properties. Any such proposal should be carried out with full consultation and approval of both the Geotechnical Engineer and BCAL.

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Volumes Summary – Ph2 Plots A, B & C

Volumes given are approximate and provided for information only. Contractor to satisfy himself of actual volumes etc.

Plot Ph2 Main Plot (D)

Excavation	General Excavation		2845 m3
	Mound I Removed		2206 m3
	Allow for soft spots at formation		500 m3
		Total	5551 m3
Filling	To Soft Spots		500 m3
	General Fill		18911 m3
		Total	19261 m3
Topsoil	Excavate Topsoil		3341 m3
	Place Topsoil To Batter 150mm thk		0 m3
Protection	Mat 200mm thk		4075 m3

Misc Areas

Topsoil	To areas trafficked by plant/haul road min 150mm thk	50 m3

NOTES
DO NOT SCALE

This drawing to be read in conjunction with all relevant BCAL, Architects, Consultants, Specialist project drawings and Specifications.

Current British Standards apply.

All dimensions are in millimetres.
All levels are in metres.

CONCRETE

Grades to be:–

Cover to be:–

For bending schedules see sheets:–

Bar notation is shown as follows:–
No. Type Size – Mark – Spacing – Layer

Reinforcement Notation Type H unless noted Grade B500A, B500B or B500C conforming to BS 4449:2005

All Scheduling to BS 8666:2005

STRUCTURAL STEEL
Unless Noted Otherwise:–
Materials and Dimensional Standards to comply with the requirements of Table 2.1, National Structural Steelwork Specification. Grade S275. Structural Hollow Sections to be Hot Finished to BS EN 10210–1

All Works to be carried out to the requirements of the the current version of the National Structural Steelwork Specification on day of manufacture..

Refer also to Drawings

No	Revision	Date	Drn	Chkd
A	Setting out line revised between points R and U, hatching etc revised to suit.	13-12-2008	BPK	
File: D:\Projects\2700–\2717\Drawings\2717–90r.dwg	Original	Oct 2007	BPK	

BCAL
CONSULTING ENGINEERS PROJECT MANAGERS
BRIAN COLE ASSOCIATES LTD.
Lloyds Bank Chambers, 48A Market Street, Wellingborough, Northamptonshire,NN81AA
Telephone:(01933)440024 Fax:(01933)440041

Client
Stepnell Ltd

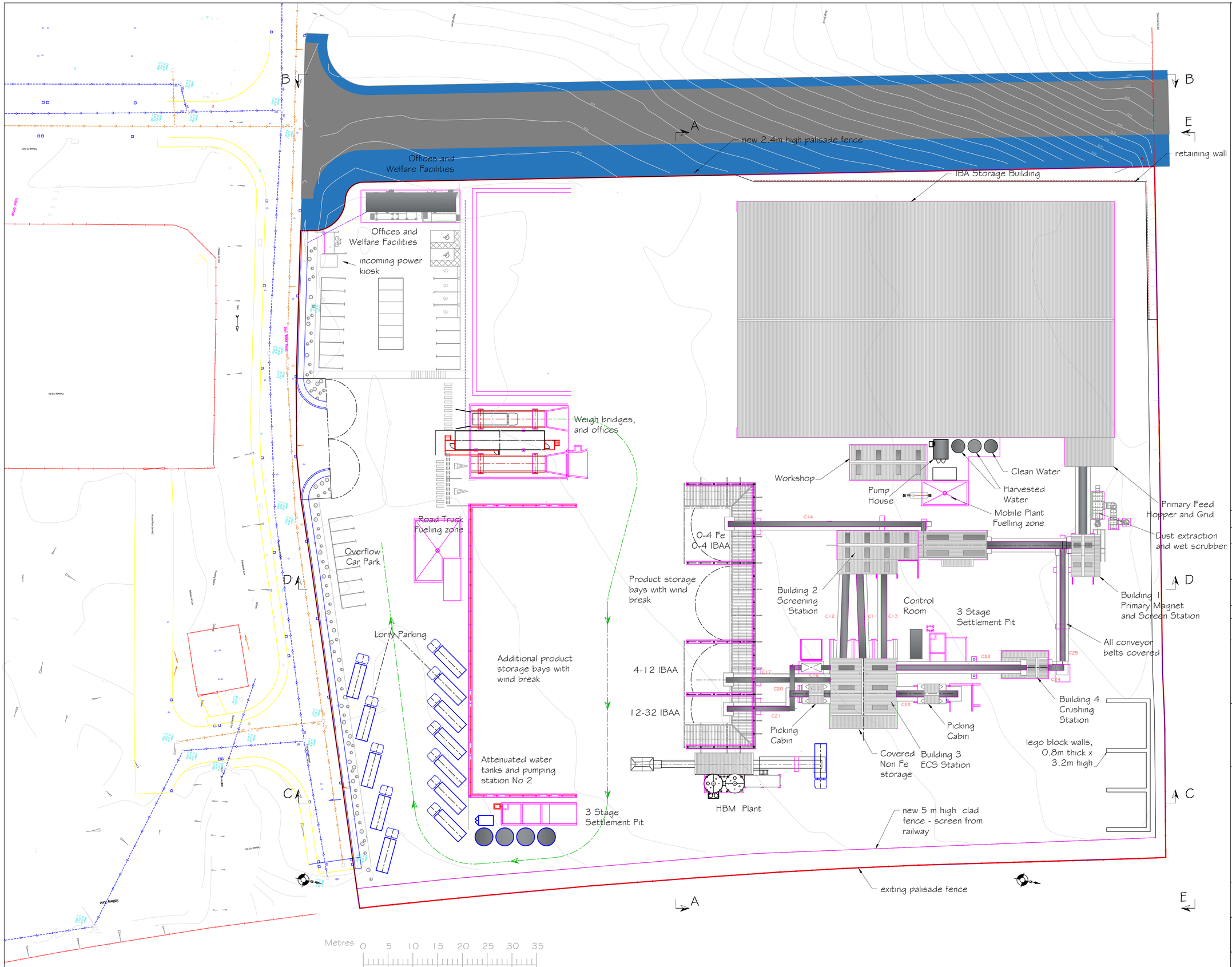
Project
Ogee Business Park

Drg. Title
Earthworks Phase 2
North East Main Plot

Scale @ A0
As Noted

Drg. No.
2712-94-A

Appendix D – Proposed Site Plans



Refer to drawing WE001-06 for view references.

