AXIS J9 (PHASE 3)

HOWES LANE, BICESTER

Site-Specific Flood Risk Assessment & Drainage Strategy

Issue 3

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BAILEY

JOHNSON

HAYES

CONSULTING ENGINEERS

SUITE 4
PHOENIX HOUSE
63 CAMPFIELD ROAD
ST ALBANS
AL1 5FL

Tel: 01727 841172
Fax: 01727 841085
Email: james.griffiths@bjh.co.uk
Email: wb@bjh.co.uk

Client – Albion Land Ltd

Project Ref – S1209 (Phase 3)

SITE SPECIFIC FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

CONTENTS

APPENDIX

1 DEVELOPMENT DESCRIPTION AND LOCATION

1a. What type of development is proposed and where will it be located?

The 6.5 Ha Axis J9 (Phase 3) site is located adjacent to Howes Lane, Bicester. The proposed industrial/commercial development is submitted for 16,942 sq metres GIA as shown on Cornish Architects Site Plan numbered 20019-TP-002F found in **Appendix A**. This is to be divided into 11 Units.

The total site owned by the client is in excess of 20 Ha with Phases 1 & 2 of Axis J9, which represents 70% of the development, already constructed and fully operational for industrial and commercial use. In addition, S278 road works have been completed to provide new access to the development from Middleton Stoney Road with upgraded drainage facilities. The new on-site estate road is now known as Empire Road. Phase 3 would be the final phase at Axis J9.

The site is currently undeveloped greenfield land with no impermeable areas. Topographical levels and details of the existing site can be found in **Appendix B**. Approximately 3.2 Ha of impermeable area is to be constructed post-development to provide buildings, access roads, service yards and car parking.

A new access road will need to be constructed in co-ordination with the Strategic Link Road (SLR) planned by Oxfordshire County Council. This will be necessary in order to connect Phases 1 & 2 to the new development in Phase 3. The design of the link road drainage has been scoped out of this FRA/Drainage Strategy. The SLR will have independent SuDS design & likely discharge into nearby ditches.

SuDS have been utilised on this site in the form of permeable car park construction where parking is not directly exposed to HGV's. Two Swales are proposed to provide online storage with Hydro-brake Manhole flow control devices to limit discharge into the wider-site drainage at Greenfield QBAR rate of 10 l/s. There are no significant areas of public open space proposed.

1b. What is its vulnerability classification?

The Scheme is classified as "less vulnerable".

1c. Is the proposed development consistent with the Local Development Documents?

The Development is consistent with the Local Development Plan.

1d. Please provide evidence that the Sequential Test or Exception Test has been applied in the selection of this site for this development type?

The Site is located in Flood Zone 1 Area and therefore the Site is appropriate.

2 GEOLOGY, HYDROLOGY AND DRAINAGE

2a. What constraints exist that must be considered for infiltration SuDS?

The ground conditions underlaying the site comprise dominant clay with subordinate hard limestone rock bands. These conditions are anticipated to be practically impermeable / of very low permeability. Hence, conventional Soakaways are not considered viable and an alternative drainage solution is recommended. Specific Soakaway or permeability testing have not been carried out on the advice of the ground investigation report produced by Applied Geology in January 2019.

2b. What is the drainage potential of the ground?

Very low permeability.

2c. What is the potential for ground instability?

It is considered that the in-situ Cornbrash Formation strata that underlays the majority of the site is suitable to support conventional strip/trench fill or pad foundations. Given the site's relative flatness it is highly unlikely there will be any stability issues.

2d. What is the potential for deterioration of groundwater quality?

Generally, ground water has been encountered at significant depths of 7.3m to 9.5m bgl. In some areas ground water in these boreholes did rise to up to 1m above ground level, indicating artesian pressure at significant depths. Given that the majority of construction works are to be at a shallow depth and no discharge is proposed into the ground at depth there will be a negligible effect on groundwater quality from the proposed development.

2e. What flood zone is the site located in?

Flood Zone 1 as shown on the EA Flood Map for Planning in **Appendix C.**

2f. What existing watercourses exist on the site?

The site is bounded by field boundary ditches on the western, northern, and eastern boundary adjacent to Howes Lane. Flows from these ditches' outlet in the north-east corner of the site discharging into an existing culvert which runs under the Howes Lane and into nearby housing estate.

The ditches on the site remain in good working condition with regular flow.

3 ASSESSMENT OF EXISTING FLOOD RISKS

3a. What sources of flooding could affect the site?(see Annex C PPS25).

We have considered all sources of potential flooding as follows:-

Fluvial (Rivers)

- Inundation of floodplains from rivers and watercourses
- Inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels
- Overtopping of defences
- Breaching of defences
- Blockages of culverts
- Blockages of flood channels, or flood corridors.

Tidal

- Sea
- Estuary
- Overtopping of defences
- Breaching of defences
- Other flows (fluvial surface water) that could pond due to tide locking
- Wave action.

Surface Water

- Sheet run – off from adjacent land (urban or rural)
- Surcharged sewers (Combined, foul or surface water sewers).

Groundwater

- Water table rising after prolonged rainfall to emerge above ground level remote from a watercourse.
- Most likely to occur in low lying areas underlain by permeable rock (aquifers).
- Groundwater recovery after pumping has ceased for mining or industry.

Infrastructure Failure

- Reservoirs
- Canals
- Industrial processes
- Burst water mains
- Blocked sewers or failed pumping stations.

The site does not have a history of Flooding and only localised flooding could occur due to blocked or inadequate drainage facilities.

3b. *For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available.*

- For fluvial flooding to occur significant inundation would need to build in the ditches discharging in north-east corner of the site. Given that the site is located at a higher level than surrounding housing areas, there is negligible risk of fluvial flooding to the site.

- There has been some recent history of the Howes Lane culvert overflowing into local gardens. In order to prevent damage to the wider housing catchment the culvert under Howes Lane will need to be upgraded.

- The site is located significantly away from the nearest sea, estuary, canal, or reservoir so flooding from all these sources is negligible risk.

- If piled foundations were used then groundwater flooding may occur due to rising artesian pressures. As described in the previous section, groundwater is of a significant depth (>7m bgl) therefore given the shallow construction and industrial use of the site, flooding from this source is low risk.

- The site benefits from falls across the site of approximately 1 in 80 towards ditches adjacent to Howes Lane. The likelihood of surface water flooding from the site is very low due to the absorbent topsoil overlaying the whole site and ditches at the low point of the site to convey flows off-site.

- There are no existing public surface water sewers on the site. In the north-east corner of the site is an existing foul water manhole. There is a risk of this becoming surcharged in extreme weather therefore risk remains low overall.

3c. *What are the existing surface water drainage arrangements for the site?*

Surface Water from the Site outfalls into the existing ditches along Howes Lane. See below Figure 1 for Existing Drainage Regime.

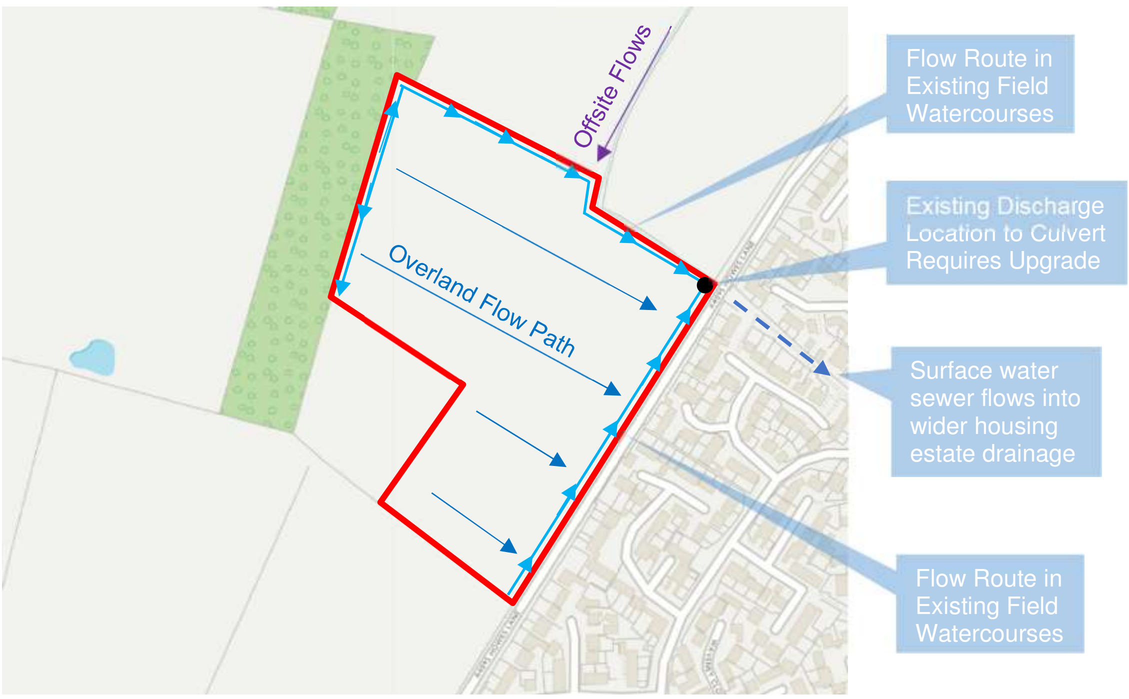


Figure 1 – Runoff Flow Routes

4 FLOOD RISK MITIGATION MEASURES

4a. How will the site be protected from flooding, including the potential impacts of climate change, over the development s lifetime?

- The existing culvert under Howes Lane is adopted. We confirm that upgrades are necessary to reduce flood risk off-site.
- Future discharge from impermeable areas is to be directed to the new formal 30 l/s hydro brake connection commissioned during Phase 1 & 2. This will result in reduced flows into the existing culvert thus minimising flood risk in the local catchment significantly.
- The on-site SuDS features are designed to cater for a 1 in 100-year + 40% Climate Change storm event, without causing flood risk to buildings. In addition, extra storage volume allowance is made for 80% of the 1 in 10-year storm event to reduce and mitigate residual risk of follow-on storms.
- As the development is to include car parks, service yards and roads where HGV's spend extended periods of time, to prevent pollution into the surface water system by-pass petrol interceptors should be provided accordingly.
- All the possible SuDS options will be assessed in order to provide the most comprehensive design for future climate change.
- Proposals to route exceedance flow through the development so that runoff does not adversely affect the development or surrounding areas.

Please see Table below summarising the Flood Risk:

Flood Source	**Potential Risk**				**Description**
	High	**Medium**	**Low**	**None**	
Fluvial/River/Sea			X		Located within Environment Agency River Flood Zone 1
Groundwater			X		No recorded history of Groundwater flooding
Canals				X	None present on or adjacent to site
Reservoirs				X	The site is outside the zone of reservoir failure risk
Sewers				X	None present on or adjacent to site.
Surface Water Runoff/Flows			X		Levels locally are at moderate falls, significant exceedance runoff velocity unlikely.
Effect of development on wider catchment			X		Exceedance flow routes directed to low areas of the site away from buildings on/off-site.

5 ASSESSMENT OF SUDS FEATURES

5a. Has the OCC SuDS Management Train been adopted for the design?

This assessment has been carried out in compliance with the Oxfordshire County Council (OCC) SuDS design guidance and The SuDS Manual C753. Axis J9 (Phase 3) is considered a major development as the development exceeds over a hectare in size.

The OCC management train has been adopted in the design process as follows:

- **Prevention** Prevention of runoff by good site design and reduction of impermeable areas.
- **Source Control** Dealing with water where and when it falls (e.g. infiltration techniques)
- **Site Control** Management of water in local area (e.g. swales, detention basins)
- **Regional Control** Management of runoff from sites (e.g. balancing ponds, wetlands).

5b. What are the proposed SuDS features for this development?

The proposed surface water system, presented by Bailey Johnson Hayes in **Appendix D** consists of the following SuDS components:

- Swales.
- Permeable Paving.
- Petrol Interceptors
- Catchpits, Gullies and Line Drains.

5c. Have calculations been provided to justify Drainage Design?

Calculations completed on MircoDrainage software are presented by Bailey Johnson Hayes in **Appendix E** consists of the following calculations:

- No above ground flooding for any conventional element of the drainage system for the critical 1 in 30-year event.
- No flooding from the drainage system to property or critical/sensitive infrastructure for the 1 in 100-year + 40% event.

5d. Is the site suitable for Infiltration/Soakaway features?

It is desirable on all sites in the UK, in the first instance that SuDS infiltration systems are considered, to reduce impermeable hard standing and treat run-off at source. Unfortunately, due to underlying clay layers to depths of greater than 5m bgl, this site is assessed to have ‘low’ permeability potential. Therefore, the use of infiltration systems such as **Soakaways** to discharge into the ground are not appropriate.

5e. Has justification for all SuDS features been provided?

Swale features have been considered for this site in order to provide a vegetated channel for the conveyance and storage of surface water. At headwall and outlet positions Riprap stones set into concrete will be introduced to reduce flows and lessen topsoil erosion near high velocity discharge and throughout the swale. The banks of the swale will be lined with approximately 300mm of topsoil with 1 in 3 slopes (max), to encourage growth of grass and local wildlife. Nominal longitudinal falls of 1 in 1000 (min) within the swales will prevent ponding of water resulting in reduced maintenance costs and increased performance.

Permeable Paving systems have been proposed for this site in order to reduce flow velocity and increase storage attenuation. Permeable paving is not appropriate in areas which are regularly trafficked by HGV's however, there is an opportunity in car parks. As there is no infiltration a 'Type C' system is to be utilised which is lined with an impermeable membrane at formation. In order to drain the permeable area, perforated pipes are provided in order to drain sub-grade layer.

Attenuation Tanks could be appropriate for this site. Care should be taken to provide appropriate cover over the tank to prevent long term damage and failure. Access points should be designed so the tanks can be maintained over its design life. As a result, tanks should not be located near buildings or HGV trafficked areas. The tank should be sealed with a welded membrane in order to prevent rising groundwater egress and reduction of storage volume. Due to the volume storage requirements being met by swales, attenuation tanks are not required.

Line Drains with **Catchpits** are recommended in the yards to meet the load requirements of HGV wheels and for easy maintenance. These features can easily be maintained to keep them free of silt and other potential contaminates over the design life. As only light contamination is expected, a Class 1 By-pass **Petrol Interceptor** is recommended for flows generated in the yards to increase water quality to acceptable levels before discharge into the site and wider-site drainage systems. See section 6 for more information on water quality.

This site is to be used predominantly for industrial storage facilities**. Rainwater Harvesting Systems** were not considered on this site due to the buildings low water demand and significant increase in maintenance cost to the end user. The height to the roof ridge is over 10m in most cases. **Green Roofs** are deemed to present an unacceptable risk to those maintaining the SuDS feature for this site. Access to the roof is to be provided for emergency roof maintenance only.

The use of **Filter Strips** or **Filter Drains** is not considered appropriate for this site due to the likelihood of HGV's regularly trafficking the yards. The run-off generated from this site is to be collected by a heavy-duty line drains and treated by petrol interceptors before discharge. The construction of gently sloping landscaped areas to drain run-off was not considered practical on this site. If spillages did occur, they could cause contamination issues in surrounding areas.

Efforts have been made to reduce impermeable area on the site, using permeable paving systems where possible as well significant ecological soft landscaping. Petrol interceptors have been provided to all yards to improve water quality discharge into the wider site. We believe that the SuDS components presented above meet the criteria set out by Oxfordshire County Council (LLFA) and Cherwell District Council (LPA) requirements. A landscaping strategy has been developed to increase biodiversity within allocated zones of this site.

6 WATER QUALITY ASSESSMENT

A Water Quality Assessment (WQA) has been undertaken below to assess the potential hazards from the site and the appropriateness of the SuDS features considered. The 'Simple Index Approach' from The SuDS Manual is used as follows:

Step 1 – Define Pollution Hazard Indices

6a. An assessment has been undertaken in Table 1 to define the potential level of hazard from different drained surfaces within the proposed development.

Table 1 – Hazard Pollution Indices for each Land Use

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Typical Industrial Roof	Low	0.3	0.3	0.05
Non-residential car parking e.g. offices	Low	0.5	0.4	0.4
Commercial Yard and Delivery Area and Parking	Medium	0.7	0.6	0.7
Sites with lorry parks and approaches to industrial estates	High	0.8	0.8	0.9

Note: The indices range from 0 (no pollution hazard) to 1 (high pollution hazard).

Step 2 – Determine SuDS Pollution Mitigation Indices

6b. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index ≥ Pollution Hazard Index
(for each contaminant type) (for each contaminant type)

Where the only destination of the runoff is to surface water – that is there is no infiltration from the SuDS to the groundwater – the surface water indices should be used. Where the principal destination of the runoff is to groundwater, but discharges to surface waters may occur once the infiltration capacity is exceeded, the groundwater indices should be used. The risk to surface waters will be low, as dilution will be high for large events, so treatment is not required. The table below indicates the mitigation indices of SuDS features used to discharge groundwater.

Indicative SuDS mitigation indices for discharges to surface waters:

Table 2 – Mitigation Indices for each SuDS feature

	Mitigation Indices		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Swale	0.5	0.6	0.6
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Proprietary treatment systems	**These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.**		

Step 3 – Conclusions and Recommendations

6c. For roof water drainage it is suggested that flows from this surface type are directed to any of the SuDS options available. Generally, low contamination is expected from the roof and therefore all proposed SuDS solutions satisfy the water quality requirements. It would be preferential to outlet into an open feature so that if any small wildlife became trapped in the system they would be able to escape more easily.

6d. Permeable paving is an option within the car parking areas. In terms of water quality, it is completely satisfied for water quality indices due to the nature of runoff filtering through the open graded stone. Thereafter, it gets a second layer of filtration as it moves into the appropriate soil. Permeable paving would be highly recommended in the car parks as it would also reduce the impermeable area of the site and mimic existing drainage.

6e. Surface water generated by yards and delivery areas is considered a 'Medium' water pollution hazard from Table 1. Runoff generated in these areas would not be adequately treated by infiltration basins or swales alone. As a result, a petrol interceptor has been specified to treat runoff to acceptable EA standard levels for each unit. This approach is considered adequate to treat runoff, subject to implementation of a certified petrol interceptors.

6f. As proposals are for general storage and distribution and details of end user requirements remain unclear an assessment has been made based on moderate future industrial use at the development. Multiple features benefiting water quality like Permeable paving, Swales and petrol interceptors have been considered for this site. If these SuDS features are provided in the final detailed design and constructed accordingly then water quality would be discharged at an acceptable quality.

7 DETAILED DRAINAGE PROPOSALS

7a. Has the drainage discharge hierarchy been followed?

The Oxfordshire County Council drainage discharge hierarchy has been followed with justification for each provided below:

1. Discharge to infiltration / Soakaway is not appropriate as the site is underlain by clay strata of very low permeability.

2. Discharge to a watercourse is achievable on this site as there are multiple accessible ditches of good quality and adequate capacity.

3. Discharge to a sewer is not possible on this site. No public surface water sewer connections exist on site.

4. Discharge to a combined sewer is not necessary on this site. Although there is an adopted foul water manhole within the site there are other more acceptable means of discharge for this development.

7b. Is evidence provided to justify discharge to an Ordinary Watercourse?

Discharge is to the wider-site drainage system which already has an approved discharge connection to a watercourse. The whole development (Inclusive of Phase 3) has been designed to discharge into a watercourse on the south-west corner of the site at no more than QBAR of 30 l/s.

Further details of the Phase 1 & 2 drainage system can be found in **Appendix F.**

7c. What are the existing rates and volumes of run-off generated by the site?

The Greenfield Run-Off for the Phase 3 Site is assessed at 10.4 l/sec for the QBAR average storm event.

7d. How is flood risk at the site likely to be affected by Climate Change?

It is accepted that climate Change is occurring however this Site is unlikely to be at risk of flooding. The risk should remain in Zone 1, i.e. 1 in 1000.The Drainage System is designed for a 100 year event + 40% for Climate Change.

7e. *How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?*

Surface Water out-flows from the Site will be restricted to less than “Greenfield” run-off at 10 l/sec. All mitigation measures will be put in place before first occupation of the site to reduce risk to everyone on & off site.

7f. What flood-related risks will remain after you have implemented the measures to protect the site from flooding?

The flood risk on completion of the Development will be low and only related to blockages to pipework and Maintenance of SuDS features.

7g. How, and by whom, will these risks be managed over the lifetime of the development.

The Drainage Systems will be managed by the Site Management Company as per the management and maintenance plan (**See Appendix G)** for the rest of the Axis J9 development.

7h. What are the foul drainage proposals for the site?

The drainage for the site has been designed in compliance with Building Regulations Part H and recommendations in Sewers for Adoption (8th Ed.). It is anticipated that foul flows will be domestic waste only from toilets, showers and handwash basins. No provisions have been made for trade effluent. All flows are to be directed into a new independent gravity system which is to discharge to an existing foul manhole in the north-east corner of the site. Wash down foul gullies are provided to all external bin stores across the Phase 3 site.

The maximum peak flow from the Axis J9 Phases 1&2 rising main is **7.5 l/sec**. In contrast, the maximum anticipated peak flow from Phase 3 is **2.5 l/sec**. Therefore overall, the average daily flow into the Thames Water adopted sewer is 1.7 l/sec and maximum peak flow is **10 l/sec**. Please see below capacity assessment for further details of daily and peak flow estimates.

Thames Water recommended daily average flow rates:

- Warehouse = 150 l/day/100m^2
- Offices = 75 l/day/10m^2

Table 3 – Summary of Area's Assessed for Foul Flow

Building	Warehouse Area	Office Area
Units 1-3	5,250 m^2	-
Unit 4	4,500 m^2	300 m^2
Unit 5	3,500 m^2	500 m^2
Unit 6-10	2,300 m^2	-
Unit 11	650 m^2	-
Total	**16,200 m^2**	**800 m^2**

Warehouse est. daily flow = 150*(16,200/100) = 24,300 l/day (0.281 l/sec)
Office estimated daily flow = 75*(800/10) = 6,000 l/day (0.0694 l/sec)

Total Average Dry Weather Flow (DWF) = 30,300 l/day (0.35 l/sec)

Maximum Peak Flow (DWF x6 * 20% for Bin Stores) = 0.35*6*1.2 = **2.5l/sec**

8 Conclusions and Recommendations

Flood Risk

The EA and Oxfordshire County Council classify the site as being located within Flood Zone 1. The site is classified as "Less Vulnerable" and therefore is compatible with for development in Flood Zone 1 as outlined in the NPPF. The site is assessed as having a low to negligible risk of flooding from all sources assessed including; fluvial, surface water, groundwater, sewer, canal, reservoir and tidal.

In order to mitigate flood risk to an acceptable level the following measures have been recommended: existing culvert under Howes Lane is to be upgraded, discharge from the site is to be limited to QBAR, on-site SuDS features are designed to cater for a 1 in 100-year + 40% Climate Change storm event, extra storage volume allowance is made for 80% of the 1 in 10-year storm event to reduce and mitigate residual risk of follow-on storms, by-pass petrol interceptors should be provided accordingly and exceedance flow through the development is to be directed so that runoff does not adversely affect the development or surrounding areas.

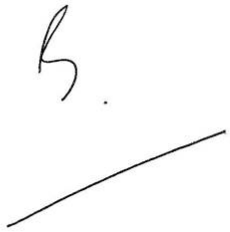
Surface Water Drainage

A SuDS and Water Quality assessment was carried out to identify potential drainage features for use on this site. Infiltration techniques were precluded from this site due to the low permeability of underlaying clay formation. It was recommended that features such as permeable paving, swales, petrol interceptors, line drains and gullies should be used wherever possible to mimic as far as practicable the natural run off regime, improve water quality , reduce run off volume and attenuate peak flows. These are designed in accordance with the current guidance, The SuDS Manual (CIRIA C753).

Using the Oxfordshire County Council SuDS design guidance, a drainage strategy for the Axis J9 (Phase 3) development was created that includes, adequate storage up to the 1 in 100-year +40% CC event with storage distributed throughout the site. No flooding is predicted in all rainfall events. Discharge from Phase 3 has been limited to 10 l/sec overall. There is also sufficient capacity in the system to cater for potential follow-on storms. All calculations have been carried out using MircoDrainage software package using FEH rainfall data.

Foul Water Drainage

The drainage for the site has been designed in compliance with Building Regulations Part H and recommendations in Sewers for Adoption (8th Ed.). The site is to be drained via a gravity system outletting to an adopted manhole near Howes Lane at an average daily flow of 0.35 l/sec and an estimated peak flow of 2.5 l/sec (max).



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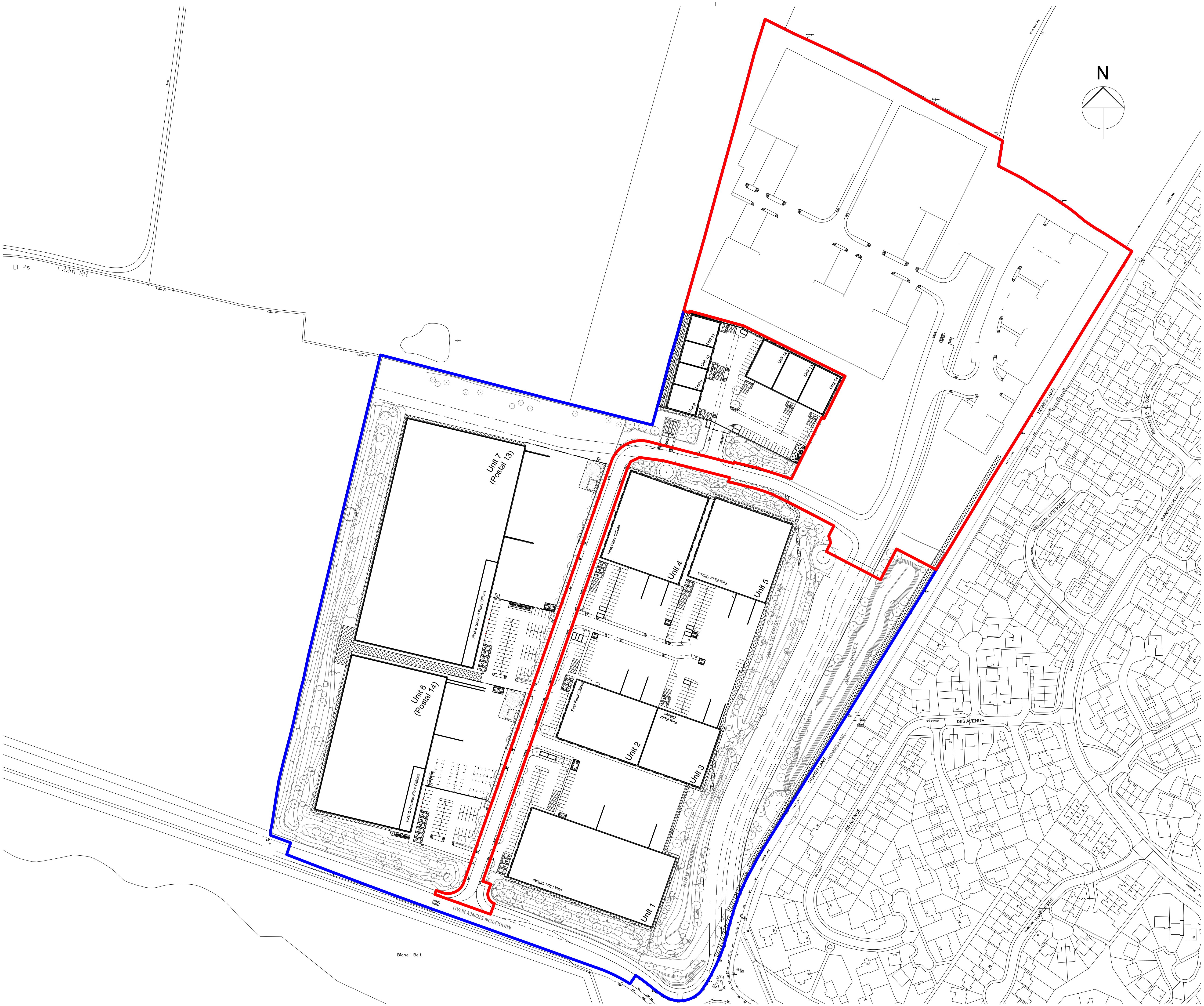
W Bailey C.Eng., F.I.Struct.E., M.I.C.E.
On behalf of Bailey Johnson Hayes

Bailey Johnson Hayes
Consulting Engineers
11th January 2022

APPENDIX A

Cornish Architects Plans

20019-TP-001B – Site Location Plan
20019-TP-002F – Proposed Site Plan



NOTES

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Subject to Statutory Approvals.

