

TRANSPORT & INFRASTRUCTURE

Wilson Bowden Developments Ltd &
Rochdale Borough Council
Atom Valley Innovation Centre (AVIC)
Plot R2, Kingsway Business Park,
Rochdale
Flood Risk Assessment & Sustainable
Drainage Statement

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY	
This Flood Risk Assessment (FRA) & Sustainable Drainage Statement (SDS) have been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG). The FRA & SDS have been produced on behalf of Wilson Bowden Developments Ltd and Rochdale Borough Council in respect of a planning application for the Atom Valley Innovation Centre (AVIC) at Plot R2, Kingsway Business Park.	
Proposals	The proposed development comprises the: 'Erection of research & development building (Use Class E) including office, laboratory & production space, function space & café, new access, car parking, servicing, boundary treatments, hard and soft landscaping and other associated works', and the realignment of the existing footpath to the Rochdale Tram, including the addition of dedicated drainage and street lighting.
Fluvial Flood Risk	The Site is shown to be located entirely within Flood Zone 1. Environment Agency (EA) Light Detection and Ranging (LiDAR) data shows the site is raised at least 8m above the nearest EA Main River, the Stanney Brook. Therefore, the site is considered to be at low risk of flooding from fluvial sources.
Pluvial Flood Risk	Based on the EA mapping, the risk of flooding to the site from surface water is considered to be Low. However, mitigation measures for the surface water flood risk on the redeveloped site are discussed in Section 6 of this report.
Sewer Flood Risk	In the event of exceedance of nearby sewers, flows are expected to be directed along Michael Faraday Avenue towards the Stanney Brook in accordance with local topography.
Ground Water Flood Risk	Based on the available information from the site investigation (Reference: KYR-BWB-ZZ-XX-RP-YE-0002, April 2024) the risk of groundwater flooding is considered to be Low.
Tida/Coastal Flood Risk	The site is remote from tidal influences and is therefore not at risk of tidal or coastal flooding.
Artificial sources Flood Risk	Due to the presence of the Stanney Brook between the site and the Rochdale canal which is expected to intercept flows in the event of canal breach, the site is considered low risk. The site is located within an area that could be affected by flooding from reservoirs in the event of a reservoir failure. Based on the safety legislation in place and the maintenance and repair responsibilities of the responsible authorities, the actual probability of a significant failure is considered to be low.
Kingsway Business Park Drainage Study	Plot R2 is part of Catchment 2 of the Kingsway Business Park drainage strategy which drains to Pond 2. Plot R2 is shown to have 2 No. existing 600mm diameter stub connections for surface water and 2 No. existing 150mm diameter foul stub connections which connect into the existing adopted foul and surface water drainage systems in Michael Faraday Avenue.
Proposed Surface Water Drainage Strategy	The development has an allowable discharge rate from Plot R2 of 284 l/s. The proposed system has been designed to accommodate all flows up to and including the 1-100-year event plus 40% climate change with no surface level flooding as is identified in the detailed hydraulic modelling.

	The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, the runoff volume from the development will be discharged at a rate equivalent pre-developed runoff rates downstream of the site. Based on an assessment of water quality treatment proposals, the proposed drainage strategy is considered to provide an appropriate level of treatment to surface water prior to discharge from the wider site.
Proposed Drainage Maintenance	Ongoing maintenance of the drainage network is integral to it functioning as designed. A draft version of the maintenance document for the below ground drainage has been included as an appendix. This will be developed at detailed design in conjunction with the Contractor for inclusion in the developments Operation and Maintenance manual.
Proposed Foul Water Drainage Strategy	The foul drainage from the development will discharge to the existing 300mm diameter foul water sewer in Michael Faraday Avenue. United Utilities have confirmed that foul drainage from the proposed development can be discharged. The details of the proposed connection will be agreed with United Utilities under a section 106 sewer connection application.
This summary should be read in conjunction with BWB's full report (ref. PLR-BWB-GEN-XX-RP-C-001_FRA & SDS) and reflects an assessment of the site based on information received by BWB at the time of production.	

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1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) & Sustainable Drainage Statement (SDS) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG). The FRA & SDS have been produced on behalf of Wilson Bowden Developments Ltd and Rochdale Borough Council in respect of a planning application for the Atom Valley Innovation Centre (AVIC) research and development building at Plot R2, Kingsway Business Park.
- 1.2 Plot R2 is located within the Kingsway Business Park which received outline planning permission in August 2014 under planning reference 14/00542/OUT. The application was supported by a site-wide FRA prepared by BWB Consulting (Reference: MCT/2014/FRA) and the principles agreed within the 2014 FRA are retained for this full planning application.
- 1.3 This FRA & SDS is intended to support a detailed planning application, the level of detail included is commensurate and subject to the nature of the proposals at the planning stage. Summary information is included as **Table 1.1**.

Table 1.1: Site Summary

Site Name	Atom Valley Innovation Centre (AVIC)
Location	Plot R2, Kingsway Business Park, Rochdale
NGR (approx.)	SD 918 126
Planning Application Site Area (ha)	1.5 ha
Development Site Area	1.124 ha
Development Type	Research & Development Building
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	Less Vulnerable
Anticipated Development Lifetime	75 years
Environment Agency Office	Greater Manchester, Merseyside and Cheshire
Lead Local Flood Authority	Rochdale Borough Council
Local Planning Authority	Rochdale Borough Council

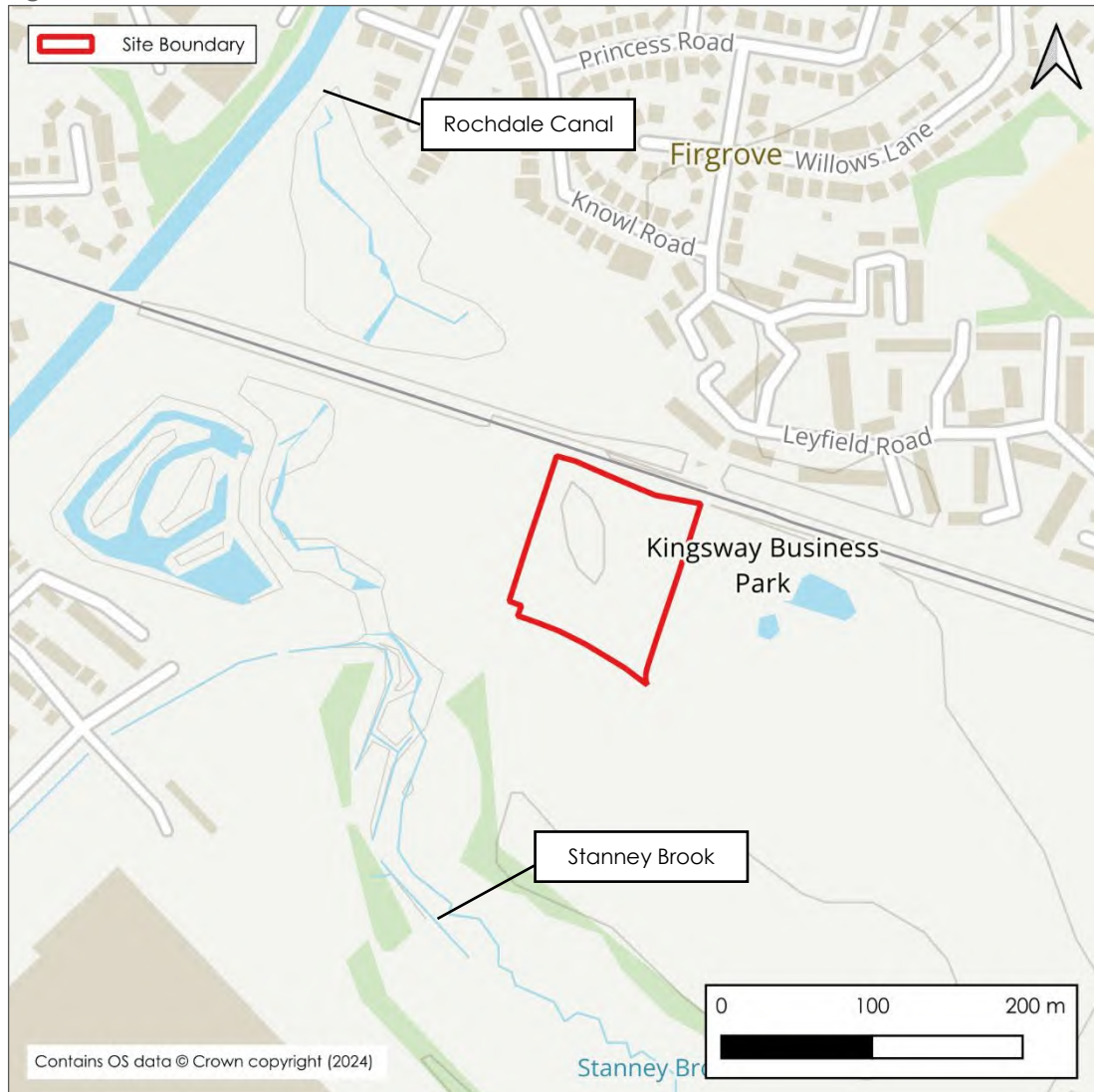
Sources of Data

- i. Topographical Survey by BWB Consulting, Reference: PPK-BWB-00-ZZ-M2-G-0001-Existing Site 2D Model_AVIC
- ii. Environment Agency (EA) consultation
- iii. Lead Local Flood Authority (LLFA) consultation.
- iv. EA 1m Light Detection and Ranging (LiDAR), 2022 dataset.
- v. EA Risk of Flooding from Surface Water Data National Planning Policy Framework (Updated 2023) and Planning Practice Guidance (Updated July 2022)
- vi. Defra Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)
- vii. Sustainable Drainage Systems Written Statement HCWS161 (December 2014)
- viii. Environment Agency Climate Change Guidance (May 2022)
- ix. Bury Rochdale and Oldham Strategic Flood Risk Assessment (Dec 2009)
- x. Rochdale Borough's Strategy for Flood Risk Management 2014-2024 (March 2014)
- xi. Flood and Water Management Act (April 2010)
- xii. United Utilities Sewer Records
- xiii. British Geological Survey (BGS) Drift & Geology Maps
- xiv. Ground Investigations by BWB Consulting (Reference: KYR-BWB-ZZ-XX-RP-YE-0002_Ph2)

Existing Site

- 1.4 The site is located within the Kingsway Business Park, approximately 2.2km southeast of Rochdale town centre. It is bound to the north by the Rochdale Metro (Pink Line), to the east and west by undeveloped parcels, and to the south by Michael Faraday Avenue and the wider Business Park. The site is predominately greenfield and undeveloped with an existing footpath from the highway to the south to the metro station to the North.
- 1.5 A copy of the site's topographical survey is included in **Appendix 1**. The site is undulating, with ground levels typically between 147m to 150.5m Above Ordnance Datum (m AOD).
- 1.6 The site's location is illustrated within Figure 1.1.

Figure 1.1: Site Location



Proposed Development

- 1.7 The proposed development comprises the: 'Erection of research & development building (Use Class E) including office, laboratory & production space, function space & café, new access, car parking, servicing, boundary treatments, hard and soft landscaping and other associated works'.
- 1.8 As a result of the proposed development the existing footpath to the Rochdale Tram will be realigned with the addition of dedicated drainage and street lighting.
- 1.9 The development will sit within Plot R2 of the Kingsway Business Park development.
- 1.10 Access, both vehicular and pedestrian, will be taken off Michael Faraday Avenue to the south. The proposed masterplan (2022-040_AVIC-DLA-XX-00-DR-A-99003) is located in **Appendix 2**.

- 1.11 The boundary area noted on the masterplan (**Appendix 2**) is the area for the planning boundary which includes existing highway and footpath to Rochdale Tram.

2. FLOOD RISK PLANNING POLICY AND GUIDANCE

National Planning Policy Framework

- 2.1 The NPPF¹ sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. PPG is also available online².
- 2.2 The PPG sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.
- 2.3 The PPG also states that alternative sources of flooding, other than fluvial (river flooding), should be considered when preparing an FRA.
- 2.4 The PPG includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3). Table 2 and Table 3 are recreated within **Appendix 3** of this report for reference.
- 2.5 This FRA is written in accordance with the NPPF and the PPG.
- 2.6 The PPG identifies that new developments should be designed to provide adequate flood risk management, mitigation, and resilience against the 'design flood' for their lifetime.
- 2.7 This is a flood event of a given annual flood probability, which is generally taken as fluvial (river) and surface water (pluvial) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)

- 2.8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event. The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water, (e.g. Pumping Station or Electricity Substation) within the development.
- 2.9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event is managed in exceedance routes that minimise the risks to people and property.

¹ Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2023.

² Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>

Sustainable Drainage Systems Written Statement HCWS161 (December 2014)

- 2.10 The Secretary of State for Communities and Local Government laid a Written Ministerial Statement in the House of Commons on 18th December 2014 setting out changes to planning that will apply for major development from 6th April 2015. This confirms that in considering planning applications, local planning authorities should consult the relevant LLFA on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.
- 2.11 Therefore, from 6th April 2015 local planning policies and decisions on planning applications relating to major developments are required to ensure that sustainable drainage systems (SuDS) are used for the management of surface water.
- 2.12 Major development is considered as development involving any one or more of the following:
- The winning and working of minerals or the use of land for mineral-working deposits.
 - Waste development.
 - The provision of 10 dwellings or more.
 - The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
 - Development carried out on a site having an area of 1 hectare or more.

Flood Map for Planning

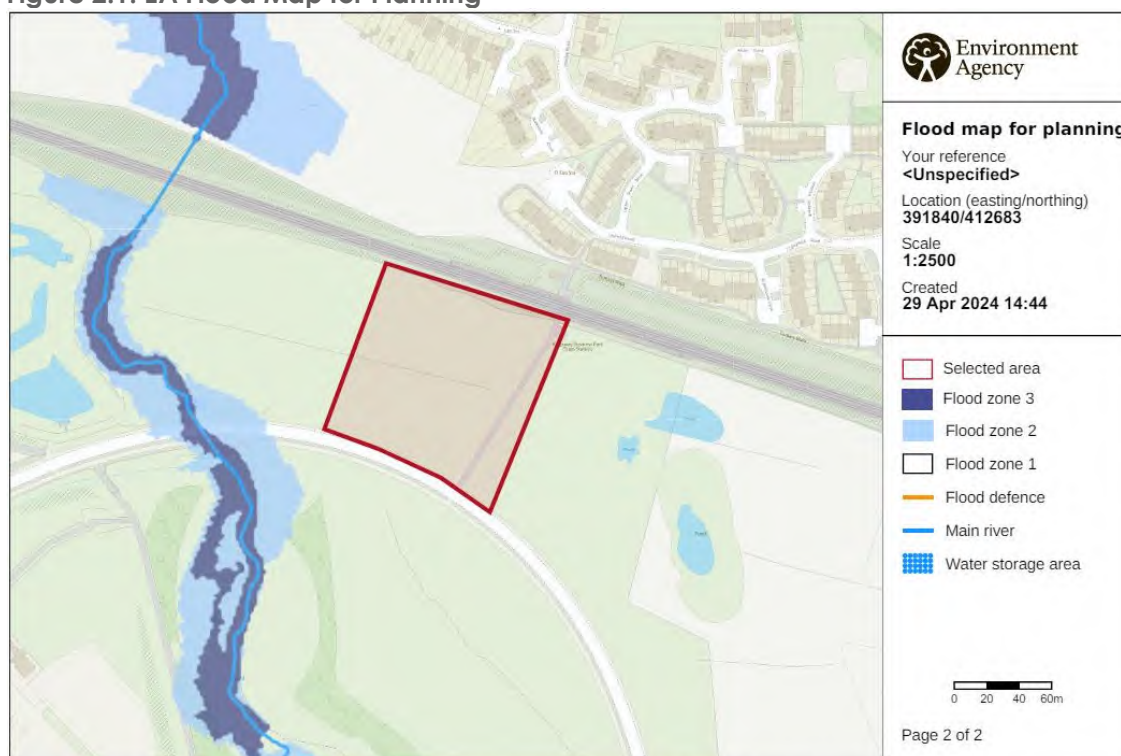
- 2.13 With particular reference to planning and development, the Flood Map for Planning identifies Flood Zones in accordance with Table 1 of the Planning Practice Guidance. Further details on the Flood Zone classifications are outlined in **Table 2.1**.

Table 2.1: Flood Zone Classifications

Flood Zone	Description
Flood Zone 1 (Low Probability)	Land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability). All land outside of Flood Zone 2 and 3.
Flood Zone 2 (Medium Probability)	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
Flood Zone 3a (High Probability)	Land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.
Flood Zone 3b (The Functional Floodplain)	Flood Zone 3b (The Functional Floodplain) is defined as land where water must flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

2.14 The site is shown to be located entirely within Flood Zone 1, as shown in **Figure 2.1**.

Figure 2.1: EA Flood Map for Planning



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Climate Change

- 2.15 Predicted future changes in peak river flows caused by climate change are provided by the EA³, with a range of projections applied to regionalised 'River Basin Districts', which are further subdivided into Management Catchments.
- 2.16 The site falls within the Irwell Management Catchment of the Northwest River Basin District. **Table 2.2** identifies the relevant peak river flow climate change allowances from this Management Catchment.

Table 2.2: Peak River Flow Climate Change Allowances for the Irwell Management Catchment within the Northwest River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2125)
Upper End	24%	43%	75%
Higher Central	15%	26%	46%
Central	12%	19%	35%

³ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>. Last Accessed May 2024

- 2.17 When determining the appropriate allowance for use in a FRA the Flood Zone classification, flood risk vulnerability and the anticipated lifespan of the development should be considered. **Table 2.3** provides a matrix summarising the EA's guidance on determining the appropriate allowance(s).

Table 2.3: Application of Appropriate Peak River Flow Climate Change Allowances

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance where a location may fall within Flood Zone 2 or 3 in the future.				
2	Use the higher central allowance	Use the central allowance			
3a	Use the higher central allowance	Development should not be permitted	Use the central allowance		
3b	Use the higher central allowance	Development should not be permitted			Use the central allowance
If development is considered appropriate by the local authority when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the higher central allowance.					

- 2.18 The site is located entirely within Flood Zone 1, the proposed development is classified as 'Less Vulnerable', and it has an anticipated lifespan of 75 years. Therefore, the Central allowance for the '2080s' epoch should be used if the site may fall within Flood Zone 2 or 3 in the future.
- 2.19 The site is located outside the Climate Change Flood Zone illustrated within the Greater Manchester Level 1 Strategic Flood Risk Assessment (SFRA) Update⁴ and therefore climate change will not be considered further within this FRA.

Strategic Flood Risk Assessment

- 2.20 A SFRA is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.
- 2.21 The Level 1 SFRA for Greater Manchester - Update has been reviewed in the production of this FRA. The SFRA provides information specific to the site location in the form of fluvial and surface water flood risk mapping, as well as records of historical flooding. The SFRA mapping identifies the site to be partially located within the '*Rochdale Opportunity Area for Further Critical Drainage Management*' which have been delineated as part of the SFRA based on United Utilities data, surface water flood hotspots and historical surface water flooding data. It also includes flood risk policy and guidance for the area.

⁴ Level 1 Strategic Flood Risk Assessment for Greater Manchester - Update (Greater Manchester Combined Authority, March 2019)

- 2.22 The Greater Manchester Level 2 Hybrid SFRA⁵ was produced to facilitate the application of Sequential and Exception Tests to screen allocated development sites. The proposed application site is not referenced within the Level 2 SFRA.

Preliminary Flood Risk Assessment

- 2.23 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the LLFA.
- 2.24 The Rochdale Metropolitan Borough Council PFRA⁶ considers flooding from surface water runoff, groundwater, ordinary watercourses and canals.
- 2.25 An Addendum⁷ to the PFRA was published in December 2017; however, it did not include any new information in relation to past or future flood risk at the site.

Local Flood Risk Management Strategy

- 2.26 A Local Flood Risk Management Strategy (LFRMS) is prepared by an LLFA to help understand and manage flood risk at a local level.
- 2.27 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.
- 2.28 The Rochdale Borough's Strategy for Flood Risk Management⁸ has been reviewed in relation to the site.

River Basin Flood Risk Management Plan

- 2.29 Flood Risk Management Plans (FRMPs) explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk. Risk management authorities include the EA, Natural Resources Wales, local councils, internal drainage boards, Highways England and LLFAs.

Local Plan

- 2.30 The Rochdale Local Plan Adopted Core Strategy⁹ has been reviewed in relation to the proposed development. The Core Strategy includes mapping showing the Kingsway Business Park as an economic growth corridor.

⁵ Level 2 Strategic Flood Risk Assessment (Greater Manchester Combined Authority, October 2020)

⁶ Preliminary Flood Risk Assessment (Rochdale Metropolitan Borough Council, May 2011)

⁷ Preliminary Flood Risk Assessment Addendum (Rochdale Metropolitan Borough Council, December 2017)

⁸ Local Flood Risk Management Strategy (Rochdale Borough Council, March 2014)

⁹ Adopted Core Strategy (Rochdale Borough Council, October 2016)

2.31 In the context of flood risk and drainage, the Core Strategy includes '*Policy G8 – Managing Water Resources and Flood Risk*' which states that Rochdale Borough Council (the LLFA) will require:

- Compliance with a 'sequential' approach to new development and flood risk, directing development away from areas of high risk in line with the NPPF.
- Compliance with advice from the EA and objectives for flood risk management set out in the LFRMS.
- Regard for the evidence of local flood risk included within the SFRA and SWMP.
- Incorporation of appropriate measures for surface water management including provision of Sustainable Drainage Systems (SuDS).