Rev	Date	Details	Drawn
7	28.03.22	Lego block walls 3.2m high added	snf
6	17.03.22	screen fence now 5m high	JWJ
5	21.01.22	Translucent panels added	JWJ
4	18.01.22	P2, T1 & T12 Civils updated	JWJ
3	15.12.21	No Fe bays - P5 shortened by 2.4m - improved access to pole drums	JWJ
2	16.09.21	0-4 conveyors combined; screening station adjusted	snf
1	05.08.21	HBM Plant relocated	snf

Project:
Proposed Wellingborough IBA Plant

Description:
Plan of proposed plant and buildings

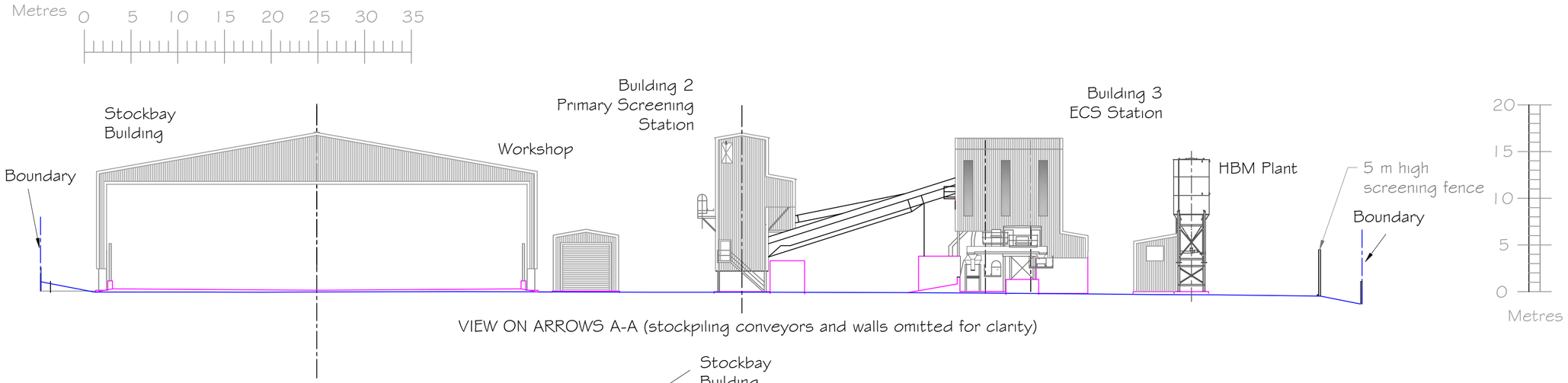
DAY AGGREGATES
Transport Avenue
Brentford
Middlesex
TW8 9HF

Date	Scale	Drawn
29.06.21	1:500	snf

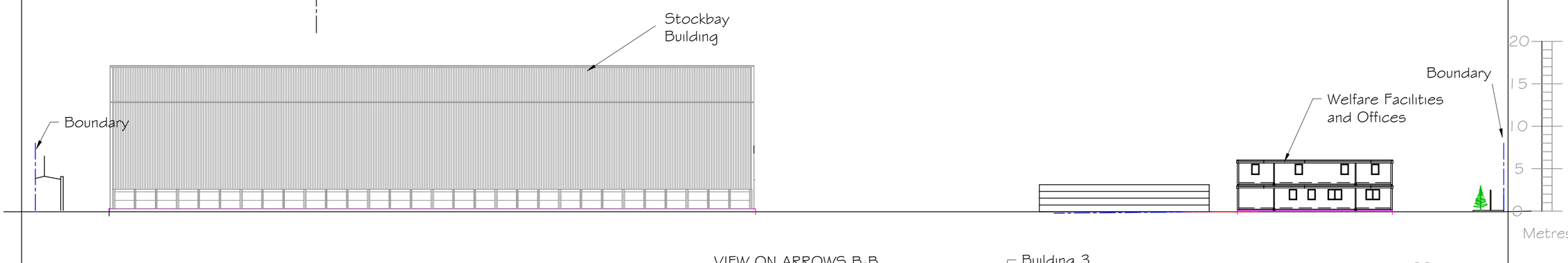
Drawing No.	Rev
WE001-05	7

Status	FOR INFORMATION

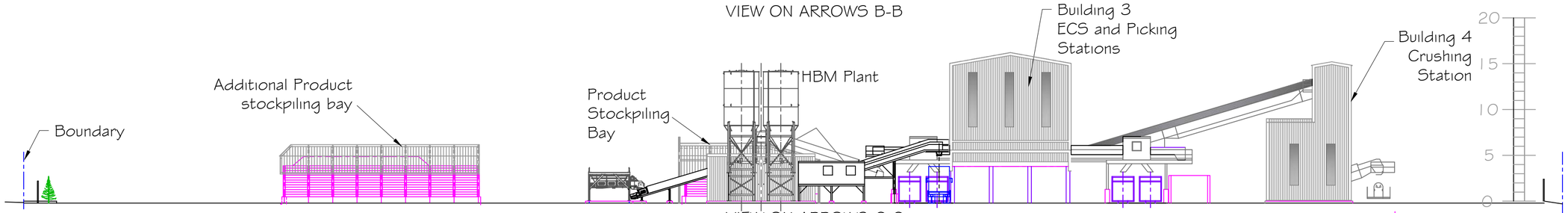
Checked	Print
JWJ	A2



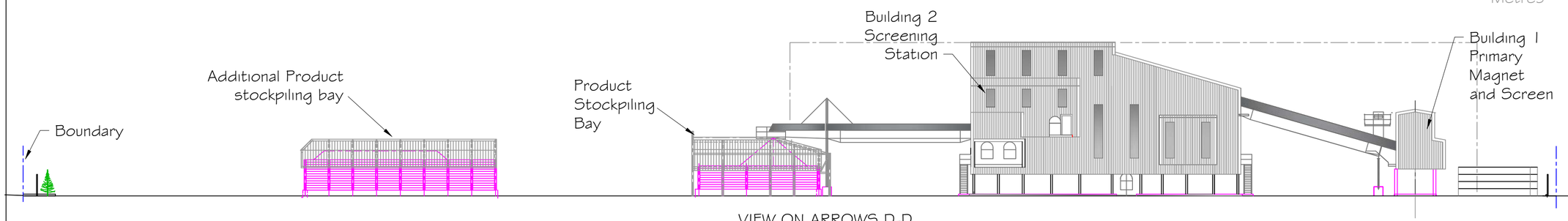
VIEW ON ARROWS A-A (stockpiling conveyors and walls omitted for clarity)