Rev	Description	Chk	Date
B	Site Boundary Updated	CS	02/09/2021
A	Site Boundary Updated	CS	31/08/2021

Peer House
8 -14 Verulam Street
London WC1X 8LZ

tel +44(0)20 7400 2120

enquiries@cornisharchitects.com
www.cornisharchitects.com

RIBA
Chartered Practice

cornisharchitects

Project Title.
PHASE 3 AXIS J9 BICESTER

Drawing Title.
SITE LOCATION PLAN

Drawing Status.
TOWN PLANNING

Scale.
0 25 metres 150

Drawn By.	Scale.	Date.	Chk'd By.
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ALBION LAND

Drawing No.	Rev.
20019 - TP - 001	B

NOTES

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Subject to Statutory Approvals.

Subject to Highways Development.

- Perameters Boundary
- Planning Site Boundary
- Ownership Boundary
- Notional Boundary
- Hedgerow Protection
- SLR License
- 2.5m high acoustic fence
- 4m high acoustic fence with acoustic gates

Rev	Description	Chk	Date
F	Site Boundary Updated	CS	02/09/2021
E	Site Boundary updated	CS	31/08/2021
D	Acousitc fences added	SK	20/08/2021
C	Sheet number amended. Road layout updated. Areas updated.	SK	16/08/2021
B	Paving around units 1-3 yards adjusted. Acoustic fence added and landscaping adjusted between units 10 and 11.	SK	29/07/2021
A	Units 6-11 moved further into the site to acheive 10m buffer to eastern site ownership boundary	SK	16/07/2021

cornisharchitects

Peer House
8 -14 Verulam Street
London WC1X 8LZ

tel +44(0)20 7400 2120

enquiries@cornisharchitects.com
www.cornisharchitects.com

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Chartered Practice

Project Title.
PHASE 3 AXIS J9 BICESTER

Drawing Title.
PROPOSED SITE PLAN

Drawing Status.
TOWN PLANNING

Scale.
0 10 metres 80

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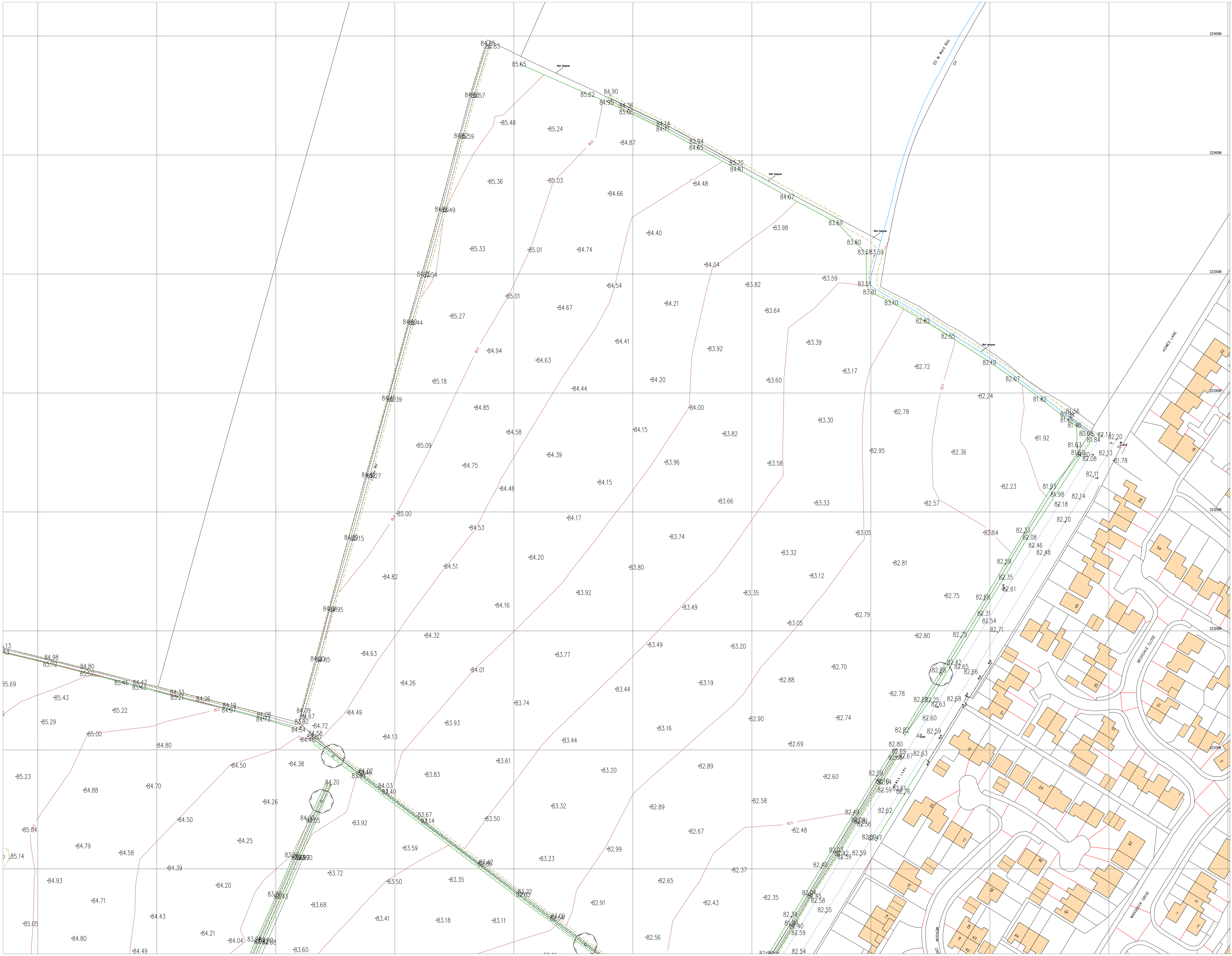
ALBION LAND

Drawing No. 20019 - TP - 002
Rev. F

Schedule of approximate areas																	
UNIT	Ground Floor GEA sm	Ground Floor GEA sf	First Floor GEA sm	First Floor GEA sf	Second Floor GEA sm	Second Floor GEA sf	Total Unit GEA sm	Total Unit GEA sf	Ground Floor GIA sm	Ground Floor GIA sf	First Floor GIA sm	First Floor GIA sf	Second Floor GIA sm	Second Floor GIA sf	Total Unit GIA sm	Total Unit GIA sf	Car Parking
1	1830	19698	224	2411	0	0	**2054**	**22109**	1759	18934	195	2104	0	0	**1954**	**21038**	23
2	1665	17922	202	2174	0	0	**1867**	**20096**	1613	17362	179	1929	0	0	**1792**	**19291**	21
3	1717	18482	211	2271	0	0	**1928**	**20753**	1650	17761	183	1973	0	0	**1833**	**19734**	21
4	4412	47491	272	2928	272	2928	**4956**	**53346**	4278	46048	238	2558	238	2558	**4753**	**51165**	53
5	3552	38234	478	5145	0	0	**4030**	**43379**	3433	36953	423	4553	0	0	**3814**	**41059**	42
6	527	5673	0	0	0	0	**527**	**5673**	491	5285	0	0	0	0	**491**	**5285**	8
7	518	5576	0	0	0	0	**518**	**5576**	492	5296	0	0	0	0	**492**	**5296**	8
8	437	4704	0	0	0	0	**437**	**4704**	412	4435	0	0	0	0	**412**	**4435**	8
9	351	3778	0	0	0	0	**351**	**3778**	328	3531	0	0	0	0	**328**	**3531**	7
10	466	5016	0	0	0	0	**466**	**5016**	430	4629	0	0	0	0	**430**	**4629**	8
11	651	7007	0	0	0	0	**651**	**7007**	600	6458	0	0	0	0	**600**	**6458**	7
TOTAL	**16126**	**173580**	**1387**	**14930**	**272**	**2928**	**17785**	**191438**	**15486**	**166691**	**1219**	**13118**	**238**	**2558**	**16901**	**181920**	**206**

APPENDIX B

Topographical Survey



A0

This survey has been produced at the survey scale detailed below with its accuracy consummate with the indicated scale and should only be used for its original intended purpose. Any scaling should only be undertaken using a stable media print produced using the original data The plotted scale may differ (for presentation purposes) from the survey scale.

It is for the use only of the party to whom it has been addressed and no responsibility is accepted to any third party for the whole or part of its contents. This survey has been prepared on the basis that all information and facts, which may affect the survey, have been disclosed to BluePlan Surveys Ltd by all parties concerned and no liability, nor responsibility can be accepted, unless full disclosure has been made.

All ground features that were visible at the time of the survey have been located, however there may have been items obscured. Pipe sizes and flow direction have been visually assessed from the surface and should be considered as approximate only.

All data remains in the ownership of BluePlan Surveys Ltd and any discrepancies between this survey and any other information should be reported to BluePlan.

Abbreviations

(where applicable)

AV	Air Valve	ME	Meter Manhole
BB	Belisha Beacon	MH	Manhole
BC	Building Canopy	MK	Marker
BH	Borehole	MS	Multi-Stem (Tree)
BL	Bed Level	MY	Mercury Manhole
BM	Bench Mark	NB	Notice Board
BDY	Boundary	RNB	Road Name Board
BO	Bollard	PO	Post
BS	Bi-Stem (Tree)	PED	Pedestrian Pad
BST	Bus Stop	PI	Pipe
BT	British Telecom Manhole	PM	Parking Meter
CE	Cat's Eye	PP	Power Point
CCTV	Closed Circuit Television	RE	Rodding Eye
CR	Cycle Rack	RTW	Retaining Wall
CTV	Cable Television Manhole	RWP	Rainwater Pipe
CUL	Culvert	SP	Sign Post
DK	Drop Kerb	SDP	Stand Pipe
DP	Drain Pipe	SK	Soakaway
DPC	Damp Proof Course	SOF	Soffit Level
D	Drain	ST	Stop Tap
DCP	Dynamic Core Penetrometer	SU	Stump (Tree)
DWB	Dog Waste Bin	SV	Stop Valve
EB	Electricity Box	SVP	Soil Vent Pipe
EL	Electricity Manhole	SW	Storm Water
EP	Electricity Pole	SY	Stay (e.g. Pylon, TP)
ER	Earthing Rod	TBM	Temporary Benchmark
FFL	Finished Floor Level	TCB	Telephone Call Box
IFL	Floor Level	TH	Threshold Level
FP	Flag Pole	TL	Traffic Light
GV	Gas Valve	TW	Top of Wall
GP	Gate Post	TP	Telegraph Pole
GS	Gravestone	TPT	Trial Pit
GY	Gully	TSI	Traffic Signal Manhole
FH	Hydrant	U/B	Under Beam
IC	Inspection Chamber	UTL	Unable To Lift
IS	Information Sign	VP	Vent Pipe
IT	Intercom	WCL	Window Cill Level
JTN	Junction Box	WHL	Window Head Level
KO	Kerb Outlet	WL	Wall Level
LP	Lamp Post	WM	Water Meter

Survey Control

Grid & Datum

Survey Grid: Local Grid ☐ Nat. Grid (OSGB36) ☑ Nat. Grid (Graph. Fit) ☐ Existing Grid ☐

Survey Datum: Local Datum ☐ Nat. Grid (OSGB36) ☑ Nat. Grid (Spot Level) ☐ O.S.B.M. ☐

General Notes

Rev	Date	Description	CAD

Client

BluePlan
35/36 Iron Gate
Derby
DE1 3GA
T: 01335 367047
F: 01332 200231
E: info@blueplan.co.uk
W: www.blueplan.co.uk

Topographical Survey

Bonner Lane, Bicester

Plotted Scale: A0@1:500
NB: Survey Scale: 1:500

Surveyor: CM	CAD: CM	Checker: AR	Rev:
Date of Issue:	12.02.12	Job No.	1553

chartered ICES

RICS

APPENDIX C

EA Flood Map for Planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Axis J9, P3	**456540/223265**	**25 Aug 2021 15:07**

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

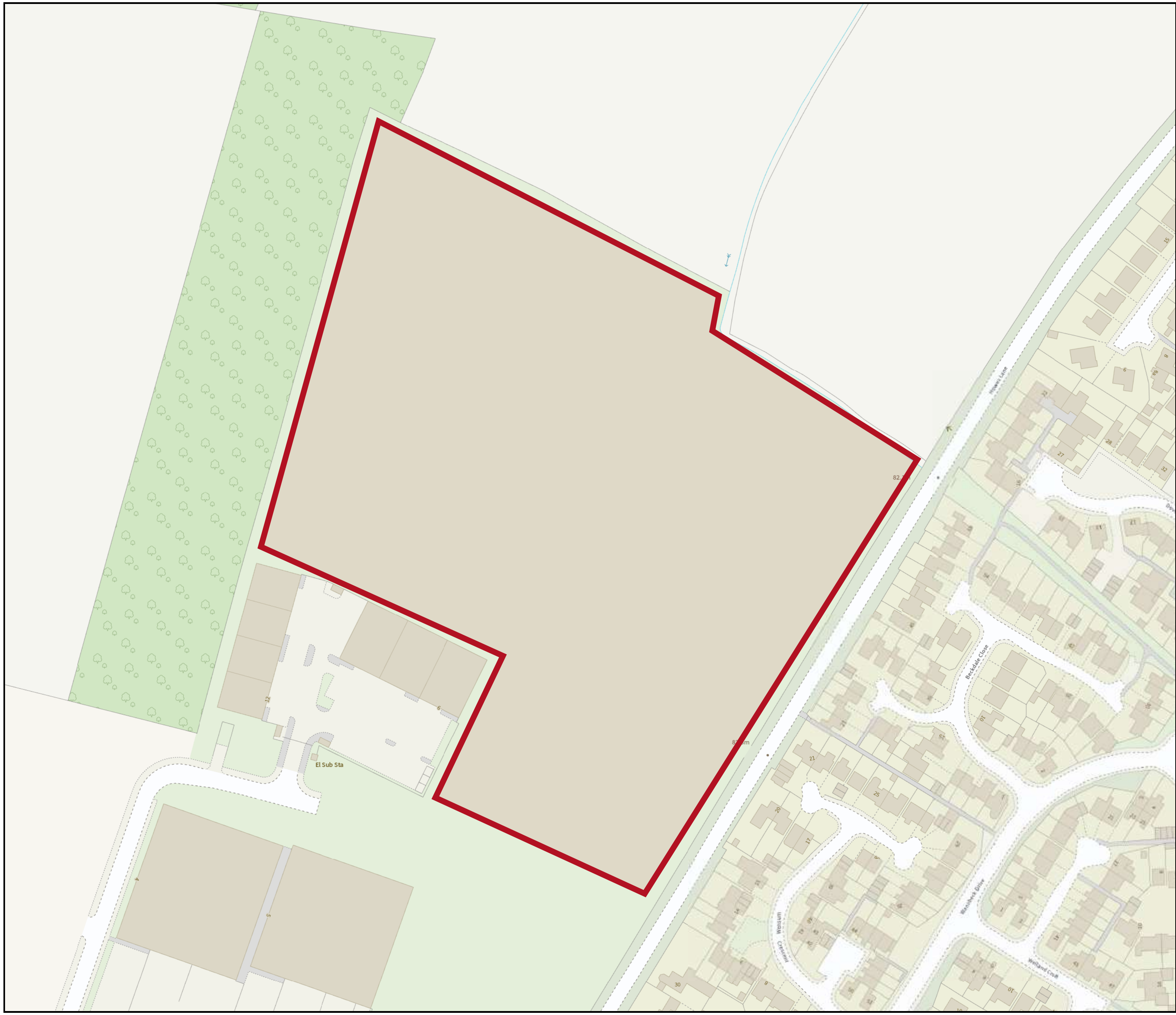
This means:

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

Notes

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

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



Environment Agency

Flood map for planning

Your reference
Axis J9, P3

Location (easting/northing)
456540/223265

Scale
1:2500

Created
25 Aug 2021 15:07

Selected area

Flood zone 3

Flood zone 3: areas benefitting from flood defences

Flood zone 2

Flood zone 1

Flood defence

Main river

Flood storage area

0 20 40 60m

APPENDIX D

BJH Concept Drainage Plans:

S1209-PH3-02D – SW Drainage Layout
S1209-PH3-03D – FW Drainage Layout
S1209-PH3-04C – External Works & Levels
S1209-PH3-05 – Typical Drainage Details

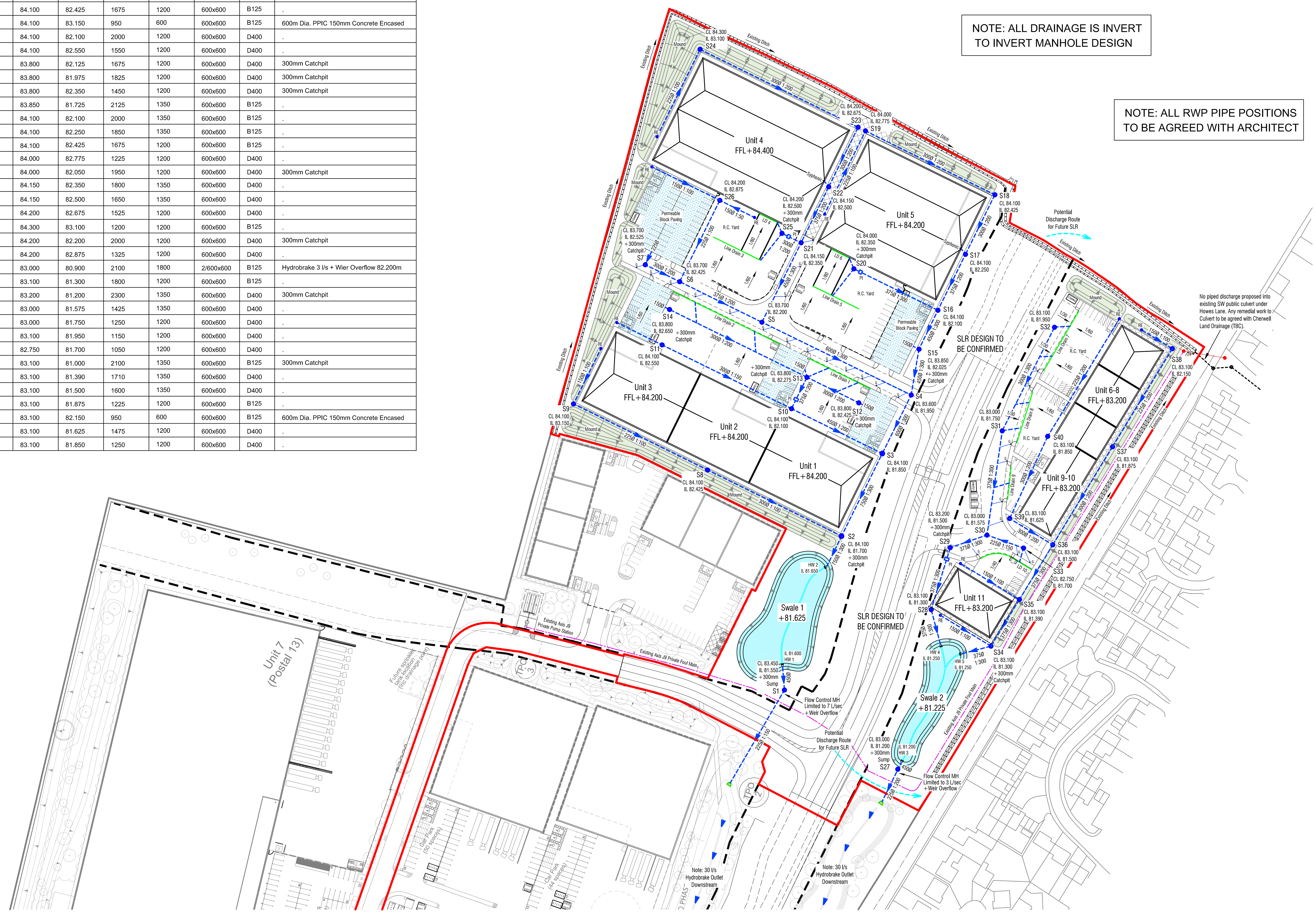
SURFACE WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
S1	83.450	81.250	2200	1800	2/600x600	B125	Hydrobrake 7 l/s + Wier Overflow 82.850m
S2	84.100	81.400	2700	1800	600x600	B125	300mm Catchpit
S3	84.100	81.850	2250	1800	600x600	B125	.
S4	83.600	81.950	1650	1800	600x600	D400	.
S5	83.700	82.200	1500	1500	600x600	D400	.
S6	83.700	82.425	1275	1350	600x600	D400	.
S7	83.700	82.225	1475	1200	600x600	D400	300mm Catchpit
S8	84.100	82.425	1675	1200	600x600	B125	.
S9	84.100	83.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S10	84.100	82.100	2000	1200	600x600	D400	.
S11	84.100	82.550	1550	1200	600x600	D400	.
S12	83.800	82.125	1675	1200	600x600	D400	300mm Catchpit
S13	83.800	81.975	1825	1200	600x600	D400	300mm Catchpit
S14	83.800	82.350	1450	1200	600x600	D400	300mm Catchpit
S15	83.850	81.725	2125	1350	600x600	B125	.
S16	84.100	82.100	2000	1350	600x600	B125	.
S17	84.100	82.250	1850	1350	600x600	B125	.
S18	84.100	82.425	1675	1200	600x600	B125	.
S19	84.000	82.775	1225	1200	600x600	D400	.
S20	84.000	82.050	1950	1200	600x600	D400	300mm Catchpit
S21	84.150	82.350	1800	1350	600x600	D400	.
S22	84.150	82.500	1650	1350	600x600	D400	.
S23	84.200	82.675	1525	1200	600x600	D400	.
S24	84.300	83.100	1200	1200	600x600	B125	.
S25	84.200	82.200	2000	1200	600x600	D400	300mm Catchpit
S26	84.200	82.875	1325	1200	600x600	D400	.
S27	83.000	80.900	2100	1800	2/600x600	B125	Hydrobrake 3 l/s + Wier Overflow 82.200m
S28	83.100	81.300	1800	1200	600x600	B125	.
S29	83.200	81.200	2300	1350	600x600	D400	300mm Catchpit
S30	83.000	81.575	1425	1350	600x600	D400	.
S31	83.000	81.750	1250	1200	600x600	D400	.
S32	83.100	81.950	1150	1200	600x600	D400	.
S33	82.750	81.700	1050	1200	600x600	D400	.
S34	83.100	81.000	2100	1350	600x600	B125	300mm Catchpit
S35	83.100	81.390	1710	1350	600x600	D400	.
S36	83.100	81.500	1600	1350	600x600	D400	.
S37	83.100	81.875	1225	1200	600x600	B125	.
S38	83.100	82.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S39	83.100	81.625	1475	1200	600x600	D400	.
S40	83.100	81.850	1250	1200	600x600	D400	.

NOTE: ALL PERMEABLE PAVING SUBGRADE DESIGN & COLLECTOR PIPE LOCATIONS TO BE CONFIRMED

NOTE: ALL DRAINAGE IS INVERT TO INVERT MANHOLE DESIGN

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH ARCHITECT



NOTE: PHASES 1, 2 & 3 TO DISCHARGE INTO WATERCOURSE / PUBLIC SEWER AS AGREED AT 30 L/S (GREENFIELD RATE) SEE BJH FRA. CONNECTION AND HYDROBRAKE MH ALREADY CONSTRUCTED AND OPERATIONAL IN PHASE 1.

Phase 3 SW Drainage Layout 1:1000

20m 10m 0 20m 40m 60m

Scale 1:1000 @A1

A1

DRAINAGE NOTES

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND BAILEY JOHNSON HAYES DRAWINGS AND SPECIFICATIONS.

2 DRAINS TO BE 'HEPWORTH SUPERSLEEVE' LAID IN CLASS S BEDDING TO BS 882 1983: TABLE 4, OR TO BS 8301 1985: APPENDIX D. 450 DIA DRAINS AND ABOVE TO BE HEPWORTH CONCRETE PIPES CLASS H . OR EQUAL APPROVED DRAINS WITHIN THE SITE MAY BE THERMOPLASTIC STRUCTURED WALL PIPE IN ACCORDANCE WITH CLAUSE E2.22 OF SFA 8th EDITION

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75 MM DOWN GRADED STONE FILL, PLACED AND COMPACTED IN 150 MM LAYERS. ALL PIPES IN ROADWAYS, SERVICE YARDS AND CARPARKS LESS THAN 1200 MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3 METRE CENTRES.

4 MANHOLES TO BE CONSTRUCTED IN PRECAST CONCRETE RINGS TO BS 5911: PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES IN FOOTPATHS OR LANDSCAPED AREAS TO BE BACKFILLED WITH 40 MM DOWN GRADED STONE FILL, COMPACTED IN LAYERS NOT EXCEEDING 150 MM THICK. MANHOLES BENEATH ROADS AND PARKING AREAS TO BE CASED IN 150 MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ALL ROAD GULLIES TO BE HEPWORTH ROAD GULLIES., REF RGR4, WITH 150 MM DIAMETER OUTLETS. GULLIES TO BE ENCASED IN 150 MM MINIMUM CONCRETE.

8 DRAINS UNDER BUILDING AND WITHIN 300 MM OF THE UNDERSIDE OF FLOORSLAB TO BE ENCASED IN 150 MM CONCRETE. CASING TO INCORPORATE FLEXIBLE FIBRE BOARD JOINTS AT SPACINGS AS RECOMMENDED BY THE PIPE MANUFACTURER. DRAINS UNDER BUILDINGS GENERALLY TO HAVE MIN 100 FULL GRANULAR SURROUND TO CLASS S BS8301

9 WHERE PIPES RUN THROUGH GROUND BEAMS, FLEXIBLE JOINT CASINGS AT EACH FACE OF THE GROUND BEAM ARE TO BE PROVIDED. PIPES WHICH RUN UNDER GROUND BEAMS TO BE PROTECTED WITH 50 MM MINIMUM POLYSTYRENE PLACED OVER THE CROWN OF THE PIPE.

10 ALL WORK TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 8TH EDITION AND BS 8301 : CODE OF PRACTICE FOR BUILDING DRAINAGE

11 WHERE DRAINS RUN CLOSE TO BUILDINGS AND INVERT LEVELS ARE BELOW FOUNDATIONS THE DRAINS SHOULD BE ENCASED AS FOLLOWS;-

(a) WHERE THE DRAIN TRENCH IS WITHIN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE UP TO FOUNDATION FORMATION LEVEL or

(b) WHERE THE DRAIN TRENCH IS FURTHER THAN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE TO A LEVEL BELOW FOUNDATION FORMATION EQUAL TO THE DISTANCE FROM THE BUILDING LESS 150mm.

KEY:

- INDICATES GULLIES
- INDICATES SURFACE WATER MANHOLES
- INDICATES NEW PIPE RUNS
- INDICATES LINE DRAIN RUNS
- INDICATES EXISTING MANHOLES

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

PRELIMINARY

Rev	Date	Revision Description
D	07.01.22	Updated to LLFA planning comments
C	02.09.21	Red line planning boundary adjusted
B	23.08.21	Updated to latest Architects layout, pipe sizes added & manholes scheduled
A	20.07.21	Updated Ditches, Mounds & SLR

Revision Schedule

Project Title

Axis J9 - Bicester

Client

ALBION LAND

Drawing Title

PHASE 3
SW Drainage Layout

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:1000 @A1
Date	23.06.21
Drawn	JNG

Drawing Number

S1209-PH3-02 D

A1

FOUL WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
F1	84.000	79.950	4050	1050	600x600	D400	.
F2	82.900	80.590	2310	1050	600x600	D400	.
F3	83.050	80.725	2325	1050	600x600	D400	.
F4	83.050	80.900	2150	1050	600x600	D400	.
F5	82.900	81.100	1800	1050	600x600	D400	.
F6	83.000	82.000	1000	1050	600x600	D400	.
F7	83.200	81.400	1800	1050	600x600	D400	.
F8	83.800	80.575	3225	1050	600x600	D400	.
F9	83.800	80.875	2925	1050	600x600	D400	.
F10	83.800	81.300	2500	1050	600x600	D400	.
F11	83.800	81.475	2325	1050	600x600	D400	.
F12	83.800	81.925	1875	1050	600x600	D400	.
F13	83.800	82.200	1600	1050	600x600	D400	.
F14	83.700	82.425	1275	1050	600x600	D400	.
F15	84.000	82.775	1225	1050	600x600	D400	.
F16	84.000	83.200	800	450	450x450	D400	450 Dia. PPIC 150mm Concrete Encased
F17	84.000	82.700	1300	450	450x450	D400	450 Dia. PPIC 150mm Concrete Encased
F18	84.000	83.000	1000	450	450x450	D400	450 Dia. PPIC 150mm Concrete Encased
F19	83.400	82.400	1000	1050	600x600	D400	.
F20	83.700	82.050	1650	1050	600x600	D400	.
F21	84.000	82.600	1400	1050	600x600	D400	.
F22	83.950	83.200	750	450	450x450	D400	450 Dia. PPIC 150mm Concrete Encased
F23	83.700	82.000	1700	1050	600x600	D400	.
F24	84.000	82.600	1400	1050	600x600	D400	.
F25	84.075	83.200	875	450	450x450	D400	450 Dia. PPIC 150mm Concrete Encased

Phase 3 FW Drainage Layout 1:1000

20m 10m 0 20m 40m 60m
Scale 1:1000 @A1

DRAINAGE NOTES

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND BAILEY JOHNSON HAYES DRAWINGS AND SPECIFICATIONS.