3. POTENTIAL SOURCES OF FLOOD RISK

Existing Site

- 3.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. Cognisant of the guidance documents reviewed in **Section 2, Table 3.1** below identifies the potential sources of flood risk to the site in its current condition. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 4**.

Table 3.1: Pre-Mitigation Sources of Flood Risk

Flood Source		Potential Risk
Fluvial		Low
Pluvial		High
Sewers		Low
Groundwater		Low
Tidal		Not at risk
Artificial Sources	Reservoir	Low
	Canal	Low

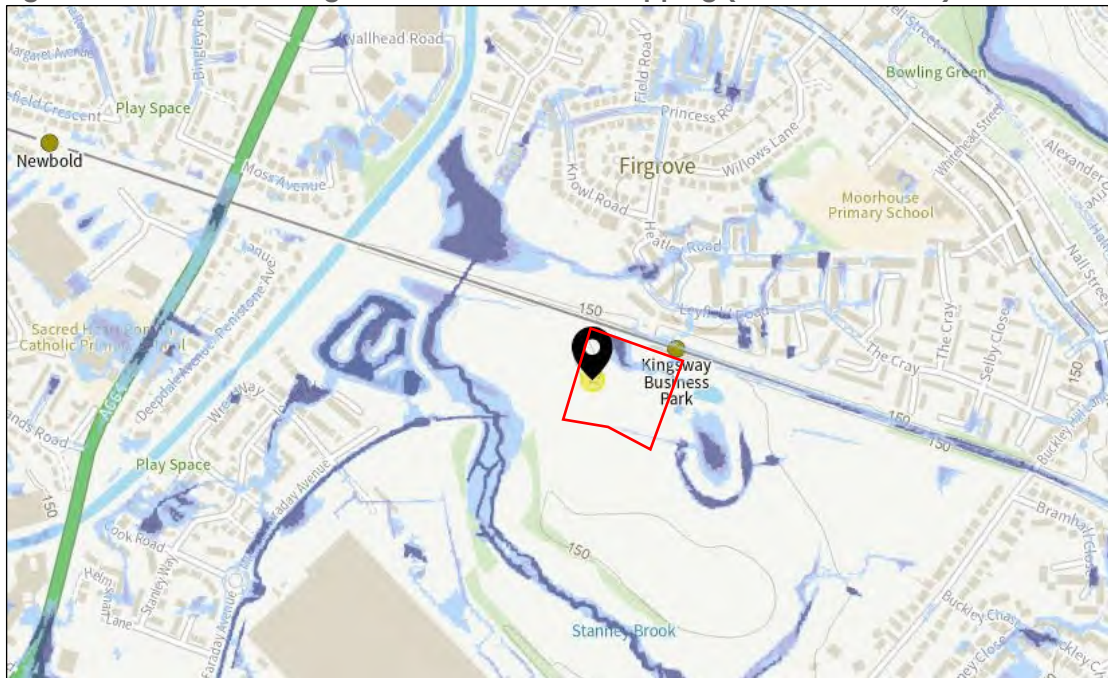
- 3.2 LiDAR shows the site is raised at least 8m above the nearest EA Main River, the Stanney Brook. Therefore, the site is considered to be at low risk of flooding from fluvial sources.

Pluvial Flood Risk

- 3.3 The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:
- High risk means that each year this area has a chance of flooding of greater than 3.3%.
 - Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.

- Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
 - Very Low risk means that each year this area has a chance of flooding of less than 0.1%.
- 3.4 The EA Risk of Flooding from Surface Water mapping indicates that the site is mostly at a very low risk of surface water flooding. However, there is a small area to the north of the site at a low to high risk of surface water flooding; this is shown in **Figure 3.1**. Whilst this does extend beyond the application site boundary, it originates within the wider land ownership boundary.
- 3.5 Based on the above, the risk of flooding to the site from surface water is considered to be Low. However, mitigation measures for the surface water flood risk on the redeveloped site are discussed in **Section 6** of this report.

Figure 3.1: Risk of Flooding from Surface Water Mapping (from EA website)



Sewer Flooding

- 3.6 There are no known existing public or private sewers within the site. However, there are existing stub connections entering the site from Michael Faraday Avenue that connect to public sewers.
- 3.7 In the event of exceedance of nearby sewers, flows are expected to be directed along Michael Faraday Avenue towards the Stanney Brook in accordance with local topography.

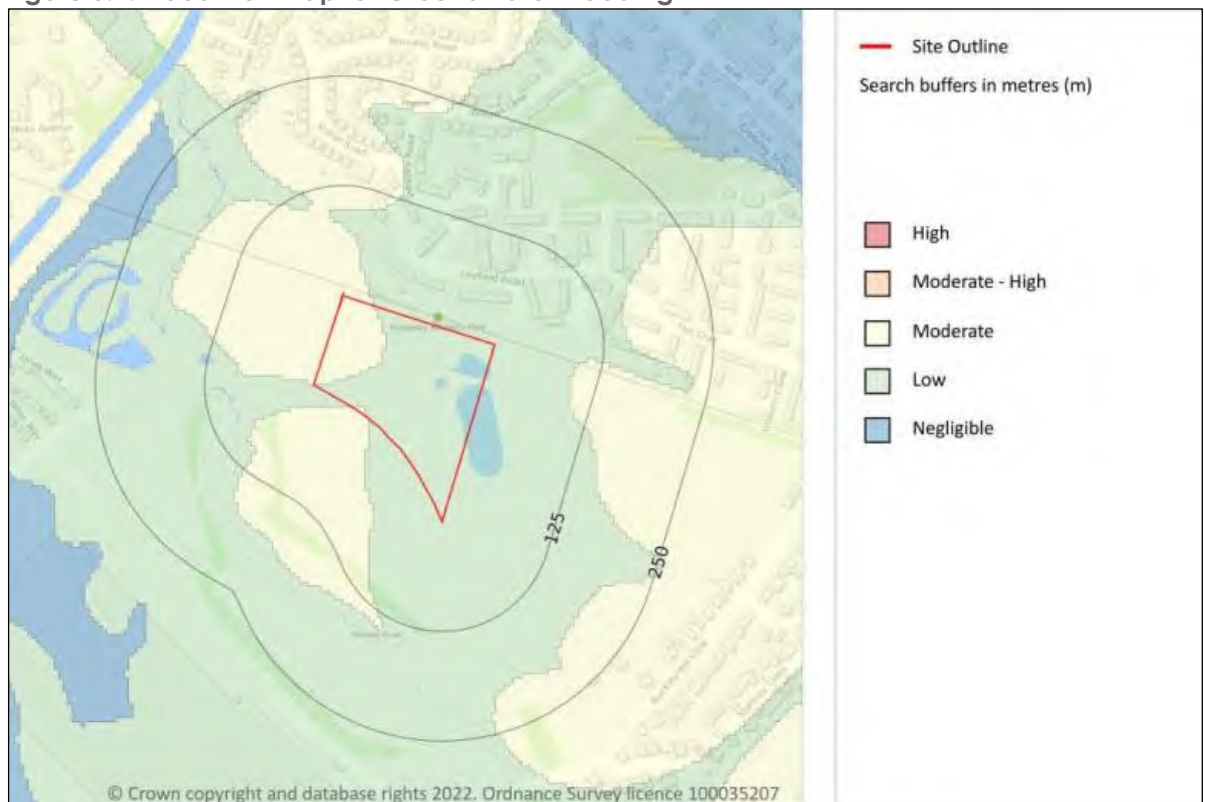
Groundwater Flooding

- 3.8 Groundwater flooding occurs when the water table rises above ground elevations, or it rises to depths containing basement level development. It is most likely to happen in low

lying areas underlain by permeable geology. This is most common on regional scale chalk aquifers, but there may also be a risk on sandstone and limestone aquifers or on thick deposits of sands and gravels underlain by less permeable strata such as that in a river valley.

- 3.9 As described in the BWB Phase 2 Geo-Environmental Assessment (Reference: KYR-BWB-ZZ-XX-RP-YE-0002, April 2024), the site is underlain by Hummocky Glacial Deposits (Sand and Gravel) to the west and Till deposits to the east, these are underlain by Pennine Lower Coal Measures bedrock.
- 3.10 Groundwater was encountered in several boreholes at depths of approx. 2.04 to 3.13m below ground level in shallow installations and 9.34m to 11.34m below ground level in deeper installations. Further groundwater monitoring is proposed to further evaluate groundwater conditions.
- 3.11 Groundwater is likely to vary seasonally at the site. The ground investigation, undertaken in early July (after a particularly dry spring/summer), will have likely captured a lowered groundwater situation at the site, with various areas of the site displaying evidence of historical waterlogging. Groundwater flooding risk is depicted in **Figure 3.2**.

Figure 3.2: Flood Risk Map for Groundwater Flooding



- 3.12 However, based on the available information above, it is considered that the risk of groundwater flooding to the site is low.

Tidal / Coastal Flood Risk

- 3.13 The site is remote from tidal influences and is therefore not at risk of tidal or coastal flooding.

Artificial Sources Flooding

- 3.14 Non-natural or artificial sources of flooding can include canals, reservoirs, lakes, etc. The potential effects of flood risk management infrastructure and other structures need to be considered.

Canal / River Interaction

- 3.15 The closest Canal to the site is the Rochdale Canal which lies approximately 400 metres to the West of the site. The site is separated from the Rochdale Canal by the Stanney Brook which is expected to intercept flows in the event of canal overtopping or breach.
- 3.16 Therefore, it is considered that the site is at low risk of flooding from the Rochdale Canal.

Reservoirs

- 3.17 The EA Reservoir Flood Map indicates that the site is located within an area that could be affected by flooding from reservoirs in the event of a reservoir failure; this is shown in **Figure 3.3**. Reservoir could potentially pose a significant hazard to the site in its existing condition.

Figure 3.3: Flood Risk Map from Reservoir Failure



- 3.18 Based on the safety legislation in place and the maintenance and repair responsibilities of the responsible authorities, the actual probability of a significant failure is considered to be low. Therefore, the risk of flooding at the site from reservoir sources is also considered to be low.

4. FLOOD RISK MITIGATION

- 4.1 **Section 3** has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA & SDS set out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Sequential Arrangement

- 4.2 The site is sequentially located entirely within Flood Zone 1 according to the EA Flood Map for Planning.

Development and External Levels

- 4.3 The ground should be profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.
- 4.4 There is an area of low to high surface water flood risk within the site which originates within the wider land ownership boundary and therefore is expected to be mitigated by the site wide surface water drainage strategy up to the 1 in 100-year + climate change event.

Groundwater Considerations

- 4.5 During the construction phase, particularly during excavations, groundwater levels will be monitored, and dewatering should be undertaken as required.

Surface Water Drainage

- 4.6 To mitigate the development's impact on the current runoff regime it is proposed to incorporate surface water management as part of the development proposals.
- 4.7 The development will discharge surface water in accordance with the site-wide approved drainage strategy which is included in **Appendix 4**.
- 4.8 Further information on the drainage approach is provided in **Section 6**.
- 4.9 The development will be designed with exceedance in mind. The proposed development drainage strategy (**Appendix 5**) combined with the proposed levels (**Appendix 14**) show how surface water will be directed away from the building towards the proposed outfall.

Foul Water Drainage

- 4.10 It is proposed to drain used water from the development separately to surface water.
- 4.11 Further information on the drainage approach is provided in **Section 8**.

5. EXISTING CONDITIONS

- 5.1 As noted in the introduction the site is located within the Kingsway Business Park, approximately 2.2km southeast of Rochdale town centre. It is currently greenfield land and entirely undeveloped.
- 5.2 A copy of the site's topographical survey is included in **Appendix 1**. The site is undulating, with ground levels typically between 149m to 150.5m above Ordnance Datum.
- 5.3 The Site is considered to drain via a natural regime of infiltration and surface runoff. During extreme rainfall events where infiltration potential is exceeded, runoff is expected to flow overland towards an existing watercourse to the south-west of the development.

Kingsway Business Park Drainage Strategy

- 5.4 Plot R2 is situated off Michael Faraday Avenue within the wider Kingsway Business Park development which is split into three distinct surface water drainage catchments, all of which are served by separate piped systems which have been adopted by United Utilities (UU) and ultimately discharge into separate attenuation features.
- 5.5 Plot R2 is part of Catchment 2 which drains to Pond 2. Plot R2 is shown to have 2 No. existing 600mm diameter stub connections for surface water and 2 No. existing 150mm diameter foul stub connections which connect into the existing adopted foul and surface water drainage systems in Michael Faraday Avenue.
- 5.6 The design of the existing sitewide drainage system was carried out by WYG Ltd and was constructed in 1999. It is understood to have been designed to accommodate the 1 in 100-year storm event for all future plots across the business park but not including an allowance for climate change.
- 5.7 Reference should be made to the BWB As Built Drainage Study KBP-BWB-ZZ-XX-RP-CD-0003, which is included in **Appendix 4** of this report. The purpose of the BWB report was to model the existing Catchment 2 drainage network based on the as-built information.
- 5.8 The BWB report concludes that the individual plots within Catchment 2 can discharge into the existing stub connections provided at a flow rate not exceeding the calculated peak discharge rate for the 100-year 15-minute duration storm event.
- 5.9 Much of the site wide drainage infrastructure for the business park has already been constructed, which acts to serve future plots as developments are brought forward. There are surface water and foul water sewers within Michael Faraday Avenue which are United Utilities (UU) assets. Their locations are noted on the BWB drawing strategy drawing located in **Appendix 5**.

Ground Conditions Summary

- 5.10 A Phase 2 Geo-Environment Assessment was undertaken by BWB Consulting (reference: PLR-BWB-ZZ-XX-RP-YE-0002_PH2). Findings from the investigation are summarised below:

- The ground conditions comprised Topsoil and Made Ground (from 0.2m to 2.3m thickness) directly underlain by Hummocky Glacial Deposits. A layer of relict topsoil between 2.3m and 2.5m was encountered below Made Ground in BH02 (2023). Hummocky Glacial Deposits typically comprised a layer of soft to firm clay (base depths of 0.8m to 3.0m) over medium dense to dense sands and sandy clays to a maximum proven depth of 15.45m
- Made Ground was encountered in all exploratory holes in the 2023 investigation and within TP101 and TP105 within the 2022 investigation. It was recorded with thicknesses of between 0.2m and 2.3m. It typically comprised a dark brown gravelly sand. Gravel comprised various natural and artificial inclusions (glass, siltstone, concrete and metal fragments) Bedrock was not encountered during the investigation.
- As noted in Section 3 the ground investigation, was undertaken in August, and will have likely captured a lowered groundwater situation at the site, with various areas of the site displaying evidence of historical waterlogging.

Existing Runoff Rates

- 5.11 An assessment of the existing surface water runoff rates from the site (1.124ha) has been undertaken and is summarised within **Table 5.1**. Calculations are included within **Appendix 6**.
- 5.12 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage¹⁰. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 5.1: Existing Runoff Rate from the Site

Return Period (Yrs.)	Runoff Rate (l/s)
1	0.7
Mean Annual Flow Rate (QBAR)	0.8
30	1.4
100	1.7

Existing Runoff Volume

- 5.13 An assessment of the existing surface water runoff rates from the site has been made for a 1 in 100-year, 6-hour storm.
- 5.14 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **113.9m³**, results are included within **Appendix 7**.

¹⁰ The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

6. SURFACE WATER DRAINAGE STRATEGY

- 6.1 The proposed development consists of the erection of a research & development building (Use Class E) including office, laboratory & production space, function space & café, new access, car parking, service yard, boundary treatments, hard and soft landscaping and other associated works. A site layout is included as **Appendix 2**.
- 6.2 This drainage strategy has been carried out in due cognisance of the Defra Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) and all other relevant national and local planning policy and guidance documents.
- 6.3 As noted in Section 5 Plot R2 is situated off Michael Faraday Avenue within the wider Kingsway Business Park development. The development is split into three distinct surface water drainage catchments, all of which are served by separate piped systems which have been adopted by United Utilities (UU) and ultimately discharge into separate attenuation features.
- 6.4 Plot R2 is part of Catchment 2 which drains to Pond 2. Plot R2 is shown to have 2 No. existing 600mm diameter stub connections for surface water and 2 No. existing 150mm diameter foul stub connections which connect into the existing adopted foul and surface water drainage systems in Michael Faraday Avenue.
- 6.5 Reference should be made to the BWB As Built Drainage Study KBP-BWB-ZZ-XX-RP-CD-0003, which is included in **Appendix 4** of this report. The purpose of the BWB report was to model the existing Catchment 2 drainage network based on the as-built information.
- 6.6 The proposed drainage strategy for Plot R2 has been formulated based on the above sitewide strategy. The proposed approach has been agreed with United Utilities (**Appendix 4**) provided that on-plot attenuation is provided for the residual volume of runoff for storm events up to and including the 100-year storm plus 40% climate change.

Peak Flow Control

- 6.7 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S35, runoff from greenfield developments should not exceed the equivalent greenfield rates for the equivalent return period events.
- 6.8 As previously stated, the wider infrastructure has been designed and installed to accommodate the 1 in 100-year storm event, with flows being restricted at the downstream attenuation features. The proposed catchment for Plot R2, amongst others, is served by the basin in 'Catchment 2' of the site wide drainage network. The restricted outflows from the attenuation features are controlled in such a way that the 1 in 10, 30, 50 and 100-year rainfall events do not exceed that of the predeveloped discharge rates.
- 6.9 BWB have previously undertaken three site wide drainage assessments across the business park which demonstrate the installed drainage networks and downstream attenuation has been designed and installed to accommodate the 100-year storm event for all future developments at the site. A summary note of the findings from the

three assessments (ref KBP-BWB-ZZ-XX-RP-CD-0004) is included as **Appendix 4**. A subsequent drawing (ref: KBP-BWB-ZZ-XX-DR-CD-0005) has been produced by BWB Consulting Ltd, this drawing shows the allowed peak flow rate of each plot within their respective catchments. Included within **Appendix 9 & 10** is email correspondence with United Utilities and Rochdale Council showing that they both find this approach acceptable.

- 6.10 Surface water drainage for Catchment 2 flows in a northerly direction to an attenuation basin where the flows are restricted and then outfall to the Stanney Brook. Based on the aforementioned drainage study the existing sewers and downstream attenuation have capacity to accept a maximum allowable discharge rate from Plot R2 of 441.8 l/s.
- 6.11 As noted in **Section 1**, the R2 proposals only occupy part of full plot considered and as such the overall discharge rate has been prorated to give a maximum allowable discharge rate from Plot R2 of 284 l/s.
- 6.12 Following the completion of the on plot hydraulic calculations has been found that the current proposed peak discharge rate from Plot R2 is lower than the maximum allowable rate of 284 l/s. The modelled discharge rates for various return periods are outlined within **Table 6.1**.

Table 6.1: Proposed Runoff Rates

Return Period (Yr.)	Proposed Discharge Rate (l/s)
2	97.5
30	190.1
30 + 40%	253.8
100	239.7
100 + 40%	277.4

- 6.13 It is envisaged that the drainage design will undergo future design iterations, however, the proposed peak flow rate will not exceed the maximum allowable rate of 284 l/s.
- 6.14 Considering the downstream infrastructure restricts flows to the equivalent pre-developed runoff rates and proposals do not increase flows above what was designed for and consented, the site is considered to fulfil the necessary peak runoff control criteria.

Modelling of Proposed Drainage System

- 6.15 A Micro Drainage network model of the proposed surface water drainage network for the main development has been produced based upon the Drainage Strategy presented within **Appendix 5**. Results from the critical storms using both FSR and Flood Estimation Handbook (FEH) rainfall methodologies are included within **Appendix 11**.
- 6.16 Based upon the Micro Drainage network model outputs, there is no requirements for on plot attenuation with peak discharge rates never exceeding the maximum allowable

rate of 284 l/s. The pipe network has been sized such that no flooding will occur up to the 1 in 30-year event. Simulations also identify no flooding during the 1 in 100-year plus climate change event.

Runoff Volume Control

- 6.17 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6¹¹ states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume. Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2 l/s/ha or less.
 Or,

- i. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,
- ii. All the runoff volume from the development should be discharged at a rate of 2 l/s/ha or less.

- 6.18 An estimate of the post-development runoff volume from the 1 in 100-year 6-hour storm can be derived from the Micro Drainage for both the impermeable and permeable areas.

- 6.19 The runoff volume for the impermeable areas is derived from the following equation using the average rainfall intensity obtained from MicroDrainage (which can be located in **Appendix 8**).

$$\begin{aligned} \text{Runoff Volume (m}^3\text{)} &= \text{Ave. Rainfall Intensity} \times \text{Storm Duration} \times \text{Impemable Area} \\ &= \frac{11.5}{1000} \times 6 \times 9350 = 645.2\text{m}^3 \end{aligned}$$

- 6.20 The runoff volumes for the permeable areas are prorated from the greenfield runoff volume located in **Appendix 7**, which equates to approximately 19.2m³.

- 6.21 The existing and post-development runoff volumes are compared within **Table 6.2**.

Table 6.2: Runoff Volume Comparison

Existing Volume (m ³)	Proposed Volume (m ³)	Difference (m ³)
113.9	645.2 + 19.2 = 664.4	550.5

¹¹ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

- 6.22 The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, the runoff volume from the development will be discharged at a rate equivalent pre-developed runoff rates downstream of the site.

Residual Risk and Designing for Exceedance

- 6.23 The proposed system has been designed to accommodate all flows up to and including the 1-100-year event plus 40% climate change with no surface level flooding as is identified in the detailed hydraulic modelling (**Appendix 11**).
- 6.24 It should be noted that if storm events in excess of the 100-year storm plus 40% climate change or blockages occur, this will result in flood water arising from the site drainage system. To mitigate this risk the below ground drainage system should have regular maintenance. This is further discussed in **Section 7**.