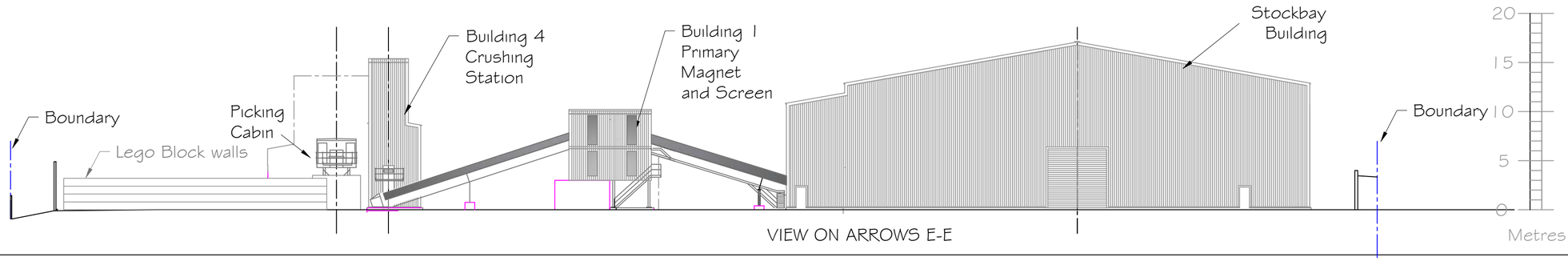
VIEW ON ARROWS B-B



VIEW ON ARROWS C-C



VIEW ON ARROWS D-D



VIEW ON ARROWS E-E

Refer to drawing WE001-05 for view references.

Rev	Date	Details	Drawn
7	28.03.22	Lego block walls 3.2m high added	snf
6	21.03.22	5m high screening fence to railway annotated. Stockbay building cladding adjusted.	snf
5	21.01.22	Translucent sheets added	JWJ
4	18.01.22	P2, T1 & T12 Civils updated	snf
3	15.12.21	No Fe bays - P5 shortened by 2.4m - improved access to pole drums	snf
2	16.09.21	0-4 conveyors combined; screening station adjusted	snf
1	05.08.21	HBM Plant relocated	snf

Project:
Proposed Wellingborough IBA Plant

Description:
Elevations of proposed plant and buildings

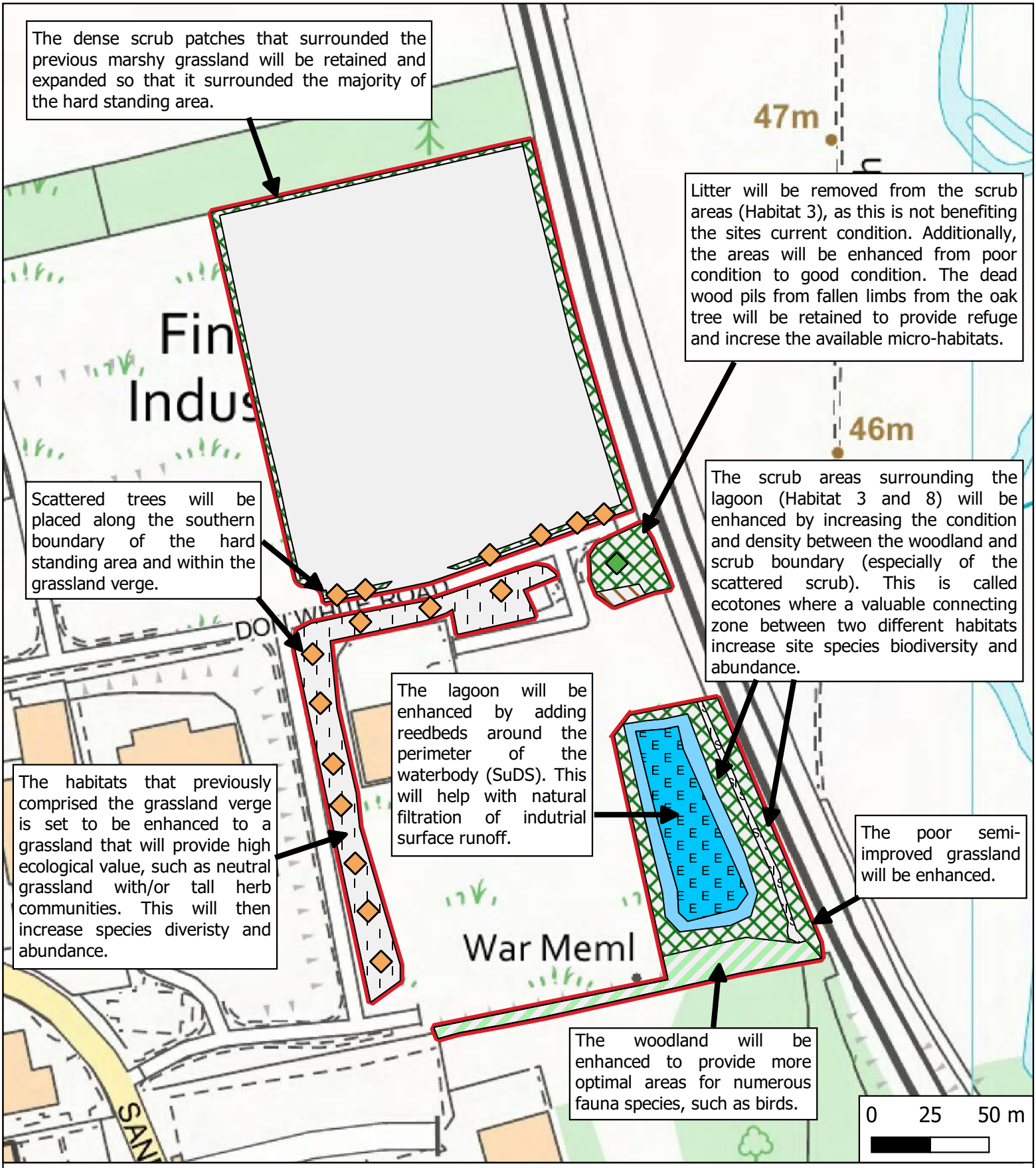
DAY AGGREGATES
Transport Avenue
Brentford
Middlesex
TW8 9HF

Date	Scale	Drawn
29.06.21	1:500at A3 1:250at A1	snf

Drawing No.	Rev
WE001-06	7

Status	FOR INFORMATION

Checked	Print
JWJ	A3



LEGEND

Restoration Plans

Scattered Trees

Oak Tree

Birch/Field Maple

Restoration Habitats

A1.2.2 - PL C Woodland

A2.1 - Dense/Continuous Scrub

B4 - Improved Grassland

B6 - Poor SI Grassland

C3.1 - Tall Ruderal Vegetation

F1 - Swamp/Reedbeds

G1.1 - Standing Water

J5 - Hard Standing

Site Boundary

Heatons
Planning Environment Design

PROJECT
Wellingborough

DRAWING TITLE
Restoration Plans

DATE
Feb 2022

REFERENCE
COV-001-W (ED.004)