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5 MANHOLES IN FOOTPATHS OR LANDSCAPED AREAS TO BE BACKFILLED WITH 40 MM DOWN GRADED STONE FILL, COMPACTED IN LAYERS NOT EXCEEDING 150 MM THICK. MANHOLES BENEATH ROADS AND PARKING AREAS TO BE CASED IN 150 MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ALL ROAD GULLIES TO BE HEPWORTH ROAD GULLIES., REF RGR4, WITH 150 MM DIAMETER OUTLETS. GULLIES TO BE ENCASED IN 150 MM MINIMUM CONCRETE.

8 DRAINS UNDER BUILDING AND WITHIN 300 MM OF THE UNDERSIDE OF FLOORSLAB TO BE ENCASED IN 150 MM CONCRETE. CASING TO INCORPORATE FLEXIBLE FIBRE BOARD JOINTS AT SPACINGS AS RECOMMENDED BY THE PIPE MANUFACTURER. DRAINS UNDER BUILDINGS GENERALLY TO HAVE MIN 100 FULL GRANULAR SURROUND TO CLASS S BS8301

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(a) WHERE THE DRAIN TRENCH IS WITHIN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE UP TO FOUNDATION FORMATION LEVEL or

(b) WHERE THE DRAIN TRENCH IS FURTHER THAN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE TO A LEVEL BELOW FOUNDATION FORMATION EQUAL TO THE DISTANCE FROM THE BUILDING LESS 150mm.

KEY:

- ○ INDICATES GULLIES
- ● INDICATES FOUL WATER MANHOLES
- — INDICATES NEW PIPE RUNS
- □ INDICATES EXISTING MANHOLES

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

PRELIMINARY

Rev	Date	Revision Description
D	07.01.22	Updated to LLFA planning comments
C	02.09.21	Red line planning boundary adjusted
B	23.08.21	Updated to latest Architects layout, pipe sizes added & manholes scheduled
A	20.07.21	Updated Ditches, Mounds & SLR

Revision Schedule

Project Title
Axis J9 - Bicester

Client
ALBION LAND

Drawing Title
PHASE 3
FW Drainage Layout

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:1000 @A1
Date 23.06.21
Drawn JNG
Drawing Number S1209-PH3-03 D

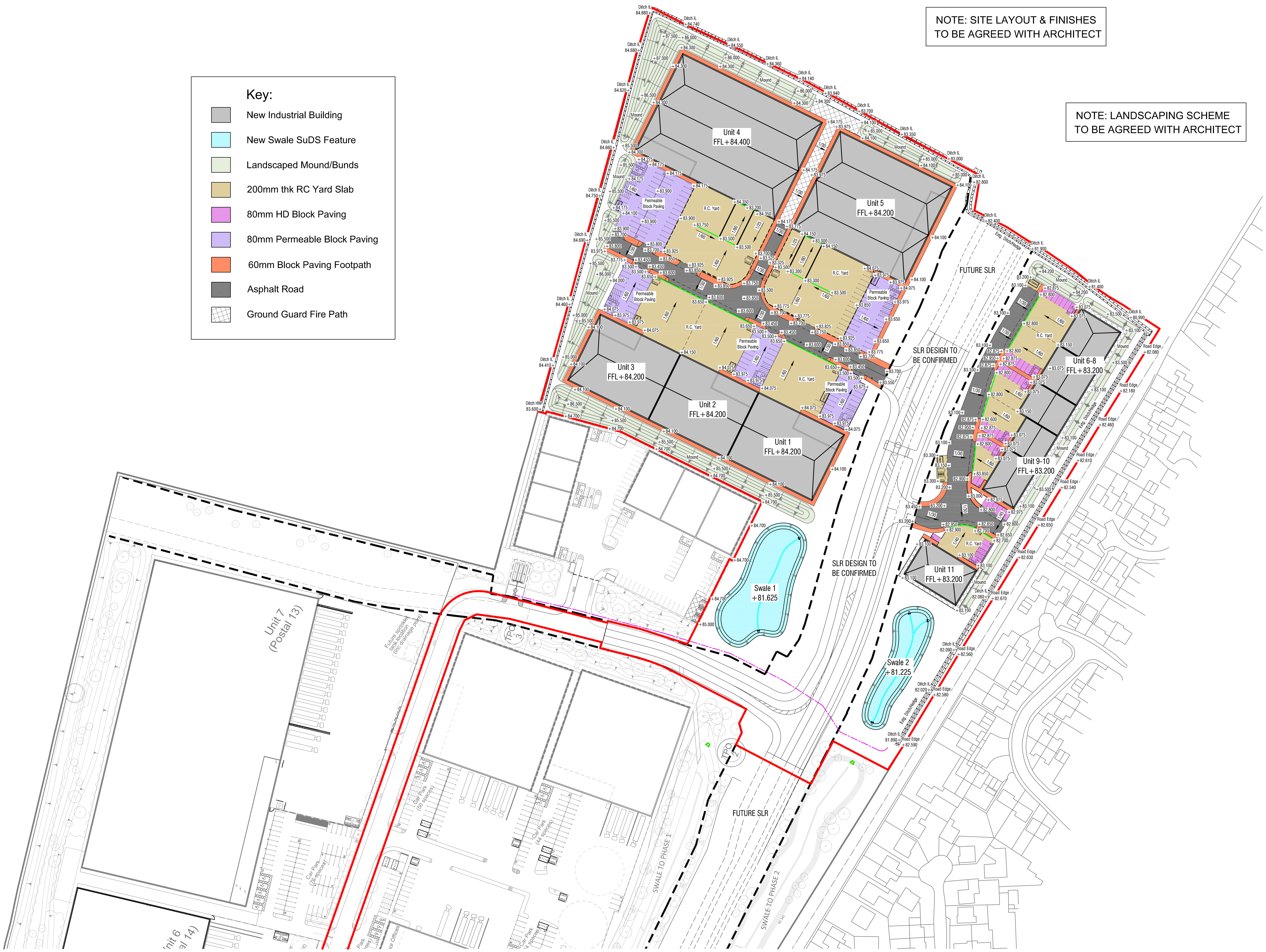
A1

NOTE: SITE LAYOUT & FINISHES TO BE AGREED WITH ARCHITECT

NOTE: LANDSCAPING SCHEME TO BE AGREED WITH ARCHITECT

Key:

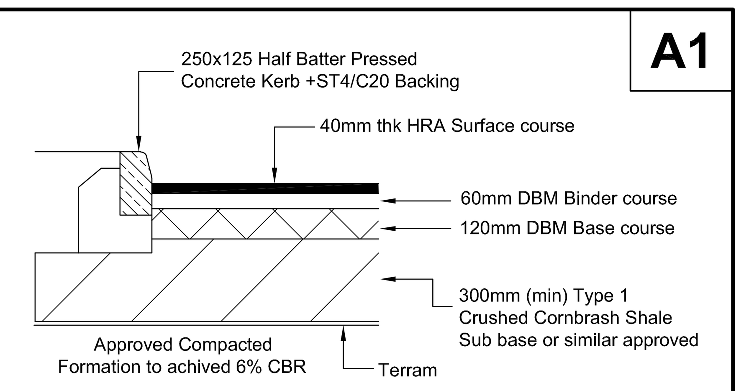
- New Industrial Building
- New Swale SuDS Feature
- Landscaped Mound/Bunds
- 200mm thk RC Yard Slab
- 80mm HD Block Paving
- 80mm Permeable Block Paving
- 60mm Block Paving Footpath
- Asphalt Road
- Ground Guard Fire Path



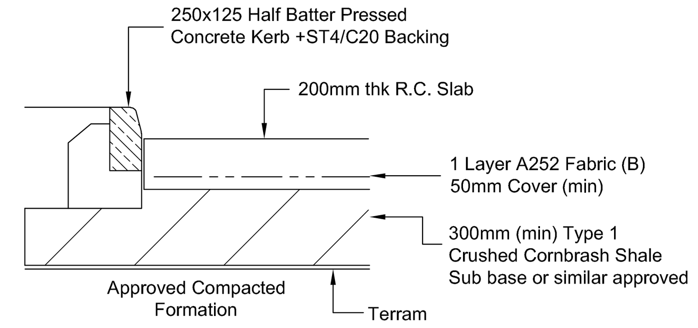
Phase 3 External Works & Levels 1:1000

20m 10m 0 20m 40m 60m

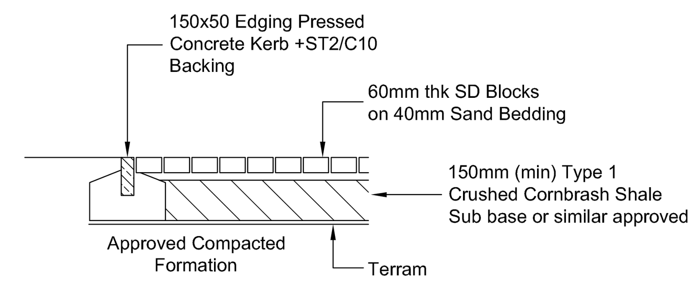
Scale 1:1000 @A1



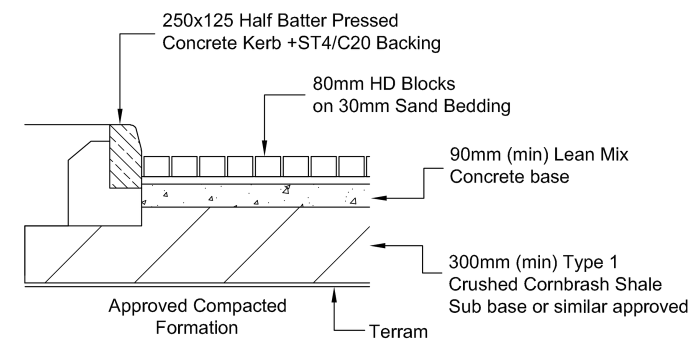
Asphalt Kerb Detail 1:25



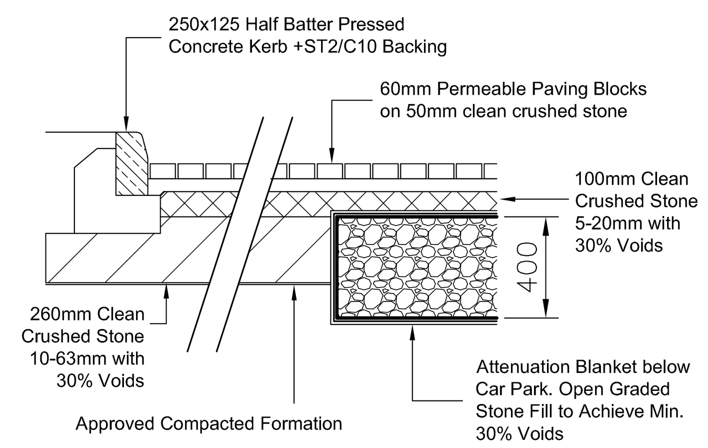
RC Yard Kerb Detail 1:25



Footpath Kerb Detail 1:25



Heavy Duty Block Paving 1:25



Permeable Block Paving 1:25

PRELIMINARY

Rev	Date	Revision Description
C	07.01.22	Updated to LLFA planning comments
B	02.09.21	Red line planning boundary adjusted
A	23.08.21	Updated to latest Architects layout, all levels raised 200mm & minor revs

Revision Schedule

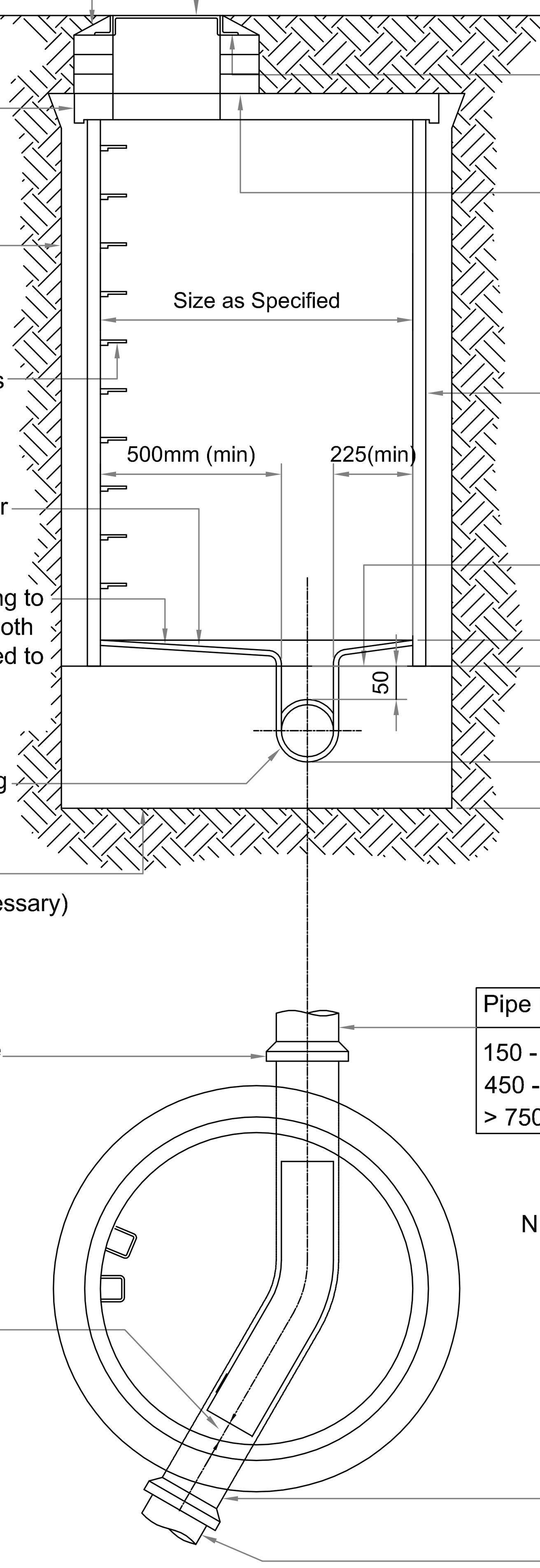
Project Title
Axis J9 - Bicester

Client
ALBION LAND

Drawing Title
PHASE 3
External Works & Levels

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:1000, 25 @A1	Drawing Number
Date	20.07.21	S1209-PH3-04 C
Drawn	JNG	

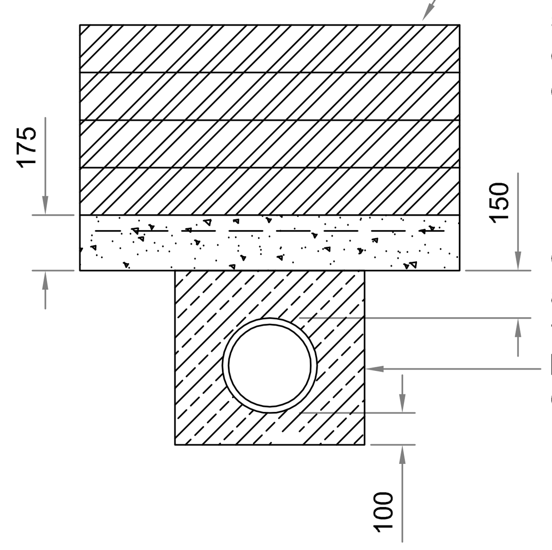


Pipe Diameter	Rocker Pipe Length
150 - 450	500 - 750
450 - 750	750 - 1000
> 750	Seek Guidance

NB. Toe Holes to be Provided in Benching of Sewers Greater than 450mmØ for Access to Invert

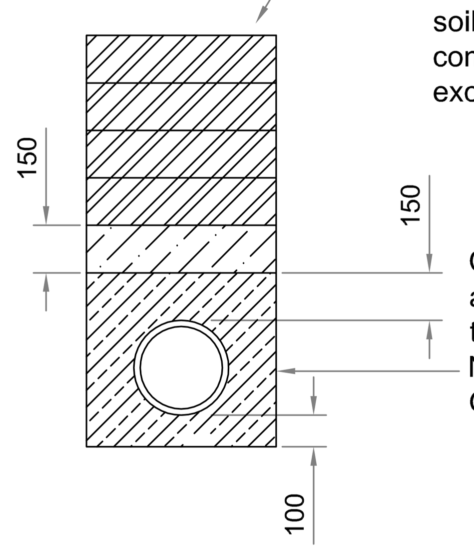
TYPICAL MANHOLE DETAILS
Depth to suit Soffit 1.35 - 3.0m

Scale 1:20



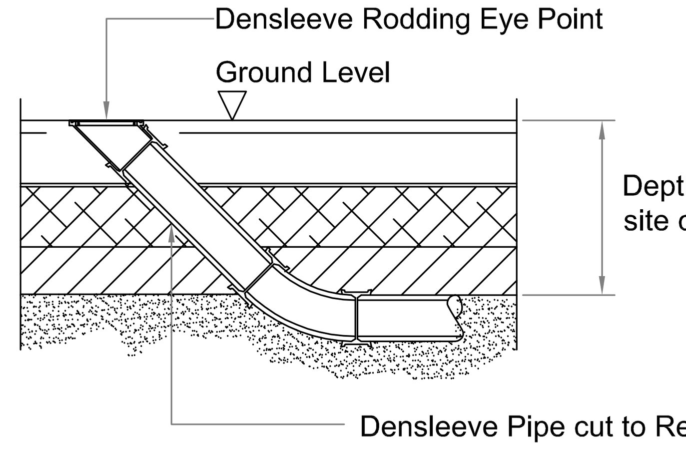
CONCRETE PROTECTION DETAIL

Scale 1:20



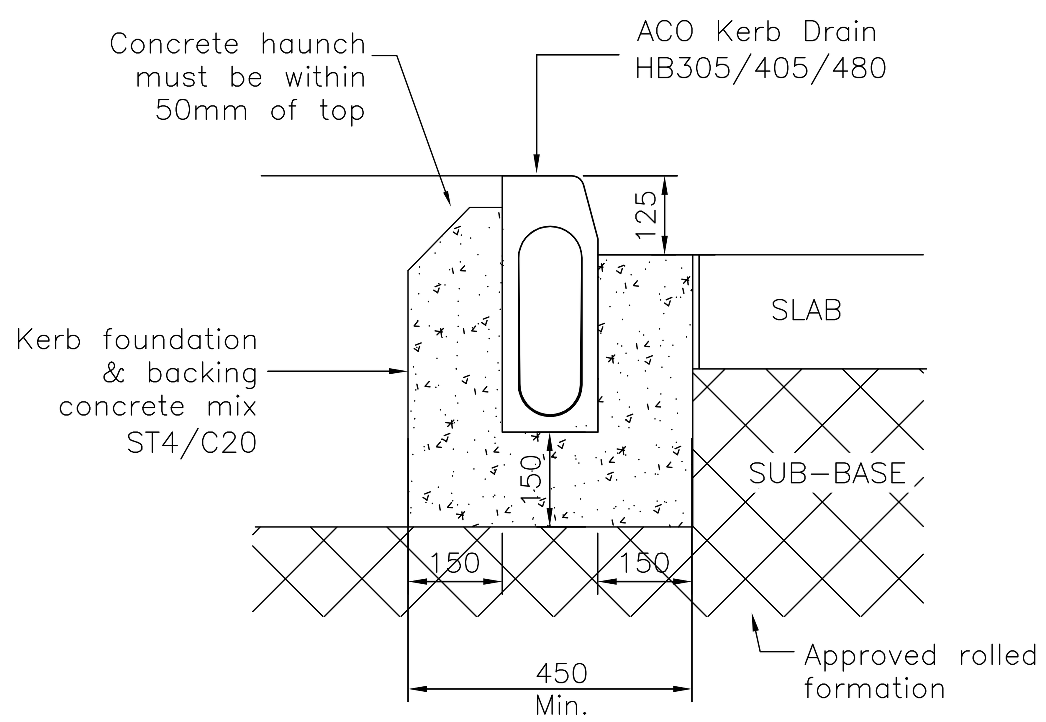
STANDARD BEDDING DETAIL

Scale 1:20



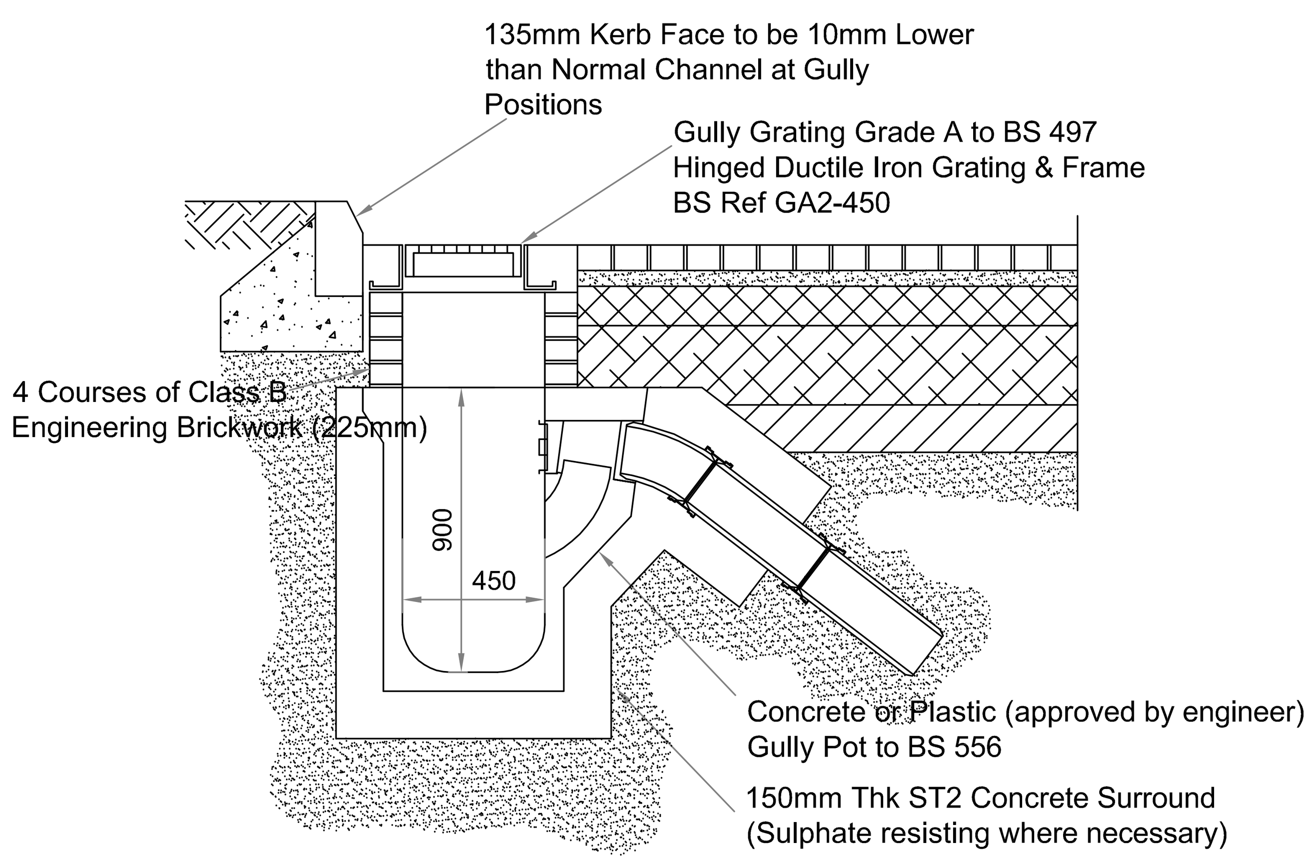
RODDING POINT DETAIL

Scale 1:20



TYPICAL KERB DRAIN DETAILS

Scale 1:10



TYPICAL GULLY DETAILS

Scale 1:20

Hardstanding notes:

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND BAILEY JOHNSON HAYES DRAWINGS AND SPECIFICATIONS

2 ALL TOPSOILS, SUBSOILS AND DELETERIOUS MATERIAL IS TO BE STRIPPED FROM BENEATH THE BUILDING ZONE FOR FORMATION LEVELS. THE EXPOSED FORMATION TO BE PROOF ROLLED WITH A TWIN WHEELED VIBRATORY ROLLER WITH A STATIC LOAD OF NOT LESS THAN 35KG/25MM WIDTH. ROLLING IS TO CONTINUE UNTIL THERE IS NO NOTICABLE DEFORMATION UNDER THE ACTION OF THE ROLLER, (MINIMUM OF 8 NO. PASSES)

3 ANY SOFT SPOTS ARE TO BE EXCAVATED OUT AS INSTRUCTED BY BJH AND FILLED/ROLLED WITH ACCEPTABLE SAND/GRAVEL FROM SITE EXCAVATIONS IN LAYERS NOT EXCEEDING 150MM THICK

4 SLABS TO BEAR UPON 1200 GAUGE VISQUEEN WHICH IS TO BE FULLY LAPPED/SEALED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS

5 ALL CONCRETE IS TO BE GRADE C35 TO BS8110, MIN CEMENT CONTENT 330KG/M3 OPC MAXIMUM FREE WATER CEMENT RATIO 0.6 MAXIMUM AGGREGATE SIZE 20MM + 5% AIR ENTRAINED.

6 THE SLAB IS TO BE LAID IN LONG BAY FASHION IN ASSOCIATION WITH THE CONCRETE SOCIETY RECOMMENDATIONS TO RECEIVE A LIGHT BRUSH FINISH

7 MINIMUM MESH LAPS 300MM SIDE AND ENDS: MINIMUM VISQUEEN LAP 300MM

8 IT IS ESSENTIAL THAT ALL TRANSVERSE JOINTS ARE CUT WITHIN 24 HOURS OF CASTING

9 ALL JOINTS ARE TO BE SEALED USING THIOFLEX 600 OR SIMILAR APPROVED

10 SLAB POURING PROGRAMME SHOULD ALLOW 72 HOURS CLEAR BETWEEN CASTING ADJACENT BAYS

Drainage notes:

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.

2 DRAINS TO BE PLASTIC HEPWORTH SUPERSLEEVE OR NAYLOR DENSLEEVE: LAID ON CLASS N GRANULAR BEDDING TO BS 882: TABLE 4 OR TO BS 8301: 1985 APPENDIX D. CONCRETE ENCASED PIPES IDENTIFIED ON BJH DRAWINGS.

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75MM DOWNGRADED STONE FILL, PLACED & COMPACTED IN LAYERS OF 150MM. ALL PIPES IN ROADWAYS / PARKING, LESS THAN 900MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3000MM CENTRES.

4 MANHOLES TO BE CONSTRUCTED OF PRECAST CONCRETE RINGS TO BS 5911-PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES BENEATH ROADS & PARKING AREAS TO BE CASED IN 150MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ROAD GULLIES TO BE HEPWORTH ROAD GULLIES REF: 213 WITH 150MM DIAMETER OUTLET OR SIMILAR APPROVED. GULLIES TO BE ENCASED IN 150MM MINIMUM CONCRETE. PLASTIC GULLY'S CAN BE USED IN YARDS AND CAR PARKS IN CONSULTATION WITH ENGINEER

8 DRAWINGS TO BE ISSUED TO HE & LOCAL AUTHORITY WELL IN ADVANCE OF COMMENCEMENT OF DRAINAGE CONSTRUCTION.

9 EXISTING MANHOLES IN ROADS TO HAVE INVERT LEVELS CONFIRMED PRIOR TO DRAINAGE CONSTRUCTION.

10 ROADS TO BE REINSTATED TO STANDARD REQUESTED BY LOCAL AUTHORITY WHERE DRAINAGE CROSSES CARRIDGEWAY.

- Allow for all Soft Spots.
- Allow for all Removal if existing Hedges / Trees & Additional Construction Depth as necessary.
- All Earth Batters Remaining to be not steeper than 1 in 2.5.
- Allow for use of Terram as Necessary in softer areas.