Water Quality

- 6.25 In accordance with the SuDS Manual a simple index approach to water quality risk management should be undertaken for the Proposed Development. This will be compiled to provide a comprehensive account of the water quality treatment provided by the proposed surface water drainage system.
- 6.26 The SuDS Manual Mitigation Index will be used to assess the treatment levels proposed in relation to the pollution hazard posed from the proposed land use(s). This methodology is adopted to ensure that surface water flows receive adequate treatment through all areas of the Site prior to final outfall.
- 6.27 **Table 6.3** shows the pollution hazard indices for the land use classification(s) that are relevant to the Proposed Development, as described within Table 26.2 in the SuDS Manual.

Table 6.3: Pollution Hazard Indices for Different Land Use Classifications

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
<u>Service Yard & Eastern part of Access Road</u> Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7

<u>Car Park area & Southern part of Access Road</u> Individual Property Driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools offices) i.e.<300 traffic movements/day	Low	0.5	0.4	0.4
---	-----	-----	-----	-----

6.28 The SuDS Mitigation Indices that are relevant to the Proposed Development, as described within Table 26.3 of the SuDS Manual, are outlined in **Table 6.4**.

Table 6.4: SuDS Mitigation Indices

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Service Yard & Eastern part of Access Road			
Site Wide Attenuation Pond	0.7	0.7	0.5
Full Retention Separator *	0.8	0.6	0.9
Car Park area & Southern part of Access Road			
Permeable Pavement	0.7	0.6	0.7
Site Wide Attenuation Pond	0.7	0.7	0.5
Additional Mitigation Measures in Localised Ares around proposed building			
Filter Drains	0.4	0.4	0.4

* The Mitigation Indices for the separator are based on a SPEL ESR Separator Range.

6.29 The pollution hazard rating and proposed SuDS Mitigation Index for the site is compared within **Table 6.5**. Where more than one SuDS component is proposed, a factor of 0.5 should be applied to the downstream (i.e., secondary and/or tertiary) treatment stages to account for the reduced performance due to reduced inflow concentrations.

Table 6.5: Comparison of Pollution Hazard Rating against Proposed Mitigation Index

Pollution Type	Pollution Hazard Rating*	Proposed Mitigation Index	Sufficient Treatment Provided?
Service Yard & Eastern part of Access Road			
TSS	0.7	1.15	✓
Metals	0.6	0.95	✓
Hydrocarbons	0.7	1.15	✓
Car Park area & Southern part of Access Road			
TSS	0.5	1.05	✓
Metals	0.4	0.95	✓
Hydrocarbons	0.4	0.95	✓

6.30 Based on the above assessment, the proposed drainage strategy is considered to provide an appropriate level of treatment to surface water prior to discharge from the wider site.

7. MAINTENANCE

- 7.1 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 7.2 An initial copy of the SuDS Operation & Maintenance Manual is included within **Appendix 12**. This will be finalised during detailed design and in conjunction with the Contractor.
- 7.3 A copy of the NW SuDS proforma for the scheme is included within **Appendix 13**.

8. FOUL WATER DRAINAGE

- 8.1 The foul water drainage layout for the plot is shown on BWB Dwg No. 232081-BWB-INF-XX-D-C-0500 which is included as **Appendix 5**.
- 8.2 It is currently proposed that all foul drainage from the development will discharge to the existing 300mm diameter foul water sewer in Michael Faraday Avenue.
- 8.3 United Utilities have confirmed that foul drainage from the proposed development can be discharged to the public sewer at an unrestricted discharge rate (**Appendix 9**).
- 8.4 The type and details of the proposed connection will be agreed with United Utilities at detailed design stage and a section 106 sewer connection application will be submitted to UU for approval.
- 8.5 An assessment of the anticipated peak foul flow from residential dwellings has been calculated based on the probability / discharge unit method outlined in BS EN 16933:2-2017 and using the maximum typical values associated with each appliance and a typical frequency factor of 0.5 (for dwellings).
- 8.6 The number and type of appliance associated with the development has been assessed and is presented in **Table 8.1** below.

Table 8.1: Anticipated foul flows from building

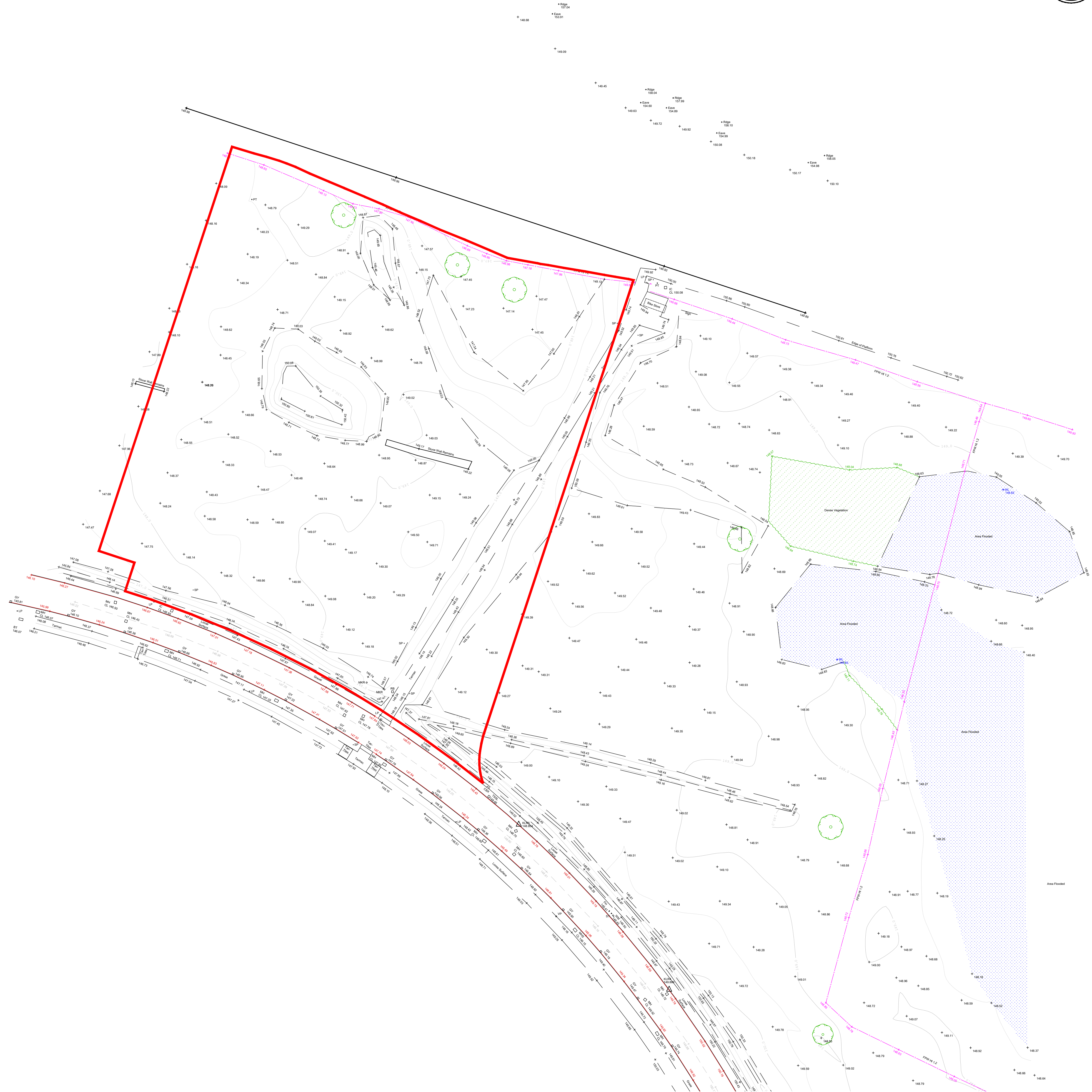
Type of Appliance	Number	Typical Discharge Unit Value (max, l/s)	Flow Rate (l/s)
Wash Hand Basin	25	0.6	15
WC (9l cistern)	21	2.5	52.5
Urinal	6	0.8	4.8
Kitchen Sink	1	1.3	1.3
Dishwasher	1	0.8	0.8
Total Flow Rate			74.4

$$Q_{ww} = K \sqrt{\sum DU} = 1.2 \sqrt{74.4} = 10.4 \text{ l/s}$$

- 8.7 The above results in a total anticipated peak foul flow rate of 10.4 l/s from the development to the foul water public sewer.

APPENDICES

APPENDIX 1: Topographical Survey



Notes

- Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
- All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.
- No scale factor has been applied to this survey, therefore the os coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
- All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
- All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
- OS license number: 100022432

Legend

- OS Buildings

Surveyed Buildings

Building

Wall

Kerb Channel Line

Top of Kerb

Edge of Surface

Top of Bank

Bottom of Bank

Canopy / Overhang

Line Marking

Centre Line

Watercourse

Centre Line

Barrier

Fence

Gate

Overhead Powerline

Overhead Utilities

Contour Lines

Inspection Chamber

Flow direction and pipe diameter

Station and Name

Monitoring Borehole

Tree / Bush / Sapling

Area of Vegetation/ Extent of Tree Canopy

Hedge

Body of Water

Body of Water from OS

Spot Level

Assumed Surface

Water Drainage Line

Surface Water Drainage Line
- AP Anchor Point

BO Back Gully

BO Bollard

BS Bus Stop

BT British Telecom

C Crest

CL Cover Level

CMP Cable Marker

Post

CCTV Security Camera

CTV Cable TV

DC Drainage

Channel

DK Drop Kerb

DP Down Pipe

Elec Electric

EP Electricity Post

ER Earth Rod

FH Fire Hydrant

FL Floodlight

FBW Fence Barbed Wire

FCB Fence Closed Board

FCL Fence Chain Link

FEL Fence Electric

FMP Fence Metal Panel

FMR Fence Metal Railing

FOB Fence Open Board

FPW Fence Post & Wire

FSP Fence Steel Palisade

FWM Fence Wire Mesh

FFL Finished Floor Level

FP Flagpole

GV Gas Valve

GY Gully

HT Height

IC Inspection Chamber

IFL Internal Floor Level

IL Invert Level (as a reduced level)

LB Litter Bin

LP Lamp Post

MH Manhole

Mkr Service Marker

PB Post Box

PT Post

RE Rodding Eye

SP Sign Post

ST Stop Tap

SV Stop Valve

TCB Telephone

Call Box

THL Threshold Level

TL Traffic Light

TP Telegraph Post

TS Traffic Signal

UTS Unable to Survey

WL Water Level

WM Water Meter

WO Wash Out

Station Coordinates			
Station Name	Eastings (m)	Northings (m)	Height (m)
KLR3	391959.350	412466.631	150.866
KLR4	391914.916	412557.217	149.889
KLR5	391879.085	412596.523	148.854

P2	02.05.24	Ridge & Eaves Levels added	DS	SS
P1	01.06.22	First Issue	DS	SS
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

BWB

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Client

Wilson Bowden

Developments Ltd &

Rochdale Borough Council

Project Title

Plot R2 AVIC, Kingsway

Drawing Title

Existing Site Plan

Drawn:	D.Smith	Reviewed:	S.Shreeves
BWB Ref:	232081	Date:	01.06.22
Scale@A1:	1:500	Status	S2
Project - Originator - Zone - Level - Type - Role - Number	PPK-BWB-00-01-DR-G-0001	Rev	P2

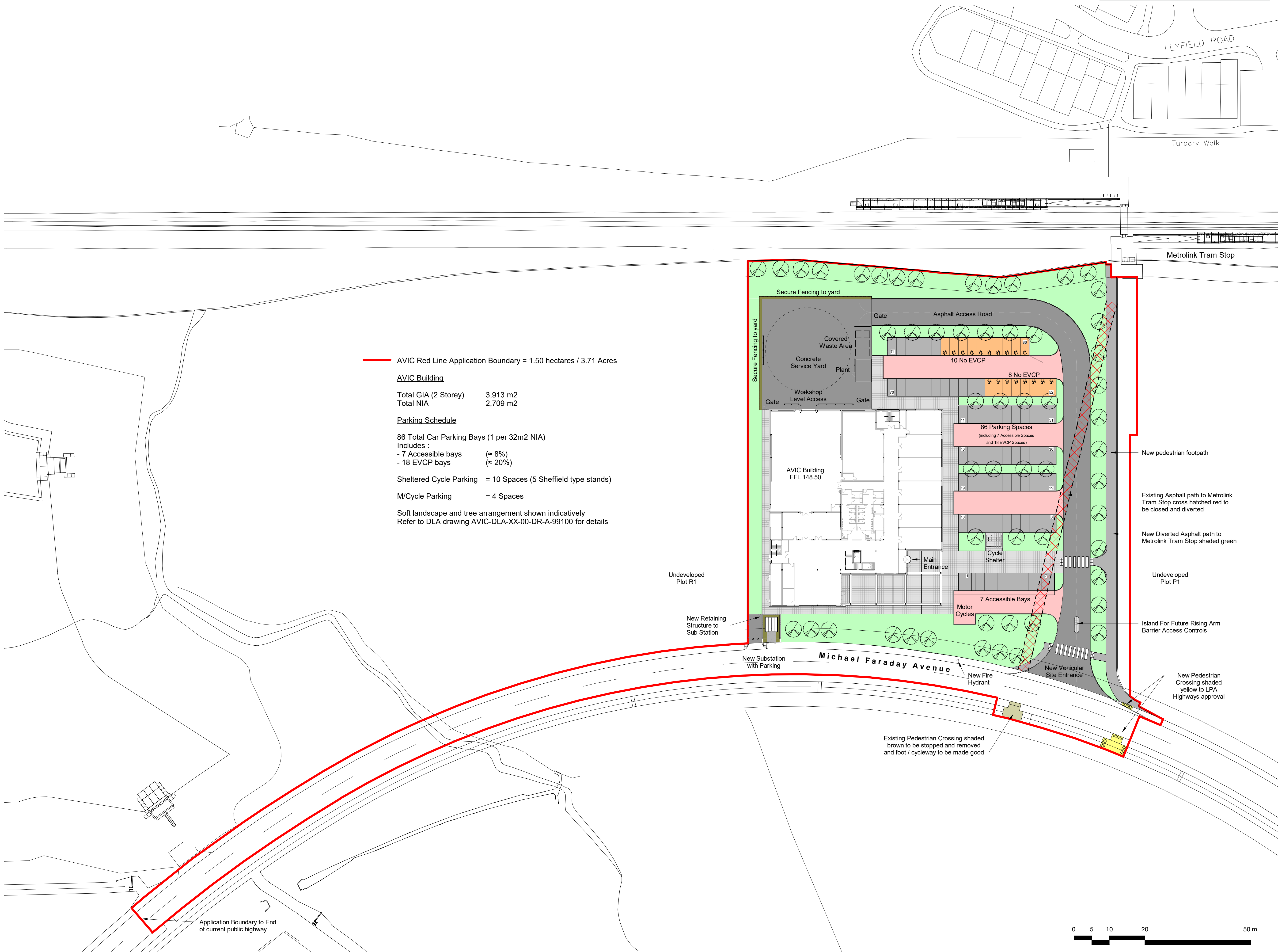
APPENDIX 2: Proposed Masterplan

Note: This is a colour drawing, in order to ensure any subsequent reproduction is viewed correctly it is to be re-printed in full colour

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DO NOT SCALE, REFER TO FIGURED DIMENSIONS ONLY

REVISIONS		
P01	FIRST ISSUE	15/04/24 PSL
P02	Application boundary revised to accommodate off site earthworks. Updated in line with Client comments	03/05/24 PSL



NORTH



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PROJECT
KINGSWAY BUSINESS PARK
PLOT R2

TITLE
GA Site Plan

SCALE
1 : 500 @ A1

DATE
12/04/24

DLA REF
2022-040

DRAWN
PSL

REVIEWED
BLG

DOCUMENT NUMBER
AVIC-DLA-XX-00-DR-A- 99003

DOCUMENT PURPOSE
PLANNING

REVISION
P02



APPENDIX 3: PPG Extracts

Flood Risk Vulnerability Classifications (recreated from the NPPF Planning Practise Guidance)

Vulnerability Classification	Description
Essential infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood. • Wind turbines. • Solar farms.
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.)
More Vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks.
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Flood Zone Compatibility (recreated from the NPPF Planning Practise Guidance)

Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1 (Low Probability)	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 2 (Medium Probability)	Development is appropriate	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 3a (High Probability)	To be deemed appropriate an exception test is required to demonstrate: The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk the sustainability benefits of the development to the community outweigh the flood risk. Additionally, essential infrastructure should be designed and constructed to remain operational and safe in times of flood.	Development should not be permitted	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate

Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 3b (The Functional Floodplain)	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk. Additionally, development should be designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage; - not impede water flows and not increase flood risk elsewhere.	Development should not be permitted	Development should not be permitted	Development should not be permitted	Development is appropriate if designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage; - not impede water flows and not increase flood risk elsewhere.

APPENDIX 4: Kingsway Drainage Strategy

Rebekah Duncan

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 19 July 2023 16:56
To: Rowan Jobling
Cc: David Gray
Subject: RE: Kingsway Site Wide Modelled Flow Rates - acceptance by LLFA Rochdale Council

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Hello Rowan,

Thanks for sending comprehensive Drainage Model information and documentation on the Kingsway Industrial Site via large file transfer. I have downloaded them.

I have spent some time reviewing the Drainage Designs which discharge the Kingsway Plots to the ponds, both when new sites are submitted for Planning and also when looking at the overall design done by BWB. I have also looked at the Microdrainage models developed by BWB and saved them on the Rochdale Drainage dept. folder.

As such, I can confirm that, to the best of my knowledge, the plot flow rates given on BWB's Plan and Tables sheet ref. KBP-BWB-ZZ-XX-DR-CD-0005, Rev: P01, dated: 03/07/2023 are suitable for use when additional Kingsway (Milnrow) plots come forward for development. As explained in the BWB documentation:-

- the plot surface water flow rates are based upon each plot discharging all flows for storms up to 1 in 100 year storm events without attenuation, and
- only the additional 40% climate change rainwater allowance needs to be accommodated by extra storage on each plot site.

regards

Stephen McCann

Drainage & Flooding Engineer

Network Improvement/Development/Flooding



☎ 01706 924606

📠 07552 570262

✉ stephen.mccann@rochdale.gov.uk

Rochdale Borough Council

Floor 2, Number One Riverside

Smith Street, Rochdale, OL16 1XU

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Please consider the environment before printing this email.

From: Rowan Jobling <Rowan.Jobling@bwbconsulting.com>

Sent: 07 July 2023 16:17

To: seweradoptions@uuplc.co.uk; Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>

Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; David Gray

<David.Gray@bwbconsulting.com>

Subject: Kingsway Site Wide Modelled Flow Rates

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Hi Stephen, Mohammed,

Good to speak with you both.

As discussed, we have now produced the attached drawing which is based on the modelling work that was previously submitted. The flow rates shown on the drawing are the peak rate for the 100yr storm event without climate change and hence any plot coming forward should be restricted to the rate identified on this drawing.

Please could you both review and confirm acceptance of the drawing. If it would help then we are happy to set up a call to run through any queries, please advise on availability if required.

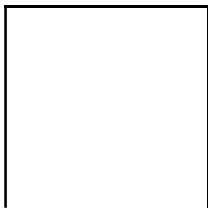
Regards

Rowan Jobling

Senior Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

M 07384 810148 W www.bwbconsulting.com



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Rebekah Duncan

From: seweradoptions@uuplc.co.uk
Sent: 20 July 2023 10:01
To: Rowan Jobling
Subject: RE: Kingsway Site Wide Modelled Flow Rates - UU REF: 04306456

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good morning Rowan,

After reviewing the provided document, drawing number: KBP-BWB-ZZ-XX-DR-CD-0005, Rev: P01, dated: 03/07/2023, prepared by BWB. I confirm that this drawing and table are acceptable to United Utilities to be used as a reference for all future plots.

- The discharge rates stated in the document are the maximum rates that can be accommodated within the adopted surface water network for each plot.
- The flow rates are for storms up to 1 in 100-year storm events without attenuation, where the 40% climate change needs to be accommodated by extra storage on each plot site.

This document is saved on ICS case number: 04306456 with all the related correspondence with LLFA for reference and guidance.

Kind regards,



Mohammed Aljafarawi (He/Him)
Developer Engineer
Developer Services & Metering
Customer Services
M: 07950474499
unitedutilities.com

----- Original Message -----

From: Rowan Jobling [rowan.jobling@bwbcconsulting.com]
Sent: 07/07/2023 16:19
To: seweradoptions@uuplc.co.uk
Cc: wastewaterdeveloperservices@uuplc.co.uk
Subject: FW: Kingsway Site Wide Modelled Flow Rates

Hi Mohammed,

Good to speak with you.

As discussed, we have now produced the attached drawing which is based on the modelling work that was previously submitted. The flow rates shown on the drawing are the peak rate for the 100yr storm event without climate change and hence any plot coming forward should be restricted to the rate identified on this drawing.

Please could you both review and confirm acceptance of the drawing. If it would help then we are happy to set up a call to run through any queries, please advise on availability if required.

Regards

Rowan Jobling

Senior Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

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Project Name	Kingsway Business Park		
Document Number	KBP-BWB-ZZ-XX-RP-CD-0003	Job Number	NTW2889
Author	M. Bailey	Status	S2
Checked	R. Jobling	Revision	P1
Approved	D. Gray	Date	28-01-2022

Introduction

BWB Consulting Ltd (BWB) has been appointed by Wilson Bowden Developments Ltd (the Client) to undertake a drainage network modelling exercise of the existing surface water drainage networks serving Kingsway Business Park, Rochdale.