SCALE
1: 10,000 @A3

STATUS
FINAL

Heatons The Arc, 6 Mallard Way, Pride Park, Derby. DE24 8GX
www.heatonplanning.co.uk

Appendix E – Flood Maps

Appendix E.1: Flood Zone Classification Map

Flood map for planning

Your reference	Location (easting/northing)	Created
6731	**489747/270660**	**12 Jan 2022 11:34**

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

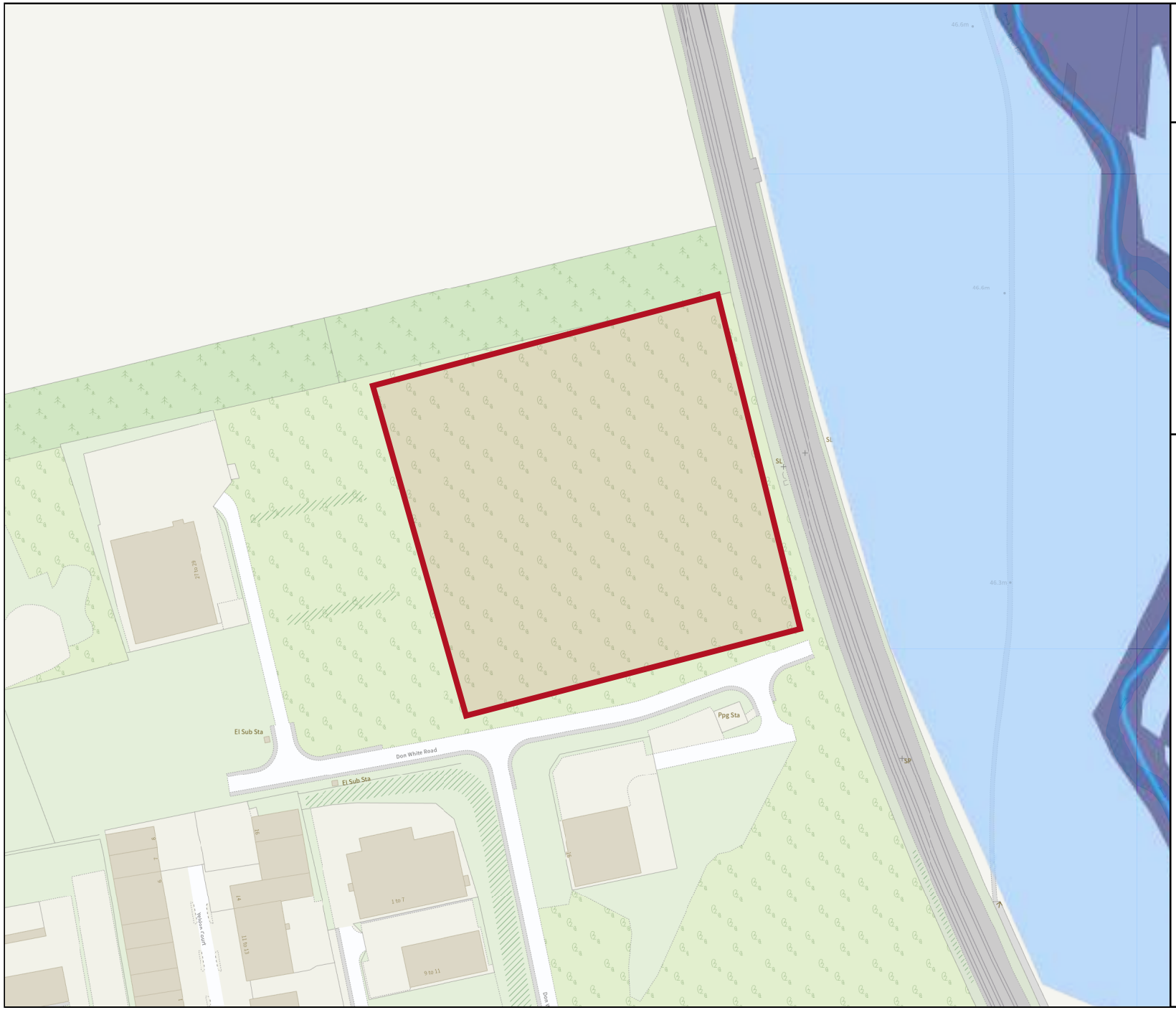
This means:

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

Notes

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

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



Environment Agency

Flood map for planning

Your reference
6731

Location (easting/northing)
489747/270660

Scale
1:2500

Created
12 Jan 2022 11:34

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

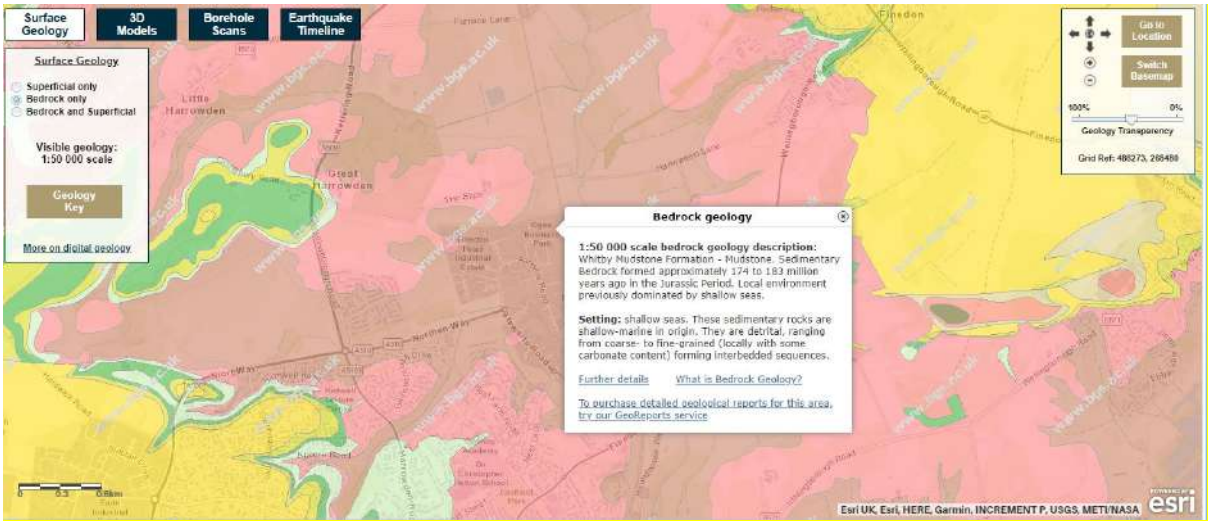
0 20 40 60m

Appendix E.2 : Extent of Flooding from Rivers or the Sea

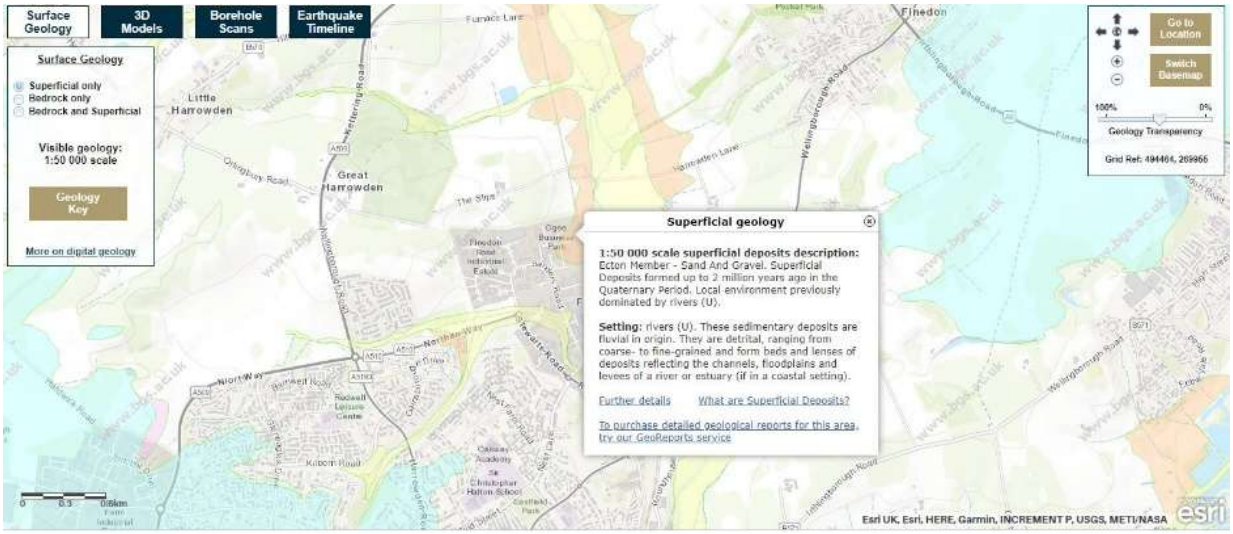
Appendix E.3: Extent of Flooding from Surface Water

Appendix A.4: Maximum Extent of Flooding from Reservoirs

Appendix F – Geotechnical Information

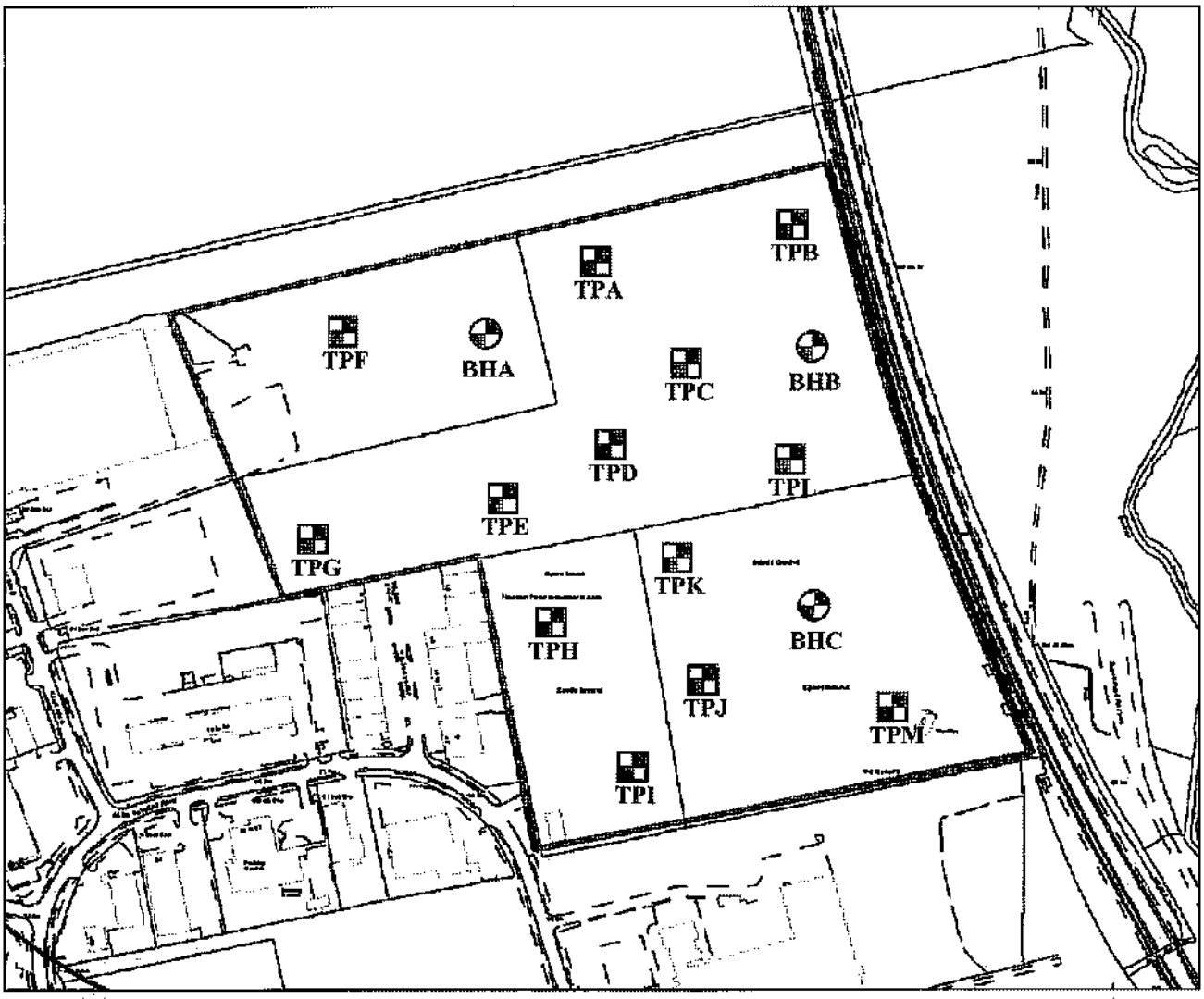


Appendix F.1 : BGS Bedrock Designation



Appendix F.2: BGS Superficial Deposits Designation

Exploratory Hole Location Plan



Project:	**Sanders Road, Wellingborough**	**GROUND ENGINEERING**	**Project No. C10346 Figure 13**
Client:	**Stepnell Limited**	Peterborough Tel : 01733 566566	

GROUND ENGINEERING

Geo-Environmental Specialists
01733 566566

Site: SANDERS ROAD, WELLINGBOROUGH

BOREHOLE BHB

Date: 08/12/05

Hole Size: 150mm dia to 10.00m

Ground Level: 47.30m. O.D.