PRELIMINARY

Rev	Date	Revision Description

Revision Schedule

Project Title
Axis J9 - Bicester

Client
ALBION LAND

Drawing Title
PHASE 3
Typical Drainage Details

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:20,10 @A1
Date 23.08.21
Drawn JNG
Drawing Number S1209-PH3-05

APPENDIX E

BJH DRAINAGE CALCULATIONS:

S1209 Rev 1 dated January 2022

PROPOSED INDUSTRIAL DEVELOPMENT,

PHASE 3, AXIS J9, HOWES LANE, BICESTER.

SURFACE WATER DRAINAGE CALCULATIONS

1.0 INTRODUCTION

The following calculations have been prepared to justify the design of a below-ground drainage system to serve the above development. This Rev 1 of the calculations is prepared to satisfy the design of the Phase 3 drainage network in co-ordination with the existing Axis J9 Phase 1 & 2 which are now completed and fully operational.

The drainage scheme for the whole site has been developed in accordance with BJH SSFRA (Issue 1), to attenuate surface water outflows from the proposed development site to a ditch off Howes Lane to a peak figure of 30 litres/second for design rainfall up to and including 100year +CC events. For further details of the existing drainage arrangements & calculations can be found in Rev 4 of the Phase 1 & 2, Axis J9 calculations package.

2.0 DRAINAGE DESIGN OVERVIEW

Approximately 70% of the 21 Ha development has been completed at Axis J9. Phases 1&2 have been split into a series of 14 Units to accommodate industrial buildings including; associated external service yards, access roads, car parking and landscaping. Three large attenuation basins/swales have been approved by the Cherwell District Council & OCC as the LLFA and are fully operational within the landscaped areas to the southeast of the development plots.

Within the Phase 3 proposals a further 11 industrial units are proposed. These have been split into two catchment areas named; Western Catchment (Units 1-5) and Eastern Catchment (Units 6-11). Previously this area was allocated for residential development only. The drainage is designed using the MircoDrainage software package and adopting FEH design rainfall.

Appended to these calculations (Appendix A) are the following drawings:

- S1209-PH3-DD01A Phases 3 Drained Areas.
- S1209-PH3-DD02A Phases 3 Network Design.
- S1209-PH3-DD03A Phase 3 Swales 1 - 2.
- S1209-PH3-DD04 Phase 3 Exceedance Flood Routes

The below-ground drainage system is modelled in the System 1 module of MircoDrainage, and then exported into the Simulation module where the two retention basins and two Hydro brake flow control devices are included. For the purpose of drainage design zero infiltration flow has been considered, in which case the results are conservative. The Phase 3 site has two separate systems which are modelled as the Western Catchment and the Eastern Catchment for clarity.

- Proposed Impermeable area for each catchment is as follows:

  Western Catchment = 0.825 Ha
  Eastern Catchment = 2.600 Ha

Overall impermeable area is 3.50 Ha including an allowance of 10% for Urban creep.

3.0 EXISTING DRAINAGE REGIME

3.1 Site Discharge

The Phase 3 site is currently undeveloped Greenfields. There is currently 0m^2 of impermeable area on the existing Phase 3 development site.

In light rainfall events precipitation is attenuated in the Topsoil upper strata and evaporated off over time. In heaver rainfall events, overland and subterrain runoff is generated which eventually is collected by an ordinary watercourse on the northern/eastern boundaries, discharging to a closed culvert under Howes Lane.

3.2 Current Runoff Rates

Using the EA/DEFRA document "Preliminary Rainfall runoff management for development (W5-074/A/TR1)" and the HR Wallingford Greenfield Runoff Estimation Tool (IH124 method) runoff rates for QBAR, 3.3% (1in30), 1% (1in100) and, 1% (1in100) plus climate change have been assessed as follows below:

The whole of the Phase 3 site is approximately 6.5 Ha.

QBAR = 10.4 l/s
1 in 30 year = 24 l/s
1 in 100 year = 33.3 l/s
1 in 100 year + 40% CC = 46.6 l/s

Calculation output from the HR Wallingford Greenfield Runoff Estimation Tool can be found in Appendix B. Soil type 2 is conservatively assumed based on the Ground Investigation Report.

Bailey Johnson Hayes
Suite 4, Phoenix House, 63 Campfield Road
St Albans, Hertfordshire. AL1 5FL
Tel: 01727 841172 Fax: 01727 841085
Web: www.bjh.co.uk

Calculations

4.0 DRAINAGE DESIGN RESULTS

4.1 Phase 3 (Eastern Catchment)

It has been decided that an allowable discharge of 3 l/s can be used, which is approximately equal to QBAR for this catchment alone. There is no requirement from OCC to have a minimum outlet flow of 5l/s. The discharge rate from this catchment is based on engineering judgement and interpolation of existing Greenfield QBAR rates due to parts of the site remaining as soft landscaping and to reduce downstream effects on Phase 1 & 2.

MircoDrainage calculation Page 2 presents results of the Quick Storage Estimate (QSE) where it is predicted that between 607 and 833 m^3 of attenuation volume is required for outlet of 3 l/s. The maximum volume possible in the system if it was allowed to fill up to a level of 82.400m (300mm freeboard from lowest site level) would have a total volume capacity of 1066 m^3.

MircoDrainage calculation Pages 3-6 present details of the drainage network input. This is followed by pages 7-9 which presents the critical summary of results for the followings return periods; 1-year, 30-year, and 100-year + 40% return periods.

Maximum Water Level Summary
Design invert level of swale 2 is 81.225m.
The maximum water level in swale 2 for the 1-year return period was 81.411m.
The maximum water level in swale 2 for the 30-year return period was 81.668m.
The maximum water level in swale 2 for the 100-year +40% return period was 82.051m.

Maximum Storage Volume Summary
Maximum allowable volume in the system is 1066 m^3.
The maximum volume in the system for the 1-year return period was 106 m^3.
The maximum volume in the system for the 30-year return period was 301 m^3.
The maximum volume in the system for the 100-year +40% return period was 643 m^3.

Follow on Storm Check

If 80% of the 10-year event followed the 100-year +40% event within 24 hours a total volume storage would be required of 850 m^3. Given the system can hold 1066 m^3 therefore OK.

By inspection no surface flooding is predicted during 1, 30, 100 year + 40% design storms. The maximum water level in the Swale was 82.051m which represents a depth of 826mm. In the worst-case rainfall event the minimum storage required for 100 year + 40% event is 643 m^3 which has been satisfied by the combination of Swale, Pipe and Manhole storage.

Bailey Johnson Hayes
Suite 4, Phoenix House, 63 Campfield Road
St Albans, Hertfordshire. AL1 5FL
Tel: 01727 841172 Fax: 01727 841085
Web: www.bjh.co.uk

Calculations

4.2 Phase 3 (Western Catchment)

It has been decided that an allowable discharge of 7 l/s can be used, which is approximately equal to QBAR for this catchment. The discharge rate from this catchment based on engineering judgement and interpolation of existing Greenfield QBAR rates due to parts of the site remaining as soft landscaping and to reduce downstream effects on Phase 1 & 2.

MircoDrainage calculation Page 10 presents results of the Quick Storage Estimate (QSE) where it is predicted that between 2080 and 2769 m^3 of attenuation volume is required for outlet discharge of 7 l/s. The maximum volume possible in the system if it was allowed to fill up to a level of 83.000m (Level at the bottom of Docks) would have a total volume capacity of 2504 m^3.

MircoDrainage calculation Pages 11-15 present details of the drainage network input. This is followed by pages 16-21 which presents the critical summary of results for the followings return periods; 1-year, 30-year, and 100-year + 40% return periods.

Maximum Water Level Summary
Design invert level of swale 1 is 81.625m.
The maximum water level in swale 1 for the 1-year return period was 81.930m.
The maximum water level in swale 1 for the 30-year return period was 82.336m.
The maximum water level in swale 1 for the 100-year +40% return period was 82.876m.

Maximum Storage Volume Summary
Maximum allowable volume in the system is 2504 m^3.
The maximum volume in the system for the 1-year return period was 415 m^3.
The maximum volume in the system for the 30-year return period was 1100 m^3.
The maximum volume in the system for the 100-year +40% return period was 2125 m^3.

By inspection no surface flooding is predicted during 1, 30, 100 year + 40% design storms. The maximum water level in the Swale was 82.876m which represents a depth of 1251mm. In the worst-case rainfall event the minimum storage required for 100 year + 40% event is 2125 m^3 which has been satisfied by the combination of Swale, Pipe and Manhole storage.

5.0 EXCEEDANCE FLOOD ROUTES

The buildings are elevated above the lower-lying attenuation basins and therefore safeguarded against flooding in the event of exceedance. In the event of failure of any part of the drainage system means of escape routes to nearby ditches have been shown in Appendix A.

APPENDIX A

BAILEY JOHNSON HAYES DRAWINGS

S1209-PH3-DD01A – Phase 3 Drained Areas

S1209-PH3-DD02A – Phase 3 Network Design

S1209-PH3-DD03A – Phase 3 Swales 1-2

S1209-PH3-DD04 – Phase 3 Exceedance Route

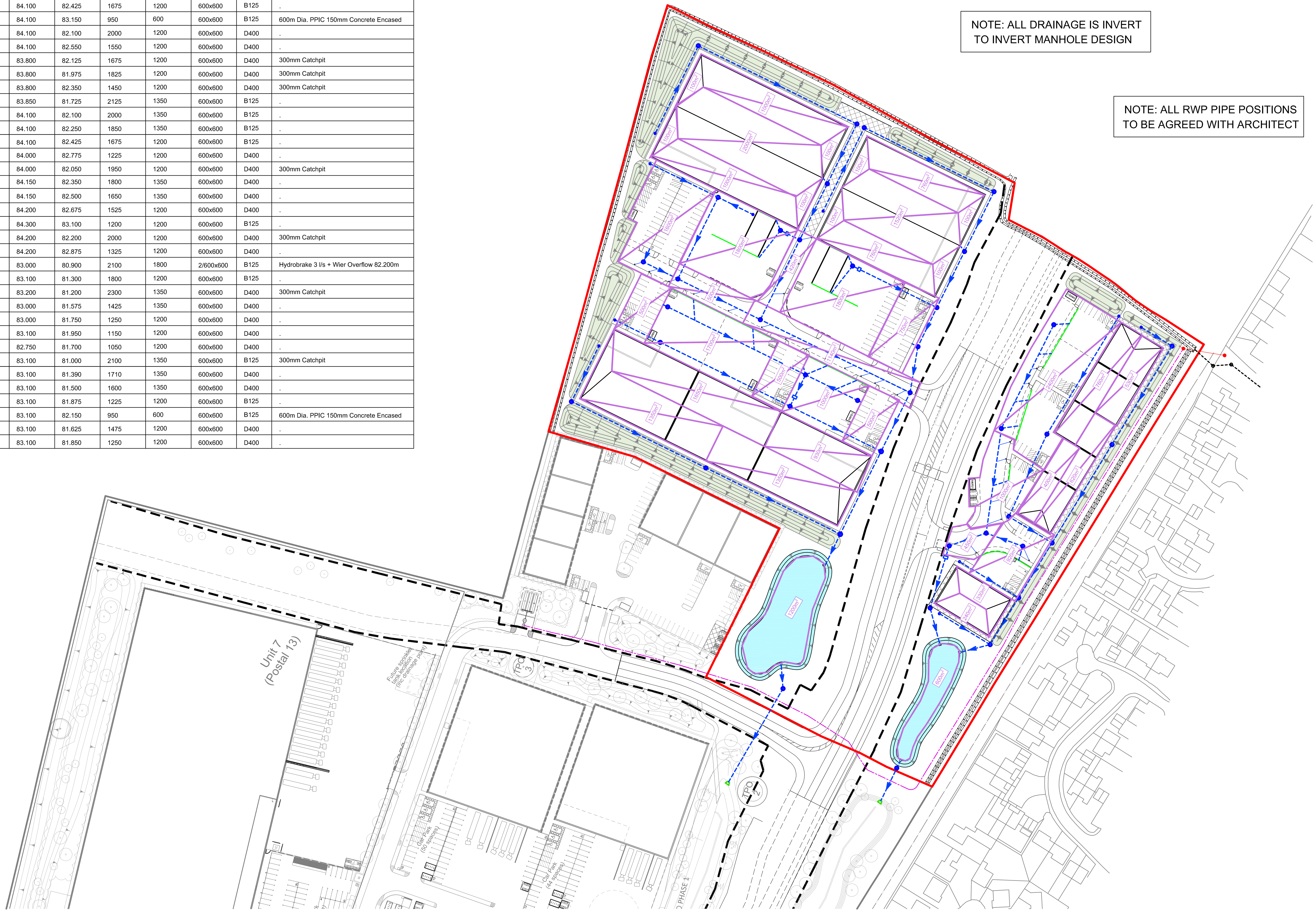
SURFACE WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
S1	83.450	81.250	2200	1800	2/600x600	B125	Hydrobrake 7 l/s + Wier Overflow 82.850m
S2	84.100	81.400	2700	1800	600x600	B125	300mm Catchpit
S3	84.100	81.850	2250	1800	600x600	B125	.
S4	83.600	81.950	1650	1800	600x600	D400	.
S5	83.700	82.200	1500	1500	600x600	D400	.
S6	83.700	82.425	1275	1350	600x600	D400	.
S7	83.700	82.225	1475	1200	600x600	D400	300mm Catchpit
S8	84.100	82.425	1675	1200	600x600	B125	.
S9	84.100	83.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S10	84.100	82.100	2000	1200	600x600	D400	.
S11	84.100	82.550	1550	1200	600x600	D400	.
S12	83.800	82.125	1675	1200	600x600	D400	300mm Catchpit
S13	83.800	81.975	1825	1200	600x600	D400	300mm Catchpit
S14	83.800	82.350	1450	1200	600x600	D400	300mm Catchpit
S15	83.850	81.725	2125	1350	600x600	B125	.
S16	84.100	82.100	2000	1350	600x600	B125	.
S17	84.100	82.250	1850	1350	600x600	B125	.
S18	84.100	82.425	1675	1200	600x600	B125	.
S19	84.000	82.775	1225	1200	600x600	D400	.
S20	84.000	82.050	1950	1200	600x600	D400	300mm Catchpit
S21	84.150	82.350	1800	1350	600x600	D400	.
S22	84.150	82.500	1650	1350	600x600	D400	.
S23	84.200	82.675	1525	1200	600x600	D400	.
S24	84.300	83.100	1200	1200	600x600	B125	.
S25	84.200	82.200	2000	1200	600x600	D400	300mm Catchpit
S26	84.200	82.875	1325	1200	600x600	D400	.
S27	83.000	80.900	2100	1800	2/600x600	B125	Hydrobrake 3 l/s + Wier Overflow 82.200m
S28	83.100	81.300	1800	1200	600x600	B125	.
S29	83.200	81.200	2300	1350	600x600	D400	300mm Catchpit
S30	83.000	81.575	1425	1350	600x600	D400	.
S31	83.000	81.750	1250	1200	600x600	D400	.
S32	83.100	81.950	1150	1200	600x600	D400	.
S33	82.750	81.700	1050	1200	600x600	D400	.
S34	83.100	81.000	2100	1350	600x600	B125	300mm Catchpit
S35	83.100	81.390	1710	1350	600x600	D400	.
S36	83.100	81.500	1600	1350	600x600	D400	.
S37	83.100	81.875	1225	1200	600x600	B125	.
S38	83.100	82.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S39	83.100	81.625	1475	1200	600x600	D400	.
S40	83.100	81.850	1250	1200	600x600	D400	.

NOTE: ALL PERMEABLE PAVING SUBGRADE DESIGN & COLLECTOR PIPE LOCATIONS TO BE CONFIRMED

NOTE: ALL DRAINAGE IS INVERT TO INVERT MANHOLE DESIGN

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH ARCHITECT



Phase 3 Drained Areas 1:1000

A1

DRAINAGE NOTES

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND BAILEY JOHNSON HAYES DRAWINGS AND SPECIFICATIONS.

2 DRAINS TO BE 'HEPWORTH SUPERSLEEVE' LAID IN CLASS S BEDDING TO BS 882 1983: TABLE 4, OR TO BS 8301 1985: APPENDIX D. 450 DIA DRAINS AND ABOVE TO BE HEPWORTH CONCRETE PIPES CLASS H . OR EQUAL APPROVED DRAINS WITHIN THE SITE MAY BE THERMOPLASTIC STRUCTURED WALL PIPE IN ACCORDANCE WITH CLAUSE E2.22 OF SFA 8th EDITION

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75 MM DOWN GRADED STONE FILL, PLACED AND COMPACTED IN 150 MM LAYERS. ALL PIPES IN ROADWAYS, SERVICE YARDS AND CARPARKS LESS THAN 1200 MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3 METRE CENTRES.

4 MANHOLES TO BE CONSTRUCTED IN PRECAST CONCRETE RINGS TO BS 5911: PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES IN FOOTPATHS OR LANDSCAPED AREAS TO BE BACKFILLED WITH 40 MM DOWN GRADED STONE FILL, COMPACTED IN LAYERS NOT EXCEEDING 150 MM THICK. MANHOLES BENEATH ROADS AND PARKING AREAS TO BE CASED IN 150 MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ALL ROAD GULLIES TO BE HEPWORTH ROAD GULLIES., REF RGR4, WITH 150 MM DIAMETER OUTLETS. GULLIES TO BE ENCASED IN 150 MM MINIMUM CONCRETE.

8 DRAINS UNDER BUILDING AND WITHIN 300 MM OF THE UNDERSIDE OF FLOORSLAB TO BE ENCASED IN 150 MM CONCRETE. CASING TO INCORPORATE FLEXIBLE FIBRE BOARD JOINTS AT SPACINGS AS RECOMMENDED BY THE PIPE MANUFACTURER. DRAINS UNDER BUILDINGS GENERALLY TO HAVE MIN 100 FULL GRANULAR SURROUND TO CLASS S BS8301

9 WHERE PIPES RUN THROUGH GROUND BEAMS, FLEXIBLE JOINT CASINGS AT EACH FACE OF THE GROUND BEAM ARE TO BE PROVIDED. PIPES WHICH RUN UNDER GROUND BEAMS TO BE PROTECTED WITH 50 MM MINIMUM POLYSTYRENE PLACED OVER THE CROWN OF THE PIPE.

10 ALL WORK TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 8TH EDITION AND BS 8301 : CODE OF PRACTICE FOR BUILDING DRAINAGE

11 WHERE DRAINS RUN CLOSE TO BUILDINGS AND INVERT LEVELS ARE BELOW FOUNDATIONS THE DRAINS SHOULD BE ENCASED AS FOLLOWS:-

(a) WHERE THE DRAIN TRENCH IS WITHIN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE UP TO FOUNDATION FORMATION LEVEL or

(b) WHERE THE DRAIN TRENCH IS FURTHER THAN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE TO A LEVEL BELOW FOUNDATION FORMATION EQUAL TO THE DISTANCE FROM THE BUILDING LESS 150mm.

KEY:

- o INDICATES GULLIES
- ● INDICATES SURFACE WATER MANHOLES
- INDICATES NEW PIPE RUNS
- INDICATES LINE DRAIN RUNS
- □ INDICATES EXISTING MANHOLES

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

20m 10m 0 20m 40m 60m

Scale 1:1000 @A1

INFORMATION

Rev	Date	Revision Description
A	07.01.22	Updated to LLFA planning comments

Revision Schedule

Project Title

Axis J9 - Bicester

Client

ALBION LAND

Drawing Title

PHASE 3
Drained Areas

BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:1000 @A1	Drawing Number
Date	23.08.21	S1209-PH3-DD01A
Drawn	JNG	

SURFACE WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
S1	83.450	81.250	2200	1800	2/600x600	B125	Hydrobrake 7 l/s + Wier Overflow 82.850m
S2	84.100	81.400	2700	1800	600x600	B125	300mm Catchpit
S3	84.100	81.850	2250	1800	600x600	B125	.
S4	83.600	81.950	1650	1800	600x600	D400	.
S5	83.700	82.200	1500	1500	600x600	D400	.
S6	83.700	82.425	1275	1350	600x600	D400	.
S7	83.700	82.225	1475	1200	600x600	D400	300mm Catchpit
S8	84.100	82.425	1675	1200	600x600	B125	.
S9	84.100	83.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S10	84.100	82.100	2000	1200	600x600	D400	.
S11	84.100	82.550	1550	1200	600x600	D400	.
S12	83.800	82.125	1675	1200	600x600	D400	300mm Catchpit
S13	83.800	81.975	1825	1200	600x600	D400	300mm Catchpit
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S17	84.100	82.250	1850	1350	600x600	B125	.
S18	84.100	82.425	1675	1200	600x600	B125	.
S19	84.000	82.775	1225	1200	600x600	D400	.
S20	84.000	82.050	1950	1200	600x600	D400	300mm Catchpit
S21	84.150	82.350	1800	1350	600x600	D400	.
S22	84.150	82.500	1650	1350	600x600	D400	.
S23	84.200	82.675	1525	1200	600x600	D400	.
S24	84.300	83.100	1200	1200	600x600	B125	.
S25	84.200	82.200	2000	1200	600x600	D400	300mm Catchpit
S26	84.200	82.875	1325	1200	600x600	D400	.
S27	83.000	80.900	2100	1800	2/600x600	B125	Hydrobrake 3 l/s + Wier Overflow 82.200m
S28	83.100	81.300	1800	1200	600x600	B125	.
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S36	83.100	81.500	1600	1350	600x600	D400	.
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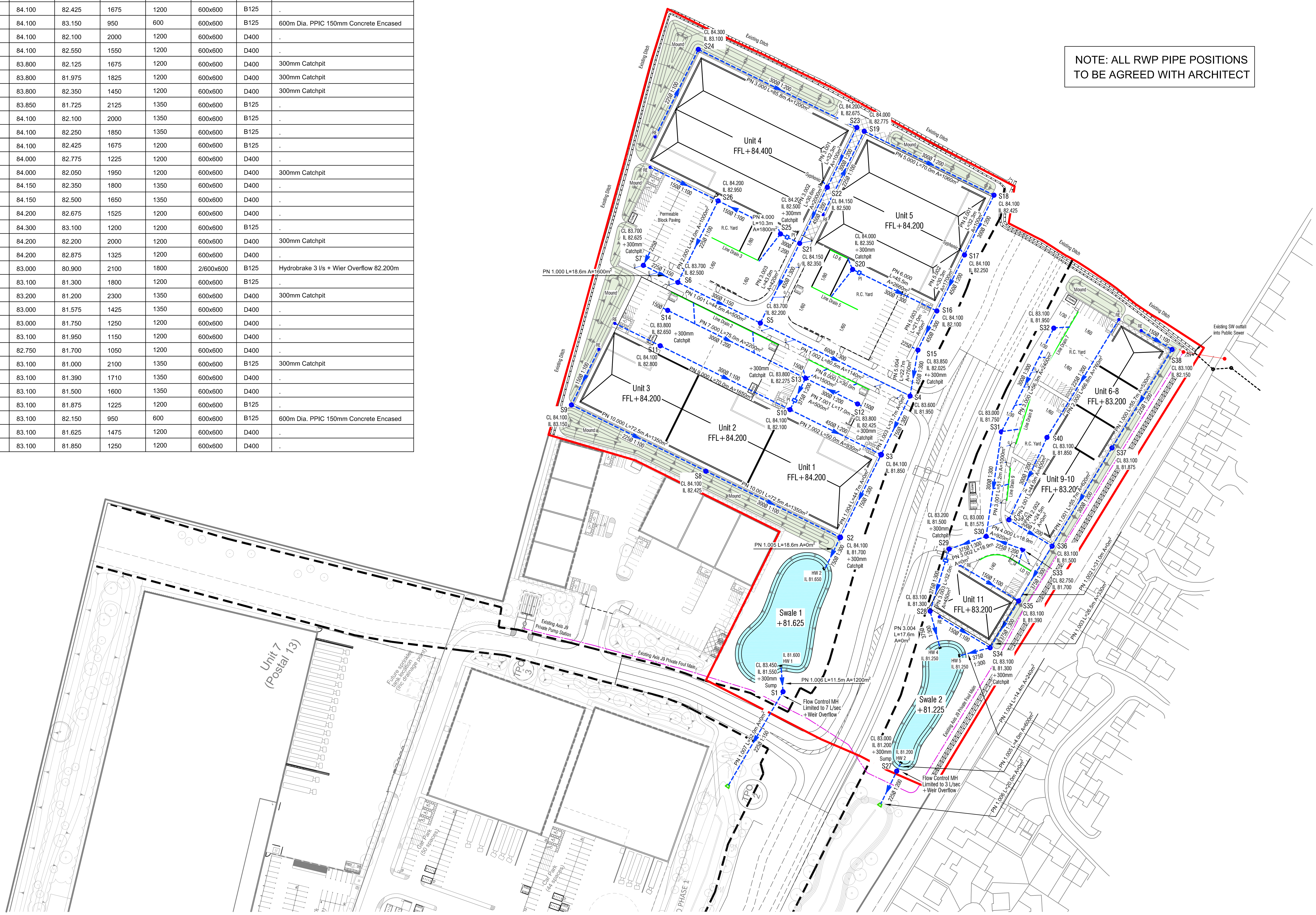
S38	83.100	82.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S39	83.100	81.625	1475	1200	600x600	D400	.
S40	83.100	81.850	1250	1200	600x600	D400	.



MicroDrainage Network Design 1:1000

A1

DRAINAGE NOTES

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4 MANHOLES TO BE CONSTRUCTED IN PRECAST CONCRETE RINGS TO BS 5911: PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES IN FOOTPATHS OR LANDSCAPED AREAS TO BE BACKFILLED WITH 40 MM DOWN GRADED STONE FILL, COMPACTED IN LAYERS NOT EXCEEDING 150 MM THICK. MANHOLES BENEATH ROADS AND PARKING AREAS TO BE CASED IN 150 MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ALL ROAD GULLIES TO BE HEPWORTH ROAD GULLIES., REF RGR4, WITH 150 MM DIAMETER OUTLETS. GULLIES TO BE ENCASED IN 150 MM MINIMUM CONCRETE.

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9 WHERE PIPES RUN THROUGH GROUND BEAMS, FLEXIBLE JOINT CASINGS AT EACH FACE OF THE GROUND BEAM ARE TO BE PROVIDED. PIPES WHICH RUN UNDER GROUND BEAMS TO BE PROTECTED WITH 50 MM MINIMUM POLYSTYRENE PLACED OVER THE CROWN OF THE PIPE.