The drainage strategy across the site is split into three distinct catchments (as shown on **Figure 1.1**), all served by separate piped systems discharging to separate attenuation features. The existing drainage was constructed in 1999 and is understood to have been designed to accommodate the 1 in 100-year storm event for all future plots across the business park.

This Technical Note is dedicated solely to the drainage network that discharges into "Pond 2" prior to flows being discharged at a restricted rate to Stanney Brook, hereafter referred to as "Catchment 2", which is located within the northern extent of the Kingsway Business Park.

This study aims to model the existing Catchment 2 drainage network (using MicroDrainage 2019.1 software) based on the as-built information. The performance of the network and attenuation pond will be assessed in order to verify the drainage strategies that have been / will be used across the business park and to facilitate the drainage of each individual plot.

This technical note will outline the following:

- The sources of data used to create the network model;
- The design parameters used to create the network model;
- The assumptions used to create the model where information is incomplete/missing;
- The results of key storm simulations; and
- Conclusions and recommendations.

This study has been based upon the most up-to date and readily available information at the time of writing.

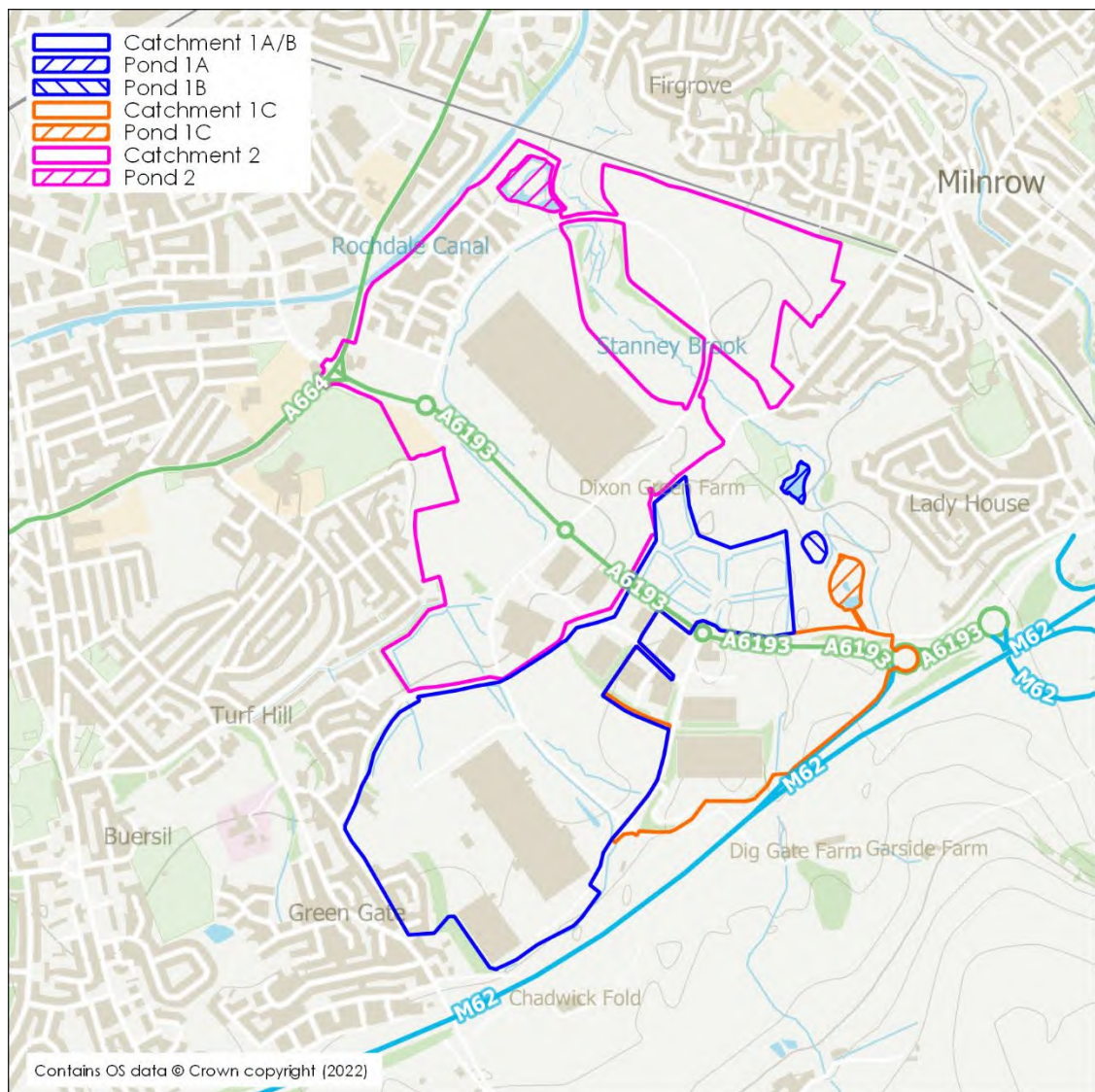


Figure 1.1: Business Park overall indicative catchments and attenuation ponds.

Sources of Information

The following sources on information have been used to recreate/remodel the Catchment 2 drainage network:

- BWB Drainage Adoptions Plan (Sheet 1 of 3; ref: LDH/037/510).
- BWB Drainage Adoptions Plan (Sheet 2 of 3; ref: LDH/037/511).
- White Young Green (WYG) Composite S104 Colourised Drawing Phases 1 and 2 – Flows to Pond 1A (ref: A030095_01-010).
- WYG Pond Area 2 – Flow Control and Outlet from Attenuation Area 2 Cross Section (D-8-003_AB1).
- WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1).
- Kingsway Business Park, Rochdale, United Utilities Adoptable Drainage, Quality File, (dated 29.10.07).
- Kingsway Business Park, Rochdale, Spine / Loop Road (Section 38), Quality File, (dated 29.10.07).
- Kingsway Business Park, Rochdale, United Utilities Adoptable Drainage, Health & Safety File, (dated 29.10.07).
- DLA Architecture Illustrative Masterplan dated 26/04/18 (ref: 2010-095/1826).
- BWB Plot M Sustainable Drainage Statement 'KPM-BWB-ZZ-XX-RP-CD-0001_SDS'.
- BWB Plot N Proposed Surface and Foul Water Drainage Layout Construction Record 'KBP-BWB-HDG-ZN-DR-D-0500'.
- BWB Plot T, JD Sports Extension Drainage Layout Construction Issue 'KBT-BWB-HDG-XX-DR-D-500/505'.

The impermeable areas used within the network model have been taken from the latest Masterplan for the wider Rochdale Business Park provided to BWB (dated 26/04/2018). The source of each contributing impermeable area used within the network model is illustrated on the Assumed Contributing Areas Catchment Plan presented as **Appendix A**.

All highways contributing areas have been assumed to be 100% of the measured area as shown in **Appendix A**.

The contributing areas for plots L, N, O, P1, P2, P3, Q, R, T1, T2, U2, V AND X have been assumed to be 90% of the measured area as shown in **Appendix A**.

The contributing areas for Plots S and U2 have been assumed to be 65% of the measured area as shown in **Appendix A**.

The contributing areas for Plot M have been taken from BWB Sustainable Drainage Statement 'KPM-BWB-ZZ-XX-RP-CD-0001_SDS'. The areas used for Plot M are provided on the contributing areas catchments drawing within **Appendix A**.

Design Parameters & Assumptions

The drainage network model created within this study uses the following parameters:

- All manhole coordinates taken from BWB & WYG S104 Agreement Drawings.
- All manhole cover and invert levels taken from WYG S104 Agreement Drawings, 'UU Adoptions Drainage Quality File' and 'Spine / Loop Road (Section 38) Quality File'. Where 'As-built' cover level information was not available assumed cover levels have been selected using 2020 1m spatial resolution Digital Terrain Model (DTM) Light Detection and Ranging (LiDAR) data.
- Pond 2 has been recreated using information from WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1)*.
- The online flow control structure recreated for the network model has been specified using information from 'Flow Control and Outlet from Attenuation Area 2 Cross Section (D-8-003_AB1)'. See **Figure 1.2**, overleaf for an extract of this control structure.
- The contributing areas for each plot have been directly inputted into the relevant network model node 'stub connection' for each plot as shown on the BWB, WYG S104 Agreement Plans and the Assumed Contributing Areas Plan within **Appendix A**.
- The contributing areas for all highways drainage have either been spread out evenly across the nearest relevant network model nodes that are located within the highways, or where a specific connection into the drainage network is shown on the BWB & WYG S104 Agreement Drawings, as shown within **Appendix A**.
- Network model simulation criteria set to default settings in MicroDrainage 2019.1.
- Simulations have been run for the network model using the 'Seasonal Return Period Wizard' for all storm durations for the 1 in 100-year event on 2.5 second increments with Dynamic Time Step turned off, Dynamic viscous Dampening and Inertia turned on.
- Simulations have been run using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies.**
 - * The detention basin volumes have been checked by recreating them in AutoCAD Civils 3D Software before being input into the MicroDrainage Network Model. The Pond 2 3D model has included the incorporation of the vole embankments within the centre of the pond.
 - ** Note that the original drainage system was designed using FSR rainfall (as stated within 'Attenuation Ponds Health & Safety File'), however FEH simulations have been ran as a sensitivity test for the recreated network model. The 15-, 30- and 60-minute storms have not been run using FEH rainfall data as it is best practice to exclude these storm events when using FEH data.

The following assumptions have been made during this study:

- Where as-built information was unavailable, the BWB and WYG S104 agreement drawings were used to input information into the MicroDrainage network model.
- The Pond 2 parameters within the network model are based on an area to depth relationship using the basin extents and design levels shown on the WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1). The volumes of each basin have been sense checked using AutoCAD Civil 3D Software before being added to the MicroDrainage Network Model.
- The contributing impermeable areas plan from the original design of the drainage system is unavailable to BWB. Therefore, for this study, the contributing areas have been assumed. The assumed contributing areas used within this study are provided within **Appendix A** and are typically 90% of the plot areas for the commercial / industrial areas, 65% for the residential areas and 100% for the road areas.

The contributing areas for each plot have been directly input into the existing stub connection constructed in anticipation of future development within the business park, as shown in **Appendix A**. This provides a conservative assessment during short-term rainfall events as surface water is directly input into the spine drainage network during each simulation. In reality, once each plot has been developed with their own drainage systems, a 'lag time' would be present where surface water is captured across various parts of individual plot drainage network and reduce the rate of surface water entering the spine drainage network during short-term events.

Additionally, the individual plots within 'Catchment 2' will include on plot attenuation which has not been considered within this study. This provides additional redundancy to the conservative nature of this model during short term storm events.

Any individual modelled plot drainage networks have not been added to the as-built model spine network due to instabilities caused by adding the large networks in the wider spine as-built network model.

Simulation Results

Two simulations have been run for the as-built network model. The simulation parameters are provided within the 'Design Parameters & Assumptions' section of this Technical Note. All simulation calculation outputs are provided within **Appendix B** and are arranged in the following order:

- i. Existing Drainage Network (FSR)
- ii. Existing Drainage Network (FEH)

An extract of the flow control structure for Pond 2 is shown in the WYG "Pond Area 2 – Flow Control and Outlet from Attenuation Area 2 Cross Section" as-built drawing is provided below as **Figure 1.2**. Additionally, the relevant as-built pond and flow control drawings have been enclosed within **Appendix C**.

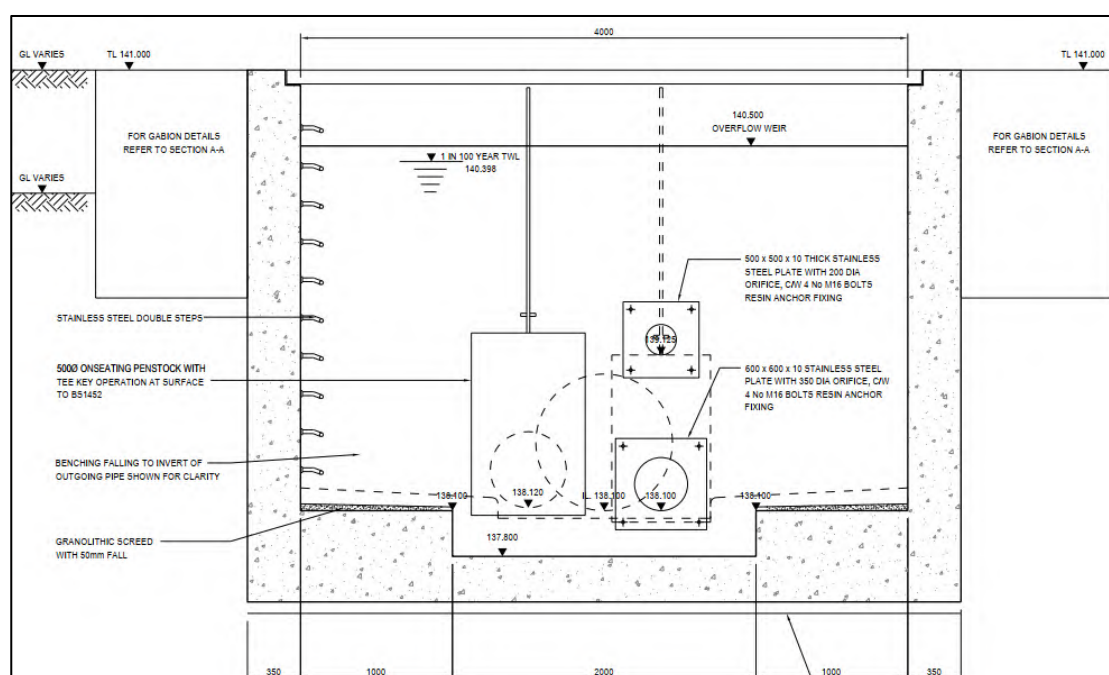


Figure 1.2: Extract of Pond 2 Flow Control structure design (WYG drawing D-8-003_AB1)

An extract of the 1 in 100-year results provided within the 'Attenuation Ponds Health & Safety File' is shown below as **Figure 1.3**. **Figure 1.3** shows the original design maximum outflows, water depths and volumes for 'Ponds 1A/1B, 1C and 2'.

Summary of 1 in 100 year results.

Pond	Critical Duration (min)	Maximum Outflow (l/s)	Maximum Depth (m)	Maximum Volume (m ³)	Permitted Outflow (l/s)
1A/1B	720	304	2.344	10276	292
1C	720	144	0.919	7143	205
2	600	555	2.039	21277	562
Σ		1003			1059

Figure 1.3: Extract of original design results for each attenuation pond in the 1 in 100-year event.

As shown on **Figure 1.3**, the original design criteria for Pond 2 include for a maximum outflow of 555l/s, with an assumed maximum water depth of 2.039m and an assumed maximum storage requirement of 21,277m³.

From a sense check of the ponds using Civils 3D, the maximum Storage volume of Pond 1C is approximately 29,533m³, based on a potential maximum water level of 140.5m Above Ordnance Datum (AOD) (i.e., the top of weir located on the flow control of the pond) to the base level of the pond.

A breakdown of the results for each simulation are provided below. In brief, the overall results of this study show that the pipe network is adequately designed to operate during the 1 in 100-year storm.

Minor flooding of 13.5m³ is shown to occur within Sir Isaac Newton Way (A6193) at manhole S317 during the 1 in 100-year critical storm event. As the critical storm for S317 is the 30-minute winter storm, it is expected that any flooding at S317 will remain within the road corridor for a short period of time before being picked up again by the drainage system as water levels within the network drop.

The results show that the attenuation pond has a maximum discharge rate of 445.5l/s, maximum water depth of 2.17m and maximum water storage volume of 26,565m³. Although there are discrepancies between the original design intent and this modelling exercise, the pond and outflow are operating within the permitted flow rate to Stanney Brook. The larger volume of storage is due to a lower modelled flow rate and accurate modelling of the pond in Civils 3D, however, the maximum water level is lower than the original design intent of 140.398m AOD.

It is understood that the original design modelling for the drainage network was undertaken in an alternative software to MicroDrainage. Additionally, the network was constructed in 1999. It is anticipated that the rainfall intensity data/methodologies used within drainage modelling software have been updated since the original design model was created. Therefore, it is expected that there would be discrepancies between the results provided within this study and the results from the original design model from which the network was constructed.

Existing Drainage Network (FSR) – Simulation Results

The results from this simulation show that the pipe network is adequately designed to receive flows from Catchment 2 after it is entirely developed. The system will be surcharged during the high intensity short duration storms (i.e., the 15-, 30- and 60-minute storms).

Minor flooding (13.5m³) is shown to occur within Sir Isaac Newton Way at S317, to the east of Plot M. This flooding is expected to remain within the road corridor for a short period of time before being picked up again by the drainage system as water levels within the network drop.

Minor flooding (31m³) is also shown to occur on Plot T at manhole S3T3 during the critical (15-minute) storm. This flood is likely due to the size of the outgoing pipe from this plot and the extent of impermeable area being input into the modelled node of S3T3. The extent of flooding at this node is not unusual for private drainage systems during the 1 in 100-year storm and it is likely that a provision is made within the car parking / service yard on Plot T to temporarily store this storm water during such an event.

It should be noted that in reality the modelled flooded volumes at S317 and S3T3 are likely to be lower than shown within the MicroDrainage network model. This is due to the design of the model directly inputting the total contributing areas of each plot directly into the connection stub nodes. In reality, the contributing areas across the catchment will be split across a vast array of private drainage networks within each plot, which will buffer against the flows within the adopted drainage network during the high intensity short duration storms.

The maximum water level within Pond 2 is shown to be 140.268m AOD, this is 130mm below the original design water level of 140.398. This shows that the pond is functioning well and should be adequate to receive the flows from the entire of Catchment 2 once it has entirely been built out.

Existing Drainage Network (FEH) – Simulation Results

A simulation has been run for the recreated network model with FEH rainfall methodologies, as a sensitivity test for the network. As stated above the original design was modelled using FSR rainfall. Therefore, the FEH results are not representative of the original design standards and should only be used as to ensure that no significant flooding occurs when using this dataset. As FEH rainfall data is considered to be less robust for short storm durations, the 15-, 30- and 60-minute return periods have been excluded from this sensitivity check.

The results from this simulation show that the pipe network is adequately designed to receive flows from Catchment 2 after it is entirely developed. The system will be surcharged during the 1 in 100-year return periods.

The maximum water level within Pond 2 is shown to be 140.272m AOD, this is 126mm below the original design water level of 140.398. This shows that the pond is functioning well and should be adequate to receive the flows from the entire Catchment once it has entirely been built out.

Conclusions and Recommendations

BWB Consulting Ltd (BWB) have been appointed by Wilson Bowden Developments Ltd to undertake a drainage network modelling exercise study of the existing surface water drainage networks serving Kingsway Business Park, Rochdale. This Technical Note focuses on the section of the drainage network that drains into Pond 2 (Catchment 2).

An as-built network model for the existing drainage infrastructure, that was installed within the business park in 1999 and adopted by United Utilities (UU) in November 2012, has been created using the best available information at the time of writing.

A list of the sources of information, design parameters and assumptions used to recreate the existing drainage network are provided within this Technical Note. The network model was created using MicroDrainage 2019.1 using a wide range of sources available to BWB, including: historical drawings, Health and Safety and Quality files.

The network has been modelled to provide a conservative approach to the assessment of the drainage network during short-term rainfall events with flows being input directly into the adopted network and no allowances being made for the on-plot drainage and attenuation.

The results from the modelling study show that the overall pipe network adopted by UU is adequate to convey flows during the 1 in 100-year critical storm event through the catchment with only minor flooding (13m³) within Sir Isaac Newton Way once the development has been entirely built out. The minor flooding occurs during the short term high intensity storm events, which is considered to have been conservatively modelled as part of this study. Additionally, the flooding shown to occur is expected to be contained within the highway carriageway for a short period of time before drainage back into the network as the water levels within the system fall.