Samples and in-situ Tests			(Date) Casing	Inst.	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Blows						
0.20	D1				Firm brown CLAY (TOPSOIL)			
0.50	D2						0.50	46.80
0.60-1.00	B1				Firm brown slightly gravelly, slightly sandy CLAY. Gravel of angular flint (HEAD DEPOSIT)			
			▼s					
1.00-1.15	U1	30	1.00				1.20	46.10
1.25	D3				Loose brown silty fine to medium SAND (RIVER TERRACE DEPOSIT)			
1.50-2.00	B2							
1.65-1.95	S	N6	1.50					
1.95	D4						2.10	45.20
2.10	D5							
2.20-2.60	U2	20	2.20		Firm brown and grey mottled CLAY (WEATHERED UPPER LIAS CLAY)			
							2.70	44.60
2.70	D6				Firm fissured dark grey CLAY			
3.20-3.60	U3	28	2.20					
3.70	D7				(WEATHERED UPPER LIAS CLAY)			
4.20-4.60	U4	35	2.20				4.20	43.10
					Stiff fissured dark grey CLAY			
4.70	D8							
5.20-5.60	U5	40	2.20					
5.70	D9							
6.20	D10				(UPPER LIAS CLAY)			
6.70-7.10	U6	65	2.20					
7.20	D11							
7.70	D12							
8.20-8.60	U7	80	2.20					
8.70	D13						9.00	38.30
9.20	D14				Very stiff fissured dark grey (UPPER LIAS CLAY)			
9.50-9.90	U8	85	2.20					
10.00	D15						10.00	37.30

REMARKS

Borehole completed at 10.00m depth

1. Excavating a pit from 0.00m to 1.00m for 1 hour
2. Borehole cased to 2.20m depth
3. Standpipe installed to 10.00m depth

Project No 10346

Scale 1:50 | Page 1/1

KEY

D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
W - Water Sample
S/C - SPT Spoon/Cone
▼ Water Strike
▼ Water Rise
N - SPT Blows for 0.3m
. - Blows for quoted penetration
V - Vane Shear Test Cohesion ( ) kPa
▼c Level on completion
c▼w Level casing withdrawn
▼s Standpipe Level

Groundwater Strikes

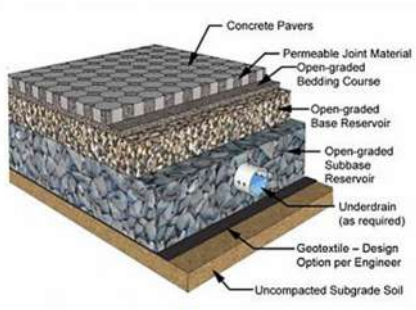
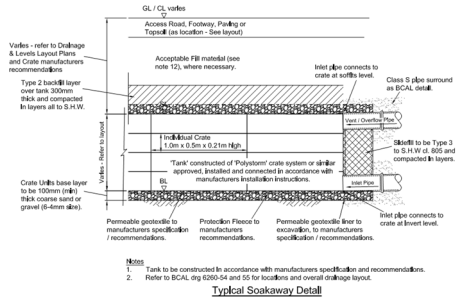
No	Struck	Rose to	Depth m Rate	Cased	Sealed

Groundwater Observations

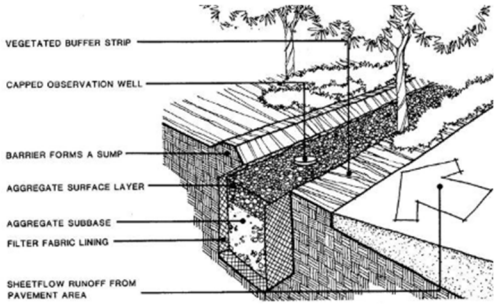
Date	Depth m Hole	Casing	Water
08/12/05	10.00	2.20	dry
08/12/05	10.00	0.00	dry
21/12/05	10.00	1.00	0.71

Appendix G – SuDS Option Study

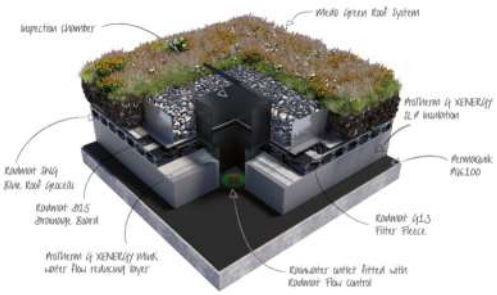
SuDS Category	Feature	Image	Description	Advantages	Disadvantages	Maintenance Requirements	Suitability Assessment
Retention	Balancing Pond		Both attenuation & treatment is provided for stormwater. Runoff for each rain event is retained & treated in the pond. The natural retention time promotes pollutant removal through sedimentation.	• Good natural way of removing pollutants • Can be used where ground water source is potentially vulnerable to contaminatio n • Well received by the community • High ecological and amenity benefits	• Negligible reduction in runoff volumes • Land take up may prohibitively high on confined site • May present a potential health & safety risk for sensitive environments such as schools	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • Vegetation management including grass cutting, weeding & re-turfing/reseedin g • Replacement or repair of inlets	✘ Not a suitable option due to limited space on the development for a pond to be located.
	Subsurface Attenuation Tank		Below ground storage systems can be created using proprietary interlocking modular geocellular products, tanks & oversized drainage pipes.	• Modular & flexible solution terms of buildability • Can offer dual usage – infiltration & storage • High void ratios mean high capacity • High strength capability of modular systems means they	• No inherent water quality treatment • Some proprietary products can be perceived as having limited effective access for maintenance	• Routine inspection including checking of inlets, outlets, control features & overflows • Cleaning requires jetting & suction techniques	✓ Yes, can be effectively utilised on this site in a number of potential locations, whilst maintaining a gravity only surface water drainage system.