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KEY:

- o INDICATES GULLIES
- ● INDICATES SURFACE WATER MANHOLES
- — INDICATES NEW PIPE RUNS
- — INDICATES LINE DRAIN RUNS
- □ INDICATES EXISTING MANHOLES

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

20m 10m 0 20m 40m 60m

Scale 1:1000 @A1

INFORMATION

Rev	Date	Revision Description
A	07.01.22	Updated to LLFA planning comments

Revision Schedule

Project Title

Axis J9 - Bicester

Client

ALBION LAND

Drawing Title

PHASE 3
MicroDrainage Network Design

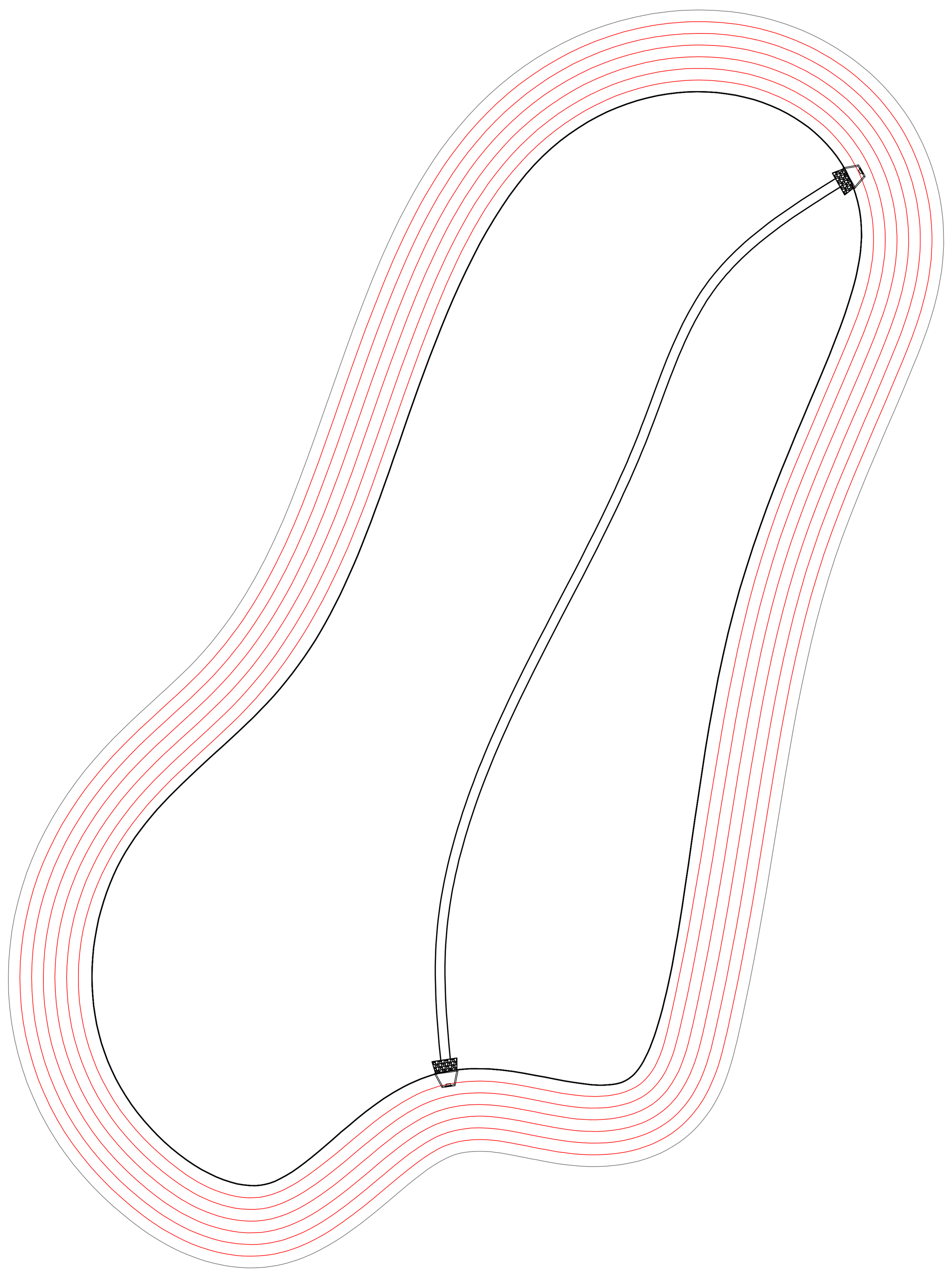
BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:1000 @A1
Date 23.08.21
Drawn JNG

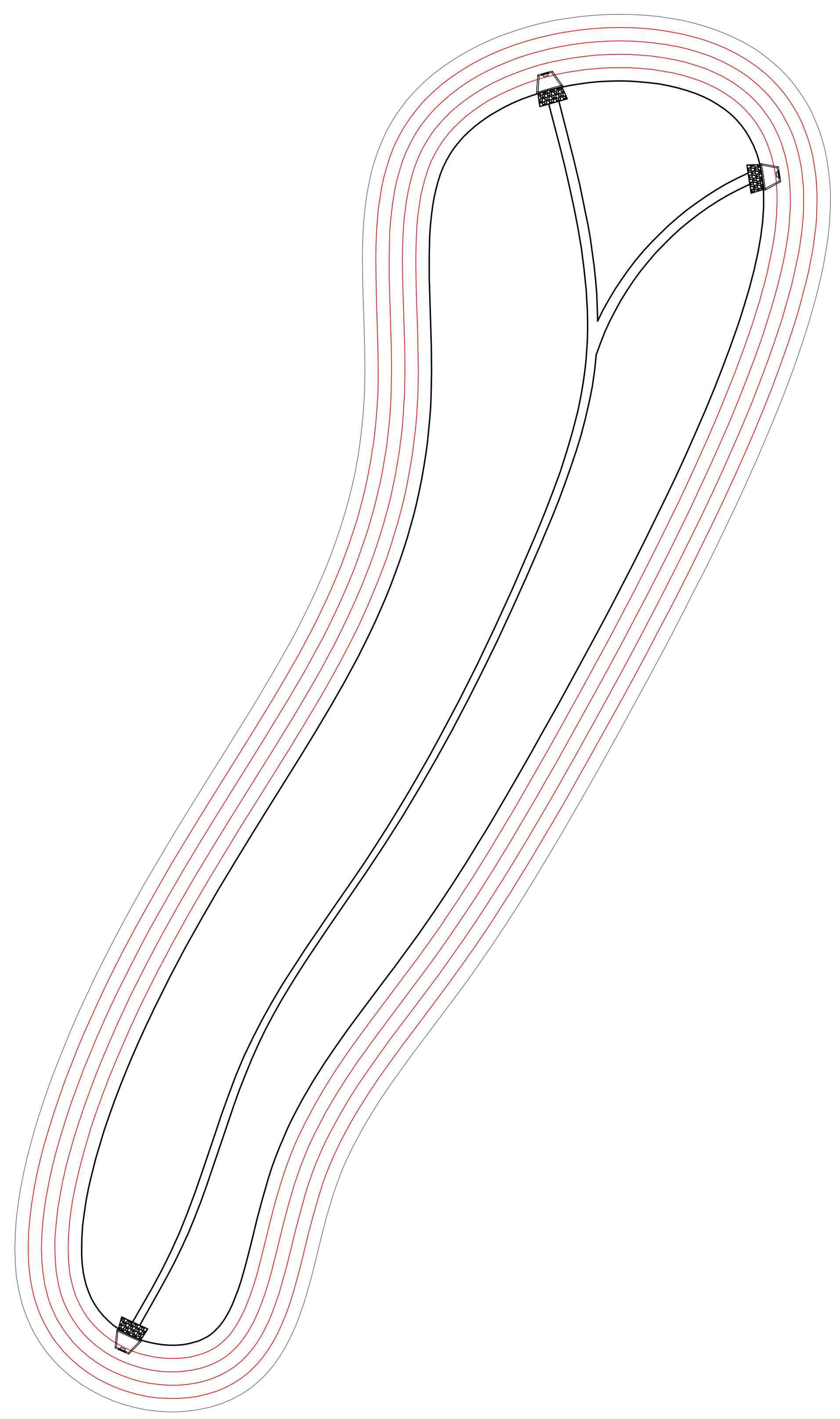
Drawing Number S1209-PH3-DD02A

A1



Swale 1 A=1537m2
81.625 ave IL

Depth = 0 Area = 1190m2
Depth = 0.2 Area = 1283m2
Depth = 0.4 Area = 1377m2
Depth = 0.6 Area = 1474m2
Depth = 0.8 Area = 1573m2
Depth = 1.0 Area = 1674m2
Depth = 1.2 Area = 1777m2
Depth = 1.4 Area = 1883m2



Swale 2 A=1537m2
81.225 ave IL

Depth = 0 Area = 594m2
Depth = 0.2 Area = 677m2
Depth = 0.4 Area = 763m2
Depth = 0.6 Area = 861m2
Depth = 0.8 Area = 941m2
Depth = 1.0 Area = 1033m2

N

Swale 1 & 2 Plan 1:250

INFORMATION

Rev	Date	Revision Description
A	07.01.22	Updated to LLFA planning comments

Revision Schedule

Project Title

Axis J9 - Bicester

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ALBION LAND

Drawing Title

PHASE 3
Swale 1 & 2

BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:1000 @A1	Drawing Number
Date	23.08.21	S1209-PH3-DD03
Drawn	JNG	

SURFACE WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
S1	83.450	81.250	2200	1800	2/600x600	B125	Hydrobrake 7 l/s + Wier Overflow 82.850m
S2	84.100	81.400	2700	1800	600x600	B125	300mm Catchpit
S3	84.100	81.850	2250	1800	600x600	B125	.
S4	83.600	81.950	1650	1800	600x600	D400	.
S5	83.700	82.200	1500	1500	600x600	D400	.
S6	83.700	82.425	1275	1350	600x600	D400	.
S7	83.700	82.225	1475	1200	600x600	D400	300mm Catchpit
S8	84.100	82.425	1675	1200	600x600	B125	.
S9	84.100	83.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S10	84.100	82.100	2000	1200	600x600	D400	.
S11	84.100	82.550	1550	1200	600x600	D400	.
S12	83.800	82.125	1675	1200	600x600	D400	300mm Catchpit
S13	83.800	81.975	1825	1200	600x600	D400	300mm Catchpit
S14	83.800	82.350	1450	1200	600x600	D400	300mm Catchpit
S15	83.850	81.725	2125	1350	600x600	B125	.
S16	84.100	82.100	2000	1350	600x600	B125	.
S17	84.100	82.250	1850	1350	600x600	B125	.
S18	84.100	82.425	1675	1200	600x600	B125	.
S19	84.000	82.775	1225	1200	600x600	D400	.
S20	84.000	82.050	1950	1200	600x600	D400	300mm Catchpit
S21	84.150	82.350	1800	1350	600x600	D400	.
S22	84.150	82.500	1650	1350	600x600	D400	.
S23	84.200	82.675	1525	1200	600x600	D400	.
S24	84.300	83.100	1200	1200	600x600	B125	.
S25	84.200	82.200	2000	1200	600x600	D400	300mm Catchpit
S26	84.200	82.875	1325	1200	600x600	D400	.
S27	83.000	80.900	2100	1800	2/600x600	B125	Hydrobrake 3 l/s + Wier Overflow 82.200m
S28	83.100	81.300	1800	1200	600x600	B125	.
S29	83.200	81.200	2300	1350	600x600	D400	300mm Catchpit
S30	83.000	81.575	1425	1350	600x600	D400	.
S31	83.000	81.750	1250	1200	600x600	D400	.
S32	83.100	81.950	1150	1200	600x600	D400	.
S33	82.750	81.700	1050	1200	600x600	D400	.
S34	83.100	81.000	2100	1350	600x600	B125	300mm Catchpit
S35	83.100	81.390	1710	1350	600x600	D400	.
S36	83.100	81.500	1600	1350	600x600	D400	.
S37	83.100	81.875	1225	1200	600x600	B125	.
S38	83.100	82.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S39	83.100	81.625	1475	1200	600x600	D400	.
S40	83.100	81.850	1250	1200	600x600	D400	.

Phase 3 Exceedance Flood Routes 1:1000

A1

DRAINAGE NOTES

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20m 10m 0 20m 40m 60m

Scale 1:1000 @A1

INFORMATION

Rev	Date	Revision Description

Revision Schedule

Project Title

Axis J9 - Bicester

Client

ALBION LAND

Drawing Title

PHASE 3
Exceedance Flood Route

BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:1000 @A1
Date 07.01.22
Drawn JNG

Drawing Number S1209-PH3-DD04

MICRODRAINAGE CALCULATIONS PHASE 3

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	James Griffiths
Site name:	Axis J9 - Phase 3
Site location:	Bicester

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

Site Details

Latitude:	51.90408° N
Longitude:	1.18047° W
Reference:	779462308
Date:	Jan 07 2022 10:20

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 6.5

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	628	628
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

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

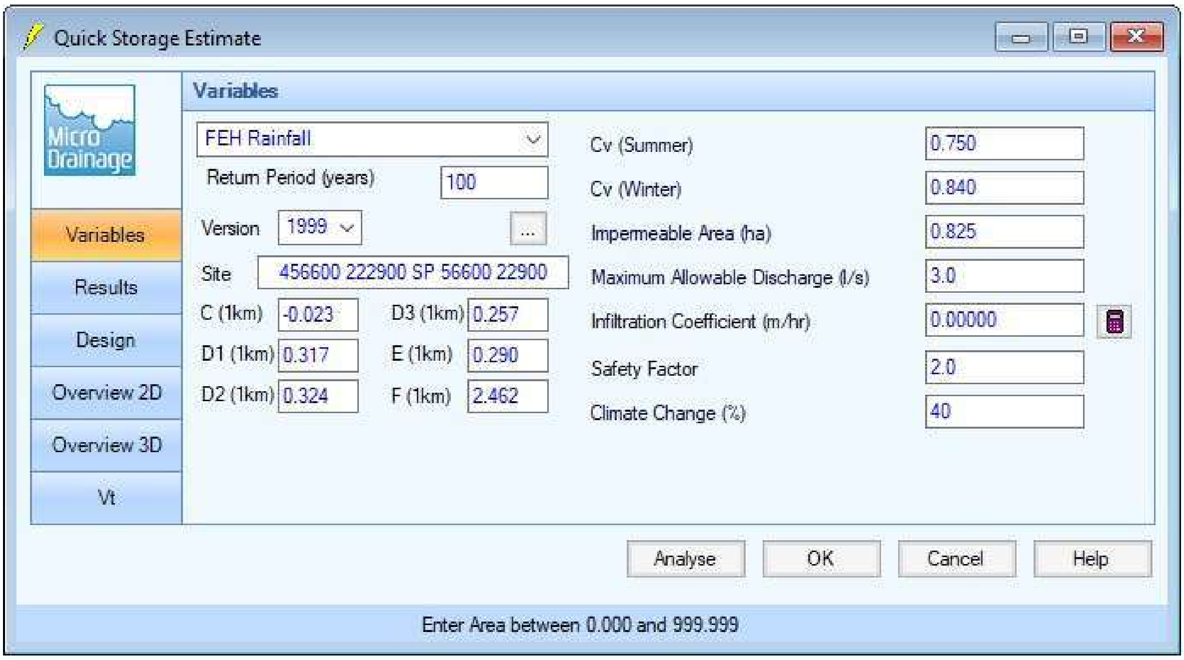
(3) Is SPR/SPRHOST ≤ 0.3?

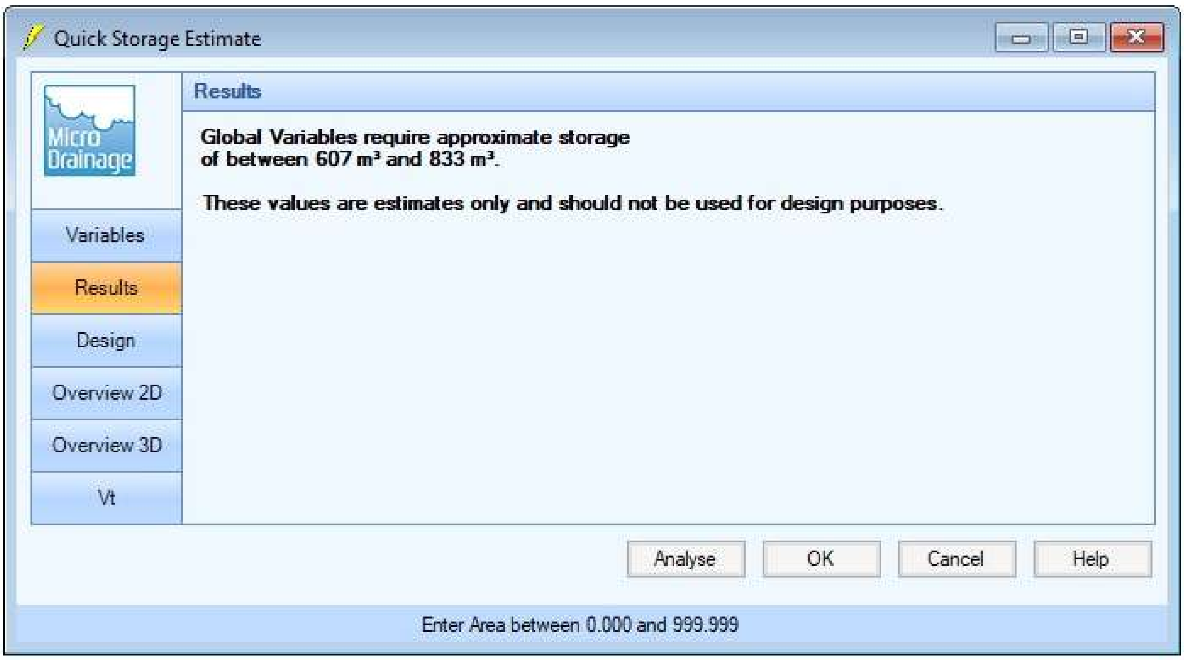
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.96	10.43
1 in 1 year (l/s):	0.82	8.87
1 in 30 years (l/s):	2.21	24
1 in 100 year (l/s):	3.07	33.28
1 in 200 years (l/s):	3.6	39.02

East Site Sub-Catchment – Quick Storage Estimates
100-year + 40% Initial Calculations





STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	Auto Design
1.000	55.700	0.275	202.5	0.053	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	55.700	0.375	148.5	0.062	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	66.800	0.350	190.9	0.076	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	44.000	0.225	195.6	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	24.500	0.125	196.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	31.000	0.110	281.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	26.500	0.090	294.4	0.033	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	14.400	0.050	288.0	0.024	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	56.300	0.200	281.5	0.240	5.00	0.0	0.600	o	375	Pipe/Conduit	
3.001	51.200	0.175	292.6	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	18.900	0.125	151.2	0.092	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	18.900	0.075	252.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.003	32.000	0.200	160.0	0.045	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.004	17.600	0.050	352.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	4.000	0.050	80.0	0.060	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	20.000	0.090	222.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	122.08	6.01	82.150	0.053	0.0	0.0	0.0	0.92	36.4	17.5
1.001	112.34	6.74	81.875	0.115	0.0	0.0	0.0	1.29	91.0	35.0
2.000	119.66	6.18	82.200	0.076	0.0	0.0	0.0	0.94	37.5	24.6
2.001	111.13	6.83	81.850	0.116	0.0	0.0	0.0	1.12	79.2	34.9
2.002	106.97	7.20	81.625	0.116	0.0	0.0	0.0	1.12	79.1	34.9
1.002	102.00	7.68	81.500	0.231	0.0	0.0	0.0	1.07	118.7	63.8
1.003	98.09	8.10	81.390	0.264	0.0	0.0	0.0	1.05	116.0	70.1
1.004	96.12	8.33	81.300	0.288	0.0	0.0	0.0	1.06	117.4	75.0
3.000	124.24	5.87	81.950	0.240	0.0	0.0	0.0	1.07	118.7	80.8
3.001	112.99	6.68	81.750	0.340	0.0	0.0	0.0	1.05	116.4	104.0
4.000	134.03	5.30	81.700	0.092	0.0	0.0	0.0	1.06	42.2	33.4
3.002	110.02	6.93	81.575	0.432	0.0	0.0	0.0	1.28	203.0	128.7
3.003	106.30	7.26	81.500	0.477	0.0	0.0	0.0	1.60	255.2	137.3
3.004	103.46	7.53	81.300	0.477	0.0	0.0	0.0	1.08	171.4	137.3
1.005	95.88	8.36	81.250	0.825	0.0	0.0	0.0	2.27	361.8	214.2
1.006	92.78	8.74	81.200	0.825	0.0	0.0	0.0	0.87	34.7«	214.2

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	Exitsing Swale	82.900	81.110	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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	E (1km)	0.290
Return Period (years)	10	F (1km)	2.462
FEH Rainfall Version	1999	Summer Storms	Yes
Site Location	456600 222900 SP 56600 22900	Winter Storms	Yes
C (1km)	-0.023	Cv (Summer)	0.750
D1 (1km)	0.317	Cv (Winter)	0.840
D2 (1km)	0.324	Storm Duration (mins)	30
D3 (1km)	0.257		

Online Controls for Storm

Complex Manhole: S27, DS/PN: 1.006, Volume (m³): 3.1

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	81.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0	Kick-Flo®	0.623	2.4
Flush-Flo™	0.297	3.0	Mean Flow over Head Range	-	2.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.3	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.4	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.2
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.4
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 82.200

Storage Structures for Storm

Tank or Pond Manhole: SWALE, DS/PN: 1.005

Invert Level (m) 81.250

Depth (m)	Area (m^2)	Depth (m)	Area (m^2)	Depth (m)	Area (m^2)
0.000	575.0	1.200	1100.0	1.201	0.0

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m^3)	Pipe Volume (m^3)	Storage Structure Volume (m^3)	Total Volume (m^3)
1.000	S38	1.074	2.215	0.000	3.289
1.001	S37	1.385	3.937	0.000	5.323
2.000	RE	1.018	2.656	0.000	3.674
2.001	S40	1.414	3.110	0.000	4.524
2.002	S39	1.668	1.732	0.000	3.400
1.002	S36	2.290	3.424	0.000	5.714
1.003	S35	2.448	2.927	0.000	5.375
1.004	S34	2.576	1.590	0.000	4.167
3.000	S32	1.646	6.218	0.000	7.864
3.001	S31	1.789	5.655	0.000	7.444
4.000	S33	1.188	0.751	0.000	1.939
3.002	S30	2.040	3.006	0.000	5.046
3.003	S29	2.433	5.089	0.000	7.523
3.004	S28	2.576	2.799	0.000	5.376
1.005	SWALE	2.648	0.636	988.486	991.770
1.006	S27	2.720	0.795	0.000	3.515
Total		30.914	46.541	988.486	1065.942

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 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 D3 (1km) 0.257
FEH Rainfall Version 1999 E (1km) 0.290
Site Location 456600 222900 SP 56600 22900 F (1km) 2.462
C (1km) -0.023 Cv (Summer) 0.750
D1 (1km) 0.317 Cv (Winter) 0.840
D2 (1km) 0.324

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

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S38	30 minute 1 year Summer I+0%	83.100	82.212	0.000	0.064	5.7	OK
1.001	S37	30 minute 1 year Summer I+0%	83.100	81.948	0.000	0.174	11.4	OK
2.000	RE	30 minute 1 year Summer I+0%	83.100	82.273	0.000	0.077	8.1	OK
2.001	S40	30 minute 1 year Summer I+0%	83.100	81.930	0.000	0.186	11.6	OK
2.002	S39	30 minute 1 year Summer I+0%	83.100	81.706	0.000	0.210	11.6	OK
1.002	S36	30 minute 1 year Summer I+0%	83.100	81.617	0.000	0.577	22.4	OK
1.003	S35	30 minute 1 year Summer I+0%	83.100	81.515	0.000	0.622	24.7	OK
1.004	S34	30 minute 1 year Summer I+0%	83.100	81.435	0.000	0.705	26.3	OK
3.000	S32	30 minute 1 year Summer I+0%	83.100	82.075	0.000	0.171	25.9	OK
3.001	S31	30 minute 1 year Summer I+0%	83.000	81.896	0.000	0.939	34.2	OK
4.000	S33	30 minute 1 year Summer I+0%	82.750	81.779	0.000	0.084	10.3	OK
3.002	S30	30 minute 1 year Summer I+0%	83.000	81.731	0.000	1.364	42.6	OK
3.003	S29	30 minute 1 year Summer I+0%	83.200	81.639	0.000	0.622	45.9	OK
3.004	S28	30 minute 1 year Summer I+0%	83.100	81.480	0.000	0.949	45.7	OK
1.005	SWALE	480 minute 1 year Winter I+0%	83.100	81.411	0.000	98.844	3.4	OK
1.006	S27	480 minute 1 year Winter I+0%	83.100	81.421	0.000	0.458	2.9	OK

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 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 D3 (1km) 0.257
FEH Rainfall Version 1999 E (1km) 0.290
Site Location 456600 222900 SP 56600 22900 F (1km) 2.462
C (1km) -0.023 Cv (Summer) 0.750
D1 (1km) 0.317 Cv (Winter) 0.840
D2 (1km) 0.324

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

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S38	30 minute 30 year Summer I+0%	83.100	82.259	0.000	0.118	16.0	OK
1.001	S37	30 minute 30 year Summer I+0%	83.100	82.009	0.000	0.452	34.5	OK
2.000	RE	30 minute 30 year Summer I+0%	83.100	82.333	0.000	0.145	22.7	OK
2.001	S40	30 minute 30 year Summer I+0%	83.100	81.996	0.000	0.506	34.0	OK
2.002	S39	30 minute 30 year Summer I+0%	83.100	81.775	0.000	0.626	33.4	OK
1.002	S36	30 minute 30 year Summer I+0%	83.100	81.717	0.000	1.856	65.8	OK
1.003	S35	720 minute 30 year Winter I+0%	83.100	81.670	0.000	2.381	7.2	OK
1.004	S34	720 minute 30 year Winter I+0%	83.100	81.669	0.000	2.963	7.6	OK
3.000	S32	30 minute 30 year Summer I+0%	83.100	82.178	0.000	0.319	72.8	OK
3.001	S31	30 minute 30 year Summer I+0%	83.000	82.038	0.000	3.364	97.8	OK
4.000	S33	30 minute 30 year Summer I+0%	82.750	81.952	0.000	0.279	26.9	SURCHARGED
3.002	S30	30 minute 30 year Summer I+0%	83.000	81.867	0.000	4.038	121.8	OK
3.003	S29	30 minute 30 year Summer I+0%	83.200	81.749	0.000	1.545	129.2	OK
3.004	S28	720 minute 30 year Winter I+0%	83.100	81.669	0.000	3.462	13.0	OK
1.005	SWALE	720 minute 30 year Winter I+0%	83.100	81.668	0.000	278.270	3.6	OK
1.006	S27	720 minute 30 year Winter I+0%	83.100	81.676	0.000	1.074	3.0	SURCHARGED

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

Simulation Criteria

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

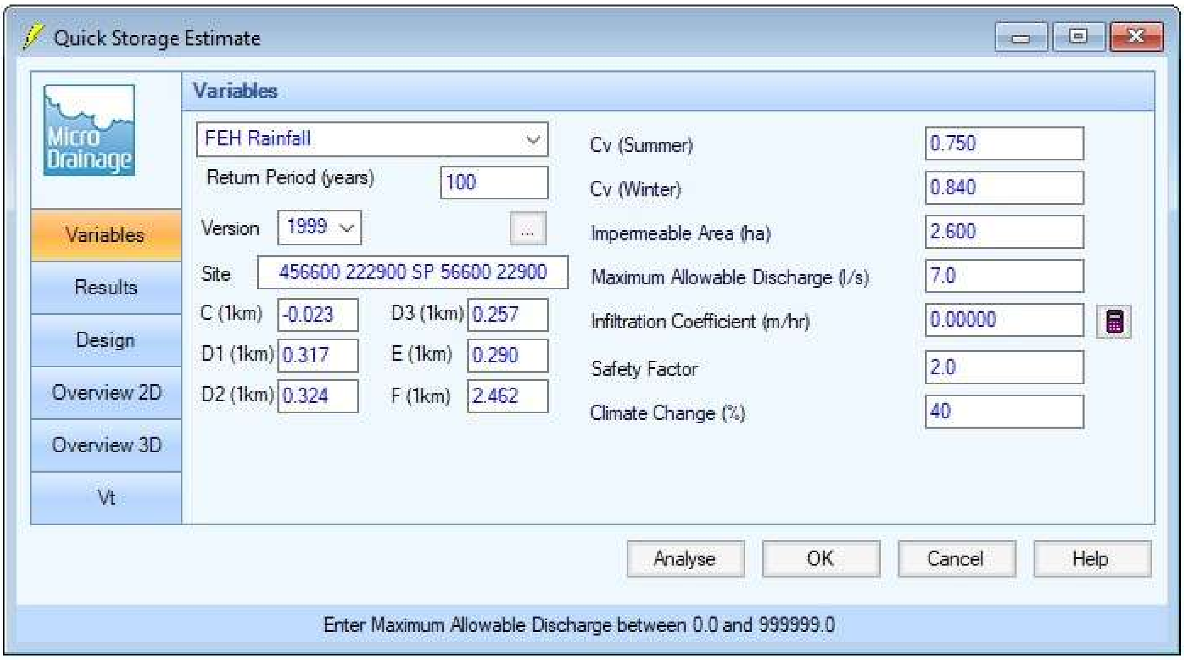
Rainfall Model FEH D3 (1km) 0.257
FEH Rainfall Version 1999 E (1km) 0.290
Site Location 456600 222900 SP 56600 22900 F (1km) 2.462
C (1km) -0.023 Cv (Summer) 0.750
D1 (1km) 0.317 Cv (Winter) 0.840
D2 (1km) 0.324