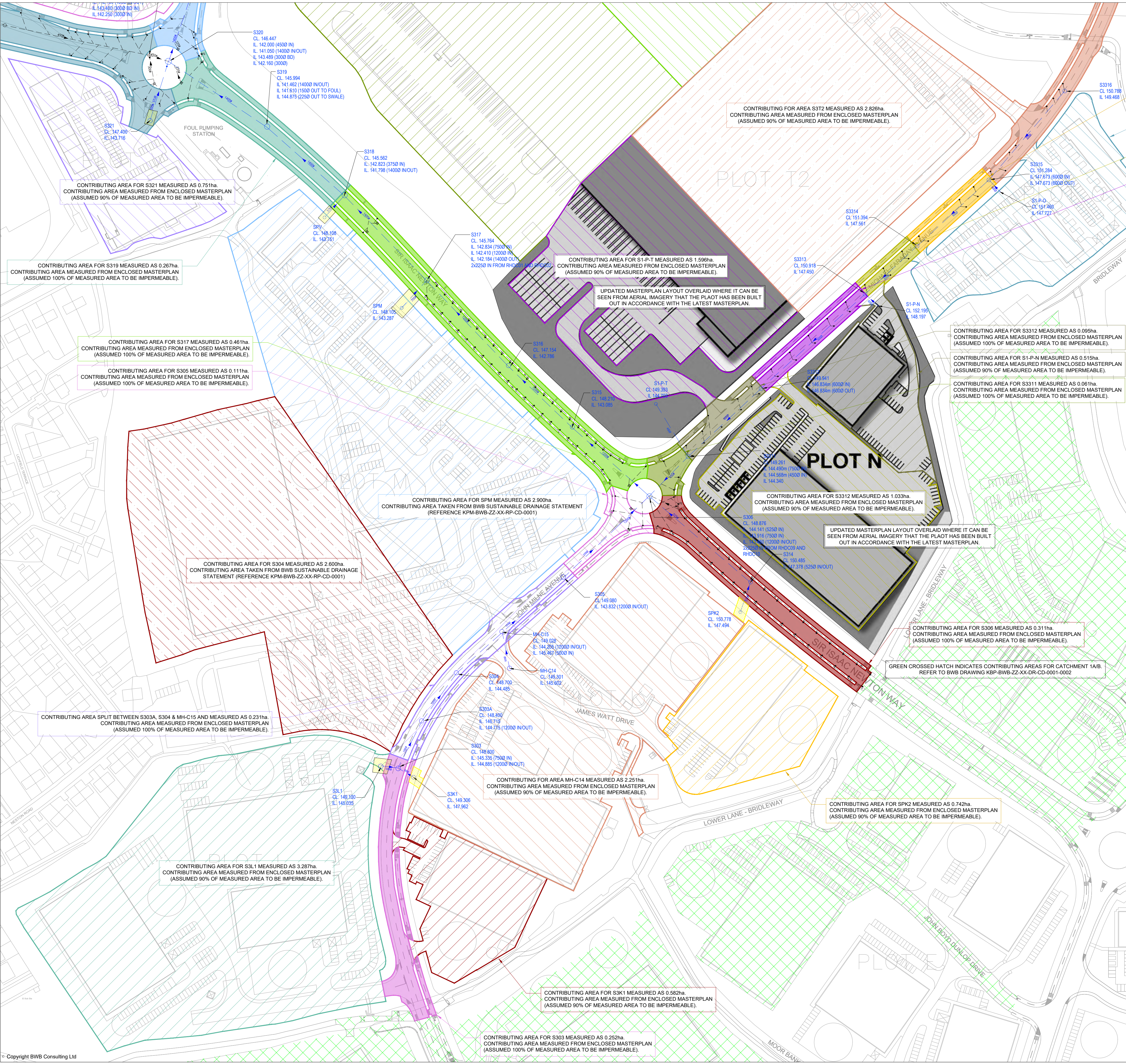
Approximately 31m³ of on plot flooding has been identified during the 1 in 100-year critical storm (15-minute) event. The extent of flooding at this node is not unusual for private drainage systems during the 1 in 100-year storm and is likely the result of the conservative nature of the recreated MicroDrainage network model with respect to short term storms.

The findings show that Pond 2 is able to safely attenuate and discharge flows from 'Catchment 2' with the maximum water level within the pond simulated to be approximately 232mm below the pond's overflow weir crest level.

The findings show that the 'Pond 2' discharges surface water at a lower rate (444.5l/s) that of the original design intent (555l/s).

Overall, based on the information available to BWB, the existing drainage network serving 'Catchment 2' of Kingsway Business Park is considered to be currently operating efficiently and safely and has been sufficiently designed to continue to do so once the entire development has been built out.

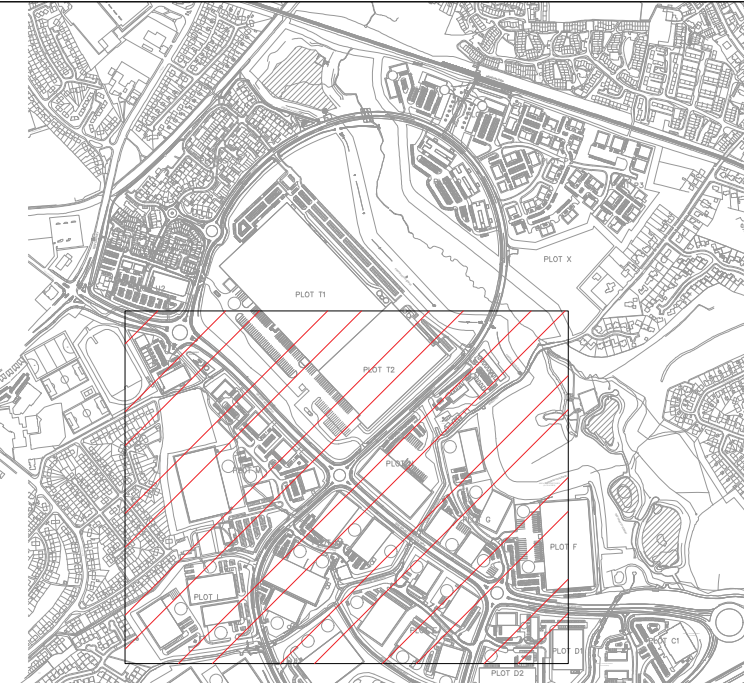
Appendix A – Assumed Contributing Areas Catchments Plan



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. This drawing is to be read in conjunction with BWB Technical Note Reference KBP-BWB-ZZ-XX-RP-CD-0002.

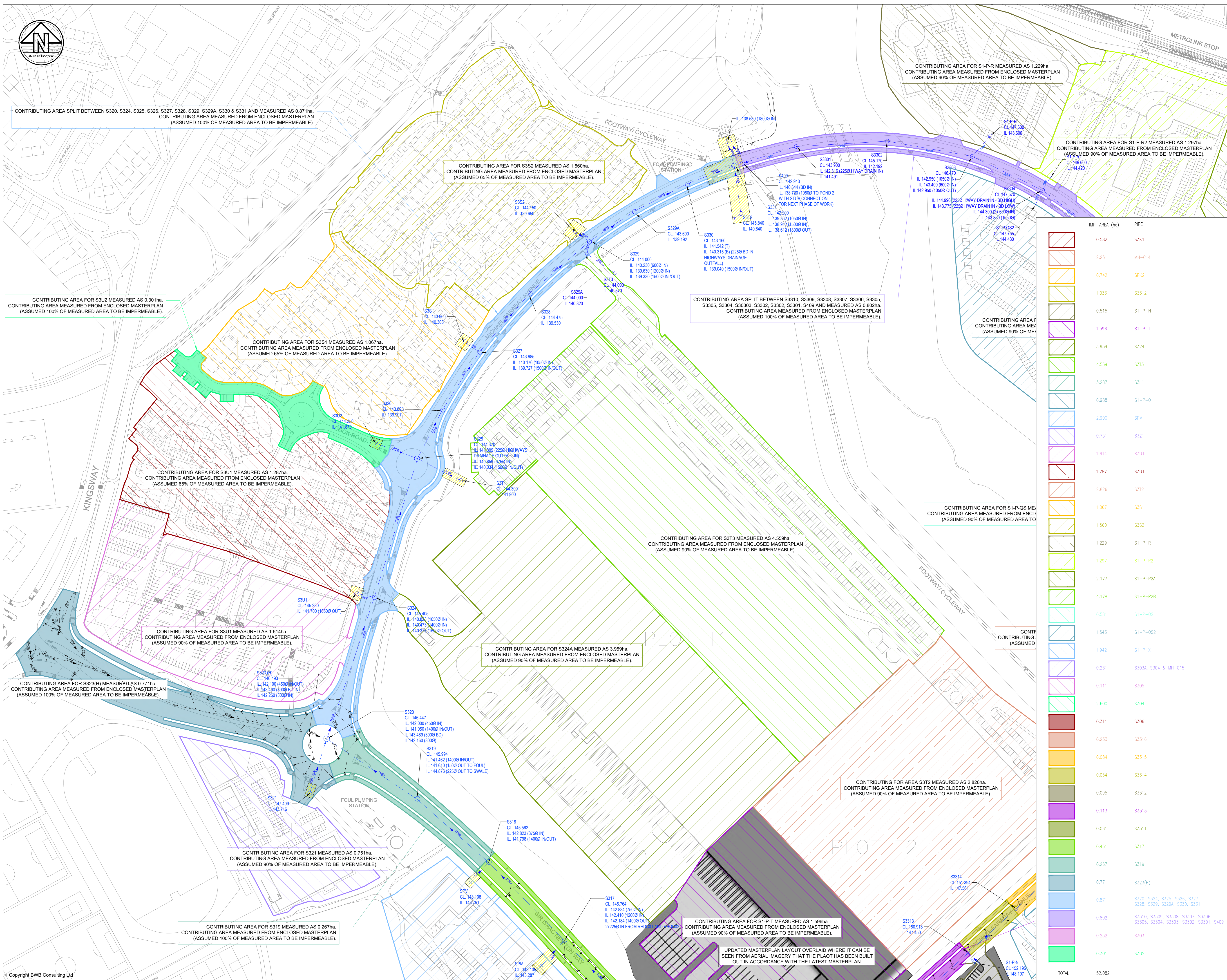
Key Plan (not to scale)



Legend

CONTRIBUTING AREA FOR CATCHMENT 1A/B - REFER TO BWB DRAWING KBP-BWB-ZZ-XX-RP-CD-0001-0002

IMP. AREA (ha)	PIPE
0.582	S3K1
2.251	MH-C14
0.742	SPK2
1.033	S3312
0.515	S1-P-N
1.596	S1-P-T
3.959	S324
4.559	S333
3.287	S3L1
0.988	S1-P-O
2.900	SPM
0.751	S321
1.614	S3U1
1.287	S3U1
2.826	S3T2
1.067	S3S1
1.560	S3S2
1.229	S1-P-R
1.297	S1-P-R2
2.177	S1-P-P2A
4.178	S1-P-P2B
0.581	S1-P-Q5
1.543	S1-P-Q52
1.942	S1-P-X
0.231	S303A, S304 & MH-C15
0.111	S305
2.600	S304
0.311	S306
0.233	S3316
0.084	S3315
0.054	S3314
0.095	S3312
0.113	S3313
0.061	S3311
0.461	S317
0.267	S319
0.771	S323(H)
0.871	S320, S324, S325, S326, S327, S328, S329, S329A, S330, S331
0.802	S3310, S3309, S3308, S3307, S3306, S3305, S3304, S3303, S3302, S3301, S409
0.252	S303
0.301	S3U2
TOTAL	52.082



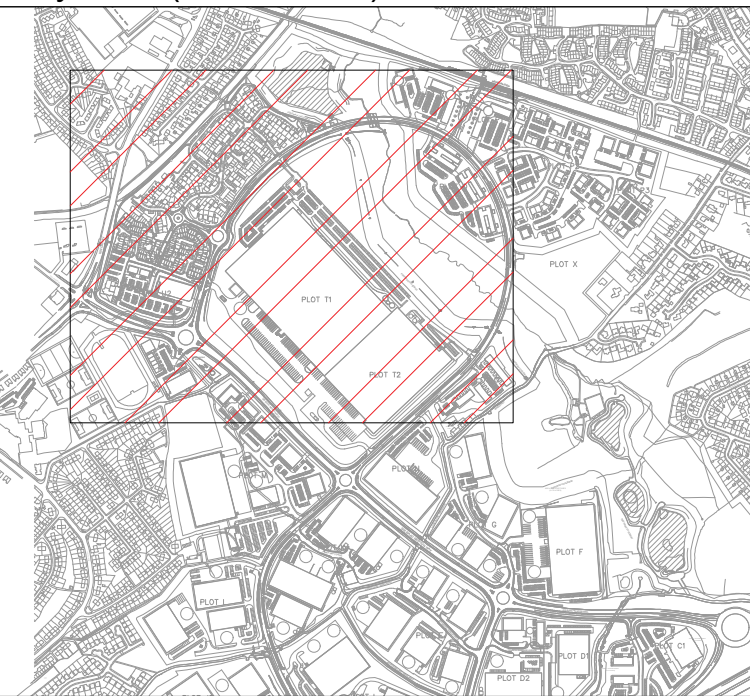
- Notes
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.

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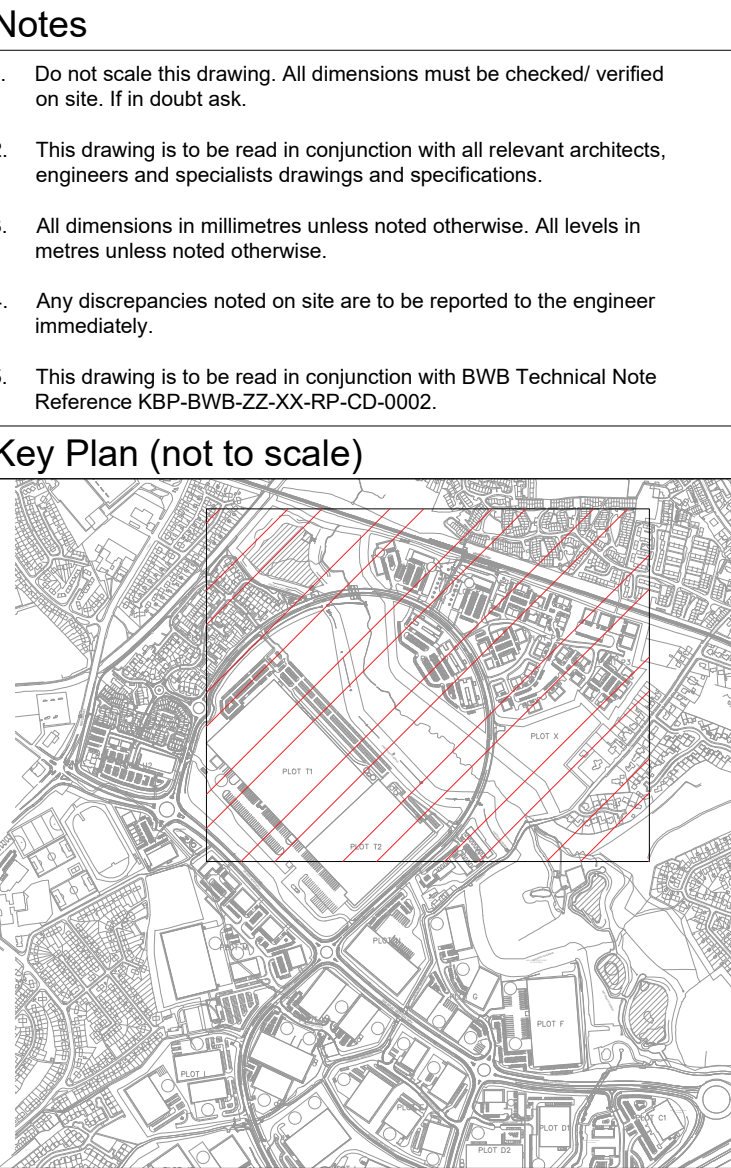
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- Key Plan (not to scale)



Legend

IMP. AREA (ha)	PIPE
0.582	S3K1
2.251	MH-C14
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1.033	S3312
0.515	S1-P-N
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4.559	S3T3
3.287	S3L1
0.988	S1-P-O
2.900	SPM
0.751	S321
1.614	S3U1
1.287	S3U1
2.826	S3T2
1.067	S3S1
1.560	S3S2
1.229	S1-P-R
1.297	S1-P-R2
2.177	S1-P-P2A
4.178	S1-P-P2B
0.581	S1-P-Q5
1.543	S1-P-Q52
1.942	S1-P-X
0.231	S303A, S304 & MH-C15
0.111	S305
2.600	S304
0.311	S306
0.233	S3316
0.084	S3315
0.054	S3314
0.095	S3312
0.113	S3313
0.061	S3311
0.461	S317
0.267	S319
0.771	S323(H)
0.871	S320, S324, S325, S326, S327, S328, S329, S329A, S330, S331
0.802	S3310, S3309, S3308, S3307, S3306, S3305, S3304, S3303, S3302, S3301, S409
0.252	S303
0.301	S3U2
TOTAL	52.082



1	28.01.22	Preliminary Issue	MB	DG
Rev	Date	Details of issue / revision	Draw	Rev

Issues & Revisions

☐ Birmingham | 0121 233 3322
☐ Leeds | 0113 233 8000
☐ London | 020 7407 3879
☒ Manchester | 0161 233 4260
☐ Nottingham | 0115 924 1100

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Project Title

KINGSWAY BUSINESS PARK

**CATCHMENT 2 ASSUMED
CONTRIBUTING AREAS
CATCHMENT PLAN
(SHEET 3 OF 3)**

Drawn:	M. Bailey	Reviewed:	D. Gray		
WB Ref:	NTW2889	Date:	28.01.22	Scale@A1:	1:1250
Drawing Status					
PRELIMINARY					
Project - Originator - Zone - Level - Type - Role - Number				Status	Rev
KBP-BWB-ZZ-XX-DR-CD-0004				S2	P1

Appendix B – MicroDrainage Network Model

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	11.794	4-8	24.082	8-12	14.047	12-16	2.159

Total Area Contributing (ha) = 52.083

Total Pipe Volume (m³) = 2652.438

Existing Network Details for Existing

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
E1.000	11.913	0.150	79.4	3.287	5.00	0.0	0.600	o	1200	Pipe/Conduit
E2.000	11.955	2.627	4.6	0.582	5.00	0.0	0.600	o	750	Pipe/Conduit
E1.001	35.859	0.170	210.9	0.252	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.002	40.155	0.230	174.6	0.077	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.003	41.606	0.280	148.6	2.677	0.00	0.0	0.600	o	1200	Pipe/Conduit
E3.000	25.330	0.135	187.6	2.251	5.00	0.0	0.600	o	500	Pipe/Conduit
E1.004	55.563	0.373	149.0	0.077	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.005	80.019	0.372	215.1	0.111	0.00	0.0	0.600	o	1200	Pipe/Conduit
E4.000	21.422	0.116	184.7	0.742	5.00	0.0	0.600	o	525	Pipe/Conduit
E4.001	89.800	3.237	27.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
E5.000	79.103	1.795	44.1	0.233	5.00	0.0	0.600	o	225	Pipe/Conduit
E6.000	11.029	0.054	204.2	0.988	5.00	0.0	0.600	o	600	Pipe/Conduit
E5.001	66.134	0.112	590.5	0.084	0.00	0.0	0.600	o	600	Pipe/Conduit
E5.002	47.917	0.111	431.7	0.054	0.00	0.0	0.600	o	600	Pipe/Conduit
E7.000	12.175	0.697	17.5	0.515	5.00	0.0	0.600	o	600	Pipe/Conduit
E5.003	95.200	0.666	142.9	0.113	0.00	0.0	0.600	o	600	Pipe/Conduit
E5.004	67.417	2.344	28.8	1.128	0.00	0.0	0.600	o	600	Pipe/Conduit
E8.000	41.835	0.135	309.9	1.596	5.00	0.0	0.600	o	450	Pipe/Conduit
E5.005	37.597	0.424	88.7	0.061	0.00	0.0	0.600	o	750	Pipe/Conduit
E1.006	70.186	0.375	187.2	0.311	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.007	59.982	0.299	200.6	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.008	80.002	0.376	212.8	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
E9.000	25.299	0.453	55.8	2.900	5.00	0.0	0.600	o	750	Pipe/Conduit
E1.009	80.058	0.386	207.4	0.461	0.00	0.0	0.600	o	1400	Pipe/Conduit
E10.000	20.302	0.928	21.9	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.000	145.035	3.287	0.0	4.20	4750.2
E2.000	147.962	0.582	0.0	13.17	5817.3
E1.001	144.885	4.121	0.0	2.57	2909.1
E1.002	144.715	4.198	0.0	2.83	3199.1
E1.003	144.485	6.875	0.0	3.07	3468.8
E3.000	145.602	2.251	0.0	1.58	310.7
E1.004	144.205	9.203	0.0	3.06	3464.5
E1.005	143.832	9.314	0.0	2.55	2880.6
E4.000	147.494	0.742	0.0	1.65	356.1
E4.001	147.378	0.742	0.0	4.26	923.2
E5.000	149.468	0.233	0.0	1.98	78.6
E6.000	147.727	0.988	0.0	1.70	480.7
E5.001	147.673	1.305	0.0	0.99	281.3
E5.002	147.561	1.359	0.0	1.17	329.6
E7.000	148.197	0.515	0.0	5.85	1652.7
E5.003	147.500	1.987	0.0	2.03	575.3
E5.004	146.834	3.115	0.0	4.55	1287.1
E8.000	144.703	1.596	0.0	1.15	182.8
E5.005	144.340	4.772	0.0	2.97	1313.4
E1.006	143.460	15.139	0.0	2.73	3089.2
E1.007	143.085	15.139	0.0	2.64	2983.4
E1.008	142.786	15.139	0.0	2.56	2896.5
E9.000	143.287	2.900	0.0	3.75	1656.4
E1.009	142.184	18.500	0.0	2.85	4389.9
E10.000	143.751	0.000	0.0	3.89	429.5