				can be installed beneath trafficked area			
	Porous Paving/Hardstanding		Porous paving (tarmac, block paving etc.) with subsurface storage.	• Reduces the rate of runoff • Effective pollutant removal • Contributes to groundwater recharge • Can offer dual usage – infiltration & storage	• Requires appropriate pre-treatment • Porous basins require large, relatively flat areas • Must be offset from building foundations • Not suitable for heavily loaded or heavily trafficked areas.	• Inspect & repair damaged pavements • Clogged or damaged geotextiles need replacement	✘ No, not suitable for this site, hardstanding areas with heavy vehicular and plant loadings are expected throughout for operational flexibility and additionally potentially contaminated run-off must be prevented from entering the water environment.
Infiltration	Trench Basins Dry Swales Soakaway		Surface water runoff from buildings and areas of external landscaping can be discharged directly into the ground via natural infiltration by use	• Reduces the rate of runoff • Effective pollutant removal • Contributes to groundwater recharge	• Requires appropriate pre-treatment • Must be offset from building foundations • Viability dictated by ground conditions	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal	✘ There is a high ground water level and the presence of existing fill material both of which render the

			of soakaways, granular-filled trenches & basins. Requires ground water levels & ground conditions are both appropriate to receive quality & quantity of water generated.	• Simple, cost-effective & natural way to dispose of surface water from the site • Easy performance observation & relatively low maintenance		• Vegetation management including trimming roots • Replacement or repair of damaged inlets, outlets, banks & overflows • Clogged or damaged geotextiles need replacement	site unsuitable for infiltration. Additionally potentially contaminated run-off must be prevented from entering the water environment.
Wetland	Shallow Wetland Extended Detention Wetland Pond Wetland Pocket Wetland Submerged Gravel Wetland Wetland Channel		Wetlands provide natural stormwater attenuation & treatment. They comprise shallow ponds & marshy areas covered in aquatic vegetation. Wetlands detain flows for an extended period, allowing sediments to consolidate & remove contaminants. They can be of significant ecological benefit.	• Good, natural pollutant removal • Lined systems can be used where groundwater is vulnerable • Well received by the community • High ecological and amenity benefits	• Land take up is potentially very high • Little reduction in runoff volumes • Requires baseflow • Requires appropriate pre-treatment • Only really suitable on relatively flat sites	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • High degree of wetland management including level reinstatement & replacement of topsoil • Replacement or repair of damaged inlets, outlets, banks & overflows	✘ Unsuitable for proposed development due to the limited size of the site with insufficient space for wetlands to be accomodated .
Filtration	Raingarden						✘

	Filter Swale Bioretention system		Strips of land featuring vegetation designed to accept runoff between a hard-surfaced area and receiving system	• Good, natural pollutant removal • Flexible – can be relatively limited & extensive in size • Modest ecological and amenity benefits • Good retrofit capabilities	• Requires landscape management • Steep sites can be problematic • No significant benefit to attenuation or flow volume reduction	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • Vegetation management including grass cutting & weeding	Seen as a token gesture towards SuDS & unlikely to offer an effective amount of attenuation to be feasible on this site.
	Filter Trench		Shallow excavations filled with no-fines material that create a temporary subsurface storage or infiltration of stormwater runoff. Receive lateral inflow from adjacent impermeable surface.	• Trenches can be well incorporated into landscaped sites • Good, natural pollutant removal • Modest ecological and amenity benefits	• High clogging potential without effective pre-treatment • Limited to small catchments • High cost of replacing filter material • Natural infiltration option dictated by ground conditions	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • Vegetation management including weed control • Replacement of geotextile & filter material	✓ (limited opportunities) This may have a limited role in collecting run-off NW of the building but is unlikely to be a suitable option for most of this site due to the ground conditions, operational requirements, high silt content of run-off and requirement to prevent

							contaminated water from entering the water environment .
	Surface Sand Filter Subsurface Sand Filter Perimeter Sand Filter		Structures designed to treat surface water runoff through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of runoff is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	• Good, natural pollutant removal • Well suited as retrofit in tightly constrained urban locations	• Not for high sediment content • Slow detention times can promote algae growth • Requires min. hydraulic head of 1.2m • High capital & maintenance costs	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • Vegetation management including grass cutting & weed control • Replacement inlets, outlets & overflows • Level reinstatement	✘ This is unlikely to be a suitable option for this site due to the ground conditions, operational requirements , high silt content of run-off and requirement to prevent contaminated water from entering the water environment.
Conveyance	Conveyance Swales Rills		Formal linear drainage features in which surface water runoff can be stored or conveyed. They can be incorporated with	• Replaces underground pipework • Limited attenuation capacity • Potential for reduction in	• Similar to balancing ponds • Potential trip hazard • Disabled access issues	• Routine inspection including checking of inlets, outlets, control features & overflows	✘ Not a conducive SUDs feature for this site due to the limited space available.

			other water features such as ponds & waterfalls.	water volumes via infiltration & plant uptake		• Litter, silt, sediment & debris removal	
Source Control	Green Roofs		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of runoff & modest attenuation of peak flows.	• Good, natural pollutant removal • Mimics greenfield state of building footprints • Ecological benefits • Benefits to insulation & sound attenuation	• Additional weight not conducive to steep roof inclines • High maintenance of vegetation & roofing system • Additional weight requires additional structural support requirements	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal • Irrigation during establishment • Replacement of topsoil & vegetation	✘ Limited effective water storage potential still requires an additional primary attenuation system. Lightweight and modular structures unsuitable for the increased loads. Additional undesirable element of maintenance imposed upon the owner.
	Blue Roofs		Water is stored within the drainage voids within the special roof system build-up which is then released slowly through orifice plates into the wider drainage	• Water can be stored at source, reducing the requirement for below ground drainage attenuation structures.	• Additional weight can only be accommodated on flat roofs • High maintenance of vegetation & roofing system	• Routine inspection including checking of inlets, outlets, control features & overflows • Litter, silt, sediment & debris removal	✘ Lightweight and modular structures unsuitable for the increased loads. Roof system would require a high degree of maintenance

			network. Can be incorporated alongside a green roof.		• Significant additional weight requires notable additional structural support requirements	• Potential irrigation during establishment • Replacement of topsoil & vegetation	in a potentially high-risk environment (working at height).
	Rainwater Harvesting	 	Rainwater from roofs and hard surfaces can be stored and used. If designed appropriately, the systems can also be used to reduce the rates and volumes of runoff.	• Can provide source control of stormwater runoff and reduce discharge volumes. • Reduces demand on mains water.	• Systems can be complex and costly to install • Above ground tanks can be unsightly • Potential requirement for pumping • Perceived risks to public health	• Routine inspection including checking of inlets, outlets, filters, control features, pumps & overflows • Litter, silt, sediment & debris removal	✓ Yes, can be effectively utilised on this site in a number of potential locations, whilst maintaining a gravity surface water drainage system.