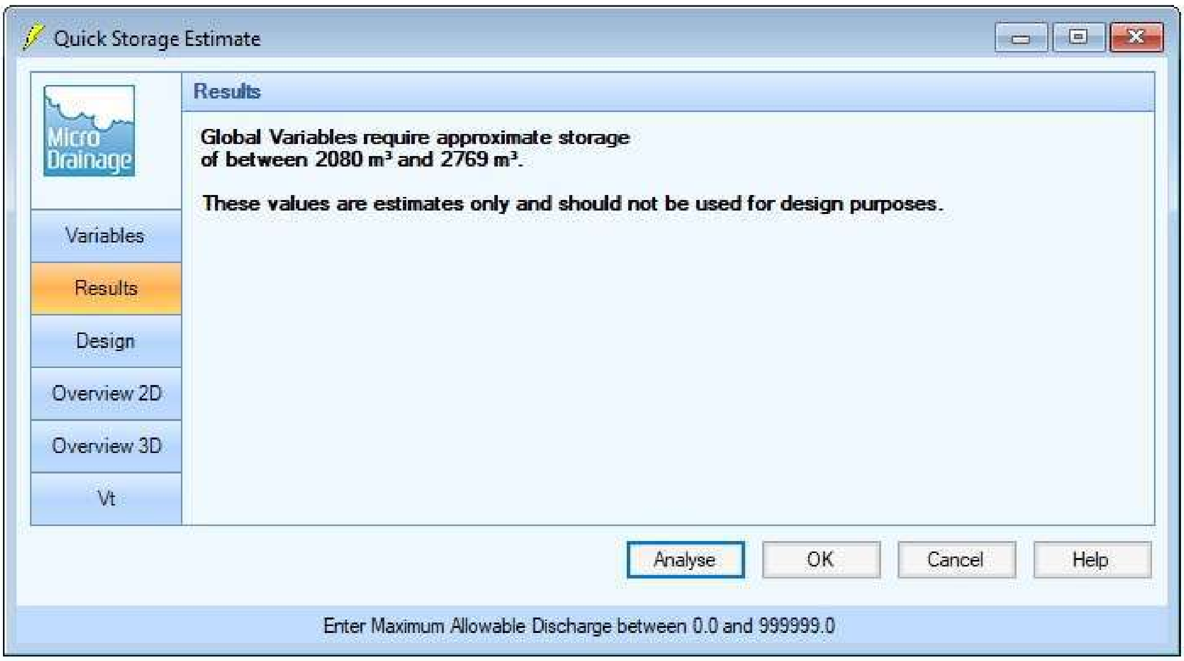
Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S38	30 minute 100 year Summer I+40%	83.100	82.350	0.000	0.220	32.2	OK
1.001	S37	30 minute 100 year Summer I+40%	83.100	82.129	0.000	1.357	67.9	OK
2.000	RE	30 minute 100 year Summer I+40%	83.100	82.657	0.000	0.511	43.6	SURCHARGED
2.001	S40	30 minute 100 year Summer I+40%	83.100	82.184	0.000	1.978	61.8	SURCHARGED
2.002	S39	30 minute 100 year Summer I+40%	83.100	82.058	0.000	3.308	54.6	SURCHARGED
1.002	S36	1440 minute 100 year Winter I+40%	83.100	82.053	0.000	5.998	6.9	SURCHARGED
1.003	S35	1440 minute 100 year Winter I+40%	83.100	82.052	0.000	4.216	7.8	SURCHARGED
1.004	S34	1440 minute 100 year Winter I+40%	83.100	82.052	0.000	3.846	8.5	SURCHARGED
3.000	S32	30 minute 100 year Summer I+40%	83.100	83.037	0.000	1.548	129.8	FLOOD RISK
3.001	S31	30 minute 100 year Summer I+40%	83.000	82.755	0.000	7.500	175.8	FLOOD RISK
4.000	S33	30 minute 100 year Summer I+40%	82.750	82.486	0.000	0.883	50.9	FLOOD RISK
3.002	S30	30 minute 100 year Summer I+40%	83.000	82.268	0.000	7.191	224.6	SURCHARGED
3.003	S29	30 minute 100 year Summer I+40%	83.200	82.107	0.000	3.654	242.4	SURCHARGED
3.004	S28	1440 minute 100 year Winter I+40%	83.100	82.052	0.000	5.944	14.4	SURCHARGED
1.005	SWALE	1440 minute 100 year Winter I+40%	83.100	82.051	0.000	593.656	3.7	SURCHARGED
1.006	S27	960 minute 100 year Winter I+40%	83.100	82.077	0.000	1.669	3.0	SURCHARGED

West Site Sub-Catchment – Quick Storage Estimates
100-year + 40% Initial Calculations





STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	Auto Design
1.000	20.000	0.100	200.0	0.160	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	45.000	0.450	100.0	0.100	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	45.000	0.225	200.0	0.050	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	85.800	0.425	201.9	0.120	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	32.300	0.175	184.6	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	30.600	0.150	204.0	0.200	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	10.300	0.150	68.7	0.180	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.003	43.000	0.150	286.7	0.042	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	80.000	0.250	320.0	0.114	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	70.000	0.350	200.0	0.106	5.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	32.300	0.175	184.6	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	30.000	0.150	200.0	0.170	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.000	45.000	0.150	300.0	0.266	5.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	133.95	5.30	82.525	0.160	0.0	0.0	0.0	1.11	78.3	58.0
2.000	129.10	5.57	82.875	0.100	0.0	0.0	0.0	1.31	52.0	35.0
1.001	119.94	6.16	82.425	0.310	0.0	0.0	0.0	1.28	141.1	100.7
3.000	118.04	6.30	83.100	0.120	0.0	0.0	0.0	1.10	78.0	38.4
3.001	112.00	6.76	82.675	0.130	0.0	0.0	0.0	1.15	81.6	39.4
3.002	107.33	7.17	82.500	0.330	0.0	0.0	0.0	1.26	139.7	95.9
4.000	138.00	5.09	82.500	0.180	0.0	0.0	0.0	1.90	134.3	67.3
3.003	101.18	7.77	82.350	0.552	0.0	0.0	0.0	1.20	190.2	151.3
1.002	92.69	8.75	82.200	0.976	0.0	0.0	0.0	1.36	383.4	245.0
5.000	121.51	6.05	82.775	0.106	0.0	0.0	0.0	1.11	78.3	34.9
5.001	115.06	6.52	82.425	0.116	0.0	0.0	0.0	1.15	81.6	36.1
5.002	110.24	6.91	82.250	0.286	0.0	0.0	0.0	1.28	141.1	85.4
6.000	126.66	5.72	82.250	0.266	0.0	0.0	0.0	1.04	115.0	91.2

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

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	Auto Design
5.003	21.000	0.075	280.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
5.004	22.700	0.075	302.7	0.075	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
1.003	31.700	0.100	317.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	🔒
7.000	75.000	0.375	200.0	0.220	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
8.000	30.000	0.150	200.0	0.150	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
7.001	17.000	0.175	97.1	0.050	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
9.000	70.000	0.450	155.6	0.165	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
7.002	50.000	0.250	200.0	0.093	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
1.004	45.000	0.150	300.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
10.000	72.500	0.725	100.0	0.135	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
10.001	72.500	0.725	100.0	0.135	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.005	18.600	0.050	372.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	🔒
1.006	11.500	0.050	230.0	0.120	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
1.007	52.000	0.350	148.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.003	106.96	7.20	82.100	0.552	0.0	0.0	0.0	1.21	192.4	159.9
5.004	103.55	7.53	82.025	0.627	0.0	0.0	0.0	1.16	185.0	175.8
1.003	89.79	9.14	81.950	1.603	0.0	0.0	0.0	1.36	385.2«	389.8
7.000	120.41	6.13	82.650	0.220	0.0	0.0	0.0	1.11	78.3	71.7
8.000	131.23	5.45	82.425	0.150	0.0	0.0	0.0	1.11	78.3	53.3
7.001	118.24	6.28	82.275	0.420	0.0	0.0	0.0	1.84	203.1	134.5
9.000	123.40	5.93	82.550	0.165	0.0	0.0	0.0	1.26	88.9	55.1
7.002	110.79	6.86	82.100	0.678	0.0	0.0	0.0	1.43	228.1	203.4
1.004	86.57	9.60	81.850	2.281	0.0	0.0	0.0	1.61	711.5	534.8
10.000	123.44	5.92	83.150	0.135	0.0	0.0	0.0	1.31	52.0	45.1
10.001	112.86	6.69	82.425	0.270	0.0	0.0	0.0	1.57	111.1	82.5
1.005	85.17	9.82	81.700	2.551	0.0	0.0	0.0	1.44	638.4	588.4
1.006	84.27	9.96	81.650	2.671	0.0	0.0	0.0	1.34	212.5«	609.6
1.007	79.57	10.77	81.600	2.671	0.0	0.0	0.0	1.07	42.6«	609.6

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	Existing Swale	82.800	81.250	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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	E (1km)	0.290
Return Period (years)	5	F (1km)	2.462
FEH Rainfall Version	1999	Summer Storms	Yes
Site Location	456600 222900 SP 56600 22900	Winter Storms	Yes
C (1km)	-0.023	Cv (Summer)	0.750
D1 (1km)	0.317	Cv (Winter)	0.840
D2 (1km)	0.324	Storm Duration (mins)	30
D3 (1km)	0.257		

Online Controls for Storm

Complex Manhole: S1, DS/PN: 1.007, Volume (m^3): 4.2

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0120-7000-1250-7000
Design Head (m)	1.250
Design Flow (l/s)	7.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	120
Invert Level (m)	81.600
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	7.0	Kick-Flo®	0.783	5.6
Flush-Flo™	0.366	7.0	Mean Flow over Head Range	-	6.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	6.9	3.000	10.6	7.000	15.8
0.200	6.6	1.400	7.4	3.500	11.4	7.500	16.3
0.300	7.0	1.600	7.9	4.000	12.1	8.000	16.9
0.400	7.0	1.800	8.3	4.500	12.8	8.500	17.4
0.500	6.9	2.000	8.7	5.000	13.5	9.000	17.8
0.600	6.7	2.200	9.1	5.500	14.1	9.500	18.3
0.800	5.7	2.400	9.5	6.000	14.7		
1.000	6.3	2.600	9.9	6.500	15.3		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 82.850

Storage Structures for Storm

Tank or Pond Manhole: SWALE, DS/PN: 1.006

Invert Level (m) 81.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1300.0	1.400	2000.0	1.401	0.0

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S7	1.329	1.414	0.000	2.743
2.000	S26	1.499	1.789	0.000	3.288
1.001	S6	1.825	4.970	0.000	6.795
3.000	S24	1.357	6.065	0.000	7.422
3.001	S23	1.725	2.283	0.000	4.008
3.002	S22	2.362	3.380	0.000	5.741
4.000	S25	1.923	0.728	0.000	2.651
3.003	S21	2.576	6.839	0.000	9.415
1.002	S5	2.651	22.619	0.000	25.270
5.000	S19	1.385	4.948	0.000	6.333
5.001	S18	1.894	2.283	0.000	4.178
5.002	S17	2.648	3.313	0.000	5.961
6.000	S20	2.505	4.970	0.000	7.475
5.003	S16	2.863	3.340	0.000	6.203
5.004	S15	2.612	3.610	0.000	6.223
1.003	S4	2.916	8.963	0.000	11.879
7.000	S14	1.301	5.301	0.000	6.602
8.000	S12	1.555	2.121	0.000	3.676
7.001	S13	2.183	1.878	0.000	4.060
9.000	S11	1.753	4.948	0.000	6.701
7.002	S10	2.863	7.952	0.000	10.815
1.004	S3	5.726	19.880	0.000	25.606
10.000	S9	1.074	2.883	0.000	3.957
10.001	S8	1.894	5.125	0.000	7.019
1.005	S2	6.107	8.217	0.000	14.324
1.006	SWALE	6.234	1.829	2293.144	2301.208
1.007	S1	2.648	2.068	0.000	4.716
Total		67.408	143.716	2293.144	2504.269

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 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 D3 (1km) 0.257
FEH Rainfall Version 1999 E (1km) 0.290
Site Location 456600 222900 SP 56600 22900 F (1km) 2.462
C (1km) -0.023 Cv (Summer) 0.750
D1 (1km) 0.317 Cv (Winter) 0.840
D2 (1km) 0.324

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

Profile(s) Summer and Winter
Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	60 minute 1 year Summer I+0%	83.700	82.614	0.000	0.095	13.2	OK
2.000	S26	60 minute 1 year Summer I+0%	84.200	82.936	0.000	0.064	8.2	OK
1.001	S6	60 minute 1 year Summer I+0%	83.700	82.537	0.000	0.437	25.0	OK
3.000	S24	60 minute 1 year Summer I+0%	84.300	83.172	0.000	0.076	9.6	OK
3.001	S23	60 minute 1 year Summer I+0%	84.200	82.749	0.000	0.195	10.3	OK
3.002	S22	60 minute 1 year Summer I+0%	84.150	82.615	0.000	0.368	25.1	OK
4.000	S25	60 minute 1 year Summer I+0%	84.200	82.578	0.000	0.083	14.9	OK
3.003	S21	60 minute 1 year Summer I+0%	84.150	82.502	0.000	0.909	42.3	OK
1.002	S5	60 minute 1 year Summer I+0%	83.700	82.387	0.000	2.490	73.8	OK
5.000	S19	60 minute 1 year Summer I+0%	84.000	82.843	0.000	0.071	8.6	OK
5.001	S18	60 minute 1 year Summer I+0%	84.100	82.495	0.000	0.183	9.3	OK
5.002	S17	60 minute 1 year Summer I+0%	84.100	82.356	0.000	0.304	22.0	OK
6.000	S20	60 minute 1 year Summer I+0%	84.000	82.366	0.000	0.159	21.7	OK
5.003	S16	60 minute 1 year Summer I+0%	84.100	82.282	0.000	2.197	41.3	OK
5.004	S15	60 minute 1 year Summer I+0%	83.850	82.247	0.000	1.412	45.2	OK
1.003	S4	60 minute 1 year Summer I+0%	83.600	82.219	0.000	6.461	115.2	OK
7.000	S14	60 minute 1 year Summer I+0%	83.800	82.750	0.000	0.107	17.7	OK
8.000	S12	60 minute 1 year Summer I+0%	83.800	82.509	0.000	0.089	12.4	OK
7.001	S13	60 minute 1 year Summer I+0%	83.800	82.390	0.000	0.623	33.8	OK
9.000	S11	60 minute 1 year Summer I+0%	84.100	82.630	0.000	0.085	13.4	OK
7.002	S10	60 minute 1 year Summer I+0%	84.100	82.255	0.000	0.891	53.6	OK
1.004	S3	60 minute 1 year Summer I+0%	84.100	82.140	0.000	6.218	161.2	OK
10.000	S9	60 minute 1 year Summer I+0%	84.100	83.221	0.000	0.075	11.0	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
10.001	S8	60 minute 1 year Summer I+0%	84.100	82.516	0.000	0.158	21.0	OK
1.005	S2	60 minute 1 year Summer I+0%	84.100	82.030	0.000	7.653	177.9	OK
1.006	SWALE	960 minute 1 year Winter I+0%	84.100	81.930	0.000	383.829	6.9	OK
1.007	S1	960 minute 1 year Winter I+0%	83.450	81.928	0.000	1.479	6.8	SURCHARGED

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 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 D3 (1km) 0.257
FEH Rainfall Version 1999 E (1km) 0.290
Site Location 456600 222900 SP 56600 22900 F (1km) 2.462
C (1km) -0.023 Cv (Summer) 0.750
D1 (1km) 0.317 Cv (Winter) 0.840
D2 (1km) 0.324

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

Profile(s) Summer and Winter
Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	60 minute 30 year Summer I+0%	83.700	82.679	0.000	0.169	35.3	OK
2.000	S26	60 minute 30 year Summer I+0%	84.200	82.980	0.000	0.113	22.0	OK
1.001	S6	60 minute 30 year Summer I+0%	83.700	82.620	0.000	1.200	67.1	OK
3.000	S24	60 minute 30 year Summer I+0%	84.300	83.223	0.000	0.133	25.7	OK
3.001	S23	60 minute 30 year Summer I+0%	84.200	82.801	0.000	0.455	27.4	OK
3.002	S22	60 minute 30 year Summer I+0%	84.150	82.705	0.000	1.064	69.4	OK
4.000	S25	60 minute 30 year Summer I+0%	84.200	82.659	0.000	0.174	39.4	OK
3.003	S21	60 minute 30 year Summer I+0%	84.150	82.632	0.000	2.614	115.1	OK
1.002	S5	60 minute 30 year Summer I+0%	83.700	82.553	0.000	7.848	193.7	OK
5.000	S19	60 minute 30 year Summer I+0%	84.000	82.890	0.000	0.124	22.9	OK
5.001	S18	60 minute 30 year Summer I+0%	84.100	82.778	0.000	3.131	21.7	SURCHARGED
5.002	S17	60 minute 30 year Summer I+0%	84.100	82.757	0.000	2.911	52.9	SURCHARGED
6.000	S20	60 minute 30 year Summer I+0%	84.000	82.739	0.000	0.692	53.5	SURCHARGED
5.003	S16	60 minute 30 year Summer I+0%	84.100	82.647	0.000	8.753	85.5	SURCHARGED
5.004	S15	60 minute 30 year Summer I+0%	83.850	82.554	0.000	3.856	93.9	SURCHARGED
1.003	S4	60 minute 30 year Summer I+0%	83.600	82.463	0.000	19.047	273.7	OK
7.000	S14	60 minute 30 year Summer I+0%	83.800	82.826	0.000	0.193	47.4	OK
8.000	S12	60 minute 30 year Summer I+0%	83.800	82.569	0.000	0.157	33.1	OK
7.001	S13	60 minute 30 year Summer I+0%	83.800	82.507	0.000	2.542	88.9	OK
9.000	S11	60 minute 30 year Summer I+0%	84.100	82.687	0.000	0.149	35.7	OK
7.002	S10	60 minute 30 year Summer I+0%	84.100	82.464	0.000	4.067	132.6	OK
1.004	S3	60 minute 30 year Summer I+0%	84.100	82.383	0.000	15.220	391.7	OK
10.000	S9	60 minute 30 year Summer I+0%	84.100	83.275	0.000	0.135	29.2	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
10.001	S8	60 minute 30 year Summer I+0%	84.100	82.585	0.000	0.398	58.0	OK
1.005	S2	960 minute 30 year Winter I+0%	84.100	82.340	0.000	20.143	54.5	OK
1.006	SWALE	960 minute 30 year Winter I+0%	84.100	82.336	0.000	1009.177	7.4	SURCHARGED
1.007	S1	1440 minute 30 year Winter I+0%	83.450	82.359	0.000	2.658	6.8	SURCHARGED

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 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	D3 (1km)	0.257
FEH Rainfall Version	1999	E (1km)	0.290
Site Location	456600 222900 SP 56600 22900	F (1km)	2.462
C (1km)	-0.023	Cv (Summer)	0.750
D1 (1km)	0.317	Cv (Winter)	0.840
D2 (1km)	0.324		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	60 minute 100 year Summer I+40%	83.700	83.652	0.000	1.269	57.4	FLOOD RISK
2.000	S26	60 minute 100 year Summer I+40%	84.200	83.790	0.000	1.029	36.3	SURCHARGED
1.001	S6	60 minute 100 year Summer I+40%	83.700	83.565	0.000	4.687	106.1	FLOOD RISK
3.000	S24	60 minute 100 year Summer I+40%	84.300	83.931	0.000	0.935	45.8	SURCHARGED
3.001	S23	60 minute 100 year Summer I+40%	84.200	83.803	0.000	7.250	44.0	SURCHARGED
3.002	S22	60 minute 100 year Summer I+40%	84.150	83.703	0.000	3.907	107.3	SURCHARGED
4.000	S25	60 minute 100 year Summer I+40%	84.200	83.713	0.000	1.367	67.1	SURCHARGED
3.003	S21	60 minute 100 year Summer I+40%	84.150	83.588	0.000	5.633	182.0	SURCHARGED
1.002	S5	60 minute 100 year Summer I+40%	83.700	83.414	0.000	13.561	319.2	FLOOD RISK
5.000	S19	60 minute 100 year Summer I+40%	84.000	83.770	0.000	1.120	36.6	FLOOD RISK
5.001	S18	60 minute 100 year Summer I+40%	84.100	83.673	0.000	6.269	38.9	SURCHARGED
5.002	S17	60 minute 100 year Summer I+40%	84.100	83.572	0.000	4.078	96.2	SURCHARGED
6.000	S20	60 minute 100 year Summer I+40%	84.000	83.591	0.000	1.912	100.3	SURCHARGED
5.003	S16	60 minute 100 year Summer I+40%	84.100	83.466	0.000	9.933	194.4	SURCHARGED
5.004	S15	60 minute 100 year Summer I+40%	83.850	83.350	0.000	5.014	218.4	SURCHARGED
1.003	S4	60 minute 100 year Summer I+40%	83.600	83.200	0.000	27.780	532.0	SURCHARGED
7.000	S14	60 minute 100 year Summer I+40%	83.800	83.800	0.313	1.608	78.3	FLOOD
8.000	S12	60 minute 100 year Summer I+40%	83.800	83.494	0.000	1.204	56.1	SURCHARGED
7.001	S13	60 minute 100 year Summer I+40%	83.800	83.400	0.000	8.846	150.3	SURCHARGED
9.000	S11	60 minute 100 year Summer I+40%	84.100	83.481	0.000	1.048	62.2	SURCHARGED
7.002	S10	60 minute 100 year Summer I+40%	84.100	83.255	0.000	8.233	242.1	SURCHARGED
1.004	S3	60 minute 100 year Summer I+40%	84.100	82.919	0.000	18.907	766.3	SURCHARGED

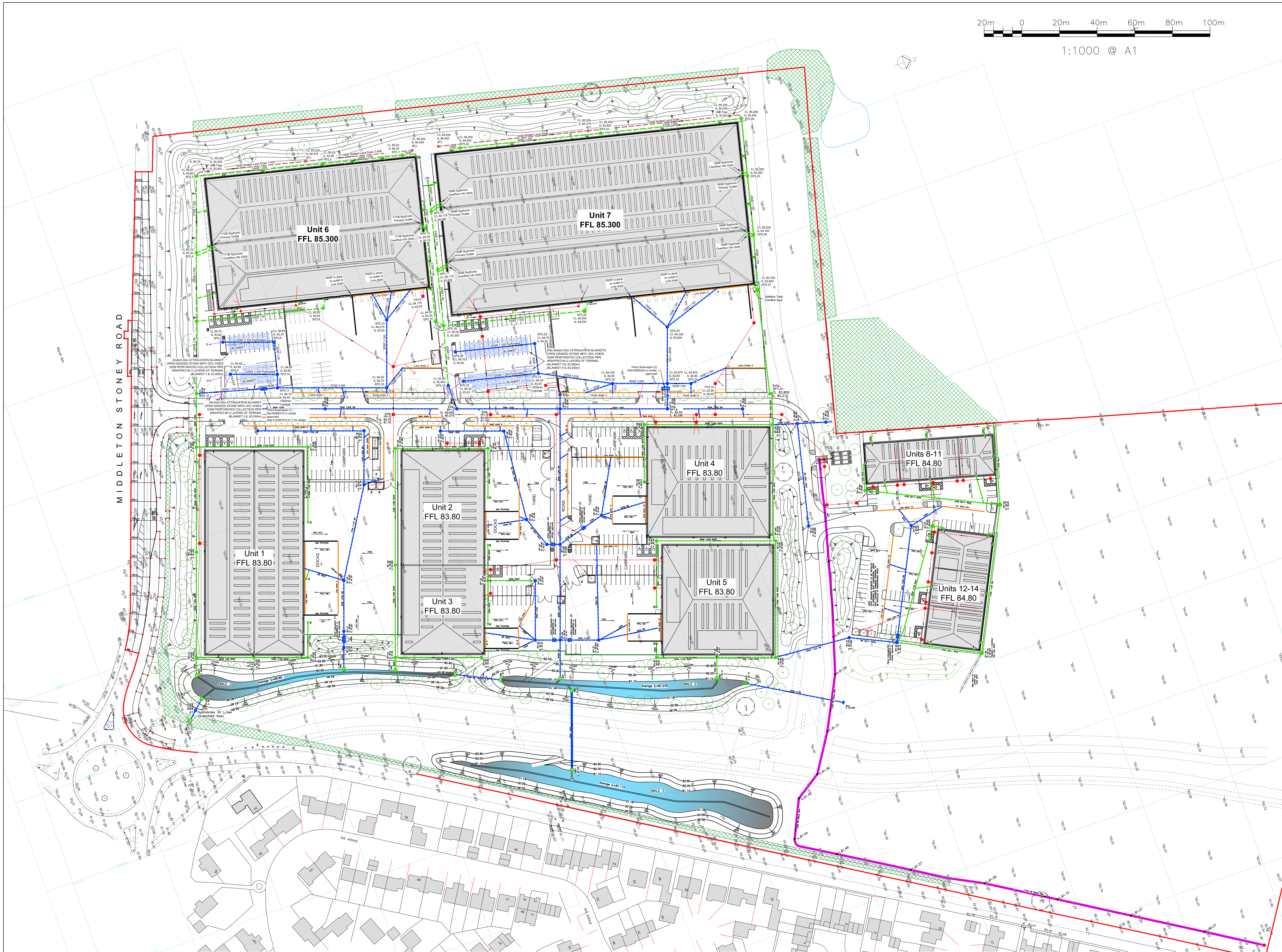
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
10.000	S9	60 minute 100 year Summer I+40%	84.100	83.939	0.000	0.886	49.4	FLOOD RISK
10.001	S8	60 minute 100 year Summer I+40%	84.100	83.230	0.000	3.558	95.1	SURCHARGED
1.005	S2	960 minute 100 year Winter I+40%	84.100	82.878	0.000	27.088	101.8	SURCHARGED
1.006	SWALE	960 minute 100 year Winter I+40%	84.100	82.876	0.000	1963.919	16.8	SURCHARGED
1.007	S1	120 minute 100 year Winter I+40%	83.450	82.876	0.000	3.397	7.1	SURCHARGED

APPENDIX F

AXIS J9 PHASES 1 & 2 PLAN:

S1209-PH2-C16(0) – Full Site Scheme Drainage Layout



Full Site Drainage Layout 1:1000

NOTES

DRAINAGE

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.

2 DRAINS TO BE HEPWORTH SUPERSLEEVE OR NAYLOR DENSLEEVE: LAID ON CLASS N GRANULAR BEDDING TO BS 882: TABLE 4 OR TO BS 8301: 1985 APPENDIX D.

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75MM DOWNGRADED STONE FILL, PLACED & COMPACTED IN LAYERS OF 150MM. ALL PIPES IN ROADWAYS / PARKING, LESS THAN 900MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3000MM CENTRES.

4 MANHOLES TO BE CONSTRUCTED OF PRECAST CONCRETE RINGS TO BS 5911-PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES BENEATH ROADS & PARKING AREAS TO BE CASED IN 150MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ROAD GULLIES TO BE HEPWORTH ROAD GULLIES REF: 213 WITH 150MM DIAMETER OUTLET OR SIMILAR APPROVED. GULLIES TO BE ENCASED IN 150MM MINIMUM CONCRETE.

8 DRAWINGS TO BE ISSUED TO NRA & LOCAL AUTHORITY WELL IN ADVANCE OF COMMENCEMENT OF DRAINAGE

9 EXISTING MANHOLES IN ROADS TO HAVE INVERT LEVELS CONFIRMED PRIOR TO DRAINAGE

10 ROADS TO BE REINSTATED TO STANDARD REQUESTED BY LOCAL AUTHORITY WHERE DRAINAGE CROSSES

KEY:

- INDICATES GULLIES
- INDICATES SURFACE WATER MANHOLES
- INDICATES FOUL MANHOLES
- INDICATES EXISTING MANHOLES
- INDICATES NEW FW PIPE RUNS
- INDICATES NEW SW PIPE RUNS
- INDICATES NEW ROOF PIPE RUNS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

INFORMATION

Rev	Date	Revision Description
0	06.04.21	First Issue

Revision Schedule

AXIS J9 – BICESTER

Client:

Albion Land Plc.

PHASE 2 - FULL SITE SCHEME
DRAINAGE LAYOUT PLAN

BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:1000 @A1
Date 06.04.21
Drawn JNG

S1209–PH2–C16(0)

APPENDIX G

SuDS MANAGEMENT PLAN

S1209/220110/WB/LDD

BAILEY
JOHNSON
HAYES
CONSULTING ENGINEERS

AXIS J9, HOWES LANE, BICESTER

SCHEDULE OF MAINTENANCE WORKS REQUIRED FOR SITE DRAINAGE & SuDS FEATURES

Bailey Johnson Hayes
Consulting Engineers

Tel: 01727 841172
Fax: 01727 841085
Email: wb@bjh.co.uk

S1209/January 2022
Issue 4

S1209/220110/WB/LDD

BAILEY
JOHNSON
HAYES
CONSULTING ENGINEERS

AXIS J9, HOWES LANE, BICESTER

SCHEDULE OF MAINTENANCE WORKS REQUIRED FOR SITE DRAINAGE & SuDS FEATURES

1.0 INTRODUCTION TO SuDS

SuDS are a new environmentally friendly approach to managing rainfall that uses landscape features to deal with surface water. SuDS aim to:

- Control the flow, volume and frequency of water leaving a development area;
- Prevent pollution by intercepting silt and cleaning runoff from hard surfaces;
- Provide attractive surroundings for the community;
- Create opportunities for wildlife.