Existing Network Details for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
E1.010	70.068	0.336	208.5	0.000	0.00	0.0	0.600	o	1400	Pipe/Conduit
E1.011	80.140	0.412	194.5	0.267	0.00	0.0	0.600	o	1400	Pipe/Conduit
E11.000	42.000	0.227	185.0	0.751	5.00	0.0	0.600	o	300	Pipe/Conduit
E12.000	13.524	0.100	135.2	0.771	5.00	0.0	0.600	o	450	Pipe/Conduit
E1.012	109.739	0.577	190.2	0.087	0.00	0.0	0.600	o	1400	Pipe/Conduit
E13.000	13.351	0.877	15.2	2.901	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.013	106.625	0.339	314.5	4.046	0.00	0.0	0.600	o	1500	Pipe/Conduit
E14.000	36.067	1.041	34.6	0.000	5.00	0.0	0.600	o	675	Pipe/Conduit
E15.000	32.713	1.011	32.4	0.301	5.00	0.0	0.600	o	675	Pipe/Conduit
E1.014	40.493	0.127	318.8	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.015	50.583	0.180	281.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E16.000	13.160	0.132	99.7	1.067	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.016	56.696	0.197	287.8	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.017	57.990	0.200	290.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E17.000	25.000	0.250	100.0	4.559	5.00	0.0	0.600	o	600	Pipe/Conduit
E17.001	9.000	0.090	100.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit
E18.000	12.736	0.020	636.8	1.560	5.00	0.0	0.600	o	1200	Pipe/Conduit
E1.018	39.976	0.138	289.7	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.019	43.686	0.152	287.4	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.020	36.994	0.128	289.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E19.000	35.519	1.478	24.0	2.826	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.021	22.240#	0.082	271.2	0.088	0.00	0.0	0.600	o	1800	Pipe/Conduit
E20.000	16.500	0.082	201.2	1.942	5.00	0.0	0.600	o	750	Pipe/Conduit
E20.001	44.135	0.414	106.6	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit
E20.002	40.455	0.382	105.9	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.010	141.798	18.500	0.0	2.84	4377.9
E1.011	141.462	18.767	0.0	2.95	4533.7
E11.000	143.716	0.751	0.0	1.15	81.5
E12.000	142.100	0.771	0.0	1.75	277.8
E1.012	141.050	20.376	0.0	2.98	4585.2
E13.000	141.700	2.901	0.0	8.85	7666.5
E1.013	140.373	27.323	0.0	2.41	4264.6
E14.000	141.900	0.000	0.0	4.46	1596.8
E15.000	141.870	0.301	0.0	4.62	1652.4
E1.014	140.034	27.711	0.0	2.40	4235.5
E1.015	139.907	27.798	0.0	2.55	4513.1
E16.000	140.308	1.067	0.0	3.45	2988.9
E1.016	139.727	28.952	0.0	2.52	4459.3
E1.017	139.530	29.039	0.0	2.51	4442.6
E17.000	140.570	4.559	0.0	2.44	688.6
E17.001	140.320	4.559	0.0	2.44	688.6
E18.000	139.650	1.560	0.0	1.48	1668.2
E1.018	139.330	35.245	0.0	2.52	4444.7
E1.019	139.192	35.332	0.0	2.53	4462.4
E1.020	139.040	35.419	0.0	2.52	4449.9
E19.000	140.840	2.826	0.0	7.04	6099.5
E1.021	138.612	38.333	0.0	2.91	7395.7
E20.000	146.382	1.942	0.0	1.97	870.0
E20.001	146.150	2.015	0.0	3.03	1930.5
E20.002	145.736	2.088	0.0	3.04	1936.9

Existing Network Details for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
E21.000	14.500	0.145	100.0	0.581	5.00	0.0	0.600	o	600	Pipe/Conduit
E22.000	22.000	0.220	100.0	4.178	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.003	52.630	0.454	115.9	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit
E23.000	21.000	0.210	100.0	2.177	5.00	0.0	0.600	o	750	Pipe/Conduit
E20.004	52.603	0.190	276.9	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.005	46.317	0.165	280.7	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.006	52.286	0.545	95.9	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E24.000	12.000	0.120	100.0	1.297	5.00	0.0	0.600	o	600	Pipe/Conduit
E25.000	13.000	0.130	100.0	1.543	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.007	57.210	0.900	63.6	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E26.000	20.000	0.200	100.0	1.229	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.008	63.532	0.758	83.8	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.009	67.003	0.701	95.6	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.010	41.345	0.847	48.8	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.011	22.710#	0.190	119.5	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E1.022	31.625#	0.100	316.3	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E21.000	145.799	0.581	0.0	2.44	688.6
E22.000	145.874	4.178	0.0	2.44	688.6
E20.003	145.354	6.920	0.0	2.91	1850.9
E23.000	145.260	2.177	0.0	2.80	1236.4
E20.004	144.750	9.170	0.0	2.07	1789.1
E20.005	144.560	9.243	0.0	2.05	1776.7
E20.006	144.395	9.316	0.0	3.52	3047.1
E24.000	144.420	1.297	0.0	2.44	688.6
E25.000	144.430	1.543	0.0	2.44	688.6
E20.007	143.850	12.229	0.0	4.33	3746.0
E26.000	143.600	1.229	0.0	2.44	688.6
E20.008	142.950	13.531	0.0	3.77	3260.8
E20.009	142.192	13.604	0.0	3.53	3052.8
E20.010	141.491	13.677	0.0	4.94	4276.3
E20.011	138.720	13.750	0.0	3.15	2728.7
E1.022	138.100	52.083	0.0	1.93	1673.3

Manhole Schedules for Existing

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
ES3311	391662.739	411950.779	391662.739	411950.779	Required	
ES306	391636.504	411923.849	391636.504	411923.849	Required	
ES315	391584.329	411970.794	391584.329	411970.794	Required	
ES316	391541.037	412012.311	391541.037	412012.311	Required	
ESPM	391468.761	412051.453	391468.761	412051.453	Required	
ES317	391485.784	412070.168	391485.784	412070.168	Required	
ESPV	391416.478	412112.633	391416.478	412112.633	Required	
ES318	391430.099	412127.688	391430.099	412127.688	Required	
ES319	391377.624	412174.120	391377.624	412174.120	Required	
ES321	391298.351	412178.215	391298.351	412178.215	Required	
ES323 (H)	391297.882	412222.386	391297.882	412222.386	Required	
ES320	391310.784	412218.333	391310.784	412218.333	Required	
ES3U1	391332.996	412324.796	391332.996	412324.796	Required	
ES324	391346.098	412322.234	391346.098	412322.234	Required	
ES3T1	391409.682	412408.348	391409.682	412408.348	Required	
ES3U2	391346.818	412436.112	391346.818	412436.112	Required	
ES325	391377.284	412424.197	391377.284	412424.197	Required	
ES326	391396.227	412459.985	391396.227	412459.985	Required	
ES3S1	391412.715	412510.143	391412.715	412510.143	Required	
ES327	391423.493	412502.591	391423.493	412502.591	Required	
ES328	391460.391	412545.638	391460.391	412545.638	Required	
ES3T3	391522.634	412560.632	391522.634	412560.632	Required	
ES329A	391502.127	412574.931	391502.127	412574.931	Required	
ES3S2	391494.037	412591.462	391494.037	412591.462	Required	
ES329	391504.138	412583.704	391504.138	412583.704	Required	
ES329A	391537.364	412605.931	391537.364	412605.931	Required	
ES330	391576.107	412626.117	391576.107	412626.117	Required	
ES3T2	391615.433	412604.533	391615.433	412604.533	Required	
ES331	391610.513	412639.709	391610.513	412639.709	Required	

Manhole Schedules for Existing

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
ES1-P-X	391983.875	412377.329	391983.875	412377.329	Required	
ES3310	391967.421	412378.562	391967.421	412378.562	Required	
ES3309	391965.020	412422.632	391965.020	412422.632	Required	
ES1-P-QS	391942.916	412456.942	391942.916	412456.942	Required	
ES1-P-P2B	391978.414	412463.282	391978.414	412463.282	Required	
ES3308	391956.442	412462.168	391956.442	412462.168	Required	
ES1-P-P2A	391956.624	412520.000	391956.624	412520.000	Required	
ES3307	391937.521	412511.279	391937.521	412511.279	Required	
ES3306	391910.518	412556.422	391910.518	412556.422	Required	
ES3305	391878.956	412590.320	391878.956	412590.320	Required	
ES1-P-R2	391843.635	412631.794	391843.635	412631.794	Required	
ES1-P-QS2	391831.493	412609.994	391831.493	412609.994	Required	
ES3304	391837.137	412621.705	391837.137	412621.705	Required	
ES1-P-R	391798.718	412661.640	391798.718	412661.640	Required	
ES3303	391785.600	412646.543	391785.600	412646.543	Required	
ES3302	391723.067	412657.763	391723.067	412657.763	Required	
ES3301	391656.181	412653.806	391656.181	412653.806	Required	
ES409	391616.692	412641.560	391616.692	412641.560	Required	
EPOND 2	391551.156	412735.562	391551.156	412735.562	Required	
E	391631.492	412760.413			No Entry	

PIPELINE SCHEDULES for Existing

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	o	1200	ES3L1	149.100	145.035	2.865	Open Manhole	2700
E2.000	o	750	ES3K1	149.306	147.962	0.594	Open Manhole	2400
E1.001	o	1200	ES303	148.800	144.885	2.715	Open Manhole	2700
E1.002	o	1200	ES303A	148.400	144.715	2.485	Open Manhole	2700
E1.003	o	1200	ES304	148.700	144.485	3.015	Open Manhole	2700
E3.000	o	500	EMH-C14	149.301	145.602	3.199	Open Manhole	1800
E1.004	o	1200	EMH-C15	149.028	144.205	3.623	Open Manhole	2700
E1.005	o	1200	ES305	149.080	143.832	4.048	Open Manhole	2700
E4.000	o	525	ESPK2	150.778	147.494	2.759	Open Manhole	1800
E4.001	o	525	ES314	150.485	147.378	2.582	Open Manhole	2100
E5.000	o	225	ES3316	150.778	149.468	1.085	Open Manhole	1200
E6.000	o	600	ES1-P-O	151.460	147.727	3.133	Open Manhole	2100
E5.001	o	600	ES3315	151.284	147.673	3.011	Open Manhole	2100
E5.002	o	600	ES3314	151.394	147.561	3.233	Open Manhole	2100
E7.000	o	600	ES1-P-N	152.195	148.197	3.398	Open Manhole	2100
E5.003	o	600	ES3313	150.918	147.500	2.818	Open Manhole	2100
E5.004	o	600	ES3312	149.941	146.834	2.507	Open Manhole	2100
E8.000	o	450	ES1-P-T	149.393	144.703	4.240	Open Manhole	1800
E5.005	o	750	ES3311	149.261	144.340	4.171	Open Manhole	2400
E1.006	o	1200	ES306	148.876	143.460	4.216	Open Manhole	3000
E1.007	o	1200	ES315	148.210	143.085	3.925	Open Manhole	2700
E1.008	o	1200	ES316	147.154	142.786	3.168	Open Manhole	2700
E9.000	o	750	ESPM	148.105	143.287	4.068	Open Manhole	2400
E1.009	o	1400	ES317	145.764	142.184	2.180	Open Manhole	3000
E10.000	o	375	ESPV	148.108	143.751	3.982	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	11.913	79.4	ES303	148.800	144.885	2.715	Open Manhole	2700
E2.000	11.955	4.6	ES303	148.800	145.335	2.715	Open Manhole	2700
E1.001	35.859	210.9	ES303A	148.400	144.715	2.485	Open Manhole	2700
E1.002	40.155	174.6	ES304	148.700	144.485	3.015	Open Manhole	2700
E1.003	41.606	148.6	EMH-C15	149.028	144.205	3.623	Open Manhole	2700
E3.000	25.330	187.6	EMH-C15	149.028	145.467	3.061	Open Manhole	2700
E1.004	55.563	149.0	ES305	149.080	143.832	4.048	Open Manhole	2700
E1.005	80.019	215.1	ES306	148.876	143.460	4.216	Open Manhole	3000
E4.000	21.422	184.7	ES314	150.485	147.378	2.582	Open Manhole	2100
E4.001	89.800	27.7	ES306	148.876	144.141	4.210	Open Manhole	3000
E5.000	79.103	44.1	ES3315	151.284	147.673	3.386	Open Manhole	2100
E6.000	11.029	204.2	ES3315	151.284	147.673	3.011	Open Manhole	2100
E5.001	66.134	590.5	ES3314	151.394	147.561	3.233	Open Manhole	2100
E5.002	47.917	431.7	ES3313	150.918	147.450	2.868	Open Manhole	2100
E7.000	12.175	17.5	ES3313	150.918	147.500	2.818	Open Manhole	2100
E5.003	95.200	142.9	ES3312	149.941	146.834	2.507	Open Manhole	2100
E5.004	67.417	28.8	ES3311	149.261	144.490	4.171	Open Manhole	2400
E8.000	41.835	309.9	ES3311	149.261	144.568	4.243	Open Manhole	2400
E5.005	37.597	88.7	ES306	148.876	143.916	4.210	Open Manhole	3000
E1.006	70.186	187.2	ES315	148.210	143.085	3.925	Open Manhole	2700
E1.007	59.982	200.6	ES316	147.154	142.786	3.168	Open Manhole	2700
E1.008	80.002	212.8	ES317	145.764	142.410	2.154	Open Manhole	3000
E9.000	25.299	55.8	ES317	145.764	142.834	2.180	Open Manhole	3000
E1.009	80.058	207.4	ES318	145.562	141.798	2.364	Open Manhole	3000
E10.000	20.302	21.9	ES318	145.562	142.823	2.364	Open Manhole	3000

PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.010	o	1400	ES318	145.562	141.798	2.364	Open Manhole	3000
E1.011	o	1400	ES319	145.994	141.462	3.132	Open Manhole	3000
E11.000	o	300	ES321	147.400	143.716	3.384	Open Manhole	1500
E12.000	o	450	ES323 (H)	146.493	142.100	3.943	Open Manhole	1800
E1.012	o	1400	ES320	146.447	141.050	3.997	Open Manhole	3660
E13.000	o	1050	ES3U1	145.280	141.700	2.530	Open Manhole	2700
E1.013	o	1500	ES324	145.405	140.373	3.532	Open Manhole	3000
E14.000	o	675	ES3T1	144.300	141.900	1.725	Open Manhole	2100
E15.000	o	675	ES3U2	144.250	141.870	1.705	Open Manhole	2100
E1.014	o	1500	ES325	144.370	140.034	2.836	Open Manhole	3000
E1.015	o	1500	ES326	143.895	139.907	2.488	Open Manhole	3000
E16.000	o	1050	ES3S1	143.960	140.308	2.602	Open Manhole	2700
E1.016	o	1500	ES327	143.985	139.727	2.758	Open Manhole	3000
E1.017	o	1500	ES328	144.475	139.530	3.445	Open Manhole	3000
E17.000	o	600	ES3T3	144.000	140.570	2.830	Open Manhole	2100
E17.001	o	600	ES329A	144.000	140.320	3.080	Open Manhole	2100
E18.000	o	1200	ES3S2	144.150	139.650	3.300	Open Manhole	2700
E1.018	o	1500	ES329	144.000	139.330	3.170	Open Manhole	3000
E1.019	o	1500	ES329A	143.600	139.192	2.908	Open Manhole	3000
E1.020	o	1500	ES330	143.160	139.040	2.620	Open Manhole	3000
E19.000	o	1050	ES3T2	145.840	140.840	3.950	Open Manhole	2700
E1.021	o	1800	ES331	142.900	138.612	2.488	Open Manhole	3660
E20.000	o	750	ES1-P-X	150.250	146.382	3.118	Open Manhole	2400
E20.001	o	900	ES3310	149.930	146.150	2.880	Open Manhole	2400
E20.002	o	900	ES3309	150.720	145.736	4.084	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.010	70.068	208.5	ES319	145.994	141.462	3.132	Open Manhole	3000
E1.011	80.140	194.5	ES320	146.447	141.050	3.997	Open Manhole	3660
E11.000	42.000	185.0	ES320	146.447	143.489	2.658	Open Manhole	3660
E12.000	13.524	135.2	ES320	146.447	142.000	3.997	Open Manhole	3660
E1.012	109.739	190.2	ES324	145.405	140.473	3.532	Open Manhole	3000
E13.000	13.351	15.2	ES324	145.405	140.823	3.532	Open Manhole	3000
E1.013	106.625	314.5	ES325	144.370	140.034	2.836	Open Manhole	3000
E14.000	36.067	34.6	ES325	144.370	140.859	2.836	Open Manhole	3000
E15.000	32.713	32.4	ES325	144.370	140.859	2.836	Open Manhole	3000
E1.014	40.493	318.8	ES326	143.895	139.907	2.488	Open Manhole	3000
E1.015	50.583	281.0	ES327	143.985	139.727	2.758	Open Manhole	3000
E16.000	13.160	99.7	ES327	143.985	140.176	2.759	Open Manhole	3000
E1.016	56.696	287.8	ES328	144.475	139.530	3.445	Open Manhole	3000
E1.017	57.990	290.0	ES329	144.000	139.330	3.170	Open Manhole	3000
E17.000	25.000	100.0	ES329A	144.000	140.320	3.080	Open Manhole	2100
E17.001	9.000	100.0	ES329	144.000	140.230	3.170	Open Manhole	3000
E18.000	12.736	636.8	ES329	144.000	139.630	3.170	Open Manhole	3000
E1.018	39.976	289.7	ES329A	143.600	139.192	2.908	Open Manhole	3000
E1.019	43.686	287.4	ES330	143.160	139.040	2.620	Open Manhole	3000
E1.020	36.994	289.0	ES331	142.900	138.912	2.488	Open Manhole	3660
E19.000	35.519	24.0	ES331	142.900	139.362	2.488	Open Manhole	3660
E1.021	22.240#	271.2	EPOND 2	140.550	138.530	0.220	Open Manhole	5600 x 4000
E20.000	16.500	201.2	ES3310	149.930	146.300	2.880	Open Manhole	2400
E20.001	44.135	106.6	ES3309	150.720	145.736	4.084	Open Manhole	2400
E20.002	40.455	105.9	ES3308	150.520	145.354	4.266	Open Manhole	2400

PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E21.000	o	600	ES1-P-QS	150.200	145.799	3.801	Open Manhole	2100
E22.000	o	600	ES1-P-P2B	150.000	145.874	3.526	Open Manhole	2100
E20.003	o	900	ES3308	150.520	145.354	4.266	Open Manhole	2400
E23.000	o	750	ES1-P-P2A	150.000	145.260	3.990	Open Manhole	2400
E20.004	o	1050	ES3307	150.570	144.750	4.770	Open Manhole	2700
E20.005	o	1050	ES3306	149.560	144.560	3.950	Open Manhole	2700
E20.006	o	1050	ES3305	148.620	144.395	3.175	Open Manhole	2700
E24.000	o	600	ES1-P-R2	149.000	144.420	3.980	Open Manhole	2100
E25.000	o	600	ES1-P-QS2	147.755	144.430	2.725	Open Manhole	2100
E20.007	o	1050	ES3304	147.570	143.850	2.670	Open Manhole	2700
E26.000	o	600	ES1-P-R	147.600	143.600	3.400	Open Manhole	2100
E20.008	o	1050	ES3303	146.470	142.950	2.470	Open Manhole	2700
E20.009	o	1050	ES3302	145.170	142.192	1.928	Open Manhole	2700
E20.010	o	1050	ES3301	143.900	141.491	1.359	Open Manhole	2700
E20.011	o	1050	ES409	142.943	138.720	3.173	Open Manhole	2700
E1.022	o	1050	EPOND 2	140.550	138.100	1.400	Open Manhole	5600 x 4000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E21.000	14.500	100.0	ES3308	150.520	145.654	4.266	Open Manhole	2400
E22.000	22.000	100.0	ES3308	150.520	145.654	4.266	Open Manhole	2400
E20.003	52.630	115.9	ES3307	150.570	144.900	4.770	Open Manhole	2700
E23.000	21.000	100.0	ES3307	150.570	145.050	4.770	Open Manhole	2700
E20.004	52.603	276.9	ES3306	149.560	144.560	3.950	Open Manhole	2700
E20.005	46.317	280.7	ES3305	148.620	144.395	3.175	Open Manhole	2700
E20.006	52.286	95.9	ES3304	147.570	143.850	2.670	Open Manhole	2700
E24.000	12.000	100.0	ES3304	147.570	144.300	2.670	Open Manhole	2700
E25.000	13.000	100.0	ES3304	147.570	144.300	2.670	Open Manhole	2700
E20.007	57.210	63.6	ES3303	146.470	142.950	2.470	Open Manhole	2700
E26.000	20.000	100.0	ES3303	146.470	143.400	2.470	Open Manhole	2700
E20.008	63.532	83.8	ES3302	145.170	142.192	1.928	Open Manhole	2700
E20.009	67.003	95.6	ES3301	143.900	141.491	1.359	Open Manhole	2700
E20.010	41.345	48.8	ES409	142.943	140.644	1.249	Open Manhole	2700
E20.011	22.710#	119.5	EPOND 2	140.550	138.530	0.970	Open Manhole	5600 x 4000
E1.022	31.625#	316.3	E	140.450	138.000	1.400	Open Manhole	0

BWB Consulting Ltd		Page 13
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ	Kingsway Business Park Existing SW Network Catchment 2 - FSR	
Date 28/01/2022 File Existing SW Network Model - P1.MDX	Designed by M. Bailey Checked by D. Gray	
Innovyze	Network 2019.1	

Synthetic Rainfall Details

Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30

BWB Consulting Ltd		Page 14
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ	Kingsway Business Park Existing SW Network Catchment 2 - FSR	
Date 28/01/2022 File Existing SW Network Model - P1.MDX	Designed by M. Bailey Checked by D. Gray	
Innovyze	Network 2019.1	

Online Controls for Existing

Complex Manhole: EPOND 2, DS/PN: E1.022, Volume (m³): 115.8

Orifice

Diameter (m) 0.350 Discharge Coefficient 0.600 Invert Level (m) 138.100

Orifice

Diameter (m) 0.200 Discharge Coefficient 0.600 Invert Level (m) 139.125

Weir

Discharge Coef 0.544 Width (m) 4.000 Invert Level (m) 140.500

Storage Structures for Existing

Tank or Pond Manhole: EPOND 2, DS/PN: E1.022

Invert Level (m) 138.100

Depth (m) Area (m²)		Depth (m) Area (m²)	
0.000	10550.0	2.450	14420.0

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.268 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