Appendix H – Proposed Drainage Strategy and Principles

NOTES

Refer also to Drawings

No	Description	Date	By	Chk

Revisions to this Drawing

Dm: BK | Date: 31/01/2022 | Chk: MB

BCAL CONSULTING
Orient House, Church Way, Wellingborough, Northamptonshire, NN8 4HJ
Tel: 01933 440024 Web: www.bcal.co.uk

Client
Day Aggregates Covanta

Project
IBA Wellingborough

Dwg. Title
Drainage Principles Areas and Pipes

Scales @ A0: 1:250 | Drawing No.: 6731-SK02-22.03 | Rev:

Ref: 6731

Status: SKETCH

Appendix J – Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.500
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-00	0.703	4.00	49.300	1200	489763.520	270632.810	1.875
S1-01	0.220	4.00	48.500	1200	489775.525	270575.733	1.830
Extg S12			48.660	1500	489782.410	270567.685	2.750

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1-00	S1-01	58.326	0.600	47.425	46.870	0.555	105.1	300	4.63	50.0
1.001	S1-01	Extg S12	10.591	0.600	46.670	45.910	0.760	13.9	500	4.66	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.533	108.4	95.3	1.575	1.330	0.703	0.0	219	1.722
1.001	5.840	1146.7	125.1	1.330	2.250	0.923	0.0	110	3.884

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	58.326	105.1	300	Circular	49.300	47.425	1.575	48.500	46.870	1.330
1.001	10.591	13.9	500	Circular	48.500	46.670	1.330	48.660	45.910	2.250

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1-00	1200	Manhole	Adoptable	S1-01	1200	Manhole	Adoptable
1.001	S1-01	1200	Manhole	Adoptable	Extg S12	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1-00	489763.520	270632.810	49.300	1.875	1200		0	1.000	47.425	300
S1-01	489775.525	270575.733	48.500	1.830	1200		1 0	1.000 1.001	46.870 46.670	300 500

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Extg S12	489782.410	270567.685	48.660	2.750	1500	1	1.001	45.910	500

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node S1-01 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.800	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	170.0		
Invert Level (m)	46.670	Diameter (m)	0.250		

Node S1-00 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	0.200	3187.0	0.0

Node S1-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	0.200	200.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	S1-00	43	49.117	1.692	265.5	123.9974	0.0000	FLOOD RISK
60 minute summer	S1-01	37	48.478	1.808	214.5	22.2721	0.0000	FLOOD RISK
60 minute summer	Extg S12	1	45.910	0.000	169.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	S1-00	1.000	S1-01	140.3	1.992	1.295	4.1073	
60 minute summer	S1-01	Orifice	Extg S12	169.3				452.4

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S2-00	0.675	4.00	49.000	1200	489817.044	270708.973	1.575
S2-01	0.218	4.00	48.200	1200	489849.211	270600.625	1.750
Extg S15			48.010	1500	489851.603	270592.956	1.670

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	S2-00	S2-01	113.022	0.600	47.425	46.600	0.825	137.0	300	5.40	50.0
2.001	S2-01	Extg S15	8.033	0.600	46.450	46.340	0.110	73.0	450	5.46	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.341	94.8	91.5	1.275	1.300	0.675	0.0	238	1.519
2.001	2.381	378.7	121.0	1.300	1.220	0.893	0.0	174	2.128

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	113.022	137.0	300	Circular	49.000	47.425	1.275	48.200	46.600	1.300
2.001	8.033	73.0	450	Circular	48.200	46.450	1.300	48.010	46.340	1.220

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	S2-00	1200	Manhole	Adoptable	S2-01	1200	Manhole	Adoptable
2.001	S2-01	1200	Manhole	Adoptable	Extg S15	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S2-00	489817.044	270708.973	49.000	1.575	1200		0	2.000	47.425	300
S2-01	489849.211	270600.625	48.200	1.750	1200		1	2.000	46.600	300
							0	2.001	46.450	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Extg S15	489851.603	270592.956	48.010	1.670	1500	1 1	2.001	46.340	450

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node S2-01 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.600	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	190.0		
Invert Level (m)	46.450	Diameter (m)	0.274		

Node S2-00 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	0.200	6750.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	S2-00	43	48.880	1.455	255.0	120.7935	0.0000	FLOOD RISK
60 minute summer	S2-01	32	48.073	1.623	193.1	5.8792	0.0000	FLOOD RISK
60 minute summer	Extg S15	1	46.340	0.000	191.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	S2-00	2.000	S2-01	125.8	1.786	1.326	7.9589	
60 minute summer	S2-01	Orifice	Extg S15	191.0				437.6

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
F2-00	0.420	4.00	48.500	1200	489838.187	270624.827	2.200
F2-01			48.200	1200	489845.824	270600.000	2.430
Extg			47.960	1200	489848.405	270595.595	2.690

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.000	F2-00	F2-01	25.975	0.600	46.300	45.770	0.530	49.0	225	4.23	50.0
3.001	F2-01	Extg	5.105	0.600	45.770	45.270	0.500	10.2	225	4.25	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	1.873	74.5	56.9	1.975	2.205	0.420	0.0	148	2.058
3.001	4.118	163.7	56.9	2.205	2.465	0.420	0.0	91	3.748

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.000	25.975	49.0	225	Circular	48.500	46.300	1.975	48.200	45.770	2.205
3.001	5.105	10.2	225	Circular	48.200	45.770	2.205	47.960	45.270	2.465

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.000	F2-00	1200	Manhole	Adoptable	F2-01	1200	Manhole	Adoptable
3.001	F2-01	1200	Manhole	Adoptable	Extg	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F2-00	489838.187	270624.827	48.500	2.200	1200		0	3.000	46.300	225
F2-01	489845.824	270600.000	48.200	2.430	1200		1	3.000	45.770	225
							0	3.001	45.770	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Extg	489848.405	270595.595	47.960	2.690	1200	1 1	3.001	45.270	225

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node F2-00 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	46.300	Product Number	CTL-SHE-0090-5000-2200-5000
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node F2-00 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	250.0	0.0	1.000	250.0	0.0	1.010	0.0	0.0

Node F2-00 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	0.0	0.0	2.000	0.0	0.0	2.200	500.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	F2-00	352	48.488	2.188	43.2	293.6556	0.0000	FLOOD RISK
360 minute winter	F2-01	352	45.798	0.028	5.0	0.0320	0.0000	OK
360 minute winter	Extg	352	45.297	0.027	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	F2-00	Hydro-Brake®	F2-01	5.0				
360 minute winter	F2-01	3.001	Extg	5.0	1.797	0.030	0.0142	139.4