2.0 MANAGING THE SuDS

The SuDS at Howes Lane have been designed for easy maintenance to comprise:

- Regular day to day care – litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a SuDS feature;
- Occasional tasks – managing pond vegetation and removing any silt that builds up in the SuDS features;
- Remedial work – repairing damage where necessary.

3.0 SUMMARY OF DRAINAGE DESIGN/FEATURES

3.1 Surface Water

A new gravity system will be constructed and outlet rates to existing ditches to Howes Lane will be restricted by use of large swales/pipes.

The system is designed to cater for 1 in 100 year + Climate Change Storm Conditions.

In order to ensure that no contamination enters the Water Courses Silt Traps and Petrol Interceptors are provided at appropriate positions.

In designing the System due reference has been given to the DEFRA CIRIA SuDS Manual.

3.2 Foul Drainage

A gravity system will be constructed to outfall to an on-Site Pumping Station with appropriate 'off-line' storage to cater for emergency breakdown of Pumps. The Foul Water is then pumped to the adopted Thames Water Sewer adjacent to Howes Lane.

4.0 SCHEDULE OF ESSENTIAL MAINTENANCE

4.1 Gullies - Inspect and de-sludge at least once a year.

4.2 Line Drains – Inspect and de-sludge silt boxes as necessary but at least once a year.

4.3 Catch Pits - Inspect and de-sludge at least once a year.

4.4 Petrol Interceptors – Maintain strictly in accordance with the Manufacturers Instructions but at least once each year. Major refurbishment should be considered on a 15-year cycle.

4.5 Pipe Works – Inspect and jet clean as necessary but at least once each year.

4.6 Head Walls/Outlets – These must be inspected and cleaned as necessary but at least twice each year. All gratings/screens and fixings should be checked and secured as necessary.

4.7 Landscaping to Swale Area – The landscaping is to be planted/managed/maintained as attached Re-Form Management & Maintenance Plan – Feb 2019, as agreed with Oxfordshire County Council and attached.

5.0 MANAGEMENT COMPANY

Appointed Management Company will be fully responsible for all maintenance works. The Management Company will appoint a Professional Management Surveying Company to ensure all infrastructure and SuDS are properly maintained and managed.

APPENDIX

1. BJH SW Drainage Plan S1209 - PH1 - C01(4). (Phase 1)
2. BJH SW Drainage Plan S1209 - PH2 - C01(14). (Phase 2)
3. BJH SW Drainage Plan S1209 - PH3 - 02D. (Phase 3)
4. Re-Form Landscape Architecture Management & Maintenance Plan RFM-XX-00-RP-L-0001-PL02.

Bailey Johnson Hayes
Consulting Engineers

S1209 – 10th January 2022

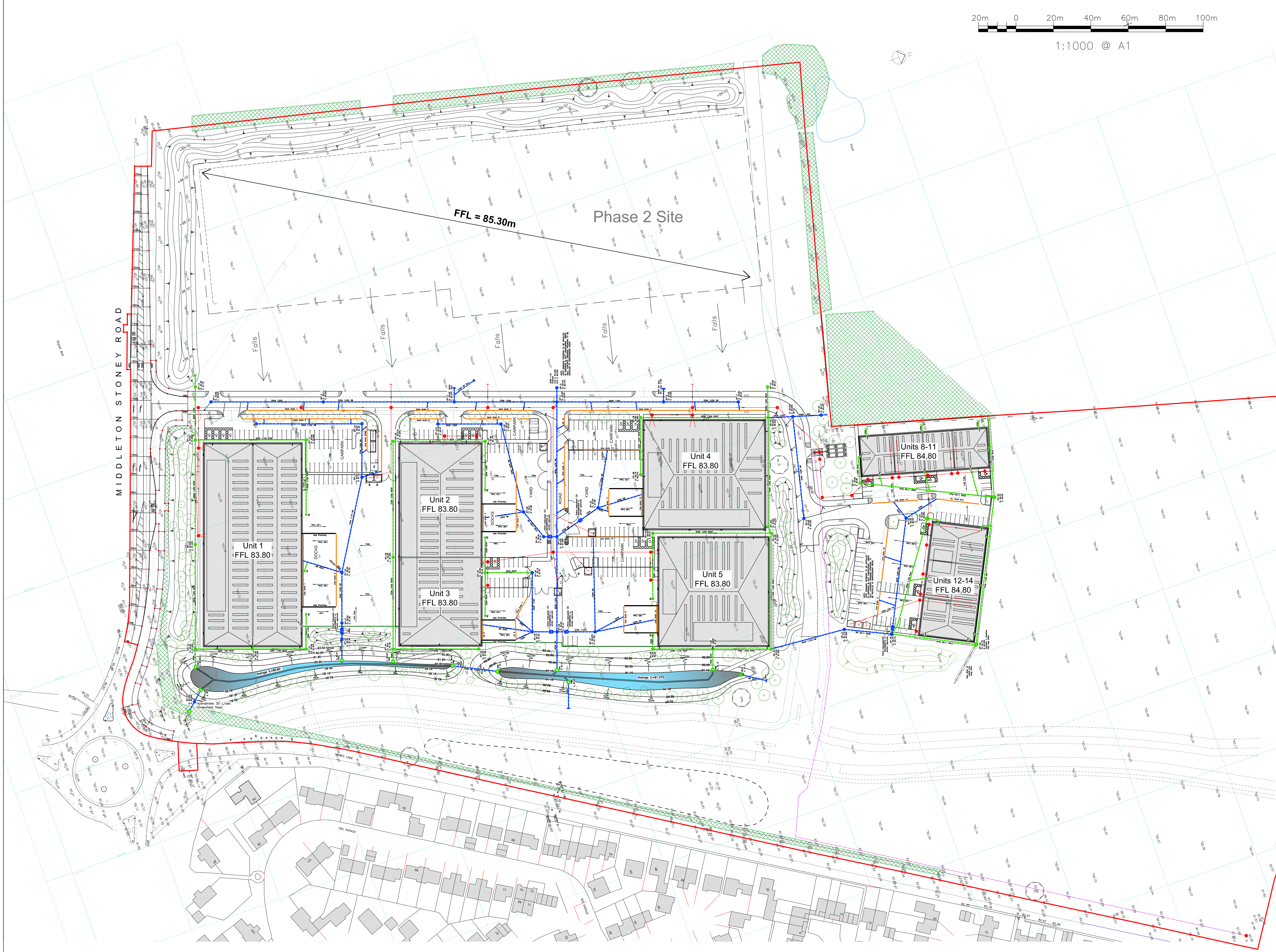
APPENDIX

1 BJH SW Drainage Plan S1209 - PH1 - C01(4). (Phase 1)

2 BJH SW Drainage Plan S1209 - PH2 - C01(14). (Phase 2)

3 BJH SW Drainage Plan S1209 - PH3 - 02D. (Phase 3)

4 Re-Form Landscape Architecture Management & Maintenance Plan
RFM-XX-00-RP-L-0001-PL02



Phase 1 SW Drainage Layout 1:1000

NOTES

DRAINAGE

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.
2. DRAINS TO BE HEPWORTH SUPERSLEEVE OR NAYLOR DENSLEEVE: LAID ON CLASS N GRANULAR BEDDING TO BS 882: TABLE 4 OR TO BS 8301: 1985 APPENDIX D.
3. ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75MM DOWNGRADED STONE FILL, PLACED & COMPACTED IN LAYERS OF 150MM. ALL PIPES IN ROADWAYS / PARKING, LESS THAN 900MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3000MM CENTRES.
4. MANHOLES TO BE CONSTRUCTED OF PRECAST CONCRETE RINGS TO BS 5911-PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.
5. MANHOLES BENEATH ROADS & PARKING AREAS TO BE CASED IN 150MM CONCRETE SURROUND.
6. ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.
7. ROAD GULLIES TO BE HEPWORTH ROAD GULLIES REF: 213 WITH 150MM DIAMETER OUTLET OR SIMILAR APPROVED. GULLIES TO BE ENCASED IN 150MM MINIMUM CONCRETE.
8. DRAWINGS TO BE ISSUED TO NRA & LOCAL AUTHORITY WELL IN ADVANCE OF COMMENCEMENT OF DRAINAGE
9. EXISTING MANHOLES IN ROADS TO HAVE INVERT LEVELS CONFIRMED PRIOR TO DRAINAGE
10. ROADS TO BE REINSTATED TO STANDARD REQUESTED BY LOCAL AUTHORITY WHERE DRAINAGE CROSSES

KEY:

- INDICATES GULLIES
- INDICATES SURFACE WATER MANHOLES
- INDICATES FOUL MANHOLES
- INDICATES EXISTING MANHOLES
- INDICATES NEW FW PIPE RUNS
- INDICATES NEW SW PIPE RUNS
- INDICATES NEW ROOF PIPE RUNS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

FINAL CONSTRUCTION ISSUE

Rev	Date	Revision Description
4	01.06.20	Final Construction issue
3	21.04.19	Units 8-14 SW updated
2	01.10.19	Construction issue
1	15.08.19	Minor setting out update
0	22.07.19	Contract Issue

Revision Schedule

AXIS J9 – BICESTER

Client:

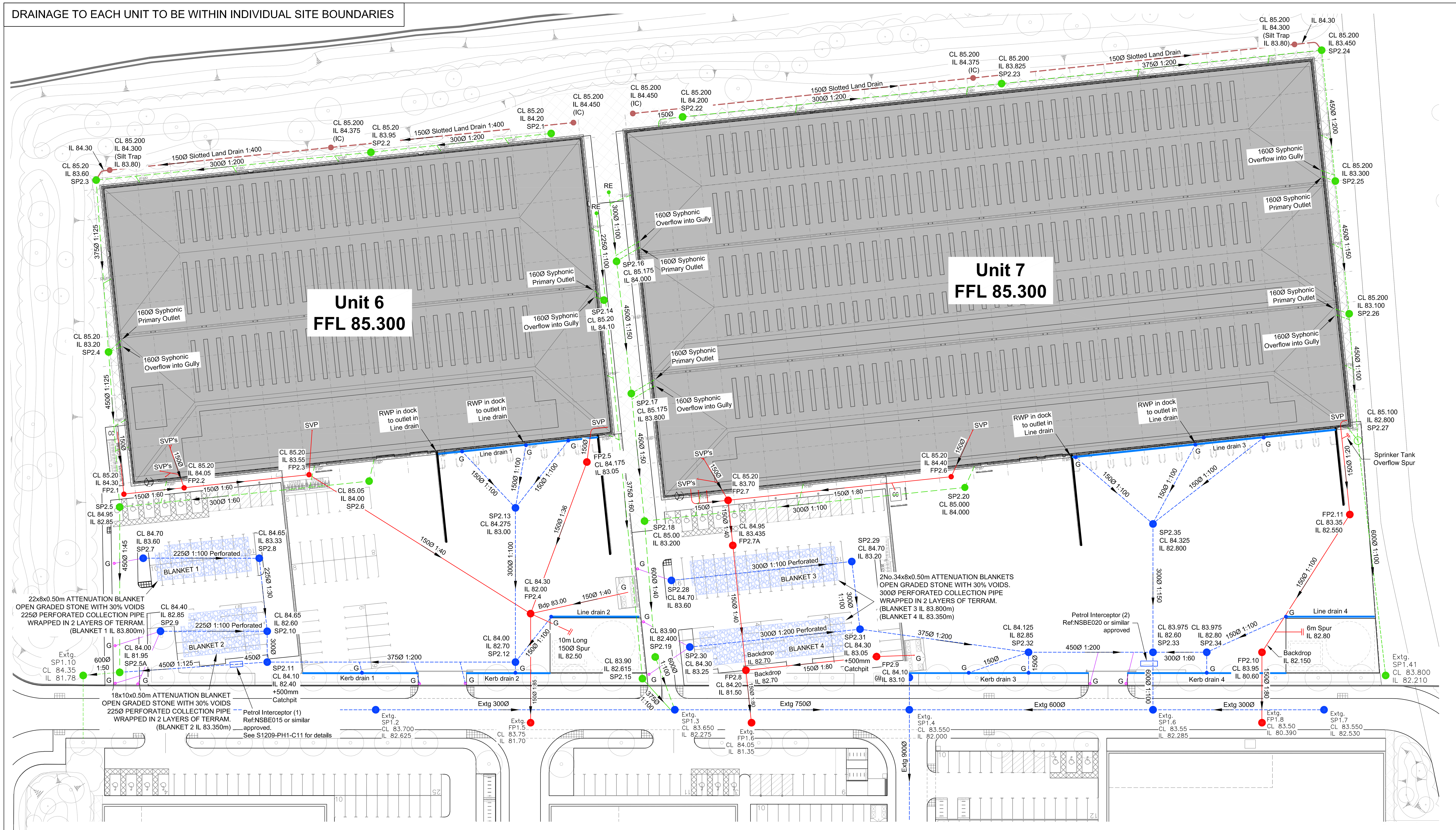
Albion Land Plc.

PHASE 1 - RMA 2
SURFACE WATER DRAINAGE PLAN

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:1000 @A1
Date 15.11.18
Drawn DJC

S1209–PH1–C01(4)



UNIT 6-7 Drainage Layout 1:500

10m 5m 0 10m 20m 30m 40m

Scale 1:500 @A1

NOTES

DRAINAGE

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.

2 DRAINS TO BE HEPWORTH SUPERSLEEVE OR NAYLOR DENSLEEVE: LAID ON CLASS N GRANULAR BEDDING TO BS 882: TABLE 4 OR TO BS 8301: 1985 APPENDIX D.

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75MM DOWNGRADED STONE FILL, PLACED & COMPACTED IN LAYERS OF 150MM. ALL PIPES IN ROADWAYS / PARKING, LESS THAN 900MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3000MM CENTRES.

4 MANHOLES TO BE CONSTRUCTED OF PRECAST CONCRETE RINGS TO BS 5911-PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES BENEATH ROADS & PARKING AREAS TO BE CASED IN 150MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ROAD GULLIES TO BE HEPWORTH ROAD GULLIES REF: 213 WITH 150MM DIAMETER OUTLET OR SIMILAR APPROVED. GULLIES TO BE ENCASED IN 150MM MINIMUM CONCRETE.

8 DRAWINGS TO BE ISSUED TO NRA & LOCAL AUTHORITY WELL IN ADVANCE OF COMMENCEMENT OF DRAINAGE

9 EXISTING MANHOLES IN ROADS TO HAVE INVERT LEVELS CONFIRMED PRIOR TO DRAINAGE

10 ROADS TO BE REINSTATED TO STANDARD REQUESTED BY LOCAL AUTHORITY WHERE DRAINAGE CROSSES

KEY:

- INDICATES GULLIES
- INDICATES SURFACE WATER MANHOLES
- INDICATES FOUL MANHOLES
- INDICATES EXISTING MANHOLES
- INDICATES NEW FW PIPE RUNS
- INDICATES NEW SW PIPE RUNS
- INDICATES NEW ROOF PIPE RUNS
- INDICATES NEW LINE DRAIN RUNS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

CONSTRUCTION

Rev	Date	Revision Description
14	01.07.21	Unit 6 RWP positions updated
13	30.06.21	Manhole SP2.21 Omitted
12	15.04.21	Drainage updated to Architects demise
11	23.02.21	Minor Revs
10	19.02.21	CONSTRUCTION ISSUE
9	11.02.21	Unit 7 FW drainage minor revs
8	04.02.21	Updated to latest site layout + revs
7	11.11.20	Unit 7 Car-Park gully outlets altered
6	09.11.20	Line Drains outlets clarified (blue)
5	03.11.20	Dock leveller added, wing walls extended
4	13.10.20	Updated to latest Architects Layout
3	01.09.20	Minor revs
2	25.08.20	Minor revs to pipe sizes
1	19.08.20	Updated to latest Architects Layout

Revision Schedule

AXIS J9 – BICESTER

Client:

Albion Land Plc.

PHASE 2 - UNITS 6-7
DRAINAGE LAYOUT PLAN

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale 1:500 @A1
Date 14.08.20
Drawn JNG

S1209–PH2–C01(14)

SURFACE WATER MANHOLES / INSPECTION CHAMBERS

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
SP2.1	85.200	84.200	1000	1200	600x600	D400	.
SP2.2	85.200	83.950	1250	1200	600x600	D400	.
SP2.3	85.200	83.600	1600	1350	600x600	D400	.
SP2.4	85.200	83.200	2000	1500	600x600	D400	Vented Cover
SP2.5	84.950	82.850	2100	1500	600x600	D400	.
SP2.5A	84.000	81.950	2050	1500	600x600	D400	.
SP2.6	85.050	84.000	1050	1200	600x600	D400	.
SP2.7	84.700	83.600	1100	1200	600x600	D400	.
SP2.8	84.650	83.330	1320	1200	600x600	D400	.
SP2.9	84.400	82.850	1550	1200	600x600	D400	.
SP2.10	84.650	82.600	2050	1200	600x600	D400	.
SP2.11	84.100	81.900	2200	1350	600x600	D400	500mm Catchpit Manhole
SP2.12	84.000	82.700	1300	1350	600x600	D400	.
SP2.13	84.275	83.000	1275	1200	600x600	D400	.
SP2.14	85.200	84.100	1100	1350	600x600	D400	Vented Cover
SP2.15	83.900	82.615	1285	1350	600x600	D400	.
SP2.16	85.175	84.000	1175	1500	600x600	D400	Vented Cover

SURFACE WATER MANHOLES / INSPECTION CHAMBERS

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
SP2.17	85.175	83.800	1375	1500	600x600	D400	Vented Cover
SP2.18	85.000	83.200	1800	1800	600x600	D400	.
SP2.19	83.900	82.400	1500	1500	600x600	D400	.
SP2.20	85.000	84.000	1000	1200	600x600	D400	.
SP2.21	.	.	.	.	.	.	Omitted
SP2.22	85.200	84.200	1000	1200	600x600	D400	.
SP2.23	85.200	83.825	1375	1200	600x600	D400	.
SP2.24	85.200	83.450	1750	1350	600x600	D400	.
SP2.25	85.200	83.300	1900	1500	600x600	D400	Vented Cover
SP2.26	85.200	83.100	2100	1500	600x600	D400	Vented Cover
SP2.27	85.100	82.800	2300	1500	600x600	D400	.
SP2.28	84.700	83.600	1100	1200	600x600	D400	.
SP2.29	84.700	83.200	1500	1200	600x600	D400	.
SP2.30	84.300	83.250	1050	1200	600x600	D400	.
SP2.31	84.300	82.550	1750	1350	600x600	D400	500mm Catchpit Manhole
SP2.32	84.125	82.850	1300	1500	600x600	D400	.
SP2.33	83.975	82.600	1375	1500	600x600	D400	.

SURFACE WATER MANHOLES / INSPECTION CHAMBERS

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
SP2.34	83.975	82.800	1175	1200	600x600	D400	.
SP2.35	84.325	82.800	1525	1200	600x600	D400	.

FOUL WATER MANHOLES

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
FP2.1	85.200	84.300	900	450	450x450	D400	PPIC 150 (Concrete Encased)
FP2.2	85.200	84.050	1150	450	450x450	D400	PPIC 150 (Concrete Encased)
FP2.3	85.200	83.550	1650	1050	600x600	D400	.
FP2.4	84.300	82.000	2300	1350	600x600	D400	Backdrop Inlet 83.000m
FP2.5	84.175	83.050	1125	1050	600x600	D400	.
FP2.6	85.200	84.400	800	450	450x450	D400	PPIC 150 (Concrete Encased)
FP2.7	85.200	83.700	1500	1050	600x600	D400	.
FP2.7A	84.950	83.435	1515	1050	600x600	D400	.
FP2.8	84.200	81.500	2700	1200	600x600	D400	2No. Backdrop Inlet(s) 82.700m
FP2.9	84.100	83.100	1000	450	450x450	D400	PPIC 150 (Concrete Encased)
FP2.10	83.950	80.600	3350	1200	600x600	D400	Backdrop Inlet 82.150m
FP2.11	83.350	82.550	800	1050	600x600	D400	.

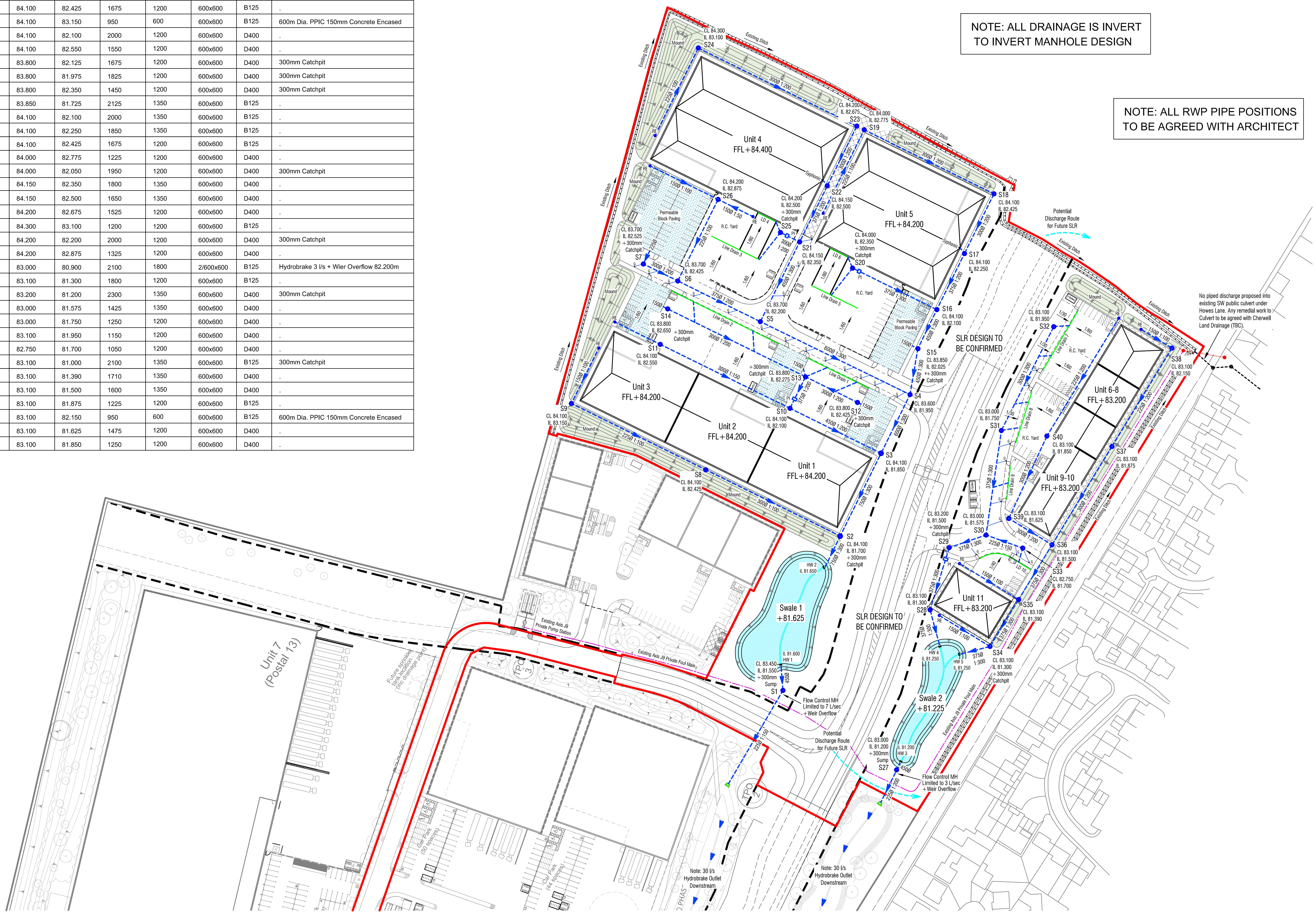
SURFACE WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
S1	83.450	81.250	2200	1800	2/600x600	B125	Hydrobrake 7 l/s + Wier Overflow 82.850m
S2	84.100	81.400	2700	1800	600x600	B125	300mm Catchpit
S3	84.100	81.850	2250	1800	600x600	B125	.
S4	83.600	81.950	1650	1800	600x600	D400	.
S5	83.700	82.200	1500	1500	600x600	D400	.
S6	83.700	82.425	1275	1350	600x600	D400	.
S7	83.700	82.225	1475	1200	600x600	D400	300mm Catchpit
S8	84.100	82.425	1675	1200	600x600	B125	.
S9	84.100	83.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S10	84.100	82.100	2000	1200	600x600	D400	.
S11	84.100	82.550	1550	1200	600x600	D400	.
S12	83.800	82.125	1675	1200	600x600	D400	300mm Catchpit
S13	83.800	81.975	1825	1200	600x600	D400	300mm Catchpit
S14	83.800	82.350	1450	1200	600x600	D400	300mm Catchpit
S15	83.850	81.725	2125	1350	600x600	B125	.
S16	84.100	82.100	2000	1350	600x600	B125	.
S17	84.100	82.250	1850	1350	600x600	B125	.
S18	84.100	82.425	1675	1200	600x600	B125	.
S19	84.000	82.775	1225	1200	600x600	D400	.
S20	84.000	82.050	1950	1200	600x600	D400	300mm Catchpit
S21	84.150	82.350	1800	1350	600x600	D400	.
S22	84.150	82.500	1650	1350	600x600	D400	.
S23	84.200	82.675	1525	1200	600x600	D400	.
S24	84.300	83.100	1200	1200	600x600	B125	.
S25	84.200	82.200	2000	1200	600x600	D400	300mm Catchpit
S26	84.200	82.875	1325	1200	600x600	D400	.
S27	83.000	80.900	2100	1800	2/600x600	B125	Hydrobrake 3 l/s + Wier Overflow 82.200m
S28	83.100	81.300	1800	1200	600x600	B125	.
S29	83.200	81.200	2300	1350	600x600	D400	300mm Catchpit
S30	83.000	81.575	1425	1350	600x600	D400	.
S31	83.000	81.750	1250	1200	600x600	D400	.
S32	83.100	81.950	1150	1200	600x600	D400	.
S33	82.750	81.700	1050	1200	600x600	D400	.
S34	83.100	81.000	2100	1350	600x600	B125	300mm Catchpit
S35	83.100	81.390	1710	1350	600x600	D400	.
S36	83.100	81.500	1600	1350	600x600	D400	.
S37	83.100	81.875	1225	1200	600x600	B125	.
S38	83.100	82.150	950	600	600x600	B125	600m Dia. PPIC 150mm Concrete Encased
S39	83.100	81.625	1475	1200	600x600	D400	.
S40	83.100	81.850	1250	1200	600x600	D400	.

NOTE: ALL PERMEABLE PAVING SUBGRADE DESIGN & COLLECTOR PIPE LOCATIONS TO BE CONFIRMED

NOTE: ALL DRAINAGE IS INVERT TO INVERT MANHOLE DESIGN

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH ARCHITECT



NOTE: PHASES 1, 2 & 3 TO DISCHARGE INTO WATERCOURSE / PUBLIC SEWER AS AGREED AT 30 L/S (GREENFIELD RATE) SEE BJH FRA. CONNECTION AND HYDROBRAKE MH ALREADY CONSTRUCTED AND OPERATIONAL IN PHASE 1.

Phase 3 SW Drainage Layout 1:1000

20m 10m 0 20m 40m 60m

Scale 1:1000 @A1

A1

DRAINAGE NOTES

1 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND BAILEY JOHNSON HAYES DRAWINGS AND SPECIFICATIONS.

2 DRAINS TO BE 'HEPWORTH SUPERSLEEVE' LAID IN CLASS S BEDDING TO BS 882 1983: TABLE 4, OR TO BS 8301 1985: APPENDIX D. 450 DIA DRAINS AND ABOVE TO BE HEPWORTH CONCRETE PIPES CLASS H . OR EQUAL APPROVED DRAINS WITHIN THE SITE MAY BE THERMOPLASTIC STRUCTURED WALL PIPE IN ACCORDANCE WITH CLAUSE E2.22 OF SFA 8th EDITION

3 ALL TRENCHES WITHIN TRAFFICKED AREAS TO BE BACKFILLED WITH 75 MM DOWN GRADED STONE FILL, PLACED AND COMPACTED IN 150 MM LAYERS. ALL PIPES IN ROADWAYS, SERVICE YARDS AND CARPARKS LESS THAN 1200 MM DEEP TO BE ENCASED IN CONCRETE. PROVIDE FLEXIBLE JOINTS AT 3 METRE CENTRES.