Water Surcharged Flooded Pipe															
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
E1.000	ES3L1	15 Winter	30	+0%	100/15 Summer				145.719	-0.516	0.000	0.47		924.3	OK
E2.000	ES3K1	15 Winter	30	+0%					148.087	-0.625	0.000	0.06		164.1	OK
E1.001	ES303	15 Winter	30	+0%	100/15 Summer				145.697	-0.388	0.000	0.59		1150.3	OK
E1.002	ES303A	15 Winter	30	+0%	100/15 Summer				145.649	-0.266	0.000	0.58		1148.5	OK
E1.003	ES304	15 Winter	30	+0%	100/15 Summer				145.608	-0.077	0.000	0.80		1697.6	OK
E3.000	EMH-C14	15 Winter	30	+0%	2/15 Summer				146.761	0.659	0.000	2.44		623.3	SURCHARGED
E1.004	EMH-C15	15 Winter	30	+0%	30/15 Winter				145.521	0.116	0.000	0.88		2166.1	SURCHARGED
E1.005	ES305	15 Winter	30	+0%	30/15 Summer				145.361	0.329	0.000	0.80		1906.5	SURCHARGED
E4.000	ESPK2	15 Winter	30	+0%					147.855	-0.164	0.000	0.79		206.6	OK
E4.001	ES314	15 Winter	30	+0%					147.553	-0.350	0.000	0.24		207.8	OK
E5.000	ES3316	15 Winter	30	+0%	100/15 Summer				149.648	-0.045	0.000	0.84		64.0	OK
E6.000	ES1-P-O	15 Winter	30	+0%	30/15 Summer				148.415	0.088	0.000	0.89		276.0	SURCHARGED
E5.001	ES3315	15 Winter	30	+0%	30/15 Summer				148.369	0.096	0.000	1.31		333.7	SURCHARGED
E5.002	ES3314	15 Winter	30	+0%	30/15 Winter				148.174	0.013	0.000	1.11		320.1	SURCHARGED
E7.000	ES1-P-N	15 Winter	30	+0%					148.365	-0.432	0.000	0.17		145.5	OK
E5.003	ES3313	15 Winter	30	+0%	100/15 Winter				147.914	-0.186	0.000	0.80		427.1	OK
E5.004	ES3312	15 Winter	30	+0%	100/15 Winter				147.157	-0.277	0.000	0.56		648.0	OK
E8.000	ES1-P-T	15 Winter	30	+0%	2/15 Summer				146.002	0.849	0.000	2.63		429.0	SURCHARGED
E5.005	ES3311	15 Winter	30	+0%	30/15 Summer				145.502	0.412	0.000	0.98		994.3	SURCHARGED
E1.006	ES306	15 Winter	30	+0%	30/15 Summer				145.184	0.524	0.000	1.24		3032.4	SURCHARGED
E1.007	ES315	15 Winter	30	+0%	30/15 Summer				144.678	0.393	0.000	1.34		2945.1	SURCHARGED
E1.008	ES316	15 Winter	30	+0%	30/15 Summer				144.121	0.135	0.000	1.20		2887.3	SURCHARGED
E9.000	ESPM	15 Winter	30	+0%	100/15 Winter				143.791	-0.246	0.000	0.77		816.3	OK
E1.009	ES317	30 Winter	30	+0%	30/30 Winter	100/30 Winter			143.608	0.024	0.000	0.91		3075.9	SURCHARGED
E10.000	ESPV	360 Winter	30	+0%	100/15 Winter				143.751	-0.375	0.000	0.00		0.0	OK
E1.010	ES318	30 Winter	30	+0%	30/30 Winter				143.368	0.170	0.000	0.91		2873.1	SURCHARGED
E1.011	ES319	30 Winter	30	+0%	30/30 Winter				143.148	0.286	0.000	0.80		2795.2	SURCHARGED
E11.000	ES321	15 Winter	30	+0%	2/15 Summer				145.299	1.283	0.000	2.57		195.2	SURCHARGED
E12.000	ES323 (H)	30 Winter	30	+0%	30/15 Summer				142.993	0.443	0.000	1.00		178.2	SURCHARGED
E1.012	ES320	30 Winter	30	+0%	30/30 Summer				142.910	0.460	0.000	0.74		2878.9	SURCHARGED
E13.000	ES3U1	30 Winter	30	+0%	30/30 Winter				142.875	0.125	0.000	0.24		681.5	SURCHARGED
E1.013	ES324	30 Winter	30	+0%	30/30 Summer				142.596	0.723	0.000	0.93		3304.7	SURCHARGED
E14.000	ES3T1	30 Winter	30	+0%	100/15 Winter				142.296	-0.279	0.000	0.00		5.0	OK
E15.000	ES3U2	30 Winter	30	+0%	100/15 Winter				142.303	-0.242	0.000	0.06		70.7	OK
E1.014	ES325	30 Winter	30	+0%	30/15 Winter				142.296	0.762	0.000	1.16		3327.6	SURCHARGED
E1.015	ES326	60 Winter	30	+0%	30/15 Winter				142.127	0.720	0.000	0.98		3193.2	SURCHARGED
E16.000	ES361	60 Winter	30	+0%	30/30 Summer				141.959	0.601	0.000	0.11		161.1	SURCHARGED
E1.016	ES327	60 Winter	30	+0%	30/15 Winter				141.954	0.727	0.000	1.00		3284.8	SURCHARGED
E1.017	ES328	60 Winter	30	+0%	30/15 Winter				141.757	0.727	0.000	1.00		3292.5	SURCHARGED
E17.000	ES3T3	15 Winter	30	+0%	2/15 Summer	100/15 Summer			143.321	2.151	0.000	2.22		1111.0	SURCHARGED
E17.001	ES329A	15 Winter	30	+0%	2/15 Summer				142.045	1.125	0.000	3.21		1114.0	SURCHARGED
E18.000	ES362	60 Winter	30	+0%	30/15 Winter				141.564	0.714	0.000	0.41		239.0	SURCHARGED
E1.018	ES329	60 Winter	30	+0%	30/15 Winter				141.559	0.729	0.000	1.28		3866.7	SURCHARGED
E1.019	ES329A	60 Winter	30	+0%	30/15 Winter				141.177	0.485	0.000	1.25		3870.7	SURCHARGED
E1.020	ES330	60 Winter	30	+0%	30/15 Winter				140.796	0.256	0.000	1.31		3875.4	SURCHARGED
E19.000	ES3T2	15 Winter	30	+0%					141.170	-0.720	0.000	0.21		798.7	OK
E1.021	ES331	30 Winter	30	+0%	100/30 Summer				140.412	0.000	0.000	1.05		4051.1	OK
E20.000	ES1-P-X	15 Winter	30	+0%	30/15 Summer				147.281	0.149	0.000	0.93		544.5	SURCHARGED
E20.001	ES3310	15 Winter	30	+0%	30/15 Summer				147.209	0.159	0.000	0.37		533.2	SURCHARGED
E20.002	ES3309	15 Winter	30	+0%	30/15 Summer				146.974	0.338	0.000	0.33		465.9	SURCHARGED
E21.000	ES1-P-QS	15 Winter	30	+0%	30/15 Summer				146.861	0.462	0.000	0.34		131.2	SURCHARGED
E22.000	ES1-P-P2B	15 Winter	30	+0%	2/15 Summer				147.852	1.378	0.000	2.23		1049.2	SURCHARGED
E20.003	ES3308	15 Winter	30	+0%	30/15 Summer				146.801	0.547	0.000	1.02		1555.0	SURCHARGED
E23.000	ES1-P-P2A	15 Winter	30	+0%	30/15 Summer				146.409	0.399	0.000	0.78		559.3	SURCHARGED
E20.004	ES3307	15 Winter	30	+0%	30/15 Summer				146.310	0.510	0.000	1.47		2060.3	SURCHARGED
E20.005	ES3306	15 Winter	30	+0%	30/15 Summer				145.849	0.239	0.000	1.49		2054.2	SURCHARGED
E20.006	ES3305	15 Winter	30	+0%	100/15 Summer				145.177	-0.268	0.000	0.91		2051.2	OK
E24.000	ES1-P-R2	15 Winter	30	+0%	30/15 Winter				145.023	0.003	0.000	1.02		354.2	SURCHARGED
E25.000	ES1-P-QS2	15 Winter	30	+0%	30/15 Summer				145.067	0.037	0.000	1.20		434.3	SURCHARGED
E20.007	ES3304	15 Winter	30	+0%	100/15 Summer				144.682	-0.218	0.000	0.88		2575.6	OK
E26.000	ES1-P-R	15 Winter	30	+0%	100/15 Summer				144.073	-0.127	0.000	0.77		345.8	OK
E20.008	ES3303	15 Winter	30	+0%	30/15 Winter				144.020	0.020	0.000	1.00		2670.7	SURCHARGED
E20.009	ES3302	15 Winter	30	+0%	30/15 Winter				143.269	0.027	0.000	1.05		2663.1	SURCHARGED
E20.010	ES3301	15 Winter	30	+0%	100/15 Winter				142.297	-0.244	0.000	0.95		2670.5	OK
E20.011	ES409	15 Winter	30	+0%	2/15 Summer				140.295	0.525	0.000	1.90		2671.9	SURCHARGED
E1.022	EPOND 2	960 Winter	30	+0%	2/720 Winter				139.864	0.714	0.000	0.33		388.3	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.268 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status
									Level (m)	Depth (m)	Volume (m³)			Flow (l/s)	
E1.000	ES3L1	30 Winter	100	+0%	100/15 Summer				148.251	2.016	0.000	0.50		983.4	SURCHARGED
E2.000	ES3K1	15 Winter	100	+0%					148.108	-0.604	0.000	0.08		211.5	OK
E1.001	ES303	30 Winter	100	+0%	100/15 Summer				147.671	1.586	0.000	0.61		1206.6	SURCHARGED
E1.002	ES303A	30 Winter	100	+0%	100/15 Summer				147.528	1.613	0.000	0.57		1126.5	SURCHARGED
E1.003	ES304	30 Winter	100	+0%	100/15 Summer				147.463	1.778	0.000	0.79		1677.6	SURCHARGED
E3.000	EMH-C14	30 Winter	100	+0%	2/15 Summer				147.665	1.563	0.000	2.65		676.3	SURCHARGED
E1.004	EMH-C15	30 Winter	100	+0%	30/15 Winter				147.418	2.013	0.000	0.86		2112.0	SURCHARGED
E1.005	ES305	30 Winter	100	+0%	30/15 Summer				147.314	2.282	0.000	0.83		1997.3	SURCHARGED
E4.000	ESPK2	15 Winter	100	+0%					147.999	-0.020	0.000	1.00		261.3	OK
E4.001	ES314	15 Winter	100	+0%					147.575	-0.328	0.000	0.30		260.8	OK
E5.000	ES3316	15 Winter	100	+0%	100/15 Summer				150.121	0.428	0.000	0.91		69.8	SURCHARGED
E6.000	ES1-P-O	15 Winter	100	+0%	30/15 Summer				148.662	0.335	0.000	1.11		345.7	SURCHARGED
E5.001	ES3315	15 Winter	100	+0%	30/15 Summer				148.600	0.327	0.000	1.62		410.9	SURCHARGED
E5.002	ES3314	30 Winter	100	+0%	30/15 Winter				148.393	0.232	0.000	1.32		378.8	SURCHARGED
E7.000	ES1-P-N	15 Winter	100	+0%					148.390	-0.407	0.000	0.22		187.7	OK
E5.003	ES3313	30 Winter	100	+0%	100/15 Winter				148.310	0.210	0.000	0.98		521.8	SURCHARGED
E5.004	ES3312	30 Winter	100	+0%	100/15 Winter				148.000	0.566	0.000	0.68		791.6	SURCHARGED
E8.000	ES1-P-T	30 Winter	100	+0%	2/15 Summer				147.812	2.659	0.000	2.62		427.4	SURCHARGED
E5.005	ES3311	30 Winter	100	+0%	30/15 Summer				147.420	2.330	0.000	1.11		1132.0	SURCHARGED
E1.006	ES306	30 Winter	100	+0%	30/15 Summer				147.154	2.494	0.000	1.34		3283.7	SURCHARGED
E1.007	ES315	30 Winter	100	+0%	30/15 Summer				146.712	2.427	0.000	1.44		3158.4	SURCHARGED
E1.008	ES316	30 Winter	100	+0%	30/15 Summer				146.248	2.262	0.000	1.26		3029.5	SURCHARGED
E9.000	ESPM	30 Winter	100	+0%	100/15 Winter				145.997	1.960	0.000	0.84		888.5	SURCHARGED
E1.009	ES317	30 Winter	100	+0%	30/30 Winter	100/30 Winter			145.776	2.192	13.308	1.01		3410.8	FLOOD
E10.000	ESPV	30 Winter	100	+0%	100/15 Winter				145.509	1.383	0.000	0.03		9.6	SURCHARGED
E1.010	ES318	30 Winter	100	+0%	30/30 Winter				145.508	2.310	0.000	1.03		3271.5	FLOOD RISK
E1.011	ES319	30 Winter	100	+0%	30/30 Winter				145.220	2.358	0.000	0.92		3216.9	SURCHARGED
E11.000	ES321	15 Winter	100	+0%	2/15 Summer				146.168	2.152	0.000	3.22		244.4	SURCHARGED
E12.000	ES323 (H)	30 Winter	100	+0%	30/15 Summer				144.975	2.425	0.000	1.33		236.6	SURCHARGED
E1.012	ES320	30 Winter	100	+0%	30/30 Summer				144.913	2.463	0.000	0.86		3348.8	SURCHARGED
E13.000	ES3U1	30 Winter	100	+0%	30/30 Winter				144.719	1.969	0.000	0.31		888.7	SURCHARGED
E1.013	ES324	30 Winter	100	+0%	30/30 Summer				144.507	2.634	0.000	1.17		4147.8	SURCHARGED
E14.000	ES3T1	30 Winter	100	+0%	100/15 Winter				144.066	1.491	0.000	0.01		19.3	FLOOD RISK
E15.000	ES3U2	30 Winter	100	+0%	100/15 Winter				144.071	1.526	0.000	0.07		92.2	FLOOD RISK
E1.014	ES325	30 Winter	100	+0%	30/15 Winter				144.064	2.530	0.000	1.44		4147.6	SURCHARGED
E1.015	ES326	30 Winter	100	+0%	30/15 Winter				143.638	2.231	0.000	1.27		4133.8	FLOOD RISK
E16.000	ES3S1	30 Winter	100	+0%	30/30 Summer				143.209	1.851	0.000	0.20		278.3	SURCHARGED
E1.016	ES327	30 Winter	100	+0%	30/15 Winter				143.204	1.977	0.000	1.28		4226.7	SURCHARGED
E1.017	ES328	30 Winter	100	+0%	30/15 Winter				142.744	1.714	0.000	1.28		4221.9	SURCHARGED
E17.000	ES3T3	15 Winter	100	+0%	2/15 Summer	100/15 Summer			144.031	2.861	31.204	2.53		1267.7	FLOOD
E17.001	ES329A	30 Winter	100	+0%	2/15 Summer				143.087	2.167	0.000	3.36		1166.1	SURCHARGED
E18.000	ES3S2	60 Winter	100	+0%	30/15 Winter				142.313	1.463	0.000	0.54		314.2	SURCHARGED
E1.018	ES329	60 Winter	100	+0%	30/15 Winter				142.306	1.476	0.000	1.65		4962.1	SURCHARGED
E1.019	ES329A	60 Winter	100	+0%	30/15 Winter				141.676	0.984	0.000	1.61		4972.9	SURCHARGED
E1.020	ES330	60 Winter	100	+0%	30/15 Winter				141.044	0.504	0.000	1.69		4976.8	SURCHARGED
E19.000	ES3T2	15 Winter	100	+0%					141.216	-0.674	0.000	0.28		1029.5	OK
E1.021	ES331	30 Winter	100	+0%	100/30 Summer				140.499	0.087	0.000	1.35		5217.8	SURCHARGED
E20.000	ES1-P-X	15 Winter	100	+0%	30/15 Summer				148.392	1.260	0.000	1.01		589.5	SURCHARGED
E20.001	ES3310	15 Winter	100	+0%	30/15 Summer				148.336	1.286	0.000	0.39		562.4	SURCHARGED
E20.002	ES3309	15 Winter	100	+0%	30/15 Summer				148.131	1.495	0.000	0.39		537.2	SURCHARGED
E21.000	ES1-P-QS	15 Winter	100	+0%	30/15 Summer				148.006	1.607	0.000	0.43		163.0	SURCHARGED
E22.000	ES1-P-P2B	15 Winter	100	+0%	2/15 Summer				149.242	2.768	0.000	2.64		1240.5	SURCHARGED
E20.003	ES3308	15 Winter	100	+0%	30/15 Summer				147.933	1.679	0.000	1.26		1908.8	SURCHARGED
E23.000	ES1-P-P2A	15 Winter	100	+0%	30/15 Summer				147.386	1.376	0.000	0.97		697.0	SURCHARGED
E20.004	ES3307	15 Winter	100	+0%	30/15 Summer				147.293	1.493	0.000	1.78		2501.3	SURCHARGED
E20.005	ES3306	15 Winter	100	+0%	30/15 Summer				146.727	1.117	0.000	1.78		2451.1	SURCHARGED
E20.006	ES3305	15 Winter	100	+0%	100/15 Summer				146.173	0.728	0.000	1.07		2427.2	SURCHARGED
E24.000	ES1-P-R2	15 Winter	100	+0%	30/15 Winter				145.632	0.612	0.000	1.36		470.9	SURCHARGED
E25.000	ES1-P-QS2	15 Winter	100	+0%	30/15 Summer				145.641	0.611	0.000	1.55		558.4	SURCHARGED
E20.007	ES3304	15 Winter	100	+0%	100/15 Summer				145.582	0.682	0.000	1.02		2975.8	SURCHARGED
E26.000	ES1-P-R	15 Winter	100	+0%	100/15 Summer				144.791	0.591	0.000	0.99		441.8	SURCHARGED
E20.008	ES3303	15 Winter	100	+0%	30/15 Winter				144.646	0.646	0.000	1.17		3138.7	SURCHARGED
E20.009	ES3302	15 Winter	100	+0%	30/15 Winter				143.693	0.451	0.000	1.22		3095.5	SURCHARGED
E20.010	ES3301	15 Winter	100	+0%	100/15 Winter				142.664	0.123	0.000	1.09		3070.9	SURCHARGED
E20.011	ES409	15 Winter	100	+0%	2/15 Summer				140.548	0.778	0.000	2.19		3072.8	SURCHARGED
E1.022	EPOND 2	960 Winter	100	+0%	2/720 Winter				140.268	1.118	0.000	0.37		445.5	FLOOD RISK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 391450 411950 SD 91450 11950 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 0