4 MANHOLES TO BE CONSTRUCTED IN PRECAST CONCRETE RINGS TO BS 5911: PART 1. RINGS TO BE BEDDED IN SEALANT STRIPS.

5 MANHOLES IN FOOTPATHS OR LANDSCAPED AREAS TO BE BACKFILLED WITH 40 MM DOWN GRADED STONE FILL, COMPACTED IN LAYERS NOT EXCEEDING 150 MM THICK. MANHOLES BENEATH ROADS AND PARKING AREAS TO BE CASED IN 150 MM CONCRETE SURROUND.

6 ALL CONNECTIONS TO RAIN WATER PIPES TO BE PROVIDED WITH RODDING ACCESS.

7 ALL ROAD GULLIES TO BE HEPWORTH ROAD GULLIES., REF RGR4, WITH 150 MM DIAMETER OUTLETS. GULLIES TO BE ENCASED IN 150 MM MINIMUM CONCRETE.

8 DRAINS UNDER BUILDING AND WITHIN 300 MM OF THE UNDERSIDE OF FLOORSLAB TO BE ENCASED IN 150 MM CONCRETE. CASING TO INCORPORATE FLEXIBLE FIBRE BOARD JOINTS AT SPACINGS AS RECOMMENDED BY THE PIPE MANUFACTURER. DRAINS UNDER BUILDINGS GENERALLY TO HAVE MIN 100 FULL GRANULAR SURROUND TO CLASS S BS8301

9 WHERE PIPES RUN THROUGH GROUND BEAMS, FLEXIBLE JOINT CASINGS AT EACH FACE OF THE GROUND BEAM ARE TO BE PROVIDED. PIPES WHICH RUN UNDER GROUND BEAMS TO BE PROTECTED WITH 50 MM MINIMUM POLYSTYRENE PLACED OVER THE CROWN OF THE PIPE.

10 ALL WORK TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 8TH EDITION AND BS 8301 : CODE OF PRACTICE FOR BUILDING DRAINAGE

11 WHERE DRAINS RUN CLOSE TO BUILDINGS AND INVERT LEVELS ARE BELOW FOUNDATIONS THE DRAINS SHOULD BE ENCASED AS FOLLOWS;-

(a) WHERE THE DRAIN TRENCH IS WITHIN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE UP TO FOUNDATION FORMATION LEVEL or

(b) WHERE THE DRAIN TRENCH IS FURTHER THAN 1M OF THE BUILDING THE TRENCH SHOULD BE FILLED WITH CONCRETE TO A LEVEL BELOW FOUNDATION FORMATION EQUAL TO THE DISTANCE FROM THE BUILDING LESS 150mm.

KEY:

- INDICATES GULLIES
- INDICATES SURFACE WATER MANHOLES
- INDICATES NEW PIPE RUNS
- INDICATES LINE DRAIN RUNS
- INDICATES EXISTING MANHOLES

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

PRELIMINARY

Rev	Date	Revision Description
D	07.01.22	Updated to LLFA planning comments
C	02.09.21	Red line planning boundary adjusted
B	23.08.21	Updated to latest Architects layout, pipe sizes added & manholes scheduled
A	20.07.21	Updated Ditches, Mounds & SLR

Revision Schedule

Project Title

Axis J9 - Bicester

Client

ALBION LAND

Drawing Title

PHASE 3
SW Drainage Layout

BAILEY JOHNSON HAYES
Consulting Engineers

ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:1000 @A1	Drawing Number
Date	23.06.21	S1209-PH3-02 D
Drawn	JNG	

Landscape Management & Maintenance Plan

AXIS J9, Bicester

for Albion Land

February 2019

RFM-XX-00-RP-L-0001-PL02

re-form
landscape architecture

T 0113 245 4695
E info@re-formlandscape.com
www.re-formlandscape.com
Tower Works |Globe Road | Leeds | LS11 5QG

1. Introduction

1.1. This Landscape Management Plan sets out the management and maintenance requirements for the first phase of the site on Middleton Stoney Road in North West Bicester known as AXIS J9. The purpose of this management plan is to aid the efficient and effective management of the site, to ensure the healthy establishment of all planting types and to preserve the design intent for the first five years after planting.

2. Site description

2.1. The development site is located on the western edge of Bicester, Oxfordshire. The A4095 (Howes Lane) runs along the eastern boundary of the site, and Middleton Stoney Road to the south. The site is approximately 20 hectares.

2.2. The site is currently used for arable crops and comprises of three fields separated with native hedgerow and incidental tree planting. The frontage to Howes Lane comprises grass verges and native hedgerow with occasional tree planting. To the west and north of the site is open pasture and farmland, bounded by hedgerows and occasional mature tree planting. A rectangular shaped plantation of young trees is located to the north of the site.

2.3. To the east of the site is a suburban residential area which is fronted along Howes Lane with a mixture of hedgerow, tree planting, and close-boarded fencing to rear gardens. To the south east of the site is Kingsmere, a housing development located on Middleton Stoney Road which is currently under construction. To the south of the site, beyond Middleton Stoney Road is Bignell Park landscape garden and house.

3. Objectives

3.1. The aims of the management plan are:

- Provide a quality landscape setting to the new development
- Conserve and enhance ecology and biodiversity
- Ensure healthy establishment of the proposed planting
- Establish important areas of green infrastructure within the new development

3.2 All maintenance operations are to be in accordance with BS7370-4: 1993 *Grounds Maintenance: recommendations for maintenance of soft landscape* other than amenity turf.

4. Phasing

4.1. The site will be delivered in phases, including an initial enabling phase. This management plan covers landscape management planting for Phase 1 as per re-form Landscape Architecture's Planting Plan RFM-XX-00-DR-L-0001.

4.2. The 'Enabling Phase' allows for the removal of existing trees and hedgerows to facilitate the start of the construction works. Refer to RFM-XX-00-DR-L-0002 'Tree removal and retention plan' for details. All existing trees and hedgerows will be protected according to BS 5837:2012 'Trees in relation to construction'.

5. Soft Landscaping & planting

5.1. This management plan is to be read in conjunction with the following drawings by re-form Landscape architecture:

- RFM-XX-00-DR-L-0001 Soft Landscape and Planting Plan
- RFM-XX-00-DR-L-0002 Tree removal and retention plan
- RFM-XX-00-DR-L-0003/4 Landscape Sections
- RFM-XX-00-DR-L-0005 Planting schedule
- RFM-XX-00-DR-L-0006 Soil Profiles

5.2. All maintenance operations are to be in accordance with BS7370-4: 1993 *Grounds Maintenance: recommendations for maintenance of soft landscape* other than amenity turf.

5.3. The proposed soft landscape will augment and enhance existing green infrastructure to the site. The proposed soft landscape and planting consists of:

- General tree planting:
  Native tree species in a range of sizes: semi mature (15% of mix), extra heavy standard (35%) and standard trees (50%). This will include deciduous and evergreen species. Tree species will be spread evenly throughout the woodland planting area to achieve desired coverage and instant impact. Trees will be planted in and around the swales to the east of the proposed development to create a layered effect to assist with screening and maximise cover for visual mitigation.

- General native woodland planting:
  In conjunction with larger trees, a native woodland mix of transplants and whips shall be provided at an average rate of 1 plant/1.5m2. This will form bands of native vegetation comprising both tree and shrub species, including deciduous and evergreen species. Native transplant and whip species will be spread evenly throughout the woodland planting area to maximize cover for visual mitigation and amenity.

- Native understory planting:
  Within more open naturalistic areas around the swale, generously spaced trees are located within areas of native woodland shrubs planted in swathes of 3-5 species at 1500mm centres.

- Native hedgerow planting:
  Hedgerow planting shall consist of trees at 3m centres and native whips (tree & shrub species) at 0.5m centres throughout the planting zone.

- Planting associated with seasonally wet swale feature:
  Swales features to be planted to be base and slopes with a moisture-tolerant species-rich grass seed mix.

- Meadow grassland:

Wildflower meadow grass is used across the site. The majority will be a wildflower mixed meadow with a variation appropriate for seasonally wet soils in the swales. There is a two strand approach to maintenance of the meadow with some areas to be left to grow longer to increase both visual amenity and species diversity across the open areas of grassland.
Some areas of amenity grass will be provided for the ‘grassroad’ emergency access routes adjacent to the buildings.

- General amenity shrub planting:
  This will comprise a variety of robust & hardy groundcover and low level (below 1.2m mature height with some specimen/accent plants, all requiring minimal maintenance. There will be a predominance of amenity shrub planting with a high proportion of evergreen and flowering species to give year round structure and interest

- Soils:
  Suitable quality topsoil shall be provided to the following depths:
  - Native woodland planting (transplants & whips) Planted areas – 300mm
  - Meadow grass to swale – 100mm low nutrient
  - Amenity shrubs – 400mm
  - Species rich/wildflower grass – 100mm low nutrient or as per supplier’s recommendations

6. Management Plan

6.1. General preamble

- Duration of plan:
  There will be a provision of 25 years for plant establishment, maintenance and replacement. The duration of the management plan is be confirmed within a detailed Management Plan to be provided by the client following practical completion of the landscape works.

- Area:
  The management plan applies to all external areas within the site boundary as shown on drawing RFM-XX-00-DR-L-0001 Soft Landscape and Planting Plan.

- Visits:
  The contractor shall notify the Client 48 hours prior to any visits to confirm suitability of time and works to be undertaken to avoid disruption to the Client’s activities.

- Specification and planting stock:
  Any replacement planting required during the period of the management plan should be undertaken in accordance with the Landscape Specification as part of the building works. All plant stock should comply as follows:

6.1..1. All plants are to be supplied in accordance with Horticultural Trade Association's National Plant Specification and from a HTA certified nursery. All plants and trees to be planted in accordance with BS3936. Delivery and backfilling of all plant material to be in accordance with BS4428:1989 'Code of practice for general landscape operations' and CPSE Code of Practice for 'Handling and Establishing Landscape Plants, Parts I, II and III'.

6.1..2. The supply and aftercare of trees will be in accordance with BS8545:2014

6.1..3. All excavated areas to be backfilled with either topsoil from site or imported to be BS3882 – General purpose grade. All topsoiled areas to be clear of rocks and rubble larger than 50mm diameter and any other debris that may interfere with the establishment of plants.

6.1..4. Existing trees and hedgerows to be retained shall be protected in accordance with BS5837, from commencement to completion of all works on site.

6.2. Machinery and Tools

Use only machines and tools suitable for the site conditions and the work to be carried out. Use hand tools around trees, plants and in confined spaces where it is impracticable to use machinery. The use of strimmers is not permitted around tree stems below 8-10cm in girth.

6.3. Chemicals

- Legislation

  Pesticides include herbicides, insecticides, fungicides and plant growth regulators. The use of pesticides is governed by legislation. The Landscape Contractor must comply with the 'The Control of Pesticides Regulations 1986' made under the 'Food and the Environment Protection Act 1985', 'The Control of Substances Hazardous to Health Regulations 1988' made under the 'Health and Safety at Work Act 1974' and any other legislation enacted during the contract period.

  All pesticides must be products on the current list of Agricultural Chemicals Approval Scheme. All pesticide users shall comply with the conditions of approval relating to use clearly stated on the product label.

  The Contractor must comply with all relevant Codes of Practice issued by DeFRA. In particular, where work is near water, comply with the 'Code of Practice for the Use of Herbicides on Weeds in Watercourses and Lakes'. Written approval from the Environment Agency should be obtained prior to the use of pesticides within these areas.

Wherever practical, other non-chemical means of plant removal should be used in consultation with the Environment Agency.

- Use of pesticides

  The Contractor shall keep a written logbook detailing all uses and pesticide applications carried out.

  The Contractor is required to notify the public of any pesticide application. A warning sign shall be posted on the railing to any public routes. Where contained solely within planting beds the sign shall be placed adjacent to edges in noticeable positions. Details of the application and a contact person shall be indicated on the sign.

  The Contractor shall in accordance with COSHH Regulations protect employees and other persons, including the public, who may be exposed to substances hazardous to health.

6.4. General planting maintenance (1 to 25 years)

- Failures of planting: general

  Any trees/shrubs/plants that have died or failed to thrive (not developing full foliage throughout all branches) within the period of this maintenance plan should be replaced.

  Years 1 – 3:
  Replacements must match the size of adjacent or nearby plants of the same species or should match the original specification, whichever is the greater.

  Years 4 – 25:
  Replacements to be as original specification. Replacements of tree species left to grow to maturity, after thinning at years 7 – 10 must be to original specification.

- Watering: general

  The contractor shall make due allowance in his rates for carrying out these tasks outside normal working hours when necessary to avoid premature evaporation or leaf damage caused through watering in bright sunlight.

  The contractor is to allow for the provision of water, water carts or hoses with a fine hose attachment or sprinklers at normal mains pressure. The contractor is to include and state in his tender the cost of compliance with this clause so that the cost of visits can be deducted in whole or in part if not required to be used.

  Drought Conditions:

Should emergency legislation restricting the use of water during drought conditions be imposed, the contractor will be required to ascertain — before operations — the availability and cost of, and arrange to collect and apply second class water by bowser or other means from an approved sewage works, deliver to site and apply as specified. When required by the Architect, the contractor shall arrange for tests of this water to be carried out in accordance with BS 6068:2000 Water Quality.

- Pests and Diseases: general

  Maintenance shall include the control of insects, fungus and disease by spraying with an approved insecticide or fungicide.

- Litter Collection: general

  The contractor shall at all times keep the site clean, tidy and free from litter and carry out a litter collection at each maintenance visit.

  'Litter' is anything whatsoever that is thrown down, dropped or otherwise deposited in onto or from any place in the open air to which the public are permitted to have access without payment.

  'Fly tipping': large items such as discarded furniture that require two or more people to lift or are in excess of 0.5m3 will be treated as fly tipping and not litter. The contractor should provide a cost for removal and depositing for fly tipping on each and every occasion.

  The contractor shall take care to avoid any spillage of fuel, oil, chemicals or other materials toxic to plant life. Plants or soil contaminated by such material must be removed off site and replaced.

- Cleanliness: general

  At completion and at each visit, remove soil and other debris from all hard surfaces and grassed areas and leave the works in a clean and tidy condition.

- Leaf Clearance: general

  The contractor is responsible for the clearance of leaves, twigs, etc from all areas of the grounds including planting beds, lawns, paths, channels, drains, car park steps and other areas specified by the Client, from leaf fall (normally October until end December). The Client will instruct the contractor when to begin.

  The clearance shall be carried out with hand raking or sweeping, or using machinery appropriate and approved by the Client.

All collected leaves to be removed from site and should not be left in piles awaiting removal but cleared immediately.

Leaves should not be left on ground for more than a week. The contractor shall schedule operations to achieve this standard.

- Management of proposed tree planting

  General Health of Trees, Years 1, 3 and 5:
  Check general health of all trees by qualified arboriculturalist. Recommendations will be made for replacements and remedial works as required.

  In order to ensure that trees do not become hazardous, the condition of all trees at the site should be checked annually. Trees should also be checked following storms, where there may be damage from wind throw.

  Deciduous trees are often vulnerable to diseases caused by pathogens, fungi, bacteria and viruses. Trees should be monitored for signs of diseases, which may include visible mushrooms and patchy and discoloured leaves. Where it is suspected that a tree may be suffering from a disease advice should be sought from an Arboriculturalist.

  Hazardous branches or mature trees that are to be removed must be surveyed for potential birds' nests or bat roosts prior to felling. Trees and hazardous branches should only be removed outside the bird-breeding season, between March and August for most species, unless a suitably qualified ecologist undertakes a survey of the affected area.

  All tree surgery works should be undertaken by a professional tree surgeon who should work in accordance with BS 3998:1989 'Recommendations for Tree Work'.

  Inspection of trees:
  Arboricultural inspections and works are to continue up to the 25 years and beyond. They will address wind damage, disease, dead wooding and tackling windblown trees.

- Newly Planted Trees

  Watering: Year 1and 2 – Establishment
  Between May and September all newly planted trees shall be watered at a rate of 50 litres per visit.

  Mulching and weeding: Years 1-3
  Maintain a mulched, weed-free area 800mm radius around each tree. Mulch should be maintained at a depth of 75mm deep. Weeding within this zone should be hand-weeding which should be done as often as required or through the use of biodegradable mulch.

Inspection of stakes, ties etc. Years 1-3
Twice a year check condition of stakes, ties, guys and guards.

Redundant ties: Check for excessive movement at ground level by pulling on tree at shoulder height. If most of movement is in the bending of the stem then it is likely that the root system is providing adequate support and stakes and ties can be removed.

Adjustment and/or replacement of ties:
Trees should be able to move approximately 50mm (2”) in all directions when staked properly. Too little movement may result in poor root structure and inability to withstand wind loading. Too much movement may cause rocking and damage of new root growth. Ties should not rub bark. Ties should be loosened, tightened or replaced as required.

Stakes to be removed after the third winter from time of planting, unless further tree stabilisation is required.

Re-firming Trees and Specimen Shrubs:
Re-firming Trees and Shrubs – shall be carried out after strong winds, frost heave and other disturbances. To re-firm the Contractor should tread around the base until firmly bedded. Any collars in the soil at the base of tree stems, created by tree movement should be broken up by fork, avoiding damage to roots. The voids should be backfilled with topsoil and re-firmed.

- Pruning newly planted trees: Years 1 onwards

Prune at appropriate times, to remove dead, dying, damaged and diseased wood along with crossing branches (where branches are rubbing together) in accordance with BS 3998: 1989, to promote healthy growth and natural shape. Trees should be allowed to grow to their natural mature height. Pruning shall only be carried out to remove dead, diseased or dying branches.

All trees shall be cut using sharp shears, reciprocating hand held cutters or secateurs.

All cuts shall be clean and any ragged edges shall be removed using a sharp knife or secateurs. Keep wounds as small as possible, cut cleanly back to sound wood leaving a smooth surface, and angled so that water will not collect on the cut area.

All arisings shall be collected immediately following cutting or at the end of each work period and taken to the designated location for disposal.

The Contractor shall ensure that trees do not present a hazard or obstruction to pedestrians, pavements, roads or signs at any time.

Once commenced, the cutting operation shall continue and be completed without delay.

The Contractor shall avoid cutting/pruning in March to June to cause minimum disturbance to nesting birds and wildlife, in compliance with the Wildlife and Countryside Act.

- Disease of fungus
  Give notice if detected. Do not apply fungicide or sealant unless instructed.

- Watering

  Water throughout the growing season in line with the maintenance schedules.

- Thinning Out

  The object of the native woodland planting is to encourage full woodland growth to encourage the screening of large units. Trees shall be checked from 3 years to ensure healthy growth. Vigorous deciduous trees in the native woodland mix shall be thinned out after 7 to 10 years to allow slower growing species to reach their full height.

  The following species are to be allowed to grow onto maturity:

  Acer campestre
  Pinus sylvestris
  Prunus avium
  Quercus robur

  These species are to be spread evenly throughout the woodland to achieve desired coverage as set out in the planting matrix. Trees that are over shadowing these species shall be selected and removed to the base. Any encroaching vegetation adjacent to public rights of way will be thinned out in order to maintain width and sightlines.

- Mulching
  All mulch beds to tree planting to be topped up in line with the maintenance programme

- Protection
  All planting shall be suitably supported during the establishment period and protected from damage caused by animals e.g. rabbits

6.5. Management of hedgerow planting

- Watering

  Water as necessary through the growing season in line with the maintenance schedules.

- Cutting back/foliage removal

  Hedgerow should be cut twice a year in the spring and summer to promote healthy growth and maintain a neat, dense form, and to maintain clear access and sightlines to adjacent public rights of way.

6.6. Management of native shrub mix

- Watering

  Water as necessary through the growing season in line with the maintenance schedules.

- Cutting back/foliage removal

  Native shrubs to be maintained at maximum 1.8m height. Plants should be cut twice a year in the spring and summer to promote healthy growth and maintain a neat, dense form.

6.7. Management of grasslands

- Mowing

  For first year of management mow regularly throughout the first year of establishment to a height of 40-60mm, removing cuttings if dense. This will control annual weeds and help maintain balance between faster growing grasses and slower developing wild flowers.

  For future years:

  Short meadow:
  Grass to be cut back three times a year in early spring, summer and autumn. The summer cut to be after flowering in July or August as a 'hay cut': cut back to c 50mm. Leave the 'hay' to dry and shed seed for 1-7 days then remove from site.
  For the spring and autumn cut; cut back to c 60mm and remove arisings.

  Care should be taken if the swale is holding water and on steeper sides of the swale. Only grass that can be safely accessed should be cut back in such conditions.

  Long meadow:
  Grass to be cut back once a year in late August and early September, left for a minimum of 3 days and then arisings removed, thus allowing the majority of the grassland plants to bloom and set seed.

  Amenity grass to ‘Grassroad’:
  Grass to be cut to height of 50mm monthly during growing season with arisings to be removed.

- Weeding

  Weeds, over 100mm in height in late May, that do not form part of the seed mix should be removed from site.

- Re-seeding

  Bare patches to be re-seeded annually in September as per the original specification. If bare patches appear, do not top dress with topsoil and do not apply fertiliser. Add grass seed as per original specification.

6.8. Amenity planting: shrub and ground cover planting

- Watering: Year 1 – Establishment
  Between May and September of the first year shrub beds will be watered on each visit if there has been no rainfall for a period of seven days. Shrub areas should be watered at a rate of 15 litres per square metre. During subsequent years watering should be undertaken as necessary.

- Weeding and mulching: Years 1-25
  Shrub beds should be weeded monthly during the growing season, March to October inclusive, utilizing the following methods:

  Ornamental shrub & perennial areas - Hand pulling only
  General amenity shrub areas - Hand pulling or herbicide spot treatment

  Use only an approved herbicide in accordance with manufacturer's instructions. Care should be taken not to spray the green parts of shrubs or low ground cover planting. All weeds are to be removed from site once they have died down.

  Remulch as necessary the whole surface of shrub beds to ensure a depth of 75mm. Ensure that the soil is thoroughly moistened prior to remulching, applying water where necessary.

- Fertiliser: Years 1-3
  Annual application of a slow release organic fertilizer in accordance with manufacturer's instructions.

- Protective fencing: Year 1
  Where newly planted areas are protected with Chestnut Paling fencing. Maintain fencing until end of Defects period then remove and reinstate ground. Make good any damage to planting until area is accepted. The fencing will remain the property of the Contractor.

- Pruning: Years 1-25
  Shrub plants should be pruned at appropriate times, to remove dead or dying and diseased shoots or branches, to promote healthy growth and natural shape. Prune

overgrowing specimens to avoid suppression of adjacent species, overgrowth onto grass or paving etc. Ensure that shrubs are maintained at a maximum of waist height.

All shrubs shall be cut using sharp shears, reciprocating hand held cutters or secateurs. Large leafed species such as Prunus should only be pruned using secateurs or similar approved equipment. All cuts shall be clean and any ragged edges shall be removed using a sharp knife or secateurs.

All arisings shall be collected immediately following cutting or at the end of each work period and taken to the designated location for disposal off site by the contractor. This includes trimmings hung up in shrubs and the sweeping of adjacent hard surfaces.

Once commenced, the cutting operation shall continue and be completed without delay.

- Maintenance of shrub area base

  The Contractor shall be required to leave the base of the shrub beds clean, tidy and weed free on every occasion that maintenance operations are carried out, and this shall include the removal of all litter,' leaves, debris and other such deleterious matter. The site shall be left clean and tidy.

  All beds and bare areas shall be maintained free of litter and weeds at all times.

  Bed soil shall be pushed back and left at a 45 degree angle from the bed edge, starting slightly below surrounding levels.

7. Maintenance schedule

On following page.

All landscape maintenance operations will be carried out in accordance with Landscape Services' Technical Specifications, as a requirement of the 106 Agreement. This is to ensure that the appropriate standard of landscape maintenance is achieved.

RF16-375

AXIS J9, BICESTER

Maintenance Schedule (Planting - Years 1-5)

re-form
landscape architecture

This maintenance schedule details when maintenance work items are to be carried out. In each identified month, the number in the shaded box details the number of times per month when a work item is to be carried out. Where a number "1" is indicated, the maintenance work item must be carried out once a month at the beginning of the month. Where a number "2" is indicated, the maintenance work item must be carried out twice in the month, once at the beginning of the month and the second occurence mid-way through the month.

Item	Description	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1.0	**Tree Planting**												
1.1	Cut back broken, diseased or dying branches. Prune trees to maintain a desirable shape in the first three years after planting.	1	1	1									
1.2	Check for general health in line with good horticultural practice. Any signs of disease or decreasing health to be reported to site management.	1	1	1	1	1	1	1	1	1	1	1	1
1.3	Top up mulch to base of trees in soft areas.						1		1				
1.4	Apply general tree fertiliser			1									
1.5	Check stakes and ties twice a year. Any broken or damaged stakes will be replaced and ties re-fixed at a slightly lower position, allowing for growth since planting. Stakes to be removed after the third winter from time of planting, unless further tree stabilisation is required.			1						1			
1.6	Water trees during summer months as necessary, minimum 2 x per month in first two years.						2	2	2	2			
1.7	To reduce excessive competition, retain a weed free area around all trees to a diameter of 1m around the base of the trees using glyphosate spray twice a year. Newly planted trees will require refirming as required during the first three years.			1							1		
2.0	**Hedgerow (Existing and proposed) and native shrub mix**												
2.1	(Proposed only) Water during summer months as necessary, minimum 2 x per month in first two years.					2	2	2	2	2	2		
2.2	(Existing and proposed) PLants should be cut twice a year in the spring and summer to promote healthy growth and maintain a neat, dense form				1				1				
3.0	**Amenity grass to 'Grassroad**												
3.1	Mow fortnightly throughout May - October to maintain a length of 35-50mm (12 visits)					2	2	2	2	2	2		
3.2	Cultivate and re-seed areas of bare ground (as necessary during spring)using exact same seed mix as originally sown.			1	1								
3.3	Weed control will include spot treatment using selective herbicide of noxious weeds such as docks, thistles, nettles, ragwort and willowherb. (one visit in spring, one visit in early autumn)			1							1		
4.0	**Meadow grassland**												
4.1	For first year of management mow regularly throughout the first year of establishment to a height of 40-60mm, removing cuttings if dense. This will control annual weeds and help maintain balance between faster growing grasses and slower developing wild flowers.				1	1	1	1	1	1			
4.1	Short meadow: Grass to be cut back three times a year in early spring, summer and autumn. The summer cut to be after flowering in July or August as a 'hay cut': cut back to c 50mm. Leave the 'hay' to dry and shed seed for 1-7 days then remove from site. For the spring and autumn cut; cut back to c 60mm and remove arisings.				1			1			1		
4.1	Long meadow: Grass to be cut back once a year in late August and early September, left for a minimum of 3 days and then arisings removed, thus allowing the majority of the grassland plants to bloom and set seed.									1			
4.1	Removal of any devleoping young scrub . Cut material should be chipped and left on site in a compost area, followed by direct treatment of stems to stop regrowth.									1			
4.1	Weed control will include spot treatment using selective herbicide of noxious weeds such as docks, thistles, nettles, ragwort and willowherb. (one visit in spring, one visit in early autumn)			1							1		
4.1	Cultivate and re-seed areas of bare ground (as necessary during spring) using exact same seed mix as originally sown.			1	1								
5.0	**Amenity Planting**												
5.1	Watering: Year 1 – Establishment Between May and September of the first year shrub beds will be watered on each visit if there has been no rainfall for a period of seven days. Shrub areas should be watered at a rate of 15 litres per square metre. During subsequent years watering should be undertaken as necessary.					1	1	1	1	1	1		
5.2	Shrub beds should be weeded monthly during the growing season, March to October Remulch as necessary			1	1	1	1	1	1	1	1		
5.3	Pruning: Shrub plants should be pruned at appropriate times, to remove dead or dying and diseased shoots or branches, to promote healthy growth and natural shape.			1	1	1	1	1	1	1	1		
5.4	All beds and bare areas shall be maintained free of litter and weeds at all times.	1	1	1	1	1	1	1	1	1	1	1	1
5.5	Fertiliser: Years 1-3 Annual application of a slow release organic fertilizer in accordance with manufacturer's instructions.				1								