										Water	Surcharged	Flooded			Pipe	Status
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Flow (l/s)	
E1.000	ES3L1	120 Summer	100	+0%					145.585	-0.650	0.000	0.33		645.0		OK
E2.000	ES3K1	120 Summer	100	+0%					148.064	-0.648	0.000	0.04		114.2		OK
E1.001	ES303	120 Summer	100	+0%					145.569	-0.516	0.000	0.41		808.2		OK
E1.002	ES303A	120 Summer	100	+0%					145.530	-0.385	0.000	0.42		819.1		OK
E1.003	ES304	120 Summer	100	+0%					145.474	-0.211	0.000	0.62		1315.8		OK
E3.000	EMH-C14	120 Summer	100	+0%	100/120 Summer				146.345	0.243	0.000	1.72		440.1	SURCHARGED	
E1.004	EMH-C15	120 Summer	100	+0%					145.383	-0.022	0.000	0.70		1708.3		OK
E1.005	ES305	120 Summer	100	+0%	100/120 Summer				145.196	0.164	0.000	0.69		1643.1	SURCHARGED	
E4.000	ESPK2	120 Summer	100	+0%					147.774	-0.245	0.000	0.56		145.5		OK
E4.001	ES314	120 Summer	100	+0%					147.522	-0.381	0.000	0.17		145.1		OK
E5.000	ES3316	120 Summer	100	+0%					149.593	-0.100	0.000	0.59		45.5		OK
E6.000	ES1-P-O	120 Summer	100	+0%					148.186	-0.141	0.000	0.62		192.8		OK
E5.001	ES3315	120 Summer	100	+0%					148.159	-0.114	0.000	0.98		250.0		OK
E5.002	ES3314	120 Summer	100	+0%					148.004	-0.157	0.000	0.89		256.9		OK
E7.000	ES1-P-N	120 Summer	100	+0%					148.335	-0.462	0.000	0.12		101.0		OK
E5.003	ES3313	120 Summer	100	+0%					147.868	-0.232	0.000	0.69		367.3		OK
E5.004	ES3312	120 Summer	100	+0%					147.131	-0.303	0.000	0.49		570.2		OK
E8.000	ES1-P-T	120 Summer	100	+0%	100/120 Summer				145.547	0.394	0.000	1.90		310.2	SURCHARGED	
E5.005	ES3311	120 Summer	100	+0%	100/120 Summer				145.336	0.246	0.000	0.84		857.7	SURCHARGED	
E1.006	ES306	120 Summer	100	+0%	100/120 Summer				145.130	0.470	0.000	1.08		2639.0	SURCHARGED	
E1.007	ES315	120 Summer	100	+0%	100/120 Summer				144.901	0.616	0.000	1.18		2579.1	SURCHARGED	
E1.008	ES316	120 Summer	100	+0%	100/120 Summer				144.674	0.688	0.000	1.00		2418.7	SURCHARGED	
E9.000	ESPM	120 Summer	100	+0%	100/120 Summer				144.624	0.587	0.000	0.54		569.0	SURCHARGED	
E1.009	ES317	120 Summer	100	+0%	100/120 Summer				144.405	0.821	0.000	0.82		2793.0	SURCHARGED	
E10.000	ESPV	120 Summer	100	+0%	100/120 Summer				144.217	0.091	0.000	0.01		4.5	SURCHARGED	
E1.010	ES318	120 Summer	100	+0%	100/120 Summer				144.212	1.014	0.000	0.84		2665.9	SURCHARGED	
E1.011	ES319	120 Summer	100	+0%	100/120 Summer				144.042	1.180	0.000	0.76		2660.5	SURCHARGED	
E11.000	ES321	120 Summer	100	+0%	100/120 Summer				144.606	0.590	0.000	1.91		144.9	SURCHARGED	
E12.000	ES323 (H)	120 Summer	100	+0%	100/120 Summer				143.951	1.401	0.000	0.85		151.3	SURCHARGED	
E1.012	ES320	120 Summer	100	+0%	100/120 Summer				143.846	1.396	0.000	0.72		2786.5	SURCHARGED	
E13.000	ES3U1	120 Summer	100	+0%	100/120 Summer				143.871	1.121	0.000	0.20		565.0	SURCHARGED	
E1.013	ES324	120 Summer	100	+0%	100/120 Summer				143.557	1.684	0.000	1.00		3543.5	SURCHARGED	
E14.000	ES3T1	120 Summer	100	+0%	100/120 Summer				143.228	0.653	0.000	0.01		10.6	SURCHARGED	
E15.000	ES3U2	120 Summer	100	+0%	100/120 Summer				143.234	0.689	0.000	0.05		59.0	SURCHARGED	
E1.014	ES325	120 Summer	100	+0%	100/120 Summer				143.229	1.695	0.000	1.24		3576.1	SURCHARGED	
E1.015	ES326	120 Summer	100	+0%	100/120 Summer				142.904	1.497	0.000	1.10		3578.0	SURCHARGED	
E16.000	ES3S1	120 Summer	100	+0%	100/120 Summer				142.582	1.224	0.000	0.15		206.5	SURCHARGED	
E1.016	ES327	120 Summer	100	+0%	100/120 Summer				142.577	1.350	0.000	1.12		3690.7	SURCHARGED	
E1.017	ES328	120 Summer	100	+0%	100/120 Summer				142.227	1.197	0.000	1.12		3695.6	SURCHARGED	
E17.000	ES3T3	120 Summer	100	+0%	100/120 Summer				142.752	1.582	0.000	1.61		807.8	SURCHARGED	
E17.001	ES329A	120 Summer	100	+0%	100/120 Summer				142.280	1.360	0.000	2.30		796.8	SURCHARGED	
E18.000	ES3S2	120 Summer	100	+0%	100/120 Summer				141.885	1.035	0.000	0.49		285.2	SURCHARGED	
E1.018	ES329	120 Summer	100	+0%	100/120 Summer				141.879	1.049	0.000	1.45		4370.1	SURCHARGED	
E1.019	ES329A	120 Summer	100	+0%	100/120 Summer				141.392	0.700	0.000	1.41		4378.6	SURCHARGED	
E1.020	ES330	120 Summer	100	+0%	100/120 Summer				140.903	0.363	0.000	1.49		4387.3	SURCHARGED	
E19.000	ES3T2	120 Summer	100	+0%					141.108	-0.782	0.000	0.15		554.4		OK
E1.021	ES331	120 Winter	100	+0%					140.412	0.000	0.000	1.18		4579.6		OK
E20.000	ES1-P-X	120 Summer	100	+0%					146.824	-0.308	0.000	0.65		381.1		OK
E20.001	ES3310	120 Summer	100	+0%					146.482	-0.568	0.000	0.27		395.2		OK
E20.002	ES3309	120 Summer	100	+0%					146.375	-0.261	0.000	0.27		381.3		OK
E21.000	ES1-P-QS	120 Summer	100	+0%	100/120 Summer				146.427	0.028	0.000	0.27		103.4	SURCHARGED	
E22.000	ES1-P-P2B	120 Summer	100	+0%	100/120 Summer				146.900	0.426	0.000	1.73		814.2	SURCHARGED	
E20.003	ES3308	120 Summer	100	+0%	100/120 Summer				146.293	0.039	0.000	0.83		1257.5	SURCHARGED	
E23.000	ES1-P-P2A	120 Summer	100	+0%	100/120 Summer				146.132	0.122	0.000	0.57		411.6	SURCHARGED	
E20.004	ES3307	120 Summer	100	+0%	100/120 Summer				145.981	0.181	0.000	1.18		1654.1	SURCHARGED	
E20.005	ES3306	120 Summer	100	+0%	100/120 Summer				145.689	0.079	0.000	1.21		1666.4	SURCHARGED	
E20.006	ES3305	120 Summer	100	+0%					145.070	-0.375	0.000	0.74		1674.8		OK
E24.000	ES1-P-R2	120 Summer	100	+0%					144.803	-0.217	0.000	0.73		254.5		OK
E25.000	ES1-P-QS2	120 Summer	100	+0%					144.852	-0.178	0.000	0.84		302.8		OK
E20.007	ES3304	120 Summer	100	+0%					144.528	-0.372	0.000	0.74		2168.6		OK
E26.000	ES1-P-R	120 Summer	100	+0%					143.913	-0.287	0.000	0.54		241.1		OK
E20.008	ES3303	120 Summer	100	+0%					143.723	-0.277	0.000	0.89		2385.2		OK
E20.009	ES3302	120 Summer	100	+0%					142.999	-0.243	0.000	0.95		2397.6		OK
E20.010	ES3301	120 Summer	100	+0%					142.238	-0.303	0.000	0.85		2404.6		OK
E20.011	ES409	960 Winter	100	+0%	100/120 Summer				140.278	0.508	0.000	0.33		470.8	SURCHARGED	
E1.022	EPOND 2	960 Winter	100	+0%	100/120 Summer				140.272	1.122	0.000	0.37		446.1	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

Appendix C – As-built drawings of Ponds and Flow Control

- ### IMPORTANT CDM / H&S NOTE

THE "AS BUILT" INFORMATION CONTAINED WITHIN THIS DRAWING HAS BEEN PROVIDED BY PRINCIPAL CONTRACTOR

AND REPRESENTS AN AS BUILT RECORD OF THE WORKS CARRIED OUT FOR:

VERIFIED AS A TRUE RECORD BY THE ABOVE CONTRACTORS REPRESENTATIVES

THE AS BUILT INFORMATION PROVIDED BY THE ABOVE COMPANY IS NOT
WARRANTED BY WYG.

AB1	AS BUILT ISSUE				
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Wilson Bowden
Developments

Project

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Project	Kingsway Business Park		
Document Number	KBP-BWB-ZZ-XX-RP-CD-0004	BWB Ref	NTW2889
Author	David Gray	Status	S2
Checked	Matthew Bailey	Revision	P1
Approved	Rowan Jobling	Date	15.07.2022

Summary of Surface Water Sewer Modelling

- 1.1. This Technical Note provides a summary of the detailed hydraulic modelling exercises undertaken to date on the surface water sewers that serve the Kingsway Business Park.
- 1.2. The drainage strategy across the business park is split into three distinct catchments (as shown on **Figure 1.1** below).

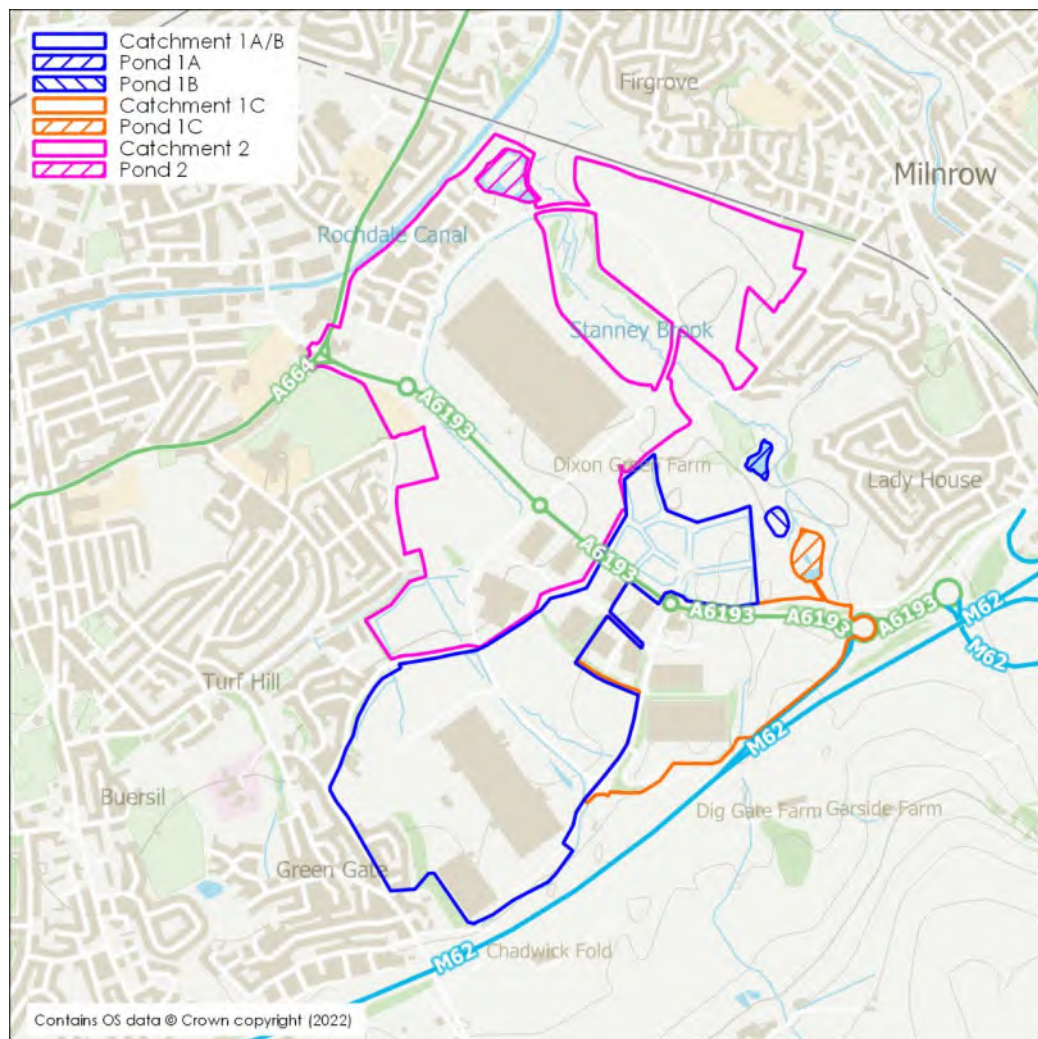


Figure 1.1: Business Park overall indicative catchments and attenuation ponds

- 1.3. Each drainage catchment is served by separate piped systems discharging to separate attenuation features. The existing drainage was constructed in 1999 and the hydraulic modelling exercises have shown that the surface water sewers have been designed to accommodate the 1 in 100-year storm event with no allowance for climate change for all plots across the business park.
- 1.4. Detailed hydraulic modelling and drawings for each drainage catchment are covered by individual reports, as listed below:
- Catchment 1A/1B – Report reference KBP-BWB-ZZ_XX-RP-CD-0001
 - Catchment 1C – Report reference KBP-BWB-ZZ_XX-RP-CD-0002
 - Catchment 2 – Report reference KBP-BWB-ZZ_XX-RP-CD-0003
- 1.5. **Table 1.1** (below) lists which Drainage catchment each development plot discharges to:

Table 1.1: Drainage Catchment Split per Plot

Drainage Catchment	Development Plots
1A/B	E (West), F, G, I, J1, J2, W
1C	C1, D1, D2, D3, D4, E(East), H
2	K, L, M, N, O, P1, P2, P3, Q, R, S, T1, T2, U1, U2, V, X

Design Parameters and Assumptions

- 1.6. The design parameters and assumptions used for each catchment vary depending on the level of information that was available at the time of the modelling work. Catchment specific information is stated in each report and key parameters are listed below:
- Impermeable areas generally taken as 90% for industrial areas and 65% for residential areas
 - Impermeable areas for roads taken as 100%
 - Where plots have been constructed, a more detailed estimate of impermeable area has been used based on the detailed drainage design
 - Network model simulation criteria set to default settings in MicroDrainage 2019.1.
 - Simulations have been run for the network model using the 'Seasonal Return Period Wizard' for all storm durations for the 1 in 100-year event on 2.5 second increments with Dynamic Time Step turned off, Dynamic Viscous Dampening and Inertia turned on.

- Simulations have been run using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies.
- The detention basin volumes have been checked by recreating them in AutoCAD Civils 3D Software before being input into the MicroDrainage Network Model.
- Note that the original drainage system was designed using FSR rainfall (as stated within 'Attenuation Ponds Health & Safety File'), however FEH simulations have been ran as a sensitivity test for the recreated network model.

Summary of findings from Catchment 1A/1B

- 1.7. The report and modelling results were reviewed and accepted by United Utilities and Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.8. A summary of the findings from the as-built drainage study is below:
 - The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum water level in the pond was higher than the original Section 104 design and is predicted to overtop the weir wall once all plots within the catchment have been developed.
 - The peak flow rate from Pond 1A/1B is shown to be lower than the consented flows to the Stanney Brook.
 - Several options were investigated to remedy the overtopping of the weir wall. The option suggested in the drainage study report was to raise the weir wall by 200mm which solved the overtopping issue.
 - In subsequent conversations and meetings with Rochdale Borough Council's drainage engineer, Stephen McCann, it was agreed that the existing orifice plate flow control would be replaced with a larger diameter orifice plate. This option lowers the anticipated maximum water level within the pond to below the weir level while maintaining peak flows below the consented flows.
 - During a site visit, it was observed that the flow control could be liable to becoming blocked with vegetation and litter. To lower the risk of future blockages, it has also been agreed to install a debris screen over the flow control.

Summary of findings from Catchment 1C

- 1.9. The report was issued to United Utilities and Rochdale Borough Council
- 1.10. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum modelled water level within Pond 1C is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 1C is considered to be operating efficiently, safely and in line with the original design.

Summary of findings from Catchment 2

- 1.11. The report and modelling results have been reviewed and accepted by Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.12. Untitled Utilities have reviewed the report and commented on some minor flooding located within Sir Isaac Newton Way. This was discussed with United Utilities who were happy with the explanation and had no further concerns (correspondence contained within **Appendix A**).
- 1.13. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with one area of minimal flooding within Sir Isaac Newton Way.
 - The flooding was in the short duration, high intensity rainfall event and would be expected to pond within the road corridor for a short time before draining back into the sewer network once the peak storm has passed.
 - The flooding in the sewer network is unrelated to water levels in Pond 2.
 - The maximum modelled water level within Pond 2 is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 2 is considered to be operating efficiently, safely and in line with the original design.

Appendix A

Correspondence with United Utilities and Rochdale Borough Council

David Gray

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 19 August 2021 20:36
To: David Gray; Rowan Jobling; Iqbal Rassool; Wastewater Developer Services
Cc: Matthew Bailey; Stephen McCann; Ward, David; John Copestake; Brennan, Adam; Walker, Jillian
Subject: GENQ 4200041062 Kingsway Business Park, Rochdale OL16 4JN

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good evening all and thank you for taking my call earlier David,

Firstly I would like to thank bwb for pulling together the modelling report, it has certainly helped clarify matters. Following a conversation between myself and Stephen McCann at the Lead Local Flood Authority we are now in a position to accept the proposed modelling report essentially as a drainage masterplan for the Business Park moving forward. However, we would request that this is subject to the provision of the mdx. Microdrainage model files being provided to Stephen at the Council for review against the modelling report to ensure its accuracy.

Once reviewed and the Lead Local Flood Authority are happy with the model outputs we will both be providing comments on the individual plots/below planning applications in turn:

DC/21/2987 – 21/00881/REM
DC/21/3213 – 21/01039/DOC
DC/21/3492 – 21/01041/DOC

As a point of note, we understand that there are a number of concerns the Lead Local Flood Authority have about Plot J2 which should be addressed but this sits outside United Utilities remit to comment.

I am on annual leave from tomorrow until Tuesday 24th August and for further information in my absence, I would suggest that Stephen McCann or David Gray would be best pace to answer any queries but I hope that this brings everyone together onto the same page.

Kind regards,



Robert Brenton
Developer Engineer
Developer Services & Metering
Customer Services
M: 07880299827
unitedutilities.com

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David Gray

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 16 November 2021 17:07
To: David Gray; john.ruckledge@environment-agency.gov.uk; Darren Clark; Tracy Hibbert; Gerard Proudman; Michael Cummings
Subject: Kingsway park pond 1A - minor change of orifice plate on outlet to Stanney Brook.

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

To All

The matter of the capacity and flow discharge from the Kingsway Park Drainage Ponds to Stanney brook was raised when BWB submitted Drainage Details for Planning Applications for the latest Kingsway Plots G, I and J2. When BWB ran the drainage model with the new plots being developed it was realised that the pond would just overtop in a 1 in 100 year storm including climate change allowance of 40%. Although this is a rare event, it was deemed necessary to avoid the overtopping. David Gray looked at options and came up with a simple but effective proposal:-

- to change the low level orifice plate in the outlet weir wall (to Stanney Brook) from 200 to 226mm dia.

This does not require major works and will fulfil the original agreed discharge flow rate to Stanney Brook. It will also keep water levels under the crest of the weir wall, and maintain a minimum of 300mm freeboard within the pond.

Therefore, I am suggesting that David Gray now organises the replacement of the orifice plate. In terms of installation, BWB will need to arrange to do this when water levels are low and obtain access through the gates. I have advised David that he can contact Michael Cummings to arrange access?

There is an email trail below.

Any comments / queries – please address them to David and myself.

I can forward the diagram of the location of the orifice plate – upon request.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



☎ 01706 924606

📠 07552 570262

✉ stephen.mccann@rochdale.gov.uk

Rochdale Borough Council
Floor 2, Number One Riverside
Smith Street, Rochdale, OL16 1XU

From: David Gray <David.Gray@bwbconsulting.com>

Sent: 07 November 2021 16:30

To: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>

Cc: Iqbal Rassool <Iqbal.Rassool@bwbconsulting.com>; Peter Davies <Peter.Davies@bwbconsulting.com>; Darren Clark <Darren.Clark@gleeds.com>; Davies, Nick <nick.davies@wilsonbowden.co.uk>; Ellis, Dave <dave.ellis@wilsonbowden.co.uk>; Henson, Henry <henry.henson@wilsonbowden.co.uk>

Subject: RE: Kingsway - Question to EA re. Weir Wall to Stanney Brook

Hi Steve,

Following our discussion last week on the weir wall at Kingsway after reviewing John's email below, I have remodelled the outflow orifice so that the proposed flows are closer to the consented flows of 304 l/sec. The modified orifice is 226mm diameter (upsized from 200mm) with the higher orifice remaining as 250mm. This seems like an eminently sensible resolution.

This does lower water levels within the basin to just below the existing weir wall as shown in the extracts from Microdrainage below. The existing weir is set at 148.25m, the modelled water level is shown to be 148.231m and the flow is 303.4 l/sec.

From previous conversations, you suggested that you would be happy with the original situation, however John's email suggests that the outflow from the pond needs to stay within the consented discharge, which we understand to be 304 l/sec. In this situation, who makes the final decision on the acceptable flow rates? At the Outlet from Pond 1A, Stanney Brook is classed as Ordinary Watercourse so falls under the remit of the LLFA so I would think that myself as LLFA Officer can approve this modification to the orifice plate. Stanney Brook changes to 'Main River' after crossing Buckley Hill lane.

The revised hydraulic modelling shows that altering the orifice does lower the estimated water levels to just below the existing weir wall while keeping within the 304 l/sec flow rate, would this proposal be acceptable to RBC?

I understand that RBC are responsible for maintenance of the pond, are you able to confirm if this extends to the outfall structure as well? If not, are you able to confirm who is responsible for the outfall structure? I understand that Environment received monies from the Developer and now maintain the pond and structures. The managers are Tracy Hibbert and Gerard Proudman who have been cc'd to this email.

I am happy to run through the revised modelling and discuss with yourself this week and agree the best way forward.

Kind Regards

David Gray

Principal Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
M 07437 015 337 T 0115 924 1100

David Gray

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 22 April 2022 15:52
To: David Gray
Subject: FW: Drainage Consultation Ref: 22/00373/FUL Plot M Kingsway
Attachments: Drainage Consultation 22-00373 FUL.docx

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Hi David,

For your ref. see appended and below.

Thanks v much for sending all the extra info this morning. The complexity of the mdx models is beyond my familiarity with using MicroDrainage but your explanations filled in the gaps so I have been able to be confident in 'approving' the proposals.

regards

Stephen McCann

Drainage & Flooding Engineer
Highways, Property & Strategic Housing



ROCHDALE
BOROUGH COUNCIL

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📠 07552 570262

✉ stephen.mccann@rochdale.gov.uk

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Please consider the environment before printing this email.

From: Stephen McCann
Sent: 22 April 2022 15:50
To: Michael Doyle <Michael.Doyle@Rochdale.Gov.UK>; 'Mohammed.Aljafarawi@uuplc.co.uk' <Mohammed.Aljafarawi@uuplc.co.uk>
Subject: Drainage Consultation Ref: 22/00373/FUL Plot M Kingsway

Hello Michael (Principal Planning Officer) and Mohammed (UU Engineer),

[Kingsway Hydraulic Modelling, Catchment 2 - 4200045304](#)

I have written my consultation, appended.

The two MicroDrainage Models, which Mohammed asked me to look at are pretty complex. I've talked to David Gray of BWB a couple of times about this and he's shown me the models in online Teams Screenshare and he has provided details to satisfy me that the system is well designed.

Mohammed, feel free to ring me to discuss OR you can ask David Gray. There are quite large flows coming off Plot M into the adopted Michael Faraday Ave sewer, but this was originally planned as such.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



 01706 924606

 07552 570262

 stephen.mccann@rochdale.gov.uk

Rochdale Borough Council

Floor 2, Number One Riverside

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